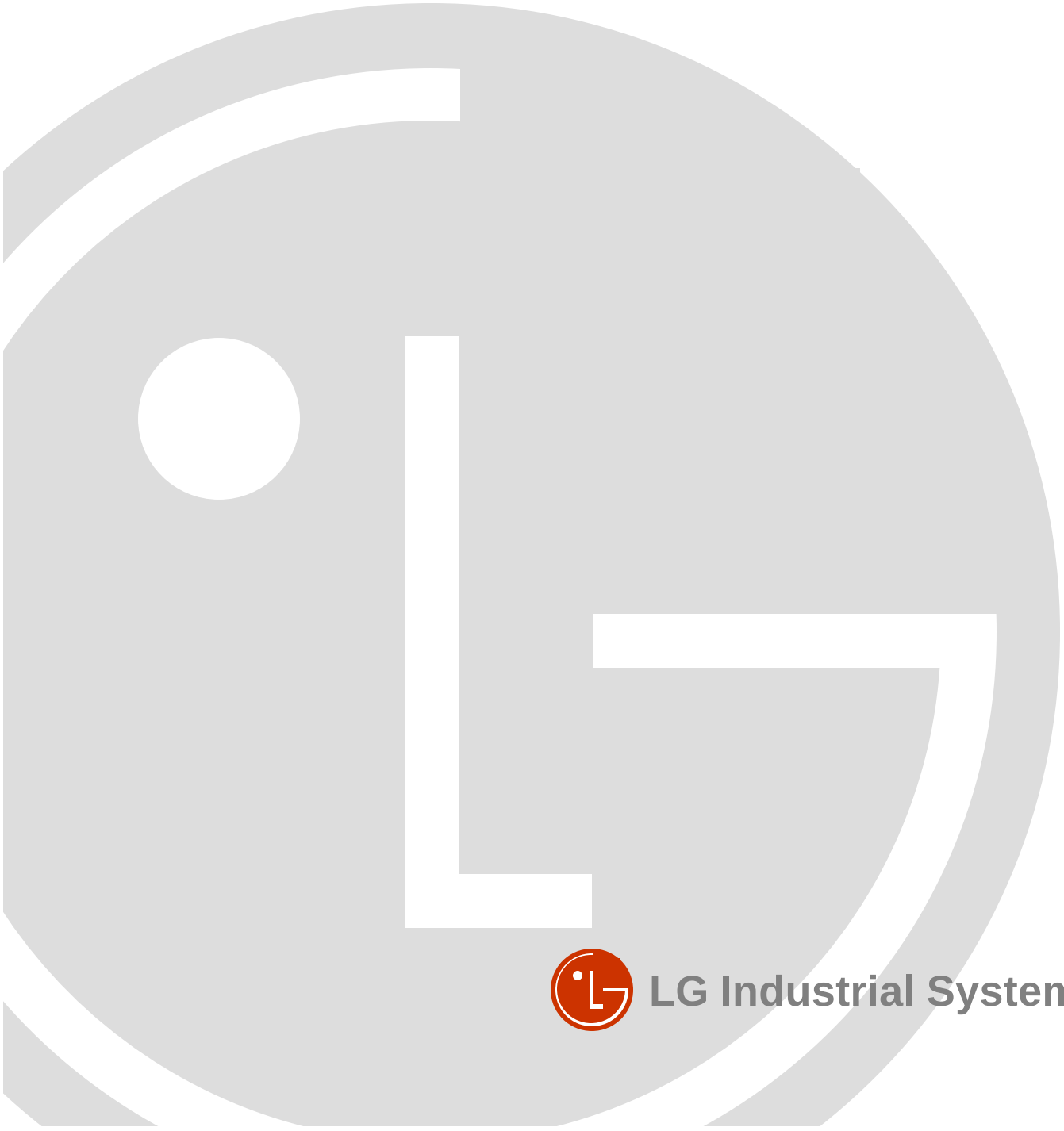
User's Manual

LG Programmable Logic Controller

G3F-AD4A
G3F-AD4B
G4F-AD2A



LG Industrial Systems

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-AD4A , G3F-AD4B and G4F-AD2A.

For safety precautions on the PLC system, see the GLOFA GM3/4 CPU User's Manuals and MASTER-K200S/300S/1000S CPU 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.

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Chapter 1. INTRODUCTION

The G4F-AD2A, G3F-AD4A and G3F-AD4B are analog/digital conversion modules for use with the GLOFA PLC GM 1/2/3/4 series CPU module and the MASTER-K PLC K300S/1000S Series CPU module. The G4F-AD2A is used on GM4 series module and the K300S series module, and the G3F-AD4A and G3F-AD4B is used on the GM1/2/3 series module and the K1000S series module. (Hereafter the G4F-AD2A, G3F-AD4A and G3F-AD4B 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 14-bit binary digital value.

1.1 Features

1.1.1 G3F-AD4A / G3F-AD4B

1) 16-Channel analog to digital conversion is possible with a single module.
The G3F-AD4A and G3F-AD4B have 16-Channel A/D conversion capacity, with each channel selectable for voltage or current input.

2) High resolution of 1/16000
High-resolution digital values can be obtained. Resolution setting applies to all channels.

4) The number of the G3F-AD4A used on one base is unlimited.

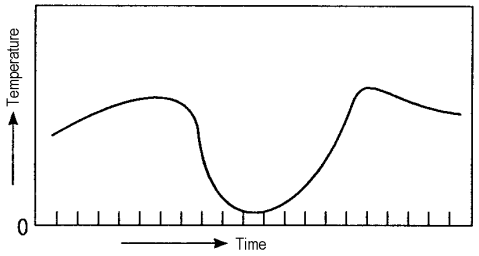
1.1.2 G4F-AD2A

1) 4-Channel analog to digital conversion is possible with a single module.
The G3F-AD2A has 4Channel A/D conversion capacity, with each channel selectable for voltage or current input.

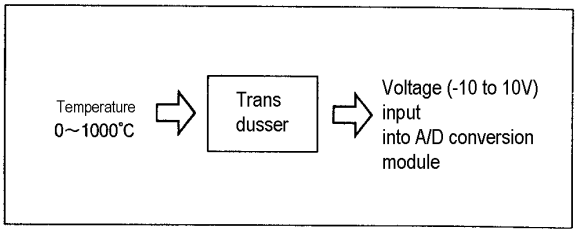
2) High resolution of 1/16000
High-resolution digital values can be obtained. Resolution setting applies to all channels.

3) The number of the G4F-AD2A used on one base is unlimited.

1.2 Glossary



[Fig 1.1] Analog Value

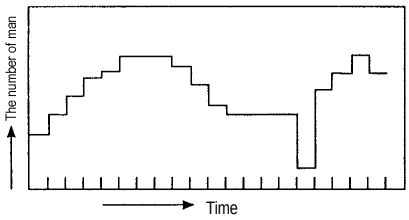


[Fig 1.2] Transducer

1.2.1 A-Analog Value

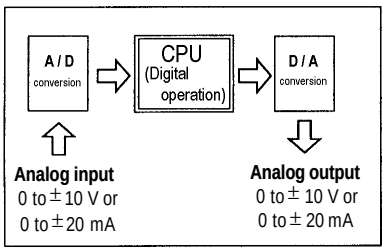
Analog value is a sequentially changing value such as voltage, current, temperature, speed, pressure, flux, etc. Temperature, for example, is sequentially changing according to the time. Because this temperature is not input on the PLC through transducer, the same analog value of DC voltage (0 to ± 10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

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.

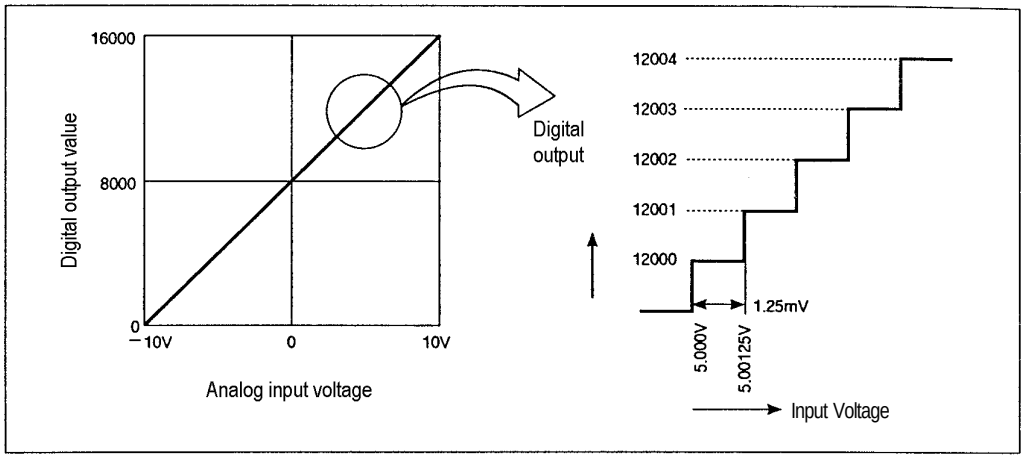


[Fig 1.4] PLC Processing

Analog value isn't written directly onto the CPU. For analog input to the CPU operation, analog converted to digital value has to be inputted onto the CPU and for analog output, the digital value of the CPU should be converted to analog value.

1.2.3 Analog/ Digital Conversion Characteristics

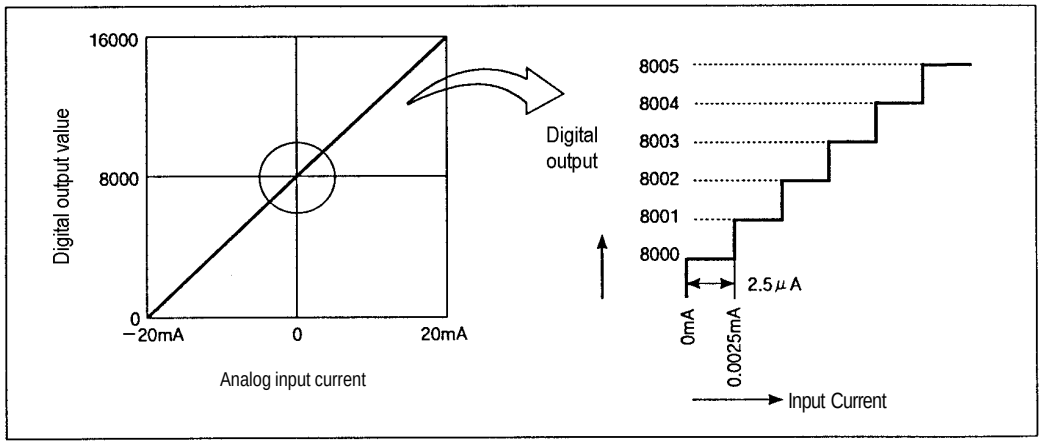
1) Voltage input



[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 operated in the CPU. On voltage input, input of –10 V leads to digital value of 0 and 10 V to 16000.
Input of 1.25 mV is equal to digital value of 1. Therefore, input less than 1.25 mV shouldn't be converted but ignored.

2) Current input



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

On current input, input of -20 mA leads to digital value of 8000 and 20 mA to 16000. Input of 2.5μA is equal to digital value of 1. Therefore, input less than 2.5μA shouldn't be converted but ignored.

Chapter 2 . SPECIFICATIONS

2.1 General Specifications

Table 2.1 shows the general specifications of GLOFA GM series and MASTER-K series.

<table>
<tr><th>No</th><th>Item</th><th colspan="8">Specifications</th><th>Standard</th></tr>
<tr><td>1</td><td>Operating ambient temperature</td><td colspan="8">0 ~ 55℃</td><td></td></tr>
<tr><td>2</td><td>Storage ambient temperature</td><td colspan="8">-25 ~ 70℃</td><td></td></tr>
<tr><td>3</td><td>Operating ambient humidity</td><td colspan="8">5 ~ 95%RH, non-condensing</td><td></td></tr>
<tr><td>4</td><td>Storage ambient humidity</td><td colspan="8">5 ~ 95%RH, non-condensing</td><td></td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Vibration</td><td colspan="8">Occasional vibration</td><td rowspan="8">IEC 61131-2</td></tr>
<tr><td>Frequency</td><td colspan="3">Acceleration</td><td colspan="2">Amplitude</td><td>Sweep count</td></tr>
<tr><td>10≤f∠57 Hz</td><td colspan="3">-</td><td colspan="2">0.075 mm</td><td rowspan="5">10 times in each direction for X, Y, Z</td></tr>
<tr><td>57 ≤f≤150 Hz</td><td colspan="3">9.8㎨ {1G}</td><td colspan="2">-</td></tr>
<tr><td colspan="7">Continuos vibration</td></tr>
<tr><td>Frequency</td><td colspan="3">Acceleration</td><td colspan="2">Amplitude</td></tr>
<tr><td>10≤f∠57 Hz</td><td colspan="3">-</td><td colspan="2">0.035 mm</td></tr>
<tr><td>57≤f≤150 Hz</td><td colspan="3">4.9㎨{0.5G}</td><td colspan="2">-</td></tr>
<tr><td>6</td><td>Shocks</td><td colspan="8">*Maximum shock acceleration: 147㎨ {15G}
*Duration time :11 ms
*Pulse wave: half sine wave pulse(3 times in each of X, Y and Z directions)</td><td>IEC 61131-2</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Noise immunity</td><td colspan="2">Square wave impulse noise</td><td colspan="5">±1,500 V</td><td></td></tr>
<tr><td colspan="2">Electrostatic discharge</td><td colspan="5">Voltage :4kV(contact discharge)</td><td>IEC 61131-2
IEC 1000-4-2</td></tr>
<tr><td colspan="2">Radiated electromagnetic field</td><td colspan="5">27 ~ 500 MHz, 10 V/m</td><td>IEC 61131-2
IEC 1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient burst noise</td><td>Severity Level</td><td>All power modules</td><td>Digital I/Os (Ue ≥ 24 V)</td><td>Digital I/Os (Ue < 24 V) Analog I/Os communication I/Os</td><td rowspan="2">IEC 61131-2
IEC 1000-4-4</td></tr>
<tr><td>Voltage</td><td>2 kV</td><td>1 kV</td><td>0.25 kV</td></tr>
<tr><td>8</td><td>Operating atmosphere</td><td colspan="8">Free from corrosive gases and excessive dust</td><td></td></tr>
<tr><td>9</td><td>Altitude for use</td><td colspan="8">Up to 2,000m</td><td></td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="8">2 or lower</td><td></td></tr>
<tr><td>11</td><td>Cooling method</td><td colspan="8">Self-cooling</td><td></td></tr>
</table>

[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-AD4A	G4F-AD2A	G3F-AD4B
I/O points		16 points		
Analog input	Voltage	–5 ~ 5 VDC (input resistance 560kΩ) –10 ~ 10 VDC (input resistance 560kΩ)		1 ~ 5 VDC (input resistance 560kΩ)
	Current	DC –20 ~ 20 mA (input resistance 250Ω)		4 ~ 20 mA (input resistance 250Ω)
	Voltage/Current selection	*. Select with the Input conversion switch on the side of the module (on: current, off: voltage) *. When current input is used, set the Input range switch to V1 / I.	*. Select in accordance with the Input terminals. *. Connect the V terminal with the I terminal on the use of current input.	*. Select with the Input conversion switch on the side of the module (on: current, off: voltage) *. Select with program initial F/B (input variable:IN_SEL, 0:current, 1:voltage)
Digital output		*. 16-bit (data: 14bit)signed binary *. May be set per channel by setting output data ("0": -192 to 16191, "1": -8192 to 8191)		*. 16-bit (data: 14bit)signed binary ("0": 0 to 16000, "1": -8000 to 8000)
Maximum resolution	1 ~ 5 VDC	-		0.25 mV (1/16000)
	-5 ~ 5 VDC	0.625 mV (1/16000)		-
	-10 ~ 10 VDC	1.25 mV (1/16000)		-
	DC 4 ~20 mA	-		1.0 μA (1/16000)
	DC -20 ~20 mA	0.0025 mA (1/16000)		-
Overall Accuracy(%)		±0.5% or lower (accuracy to full scale) (±0.3% at ambient temperature 25℃)	±0.2% or lower (accuracy to full scale)	±0.5% or lower (accuracy to full scale) (±0.3% at ambient temperature 25℃
Maximum conversion speed (ms/channel)		3.0	5.0	3.0
Maximum absolute input		Voltage(V):±12, Current (mA):±25		
Number of analog input point		16 channels/module	4 channels/module	16 channels/module
Isolation		Between input terminals and PLC: Photo coupler isolation (Between channels : Non-isolated)		
Terminals connected		38-point terminal block	20-point terminal block	38-point terminal block
Internal current consumption(A)		0.67 A	0.4 A	0.54 A
Weight (g)		630	360	560

[Table 2.2] Performance Specifications

! CAUTION

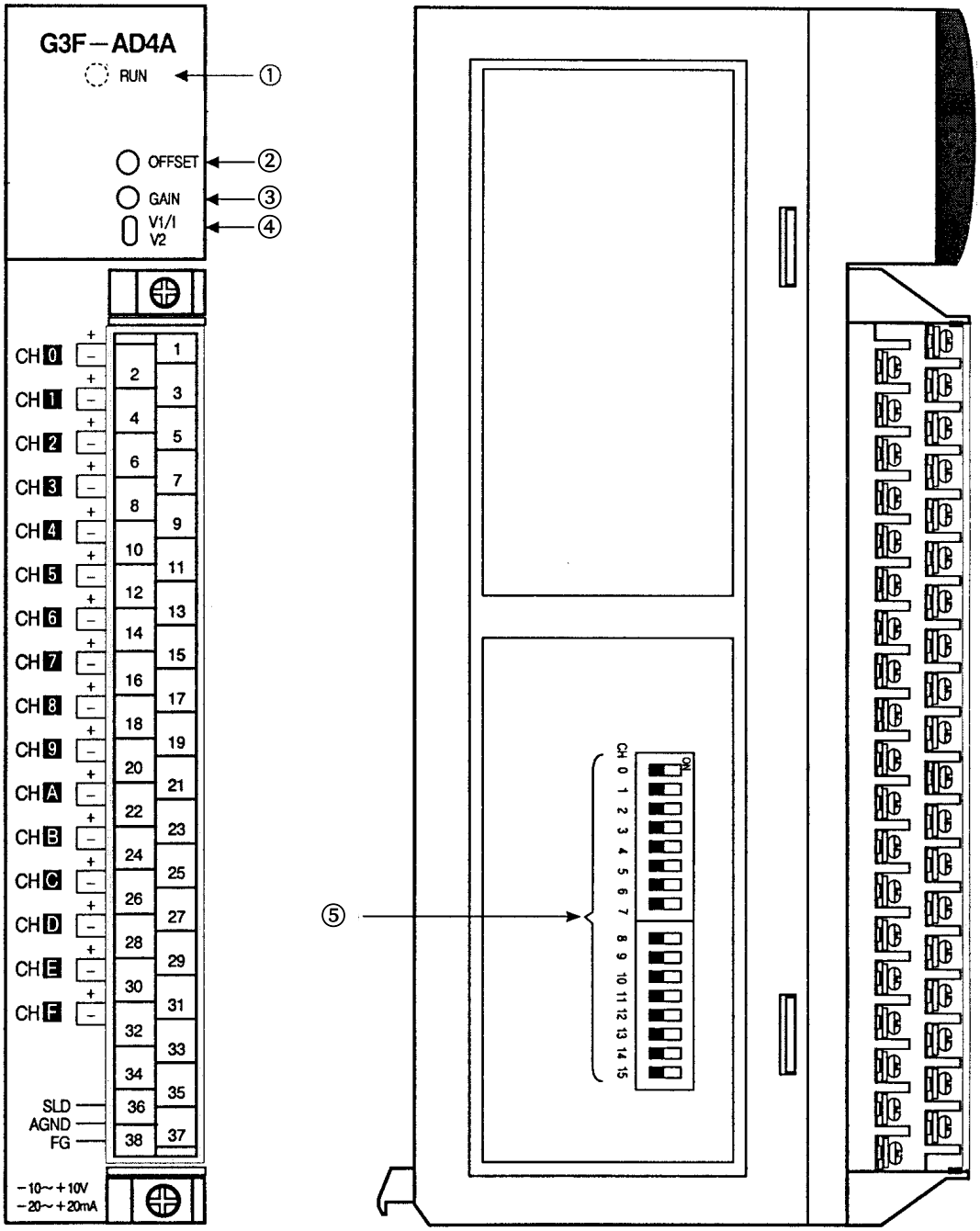
The offset / gain value of G3F-AD4B A/D conversion module at factory has been fixed. Therfore it is not Changed.

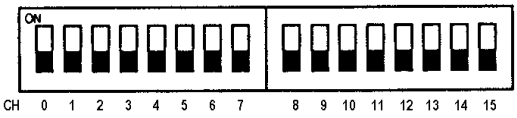
2.3 Names of Parts and Functions

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

2.3.1 G3F-AD4A

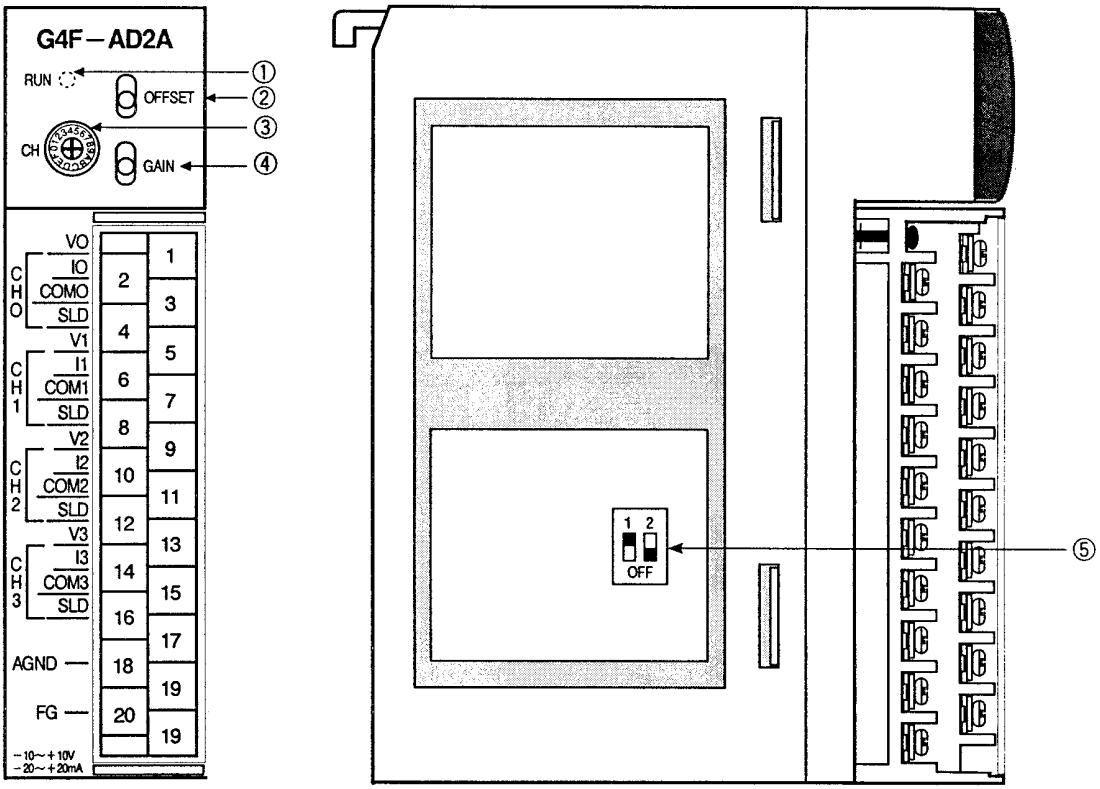
The names of parts and functions of the A/D conversion module are shown



<table>
<tr><th>No</th><th>Descriptions</th></tr>
<tr><td>①</td><td>RUN LED
Indicates the operating status of the G3F-AD4A
(1) On : Normal operation
(2) Flicker : An error has occurred. (For more information, see the General Section 4.1)
(3) Off : DC 5 V power-off or G3F-AD4A module fault.</td></tr>
<tr><td>②</td><td>Offset Trimmer
Used to make micro adjustment of an offset value.</td></tr>
<tr><td>③</td><td>Gain Trimmer
Used to make micro adjustment of a gain value.</td></tr>
<tr><td>④</td><td>Input range switch
- On factory set, the voltage range has to be set to from -10 to 10 VDC.
(1) Set to voltage ▲ V1 : Voltage range -5 ~ 5 VDC
 ▼ V2 : Voltage range -10 ~ 10 VDC
(2) Set to current ▲ I : Current range -20 ~ 20 mA
 ▼ : Unusable</td></tr>
<tr><td>⑤</td><td>Input select switch
(1) Used to select the analog input(voltage or current input) of each channel
-Set to OFF to use voltage input. -Set to ON to uses current input.
(2) On factory set, it has to be set to voltage input condition. (Every Dip Switch is off.)
  </td></tr>
</table>

2.3.2 G4F-AD2A

This section shows the names of parts and functions of G4F-AD2A module.

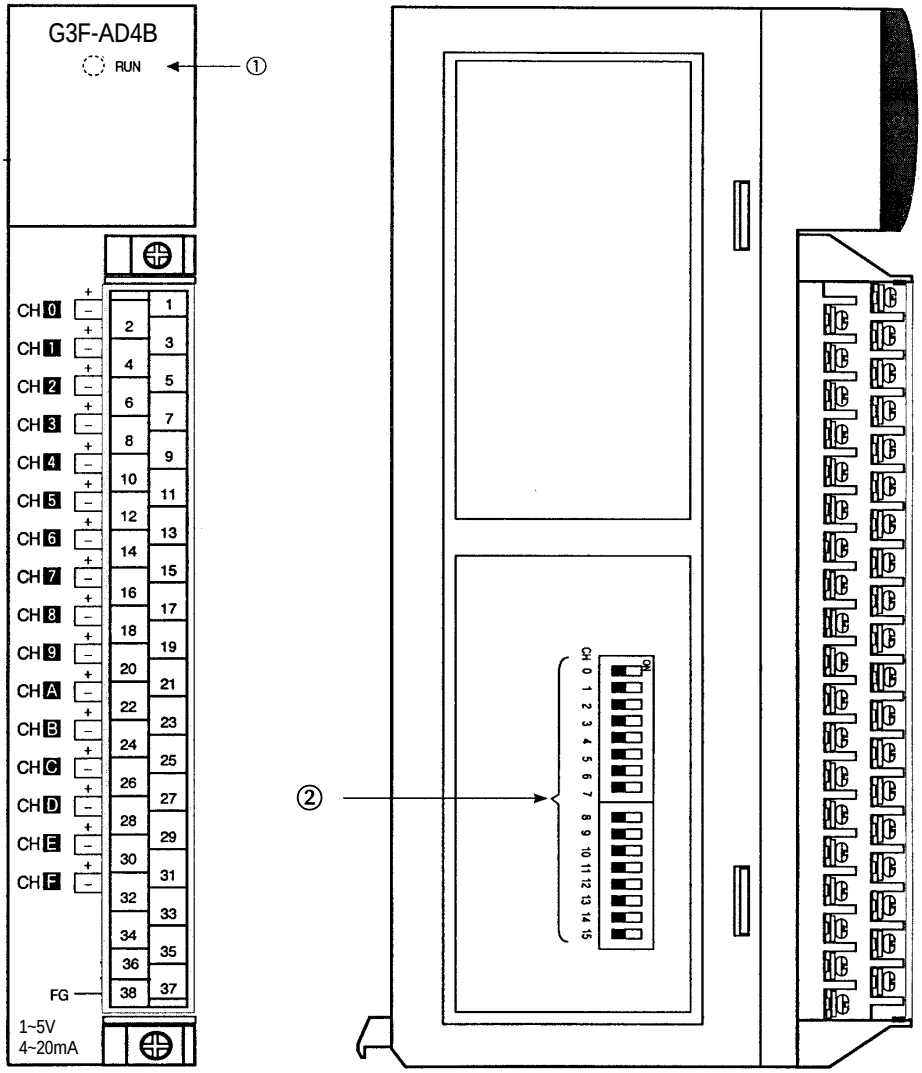


No	Descriptions	No	Descriptions
←	**RUN LED** Indicates the operating status of the G4F-AD2A. Normal mode: channel switch's setting range: 4 to F - ON : Normal operation. - Flicker : An error has occurred. - OFF : DC5V power-off or G3F-AD4A module fault. Test mode: channel switch's range: 0 to 3 - Flicker(per 1.0sec) : No operation of offset/gain switch. - ON : Offset/gain switch adjusted upward. - Flicker(per 0.2sec) : offset/gain setting error.	↓	**GAIN switch** Adjust upward, and the analog input value of corresponding channels is stored as a gain value.
↑	**Offset switch** Adjust upward, and the analog input value of corresponding channels is stored as an offset value.	°	**Input range select switch**
→	**Channel switch for the test mode** Corresponding channels will be selected in the adjustment of offset/gain value. (Valid range: 0 to 3)		

Analog input		Switch
Voltage	-10 ~ 10 VDC	
	-5 ~ 5 VDC	
Current	-20 ~ 20 mA	

* Don't put the input switch on or
* It leads to malfunction.

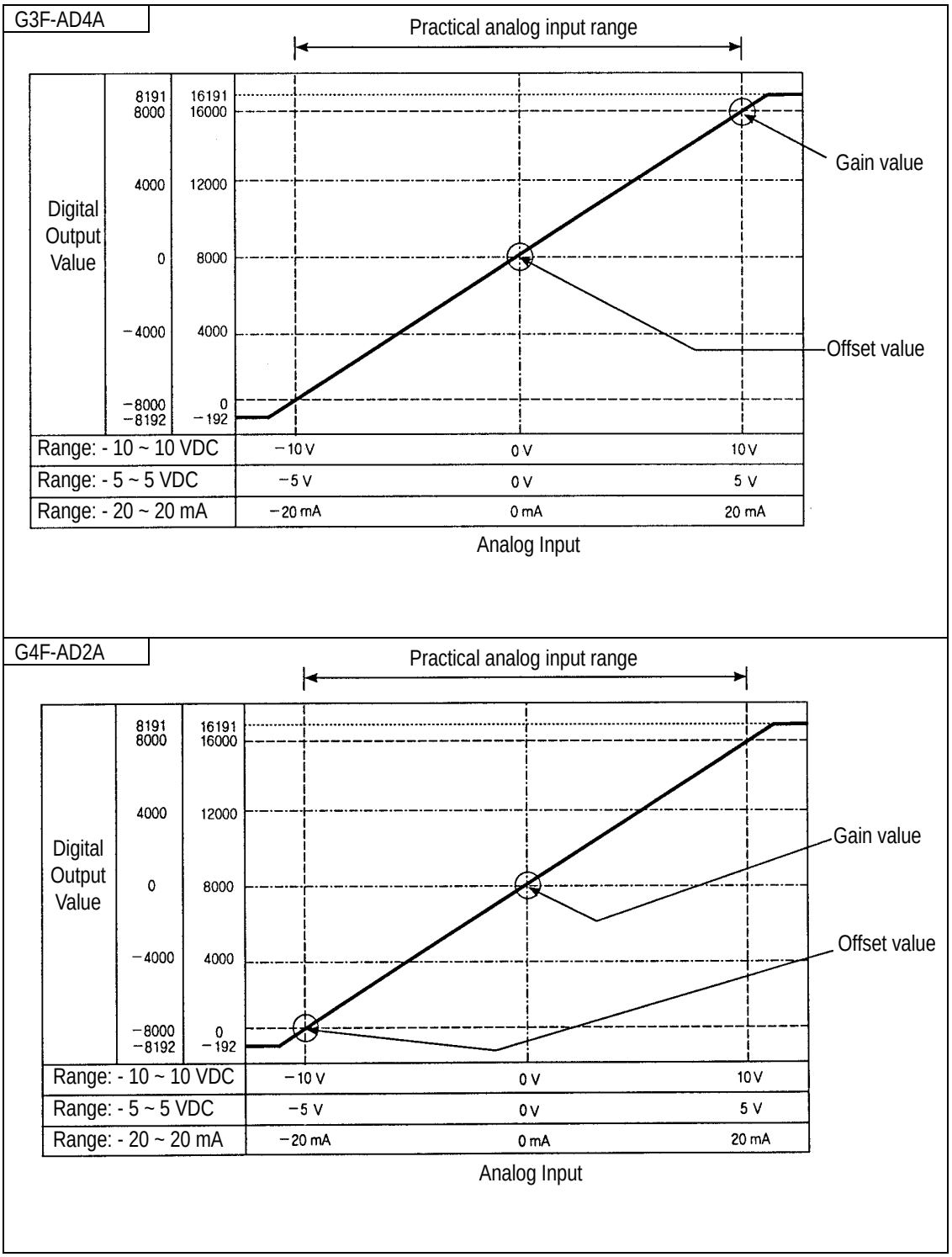
2.3.3 G3F-AD4B



	Description
←	RUN LED Indicates the operating status of G3F-AD4B
↑	Selection switch of voltage/current 1) The switch status at voltage selection The switch locates OFF status. 2) The switch status at current selection The switch locates ON status.

2.4 I/O Conversion Characteristics

Input / Output (hereafter I/O) conversion characteristics are expressed by the angle of the line connecting the offset value and gain value used to convert the analog signals, input to the PLC into digital values.
The I/O conversion characteristics of the A/D conversion module are shown as below.



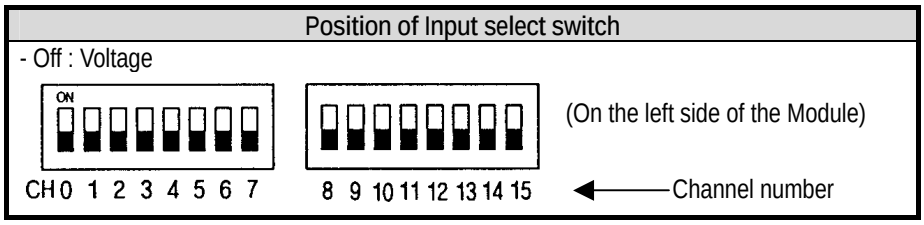
[Fig 2.1] I/O Conversion Characteristics

2.4.1 G3F-AD4A I/O Characteristics

The G3F-AD4A allows voltage or current input to be selected per channel by the input select switch. Offset / gain setting is performed for 16 channels in block.

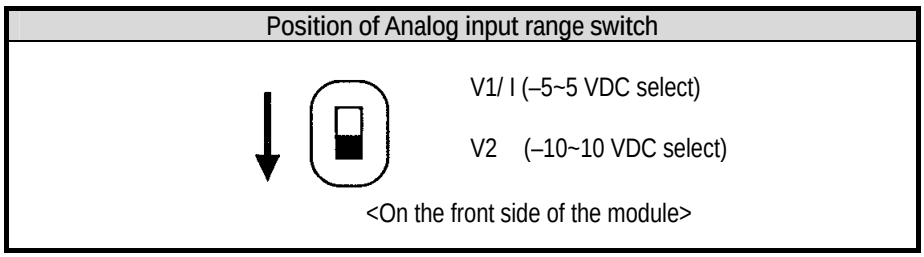
1) Voltage Input Characteristics

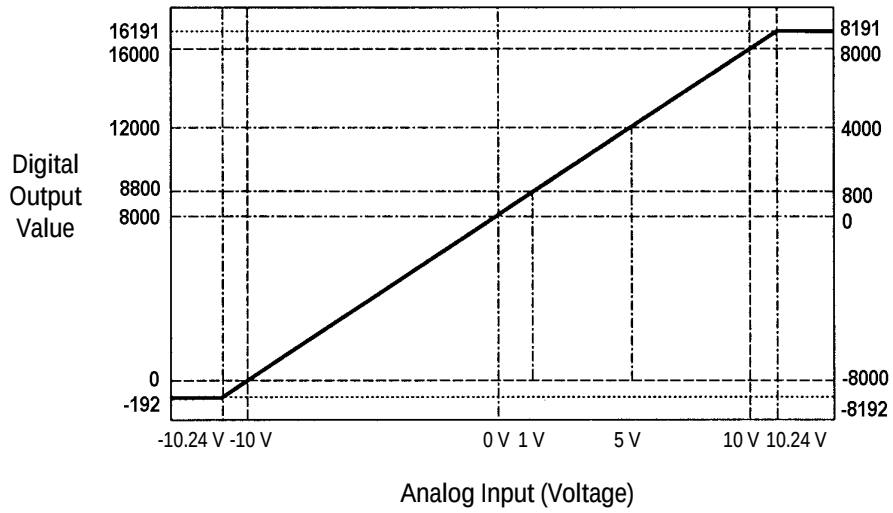
For voltage input, the input select switch of each channel is set to "off".



a) Range : -10 ~ 10 VDC

-The analog input range switch has to be set to downward (V2).



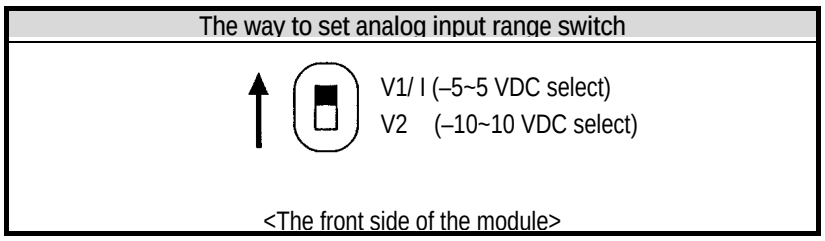


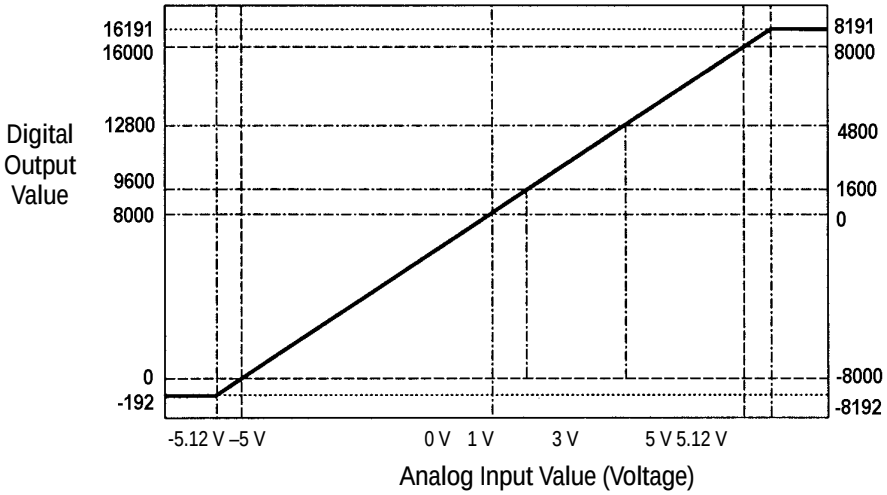
-The digital output value according to voltage input characteristics will be shown as below.

Digital output range	Analog input voltage						
	-10.24V	-10 V	0 V	1 V	5 V	10V	10.24V
-192~16191	-192	0	8000	8800	12000	16000	16191
-8192~8191	-8192	-8000	0	800	4000	8000	8191

b) Range: -5 ~ 5 VDC

-The analog input range switch has to be set upward (V1/ I)





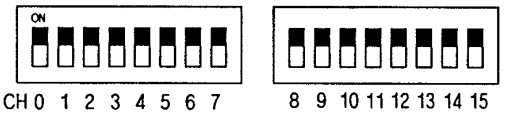
-The digital output value according to voltage input characteristics will be shown as below.

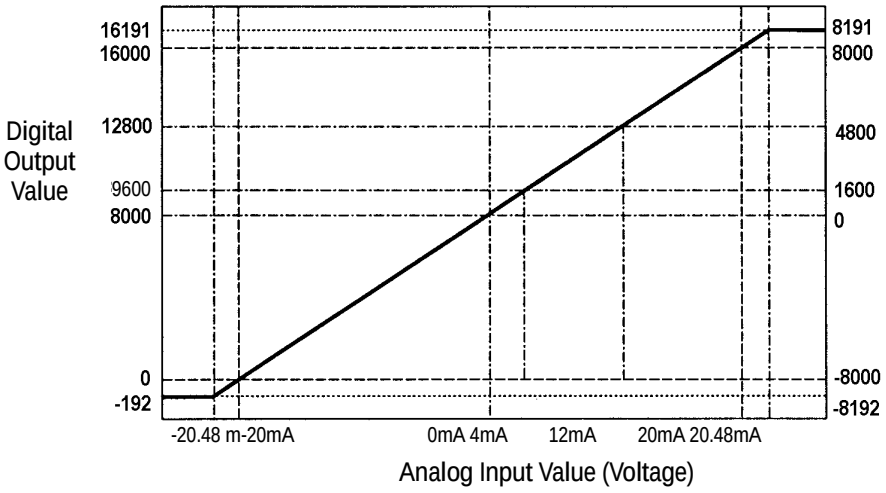
Digital output range	Analog input voltage						
	-5.12 V	-5 V	0 V	1 V	3 V	5 V	5.12 V
-192~16191	-192	0	8000	9600	12800	16000	16191
-8192~8191	-8192	-8000	0	1600	4800	8000	8191

2) Current Input Characteristics

- For current input, the input select switch of each channel is set to "on".

Analog input range switch has to be set upward (V1/ I).

Input select switch position	Analog input range switch position
	V1/ I (DC –20~20mA) V2 (Current input disable)



- The digital output value according to current input characteristics will be shown as below.

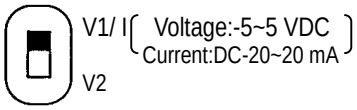
Digital output range	Analog input current						
	-20.48 mA	-20 mA	0 mA	4 mA	12	20	20.48 mA
-192~16191	-192	0	8000	9600	12800	16000	16191
-8192~8191	-8192	-8000	0	1600	4800	8000	8191

3) Simultaneous Voltage and Current Input Characteristics

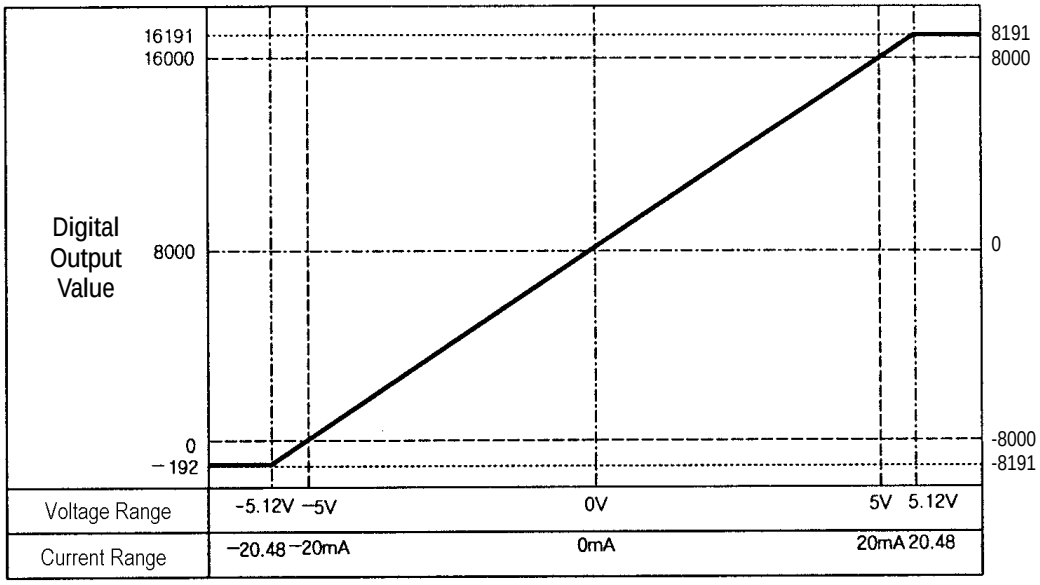
For simultaneous voltage and current input, the input conversion switch of each channel is set to corresponding voltage and current range.

Analog input switch has to be set upward (V1/ I).

Ex) Voltage input range: 0 to 7 Current input range: 8 to 15

Input select switch position	Analog input range switch position
	

- For simultaneous voltage and current input, voltage input range has to be set only to the range [-5 ~ 5 VDC].



Analog Input

- Simultaneous voltage and current input characteristics lead to digital output value as below.

Digital output range	Analog input				
	-5.12 V	-5 V	0 V	5 V	5.12 V
	-20.48 mA	-20 mA	0 mA	20 mA	20.48 mA
-192~16191	-192	0	8000	16000	16191
-8192~8191	-8192	-8000	0	8000	8191

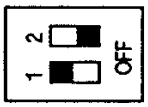
2.4.2 G4F-AD2A I/O Characteristics

1) Voltage Input Characteristics

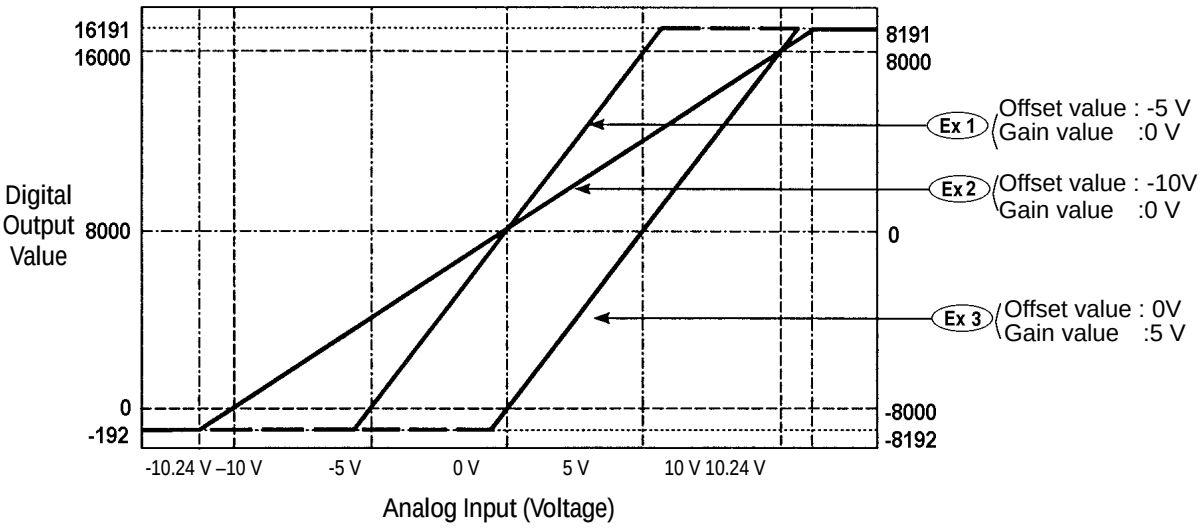
- The G4F-AD2A is capable of selecting voltage/current and adjusting offset/gain for each channel.
- For voltage input, the input conversion switch may be set to the range such as from-10 to 10 VDC, or from -5 to 5 VDC.

a) -10 ~ 10 VDC

Position of input range switch



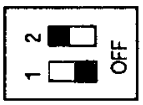
Turn switch 1 on and switch 2 off.
(On the left side of the module)



- When offset/gain setting is changed, digital output value to voltage input characteristics are as below.

Section	Digital output range	Offset value	Gain value	Analog input voltage					
				- 10 V	- 5 V	0 V	3 V	5 V	10 V
Ex 1	-192 ~ 16191	-5 V	0 V	-192	0	8000	12800	16000	16191
Ex 2		-10 V	0 V	0	4000	8000	10400	12000	16000
Ex 3		0 V	5 V	-192	-192	0	4800	8000	16000
Ex 1	-8192 ~ 8191	-5 V	0 V	-8192	-8000	0	4800	8000	8191
Ex 2		-10 V	0 V	0	-4000	0	2400	4000	8000
Ex 3		0 V	5 V	-8192	-8192	-8000	-3200	0	8000

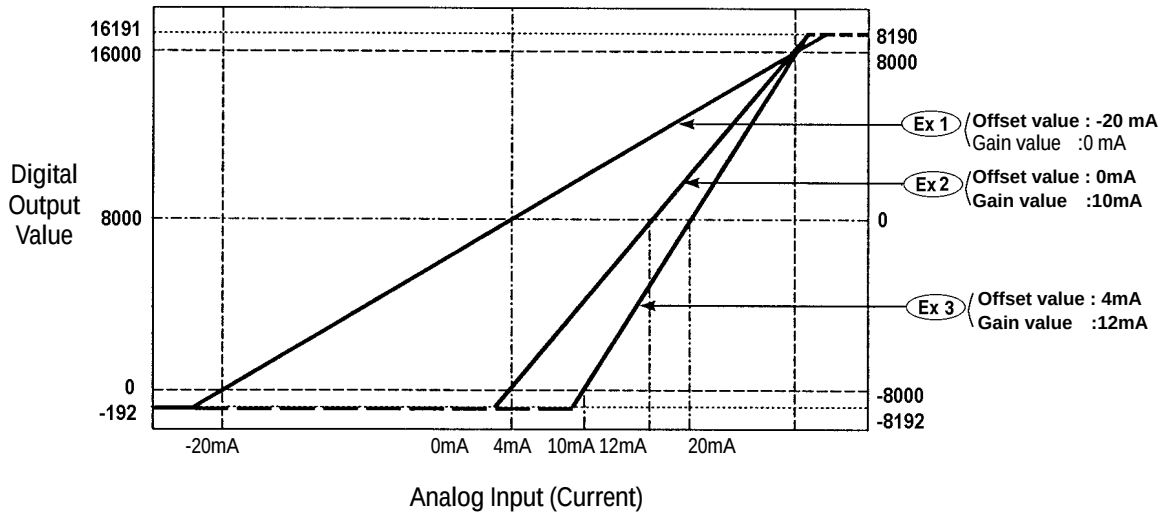
b) -5 ~ 5 VDC

Position of input range switch
 Turn switch 1 off and switch 2 on. (On the left side of the module)

- When offset/gain setting is changed, digital output value to voltage input characteristics are shown as below.

Section	Digital output range	Offset value	Gain value	Analog input voltage				
				- 5 V	0 V	1 V	3 V	5 V
Ex 1	-192 ~ 16191	-5 V	0 V	0	8000	9600	12800	16000
Ex 2		0 V	2.5 V	-192	0	3200	9600	16000
Ex 3		1 V	3 V	-192	-192	0	8000	16000
Ex 1	-8192 ~ 8191	-5 V	0 V	-8000	0	1600	4800	8000
Ex 2		0 V	2.5 V	-8192	-8000	-4800	1600	8000
Ex 3		1 V	3 V	-8192	-8192	-8000	0	8000

2) Current Input Characteristics



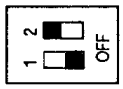
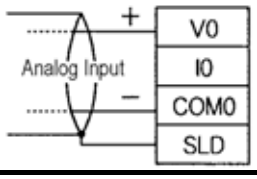
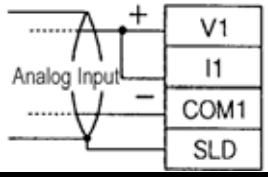
- When offset/gain setting is changed, digital output value to current input characteristics are shown as below.

Section	Digital output range	Offset value	Gain value	Analog input current					
				- 20 mA	0 mA	4 mA	10 mA	12 mA	20 mA
Ex 1	-192 ~ 16191	-20 mA	0 mA	0	8000	9600	12000	12800	16000
Ex 2		0 mA	10 mA	-192	0	3200	8000	9600	16000
Ex 3		4 mA	12 mA	-192	-192	0	6000	8000	16000
Ex 1	-8192 ~ 8191	-20 mA	0 mA	-8000	0	1600	4000	4800	8000
Ex 2		0 mA	10 mA	-8192	-8000	-4800	0	1600	8000
Ex 3		4 mA	12 mA	-8192	-8192	-8000	-2000	0	8000

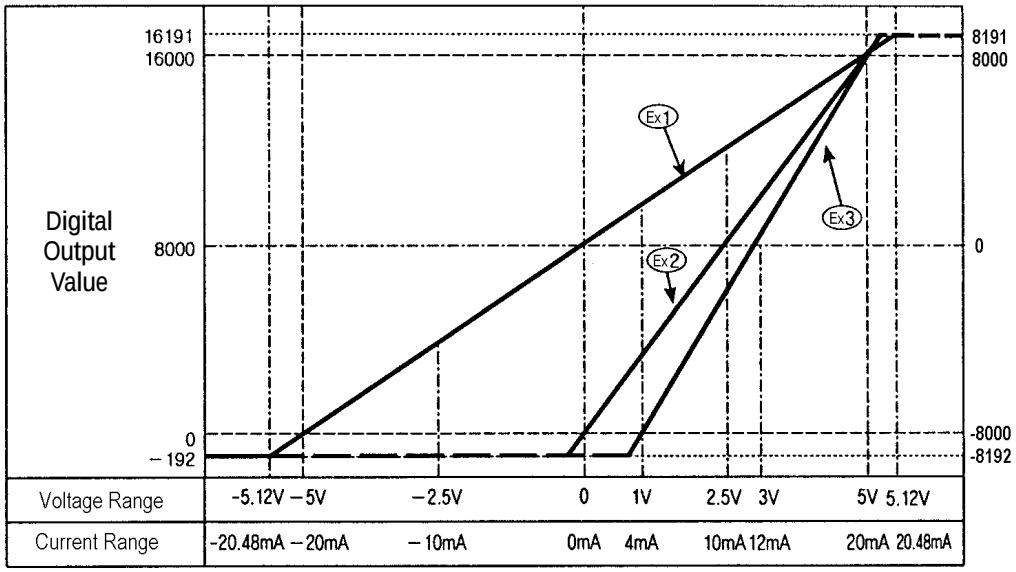
3) Simultaneous Voltage and Current Input Characteristics

-When voltage and current are input simultaneously, the input range switch of the left side of the module has to be set to the range from -5 to 5 VDC. (Switch 1 turns Off, Switch 2 turns On)

Ex) Voltage input channel : 0, Current input channel : 1

Input range select switch (on the left side of module)	Terminal connection	
	voltage input (channel 0)	current input (channel 1)
 -5 ~ 5 VDC -10 ~ 10 VDC		

-When voltage and current are input simultaneously, voltage input range has to be set only to the range from -5 to 5 VDC.



Analog Input

-When offset/gain setting is changed, digital output value to voltage/current input characteristics are shown as below.

Section	Digital output range	Offset value (Voltage / Current)	Gain value (Voltage / Current)	Analog input					
				-5 V	0 V	1 V	2.5 V	3 V	5 V
				- 20 mA	0 mA	4 mA	10 mA	12 mA	20 mA
Ex 1	-192 ~ 16191	-5 V / -20 mA	0 V / 0 mA	0	8000	9600	12000	12800	16000
Ex 2		0 V / 0 mA	2.5 V / 10 mA	-192	0	3200	8000	9600	16000
Ex 3		1V / 4 mA	3 V / 12 mA	-192	-192	0	6000	8000	16000
Ex 1	-8192 ~ 8191	-5 V / -20 mA	0 V / 0 mA	-8000	0	1600	4000	4800	8000
Ex 2		0 V / 0 mA	2.5 V / 10 mA	-8192	-8000	-4800	0	1600	8000
Ex 3		1 V / 4 mA	3 V / 12 mA	-8192	-8192	-8000	-2000	0	8000

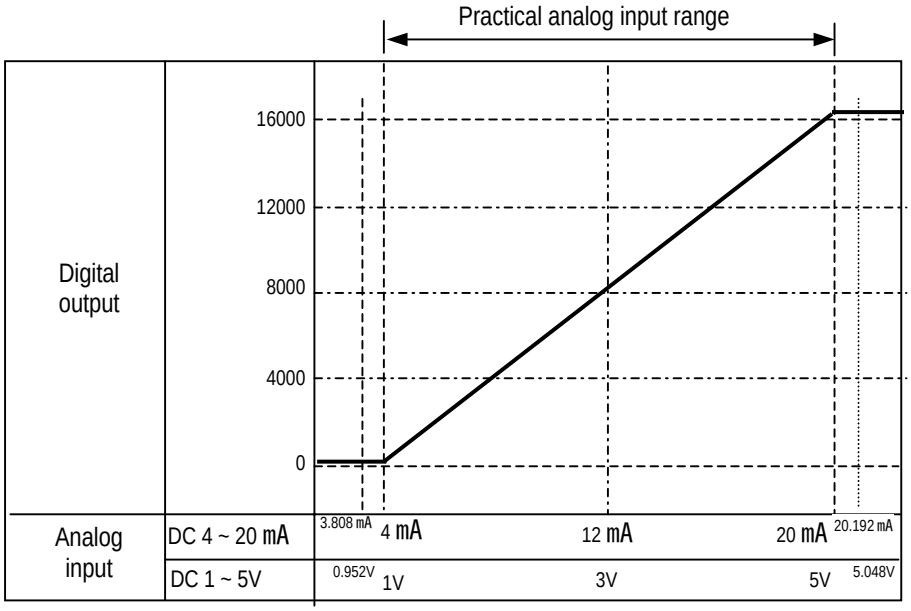
! Caution

1. When digital output is set to the range of -192 to 16191, despite a analog input more than the range of -192 to 16191, Digital output value is set to-192 or 16191.
   When digital output is set to the range of –8192 to 8191, despite a analog input more than the range of -8192 or 8191, digital output value is set to -8192 or 8191.
2. Do not apply ±15 V /±25 mA or more. This will damage the module due to a heat rise.
3. Set an offset/gain value on the G4F-AD2A to the range that gain value is more than offset value, or you won't get an accurate digital output.

2.4.3 G3F-AD4B I/O Characteristics

▶ I/O conversion characteristics are expressed by the angle of used to convert the analog signals(voltage or current input), input to the PLC into digital values as shown below

▶ A/D coversion module is possible to select voltage/current by analog input range select switch by channel but cannot change offset/gain value because it is set



I/O Conversion characteristics

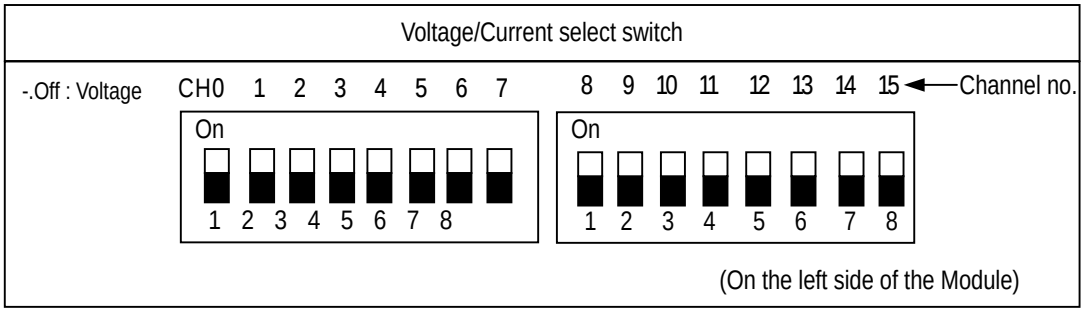
Caution

1. Despite a analog input more than the range of 16000 or 0, digital output value is set to 16000 or 0.
2. Do not apply +15 V /+25 mA or more. This will damage the module due to a heat rise.

1) Voltage input characteristics(DC 1 ~5V)

▶ For voltage input, input variables IN_SEL of initial funtion block is set to “1”

▶ The position of voltage/current select switch is set to “off” by channel



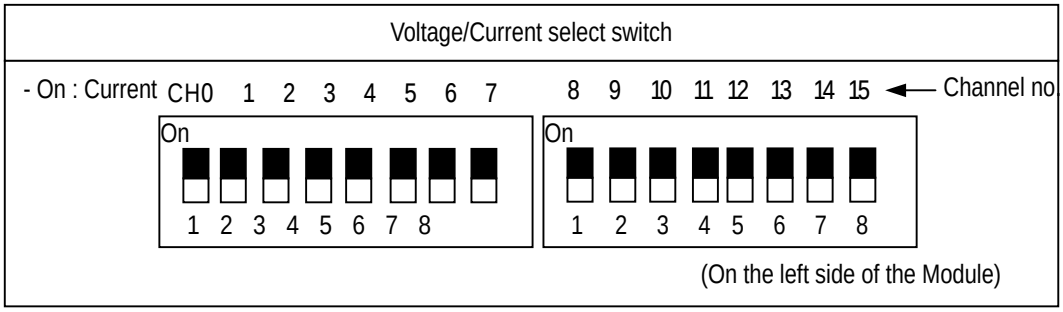
▶Digital value to voltage input characteristics is shown as below

Section	Analog input voltage(V)						
	Lower 1	1	2	3	4	5	Upper 5
Digital output	0	0	4000	8000	12000	16000	16000

2) Current input characteristics(DC 4 ~20mA)

▶ For current input, input variables IN_SEL of initial funtion block is set to “0”

▶ The position of voltage/current select switch is set to “on” by channel



▶ Digital value to current input characteristics is shown as below

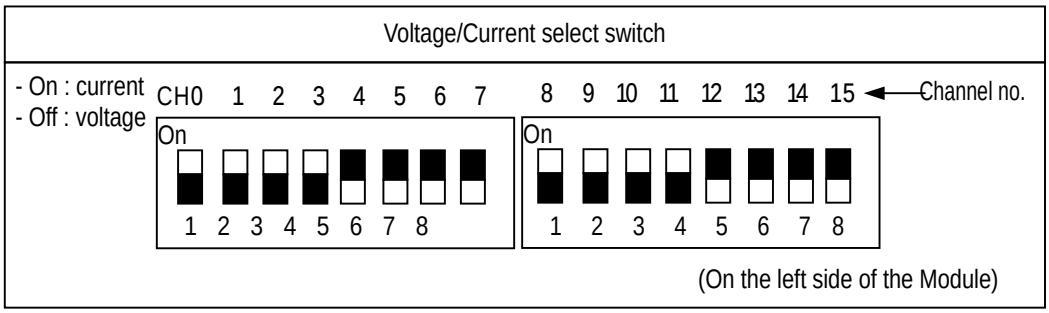
Section	Analog input current(㎃)						
	Lower 4	4	8	12	16	20	Upper 20
Digital output	0	0	4000	8000	12000	16000	16000

3) Simultaneous Voltage and Current Input Characteristics

▶ For the channel used to voltage input, input variable IN_SEL of initial funtion block is set to “1” by channel, and the position of voltage/current select switch is set to “off”

▶ For the channel used to current input, input variable IN_SEL of initial funtion block is set to “0” by channel, and the position of voltage/current select switch is set to “on”

Ex) The channel used to voltage input : channel 0~3, 8~11, The channel used to current input : channel 4~7,12~15

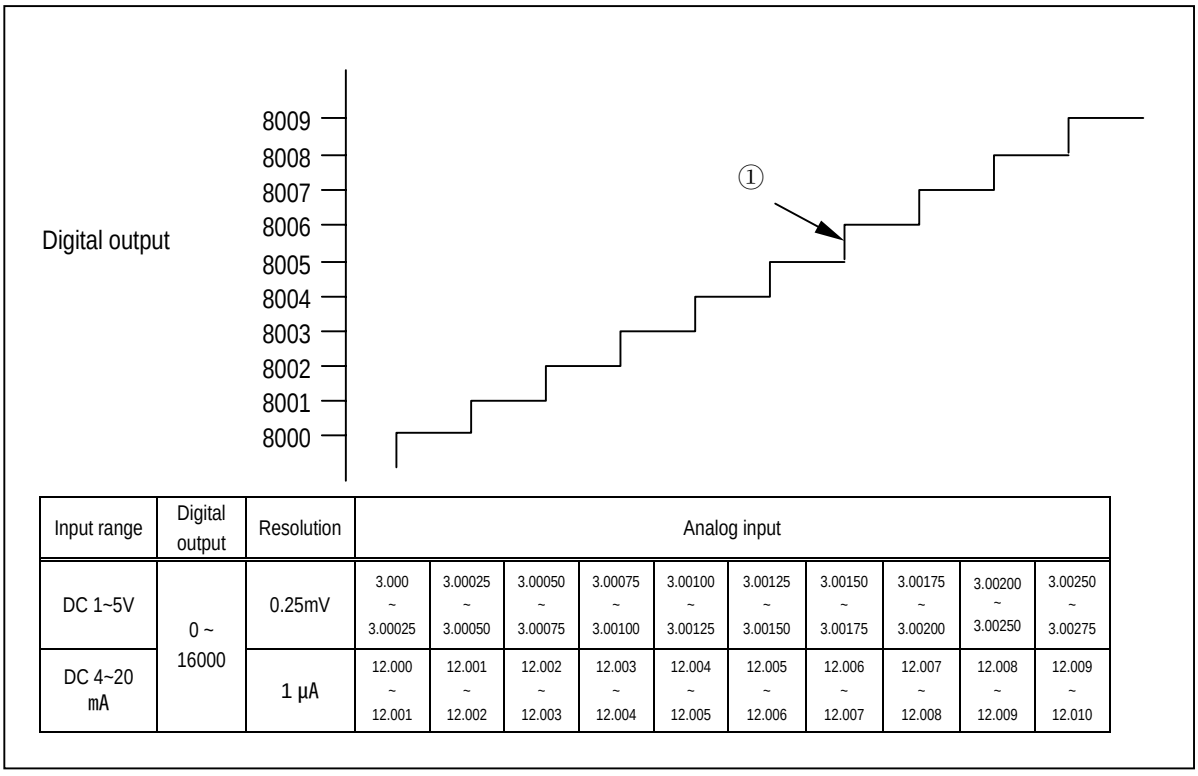


▶Digital output to voltage/current input characteristics is shown as below

Section		Analog input						
Input type	1~ 5V	Lower 1	1	2	3	4	5	Upper 5
	4~20mA	Lower 4	4	8	12	16	20	Upper 20
Digital output		0	0	4000	8000	12000	16000	16000

4) The connection between Analog input and Digital output

The connection between Analog input and Digital output is shown as below



Input range	Digital output	Resolution	Analog input									
DC 1~5V	0 ~ 16000	0.25mV	3.000 ~ 3.00025	3.00025 ~ 3.00050	3.00050 ~ 3.00075	3.00075 ~ 3.00100	3.00100 ~ 3.00125	3.00125 ~ 3.00150	3.00150 ~ 3.00175	3.00175 ~ 3.00200	3.00200 ~ 3.00250	3.00250 ~ 3.00275
DC 4~20 mA		1 μA	12.000 ~ 12.001	12.001 ~ 12.002	12.002 ~ 12.003	12.003 ~ 12.004	12.004 ~ 12.005	12.005 ~ 12.006	12.006 ~ 12.007	12.007 ~ 12.008	12.008 ~ 12.009	12.009 ~ 12.010

Analog input and Digital output

2.4.4 The connection between Offset/Gain Setting and Digital Output Value

1) Resolution

Resolution is determined as below formulas.

(1) Voltage input

$$\text{Resolution} = \frac{\text{Gain value} - \text{Offset value}}{8000} \times 1000\ (\text{mV})$$

Ex) Gain value : 0 V Offset value : - 10 V

$$\text{Resolution} = \frac{0 - (-10)}{8000} \times 1000\ \text{mV} = 1.25\ \text{mV}$$

(2) Current input

$$\text{Resolution} = \frac{\text{Gain value} - \text{Offset value}}{8000} \times 1000\ (\mu\text{A})$$

Ex) Gain value : 0 mA Offset value : - 20 mA

$$\text{Resolution} = \frac{0 - (-20)}{8000} \times 1000\ \mu\text{A} = 2.5\ \mu\text{A}$$

2) The connection between Maximum Resolution and Digital Output Value

On the occasion of calculating, as follows, by offset/gain setting, digital output value 1 at a time doesn't increase or decrease.

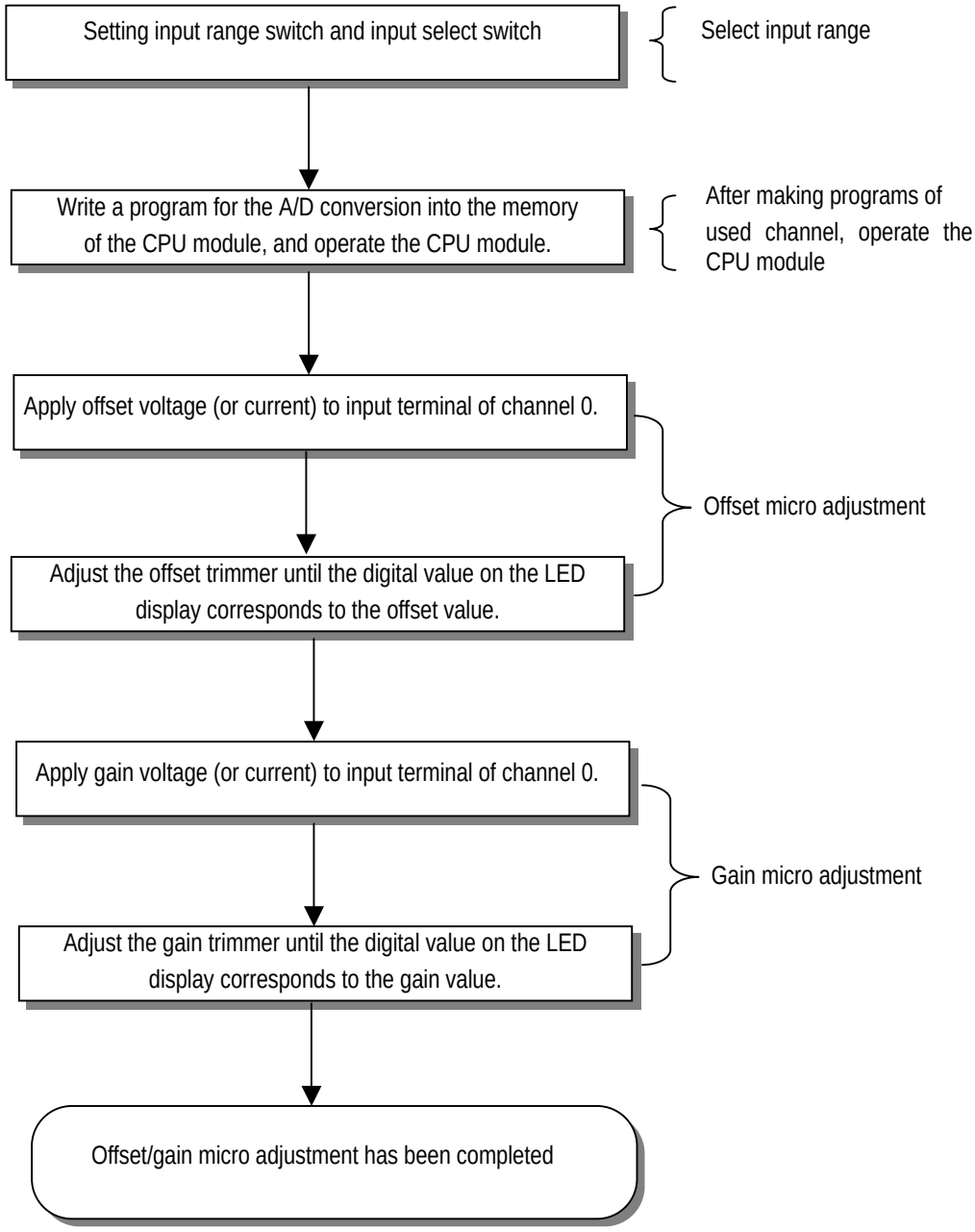
$$\frac{\text{Gain value} - \text{Offset value}}{8000} < \text{Resolution}$$

3) Offset / Gain Setting

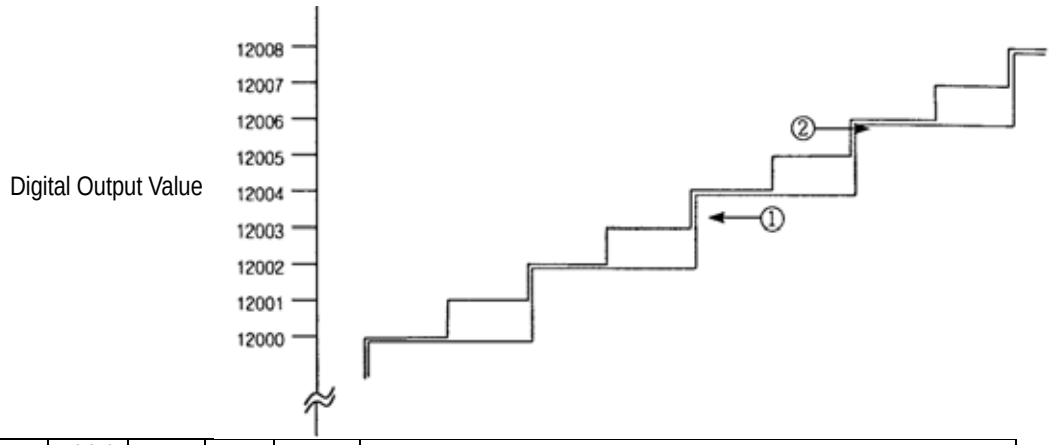
(1) Offset/gain setting of the G3F-AD4A

a) Offset/gain sets procedure.

: Offset/gain setting is performed for 16 channels in block.

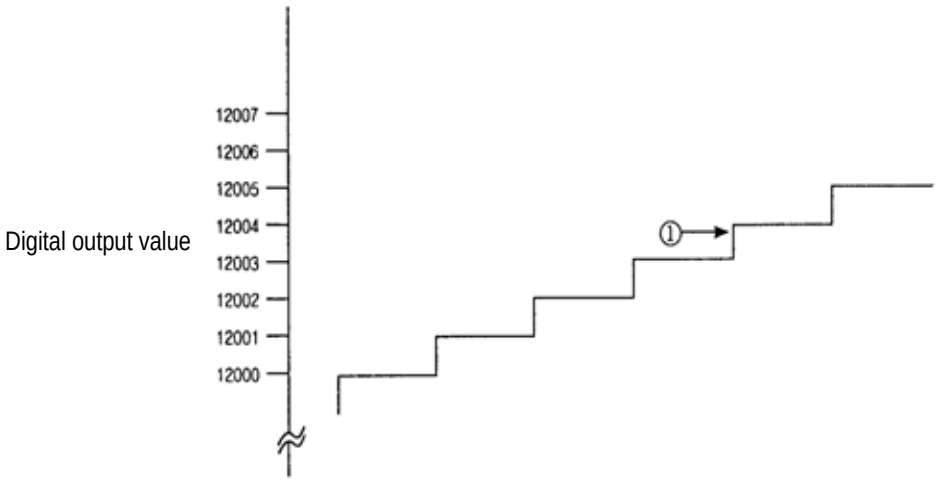


b) I/O characteristics in accordance with Offset/Gain setting



No	Input range	Digital output range	Offset value	Gain value	Resolution	Analog input value (V)							
※	DC–1 0~10V	-192 ~ 16191	0V	10V	1.25 mV	5.000 ~ 5.00125		5.00125 ~ 5.0025		5.0025 ~ 5.00375		5.00375 ~ 5.005	
※	DC –5~5V	-192 ~ 16191	0V	5V	0.625 mV	5.000 ~ 5.000625	5.00625 ~ 5.00125	5.00125 ~ 5.001875	5.001875 ~ 5.0025	5.0025 ~ 5.003125	5.003125 ~ 5.00375	5.00375 ~ 5.004375	5.004375 ~ 5.005

Voltage input and digital output value



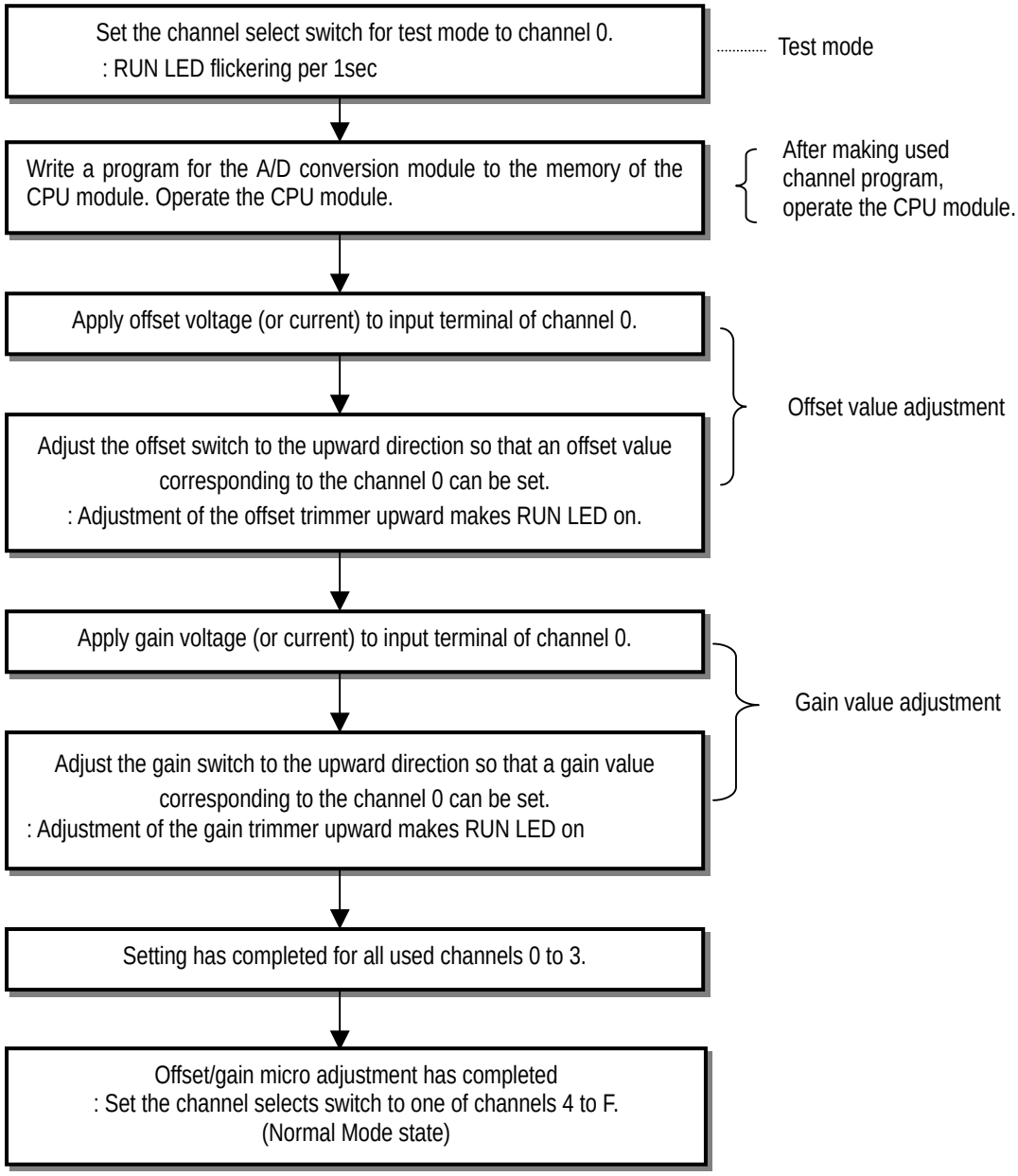
No	Input range	Digital output range	Offset value	Gain value	Resolution	Analog input value (mA)					
※	DC–2 0~20 mA	-192 ~ 16191	0 mA	20 mA	0.0025 mA	10.000 ~ 10.0025	10.0025 ~ 10.0050	10.0050 ~ 10.0075	10.0075 ~ 10.0100	10.0100 ~ 10.0125	10.0125 ~ 10.0150

Current input and digital output value

(2) Offset/Gain Setting of the G4F-AD2A

a) Offset/gain Setting Procedure

Set offset / gain values for each channel.



REMARK

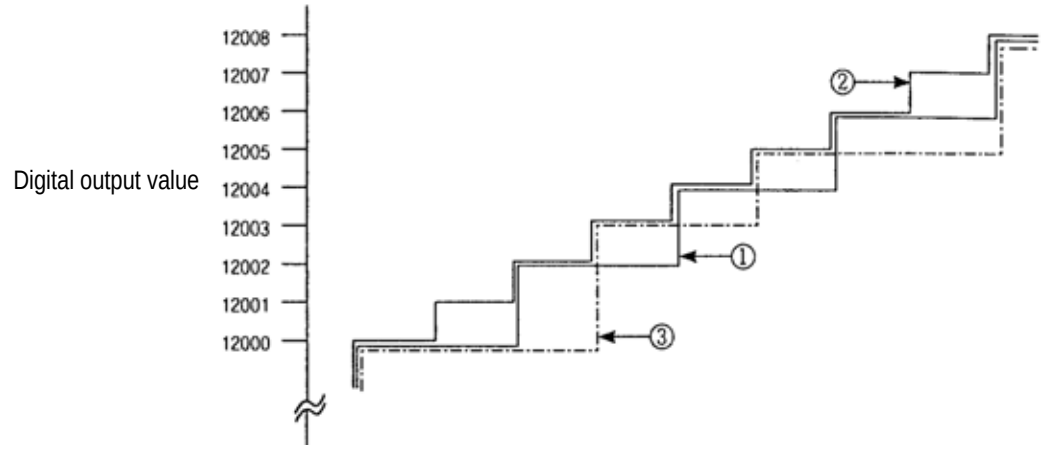
(1) Set offset/gain value within practical input range.

(2) Offset/gain value is stored in the G4F-AD2A and remains after power-off.

(3) Set offset/gain value to the range of from-10 to 10 volts DC or from –20 to 20 mA.
However, if this range is exceeded, the resolution and accuracy will be impaired.

(4) At the change of grounding position in the *5 of 3.2.2, be sure to restart offset/gain value from the beginning

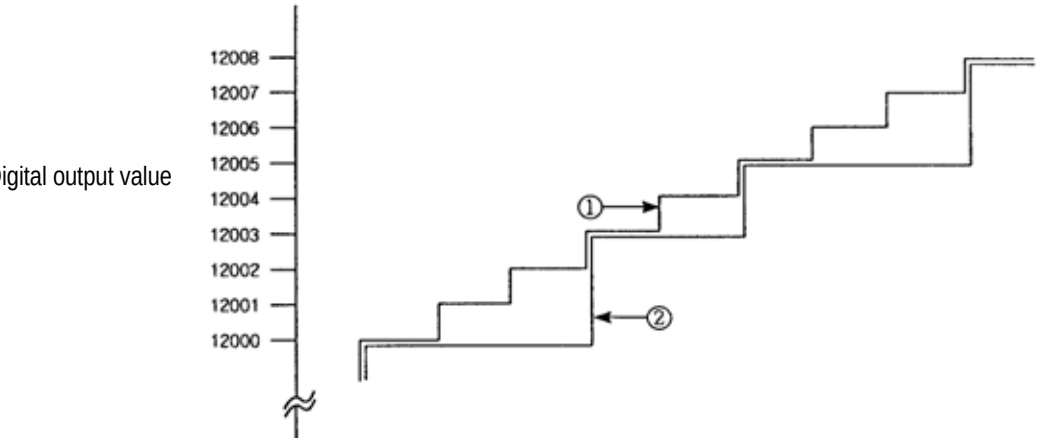
b) Input/output Characteristics According to Offset/Gain Setting



No	Input range	Digital output range	Offset value	Gain value	Resolution	Analog input value (V)							
ℵ	DC -10~ 10 V	-192 ~ 16191	0 V	10 V	1.25 mV	5.000 ~ 5.00125		5.00125 ~ 5.0025		5.0025 ~ 5.00375		5.00375 ~ 5.005	
ℑ	DC -5 ~ 5 V	-192 ~ 16191	0 V	5 V	0.625 mV	5.000 ~ 5.000625	5.00625 ~ 5.00125	5.00125 ~ 5.001875	5.001875 ~ 5.0025	5.0025 ~ 5.003125	5.003125 ~ 5.00375	5.00375 ~ 5.004375	5.004375 ~ 5.005
ℑ	DC -5 ~ 5 V	-192 ~ 16191	1 V	2.5 V	0.125 mV	4.000 ~ 4.000625			4.000625 ~ 4.00125			4.00125 ~ 4.001875	

* ℜ is over the maximum resolution, so digital value 1 at a time doesn't increase or decrease.

Voltage input and digital output value

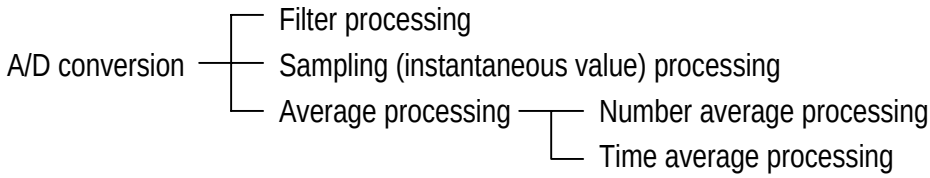


No	Input range	Digital output range	Offset value	Gain value	Reso-lution	Analog input value (mA)								
ℵ	DC -20~20 mA	-192 ~ 16191	-20 mA	0 mA	0.0025 mA	10.000 ~ 10.0025	10.0025 ~ 10.0050	10.0050 ~ 10.0075	10.0075 ~ 10.0100	10.0100 ~ 10.0125	10.0125 ~ 10.0150	10.0150 ~ 10.0175	10.0175 ~ 10.0200	10.0200 ~ 10.0225
ℑ	DC -20~20 mA	-192 ~ 16191	4 mA	12 mA	0.001 mA	16.000 ~ 16.0025			16.0025 ~ 16.0050			16.0050 ~ 16.0075		

* ℑ is over the maximum resolution so digital value 1 at a time doesn't increase or decrease.

Current input and Digital output value

2.5 A/D Conversion Characteristics



2.5.1 Filter Processing

Filter processing noise or the quick change of input value helps to use a stable digital value compared with analog value.

$$PVfn = (1 - \alpha) \times PVn + \alpha\ PVfn_{-1}$$

PVfn : present filter output value
PVn : present A/D conversion value
$PVfn_{-1}$: previous filter output value
α : Filter constant(the range: 0.01 to 0.99)
Filter constants used here are 1 to 99.

Ex1) G3F-AD4A/G4F-AD2A

Offset value : –10 VDC, Gain Value : 0 VDC

(Voltage input range : -10 ~ 10 VDC, Digital output range : -192 ~ 16191)

When analog value is changed in the sequence like -10V, -5V, 0V, and 5V, filter output is shown as below.

Value of α	Filter output value				Remarks
0.01	0	3960	7960	11960	α leaning to the previous value by 1 %
0.5	0	2000	5000	8500	α leaning to the previous value by 50 %
0.99	0	40	120	239	α leaning to the previous value by 99 %

Ex2) G3F-AD4B

Voltage input range : 1 ~ 5 VDC, Digital output range : 0 ~ 16000

When analog value is changed in the sequence like 1V, 2V, 3V, and 4V, filter output is shown as below.

Value of α	Filter output value				Remarks
0.01	0	3960	7960	11960	α leaning to the previous value by 1 %
0.5	0	2000	5000	8500	α leaning to the previous value by 50 %
0.99	0	40	120	239	α leaning to the previous value by 99 %

That is, filter disable allows present A/D conversion value to be displayed and filter enable allows A/D conversion value to be displayed by filter constant according to the relative importance between present A/D conversion value and previous value.

2.5.2 Sampling Processing (Instantaneous Value)

This is general A/D conversion processing. In other words, analog input value is to be converted to digital value without average processing in direct. Sampling period for writing digital value to the memory is changed according to the number of used channels.

(Process time) = (Number of channels) × Conversion speed

Ex) When 3 channels are used.

- G3F – AD4A(G3F-AD4B) : 3(number of channel used) × 3(Conversion speed) = 9 (ms)
- G4F – AD2A : 3(number of channel used) × 5(Conversion speed) = 15 (ms)

Sampling processing means, when average processing isn't used, analog input value is to be converted to digital value in direct.

2.5.3 Average Processing

1) The Cause of Average Processing

Average processing of noise or abnormal analog input is used to stabilize system control.

2) Kinds of Average Processing

There are kinds of average processing, which are time average and number average.

(1) Time Average Processing

a) Setting Range

G3F-AD4A(G3F-AD4B) : 96 to 12,000 (ms)

G4F-AD2A : 40 to 20,000(ms)

b) On the time average processing, the number of average processing within the Set time is determined according to the number of used channels .

$$\text{Processing number} = \frac{\text{Set time}}{\text{Used channels} \times \text{Conversion speed}}$$

Ex) Used channels : 4, Set time : 120 ms

G3F-AD4A(G3F-AD4B) : 120÷(4×3) = 10 count

G4F-AD2A : 120÷(4×5) = 6 count

c) When Set time divided by(Number of used channel×Conversion speed) makes the residue occur, the processing number will be [{ average processing number ÷ (the number of used channel × conversion speed) } + 1] by raising the residue.

Ex) Used channels: 4, Set time : 150 ms

G3F-AD4A(G3F-AD4B) : 150÷(4×3) = 12 count + remain 6 ⟶ 13 count

G4F-AD2A : 150÷(4×5) = 7 count + remain 10⟶ 8 count

(2) Number Average Processing

a) Setting range

G3F - AD4A(G3F-AD4B, G4F-AD2A) : 2 to 4000 (count)

b) Number average processing period for writing digital value to the buffer memory is changed according to the number of channels.

Processing time = Setting times×Number of used channels×Conversion speed

Ex) Used channels: 4, Average processing time: 50 count.

G3F - AD4A(G3F-AD4B) : 50×4×3 = 600 ms

G4F - AD2A : 50×4×5 = 1000 ms

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

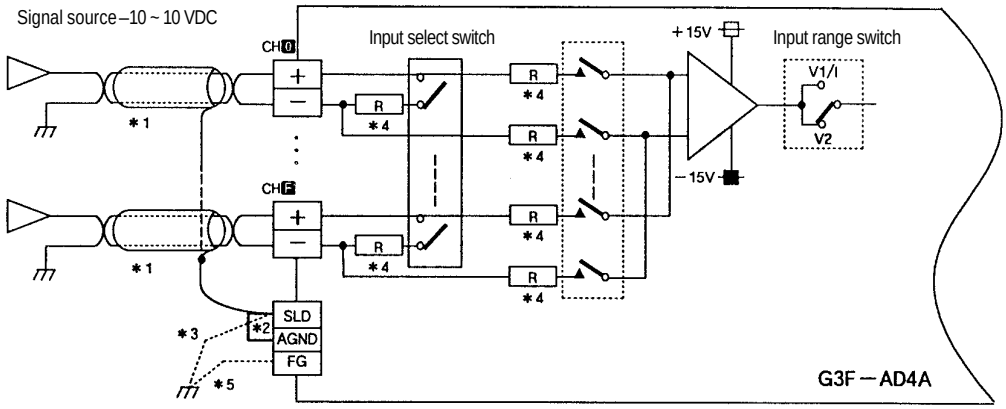
3.2.1 Wiring Precautions

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㎟) 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.
6) Don't put the power cable in front of the LED display
(In order to read the digital value on the LED correctly)

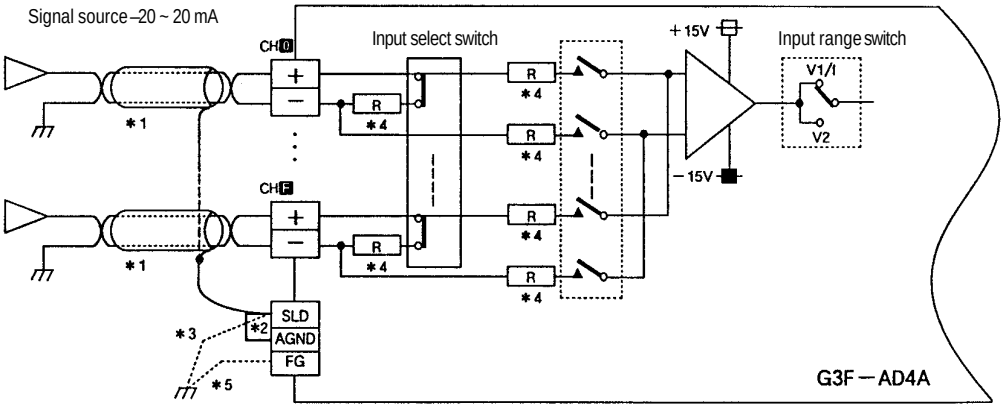
3.2.2 Wiring Examples

1) G3F-AD4A

(1) Voltage Input



(2) Current Input



*1 For the cable, use a two-core twisted shielded wire.

*2 The SLD terminal and AGND terminal has to be connected.

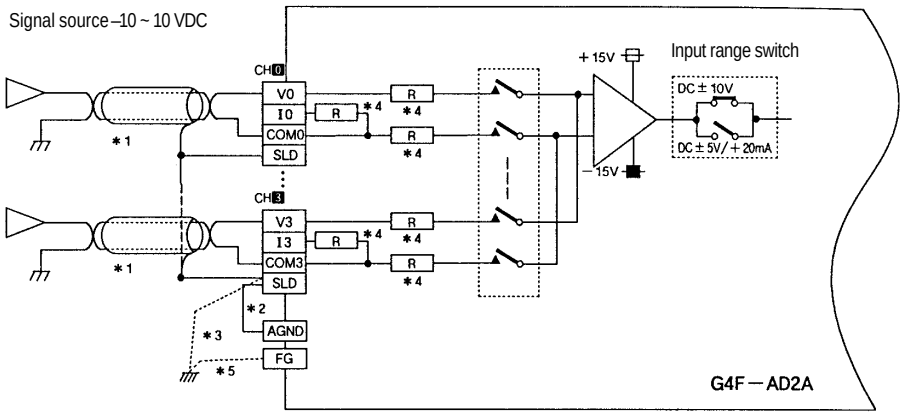
*3 When there is much noise, the SLD terminal and FG terminal has to be grounded.

*4 Input resistance has been shown.

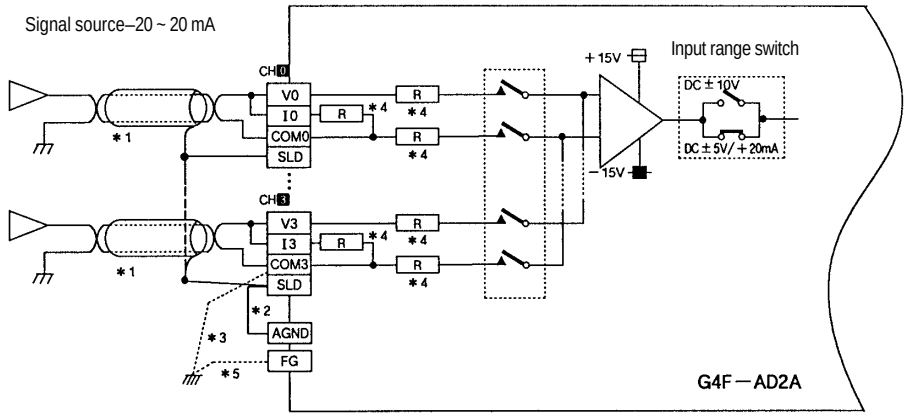
*5 When there is much noise, FG of the power supply module must be grounded.

2) G4F-AD2A

(1) Voltage Input



(2) Current Input



*1 For the cable, use a two-core twisted shielded wire.

*2 The SLD terminal and AGND terminal has to be connected.

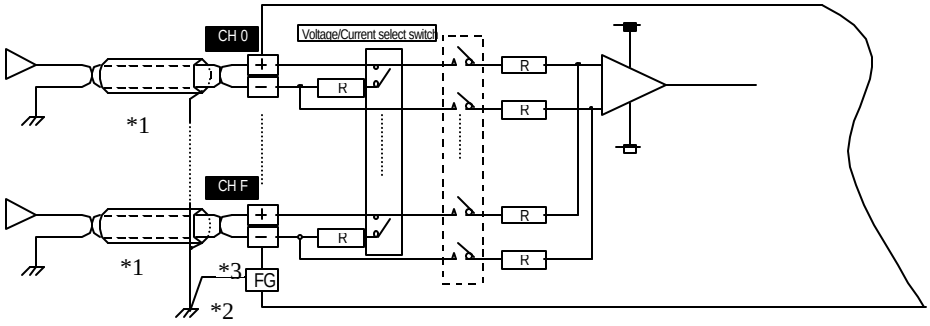
*3 When there is much noise, the SLD terminal and FG terminal has to be grounded.

*4 Input resistance has been shown.

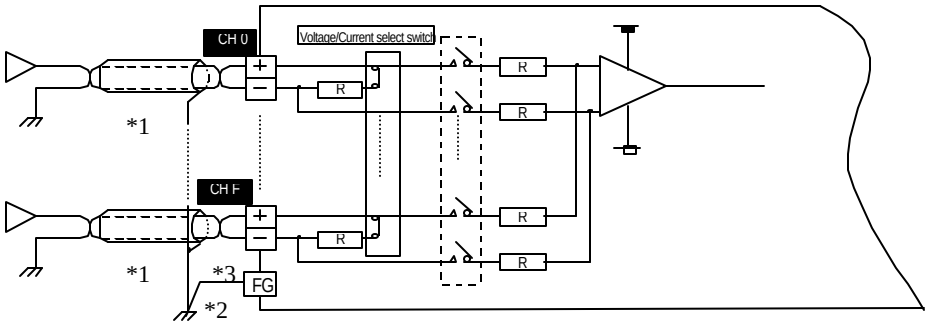
*5 When there is much noise, FG of the power supply module must be grounded.

3) G3F-AD4B

(1) Voltage Input



(2) Current Input



*1 For the cable, use a two-core twisted shielded wire.

*2 When there is much noise, shielded wire has to be grounded

*3 When there is much noise, the shielded wire and FG terminal has to be grounded.

CHAPTER 4. FUNCTION BLOCK

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

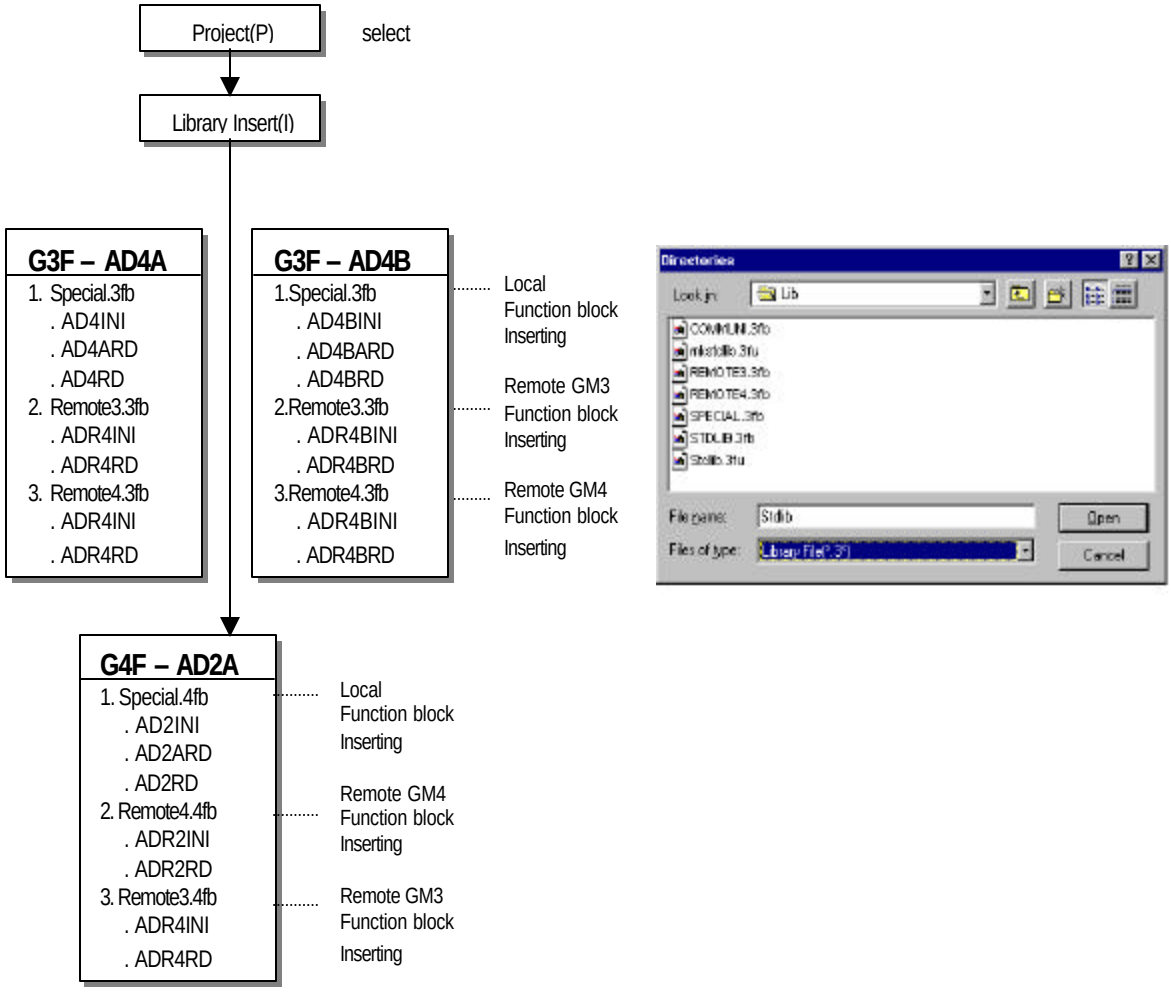
A kind of function block is as follows.

No	G3F-AD4A		G4F-AD2A		G3F-AD4B		Function
	Local	Remote	Local	Remote	Local	Remote	
1	AD4INI	ADR4INI	AD2INI	ADR2INI	AD4BINI	ADR4BINI	Initializing module
2	AD4ARD	ADR4RD	AD2ARD	ADR2RD	AD4BARD	ADR4BRD	Reading A/D conversion value(Array Type)
3	AD4RD	-	AD2RD	-	AD4BRD	-	Reading A/D conversion value(Single Type)

4.1 Insertion 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.

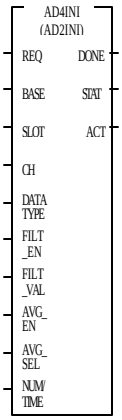
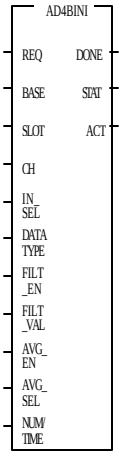
Function block can be inserted only in the open condition of the Project.



4.2 Local Function Block

4.2.1 Module Initialization : (G3F-AD4A: AD4INI, G4F-AD2A: AD2INI, G3F-AD4B: AD4BINI)

Module Initialization function block is a program for the use in setting base location number and the slot location number of an A/D conversion module, specifying an available channel enable, a data type for A/D conversion, filter processing data, and average processing data.

Function block	I/O	Variable	Data type	Descriptions
G3F-AD4A (G4F-AD2A)  G3F-AD4B 	Input	REQ	BOOL	Function Block Execution Request Area - The execution of function block initialization 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 : GM1 series(0 to 31), GM2 series(0 to 7), GM3/4 series(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 [Array] *note1	Available Channel Specification Area - Available channels are specified in this area. - Enabled channels are specified to 1 and disabled channels are specified to 0.
		IN_ SEL *note3	BOOL [Array]	Analog Input Type(current/voltage) Specification Area - 0 is for the select of current input - 1 is for the select of voltage input
		DATA TYPE	BOOL [Array] *note1	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. (G3F-AD4B: 0~16000) - 1 is for the range of -8192 to 8191. (G3F-AD4B: -8000~8000)
		FILT _EN	BOOL [Array] *note2	Filter Processing Enable Specification Area - 0 is for the sampling processing. - 1 is for the filter processing.
		FILT _VAL	USINT [Array] *note2	Filter Constant Setting Area - Setting range: 1 to 99
		AVG_ EN	BOOL [Array] *note2	Average Processing Enable Specification Area - 1 is for the average processing. - 0 is for the sampling process.
		AVG_ SEL	BOOL [Array] *note2	Average process Type Specification Area - 1 is for the time average. - 0 is for the number average.
		NUM/ TIME	USINT [Array] *note2	Average Number or Average Time Set Area - The number or time is set in accordance with the average process type specified on the AVG_SEL. - Average number :2 to 4000 (count) - Average time : G3F-AD4A/G3F-AD4B: 96 to12,000(ms), G4F-AD2A: 40 to 20,000(ms)
	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. - Error code is referred to GM Section 1.4.
		ACT	BOOL [Array] *note1	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

*note 1 : The number of array is G3F-AD4A of 16, G3F-AD4B of 16 and G4F-AD2A of 4 .

*note 2 : The number of array is G3F-AD4A of 4, G3F-AD4B of 16 and G4F-AD2A of 4 .

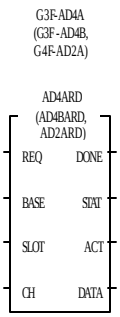
On the G3F-AD4A, the element number (0) is specified to channel 0, 1, 2, 3 in block,
the element number (1) is specified to channel 4, 5, 6, 7, in block.
the element number (2) is specified to channel 8, 9, 10, 11 in block.
the element number (3) is specified to channel 12, 13, 14, 15 in block.

On the G4F-AD2A, the element numbers means the channel ones.

*note 3 : Only on the G3F-AD4B, the number of array is 16, the element numbers means the channel ones.

4.2.2 Module Reading-Array Type : (G3F-AD4A : AD4ARD, G4F-AD2A : AD2ARD, G3F-AD4B : AD4BARD)

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
	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 : GM1 series(0 to 31), GM2 series(0 to 7), GM3/4 series(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 [Array] *note1	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	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. - Error code is referred to Section 4.4.
		ACT	BOOL [Array] *note1	Channel Operation Display Area - The channel specified after executing the function block read with no error is right, 1 is written and, on the non-specified channel, 0 is written
		DATA	INT [Array] *note1	A/D Conversion Value Output Area

REMARK

*note 1: The number of array is G3F-AD4A of 16, G3F-AD4B of 16 and G4F-AD2A of 4 , the element numbers means the channel ones.

4.2.3 Module Reading - Single Type : (G3F-AD4A : AD4RD, G4F-AD2A : AD2RD, G3F-AD4B : AD4BRD)

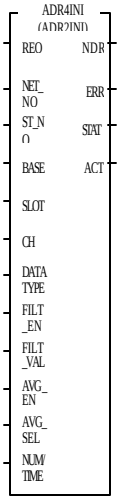
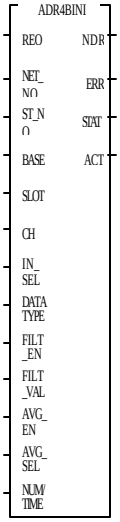
Single type of function block for reading the module is performed for only one channel and the specified channel is used to read output variable of data displayed from A/D conversion digital value.

Function Block	I/O	Variable	Data type	Descriptions
G3F-AD4A (G3F-AD4B, G4F-AD2A) AD4RD (AD4BRD, AD2RD) 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 Module Location Number Area - The base No. on which A/D conversion module is mounted is written on this area. - Setting range : GM1 series(0 to 31), GM2 series(0 to 7), GM3/4 series(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	USINT	Available Channel Specification Area - Available channels are specified in this area. - Setting range: G3F-AD4A/G3F-AD4B : 0 to 15, G4F-AD2A : 0 to 3
	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 initialization, the error code number is written. - Error code is referred to Section 4.4.
		DATA	INT	A/D Conversion Value Output Area

4.3 Remote Function Block

4.3.1 Module Initialization : (G3F-AD4A: ADR4INI, G4F-AD2A: ADR2INI, G3F-AD4B: ADR4BINI)

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 available channel enable, a data type for A/D conversion, filter process data, and average process data.

Function Block	I/O	Variable	Data type	Descriptions
G3F-AD4A (G4F-AD2A)  	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 [Array] *note1	Available Channel Specification Area - Available channels are specified in this area. - Enabled channels are specified to 1 and disabled channels are specified to 0.
		IN_SEL*note3	BOOL [Array]	Analog Input Type(current/voltage) Specification Area - 0 is for the select of current input. – 1 is for the select of voltage input.
		DATA TYPE	BOOL [Array] *note1	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. (G3F-AD4B : 0 ~ 16000) - 1 is for the range of -8192 to 8191. (G3F-AD4B : -8000 ~ 8000)
		FILT_EN	BOOL [Array] *note2	Filter Process Enable Specification Area - 0 is for the sampling processing. - 1 is for the filter processing.
		FILT_VAL	USINT [Array] *note2	Filter Constant Setting Area - Setting range: 1 to 99
		AVG_EN	BOOL [Array] *note2	Average Process Enable Specification Area - 1 is for the average processing. - 0 is for the sampling process.
		AVG_SEL	BOOL [Array] *note2	Average process Type Specification Area - 1 is for the time average. - 0 is for the number average.
		NUM/TIME	USINT [Array] *note2	Average Number or Average Time Set Area - The number or time is set in accordance with the average process type specified on the AVG_SEL. - Average number :2 to 4000(count) - Average time : G3F-AD4A/G3F-AD4B 96 to12,000(ms), G4F-AD2A: 40 to 20,000(ms)
G3F-AD4B  	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. - Error code is referred to Section 4.4.
		ACT	BOOL [Array] *note1	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

*note 1 : The number of array is G3F-AD4A of 16, G3F-AD4B of 16 and G4F-AD2A of 4 .
*note 2 : The number of array is G3F-AD4A of 4, G3F-AD4B of 16 and G4F-AD2A of 4.
On the G3F-AD4A, the element number (0) is specified to channel 0, 1, 2, 3 in block,
the element number (1) is specified to channel 4, 5, 6, 7, in block.
the element number (2) is specified to channel 8, 9, 10, 11 in block.
the element number (3) is specified to channel 12, 13, 14, 15 in block.
On the G4F-AD2A, the element numbers means the channel ones.
*note 3 : Only on the G3F-AD4B, the number of array is 16, the element numbers means the channel ones.

4.3.2 Module Reading: (G3F-AD4A: ADR4RD, G4F-AD2A: ADR2RD, G3F-AD4B: ADR4BRD)

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
G3F-AD4A (G3F-AD4B, G4F-AD2A) ADR4RD (ADR4BRD, ADR2RD) REQ NDR NET_NO ERR ST_NO STAT BASE ACT SLOT DATA 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 [Array] *note1	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 atthe 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. - Error code is referred to Section 4.4.
		ACT	BOOL [Array] *note1	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 [Array] *note1	A/D Conversion Value Output Area

REMARK

*note 1: The number of array is G3F-AD4A of 16, G3F-AD4B of 16 and G4F-AD2A of 4, the element numbers means the channel ones.

4.4 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 Section 4.2)
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
10		Test mode	-	O	O	Transmit the test mode to normal mode (G4F-AD2A only)
16		Filter value exceeding the proper range	O	-	-	Correct the value to the range of 1 to 99
17		Average number/time value exceeding the proper range	O	-	-	Correct the value to the proper range (Number:2 to 4,000 Time: G3F-AD4A, G3F-AD4B 96 to 12,000(ms) G4F-AD2A 40 to 20,000(ms))
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 Section 4.2)
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
138		Test mode	-	O		Transmit the test mode to normal mode (G4F-AD2A only)
144		Filter value exceeding the proper range	O	-		Correct the value to the range of 1 to 99
145		Average number/time value exceeding the proper range	O	-		Correct the value to the proper range (Number:2 to 4,000 Time: G3F-AD4A, G3F-AD4B 96 to 12,000(ms) G4F-AD2A 40 to 20,000(ms))

Chapter 5. GM PROGRAMMING

5.1 Programming for Distinction of A/D Conversion Value

1) System Configuration

GM3-PA1A	GM3-CPUA	G3F-AD4A	G3Q-RY4A

2) Initial Settings

(1) Available channel enable : channel 0, 2, 4
(2) Conversion data range: -192 to 16191(channel 0, 2, 4)
(3) Filter channel enabled : channel 0
(4) Filter constant setting : channel 0 = 50
(5) Average processing setting : channel 2, 4
(6) Number average setting and set value : channel 2 = 100 count
(7) Time average setting and set value : channel 4 = 200 ms
(8) Analog input : current input(DC –20 ~ 20 mA)

3) Descriptions of the Program

(1) The digital value less than 12,000 of channel 0 turns %Q0.1.0 on.
(2) The digital value more than 13,600 of channel 2 turns %Q0.1.1 on.
(3) The digital value more than 12,000 or same, and less than 13,600 or same of channel 4 turns %Q0.1.2 on.
(4) The digital value of the same as 12,800 of channel 4 turns %Q0.1.3 on.

4) Programming

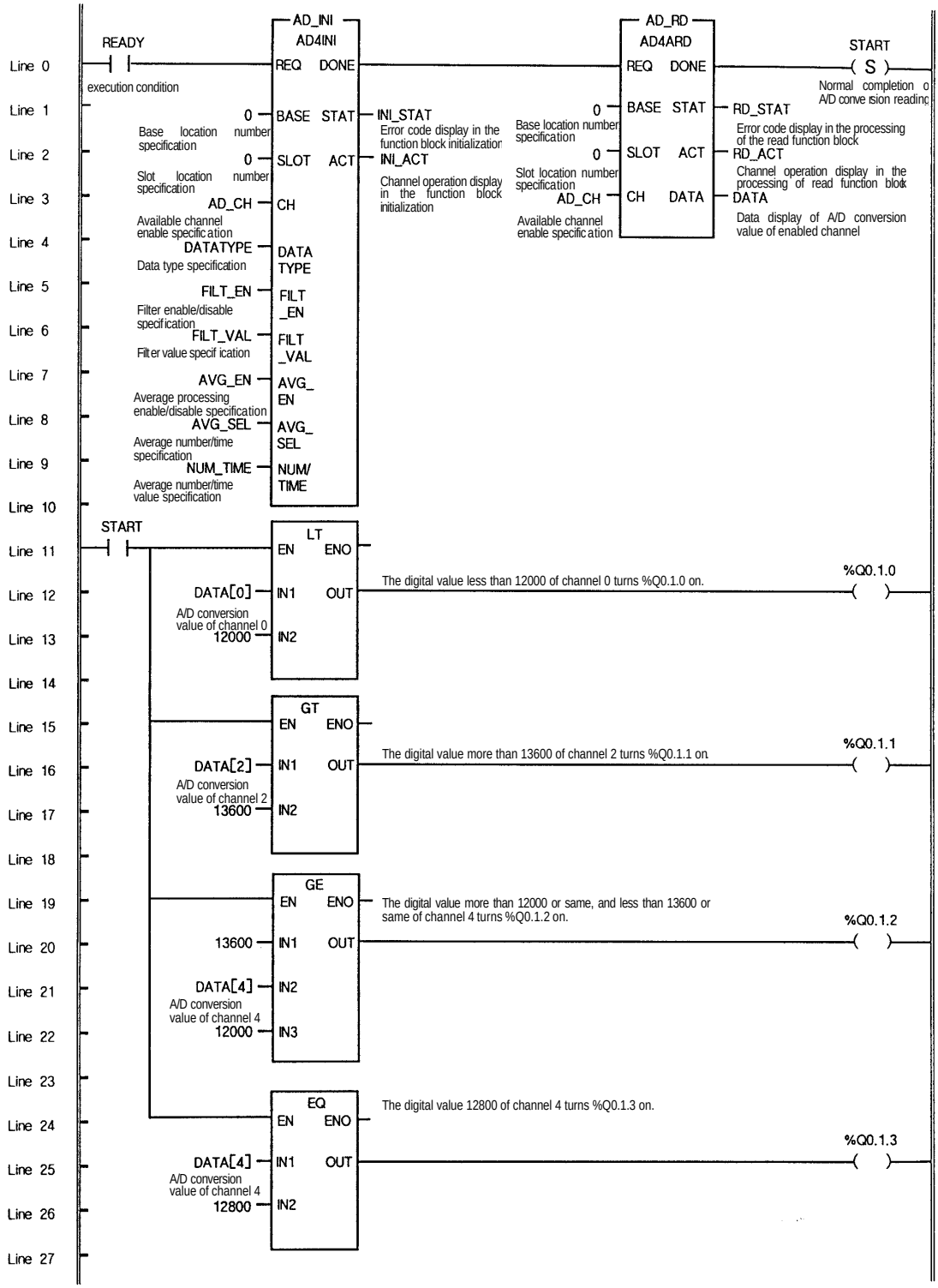
(1) G3F-AD4A

A) Precautions of the programming

REMARK

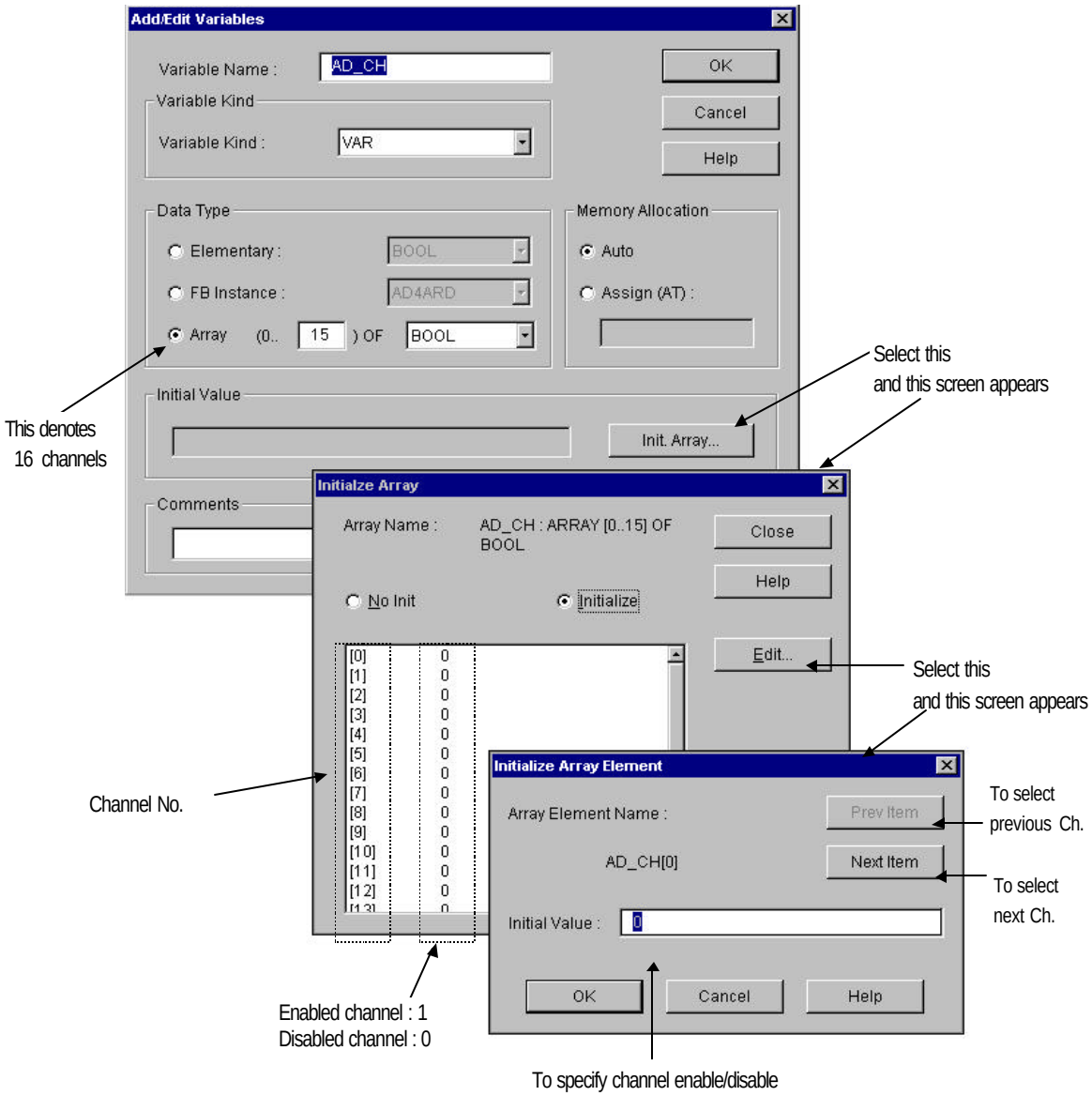
- In the Initial setting
  1) At the part of (3), if channel 0 is enabled to the filter processing, channel 0 to 3 will be enabled to the filter processing in block.
  2) At the part of (4), if channel 0 is enabled to the filter constant, channel 0 to 3 will be enabled to the filter constant of 50 in block.
  3) At the part of (5), if channel 2 and 4 are enabled to the average processing, channel 0 to 3 and 4 to 7 will be enabled to the average processing in block.
  4) At the part of (6),if channel 2 is enabled to the number average value of 100, channel 0 to 3 will be enabled to the number average value of 100 in block.
  5) At the part of (7), if channel 4 is enabled to the time average value of 200ms, channel 4 to 7 will be enabled to the time average value of 200 ms in block.

B) Programming Example

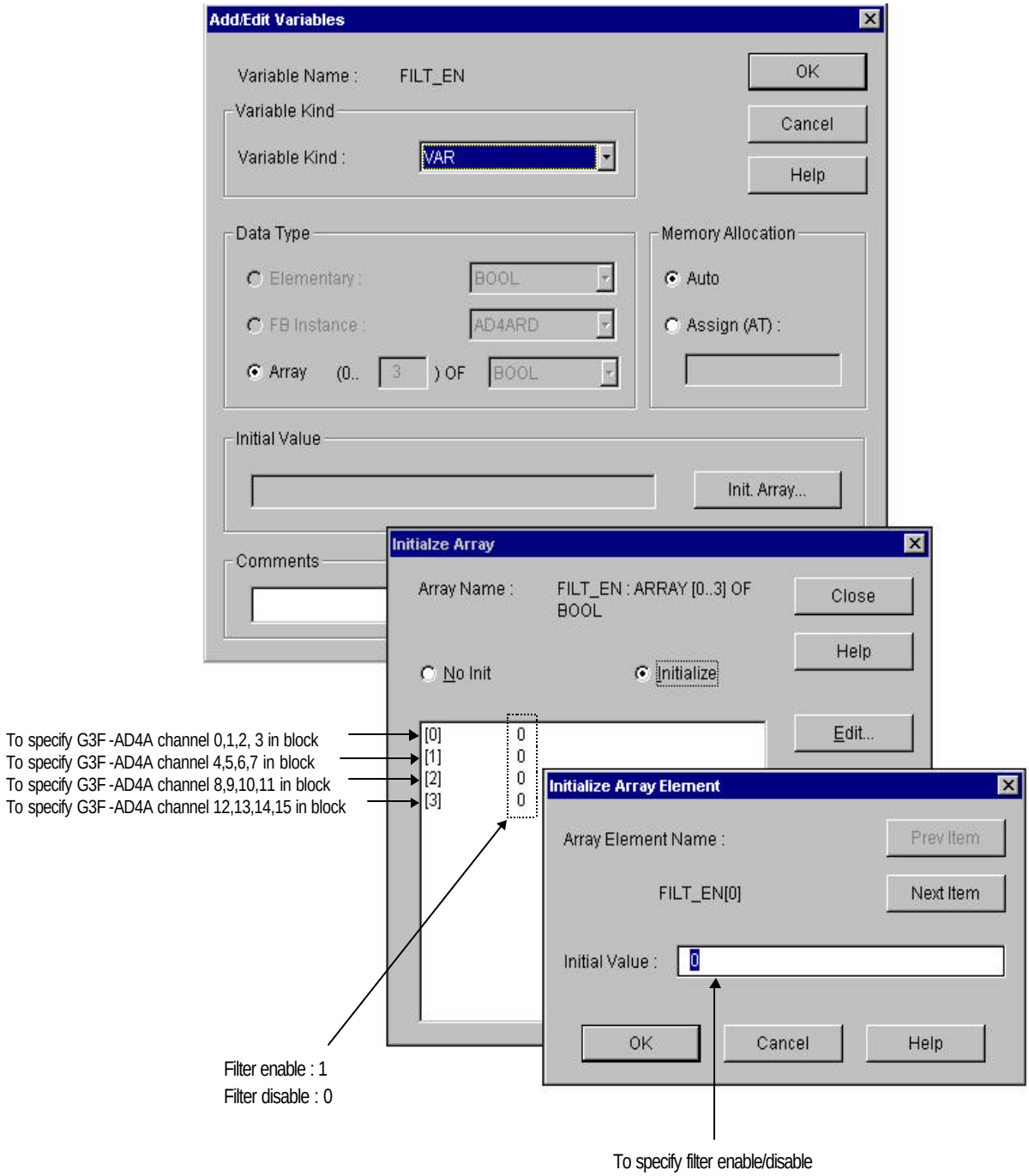


C) Specifying initial value of input/output variables on the program.

(a) Specifying channels



(b) Specifying filter enable/disable



D) Input/output variables on Programming

Variable Name	Var_Kind	Data Type	(AT Address) (Initial Value)
AD_CH	: VAR	: ARRAY [0..15] OF BOOL	: = { 1,0,1,0,1,0,0,0,0,0,0,0,0,0,0,0 }
AD_INI	: VAR	: FB instance	
AD_RD	: VAR	: FB instance	
AVG_EN	: VAR	: ARRAY [0..3] OF BOOL	: = { 1,1,0,0 }
AVG_SEL	: VAR	: ARRAY [0..3] OF BOOL	: = { 0,1,0,0 }
DATA	: VAR	: ARRAY [0..15] OF INT	
DATATYPE	: VAR	: ARRAY [0..15] OF BOOL	: = { 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 }
FILT_EN	: VAR	: ARRAY [0..3] OF BOOL	: = { 1,0,0,0 }
FILT_VAL	: VAR	: ARRAY [0..3] OF USINT	: = { 50,0,0,0 }
INI_ACT	: VAR	: ARRAY [0..15] OF BOOL	
INI_STAT	: VAR	: USINT	
NUM_TIME	: VAR	: ARRAY [0..3] OF UNIT	: = { 100,200,0,0 }
RD_ACT	: VAR	: ARRAY [0..15] OF BOOL	
RD_STAT	: VAR	: USINT	
READY	: VAR	: BOOL	
START	: VAR	: BOOL	

(2) G3F-AD4B

A) Input/output variables on Programming

Variable Name		Var_Kind	Data Type	(AT Address) (Initial Value)
AD_CH		: VAR	: ARRAY [0..15] OF BOOL	: = { 1,0,1,0,1,0,0,0,0,0,0,0,0,0,0,0 }
AD_INI		: VAR	: FB instance	
AD_RD		: VAR	: FB instance	
AVG_EN	※1	: VAR	: ARRAY [0..15] OF BOOL	: = { 0,0,1,0,1,0,0,0,0,0,0,0,0,0,0,0 }
AVG_SEL	※2	: VAR	: ARRAY [0..15] OF BOOL	: = { 1,0,1,0,1,0,0,0,0,0,0,0,0,0,0,0 }
DATA		: VAR	: ARRAY [0..15] OF INT	
DATATYPE		: VAR	: ARRAY [0..15] OF BOOL	: = { 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 }
FILT_EN	※3	: VAR	: ARRAY [0..15] OF BOOL	: = { 1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 }
FILT_VAL	※4	: VAR	: ARRAY [0..15] OF USINT	: = { 50,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 }
INI_ACT		: VAR	: ARRAY [0..15] OF BOOL	
IN_SEL	※5	: VAR	: ARRAY [0..15] OF BOOL	: = { 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 }
INI_STAT		: VAR	: USINT	
NUM_TIME	※6	: VAR	: ARRAY [0..15] OF UNIT	: = { 0,0,100,0,200,0,0,0,0,0,0,0,0,0,0,0 }
RD_ACT		: VAR	: ARRAY [0..15] OF BOOL	
RD_STAT		: VAR	: USINT	
READY		: VAR	: BOOL	
START		: VAR	: BOOL	

B) The difference of G3F-AD4A and G3F-AD4B

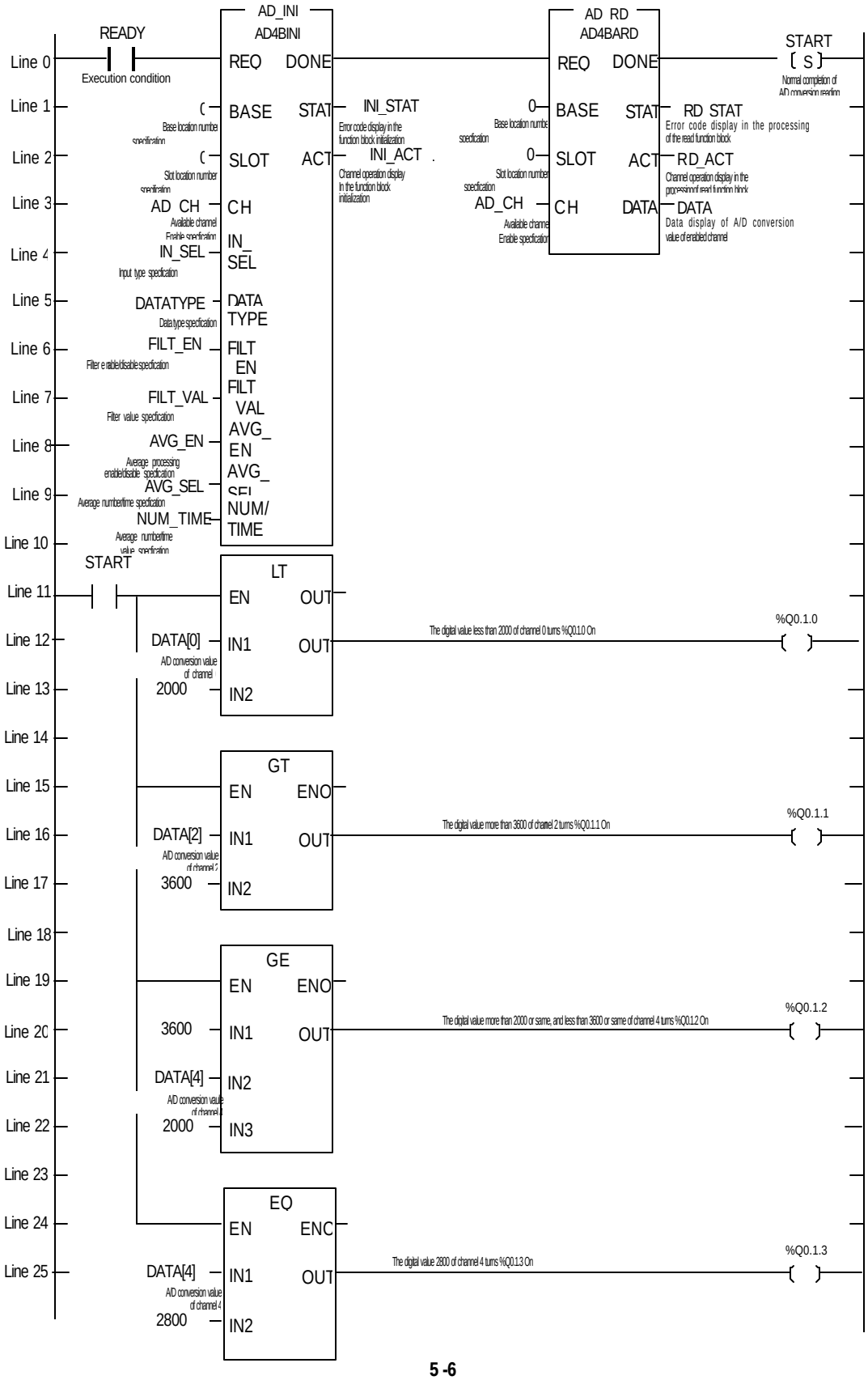
(a) It is different only to input variable of initial function block

(b) ※1 is used only to the G3F-AD4B

(c) ※2, ※3, ※4, ※5, ※6 are filter and average processing function, it is processed 4 channel in block of the G3F-AD4A and is processed every channel of the G3F-AD4B

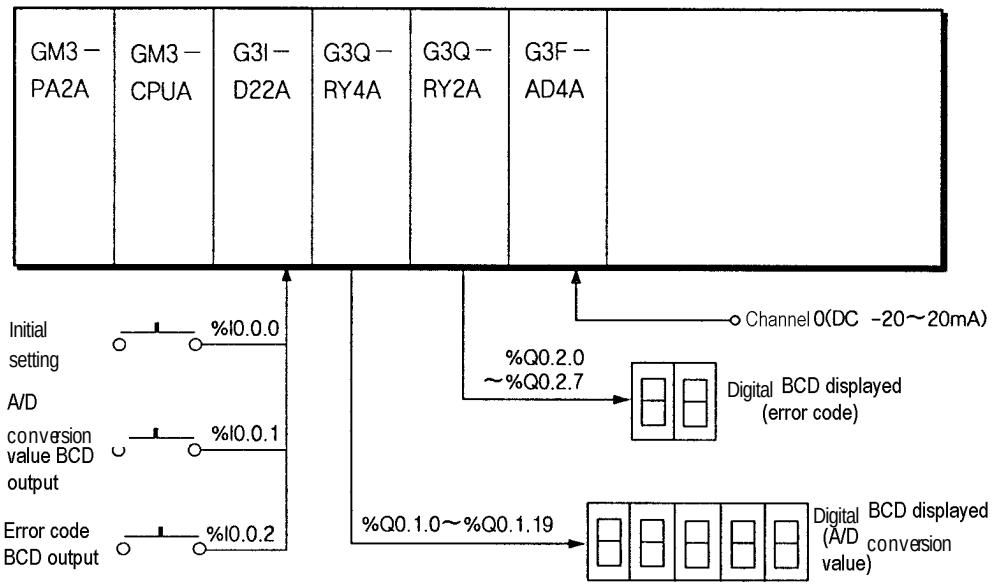
Section	Input Variable Name	G3F-AD4A		G3F-AD4B		Remark
		Variable Name	Data type	Variable Name	Data type	
※1	AVG_EN	AVG_EN	ARRAY[0..3] OF BOOL	AVG_EN	ARRAY[0..15] OF BOOL	
※2	AVG_SEL	AVG_SEL	ARRAY[0..3] OF BOOL	AVG_SEL	ARRAY[0..15] OF BOOL	
※3	FILT_EN	FILT_EN	ARRAY[0..3] OF BOOL	FILT_EN	ARRAY[0..15] OF BOOL	
※4	FILT_VAL	FILT_VAL	ARRAY[0..3] OF USINT	FILT_VAL	ARRAY[0..15] OF USINT	
※5	IN_SEL	-	-	IN_SEL	ARRAY[0..15] OF BOOL	Only G3F-AD4B
※6	NUM_TIME	NUM_TIME	ARRAY[0..3] OF USINT	NUM_TIME	ARRAY[0..15] OF USINT	

C) Programming Example



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

1) System Configuration



2) Initial Settings

(1) Available channel enabled : channel 0,

(2) Time average processing specification: 100 ms

(3) Data output type setting: -192 to 16191

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

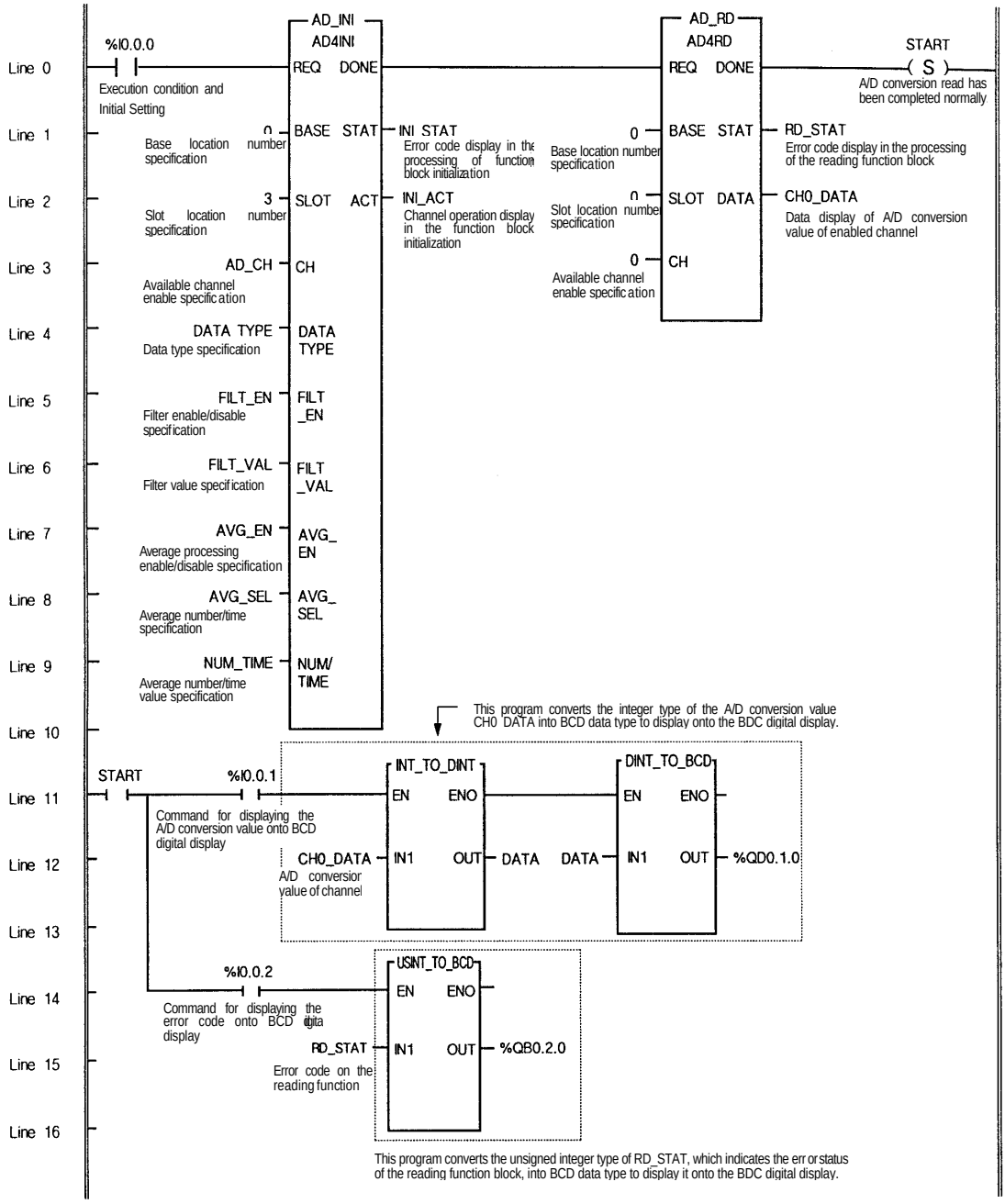
3) Descriptions of the Program

(1) %I0.1.0 turning On leads to the initial setting of A/D conversion module.

(2) %I0.1.1 turning On leads to displaying A/D conversion value on the BCD display.(%Q0.1.0 to %Q0.1.19)

(3) %I0.1.2 turning On leads to displaying error code of function block on the BCD display,
(%Q0.2.0 to %Q0.2.7)

4) Programming

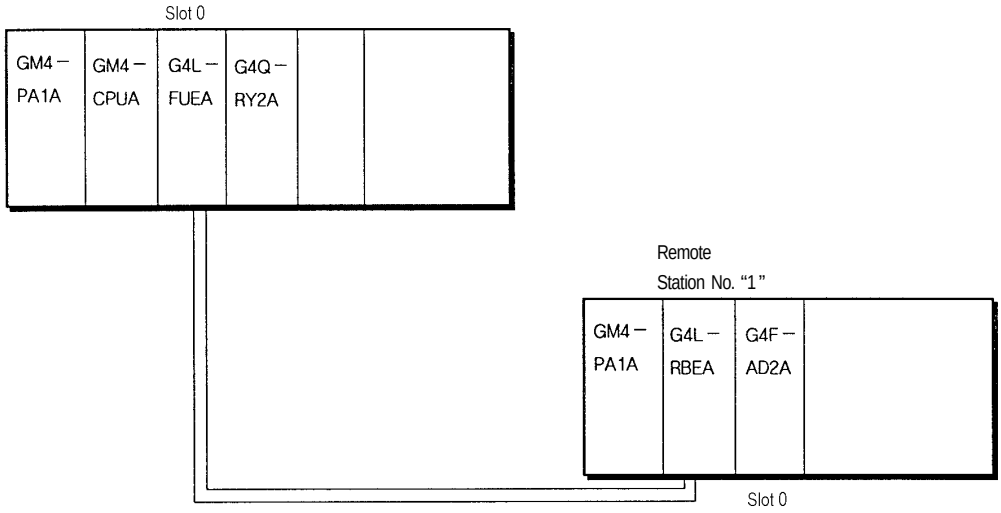


5) Input/output variables on the programming

Variable Name	Var Kind	Data Type	(AT Address) (Initial Value)
AD_CH	: VAR	: ARRAY [0..15] OF BOOL	: = {1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0}
AD_INI	: VAR	: FB Instance	
AD_RD	: VAR	: FB Instance	
AVG_EN	: VAR	: ARRAY [0..3] OF BOOL	: = {1,0,0,0}
AVG_SEL	: VAR	: ARRAY [0..3] OF BOOL	: = {1,0,0,0}
CH0_DATA	: VAR	: INT	
DATA	: VAR	: DINT	
DATATYPE	: VAR	:ARRAY [0..15] OF BOOL	: = {0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0}
FILT_EN	: VAR	: ARRAY [0..3] OF BOOL	: = {0,0,0,0}
FILT_VAL	: VAR	: ARRAY [0..3] OF USINT	: = {0,0,0,0}
INI_ACT	: VAR	: ARRAY [0..15] OF BOOL	
INI_STAT	: VAR	: USINT	
NUM_TIME	: VAR	: ARRAY [0..3] OF UINT	: = {100,0,0,0}
RD_STAT	: VAR	: USINT	
START	: VAR	: BOOL	

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

1) System Configuration



2) Initial Settings

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

(2) Conversion data range: -192 to 16191

(3)Time average processing channel: channel 0(setting value: 1,000 ms)

3) Descriptions of the Program

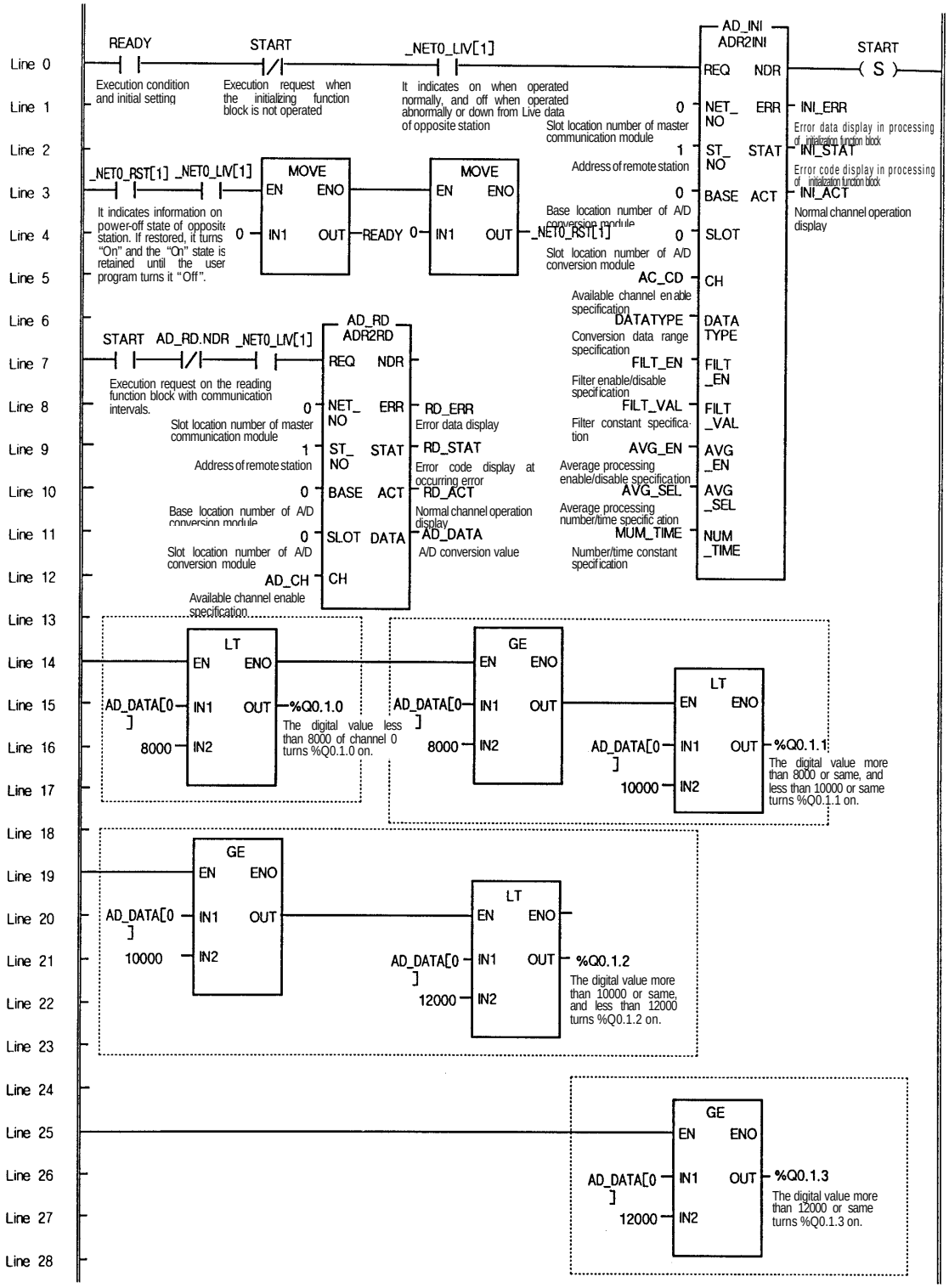
(1)The digital value less than 8000of channel 0 turns %Q0.1.0 on.

(2)The digital value more than 8000 or same, and less than 10,000 or same of channel 0 turns %Q0.1.1 on.

(3)The digital value more than 10,000 or same, and less than 12,000 of channel 0 turns %Q0.1.2 on.

(4)The digital value more than 12,000 or same of channel 0 turns %Q0.1.3 on.

4) Programming example



5) Input/output variables used on the programming

Variable Name	Var Kind	Data Type	(AT Address) (Initial Value)
AD_CH	: VAR	: ARRAY [0..3] OF BOOL	: = {0,0,0,0}
AD_DATA	: VAR	: ARRAY [0..3] OF INT	
AD_INI	: VAR	: FB Instance	
AD_RD	: VAR	: FB Instance	
AVG_EN	: VAR	: ARRAY [0..3] OF BOOL	: = {1,0,0,0}
AVG_SEL	: VAR	: ARRAY [0..3] OF BOOL	: = {1,0,0,0}
DATATYPE	: VAR	:ARRAY [0..3] OF BOOL	: = {0,0,0,0}
FILT_EN	: VAR	: ARRAY [0..3] OF BOOL	: = {0,0,0,0}
FILT_VAL	: VAR	: ARRAY [0..3] OF USINT	: = {0,0,0,0}
INI_ACT	: VAR	: ARRAY [0..3] OF BOOL	
INI_ERR	: VAR	: BOOL	
INI_STAT	: VAR	: USINT	
NUM_TIME	: VAR	: ARRAY [0..3] OF UINT	: = {1000,0,0,0}
RD_STAT	: VAR	: ARRAY [0..3] OF BOOL	
RD_ERR	: VAR	: BOOL	
RD_STAT	: VAR	: USINT	
READY	: VAR	: BOOL	

Chapter 6. BUFFER MEMORY CONFIGURATION AND FUNCTION

The A/D conversion module has a buffer memory for communication of data with the PLC CPU.

6.1 Buffer Memory Configuration

6.1.1 G3F-AD4A buffer memory

Address (Decimal)	Descriptions	Detail descriptions	Non-initialization	Remark
0.	Available channel specification	Bit on(1):Channel enable, Bit off(0):Channel disable	No allowance for use	Read/write
1.	Data output type specification	Bit on(1): -8192 to 8191, Bit off(0): -192 to 16191	Set the data output type to -192 to 16191	
2.	Filter processing specification	Bit on(1):Filter processing , Bit off(0):Sampling processing	Process by sampling	
3.	Filter constant setting to channel 0,1,2,3	Setting range:1 to 99	Set the filter constant to "1"	
4.	Filter constant setting to channel 4,5,6,7			
5.	Filter constant setting to channel 8,910,11			
6.	Filter constant setting to channel 12,13,14,15			
7.	Average processing specification	Bit on(1):Average processing , Bit off(0):Sampling processing	Process by sampling	
8.	Time/number average specification	Bit on(1):Time average, Bit off(0):Number average	Specify to number average	
9.	Average time/number setting to channel 0, 1, 2, 3	Setting range Time average: 96 to 12, 000(ms) Number average: 2 to 4,000(count)	Set to the constant"96"	
10.	Average time/number setting to channel 4, 5, 6, 7			
11.	Average time/number setting to channel 8, 9, 10, 11			
12.	Average time/number setting to channel 12, 13, 14, 15			
13.	Set data specification	Bit on(1):Change the buffer address 0 to 12 into new specification value Bit off(0):Remain the buffer of address 0 to 12 in the previous value	Non-specification	
14.	A/D Conversion value to channel 0	-	-	Read only enable
15.	A/D Conversion value to channel 1			
16.	A/D Conversion value to channel 2			
17.	A/D Conversion value to channel 3			
18.	A/D Conversion value to channel 4			
19.	A/D Conversion value to channel 5			
20.	A/D Conversion value to channel6			
21.	A/D Conversion value to channel 7			
22.	A/D Conversion value to channel 8			
23.	A/D Conversion value to channel 9			
24	A/D Conversion value to channel 10			
25.	A/D Conversion value to channel 11			
26.	A/D Conversion value to channel 12			
27.	A/D Conversion value to channel 13			
28.	A/D Conversion value to channel 14			
29.	A/D Conversion value to channel 15			
30.	Channel operation data	Bit on(1):Operation, Bit off(0):Operation stop	Operation stop	
31.	Error code to channel 0, 1, 2, 3	0 : Normal operation 16 : Filter constant setting range exceeding 17 : Average number/time constant setting range exceeding	-	
32.	Error code to channel 4, 5, 6, 7			
33.	Error code to channel 8, 9, 10, 11			
34.	Error code to channel 12, 13, 14, 15			

6.1.2 G3F-AD4B buffer memory

Address (Decimal)	Descriptions	Detail descriptions	Non-initialization	Remark
0.	Available channel specification	Bit on(1):Channel enable, Bit off(0):Channel disable	No allowance for use	Read/write
1.	Input used specification	Bit on(1):voltage input, Bit off(0):current input	Set to the current input	
2.	Data output type specification	Bit on(1): -8000 to 8000, Bit off(0):0 to 16000	Set the data output type to 0 to 16000	
3.	Filter processing specification	Bit on(1):Filter processing , Bit off(0):Sampling processing	Process by sampling	
4.	Filter constant setting to channel 0	Setting range:1 to 99	Set the filter constant to "1"	
5.	Filter constant setting to channel 1			
6.	Filter constant setting to channel 2			
7.	Filter constant setting to channel 3			
8.	Filter constant setting to channel 4			
9.	Filter constant setting to channel 5			
10.	Filter constant setting to channel 6			
11.	Filter constant setting to channel 7			
12.	Filter constant setting to channel 8			
13.	Filter constant setting to channel 9			
14.	Filter constant setting to channel 10			
15.	Filter constant setting to channel 11			
16.	Filter constant setting to channel 12			
17.	Filter constant setting to channel 13			
18.	Filter constant setting to channel 14			
19.	Filter constant setting to channel 15			
20.	Average processing specification	Bit on(1):Average processing, Bit off(0):Sampling processing	Process by sampling	
21.	Time/number average specification	Bit on(1):Time average, Bit off(0):Number average	Specify to number average	
22.	Average time/number setting to channel 0	Setting range Time average: 96 to 12,000(ms) Number average: 2 to 4,000(count)	Set to the constant"96"	
23.	Average time/number setting to channel 1			
24.	Average time/number setting to channel 2			
25.	Average time/number setting to channel 3			
26.	Average time/number setting to channel 4			
27.	Average time/number setting to channel 5			
28.	Average time/number setting to channel 6			
29.	Average time/number setting to channel 7			
30.	Average time/number setting to channel 8			
31.	Average time/number setting to channel 9			
32.	Average time/number setting to channel 10			
33.	Average time/number setting to channel 11			
34.	Average time/number setting to channel 12			
35.	Average time/number setting to channel 13			
36.	Average time/number setting to channel 14			
37.	Average time/number setting to channel 15			
38.	Set data specification	"0" Bit on(1):Change the buffer address 0 to 37 into new specification value "0" Bit off(0):Remain the buffer of address 0 to 37 in the previous value	Non-specification	
39.	A/D Conversion value to channel 0	-	-	Read only enable
40.	A/D Conversion value to channel 1			
41.	A/D Conversion value to channel 2			
42.	A/D Conversion value to channel 3			
43.	A/D Conversion value to channel 4			
44.	A/D Conversion value to channel 5			
45.	A/D Conversion value to channel 6			
46.	A/D Conversion value to channel 7			

Address (Decimal)	Descriptions	Detail descriptions	Non-initialization	Remark
47.	A/D Conversion value to channel 8	-	-	Read only enable
48.	A/D Conversion value to channel 9			
49.	A/D Conversion value to channel 10			
50.	A/D Conversion value to channel 11			
51.	A/D Conversion value to channel 12			
52.	A/D Conversion value to channel 13			
53.	A/D Conversion value to channel 14			
54.	A/D Conversion value to channel 15			
55.	Channel operation data	Bit on(1):Operation, Bit off(0):Operation stop	Operation stop	
56.	Error code to channel 0	0 : Normal operation 16 : Filter constant setting range exceeding 17 : Average number/time constant setting range exceeding	-	
57.	Error code to channel 1			
58.	Error code to channel 2			
59.	Error code to channel 3			
60.	Error code to channel 4			
61.	Error code to channel 5			
62.	Error code to channel 6			
63.	Error code to channel 7			
64.	Error code to channel 8			
65.	Error code to channel 9			
66.	Error code to channel 10			
67.	Error code to channel 11			
68.	Error code to channel 12			
69.	Error code to channel 13			
70.	Error code to channel 14			
71.	Error code to channel 15			

6.1.3 G4F-AD2A buffer memory

Address (Decimal)	Descriptions	Detail descriptions	Non-initialization	Remark
0.	Available channel specification	Bit on(1): Channel enable Bit off(0): Channel disable	No allowance for use	Read/Write enable
1.	Data output type specification	Bit on(1): -8192 to 8191 Bit off(0): -192 to 16191	Set the data output type to -192 to 16191	
2.	Filter processing specification	Bit on(1): Filter processing Bit off(0): Sampling processing	process by sampling	
3.	Filter constant setting to channel 0	Setting range : 1 to 99	Set the filter constant to "1"	
4.	Filter constant setting to channel 1			
5	Filter constant setting to channel 2			
6.	Filter constant setting to channel 3			
7.	Average processing specification	Bit on(1) : Average processing Bit off(0) : Sampling processing	Process by sampling	
8.	Time/Number average specification	Bit on(1) : Time average Bit off(0) : Number average	Specify to number average	
9.	Average time/number setting to channel 0	Setting range Time average : 40 to 20,000(ms) umber average: 2 to 4,000 (count)	Set to the constant "40"	
10	Average time/number setting to channel 1			
11.	Average time/number setting to channel 2			
12.	Average time/number setting to channel 3			
13.	Set data specification	Bit on(1):Change the bufferof address 0 to 12 Bit off(0):Remain the buffer of address 0 to 12 in the precious value	Non-specification	
14.	A/D Conversion value to channel 0	-	-	Read only enable
15.	A/D Conversion value to channel 1			
16.	A/D Conversion value to channel 2			
17	A/D Conversion value to channel 3			
18.	Channel operation data	Bit on(1) : Operation Bit off(0) : Operation stop	Operation stop	
19.	Error code to channel 0	0 : Normaloperation 16 : Filter constant setting range exceeding 17 : Average number/time constant setting range exceeding	-	
20	Error code to channel 1			
21.	Error code to channel 2			
22.	Error code to channel 3			

6.2 Buffer Memory Functions

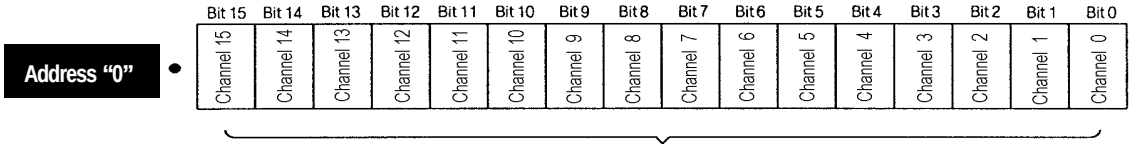
▶ Each address of buffer memory has been occupied by one word, and it is displayed as 16 Bit

▶ Each address is composed of 16 Bit, and each Bit can be executed by specifying Bit on to 1 or Bit off to 0

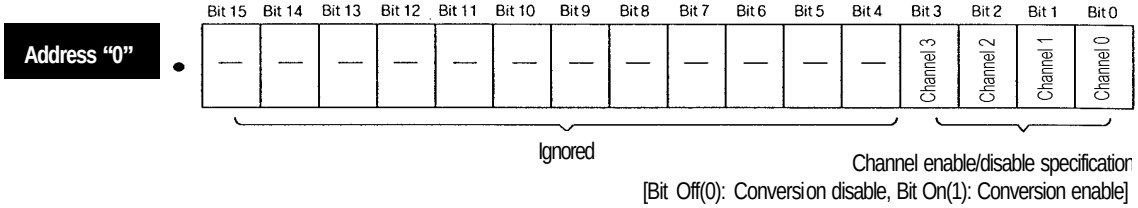
6.2.1 Available Channel Specification Area (G3F-AD4A,G3F-AD4B: address 0, G4F-AD2A: address 0)

1) A/D conversion enable/ disable can be specified for every channel.
2) Banning disabled channel conversion turns the sampling period short.
3) If enable channel isn't specified, every channel comes to be disabled.
4) A/D conversion enable/disable is like this as follows.

(1) G3F-AD4A, G3F-AD4B

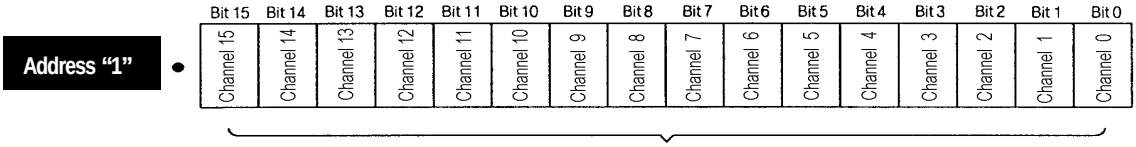


(2) G4F-AD2A



6.2.2 Input Used Type Specification Area (G3F-AD4B: address 1)

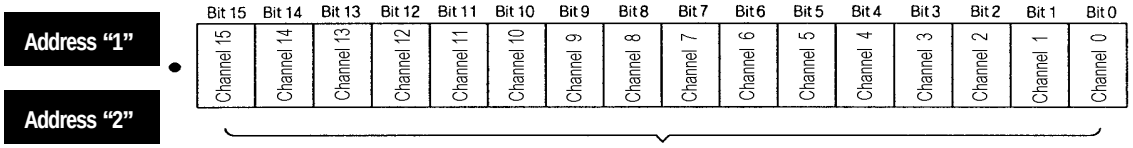
1) Input used type can be specified for every channel only the G3F-AD4B
2) Input used type(current/voltage) specification is like this as follows.



6.2.3 Data Output Type Specification Area (G3F-AD4A: address 1, G4F-AD2A: address 1, G3F-AD4B:address2)

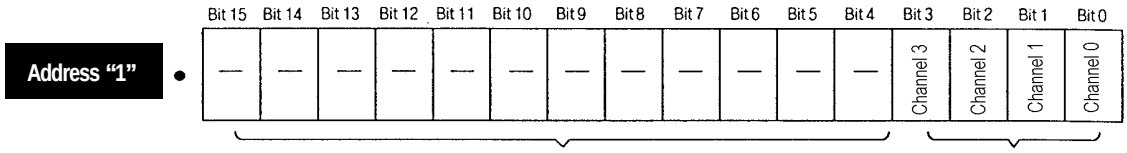
1) Digital data output type from analog input can be specified for every channel.
2) If output data type isn't specified, every channel will be set to the range of -192 to 19161 for the G3F-AD4A and the G4F- AD2A, and set to the range of 0 to 16000 for the G3F-AD4B.
3) Data output type specification is like this as follows.

(1) G3F – AD4A, G3F-AD4B



Output data type specification
G3F-AD4A : [Bit Off(0): -192~16191, Bit On(1): -8192~8191]
G3F-AD4B : [Bit Off(0): 0~16000, Bit On(1): -8000~8000]

(2) G4F – AD2A

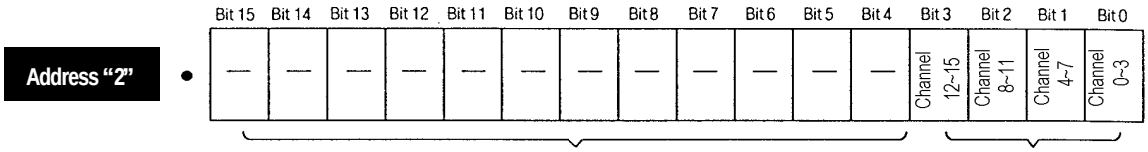


Ignored Output data type specification
[Bit Off(0) : -192~16191, Bit On(1) : -8192~8191]

6.2.4 Filter Processing Enable/Disable Specification Area (G3F-AD4A: address2,G4F-AD2A: address 2, G3F-AD4B:address3)

1) Filter processing enable/disable can be specified to 4 channels of the K7F-AD4A, 1 channel of the K4F-AD2A and the G3F-AD4B.
2) When filter processing isn't specified, sampling processes every channel.
3) Filter processing specification is as follows.

(1) G3F-AD4A



Ignored Filter processing specification
[Bit Off(0) : Sampling processing, Bit On(1) :Filter processing]

A) 4 bits are available, and 1 bit for filter processing is performed for continuous 4 channels in block.

Bit 0 : Filter processing enable/disable to channel 0,1,2,3 is specified in block.

Bit 1 : Filter processing enable/disable to channel 4,5,6,7 is specified in block.

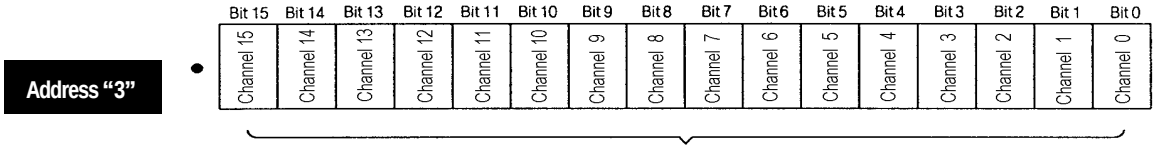
Bit 2 : Filter processing enable/disable to channel 8,9,10,11 is specified in block.

Bit 3 : Filter processing enable/disable to channel 12,13,14,15 is specified in block.

B) Filter processing enable/disable to 4 channel in a bit shouldn't be specified by channel.

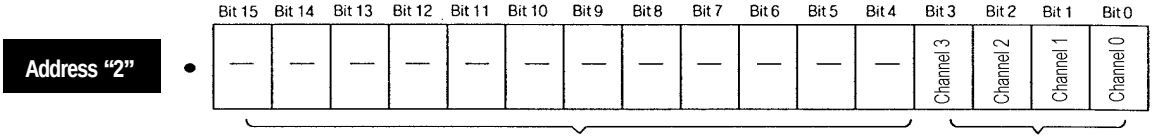
(Ex. Filter processing to channel 0 and sampling processing to channel 1 shouldn't be specified.)

(2) G3F-AD4B



[Bit Off(0) : Sampling processing, Bit On(1) :Filter processing]

(3) G4F-AD2A



[Bit Off(0) : Sampling processing, Bit On(1) :Filter processing]

6.2.5 Filter Constant Setting Area (G3F-AD4A, G4F-AD2A: address 3 to 6, G3F-AD4B: address 4 to 19)

1) Filter constant setting can be specified to 4 channels of the G3F-AD4A, 1 channel of the G4F-AD2A and the G3F-AD4B.

2) Filter constant setting range is 1 to 99.

3) When setting value is out of the range, error code number 16 is written to buffer memory address 31 to 34(of the G3F-AD4A) and the previous data remain as A/D conversion value.

4) When filter constant isn't set, filter constant will be set to 1.

5) Filter constant setting is as follows.

Address	Filter constant setting to each channel	
	G3F-AD4A	G4F-AD2A
address 3	Filter constant setting in block to channel 0, 1, 2, 3	Filter constant setting to channel 0.
address 4	Filter constant setting in block to channel 4, 5, 6, 7	Filter constant setting to channel 1
address 5	Filter constant setting in block to channel 8, 9, 10, 11	Filter constant setting to channel 2
address 6	Filter constant setting in block to channel 12, 13, 14, 15	Filter constant setting to channel 3.

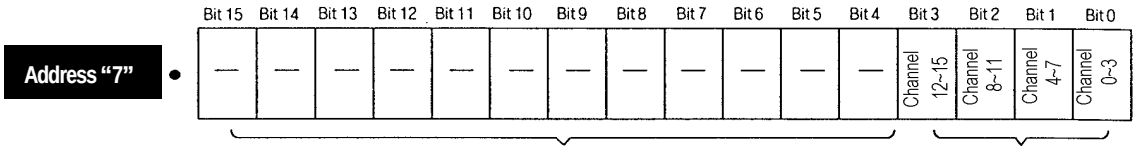
Remark

Before average number/time constant value is set, average processing enable/disable specifying and number/time average processing setting have to be set.

6.2.6 Average Processing Enable/Disable Specification Area (G3F-AD4A: address7, G4F-AD2A : address 7, G3F -AD4B : address 20)

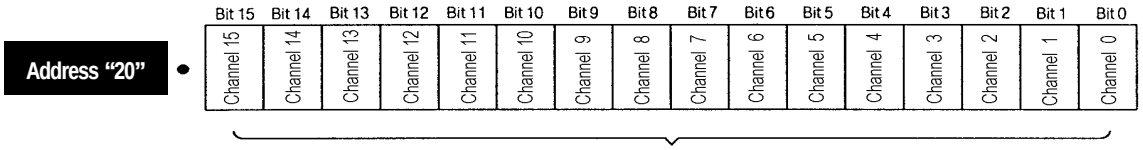
1) Average processing enable/disable can be specified to 4 channels of the G3F-AD4A, 1 channel of the G4F-AD2A and 1 channel of the G3F-AD4B
2) When average processing isn't specified, every channel get processed by sampling.
3) Average processing specification is as follows.

(1) G3F-AD4A

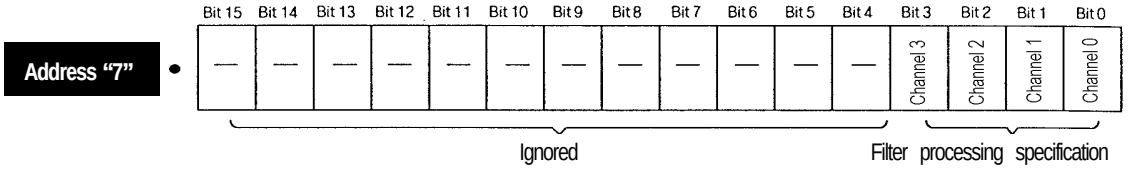


A) 4 bits are available, and 1 bit for average processing is performed for continuous 4 channels in block.
Bit 0 : Average processing enable/disable to channel 0,1,2,3 is specified in block.
Bit 1 : Average processing enable/disable to channel 4,5,6,7 is specified in block.
Bit 2 : Average processing enable/disable to channel 8,9,10,11 is specified in block.
Bit 3 : Average processing enable/disable to channel 12,13,14,15 is specified in block.
B) Average processing enable/disable to 4 channel in a bit should not be specified in block.
(Ex. Average processing to channel 0 and sampling processing to channel should not be specified.)

(2) G3F-AD3B



(3) G4F-AD2A



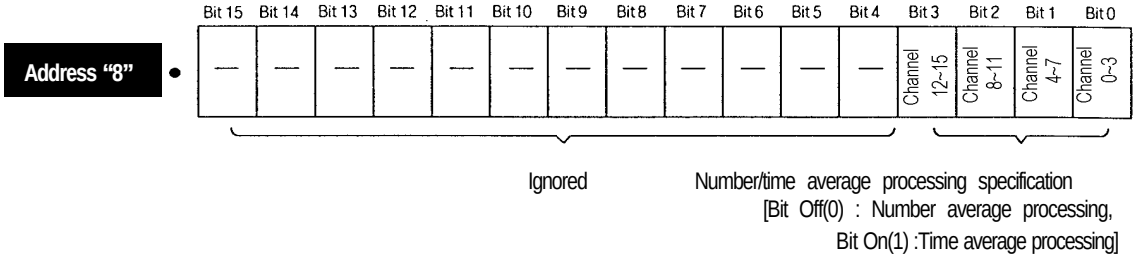
6.2.7 Number / Time Average Processing Setting Area (G3F-AD4A,G4F-AD2A: address 8, G3F-AD4B: address 21)

1) It depends on A/D conversion module channel whether average processing is followed to time or number. (G3F-AD4A for 4 channel in block, G4F-AD2A/G3F-AD4B for every channel)

2) No specification of number/time average processing leads to number average processing.

3) Number/time average processing is as follows.

(1) G3F – AD4A



A) 4 bits are available, and 1 bit for number/time average processing setting is performed for continuous 4 channels in block.

Bit 0 : Number/time average processing to channel 0,1,2,3 is specified in block.

Bit 1 : Number/time average processing to channel 4,5,6,7 is specified in block.

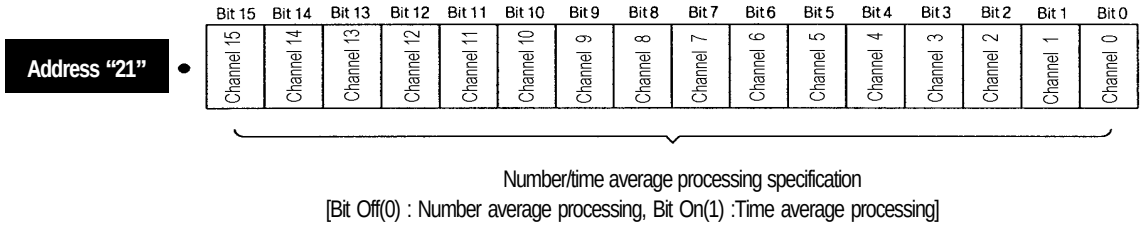
Bit 2 : Number/time average processing to channel 8,9,10,11 is specified in block.

Bit 3 : Number/time average processing to channel 12,13,14,15 is specified in block.

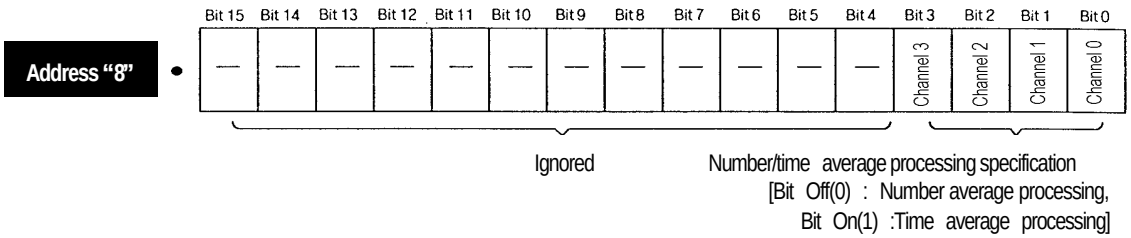
B) Number/time average processing to 4 channel in a bit should not be specified in block.

(Ex. Number average processing to channel 0 and time average processing to channel should not be specified.)

(2) G3F-AD4B



(3) G4F – AD2A



Remark

Before number /time average processing is set, average processing enable/disable has to be specified.

6.2.8 Average Number / Time Constant Setting Area (G3F-AD4A, G4F-AD2A : address 9 to 12, G3F-AD4B : address 22 to 37)

1) Average number/time constant setting range is as follows.
   (1) Average number setting range: 2 to 4000 (count) .
   (2) Average time setting range: G3F-AD4A , G3F-AD4B (96 to 12000 ms), G4F-AD2A (40 to 20000ms)
2) When setting value is out of the range, error code number 17 is written to buffer memory address 31 to 34 and the previous data remain as A/D conversion value.
3) When average number/time constant isn't set G3F-AD4A/G3F-AD4B of 96 and G4F-AD2A of 40 will be set.
4) Average number/time constant setting is as follows.

Address	Average number/time constant setting to each channel	
	G3F – AD4A	G4F – AD2A
address 9	Average number/time constant setting in block to channel 0, 1, 2, 3,	Average number/time constant setting channel 0.
address 10	Average number/time constant setting in block to channel 4, 5, 6, 7	Average number/time constant setting channel 1
address 11	Average number/time constant setting in block to channel 8, 9, 10, 11	Average number/time constant setting channel 2
address 12	Average number/time constant setting in block to channel 12, 13, 14, 15	Average number/time constant setting channel 3.

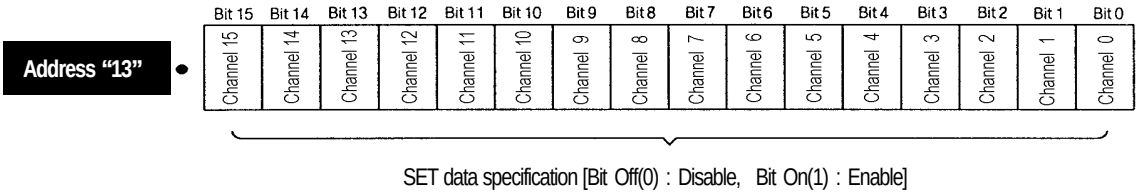
REMARK

Before average number/time constant value is set, average processing enable/disable Specifying and number/time average processing setting have to be set.

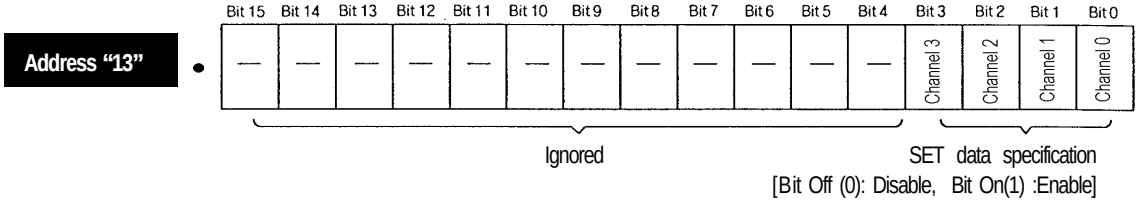
6.2.9 SET Data Specification Area (G3F-AD4A/G4F-AD2A: address 13, G3F-AD4B: address 38)

1) When specified bit of each channel isn't turned on in the SET data specification area(addr ess 13), A/D conversion isn't executed by A/D conversion module's data which users specified address 0 to 12 and the previous data remains. (G3F-AD4A, G4F-AD2A)
2) SET data is specified as follows.

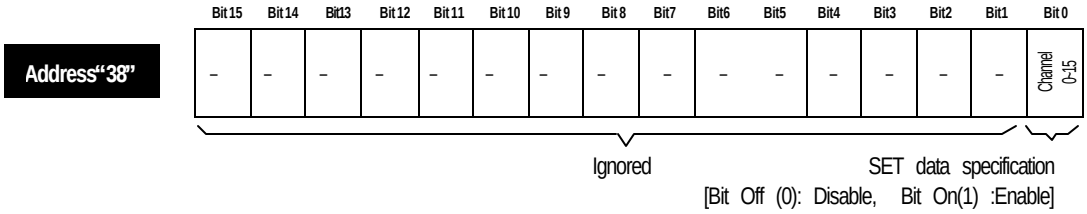
(1) G3F – AD4A



(2) G4F – AD2A



(3) G3F-AD4B



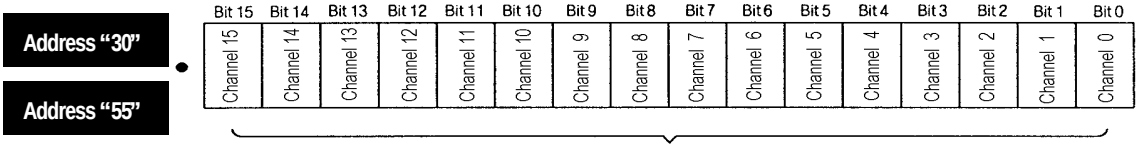
6.2.10 Digital Output Area (G3F-AD4A : address 14 to 29, G4F-AD2A : address 14 to 17, G3F-AD4B : address 39 to 54)

1) Digital output value to analog input value through terminals is stored in this area.
2) When error occurs, the previous digital value remains.

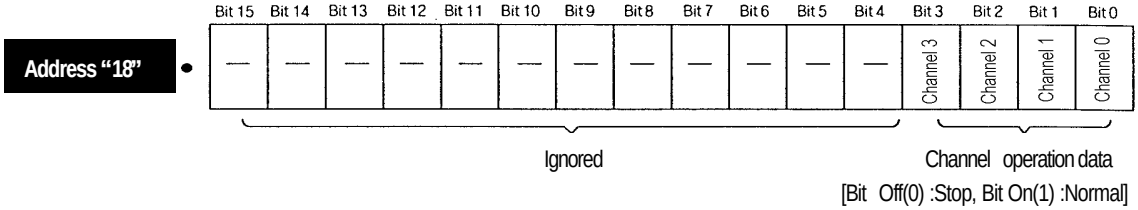
6.2.11 Channel Operation Data Storage Area (G3F-AD4A : address 30, G4F-AD2A : address 18, G3F-AD4B : address 55)

Channel operation data is stored in this area.

(1) G3F – AD4A, G3F-AD4B



(2) G4F – AD2A



6.2.12 Error Code Display Area (G3F-AD4A : address 31 to 34, G4F-AD2A : address 19 to 22, G3F-AD4B : address 56 to 71)

1) Error code is as follows.

Error code	Descriptions	Remarks
16	Filter constant setting range exceeding	RUN LED flickering(per 0.6sec)
17	Average number/time setting range exceeding	RUN LED flickering(per 0.6sec)

2) When two types of error have occurred simultaneously, 17 and 16 are displayed in the order.

3) Error code display channel of each address is as follows.

G3F-AD4A		G4F-AD2A	
Address	**Specified channel**	**Address**	**Specified channel**
31	error code display to channel 0, 1, 2, 3	19	error code display to channel 0
32	error code display to channel 4, 5, 6, 7	20	error code display to channel 1
33	error code display to channel 8, 9, 10, 11	21	error code display to channel 2
34	error code display to channel 12, 13, 14, 15	22	error code display to channel 3

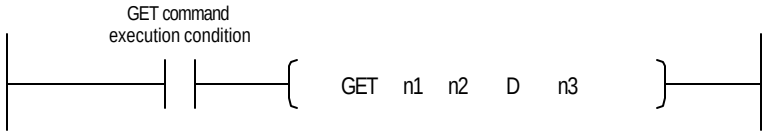
Chapter 7. SPECIAL MODULE COMMAND (BUFFER MEMORY READ/ WRITE)

A/D conversion module occupies 16 I/O points.

7.1 Local Command

7.1.1 Buffer Memory Read - GET, GETP

<Format>

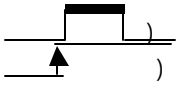


Symbol	Descriptions	Device used
n1	Slot number assigned to special module	Integer
n2	First address of the buffer memory of special module from which data are read	Integer
D	First address of device which will store read data.	M, P, K, L, T, C, D, #D
n3	Number of words of data read	Integer

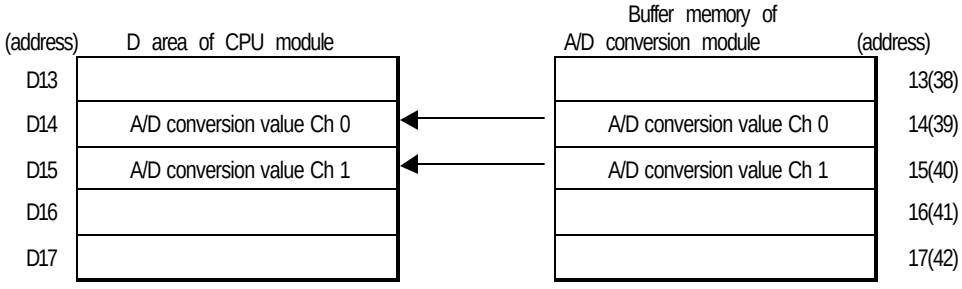
< Distinction of GET and GETP>

GET: Continuously executes read while the read signal is on ( )

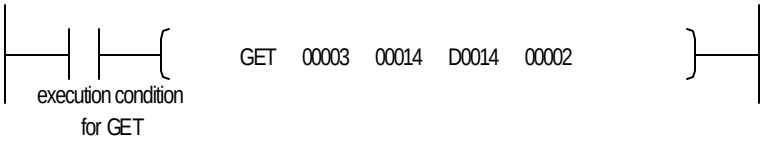
GETP: Execute read by rising edge on the read signal ( )



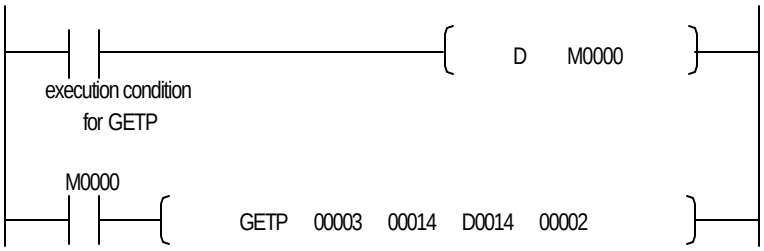
ex 1) A/D conversion module is mounted on the slot 3 of base, and data from the buffer memory address 14 and 15 is read to the CPU D14 and D15. (( ) : Buffer memory address of the G3F-AD4B)



<GET>

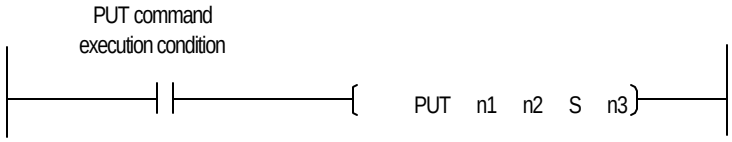


<GETP>



7.1.2 Buffer Memory Write- PUT, PUTP

<Format>

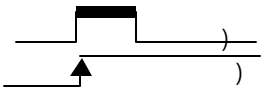


Symbol	Descriptions	Device used
n1	Slot number assigned to special module	Integer
n2	First address of the buffer memory of special module to which data will be written.	Integer
D	First address of device which will store write data.	M, P, K, L, T, C, D, #D
n3	Number of words of data that will be written	Integer

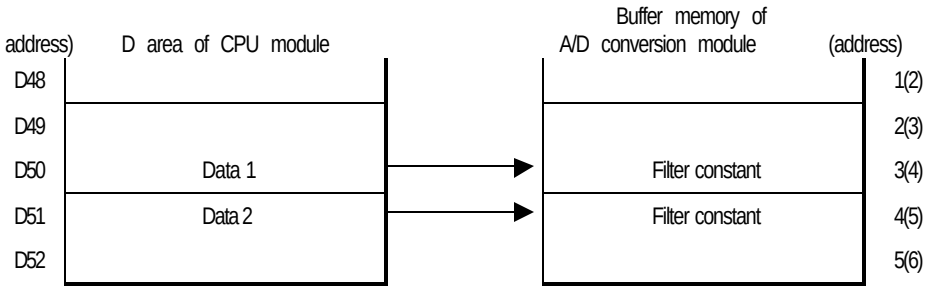
<Distinction of PUT and PUTP>

PUT : Continuously executes write while the write signal is on. ( )

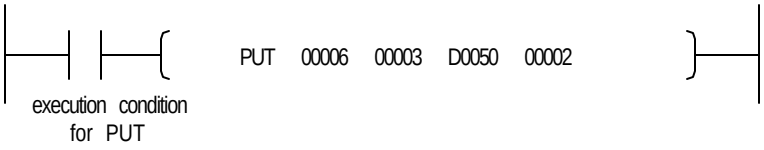
PUTP : Execute write by switching on the write signal. ( )



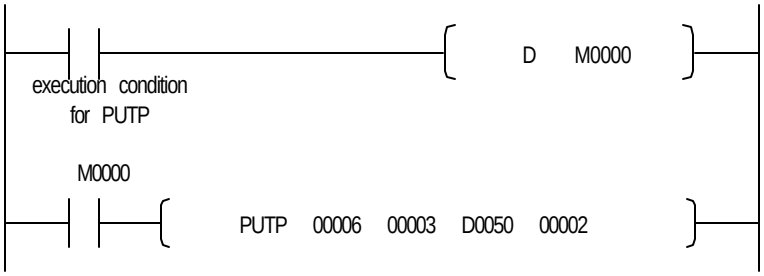
ex1) A/D conversion module is mounted on the slot 6 of base, and data from the CPU D50 and D51 is written to the buffer memory address 3, and 4.(( ) : Buffer memory address of the G3F-AD4B)



<PUT>



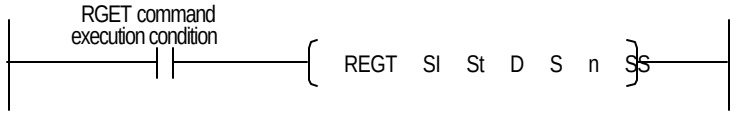
<PUTP>



7.2 Remote Command

7.2.1 Buffer Memory Read - RGET

<Format>

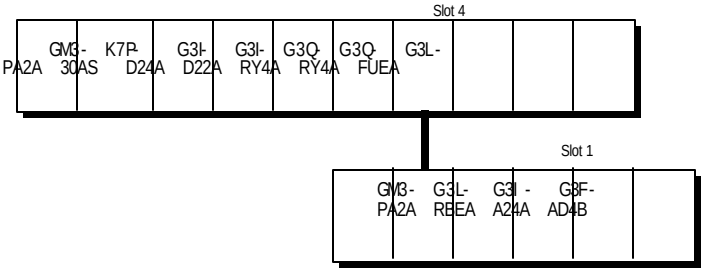


Symbol	Descriptions	Device used
SI	AB | CD (upper (8 bit) lower (8 bit)) Upper(AB) : the code value of A/D Conversion module G3F-AD4A: 00h, G3F-AD4B: 0Ah G4F-AD2A: 80h Lower (CD): the slot number of communication module of the master station. Setting range: 0 to 7	Integer
St	EF | GH (upper (8 bit) lower (8 bit)) Upper (EF): Slot number of A/D conversion module of remote station. Setting range: 0 to 31 Lower(GH): communication module station number of remote. Setting range: 0 to 63	Integer
D	First address of device which stores read data.	M, P, K, L, T, C, D, #D
S	First address of special module which will store read data.	Integer
n	Number of words of data read	Integer, D
SS	Condition data display area of link	M, P, K, L, T, C, D, #D

REMARK

To read buffer memory data of A/D conversion module with RGET command, configure the program so that execution condition of low(0) will be changed into high(1) at rising edge (—↑) . Or not, buffer memory data of A/D conversion module won't be read.

<ex>
[configuration]

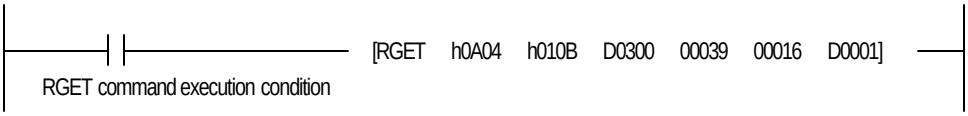


Remote Station No.11 (0Bh)

[Buffer memory read]

1) Read buffer memory address 39 to 54(16 Words) which A/D conversion value is stored.
2) Store read data to the next D0300
3) Store information on the status of communication to D0001.

[Program]



7.2.2 Buffer Memory Write – RPUT

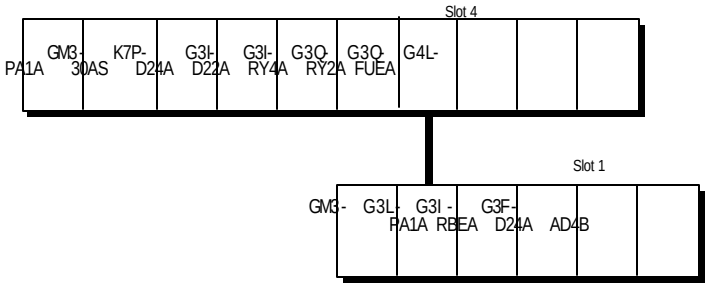
<Format>

Symbol	Descriptions	Device used
Sl	AB | CD upper (8 bit) lower (8 bit) Upper(AB): the code vale of A/Conversion module G3F-AD4A: 00h, G3F-AD4B: 0Ah G4F-AD2A: 80h Lower (CD): the slot number of communication module of the master station. setting range: 0 to 7	Integer
St	EF | GH upper (8 bit) lower (8 bit) Upper(EF): Slot number of A/D conversion module of remote station. setting range: 0 to 31 Lower (GH): communication module number of remote station. setting range :0 to 63	Integer
S	First address of device which stores write data.	M, P, K, L, T, C, D, #D
D	First address of special module which will write data.	Integer
n	Number of words of data write.	Integer, D
SS	Condition data display area of link	M, P, K, L, T, C, D, #D

REMARK

To write on buffer memory data of A/D conversion module with RPUT command, configuration the program so that execution condition of low(0) will be changed into high(1) at rising edge (↑). Or not, buffer memory data of A/D conversion module won't be updated

<ex>
[configuration]

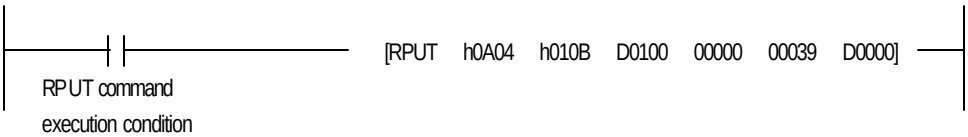


Remote station No.11 (0Bh)

[Buffer memory write]

1) Data on D100 to D138(39 words) of the CPU module device
2) is written onto buffer memory address 0 to 38 of A/D conversion module
3) and store information on the statues of communication to D0000.

[program]

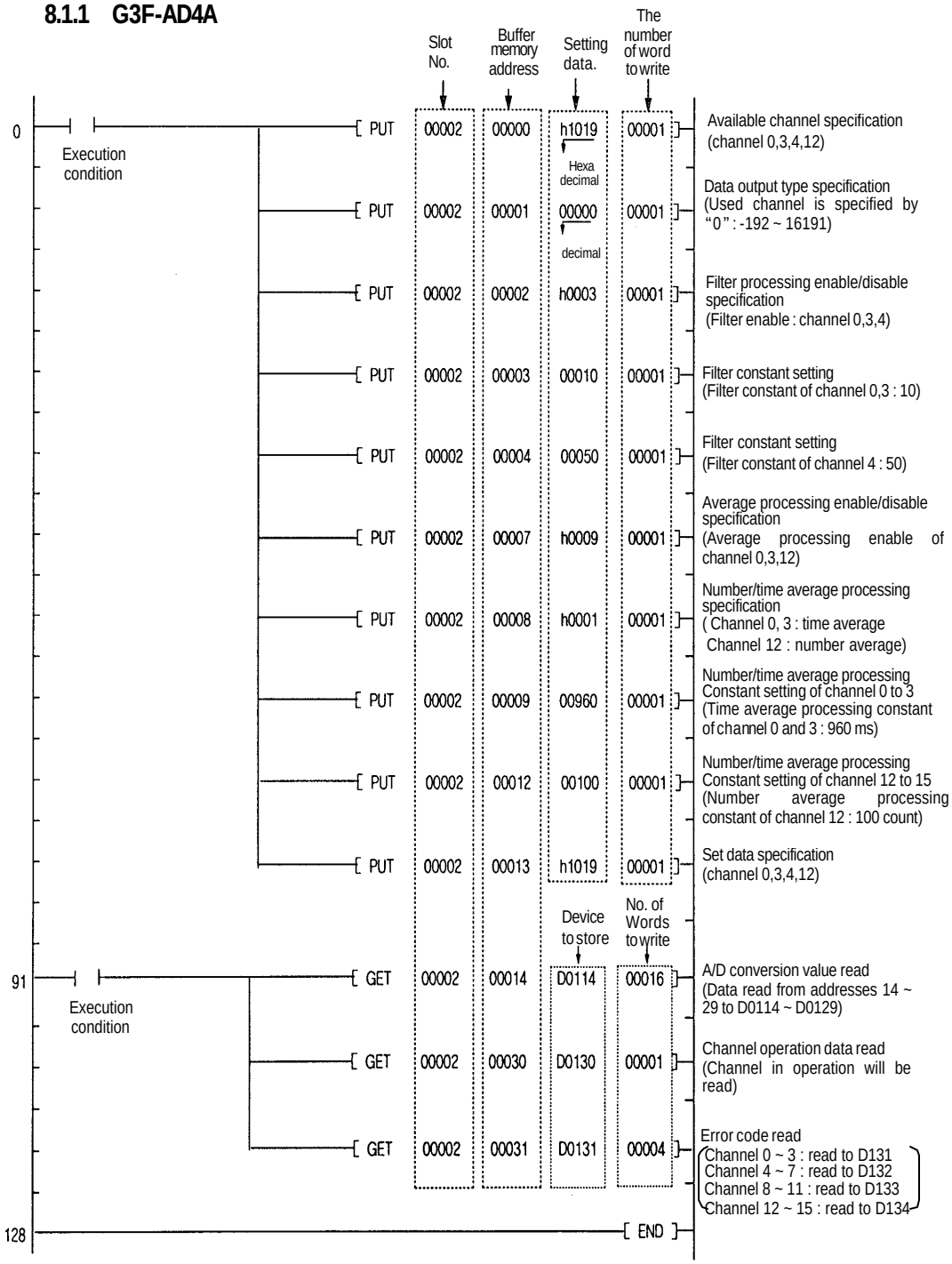


Chapter 8. MK PROGRAMMING

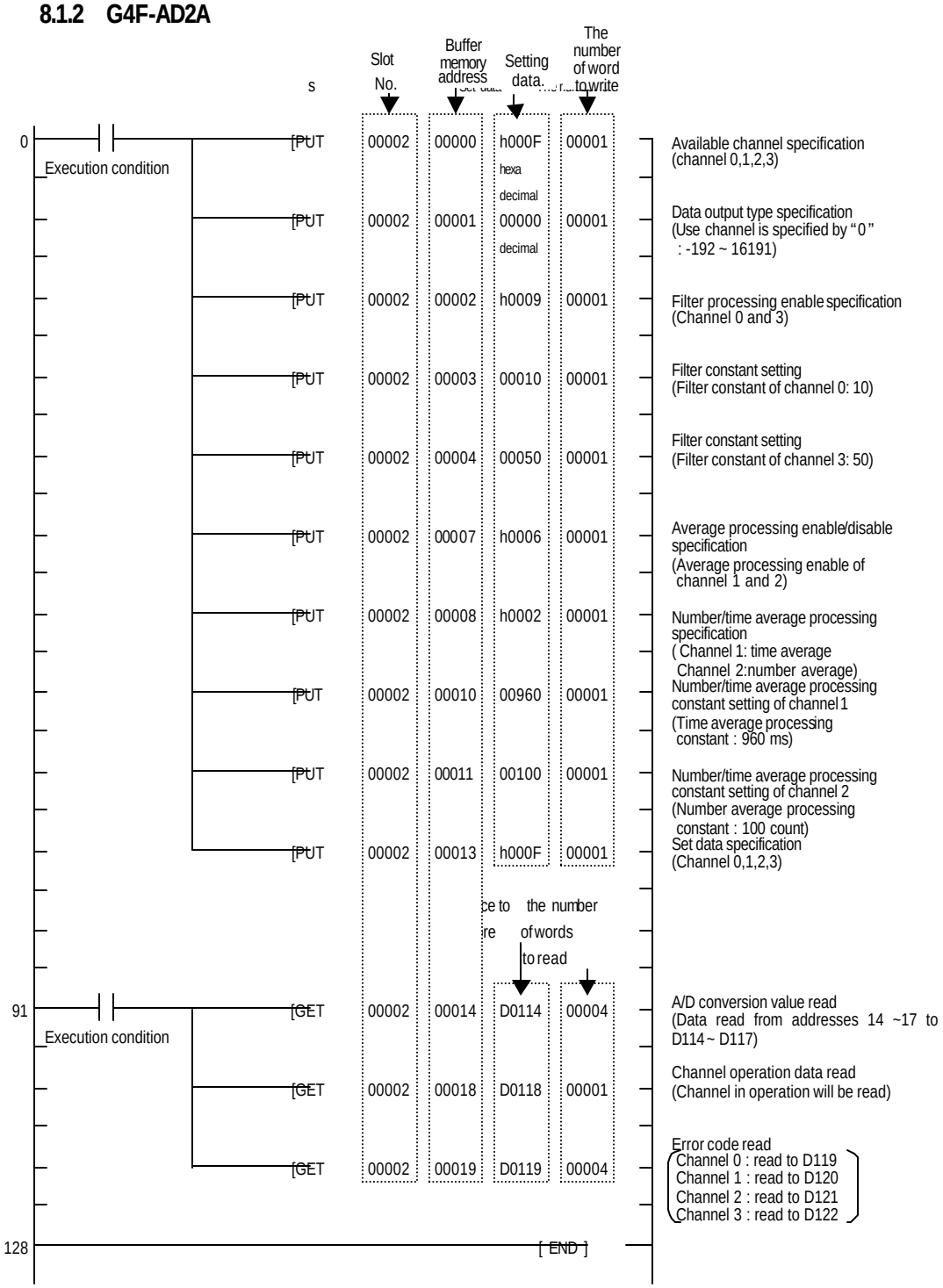
8.1 Basic Programming

- This shows the method of operation condition setting for buffer memory in the A/D conversion module.
- The A/D conversion module is mounted on the slot 2.
- A/D conversion module occupies 16 I/O points.

8.1.1 G3F-AD4A



8.1.2 G4F-AD2A


Slot No.
Buffer memory address
Setting data.
The number of word to write
0
Execution condition
[PUT
00002
00000
h000F
hexa
decimal
00001
Available channel specification
(channel 0,1,2,3)
[PUT
00002
00001
00000
decimal
00001
Data output type specification
(Use channel is specified by "0"
: -192 ~ 16191)
[PUT
00002
00002
h0009
00001
Filter processing enable specification
(Channel 0 and 3)
[PUT
00002
00003
00010
00001
Filter constant setting
(Filter constant of channel 0: 10)
[PUT
00002
00004
00050
00001
Filter constant setting
(Filter constant of channel 3: 50)
[PUT
00002
00007
h0006
00001
Average processing enable/disable specification
(Average processing enable of channel 1 and 2)
[PUT
00002
00008
h0002
00001
Number/time average processing specification
(Channel 1: time average
Channel 2:number average)
[PUT
00002
00010
00960
00001
Number/time average processing constant setting of channel 1
(Time average processing constant : 960 ms)
[PUT
00002
00011
00100
00001
Number/time average processing constant setting of channel 2
(Number average processing constant : 100 count)
[PUT
00002
00013
h000F
00001
Set data specification
(Channel 0,1,2,3)
the number of words to read
91
Execution condition
[GET
00002
00014
D0114
00004
A/D conversion value read
(Data read from addresses 14 ~17 to D114 ~ D117)
[GET
00002
00018
D0118
00001
Channel operation data read
(Channel in operation will be read)
[GET
00002
00019
D0119
00004
Error code read
Channel 0 : read to D119
Channel 1 : read to D120
Channel 2 : read to D121
Channel 3 : read to D122
128
[END]

8.2 Application Programming

8.2.1 Programming for Distinction of A/D Conversion Value.

1) System Configuration

GM3-PA1A	K7P-30AS	G3F-AD4A	G3Q-RY4A

2) Initial Settings

No.	Item	Initial setting	Buffer memory address	The value of words to write	Remark
1	Available channel	Channel 0,2,4	0	h0015 or 00021	
2	Data output type	- 192 ~ 16191	1	h0000 or 00000	
3	Filter processing enable/disable specification	Channel 0	2	h0001 or 00001	
4	Filter constant setting	50	3	h0032 or 00050	
5	Average processing enable/disable specification	Channel 2,4	7	h0003 or 00003	Ch2 : bit0 On Ch4 : bit1 On
6	Number/time average specification	Average number : ch2 Average time : ch4	8	h0002 or 00002	Ch2 : bit0 Off Ch4 : bit1 On
7	Number/time average processing specification	Average number : 100 Average time : 200ms	9 10	h0064 or 00100 h00C8 or 00200	
8	Analog input	Input current (DC –20 ~ 20mA)	-	-	
Other	Set data specification	-	13	h0015 or 00021	

3) Descriptions of the Program

(1) Digital value less than 12000 of channel 0 turns P0010 on.

(2) Digital value more than 13600 of channel 2 turns P0011 on.

(3) Digital value 12000 or more and 13600 or less of channel 4 turns P0012 on.

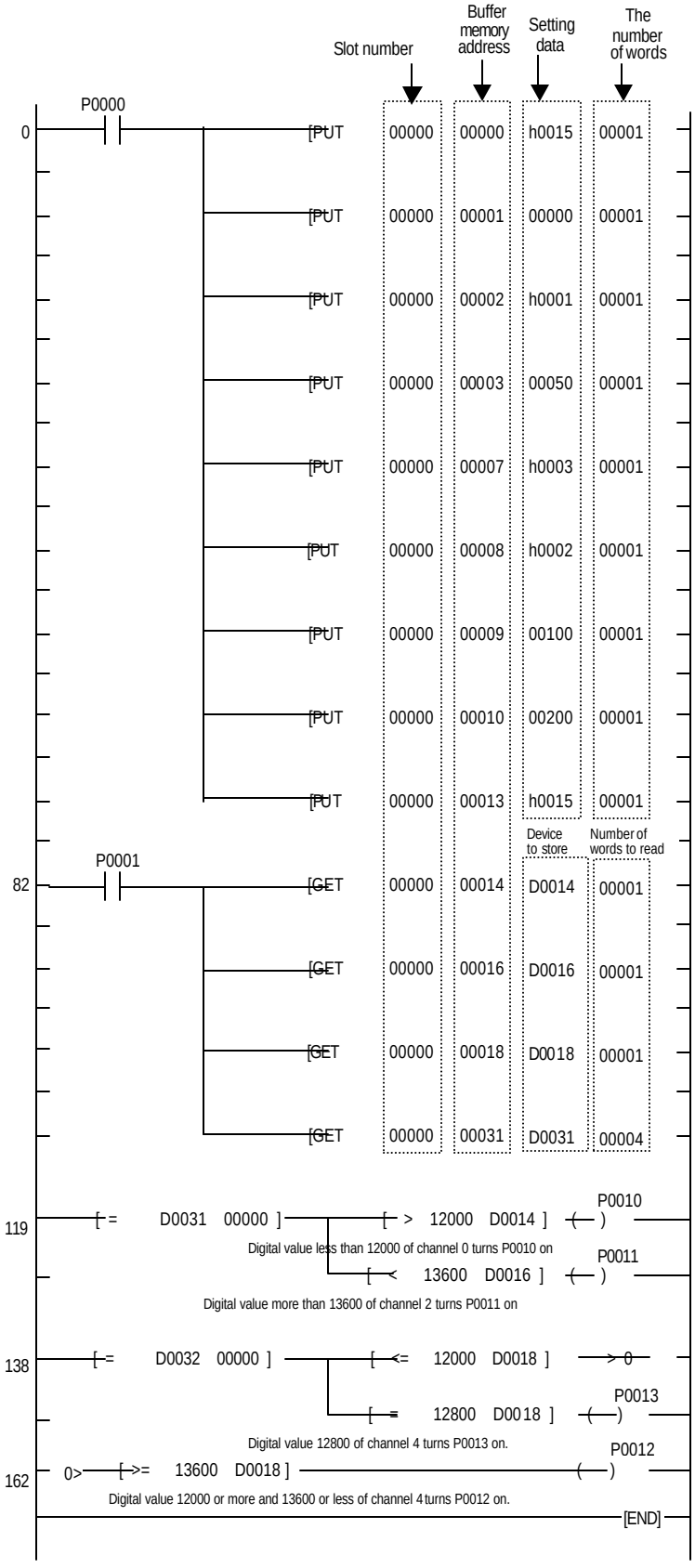
(4) Digital value 12800 of channel 4 turns P0013 on.

Remark

- In the Initial setting

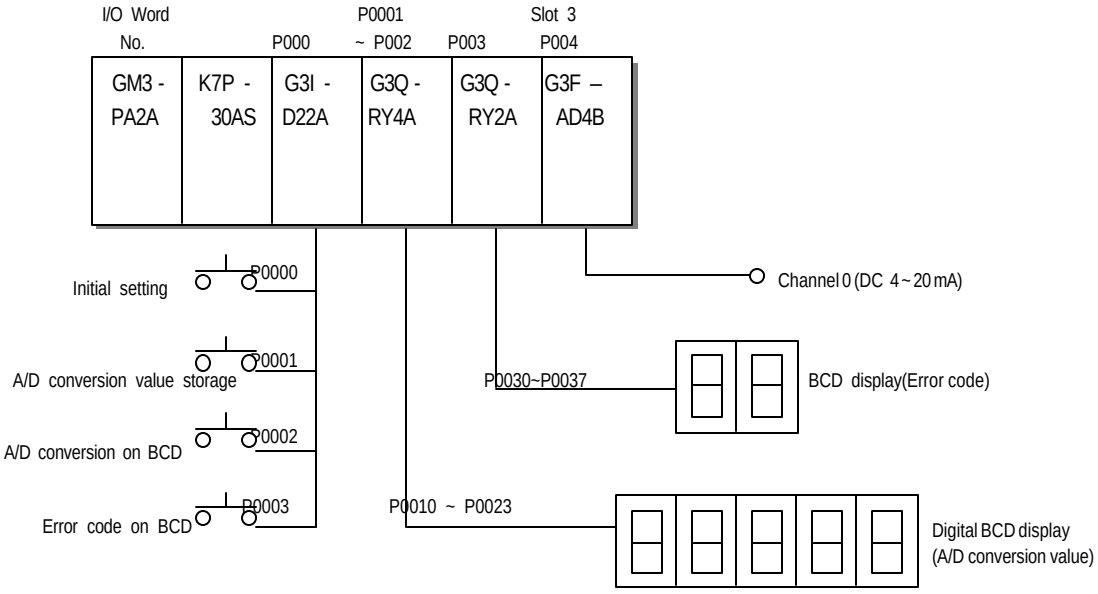
1) At the part of (3), if channel 0 is enabled to the filter processing, channel 0 to 3 will be enabled to the filter processing in block.
2) At the part of (4), if channel 0 is enabled to the filter constant, channel 0 to 3 will be enabled to the filter constant of 50 in block.
3) At the part of (5), if channel2 and 4 are enabled to the average processing, channel 0 to 3 and 4 to 7 will be enabled to the average processing in block.
4) At the part of (6),if channel 2 is enabled to the number average value of 100, channel 0 to3 will be enabled to the number average value of 100 in block.
5) At the part of (7), if channel 4 is enabled to the time average value of 200ms, channel 4 to 7 will be enabled to the time average value of 200 ms in block.

4) Programming Example



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

(1) System Configuration



(2) Initial settings

① Enabled channel: channel 0

② Time average processing specification:100ms

③ Data output type setting: 0 to 16000

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

(3) Descriptions of the program

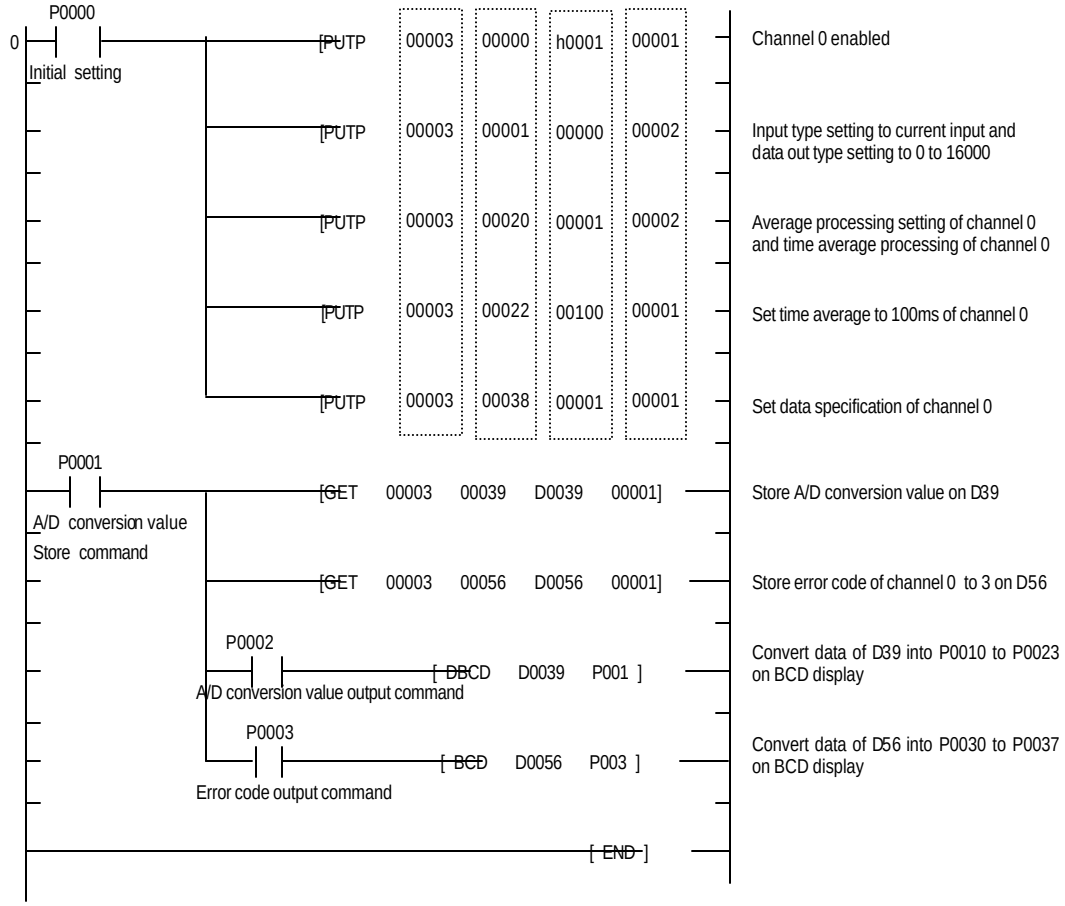
① A/D conversion module is initialized when P0000 turns on.

② A/D conversion value is stored to D39 and error code is stored to D56 when P0001 turns on.

③ A/D conversion value is displayed on the digital BCD display when P0002 turns on. (P0030 ~ P0037)

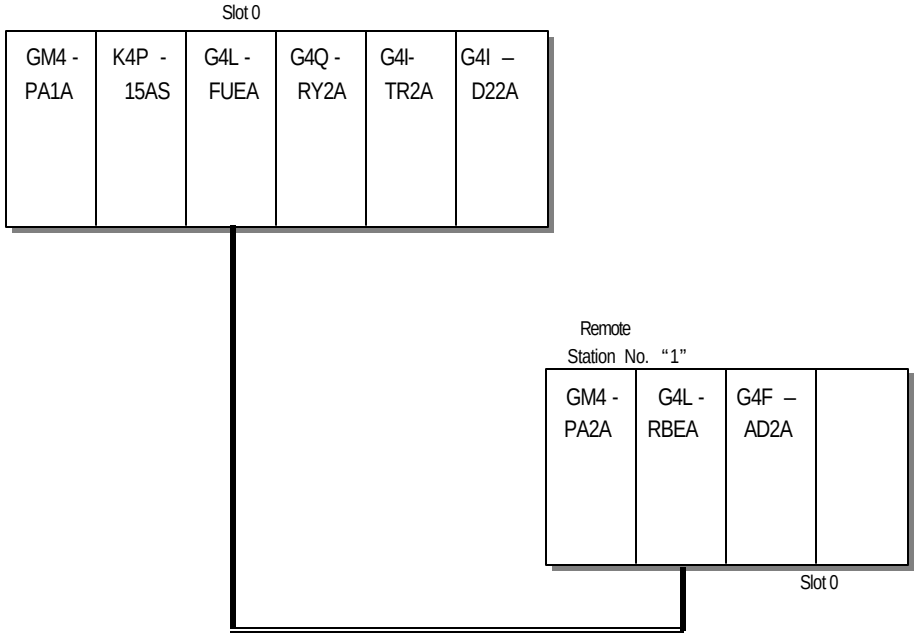
④ Error code is displayed on the digital BCD display when P0003 turns on. (P0010 ~ P0023)

(4) Programming example



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

(1) System Configuration



(2) Initial Settings

① Enabled channel: channel 0

② Data output range: -192 to 16191

③ Time average processing specification: channel 0(Set value :1000ms)

(3) Descriptions of the Program

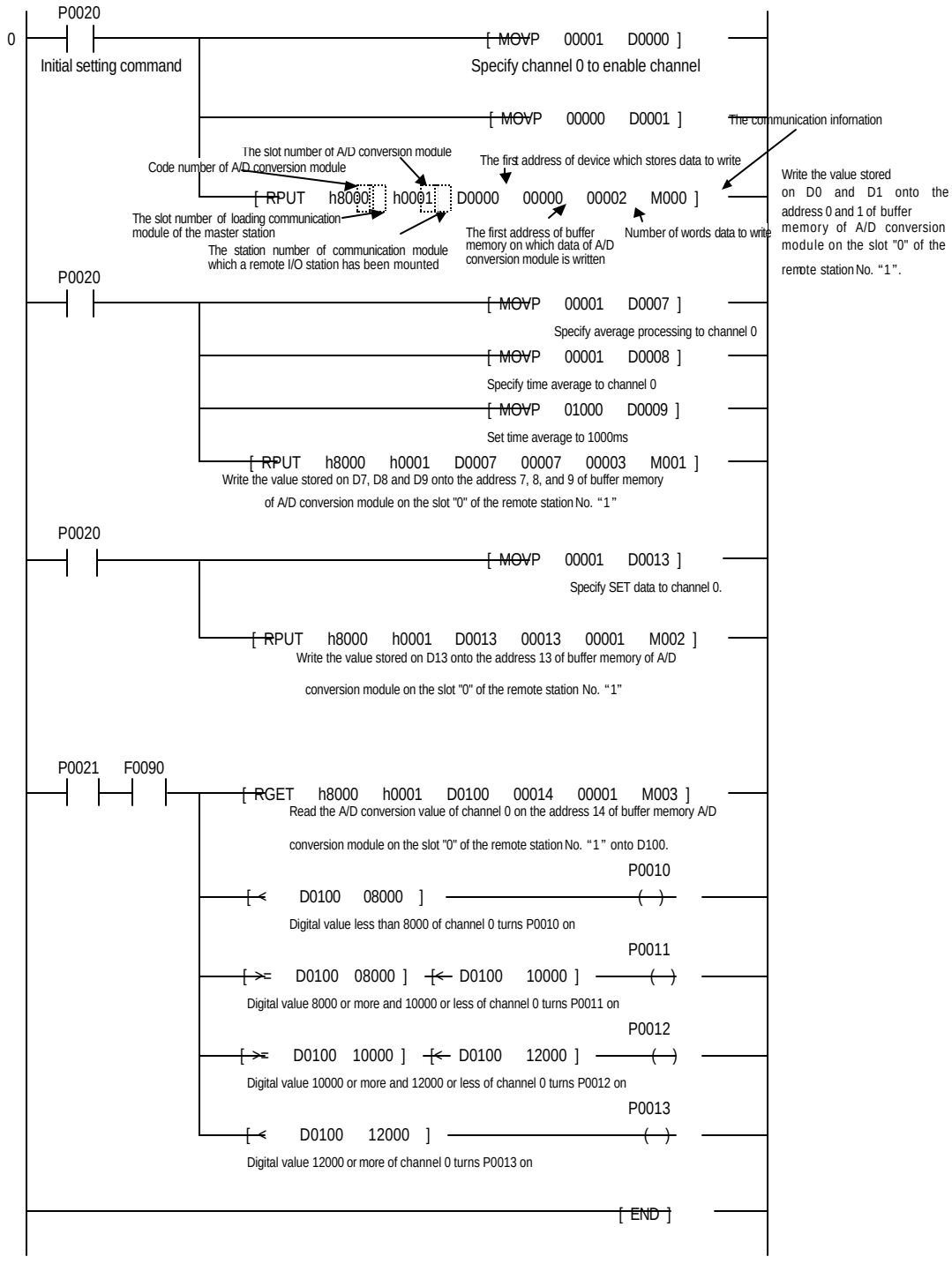
① Digital value less than 8000 of channel 0 turns P0010 on.

② Digital value 8000 or more and 10000 or less of channel 0 turns P0011 on.

③ Digital value 10000 or more and 12000 or less of channel 0 turns P0012 on.

④ Digital value more than 12000 of channel 0 turns P0013 on.

4) Programming Example



Chapter 9. TROUBLESHOOTING

This section shows the descriptions of the error code and troubleshooting during use of the A/D conversion module.

9.1 Error Code

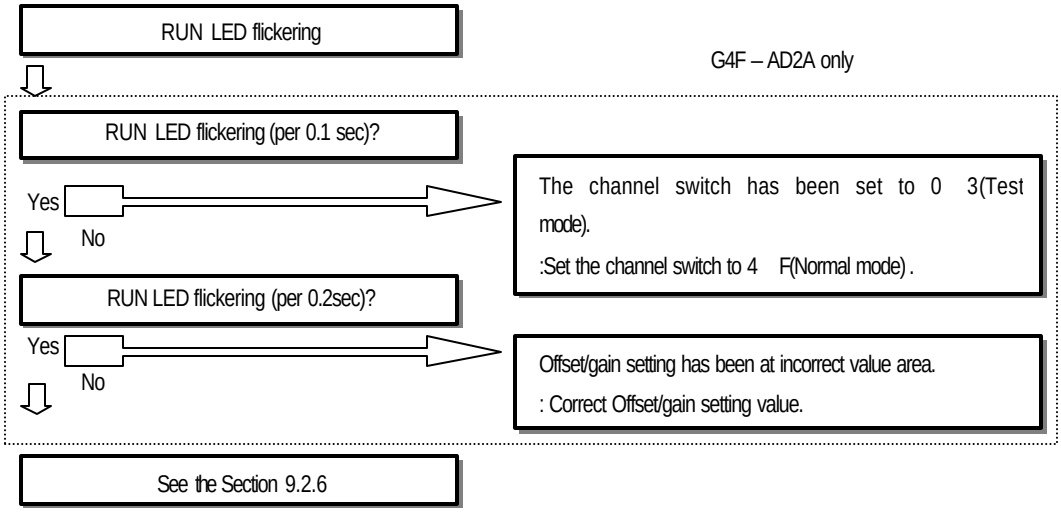
9.1.1 Error Code Indicated by RUN LED Flickering

Errors occurring during RUN LED flickering are shown as below.

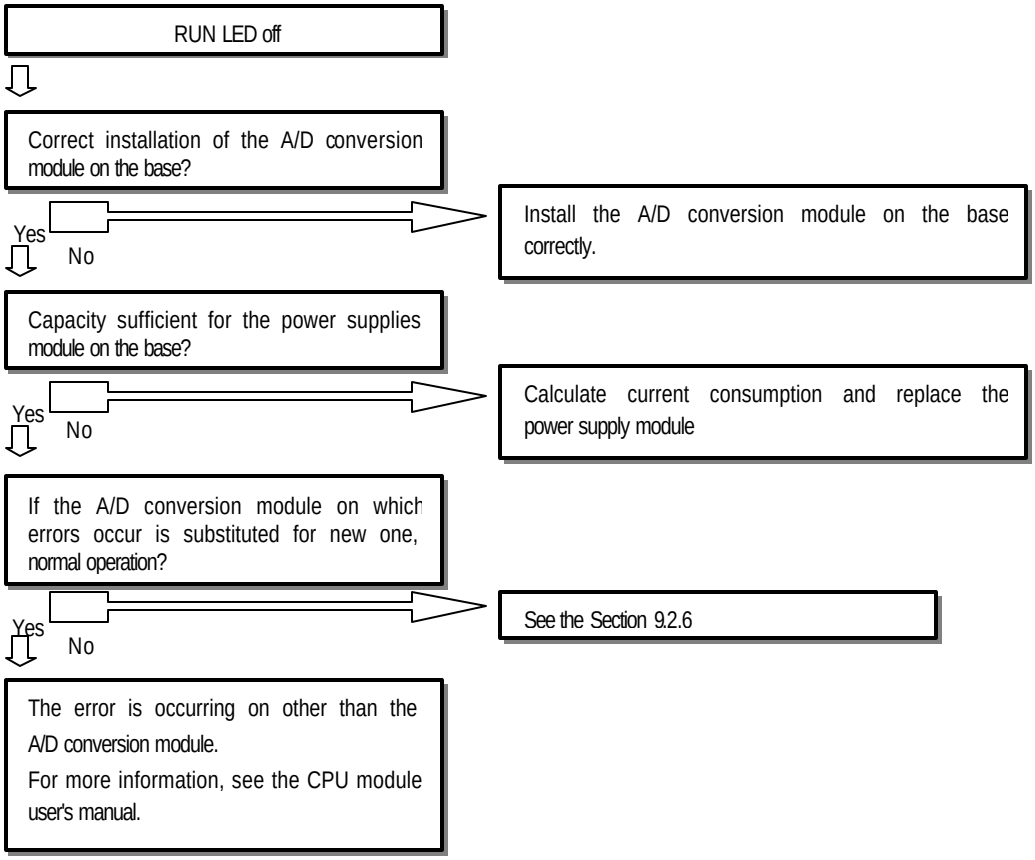
RUN LED	Descriptions	Remarks
flicker(per 0.1sec)	WDT error	
flicker(per 0.2sec)	System error	
	Buffer memory error	
	Offset / gain setting error	Only G4F-AD2A
flicker(per 0.6sec)	A/D conversion error	

9.2 Troubleshooting

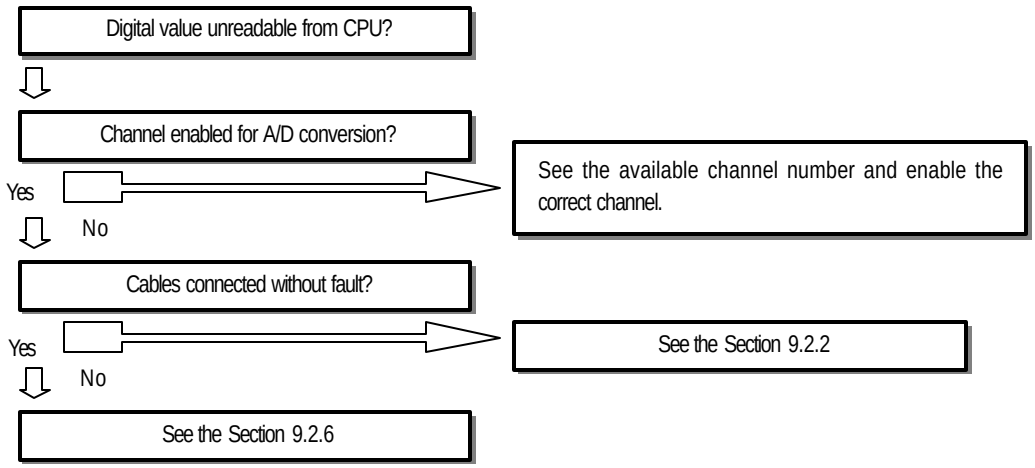
9.2.1 RUN LED Flickering



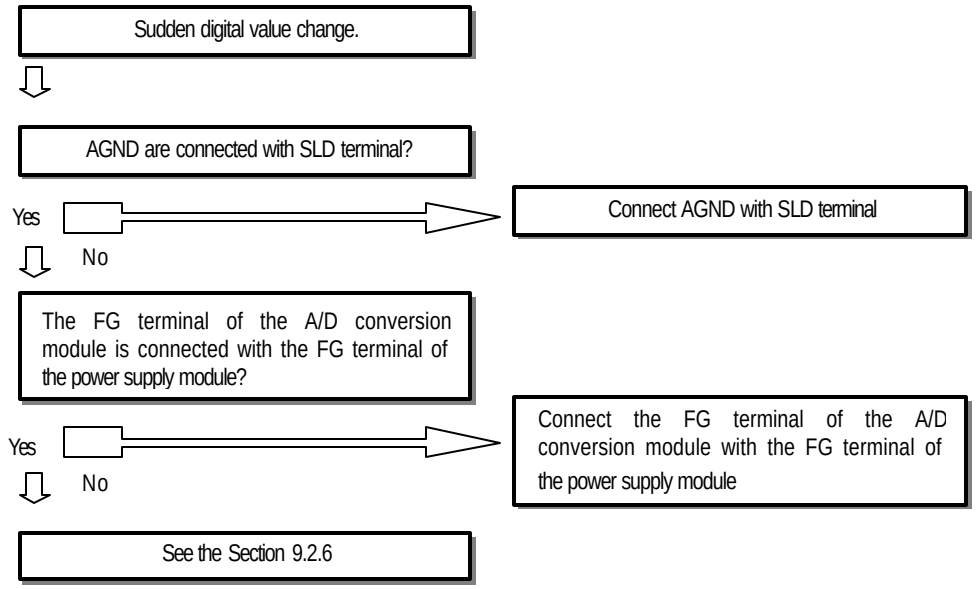
9.2.2 RUN LED Off



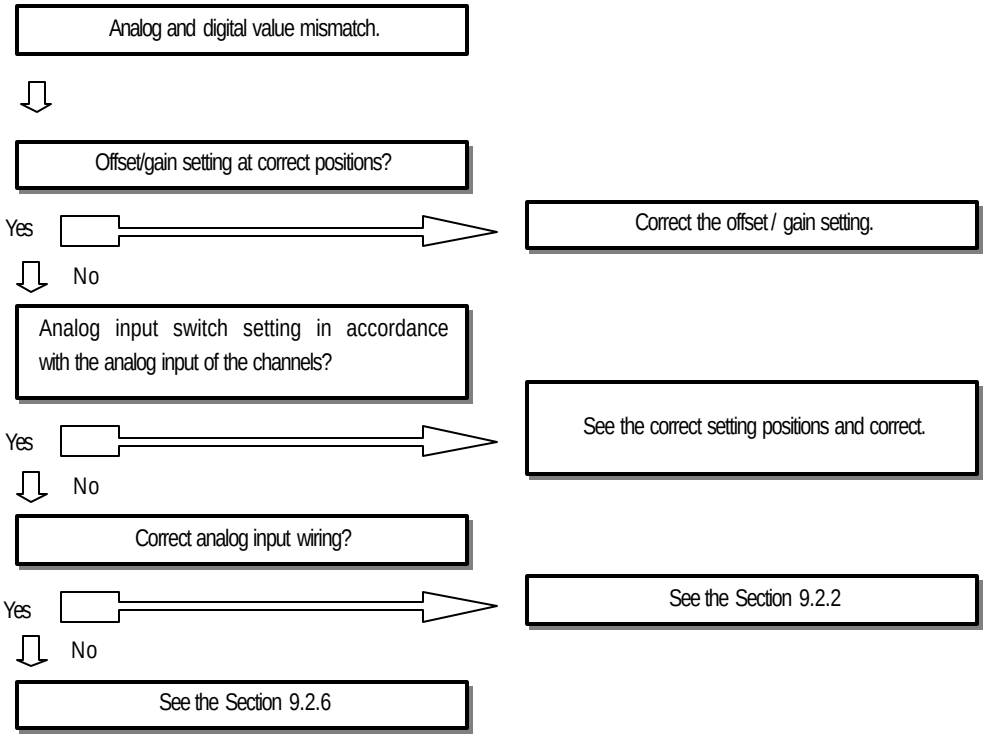
9.2.3 Digital Value Unreadable from the CPU Module



9.2.4 Sudden Digital Value Change



9.2.5 Analog and Digital Value Mismatch

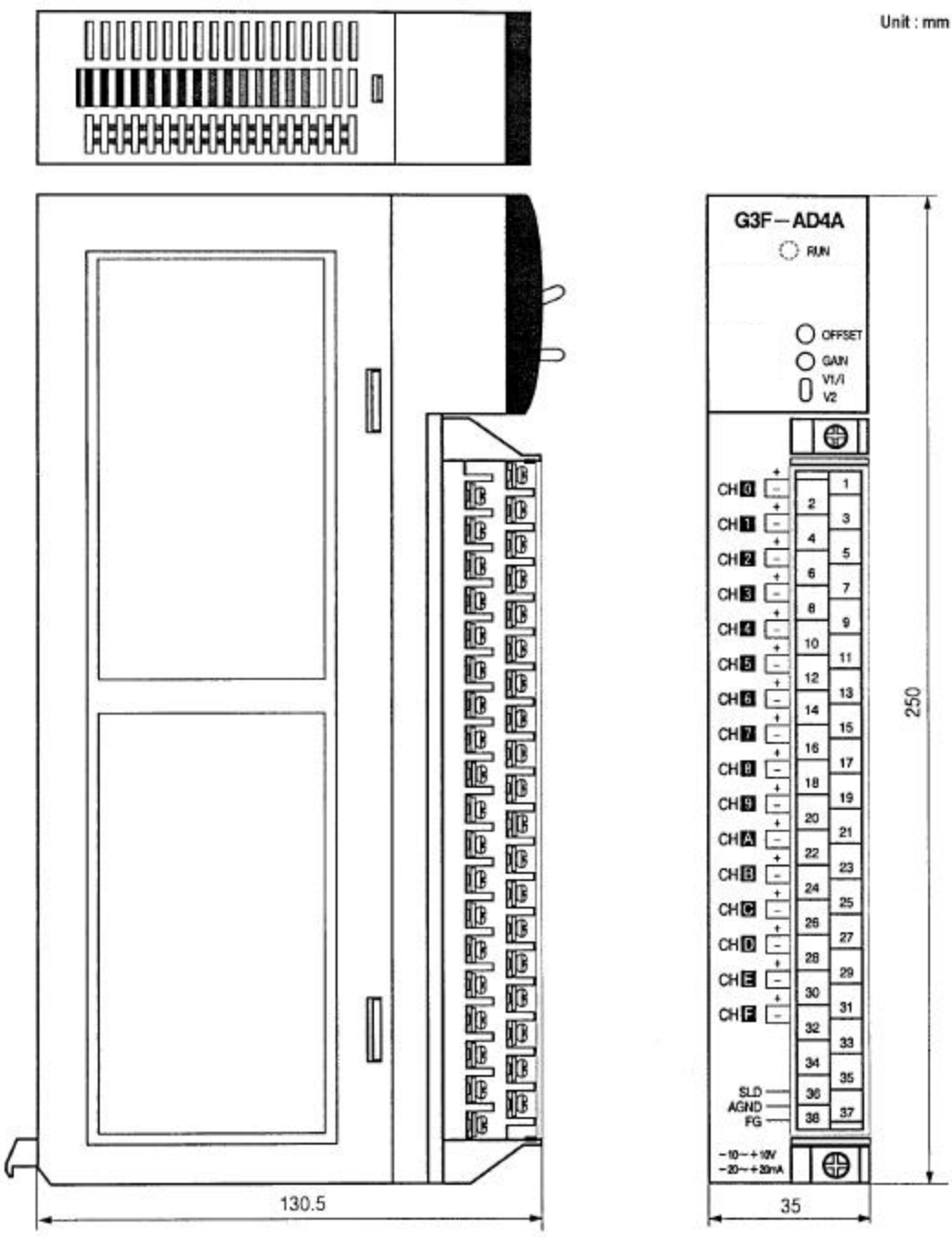
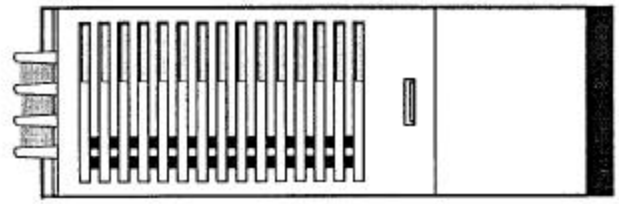
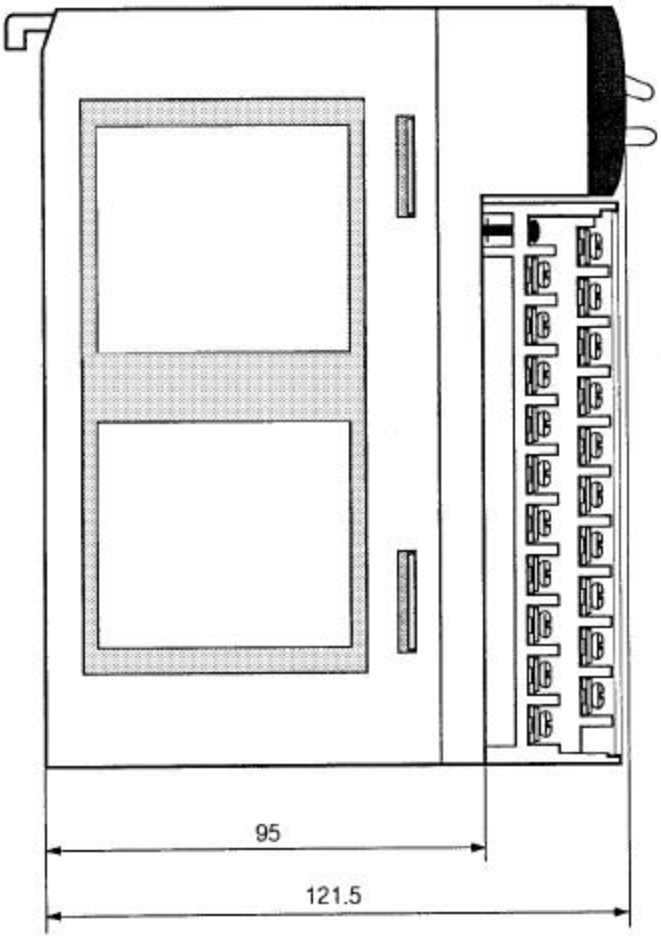
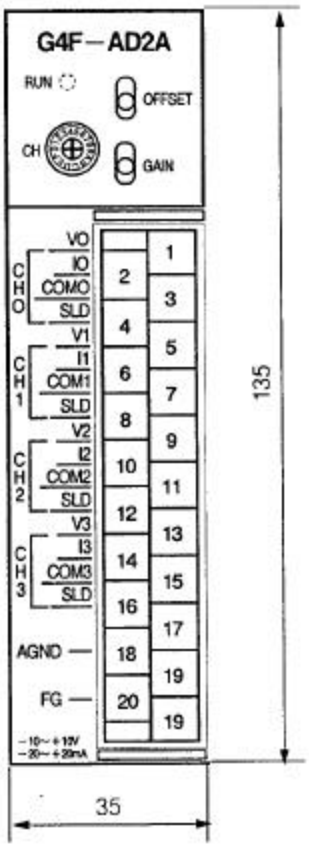


9.2.6 A/D Conversion Module Hardware Fault

A/D conversion module hardware fault.
Please contact our representatives or the service station with fault details.

Chapter 10. DIMENSIONS

10.1 G3F-AD4A, G3F-AD4B Dimensions



10.2 G4F-AD2A Dimensions