Panasonic®

PROGRAMMABLE CONTROLLER

MEWNET FP3
D/A CONVERTER UNIT
Technical Manual

MEWNET FP3 D/A CONVERTER UNIT Technical Manual
ACG-M0012-1 '91.05

Matsushita Electric Works, Ltd.

Safety Precautions

Observe the following notices to ensure personal safety or to prevent accidents.
To ensure that you use this product correctly, read this User's Manual thoroughly before use.
Make sure that you fully understand the product and information on safe.
This manual uses two safety flags to indicate different levels of danger.

WARNING

If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.

-Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
-Do not use this product in areas with inflammable gas. It could lead to an explosion.
-Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

CAUTION

If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.

-To prevent abnormal exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assure in these specifications.
-Do not dismantle or remodel the product. It could lead to abnormal exothermic heat or smoke generation.
-Do not touch the terminal while turning on electricity. It could lead to an electric shock..
-Use the external devices to function the emergency stop and interlock circuit.
-Connect the wires or connectors securely.
The loose connection might cause abnormal exothermic heat or smoke generation
-Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It might cause exothermic heat or smoke generation.
-Do not undertake construction (such as connection and disconnection) while the power supply is on.

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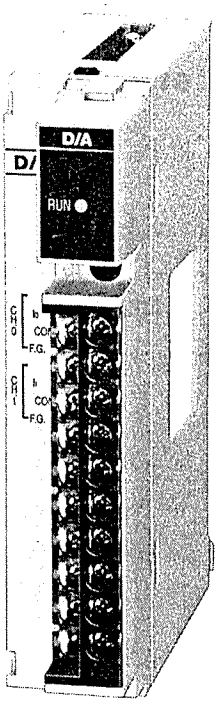
A. Features

"PC" is the abbreviation for Programmable Controller.

■ FEATURES



FP3 D/A CONVERTER UNIT

1. Multiple channels in one unit

The two channels of analog data output are provided in one unit.
A shared memory is built in to permit optional data write.

2. Units with different analog output ranges

Use the type No. AFP3410 for an analog output range of -10 V to +10 V and -20 mA to +20 mA,
or the type No. AFP3411 for 1 V to 5 V and 4 mA to 20 mA.

3. High speed conversion at 5 millisec per 2 channels

High-speed data conversion is realized at 5 millisec per 2 channels.
This feature is particularly useful for position control and precision rotation control demanding high speed.

4. Analog output upper and lower limit set function

The upper and lower limits for an analog output can be set for each channel according to the output load device.

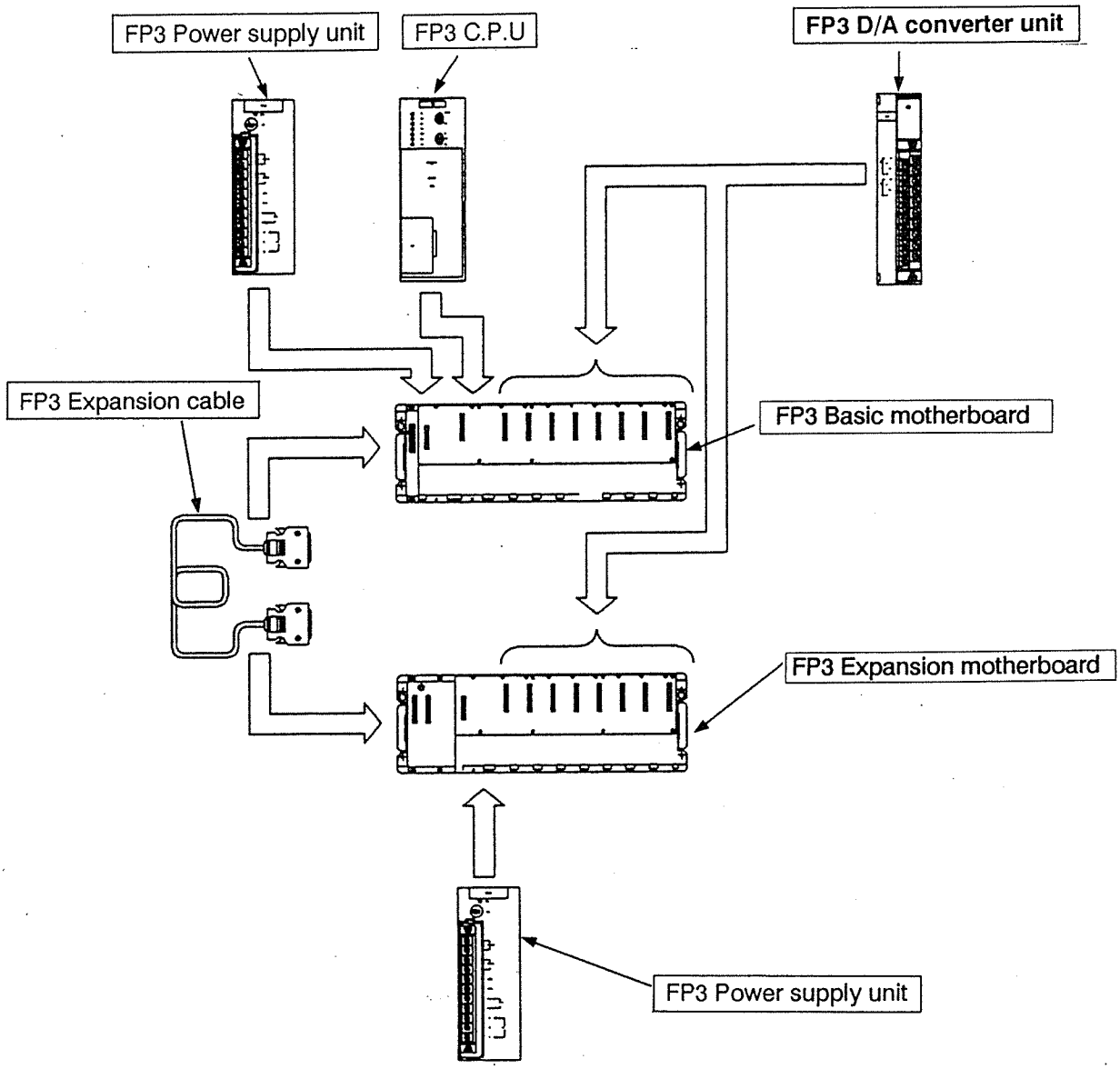
5. Internally insulated by photocoupler between power supply and analog output

The Programmable Controller interior and analog output are insulated with a photocoupler to prevent
a trouble caused by an output noise.

B. System configuration

"PC" is the abbreviation for Programmable Controller.

■ SYSTEM CONFIGURATION



The figure above shows the system configuration.
The D/A converter unit can be freely mounted in any position without regard to the Basic motherboard and Expansion motherboard.
However, the number of units that can be installed is limited by capacity of the power supply unit.

• Refer to page M-2 ■ MOUNTING METHOD for details.

C. Specifications

"PC" is the abbreviation for Programmable Controller.

■ SPECIFICATIONS

1. General Specifications

Items	Specifications
Ambient operating temperature	0°C to 55°C (32°F to 131°F) (see note.)
Ambient storage temperature	–20°C to 70°C (–4°F to 158°F)
Ambient operating humidity	30 to 85%RH (non-condensing)
Ambient storage humidity	30 to 85%RH (non-condensing)
Breakdown voltage	Between DC external terminal block and ground, 500V AC, 1 minute
Insulation resistance	Between DC external terminal block and ground, Over 100M ohm (with 500VDC mega)
Vibration resistance	10Hz to 55Hz, 1 cycle per minute; double amplitude 0.75mm, 10 minutes in each of the X, Y and Z axes.
Shock resistance	Min. 98m/s^2, 4 times in each of the X, Y and Z axes
Noise resistance	1000V, 50 nanosec. 1 microsec. pulse widths (based on in-house measurements)
Operating condition	Free of corrosive gases and excessive dust

Note :

- Do not mount the D/A converter unit adjacent to the output unit or the power supply unit.
- In case you need to mount the D/A converter unit adjacent to the output unit or the power supply unit. Ambient temperature is 0°C to 50°C (32°F to 122°F).

2. Performance specifications

<table>
<tr><td>Digital input</td><td colspan="8">16-bit binary
K-2000 to K2000 (HF830 to H07D0) ┐ –10 V to 10 V / –20 mA to 20 mA range unit (: AFP3410)
K0 to K4000 (H0000 to H0FA0) ┐ 1 V to 5 V / 4 mA to 20 mA range unit (: AFP3411)</td></tr>
<tr><td>Analog output</td><td colspan="8">Voltage: 1 to 5V / -10 to +10V ← For each unit
Current: 4 to 20mA / -20 to +20mA ← For each unit
For each output terminal (Refer to Note.)</td></tr>
<tr><td rowspan="5">I/O characteristics</td><td rowspan="2">Range : 0 V to ± 10 V</td><td>Digital input</td><td>+2000</td><td>+1000</td><td>± 0</td><td>–1000</td><td>–2000</td><td rowspan="2">Part No. AFP3410</td></tr>
<tr><td>Analog output</td><td>+10 V</td><td>+5 V</td><td>± 0 V</td><td>–5 V</td><td>–10 V</td></tr>
<tr><td rowspan="2">Range : 0 mA to ± 20 mA</td><td>Digital input</td><td>+2000</td><td>+1000</td><td>± 0</td><td>–1000</td><td>–2000</td><td rowspan="2">Part No. AFP3410</td></tr>
<tr><td>Analog output</td><td>+20 mA</td><td>+10 mA</td><td>± 0 mA</td><td>–10 mA</td><td>–20 mA</td></tr>
<tr><td rowspan="2">Range : 1 V to 5 V</td><td>Digital input</td><td>+4000</td><td>+3000</td><td>+2000</td><td>+1000</td><td>± 0</td><td rowspan="2">Part No. AFP3411</td></tr>
<tr><td>Analog output</td><td>+5 V</td><td>+4 V</td><td>+3 V</td><td>+2 V</td><td>+ 1V</td></tr>
<tr><td rowspan="2">Range : 4 mA to 20 mA</td><td>Digital input</td><td>+4000</td><td>+3000</td><td>+2000</td><td>+1000</td><td>± 0</td><td rowspan="2">Part No. AFP3411</td></tr>
<tr><td>Analog output</td><td>+20 mA</td><td>+16 mA</td><td>+12 mA</td><td>+8 mA</td><td>+4mA</td></tr>
<tr><td>Maximum resolution</td><td colspan="8">1/4000
Voltage: 1mV (1 to 5V range) 5mV (-10 to +10V range) Current: 4 microampere(4 to 20 mA range) 10 microampere(–20 to +20 mA range)</td></tr>
<tr><td>Overall accuracy</td><td colspan="8">±0.5% per F.S.[at 25°C(77°F)] ,
±1.0% per F.S.[at 0°C to 55°C(32°F to 131°F)]</td></tr>
<tr><td>Conversion speed</td><td colspan="8">Within 4 millisec per channel
(within 5 millisec for 2 channels when writing 2 channels in succession)</td></tr>
<tr><td>External output impedance</td><td colspan="8">0.5 Ω at voltage output maximum</td></tr>
<tr><td>Maximum external output current</td><td colspan="8">±20 mA at voltage output maximum</td></tr>
<tr><td>Allowable load resistance of external output</td><td colspan="8">0 to 550 Ω at current output</td></tr>
<tr><td>Number of channels</td><td colspan="8">2 channels per unit</td></tr>
<tr><td>Insulation method</td><td colspan="8">Photocoupler between output terminal and Programmable Controller power supply
(Not insulated between channels)</td></tr>
<tr><td>Number of Occupied input/output points</td><td colspan="8">16 input points</td></tr>
<tr><td>Internal consumption current</td><td colspan="8">5V 0.7 A</td></tr>
<tr><td>External connection method</td><td colspan="8">Terminal board connection (Terminal screws M3.5 thread)</td></tr>
<tr><td>Applicable wire size</td><td colspan="8">0.5 to 1.25mm²</td></tr>
<tr><td>Weight</td><td colspan="8">Approx. 400g (0.88 lbs.)</td></tr>
</table>

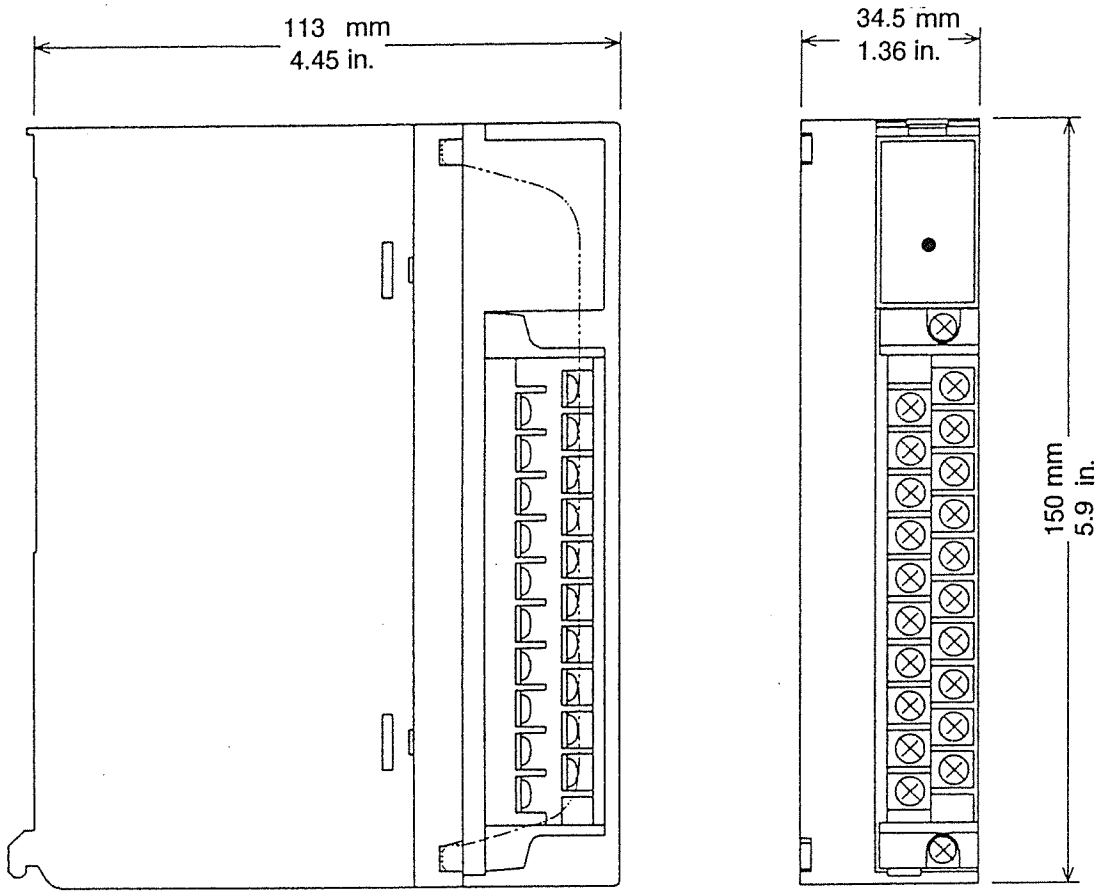
Notes:

- The selections for voltage output or current output and the output terminals are set by analog output range set switches (DIP switches).
- A channel cannot be used for the simultaneous output of voltage and current.
- Do not connect unused terminals.

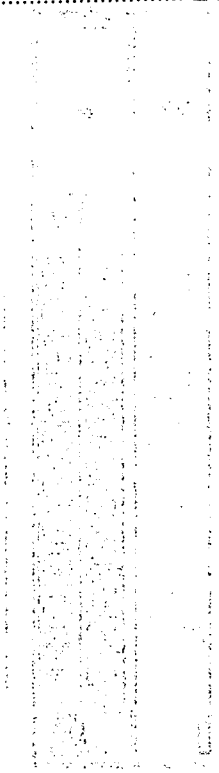
D. Dimensions

"PC" is the abbreviation for Programmable Controller.

■ DIMENSIONS



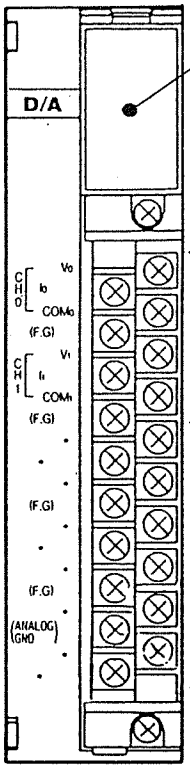
E. Part names and Functions



"PC" is the abbreviation for Programmable Controller

■ PART NAMES AND FUNCTIONS

(Front side)



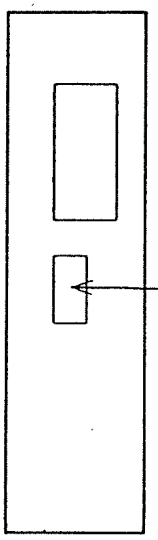
Operating indicator LED

- ON : Normal operation
- Flashing : Set data error or C.P.U write address error occurs
- OFF : 5V power source disconnected or watchdog timer error occurs

Output terminals

No use terminals

(Rear side)



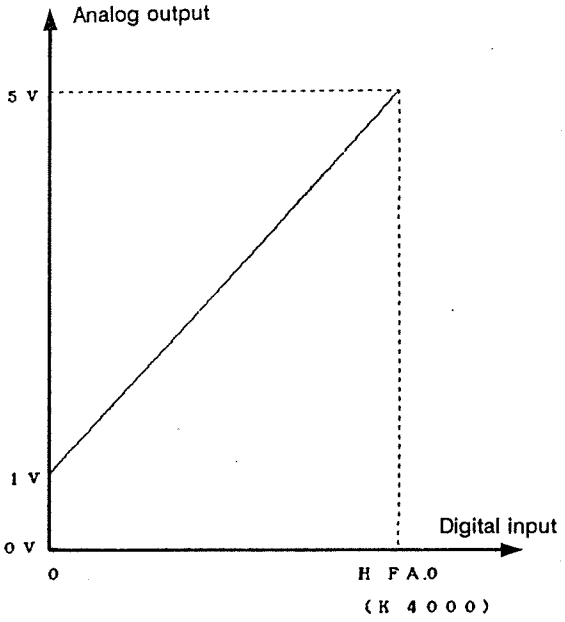
Analog output range set switches (DIP switches) : SW1

- These switches are used to set the analog output range.
- The output ranges have been set for voltage output when shipped from the factory.
- Refer to page K-2 ■ SETTING THE ANALOG OUTPUT RANGE for details.

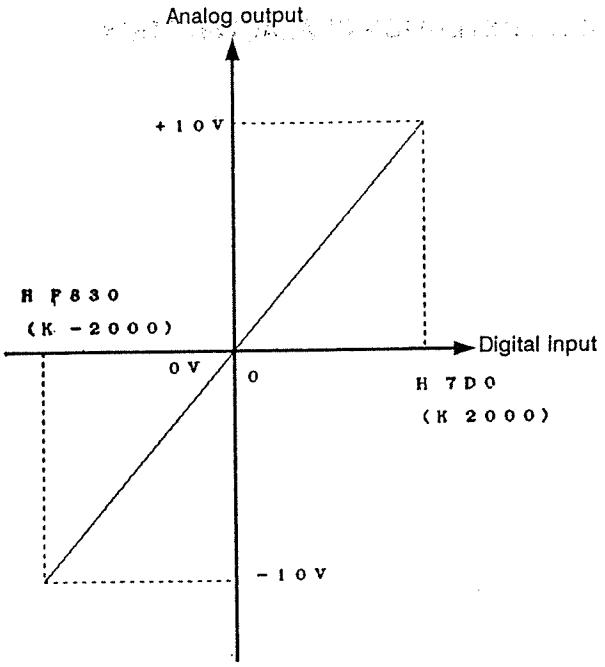
F. D/A Conversion characteristics

"PC" is the abbreviation for Programmable Controller.

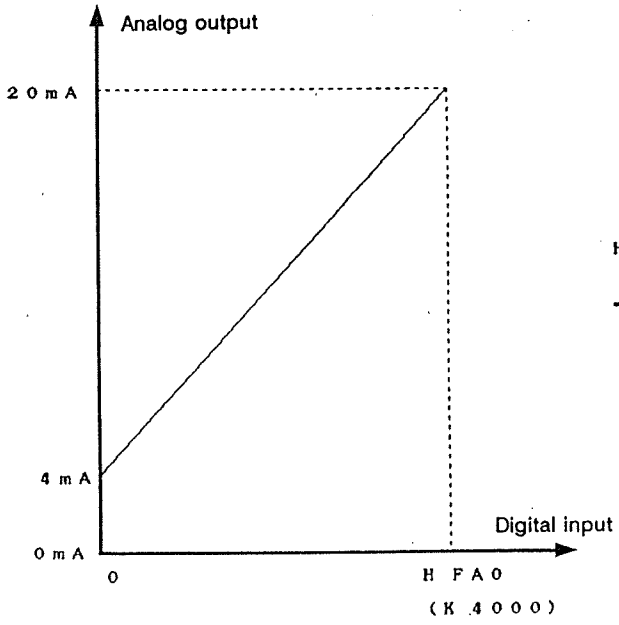
■ D/A CONVERSION CHARACTERISTICS



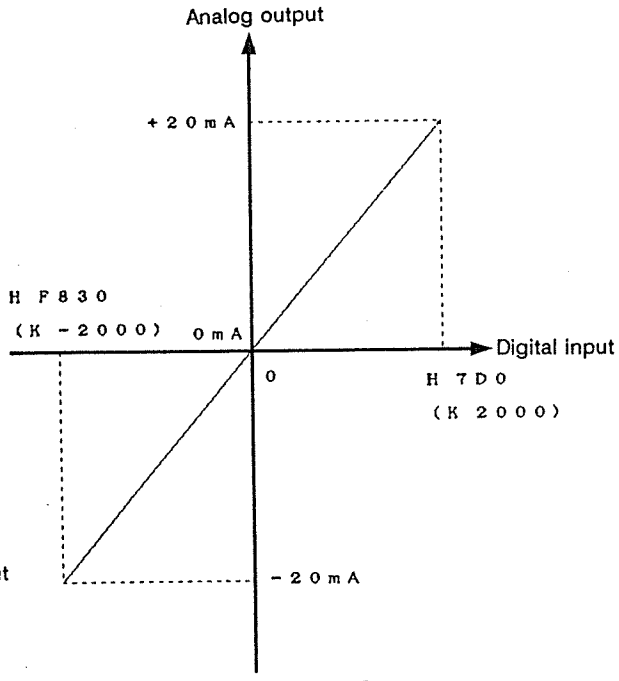
[1 to 5V range]



[0 to ±10V range]



[4 to 20mA range]



[0 to ±20mA range]

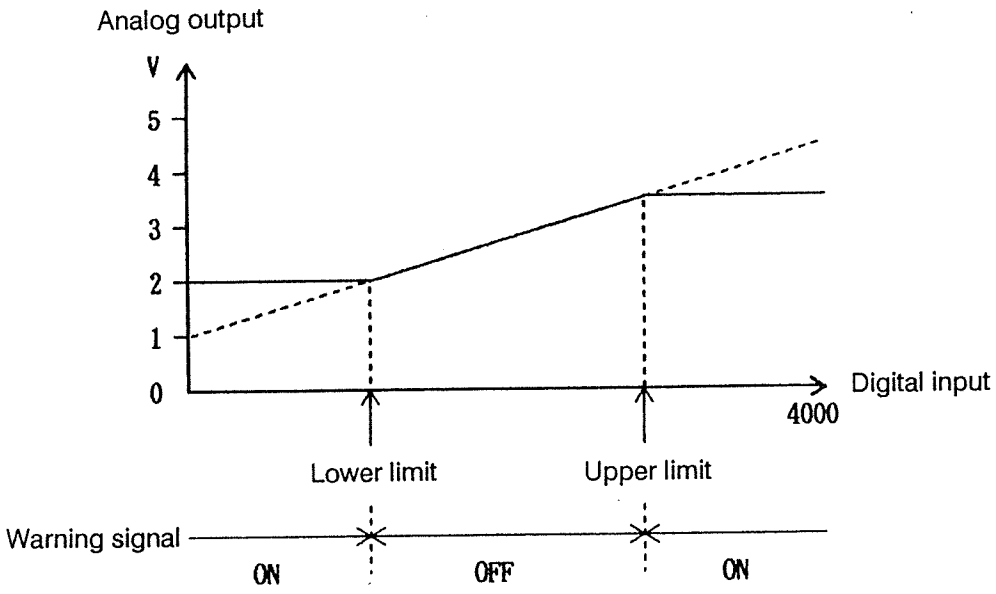
G. Analog output upper and lower limit set function

"PC" is the abbreviation for Programmable Controller.

■ ANALOG OUTPUT UPPER AND LOWER LIMIT SET FUNCTION

- This function allows the range of the output voltage or output current values for the this unit to be set by setting the upper and lower limits for the digital input values from the FP3 C.P.U.
- A warning signal is sent to the FP3 C.P.U from the D/A converter unit when the digital input value exceeds the upper limit or falls below the lower limit.
  (The warning signals are sent as input contact signals X □3 to X □6.)

Example :



Note :

Upper and lower limits which exceed the digital input range for the respective output range cannot be set.

- I/O characteristics for the FP3 D/A converter unit

Digital input	Analog output range		Part No.
	Voltage (V)	Current (mA)	
+2000	+10	+20	AFP3410
+1000	+ 5	+10	
0	0	0	
-1000	- 5	-10	
-2000	-10	-20	
4000	5	20	AFP3411
3000	4	16	
2000	3	12	
1000	2	8	
0	1	4	

H. Shared Memory

"PC" is the abbreviation for Programmable Controller.

■ SHARED MEMORY ALLOCATION

- The D/A converter unit contains shared memory which can be read or written from the FP3 C.P.U.

- **Allocation of shared memory**

Address		
0	Analog output limit channel designation	--Write-only from the C.P.U
1	CH. 0 Upper limit value	
2	CH. 0 lower limit value	
3	CH. 1 upper limit value	
4	CH. 1 lower limit value	
5	CH. 0 D/A conversion input	
6	CH. 1 D/A conversion input	
7	Data error code	----Read-only from the C.P.U

Reference :

Refer to page H-3 " ■ CONTENTS AND DATA FORMAT OF SHARED MEMORY " for details on the contents and data format at each address in the shared memory shown above.

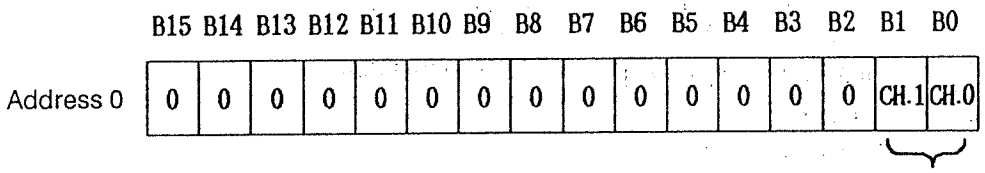
■ CONTENTS AND DATA FORMAT OF SHARED MEMORY

Overview :

- Addresses 0 to 4 represent the area where the settings of the analog output upper and lower limit set function are to be written.
- Addresses 5 and 6 represent the area where the digital input value for D/A conversion is to be written.
- Address 7 represents the area where codes indicating the type of errors that occurred is to be written.

1. Analog output upper and lower limit channel designation (Address 0)

- Specify the channel for which the range of analog output values is to be limited with the analog output upper and lower limit set function.
- When shipped from the factory, both channels (CH. 0 and CH. 1) are set so that their analog outputs are not limited.
- The analog output is not limited if a channel is not specified even though the upper and lower limits are set.



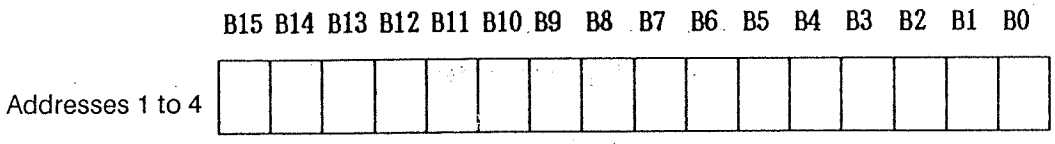
B2 to B15 of address 0 are not used.

Designation of channel for which the analog output is to be limited

1 : Enable limit
0 : Disable limit

2. Analog output upper and lower limit values (Addresses 1 to 4)

- Set the upper and lower limits for the output channel for which the analog output is to be limited.
- Write the values of the upper and lower limits for the channel for which the analog output is to be limited as digital values which match the output range of the channel.



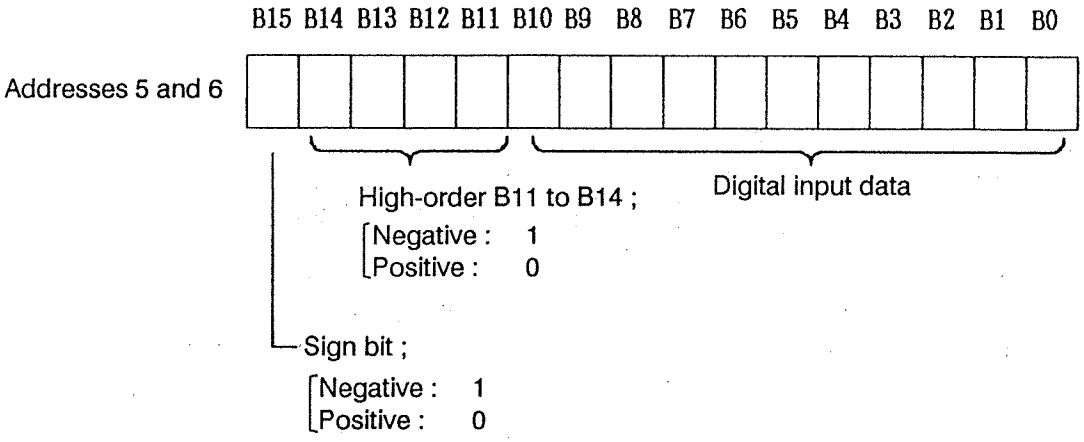
3. D/A conversion digital input (Addresses 5 and 6)

- Addresses 5 and 6 represent the area where the digital input value for D/A conversion is to be written.
- Write the value in the format matching the output range of the D/A converter unit to be used.
- The data formats for the different units are shown below.

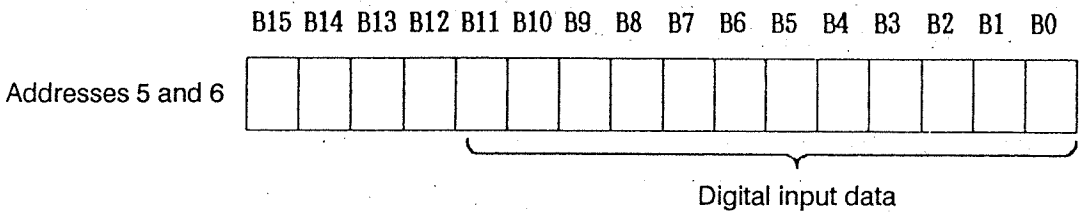
- **This unit provides a range of -10 V to +10 V (or -20 mA to +20 mA)**

Note :

Express a negative digital value in two's complement.



- **This unit provides a range of 1 V to 5 V (or 4 mA to 20 mA)**



4. Data error code (Address 7)

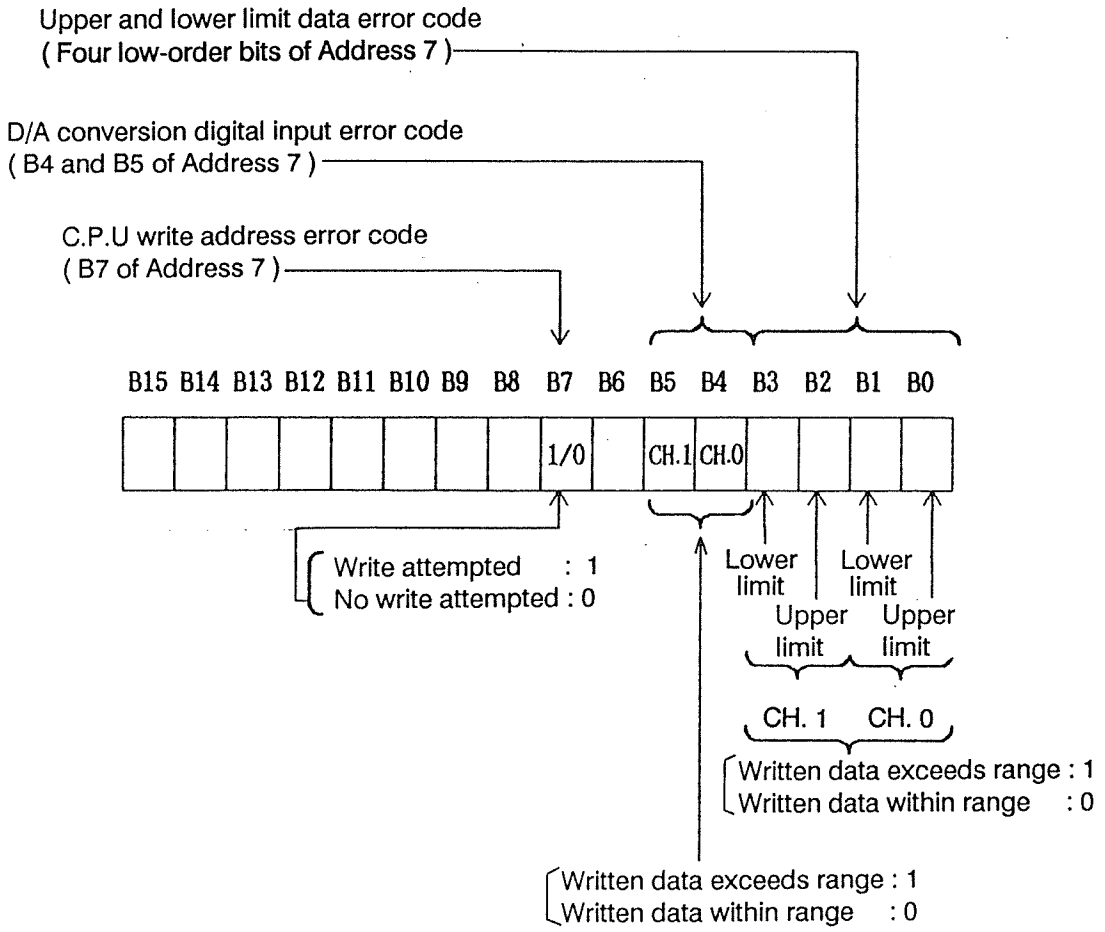
- Codes indicating the occurrence of three types of errors are set in address 7.

  Upper and lower limit data error
  D/A conversion digital input error
  C.P.U write address error

- **Upper and lower limit data error code (4 low order bits of Address 7)**
  If the upper and lower limit values written to addresses 1 to 4 from the C.P.U exceed the usable range, the error code is written to the four low order bits of address 7.

- **D/A conversion digital input error code (B4 and B5 of Address 7)**
  If the D/A conversion digital input data written from the C.P.U exceeds the conversion range, the error code is written to B4 and B5 of address 7.

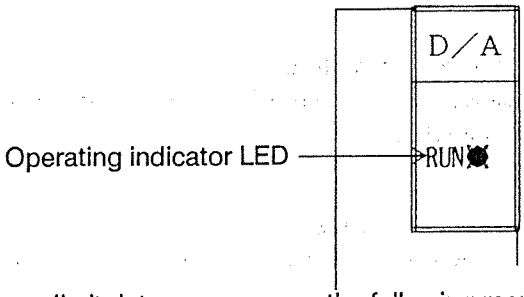
- **C.P.U write address error code (B7 of Address 7)**
  If the C.P.U attempts to write to an address which cannot be accessed in the shared memory, the error code is written to B7 of address 7.



Notes :

- B6 and B8 to B15 of address 7 are not used.

The error codes are set as shown above when the upper and lowerlimit data error, D/A conversion digital input data error and C.P.U write address error occurs.
When an error occurs, the operating indicator LED on the front panel changes state from ON to flashing.



If the upper and lower limit data error occurs, the following results.

- The output of the channel cannot be limited.
- Warning signals resulting from limiting the output of the channel cannot be issued.
- X0 (D/A conversion ready flag when analog output limits are set) turns OFF.
- If the D/A conversion digital input error occurs, the last value (voltage or current) of the analog output before the error is held.

I. Inputs for C.P.U

"PC" is the abbreviation for Programmable Controller.

■ INPUTS FOR C.P.U

- The number assigned to X is determined by the mounted position of the D/A Converter Unit on the motherboard and the number of points of the other I/O units.
- The input numbers shown in table below are assigned when the D/A converter unit has been mounted to slot No. 0 on the Basic motherboard.

The D/A converter unit provides input signals for the C.P.U as 16 points, X0 to XF.

Input signal number	Description
X0	**D/A conversion ready flag when the analog output upper and lower limits are set** • After the conditions (channel designation, upper limit, lower limit) of the analog output limit are written from the FP3 as a result of the operation and execution of the FP3 C.P.U, the flag is turned ON when the analog output limits are ready. • It is used as a write execution condition for the D/A input data when setting the analog output upper and lower limits.
X1	**CH. 0 digital input data validity flag** • OFF when the digital input data of CH. 0 is valid for the set range and ON when it is invalid.
X2	**CH. 1 digital input data validity flag** • OFF when the digital input data of CH. 1 is valid for the set range and ON when it is invalid.
X3	**Warning signal** • ON only when the CH. 0 digital input value is greater than the upper limit
X4	**Warning signal** • ON only when the CH. 0 digital input value is less than the lower limit
X5	**Warning signal** • ON only when the CH. 1 digital input value is greater than the upper limit
X6	**Warning signal** • ON only when the CH. 1 digital input value is less than the lower limit
X7 ~ XF	**Not used**

X0 and X3 to X6 turn OFF when the analog output limit set conditions are newly written.

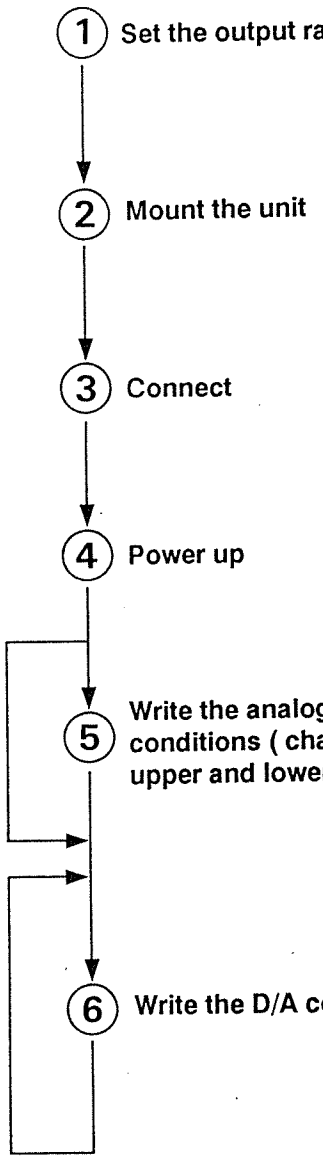
- The FP3 D/A converter unit does not provide output contact signals (Y) for the FP3 C.P.U.

J. Operating procedure

"PC" is the abbreviation for Programmable Controller.

■ OPERATING PROCEDURE

- **The operating procedure is given below.**



① Set the output range : Select voltage or current output with the Analog output range set switches (DIP switches) on the rear panel.

② Mount the unit : The D/A converter unit occupies the input contact signal for the C.P.U.

③ Connect : Connect the analog output signals.

④ Power up

⑤ Write the analog output limit set conditions (channel designation, upper and lower limit setting) : Initialize the D/A converter unit through the sequence program. (Initialize at the first scan after starting operation.)

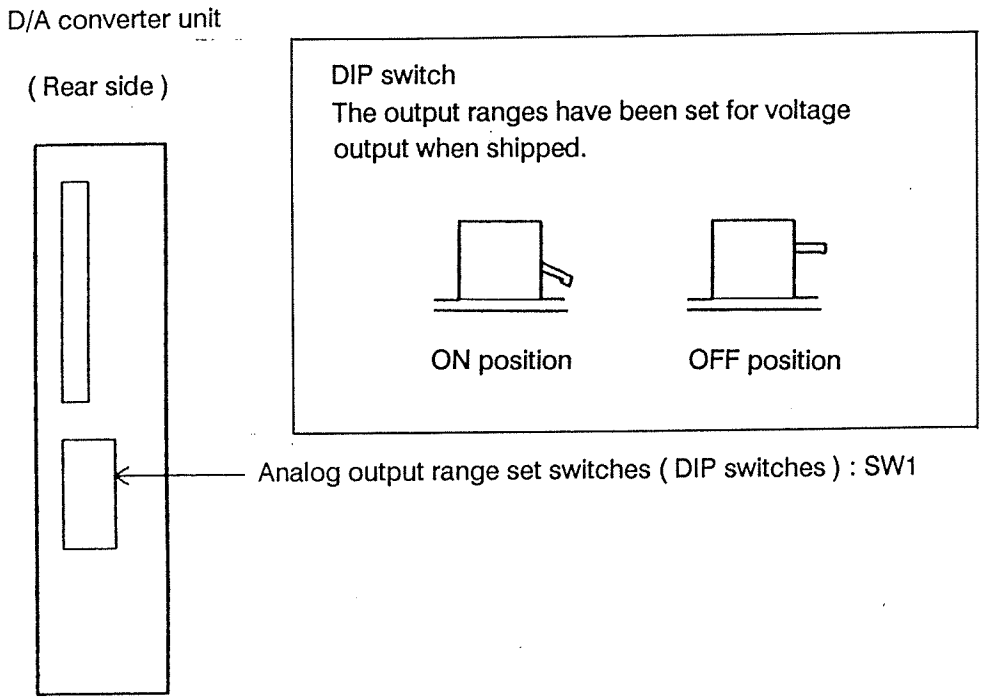
⑥ Write the D/A conversion input data : Write D/A conversion input data to the D/A converter unit through the sequence program.

K. Setting the analog output range

"PC" is the abbreviation for Programmable Controller.

■ SETTING THE ANALOG OUTPUT RANGE

- Set the output range (voltage or current) for each analog output channel with the Analog output range set switches (DIP switches) on the rear panel of the D/A converter unit.



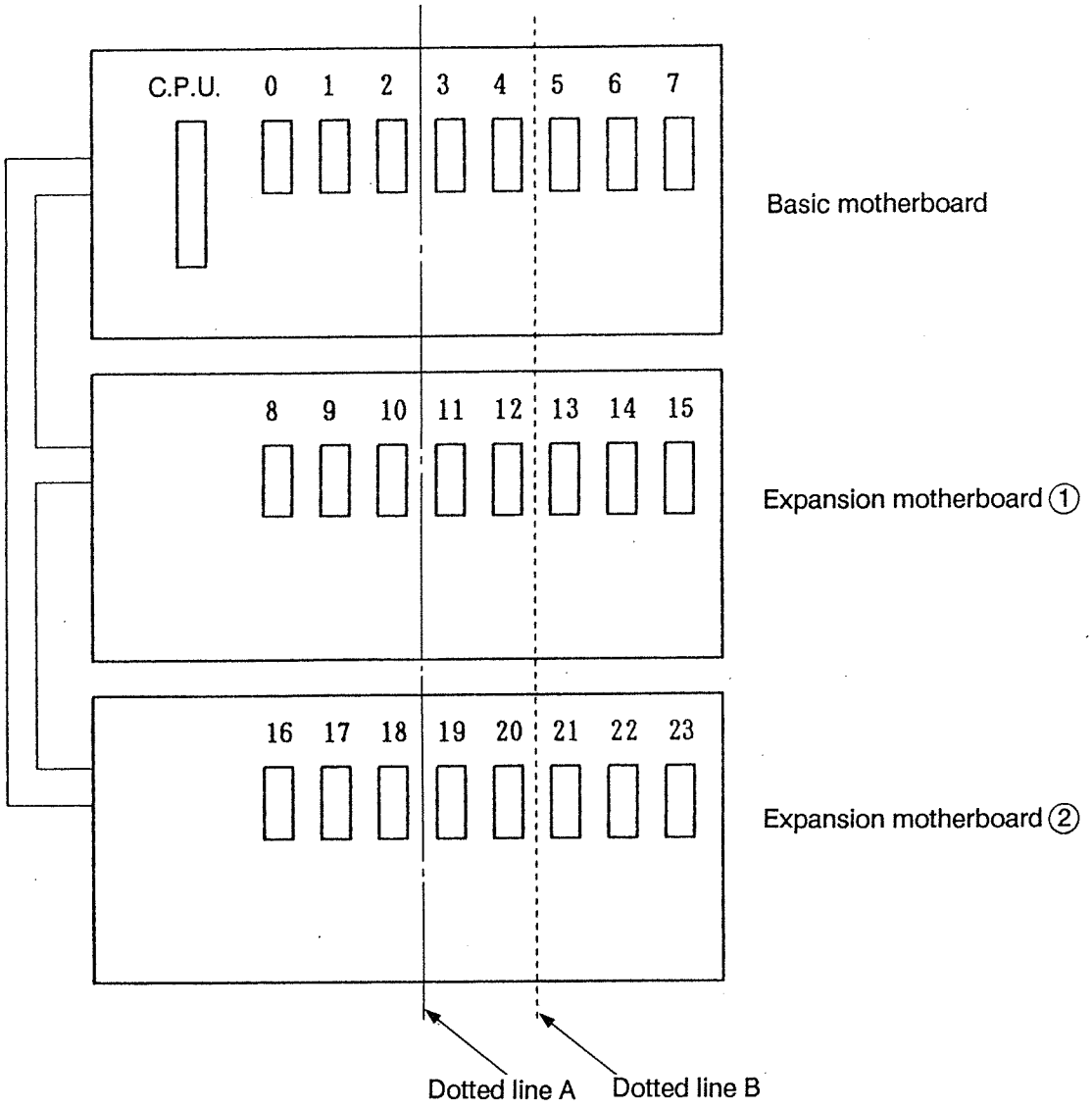
Output channel	CH. 0		CH. 1		——	——
SW1	SW1-1		SW1-2		SW1-3	SW1-4
	OFF	ON	OFF	ON	Not used	
Set range	Voltage output	Current output	Voltage output	Current output		

- SW1-3 and SW1-4 are unrelated to this setting.

L. I/O slot numbering

"PC" is the abbreviation for Programmable Controller.

■ I/O SLOT NUMBERING



- The dotted line A indicates the case of using a 3-point base motherboard.
- The dotted line B indicates the case of using a 5-point base motherboard. In this case, the numbers is normally as shown above.

M. Mounting method

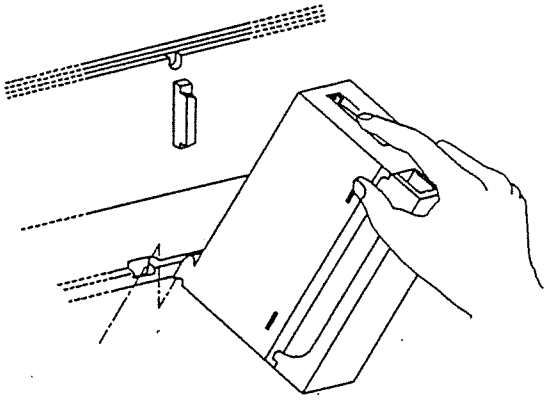
"PC" is the abbreviation for Programmable Controller.

■ MOUNTING METHOD

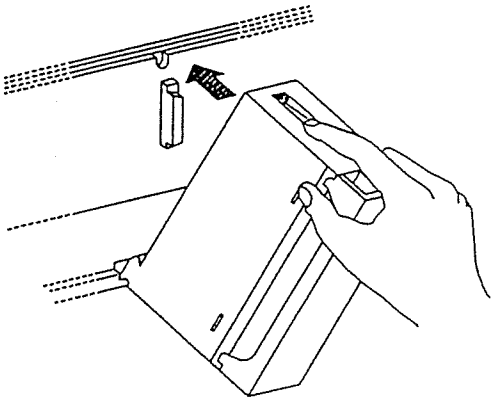
Notes:

- Before mounting the unit, remove the connector cover on the motherboard.
- Do not mount D/A converter unit adjacent to the output unit or the power supply unit. However, in case you need to mount D/A converter unit adjacent to the output unit or the power supply unit. Ambient temperature should be 50°C(122°F) or lower.
- Select and combine the units so that consumption current by each units mounted motherboard does not exceed the capacity of each power supply unit.

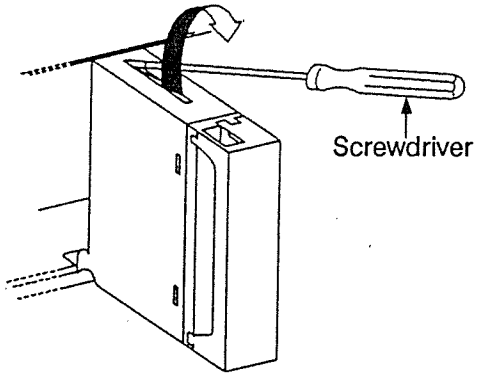
1. Fit the two unit tabs into the unit holes on the motherboard.
   - An attempt to mount the unit without aligning the tab may damage the connector.



2. Push the unit in the direction of the arrow and mount onto the motherboard.



3. After properly mounting the unit to the motherboard, secure the mounting screw at the top.



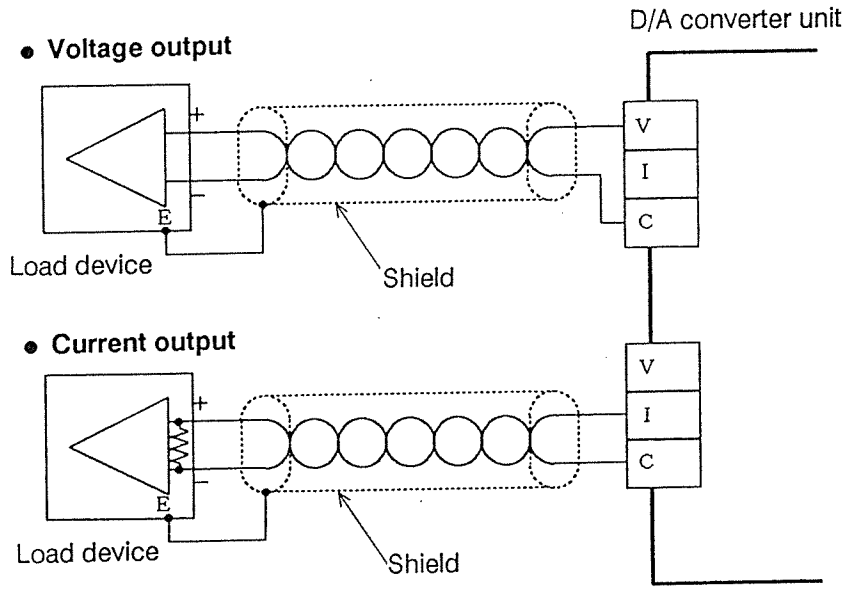
Reverse the procedure to remove the unit.

N. Connection of analog output signal

"PC" is the abbreviation for Programmable Controller.

■ CONNECTION OF ANALOG OUTPUT SIGNAL

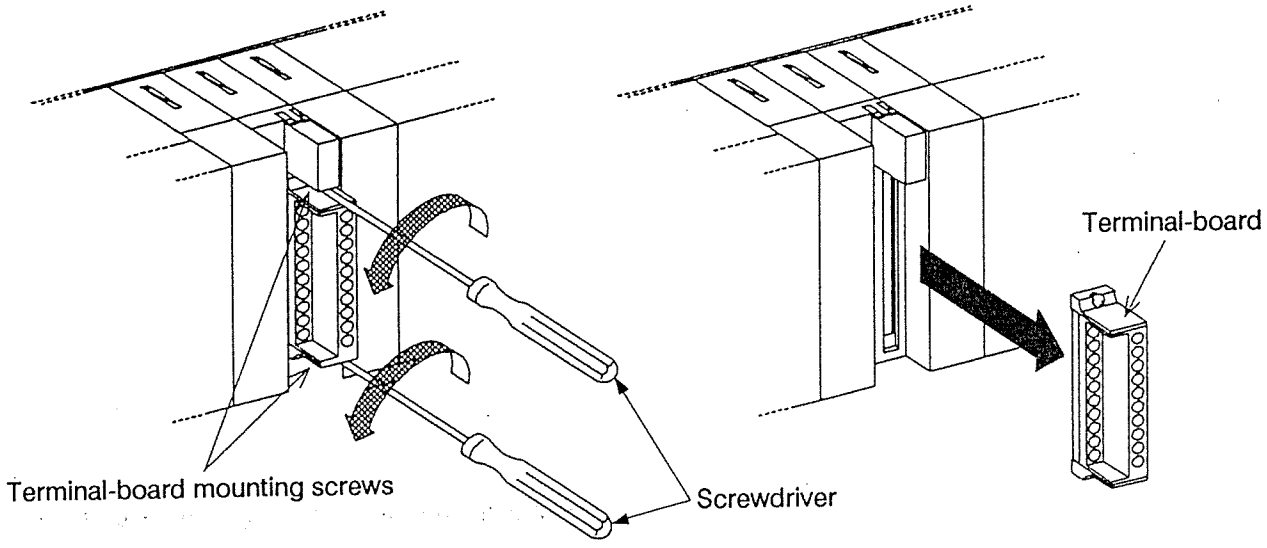
- This shows the connection of the voltage output and current output in the D/A converter unit.



Notes

- Use the two-core twisted pair shielding wire for the analog output signal line.
- Do not put the analog output signal wire close to the AC power cable, high-tension wire and load wires except thoser for the Programmable Controller and don't bundle them with those lines.
- Connect the shield of the shielded wiring to the load device to ground it. However, sometimes it may be better to connect it common for analog-output signal line depending on the external noise environment.
- Don't use the same cable for the signal wire and the AC wiring to the other units.

- When making connections on the terminal board, remove the board as shown below to make the procedure easier.
- Remount the terminal-board after the connection is completed.

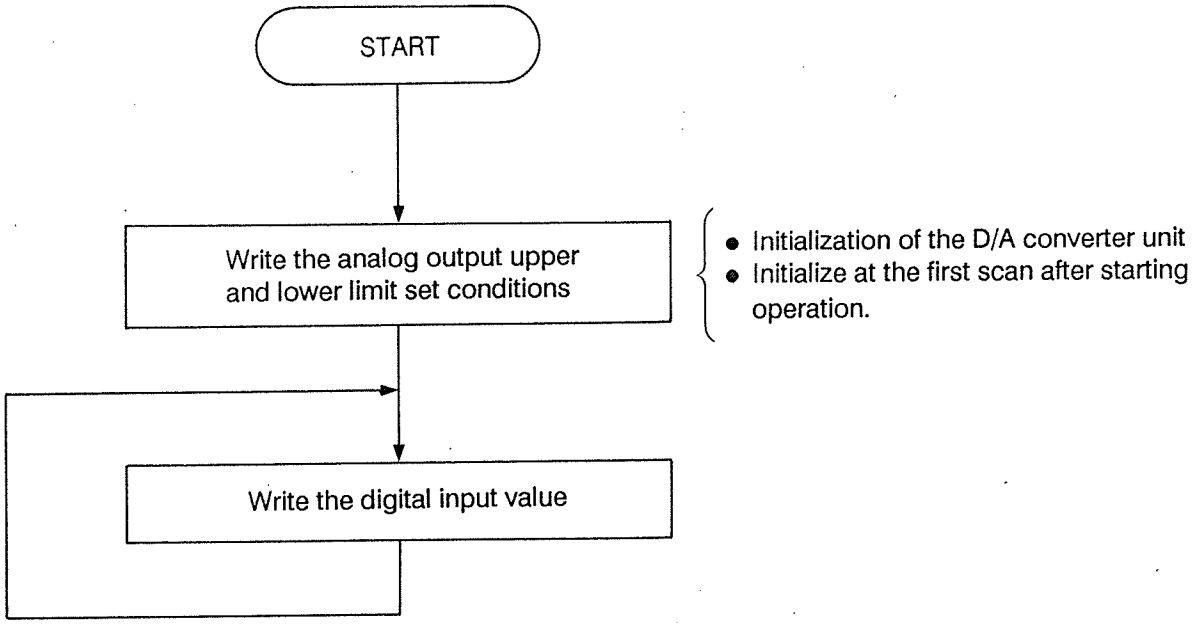


O. Initialization and digital input write procedure

"PC" is the abbreviation for Programmable Controller.

■ INITIALIZATION AND DIGITAL INPUT WRITE PROCEDURE

- Initialize and write the digital input through a sequence program for the C.P.U according to the procedure below.

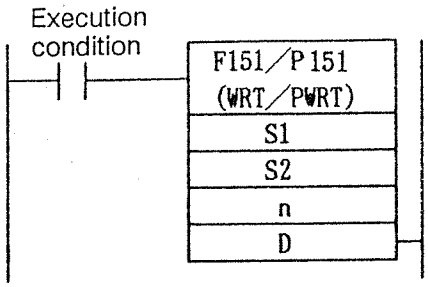


P. Sequence program examples

"PC" is the abbreviation for Programmable Controller.

■ SEQUENCE PROGRAM EXAMPLES

1. Basic program to write to the D/A converter unit



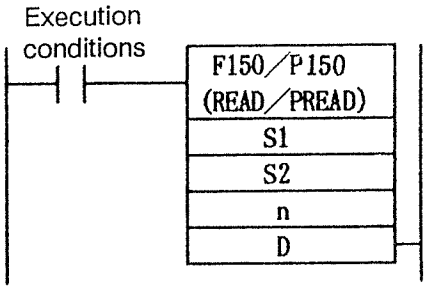
S1 : D/A converter unit mounted slot

S2 : Start I/O of write data

n : Number of words to be written

D : Start memory address of the D/A converter unit for data to be written

2. Basic program to read from the D/A converter unit



S1 : D/A converter unit mounted slot

S2 : Start address of memory in the D/A converter unit for data to be read

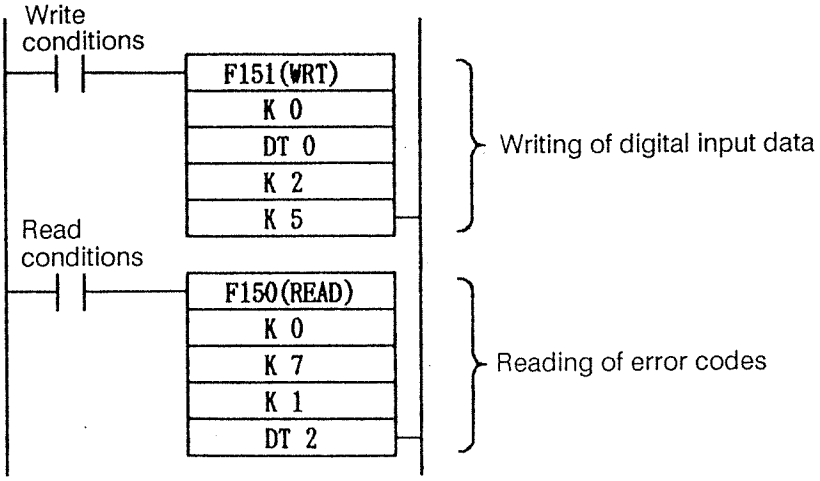
n : Number of words to be read

D : Start I/O number for read data storage

3. General program example (1)

Example 1 : Analog output without limiting

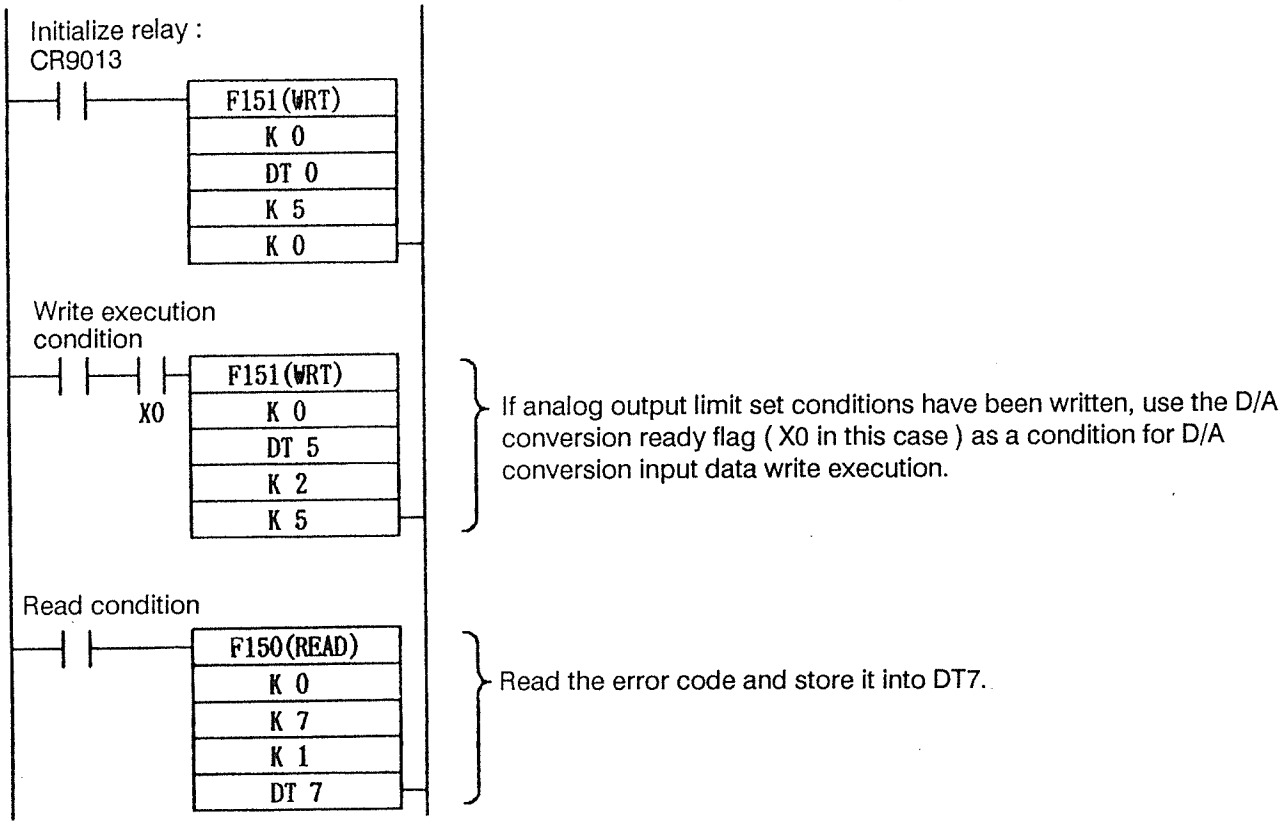
- Data DT0 and DT1 which enter CH. 0 and CH. 1 of the D/A converter unit mounted to slot No. 0 are output as analog data and error codes are loaded into DT2.



4. General program example (2)

Example 2 : Analog output with limiting

- Analog output limits are provided for outputs CH. 0 and CH. 1 of the D/A converter unit at slot No. 0 and the D/A conversion input data is written.
  (DT0 to DT4 represent the analog output limit set conditions and DT5 and DT6 represent the D/A conversion input data)



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ACG-M0012-1 MAY 91 8ZHo

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Printed in Japan.