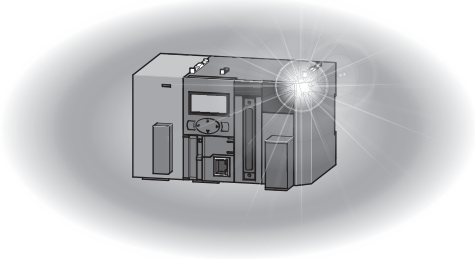
MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC *L* series

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

-L60AD4
-L60ADVL8
-L60ADIL8



●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 (all phases) used in the system 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 Safety Guidelines provided with the CPU module or head module. 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 until they click. Incorrect interconnection may cause malfunction, failure, or drop of the module.
- Tighten the screws 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

- Individually ground the FG terminal of the programmable controller with a ground resistance of 100 ohms or less. Failure to do so may result in electric shock or malfunction.
- Tighten the terminal block screws 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.
- 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 (all phases) used in the system before cleaning the module or retightening the terminal block screws. 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 (all phases) used in the system before mounting or removing a module. Failure to do so may cause the module to fail or malfunction.
- Tighten the terminal block screws 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.
- After the first use of the product (module, display unit, and terminal block), do not connect/disconnect the product more than 50 times (in accordance with IEC 61131-2). Exceeding the limit may cause 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 an actual system, ensure the applicability and confirm that it will not cause system control problems.
■Relevant modules: L60AD4, L60ADVL8, L60ADIL8

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 263, Appendix 9)

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

(1) Method of ensuring compliance

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

- MELSEC-L CPU Module User's Manual (Hardware Design, Maintenance and Inspection)
- MELSEC-L CC-Link IE Field Network Head Module User's Manual
- Safety Guidelines (This manual is included with the CPU module or base unit.)

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

(2) Additional measures

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, branch module, extension module, 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) Head module User's Manual

Manual name manual number (model code)	Description
MELSEC-L CC-Link IE Field Network Head Module User's Manual SH-080919ENG, 13JZ48	Specifications, procedures before operation, system configuration, installation, wiring, settings, and troubleshooting of the head module

(3) Operating manual

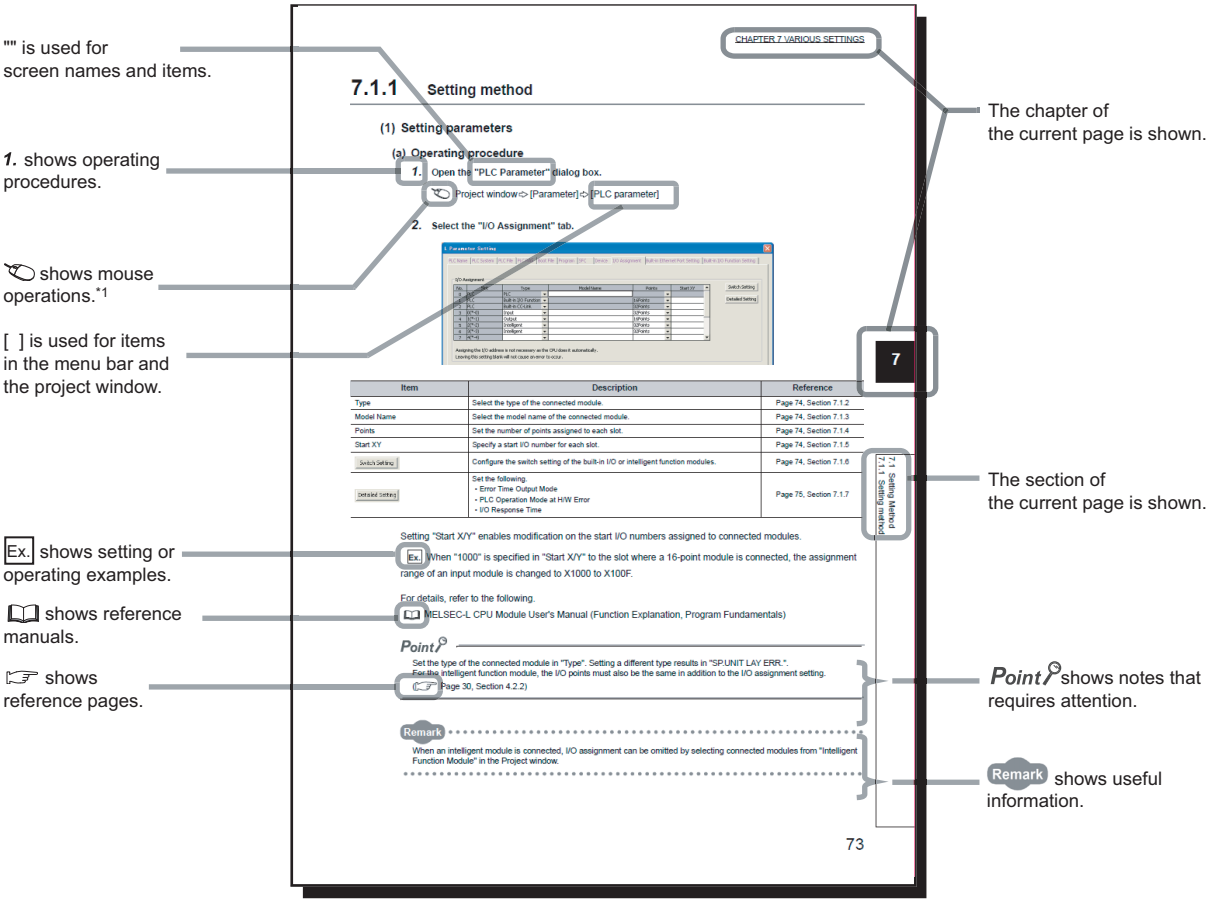
Manual name manual number (model code)	Description
GX Works2 Version 1 Operating Manual (Common) SH-080779ENG, 13JU63	System configuration, parameter settings, and online operations of GX Works2, which are common to Simple projects and Structured projects
GX Developer Version 8 Operating Manual SH-080373E, 13JU41	Operating methods of GX Developer, such as programming, printing, monitoring, and debugging

CONTENTS

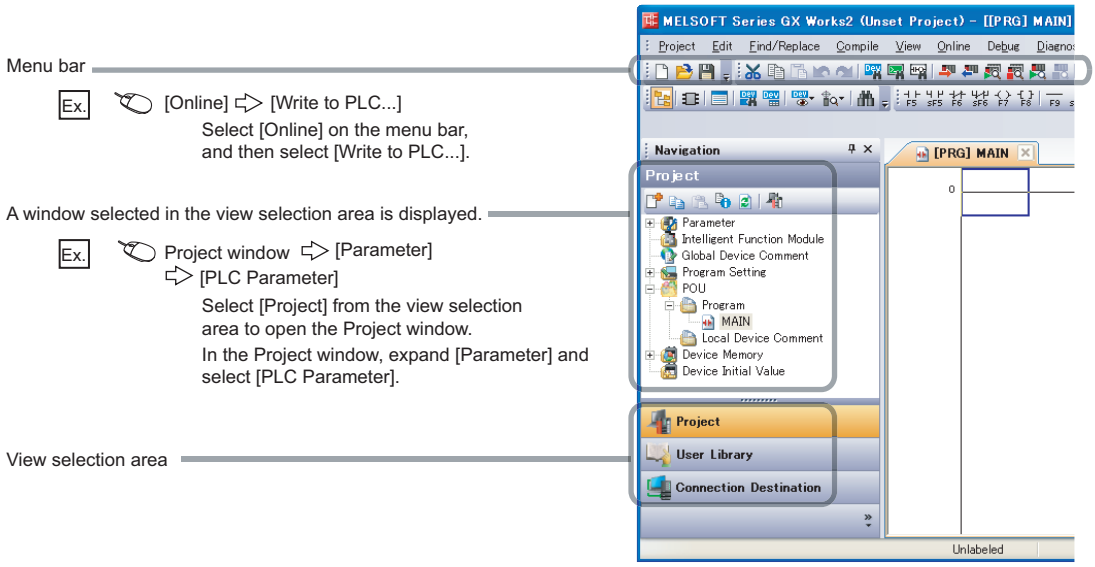
MANUAL PAGE ORGANIZATION

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

The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.

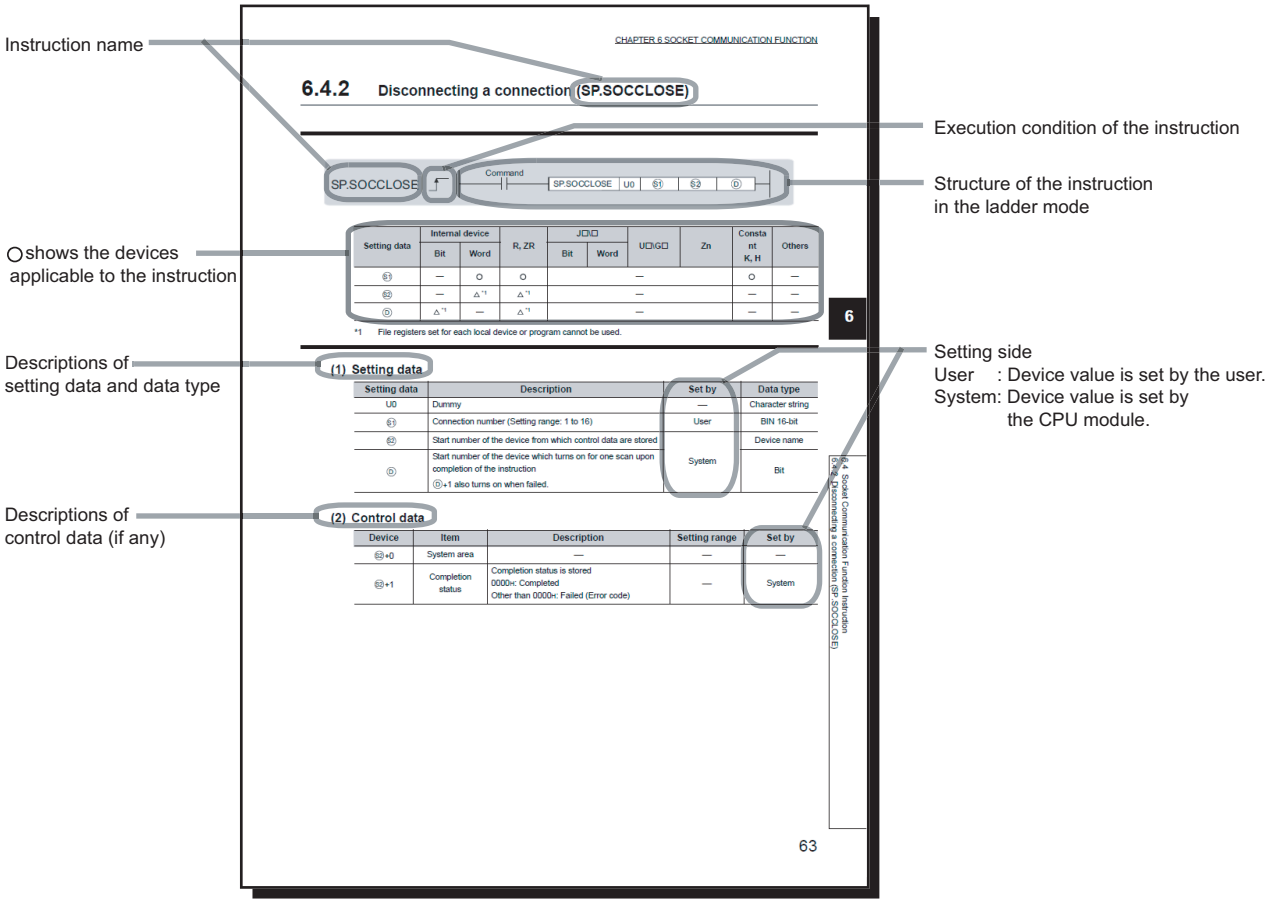


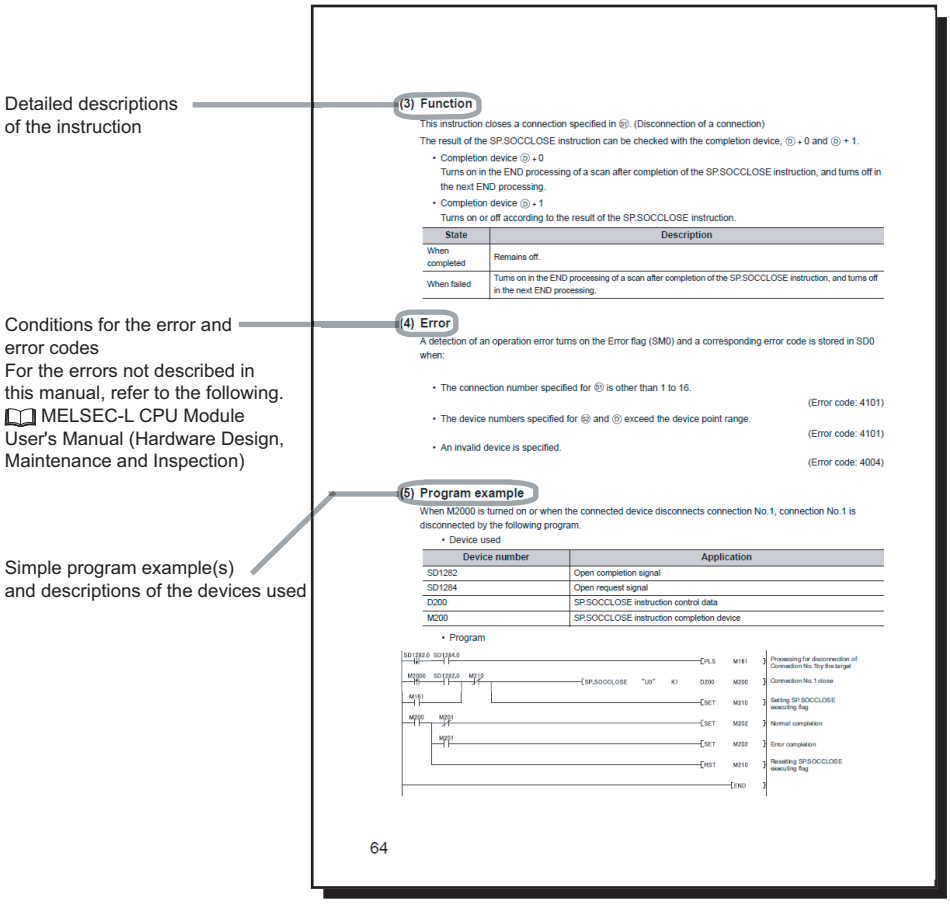
*1 The mouse operation example (for GX Works2) is provided below.



Pages describing instructions are organized as shown below.

The following illustration is for explanation purpose only, and should not be referred to as an actual documentation.





- 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 U□\G□	Index register Zn	Constant*4	Others*4
	Bit	Word		Bit	Word				
Applicable device*2	X, Y, M, L, SM, F, B, SB, FX, FY *3	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

*2 For details on each device, refer to the following.
MELSEC-L CPU Module User's Manual (Function Explanation, Program Fundamentals)

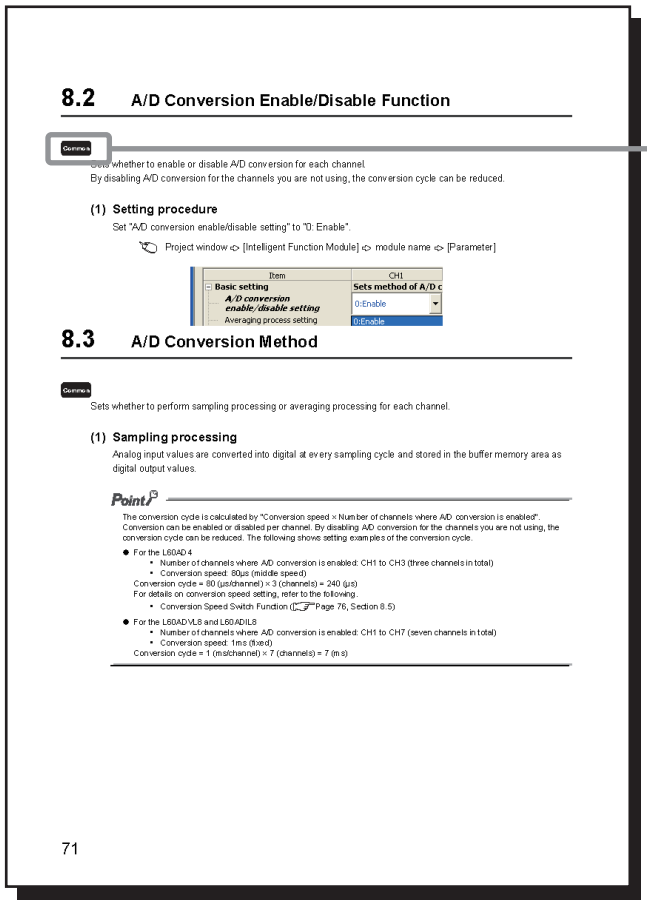
*3 FX and FY can be used for bit data only, and FD for word data only.

*4 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

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



8.2 A/D Conversion Enable/Disable Function

Common

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 c
A/D conversion enable/disable setting	0:Enable
Averaging process setting	0:Enable

8.3 A/D Conversion Method

Common

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

(1) Sampling processing

Analog input values are converted into digital at every sampling cycle and stored in the buffer memory area as digital output values.

Point

The conversion cycle is calculated by "Conversion speed × Number of channels where A/D conversion is enabled". Conversion can be enabled or disabled per channel. By disabling A/D conversion for the channels you are not using, the conversion cycle can be reduced. The following shows setting examples of the conversion cycle.

- For the L60AD4
  - Number of channels where A/D conversion is enabled: CH1 to CH3 (three channels in total)
  - Conversion speed: 80μs (middle speed)

Conversion cycle = 80 (μs/channel) × 3 (channels) = 240 (μs)
For details on conversion speed setting, refer to the following.

- Conversion Speed Switch Function (Page 76, Section 8.5)

- For the L60ADVL8 and L60ADIL8
  - Number of channels where A/D conversion is enabled: CH1 to CH7 (seven channels in total)
  - Conversion speed: 1ms (fixed)

Conversion cycle = 1 (ms/channel) × 7 (channels) = 7 (ms)

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Each icon indicates the available module.

The meaning of each icon is as follows.

Icon	Description
Common	The corresponding buffer memory area, I/O signal, or function is common to the A/D converter modules regardless of the model.
AD4	The corresponding buffer memory area, I/O signal, or function is for the L60AD4.
ADVL8	The corresponding buffer memory area, I/O signal, or function is for the L60ADVL8.
ADIL8	The corresponding buffer memory area, I/O signal, or function is for the L60ADIL8.

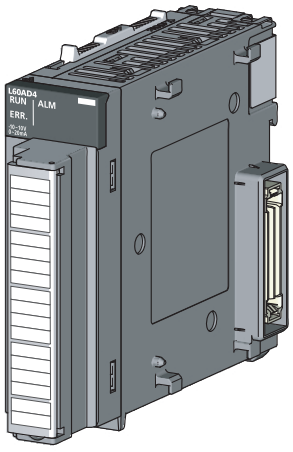
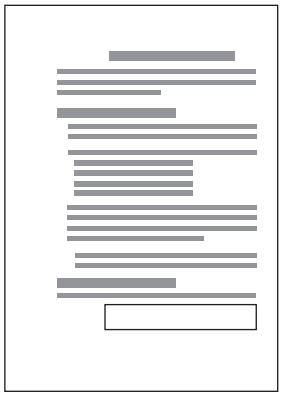
TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
A/D converter module	A generic term for the L60AD4, L60ADVL8, and L60ADIL8
Buffer memory	A memory in an intelligent function module, where data (such as setting values and monitoring values) exchanged with a CPU module are stored
Display unit	A liquid crystal display to be attached to the CPU module
Factory default setting	A 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 Configurator-AD	A setting and monitoring tool added in GX Developer (for A/D converter modules)
GX Developer	The product name of the software package for the MELSEC programmable controllers
GX Works2	
Head module	The abbreviation for the LJ72GF15-T2 CC-Link IE Field Network head module
L60AD4	The abbreviation for the L60AD4 analog-digital converter module
L60ADIL8	The abbreviation for the L60ADIL8 analog-digital converter module
L60ADVL8	The abbreviation for the L60ADVL8 analog-digital converter module
Normal mode	The drive modes set in the switch setting window. Note that the normal mode is displayed as "Normal (A/D Converter Processing, D/A Converter Processing) Mode" on the programming tool.
Offset/gain setting mode	
Programming tool	A generic term for GX Works2 and GX Developer
Switch setting	A generic term for the setting items in the window that is displayed by double-clicking "Switch Setting" of the specified module on the project window of GX Works2
User range setting	An analog input range where a user can set any values. To use this range, the offset and gain values have to be set.
Watchdog timer error	An error that occurs if the internal processing of the A/D converter module fails. The module monitors its own internal processing by using the watchdog timer.

PACKING LIST

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

A/D converter module	
	
A/D converter module	Before Using the Product

CHAPTER 1 A/D CONVERTER MODULE

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

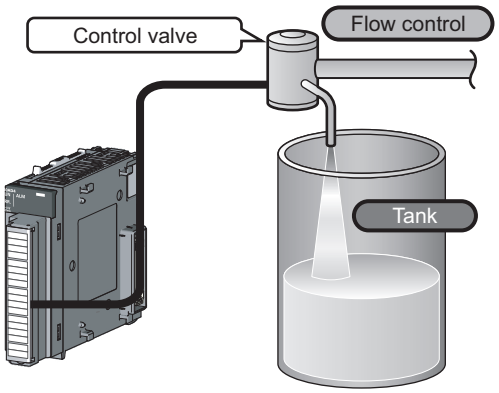
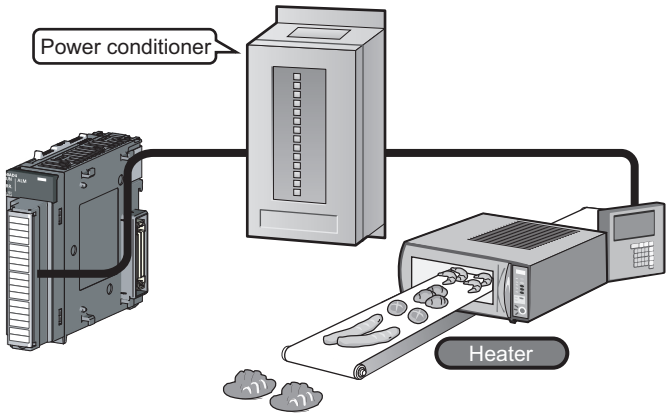
1.1 Application

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

1.2 Features

(1) Common features of the A/D converter module

(a) Comparing/monitoring the measurement target

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

(b) Easy setting with GX Works2

Programming is reduced since the initial setting or auto refresh setting can be configured on the screen. In addition, setting status and operation status of modules can be checked easily.

(2) Features of the L60AD4

(a) Response by high-speed conversion

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

(b) Detailed control by high resolution

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

(c) 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).

(d) Operation of digital output values

The shift function, digital clipping function, and difference conversion function, as well as the scaling function, can represent the digital output value in a numeric value easy to understand according to the use environment.

(e) Logging function

An analysis of data collected by logging function increases maintainability of used system.

(f) Flow amount integration function

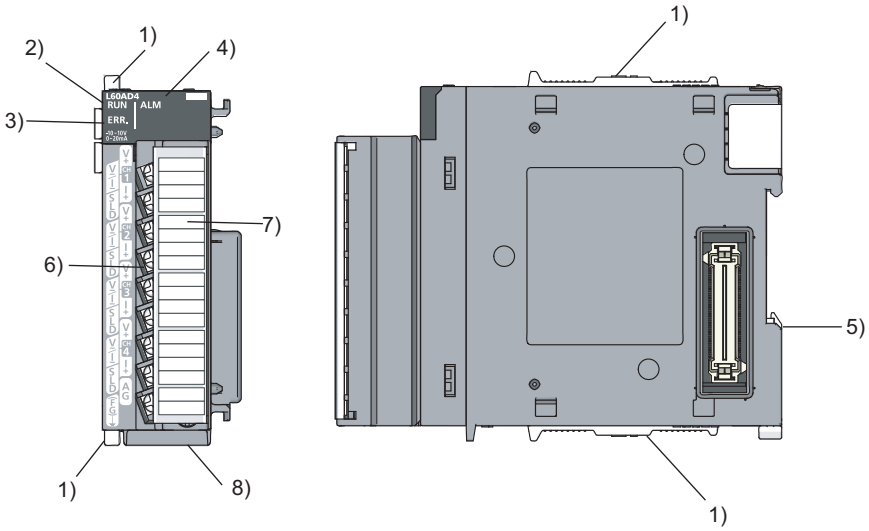
The flow amount integration function executes the integral processing of input (instantaneous flow amount) from a flow meter and easily calculates the flow amount in a certain period. By registering/outputting the calculated flow amount, system operation can be improved and man-hours for programming can be reduced.

(3) Features of the L60ADVL8 and L60ADIL8

The L60ADVL8 and L60ADIL8 have the same basic function as that of the L60AD4, and have the analog input capability twice as that of the L60AD4 (eight channels). This reduces the number of analog input modules used, lowers the cost, and saves the spaces in the system that uses a large number of analog inputs.

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[*2] Off: The module is operating normally.
5)	DIN rail hook	A hook used to mount the module to a DIN rail
6)	Terminal block[*3]	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 179, Section 11.4)

*2 Alarm Code List (Page 183, Section 11.5)

*3 Terminal Block for the signal assignment of the terminal blockPage 46, Section 6.2)

Memo

CHAPTER 3 SPECIFICATIONS

This chapter describes general specifications, performance specifications, function list, list of I/O signals and list of buffer memory address.

3.1 General Specifications

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

The manual "Safety Guidelines", the manual supplied with the a CPU module or head module

3.2 Performance Specifications

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

(1) L60AD4

Item		Model			
		L60AD4			
Number of analog input channels		4 channels			
Analog input	Voltage	-10 to 10 VDC (input resistance 1M Ω)			
	Current	0 to 20mADC (input resistance 250 Ω)			
Digital output	Digital output value	-20480 to 20479			
	When using the scaling function	-32768 to 32767			
I/O characteristics, resolution[*1]		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
			1 to 5V (Extended mode)	-5000 to 22500	200μV
			User range setting	-20000 to 20000	307μV[*2]
		Current	0 to 20mA	0 to 20000	1000nA
			4 to 20mA		800nA
			4 to 20mA (Extended mode)	-5000 to 22500	800nA
			User range setting	-20000 to 20000	1230nA[*2]
Accuracy (accuracy for the maximum value of the digital output value)[*3]	Ambient temperature 25±5°C	Within ±0.1% (±20digit)			
	Ambient temperature 0 to 55°C	Within ±0.2% (±40digit)			
Conversion speed[*4*5*6]		High-speed: 20μs/channel Medium speed: 80μs/channel Low speed: 1ms/channel			
Absolute maximum input		Voltage: ±15V, Current: 30mA[*7]			
Offset/gain setting count[*8]		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)			
External interface		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 For details on the I/O conversion characteristics, refer to the following.
I/O conversion characteristic of A/D conversion (Page 235, Appendix 3)

*2 Maximum resolution in the user range setting.

*3 Except when receiving noise influence.

*4 The default value is 80μs/channel.

*5 The logging function can be used only in the middle speed (80μs/channel) or low speed (1ms/channel).

*6 The flow amount integration function can be used only in the low speed (1ms/channel).

*7 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.

*8 If the number of offset/gain settings exceeds 50000 times, an error (error code: 170) occurs.

(2) L60ADVL8

<table>
<tr><th colspan="2" rowspan="2">Item</th><th colspan="4">Model</th></tr>
<tr><th colspan="4">L60ADVL8</th></tr>
<tr><td colspan="2">Number of analog input channels</td><td colspan="4">8 channels</td></tr>
<tr><td>Analog input</td><td>Voltage</td><td colspan="4">-10 to 10 VDC (input resistance 1.8M Ω)</td></tr>
<tr><td rowspan="2">Digital output</td><td>Digital output value</td><td colspan="4">-16384 to 16383</td></tr>
<tr><td>When using the scaling function</td><td colspan="4">-32768 to 32767</td></tr>
<tr><td colspan="2" rowspan="8">I/O characteristics, resolution*1</td><td colspan="2">Analog input range</td><td>Digital output value</td><td>Resolution</td></tr>
<tr><td rowspan="6">Voltage</td><td>0 to 10V</td><td>0 to 16000</td><td>625μV</td></tr>
<tr><td>0 to 5V</td><td rowspan="2">0 to 8000</td><td>625μV</td></tr>
<tr><td>1 to 5V</td><td>500μV</td></tr>
<tr><td>-10 to 10V</td><td>-16000 to 16000</td><td>625μV</td></tr>
<tr><td>1 to 5V (Extended mode)</td><td>-2000 to 9000</td><td>500μV</td></tr>
<tr><td>User range setting</td><td>-8000 to 8000</td><td>414μV*2</td></tr>
<tr><td colspan="2" rowspan="8">Accuracy
(accuracy for the maximum value of the digital output value)*3</td><td colspan="2" rowspan="2">Analog input range</td><td colspan="2">Ambient temperature</td></tr>
<tr><td>25±5°C</td><td>0 to 55°C</td></tr>
<tr><td rowspan="6">Voltage</td><td>0 to 10V</td><td>Within ±0.2% (±32digit)</td><td>Within ±1% (±160digit)</td></tr>
<tr><td>0 to 5V</td><td rowspan="2">Within ±0.2% (±16digit)</td><td rowspan="2">Within ±1% (±80digit)</td></tr>
<tr><td>1 to 5V</td></tr>
<tr><td>-10 to 10V</td><td>Within ±0.2% (±32digit)</td><td>Within ±1% (±160digit)</td></tr>
<tr><td>1 to 5V (Extended mode)</td><td>Within ±0.2% (±16digit)</td><td>Within ±1% (±80digit)</td></tr>
<tr><td colspan="2">Conversion speed</td><td colspan="4">1ms/channel</td></tr>
<tr><td colspan="2">Absolute maximum input</td><td colspan="4">Voltage: ±15V</td></tr>
<tr><td colspan="2">Offset/gain setting count*4</td><td colspan="4">Up to 10000 counts</td></tr>
<tr><td colspan="2">Isolation method</td><td colspan="4">Between input terminals and programmable controller power supply: photocoupler isolation
Between input channels: no isolation</td></tr>
<tr><td colspan="2">Dielectric withstand voltage</td><td colspan="4">Between input terminals and programmable controller power supply: 500VACrms for 1 minute</td></tr>
<tr><td colspan="2">Insulation resistance</td><td colspan="4">Between input terminals and programmable controller power supply: 500VDC 10MΩ or higher</td></tr>
<tr><td colspan="2">Number of occupied I/O points</td><td colspan="4">16 points (I/O assignment: Intelligent 16 points)</td></tr>
<tr><td colspan="2">External interface</td><td colspan="4">18-point terminal block</td></tr>
<tr><td colspan="2">Applicable wire size</td><td colspan="4">0.3 to 0.75mm^2</td></tr>
<tr><td colspan="2">Applicable solderless terminal</td><td colspan="4">R1.25-3 (solderless terminals with sleeve are not usable)</td></tr>
<tr><td colspan="2">Internal current consumption (5VDC)</td><td colspan="4">0.20A</td></tr>
<tr><td colspan="2">Weight</td><td colspan="4">0.19kg</td></tr>
</table>

*1 For details on the I/O conversion characteristics, refer to the following.
I/O conversion characteristic of A/D conversion (☞Page 235, Appendix 3)

*2 Maximum resolution in the user range setting.

*3 Except when receiving noise influence.

*4 If the number of offset/gain settings exceeds 10000 times, an error (error code: 170) occurs.

(3) L60ADIL8

Item		Model			
		L60ADIL8			
Number of analog input channels		8 channels			
Analog input	Current	0 to 20mADC (input resistance 250 Ω)			
Digital output	Digital output value	-8192 to 8192			
	When using the scaling function	-32768 to 32767			
I/O characteristics, resolution[*1]		Analog input range		Digital output value	Resolution
		Current	0 to 20mA	0 to 8000	2500nA
			4 to 20mA		2000nA
			4 to 20mA (Extended mode)	-2000 to 9000	2500nA
			User range setting	-8000 to 8000	1660nA[*2]
Accuracy (accuracy for the maximum value of the digital output value)[*3]		Analog input range		Ambient temperature	
				25±5°C	0 to 55°C
		Current	0 to 20mA	Within ±0.2% (±16digit)	Within ±1% (±80digit)
			4 to 20mA		
			4 to 20mA (Extended mode)		
Conversion speed		1ms/channel			
Absolute maximum input		Current: 30mA[*4]			
Offset/gain setting count[*5]		Up to 10000 counts			
Isolation method		Between input terminals and programmable controller power supply: photocoupler isolation Between input channels: no isolation			
Dielectric withstand voltage		Between input terminals and programmable controller power supply: 500VACrms for 1 minute			
Insulation resistance		Between input terminals and programmable controller power supply: 500VDC 10MΩ or higher			
Number of occupied I/O points		16 points (I/O assignment: Intelligent 16 points)			
External interface		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)		0.21A			
Weight		0.19kg			

*1 For details on the I/O conversion characteristics, refer to the following.
I/O conversion characteristic of A/D conversion (☞Page 235, Appendix 3)

*2 Maximum resolution in the user range setting.

*3 Except when receiving noise influence.

*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.

*5 If the number of offset/gain settings exceeds 10000 times, an error (error code: 170) occurs.

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 or the head module.

For the maximum number of parameters that can be set in the CPU module or the head module (maximum number of parameter settings), refer to the following.

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

MELSEC-L CC-Link IE Field Network Head Module User's Manual

(1) Number of A/D converter module parameters

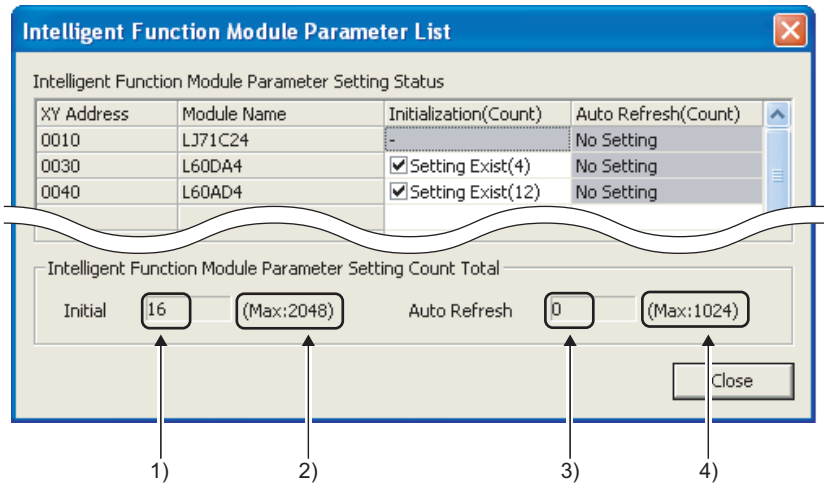
For A/D converter modules, the following number of parameters can be set per module.

Target module	Initial setting	Auto refresh setting
L60AD4	12	75 (maximum number of settings)
L60ADVL8, L60ADIL8	8	37 (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]



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	Applicable model		Reference
				L60AD4	L60ADVL8, L60ADIL8	
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 69, Section 8.2
A/D conversion method	Sampling processing		Analog input values are converted into digital at every sampling cycle and stored in the buffer memory as digital output values.	○	○	Page 69, Section 8.3 (1)
	Averaging processing	Time average	A/D conversion is performed for a set period of time and averaging processing is performed on the total value excluding the maximum and the minimum values. The values obtained in averaging processing are stored in the buffer memory. The number of processing times within a set period of time changes depending on the number of channels where A/D conversion is enabled.	○	○	Page 70, Section 8.3 (2) (a)
		Count average	A/D conversions are performed a set number of times and averaging processing is performed on the total value excluding the maximum and the minimum values. The values obtained in averaging processing are stored in the buffer memory. The time taken for the mean value calculated through average processing to be stored in the buffer memory changes depending on the number of channels where A/D conversion is enabled.	○	○	Page 71, Section 8.3 (2) (b)
		Moving average	The average of a specified number of digital output values is calculated at every sampling cycle and is stored in the buffer memory. Because the target set of values for averaging processing shifts to another to involve a subsequent value at every sampling processing, the latest digital output values can be always obtained.	○	○	Page 71, Section 8.3 (2) (c)
Range switching function			The input range to use can be selected from the following ranges: • Factory default range (4 to 20mA, 0 to 20mA, 1 to 5V, 0 to 5V, -10 to 10V, 0 to 10V) • User range • Extended mode range (4 to 20mA (Extended mode), 1 to 5V (Extended mode))	○	○	Page 54, Section 7.2
Conversion speed switch function			The conversion speed can be selected from 20μs, 80μs or 1ms.	○	×	Page 75, Section 8.5
Input range extension function			This function extends the input range of 4 to 20mA and that of 1 to 5V. By combining this function with the input signal error detection function, simple disconnection detection can be executed.	○	○	Page 74, Section 8.4
Maximum value/minimum value hold function			This function stores the maximum digital value and minimum digital output value in the buffer memory for each channel. When an operation function such as the scaling function is used, the maximum and minimum scaling values (digital operation values) are stored.	○	○	Page 76, Section 8.6
Input signal error detection function			This function outputs an alarm when the analog input value exceeds a preset range.	○	○	Page 77, Section 8.7
Input signal error detection extension function			The detection method of the input signal error detection function can be extended. Use this function to detect the input signal error only in the lower limit or upper limit, or to execute the disconnection detection.	○	○	Page 82, Section 8.8
Warning output function (process alarm)			This function outputs alarm when a digital output value is in the range set in advance. When an operation function such as the scaling function is used, the scaling value (digital operation value) is the target of detection.	○	○	Page 85, Section 8.9
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 88, Section 8.10
Shift function			The A/D converter module adds the set shifting amount to conversion value to the scaling value (digital operation value) and stores in the buffer memory. Fine adjustment can be performed easily when the system starts.	○	×	Page 94, Section 8.11

Item	Description	Applicable model		Reference
		L60AD4	L60ADVL8, L60ADIL8	
Digital clipping function	When the input voltage or current exceeds the input range, the maximum value of the scaling value (digital operation value) can be set to 20000, and the minimum value can be set to 0 or -20000.	○	×	Page 99, Section 8.12
Difference conversion function	This function subtracts the difference conversion reference value from the scaling value (digital operation value) and stores the acquired value in the buffer memory.	○	×	Page 103, Section 8.13
Logging function	This function logs the digital output value or scaling value (digital operation value). The data of 10000 points can be logged for each channel.	○	△ *1	Page 108, Section 8.14
Flow amount integration function	This function converts analog values that are input to the A/D converter module from a flow meter (a value obtained by converting the instantaneous flow amount to a voltage value or current value) into digital and integrates the digital values to calculate the flow amount in a certain period of time.	○	×	Page 123, Section 8.15
Error log function	This function stores errors and alarms that occurred in the A/D converter module in the buffer memory. Sixteen errors and alarms in total can be stored.	○	○	Page 133, Section 8.16
Module error collection function	This function collects errors and alarms that occurred in the A/D converter module and stores to the CPU module.	○	○	Page 136, Section 8.17
Error clear function	Clearing the error from the system monitor at error occurrence is possible.	○	○	Page 137, Section 8.18
Saving and restoring offset/gain values	The offset/gain value of the user range can be saved or restored.	○	○	Page 138, Section 8.19
Offset/gain setting	This function compensates for errors in digital output values.	○	○	Page 60, Section 7.5

*1 To use the logging function with the L60ADVL8 or L60ADIL8, use the data logging function of the CPU module.
For the data logging function of the CPU module, refer to the following.
QnUDVCPU/LCPU User's Manual (Data Logging Function)

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 192, 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 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".
- Do not use the "Use prohibited" signals shown above because the system uses them.
  If users use (turn on) the signals, the functions of the A/D converter module cannot be guaranteed.
- The I/O signals are common in the A/D converter modules.

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 199, Appendix 2)

Point

Do not write data to the system areas and read-only areas 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	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
0	0H	A/D conversion enable/disable setting		0000H	R/W	○
1	1H	CH1 Time Average/ Count Average/Moving Average		0	R/W	○
2	2H	CH2 Time Average/ Count Average/Moving Average		0	R/W	○
3	3H	CH3 Time Average/ Count Average/Moving Average		0	R/W	○
4	4H	CH4 Time Average/ Count Average/Moving Average		0	R/W	○
5	5H	System area	CH5 Time Average/ Count Average/Moving Average	0	R/W	○
6	6H	System area	CH6 Time Average/ Count Average/Moving Average	0	R/W	○
7	7H	System area	CH7 Time Average/ Count Average/Moving Average	0	R/W	○
8	8H	System area	CH8 Time Average/ Count Average/Moving Average	0	R/W	○
9	9H	Averaging process setting (used to replace Q64AD, Q68ADV, Q68ADI)		0000H	R/W	○
10	AH	A/D conversion completed flag		0000H	R	—
11	BH	CH1 Digital output value		0	R	—
12	CH	CH2 Digital output value		0	R	—
13	DH	CH3 Digital output value		0	R	—
14	EH	CH4 Digital output value		0	R	—
15	FH	System area	CH5 Digital output value	0	R	—
16	10H	System area	CH6 Digital output value	0	R	—
17	11H	System area	CH7 Digital output value	0	R	—
18	12H	System area	CH8 Digital output value	0	R	—
19	13H	Latest error code		0	R	—
20	14H	Setting range (CH1 to CH4)		0000H	R	—
21	15H	System area	Setting range (CH5 to CH8)	0000H	R	—
22	16H	Offset/gain setting mode Offset specification		0000H	R/W	—
23	17H	Offset/gain setting mode Gain specification		0000H	R/W	—
24	18H	Averaging process setting (CH1 to CH4)		0000H	R/W	○
25	19H	System area	Averaging process setting (CH5 to CH8)	0000H	R/W	○
26	1AH	Conversion speed setting	System area	0001H	R/W	○
27	1BH	Input signal error detection extension setting (CH1 to CH4)		0000H	R/W	○

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
28	1CH	System area	Input signal error detection extension setting (CH5 to CH8)	0000H	R/W	○
29	1DH	Digital clipping enable/disable setting	System area	000FH	R/W	○
30	1EH	CH1 Maximum value		0	R	—
31	1FH	CH1 Minimum value		0	R	—
32	20H	CH2 Maximum value		0	R	—
33	21H	CH2 Minimum value		0	R	—
34	22H	CH3 Maximum value		0	R	—
35	23H	CH3 Minimum value		0	R	—
36	24H	CH4 Maximum value		0	R	—
37	25H	CH4 Minimum value		0	R	—
38	26H	System area	CH5 Maximum value	0	R	—
39	27H	System area	CH5 Minimum value	0	R	—
40	28H	System area	CH6 Maximum value	0	R	—
41	29H	System area	CH6 Minimum value	0	R	—
42	2AH	System area	CH7 Maximum value	0	R	—
43	2BH	System area	CH7 Minimum value	0	R	—
44	2CH	System area	CH8 Maximum value	0	R	—
45	2DH	System area	CH8 Minimum value	0	R	—
46	2EH	System area		—	—	—
47	2FH	Input signal error detection setting		000FH (AD4) 00FFH (ADL8) *3	R/W	○
48	30H	Warning output setting		000FH (AD4) 00FFH (ADL8) *3	R/W	○
49	31H	Input signal error detection flag		0000H	R	—
50	32H	Warning output flag (Process alarm)		0000H	R	—
51	33H	System area		—	—	—
52	34H					
53	35H	Scaling enable/disable setting		000FH (AD4) 00FFH (ADL8) *3	R/W	○
54	36H	CH1 Scaling value (digital operation value)		0	R	—
55	37H	CH2 Scaling value (digital operation value)		0	R	—
56	38H	CH3 Scaling value (digital operation value)		0	R	—
57	39H	CH4 Scaling value (digital operation value)		0	R	—
58	3AH	System area	CH5 Scaling value (digital operation value)	0	R	—
59	3BH	System area	CH6 Scaling value (digital operation value)	0	R	—
60	3CH	System area	CH7 Scaling value (digital operation value)	0	R	—
61	3DH	System area	CH8 Scaling value (digital operation value)	0	R	—

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
62	3EH	CH1 Scaling lower limit value		0	R/W	○
63	3FH	CH1 Scaling upper limit value		0	R/W	○
64	40H	CH2 Scaling lower limit value		0	R/W	○
65	41H	CH2 Scaling upper limit value		0	R/W	○
66	42H	CH3 Scaling lower limit value		0	R/W	○
67	43H	CH3 Scaling upper limit value		0	R/W	○
68	44H	CH4 Scaling lower limit value		0	R/W	○
69	45H	CH4 Scaling upper limit value		0	R/W	○
70	46H	System area	CH5 Scaling lower limit value	0	R/W	○
71	47H	System area	CH5 Scaling upper limit value	0	R/W	○
72	48H	System area	CH6 Scaling lower limit value	0	R/W	○
73	49H	System area	CH6 Scaling upper limit value	0	R/W	○
74	4AH	System area	CH7 Scaling lower limit value	0	R/W	○
75	4BH	System area	CH7 Scaling upper limit value	0	R/W	○
76	4CH	System area	CH8 Scaling lower limit value	0	R/W	○
77	4DH	System area	CH8 Scaling upper limit value	0	R/W	○
78 to 85	4EH to 55H	System area		—	—	—
86	56H	CH1 Process alarm lower lower limit value		0	R/W	○
87	57H	CH1 Process alarm lower upper limit value		0	R/W	○
88	58H	CH1 Process alarm upper lower limit value		0	R/W	○
89	59H	CH1 Process alarm upper upper limit value		0	R/W	○
90	5AH	CH2 Process alarm lower lower limit value		0	R/W	○
91	5BH	CH2 Process alarm lower upper limit value		0	R/W	○
92	5CH	CH2 Process alarm upper lower limit value		0	R/W	○
93	5DH	CH2 Process alarm upper upper limit value		0	R/W	○
94	5EH	CH3 Process alarm lower lower limit value		0	R/W	○
95	5FH	CH3 Process alarm lower upper limit value		0	R/W	○
96	60H	CH3 Process alarm upper lower limit value		0	R/W	○
97	61H	CH3 Process alarm upper upper limit value		0	R/W	○
98	62H	CH4 Process alarm lower lower limit value		0	R/W	○
99	63H	CH4 Process alarm lower upper limit value		0	R/W	○
100	64H	CH4 Process alarm upper lower limit value		0	R/W	○
101	65H	CH4 Process alarm upper upper limit value		0	R/W	○
102	66H	System area	CH5 Process alarm lower lower limit value	0	R/W	○
103	67H	System area	CH5 Process alarm lower upper limit value	0	R/W	○
104	68H	System area	CH5 Process alarm upper lower limit value	0	R/W	○

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
105	69H	System area	CH5 Process alarm upper upper limit value	0	R/W	○
106	6AH	System area	CH6 Process alarm lower lower limit value	0	R/W	○
107	6BH	System area	CH6 Process alarm lower upper limit value	0	R/W	○
108	6CH	System area	CH6 Process alarm upper lower limit value	0	R/W	○
109	6DH	System area	CH6 Process alarm upper upper limit value	0	R/W	○
110	6EH	System area	CH7 Process alarm lower lower limit value	0	R/W	○
111	6FH	System area	CH7 Process alarm lower upper limit value	0	R/W	○
112	70H	System area	CH7 Process alarm upper lower limit value	0	R/W	○
113	71H	System area	CH7 Process alarm upper upper limit value	0	R/W	○
114	72H	System area	CH8 Process alarm lower lower limit value	0	R/W	○
115	73H	System area	CH8 Process alarm lower upper limit value	0	R/W	○
116	74H	System area	CH8 Process alarm upper lower limit value	0	R/W	○
117	75H	System area	CH8 Process alarm upper upper limit value	0	R/W	○
118 to 141	76H to 8DH	System area		—	—	—
142	8EH	CH1 Input signal error detection setting value		50	R/W	○
143	8FH	CH2 Input signal error detection setting value		50	R/W	○
144	90H	CH3 Input signal error detection setting value		50	R/W	○
145	91H	CH4 Input signal error detection setting value		50	R/W	○
146	92H	System area	CH5 Input signal error detection setting value	50	R/W	○
147	93H	System area	CH6 Input signal error detection setting value	50	R/W	○
148	94H	System area	CH7 Input signal error detection setting value	50	R/W	○
149	95H	System area	CH8 Input signal error detection setting value	50	R/W	○
150	96H	CH1 Shifting amount to conversion value	System area	0	R/W	—
151	97H	CH2 Shifting amount to conversion value	System area	0	R/W	—
152	98H	CH3 Shifting amount to conversion value	System area	0	R/W	—
153	99H	CH4 Shifting amount to conversion value	System area	0	R/W	—
154 to 157	9AH to 9DH	System area		—	—	—
158	9EH	Mode switching setting		0	R/W	○
159	9FH					
160 to 171	A0H to ABH	System area		—	—	—
172	ACH	CH1 Difference conversion trigger	System area	0	R/W	—
173	ADH	CH2 Difference conversion trigger	System area	0	R/W	—
174	AEH	CH3 Difference conversion trigger	System area	0	R/W	—

Address (decimal)	Address (hexadecimal)	Name		Default[*1]	Read/Write[*2]	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
175	AFH	CH4 Difference conversion trigger	System area	0	R/W	—
176 to 179	B0H to B3H	System area		—	—	—
180	B4H	CH1 Difference conversion reference value	System area	0	R	—
181	B5H	CH2 Difference conversion reference value	System area	0	R	—
182	B6H	CH3 Difference conversion reference value	System area	0	R	—
183	B7H	CH4 Difference conversion reference value	System area	0	R	—
184 to 189	B8H to BDH	System area		—	—	—
190	BEH	CH1 Difference conversion status flag	System area	0	R	—
191	BFH	CH2 Difference conversion status flag	System area	0	R	—
192	C0H	CH3 Difference conversion status flag	System area	0	R	—
193	C1H	CH4 Difference conversion status flag	System area	0	R	—
194 to 199	C2H to C7H	System area		—	—	—
200	C8H	Pass data classification setting	System area	0	R/W	○
201	C9H	System area		—	—	—
202	CAH	CH1 Industrial shipment settings offset value (L)	CH1 Industrial shipment settings offset value	0	R/W	—
203	CBH	CH1 Industrial shipment settings offset value (H)	CH1 Industrial shipment settings gain value	0	R/W	—
204	CCH	CH1 Industrial shipment settings gain value (L)	CH2 Industrial shipment settings offset value	0	R/W	—
205	CDH	CH1 Industrial shipment settings gain value (H)	CH2 Industrial shipment settings gain value	0	R/W	—
206	CEH	CH2 Industrial shipment settings offset value (L)	CH3 Industrial shipment settings offset value	0	R/W	—
207	CFH	CH2 Industrial shipment settings offset value (H)	CH3 Industrial shipment settings gain value	0	R/W	—
208	D0H	CH2 Industrial shipment settings gain value (L)	CH4 Industrial shipment settings offset value	0	R/W	—
209	D1H	CH2 Industrial shipment settings gain value (H)	CH4 Industrial shipment settings gain value	0	R/W	—
210	D2H	CH3 Industrial shipment settings offset value (L)	CH5 Industrial shipment settings offset value	0	R/W	—
211	D3H	CH3 Industrial shipment settings offset value (H)	CH5 Industrial shipment settings gain value	0	R/W	—
212	D4H	CH3 Industrial shipment settings gain value (L)	CH6 Industrial shipment settings offset value	0	R/W	—
213	D5H	CH3 Industrial shipment settings gain value (H)	CH6 Industrial shipment settings gain value	0	R/W	—
214	D6H	CH4 Industrial shipment settings offset value (L)	CH7 Industrial shipment settings offset value	0	R/W	—
215	D7H	CH4 Industrial shipment settings offset value (H)	CH7 Industrial shipment settings gain value	0	R/W	—
216	D8H	CH4 Industrial shipment settings gain value (L)	CH8 Industrial shipment settings offset value	0	R/W	—
217	D9H	CH4 Industrial shipment settings gain value (H)	CH8 Industrial shipment settings gain value	0	R/W	—

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
218	DAH	CH1 User range settings offset value (L)	CH1 User range settings offset value	0	R/W	—
219	DBH	CH1 User range settings offset value (H)	CH1 User range settings gain value	0	R/W	—
220	DCH	CH1 User range settings gain value (L)	CH2 User range settings offset value	0	R/W	—
221	DDH	CH1 User range settings gain value (H)	CH2 User range settings gain value	0	R/W	—
222	DEH	CH2 User range settings offset value (L)	CH3 User range settings offset value	0	R/W	—
223	DFH	CH2 User range settings offset value (H)	CH3 User range settings gain value	0	R/W	—
224	E0H	CH2 User range settings gain value (L)	CH4 User range settings offset value	0	R/W	—
225	E1H	CH2 User range settings gain value (H)	CH4 User range settings gain value	0	R/W	—
226	E2H	CH3 User range settings offset value (L)	CH5 User range settings offset value	0	R/W	—
227	E3H	CH3 User range settings offset value (H)	CH5 User range settings gain value	0	R/W	—
228	E4H	CH3 User range settings gain value (L)	CH6 User range settings offset value	0	R/W	—
229	E5H	CH3 User range settings gain value (H)	CH6 User range settings gain value	0	R/W	—
230	E6H	CH4 User range settings offset value (L)	CH7 User range settings offset value	0	R/W	—
231	E7H	CH4 User range settings offset value (H)	CH7 User range settings gain value	0	R/W	—
232	E8H	CH4 User range settings gain value (L)	CH8 User range settings offset value	0	R/W	—
233	E9H	CH4 User range settings gain value (H)	CH8 User range settings gain value	0	R/W	—
234 to 999	EAH to 3E7H	System area		—	—	—
1000	3E8H	CH1 Logging enable/disable setting	System area	1	R/W	○
1001	3E9H	CH2 Logging enable/disable setting	System area	1	R/W	○
1002	3EAH	CH3 Logging enable/disable setting	System area	1	R/W	○
1003	3EBH	CH4 Logging enable/disable setting	System area	1	R/W	○
1004 to 1007	3ECH to 3EFH	System area		—	—	—
1008	3F0H	CH1 Logging hold request	System area	0	R/W	—
1009	3F1H	CH2 Logging hold request	System area	0	R/W	—
1010	3F2H	CH3 Logging hold request	System area	0	R/W	—
1011	3F3H	CH4 Logging hold request	System area	0	R/W	—
1012 to 1015	3F4H to 3F7H	System area		—	—	—
1016	3F8H	CH1 Logging hold flag	System area	0	R	—
1017	3F9H	CH2 Logging hold flag	System area	0	R	—
1018	3FAH	CH3 Logging hold flag	System area	0	R	—
1019	3FBH	CH4 Logging hold flag	System area	0	R	—
1020 to 1023	3FCH to 3FFH	System area		—	—	—
1024	400H	CH1 Logging data setting	System area	1	R/W	○
1025	401H	CH2 Logging data setting	System area	1	R/W	○

Address (decimal)	Address (hexadecimal)	Name		Default[*1]	Read/Write[*2]	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
1026	402H	CH3 Logging data setting	System area	1	R/W	○
1027	403H	CH4 Logging data setting	System area	1	R/W	○
1028 to 1031	404H to 407H	System area		—	—	—
1032	408H	CH1 Logging cycle setting value	System area	4	R/W	○
1033	409H	CH2 Logging cycle setting value	System area	4	R/W	○
1034	40AH	CH3 Logging cycle setting value	System area	4	R/W	○
1035	40BH	CH4 Logging cycle setting value	System area	4	R/W	○
1036 to 1039	40CH to 40FH	System area		—	—	—
1040	410H	CH1 Logging cycle unit setting	System area	1	R/W	○
1041	411H	CH2 Logging cycle unit setting	System area	1	R/W	○
1042	412H	CH3 Logging cycle unit setting	System area	1	R/W	○
1043	413H	CH4 Logging cycle unit setting	System area	1	R/W	○
1044 to 1047	414H to 417H	System area		—	—	—
1048	418H	CH1 Logging points after trigger	System area	5000	R/W	○
1049	419H	CH2 Logging points after trigger	System area	5000	R/W	○
1050	41AH	CH3 Logging points after trigger	System area	5000	R/W	○
1051	41BH	CH4 Logging points after trigger	System area	5000	R/W	○
1052 to 1055	41CH to 41FH	System area		—	—	—
1056	420H	CH1 Level trigger condition setting	System area	0	R/W	○
1057	421H	CH2 Level trigger condition setting	System area	0	R/W	○
1058	422H	CH3 Level trigger condition setting	System area	0	R/W	○
1059	423H	CH4 Level trigger condition setting	System area	0	R/W	○
1060 to 1063	424H to 427H	System area		—	—	—
1064	428H	CH1 Trigger data	System area	54	R/W	○
1065	429H	CH2 Trigger data	System area	55	R/W	○
1066	42AH	CH3 Trigger data	System area	56	R/W	○
1067	42BH	CH4 Trigger data	System area	57	R/W	○
1068 to 1071	42CH to 42FH	System area		—	—	—
1072	430H	Level data 0	System area	0	R/W	—
1073	431H	Level data 1	System area	0	R/W	—
1074	432H	Level data 2	System area	0	R/W	—
1075	433H	Level data 3	System area	0	R/W	—
1076	434H	Level data 4	System area	0	R/W	—
1077	435H	Level data 5	System area	0	R/W	—
1078	436H	Level data 6	System area	0	R/W	—
1079	437H	Level data 7	System area	0	R/W	—
1080	438H	Level data 8	System area	0	R/W	—
1081	439H	Level data 9	System area	0	R/W	—
1082	43AH	CH1 Trigger setting value	System area	0	R/W	○
1083	43BH	CH2 Trigger setting value	System area	0	R/W	○

Address (decimal)	Address (hexadecimal)	Name				Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4			L60ADVL8, L60ADIL8			
1084	43CH	CH3 Trigger setting value			System area	0	R/W	○
1085	43DH	CH4 Trigger setting value			System area	0	R/W	○
1086 to 1089	43EH to 441H	System area				—	—	—
1090	442H	CH1 Head pointer			System area	0	R	—
1091	443H	CH2 Head pointer			System area	0	R	—
1092	444H	CH3 Head pointer			System area	0	R	—
1093	445H	CH4 Head pointer			System area	0	R	—
1094 to 1097	446H to 449H	System area				—	—	—
1098	44AH	CH1 Latest pointer			System area	0	R	—
1099	44BH	CH2 Latest pointer			System area	0	R	—
1100	44CH	CH3 Latest pointer			System area	0	R	—
1101	44DH	CH4 Latest pointer			System area	0	R	—
1102 to 1105	44EH to 451H	System area				—	—	—
1106	452H	CH1 Number of logging data			System area	0	R	—
1107	453H	CH2 Number of logging data			System area	0	R	—
1108	454H	CH3 Number of logging data			System area	0	R	—
1109	455H	CH4 Number of logging data			System area	0	R	—
1110 to 1113	456H to 459H	System area				—	—	—
1114	45AH	CH1 Trigger pointer			System area	0	R	—
1115	45BH	CH2 Trigger pointer			System area	0	R	—
1116	45CH	CH3 Trigger pointer			System area	0	R	—
1117	45DH	CH4 Trigger pointer			System area	0	R	—
1118 to 1121	45EH to 461H	System area				—	—	—
1122	462H	CH1 Logging cycle monitor value		(s)	System area	0	R	—
1123	463H			(ms)	System area	0	R	—
1124	464H			(μs)	System area	0	R	—
1125	465H	CH2 Logging cycle monitor value		(s)	System area	0	R	—
1126	466H			(ms)	System area	0	R	—
1127	467H			(μs)	System area	0	R	—
1128	468H	CH3 Logging cycle monitor value		(s)	System area	0	R	—
1129	469H			(ms)	System area	0	R	—
1130	46AH			(μs)	System area	0	R	—
1131	46BH	CH4 Logging cycle monitor value		(s)	System area	0	R	—
1132	46CH			(ms)	System area	0	R	—
1133	46DH			(μs)	System area	0	R	—
1134 to 1153	46EH to 481H	System area				—	—	—
1154	482H	CH1 Trigger detection time	First two digits of the year	Last two digits of the year	System area	0	R	—
1155	483H		Month	Day	System area	0	R	—
1156	484H		Hour	Minute	System area	0	R	—
1157	485H		Second	Day of the week	System area	0	R	—

Address (decimal)	Address (hexadecimal)	Name				Default[*1]	Read/Write[*2]	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4			L60ADVL8, L60ADIL8			
1158	486H	CH2 Trigger detection time	First two digits of the year	Last two digits of the year	System area	0	R	—
1159	487H		Month	Day	System area	0	R	—
1160	488H		Hour	Minute	System area	0	R	—
1161	489H		Second	Day of the week	System area	0	R	—
1162	48AH	CH3 Trigger detection time	First two digits of the year	Last two digits of the year	System area	0	R	—
1163	48BH		Month	Day	System area	0	R	—
1164	48CH		Hour	Minute	System area	0	R	—
1165	48DH		Second	Day of the week	System area	0	R	—
1166	48EH	CH4 Trigger detection time	First two digits of the year	Last two digits of the year	System area	0	R	—
1167	48FH		Month	Day	System area	0	R	—
1168	490H		Hour	Minute	System area	0	R	—
1169	491H		Second	Day of the week	System area	0	R	—
1170 to 1299	492H to 513H	System area				—	—	—
1300	514H	CH1 Flow amount integration enable/disable setting			System area	1	R/W	○
1301	515H	CH2 Flow amount integration enable/disable setting			System area	1	R/W	○
1302	516H	CH3 Flow amount integration enable/disable setting			System area	1	R/W	○
1303	517H	CH4 Flow amount integration enable/disable setting			System area	1	R/W	○
1304 to 1307	518H to 51BH	System area				—	—	—
1308	51CH	CH1 Integration cycle setting			System area	4	R/W	○
1309	51DH	CH2 Integration cycle setting			System area	4	R/W	○
1310	51EH	CH3 Integration cycle setting			System area	4	R/W	○
1311	51FH	CH4 Integration cycle setting			System area	4	R/W	○
1312 to 1315	520H to 523H	System area				—	—	—
1316	524H	CH1 Flow amount time unit setting			System area	0	R/W	○
1317	525H	CH2 Flow amount time unit setting			System area	0	R/W	○
1318	526H	CH3 Flow amount time unit setting			System area	0	R/W	○
1319	527H	CH4 Flow amount time unit setting			System area	0	R/W	○
1320 to 1323	528H to 52BH	System area				—	—	—
1324	52CH	CH1 Unit scaling setting			System area	0	R/W	○
1325	52DH	CH2 Unit scaling setting			System area	0	R/W	○
1326	52EH	CH3 Unit scaling setting			System area	0	R/W	○
1327	52FH	CH4 Unit scaling setting			System area	0	R/W	○
1328 to 1331	530H to 533H	System area				—	—	—
1332	534H	CH1 Integrated flow amount (L)			System area	0	R	—

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
1333	535H	CH1 Integrated flow amount (H)	System area	0	R	—
1334	536H	CH2 Integrated flow amount (L)	System area	0	R	—
1335	537H	CH2 Integrated flow amount (H)	System area	0	R	—
1336	538H	CH3 Integrated flow amount (L)	System area	0	R	—
1337	539H	CH3 Integrated flow amount (H)	System area	0	R	—
1338	53AH	CH4 Integrated flow amount (L)	System area	0	R	—
1339	53BH	CH4 Integrated flow amount (H)	System area	0	R	—
1340 to 1347	53CH to 543H	System area		—	—	—
1348	544H	CH1 Integration cycle monitor value	System area	0	R	—
1349	545H	CH2 Integration cycle monitor value	System area	0	R	—
1350	546H	CH3 Integration cycle monitor value	System area	0	R	—
1351	547H	CH4 Integration cycle monitor value	System area	0	R	—
1352 to 1355	548H to 54BH	System area		—	—	—
1356	54CH	CH1 Flow amount integration temporary stop request	System area	0	R/W	—
1357	54DH	CH2 Flow amount integration temporary stop request	System area	0	R/W	—
1358	54EH	CH3 Flow amount integration temporary stop request	System area	0	R/W	—
1359	54FH	CH4 Flow amount integration temporary stop request	System area	0	R/W	—
1360 to 1363	550H to 553H	System area		—	—	—
1364	554H	CH1 Flow amount integration temporary stop flag	System area	0	R	—
1365	555H	CH2 Flow amount integration temporary stop flag	System area	0	R	—
1366	556H	CH3 Flow amount integration temporary stop flag	System area	0	R	—
1367	557H	CH4 Flow amount integration temporary stop flag	System area	0	R	—
1368 to 1371	558H to 55BH	System area		—	—	—
1372	55CH	CH1 Integrated flow amount clear request	System area	0	R/W	—
1373	55DH	CH2 Integrated flow amount clear request	System area	0	R/W	—
1374	55EH	CH3 Integrated flow amount clear request	System area	0	R/W	—
1375	55FH	CH4 Integrated flow amount clear request	System area	0	R/W	—
1376 to 1379	560H to 563H	System area		—	—	—
1380	564H	CH1 Integrated flow amount clear flag	System area	0	R	—
1381	565H	CH2 Integrated flow amount clear flag	System area	0	R	—
1382	566H	CH3 Integrated flow amount clear flag	System area	0	R	—
1383	567H	CH4 Integrated flow amount clear flag	System area	0	R	—
1384 to 1699	568H to 6A3H	System area		—	—	—

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
1700	6A4H	System area	CH1 A/D conversion status	0	R	—
1701	6A5H	System area	CH2 A/D conversion status	0	R	—
1702	6A6H	System area	CH3 A/D conversion status	0	R	—
1703	6A7H	System area	CH4 A/D conversion status	0	R	—
1704	6A8H	System area	CH5 A/D conversion status	0	R	—
1705	6A9H	System area	CH6 A/D conversion status	0	R	—
1706	6AAH	System area	CH7 A/D conversion status	0	R	—
1707	6ABH	System area	CH8 A/D conversion status	0	R	—
1708	6ACH	System area		—	—	—
1709	6ADH					
1710	6AEH	System area	CH1 Analog input monitor	0	R	—
1711	6AFH	System area	CH1 Analog input monitor unit	0	R	—
1712	6B0H	System area	CH2 Analog input monitor	0	R	—
1713	6B1H	System area	CH2 Analog input monitor unit	0	R	—
1714	6B2H	System area	CH3 Analog input monitor	0	R	—
1715	6B3H	System area	CH3 Analog input monitor unit	0	R	—
1716	6B4H	System area	CH4 Analog input monitor	0	R	—
1717	6B5H	System area	CH4 Analog input monitor unit	0	R	—
1718	6B6H	System area	CH5 Analog input monitor	0	R	—
1719	6B7H	System area	CH5 Analog input monitor unit	0	R	—
1720	6B8H	System area	CH6 Analog input monitor	0	R	—
1721	6B9H	System area	CH6 Analog input monitor unit	0	R	—
1722	6BAH	System area	CH7 Analog input monitor	0	R	—
1723	6BBH	System area	CH7 Analog input monitor unit	0	R	—
1724	6BCH	System area	CH8 Analog input monitor	0	R	—
1725	6BDH	System area	CH8 Analog input monitor unit	0	R	—
1726 to 1799	6BEH to 707H	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

*3 (AD4) indicates the L60AD4. (ADL8) indicates the L60ADVL8 and L60ADIL8.

(2) Error history (Un\G1800 to Un\G4999)

This area is common to L60AD4, L60ADVL8, and L60ADIL8.

Address (decimal)	Address (hexadecimal)	Name				Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
1800	708H	Latest address of error history				0	R	—
1801 to 1809	709H to 711H	System area				—	—	—
1810	712H	No.1	Error code			0	R	—
1811	713H		Error time	First two digits of the year	Last two digits of the year	0	R	—
1812	714H			Month	Day	0	R	—
1813	715H			Hour	Minute	0	R	—
1814	716H			Second	Day of the week	0	R	—
1815 to 1819	717H to 71BH		System area			—	—	—
1820 to 1829	71CH to 725H	No.2	Same as No. 1					—
1830 to 1839	726H to 72FH	No.3	Same as No. 1					—
1840 to 1849	730H to 739H	No.4	Same as No. 1					—
1850 to 1859	73AH to 743H	No.5	Same as No. 1					—
1860 to 1869	744H to 74DH	No.6	Same as No. 1					—
1870 to 1879	74EH to 757H	No.7	Same as No. 1					—
1880 to 1889	758H to 761H	No.8	Same as No. 1					—
1890 to 1899	762H to 76BH	No.9	Same as No. 1					—
1900 to 1909	76CH to 775H	No.10	Same as No. 1					—
1910 to 1919	776H to 77FH	No.11	Same as No. 1					—
1920 to 1929	780H to 789H	No.12	Same as No. 1					—
1930 to 1939	78AH to 793H	No.13	Same as No. 1					—
1940 to 1949	794H to 79DH	No.14	Same as No. 1					—
1950 to 1959	79EH to 7A7H	No.15	Same as No. 1					—
1960 to 1969	7A8H to 7B1H	No.16	Same as No. 1					—
1970 to 4999	7B2H to 1387H	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

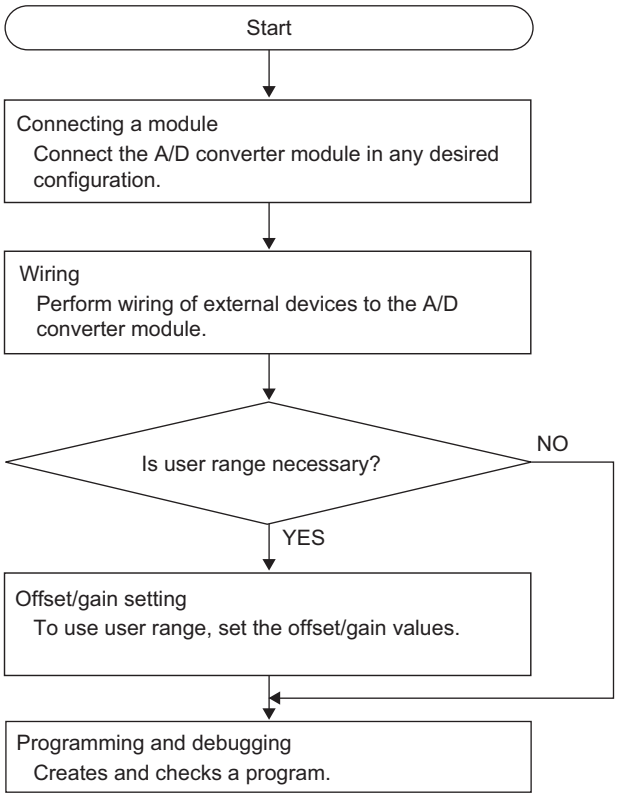
(3) Logging section (Un\G5000 to Un\G61439)

Address (decimal)	Address (hexadecimal)	Name		Default*1	Read/Write*2	Item enabled by turning on and off Operating condition setting request (Y9)
		L60AD4	L60ADVL8, L60ADIL8			
5000 to 14999	1388H to 3A97H	CH1 Logging data	System area	0	R	—
15000 to 24999	3A98H to 61A7H	CH2 Logging data	System area	0	R	—
25000 to 34999	61A8H to 88B7H	CH3 Logging data	System area	0	R	—
35000 to 44999	88B8H to AFC7H	CH4 Logging data	System area	0	R	—
45000 to 61439	AFC8H to EFFFH	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

CHAPTER 4 PROCEDURES BEFORE STARTING THE OPERATION

This chapter describes the procedures before starting the operation.



For the connection of the module, refer to the following.

• Page 43, Section 5.1

For the wiring, refer to the following.

• Page 51, Section 6.4

For the offset/gain setting, refer to the following.

• Page 60, Section 7.5

Memo

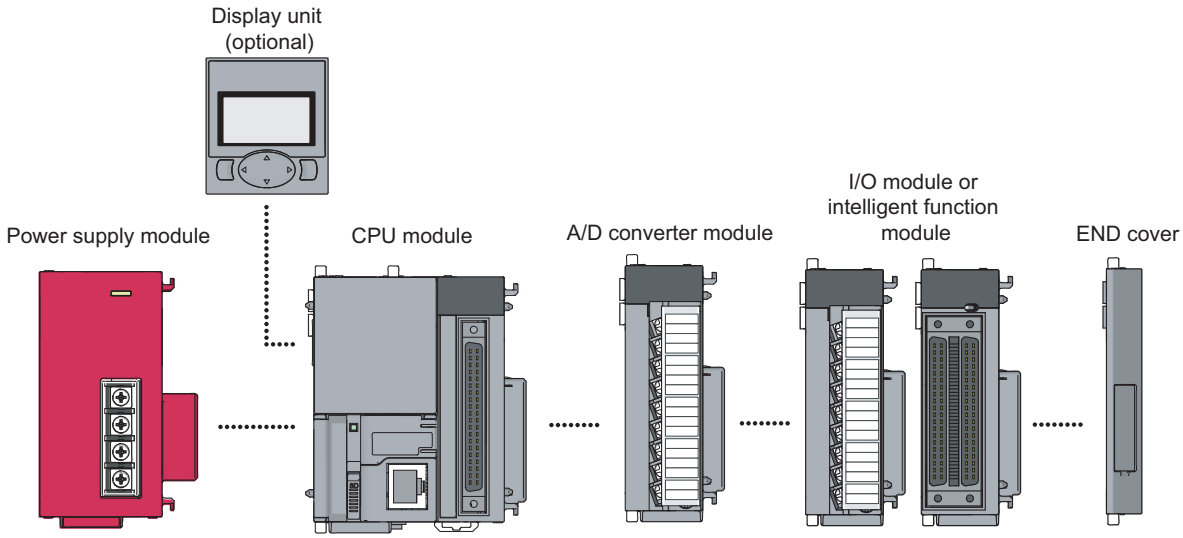
CHAPTER 5 SYSTEM CONFIGURATION

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

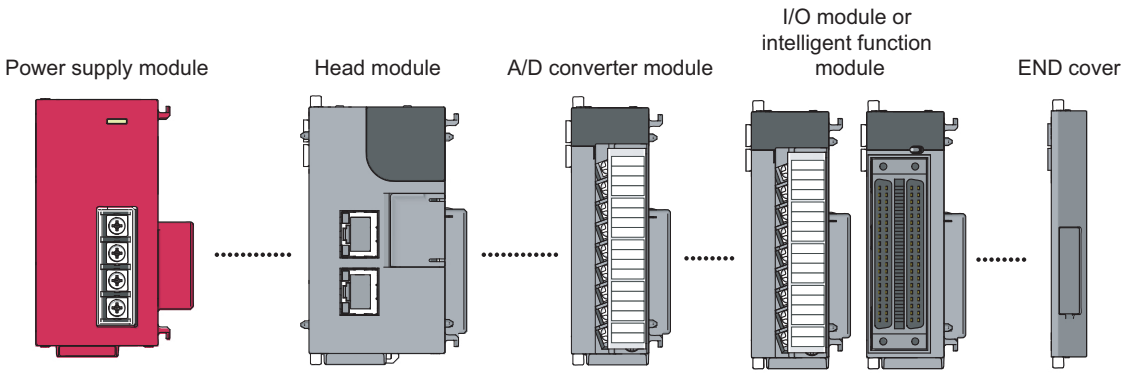
5.1 Overall System Configuration

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

(1) When connected to a CPU module



(2) When connected to a head module



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)

MELSEC-L CC-Link IE Field Network Head Module User's Manual

(2) Compatible software version

For the compatible software versions, refer to the following.

(a) L60AD4

Software	Version
GX Works2	Version 1.20W or later
GX Developer	Version 8.88S or later
GX Configurator-AD	Version 2.11M or later

(b) L60ADVL8, L60ADIL8

Software	Version
GX Works2	Version 1.513K or later
GX Developer	Version 8.88S or later
GX Configurator-AD	Not applicable

5.3 Restrictions When A/D Converter Module is Connected to Head Module

The following describes the restriction when the A/D converter module is connected to a head module.

- Dedicated instruction cannot be used.

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)

MELSEC-L CC-Link IE Field Network Head Module User's Manual

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

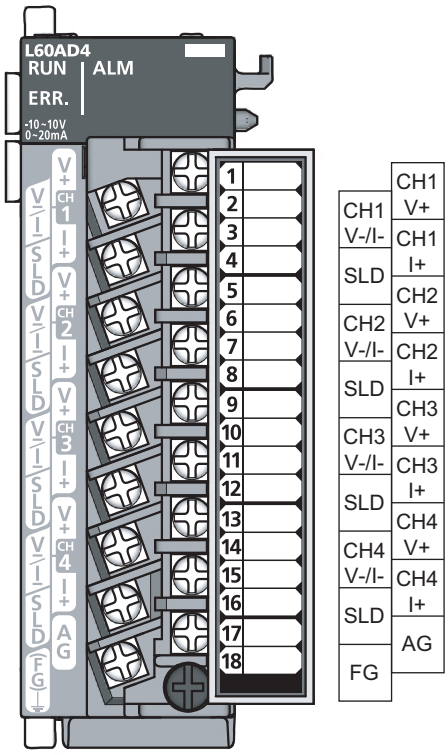
The table below shows applicable solderless terminals connected to the terminal block. When wiring, use applicable wires and an appropriate tightening torque. Use UL-approved solderless terminals and, for processing, use a tool recommended by their manufacturer. Also, sleeved solderless terminals cannot be used.

Solderless terminal		Wire			
Model	Tightening torque	Diameter	Type	Material	Temperature rating
R1.25-3	0.42 to 0.58N · m	AWG 22 to AWG 18	Stranded	Copper	75°C or more

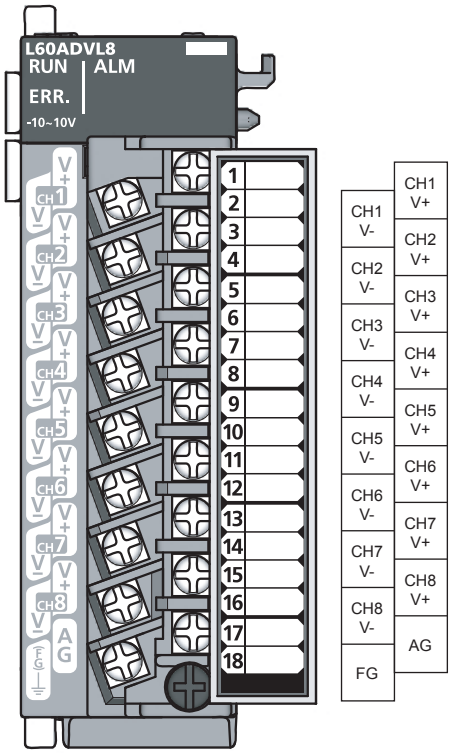
(2) Signal names of the terminal block

The following shows signal names of the terminal block.

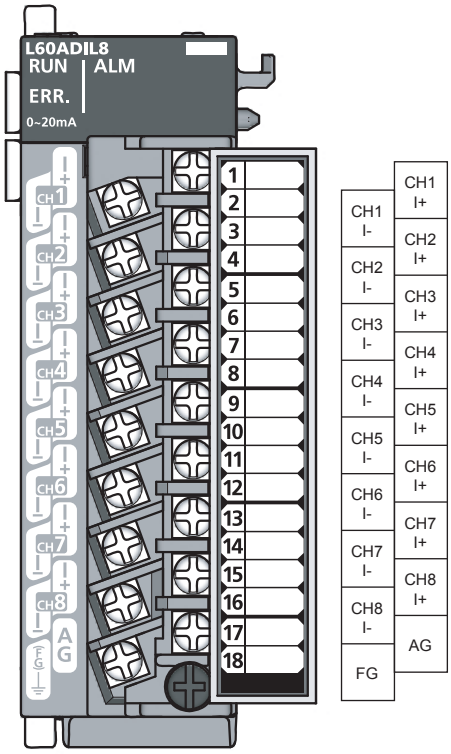
(a) L60AD4

Terminal block	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	

(b) L60ADVL8

Terminal block	Pin number	Signal name	
	1	CH1	V+
	2		V-
	3	CH2	V+
	4		V-
	5	CH3	V+
	6		V-
	7	CH4	V+
	8		V-
	9	CH5	V+
	10		V-
	11	CH6	V+
	12		V-
	13	CH7	V+
	14		V-
	15	CH8	V+
	16		V-
	17	AG	
	18	FG	

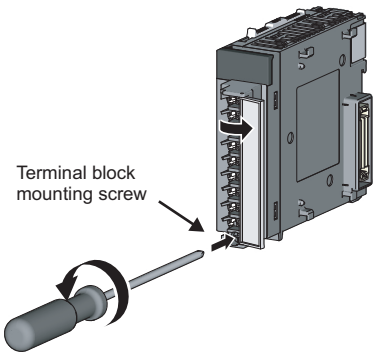
(c) L60ADIL8

Terminal block	Pin number	Signal name	
	1	CH1	I+
	2		I-
	3	CH2	I+
	4		I-
	5	CH3	I+
	6		I-
	7	CH4	I+
	8		I-
	9	CH5	I+
	10		I-
	11	CH6	I+
	12		I-
	13	CH7	I+
	14		I-
	15	CH8	I+
	16		I-
	17	AG	
	18	FG	

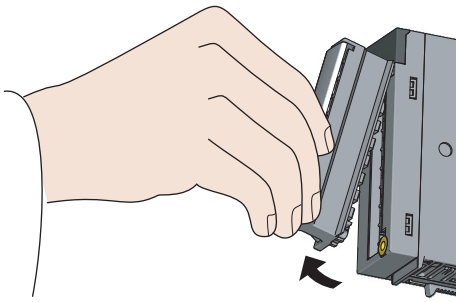
(3) Removal and installation of the terminal block

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

(a) Removal procedure

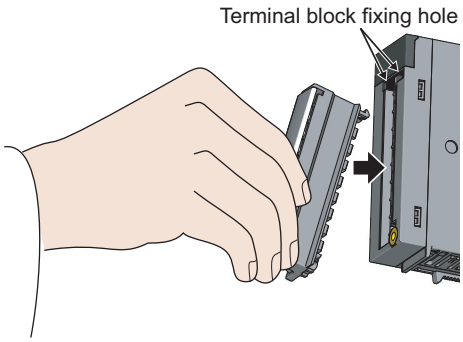


1. **Open the terminal cover and loosen the terminal block mounting screw.**

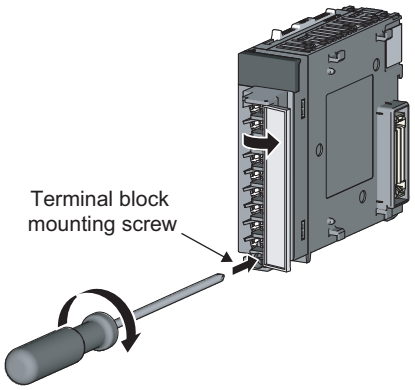


2. **Using the terminal block fixing holes as a fulcrum, remove the terminal block.**

(b) Installation procedure



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.**



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

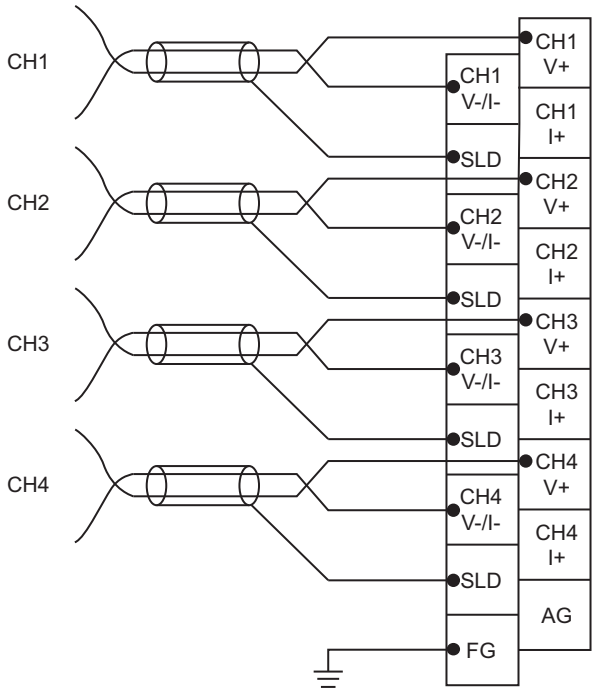
6.3 Wiring

(1) Wiring to a terminal block

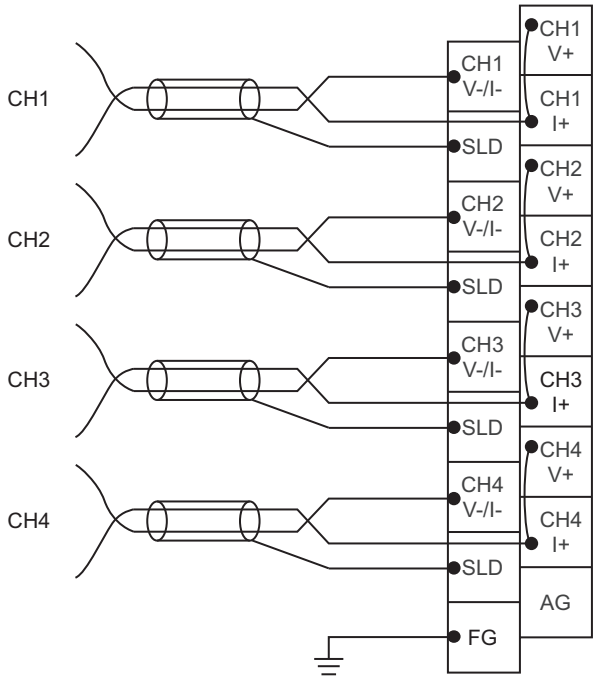
The following shows wirings to a terminal block.

(a) L60AD4

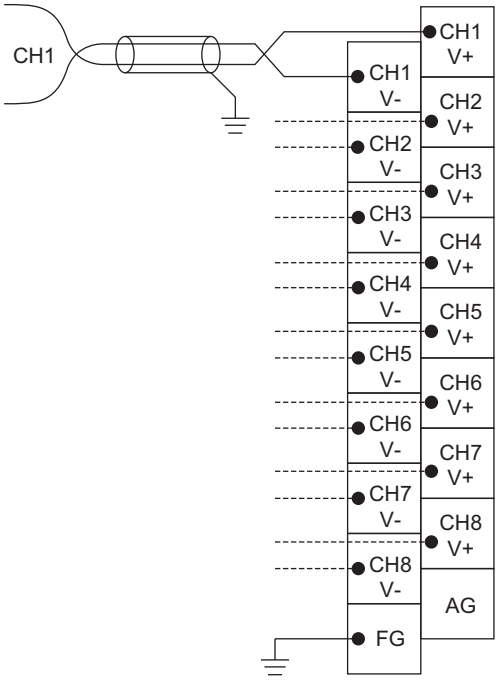
- For the voltage input



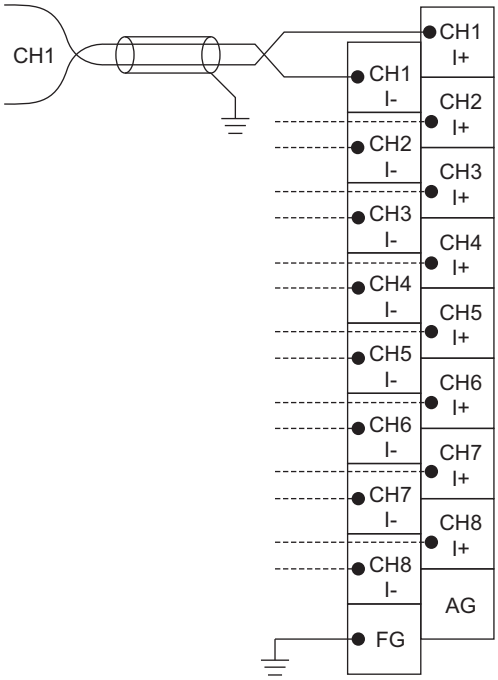
- For the current input



(b) L60ADVL8



(c) L60ADIL8



6.4 External Wiring

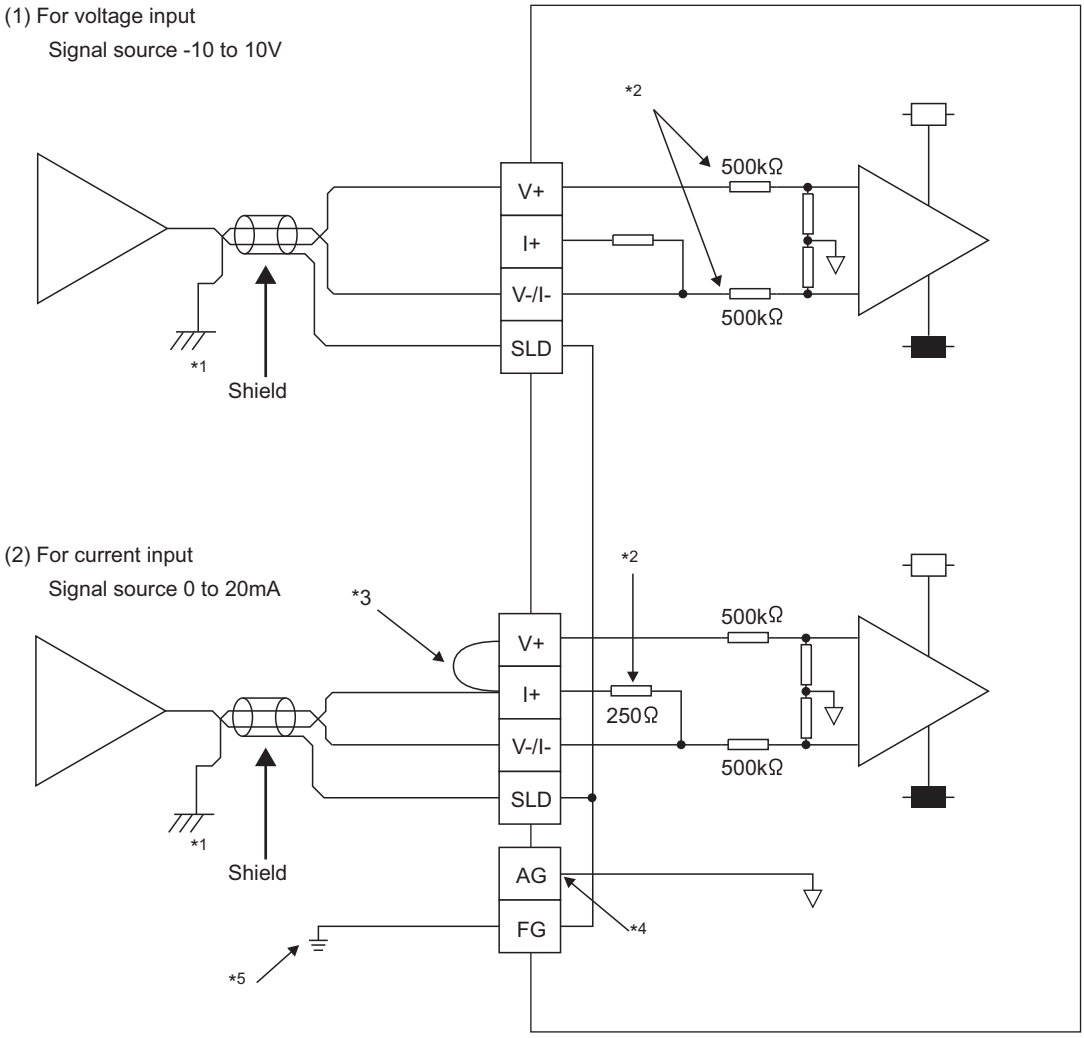
The following describes the external wiring.

Point

If the circuit between the terminals of unused channels is kept open and the A/D conversion is enabled, the A/D converter module may output an undefined digital value.
To prevent this phenomenon, perform any of the following measures.

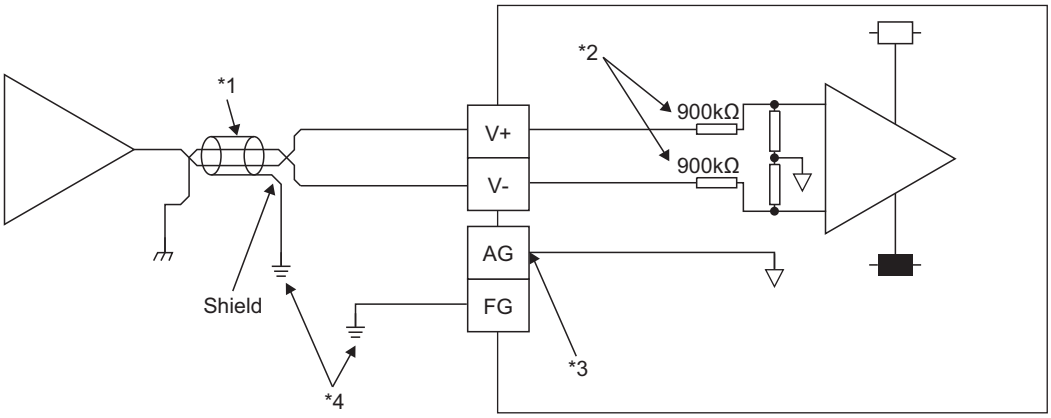
- Set A/D conversion enable/disable setting (Un\G0) in the unused channel to A/D conversion disable (1).
  Note that A/D conversion enable/disable setting (Un\G0) from A/D conversion enable (0) to A/D conversion disable (1) reduces the conversion cycle.
- For the L60AD4 or L60ADVL8, short-circuit the input terminal (V+) and (V-) of the unused channel.

(1) L60AD4



*1 For the wire, use the shielded twisted pair cable.
*2 This indicates the input resistances of the L60AD4.
*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 and ground the FG terminal.
In addition, ground the FG terminal of the power supply module.

(2) L60ADVL8



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

*2 This indicates the input resistances of the L60ADVL8.

*3 In either of the following cases, connect the AG terminal and the GND of the external device.

- When the potential difference is found between the AG terminal and the GND of the external device
- When the GNDs of the external device which are connected to each channel are common

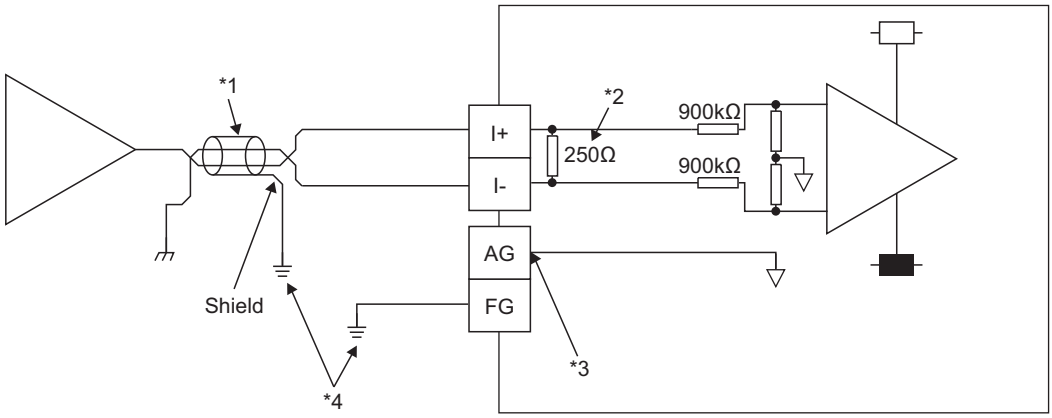
For details, refer to Page 189, Section 11.6.2 (2) (c).

If the AG terminal is connected to the GND of the external device, some errors may be observed on the I/O conversion characteristic.

When some errors are observed on the I/O conversion characteristic, adjust the I/O conversion characteristic with the offset/gain setting.

*4 Always ground the shielded wire for each channel and FG terminal. In addition, ground the FG terminal of the power supply module.

(3) L60ADIL8



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

*2 This indicates the input resistances of the L60ADIL8.

*3 In either of the following cases, connect the AG terminal and the GND of the external device.

- When the potential difference is found between the AG terminal and the GND of the external device
- When the GNDs of the external device which are connected to each channel are common

For details, refer to Page 189, Section 11.6.2 (2) (c).

If the AG terminal is connected to the GND of the external device, some errors may be observed on the I/O conversion characteristic.

When some errors are observed on the I/O conversion characteristic, adjust the I/O conversion characteristic with the offset/gain setting.

*4 Always ground the shielded wire for each channel and FG terminal. In addition, ground the FG terminal of the power supply module.

CHAPTER 7 VARIOUS SETTINGS

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

Point

- After writing the contents of new module, 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.
- After writing the contents of switch settings into the CPU module, reset the CPU module or switch on the power supply, to validate the setting contents.

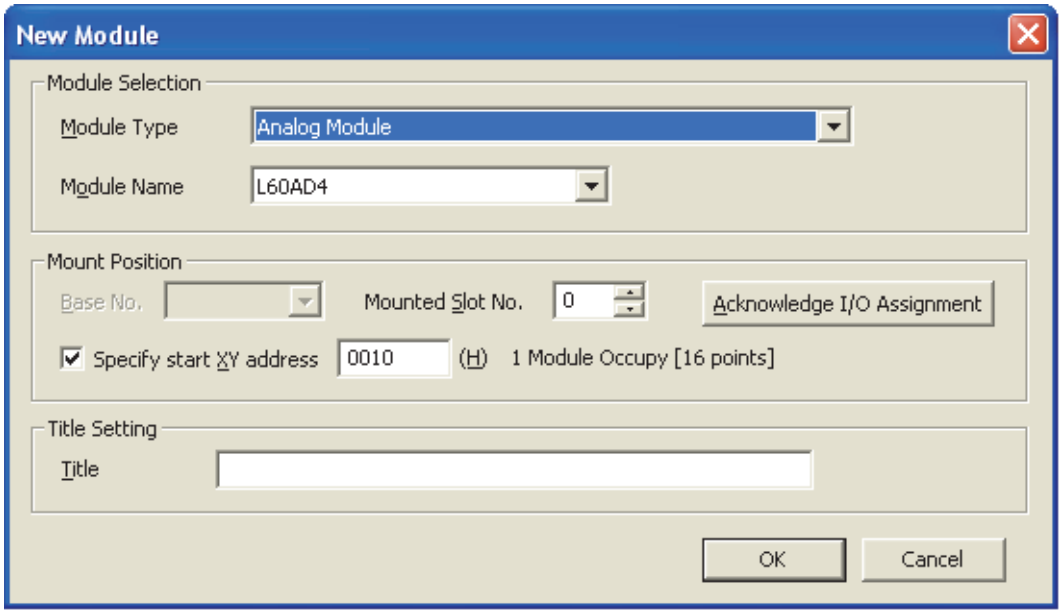
7.1 Addition of Modules

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

(1) Addition procedure

Open the "New Module" dialog box.

Project window ⇨ [Intelligent Function Module] ⇨ Right-click ⇨[New Module]



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.

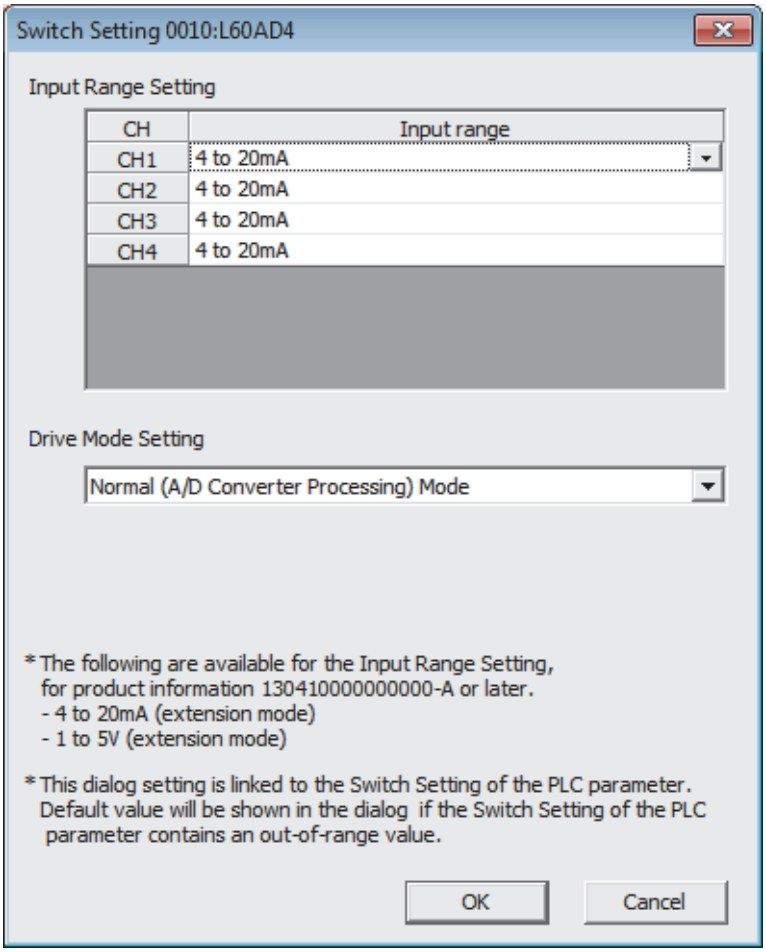
7.2 Switch Setting

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

(1) Setting procedure

Open the "Switch Setting" dialog box.

Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Switch Setting]



Item	Description	Setting value	
Input Range Setting	Set the input range used in each channel.	For the L60AD4	• 4 to 20mA (default value) • 0 to 20mA • 1 to 5V • 0 to 5V • -10 to 10V • 0 to 10V • 4 to 20mA (Extended mode) • 1 to 5V (Extended mode) • User range setting
		For the L60ADVL8	• 1 to 5V • 0 to 5V • -10 to 10V • 0 to 10V (default value) • 1 to 5V (Extended mode) • User range setting
		For the L60ADIL8	• 4 to 20mA (default value) • 0 to 20mA • 4 to 20mA (Extended mode) • User range setting
Drive Mode Setting	Set the operation mode. Set "Offset/gain Setting" to configure the offset/gain setting with the user range being selected.	• Normal (A/D conversion processing) mode (default value) • Offset/gain setting mode	

(a) Intelligent function module switch setting (Switch 1 to 5)

The items described above also can be set in Switch 1 to 5 of the intelligent function module switch setting of "PLC parameter". The following are the switches to set each item.

- Switch 1 and 2: Input range setting
- Switch 4: Drive mode setting

For the setting procedure, refer to the following.

- Intelligent function module switch setting (☞Page 264, Appendix 9.1 (2))

Though the example of procedure is for GX Developer, same settings and values can be used for GX Works2 as well.

7.3 Parameter Setting

Set the parameters of each channel.

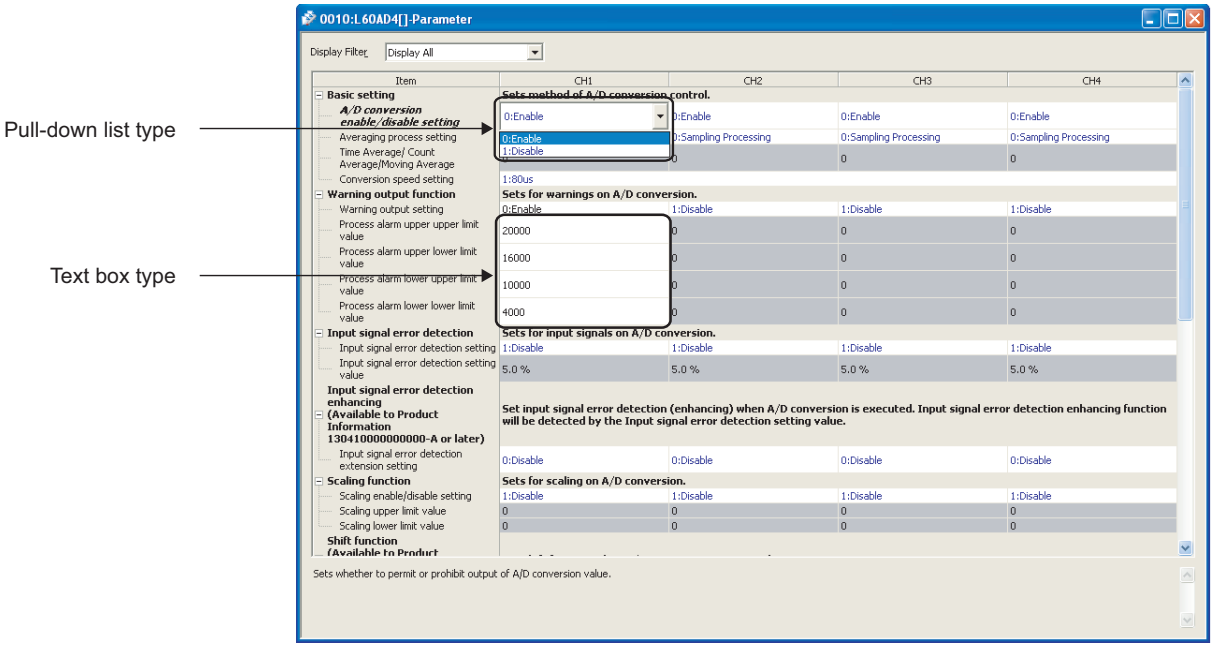
By setting the parameters, the setting by programming is unnecessary.

(1) Setting procedure

Open the "Parameter" dialog box.

1. Start "Parameter"

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



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. For setting CH2 to CH4, follow the operation of step2.

Item		Setting value		Reference
Basic setting	A/D conversion enable/disable setting	0: Enable (default value) 1: Disable		Page 69, Section 8.2
	Averaging process setting	0: Sampling Processing (default value) 1: Time Average 2: Count Average 3: Moving Average		Page 69, Section 8.3
	Time Average/ Count Average/Moving Average	Time Average (For the L60AD4)	20μs: 2 to 1500ms (default value: 0) 80μs, 1ms: 2 to 5000ms (default value: 0)	
		Time Average (For the L60ADVL8 or L60ADIL8)	4 to 5000ms (default value: 0)	
		Count Average	4 to 62500 times (default value: 0)	
		Moving Average	2 to 1000 times (default value: 0)	
	Conversion speed setting[*1]	0: 20μs 1: 80μs (default value) 2: 1ms		Page 75, Section 8.5
Warning output function	Warning output setting	0: Enable 1: Disable (default value)		Page 85, Section 8.9
	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 77, Section 8.7
	Input signal error detection setting value	0 to 25.0% (default value: 5.0%)		
Input signal error detection extension	Input signal error detection extension setting	0: Disable (default value) 1: Upper and Lower Detection 2: Lower Detection 3: Upper Detection 4: Disconnection Detection		Page 82, Section 8.8
Scaling function	Scaling enable/disable setting	0: Enable 1: Disable (default value)		Page 88, Section 8.10
	Scaling upper limit value	-32000 to 32000 (default value: 0)		
	Scaling lower limit value	-32000 to 32000 (default value: 0)		
Shift function[*1]	Shifting amount to conversion value	-32768 to 32767 (default value: 0)		Page 94, Section 8.11
Digital clipping function[*1]	Digital clipping function enable/disable setting	0: Enable 1: Disable (default value)		Page 99, Section 8.12

Item		Setting value		Reference
Logging function*2	Logging enable/disable setting	0: Enable 1: Disable (default value)		Page 108, Section 8.14
	Logging data setting	0: Digital Output Value 1: Scaling Value (Digital Operation Value) (default value)		
	Logging cycle setting value	μs: 80 to 32767 (default value: 4) ms: 1 to 32767 (default value: 4) s: 1 to 3600 (default value: 4)		
	Logging cycle unit setting	0: μs 1: ms (default value) 2: s		
	Logging points after trigger	1 to 10000 (default value: 5000)		
	Level trigger condition setting	0: Disable (default value) 1: Above 2: Below 3: Pass Through		
	Trigger data	0 to 4999	(CH1 default value: 54) (CH2 default value: 55) (CH3 default value: 56) (CH4 default value: 57)	
	Trigger setting value	-32768 to 32767 (default value: 0)		
Flow amount integration function*1	Flow amount integration enable/disable setting	0: Enabled 1: Disabled (default value)		Page 123, Section 8.15
	Integration cycle setting	1 to 5000ms (default value: 4ms)		
	Flow amount time unit setting	0: /s (default value) 1: /min 2: /h		
	Unit scaling setting	0: × 1 (default value) 1: × 10 2: × 100 3: × 1000 4: × 10000		

*1 The L60ADVL8 or L60ADIL8 does not support this function.

*2 To use the logging function with the L60ADVL8 or L60ADIL8, use the data logging function of the CPU module. For the data logging function of the CPU module, refer to the following.

QnUDVCPU/LCPU User's Manual (Data Logging Function)

7.4 Auto Refresh

Set the buffer memory areas of the A/D converter module to be refreshed automatically.
By the auto refresh setting, reading/writing data by programming is unnecessary.

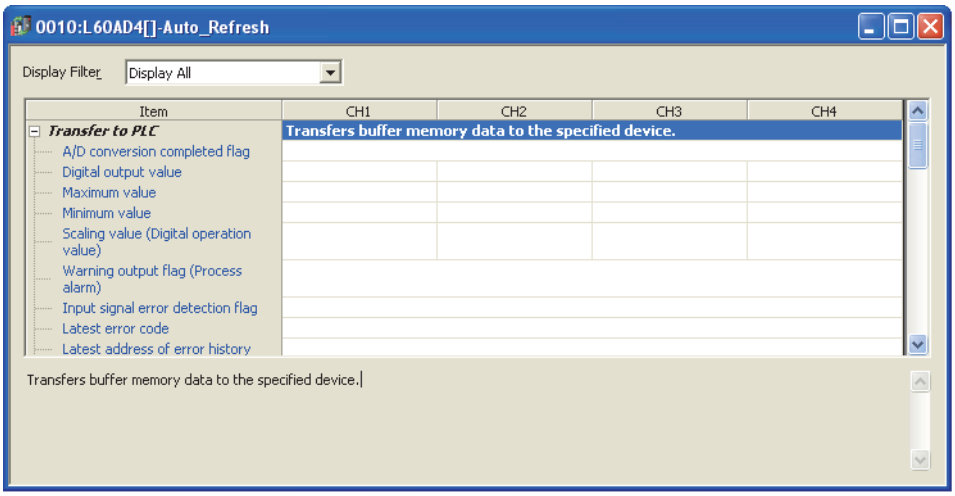
(1) Setting procedure

Open the "Auto_Refresh" dialog box.

1. Start "Auto_Refresh".

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

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



Point

Available devices are X, Y, M, L, B, T, C, ST, D, W, R, and ZR.
When a bit device X, Y, M, L, or B is used, set the number that is divisible by 16 points (example: X10, Y120, M16). Data in the buffer memory are stored in 16 points of devices from the set device No. (Example: When X10 is set, the data are stored in X10 to X1F.)

7.5 Offset/Gain Setting

When using the user range, configure the offset/gain setting with the following operations.

When using factory default settings, the offset/gain is not required.

The offset/gain setting can be configured from the following two types of operations.

- Setting from "Offset/Gain Setting" of GX Works2 (Page 60, Section 7.5.1).
- Setting from a program (Page 63, Section 7.5.2)

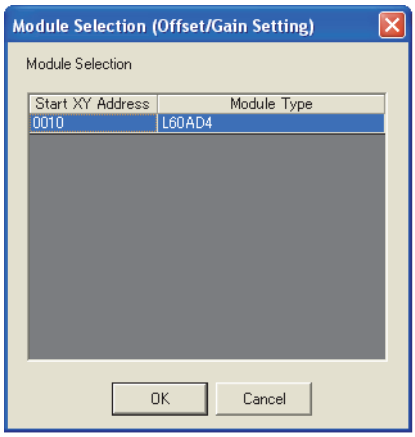
Configure the offset/gain setting in accordance with the actual use situation.

7.5.1 Setting from GX Works2 "Offset/Gain Setting"

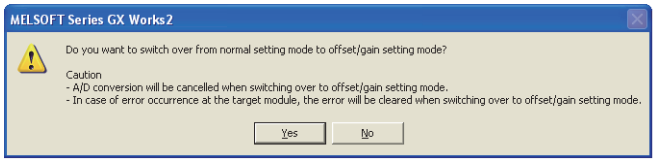
(1) Setting procedure

Open the "Offset/Gain Setting" dialog box.

[Tool] ⇨ [Intelligent Function Module Tool] ⇨ [Analog Module] ⇨[Offset/gain Setting...]



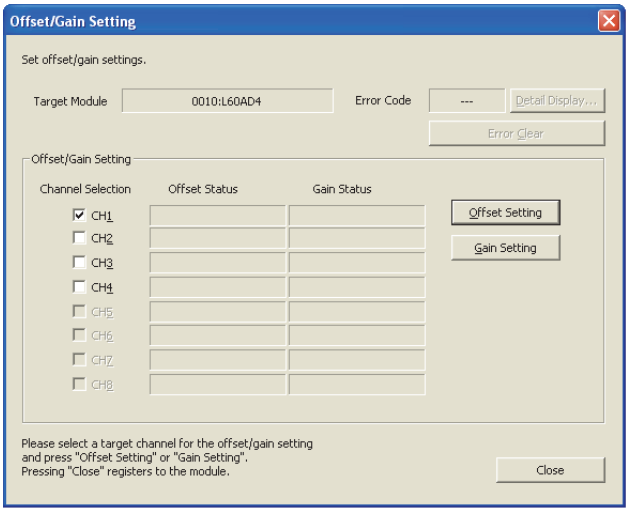
↓



↓

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

2. **Click the Yes button.**



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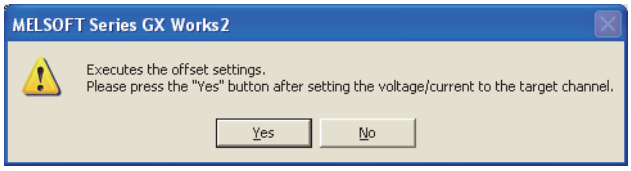

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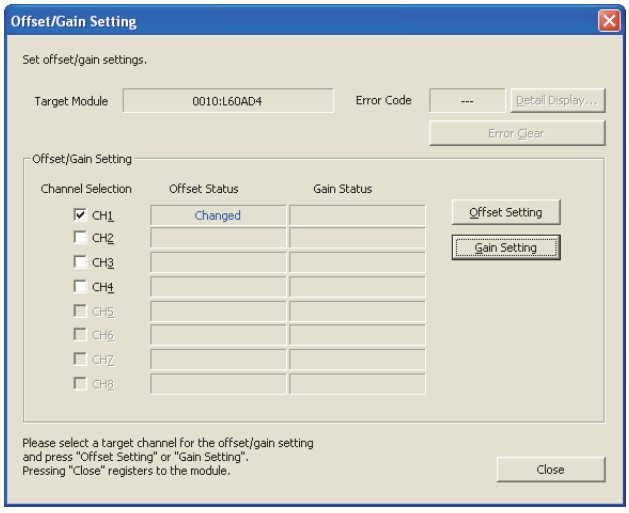

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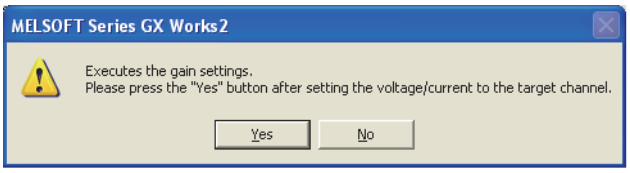

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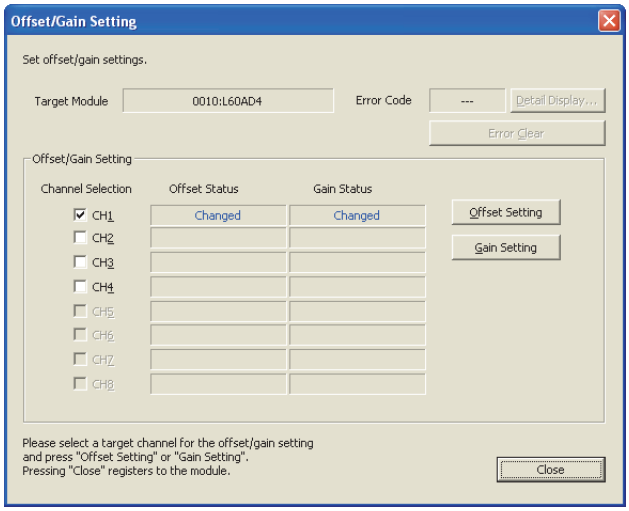
3. **Select the channel to use the offset/gain setting, and click the Offset Setting button.**

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

5. **Check that "Offset Status" is changed to "Changed".**

6. **Click the Gain Setting button.**

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



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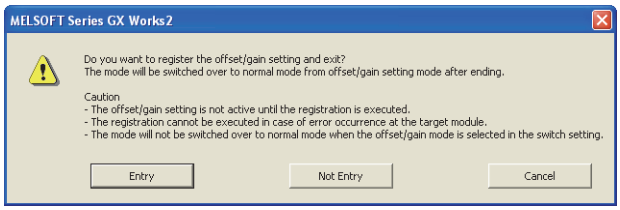


↓

End

8. **Check that "Gain Status" is changed to "Changed".**

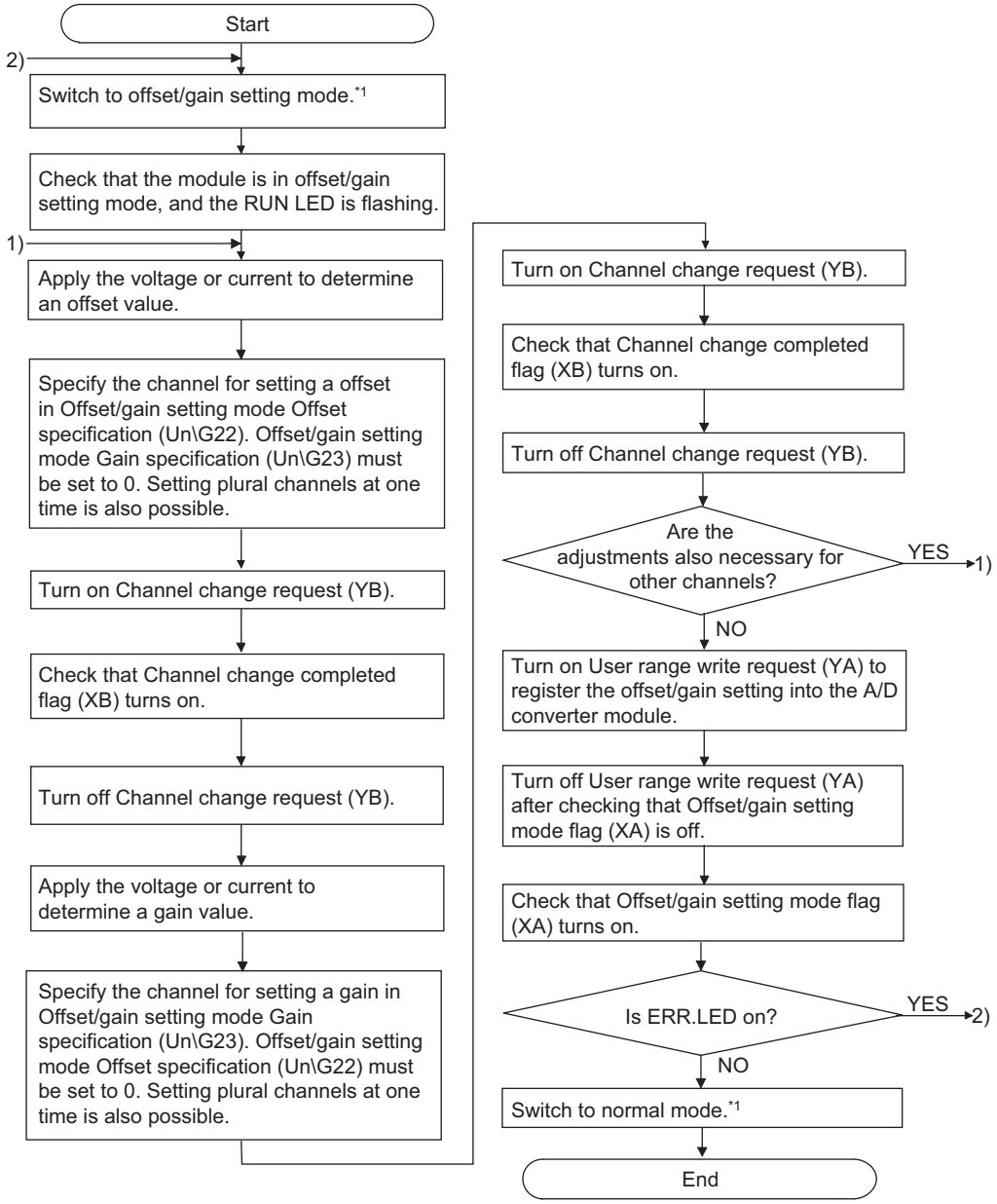
9. **Click the** Close **button.**

10. **Click the** Entry **button.**

7.5.2 Setting from a program

(1) Setting procedure

The following describes the procedures when setting the offset/gain from a program.



*1 The following shows the procedure for switching the mode (normal mode → offset/gain setting mode or offset/gain setting mode → normal mode).

- Dedicated instruction (G(P).OFFGAN) (Page 65, Section 7.5.2 (2) (b))
- Setting for Mode switching setting (Un\G158, Un\G159) and turning on and off Operating condition setting request (Y9) (Page 66, Section 7.5.2 (2) (c))
- Switch setting (Page 66, Section 7.5.2 (2) (d))

Point

- Offset and gain values are recorded in the flash memory in the A/D converter module by turning on and 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 to prevent an improper write to flash memory. The error code (170) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR.LED turns on.
- If the power is turned off or the CPU module is reset while offset and gain values are being written to the flash memory (while Offset/gain setting mode flag (XA) is off), a write to the flash memory may fail and the offset and gain values may be deleted.
  Therefore, do not turn off the power or do not reset the CPU module while data is being written in the 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 235, 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. The error code (500) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the 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 179, Section 11.4)

(2) Program example

(a) Device

Ex I/O number of the A/D converter module is X/Y30 to 3F

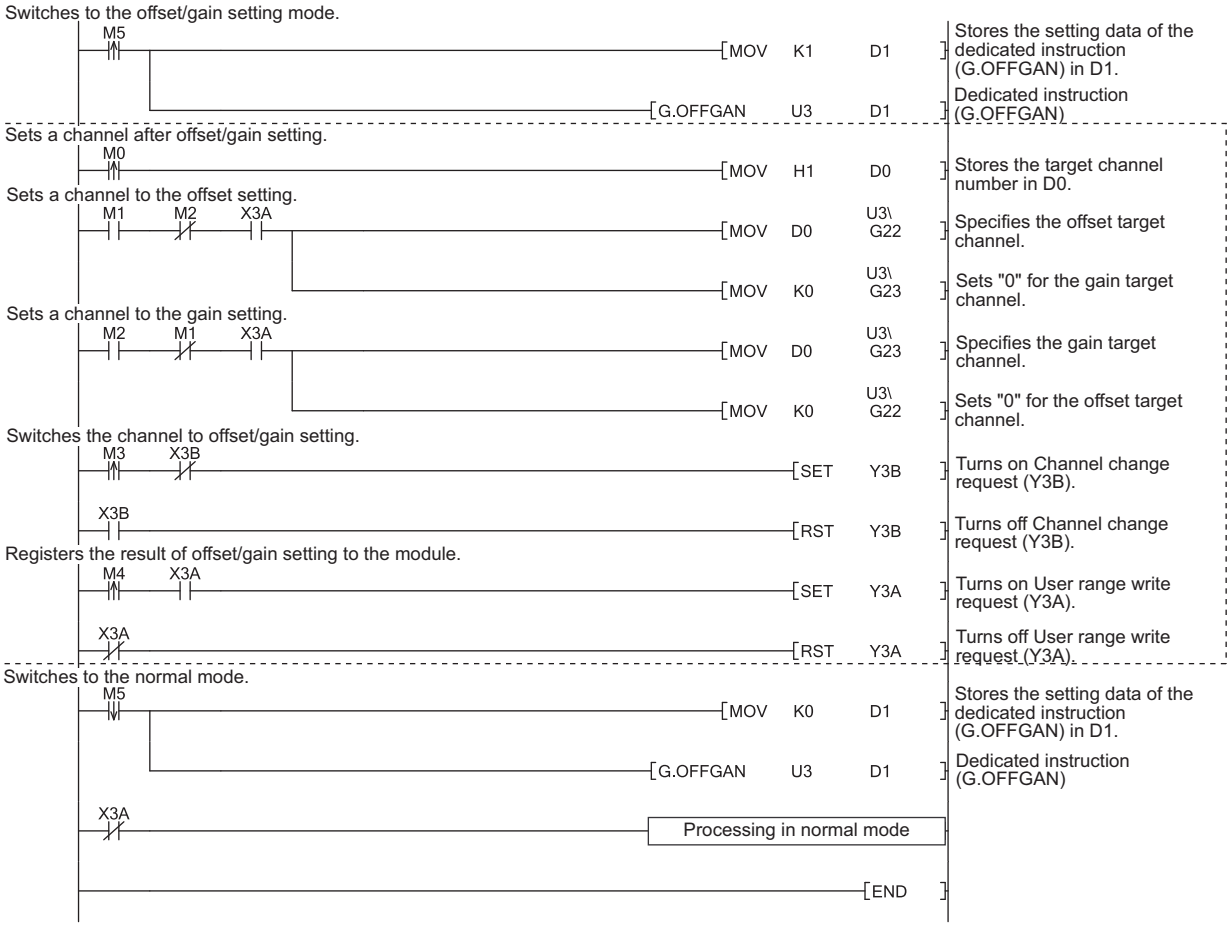
The following shows the devices used in the program example.

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)

(b) Switching the mode by the dedicated instruction (G(P).OFFGAN)

This program performs the following operations using the dedicated instruction (G(P).OFFGAN):

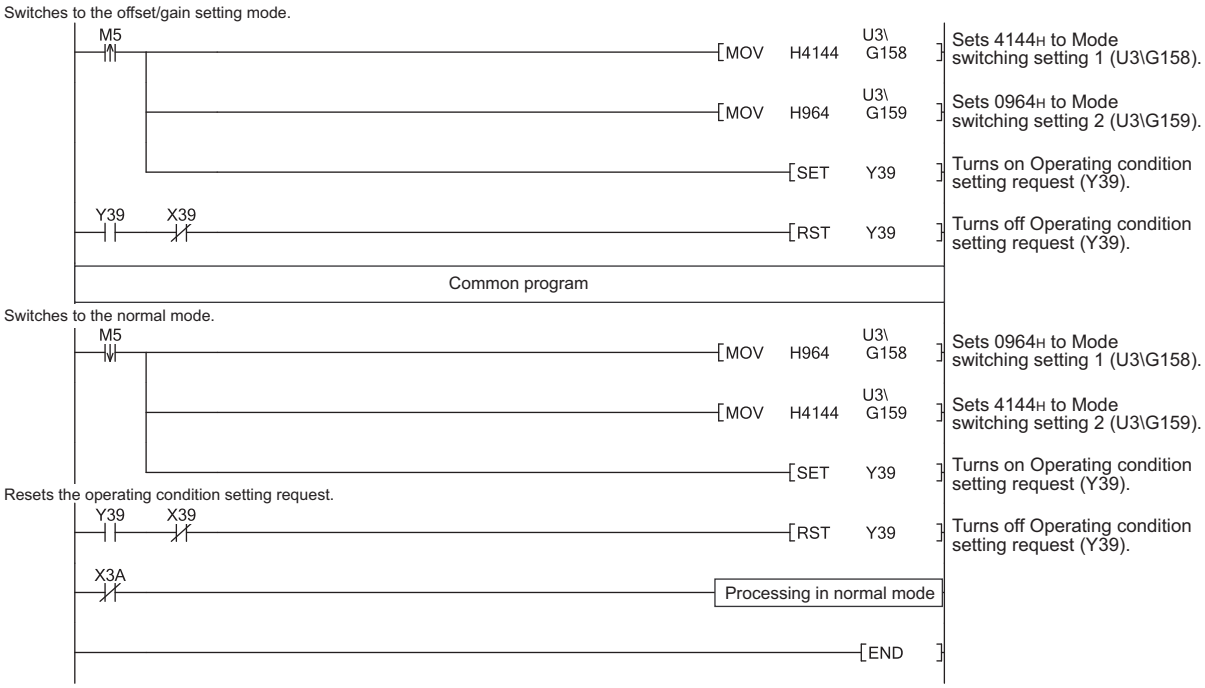
- first, switches the mode to the offset/gain setting mode by the dedicated instruction (G(P).OFFGAN),
- second, switches the channels for which the offset/gain settings is configured,
- third, writes the offset/gain value to the A/D converter module,
- finally, switch the mode from offset/gain setting mode to the normal mode by the dedicated instruction (G(P).OFFGAN).



Point

- The program enclosed by the doted line is the common programs among the following three programs.
  - Switching the mode by the dedicated instruction (G(P).OFFGAN) (Page 65, Section 7.5.2 (2) (b))
  - Switching the mode by setting Mode switching setting (Un\G158, Un\G159) and by Operating condition setting request (Y9) (Page 66, Section 7.5.2 (2) (c))
  - Switching the mode by the switch setting (Page 66, Section 7.5.2 (2) (d))
- When the mode has been switched from offset/gain setting mode to normal mode by the dedicated instruction (G(P).OFFGAN), Module READY (X0) turns 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.

(c) Switching the mode by Mode switching setting (Un\G158, Un\G159) and Operating condition setting request (Y9)



Point

When the mode has been switched from offset/gain setting mode to normal mode by the setting for Mode switching setting (Un\G158, Un\G159), Module READY (X0) turns 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.

(d) Switching the mode by the switch setting

The programs other than the common program is not necessary.

Configure the switch setting, and reset the CPU module or turn off and on the power to switch the mode.

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.

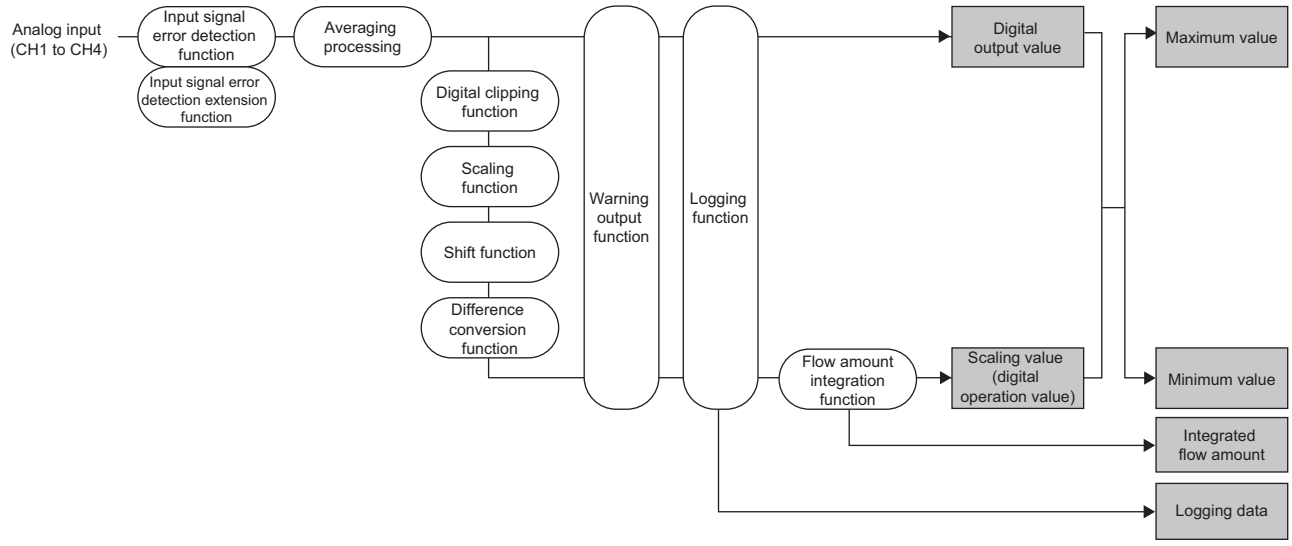
For details on I/O signals and buffer memory, refer to the following.

- Details of I/O signals (☞Page 192, Appendix 1)
- Details of buffer memory addresses (☞Page 199, Appendix 2)

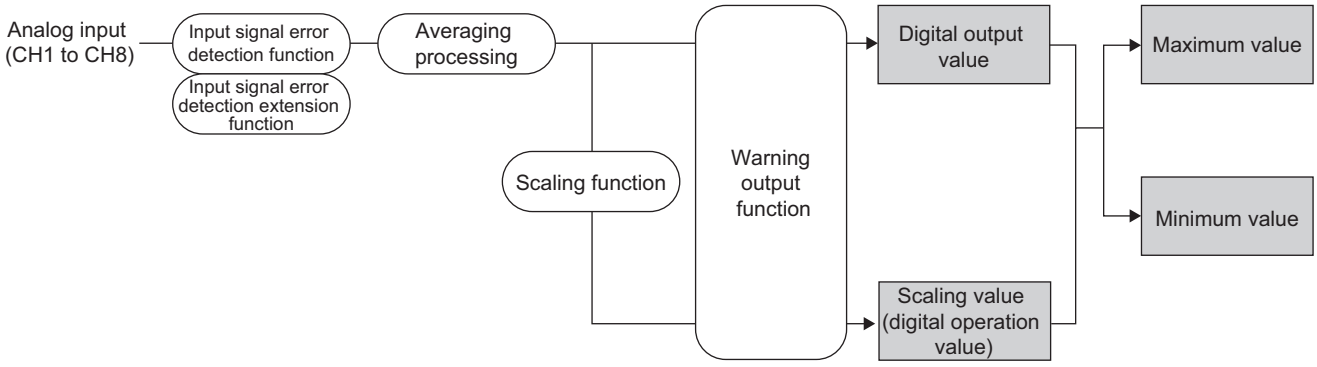
8.1 Processing Order of Each Function

Analog input values and the digital values of (1) to (5) 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.

AD4



ADVL8 **ADIL8**



(1) Digital output values Common

Digital values after sampling processing or averaging processing has been performed are stored.

(2) Scaling values (digital operation values) Common

Values obtained by operating the digital output value using the following functions are stored. When the following functions are not used, the same value as the digital output value is stored.

Module	Function
L60AD4	Digital clipping function, scaling function, shift function, or difference conversion function
L60ADVL8, L60ADIL8	Scaling function

(3) Maximum and minimum values Common

The maximum and minimum values of the scaling values (digital operation values) are stored.

(4) Logging data AD4

When the logging function is used, digital output values or scaling values (digital operation values) are collected. For details on the logging function, refer to the following.

- Logging Function (☞Page 108, Section 8.14)

(5) Integrated flow amount AD4

When the flow amount integration function is used, scaling values (digital operation values) are integrated. For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

Point

- When averaging processing (time average/count average) is performed on digital output value, scaling values (digital operation values), and maximum and minimum values, the values are stored at every averaging process cycle.
- In the use of the input signal error detection function or input signal error detection extension function, A/D conversion is stopped if an input signal error occurs. In this case, the digital output values, scaling values (digital operation values), and maximum and minimum values are not updated. The values obtained before the input signal error is detected are held. When the analog input signal returns to a normal value, A/D conversion resumes.
  For details, refer to the following.
  - Input signal error detection function (☞Page 77, Section 8.7)
  - Input signal error detection extension function (☞Page 82, Section 8.8)

8.2 A/D Conversion Enable/Disable Function

Common

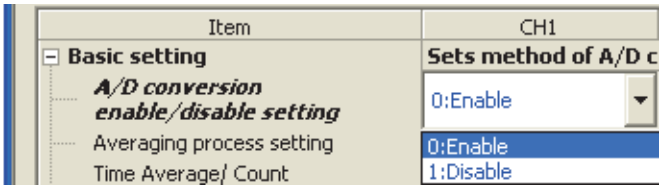
Sets whether to enable or disable A/D conversion for each channel.

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]



8.3 A/D Conversion Method

Common

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

(1) Sampling processing

Analog input values are converted into digital at every sampling cycle and stored in the buffer memory area as digital output values.

Point

The conversion cycle is calculated by "Conversion speed × Number of channels where A/D conversion is enabled". Conversion can be enabled or disabled per channel. By disabling A/D conversion for the channels you are not using, the conversion cycle can be reduced. The following shows setting examples of the conversion cycle.

- For the L60AD4
  - Number of channels where A/D conversion is enabled: CH1 to CH3 (three channels in total)
  - Conversion speed: 80μs (middle speed)

  Conversion cycle = 80 (μs/channel) × 3 (channels) = 240 (μs)

  For details on conversion speed setting, refer to the following.
  - Conversion Speed Switch Function (☞Page 75, Section 8.5)
- For the L60ADVL8 and L60ADIL8
  - Number of channels where A/D conversion is enabled: CH1 to CH7 (seven channels in total)
  - Conversion speed: 1ms (fixed)

  Conversion cycle = 1 (ms/channel) × 7 (channels) = 7 (ms)

(2) Averaging processing

Averaging processing is performed on the digital output values for each channel. The values obtained in averaging processing are stored in the buffer memory area.

There are three processes in averaging processing, as follows:

- Time average
- Count average
- Moving average

(a) Time average

A/D conversion is performed for a set time and averaging processing is performed on the total value excluding the maximum and minimum values. The values obtained in averaging processing are stored in the buffer memory area.

The processing count within the setting time varies depending on the number of channels where A/D conversion is enabled.

$$\text{Number of processing times} = \frac{\text{Setting time}}{\text{Conversion speed} \times \text{Number of channels where A/D conversion is enabled}}$$

Ex For the L60AD4, the processing count for the following settings is calculated below:

Item	Setting
Number of channels where A/D conversion is enabled	4 channels (CH1 to CH4)
Conversion speed	20μs
Set period of time	15ms

$$\frac{15}{4 \times 0.02} = 187.5 \text{ (times)} \quad \cdots \text{ Numbers after the decimal point are rounded down.}$$

→ The processing is performed 187 times and its average value is output.

Point

The valid lower limit setting value for the time average is calculated by "(minimum processing count of 4) × (conversion speed) × (number of channels where A/D conversion is enabled)". 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).

The following shows an example of the valid lower limit setting value.

- Number of channels where A/D conversion is enabled: CH1 to CH4 (four channels in total)
- Conversion speed: 1ms

Valid lower limit setting value = 4 × 1 (ms/channel) × 4 (channels) = 16 (ms)

(b) Count average

A/D conversions are performed a set number of times and averaging processing is performed on the total value excluding the maximum and the minimum values. The values obtained in averaging processing are stored in the buffer memory area.

The time taken for the mean value calculated through average processing to be stored in the buffer memory area changes depending on the number of channels where A/D conversion is enabled.

Processing time = Setting time × (Conversion speed × Number of channels where A/D conversion is enabled)

Ex For the L60AD4, the processing time for the following settings is calculated below.

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

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

Point

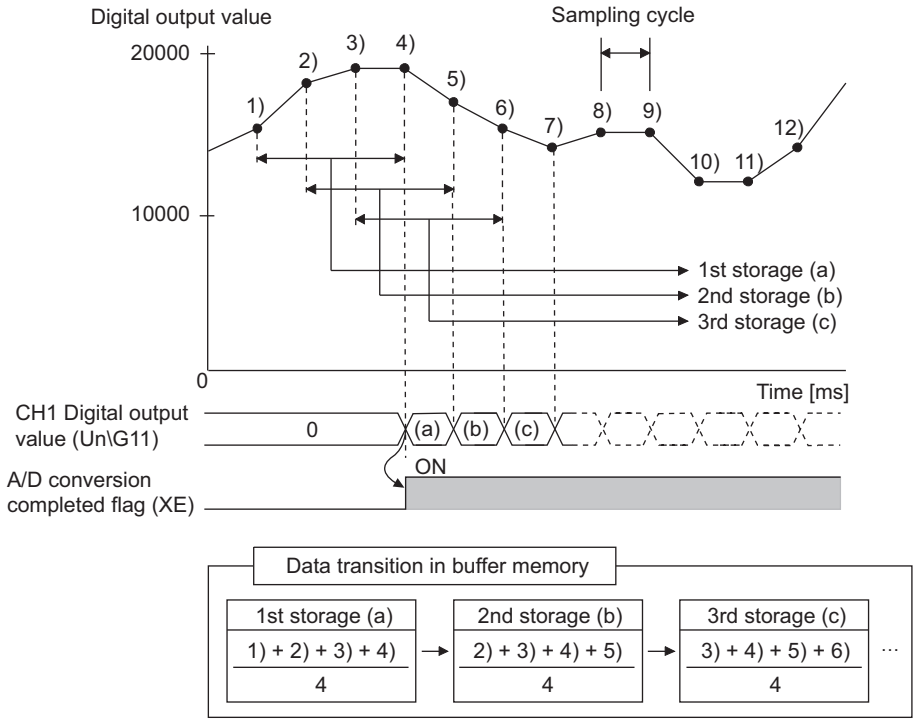
Because the count average requires a sum of at least two counts, not counting the maximum and minimum values, the set number of times should be set to 4 or more.

(c) Moving average

The average of a specified number of digital output values is calculated at every sampling cycle and is stored in the buffer memory.

Because the target set of values for averaging processing shifts to another to involve a subsequent value at every sampling processing, the latest digital output values can be always obtained.

For the L60AD4, the moving average processing for a set number of times of 4 is shown below:

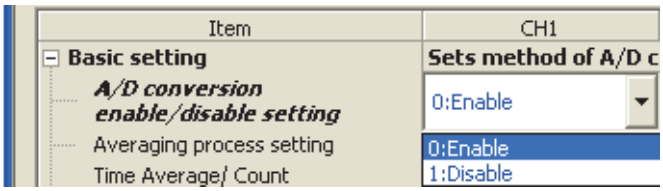


(3) Setting procedure

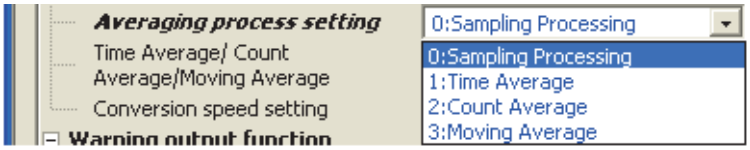
(a) Sampling processing

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

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



2. For "Averaging process setting", select "0: Sampling Processing".

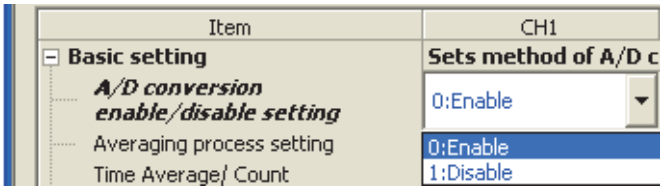


(b) Averaging processing

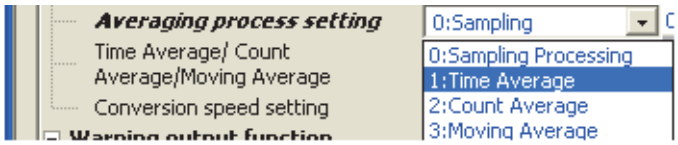
Ex To select "1: Time Average" for "Averaging process setting":

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

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



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



3. **For "Time Average/ CountAverage/Moving Average", enter the following:**

- L60AD4

Setting item	Conversion speed	Setting range
Time Average	20 μs	2 to 1500 ms
	80 μs, 1 ms	2 to 5000 ms
Count Average	20 μs, 80 μs, 1 ms	4 to 62500 times
Moving Average	20 μs, 80 μs, 1 ms	2 to 1000 times

- L60ADVL8, L60ADIL8

Setting item	Setting range
Time Average	4 to 5000ms
Count Average	4 to 62500 times
Moving Average	2 to 1000 times

8.4 Input Range Extension Function

Common

Using this function, the available input range in 4 to 20mA and 1 to 5V can be extended.

Input range setting	Input range	Digital output value
4 to 20mA	4 to 20mA	0 to 20000 (L60AD4)
1 to 5V	1 to 5V	0 to 8000 (L60ADVL8, L60ADIL8)

Input range setting	Input range	Digital output value
4 to 20mA (Extended mode)	0.0 to 22.0mA	-5000 to 22500 (L60AD4)
1 to 5V (Extended mode)	0.0 to 5.5V	-2000 to 9000 (L60ADVL8, L60ADIL8)

(1) Overview

- The analog input value can be monitored in the extended mode even if errors vary depending on sensors and the analog input value is less than 4mA or 1V in the input range of 4 to 20mA and 1 to 5V.
- The slope of I/O characteristics of the extended mode is the same as that of the normal range. However, the upper limit value and the lower limit value of the input range and the digital output value are extended. For details, refer to I/O Conversion Characteristic of A/D Conversion (☞Page 235, Appendix 3).
- The resolution is the same between the extended input range and the input range of 4 to 20mA and 1 to 5V (for the L60AD4, 800nA and 200μV). This enables the A/D conversion with higher resolution compared to the use of the input range of 0 to 20mA and 0 to 5V (for the L60AD4, resolution of 1000nA and 250μV).

(2) Setting procedure

Set the input range into the extended mode in "Input Range Setting" of "Switch Setting".

Point

If the input range extended mode function and the following functions are simultaneously used, the scaling value (digital operation value) may exceed the range of -32768 to 32767.

Module	Function
L60AD4	Scaling function, shift function, or difference conversion function
L60ADVL8, L60ADIL8	Scaling function

In this case, a value fixed at the upper limit value (32767) or at the lower limit value (-32768) is stored as a scaling value (digital operation value).

Ex. When 32000 is set for the scaling upper limit value and -32000 is set for the scaling lower limit value for the L60AD4, the following operation is performed.

- When the digital output value is 20240 or greater, 32767 is stored as a scaling value (digital operation value).
- When the digital output value is -240 or smaller, -32768 is stored as a scaling value (digital operation value).

8.5 Conversion Speed Switch Function

AD4

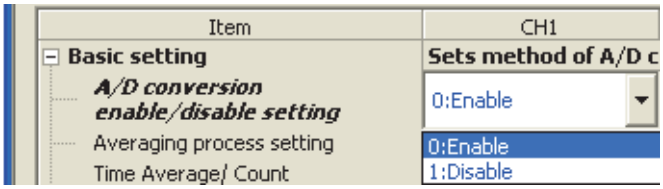
You can select from three conversion speeds:

- 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".

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



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

8.6 Maximum and Minimum Values Hold Function

Common

This function stores the maximum digital output value and minimum digital output value in the buffer memory for each channel.

If averaging processing is specified, the values are updated per averaging process cycle. Otherwise they are updated per sampling cycle.

For a list of buffer memory addresses to which the values are stored, refer to the following.

- List of Buffer Memory Addresses (☞Page 28, Section 3.5)

(1) Resetting maximum and minimum values

When one of the following operations is performed, the maximum value and the minimum value are replaced with the current digital output value.

- Tuning on and off Maximum value/minimum value reset request (YD)
- Turning on and off Operating condition setting request (Y9)

When Operating condition setting request (Y9) is turned on and off, A/D conversion is reset and are resumed from the beginning.

(2) Targets of the maximum and minimum values

The maximum and minimum values of the digital output value are stored.

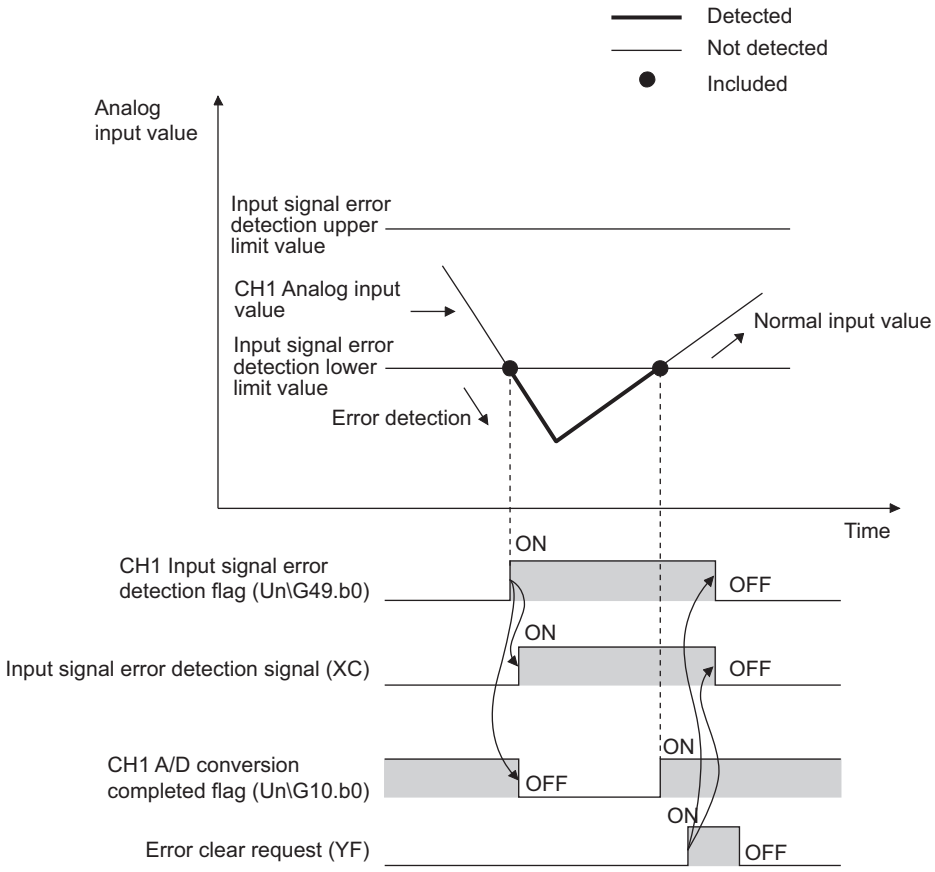
When any of the following functions is used, the maximum and minimum scaling values (digital operation values) are stored.

Module	Function
L60AD4	Digital clipping function, scaling function, shift function, or difference conversion function
L60ADVL8, L60ADIL8	Scaling function

8.7 Input Signal Error Detection Function

Common

This function outputs an alarm when the analog input value exceeds a preset range. By using the input signal error detection extension function, the upper limit detection, lower limit detection, or disconnection detection can be set.
For details on the input signal error detection extension function, refer to the following.
Input signal error detection extension function (☞Page 82, Section 8.8)



(1) Notification of input signal error

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:

For details on alarm codes, refer to the following.

- Alarm code list (☞Page 183, Section 11.5)

(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. "During A/D conversion or unused (0)" is stored in the bit of A/D conversion completed flag (Un\G10) corresponding to the channel and A/D conversion completed flag (XE) turns off.

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 of the digital output value, A/D conversion completion (1) is stored in the bit of A/D conversion completed flag (Un\G10) corresponding to the channel. (The ALM LED remains flashing.)

(3) Detection cycle

This function is executed per sampling cycle.

(4) Clearing the input signal error detection

After the analog input value returns within the setting range, turn on and off Error clear request (YF).

When the input signal error is cleared, 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) Setting the input signal error detection upper and lower limit values

Set the input signal error detection upper and lower limit values in increments of 1 (0.1%) based on the input signal error detection setting value.

Input signal error detection setting value is reflected in both the input signal error detection upper and lower limit values.

(a) Input signal error detection upper limit value

Add the gain value to "Input range width (gain value - offset value) multiplied by input signal error detection setting value". Only a value equal to or greater than the gain value can be set.

The input signal error detection setting value is calculated by the following formula:

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

(b) Subtract the gain value from Input signal error detection lower limit value

This value is calculated by subtracting "Input range width (gain value - offset value) multiplied by input signal error detection setting value" from the lower limit value of the input range. Only a value equal to or smaller than the lower limit value of the range can be set.

The input signal error detection setting value is calculated by the following formula:

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

Remark

The following table lists the lower limit value, offset value, or gain value for each range.

Analog input range		Lower limit value	Offset value	Gain value
Voltage	0 to 10V	0V		10V
	0 to 5V	0V		5V
	1 to 5V	1V		5V
	-10 to 10V	-10V	0V	10V
	1 to 5V (Extended mode)	1V		5V
	User range setting	Analog input value when the digital output value is as follows • -20000 (for the L60AD4) • -8000 (for the L60ADVL8)	Analog input value set as a offset value by the user	Analog input value set as a gain value by the user
Current	0 to 20mA	0mA		20mA
	4 to 20mA	4mA		20mA
	4 to 20mA (Extended mode)	4mA		20mA
	User range setting	Analog input value when the digital output value is as follows • -20000 (for the L60AD4) • -8000 (for the L60ADIL8)	Analog input value set as a offset value by the user	Analog input value set as a gain value by the user

(6) Example of input signal error detection

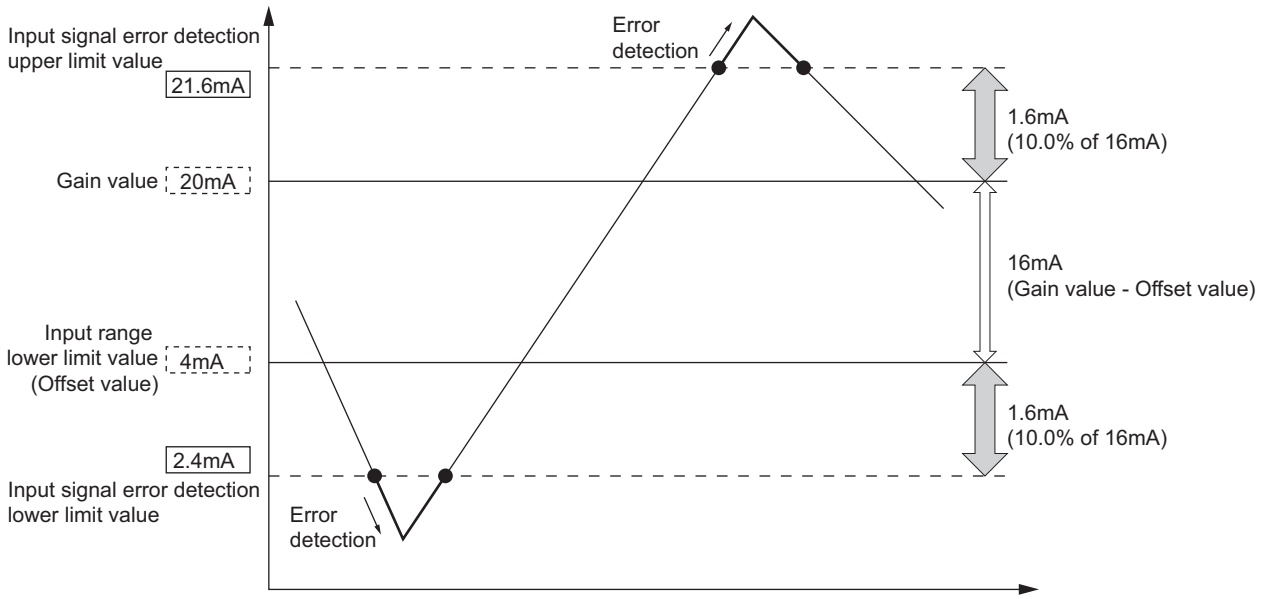
To detect an input signal error when the analog input value is 2.4mA or smaller in a channel where an input range is set to 4 to 20mA, substitute the following values into the input signal error detection lower limit value.

- Input signal error detection lower limit value: 2.4mA
- Input range lower limit value (Offset value): 4.0mA
- Gain value: 20.0mA

$$\text{Input signal error detection setting value} = \frac{4.0 - 2.4}{20.0 - 4.0} \times 1000$$

$$= 100(10.0\%)$$

Therefore, set the input signal error detection setting value to 100 (10.0%).
In this case, the input signal error detection value behaves as follows. (With the 100 (10%) setting, an error is detected when the value is not only 2.4mA, but also 21.6mA.)

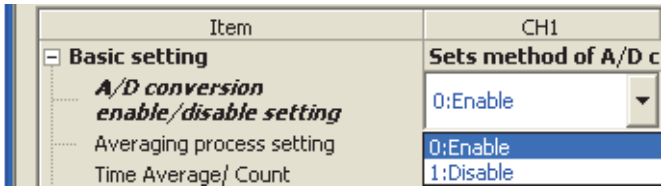


(7) Setting procedure

To enable the input signal error detection function, the input signal error detection extension function should be disabled. When the input signal error detection extension function is enabled, the setting of input signal error detection function is ignored.

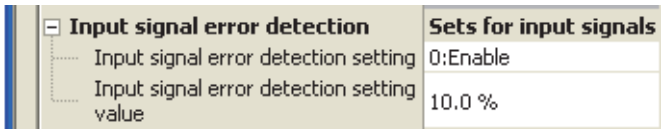
1. Set "A/D conversion enable/disable setting" to "0: Enable".

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

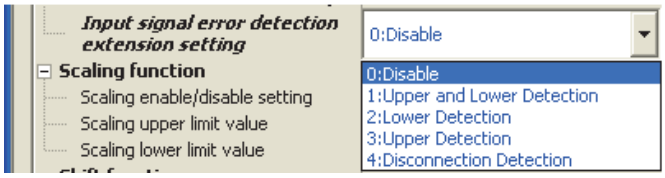


2. Set "Input signal error detection setting" to "0: Enable".

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



4. Set "Input signal error detection extension setting" to "0: Disable".



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

8.8 Input Signal Error Detection Extension Function

Common

Using this function, the detection method of the input signal error detection function can be extended. Use this function to detect an input signal error only at the lower or upper limit, or to execute the disconnection detection. To enable this function, the input signal error detection function does not need to be enabled.

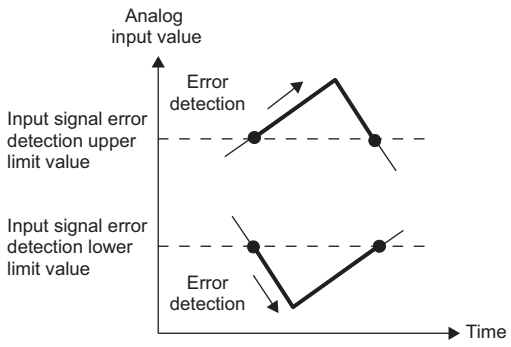
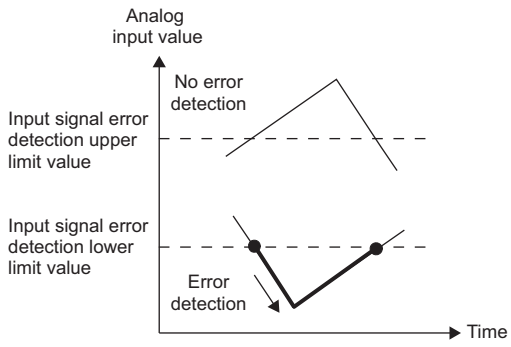
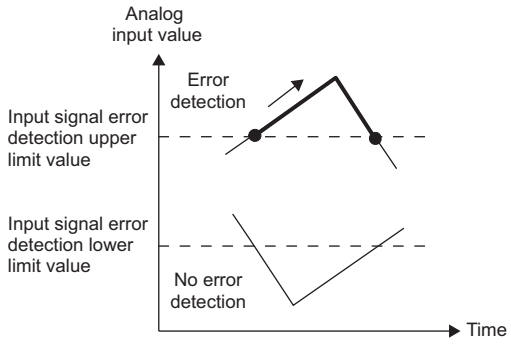
(1) Detection method

As well as the input signal error detection function, an error can be detected with input signal error detection upper limit value and input signal error detection lower limit value.

For details on the setting procedure of input signal error detection upper limit value and input signal error detection lower limit value, refer to the following.

- Input signal error detection function (☞Page 77, Section 8.7)

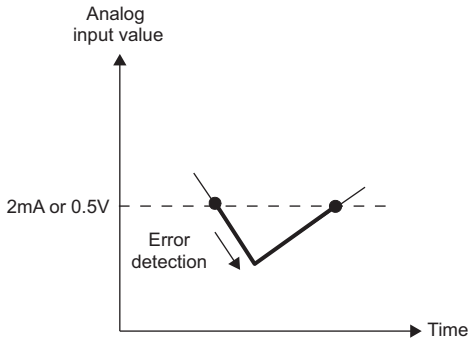
The detection method can be selected from the following list:

Detection method	Detection condition	
Lower upper limit detection	An error is detected when the analog input value is equal to or greater than the input signal error detection upper limit value, or is equal to or smaller than the input signal error detection lower limit value.	
Lower limit detection	An error is detected when the analog input value is equal to or smaller than the input signal error detection lower limit value. An error is not detected when the analog input value is equal to or greater than the input signal error detection upper limit value.	
Upper limit detection	An error is detected when the analog input value is equal to or greater than the input signal error detection upper limit value. An error is not detected when the analog input value is equal to or smaller than the input signal error detection lower limit value.	
Disconnection detection	Disconnection detection is performed. For details, refer to the following. • Disconnection detection (☞Page 83, Section 8.8 (1) (a))	

(a) Disconnection detection

By combining this detection method with the input range extension function, simple disconnection detection can be performed. When either of the following conditions is satisfied, the function judges that a disconnection has occurred and Input signal error (1) is stored in the bit of Input signal error detection flag (Un\G49) corresponding to the channel number.

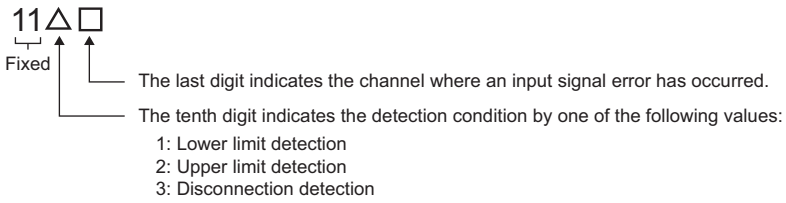
Input range	Disconnection detection condition
4 to 20mA (Extended mode)	Analog input value ≤ 2mA
1 to 5V (Extended mode)	Analog input value ≤ 0.5V



The setting for CH☐ Input signal error detection setting value (Un\G142 to Un\G149) is ignored.

(2) Notification of input signal error

When an input signal error or a disconnection is detected, 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 11△☐ gets stored in Latest error code (Un\G19). The value of the alarm code to be stored varies depending on the condition (upper limit, lower limit, or disconnection detection) under which an error of the analog input value is detected. The following shows the alarm code to be stored.



For details on alarm codes, refer to the following.

- Alarm code list (☞Page 183, Section 11.5)

(3) Operation of the input signal error detection extension function

The operation is the same as that of the input signal error detection function.
For details, refer to the following.

- Input signal error detection function (☞Page 77, Section 8.7)

(4) Detection cycle

This function is executed per sampling cycle.

(5) Clearing the input signal error detection

As in the input signal error detection function, turn on and off Error clear request (YF) after the analog input value returns within the setting range. When the disconnection detection is set, after the analog input value exceeds 2.0mA or 0.5V, turn on and off Error clear request (YF).

For details, refer to the following.

- Input signal error detection function (☞Page 77, Section 8.7)

(6) Specifying the input signal error detection upper and lower limit values

As well as the input signal error detection function, set them based on the input signal error detection setting value.

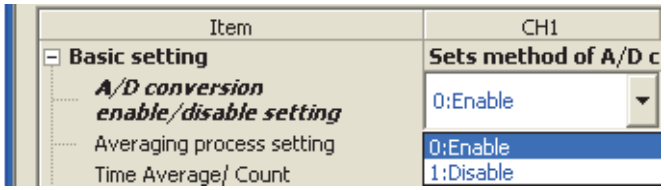
For details, refer to the following.

- Input signal error detection function (☞Page 77, Section 8.7)

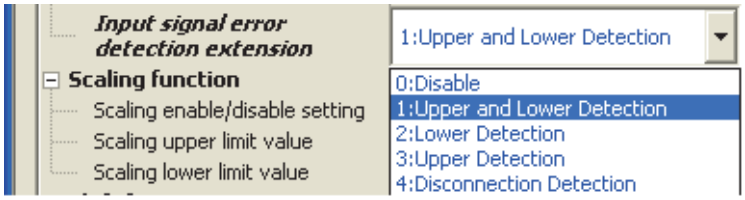
(7) Setting procedure

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

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



2. Set the detection method in "Input signal error detection extension setting"



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

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

Point

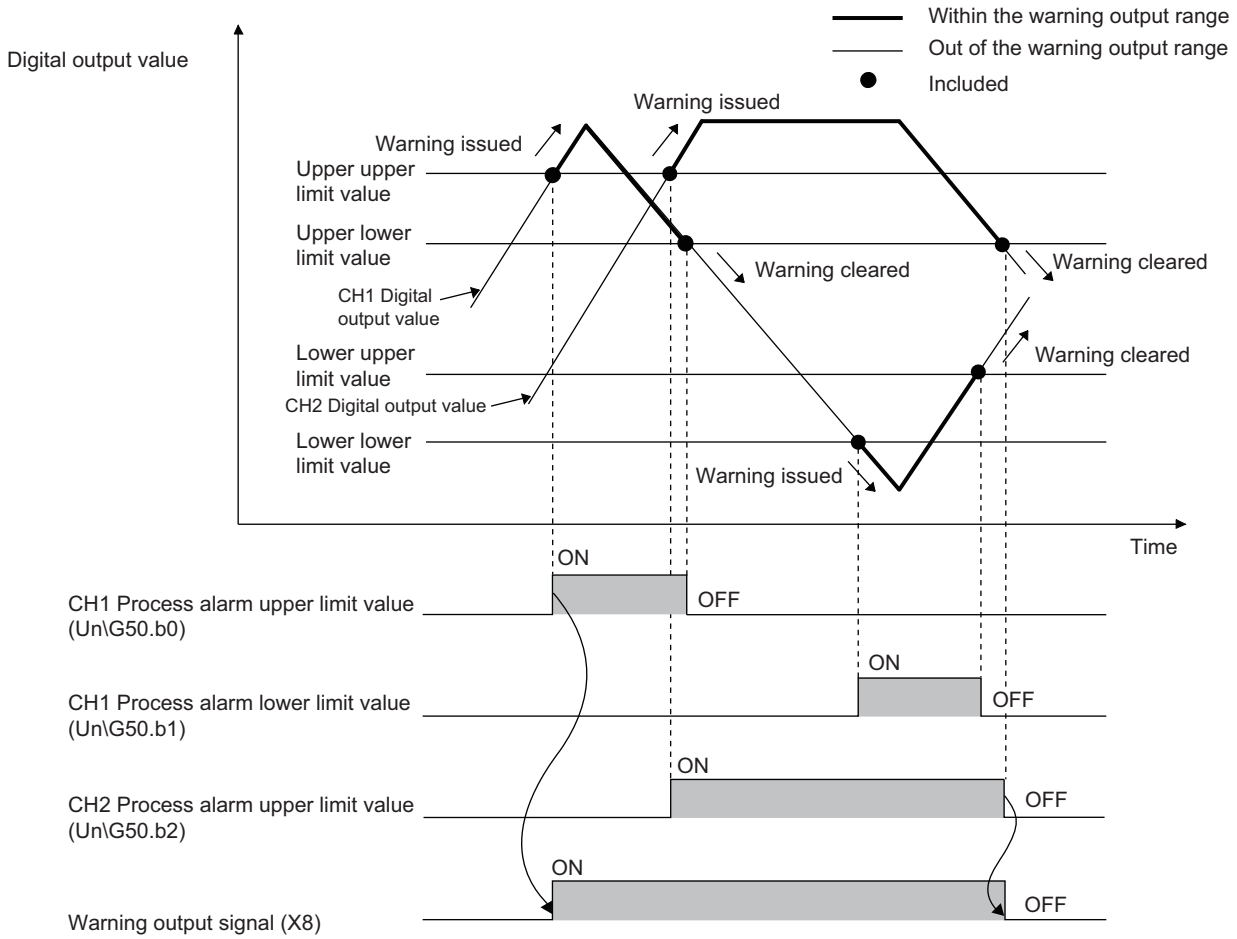
- If "4: Disconnection Detection" is set to a channel whose input range is not 4 to 20mA (Extended mode) or 1 to 5V (Extended mode), an error occurs. The error code (82☐) is stored in Latest error code (Un\G19) and Error flag (XF) turns on.
- The setting in "Input signal error detection setting" is ignored when "Input signal error detection extension setting" is set to other than "0: Disable". An input signal error is detected according to the setting of "Input signal error detection extension setting".
- When the specifications of disconnection detection, 2mA (4 to 20mA (Extended mode) or 0.5V (input range: 1 to 5V (Extended mode)), do not fill the needs of the system, set "Input signal error detection setting" to "2: Lower Detection" and set "Input signal error detection setting value" to a judging value to detect a disconnection.

8.9 Warning Output Function (Process Alarm)

Common

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

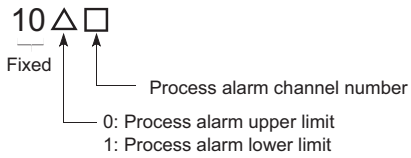
When an operation function such as the scaling function is used, the scaling value (digital operation value) is the target of detection.



(1) Operation performed when a warning is output

When the digital output value falls within a warning output range, equal to or greater than the process alarm upper upper limit value or equal to or smaller than the process alarm lower lower limit value, a warning is notified by the following operations.

- Alarm ON (1) is stored in Warning output flag (Process alarm) (Un\G50).
- Warning output signal (X8) turns on.
- The ALM LED turns on.
- The alarm code (10△□) is stored in Latest error code (Un\G19). The alarm code that is stored is shown below:



The A/D conversion in the channels where a warning is output continues.

(2) Operations performed after a warning is output

After the alarm is output, once the digital output value is smaller than the process alarm upper lower limit value or greater than the process alarm lower upper limit value, Normal (0) 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.

However, the alarm code (10△□) stored in Latest error code (Un\G19) is not cleared. To clear the alarm code (10△□), turn on and off Error clear request (YF).

(3) Warning 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).

When another A/D conversion method is specified, the function is executed per sampling cycle.

(4) Warning detection target

When any of the following functions is used, the warning output function monitors CH□ Scaling value (digital operation value) (Un\G54 to Un\G57) for warning output.

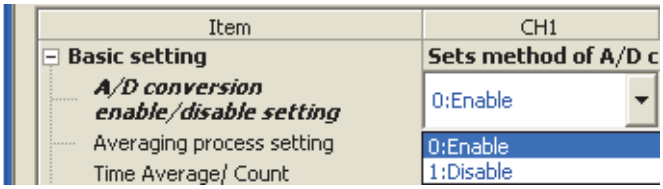
For CH1 Process alarm lower lower limit value (Un\G86) through CH8 Process alarm upper upper limit value (Un\G117), set values considering the setting contents of the following functions.

Module	Function
L60AD4	Digital clipping function, scaling function, shift function, or difference conversion function
L60ADVL8, L60ADIL8	Scaling function

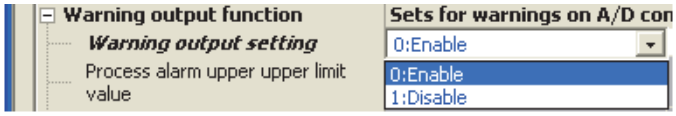
(5) Setting procedure

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

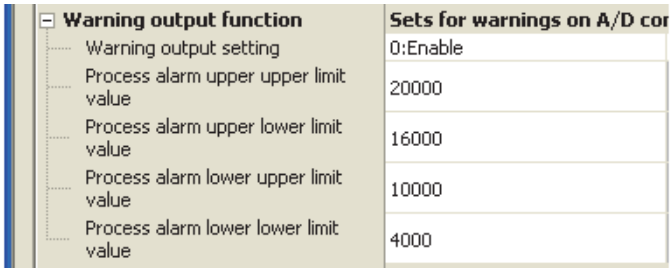
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Warning output setting" to "0: Enable".



3. Specify the values for "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".



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

8.10 Scaling Function

Common

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.

The converted values are stored in CH□ Scaling value (digital operation value) (Un\G54 to Un\G61).

(1) Concept of scaling setting

Ex If the input range is set to -10 to 10V in the L60AD4

For the scaling lower limit value, set a value corresponding to the lower limit value of the input range (-20000).

For the scaling upper limit value, set a value corresponding to the upper limit value of the input range (20000).

(2) Calculation of the scaling value (digital operation value)

The scaling value is calculated based on the following formulas.

(Values after the decimal point are rounded off during scale conversion.)

- Voltage: 0 to 10V, 0 to 5V, 1 to 5V 1 to 5V (Extended mode)*1, user range setting
- Current: 0 to 20mA, 4 to 20mA, 4 to 20mA (Extended mode)*1, user range setting

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

- When voltage is -10 to 10V

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

Item	Description
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

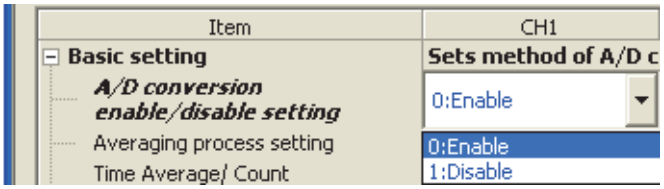
*1 Although the digital output value range in the extended mode is -5000 to 22500 (L60AD4) or -2000 to 9000 (L60ADVL8, L60ADIL8), this function scales digital output values that are within the range of 0 to 20000 (L60AD4) or 0 to 8000 (L60ADVL8, L60ADIL8). For the setting example of scaling using the extended mode, refer to the following.

- Example of scaling setting (☞Page 90, Section 8.10 (4))

(3) Setting procedure

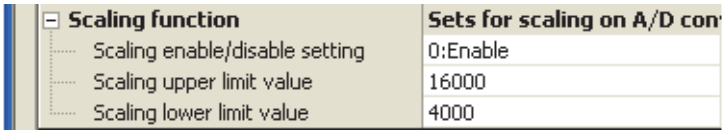
1. Set "A/D conversion enable/disable setting" to "0: Enable".

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



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

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



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

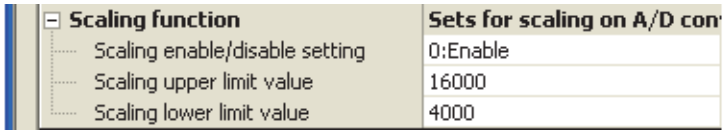
Point

- 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.
- Your scaling settings must meet the following condition:
  Scaling upper limit value > Scaling lower limit value

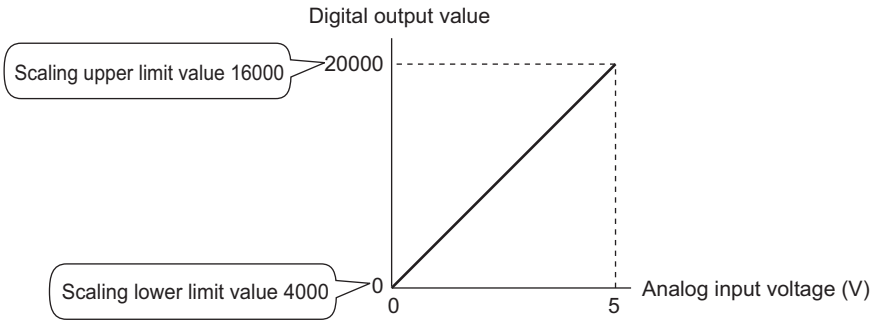
(4) Example of scaling setting

Ex When the following values are set for a channel with the input range of 0 to 5V in the L60AD4

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000



The digital output values and scaling values (digital operation values) are as follows:



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

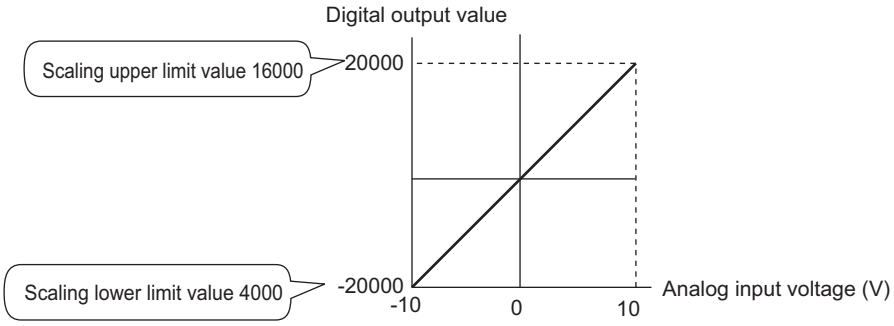
When the input range is set to 0 to 5V in the L60ADVL8, the same scaling value (digital operation value) is stored for the analog input voltage (V).

Ex When the following values are set for a channel with the input range of -10 to 10V in the L60AD4

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000

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 (digital operation values) are as follows:

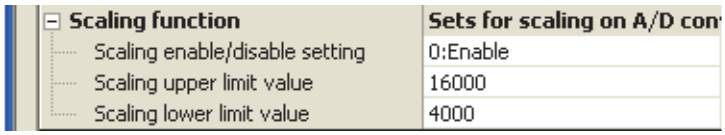


Analog input voltage (V)	Digital output value	Scaling value (digital operation value)
-10	-20000	4000
-5	-10000	7000
0	0	10000
5	10000	13000
10	20000	16000

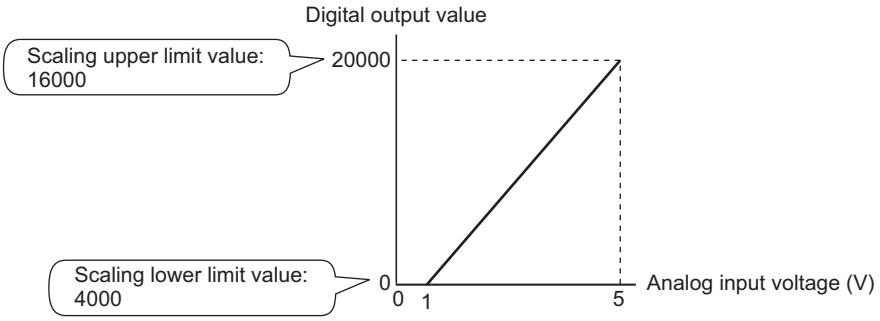
When the input range is set to -10 to 10V in the L60ADVL8, the same scaling value (digital operation value) is stored for the analog input voltage (V).

Ex When the following values are set for a channel with the input range of 1 to 5V (Extended mode) in the L60AD4

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000



The digital output values and scaling values (digital operation values) are as follows:



Analog input voltage (V)	Digital output value	Scaling value (digital operation value)
0	-5000	1000
1	0	4000
2	5000	7000
3	10000	10000
4	15000	13000
5	20000	16000
5.5	22500	17500

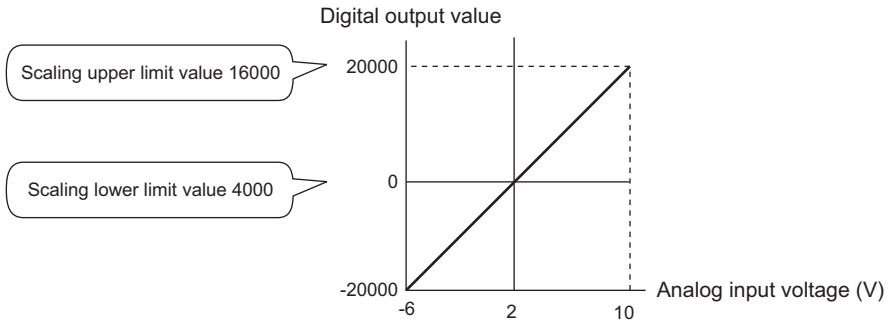
When the input range is set to 1 to 5V (Extended mode) in the L60ADVL8, the same scaling value (digital operation value) is stored for the analog input voltage (V).

Ex When the following values are set for a channel with the user range of 2 to 10V in the L60AD4

- "Scaling enable/disable setting": "0: Enable"
- "Scaling upper limit value": 16000
- "Scaling lower limit value": 4000

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 (digital operation values) are as follows:



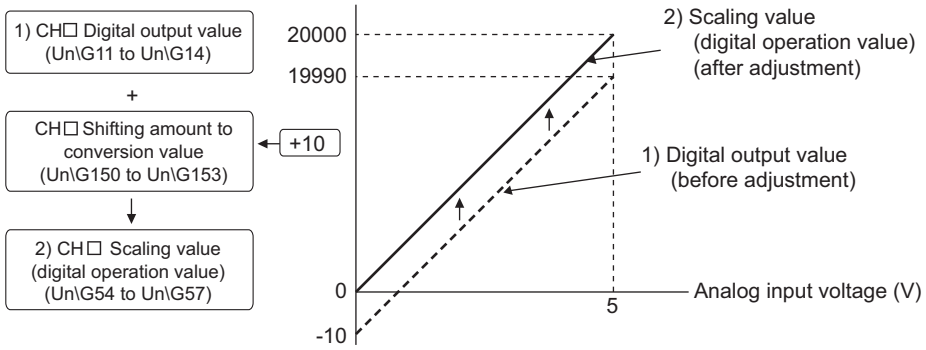
Analog input voltage (V)	Digital output value	Scaling value (digital operation value)
-6	-20000	-8000
-4	-15000	-5000
-2	-10000	-2000
0	-5000	1000
2	0	4000
4	5000	7000
6	10000	10000
8	15000	13000
10	20000	16000

When the user range is set to 2 to 10V in the L60ADVL8, the same scaling value (digital operation value) is stored for the analog input voltage (V).

8.11 Shift Function

AD4

Using this function, the set shifting amount to conversion value can be added (shifted) to the digital output value and it can be stored in the buffer memory. When the shifting amount to conversion value is changed, it is reflected to the scaling value (digital operation value) in real time. Therefore, fine adjustment can be easily performed when the system starts.



Input voltage (V)	CH☐ Digital output value (Un\G11 to Un\G14)
0	-10
5	11990

Input voltage (V)	CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57)
0	0
5	20000

(1) Operation of the shift function

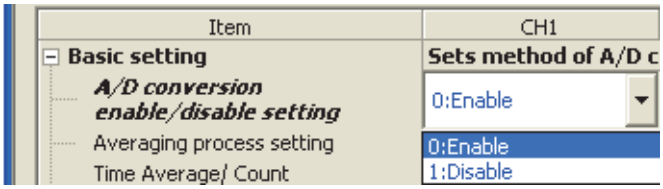
The set shifting amount to conversion value is added to the scaling value (digital operation value). The scaling value (digital operation value) with shift addition is stored in CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57). The shit amount is added in every sampling cycle for sampling processing, while it is added in every averaging process cycle for averaging processing. Then, those added values are stored in CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57).

If some value is set to the shifting amount to conversion value, the shifting amount to conversion value is added regardless of the status change (OFF → ON → OFF) of Operating condition setting request (Y9).

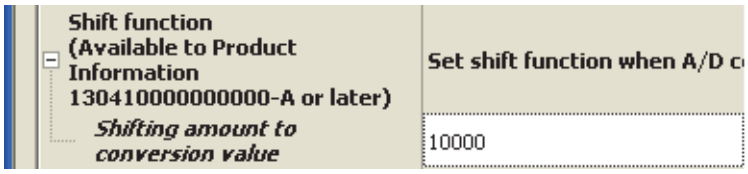
(2) Setting procedure

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

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



2. Set a value to "Shifting amount to conversion value".



The initial value of the shifting amount to conversion value is 0.

Item	Setting range
Shifting amount to conversion value	-32768 to 32767

Point

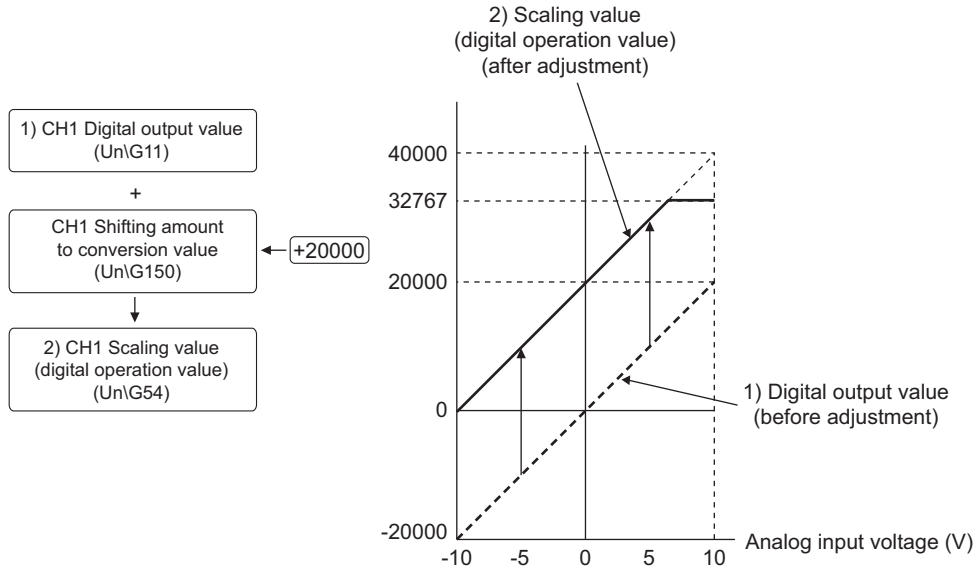
If the digital output value exceeds the range of -32768 to 32767 as a result of shift addition, the digital output value is fixed to the lower limit value (-32768) or the upper limit value (32767).

(3) Setting example

Ex When the following settings are used for a channel with input range of -10 to 10V:

- "Shifting amount to conversion value": 20000

The following figure and table show CH1 Digital output value (Un\G11) and CH1 Scaling value (digital operation value) (Un\G54).



Input voltage (V)	CH1 Digital output value (Un\G11)	CH1 Scaling value (digital operation value) (Un\G54)
-10	-20000	0
-5	-10000	10000
0	0	20000
5	10000	30000
10	20000	32767*1

*1 Since the value exceeds the range of -32768 to 32767, it is fixed to 32767 (the upper limit value).

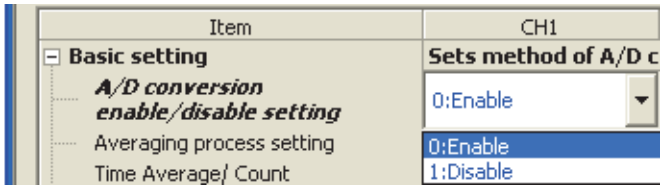
(4) Setting example of when both the scaling function and shift function is used

Ex When the following settings are used for the A/D converter module with input range of 0 to 5V:

- "Scaling upper limit value": 12000
- "Scaling lower limit value": 2000
- "Shifting amount to conversion value": 2000

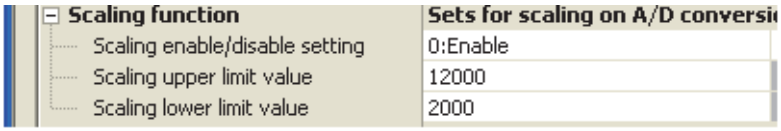
1. Set "A/D conversion enable/disable setting" to "0: Enable".

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

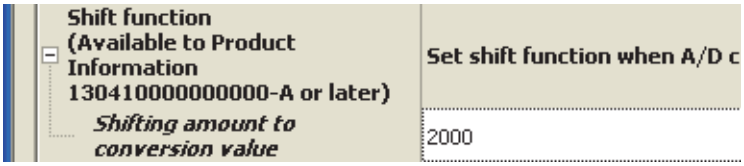


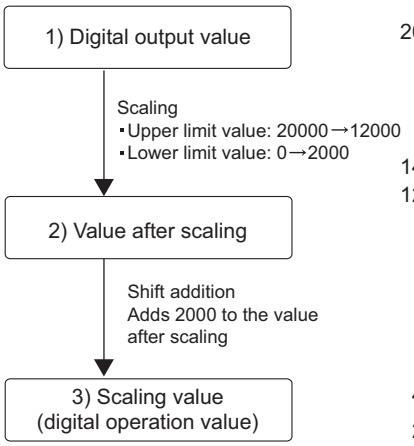
2. Set "Scaling enable/disable setting" to "0: Enable".

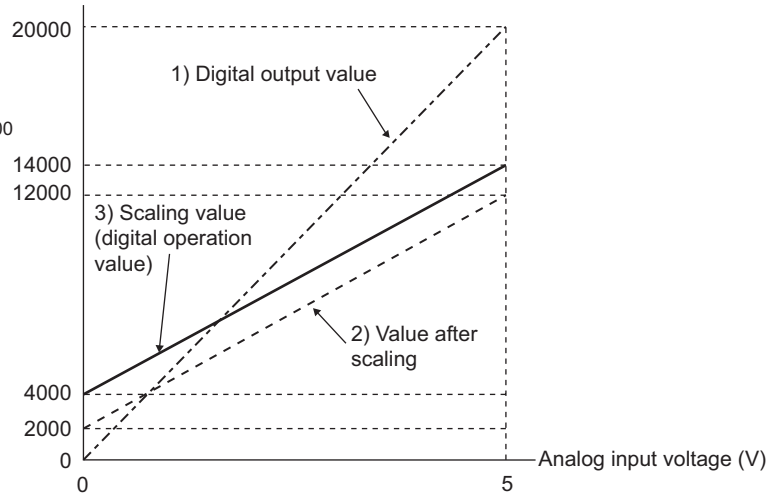
3. Set values for "Scaling upper limit value" and "Scaling lower limit value".



4. Set a value to "Shifting amount to conversion value".







Input voltage (V)	Digital output value	Value after scaling	Scaling value (digital operation value)
0	0	2000	4000
1	4000	4000	6000
2	8000	6000	8000
3	12000	8000	10000
4	16000	10000	12000
5	20000	12000	14000

Point

When the shift function is used with the digital clipping function and scaling function, shift addition is executed on the value after digital clipping and scale conversion.
Therefore, the range of the scaling value (digital operation value) is determined as -32768 to 32767.
For a setting example of when the digital clipping function, scaling function, and shift function are used together, refer to the following.

- Setting example of when the digital clipping function, scaling function, and shift function are used together (☞Page 101, Section 8.12 (4))

8.12 Digital Clipping Function

AD4

The range of the scaling value (digital operation value) for voltage or current over the input range is fixed between the maximum digital output value and the minimum digital output value.

(1) Concept of digital clipping setting

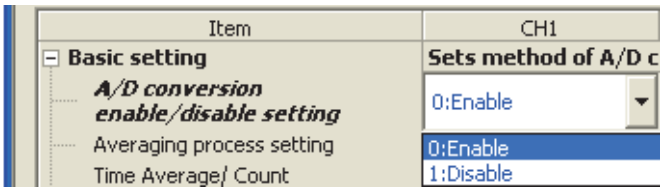
The following table lists the output range of the scaling value (digital operation value) when the digital clipping function is enabled for each range.

Input range	Output range of the scaling value (digital operation value)	
	Digital clipping function enabled	Digital clipping function disabled
4 to 20mA	0 to 20000	-480 to 20479
0 to 20mA		
1 to 5V		
0 to 5V		
0 to 10V		
-10 to 10V	-20000 to 20000	-20480 to 20479
User range setting		
4 to 20mA (Extended mode) 1 to 5V (Extended mode)	-5000 to 22500	-5480 to 22979

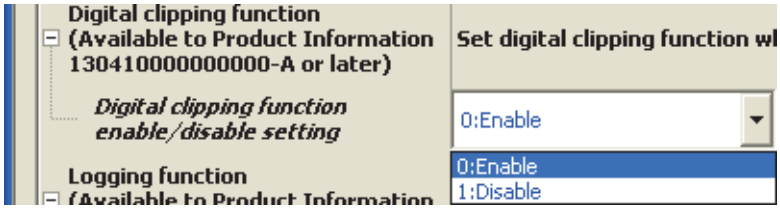
(2) Setting procedure

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

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



2. **Set "Digital clipping function enable/disable setting" to "0: Enable".**



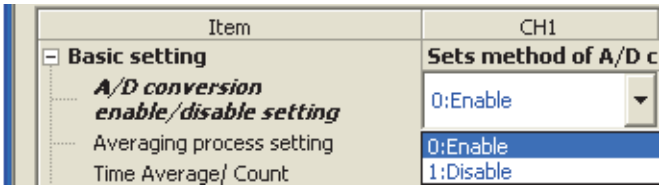
(3) Setting example of when both the digital clipping function and scaling function are used

Ex When setting as follows for the A/D converter module with input range of 0 to 5V:

- "Scaling upper limit value": 32000
- "Scaling lower limit value": 0
- "Digital clipping function enable/disable setting": "0: Enable"

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

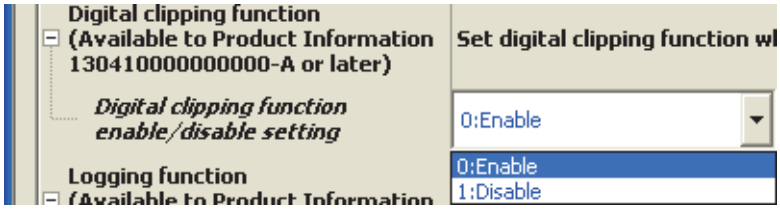
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



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

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

4. Set "Digital clipping function enable/disable setting" to "0: Enable".



In this case, scale conversion is performed on the digital-clipped digital output value. Therefore, the digital output range of the scaling value (digital operation value) is determined as 0 to 32000.

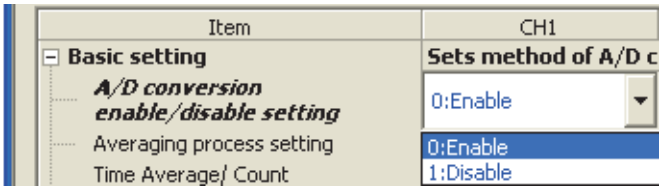
(4) Setting example of when the digital clipping function, scaling function, and shift function are used together

Ex When setting as follows for the A/D converter module with input range of 0 to 5V:

- "Scaling upper limit value": 12000
- "Scaling lower limit value": 2000
- "Shifting amount to conversion value": 2000
- "Digital clipping function enable/disable setting": "0: Enable"

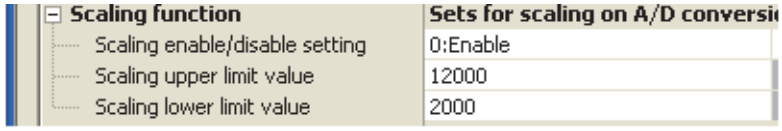
1. Set "A/D conversion enable/disable setting" to "0: Enable".

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

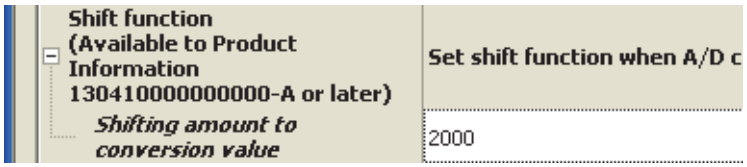


2. Set "Scaling enable/disable setting" to "0: Enable".

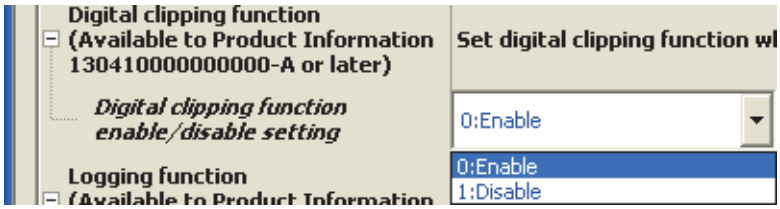
3. Set values for "Scaling upper limit value" and "Scaling lower limit value".



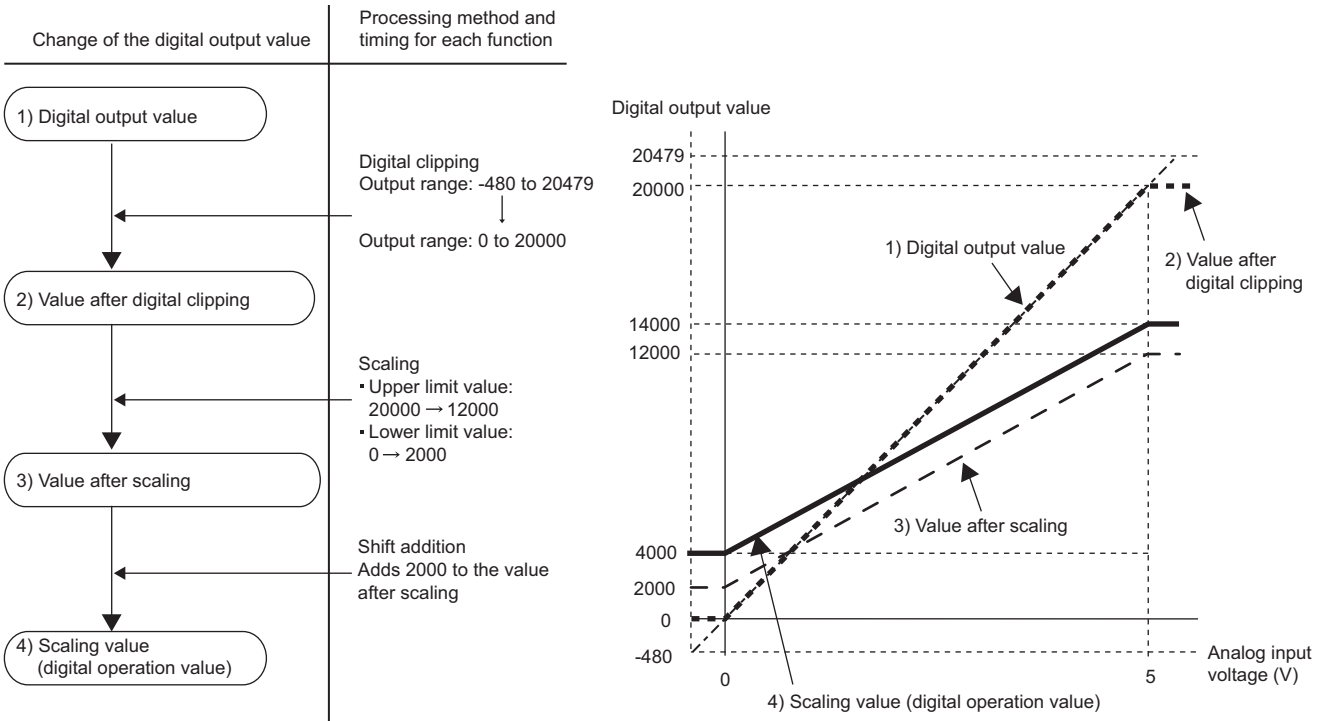
4. Set a value to "Shifting amount to conversion value".



5. Set "Digital clipping function enable/disable setting" to "0: Enable".



Digital output values are processed in the order of 1) to 4) below and stored as scaling values (digital operation values).



Input voltage (V)	Digital output value	Scaling value (digital operation value)
-0.12	-480	4000
0	0	4000
1	4000	6000
2	8000	8000
3	12000	10000
4	16000	12000
5	20000	14000
5.12	20479	14000

Point

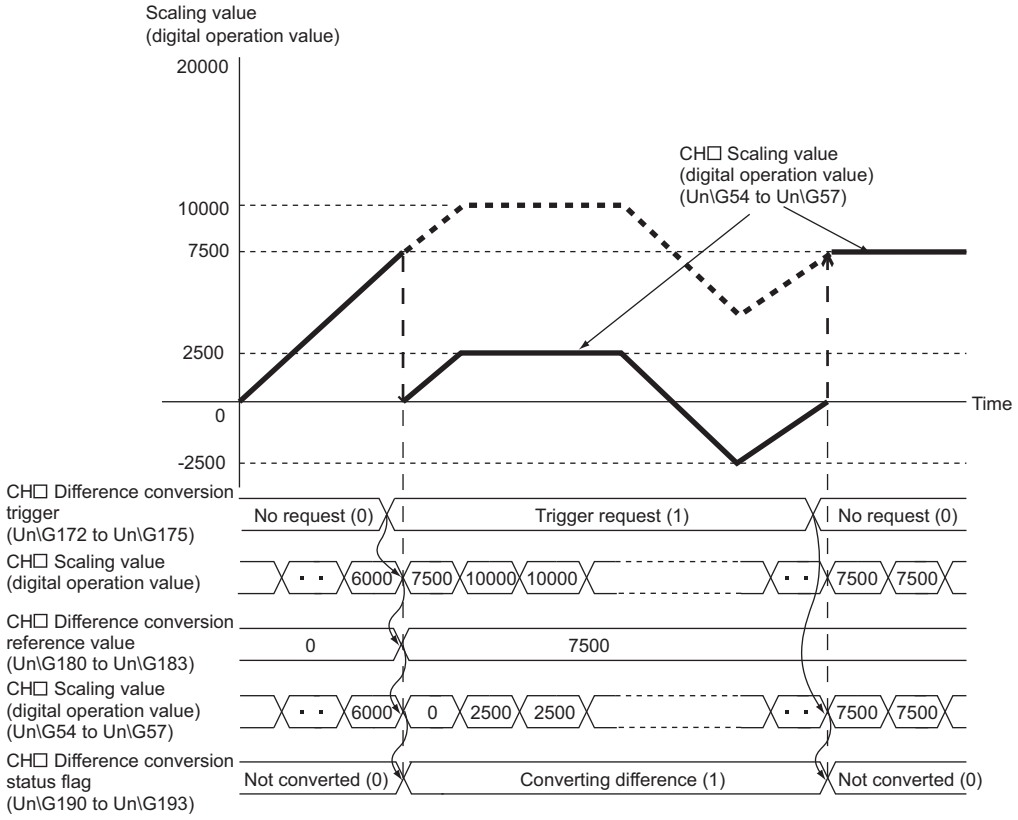
When the digital clipping function is used with the scaling function, shift function, and difference conversion function, the scale conversion, shift addition, and difference conversion are executed on the value after digital clipping.
For details, refer to the following.

- Processing each function (☞Page 67, Section 8.1)

8.13 Difference Conversion Function

AD4

The scaling value (digital operation value) at the start of this function is treated as 0 (reference value). Thereafter, values that increase or decrease from the reference value are stored in the buffer memory.



(1) Operation of the difference conversion function

When the difference conversion starts, the scaling value (digital operation value) at that time (the data stored inside the A/D converter module before difference conversion) is determined as the difference conversion reference value. The value acquired by subtracting the difference conversion reference value from the scaling value (digital operation value) is stored in CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57). Therefore, CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57) at the start of this function is 0. (since the scaling value (digital operation value) equals to the difference conversion reference value at the start)

Scaling value (digital operation value) after difference conversion = Scaling value (digital operation value) - Difference conversion reference value

(2) How to use difference conversion

(a) Starting difference conversion

1. **Change CH□ Difference conversion trigger (Un\G172 to Un\G175) from No request (0) to Trigger request (1).**

The rise of No request (0) → Trigger request (1) is detected as a trigger. When the trigger is detected, the scaling value (digital operation value) at the start is output to the difference conversion reference value. The value acquired by subtracting the difference conversion reference value from the scaling value (digital operation value) is stored in CH□ Scaling value (digital operation value) (Un\G54 to Un\G57). After the value is stored, CH□ Difference conversion status flag (Un\G190 to Un\G193) changes to Converting difference (1).

(b) Stopping difference conversion

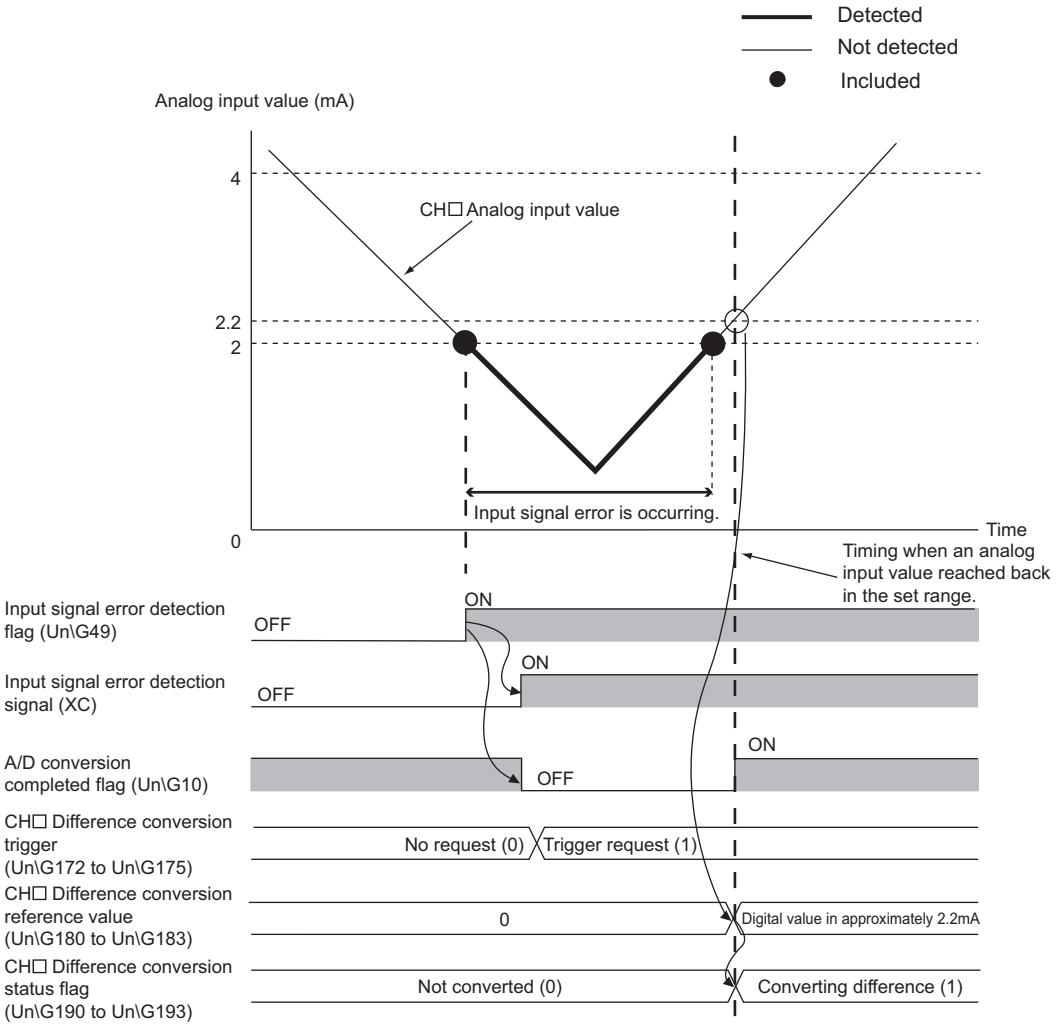
1. **Change CH□ Difference conversion trigger (Un\G172 to Un\G175) from Trigger request (1) to No request (0).**

The fall of Trigger request (1) → No request (0) is detected as a trigger. When the trigger is detected, the difference conversion stops, and CH□ Difference conversion status flag (Un\G190 to Un\G193) changes to Not converted (0). After that, the scaling value (digital operation value) is stored as it is in CH□ Scaling value (digital operation value) (Un\G54 to Un\G57).

(3) Points for the use of the difference conversion function

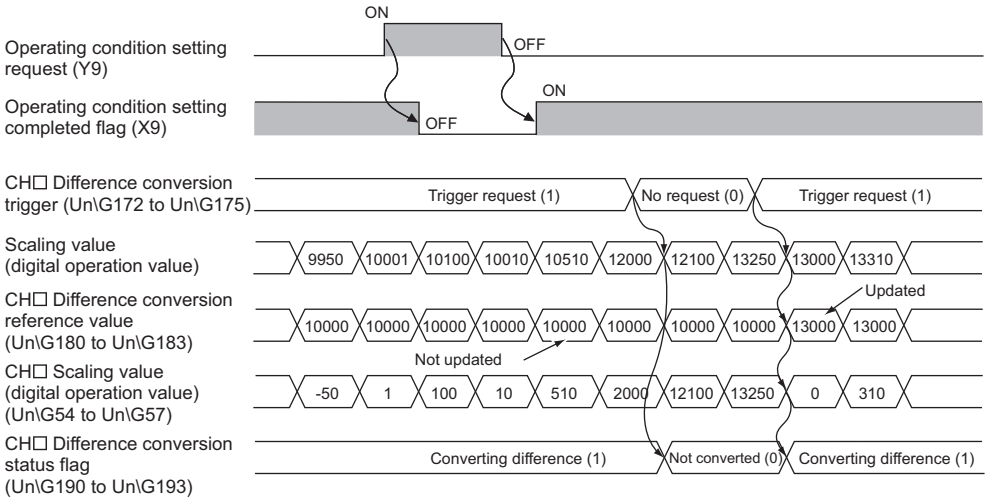
(a) Operation of when an input signal error occurs

While an input signal error is occurring, even if Difference conversion trigger (Un\G172 to Un\G175) changes No request (0) → Trigger request (1), the difference conversion does not start. After the analog input value returns within the setting range, change Difference conversion trigger (Un\G172 to Un\G175) from No request (0) to Trigger request (1) again. If an input signal error occurs in the status of Trigger request (1), the difference conversion starts just when the analog input value returns within the setting value, treating the scaling value (digital operation value) as the difference conversion reference value.



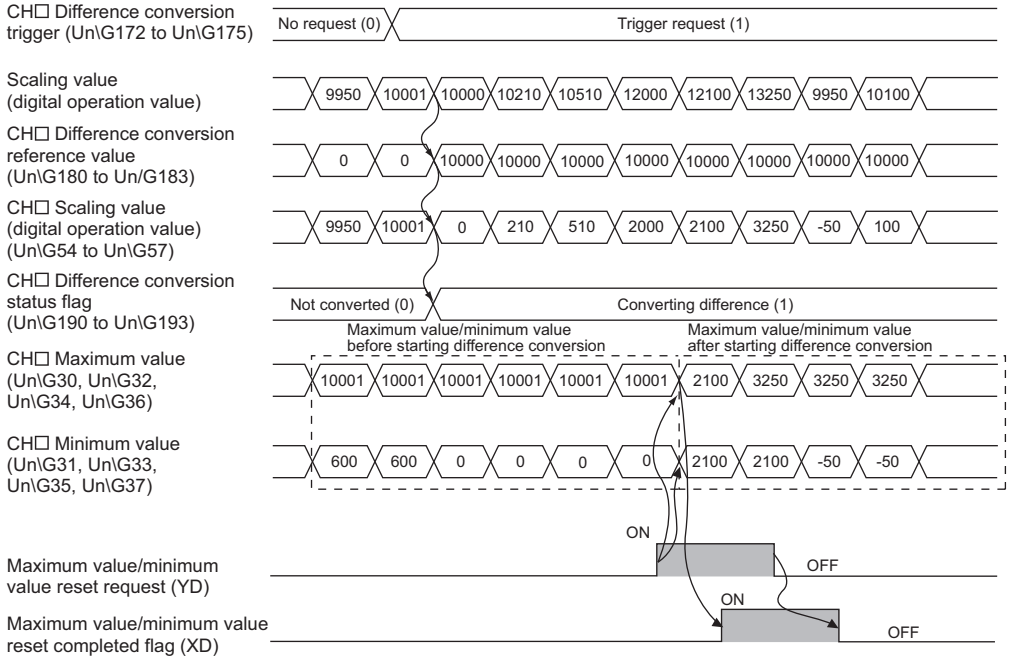
(b) Operation of when Operating condition setting request (Y9) is turned on and off during difference conversion

During the difference conversion, even if Operating condition setting request (Y9) is turned on and off, the difference conversion before Operating condition setting request (Y9) continues and the difference conversion reference value is not updated. To update the difference conversion reference value, restart the difference conversion by changing Difference conversion trigger Trigger request (1) → No request (0) → Trigger request (1) again.



(c) Operation of the maximum value and the minimum value

The maximum value and the minimum value of the values acquired by the difference conversion are stored in CH☐ Maximum value and CH☐ Minimum value during the difference conversion. However, values before the difference conversion may be stored as follows. To update the maximum value and the minimum value after the difference conversion start, turn on and off Maximum value/minimum value reset request (YD).



(d) Operation of when the averaging processing is set

If the difference conversion starts while the averaging processing is set, the following operations are performed at the completion of the first averaging processing.

- The scaling value (digital operation value) is determined as the difference conversion reference value.
- CH□ Difference conversion status flag (Un\G190 to Un\G193) changes to Converting difference (1).

Point

- The difference conversion function can be started at any timing.
- When the difference conversion function is used with the digital clipping function, scaling function, and shift function, each scaling value (digital operation value) is determined as a difference conversion reference value.
- If other than No request (0) or Trigger request (1) is set in CH□ Difference conversion trigger (Un\G172 to Un\G175) during the difference conversion, an error occurs. Though the difference conversion continues.
- Even if the digital clipping function, scaling function, and shift function are set valid, the difference conversion reference value is not updated. To update the difference conversion reference value, stop the difference conversion (change the setting of CH□ Difference conversion trigger (Un\G172 to Un\G175) from Trigger request (1) to No request (0)). Then, enable the digital clipping function, scaling function, and shift function and resume the difference conversion (change the setting of CH□ Difference conversion trigger (Un\G172 to Un\G175) from No request (0) to Trigger request (1)).
  For how to enable each function, refer to the following.
  - Digital Clipping Function (☞Page 99, Section 8.12)
  - Scaling Function (☞Page 88, Section 8.10)
  - Shift function (☞Page 94, Section 8.11)

8.14 Logging Function

AD4

This function stores 10000 points of digital output values or scaling values (digital operation values) in the buffer memory for each channel. The data collection can be stopped by using the status change of the data as a trigger. The data retention around the trouble allows easy symptom analysis.

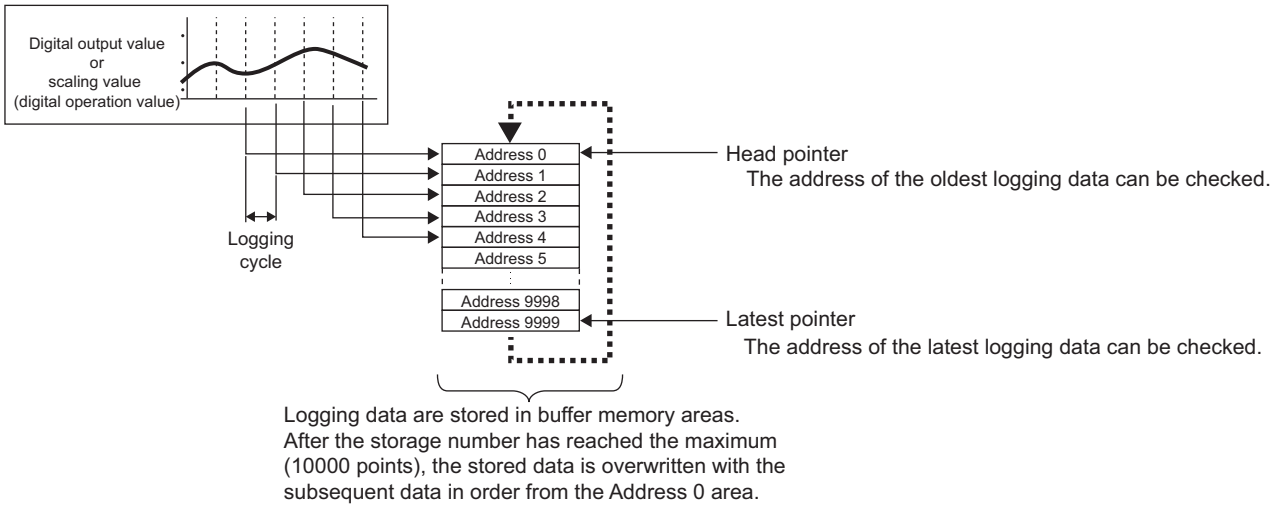
(1) Logging function

(a) Collecting logging data

Logging data is collected as follows.

- For each channel, 10000 points of latest digital output values or scaling values can always be collected.
- The data can be collected at intervals of 80μs at a minimum and of 3600s at a maximum.

An address where the latest/oldest data is stored can be checked with the latest/head pointer.

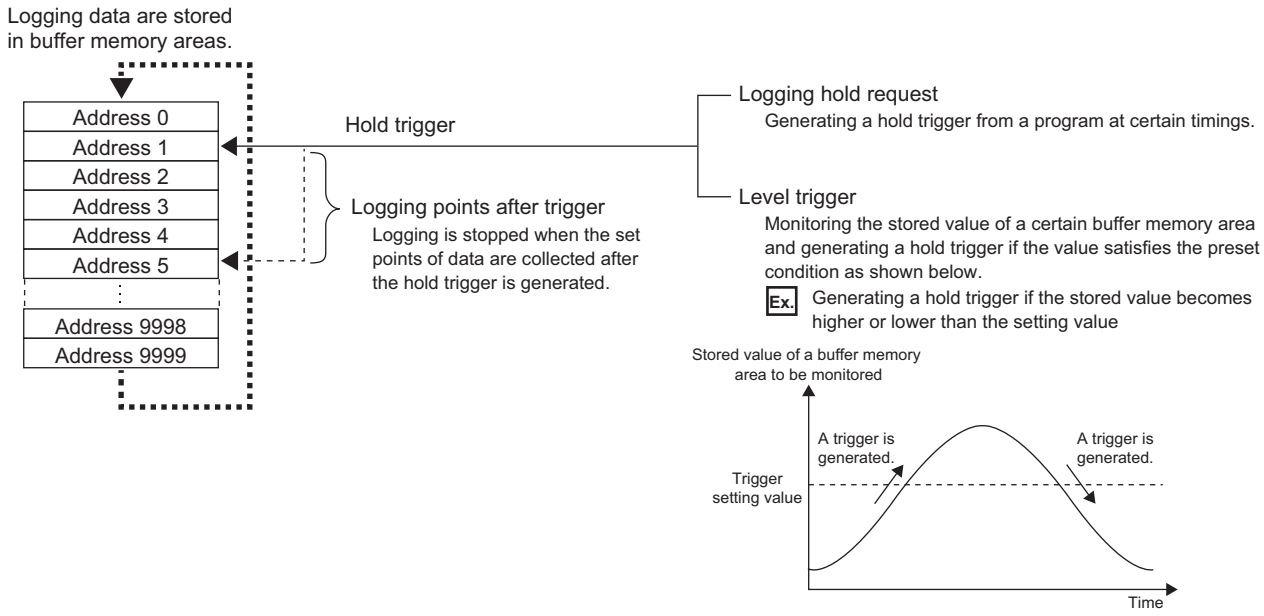


(b) Stopping logging

Logging data is refreshed at high speed during logging. To refer to the logging data without paying attention to the refresh cycle, stop the logging operation.

Logging can be stopped by the hold trigger. (☞Page 115, Section 8.14.1)

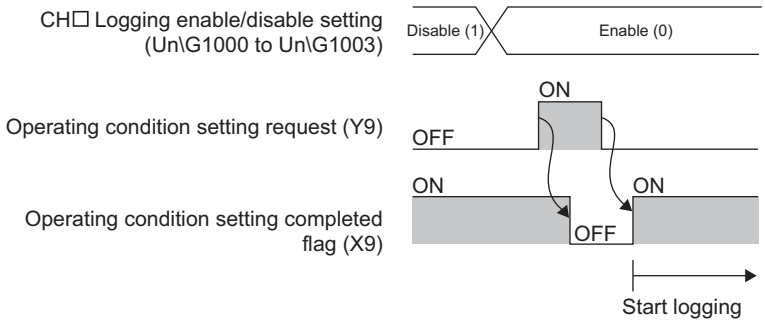
- A hold trigger allows two options: "Logging hold request" or "Level trigger".
- The number of data points to be collected after a hold trigger occurs can be set.



(2) Operation of logging

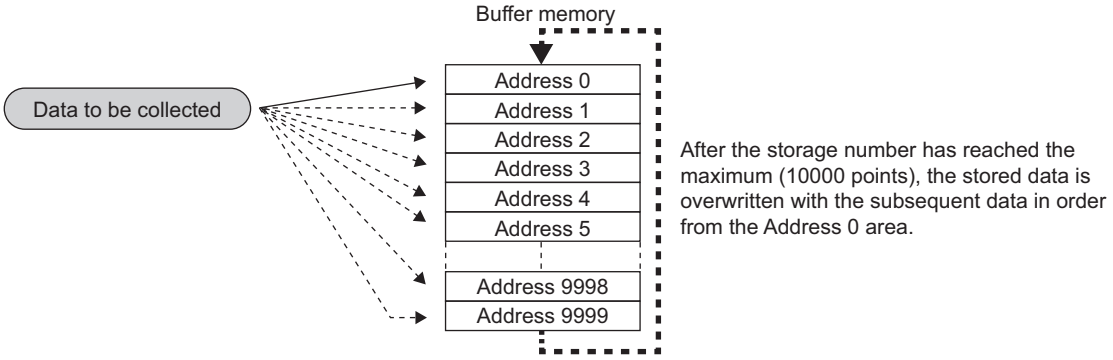
(a) Starting logging data collection

Logging data collection starts when Enable (0) is set to CH☐ Logging enable/disable setting (Un\G1000 to Un\G1003) and Operating condition setting request (Y9) is turned on and off. Data are collected on the preset logging cycle.



(b) Logging data

Logging data are stored in the following buffer memory areas.



Channel	Storage area for logging data
CH1	CH1 Logging data (Un\G5000 to Un\G14999)
CH2	CH2 Logging data (Un\G15000 to Un\G24999)
CH3	CH3 Logging data (Un\G25000 to Un\G34999)
CH4	CH4 Logging data (Un\G35000 to Un\G44999)

If logging has been performed even once, all data in CH☐ Logging data (Un\G5000 to Un\G44999) are cleared to 0 when Operating condition setting request (Y9) is turned off and on.

(3) Logging data setting

Select one of the following data types with CH☐ Logging data setting (Un\G1024 to Un\G1027).

- Digital output value (0)
- Scaling value (digital operation value) (1)

(4) Logging cycle

(a) Logging cycle setting

Set the logging cycle with CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043).

CH□ Logging cycle setting value (Un\G1032 to Un\G1035): Set a time interval at which data are collected.

CH□ Logging cycle unit setting (Un\G1040 to Un\G1043): Set the unit of the time interval at which data are collected.

Setting value of CH□ Logging cycle unit setting (Un\G1040 to Un\G1043)	Available setting range of CH□ Logging cycle setting value (Un\G1032 to Un\G1035)
μs (0)	80 to 32767
ms (1)	1 to 32767
s (2)	1 to 3600

The logging cycle must be an integral multiple of the conversion cycle. If the set logging cycle is not an integral multiple of the conversion cycle, the actual logging cycle becomes the integral multiple of the conversion cycle which is smaller than the set logging cycle.

The following table lists the conversion cycle of each A/D conversion method.

Conversion method	The conversion cycle
Sampling processing	Conversion speed × Number of channels where A/D conversion is enabled
Time average	$\left(\frac{\text{Time set in "Time Average/ Count Average/Moving Average"}}{\text{Conversion speed} \times \text{Number of channels where A/D conversion is enabled}}\right)^{*1} \times \text{Conversion speed} \times \text{Number of channels where A/D conversion is enabled}$ *1 The value after the decimal point is rounded off.
Count average	Number of times set in "Time Average/Count Average/Moving Average") × Conversion speed × Number of channels where A/D conversion is enabled
Moving average	Conversion speed × Number of channels where A/D conversion is enabled

Ex With the following settings, the conversion cycle is 160μs and the actual logging is performed every 6880μs (the integral multiple of 160μs). The values are stored in CH1 Logging cycle monitor value (Un\G1122 to Un\G1124) as shown in the following table.

- A/D conversion-enabled channels: CH1, CH2
- CH1 Averaging process setting: Sampling processing
- CH1 Logging cycle setting value: 7000
- CH1 Logging cycle unit setting: μs

Buffer memory address	Item		Stored value
1122	CH1 Logging cycle monitor value	s	0
1123		ms	6
1124		μs	880

(b) When the logging function turns disabled

The logging is not performed when any of the following error occurs after the logging function is enabled and Operating condition setting request (Y9) is turned on and off.

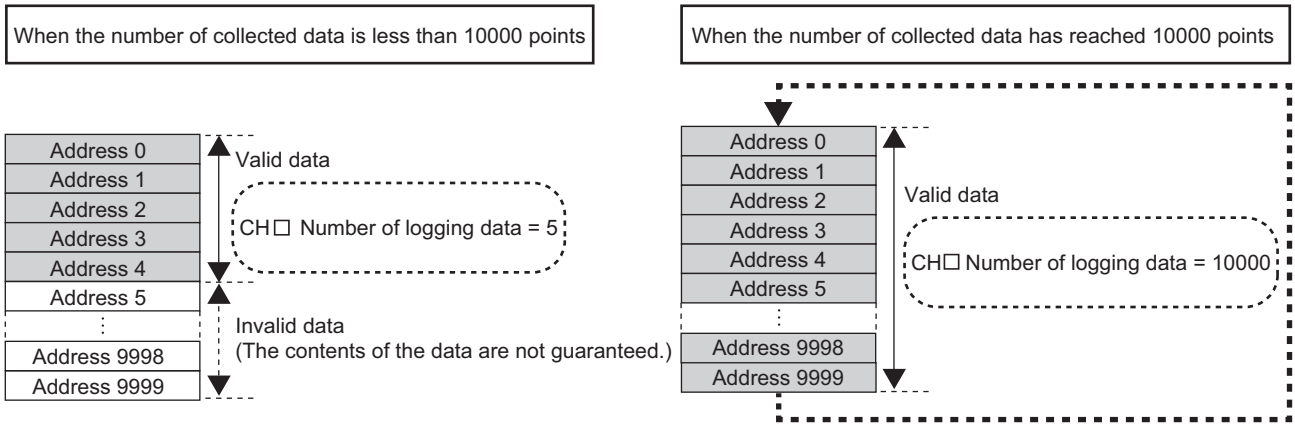
- Error code (20□): Setting error of CH□ Time Average/ Count Average/Moving Average (Un\G1 to Un\G4)
- Error code (30□): Setting error of CH□ Time Average/ Count Average/Moving Average (Un\G1 to Un\G4)
- Error code (31□): Setting error of CH□ Time Average/ Count Average/Moving Average (Un\G1 to Un\G4)
- Error code (360): Setting error of Conversion speed setting (Un\G26)
- Error code (200□ to 208□): Setting error of a parameter setting item of the logging function

Point

- When Operating condition setting request (Y9) is turned on and off on the condition that the logging cycle determined by CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) is shorter than the conversion cycle, an error occurs and logging does not start. The error code (202□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR. LED turns on.
- While "Conversion speed" is set as 20μs (0), setting CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) to Enable(0) causes an error, and the logging is not performed. The error code (200□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR. LED turns on.
- When the input signal error detection function and the input signal error detection extension function are set, setting CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) to Enable (0) causes an error, and the logging is not performed. The error code (208□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR. LED turns on.

(5) Number of logging data

The number of valid data in CH☐ Logging data (Un\G5000 to Un\G44999) can be checked with CH☐ Number of logging data (Un\G1106 to Un\G1109).

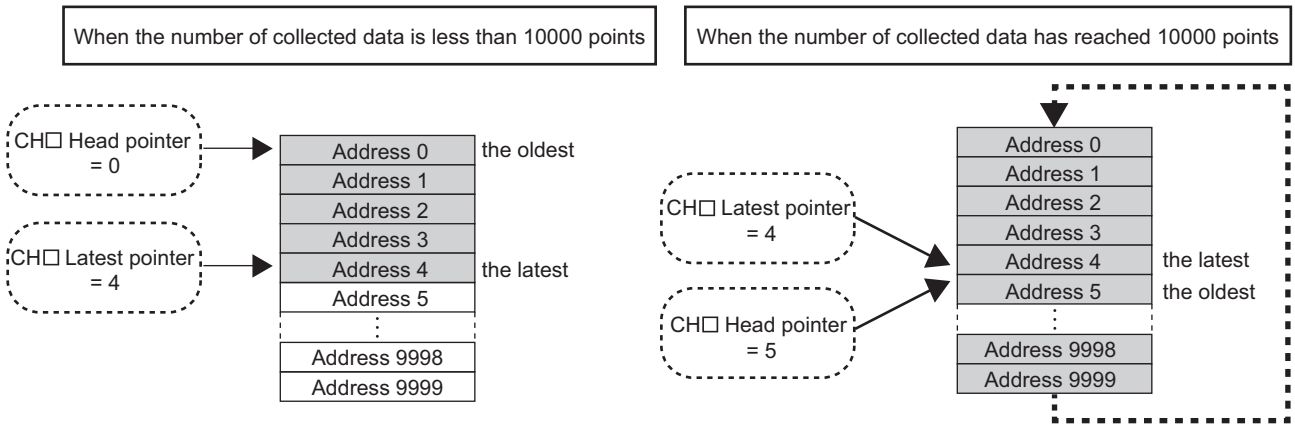


The number of logging data increases one by one each time new data is stored.
When CH☐ Logging data (Un\G5000 to Un\G44999) becomes full (Number of logging data = 10000), the next data is stored in the first address of CH☐ Logging data (Un\G5000 to Un\G44999), and the logging operation continues overwriting the existing data. The number of logging data is fixed to 10000.

(6) Head pointer and latest pointer

The storage location of the oldest data and the latest data in CH☐ Logging data (Un\G5000 to Un\G44999) can be checked with the following buffer memory areas.

Buffer memory	Description
CH☐ Head pointer (Un\G1090 to Un\G1093)	The buffer memory address where the oldest data is stored can be checked in CH☐ Logging data (Un\G5000 to Un\G44999). The offset value (0 to 9999) counted from the start address (Un\G5000, Un\G15000, Un\G25000, Un\G35000) of CH☐ Logging data (Un\G5000 to Un\G44999) is stored.
CH☐ Latest pointer (Un\G1098 to Un\G1101)	The buffer memory address of the latest data in CH☐ Logging data (Un\G5000 to Un\G44999) can be checked with this buffer memory area. The offset value (0 to 9999) counted from the start address (Un\G5000, Un\G15000, Un\G25000, Un\G35000) of CH☐ Logging data (Un\G5000 to Un\G44999) is stored.



The head pointer does not change until CH☐ Logging data (Un\G5000 to Un\G44999) becomes full after the logging start (The value is fixed to 0). The head pointer moves by one point when CH☐ Logging data (Un\G5000 to Un\G44999) becomes full and the overwriting of data starts from the first address.

(7) When checking logging data without stopping logging

Logging data can be checked during logging operation with CH□ Head pointer (Un\G1090 to Un\G1093), CH□ Latest pointer (Un\G1098 to Un\G1101), and CH□ Number of logging data (Un\G1106 to Un\G1109).
To check logging data during logging operation, follow the precautions below because logging data may be refreshed while data is being read out.

- Set the cycle to CH□ Logging cycle setting value (Un\G1032 to Un\G1035) so that data checking and reading surely complete before logging data is refreshed. If the logging cycle is short, logging data may be refreshed during data checking and reading.
- After obtaining the logging data which need to be checked, monitor the variation of the head pointer and the number of logging data, and obtain logging data just after the stored value has changed.
- If the data refresh and the data being checked do not synchronize due to the relationship between the logging cycle and the scan time of the CPU module, adjust the logging cycle.

To check the logging data without paying attention to logging cycle, stop the logging operation. (☞Page 115, Section 8.14.1)

8.14.1 Stopping logging

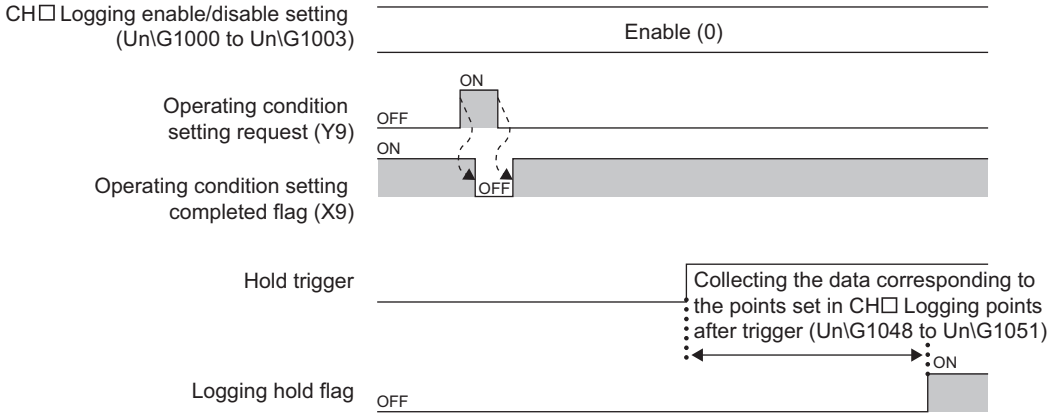
Logging operation stops (hold) when the preset trigger condition is satisfied and the set points of the data are collected.

A trigger that is generated when the condition is satisfied is called a hold trigger.

To generate a hold trigger, the following two methods are available.

- Logging hold request (☞Page 118, Section 8.14.2)
- Level trigger (☞Page 119, Section 8.14.3)

When a hold trigger is detected during data collection, the logging operation stops after the points of the data set in CH☐ Logging points after trigger (Un\G1048 to Un\G1051) are collected.



(1) Logging points after trigger

Set the number of data collected in the period from the detection of a hold trigger to logging operation stop to CH☐ Logging points after trigger (Un\G1048 to Un\G1051).

(2) Confirming stop of logging

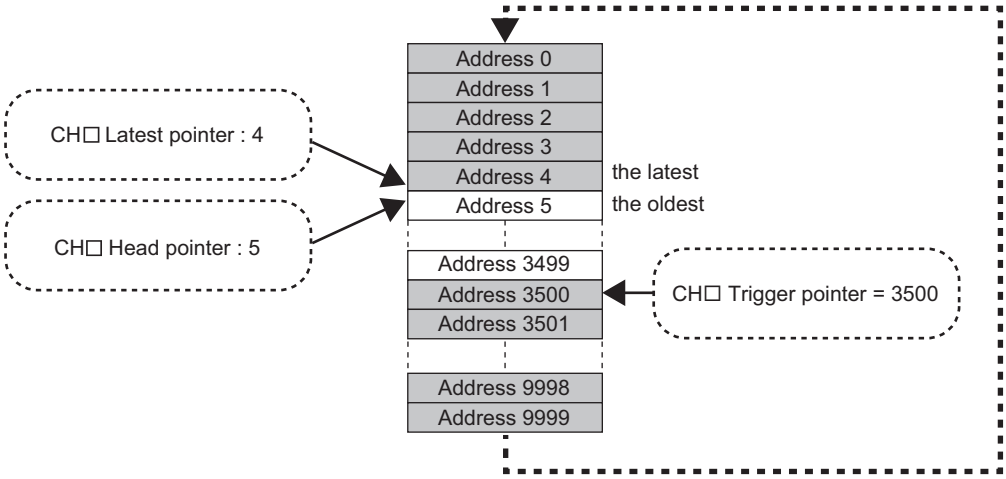
Check that CH☐ Logging hold flag (Un\G1016 to Un\G1019) is On (1).

(3) Checking data when a hold trigger has occurred

The storage location of the data when a hold trigger has occurred can be checked with CH☐ Trigger pointer (Un\G1114 to Un\G1117). The offset value (0 to 9999) counted from the start address (Un\G5000, Un\G15000, Un\G25000, Un\G35000) of CH☐ Logging data (Un\G5000 to Un\G44999) is stored in CH☐ Trigger pointer (Un\G1114 to Un\G1117).

Ex The stored value of the trigger pointer when the logging operation stops under the following conditions

- CH1 Logging points after trigger (Un\G1048): 6505 points
- The data where a hold trigger has occurred: 3500th data



(a) Checking trigger detection time

The trigger detection time can be checked with CH☐ Trigger detection time (Un\G1154 to Un\G1169).
Even when the logging cycle is set as less than 1s, the minimum time unit recorded in the Trigger detection time (Un\G1154 to Un\G1157) is second. Use the trigger detection time as an indication to refer to the logging data.

Ex When CH1 Trigger detection time (Un\G1154 to Un\G1157) is monitored

	b15 to b8	b7 to b0
Un\G1154	First two digits of the year	Last two digits of the year
Un\G1155	Month	Day
Un\G1156	Hour	Minute
Un\G1157	Second	Day of the week

- First two digits of the year, last two digits of the year, month, day, hour, minute, and second are all stored in the BCD code.
- In the day of the week segment, one of the following values in the BCD code indicating the corresponding day is stored.

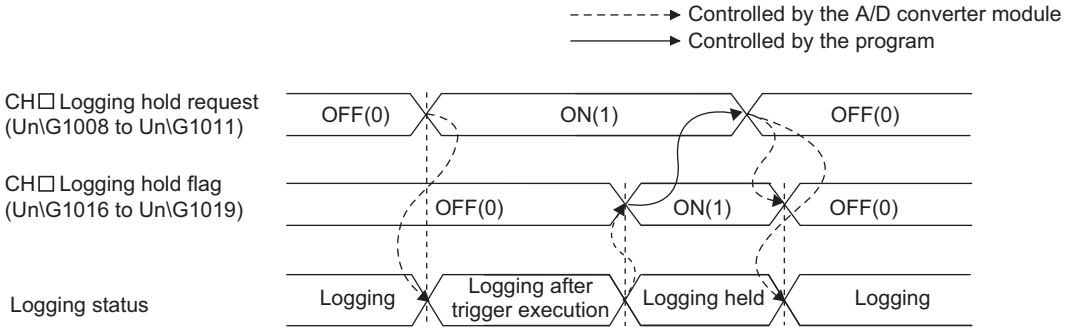
Storage contents			
Sunday: 00H	Monday: 01H	Tuesday: 02H	Wednesday: 03H
Thursday: 04H	Friday: 05H	Saturday: 06H	

Point

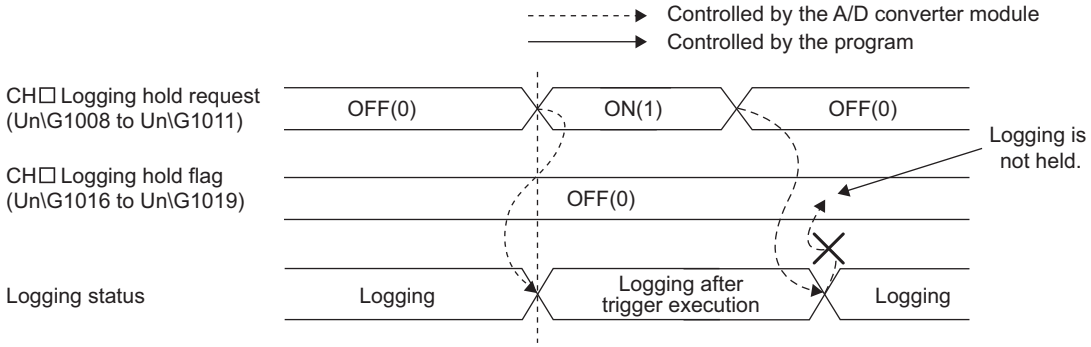
The trigger detection time is obtained from the clock data of the CPU module. Therefore, when a hold trigger is generated right after the programmable controller system is powered on, the A/D converter module may not obtain the clock data from the CPU module. If the module could not obtain the time, the trigger detection time is recorded as "0:0:0 on January 1st, 2000".

(4) Restarting logging

To restart logging, change the value in CH☐ Logging hold request (Un\G1008 to Un\G1011) from On (1) to Off (0). After logging is restarted, the value is stored from the head buffer memory area of CH☐ Logging data (Un\G5000 to Un\G44999).
In addition, Off (0) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019).
It may take time until On (1) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019) after the value in CH☐ Logging hold request (Un\G1008 to Un\G1011) is changed to On (1). To restart logging, check that On (1) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019) and change the value in CH☐ Logging hold request (Un\G1008 to Un\G1011) to Off (0).



- Logging does not stop when Off (0) is set to CH☐ Logging hold request (Un\G1008 to Un\G1011) before On (1) is stored in CH☐ Logging hold flag (Un\G1016 to Un\G1019).



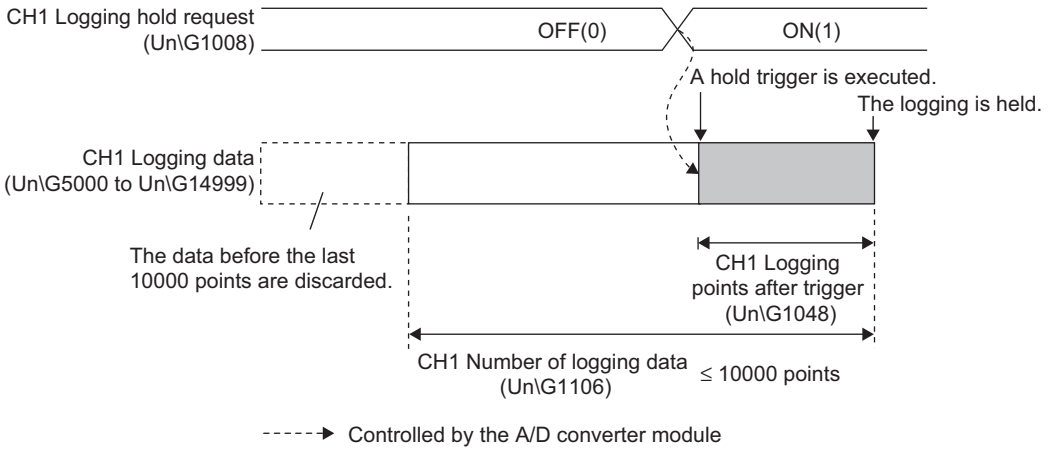
(a) Each buffer memory when logging is restarted

When logging resumes, the value in each buffer memory area below is as follows.

Buffer memory	Value status
CH☐ Head pointer (Un\G1090 to Un\G1093)	Values are initialized. (Initial value: 0)
CH☐ Latest pointer (Un\G1098 to Un\G1101)	
CH☐ Number of logging data (Un\G1106 to Un\G1109)	
CH☐ Trigger pointer (Un\G1114 to Un\G1117)	
CH☐ Trigger detection time (Un\G1154 to Un\G1169)	
CH☐ Logging data (Un\G5000 to Un\G44999)	• The values before logging restarts are not initialized. • After logging is restarted, the value is stored from the start address (Un\G5000, Un\G15000, Un\G25000, Un\G35000) of CH☐ Logging data (Un\G5000 to Un\G44999). To refer to the logging data, check which area has valid data with CH☐ Number of logging data (Un\G1106 to Un\G1109).

8.14.2 Logging hold request

A hold trigger is generated from a program at any timing.
Logging starts when On (1) is set to CH☐ Logging hold request (Un\G1008 to Un\G1011) and stops after a preset number of the data is collected.



Point

- The following delay time occurs until the A/D converter module receives a hold trigger after the value in CH☐ Logging hold request (Un\G1008 to Un\G1011) is changed to On (1).
  Trigger delay = Logging cycle (Actual logging cycle) + Scan time of the CPU module
- Check that On (1) is set to CH☐ Logging hold flag (Un\G1016 to Un\G1019) and change the value in CH☐ Logging hold request (Un\G1008 to Un\G1011) to Off (0). If the value in CH☐ Logging hold request (Un\G1008 to Un\G1011) is changed to Off (0) before the logging stops, the logging does not stop.
- If a value other than Off (0) and On (1) is set to CH☐ Logging hold request (Un\G1008 to Un\G1011), an error occurs. The error code (207☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the ERR. LED turns on.

(1) Checking on logging stop

Check that CH☐ Logging hold flag (Un\G1016 to Un\G1019) is On (1).

8.14.3 Level trigger

When a value in the monitored buffer memory area of the A/D converter module satisfies a preset condition, a hold trigger is generated.
The target data of a level trigger is monitored on the refresh cycle of the digital output value or the scaling value (digital operation value).

(1) Initial setting of a level trigger

(a) Setting of a target to be monitored

As a condition to generate a hold trigger, set the buffer memory address to be monitored to CH☐ Trigger data (Un\G1064 to Un\G1067).

Item	Setting range
CH☐ Trigger data (Un\G1064 to Un\G1067)	0 to 4999

To monitor a device value of a module other than the A/D converter module such as a device of the CPU module, configure the setting as shown below.

- Set a value between 1072 and 1081 (Level data ☐ (Un\G1072 to Un\G1081)) to CH☐ Trigger data (Un\G1064 to Un\G1067).
- Write a value of the monitored device to Level data ☐ (Un\G1072 to Un\G1081) by using the MOV instruction.

Item	Setting range
Level data ☐ (Un\G1072 to Un\G1081)	-32768 to 32767

Ex Usage example of Level data ☐ (Un\G1072 to Un\G1081)
To monitor the data register D100 in the CPU module and operate the level trigger in CH1, create a program as follows.

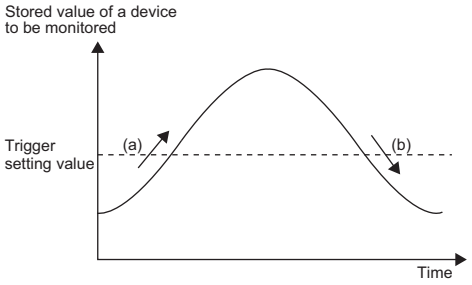
1. **Set 1073 (Level data 1) to CH1 Trigger data (Un\G1064). (When Level data 1 is used)**
2. **Store the storage data of D100 in Level data 1 (Un\G1073) by the program continuously. (The start I/O number is set to 10_H in the following program example.)**

Point

Specify appropriate data such as CH☐ Digital output value (Un\G11 to Un\G14), CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57), and Level data ☐ (Un\G1072 to Un\G1081) to CH☐ Trigger data (Un\G1064 to Un\G1067). When a setting area or a system area is specified, normal operation is not guaranteed.

(b) Setting of the condition

- Set a condition to generate a hold trigger to CH☐ Level trigger condition setting (Un\G1056 to Un\G1059).

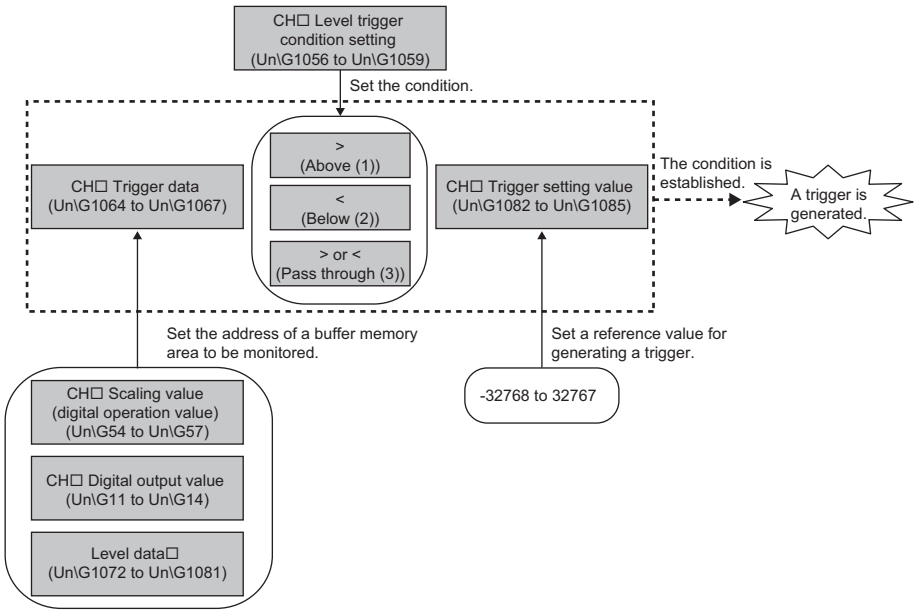
Setting value	Description	
Above (1)		A hold trigger is generated under the condition (a).
Below (2)		A hold trigger is generated under the condition (b).
Pass through (3)	(a) A hold trigger is generated when the relation between the values changes from "Stored value of a buffer memory area to be monitored ≤ Trigger setting value" to "Stored value of a buffer memory area to be monitored ≥ Trigger setting value". (b) A hold trigger is generated when the relation between the values changes from "Stored value of a buffer memory area to be monitored ≥ Trigger setting value" to "Stored value of a buffer memory area to be monitored ≤ Trigger setting value".	A hold trigger is generated under the condition (a) or (b).

- Set a value where a hold trigger is generated to CH☐ Trigger setting value (Un\G1082 to Un\G1085).

Item	Setting range
CH☐ Trigger setting value (Un\G1082 to Un\G1085)	-32768 to 32767

Point

The following figure shows the relation between setting items to be configured for the initial setting of a level trigger.



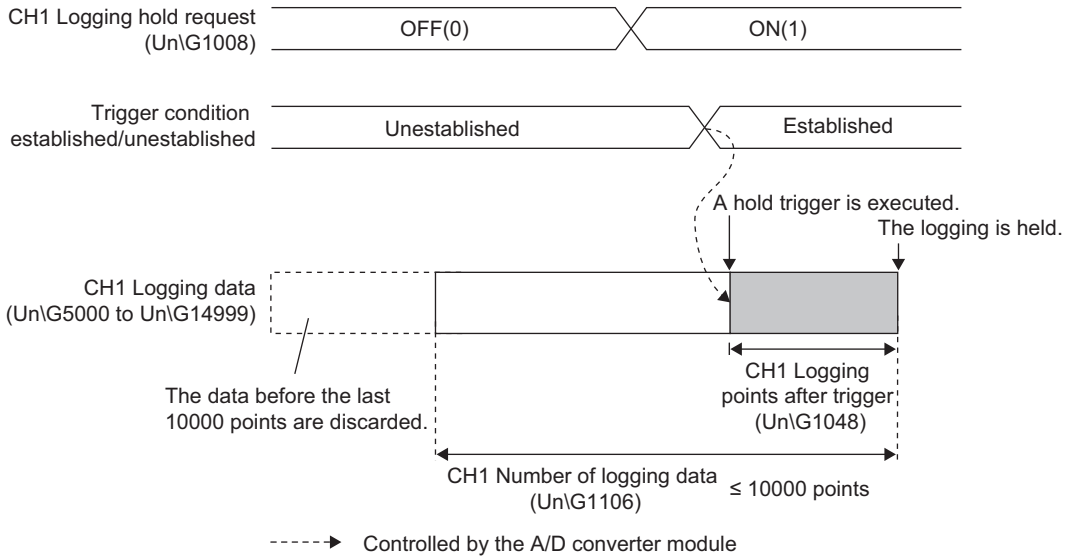
For example, to generate a hold trigger when a value in CH1 Digital output value becomes greater than 10000, configure settings as follows.

- CH1 Level trigger condition setting (Un\G1056): Above (1)
- CH1 Trigger data (Un\G1064): 11
- CH1 Trigger setting value (Un\G1082): 10000

(2) Operation of a level trigger

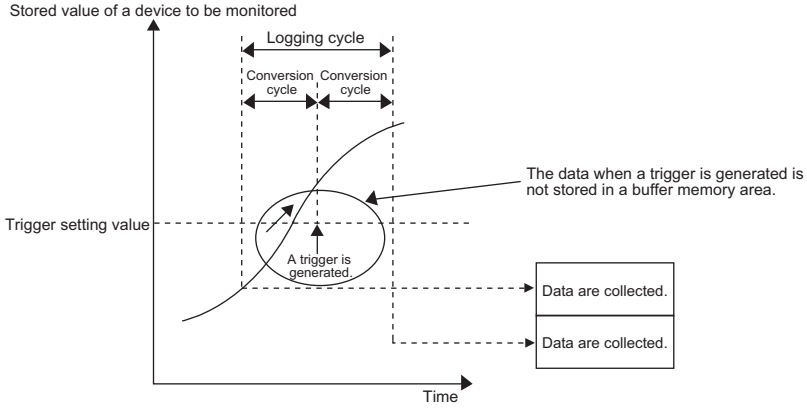
To use a level trigger, set On (1) to CH Logging hold request (Un\G1008 to Un\G1011) in advance. At the point where On (1) has been set, the module becomes the trigger condition wait status.

Data collection starts when the trigger condition has been satisfied, and stops when the set points of the data have been collected.



Point

The target data of a level trigger is detected on the refresh cycle of the digital output value or the scaling value. Therefore, the data when a hold trigger is generated may not be stored in CH□ Logging data (Un\G5000 to Un\G44999) depending on the setting of the logging cycle. To store the data when a hold trigger is generated in CH□ Logging data (Un\G5000 to Un\G44999), arrange related settings so that the conversion cycle of the target value (a trigger data) and the logging cycle (actual logging cycle) have the same time period.



(a) Checking on logging stop

Check that CH□ Logging hold flag (Un\G1016 to Un\G1019) is On (1).

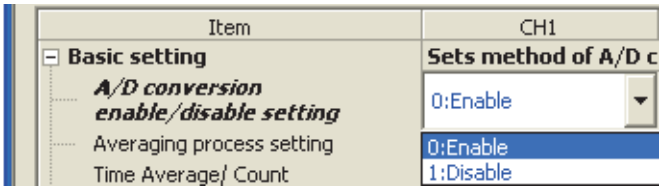
8.14.4 Initial setting for the logging function

The following are the initial setting procedure to use the logging function.

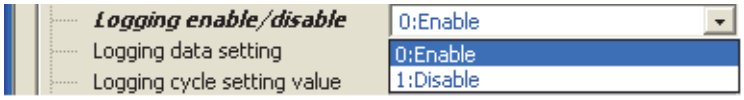
(1) Setting procedure

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

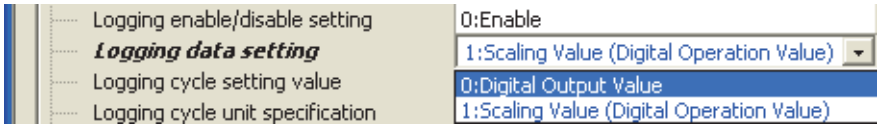
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



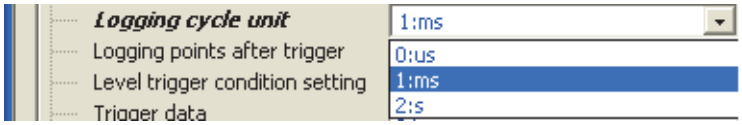
2. Set "Logging enable/disable setting" to "0: Enable".



3. Set the target data in "Logging data setting".



4. Select a unit of "Logging cycle setting value" in "Logging cycle unit specification", and set the cycle of storing logging data to "Logging cycle setting value".

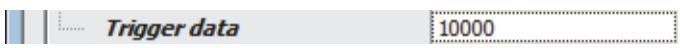


5. Set "Logging points after trigger" to the number of the data points collected for the time period from a hold trigger occurrence to logging stop.

6. Set a condition to generate a hold trigger in "Level trigger condition setting". When "Level trigger condition setting" is set to "0: Disable", skip the procedure 7 and 8.

7. Set the buffer memory address to be monitored using a level trigger to "Trigger data".

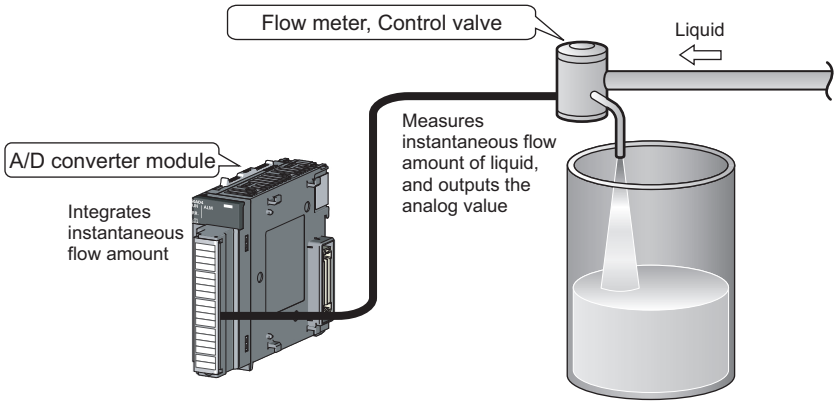
8. Set "Trigger setting value" to a level where a level trigger operates.

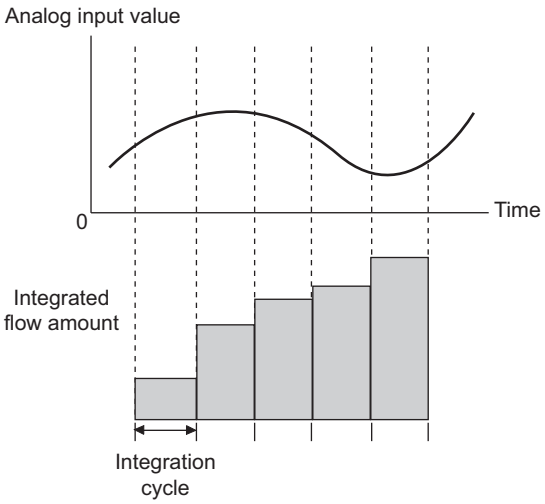


8.15 Flow Amount Integration Function

AD4

This function converts analog values that are input to the A/D converter module from a flow meter (a value obtained by converting the instantaneous flow amount to a voltage value or current value) into digital and integrates the digital values to calculate the flow amount in a certain period of time. In this function, integral processing is performed regarding the scaling value (digital operation value) as the instantaneous flow amount.
In the flow amount integration function, the conversion speed can be set in 1ms.





(1) Concept of integral processing

With this function, integral processing is performed using the following formula.

$$\text{Integrated flow amount} = (\text{Instantaneous flow amount} \times \frac{\Delta T}{T} \times \text{Unit scaling}) + \text{Previous amount}$$

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Integrated flow amount</td><td>This is a result of the integral processing. The integrated flow amount is stored in CH☐ Integrated flow amount (Un\G1332 to Un\G1339) in the range of 0 to 2147483647.</td></tr>
<tr><td>Instantaneous flow amount</td><td>This is an instantaneous flow amount value output in analog from the flow meter. In this function, the value stored in CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57) as the instantaneous flow amount.</td></tr>
<tr><td>DT</td><td>This is an integration cycle (ms) set in CH☐ Integration cycle setting (Un\G1308 to Un\G1311). Set this cycle according to the output cycle of the flow meter connected to the A/D converter module.
Ex. When the flow meter outputs instantaneous flow amount in analog at intervals of 500ms, set 500.</td></tr>
<tr><td>T</td><td>This is a conversion value to convert the time unit of instantaneous flow amount to ms. Set this value in CH☐ Flow amount time unit setting (Un\G1316 to Un\G1319). Set this cycle according to the range of the flow meter connected to the A/D converter module.
The following table lists the values of T for CH☐ Flow amount time unit setting (Un\G1316 to Un\G1319).
<table>
<tr><th>Range of flow meter</th><th>Setting value of CH☐ Flow amount time unit setting (Un\G1316 to Un\G1319)</th><th>T (ms)</th></tr>
<tr><td>/s</td><td>0</td><td>1000</td></tr>
<tr><td>/min</td><td>1</td><td>60000</td></tr>
<tr><td>/h</td><td>2</td><td>3600000</td></tr>
</table>
Ex. When the range of the flow meter is cm^3/s, set /s (0).</td></tr>
<tr><td>Unit scaling</td><td>This is unit scaling of the integrated flow amount. Set this valule in CH☐ Unit scaling setting (Un\G1324 to Un\G1327).
This is used when the value of instantaneous flow amount × DT/T is 0 to 1.
The following table lists the values of unit scaling for CH☐ Unit scaling setting (Un\G1324 to Un\G1327).
<table>
<tr><th>Setting value of CH☐ Unit scaling setting (Un\G1324 to Un\G1327)</th><th>Unit scaling</th></tr>
<tr><td>0</td><td>1</td></tr>
<tr><td>1</td><td>10</td></tr>
<tr><td>2</td><td>100</td></tr>
<tr><td>3</td><td>1000</td></tr>
<tr><td>4</td><td>10000</td></tr>
</table>
Ex. When the value of DT/T is 0.0083...(DT=500(ms), T=60000(ms))
Set × 1000 (3) or × 10000 (4).</td></tr>
<tr><td>Previous amount</td><td>This is a value stored in CH☐ Integrated flow amount (Un\G1332 to Un\G1339) before integral processing.</td></tr>
</table>

Point

- If the instantaneous flow amount is less than 0, integral processing is not performed.
- The value acquired by rounding off the part after the decimal point is stored in CH☐ Integrated flow amount (Un\G1332 to Un\G1339). (Inside the A/D converter module, calculation is performed including the value after the decimal point in integral processing.)
- The value within the range of 0 to 2147483647 is stored in CH☐ Integrated flow amount (Un\G1332 to Un\G1339). If the value exceeds the upper limit (2147483647), the excessive part is stored in CH☐ Integrated flow amount (Un\G1332 to Un\G1339).

  Ex. When the previous amount is 2147483000 and the present amount (Instantaneous flow amount × Unit scaling × DT/T) is 5000,
  (2147483000 + 5000) - 2147483647 = 4353 is stored in CH☐ Integrated flow amount (Un\G1332 to Un\G1339).

(2) Concept of integration cycle

Set the integration cycle according to the analog output cycle of the flow meter connected to the A/D converter module. In addition, set this cycle as an integral multiple of the updating cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57).

The updating cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57) equals to the conversion cycle of the specified A/D conversion method. The following table lists the conversion cycle of each A/D conversion method.

A/D conversion method	Conversion cycle
Sampling processing	Conversion speed*1 × Number of channels where A/D conversion is enabled (ms)
Count average processing	$\left(\frac{\text{Time set in "Time Average/Count Average/Moving Average"}}{\text{Number of channels where A/D conversion is enabled}}\right)^{*2} \times \text{Conversion speed}^{*1} \times \text{Number of channels where A/D conversion is enabled}$ (ms)
Time average processing	(Number of times set in "Time Average/ Count Average/Moving Average") × Conversion speed*1 × Number of channels where A/D conversion is enabled (ms)
Moving average processing	Conversion speed*1 × Number of channels where A/D conversion is enabled (ms)

*1 In the flow amount integration function, the conversion speed can be set in 1ms. Therefore, the conversion speed is 1ms.

*2 The value after the decimal point is rounded off.

If the setting value of CH□ Integration cycle setting (Un\G1308 to Un\G1311) is not an integral multiple of the updating cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57), the maximum value of an integral multiple less than the value set in CH□ Integration cycle setting (Un\G1308 to Un\G1311) is calculated as the integration cycle.

Check the calculated integration cycle, which is stored in CH□ Integration cycle monitor value (Un\G1348 to Un\G1351).

Ex When the integration cycle is calculated with the following settings

- A/D conversion enable in CH1 to CH3
- "Averaging process setting" is "0: Sampling processing"
- "Integration cycle setting" is 5000

Since the updating cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57) is 3ms, the integration cycle is determined as 4998ms (the maximum cycle of an integral multiple of 3ms).

Point

If CH□ Integration cycle setting (Un\G1308 to Un\G1311) is less than the updating cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57), the flow amount integration function turns disabled and an error (error code: 212□) occurs.

(3) Concept of unit scaling

Unit scaling adjusts the number of digits of the integrated flow amount by multiplying "instantaneous flow amount × DT/T" by a multiple of 10.

Set the unit scaling to store the value after the decimal point of "instantaneous flow amount × DT/T" in CH☐ Integrated flow amount (Un\G1332 to Un\G1339).

Ex When the value of "instantaneous flow amount × DT/T" is 123.45

By setting 100 as a unit scaling, the value of "instantaneous flow amount × DT/T" turns 12345 and the value after the decimal point can be stored in CH☐ Integrated flow amount (Un\G1332 to Un\G1339).

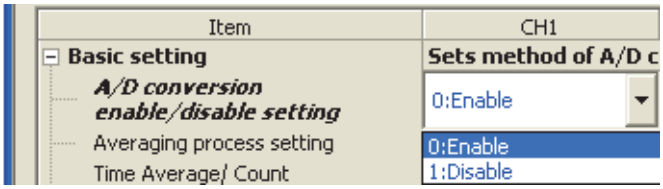
The following table lists the indications of the calculated value of DT/T acquired by the combination of CH☐ Flow amount time unit setting (Un\G1316 to Un\G1319) and CH☐ Integration cycle setting (Un\G1308 to Un\G1311) and the value set in CH☐ Unit scaling setting (Un\G1324 to Un\G1327).

Setting value of CH☐ Flow amount time unit setting (Un\G1316 to Un\G1319) (T)	Setting value of CH☐ Integration cycle setting (Un\G1308 to Un\G1311) (DT)	DT/T	Indication of unit scaling
0 (T = 1000)	1	0.001	× 1000
	500	0.5	× 10
	1000	1	× 1
	5000	5	× 1
1 (T = 60000)	1	0.000016666	× 10000
	500	0.008333333	× 10000
	1000	0.016666666	× 1000
	5000	0.083333333	× 1000
2 (T = 3600000)	1	0.000000277	× 10000
	500	0.000138888	× 10000
	1000	0.000277777	× 10000
	5000	0.001388888	× 10000

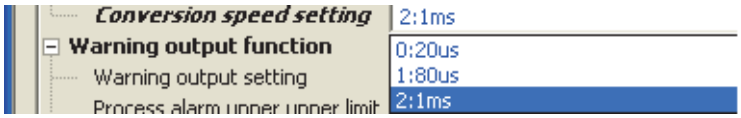
(4) Setting procedure

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

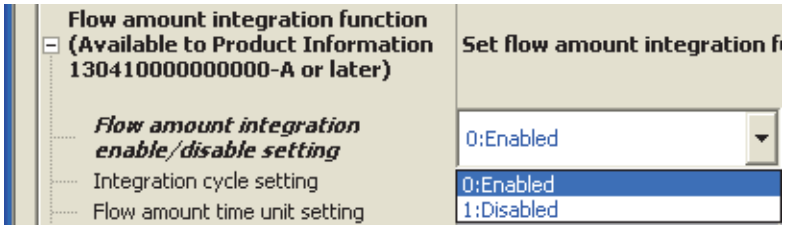
Project window ⇨ [Intelligent Function Module] ⇨ module name ⇨ [Parameter]



2. Set "Conversion speed setting" to "2: 1ms".



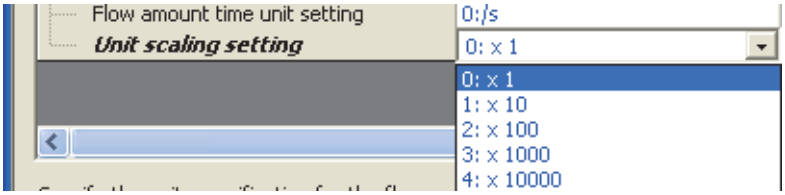
3. Set "Flow amount integration enable/disable setting" to "0: Enabled".



4. Set a value for "Integration cycle setting".

5. Set a value for "Flow amount time unit setting"

6. Set a value for "Unit scaling setting"

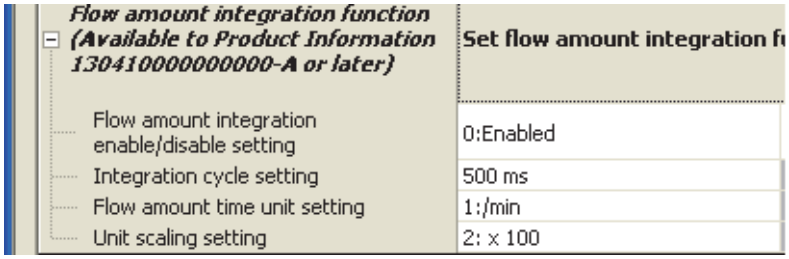


Item	Setting range
Integration cycle setting	1 to 5000ms

Ex When the flow meter connected to the A/D converter module output the instantaneous flow amount (range: cm^3/min) in analog at intervals of 500ms

- "Integration cycle setting": 500ms
- "Flow amount time unit setting": "1: /min"
- "Unit scaling setting": "2: × 100"
- Value in CH□ Scaling value (digital operation value) (Un\G54 to Un\G57) when integral processing is performed: 5000
- Previous amount: 11000 (Maintained amount inside the A/D converter module: 11000.127)

The following formulation shows the integrated flow amount with the above settings.



$$\text{Integrated flow amount} = (\text{Instantaneous flow amount} \times \frac{\Delta T}{T} \times \text{Unit scaling}) + \text{Previous amount}$$

$$= (5000 \times \frac{500}{60000} \times 100) + 11000.127$$

$$= 4166.666\cdots + 11000.127$$

$$= 15166.7936\cdots$$

"15166" acquired by rounding off the value after the decimal point is stored in CH□ Integrated flow amount (Un\G1332 to Un\G1339).

(5) Flow amount integration temporary stop

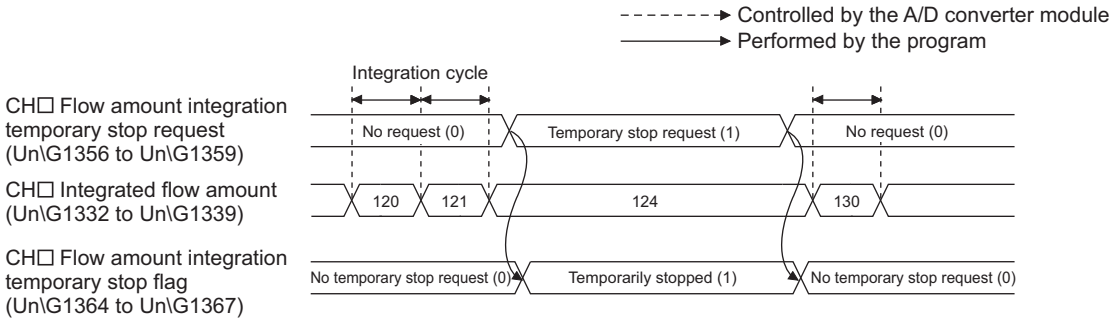
The flow amount integration can be stopped temporarily through a program. Flow amount integration function can be temporarily stopped by changing the value of CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) during its operation. CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) operates only when the flow amount integration function is enabled.

(a) Operation procedure to stop the flow amount integration temporarily

1. **While the flow amount integration function is operating, change the CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) of the channel to be stopped temporarily No request (0) → Temporary stop request (1).**
2. **When the rise of No request (0) → Temporary stop request (1) is detected, the flow amount integration function is temporarily stopped, and CH☐ Flow amount integration temporary stop flag (Un\G1364 to Un\G1367) of the corresponding channel turns Temporarily stopped (1).**

(b) Operation procedure to restart the flow amount integration (to cancel temporary stop)

1. **While the flow amount integration function is temporarily stopped, change the CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) of the stopped channel Temporary stop request (1) → No request (0).**
2. **When the fall of Temporary stop request (1) → No request (0) is detected, the flow amount integration function is restarted, and CH☐ Flow amount integration temporary stop flag (Un\G1364 to Un\G1367) of the corresponding channel turns No temporary stop request (0).**

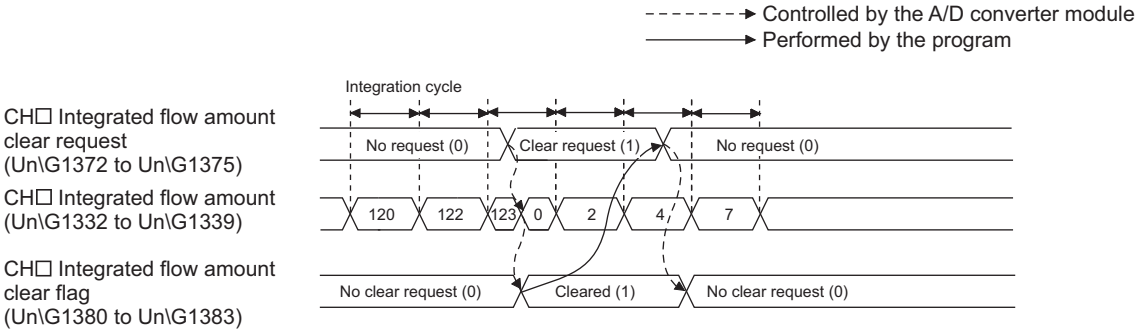


(6) Clearing the integrated flow amount

The integrated flow amount can be cleared in a program. The integrated flow amount can be cleared by changing the value of CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) while the flow amount integration function is operating. CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) operates only when the flow amount integration function is enabled.

(a) Operation procedure to clear the integrated flow amount

1. **While the flow amount integration function is operating, change the CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) of the channel to be cleared No request (0) → Clear request (1).**
2. **When the rise of No request (0) → Clear request (1) is detected, the value of CH☐ Integrated flow amount (Un\G1332 to Un\G1339) of the corresponding channel is cleared to zero.**
3. **After it is cleared, CH☐ Integrated flow amount clear flag (Un\G1380 to Un\G1383) of the cleared channel turns Cleared (1)**
4. **Confirm CH☐ Integrated flow amount clear flag (Un\G1380 to Un\G1383) is Cleared (1) and change CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) Clear request (1) → No request (0).**
5. **When the fall of Clear request (1) → No request (0) is detected, CH☐ Integrated flow amount clear flag (Un\G1380 to Un\G1383) turns No request (0).**

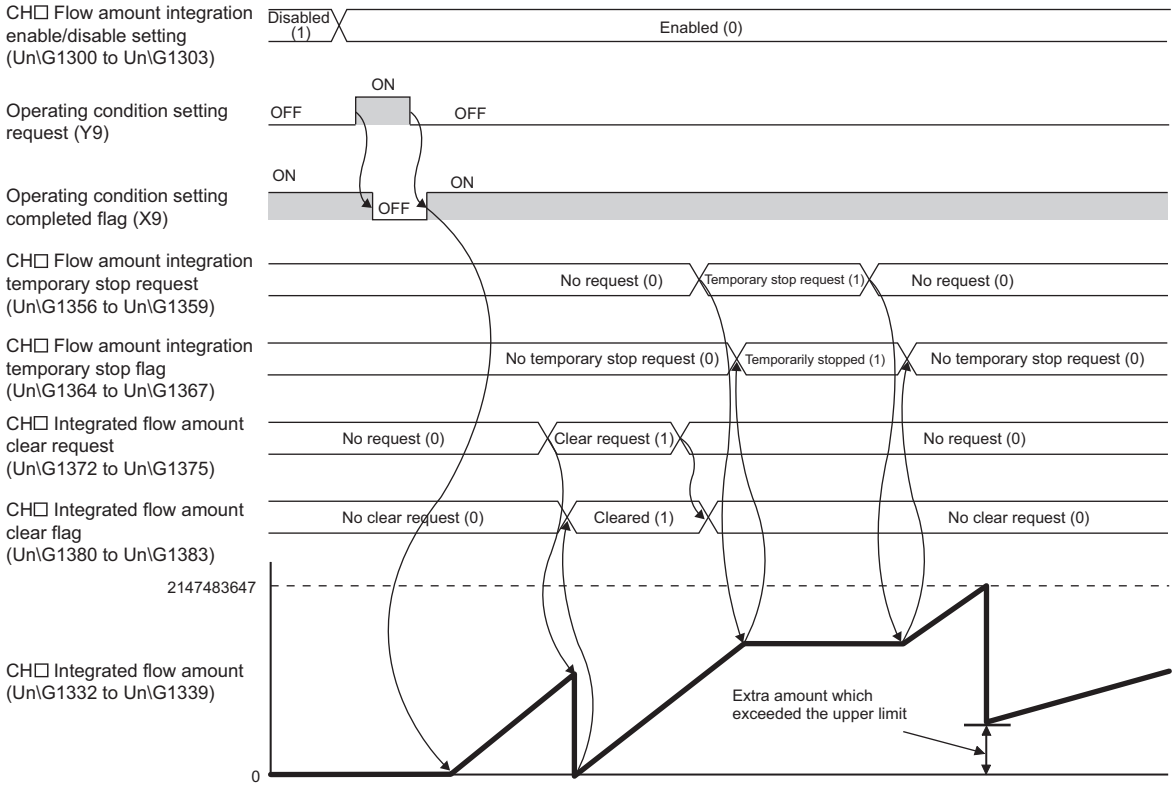


Point

- CH☐ Integrated flow amount (Un\G1332 to Un\G1339) is also cleared to zero in the following case.
  - Set CH☐ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303) to Enable (0) and turn on and off Operating condition setting request (Y9).

(7) Change of the integrated flow amount

The following timing chart shows the timings that the integrated flow amount changes.



(8) Operation when an input signal error occurs

The integral processing cannot be performed while an input signal error is occurring. When the analog input value returns within the setting range and the A/D conversion is restarted, the integral processing is performed.

(9) Operation when Operating condition setting request (Y9) is turned on and off

The following processing is performed by changing the settings in the corresponding buffer memory areas and turning on and off Operating condition setting request (Y9). When the integration cycle or parameter of the intergral processing has been changed, the processing clears CH☐ Integrated flow amount (Un\G1332 to Un\G1339) to zero and applies the new setting to the flow amount integration function.

For details on the integration cycle or parameter of the intergral processing, refer to the following.

- Concept of integral processing (☞Page 124, Section 8.15 (1))
- Concept of integration cycle (☞Page 125, Section 8.15 (2))

Buffer memory	Processing after changing setting
A/D conversion enable/disable setting (Un\G0)	• The integration cycle changes in the changed channel. However, the integral processing stops in the channel in which A/D conversion enable/disable setting (Un\G0) changes from Enable (0) to Disable (1), and CH☐ Integrated flow amount (Un\G1332 to Un\G1339) maintains the value before changing. • The integration cycle changes in the unchanged channel.
CH☐ Time Average/ Count Average/Moving Average (Un\G1 to Un\G4)	• The integration cycle changes in the changed channel. However, when the integration cycle is the same as that before changing, CH☐ Integrated flow amount (Un\G1332 to Un\G1339) of the changed channel is not cleared and the intergral processing continues. • The intergral processing continues in the unchanged channel.
Averaging process setting (used to replace Q64AD) (Un\G9)	
Averaging process setting (Un\G24)	
CH☐ Integration cycle setting (Un\G1308 to Un\G1311)	
CH☐ Flow amount time unit setting (Un\G1316 to Un\G1319)	• The parameter of the intergral processing changes in the changed channel. • The intergral processing continues in the unchanged channel.
CH☐ Unit scaling setting (Un\G1324 to Un\G1327)	

Point

If Operating condition setting request (Y9) is turned on and off and one of the following error occurs, the flow amount integration function turns disabled.

- Setting error of CH☐ Time Average/ Count Average/Moving Average (Un\G1 to Un\G4) (error code: 20☐, error code: 30☐, error code: 31☐)
- Setting error of Conversion speed setting (Un\G26) (error code: 360☐, error code: 210☐)
- Setting error of CH☐ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303) (error code: 210☐)
- Setting error of CH☐ Integration cycle setting (Un\G1308 to Un\G1311) (error code: 211☐, error code 212☐)
- Setting error of CH☐ Flow amount time unit setting (Un\G1316 to Un\G1319) (error code: 213☐)
- Setting error of CH☐ Unit scaling setting (Un\G1324 to Un\G1327) (error code: 214☐)

For details on the error contents, refer to the following.

- Error code list (☞Page 179, Section 11.4)

8.16 Error Log Function

Common

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 total 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. Error occurrence time is stored as follows:

Ex For error history No. 1

	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	

Item	Storage contents		Storage example*1
First two digits of the year/Last two digits of the year	Stored in BCD code.		2011H
Month/Day			329H
Hour/Minute			1035H
Second			40H
Day of the week	One of the following values is stored for each day of the week in BCD code.		2H
	• Sunday: 0	• Monday: 1	
	• Tuesday: 2	• Wednesday: 3	
	• Thursday: 4	• Friday: 5	
	• Saturday: 6		

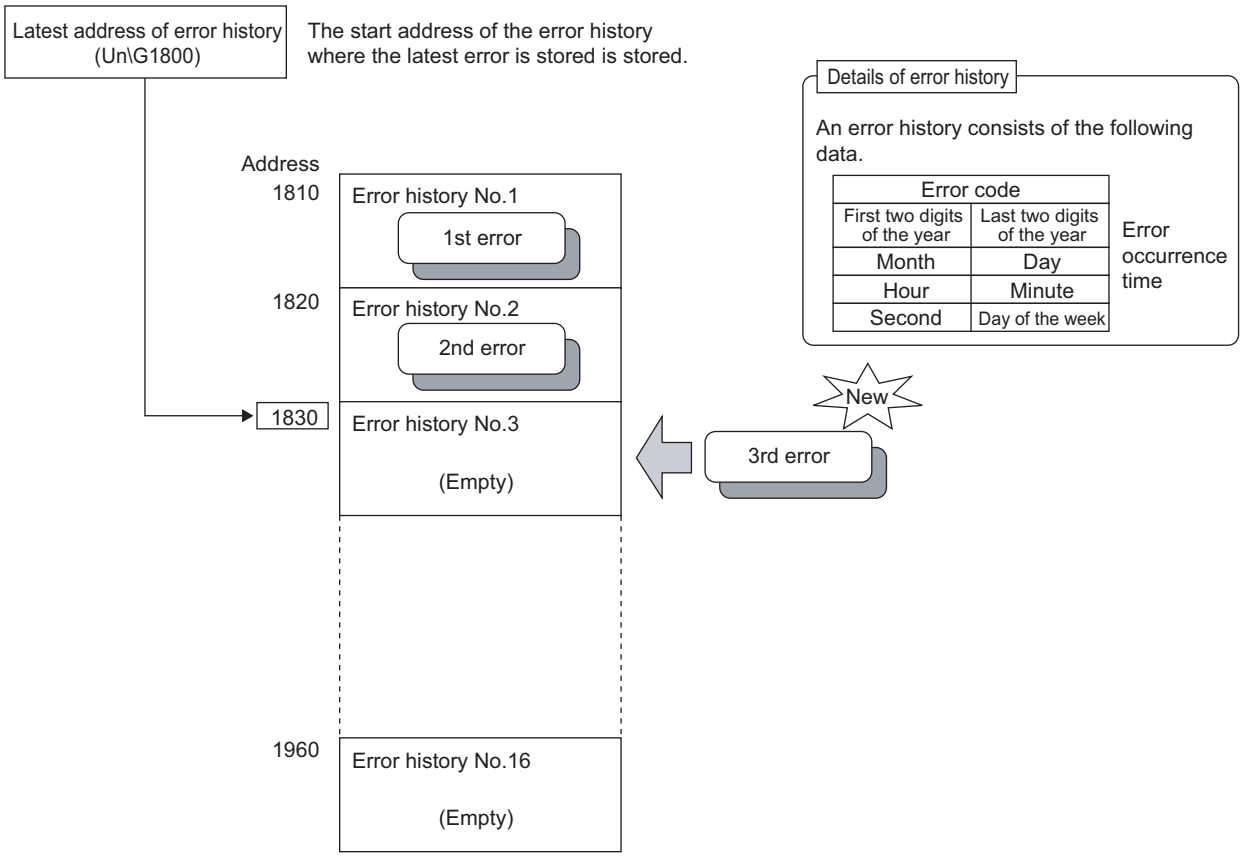
*1 Those are values when an error occurs at 10:35:40 on Tuesday, March 29th, 2011.

(2) Checking error history

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

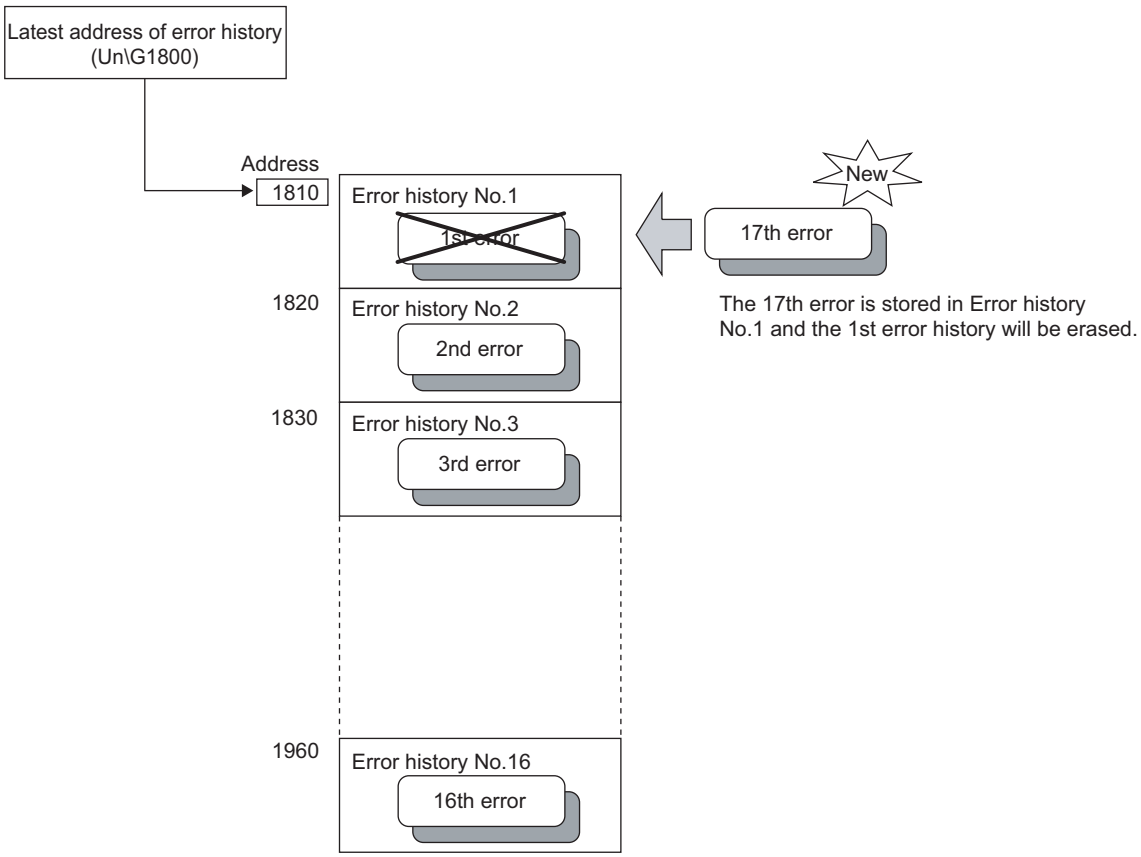
When the third error occurs:

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 address of error history (Un\G1800).



Ex 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 address of error history (Un\G1800).



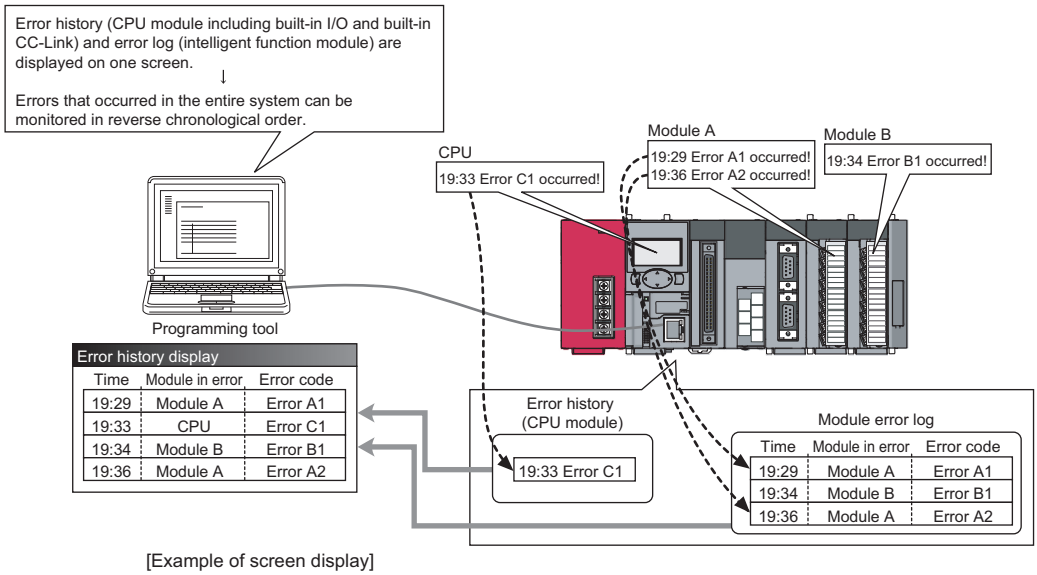
Point

- 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 the power supply of the A/D converter module is turned off, or when the CPU module is reset.

8.17 Module Error Collection Function

Common

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



[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)

8.18 Error Clear Function

Common

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

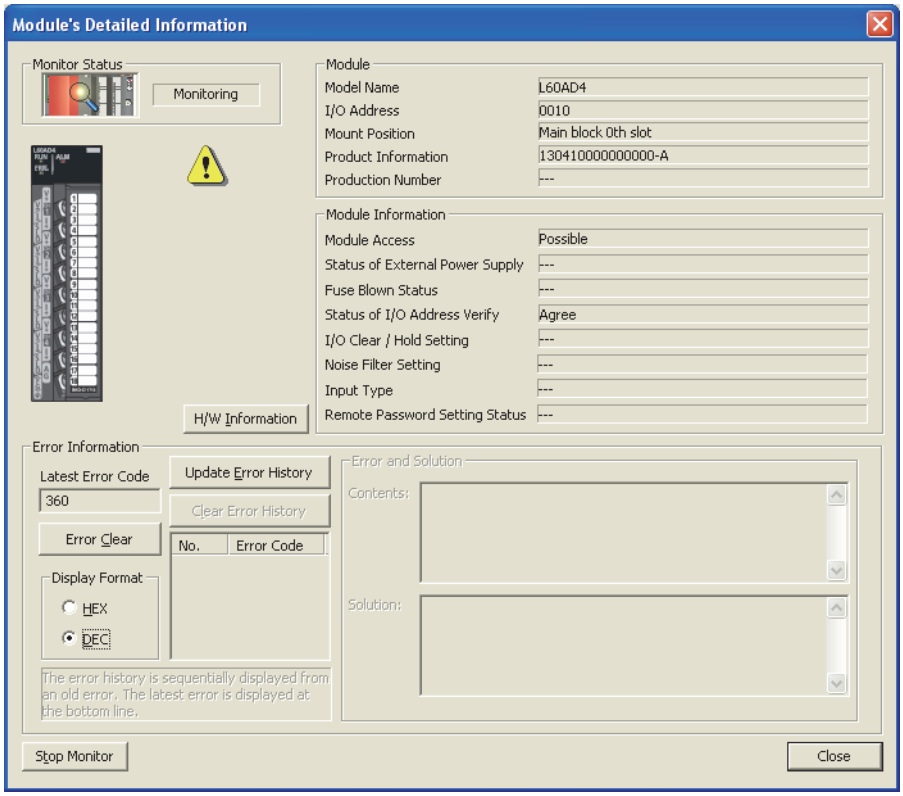
By clicking the Error Clear button in the system monitor, the latest error code stored in Latest error code (Un\G19) is cleared and the ERR. LED is turned off. The operation is the same as Error clear request (YF) as well as executing error clear from the display unit.

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 198, Appendix 1.2 (5))
- Checking/Clearing an Error (Page 155, Section 9.4)

[Diagnostics] ⇨ [System Monitor...] ⇨ Error Module



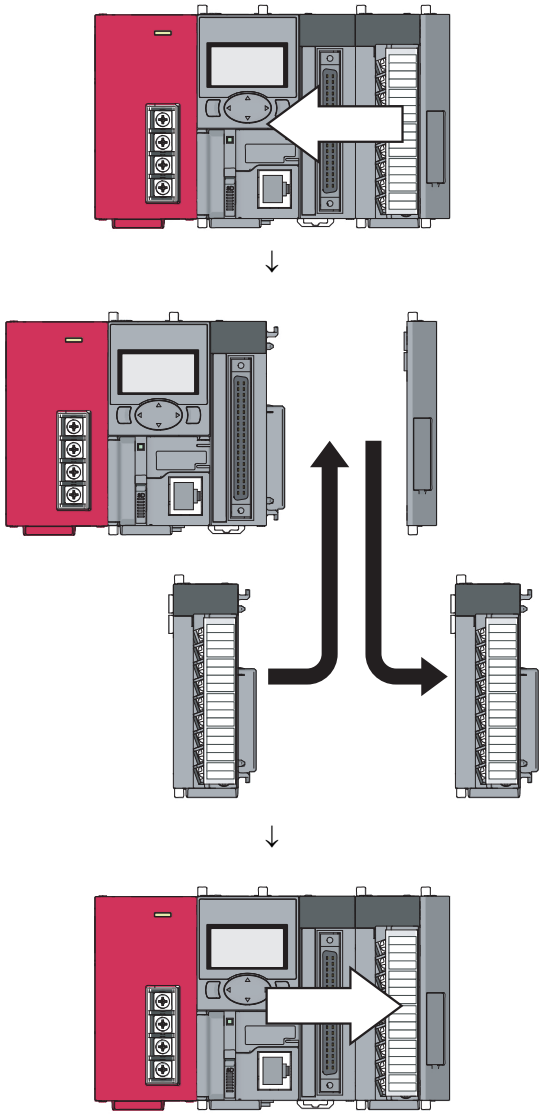
8.19 Saving and Restoring Offset/Gain Values

Common

With the A/D converter module, the offset/gain value of the user range can be saved and restored.
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, the offset/gain values set for one of the modules can be applied 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:



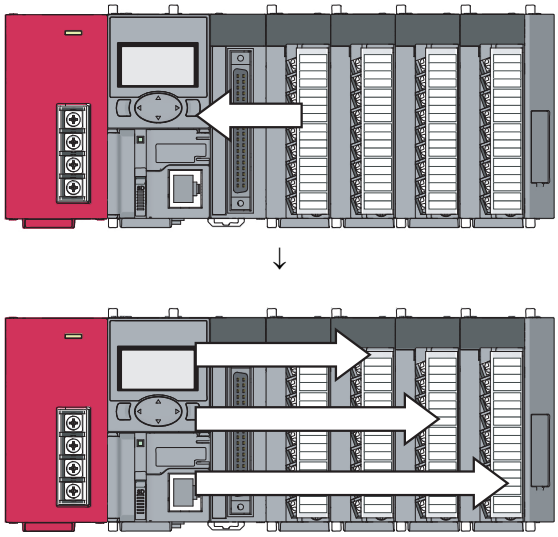
1. **Save the offset/gain values.**

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

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

(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, and 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 memory card. (To write data: use the SP.FWRITE instruction. To read data: use the SP.FREAD instruction.)
- Store the saved data

For use of dedicated instructions, refer to the following.

- Dedicated Instructions (☞Page 241, Appendix 5)

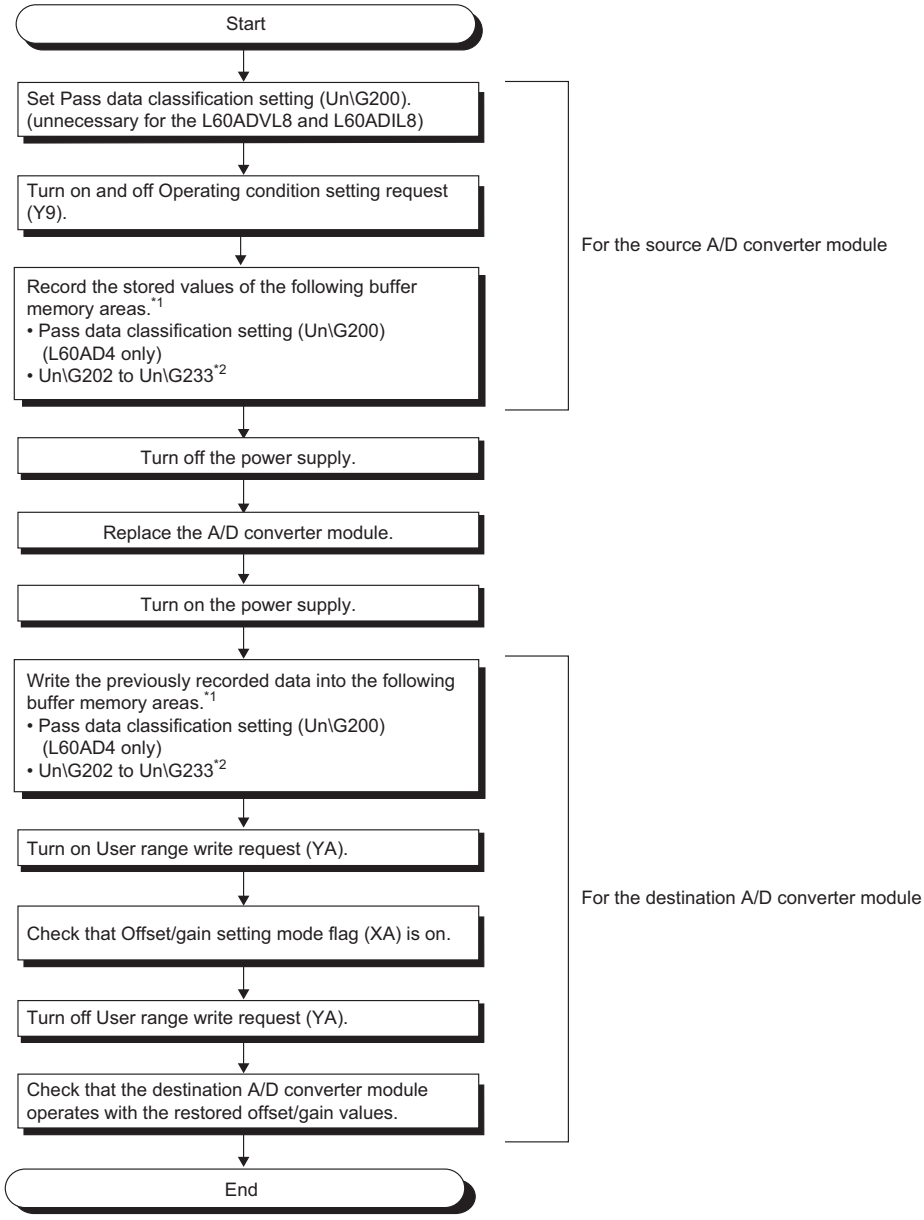
(b) Saving and restoring by reading from and writing to the buffer memory

Use the following buffer memory areas and User range write request (YA). Read the offset/gain values from the source A/D converter module, and use the buffer memory again to write to the destination A/D converter module.

Module	Buffer memory
L60AD4	• 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)
L60ADVL8 L60ADIL8	CH1 Industrial shipment settings offset value (Un\G202) to CH8 User range settings gain value (Un\G233)

The procedure for using the buffer memory is described below.

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



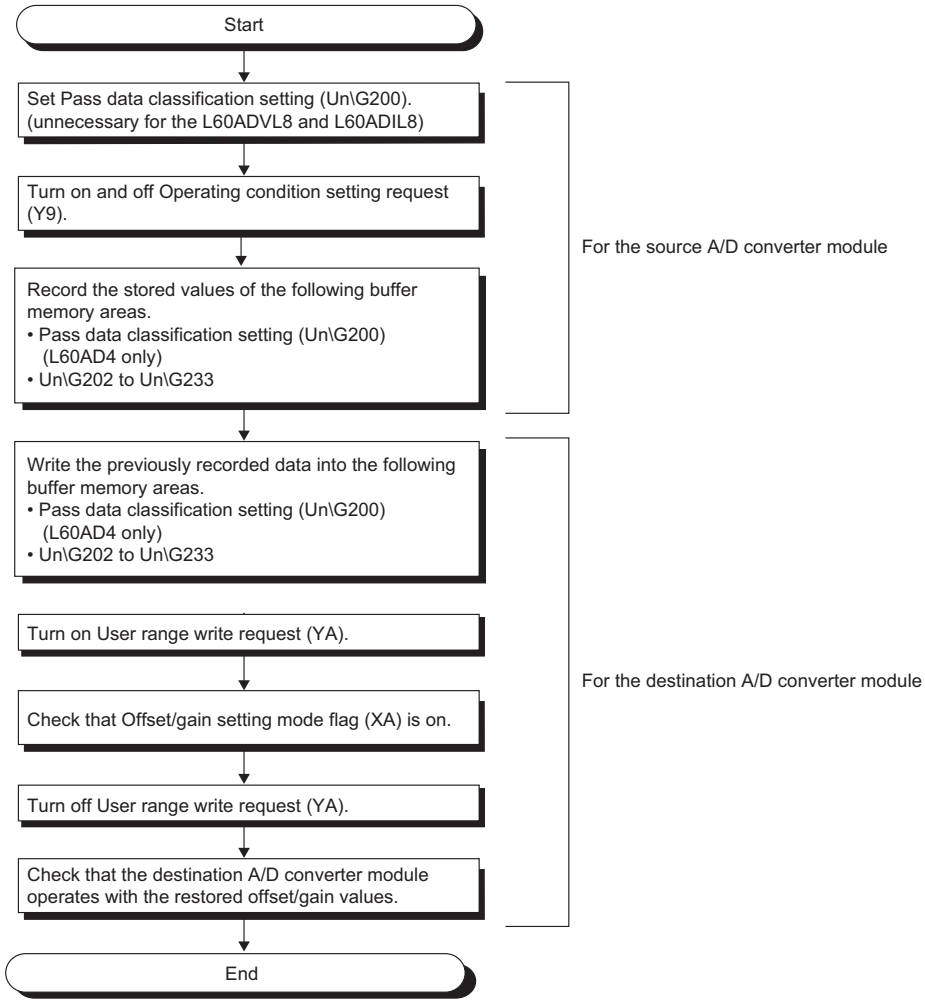
*1 When replacing modules, you can prevent the saved offset/gain value data from getting deleted, by doing one of the following before turning the power off:

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

*2 Areas used differ depending on the modules.
For details, refer to the following.

- List of Buffer Memory Addresses (☞Page 28, Section 3.5)

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



(3) Range reference tables

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

(a) L60AD4

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

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. 00000007H
					Current	Approx. 0000000EH
204, 205	208, 209	212, 213	216, 217	Industrial shipment settings gain value	Voltage	Approx. 00008011H
					Current	Approx. 00008018H

- 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. 00000007H
	1V	Approx. 00000CD4H
	5V	Approx. 0000400CH
	10V	Approx. 00008011H
Current	0mA	Approx. 00000007H
	4mA*1	Approx. 00000CD4H
	20mA*2	Approx. 0000400CH

*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.

(b) L60ADVL8

- Reference table for CH1 Industrial shipment settings offset value (Un\G202) to CH8 Industrial shipment settings gain value (Un\G217)

Address (decimal)								Description	Reference value (hexadecimal)
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8		
202	204	206	208	210	212	214	216	Industrial shipment settings offset value	Approx. 8000H
203	205	207	209	211	213	215	217	Industrial shipment settings gain value	Approx. DF79H

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

Offset/gain value	Reference value (hexadecimal)
0V*1	Approx. 8000H
1V	Approx. 898CH
5V	Approx. AFBCH
10V*2	Approx. DF79H

*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.

(c) L60ADIL8

- Reference table for CH1 Industrial shipment settings offset value (Un\G202) to CH8 Industrial shipment settings gain value (Un\G217)

Address (decimal)								Description	Reference value (hexadecimal)
CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8		
202	204	206	208	210	212	214	216	Industrial shipment settings offset value	Approx. 8000H
203	205	207	209	211	213	215	217	Industrial shipment settings gain value	Approx. AFBDH

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

Offset/gain value	Reference value (hexadecimal)
0mA	Approx. 8000H
4mA*1	Approx. 898CH
20mA*2	Approx. AFBDH

*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 module, the status of the system can be checked and the system settings can be changed without the software package.
In addition, if a problem occurs, the cause of the problem can be identified by displaying the error information.
For details on how to check and clear an error from the display unit, refer to the following.

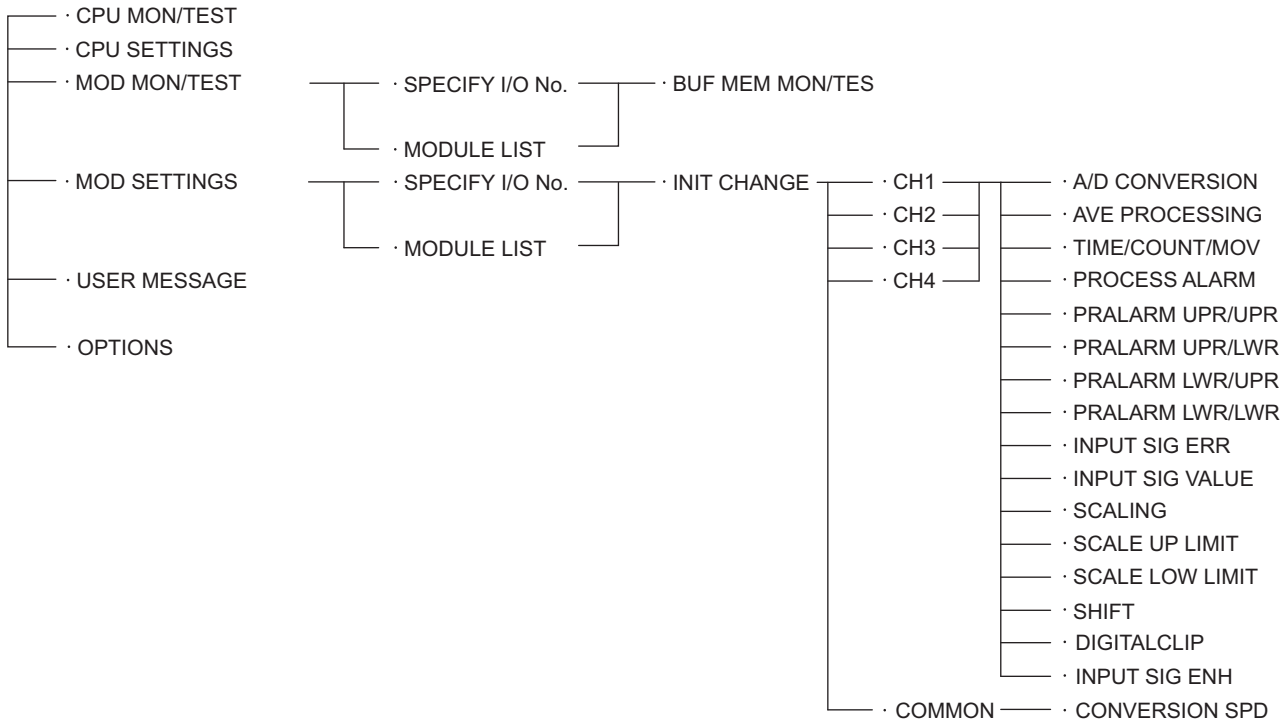
- Checking and Clearing Errors (Page 155, Section 9.4)

9.2 Menu Transition

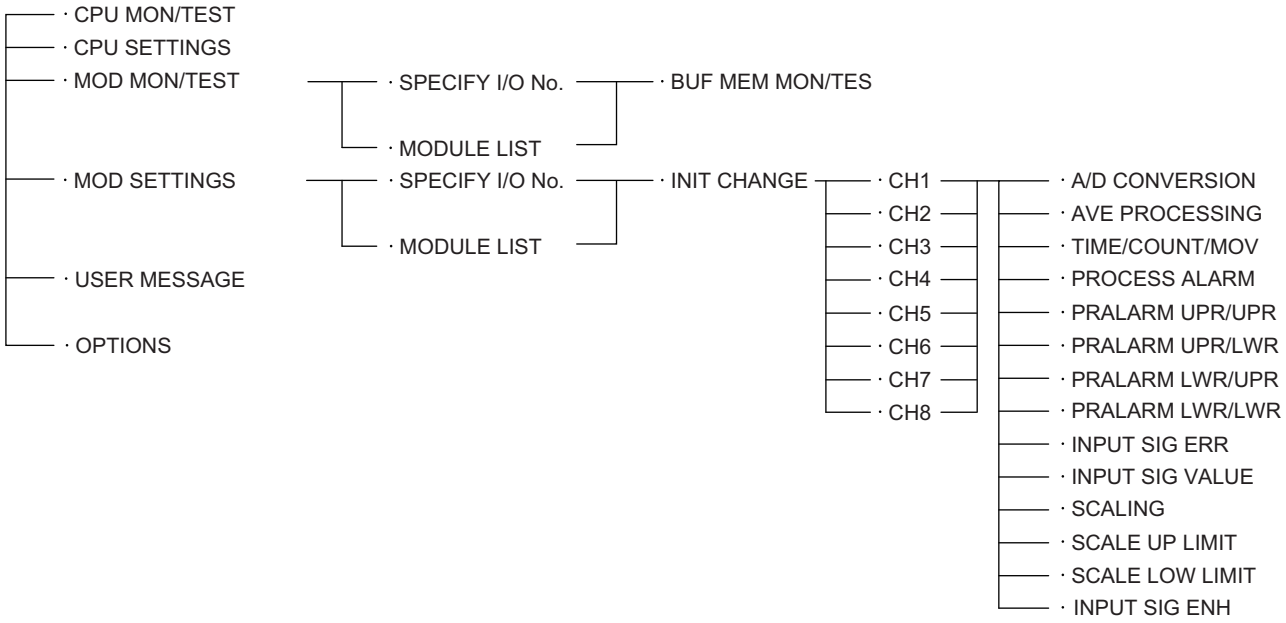
(1) Organization

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

(a) L60AD4



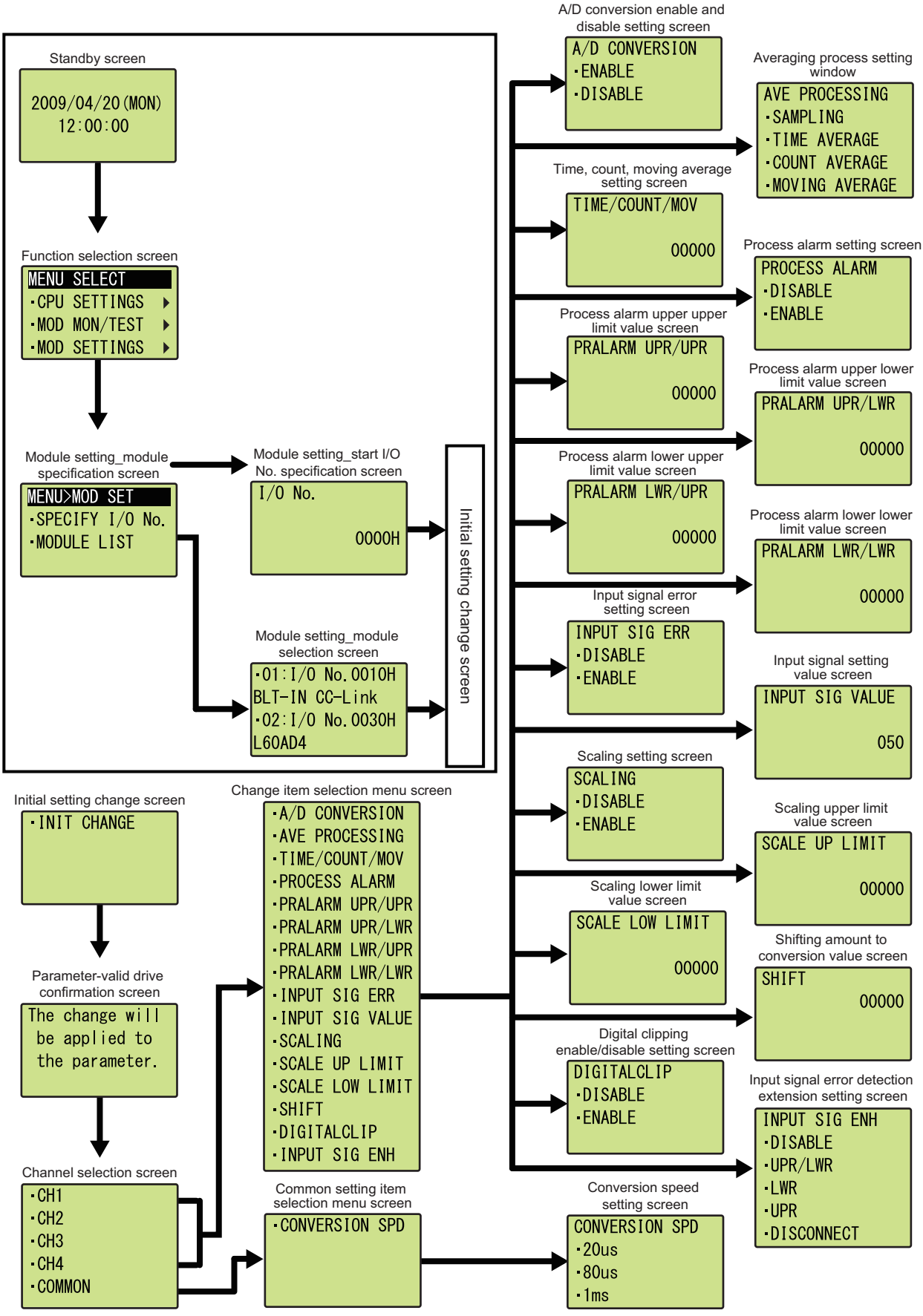
(b) L60ADVL8, L60ADIL8



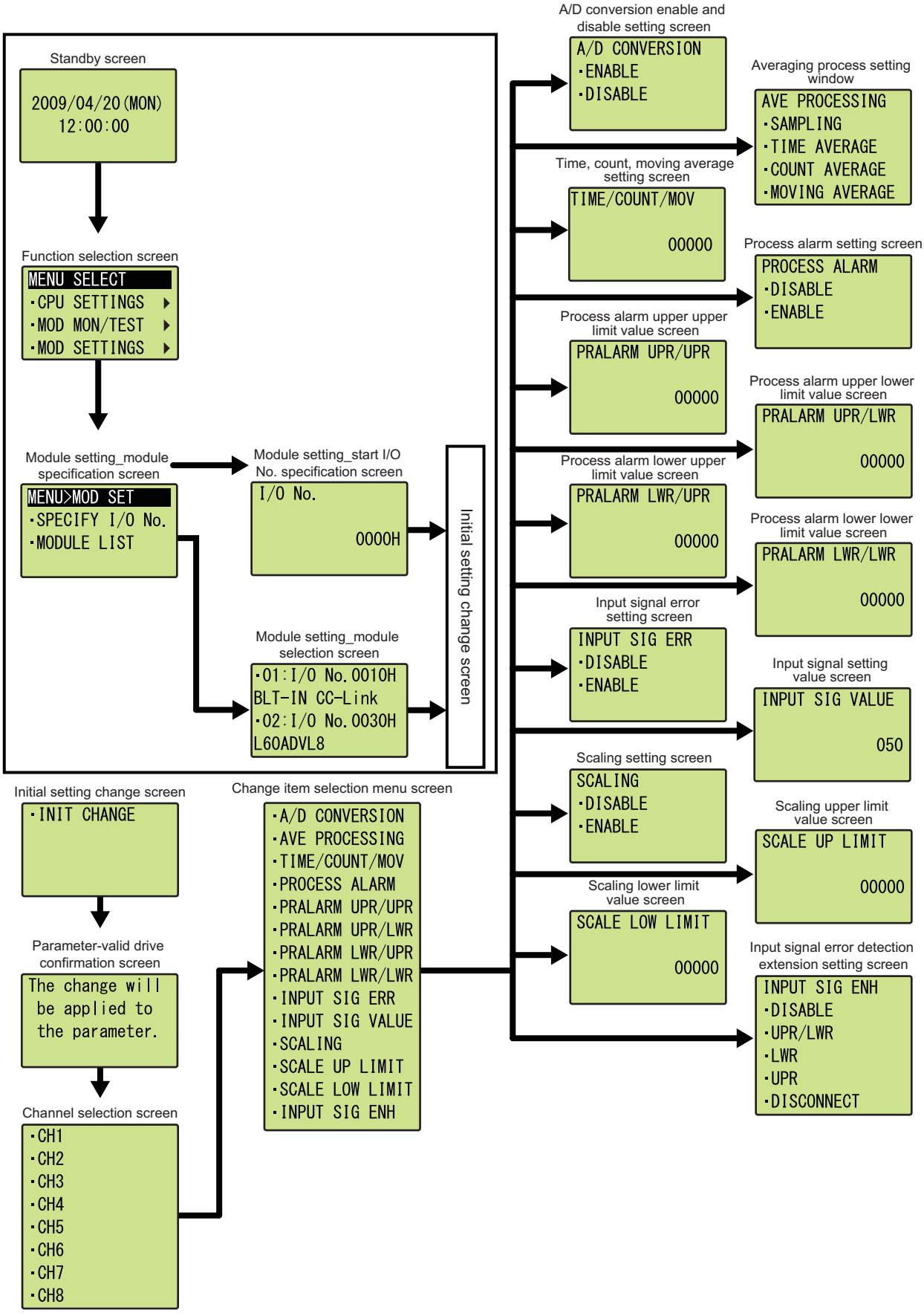
(2) Screen transitions up to the initial setting change screen

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

(a) L60AD4


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
·SHIFT
·DIGITALCLIP
·INPUT SIG ENH
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 setting window
AVE PROCESSING
·SAMPLING
·TIME AVERAGE
·COUNT AVERAGE
·MOVING AVERAGE
Time, count, moving average setting screen
TIME/COUNT/MOV
00000
Process alarm setting screen
PROCESS ALARM
·DISABLE
·ENABLE
Process alarm upper upper limit value screen
PRALARM UPR/UPR
00000
Process alarm upper lower limit value screen
PRALARM UPR/LWR
00000
Process alarm lower upper limit value screen
PRALARM LWR/UPR
00000
Process alarm lower lower limit value 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 value screen
SCALE UP LIMIT
00000
Scaling lower limit value screen
SCALE LOW LIMIT
00000
Shifting amount to conversion value screen
SHIFT
00000
Digital clipping enable/disable setting screen
DIGITALCLIP
·DISABLE
·ENABLE
Input signal error detection extension setting screen
INPUT SIG ENH
·DISABLE
·UPR/LWR
·LWR
·UPR
·DISCONNECT

(b) L60ADVL8, L60ADIL8



9.3 List of Setting Value Change Screens

The following is a list of setting value change screens.

(1) L60AD4

(a) 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 setting	AVE PROCESSING	Selection	—	—
Time Average/Count Average/Moving Average	TIME/COUNT/MOV	Numeric	62500	0
Warning output setting	PROCESS ALARM	Selection	—	—
Process alarm upper upper limit value	PRALARM UPR/UPR	Numeric	32767	-32768
Process alarm upper lower limit value	PRALARM UPR/LWR	Numeric	32767	-32768
Process alarm lower upper limit value	PRALARM LWR/UPR	Numeric	32767	-32768
Process alarm lower lower limit value	PRALARM LWR/LWR	Numeric	32767	-32768
Input signal error detection function	INPUT SIG ERR	Selection	—	—
Input signal error detection setting value	INPUT SIG VALUE	Numeric	250	0
Scaling function	SCALING	Selection	—	—
Scaling upper limit value	SCALE UP LIMIT	Numeric	32000	-32000
Scaling lower limit value	SCALE LOW LIMIT	Numeric	32000	-32000
Shifting amount to conversion value	SHIFT	Numeric	32767	-32768
Digital clipping function	DIGITALCLIP	Selection	—	—
Input signal error detection enhancing setting value	INPUT SIG ENH	Selection	—	—
Conversion speed	CONVERSION SPD	Selection	—	—

(2) L60ADVL8, L60ADIL8

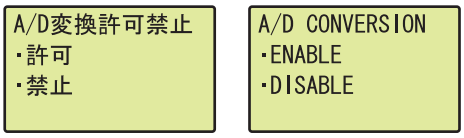
(a) Displayed in English:

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 setting	AVE PROCESSING	Selection	—	—
Time Average/ Count Average/Moving Average	TIME/COUNT/MOV	Numeric	62500	0
Warning output setting	PROCESS ALARM	Selection	—	—
Process alarm upper upper limit value	PRALARM UPR/UPR	Numeric	32767	-32768
Process alarm upper lower limit value	PRALARM UPR/LWR	Numeric	32767	-32768
Process alarm lower upper limit value	PRALARM LWR/UPR	Numeric	32767	-32768
Process alarm lower lower limit value	PRALARM LWR/LWR	Numeric	32767	-32768
Input signal error detection function	INPUT SIG ERR	Selection	—	—
Input signal error detection setting value	INPUT SIG VALUE	Numeric	250	0
Scaling function	SCALING	Selection	—	—
Scaling upper limit value	SCALE UP LIMIT	Numeric	32000	-32000
Scaling lower limit value	SCALE LOW LIMIT	Numeric	32000	-32000
Input signal error detection enhancing setting value	INPUT SIG ENH	Selection	—	—

(3) A/D conversion enable/disable setting Common

Select "ENABLE" or "DISABLE" in the "A/D CONVERSION" screen.

"A/D CONVERSION" screen



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

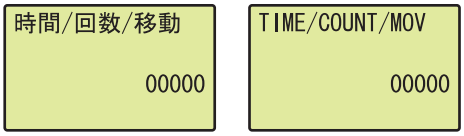
(4) Averaging process setting Common

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

"AVE PROCESSING" screen

↓

"TIME/COUNT/MOV" screen



1. **Use the ▲ and ▼ buttons to select "SAMPLING", "TIME AVERAGE", "COUNT AVERAGE", or "MOVING AVERAGE", and then confirm with the . OK button. (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

- L60AD4

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

- L60ADVL8, L60ADIL8

Input item	Input range	
	Input upper limit	Input lower limit
TIME	5000	4
COUNT	62500	4
MOV	1000	2

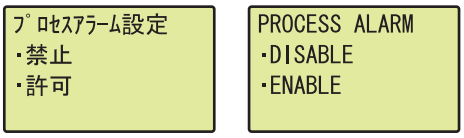
Point

A value between 0 and 62500 can be input for any type of averaging processing on the display unit. However, if the value is outside the setting range of the selected averaging processing, an error occurs on the A/D converter module.

(5) Warning output setting Common

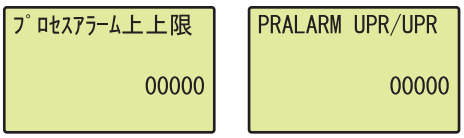
Select "DISABLE" or "ENABLE" in the "PROCESS ALARM" screen.

"PROCESS ALARM" screen



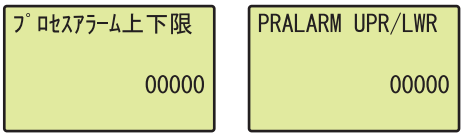
↓

"PRALARM UPR/UPR" screen



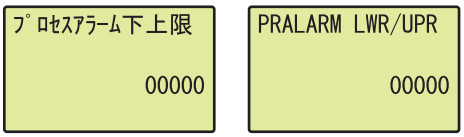
↓

"PRALARM UPR/LWR" screen



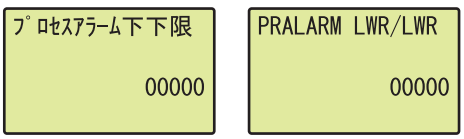
↓

"PRALARM LWR/UPR" screen



↓

"PRALARM LWR/LWR" screen



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.)**

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.**

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.**

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.**

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.**

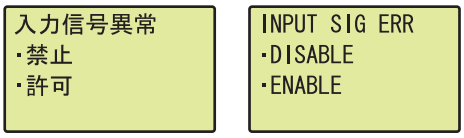
Table of input items

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

(6) Input signal error detection setting Common

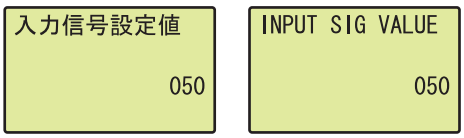
Select "DISABLE" or "ENABLE" in the "INPUT SIG ERR" screen.

"INPUT SIG ERR" screen



↓

"INPUT SIG VALUE" screen



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.**

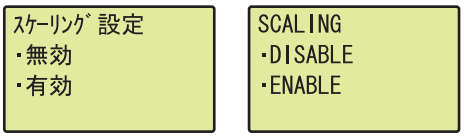
Table of input items

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

(7) Scaling setting Common

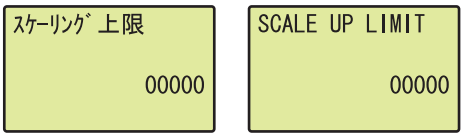
Select "DISABLE" or "ENABLE" in the "SCALING" screen.

"SCALING" screen



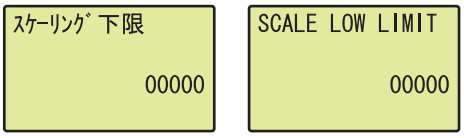
↓

"SCALE UP LIMIT" screen



↓

"SCALE LOW LIMIT" screen



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.)**

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.**

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.**

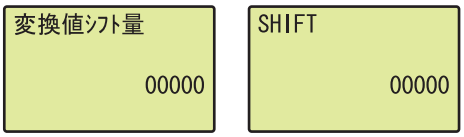
Table of input items

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

(8) Shifting amount to conversion value AD4

Set the shifting amount to conversion value in the "SHIFT" screen.

"SHIFT" screen



1. **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.**

Input item lists

Input item	Input range	
	Input upper limit	Input lower limit
SHIFT	32767	-32768

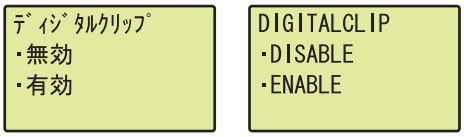
Point

The "Shifting amount to conversion value" is reflected to the scaling value regardless of turning on and off Operating condition setting request (Y9). However, when the "Shifting amount to conversion value" is set in a display unit, it is not reflected just after setting. As well as other functions of display unit, turn the CPU module STOP → RUN → STOP → RUN to reflect the setting value.

(9) Digital clipping enable/disable setting AD4

Select "DISABLE" or "ENABLE" in the "DIGITALCLIP" screen.

"DIGITALCLIP" screen

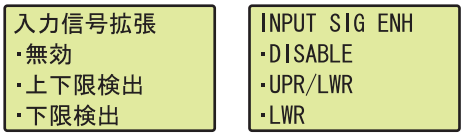


1. Use the ▲ and ▼ buttons to select "DISABLE" or "ENABLE", and then confirm with the OK button.

(10)Input signal error detection extension setting Common

Select a detection method in the "INPUT SIG ENH" screen.

"INPUT SIG ENH" screen



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

- DISABLE
- UPR/LWR
- LWR
- UPR
- DISCONNECT

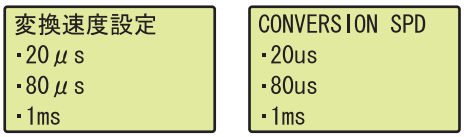
Point

When "INPUT SIG ENH" is set to other than "DISABLE", setting "INPUT SIG ERR" to "ENABLE" is not necessary. The setting of "INPUT SIG ERR" will be ignored.

(11)Conversion speed setting AD4

In the "CONVERSION SPD" screen, specify the conversion speed of the A/D conversion processing.

"CONVERSION SPD" screen



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

9.4 Checking and Clearing Errors

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

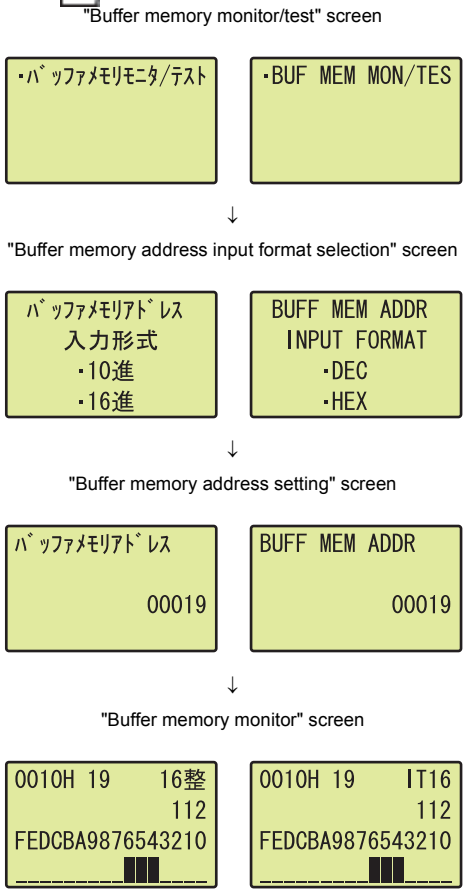
(1) Checking the error

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".

For details on the error codes or alarm codes, refer to the following.

- Error Code List (☞Page 179, Section 11.4)
- Alarm Code List (☞Page 183, Section 11.5)

Ex When an error occurs in the A/D converter module with a start I/O number of 10



1. **Press the OK button.**

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

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.**

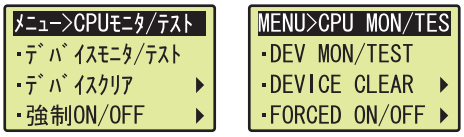
4. **You can check the error that occurred, in the "Buffer memory monitor" screen.**

(2) Clearing errors

An error can be cleared by eliminating the cause of the error, and turning on and off Error clear request (YF) from "Device Monitor/Test".

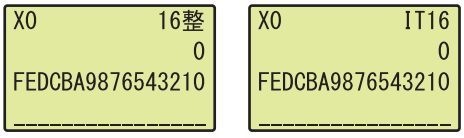
Ex When an error occurs in the A/D converter module with a start I/O number of 10

"CPU monitor/test" screen



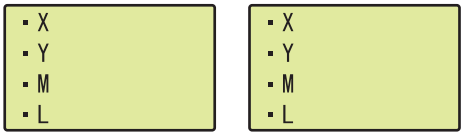
↓

"Device monitor" screen



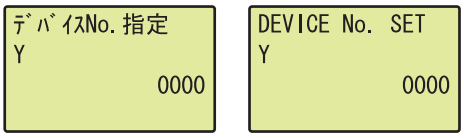
↓

"Device selection" window



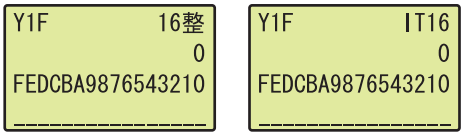
↓

"DEVICE No. SET" screen



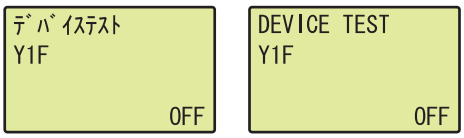
↓

"Device monitor" screen

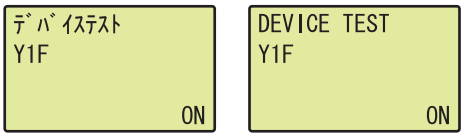


↓

"Device test" screen



↓



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

2. **Press the ◀ button.**

3. **Use the ▲ and ▼ buttons to set the device to Y. Confirm with the OK button.**

4. **Set the device as a target of Error clear request (Y1F). Confirm with the OK button.**

5. **Press the OK button.**

6. **Press the OK button.**

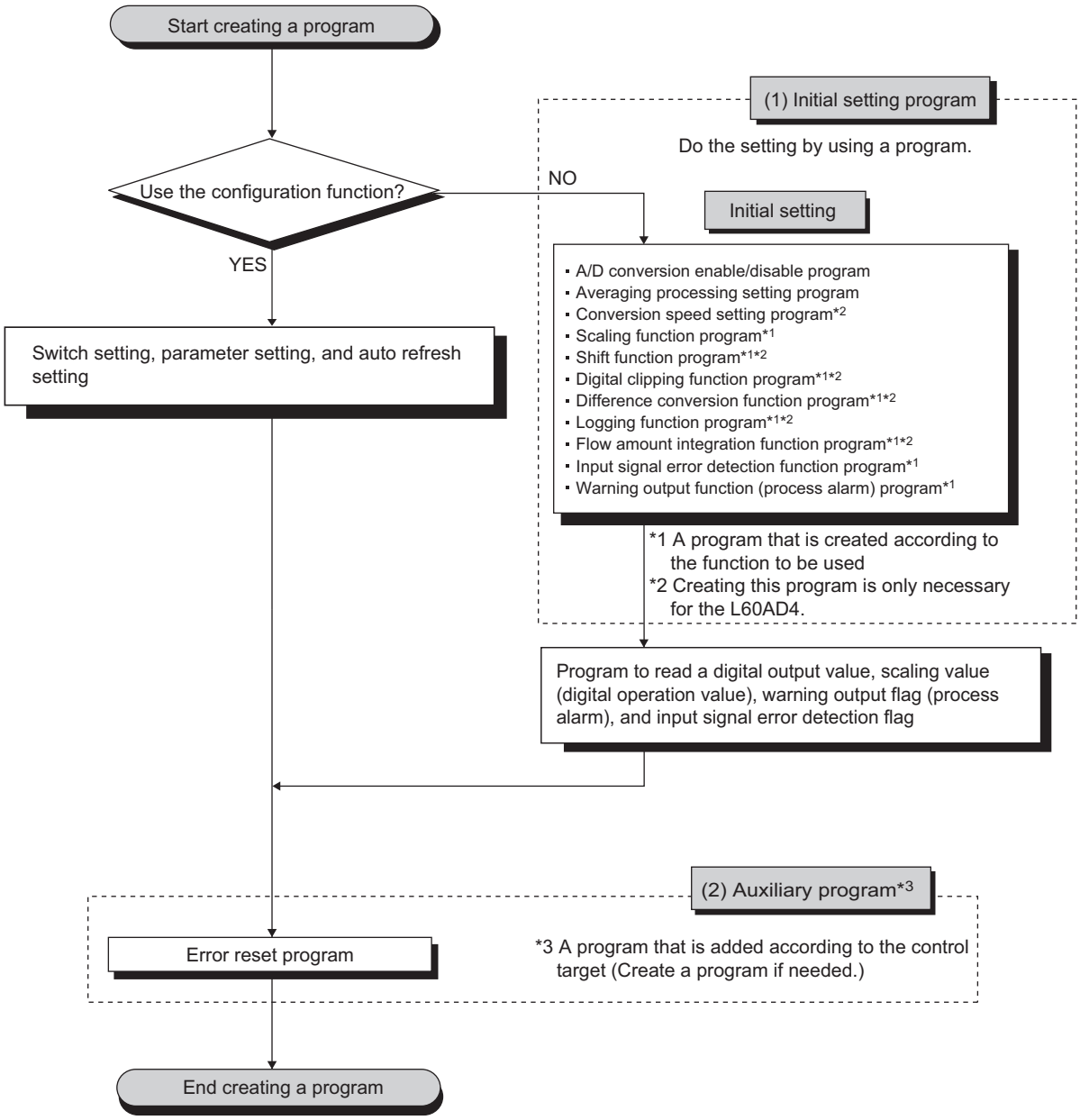
7. **Use the ▲ and ▼ buttons to select ON. Confirm with the OK button.**

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.

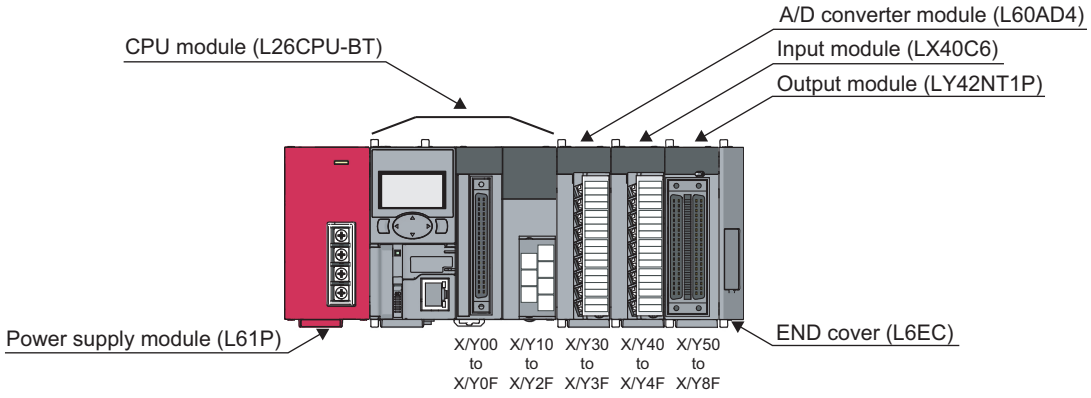


10.2 When Using the Module in a Standard System Configuration

This section describes the following system configuration and a program example of operation condition.

(1) System configuration

The following shows a system configuration example.



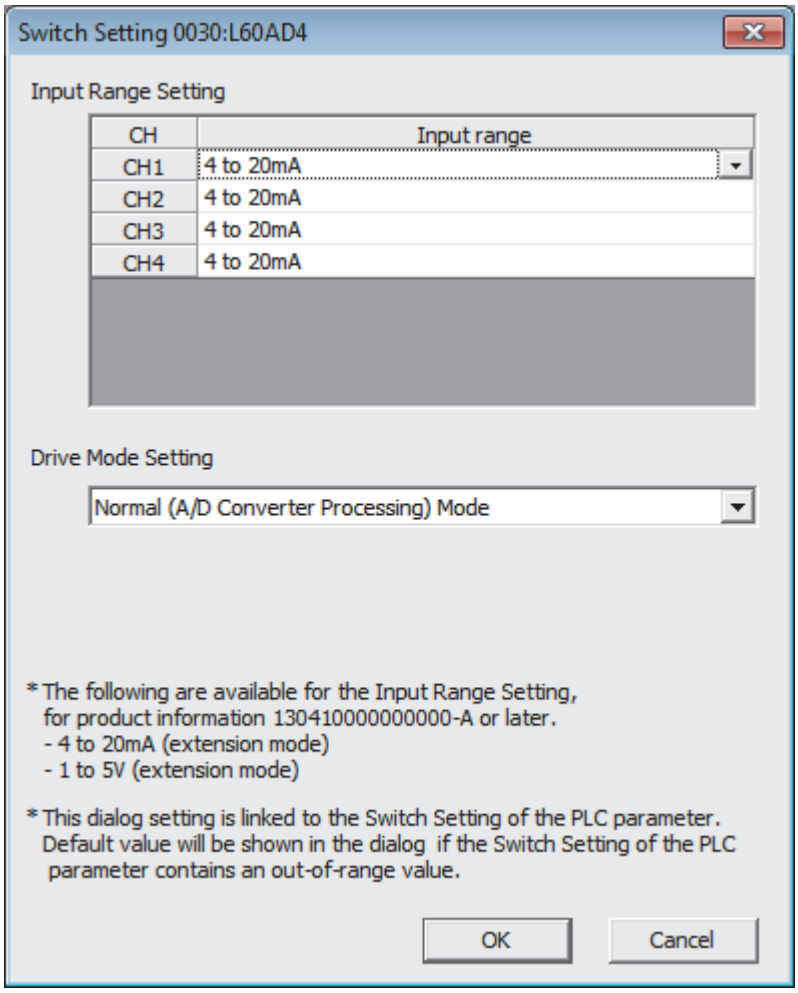
(2) Programming condition

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]⇨[L60AD4]⇨[Switch Setting]



(4) Initial setting description

(a) Channel setting

Item	Description			
	CH1	CH2	CH3	CH4[*1]
A/D conversion enable/disable setting	Enable	Enable	Enable	Disable
Averaging process setting	Sampling processing	Count average	Moving average	Sampling processing
Time Average/ Count Average/Moving Average	0	50 times	10 times	0
Conversion speed setting[*3]	20μs			
Warning output setting	Disable	Enable	Disable	Disable
Process alarm upper upper limit value	0	20000[*2]	0	0
Process alarm upper lower limit value	0	18000[*2]	0	0
Process alarm lower upper limit value	0	3000[*2]	0	0
Process alarm lower lower limit value	0	0[*2]	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%
Input signal error detection extension setting	Disable	Disable	Disable	Disable
Scaling enable/disable setting	Disable	Disable	Enable	Disable
Scaling upper limit value	0	0	32000	0
Scaling lower limit value	0	0	0	0
Shifting amount to conversion value[*3]	0	0	10000	0
Digital clipping function enable/disable setting[*3]	Disable	Disable	Enable	Disable

*1 When using the L60ADVL8 or L60ADIL8, configure the same setting for CH5 to CH8.
*2 When using the L60ADVL8 or L60ADIL8, set values within the digital output range of the input range used.
*3 The L60ADVL8 or L60ADIL8 does not supprt this item.

(b) Device for user

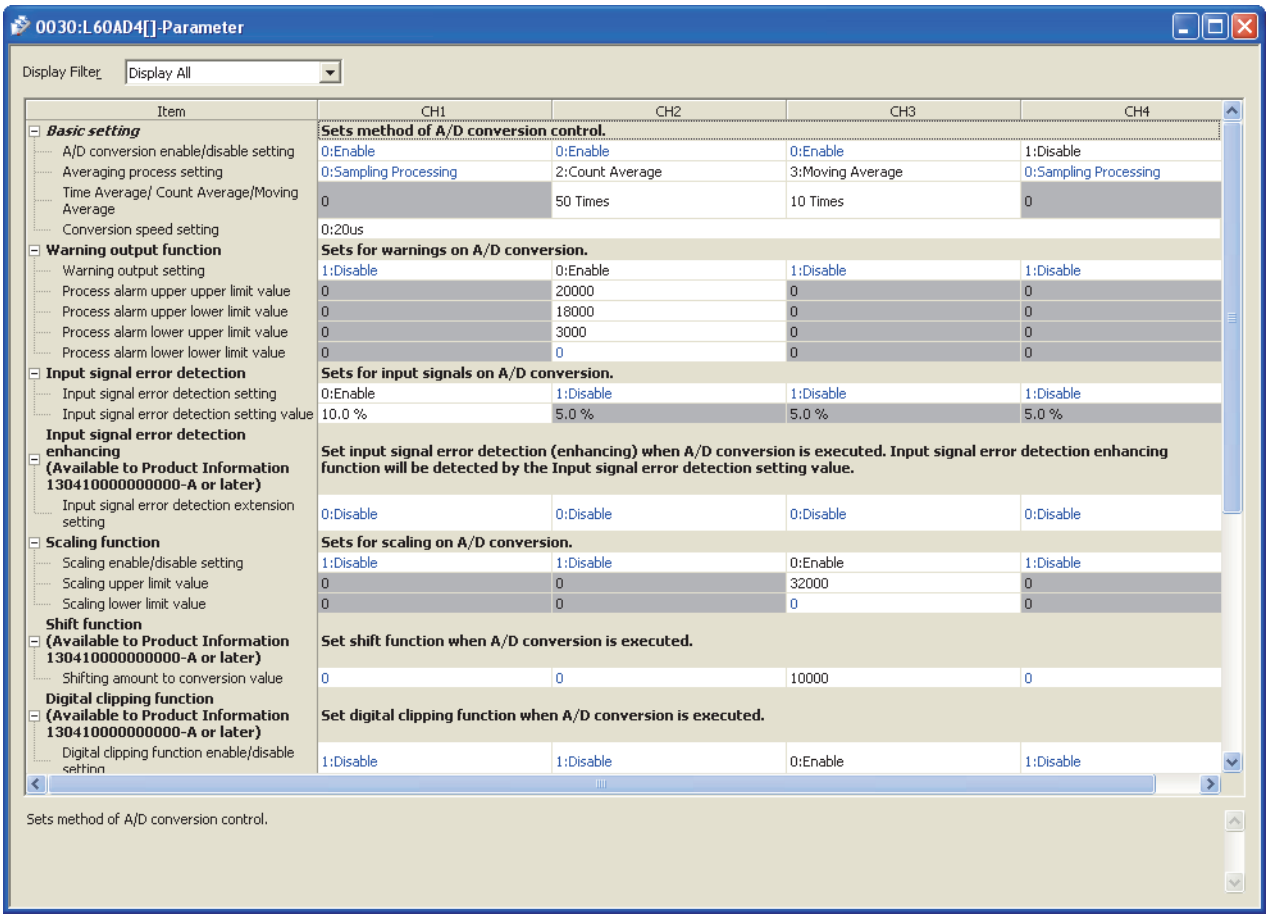
Device	Description	
D1(D11)	CH1 Digital output value	
D2(D12)	CH2 Digital output value	
D8	Input signal error detection flag	
D10	Error code	
D18	Warning output flag	
D28(D13)	CH3 Scaling value (digital operation value)	
M0	CH1 A/D conversion completed flag	
M1	CH2 A/D conversion completed flag	
M2	CH3 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 4 digits)	LY42NT1P (Y50 to 5F)

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

(a) Parameter setting

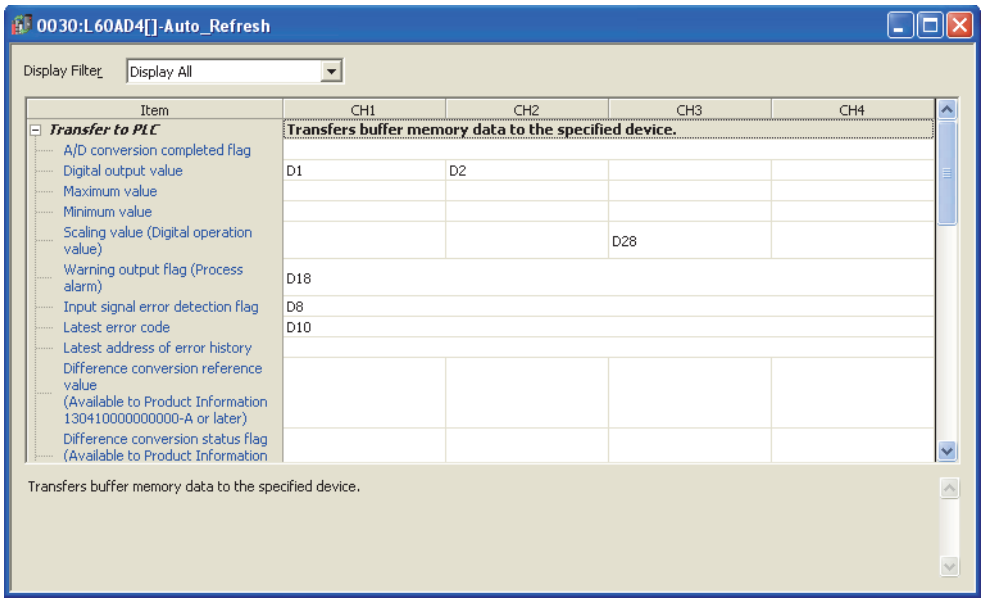
Set the contents of initial settings in the parameter.

Project window⇨[Intelligent Function Module]⇨[L60AD4]⇨[Parameter]



(b) Auto refresh setting

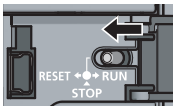
Project window⇨[Intelligent Function Module]⇨[L60AD4]
⇨[Auto_Refresh]



(c) Writing parameter of intelligent function module

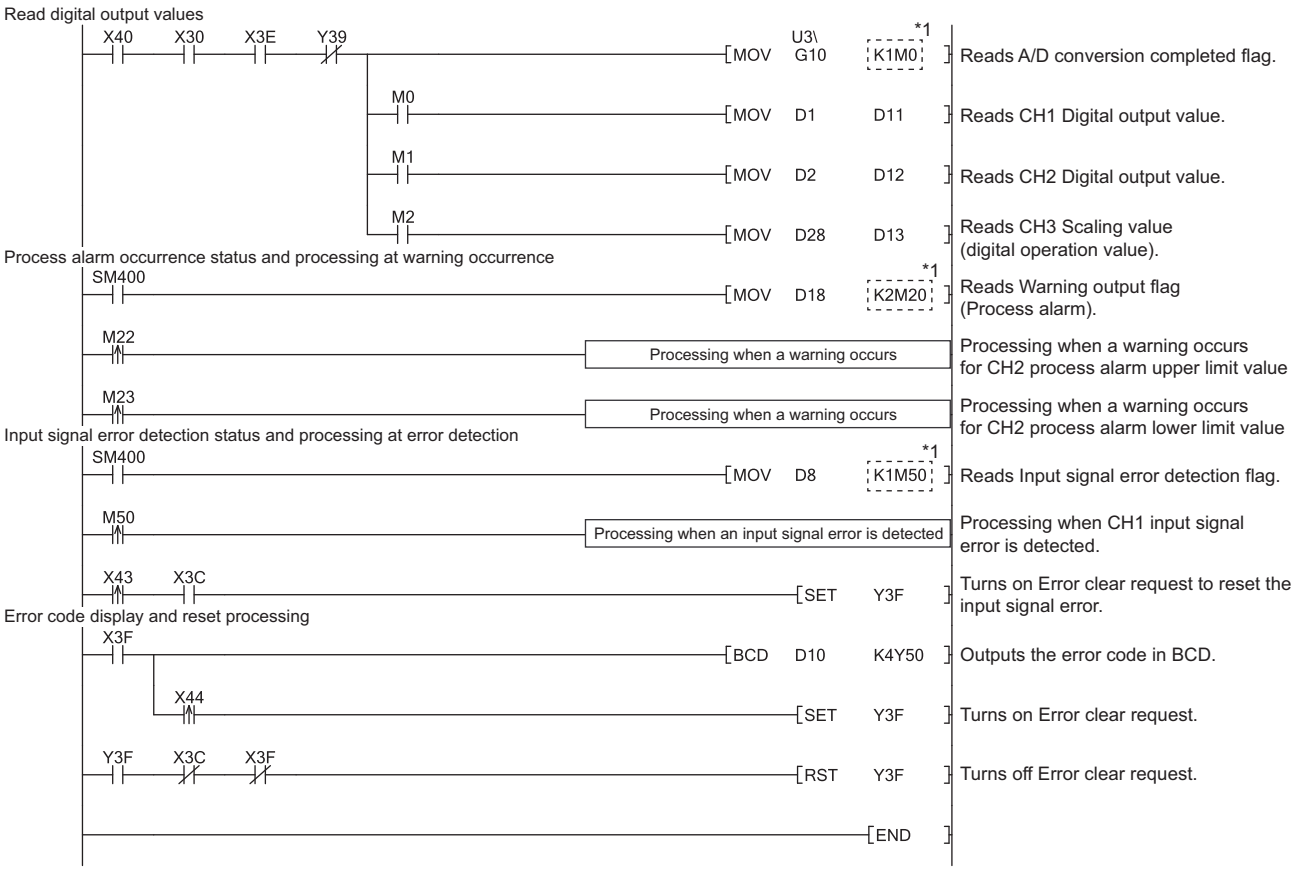
Write the set parameter to the CPU module and reset the CPU module, or then off and then on the programmable controller power supply.

[Online]⇨[Write to PLC...]



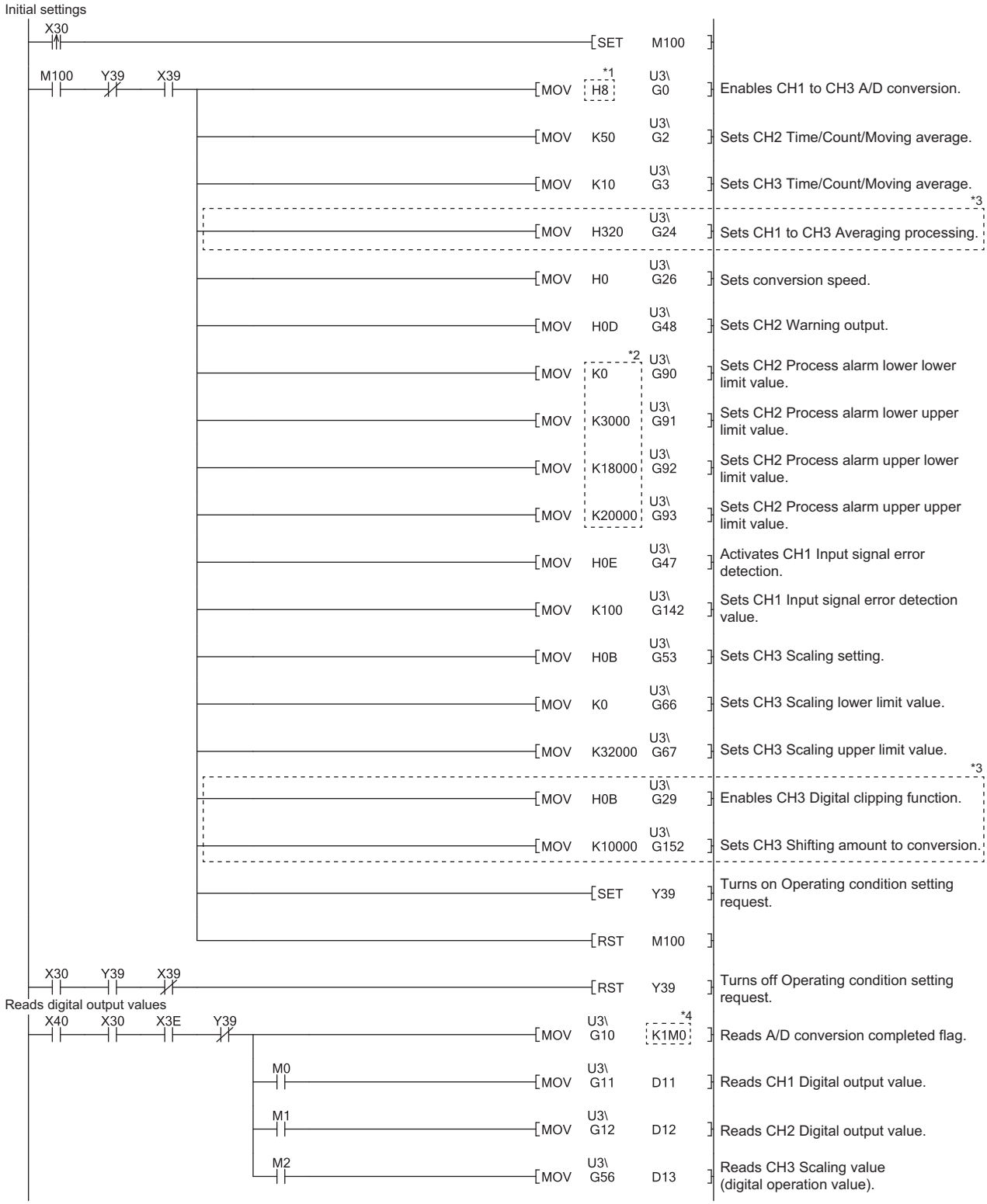
or Power OFF → ON

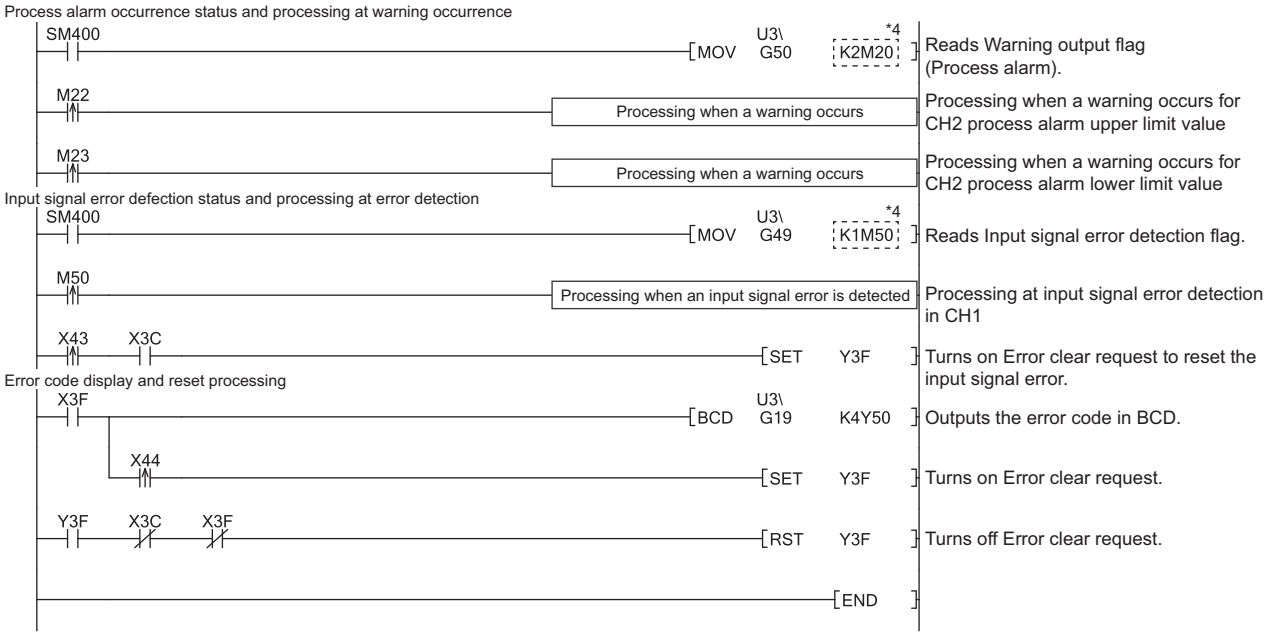
(d) Program example



*1 When using the L60ADVL8 or L60ADIL8 and enabling A/D conversion for five channels or more, increase the number of digits to be specified. (For example, change K1M0 to K2M0.)

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





*1 When using the L60ADVL8 or L60ADIL8, change H8 to HF8.

*2 When using the L60ADVL8 or L60ADIL8, this setting is not required.

*3 When using the L60ADVL8 or L60ADIL8, set values within the digital output range of the input range used.

*4 When using the L60ADVL8 or L60ADIL8 and enabling A/D conversion for five channels or more, increase the number of digits to be specified. (For example, change K1M0 to K2M0.)

10.3 When A/D Converter Module is Connected to Head Module

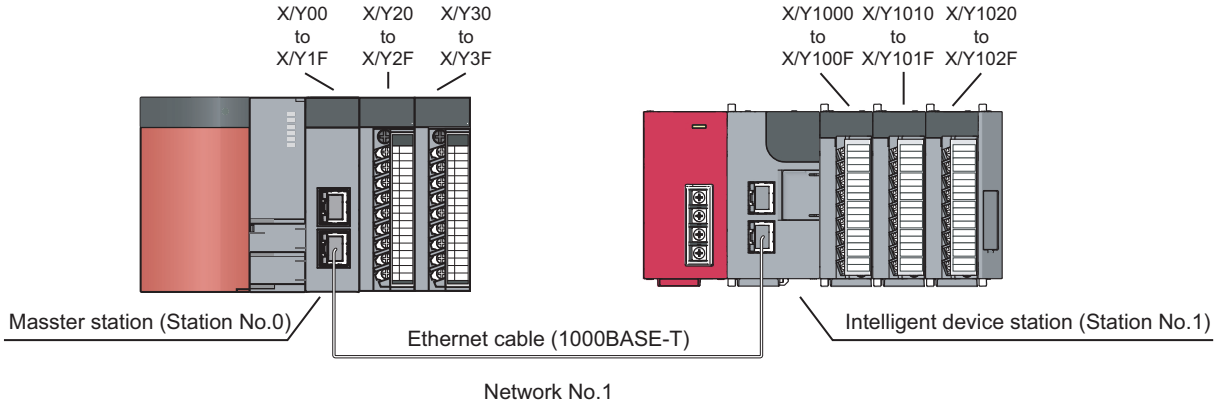
This section describes the system configuration of A/D converter module and a program example of operation condition.

(1) System configuration

The following describes the system configuration examples when the A/D converter module is mounted to a head module.

Power supply module (Q62P)
CPU module (Q10UDHCPU)
Master/local module (QJ71GF11-T2)
Input module (QX10)
Output module (QY10)

Power supply module (L61P)
Head module (LJ72GF15-T2)
A/D converter module (L60AD4)
Input module (LX40C6)
Output module (LY10R2)
END cover (L6EC)



(2) Programming conditions

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) Description of initial settings

Item	Description			
	CH1	CH2	CH3	CH4[*1]
A/D conversion enable/disable setting	Enable	Enable	Enable	Disable
Averaging process setting	Sampling processing	Count average	Moving average	Sampling processing
Time Average/Count Average/ Moving Average	0	50 times	10 times	0
Conversion speed setting[*3]	20μs			
Warning output setting	Disable	Enable	Disable	Disable
Process alarm upper upper limit value	0	20000[*2]	0	0
Process alarm upper lower limit value	0	18000[*2]	0	0
Process alarm lower upper limit value	0	3000[*2]	0	0
Process alarm lower lower limit value	0	0[*2]	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%
Input signal error detection extension setting	Disable	Disable	Disable	Disable
Scaling enable/disable setting	Disable	Disable	Enable	Disable
Scaling upper limit value	0	0	32000	0
Scaling lower limit value	0	0	0	0
Shifting amount to conversion value[*3]	0	0	10000	0
Digital clipping function enable/disable setting[*3]	Disable	Disable	Enable	Disable

*1 When using the L60ADVL8 or L60ADIL8, configure the same setting for CH5 to CH8.
*2 When using the L60ADVL8 or L60ADIL8, set values within the digital output range of the input range used.
*3 The L60ADVL8 or L60ADIL8 does not supprt this item.

(4) Devices used by a user

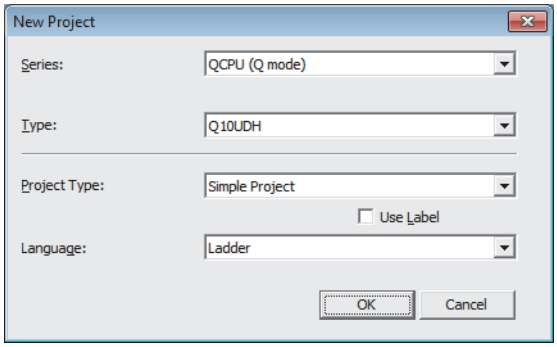
Device	Description	
W1000	A/D conversion completed flag	
W1001	CH1 Digital output value	
W1002	CH2 Digital output value	
W1008	Input signal error detection flag	
W1010	Latest error code	
W1018	Warning output flag (Process alarm)	
W1028	CH3 Scaling value (digital operation value)	
M0	CH1 A/D conversion completed flag	
M1	CH2 A/D conversion completed flag	
M2	CH3 A/D conversion completed flag	
M20 to M27	Warning output flag (Process alarm)	
M50 to M53	Input signal error detection flag	
X20	Digital output value read command input signal	QX10 (X20 to X2F)
X23	Input signal error detection reset signal	
X24	Error reset signal	
Y30 to Y3F	Error code display (BCD 4 digits)	QY10 (Y30 to Y3F)
SB49	Data link status (own station)	
SWB0.0	Data link status (each station) (station number 1)	
N0	Nesting (station number 1)	
M100	Flag for meeting the communication condition (station number 1)	

(5) Setting on master station

1. Create a project on GX Works2.

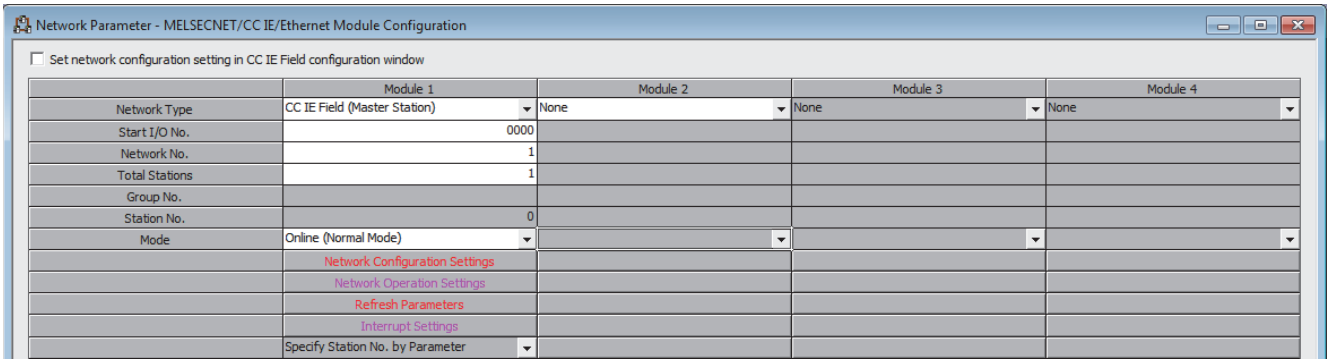
Select "QCPU (Q mode)" for "PLC Series" and select "Q10UDH" for "Type".

[Project]⇨[New...]



2. Display the network parameter setting screen and configure the setting as follows.

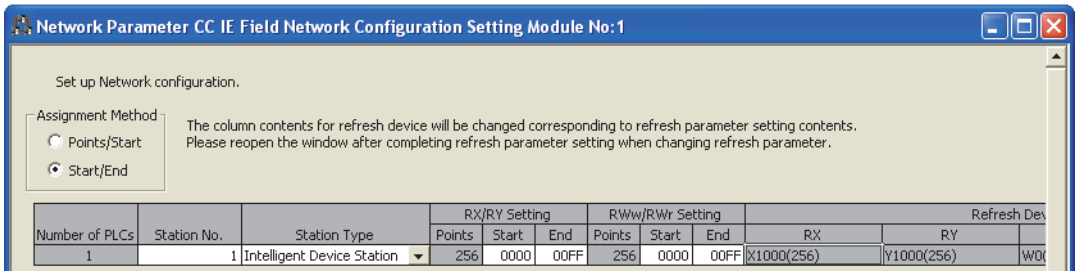
Project window⇨[Parameter]⇨[Network Parameter]
⇨[Ethernet/CC IE/MELSECNET]



3. Display the Network Configuration Setting screen and configure the setting as follows.

Project window⇨[Parameter]⇨[Network Parameter]

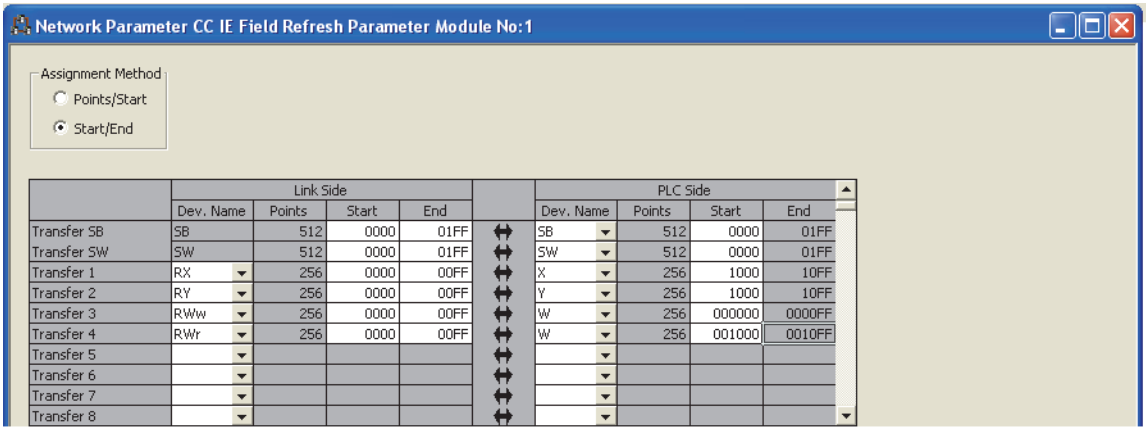
⇨[Ethernet/CC IE/MELSECNET]⇨ Network Configuration Setting button



4. Display the Auto Refresh setting screen for the A/D converter module (L60AD4) and configure the setting as follows.

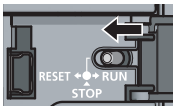
Project window⇨[Parameter]⇨[Network Parameter]

⇨[Ethernet/CC IE/MELSECNET]⇨ Refresh Parameters button



5. Write the set parameter to the CPU module of the master station and reset the CPU module, or turn off and then on the programmable controller power supply.

[Online]⇨[Write to PLC...]



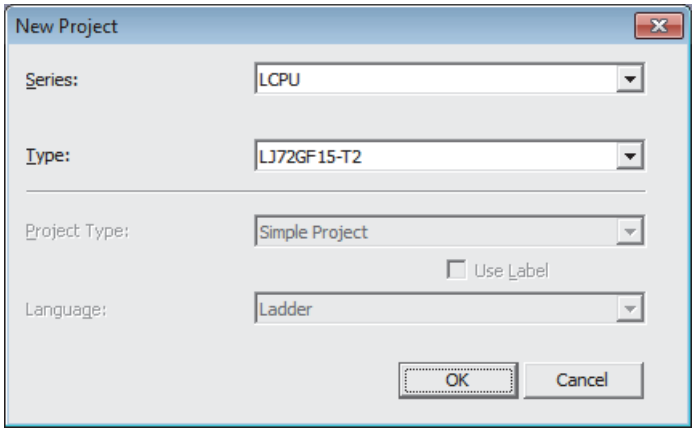
or Power OFF → ON

(6) Setting by intelligent device station

1. Create a project for GX Works2.

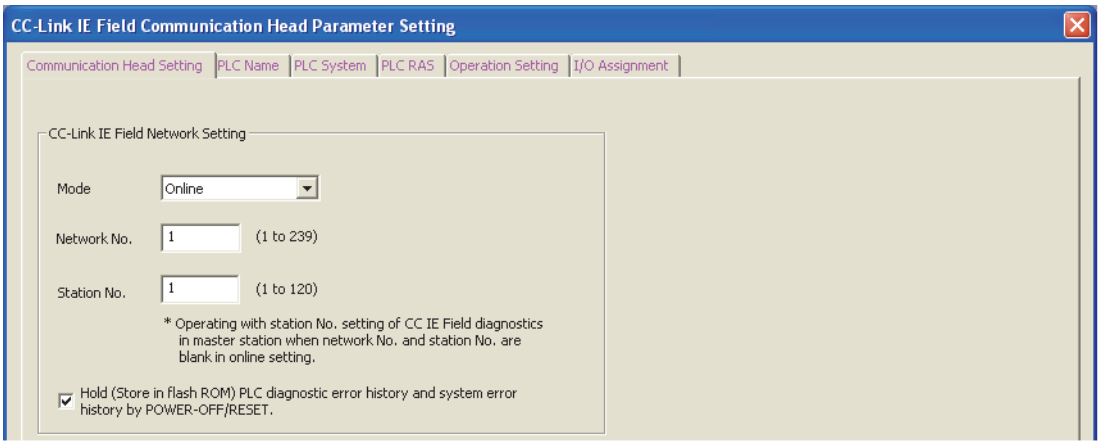
Select "LCPU" for "PLC Series" and select "LJ72GF15-T2" for "Type".

[Project]⇨[New...]



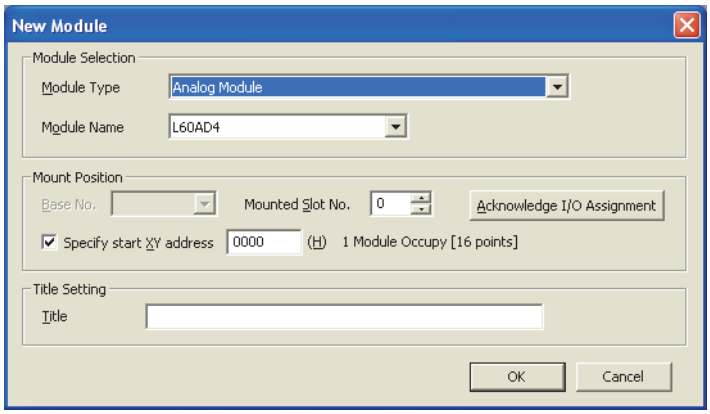
2. Display the PLC Parameter setting screen and configure the setting as follows.

Project window⇨[Parameter]⇨[PLC parameter]⇨"Communication Head Setting"



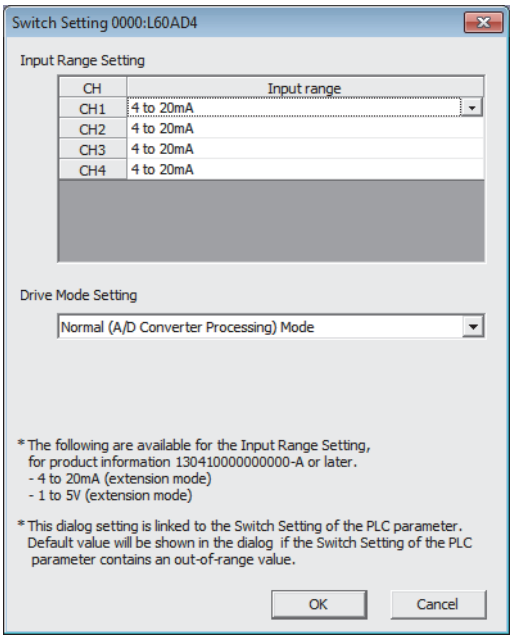
3. Add the A/D converter module (L60AD4) to the GX Works2 project.

Project window⇨[Intelligent Function Module]⇨Right-click⇨[New Module]



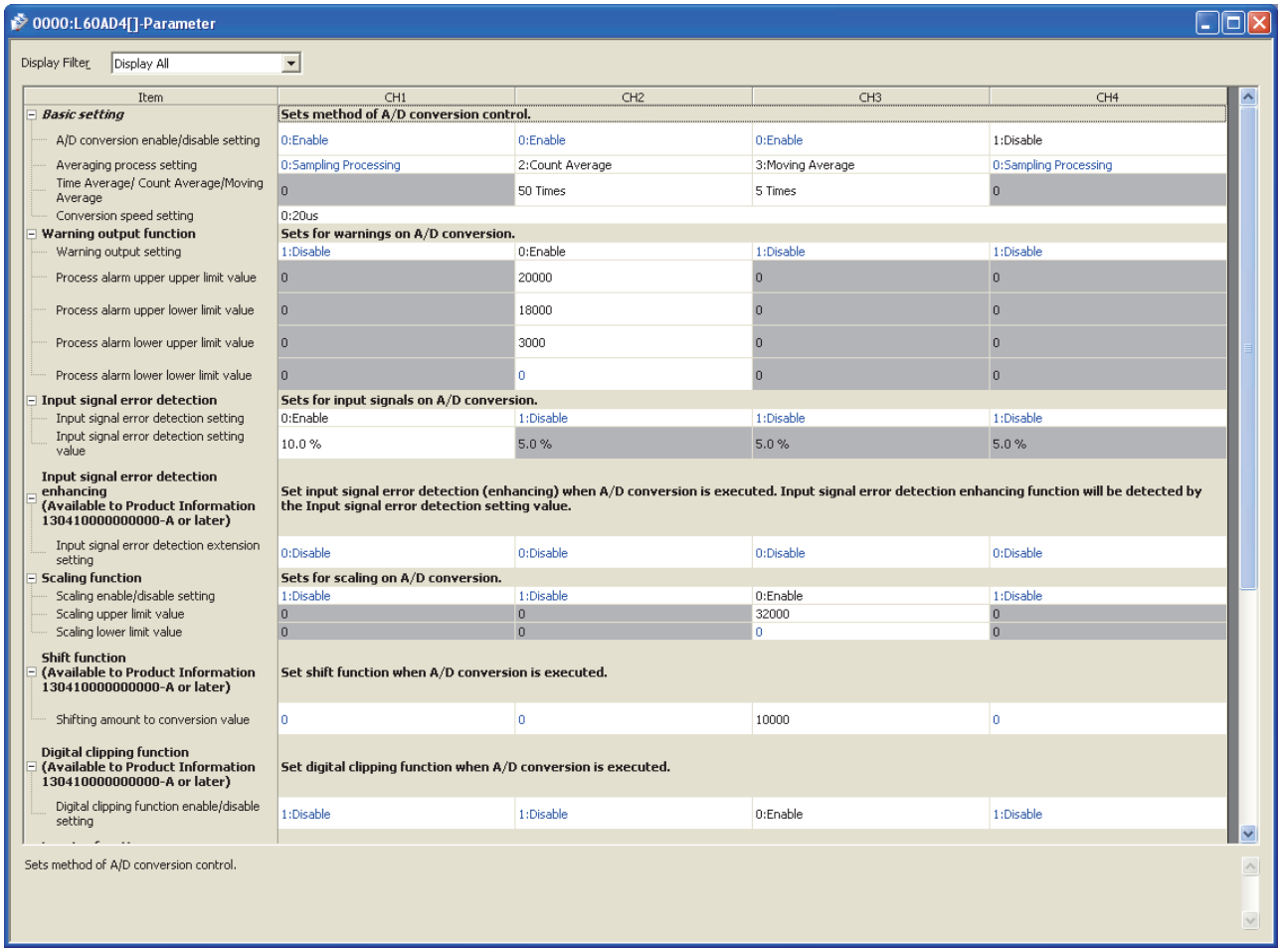
4. Display the Switch Setting screen for the A/D converter module (L60AD4) and configure the setting as follows.

Project window⇨[Intelligent Function Module]⇨[L60AD4]⇨[Switch Setting]



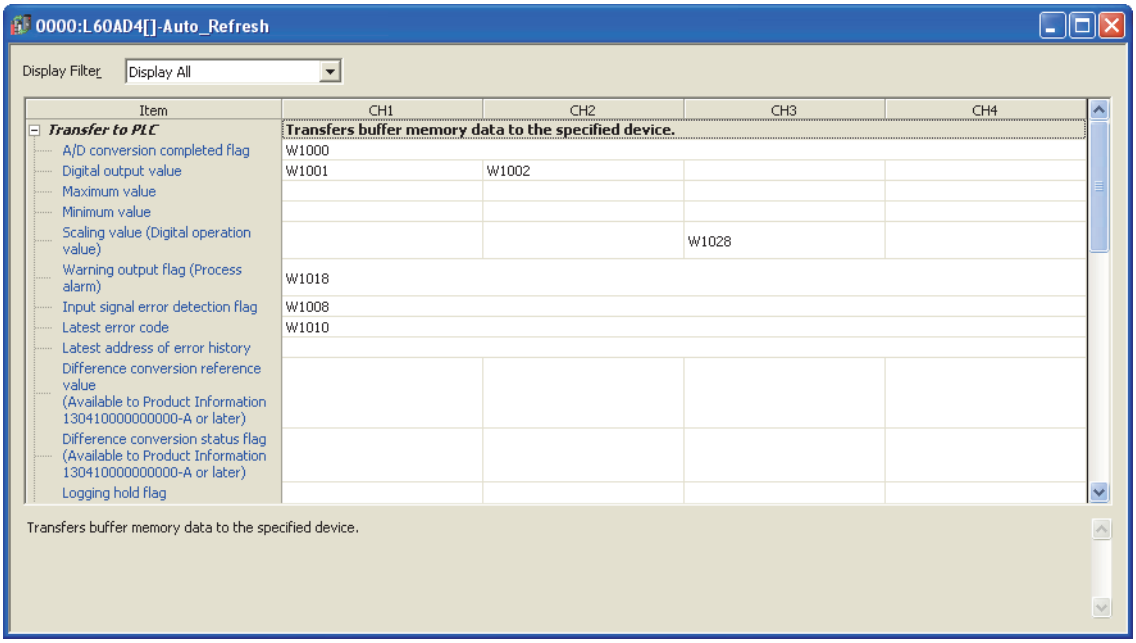
5. **Display the initial setting screen for the A/D converter module (L60AD4) and configure the setting as follows.**

Project window⇨[Intelligent Function Module]⇨[L60AD4]⇨[Parameter]



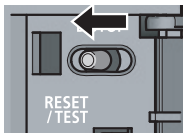
6. Display the Auto Refresh setting screen for the A/D converter module (L60AD4) and configure the setting as follows.

Project window⇨[Intelligent Function Module]⇨[L60AD4]
⇨[Auto_Refresh]



7. Write the set parameter to the head module and reset the head module, or turn off and then on the programmable controller power supply.

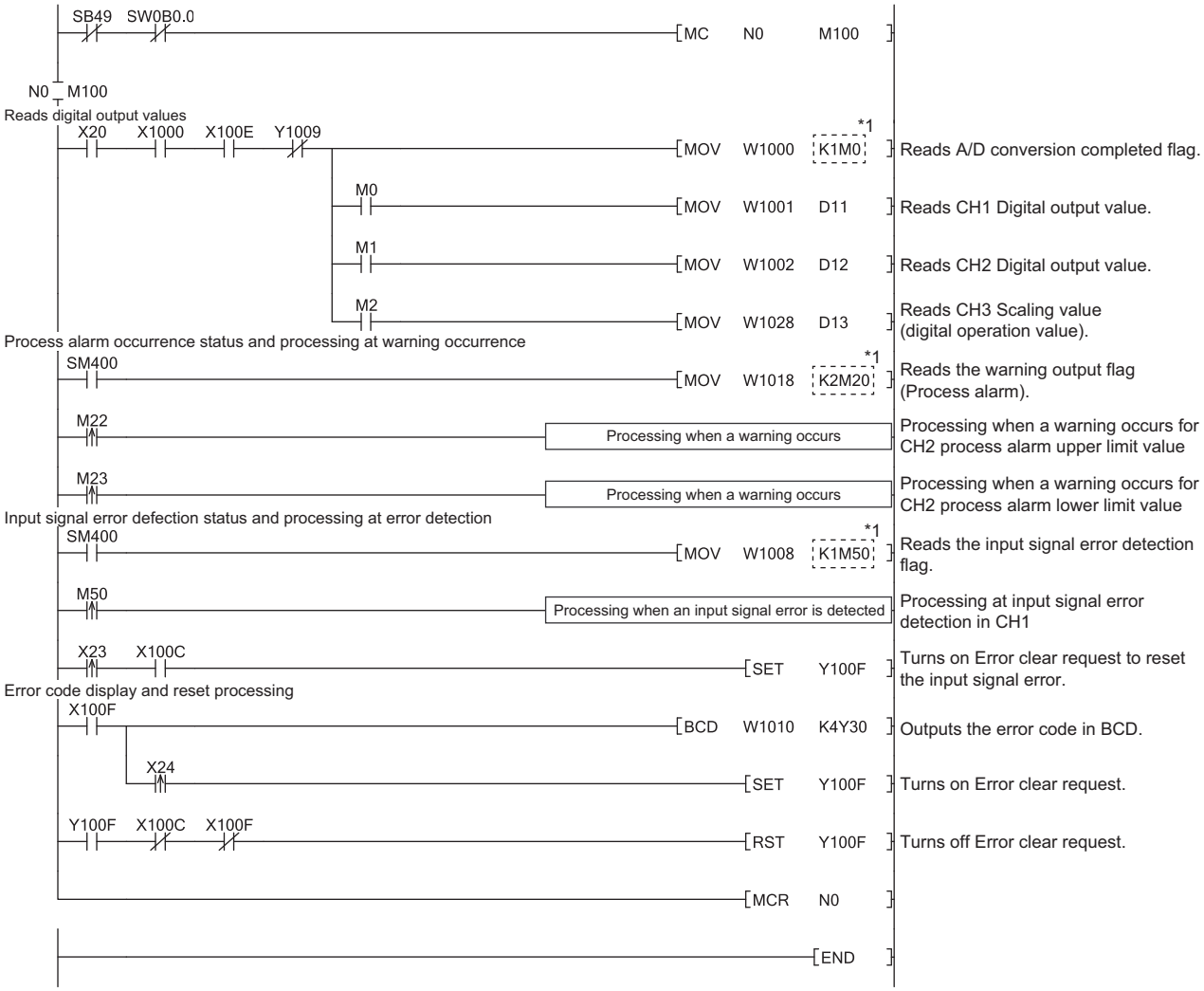
[Online]⇨[Write to PLC...]



or Power OFF→ON

(7) Program example

The following shows a program example. The program can be written to the CPU module of the master station.



*1 When using the L60ADVL8 or L60ADIL8 and enabling A/D conversion for five channels or more, increase the number of digits to be specified. (For example, change K1M0 to K2M0.)

CHAPTER 11 TROUBLESHOOTING

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

(1) Checking for the error codes and the alarm codes

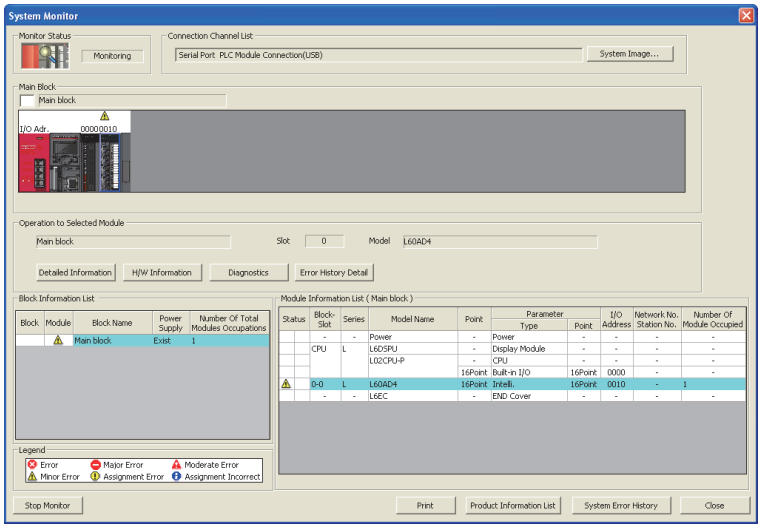
Errors and alarms occurred in the A/D converter module can be checked by any of the following methods: Choose the checking methods for the purpose and application.

- Checking on the module detailed Information (Page 176, Section 11.1)
- Checking by Latest Error Code (Un\G19) (Page 177, Section 11.2)
- Checking on the module error collection function (Page 178, Section 11.3)
- Checking by a display unit (Page 155, Section 9.4)

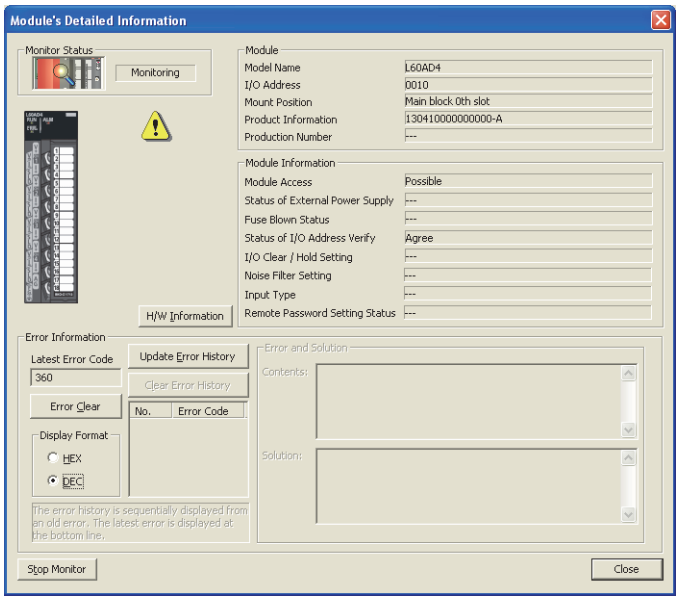
11.1 Checking on the Module Detailed Information

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

[Diagnostics] ⇨ [System Monitor…]



↓



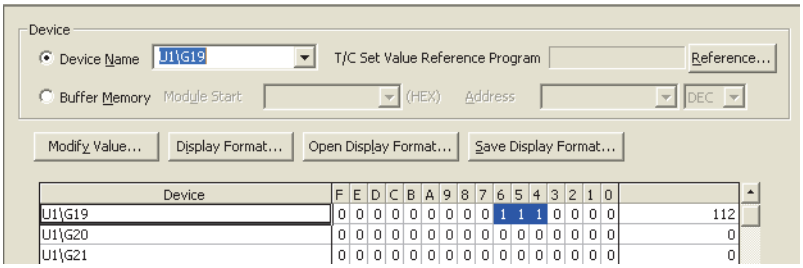
1. **Select the A/D converter module in "Main Block" and click the Detailed Information button.**

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

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]



Point

When multiple errors or alarms occur, the latest error code or alarm code is stored in Latest error code (Un\G19).

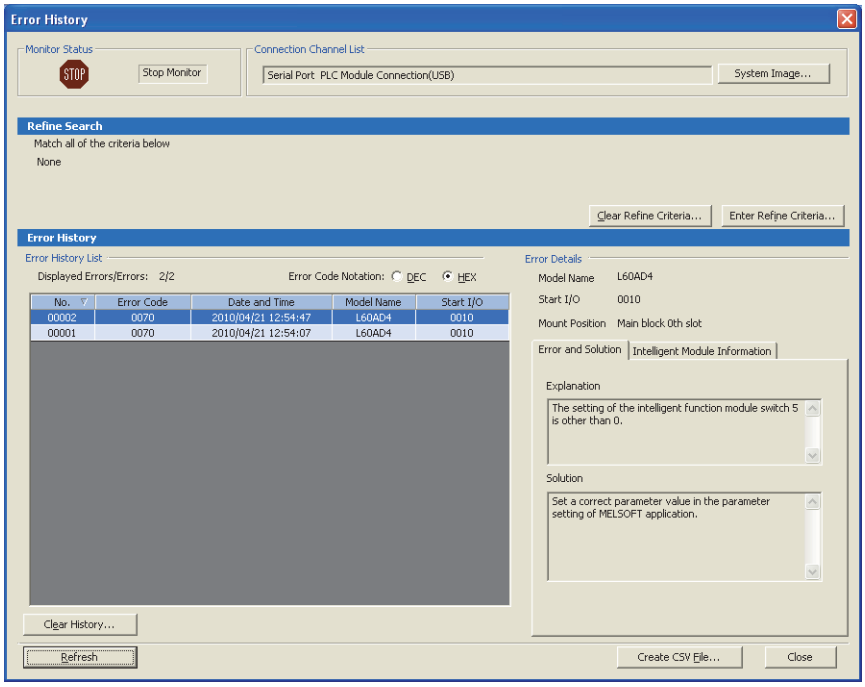
11.3 Checking on the Module Error Collection Function

The module error collection function can store the errors that occurred in the A/D converter module to the CPU module. Once being stored, the errors remain even after powering off or resetting 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



(2) Errors to be collected

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

- Error code list (Page 179, Section 11.4)
- Alarm code list (Page 183, Section 11.5)

11.4 Error Code List

The following table lists error codes. When an error occurs, the error code is stored in Latest error code (Un\G19). The error is reported to the CPU module also.

Error code (decimal)	Target module	Description and cause of error	Action
10□	L60AD4 L60ADVL8 L60ADIL8	The input range is set with a value outside the setting range for Switch 1 or 2 of the intelligent function module switch setting of "PLC parameter". The channel with the invalid setting fits in □.	Set a valid value to the input range for Switch 1 or 2 of the intelligent function module switch setting.
111	L60AD4 L60ADVL8 L60ADIL8	A hardware failure has occurred on the module.	Power off and on the module. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
112	L60AD4 L60ADVL8 L60ADIL8	A value other than 0 is set to Switch 5 on the intelligent function module switch setting of "PLC parameter".	Set 0 to Switch 5 on the intelligent function module switch setting.
113[*1]	L60AD4 L60ADVL8 L60ADIL8	The data in the flash memory has a problem.	Check the digital output value. If there is a problem of the digital output value, please consult your local Mitsubishi representative.
120[*1]	L60AD4 L60ADVL8 L60ADIL8	An invalid value is set to the offset/gain setting. The channel where the error has occurred cannot be identified.	Start over the offset/gain setting of all channels where the user range setting is used. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
12□[*1]	L60AD4 L60ADVL8 L60ADIL8	An invalid value is set to the offset/gain setting. The channel where the error has occurred fits in □.	Start over the offset/gain setting of the channel where the error has occurred. If the error occurs again, a failure might have occurred on the module. Please consult your local Mitsubishi representative.
161[*1*2]	L60AD4 L60ADVL8 L60ADIL8	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]	L60AD4 L60ADVL8 L60ADIL8	• The G(P).OGSTOR instruction has been consecutively executed. • For the offset/gain setting, a setting value has been consecutively written to the flash memory more than 25 times.	• Execute the G(P).OGSTOR instruction only once per module. • Write the setting value into the flash memory only once for each offset/gain setting.
163[*1]	L60AD4 L60ADVL8 L60ADIL8	• The G(P).OGSTOR instruction has been executed on a module different from the one on which the G(P).OGLOAD instruction was executed. • The G(P).OGSTOR instruction has been executed ahead of the G(P).OGLOAD instruction.	• Execute the G(P).OGLOAD and G(P).OGSTOR instructions to the same module. • After executing the G(P).OGLOAD instruction on the module from where data is restored, execute the G(P).OGSTOR instruction on the module to where the data is restored.
170[*1]	L60AD4 L60ADVL8 L60ADIL8	The offset/gain setting was configured exceeding the maximum number of times.	No more offset/gain setting is reflected on the operation successfully.

Error code (decimal)	Target module	Description and cause of error	Action
20□[*1]	L60AD4	• Although the conversion speed has been set to 20μs, the averaging time value set in CH□ Time Average/Count Average/Moving Average (Un\G1 to Un\G4) is outside the range of 2 to 1500ms. • Although the conversion speed has been set to 80μs or 1ms, the averaging time value set in CH□ Time Average/Count Average/Moving Average (Un\G1 to Un\G4) is outside the range of 2 to 5000ms. • The averaging time value set in CH□ Time Average/Count Average/Moving Average (Un\G1 to Un\G4) is less than "4 × Number of used channels × Conversion speed" (ms). The channel where the error has occurred fits in □.	• When the conversion speed is 20μs, set the averaging time to a value in the range of 2 to 1500ms. • When the conversion speed is 80μs or 1ms, set the averaging time to a value in the range of 2 to 5000ms. • Set the averaging time to a value equal to or more than "4 × Number of used channels × Conversion speed" (ms).
	L60ADVL8 L60ADIL8	• The averaging time value set in CH□ Time Average/Count Average/Moving Average (Un\G1 to Un\G8) is outside the range of 4 to 5000ms. • The averaging time value set in CH□ Time Average/Count Average/Moving Average (Un\G1 to Un\G8) is less than "4 × Number of used channels × 1 (Conversion speed)" (ms). The channel where the error has occurred fits in □.	• Set the averaging time to a value within the range of 4 to 5000ms. • Set the averaging time to a value equal to or more than "4 × Number of used channels × 1 (Conversion speed)" (ms).
30□[*1]	L60AD4 L60ADVL8 L60ADIL8	The averaging count value set in CH□ Time Average/Count Average/Moving Average (Un\G1 to Un\G8) is outside the range of 4 to 62500. The channel where the error has occurred fits in □.	Set the averaging count to a value in the range of 4 to 62500.
31□[*1]	L60AD4 L60ADVL8 L60ADIL8	The moving average count value set in CH□ Time Average/Count Average/Moving Average (Un\G1 to Un\G8) is outside the range of 2 to 1000. The channel where the error has occurred fits in □.	Set the moving average count to a value in the range of 2 to 1000.
360[*1]	L60AD4	The value set in Conversion speed setting (Un\G26) is outside the range of 0 to 2.	Set one of the following values in Conversion speed setting (Un\G26). • 20μs (0) • 80μs (1) • 1ms (2)
37□[*1]	L60AD4	The value set in CH□ Difference conversion trigger (Un\G172 to Un\G175) is other than 0 and 1. The channel where the error has occurred fits in □.	Set the value in CH□ Difference conversion trigger (Un\G172 to Un\G175) to No request (0) or Trigger request (1).
40□[*1]	L60AD4 L60ADVL8 L60ADIL8	When the user range is set or restored, values are as follows: Offset value ≥ Gain value The channel where the error has occurred fits in □.	Set values so that they meet the following condition: Offset value < Gain value
500[*1]	L60AD4 L60ADVL8 L60ADIL8	When the offset/gain setting is configured, channels or 0s are set simultaneously in both Offset/gain setting mode Offset specification (Un\G22) and Offset/gain setting mode Gain specification (Un\G23).	Correct the setting in Offset/gain setting mode Offset specification (Un\G22) and/or the Offset/gain setting mode Gain specification (Un\G23).
6△□[*1]	L60AD4 L60ADVL8 L60ADIL8	The settings in CH1 Process alarm lower lower limit value (Un\G86) to CH8 Process alarm upper upper limit value (Un\G117) are invalid. The channel with the invalid setting fits in □. A value fits in △ indicates that the alarm status is as follows: 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 settings in CH1 Process alarm lower lower limit value (Un\G86) to CH8 Process alarm upper upper limit value (Un\G117).
80□[*1]	L60AD4 L60ADVL8 L60ADIL8	The value set in CH□ Input signal error detection setting value (Un\G142 to Un\G149) is outside the range of 0 to 250. The channel where the error has occurred fits in □.	Set a value within the range of 0 to 250 in CH□ Input signal error detection setting value (Un\G142 to Un\G149).
81□[*1]	L60AD4 L60ADVL8 L60ADIL8	The value set in Input signal error detection extension setting (Un\G27, Un\G28) is outside the range of 0 to 4. The channel where the error has occurred fits in □.	Set one of the following values in Input signal error detection extension setting (Un\G27, Un\G28) for the channel where the error has occurred. • Disable (0) • Upper/lower limit detection (1) • Lower limit detection (2) • Upper limit detection (3) • Disconnection detection (4)

Error code (decimal)	Target module	Description and cause of error	Action
82□[*1]	L60AD4 L60ADVL8 L60ADIL8	A value set in Input signal error detection extension setting (Un\G27, Un\G28) is Disconnection detection (4), besides the set input range for the same channel is other than the following. • 4 to 20mA (Extended mode) • 1 to 5V (Extended mode) The channel where the error has occurred fits in □.	• To perform disconnection detection using the input signal error detection extension function, set the input range of the corresponding channel to 4 to 20mA (Extended mode) or 1 to 5V (Extended mode). • Not to perform disconnection detection using the input signal error detection extension function, set Input signal error detection extension setting (Un\G27, Un\G28) of the corresponding channel to the value other than Disconnection detection (4).
90□[*1]	L60AD4 L60ADVL8 L60ADIL8	The values set in CH1 Scaling lower limit value (Un\G62) to CH8 Scaling upper limit value (Un\G77) are outside the range of -32000 to 32000. The channel where the error has occurred fits in □.	Set a value within the range of -32000 to 32000 in CH1 Scaling lower limit value (Un\G62) to CH8 Scaling upper limit value (Un\G77).
91□[*1]	L60AD4 L60ADVL8 L60ADIL8	The values set in CH1 Scaling lower limit value (Un\G62) to CH8 Scaling upper limit value (Un\G77) are as follows: Scaling lower limit value ≥ Scaling upper limit value. The channel where the error has occurred fits in □.	Set the values in CH1 Scaling lower limit value (Un\G62) to CH8 Scaling upper limit value (Un\G77) so that they meet the following condition: Scaling upper limit value > Scaling lower limit value
99□[*1*3]	L60AD4	For some channels, user range setting is used and besides the scaling function is enabled. The channel with the invalid setting fits in □.	Disable the scaling function of the channel where a user range setting is used.
200□[*1]	L60AD4	CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set Enable (0) or Disable (1) in CH□ Logging enable/disable setting (Un\G1000 to Un\G1003).
		Conversion speed is set to 20μs, and besides CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Enable (0). The channel where the error has occurred fits in □.	To use the logging function, set the conversion speed to 80μs or 1ms.
201□[*1]	L60AD4	A value outside the setting range is set in one or both of CH□ Logging cycle setting value (Un\G1032 to Un\G1035) or/and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043). The channel where the error has occurred fits in □.	Set a value within the setting range in one or both of CH□ Logging cycle setting value (Un\G1032 to Un\G1035) or/and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043). For the setting method of the logging cycle, refer to the following. • Logging function (☞ Page 108, Section 8.14)
202□[*1]	L60AD4	The set logging cycle is shorter than the update cycle of the logged value (digital output value or scaling value (digital operation value)). The channel where the error has occurred fits in □.	Set CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) so that the logging cycle is equal to or longer than the update cycle of the logged value. For the setting method of the logging cycle, refer to the following. • Logging function (☞ Page 108, Section 8.14)
203□[*1]	L60AD4	CH□ Logging data setting (Un\G1024 to Un\G1027) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set Digital output value (0) or Scaling value (digital operation value) (1) in CH□ Logging data setting (Un\G1024 to Un\G1027).
204□[*1]	L60AD4	CH□ Logging points after trigger (Un\G1048 to Un\G1051) is set to a value outside the range of 1 to 10000. The channel where the error has occurred fits in □.	Set a value within the range of 1 to 10000 in CH□ Logging points after trigger (Un\G1048 to Un\G1051).
205□[*1]	L60AD4	CH□ Level trigger condition setting (Un\G1056 to Un\G1059) is set to a value outside the range of 0 to 3. The channel where the error has occurred fits in □.	Set one of the following values in CH□ Level trigger condition setting (Un\G1056 to Un\G1059). • Disable (0) • Above (1) • Below (2) • Pass through (3)
206□[*1]	L60AD4	CH□ Trigger data (Un\G1064 to Un\G1067) is set to a value outside the range of 0 to 4999. The channel where the error has occurred fits in □.	Set a value within the range of 0 to 4999 in CH□ Trigger data (Un\G1064 to Un\G1067).
207□[*1]	L60AD4	CH□ Logging hold request (Un\G1008 to Un\G1011) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set OFF (0) or ON (1) in CH□ Logging hold request (Un\G1008 to Un\G1011).

Error code (decimal)	Target module	Description and cause of error	Action
208□*1	L60AD4	CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Enable (0), and besides the input signal error detection function or the input signal error detection extension function is enabled. The channel where the error has occurred fits in □.	To use the logging function, set the following buffer memory areas as below. • Set Disable (0) in Input signal error detection extension setting (Un\G27) • Set Disable (1) in Input signal error detection setting (Un\G47).
210□*1	L60AD4	CH□ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set Enable (0) or Disable (1) in CH□ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303).
		Conversion speed is set to 20μs or 80μs, and besides CH□ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303) is set to Enable (0). The channel where the error has occurred fits in □.	To use the flow amount integration function, set the conversion speed to 1ms.
211□*1	L60AD4	CH□ Integration cycle setting (Un\G1308 to Un\G1311) is set to a value outside the range of 1 to 5000. The channel where the error has occurred fits in □.	Set a value within the range of 1 to 5000 in CH□ Integration cycle setting (Un\G1308 to Un\G1311).
212□*1	L60AD4	The set value in CH□ Integration cycle setting (Un\G1308 to Un\G1311) is shorter than the update cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57). The channel where the error has occurred fits in □.	Set CH□ Integration cycle setting (Un\G1308 to Un\G1311) so that the integration cycle is equal to or longer than the update cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57). For the setting method of the integration cycle, refer to the following. • Flow amount integration function (☞Page 123, Section 8.15)
213□*1	L60AD4	CH□ Flow amount time unit setting (Un\G1316 to Un\G1319) is set to a value outside the range of 0 to 2. The channel where the error has occurred fits in □.	Set one of the following values in CH□ Flow amount time unit setting (Un\G1316 to Un\G1319). • /s (0) • /min (1) • /h (2)
214□*1	L60AD4	CH□ Unit scaling setting (Un\G1324 to Un\G1327) is set to a value outside the range of 0 to 4. The channel where the error has occurred fits in □.	Set one of the following values in CH□ Unit scaling setting (Un\G1324 to Un\G1327). • × 1 (0) • × 10 (1) • × 100 (2) • × 1000 (3) • × 10000 (4)
215□*1	L60AD4	CH□ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set No request (0) or Temporary stop request (1) in CH□ Flow amount integration temporary stop request (Un\G1356 to Un\G1359).
216□*1	L60AD4	CH□ Integrated flow amount clear request (Un\G1372 to Un\G1375) is set to a value other than 0 and 1. The channel where the error has occurred fits in □.	Set No request (0) or Clear request (1) in CH□ Integrated flow amount clear request (Un\G1372 to Un\G1375).

*1 This error code can be cleared by setting a value within the setting range and performing either of the following operations.
- Turning on and off Error clear request (YF)
- Turning on and off Operating condition setting request (Y9)

When Operating condition setting request (Y9) is turned on and off, A/D conversion is reset and are resumed from the beginning.

*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).

*3 For the L60AD4 with a serial number (first five digits) 13041 or later, the scaling function can be used on the channel where a user range setting is used; therefore, an error does not occur.

Point

For Switch 1 to 5, refer to the following.
- Intelligent function module switch setting (☞Page 264, Appendix 9 (2))

11.5 Alarm Code List

The following shows an alarm code list.

Alarm code (decimal)	Target module	Description and cause of alarm	Action
10△□*1	L60AD4 L60ADVL8 L60ADIL8	A process alarm is occurring. The channel where the process alarm has occurred fits in □. A value fits in △ indicates that the alarm status is as follows: 0: Upper limit of a process alarm 1: Lower limit of a process alarm	When the scaling value (digital operation value) returns to the one within the setting range, the corresponding bit of Warning output flag (Process alarm) (Un\G50) and Warning output signal (X8) turn off. The alarm code can be cleared by turning off, on, and off Error clear request (YF) after the scaling value (digital operation value) returns to the one within the setting range.
110□*1	L60AD4 L60ADVL8 L60ADIL8	An input signal error is occurring. The channel where the input signal error has occurred fits in □. This alarm code is stored when an input signal error is detected according to the setting of the input signal error detection function.	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 off Error clear request (YF) after the analog input value returns to the one within the setting range.
11△□*1	L60AD4 L60ADVL8 L60ADIL8	An input signal error is occurring. The channel where the input signal error has occurred fits in □. A value fits in △ indicates that the detection status is as follows: 1: Upper limit detection 2: Lower limit detection 3: Disconnection detection This alarm code is stored when an input signal error is detected according to the setting of the input signal error detection extension function.	

*1 This alarm code can be cleared by setting a value within the setting range and performing either of the following operations.
- Turning on and off Error clear request (YF)
- Turning on and off Operating condition setting request (Y9)

When Operating condition setting request (Y9) is turned on and off, A/D conversion is reset and are resumed from the beginning.

Point

For Switch 1 to 5, refer to the following.
- Intelligent function module switch setting (☞Page 264, Appendix 9 (2))

11.6 Troubleshooting

11.6.1 Troubleshooting using LEDs

(1) When the RUN LED flashes or turns off

(a) When flashing

Check item	Cause	Action
Is the operation mode setting in the offset/gain setting mode?	Offset/gain setting mode is set to the drive mode setting in the switch setting.	Set normal mode to the drive mode setting in the switch setting. After that, power off and on the module or reset the CPU module.
	The G(P).OFFGAN instruction has been executed and the mode has been switched to offset/gain setting mode.	When using the A/D converter module in normal mode, check if the program for the G(P).OFFGAN instruction has been mistakenly executed.
	The value in Mode switching setting (Un\G158, Un\G159) has been changed and the mode has been switched to offset/gain setting mode.	When using the A/D converter module in normal mode, check if the program to change the value in Mode switching setting (Un\G158, Un\G159) has been mistakenly executed.

(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 the module connected properly?	Check the module connection.
The case other than the above	A watchdog timer error may have occurred. 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 representative.

(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 the action described in the error code list. • Error Code List (Page 179, 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, 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). For the action, refer to the following. • Alarm Code List (Page 183, Section 11.5)

(b) When flashing

Check item	Action
Is there any input signal error?	Check Input signal error detection flag (Un\G49) Input signal error detection flag (Un\G49) turns on when an analog input value becomes the input signal error detection upper limit value or greater, or input signal error detection lower limit value or smaller. When Input signal error detection flag (Un\G49) is on, check the external wiring, voltage value, or current value of analog input signal.

11.6.2 Troubleshooting for the A/D conversion

(1) When digital output value cannot be read AD4

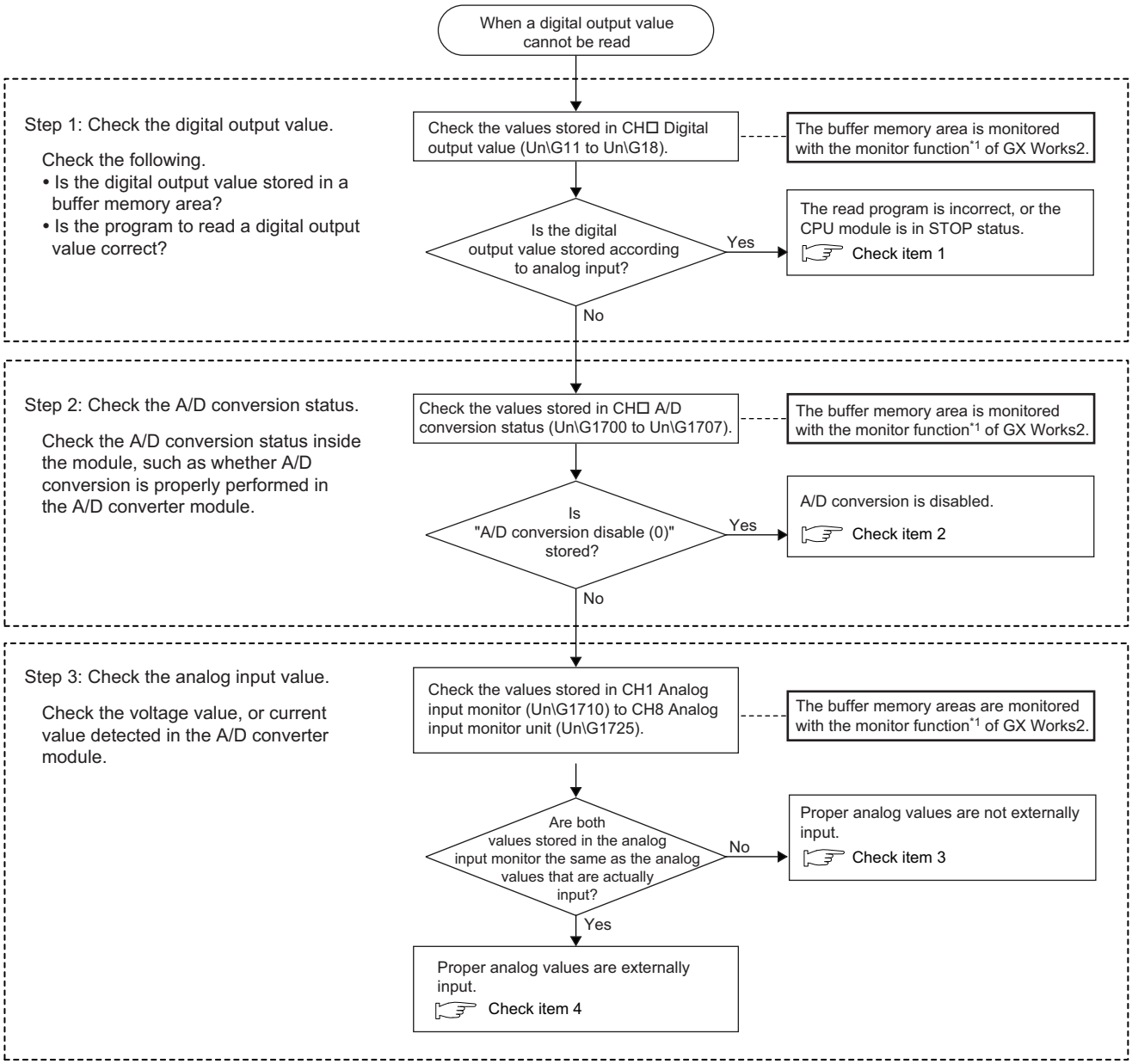
Check item	Action
Is there any problem with wiring, such as off or disconnection of analog signal lines?	Check the faulty area by checking signal line visually or conductively.
Is the CPU module in the STOP status?	Change the status of the CPU module to RUN.
Is the offset/gain setting correct?	Check if the offset/gain setting is correct. If the user range is selected, use the factory default setting for the input range and check if the A/D conversion is performed. If the A/D conversion is properly executed, configure the offset/gain setting again.
Is input range setting correct?	Check Setting range (Un\G20). If the input range setting is incorrect, correct the switch setting.
Is A/D conversion disable (1) set to A/D conversion enable/disable setting (Un\G0) of the channel to input a value?	Check A/D conversion enable/disable setting (Un\G0) and set A/D conversion enable (0) using a program or parameter setting.
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. When the problem has been solved, check the program again.
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 where A/D conversion is enabled" 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?	If the wiring is long, a potential difference may occur between the AG terminal and the external device GND, and A/D conversion may not be performed properly. Connect the AG terminal and the external device GND to eliminate the potential difference.
Is the same external device GND used for all channels?	If the same external device GND is used for all channels, noise occurs between channels and some errors may occur in A/D converted values. Connect the AG terminal and the external device GND to eliminate the errors.

Point

If digital output value cannot be read even after taking the above actions, the A/D converter module may be failed. Please consult your local Mitsubishi representative.

(2) When digital output value cannot be read ADVL8 ADIL8

Check the cause with the flowchart below.



*1 Use "Device/Buffer Memory Batch Monitor" or "Intelligent Function Module Monitor".

Point

If digital output value cannot be read even after taking the above actions, the A/D converter module may be failed. Please consult your local Mitsubishi representative.

(a) Check item 1

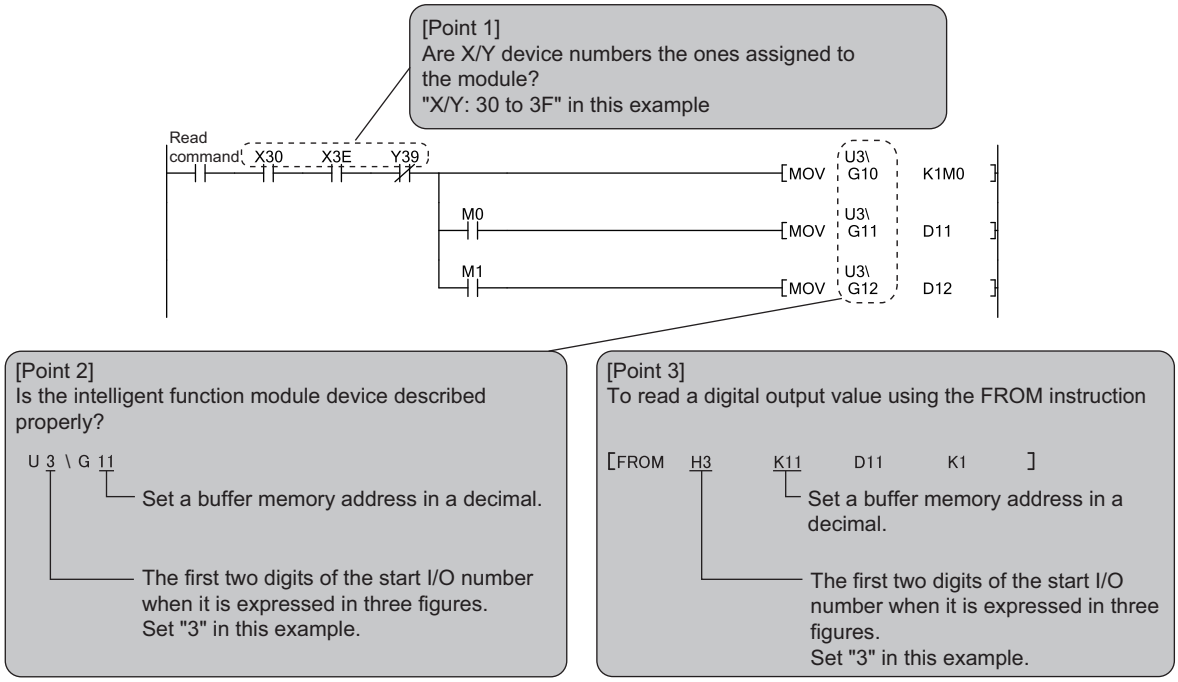
The read program is incorrect, or the CPU module is in STOP status. Check the following items.

Check item	Action
Is the program to read a digital output value correct?	Check CH□ Digital output value (Un\G11 to Un\G18). If the digital output value is stored according to the analog input, correct the read program.
Is the auto refresh setting correct?	If the values in CH□ Digital output value (Un\G11 to Un\G18) are transferred to the device of the CPU module using auto refresh, check that the auto refresh setting is correct.
Is the CPU module in the STOP status?	Change the status of the CPU module to RUN.

Point

The following are the points to check the read program.

- Program example for the A/D converter module where the start I/O number is set to X/Y30



(b) Check item 2

A/D conversion is disabled. Check the following items.

Check item	Action
Is A/D conversion disable (1) set to A/D conversion enable/disable setting (Un\G0) of the channel to input a value?	Check A/D conversion enable/disable setting (Un\G0) and set A/D conversion enable (0) using a program or parameter setting.
Is Operating condition setting request (Y9) performed?	Check that the digital output value is stored in the CH□ Digital output value (Un\G11 to Un\G18) after turning on and off*1 Operating condition setting request (Y9). If a correct value is stored, check the program whether the descriptions of Operating condition setting request (Y9) is correct.

*1 If Operating condition setting request (Y9) is on, A/D conversion does not start. Therefore, check that Operating condition setting completed flag (X9) is off after turning on Operating condition setting request (Y9), and turn off Operating condition setting request (Y9).

(c) Check item 3

An analog value is not properly input from outside. Check the following items.

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 there any potential difference between the AG terminal and the external device GND?	If the wiring is long, a potential difference may occur between the AG terminal and the external device GND, and A/D conversion may not be performed properly. Connect the AG terminal and the external device GND to eliminate the potential difference.
Is the same external device GND used for all channels?	If the same external device GND is used for all channels, noise occurs between channels and some errors may occur in A/D converted values. Connect the AG terminal and the external device GND to eliminate the errors.

(d) Check item 4

An analog value is properly input from outside. Check the following items in order.

No.	Check item	Action
1	Is input range setting correct?	Check Setting range (Un\G20, Un\G21). If the input range setting is incorrect, correct the switch setting.
2	Is there any input signal error?	A digital output value is not updated if an input signal error is detected. Check if Input signal error detected (3) is set to CH□ A/D conversion status (Un\G1700, to Un\G1707). If Input signal error detected (3) is set, check the values in Input signal error detection extension setting (Un\G27, Un\G28), Input signal error detection setting (Un\G47), and CH□ Input signal error detection setting value (Un\G142 to Un\G149), and check that the input signal error detection upper limit value and the input signal error detection lower limit value are appropriate. For details on the input signal error detection function and input signal error detection extension function, refer to the following. • Input Signal Error Detection Function (☞Page 77, Section 8.7) • Input Signal Error Detection Extension Function (☞Page 82, Section 8.8) If the values are appropriate, change the analog input value so that an input signal error does not occur.
3	Is the offset/gain setting correct?	After turning on and off Operating condition setting request (Y9), compare the values of CH1 Industrial shipment settings offset value (Un\G202) to CH8 User range settings gain value (Un\G233) with the values in the range reference tables. If the stored values are not desired offset/gain values, perform the offset/gain setting again. For the range reference table, refer to the following. • Range reference table (☞Page 143, Section 8.19 (3))

Point

An input signal error may be detected in the following cases even though the analog input signal has a correct value.

- When the value for input range setting, Input signal error detection extension setting (Un\G27, Un\G28), Input signal error detection setting (Un\G47), or CH□ Input signal error detection setting value (Un\G142 to Un\G149) is incorrect
- When the offset/gain setting is not properly configured with the user range being used

A digital output value is not updated if an input signal error is detected.
When checking whether a digital output value can be properly read or not at the system start-up, check the operation with the input signal error detection function and input signal error detection extension function being disabled to prevent the misunderstanding of the cause of a problem. Enable the input signal error detection function and input signal error detection extension function after checking that a digital output value was properly read.

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

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

(4) When a digital output value does not fall within the range of accuracy Common

Check item	Action
Is any measure against noise taken?	Take measures against noise, such as using a shielded cable for connection.

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	0000H : Indicates the LED off. 0001H : Indicates the LED on. Alternating indication between 0000H and 0001H : Indicates the LED flashing. (GX Works2 displays the communication status with the A/D converter module, so that the displaying intervals of 0000H and 0001H are not always even.)
2)	ERR. LED	
3)	ALM LED	

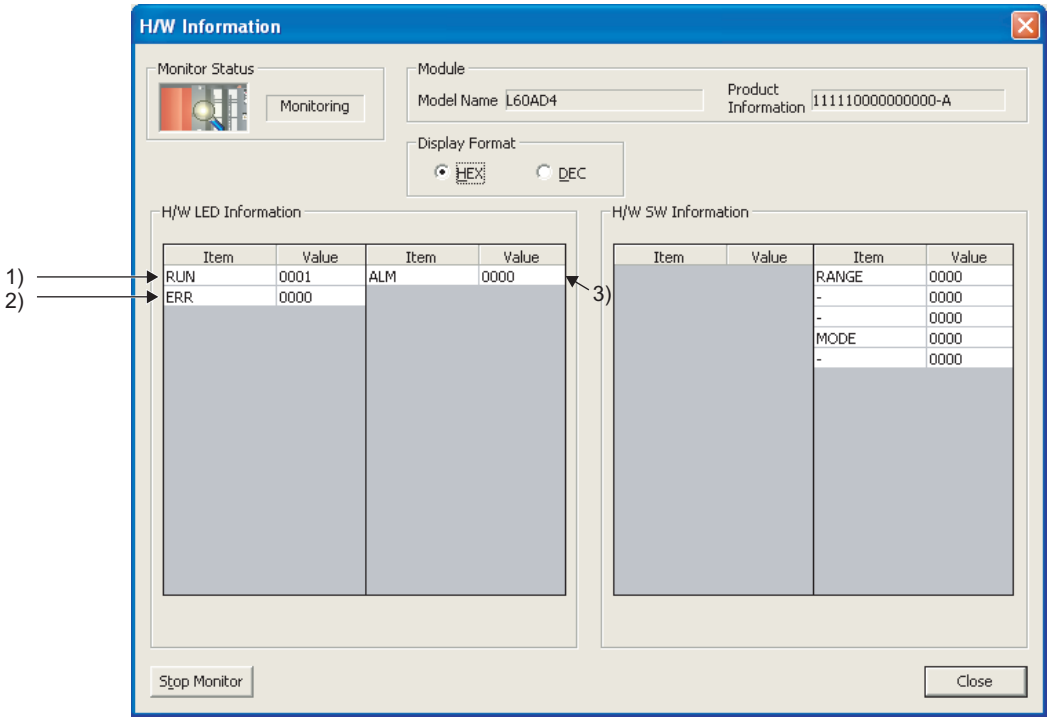
(2) Hardware switch information

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 264, Appendix 9.1 (2))

Item		Intelligent function module switch
L60AD4	L60ADVL8, L60ADIL8	
RANGE	RANGE1	Switch1
—	RANGE2	Switch2
—	—	Switch3
MODE	MODE	Switch4
—	—	Switch5



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 numbers (X/Y) described in Appendix 1are for the case when the start I/O number of the A/D converter module is set to 0.

Appendix 1.1 Input signal

(1) Module READY (X0) Common

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.

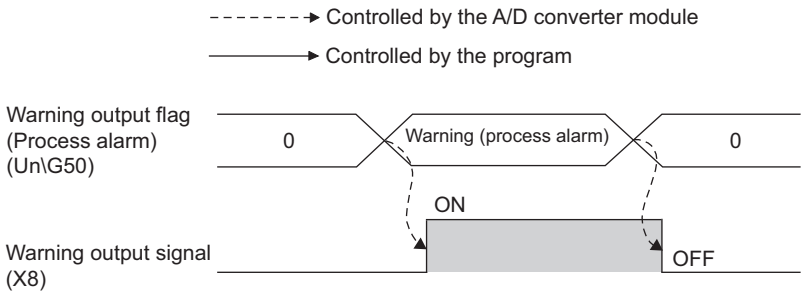
- In the offset/gain setting mode (In this case, the A/D conversion processing is executed)
- When a watch dog timer error occurs to the A/D converter module (In this case, the A/D conversion processing is not executed)

(2) Warning output signal (X8) Common

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

(a) Process alarm

- Warning output signal (X8) turns on when a digital output value of an A/D conversion enabled channel becomes equal to or greater than the process alarm upper upper limit value or equal to or smaller than the process alarm lower lower limit value 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.

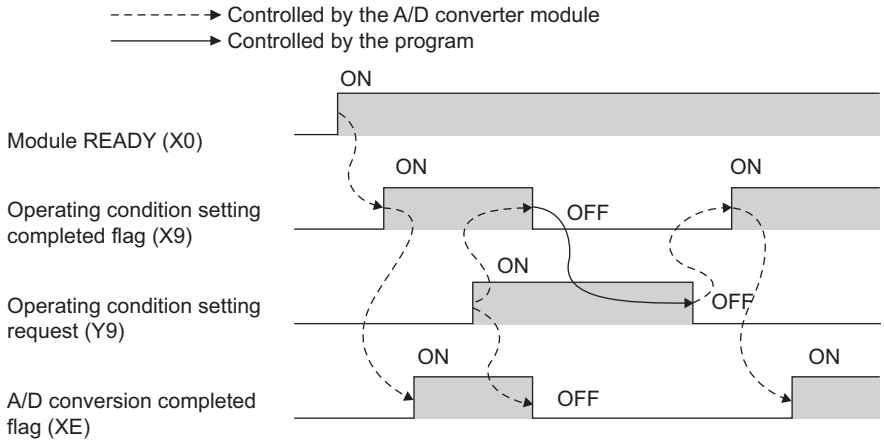


(3) Operating condition setting completed flag (X9) Common

When changing the value of a buffer memory area, use Operating condition setting completed flag (X9) as an interlock condition to turn on and off Operating condition setting request (Y9). For the buffer memory items that require Operating condition setting request (Y9) to be turned on and off to enable the new value, refer to the following.

- List of Buffer Memory Addresses (☞Page 28, Section 3.5)

When Operating condition setting completed flag (X9) is OFF, the A/D conversion processing is not executed.
When Operating condition setting request (Y9) is on, Operating condition setting completed flag (X9) turns off.

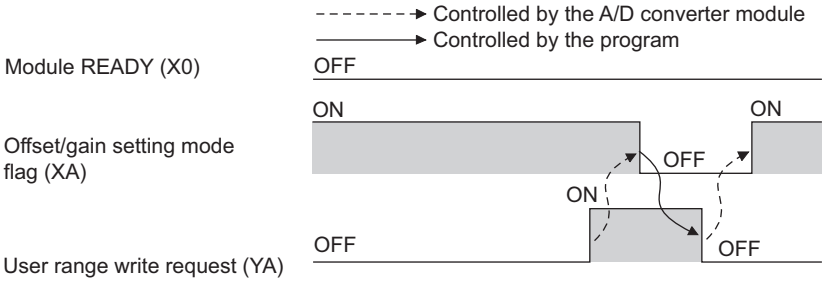


(4) Offset/gain setting mode flag (XA) Common

(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 on and off User range write request (YA).
For the offset/gain setting, refer to the following.

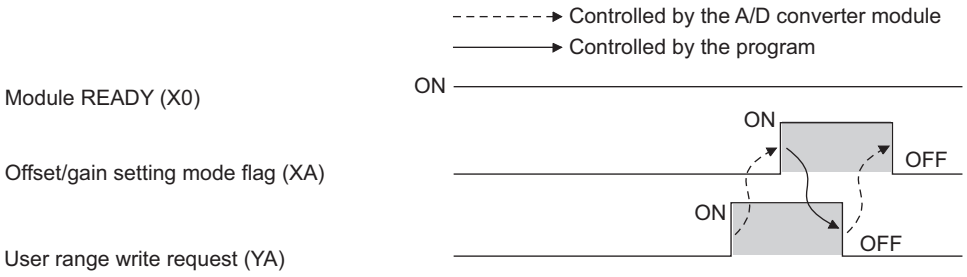
- Offset/gain setting (☞Page 60, Section 7.5)



(b) Normal mode

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

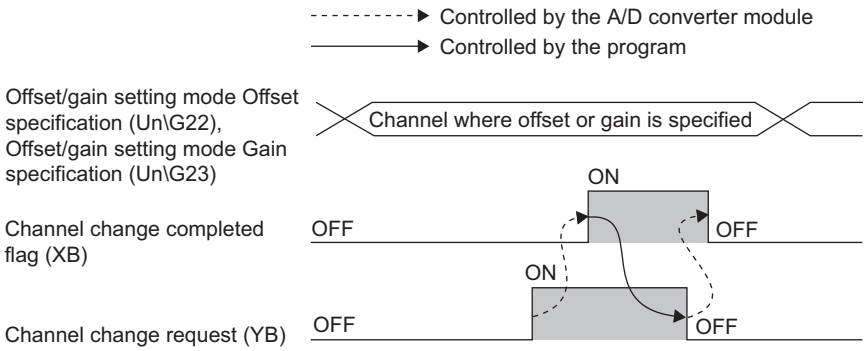
- Save/restoration of offset/gain value (☞Page 138, Section 8.19)



(5) Channel change completed flag (XB) Common

When changing a channel to perform the offset/gain setting in the offset/gain mode, use Channel change completed flag (XB) as an interlock condition to turn on and off Channel change request (YB).
For the offset/gain setting, refer to the following.

- Offset/gain setting (☞Page 60, Section 7.5)



(6) Input signal error detection signal (XC) Common

(a) Turning Input signal error detection signal (XC) ON

- 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\G149) in any channel which has been A/D conversion-enabled, after validating Input signal error detection setting (Un\G47).
- 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\G149) in any channel which has been A/D conversion-enabled, after setting the detection condition in Input signal error detection extension setting (Un\G27, Un\G28). When the disconnection detection is set, the signal ignores the setting for CH☐ Input signal error detection setting value (Un\G142 to Un\G149), and turns to on at the disconnection detection.

When Input signal error detection signal (XC) turns on, the following operations are applied.

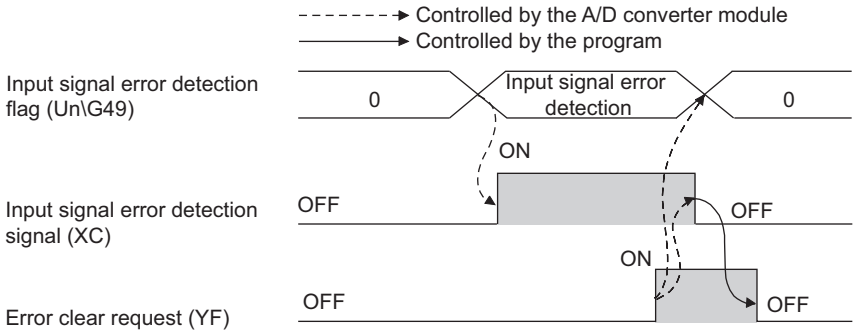
- A/D conversion completed flag (Un\G10) of the corresponding channel turns off (stores 0).
- The digital output value or scaling value (digital operation value) of the corresponding channel obtained immediately before the error is detected is held.
- ALM LED flashes.

(b) Turning Input signal error detection signal (XC) OFF

After setting the analog input value within the range set, turn on and off Error clear request (YF) and Input signal error detection signal (XC) turns off.

When Input signal error detection signal (XC) turns off, the following operations are applied.

- ALM LED turns off.
- Latest error code (Un\G19) is cleared.

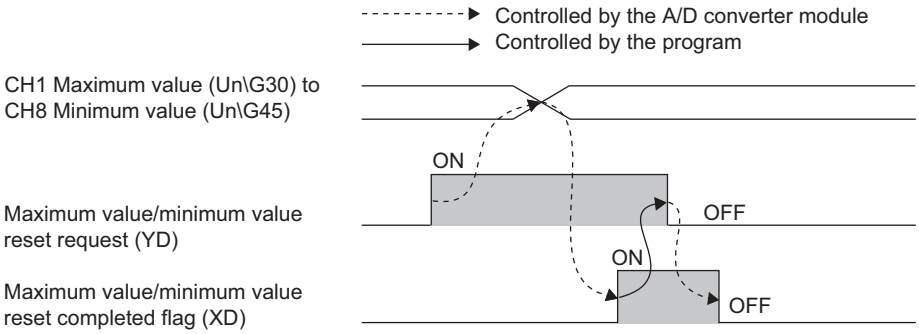


Point

When the analog input value falls within the range set, A/D conversion resumes regardless of turning on and off Error clear request (YF). However, the ON status of Input signal error detection signal (XC) and the flashing status of the ALM LED are not cleared. When the first A/D conversion after the resumption is completed, A/D conversion completed flag (Un\G10) turns to A/D conversion completed (1).
Averaging processing starts over after the A/D conversion resumed.

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

Maximum value/minimum value reset completed flag (XD) turns on after resetting the maximum or minimum values stored in CH1 Maximum value (Un\G30) to CH8 Minimum value (Un\G45) by turning on Maximum value/minimum value reset request (YD).

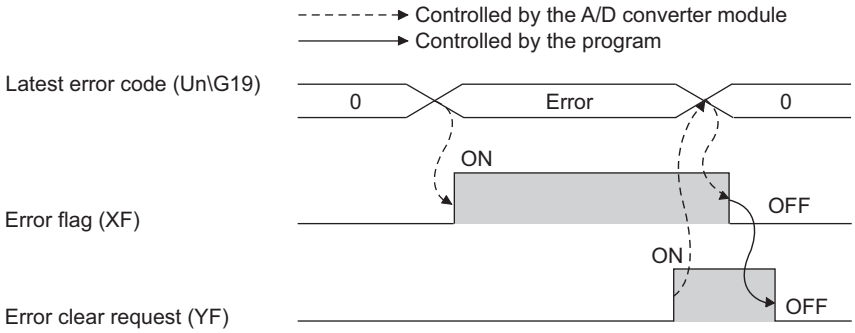


(8) A/D conversion completed flag (XE) Common

A/D conversion completed flag (XE) turns on when all A/D conversion-enabled channels complete the first A/D conversions.

(9) Error flag (XF) Common

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



(a) Turning off Error flag (XF)

Error flag (XF) turns when the error cause is eliminated and either of the following two operations is performed.

- Turning on and off Error clear request (YF)
- Turning on and off Operating condition setting request (Y9)

At the time of turning on Error clear request (YF) or Operating condition setting request (Y9), Error flag (XF) and Latest error code (Un\G19) are cleared.

When Operating condition setting request (Y9) is turned on and off, A/D conversion is reset and resumes from the beginning.

Appendix 1.2 Output signal

(1) Operating condition setting request (Y9) Common

Turn on and off Operating condition setting request (Y9) to enable the initial settings of the A/D converter module.

For the timing of turning on and off the signal, refer to the following.

- Operating condition setting completed flag (X9) (Page 193, Appendix 1.1 (3))

For the buffer memory items that are enabled, refer to the following.

- List of Buffer Memory Addresses (Page 28, Section 3.5)

(2) User range write request (YA) Common

(a) Offset/gain setting mode

Turn on and off User range write request (YA) to register the adjusted offset/gain setting values in the A/D converter module.

The data is written to the flash memory at the timing when this signal is turned off and on.

For the timing of turning on and off the signal, refer to the following.

- Offset/gain setting mode flag (XA) (Page 194, Appendix 1.1 (4))

For the offset/gain setting, refer to the following.

- Offset/Gain Setting (Page 60, Section 7.5)

(b) Normal mode

Turn on and off User range write request (YA) to restore the user range setting.

For the timing of turning on and off the signal, refer to the following.

- Offset/gain setting mode flag (XA) (Page 194, Appendix 1.1 (4))

For user range setting restoration, refer to the following.

- Saving and Restoring Offset/Gain Values (Page 138, Section 8.19)

(3) Channel change request (YB) Common

Turn on and off Channel change request (YB) in the offset/gain mode to change a channel to perform the offset/gain setting.

For the timing of turning on and off the signal, refer to the following.

- Channel change completed flag (XB) (Page 194, Appendix 1.1 (5))

For the offset/gain setting, refer to the following.

- Offset/Gain Setting (Page 60, Section 7.5)

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

Turn on and off Maximum value/minimum value reset request (YD) to reset CH1 Maximum value (Un\G30) to CH8 Minimum value (Un\G45).

For the timing of turning on and off the signal, refer to the following.

- Maximum value/minimum value reset completed flag (XD) (Page 196, Appendix 1.1 (7))

(5) Error clear request (YF) Common

To clear Error flag (XF), Input signal error detection signal (XC), and Latest error code (Un\G19), turn on and off Error clear request (YF).

For the timing of turning on and off the signal, refer to the following.

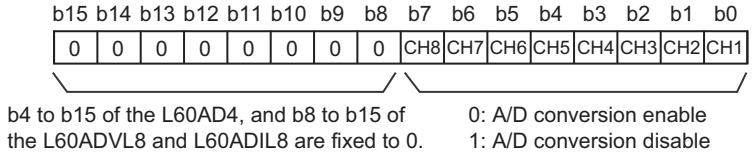
- Input signal error detection signal (XC) (☞Page 195, Appendix 1.1 (6))
- Error flag (XF) (☞Page 196, Appendix 1.1 (9))

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) Common

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



(a) Enabling the setting

Turn on and 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□ Time Average/ Count Average/Moving Average (Un\G1 to Un\G8) Common

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

- The following shows the setting range.

Module	Processing method	Conversion speed setting	Setting range
L60AD4	Time average	20μs	2 to 1500 (ms)
		80μs, 1ms	2 to 5000 (ms)
	Count average	20μs, 80μs, 1ms	4 to 62500 (times)*1
	Moving average	20μs, 80μs, 1ms	2 to 1000 (times)
L60ADVL8 L60ADIL8	Time average	—	4 to 5000 (ms)
	Count average		4 to 62500 (times)*1
	Moving average		2 to 1000 (times)

*1 When specifying a setting between 32768 and 62500 (times) in the program, configure the setting in hexadecimal. When specifying a setting of 62500 (times), set F424H.

- 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 flag (XF) turns on. The A/D conversion is processed in the setting configured before the error occurrence.
- On a channel where Averaging process setting (Un\G24, Un\G25) has been set to Sampling processing (0), any setting for this area is ignored.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

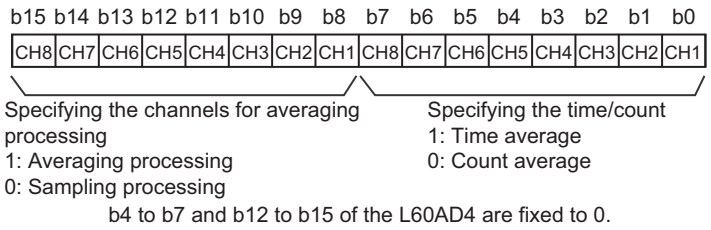
All channels are set to Disable (0).

Point

Because 0 is set as a default value, change the value according to the processing method.

(3) Averaging process setting (used to replace Q64AD, Q68ADV, Q68ADI) (Un\G9)Common

Write the setting for averaging processing when using the sequence program for initial setting of the Q64AD, Q68ADV, or Q68ADI.



(a) Enabling the setting

To enable the setting, turn on and off Operating condition setting request (Y9) after setting Averaging process setting (Un\G24, Un\G25) to Sampling processing (0).

Point

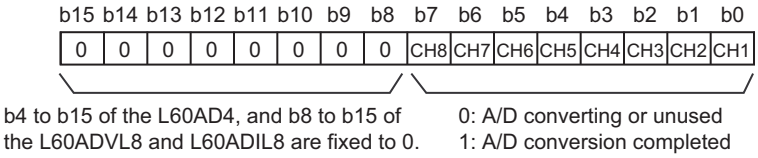
When selecting the moving average, it is necessary to write 0 to (Un\G9), and write the moving average to Averaging process setting (Un\G24, Un\G25).

(b) Default value

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

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

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

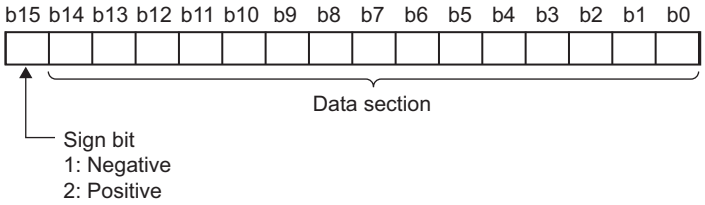


(a) A/D conversion completion

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 on and off Operating condition setting request (Y9) turns the flag back to its default "During A/D conversion or unused (0)", and the flag is turned to A/D conversion completion (1) when the first A/D conversion is completed.

(5) CH□ Digital output value (Un\G11 to Un\G18) Common

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



(a) Updating cycle

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

(6) Latest error code (Un\G19) Common

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.

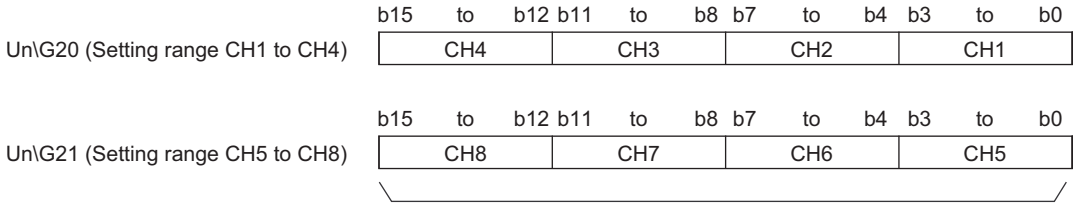
- Error code list (Page 179, Section 11.4)
- Alarm code list (Page 183, Section 11.5)

(a) Clearing an error

Turn on and off Error clear request (YF) or Operating condition setting request (Y9).
When Operating condition setting request (Y9) is turned on and off, A/D conversion is reset and are resumed from the beginning.

(7) Setting range (Un\G20, Un\G21) Common

The input range and output range that have been set using the switch setting can be checked with this area.



For the L60AD4, data in Un\G21 are fixed to 0.

Input range	Setting value
4 to 20mA	0H
0 to 20mA	1H
1 to 5V	2H
0 to 5V	3H
-10 to 10V	4H
0 to 10V	5H
4 to 20mA (Extended mode)	AH
1 to 5V (Extended mode)	BH
User range setting	FH

Point

- Input range cannot be changed in Setting range (Un\G20, Un\G21).
  To change the input range, change the Switch Setting.
  For the Switch Setting, refer to the following.
  - Switch setting (☞Page 54, Section 7.2)
- When 0H (default) is set for the intelligent function module switch setting, the L60ADVL8 operates with 5H (0 to 10V) and this buffer memory area stores 5H.

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

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	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Offset/gain setting mode Gain specification (Un\G23)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

b4 to b15 of the L60AD4, and b8 to b15 of the L60ADVL8 and L60ADIL8 are fixed to 0.

1: Setting-target channel
0: Disable

(a) Enabling the setting

In the offset/gain setting mode, turn on and off Channel change request (YB) to enable the setting.

(b) Default

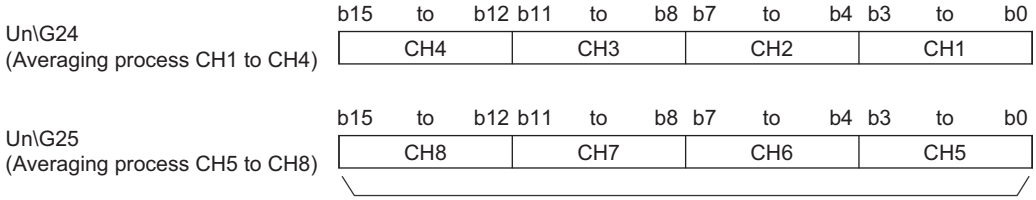
All channels are set to Disable (0).

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, an error (error code: 500) occurs.
- For details on offset/gain setting, refer to the following.
  - Offset/gain setting (Page 60, Section 7.5)

(9) Averaging process setting (Un\G24, Un\G25) Common

Configure the setting when selecting sampling or averaging processing for each channel.
Averaging processing includes time average, count average and moving average.



For the L60AD4, data in Un\G25 are fixed to 0.

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

- The channel to which a value out of the above setting range is written performs the operation in the sampling processing.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

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

Point

When using Averaging process setting (used to replace Q64AD, Q68ADV, or Q68ADI) (Un\G9), the value set in Averaging process setting (Un\G24, Un\G25) is ignored. (The operation is performed in the averaging process setting in Averaging process setting (used to replace Q64AD, Q68ADV, or Q68ADI) (Un\G9).)

(10)Conversion speed setting (Un\G26) AD4

Set the conversion speed for all channels.

When the value of 0003H to FFFFH is set, an error occurs and the operation is performed in the previous setting.

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

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

80μs (1) is set as the default value.

(11)Input signal error detection extension setting (Un\G27, Un\G28) Common

In the input signal error detection extension function, set the error detection method for each channel. When Input signal error detection extension setting (Un\G27, Un\G28) is set to other than Disable (0), the input signal error detection extension function turns enabled.

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

- Input signal error detection extension function (☞Page 82, Section 8.8)

Un\G27 (Input signal error detection extension setting CH1 to CH4)

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

Un\G28 (Input signal error detection extension setting CH5 to CH8)

b15 to b12	b11 to b8	b7 to b4	b3 to b0
CH8	CH7	CH6	CH5

For the L60AD4, data in Un\G28 are fixed to 0.

Detection method	Setting value
Disable	0H
Lower upper limit detection	1H
Lower limit detection	2H
Upper limit detection	3H
Disconnection detection	4H

- When a value out of the setting range above is set to a channel, an error occurs in the channel, an error code (81☐) is stored in Latest error code (Un\G19), and Error flag (XF) turns on. The operation is performed in the setting configured before the error occurrence.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Disable (0).

Point

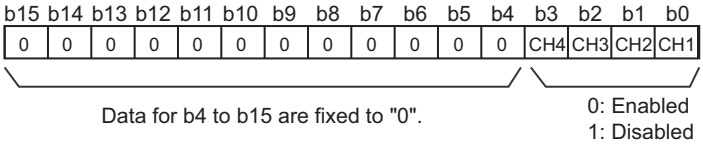
- Disconnection detection (4) is valid only when the input range is set as 4 to 20mA (extended mode) or 1 to 5V (extended mode). When the channel with another range is set to Disconnection detection (4), an error occurs.
- When Input signal error detection extension setting (Un\G27, Un\G28) is set to Lower upper limit detection (1), Upper limit detection (2), Lower limit detection (3), or Disconnection detection (4), the setting of Input signal error detection setting (Un\G47) is ignored.

(12)Digital clipping enable/disable setting (Un\G29) AD4

Set whether the digital clipping function is enabled or disabled, for each channel.

For details on the digital clipping function, refer to the following.

- Digital Clipping Function (☞Page 99, Section 8.12)



(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Disable (1).

(13)CH1 Maximum value (Un\G30) to CH8 Minimum value (Un\G45) Common

The maximum and minimum digital output values are stored as signed 16-bit binary.

In the following cases, CH1 Maximum value (Un\G30) to CH8 Minimum value (Un\G45) are updated to the current value.

- When Maximum value/minimum value reset request (YD) is turned on and off
- When turning on and off Operating condition setting request (Y9) changes the setting

Point

- For the channel to which the averaging processing is specified, the maximum and minimum values are stored at averaging processing time intervals.
- In CH□ Maximum value (Un\G30) to CH□ Minimum value (Un\G45), the values calculated by each function is stored using the following functions:

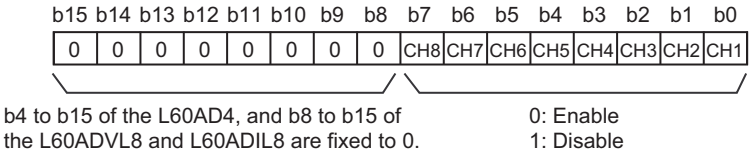
Module	Functions
L60AD4	Digital clipping function, scaling function, shift function, or difference conversion function
L60ADVL8, L60ADIL8	Scaling function

(14)Input signal error detection setting (Un\G47)Common

Set whether the input signal error detection is enabled or disabled for each channel. Only the lower upper limit detection can be used as the detection method of an input signal error in this area.

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

- Input Signal Error Detection Function (☞Page 77, Section 8.7)



(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

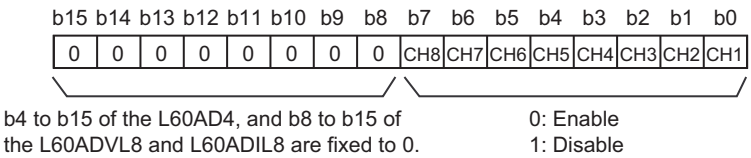
All channels are set to disable (1) as the default value.

Point

When Input signal error detection extension setting (Un\G27, Un\G28) is set to other than Disable (0), the setting in this area is ignored.

(15)Warning output setting (Un\G48)Common

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



(a) Enabling the setting

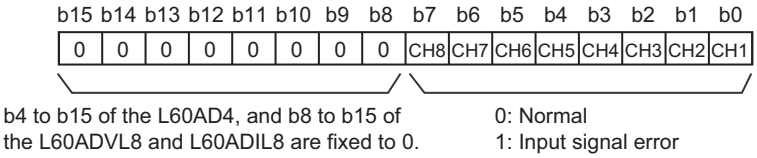
Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

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

(16)Input signal error detection flag (Un\G49) Common

Input signal status can be checked with this flag.



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

- When the detection method is set in Input signal error detection extension setting (Un\G27, Un\G28), Input signal error detection flag (Un\G49) corresponding to each channel is turned to input signal error (1) when the analog input value out of the setting range for CH☐ Input signal error detection setting value (Un\G142 to Un\G149) is detected according to the set condition of the detection method.
- When Input signal error detection setting (Un\G47) is set to Enable (0) and Input signal error detection extension setting (Un\G27, Un\G28) is set to Disable (0), Input signal error detection flag (Un\G49) corresponding to each channel is turned to input signal error (1) when the analog input value out of the setting range for CH☐ Input signal error detection setting value (Un\G142 to Un\G149) is detected.
- 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)

To clear Input signal error detection flag (Un\G49), adjust the analog input value so that it falls within the setting range then turn on and off Error clear request (YF).

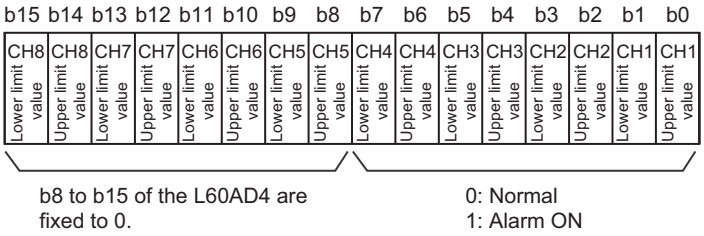
Turning on and off Operating condition setting request (Y9) also clears Input signal error detection flag (Un\G49), but A/D conversion is reset and resumed from the beginning.

(17)Warning output flag (Process alarm) (Un\G50)Common

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

For details on the warning output function, refer to the following.

- Warning Output Function (Process Alarm) (☞Page 85, Section 8.9)



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

- When the digital output value is out of the range specified in CH1 Process alarm lower lower limit value (Un\G86) to CH8 Process alarm upper upper limit value (Un\G117), Warning output flag (Process alarm) (Un\G50) corresponding to each channel is turned to alarm ON (1).
- 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.

(b) Clearing Warning output flag (Process alarm) (Un\G50)

When the digital output value returns within the setting range, the Warning output flag (Process alarm) (Un\G50) is automatically cleared.

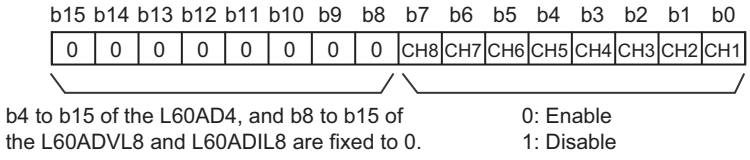
Turning on and off Operating condition setting request (Y9) also clears Input signal error detection flag (Un\G49), but A/D conversion is reset and resumed from the beginning.

(18)Scaling enable/disable setting (Un\G53)Common

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

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

- Scaling Function (☞Page 88, Section 8.10)



(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

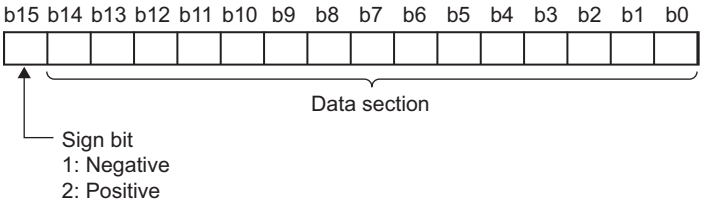
(b) Default value

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

(19)CH□ Scaling value (digital operation value) (Un\G54 to Un\G61)Common

The scaling value (digital operation value) which is obtained by the following functions is stored as signed 16-bit binary.

Module	Functions
L60AD4	Digital clipping function, scaling function, shift function, or difference conversion function
L60ADVL8, L60ADIL8	Scaling function



(a) Updating cycle

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

Point

When the functions above are not used, the same value as the one in CH□ Digital output value (Un\G11 to Un\G18) is stored.

(20)CH1 Scaling lower limit value (Un\G62) to CH8 Scaling upper limit value (Un\G77)Common

Set the range of scale conversion for each channel.
For details on scaling function, refer to the following.

- Scaling Function (☞Page 88, Section 8.10)

(a) Setting range

- Setting range: -32000 to 32000 (scaling upper limit value > scaling lower limit value)
- 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 flag (XF) is turned ON and the operation is performed in the setting configured before the error occurrence.
- When Scaling enable/disable setting (Un\G53) is set to Invalid (1), the setting for CH1 Scaling lower limit value (Un\G62) to CH8 Scaling upper limit value (Un\G77) are ignored.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 0.

Point

Change the setting value to use the scaling function, since 0 is set as the default value.

(21)CH1 Process alarm lower lower limit value (Un\G86) to CH8 Process alarm upper upper limit value (Un\G117)Common

Set the digital output value range for each channel. 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.

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

- Warning Output Function (Process Alarm) (☞Page 85, Section 8.9)

(a) Setting range

- Setting range is -32768 to 32767.
- When 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 flag (XF) turns on. The operation is performed in the setting configured before the error occurrence.
- When the following functions are used, warning targets are scaling values that reflect the operations of each function. Set values considering operation results of each function.

Module	Functions
L60AD4	Digital clipping function, scaling function, shift function, or difference conversion function
L60ADVL8, L60ADIL8	Scaling function

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

0 is set as the default value.

Point

Change the setting value to use the warning output function (process alarm), since 0 is set as the default value.

(22)CH□ Input signal error detection setting value (Un\G142 to Un\G149) Common

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

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

- Input signal error detection function (☞Page 77, Section 8.7)
- Input signal error detection extension function (☞Page 82, Section 8.8)

(a) Setting procedure

- Setting range is 0 to 250 (0 to 25.0%). Set in increments of 1 (0.1%).
- When a value out of the setting range above is set to a channel, an error occurs in the channel, an error code (80□) is stored in Latest error code (Un\G19) and Error flag (XF) turns on. The operation is performed in the setting configured before the error occurrence.
- The input signal error detection upper and lower limit values are calculated as follows based on the input signal error detection setting value. The calculating input signal error detection upper and lower limit values will be different depending on the input range to be used.

[Input signal error detection upper limit value]

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

[Input signal error detection lower limit value]

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

Ex When the input signal error detection setting value is set to 100 (10%)

Range to be used: 4 to 20mA

The upper and lower limit values of input signal error detection are as follows:

$$\text{Input signal error detection upper limit value} = 20 + (20 - 4) \times \frac{100}{1000} = 21.6\text{mA}$$

$$\text{Input signal error detection lower limit value} = -4 - (20 - 4) \times \frac{100}{1000} = -2.4\text{mA}$$

- Conditions vary as follows depending on the setting in Input signal error detection extension setting (Un\G27, Un\G28).

Input signal error detection extension setting (Un\G27, Un\G28)	Detection condition
Lower upper limit detection (1)	At the input signal error detection upper limit value or the input signal error detection lower limit value
Lower limit detection (2)	At the input signal error detection lower limit value
Upper limit detection (3)	At the input signal error detection upper limit value
Disconnection detection (4)	• In 2mA or less, or 0.5V or less • The setting of CH□ Input signal error detection setting value (Un\G142 to Un\G149) is ignored. • Input range other than 4 to 20mA (extended mode) or 1 to 5V (extended mode) cannot be used.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

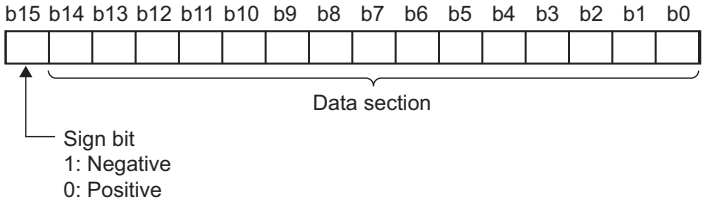
All channels are set to 5% (50).

(23)CH□ Shifting amount to conversion value (Un\G150 to Un\G153) AD4

Set the shifting amount to conversion value that is to be used for the shift function.

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

- Shift function (☞ Page 94, Section 8.11)



(a) Setting range

Setting range is -32768 to 32767.

(b) Enabling the setting

When the value is set, set shifting amount to conversion value turns valid regardless of turning on and off Operating condition setting request (Y9).

(c) Default value

All channels are set to Disable (0).

(24)Mode switching setting (Un\G158, Un\G159) Common

Set the setting value for the mode to be switched to.

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

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) After the mode is switched

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

Point

In the following cases, the mode is not switched and only the operating condition is changed.

- When turning on and off Operating condition setting request (Y9) after a value other than the above is written
- When turning on and off Operating condition setting request (Y9) after a setting value that sets the mode same as that before mode switching is written

(25)CH□ Difference conversion trigger (Un\G172 to Un\G175) AD4

Use this buffer memory as a trigger to start/stop the difference conversion.

For details on the difference conversion function, refer to the following.

- Difference Conversion Function (☞Page 103, Section 8.13)

Difference conversion trigger	Setting value
No request	0
Trigger request	1

- In the channel where a setting value other than the above is set, an error occurs. The error code (37□) is stored in Latest error code (Un\G19) and Error flag (XF) turns on. However, the difference conversion continues.

(a) Starting/Stopping the difference conversion

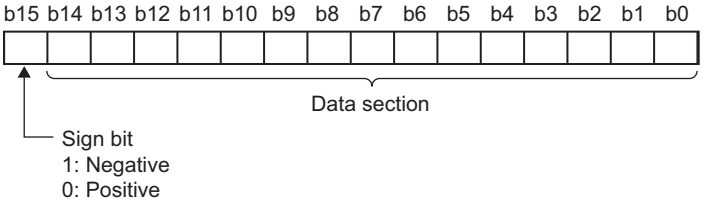
- When the setting value is turned No request (0) → Trigger request (1), the difference conversion starts.
- When the setting value is turned Trigger request (0) → No request (1), the difference conversion stops.

(b) Default value

All channels are set to No request (0).

(26)CH□ Difference conversion reference value (Un\G180 to Un\G183) AD4

This is the area for storing the scaling value (digital operation value) at the start of the difference conversion as the difference conversion reference value.



(a) Storage range

The storage range is -32768 to 32767.

Point

- The difference conversion reference value is updated when CH□ Difference conversion trigger (Un\G172 to Un\G175) is turned No request (0) → Trigger request (1).
- Even if CH□ Difference conversion status flag (Un\G190 to Un\G193) is turned Converting difference (1) → Not converted (0), CH□ Difference conversion reference value (Un\G180 to Un\G183) is not cleared.

(27)CH□ Difference conversion status flag (Un\G190 to Un\G193) AD4

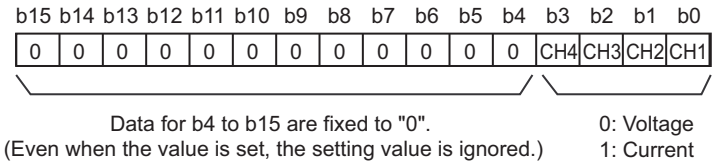
Difference conversion status can be checked with this flag.

Difference conversion status	CH□ Difference conversion status flag (Un\G190 to Un\G193)
Not converted	0
Converting difference	1

- When CH□ Difference conversion trigger (Un\G172 to Un\G175) is turned No request (0) → Requested (1), CH□ Difference conversion status flag (Un\G190 to Un\G193) is turned to Converting difference (1).
- When CH□ Difference conversion trigger (Un\G172 to Un\G175) is turned Requested (1) → No request (0), CH□ Difference conversion status flag (Un\G190 to Un\G193) is turned Converting difference (1) → Not converted (0).

(28)Pass data classification setting (Un\G200) AD4

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



(29)CH□ Offset/gain setting value saving area (Un\G202 to Un\G233) Common

This area stores data used to restore the offset/gain setting value of the user range.

Data arrangement differs depending on the modules used.

Address	Description	
	L60AD4	L60ADVL8, L60ADIL8
Un\G202	CH1 Industrial shipment settings offset value (L)	CH1 Industrial shipment settings offset value
Un\G203	CH1 Industrial shipment settings offset value (H)	CH1 Industrial shipment settings gain value
: :	: :	: :
Un\G216	CH4 Industrial shipment settings gain value (L)	CH8 Industrial shipment settings offset value
Un\G217	CH4 Industrial shipment settings gain value (H)	CH8 Industrial shipment settings gain value
Un\G218	CH1 User range settings offset value (L)	CH1 User range settings offset value
Un\G219	CH1 User range settings offset value (H)	CH1 User range settings gain value
: :	: :	: :
Un\G232	CH4 User range settings gain value (L)	CH8 User range settings offset value
Un\G233	CH4 User range settings gain value (H)	CH8 User range settings gain value

In any of the following operations, the data to be used is stored (saved).

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

*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, set the data saved in this area to the same area in the A/D converter module where the data is restored.

For the setting procedure of offset/gain values or saving and restoring offset/gain values, refer to the following.

- Offset/gain setting (☞Page 60, Section 7.5)
- Saving and restoring offset/gain values (☞Page 138, Section 8.19)

(30)CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) AD4

Set whether the logging is enabled or disabled.

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

- Logging function (☞Page 108, Section 8.14)

Logging enable/disable setting	Setting value
Enable	0
Disable	1

- When a value other than the above setting range is set, an error occurs and the error code (200□) is stored in Latest error code (Un\G19). The logging function is not started.
- When Conversion speed setting (Un\G26) is set to 20μs (0) and CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Enable (0), an error occurs and the error code (200□) is stored in Latest error code (Un\G19). The logging function is not started.
- When Input signal error detection setting (Un\G47) is set to Enable (0) and CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Enable (0), an error occurs and the error code (208□) is stored in Latest error code (Un\G19). The logging function is not started.
- When Input signal error detection extension setting (Un\G27) is set to other than Disable (0) and CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Enable (0), an error occurs and the error code (208□) is stored in Latest error code (Un\G19). The logging function is not started.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

Enabling the setting starts the logging.

(b) Default value

All channels are set to Disable (1).

(31)CH☐ Logging hold request (Un\G1008 to Un\G1011) AD4

Use Logging hold request (Un\G1008 to Un\G1011) as a trigger to hold (stop) the logging at any timing during the logging.

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

- Logging function (☞Page 108, Section 8.14)

Logging hold request	Setting value
Off	0
On	1

- In the channel where a value other than the above setting values is set, an error occurs. Then, the error code (207☐) is stored in Latest error code (Un\G19) and Error flag (XF) turns on. However, the logging continues.
- When CH☐ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH☐ Logging hold request (Un\G1008 to Un\G1011) is ignored.

(a) Operation of the logging hold processing

- In the case that CH☐ Level trigger condition setting (Un\G1056 to Un\G1059) is set to Disable (0), when CH☐ Logging hold request (Un\G1008 to Un\G1011) changes from OFF (0) to ON (1), the logging hold processing starts.
- In the case that CH☐ Level trigger condition setting (Un\G1056 to Un\G1059) is set to other than Disable (0), when the trigger condition is satisfied after CH☐ Logging hold request (Un\G1008 to Un\G1011) changes from OFF (0) to ON (1), the logging hold processing starts. When the level trigger is enabled, use Logging hold request (Un\G1008 to Un\G1011) as an interlock to operate the level trigger.
- If CH☐ Logging hold request (Un\G1008 to Un\G1011) is turned to ON (1) → OFF (1), the hold status (stop) is cleared and the logging restarts.

(b) Default value

All channels are set to OFF (0).

Point

The hold status of logging can be checked by monitoring CH☐ Logging hold flag (Un\G1016 to Un\G1019).

(32)CH☐ Logging hold flag (Un\G1016 to Un\G1019) AD4

Hold (stop) status of logging can be checked with this flag.

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

- Logging Function (☞Page 108, Section 8.14)

Hold status of logging	Stored value
Off	0
On	1

- This flag turns to On (1) at the time of the transition from the status in which data are collected in CH☐ Logging data (Un\G5000 to Un\G44999) to the stop status
- When the logging restarts by turning CH☐ Logging hold request (Un\G1008 to Un\G1011) from On (1) to Off (0), CH☐ Logging hold flag (Un\G1016 to Un\G1019) is turned to Off (0).

(33)CH□ Logging data setting (Un\G1024 to Un\G1027) AD4

When using the logging function, set the digital output value or the scaling value (digital operation value) as the target value for collecting.

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

- Logging function (☞Page 108, Section 8.14)

Target of logging	Setting value
Digital output value	0
Scaling value (digital operation value)	1

- In the channel where a value other than the above setting values is set, an error occurs. Then, the error code (203□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the logging cannot be performed.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Logging data setting (Un\G1024 to Un\G1027) is ignored.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Scaling value (digital operation value) (1).

(34)CH□ Logging cycle setting value (Un\G1032 to Un\G1035), CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) AD4

Set the cycle of storing the logging data.
CH□ Logging cycle setting value (Un\G1032 to Un\G1035): Set a time interval at which data are collected. CH□ Logging cycle unit setting (Un\G1040 to Un\G1043): Set the unit of the time interval at which data are collected.
For details on the logging function, refer to the following.

- Logging function (☞Page 108, Section 8.14)

(a) Setting range

- The available setting range of CH□ Logging cycle setting value (Un\G1032 to Un\G1035) depends on the setting for CH□ Logging cycle unit setting (Un\G1040 to Un\G1043).

Logging cycle unit	Setting value of CH□ Logging cycle unit setting (Un\G1040 to Un\G1043)	Available setting range of CH□ Logging cycle setting value (Un\G1032 to Un\G1035)
μs	0	80 to 32767
ms	1	1 to 32767
s	2	1 to 3600

- When either CH□ Logging cycle setting value (Un\G1032 to Un\G1035) or CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) is set to a value outside the above range, an error occurs. The error code (201□) is stored in Latest error code (Un\G19) and Error flag (XF) turns on. Logging cannot be performed.
- When a set logging cycle is shorter than the refresh cycle of the target data for logging, an error occurs. The error code (202□) is stored in Latest error code (Un\G19) and Error flag (XF) turns on. Logging cannot be performed.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) are ignored.

(b) Actual logging cycle

The actual logging cycle is an integral multiple of the conversion cycle of digital output value or scaling value (digital operation value).

Ex When the conversion cycle is set to 80μs and the A/D conversion is performed for CH1 to CH3 with the sampling processing
The actual logging cycle is an integral multiple of 240μs (80μs × 3) with the value set in CH□ Logging cycle setting value (Un\G1032 to Un\G1035) and CH□ Logging cycle unit setting (Un\G1040 to Un\G1043) as the upper limit value.

(c) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(d) Default value

- For CH□ Logging cycle setting value (Un\G1032 to Un\G1035), all channels are set to 4.
- For CH□ Logging cycle unit setting (Un\G1040 to Un\G1043), all channels are set to ms (1).

(35)CH□ Logging points after trigger (Un\G1048 to Un\G1051) AD4

When the logging function is used, set the data points recorded from hold trigger occurs until logging holds.
For details on the logging function, refer to the following.

- Logging function (Page 108, Section 8.14)

(a) Setting range

- Setting range is 1 to 10000.
- In the channel where a value out of the above range is set, an error occurs. Then, the error code (204□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and logging cannot be performed.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Logging points after trigger (Un\G1048 to Un\G1051) is ignored.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 5000.

(36)CH□ Level trigger condition setting (Un\G1056 to Un\G1059) AD4

When the level trigger is used with the logging function, set the occurrence condition of the hold trigger.
For details on the logging function, refer to the following.

- Logging function (Page 108, Section 8.14)

Setting	Setting value
Disable	0
Above	1
Below	2
Pass through	3

- In the channel where a value other than the above setting values is set, an error occurs. Then, the error code (205□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the logging cannot be performed.
- When CH□ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH□ Level trigger condition setting (Un\G1056 to Un\G1059) is ignored.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Disable (0).

(37)CH☐ Trigger data (Un\G1064 to Un\G1067) AD4

When the logging function is used, set the buffer memory address monitored for the occurrence condition of level trigger.

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

- Logging function (☞Page 108, Section 8.14)

(a) Setting range

- Setting range is 0 to 4999.
- In the channel where a value out of the above range is set, an error occurs. Then, the error code (206☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and logging cannot be performed.
- When CH☐ Logging enable/disable setting (Un\G1000 to Un\G1003) is set to Disable (1), the setting for CH☐ Trigger data (Un\G1064 to Un\G1067) is ignored.

Point

Set the following buffer memory addresses for CH☐ Trigger data (Un\G1064 to Un\G1067). For buffer memory addresses, refer to the list of buffer memory addresses (☞Page 28, Section 3.5).

- CH☐ Digital output value (Un\G11 to Un\G14): 11 to 14
- CH☐ Scaling value (Un\G54 to Un\G57): 54 to 57
- Level data ☐ (Un\G1072 to Un\G1081): 1072 to 1081
- Buffer memory addresses shown with "R" in the list of buffer memory addresses

Do not use the buffer memory addresses shown with "R/W" and "W" (except for Level data ☐ (Un\G1072 to Un\G1081)) and system areas in the list.

If the above areas are set, normal operations of the A/D converter module are not guaranteed.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

Channel	Default value	Buffer memory to be monitored
CH1	54	CH1 Scaling value (digital operation value) (Un\G54)
CH2	55	CH2 Scaling value (digital operation value) (Un\G55)
CH3	56	CH3 Scaling value (digital operation value) (Un\G56)
CH4	57	CH4 Scaling value (digital operation value) (Un\G57)

(38)Level data □ (Un\G1072 to Un\G1081) AD4

This is the area for storing the data to be monitored when the level trigger of the logging function is used. 10 types of data are available: Level data 0 (Un\G1072) to Level data 9 (Un\G1081)

Use Level data □ (Un\G1072 to Un\G1081) to monitor device values in other than the A/D converter module and generate triggers.

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

- Logging function (☞Page 108, Section 8.14)

(a) Setting range

Setting range is -32768 to 32767.

(b) Default value

All are set to 0.

(39)CH□ Trigger setting value (Un\G1082 to Un\G1085) AD4

When the logging function is used, set a level where a level trigger is generated.

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

- Logging function (☞Page 108, Section 8.14)

(a) Setting range

Setting range is -32768 to 32767.

(b) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(c) Default value

All channels are set to 0.

(40)CH□ Head pointer (Un\G1090 to Un\G1093) AD4

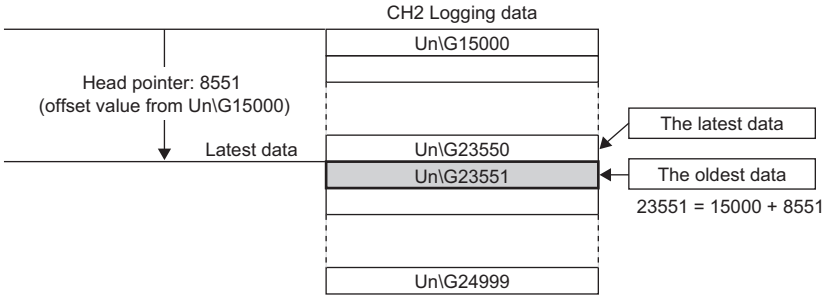
The buffer memory address where the oldest data is stored can be checked in CH□ Logging data (Un\G5000 to Un\G44999).

This area stores the offset value (0 to 9999) counted from the start address (CH1: Un\G5000, CH2: Un\G15000, CH3: Un\G25000, CH4: Un\G35000) of CH□ Logging data (Un\G5000 to Un\G44999).

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

- Logging Function (☞Page 108, Section 8.14)

Ex When the value of CH2 Head pointer (Un\G1091) is 8551



Point

- The value in CH□ Head pointer (Un\G1090 to Un\G1093) is fixed to 0 since the oldest data is stored in the start address of CH□ Logging data (Un\G5000 to Un\G44999) while the data of first 10000 points is logged from the logging is stated. After the number of collected data points reaches 10000, the place of CH□ Latest pointer (Un\G1090 to Un\G1093) increases one by one.
- When CH□ Logging hold request (Un\G1008 to Un\G1011) is changed from On (1) to Off (0), CH□ Head pointer (Un\G1090 to Un\G1093) is cleared to zero.

(41)CH□ Latest pointer (Un\G1098 to Un\G1101) AD4

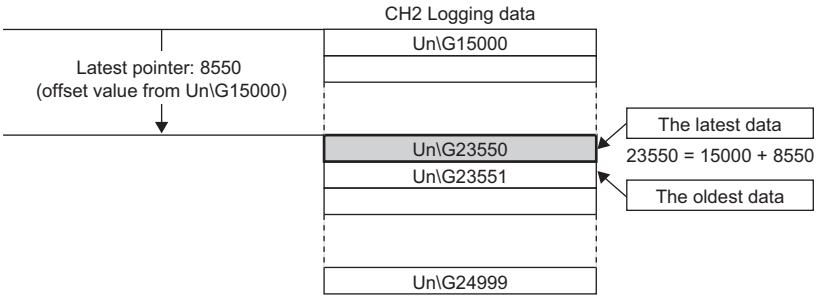
The buffer memory address where the latest data is stored can be checked in CH□ Logging data (Un\G5000 to Un\G24999).

This area stores the offset value (0 to 9999) counted from the start address (CH1: Un\G5000, CH2: Un\G15000, CH3: Un\G25000, CH4: Un\G35000) of CH□ Logging data (Un\G5000 to Un\G44999).

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

- Logging Function (☞Page 108, Section 8.14)

Ex When the value of CH2 Latest pointer (Un\G1099) is 8550



Point

- CH□ Latest pointer (Un\G1098 to Un\G1101) increases one by one each time data is stored from the logging starts.
- When CH□ Logging hold request (Un\G1008 to Un\G1011) is changed from On (1) to Off (0), CH□ Number of logging data (Un\G1106 to Un\G1109) is cleared to zero.

(42)CH□ Number of logging data (Un\G1106 to Un\G1109) AD4

The number of data stored in CH□ Logging data (Un\G5000 to Un\G44999) can be checked during the logging.

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

- Logging Function (☞Page 108, Section 8.14)

Point

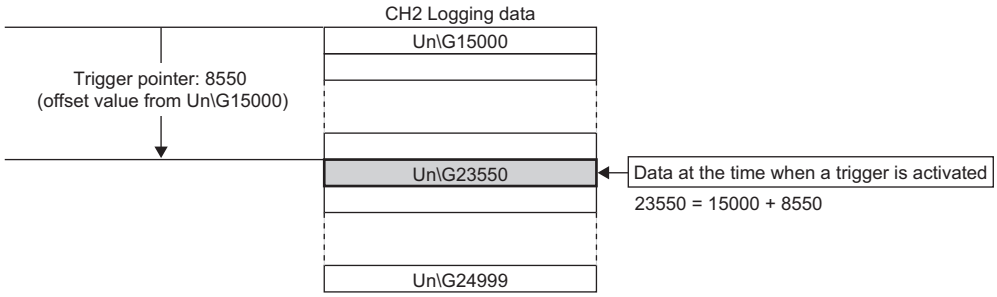
- The number of logging data increases one by one each time data is stored from the logging starts.
- When the number of logging data reaches 10000, CH□ Number of logging data (Un\G1106 to Un\G1109) is fixed to 10000 since the data points are overwritten from the head again.
- When CH□ Logging hold request (Un\G1008 to Un\G1011) is changed from On (1) to Off (0), CH□ Number of logging data (Un\G1106 to Un\G1109) is cleared to zero.

(43)CH□ Trigger pointer (Un\G1114 to Un\G1117) AD4

The address of buffer memory which stores the data of when a hold trigger was executed can be checked in CH□ Logging data (Un\G5000 to Un\G44999).
This area stores the offset value (0 to 9999) counted from the start address (CH1: Un\G5000, CH2: Un\G15000, CH3: Un\G25000, CH4: Un\G35000) of CH□ Logging data (Un\G5000 to Un\G44999).
For details on the logging function, refer to the following.

- Logging Function (☞Page 108, Section 8.14)

Ex When the value of CH2 Trigger pointer (Un\G1115) is 8550



Point

When CH□ Logging hold request (Un\G1008 to Un\G1011) is changed from On (1) to Off (0), CH□ Trigger pointer (Un\G1114 to Un\G1117) is cleared to zero.

(44)CH□ Logging cycle monitor value (Un\G1122 to Un\G1133) AD4

This is the area for storing the actual logging cycle which is calculated from the update cycle of data to be logged.
When Operating condition setting request (Y9) is turned on and off, the logging cycle is stored in CH□ Logging cycle monitor value (Un\G1122 to Un\G1133) in the corresponding channel where the logging function is enabled.
For details on the logging function, refer to the following.

- Logging function (☞Page 108, Section 8.14)

The following figure shows how values are stored in CH1 Logging cycle monitor value (Un\G1122 to Un\G1124).

	b15 to b0
Un\G1122	s
Un\G1123	ms
Un\G1124	μs

Ex When the calculated value of logging cycle in CH1 is 6960μs

Buffer memory address	Stored value
Un\G1122	0 (s)
Un\G1123	6 (ms)
Un\G1124	960 (μs)

(45)CH□ Trigger detection time (Un\G1154 to Un\G1169) AD4

The time that the hold trigger occurred is recorded.

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

- Logging Function (☞Page 108, Section 8.14)

The following figure shows how values are stored in CH1 Trigger detection time (Un\G1154 to Un\G1157).

	b15 to b8	b7 to b0
Un\G1154	First two digits of the year	Last two digits of the year
Un\G1155	Month	Day
Un\G1156	Hour	Minute
Un\G1157	Second	Day of the week

Item	Storage contents		Storage example*1
First two digits of the year/Last two digits of the year	Stored in BCD code.		2011H
Month/Day			329H
Hour/Minute			1035H
Second			40H
Day of the week	One of the following values is stored for each day of the week in BCD code.		2H
	• Sunday: 0	• Monday: 1	
	• Tuesday: 2	• Wednesday: 3	
	• Thursday: 4	• Friday: 5	
	• Saturday: 6		

*1 Those are values when a hold trigger is detected at 10:35:40 on Tuesday, March 29th, 2011.

Point

- Time units shorter than one second are not recorded.
- When CH□ Logging hold request (Un\G1008, Un\G1011) is changed from On (1) to Off (0), CH□ Trigger detection time (Un\G1154 to Un\G1169) is cleared to zero.

(46)CH□ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303) AD4

Set whether the flow amount integration function is enabled or disabled.
For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

Flow amount integration enable/disable setting	Setting value
Enable	0
Disable	1

- In the channel where a setting value other than the above is set, an error occurs. The error code (201□) is stored in Latest error code (Un\G19) and Error flag (XF) turns on.
- In the channel where the conversion speed is set to 20μs or 80μs and CH□ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303) is Enable (0), an error occurs. The error code (201□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the flow amount integration function is not enabled.

(a) Enabling the setting

Turn on and off Operating condition setting request (Y9) to enable the setting.

(b) Default value

All channels are set to Disable (1).

(47)CH□ Integration cycle setting (Un\G1308 to Un\G1311) AD4

Set the integration cycle of flow amount integration in each channel.
For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

(a) Setting range

- Setting range is 1 to 5000 (ms).
- In the channel where a value other than the above is set, an error occurs. Then, the error code (211□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the flow amount integration function cannot be performed.
- When the set integration cycle is below the data updated cycle of CH□ Scaling value (digital operation value) (Un\G54 to Un\G57), an error occurs. Then, the error code (212□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the flow amount integration function cannot be performed.

(b) Default value

All channels are set to 4 (ms).

(48)CH□ Flow amount time unit setting (Un\G1316 to Un\G1319) AD4

Set a conversion value to convert the time unit of instantaneous flow amount to ms.

Set CH□ Flow amount time unit setting (Un\G1316 to Un\G1319) to the range of the flow meter connected to the A/D converter module.

For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

Flow amount time unit	Setting value
/s	0
/min	1
/h	2

- In the channel where a setting value other than the above is set, an error occurs. The error code (213□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the flow amount integration function is not enabled.

Ex When the range of the flow meter is "cm^3/s", set / (0).

(a) Default value

All channels are set to /s (0).

(49)CH□ Unit scaling setting (Un\G1324 to Un\G1327) AD4

Set the unit scaling that is used for the flow amount integration function.

For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

Unit scaling	Setting value
× 1	0
× 10	1
× 100	2
× 1000	3
× 10000	4

- In the channel where a setting value other than the above is set, an error occurs. The error code (214□) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the flow amount integration function is not enabled.

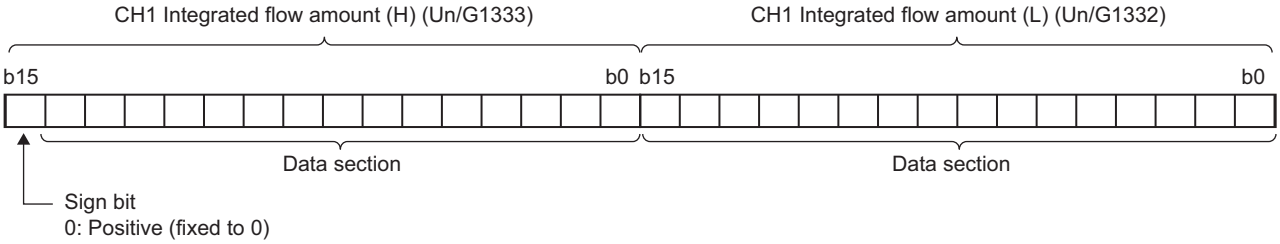
(a) Default value

All channels are set to × 1 (0).

(50)CH☐ Integrated flow amount (Un\G1332 to Un\G1339) AD4

This is the area for storing the result of the integral processing performed by the flow amount integration function.
The integrated flow amount is stored with 32-bit signed binary.
For details on the flow amount integration function, refer to the following.

- Flow Amount Integration Function (☞Page 123, Section 8.15)



(a) Storage range

The value is stored within the range of 0 to 2147483647.

(51)CH☐ Integration cycle monitor value (Un\G1348 to Un\G1351) AD4

This is the area for storing the integration cycle which is calculated from the update cycle of CH☐ Scaling value (digital operation value) (Un\G54 to Un\G57).
For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

(a) Storage range

When CH☐ Flow amount integration enable/disable setting (Un\G1300 to Un\G1303) is Enable (0), the value is stored within the range of 1 to 5000. When it is Disable (1), the value is fixed to 0.

(52)CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) AD4

Stops the integral processing temporarily while the flow amount integration function is operating.
For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

Flow amount integration temporary stop request	Setting value
No request	0
Temporary stop request	1

- In the channel where a setting value other than the above is set, an error occurs. The error code (215☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the setting is ignored.
- When CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) is turned No request (0) → Temporary stop request (1) while the flow amount integration function is operating, the flow amount integration function temporarily stops.
- When CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) is turned Temporary stop request (1) → No request (0) while the flow amount integration function temporarily stops, the flow amount integration function restarts.

(a) Default value

All channels are set to No request (0).

(53)CH☐ Flow amount integration temporary stop flag (Un\G1364 to Un\G1367) AD4

Flow amount integration temporary stop request status can be checked with this flag.

Flow amount integration temporary stop request status	Stored value
No temporary stop request	0
Temporary stopping	1

- While the flow amount integration function temporarily stops by CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) being turned No request (0) → Temporary stop request (1), CH☐ Flow amount integration temporary stop flag (Un\G1364 to Un\G1367) is turned to Temporary stop request (1).
- When the flow amount integration function restarts by CH☐ Flow amount integration temporary stop request (Un\G1356 to Un\G1359) being turned Temporary stop request (1) → No request (0), CH☐ Flow amount integration temporary stop flag (Un\G1364 to Un\G1367) is turned to No temporary stop request (1).

(54)CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) AD4

When the flow amount integration function is enabled, the value of CH☐ Integrated flow amount (Un\G1332 to Un\G1339) can be cleared to zero.

For details on the flow amount integration function, refer to the following.

- Flow amount integration function (☞Page 123, Section 8.15)

Integrated flow amount clear request	Setting value
No request	0
Clear request	1

- In the channel where a setting value other than the above is set, an error occurs. The error code (216☐) is stored in Latest error code (Un\G19), Error flag (XF) turns on, and the setting is ignored.
- When CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) is turned to No request (0) → Clear request (1) while the flow amount integration function is operating, the value of CH☐ Integrated flow amount (Un\G1332 to Un\G1339) in the corresponding channel is cleared to zero.

(a) Default value

All channels are set to No request (0).

(55)CH☐ Integrated flow amount clear flag (Un\G1380 to Un\G1383) AD4

Integrated flow amount clear request status can be checked with this flag.

Integrated flow amount clear flag	Setting value
No clear request	0
Cleared	1

- When CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) is turned No request (0) → Clear request (1) and the value of CH☐ Integrated flow amount (Un\G1332 to Un\G1339) is cleared, CH☐ Integrated flow amount clear flag (Un\G1380 to Un\G1383) is turned to Cleared (1).
- When CH☐ Integrated flow amount clear request (Un\G1372 to Un\G1375) is turned to Clear request (1) → No request (0), CH☐ Integrated flow amount clear flag (Un\G1380 to Un\G1383) is turned to No clear request (0).

(56)CH□ A/D conversion status (Un\G1700 to Un\G1707) ADVL8 ADIL8

The status of A/D conversion is stored.

Use this area for troubleshooting. For details, refer to the following.

- When digital output value cannot be read (☞Page 187, Section 11.6.2 (2))

A/D conversion status	Stored value	Description
A/D conversion disable	0	A/D conversion has been disabled. A/D conversion has not been performed on the corresponding channel.
A/D conversion start	1	A/D conversion has been enabled and the first A/D conversion has yet to be complete.
A/D conversion completion	2	The first A/D conversion has been complete. A/D conversion is in execution.
Input signal error detected	3	In the use of the input signal error detection function, an input signal error has been detected. (When the input signal error detection function is not used, this value is not stored.)

(57)CH□ Analog input monitor (Un\G1710, Un\G1712, Un\G1714, Un\G1716, Un\G1718, Un\G1720, Un\G1722, Un\G1724) ADVL8 ADIL8

The amount of analog input, a current or a voltage, is stored for each channel.

This value is updated at periods of about 1ms.

Use this area for troubleshooting. For details, refer to the following.

- When digital output value cannot be read (☞Page 187, Section 11.6.2 (2))

The value stored in CH□ Analog input monitor (Un\G1710, Un\G1712, Un\G1714, Un\G1716, Un\G1718, Un\G1720, Un\G1722, Un\G1724) depends on the value stored in CH□ A/D conversion status (Un\G1700 to Un\G1707), as described below.

(a) "1: A/D conversion start", "2: A/D conversion completion", "3: Input signal error detected"

The following values are stored.

Module	Storage contents
L60ADVL8	The product of Input voltage [V] and 100 is stored. When 10V is input, 1000 is stored.
L60ADIL8	The product of Input amperage [mA] and 100 is stored. When 20mA is input, 2000 is stored.

Point

Do not use the value in this area for actual controls because the value does not have the resolution and accuracy described in the performance specifications (☞Page 21, Section 3.2).

Use the value as a guide to the status of analog input at a system startup or other events.

(58)CH□ Analog input monitor unit (Un\G1711, Un\G1713, Un\G1715, Un\G1717, Un\G1719, Un\G1721, Un\G1723, Un\G1725) ADVL8 ADIL8

The unit of the value in CH□ Analog input monitor (Un\G1710, Un\G1712, Un\G1714, Un\G1716, Un\G1718, Un\G1720, Un\G1722, Un\G1724) is stored.

Use this area for troubleshooting. For details, refer to the following.

- When digital output value cannot be read (☞Page 187, Section 11.6.2 (2))

Unit	Stored value
× 10^{-2}mA	0
× 10^{-2}V	1

(59)Latest error code address (Un\G1800) Common

The buffer memory address of Error history No.□ (Un\G1810 to Un\G1969) that has been storing the latest error code is stored.

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

Sixteen errors that have occurred in the module are recorded at a maximum.

For details of the error log function, refer to the following.

- Error Log Function (☞Page 133, Section 8.16)

	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	

Item	Storage contents		Storage example*1
First two digits of the year/Last two digits of the year	Stored in BCD code.		2011H
Month/Day			329H
Hour/Minute			1035H
Second			40H
Day of the week	One of the following values is stored for each day of the week in BCD code.		2H
	• Sunday: 0	• Monday: 1	
	• Tuesday: 2	• Wednesday: 3	
	• Thursday: 4	• Friday: 5	
	• Saturday: 6		

*1 Those are values when an error occurs at 10:35:40 on Tuesday, March 29th, 2011.

(61)CH□ Logging data (Un\G5000 to Un\G44999) AD4

This is an area for storing the logged data.

Up to 10000 data can be stored per channel. After the number of data points stored in CH□ Logging data (Un\G5000 to Un\G44999) for each channel reaches 10000, the logging is continued overwriting the data from the head.

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

- Logging function (☞Page 108, Section 8.14)

Point

- When Operating condition setting request (Y9) is turned on and off, the logging data in all the channels are cleared to zero.
- Even if CH□ Logging hold request (Un\G1008 to Un\G1011) is changed from On (1) to Off (0) and the logging restarts, the logged data is not cleared to zero.

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) from outside of programmable controller to digital output value.

(1) Offset value

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

(2) Gain value

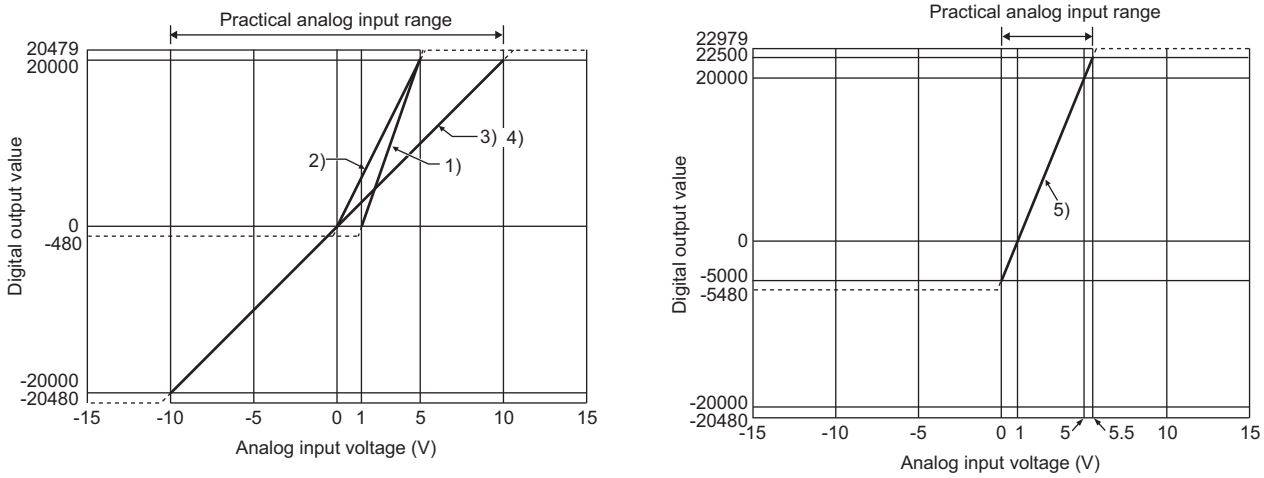
This is the analog input value (voltage or current) when the digital output value becomes the following value.

Module	Digital output value
L60AD4	20000
L60ADVL8	• 8000 (1 to 5V, 0 to 5V, 1 to 5V, (Extended mode), user range setting) • 16000 (-10 to 10V, 0 to 10V)
L60ADIL8	8000

(3) I/O conversion characteristic of the L60AD4

(a) 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	
5)	1 to 5V (Extended mode)	1V	5V	-5000 to 22500	200μV
—	User range setting	*1	*1	-20000 to 20000	307μV*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.
- Setting range for offset value and gain value: -10 to 10V
- ((gain value)-(offset value)) ≥ 4.0V

*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	
1 to 5V (Extended mode)	-5480	22979
User range setting	-20480	20479

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

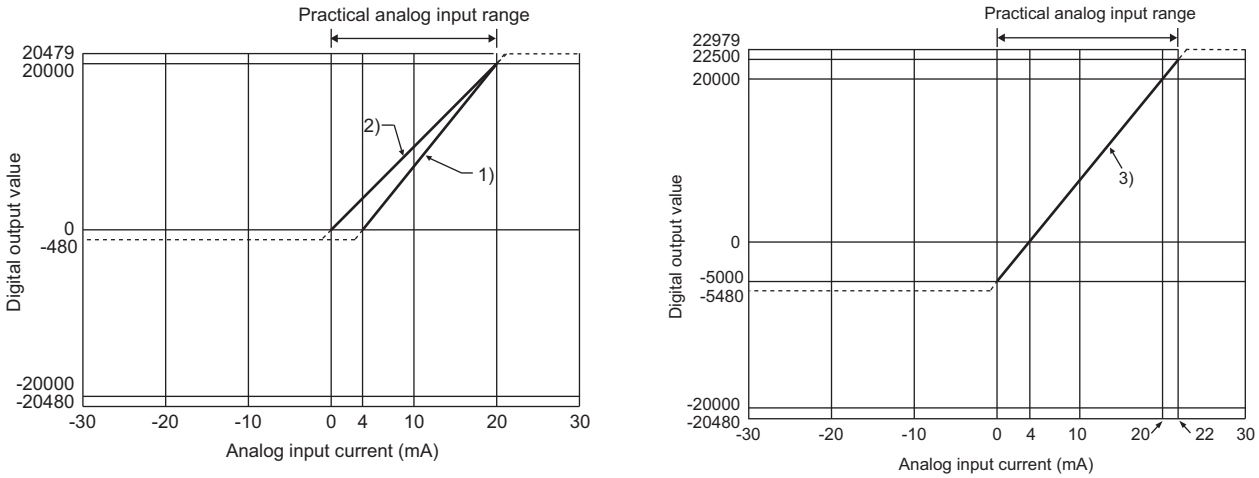
Point

- 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 of voltage input characteristic.)
- Do not input a value of ±15V or more. This may damage the elements.

A

(b) 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)	4 to 20mA (Extended mode)	4mA	20mA	-5000 to 22500	800nA
—	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 ≤ 20mA, offset value ≥ 0mA
- ((gain value) - (offset value)) ≥ 16.0mA

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

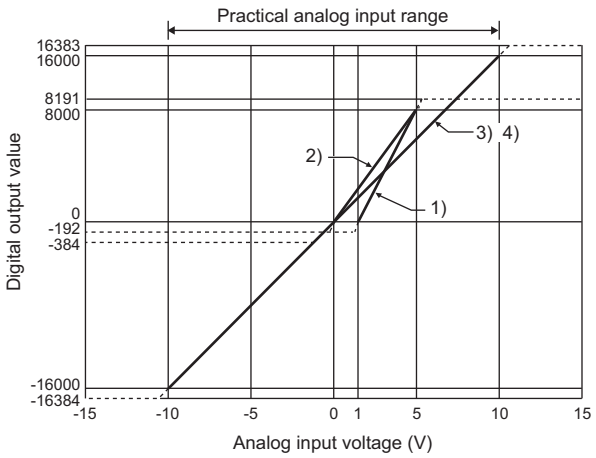
Input range setting	Digital output value	
	Minimum	Maximum
4 to 20mA	-480	20479
0 to 20mA		
4 to 20mA (Extended mode)	-5480	22979
User range setting	-20480	20479

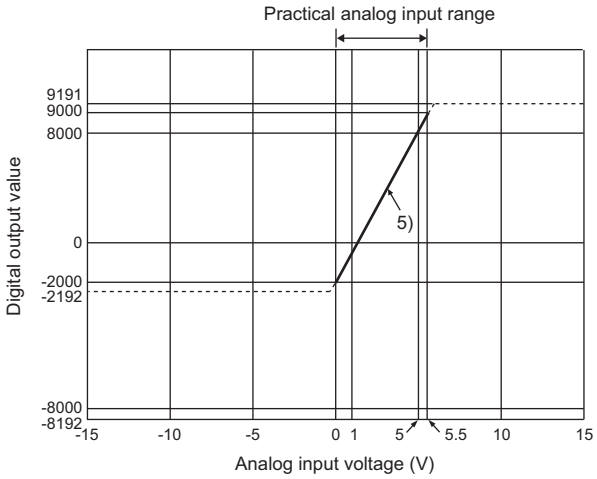
*3 This is the maximum resolution in user range setting.

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 of current input characteristic.)
- Do not input a value of ±30mA or more. This may damage the elements.

(4) I/O conversion characteristic of the L60ADVL8





No.	Input range setting	Offset value	Gain value	Digital output value*2	Resolution
1)	1 to 5V	1V	5V	0 to 8000	500μV
2)	0 to 5V	0V	5V		625μV
3)	-10 to 10V	0V	10V	-16000 to 16000	625μV
4)	0 to 10V	0V	10V	0 to 16000	
5)	1 to 5V (Extended mode)	1V	5V	-2000 to 9000	500μV
—	User range setting	*1	*1	-8000 to 8000	414μV*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.
- Setting range for offset value and gain value: -10 to 10V
- ((gain value)-(offset value)) ≥ 3.7V

*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	-192	8191
0 to 5V		
-10 to 10V	-16384	16383
0 to 10V	-384	
1 to 5V (Extended mode)	-2192	9191
User range setting	-8192	8191

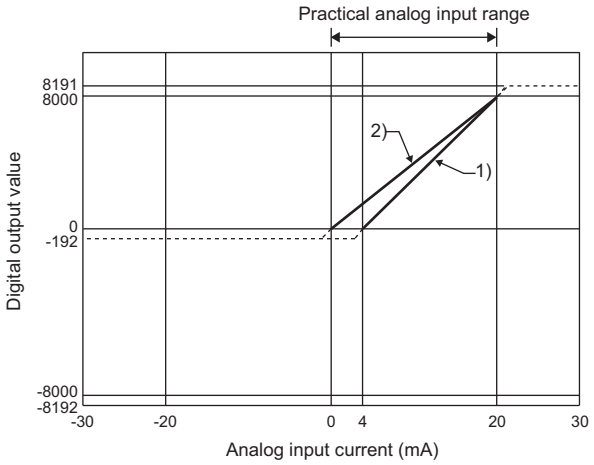
*3 This is the maximum resolution in user range setting.

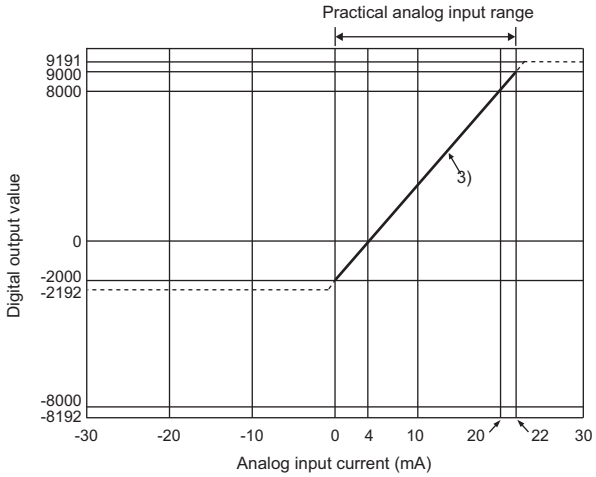
Point

- 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 of voltage input characteristic.)
- Do not input a value of ±15V or more. This may damage the elements.

A

(5) I/O conversion characteristic of the L60ADIL8





No.	Input range setting	Offset value	Gain value	Digital output value*2	Resolution
1)	4 to 20mA	4mA	20mA	0 to 8000	2000nA
2)	0 to 20mA	0mA	20mA		2500nA
3)	4 to 20mA (Extended mode)	4mA	20mA	-2000 to 9000	2000nA
—	User range setting	*1	*1	-8000 to 8000	1660nA*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 ≤ 20mA, offset value ≥ 0mA
- ((gain value) - (offset value)) ≥ 14.6mA

*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	-192	8191
0 to 20mA		
4 to 20mA (Extended mode)	-2192	9191
User range setting	-8192	8191

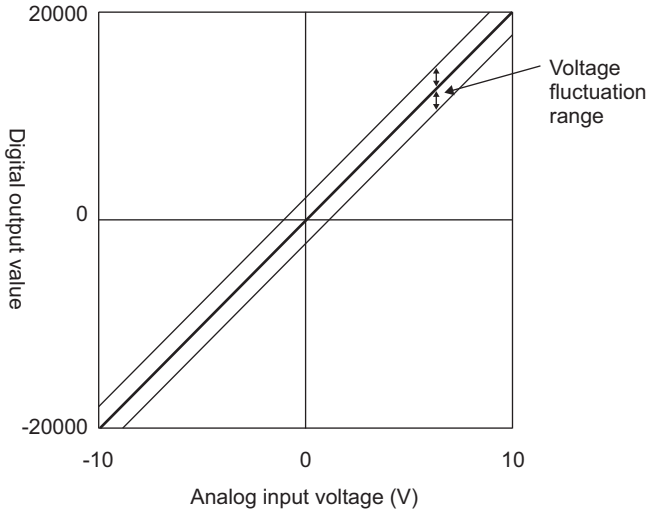
*3 This is the maximum resolution in user range setting.

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 of current input characteristic.)
- 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 for the L60AD4.



The fluctuation range varies depending on the ambient temperature and input range as shown below.
However, influence by noises is excluded.

Module	Analog input range	Fluctuation range	
		Ambient temperature: 25 ±5°C	Ambient temperature: 0 ±55°C
L60AD4	For all the analog input ranges	±0.1% (±20digit)	±0.2% (±40digit)
L60ADVL8	0 to 10V	Within ±0.2% (±32digit)	Within ±1% (±160digit)
	0 to 5V	Within ±0.2% (±16digit)	Within ±1% (±80digit)
	1 to 5V		
	-10 to 10V	Within ±0.2% (±32digit)	Within ±1% (±160digit)
	1 to 5V (Extended mode)	Within ±0.2% (±16digit)	Within ±1% (±80digit)
L60ADIL8	For all the analog input ranges	Within ±0.2% (±16digit)	Within ±1% (±80digit)

Appendix 5 Dedicated Instructions

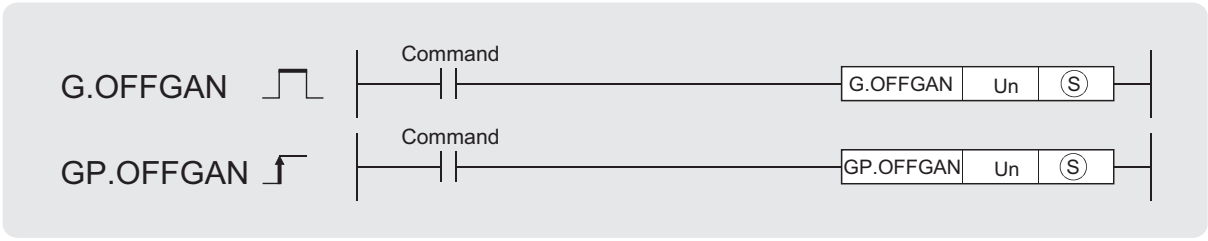
This chapter describes the dedicated instructions that can be used in A/D converter module.

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 from the normal mode to the offset/gain setting mode. • The operation mode is changed from the offset/gain setting mode 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 FEH	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, and the RUN LED flashes.)
- Offset/gain setting mode → normal mode (Offset/gain setting mode flag (XA) is off, and the RUN LED is on.)

Point

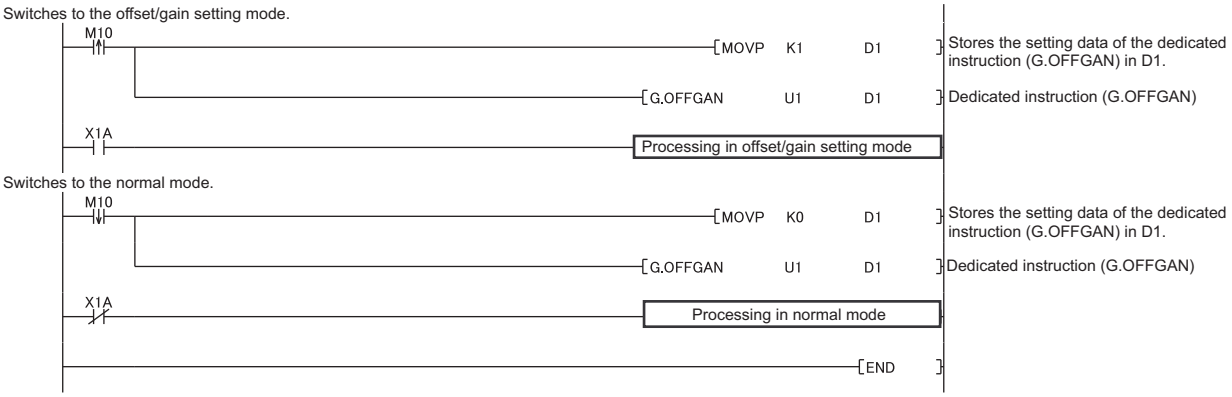
- When the mode is switched from the offset/gain setting mode to the normal mode, Module READY (X0) turns from OFF to ON.
  Note that if a program includes the initial settings to be executed at ON of Module READY (X0), this instruction performs the initial setting process.
- When the mode is switched from the offset/gain setting mode to the normal mode, the A/D converter module operates under the previous operating condition.
- If the mode to be switched to is the same as the current mode (if this instruction is performed when the operation mode is the normal mode and "0: Changed to the normal mode" is set, or when the operation mode is the offset/gain setting mode and "1: Changed to the offset/gain setting mode" is set), the operation is invalid.

(3) Errors

The instruction has no errors.

(4) Program example

The following shows the program of the A/D converter module, which is 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. Turning off M10 restores the operation mode to the normal mode.



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 FEH	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

(a) L60AD4*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	0000H to 000FH	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
Ⓢ+30	CH3 User range settings gain value (L)	—	—	System
Ⓢ+31	CH3 User range settings gain value (H)	—	—	System

Device	Item	Setting data	Setting range	Set by
Ⓢ+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.

(b) L60ADVL8, L60ADIL8

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	System area	—	—	—
Ⓢ+3	System area	—	—	—
Ⓢ+4	CH1 Industrial shipment settings offset value	—	—	System
Ⓢ+5	CH1 Industrial shipment settings gain value	—	—	System
Ⓢ+6	CH2 Industrial shipment settings offset value	—	—	System
Ⓢ+7	CH2 Industrial shipment settings gain value	—	—	System
Ⓢ+8	CH3 Industrial shipment settings offset value	—	—	System
Ⓢ+9	CH3 Industrial shipment settings gain value	—	—	System
Ⓢ+10	CH4 Industrial shipment settings offset value	—	—	System
Ⓢ+11	CH4 Industrial shipment settings gain value	—	—	System
Ⓢ+12	CH5 Industrial shipment settings offset value	—	—	System
Ⓢ+13	CH5 Industrial shipment settings gain value	—	—	System
Ⓢ+14	CH6 Industrial shipment settings offset value	—	—	System
Ⓢ+15	CH6 Industrial shipment settings gain value	—	—	System
Ⓢ+16	CH7 Industrial shipment settings offset value	—	—	System
Ⓢ+17	CH7 Industrial shipment settings gain value	—	—	System
Ⓢ+18	CH8 Industrial shipment settings offset value	—	—	System
Ⓢ+19	CH8 Industrial shipment settings gain value	—	—	System
Ⓢ+20	CH1 User range settings offset value	—	—	System
Ⓢ+21	CH1 User range settings gain value	—	—	System
Ⓢ+22	CH2 User range settings offset value	—	—	System
Ⓢ+23	CH2 User range settings gain value	—	—	System
Ⓢ+24	CH3 User range settings offset value	—	—	System
Ⓢ+25	CH3 User range settings gain value	—	—	System
Ⓢ+26	CH4 User range settings offset value	—	—	System
Ⓢ+27	CH4 User range settings gain value	—	—	System
Ⓢ+28	CH5 User range settings offset value	—	—	System
Ⓢ+29	CH5 User range settings gain value	—	—	System
Ⓢ+30	CH6 User range settings offset value	—	—	System
Ⓢ+31	CH6 User range settings gain value	—	—	System

Device	Item	Setting data	Setting range	Set by
Ⓢ+32	CH7 User range settings offset value	—	—	System
Ⓢ+33	CH7 User range settings gain value	—	—	System
Ⓢ+34	CH8 User range settings offset value	—	—	System
Ⓢ+35	CH8 User range settings gain value	—	—	System

(3) Functions

- This instruction reads the industrial shipment setting and the offset/gain setting value of the A/D converter module in the user range to the CPU module.
- There are two interlock signals of the G(P).OGLOAD instruction: a completion deviceⒹ, and a completion status indication deviceⒹ+1.

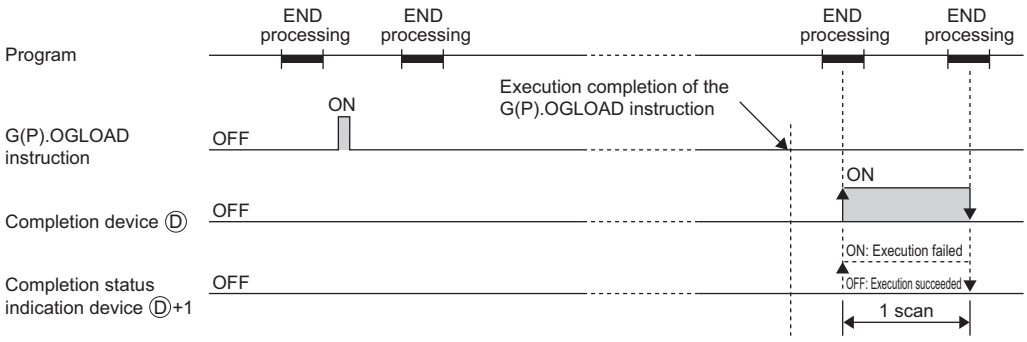
(a) Completion device

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 on and 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.

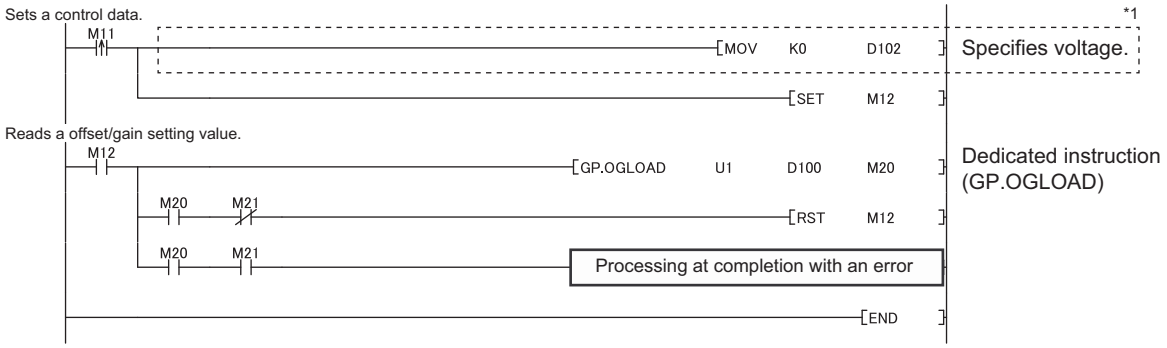


(4) Errors

The instruction has no errors.

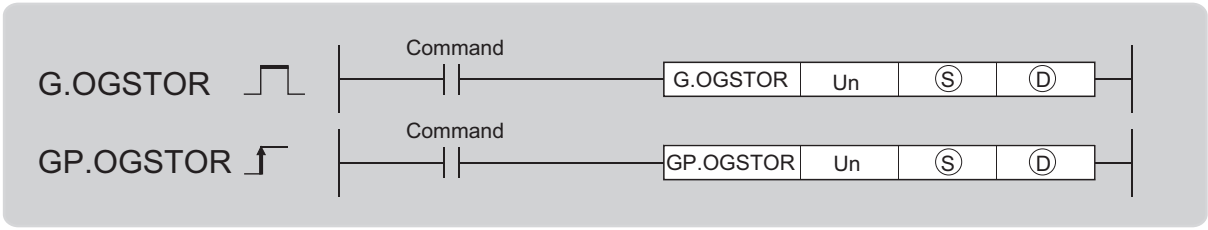
(5) Program example

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.



*1 The L60ADVL8 or L60ADIL8 does not require the area surrounded by a broken line.

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 FEH	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

(a) L60AD4

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	0000H to 000FH	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
Ⓢ+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

Device	Item	Setting data	Setting range	Set by
Ⓢ+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

(b) L60ADVL8, L60ADIL8

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	System area	—	—	—
Ⓢ+3	System area	—	—	—
Ⓢ+4	CH1 Industrial shipment settings offset value	—	—	System
Ⓢ+5	CH1 Industrial shipment settings gain value	—	—	System
Ⓢ+6	CH2 Industrial shipment settings offset value	—	—	System
Ⓢ+7	CH2 Industrial shipment settings gain value	—	—	System
Ⓢ+8	CH3 Industrial shipment settings offset value	—	—	System
Ⓢ+9	CH3 Industrial shipment settings gain value	—	—	System
Ⓢ+10	CH4 Industrial shipment settings offset value	—	—	System
Ⓢ+11	CH4 Industrial shipment settings gain value	—	—	System
Ⓢ+12	CH5 Industrial shipment settings offset value	—	—	System
Ⓢ+13	CH5 Industrial shipment settings gain value	—	—	System
Ⓢ+14	CH6 Industrial shipment settings offset value	—	—	System
Ⓢ+15	CH6 Industrial shipment settings gain value	—	—	System
Ⓢ+16	CH7 Industrial shipment settings offset value	—	—	System
Ⓢ+17	CH7 Industrial shipment settings gain value	—	—	System
Ⓢ+18	CH8 Industrial shipment settings offset value	—	—	System
Ⓢ+19	CH8 Industrial shipment settings gain value	—	—	System
Ⓢ+20	CH1 User range settings offset value	—	—	System
Ⓢ+21	CH1 User range settings gain value	—	—	System
Ⓢ+22	CH2 User range settings offset value	—	—	System
Ⓢ+23	CH2 User range settings gain value	—	—	System
Ⓢ+24	CH3 User range settings offset value	—	—	System
Ⓢ+25	CH3 User range settings gain value	—	—	System
Ⓢ+26	CH4 User range settings offset value	—	—	System
Ⓢ+27	CH4 User range settings gain value	—	—	System
Ⓢ+28	CH5 User range settings offset value	—	—	System
Ⓢ+29	CH5 User range settings gain value	—	—	System
Ⓢ+30	CH6 User range settings offset value	—	—	System
Ⓢ+31	CH6 User range settings gain value	—	—	System
Ⓢ+32	CH7 User range settings offset value	—	—	System
Ⓢ+33	CH7 User range settings gain value	—	—	System

Device	Item	Setting data	Setting range	Set by
Ⓢ+34	CH8 User range settings offset value	—	—	System
Ⓢ+35	CH8 User range settings gain value	—	—	System

(3) Functions

- This instruction restores the industrial shipment setting and offset/gain setting value in the user range stored in the CPU module to the A/D converter module.
- There are two interlock signals of G(P).OGSTOR: a completion deviceⒹand a completion status indication deviceⒹ+1.

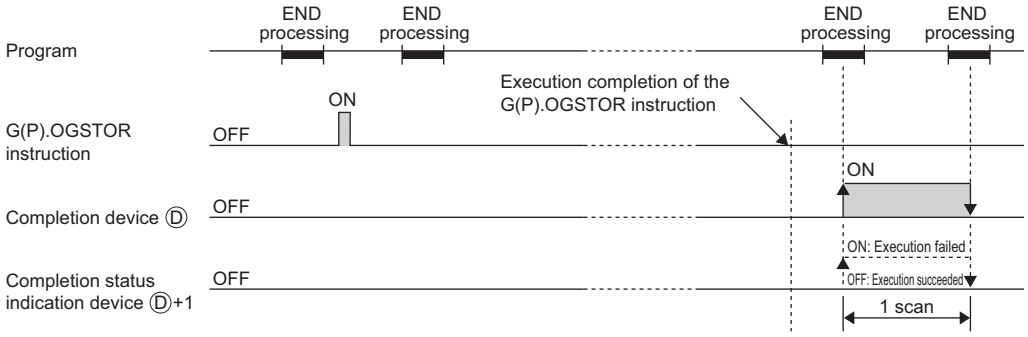
(a) Completion device

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

(b) Completion status indication device

This device turns on and 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.



(c) Accuracy

The accuracy after the restoration of the offset/gain setting value is lower than the one before the restoration. The difference is about three times.

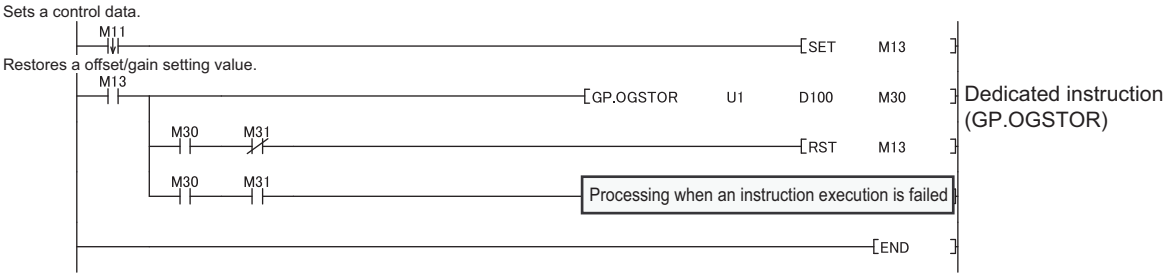
(4) Errors

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.



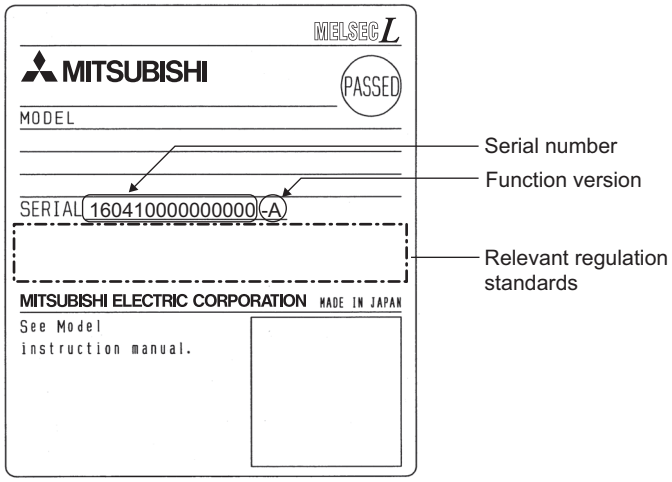
Appendix 6 Checking Serial Number and Function Version

The serial number and the function version of the A/D converter module can be checked with the following methods.

- Checking on the rating plate
- Checking on the front part of the module
- Checking on the system monitor of a programming tool

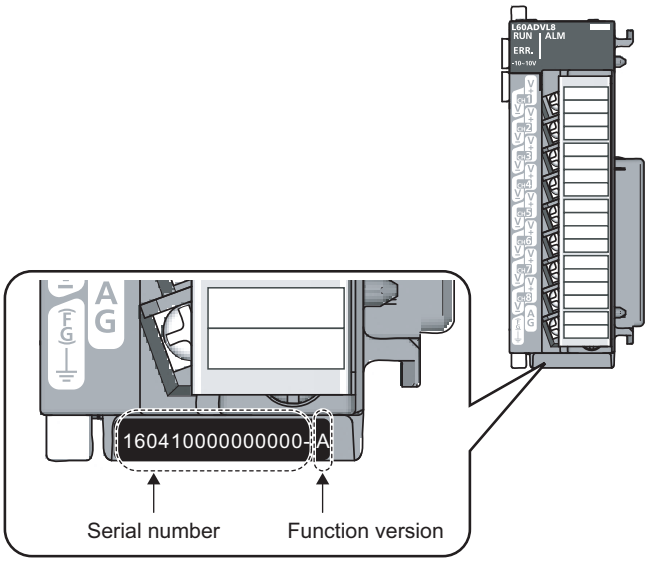
(1) Checking on the rating plate

The rating plate is on the side of the A/D converter module.



(2) Checking on the front part of the module

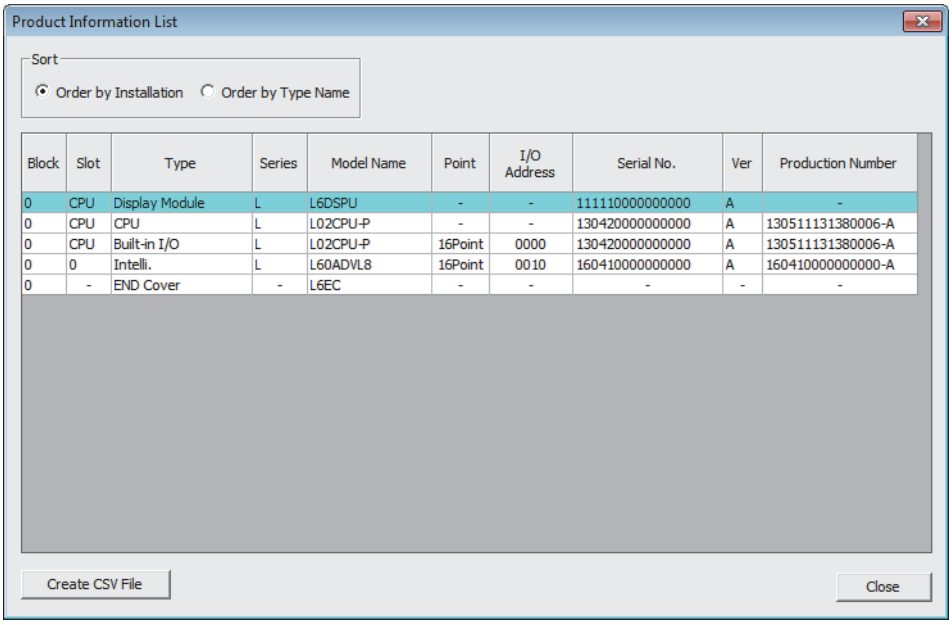
The function version and serial number on the rating plate are also shown on the front part (bottom part) of the module.



(3) Checking on the system monitor

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

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



(a) Displaying product number

The serial number (product number) on the rating plate is displayed in "Production Number".

Thus, the serial number (product number) can be checked without checking the module.

Point

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

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

Appendix 7 Addition and Change of Functions

Appendix 7.1 Addition of functions

The following table lists functions added to the L60AD4 and GX Works2, and product information of the compatible L60AD4 and software version of GX Works2.

Added contents		Upper 5 digits of product information compatible with the L60AD4	Compatible version of GX Works2	Reference
Input range extension function		13041 or later	1.62Q or later	Page 74, Section 8.4
Input signal error detection extension function				Page 82, Section 8.8
Shift function				Page 94, Section 8.11
Digital clipping function				Page 99, Section 8.12
Difference conversion function				Page 103, Section 8.13
Logging function				Page 108, Section 8.14
Flow amount integration function				Page 123, Section 8.15
Display unit	SHIFT screen			Page 153, Section 9.3 (8)
	DIGITALCLIP screen			Page 154, Section 9.3 (9)
	INPUT SIG ENH screen			Page 154, Section 9.3 (10)

Appendix 7.2 Change of functions

The following table lists functions changed in the L60AD4 and GX Works2, and product information of the compatible L60AD4 and software version of GX Works2.

Changed contents	Upper 5 digits of product information compatible with the L60AD4	Compatible version of GX Works2	Reference
CH□ Scaling value (digital operation value) (Un\G54 to Un\G57)	13041 or later	1.62Q or later	Page 256, Appendix 7.2 (1)
Maximum value/minimum value hold function			Page 257, Appendix 7.2 (2)
Input signal error detection function			Page 257, Appendix 7.2 (3)
Warning output function (Process alarm)			Page 257, Appendix 7.2 (4)
Scaling function			Page 258, Appendix 7.2 (5)

(1) CH□ Scaling value (digital operation value) (Un\G54 to Un\G57)

When the digital clipping function, scaling function, shift function, or difference conversion function is not used, the same value as the one in CH□ Digital output value (Un\G11 to Un\G14) is stored.

(a) When the non-compatible version of the L60AD4 is used

When the scaling function is not used, the value is not stored in CH□ Scaling value (digital operation value) (Un\G54 to Un\G57).

(2) Maximum value/minimum value hold function

The digital output value is 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).

When any of the following functions is used, a value operated by the function is stored.

- Digital clipping function
- Scaling function
- Shift function
- Difference conversion function

For details on the maximum value/minimum value hold function, refer to the following.

- Maximum value/minimum value hold function (☞Page 76, Section 8.6)

(a) When the non-compatible version of the L60AD4 is used

When the scaling function is not used, the digital output value is 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).

When the scaling function is used, the scaling value (digital operation value) is 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).

(3) Input signal error detection function

The detection cycle is changed to the sampling cycle.

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

- Input signal error detection function (☞Page 77, Section 8.7)

(a) When the non-compatible version of the L60AD4 is used

The detection cycle is detected per sampling cycle or averaging process cycle depending on the specified A/D conversion method.

(4) Warning output function (Process alarm)

The alarm output function monitors CH□ Digital output value (Un\G11 to Un\G14) for alarm output.

When any of the following functions is used, the alarm output function monitors CH□ Scaling value (digital operation value) (Un\G54 to Un\G57) for alarm output.

- Digital clipping function
- Scaling function
- Shift function
- Difference conversion function

For details on the warning output function, refer to the following.

- Warning output function (Process alarm) (☞Page 85, Section 8.9)

(a) When the non-compatible version of the L60AD4 is used

When the scaling function is not used, the alarm output function monitors CH□ Digital output value (Un\G11 to Un\G14) for alarm output.

When the scaling function is used, the alarm output function monitors CH□ Scaling value (digital operation value) (Un\G54 to Un\G57) for alarm output.

(5) Scaling function

The scaling function can be used in a channel in which the user range is used.

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

- Scaling function (☞Page 88, Section 8.10)

(a) When the non-compatible version of the L60AD4 is used

For the L60AD4 of non-compatible version, when the scaling function is set to be enabled in a channel in which the user range is used, an error occurs (error code: 99□). After the error occurrence, the error code is stored in Latest error code (Un\G19) and Error flag (XF) is turned to ON. The scaling function performs in the setting before the error.

For details on how to resolve the error, refer to the following.

- Error code list (☞Page 179, Section 11.4)

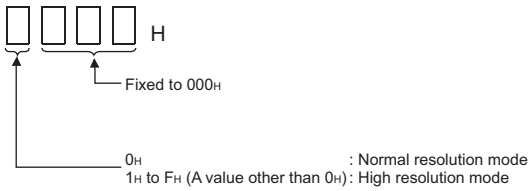
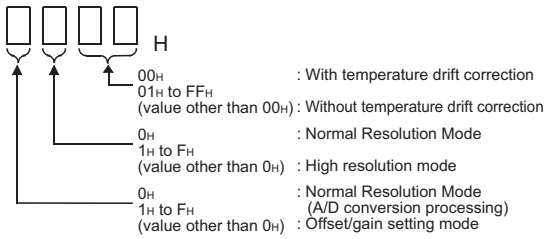
Appendix 8 Differences with Q Series

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

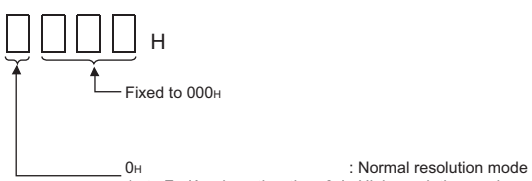
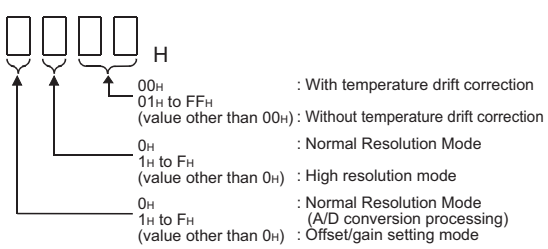
(a) Comparison of the specifications between the L60AD4 and Q64AD

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 setting (used to replace Q64AD) (Un\G9) Averaging process setting (Un\G24)	Averaging process setting (used to replace Q64AD) (Un\G9)
Intelligent function module switch setting		
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.)

(b) Comparison of the specifications between the L60ADVL8/L60ADIL8 and Q68ADV/Q68ADI

The following table shows a comparison of the specifications between the L60ADVL8/L60ADIL8 and Q68ADV/Q68ADI.

Difference	L60ADVL8/L60ADIL8	Q68ADV/Q68ADI
Resolution change function	L60ADVL8 (1/8000 or 1/16000) (resolution change function is not installed) L60ADIL8 (1/8000) (resolution change function is not installed)	2 types; normal resolution (1/4000) and high resolution (1/12000 or 1/16000)
Average time	4 to 5000ms	2 to 5000ms
Averaging process specification	Averaging process setting (used to replace Q68ADV or Q68ADI) (Un\G9) Averaging process setting (Un\G24)	Averaging process setting (used to replace Q64AD) (Un\G9)
Intelligent function module switch setting		
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 8.1 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/L60ADVL8/L60ADIL8 for the input signals and the buffer memory assignment of the L60AD4/L60ADVL8/L60ADIL8 are compatible between the L60AD4/L60ADVL8/L60ADIL8 and Q64AD/Q68ADV/Q68ADI.
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 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.

(a) When a program is applied to the L60AD4

Module		Averaging process specification	Description of application
Applied from	Applied to	Applied from	
Q64AD	L60AD4	Sampling processing Averaging process Count average (Setting: Un\G9)	Applicable without making any change. Note the following. • Apply the sequence program with the conversion speed setting of 80μs.
Q68ADV/Q68ADI		Sampling processing Averaging process Count average (Setting: Un\G9)	Applicable without making any change. Note the following. • Apply the sequence program with the conversion speed setting of 80μs.
Q62AD-DGH /Q64AD-GH		Sampling processing 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).) Note the following. • Set 0 to the buffer memory address (Un\G9) of the module.
Q68AD-G		Sampling processing 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).) Note the following. • Set 0 to the buffer memory address (Un\G9) of the module.
Q66AD-DG		Sampling processing 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).) Note the following. • Set 0 to the buffer memory address (Un\G9) of the module.
Q64ADH		Sampling processing Averaging processing Count average Moving average (Setting: Un\G24)	Applicable without making any change.

(b) When a program is applied to the L60ADVL8 or L60ADIL8

Module		Averaging process specification	Description of application
Applied from	Applied to	Applied from	
Q68ADV/Q68ADI	L60ADVL8/L60ADIL8	Sampling processing Averaging processing Count average (Setting: Un\G9)	Applicable without making any change. Note the following. • The conversion speed is 1ms.
Q68AD-G		Sampling processing Averaging processing 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).) Note the following. • The conversion speed is 1ms. • Set 0 to the buffer memory address (Un\G9) of the module.
Q66AD-DG		Sampling processing Averaging processing 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).) Note the following. • The conversion speed is 1ms. • 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 199, 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

Even if the resolutions differ between the L60AD4, L60ADVL8, or L60ADIL8 and a Q-series A/D converter module, the scaling function enables the program to be applied from the Q-series A/D converter module to any of them.

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.
- The resolution of the Q64ADH and L60AD4 is the same. Using the scaling function is not necessary.

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Appendix 9 When Using GX Developer or GX Configurator-AD

Appendix 9 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 9.1 Operation of GX Developer

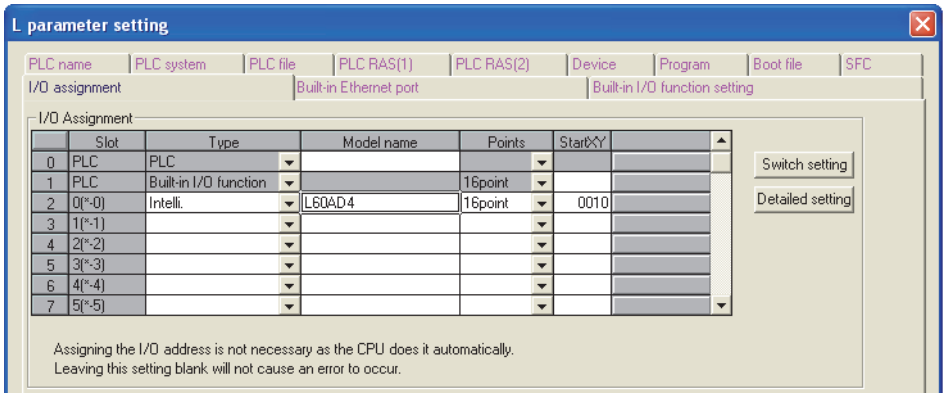
Configure the setting on the following screen when using GX Developer.

Screen name	Application	Reference
I/O assignment	Set the type of module to be installed and the range of I/O signal.	Page 263, Appendix 9.1 (1)
Switch setting	Configure the switch setting of an intelligent function module.	Page 264, Appendix 9.1 (2)
Offset/gain setting	Configure the setting when using the user range setting for the input range.	Page 63, Section 7.5.2

(1) I/O assignment

Configure the setting from "I/O assignment" in "PLC parameter".

Parameter⇨[PLC parameter]⇨[I/O assignment]

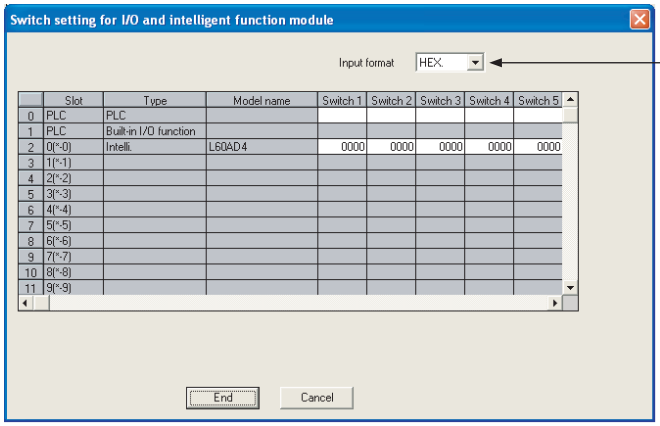


Item	Description
Type	Select "Intelli.".
Model name	Enter the model name of the A/D converter module.
Points	Select "16 point".
Start XY	Enter a desired start I/O number of the A/D converter module.

(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.



Item	Setting item			
Switch 1	Common	Input range setting (CH1 to CH4) □□□□ H CH4 CH3 CH2 CH1	Analog input range	Input range setting
			4 to 20mA	0H*2
			0 to 20mA	1H
			1 to 5V	2H
			0 to 5V	3H
Switch 2	ADVL8 ADIL8	Input range setting (CH5 to CH8)*3 □□□□ H CH8 CH7 CH6 CH5	-10 to 10V	4H
			0 to 10V	5H
			4 to 20mA (Extended mode)	AH
			1 to 5V (Extended mode)	BH
			User range setting	FH
Switch 3	—	0: Fixed (blank)		
Switch 4	Common	□□□□ H Fixed to 000H 0H : Normal (A/D converter processing) mode 1H to FH (A value other than 0H) *1 : Offset/gain setting mode		
Switch 5	—	0: Fixed (blank)		

*1 The operation is the same when any value within the setting range is set.

*2 When 0H is set for the L60ADVL8, the operation with the setting 5H (analog input range of 0 to 10V) is applied.

*3 For the L60AD4, set 0000H.

(a) Setting range of the input range setting by modules

The setting range of the input range setting differs depending on the model of the A/D converter module.

Model name	Setting range
L60AD4	0H to 5H, AH, BH, FH
L60ADVL8	0H, 2H to 5H, BH, FH
L60ADIL8	0H, 1H, AH, FH

Appendix 9.2 Operation of GX Configurator-AD

When setting the L60AD4 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.

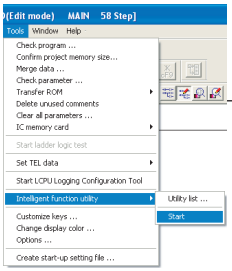
Point

- GX Configurator-AD does not support the L60ADVL8 or L60ADIL8. To set the parameter of the L60ADVL8 or L60ADIL8, use GX Works2.
- Setting of contents added to the L60AD4 cannot be configured when the upper 5 digits of product information are 13041 or later. Set by programming. Other setting contents are the same as those of GX Works2. (Page 53, CHAPTER 7)

When using GX Configurator-AD, configure the settings on the following screens.

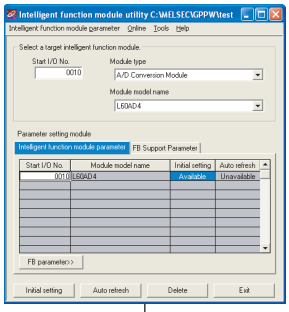
Screen name	Application
Initial setting	This setting configures the settings such as A/D conversion enable/disable setting.
Auto refresh setting	This setting transfers data in the buffer memory to specified devices.
Monitor/test	This function enables the user to monitor/test the buffer memory and I/O 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



[Tools] - [Intelligent function utility] - [Start]

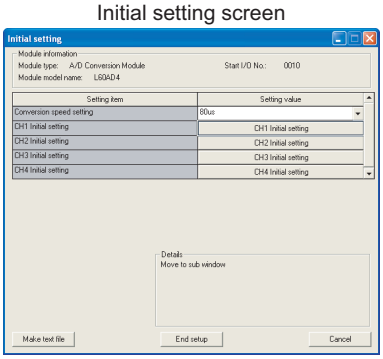
Screen for selecting a target intelligent function module



1)

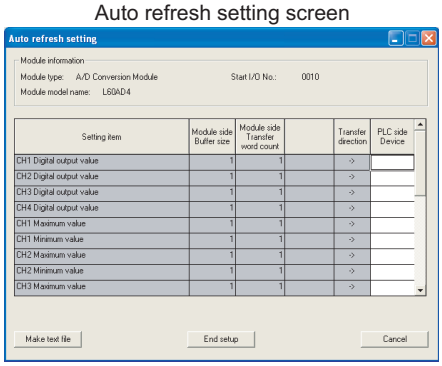
Initial setting

Initial setting screen



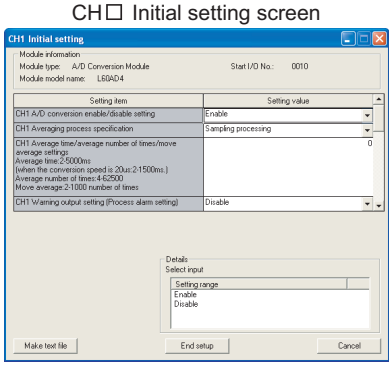
Auto refresh

Auto refresh setting screen



CH☐ Initial setting

CH☐ Initial setting screen



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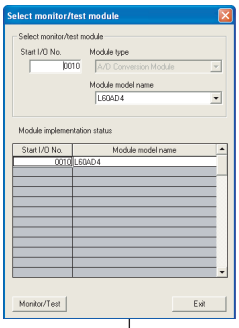
1)

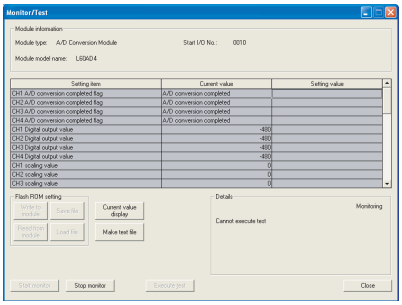
[Online] - [Monitor/Test]

Select monitor/test module screen

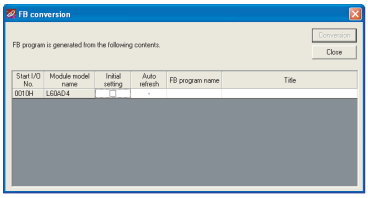


Select a module to be monitored/tested.

Monitor/Test screen



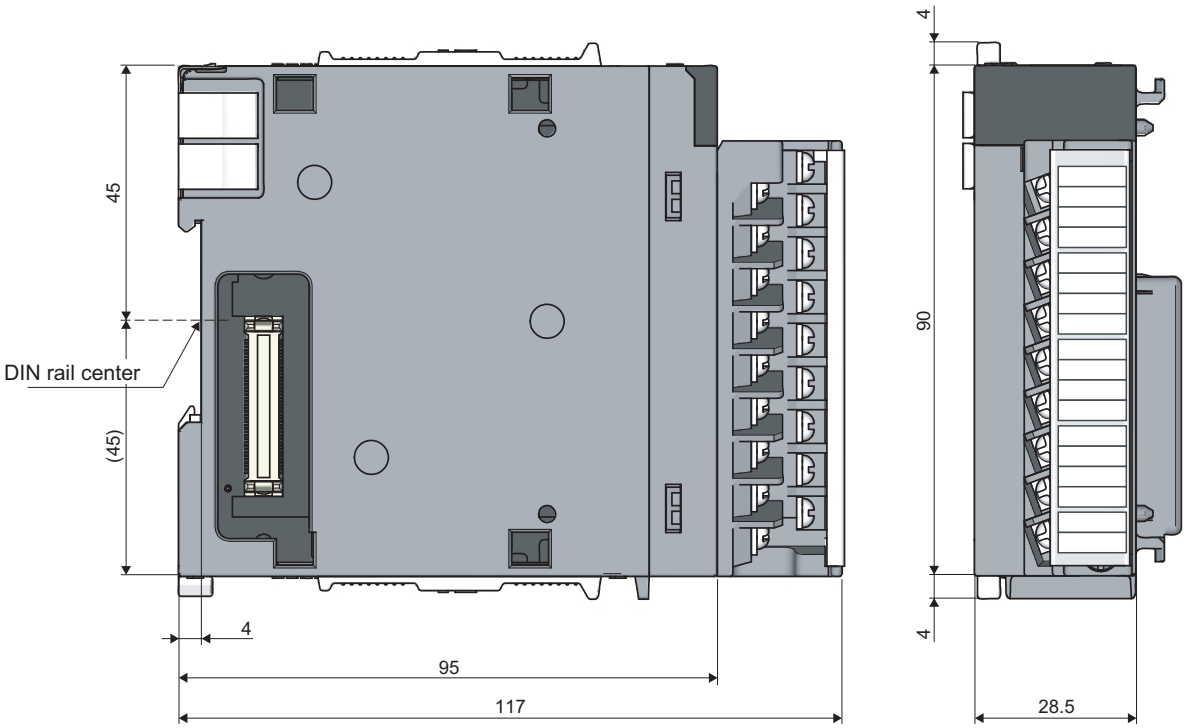
FB conversion screen



Appendix 10 External Dimensions

The following shows the external dimensions of A/D converter module.

(1) L60AD4, L60ADVL8, L60ADIL8



(Unit: mm)

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REVISIONS

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

Print date	*Manual number	Description
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June 2015	SH(NA)-080899ENG-F	Partial correction Appendix 2

Japanese manual version SH-080877-F

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

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

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MODEL CODE: 13JZ42

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