User's Manual

LG Programmable Logic Controller

GLOFA G3F – AD3A
G4F – AD3A

LG Industrial Systems

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SAFETY PRECAUTIONS

Be sure to read carefully the safety precautions given in data sheet and user's manual before operating the module and follow them.

The precautions explained here only apply to the G3F-AD3A and G4F-AD3A.

For safety precautions on the PLC system, see the GLOFA GM3/4 User's Manuals.

A precaution is given with a hazard alert triangular symbol to call your attention, and precautions are represented as follows according to the degree of hazard.

| ⚠ **WARNING** | ⇒ | If not provided with proper prevention, it can cause death or fatal injury or considerable loss of property. |
| ⚠ **CAUTION** | ⇒ | If not properly observed, it can cause a hazard situation to result in severe or slight injury or a loss of property. |

However, a precaution followed with ⚠ **CAUTION** can also result in serious conditions.

Both of two symbols indicate that an important content is mentioned, therefore, be sure to observe it.

Keep this manual handy for your quick reference in necessary.

Design Precautions

⚠ **CAUTION**

▶ Do not run I/O signal lines near to high voltage line or power line. Separate them as 100 mm or more as possible. Otherwise, noise can cause module malfunction.

Installation Precautions

⚠ **CAUTION**

▶ Operate the PLC in the environment conditions given in the general specifications.
▶ If operated in other environment not specified in the general specifications, it can cause an electric shock, a fire, malfunction or damage or degradation of the module
▶ Make sure the module fixing projections is inserted into the module fixing hole and fixed.
▶ Improper installation of the module can cause malfunction, disorder or falling.

Wiring Precautions

⚠ **CAUTION**

▶ When grounding a FG terminal, be sure to provide class 3 grounding which is dedicated to the PLC.
▶ Before the PLC wiring, be sure to check the rated voltage and terminal arrangement for the module and observe them correctly.
  If a different power, not of the rated voltage, is applied or wrong wiring is provided, it can cause a fire or disorder of the nodule.
▶ Drive the terminal screws firmly to the defined torque.
  If loosely driven, it can cause short circuit, a fire or malfunction.
▶ Be careful that any foreign matter like wire scraps should not enter into the module.
  It can cause a fire, disorder or malfunction.

Test Run and Maintenance Precautions

⚠ **WARNING**

▶ Do not contact the terminals while the power is applied.
  It can cause malfunction.
▶ When cleaning or driving a terminal screw, perform them after the power has been turned off
▶ Do not perform works while the power is applied, which can cause disorder or malfunction.

⚠ **CAUTION**

▶ Do not separate the module from the printed circuit board(PCB), or do not remodel the module.
  They can cause disorder, malfunction, damage of the module or a fire.
  When mounting or dismounting the module, perform them after the power has been turned off.
▶ Do not perform works while the power is applied, which can cause disorder or malfunction.

Waste Disposal Precautions

⚠ **CAUTION**

▶ When disposing the module, do it as an industrial waste.

Chapter 1.   INTRODUCTION

The G4F-AD3A and the G3F-AD3A are analog/digital conversion modules for use with the GLOFA PLC GM 1/2/3/4 series CPU module. The G4F-AD3A is used on GM4 series module, and the G3F-AD3A is used on the GM1/2/3 series module. (Hereafter the G4F-AD3A and G3F-AD3A are called the A/D conversion module) The A/D conversion module is to convert an analog input signal (voltage or current) from external sensors into a 12-bit signed BIN (Binary) digital value.

1.1   Features

1) 8-Channel analog to digital conversion is possible with a single module.
    The G3F-AD3A or G4F-AD3A has 8-Channels of A/D conversion each other, with each channel selectable for voltage or current input.

2) The number of the A/D module used on a base unit is unlimited.

1.2   Glossary
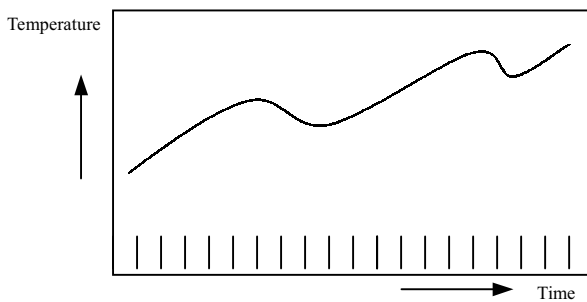
[Fig 1.1] Analog Value
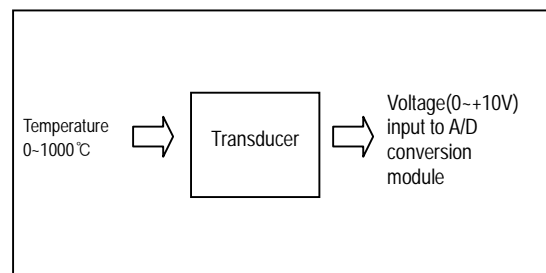
[Fig 1.2] Transducer

1.2.1   A-Analog Value
Analog value is a sequentially changing value such as voltage, current, temperature, speed, pressure, flux, etc. Temperature, for example, is sequentially changing according to the time. Because this temperature is not input to the PLC, the analog value of DC voltage (0 to +10 V) or current (4 to 20 mA) in accordance with the temperature should be inputted to the PLC through transducer.

1.2.2   D-Digital Value
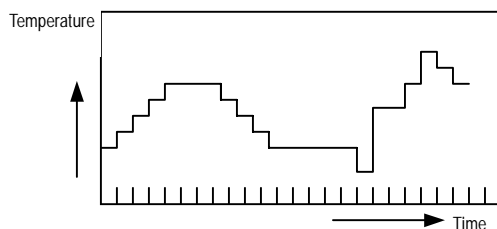
[Fig 1.3] Digital Value

Digital value is non-sequentially changing value written as the number like 0, 1, 2, 3. The signal of on or off is written as digital value of 0 or 1.
There are BCD value and binary value in the range of digital value.
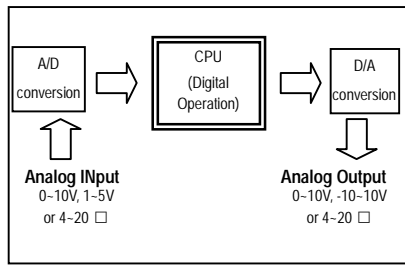
[Fig 1.4] PLC Processing

Analog value can not be written directly to the CPU. For analog input to the CPU operation, analog data converted to digital value has to be inputted to the CPU and the digital value of the CPU should be converted to analog value for analog output.

1.2.3   Analog/Digital Conversion Characteristics

1) Voltage input
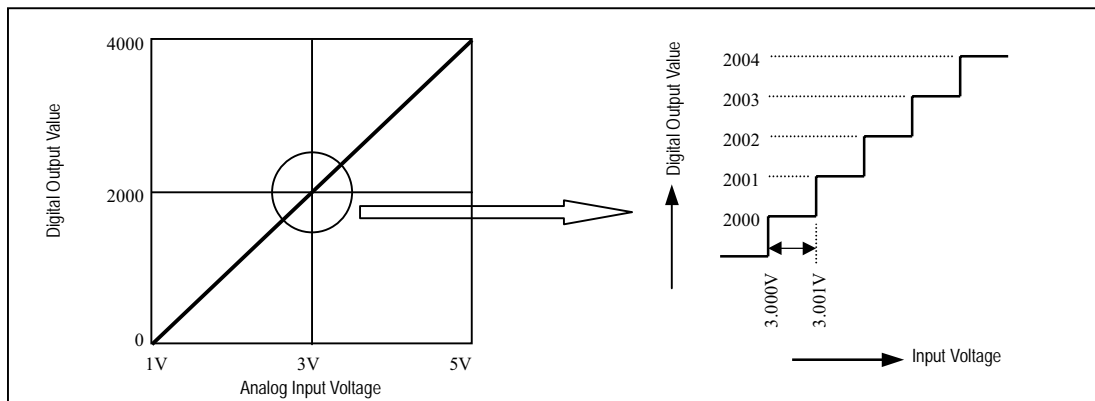
[Fig 1.5] A/D Conversion Characteristics (Voltage Input)

Analog/digital conversion module allows external analog input to be converted to digital value and to be processed in the CPU. On voltage input, input of 1V leads to digital value of 0 and 5V to 4000 as digital value. Input of 1mV is equal to digital value of 1. Therefore, input less than 1mV shouldn't be converted.

2) Current input
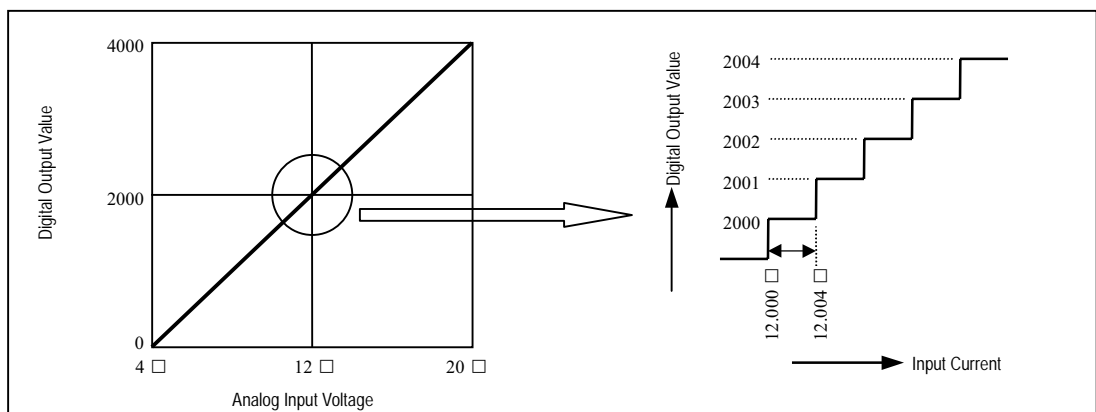
[Fig 1.6]   A/D Conversion Characteristics (Current input)

On current input, input of 4mA leads to digital value of 0, 12mA to 2000 and 20mA to 4000. Input of $4\mu A$ is equal to digital value of 1. Therefore, input less than $4\mu A$ shouldn't be converted.

Chapter 2 .   SPECIFICATIONS

2.1   General Specifications

Table 2.1 shows the general specifications of GLOFA GM series.

Item	Specifications					Standard
Operating ambient temperature	0 ~ 55℃					
Storage ambient temperature	-25 ~ 70℃					
Operating ambient humidity	5 ~ 95%RH, non-condensing					
Storage ambient Humidity	5 ~ 95%RH, non-condensing					
Vibration	**In case of occasional vibration**			Sweep count		IEC 1131-2
	Frequency	Acceleration	Amplitude	10 times in each direction for X, Y, Z		
	10≤f∠57 Hz	-	0.075 mm			
	57≤f≤150 Hz	9.8㎧² (1G)	-			
	In case of continuos vibration					
	Frequency	Acceleration	Amplitude			
	10≤f∠57 Hz	-	0.035 mm			
	57≤f≤150 Hz	4.9㎧²(0.5G)	-			
Shocks	*Maximum shock acceleration: 147㎧² {15G} *Duration time :11 ms *Pulse wave: half sine wave pulse(3 times in each of X, Y and Z directions)					IEC 1131-2
Noise immunity	Square wave impulse noise	±1,500 V				LGIS Standard
	Electrostatic discharge	Voltage :4kV(contact discharge)				IEC 1131-2 IEC 801-2
	Radiated electromagnetic field	27 ~ 500 MHz, 10 V/m				IEC 1131-2 IEC 801-3
	Fast transient & burst noise	**Modules**	All power modules	Digital I/Os (Ue≥ 24 V)	Digital I/Os (Ue < 24 V) Analog I/Os communication I/Os	IEC 1131-2 IEC 801-4
		Voltage	2 kV	1 kV	0.25 kV	
Operating atmosphere	Free from corrosive gases and excessive dust					
Altitude for use	Up to 2,000m					
Pollution degree	2 or lower					
Cooling method	Self-cooling					

[Table 2.1] General specifications

REMARK

1) IEC(International Electrotechnical Commission)

: The international civilian organization which produces standards for electrical and electronics industry.

2) Pollution degree

: It indicates a standard of operating ambient pollution level.

The pollution degree 2 means the condition in which normally, only non-conductive pollution occurs.

Occasionally, however, a temporary conductivity caused by condensation shall be expected.

2.2   Performance Specifications

Table 2-2 shows performance specifications of A/D conversion module.

Items		Specifications	
		G3F-AD3A	G4F-AD3A
Analog input	Voltage	1 ~ 5 VDC (input resistance 600kΩ) 0 ~ 10 VDC (input resistance 600kΩ)	
	Current	DC4 ~ 20 mA (input resistance 250Ω)	
	Voltage/Current selection	- Adjust input selection switch for each channel on side of module. (ON : Current, OFF : Voltage) - Selection of voltage range by program	
Digital output		- 16 bit binary value	
Maximum resolution	1 ~ 5VDC	1 mV (1/4000)	
	0 ~ 10VDC	2.5 mV (1/4000)	
	DC 4 ~20mA	4μA (1/4000)	
Overall Accuracy		±0.5% (accuracy to full scale)	
Max. conversion speed		5.0 ms/channel	
Max. absolute input		Voltage : 15V, Current : 25mA	
Number of analog input point		8 channels/module	
Isolation		Between input terminals and PLC: Photo coupler isolation (Between channels : Non-isolated)	
Terminals connected		20-point terminal block	
Internal current consumption		0.5 A	0.5 A
Weight		310	280

[Table 2.2] Performance Specifications

> **⚠ CAUTION**
>
> The manufacturer set value of A/D conversion module has been current input mode.

2.3   Names of Parts and Functions

The names of parts and functions of the A/D conversion module are shown as below.

2.3.1   G3F-AD3A
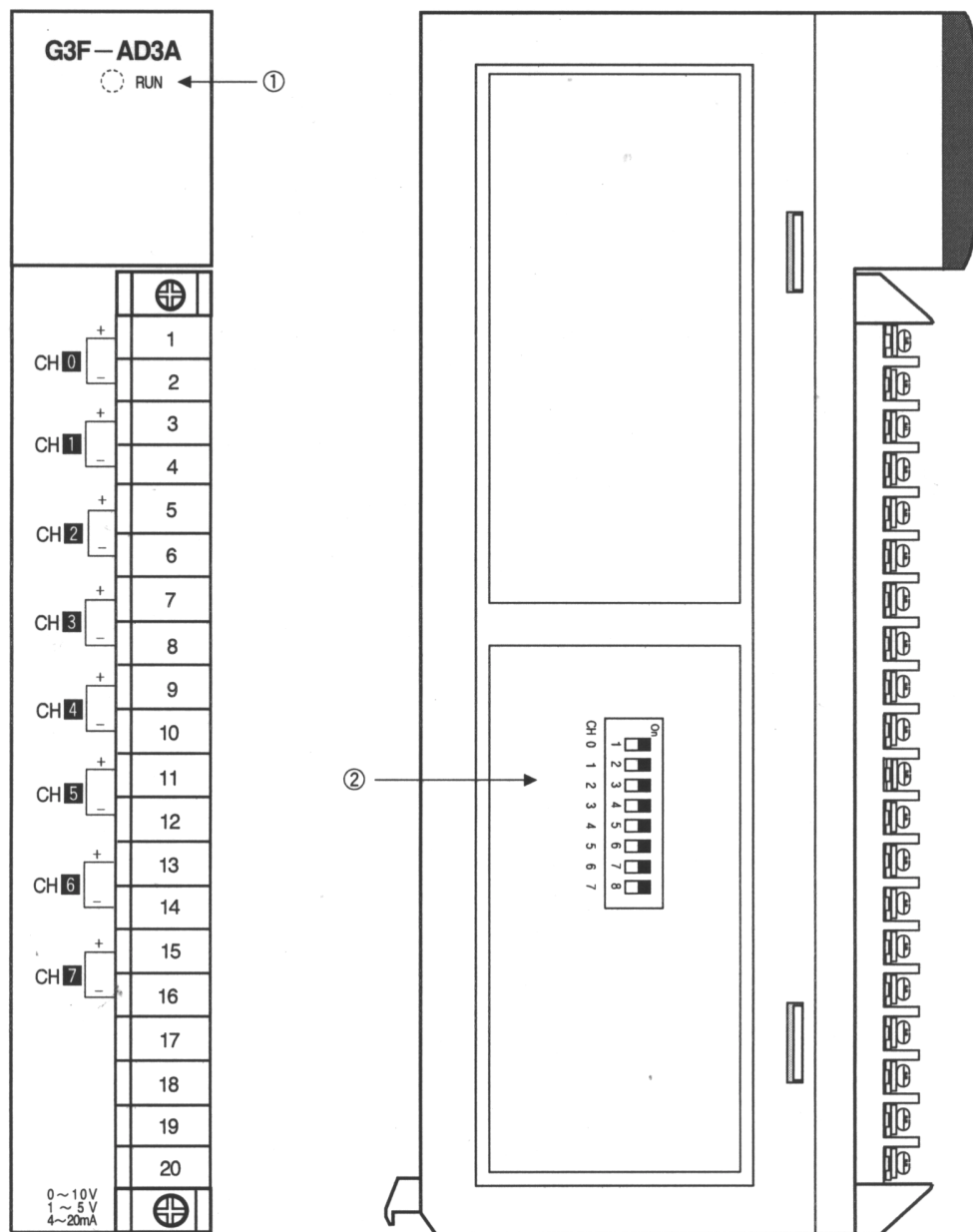
2.3.2   G4F-AD3A

No	Description	
①	RUN LED	
	Indicates the operating status of the G3F-AD3A and G4F-AD3A.	
②	Selection switch of voltage/current	
	1)The switch status at voltage selection	
	The switch locates off status.	
	2)The switch statues at current selection	
	The switch locates on status	

2.4　I/O Conversion Characteristics

Input / Output (hereafter I/O) conversion characteristics are expressed with the angle of the line between analog input(voltage and current) and matched digital value.

The voltage or current input for a channel is selected by analog input selection switch and the value of Offset / Gain can not be changed because it is fixed.

Practical analog input range

Digital Output Value		4047 4000 3000 2000 1000 0 -48			
Analog Input	DC 0 ~ 10V	-0.12V 0V	5V	10V 10.12V	
	DC 1 ~ 5V	0.952V 1V	3V	5V 5.048V	
	DC 4 ~ 20 □	3.808 □ 4 □	12 □	20 □ 20.192 □	
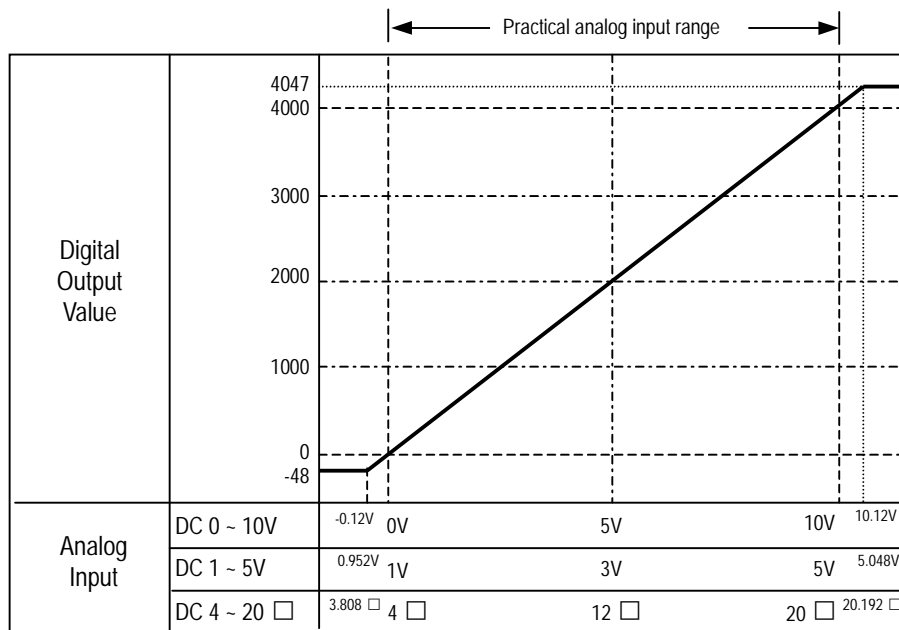
[Fig 2.1]　I/O Conversion Characteristics

REMARK
　1. The analog output value of over 4047 or –48 is fixed as 4047 or –48.
　2. Keep the input voltage and current not to exceed +15V and 25mA.

2.4.1　Voltage Input Characteristics

For voltage input, the corresponding input selection switch of each channel should be set to "off".

Input selection switch
- Off : Voltage
On [switch diagram 1 2 3 4 5 6 7 8] (This switch is located on the side of module)
CH0　1　2　3　4　5　6　7 ◄———— Number of channel
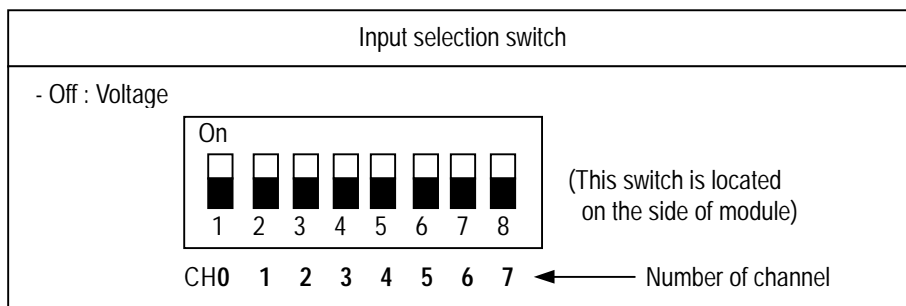
– The voltage input range is selected in program.

Input selection switch has to be located at off.

1) Voltage input range : DC 0 ~10V

Digital output value for input voltage is shown as follows.

	Analog input voltage (V)						
	-0.12	0	2.5	5	7.5	10	10.12
Digital output value	-48	0	1000	2000	3000	4000	4047

2) Voltage input range : DC 1 ~5V

Digital output value for input voltage is shown as follows.

	Analog input voltage (V)						
	0.952	1	2	3	4	5	5.048
Digital output value	-48	0	1000	2000	3000	4000	4047

2.4.2 Current Input Characteristics

For current input, the corresponding input selection switch of each channel should be set to "on".

Input selection switch
- On : Current
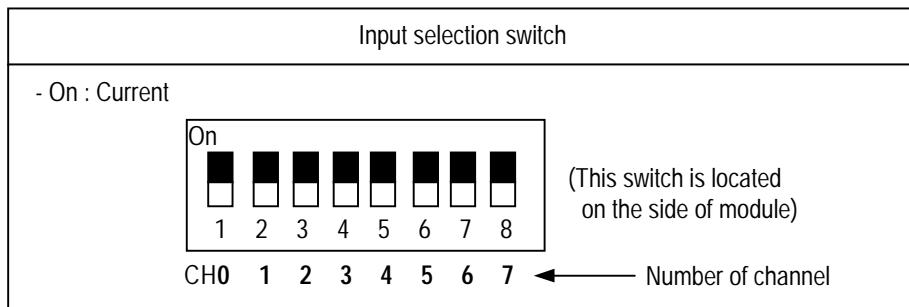
- Digital output value for input current is shown as follows.

	Analog input current(□)						
	3.808	4	8	12	16	20	20.192
Digital output value	-48	0	1000	2000	3000	4000	4047

2.4.3 Simultaneous Voltage and Current Input Characteristics

For simultaneous voltage and current input, the input conversion switch of each channel is set to corresponding voltage and current range.

Ex) Voltage input range: 0 to 3　　　Current input range: 4 to 7

```
Input selection switch

- On : Current
- Off : Voltage
                  On
                  ┌─┬─┬─┬─┬─┬─┬─┬─┐          (제품의 좌측면에 위치)
                  │ │ │ │ │█│█│█│█│
                  │█│█│█│█│ │ │ │ │
                  └─┴─┴─┴─┴─┴─┴─┴─┘
                   1 2 3 4 5 6 7 8

                  CH0 1 2 3 4 5 6 7 ◄──── 채널 번호
```
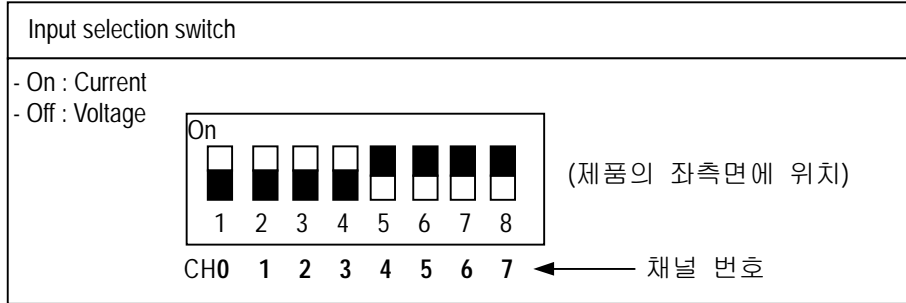
- Digital output value for analog input is shown as follows..

		Analog input						
Voltage (V)	0~10V	-0.12	0	2.5	5	7.5	10	10.12
	1~5V	0.952	1	2	3	4	5	5.048
Current (mA)	4~20 mA	3.808	4	8	12	16	20	20.192
Digital output value		-48	0	1000	2000	3000	4000	4047

2.4.4 Analog input and Digital output characteristics

No	Input range	Digital output value	Resolution	Analog input value									
①	DC 0~10V	0 ~ 4000	2.5 mV	5.000 ~ 5.0025			5.0025 ~ 5.005			5.005 ~ 5.0075			5.0075 ~ 5.010
②	DC 1~5V		1mV	3.000 ~ 3.001	3.001 ~ 3.002	3.002 ~ 3.003	3.003 ~ 3.004	3.004 ~ 3.005	3.005 ~ 3.006	3.006 ~ 3.007	3.007 ~ 3.008	3.008 ~ 3.009	3.009 ~ 3.010
③	DC 4~20 □		4 □	12.000 ~ 12.004	12.004 ~ 12.008	12.008 ~ 12.012	12.012 ~ 12.016	12.016 ~ 12.020	12.020 ~ 12.024	12.024 ~ 12.028	12.028 ~ 12.032	12.032 ~ 12.036	12.036 ~ 12.040
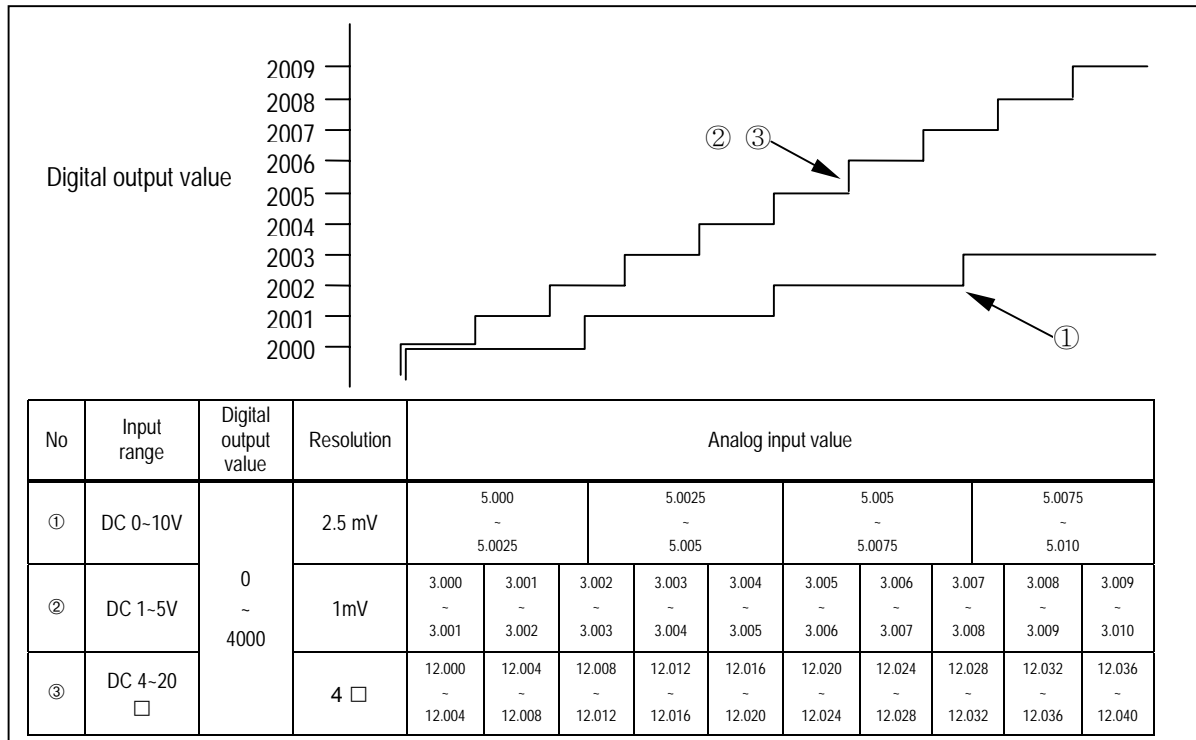
Analog input and Digital output

2.5 Average Processing

G3F-AD3A and G4F-AD3A has a average processing function of the number of times to stabilize the system control from the abnormal analog input or external noise.

1) Setting range : 2 ~ 255

2) The processing time to write averaged digital value to buffer memory is changed according to the number of channel.

Processing time　=　Setting times　X　Number of enabled channel　X　Conversion speed

Example) using channels : 4, setting times : 50

Processing time　=　50　X　4　X　5　=　1000□

Chapter 3.   INSTALLATION AND WIRING

3.1   Installation

3.1.1   Installation Ambience

This module has high reliability regardless of its installation ambience. But be sure to check the following for system in higher reliability and stability.

1)   Ambience Requirements

Avoid installing this module in locations, which are subjected or exposed to:
- Water leakage and dust a large amount of dust, powder and other conductive power, oil mist, salt, of organic solvent exists.
- Mechanical vibrations of impacts are transmitted directly to the module body.
- Direct sunlight.
- Dew condensation due to sudden temperature change.
- High or low temperatures (outside the range of 0-55 ℃)

2)   Installing and Wiring
- During wiring or other work, do not allow any wire scraps to enter into it.
- Install it on locations that are convenient for operation.
- Make sure that it is not located near high voltage equipment on the same panel.
- Make sure that the distance from the walls of duct and external equipment be 50 mm or more.
- Be sure to be grounded to locations that have good noise immunity.

3.1.2   Handling Precautions

From unpacking to installation, be sure to check the following:
1) Do not drop it off, and make sure that strong impacts should not be applied.
2) Do not dismount printed circuit boards from the case. It can cause malfunctions.
3) During wiring, be sure to check any foreign matter like wire scraps should not enter into the upper side of the PLC, and in the event that foreign matter entered into it, always eliminate it.
4) Be sure to disconnect electrical power before mounting or dismounting the module.

3.2   Wiring

3.2.1   Wiring Precautions

1) Separate AC and external input signal of A/D conversion module wiring not to be affected by surge or induced noise in the AC.

2) External wiring has to be at least AWG22(0.3㎜²) and be selected in consideration of operating ambience and/or allowable current.

3) Separate wiring from devices and/or substances generating intense heat, and oil not to make short-circuit which leads to damage and/or mis-operation.

4) Identify the polarity of terminal block before external power supply is made connected.

5) Separate external wiring sufficiently from high voltage and power supply cable not to cause induced failure and/or malfunction.

3.2.2   Wiring Examples

1)   Voltage Input
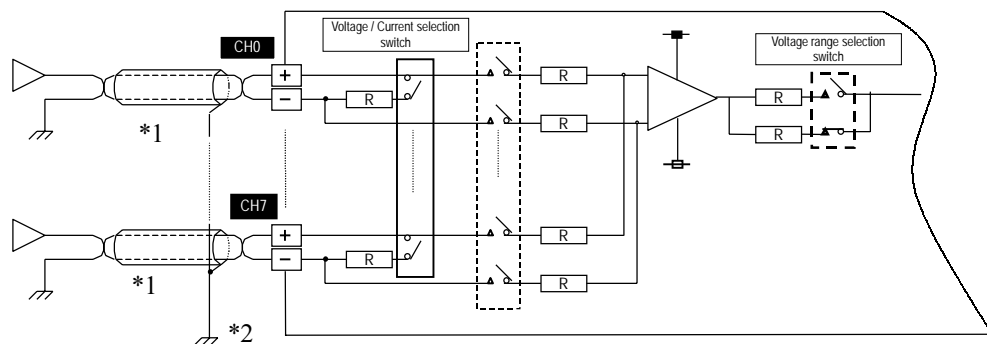
2)   Current Input
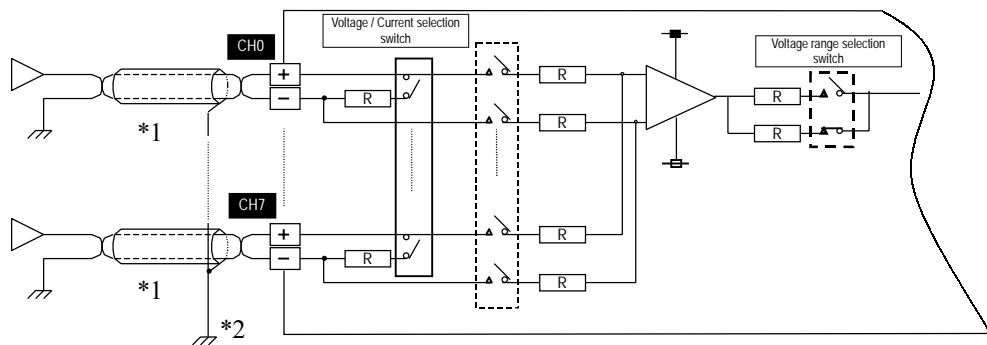
*1 For the cable, use a two-core twisted shielded wire.

*2 If noise is expected, the This has to be grounded.

Chapter 4.   DIMENSIONS

4.1   G3F-AD3A

(Unit : mm)

4 - 2
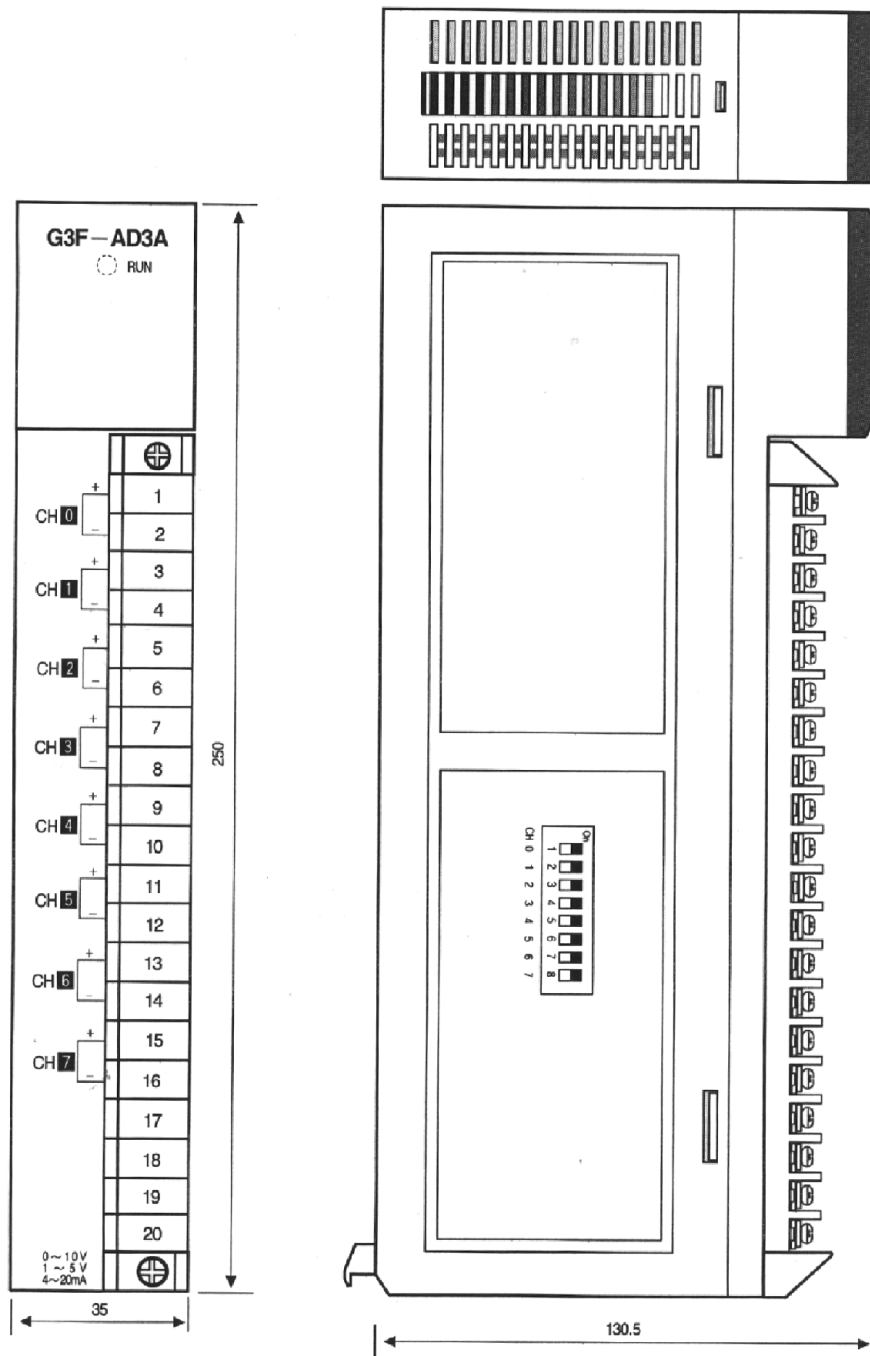
4.2   G4F-AD3A

(Unit : mm)

CHAPTER   5.   FUNCTION BLOCK

This shows function block for A/D conversion module on the GMWIN.

A kind of function block is as follows.

No	G3F-AD3A		G4F-AD3A		Function
	Local	Remote	Local	Remote	
1	AD3INI	ADR3INI	AD3INI	ADR3INI	Initializing module
2	AD3ARD	ADR3RD	AD3ARD	ADR3RD	Reading A/D converted value(array Type)
3	AD3RD	-	AD3RD	-	Reading A/D converted value(Single Type)

The function block type and functions of input/output parameters of G3F-AD3A and G4F-AD3A are same.

5.1 Registration of the Function Block for A/D Conversion Module on the GMWIN

Function Block is inserted on the execution of the GMWIN according to following procedure.

Function block can be inserted only in the open condition of the Project.
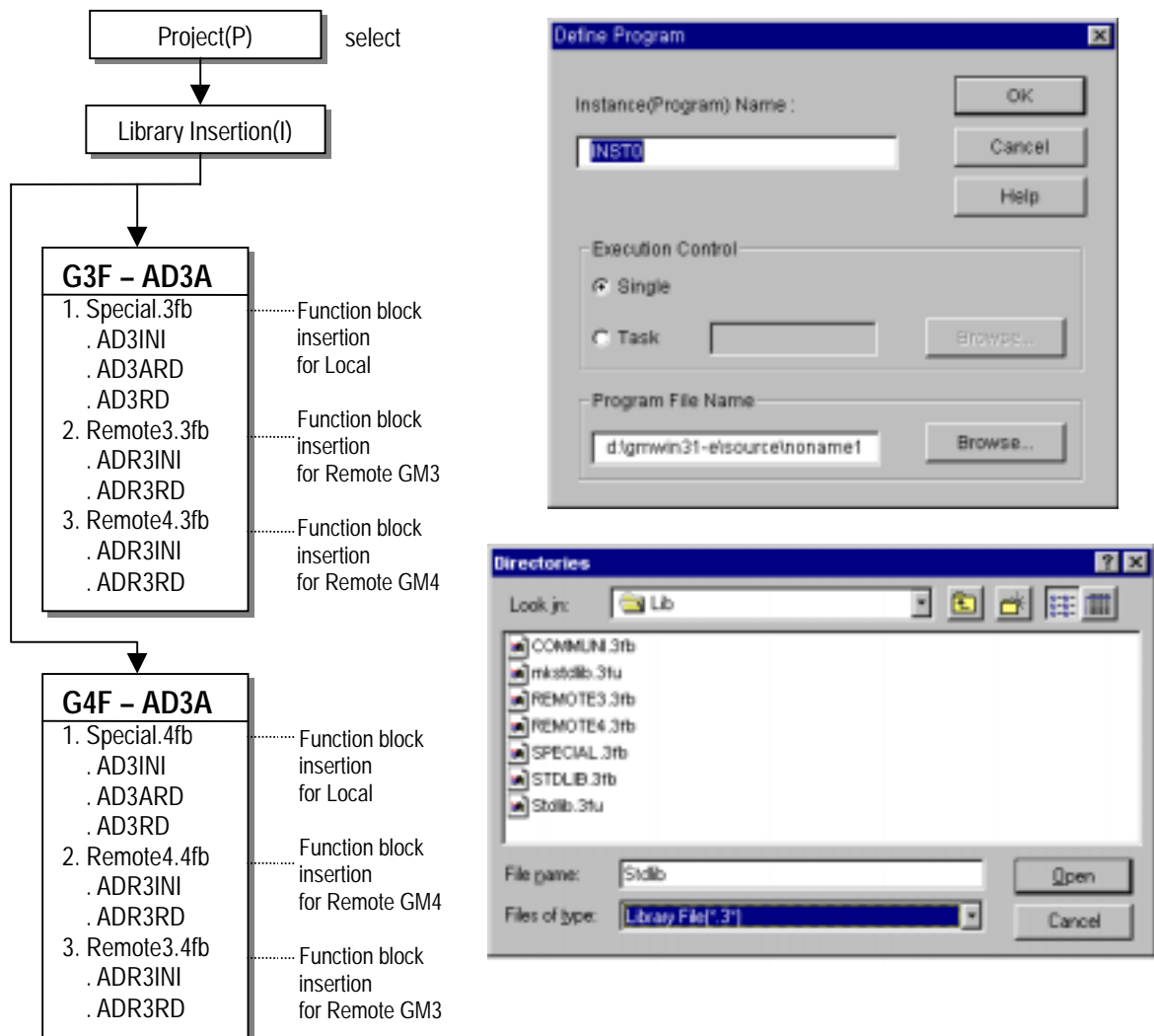
5.2   Function Block for Local

5.2.1   Module Initialization : (AD3INI)

Module Initialization function block is used in a program with setting of A/D conversion module located base number, slot number of located module on base, specifying a channel enable, analog input data type and the information of average processing.

Function block	I/O	Variable	Data type	Descriptions
AD3INI REQ DONE BASE STAT SLOT ACT CH TYPE AVG_ EN AVG_ NUM	Input	REQ	BOOL	Function Block Execution Request Area - The execution of function block initialization is requested in this area. - If the status of condition connected with this area is changed from low(0) to high(1), function block initialization for the module is executed.
		BASE	USINT	Base Location Number Area - The base No. on which A/D conversion module is mounted is written on this area. - Setting range : 0 to 3
		SLOT	USINT	Slot Location Number Area - The slot No. on which A/D conversion module is mounted is written on this area. - Setting range: 0 to 7
		CH	BOOL[8]	Available Channel Specification Area - Enabled channels are specified to 1 and disabled channels are specified to 0.
		TYPE	BOOL[8]	Analog Input Data Type Specification Area - Output digital data type for each channel is specified in this area. - 0 is for the range of 1 ~ 5VDC and DC4 ~ 20mA. - 1 is for the range of 0 ~ 10VDC
		AVG_ EN	BOOL[8]	Enable / Disable of Average processing - 0 is for the sampling processing. - 1 is for the average processing of the number of times.
		AVG_ NUM	USINT[8]	Set a constant of the average processing of the number of times. - Setting range : 2 ~ 255
	Output	DONE	BOOL	Function Block Execution Complete Area - When function block initialization is executed with no error, 1 is written and until next execution, 1 is continuing. When error occurs, 0 is written and operation come to stop.
		STAT	USINT	Error Code Display Area - When error occurs during function block initialization, the error code number is written.
		ACT	BOOL[8]	Channel Operation Display Area - After execution the function block of initialization with no error, if the setting condition of specified channel is normal then output '1', or if abnormal, output 0'. - No specified channel is '0'.-

REMARK

BOOL[8] and USINT[8] of data type means that the number of element is 8, and also this means the whole number of channels and channel number.

5.2.2 Module Reading-Array Type : (AD3ARD)

Array type of function block for reading the module is performed for every channel in block and the specified channels are used to read output variable of data displayed from A/D conversion digital value.

Function block	I/O	Variable	Data type	Descriptions
AD3ARD REQ DONE BASE STAT SLOT ACT CH DATA	Input	REQ	BOOL	Function Block Execution Request Area - The execution of function block reading is requested in this area. - If the status to be connected with this area is satisfied on the program operation and input condition changes from low(0) to high(1), function block initialization for the module is executed.
		BASE	USINT	Base Location Number Area - The base No. on which A/D conversion module is mounted is written on this area. - Setting range : 0 to 3
		SLOT	USINT	Slot Location Number Area - The slot No. on which A/D conversion module is mounted is written on this area. - Setting range: 0 to 7
		CH	BOOL[8]	Available Channel Specification Area - Enabled channels are specified to 1 and disabled channels are specified to 0.
	output	DONE	BOOL	Function Block Execution Complete Area - When function block reading is executed with no error, 1 is written and until next execution, 1 is continuing. When error occurs, 0 is written and operation come to stop
		STAT	USINT	Error Code Display Area - When error occurs during function block reading, the error code number is written.
		ACT	BOOL[8]	Channel Operation Display Area - After execution the function block of initialization with no error, if the setting condition of specified channel is normal then output '1', or if abnormal, output 0'. - No specified channel is '0'.-
		DATA	INT[8]	A/D Conversion Value Output Area Output data range : -48 ~ 4047

REMARK

BOOL[8] and USINT[8] of data type means that the number of element is 8, and also this means the whole number of channels and channel number.

5.2.3   Module Reading - Single Type : (AD3RD)

Single type of function block for reading the module is performed for only one channel and the specified channel is used to read output variable of data displayed from A/D conversion digital value.

Function block	I/O	Variable	Data type	Descriptions
AD3RD REQ DONE BASE STAT SLOT DATA CH	Input	REQ	BOOL	Function Block Execution Request Area - The execution of function block reading is requested in this area. - If the status to be connected with this area is satisfied on the program operation and input condition changes from low(0) to high(1), function block initialization for the module is executed.
		BASE	USINT	Base Module Location Number Area - The base No. on which A/D conversion module is mounted is written on this area. - Setting range : 0 ~ 3
		SLOT	USINT	Slot Location Number Area - The slot No. on which A/D conversion module is mounted is written on this area. - Setting range: 0 to 7
		CH	USINT	Available Channel Specification Area - Enabled channels are specified to 1 and disabled channels are specified to 0.
	output	DONE	BOOL	Function Block Execution Complete Area - When function block reading is executed with no error, 1 is written and until next execution, 1 is continuing. When error occurs, 0 is written and operation come to stop.
		STAT	USINT	Error Code Display Area - When error occurred during function block initialization, the error code number is written.
		DATA	INT	A/D Conversion Value Output Area Output data range : -47 ~ 2048

5.3   Remote Function Block

5.3.1   Module Initialization : (ADR3INI)

Module Initialization function block is a program for the use in setting the location number of the slot on which the communication module of A/D conversion module of the master station is mounted, the address number of communication module which a remote I/O station has, the base location number, and the slot location number, and specifying the an available channel enable, a data type for A/D conversion, and average process data.

Function block	I/O	Variable	Data type	Descriptions
ADR3INI REQ NDR NET_ NO ERR ST_N STAT O BASE ACT SLOT CH TYPE AVG_ EN AVG_ NUM	Input	REQ	BOOL	Function Block Execution Request Area on Rising Edge. - The execution of write function block is requested in this area. - If the status to be connected with this area is satisfied on the program operation and input condition changes from low(0) to high(1), function block initialization for the module is executed.
		NET_NO	USINT	The location number of the slot on which the transmission module of the master station is mounted. -Setting range: 0 to 7
		ST_NO	USINT	Station number of the communication module which a remote I/O station has. - Setting range : 0 to 63
		BASE	USINT	Base Location Number Area - The base No. on which A/D conversion module is mounted is written on this area. - Setting range : 0 to 3
		SLOT	USINT	Slot Location Number Area - The slot No. on which A/D conversion module is mounted is written on this area. - Setting range: 0 to 7
		CH	BOOL[8]	Available Channel Specification Area - Available channels are specified in this area. - Enabled channels are specified to 1 and disabled channels are specified to 0.
		TYPE	BOOL[8]	Output Data Type Specification Area - Output digital data type for each channel is specified in this area. - 0 is for the range of -192 to 16191. - 1 is for the range of -8192 to 8191.
		AVG_EN	BOOL[8]	Average Process Enable Specification Area - 1 is for the average processing. - 0 is for the sampling process.
		AVG_NUM	USINT[8]	Set a constant of the average processing of the number of times. - Setting range : 2 ~ 255
	Output	NDR	BOOL	When function block execution is completed with no error, 1 is written. During the scan which the execution condition has been made, 1 is continuing and at the next scan. 0 is written.
		ERR	BOOL	Error Data Display Area - When error occurs during function block initialization, 1 is written and the operation comes to stop. During the scan which the execution condition has been made, 1 is continuing and at the next scan, 0 is written.
		STAT	USINT	Error Code Display Area - When error occurs during function block initialization, the error code number is written.
		ACT	BOOL[8]	Channel Operation Display Area - The channel specified after executing the function block initialization with no error is right, 1 is written and, on the non-specified channel, 0 is written.

REMARK

BOOL[8] and USINT[8] of data type means that the number of element is 8, and also this means the whole number of channels and channel number.

5.3.2   Module Reading (ADR3RD)

Function block for reading the module is performed for every channel in block and the specified channels are used to read output variable of data displayed from A/D conversion digital value.

Function block	I/O	Variable	Data type	Descriptions
ADR3RD REQ NDR NET_ NO ERR ST_N STAT O BASE DATA SLOT CH	Input	REQ	BOOL	Function Block Execution Request Area - The execution of read function block is requested in this area. - If the status to be connected with this area is satisfied on the program operation and input condition changes from low(0) to high(1), function block reading for the module is executed.
		NET_ NO	USINT	The location number of the slot on which the communication module of the master station is mounted. - Setting range: 0 to 7
		ST_NO	USINT	The station number of the communication module which a remote I/O station has. - Setting range : 0 to 63
		BASE	USINT	Base Module Location Number Area - The base No. on which A/D conversion module is mounted is written on this area. - Setting range : 0 to 3
		SLOT	USINT	Slot Location Number Area - The slot No. on which A/D conversion module is mounted is written on this area. - Setting range: 0 to 7
		CH	BOOL[8]	Available Channel Specification Area - Available channels are specified in this area. - Enabled channels are specified to 1 and disabled channels are specified to 0.
	Output	NDR	BOOL	When function block execution is completed with no error, 1 is written. During the scan which the execution condition has been made, 1 is continuing and at the next scan. 0 is written.
		ERR	BOOL	Error Data Display Area - When error occurs during the execution of function block reading, 1 is written and the operation comes to stop. During the scan which the execution condition has been made, 1 is continuing and at the next scan, 0 is written.
		STAT	USINT	Error Code Display Area - When error occurs during the execution of function block reading, the error code number is written.
		ACT	BOOL[8]	Channel Operation Display Area -The channel specified after executing the function block reading with no error is right, 1 is written and, on the non-specified channel, 0 is written.
		DATA	INT[8]	A/D Conversion Value Output Area

REMARK

BOOL[8] and USINT[8] of data type means that the number of element is 8, and also this means the whole number of channels and channel number.

5.4   Errors on Function Block

This shows errors and resolutions in accordance with them.

STAT No.	Local /Remote	Descriptions	Function block			Resolutions
			Initiali- zation	Read		
				Array type	Single type	
0	Local	Operating with no fault	O	O	O	-
1		The base location number is exceeding the proper setting range	O	O	O	Correct the number in accordance with the proper range (See GM Section1.2)
2		H/W error of the base	O	O	O	Contact the service station
3		The slot location number is exceeding the proper setting range	O	O	O	Set the right number to the slot loading the A/D conversion module
4		The A/D conversion module on the slot is empty	O	O	O	Load the A/D conversion module to the specified slot
5		The module loaded isn't the A/D module	O	O	O	Load the A/D conversion module to the specified slot
6		The channel number is exceeding the proper range	-	-	O	Specify the available channel correctly
7		H/W error of the A/D conversion module	O	O	O	Contact the service station
8		The A/D conversion module's shared memory error	O	O	O	Contact the service station
9		The available channels are not specified	-	O	O	Make a correct specification of the available channel on the initialize function block
17		Average number exceeding the proper range	O	-	-	Correct the value to the proper range (Number: 2 to 255)
128	Remote	H/W error of the communication module for remote	O	O		See the manual for the remote communication module
129		The base location number is exceeding the proper setting range	O	O		Correct the number in accordance with the proper range (See GM Section 1.2)
131		The slot location number is exceeding the proper setting range	O	O		Set the right number to the slot mounting the A/D conversion module
133		The module loaded isn't the A/D module	O	O	-	Mount the A/D conversion module to the specified slot
135		H/W error of the A/D conversion module	O	O		Contact the service station
136		The A/D conversion module's shared memory error	O	O		Contact the service station
137		The available channels are not specified	-	O		Make a correct specification of the available channel on the initializing function block
145		Average number exceeding the proper range	O	-		Correct the value to the proper range (Number: 2 to 255)

Chapter 6.   PROGRAMMING

6.1   Programming for Distinction of A/D Conversion Value

1) System Configuration

GM3-PA1A	GM3-CPUA	G3F-AD3A	G3Q-RY4A

2) Initial Settings

(1) Available channel enable : channel 0, 2, 3
(2) Analog input : current input(DC4 ~ 20 mA)
(3) Average processing setting : channel 2(100 times), channel 3(50 times)

3) Descriptions of the Program

(1) The digital value less than 2,000 of channel 0 turns %Q0.1.0 on.
(2) The digital value more than 3,600 of channel 2 turns %Q0.1.1 on.
(3) The digital value more than 2,000 or same, and less than 3,600 or same of channel 4 turns %Q0.1.2 on.
(4) The digital value of the same as 2,800 of channel 4 turns %Q0.1.3 on.

4) Programming Example

		AD_INI AD3INI				AD_RD AD3RD				

ROW 0 — READY ⊢⊢ — REQ   DONE — ...... — REQ   DONE — START (S)

ROW 0 READY / execution condition — REQ | DONE — (AD_RD) REQ | DONE — START (S) Normal completion of A/D conversion reading

ROW 1 — 0 / Base location number specification — BASE | STAT — INI_STAT / Error code display in the function block initialization — 0 / Base location number specification — BASE | STAT — RD_STAT / Error code display in the processing of the read function block

ROW 2 — 0 / Slot location number specification — SLOT | ACT — INI_ACT / Channel operation display in the function block initialization — 0 / Slot location Number specification — SLOT | ACT — RD_ACT / Channel operation display in the processing of read function block initialization

ROW 3 — AD_CH / Available channel enable specification — CH — AD_CH / Available channel enable specification — CH | DATA — DATA / Data display of A/D conversion value of enabled channel

ROW 4 — DATATYPE / Data type specification — TYPE

ROW 5 — AVG_EN / Average processing enable/disable specification — AVG-EN

ROW 6 — AVG_NUM / Average number value specification — AVG-NUM

ROW 7

ROW 8 — START ⊢⊢ — | LT | EN   OUT

ROW 9 — DATA[0] / A/D conversion value of channel 0 — IN1   OUT — The digital value less than 2000 of channel 0 turns %Q0.1.0 on. — %Q0.1.0 ( )

ROW 10 — 2000 — IN2

ROW 11

ROW 12 — | GT | EN   ENO

ROW 13 — DATA[2] / A/D conversion value of channel 2 — IN1   OUT — The digital value more than 3600 of channel 2 turns %Q0.1.1 on. — %Q0.1.1 ( )

ROW 14 — 3600 — IN2

ROW 15

ROW 16 — | GE | EN   ENO

ROW 17 — 3600 — IN1   OUT — The digital value more than 2000 or same, and less than 3600 or same of channel 4 turns %Q0.1.2 on. — %Q0.1.2 ( )

ROW 18 — DATA[4] / A/D conversion value of channel 3 — IN2

ROW 19 — 2000 — IN3

ROW 20

ROW 21 — | EQ | EN   ENO

ROW 22 — DATA[4] / A/D conversion value of channel 4 — IN1   OUT — The digital value 2800 of channel 4 turns %Q0.1.3 on. — %Q0.1.3 ( )

ROW 23 — 2800 — IN2

ROW 24

5) Specifying initial value of input/output variables on the program.(Specifying channels)

This denotes
4 channels

Select this
and this screen appears

Select this
and this screen appears

To select
previous Ch.

Channel No.

Enabled channel : 1
Disabled channel : 0

To specify channel enable/disable

To select
next Ch.

6) Input/output variables on Programming

Variable Name	Var_Kind	Data Type	(AT Address) (Initial Value)
AD_CH	: VAR	: ARRAY [0..7] OF BOOL	: = { 1,0,1,0,1,0,0,0,0 }
AD_INI	: VAR	: FB instance	
AD_RD	: VAR	: FB instance	
AVG_EN	: VAR	: ARRAY [0..7] OF BOOL	: = { 0,1,0,1,0,0,0,0 }
AVG_NUM	: VAR	: ARRAY [0..7] OF USINT	: = { 0,0,100,50,0,0,0,0 }
DATA	: VAR	: ARRAY [0..7] OF INT	
DATATYPE	: VAR	: ARRAY [0..7] OF BOOL	: = { 0,0,0,0,0,0,0,0 }
INI_ACT	: VAR	: ARRAY [0..7] OF BOOL	
INI_STAT	: VAR	: USINT	
RD_ACT	: VAR	: ARRAY [0..7] OF BOOL	
RD_STAT	: VAR	: USINT	
READY	: VAR	: BOOL	
START	: VAR	: BOOL	

6.2 Programming for Display of A/D Conversion Value and Error Code on BCD Display

1) System Configuration

| GM4-PA2A | GM4-CPUA | G4I-D22A | G4Q-RY2A | G4Q-RY2A | G4F-AD3A |

Channel 0 (4~20mA)

Initialize ──o‾o── %I0.0.0

Display error code with BCD ──o‾o── %I0.0.1

Display A/D conversion data with BCD ──o‾o── %I0.0.2

%Q0.2.0 ~%Q0.2.7 → Digital BCD Display (displaying error)

%Q0.1.0 ~%Q0.1.15 → Digital BCD Display (displaying A/D conversion value)
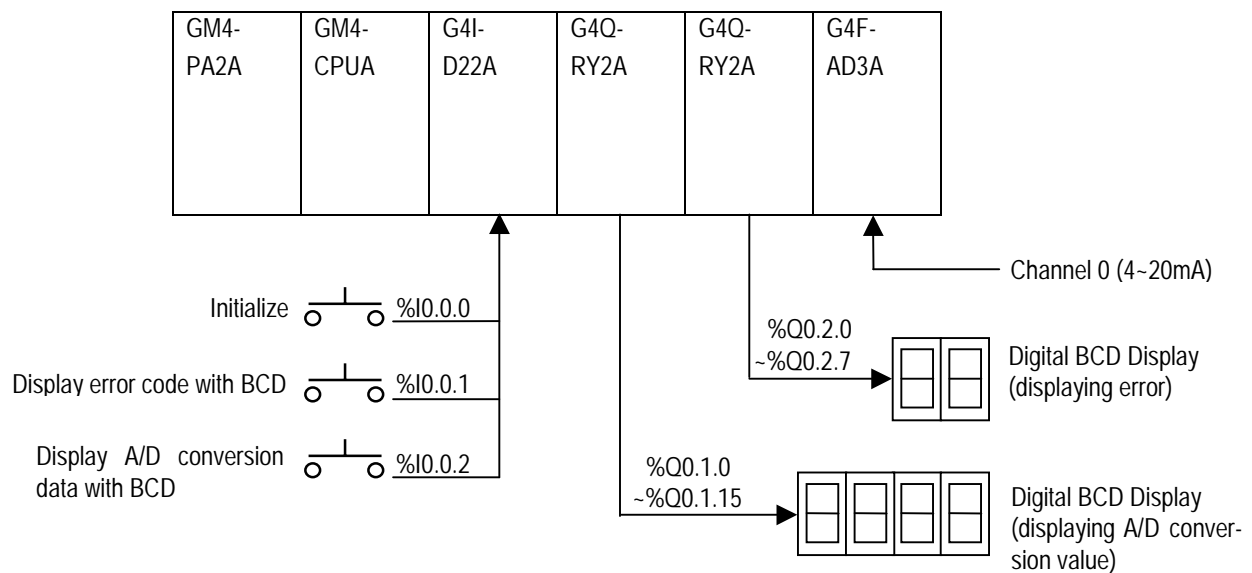
2) Initial Settings

(1) Available channel enabled : channel 0,

(2) Analog input : current input(DC 4 to 20 mA)

(3) Average processing setting : 10 times

3) Descriptions of the Program

(1) %I0.0.0 turning On leads to the initial setting of A/D conversion module.

(2) %I0.0.1 turning On leads to displaying A/D conversion value on the BCD display.(%Q0.1.0 to %Q0.1.15)

(3) %I0.0.2 turning On leads to displaying error code of function block on the BCD display,
(%Q0.2.0 to %Q0.2.7)

4) Programming

		AD_INI		AD_RD	
		AD3INI		AD3AD	

ROW 0 — %I0.0.0 —| |— REQ DONE ——— REQ DONE —(S)— START
Execution condition and Initial Setting
A/D conversion read has been completed normally.

ROW 1 — 0 —BASE STAT— INI_STAT   0 —BASE STAT— RD_STAT
Base location number specification
Error code display in the processing of function block initialization
Base location number specification
Error code display in the processing of the reading function block

ROW 2 — 3 —SLOT ACT— INI_ACT   3 —SLOT DATA— CH0_DATA
Slot location number specification
Channel operation display in the function block initialization
Slot location number specification
Data display of A/D conversion value of enabled channel

ROW 3 — AD_CH —CH   0 —CH
Available channel enable specification
Available channel enable specification

ROW 4 — DATATYPE —TYPE
Data type specification

ROW 5 — AVG_EN —AVG-EN
Average processing enable/disable specification

ROW 6 — AVG_NUM —AVG-NUM
Average number value specification

> This program converts the integer type of the A/D conversion value CH0_DATA into BCD data type to display onto the BDC digital display.

ROW 7

ROW 8 — START —| |—— %I0.0.1 —| |—   INT_TO_BCD
Command for displaying the A/D conversion value onto BCD digital display
— EN   ENO —

ROW 9 — CH0_DATA —IN1   OUT— %QW0.1.0
A/D conversion value of channel 0

ROW 10

ROW 11 — %I0.0.2 —| |—   USINT_TO_BCD
Command for displaying the error code onto BCD digital display
— EN   ENO —

ROW 12 — RD_STAT —IN1   OUT— %QB0.2.0
Error code on the reading function

ROW 13

This program converts the unsigned integer type of RD_STAT, which indicates the error status of the reading function block, into BCD data type to display it onto the BDC digital display.

5) Input/output variables on the programming

Variable Name	Var_Kind	Data Type	(AT Address) (Initial Value)
AD_CH	: VAR	: ARRAY [0..7] OF BOOL	: = {1,0,0,0,0,0,0,0}
AD_INI	: VAR	: FB Instance	
AD_RD	: VAR	: FB Instance	
AVG_EN	: VAR	: ARRAY [0..7] OF BOOL	: = {1,0,0,0,0,0,0,0}
CH0_DATA	: VAR	: INT	
DATA	: VAR	: DINT	
DATATYPE	: VAR	:ARRAY [0..7] OF BOOL	: = {0,0,0,0,0,0,0,0}
INI_ACT	: VAR	: ARRAY [0..7] OF BOOL	
INI_STAT	: VAR	: USINT	
AVG_NUM	: VAR	: ARRAY [0..7] OF UINT	: = {10,0,0,0,0,0,0,0}
RD_STAT	: VAR	: USINT	
START	: VAR	: BOOL	

6.3   Programming for Loading the A/D Conversion Module
on Remote I /O Station

1) System Configuration

Slot 0

GM4-PA1A	GM4-CPUA	G4L-FUEA	G4Q-RY2A

Remote Station No. "1"

GM4-PA1A	G4L-RBEA	G4F-AD3A	

Slot 0
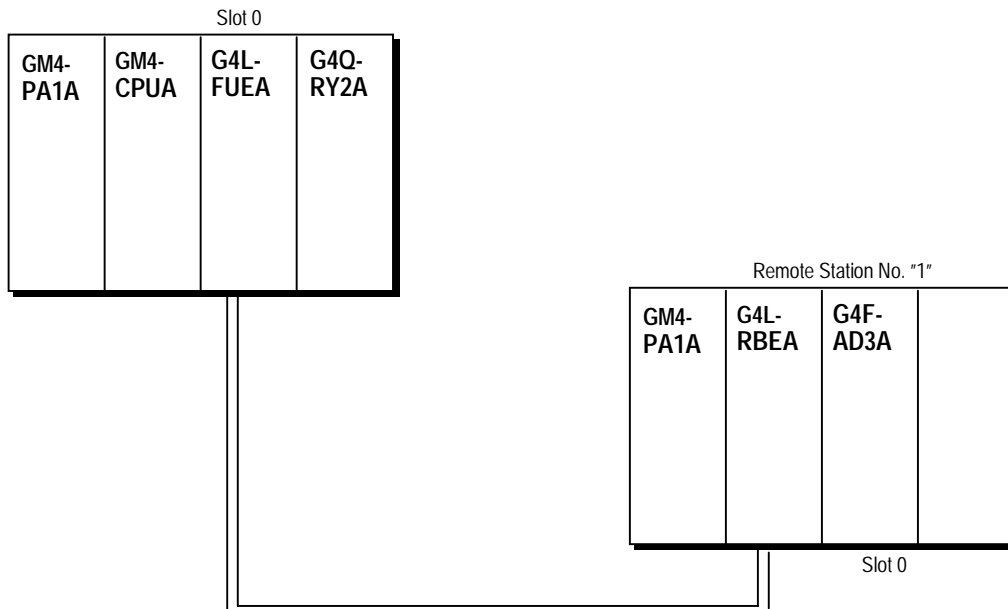
2) Initial Settings

(1) A/D conversion enabling channel: channel 0

(2) Conversion data range: -48 to 4047

(3) Average processing setting: channel 0(setting value: 50 times)

3) Descriptions of the Program

(1)The digital value less than 2000of channel 0 turns %Q0.1.0 on.

(2)The digital value more than 2000 or same, and less than 10,000 or same of channel 0 turns %Q0.1.1 on.

(3)The digital value more than 3,000 or same, and less than 12,000 of channel 0 turns %Q0.1.2 on.

(4)The digital value more than 4,000 or same of channel 0 turns %Q0.1.3 on.

4) Programming example

It indicates on when operated normally, and off when operated abnormally or down from Live data of opposite station

Line 0
READY   START   _NETO_LIV[1]   AD_INI
                                                            ADR3INI   START
                                                            REQ   NDR   —(S)—

Execution condition and initial setting
Execution request when the initializing function block is not operated

Line 1
                                    0 —NET_   NDR— SRD_ST
                                         NO   Error data display in processing of initialization function block
Slot location number of master communication module

Line 2
                                    1 —ST_   STAT— INI_STAT
                                         NO   Error code display in processing of initialization function block
Address of remote station

Line 3
_NETO_RST[1] _NETO_LIV[1]   MOVE   MOVE   0 —BASE   ACT— INI_ACT
                             EN ENO   EN ENO   Normal channel operation display
                                                 Base location number of A/D conversion module

Line 4
It indicates information on power-off state of opposite station. If restored, it turns "On" and the "On" state is retained until the user program turns it "Off".
              0 —IN1 OUT— READY 0 —IN1 OUT— _NETO_RST[1] —SLOT
                                                 0
                                                 Slot location number of A/D conversion module

Line 5
                                          AC_CH —CH
                                          Available channel enable specification

Line 6
                                          INPUT TYPE —TYPE
                                          Conversion data range specification

Line 7
START   AD_RD.NDR   _NETO_LIV[1]   AD_RD
                                          ADR3RD   AVG_EN —AVG_EN
                                          REQ   NDR
Execution request on the reading function block with communication intervals.

Line 8
                          0 —NET_   ERR— RD_ERR   AVG_NUM —AVG_NUM
                               NO   Error data display   Average processing number specification
Slot location number of master communication module   Average processing enable/disable specification

Line 9
                          1 —ST_   STAT— RD_STAT
                               NO   Error code display at occurring error
Address of remote station

Line 10
                          0 —BASE   ACT— RD_ACT
                                              Normal channel operation display
Base location number of A/D conversion module

Line 11
                          0 —SLOT   DATA— AD_DATA
                                              A/D conversion value
Slot location number of A/D conversion module

Lind 12
                          AD_CH —CH

Line 13
              LT   GE
              EN ENO   EN ENO

Line 14
AD_DATA[0] —IN1 OUT— %Q0.1.0   AD_DATA[0] —IN1 OUT—   LT
                      The digital value less than 2000 of channel 0 turns %Q0.1.0 on.   EN ENO

Line 15
        2000 —IN2   2000 —IN2   AD_DATA[0] —IN1 OUT— %Q0.1.1
                                                                        The digital value more than 2000 or same, and less than 3000 or same turns %Q0.1.1 on.

Line 16
                                                      3000 —IN2

Line 17

Line 18

Line 19
              GE
              EN ENO

Line 20
AD_DATA[0] —IN1 OUT—   LT
                                  EN ENO

Line 21
        3000 —IN2   AD_DATA[0] —IN1 OUT— %Q0.1.2
                                                The digital value more than 3000 or same, and less than 4000 turns %Q0.1.2 on.

Line 22
                              4000 —IN2

Line 23

Line 24

Line 25
                                          GE
                                          EN ENO

Line 26
                          AD_DATA[0] —IN1 OUT— %Q0.1.2
                                              The digital value more than 12000 or same turns %Q0.1.3 on.

Line 27
                                  4000 —IN2

Line 28

5) Input/output variables used on the programming

Variable Name	Var_Kind	Data Type	(AT Address) (Initial Value)
AD_CH	: VAR	: ARRAY [0..7] OF BOOL	: = {0,0,0,0,0,0,0,0}
AD_DATA	: VAR	: ARRAY [0..7] OF INT	
AD_INI	: VAR	: FB Instance	
AD_RD	: VAR	: FB Instance	
AVG_EN	: VAR	: ARRAY [0..7] OF BOOL	: = {1,0,0,0,0,0,0,0}
AVG_SEL	: VAR	: ARRAY [0..7] OF BOOL	: = {1,0,0,0,0,0,0,0}
INPUTTYPE	: VAR	:ARRAY [0..7] OF BOOL	: = {0,0,0,0,0,0,0,0}
INI_ACT	: VAR	: ARRAY [0..7] OF BOOL	
INI_ERR	: VAR	: BOOL	
INI_STAT	: VAR	: USINT	
AVG_NUM	: VAR	: ARRAY [0..7] OF UINT	: = {50,0,0,0,0,0,0,0}
RD_STAT	: VAR	: ARRAY [0..7] OF BOOL	
RD_ERR	: VAR	: BOOL	
RD_STAT	: VAR	: USINT	
READY	: VAR	: BOOL	