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Programmable Logic Controller

XGT Isolated Analog Input Module

XGT Series

User's Manual

XGF-AD4S

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LS Industrial Systems

Safety Instructions

Before using the product …

For your safety and effective operation, please read the safety instructions thoroughly before using the product.

- Safety Instructions should always be observed in order to prevent accidents or risks with the safe and proper use of the product.

- Instructions are separated into “Warning” and “Caution”, and the meaning of the terms is as follows;

⚠ **Warning**	This symbol indicates the possibility of serious injury or death if some applicable instruction is violated
⚠ **Caution**	This symbol indicates the possibility of slight injury or damage to products if some applicable instruction is violated

- The marks displayed on the product and in the user’s manual have the following meanings.

  ⚠ Be careful! Danger may be expected.

  ⚠ Be careful! Electric shock may occur.

- The user’s manual should be kept available and accessible to any user of the product even after it’s been read.

Safety Instructions

Safety Instructions when designing

⚠Warning

- **Please, install protection circuit on the exterior of PLC to protect the whole control system from any error in external power or PLC module.** Any abnormal output or operation may cause serious problem in safety of the whole system.
  - Install applicable protection unit on the exterior of PLC to protect the system from physical damage such as emergent stop switch, protection circuit, the upper/lowest limit switch, forward/reverse operation interlock circuit, etc.
  - If any system error (watch-dog timer error, module installation error, etc.) is detected during CPU operation in PLC, the whole output is designed to be turned off and stopped for system safety. However, if CPU error is caused on output device itself, such as relay or TR, it can not be detected, the output may be kept on, which may cause serious problems. Thus, you are recommended to install an additional circuit to monitor the output status.

- **Never connect over-rated load to the output module nor allow the output circuit to have a short circuit**, for it may cause a fire.

- **Never let the external power of the output circuit be designed to turn on earlier than PLC power**, for it may cause abnormal output or operation.

- **In case of data exchange between computer or other external equipment and PLC through communication or any operation of PLC (e.g. operation mode change), please install interlock in the sequence program to protect the system from any error**. If not, it may cause abnormal output or operation.

Safety Instructions

Safety Instructions when designing

⚠ Caution

- **I/O signal or communication line shall be wired at least 100mm away from the high-voltage cable or power line.** If not, it may cause abnormal output or operation.

Safety Instructions when designing

⚠ Caution

- **Use PLC only in the environment specified in PLC manual or general standard of data sheet.** If not, electric shock, fire, abnormal operation of the product or flames may be caused.
- **Before installing the module, be sure PLC power is off.** If not, electric shock or damage on the product may be caused.
- **Be sure that each module of PLC is correctly secured.** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused.
- **Be sure that I/O or extension connector is correctly secured.** If not, electric shock, fire or abnormal operation may be caused.
- **If lots of vibration is expected in the installation environment, don't let PLC directly vibrated.** Electric shock, fire or abnormal operation may be caused.
- **Don't let any foreign metallic materials inside the product**, for it may cause electric shock, fire or abnormal operation.

Safety Instructions

Safety Instructions when wiring

⚠Warning

- **Prior to wiring, be sure that power of PLC and external power is turned off.** If not, electric shock or damage on the product may be caused.

- **Before PLC system is powered on, be sure that all the covers of the terminal are securely closed.** If not, electric shock may be caused

⚠Caution

- **Let the wiring installed correctly after checking the rated voltage of each product and the arrangement of terminals.** If not, fire, electric shock or abnormal operation may be caused.

- **Secure the screws of terminals tightly with specified torque when wiring.** If the screws of terminals get loose, short circuit, fire or abnormal operation may be caused.

- **Make sure to use the ground wire of Class 3 for FG terminals, which is exclusively used for PLC**. If the terminals are not grounded correctly, abnormal operation may be caused.

- **Don't let any foreign materials such as wiring waste inside the module while wiring,** for it may cause fire, damage on the product or abnormal operation.

Safety Instructions

Safety Instructions for test-operation or repair

⚠ Warning

- **Don't touch the terminal when powered**. Electric shock or abnormal operation may occur.
- **Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Don't let the battery get recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

⚠ Caution

- **Don't remove PCB from the module case nor remodel the module.** Fire, electric shock or abnormal operation may occur.
- **Prior to installing or disassembling the module, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Keep any wireless installations or cell phone at least 30cm away from PLC**. If not, abnormal operation may be caused.

Safety Instructions for waste disposal

⚠ Caution

- **Product or battery waste should be processed as industrial waste.** The waste may discharge toxic materials or explode by itself.

Revision History

Version	Date	Remark	Page
V 1.0	’06.05	First Edition	-
V 1.1	’09.06	Add About User’s manual	-
		Fix Error code address	5-6,5-9,5-12
		Add Configuration and Function of Internal Memory (For XGI,XGR)	CH7
		Add Programming (For XGI,XGR)	CH8
		Fix Troubleshooting, CH7→CH9	CH9

※ The number of User’s manual is indicated right part of the back cover.

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Thank you for purchasing PLC of LS Industrial System Co.,Ltd.
Before use, make sure to carefully read and understand the User's Manual about the functions, performances, installation and programming of the product you purchased in order for correct use and importantly, let the end user and maintenance administrator to be provided with the User's Manual.

The User's Manual describes the product. If necessary, you may refer to the following description and order accordingly. In addition, you may connect our website (http://eng.lsis.biz/) and download the information as a PDF file.

Relevant User's Manuals

Title	Description
XG5000 User's Manual (for XGK, XGB)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGK, XGB CPU
XG5000 User's Manual (for XGI, XGR)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGI, XGR CPU
XGK/XGB Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGK, XGB CPU.
XGI/XGR/XEC Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGI, XGR,XEC CPU.
XGK CPU User's Manual (XGK-CPUA/CPUE/CPUH/CPUS/CPUU)	XGK-CPUA/CPUE/CPUH/CPUS/CPUU user manual describing about XGK CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGI CPU User's Manual (XGI-CPUU/CPUH/CPUS)	XGI-CPUU/CPUH/CPUS user manual describing about XGI CPU module, power module, base, IO module, specification of extension cable and system configuration, EMC standard
XGR redundant series User's Manual	XGR- CPUH/F, CPUH/T user manual describing about XGR CPU module, power module, extension drive, base, IO module, specification of extension cable and system configuration, EMC standard

Current XGF-AD4S manual is written based on the following version.

Related OS version list

Product name	OS version
XGK-CPUH, CPUS, CPUA, CPUE, CPUU	V3.0
XGI-CPUU, CPUH, CPUS	V2.1
XGR-CPUH/F, CPUH/T	V1.3
XG5000(XG-PD)	V3.0

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Chapter 1 Introduction

This user's manual is to describe the isolated analog input module XGF-AD4S.
This module is used to convert analog signal (voltage or current input) from PLC's external device to signed 16-bit binary data of digital value.

1.1 Characteristics

1) The channels are isolated from each other.
   High reliability can be assured without mutual interference.

2) High resolution of 1/64000
   High resolution digital value can be assured by 1/64000.

3) High accuracy
   High conversion accuracy of ±0.05 % (ambient temperature of 25 ℃) is available.
   Temperature coefficient is high accuracy as 40 ppm/℃.

4) Operation parameters setting / monitoring
   Operation parameters setting are available now by means of [I/O Parameters Setting] for which user interface is reinforced to increase user's convenience. With [I/O Parameters Setting] used, the sequence program can be reduced. In addition, through [Special Module Monitoring] function, A/D conversion value can be easily monitored.

5) Various formats of digital output data provided
   3 formats of digital output data are available as specified below;
   - Signed Value: -32000 ~ 32000
   - Precise Value: Refer to Chapter 2.2 Display based on analog input range.
   - Percentile Value: 0 ~ 10000

6) Input disconnection detection function
   This function is used to detect the disconnection of input circuit when 1 ~ 5 V (4 ~ 20 mA) of analog input signal range is used.

Chapter 2 Specifications

2.1 General Specifications

General specifications of XGT series are as specified in Table 2.1.

[Table 2.1] General Specifications

<table>
<tr><th>No.</th><th>Item</th><th colspan="6">Specifications</th><th>Related standards</th></tr>
<tr><td>1</td><td>Operating temp.</td><td colspan="6">0℃ ~ +55℃</td><td>-</td></tr>
<tr><td>2</td><td>Storage temp.</td><td colspan="6">-25℃ ~ +70℃</td><td>-</td></tr>
<tr><td>3</td><td>Operating humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td>-</td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td>-</td></tr>
<tr><td rowspan="9">5</td><td rowspan="9">Vibration</td><td colspan="5">For discontinuous vibration</td><td>-</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td>Number</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10≤f< 57 ㎐</td><td colspan="2">-</td><td>0.075mm</td><td rowspan="7">Each 10 times in X,Y,Z directions</td></tr>
<tr><td>57≤f≤150 ㎐</td><td colspan="2">9.8m/s (1G)</td><td>-</td></tr>
<tr><td colspan="4">For continuous vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td></tr>
<tr><td>10≤f< 57 ㎐</td><td colspan="2">-</td><td>0.035mm</td></tr>
<tr><td>57≤f≤150 ㎐</td><td colspan="2">4.9m/s (0.5G)</td><td>-</td></tr>
<tr><td>6</td><td>Shocks</td><td colspan="6">* Max. impact acceleration: 147 ㎨(15G)
* Authorized time: 11 ㎳
* Pulse wave : Sign half-wave pulse
(Each 3 times in X,Y,Z directions)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Noise</td><td colspan="3">Square wave impulse noise</td><td colspan="2">±1,500V</td><td>LSIS standard</td></tr>
<tr><td colspan="3">Electrostatic discharging</td><td colspan="2">Voltage : 4kV
(contact discharging)</td><td>IEC61131-2
IEC61000-4-2</td></tr>
<tr><td colspan="3">Radiated electromagnetic field noise</td><td colspan="2">27 ~ 500MHz, 10 V/m</td><td>IEC61131-2,
IEC61000-4-3</td></tr>
<tr><td rowspan="2">Fast Transient /burst noise</td><td>Class</td><td>Power module</td><td colspan="2">Digital/
Analog I/O
communication interface</td><td rowspan="2">IEC61131-2
IEC61000-4-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td colspan="2">1kV</td></tr>
<tr><td>8</td><td>Ambient conditions</td><td colspan="6">No corrosive gas or dust</td><td>-</td></tr>
<tr><td>9</td><td>Operating height</td><td colspan="6">2000m or less</td><td>-</td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="6">2 or less</td><td>-</td></tr>
</table>

Remark

1) IEC (International Electrotechnical Commission):
An international nongovernmental organization which promotes internationally cooperated standardization in electric/electronic fields publishes international standards and manages applicable estimation system related with.
2) Pollution level: An index indicating pollution level of the operating environment which decides insulation performance of the devices. For instance, Pollution level 2 indicates the state generally that only non-conductive pollution occurs. However, this state contains temporary conduction due to dew produced.

2.2 Performance Specifications

Performance specifications of isolated Analog Input Module XGF-AD4S is specified in Table 2.2.

[Table 2.2] Performance Specifications

<table>
<tr><td rowspan="2">Item</td><td colspan="5">Specifications</td></tr>
<tr><td colspan="3">Voltage Input</td><td colspan="2">Current Input</td></tr>
<tr><td>Analog input range</td><td colspan="3">DC 1 ~ 5 V
DC 0 ~ 5 V
DC 0 ~ 10 V
DC -10 ~ 10 V
(Input Resistance: 1 MΩ min.)</td><td colspan="2">DC 4 ~ 20 mA
DC 0 ~ 20 mA
(Input Resistance: 250 Ω)</td></tr>
<tr><td>Analog input range setting</td><td colspan="5">► Analog input range can be selected through user program or [I/O parameter].
► Respective input ranges can be set based on channels.</td></tr>
<tr><td>Digital output</td><td colspan="5">(1) Voltage Type
<table>
<tr><td>Analog input / Digital output</td><td>1 ~ 5 V</td><td>0 ~ 5 V</td><td>0 ~ 10 V</td><td>-10 ~ 10 V</td></tr>
<tr><td>Signed Value</td><td colspan="4">-32000 ~ 32000</td></tr>
<tr><td>Precise Value</td><td>1000 ~ 5000</td><td>0 ~ 5000</td><td>0 ~ 10000</td><td>-10000 ~ 10000</td></tr>
<tr><td>Percentile Value</td><td colspan="4">0 ~ 10000</td></tr>
</table>
(2) Current Type
<table>
<tr><td>Analog input / Digital output</td><td>4 ~ 20 ㎃</td><td>0 ~ 20 ㎃</td></tr>
<tr><td>Signed Value</td><td colspan="2">-32000 ~ 32000</td></tr>
<tr><td>Precise Value</td><td>4000 ~ 20000</td><td>0 ~ 20000</td></tr>
<tr><td>Percentile Value</td><td colspan="2">0 ~ 10000</td></tr>
</table>
► Signed 16-bit binary value (-32768 ~ 32767)
► Format of digital output data can be set through user program or [I/O Parameter setting] respectively based on channels.</td></tr>
<tr><td>Max. resolution</td><td colspan="5">
<table>
<tr><td>Analog input range</td><td>Resolution (1/64000)</td><td>Analog input range</td><td>Resolution (1/64000)</td></tr>
<tr><td>1 ~ 5 V</td><td>62.5 ㎶</td><td rowspan="2">4 ~ 20 ㎃</td><td rowspan="2">250 ㎁</td></tr>
<tr><td>0 ~ 5 V</td><td>78.1 ㎶</td></tr>
<tr><td>0 ~ 10 V</td><td>156.3 ㎶</td><td rowspan="2">0 ~ 20 ㎃</td><td rowspan="2">312.5 ㎁</td></tr>
<tr><td>-10 ~ 10 V</td><td>312.5 ㎶</td></tr>
</table>
</td></tr>
<tr><td>Accuracy</td><td colspan="5">±0.05% or less (when ambient temperature is 25 ℃)
Temperature coefficient: ±40ppm/℃ (0.0040%/℃)</td></tr>
<tr><td>Conversion speed</td><td colspan="5">Maximum of 10ms / module</td></tr>
<tr><td>Absolute input</td><td colspan="3">Maximum of ±15 V</td><td colspan="2">Maximum of ±30 ㎃</td></tr>
<tr><td>Analog input points</td><td colspan="5">4 channels/1 module</td></tr>
<tr><td>Insulation specification</td><td colspan="5">Photo-coupler insulation between input terminal and PLC power
(no insulation between channels)
<table>
<tr><td>Item</td><td>Insulation method</td><td>Insulation voltage immunity</td><td>Insulation resistance</td></tr>
<tr><td>Between channels</td><td>Transformer</td><td rowspan="2">500 V AC, 50/60 Hz, 1min, Leakage current less than 10 mA</td><td rowspan="2">500 V DC, over than 10㏁</td></tr>
<tr><td>Between input terminal and PLC power</td><td>Photo coupler</td></tr>
</table>
</td></tr>
<tr><td>Terminal connected</td><td colspan="5">18-point terminal</td></tr>
<tr><td>I/O points occupied</td><td colspan="5">Fixed type: 64 points, Non fixed type: 16 points</td></tr>
<tr><td>Internal-consumed current</td><td colspan="5">DC 5 V: 610 ㎃</td></tr>
<tr><td>Weight</td><td colspan="5">140g</td></tr>
</table>

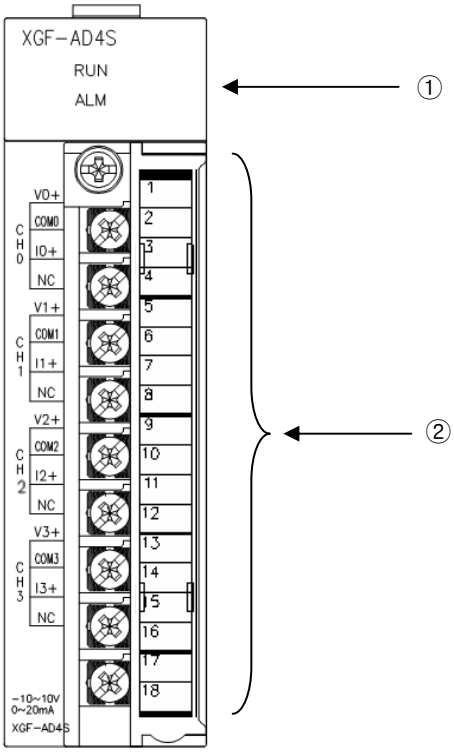
Remark

1) When Analog Input Module is made at factory, Offset/Gain value about analog input range is fixed and you can't change them.
2) Offset Value: Analog input value of which digital output value becomes -32000 when you set digital output type as Unsigned Value
3) Gain Value: Analog input value of which digital output value becomes 32000 when you set digital output type as Unsigned Value

2.3 Part names and Functions

Respective designations of the parts are as described below.

2.3.1 XGF-AD4S



No.	Description
①	Status Display LED
	RUN: On: In normal operation Flickering: Error occurs (Refer to 9.1 for more details) Off: DC 5V disconnected or XGF-AD4S module error **ALM**: Flickering: Alarm detected(Process alarm, rate of change alarm set by XG5000) OFF: In normal operation
②	Terminal
	▶ Analog input terminal, whose respective channels can be connected with external devices.

2.4 Characteristics of A/D Conversion

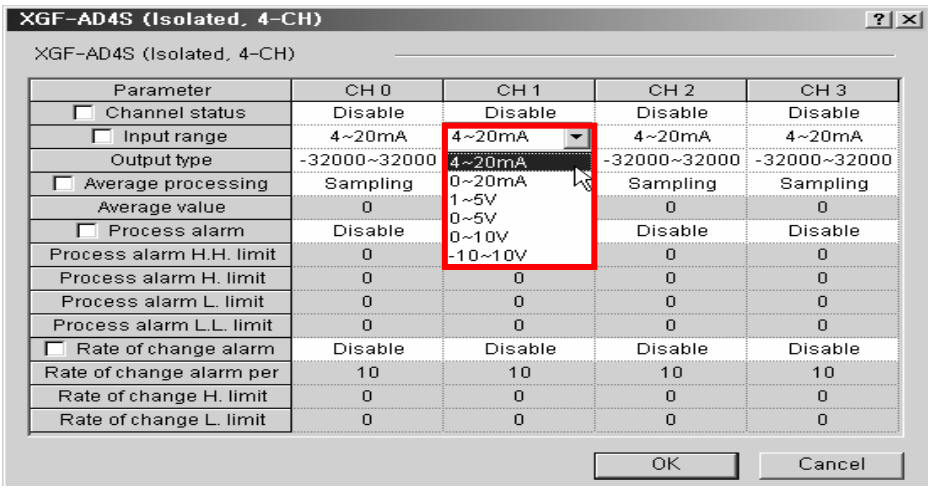
2.4.1 How to select the range of the A/D conversion

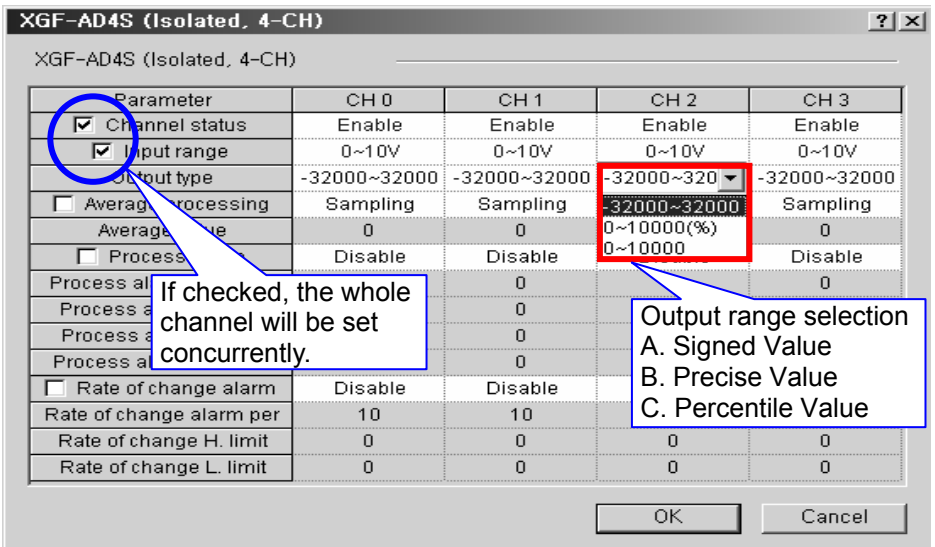
XGF-AD4S with isolated 4 input channels are used for voltage/current inputs, where Offset/Gain can not be adjusted by user. Voltage/Current input range can be set for respective channels through user program (Refer to the Chapter) or I/O parameter setting with XG5000 programming tool.
Digitalized output formats are specified in three types as below;

A. Signed Value
B. Precise Value
C. Percentile Value

For example, if the range is 4 ~ 20mA,

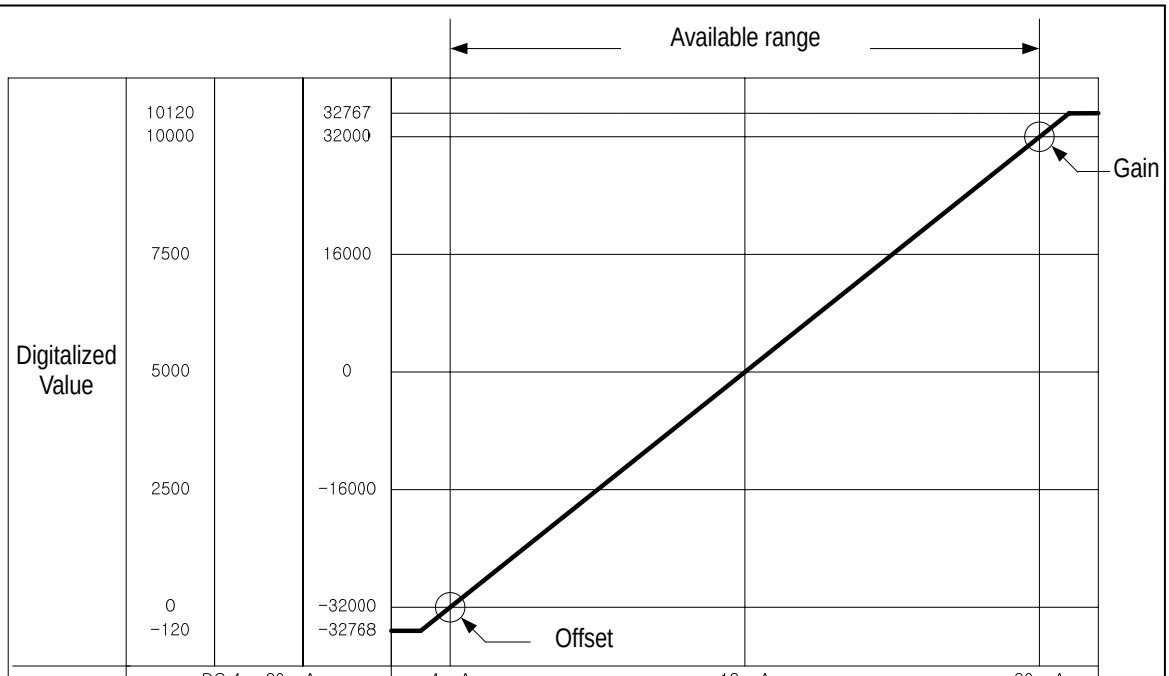
▶ On the XG5000 menu [I/O Parameters Setting], set [Input range] to “4 ~ 20mA”.





2.4.2 Characteristics of the A/D conversion

Characteristics of A/D conversion are the inclination connected in a straight line between Offset and Gain values when converting analog signal (voltage or current input) to digital value. A/D conversion characteristics of Analog Input Modules are as described below.



Analog input	DC 4 ~ 20 mA	4 mA	12 mA	20 mA
	DC 0 ~ 20 mA	0 mA	10 mA	20 mA
	DC 1 ~ 5 V	1 V	3 V	5 V
	DC 0 ~ 5 V	0 V	2.5 V	5 V
	DC 0 ~ 10 V	0 V	5 V	10 V
	DC −10 ~ 10 V	−10 V	0 V	10 V

Remark

1. When Analog Input Module is released from the factory, Offset/Gain value is as adjusted for respective analog input ranges, which is unavailable for user to change.
2. Offset Value: Analog input value where digitalized value is -32,000.
3. Gain Value: Analog input value where digitalized value is 32,000.

2.4.3 Digitalized output values of each inputs

1. Analog input current (4~20mA)

Kinds of outputs	Analog input current (4~20mA)						
	3.808	4	8	12	16	20	20.192
Signed value	-32768	-32000	-16000	0	16000	32000	32767
Precise Value	3808	4000	8000	12000	16000	20000	20192
Percentile value	-120	0	2500	5000	7500	10000	10120

2. Analog input current (0~20mA)

Kinds of outputs	Analog input current (0~20mA)						
	-0.24	0	5	10	15	20	20.24
Signed value	-32768	-32000	-16000	0	16000	32000	32767
Precise Value	-240	0	5000	10000	15000	20000	20240
Percentile value	-120	0	2500	5000	7500	10000	10120

3. Analog input Voltage (1~5V)

Kinds of outputs	Analog input Voltage (1~5V)						
	0.952	1	2	3	4	5	5.048
Signed value	-32768	-32000	-16000	0	16000	32000	32767
Precise Value	952	1000	2000	3000	4000	5000	5048
Percentile value	-120	0	2500	5000	7500	10000	10120

4. Analog input Voltage (0~5V)

Kinds of outputs	Analog input Voltage (0~5V)						
	-0.06	0	1.25	2.5	3.75	5	5.06
Signed value	-32768	-32000	-16000	0	16000	32000	32767
Precise Value	-60	0	1250	2500	3750	5000	5060
Percentile value	-120	0	2500	5000	7500	10000	10120

5. Analog input Voltage (0~10V)

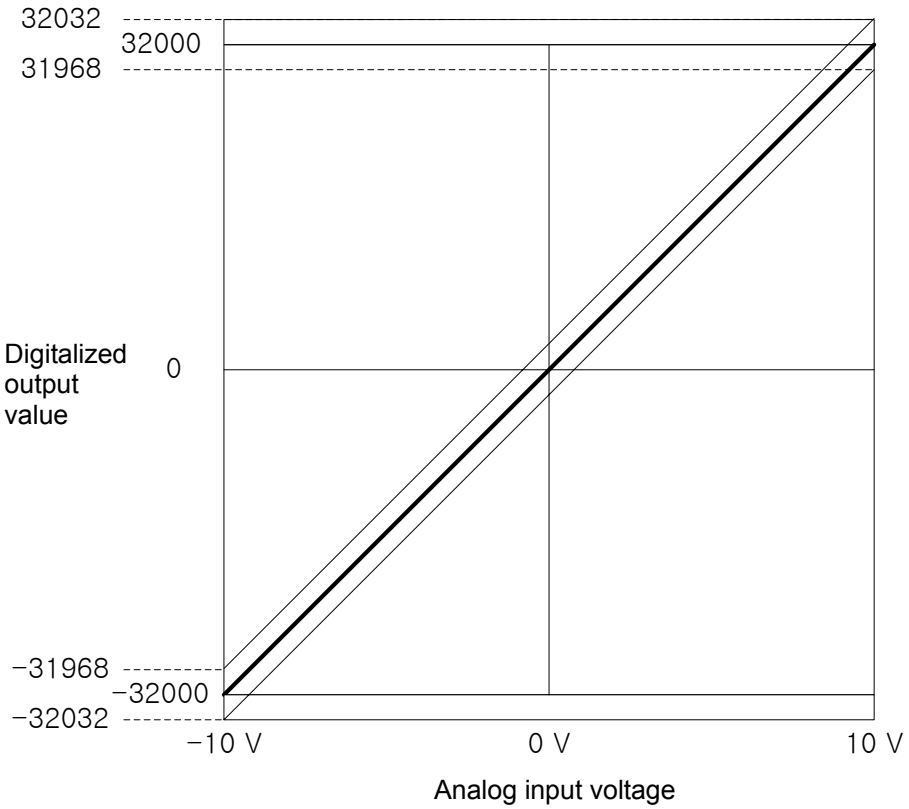
Kinds of outputs	Analog input Voltage (0~10V)						
	-0.12	0	2.5	5	7.5	10	10.12
Signed value	-32768	-32000	-16000	0	16000	32000	32767
Precise Value	-120	0	2500	5000	7500	10000	10120
Percentile value	-120	0	2500	5000	7500	10000	10120

6. Analog input Voltage (-10~10V)

Kinds of outputs	Analog input Voltage (-10~10V)						
	-10.24	-10	-5	0	5	10	10.24
Signed value	-32768	-32000	-16000	0	16000	32000	32767
Precise Value	-10240	0	2500	5000	7500	10000	10240
Percentile value	-120	0	2500	5000	7500	10000	10120

2.4.4 Accuracy

The accuracy of digital output value is not changed even when input range is changed.
Fig. 2.1 shows the changing range of the accuracy at ambient temperature of 25℃
with analog input range of -10 ~ 10 V selected and the digitalized outputs of signed value.
The error tolerance at ambient temperature of 25°C is ±0.05% and the temperature coefficient is 17.7ppm/°C.



[Fig. 2.1] Accuracy

2.5 Functions of Analog Input Module

Functions of Analog Input Module are as described below in Table 2.3.

[Table 2.3] List of Functions

Function Item	Details
Enabling the Channels	Enables the specified channels to execute A/D conversion.
Selecting the range of input	4 types of voltage inputs and 2 types of current inputs are available for the XGF-AD4S module.
Selecting the output data	3 kinds of the output data formats are provided in this module. (Signed, Precise and Percentile value)
A/D conversion methods	(1) Sampling processing Sampling processing will be performed when the average processing is not specified. (2) Average processing A. Time average processing B. Count average processing C. Moving average processing D. Weighted average processing
Alarm processing	Process alarm and change rate alarm processing are available.
Detecting the disconnection of input signal	If an analog input with the range of 1 ~ 5 V (4 ~ 20 ㎃) is disconnected, it is detected by a user program.

2.5.1 Sampling processing

The sampling period (Processing time) depends on the number of the channels in use.

Processing time = Maximum of 10ms per module

2.5.2 Average processing

This processing is used to execute A/D conversion with specified count or time and to save the average of the accumulated sum on memory. Average processing option and time/count value can be defined through user program or I/O parameters setting for respective channels.

1) What is the average processing used for

This process is used to reduce the influence caused by abnormal analog input signal such as noise.

2) Kinds of average processing

There are four (4) kinds of average processing, Time, Count, Moving and Weighted average.

(1) Time average processing

A. Setting range: 16 ~ 4000 (ms)

B. Number of processing $= \dfrac{\text{Setting time}}{10\text{ms}}$ [times]

Ex.) Setting time: 68 ms

$$\text{Number of processing} = \frac{68\text{ms}}{10\text{ms}} = 6.8 \Rightarrow 6\ \text{[times](rounded)}$$

*1: If setting value of time average is not specified within 16 ~ 4000, RUN LED blinks at an interval of 1 second. In order to set RUN LED to On state, set the setting value within the range again and then change the PLC CPU from STOP to RUN mode. Be sure to use request flag of error clear (UXY.11.0) to clear the error during RUN.
*2: If any error occurs in setting value of time average, the default value 16 will be saved.

(2) Count average processing

A. Setting range: 2 ~ 500 (times)
The average value of input data at designated times is saved as a real input data.

B. Process time = setting count x 10ms

Ex.) Average processing count time is 50.

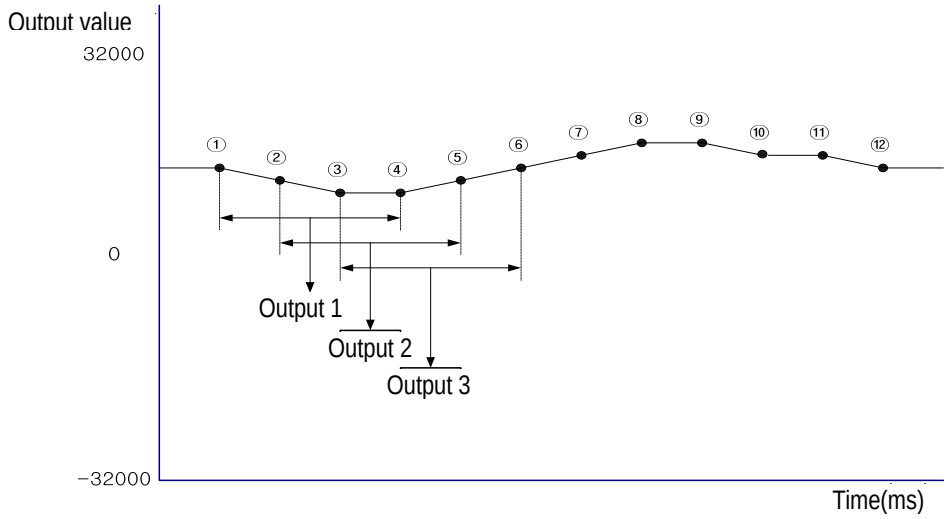
Processing time = 50 x 10ms = 500ms

*1: If setting value of count average is not specified within 2 ~ 500, RUN LED blinks at an interval of 1 second. In order to set RUN LED to On state, set the setting value within the range and then change PLC CPU from STOP to RUN mode. Be sure to use request flag of error clear (UXY.11.0) to clear the error during RUN..
*2: If any error occurs in setting the value, the default value 2 will be saved.

(3) Moving average processing

A. Setting range: 2 ~ 200(times)

B. This process outputs the newest average value in every sampling at the designated count times. The Fig 2.2 shows the Moving average processing with 4 count times.



Output 1 = (① + ② + ③ + ④) / 4
Output 2 = (② + ③ + ④ + ⑤) / 4
Output 3 = (③ + ④ + ⑤ + ⑥) / 4

[Fig. 2.2] Average processing

(4) Weighted average processing

A. Setting range: 1 ~ 99(%)

$$F[n] = (1 - \alpha) \times A[n] + \alpha \times F[n - 1]$$

F[n]: Current Weighted average output
A[n]: Current A/D conversion value
F[n-1]: Former Weighted average output
α: Weighted average constant (0.01 ~ 0.99)

*1: If setting value of count average is not specified within 1 ~ 99, RUN LED blinks at an interval of 1 second. In order to set RUN LED to On status, reset the setting value of frequency average within 2 ~ 500 and then convert PLC CPU from STOP to RUN. Be sure to use request flag of error clear (UXY.11.0) to clear the error through modification during RUN.
*2: If any error occurs in setting the value, the default value 1 will be saved.

B. Voltage Input (for example)

•Analog input range: DC -10 ~ 10 V, Digital output range: -32000 ~ 32000.
•When an analog input changes rapidly –10 V to 10 V (-32000 → 32000), the outputs of Weighted average according to the constant(α) are as shown below.

α	Outputs of Weighted average				Remarks
	0 scan	1 scan	2 scan	3 scan	
*1) 0.01	0	31360	31993	31999	Weighted 1% to former value
*2) 0.5	0	0	16000	24000	Weighted 50% to former value
*3) 0.99	0	-31360	-30726	-30099	Weighted 99% to former value

*1) Outputs 32000 after about 4 scans
*2) Outputs 32000 after about 24 scans
*3) Outputs 32000 after about 1629 scans(16.29s)

C. Current Input (for example)

• Analog input range: DC 0 ~ 20 mA, Digital output range: -32000 ~ 32000.
• When an analog input changes rapidly 0 mA to 10 mA (-32000 → 16000), the outputs of Weighted average according to the constant(α) are shown below.

α	Outputs of Weighted average				ㅂ| ㄱ
	0 scan	1 scan	2 scan	3 scan	
*1) 0.01	0	15520	15995	15999	Weighted 1% to former value
*2) 0.5	0	-8000	4000	10000	Weighted 50% to former value
*3) 0.99	0	-31520	-31044	-30574	Weighted 99% to former value

*1) Outputs 16000 after about 4 scans
*2) Outputs 16000 after about 24 scans
*3) Outputs 16000 after 1600 scans (16s)

• To get the stabilized output against rapid input changes (e.g. noise), this weighted average processing will be helpful.

2.5.3 Alarm processing

1) Process Alarm

When the digital value becomes greater than process alarm HH limit value, or less than LL limit value, the alarm flag turns on and the alarm LED on the front of the module flickers.
When the digital output value becomes less than process alarm H limit value, or greater than L limit value, the alarms are cleared.

2) Change rate alarm

This function enables to sample data cyclically with the period set in the parameter of 'Rate of change alarm period' and to compare every two sample data.
The unit used for 'Rate of change H limit' and 'Rate of change L limit' is percentage per second (%/s).

(1) Setting rate of the sampling period: 10 ~ 5000(ms)

If '1000' is set for the period, the input data is sampled and compared every 1 second.

(2) Setting range of change rate limit: -32768 ~ 32767(-3276.8%/s ~ 3276.7%/s)

(3) Calculation of the criterion

The criterion of change rate alarm

= High limit or Low limit of change rate alarm X 0.001 X 64000 X Detection period ÷ 1000

A. An example for change rate setting 1(Rising rate detection)

a) Detection period of Ch. 0: 10(ms)
b) Alarm high(H) limit of Ch. 0: 100(10.0%)
c) Alarm low(L) limit of Ch. 0: 90(9.0%)
d) Alarm high(H) criterion of Ch.0
= 100 X 0.001 X 64000 X 10 ÷ 1000 = 64
e) Alarm low(L) criterion of Ch.0
= 90 X 0.001 X 64000 X 10 ÷ 1000 = 57.6 = 57
f) When the deviation value of ([n]th digital value) – ([n-1]th digital value) becomes greater than 64, high(H) change rate detection flag of Ch.0(CH0 H) turns on.
g) When the deviation value of ([n]th digital value) – ([n-1]th digital value) becomes less than 57, low(L) change rate detection flag f Ch.0(CH0 L) turns on.

B. An example for change rate setting 2(Falling rate detection)

a) Detection period of Ch. 0: 100(ms)
b) Alarm high(H) limit of Ch. 0: -10(-1.0%)
c) Alarm low(L) limit of Ch. 0: -20(-2.0%)
d) Alarm high(H) criterion of Ch.0
= -10 X 0.001 X 64000 X 100 ÷ 1000 = -64
e) Alarm low(L) criterion of Ch.0
= -20 X 0.001 X 64000 X 100 ÷ 1000 = -128
f) When the deviation value of ([n]th digital value) – ([n-1]th digital value) becomes greater than -64, high(H) change rate detection flag of Ch.0(CH0 H) turns on.
g) When the deviation value of ([n]th digital value) – ([n-1]th digital value) becomes less than -128, low(L) change rate detection flag f Ch.0(CH0 L) turns on.

C. An example for change rate setting 3 (Detection of change rate)

a) Detection period of Ch. 0: 1000(ms)

b) Alarm high(H) limit of Ch. 0: 2(0.2%)

c) Alarm low(L) limit of Ch. 0: -2(-0.2%)

d) Alarm high(H) criterion of Ch.0

= 2 X 0.001 X 64000 X 1000 ÷ 1000 = 128

e) Alarm low(L) criterion of Ch.0

= -2 X 0.001 X 64000 X 1000 ÷ 1000 = -128

f) When the deviation value of ([n]th digital value) – ([n-1]th digital value) becomes greater than 128, high(H) change rate detection flag of Ch.0(CH0 H) turns on.

g) When the deviation value of ([n]th digital value) – ([n-1]th digital value) becomes less than -128, low(L) change rate detection flag f Ch.0(CH0 L) turns on.

2.5.4 Detection of input disconnection

1) Available inputs

This detection function is available for the analog inputs of 4 ~ 20 mA and 1 ~ 5 V
The detecting condition is as below.

Input range	Detecting range
4 ~ 20 mA	Less than 0.8 mA
1 ~ 5 V	Less than 0.2 V

2) Detection status

The detection status of each channel is saved in Uxy.10.z
(x: base number, y: slot number, z: bit number)

Bit number	16	15	---	5	4	**3**	**2**	**1**	**0**
Initial value	0	0	0	0	0	**0**	**0**	**0**	**0**
Channel number	-	-	-	-	-	**Ch.3**	**Ch.2**	**Ch.1**	**Ch.0**

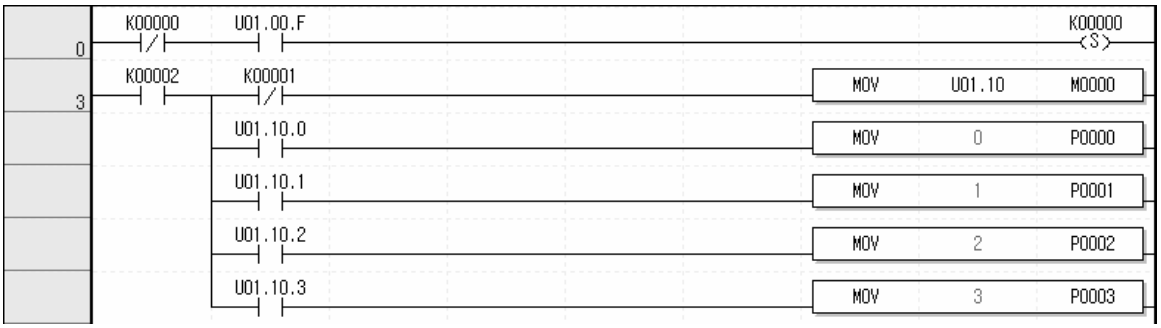
BIT	Description
0	Normal operation
1	Disconnection

3) Operation of the detection status

Each bit is set to ‘1’ when detecting disconnection, and returned to ‘0’ when detecting connection.
The status bits can be used in a user program for detecting the disconnection.

4) Program example

As for the module mounted on base 0, slot 1,
If disconnection is detected, the channel number is stored in each ‘P’ area.



Chapter 3 Installation and Wiring

3.1 Installation

3.1.1 Installation environment

This product is of high reliance regardless of installation environment. However, for the sake of reliance and stability of the system, please pay attention to the precautions described below.

1) Environmental conditions
   - To be installed on the control panel waterproof and dustproof.
   - No continuous impact or vibration shall be expected.
   - Not to be exposed to direct sunlight.
   - No dew shall be caused by rapid temperature change.
   - Ambient temperature shall be kept 0-55℃.

2) Installation work
   - Do not leave wiring waste inside the PLC after wiring or drilling screw holes.
   - To be installed on a good location to work on.
   - Don't let it be installed on the same panel as the high-voltage device.
   - Let it be kept at least 50㎜ away from duct or near-by module.
   - To be grounded in an agreeable place free from noise.

3.1.2 Precautions for handling

Precautions for handling isolated Analog Input Module are as described below from the opening to the installation.

1) Don't let it be dropped or shocked hardly.
2) Don't remove PCB from the case. It will cause abnormal operation.
3) Don't let any foreign materials including wiring waste inside the top of the module when wiring. Remove foreign materials if any inside.
4) Don't install or remove the module while powered on.

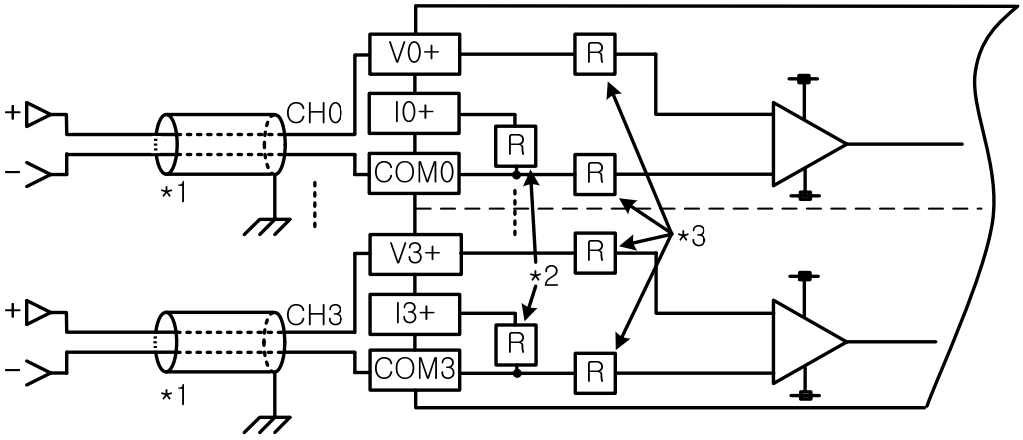
3.2 Wiring

3.2.1 Precautions for wiring

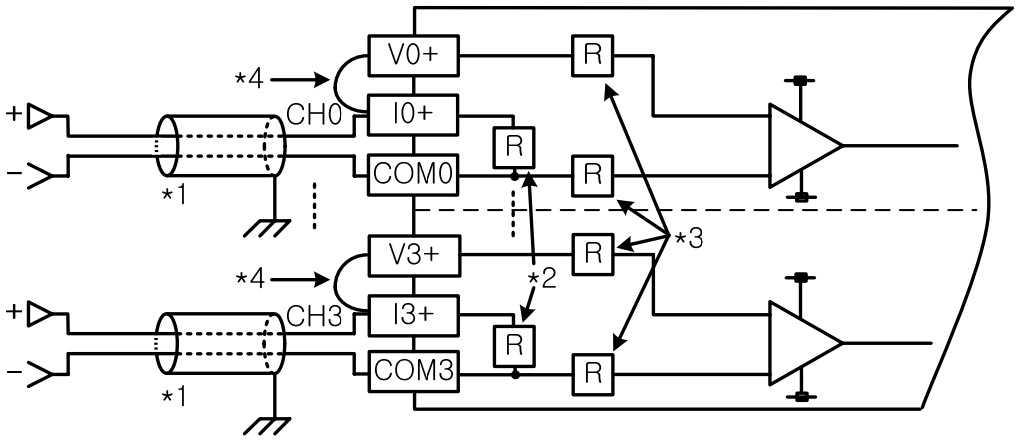
1) Don't let AC power line near to Analog Input Module's external input sign line. With an enough distance kept away in between, it will be free from surge or inductive noise.
2) Cable shall be selected in due consideration of ambient temperature and allowable current, whose size is not less than the max. cable standard of AWG22 (0.3㎟).
3) Don't let the cable too close to hot device and material or in direct contact with oil for long, which will cause damage or abnormal operation due to short-circuit.
4) Check the polarity when wiring the terminal.
5) Wiring with high-voltage line or power line may produce inductive hindrance causing abnormal operation or defect.

3.2.2 Wiring examples

1) Voltage input

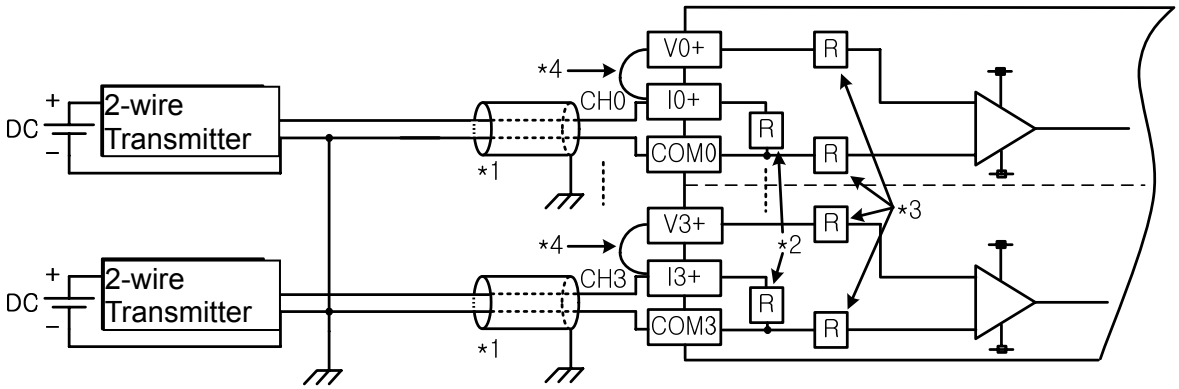


2) Current input

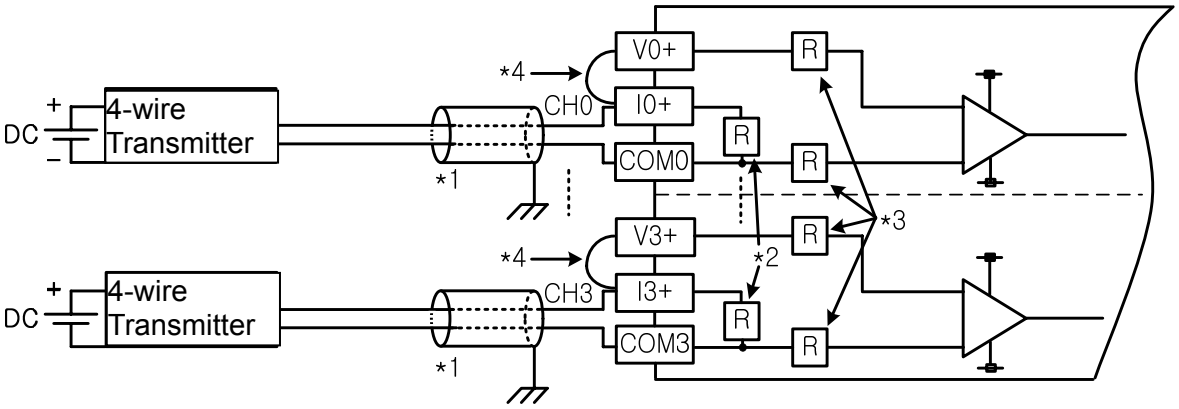


*1) Use a 2-core twisted shielded wire. AWG 22 is recommended for the cable standard.
*2) Input resistance for current input is 250 Ω (typ.).
*3) Input resistance for voltage input is 1 MΩ (min.).
*4) In case of current input, short V+ and I+ terminal.

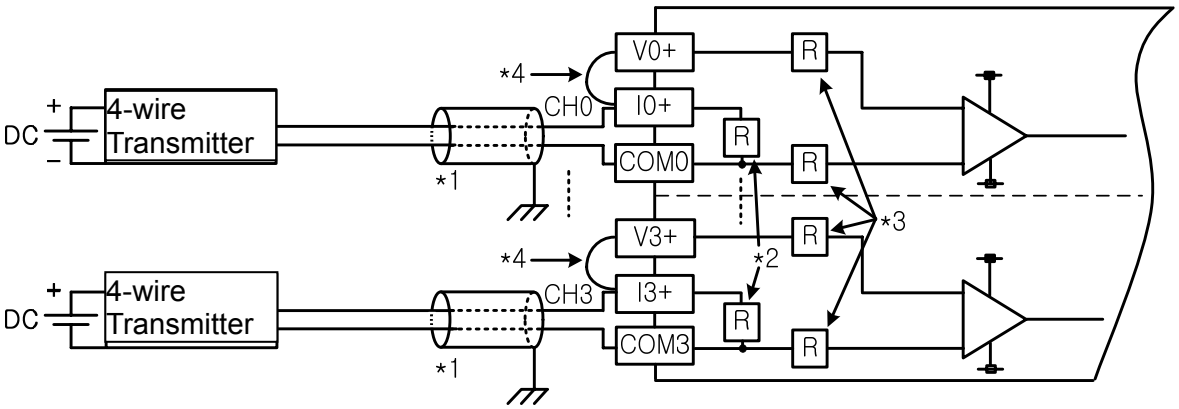
3) Wiring example of 2-wire sensor/transmitter (Current input)



4) Wiring example of 4- wire sensor/transmitter (Current input)



5) Wiring example of 4- wire sensor/transmitter (Voltage input)

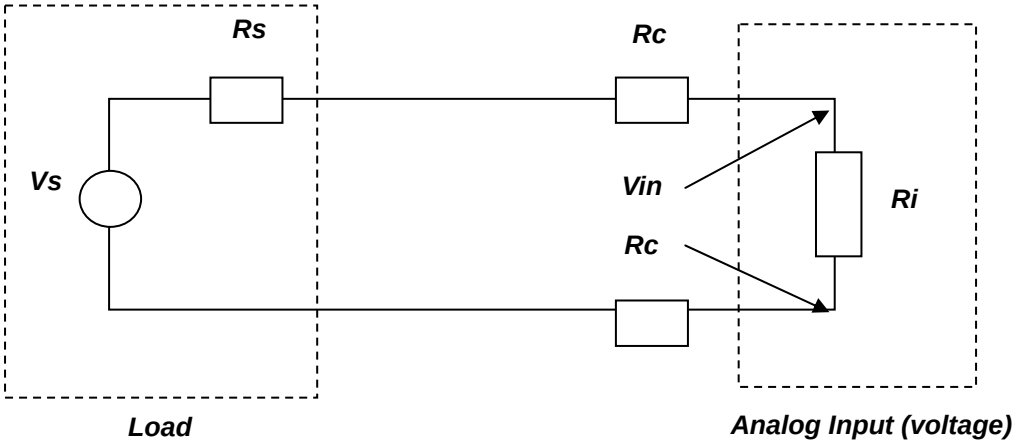


-. Analog input module does not provide power for the input device. Use an external power supplier.

* 1) Use a 2-core twisted shielded wire. AWG 22 is recommended for the cable standard.
* 2) Input resistance for current input is 250 Ω (typ.).
* 3) Input resistance for voltage input is 1 MΩ (min.).

6) Relationship between voltage input accuracy and wiring length

In voltage input, the wiring (cable) length between transmitter or sensor and module has an effect on digital-converted values of the module as specified below;



Where,

Rc: Resistance value due to line resistance of cable

Rs: Internal resistance value of transmitter or sensor

Ri: Internal resistance value (1㏁) of voltage input module

Vin: Voltage allowed to analog input module

% Vi: Tolerance of converted value (%) due to source and cable length in voltage input

$$Vin = \frac{Ri \times Vs}{\left[Rs + \left(2 \times Rc\right) + Ri\right]}$$

$$\%Vi = \left(1 - \frac{Vin}{Vs}\right) \times 100\,\%$$

Remark

In current input, there will be no accuracy tolerance caused by cable length and internal resistance of the source.

Chapter 4 Operation Procedures and Monitoring

4.1 Setting the Operation Parameters

There are two ways of setting the operation parameters.
One is to set in the [I/O Parameters] of the XG5000, the other is to set in a user program with the internal memory of the module.(Refer to the Chapter 5 for the setting in a program)

4.1.1 Parameters for the XGF-AD4S module

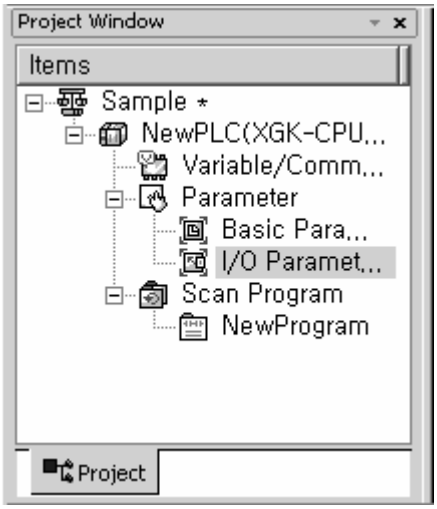
Setting items for the module are as described below in the table 4.1.

[Table 4. 1] Function of [I/O Parameters]

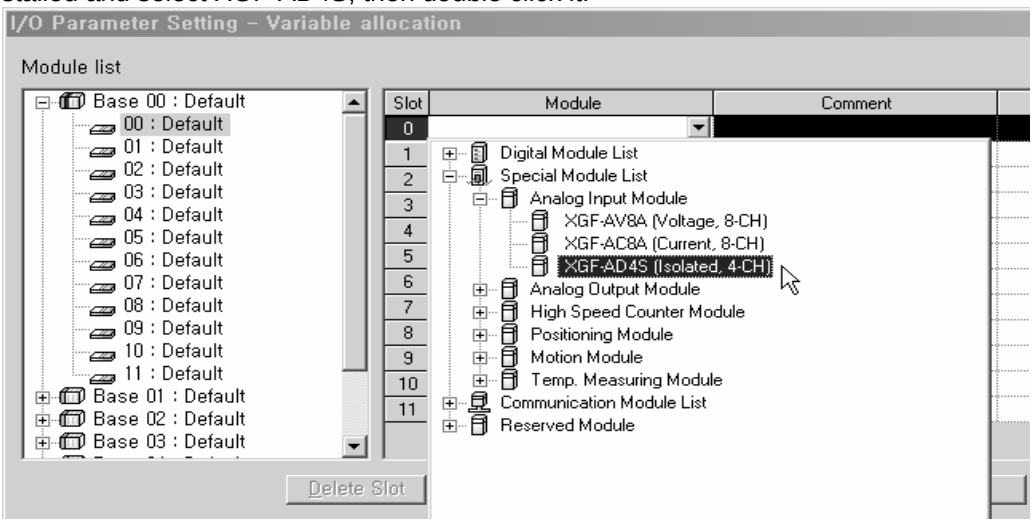
Item	Details
[I/O parameters]	(1) Specify the following items necessary for the module operation. - Channel status: Enable/Disable each channel to operate - Input range: Setting ranges of input voltage/current - Output type: Setting the type of digitalized value - Average processing: Selecting the method of average processing - Average value setting - Process alarm: Enable/disable the alarm processing - Process alarm HH, H, L and LL limit setting - Rate of change alarm: Enable/disable the alarm processing - Rate of change alarm percentile, H and L limit (2) The data set above can be downloaded at any time regardless of the status of the CPU(Run or Stop)

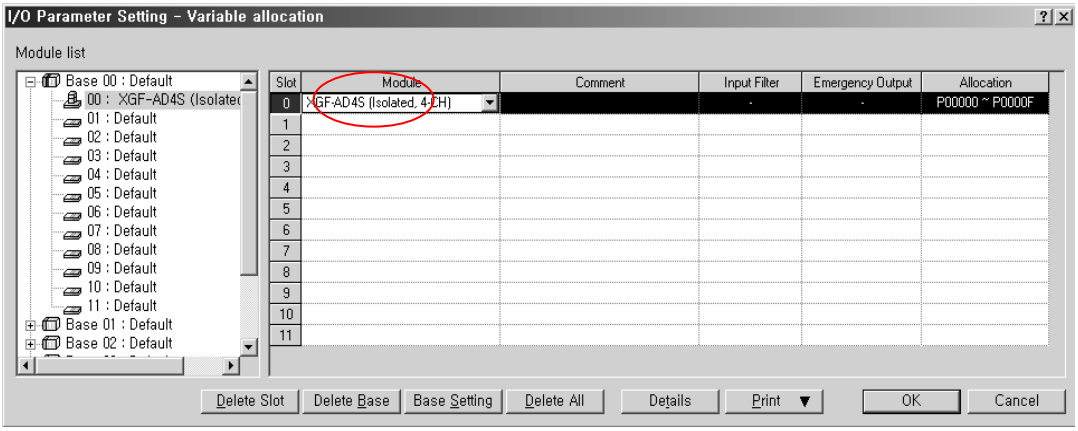
4.1.2 The procedure of setting parameters with XG5000

1) Open XG5000 to create a project. (Refer to XG5000 programming manual for details)
2) Double-click [I/O parameters] on the project window.

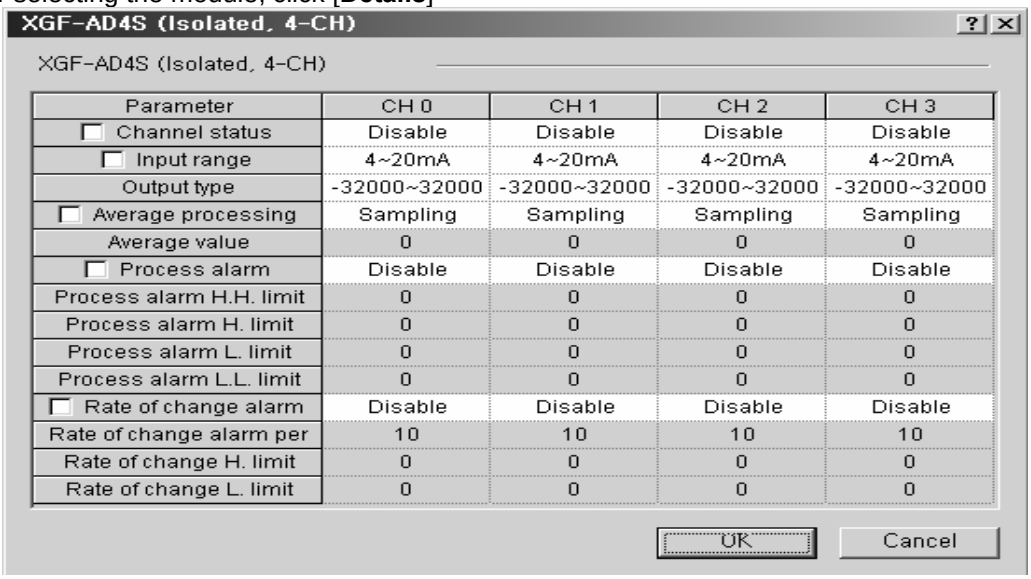


3) On the 'I/O parameters setting' screen, click the slot number on which the XGF-AD4S module is installed and select XGF-AD4S, then double click it.



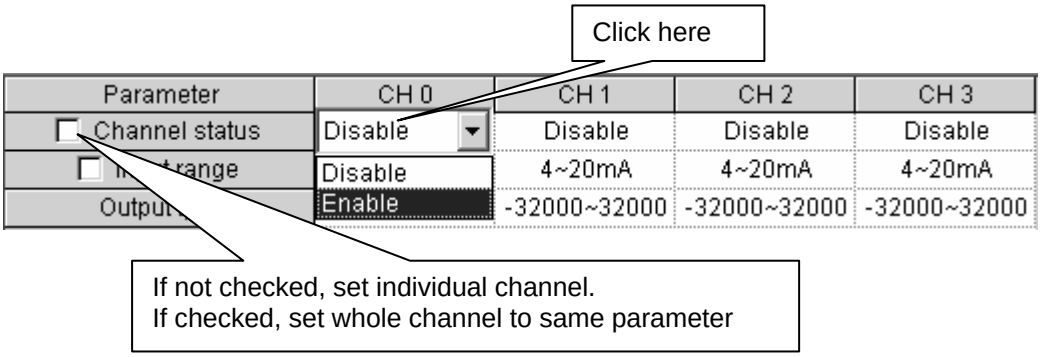


4) After selecting the module, click [**Details**]

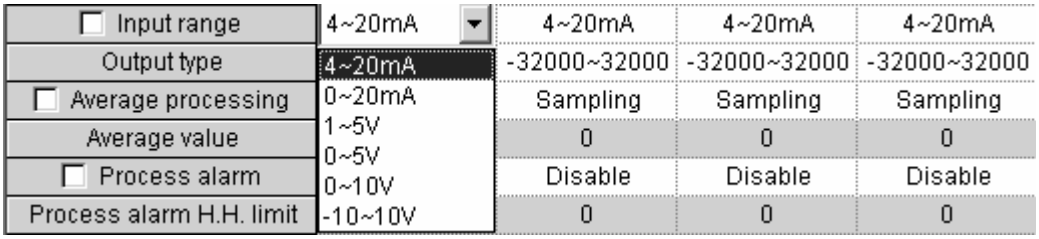


5) Set the individual parameters.

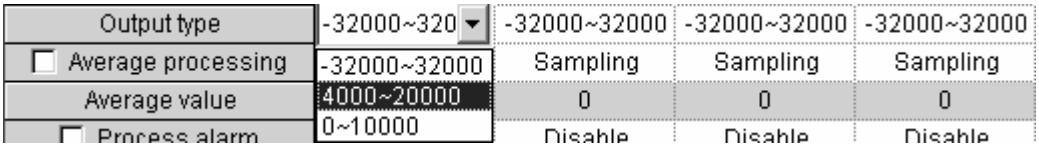
(1) Channel status: Set to Enable or Disable.



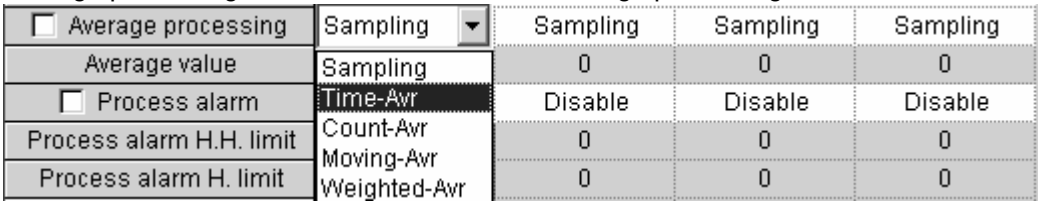
(2) Input range: Select the range of analog input.



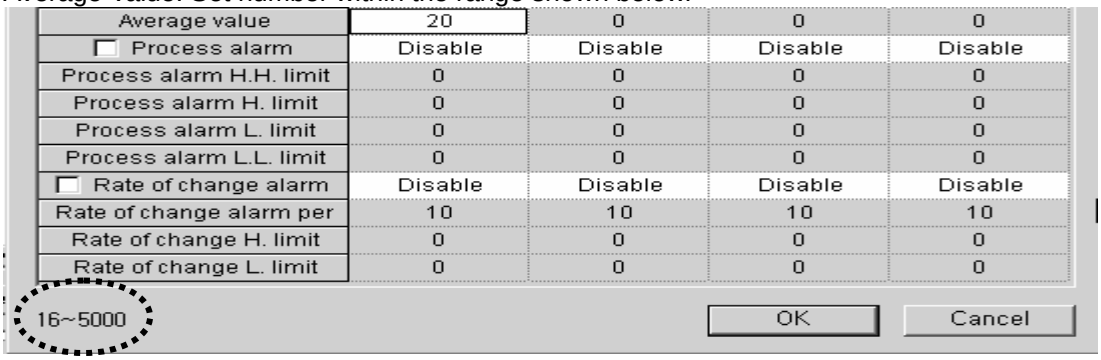
(3) Output type: Select the type of converted digital value.



(4) Average processing: Select the method of the average processing.



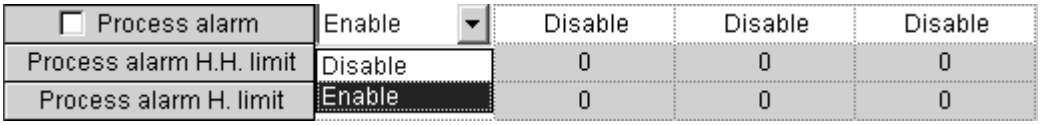
(5) Average Value: Set number within the range shown below.



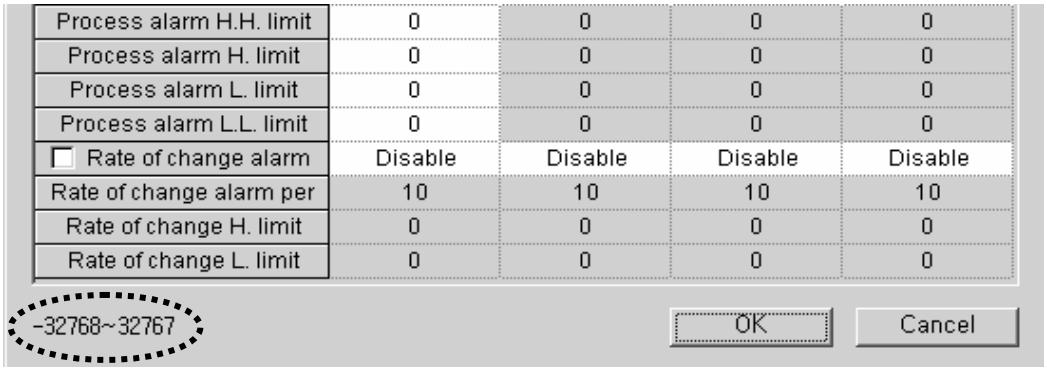
[Setting range of the average processing]

Average processing	Setting range
Time average	16 ~ 5000(ms)
Count average	2 ~ 500
Moving average	2 ~ 100
Weighted average	1 ~ 99(%)

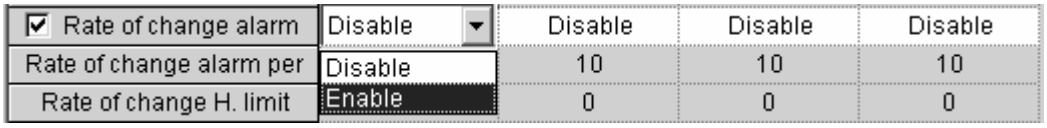
(6) Process alarm: Set Enable or Disable for Process alarm.



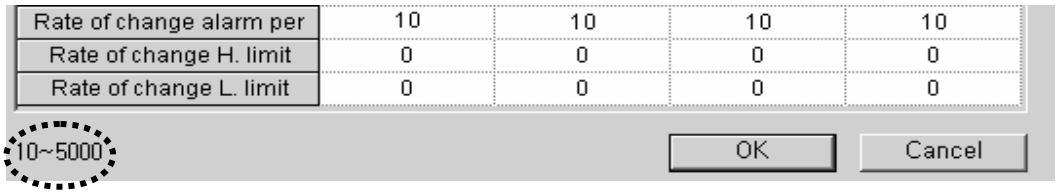
(7) Process alarm limits: Set each criterion for limit within the range shown below.



(8) Rate of change alarm: Set Enable or disable alarm for the change rate.



(9) Rate of change limits: Set each criterion for limit within the range shown below.



4.2 Monitoring the Special Module

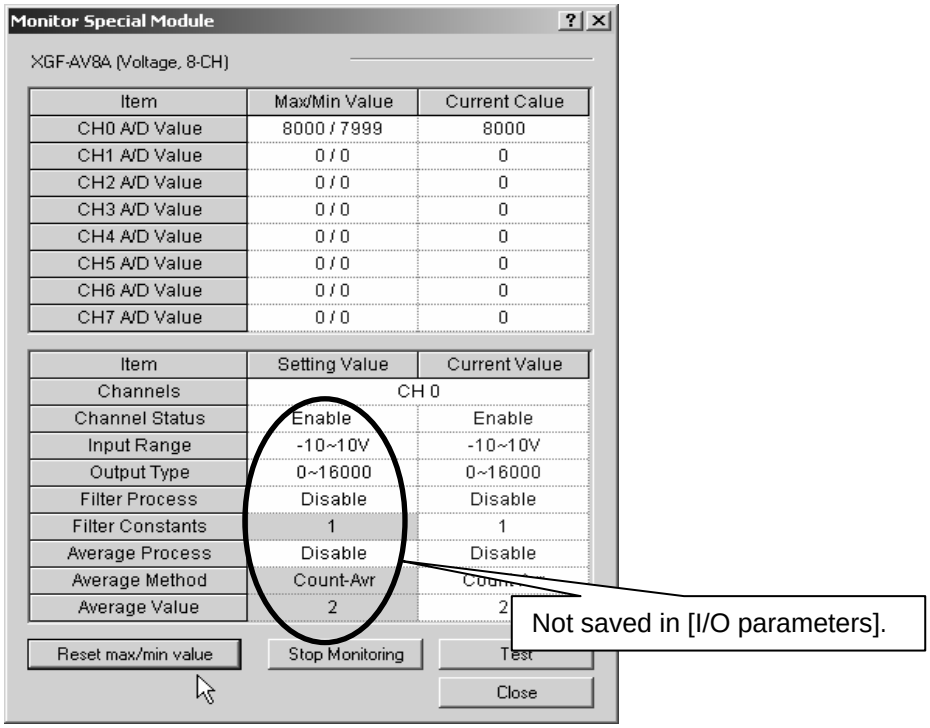
Functions of Monitoring Special Module are as described below in table 4.2.

[Table 4. 2] Functions of Special Module Monitoring

Item	Details
[Special Module Monitoring]	(1) Monitor/Test After connecting XG5000 with the PLC, select [Special Module Monitoring] in the [Monitor] menu. The XGF-AD4S module can be monitored and tested. When testing the module, the CPU should be stopped. (2) Monitoring the max./min. value The max./min. value of the channel can be monitored during Run. However, when [Monitoring/Test] screen is closed, the max./min. value will not be saved. (3) The parameters specified for the test in the [Special Module Monitor] screen are not saved in the [I/O parameter] when closing the screen.

Remark

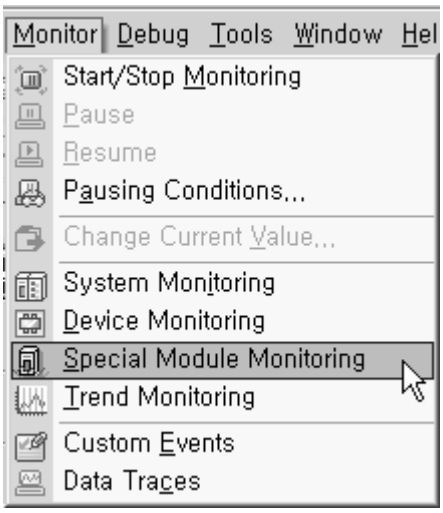
The screen may not be normally displayed due to insufficient system resource. In such a case, close the screen and finish other applications in order to restart XG5000.



- Test function of [Monitor Special Module] is provided for user to check the normal operation of the special module even without a program.

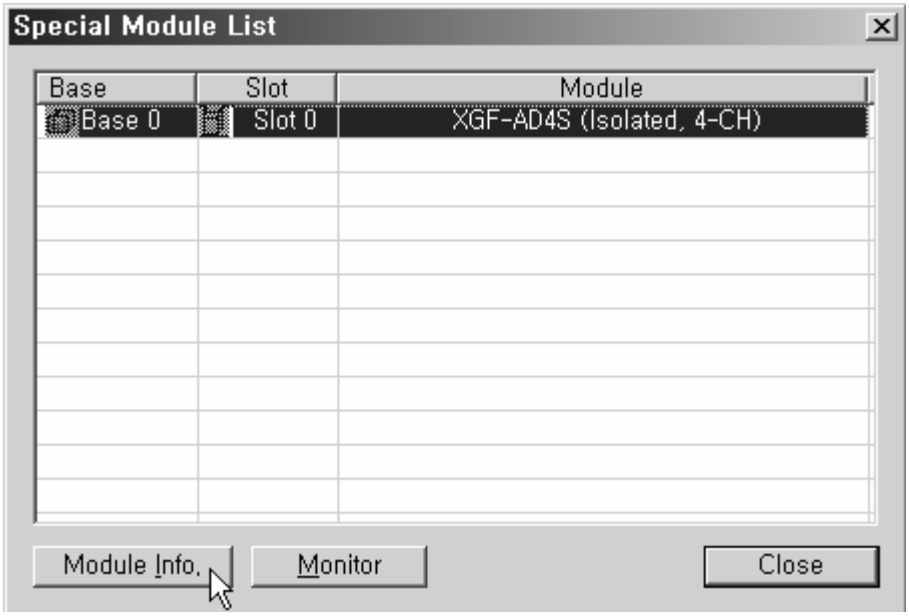
4.2.1 Start with [Special Module Monitoring]

After connecting to the PLC, click [Monitor] -> [Special Module Monitoring].
If the status is not [Online], [Special Module Monitoring] menu will not be active.



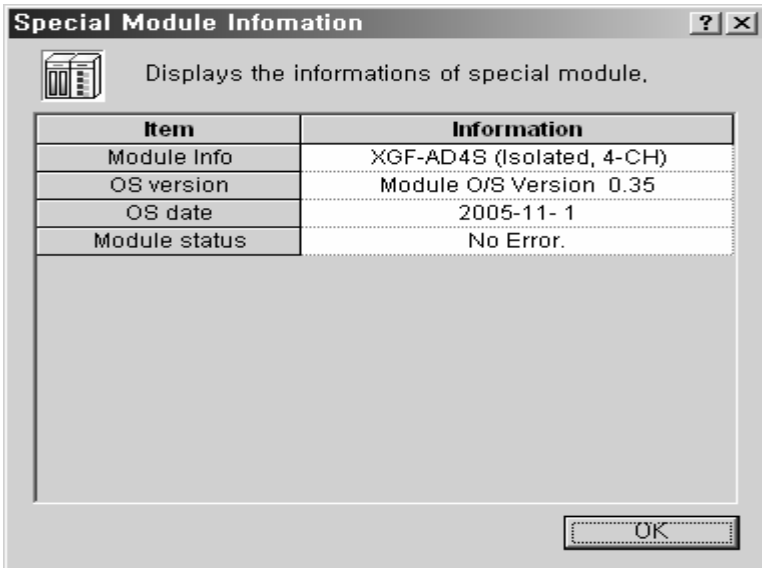
4.2.2 How to use [Special Module Monitoring]

1) 'Special Module List' screen will be shown as Fig. 5.1. The module installed on the present PLC system will be displayed on the screen.



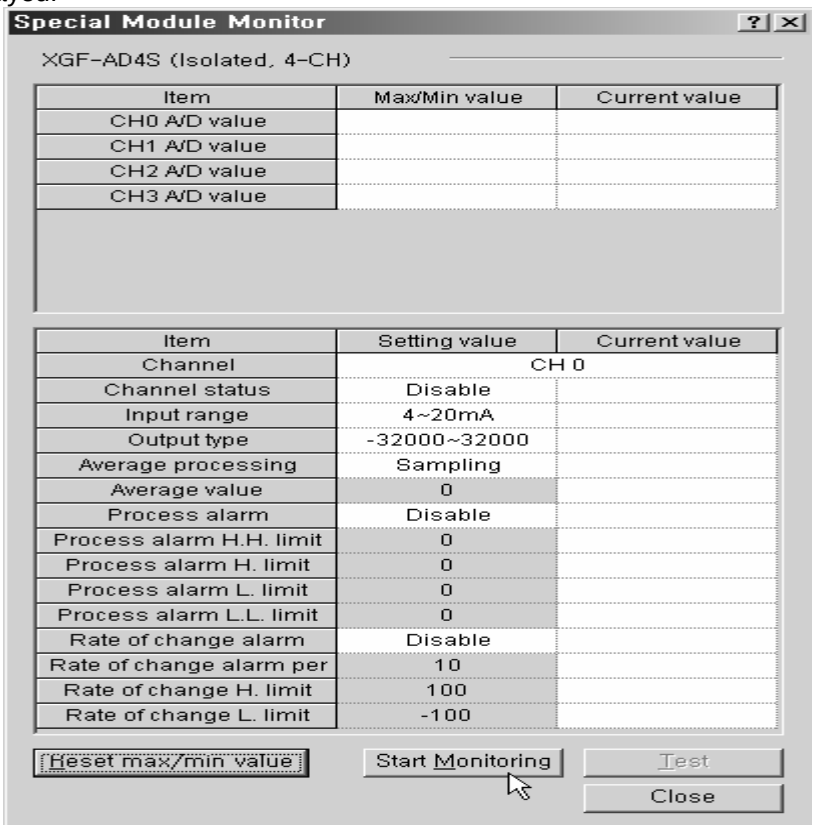
[Fig. 5. 1] [Special Module List]

2) Select Special Module in Fig. 5.1 and click [Module Info.] to display the information as Fig. 5.2.



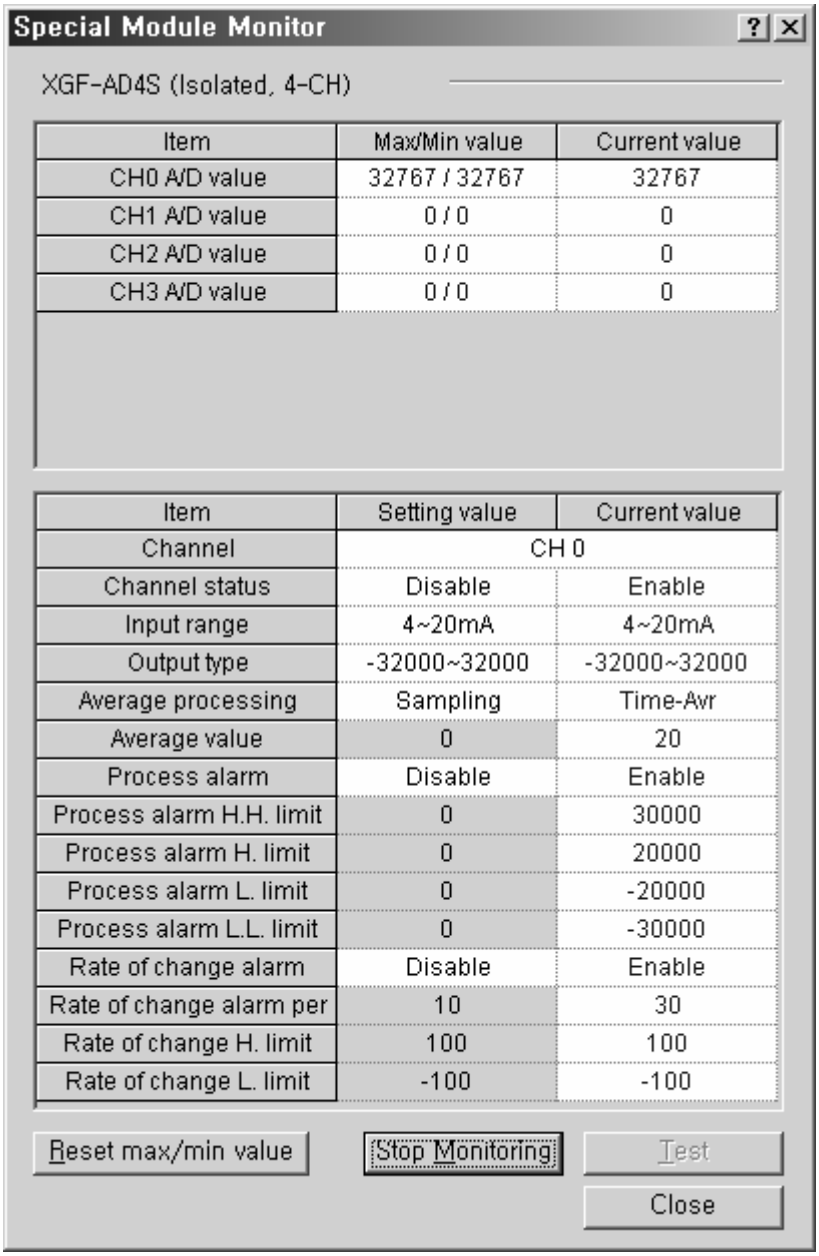
[Fig. 5. 2] [Special Module Information]

3) In order to monitor the special module, click [Monitor] after selecting the module in the Special Module List screen (Fig. 5.1). Then [Special Module Monitoring] screen as Fig. 5.3, will be displayed.



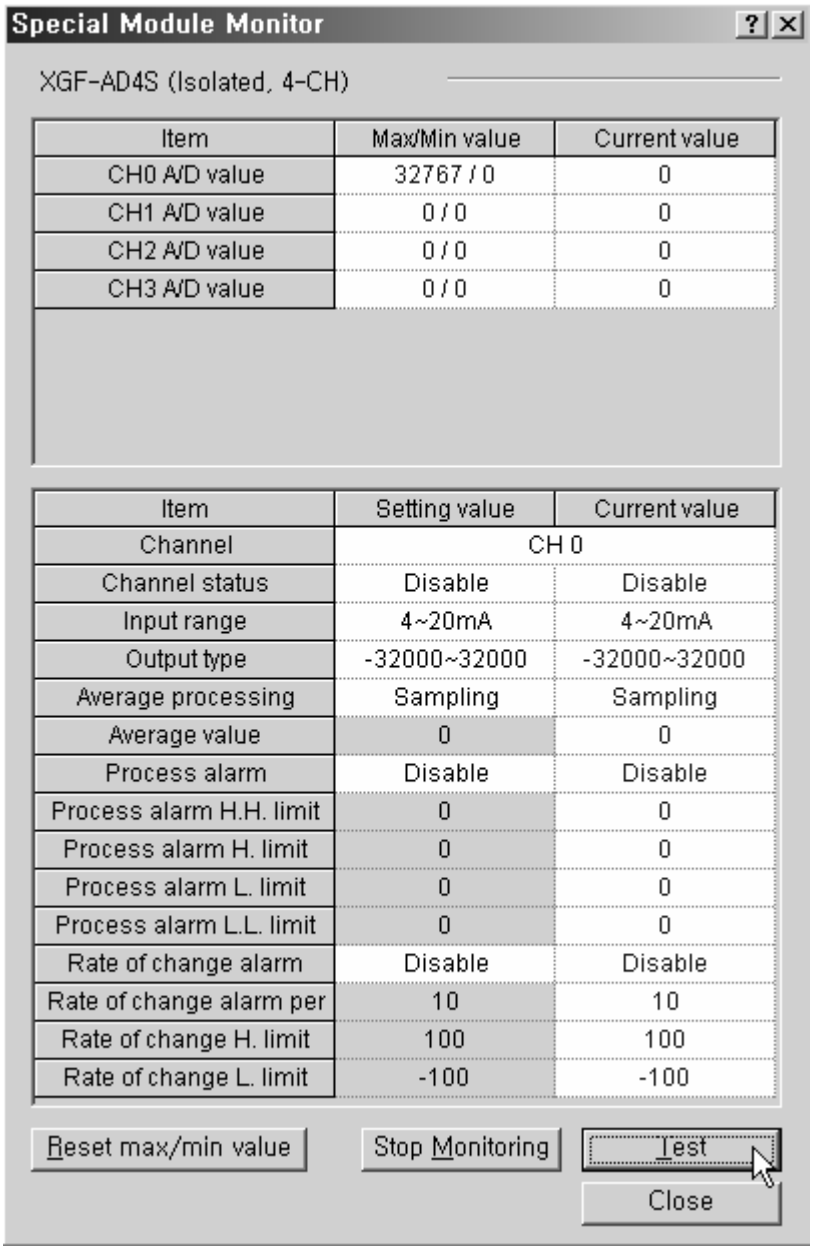
[Fig. 5. 3] [Special Module Monitor]

(1) [Start Monitoring]: Click [Start Monitoring] to display A/D converted value of the presently operated channel. Fig. 5.4 is the monitoring screen displayed when the whole channel of XGF-AD4S are in Stop status. In the present value field at the screen bottom, presently specified parameters of Analog Input Module are displayed.



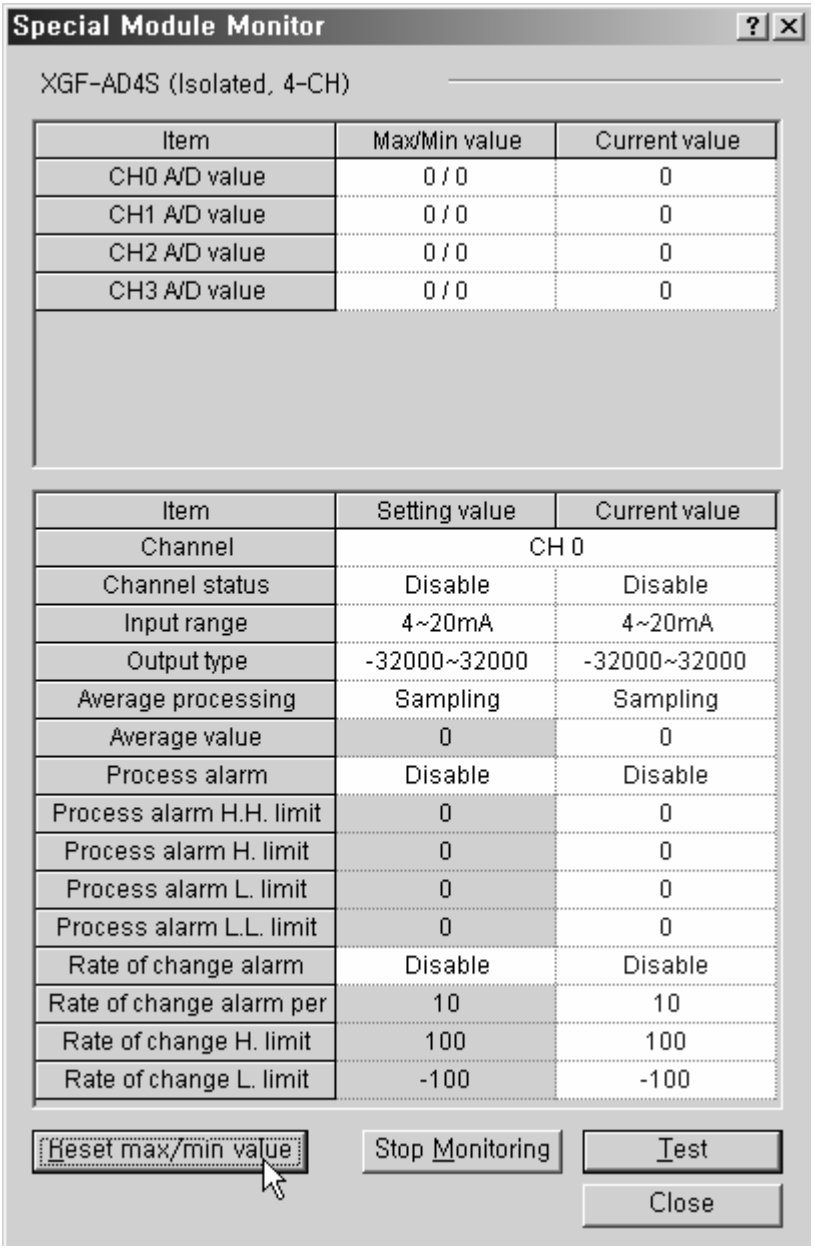
[Fig. 5. 4] Execution screen of [Start Monitoring]

(2) [Test]: [Test] is used to change the presently specified parameters of Analog Input Module. Click the setting value at the bottom field of the screen to change parameters. Fig. 5.5 will be displayed after [Test] is executed with channel 0's input voltage range changed to -10 ~ 10 V in the state of input not wired.
This function is executed in the state of CPU stop.



[Fig. 5. 5] Execution screen of [Test]

(3) [Reset Max./Min. value]: The max./min. value field at the upper screen shows the max. value and the min. value of A/D converted value. Click [Reset max./min. value] to initialize the max./min. value. Then the current value of the channel 0 is reset.



[Fig. 5. 6] Execution screen of [Reset max./min. value]

(4) [Close]: [Close] is used to escape from the monitoring/test screen. When the monitoring/test screen is closed, the max. value, the min. value and the present value will not be saved any more.

4.3 Registration of Analog Register [U]

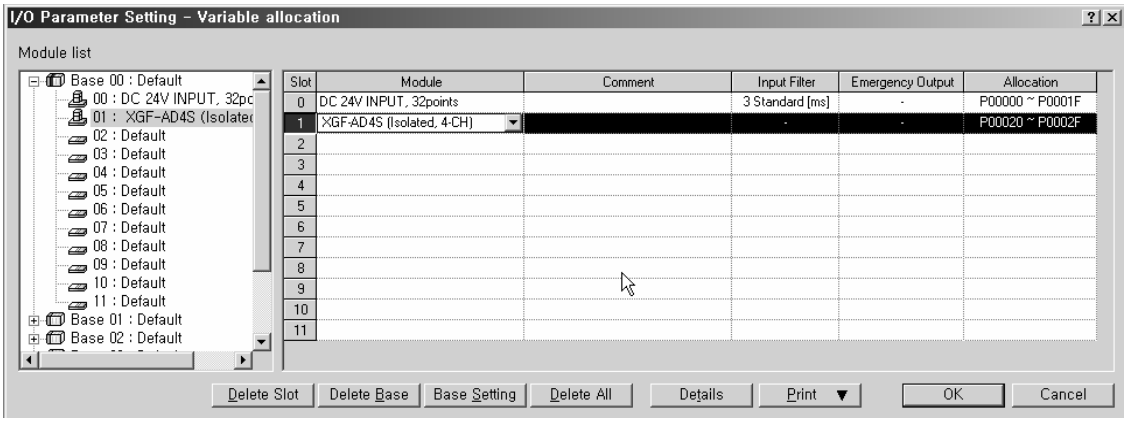
This section describes the automatic registration function of the analog register U in the XG5000

4.3.1 Registration of Analog Register [U]

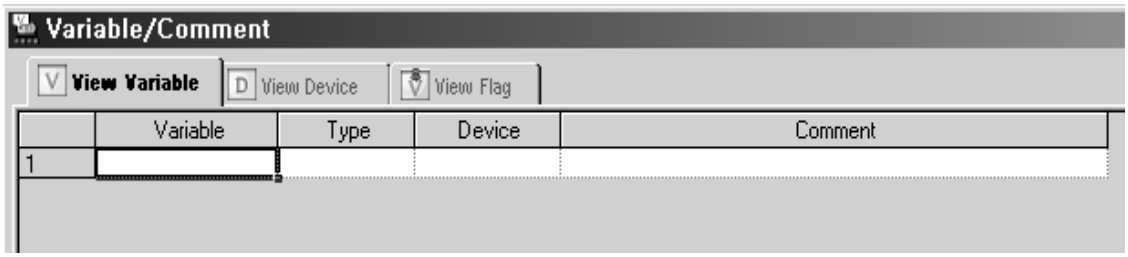
It registers the variables for each module referring to the special module information that is set in the I/O parameter. The user can modify the variables and comments.

[Procedure]

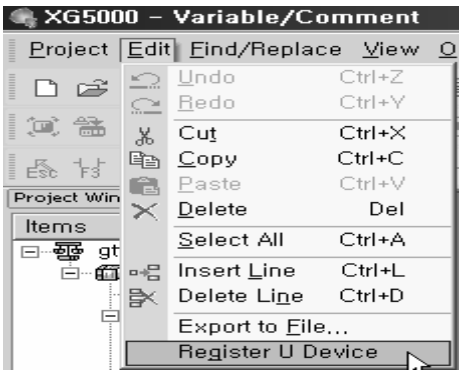
1) Select the special module type in the [I/O parameter setting] window.



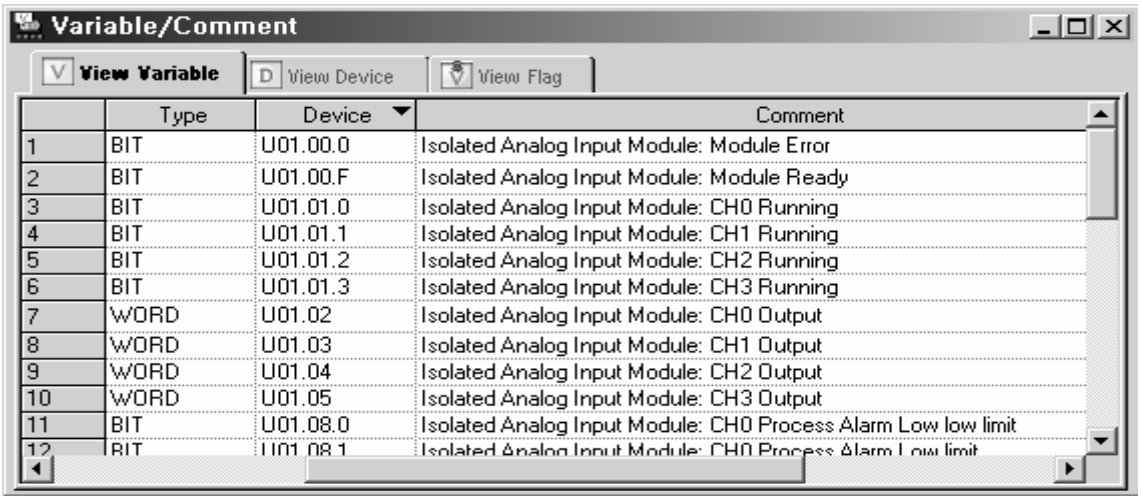
2) Double click 'Variable/Comment' from the project window.



3) Select [Edit] -> [Register U Device]. And Click [Yes]



4) As shown below, the variables are registered.



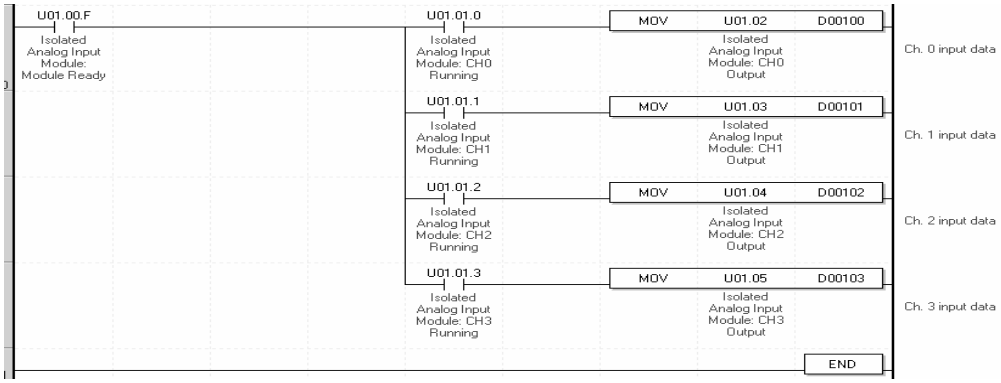
	Type	Device	Comment
1	BIT	U01.00.0	Isolated Analog Input Module: Module Error
2	BIT	U01.00.F	Isolated Analog Input Module: Module Ready
3	BIT	U01.01.0	Isolated Analog Input Module: CH0 Running
4	BIT	U01.01.1	Isolated Analog Input Module: CH1 Running
5	BIT	U01.01.2	Isolated Analog Input Module: CH2 Running
6	BIT	U01.01.3	Isolated Analog Input Module: CH3 Running
7	WORD	U01.02	Isolated Analog Input Module: CH0 Output
8	WORD	U01.03	Isolated Analog Input Module: CH1 Output
9	WORD	U01.04	Isolated Analog Input Module: CH2 Output
10	WORD	U01.05	Isolated Analog Input Module: CH3 Output
11	BIT	U01.08.0	Isolated Analog Input Module: CH0 Process Alarm Low low limit
12	BIT	U01.08.1	Isolated Analog Input Module: CH0 Process Alarm Low limit

4.3.2 Save variables

1) The contents of ‘View Variable’ can be saved as a text file.
2) Select [Edit] -> [Export to File].
3) The contents of ‘View variable’ are saved as a text file.

4.3.3 View variables

1) The example program of XG5000 is as shown below.



2) Four display types can be selected in the [View] menu,

Chapter 5 Configuration and Function of Internal Memory

Analog Input Module has the internal memory to transmit/receive data to/from PLC CPU.

5.1 Internal Memory Configuration

Configuration of internal memory is as described below.

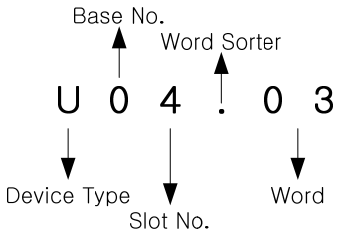
5.1.1 I/O area of A/D converted data

I/O area of A/D converted data is as displayed in Table 5.1.

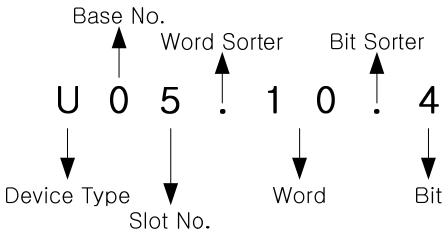
[Table 5. 1] I/O area of A/D converted data

Device assigned	Details	R/W	Sign direction
UXY.00.0 UXY.00.F	Module ERROR flag Module READY flag	R	A/D → CPU
UXY.01.0 UXY.01.1 UXY.01.2 UXY.01 3	CH0 Run flag CH1 Run flag CH2 Run flag CH3 Run flag	R	A/D → CPU
UXY.02	CH0 digital output value	R	A/D → CPU
UXY.03	CH1 digital output value	R	
UXY.04	CH2 digital output value	R	
UXY.05	CH3 digital output value	R	
UXY.06	Not used area	R	
UXY.07	Not used area	R	
UXY.08.0 UXY.08.1 UXY.08.2 UXY.08.3 UXY.08.4 UXY.08.5 UXY.08.6 UXY.08.7 UXY.08.8 UXY.08.9 UXY.08.A UXY.08.B UXY.08.C UXY.08.D UXY.08.E UXY.08.F	CH0 process alarm H-H limit detection flag (HH) CH0 process alarm H limit detection flag (H) CH0 process alarm L limit detection flag (L) CH0 process alarm L-L limit detection flag (LL) CH1 process alarm H-H limit detection flag (HH) CH1 process alarm H limit detection flag (H) CH1 process alarm L limit detection flag (L) CH1 process alarm L-L limit detection flag (LL) CH2 process alarm H-H limit detection flag (HH) CH2 process alarm H limit detection flag (H) CH2 process alarm L limit detection flag (L) CH2 process alarm L-L limit detection flag (LL) CH3 process alarm H-H limit detection flag (HH) CH3 process alarm H limit detection flag (H) CH3 process alarm L limit detection flag (L) CH3 process alarm L-L limit detection flag (LL)	R	
UXY.09.0 UXY.09.1 UXY.09.2 UXY.09.3 UXY.09.4 UXY.09.5 UXY.09.6 UXY.09.7	CH0 change rate alarm H limit detection flag (H) CH0 change rate alarm L limit detection flag (L) CH1 change rate alarm H limit detection flag (H) CH1 change rate alarm L limit detection flag (L) CH2 change rate alarm H limit detection flag (H) CH2 change rate alarm L limit detection flag (L) CH3 change rate alarm H limit detection flag (H) CH3 change rate alarm L limit detection flag (L)	R	A/D → CPU
UXY.10.0 UXY.10.1 UXY.10.2 UXY.10.3	CH0 disconnection detection flag (1~5V or 4~20mA) CH1 disconnection detection flag (1~5V or 4~20mA) CH2 disconnection detection flag (1~5V or 4~20mA) CH3 disconnection detection flag (1~5V or 4~20mA)	R	A/D → CPU
UXY.11.0	Error clear request flag	W	CPU → A/D

1) In the device assigned, X stands for the Base No. and Y for the Slot No. on which module is installed.
2) In order to read 'CH1 digital output value' of Analog Input Module installed on Base No.0, Slot No.4, it shall be displayed as U04.03.



3) In order to read 'Flag to detect CH4 disconnection' of Analog Input Module installed on Base No.0, Slot No.5, it shall be displayed as U05.10.4.



5.1.2 Operation parameters setting area

Setting area of Analog Input Module's Run parameters is as described in Table 5.2.

[Table 5. 2] Setting area of Run parameters

Memory address		Details	R/W	Remarks
HEX	DEC			
0_H	0	Channel enable/disable setting	R/W	PUT
1_H	1	Setting ranges of input voltage/current	R/W	PUT
2_H	2	Output data format setting	R/W	PUT
3_H	3	Filter processing enable/disable setting	R/W	PUT
4_H	4	CH0 average value setting	R/W	PUT
5_H	5	CH1 average value setting		
6_H	6	CH2 average value setting		
7_H	7	CH3 average value setting		
8_H	8	Alarm process setting	R/W	PUT
9_H	9	CH0 process alarm H-H limit setting (HH)	R/W	PUT
A_H	10	CH0 process alarm H limit setting (H)		
B_H	11	CH0 process alarm L limit setting (L)		
C_H	12	CH0 process alarm L-L limit setting (LL)		
D_H	13	CH1 process alarm H-H limit setting (HH)		
E_H	14	CH1 process alarm H limit setting (H)		
F_H	15	CH1 process alarm L limit setting (L)		
10_H	16	CH1 process alarm L-L limit setting (LL)		
11_H	17	CH2 process alarm H-H limit setting (HH)		
12_H	18	CH2 process alarm H limit setting (H)		
13_H	19	CH2 process alarm L limit setting (L)		
14_H	20	CH2 process alarm L-L limit setting (LL)		
15_H	21	CH3 process alarm H-H limit setting (HH)		
16_H	22	CH3 process alarm H limit setting (H)		
17_H	23	CH3 process alarm L limit setting (L)		
18_H	24	CH3 process alarm L-L limit setting (LL)		
19_H	25	CH0 change rate alarm detection period setting	R/W	PUT
$1A_H$	26	CH1 change rate alarm detection period setting		
$1B_H$	27	CH2 change rate alarm detection period setting		
$1C_H$	28	CH3 change rate alarm detection period setting		
$1D_H$	29	CH0 change rate alarm H limit setting	R/W	PUT
$1E_H$	30	CH0 change rate alarm L limit setting		
$1F_H$	31	CH1 change rate alarm H limit setting		
20_H	32	CH1 change rate alarm L limit setting		
21_H	33	CH2 change rate alarm H limit setting		
22_H	34	CH2 change rate alarm L limit setting		
23_H	35	CH3 change rate alarm H limit setting		
24_H	36	CH3 change rate alarm L limit setting		
25_H	37	Error code	R/W	GET

※ R/W is to denote Read/Write if available from PLC program.

5.2 A/D Converted Data I/O Area

5.2.1 Module READY/ERROR flag (UXY.00, X: Base No., Y: Slot No.)

1) **UXY.00.F:** It will be ON when PLC CPU is powered or reset with A/D conversion ready to process A/D conversion.
2) **UXY.00.0:** It is a flag to display the error status of Analog Input Module.

UXY.00

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
RDY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	ERR

⇩ Module READY
Bit ON (1): READY, Bit Off (0): NOT READY

⇩ Error information
Bit ON (1): Error, Bit Off (0): Normal

5.2.2 Run channel flag (UXY.01, X: Base No., Y: Slot No.)

The area where Run information of respective channels is saved.

UXY.01

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—					CH3	CH2	CH1	CH0

Run channel information
Bit ON (1): During Run, Bit Off (0): Operation Stop

5.2.3 Digital output value (UXY.02 ~ UXY.05, X: Base No., Y: Slot No.)

1) A/D converted-digital output value will be output to buffer memory addresses 2 ~ 9 (UXY.02 ~ UXY.09) for respective channels.
2) Digital output value will be saved in 16-bit binary.

UXY.02 ~ UXY.09

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Channel # digital output value															

Address	Details
Address No.2	CH0 digital output value
Address No.3	CH1 digital output value
Address No.4	CH2 digital output value
Address No.5	CH3 digital output value

5.2.4 Flag to detect process alarm

(UXY.08.Z, X:Base No., Y:Slot No., Z: Alarm bit according to channel)

1) Each process alarm detection signal about input channel is saved at UXY.08
2) Each bit is set as 1 when detecting process alarm and if process alarm detection is restored, each bit returns into 0. Each bit can be used to detect process alarm detection with execution condition at user program.

UXY.08

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
CH3LL	CH3L	CH3H	CH3HH	CH2LL	CH2L	CH2H	CH2HH	CH1LL	CH1L	CH1H	CH1HH	CH0LL	CH0L	CH0H	CH0HH

BIT	Details
0	Meet setting range
1	Exceed setting range

5.2.5 Change rate alarm detection flag

(UXY.09.Z, X: Base No, Y: Slot No, Z: Alarm according to channel)

1) Each change rate alarm detection signal about input channel is saved at UXY.09.
2) Each bit is set as 1 when detecting process alarm and if process alarm detection is restored, each bit returns into 0. Each bit can be used to detect process alarm detection with execution condition at user program.

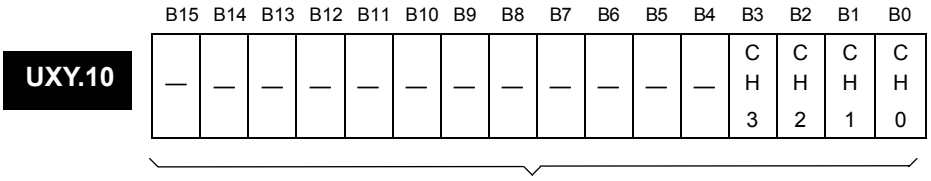
UXY.09

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—	CH3L	CH3H	CH2L	CH2H	CH1L	CH1H	CH0L	CH0H

BIT	Details
0	Meet setting range
1	Exceed setting range

5.2.6 Flag to detect disconnection (UXY.10.Z, X: Base No., Y: Slot No., Z: Channel No.)

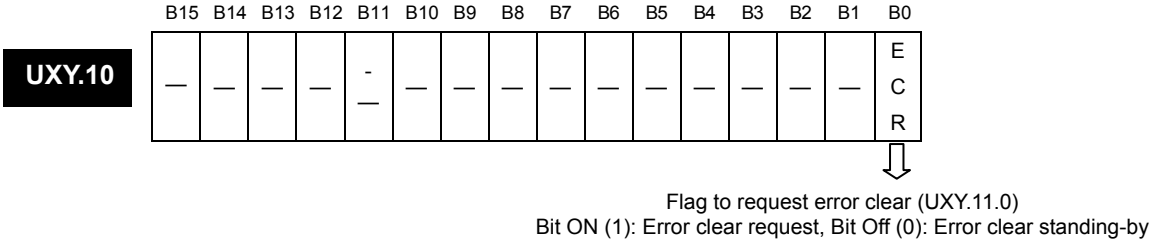
1) Detection sign of disconnection for respective input channels is saved in UXY.10.
2) Each bit will be set to 1 if an assigned channel is detected as disconnected, and it will be back to 0 if connected back. In addition, each bit can be used to detect the disconnection in the user program together with execution conditions.



BIT	Description
0	Normal
1	disconnection

5.2.7 Flag to request error clear (UXY.11.0, X: Base No., Y: Slot No.)

1) If a parameters setting error occurs, address No.37's error code will not be automatically erased even if parameters are changed correctly. At this time, turn the 'error clear request' bit ON to delete address No.37's error code and the error displayed in XG5000's [System Monitoring]. In addition, RUN LED which blinks will be back to On status.
2) The 'flag to request error clear' shall be used surely together with UXY.00.0 attached thereon for guaranteed Normal operation. Its application shall be as shown below in Fig. 5.1.



[Fig. 5. 1] How to use the flag

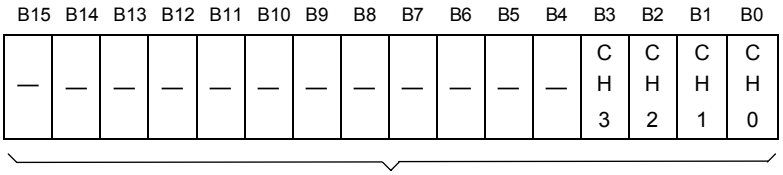
5.3 Operation Parameters Setting Area

▶ 1 word is assigned for each address in the internal memory, which can be displayed in 16 bits.
▶ If each bit of 16 bits configuring the address is On, let it set to “1”, and if it is Off, let it set to “0” so to realize the respective functions.

5.3.1 How to specify the channel to use (address No.0)

1) Allowed/Prohibited A/D conversion can be set for respective channels.
2) Set the unused channel Prohibited from converted so to reduce the conversion cycle for respective channels.
3) If the channel to use is not specified, all the channels will be set to Prohibited.
4) Allowed/Prohibited A/D conversion is as specified below.

Address “0”



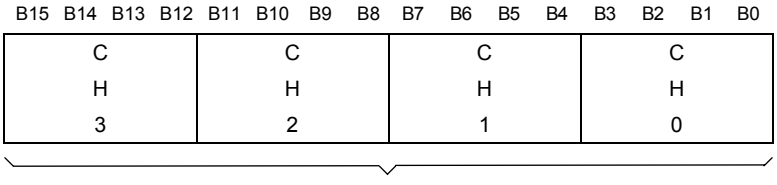
BIT	Description
0	Disable
1	Enable

5) The value specified in B8 ~ B15 will be disregarded.

5.3.2 How to specify the range of input voltage/current (address No.1)

1) The range of analog input voltage/current can be specified for respective channels.
2) If the analog input range is not specified, the range of all the channels will be set to 1 ~ 5 V (4 ~ 20 mA).
3) Setting range of analog input voltage/current is as specified below.

Address “1”



BIT	Description
0000	4 mA ~ 20 mA
0001	0 mA ~ 20 mA
0010	1 V ~ 5 V
0011	0 V ~ 5 V
0100	0 V ~ 10 V
0101	-10 V ~ 10 V

5.3.3 How to specify the range of output data (address No.2)

1) The range of digital output data for analog input can be specified for respective channels.
2) If the output data range is not specified, the range of all the channels will be set to 0 ~ 16000.
3) Setting range of digital output data range is as specified below.

Address "2"

B15 B14 B13 B12	B11 B10 B9 B8	B7 B6 B5 B4	B3 B2 B1 B0
CH3	CH2	CH1	CH0

BIT	Description
0000	-32000 ~ 32000
0001	Precise Value
0010	0 ~ 10000

Precise value has the following digital output ranges for the analog input range.

(1) Voltage

Analog input / Digital output	-10 ~ 10V	0 ~ 10V	0 ~ 5V	1 ~ 5V
Precise Value	-10000 ~ 10000	0 ~ 10000	0 ~ 5000	1000 ~ 5000

(2) Current

Analog input / Digital output	4 ~ 20 ㎃	0 ~ 20 ㎃
Precise Value	4000 ~ 20000	0 ~ 20000

5.3.4 How to specify filter process (address No.3)

1) Allowed/Prohibited filter process can be specified for respective channels.
2) If the filter process is not specified, all the channels will be sampled.
3) Setting of the filter process is as specified below.

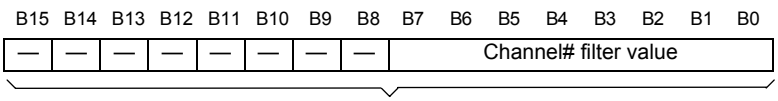
B15 B14 B13 B12	B11 B10 B9 B8	B7 B6 B5 B4	B3 B2 B1 B0
CH3	CH2	CH1	CH0

BIT	Details
0000	Sampling process
0001	Time average
0010	Count average
0011	Moving average
0100	Weighted average

5.3.5 How to specify filter constant (address No.4 ~ 7)

1) Default of the filter constant is 1.
2) Setting range of the filter constant is 1 ~ 99.
3) If other value exceeding the setting range is specified, error code 50# will be displayed on display address (37) of the error code. At this time, A/D converted value keeps the previous data. (# of the error code stands for the channel with error found)
4) If the filter constant is not specified, the filter constant will be set to '1'.
5) Setting of the filter constant is as specified below.

Address "4 ~ 7"



Address	Details
Address No.4	CH0 filter value
Address No.5	CH1 filter value
Address No.6	CH2 filter value
Address No.7	CH3 filter value
Address No.8	CH4 filter value
Address No.9	CH5 filter value
Address No.10	CH6 filter value
Address No.11	CH7 filter value

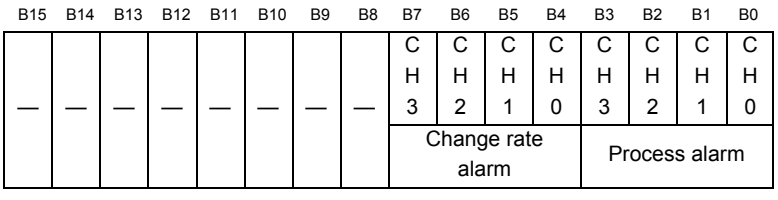
Notes

In order to make filter constant effective, the filter process shall be previously set to 'Allowed'.

5.3.6 Alarm process setting (Address 8)

1) This is area to set Enable/Disable of Alarm process. Each channel can be set separately
2) Initial value of this area is 0.
3) Setting of alarm process is as follows.

Address"8"



BIT	Details
0	Disable
1	Enable

5.3.7 Process alarm value setting (address 9 ~ 24)

1) This is area to set Process alarm value. Setting range is different according to range of output data.

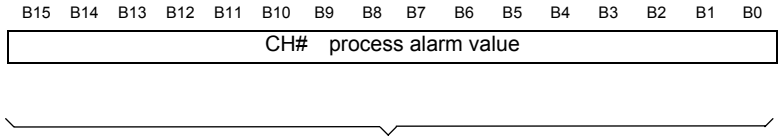
(1) Signed Value: -32768 ~ 32767
(2) Precise Value

4 ~ 20 mA	3808 ~ 20192
0 ~ 20 mA	-240 ~ 20240
1 ~ 5 V	952 ~ 5048
0 ~ 5 V	-60 ~ 5060
0 ~ 10 V	-120 ~ 10120
-10 ~ 10 V	-10240 ~ 10240

(3) Percentile Value: -120 ~ 10120

2) For detail of process alarm function, refer to CH2.5.2.

Address "9 ~ 24'



Address	Details
9	CH0 process alarm H-H limit setting
10	CH0 process alarm H limit setting
11	CH0 process alarm L limit setting
12	CH0 process alarm L-L limit setting
13	CH1 process alarm H-H limit setting
14	CH1 process alarm H limit setting
15	CH1 process alarm L limit setting
16	CH1 process alarm L-L limit setting
17	CH2 process alarm H-H limit setting
18	CH2 process alarm H limit setting
19	CH2 process alarm L limit setting
20	CH2 process alarm L-L limit setting
21	CH3 process alarm H-H limit setting
22	CH3 process alarm H limit setting
23	CH3 process alarm L limit setting
24	CH3 process alarm L-L limit setting

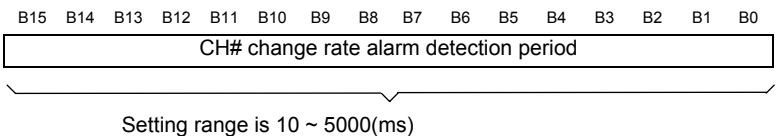
Notes

To set process alarm value, enable process alarm process in advance

5.3.8 Change rate alarm detection period setting (address 25 ~ 28)

1) Setting range is 0 ~ 5000(ms).
2) When value is out of range, error code 60# is displayed at error code indication address. At this time, default value (10) is applied
3) Setting of change rate alarm detection period is as follows.

Address "25 ~ 28"



Address	Details
25	CH0 change rate alarm detection period
26	CH1 change rate alarm detection period
27	CH2 change rate alarm detection period
28	CH3 change rate alarm detection period

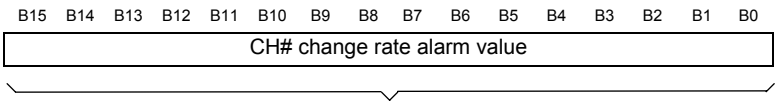
Notes

When setting change rate alarm detection period, enable change rate alarm process in advance. And specify the Low/High limit of change rate alarm

5.3.9 Change rate alarm value setting (Address 29 ~ 36)

1) Range is -32768 ~ 32767(-3276.8% ~ 3276.7%).
2) Setting is as follows.

Adress"29 ~ 36"



Address	Details
29	CH0 change rate alarm H limit setting
30	CH0 change rate alarm L limit setting
31	CH1 change rate alarm H limit setting
32	CH1 change rate alarm L limit setting
33	CH2 change rate alarm H limit setting
34	CH2 change rate alarm L limit setting
35	CH3 change rate alarm H limit setting
36	CH3 change rate alarm L limit setting

Notes

When setting change rate value, enable change rate alarm process in advance. And specify the Low/High limit of change rate alarm

5.3.10 Error code (address No.37)

1) Error codes detected from Analog Input Module will be saved.
2) Error types and details are as specified below.

Address "37"

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—	Error code							

Refer to the table below for detailed error codes.

Error code (Dec.)	Description	RUN LED status
0	Normal operation	RUN LED ON
10	Module error (ASIC reset error)	Flickers every 0.2 sec.
11	Module error (ASIC RAM or Register error)	
20#	Time average set value error	Flickers every 1 sec.
30#	Count average set value error	
40#	Moving average set value error	
50#	Weighted average set value error	
60#	Change rate alarm detection period set value error	

※ # of the error code stands for the channel with error found.
※ Refer to 9.1 for more details on error codes.

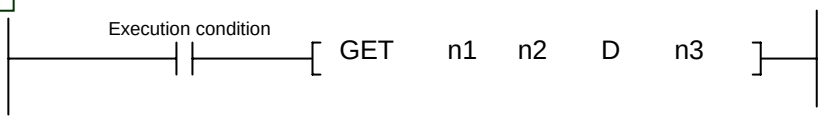
3) If 2 or more errors occur, the module will not save other error codes than the first error code found.
4) If an error found is corrected, use the 'flag to request error clear' (refer to 5.2.5), or let power OFF → ON in order to stop LED blinking and to delete the error code.

Chapter 6 Programming

6.1 Programming for setting the Operation Parameters

6.1.1 Reading the operation parameters (GET, GETP instruction)

Type



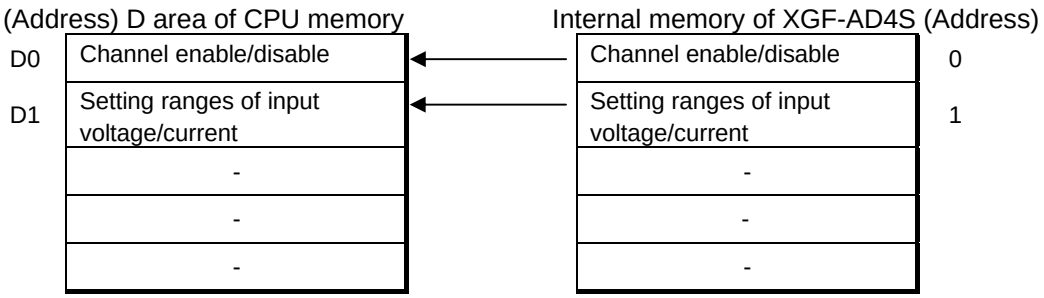
Type	Description	Area available
n1	Slot No. of the special module	Integer
n2	Top address of the buffer memory to be read from	Integer
D	Top address to save the data	M, P, K, L, T, C, D, #D
n3	Number of words to be read	Integer

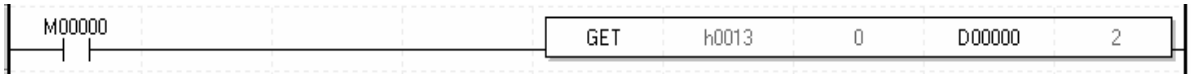
< Difference between GET instruction and GETP instruction >

GET: Every scan executed while the execution condition is ON. ( )

GETP: Executed only one time while the execution condition is ON. ( )

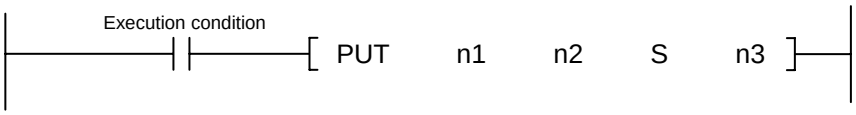
Ex. If a XGF-AD4S module is installed on Base No.1 and Slot No.3(h13), and the data in buffer memory addresses 0 and 1 is read and stored in D0 and D1 of CPU memory,





6.1.2 Writing the operation parameters (PUT, PUTP instruction))

Type



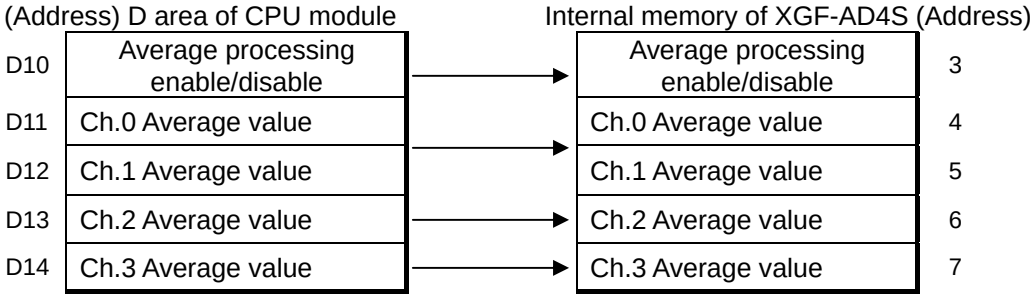
Type	Description	Area available
n1	Slot No. of the special module	Integer
n2	Top address of the buffer memory to be written from the CPU	Integer
S	Top address of the CPU memory to be sent or integer	M, P, K, L, T, C, D, #D, integer
n3	Number of words to be sent	Integer

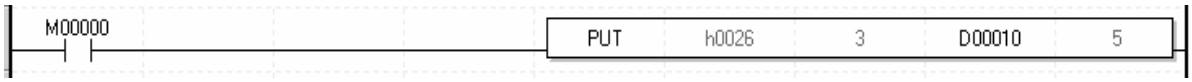
< Difference between PUT instruction and PUTP instruction**>**

PUT: Every scan executed while the execution condition is ON. ( )

PUTP: Executed only one time while the execution condition is ON. ( )

Ex. If a XGF-AD4S module is installed on Base No.2 and Slot No.6(h26), and the data in the CPU memory D10~D13 is written to the buffer memory 12~15.





6.2 Basic Program

There are two ways of setting the operation parameters.
One is to set in the [I/O parameters], the other is to set in the scan program.
An example configuration for description

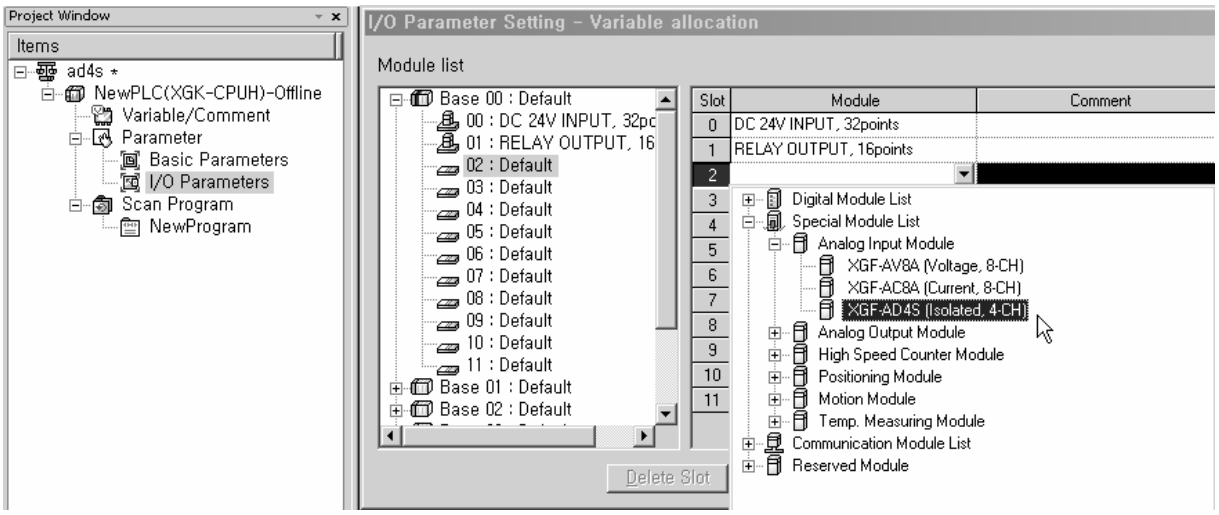
Base number: 0, Slot number: 2.

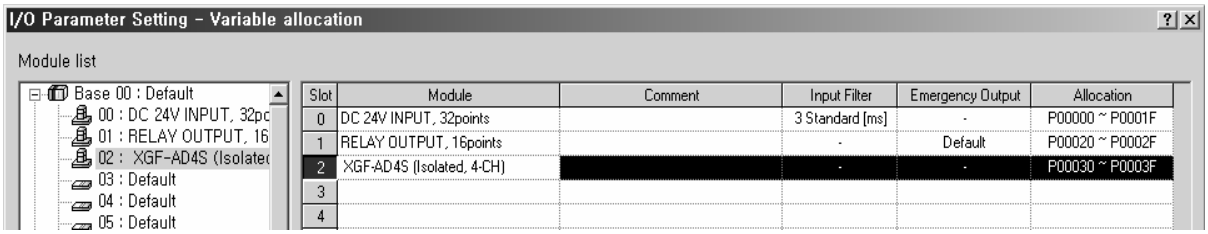
Power module	CPU module	XGI-D22A	XGQ-RY2A	**XGF-AD4S**	

XGF-AD4S takes 16 points (one word) in the “P” area. (Selectable between 16 or fixed 64 points)

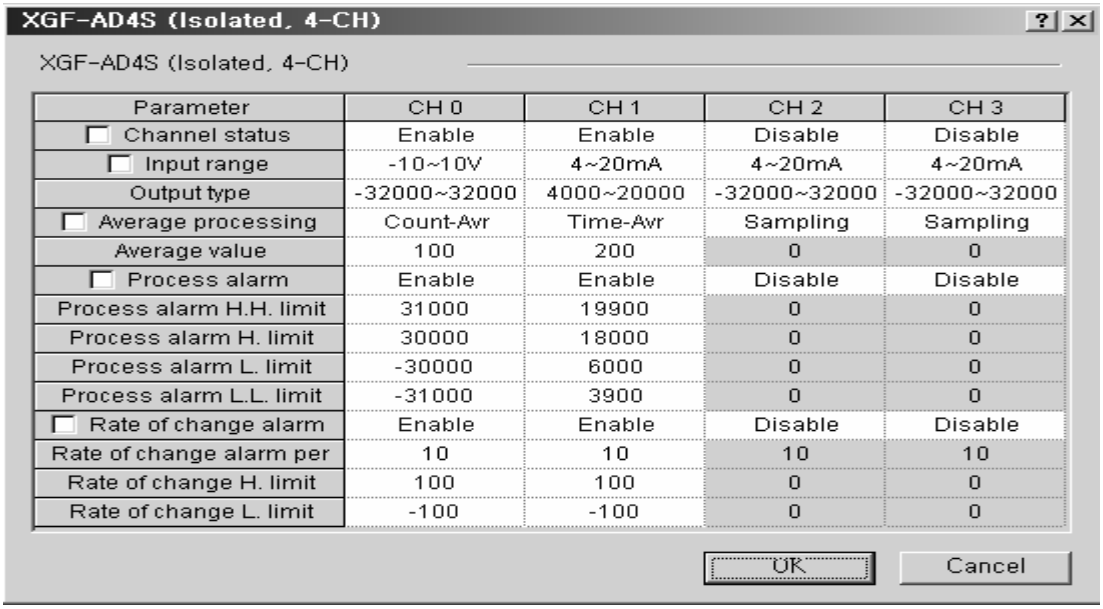
6.2.1 Setting the parameters in the [I/O Parameters]

1. Open [I/O Parameters], and select XGF-AD4S module.





2. Click [Details], and set the parameters.

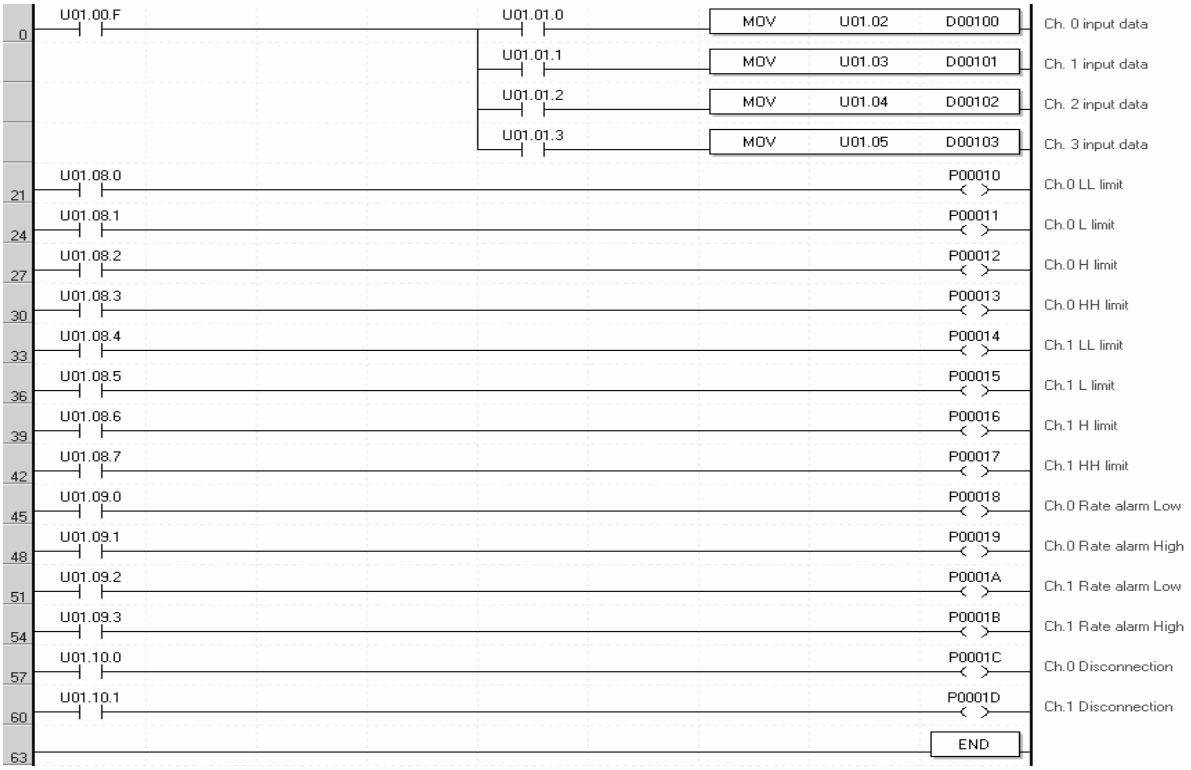


Parameter	CH 0	CH 1	CH 2	CH 3
Channel status	Enable	Enable	Disable	Disable
Input range	-10~10V	4~20mA	4~20mA	4~20mA
Output type	-32000~32000	4000~20000	-32000~32000	-32000~32000
Average processing	Count-Avr	Time-Avr	Sampling	Sampling
Average value	100	200	0	0
Process alarm	Enable	Enable	Disable	Disable
Process alarm H.H. limit	31000	19900	0	0
Process alarm H. limit	30000	18000	0	0
Process alarm L. limit	-30000	6000	0	0
Process alarm L.L. limit	-31000	3900	0	0
Rate of change alarm	Enable	Enable	Disable	Disable
Rate of change alarm per	10	10	10	10
Rate of change H. limit	100	100	0	0
Rate of change L. limit	-100	-100	0	0

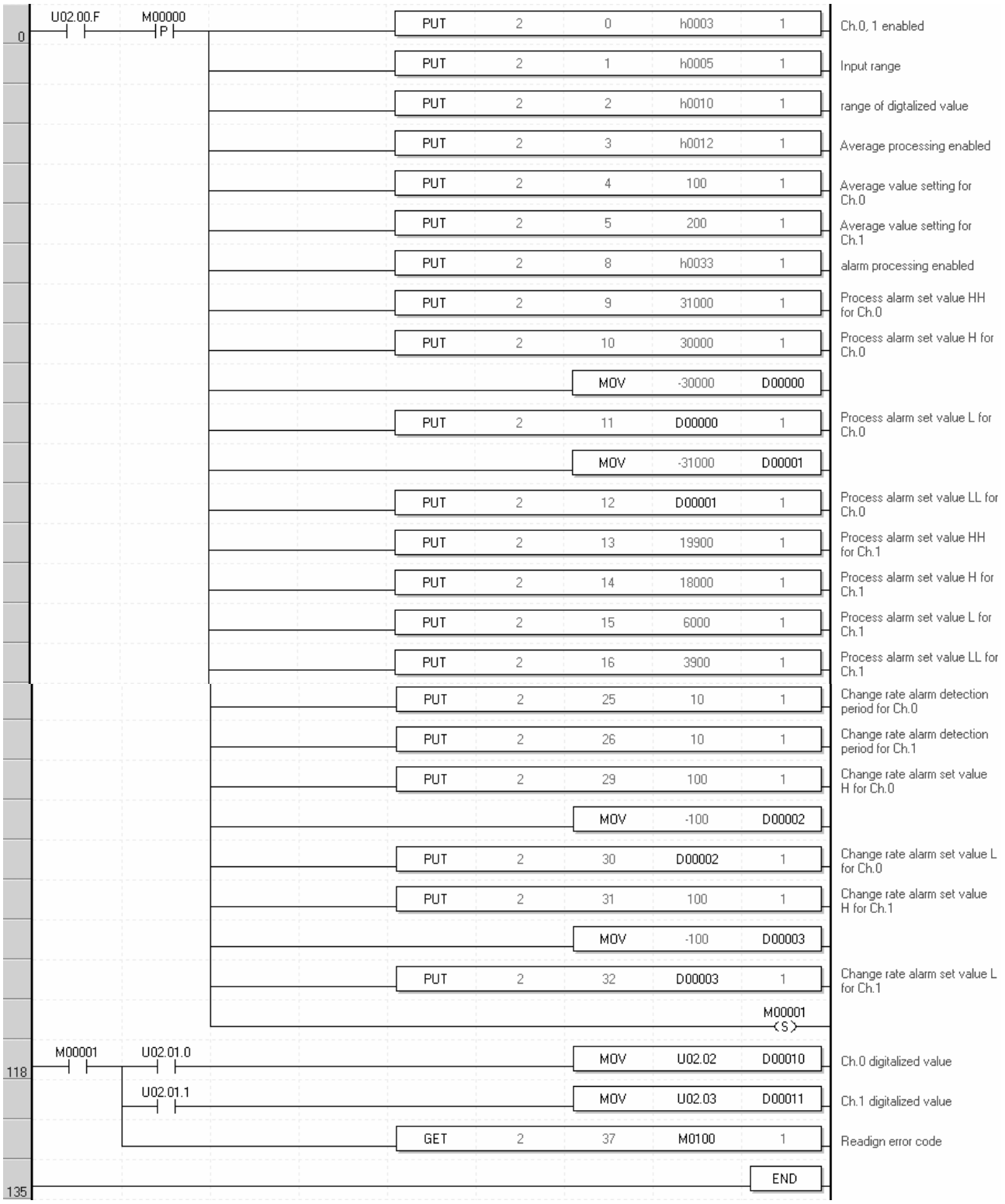
Refer to the 'Chapter 2 Specifications' for the detailed description of each item.

3. Scan program

After setting the parameters in [I/O Parameters], make a program for reading the analog input data.



6.2.2 Setting the parameters in a scan program



Chapter 7 Configuration and Function of Internal Memory (For XGI/XGR)

7.1 Global Variable (Data area)

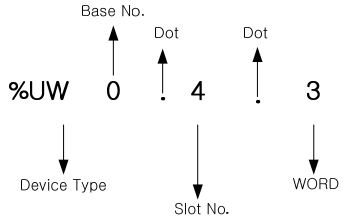
7.1.1 A/D conversion data IO area configuration

Indicates A/D conversion data IO area at table 7.1

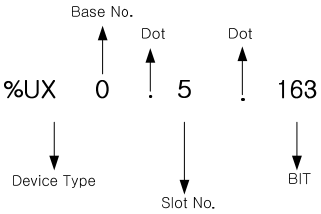
[Table 7. 1] A/D conversion data IO area

Global variable	Memory allocation	Contents	Read/Write
_xxyy_ERR _xxyy_RDY	%UXxx.yy.0 %UXxx.yy.15	Module ERROR flag Module READY flag	Read
_xxyy_CH0_ACT _xxyy_CH1_ACT _xxyy_CH2_ACT _xxyy_CH3_ACT	%UXxx.yy.16 %UXxx.yy.17 %UXxx.yy.18 %UXxx.yy.19	CH 0 RUN flag CH 1 RUN flag CH 2 RUN flag CH 3 RUN flag	Read
_xxyy_CH0_DATA	%UWxx.yy.2	CH 0 Digital output value	Read
_xxyy_CH1_DATA	%UWxx.yy.3	CH 1 Digital output value	Read
_xxyy_CH2_DATA	%UWxx.yy.4	CH 2 Digital output value	Read
_xxyy_CH3_DATA	%UWxx.yy.5	CH 3 Digital output value	Read
_xxyy_CH0_IDD _xxyy_CH1_IDD _xxyy_CH2_IDD _xxyy_CH3_IDD	%UXxx.yy.160 %UXxx.yy.161 %UXxx.yy.162 %UXxx.yy.163	CH0 disconnection detection flag (1~5V or 4~20mA) CH1 disconnection detection flag (1~5V or 4~20mA) CH2 disconnection detection flag (1~5V or 4~20mA) CH3 disconnection detection flag (1~5V or 4~20mA)	Read
_xxyy_CH0_PALL _xxyy_CH0_PAL _xxyy_CH0_PAH _xxyy_CH0_PAHH _xxyy_CH1_PALL _xxyy_CH1_PAL _xxyy_CH1_PAH _xxyy_CH1_PAHH _xxyy_CH2_PALL _xxyy_CH2_PAL _xxyy_CH2_PAH _xxyy_CH2_PAHH _xxyy_CH3_PALL _xxyy_CH3_PAL _xxyy_CH3_PAH _xxyy_CH3_PAHH _xxyy_CH0_RAL _xxyy_CH0_RAH _xxyy_CH1_RAL _xxyy_CH1_RAH _xxyy_CH2_RAL _xxyy_CH2_RAH _xxyy_CH3_RAL _xxyy_CH3_RAH	%UXxx.yy.128 %UXxx.yy.129 %UXxx.yy.130 %UXxx.yy.131 %UXxx.yy.132 %UXxx.yy.133 %UXxx.yy.134 %UXxx.yy.135 %UXxx.yy.136 %UXxx.yy.137 %UXxx.yy.138 %UXxx.yy.139 %UXxx.yy.140 %UXxx.yy.141 %UXxx.yy.142 %UXxx.yy.143 %UXxx.yy.144 %UXxx.yy.145 %UXxx.yy.146 %UXxx.yy.147 %UXxx.yy.148 %UXxx.yy.149 %UXxx.yy.150 %UXxx.yy.151	CH0 process alarm LL-limit CH0 process alarm L-limit CH0 process alarm H-limit CH0 process alarm HH-limit CH1 process alarm LL-limit CH1 process alarm L-limit CH1 process alarm H-limit CH1 process alarm HH-limit CH2 process alarm LL-limit CH2 process alarm L-limit CH2 process alarm H-limit CH2 process alarm HH-limit CH3 process alarm LL-limit CH3 process alarm L-limit CH3 process alarm H-limit CH3 process alarm HH-limit CH0 change rate alarm L-limit CH0 change rate alarm H-limit CH1 change rate alarm L-limit CH1 change rate alarm H-limit CH2 change rate alarm L-limit CH2 change rate alarm H-limit CH3 change rate alarm L-limit CH3 change rate alarm H-limit	Read
_xxyy_CH0_IDD _xxyy_CH1_IDD _xxyy_CH2_IDD _xxyy_CH3_IDD	%UXxx.yy.160 %UXxx.yy.161 %UXxx.yy.162 %UXxx.yy.163	CH0 input disconnection detection CH1 input disconnection detection CH2 input disconnection detection CH3 input disconnection detection	Read
_xxyy_ERR_CLR	%UXxx.yy.176	Error clear request flag	Write

1) In the device allocation, xx means base number where module is installed and yy means base number where module is installed.
2) To read 'CH1 digital output value' of Analog Input Module installed at base 0, slot 4, expression is %UW0.4.3.



3) To read 'CH3 disconnection detection flag' of Analog Input Module installed at base 0, slot 5, expression is %UX0.5.163.



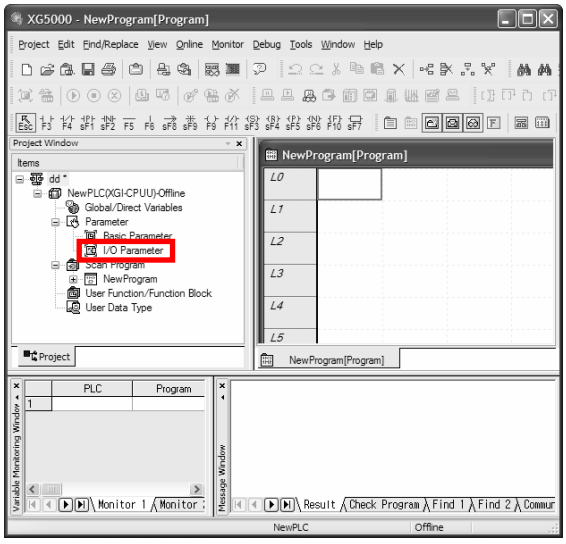
7.1.2 How to use global variable

- In order to register global variable, there are two method, auto registration after setting I/O parameter at project window and batch registration after setting I/O parameter

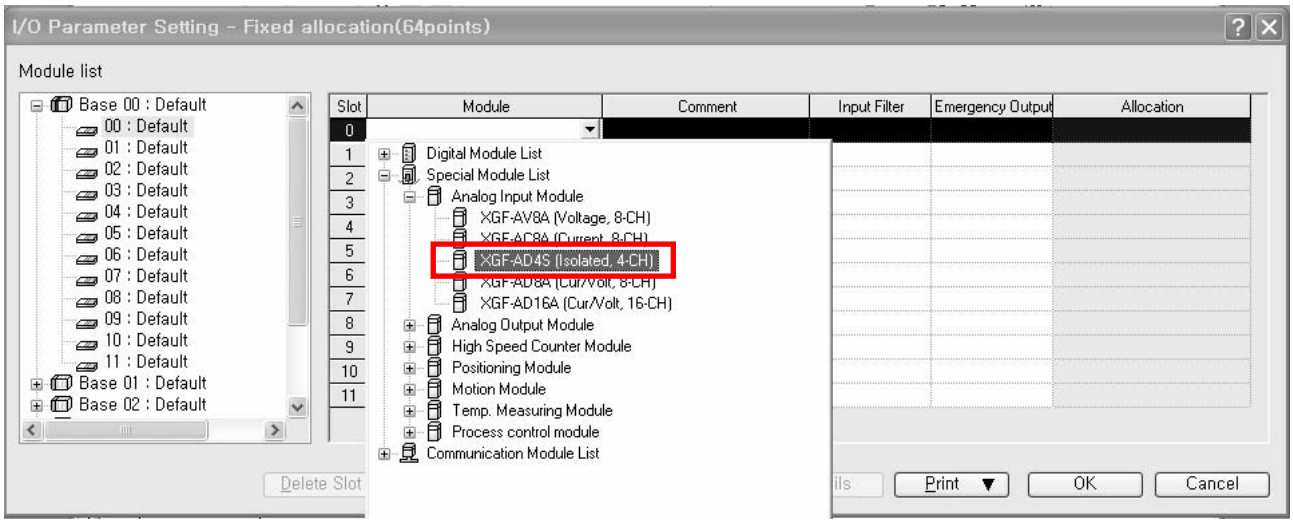
(1) I/O parameter registration

- Registers module you want to use at I/O parameter

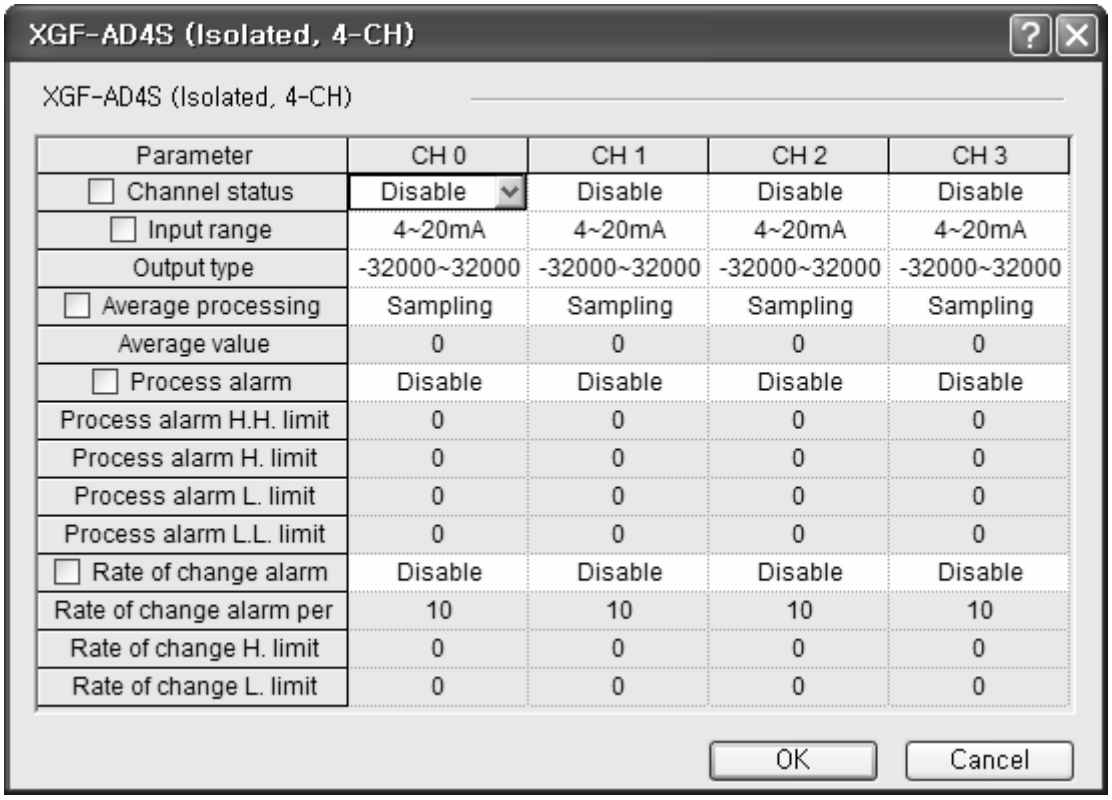
(a) Double-click I/O parameter of project window



(b) Select XGF-AD4S module at I/O parameter window

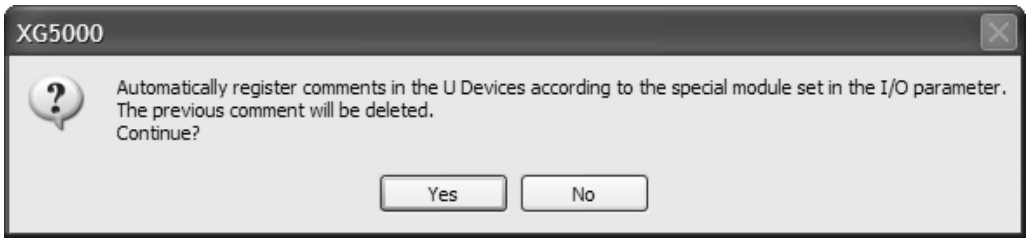


(c) Set parameter by pressing [Details] and select [OK]



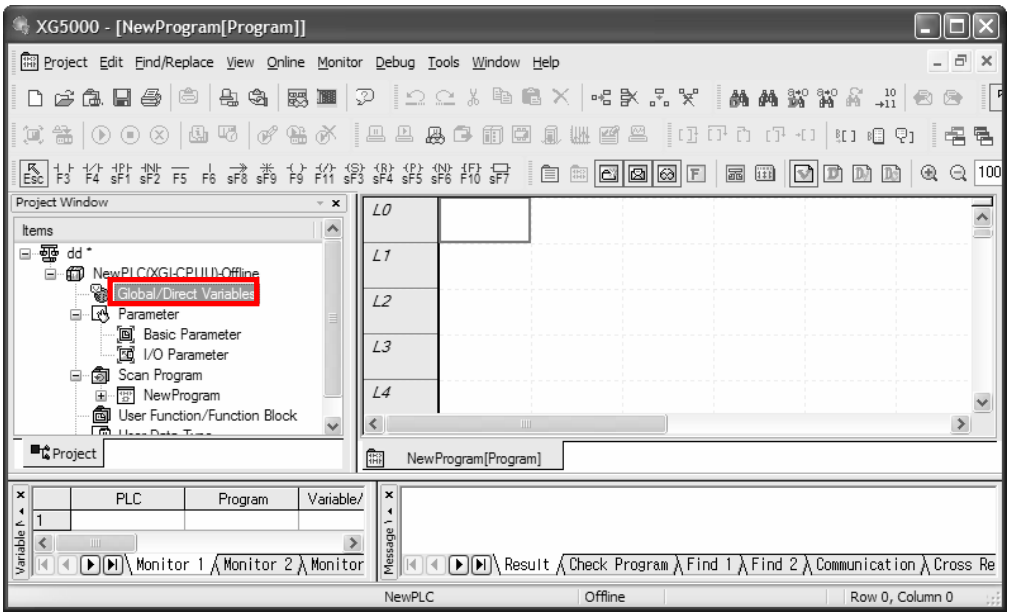
(d) Select [Yes]

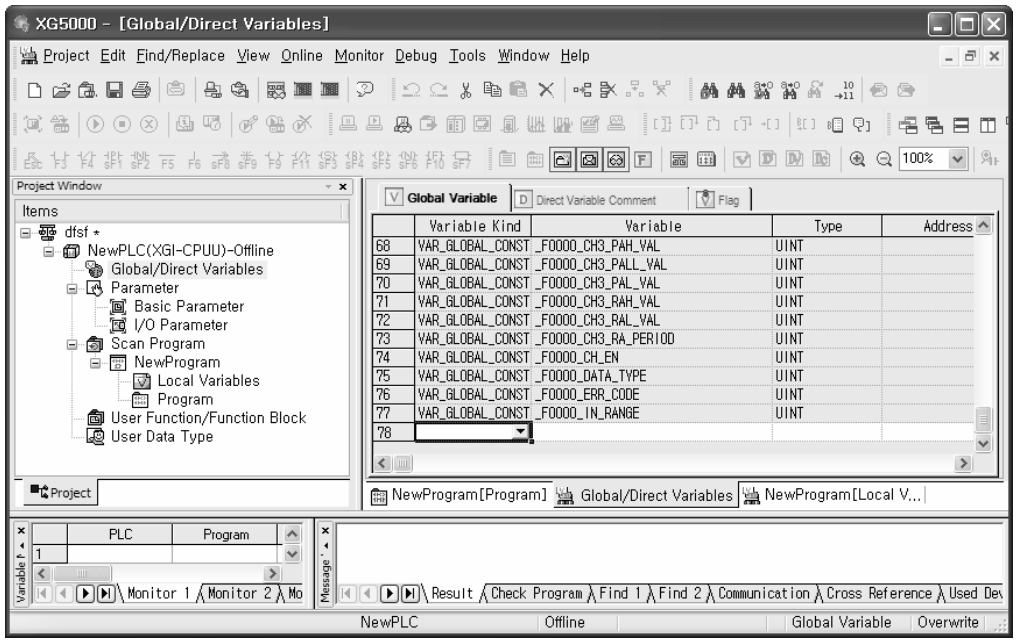
- Auto-register global variable of module set in I/O parameter



(e) Global variable auto registration check

- Double-click Global/Direct Variable of project window

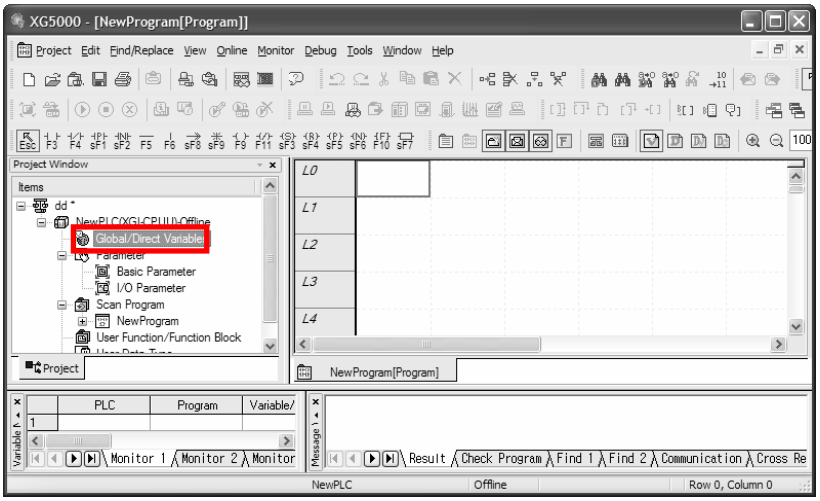




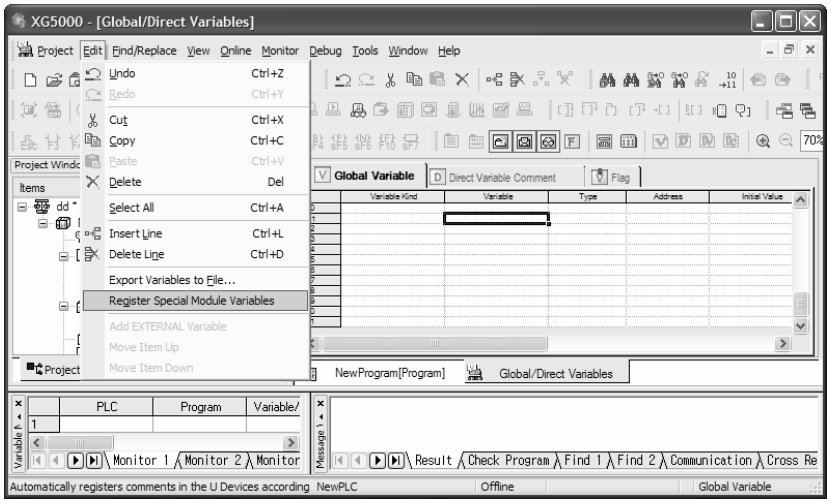
(2) Global variable registration

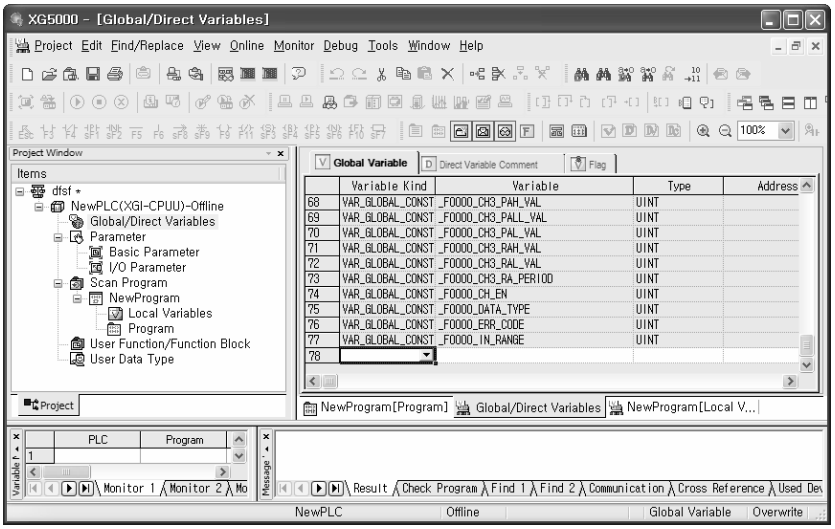
- Registers global variable set in I/O parameter

(a) Double-click Global/Direct Variable of project window



(b) Select [Register Special Module Variables] at menu [Edit]

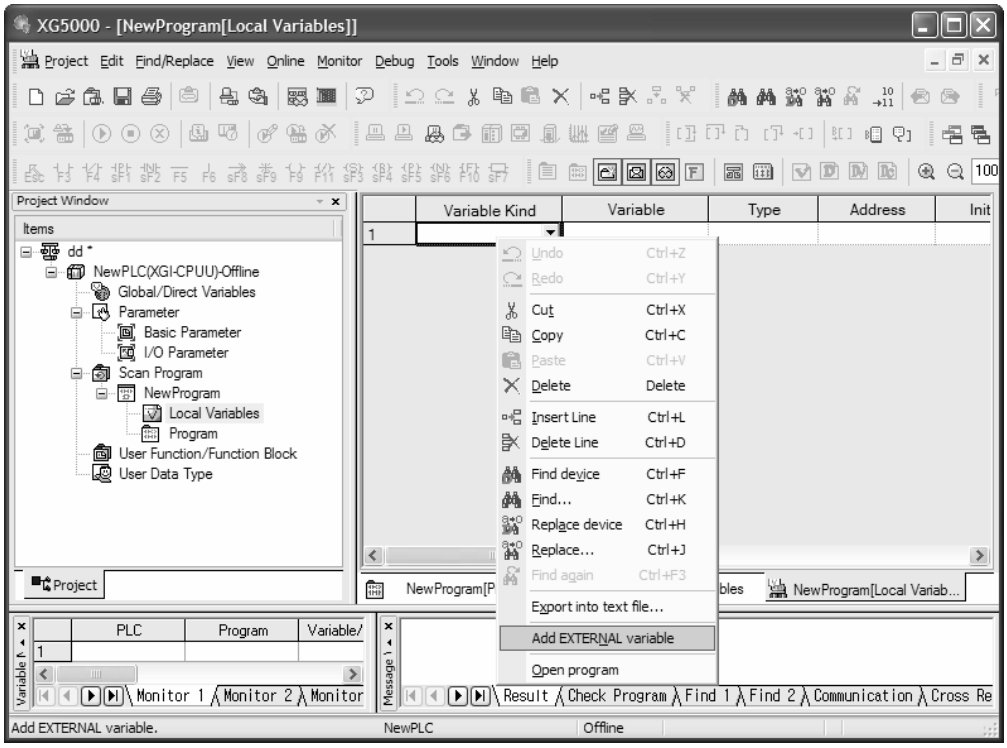




(3) Local variable registration
- Registers variable among registered global variable you want to use as local variable.

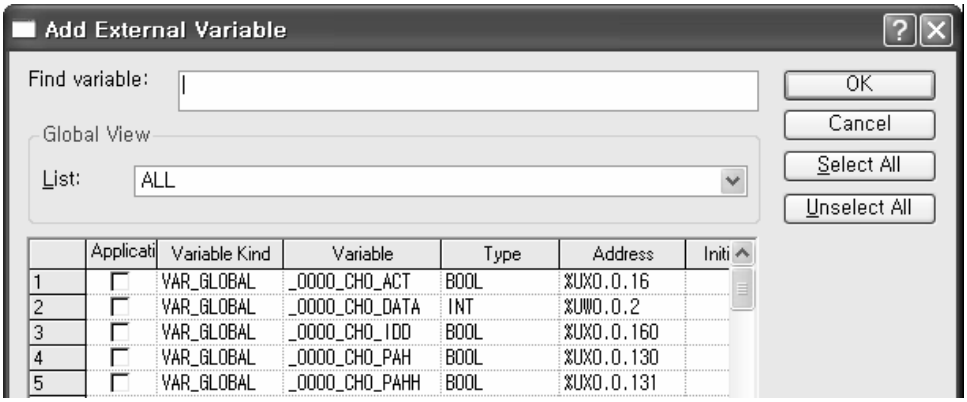
(a) Double-click local variable to use in the following scan program.

(b) Click right button of mouse in the right local variable window and select “Add EXTERNAL variable”.

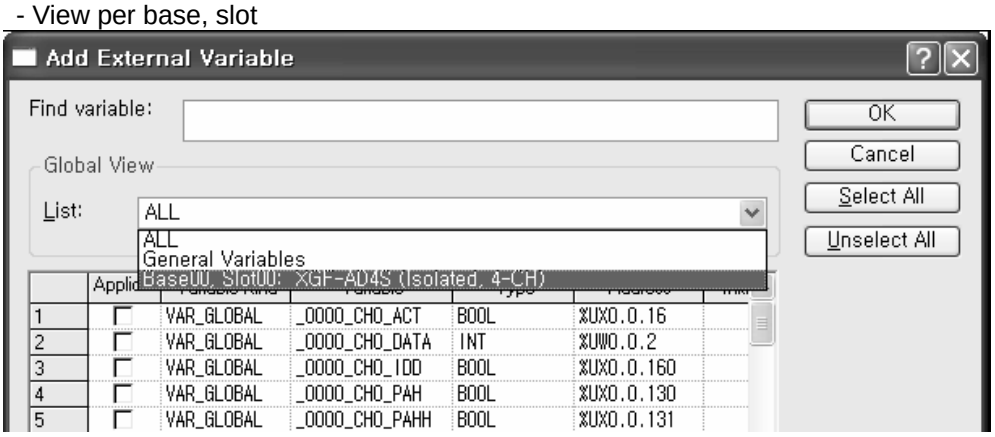


(c) Select local variable to add at Global View on “Add External Variable” window (“All” or “Base, slot”).

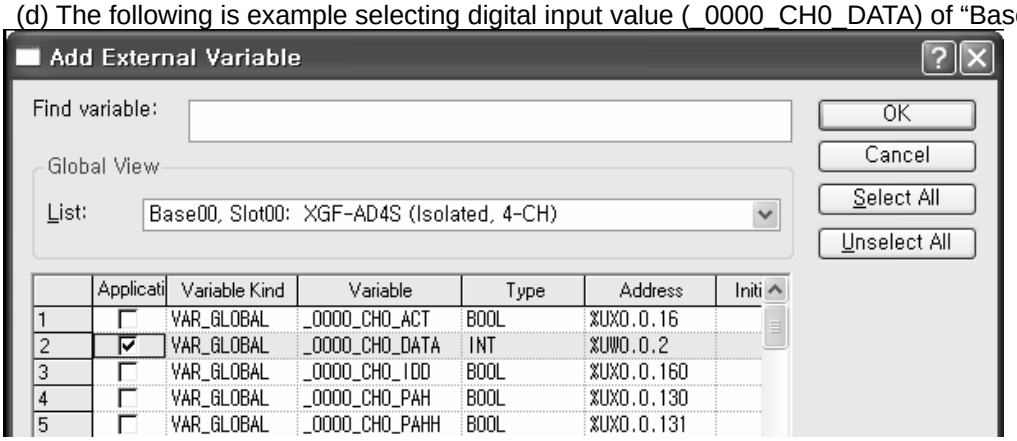
-View All



- View per base, slot

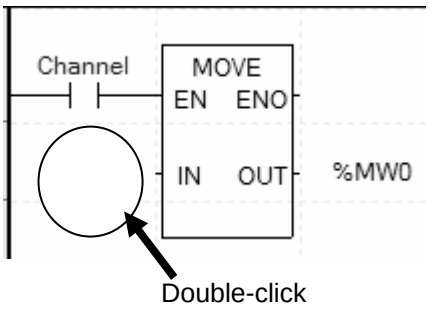


(d) The following is example selecting digital input value (_0000_CH0_DATA) of “Base00, Slot00”.

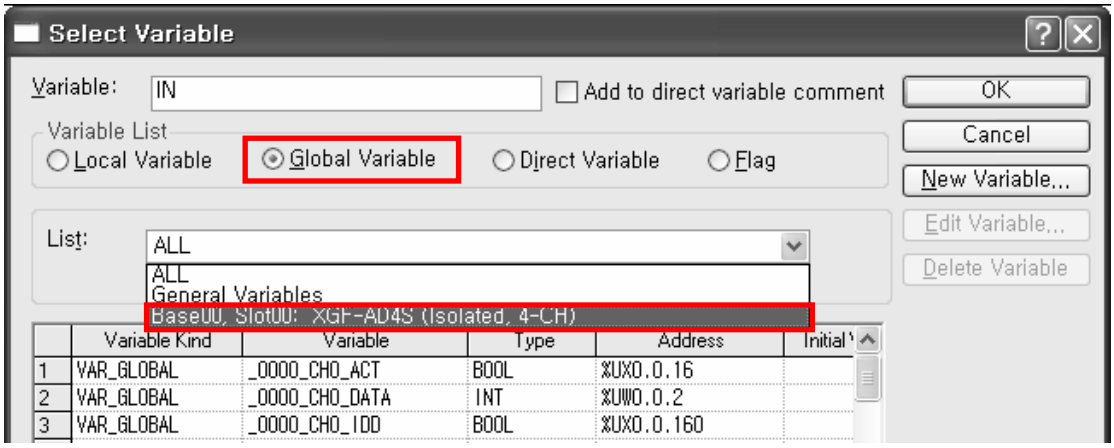


(4) How to use local variable on program
- It describes the added global variable at local program.
- The following is example getting the conversion value of CH0 of Analog Input Module to %MW0.

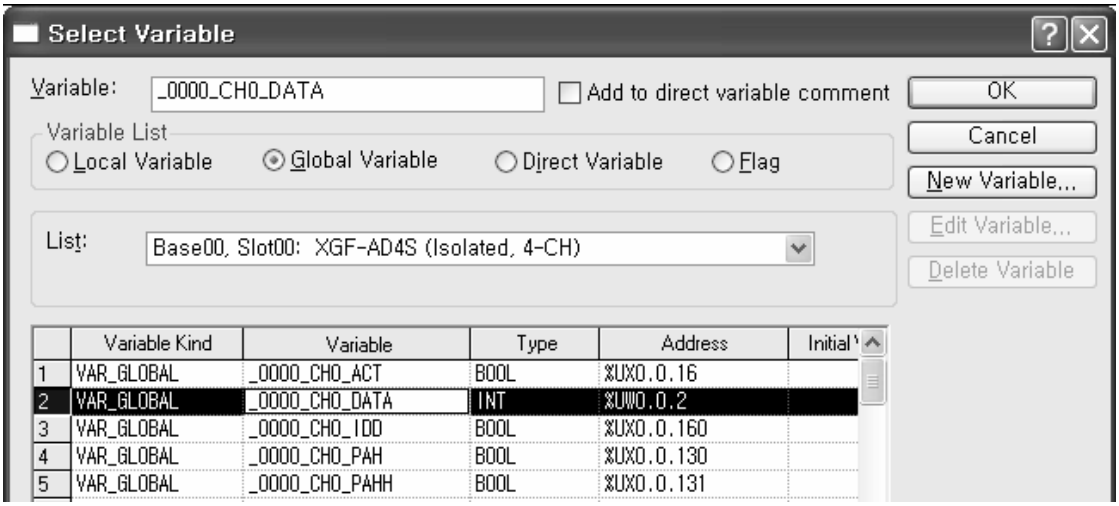
(a) At part reading A/D conversion data to %MW0 by using the following MOVE function, double-click variable part ahead of IN, then “Select Variable” window shows up.



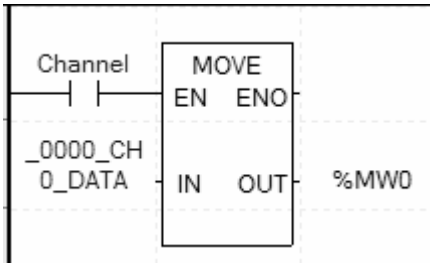
(b) Select global variable at variable type at Select Variable window. And select relevant base (0 base, 0 slot) at global variable view item.



(c) Double-click or select _0000_CH0_DATA corresponding to CH0 A/D conversion data and click [OK].



(d) The following figure is result adding global variable corresponding to CH0 A/D conversion value.



7.2 PUT/GET Function Block use area (Parameter area)

7.2.1 PUT/GET Function Block use area (Parameter area)

It indicates operation parameter setting area of Analog Input Module at table 7.2.

[Table 7. 2] Operation parameter setting area

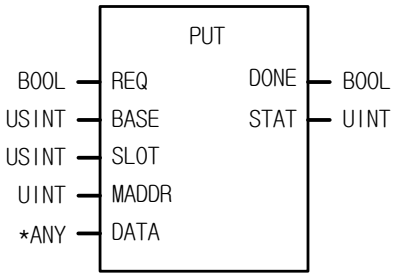
Global variable	Contents	R/W	Instruction
_Fxxyy_ALM_EN _Fxxyy_AVG_SEL _Fxxyy_CH_EN	Set alarm process Set average process method Set channel to use	R/W	PUT
_Fxxyy_CH0_AVG_VAL _Fxxyy_CH0_PAH_VAL _Fxxyy_CH0_PAHH_VAL _Fxxyy_CH0_PAL_VAL _Fxxyy_CH0_PALL_VAL _Fxxyy_CH0_RA_PERIOD _Fxxyy_CH0_RAH_VAL _Fxxyy_CH0_RAL_VAL	CH0 average value CH0 process alarm H-limit setting value CH0 process alarm HH-limit setting value CH0 process alarm L-limit setting value CH0 process alarm LL-limit setting value CH0 change rate alarm detection period setting CH0 change rate H-limit setting value CH0 change rate L-limit setting value	R/W	PUT
_Fxxyy_CH1_AVG_VAL _Fxxyy_CH1_PAH_VAL _Fxxyy_CH1_PAHH_VAL _Fxxyy_CH1_PAL_VAL _Fxxyy_CH1_PALL_VAL _Fxxyy_CH1_RA_PERIOD _Fxxyy_CH1_RAH_VAL _Fxxyy_CH1_RAL_VAL	CH1 average value CH1 process alarm H-limit setting value CH1 process alarm HH-limit setting value CH1 process alarm L-limit setting value CH1 process alarm LL-limit setting value CH1 change rate alarm detection period setting CH1 change rate H-limit setting value CH1 change rate L-limit setting value	R/W	PUT
_Fxxyy_CH2_AVG_VAL _Fxxyy_CH2_PAH_VAL _Fxxyy_CH2_PAHH_VAL _Fxxyy_CH2_PAL_VAL _Fxxyy_CH2_PALL_VAL _Fxxyy_CH2_RA_PERIOD _Fxxyy_CH2_RAH_VAL _Fxxyy_CH2_RAL_VAL	CH2 average value CH2 process alarm H-limit setting value CH2 process alarm HH-limit setting value CH2 process alarm L-limit setting value CH2 process alarm LL-limit setting value CH2 change rate alarm detection period setting CH2 change rate H-limit setting value CH2 change rate L-limit setting value	R/W	PUT
_Fxxyy_CH3_AVG_VAL _Fxxyy_CH3_PAH_VAL _Fxxyy_CH3_PAHH_VAL _Fxxyy_CH3_PAL_VAL _Fxxyy_CH3_PALL_VAL _Fxxyy_CH3_RA_PERIOD _Fxxyy_CH3_RAH_VAL _Fxxyy_CH3_RAL_VAL	CH3 average value CH3 process alarm H-limit setting value CH3 process alarm HH-limit setting value CH3 process alarm L-limit setting value CH3 process alarm LL-limit setting value CH3 change rate alarm detection period setting CH3 change rate H-limit setting value CH3 change rate L-limit setting value	R/W	PUT
_Fxxyy_DATA_TYPE _Fxxyy_IN_RANGE	Output data type setting Input current/voltage setting	R/W	PUT
_Fxxyy_ERR_CODE	Error code	R	GET

※ At device allocation, xx means base number and yy means slot number where module is equipped.

7.2.2 PUT/GET instruction

(1)PUT instruction

PUT
Writing data to special module

Function Block	Description
	**Input** REQ : execute function when 1 BASE : set base position SLOT : set slot position MADDR : module address DATA : data to save module **Output** DONE : Output 1 when normal STAT : Error information

*ANY: WORD, DWORD, INT, USINT, DINT, UDINT type available among ANY type

■ **Function**

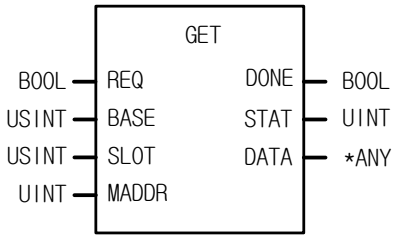
Read data from designated special module

Function Block	Input(ANY) type	Description
PUT_WORD	WORD	Save WRD data into the designated module address (MADDR).
PUT_DWORD	DWORD	Save DWORD data into the designated module address (MADDR).
PUT_INT	INT	Save INT data into the designated module address (MADDR).
PUT_UINT	UINT	Save UNIT data into the designated module address (MADDR).
PUT_DINT	DINT	Save DINT data into the designated module address (MADDR).
PUT_UDINT	UDINT	Save UDINT data into the designated module address (MADDR).

(2) GET instruction

GET

Reading from special module data

Function block	Description
	**Input** REQ : execute function when 1 BASE : set base position SLOT : set slot position MADDR : module address 512(0x200) ~ 1023(0x3FF) **Output** DONE : output 1 when normal STAT : Error information DATA : data to read from module

*ANY: WORD, DWORD, INT, UINT, DINT, UDINT type available among ANY type

■ **Function**

Read data from designated special module

Function Block	Output(ANY) type	Description
GET_WORD	WORD	Read data as much as WORD from the designated module address (MADDR).
GET_DWORD	DWORD	Read data as much as DWORD from the designated module address (MADDR).
GET_INT	INT	Read data as much as INT from the designated Module address (MADDR).
GET_UINT	UINT	Read data as much as UNIT from the designated module address (MADDR).
GET_DINT	DINT	Read data as much as DINT from the designated module address (MADDR).
GET_UDINT	UDINT	Read data as much as UDINT from the designated module address (MADDR).

7.2.3 Example using PUT/GET instruction

(1) Enable channel

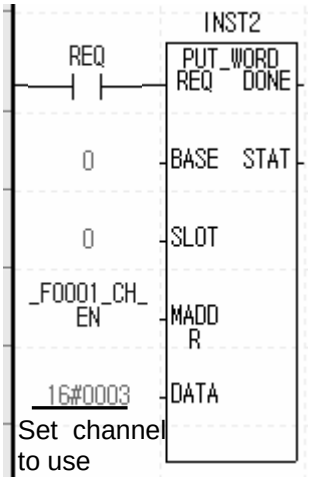
(a) You can enable/disable A/D conversion per channel
(b) Disable channel not using to reduce the conversion cycle per channel
(c) When channel is not designated, all channels are set as not used
(d) Enable/disable of A/D conversion is as follows

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
–	–	–	–	—	–	–	–	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

Bit	Description
0	Stop
1	Run

16#0003 : 0000 0000 0000 0011

CH3, CH2, CH1, CH0



(e) The value in B4~B15 is ignored.
(f) The right figure is example enabling CH0~CH1 of A/D module equipped at slot 0.

(2) Input voltage/current range setting

(a) You can set input voltage/current range per channel
(b) When analog input range is not set, all channels are set as 1 ~ 5V (4 ~ 20mA)
(c) Setting of analog input voltage/current range is as follows.

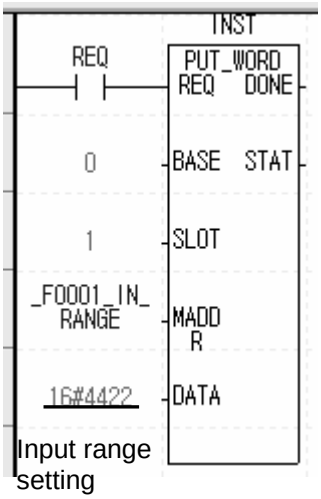
- The following is example setting CH0~CH1 as 1~5V and CH2~CH3 as 0~10V

B15 B14 B13 B12	B11 B10 B9 B8	B7 B6 B5 B4	B3 B2 B1 B0
CH3	CH2	CH1	CH0

Bit	Description
0000	4 mA ~ 20 mA
0001	0 mA ~ 20 mA
0010	1 V ~ 5 V
0011	0 V ~ 5 V
0100	0 V ~ 10 V
0101	-10 V ~ 10 V

16#4422 : 0100 0100 0010 0010

CH3, CH2, CH1, CH0



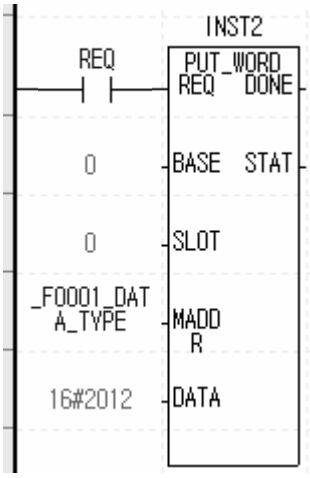
(3) Out put data range setting

(a) Digital output data range about analog input can be set per channel.
(b) When output data range is not set, all channels are set as -32000~32000.
(c) Setting of digital output data range is as follows

B15 B14 B13 B12	B11 B10 B9 B8	B7 B6 B5 B4	B3 B2 B1 B0
CH3	CH2	CH1	CH0

Bit	Description
0000	-32000 ~ 32000
0001	Precise value
0010	0~10000

16#2012 : 0010 0000 0001 0010
CH3, CH2, CH1, CH0



Precise value has the following digital output range about analog input range

1) Current

Analog input / Digital output	4 ~ 20 mA	0 ~ 20 mA
Precise Value	4000 ~ 20000	0 ~ 20000

2) Voltage

Analog input / Digital output	-10 ~ 10V	0 ~ 10V	0 ~ 5V	1 ~ 5V
Precise Value	-10000 ~ 10000	0 ~ 10000	0 ~ 5000	1000 ~ 5000

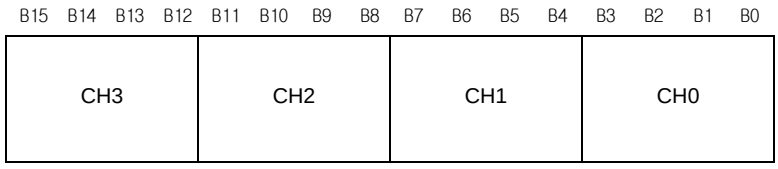
(4) Filter process setting

(a) You can enable/disable filter process per channel

(b) Filter process is not set, all channels are set as enable

(c) Setting of filter process is as follows

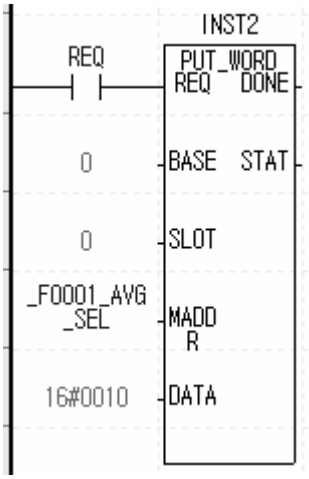
(d) The following figure is example using filter about CH4



Bit	Contents
0000	Sampling process
0001	Time average
0010	Count average
0011	Moving average
0100	Weighted average

16#0010 : 0000 0000 0001 0000

CH3, CH2, CH1, CH0



(5) Filter constant setting

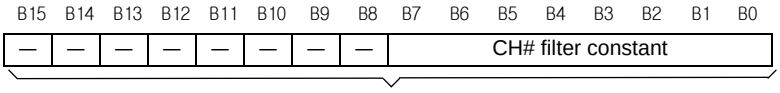
(a) Initial value of filter constant is 0

(b) Setting range of filter constant is as follows.

Average method	Setting range
Time average	16 ~ 5000(ms)
Count average	2 ~ 500(times)
Moving average	2 ~ 100(times)
Weighted average	0 ~ 99(%)

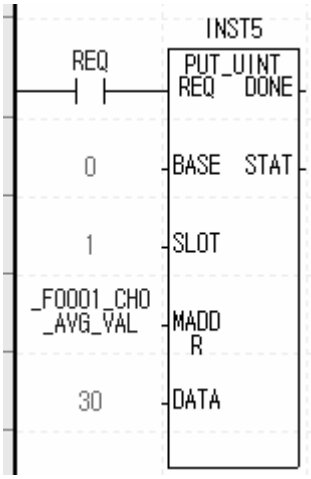
(c) When setting value other than setting range, it indicates error number at error code indication (_F0001_ERR_CODE). At this time, A/D conversion value keeps previous data. (# means the channel where error occurs at error code)

(d) Setting of filter constant is as follows



Setting range is different according to average method

Address	Contents
_Fxxyy_CH0_AVG_VAL	CH0 filter constant setting
_Fxxyy_CH1_AVG_VAL	CH1 filter constant setting
_Fxxyy_CH2_AVG_VAL	CH2 filter constant setting
_Fxxyy_CH3_AVG_VAL	CH3 filter constant setting



※ At device allocation, x means base number, y means slot number where module is equipped

Note

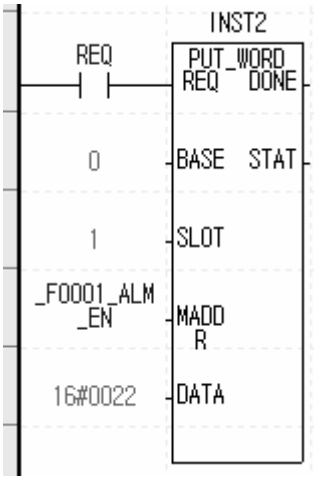
Before you set Time/Count average value, enable the average process and select average method (Time/Count).

(6) Alarm process setting

(a) This is are to enable/disable alarm process and it can be set per channels
(b) Default of this area is 0.
(c) Setting of alarm process is as follows.

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
—	—	—	—	—	—	—	—	CH3	CH2	CH1	CH0	CH3	CH2	CH1	CH0
								Change rate alarm				Process alarm			

BIT	Contents
0	Disable
1	Enable



(7) Process alarm value setting

(a) This is area to set process alarm value per channels. Range of process alarm is different according to data range.

1) Signed Value: -32768 ~ 32767
2) Precise Value

Range	Value
4 ~ 20 mA	3808 ~ 20192
0 ~ 20 mA	-240 ~ 20240
1 ~ 5 V	952 ~ 5048
0 ~ 5 V	-60 ~ 5060
0 ~ 10 V	-120 ~ 10120
-10 ~ 10 V	-10240 ~ 10240

3) Percentile Value: -120 ~ 10120

(b) For detail of process alarm, refer to 2.5.2.

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
CH# process alarm setting value															

Variable	Contents
_F0001_CH0_PAHH_VAL	CH0 process alarm HH-limit
_F0001_CH0_PAH_VAL	CH0 process alarm H-limit
_F0001_CH0_PAL_VAL	CH0 process alarm L-limit
_F0001_CH0_PALL_VAL	CH0 process alarm LL-limit
_F0001_CH1_PAHH_VAL	CH1 process alarm HH-limit
_F0001_CH1_PAH_VAL	CH1 process alarm H-limit
_F0001_CH1_PAL_VAL	CH1 process alarm L-limit
_F0001_CH1_PALL_VAL	CH1 process alarm LL-limit
_F0001_CH2_PAHH_VAL	CH2 process alarm HH-limit
_F0001_CH2_PAH_VAL	CH2 process alarm H-limit
_F0001_CH2_PAL_VAL	CH2 process alarm L-limit
_F0001_CH2_PALL_VAL	CH2 process alarm LL-limit
_F0001_CH3_PAHH_VAL	CH3 process alarm HH-limit
_F0001_CH3_PAH_VAL	CH3 process alarm H-limit
_F0001_CH3_PAL_VAL	CH3 process alarm L-limit
_F0001_CH3_PALL_VAL	CH3 process alarm LL-limit

Note

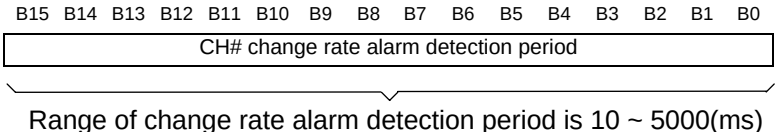
Before you set process alarm value, enable process alarm.

(8) Change rate alarm detection period setting

(a) Range of change rate alarm detection period is 10 ~ 5000(ms)

(b) If you set the value out of range, error code 60# is indicated at error code indication address. At this time, change rate alarm detection period is applied as default value (10)

(c) Setting of change rate alarm detection period is as follows.



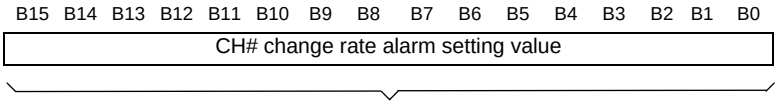
Variable	Contents
_F0001_CH0_RA_PERIOD	CH0 change rate alarm detection period
_F0001_CH1_RA_PERIOD	CH1 change rate alarm detection period
_F0001_CH2_RA_PERIOD	CH2 change rate alarm detection period
_F0001_CH3_RA_PERIOD	CH3 change rate alarm detection period

Note

Before you set the change rate alarm period, enable change rate alarm and set H/L-limit of change rate alarm.

(9) Change rate alarm setting value

(a) Range of change rate alarm value is -32768 ~ 32767(-3276.8% ~ 3276.7%).
(b) Setting of change rate alarm value is as follows.



Range of change rate alarm value is -32768 ~ 32767

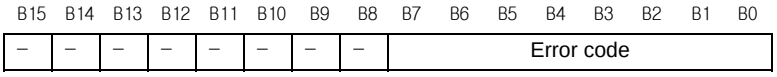
Variable	Contents
_F0001_CH0_RAL_VAL	CH0 change rate alarm H-limit setting
_F0001_CH0_RAL_VAL	CH0 change rate alarm L-limit setting
_F0001_CH1_RAL_VAL	CH1 change rate alarm H-limit setting
_F0001_CH1_RAL_VAL	CH1 change rate alarm L-limit setting
_F0001_CH2_RAL_VAL	CH2 change rate alarm H-limit setting
_F0001_CH2_RAL_VAL	CH2 change rate alarm L-limit setting
_F0001_CH3_RAL_VAL	CH3 change rate alarm H-limit setting
_F0001_CH3_RAL_VAL	CH3 change rate alarm L-limit setting

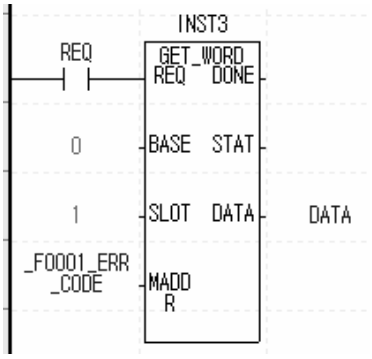
Note

Before you set the change rate alarm detection period, enable change rate alarm process and set alarm H/L- limit.

(10) Error code

(a) Saves error code detected at Analog Input Module
(b) Error type and contents are as follows
(c) The following figure is program example reading error code





Error code (Dec.)	Description	RUN LED status
0	Normal operation	RUN LED ON
10	Module error (ASIC reset error)	Flickers every 0.2 sec.
11	Module error (ASIC RAM or Register error)	
20#	Time average set value error	Flickers every 1 sec.
30#	Count average set value error	
40#	Moving average set value error	
50#	Weighted average set value error	
60#	Change rate alarm detection period set value error	

※ At error code, # indicates channel where error occurs
※ For more detail error code, refer to 9.1

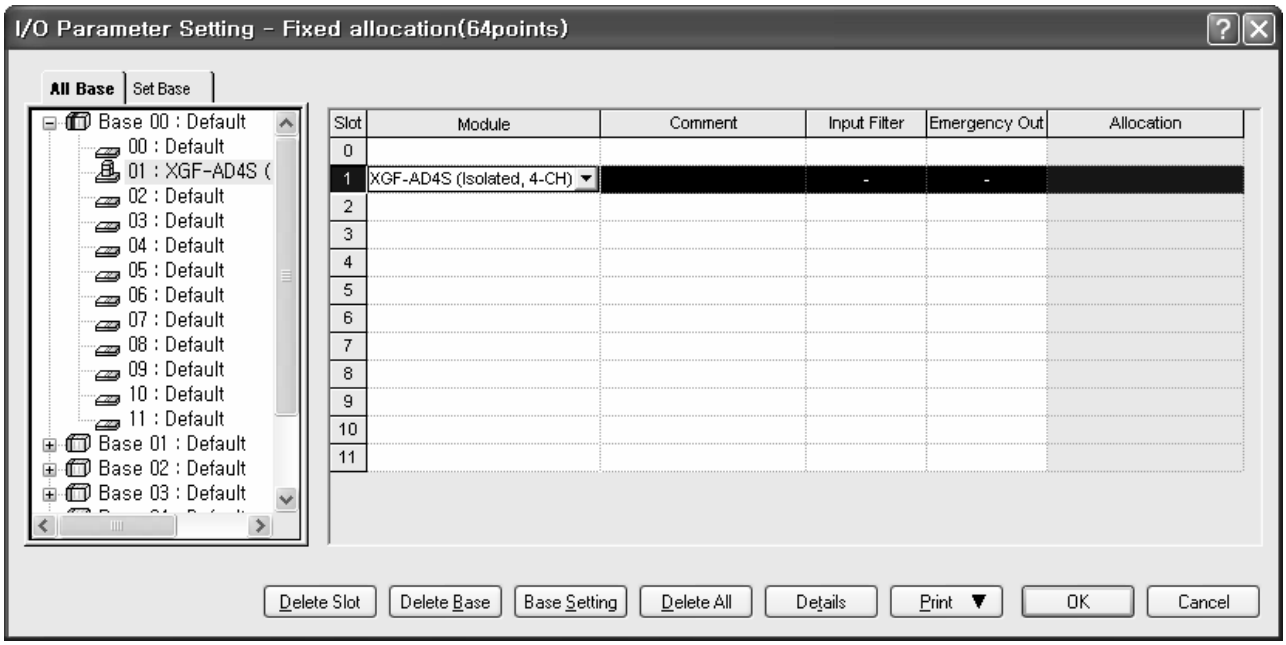
(d) In case two error codes occurs, module saves first occurred error code and later occurred error code is not saved
(e) In case error occurs, after modifying error, use “Error clear request flag”(referring to 5.2.7), restart power to delete error code and stop LED flicker

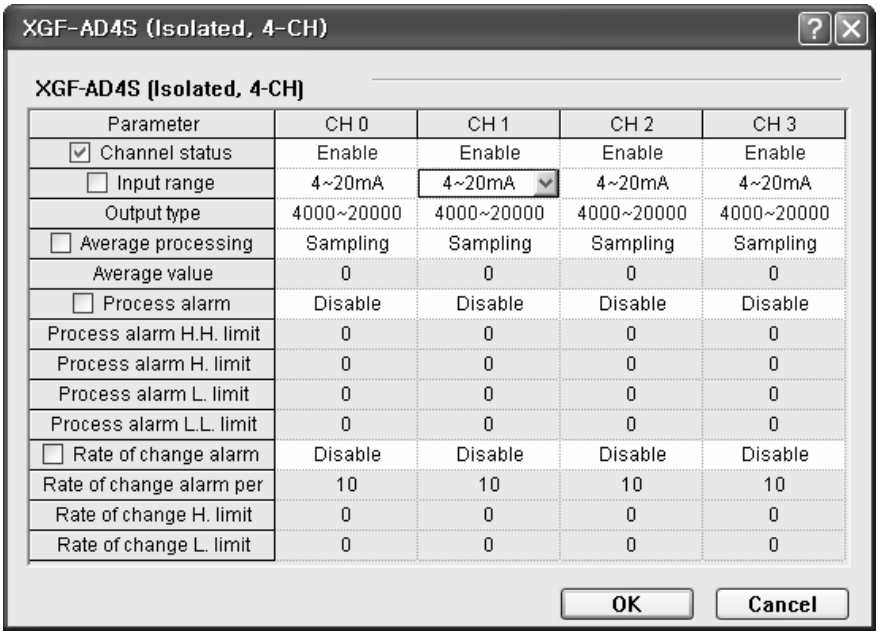
Chapter 8 Programming (For XGI/XGR)

8.1 Basic Program

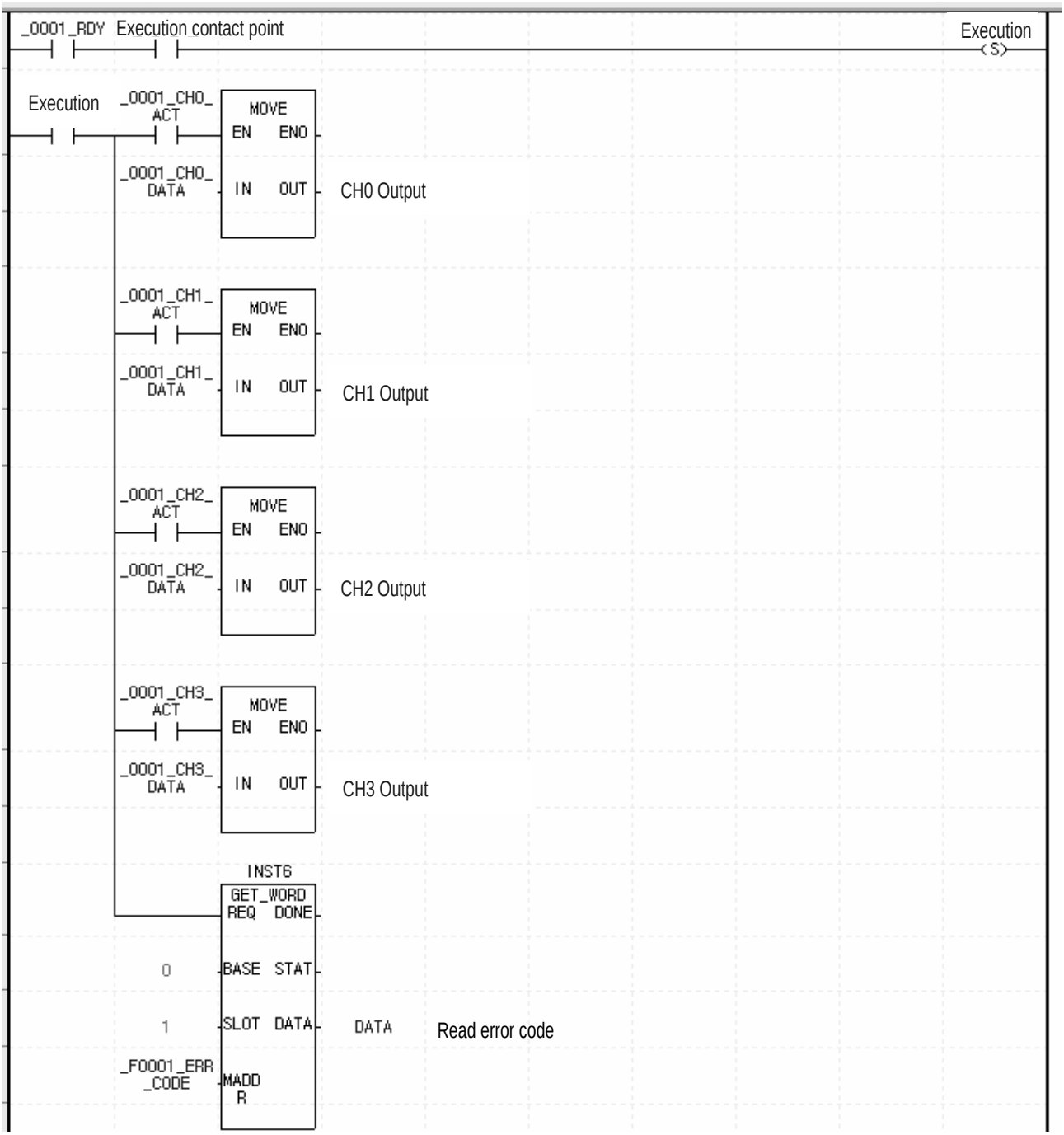
- It describes about how to set operation condition at internal memory of Analog Input Module.
- Analog Input Module is equipped at slot 2
- IO occupation points of Analog Input Module are 16 points (Flexible type)
- Initial setting condition is saved at internal memory by 1 time input

(1) Program example using [I/O Parameter]

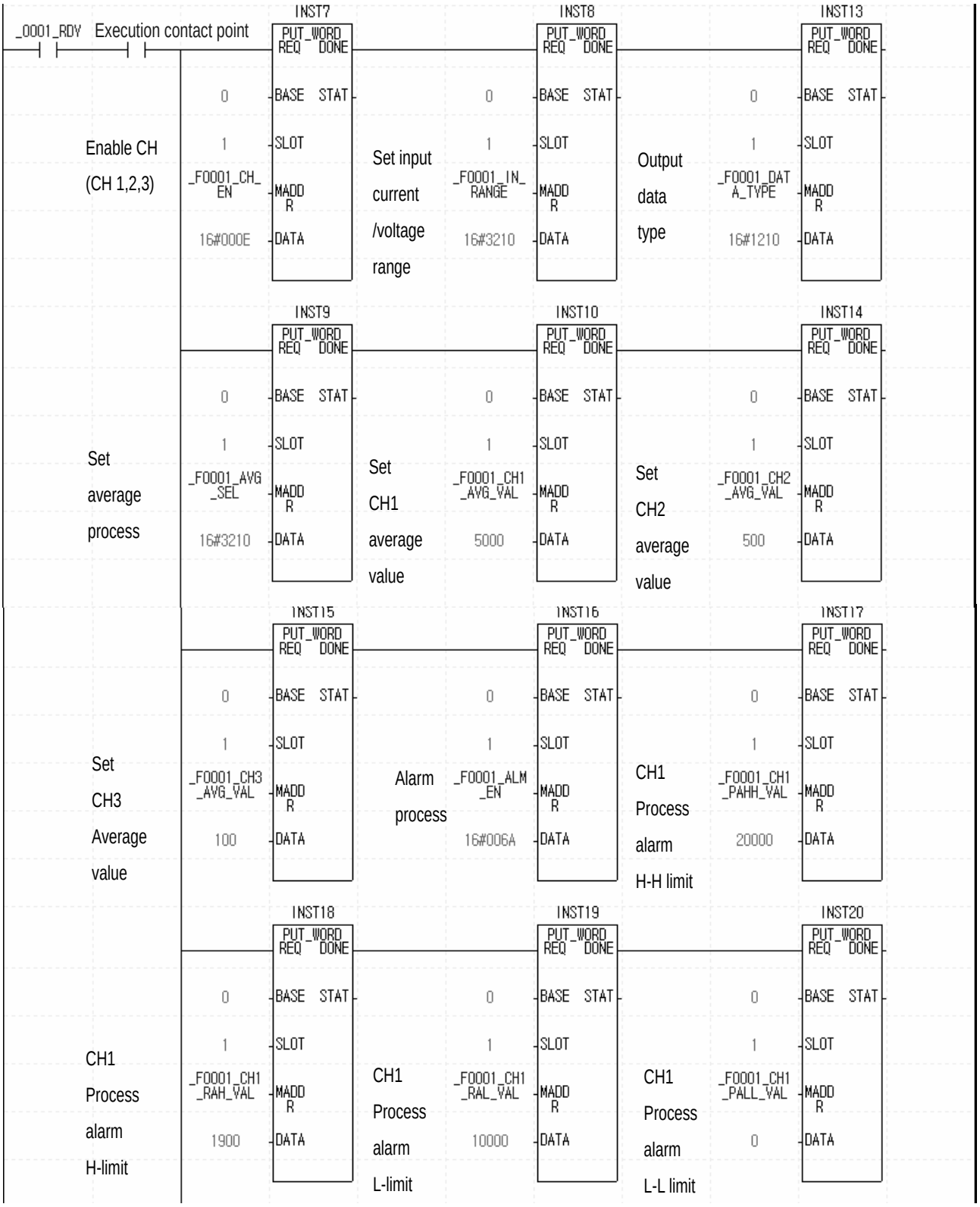


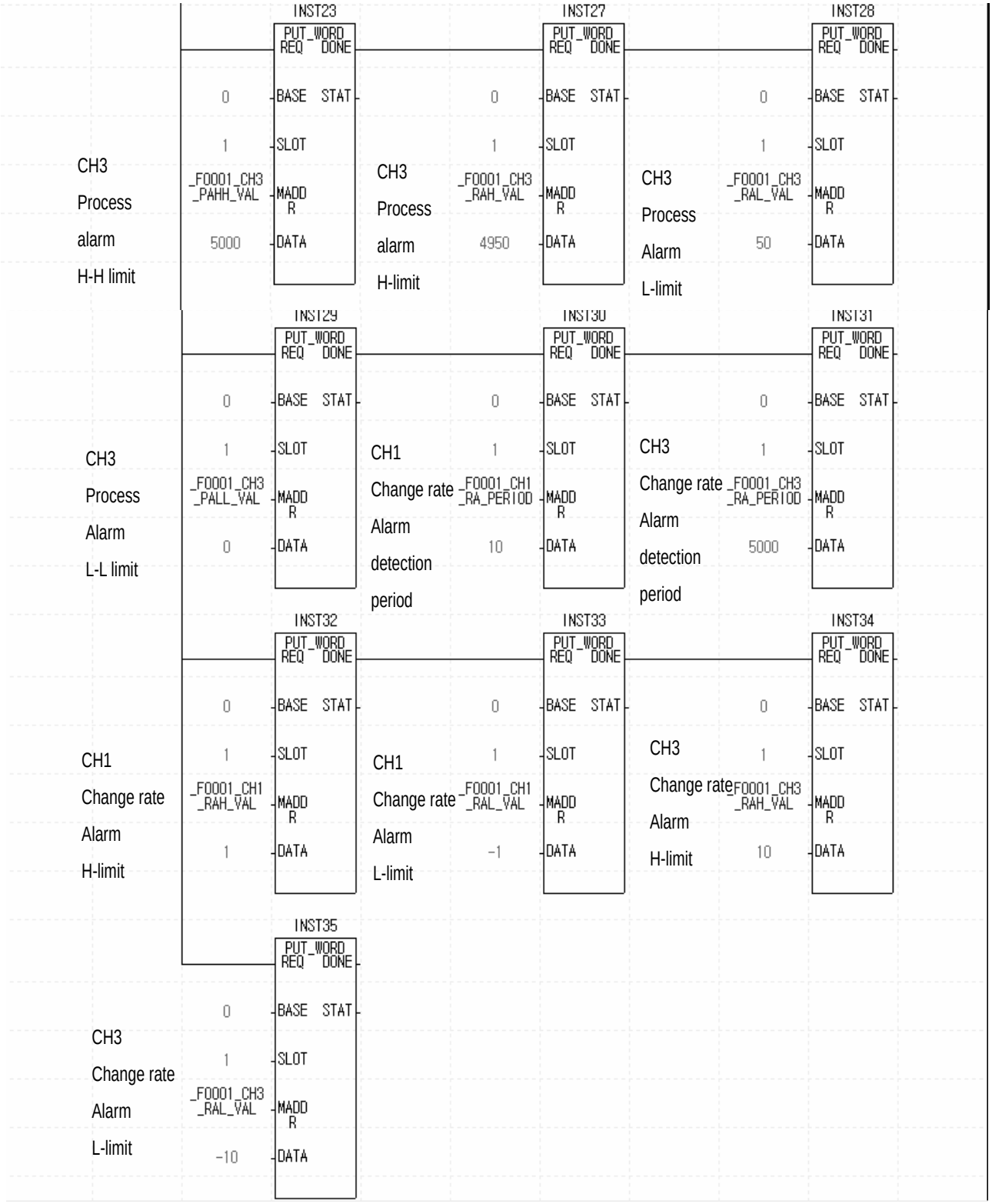


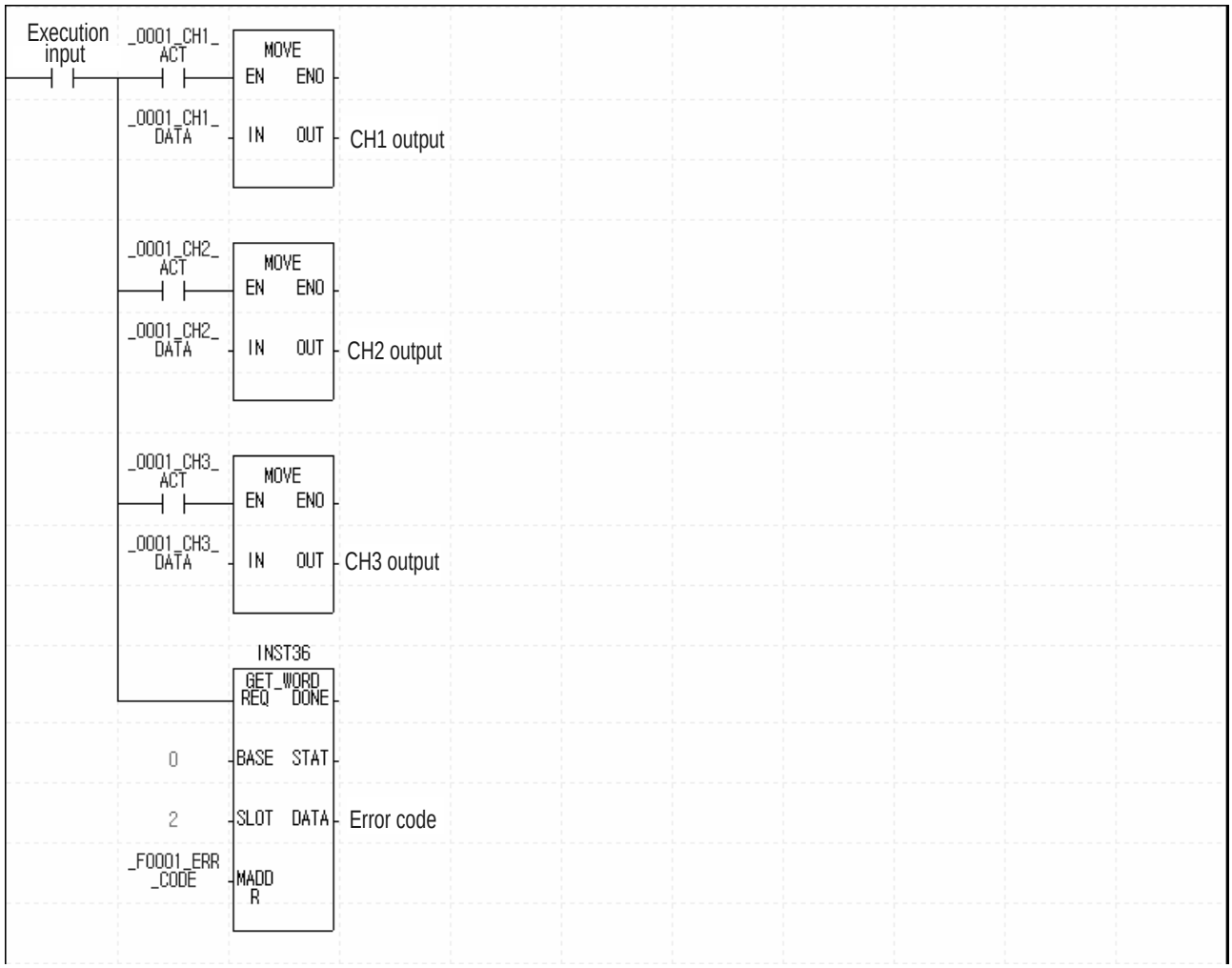
(2) Program example using [I/O Parameter]



(3) Program example using PUT/GET instruction



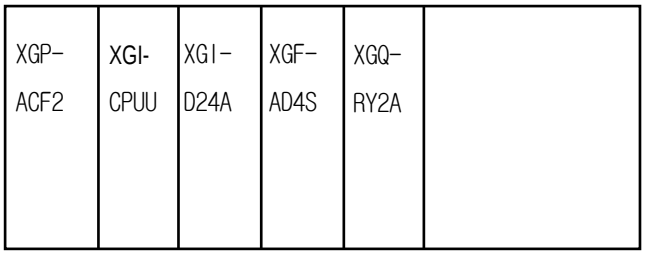

INST23
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH3_PAHH_VAL MADDR
5000 DATA
CH3 Process alarm H-H limit
INST27
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH3_RAH_VAL MADDR
4950 DATA
CH3 Process alarm H-limit
INST28
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH3_RAL_VAL MADDR
50 DATA
CH3 Process Alarm L-limit
INST29
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH3_PALL_VAL MADDR
0 DATA
CH3 Process Alarm L-L limit
INST30
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH1_RA_PERIOD MADDR
10 DATA
CH1 Change rate Alarm detection period
INST31
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH3_RA_PERIOD MADDR
5000 DATA
CH3 Change rate Alarm detection period
INST32
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH1_RAH_VAL MADDR
1 DATA
CH1 Change rate Alarm H-limit
INST33
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH1_RAL_VAL MADDR
-1 DATA
CH1 Change rate Alarm L-limit
INST34
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH3_RAH_VAL MADDR
10 DATA
CH3 Change rate Alarm H-limit
INST35
PUT_WORD
REQ DONE
0 BASE STAT
1 SLOT
_F0001_CH3_RAL_VAL MADDR
-10 DATA
CH3 Change rate Alarm L-limit


Execution input
_0001_CH1_ACT
MOVE
EN ENO
_0001_CH1_DATA
IN OUT
CH1 output
_0001_CH2_ACT
MOVE
EN ENO
_0001_CH2_DATA
IN OUT
CH2 output
_0001_CH3_ACT
MOVE
EN ENO
_0001_CH3_DATA
IN OUT
CH3 output
INST36
GET_WORD
REQ DONE
0
BASE STAT
2
SLOT DATA
Error code
_F0001_ERR_CODE
MADDR

8.2 Application Program

8.2.1 Program to sort A/D converted value in size

(1) System configuration



(2) Initial setting content

No.	Item	Initial setting content	Variable name	Value to write at internal memory
1	Used channel	CH0, Ch2, CH3	0	'h000D'or 13'
2	Input voltage range	-10 ~ 10 V	1	'h5505'or 21765'
3	Output data range	-32000~32000	2	'h0000'or 0'
4	Average process	CH0, 2, 3 (Weight, Count, time)	3	'h1204'or 4612'
5	Average value	CH0 weight average value: 50 (%)	4	'h0032'or 50'
6	Average value	CH2 count average value: 100	6	'h0064'or 100'
7	Average value	CH3 time average value: 200 (ms)	7	'h00C8'or'200'

(3) Program description

(a) When digital value of CH0 is smaller than 12000, turn on 0th contact point of relay output module equipped at No.2 slot (%QX0.2.0).

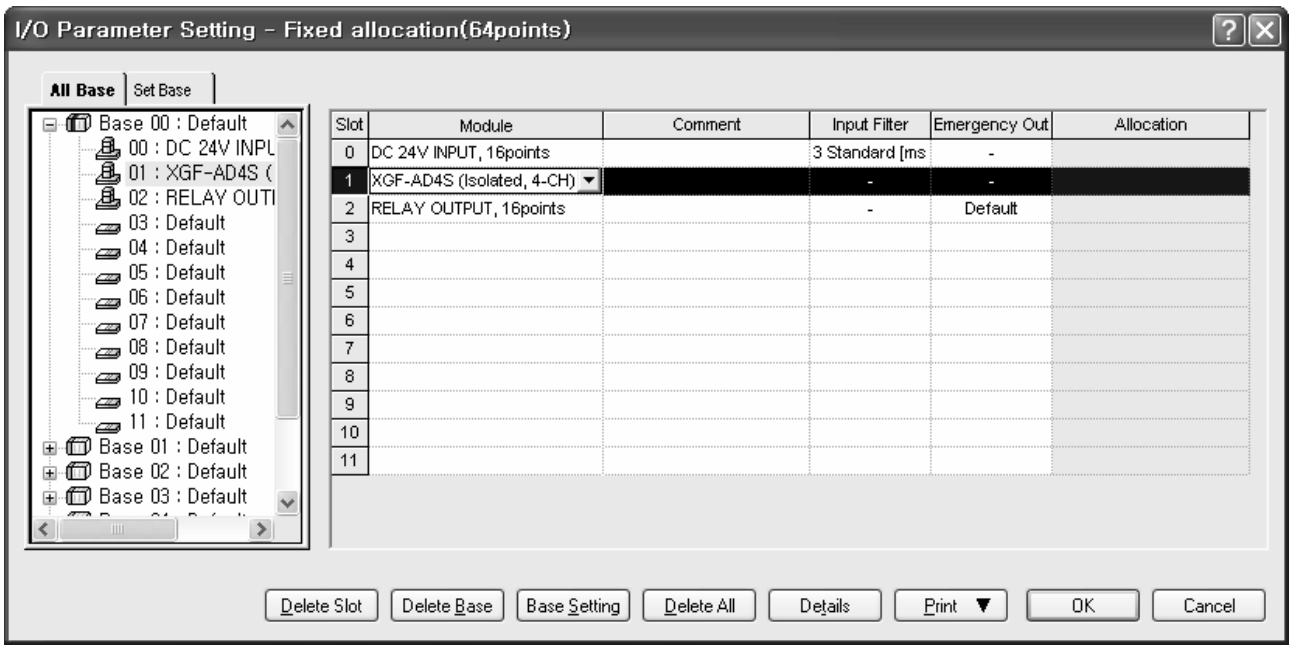
(b) When digital value of CH2 is larger than 13600, turn on second contact point of relay output module equipped at No.2 slot (%QX0.2.2).

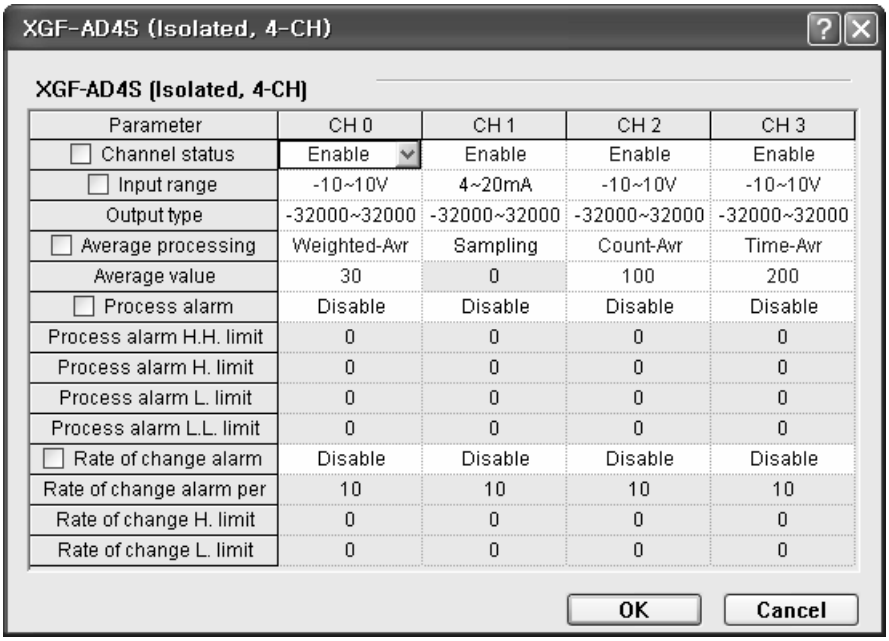
(c) When digital value of CH4 is larger or equal than 12000 and smaller than 13600, turn on 4th contact point of relay output module equipped at No.2 slot (%QX0.2.4)

(d) When digital value of CH4 is same with 12800, turn on 5th contact point of relay output module equipped at No.2 slot (%QX0.2.5).

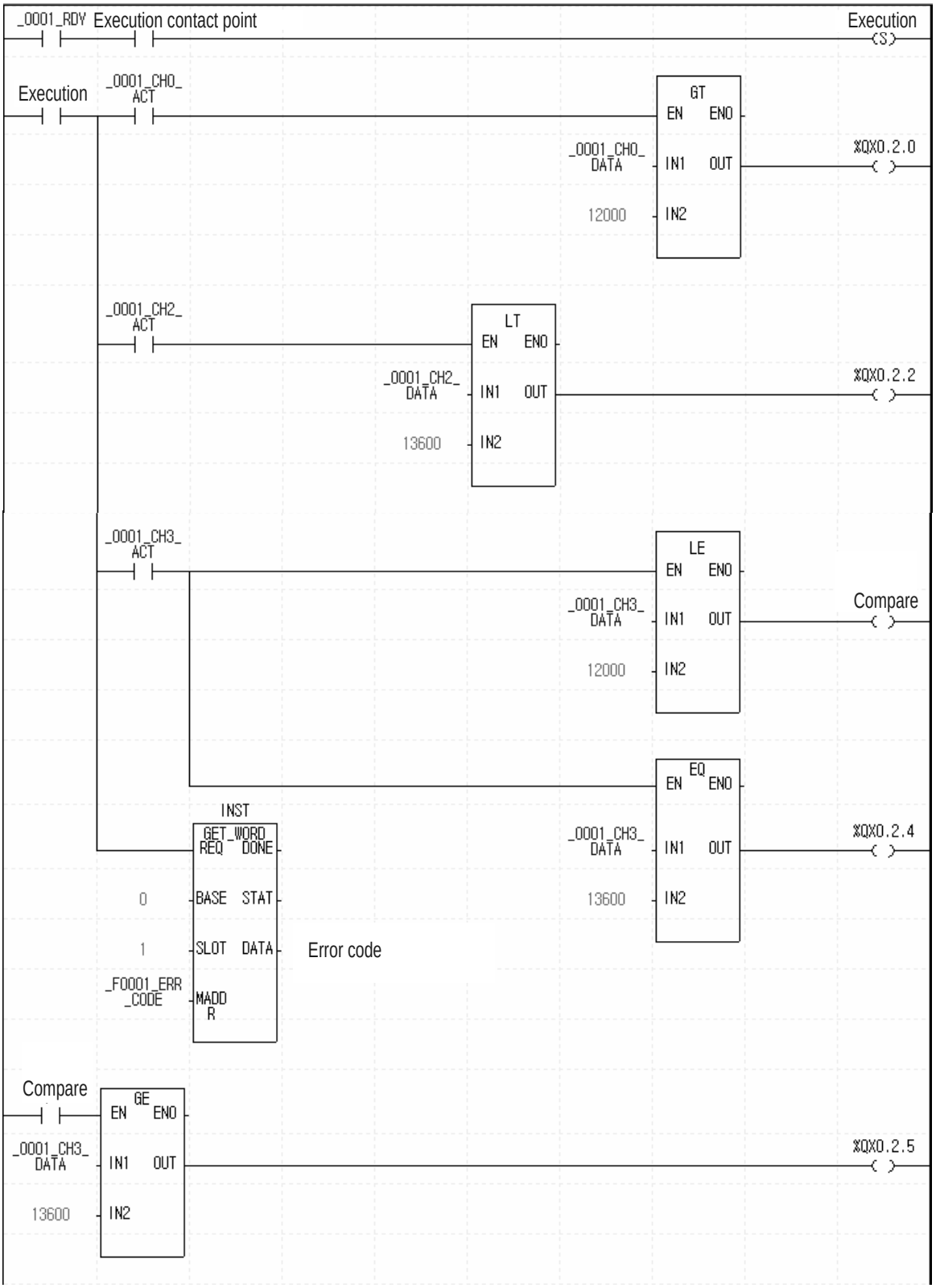
(4) Program

(a) Program example using [I/O Parameter]



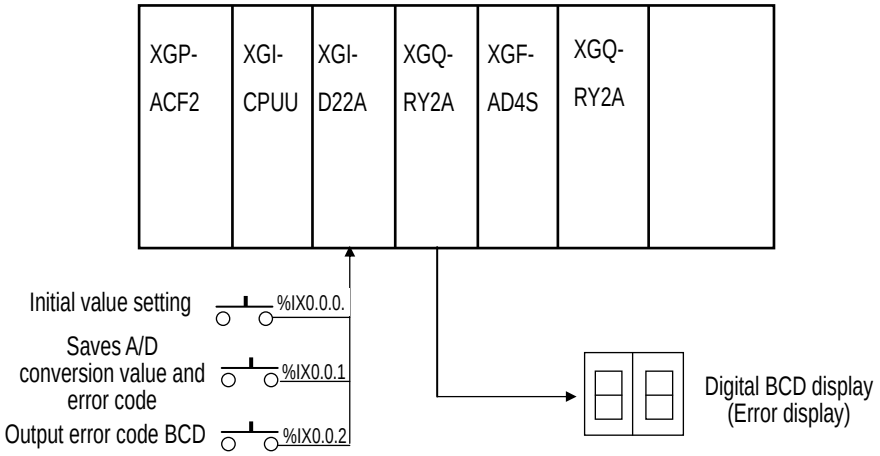


(b) Program example using [I/O Parameter]



8.2.2 Program to output error codes of analog input module to BCD display

(1) System configuration



(2) Details of initial setting

(a) Used CH: CH 0

(b) Analog input current range: DC 4 ~ 20 mA

(c) Time average process setting: 100 (ms)

(d) Digital output data range: -32000~32000

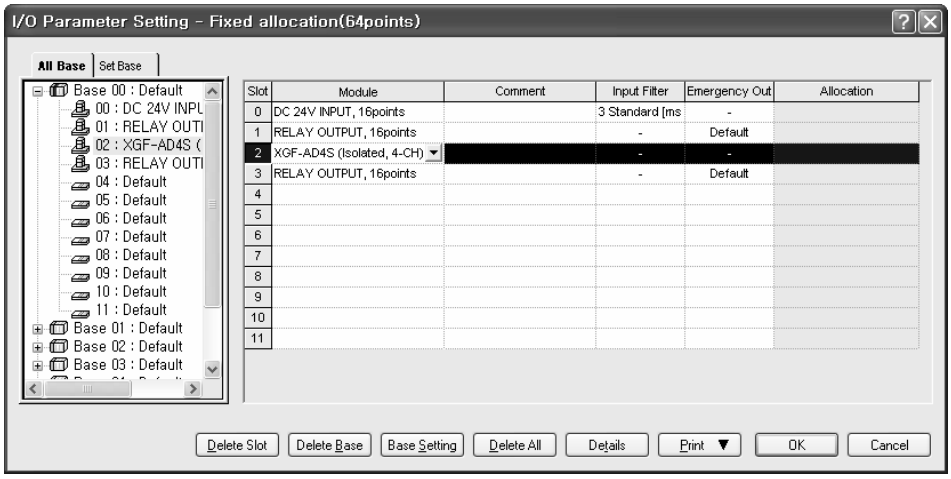
(3) Program description

(1) If %IX0.0.0 is On, A/D converted value and error code will be saved respectively on "Conversion value" and "Error code".

(2) If %IX0.0.2 is On, applicable error code will be output to digital BCD display. (%QW0.2.0)

(4) Program

(1) Program example using [I/O Parameter]



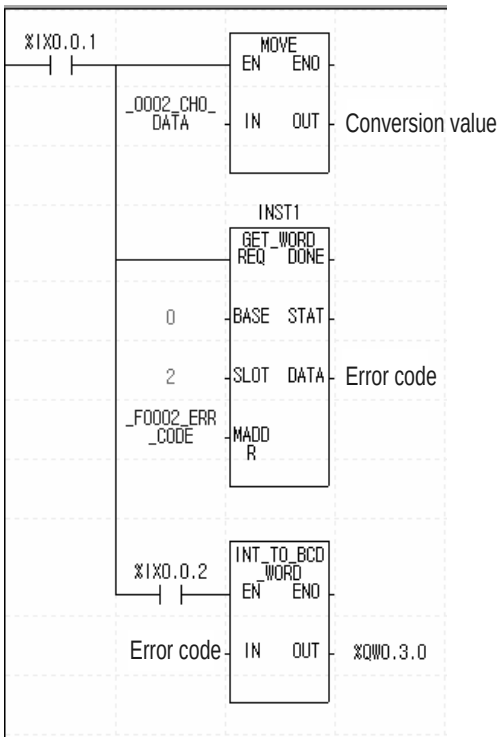
XGF-AD4S (Isolated, 4-CH)

XGF-AD4S (Isolated, 4-CH)

Parameter	CH 0	CH 1	CH 2	CH 3
Channel status	Enable	Disable	Disable	Disable
Input range	4~20mA	4~20mA	4~20mA	4~20mA
Output type	-32000~32000	-32000~32000	-32000~32000	-32000~32000
Average processing	Time-Avr	Sampling	Sampling	Sampling
Average value	100	0	0	0
Process alarm	Disable	Disable	Disable	Disable
Process alarm H.H. limit	0	0	0	0
Process alarm H. limit	0	0	0	0
Process alarm L. limit	0	0	0	0
Process alarm L.L. limit	0	0	0	0
Rate of change alarm	Disable	Disable	Disable	Disable
Rate of change alarm per	10	10	10	10
Rate of change H. limit	0	0	0	0
Rate of change L. limit	0	0	0	0

16~5000 OK Cancel

5) Program example using [I/O Parameter]



Chapter 9 Troubleshooting

Details and diagnosis of errors which occur while this module is operating will be described.

9.1 Error Codes

Errors which occur when RUN LED of this module blinks are as described in Table 9.1.
These error codes are stored in the internal memory of the XGF-AD4S module. (Address 37)

[Table 9. 1] List of error codes

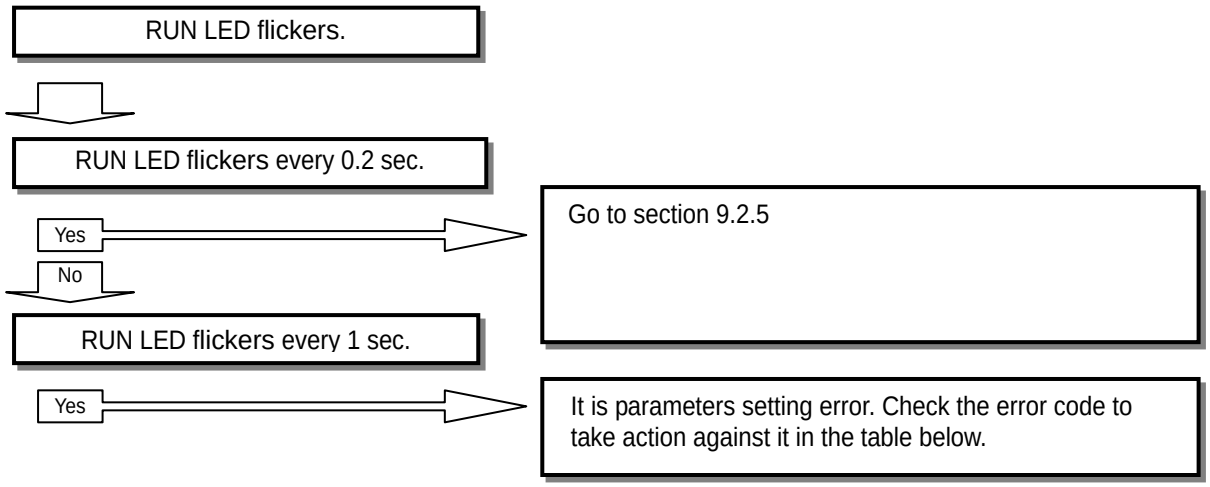
Error code (Dec.)	Description	RUN LED status
0	Normal operation	RUN LED ON
10	Module error (ASIC reset error)	Flickers every 0.2 sec.
11	Module error (ASIC RAM or Register error)	
20#	Time average set value error	Flickers every 1 sec.
30#	Count average set value error	
40#	Moving average set value error	
50#	Weighted average set value error	
60#	Change rate alarm detection period set value error	

Remark

(1) # of the error code stands for the channel number with error found.
(2) If 2 or more errors occur, the module will not save other error codes than the first error code found.
(3) Use the flag to request error clear to delete the error code from the scan program. (Refer to 5.2.5)

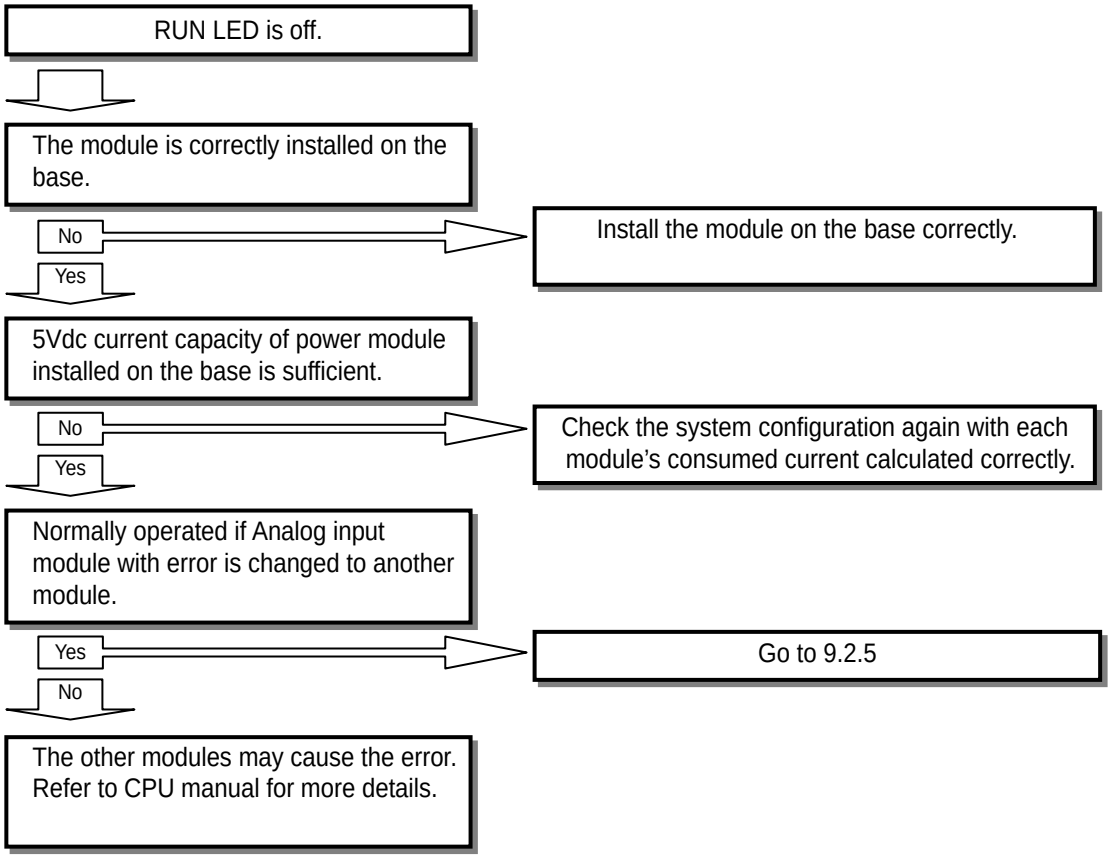
9.2 Troubleshooting

9.2.1 RUN LED flickers

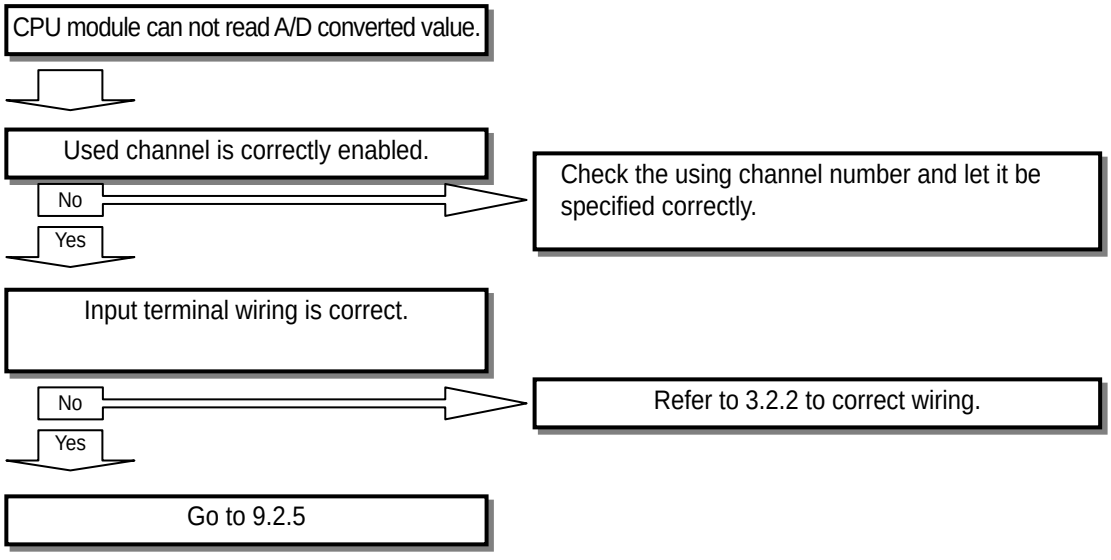


Error code (Decimal)	Contents	Measures
20#	Out of the range of the time average set value	Set within the range of 16 ~ 5000
30#	Out of the range of the count average set value	Set within the range of 2 ~ 500
40#	Out of the range of the moving average set value	Set within the range of 2 ~ 100
50#	Out of the range of the weighted average set value	Set within the range of 1 ~ 99
60#	Out of the range of the change rate alarm period set value	Set within the range of 10 ~ 5000

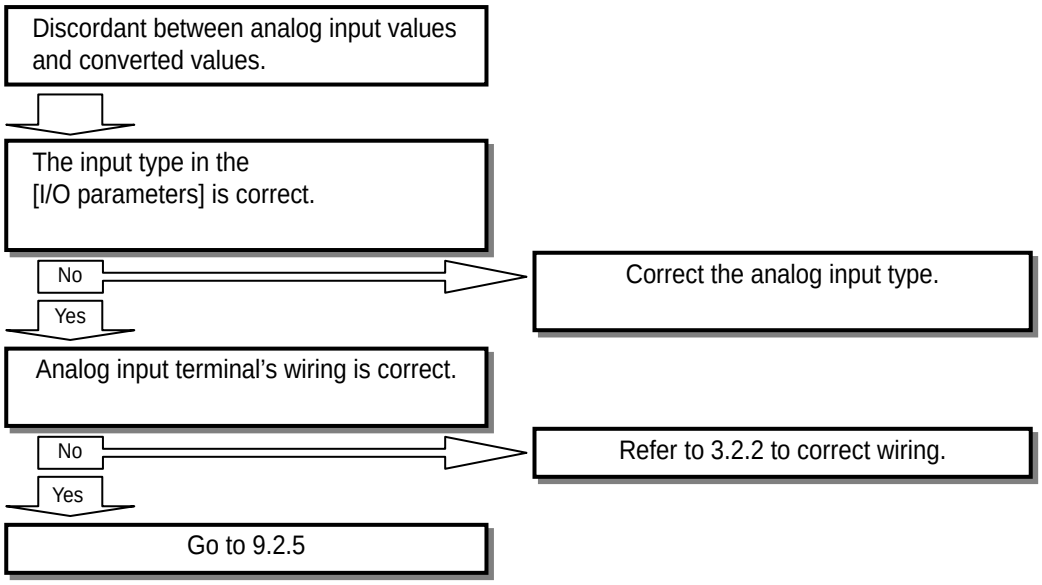
9.2.2 RUN LED is off



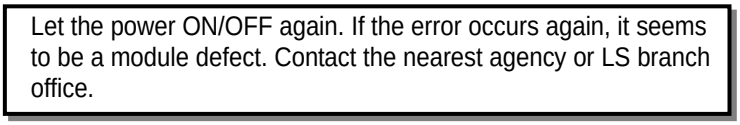
9.2.3 CPU module cannot read A/D converted value



9.2.4 Discordant between analog input value & digital output value



9.2.5 H/W error of Analog Input Module



9.2.6 Checking operation status of the module through XG5000 system monitor

Module type, module information, O/S version and module status of the module can be checked through the XG5000 system monitoring function.

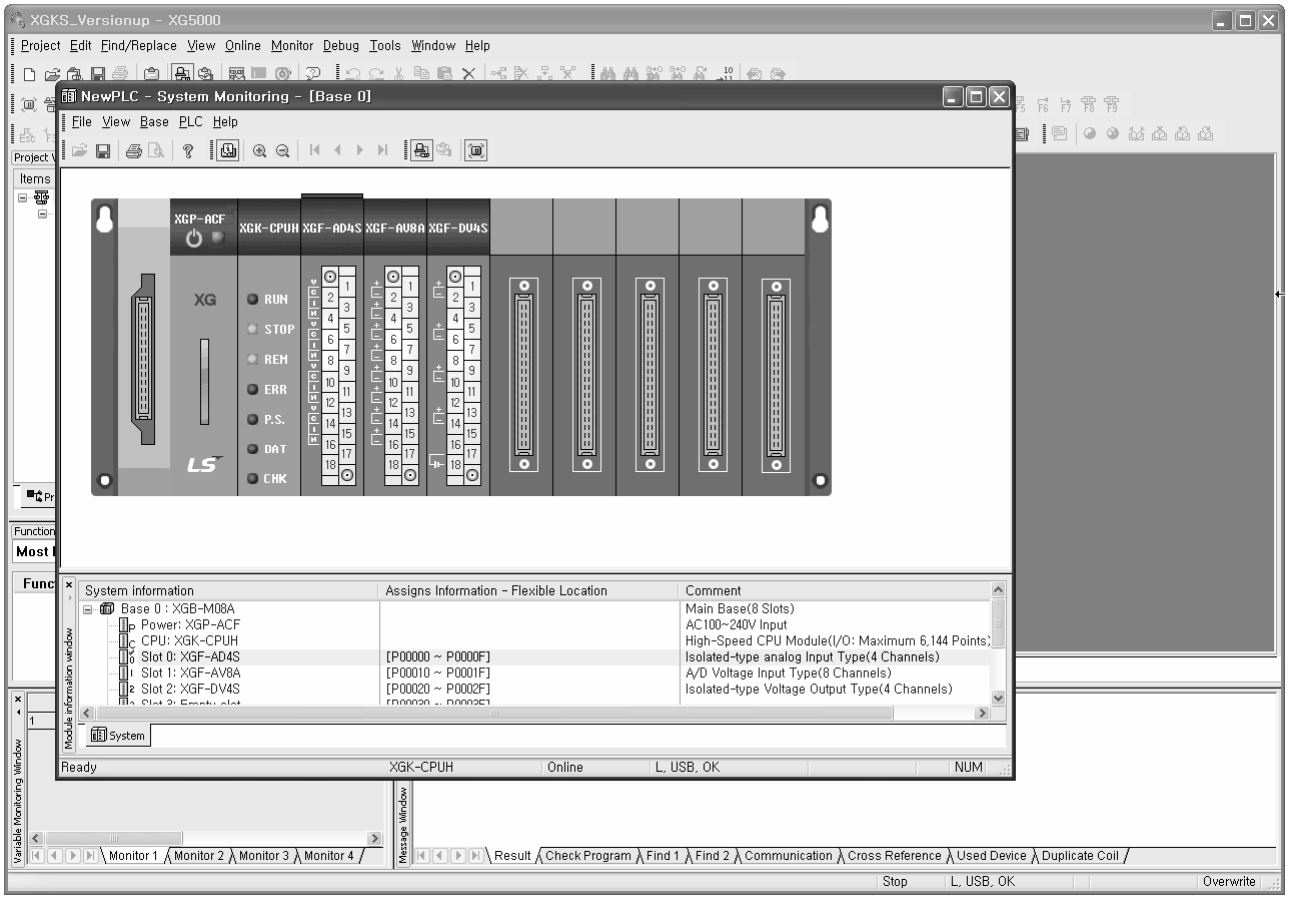
1) Execution sequence

Two ways are available for the execution.

(1) [Monitor] -> [System Monitoring] -> And on the system screen, click the right mouse button to display [Module Information].
(2) [Monitor] -> [System Monitoring] -> And Double-click the module on the system screen.

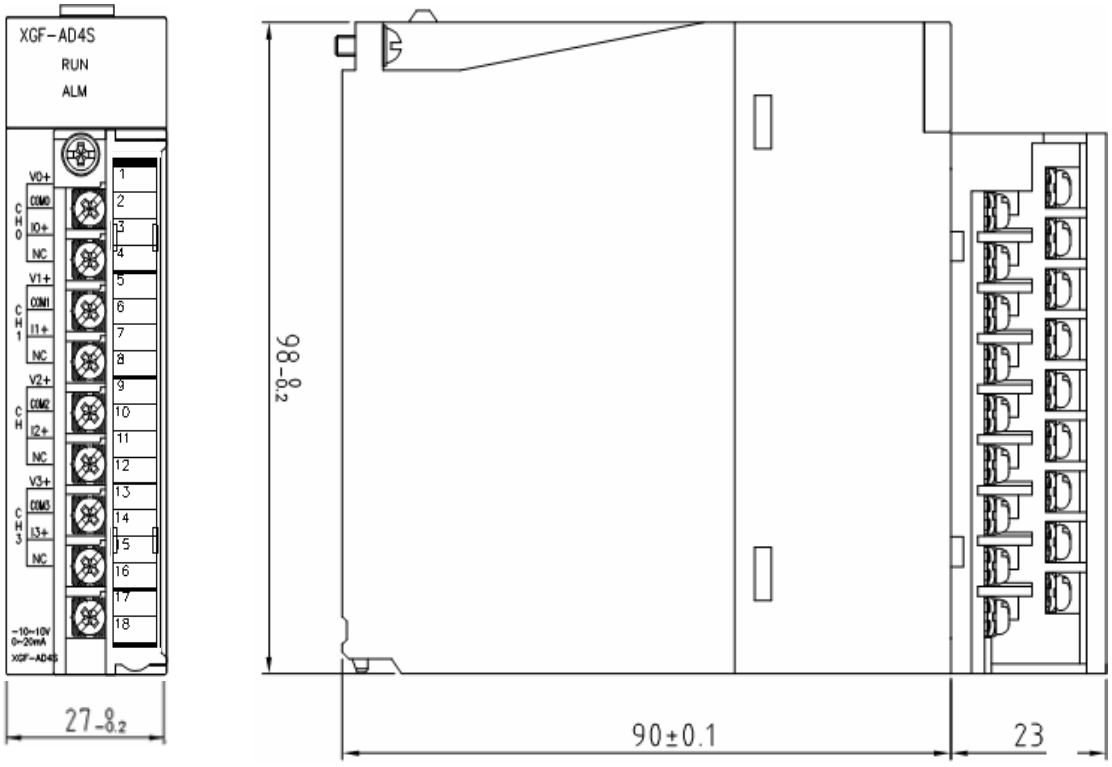
2) Module information

(1) Module info: shows type of the module.
(2) O/S version: shows the OS version of the module.
(3) O/S date: shows the preparation date of the O/S.
(4) Module status: shows the present error code. (Refer to 7.1 for detailed error codes)


XGKS_Versionup - XG5000
Project Edit Find/Replace View Online Monitor Debug Tools Window Help
NewPLC - System Monitoring - [Base 0]
File View Base PLC Help
XGP-ACF
XGK-CPUH
XGF-AD4S
XGF-AV8A
XGF-DV4S
XG
RUN
STOP
REM
ERR
P.S.
DAT
CHK
System Information
Assigns Information - Flexible Location
Comment
Base 0 : XGB-M08A
Main Base(8 Slots)
Power: XGP-ACF
AC100~240V Input
CPU: XGK-CPUH
High-Speed CPU Module(I/O: Maximum 6,144 Points)
Slot 0: XGF-AD4S
[P00000 ~ P0000F]
Isolated-type analog Input Type(4 Channels)
Slot 1: XGF-AV8A
[P00010 ~ P0001F]
A/D Voltage Input Type(8 Channels)
Slot 2: XGF-DV4S
[P00020 ~ P0002F]
Isolated-type Voltage Output Type(4 Channels)
Module information window
System
Ready
XGK-CPUH
Online
L, USB, OK
NUM
Variable Monitoring Window
Monitor 1
Monitor 2
Monitor 3
Monitor 4
Message Window
Result
Check Program
Find 1
Find 2
Communication
Cross Reference
Used Device
Duplicate Coil
Stop
L, USB, OK
Overwrite

Appendix 1 Dimension

XGF-AD4S



Warranty

1. Warranty Period

The product you purchased will be guaranteed for 18 months from the date of manufacturing.

2. Scope of Warranty

Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

(1) Any trouble attributable to unreasonable condition, environment or handling otherwise specified in the manual,
(2) Any trouble attributable to others' products,
(3) If the product is modified or repaired in any other place not designated by the company,
(4) Due to unintended purposes
(5) Owing to the reasons unexpected at the level of the contemporary science and technology when delivered.
(6) Not attributable to the company; for instance, natural disasters or fire

3. Since the above warranty is limited to PLC unit only, make sure to use the product considering the safety for system configuration or applications.

Environmental Policy

LS Industrial Systems Co.,Ltd supports and observes the environmental policy as below.

Environmental Management

LS Industrial Systems considers the environmental preservation as the preferential management subject and every staff of LS Industrial Systems use the reasonable endeavors for the pleasurably environmental preservation of the earth.

About Disposal

LS Industrial Systems' PLC unit is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin(cover) from the product as they are reusable.

LS values every single customer.

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Always at your service, standing for our customers.

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