Panasonic®

PROGRAMMABLE CONTROLLER

FP3/10S

A/D CONVERTER UNIT (G/I TYPE)

Technical Manual

FP3/10S A/D CONVERTER UNIT (G/I TYPE) Technical Manual
ACG-M0069-1 '96.2

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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Preface

1. A/D Converter Units

This manual explains A/D converter units with 8-channel analog input possibility (G and I types). The analog input range and part number for each unit are configured as follows:

Type	Input range	Part number
G type	4 mA to 20 mA (DC)	AFP3405
(Non-insulated between channels)	1 V to 5 V	AFP3403
	-10 V to +10 V	AFP3402
I type	4 mA to 20 mA (DC) or 1 V to 5 V	AFP3406
(Insulated between channels)	0 mA to 20 mA (DC) or 0 V to 5 V	AFP3407
	-20 mA to +20 mA (DC) or -10 V to +10 V	AFP3408

2. Differences Between 8-channel Types and Conventional 4-channel Type A/D Converter Units

The performance, functions and operation of the A/D converter units described in this manual are different from those of the conventional 4-channel type (AFP3400). Be sure to note the following points in particular.

1) The G type and I type cannot be used on a MEWNET-F (remote I/O) slave station.
2) Allocation of shared memory and values for the G and I types are different from those of the 4-channel unit. Therefore, the program for G and I types and that for 4-channel type must be changed.
3) The G type and I type do not have an averaging, maximum and minimum value settings, an alarm signal generation and scaling functions, which the 4-channel type AFP3400 has.

Note:

- For details about the 4-channel type A/D converter unit (AFP3400), refer to "A/D CONVERTER UNIT Technical Manual."

3. Composition of the Manual

The G TYPE/I TYPE A/D CONVERTER UNIT Technical Manual is composed of the following chapters:

- 1. FEATURES:

The features and basics about the units are explained.

- 2. SPECIFICATIONS:

The specifications for the G type and I type A/D converter units are given.

- 3. INSTALLATION AND SETTINGS:

The unit installation, settings and wiring descriptions are given.

- 4. PROGRAMMING FOR A/D CONVERTER UNITS:

Key knowledge about programming for the A/D converter units is given.

- 5. TROUBLESHOOTING:

Steps to take when an error occurs are given.

- 6. APPENDIX:

Major data and explanations for using the A/D converter units are given for your reference.

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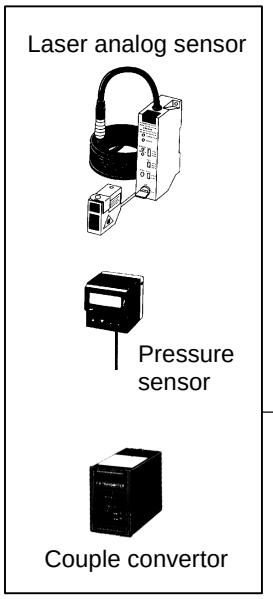
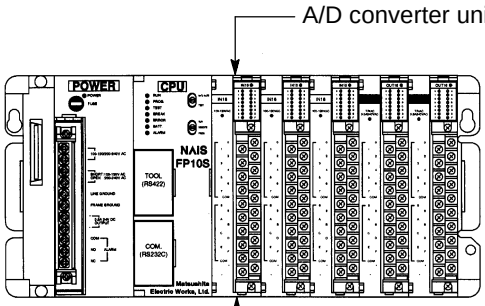
1-1. Features and Functions





Analog input
(8 channels per unit)

Type	Input range	Part number
G type (Non-insulated between channels)	4 mA to 20 mA DC	AFP3405
	1 V to 5 V DC	AFP3403
	-10 V to +10 V DC	AFP3402
I type (Insulated between channels)	4 mA to 20 mA DC or 1 V to 5 V DC	AFP3406
	0 mA to 20 mA DC or 0 V to 5 V DC	AFP3407
	-20 mA to +20 mA or -10 V to +10 V DC	AFP3408

• Analog input unit for the FP3 and the FP10S

Converts an analog current or voltage from such sensors as displacement and pressure sensors into digital values for processing by an FP3 or FP10S CPU.

• Eight-channel input is possible

Each unit is equipped with eight channels, allowing you to save space.

• The G (General purpose)-type puts the emphasis on economy with no insulation between channels

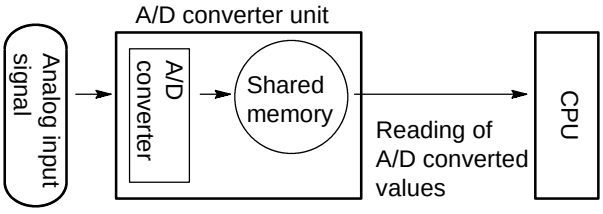
Each G-type unit has fixed input range.

• The I (Insulated)-type has insulation between channels

The I-type features insulation between channels, allowing selection of an input range for each channel. Current input and voltage input can be both used at the same time. Because the channels are insulated from each other, it doesn't matter if the ground levels of input devices are different.

• Programs are based on reading a shared memory

Input from external devices is automatically converted into digital values and written to a shared memory in the A/D converter unit. Data is read from the A/D converter unit to the CPU unit based on an instruction from the user program.

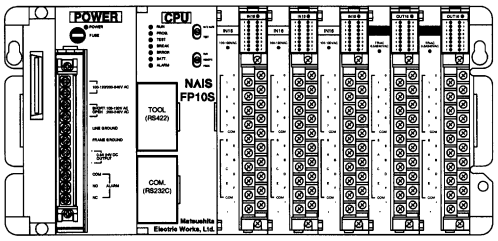


1-2. Limitations on Configurations

1. Limitations on Unit Installation Position

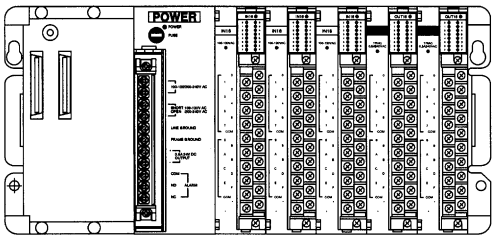
There are no limitations on the installation position when the G or I type A/D converter unit is used on the basic system (master backplane with a CPU) or on the expansion system (expansion backplane).

Basic system



Can be installed in any position.

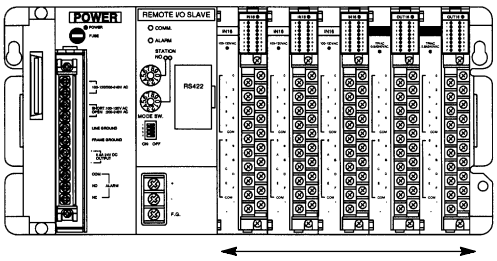
Expansion system



Can be installed in any position.

No G or I type A/D converter unit can be installed on an MEWNET-F (remote I/O) slave unit system.

MEWNET-F slave unit system



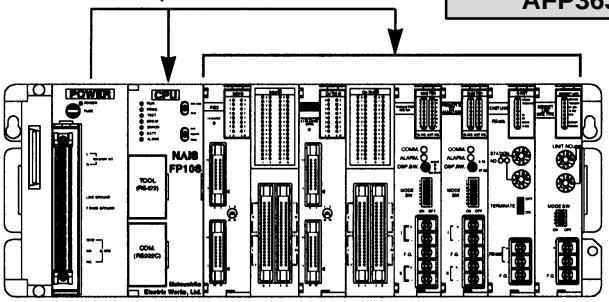
Cannot be used on a MEWNET-F (remote I/O) slave station.

2. Limitations on Unit Current Consumption

There is limitation current consumption when configuring the FP3 and FP10S systems.
The 5 V power for unit operation is supplied from a power supply unit on the backplane and the total power consumption of all installed units must be less than the power supply unit capacity.
The current consumption for each G and I type A/D converter unit is 400 mA at 5 V DC.
Be sure to verify that the capacity of the power supply unit of the backplane is sufficient for controlling units installed.

Power supply unit	Rated output current (5 V)
AFP3631	2.4 A
AFP3636	6 A
AFP3634	2.4 A

The internal power supply (5 V) goes to each unit via the backplane bus.



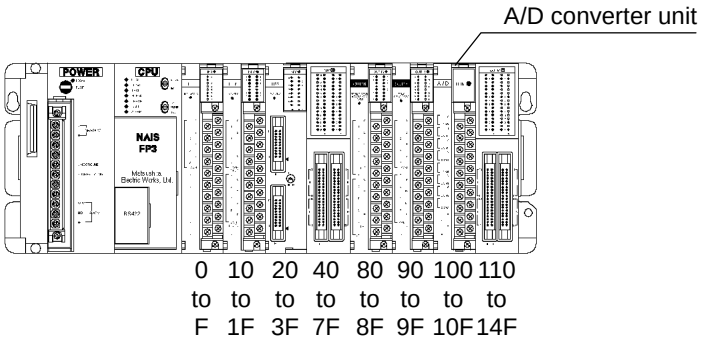
Note:

- For details about the limitations on the current consumption, refer to “FP3/FP10S HARDWARE Technical Manual.”

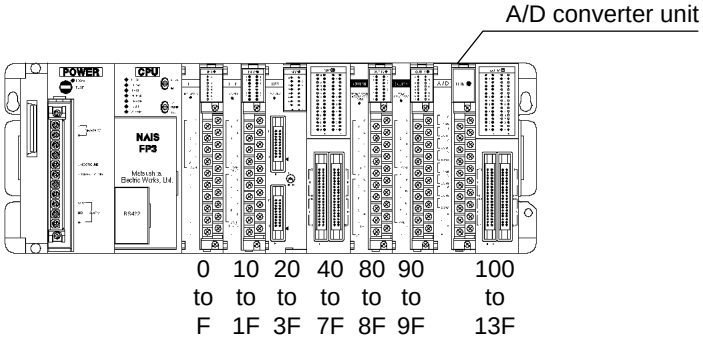
1-3. I/O Allocation and Slot Position

1. I/O Allocation

- I/O addresses for each unit can be allocated according to the type of units and its location in one of the following two methods:
  - Automatic I/O allocation
  - I/O addresses are automatically allocated according to the type of units and its location each time power is supplied to the system.
  - With this I/O allocation method, sixteen points (16SE) are occupied for each of G and I type A/D converter units.



  - Arbitrary I/O allocation
  - I/O addresses can be freely allocated using the NPST-GR Software.
  - With this I/O allocation method, G and I type A/D converter units can be allocated as unit having no input or output (0SE).



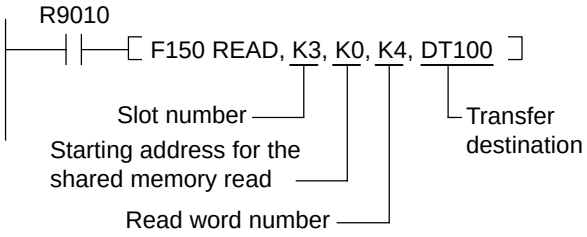
Note:

- For details about the automatic and arbitrary I/O allocation methods, refer to the “FP3/FP10S HARDWARE Technical Manual.”

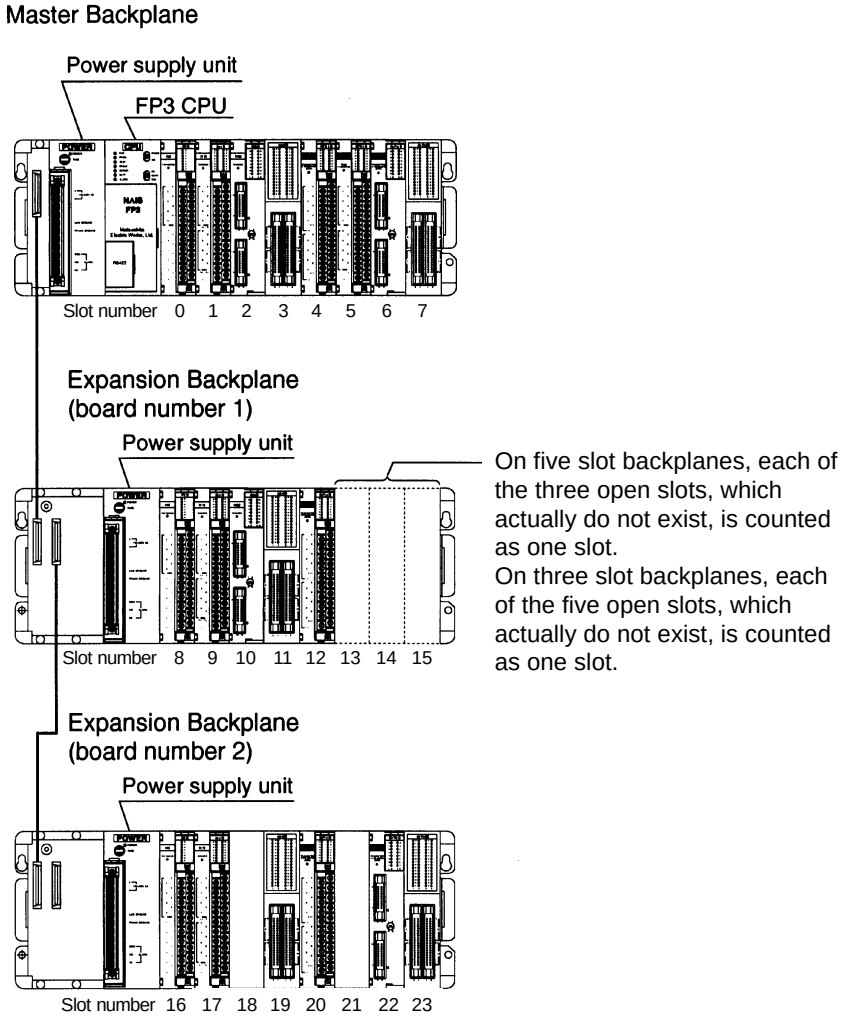
2. Slot Position

- For programming for the G and I type A/D converter units control, the unit position (slot number) is required as:

Program example



- Slot numbers are used for expressing the position of units except for the CPU and power supply unit. The slot number is assigned for each unit for the FP3 and FP10S systems, starting from the unit in the slot nearest to the CPU as shown in the following example.



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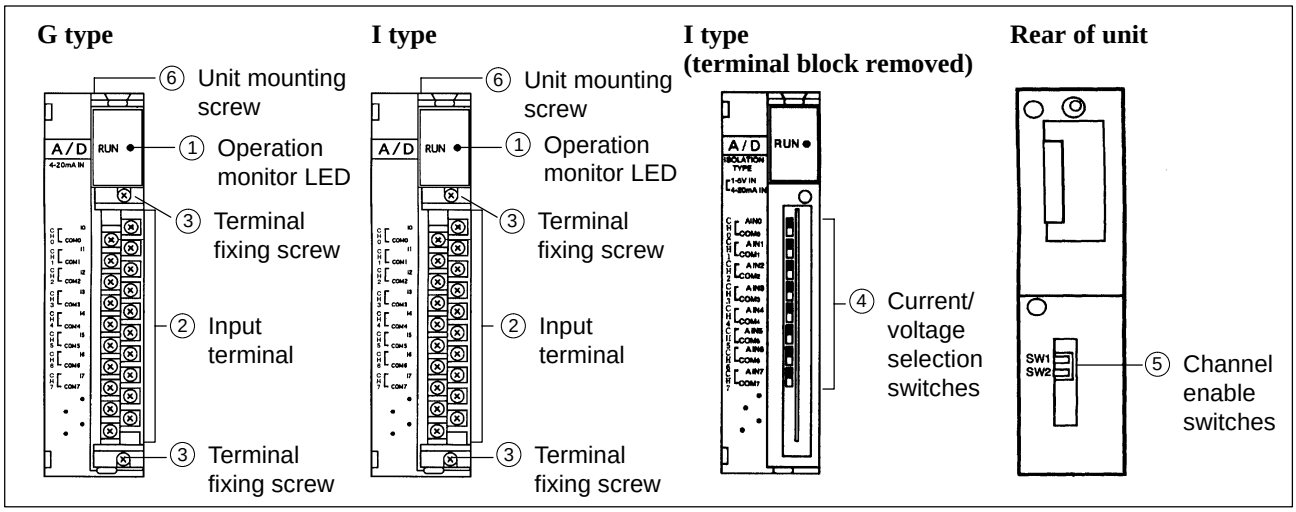
2-1. Parts Terminology and Functions



① Operation monitor LED

ON when the power is supplied to the unit.

② Input terminal

Input wiring section connected to input field devices. This terminal block can be removed by loosening the terminal fixing screws. Terminals marked with "•" cannot be used.

③ Terminal fixing screw

The terminal block can be removed after loosening these screw.

④ Current/voltage selection switches (I type)

Selects the analog input for voltage or current specifications. Each channel has this switch and is set in the down (current specifications) position when shipped from the factory.

AFP3406

1 V to 5 V range

4 mA to 20 mA range

AFP3407

0 V to 5 V range

0 mA to 20 mA range

AFP3408

-10 V to +10 V range

-20 mA to +20 mA range

⑤ Channel enable switches

Specifies the available channels using the SW1 and SW2 switches. The more channels are enabled, the less the conversion speed becomes.
All channels are enabled when shipping from the factory.

SW1	SW2	Enabled channels
ON	ON	1 channel: CH0
ON	OFF	2 channels: CH0 and CH1
OFF	ON	4 channels: CH0 through CH3
OFF	OFF	8 channels: CH0 through CH7

⑥ Unit mounting screw

This screw secures the unit to the backplane.

Note:

- For details about the current/voltage selection switches and the channel enable switches, refer to page 26, "3-2. Channel Enable Setting" and page 27, "3-3. Current/Voltage Switching (I type only)."

2-2. General Specifications

Item	Descriptions
Ambient temperature	0 °C to 55 °C/32 °F to 131 °F
Ambient humidity	30 % to 85 % RH (non-condensing)
Storage temperature	-20 °C to 70 °C/-4 °F to 158 °F
Storage humidity	30 % to 85 % RH (non-condensing)
Vibration resistance	10 Hz to 55 Hz, 1 cycle/min: double amplitude of 0.75 mm/0.030 in., 10 min on 3 axes
Shock resistance	98 m/s^2 or more, 4 times on 3 axes
Noise immunity	1,000 Vp-p with pulse width 50 ns or 1 μs (based on in-house measurements)
Operating condition	Free from corrosive gases and excessive dust

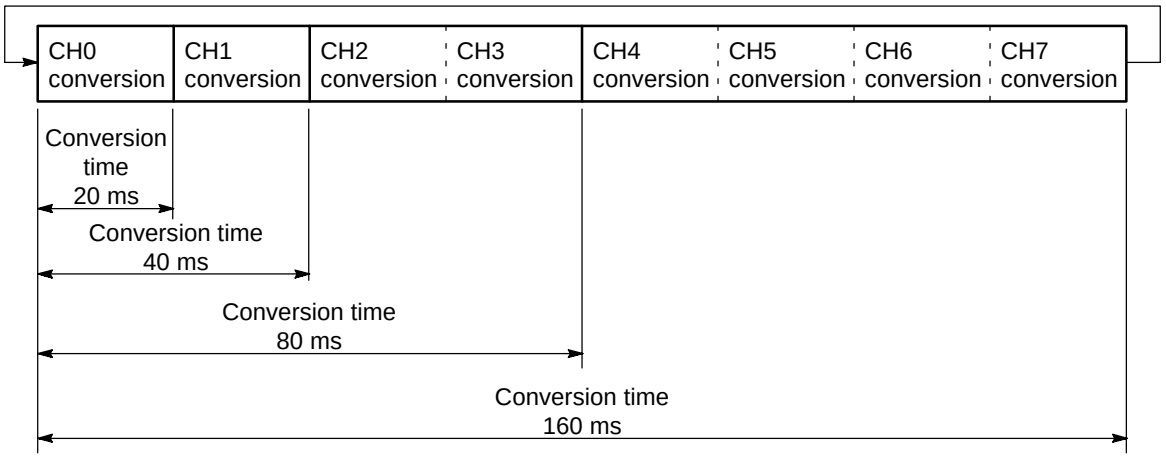
2-3. G (General Purpose) Type Specifications

1. Performance Specifications

Item	Descriptions		
	AFP3405	AFP3403	AFP3402
Number of channels	8 channels per unit		
Input signal range	4 mA to 20 mA	1 V to 5 V	-10 V to +10 V
Resolution	1/8000		
Overall accuracy	1 % of full-scale (0 °C to 55 °C/32 °F to 131 °F) 0.5 % of full-scale (at 25 °C/77 °F)		
Conversion speed	Max. 20 ms per channel (*1)		
Input impedance	For analog voltage input type: 1 MΩ or more For analog current input type: 250 Ω		
Absolute maximum input	For analog voltage input type: +15 V For analog current input type: + 30 mA		
A/D conversion value	K0 to K8000		K-4000 to K+4000
Insulation	Optical coupler insulation between analog input terminal and internal circuit No insulation between analog input channels		
Breakdown voltage	500 V AC for 1 min between analog input terminal and ground		
Insulation resistance	100 MΩ or more, across analog input terminal and ground (measured with a 500 V DC megger testing)		
Internal current consumption (at 5 V DC)	400 mA		
Connection method	Terminal block (M 3.5 screw)		

Note:

• (*1): The time required for the A/D conversion will vary depending on the number of enabled channels.



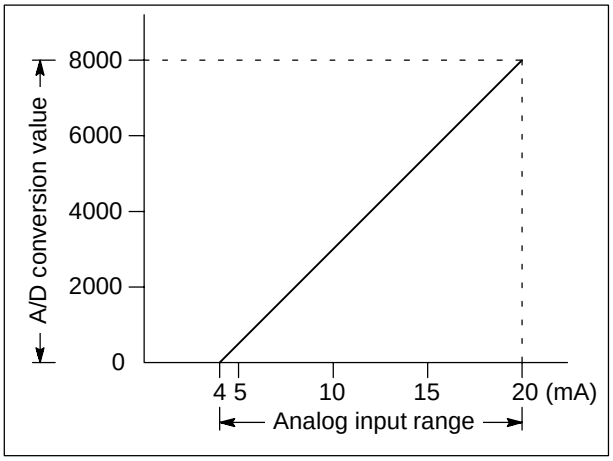
2. A/D Conversion Characteristics

1) AFP3405

Rated input: 4 mA to 20 mA

■ Analog input range vs A/D converted value characteristics

Input current (mA)	A/D converted value
4	0
5	500
6	1000
7	1500
8	2000
9	2500
10	3000
11	3500
12	4000
13	4500
14	5000
15	5500
16	6000
17	6500
18	7000
19	7500
20	8000



Note:

- If the input value exceeds the rated analog input range, the A/D converted value becomes:

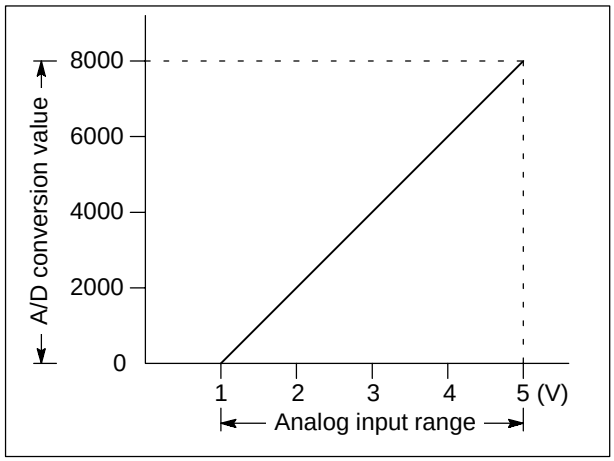
Input value	A/D converted value
Less than 4 mA (Including negative value)	0
20 mA to20.192 mA	8001 to 8192
More than 20.199 mA	Not fixed

2) AFP3403

Rated input: 1 V to 5 V

■ **Analog input range vs A/D converted value characteristics**

Input voltage (V)	A/D converted value
1.0	0
1.5	1000
2.0	2000
2.5	3000
3.0	4000
3.5	5000
4.0	6000
4.5	7000
5.0	8000



Note:

• If the input value exceeds the rated analog input range, the A/D converted value becomes:

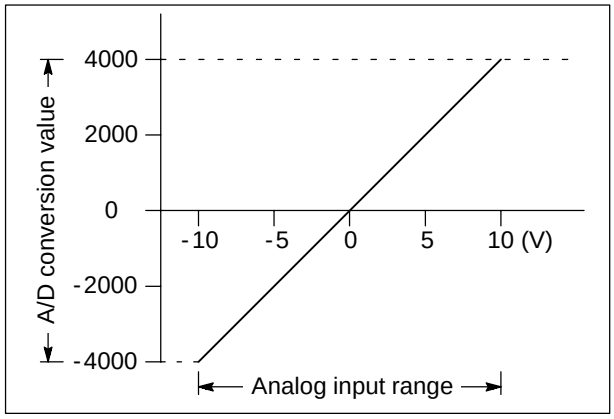
Input value	A/D converted value
Less than 1.0 V (Including negative value)	0
5 V to 5.096 V	8001 to 8192
More than 5.096 V	Not fixed

3) AFP3402

Rated input: -10 V to +10 V

■ **Analog input range vs A/D converted value characteristics**

Input voltage (V)	A/D converted value
-10.0	-4000
-7.5	-3000
-5.0	-2000
-2.5	-1000
0.0	0
+2.5	+1000
+5.0	+2000
+7.5	+3000
+10.0	+4000



Note:

• If the input value exceeds the rated analog input range, the A/D converted value becomes:

Input value	A/D converted value
Less than -10.24 V	-4096
-10.24 V to -10.0025	-4096 to -4001
+10.0025 V to +10.24 V	+4001 to +4096
More than +10.24 V	Not fixed

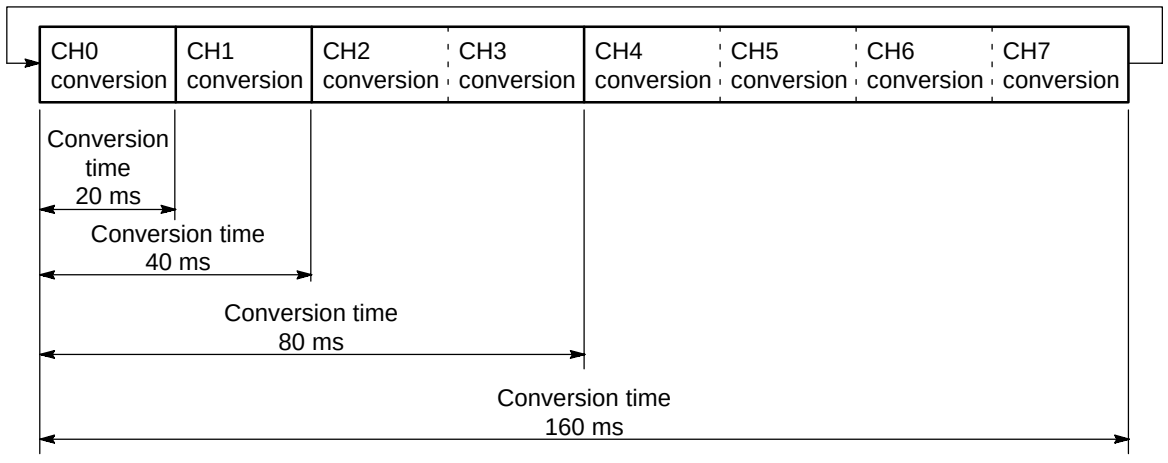
2-4. I (Insulated) Type Specifications

1. Performance Specifications

Item	Descriptions		
	AFP3406	AFP3407	AFP3408
Number of channels	8 channels per unit		
Input signal range	4 mA to 20 mA or 1 V to 5 V (can be selected for each channel by dip switch)	0 mA to 20 mA or 0 V to 5 V	-20 mA to +20 mA or -10 V to +10 V
Resolution	1/8000		
Overall accuracy	1 % of full-scale (0 °C to 55 °C/32 °F to 131 °F) 0.5 % of full-scale (at 25 °C/77 °F)		
Conversion speed	Max. 20 ms per channel (*1)		
Input impedance	For analog voltage input: 1 MΩ or more For analog current input: 250 Ω		
Absolute maximum input	For analog voltage input: +15 V For analog current input: +30 mA		
A/D conversion value	0 to K8000		-4000 to +4000
Insulation	Optical coupler insulation between analog input terminal and internal circuit PhotoMOS relay insulation between analog input channels		
Breakdown voltage	500 V AC for 1 min between analog input terminal and ground 250 V DC for 1 min between each analog input terminal		
Insulation resistance	100 MΩ or more, across analog input terminal and ground (measured with a 500 V DC megger testing) 10 MΩ or more, across analog input terminals (measured with a 500 V DC megger testing)		
Internal current consumption (at 5 V DC)	400 mA		
Connection method	Terminal block (M 3.5 screw)		

Note:

• (*1): The time required for the A/D conversion will vary depending on the number of enabled channels.



2. A/D Conversion Characteristics

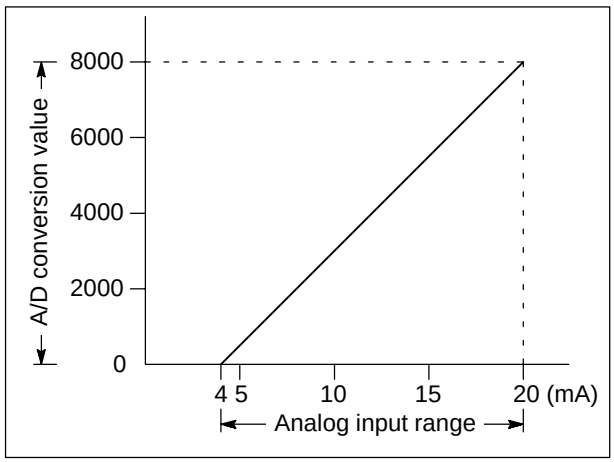
1) AFP3406

Rated input: 4 mA to 20 mA or 1 V to 5 V

(1) In 4 mA to 20 mA range mode

■ **Analog input range vs A/D converted value characteristics**

Input current (mA)	A/D converted value
4	0
5	500
6	1000
7	1500
8	2000
9	2500
10	3000
11	3500
12	4000
13	4500
14	5000
15	5500
16	6000
17	6500
18	7000
19	7500
20	8000



Note:

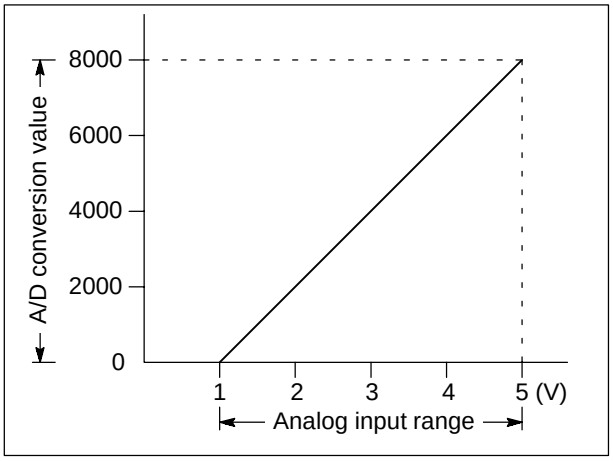
- If the input value exceeds the rated analog input range, the A/D converted value becomes:

Input value	A/D converted value
Less than 4 mA (Including negative value)	0
20 mA to 20.192 mA	8001 to 8192
More than 20.199 mA	Not fixed

(2) In 1 V to 5 V range mode

■ **Analog input range vs A/D converted value characteristics**

Input voltage (V)	A/D converted value
1.0	0
1.5	1000
2.0	2000
2.5	3000
3.0	4000
3.5	5000
4.0	6000
4.5	7000
5.0	8000



Note:

• If the input value exceeds the rated analog input range, the A/D converted value becomes:

Input value	A/D converted value
Less than 1.0 V (Including negative value)	0
5 V to 5.096 V	8001 to 8192
More than 5.096 V	Not fixed

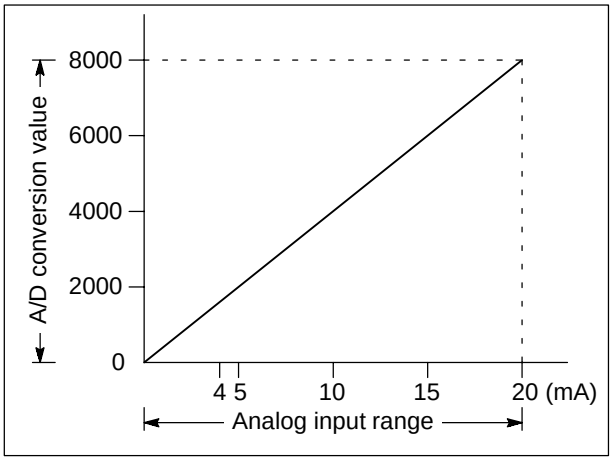
2) AFP3407

Rated input: 0 mA to 20 mA or 0 V to 5 V

(1) In 0 mA to 20 mA range mode

■ **Analog input range vs A/D converted value characteristics**

Input current (mA)	A/D converted value
0.0	0
2.5	1000
5.0	2000
7.5	3000
10.0	4000
12.5	5000
15.0	6000
17.5	7000
20.0	8000



Note:

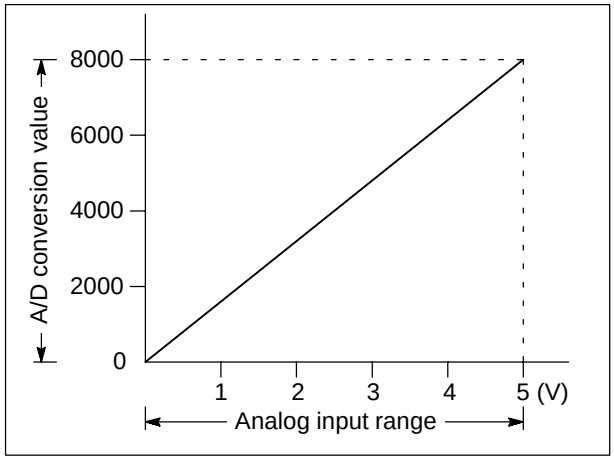
• If the input value exceeds the rated analog input range, the A/D converted value becomes:

Input value	A/D converted value
Less than 0 mA	0
20 mA to 20.48 mA	8001 to 8192
More than 20.48 mA	Not fixed

(2) In 0 V to 5 V range mode

■ **Analog input range vs A/D converted value characteristics**

Input voltage (V)	A/D converted value
0.0	0
0.5	800
1.0	1600
1.5	2400
2.0	3200
2.5	4000
3.0	4800
3.5	5600
4.0	6400
4.5	7200
5.0	8000



Note:

- If the input value exceeds the rated analog input range, the A/D converted value becomes:

Input value	A/D converted value
Less than 0 V	0
5 V to 5.12 V	8001 to 8192
More than 5.12 V	Not fixed

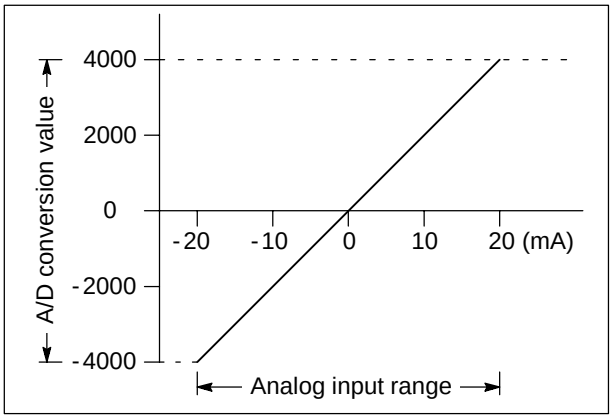
3) AFP3408

Rated input: -20 mA to +20 mA or -10 V to +10 V

(1) In -20 mA to +20 mA range mode

■ **Analog input range vs A/D converted value characteristics**

Input current (mA)	A/D converted value
-20.0	-4000
-15.0	-3000
-10.0	-2000
-5.0	-1000
0.0	0
+5.0	+1000
+10.0	+2000
+15.0	+3000
+20.0	+4000



Note:

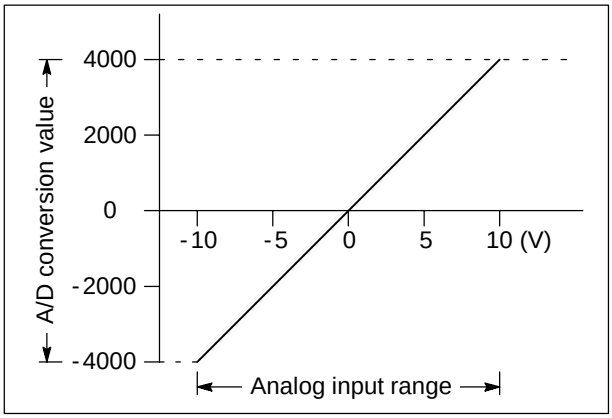
• If the input value exceeds the rated analog input range, the A/D converted value becomes:

Input value	A/D converted value
Less than -20.475 mA	-4096
-20.475 mA to -20.005 mA	-4096 to -4001
+20.005 mA to +20.475 mA	+4001 to +4096
More than +20.475 V	Not fixed

(2) In -10 V to +10 V range mode

■ **Analog input range vs A/D converted value characteristics**

Input voltage (V)	A/D converted value
-10.0	-4000
-7.5	-3000
-5.0	-2000
-2.5	-1000
0.0	0
+2.5	+1000
+5.0	+2000
+7.5	+3000
+10.0	+4000



Note:

• If the input value exceeds the rated analog input range, the A/D converted value becomes:

Input value	A/D converted value
Less than -10.24 V	-4096
-10.24 V to -10.0025 V	-4096 to -4001
+10.0025 V to +10.24 V	+4001 to +4096
More than +10.24 V	Not fixed

2-5. Shared Memory Specifications

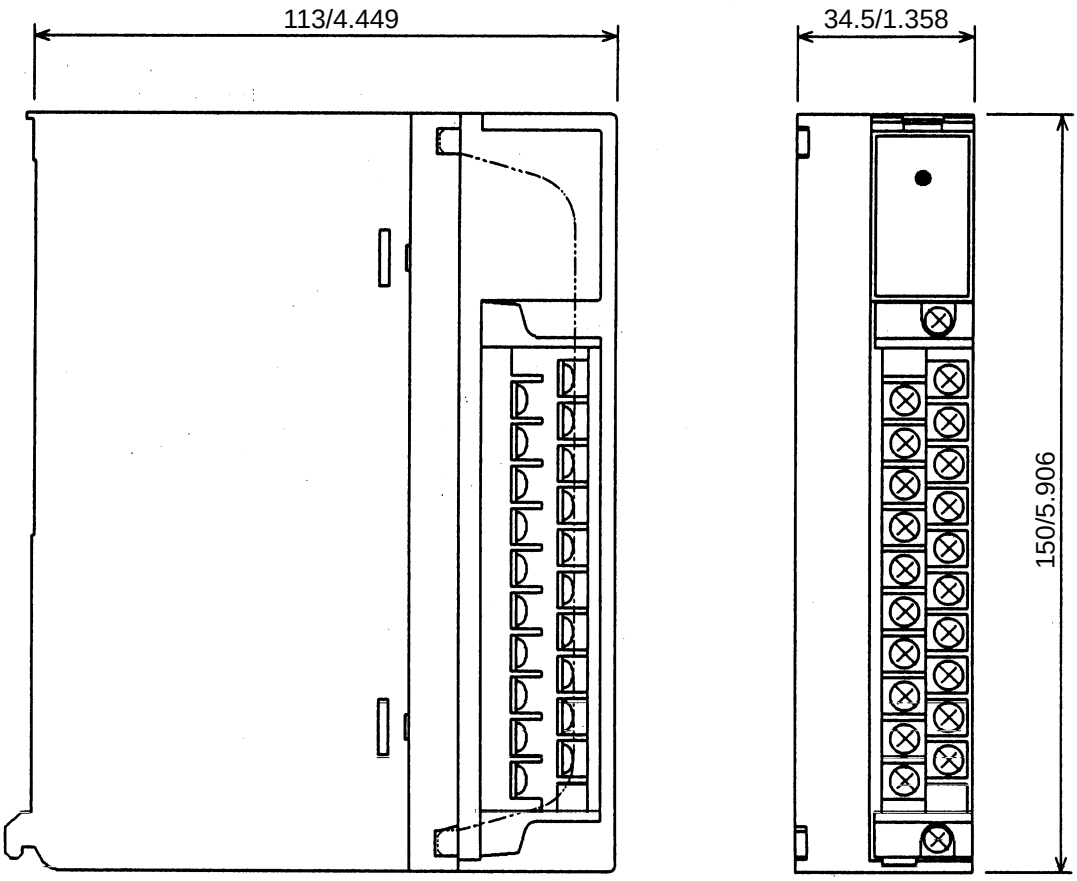
The shared memory is used for communication between the FP3/FP10S CPU and G and I type A/D converter unit. For accessing the A/D converter unit, the CPU should execute **F150 (READ)/P150 (PREAD)** instructions specifying the slot number of the unit and shared memory address. The shared memory of the G and I type A/D converter units is configured as follows:

Shared memory address (word units)	Channel of the unit	Description
0	CH0	Input analog value is converted to the digital data and stored in the specified address of the shared memory. The range of the A/D conversion value is - K0 to K8000 or - K-4000 to K+4000 (The A/D conversion value range is decided by the unit's specifications)
1	CH1	
2	CH2	
3	CH3	
4	CH4	
5	CH5	
6	CH6	
7	CH7	

Note:

- Since the shared memory is a non-hold (volatile) type, its values are cleared to 0 when the power is turned OFF. When you need to stored the A/D converted data, be sure to take an appropriate measure using your program such as transferring its contents to the hold-type CPU's registers.

2-6. Dimensions



(Unit: mm/in.)

CHAPTER 3

INSTALLATION AND SETTINGS

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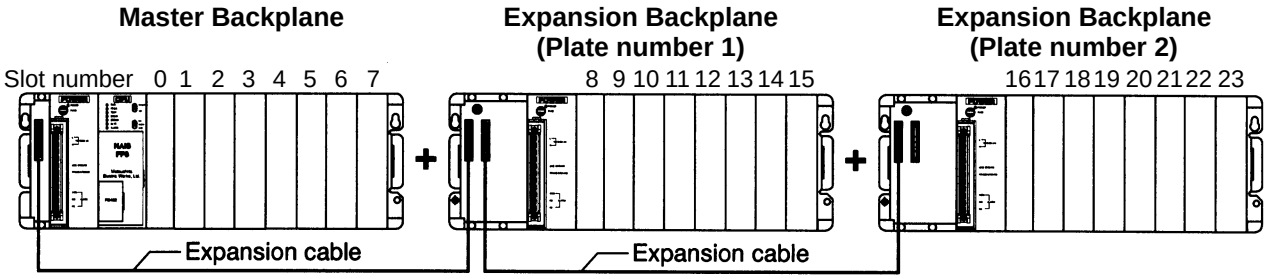
3. Installation Environment 24
3-2. Channel Enable Settings 26
3-3. Current/Voltage Switching (I type only) 27
3-4. Wiring 29

3-1. Installing an A/D Converter Unit

1. Basic Configurations

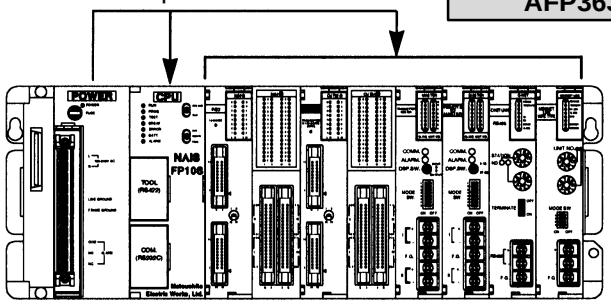
■ Location and restrictions



- The G and I type A/D converter unit can be installed on any slot position of a CPU equipped master backplane or expansion backplanes.
- The G and I type A/D converter unit cannot be installed on a MEWNET-F (remote I/O) slave station.
- When building up an FP3/FP10S system, take current consumption into consideration as follows:

The internal power supply (5 V) goes to each unit via the backplane bus.

Power supply unit	Rated output current (5 V)
AFP3631	2.4 A
AFP3636	6 A
AFP3634	2.4 A



■ I/O allocation

- In the automatic I/O allocation, 16 points of I/Os (16SE) are automatically allocated for each A/D converter unit when the power is supplied to the FP3/FP10S system.
- If the arbitrary I/O allocation is used, G and I type A/D converter unit can be set as unit having no input or output (0SE).

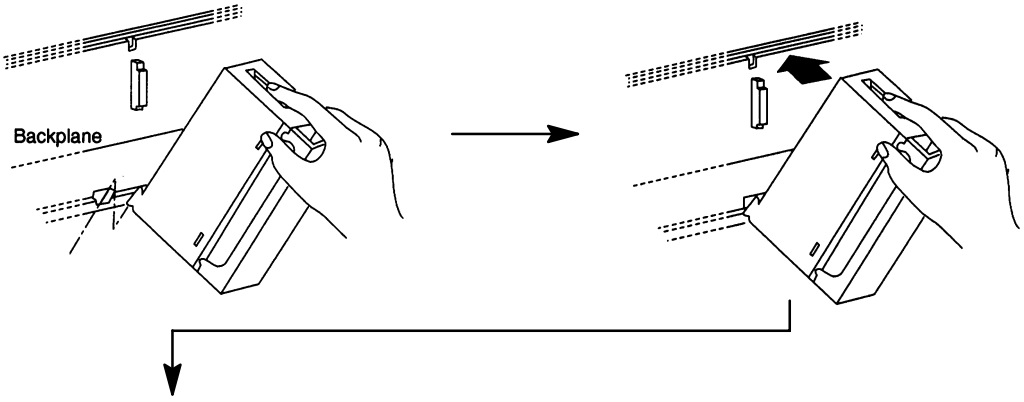
Note:

- For details about the I/O allocation, refer to the “FP3/FP10S HARDWARE Technical Manual.”

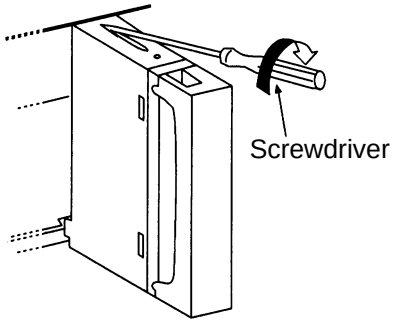
2. How to Install an A/D Converter Unit

Before installing the unit, remove the connector cover on the backplane.

1. Fit the unit tabs (two) into the unit holes on the backplane.
2. Push the unit in the direction of the arrow and install onto the backplane.



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



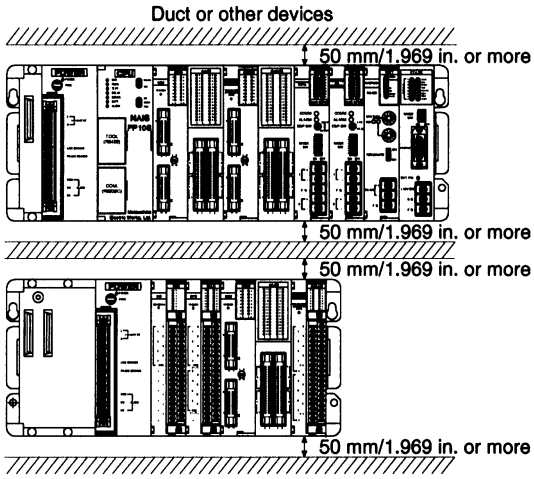
Notes:

- Be sure to turn OFF the power of the FP3/FP10S system before installing units.
- Do not drop the unit or apply excessive force on it.
- Be sure to secure the mounting screw at the top.
- Do not allow parts or other objects to fall into the unit while making wiring connections.
- Leave the dust proofing label on the upper surface of the unit until the wiring is finished.
- Do not touch the connectors on the rear side of the unit. Static electricity may damage the A/D converter unit.

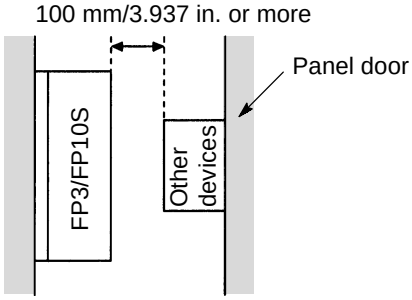
3. Installation Environment

■ Installation space

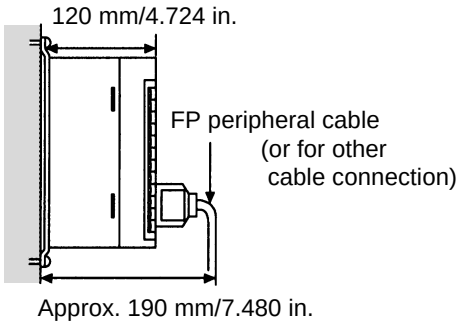
- Leave at least 50 mm/1.969 in. of space between the upper and lower section and the FP3/FP10S system to allow heat to radiate and to facilitate unit replacement.



- When installing devices facing the FP3/FP10S such as on the door of the panel, leave a space of at least 100 mm/3.937 in. between that device and the unit to avoid the effects of heat or radiated noise.



- Although the depth of the unit is 120 mm/4.724 in., leave a space of at least 200 mm/7.874 in. from the mounting surface for tool connections and wiring.



■ Notes on usage

The unit should be used within the following conditions.

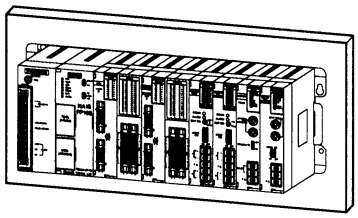
- At ambient temperatures of 0 °C to 55 °C/32 °F to 131 °F.
- At ambient humidity of 30 % to 85 % RH.

It should be used in a place where it will not be exposed to:

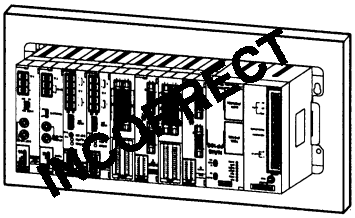
- Sudden temperature change causing dew condensation.
- Inflammable or corrosive gas.
- Excessive airborne dust or iron particles.
- Benzine, paint thinner, alcohol, other organic solvents or strong alkaline solutions of ammonia or caustic soda.
- Excessive vibration or shock.
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters or any other equipment that generates high switching surges.
- Water splashes.
- Direct sunlight.

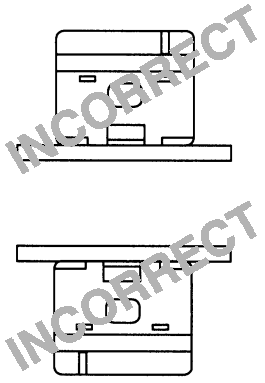
■ Notes on installation

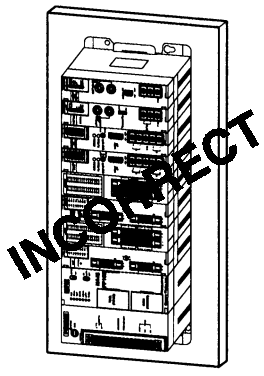
- Do not install the programmable controller vertically or horizontally since it may cause abnormal heat generation within the programmable controller above devices which generate large amounts of heat such as heaters, transformers or power resistors.
- Keep the surface of each unit at least 100 mm/3.937 in. away from power lines and electromagnetic switching devices to prevent the influence of noise radiation. In particular, observe this distance when installing control panel doors.
- Install the unit only as shown below.



- Do not install as shown below.

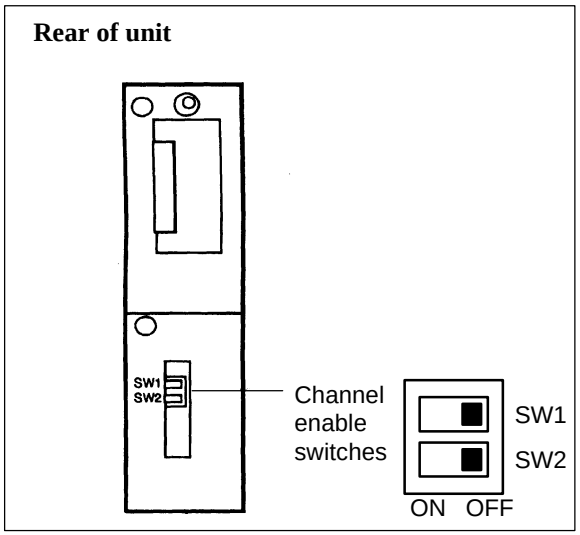






3-2. Channel Enable Settings

Each of G and I type A/D converter units has 8 analog input channels. Using two dip switches (SW1 and SW2) on the rear of the unit, you can select the number of effective channels for your convenience.



Note:

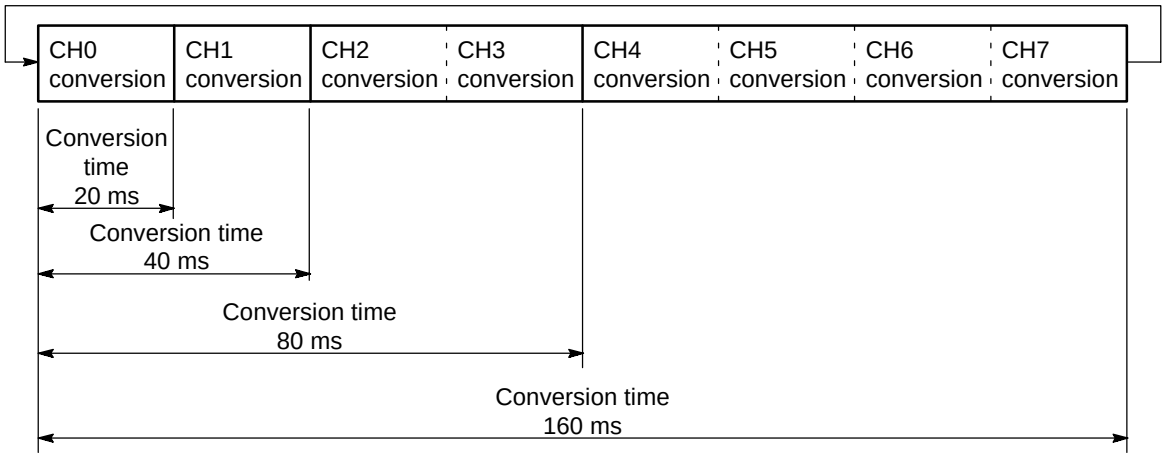
- The SW1 and SW2 are set to OFF position at factory before shipping. In this setting, all 8 channels are enabled.

■ Channel enable switches (SW1 and SW2) settings

SW1	SW2	Enabled channels	A/D conversion time
ON	**ON**	CH0	20 ms
ON	**OFF**	CH0 and CH1	40 ms
OFF	**ON**	CH0 to CH3	80 ms
OFF	**OFF**	CH0 to CH7	160 ms

■ A/D conversion time

The A/D conversion time will vary depending on the number of channels enabled.

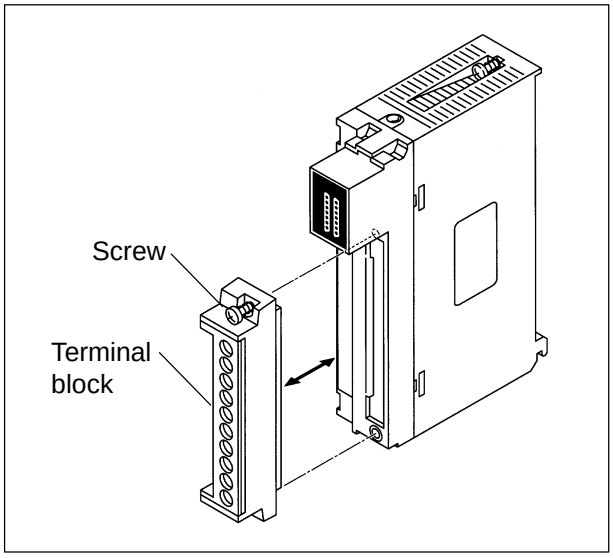


3-3. Current/Voltage Switching (I type only)

With the I type A/D converter unit, analog input mode can be selected from current or voltage mode for each channel. The current or voltage selection is done according to the following procedure.

Step 1:

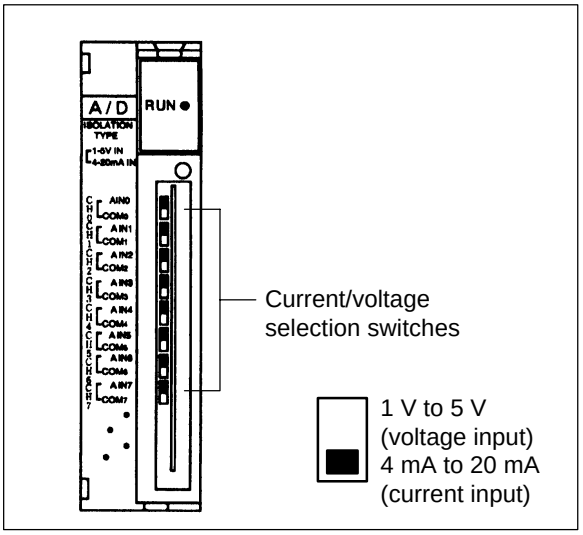
• Remove the terminal block from the unit.



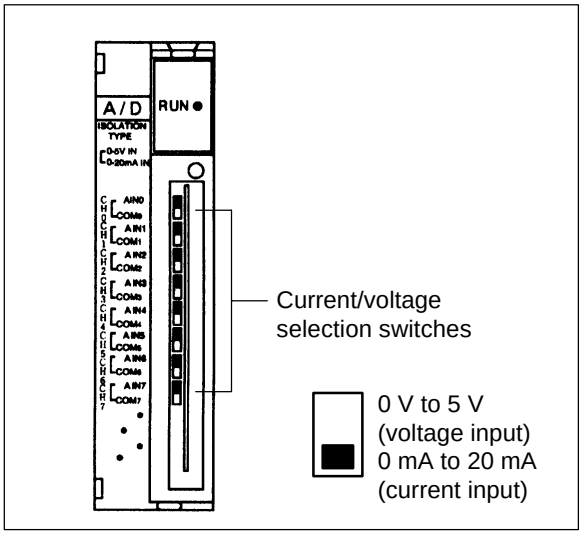
Step 2:

• The input range of each channel is set with eight slide switches.

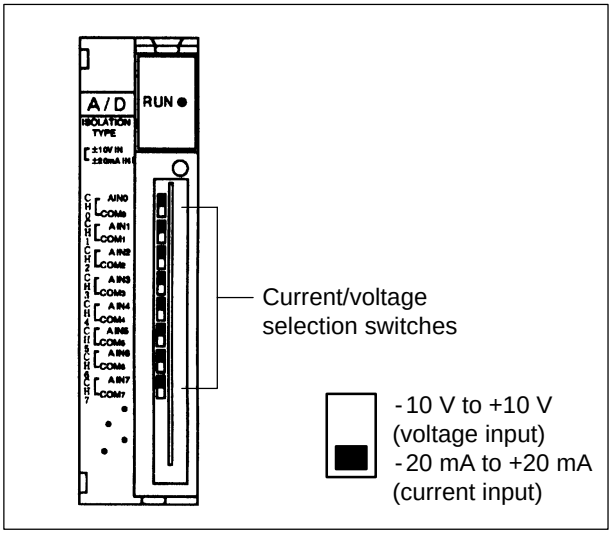
AFP3406



AFP3407



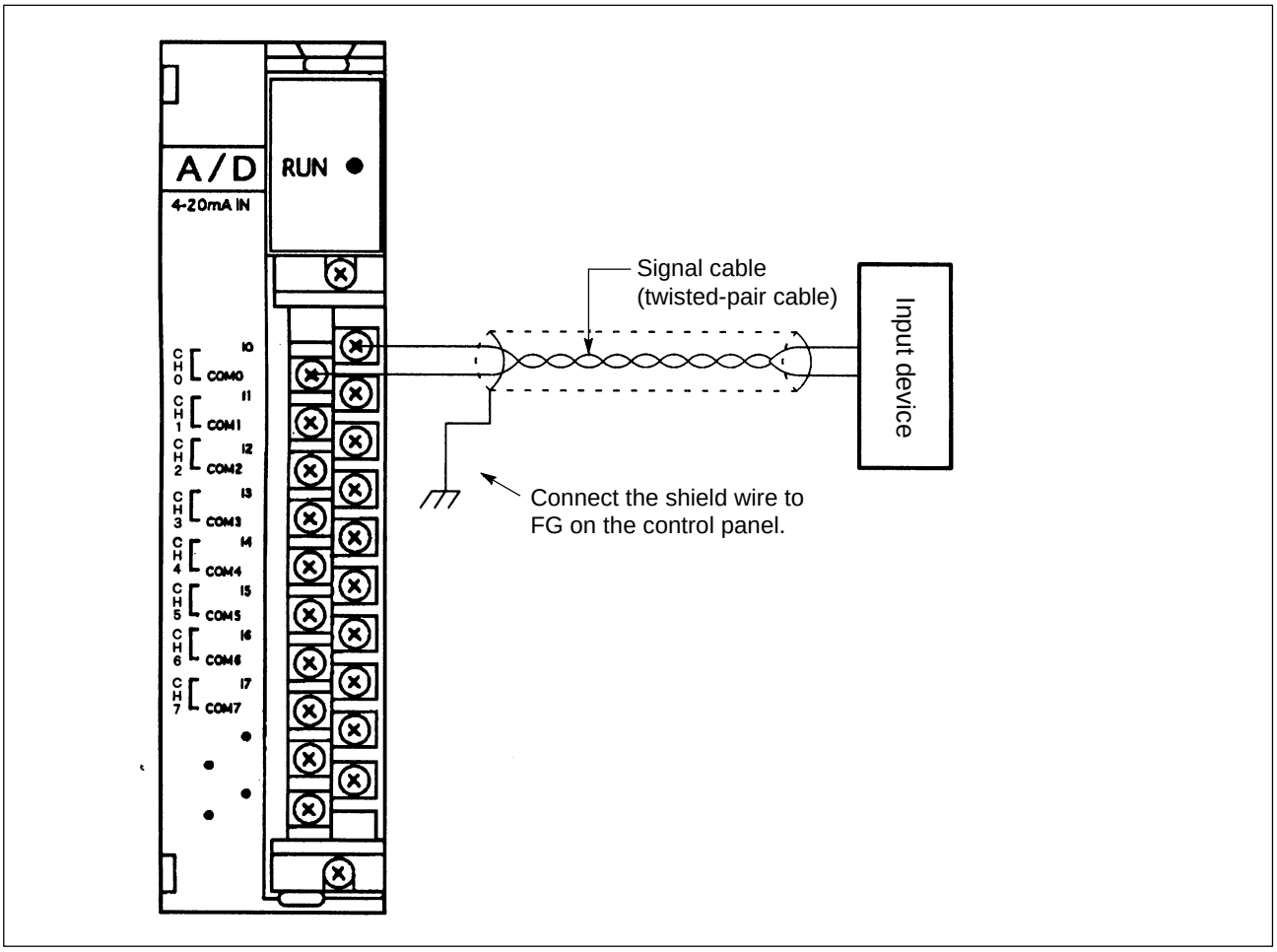
AFP3408



Note:

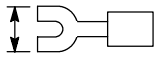
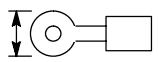
- All units are set to the current input as follows at the factory before shipping.
  - AFP3406: 4 mA to 20 mA mode
  - AFP3407: 0 mA to 20 mA mode
  - AFP3408: -20 mA to +20 mA mode

3-4. Wiring



■ Cautions regarding wiring

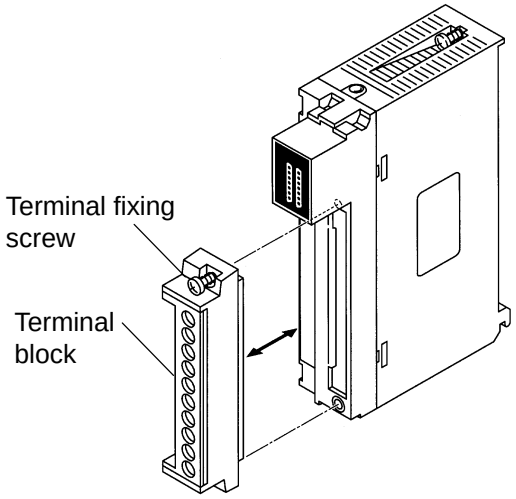
- Be sure to use a shielded twisted-pair cable for connection to field input devices.
- M3.5 screws are used for terminals. Suitable pressure connection terminals are:

Terminal style	Specifications	Recommended wire size
Fork terminal	7.2 mm/0.283 in. or less 	0.25 mm^2 to 2.63 mm^2 A.W.G.33 through A.W.G.13
Round terminal	7.2 mm/0.283 in. or less 	

- Be sure to connect the negative (-) load to the COM terminal.
- Be sure to ground the shielded wire to the frame ground on the control panel where the FP3/FP10S system is installed. In order to prevent the influence of induction and noise, be sure not to connect the shielded wire at the input field device side.
- Keep the analog input wires at least 50 cm/19.7 in. away from the load, high-voltage or power wires.
- Never bind the analog input wires together with the load, high-voltage or power wires.

■ Removable terminal block

- If the terminal fixing screws at both ends are loosened, the terminal block of the A/D converter unit can be pulled out from the unit for wiring convenience.
- Never forget to tighten these screws after the wiring completed.



CHAPTER 4

PROGRAMMING FOR A/D CONVERTER UNITS

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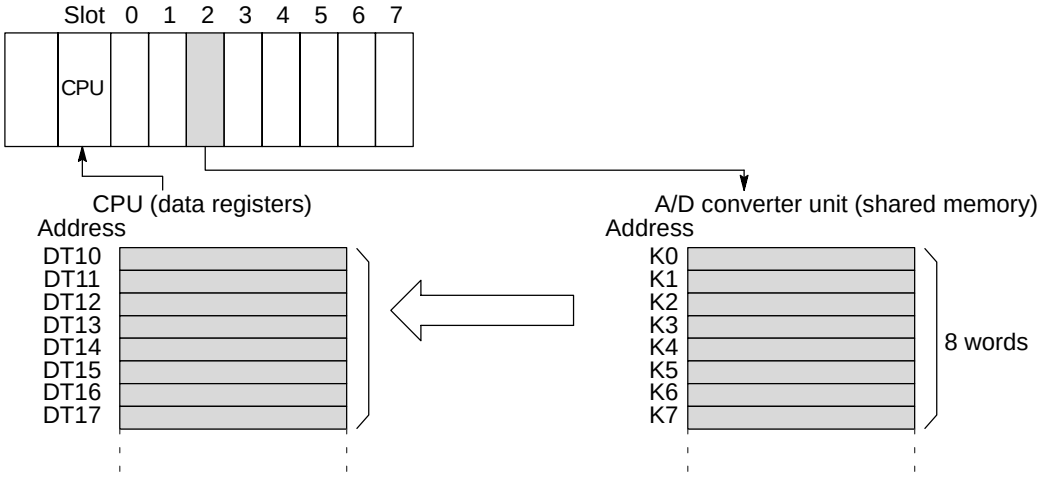
4-1. The Basics of Programming

In order to read the A/D converted value in the G and I type A/D converter unit, the **F150 (READ)/P150 (PREAD)** instruction is programmed in the CPU. Then, the A/D converted value become available in the FP3/FP10S CPU for processing.
In this section, the **F150 (READ)/P150 (PREAD)** instruction is explained using two examples.

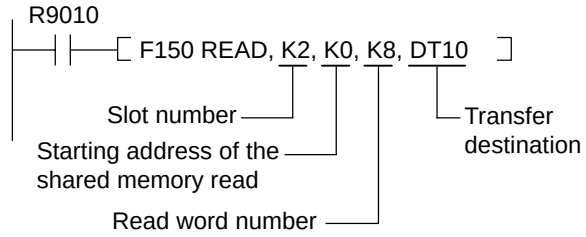
■ Program example 1

Condition:

- A/D converter slot position: Slot 2 position
- Number of enabled channels: 8 channels (CH0 to CH7)
- CPU registers for storing A/D converted value: DT10 to DT17



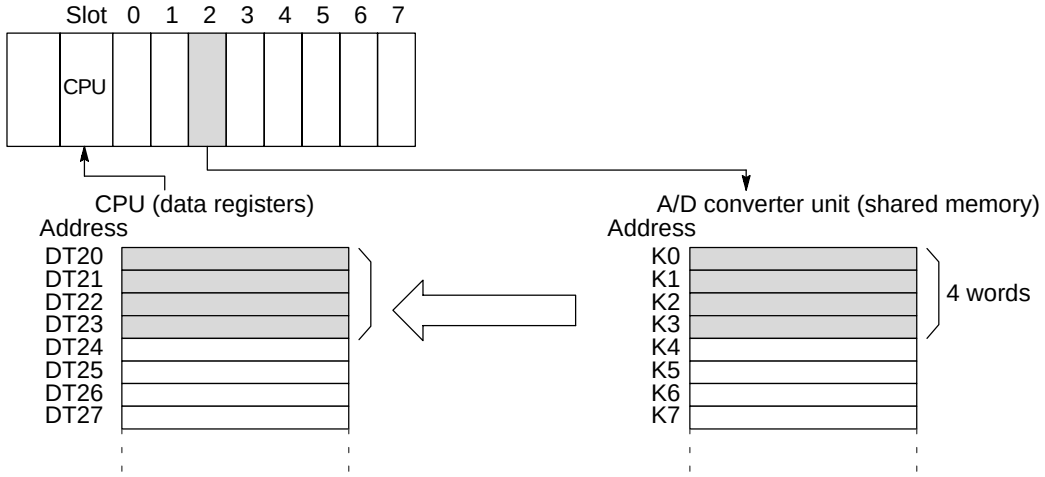
Program



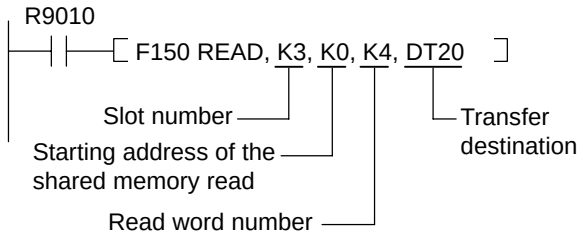
■ Program example 2

Condition:

- A/D converter slot position: Slot 2 position
- Number of enabled channels: 4 channels (CH0 to CH3)
- CPU registers for storing A/D converted value: DT20 to DT23

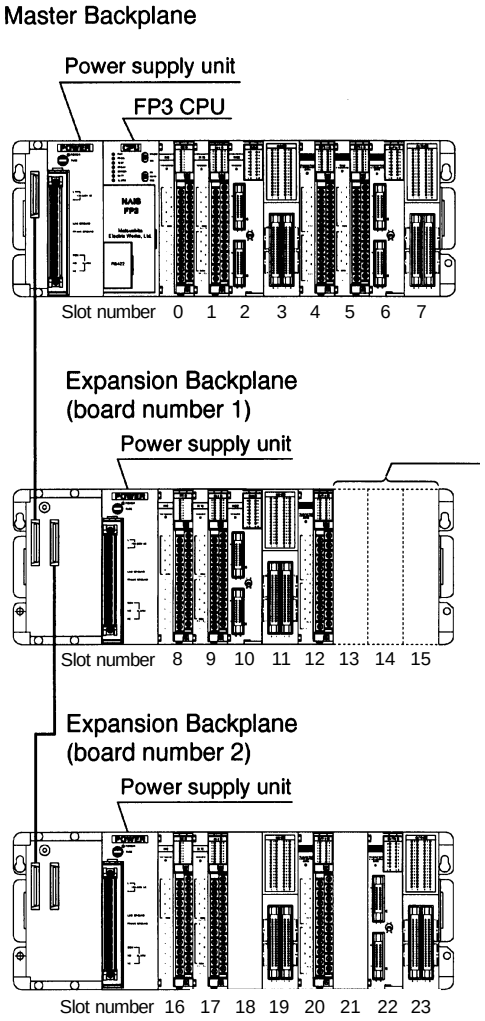


Program



■ Slot number

Slot numbers are used to express the position of FP3/FP10S units except for the CPU and power supply unit. The slot numbers are assigned for each unit starting from the unit nearest to the CPU and power supply unit. Even if you are using 3- or 5-slot backplane, the open slots, which actually do not exist, is counted as one slot.



On five slot backplanes, each of the three open slots, which actually do not exist, is counted as one slot.
On three slot backplanes, each of the five open slots, which actually do not exist, is counted as one slot.

■ Shared memory

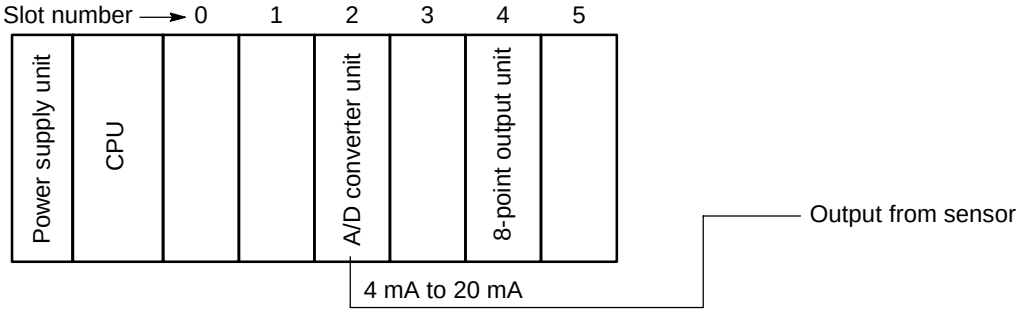
Values converted from analog to digital are stored in the shared memory of the A/D converter unit as follows:

Shared memory address (word units)	16 bits
K0	A/D converted value of CH0
K1	A/D converted value of CH1
K2	A/D converted value of CH2
K3	A/D converted value of CH3
K4	A/D converted value of CH4
K5	A/D converted value of CH5
K6	A/D converted value of CH6
K7	A/D converted value of CH7

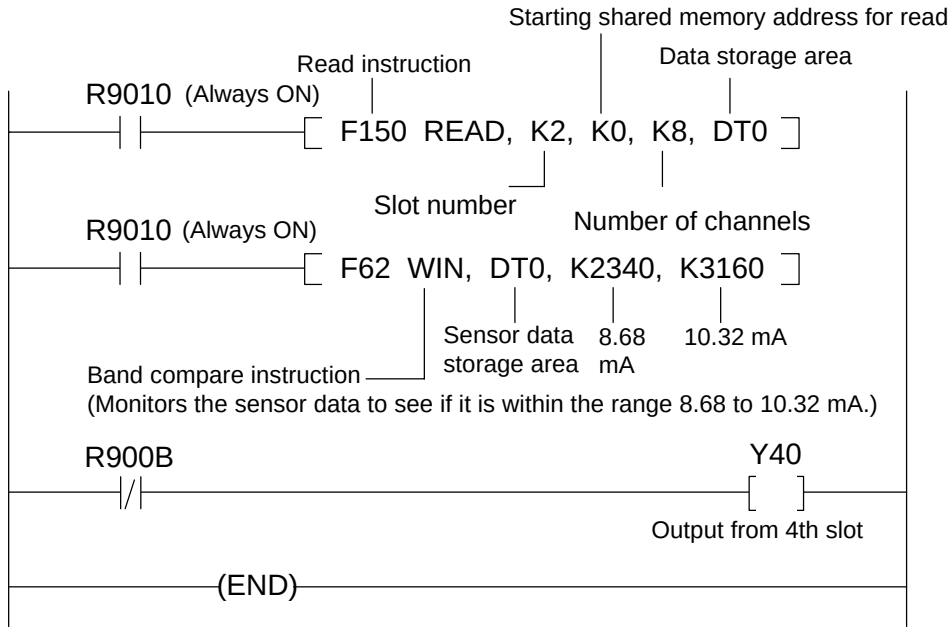
4-2. Application Program Example

■ Condition

- Type of A/D converter unit: AFP3406 (I type with 4 mA to 20 mA/1 V to 5 V range)
- Channel enable settings (on the rear of the unit): SW1: ON and SW2: ON (only CH0 enabled)
- Channel 0 current/voltage selection switch setting: Down side setting
- A/D converter unit slot position: Slot 2 position
- Input field device: Sensor outputting 4 mA to 20 mA
- CPU register for storing A/D converted value: DT0



■ Application program



■ Explanation of program

The analog data ranging 4 mA to 20 mA is input to the channel 0 of the A/D converter unit.
The analog input value is converted to the digital value and stored in the shared memory.
The value in the shared memory is feed into DT0 of the CPU using R9010 (always ON special internal relay) and **F150 (READ)** instruction.
The read value is checked by the **F62 (WIN)** instruction if the input satisfies the following condition or not:
2340 (8.68 mA) ≦ DT10 ≦ 3160 (10.32 mA).
If the input is not in the range, Y40 turns ON.

CHAPTER 5

TROUBLESHOOTING

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5-3. Total-check Error Codes 44
5-4. Self-diagnostic Error Codes 45

5-1. Checkpoints for Troubleshooting

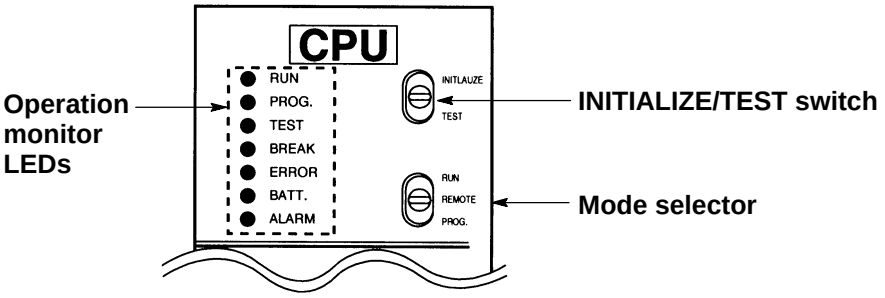
When something goes wrong with the A/D converter unit installed FP3/FP10S system or with the A/D converted value, check the FP3/FP10S system using the troubleshooting flowcharts in "5-2. Troubleshooting."
But, first of all, be sure to check the entire system including peripheral devices, referring to the:

- Observe what is happening.
- Check for error repetition.
- Check the status of indicators.
- Check that power is properly supplied to the FP3/FP10S system.
- Check whether the trouble detected is in the FP3/FP10S system or in other field devices.
- Check whether there is a problem with the program or not.

■ Operation monitor LEDs of the FP3/FP10S CPU

The status of the operation monitor LEDs on the FP3/FP10S CPU vary depending on the condition. When checking the operation status of programmable controllers, be sure to check the operation monitor LEDs while referring to the table below.

FP3 CPU example

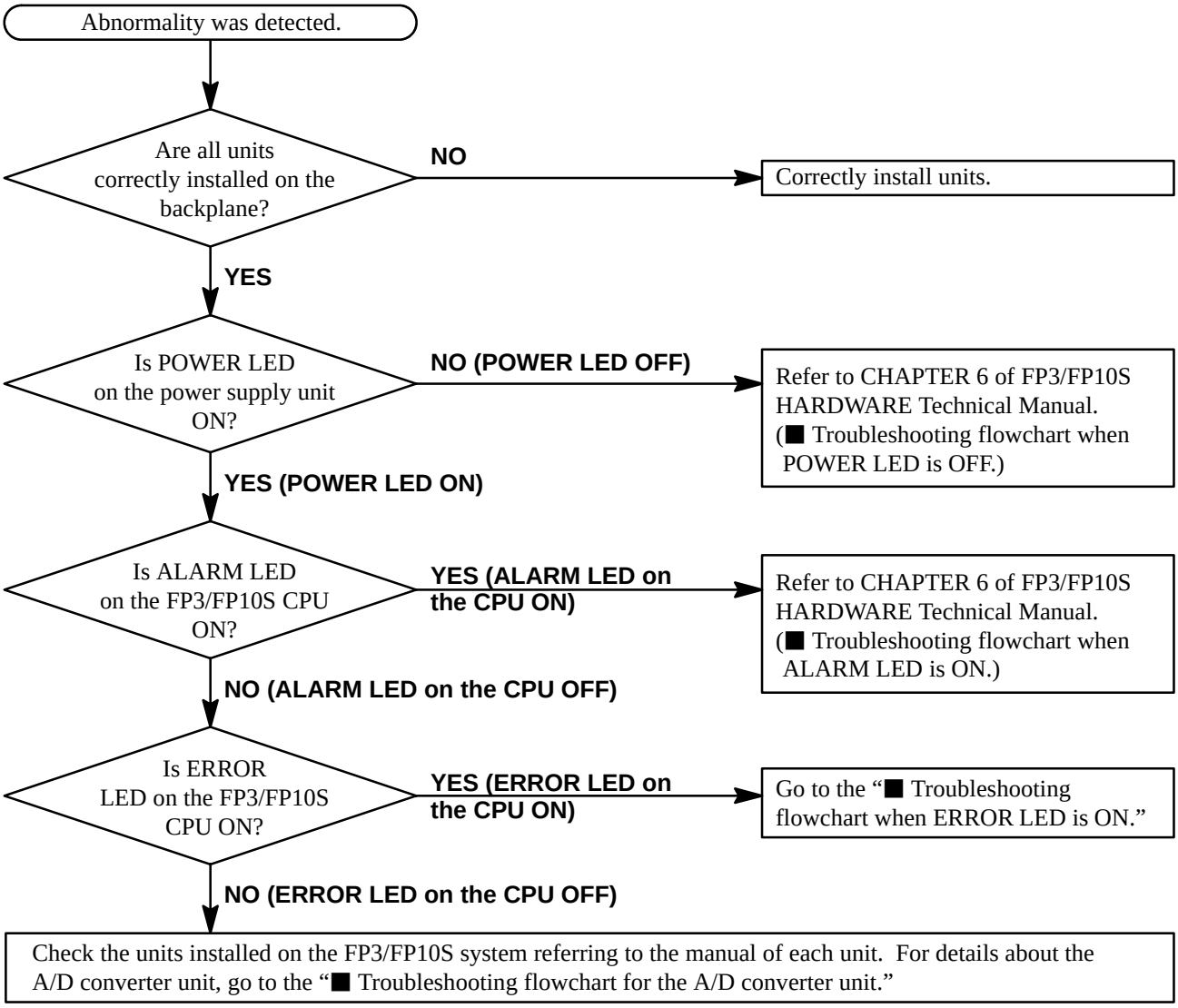


LED status							Description	Program execution status	Condition
RUN LED	PROG. LED	TEST LED	BREAK LED	ERROR LED	BATT. LED	ALARM LED			
ON	OFF	OFF	OFF	OFF	Varies	OFF	Operation in the RUN mode	Executing	Normal condition
OFF	ON	Varies	OFF	Varies	Varies	OFF	Operation in the PROG. mode	Not-executing	
Flashes	OFF	Varies	OFF	Varies	Varies	OFF	Forced ON/OFF in the RUN mode	Executing	
OFF	ON	Varies	OFF	Varies	Varies	OFF	Forced ON/OFF in the PROG. mode	Not-executing	
ON	OFF	ON	ON	Varies	Varies	OFF	TEST/RUN (break condition)	Not-executing	
ON	OFF	ON	OFF	Varies	Varies	OFF	TEST/RUN (operating condition)	Executing	
OFF	Varies	Varies	Varies	ON	Varies	OFF	Self-diagnostic error (stops)	Not-executing	Abnormal condition
ON	OFF	OFF	OFF	ON	Varies	OFF	Self-diagnostic error (continues)	Executing	
Varies	Varies	Varies	Varies	Varies	ON	OFF	CPU backup battery error	Executing	
Varies	Varies	Varies	Varies	Varies	Varies	ON	Watchdog timer error	Not-executing	
OFF	Flashes	Varies	OFF	Varies	Varies	OFF	MEWNET-F slave waiting error	Not-executing	

5-2. Troubleshooting

When something goes wrong with the A/D converter installed FP3/FP10S system, refer to the troubleshooting flowcharts starting from the "■ Main troubleshooting flowchart."

■ Main troubleshooting flowchart



■ Troubleshooting flowchart when ERROR LED is ON

<Condition: an error is detected by the self-diagnostic function>

Set the mode of the programmable controller from RUN to PROG.

Is ERROR LED on the programmable controller turned OFF?

NO (ERROR LED ON) → **Go to page 41**

YES (ERROR LED OFF)

Probably a total-check error. Check the program using the programming tool.

- **Using NPST-GR Software Ver. 3.1**

<If you are using MENU 1 screen type>
Open [NPST MENU] by pressing Esc, and then select "CHECK A PROGRAM" to skip to the [CHECK A PROGRAM] subwindow.

In the [CHECK A PROGRAM] subwindow, select "1. TOTALLY CHECK A PROGRAM."

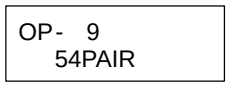
<If you are using MENU 2 screen type>
Open [ONLINE MONITOR FUNCTION MENU] by pressing Esc, and then select "V. TOTALLY CHECK."

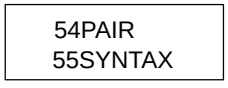
In the [TOTALLY CHK] window, press F1 to execute the program check.

You can get the address and program where a total-check error occurs. The type of errors can also be displayed on the display.

- **Using FP programmer II**

Press the keys on the FP programmer II as shown on the right. When a total-check error occurs, the screen shown on the right is displayed.





You can find the address and program where a total-check error occurs by pressing the READ key.

Correct the program referring to page 44, "5-3. Total-check Error Codes."

Set the mode of the programmable controller from PROG. to RUN.

From page 40

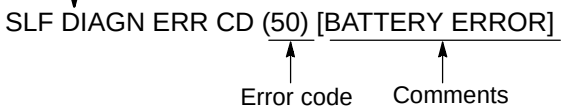
Probably a self-diagnostic error.
Check the program using the programming tool.

- **Using NPST-GR Software Ver. 3.1**

<If you are using MENU 1 screen type>
Open [NPST MENU] by pressing Esc, and then select "MONITOR" to skip to the [MONITOR] subwindow. In the [MONITOR] subwindow, select "7. STATUS DISPLAY."

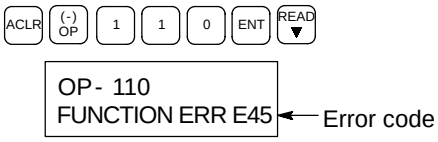
<If you are using MENU 2 screen type>
Open [ONLINE MONITOR FUNCTION MENU] by pressing Ctrl + F10 together, and then select "P. STATUS DISPLAY."

At the bottom of the [STATUS DISPLAY] window, you can find the error code in "( )", represented in decimal, and comments in "[ ]", as shown on the right.



- **Using FP programmer II**

Press the keys on the FP programmer II as shown on the right.
When self-diagnostic error occurs, the screen shown on the right is displayed.



Check the FP3 or FP10S referring to page 45, "5-4. Self-diagnostic Error Codes."

- If the self-diagnostic error code of E45 is found in the CPU-A/D converter unit communication program section, go to the "■ Troubleshooting flowchart for the A/D converter unit."

Cancel error status and start operation again.

- You can cancel the error status in the following ways:

- Turn the power OFF and then ON.
- Cancel the error status using the NPST-GR Software Ver. 3.1 or the FP programmer II. To perform this function, use "OP 112" of the FP programmer II or [STATUS DISPLAY] of NPST-GR Software Ver. 3.1. (This function is not available with a conventional FP programmer or with NPST-GR Software Ver. 3.0 or earlier.)
- Cancel the error status using the **F148 (ERR)/P148 (PERR)** instruction.

Note:

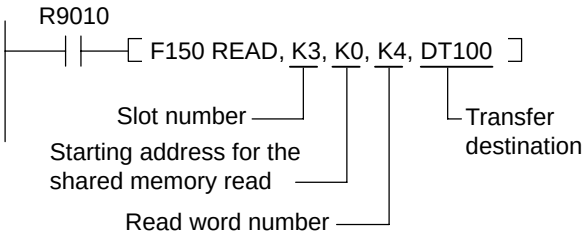
- The error cancellation function of the programming tool and the **F148 (ERR)/ P148 (PERR)** instruction is available for FP3 with a CPU version V.4.4 or later and all FP10S.

■ Troubleshooting flowchart for the A/D converter unit

Check the communication program

- Check that the slot number, shared memory address and the other program specifications for the **F150 (READ)/P150 (PREAD)** instruction is correct.

Program example



Notes:

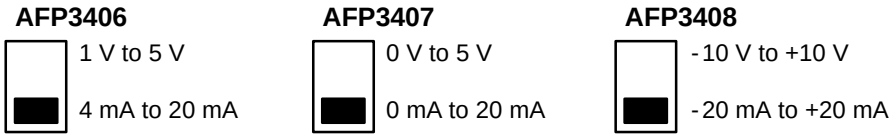
- For details about the slot number, refer to page 4, “1-3. I/O Allocation and Slot Position.”
- For details about the shared memory configuration of the G and I type A/D converter unit, refer to page 18, “2-5. Shared Memory Specifications.”

Check if the input wires are connected properly.

- Refer to page 29, “3-4. Wiring” for details.

If you are using an I type A/D converter unit, check the current/voltage selection switches.

- The current/voltage selection switches under the terminal block.
  (1) Turn OFF the power for the FP3/FP10S system and the input devices.
  (2) Remove the terminal block from the unit by loosening the terminal fixing screws.
  (3) Check the settings for each channel



Go to next page.

From the previous page.

Check the channel enable settings of the A/D converter unit.

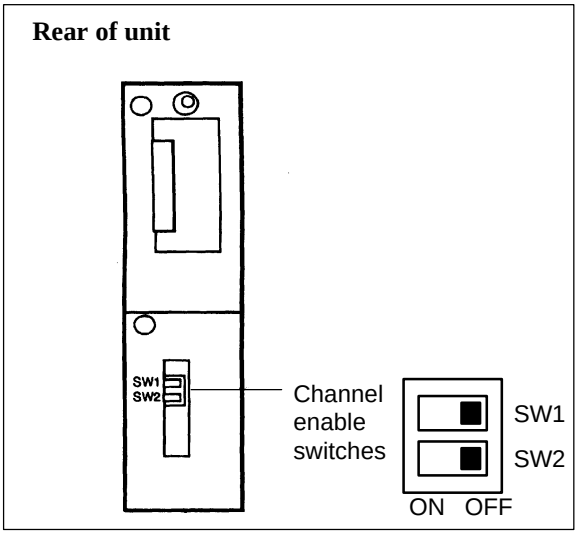
- The channel enable switches on the rare side of the unit.

  (1) Turn OFF the power for the FP3/FP10S system and the input devices.

  (2) Remove the unit from the backplane.

  (3) Check the settings for dip switches referring to the following.

SW1	SW2	Enabled channels
ON	ON	1 channel: CH0
ON	OFF	2 channels: CH0 and CH1
OFF	ON	4 channels: CH0 through CH3
OFF	OFF	8 channels: CH0 through CH7



5-3. Total-check Error Codes

Error code	Name of error	Description	Steps to take
E1	**Syntax error**	Instruction is incorrectly programmed.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and input the instruction set correctly, referring to the description for the instruction.
E2	**Duplicated output error**	Two or more **OT** and **KP** instructions are programmed using a relay.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and correct the program so that one relay is not used for two or more **OT** and **KP** instructions. This error can be disregarded by changing system register 20 setting to K1 (ENAB).
E3	**Not pair error**	One of the instructions, which must be paired, is missing (e.g., **JP** and **LBL**). The paired instruction sets may have been programmed in the incorrect order (e.g., **MC** and **MCE**).	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and program the missing instruction sets in the proper order, referring to the description of the instruction.
E4	**System register parameter error**	The operand for the instruction is outside the range set in the system register.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and check the system register parameter using FP programmer II or NPST-GR Software (1. SYSTEM REGISTER in the PLC CONFIGURATION).
E5	**Program area error**	The instruction has been programmed in the incorrect position (e.g., **INT** and **IRET** instructions are programmed at the address before the **ED** instruction).	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and program the instruction in the proper position referring to the description of the instruction.
E6	**Compile memory full error**	The program stored in the FP10S/FP10 is too large to compile in the program memory.	Set the mode of FP10S/FP10 to PROG. and reduce the total number of steps for the program.
E7	**High-level instruction type error**	In the program, high-level instructions, which execute in every scan and at the leading edge of the trigger, are programmed to be triggered by one contact [e.g., **F0 (MV)** and **P0 (PMV)** are programmed using the same trigger continuously].	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and correct the program so that the high-level instructions executed in every scan and only at the leading edge are triggered separately.
E8	**Operand error**	Incorrect operand has been entered for the instruction.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and program the instruction with the proper operand, referring to the description of the instruction.
E9	**No program error**	Program may be damaged.	Set the mode of FP10S/FP10 to PROG. and try to send the program again using NPST-GR.

5-4. Self-diagnostic Error Codes

Error code (Hexadecimal)	Name of error	Program execution	Description	Steps to take
E20 (H14)	**BPU error**	Stops	Probably a hardware abnormality.	Please contact your dealer.
E21 (H15)	**RAM error**	Stops	Probably an abnormality in the internal RAM.	Please contact your dealer.
E22 (H16)	**RAM error**			
E26 (H1A)	**User ROM checksum error**	Stops	Probably an abnormality in the optional ROM.	Re-make user ROM and try operating again.
E27 (H1B)	**Intelligent module installation error**	Stops	Intelligent modules installed exceed the limitations [e.g., more than 3 standard link modules (such as MEWNET-P/-W C-NET or C.C.U.) are installed on the FP3].	Turn OFF FP-C/FP3/FP5/FP10S/ FP10 power and configure intelligent modules referring to the hardware manual or technical sheets for each CPU.
E28 (H1C)	**System register error**	Stops	Probably an abnormality in the system register.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and initialize system registers.
E29 (H1D)	**System bus time out error**	Stops	Probably a hardware abnormality.	Please contact your dealer.
E30 (H1E)	**Interrupt error**	Stops	Probably a hardware abnormality.	Please contact your dealer.
E31 (H1F)	**Interrupt error**	Stops	Interrupt program was executed even if no interrupt trigger turned ON. Probably a hardware abnormality or an abnormality caused by noise.	Turn OFF FP-C/FP3/FP5/FP10S/ FP10 power and check the surrounding noise level.
E32 (H20)	**Interrupt error**	Stops	Interrupt program was executed even when no interrupt trigger was turned ON. Probably a hardware abnormality or an abnormality caused by noise.	Turn OFF FP-C/FP3/FP5/FP10S/ FP10 power and check the surrounding noise level.
			Probably an **INT** program corresponding to the interrupt trigger is missing.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and make an **INT** program which corresponds to the interrupt trigger.
E33 (H21)	**Multi-CPU data unmatch error (CPU2 only)**	CPU2 stops	Occurs when a FP3 or FP10S is used as CPU2 for a multi-CPU system.	Please contact your dealer.

Error code (Hexadecimal)	Name of error	Program execution	Description	Steps to take
E34 (H22)	**Abnormal module error**	Stops	An abnormal module is installed.	Check the contents of special data register: - FP-C/FP3/FP5: DT9036 - FP10S/FP10: DT90036 and locate the abnormal module. Then turn OFF the FP-C/FP3/FP5/ FP10S/FP10 and replace the unit with a new one.
E35 (H23)	**MEWNET-F slave illegal module error**	Stops	A module, which cannot be installed on the slave station of the MEWNET-F link system, is installed on the slave station (e.g., MEWNET-W link unit is installed).	Remove the illegal module from the slave station referring to the hardware manual or technical sheets for each CPU.
E36 (H24)	**MEWNET-F slave slot number error**	Stops	The number of slots or I/Os used for MEWNET-F exceeds the limitation.	Re-configure the system so that the number of slots and I/Os is within the specified range. Refer to the MEWNET-F (REMOTE I/O) SYSTEM Technical Manual.
E37 (H25)	**MEWNET-F I/O mapping error**	Stops	I/O overlap or I/O setting that is over the range is detected in the allocated I/O and MEWNET-F I/O map.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and re-configure the I/O map correctly.
E38 (H26)	**MEWNET-F slave I/O mapping error**	Stops	I/O mapping for MEWNET-F I/O terminal boards, I/O terminal units and I/O link module is not correct.	Set the mode of FP-C/FP3/FP5/ FP10S/FP10 to PROG. and re-configure the I/O map for slave stations according to the I/O points of the slave stations.
E39 (H27)	**IC card read error**	Stops	IC card does not exist or program file in the IC card is damaged or is not found when FP10S/FP10 reads the program from the IC card.	Turn OFF the FP10S/FP10 power and properly insert an IC card with the correct program. Then try to read again.
E40 (H28)	**Output module fuse blow error (FP5/FP10)**	Selectable (default: stops) **System register 21:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)**	Blown fuse in FP5/FP10 output module is detected.	Check the contents of special data registers: - FP5: DT9002 and DT9003 - FP10: DT90002 and DT90003 and locate the module with the blown fuse. Then replace fuse.
	MEWNET-TR master module error (FP3/FP10S)	Selectable (default: stops) **System register 21:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)**	Erroneous MEWNET-TR master module is detected.	Check the contents of special data registers: - FP3: DT9002 and DT9003 - FP10S: DT90002 and DT90003 and locate the erroneous MEWNET-TR master module. Then check the module referring to the FP3/FP10S MEWNET-TR (Remote I/O) SYSTEM Technical Manual.

Error code (Hexadecimal)	Name of error	Program execution	Description	Steps to take
E41 (H29)	**Intelligent module error**	Selectable (default: stops) **System register 22:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)**	An abnormality in an intelligent module.	Check the contents of special data registers: - FP-C/FP3/FP5: DT9006 and DT9007 - FP10S/FP10: DT90006 and DT90007 and locate the abnormal intelligent module. Then check the module referring to its manual.
E42 (H2A)	**I/O verify error**	Selectable (default: stops) **System register 23:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)**	I/O wiring condition has changed compared to that at time of power-up.	Check the contents of special data registers: - FP-C/FP3/FP5: DT9010 and DT9011 - FP10S/FP10: DT90010 and DT90011 and locate the erroneous module. Then check the module and correct the wiring.
E43 (H2B)	**System watchdog timer error**	Selectable (default: stops) **System register 24:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)** **System register 30:** **Using this register, you can change the value of system watchdog timer in the range of 10 ms to 640 ms.**	Scan time required for program execution exceeds the setting of the system watchdog timer.	Check the program and modify it so that FP5/FP10S/FP10 can execute a scan within the specified time.
E45 (H2D)	**Operation error**	Selectable (default: stops) **System register 26:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)**	An abnormality was detected when a high-level or basic instruction was executed.	Check the contents of special data registers: - FP-C/FP3/FP5: DT9017 and DT9018 - FP10S/FP10: DT90017 and DT90018 to find the program address where the operation error occurred. Then correct the program referring to the description of the instruction.
E46 (H2E)	**MEWNET-F communication error**	Selectable (default: stops) **System register 27:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)**	A communication abnormality was caused by a transmission cable or during the power-down of a slave station.	Check the contents of special data registers: - FP-C/FP3/FP5: DT9131 to DT9137 - FP10S/FP10: DT90131 to DT90137 and locate the abnormal slave station. Then recover the slave condition referring to the MEWNET-F(REMOTE I/O) SYSTEM Technical Manual.

Error code (Hexadecimal)	Name of error	Program execution	Description	Steps to take
E47 (H2F)	**MEWNET-F attribute error**	Selectable (default: stops) **System register 28:** **- to stop execution, set K0 (STOP)** **- to continue execution, set K1 (CONT)**	In the module on the slave station, an abnormality such as: - missing module - output unit fuse blow - abnormal intelligent unit was detected.	Check the contents of special data registers: - FP-C/FP3/FP5: DT9131 to DT9137 - FP10S/FP10: DT90131 to DT90137 and locate the abnormal slave station. Then recover the slave condition referring to the MEWNET-F (REMOTE I/O) SYSTEM Technical Manual.
E50 (H32)	**Backup battery error**	Continues **System register 4:** **By setting this system register in K0 (NO), you can disregard this error. If you set to disregard this error:** **- E50 error does not turn ON even if the backup battery of the CPU lowers or is disconnected. (However, the BATT. LED turns ON.)** **- E54 and E55 errors do not occur even if the battery for the FP10S/FP10 IC card lowers. (For these errors, the BATT. LED does not turn ON.)** **System register 4 is available for FP-C/ FP3/FP5 with CPU version V.4.4 or later and all FP10S/FP10s.**	The voltage of the backup battery lowered or the connector of the backup battery was disconnected.	Check the connection of the backup battery and then replace batteries if necessary.
E51 (H33)	**MEWNET-F terminal station error**	Continues	Terminal station settings were not properly performed.	Check stations at both ends of the communication path, and set them in the terminal station using the DIP switches.
E52 (H34)	**MEWNET-F I/O update synchronous error**	Continues	MEWNET-F system error.	Set the INITIALIZE/TEST selector to the INITIALIZE position while keeping the mode selector in the RUN position. If the same error occurs after this, please contact your dealer.
E53 (H35)	**Multi-CPU registration error (CPU2 only)**	Continues	Abnormality was detected when the multi-CPU system was used.	Please contact your dealer.

Error code (Hexadecimal)	Name of error	Program execution	Description	Steps to take
E54 (H36)	**FP10S/FP10 IC card backup battery error (The BATT. LED does not turn ON for this error.)**	Continues	The contents of the IC card cannot be guaranteed since the voltage of the backup battery for the FP10S/FP10 IC card lowered.	Replace the backup battery of the FP10S/FP10 IC card as soon as possible.
		System register 4: **By setting this system register in K0 (NO), you can disregard this error. If you set to disregard this error:** **- E54 and E55 errors do not occur even if the battery for the FP10S/FP10 IC card lowers. (For these errors, the BATT. LED does not turn ON.)** **- E50 error does not turn ON even if the backup battery of the CPU lowers or is disconnected. (However, the BATT. LED turns ON.)**		
E55 (H37)	**FP10S/FP10 IC card backup battery error (The BATT. LED does not turn ON for this error.)**	Continues	The voltage of the backup battery for FP10S/FP10 IC card lowers.	Replace the backup battery of the FP10S/FP10 IC card.
		System register 4: **By setting this system register in K0 (NO), you can disregard this error. If you set to disregard this error:** **- E54 and E55 errors do not occur even if the battery for the FP10S/FP10 IC card lowers. (For these errors, the BATT. LED does not turn ON.)** **- E50 error does not turn ON even if the backup battery of the CPU lowers or is disconnected. (However, the BATT. LED turns ON.)**		
E100 (H64) to E199 (HC7)	**Self-diagnostic error set by F148 (ERR)/ P148 (PERR) instruction**	Stops	The self-diagnostic error specified by the **F148 (ERR)/P148 (PERR)** instruction is transferred to: - FP-C/FP3/FP5: DT9000 - FP10S/FP10: DT90000	Take steps to clear the error condition according to the specification you chose.
E200 (HC8) to E299 (H12B)		Continues		

CHAPTER 6

APPENDIX

6-1. Shared Memory Allocation 52
6-2. Instruction for Accessing Shared Memory 53
6-3. Terminology 56

6-1. Shared Memory Allocation

The shared memory of the G and I type A/D converter units is configured as follows:

Shared memory address (word units)	Channel of the unit	Description
0	CH0	Input analog value is converted to the digital data and stored in the specified address of the shared memory. The range of the A/D conversion value is - K0 to K8000 or - K-4000 to K+4000 (The A/D conversion value range is decided by the unit's specifications)
1	CH1	
2	CH2	
3	CH3	
4	CH4	
5	CH5	
6	CH6	
7	CH7	

Note:

- Since the shared memory is a non-hold (volatile) type, its values are cleared to 0 when the power is turned OFF. When you need to stored the A/D converted data, be sure to take an appropriate measure using your program such as transferring its contents to the hold-type CPU's registers.

6-2. Instruction for Accessing Shared Memory

For accessing the shared memory installed on the CPU equipped and expansion backplanes, the **F150 (READ)/P150 (PREAD)** instruction is used. In this section, the explanation for the instruction is explained.

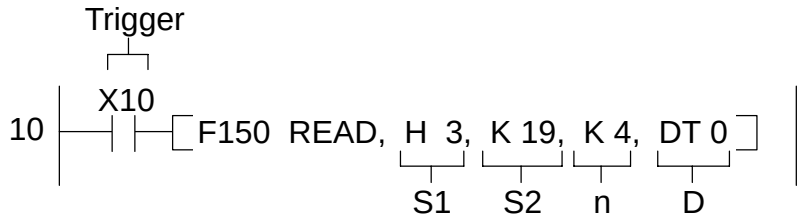
F150 (READ)
P150 (PREAD)

Data read from intelligent module

Step	Availability
9	All FP-C/FP3/FP5s and FP10S/FP10s
9	

Outline Reads data from the shared memory in an intelligent module.
(P150: executed only when the leading edge of the trigger is detected.)

Program example

Ladder Diagram	Boolean Non-ladder	
	Address	Instruction
	10	ST X 10
	11	F150 (READ)
		H 3
		K 19
		K 4
		DT 0

S1	16-bit equivalent constant for specifying the bank number in the shared memory of the intelligent module.
S2	16-bit equivalent constant for specifying the starting address in the shared memory of the intelligent module (source data address).
n	16-bit equivalent constant for specifying the number of words to be read.
D	Starting 16-bit area address for storing read data (destination data address).

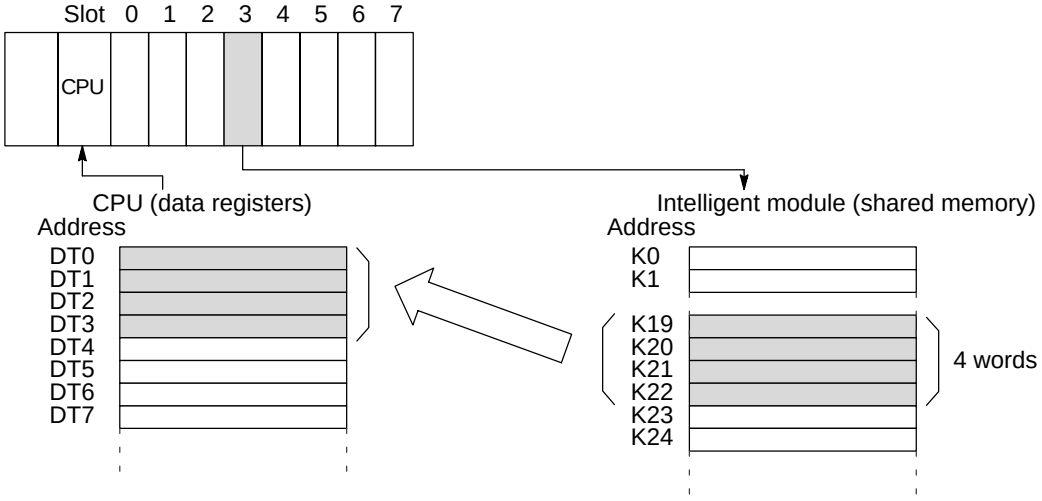
■ **Operands**

Operand	Relay				Timer/Counter		Register			Index register		Constant		Index modifier
	WX	WY	WR	WL	SV	EV	DT	LD	FL	IX	IY	K	H	
S1	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	N/A	N/A	A	A	A
S2	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	N/A	N/A	A	A	A
n	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A
D	N/A	A	A	A	A	A	A	A	A	N/A	N/A	N/A	N/A	A

A: Available
N/A: Not Available

■ Explanation of example

• Reads four words of data stored in the addresses starting from K19 of the intelligent module shared memory (located in slot 3) and stores them in data registers DT0 to DT3 when trigger X10 turns ON.



Description

• This instruction enables a CPU to read data stored in the shared memory of the intelligent module and store them in the specified operand when the trigger turns ON.
• The location and bank number of the intelligent module is specified by S1. The address in the shared memory of the intelligent module is specified by S2 if it does not have banks, and is specified by the combination of S1 and S2 if it does have banks in the shared memory. For details about the shared memory configuration of each intelligent module, refer to the intelligent module manual, and for details about the S1 settings refer to "■ Specifying the module location and bank number S1" in the following section.
• The number of data items read is specified by n, a decimal or hexadecimal constant.

■ Flag conditions

• Error flag (R9007): Turn ON and stays ON when:
- The area specified using the index modifier exceeds the limit.
- The area specified using n and D exceeds the limit of the area range.
The error address is transferred to:
- FP-C/FP3/FP5: DT9017
- FP10S/FP10: DT90017
and held.

• Error flag (R9008): Turns ON for an instant when:
- The area specified using the index modifier exceeds the limit.
- The area specified using n and D exceeds the limit of the area range.
The error address is transferred to:
- FP-C/FP3/FP5: DT9018
- FP10S/FP10: DT90018

Note:

• When using special internal relay R9008 as the flag for this instruction, be sure to program it at the address immediately after the instruction.

■ Specifying the module location and bank number S1

The location of the intelligent module and its bank number in the shared memory are specified by the constant S1. Among intelligent modules for FP series programmable controllers, there are ones with and without bank sections in the shared memory. The setting of S1 varies depending on whether you access the module with or without bank sections as follows:

- Accessing the intelligent module with bank section

S1 = H □ □ □ □

Slot number *2:
- FP-C: H00 to 03, H07 to H0A and H10 to H13
- FP3/FP10S: H00 to H17
- FP5/FP10: H00 to H1F

Bank number *1: H00 to HFF

- Accessing the intelligent module without bank section

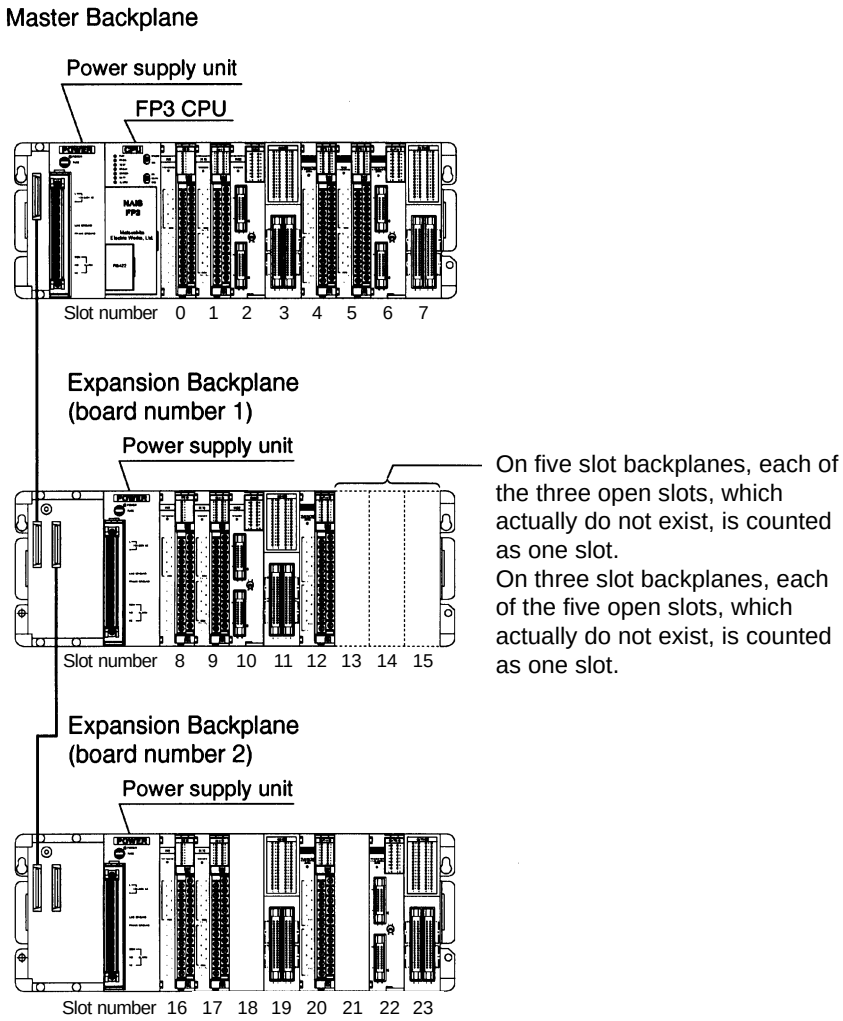
S1 = H 0 0 □ □

Slot number *2:
- FP-C: H00 to 03, H07 to H0A and H10 to H13
- FP3/FP10S: H00 to H17
- FP5/FP10: H00 to H1F

*1 The intelligent modules with bank sections in the shared memory are:
- Data memory units: AFP32091 and AFP32092 for FP3/FP10S
- ET-LAN unit: AFP3790 for FP3/FP10S

*2 Slot numbers are used to express the position of FP-C/FP3/FP5/FP10S/FP10 units except for the CPU and power supply module. The slot numbers are assigned for each module starting from the unit nearest the CPU and power supply module. If you are using an FP-C with the intelligent board function built in, the intelligent board is regarded as the module in slot 7.

- FP3 slot numbering example



6-3. Terminology

active open: One of connection opening methods for TCP/IP communication. To establish a virtual connection with another node, an active node must initiate an open call to a passive node.

address: An alphanumeric value that identifies where data is stored.

ambient temperature: The temperature of the air surrounding a system.

American Wire Gauge (AWG): A standard system used for designating the size of electrical conductors. Larger gauge numbers have smaller diameter.

AND: A Boolean operation that produces a logic “1” output if all inputs are “1”, and a logic “0” if any input is “0.”

ARP: Abbreviation for Address Resolution Protocol. This is used to transmit the Ethernet (physical) address, which is essential to Ethernet communication, by specifying the IP address. When communicating with a node address, whose Ethernet address is unknown, you only need to specify its IP address if the destination node has the ARP function.

ASCII: American Standard Code for Information Interchange. ASCII is normally used when alphanumeric (letters and decimal numbers) and control codes are sent as information to printers, etc. ASCII can be represented using 7 or 8 bits and is often expressed in a 2-digit hexadecimal form converted from specific binary expressions. ASCII expressed in 2-digit hexadecimals is called “ASCII HEX code.” For details about actual ASCII codes, refer to the table for ASCII.
[EXAMPLE] When a letter “M” is expressed in ASCII code:
7-bit ASCII : 1001101 (binary)
ASCII HEX code: 4D (hexadecimal)

asynchronous: Not synchronous. Repeated operations that take place in patterns unrelated over time.

AWG: See American Wire Gauge (AWG).

backplane: A printed circuit board located in the back of a chassis, that contains a data bus, power bus, and mating connectors for units. For FP3, FP5, FP10S and FP10 programmable controllers, two types of backplanes are available:
Master Backplane
Expansion Backplane

backup: A device that is kept available to replace something that may fail during operation.

baseband communication: A communication method which uses digital signals, without modulating them, in a complete bandwidth frequency.

battery backup: A battery or set of batteries that will provide power to the processor memory only when system power is lost. FP3 CPU, FP10S CPU, and S-RAM type IC cards have a battery backup system.

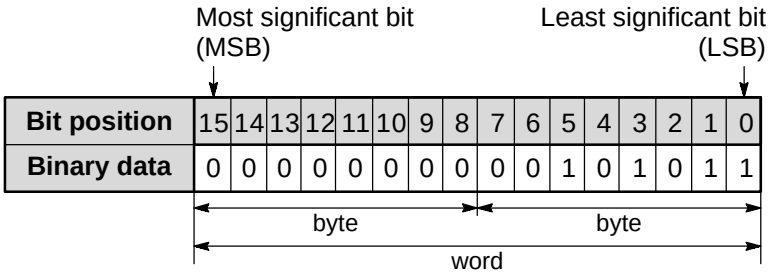
battery low: A condition that exists when the backup battery voltage drops low enough to require battery replacement. For FP3 CPU, FP10S CPU, S-RAM and S-RAM/Flash-EEPROM type IC cards, the ERROR LED turns ON.

baud: Formally defined as the shortest pulse width in data communication. However, usually used to refer to the number of binary bits transmitted per second (bps) during serial data communication.

BCC: See Block Check Code

BCD: See Binary Coded Decimal

binary: In general, programmable controllers work with binary numbers in one form or another to represent various codes or quantities. The binary number system uses the number 2 as the base and the only allowable symbols are “0” and “1.” There are no 2s, 3s, etc. Each digit of binary is called as “bit.” “Bit” means “binary digit.” A group of 8 bits is called a “byte” and a group of 16 bits (two bytes) is called a “word.”



The binary number “0000000000101011” is expressed in decimal as follows:

$1 \times 2^0 + 1 \times 2^1 + 0 \times 2^2 + 1 \times 2^3 + 0 \times 2^4 + 1 \times 2^5 + ... + 0 \times 2^{15}$

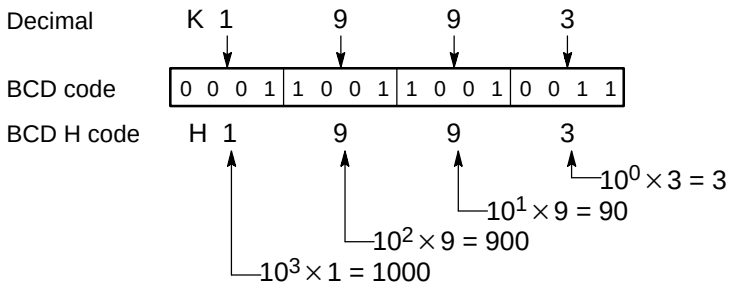
$= 1 + 2 + 0 + 8 + 0 + 32 + ... + 0$

$= 43$

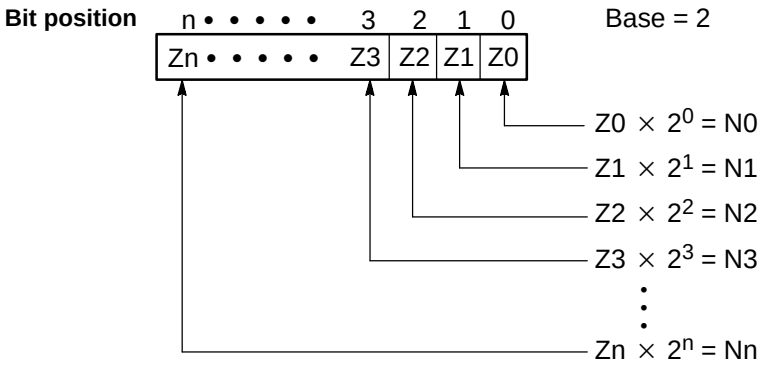
Binary Coded Decimal (BCD): One of the codes expressed in binary. BCD is a binary code in which each decimal digit from 0 to 9 is represented by four binary digits (bits). The four positions have a weighted value of 1, 2, 4, and 8, respectively, starting with the least significant bit. A thumbwheel switch is specified as a BCD device, and when connected to a programmable controller, each decimal digit requires four inputs.

BCD is usually expressed grouping four bits as one digit in the same way as the hexadecimal constant H. **When BCD is grouped in four bit units, the BCD is expressed by adding the prefix H to the data. Since the weight of each BCD H code is same as that of decimals, be sure to pay attention not to be confused with hexadecimal numbers when BCD H code is handled.**

Example: When K1993 (decimal) is expressed in BCD.



binary number system: A number system that uses two symbols, “0” and “1.” Each digit position has a weighted value of 1, 2, 4, 8, 16, 32, 64, and so on beginning with the least significant (right-most) digit.



The sum of N0 through Nn is the decimal equivalent of the number in base “2.”

Block Check Code (BCC): This code is used to detect errors in message transmissions. It is created by Exclusive ORing all of the codes from the header though the last text character, then translating the result (8-bit) data into two ASCII characters.

broadband communication: A communication method which modulates data, such as that for voice and video data transmission, into narrower bands for communication with different users.

buffer: A group of registers used for temporary data storage. This is used for data transmission and works effectively when there are transmission rate differences between sending and receiving devices.

bug: Software errors which will cause unexpected actions.

bus: Power distribution conductors.

Central Processing Unit: The Central Processing Unit is usually referred to as the CPU. The CPU controls system activities of the programmable controller.

character: A symbol such as a letter of the alphabet or decimal number. An ASCII character is most commonly used to express characters using binary.

complement: A logical operation that inverts a signal or bit. The complement of “1” is “0”, and the complement of “0” is “1.”

computer link: The term “computer link” means the link that functions between a programmable controller and a computer. In the computer link, a computer always initiates communication to a programmable controller and communication is performed using the MEWTOCOL-COM protocol for FP series programmable controllers. To perform computer link communication, you need to prepare a program in the computer that conforms to the MEWTOCOL-COM format. You do not have to make a program for the programmable controller.

connection: In data communication, a circuit between two data terminals.

CPU: See Central Processing Unit.

CRT: Abbreviation for cathode-ray tube.

data transfer: The data transfer function enables a programmable controller to send or get data to/from another programmable controller. This function is usually used between programmable controllers using the **F145 (SEND)/P145 (PSEND)** and **F146 (RECV)/P146 (PRECV)** instructions through the link modules. If you use this for communication with a computer, you need to prepare programs that conform to the MEWTOCOL-DAT format at the computer.

debug: Removing errors from a program.

decimal number system: The decimal number system uses the number 10 as the base and the allowable symbols are “0”, “1”, “2”, “3”, “4”, “5”, “6”, “7”, “8”, and “9.” Each digit position has a weighted value of 1, 10, 100, 1000, and so on, beginning with the least significant (right-most) digit.

duplex: See full-duplex.

EEPROM: Electrically Erasable Programmable Read Only Memory. EEPROM can be programmed and erased by electrical pulses.

EPROM: Erasable Programmable Read Only Memory. EPROM can be reprogrammed after being entirely erased with the use of an ultra-violet light source.

FIFO: See First-In-First-Out.

First-In-First-Out: The order that data is written in, and read from registers.

flag: A relay used to detect and remember certain events in the programmable controller. In FP series programmable controllers, some of the special internal relays are used as flags.

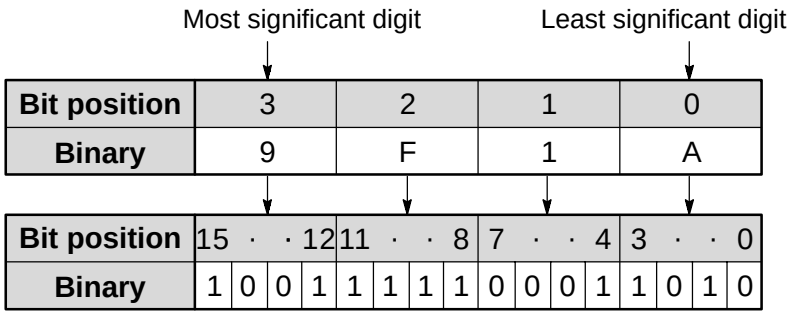
full-duplex: A communication link in which data can be transmitted and received at the same time.

half-duplex: A communication link in which transmission is limited to one direction at a time.

handshake communication: Data exchanges between two pieces of devices. For FP series programmable controllers, main signal exchanges between the CPU and the shared memory of intelligent units are referred to as handshake communication.

hexadecimal:

The hexadecimal number system uses 16 as the base. The allowable symbols are numbers 0 through 9 and letters A through F. The letters are substituted for numbers 10 to 15, respectively, to represent all 16 numbers in one digit. The binary number system can easily be represented in hexadecimal with 4 bit groups. In this manner, a very large binary number can be represented by a hexadecimal number with significantly fewer digits.



hold:

The memory area whose contents will not be lost or modified if operating power is lost or if the mode of the programmable controller is changed from RUN to PROG.

ICMP:

Abbreviation for Internet Control Message Protocol. This is used to transmit an error message in a network. The FP3/FP10S ET-LAN unit supports the echo reply option to the ping command.

interrupt:

The act of performing a more urgent task by putting off the presently executing task. FP series programmable controllers have three types of interrupts, as follows:
- input initiated interrupt
- high-speed counter initiated interrupt
- time initiated interrupt

I/O:

Abbreviation of Input/Output.

I/O update:

Taking the input data at the input interface into the memory for program execution and outputting the result of program execution to the output interface.

IP:

Abbreviation for Internet Protocol. IP is used to transmit data in datagram units to a destination node specified by an IP address. It provides functions such as the dividing and reassembling of communication data, and communication services between networks via a router.

ladder diagram:

A standard for representing relay-logic systems.

layer:

The conceptual service groups in a network architecture hierarchy. (e.g., transport layer, network layer, data link layer, and physical layer, etc.)
In FP series programmable controller networks, the word layer is regarded as a subnetwork which should be accessed via relay stations.

LCD:

Abbreviation for Liquid Crystal Display.

leading edge differential:

A programming technique to operate a bit only for one scan at the moment its input condition turns ON from the OFF state.

Least Significant Bit (LSB): The bit which represents the smallest value in a byte, word, or double-word.

Least Significant Digit (LSD): The digit which represents the smallest value in a number.

LED: Abbreviation for Light-Emitting Diode.

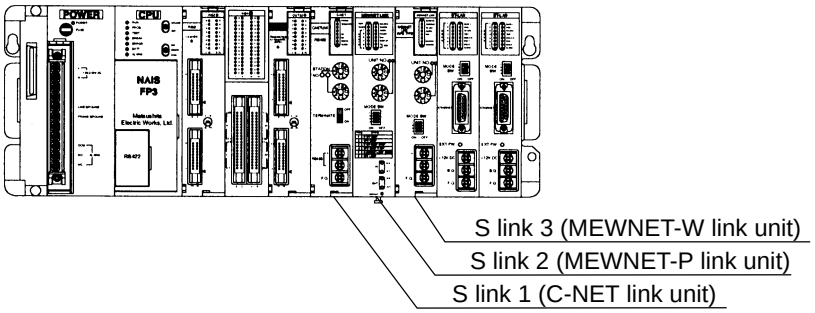
link module: Link modules available for the FP-C/FP3/FP5/FP10S/FP10 are classified into two types: those for the ”standard link system” and those for the ”high-level link system.” Modules for the ”standard link system” and ”high-level link system” are as follows:

- Modules for the standard link system:
  Computer communication modules, C-NET link module, MEWNET-P (Optical) link modules and MEWNET-W (Wire) link modules
- Modules for the high-level link system:
  ET-LAN modules and MEWNET-H link modules

link number: Link numbers are used to express the position of link modules separately for the standard and high-level link systems, starting from the link module at the smallest slot position, as follows:

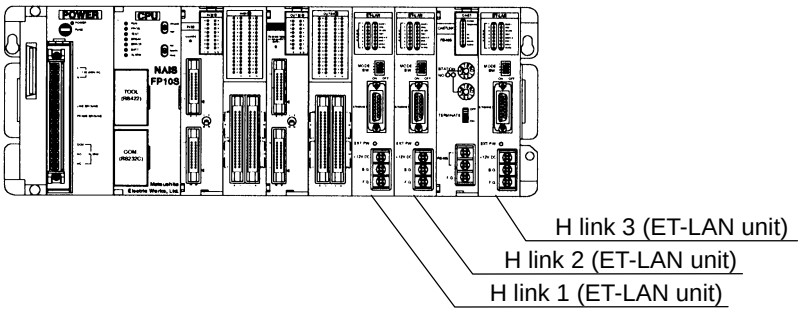
[Link number for standard link system]

- FP-C/FP3/FP5: “S link 1”, “S link 2” and “S link 3”
- FP10S/FP10: “S link 1”, “S link 2”, “S link 3”, “S link 4” and “S link 5”



[Link number for high-level link system]

- FP-C: No high-level link modules available for FP-C.
- FP3/FP5/FP10S/FP10: “H link 1”, “H link 2” and “H link 3”



malfunction: Incorrect function.

Master Control Relay: A relay which controls any series of programs with its operation. If the master control relay is de-energized, all of the contacts and devices controlled by the master control relay are de-energized.

MEWTOCOL-COM: A communication protocol for FP series programmable controllers that performs communication between a computer and programmable controllers.

modem: Abbreviation for MOdulator/DEModulator. The modem modulates digital signals and transmits them through a telephone line.

Most Significant Bit (MSB): The bit which represents the greatest value in a byte, word, or double-word.

Most Significant Digit (MSD): The digit which represents the greatest value in a number.

multidrop link: A communication link in which one host can communicate with two or more stations.

network: A group of nodes that use links to exchange information.

node: A communication station such as computer or programmable controller that is connected to a network.

noise: Random, unexpected electrical signals, that are caused by radio waves or by electrical or magnetic fields.

non-hold: The memory area whose contents will be lost or modified if operating power is lost or if the mode of the programmable controller is changed from RUN to PROG.

normally-closed contact: A contact which is closed when the coil of the relay is not activated.

normally-open contact: A contact which is open when the coil of the relay is not activated.

offline: Not being in continuous communication with another processor.

online: Being in continuous communication with another processor.

overflow: The act of exceeding the maximum limit in a registers capacity.

parity check: A check method for the number of 1s in a character when data communication is performed. The parity check is performed by calculating the number of ones in a character.

passive open: One of connection opening methods for TCP/IP communication. To establish a virtual connection with another node, an active node must initiate an open call to a passive node. When using Ethernet, there are two passive open methods, unpassive and fullpassive.

PC link:

The term “PC link” means one of the link functions between programmable controllers that use specified relays and data registers. In the PC link, you do not have to make a complicated program to enable communication. The PC link function is available separately for the standard link system and high-level link system as follows:

[PC link for standard link system]

In the standard link system, a maximum of two PC links are available per CPU using MEWNET-P or MEWNET-W link modules. The two PC links for the standard link system are called “PC link S0” and “PC link S1.” For each link communication, 1,024 link relay (L) points and 128 link data register (LD) words are used.

The PC link S0 and S1 allocations can be set using system register 46* as follows:

- When system register 46 is K0, PC link S0 is assigned for the module with the smaller slot number (module with a smaller S link number) of the two.
- When system register 46 is K1, PC link S0 is assigned for the module with the larger slot number (module with a larger S link number) of two.

* System register 46 is available for any FP-C/FP3/FP5 with CPU version V.4.4. or later and any FP10S/FP10.

[PC link for high-level link system]

In the high-level link system, a maximum of two PC links are available per CPU using MEWNET-H link modules. The two PC links for the high-level link systems are called “PC link H0” and “PC link H1.” For each link communication, you can assign relays and registers using setting tools.

The PC link H0 and H1 allocations are determined by the position of the MEWNET-H link modules. Between the two MEWNET-H link modules used for the PC link, PC link H0 is assigned for the module at the smaller slot number (module with the smaller H link number) of the two, and PC link H1 is assigned for the module at the larger slot number (module with the larger H link number).

peripheral device:

Devices that are connected to the programmable controller.

PLC:

Abbreviation for Programmable Logic Controller. See programmable controller.

potentiometer:

A simple transducer which works based on resistance change.

programmable controller:

A control device which can be programmed to control process or machine operations. A programmable controller is often referred to as a PLC when abbreviated.

RAM:

Random Access Memory. RAM provides an excellent means for easily creating and altering a program. Many of the FP series programmable controllers use RAM with battery backup for the application memory.

register:

A unit of memory for various types of data. A register is usually 16 bits wide.

repeater:

In an Ethernet LAN, a device that re-sends or relays a signal traveling along a LAN cable. It is used to overcome restrictions in segment length in the LAN.

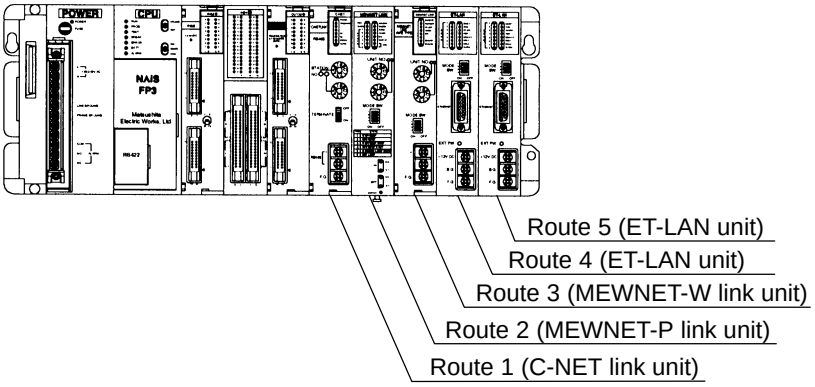
ROM:

Read Only Memory. See EEPROM and EPROM.

route number:

Route numbers are used to express the position of standard and high-level link modules together. The numbers are assigned starting from the link module at the smallest slot position as follows:

- FP-C: “route 1”, “route 2” and “route 3” only with 3 standard link modules.
  (For FP-C, no high-level link modules are available.)
- FP3/FP5: “route 1”, “route 2”, “route 3”, “route 4”, “route 5” and “route 6” including 3 standard and 3 high-level link modules.
- FP10S/FP10: “route 1”, “route 2”, “route 3”, “route 4”, “route 5”, “route 6”, “route 7” and “route 8” including 3 standard and 5 high-level link modules.



RS232C:

An EIA communication standard for data transmission media that is less than 15 m. Most common serial communication standard.

RS422:

An EIA communication standard for data transmission media.

rung:

Term for a ladder program. A rung refers to the programmed instructions that drive one output.

scan:

Time required to read all inputs, execute the program, and update local and remote information.

segment:

In a network, this refers to a piece of coaxial cable that is closed on both ends by a terminator. The segment length is the distance between terminators and varies depending on the type of network.

self-diagnostic function:

A function within the programmable controller which monitors operation and indicates any fault that is detected.

serial communication:

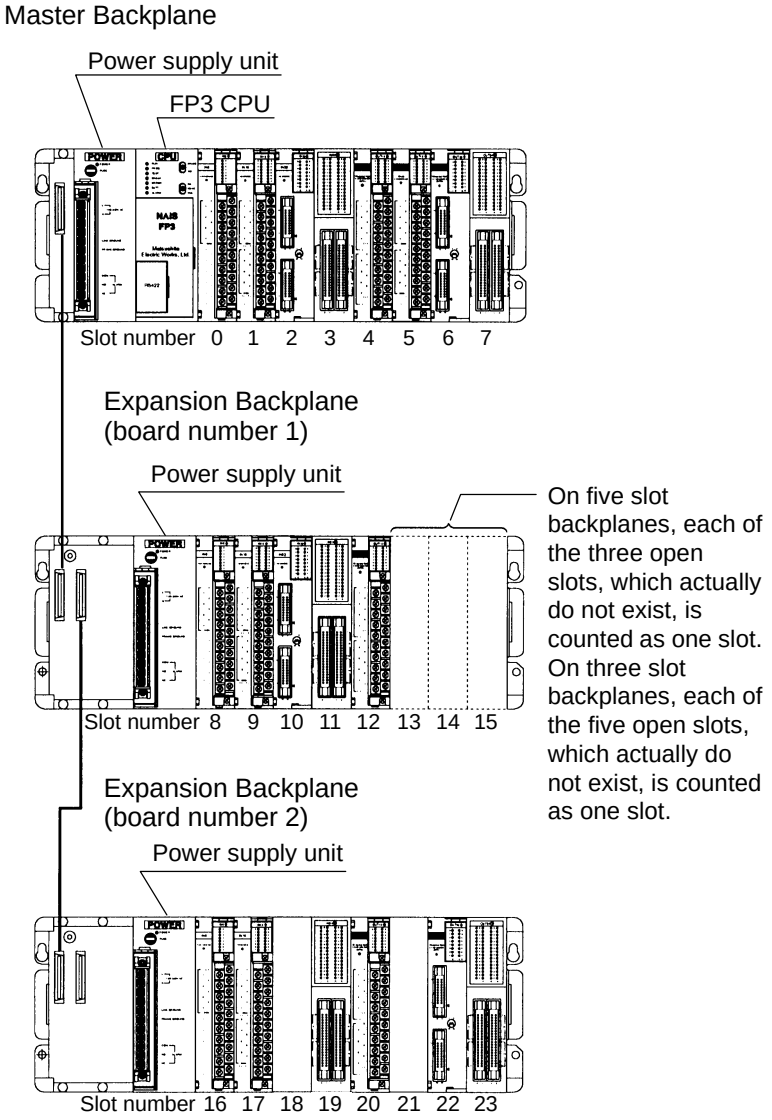
A communication style in which data is transmitted bit by bit serially.

shared memory:

Memory that can be accessed by two or more pieces of devices. In FP series programmable controllers, some intelligent modules have shared memory which can be accessed by both the CPU and the intelligent module.

slot number:

Slot numbers are used for expressing the position of modules except for the CPU and power supply module. The slot numbers are assigned for each module, starting from the module in the slot nearest to the CPU.
In the slot numbering system, all types of backplanes are regarded as the 8-slot type and the number is assigned in the order: CPU equipped master backplane, expansion backplane with board number 1, and then the expansion backplane with board number 2, starting from slot number 0.



stop bit:

The last bit when a character is transmitted.

subnet:

In TCP/IP communication, a part of a network specified by a part of the internet address.

system errors:

Errors resulting from the device or the environment.

system register:

The registers used only for system settings of the programmable controller.

TCP: Abbreviation for Transmission Control Protocol. This is a connection-based communication method. Since communication services including re-transmission, sequence and flow control for the communication data are provided, this protocol guarantees high communication reliability.

10 BASE 5 network: One of the CSMA/CD method networks which allows 10 Mbps baseband local area communication with a maximum segment length of 500 m. Usually referred to as Ethernet.

10 BASE T network: One of the CSMA/CD method networks which allows 10 Mbps baseband local area communication with twisted-pair cable.

10 BASE 2 network: One of the CSMA/CD method networks which allows 10 Mbps baseband local area communication with a maximum segment length of 200 m. Usually referred to as Cheapernet.

trailing edge differential: A programming technique to operate a bit only for one scan at the moment its input condition turns OFF from the ON state.

two's complement: A number system used to express positive and negative numbers in binary. In this system, the number becomes negative if the most significant bit of the data is "1." In FP series programmable controllers, numbers are expressed using the two's complement.

UDP: Abbreviation for User Diagram Protocol. This is a connectionless communication method. Since no re-transmission, sequence, or flow control for communication data is provided, support at the application level is required to guarantee communication reliability.

underflow: The act of going below the minimum limit in a register's capacity.

watchdog timer: A timer that monitors processing time of the programmable controller. If the program does not time out, the processor is assumed to be faulty.

word: A unit of bits which is usually executed at the same time. A word is composed of 16 bits.

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RECORD OF CHANGES

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