

**Panasonic<sup>®</sup>**

**PROGRAMMABLE CONTROLLERS**

**FP0**

**Hardware Manual**

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## BEFORE BEGINNING

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# Before You Start

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## Installation environment

Do not use the unit where it will be exposed to the following:

- **Direct sunlight and ambient temperatures outside the range of 0°C to 55°C/32°F to 131°F.**
- **Ambient humidity outside the range of 30% to 85% RH and sudden temperature changes causing condensation.**
- **Inflammable or corrosive gas.**
- **Excessive vibration or shock.**
- **Excessive airborne dust or metal particles.**
- **Water in any form including spray or mist.**
- **Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.**
- **Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges.**

## Static electricity

- **In dry locations, excessive static electricity can cause problems. Before touching the unit, always touch a grounded piece of metal in order to discharge static electricity.**

## Cleaning

- **Do not use thinner-based cleaners because they deform the unit case and cause the colors to fade.**

## Power supplies

- **An insulated power supply with an internal protective circuit should be used. The power supply for the FP0 control unit operation is a non-insulated circuit, so if an incorrect voltage is directly applied, the internal circuit may be damaged or destroyed. If using a power supply without a protective circuit, power should be supplied through a protective element such as a fuse.**

## **Power supply sequence**

- **Have the power supply sequence such that the power supply of the FP0 control unit turns OFF before the power supply for I/O.**
- **If the power supply for I/O is turned OFF before the power supply of FP0 control unit, the FP0 control unit will detect the input fluctuations and may begin an unscheduled operation.**

## **Before turning ON the power**

When turning ON the power for the first time, be sure to take the precautions given below.

- **When carrying out assembly, check to make sure that there are no scraps of wiring, particularly conductive fragments, adhering to the unit.**
- **Verify that the power supply wiring, I/O wiring, and power supply voltage are all correct.**
- **Sufficiently tighten the installation screws and terminal screws.**
- **Set the mode switch to PROG. mode.**

# Important Symbols

---

The following symbols are used in this manual:



**Whenever the warning triangle is used, especially important safety instructions are given. If they are not adhered to, the results could be:**

- **personal injury and/or**
- **significant damage to instruments or their contents, e.g. data**



**Note**

**Contains important additional information or indicates that you should proceed with caution.**



**Example:**

**Contains an illustrative example of the previous text section.**



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## Record of Changes



# Chapter 1

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## Overview

# 1.1 Control Units

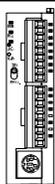
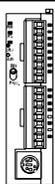
The in-/output units provide different amount of points, are equipped with/without RS232C port and with terminals or MIL connectors.

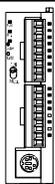
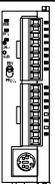


**Note**

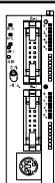
Additional units may be available since we are constantly expanding our product line. Please check our Web site for details:  
<http://www.panasonic-electric-works.com/peweu/en/html/fp0.php>

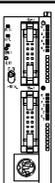
### Terminal type

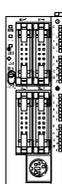
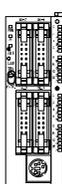
<b>10 points</b>	<b>10 points with RS232C</b>
	
<p>( Input: 6 Relay output: 4 )</p>	
<b>FP0-C10RS</b>	<b>FP0-C10CRS</b>

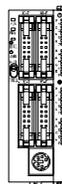
<b>14 points</b>	<b>14 points with RS232C port</b>
	
<p>( Input: 8 Relay output: 6 )</p>	
<b>FP0-C14RS</b>	<b>FP0-C14CRS</b>

### MIL type

<b>16 points</b>

<p>( Input: 8 Transistor output: 8 )</p>
<p>NPN open collector: <b>FP0-C16T</b>                  PNP open collector: <b>FP0-C16P</b></p>

<b>16 points with RS232C port</b>

<p>( Input: 8 Transistor output: 8 )</p>
<p>NPN open collector: <b>FP0-C16CT</b>                  PNP open collector: <b>FP0-C16CP</b></p>

<b>32 points</b>	<b>32 points with RS232C port</b>
	
<p>( Input: 16 Transistor output: 16 )</p>	
<p>NPN open collector: <b>FP0-C32T</b>                  PNP open collector: <b>FP0-C32P</b></p>	

<b>32 points with RS232C port</b>

<p>( Input: 16 Transistor output: 16 )</p>
<p>PNP open collector: <b>FP0-T32CP</b></p>

## 1.2 Expansion Units

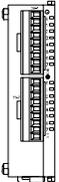
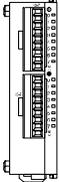
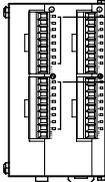
Expansion units provide digital and analog in-/outputs. There are combined in-/output units, input units, and transistor output units. They are either equipped with terminals or with MIL connectors.



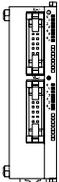
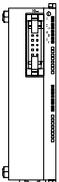
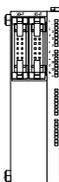
**Note**

Additional units may be available since we are constantly expanding our product line. Please check our Web site for details:  
<http://www.panasonic-electric-works.com/peweu/en/html/fp0.php>

### Terminal type

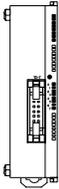
8 points	16 points	32 points
 <p>( Input: 4 Relay output: 4 )</p> <p><b>FP0-E8RS</b></p>	 <p>( Input: 8 Relay output: 8 )</p> <p><b>FP0-E16RS</b></p>	 <p>( Input: 16 Relay output: 16 )</p> <p><b>FP0-E32RS</b></p>

### MIL type

<p><b>16 points</b></p>  <p>( Input: 8 Transistor output: 8 )</p> <p>NPN open collector: <b>FP0-E16T</b>                      PNP open collector: <b>FP0-E16P</b></p>	<p><b>32 points</b></p>  <p>( Input: 16 Transistor output: 16 )</p> <p>NPN open collector: <b>FP0-E32T</b>                      PNP open collector: <b>FP0-E32P</b></p>
<p><b>8 inputs</b></p>  <p><b>FP0-E8X</b></p>	<p><b>16 inputs</b></p>  <p><b>FP0-E16X</b></p>

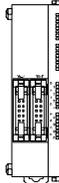
**MIL type, continued**

**8 transistor outputs**



NPN open collector: **FP0-E8YT**  
 PNP open collector: **FP0-E8YP**

**16 transistor outputs**



NPN open collector: **FP0-E16YT**  
 PNP open collector: **FP0-E16YP**

## 1.3 Other Units

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### Note

Additional units may be available since we are constantly expanding our product line. Please check our Web site for details:  
<http://www.panasonic-electric-works.com/peweu/en/html/fp0.php>

### 1.3.1 Analog Units

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### Note

Separate manuals exist for our various analog units. Please check our Web site for details:  
<http://www.panasonic-electric-works.com/peweu/en/html/fp0.php>

### 1.3.2 Link Unit

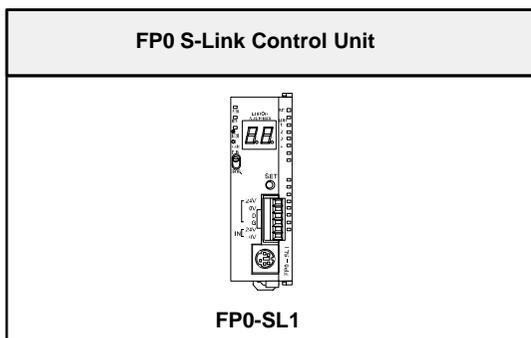
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Please refer to the “MEWNET-F Remote I/O System Technical Manual.”

### 1.3.3 S-Link Control Unit

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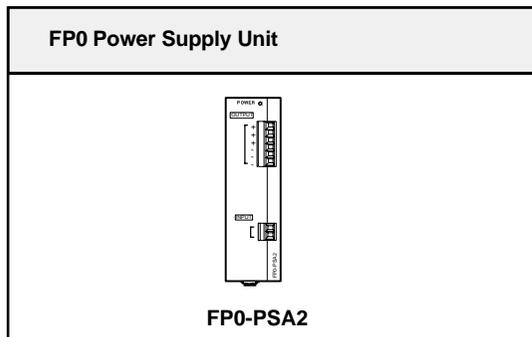
FP0 connects directly to the S-LINK for reduced wiring and simple installation. It can control up to 128 points for S-LINK related devices. Similar to other FP0 units, up to three expansion units can be used for efficient I/O wiring.



### 1.3.4 FP0 Power Supply Unit

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The power supply unit FP0-PSA2 provides stable 24V DC distribution voltage for a broad spectrum of applications.



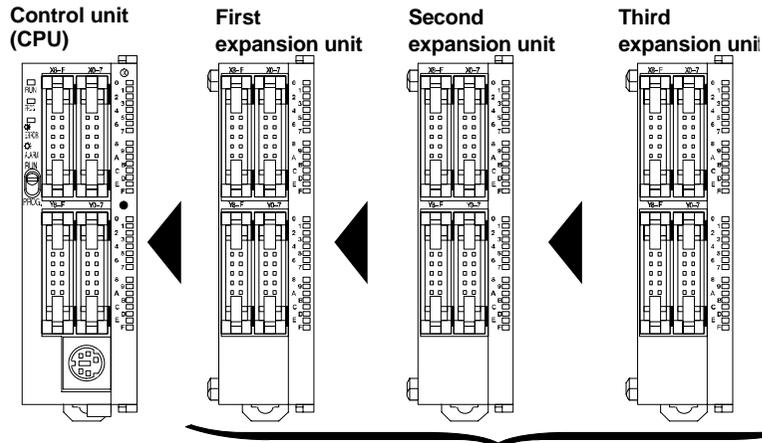
## 1.4 Expansion with Units

Be sure to check that the units are added according to the restrictions below.



### Notes

- A maximum of three expansion I/O units, analog I/O units, or I/O link units can be connected to one control unit.



Maximum possible expansion: total of 3 units

- There are no restrictions on the combination of different types of control and expansion units.
- A combination of relay output types and transistor output types is also possible.
- The expansion unit can be attached directly to the control unit easily. Special expansion cables, backplanes, and so forth, are unnecessary as the expansion unit employs a stacking system that uses expansion connector and expansion hooks on the surface of the unit itself.

Controllable I/O Points			
CPU type	CPU only	Expansion unit is of the same output type as CPU	Expansion unit is a transistor output type
C10R	10 points	max. 58 points	max. 106 points
C14R	14 points	max. 62 points	max. 110 points
C16T/C16P	16 points	max. 112 points	max. 112 points
C32T/C32P	32 points	max. 128 points	max. 128 points

# 1.5 Combining Units

## Relay Output Units

$$\left( \begin{array}{c} \text{Total number of} \\ \text{I/O points} \end{array} \right) = \left( \begin{array}{c} \text{Control} \\ \text{unit} \end{array} \right) + \left( \begin{array}{c} \text{First} \\ \text{expansion} \\ \text{I/O unit} \end{array} \right) + \left( \begin{array}{c} \text{Second} \\ \text{expansion} \\ \text{I/O unit} \end{array} \right) + \left( \begin{array}{c} \text{Third} \\ \text{expansion} \\ \text{I/O unit} \end{array} \right)$$

<b>10</b>	=	<b>10</b>
Input: 6    Output: 4		Input: 6    Output: 4

<b>14</b>	=	<b>14</b>
Input: 8    Output: 6		Input: 8    Output: 6

<b>18</b>	=	<b>10</b>	+	<b>8</b>
Input: 10    Output: 8		Input: 6    Output: 4		Input: 4    Output: 4

<b>22</b>	=	<b>14</b>	+	<b>8</b>
Input: 12    Output: 10		Input: 8    Output: 6		Input: 4    Output: 4

<b>26</b>	=	<b>10</b>	+	<b>16</b>
Input: 14    Output: 12		Input: 6    Output: 4		Input: 8    Output: 8

<b>10</b>	+	<b>8</b>	+	<b>8</b>
Input: 6    Output: 4		Input: 4    Output: 4		Input: 4    Output: 4

<b>30</b>	=	<b>14</b>	+	<b>16</b>
Input: 16    Output: 14		Input: 8    Output: 6		Input: 8    Output: 8

<b>14</b>	+	<b>8</b>	+	<b>8</b>
Input: 8    Output: 6		Input: 4    Output: 4		Input: 4    Output: 4

<b>34</b>	=	<b>10</b>	+	<b>16</b>	+	<b>8</b>
Input: 18    Output: 16		Input: 6    Output: 4		Input: 8    Output: 8		Input: 4    Output: 4

<b>10</b>	+	<b>8</b>	+	<b>8</b>	+	<b>8</b>
Input: 6    Output: 4		Input: 4    Output: 4		Input: 4    Output: 4		Input: 4    Output: 4

<b>38</b>	=	<b>14</b>	+	<b>16</b>	+	<b>8</b>
Input: 20    Output: 18		Input: 8    Output: 6		Input: 8    Output: 8		Input: 4    Output: 4

<b>14</b>	+	<b>8</b>	+	<b>8</b>	+	<b>8</b>
Input: 8    Output: 6		Input: 4    Output: 4		Input: 4    Output: 4		Input: 4    Output: 4

<b>42</b>	=	<b>10</b>	+	<b>16</b>	+	<b>16</b>
Input: 22    Output: 20		Input: 6    Output: 4		Input: 8    Output: 8		Input: 8    Output: 8

<b>10</b>	+	<b>16</b>	+	<b>8</b>	+	<b>8</b>
Input: 6    Output: 4		Input: 8    Output: 8		Input: 4    Output: 4		Input: 4    Output: 4

<b>46</b>	=	<b>14</b>	+	<b>16</b>	+	<b>16</b>
Input: 24    Output: 22		Input: 8    Output: 6		Input: 8    Output: 8		Input: 8    Output: 8

<b>14</b>	+	<b>16</b>	+	<b>8</b>	+	<b>8</b>
Input: 8    Output: 6		Input: 8    Output: 8		Input: 4    Output: 4		Input: 4    Output: 4

<b>50</b>	=	<b>10</b>	+	<b>16</b>	+	<b>16</b>	+	<b>8</b>
Input: 26    Output: 24		Input: 6    Output: 4		Input: 8    Output: 8		Input: 8    Output: 8		Input: 4    Output: 4

<b>54</b>	=	<b>14</b>	+	<b>16</b>	+	<b>16</b>	+	<b>8</b>
Input: 28    Output: 26		Input: 8    Output: 6		Input: 8    Output: 8		Input: 8    Output: 8		Input: 4    Output: 4

<b>58</b>	=	<b>10</b>	+	<b>16</b>	+	<b>16</b>	+	<b>16</b>
Input: 30    Output: 28		Input: 6    Output: 4		Input: 8    Output: 8		Input: 8    Output: 8		Input: 8    Output: 8

<b>62</b>	=	<b>14</b>	+	<b>16</b>	+	<b>16</b>	+	<b>16</b>
Input: 32    Output: 30		Input: 8    Output: 6		Input: 8    Output: 8		Input: 8    Output: 8		Input: 8    Output: 8

**Transistor Output Units**

$$\left( \begin{array}{c} \text{Total number of} \\ \text{I/O points} \end{array} \right) = \left( \begin{array}{c} \text{Control} \\ \text{unit} \end{array} \right) + \left( \begin{array}{c} \text{First} \\ \text{expansion} \\ \text{I/O unit} \end{array} \right) + \left( \begin{array}{c} \text{Second} \\ \text{expansion} \\ \text{I/O unit} \end{array} \right) + \left( \begin{array}{c} \text{Third} \\ \text{expansion} \\ \text{I/O unit} \end{array} \right)$$

<b>16</b>
Input: 8    Output: 8

=

<b>16</b>
Input: 8    Output: 8

<b>32</b>
Input: 16    Output: 16

=

<b>32</b>
Input: 16    Output: 16

=

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

<b>48</b>
Input: 24    Output: 24

=

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

=

<b>16</b>
Input: 8    Output: 8

+

<b>32</b>
Input: 16    Output: 16

=

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

<b>64</b>
Input: 32    Output: 32

=

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

=

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

=

<b>16</b>
Input: 8    Output: 8

+

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

=

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

<b>80</b>
Input: 40    Output: 40

=

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

=

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

=

<b>16</b>
Input: 8    Output: 8

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

=

<b>16</b>
Input: 8    Output: 8

+

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

<b>96</b>
Input: 48    Output: 48

=

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

=

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

+

<b>16</b>
Input: 8    Output: 8

=

<b>16</b>
Input: 8    Output: 8

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

<b>112</b>
Input: 56    Output: 56

=

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>16</b>
Input: 8    Output: 8

=

<b>16</b>
Input: 8    Output: 8

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

<b>128</b>
Input: 64    Output: 64

=

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

+

<b>32</b>
Input: 16    Output: 16

## 1.6 Programming Tools

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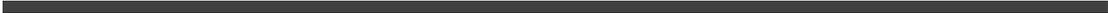
Two Windows programming tools are available:

- FPWIN Pro
- FPWIN GR

Please contact your sales representative or refer to our Web site for details:

[http://www.panasonic-electric-works.com/peweu/en/html/programmable\\_controllers.php](http://www.panasonic-electric-works.com/peweu/en/html/programmable_controllers.php).

# Chapter 2



## Control Units

## 2.1 Parts and Terminology



### Note

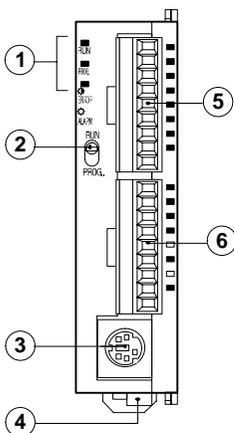
Additional units may be available since we are constantly expanding our product line. Please check our Web site for details:

<http://www.panasonic-electric-works.com/peweu/en/html/fp0.php>

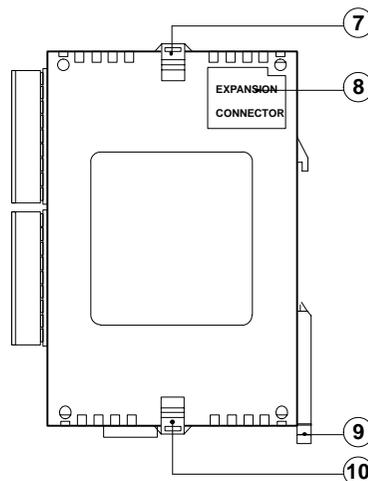
There are fourteen different control unit types available:

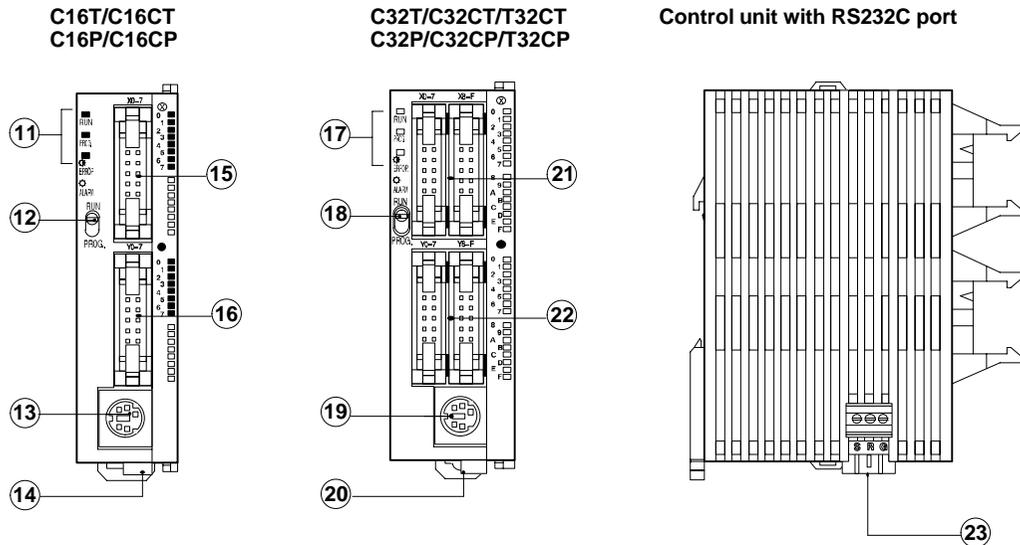
1. C10RS terminal type
2. C14RS terminal type
3. C10CRS (with RS232C port) terminal type
4. C14CRS (with RS232C port) terminal type
5. C16T
6. C16P
7. C16CT (with RS232C port)
8. C16CP (with RS232C port)
9. C32T
10. C32P
11. C32CT (with RS232C port)
12. C32CP (with RS232C port)
13. T32CP (with RS232C port)
14. T32CT (with RS232C port)

**C10RS/C14RS  
C10CRS/C14CRS  
(terminal type)**



**All control unit types**





① ①① ①⑦ **Status indicator LEDs**

display the operation mode and error statuses (see page 14).

② ②② ②⑧ **Mode switch**

changes the operation mode (see page 14).

③ ③③ ③⑨ **Tool port (RS232C)**

is used to connect a programming tool (see page 14).

④ ④④ ④⑨ **Power supply connector**

Supply 24 V DC. It is connected using the power supply cable (AFP0581) that comes with the unit.

⑤ **Input terminal (9-pin)**

⑥ **Output terminal (9-pin)**

The input and output terminals use a terminal block socket made by Phoenix Contact Co. (product number: 1840434) (see page 100).

⑦ ⑦⑦ **Expansion hook**

is used to secure expansion units. The hook is also used for installation on FP0 flat type mounting plate (AFP0804).

⑧ **Expansion connector**

connects an expansion unit to the internal circuit of the control unit (see page 83).

⑨ **DIN rail attachment lever**

allows simple attachment to a DIN rail.

The lever is also used for installation on FP0 slim type mounting plate (AFP0803).

⑮ **Input connector (10-pin)**

⑯ **Output connector (10-pin)**

Use a MIL type connector for the input and output connectors (⑮ and ⑯) (see page 102).

⑰ **Input connectors (10-pin × 2)**

⑱ **Output connectors (10-pin × 2)**

Use a MIL type connector for the input and output connectors (⑰ and ⑱) (see page 102).

⑳ **RS232C port**

Use this port to connect to devices with an RS232C port, such as an I.O.P., a bar code reader, or an image checker, enabling data input and output. (see page 104 ).

## 2.1.1 Status Indicator LEDs

These LEDs display the current mode of operation or the occurrence of an error.

LED	Description
<b>RUN (green)</b>	Illuminates when in the RUN mode and indicates the execution of a program. It flashes during forced input/output.
<b>PROG. (green)</b>	Illuminates when in the PROG. mode and indicates that operation has stopped.
<b>ERROR/ALARM (red)</b>	Flashes when an error is detected during the self-diagnostic function. Illuminates if a hardware error occurs, or if operation slows because of the program, and the watchdog timer is activated.

## 2.1.2 Mode Switch

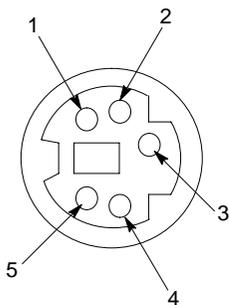
This switch turns ON and OFF (RUN/PROG.) the operation of the FP0. The FP0 can also be turned ON and OFF by the programming tool.

Switch position	Operation mode
<b>RUN (upward)</b>	This sets the RUN mode. The program is executed and operation begins.
<b>PROG. (downward)</b>	This sets the PROG. mode.

When performing remote switching from the programming tool, the position of the mode switch and the actual mode of operation may differ. Verify the mode with the status indicator LED. Otherwise, restart the FP0 and change the mode of operation with the mode switch.

## 2.1.3 Tool Port

The tool port is used to connect a programming tool.



Pin no.	Abbreviation
1	-
2	SD (TXD)
3	SG
4	RD (RXD)
5	+ 5 V

Pin assignment

## 2.2 Specifications

### 2.2.1 General Specifications

Item	Description	
Ambient humidity	30% to 85% RH (non-condensing)	
Ambient temperature	0°C to +55°C/32°F to +131°F	
Allowed momentary power off time	C10/C14	5ms at 21.6V, 10ms at 24V
	C16/C32/T32	10ms at 21.6V, 10ms at 24V
Breakdown voltage	500V AC for 1 minute between I/O terminal and power supply/ground terminal 1500V AC for 1 minute between I/O terminal and power supply/ground terminal (relay output type only)	
Insulation resistance	min. 100M $\Omega$ (measured with a 500V DC megger) between I/O terminal and ground terminal	
Noise immunity	1,000Vp-p with pulse widths 50ns and 1 $\mu$ s (based on in-house measurements)	
Operating condition	Free from corrosive gases and excessive dust	
Operating voltage range	21.6V to 26.4V DC	
Rated operating voltage	24V DC	
Rated current consumption	300mA or less (see page 16)	
Shock resistance	Shock of 98m/s <sup>2</sup> or more, 4 times on 3 axes	
Storage humidity	30% to 85% RH (non-condensing)	
Storage temperature	-20 °C to +70°C/-4 °F to +158°F	
Vibration resistance	10Hz to 55Hz, 1 cycle/min: double amplitude of 0.75mm/ 0.030in., 10min. on 3 axes	

### 2.2.2 Weight

Type	Weight
C10RS/C10CRS	approx. 100g/3.53oz
C14RS/C14CRS	approx. 105g/3.70oz
C16T/C16CT/C16P/C16CP	approx. 85g/3.00oz
C32T/C32CT/C32P/C32CP	approx. 115g/4.06oz
T32CP	approx. 130g/4.59oz.
E8RS/E8RM	approx. 90g/3.17oz
E8X/E8YT/E8YP	approx. 65g/2.29oz
E16RS/E16RM	approx. 105g/3.70oz
E16T/E16P/E16X/E16YT/E16YP	approx. 70g/2.47oz
E32T/E32P	approx. 85g/3.00oz
E32RS	approx. 210g/7.40oz

### 2.2.3 Current Consumed by the Control Unit

The current consumed at the power supply connector of the control unit is the sum of the current consumed by of the various units being used.

Type		Current consumption (at 24V DC)
Control unit	C10RS, C10CRS	100mA or less
	C14RS, C14CRS	100mA or less
	C16T, C16CT, C16P, C16CP	40mA or less
	C32T, C32CT, C32P, C32CP, T32CP, T32CT	60mA or less
Expansion I/O unit	E8X	10mA or less
	E8YT, E8YP	15mA or less
	E8RS, E16RS, E16X	20mA or less
	E16YT, E16YP, E16T, E16P	25mA or less
	E32T, E32P, E32RS	40mA or less
Analog I/O unit	A21	20mA or less
FP Programmer † Ver. 2 (AFP1114V2)		50mA or less
C-NET adapter S2 type (AFP15402)		50mA or less

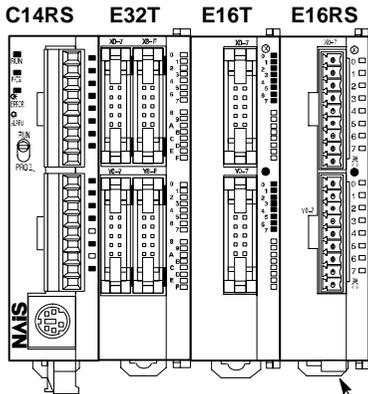
#### Current consumed when the unit requires an external power supply

With a relay output type of expansion I/O unit and an analog I/O unit, it is necessary to provide a power supply to drive internal circuits.

Type		Current consumption (at 24V DC)
Expansion I/O unit	E8RS	50mA
	E16RS	100mA
	E32RS	200mA
Analog I/O unit	A21	100mA



**Example: Current consumption**



At power supply connector of expansion IO unit FP0 E16RS

Type	Current consumption
FP0 E16RS	100mA

At power supply connector of control unit

Type	Current consumption
FP0 C14RS	100mA
FP0 E32T	40mA
FP0 E16T	25mA
FP0 E16RS	20mA
<b>Total current consumption</b>	<b>185mA or less</b>

## 2.2.4 Performance Specifications

Item		Relay output type		Transistor output type		
		C10RS C10CRS	C14RS C14CRS	C16T C16CT C16P C16CP	C32T C32CT C32P C32CP	T32CP
Programming method/Control method		Relay symbol/Cyclic operation				
Controllable I/O points	Control unit only	total: 10 (Input: 6) (Output: 4)	total: 14 (Input: 8) (Output: 6)	total: 16 (Input: 8) (Output: 8)	total: 32 (Input: 16) (Output: 16)	
	When the expansion unit is the same output type as the control unit	max. 58	max. 62	max. 112	max. 128	
	When the expansion unit is a transistor output type	max. 106	max. 110	max. 112	max. 128	
Program memory		Built in EEPROM (no back-up battery required)			RAM, battery back-up	
Program capacity		2,720 steps			5,000 steps	10,000 steps
Numbers of instruction	Basic instruction	83 types				
	High-level instruction	114 types				115 types
Operation speed		0.9μs/step (basic instruction)				
I/O update time and Base time		Without expansion: 0.3ms With expansion: 0.3ms + (1 × Number of expansion unit) ms				
Operation memory points	Relays	Internal relay (R)	1,008 points (R0 to R62F)			
		Special internal relay (R)	64 points (R9000 to R903F)			
		Timer/Counter (T/C)	144 points (initial setting is 100 timer points, T0 to T99 / 44 counter points, C100 to C143 (see notes) Timer range: 1ms, 10ms, 100ms, 1s; selected by instruction			



### Note

The proportion of timer points to counter points can be changed using system register 5. See the programming tool's online help.

Item			Relay output type		Transistor output type		
			C10RS C10CRS	C14RS C14CRS	C16T C16CT C16P C16CP	C32T C32CT C32P C32CP	T32CP T32TP
Operation memory points	Memory areas	Data register (DT)	1,660 words (DT0 to DT1659)			6,144 words (DT0 to DT6143)	16,383 words (DT0 to DT16382)
		Special data register (DT)	112 words (DT9000 to DT9111, for T32CP DT90000 to DT90111)				
		Index registers (IX, IY)	2 words				
Differential points			Unlimited number of points				
Master control relay points (MCR)			32 points				
Number of labels (JP and LOOP)			64 labels				255 labels
Number of step ladders			128 stages				704 stages
Number of subroutines			16 subroutines				100 sub-routines
Number of interrupt programs			7 programs (external: 6, internal: 1)				
Self-diagnostic function			Such as watchdog timer, program syntax check, run-time error				
Memory backup (see notes)	Timer		Non-hold type: all points				Set with system registers 5 (border between timer and counter) and 6
	Counter	Non-hold type	From set value to C139			From set value to C127	
		Hold type	4 points (elapsed values) C140 to C143			16 points (elapsed values) C128 to C143	
	Internal relay	Non-hold type	976 points (R0 to R60F) 61 words (WR0 to WR60)			880 points (R0 to R54F) 55 words (WR0 to WR54)	Set with system register 7
		Hold type	32 points (R610 to R62F) 2 words (WR61 to WR 62)			128 points (R550 to R62F) 8 words (WR55 to WR62)	
	Data registers	Non-hold type	1652 words (DT0 to DT1651)			6112 words (DT0 to DT6111)	Set with system register 8
Hold type		8 words (DT1652 to DT1659)			32 words (DT6112 to DT6143)		



## Notes

- The program, system registers and the hold type areas (internal relay, data register and counter) are backed up by the built in EEPROM.
- For T32CP and T32CT, all data registers are backed up by storage battery. Once charged (at least 22 hours), back-up lasts for 15 days at 25°C/77°F.

Item		Relay output type		Transistor output type		
		C10RS C10CRS	C14RS C14CRS	C16T C16CT C16P C16CP	C32T C32CT C32P C32CP	T32CP T32CT
Special functions	Pulse catch input	Total 6 points ( X0 and X1: 50µs X2 to X5: 100µs )				
	Interrupt input					
	RS232C port (see note 1)	Available unit: FP0-C10CRS, C10CRM, C14CRS, C14CRM, C16CT, C16CP, C32CT, C32CP, T32CP, T32CT Baud rate: 300, 600, 1200, 2400, 4800, 9600, and 19200bps Transmission distance: 3m/9.84ft. Terminal block: 3-pin, made by Phoenix Contact Co. (product number: MKDS 1/3-3.5) Communication method: half-duplex				
	Periodical interrupt	0.5ms to 30s interval				
	Constant scan	Available				
	High-speed counter function (see notes 2, 3)	Counter mode: Addition/subtraction (one phase)				
		<ul style="list-style-type: none"> <li>• Input point number: 4 channels maximum</li> <li>• Maximum counting speed: 10kHz maximum for all 4 channels (see note 4)</li> <li>• Input contacts used: <ul style="list-style-type: none"> <li>X0: count input (ch 0)</li> <li>X1: count input (ch 1)</li> <li>X2: reset input (see note 5)</li> <li>X3: count input (ch 2)</li> <li>X4: count input (ch 3)</li> <li>X5: reset input (see note 5)</li> </ul> </li> <li>• Minimum input pulse width: X0, X1.. 50µs &lt;10kHz&gt; X3, X4 ..100µs &lt;5kHz&gt;</li> </ul>				
Pulse output function (see note 3)	Output point number	_____		Two independent points (Y0 and Y1) (No interpolation function)		
	Output frequency	_____		40Hz to 10kHz (Y0/Y1: one-point output) 40Hz to 5kHz (Y0/Y1: two-point output)		
	Special functions	PWM output function (see note 3)	Output point number	_____		Two points (Y0 and Y1)
Output frequency		_____		Frequency: 0.15Hz to 38Hz (see note 6) Duty: 0.1% to 99.9%		

**Notes**

- 1) The driver IC for the RS232C port conforms completely to EIA/TIA-232E and CCITT V28 standards.
- 2) The combinations 1 phase x 2 channels and 2 phases x 1 channel are also possible for the high-speed counter.
- 3) For details and limitations on the high-speed counter, pulse output, and PWM output functions. See FP0 Programming Manual.
- 4) The max. counting speed (10kHz) is the counting speed with a rated input voltage of 24V DC and an ambient temperature of 25°C/77°F. The counting speed (frequency) will decrease depending on the voltage and temperature.
- 5) If the unit is equipped with both reset inputs X2 and X5, X2 serves as the reset input for X1. If X3 and X4 are used, X5 serves as the reset input for X4.
- 6) With control unit's CPU that is Ver.2.0 or a subsequent version, the frequency will be 0.15Hz to 1kHz.

**2.2.5 Input Specifications**

Item		Description
Insulation method		optical coupler
Rated input voltage		24V DC
Rated input current		approx. 4.3mA (at 24V DC)
Input impedance		approx. 5.6kΩ
Operating voltage range		21.6 to 26.4V DC
Input points per common (see note 1)	C10RS, C10CRS	6 points/common
	C14RS, C14CRS	8 points/common
	C16T, C16CT, C16P, C16CP	8 points/common
	C32T, C32CT, C32P, C32CP, T32CP, T32CT	16 points/common
ON voltage/ON current		19.2V or less/3mA or less
OFF voltage/OFF current		2.4V or more/1mA or more
Response time (at 24V DC and 25°C/66°F)	OFF ↔ ON	50μs or less (at X0, X1) (see note 2) 100μs or less (at X2 to X5) (see note 2) 2ms or less (at X6 to XF)
	ON ↔ OFF	the same as above
Operating mode indicator		LED

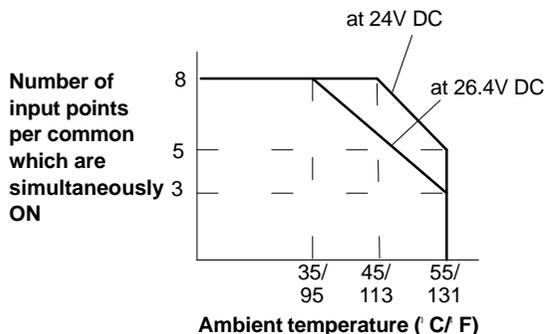
**Notes**

- 1) Either positive or negative polarity is possible for the input voltage supply.
- 2) X0 through X5 are inputs for the high-speed counter and have a fast response time. If used as normal inputs, we recommend inserting a timer in the ladder program as chattering and noise may be interpreted as an input signal.

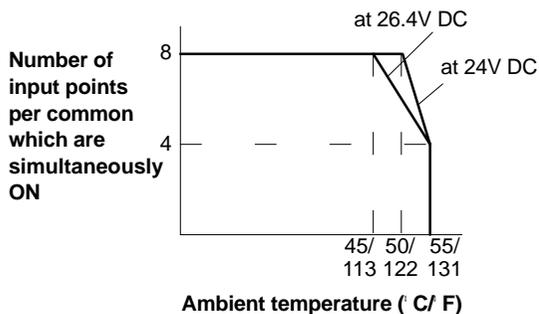
### Limitations on Number of Simultaneous Input ON Points

Keep the number of input points per common which are simultaneously ON within the following range as determined by the temperature.

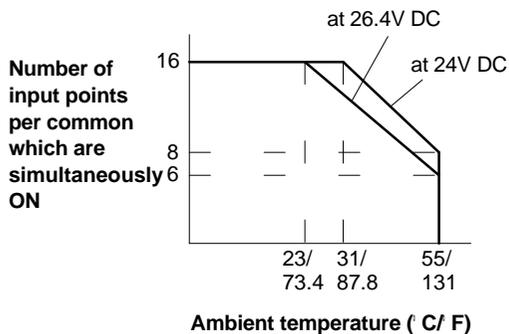
#### FP0-C14RS/C14CRS



#### FP0-C16T/C16CT/C16P/C16CP



#### FP0-C32T/C32CT/C32P/C32CP/T32CP



## 2.2.6 Output Specifications

### Relay Output Type

FP0 relay output types: C10RS, C10CRS, C14RS, C14CRS

Item		Description
Output type		Normally open (1 Form A) relay output
Rated control capacity		2A 250V AC, 2A 30V DC (4.5A maximum per common)
Output points per common	C10RS, C10CRS	2 points/common + 1 point/common + 1 point/common
	C14RS, C14CRS	4 points/common + 1 point/common + 1 point/common
Response time	OFF → ON	approx. 10ms
	ON → OFF	approx. 8ms
Mechanical life time		20,000,000 operations or more
Electrical life time		100,000 operations or more
Surge absorber		None
Operating mode indicator		LED

## Transistor Output Type

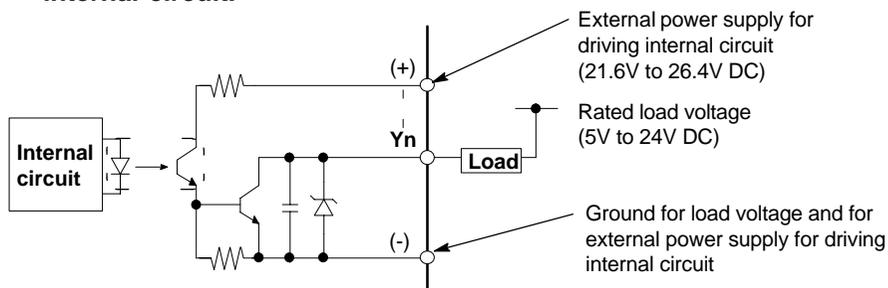
FP0 transistor output types: C16T, C16CT, C16P, C16CP, C32T, C32CT, C32P, C32CP, T32CP, T32CT

Item		Description
Insulation method		optical coupler
Output type		open collector
Rated load voltage		NPN open collector type: 5 to 24V DC (see notes) PNP open collector type: 24V DC
Operating load voltage range		NPN open collector type: 4.75 to 26.4V DC (see notes) PNP open collector type: 21.6 to 26.4V DC
Max. load current		0.1A
Max. surge current		0.3A
Output points per common	C16T, C16CT, C16P, C16CP	8 points/common
	C32T, C32CT, C32P, C32CP, T32CP, T32CT	16 points/common
OFF state leakage current		100 $\mu$ A or less
ON state voltage drop		1.5V or less
External power supply for driving internal circuit	Voltage	21.6 to 26.4V DC
	Current	Y0 and Y1: 5mA/1 point, except Y0 and Y1: 3mA/1 point
Response time	OFF $\rightarrow$ ON	1ms or less (Y0 and Y1 only: 50 $\mu$ s or less)
	ON $\rightarrow$ OFF	1ms or less (Y0 and Y1 only: 50 $\mu$ s or less)
Surge absorber		Zener diode
Operating mode indicator		LED



### Notes

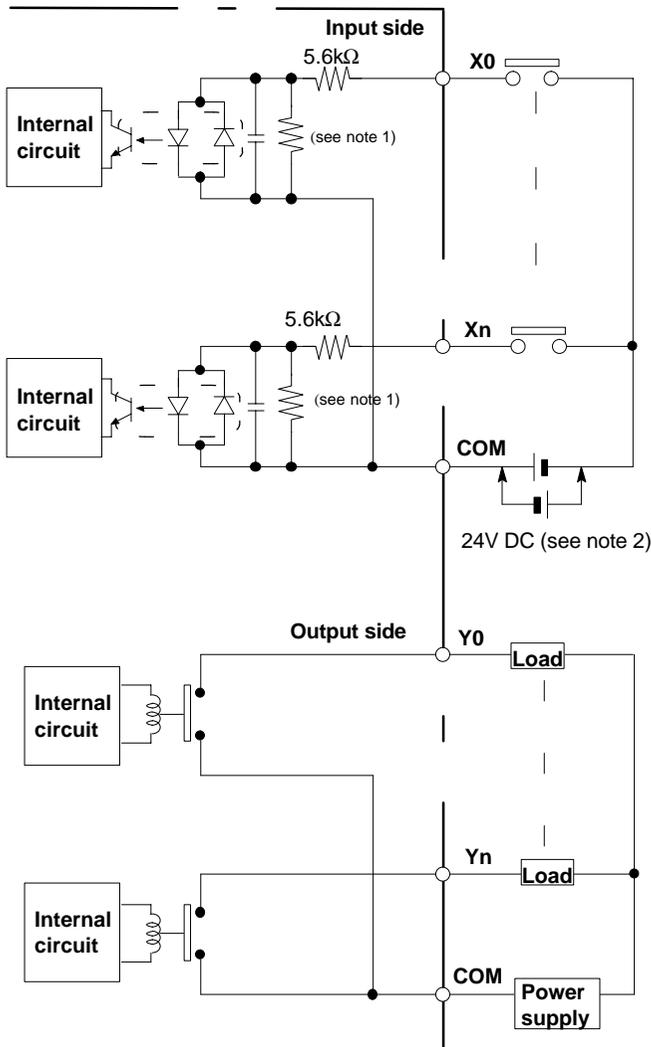
- The T32CP control unit uses only the PNP open collector.
- For NPN open collector type, able to be used with different voltages for the load voltage and the external power supply for driving the internal circuit.



## 2.3 Internal Circuit Diagram

### 2.3.1 Relay Output Type

FP0-C10RS/C10CRS/C14RS/C14CRS



#### Notes

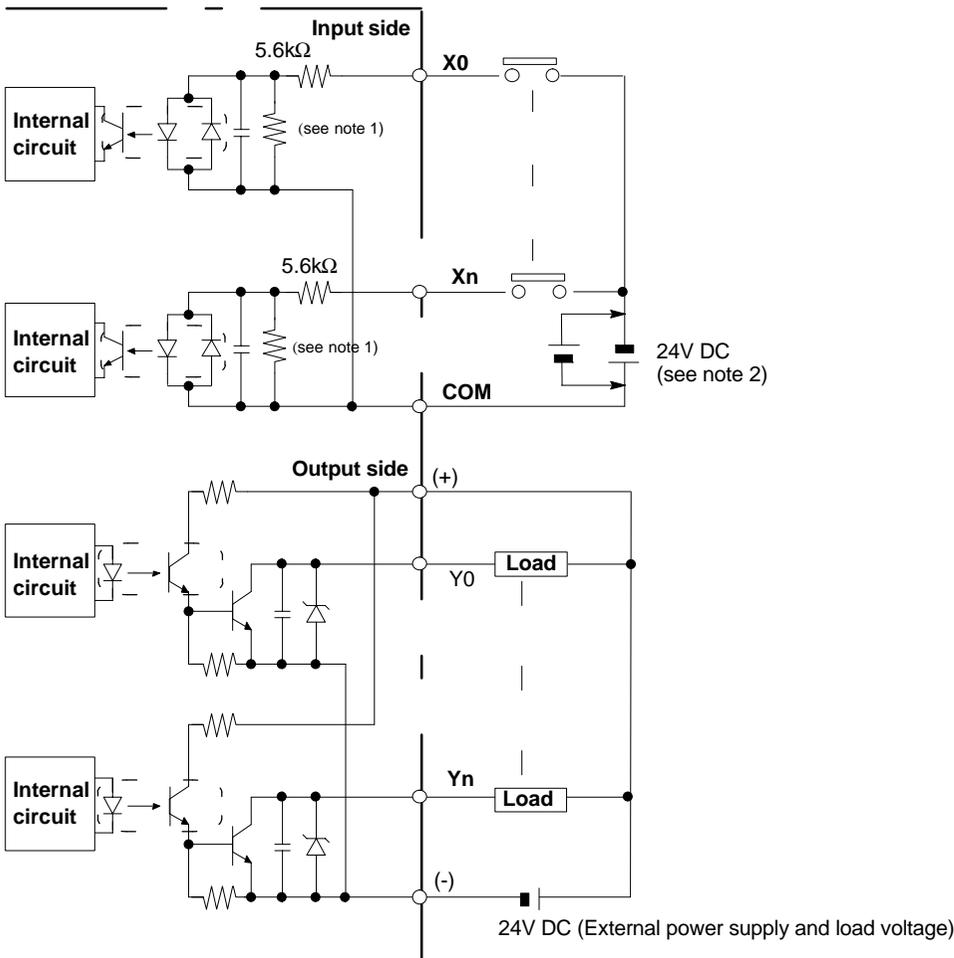
- 1) The resistor in the control unit is 2kΩ for X0 through X5, and 1kΩ for X6 and X7.
- 2) Either positive or negative polarity is possible for the input voltage supply.

## 2.3.2 Transistor Output Type

### NPN Open Collector Type

This example is when the values of the rated load voltage and external power supply for driving the internal circuit are the same. In this set-up, there is only one power supply.

#### FP0-C16T/C16CT/C32T/C32CT/T32CT

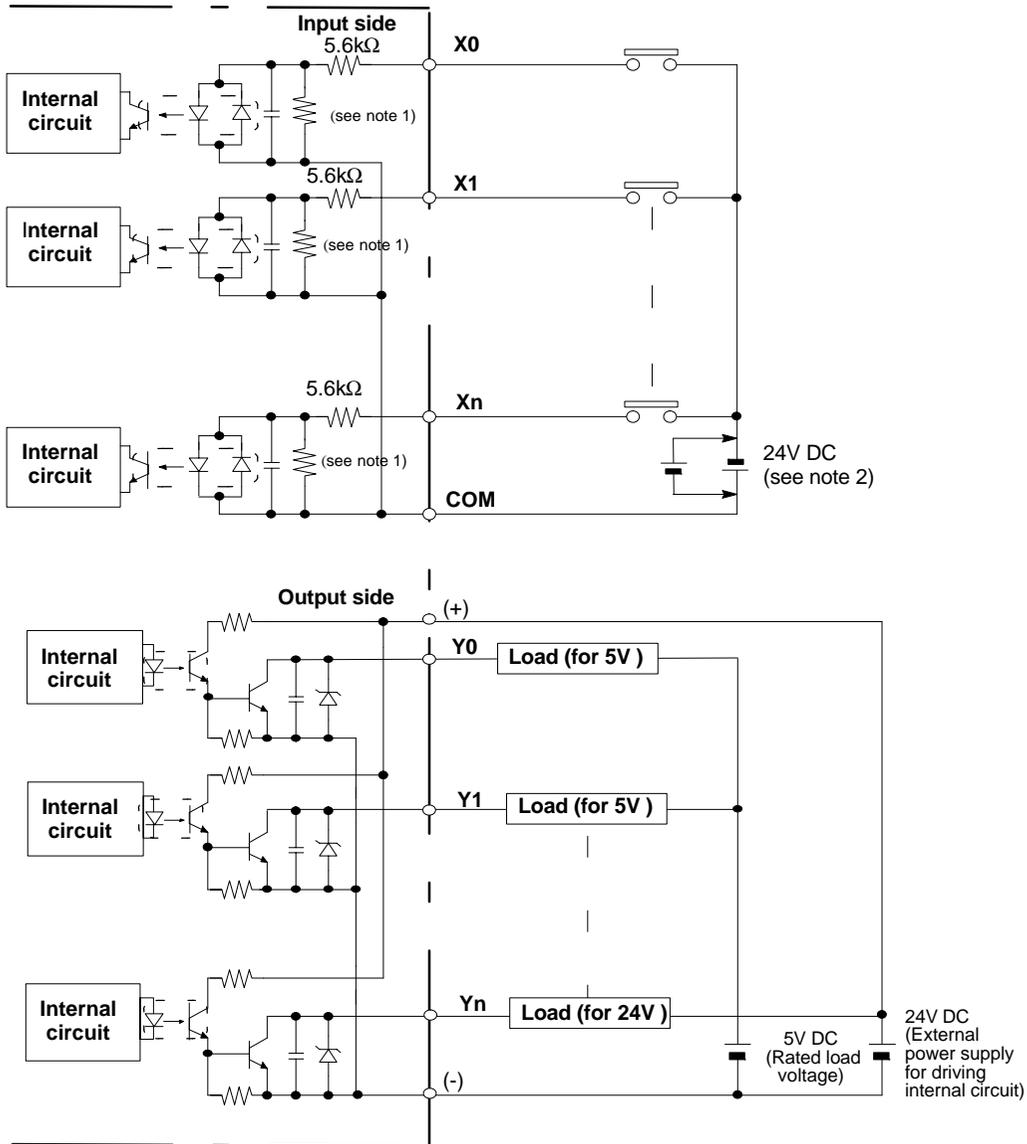


### Notes

- 1) The resistor in the control unit is 2k $\Omega$  for X0 through X5, and 1k $\Omega$  for X6 through XF.
- 2) Either positive or negative polarity is possible for the input voltage supply.

The load voltage differs from the 24V DC external power supply for the driving the internal circuit. 5V DC and 12V DC and other load voltages can also be connected.

**FP0-C16T/C16CT/C32T/C32CT/T32CT**

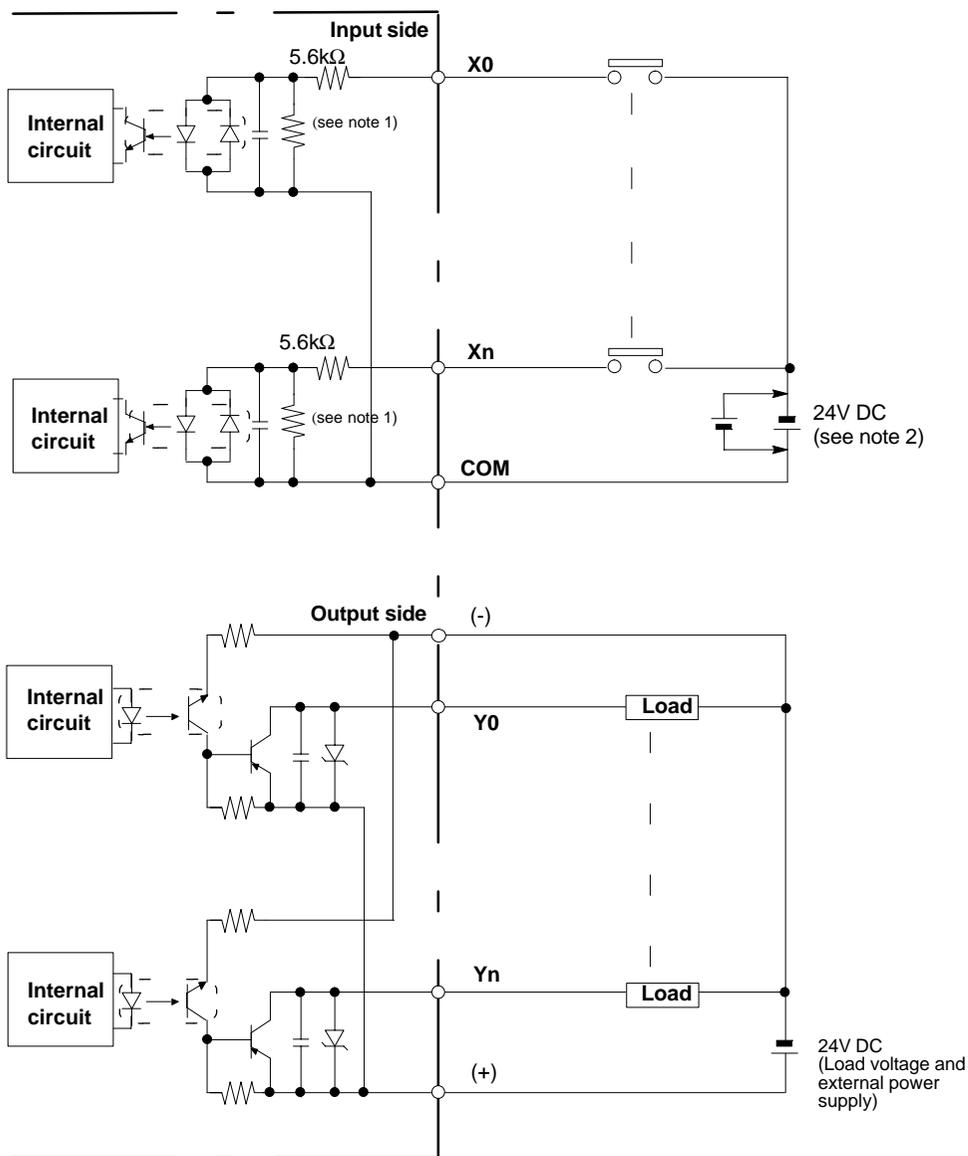


**Notes**

- 1) The resistor in the control unit is 2kΩ for X0 through X5, and 1kΩ for X6 through XF.
- 2) Either positive or negative polarity is possible for the input voltage supply.

## PNP Open Collector Type

FP0-C16P/C16CP/C32P/C32CP/T32CP

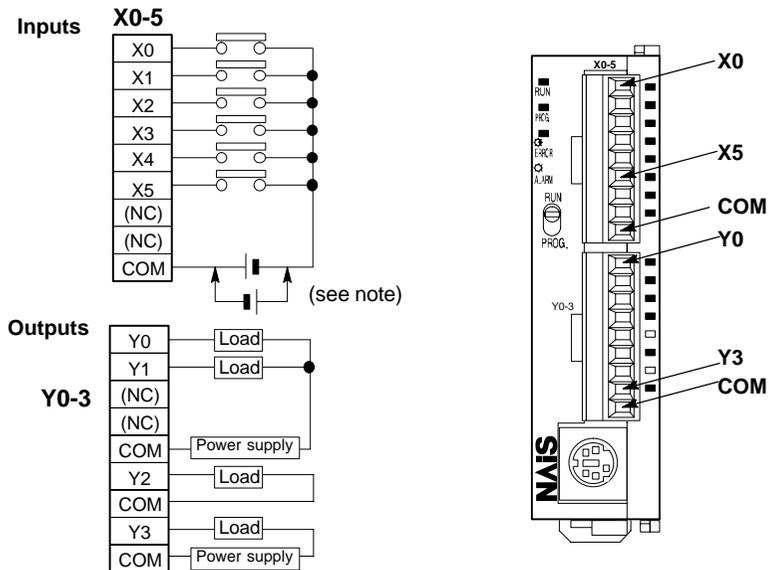


## Notes

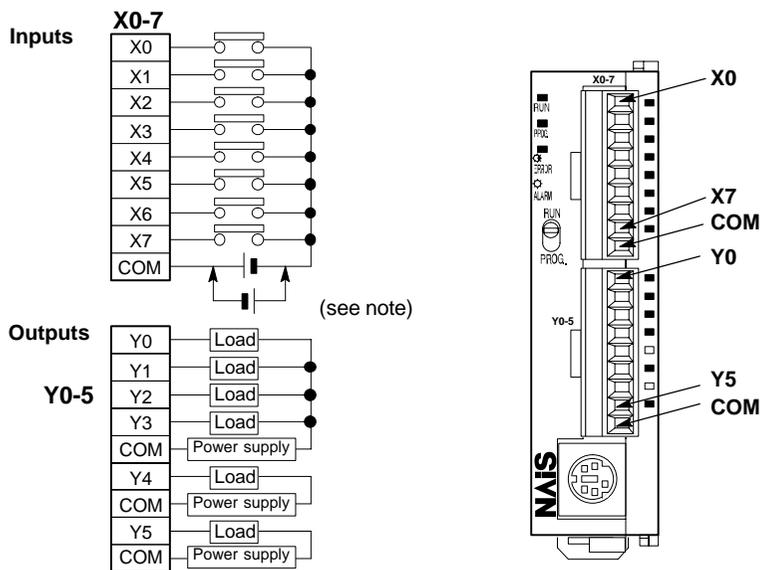
- 1) The resistor in the control unit is 2kΩ for X0 through X5, and 1kΩ for X6 through XF.
- 2) Either positive or negative polarity is possible for the input voltage supply.

## 2.4 Pin Layouts

### 2.4.1 C10RS/C10CRS



### 2.4.2 C14RS/C14CRS

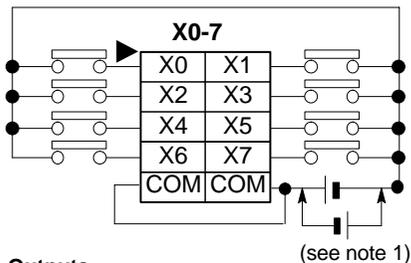


**Note**

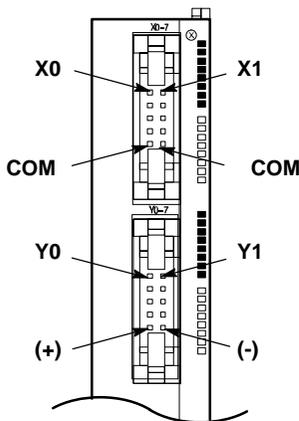
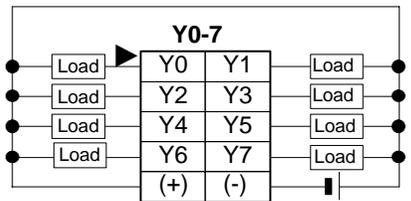
Either positive or negative polarity is possible for the input voltage supply.

### 2.4.3 C16T/C16CT

**Inputs**



**Outputs**

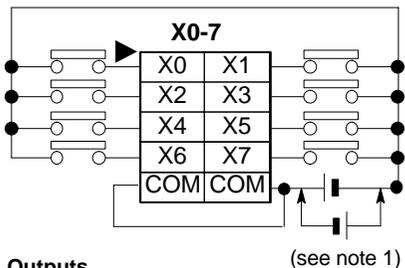


**Notes**

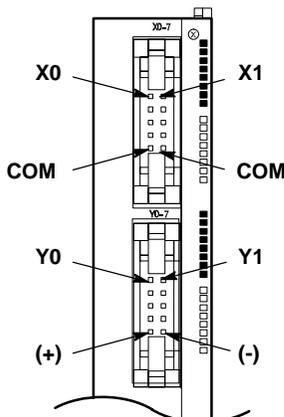
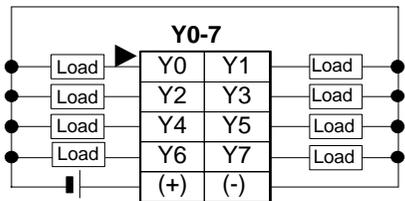
- 1) Either positive or negative polarity is possible for the input voltage supply.
- 2) The two COM terminals of input terminal (X0-7) are connected internally, however they should be externally connected as well.

### 2.4.4 C16P/C16CP

**Inputs**



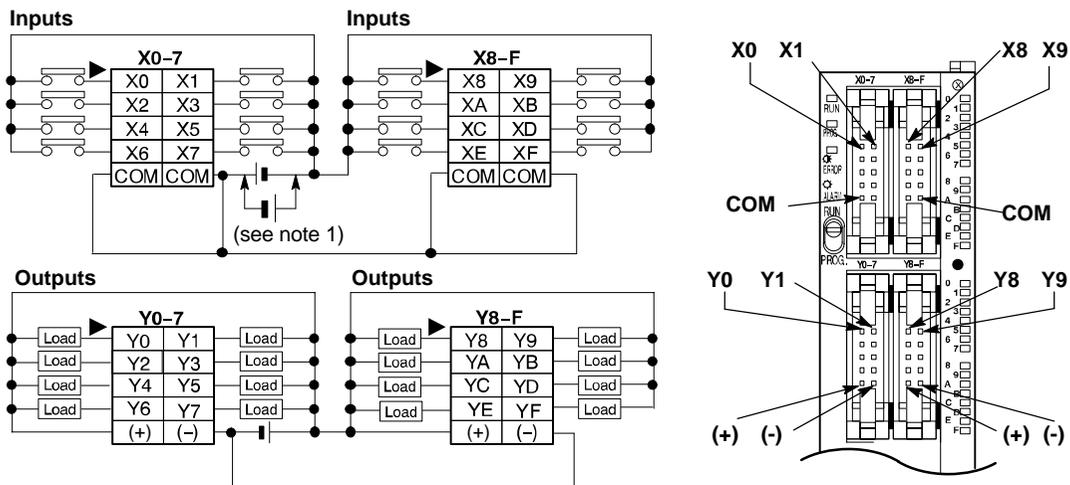
**Outputs**



**Notes**

- 1) Either positive or negative polarity is possible for the input voltage supply.
- 2) The two COM terminals of input terminal (X0-7) are connected internally, however they should be externally connected as well.

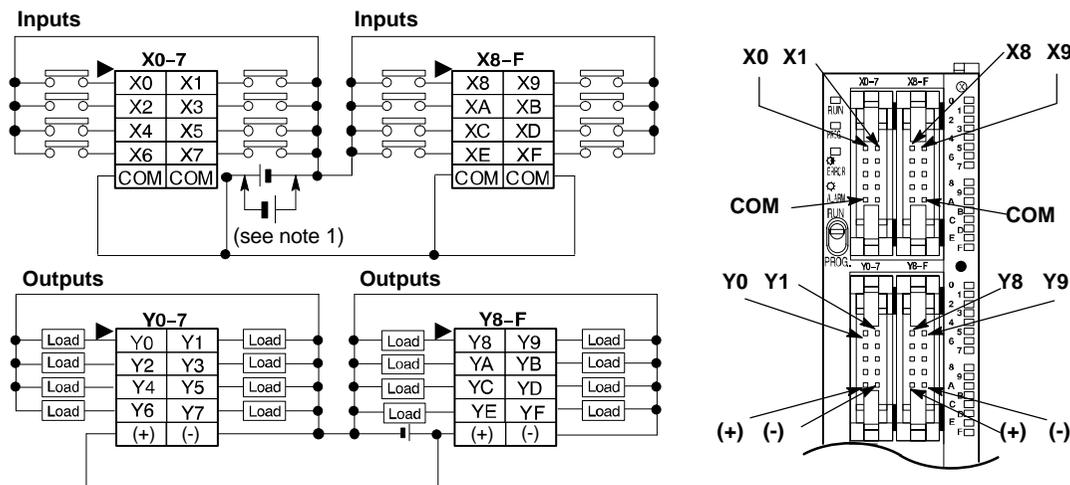
### 2.4.5 C32T/C32CT/T32CT



**Notes**

- 1) Either positive or negative polarity is possible for the input voltage supply.
- 2) The four COM terminals of input terminals (X0-7 and X8-F) are connected internally, however they should be externally connected as well.
- 3) The (+) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.
- 4) The (-) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.

### 2.4.6 C32P/C32CP/T32CP



**Notes**

- 1) **Either positive or negative polarity is possible for the input voltage supply.**
- 2) **The four COM terminals of input terminals (X0-7 and X8-F) are connected internally, however they should be externally connected as well.**
- 3) **The (+) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.**
- 4) **The (-) terminals of output terminals (Y0-7) and output terminals (Y8-F) are connected internally, however they should be externally connected as well.**

# Chapter 3

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## Expansion I/O Units

### 3.1 Parts and Terminology

There are twelve different expansion I/O unit types available:

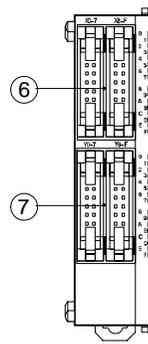
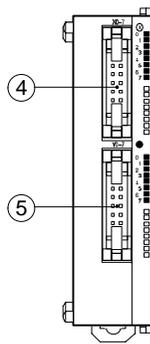
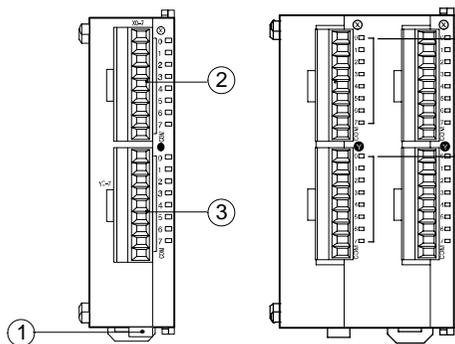
1. E8RS terminal type
2. E16RS terminal type
3. E16T
4. E16P
5. E32T
6. E32P
7. E32RS
8. E8X input type
9. E16X input type
10. E8YT output type
11. E8YP output type
12. E16YT output type
13. E16YP output type

**E8RS/E16RS  
(terminal type)**

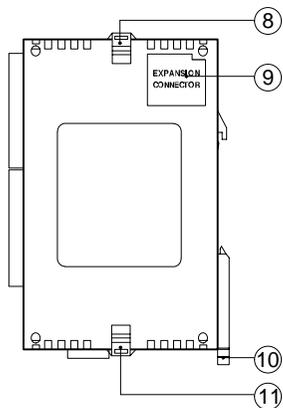
**E32RS  
(terminal type)**

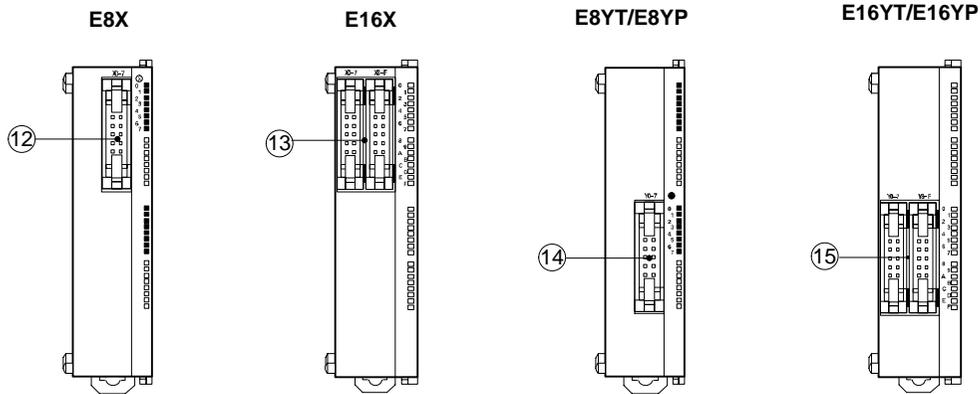
**E16T/E16P**

**E32T/E32P**



**Side view of all expansion I/O unit types**





① **Power supply connector**

Supply 24V DC. It is connected using the power supply cable (AFP0581) that comes with the unit.

② **Input terminal (9-pin)**

③ **Output terminal (9-pin)**

The input and output terminals (② and ③) use a terminal block socket made by Phoenix Contact Co. (product number: 1840434) (see page 100).

④ ⑫ **Input connector (10-pin)**

⑤ ⑭ **Output connector (10-pin)**

⑥ ⑬ **Input connector (10-pin × 2)**

⑦ ⑮ **Output connector (10-pin × 2)**

Use a MIL type connector for the input and output connectors (④ to ⑮) (see page 102).

⑧ ⑪ **Expansion hook**

is used to secure expansion units.

⑨ **Expansion connector**

connects an expansion unit to the internal circuit of the expansion I/O unit (see page 83).

⑩ **DIN rail attachment lever**

allows simple attachment to a DIN rail.

The lever is also used for installation on FP0 slim type mounting plate (AFP0803).

## 3.2 Specifications

### 3.2.1 General Specifications

For more details on the general specifications, see page 15.

### 3.2.2 Input Specifications

Item	Description	
Insulation method	optical coupler	
Rated input voltage	24V DC	
Rated input current	approx. 4.3mA (at 24V DC)	
Input impedance	approx. 5.6k $\Omega$	
Operating voltage range	21.6 to 26.4V DC	
Input points per common (see note)	E8RS	4 points/common
	E16RS, E16T, E16P, E8X, E32RS	8 points/common
	E32T, E32P, E16X	16 points/common
ON voltage/ON current	19.2V or less/3mA or less	
OFF voltage/OFF current	2.4V or more/1mA or more	
Response time (at 24V DC and 25°C/66°F)	OFF $\leftrightarrow$ ON	2ms or less
	ON $\leftrightarrow$ OFF	the same as above
Operating mode indicator	LED	



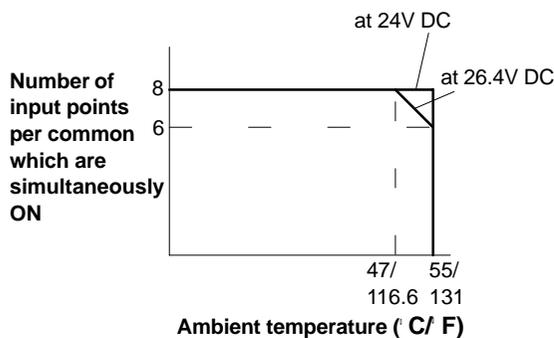
#### Note

Either positive or negative polarity is possible for the input voltage supply.

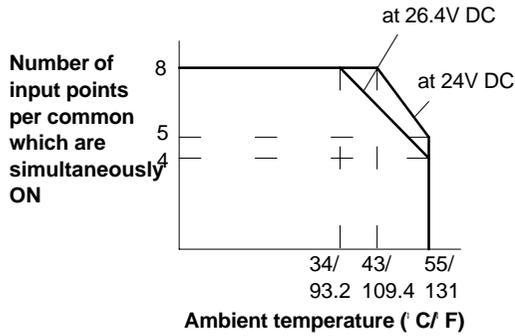
#### Limitations on Number of Simultaneous Input ON Points

Keep the number of input points per common which are simultaneously ON within the following range as determined by the temperature.

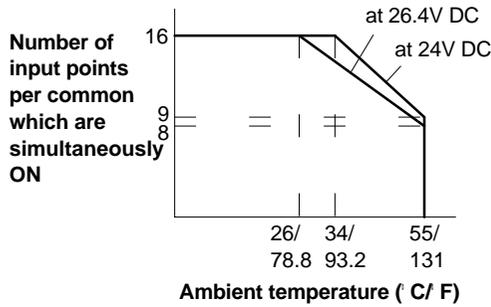
##### FP0-E16RS



**FP0-E16T/E16P/E8X**



**FP0-E32T/E32P/E16X**



**3.2.3 Output Specifications**

**Relay Output Type**

FP0 relay output types: E8RS, E16RS and E32RS

Item	Description	
Output type	Normally open (1 Form A) relay output	
Rated control capacity	2A 250V AC, 2A 30V DC (4.5A maximum per common)	
Output points per common	E8RS	4 points/common
	E16RS, E32RS	8 points/common
Response time	OFF ↔ ON	approx. 10ms
	ON ↔ OFF	approx. 8ms
Mechanical life time	20,000,000 operations or more	
Electrical life time	100,000 operations or more	

Item	Description
Surge absorber	None
Operating mode indicator	LED

### Transistor Output Type

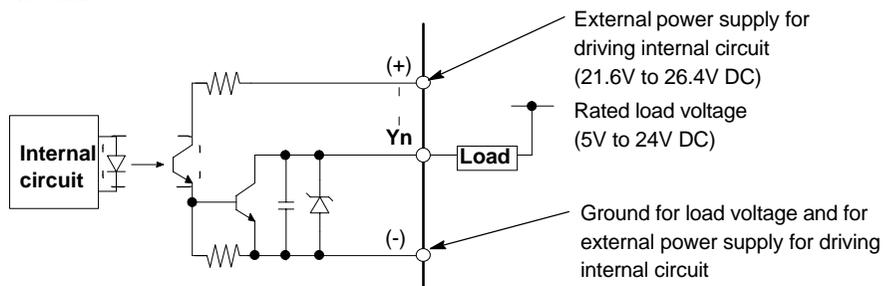
FP0 transistor output types: E16T, E16P, E32T, E32P, E8YT, E8YP, E16YT, E16YP

Item	Description	
Insulation method	optical coupler	
Output type	open collector	
Rated load voltage	NPN open collector type: 5 to 24V DC (see note) PNP open collector type: 24V DC	
Operating load voltage range	NPN open collector type: 4.75 to 26.4V DC PNP open collector type: 21.6 to 26.4V DC	
Max. load current	0.1A	
Max. surge current	0.3A	
Output points per common	E16T, E16P, E8YT, E8YP	8 points/common
	E32T, E32P, E16YT, E16YP	16 points/common
OFF state leakage current	100 $\mu$ A or less	
ON state voltage drop	1.5V or less	
External power supply for driving internal circuit	Voltage	21.6 to 26.4V DC
	Current	Y0 and Y1: 5mA/1 point, except Y0 and Y1: 3mA/1 point
Response time	OFF $\rightarrow$ ON	1ms or less (Y0 and Y1 only: 50 $\mu$ s or less)
	ON $\rightarrow$ OFF	1ms or less (Y0 and Y1 only: 50 $\mu$ s or less)
Surge absorber	Zener diode	
Operating mode indicator	LED	



### Note

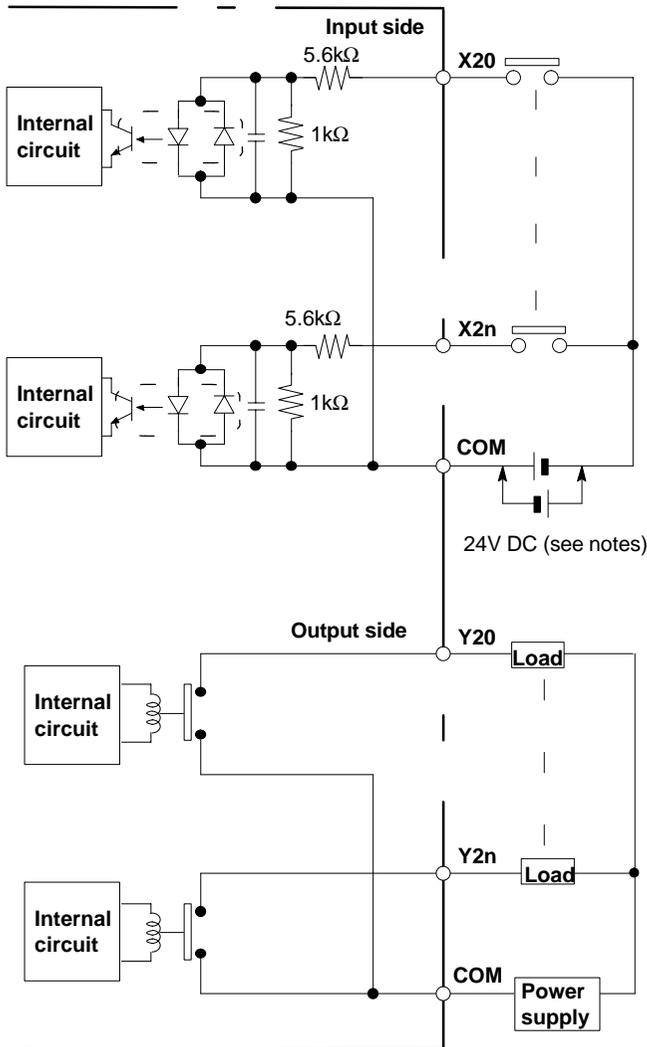
For NPN open collector type, able to be used with different voltages for the load voltage and the external power supply for driving the internal circuit.



## 3.3 Internal Circuit Diagram

### 3.3.1 Relay Output Type

FP0-E8RS/E16RS/E32RS



#### Notes

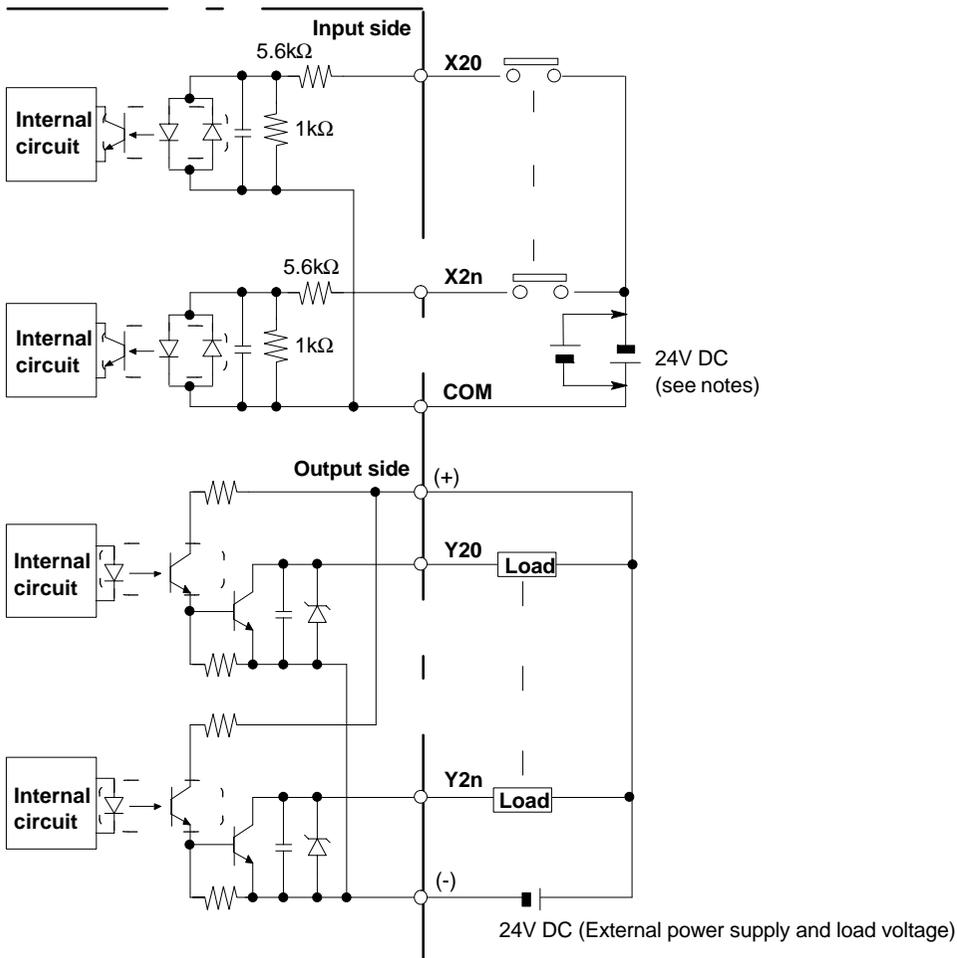
- Either positive or negative polarity is possible for the input voltage supply.
- The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (see page 78).

### 3.3.2 Transistor Output Type

#### NPN Open Collector Type

This example is when the values of the rated load voltage and external power supply for driving the internal circuit are the same. In this set-up, there is only one power supply.

#### FP0-E16T/E32T



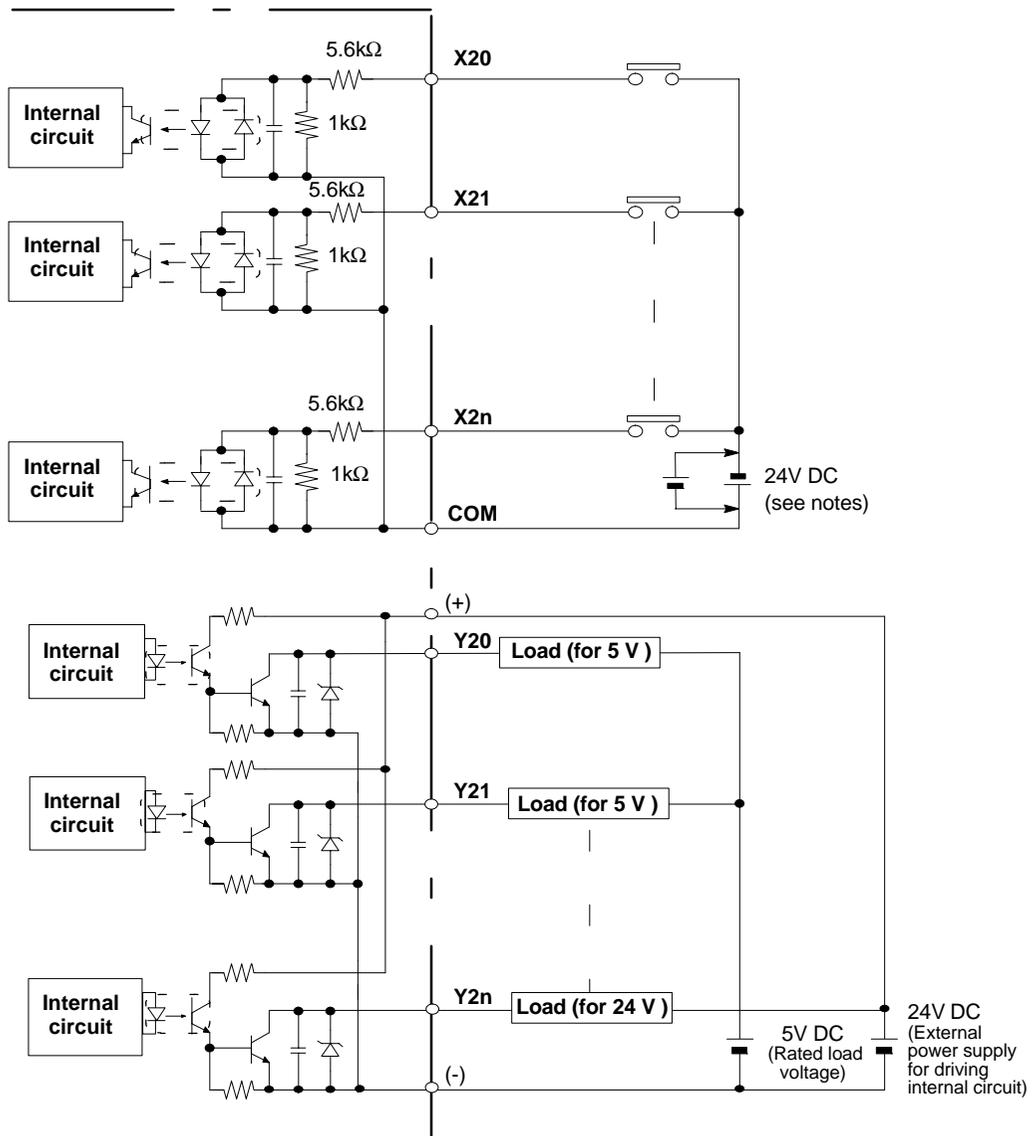
#### Notes

- Either positive or negative polarity is possible for the input voltage supply.
- The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (see page 78).

The load voltage may differ from the 24V DC external power supply for driving the internal circuit.

5V DC and 12V DC and other load voltages can also be connected.

### FP0-E16T/E32T

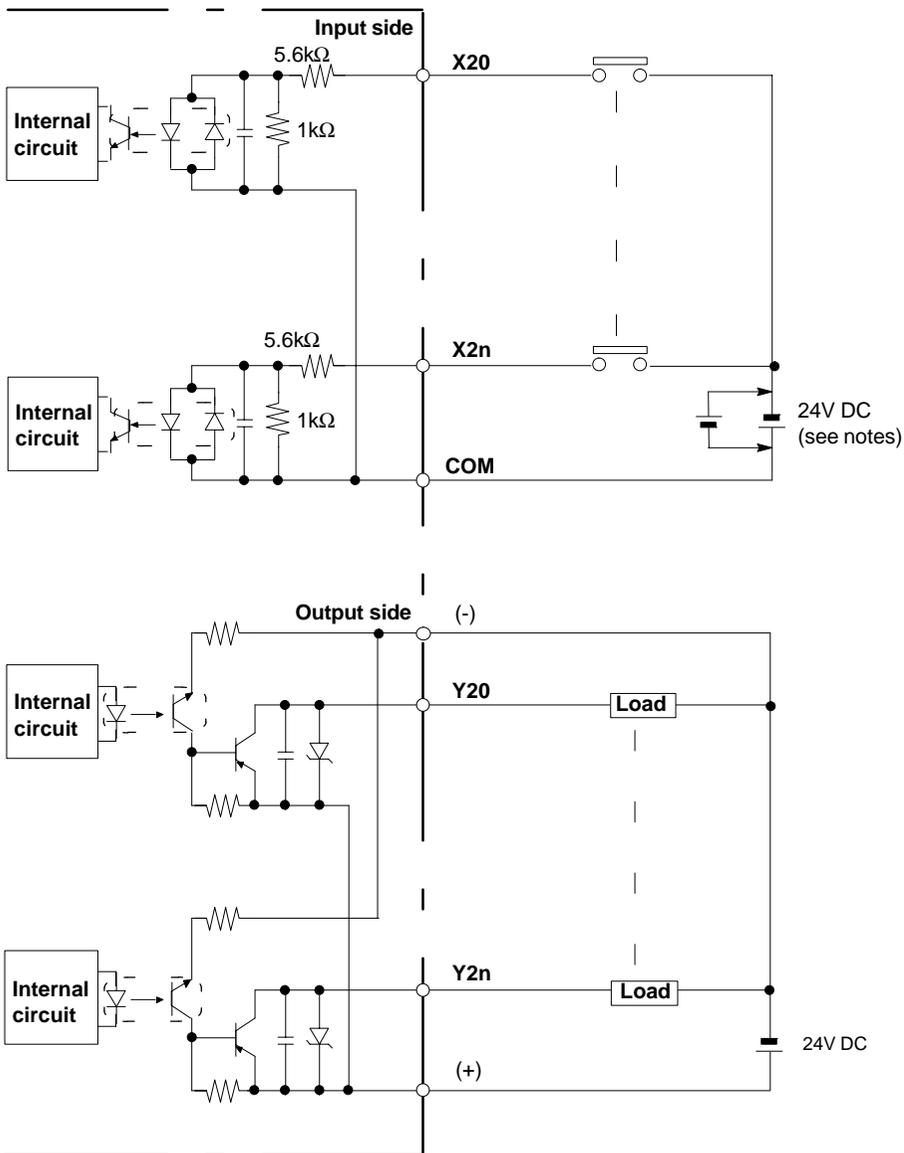


### Notes

- Either positive or negative polarity is possible for the input voltage supply.
- The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (see page 78).

## PNP Open Collector Type

FP0-E16P/E32PT

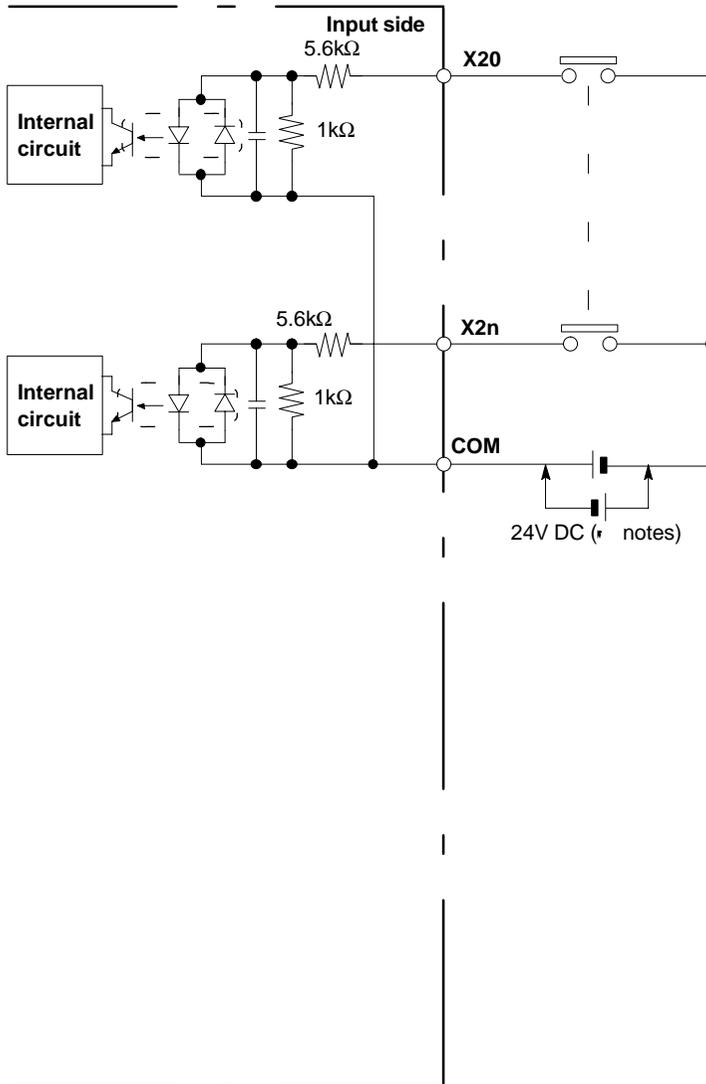


## Notes

- Either positive or negative polarity is possible for the input voltage supply.
- The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit (see page 78).

### 3.3.3 Expansion Input Units

FP0-E8X/E16X



#### Notes

- Either positive or negative polarity is possible for the input voltage supply.
- The input number given above is the input number when the expansion input unit is installed as the first expansion unit (see page 78).

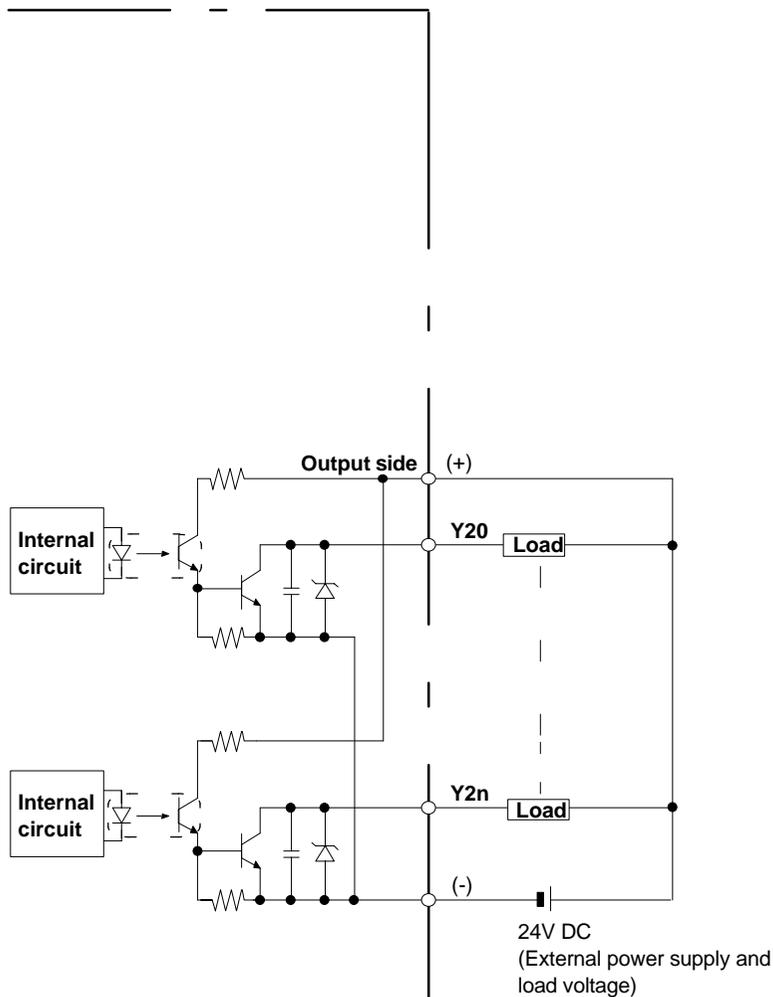
### 3.3.4 Expansion Output Units

#### NPN Open Collector Type

##### When the load voltage and external power supply are the same

This example is when the values of the rated load voltage and external power supply for driving the internal circuit are the same. In this set-up, there is only one power supply.

#### FP0-E8YT/E16YT



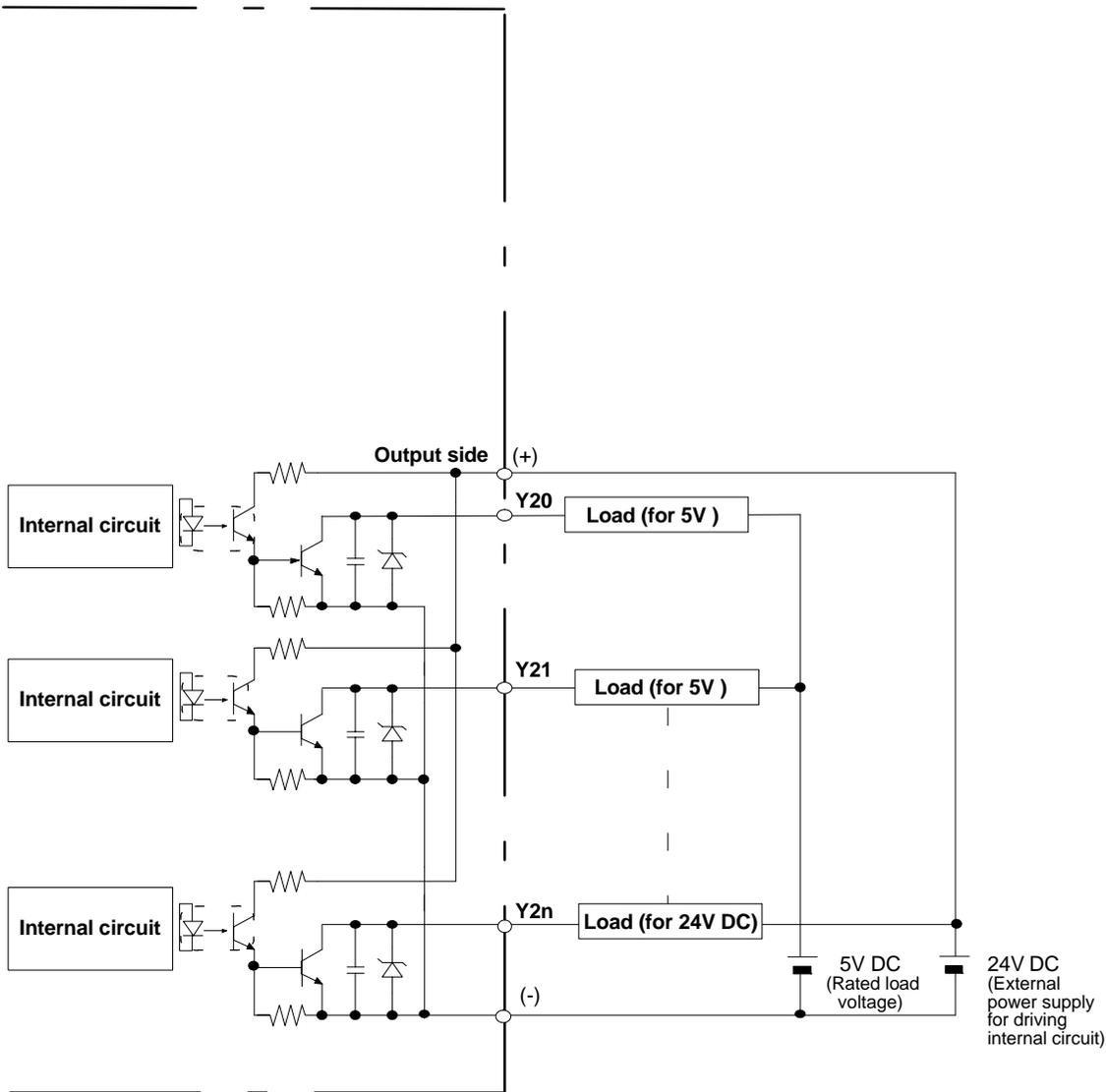
#### Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (see page 78).

#### When the load voltage differs from the 24V DC external power supply for driving the internal circuit

Other than 24V DC load voltage, 5V DC and 12V DC and other load voltages can be connected.

**FP0-E8YT/E16YT**

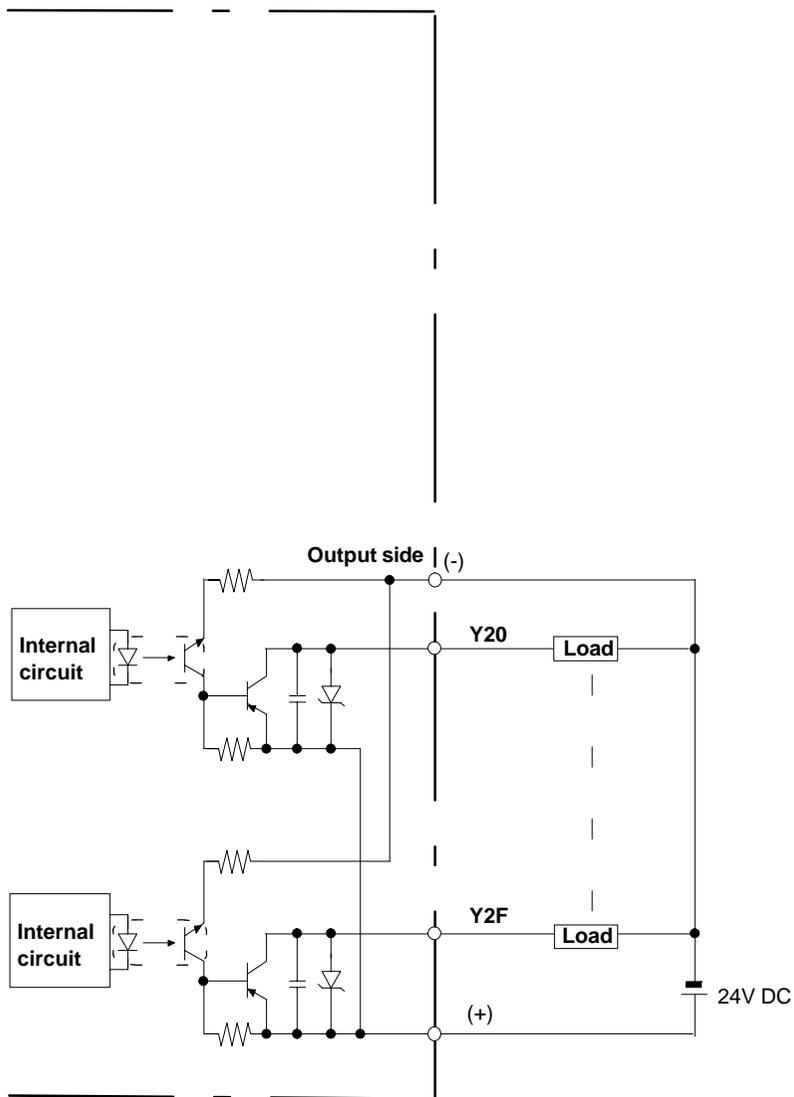


**Note**

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (see page 78).

### PNP Open Collector Type

FP0-E8YP/E16YP



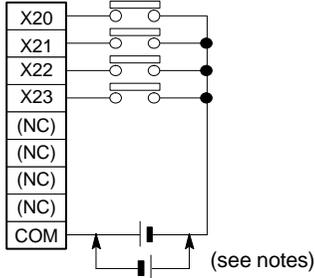
#### Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (see page 78).

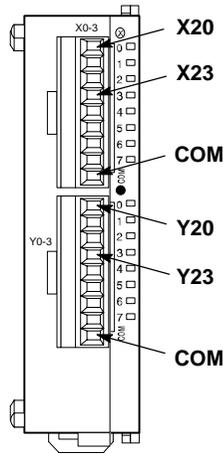
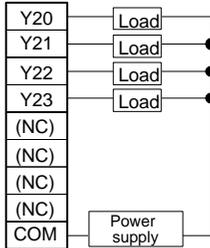
## 3.4 Pin Layouts

### 3.4.1 E8RS

**Inputs**



**Outputs**

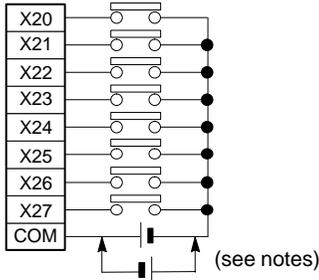


**Notes**

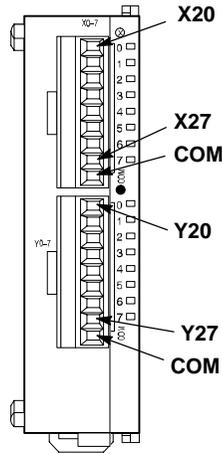
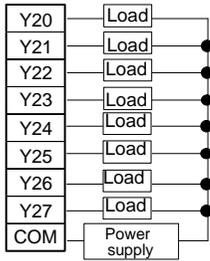
- Either positive or negative polarity is possible for the input voltage supply.
- The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 78).

### 3.4.2 E16RS

**Inputs**



**Outputs**

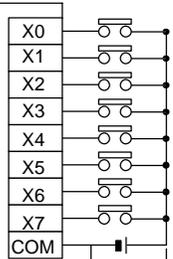


**Notes**

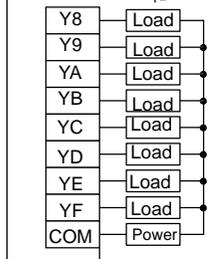
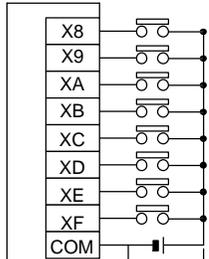
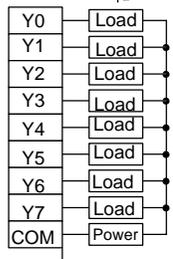
- Either positive or negative polarity is possible for the input voltage supply.
- The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 78).

### 3.4.3 E32RS

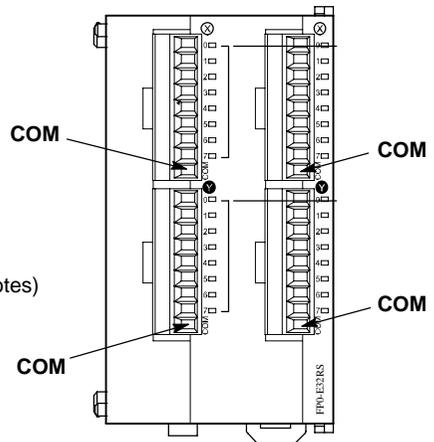
**Inputs**



**Outputs**



(see notes)

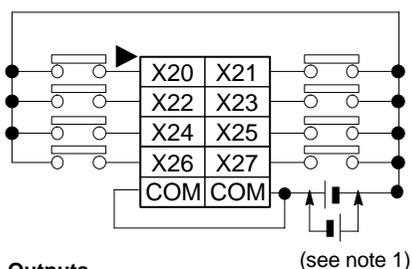


 **Notes**

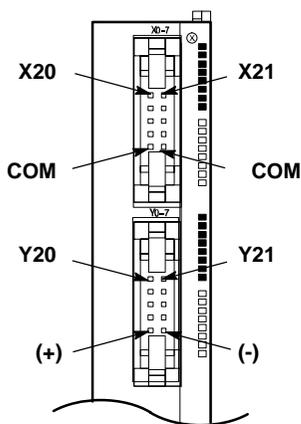
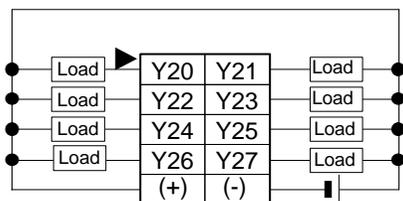
- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 78).**

**3.4.4 E16T**

**Inputs**



**Outputs**

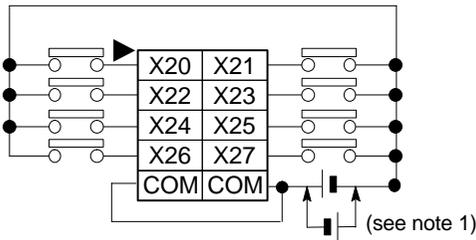


 **Notes**

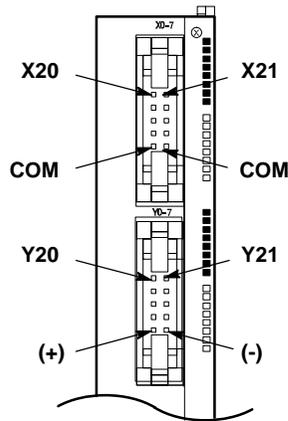
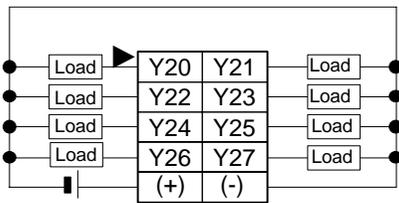
- 1) **Either positive or negative polarity is possible for the input voltage supply.**
- 2) **The two COM terminals of input terminals are connected internally, however they should be externally connected as well.**
- 3) **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 78).**

### 3.4.5 E16P

**Inputs**



**Outputs**

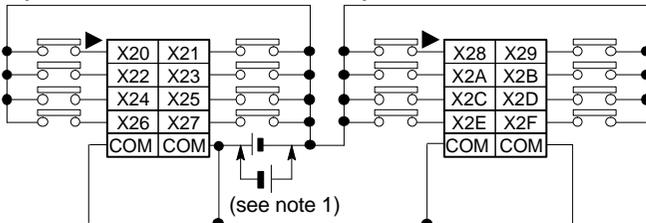


**Notes**

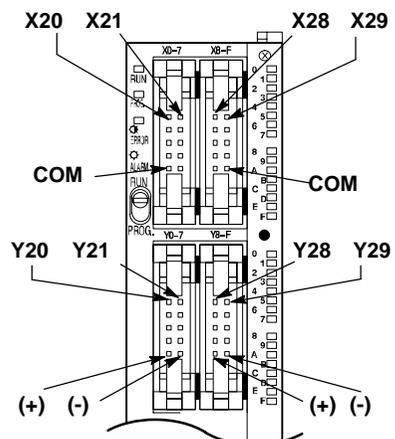
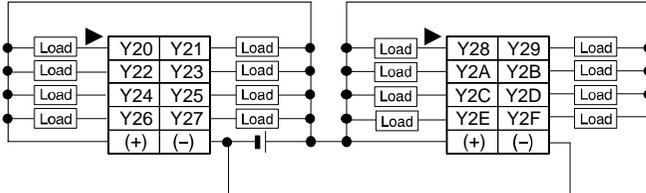
- 1) Either positive or negative polarity is possible for the input voltage supply.
- 2) The two COM terminals of input terminals are connected internally, however they should be externally connected as well.
- 3) The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 78).

### 3.4.6 E32T

**Inputs**



**Outputs**

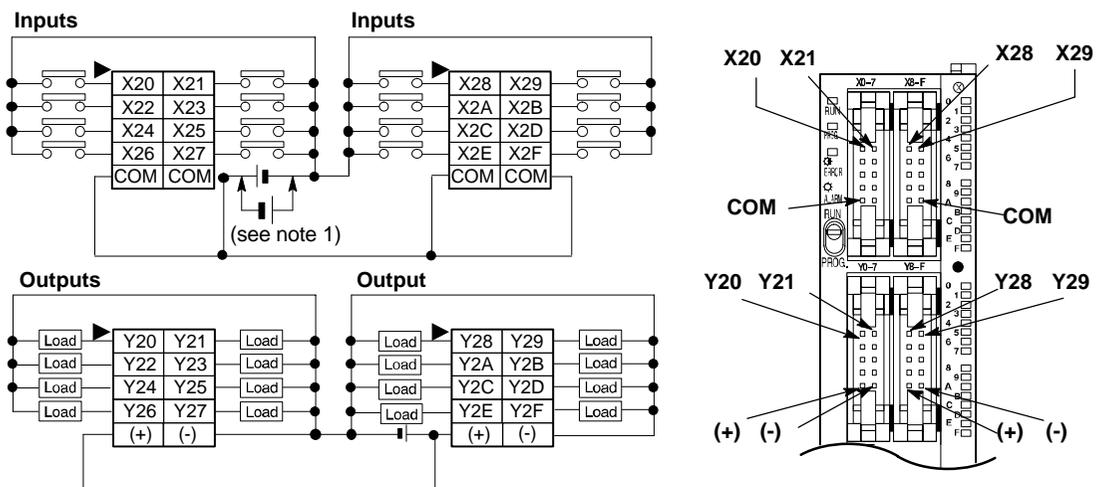


**Notes**

- 1) Either positive or negative polarity is possible for the input voltage supply.

- 2) The four COM terminals of input terminals are connected internally, however they should be externally connected as well.
- 3) The two (+) terminals of output terminals are connected internally, however they should be externally connected as well.
- 4) The two (-) terminals of the output terminals are connected internally, however they should be externally connected as well.
- 5) The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit.  
The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 78).

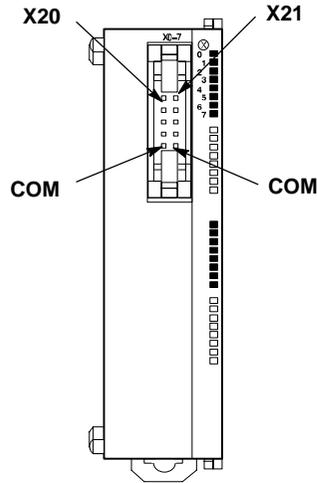
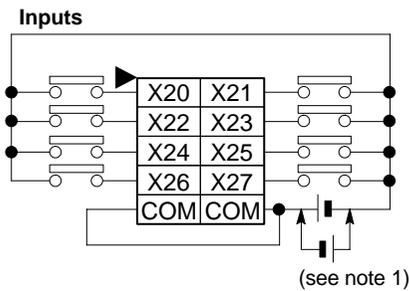
### 3.4.7 E32P



#### Notes

- 1) Either positive or negative polarity is possible for the input voltage supply.
- 2) The four COM terminals of input terminals are connected internally, however they should be externally connected as well.
- 3) The two (+) terminals of output terminals are connected internally, however they should be externally connected as well.
- 4) The two (-) terminals of the output terminals are internally connected, however they should be externally connected as well.
- 5) The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit.  
The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 78).

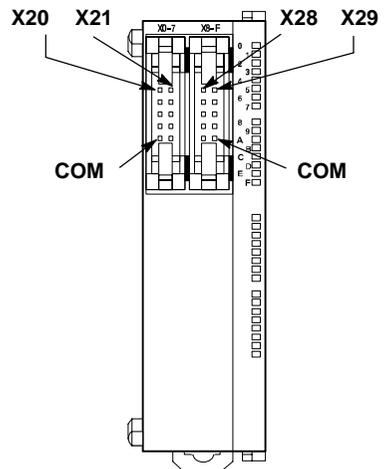
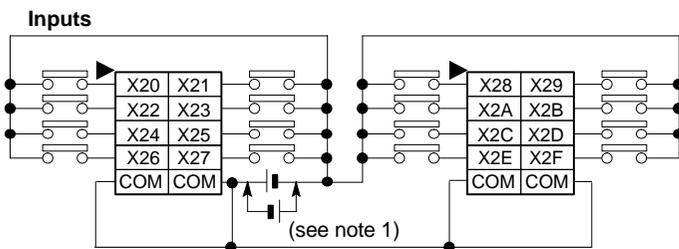
### 3.4.8 E8X



#### Notes

- 1) Either positive or negative polarity is possible for the input voltage supply.
- 2) The two COM terminals of input terminals are connected internally, however they should be externally connected as well.
- 3) The input number given above is the input number when the expansion input unit is installed as the first expansion unit. The input numbers for the expansion input units will differ depending on the location where they are installed (see page 78).

### 3.4.9 E16X



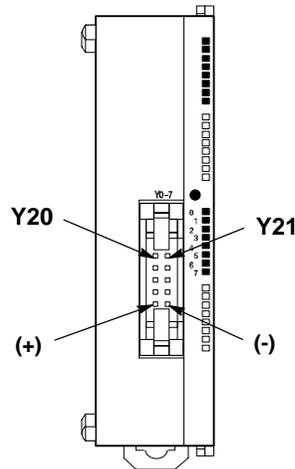
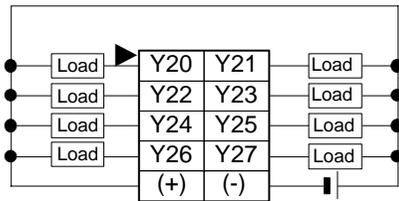
#### Notes

- 1) Either positive or negative polarity is possible for the input voltage supply.

- 2) The four COM terminals of input terminals are connected internally, however they should be externally connected as well.
- 3) The input number given above is the input number when the expansion input unit is installed as the first expansion unit. The input numbers for the expansion input units will differ depending on the location where they are installed (see page 78).

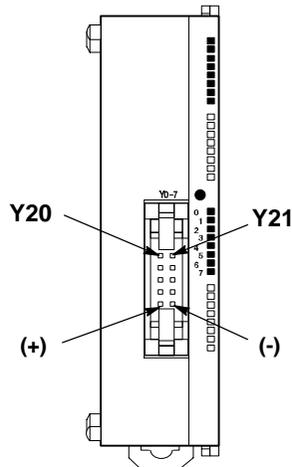
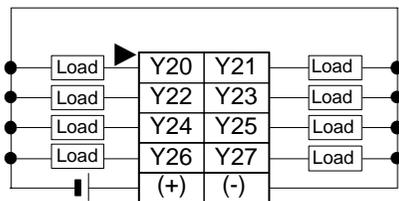
### 3.4.10 E8YT

Outputs



### 3.4.11 E8YP

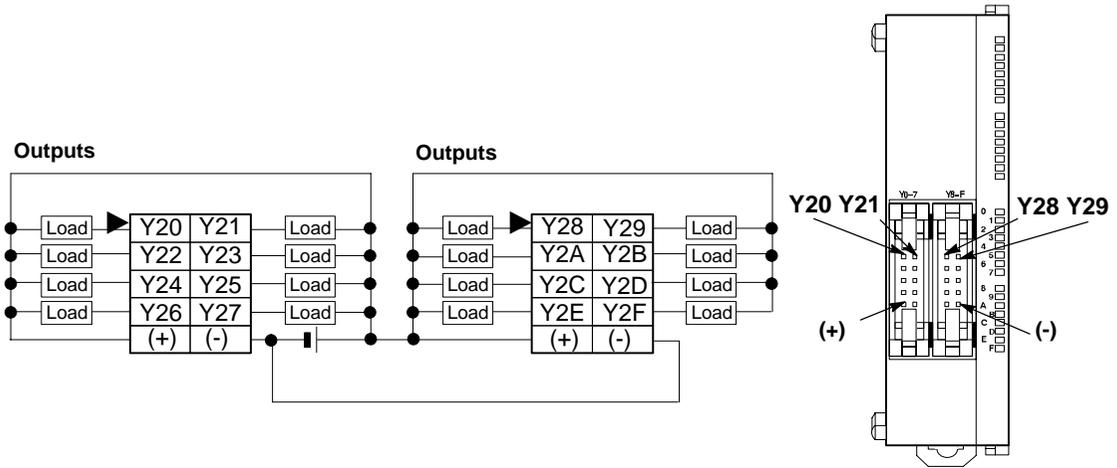
Outputs



**Note**

The output number given above is the output number when the expansion output unit is installed as the first expansion unit. The output numbers for the expansion output units will differ depending on the location where they are installed (see page 78).

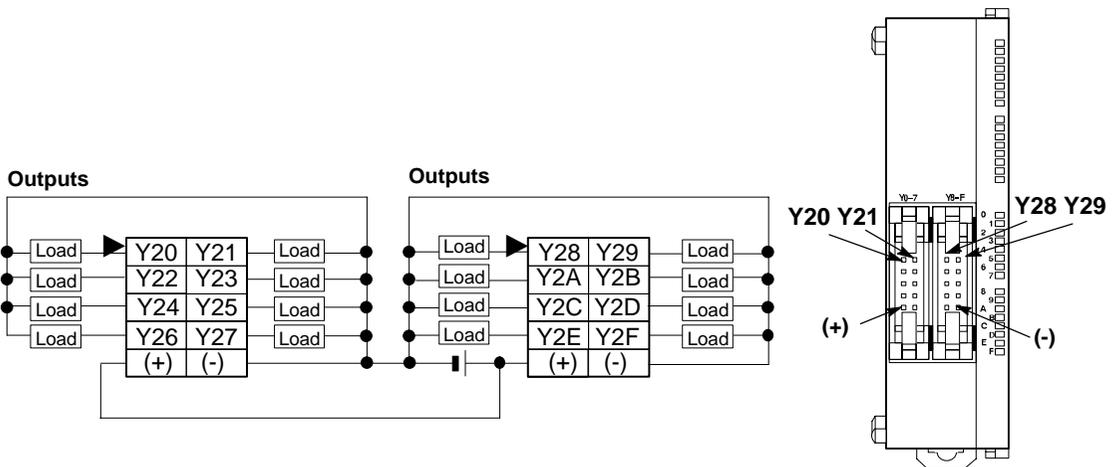
### 3.4.12 E16YT



#### Notes

- The two (+) terminals of the output terminals are connected internally, however they should be externally connected as well.
- The two (-) terminals of the output terminals are connected internally, however they should be externally connected as well.
- The output number given above is the output number when the expansion output unit is installed as the first expansion unit. The output numbers for the expansion output units will differ depending on the location where they are installed (see page 78).

### 3.4.13 E16YP



#### Notes

- The two (+) terminals of the output terminals are connected internally, however they should be externally connected as well.

- **The two (-) terminals of the output terminals are connected internally, however they should be externally connected as well.**
- **The output number given above is the output number when the expansion output unit is installed as the first expansion unit. The output numbers for the expansion output units will differ depending on the location where they are installed (see page 78).**

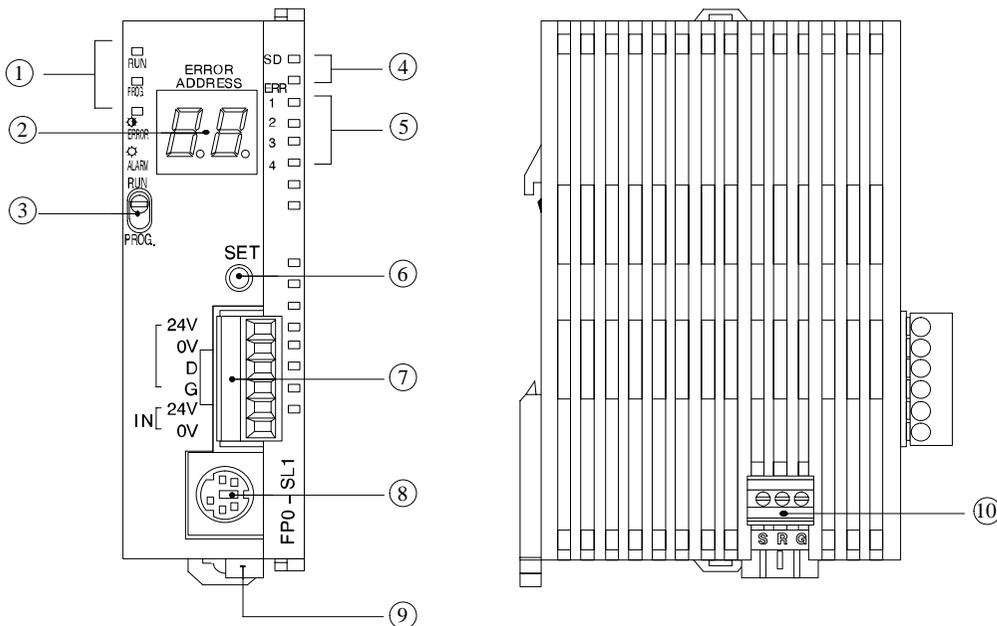


# Chapter 4

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## S-LINK Control Unit

## 4.1 Names and Functions



### ① Status indicator LED

The LED displays the operation mode and error statuses.

### ② ERROR ADDRESS display (2-digit hexadecimal display)

The address at which the S-LINK system error occurred is displayed.

### ③ Mode switch

The mode switch changes the operation mode.

### ④ Transmission indicator (SEND)

This flashes when input or output data is transmitted between the various units of the S-LINK system.

### ⑤ ERROR indicators

These light if an error occurs in the S-LINK system.

ERR1 (Error 1): Short circuit between D - G line.

ERR2: Unused

ERR3 (Error 3): Abnormal voltage level between D - G line.

ERR4 (Error 4): Broken wire or S-LINK I/O device error

### ⑥ System SET button

Pressing the system SET button reads the connection status for the S-LINK system and stores it in the memory. In subsequent operation, the S-LINK unit checks for errors using the connection status registered at this time.

The output unit data effective at the time that the system SET button was pressed is retained.

### ⑦ S-LINK terminal block (6-pin)

The power supply and signal wires of the S-LINK system are connected to the S-LINK terminal block.

The S-LINK terminal block can be detached from the FP0 S-LINK control unit for wiring operations.

For detailed information, refer to section “4.4.2 Wiring to S-LINK Terminal Block.”

⑧ **Tool port (RS232C)**

The tool port (RS232C) is used to connect a programming tool.

⑨ **Power supply connector**

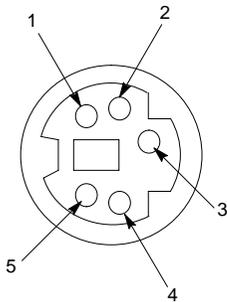
Supply 24V DC to the power supply connector. It is connected using the power supply cable (AFP0581) that comes with the unit.

⑩ **RS232C port**

Use this port to connect to devices with an RS232C port, such as an I.O.P., a bar code reader, or an image checker, enabling data input and output.

**Tool port (RS232C) specifications**

**Pin assignment**



Pin no.	Abbreviation
1	—
2	SD (TXD)
3	SG
4	RD (RXD)
5	+ 5 V

**Settings when shipped from the factory**

Default value	
	Baud rate: 9600bps
	Character bit: 8bits
	Parity check: Odd
	Stop bit: 1bit

## 4.2 General Specifications

---

Item	Description
Rated operating voltage	24V DC
Operating voltage range	21.6V to 26.4V DC
Rated current consumption	150mA or less
Allowed momentary power off time	10ms at 21.6V, 10ms at 24V
Ambient temperature	0°C to +55°C/32°F to +131°F
Storage temperature	-20 °C to +70°C/-4 °F to +158°F
Ambient humidity	30% to 85% RH (non-condensing)
Storage humidity	30% to 85% RH (non-condensing)
Breakdown voltage	500V AC for 1 minute between S-LINK terminal block and power supply/ground terminals
Insulation resistance	min. 100MΩ (measured with a 500V DC megger) between S-LINK terminal block and power supply/ground terminals
Vibration resistance	10Hz to 55Hz, 1 cycle/min: double amplitude of 0.75mm/ 0.030in., 10 min on 3 axes
Shock resistance	Shock of 98m/s <sup>2</sup> or more, 4 times on 3 axes
Noise immunity	1,000 Vp-p with pulse widths 50ns and 1μs (based on in-house measurements)
Operating condition	Free from corrosive gases and excessive dust

## 4.3 S-LINK Controller Specifications

Item	Description	
<b>Rated power supply voltage</b>	24V DC +/-10% / Allowable ripple p - p +/-10% max. (Supplied from IN - 24V, IN - 0V of the S-LINK terminal block)	
<b>Current consumption (* note 1)</b>	[S-LINK controller current consumption (including D - G line current consumption)] 24V DC 1.6A max. [Maximum current which can be supplied (supplied to S-LINK unit and I/O devices from 24V - 0V line)] + 24V DC 5A (fuse: 5A)	
<b>Transmission method</b>	Bi-directional time-divided multiple signal transmission	
<b>Synchronization method</b>	Bit synchronization, frame synchronization	
<b>Transmission protocol</b>	S-LINK protocol	
<b>Transmission speed</b>	28.5kbps	
<b>Transmission delay time</b>	Max. 10.7ms	
<b>Transmission distance</b>	Main signal wire: up to a distance to 200m max. (400m when a booster is used)	
<b>FAN-out (* note 2)</b>	320	
<b>Connection method (* note 3)</b>	'T'-branch multi-drop wiring	
<b>No. of input/output points</b>	64 points input/64 points output Fixed	
<b>Display indicators</b>	<b>Transmission display (SEND)</b>	Green LED blinks in response to synchronization signals
	<b>Error indicator</b>	Red LED light up depending on the error
	<b>Error address display</b>	If the system error occurs, the error address is displayed using the red 7-segment LED.



### Notes

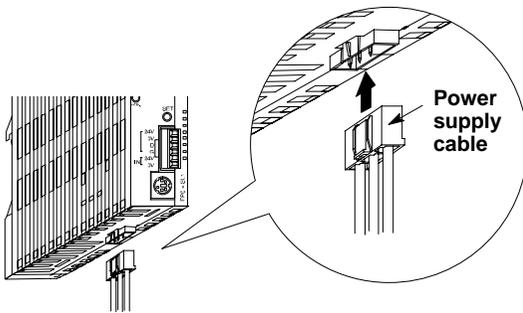
- 1) For detailed information on current consumption, refer to “Determining the Power Supply” in the “S-LINK Design Manual.”
- 2) The output capacitance for the D-G line of the S-LINK controller and booster is indicated by FAN-out, and the input capacitance from the D-G line of the S-LINK configuration unit is indicated by FAN-in. When configuring the S-LINK system, the configuration should be set up so that the FAN-out total > or = the FAN-in total. (For detailed information on calculating the FAN-in value and other values, see the “S-LINK Design Manual.”
- 3) The FP0 S-LINK control unit does not have a loop wiring function.

## 4.4 Wiring the Power Supply

With the FP0 S-LINK control unit, power must be supplied at two locations (power supply connector and S-LINK terminal block).

### 4.4.1 Wiring to Power Supply Connector

This is the power supply for the programmable controller section and the S-LINK controller in the S-LINK control unit (24V DC, 150mA).

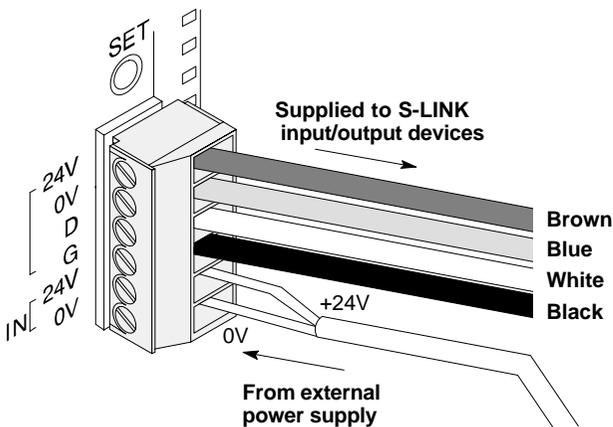


### 4.4.2 Wiring to S-LINK Terminal Block

This is the power supply for the S-LINK controller in the S-LINK control unit and other S-LINK input/output devices to which power is supplied through the 24V - 0V line of the S-LINK main cable.

The current consumption for the overall S-LINK system is calculated by referring to the section entitled "Determining the Power Supply" in the "S-LINK Design Manual." (For standard purposes, a power supply exceeding 24V DC, 1.6 A should be selected.)

#### Supply of power to S-LINK terminal block



S-LINK terminal block: MC1.5/6-ST-3.5 (Made by Phoenix Contact Co.)

Terminal name	Color of connecting cable	Description
24V	Brown	Main wire (for S-LINK I/O devices)
0V	Blue	
D	White	
G	Black	
IN-24V	—	External power supply input for S-LINK
IN-0V	—	

### Suitable wires (twisted wire)

Size	AWG#20 to 16
Normal cross-section surface area	0.5 to 1.25mm <sup>2</sup>



### Notes

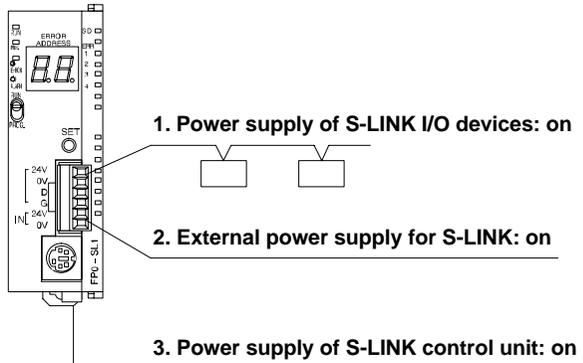
- The S-LINK section is protected by a fuse, but if too many input/output devices are connected, or if the current consumption is heavy enough to cause the fuse to blow, we recommend providing a local power supply.
- A short-circuit between D-G, or between D-24V, triggers the protective circuit, but there is no protection against short-circuiting between G-24V or 0V-24V. Be aware that a short-circuit can cause a breakdown or malfunction.

## 4.5 Sequence of Turning on Power Supplies

When turning on the power supplies to the S-LINK control unit, follow the sequence outlined below.

### Procedure:

1. Turn on the power supply to the S-LINK I/O devices connected to the S-LINK system.
2. Turn on the external power supply to the S-LINK.
3. Last, turn on the power supply to the S-LINK control unit itself.



If using the power supply of booster, start up the booster before the external power supply for S-LINK.

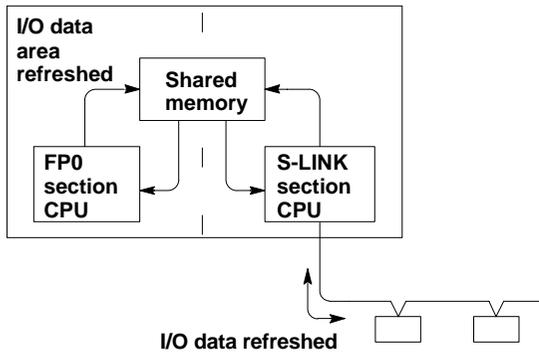
When turning off the power supplies, reverse the order of the sequence noted above.

## 4.6 Operation When Power Supply is Turned On

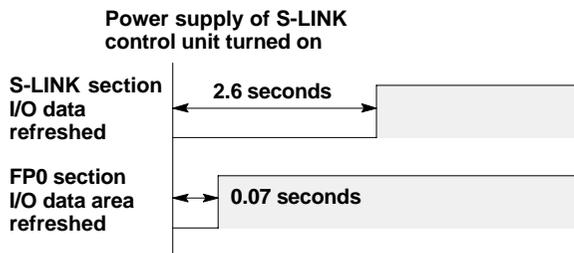
### Refreshing S-LINK I/O data

With the S-LINK control unit, I/O data is refreshed by the CPUs of both the FP0 section and the S-LINK section, through the memory shared between them.

#### S-LINK control unit



The illustration below shows the time required until the first refreshing is completed by the S-LINK control unit after the power supply has been turned on. (The external power supply for the S-LINK is already on.)



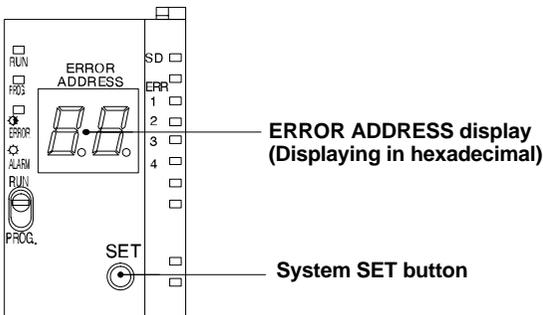
When the power supply to the S-LINK control unit is turned on, it takes approximately 2.6 seconds for the S-LINK I/O data to be verified by the FP0 section. Be particularly careful with regard to the FP0 sequence program, if using the S-LINK input at the b contact relay when the power supply is turned on.

## 4.7 S-LINK System Address Recognition

### 4.7.1 Recognizing the Address

Before the S-LINK system is being operated for the first time, turn on the power supply and then press the system SET button.

When the system SET button is pressed, the number of connected devices recognized by S-LINK control unit blinks on the error address display in hexadecimal.



If the actual number of connected devices differs from the number displayed, since an unrecognized S-LINK device exists, check for address overlapping, improper connection, etc..

Subsequently, an error check is carried out based on this status. When an address is recognized, that status is stored in the EEPROM, so it is not necessary to press the system SET button after that point (each time the power supply is turned on).

When the power supply is switched on for the first time after completing the S-LINK system wiring, an arbitrary error display may appear. This does not indicate any abnormal operation. If the system SET button is pressed, this display is erased.

If an error address is displayed during operation, confirm the address, and then turn off the power supply, correct the address at the location where the error occurred, and turn the power supply on again. Check to make sure the error address display has disappeared. (Do not press the system SET button in this case.)

If the system SET button is pressed after an error has occurred and before it is canceled, the error will be canceled. If the cause of the error has not been corrected at that point, however, be aware that the I/O device for that address will be skipped during any subsequent checks.



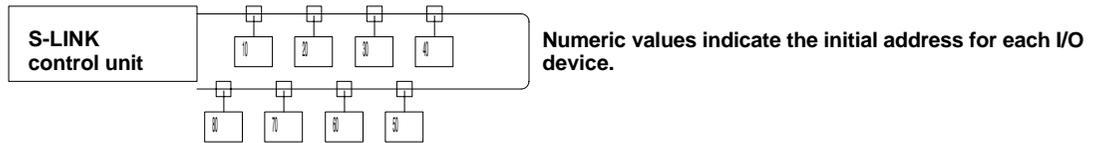
#### Note

**If the system SET button is pressed without recovery having been made, that status will be recognized for that address, and any locations where recovery has not been made will not be recognized.**

### 4.7.2 Address Setting of S-LINK I/O Device

Addresses can be set freely, regardless of the position of the I/O device connected to the system, but problems in the wiring of the main cable, such as broken or disconnected wires, can be detected more easily if I/O devices closer to the S-LINK control unit are given smaller addresses,

and addresses increase in sequential order for I/O devices which are farther away from the S-LINK control unit.



Up to two I/O devices can be assigned the same address within the system for any individual S-LINK control unit. Do not set the same address for three or more I/O devices.

Up to seven boosters can be connected to one system for any individual S-LINK control unit, but the actual number which can be connected varies depending on the units configuring the system and the wiring length.

**Note**

**The FP0 S-LINK control unit does not have a loop wiring function.**

## 4.8 Judging Errors from the Error Indicators

If an error occurs in the S-LINK system, the ERROR indicator indicated in the table below lights, depending on the content of the error.

ERROR indicators				Description	Steps to take
ERR1	ERR2	ERR3	ERR4		
on	off	on	off	Short-circuit between D-G ☛ note 1	If the ERR1 or ERR3 indicator lights, output of the signal being transmitted stops, and none of the S-LINK devices connected to the system will operate. Also, if a short-circuit occurs at a location far away, there may be times when ERR1 does not light. Check the S-LINK signal/power line.
off	off	on	off	Error in level of signal being transmitted	There is a possibility that the wiring length, the configuration, or the number of configuration devices connected to the system exceeds the rated limit. Check the system configuration once again.
off	off	off	on	Address has been changed/ D or G line is broken or disconnected/ Error in S-LINK unit for displayed address ☛ note 2	Check to see if the S-LINK signal/power line is broken or disconnected, or if the address is incorrect. In this case, transmission signals are being output, so the S-LINK input/output devices operate normally.

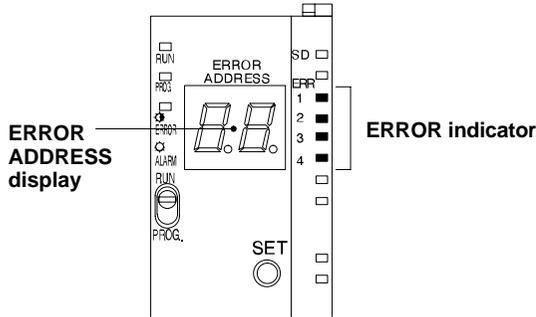


### Notes

- 1) This ERROR indicator lights even if the external power supply to the S-LINK has not been turned on, but this does not indicate a breakdown in the S-LINK control unit itself. Check the external power supply to the S-LINK.
- 2) ERR4 is held, so to cancel it, one of the following is required: turn the power supply to the FP0 off and then on again, press the system SET button and enter the settings again, or turn the power supply on the S-LINK side off and then on again.

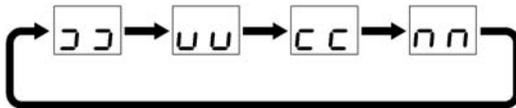
## 4.9 Judging Errors Address Displays

The transmission line is monitored at all times, and if an error occurs, the address at which the error occurred is displayed as a hexadecimal value.



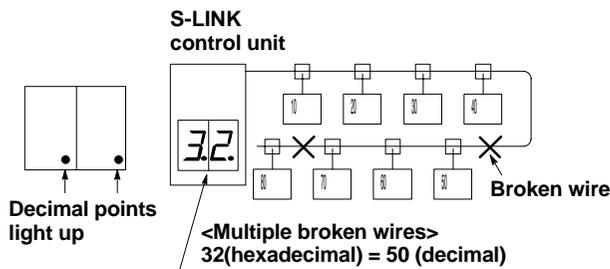
During normal transmission:

The “**33**” shaped character rotates in the clockwise direction.



If an error occurs:

The address is displayed. In case faults occur at several locations, the smallest error address is displayed and the decimal points light up simultaneously.



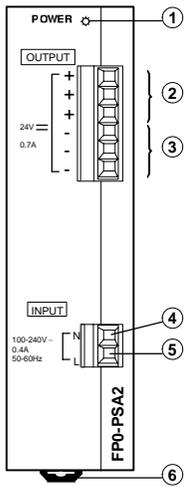


# Chapter 5

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## Power Supply Unit

## 5.1 Power Supply Unit, FP0-PSA2



- ① LED is ON, when the output is on
- ② 24V DC output terminals, 0,7A
- ③ 0V DC output terminals, 0,7A
- ④ N: 100-240V AC input terminal, 0,4A
- ⑤ L: 100-240V AC input terminal, 0,4A
- ⑥ DIN hook

## 5.2 Specifications

Performance Specifications		
Primary Side	Rated operating voltage	115/230V AC
	Operating voltage range	85 to 265V AC
	Rated operating frequency	50/50Hz
	Operating frequency range	40 to 70Hz
	Inrush current	<50A at 55° C/131°F
	Current consumption	145mA (at 230V and 0.7A output current)
	Over voltage protection	PROTECTED
Secondary Side	Rated output voltage	24V DC
	Output voltage range	23.5V to 24.5V DC
	Nominal output current	0.7A
	Output current range	0 to 0.7A
	Output ripple	<60mVpp
	Short circuit protected	electronic, automatic restart mode
	Over voltage protected	Yes
	Over load protected	Yes (switch off at -0.8A and more)
	Holding time	min. 20ms at 230V AC

General Specifications	
Characteristics	primary switched, temperature and current peak controlled
Ambient temperature	0° C/32°F to +55° C/131°F
Storage temperature	-20° C/-4°F to +70° C/158°F
Ambient humidity	5 to 95% non condensing
Storage humidity	5 to 95% non condensing
Vibration resistance	10 to 55Hz, 1 cycle/min., double amplitude of 0.75mm, 10 min. on 3 axes
Shock resistance	10g min., 4 times on 3 axes
Life time min.	7 years at nom. load, 25° C/77°F ambient temperature, 20000h at 55° C/131°F with full load/continuous operation
Mounting	DIN rail or FPO flat attachment plate
Size	90× 60× 30.4mm
Input connector AC side	MC connector, 2 pin
Output connector	DC connector, 6 pin, 3 pins for "+" and 3 pins for "-"
Status display	LED (green) at the front side for the secondary voltage indication



### Note

Before you turn the power on, see page 108.



# Chapter 6

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## I/O Allocation

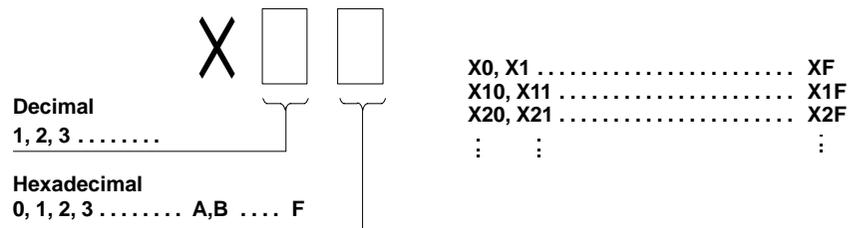
## 6.1 I/O Number

Since input relay (X) and output relay (Y) are handled in units of 16 points, they are expressed as a combination of decimal and hexadecimal numbers as shown below.



**Example:**

### External input relay (X)



### Specifying X and Y numbers

On the FP0, the same numbers are used for input and output.

Example: The same number "X20 and Y20" can be used for input and output

## 6.2 Control Unit

---

The I/O allocation of the FP0 control unit is fixed.

Type		I/O number
C10RS, C10CRS	Input: 6 points	X0 to X5
	Output: 4 points	Y0 to Y3
C14RS, C14CRS	Input: 8 points	X0 to X7
	Output: 6 points	Y0 to Y5
C16T, C16CT, C16P, C16CP	Input: 8 points	X0 to X7
	Output: 8 points	Y0 to Y7
C32T, C32CT, C32P, C32CP, T32CP, T32TP	Input: 16 points	X0 to XF
	Output: 16 points	Y0 to YF

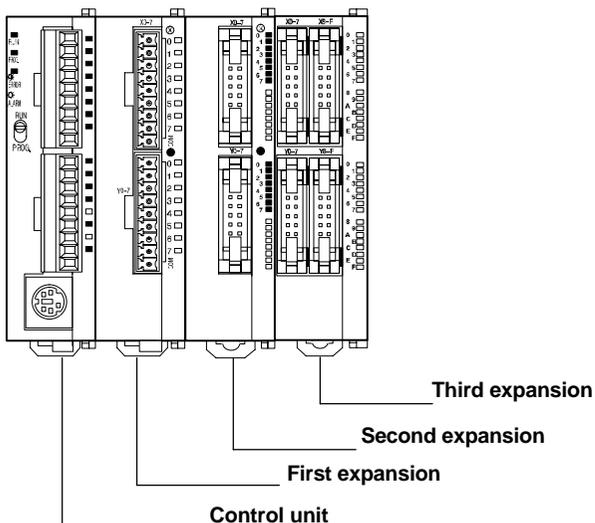
### 6.3 Expansion I/O Unit

Up to three expansion I/O units can be added.

I/O numbers do not need to be set as I/O allocation is performed automatically by the FP0 control unit when an expansion I/O unit is added.

The I/O allocation of expansion I/O unit is determined by the installation location.

Type		I/O number		
		First expansion	Second expansion	Third expansion
E8RS	Input: 4 points	X20 to X23	X40 to X43	X60 to X63
	Output: 4 points	Y20 to Y23	Y40 to Y43	Y60 to Y63
E8X	Input: 8 points	X20 to X27	X40 to X47	X60 to X67
E8YT/E8YP	Output: 8 points	Y20 to Y27	Y40 to Y47	Y60 to Y67
E16RS/E16T/E16P	Input: 8 points	X20 to X27	X40 to X47	X60 to X67
	Output: 8 points	Y20 to Y27	Y40 to Y47	Y60 to Y67
E16X	Input: 16 points	X20 to X2F	X40 to X4F	X60 to X6F
E16YT/E16YP	Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F
E32T/E32P/E32RS	Input: 16 points	X20 to X2F	X40 to X4F	X60 to X6F
	Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F



# Chapter 7

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## Installation

## 7.1 Important Notes

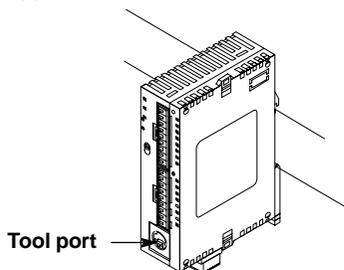
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Please, read the following notes carefully before installing your FP0.

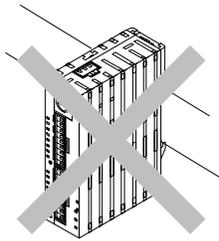


### Notes

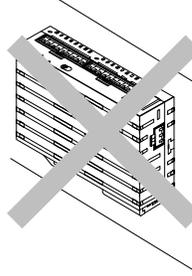
- **Avoid installing the unit in the following locations:**
  - Ambient temperatures outside the range of 0°C to 55°C/32°F to 131°F
  - Ambient humidity outside the range of 30% to 85% RH
  - Sudden temperature changes causing condensation
  - Inflammable or corrosive gases
  - Excessive airborne dust or metal particles
  - Benzene, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda
  - Excessive vibration or shock
  - Direct sunlight
  - Water in any form including spray or mist
- **Avoid noise interference from the following items:**
  - Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges
  - If noise occurs in the power supply line even after the above countermeasures are taken, it is recommended to supply power through an insulated transformer, noise filter, or the like.
- **Measures regarding heat discharge**
  - Always install the unit orientated with the tool port facing outward on the bottom in order to prevent the generation of heat.



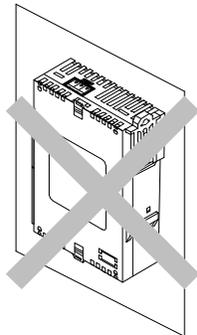
- **Do not install the FP0 control unit as shown below.**



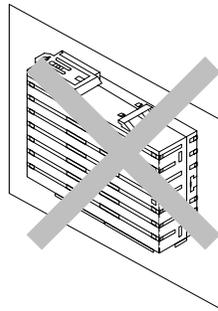
Upside-down



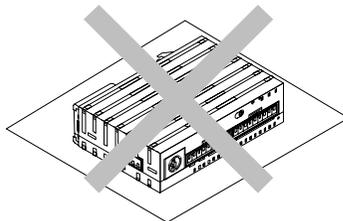
I/O connectors or I/O terminals on top



Installation which blocks the air duct

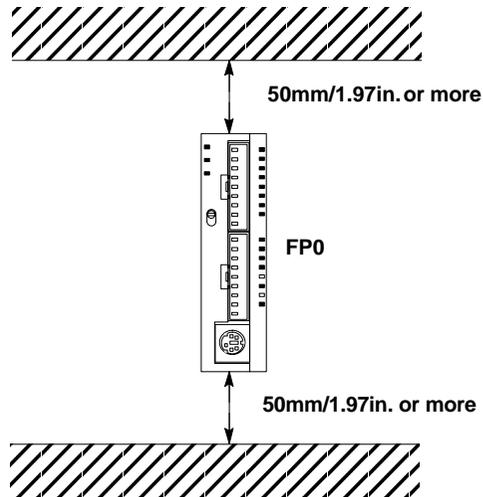


Installations such that the I/O connectors or I/O terminals face down

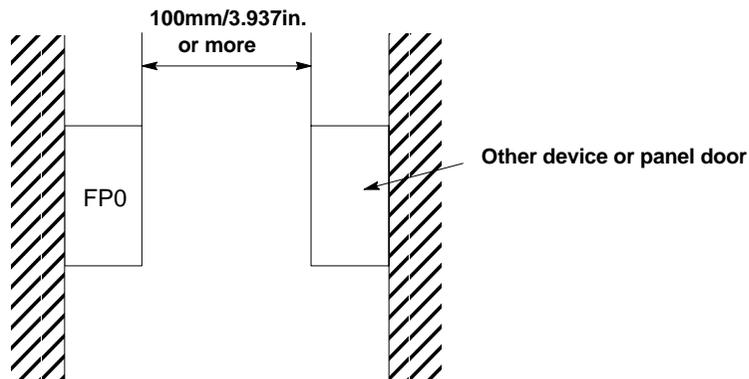


Horizontal installation of the unit

- **Do not install the unit above devices which generate heat such as heaters, transformers or large scale resistors.**
- **Installation space**
  - **Leave at least 50mm/1.97in. of space between the wiring ducts of the unit and other devices to allow heat radiation and unit replacement.**



- **Maintain a minimum of 100mm/3.937in. between devices to avoid adverse affects from noise and heat when installing a device or panel door to the front of the FP0 unit.**

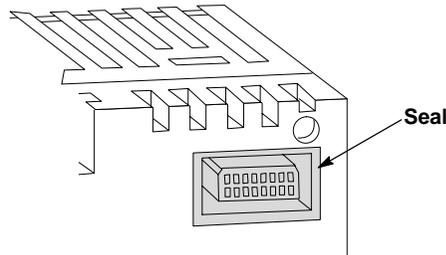


- **Keep the first 100mm/3.937in. from the front surface of the FP0 control unit open in order to allow room for programming tool connections and wiring.**

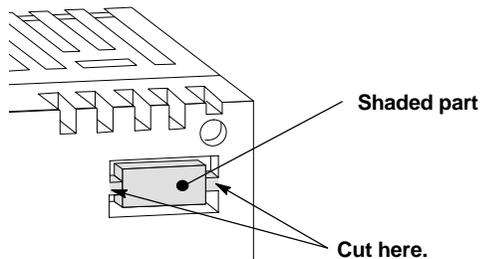
## 7.2 Adding Expansion Units

### Procedure:

1. **Peel the seal on the side of the unit so that the internal connector is exposed.**

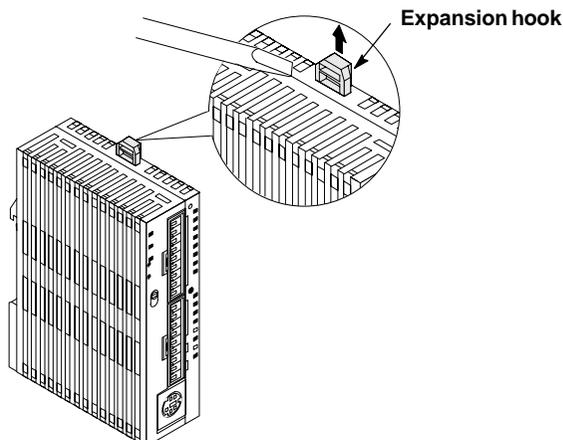


When peeling the seal on the side of the initial lot products, the shaded part is exposed. Cut off the shaded part with a pair of nippers or similar tool so that the internal connector is exposed.

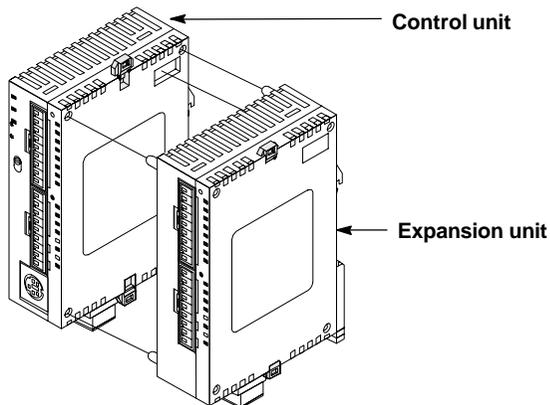


When removing the shaded part, use a sharp cutting object, making sure that the shaded part is removed leaving a smooth surface. Note that failure to remove the shaded part completely can result in damage to the connector.

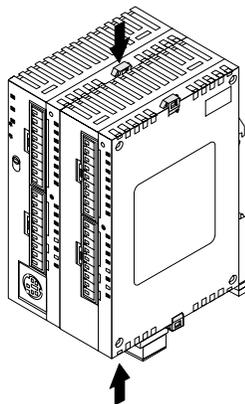
2. **Raise the expansion hooks on the top and bottom sides of the unit with a screwdriver.**



3. Align the pins and holes in the four corners of the control unit and expansion unit, and insert the pins into the holes so that there is no gap between the units.



4. Press down the expansion hooks raised in step 2 to secure the unit.

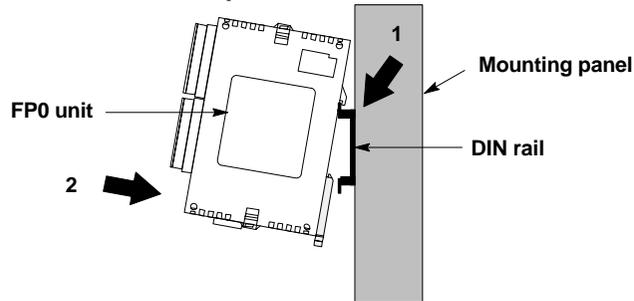


## 7.3 Attachment to DIN Rails

The FP0 unit enables one-touch attachment to DIN rails.

**Procedure:**

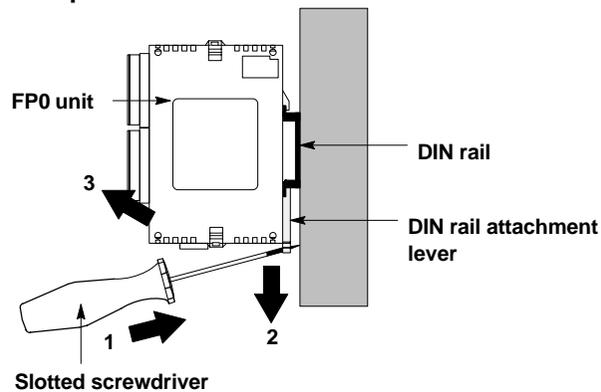
1. Fit the upper hook of the FP0 unit onto the DIN rail.
2. Without moving the upper hook, press on the lower hook to fit the FP0 unit into position.



You can easily remove the FP0 unit as described below.

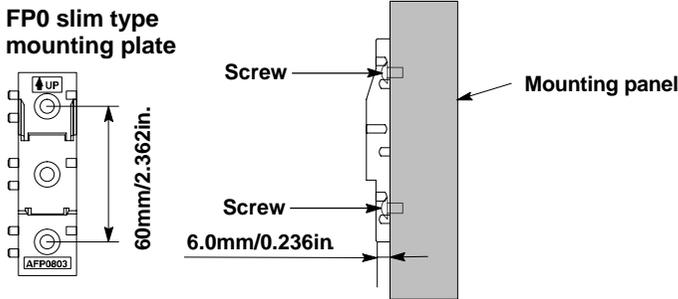
**Procedure:**

1. Insert a slotted screwdriver into the DIN rail attachment lever.
2. Pull the attachment lever downwards.
3. Lift up the FP0 unit and remove it from the rail.



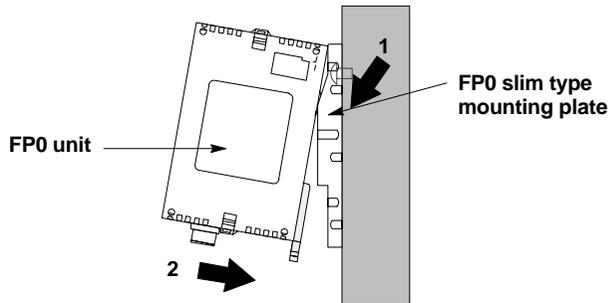
## 7.4 Installation Using FP0 Slim Type Mounting Plate

Use M4 size pan-head screws for attachment of FP0 slim type mounting plate (AFP0803) to mounting panel. For a diagram showing detailed dimensions of the FP0 slim type mounting plate, see page 155.



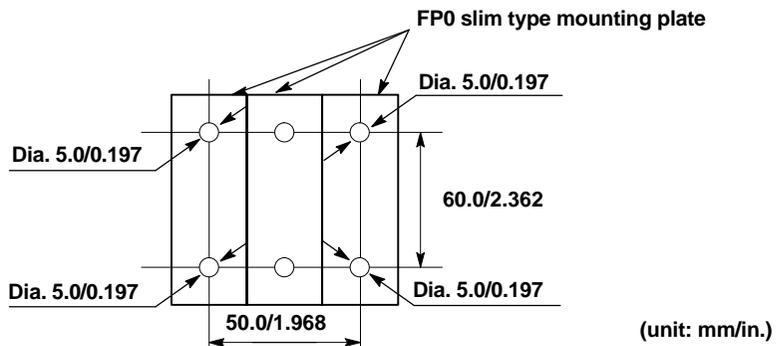
### Procedure:

1. Fit the upper hook of the FP0 unit onto the FP0 slim type mounting plate.
2. Without moving the upper hook, press on the lower hook to fit the FP0 unit into position.



When using an expansion unit, tighten the screws after joining all of the FP0 slim type mounting plate to be connected. Tighten the screws at each of the four corners.

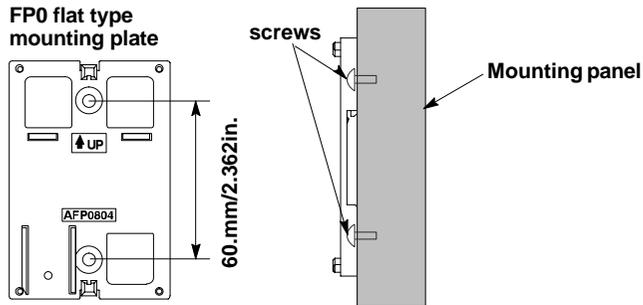
### Example: Two expansion units



## 7.5 Installation Using FP0 Flat Type Mounting Plate

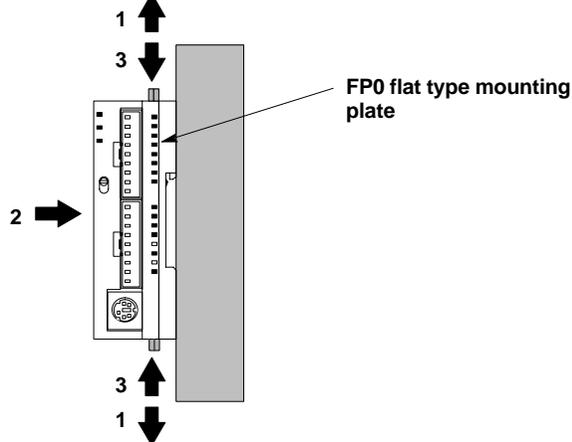
Use M4 size pan-head screws to attach FP0 flat type mounting plate (AFP0804) and install according to the dimensions shown below.

For a diagram showing detailed dimensions of the FP0 flat type mounting plate, see page 157.



### Procedure:

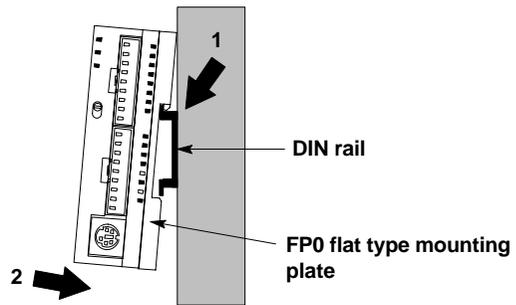
1. Raise the expansion hooks on the top and bottom of the unit.
2. Install the FP0 unit on the FP0 flat type mounting plate.
3. Align the expansion hooks with the plate and press the hooks back down.



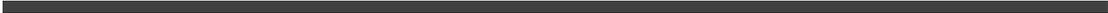
### Notes

- The FP0 flat type mounting plate (AFP0804) cannot be used for an expansion unit.

- An FP0 unit with an attached FP0 flat type mounting plate can also be installed sideways on a DIN rail.



# Chapter 8



## Wiring

## 8.1 Safety Instructions

---

In certain applications, malfunction may occur for the following reasons:

- Power ON timing differences between the FP0 control unit and I/O or motorized devices
- An operation time lag when a momentary power drop occurs
- Abnormality in the FP0 unit, power supply circuit, or other devices

In order to prevent a malfunction resulting in system shutdown choose the adequate safety circuits or other safety measures listed in the following:

### 8.1.1 Interlock Circuit

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When a motor clockwise/counter-clockwise operation is controlled, provide an interlock circuit that prevents clockwise and counter-clockwise signals from being input into the motor at the same time.

### 8.1.2 Emergency Stop Circuit

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Add an emergency stop circuit to controlled devices in order to prevent a system shutdown or an irreparable accident when malfunction occurs.

### 8.1.3 Start Up Sequence

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The FP0 should be operated after all of the outside devices are energized. To keep this sequence, the following measures are recommended:

- Set the mode switch from PROG. mode to RUN mode after power is supplied to all of the outside devices
- Program the FP0 so as to disregard the inputs and outputs until the outside devices are energized



#### Note

**When stopping the operation of FP0, also have the I/O devices turned OFF after the FP0 has stopped operating.**

### 8.1.4 Momentary Power Failures

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If the duration of the power failure is less than 5ms, the FP0 continues to operate. If the power is OFF for 5ms or longer, operation changes depending on the combination of units, the power supply voltage, and other factors. (In some cases, operation may be the same as that for a power supply reset.)

If operation is to be continued following recovery from the momentary power failure, use an automatic retaining sequence program that uses a hold type internal relay.

### 8.1.5 Protecting Power Supply and Output Sections

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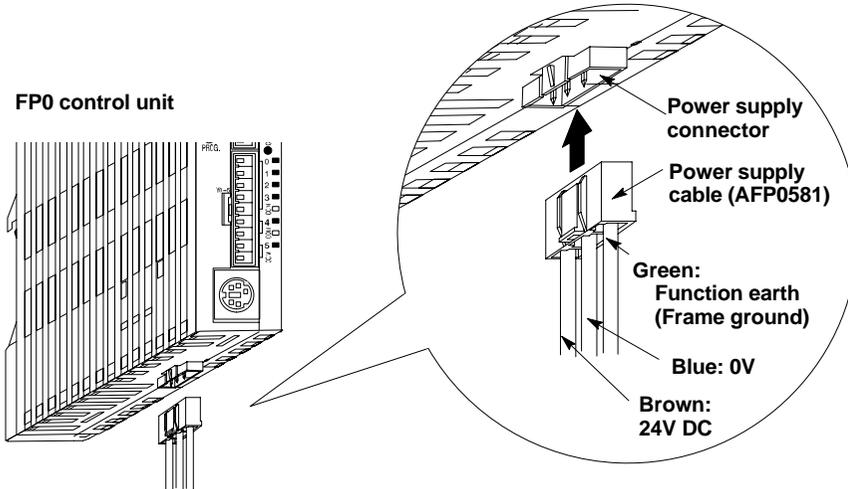
An insulated power supply with an internal protective circuit should be used. The power supply for the control unit operation is a non-insulated circuit, so if an incorrect voltage is directly applied,

the internal circuit may be damaged or destroyed. If using a power supply without a protective circuit, power should be supplied through a protective element such as a fuse.

If current exceeding the rated control capacity is being supplied in the form of a motor lock current or a coil shorting in an electromagnetic device, a protective element such as a fuse should be attached externally.

## 8.2 Wiring the Power Supply to the Control Unit

Use the power supply cable (AFP0581) that comes with the unit to connect the power supply.



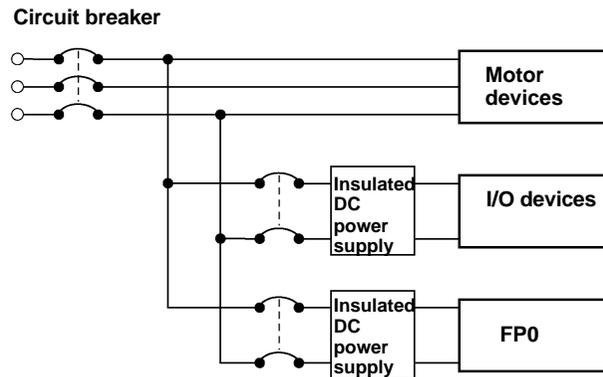
Item	Descriptions
Rated voltage	24V DC
Operating voltage range	21.6 to 26.4V DC



### Notes

- To minimize adverse effects from noise, twist the brown and blue wires of the power supply cable.
- To protect the system against erroneous voltage from the power supply line, use an insulated power supply with an internal protective circuit.
- The regulator on the FP0 unit is a non-insulated type.
- If using a power supply device without an internal protective circuit, always make sure power is supplied to the unit through a protective element such as a fuse.

- **Isolate the wiring systems to the FP0, input/output devices, and motor devices.**

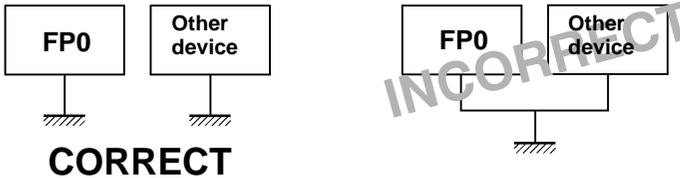


- **The power supply sequence should be set up so that power to the control unit is turned OFF before the input/output power supplies.**
- **If the input/output power supplies are turned OFF before the power to the control unit, the FP0 control unit may detect a drop in the input level, and malfunction.**
- **Be sure to supply power to a control unit and an expansion unit from the same power supply, and turn the power ON and OFF simultaneously for both.**

## 8.3 Grounding

Under normal conditions, the inherent noise resistance is sufficient. However, in situations of excess noise, ground the instrument to increase noise suppression.

For grounding purposes, use wiring with a **minimum of 2mm<sup>2</sup>**. The grounding connection should have a resistance of **less than 100Ω**.

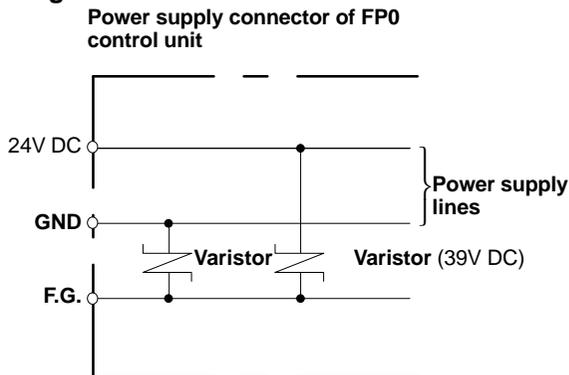


### Notes

- The point of grounding should be as close to the FP0 control unit as possible. The ground wire should be as short as possible.
- If two devices share a single ground point, it may produce an adverse effect. Always use an exclusive ground for each device.
- Depending on the surroundings in which the equipment is used, grounding may cause problems.

### Example:

Since the power supply line (24V DC and GND terminal) of the FP0 power supply connector is connected to the frame ground (F.G.) through a varistor, the varistor may be shorted out if there is an irregular potential between the power supply line (24V DC and GND) and ground.



## 8.4 Input Wiring



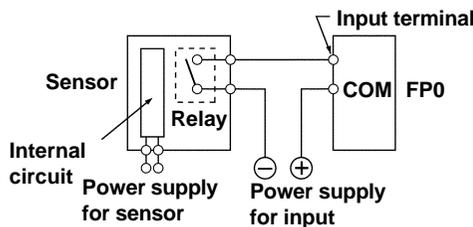
### Notes

- Be sure to select the thickness (dia.) of the input wires while taking into consideration the required current capacity.
- Arrange the wiring so that the input and output wiring are separated, and so that the input wiring is separated from the power wiring, as much as possible. Do not route them through the same duct or wrap them up together.
- Separate the input wires from the power and high voltage wires by at least 100mm/3.937in.

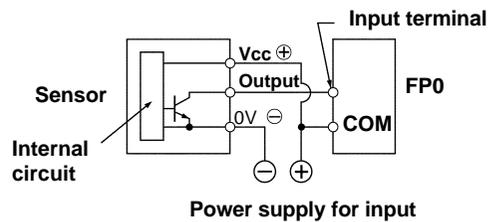
In this section you find some examples for wiring sensors, an LED-equipped reed switch, a two-wire type sensor and a LED-equipped limit switch.

### 8.4.1 Sensors

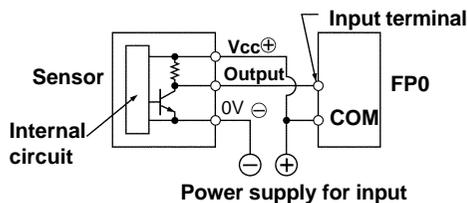
#### Relay output type



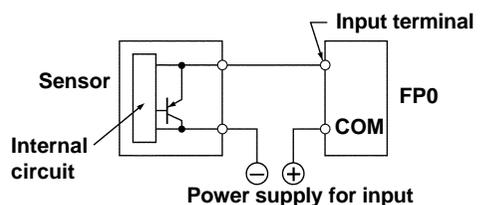
#### NPN open collector output type



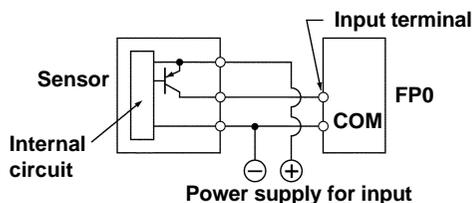
#### Universal output type



#### Two-wire type (r next page)

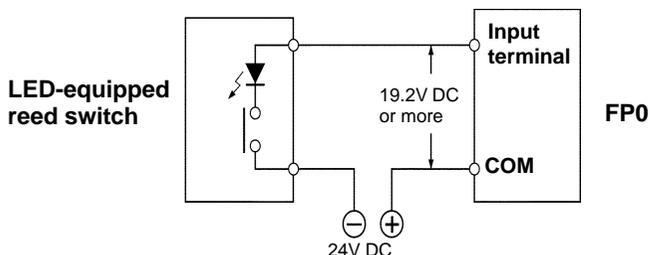


#### PNP open collector output type



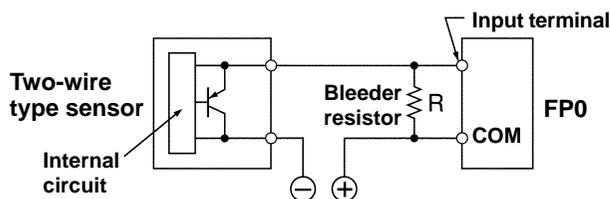
### 8.4.2 LED-Equipped Reed Switch

When a LED is connected to an input contact such as LED-equipped reed switch, make sure that the ON voltage applied to the FP0 input circuit is greater than 19.2V DC. In particular, take care when connecting a number of switches in series.



### 8.4.3 Two-Wire Type Sensor

If the input of the FP0 does not turn OFF because of leakage current from the two-wire type sensor, the use of a bleeder resistor is recommended, as shown below.



**I: Sensor's leakage current (mA)**

**R: Bleeder resistor (kΩ)**

The OFF voltage of the FP0 input is 2.4V, therefore, select an R value so that the voltage between the COM terminal and the input terminal will be less than 2.4V.

The impedance of the FP0 input terminal is 5.6kΩ.

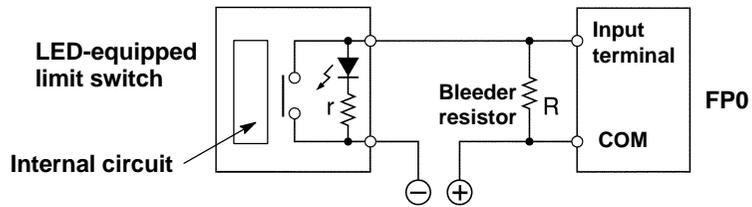
The resistance R of the bleeder resistor is:  $R \leq \frac{13.44}{5.6 \times I - 2.4} \text{ (k}\Omega\text{)}$

The wattage W of the resistor is:  $W = \frac{(\text{Power supply voltage})^2}{R}$

In the actual selection, use a value that is 3 to 5 times the value of W.

### 8.4.4 LED-Equipped Limit Switch

If the input of the FP0 does not turn OFF because of the leakage current from the LED-equipped limit switch, the use of a bleeder resistor is recommended, as shown below.



**r: Internal resistor of limit switch (k $\Omega$ )**

**R: Bleeder resistor (k $\Omega$ )**

The OFF voltage of the FP0 input is 2.4V, therefore when the power supply voltage is 24V, select R so

that the current will be greater than  $I = \frac{24 - 2.4}{r}$

The resistance R of the bleeder resistor is:  $R \leq \frac{13.44}{5.6 \times I - 2.4}$  (k $\Omega$ )

The wattage W of the resistor is:  $W = \frac{(\text{Power supply voltage})^2}{R}$

In the actual selection, use a value that is 3 to 5 times the value of W.

## 8.5 Output Wiring



### Notes

- There is no fuse protection built into the output circuit. Therefore, in order to protect against overheating of the output circuitry caused by possible short circuits, install an external fuse at each point. However, in case of a short circuit, the control unit itself may not be protected.
- Be sure to select the thickness (dia.) of the output wires while taking into consideration the required current capacity.
- Arrange the wiring so that the input and output wiring are separated, and so that the output wiring is separated from the power wiring, as much as possible. Do not route them through the same duct or wrap them up together.
- Separate the output wires from the power and high voltage wires by at least 100mm/3.937in.

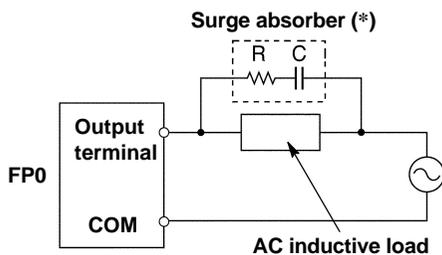
Protect the outputs as described below.

### 8.5.1 Protective Circuit for Inductive Loads

With an inductive load, a protective circuit should be installed in parallel with the load.

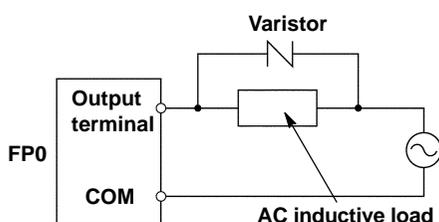
When switching DC inductive loads with FP0 relay output type, be sure to connect a diode across the ends of the load.

#### When using an AC inductive load

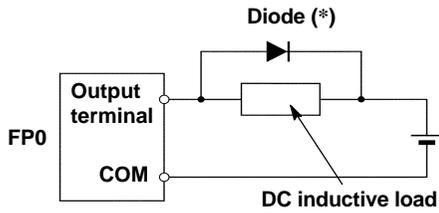


\*Example of surge absorber:

[R: 50Ω , C: 0.47μ F]



**When using a DC inductive load**

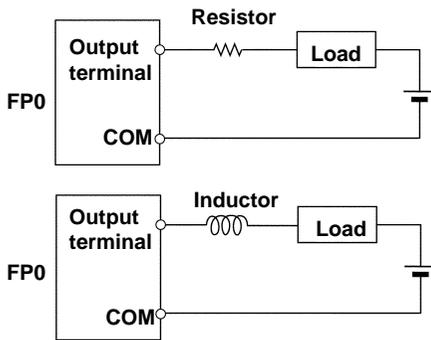


(\*) Diode:

- [ Reverse voltage ( $V_R$ ): 3 times the load voltage
- [ Average rectified forward current ( $I_0$ ): Load current or more ]

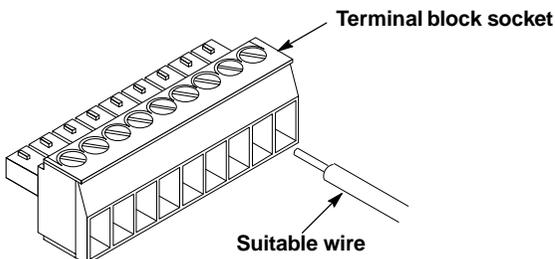
**8.5.2 Precautions for Using Capacitive Loads**

When connecting loads with large in-rush currents, connect a protection circuit as shown below to minimize their effect.



## 8.6 Wiring the Terminal Block Socket

A screw-down connection type terminal block socket for the terminal of the FP0 control unit and analog I/O unit is used. The terminal block socket and suitable wires are given below.



### Terminal block socket

Item	Description
Manufacturer	Phoenix Contact Co.
Model	MC1,5/9-ST-3,5
Product number	1840434

### Suitable wires (twisted wire)

Item	Description
Control unit	Size: AWG #24 to 16
	Conductor cross-sectional area: 0.3 to 1.25mm <sup>2</sup>
Analog I/O unit	Size: AWG #28 to 16
	Conductor cross-sectional area: 0.08 to 1.25mm <sup>2</sup>

### Pole terminal with a compatible insulation sleeve

If a pole terminal is being used, the following models are marketed by Phoenix Contact Co.

Manufacturer	Cross-sectional area (mm <sup>2</sup> )	Size	Product number
Phoenix Contact Co.	0.25	AWG #24	AI 0,25-6YE
	0.50	AWG #20	AI 0,5-6WH
	0.75	AWG #18	AI 0,75-6GY
	1.00	AWG #18	AI 1-6RD

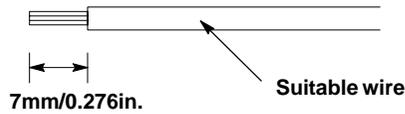
### Pressure welding tool for pole terminals

Manufacturer	Phoenix Contact Co.
Type	CRIMPFOX UD6
Product number	12 04 43 6

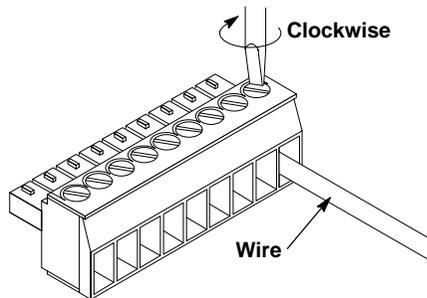
When tightening the terminals of the terminal block socket, use a screwdriver (Phoenix Contact Co., Product no. 1205037) with a blade size of 0.4 × 2.5. The tightening torque should be 0.22 to 0.25Nm (2.3 to 2.5kgfcm) or less.

**Procedure:**

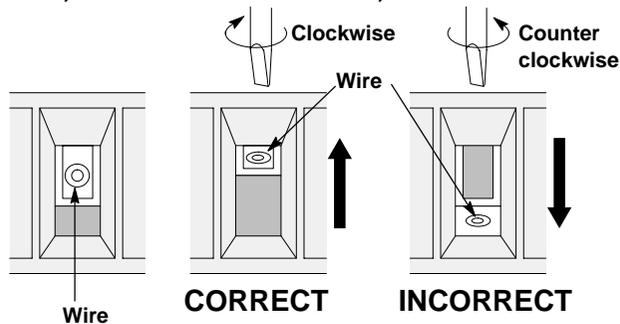
1. Remove a portion of the wire's insulation.



2. Insert the wire into the terminal block socket until it contacts the back of the block socket, and then tighten the screw clockwise to fix the wire in place.

**Notes**

- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure stress is not applied to the wire.
- In the terminal block socket construction, if the wire closes upon counter-clockwise rotation, the connection is faulty. Disconnect the wire, check the terminal hole, and then re-connect the wire.



## 8.7 Wiring the MIL Connector

The housings, semi-cover and pressure welders listed below come supplied with the FP0. Use the wires given below. Also, use the required pressure connection tools for connecting the wires.

### Supplied connector

Unit	Type/Order number		C16/E16	C32/E32
C16/C32 E16/E32	Housing	10-pin type only	2 pieces	4 pieces
	Semi-cover	AXW61001	2 pieces	4 pieces
	Welder (contact)	AXW7221	5-pin × 4	5-pin × 8

### Suitable wires (twisted wire)

Size	Conductor cross-sectional area	Insulation thickness	Rated current
AWG#22	0.3mm <sup>2</sup>	dia. 1.5 to dia. 1.1	3A
AWG#24	0.2mm <sup>2</sup>		

### Pressure connection tool order number: **AXY52000**

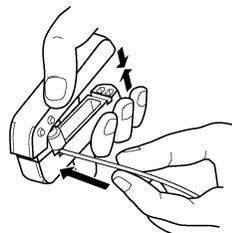
The wire end can be directly crimped without removing the wire's insulation, saving labor.

#### Procedure:

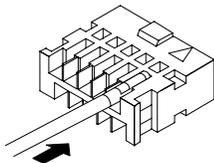
1. Bend the welder (contact) back from the carrier, and set it in the pressure connection tool.



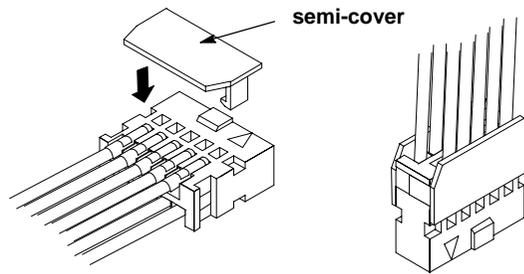
2. Insert the wire without removing its insulation until it stops, and lightly grip the tool.



3. After press-fitting the wire, insert it into the housing.



4. When all wires have been inserted, fit the semi-cover into place.

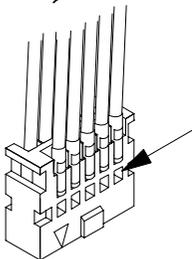
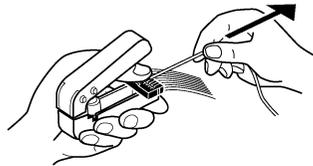


#### Note

If using a MIL connector for flat cables, please specify the order number AXM110915.

### 8.7.1 Contact Puller Pin for Rewiring

If there is a wiring mistake or the cable is incorrectly pressure-connected, the contact puller pin provided with the fitting can be used to remove the contact.

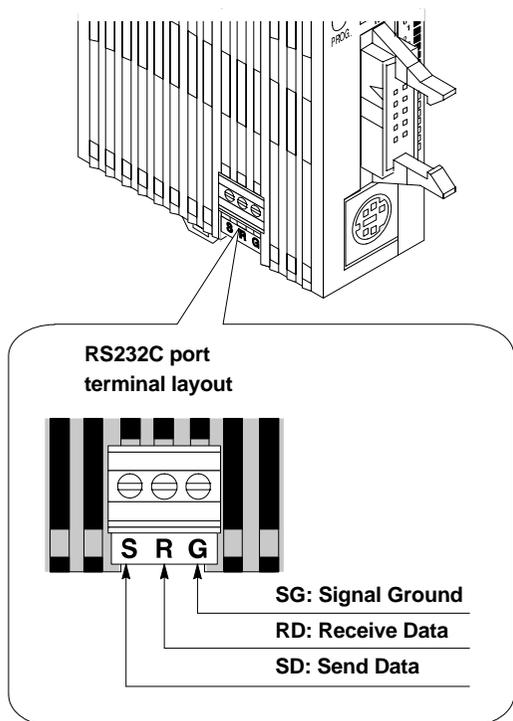


Press the housing against the pressure connection tool so that the contact puller pin comes in contact with this section.

## 8.8 Wiring the RS232C Port

When using the RS232C port, use the screw-down connection type terminal and the wire according to the following procedures.

**FP0 Control unit with RS232C port  
(FP0 C10CRS/C14CRS/C16CT/C16CP/C32CT/C32CP/T32CP)**



Item	Specification
Baud rate	300/600/1200/2400/4800/9600/19200bps
Transmission distance	3m/9.84ft.
Terminal block	Made by Phoenix Contact Co. (3-pin) Product number: MKDS 1/3-3.5
Communication method	half-duplex

### Settings when shipped from the factory

These are changed using system registers 412 to 414. The settings in effect when the unit is shipped from the factory are noted below.

412	RS232C port is not used.
413	Character bit: 8 bits Parity check: odd Stop bit: 1 bit Header: without STX code Terminator: CR
414	Baud rate: 9600bps

### Suitable wires (twisted wire)

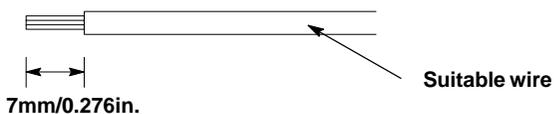
- Size: AWG #28 to 16
- Conductor cross-sectional area: 0.08 to 1.25mm<sup>2</sup>

Use a shielded wire of the above wiring. We recommend grounding the shield section. Also, if using a pole terminal, see page 100.

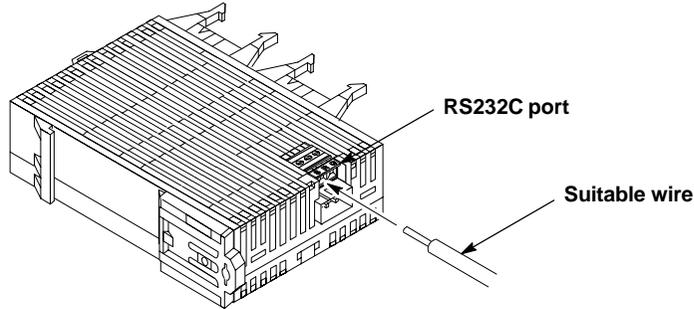
When tightening the RS232C port, use a screwdriver (Phoenix Contact Co., Product no. 1205037) with a blade size of 0.4 × 2.5. The tightening torque should be 0.22 to 0.25 Nm (2.3 to 2.5kgfcm) or less.

### Procedure:

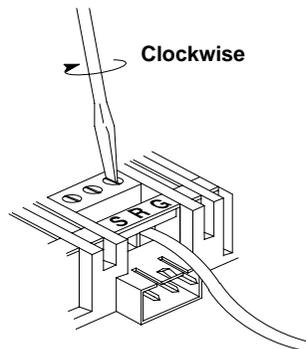
1. Remove a portion of the wire's insulation.



2. Insert wire into the RS232C port until it contacts the back of the RS232C port.

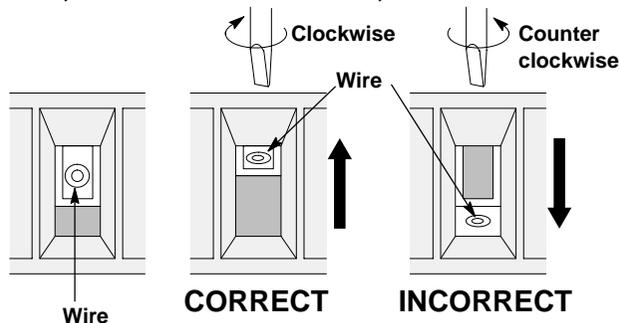


3. Tighten the screw clockwise to fix the wire in place.



### Notes

- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure stress is not applied to the wire.
- In the RS232C port terminal construction, if the wire closes upon counter-clockwise rotation, the connection is faulty. Disconnect the wire, check the terminal hole, and then re-connect the wire.





# Chapter 9

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## Trial Operation

## 9.1 Before Turning ON the Power

After wiring, be sure to check the items below before turning ON the power supply to the programmable controller.

Item	Description
Unit mounting status	<ul style="list-style-type: none"> <li>- Does the unit type match the device list during the design stage?</li> <li>- Are all of the units firmly attached?</li> </ul>
Power supply	<ul style="list-style-type: none"> <li>- Is operating voltage supplied correctly?</li> <li>- Is the power supply cable properly connected?</li> <li>- Are both voltage and polarity connected correctly for each connection?</li> <li>- Protection against excess current: when overloaded, output voltage lowers. Although the output voltage will return to normal when the load returns to normal, be careful as long overloads or shortcircuits will cause deterioration or destruction of internal elements. (see note)</li> <li>- When output voltage decreases due to a generation of excess voltage within the power supply, turn off the AC input for at least one minute. After that turn the input on again. (see note)</li> <li>- Attaching additional power supply units in parallel is not allowed! It may destroy internal elements and the load of the power supply. (see note)</li> </ul>
Check input/output terminals	<ul style="list-style-type: none"> <li>- Does the wiring of connector and terminal match?</li> <li>- Is the operating voltage of I/O correct?</li> <li>- Are the connectors of I/O properly connected?</li> <li>- Is the wire size correct?</li> </ul>
Setting of control unit	<ul style="list-style-type: none"> <li>- Is the mode switch set to the PROG. mode?</li> </ul>



### Note

These precautions concern the FP0-PSA2 power supply unit specifically.

## 9.2 Turning the Power ON

---

After checking the items given on the previous page, perform the trial operation by adhering to the following procedure.

**Procedure:**

1. **Before turning ON the power, check the items described on the previous page**
2. **Turn ON the power**
3. **Check that the control unit's PROG. LED is ON**
4. **Enter the program**

When using a programming tool, perform the operation "Clear Program" before inputting. Enter the program using NPST-GR software or the FP programmer II Ver.2. Use the programming tool's "total check function" to check for syntax errors.
5. **Check output wiring**

Use the forced output function to check the output wiring.
6. **Check input wiring**

Check the input wiring by watching the ON/OFF status of the input state LEDs or by using the monitoring function of the programming tool.
7. **Switch the mode switch from PROG. to RUN mode**
8. **If the RUN LED turns ON, check the operation of the program**
9. **Edit the program (debug) if necessary**

If there is an error in the operation, check the program using the monitoring function of the programming tool. And then correct the program.
10. **Save the edited program**

We highly recommend to save the newly created program onto a floppy disk.



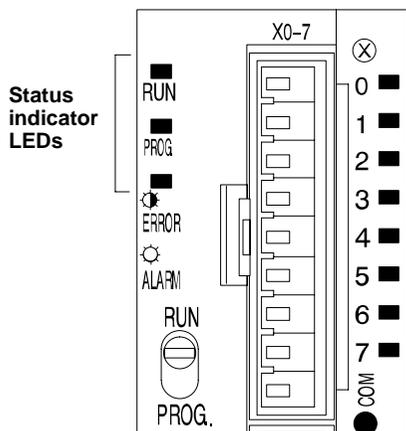
## **Chapter 10**

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# **Self-Diagnostic and Troubleshooting**

## 10.1 Self-Diagnostic Function

The FP0 control unit has a self-diagnostic function which identifies errors and stops operation if necessary. When an error occurs, the status of the status indicator LEDs on the FP0 control unit change, as shown in the table.



Condition	LED status			Description	Program execution status
	RUN	PROG.	ERROR/ALARM		
Normal condition	ON	OFF	OFF	Normal operation in RUN mode	Operation
	OFF	ON	OFF	Normal operation in PROG. mode	Stop
	Blink	OFF	OFF	Forcing ON/OFF in RUN mode	Operation
Abnormal condition	ON	OFF	Blink	When a self-diagnostic error occurs	Operation
	OFF	ON	Blink		Stop
	Varies	Varies	ON	When a system watchdog timer error occurs	Stop

Normally, if an error occurs, operation of FP0 stops.

### 10.1.1 Allowing Duplicated Output

In FPWIN Pro, system register 20 is fixed at the setting “ENAB”, meaning a duplicated output is not regarded as an error and the FP0 continues to operate.

### 10.1.2 Continuing After an Operation Error

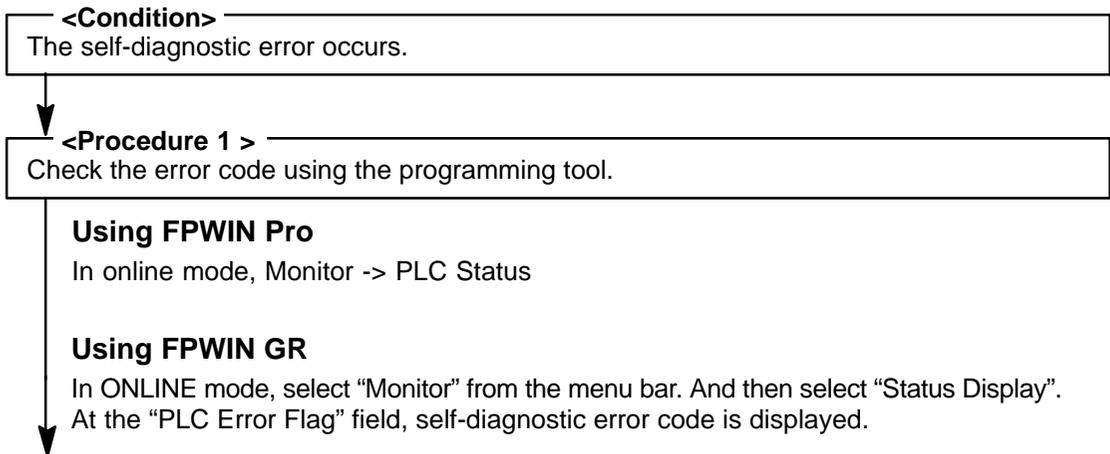
When you change system register 26 settings (“CONT”) using the programming software, the FP0 continues to operate. In this case, even if the FP0 continues to operate, this is regarded as an error.

## 10.2 Troubleshooting

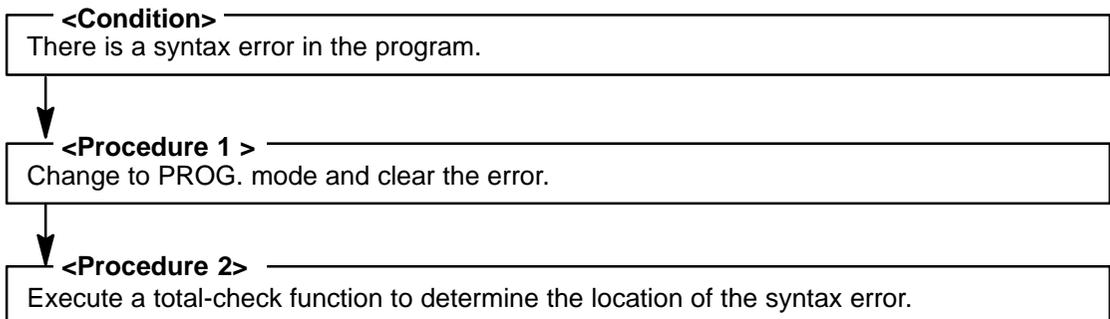
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### 10.2.1 ERROR/ALARM LED is Flashing

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#### Error code is 1 to 9



Refer to your software online help for details about the total-check method.

**Error code is 31 or higher****<Condition>**

A self-diagnostic error other than a syntax error has occurred.

**<Procedure 1 >**

Use the programming tool in PROG. mode to clear the error.

**Using FPWIN Pro**

Monitor -> PLC Status -> Click Clear

- In the PROG. mode, the power supply can be turned OFF and then ON again to clear the error, but all of the contents of the operation memory except hold type data are cleared.
- An error can also be cleared by executing a self-diagnostic error set instruction F148 (ERR).

**Using FPWIN GR**

Click the "Clear Error" button in the status display menu described on the previous page.

**<Procedure 2>**

Follow the procedures described in the table of error codes (see page 121).

**Note**

**When an operation error (error code 45) occurs, the address at which the error occurred is stored in special data registers DT9017 and DT9018. If this happens, monitor the address at which the error occurred before cancelling the error.**

## 10.2.2 ERROR/ALARM LED is ON

### <Condition>

The system watchdog timer has been activated and the operation of FP0 has been stopped.

### <Procedure 1 >

Set the mode switch from RUN to PROG. and turn the power OFF and then ON.

If the ERROR/ALARM LED is turned ON again, there is probably an abnormality in the FP0. Please contact your dealer.

If the ERROR/ALARM LED is blinking, go to section 10.2.1.

### <Procedure 2>

Set the mode switch from PROG. to RUN.

If the ERROR/ALARM LED is turned ON, the program execution time is too long. Check:

- if instructions such as **JP** or **LOOP** are programmed in such a way that a scan can never finish.
- that interrupt instructions are executed in succession.

## 10.2.3 All LEDs are OFF

### <Procedure 1 >

Check the power supply wiring.

### <Procedure 2>

Check if the power supplied to the FP0 control unit is in the range of the rating.

Be sure to check the fluctuation in the power supply.

### <Procedure 3>

Disconnect the power supply wiring to the other devices if the power supplied to the FP0 control unit is shared with them.

If the LEDs on the FP0 control unit turn ON at this moment, the capacity of the power supply is not enough to control other devices as well.

Prepare another power supply for other devices or increase the capacity of the power supply.

## 10.2.4 Diagnosing Output Malfunction

---

### Check of output condition (output indicator LEDs are ON)

**<Procedure 1 >**

Check the wiring of the loads.



**<Procedure 2>**

Check if the power is properly supplied to the loads.

If the power is properly supplied to the load, there is probably an abnormality in the load. Check the load again.

If the power is not supplied to the load, there is probably an abnormality in the FP0's output circuit. Please contact your dealer.

### Check of output condition (output indicator LEDs are OFF)

**<Procedure 1 >**

Monitor the output condition using a programming tool.

If the output monitored is turned ON, there is probably a duplicated output error.



**<Procedure 2>**

Forcing ON the output using a programming tool.

If the output indicator LED is turned ON, go to input condition check.

If the output indicator LED remains OFF, there is probably an abnormality in the FP0's output circuit. Please contact your dealer.

### Check of input condition (input indicator LEDs are OFF)

**<Procedure 1 >**

Check the wiring of the input devices.



**<Procedure 2>**

Check that the power is properly supplied to the input terminals.

If the power is properly supplied to the input terminal, there is probably an abnormality in the FP0's input circuit. Please contact your dealer.

If the power is not properly supplied to the input terminal, there is probably an abnormality in the input device or input power supply. Check the input device and input power supply.

### Check of input condition (input indicator LEDs are ON)

#### <Procedure >

Monitor the input condition using a programming tool.

If the input monitored is OFF, there is probably an abnormality in the FP0's input circuit. Please contact your dealer.

If the input monitored is ON, check the program again.

Also, check the leakage current at the input devices (e.g., two-wire type sensor) and check for the duplicated use of output or the program flow when a control instruction such as **MC** or **JP** is used.

Check the settings of the I/O allocation.

## 10.2.5 Communication Error with Programming Software

#### <Procedure 1 >

Check if the baud rate and character bits settings of the FP0 and the software are the same.

#### Using FPWIN Pro

Online -> Communication Parameters

#### Using FPWIN GR

Option -> Communication Settings

#### Settings on the FP0 side

The baud rate of the FP0 control unit is factory set to 9,600bps.

#### <Procedure 2>

Check the FP PC cable and RS232C port adapter.

RS232C port adapter: Needs to be customized to match your computer.

#### <Procedure 3>

Confirm the setting of the computer referring to the manual for your computer.

Set your computer's RS232C parameter to asynchronous.

## 10.2.6 PROTECT ERROR is Displayed

---

### When a password is set for the programmable controller

**<Procedure >**

Enter a password in the password setting menu.

**Using FPWIN Pro**

Online -> PLC Password

**Using FPWIN GR**

Tool -> Set PLC Password

## 10.2.7 Program Mode does not Change to RUN

---

**<Condition>**

A syntax error has occurred.

**<Procedure >**

Execute a total-check function to determine the location of the syntax error.

Refer to your software manual for details about the total-check method.

## 10.3 Error Codes

---

### 10.3.1 Total-Check Function

---

When the ERROR/ALARM LED on the FP0 control unit is blinking, a self-diagnostic error or syntax check error has occurred. Verify the contents of the error and take the appropriate steps.

**Procedure:**            **Error confirmation**

1. **Use the programming tool to call up the error code**  
See page 113.
2. **Check the error contents in the error code list of section 10.3.2 and 10.3.3 using the error code ascertained above.**

#### 10.3.1.1 Syntax Check Error

---

This is an error detected by the total-check function when there is a syntax error or incorrect setting written in the program. When the mode switch of control unit is switched to the RUN mode, the total-check function automatically activates and eliminates the possibility of incorrect operation from syntax check errors in the program.

**When a syntax check error is detected**

- ERROR/ALARM LED begins blinking.
- Operation will not begin even after switching to the RUN mode.
- Remote operation cannot be used to change to RUN mode.

**Clearing a syntax error**

By changing to the PROG. mode, the error will clear and the ERROR/ALARM LED will turn OFF.

**Steps to take for syntax error**

- Change to PROG. mode, and then execute the total-check function while on-line with the programming tool connected. This will call up the error contents and the address at which the error occurred.
- Correct the program while referring to the error contents.

#### 10.3.1.2 Self-Diagnostic Error

---

This error occurs when the controller's self-diagnostic function detects the occurrence of an abnormality in the system. The self-diagnostic function monitors the memory abnormal detection, I/O abnormal detection, and other devices.

**When the self-diagnostic error occurs**

- ERROR/ALARM LED begins blinking.
- The operation of the controller might stop depending on the content of error and the system resistor setting.
- The error codes will be stored in the special data register DT9000.

- In the case of operation error, the error address will be stored in the DT9017 and DT9018.

### Clearing the self-diagnostic error

- See page 113.
- Errors can also be cleared by turning OFF an ON the power. However, memory contents not stored with the hold type data will also be cleared.
- The error can also be cleared depending on the self-diagnostic error set instruction **F148(ERR)**.

### Steps to take for self-diagnostic error

The steps to be taken will differ depending on the error contents. For more details, use the error code obtained above and see page 121.

## 10.3.2 Syntax Check Error Codes

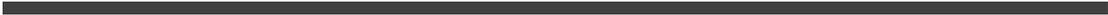
Error code	Name of error	Operation status	Description and steps to take
E1	<b>Syntax error (SYNTAX)</b>	Stops	A program with a syntax error has been written. <b>Change to PROG. mode and correct the error.</b>
E2	<b>Duplicated output error (DUP USE)</b>	Stops	Two or more <b>OT(Out)</b> instructions and <b>KP(Keep)</b> instructions are programmed using the same relay. This error also occurs if you have the same timer/counter numbers. <b>Correct the program so that one relay is not used for two or more OT(Out) instructions and KP(Keep) instructions. Or, set the double output to "K1: enable" in system register 20.</b>
E3	<b>Not paired error (PAIR)</b>	Stops	For instructions which must be used in a pair such as jump ( <b>JP</b> and <b>LBL</b> ), one instruction is either missing or in an incorrect position. <b>Change to PROG. mode and enter the two instructions which must be used in a pair in the correct positions.</b>
E4	<b>System register parameter error (Mismatch)</b>	Stops	An instruction has been written which does not agree with system register settings. For example, the number specification in a program does not agree with the timer/counter range setting. <b>Change to PROG. mode, check the system register settings, and adjust so that the settings and the program agree.</b>
E5	<b>Program area error (PRG AREA)</b>	Stops	An instruction which must be written to a specific area (main program area or subprogram area) has been written to a different area (for example, a subroutine <b>SUB</b> to <b>RET</b> is placed before an <b>ED</b> instruction). <b>Change to PROG. mode and enter the instruction into the correct area.</b>
E8	<b>Operand error (OPR COMBI)</b>	Stops	There is an incorrect operand in an instruction which requires a specific combination operands (for example, the operands must all be of a certain type). <b>Enter the correct combination of operands.</b>

### 10.3.3 Self-Diagnostic Error Codes

Error code	Name of error	Operation status	Description and steps to take
E31	Interrupt error 1	Stops	An interrupt occurred without an interrupt request. A hardware problem or error due to noise is possible. <b>Turn OFF the power and check the noise conditions.</b>
E32	Interrupt error 2	Stops	An interrupt occurred without an interrupt request. A hardware problem or error due to noise is possible. <b>Turn OFF the power and check the noise conditions.</b>  There is no interrupt program for an interrupt which occurred. <b>Check the number of the interrupt program and change it to agree with the interrupt request.</b>
E45	Operation error	Selects	Operation became impossible during a high-level instruction. The cause of the operation error varies depending on the instruction. In system register 26, select "1: Continue operation" or "0: Stop"
E100 to E199	Self-diagnostic error set by F148 (ERR) instruction	Stops	The error set using high-level instruction F148(ERR) has occurred. <b>Clear the error based on the set detection conditions</b>
E200 to E299		Continues	



# Appendix A



## System Registers

## A.1 System Registers

---

System registers are used to set values (parameters) which determine operation ranges and functions used. Set values based on the use and specifications of your program.

There is no need to set system registers for functions which will not be used.

The explanations in this chapter often utilize FPWIN GR conventions. When using FPWIN Pro for programming, please note these slight differences:

- Hexadecimal values are represented by the prefix 16# and not H.
- Decimal values do not require a K prefix.

Moreover in FPWIN Pro, there is an “Additional Information” column for each System Register that briefly explains its use.

### A.1.1 Types of System Registers

---

#### **Allocation of timers and counters (System register 5)**

The number of timers and counters is set by specifying the leading counter number.

#### **Hold types and non-hold type settings (System register 6 to 8 and 14)**

With the FP0, the areas held in the event of a power supply interruption are fixed, and the settings for system register 6 to 8 and 14, will be invalid.

#### **Operation mode settings for errors (System register 20, 23 ,26 and 27)**

Set the operation mode effective when errors such as duplicated use of output, operation, and I/O verification errors occur.

#### **Time settings (System register 31 and 34)**

Set the time-out error detection time and the constant scan time.

#### **Input settings (System register 400 to 403)**

When using the high-speed counter function, pulse catch function or interrupt function, set the operation mode and the input number to be used as a special input.

#### **Tool port settings (System register 410, 411 and 414)**

Set the tool port parameters when computer link will be used.

#### **RS232C port settings (System register 412 to 418)**

Only applicable for unit with RS232C port.

#### **Modem connection setting (System register 411)**

Set to "Modem connection" when the tool port will be used for modem communication.

### A.1.2 Checking and Changing System Register Settings

---

System register values (parameters) can be set with decimal or hexadecimal constants.

If you are going to use a value which is already set (the value which appears when read), there is no need to write it again.

## Using FPWIN Pro

### Procedure:

1. **Set the mode of the FP0 control unit to PROG.**
2. **Project Navigator -> PLC -> System Register.**
3. **To change a set value, write the new value as indicated in the system register table.**
4. **Go Online by clicking the Online button or selecting Online mode under Online.**
5. **Download Project**  
 Online -> Download Program Code and PLC Configuration. This downloads the project and the system registers. To download system registers only: Online -> PLC Configuration -> activate System Registers box -> Download to PLC

## Using FPWIN GR

For more details about system register settings, see "Control FPWIN GR Operational Guide Book."

### A.1.3 Precautions When Setting System Registers

System register settings are effective from the time they are set. However, input, Tool port, RS232C port, and modem connection settings become effective when the mode is changed from PROG. to RUN. With regard to the modem connection setting, when the power is turned on or when the mode is changed from PROG. to RUN, the controller sends a command to the modem which enables it for reception.

When the initialized operation is performed, all set system register values (parameters) will be initialized.

### A.1.4 Content of System Register Settings

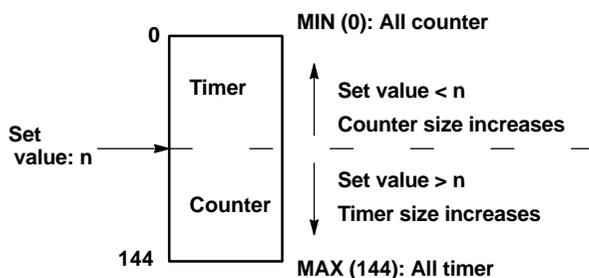
#### Setting the timers and counters (System register 5)

By indicating the counter start number, the timer and counter are split into two areas. The timer and counter together total 144 points, and the default value for the split is 100. Thus the point allotment is as shown in the table below.

<b>Timer</b>	100 points (No. 0 to No. 99)
<b>Counter</b>	44 points (No. 100 to No. 143)

#### Setting example

To increase the number of timers to 120, change the value of system register 5 to K120.



### Hold types and non-hold type settings (System registers 6 to 8 and 14)

With the FP0, the areas held in the event of a power supply interruption are fixed at the areas shown in the table below, and the settings for system registers 6 to 8 and 14, will be invalid.

#### C10/C14/C16 series

<b>Timer</b>	Non-hold type: All points
<b>Counter</b>	Non-hold type: From the set value to C139
	Hold type: 4 points (elapsed values) C140 to C143
<b>Internal relay</b>	Non-hold type: 976 points (R0 to R60F) 61 words (WR0 to WR60)
	Hold type: 32 points (R610 to R62F) 2 words (WR61 to WR62)
<b>Data register</b>	Non-hold type: 1652 words (DT0 to DT1651)
	Hold type: 8 words (DT1652 to DT1659)

#### C32 series

<b>Timer</b>	Non-hold type: All points
<b>Counter</b>	Non-hold type: From the set value to C127
	Hold type: 16 points (elapsed values) C128 to C143
<b>Internal relay</b>	Non-hold type: 880 points (R0 to R54F) 55 words (WR0 to WR54)
	Hold type: 128 points (R550 to R62F) 8 words (WR55 to WR62)
<b>Data register</b>	Non-hold type: 6112 words (DT0 to DT6111)
	Hold type: 32 words (DT6112 to DT6143)



#### Note

For more information on performance specifications, also for the T32CP/T32CT unit, see page 18.

## A.2 Tables of System Registers

C10, C14, C16 and C32 in the table respectively indicate 10-point, 14-point, 16-point and 32-point type FP0 control units.

The explanations in this chapter often utilize FPWIN GR conventions. When using FPWIN Pro for programming, please note these slight differences:

- Hexadecimal values are represented by the prefix 16# and not H.
- Decimal values do not require a K prefix.

Moreover in FPWIN Pro, there is an “Additional Information” column for each System Register that briefly explains its use.

Address		Name of system register	Default value	Set value (parameter)
Allocation of user memory	0	Sequence program area capacity	—	The set values are fixed and cannot be changed. The stored values vary depending on the model and type. K3: 3 K words (FP0 C10, C14, C16) K5: 5 K words (FP0 C32)
	1 to 3	Unused	—	—
Hold/Non-hold	5	Timer and counter division (setting of leading counter number)	K100	K0 to K144 For detailed information, see page 125.
	6 to 8	Unused	—	With the FP0, values set with the programming tool become invalid.
	9 to 13	Unused	—	—
	14	Unused	—	With the FP0, values set with the programming tool become invalid.
	15	Unused	—	—
Action on error	20	Disable or enable setting for duplicated output	K0	K0: Disable (will be syntax error) K1: Enable (will not be syntax error)
	21, 22	Unused	—	—
	23	Operation setting when an I/O verification error occurs	K0	K0: Stop K1: Continuation
	24, 25	Unused	—	—
	26	Operation setting when an operation error occurs	K0	K0: Stop K1: Continuation
	27 to 29	Unused	—	—
	4	Unused	—	With the FP0, values set with the programming tool become invalid.

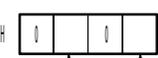
Address		Name of system register	Default value	Set value (parameter)
Time setting	30	FPWIN Pro: Watchdog timer's time-out time FPWIN GR: Unused		Fixed.
Time setting	31	Wait time setting for multi-frame communication	K2600 (6500ms)	K4 to K32760: 10ms to 81900ms Use of default setting (K2600/ 6500ms) is recommended. set value × 2.5ms = Wait time setting for multi-frame communication (ms)  In FPWIN Pro or FPWIN GR, enter the time (a number divisible by 2.5).
	32, 33	Unused	—	With the FP0, values set with the programming tool become invalid.
	34	Constant value settings for scan time	K0	K1 to K64 (2.5ms to 160ms): Scans once each specified time interval. K0: Normal scan set value × 2.5ms = Constant value setting for scan time (ms)  In FPWIN Pro or FPWIN GR, enter the time (a number divisible by 2.5).

Address		Name of system register	Default value	Set value (parameter)	
Input setting	400	High-speed counter mode settings (X0 to X2)	H0	CH0	0: Do not set input X0 as high-speed counter. 1: 2-phase input (X0, X1) 2: 2-phase input (X0, X1), Reset input (X2) 3: Incremental input (X0) 4: Incremental input (X0), Reset input (X2) 5: Decremental input (X0) 6: Decremental input (X0), Reset input (X2) 7: Individual input (X0, X1) 8: Individual input (X0, X1), Reset input (X2) 9: Direction decision (X0, X1) 10: Direction decision (X0, X1), Reset input (X2)
				CH1	0: Do not set input X1 as high-speed counter. 3: Incremental input (X1) 4: Incremental input (X1), Reset input (X2) 5: Decremental input (X1) 6: Decremental input (X1), Reset input (X2)



### Notes

- If the operation mode is set to 2-phase, individual, or direction differentiation, the setting for CH1 is invalid.
- If reset input settings overlap, the setting of CH1 takes precedence.
- If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] -> [Pulse catch] -> [Interrupt input].

Address		Name of system register	Default value	Set value (parameter)	
Input setting	400	High-speed counter mode settings (X0 to x2)	H0	CH0/ CH1	 <ul style="list-style-type: none"> <li>0: Do not use high-speed counter.</li> <li>1: 2-phase input (X0, X1)</li> <li>2: 2-phase input (X0, X1), Reset input (X2)</li> <li>3: Incremental input (X0)</li> <li>4: Incremental input (X0), Reset input (X2)</li> <li>5: Decremental input (X0)</li> <li>6: Decremental input (X0), Reset input (X2)</li> <li>7: Individual input (X0, X1)</li> <li>8: Individual input (X0, X1), Reset input (X2)</li> <li>9: Direction decision (X0, X1)</li> <li>A: Direction decision (X0, X1), Reset input (X2)</li> </ul> <ul style="list-style-type: none"> <li>0: Do not use high-speed counter.</li> <li>3: Incremental input (X1)</li> <li>4: Incremental input (X1), Reset input (X2)</li> <li>5: Decremental input (X1)</li> <li>6: Decremental input (X1), Reset input (X2)</li> </ul>



**Notes**

- If the operation mode is set to 2-phase, individual, or direction differentiation, the setting for CH1 is invalid.
- If reset input settings overlap, the setting of CH1 takes precedence.
- If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] -> [Pulse catch] -> [Interrupt input].

Address		Name of system register	Default value	Set value (parameter)	
Input setting	401	High-speed counter mode settings (X3 to X5)	H0	CH2	0: Do not set input X3 as high-speed counter. 1: 2-phase input (X3, X4) 2: 2-phase input (X3, X4), Reset input (X5) 3: Incremental input (X3) 4: Incremental input (X3), Reset input (X5) 5: Decremental input (X3) 6: Decremental input (X3), Reset input (X5) 7: Individual input (X3, X4) 8: Individual input (X3, X4), Reset input (X5) 9: Direction decision (X3, X4) 10: Direction decision (X3, X4), Reset input (X5)
				CH3	0: Do not set input X4 as high-speed counter. 3: Incremental input (X4) 4: Incremental input (X4), Reset input (X5) 5: Decremental input (X4) 6: Decremental input (X4), Reset input (X5)



**Notes**

- If the operation mode is set to 2-phase, individual, or direction differentiation, the setting for CH3 is invalid.
- If reset input settings overlap, the setting of CH3 takes precedence.
- If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] -> [Pulse catch] -> [Interrupt input].

Address		Name of system register	Default value	Set value (parameter)												
Input setting	402	Pulse catch input function settings	H0	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>X5</td><td>X4</td><td>X3</td><td>X2</td><td>X1</td><td>X0</td> </tr> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table> 0: Standard input 1: Pulse catch input	X5	X4	X3	X2	X1	X0	0	0	0	0	0	0
	X5	X4	X3	X2	X1	X0										
0	0	0	0	0	0											
	403	Interrupt input settings	H0	Define which input is an interrupt input and which edge triggers the interrupt.												



**Note**

If system register 400 to 403 are set simultaneously for the same input relay, the following precedence order is effective: [High-speed counter] -> [Pulse catch] -> [Interrupt input].

When the high-speed counter is being used in the incremental input mode, even if input X0 is specified as an interrupt input and as pulse catch input, those settings are invalid, and input X0 functions as counter input for the high-speed counter.

No. 400: H1 <- This setting will be valid.

No. 402: H1

No. 403: H1

Address		Name of system register	Default value	Set value (parameter)	
Tool port setting	410	Unit number setting for tool port (when connecting C-NET)	K1	K1 to K32 (Unit No. 1 to 32)	
	411	Communication format setting for tool port  Setting item • Default setting value • Modem communication: Disabled • Data length (character bits): 8 bits	H0	Using <b>FPWIN Pro</b> or <b>FPWIN GR</b> Select items from the menu.  When connecting a modem, set the unit number to 1 with system register 410.	
	414	Baud rate setting for tool port	H0	0: 9600 bps 1: 19200 bps	
RS232C port setting	412	Communication method setting for RS232C port	K0	Select items from the menu.	
	413	Communication format setting for RS232C port Setting item/Default setting value - Start code: None - Terminal code: CR - Stop bit: 1 bit - Parity check: With odd - Data length: 8 bits	H3	Select items from the menu.	
	414	Baud rate setting for RS232C port	H1	0: 19200 bps 1: 9600 bps 2: 4800 bps 3: 2400 bps 4: 1200 bps 5: 600 bps 6: 300 bps	
	415	Unit number setting for RS232C port (when connecting C-NET)	K1	K1 to K32 (unit No. 1 to 32)	
	416	Modem compatibility setting for RS232C port	H0	Select items from the menu.	
	417	Starting address setting for reception buffer	K0	C10C/C14C/C16C type: K0 to K1660 C32C type: K0 to K6144	
	418	Capacity setting for reception buffer	C10C/ C14C/ C16C type	K1660	K0 to K1660
			C32C/ T32CP / T32CT type	K6144	K0 to K6144

# Appendix B

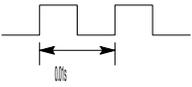
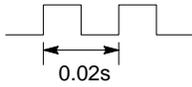
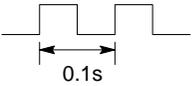
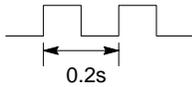
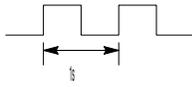
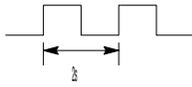
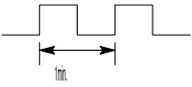


## Special Internal Relays

## B.1 Special Internal Relays

The special internal relays turn on and off under special conditions. The on and off states are not output externally. Writing is not possible with a programming tool or an instruction.

FP Address	Name	Description
R9000	Self-diagnostic error flag	Turns on when a self-diagnostic error occurs. The self-diagnostic error code is stored in DT9000.
R9001 to R9003	—————	Not used
R9004	I/O verification error flag	Turns on when an I/O verification error occurs. The position number of the I/O where the verification error was occurred is stored in DT9010.
R9005, R9006	—————	Not used
R9007	Operation error flag (hold)	Turns on and keeps the on state when an operation error occurs. The address where the error occurred is stored in DT9017 (indicates the first operation error which occurred).
R9008	Operation error flag (non-hold)	Turns on for an instant when an operation error occurs. The address where the operation error occurred is stored in DT9018. The contents change each time a new error occurs.
R9009	Carry flag	Turns on for an instant, - when an overflow or underflow occurs. - when "1" is set by one of the shift instructions.
R900A	> flag	Turns on for an instant when the compared results become larger in the "F60 (CMP) to F63 (DWIN) comparison instructions."
R900B	= flag	Turns on for an instant, - when the compared results are equal in the comparison instructions (F60 to F63). - when the calculated results become 0 in the arithmetic instructions.
R900C	< flag	Turns on for an instant when the compared results become smaller in the "F60 (CMP) to F63 (DWIN) comparison instructions."
R900D	Auxiliary timer contact	Turns on when the set time elapses (set value reaches 0) in the timing operation of the F137 (STMR)/F183 (DSTM) auxiliary timer instruction. It turns off when the trigger for auxiliary timer instruction turns off.
R900E	Tool port error flag	This turns on when an error occurs during communication with a programming tool.
R900F	Constant scan error flag	Turns on when scan time exceeds the time specified in system register 34 during constant scan execution.
R9010	Always on relay	Always on.
R9011	Always off relay	Always off.
R9012	Scan pulse relay	Turns on and off alternately at each scan.
R9013	Initial on pulse relay	Turns on only at the first scan in the operation. Turns off from the second scan and maintains the off state.
R9014	Initial off pulse relay	Turns off only at the first scan in the operation. Turns on from the second scan and maintains the on state.
R9015	Step ladder initial on pulse relay	Turns on for an instant only in the first scan of the process the moment step ladder process is opened.

FP Address	Name	Description	
R9016, R9017	—————	Not used	
R9018	<b>0.01s clock pulse relay</b>	Repeats on/off operations in 0.01s cycles. (on : off = 0.005s : 0.005s)	
R9019	<b>0.02s clock pulse relay</b>	Repeats on/off operations in 0.02s cycles. (on : off = 0.01s : 0.01s)	
R901A	<b>0.1s clock pulse relay</b>	Repeats on/off operations in 0.1 s cycles. (on : off = 0.05s : 0.05s)	
R901B	<b>0.2s clock pulse relay</b>	Repeats on/off operations in 0.2s. cycles (on : off = 0.1s : 0.1s)	
R901C	<b>1s clock pulse relay</b>	Repeats on/off operations in 1s cycles. (on : off = 0.5s : 0.5s)	
R901D	<b>2s clock pulse relay</b>	Repeats on/off operations in 2s cycles. (on : off = 1s : 1s)	
R901E	<b>1min clock pulse relay</b>	Repeats on/off operations in 1 min cycles. (on : off = 30s : 30s)	
R901F	—————	Not used	
R9020	<b>RUN mode flag</b>	Turns off while the mode selector is set to PROG. Turns on while the mode selector is set to RUN.	
R9021 to R9025	—————	Not used	
R9026 (see note)	<b>Message flag</b>	Turns on while the <b>F149 (MSG)</b> instruction is executed.	
R9027 (see note)	<b>Remote mode flag</b>	Turns on while the mode selector is set to REMOTE.	
R9028	—————	Not used	
R9029 (see note)	<b>Forcing flag</b>	Turns on during forced on/off operation for I/O relay and timer/counter contacts.	
R902A (see note)	<b>External interrupt enable flag</b>	Turns on while the external interrupt trigger is enabled by the <b>ICTL</b> instruction.	
R902B (see note)	<b>Interrupt error flag</b>	Turns on when an interrupt error occurs.	



### Note

Used by the system.

FP Address	Name	Description
R902C to R902F	—————	Not used
R9030, R9031	—————	Not used
R9032	<b>RS232C port mode flag</b>	When "General-use port" is selected, "K2" goes on.
R9033	<b>Printout instruction flag</b>	Turns on while a <b>F147 (PR)</b> instruction is executed. Turns off when a <b>F147 (PR)</b> instruction is not executed.
R9034	<b>Rewrite during RUN flag</b>	This is a special internal relay that goes on for only the first scan following the completion of rewriting in the RUN mode. (CPU Ver. 2.0 or later available)
R9037	<b>RS232C communication error flag</b>	Turns on when the serial data communication error occurs.
R9038	<b>RS232C reception completed flag</b>	Turns on when a terminator is received during the serial data communicating.
R9039	<b>RS232C transmission completed flag</b>	Turns on while data is not send during the serial data communicating. Turns off while data is being sent during the serial data communicating.
R903A	<b>High-speed counter control flag for ch0</b>	Turns on while the high-speed counter instruction " <b>F166 (HC1S) to F170 (PWM)</b> " is executed.
R903B	<b>High-speed counter control flag for ch1</b>	Turns on while the high-speed counter instruction " <b>F166 (HC1S) to F170 (PWM)</b> " is executed.
R903C	<b>High-speed counter control flag for ch2</b>	Turns on while the high-speed counter instruction " <b>F166 (HC1S) to F170 (PWM)</b> " is executed.
R903D	<b>High-speed counter control flag for ch3</b>	Turns on while the high-speed counter instruction " <b>F166 (HC1S) to F170 (PWM)</b> " is executed.
R903E, R903F	—————	Not used

# Appendix C

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## Special Data Registers

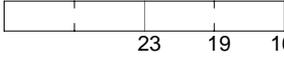
## C.1 Special Data Registers

The special data registers are one word (16-bit) memory areas which store specific information. With the exception of registers for which “Writing is possible” is indicated in the “Description” column, these registers cannot be written to.

The explanations in this chapter often utilize FPWIN GR conventions. When using FPWIN Pro for programming, please note these slight differences:

- Hexadecimal values are represented by the prefix 16# and not H.
- Decimal values do not require a K prefix.

FP Addresses		Description
T32CP/CT	Other Types	
DT90000	DT9000	<b>Self-diagnostic error code</b> The self-diagnostic error code is stored here when a self-diagnostic error occurs. Monitor the error code using decimal display. For detailed information, see page 119.
DT90010	DT9010	<b>I/O verify error unit</b> The position of the I/O for which an error occurred is stored in bits 0 to 3.
DT90014	DT9014	<b>Auxiliary register for operation</b> One shift-out hexadecimal digit is stored in bit positions 0 to 3 when an <b>F105 (BSR)</b> or <b>F106 (BSL)</b> instruction is executed.
DT90015	DT9015	<b>Auxiliary register for operation</b> The divided remainder (16-bit) is stored in DT9015 when an <b>F32 (%)</b> or <b>F52 (B%)</b> instruction is executed.
DT90016	DT9016	
DT90017	DT9017	<b>Operation error address (hold)</b> After commencing operation, the address where the first operation error occurred is stored. Monitor the address using decimal display.
DT90018	DT9018	<b>Operation error address (non-hold)</b> The address where a operation error occurred is stored. Each time an error occurs, the new address overwrites the previous address. At the beginning of scan, the address is 0. Monitor the address using decimal display.
DT90019	DT9019	<b>2.5 ms ring counter</b> The data stored here is increased by one every 2.5 ms. (H0 to HFFFF) Difference between the values of the two points (absolute value) × 2.5 ms = Elapsed time between the two points.

FP Addresses		Description
T32CP/CT	Other Types	
DT90022	DT9022	<b>Scan time (current value) (see note 1)</b> The current scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) × 0.1 K50 indicates 5 ms.
DT90023	DT9023	<b>Scan time (minimum value) (see note 1)</b> The minimum scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) × 0.1 K50 indicates 5 ms.
DT90024	DT9024	<b>Scan time (maximum value) (see note 1)</b> The maximum scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) × 0.1 K125 indicates 12.5 ms.
DT90025	DT9025	<b>Mask condition monitoring register for interrupts(INT 0 to 5)</b> The mask conditions of interrupts using ICTL instruction can be monitored here. Monitor using binary display. 15    11    7    3    0 (Bit No.)  0: interrupt disabled (masked) 1: interrupt enabled (unmasked)
DT90026	DT9026	Not used
DT90027	DT9027	<b>Periodical interrupt interval (INT 24)</b> The value set by ICTL instruction is stored. - K0: periodical interrupt is not used - K1 to K3000: 10 ms to 30 s
DT90028	DT9028	Not used
DT90029	DT9029	Not used
DT90030	DT9030 (see note 2)	<b>Message 0</b> <b>Message 1</b> <b>Message 2</b> <b>Message 3</b> <b>Message 4</b> <b>Message 5</b> The contents of the specified message are stored in these special data registers when an <b>F149 (MSG)</b> instruction is executed.
DT90031	DT9031 (see note 2)	
DT90032	DT9032 (see note 2)	
DT90033	DT9033 (see note 2)	
DT90034	DT9034 (see note 2)	
DT90035	DT9035 (see note 2)	
DT90036	DT9036	Not used
DT90037	DT9037	<b>Work 1 for F96 (SRC) instruction</b> The number of data that match the searched data is stored here when an <b>F96 (SRC)</b> instruction is executed.



## Notes

- 1) Scan time display is only possible in RUN mode, and shows the operation cycle time. The maximum and minimum values are cleared when each the mode is switched between RUN mode and PROG. mode.
- 2) Used by the system.

FP Addresses		Description
T32CP/CT	Other Types	
DT90038	DT9038	<b>Work 2 for F96 (SRC) instruction</b> The position of the first matching data, counting from the starting 16-bit area, is stored here when an <b>F96 (SRC)</b> instruction is executed.
DT90039 to DT90043	DT9039 to DT9043	Not used
DT90044	DT9044	<b>High-speed counter elapsed value for ch0</b> The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the <b>ED</b> instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9044 and DT9045. The value can be written by executing a <b>DMV (F1)</b> instruction.
DT90045	DT9045	
DT90046	DT9046	<b>High-speed counter target value for ch0</b> The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here.
DT90047	DT9047	Target values have been preset for the various instructions, to be used when the high-speed counter related instruction <b>F166</b> to <b>F170</b> is executed. These preset values can only be read, and cannot be written.
DT90048	DT9048	<b>High-speed counter elapsed value area for ch1</b> The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the <b>ED</b> instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9048 and DT9049. The value can be written by executing a <b>DMV (F1)</b> instruction.
DT90049	DT9049	
DT90050	DT9050	<b>High-speed counter target value area for ch1</b> The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here.
DT90051	DT9051	Target values have been preset for the various instructions, to be used when the high-speed counter related instruction <b>F166</b> to <b>F170</b> is executed. These preset values can only be read, and cannot be written.

FP Addresses		Description
T32CP/CT	Other Types	
DT90052	DT9052	<p><b>High-speed counter control flag</b>                      A value can be written with an <b>MV (F0)</b> instruction to reset the high-speed counter, disable counting, stop high-speed counter instruction (<b>F168</b>), and clear the high-speed counter.</p> <p>Control code setting                      Control code = <input type="checkbox"/><input type="checkbox"/><input type="checkbox"/><input type="checkbox"/> (Binary)</p> <ul style="list-style-type: none"> <li>└─ Software reset 0: Yes / 1: No</li> <li>└─ Count 0: Enable / 1: Disable</li> <li>└─ Hardware reset 0: Enable / 1: Disable</li> <li>└─ High-speed counter clear 0: Continue / 1: Clear</li> </ul> <p>Software is not reset: H0 (0000)                      Perform software reset: H1 (0001)                      Disable count: H2 (0010)                      Disable hardware reset: H4 (0100)                      Stop pulse output (clear instruction): H8 (1000)                      Perform software reset and stop pulse output: H9 (1001)</p> <p>The 16 bits of DT9052 are allocated in groups of four to high-speed channels 0 to 3 as shown below.</p> <div style="text-align: center;"> <p style="text-align: center;">bit 15    12 11    8 7    4 3    0</p> <p style="text-align: center;">DT9052</p> <p style="text-align: center;">for ch3    for ch2    for ch1    for ch0</p> </div> <p>A hardware reset disable is only effective when using the reset inputs (X2 and X5). In all other cases it is ignored.</p> <p>When using pulse output, a hardware reset input is equivalent to an home point proximate input.</p>
DT90053		<p><b>Clock/calendar monitor (hour/minute)</b>                      Hour and minute data of the clock/calendar are stored here. This data is read-only data; it cannot be overwritten.</p> <div style="text-align: center;"> <p style="text-align: center;">Higher 8 bits    Lower 8 bits</p> <p style="text-align: center;">Hour data    Minute data H00 to H23 (BCD)    H00 to H59 (BCD)</p> </div>

FP Addresses		Description																												
T32CP/CT	Other Types																													
DT90054		<p><b>DT90054, Clock/calendar monitor and setting (minute/second)</b>  <b>DT90055, Clock/calendar monitor and setting (day/hour)</b>  <b>DT90056, Clock/calendar monitor and setting (year/month)</b>  <b>DT90057, Clock/calendar monitor and setting (day-of-the-week)</b></p> <p>The year, month, day, hour, minute, second, and day-of-the-week data for the calendar timer is stored. The built-in calendar timer will operate correctly through the year 2099 and supports leap years. The calendar timer can be set (the time set) by writing a value using a programming tool or a program that uses the <b>F0 (MV)</b> transfer instruction.</p> <div style="text-align: center;"> <p style="margin-left: 100px;">Higher 8 bits                      Lower 8 bits</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 8px; height: 12px;"></td><td style="width: 8px; height: 12px;"></td> <td style="width: 8px; height: 12px;"></td><td style="width: 8px; height: 12px;"></td> </tr> </table> </div> <table border="1" style="margin-left: auto; margin-right: auto; margin-top: 10px;"> <tr> <td style="width: 150px;"><b>DT90054</b></td> <td>Minute H00 to H59 (BCD)</td> <td>Second H00 to H59 (BCD)</td> </tr> <tr> <td><b>DT90055</b></td> <td>Day H01 to H31 (BCD)</td> <td>Hour H00 to H23 (BCD)</td> </tr> <tr> <td><b>DT90056</b></td> <td>Year H00 to H99 (BCD)</td> <td>Month H01 to H12 (BCD)</td> </tr> <tr> <td><b>DT90057</b></td> <td>_____</td> <td>Day-of-the-week H00 to H06 (BCD)</td> </tr> </table>																	<b>DT90054</b>	Minute H00 to H59 (BCD)	Second H00 to H59 (BCD)	<b>DT90055</b>	Day H01 to H31 (BCD)	Hour H00 to H23 (BCD)	<b>DT90056</b>	Year H00 to H99 (BCD)	Month H01 to H12 (BCD)	<b>DT90057</b>	_____	Day-of-the-week H00 to H06 (BCD)
<b>DT90054</b>			Minute H00 to H59 (BCD)	Second H00 to H59 (BCD)																										
<b>DT90055</b>			Day H01 to H31 (BCD)	Hour H00 to H23 (BCD)																										
<b>DT90056</b>			Year H00 to H99 (BCD)	Month H01 to H12 (BCD)																										
<b>DT90057</b>	_____	Day-of-the-week H00 to H06 (BCD)																												
DT90055																														
DT90056																														
DT90057																														

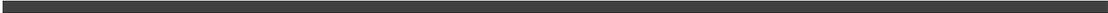
FP Addresses		Description
T32CP/CT	Other Types	
DT90058		<p><b>Clock/calendar time setting and 30s correction</b>                      The clock/calendar is adjusted as follows.</p> <p><b>When setting the clock/calendar by program that uses F0 (MV) instructions</b>                      By setting the the highest bit of DT90058 to 1, the time becomes that written to DT90054 to DT90057 by <b>F0 (MV)</b> instruction. After the time is set, DT90058 is cleared to 0. (Cannot be performed with any instruction other than <b>F0 (MV)</b> instruction.)</p> <p><b>Example: FPWIN GR</b>                      Set the time to 12:00:00 on the 5th day when the X0 turns ON.</p> <pre>                     graph LR                         X0 --- DF                         X0 --- One[1]                         One --- F0_0["[ F0 MV, H 0, DT90054 ]"]                         One --- F0_512["[ F0 MV, H 512, DT90055 ]"]                         One --- F0_8000["[ F0 MV, H8000, DT90058 ]"]                     </pre> <p>... Inputs 0 minutes and 0 seconds                      ... Inputs 12th hour 5th day                      ... Sets the time</p> <p><b>Note</b></p> <p><b>If you changed the values of DT90054 to DT90057 with the data monitor functions of FPWIN GR software, the time will be set when the new values are written. Therefore, it is unnecessary to write to DT90058.</b></p> <p><b>When the correcting times less than 30 seconds</b>                      By setting the lowest bit of DT90058 to 1, the value will be moved up or down and become exactly 0 seconds. After the correction is completed, DT90058 is cleared to 0.</p> <p><b>Example: FPWIN GR</b>                      Correct to 0 seconds with X0 turns ON</p> <pre>                     graph LR                         X0 --- DF                         X0 --- One[1]                         One --- F0_1["[ F0 MV, H 1, DT90058 ]"]                     </pre> <p>Correct to 0 second.</p> <p>At the time of correction, if between 0 and 29 seconds, it will be moved down, and if the between 30 and 59 seconds, it will be moved up. In the example above, if the time was 5 minutes 29 seconds, it will become 5 minutes 0 second; and, if the time was 5 minutes 35 seconds, it will become 6 minutes 0 second.</p>

FP Addresses		Description
T32CP/CT	Other Types	
DT90059	DT9059	<p><b>Serial communication error code</b></p> <p>DT90059/DT9059</p> <ul style="list-style-type: none"> <li>• Tool port <ul style="list-style-type: none"> <li>bit 0 = 1: Over run error</li> <li>bit 1 = 1: Framing error</li> <li>bit 2 = 1: Parity error</li> </ul> </li> <li>• RS232C port <ul style="list-style-type: none"> <li>bit 8 = 1: Over run error</li> <li>bit 9 = 1: Framing error</li> <li>bit 10 = 1: Parity error</li> </ul> </li> </ul>

FP Addresses		Description																
T32CP/CT	Other Types																	
DT90060	DT9060	Process number: 0 to 15	<p><b>Step ladder process</b> Indicates the startup condition of the step ladder process. When the process starts up, the bit corresponding to the process number turns on "1".</p> <p>Monitor using binary display.</p> <div style="text-align: center;"> <table style="margin: auto;"> <tr> <td style="padding: 0 10px;">15</td> <td style="padding: 0 10px;">11</td> <td style="padding: 0 10px;">7</td> <td style="padding: 0 10px;">3</td> <td style="padding: 0 10px;">  (Bit No.)</td> </tr> <tr> <td colspan="5" style="text-align: center;">DT9060 <span style="font-size: 1.5em;">[</span> <span style="font-size: 1.5em;">]</span></td> </tr> <tr> <td style="padding: 0 10px;">15</td> <td style="padding: 0 10px;">11</td> <td style="padding: 0 10px;">7</td> <td style="padding: 0 10px;">3</td> <td style="padding: 0 10px;">  (Process No.)</td> </tr> </table> <p style="margin-left: 150px;">0: not-executing 1: executing</p> </div> <p>A programming tool can be used to write data.</p>	15	11	7	3	(Bit No.)	DT9060 <span style="font-size: 1.5em;">[</span> <span style="font-size: 1.5em;">]</span>					15	11	7	3	(Process No.)
15	11	7		3	(Bit No.)													
DT9060 <span style="font-size: 1.5em;">[</span> <span style="font-size: 1.5em;">]</span>																		
15	11	7		3	(Process No.)													
DT90061	DT9061	Process number: 16 to 31																
DT90062	DT9062	Process number: 32 to 47																
DT90063	DT9063	Process number: 48 to 63																
DT90064	DT9064	Process number: 64 to 79																
DT90065	DT9065	Process number: 80 to 95																
DT90066	DT9066	Process number: 96 to 111																
DT90067	DT9067	Process number: 112 to 127																
DT90104	DT9104	<p><b>High-speed counter elapsed value area for ch2</b> The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the <b>ED</b> instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9104 and DT9105.</p> <p>The value can be written by executing a <b>DMV (F1)</b> instruction.</p>																
DT90105	DT9105																	
DT90106	DT9106	<p><b>High-speed counter target value area for ch2</b> The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here.</p>																
DT90107	DT9107	<p>Target values have been preset for the various instructions, to be used when the high-speed counter related instruction <b>F166</b> to <b>F170</b> is executed. These preset values can only be read, and cannot be written.</p>																
DT90108	DT9108	<p><b>High-speed counter elapsed value area for ch3</b> The elapsed value (24-bit data) for the high-speed counter is stored here. Each time the <b>ED</b> instruction is executed, the elapsed value for the high-speed counter is automatically transferred to the special registers DT9108 and DT9109.</p> <p>The value can be written by executing a <b>DMV (F1)</b> instruction.</p>																
DT90109	DT9109																	
DT90110	DT9110	<p><b>High-speed counter target value area for ch3</b> The target value (24-bit data) of the high-speed counter specified by the high-speed counter instruction is stored here.</p>																
DT90111	DT9111	<p>Target values have been preset for the various instructions, to be used when the high-speed counter related instruction <b>F166</b> to <b>F170</b> is executed. These preset values can only be read, and cannot be written.</p>																

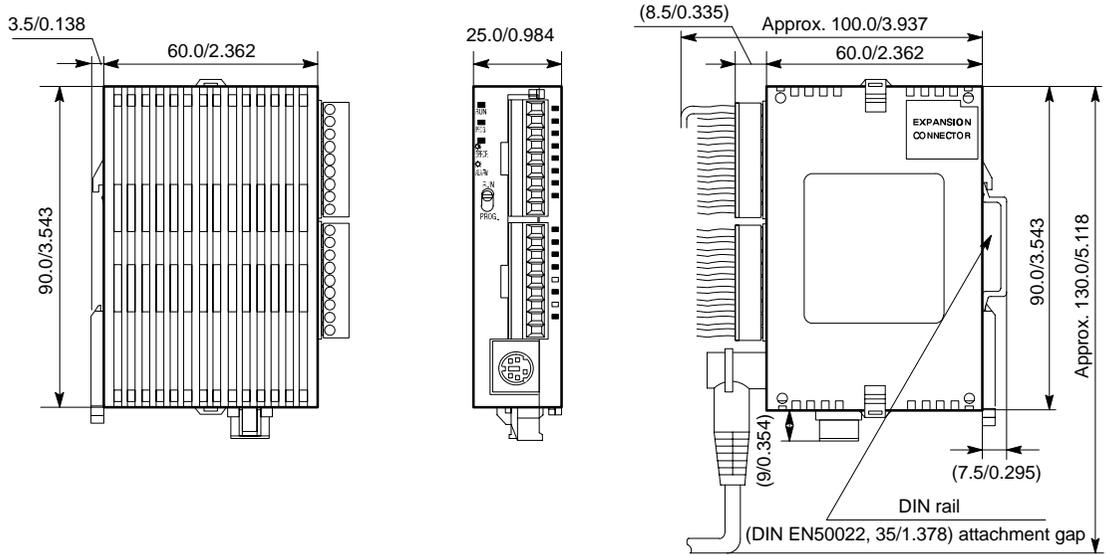


# Appendix D



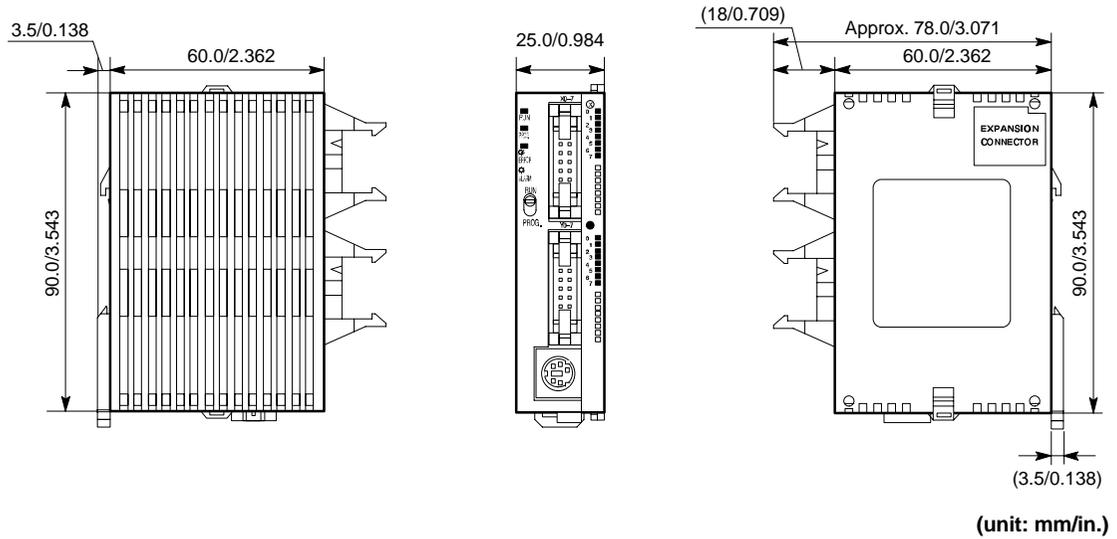
## Dimensions

## D.1 C10RS-10CRS-14RS-14CRS/E8RS-16RS

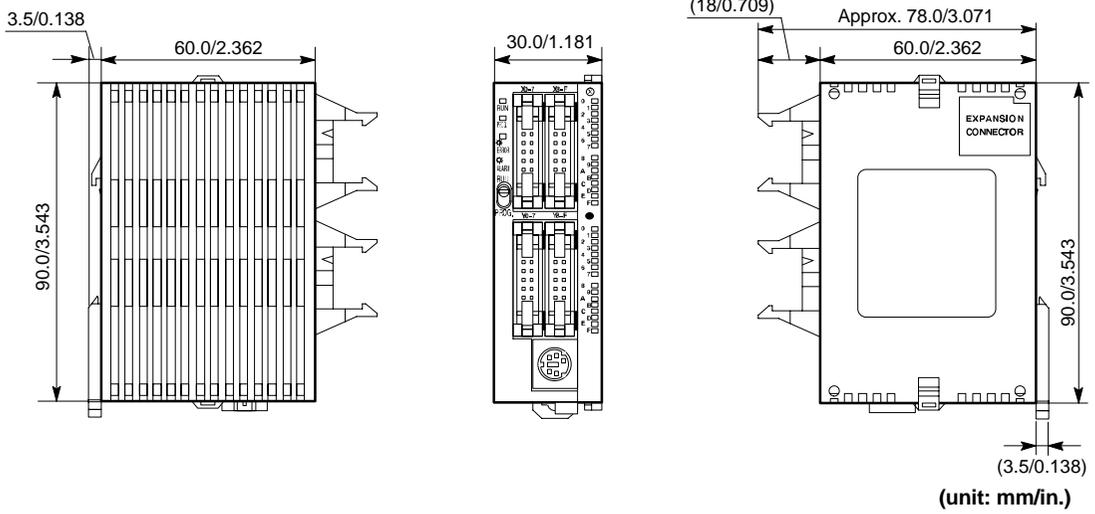


(unit: mm/in.)

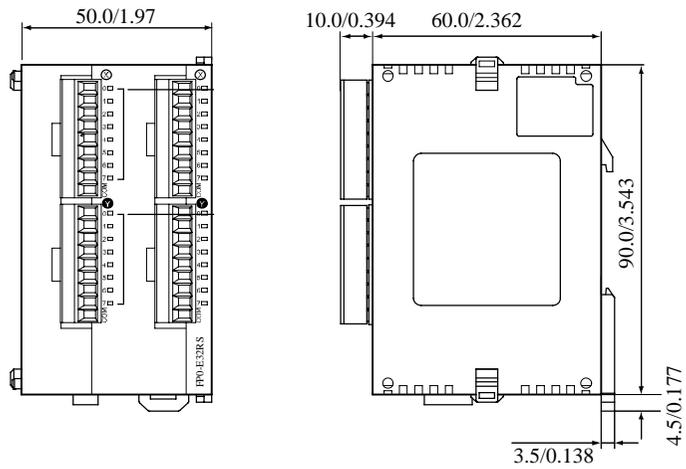
## D.2 C16T-16CT-16P-16CP/E16T-16P-8X-8YT-8YP



### D.3 C32T-32CT-32P-32CP/E32T-32P-16X-16YT-16YP

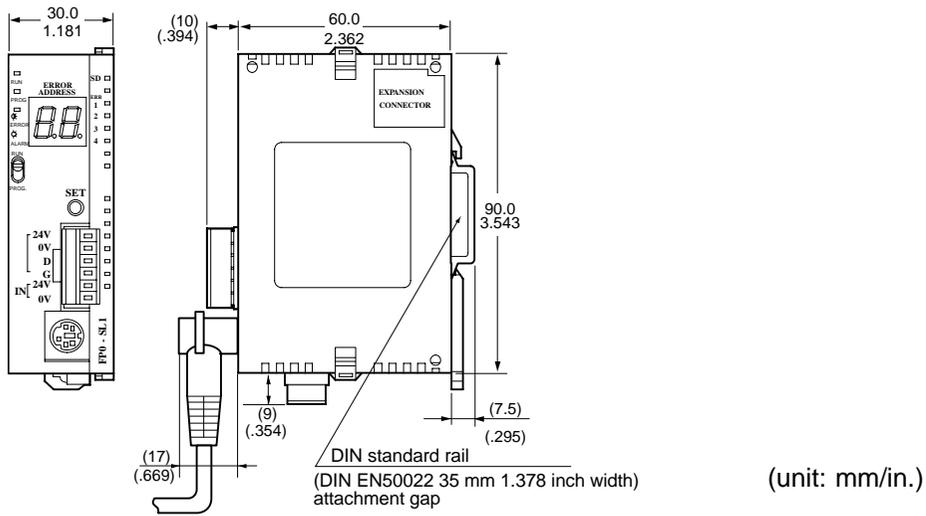


# D.4 E32RS

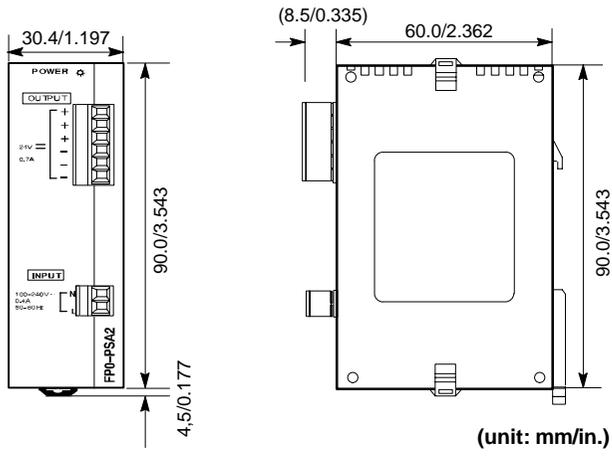


(unit: mm/in.)

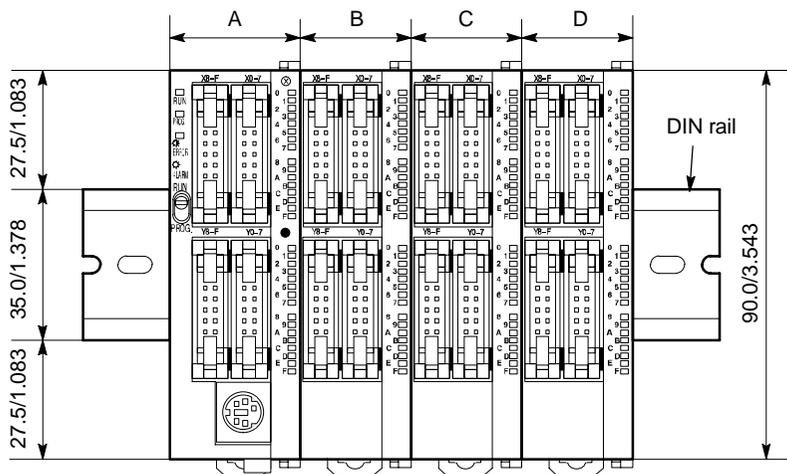
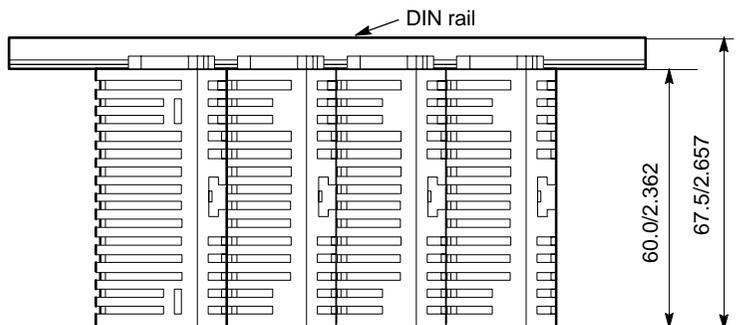
## D.5 S-Link Control Unit



# D.6 Power Supply Unit



## D.7 Mounting on DIN Rail



(unit: mm/in.)



**Note**

**A + B + C + D dimensions (Unit: mm/in.)**

Control unit type	A (Control unit only)	A+B (1 expansion unit connected)	A+B+C (2 expansion units connected)	A+B+C+D (3 expansion units connected)
C10RS, C10CRS, C14RS, C14CRS, C16T, C16CT, C16P, C16CP	25/0.984	50/1.969	75/2.953	100/3.937
C32T, C32CT, C32P, C32CP	30/1.181	55/2.165	80/3.150	105/4.134

## D.8 FP0 Slim Type Mounting Plate

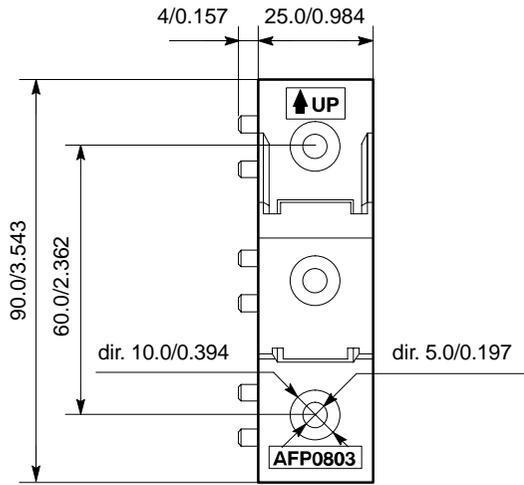
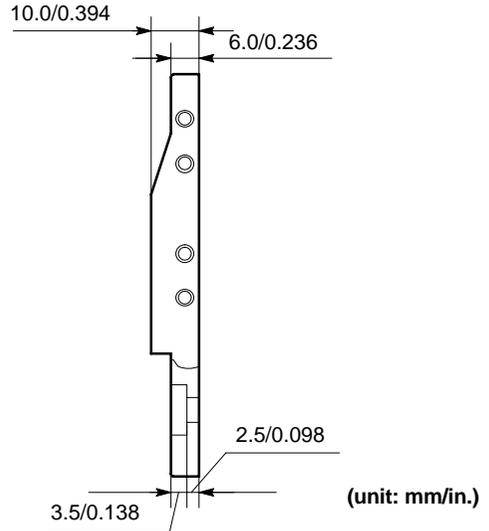


Figure 1 : One plate



(unit: mm/in.)

(unit: mm/in.)

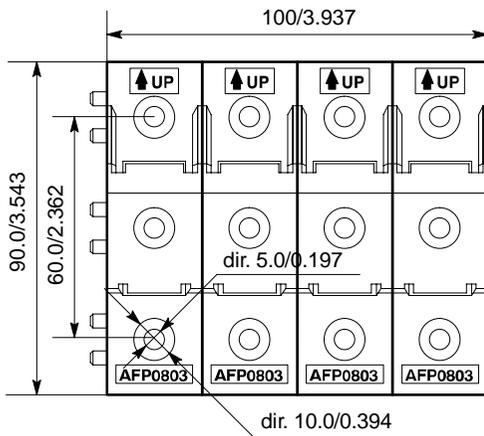
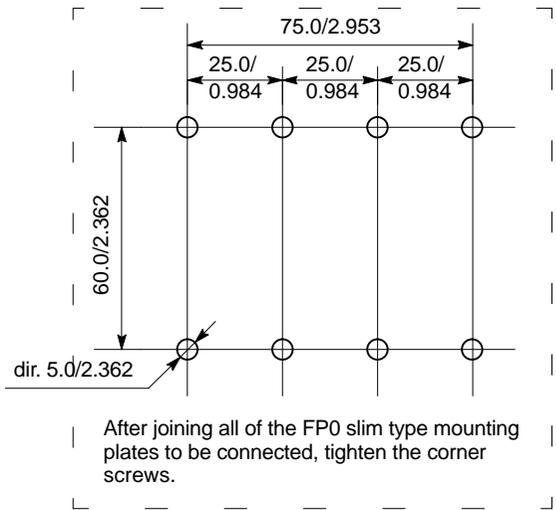


Figure 2 : Four plates in series

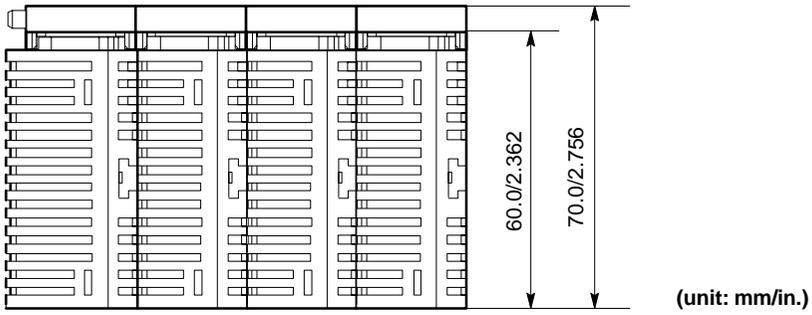


After joining all of the FP0 slim type mounting plates to be connected, tighten the corner screws.

(unit: mm/in.)

Figure 3 : Mounting hole dimensions

### D.8.1 Dimensions When Using FP0 Slim Type Mounting Plate



# D.9 FP0 Flat Type Mounting Plate

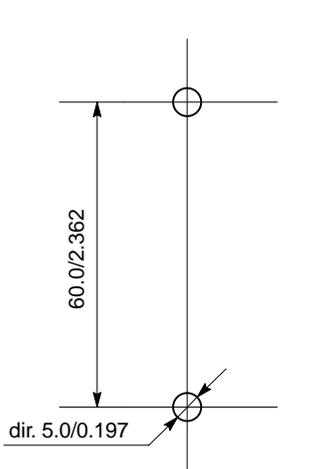
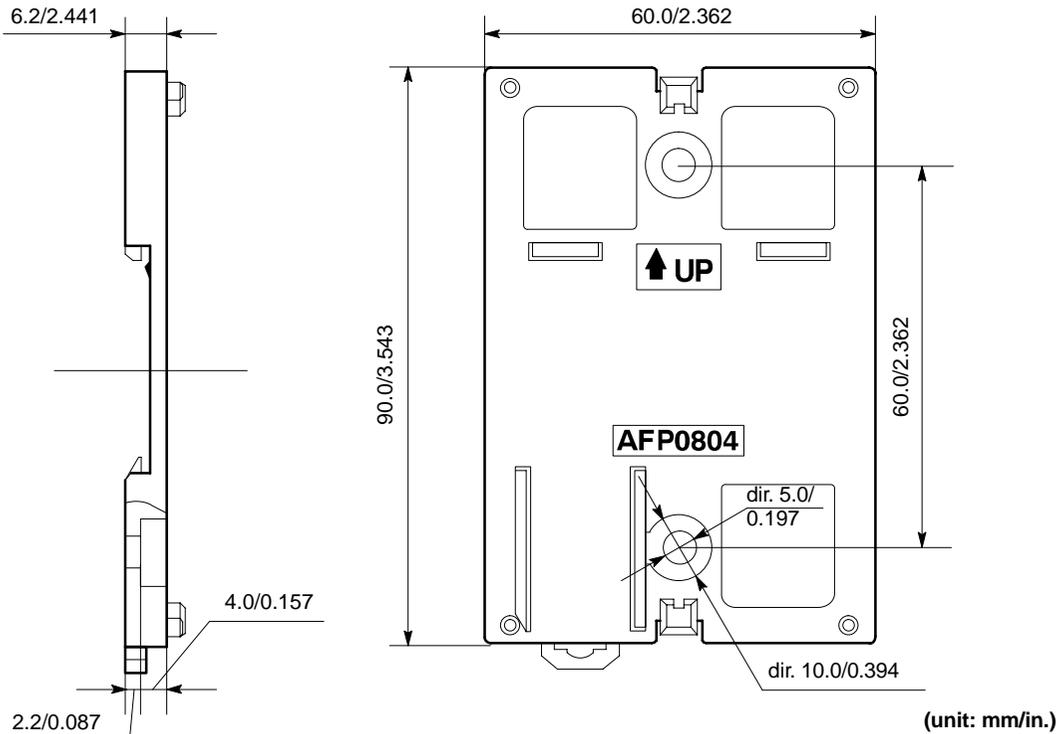


Figure 4 : Mounting hole dimensions

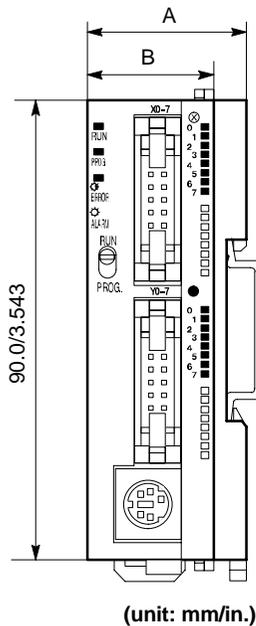


Figure 5 :  
Dimensions when  
mounted on rail

Unit type	A (mm/in.)	B (mm/in.)
C10RS	31.2/1.23	25/0.98
C10CRS		
C14RS		
C14CRS		
C16T		
C16CT		
C16P	36.2/1.43	30/1.18
C16CP		
C32T		
C32CT		
C32P		
C32CP		



**Note**

Cannot be used if system is expanded



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# Record of Changes

Manual no.	Date	Description of changes
ACG-M0084-1	Jan. 1997	First edition
ACG-M0084-2	Jul. 1997	Second edition - format change, A5 to B5 - new addition of FP0 transistor output type information
ACG-M0084-3	Jun. 1998	Third edition - descriptions for FP0 control units with RS232C port are added - descriptions for FP0 input only and output only type expansion units are added - descriptions for FP0 analog I/O unit is added
ACGM0084END V3.1	Jan. 1999	European edition - Molex type units removed - T32CP control unit information added - power supply unit information added
AGGM0084END V3.2	Sept. 1999	FP0 I/O Link Unit information added
ACGM0084END V3.3	Feb. 2000	System registers, special internal relays, and special data registers added
ACGM0084END V3.4	May 2001	Error removal, product updates. I.O.P. connection information deleted. For information on I.O.P.s, see the relevant GT or GK series manuals. Important note added for thermocouple setting using the analog mode.
ACGM0084V3.5EN	January 2009	Added FP0-E32RS expansion unit. Deleted discontinued products, e.g. FP Programmer II, programming software NPST-GR, etc. Moved FP0-A21 analog unit to separate manual: see "FP0-A21 Analog I/O Unit Technical Manual." Added FP0-SL1 (FP0 S1-Link control unit) from parent company's manual. FP0 I/O Link Unit information removed. See "MEWNET-F Remote I/O System Technical Manual." Updated corporate logo (Panasonic) and company name





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