

Analog-Digital Converter
Module

User's Manual

MITSUBISHI



Mitsubishi Programmable
Logic Controller

MELSEC-Q

Q64AD

Q68ADV

Q68ADI

SW0D5C-QADU-E

• SAFETY PRECAUTIONS •

(Always read these instructions before using this equipment.)

Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.

The instructions given in this manual are concerned with this product. For the safety instructions of the programmable controller system, please read the CPU module user's manual.


In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".



Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.



Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Note that the  CAUTION level may lead to a serious consequence according to the circumstances. Always follow the instructions of both levels because they are important to personal safety.

Please store this manual in a safe place and make it accessible when required. Always forward it to the end user.

[DESIGN PRECAUTION]

DANGER

- Do not write data into the "system area" of the buffer memory of intelligent function modules. Also, do not use any "prohibited to use" signals as an output signal to an intelligent function module from the PLC CPU.
Writing data into the "system area" or outputting a signal for "prohibited to use" may cause a PLC system malfunction.

CAUTION

- Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
They should be installed 100mm(3.9inch) or more from each other.
Not doing so could result in noise that may cause malfunction.

[INSTALLATION PRECAUTIONS]

CAUTION

- Use in an environment that meets the general specifications contained in the user's manual of the CPU module.
Using this PLC in an environment outside the range of the general specifications may cause electric shock, fire, malfunction, and damage to or deterioration of the product.
- When installing the module, securely insert the module fixing tabs into the mounting holes of the base unit while pressing the installation lever located at the bottom of the module downward. Improper installation may result in malfunction, breakdown or the module coming loose and dropping.
Securely fix the module with screws if it is subject to vibration during use.
- Tighten the screws within the range of specified torque.
If the screws are loose, it may cause the module to fallout, short circuits, or malfunction.
If the screws are tightened too much, it may cause damage to the screw and/or the module, resulting in fallout, short circuits or malfunction.
- Switch all phases of the external power supply off when mounting or removing the module.
Not doing so may cause damage to the module.
- Do not directly touch the conductive area or electronic components of the module.
Doing so may cause malfunction or failure in the module.

[WIRING PRECAUTIONS]

CAUTION

- Always ground the FG terminal for the PLC.
There is a risk of electric shock or malfunction.
- When turning on the power and operating the module after wiring is completed, always attach the terminal cover that comes with the product.
There is a risk of electric shock if the terminal cover is not attached.
- Tighten the terminal screws within the range of specified torque.
If the terminal screws are loose, it may result in short circuits or malfunction.
If the terminal screws are tightened too much, it may cause damage to the screw and/or the module, resulting in short circuits or malfunction.
- Be careful not to let foreign matter such as sawdust or wire chips get inside the module.
They may cause fires, failure or malfunction.
- The top surface of the module is covered with protective film to prevent foreign objects such as cable offcuts from entering the module when wiring.
Do not remove this film until the wiring is complete.
Before operating the system, be sure to remove the film to provide adequate ventilation.

[STARTING AND MAINTENANCE PRECAUTIONS]

CAUTION

- Do not disassemble or modify the modules.
Doing so could cause failure, malfunction injury or fire.
- Switch all phases of the external power supply off when mounting or removing the module.
Not doing so may cause failure or malfunction of the module.
- Do not touch the connector while the power is on.
Doing so may cause malfunction.
- Switch all phases of the external power supply off when cleaning or retightening the terminal screws and module installation screws.
Not doing so may cause failure or malfunction of the module.
If the screws are loose, it may cause the module to fallout, short circuits, or malfunction.
If the screws are tightened too much, it may cause damages to the screws and/or the module, resulting in the module falling out, short circuits or malfunction.

[DISPOSAL PRECAUTIONS]

CAUTION

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

REVISIONS

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

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INTRODUCTION

Thank you for purchasing the MELSEC-Q series PLC.

Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Q series PLC you have purchased, so as to ensure correct use.

Please forward a copy of this manual to the end user.

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Conformation to the EMC Directive and Low Voltage Instruction

For details on making Mitsubishi PLC conform to the EMC directive and low voltage instruction when installing it in your product, please see Chapter 3, "EMC Directive and Low Voltage Instruction" of the PLC CPU User's Manual (Hardware).

The CE logo is printed on the rating plate on the main body of the PLC that conforms to the EMC directive and low voltage instruction.

About the Generic Terms and Abbreviations

Unless otherwise specified, this manual uses the following general terms and abbreviations.

Abbreviation/general terms	Description of the abbreviation/general terms
A/D conversion module	General term for Q64AD, Q68ADI, Q68ADV
Personal computer	IBM PC/AT or upwardly compatible computer with Windows 95 or higher installed.
GPPW	Abbreviation of the GPP Function Software Package for Windows (Products after SW4D5C-GPPW-E)
QCPU (Q mode)	General term for Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU
Windows	General term for Microsoft Windows 95 (Japanese version), Windows 98 (Japanese version) and Windows NT Workstation 4.0 (Japanese version)

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Product Structure

The product structure of this product is given in the table below.

Manual Name	Product name	Quantity
Q64AD	Q64AD Model Analog-Digital Conversion Module	1
Q68ADV	Q68ADV Model Analog -Digital Conversion Module	1
Q68ADI	Q68ADI Model Analog -Digital Conversion Module	1
SW0D5C-QADU-E	Utility package for SW0D5C-QADU-E Model A/D Conversion Module	1
	SW0D5F-QADKEY-E Model License-key diskette	1

1 OVERVIEW

This User's Manual describes the specifications, handling and programming methods for the Q64AD analog-digital conversion module (hereinafter referred to as the Q64AD), Q68ADV analog-digital conversion module (hereinafter referred to as the Q68ADV), and Q68ADI analog-digital conversion module (hereinafter referred to as the Q68ADI), which are used in conjunction with MELSEC-Q Series CPUs. In this manual, the Q64AD, Q68ADV, and Q68ADI are collectively referred to as the A/D conversion modules.

1.1 Features

- (1) Select the type of module according to the application.
 - Q64AD 4 channels, where the voltage input or current input can be selected for each channel.
 - Q68ADV 8 channels, all of which are voltage input.
 - Q68ADI 8 channels, all of which are current input.
- (2) High speed conversion
Conversion is performed at a high speed of 80 μ s/channel. Also, the temperature drift compensation function can be performed using a processing time of "conversion time for all channels + 160 μ s".
- (3) High degree of accuracy
The degree of accuracy for the conversion process is $\pm 0.1\%$ (When the ambient temperature is 25 ± 5 °C).
- (4) Changing the input range
Input range *1 change can easily be set using GPPW function software package (hereinafter referred to as GPPW).
*1: Input range refers to the type of offset/gain settings. The most frequently used range is set as the default but the user can also set the offset/gain.
- (5) Easy settings using the utility package
A utility package is sold separately (SW0D5C-QADU-E).
The utility package is not a required item. However, it can be used to set initial settings and automatic refresh settings on screen, reduce sequence programs, and check settings and operating status.

2 SYSTEM CONFIGURATION

2.1 Applicable Systems

The A/D conversion modules can be used with the following systems.

(1) Applicable CPU modules

The module can be used with a CPU module that operates in Q mode. Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU and Q25HCPU

(2) Number of modules that can be used in one system

There is no limit in the number of modules that can be used, as long as the number of I/O points is within the range allowed for the CPU used.

(3) Loading slot

The module can be loaded in any slot position in the standard base or expansion base.

However, a power shortage may occur depending on the combination with other installed modules and the number of modules used, so always take into consideration the power supply capacity when installing modules.

(4) Software packages supported

The following are software packages supported by the A/D conversion modules.

Item name	Model	Remarks
GPPW function software package	SW4D5C-GPPW-E	Required SW3D5C-GPPW-E or earlier packages cannot be used.
Utility package for the A/D conversion module	SW0D5C-QADU-E	Enables easy initial settings.

3 SPECIFICATIONS

3.1 Performance Specifications

3.1.1 Performance specifications list

Table 3.1 shows the performance specifications of the A/D conversion modules.

Table 3.1 Performance specifications

Model name		Q64AD	Q68ADV	Q68ADI																					
Item																									
Analog input points		4 points (4 channels)	8 points (8 channels)	8 points (8 channels)																					
Analog input	Voltage	-10 to 10 V DC (Input resistance value 1M Ω)		—																					
	Current	0 to 20 mA DC (input resistance value 250 Ω)	—	0 to 20 mA DC (input resistance value 250 Ω)																					
Digital output		-4096 to 4095																							
I/O characteristics, Maximum resolution		<table border="1"> <thead> <tr> <th>Input</th> <th>Analog input range</th> <th>Maximum resolution</th> <th>Digital output value</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Voltage</td> <td>0 to 10 V</td> <td>2.5 mV</td> <td rowspan="3">0 to 4000</td> </tr> <tr> <td>0 to 5 V</td> <td>1.25 mV</td> </tr> <tr> <td>1 to 5 V</td> <td>1.0 mV</td> </tr> <tr> <td rowspan="3">Current</td> <td>-10 to 10 V</td> <td>2.5 mV</td> <td>-4000 to 4000</td> </tr> <tr> <td>0 to 20 mA</td> <td>5 μ A</td> <td rowspan="2">0 to 4000</td> </tr> <tr> <td>4 to 20 mA</td> <td>4 μ A</td> </tr> </tbody> </table>			Input	Analog input range	Maximum resolution	Digital output value	Voltage	0 to 10 V	2.5 mV	0 to 4000	0 to 5 V	1.25 mV	1 to 5 V	1.0 mV	Current	-10 to 10 V	2.5 mV	-4000 to 4000	0 to 20 mA	5 μ A	0 to 4000	4 to 20 mA	4 μ A
		Input	Analog input range	Maximum resolution	Digital output value																				
		Voltage	0 to 10 V	2.5 mV	0 to 4000																				
			0 to 5 V	1.25 mV																					
			1 to 5 V	1.0 mV																					
		Current	-10 to 10 V	2.5 mV	-4000 to 4000																				
0 to 20 mA	5 μ A		0 to 4000																						
4 to 20 mA	4 μ A																								
Accuracy (Full scale accuracy)	Ambient temperature 25 \pm 5 $^{\circ}$ C	\pm 0.1 %																							
	Ambient temperature 0 to 55 $^{\circ}$ C	With temperature drift compensation : \pm 0.3 % With no temperature drift compensation : \pm 0.4 %																							
Conversion speed		80 μ s/channel (When there is temperature drift, the time calculated by adding 160 μ s will be used regardless of the number of channels used)																							
Absolute maximum input		Voltage : \pm 15 V Current : \pm 30 mA																							
Insulation method		Between the I/O terminal and PLC power supply : Photocoupler insulation Between channels : Non-insulated																							
Number of occupied points		16 points																							
Connection terminals		18-point terminal block																							
Applicable wire size		0.3 to 0.75 mm ²																							
Applicable solderless terminal		R1.25-3 (A solderless terminal with sleeve cannot be used)																							
Internal current consumption (5 V DC)		0.63 A	0.64 A	0.64 A																					
Weight		0.18 kg	0.19 kg	0.19 kg																					

REMARK

See the user's manual for the CPU module being used for general specifications of the A/D conversion modules.

3.1.2 I/O conversion characteristic

The I/O conversion characteristic represents the angle formed by a straight line connecting the "offset value" and "gain value" when the analog signals (voltage or current input) from outside the PLC are converted to digital values.

Offset value

The offset value denotes the analog input value (voltage or current) that makes the digital output value 0.

Gain value

The gain value denotes the analog input value (voltage or current) that makes the digital output value 4000.

(1) Voltage input characteristic

A voltage input characteristic graph is shown in Figure 3.1.

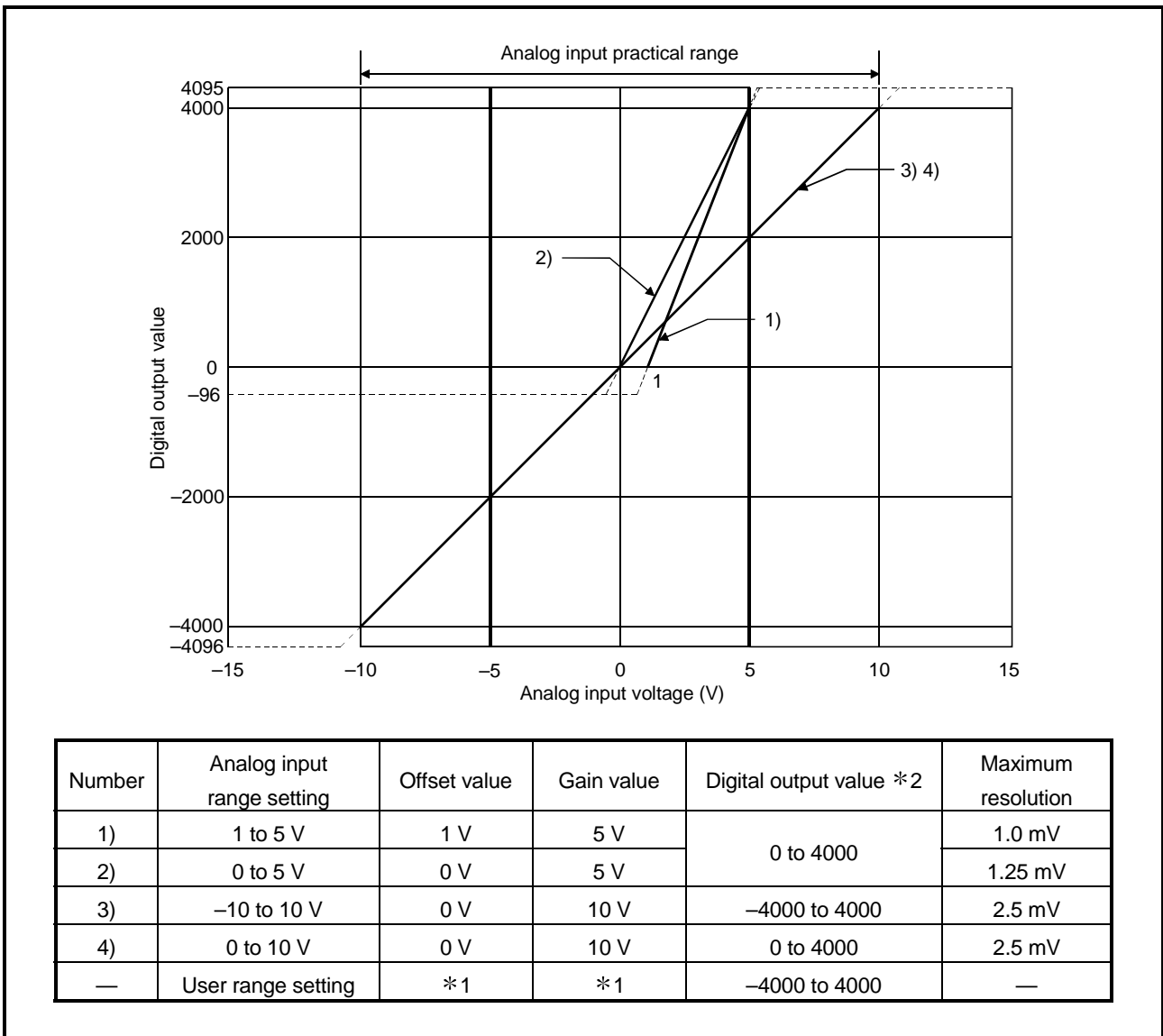


Figure 3.1 Voltage input characteristic

POINT

- (1) Do not input an analog input voltage of more than ± 15 V. The input elements may be damaged.
- (2) Set the offset/gain values for the user setting range *1 within a range in which the following conditions are satisfied.
 $\{ (\text{Gain value}) - (\text{Offset value}) \} > 1.5 \text{ V}$
- (3) When an analog value that exceeds the range for the digital output value *2 is entered, the digital output value will be fixed at the maximum or minimum value.
 - For 0 to 4000, the range for the digital output value is from -96 to 4095.
 - For -4000 to 4000, the range for the digital output value is from -4096 to 4095.

(2) Current input characteristic

A current input characteristic graph is shown in Figure 3.2.

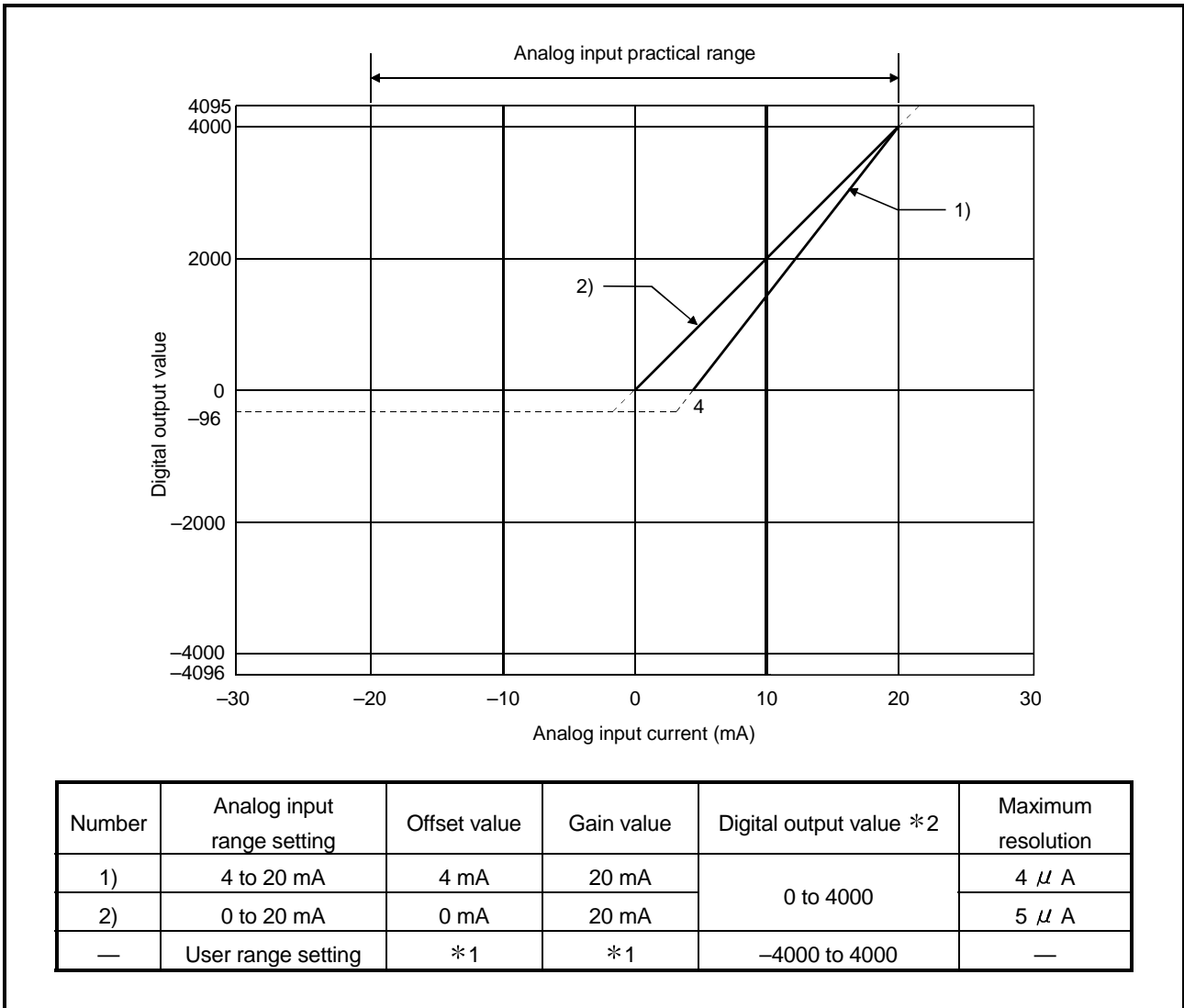


Figure 3.2 Current input characteristic

POINT
(1) Do not input an analog input current of more than ± 30 mA. A breakdown may result due to overheating.
(2) Set the offset/gain values for the user setting range *1 within a range in which the following conditions are satisfied. $\{ (\text{Gain value}) - (\text{Offset value}) \} > 5.5 \text{ mA}$
(3) When an analog value that exceeds the range of the digital output value *2 is entered, the digital output value will be fixed at the maximum or minimum value. <ul style="list-style-type: none"> For 0 to 4000, the range for the digital output value is from -96 to 4095.

3.1.3 Accuracy

Accuracy is expressed as a full-scale value.

For example, the accuracy is $\pm 0.1\%$ (± 4 for digital output value) when the module is used in an ambient temperature of 25 ± 5 °C, and $\pm 0.3\%$ (± 12 for digital output value) in an ambient temperature of 0 to 55 °C with temperature drift compensation function.

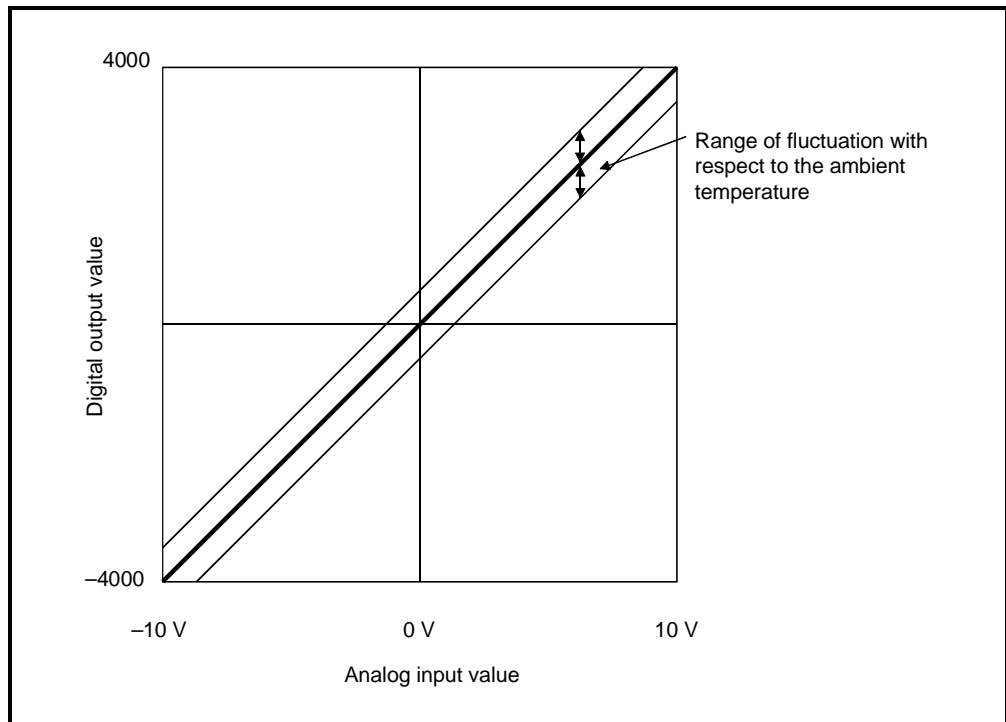


Figure 3.3 Accuracy

3.2 Function List

Table 3.2 shows the function list of the A/D conversion modules.

Table 3.2 Function list

Item	Function	Reference section
A/D conversion enable/disable setting	(1) Specifies whether to enable or disable the A/D conversion for each channel. (2) By disabling the conversion for the channels that are not used, the sampling time can be shortened.	Section 3.4.2
A/D conversion method	(1) Sampling processing The A/D conversion for analog input values is performed successively for each channel, and the digital output value is output upon each conversion. (2) Averaging processing For each channel, A/D conversion values are averaged for the set number of times or set amount of time, and the average value is output as a digital value.	Section 3.2.1
Maximum and minimum values hold function	(1) The maximum and minimum values of the digital output values is retained in the module.	Section 3.2.2
Temperature drift compensation function	(1) Errors arising from changes in the ambient temperature of the module are automatically compensated for to improve conversion accuracy. (2) The temperature drift compensation function can be performed at (A/D conversion time for all channels) + 160 μ s.	—

3.2.1 A/D conversion methods

There are two A/D conversion methods, sampling processing and averaging processing.

(1) Sampling processing

A/D conversion is performed successively for the analog input value, and the converted digital output values are stored in the buffer memory.

The sampling processing time depends on the number of channels used (the number of channels set to A/D conversion enable) and whether the temperature drift compensation function is available.

(a) Without the temperature drift compensation function

$$(\text{Processing time}) = (\text{Number of channels used}) \times 80 (\mu \text{ s}/1 \text{ channel})$$

(b) With the temperature drift compensation function

$$(\text{Processing time}) = (\text{Number of channels used}) \times 80 (\mu \text{ s}/1 \text{ channel}) + 160 \mu \text{ s}$$

[Example]

When three channels (channels 1, 2 and 4) are A/D conversion enabled with the temperature drift compensation function, the sampling processing time is 400 μ s.

$$3 \times 80 + 160 = 400 (\mu \text{ s})$$

(2) Averaging processing

For channels for which averaging processing is specified, A/D conversion is performed for the set number of times or the set amount of time. The average value is calculated from the sum of values excluding the maximum and minimum values, and then stored in the buffer memory.

(a) When averaging processing is specified for the set amount of time

1) The number of processing repetitions within the set time differs according to the number of channels used (number of channels for which A/D conversion is enabled) and whether or not temperature-drift compensation is used.

- Without the temperature drift compensation function

$$\text{(Number of processing repetitions)} = \frac{\text{(Set time)} \times 1000}{\text{(Number of channels used)} \times 80 (\mu \text{ s/1 channel})}$$

- With the temperature drift compensation function

$$\text{(Number of processing repetitions)} = \frac{\text{(Set time)} \times 1000}{\text{(Number of channels used)} \times 80 (\mu \text{ s/1 channel}) + 160}$$

[Example]

When averaging processing is performed with four channels (channels 1, 2, 3, and 4) for the set time of 50 ms with the temperature drift compensation function on, measurement is performed 104 times and the average value is output.

$$\frac{50 \times 1000}{(4 \times 80) + 160} = 104.17 \text{ (times)} \dots\dots \text{Round down the number.}$$

2) When 7 or 8 channels are used with the temperature drift compensation function on, set the average time to 3 ms or more.

If the time is set to 2 ms or less, the average number of times becomes less than 3 and it causes the digital output value to become 0 since a sum excluding the maximum and minimum values will be averaged.

(b) When the averaging processing is specified for the set number of times

The time required to store the average value calculated using the average number of times in the buffer memory differs according to the number of channels used (the number of channels set to A/D conversion enable) and whether or not the temperature drift compensation is used.

1) Without the temperature drift compensation function

$$\text{(Processing time)} = \text{(Set number of times)} \times \frac{\{(\text{Number of channels used}) \times 80\}}{1000} \quad \text{(Unit: ms)}$$

2) With the temperature drift compensation function

$$\text{(Processing time)} = \text{(Set number of times)} \times \frac{\{[(\text{Number of channels used}) \times 80] + 160\}}{1000} \quad \text{(Unit: ms)}$$

[Example]

When averaging processing is performed with four channels (1, 2, 3 and 4) for the set number of 100 times with temperature-drift compensation on, an average value is output every 48 ms.

$$100 \times \{(4 \times 80) + 160\} \div 1000 = 48 \text{ (ms)}$$

3.2.2 Maximum and minimum values hold function

- (1) The maximum and minimum digital output values for each channel are stored in buffer memory addresses 30 to 45 (Un\G30 to Un\G45).
- (2) When the operating condition setting completed flag (X09) turns OFF, the values are cleared to 0 and new maximum and minimum values are stored when conversion begins.
- (3) Since the area for storing the maximum and minimum values can be rewritten with the sequence program, the maximum and minimum values within a specific period of time can be checked.

3.3 I/O Signals for the PLC CPU

3.3.1 List of I/O signals

Table 3.3 shows a list of the I/O signals for the A/D conversion modules.

Table 3.3 List of I/O signal

Signal direction CPU ← A/D conversion module		Signal direction CPU → A/D conversion module	
Device No. (Input)	Signal name	Device No. (Output)	Signal name
X00	Module READY	Y00	Use prohibited *1
X01	Temperature drift compensation flag	Y01	
X02	Use prohibited *1	Y02	
X03		Y03	
X04		Y04	
X05		Y05	
X06		Y06	
X07		Y07	
X08		Y08	
X09		Operating condition setting completed flag	
X0A	Offset/gain setting mode flag	Y0A	User range write request
X0B	Channel change completed flag	Y0B	Channel change request
X0C	Use prohibited *1	Y0C	Use prohibited *1
X0D		Y0D	Maximum value/minimum value reset request
X0E	A/D conversion completed flag	Y0E	Use prohibited *1
X0F	Error flag	Y0F	Error clear request

POINT

*1 These signals cannot be used by the user since they are for system use only. If these are turned ON/OFF by the sequence program, the functioning of the A/D conversion module cannot be guaranteed.

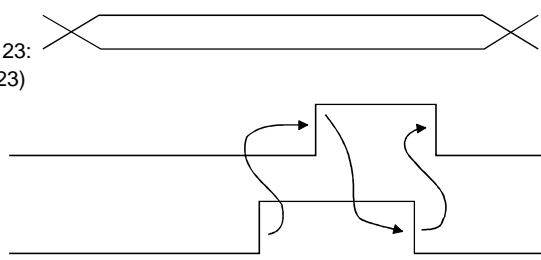
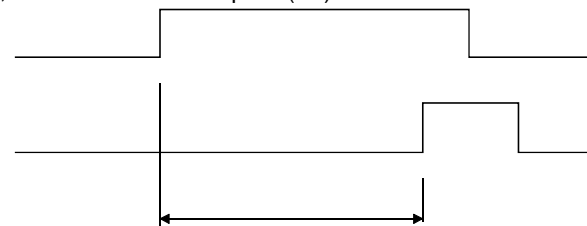
3.3.2 Details of I/O signals

I/O signals for the A/D conversion modules are explained in detail below.

(1) Input signals

Device No.	Signal Name	Description
X0	Module READY	<p>(1) When the PLC CPU is powered on or reset, this signal turns on once the preparation for A/D conversion has been completed, and A/D conversion processing is then performed.</p> <p>(2) When the Module READY signal is off, A/D conversion processing is not performed. Module READY (X0) turns off in the following situations:</p> <ul style="list-style-type: none"> • During offset/gain setting mode • When the A/D conversion module has a watchdog timer error *1
X1	Temperature drift compensation flag	<p>(1) When A/D conversion processing is being performed with the temperature drift compensation function on, the flag indicating temperature drift compensation status (X1) turns ON.</p>
X9	Operating condition setting completed flag	<p>(1) This is used as an interlock condition for turning the operating condition setting request (Y9) ON/OFF when the setting for A/D conversion enable/disable (buffer memory address 0: Un\G0) is changed.</p> <p>(2) When the operating condition setting completed flag (X9) is OFF, A/D conversion processing is not performed. Under the following conditions, the operating condition setting completed flag (X9) turns OFF.</p> <ul style="list-style-type: none"> • When Module READY (X0) is OFF • When operating condition setting request (Y9) is ON <p>The diagram shows four signals over time: Module READY (X0), Operating condition setting completed (X9), Operating condition change request (Y9), and A/D conversion completed (XE). X0 is initially ON, then turns OFF. X9 is initially ON, then turns OFF when X0 turns OFF. Y9 is initially OFF, then turns ON. XE is initially OFF, then turns ON when Y9 turns ON. Arrows indicate that X0 and X9 are inputs to the logic, and Y9 and XE are outputs.</p>
XA	Offset/gain setting mode flag	<p>(1) This is used as an interlock condition for setting the offset/gain request (YA) to ON/OFF when registering the value after adjustment of the offset/gain settings have been completed.</p> <p>(2) See Section 4.6 regarding the offset/gain settings.</p> <p>The diagram shows three signals over time: Module READY (X0), Offset/gain setting mode flag (XA), and User range write request (YA). X0 is initially ON, then turns OFF. XA is initially OFF, then turns ON when X0 turns OFF. YA is initially OFF, then turns ON when XA turns ON. Arrows indicate that X0 and XA are inputs to the logic, and YA is an output.</p>

*1 A watchdog timer error occurs when the program calculations are not completed within the scheduled time due to malfunctions of A/D conversion module hardware. When a watchdog timer error occurs, the RUN LED for the A/D conversion module turns off.

Device No.	Signal name	Description
XB	Channel change completed flag	<p>(1) This is used as an interlock condition for setting the channel change request (YB) to ON/OFF when changing the channel for which the offset/gain settings are to be performed.</p> <p>(2) See Section 4.6 regarding the offset/gain settings.</p> <p>Offset/gain setting mode Offset/gain specifications (buffer memory addresses 22 and 23: Un\G22 and Un\G23)</p>  <p>Channel change completed flag (XB)</p> <p>Channel change request (YB)</p>
XE	A/D conversion completed flag	<p>(1) This turns ON when conversion for all of the channels that are conversion enabled has been completed.</p>
XF	Error flag	<p>(1) The error flag turns ON when a write error occurs.</p> <p>(2) To clear the error code, set the error clear request (YF) to ON.</p>  <p>Error flag (XF)</p> <p>Error clear request (YF)</p> <p>The error code is read during this interval.</p>

(2) Output signals

Device No.	Signal name	Description
Y9	Operating condition setting request	(1) This turns ON when A/D conversion is enabled/disabled, or when averaging processing specification, the settings for the average time or number of times (when averaging processing is specified) is enabled. (2) See the X9 column for ON/OFF timing.
YA	User range write request	(1) This turns ON when the value for the adjusted offset/gain settings are registered in the A/D conversion module. (2) See the XA column for ON/OFF timing. See Section 4.6 for offset/gain settings.
YB	Channel change request	(1) This turns ON when changing the channel for which offset/gain settings are to be performed. (2) See the XB column for ON/OFF timing. See Section 4.6 for offset/gain settings.
YD	Maximum value/minimum value reset request	(1) The maximum and minimum values stored in buffer memory addresses 30 to 45 (Un\G30 to Un\G45) are cleared by setting the maximum and minimum value reset request (YD) to ON.
YF	Error clear request	(1) This turns ON when a write error is cleared. (2) See the XF column for ON/OFF timing.

3.4 Buffer Memory

3.4.1 Buffer memory assignment

The following explanation is based on the Q68ADV and Q68ADI with eight channel analog input (CH1 to CH8).

Table 3.4 Buffer memory assignment

Address		Description	R/W * 2	Address		Description	R/W
Hexadecimal	Decimal			Hexadecimal	Decimal		
0 _H	0	A/D conversion enable/disable setting	R/W	18 _H	24	System area	—
1 _H	1	CH1 Average time/average number of times	R/W	19 _H	25		
2 _H	2	CH2 Average time/average number of times	R/W	1A _H	26		
3 _H	3	CH3 Average time/average number of times	R/W	1B _H	27		
4 _H	4	CH4 Average time/average number of times	R/W	1C _H	28		
5 _H	5	CH5 Average time/average number of times * 1	R/W	1D _H	29		
6 _H	6	CH6 Average time/average number of times * 1	R/W	1E _H	30	CH1 Maximum value	R/W
7 _H	7	CH7 Average time/average number of times * 1	R/W	1F _H	31	CH1 Minimum value	R/W
8 _H	8	CH8 Average time/average number of times * 1	R/W	20 _H	32	CH2 Maximum value	R/W
9 _H	9	Averaging process setting	R/W	21 _H	33	CH2 Minimum value	R/W
A _H	10	A/D conversion completed flag	R	22 _H	34	CH3 Maximum value	R/W
B _H	11	CH1 Digital output value	R	23 _H	35	CH3 Minimum value	R/W
C _H	12	CH2 Digital output value	R	24 _H	36	CH4 Maximum value	R/W
D _H	13	CH3 Digital output value	R	25 _H	37	CH4 Minimum value	R/W
E _H	14	CH4 Digital output value	R	26 _H	38	CH5 Maximum value * 1	R/W
F _H	15	CH5 Digital output value * 1	R	27 _H	39	CH5 Minimum value * 1	R/W
10 _H	16	CH6 Digital output value * 1	R	28 _H	40	CH6 Maximum value * 1	R/W
11 _H	17	CH7 Digital output value * 1	R	29 _H	41	CH6 Minimum value * 1	R/W
12 _H	18	CH8 Digital output value * 1	R	2A _H	42	CH7 Maximum value * 1	R/W
13 _H	19	Error code	R/W	2B _H	43	CH7 Minimum value * 1	R/W
14 _H	20	Setting range (CH1 to CH4)	R	2C _H	44	CH8 Maximum value * 1	R/W
15 _H	21	Setting range (CH5 to CH8) * 1	R	2D _H	45	CH8 Minimum value * 1	R/W
16 _H	22	Offset/gain setting mode Offset specification	R/W				
17 _H	23	Offset/gain setting mode Gain specification	R/W				

*1 When Q64AD is used, buffer memory addresses for CH5 to CH8 become blank.

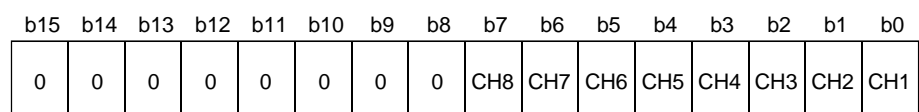
*2 Indicates whether reading and writing to/from a sequence program are enabled.

R : Read enabled

W : Write enabled

3.4.2 A/D conversion enable/disable setting (buffer memory address 0: Un\G0)

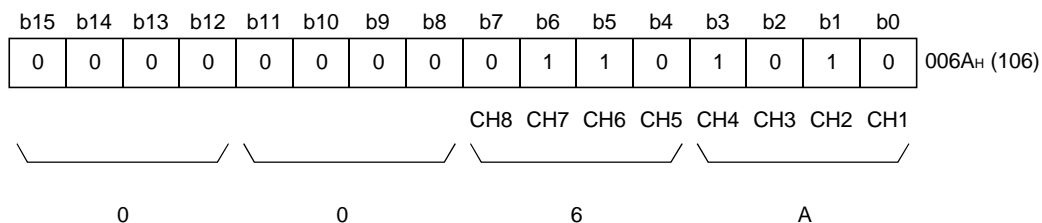
- (1) Sets whether the output of an A/D conversion value is enabled or disabled for each channel.
- (2) It is necessary to set the operating condition setting request (Y9) to ON/OFF in order to enable the A/D conversion enable/disable setting. (See Section 3.2.2.)
- (3) By default, A/D conversion is enabled for all channels.
- (4) In the case of the Q64AD module, b4 to b7 (CH5 to CH8) become invalid.



For the Q64AD, information for b4 to b15 is fixed at 0, and
0 : A/D conversion enabled
for the Q68ADV (I), information for b8 to b15 is fixed at 0.
1 : A/D conversion disabled

Example

When the channels used for A/D conversion are 1, 3, 5 and 8, 006Ah (106) is stored in buffer memory address 0 (Un\G0).

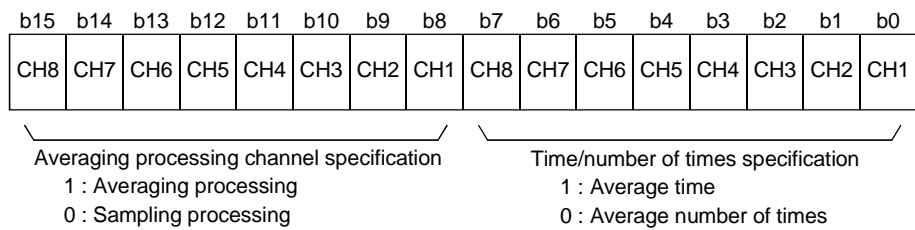


3.4.3 CH□ average time/average number of times (buffer memory addresses 1 to 8: Un\G1 to Un\G8)

- (1) Sets the average time or average number of times for each channel for which averaging processing was specified.
- (2) The setting range is as shown below:
 Averaging processing by the number of times: 4 to 62500
 Averaging processing by time: 2 to 5000 ms
- (3) Zero is set as the default.

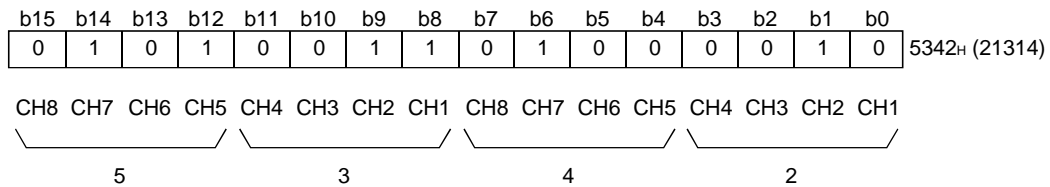
3.4.4 Averaging processing setting (buffer memory address 9: Un\G9)

- (1) When selecting sampling processing or averaging processing, write the setting to buffer memory address 9 (Un\G9).
- (2) When averaging processing is selected, select average time or average number of times.
- (3) By default, sampling processing is set for all channels.
- (4) In the case of the Q64AD module, b4 to b7 and b12 to b15 (CH5 to CH8) are invalid.



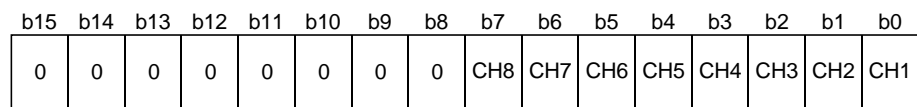
Example

To average channels 1 and 5 for the set number of times and channels 2 and 7 for the set amount of time, and to sample-process other channels, store 5342_H (21314) in buffer-memory address 9 (Un\G9).



3.4.5 A/D conversion completed flag (buffer memory address 10: Un\G10)

- (1) When A/D conversion for the channels enabled for conversion is complete, the A/D conversion completed flag is set to 1. The A/D conversion completed flag (XE) is set to ON when the conversion for all A/D conversion enabled channels is complete.
- (2) When the operating condition setting request (Y9) is set to ON, the flag returns to the default setting of 0 and changes to 1 when A/D conversion is complete.
- (3) In the case of the Q64AD module, b4 to b7 (CH5 to CH8) are invalid.

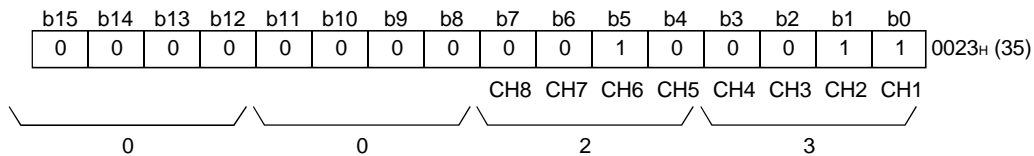


For the Q64AD, information for b4 to b15 is fixed at 0,
and for the Q68AD, information for b8 to b15 is fixed at 0.

1 : A/D conversion completed
0 : A/D conversion in progress
or not used

Example

When A/D conversion is enabled for channels 1, 2 and 6 and all conversions for these channels are complete, 0023H (35) is stored in buffer-memory address 10 (Un\G10).



3.4.6 Digital output values (buffer memory addresses 11 to 18: Un\G11 to Un\G18)

- (1) The digital output values after A/D conversion are stored in the buffer memory addresses from 11 to 18 (Un\G11 to Un\G18) for each channel.
- (2) The digital output values are expressed with 16-bit signed binary values.

3.4.7 Write data error codes (buffer memory address 19: Un\G19)

- (1) The error codes generated by the A/D conversion modules are stored here.
- (2) See Section 7.1 for the details of the error codes.

3.4.8 Setting ranges (buffer memory addresses 20 and 21: Un\G20 and Un\G21)

- (1) These areas are used to confirm the setting ranges of the A/D conversion module.
- (2) The setting values for CH1 to CH4 are stored in buffer memory address 20 (Un\G20) and setting values for CH5 to CH8 are stored in buffer memory address 21 (Un\G21). In the case of the Q64AD module, buffer memory address 21 (Un\G21) is invalid.

	b15 to b12	b11 to b8	b7 to b4	b3 to b0
Un\G20	CH4	CH3	CH2	CH1
Un\G21	CH8	CH7	CH6	CH5

The setting values are as follows.

Input range	Setting value
4 to 20 (mA)	0H
0 to 20 (mA)	1H
1 to 5 (V)	2H
0 to 5 (V)	3H
-10 to 10 (V)	4H
0 to 10 (V)	5H
User range setting	FH

- (3) Default setting is 0.
When the setting for Q68ADV is 0, the analog input range operates between 0 to 10V.
(When the setting is 5H, the analog input range will be the same as above.)

3.4.9 Offset/gain setting mode (buffer memory addresses 22 and 23: Un\G22 and Un\G23)

- (1) Specifies the channel to be adjusted for the offset/gain settings.
- (2) The channel for which the offset is to be adjusted is specified in buffer memory address 22 (Un\G22) and the channel for which the gain is to be adjusted is specified in buffer memory address 23 (Un\G23).
- (3) Although it is possible to set multiple channels at the same time, set the offset and gain separately (buffer memory addresses 22 and 23: Set either Un\G22 or Un\G23 to 0). If both are set at the same time, an offset/gain setting mode error (error code 500) occurs.
- (4) For Q64AD, b4 to b7 (information for CH5 to CH8) are invalid.
- (5) See Section 4.6 for the details of the offset/gain settings.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G22 (Offset specification)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Un\G23 (Gain specification)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

1 : Channel to be set
0 : Invalid

3.4.10 Maximum and minimum values storage area (buffer memory addresses 30 to 45: Un\G30 to Un\G45)

- (1) The maximum and minimum values of the converted digital value for each channel are stored.
- (2) The stored values for all channels will be cleared to 0 when the operating condition setting request (Y9) is set to ON and the setting is changed or when the maximum and minimum values reset request (YD) is set to ON.
- (3) The maximum and minimum values are stored for each sample processing time (measurement), even with channels for which averaging processing is specified.

4 SETUP AND PROCEDURES BEFORE OPERATION

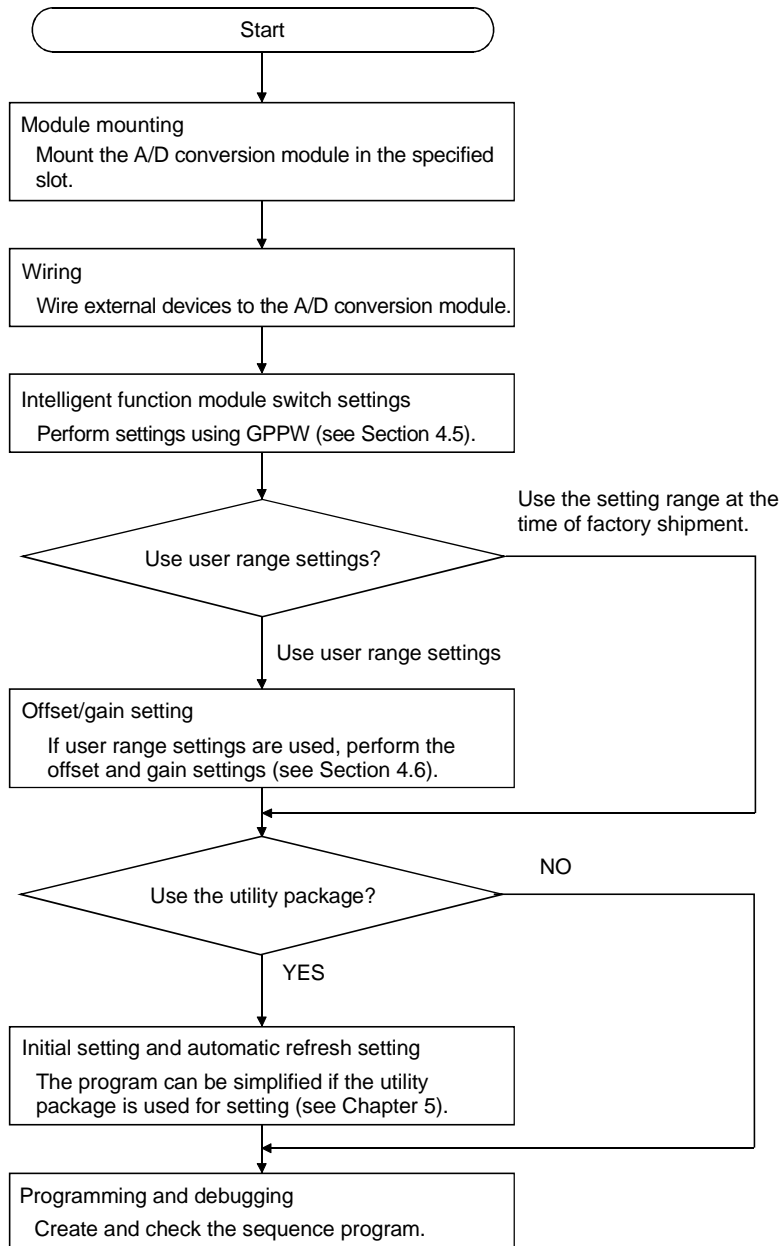
4.1 Handling Precautions

- (1) Do not drop the module or subject it to heavy impact.
- (2) Do not remove the PCB of the module from its case. Doing so may cause the module to fail.
- (3) Be careful not to let foreign particles such as swarf or wire chips enter the module. They may cause a fire, mechanical failure or malfunction.
- (4) The top surface of the module is covered with a protective film to prevent foreign objects such as wire burrs from entering the module during wiring. Do not remove this film until the wiring is complete. Before operating the system, be sure to remove the film to provide adequate ventilation.
- (5) Tighten the terminal screws using torque within the following ranges. Loose screws may cause short circuits, mechanical failures or malfunctions.

Screw location	Clamping torque range
Module mounting screws (M3 screws)	36 to 48 N · cm
Terminal block screws (M3 screws)	42 to 58 N · cm
Terminal block mounting screws (M3.5 screws)	66 to 89 N · cm

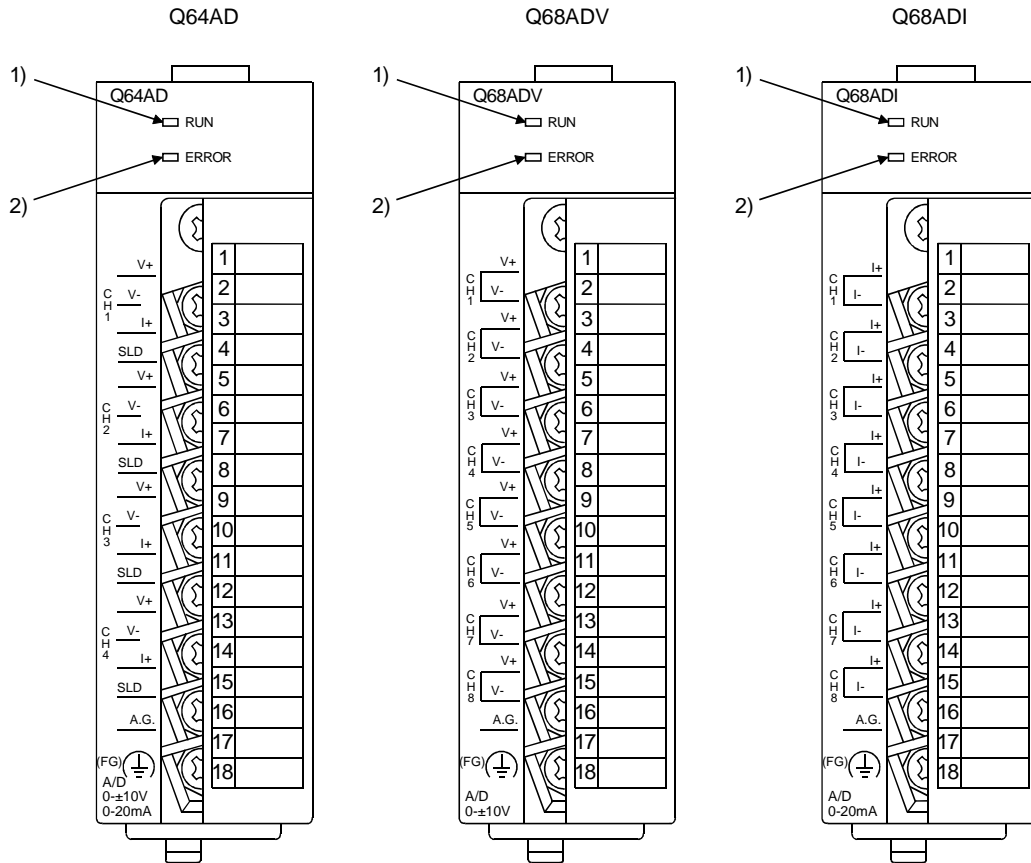
- (6) To mount the module on the base, securely insert the module fastening latch into the fastening hole on the base. Improper installation may result in a module malfunction, or may cause the module to fall off.

4.2 Setup and Procedures before Operation



4.3 Part Identification Nomenclature

The name of each part of the A/D conversion module is listed below.



Number	Name and appearance	Description
1)	RUN LED	Displays the operating status of the A/D conversion module. On : Normal operation Flashing : During offset/gain setting mode Off : 5 V power supply interrupted or watch dog timer error
2)	ERROR LED	Displays the error status of the A/D conversion module. On : Error Off : Normal operation Flashing : Error in switch settings Switch No. 5 of the intelligent function module has been set to a value other than zero "0".

Terminal number	Signal name					
	Q64AD		Q68ADV		Q68ADI	
1	CH1	V +	CH1	V +	CH1	I +
2		V -		V -		I -
3		I +	CH2	V +	CH2	I +
4		SLD		V -		I -
5	CH2	V +	CH3	V +	CH3	I +
6		V -		V -		I -
7		I +	CH4	V +	CH4	I +
8		SLD		V -		I -
9	CH3	V +	CH5	V +	CH5	I +
10		V -		V -		I -
11		I +	CH6	V +	CH6	I +
12		SLD		V -		I -
13	CH4	V +	CH7	V +	CH7	I +
14		V -		V -		I -
15		I +	CH8	V +	CH8	I +
16		SLD		V -		I -
17	A.G. (ANALOG GND)					
18	FG					

4.4 Wiring

The wiring precautions and examples of module connection are provided below.

4.4.1 Wiring precautions

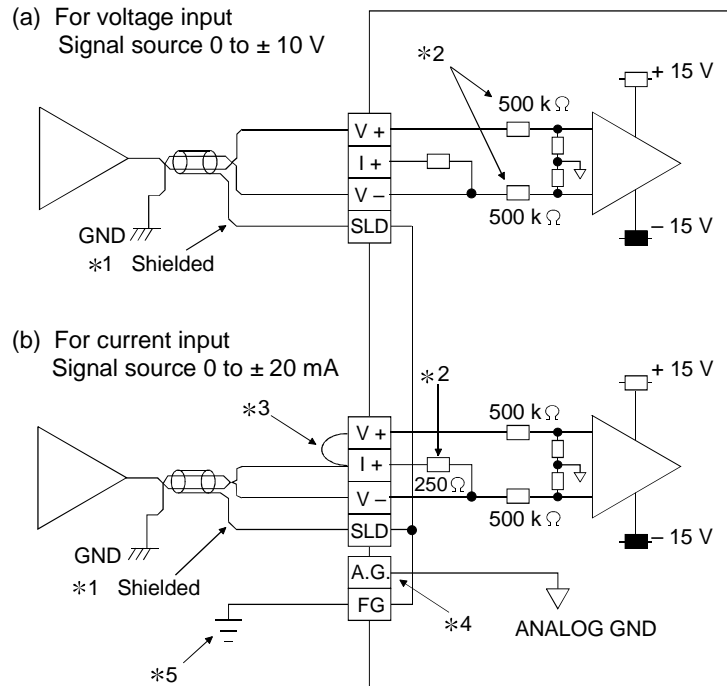
In order to optimize the functions of the A/D conversion module and ensure system reliability, external wiring that is protected from noise is required.

Please observe the following precautions for external wiring:

- (1) Use separate cables for alternating current and external input signals for Q64AD and Q68ADV (I) in order to avoid A/C surges and induction effects.
- (2) Do not mount the cables close to or bundle them with the main circuit line, a high-voltage cable or a load cable from other than the PLC. This may increase the effects of noise, surges and induction.
- (3) Perform an one-point grounding for shielded lines and the shields of sealed cables.
- (4) A solderless terminal with insulating sleeve cannot be used for the terminal block. Covering the cable-connection portion of the solderless terminal with a marked tube or an insulation tube is recommended.

4.4.2 External wiring

(1) Q64AD



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

*2 Shows input resistance of Q64AD.

*3 If current input, always connect to (V +) and (I +) terminals.

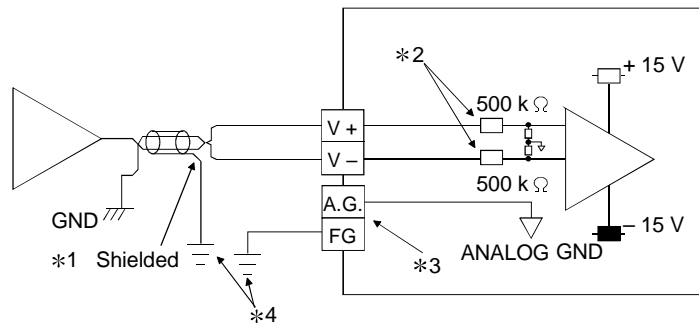
*4 "A.G." terminal does not normally require wiring. However, it can be used as GND for compatible equipment under the following conditions.

(1) When there is a difference in polarity between "A.G." and "GND for compatible equipment".

(2) As an alternative for 0 V input when only the + side is open on a \pm wire.

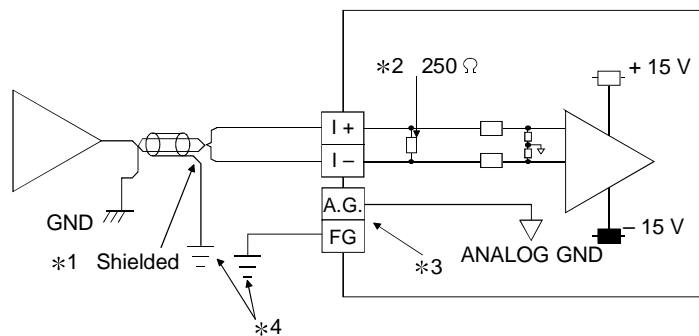
*5 Always use a ground. In addition, ground the FB of the power supply module.

(2) Q68ADV



- *1 Use a twisted two core shielded wire for the power wire.
- *2 Shows input resistance of Q68ADV.
- *3 "A.G." terminal does not normally require wiring. However, it can be used as GND for compatible equipment ground under the following conditions.
 - (1) When there is a difference in polarity between "A.G" and "GND for compatible equipment".
 - (2) As an alternative for 0 V input when only the + side is open on a ± wire.
- *4 Always use a ground. In addition, ground the FB of the power supply module.

(3) Q68ADI



- *1 Use a twisted two core shielded wire for the power wire.
- *2 Shows input resistance of Q68ADI.
- *3 "A.G." terminal does not normally require wiring. However, it can be used as GND for compatible equipment ground under the following conditions.
 - (1) When there is a difference in polarity between "A.G" and "GND for compatible equipment".
 - (2) As an alternative for 0 V input when only the + side is open on a ± wire.
- *4 Always use a ground. In addition, ground the FB of the power supply module.

4.5 Switch Setting for Intelligent Function Module

The settings for the intelligent function module are performed using the I/O assignment settings for GPPW.

- (1) The intelligent function module switches consist of switches 1 to 5 and are set using 16 bit data. When the intelligent function module switches are not set, the default value for switches 1 to 5 is 0.

Table 4.1 Switch setting item

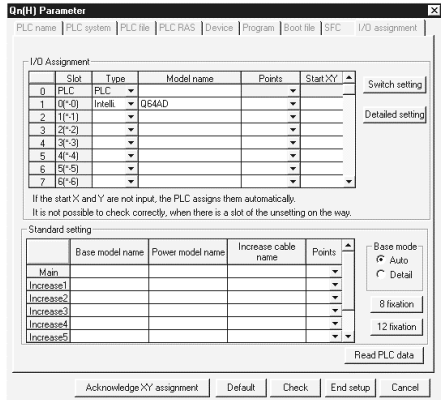
		Setting item																	
Switch 1	Input range setting <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> H </div> <p style="text-align: center; margin-top: 5px;">CH4CH3CH2CH1</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Analog input range</th> <th>Input range setting value</th> </tr> </thead> <tbody> <tr> <td>4 to 20 mA</td> <td>0H * 1</td> </tr> <tr> <td>0 to 20 mA</td> <td>1H</td> </tr> <tr> <td>1 to 5 V</td> <td>2H</td> </tr> <tr> <td>0 to 5 V</td> <td>3H</td> </tr> <tr> <td>- 10 to 10 V</td> <td>4H</td> </tr> <tr> <td>0 to 10 V</td> <td>5H</td> </tr> <tr> <td>User range setting</td> <td>FH</td> </tr> </tbody> </table>	Analog input range	Input range setting value	4 to 20 mA	0H * 1	0 to 20 mA	1H	1 to 5 V	2H	0 to 5 V	3H	- 10 to 10 V	4H	0 to 10 V	5H	User range setting	FH	
	Analog input range		Input range setting value																
4 to 20 mA	0H * 1																		
0 to 20 mA	1H																		
1 to 5 V	2H																		
0 to 5 V	3H																		
- 10 to 10 V	4H																		
0 to 10 V	5H																		
User range setting	FH																		
Switch 2	Input range setting <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> H </div> <p style="text-align: center; margin-top: 5px;">CH8CH7CH6CH5</p>																		
Switch 3	Not used																		
Switch 4	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> H </div> <div style="margin-left: 20px; margin-top: 10px;"> <p>00H : With temperature drift correction</p> <p>Other than 00H : Without temperature drift correction</p> <p>00H : Normal mode (A/D conversion processing)</p> <p>Other than 00H : Offset/gain setting mode</p> </div>																		
Switch 5	0 : Fixed																		

Depending on the type of module used, the settings for A/D unit input range are shown below.

- Q64AD..... 0H to 5H, FH
 - Q68ADV 0H, 2H to 5H, FH
 - Q68ADI..... 0H, 1H, FH
- *1 When the setting is 0H, the input operating range will be 0t o 10V.

(2) Operating procedure

Start the settings with GPPW I/O assignment setting screen.



(a) I/O assignment setting screen

Set the following for the slot in which the A/D conversion module is mounted.

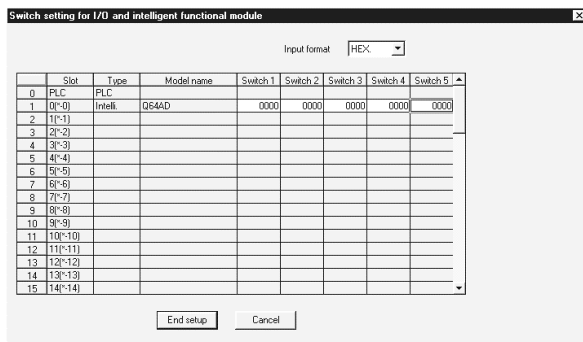
The type setting is required; set other items as needed.

Type : Select "intelli."

Model name : Enter the module model name.

Points : Select 16 points.

Start XY : Enter the start I/O number for the A/D conversion module.



(b) Switch setting for intelligent function module screen

Click on [Switch setting] on the I/O assignment setting screen to display the screen shown at left, then set switches 1 to 5.

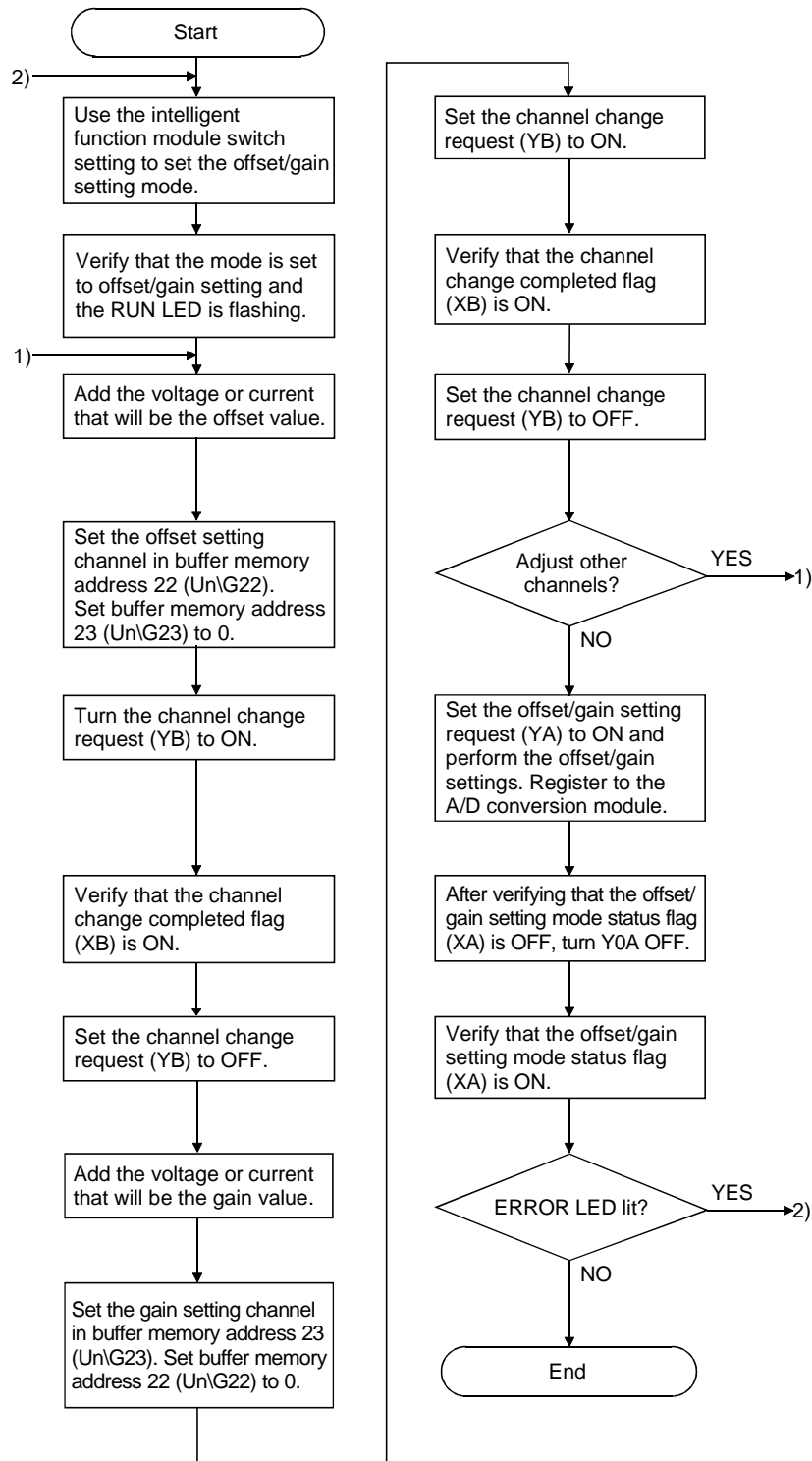
The switches can easily be set if values are entered in hexadecimal. Change the entry format to hexadecimal and then enter the values.

REMARK

The "Error time output mode" and the "H/W error time CPU operation mode" for the intelligent function module detailed setting need not be set since they are invalid for the A/D conversion module.

4.6 Offset/Gain Settings

Follow the steps below to perform the offset/gain settings. If the utility package is installed, perform the offset/gain settings according to the procedure described in Section 5.6.2.



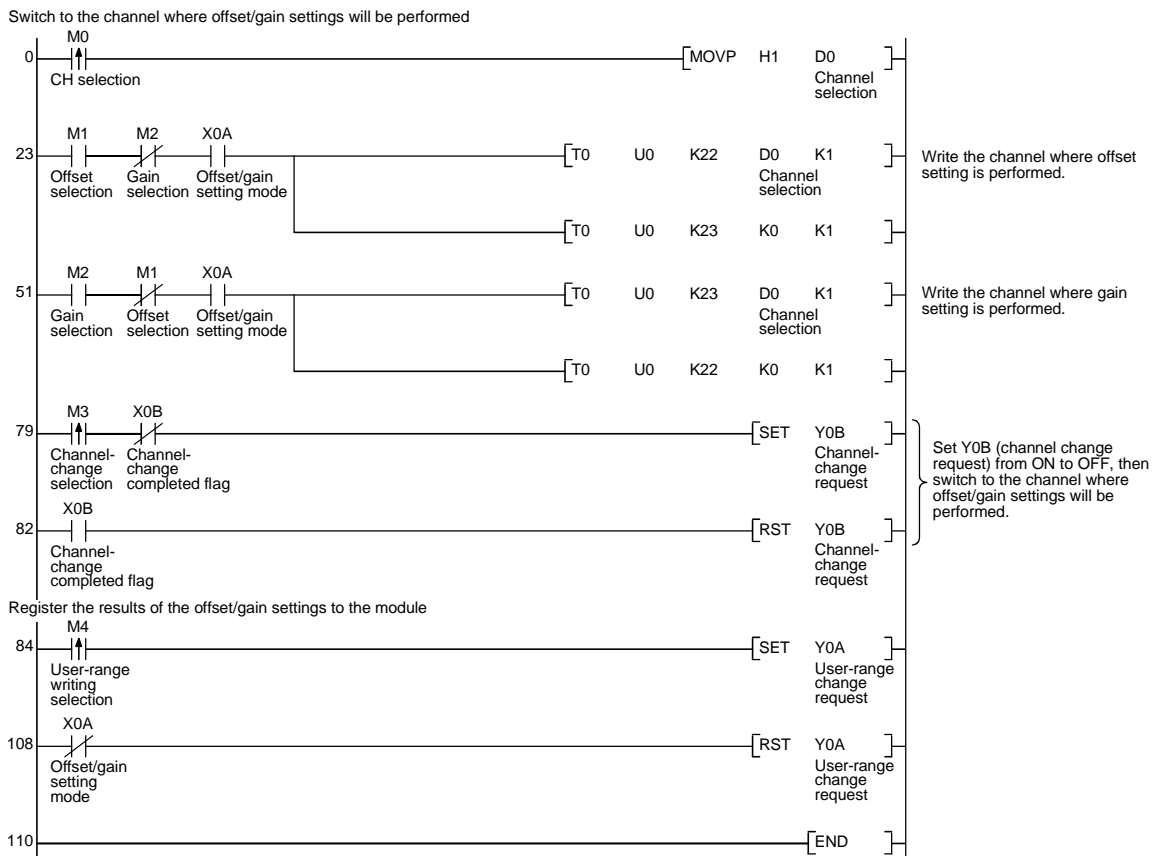
POINT
(1) Perform the offset/gain settings in the range that satisfies the conditions specified in Section 3.1.2, (1) and (2). When the setting exceeds this range, the maximum resolution or total accuracy may not be within the range indicated in the performance specification.
(2) Perform the offset/gain settings separately for each channel. If channels are set in buffer memory addresses 22 (Un\G22) and 23 (Un\G23) at the same time, an error will occur and the ERROR LED will be lit.
(3) After the offset/gain settings are completed, verify that the offset and gain values have been set correctly under actual usage conditions.
(4) The offset/gain values are stored in the module, and will not be erased even the power is shut off.

REMARK

This program switches the channels where the offset/gain settings are performed and writes the offset/gain values to the A/D conversion module.

In this example, the I/O signals for the A/D conversion module are X/Y0 to X/YF.

- Channel selection M0
- Offset setting M1
- Gain setting M2
- Channel change command M3
- Offset/gain setting value write command to the module M4



5 UTILITY PACKAGE (SW0D5C-QADU-E)

5.1 Utility Package Functions

Table 5.1 shows an overview of the utility package functions.

Table 5.1 Utility package (SW0D5C-QADU-E) function list

Item	Description	Reference section
Initial Setting *1	(1) Sets the following items that require initial setting. <ul style="list-style-type: none"> • CH A/D conversion enable/disable setting • CH Sampling process/averaging process setting • CH Time/number of times specifying • CH Average time/average number of times setting (2) The data for which initial setting has been completed is registered in the parameters for the PLC CPU, and automatically written to the A/D conversion module when the PLC CPU changes to the RUN status.	Section 5.4
Automatic Refresh Settings *1	(1) Sets automatic refresh for the A/D conversion module buffer memory. (2) The buffer memory that was set for automatic refresh is automatically read and written to the specified device when the END command for the PLC CPU is executed.	Section 5.5
Monitor/test	(1) Monitor/test The buffer memory and I/O signals for the A/D conversion modules are monitored and tested. (2) Operating condition setting Changes the A/D operating status during operation. (3) Offset/gain setting When setting the offset/gain to a value selected by the user (when the analog output range setting is user range setting), the offset and gain can be easily set while viewing the screen.	Section 5.6

POINT

<p>*1 If initial setting and automatic refresh setting are performed, the intelligent function module parameters require a maximum of 76 bytes per module.</p>
--

5.2 Installing and Uninstalling the Utility Package

For installing and uninstalling SW0D5C-QADU-E, see the GPP Function Software for Windows Package SW0D5C-GPPW-E Operating Manual (Startup).

5.2.1 User precautions

The following provides the precautions on using the SW0D5C-QADU-E:

(1) **Important safety information**

Since SW0D5C-QADU-E is add-on software for GPPW, read "Safety Precautions" and the basic operating procedures in GPPW's operating manual.

(2) **About installation**

The SW0D5C-QADU-E is an add-on package for SW4D5-GPPW-E (V) or later versions. Therefore, install SW0D5C-QADU-E in a peripheral device in which SW4D5-GPPW-E or a later version has been installed.

(3) **About the license-key diskette**

The license-key diskette is required to install or uninstall SW0D5C-QADU-E. Please keep the diskette in a safe location.

(4) **About display-screen errors while using the intelligent function module utility**

There may be cases in which the screen will not properly display while the intelligent function module utility is being used, due to a lack of system resources. If this occurs, close the intelligent function module utility first and then GPPW (program, comments, etc.) and other applications. Next, restart GPPW and the intelligent function module utility.

(5) **To start the intelligent function module utility**

(a) In GPPW, select "QCPU (Q mode)" for the PLC series and specify the project.

If something other than "QCPU (Q mode)" is selected for the PLC series, or if the project is not specified, the intelligent function module utility will not start.

(b) Multiple intelligent function module utilities can be started.

However, the [Open file]/[Save file] intelligent function module's parameter operations can only be performed by a single intelligent function module utility. Other intelligent function module utilities can perform the [Monitor/test] operation only.

(6) **How to switch screens when two or more intelligent function module utilities are started**

When two or more intelligent function module utility screens cannot be displayed side by side, use the task bar to change the intelligent function module utility screen so that it is displayed on top of other screens.



5.2.2 Operating environment

This section describes the operating environment of the SW0D5C-QADU-E.

Item		Peripheral devices
Installation (Add-on) *1		Add-on to SW4D5-GPPW-E or later
Language *2		Install with SW4D5-GPPW-E
CPU		Pentium 133 MHz or faster recommended
Memory		32 MB or more recommended
Free space	For installation (HD)	Minimum 3 MB
	For execution (Virtual memory)	Minimum 10 MB
Display		800 × 600 pixels or higher resolution
Operating system		Microsoft Windows 95, Microsoft Windows 98, Microsoft Windows NT Workstation 4.0

*1 SW0D5C-QADU-E cannot be installed with SW0D5C-GPPW-E, SW1D5C-GPPW-E, SW2D5C-GPPW-E and SW3D5C-GPPW-E.

*2 Please install SW0D5C-QADU-E with a software package of the same language.


SW0D5C-QADU-E (English version) cannot be installed with SW4D5C-GPPW (Japanese version), and SW0D5C-QADU-E (Japanese version) cannot be installed with SW4D5C-GPPW-E (English version).

5.3 Explanation of Utility Package Operation

5.3.1 How to perform common utility package operations

(1) Available control keys

Special keys that can be used during operation of the utility package and their applications are shown in the table below.

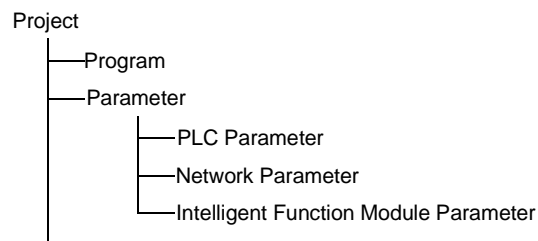
Name of key	Application
Esc	Cancels a newly entered value when entering data in a cell. Closes the window.
Tab	Moves between controls in the window.
Ctrl	Used in conjunction with the mouse when multiple cells are selected in the selection test.
Alt	Deletes the character where the cursor is positioned. When a cell is selected, clears all of the setting contents.
Delete	Deletes the character where the cursor is positioned. When a cell is selected, clears all of the setting contents.
Back Space	Deletes the character where the cursor is positioned.
	Moves the cursor.
Page Up	Moves the cursor one page up.
Page Down	Moves the cursor one page down.
Enter	Confirms the value entered in the cell.

(2) Data to be created with the utility package

The data and files shown below that are created with the utility package are also processed using GPPW operation. Figure 5.1 shows which operation processes which data or file.

<Intelligent function module parameters>

- (a) This data is created with the automatic refresh setting, and stored in the intelligent function module parameter file of the project to be created using GPPW.



- (b) Steps 1) to 3) shown in Figure 5.1 are performed using the following operations.

- 1) Operating from GPPW.
[Project] → [Open existing project] / [Save project] / [Save project as]
- 2) Operating from the utility parameter setting module selection screen.
[File] → [Open file] / [Save file]
- 3) Operating from GPPW.
[Online] → [Read from PLC] / [Write to PLC] → "Intelligent function module parameters"
Or, operate from the utility parameter setting module selection screen.
[Online] → [Read from PLC] / [Write to PLC]

<Text file>

- (a) A text file is created by performing the initial setting or automatic refresh setting, or selecting text file creation in the monitor/test screen. The text files can be utilized to create user documents.

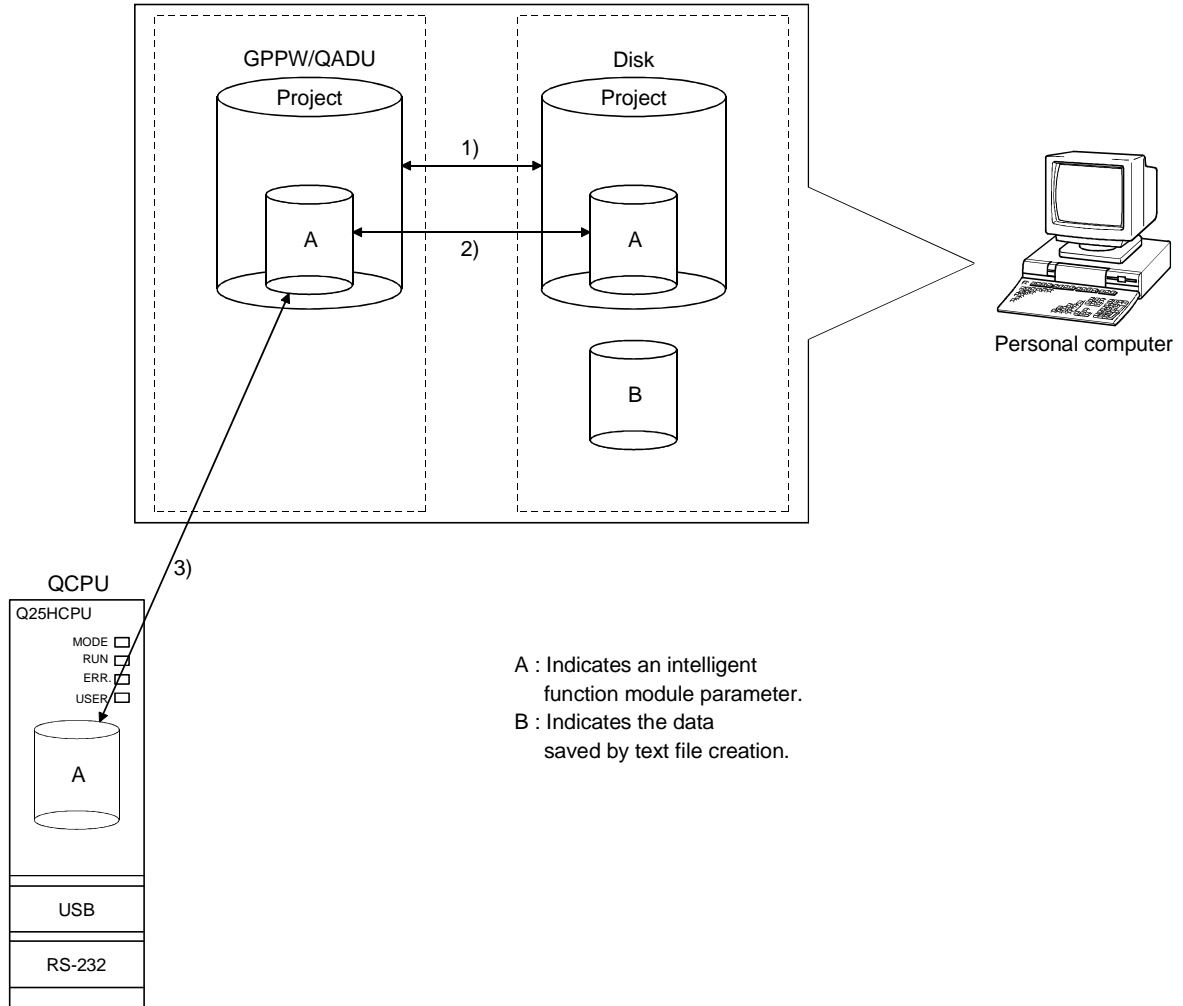
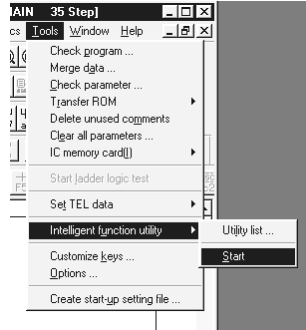


Figure 5.1 Correlation chart for data created using the utility package

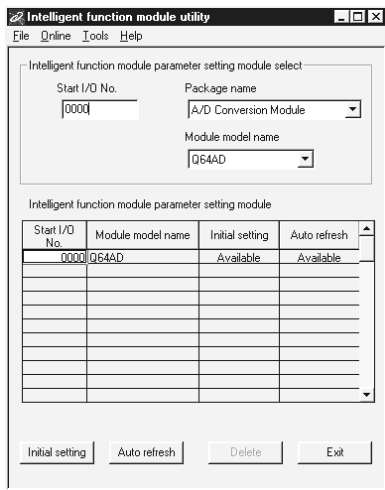
5.3.2 Operation overview

GPPW screen



[Tools] – [Intelligent function utility] – [Start]

Intelligent function module parameter setting module select screen



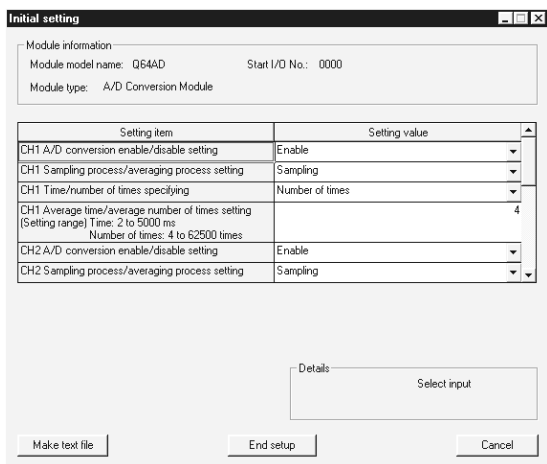
Enter "Start I/O No.", then select "Package name" and "Module model name".

See Section 5.3.3

Initial setting

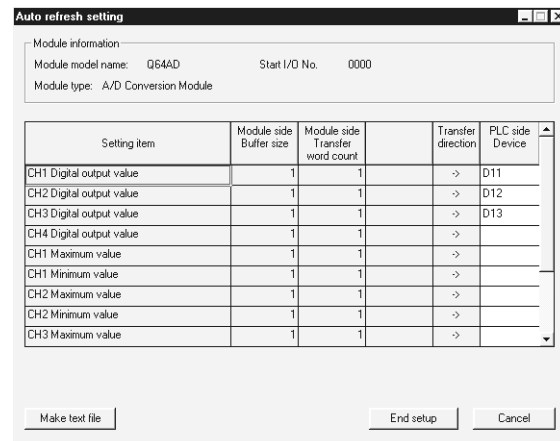
Auto refresh

Initial setting screen



See Section 5.4

Automatic refresh settings screen



See Section 5.5

1) [Online] – [Monitor/test]

Select monitor/test module screen

Start I/O No.	Module model name
0000	Q64AD
0010	Q series input module
0030	Q series output module

Enter "Start I/O No.", then select "Package name" and "Module model name".

Monitor/test screen

Setting item	Current value	Setting value
A/D conversion completed flag	0000000000001111	
CH1 Digital output value	532	
CH2 Digital output value	479	
CH3 Digital output value	1033	
CH4 Digital output value	1001	
Error code	0	
Setting range (CH1 to CH4)	0000	
X/Y monitor/test		X/Y monitor/test
Maximum value/minimum value information		Max value/min value info.
Operating condition setting		Operating setting
Offset/gain setting		Offset/gain setting

See Section 5.5

5.3.3 Starting the intelligent function module utility

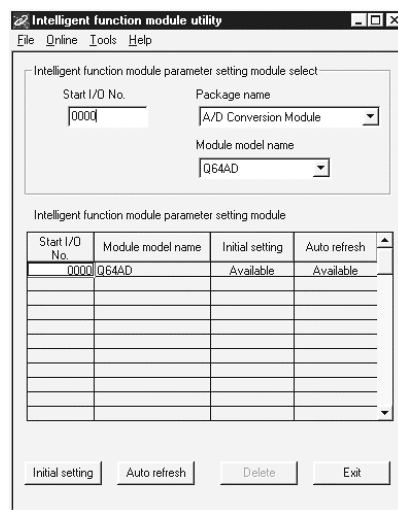
[Purpose of setting]

Start the intelligent function module utility from GPPW, and display the module selection screen for the intelligent function module utility parameter setting. The screens for performing initial setting, automatic refresh setting and monitor/test module selection (selecting the module for which monitoring/testing is to be performed) can be started from this screen.

[Startup procedure]

[Tools] → [Intelligent function utility] → [Start]

[Setting screen]



[Explanation of items]

(1) How to start each screen

(a) Starting initial setting

"Start I/O No.*" → "Package name" → "Module model name" →

Initial setting

(b) Starting automatic refresh setting

"Start I/O No.*" → "Package name" → "Module model name" →

Auto refresh

(c) Monitor/test module selection screen

Online → **Monitor/test**

* Enter the start I/O numbers in hexadecimal.

(2) Explanation of screen command buttons

Delete

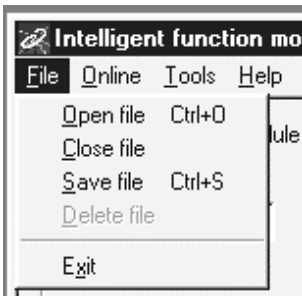
Deletes the initial setting and automatic refresh setting for the selected module.

Exit

Ends the Intelligent function module utility.

(3) Menu bar

(a) File items



With file operation, the intelligent function module parameters for the project opened by GPPW can be processed.

[Open file] : Reads the parameter file.

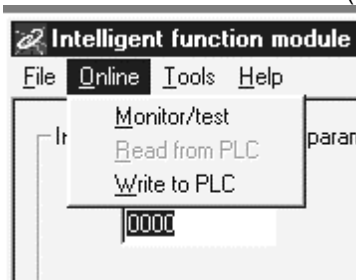
[Close file] : Closes the parameter file. If revisions were made, the dialog box asking whether to save the file appears.

[Save file] : Saves the parameter file.

[Delete file] : Deletes the parameter file.

[Exit] : Ends the intelligent function module utility.

(b) Online items



[Monitor/test] : Starts the monitor/test module selection screen.

[Read from PLC] : Reads the intelligent function module parameters from the CPU module.

[Write to PLC] : Writes the intelligent function module parameters to the CPU module.

POINT

(1) Saving the intelligent function module parameter files

Since files cannot be saved using the GPPW project save operation, save the files using the module selection screen for intelligent function module parameter setting described above.

(2) Reading from and writing to PLC operations for the intelligent function module parameters using GPPW

(a) After the intelligent function module parameters are saved in a file, they can be read from and written into the PLC.

(b) Set the target PLC CPU using GPPW [Online] → [Transfer setup].

5.4 Initial Setting

[Purpose of setting]

The following A/D initial setting parameters are set:

- A/D conversion enable/disable setting
- Sampling process/averaging process setting
- Time/number of times specifying
- Average time/average number of times setting

By performing these initial settings, the sequence program settings are not required.

[Startup procedure]

"Start I/O No.*" → "Package name" → "Module model name" → Initial setting

[Setting screen]

Setting item	Setting value
CH1 A/D conversion enable/disable setting	Enable
CH1 Sampling process/averaging process setting	Sampling
CH1 Time/number of times specifying	Number of times
CH1 Average time/average number of times setting (Setting range) Time: 2 to 5000 ms Number of times: 4 to 62500 times	4
CH2 A/D conversion enable/disable setting	Enable
CH2 Sampling process/averaging process setting	Sampling

[Explanation of items]

(1) Setting contents

Set whether A/D conversion is enabled or disabled and the A/D conversion method for each channel.

(2) Explanation of command buttons

- | | |
|----------------|---|
| Make text file | Outputs the screen display in text file format. |
| End setup | Confirms the setting data and ends the operation. |
| Cancel | Cancels the setting data and ends the operation. |

POINT

Initial settings are stored in the intelligent function module parameters. After the initial settings are written to the CPU module, they are validated by operating the RUN-STOP switch as follows, STOP → RUN → STOP → RUN, turning the power OFF and then ON, or resetting the CPU module.

When using a sequencer program to write the initial settings, when the CPU is switched from STOP to RUN the initial settings will be written, So ensures that programming is carried out to re-execute the initial settings.

5.5 Automatic Refresh Settings

[Purpose of setting]

Sets the buffer memory for the A/D conversion module to be automatically refreshed.

[Startup procedure]

"Start I/O No.*" → "Package name" → "Module model name" → Auto refresh

[Setting screen]

Setting item	Module side Buffer size	Module side Transfer word count	Transfer direction	PLC side Device
CH1 Digital output value	1	1	->	D11
CH2 Digital output value	1	1	->	D12
CH3 Digital output value	1	1	->	D13
CH4 Digital output value	1	1	->	
CH1 Maximum value	1	1	->	
CH1 Minimum value	1	1	->	
CH2 Maximum value	1	1	->	
CH2 Minimum value	1	1	->	
CH3 Maximum value	1	1	->	

[Explanation of items]

(1) Contents of the screen display

- Model side Buffer size** : Displays the size of the buffer memory for the setting item that can be transferred (fixed at one word).
- Model side Transfer word count** : Displays the number of words to transfer the CPU device from the head device (fixed at one word).
- Transfer direction** : " \leftarrow " indicates that data is written from the device to the buffer memory.
" \rightarrow " indicates that data is read from the buffer memory to the device.
- PLC side Device** : Enter the device at the CPU module to be automatically refreshed.
The devices that can be used are X, Y, M, L, B, T, C, ST, D, W, R, ZR. When using bit devices, K, Y, M, L or B, set a number that can be divided by 16 points (examples: X10, Y120, M16).
Also, buffer memory data is stored in 16 point blocks starting from the device number that was set. For example, if X10 is set, data will be stored from X10 to X1F.

(2) Explanation of command buttons

A file containing the screen contents is created in text file format.

Confirms the setting data and ends the operation.

Cancels the setting data and ends the operation.

POINT

The automatic refresh settings are stored in the intelligent function module parameters. After the automatic refresh settings are written to the CPU module, they are validated by performing STOP → RUN → STOP → RUN operations for the CPU module, turning the power OFF and then ON, or resetting the CPU module. The automatic refresh settings cannot be changed from the sequencer program. However, it is possible to add a process similar to automatic refresh by using the FROM/TO instructions of the sequence program.

5.6 Monitor/Test

5.6.1 Monitor/test screen

[Purpose of setting]

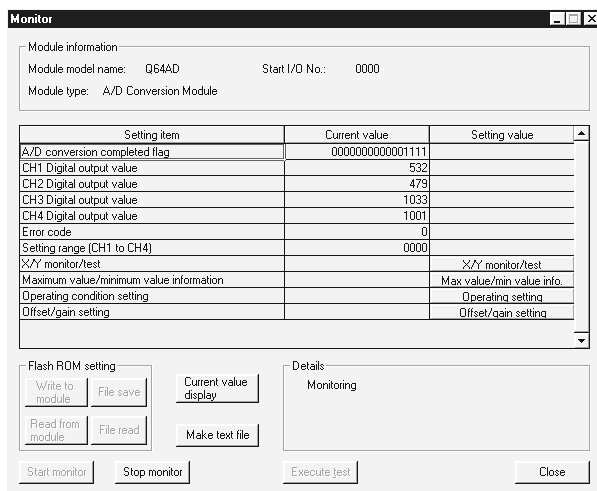
Buffer memory monitoring/testing, I/O signals monitoring/testing, operating condition setting, offset/gain settings (see Section 5.6.2) are started from this screen.

[Startup procedure]

Monitor/test module selection screen → "Start I/O No.*" → "Package name" → "Module model name" → **Monitor/test**

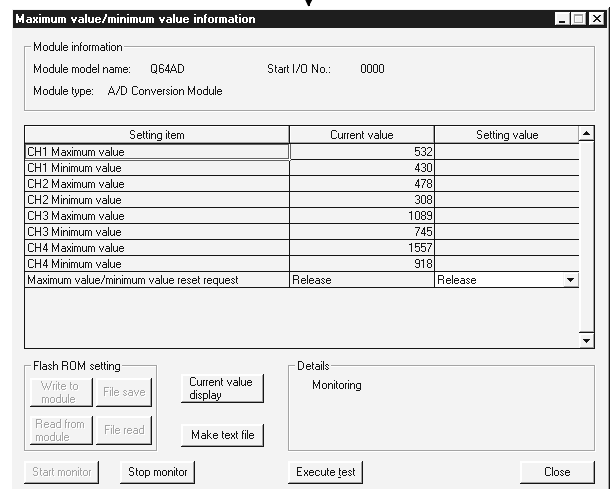
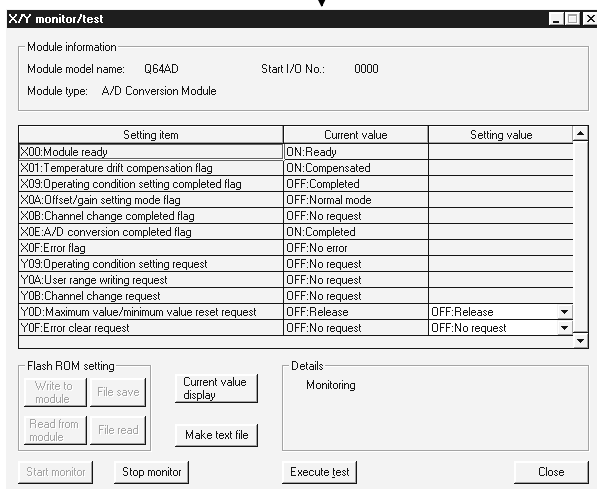
* Enter the start I/O numbers in hexadecimal.

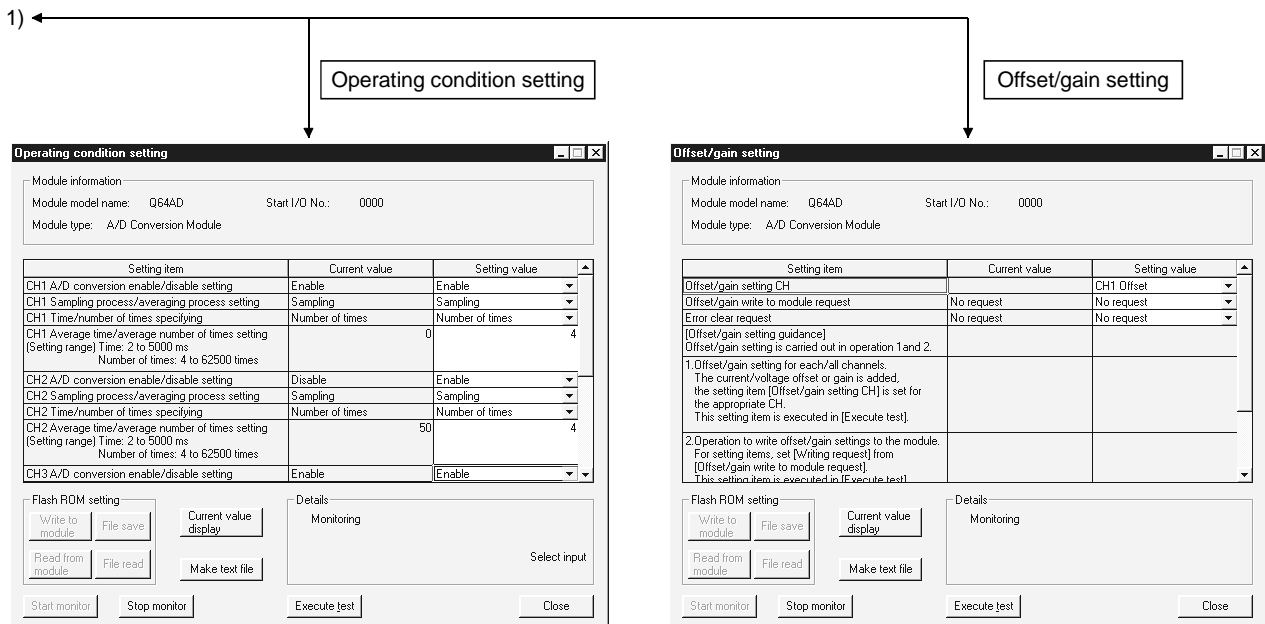
[Setting screen]



X/Y monitor/test

Max value/min value info.





[Explanation of items]

(1) Contents of screen display

- Setting item : The I/O signal or buffer memory names are displayed.
 Current value : The I/O signal status or current value of buffer memory are monitored.
 Setting value : Select or enter the data to be written during test operation.

(2) Explanation of the command buttons

Current value display	The current value of the selected item is displayed. (This is used to check text that cannot be displayed in the current value field. However, in this utility package, all items can be displayed in the display fields).
Make text file	Creates a file consisting of the screen contents in text file format.
Start monitor /	Selects whether or not the current value fields are monitored.
Stop monitor	
Select test	Performs a test of the selected item. To select more than one item, select multiple items while holding down the Ctrl key.
Close	Closes the screen currently displayed and returns to the previously displayed screen.

POINT

If the selection test operation is performed while deleting the setting value using the Delete key (the setting value field is blank), the message "Completed" will be displayed but write operation will not be performed.

REMARK

The following describes an example where sampling process for the selection test operation is changed to a 10-time averaging process setting.

- (1) Set averaging process in the setting value field for CH Sampling process/Averaging process setting.
- (2) Set number of times in the setting value field for CH Time/number of times specifying.
- (3) Click the setting value field for CH Average time/average number of times setting to select.
- (4) After entering the average number of times, press the Enter key.
At this point, nothing has been written to the A/D conversion module.
- (5) Select the setting value fields that were specified in steps 1 to 4 while holding down the Ctrl key.
- (6) Click Select test to execute write operation.

Once writing has been completed, the value that was written will be displayed in the present value field.

5.6.2 Offset/gain setting operation

Perform the offset/gain setting operation in the following sequence.

(1) **Switch to the offset/gain setting mode**

Change switch 4 for intelligent function module switch setting to the offset/gain setting mode (see Section 4.5).

(2) **Switch to the offset/gain setting screen**

Display the offset/gain setting screen using the operation described in Section 5.6.1.

(3) **Adjustment of the offset and gain values**

(a) **Set the analog input value for the offset value**

Add the voltage or current that will determine the offset value to the channel to be set.

(b) **Select the channel for which the offset value is to be adjusted**

Make the selection from the offset/gain setting channel field, and then click on the button.

(c) **Set the analog input value for the gain value**

Add the voltage or current that will determine the gain value to the channel to be set.

(d) **Select the channel for which the gain value is to be adjusted**

Make the selection from the offset/gain setting channel field, and then click on the button.

(e) **To set the offset/gain for more than one channel, repeat steps (a) to (d).**

(4) **Write the offset/gain setting values to the module**

Write the offset/gain settings to the module after completing the settings for all channels using the user range setting. Note that if settings are written while offset/gain settings are incomplete, the status at that point will be written to the module.

(a) **Write to the A/D conversion module**

Select "Write requested" from the setting value field for the offset/gain setting write request, and then click on the button.

(b) **Confirm execution of write operation**

Confirm that the current value field display for the offset/gain module write request changes from "Write request" to "No write request".

(c) **Error handling**

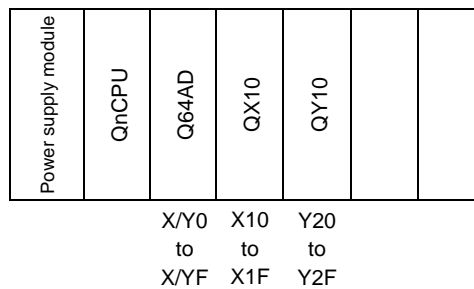
Confirm that the ERROR LED for the A/D conversion module is off. If the ERROR LED is lit, click on , check the error code on the monitor screen, and then perform the offset/gain settings again.

6 PROGRAMMING

Using a sample system configuration shown below, details of the A/D conversion module program are explained in the following two scenarios: when the utility package is used and when the utility package is not used.

System configuration used in the program explanation

(1) System configuration



(2) Program conditions

This program reads the digital output values that have been A/D converted using CH 1 to CH3 of the Q64AD. CH1 performs sampling processing, CH2 performs averaging processing every 50 times, and CH3 performs averaging processing every 1000 ms. An error code appears in BCD format if a write error occurs.

(a) Contents of initial setting

- A/D conversion enable channel
.....CH1 to CH3
- Channel performing averaging processing using number of times
.....The average number of times set for CH2 is 50.
- Channel performing averaging processing using time
.....The average time set for CH3 is 1000 ms

(b) Devices used by the user

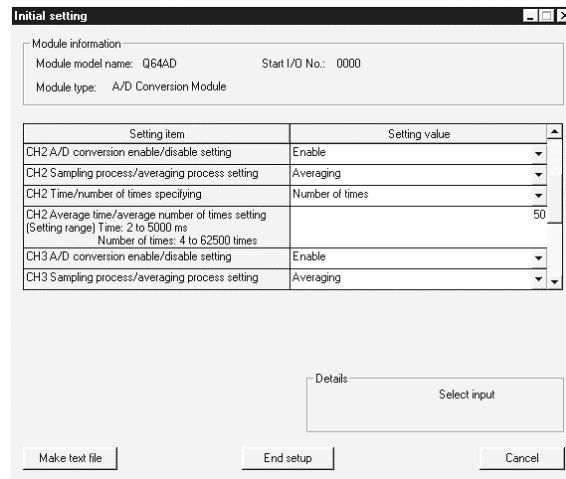
- Error reset signal X10
- Input signal for digital output value read command X11
- Error code display (3-digit BCD) Y20 to Y2B
- CH1 digital output value D11
- CH2 digital output value D12
- CH3 digital output value D13
- Error code D14

6.1 Programming Example Using the Utility Package

6.1.1 Operating the utility package

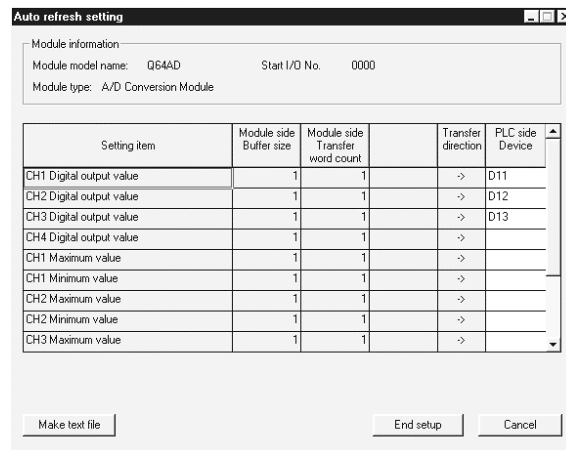
(1) Initial setting (see Section 5.4)

Set channel 1 to sampling processing, channel 2 to averaging processing for 50 times and channel 3 to averaging processing for 1000 ms.



(2) Auto refresh setting (see Section 5.5)

Set the digital output values and error codes for CH1 to 3.

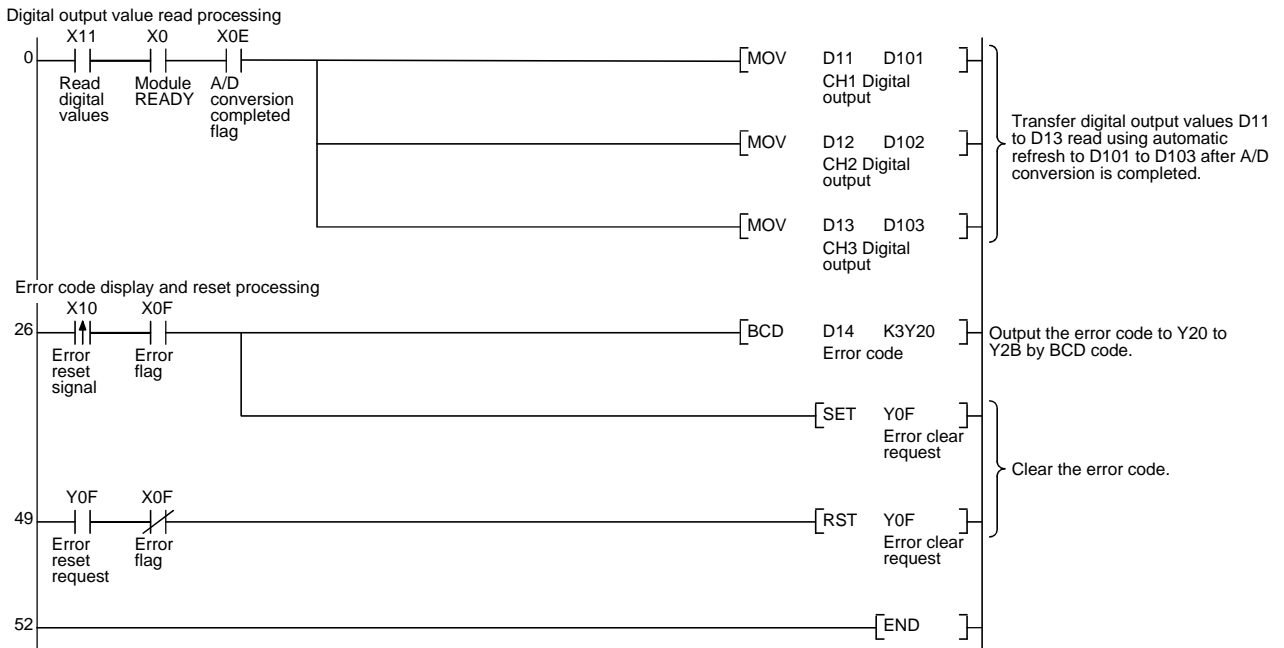


(3) Writing the intelligent function module parameters (see Section 5.3.3)

Write the intelligent function module parameters to the CPU module.

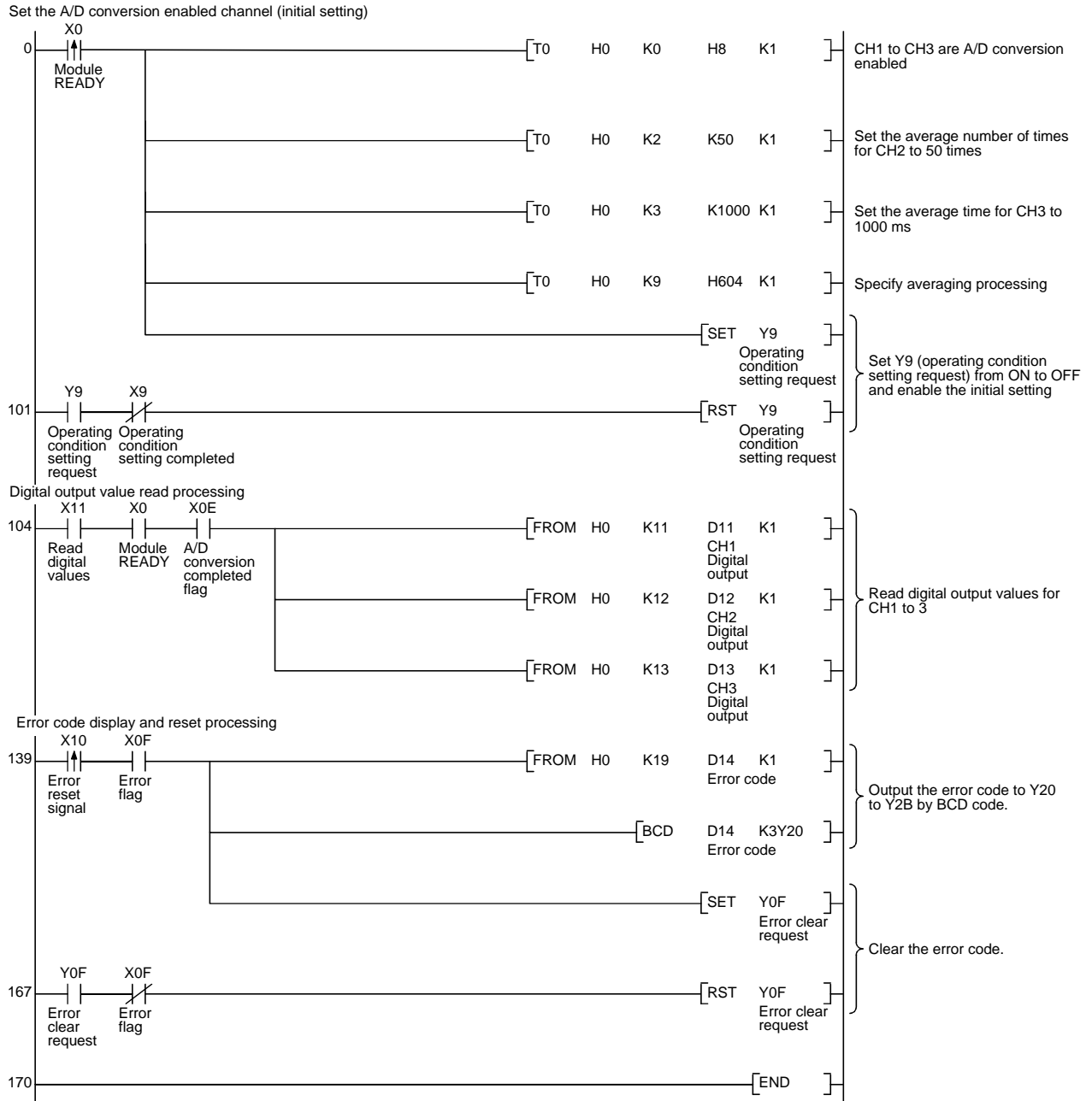
This operation is performed using the parameter setting module selection screen.

6.1.2 Programming example



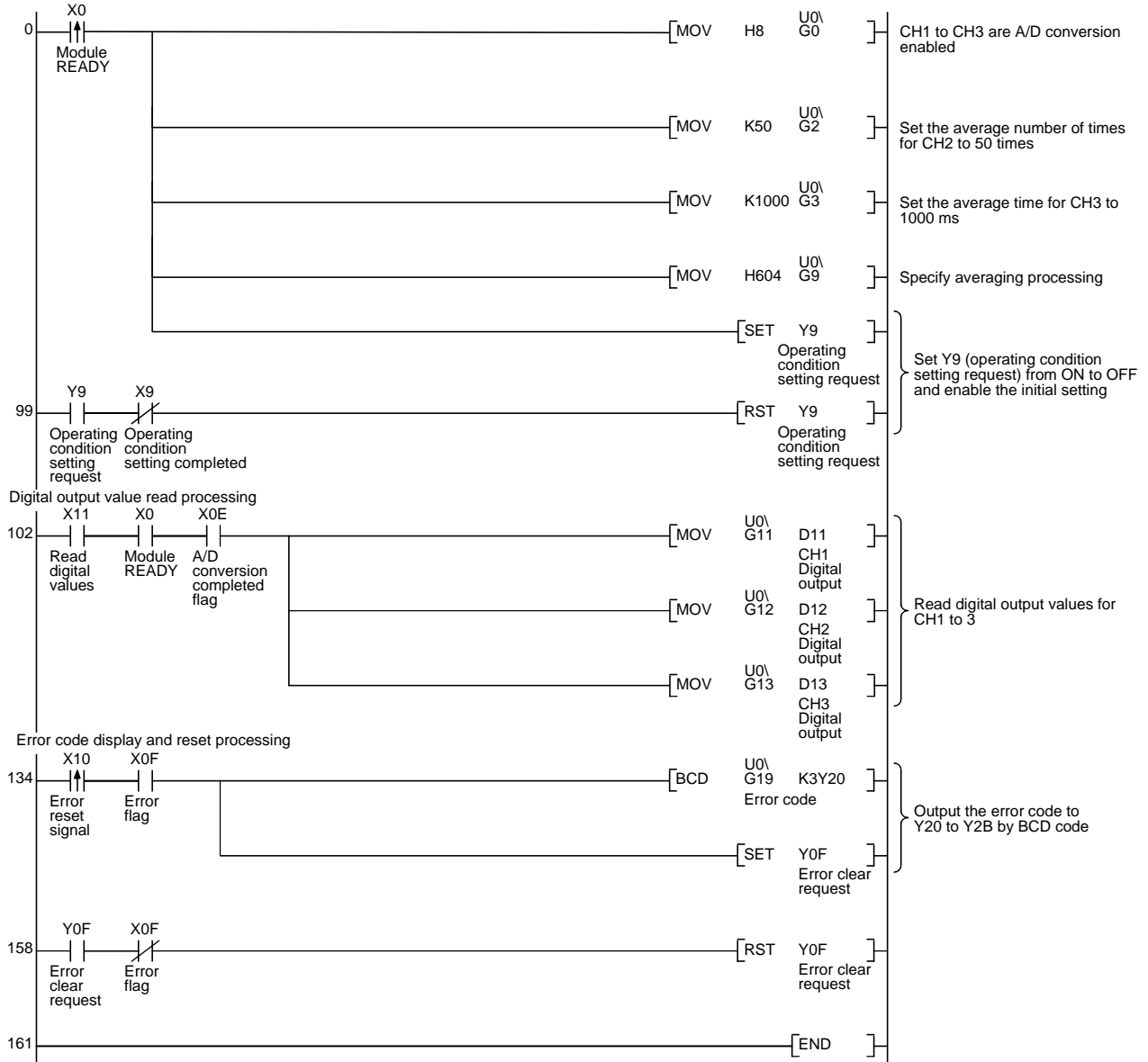
6.2 Programming Example without Using the Utility Package

(1) Programming example using the FROM/TO commands



(2) Programming example using the intelligent function module device (U□\G□)

Set the A/D conversion enabled channel (initial setting)



7 TROUBLESHOOTING

The following section explains the types of errors that may occur when the A/D conversion module is used, and how to troubleshoot such errors.

7.1 Error Code List

If an error occurs in the A/D conversion module while writing to or reading data from the PLC CPU, the applicable error code is written to buffer memory address 19 (Un\G19).

Table 7.1 Error code list

Error code (decimal)	Error description	Processing
10□	The input range is set an illegal value using the intelligent function module switch in GPPW. □ indicates the incorrectly specified channel number.	Reset to the correct parameter with GPPW parameter setting. (See Section 4.5.)
111	Module error at startup.	Turn the power OFF and ON again. If the error occurs again, the module may be malfunctioning. Contact the nearest distributor or branch office with the description of the problem.
20□	The average time setting value for buffer memory addresses 1 to 8 (Un\G1 to Un\G8) is outside the range of 2 to 5000 ms. □ indicates the incorrectly specified channel number.	Reset the average time setting to a value within the range of 2 to 5000 ms.
30□	The average number of times setting value for buffer memory addresses 1 to 8 (Un\G1 to Un\G8) is outside the range of 4 to 62500 times. □ indicates the incorrectly specified channel number.	Reset the average number of times setting value to within the range of 4 to 62500 times.
40□	The offset value is equal to or larger than the gain value. □ indicates the error causing channel number.	Reset so that the offset value becomes smaller than the gain value.
500	The offset/gain channels were set at the same time during offset and gain value settings, or both were set to 0.	Reset the contents of buffer memory addresses 22 and 23 (Un\G22 and Un\G23).

POINT

- (1) If more than one error occurs, the error code first detected by the A/D conversion module is stored. No other error codes will be stored.
- (2) The error can be cleared by setting the error clear request (YF) to "ON".

7.2 Troubleshooting

7.2.1 When the "RUN" LED is flashing or turned off

(1) When flashing

Check item	Corrective action
Is the mode set to the offset/gain setting mode?	Reset switch 4 of the intelligent function module setting for GPPW to the normal mode (see Section 4.5).

(2) When off

Check item	Corrective action
Is the power being supplied?	Confirm that the supply voltage for the power supply module is within the rated range.
Is the capacity of the power supply module adequate?	Calculate the current consumption of the CPU module, I/O module and intelligent function module mounted on the base unit to see if the power supply capacity is adequate.
Has a watchdog timer error occurred?	Reset the PLC CPU and verify that it is lit. If the RUN LED does not light even after doing this, the module may be malfunctioning. Contact the nearest distributor or branch office with a description of the problem.
Is the module correctly mounted on the base unit?	Check the mounting condition of the module.

7.2.2 When the "ERROR" LED is on or flashing

(1) When on

Check item	Corrective action
Is an error being generated?	Confirm the error code and take corrective action described in Section 7.1.

(2) When flashing

Check item	Corrective action
Is intelligent function module setting switch 5 set to "other than 0"?	Using GPPW parameter setting, set intelligent function module setting switch 5 to "0" (see Section 4.5).

7.2.3 When the digital output values cannot be read

Check item	Corrective action
Is there any fault with the analog signal lines such as disconnection?	Check for faulty condition of the lines visually and perform a continuity check of the signal lines.
Is the CPU module in the STOP status?	Set the CPU module to the RUN status.
Are the offset/gain settings correct?	Verify that the offset/gain settings are correct (see Sections 4.6 and 5.6.2). If the user range is being used, switch to a different default input range and check if A/D conversion is correctly performed. If it is correctly performed, redo the offset/gain settings.
Is the input range setting correct?	Check buffer memory addresses 20 and 21 (Un\G20 and Un\G21) in GPPW system monitor. If the input range setting is incorrect, redo the GPPW intelligent function module switch setting (see Section 4.5).
Is the A/D conversion enable/disable setting for the channel that was input set to A/D conversion disabled?	Check the ON/OFF status with buffer memory 0 (Un\G0) in GPPW system monitor and review the initial setting of the sequence program or utility package (see Section 3.4).
Has the operating condition setting request (Y9) been executed?	From GPPW, set the operating condition setting request (Y9) from ON to OFF, and check that the digital output values are stored in buffer memory addresses 11 to 18 (Un\G11 to Un\G18). If so, review the initial setting of the Sequence program or utility package (see Section 3.3).

7.2.4 Checking the A/D conversion module status using GPPW system monitor

When the A/D conversion module detail information is selected in GPPW system monitor, error codes and LED status can be checked.

(1) Operating GPPW

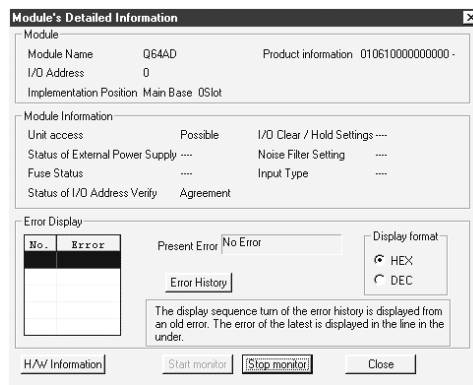
[Diagnostics] → [System monitor] → "Select A/D conversion module" →

Module Detailed Information

(2) Checking the error codes using Module's detailed information

The error code stored in memory address 19 (Un\G19) of the A/D conversion module buffer is displayed in the latest error code field shown in the figure below.

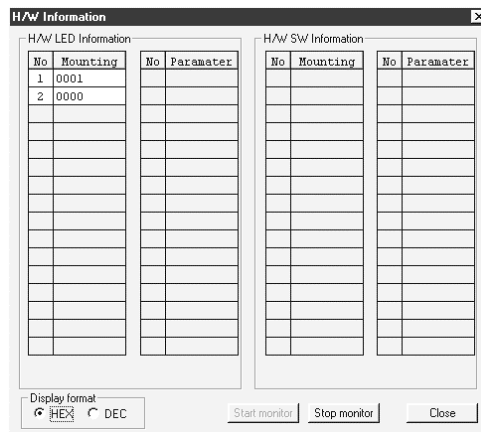
(When the **Error History** button is pressed, the contents displayed in the latest error code field are displayed in the No. 1 field.)



(3) Checking the LED status using H/W information

The LED status is displayed in the mounting field under the H/W LED information.

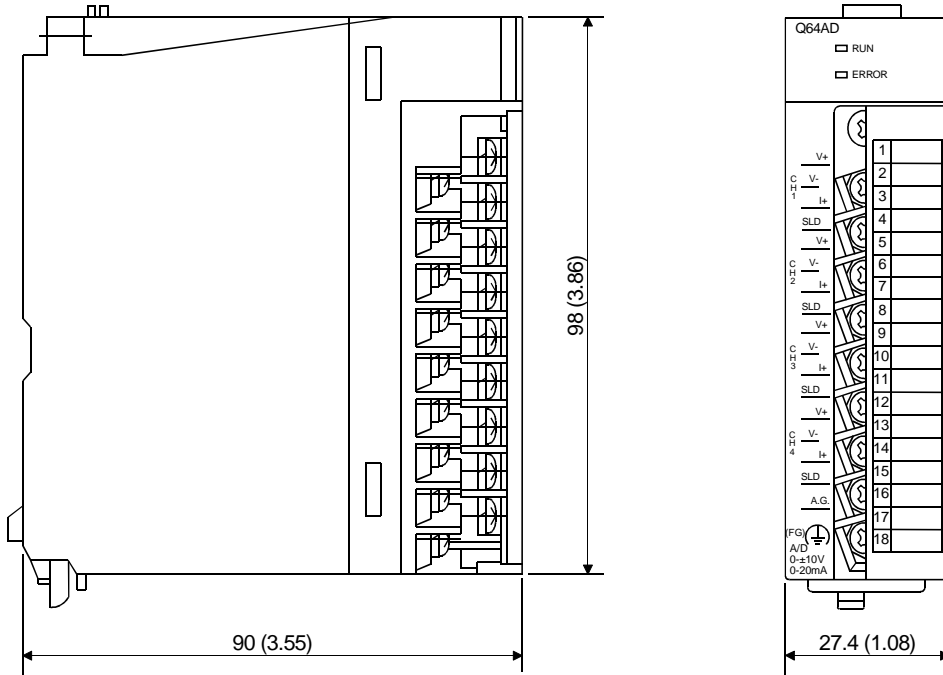
No.	LED name	Status
1	RUN LED	0000H : Indicates that LED is unlit.
2	ERROR LED	0001H : Indicates that LED is lit



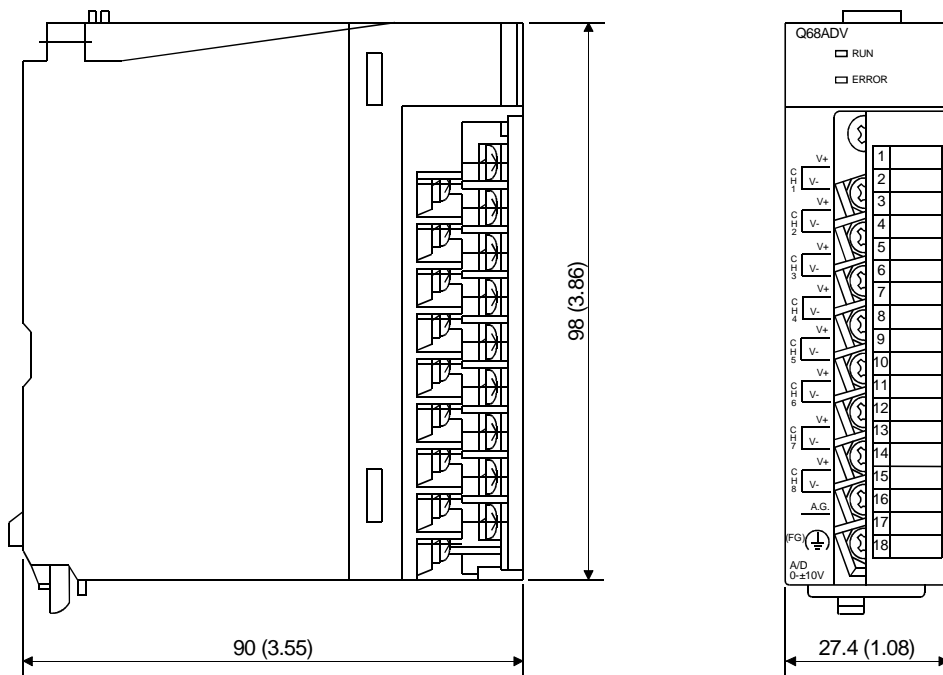
APPENDIX

Appendix 1. External Dimension Diagram

(1) Q64AD

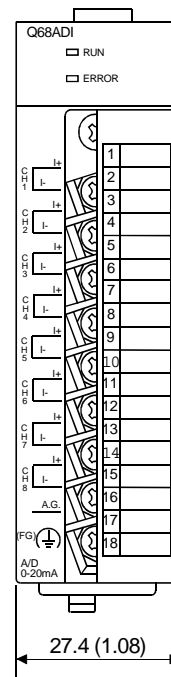
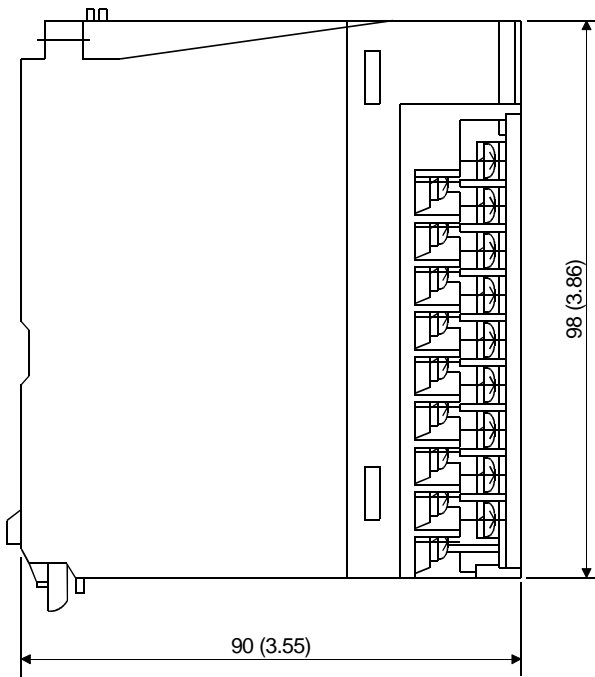


(2) Q68ADV



App.

(3) Q68ADI



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WARRANTY

Please confirm the following product warranty details before starting use.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "problems") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the dealer or Mitsubishi Service Company.

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

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.

Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

- (1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
- (2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
 1. Problems occurring from inappropriate storage or handling, carelessness or negligence by the user. Problems caused by the user's hardware or software design.
 2. Problems caused by unapproved modifications, etc., to the product by the user.
 3. When the Mitsubishi product is assembled into a user's device, trouble 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. Problems that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
 5. Problems caused by external irresistible forces such as fires or abnormal voltages, and problems caused by force major such as earthquakes, lightning, wind and water damage.
 6. Problems caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
 7. Any other trouble found not to be the responsibility of Mitsubishi or the user.

2. Onerous repair term after discontinuation of production

- (1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
- (2) Product supply (including repair parts) is not possible after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of chance loss and secondary loss from warranty liability

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

5. Changes in product specifications

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

6. Product application

- (1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problems or faults should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problems or fault.
- (2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or the Department of Defense shall be excluded from the programmable logic controller applications.

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

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

Analog-Digital Converter Module

User's Manual

MODEL	Q-A/D-U-S-E
MODEL CODE	13JR03
SH(NA)-080055-A(9912)MEE	



HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUCHI TOKYO 100-8310 TELEX : J24532 CABLE MELCO TOKYO
NAGOYA WORKS : 1-14 , YADA-MINAMI 5 , HIGASHI-KU, NAGOYA , JAPAN

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Specifications subject to change without notice.