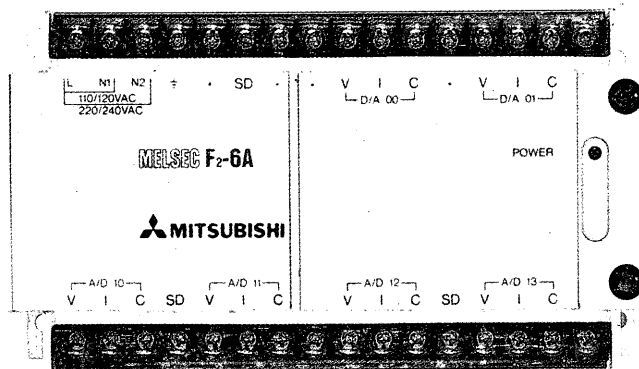


INSTRUCTION MANUAL

ANALOGUE INPUT/OUTPUT UNIT F2-6A-E



- This manual provides technical information and guidance on the use of the analogue input/output unit type F₂-6A-E.
- Users should ensure that the detail of this manual is studied and understood before attempting to install or use the units.
- Information concerning the programming of the system, using the programmer unit, is covered in a separate manual.

CONTENTS

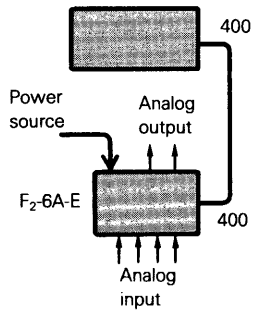
1. General	1
— Extension configuration	1
— Analog signal configuration	1
— Applicable programmable controllers	1
2. General description of installation/wiring work	2
— Installation dimension	2
— Installation position of extension unit	3
— Installation of extension cable	3
— Environmental conditions	4
— Installation work	4
— Wiring work	4
3. Connection of input/output and power source	5
— Connection of earth to power source	5
— Connection of analog input/output	6
4. Data transfer	7
— Program example	9
5. Adjustment procedure	10
— Preparations	10
— Program writing	10
— Selection of output type	12
— Adjustment of volume	13
— Selection of input type	14
— Connection of input/output circuit	15
— Adjustment of volume	16
6. Specifications and outside dimensions	17
— General specifications	17
— Output specifications	19
— Input specifications	20

General

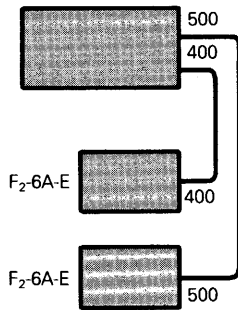
The type F₂-6A-E analog input/output unit is used in extension to the basic unit of F₁ series programmable controller, and designed to allow the handling of 4-point analog input and 2-point analog output.

Extension configuration

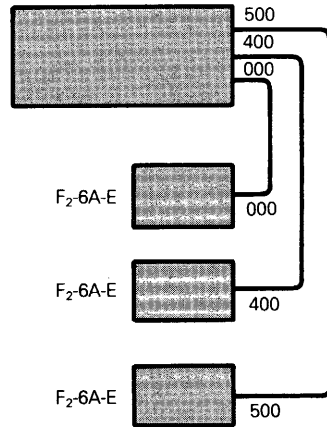
F₁-20MR-ES, F₁-20MR-UL
F₁-30MR-ES, F₁-30MR-UL



F₁-40MR-ES, F₁-40MR-UL



F₁-60MR-ES, F₁-60MR-UL



The analog input/output unit may be used up to a maximum of three units, depending upon the type name of basic unit used for the programmable controller.

The power voltage to this unit is commonly supplied from the AC110V/220V system, and turned on/off simultaneously when the power to the programmable controller is turned on/off.

Analog signal configuration

The configuration of analog signal may be changed as follows for use in the same manner as 4-point analog input (4 channels) and 2-point analog output (2 channels);

- Voltage input/output: 0 ~ 5V or 0 ~ 10V
- Current input/output: 0 ~ 20mA or 4 ~ 20mA

It is possible to use voltage input/output and current input/output in combination for each analog input/output. In such a case, select either voltage or current for the signal of the same channel.

If the analog signal of 4 ~ 20mA is used, it is necessary to use all inputs as 4 ~ 20mA.

These analog signals are treated as 8-bit binary digital values within the unit.

A photo-coupler is used for insulation between the analog signal and digital signal.

Bear in mind that no insulation is provided between each channel of the analog signal.

Applicable programmable controllers

The extension of analog input/output unit is applicable to the following programmable controllers.

It is not applicable to F₁-12MR-ES and F₁-12MR-UL programmable controller.

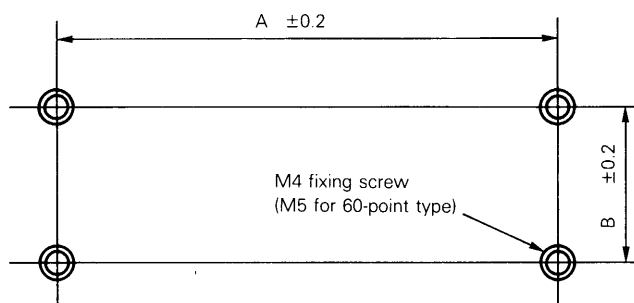
- F₁-20MR-ES · F₁-20MR-UL
- F₁-30MR-ES · F₁-30MR-UL
- F₁-40MR-ES · F₁-40MR-UL
- F₁-60MR-ES · F₁-60MR-UL



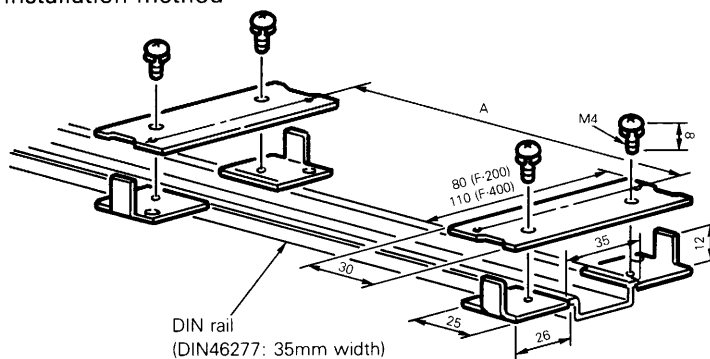
General description of installation/wiring work

Installation dimension

[1] Direct mounting method



[2] DIN rail installation method



- Do not attempt to install the unit on the floor or ceiling, but on the wall surface, for prevention of temperature rise.

The unit installation dimensions are as shown in the following table.

In the case of direct installation, drill the holes for installation screws of the following dimensions, depending upon the type of machine installed.

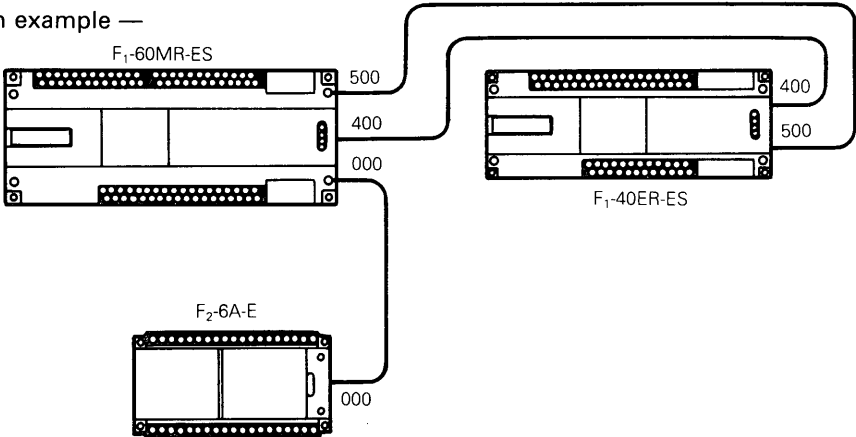
Apart from the problem with the indication direction, the unit may be installed to vertical direction with the extension connector directed downward.

	A	B	DIN installation space
F-4T	140	35	—
F ₁ -12M, 10E, F ₂ -6A	155	70	F-20D
F ₁ -20M, 20E	240	70	F-20D
F ₁ -30M	265	70	F-20D
F ₁ -40M, 40E	290	100	F-40D
F ₁ -60M, 60E	335	125	—

DIN installation base is supplied in two assemblies. Secure them to the right and left of the rail temporarily, and then tighten the screws securely after installing the programmable controller.

Installation position of extension unit

— Installation example —



The extension unit may be installed at the upper side/lower side or the right-hand side of the basic unit.

The extension cable is attached to the extension unit, and has a length of 450mm for type F₂-6A and other types with point of less than 20 and that of 600mm for types with point of 40 ~ 60.

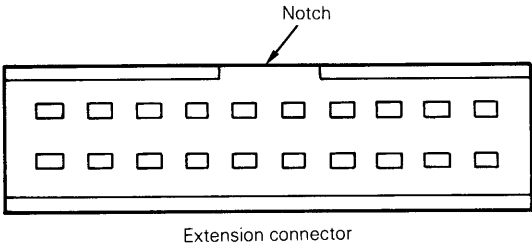
Each unit may be installed anywhere within the reach of cable.

It is advised to secure a space of more than 50mm around each unit for ventilation, and another space of (more than 50mm) for attaching/detaching of extension cable.

The basic unit is attached with a label for extension connector No.

Since the extension unit with point of less than 20 may be connected to any connector of #000, #400 or #500, stick the label to the surface of programmable controller, depending upon the connecting connector No.

Installation of extension cable



The extension unit is most readily affected by noise, therefore, be sure to keep it away from the other electrical wirings more than 30 ~ 50mm.

Remove the connector cover from right side surface of both basic unit and extension unit to connect the extension cable.

Since the connector located at each side of the extension cable is provided with false insertion preventing projection, direct the projection upward and align it with the notch of the unit.

Each side of the cable may be installed with either the basic unit or extension unit.

— Points to note on installation —

Environmental conditions

- Do not attempt to install the equipment at such places where there exist dust, oily smoke, conductive dust, corrosive gas, etc.
- Do not install the equipment directly at such place where the vibration or shock may be applied.
- Do not install the equipment near the heat-generating substance, or at such places where direct sunshine may be applied, or where dewing may occur, or the equipment may be exposed to rain and wind.

Installation work

- Check carefully that cutting chips or cutting wire pieces are not mixed in the programmable controller before starting the screw hole machining or wiring.
- For prevention of heating, remove the dust-preventing sheet wound at the ventilation window of programmable controller after completion of the work.
- Be sure to secure a space of more than 50mm between the unit main body and the other equipment and between the unit main body and the structure.

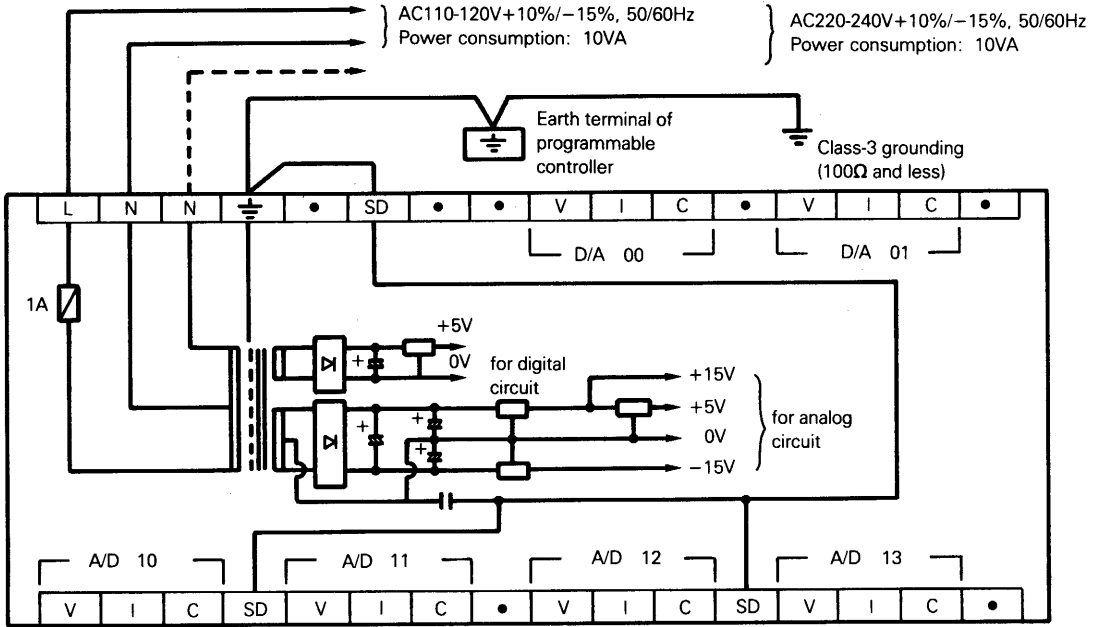
Wiring work

- It is advised to keep the wiring away from the high-voltage line, high-voltage equipment and power equipment as far as applicable.
- Do not attempt to pass the signal input line and output line of the programmable controller through the same cable.
- Do not attempt to pass the signal input line and output line through the same duct, or bind them together with the other output line and other power line and output line.
- Minimize the length of analog input/output line to avoid noise mixing.
Normally, keep the maximum wiring length to within 20m.

3

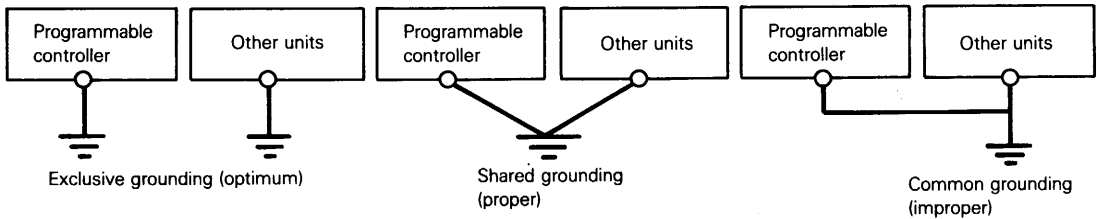
Connection of input/output and power source

Connection of earth to power source



— Points to note on connection —

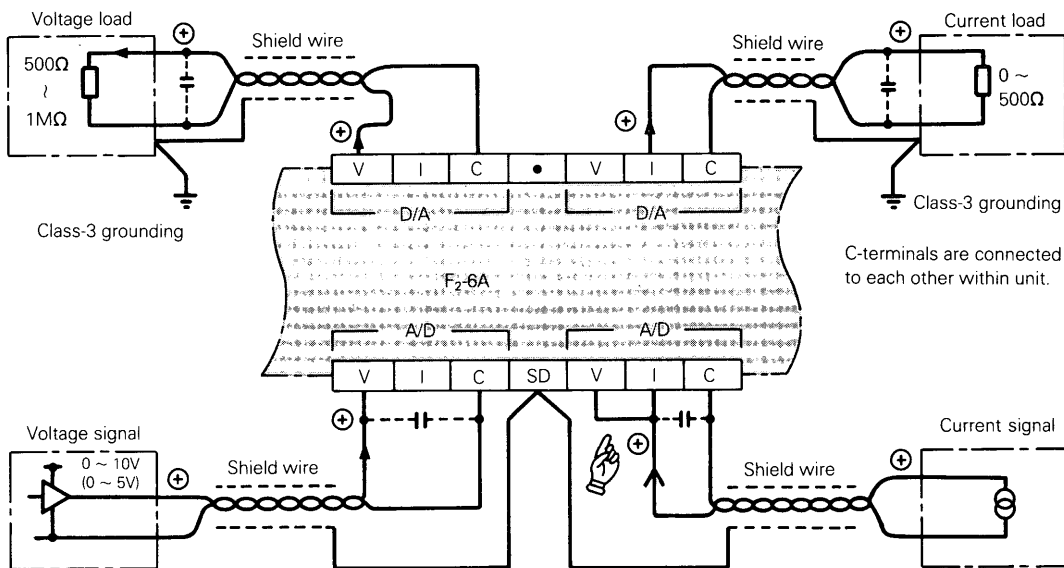
- This unit uses common AC110V/220V power source. Extreme care needs to be taken not to connect the wiring falsely, as connecting 220V to 110V terminal or making the power line to contact with the input/output line falsely can cause the programmable controller to be burnt. In addition, be sure to turn on/off the power to the unit together with the power to the basic unit of the programmable controller.
- Connect the earth terminal of the unit to that of basic unit of the programmable controller to ground at the basic unit as illustrated. Do not fail to ground the SD terminal. The resistance for earthing should be less than 100Ω. The earthing must not be shared with any high power equipment such as a motor system etc.



- The power fuse can be replaced by opening the left side cover on the upper surface of the unit.

— Fuse 250V, 1A, 5.3φ × 20 glass tube fuse

Connection of analog input/output



— Points to note on connection —

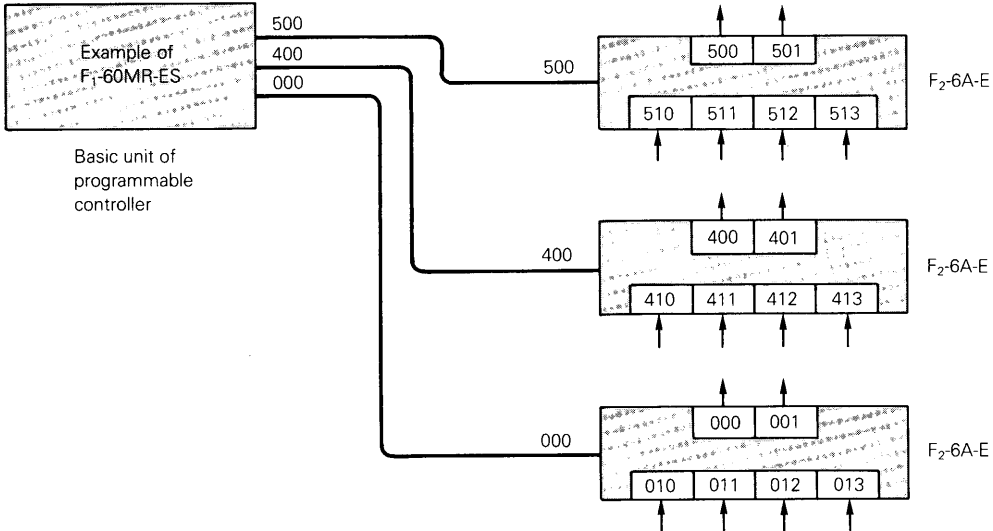
- Use a twisted pair wire with shield for input/output signal line. Do not wire the signal line, if possible, in parallel to or close to the power line and drive line. Execute the class-3 grounding of the shield line at the signal reception side. The earthing must be shared with the high voltage system. Where execution of grounding is difficult, the unit may be used without grounding. In case the external wiring may be accompanied by noise or ripple, connect a capacitor of approx $0.1 \sim 0.47\mu\text{F}/25\text{V}$ across the signal reception terminal.
- The internal resistance of this unit against the analog input is $200\text{k}\Omega$ for input of $0 \sim 5\text{V}$, $85\text{k}\Omega$ for that of $0 \sim 10\text{V}$, and 250Ω for that of $0 \sim 20\text{mA}$ and $4 \sim 20\text{mA}$ respectively. Select the signal source having proper voltage/internal resistance with the above point taken into account. In the case of current input, connect the I terminal to V-terminal to each other.
- Each input/output channel may be used either in the current type or voltage type. If the input is used as $4 \sim 20\text{mA}$, however, all the inputs need to be unified to $4 \sim 20\text{mA}$.
- Special care needs to be taken not to short circuit across the analog output channel, as the internal element may be damaged. Also, do not apply the signal of over 12V or over 22mA to the analog input. Otherwise, the internal element may be damaged.

4

Data transfer

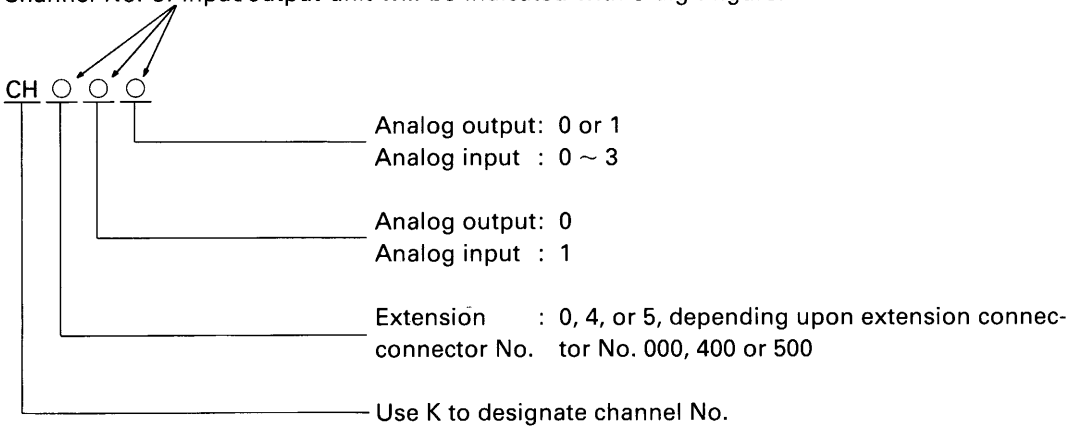
In performing the adjustment of this analog input/output unit, it is necessary to transfer the data between the programmable controller and analog input/output unit. This section will describe the data transfer procedure in advance.

Channel No.



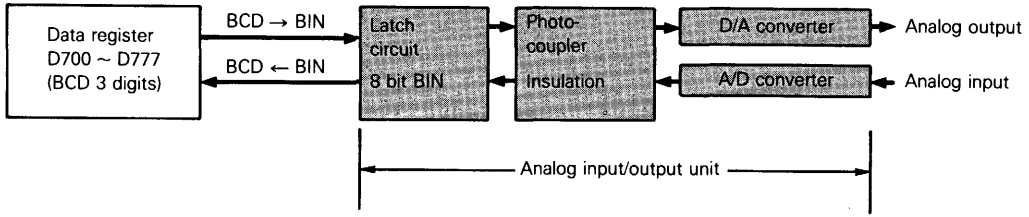
Note:

Channel No. of input/output unit will be indicated with 3-digit figure.



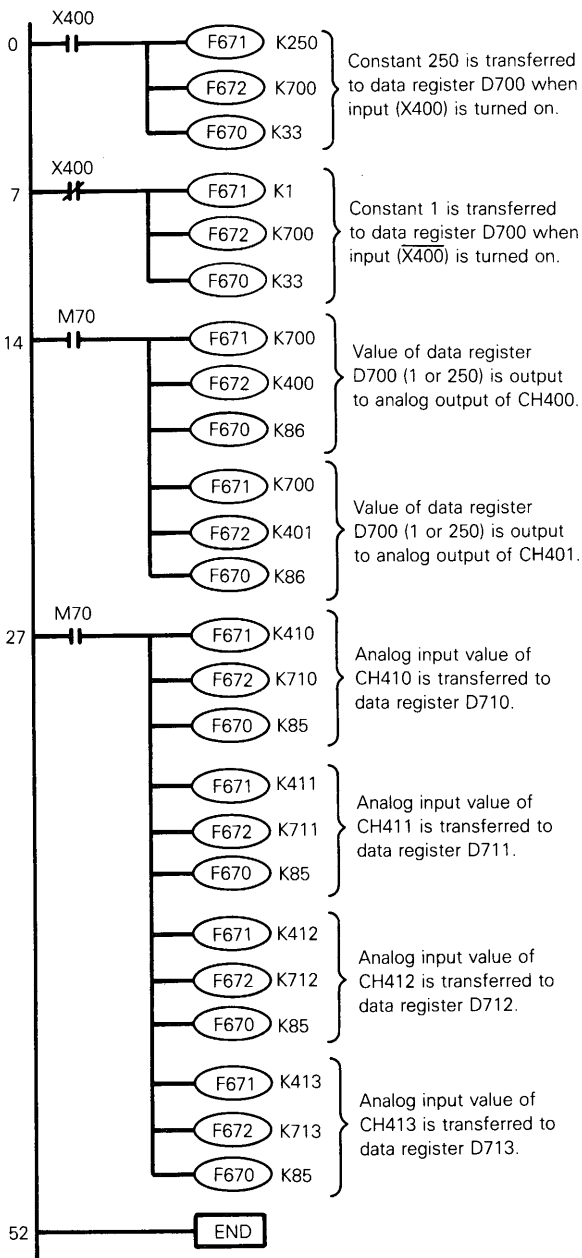
— Handling of data —

The data communication between the programmable controller and analog input/output unit is executed between the data registers D700 ~ D770 (BCD 3-digit) built in the programmable controller and latch memory (8-bit binary) built in the input/output unit.



Program example

The following circuit shows a circuit which is suitable to the initial adjustment of this analog input/output unit.



Loading

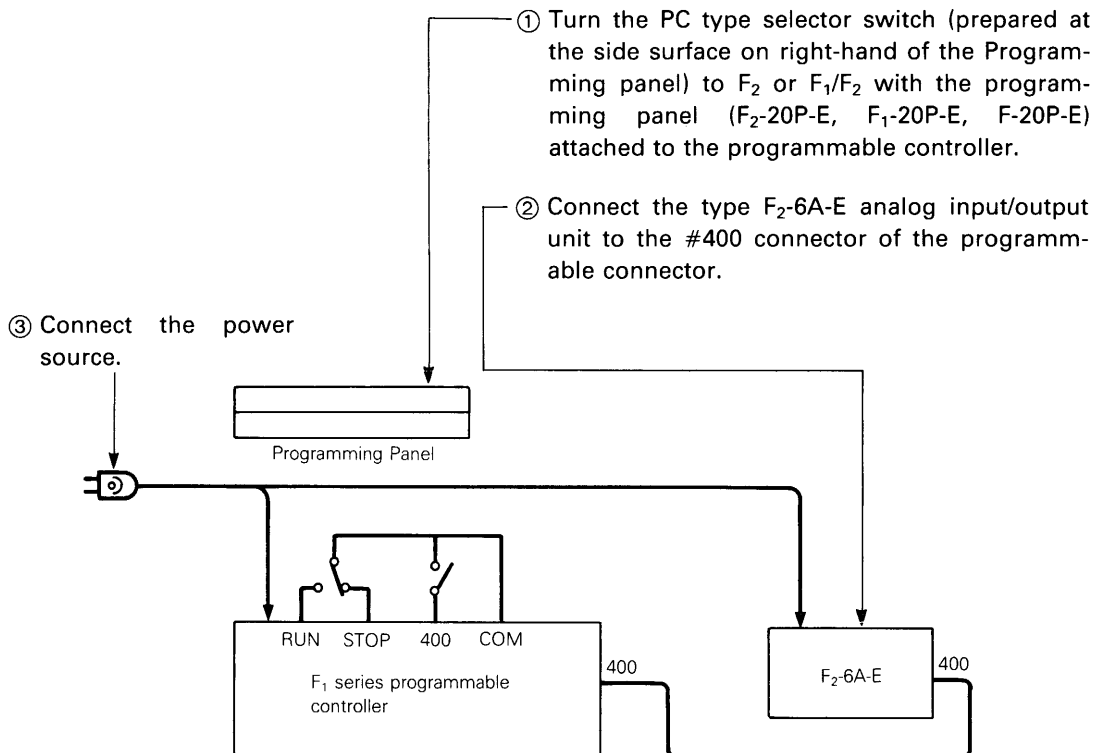
0	LD	400	45	K	85
1	OUT	671	46	OUT	671
2	K	250	47	K	413
3	OUT	672	48	OUT	672
4	K	700	49	K	713
5	OUT	670	50	OUT	670
6	K	33	51	K	85
7	LDI	400	52	END	
8	OUT	671			
9	K	1			
10	OUT	672			
11	K	700			
12	OUT	670			
13	K	33			
14	LD	70			
15	OUT	671			
16	K	700			
17	OUT	672			
18	K	400			
19	OUT	670			
20	K	86			
21	OUT	671			
22	K	700			
23	OUT	672			
24	K	401			
25	OUT	670			
26	K	86			
27	LD	70			
28	OUT	671			
29	K	410			
30	OUT	672			
31	K	710			
32	OUT	670			
33	K	85			
34	OUT	671			
35	K	411			
36	OUT	672			
37	K	711			
38	OUT	670			
39	K	85			
40	OUT	671			
41	K	412			
42	OUT	672			
43	K	712			
44	OUT	670			

5

Adjustment procedure

[Adjustment program]

Preparations



Program writing

Programming panel : Monitor/program selector switch at "Program" side
 Programmable controller: STOP

Write all the programs, referring to the "List of instructions" given on the previous page.

Then, read these programs in the following procedure for checking.

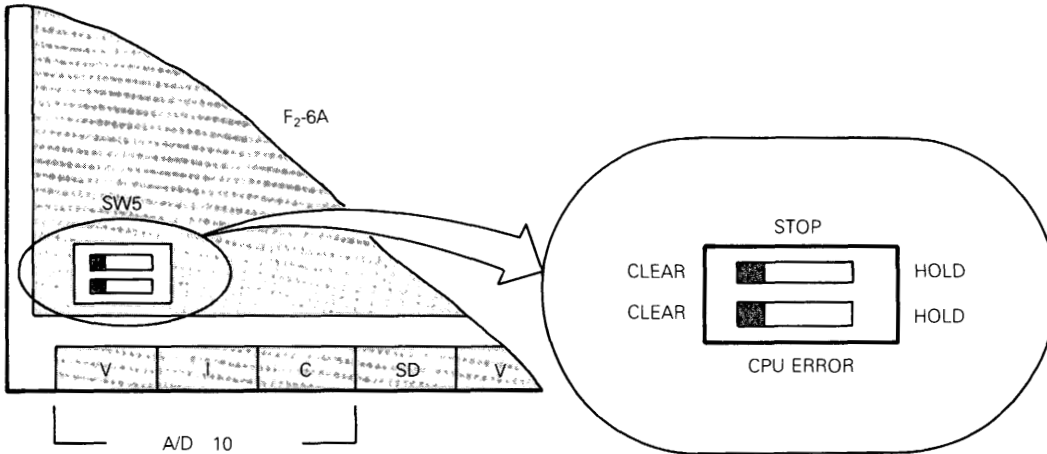
.....

— Mode setting for analog input/output unit —

When the upper left side cover of the type F₂-6A-E analog input/output unit is opened, two-throw switch SW5 is found at the lower left side of the unit.

The switch is used to make selection on whether the analog output is retained at the current level (HOLD) or turned to "0" (CLEAR) when the programmable controller is stopped or CPU ERROR occurs.

In either case, the analog output is cleared when the projection is turned to left side, and held when it is turned to right side.

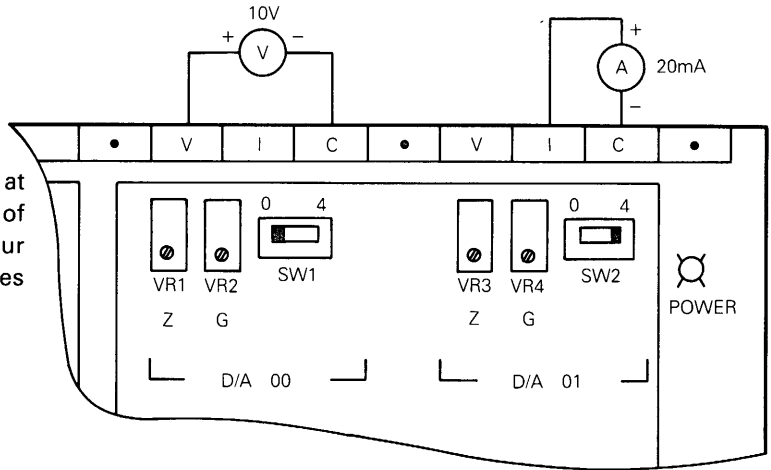


Note: Keep in mind that the mode selection at the CPU ERROR side is treated preferentially over the mode selection at the STOP side.

Selection of output type

[Adjustment of analog output]

- ① Connect a voltmeter (across V and C terminals) or an ammeter (across I and C terminals) to the analog output terminal.



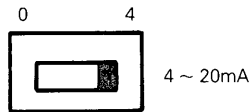
- ② When the cover (located at right on upper surface of unit) is opened, four volumes and two switches are found.

Reference: Ammeter/voltmeter

Digital voltmeter type TR6843 or TR6844 made by ADVANTEST

- ③ Selection of output type (SW1 and SW2)

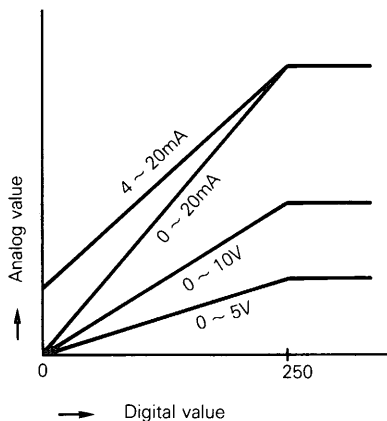
0 ~ 5V output
0 ~ 10V output
0 ~ 20mA output



- Turn the projection of switch to left or right, depending upon the desired output type.

— Preliminary knowledge for volume adjustment (1) —

■ Handling of gain adjustment



To facilitate the digital/analog conversion, the digital value of 0 ~ 250 is generally converted into the analog value of 0 ~ 5V, 0 ~ 10V, 0 ~ 20mA, 4 ~ 20mA, etc.

When necessary to maximize the 8-bit resolution, it will be possible to adjust the digital value of 0 ~ 255 into full-scale analog value.

This section describes the adjustment procedure in correspondence to 250 full-scale.

■ Zero adjustment

This section describes the adjustment procedure for case when the analog output corresponds to "1" with the digital value set as "1" to facilitate the adjustment procedure. When adjusting the digital value of 0 ~ 250 to analog value of 0 ~ 10V, for instance, it is all right to adjust the digital value to 0.04V (=10/250) when it is "1".

Adjustment of volume

[Adjustment of analog output]

④ Zero adjustment volume (VR1 and VR3)

When the volume is turned clockwise (16 turns, max.), the analog value is increased toward positive value.

- Turn the "Monitor/Program selector switch (located at the center of programming panel) to "Monitor" side, and turn on the RUN input of the programmable controller.
- When the input (X400) of the programmable controller is turned off, the value of "1" will be transferred to the analog input/output unit.
- Turn the zero adjustment volume to assure the value shown in the following table, while observing the voltmeter or ammeter.

Table-1

Output type	0 ~ 5V	0 ~ 10V	0 ~ 20mA	4 ~ 20mA
Meter value	0.020V	0.040V	0.080mA	4.064mA

⑤ Gain adjustment volume (VR2, VR4)

When the volume is turned clockwise (16 turns, max.), the analog output is increased.

- When the input (X400) of the programmable controller is turned on, the value of "250" will be transferred to the analog input/output unit.

Table-2

Output type	0 ~ 5V	0 ~ 10V	0 ~ 20mA	4 ~ 20mA
Meter value	5V	10V	20mA	20mA

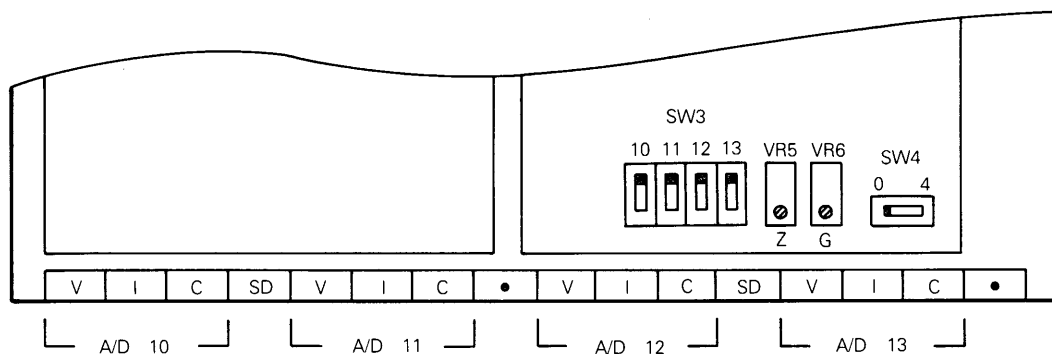
Appendix:

- Perform the adjustment of zero and gain for several times alternately.
- It is possible to select the different output type for channel-00 and channel-01 of analog output.
- Perform the above adjustment for each channel.

Selection of input type

[Adjustment of analog input]

When the right cover on the upper surface of the analog input/output unit is opened, switches SW3 and SW4, and volumes VR5, VR6 are found arranged at the lower part.



To set the input type, change SW3 and SW4 as shown in the following table;

Table-3

Input type	0 ~ 5V	0 ~ 10V	0 ~ 20mA	4 ~ 20mA	Remarks
Switch SW3	Downward	Upward	Downward	Downward	Set for each channel
Switch SW4	Leftward	Leftward	Leftward	Rightward	Common setting for all channels

Note: The input types of 0 ~ 5V, 0 ~ 10V and 0 ~ 20mA can be selected in combination optionally for each input channel.

If 4 ~ 20mA is selected even for one channel, all the channels need to be set at 4 ~ 20mA.

— Preliminary knowledge for volume adjustment (2) —

• Handling of adjustment signal input

The adjustment will be made more readily by the use of variable voltage generator (type TR6141 PROGRAMMABLE VOLTAGE/CURRENT GENERATOR: made by ADVANTEST) as an input signal source for adjustment for instance.

This section describes the procedure for case when the analog output of this unit is used for analog input signal source.

• Handling of each input channel

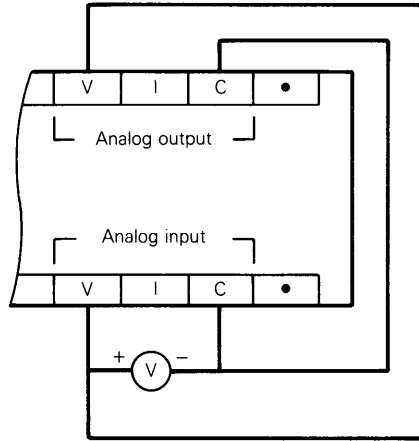
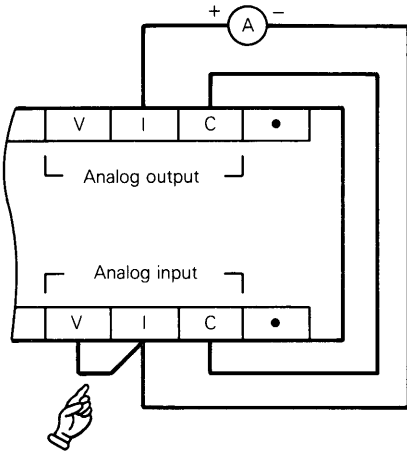
The zero and gain adjustments are made commonly to each input/output channel, therefore, one volume is used.

It is so designed that the other channels can be adjusted automatically by adjusting either one of specific input channels.

It is advised to perform the adjustment check of other channels for caution's sake.

Connection of input/output circuit

[Adjustment of analog input]



Connection of current input

Note:

In the case of current input, connect V, I, terminals.

Connection of voltage input

Reference:

Voltmeter + Ammeter
Type TR6843 or TR6844 digital multimeter
made by ADVANTEST

Use the analog output of the same type as the desired analog input type for signal source, and connect it to the analog input as shown in the above figure.

In case the input/output type is different, adjust the output type to the same one as the input type in advance and adjust the output again after completion of the input adjustment.

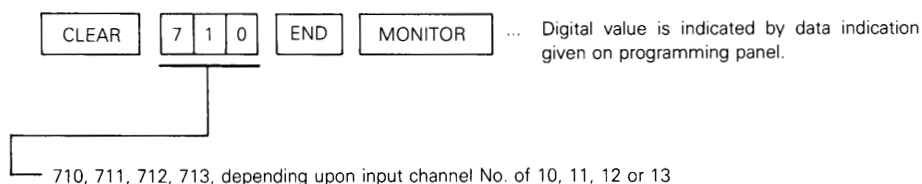
Adjustment of volume

[Adjustment of analog input]

① Adjustment of zero adjustment volume (VR5)

When the volume is turned clockwise (16 turns, max.), the analog adjustment circuit is increased to positive value.

- Check that the "Monitor/Program" selector switch (located at the center of programming panel) is selected to "Monitor" side, and then turn on the RUN input of the programmable controller.
- When the input X400 of the programmable controller is turned off, the digital setting value against the analog output is turned to "1", by which the value indicated by the voltmeter or ammeter will be as shown in Table-1.
- Operate the programming panel as follows to check at what digital value the analog input signal is transferred at the programmable controller side.



- Make the adjustment so that the data indication on the programming panel turns to "1", while turning the zero adjustment volume VR5.

② Adjustment of gain adjustment volume (VR6)

When the volume is turned clockwise (16 turns, max.), the digital reading value is increased.

- When the input X400 of the programmable controller is turned on, the digital setting value for analog output turns to "250", by which the value indicated by the voltmeter or ammeter will be as shown in Table-2.
- Turn the gain adjustment volume VR6 so that the data indicated by the programming panel turns to be "250".

Appendix:

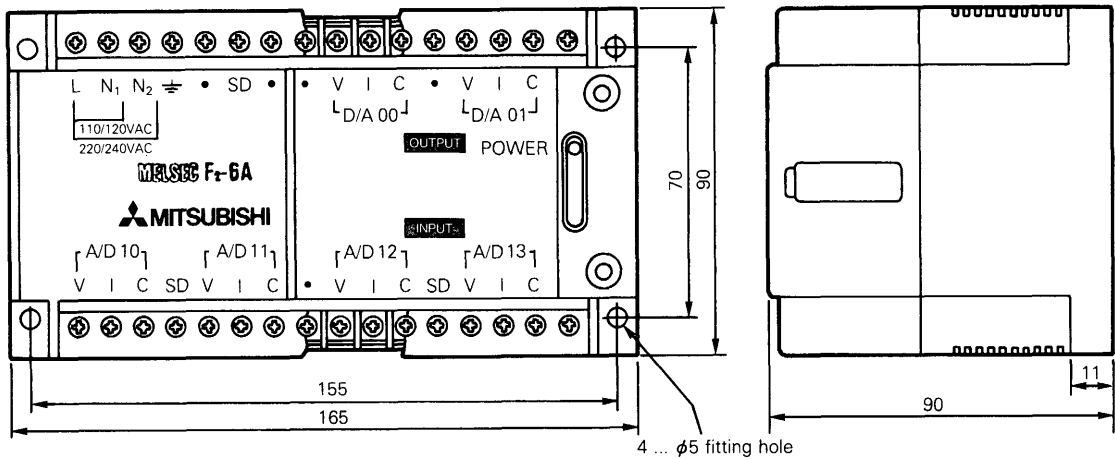
- Perform the zero/gain adjustment for several times alternately.
- Perform the similar check for other input channels other than the adjustment input channel.



Specifications and outside dimensions

General specifications

Power voltage	AC110-120V/220V-240V $\pm 10\%$ -15% 50/60Hz, single phase
Ambient temperature	0 ~ 55°C
Ambient humidity	45 ~ 85% (without dewing)
Vibration resistance	In compliance to JIS C0911 (10 ~ 55Hz, 0.5mm) (max. 2G) To directions of 3 axes for two hours respectively
Shock resistance	In compliance to JIS C0912 (10G, 3 times to directions of 3 axes)
Noise immunity	1,000V by 1 μ s noise simulator
Insulation withstand voltage	AC1,500V for one minute (measured across all terminals and earth terminal)
Insulation resistance	5M Ω and over when measured with DC500V megger (across all terminals and earth terminal)
Grounding	Class-3 grounding (100 Ω and less) Where no grounding is possible, the equipment may be used without grounding).
Working atmosphere	Absence of corrosive gas or excessive dust



Accessories : Extension cable (450mm) ... one

Weight : Approx. 1kg

Exterior color: Munsell 5Y7/1

Output specification

<p>Analog output type</p>	<p>Voltage output: DC0 ~ 5V } DC0 ~ 10V } *</p> <p>* External load resistance: 500Ω ~ 1MΩ</p>
<p></p>	<p>Current output: DC0 ~ 20mA } DC4 ~ 20mA } *</p> <p>* External load resistance: 0 ~ 500Ω</p>
<p>Number of output point</p>	<p>2CH</p> <p>Note: It is possible to select optional output type for each channel.</p>
<p>Digital input type</p>	<p>BCD 3-digit setting value of 0 ~ 255 is converted into binary value for reception from programmable controller.</p>
<p>Insulation</p>	<p>Insulation with photo-coupler between digital input and analog output Non-insulation between analog output and each channel</p>
<p>Overall accuracy</p>	<p>Voltage output ... ±120mV Current output ... ±0.24mA</p>
<p>Conversion speed</p>	<p>Voltage output ... 300μs/CH (including transfer time from programmable controller) Current output ... 300μs/CH (including transfer time from programmable controller)</p>

Input specifications

<p>Analog input type</p>	<p>Voltage input: DC0 ~ 5V (internal resistance: 200kΩ)</p> <p>DC0 ~ 10V (internal resistance: 85kΩ)</p> <p>Current input: DC0 ~ 20mA (internal resistance: 250Ω)</p> <p>DC4 ~ 20mA (internal resistance: 250Ω)</p>
<p>Number of input point</p>	<p>4CH</p> <p>Note: It is possible to select optional input type for each channel. In the case of 4 ~ 20mA input, however, the input type must be the same for all input channels.</p>
<p>Digital output type</p>	<p>8-bit binary data is sent to the programmable controller, in which it is treated as 0 ~ 255 BCD 3-digit value.</p>
<p>Insulation</p>	<p>Photo-coupler insulation between analog input and digital output</p> <p>Non-insulation between analog input and each channel</p>
<p>Overall accuracy</p>	<p>Voltage input ... ± 5 digits ($\pm 5/255$)</p> <p>Current input ... ± 5 digits ($\pm 5/255$)</p>
<p>Conversion speed</p>	<p>Voltage input ... 500μs/CH (including transfer time to programmable controller)</p> <p>Current input ... 500μs/CH (including transfer time to programmable controller)</p>

MEMO

 **MITSUBISHI ELECTRIC CORPORATION**
HEAD OFFICE: MITSUBISHI DENKI BLDG, MARUNOUCHI, TOKYO 100. TELEX: J24532 CABLE: MELCO TOKYO
