NAiS

NAiS FP0 Hardware Manual

Matsushita Electric Works, Ltd.

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NAiS

PROGRAMMABLE CONTROLLER

FP SERIES FP0

Hardware Manual

BEFORE BEGINNING

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- **When physical defects are due to defective equipment other than the distributed product.**
- **When physical defects are due to modifications/repairs by someone other than Matsushita Electric Works, Ltd.**
- **When physical defects are due to natural disasters.**

Before You Start

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.

next page

Indicates that the text will be continued on the next page.

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Chapter 1

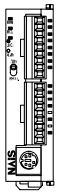
Overview

1.1 Control Units

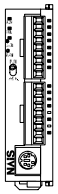
The in–/output units provide different amount of points, are equipped with/without RS232C port and with terminals or MIL connectors.

Terminal type

10 points | **10 points with RS232C**

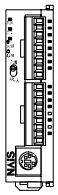


Input: 6
Relay output: 4

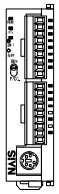


FP0-C10RS **FP0-C10CRS**

14 points | **14 points with RS232C port**



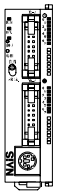
Input: 8
Relay output: 6



FP0-C14RS **FP0-C14CRS**

MIL type

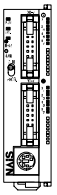
16 points



Input: 8
Transistor output: 8

NPN open collector: **FP0-C16T**
PNP open collector: **FP0-C16P**

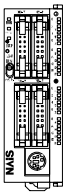
16 points with RS232C port



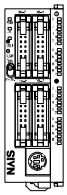
Input: 8
Transistor output: 8

NPN open collector: **FP0-C16CT**
PNP open collector: **FP0-C16CP**

32 points | **32 points with RS232C port**

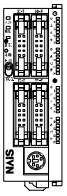


Input: 16
Transistor output: 16



NPN open collector: **FP0-C32T**
PNP open collector: **FP0-C32P**

32 points with RS232C port



Input: 16
Transistor output: 16

PNP open collector: **FP0-T32CP**

1.2 Expansion Units

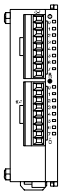
Expansion units provide digital and analog in–/outputs.

1.2.1 Expansion I/O Units

There are combined in–/output units, input units, and transistor output units. They are either equipped with terminals or with MIL connectors.

Terminal type

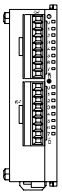
8 points



(Input: 4 Relay output: 4)

FP0-E8RS

16 points

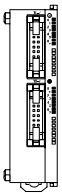


(Input: 8 Relay output: 8)

FP0-E16RS

MIL type

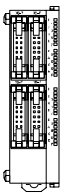
16 points



(Input: 8 Transistor output: 8)

NPN open collector: **FP0-E16T**
PNP open collector: **FP0-E16P**

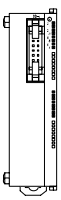
32 points



(Input: 16 Transistor output: 16)

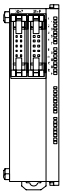
NPN open collector: **FP0-E32T**
PNP open collector: **FP0-E32P**

8 inputs



FP0-E8X

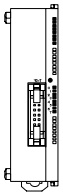
16 inputs



FP0-E16X

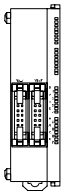
MIL type, continued

8 transistor outputs



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

16 transistor outputs

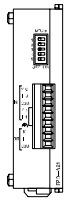


NPN open collector: **FP0-E16YT**
PNP open collector: **FP0-E16YP**

1.2.2 Intelligent Unit and Link Unit

The analog unit provides 2 inputs and 1 output.

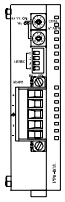
Analog I/O unit (**Input: 2 channels** **Output: 1 channel**)



FP0-A21

The FP0 I/O Link Unit works as the slave station of a remote I/O system. The FP0 I/O Link Unit exchanges I/O information with the master unit.

FP0 I/O Link Unit (**Input: 32 points** **Output: 32 points**)

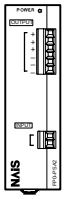


FP0–IOL

1.2.3 FP0 Power Supply Unit

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

FP0 Power Supply Unit



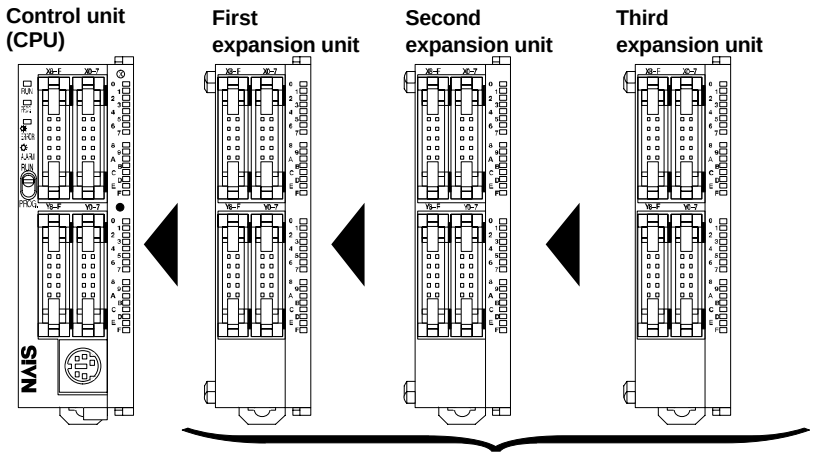
FP0–PSA2

1.3 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.**



- **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

1.4 Combinating Units

Relay Output Units

Total number of I/O points	=	Control unit	+ First expansion I/O unit	+ Second expansion I/O unit	+ Third expansion I/O unit
10 (Input: 6 / Output: 4)	=	**10** (Input: 6 / Output: 4)			
14 (Input: 8 / Output: 6)	=	**14** (Input: 8 / Output: 6)			
18 (Input: 10 / Output: 8)	=	**10** (Input: 6 / Output: 4)	+ **8** (Input: 4 / Output: 4)		
22 (Input: 12 / Output: 10)	=	**14** (Input: 8 / Output: 6)	+ **8** (Input: 4 / Output: 4)		
26 (Input: 14 / Output: 12)	=	**10** (Input: 6 / Output: 4)	+ **16** (Input: 8 / Output: 8)		
	=	**10** (Input: 6 / Output: 4)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)	
30 (Input: 16 / Output: 14)	=	**14** (Input: 8 / Output: 6)	+ **16** (Input: 8 / Output: 8)		
	=	**14** (Input: 8 / Output: 6)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)	
34 (Input: 18 / Output: 16)	=	**10** (Input: 6 / Output: 4)	+ **16** (Input: 8 / Output: 8)	+ **8** (Input: 4 / Output: 4)	
	=	**10** (Input: 6 / Output: 4)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)
38 (Input: 20 / Output: 18)	=	**14** (Input: 8 / Output: 6)	+ **16** (Input: 8 / Output: 8)	+ **8** (Input: 4 / Output: 4)	
	=	**14** (Input: 8 / Output: 6)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)
42 (Input: 22 / Output: 20)	=	**10** (Input: 6 / Output: 4)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)	
	=	**10** (Input: 6 / Output: 4)	+ **16** (Input: 8 / Output: 8)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)
46 (Input: 24 / Output: 22)	=	**14** (Input: 8 / Output: 6)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)	
	=	**14** (Input: 8 / Output: 6)	+ **16** (Input: 8 / Output: 8)	+ **8** (Input: 4 / Output: 4)	+ **8** (Input: 4 / Output: 4)
50 (Input: 26 / Output: 24)	=	**10** (Input: 6 / Output: 4)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)	+ **8** (Input: 4 / Output: 4)
54 (Input: 28 / Output: 26)	=	**14** (Input: 8 / Output: 6)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)	+ **8** (Input: 4 / Output: 4)
58 (Input: 30 / Output: 28)	=	**10** (Input: 6 / Output: 4)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)
62 (Input: 32 / Output: 30)	=	**14** (Input: 8 / Output: 6)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)	+ **16** (Input: 8 / Output: 8)

Transistor Output Units

Total number of I/O points	=	Control unit	+	First expansion I/O unit	+	Second expansion I/O unit	+	Third expansion I/O unit
16 (Input: 8, Output: 8)	=	16 (Input: 8, Output: 8)						
32 (Input: 16, Output: 16)	=	32 (Input: 16, Output: 16)						
	=	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)				
48 (Input: 24, Output: 24)	=	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)				
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)				
	=	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)		
64 (Input: 32, Output: 32)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)				
	=	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)		
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)		
	=	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
80 (Input: 40, Output: 40)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)		
	=	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)		
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
96 (Input: 48, Output: 48)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)		
	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)	+	16 (Input: 8, Output: 8)
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)
112 (Input: 56, Output: 56)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	16 (Input: 8, Output: 8)
	=	16 (Input: 8, Output: 8)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)
128 (Input: 64, Output: 64)	=	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)	+	32 (Input: 16, Output: 16)

1.5 Programming Tools

Type		Description	Order number
PC software	**FPWIN Pro**	Program editing windows software for use with commercially available computers. (System required: IBM compatible with Pentium 1 processor, 60MB free hard disk, CD–ROM drive, 32MB RAM (recommended), and Windows 3.11/95/98/2000/NT)	FPWINPro C/F/S/U DED/END/ FRD
	FPWIN GR	Program editing windows software for use with commercially available computers. (System required: IBM compatible with Pentium 100MHz processor, 15MB free hard disk, 32MB RAM (recommended), and Windows 95/98/NT.)	FPWINGR FD By summer 2001: Ital. and Span. versions
	FP PC cable	Cable needed for connection between the tool port of FP0 control unit and the RS232C port (25 pins) of RS232C port adapter.	AFC8513 (3m/9.84ft.) (see note 2)
Programmer	**FP programmer II Ver. 2 (see note 1)**	Handheld programming device	AFP1114V2
	FP peripheral cable	Cable needed for connection between the tool port of FP0 control unit and the FP programmer II's communication port.	AFC8521 (1m/3.28ft.) AFC8523 (3m/9.84ft.)

Notes

1) When FP programmers (AFP1112A/AFP1114) are used, reading and writing of the following FP0 instructions are not possible and the functions cannot be used.

- **High–speed counter function (related instructions: F166/F167)**
- **Pulse output function (related instructions: F168/F169)**
- **PWM output function (related instruction: F170)**
- **1ms unit timer instruction (TML)**
- **32–bit auxiliary timer instruction (F183)**
- **Changing the communication baud rate to 19,200bps (factory setting is 9600bps)**

2) If the FP PC cable (AFC8513) is to be connected to a computer (IBM PC/AT compatible), use a commercially available 9 pin – 25 pin port adapter.

Chapter 2

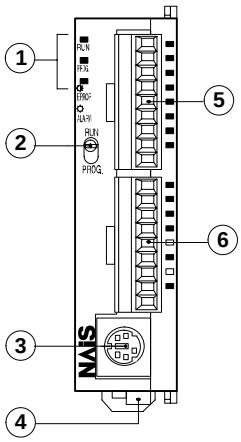
Control Units

2.1 Parts and Terminology

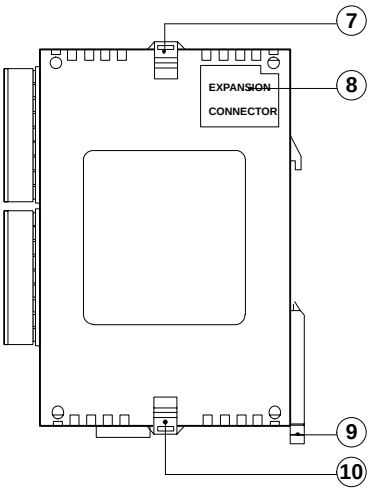
There are thirteen different control unit types available:

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)

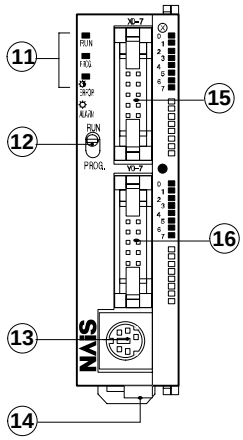
C10RS/C14RS
C10CRS/C14CRS
(terminal type)



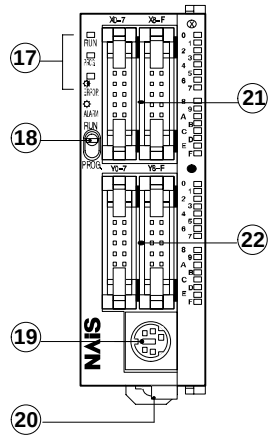
All control unit types



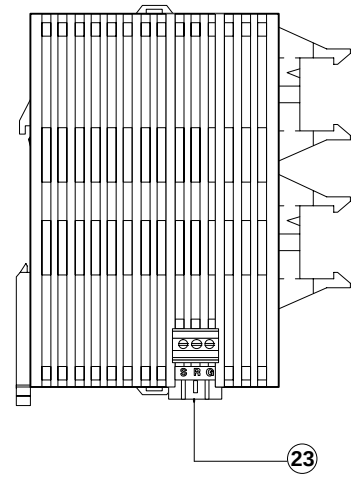
C16T/C16CT
C16P/C16CP



C32T/C32CT
C32P/C32CP/T32CP



Control unit with RS232C port



① ⑪ ⑰ Status indicator LEDs

display the operation mode and error statuses (see page 2-4).

② ⑫ ⑱ Mode switch

changes the operation mode (see page 2-4).

③ ⑬ ⑲ Tool port (RS232C)

is used to connect a programming tool (see page 2-4).

④ ⑭ ⑲ 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 9 - 12).

⑦ ⑩ 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 8 - 5).

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 9 - 14).

㉑ Input connectors (10-pin × 2)

㉒ Output connectors (10-pin × 2)

Use a MIL type connector for the input and output connectors (㉑ and ㉒) (see page 9 - 14).

㉓ 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 9 - 16).

2.1.1 Status Indicator LEDs

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

LED	Description
RUN (green)	Illuminates when in the RUN mode and indicates the execution of a program. It flashes during forced input/output.
PROG. (green)	Illuminates when in the PROG. mode and indicates that operation has stopped.
ERROR/ALARM (red)	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

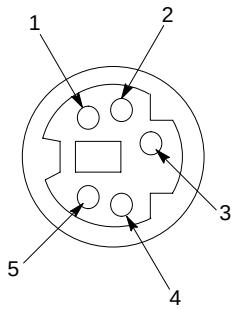
This switch turns ON and OFF (RUN/PROG.) the operation of the FP0. The FP0 can also be turned ON and OFF by the programming tool.

Switch position	Operation mode
RUN (upward)	This sets the RUN mode. The program is executed and operation begins.
PROG. (downward)	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. 100MΩ (measured with a 500V DC megger) between I/O terminal and ground terminal
Noise immunity		1,000Vp-p with pulse widths 50ns and 1µs (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 2-6)
Shock resistance		Shock of 98m/s^2 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

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.

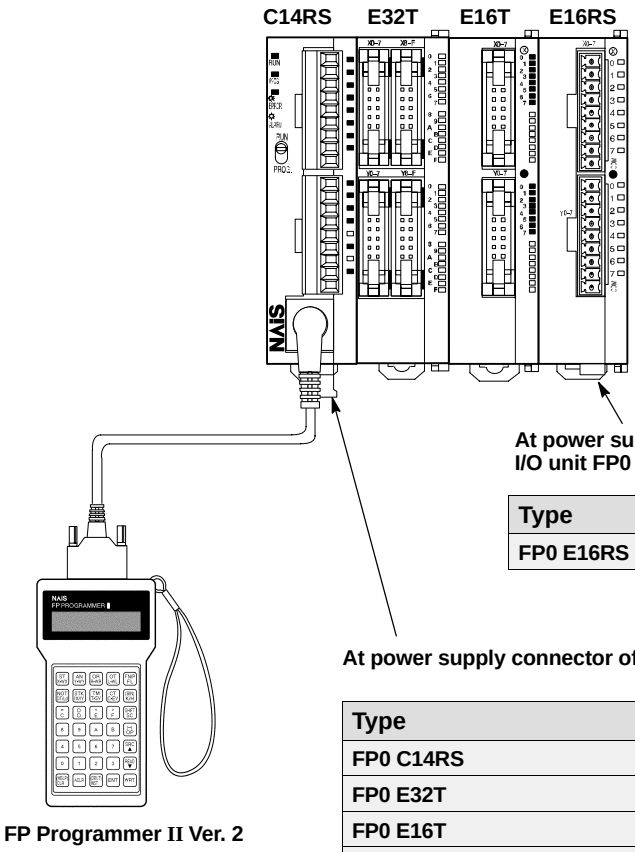
Type		Current consumption (at 24V DC)
Control unit	**C10RS, C10CRS**	100mA or less
	C14RS, C14CRS	100mA or less
	C16T, C16CT, C16P, C16CP	40mA or less
	C32T, C32CT, C32P, C32CP, T32CP	60mA or less
Expansion I/O unit	**E8X**	10mA or less
	E8YT, E8YP	15mA or less
	E8RS, E16RS, E16X	20mA or less
	E16YT, E16YP, E16T, E16P	25mA or less
	E32T, E32P	40mA or less
Analog I/O unit	**A21**	20mA or less
FP Programmer II 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
Analog I/O unit	**A21**	100mA

Example: Current consumption



FP Programmer II Ver. 2

At power supply connector of expansion I/O 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
FP Programmer II Ver. 2	50mA
Total current consumption	235mA or less

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 FP0 Programming Manual.

Item			Relay output type		Transistor output type		
			C10RS C10CRS	C14RS C14CRS	C16T C16CT C16P C16CP	C32T C32CT C32P C32CP	T32CP
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, 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.**

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="2">Relay output type</th><th colspan="3">Transistor output type</th></tr>
<tr><th>C10RS
C10CRS</th><th>C14RS
C14CRS</th><th>C16T
C16CT
C16P
C16CP</th><th>C32T
C32CT
C32P
C32CP</th><th>T32CP</th></tr>
<tr><td rowspan="8">Special functions</td><td>Pulse catch input</td><td></td><td colspan="5" rowspan="2">Total 6 points
(X0 and X1: 50µs
X2 to X5: 100µs)</td></tr>
<tr><td>Interrupt input</td><td></td></tr>
<tr><td colspan="2">RS232C port (see note 1)</td><td colspan="5">Available unit: FP0-C10CRS, C10CRM, C14CRS, C14CRM, C16CT, C16CP, C32CT, C32CP, and T32CP
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</td></tr>
<tr><td colspan="2">Periodical interrupt</td><td colspan="5">0.5ms to 30s interval</td></tr>
<tr><td colspan="2">Constant scan</td><td colspan="5">Available</td></tr>
<tr><td colspan="2">High-speed counter function (see notes 2, 3)</td><td colspan="5">Counter mode: Addition/subtraction (one phase)
• Input point number: 4 channels maximum
• Maximum counting speed: 10kHz maximum for all 4 channels (see note 4)
• Input contacts used:
X0: count input (ch 0)
X1: count input (ch 1)
X2: reset input (see note 5)
X3: count input (ch 2)
X4: count input (ch 3)
X5: reset input (see note 5)
• Minimum input pulse width: X0, X1.. 50µs <10kHz>
X3, X4 ..100µs <5kHz>

Counter mode: Two-phase/individual/direction decision (two phase)
• Input point number: 2 channels maximum
• Maximum counting speed: kHz maximum for all 2 channels
• Input contacts used:
X0: count input (ch 0)
X1: count input (ch 0)
X2: reset input
X3: count input (ch 2)
X4: count input (ch 2)
X5: reset input
• Minimum input pulse width: X0, X1.. 50µs <10kHz>
X3, X4 ..100µs <5kHz></td></tr>
<tr><td rowspan="2">Pulse output function (see note 3)</td><td>Output point number</td><td colspan="2">————————</td><td colspan="3">Two independent points (Y0 and Y1)
(No interpolation function)</td></tr>
<tr><td>Output frequency</td><td colspan="2">————————</td><td colspan="3">40Hz to 10kHz
(Y0/Y1: one-point output)
40Hz to 5kHz
(Y0/Y1: two-point output)</td></tr>
<tr><td rowspan="2">Special functions</td><td rowspan="2">PWM output function (see note 3)</td><td>Output point number</td><td colspan="2">————————</td><td colspan="3">Two points (Y0 and Y1)</td></tr>
<tr><td>Output frequency</td><td colspan="2">————————</td><td colspan="3">Frequency: 0.15Hz to 38Hz
(see note 6)
Duty: 0.1% to 99.9%</td></tr>
</table>

Notes

1) **When using the RS232C port for communication, retransmission is recommended.**
   The driver IC for the RS232C port conforms completely to EIA/TIA-232E and CCITT V28 standards.
2) **The combinations 1 phase × 2 channels and 2 phases × 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 X0 and X1, 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	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

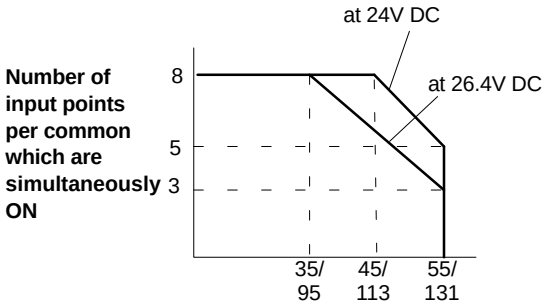
1) **Either positive or negative polarity is possible for the input voltage supply.**

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.

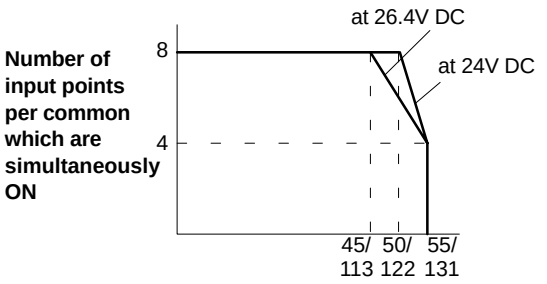
Limitations on Number of Simultaneous Input ON Points

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

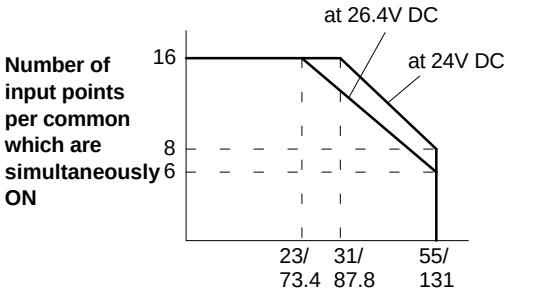
FP0–C14RS/C14CRS



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

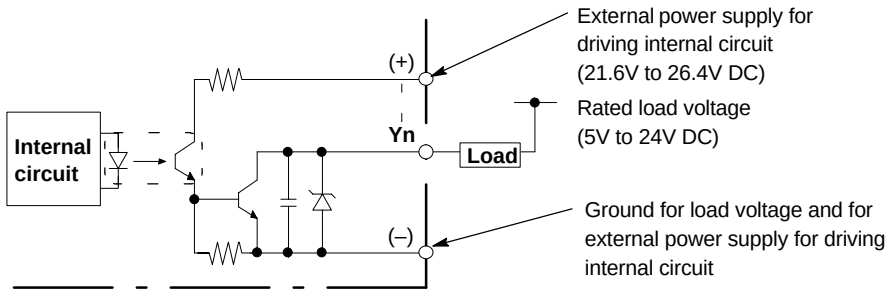
FP0 transistor output types: C16T, C16CT, C16P, C16CP, C32T, C32CT, C32P, C32CP, T32CP

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	16 points/common
OFF state leakage current		100µA 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 → ON**	1ms or less (Y0 and Y1 only: 50µs or less)
	ON → OFF	1ms or less (Y0 and Y1 only: 50µs or less)
Surge absorber		Zener diode
Operating mode indicator		LED

Notes

- **The T32CP control unit uses only the PNP open collector.**

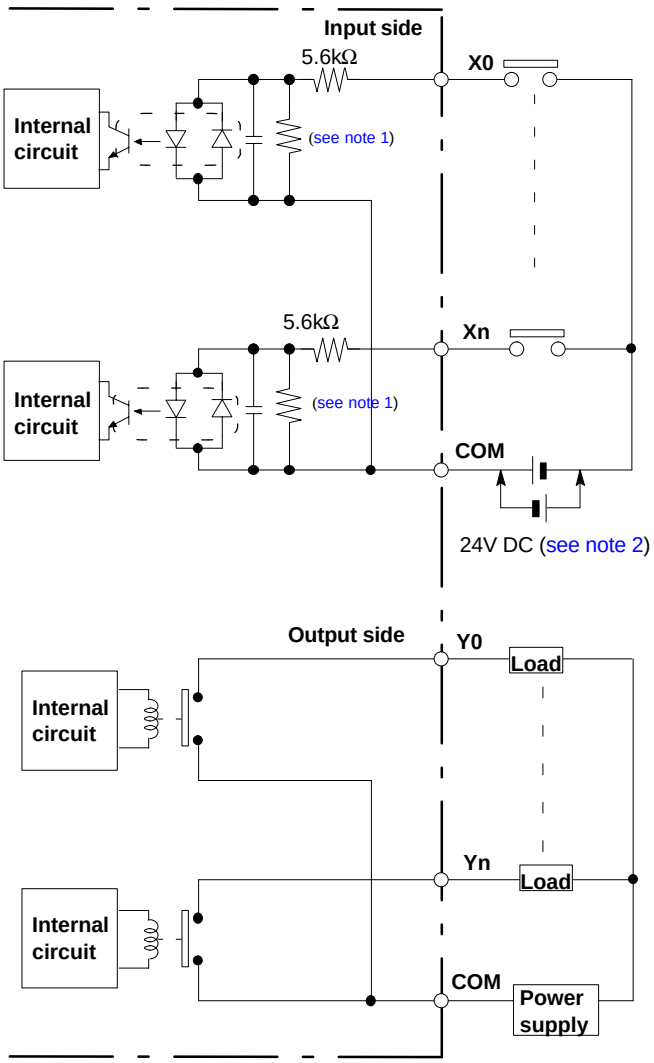
- **For NPN open collector type, able to be used with different voltages for the load voltage and the external power supply for driving the internal circuit.**



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.**

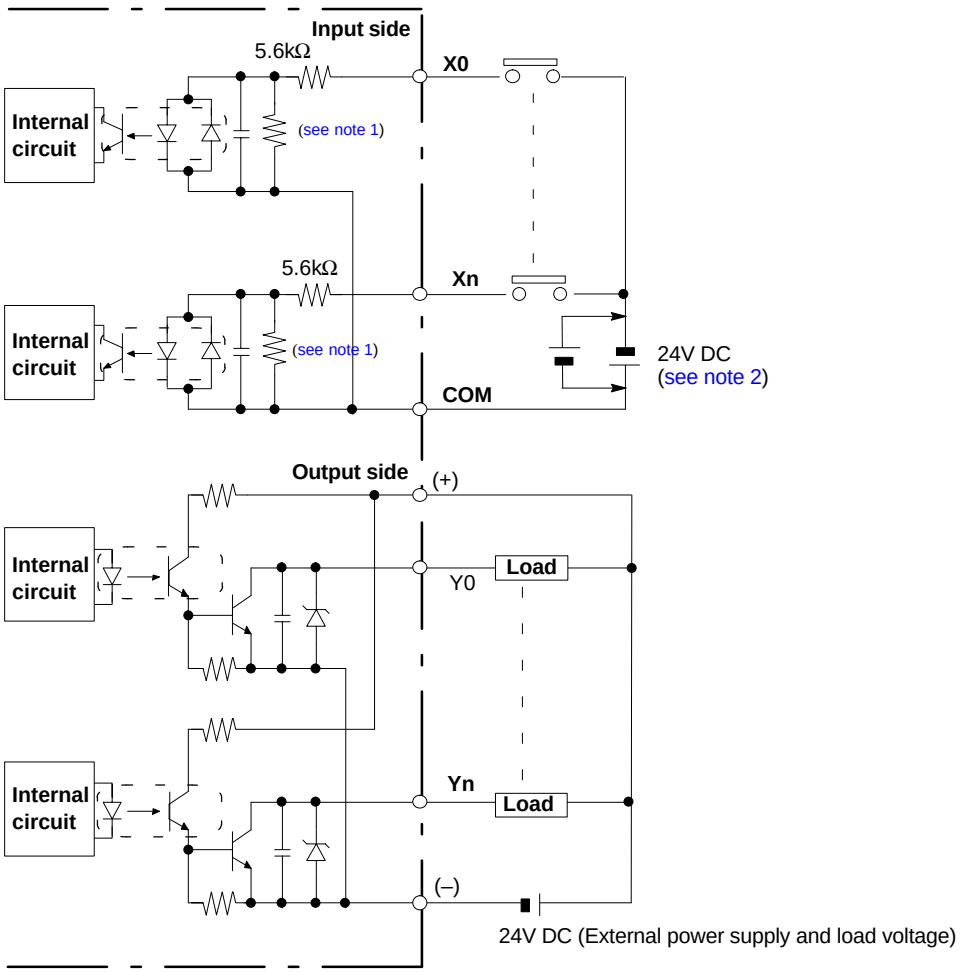
2) **Either positive or negative polarity is possible for the input voltage supply.**

2.3.2 Transistor Output Type

NPN Open Collector Type

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-C16T/C16CT/C32T/C32CT



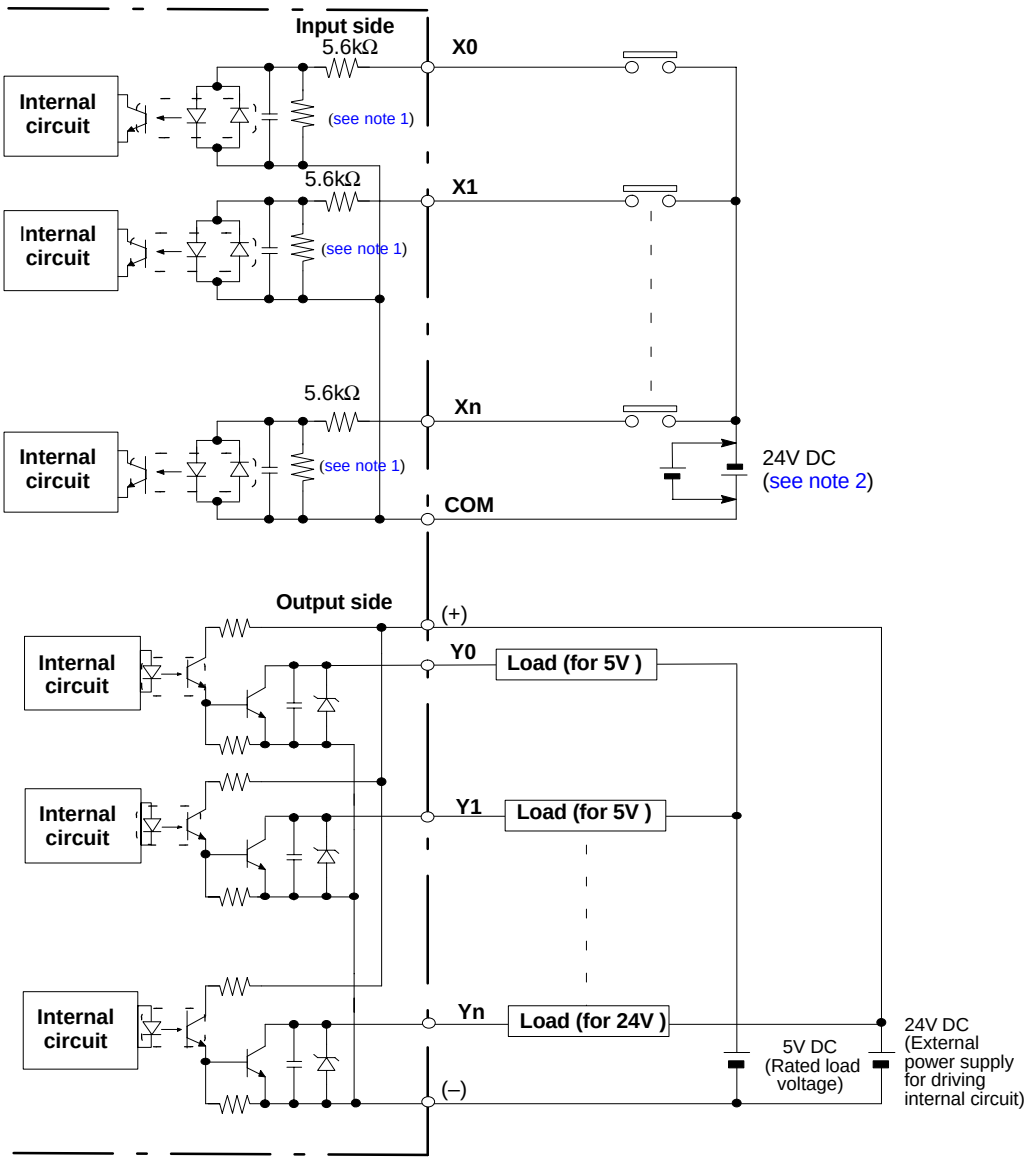
Notes

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.**

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

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

FP0-C16T/C16CT/C32T/C32CT

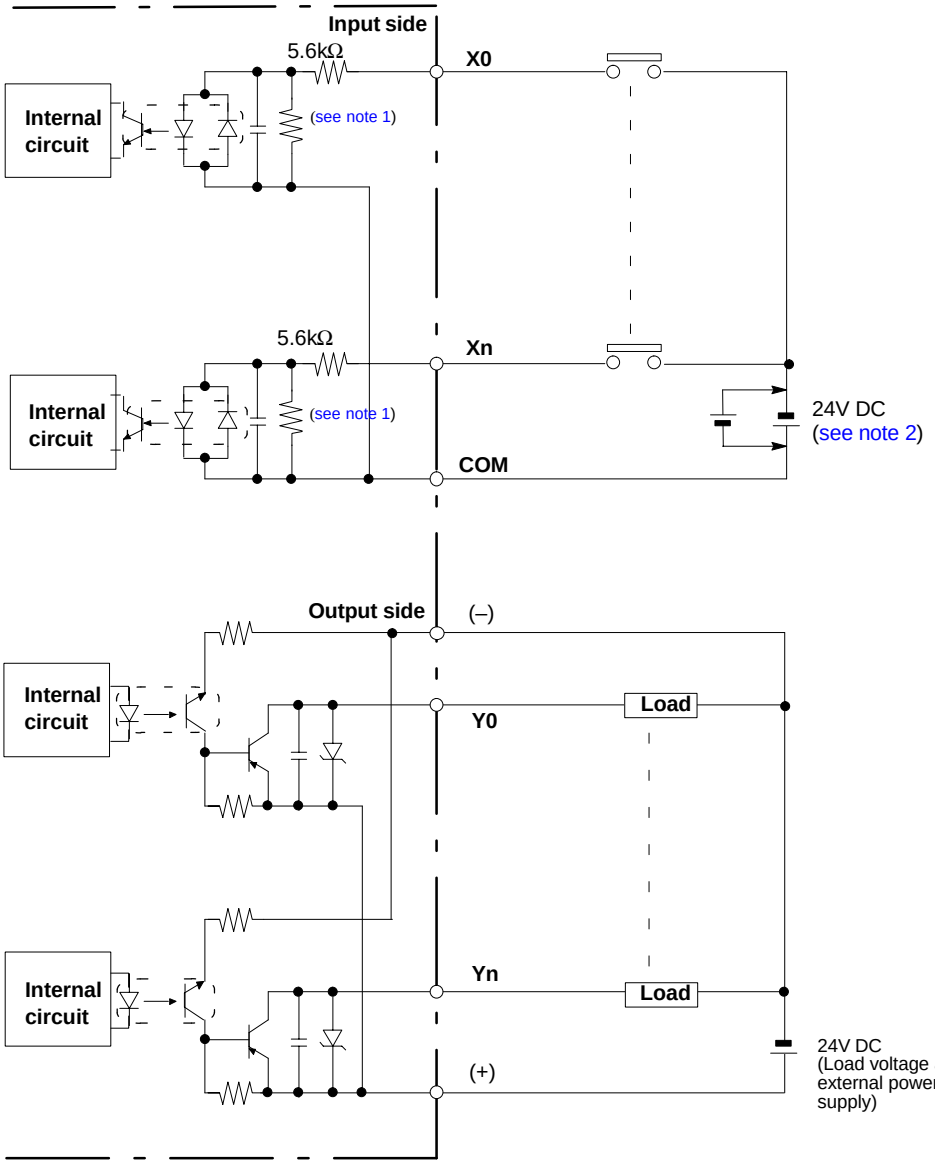


Notes

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

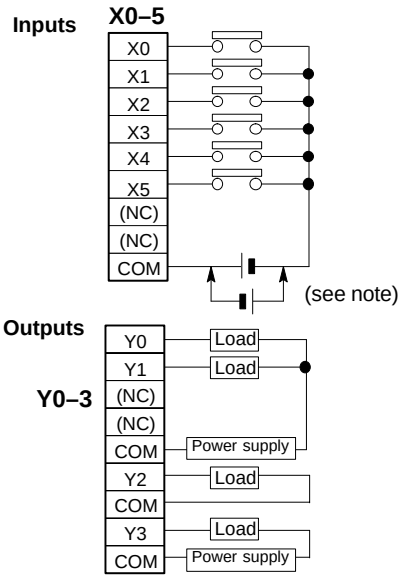


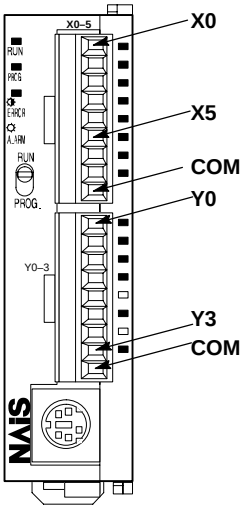
Notes

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.**

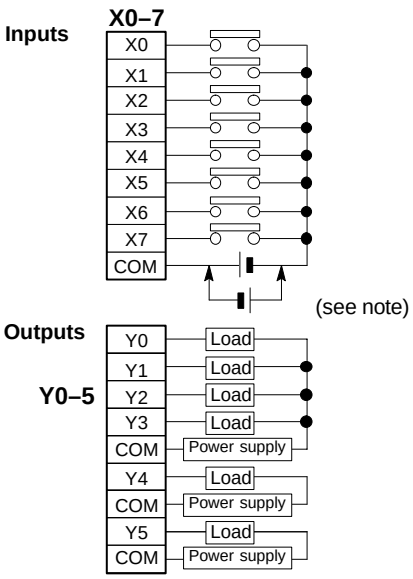
2.4 Pin Layouts

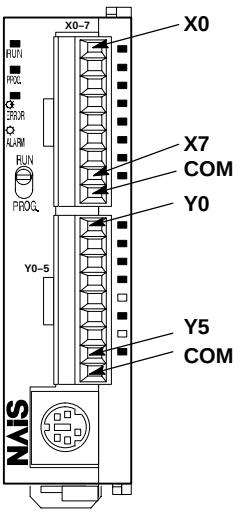
2.4.1 C10RS/C10CRS





2.4.2 C14RS/C14CRS



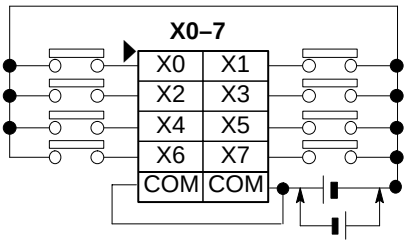


Note

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

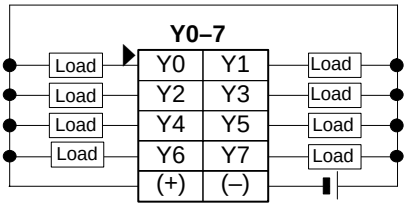
2.4.3 C16T/C16CT

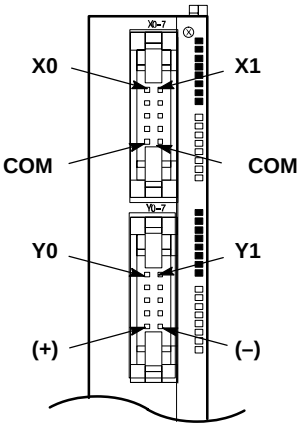
Inputs



(see note 1)

Outputs



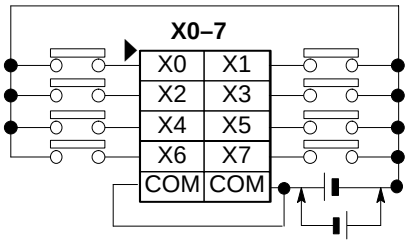


Notes

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.**

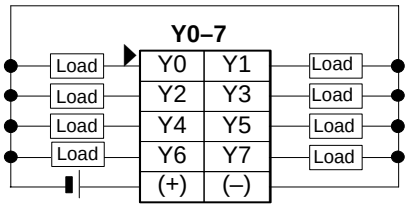
2.4.4 C16P/C16CP

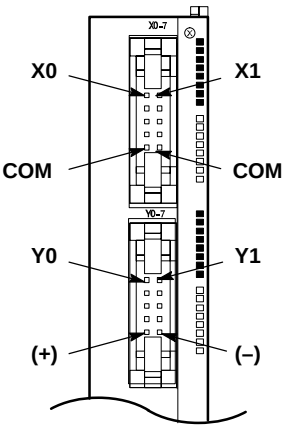
Inputs



(see note 1)

Outputs



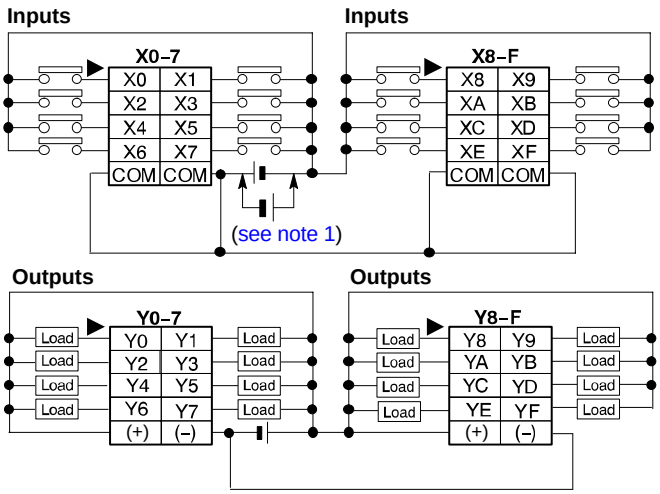


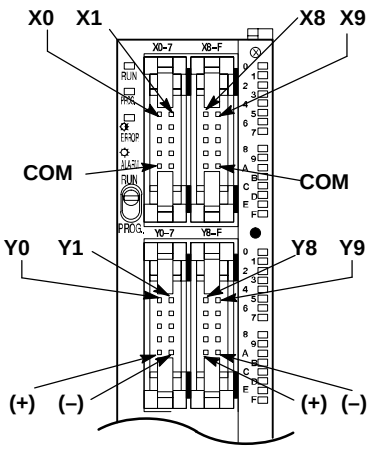
Notes

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





Notes

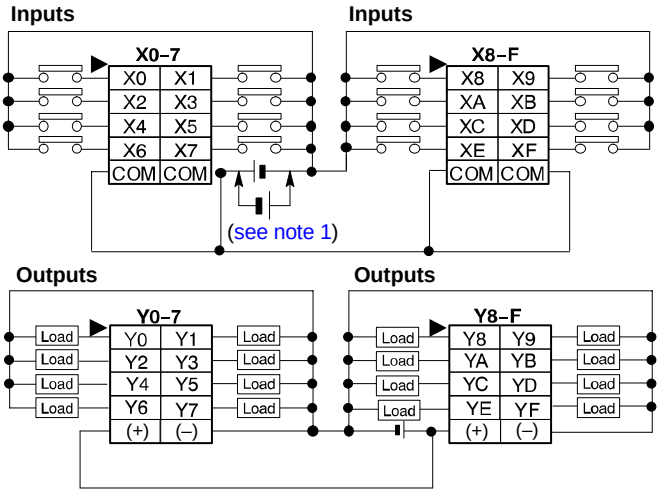
1) Either positive or negative polarity is possible for the input voltage supply.

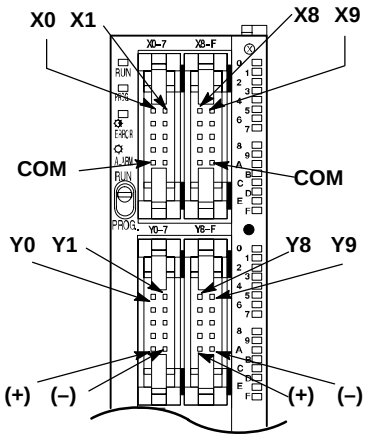
2) The four COM terminals of input terminals (X0–7 and X8–F) are connected internally, however they should be externally connected as well.

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

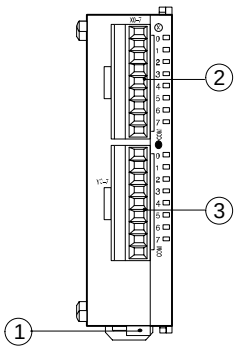
Expansion I/O Units

3.1 Parts and Terminology

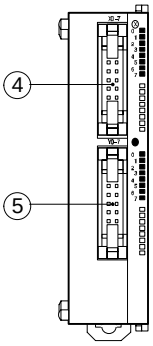
There are twelve different expansion I/O unit types available:

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

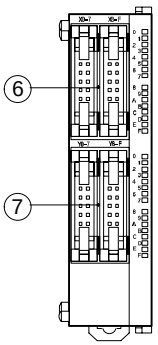
E8RS/E16RS (terminal type)



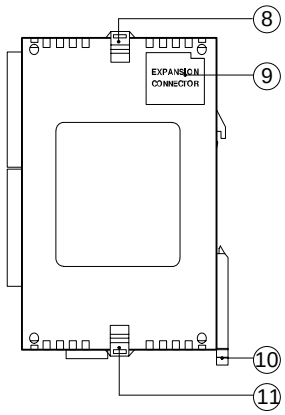
E16T/E16P

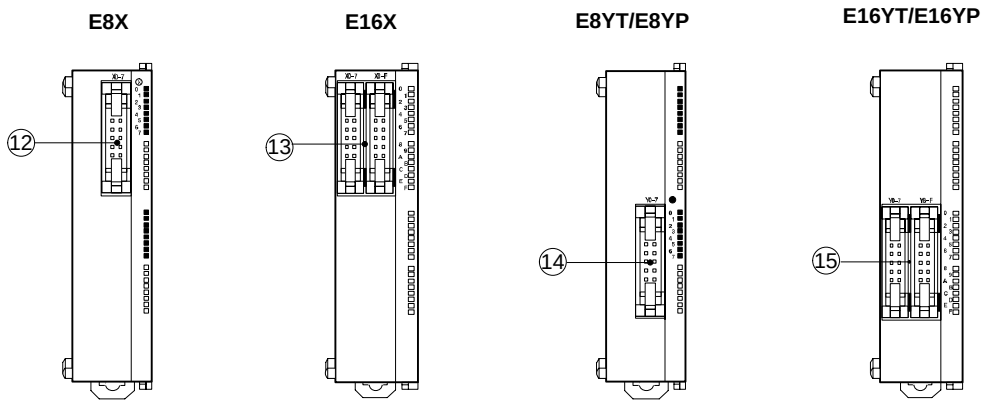


E32T/E32P



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 9 - 12).

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 9 - 14).

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 8 - 5).

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 2-5.

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. 5.6kΩ
Operating voltage range		21.6 to 26.4V DC
Input points per common (see note)	**E8RS**	4 points/common
	E16RS, E16T, E16P, E8X	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 ↔ ON**	2ms or less
	ON ↔ OFF	the same as above
Operating mode indicator		LED

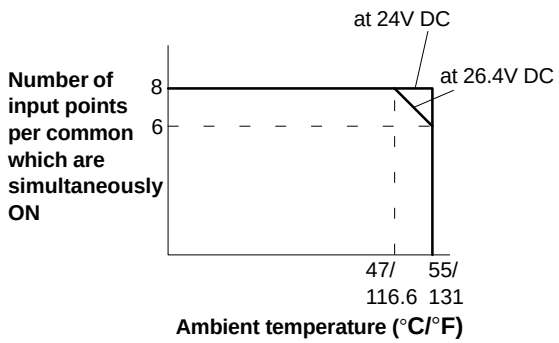
Note

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

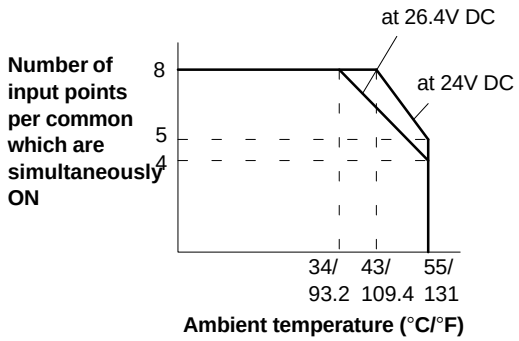
Limitations on Number of Simultaneous Input ON Points

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

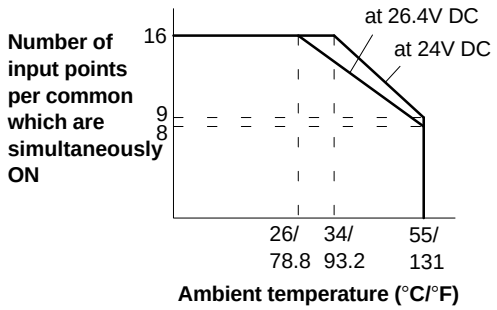
FP0–E16RS



FP0–E16T/E16P/E8X



FP0–E32T/E32P/E16X



3.2.3 Output Specifications

Relay Output Type

FP0 relay output types: E8RS and E16RS

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	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

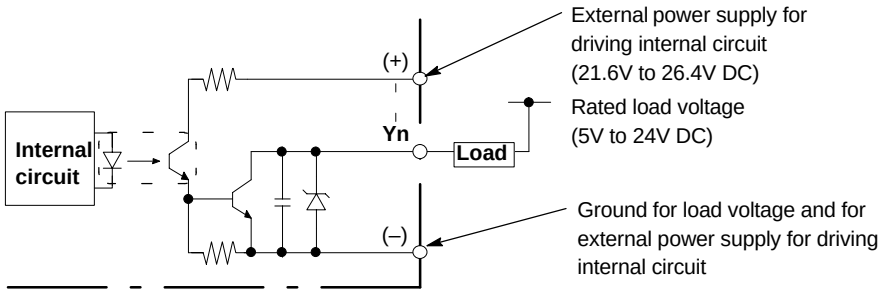
Transistor Output Type

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		100μA 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 → ON**	1ms or less (Y0 and Y1 only: 50μs or less)
	ON → OFF	1ms or less (Y0 and Y1 only: 50μs or less)
Surge absorber		Zener diode
Operating mode indicator		LED

Note

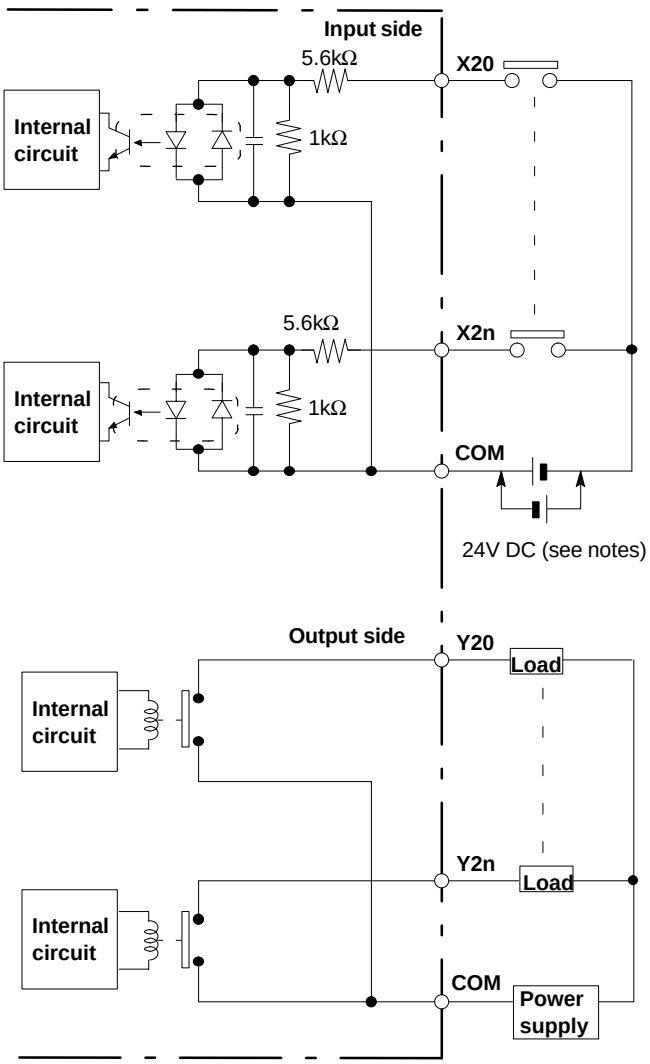
For NPN open collector type, able to be used with different voltages for the load voltage and the external power supply for driving the internal circuit.



3.3 Internal Circuit Diagram

3.3.1 Relay Output Type

FP0-E8RS/E16RS



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 7 - 4).**

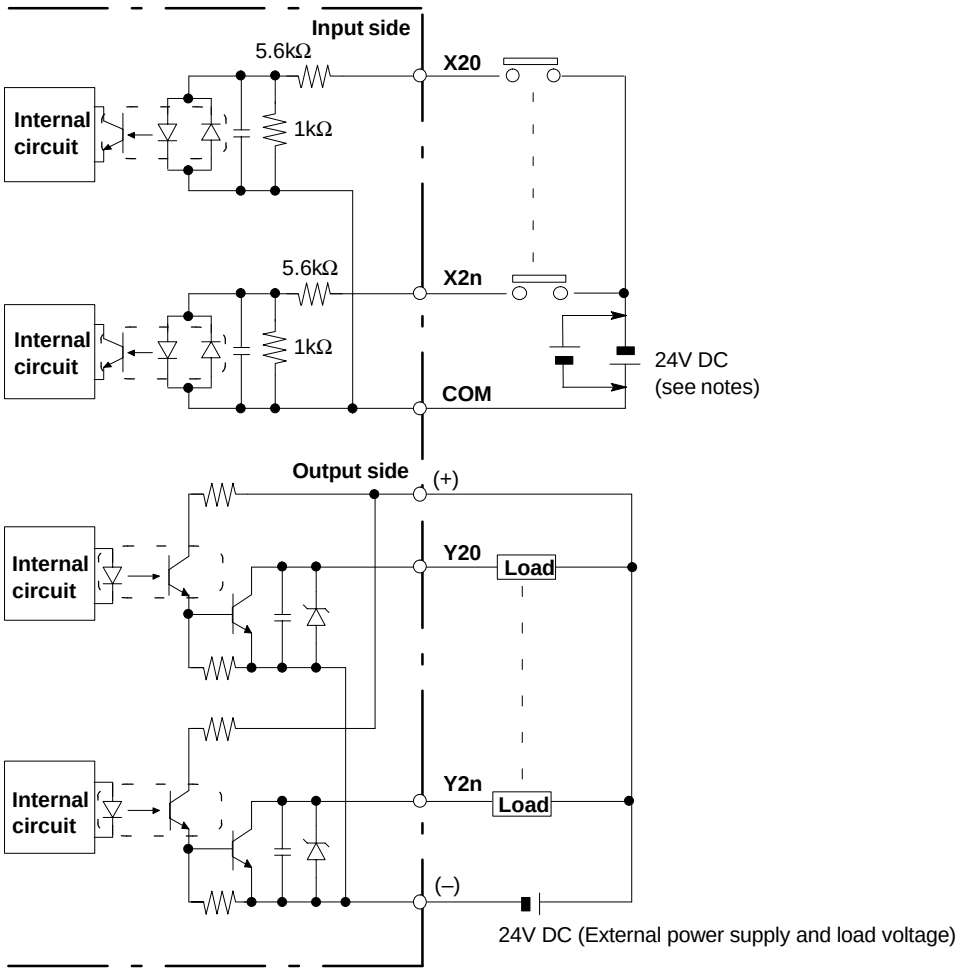
3.3.2 Transistor Output Type

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-E16T/E32T



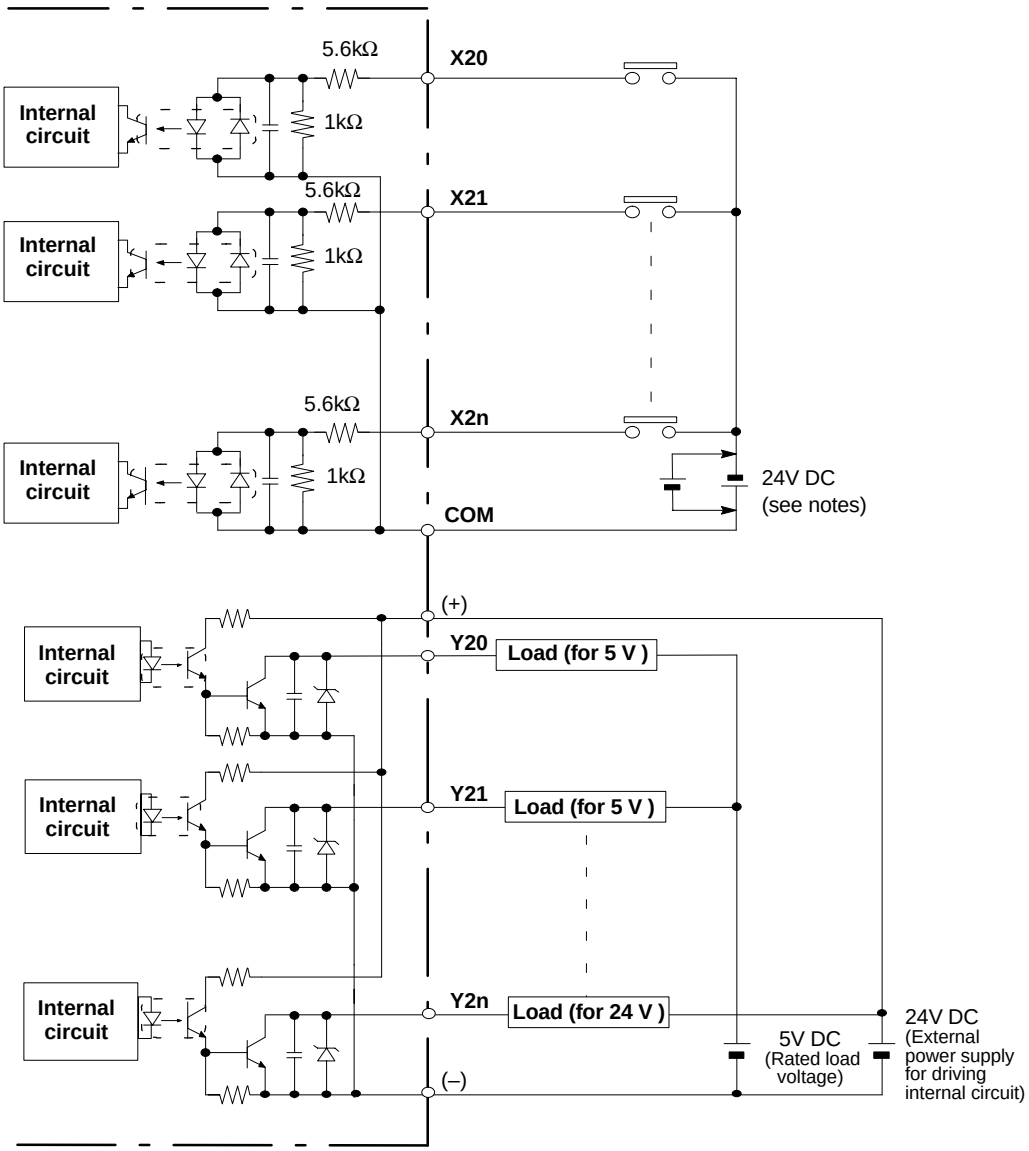
Notes

- **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 7 - 4).**

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-E16T/E32T

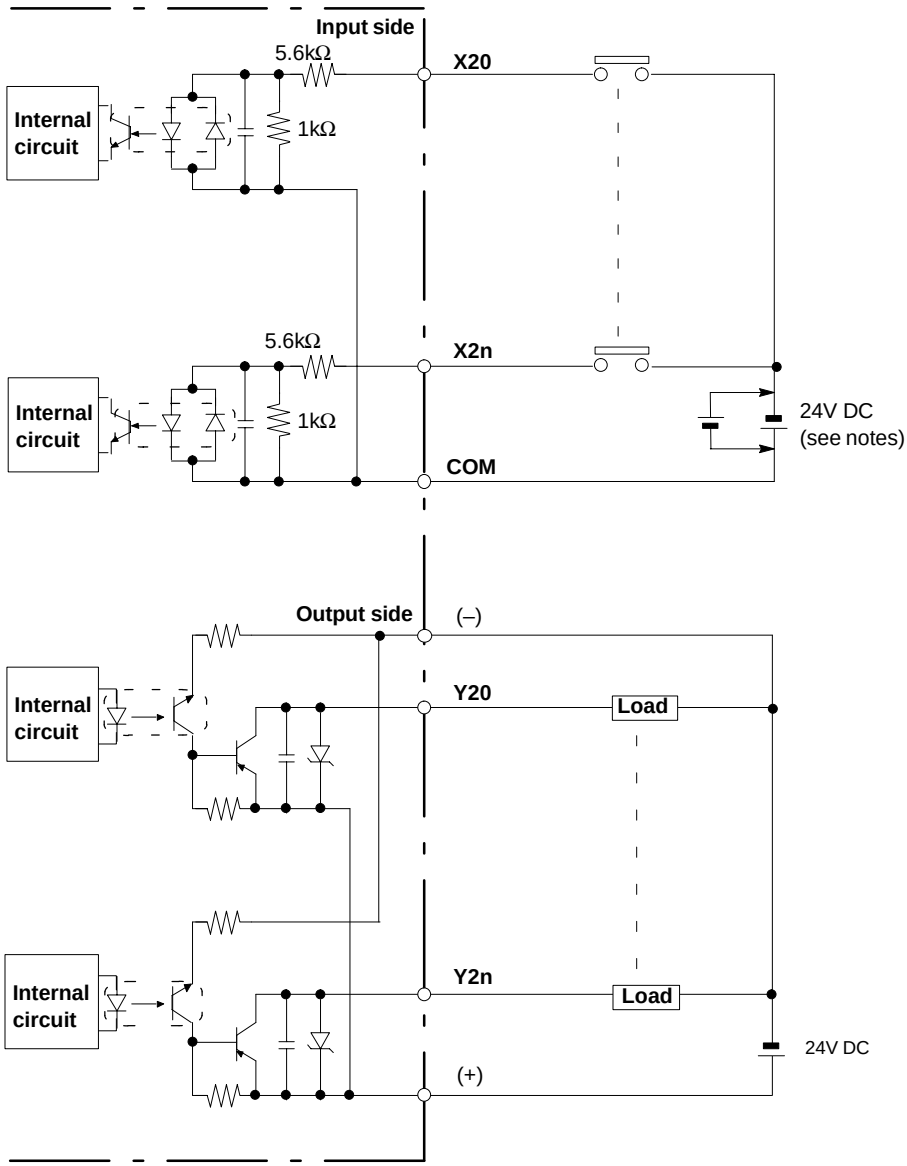


Notes

- **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 7 - 4).**

PNP Open Collector Type

FP0-E16P/E32PT

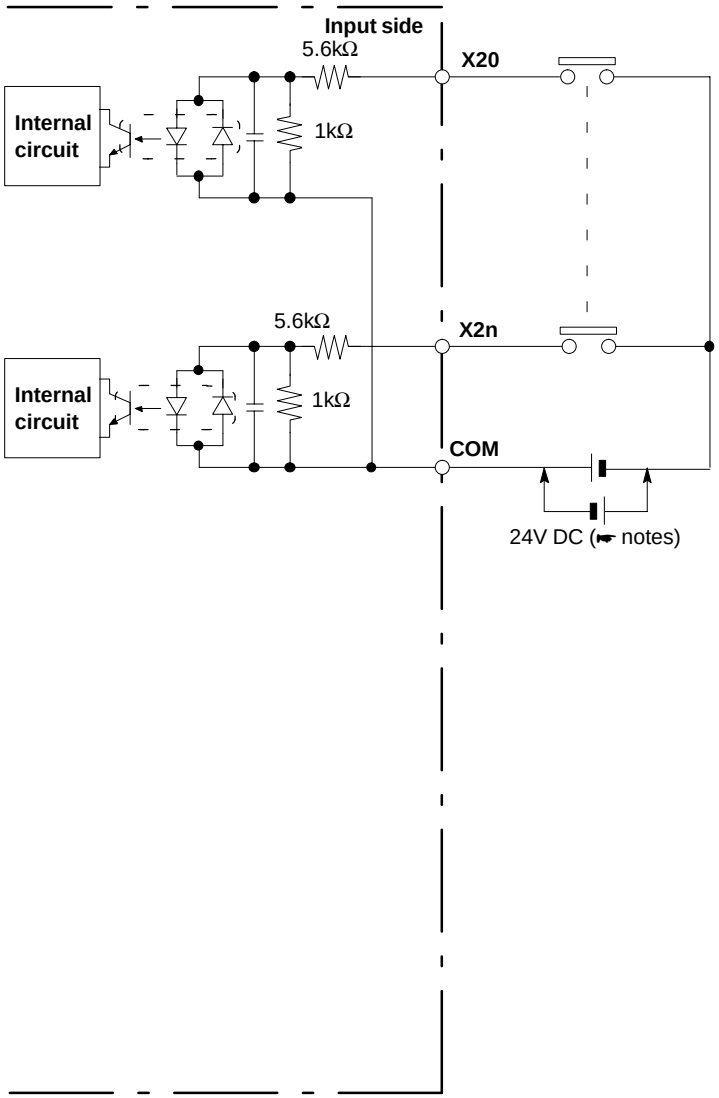


Notes

- **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 7 - 4).**

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 7 - 4).**

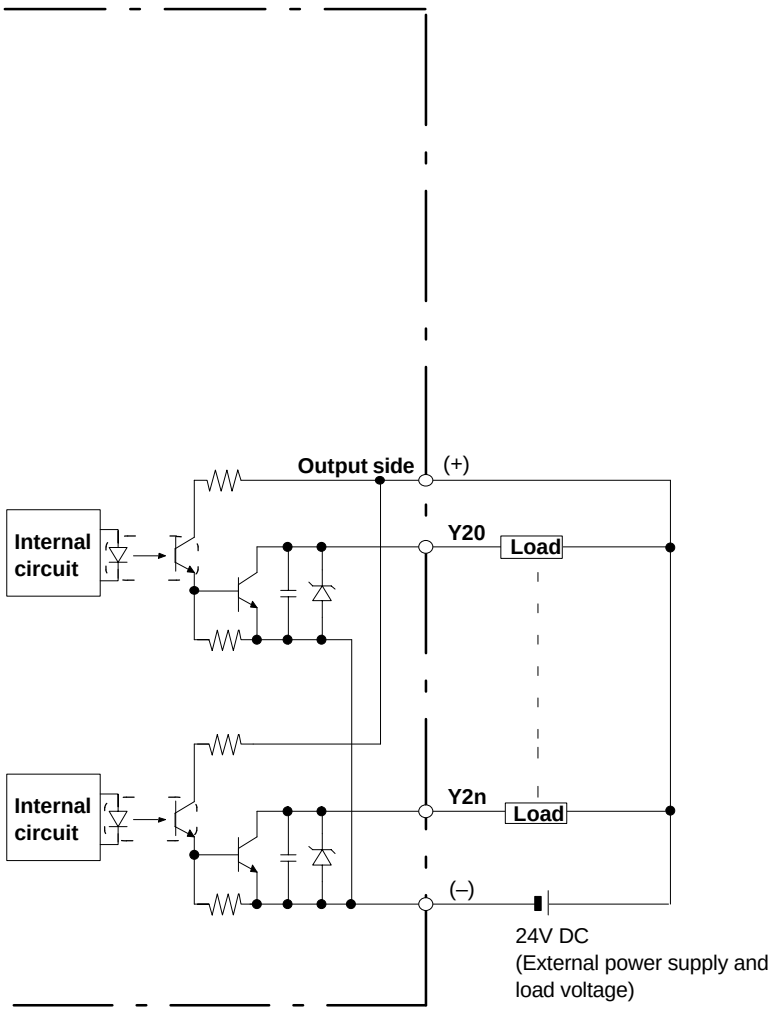
3.3.4 Expansion Output Units

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



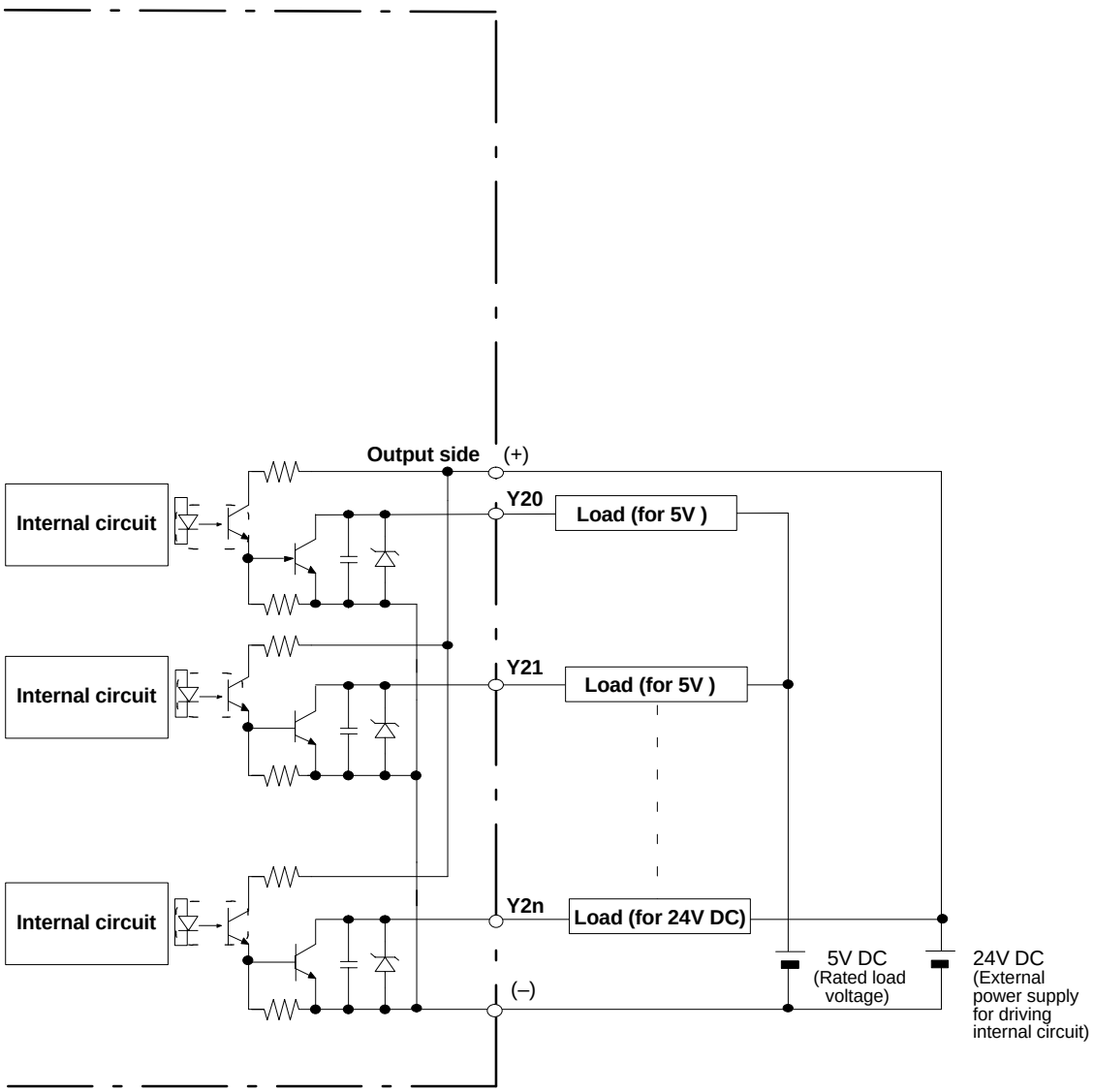
Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (see page 7 - 4).

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

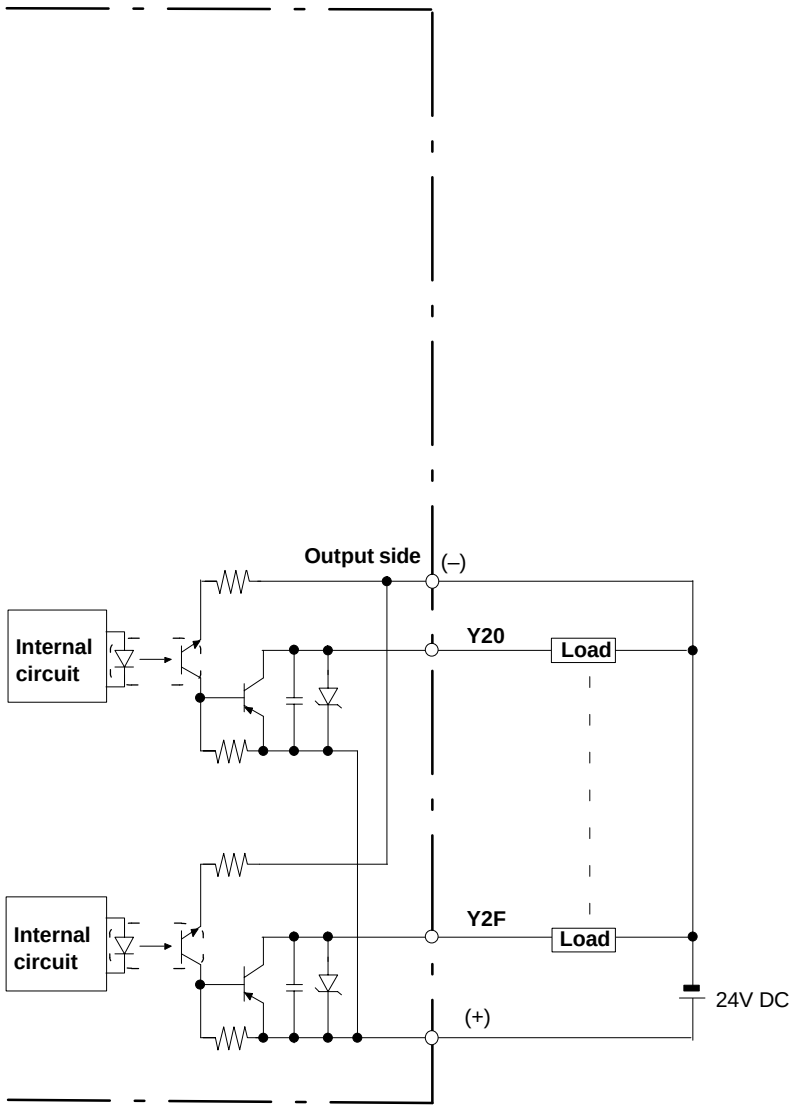


Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (see page 7 - 4).

PNP Open Collector Type

FP0-E8YP/E16YP

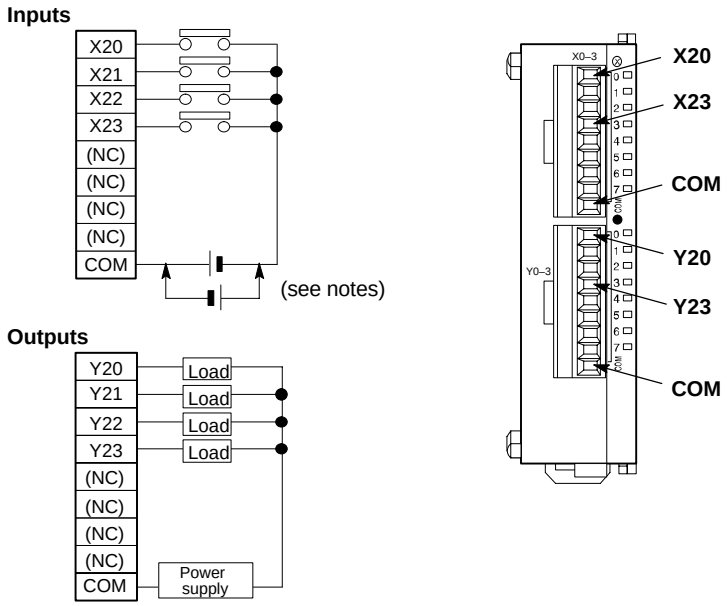


Note

The output number given above is the output number when the expansion output unit is installed as the first expansion unit (see page 7 - 4).

3.4 Pin Layouts

3.4.1 E8RS

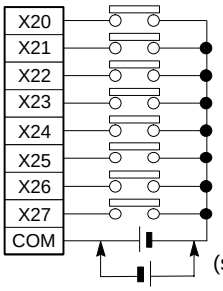


Notes

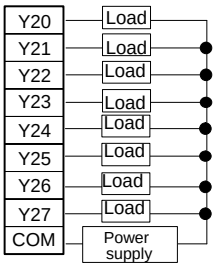
- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 7 - 4).**

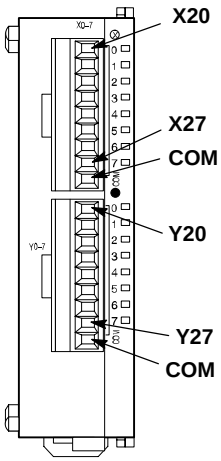
3.4.2 E16RS

Inputs



Outputs



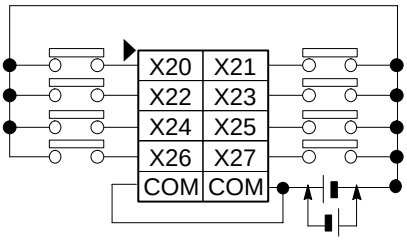


Notes

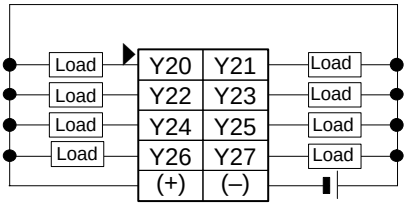
- **Either positive or negative polarity is possible for the input voltage supply.**
- **The I/O number given above is the I/O number when the expansion I/O unit is installed as the first expansion unit. The I/O numbers for the expansion I/O units will differ depending on the location where they are installed (see page 7 - 4).**

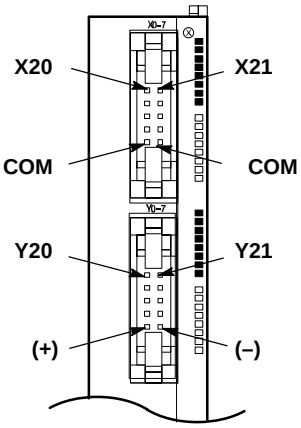
3.4.3 E16T

Inputs



Outputs



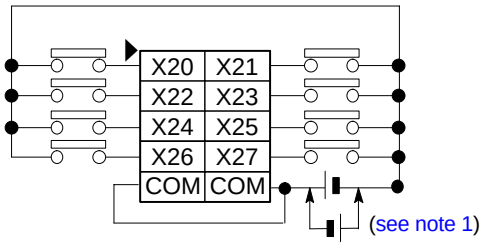


Notes

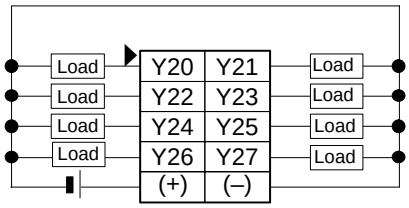
1) **Either positive or negative polarity is possible for the input voltage supply.**
2) **The two COM terminals of input terminals are connected internally, however they should be externally connected as well.**
3) **The I/O number given above is the I/O number when the expansion I/O unit is installed 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 7 - 4).**

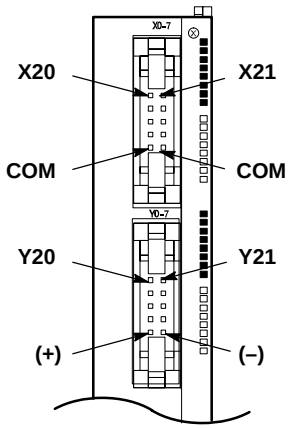
3.4.4 E16P

Inputs



Outputs

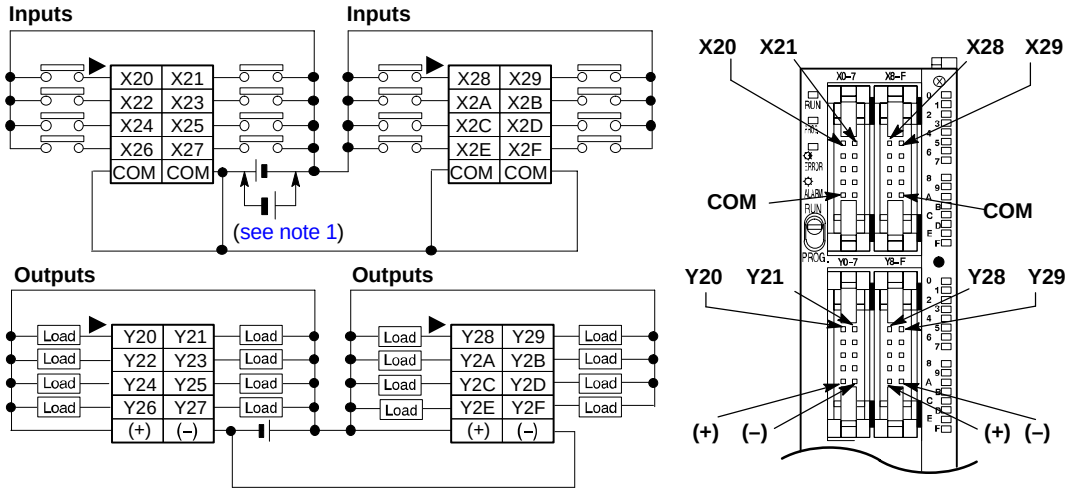




Notes

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 7 - 4).**

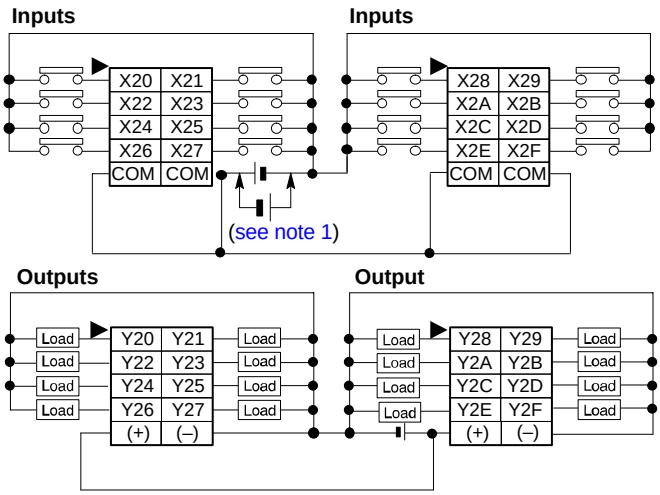
3.4.5 E32T

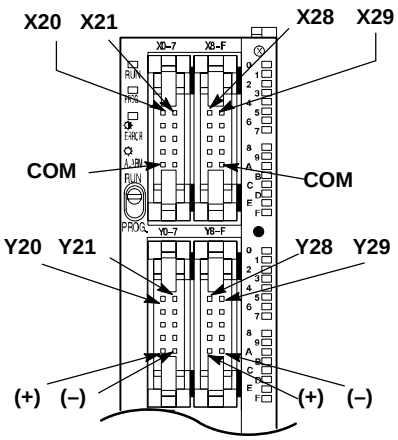


Notes

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 7 - 4).**

3.4.6 E32P

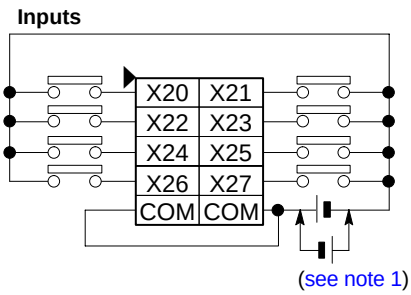


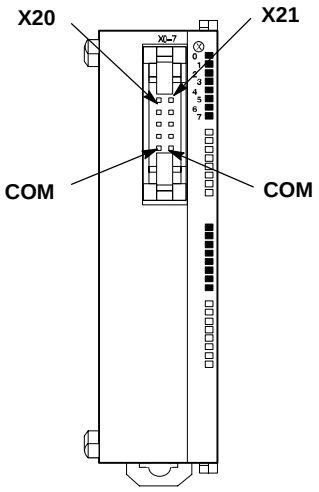


Notes

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 7 - 4).**

3.4.7 E8X

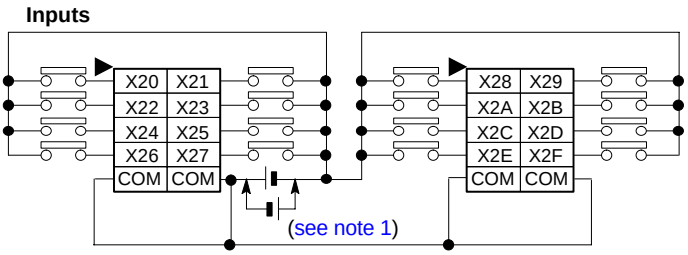


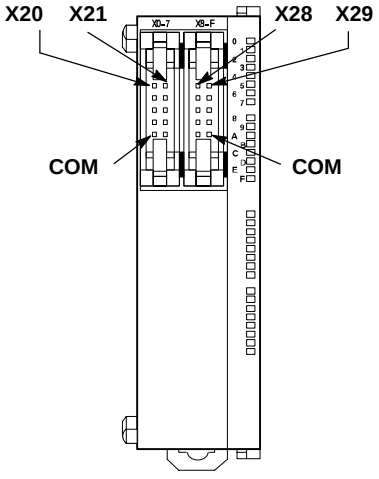


Notes

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 7 - 4).**

3.4.8 E16X

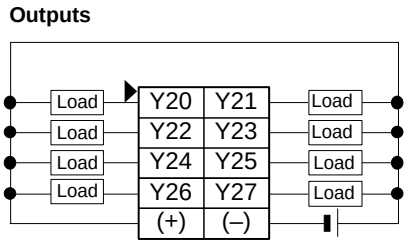


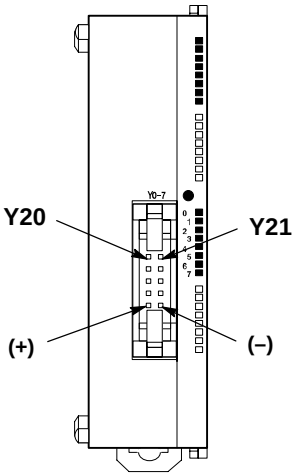


Notes

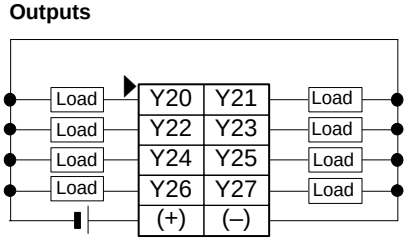
1) **Either positive or negative polarity is possible for the input voltage supply.**
2) **The four COM terminals of input terminals are connected internally, however they should be externally connected as well.**
3) **The input number given above is the input number when the expansion input unit is 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 7 - 4).**

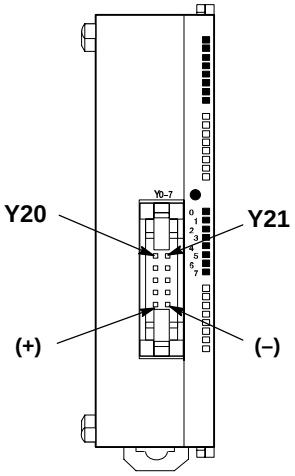
3.4.9 E8YT





3.4.10 E8YP

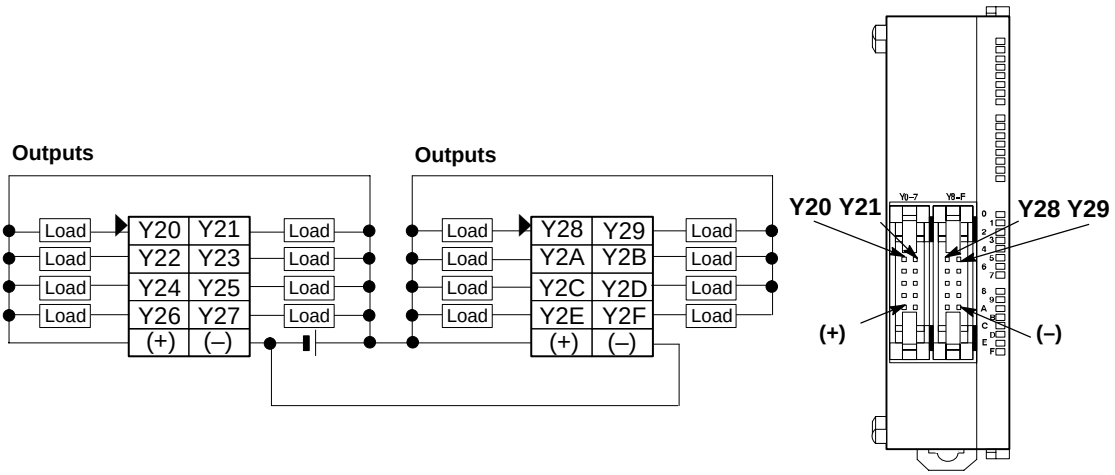




Note

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 7 - 4).

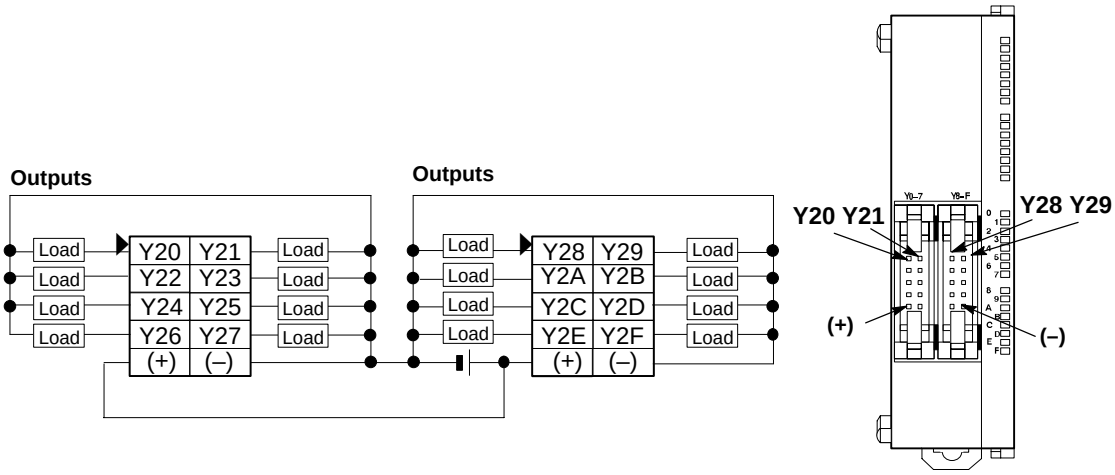
3.4.11 E16YT



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 7 - 4).**

3.4.12 E16YP



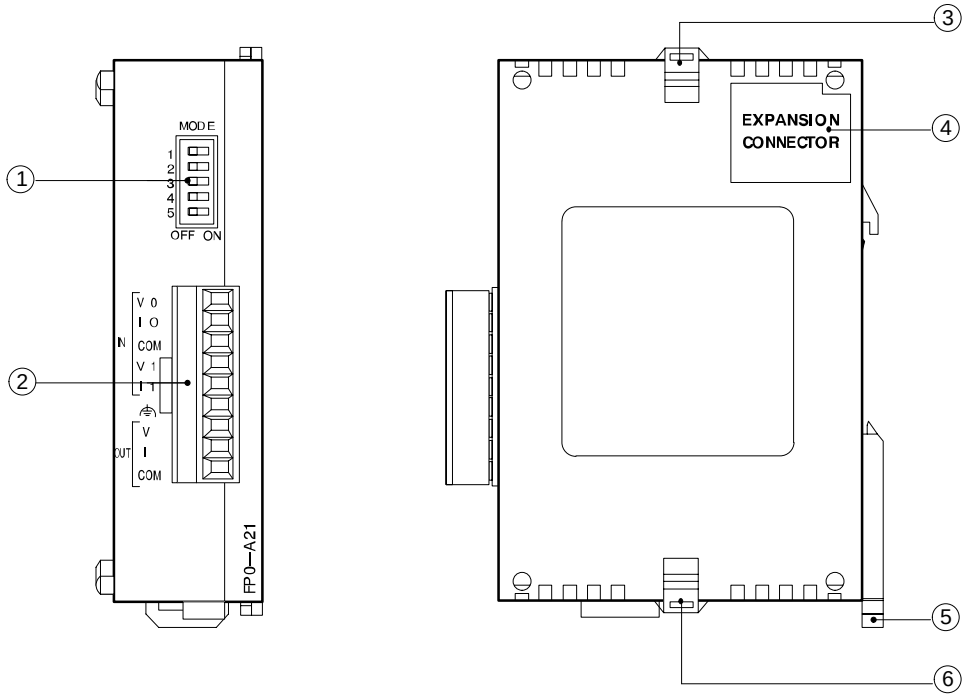
Notes

- **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 7 - 4).**

Chapter 4

Analog I/O Unit

4.1 Parts and Terminology



① Analog mode (DIP) switch

is used to switch between input and output modes (voltage/current). With the analog I/O unit, both input channels are operated in the same range (see page 4-3).

② Analog I/O terminal (9-pin)

Use a terminal block socket made by Phoenix Contact Co. (product number: 1840434) (see page 4-4 and 9 - 12).

③ ⑥ Expansion hook

is used to secure expansion units.

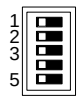
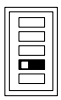
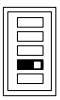
④ Expansion connector

connects an expansion unit to the internal circuit of the analog I/O unit (see page 8 - 5).

⑤ 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).

4.1.1 Analog Mode Switch Setting

Mode	Switch number	Range									
Analog input range switching	1 to 3, 5	0 to 5V 0 to 20mA		–10 to +10V		K type thermo–couple (see notes 3, 4)		J type thermo–couple (see notes 3, 4)		T type thermo–couple (see notes 3, 4)	
		No averaging (see note 1)	With averaging (see note 2)	No averaging (see note 1)	With averaging (see note 2)	Temperature of terminal to 1000°C	–100°C to temperature of terminal	Temperature of terminal to 750°C	–100°C to temperature of terminal	Temperature of terminal to 350°C	–100°C to temperature of terminal
											
Analog output range switching	4	0 to 20mA	–10 to +10V								
											

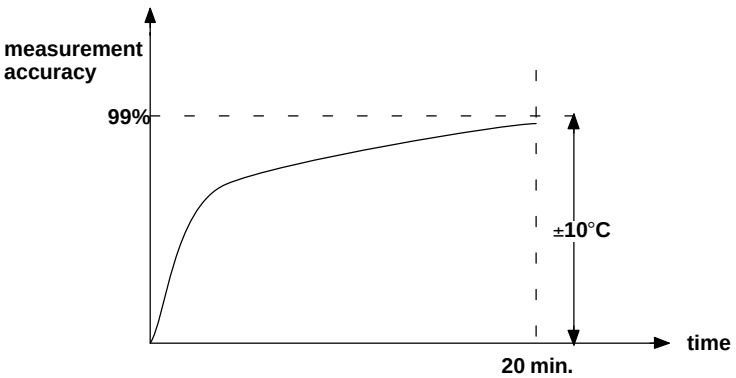
Notes

1) **No averaging: Conversion data is set for the specified input contact point area for each A/D conversion, on each channel.**

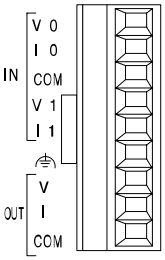
2) **With averaging: On each channel, for each A/D conversion, the maximum and minimum values from the data of the last ten times are excluded, and the data from the other eight times is averaged, and the result set (see page 4-17).**

3) **If a thermocouple setting is used, averaging is carried out, regardless of the switch settings (see page 4-18).**

4) **After turning on the analog unit, 20 minutes are required for the transient state to reach a measurement accuracy of 99%. During this time, deviations of ±10°C can occur.**



4.1.2 Analog I/O Terminal



Pin number	Name	Description
1	IN/V 0	Analog input (channel 0), voltage input
2	IN/I 0	Analog input (channel 0), current input
3	IN/COM	Analog input (channel 0 and 1), analog input common
4	IN/V 1	Analog input (channel 1), voltage input
5	IN/I 1	Analog input (channel 1), current input
6	⏚	Ground for analog cable
7	OUT/V	Voltage output
8	OUT/I	Current output
9	OUT/COM	Analog output common

4.2 Specifications

4.2.1 General Specifications

Item	Description
Rated operation voltage	24V DC
Operating voltage range	21.6 to 26.4V DC
Rated current consumption	100mA or less (see page 2-6)
Allowed momentary power off time	10ms
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 I/O terminal and power supply/ground terminal 500V AC for 1 minute between input and output terminals
Insulation resistance	min. 100MΩ (measured with a 500V DC megger) for between I/O terminal and power supply/ground terminal min. 100MΩ (measured with a 500V DC megger) for between input and output terminals
Vibration resistance	10Hz to 55Hz, 1 cycle/min: double amplitude of 0.75mm/ 0.030in., 10min. on 3 axes
Shock resistance	Shock of 98m/s^2 or more, 4 times on axes
Noise immunity	1,000Vp-p with pulse widths 50ns and 1µs (based on in-house measurements)
Operating condition	Free from corrosive gases and excessive dust
Weight	appox. 100g/3.53oz

4.2.2 Analog Input Specifications

Item			Description
Number of input points			2 channels/unit
Input range	**Voltage range**		0 to 5V/–10 to +10V
	Current range		0 to 20mA
	Thermocouple range		K, J and T type thermocouples
Digital output	**0 to 5V/ 0 to 20mA**		K0 to K4000 (H0 to H0FA0)
	–10 to +10V		K – 2000 to K + 2000 (HF830 to H07D0)
	Thermo–couple (units in °C)	**K type**	K (temperature of terminal) to K1000 (see note 1) K – 100 to K (temperature of terminal) (see note 2)
		J type	K (temperature of terminal) to K750 (see note 1) K – 100 to K (temperature of terminal) (see note 2)
		T type	K (temperature of terminal) to K350 (see note 1) K – 100 to K (temperature of terminal) (see note 2)
			When disconnected: K 20000
Resolution			1/4000
Conversion speed	**Voltage/ current range**		1ms/channel (see note 3)
	Thermocouple range		560ms (fixed)

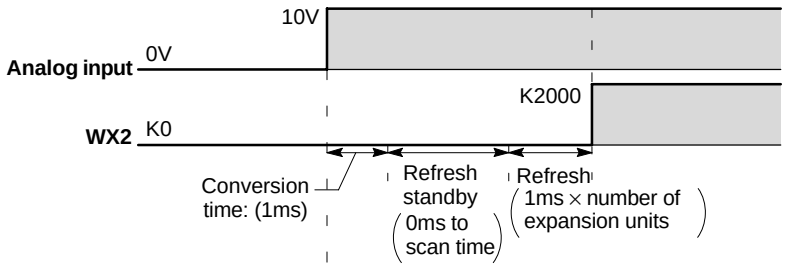
Item		Description
Overall precision	**Voltage/ current range**	±1% F.S. or less (0 to 55°C/32 to 131°F) ±0.6% F.S. or less (25°C/77°F)
	Thermocouple range	Offset error (0 to 55°C/32 to 131°F): ±2% F.S. or less (K type thermocouple) (see note 4) ±2.7% F.S. or less (J type thermocouple) (see note 4) ±5.8% F.S. or less (T type thermocouple) (see note 4) Linearity error: ±1% F.S. or less(0 to 55°C/32 to 131°F)
Input impedance	**Voltage range**	1MΩ or more
	Current range	250Ω
Absolute maximum input	**Voltage range**	±15V
	Current range	+30mA
Insulation method (see note 5)		Between analog input terminal to FP0 internal circuit: photocoupler insulation (non-insulated between analog inputs) Between analog input terminal to analog I/O unit external power supply: insulation-type DC/DC converter Between analog input terminal to analog output terminal: insulation-type DC/DC converter
Number of input contact points		32 input contact points: 16 points for 1st half: analog input CH0 data (WX2) (see note 6) 16 points for last half: analog input CH1 data (WX3) (see note 6)

Notes

1) A temperature lower than the terminal temperature of the analog I/O unit cannot be measured.

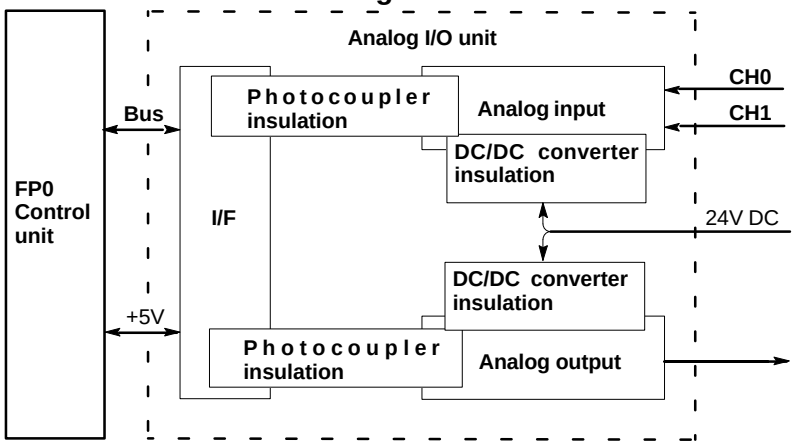
2) A temperature higher than the terminal temperature of the analog I/O unit cannot be measured.

3) The time noted below is required before the analog data is reflected in the control unit input.



4) See page 4-16, "Boosting the Precision of the Thermocouple Range."

5) Refer to the schematic diagram of insulation methods below.



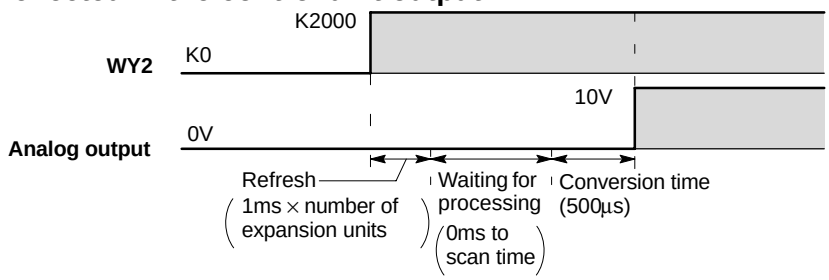
6) The number for the input contact point being used varies depending on the expansion location (see page 7 - 5).

4.2.3 Analog Output Specifications

Item		Description
Number of output points		1 channel/unit
Output range	**Voltage range**	–10 to +10V
	Current range	0 to 20mA
Digital input	**–10 to +10V**	K – 2000 to K + 2000 (HF830 to H07D0)
	0 to 20mA	K0 to K4000 (H0 to H0FA0)
Resolution		1/4000
Conversion speed		500µs (see note 1)
Overall precision		±1% F.S. or less (0 to 55°C/32 to 131°F) ±0.6% F.S. or less (25°C/77°F)
Output impedence	**Voltage range**	0.5Ω
Maximum output current	**Voltage range**	±10mA
Allowable output load resistance	**Current range**	300Ω or less
Insulation method (see note 2)		Between analog output terminal to FP0 internal circuit: Photocoupler insulation Between analog output terminal to analog I/O unit external power supply: insulation-type DC/DC converter Between analog output terminal to analog input terminal: insulation-type DC/DC converter
Number of output contact points		16 output contact points: analog output data (WY2) (see note 3)

Notes

1) **The time noted below is required before the analog data is reflected in the control unit output.**

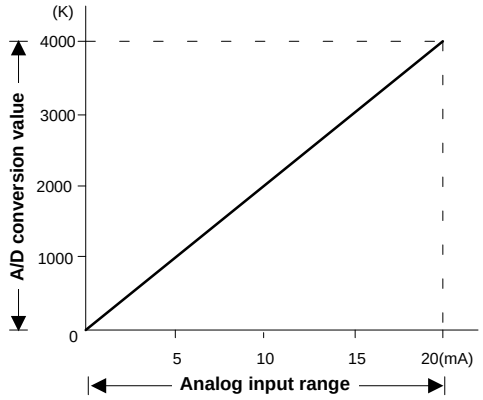


2) **Refer to the schematic diagram of insulation methods on the previous page.**

3) **The number for the output contact point being used varies depending on the expansion location (see page 7 - 5).**

4.3 A/D Conversion Characteristics

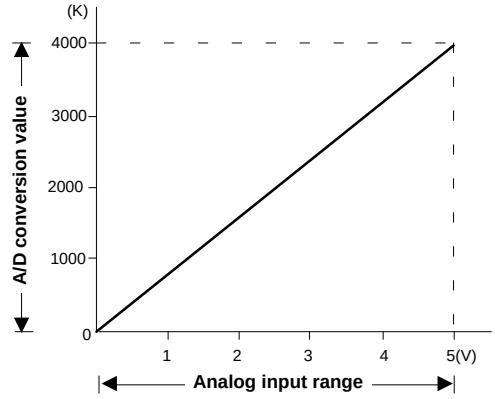
Current range: 0 to 20mA DC input



Corresponding table of A/D conversion values	
Input current (mA)	**A/D conversion value**
0.0	0
2.5	500
5.0	1000
7.5	1500
10.0	2000
12.5	2500
15.0	3000
17.5	3500
20.0	4000

Processing if the range is exceeded	
Input value	**Converted value**
0mA or less (including negative value)	0
20mA or more	4000

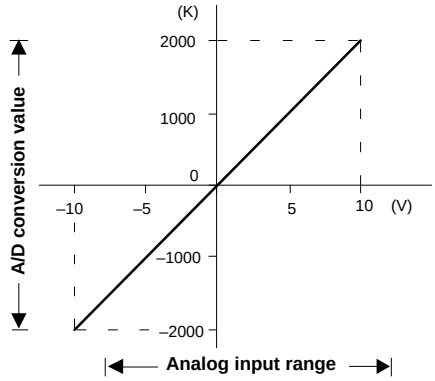
Voltage range: 0 to 5V DC input



Corresponding table of A/D conversion values	
Input voltage (V)	**A/D conversion value**
0.0	0
0.5	400
1.0	800
1.5	1200
2.0	1600
2.5	2000
3.0	2400
3.5	2800
4.0	3200
4.5	3600
5.0	4000

Processing if the range is exceeded	
Input value	**Converted value**
0V or less (including negative value)	0
5V or more	4000

Voltage range: –10 to +10V DC input

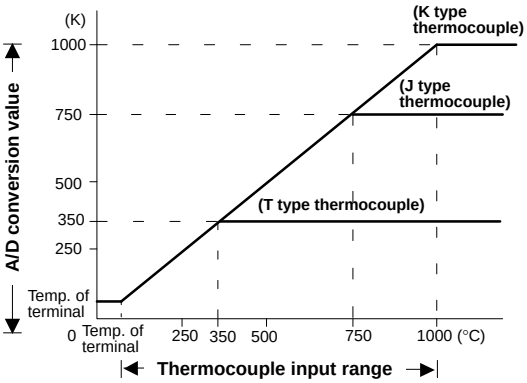


Corresponding table of A/D conversion values	
Input voltage (V)	**A/D conversion value**
–10.0	–2000
–7.5	–1500
–5.0	–1000
–2.5	–500
0.0	0
+2.5	+500
+5.0	+1000
+7.5	+1500
+10.0	+2000

Processing if the range is exceeded	
Input value	**Converted value**
–10V or less	–2000
+10V or more	+2000

Thermocouple input

Setting a temperature higher than the temperature of the terminal using the analog mode switch (see page 4-3)



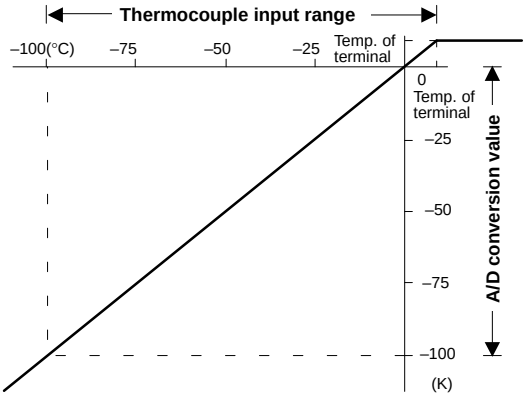
Corresponding table of A/D conversion values	
Temperature (°C)	**A/D conversion value**
Temperature of terminal	Temperature of terminal
25	25
250	250
350	350
500	500
750	750
1000	1000

Processing if the range is exceeded		
Input value		**Converted value**
Temperature of terminal or less		Temperature of terminal
Upper limit	**350°C or more (with T type thermocouple)**	350
	750°C or more (with J type thermocouple)	750
	1000°C or more (with K type thermocouple)	1000
Disconnected		20000

If the measured temperature exceeds the upper limit of the range, a value higher than the upper limit value is not output.

Thermocouple input

Setting a temperature lower than the temperature of terminal using the analog mode switch (see page 4-3)



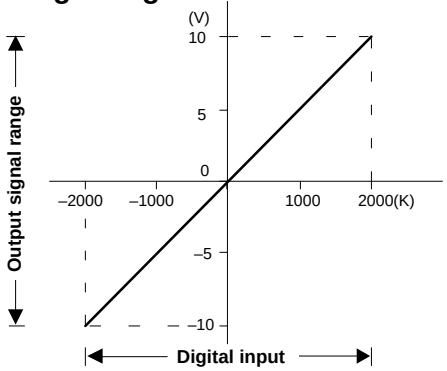
Corresponding table of A/D conversion values	
Temperature (°C)	**A/D conversion value**
Temperature of terminal	Temperature of terminal
0	0
–25	–25
–50	–50
–75	–75
–100	–100

Processing if the range is exceeded		
Input value		**Converted value**
Temperature of terminal or more		Temperature of terminal
Lower limit	**with T type thermocouple**	–250
	with J type thermocouple	–200
	with K type thermocouple	–250
Disconnected		20000

A value is output even if the boundary of the measured value (–100°C) is exceeded, but the measurement accuracy cannot be guaranteed.

4.4 D/A Conversion Characteristics

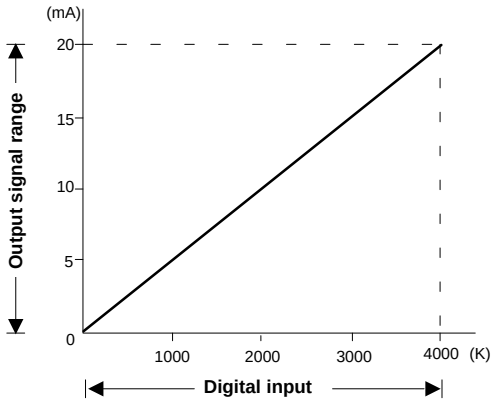
Voltage range: –10 to +10V DC output



Corresponding table of D/A conversion values	
Digital input value	**Output voltage (V)**
–2000	–10.0
–1500	–7.5
–1000	–5.0
–500	–2.5
0	0.0
+500	+2.5
+1000	+5.0
+1500	+7.5
+2000	10.0

Processing if the range is exceeded	
Digital input value	**Analog output value**
–2001 or less	Constant (value just before –2001 is input)
+2001 or more	Constant (value just before +2001 is input)

Current range: 0 to 20mA output



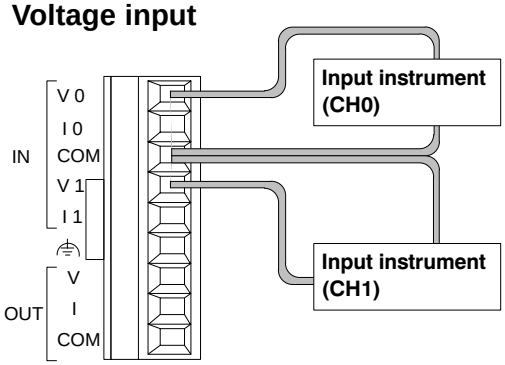
Corresponding table of D/A conversion values	
Digital input value	**Output current (mA)**
0	0.0
500	2.5
1000	5.0
1500	7.5
2000	10.0
2500	12.5
3000	15.0
3500	17.5
4000	20.0

Processing if the range is exceeded	
Digital input value	**Analog output value**
Negative value	Constant (value just before negative value is input)
4001 or more	Constant (value just before 4001 is input)

4.5 Wiring

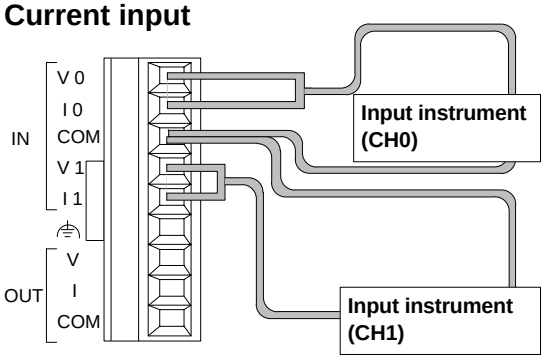
4.5.1 Analog Input Wiring

Voltage input



Connect input instrument between IN/V and IN/COM terminal.

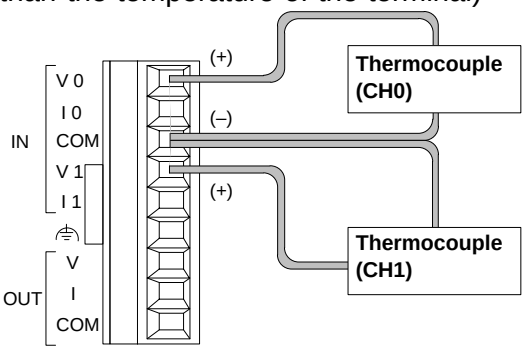
Current input



First, connect both IN/V terminal and IN/I terminal. And then connect input instrument between it and IN/COM terminal.

Thermocouple input

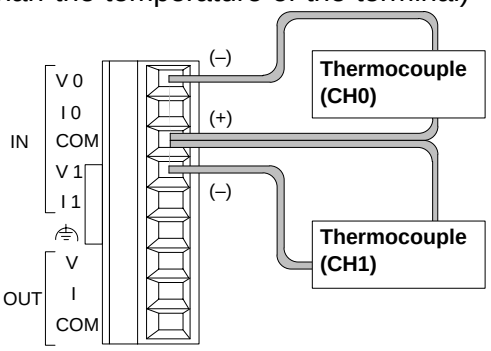
(when measured at temperature higher than the temperature of the terminal)



Connect IN/V terminal to the (+) side of the thermocouple, and connect IN/COM terminal to the (–) side of the thermocouple.

Thermocouple input

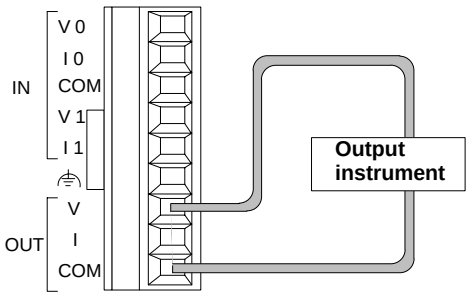
(when measured at temperature lower than the temperature of the terminal)



Connect IN/V terminal to the (–) side of the thermocouple, and connect IN/COM terminal to the (+) side of the thermocouple.

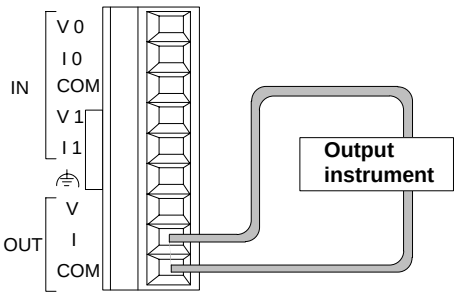
4.5.2 Analog Output Wiring

Voltage output



Connect output instrument between OUT/V and OUT/COM terminal.

Current output



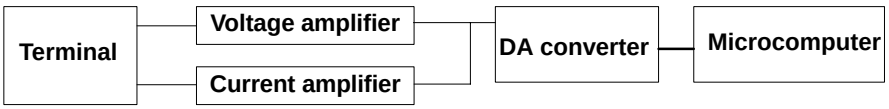
Connect output instrument between OUT/I and OUT/COM terminal.

Notes

- **Always make sure the switch settings and the terminal base wiring connections match. For output, in particular, if the settings and the wiring connections are wrong, the control unit will output values like those shown below, even in the PROG. mode. (For information on switch settings, see page 4-3)**

Item	Output terminal (OUT)	
	Current terminal (I)	Voltage terminal (V)
0mA output based on current range setting	0mA	–10V
0V output based on voltage range setting	10mA	0V

- **DA internal block diagram**
  A voltage amplifier and current amplifier are connected in parallel to a single DA converter IC.



  Also, the digital value that is sent to the DA converter IC to achieve a voltage output of 0V is different from that input to the DA converter IC to achieve a current output of 0mA.
  As a result, if the voltage output is set to 0V, 10mA is output from the current output terminal, and conversely, if the current output is set to 0mA, –10V is output from the voltage output terminal.

- **For voltage output**

Value of WY	K–2000	K0	K2000
Digital value to DA converter	0	2047	4095
Analog output	–10V	0V	+10V

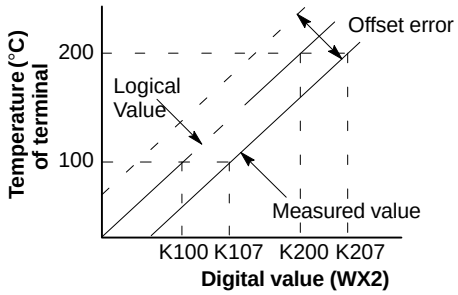
- **For current output**

Value of WY	K0	K2000	K4000
Digital value to DA converter	0	2047	4095
Analog output	0mA	10mA	20mA

4.6 Boosting the Precision of the Thermocouple Range

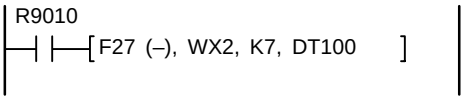
When a high degree of precision is required, we recommend correcting the offset using the program.

Example:



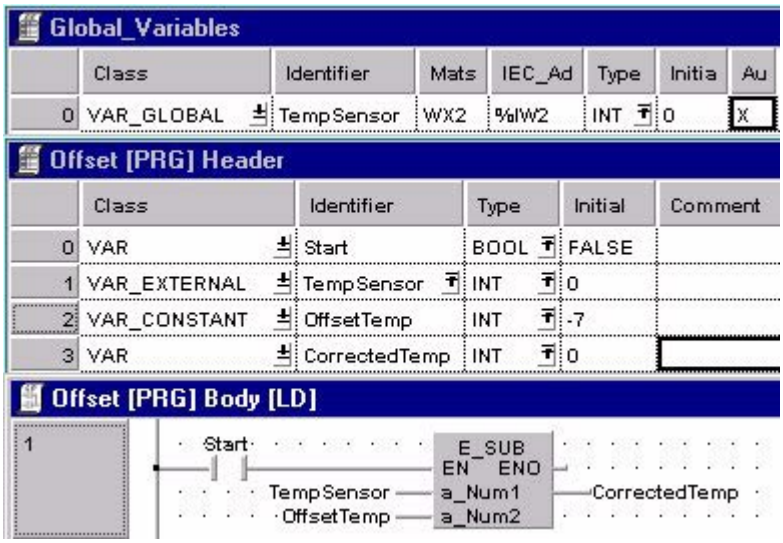
In the above case, seven should be subtracted from the value of WX2.

Program example, FPWIN GR



The value with the offset value of “7” subtracted is stored at DT100.

Program example, FPWIN Pro



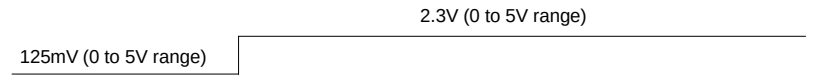
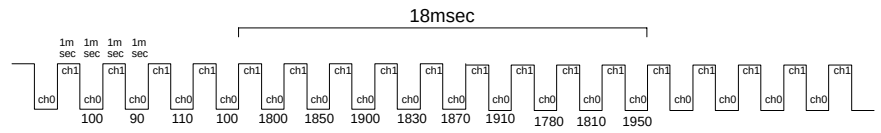
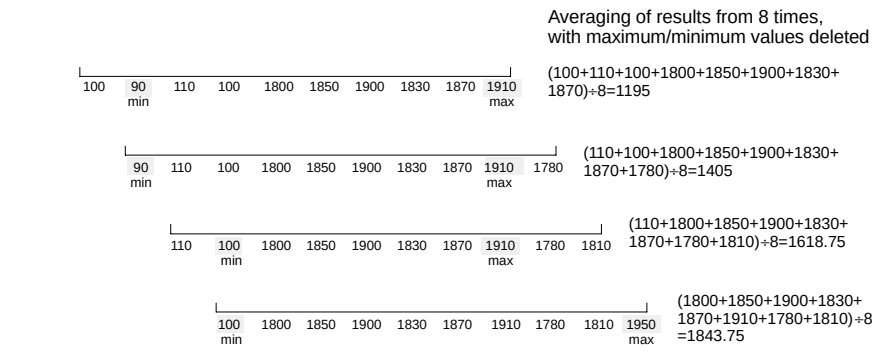
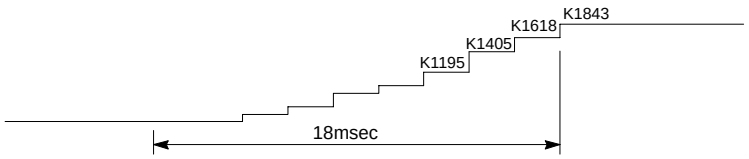
Note

We recommend initiating correction using the offset value taken approximately 5 minutes after power is turned ON in order to take into consideration the heat generated by the unit itself.

4.7 Averaging Function

4.7.1 Averaging for Voltage Ranges and Current Ranges

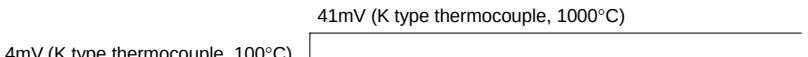
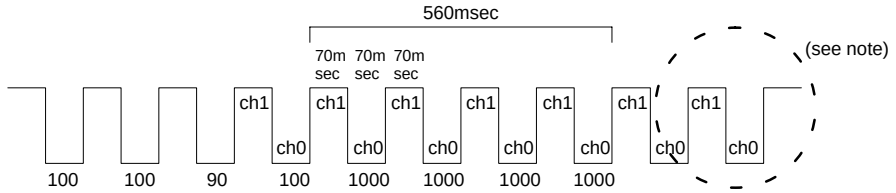
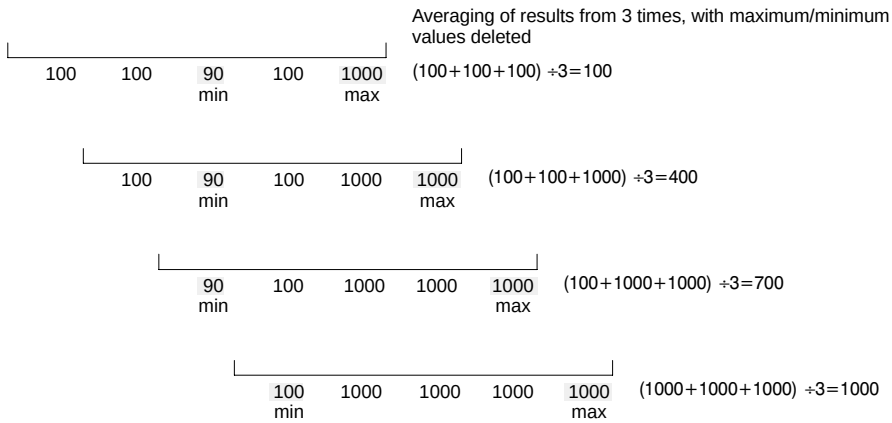
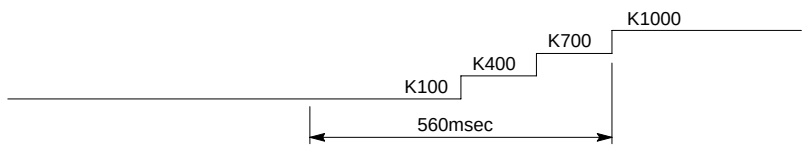
When the input range is set to a voltage range or current range, processing like that shown below is carried out internally by analog I/O unit.

Operation item	Time chart
Analog input value for ch0	
Reading time	
Internal processing for analog I/O unit ch0	
Digital output value for ch0	

Starting with the most recent data, the data from the last ten times is taken. The maximum and minimum values are deleted, and then averaging is carried out on the remaining eight items. The value obtained from the most recent averaging is normally used as the value output at this time. (If a fraction results from the calculation, it is rounded off.)

4.7.2 Averaging for a Thermocouple Range

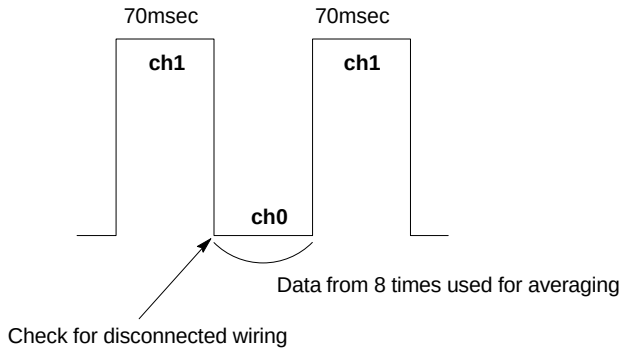
When the input range is set to a thermocouple (K, J or T type), processing like that shown below is carried out internally in the analog I/O unit.

Operation item	Time chart
Analog input value ch0 (thermocouple input)	
Reading time	
Internal processing for analog I/O unit ch0	
Digital output value (WX) (temperature °C)	

Starting from the most recent data, the data from the last five times is taken. The maximum and minimum values are deleted, and then averaging is carried out on the remaining three items. The value obtained from the most recent averaging is normally used as the value output at this time. (If a fraction results from the calculation, it is rounded off.)

Note

In the read timing, the minimum and maximum values are subtracted from the data from the last ten times, just as in averaging processing on page 4-17, and the data from the remaining eight times is used for the averaging.



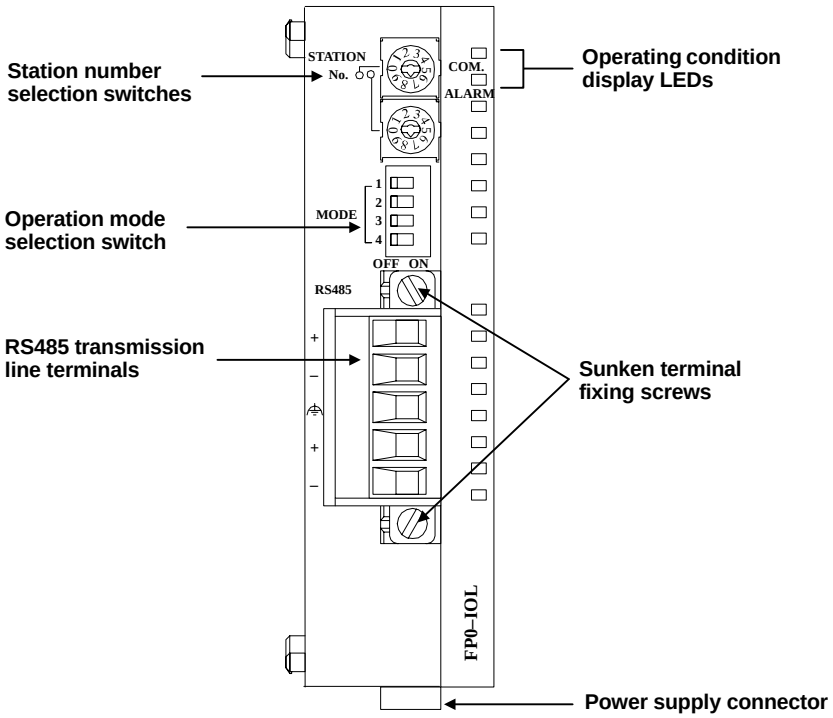
If a disconnected wire is detected, a value of K20000 is output.

Chapter 5

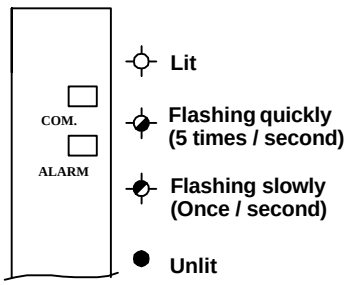
FP0 I/O Link Unit (MEWNET–F)

5.1 FP0 I/O Link Unit (MEWNET–F)

The FP0 I/O Link Unit (MEWNET–F) works as the slave station of a Remote I/O System. The FP0 I/O Link Unit exchanges I/O information with the Master Unit. Use a two–conductor cable to connect the master unit and the FP0 I/O Link Unit. To connect the FP0 I/O Link Unit to the FP0 Control Unit or FP0 Expansion Unit, use the expansion connector. The FP0 I/O Link Unit functions as a buffer. The output from the master unit is sent to the input of the FP0 through the FP0 I/O Link Unit. The output from the FP0 is sent to the input of the master unit from the FP0 I/O Link Unit. Be sure to connect the FP0 I/O Link Unit with a master unit. Without a master station, the slave station (including FP0 I/O Link Unit) will not work.

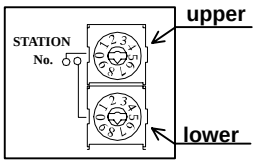


5.1.1 Operating Condition Display LEDs



COM (Green)	Displays communication condition. : Standby : Normal communication mode : Communication stop mode ● : Communication error
ALARM (Red)	Displays the unit's trouble condition : Unit trouble : Selection error ● : Normal

5.1.2 Station Number Selection Switches

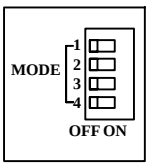


Functional description
– Sets the station number of the FP0 I/O Link Unit.
– The working range is 01–32.
– If the switches are not within this range, a selection error will occur and communication will be impossible.

Note

In case of a selection error, the ALARM LED will flash.

5.1.3 Operation Mode Selection Switches



Switch No.	Function	OFF	ON
1	Terminal station selection.	Not a terminal station.	Operates as a terminal station.
2			
3	Output condition during a communication error.	Not retained.	Retained.
4	I/O Link error flag.	Invalid.	Valid.

Notes

- **Switches 1 and 2 must always be set the same (ON or OFF).**
- **In case I/O Link error flag is valid, the MSB (most significant bit) of the 2 words allocated [32 bit: WX (n, n+1)] is assigned as an error flag to the Control Unit (0: normal, 1: abnormal).**

5.2 Precautions for Handling

In addition to the precautions taken for all FP0 components (see Before You Start), adhere to the following:

- **When handling numerical data, have the FP0 I/O Link Unit read the data twice because the unit does not guarantee the simultaneity of data.**
- **Turn OFF the power when wiring the FP0 I/O Link Unit or when adding an FP0 I/O Link Unit.**
- **Be careful not to leave wire wastes inside the units when wiring.**
- **Do not touch the unit's expansion connector with your hand. This may result in a poor contact, and the static electricity from your hand may damage the components.**
- **Do not bang or drop the FP0 I/O Link Unit as its case is made of resin.**
- **Keep the unit as far away as possible from high–voltage or high–current cables, high tension equipment, power generating equipment and radio equipment.**
- **Separate the wiring for the power supply lines and the transmission lines in separate conduits. At the very least they should be separated as far away from each other as possible.**

5.3 Specifications

5.3.1 General Specifications

Item	Specification
Rated supply voltage	24V DC
Supply voltage range	21.6 to 26.4V DC
Consumption current	I/O Link unit: max. 40mA / 24V DC
	Control unit: max. 30mA / 24V DC
Allowed momentary power off time	10ms (max)
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	RS485 terminals ←→ Power supply / function earth terminals: AC500V 1minute
Insulation resistance	RS485 terminals ← → Power supply / function earth terminals: min. 100MΩ (measured with a 500V DC megger)
Vibration resistance	10Hz to 55Hz, 1 cycle/min.: double amplitude 0.75mm (0.03in.), 10 minutes on 3 axes.
Shock resistance	Minimum 98m/s^2, 4 times on 3 axes.
Noise immunity	1000Vp–p with pulse widths 50ns and 1µs (based on in–house measurements)
Operating condition	Free from corrosive gases and excessive dust
Weight	Approx. 85g

5.3.2 Performance Specifications

Item	Specifications
Communication method	Two–line, half–duplex
Synchronous method	Asynchronization system
Communication rate	0.5Mbps
Interface	RS485
Communication error check method	CRC (Cyclic Redundancy Check)
I/O map of FP0 I/O Link Unit	32X / 32Y

5.3.3 Master and Slave Stations

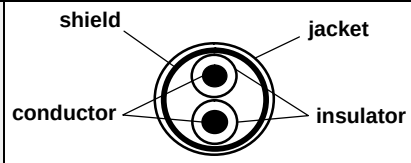
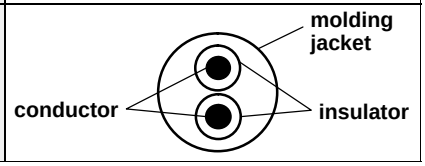
Master and Slave Stations			
Number of master units per CPU			Max. 4 units.
Number of slave stations per Master unit			Max. 32 units.
Number of I/O points per CPU	FP2, FP3, FP–C		Max. 2,048 points
	FP2SH, FP10SH		Max. 8,192 points
Number of I/O points per Master unit	CPU unit Ver.: Lower Ver. than below	Master unit Ver. Ver. 1.4 or lower	Max. 1,024 points
	CPU unit Ver.: FP3 Ver. 4.6 or higher FP–C Ver. 4.6 or higher	Master unit Ver. Ver. 1.5 or higher	Max. 2,048 points
	CPU unit Ver.: FP2, FP2SH, FP10SH Ver. 1.0 or higher	Master unit Ver. Ver. 1.5 or higher	Max. 4,096 points
Number of I/O points per one I/O Link unit			64 points (Input 32 points + Output 32 points) (see note)

Note

If the I/O Link error flag is on (valid), there are 63 I/O points (Input 31 points + Output 32 points).

5.3.4 Recommended Cables

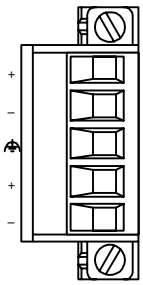
Recommended Cables for FP Remote I/O System [MEWNET–F]						
Cable	Conductor		Insulator		Diameter of cable	Communication distance (Total extension)
	Size	Resistance (at 20°C)	Material	Thickness		
Twisted pair cable with shield	Min.1.25mm^2 (AWG16 or larger)	Max. 16.8 Ω /km	Polyethylene	Max. 0.5mm	Approx. 8.5mm	700m (300m, see note 5)
	Min.0.5mm^2 (AWG20 or larger)	Max. 33.4 Ω/km	Polyethylene	Max. 0.5mm	Approx. 7.8mm	600m (300m, see note 5)
Vinyl Cab-tyre Cable (VCTF)	Min.0.75mm^2 (AWG18 or larger)	Max. 25.1 Ω /km	Polyvinyl Chloride	Max. 0.6mm	Approx. 6.6mm	400m (200m, see note 5)

Cable	Cross–section
Twisted pair with shield	
VCTF	

Notes

1) **The electric characteristic of polyvinyl chloride is inferior to polyethylene, so the maximum communication distance is short.**
2) **Twisted pair cable should be a shielded type.**
3) **Use only one type of communication cable, i.e. do not mix cable types.**
4) **Twisted pair cable should especially be used in an environment with extensive noise.**
5) **If AFP3740, AFP87441, AFP87442, AFP3741 are in the network, the communication distance should be limited as stated above.**

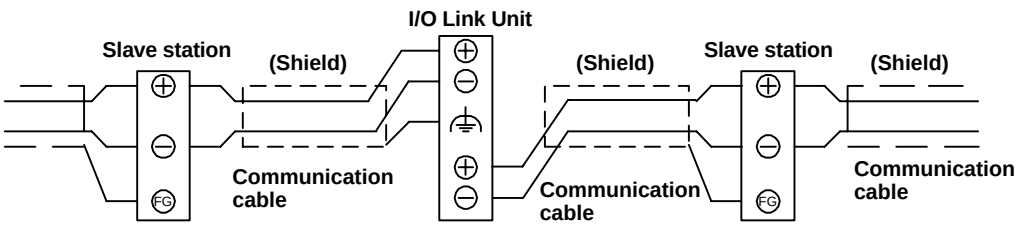
5.3.5 Terminal Pin Layout



Each ⊕ and ⊖ terminal is connected internally. The ground terminal is connected internally to the power supply's top pin on the side of the unit.

Using relayed wiring, the ingoing cable should be connected to the upper terminal and the outgoing cable should be connected from the lower terminal (see page 5-7).

5.3.6 Communication Line Wiring Diagram



When connecting the communication cable, be sure to connect the ⊕ side terminal of a slave station to the ⊕ side terminal of the FP0 I/O Link Unit, and the ⊖ side terminal of a slave station to the ⊖ side terminal of the FP0 I/O Link Unit. No more than two pairs of cables should be connected to one RS485 port.

Be sure to follow the wiring diagram and the terminal symbol sheet when setting up your system.

Tightening torque for both terminals and fixing screws must be 0.5 to 0.6 Nm (5.1 to 6.1 kgfcm).

5.3.7 Related Product Names and Numbers

Product name		Specifications		Order number
Master station	**Master Unit**	FP–2 Multi–Wire Link Unit		FP2–MW
		FP3 Remote I/O Master Unit		AFP3742
		FP–C CPU with MEWNET–F Board		AFC3224
		FP–C MEWNET–F Master Board		AFC3740
Slave station	**Slave Unit**	FP3 Remote I/O Slave Unit		AFP3743
	FP I/O Terminal Board	Operating voltage: 12V DC, 0.2A Tr. Output		AFP87445
	Connector type	Operating voltage: 24V DC, 0.2A Tr. Output		AFP87446
	FP I/O Terminal board	Operating voltage: 24V DC, 0.2A Tr. Output		AFP87444
	Screw terminal board type	Operating voltage: 24V DC, 2A Ry. Output		AFP87432
	FP I/O Terminal Unit	Basic Unit	8–point input unit	AFP87421
		DC Input	16–point input unit	AFP87422
			8–point output unit	AFP87423
		0.5A Tr. Output	16–point output unit	AFP87424
		Expansion Unit	8–point input unit	AFP87425
		DC Input	16–point input unit	AFP87426
			8–point output unit	AFP87427
		0.5A Tr. Output	16–point output unit	AFP87428
	FP1 I/O Link Unit	Operating voltage: 24V DC		AFP1732
		Operating voltage: 100 to 240V AC		AFP1736
	FP–M I/O Link Board	Operating voltage: 24V DC		AFC1732

5.4 Using the FP0 I/O Link Unit

In this section, the operation mode, master unit and slave connections, the remote I/O system communication error flag and I/O numbers are explained.

5.4.1 Operation Mode

The operation mode is set with the operating mode selection switch.

Terminal Station Selection

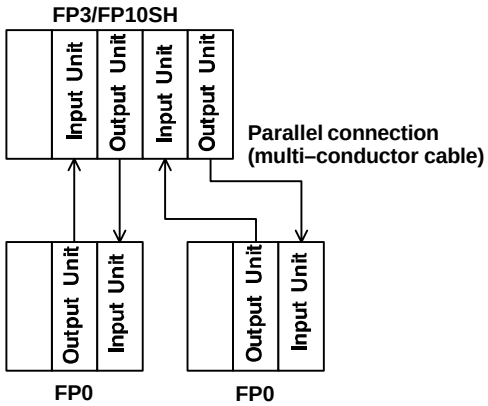
The terminal station is located at each end of the communication line. If it is not set up properly, a communication error may occur. (For more details, see ACGM0028END, REMOTE I/O SYSTEM.)

Communication Error Output Mode

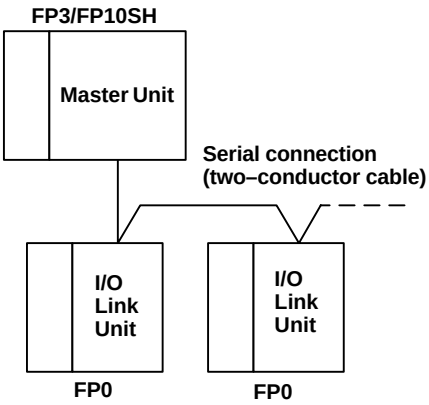
If the communication error occurs in the Remote I/O System, the FP0 I/O Link Unit will select either the “Output OFF” or “Output HOLD” mode. (In the case below, the output of the FP0 I/O Link Unit is the output from the FP3 / FP10SH to the FP0. This is the input for the FP0.) However, if system register No. 27 in the FP3 / FP10SH CPU is set to ”0” and a communication error occurs with a slave station, the output mode will be set to “Output OFF”.

5.4.2 Parallel Versus Serial Connection

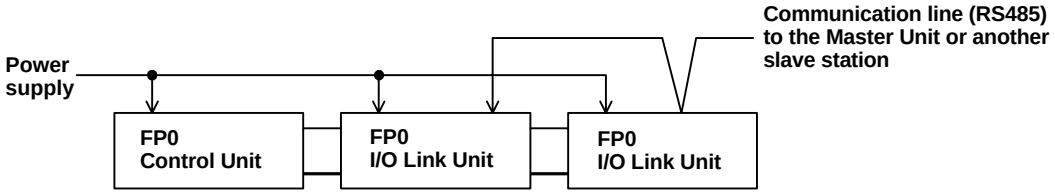
In a parallel setup, the input and output of the FP0 are directly connected to the input and output of the FP3/FP10SH, for example. I/O information can be exchanged asynchronously between the FP3/FP10SH and the FP0.



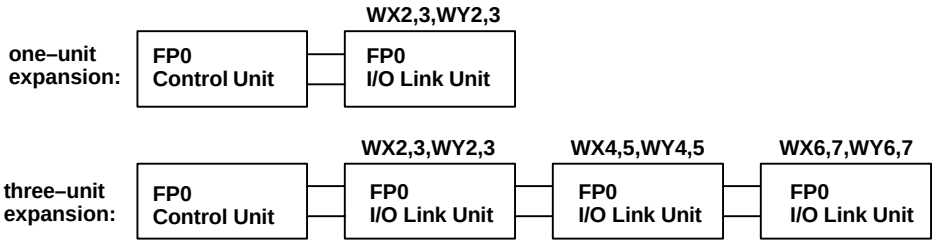
Using the serial connector, the FP0 I/O Link Unit works as the slave station of the Remote I/O System. The FP0 I/O Link Unit exchanges I/O information with the FP3/FP10SH. Use a two–conductor cable to connect the FP3/FP10SH and the FP0 I/O Link Unit. To connect the FP0 I/O Link Unit and the FP0 Control Unit or FP0 Expansion Unit, use an expansion connector. The FP0 I/O Link Unit functions as a buffer. The output from the FP3/FP10SH is sent to the input of the FP0 through the FP0 I/O Link Unit. The output from the FP0 is sent to the input of the FP3/FP10SH from the FP0 I/O Link Unit. Be sure to connect the FP0 I/O Link Unit with one FP3/FP10SH Master Unit. Without a master station, the slave station (including FP0 I/O Link Unit) will not work.



5.4.3 FP0 Connections



To connect the FP0 I/O Link Unit to the FP0, add an expansion unit to the main (or another) unit. Three FP0 I/O Link Units can be connected to one FP0 Control Unit.



5.4.4 Remote I/O System Communication Error Flag (FP0)

The communication condition of the Remote I/O System can be checked from the FP0 side. This is only valid when operation mode selection switch No.4 is ON.

Communication condition	Normal	Trouble
I/O link error flag	0	1

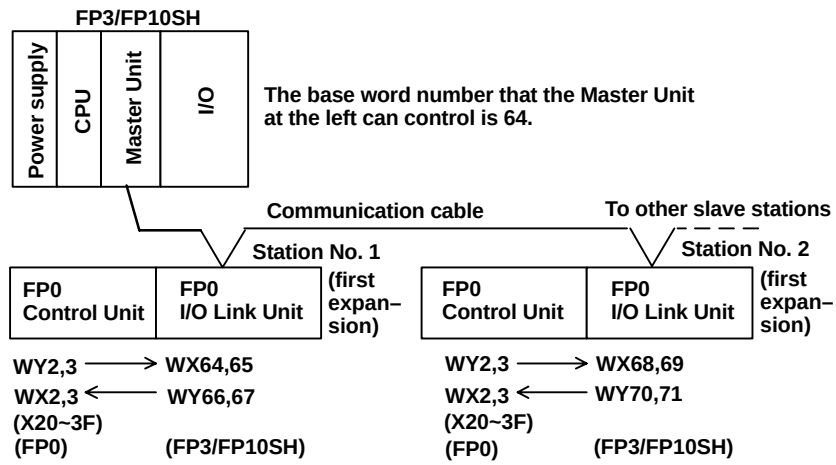
Notes

- **This flag indicates the state of the communication condition between the FP0 I/O Link Unit and the Master Unit. If a communication error occurs at other slave stations while the Master Unit's operation mode switch No. 7 (communication error operation mode) is set to "0" (operation stop mode), this flag turns on.**
- **This flag is assigned the MSB (most significant bit) of Input 2 words [32bits: WX (n, n+1)] in the FP0 I/O Link Unit. For details, see page 5-11, Example 1.**

5.4.5 I/O Number

Example 1:

Below is an example of the Remote I/O System connected to the FP0 I/O Link Unit. (I/O link error flag is invalid.)



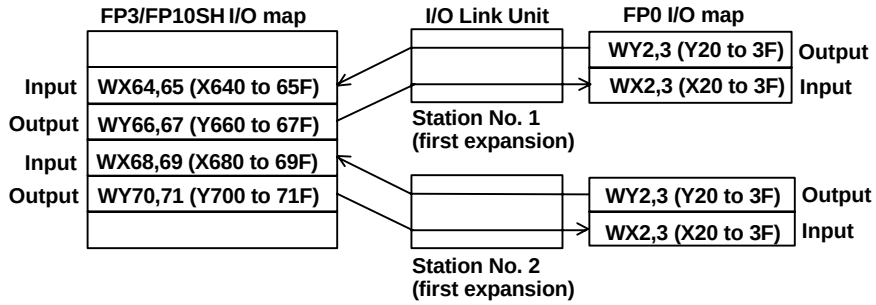
The I/O Link Unit is identified by the Master Unit in the FP3/FP10SH as a slave station. The total number of I/O points is 64 (32X, 32Y, i.e input: 32 points, output: 32 points).

next page

Accordingly, the I/O number of the individual FP0 I/O Link Unit identified by the FP3/FP10SH is determined by the base word number of the Master Unit and the station number of the FP0 I/O Link Unit.

In the remote I/O map, the Input numbers are allocated first. For example, in the drawing shown above, when the FP0 I/O Link Unit of station no. 1 is connected to a Master Unit whose base word number is 64, the input number from the FP3/FP10SH to the FP0 I/O Link Unit is WX64 and 65 (X640 to 65F), and the output number is WY66 and 67 (Y660 to 67F). When the FP0 I/O Link Unit of station no. 2 is connected in the same manner, the input number from FP3/FP10SH to the FP0 I/O Link Unit is WX68 and 69 (X680 to 69F), and the output number is WY70 and 71 (Y700 to 71F).

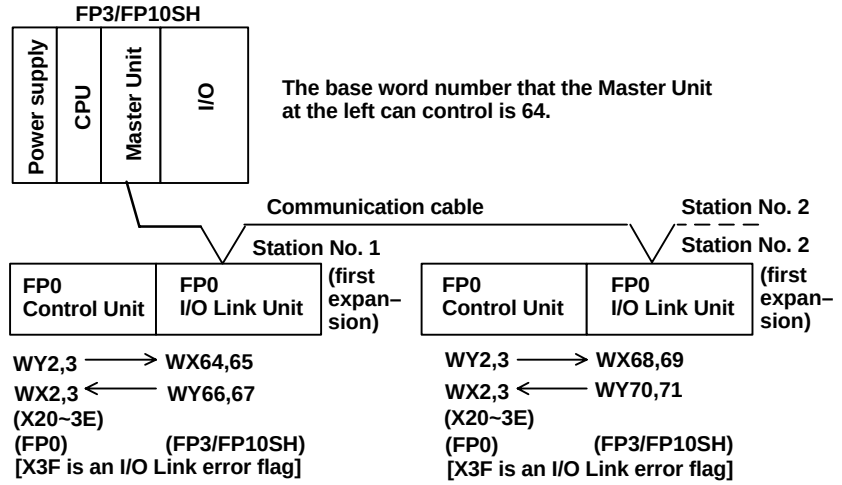
The relationship between the input/output of the FP3/FP10SH and that of the FP0 from the illustration above is shown below:



For example, when the Y20 in the FP0 at station no. 1 turns ON, the X640 in the FP3/FP10SH turns ON. When the Y660 in the FP3/FP10SH turns ON, the X20 in the FP0 at station no. 1 turns ON. Similarly, when the Y20 in the FP0 at station no. 2 turns ON, the X680 in the FP3/FP10SH turns ON. When the Y700 in the FP3/FP10SH turns ON, the X20 in the FP0 at station no. 2 turns ON. In this way, the FP0 I/O Link Unit can exchange I/O information between the FP3/FP10SH and the FP0.

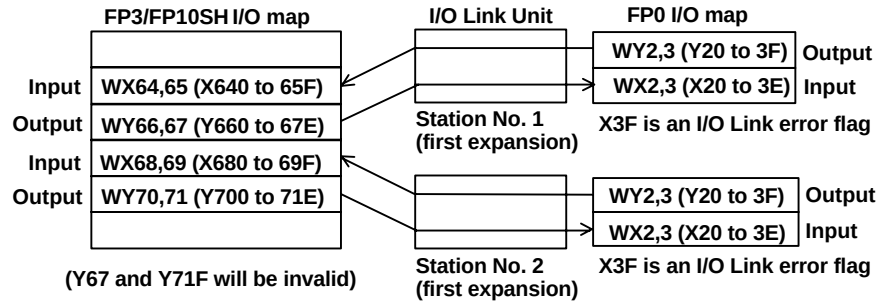
Example 2:

Remote I/O system in which the FP0 Control Unit has one FP0 I/O Link Unit. (I/O Link error flag is valid.)



The difference from example 1 is that the MSB (most significant bit) of 2 words input (here X3F) is the I/O Link error flag. This error flag indicates the communication condition between this I/O Link Unit and the master unit.

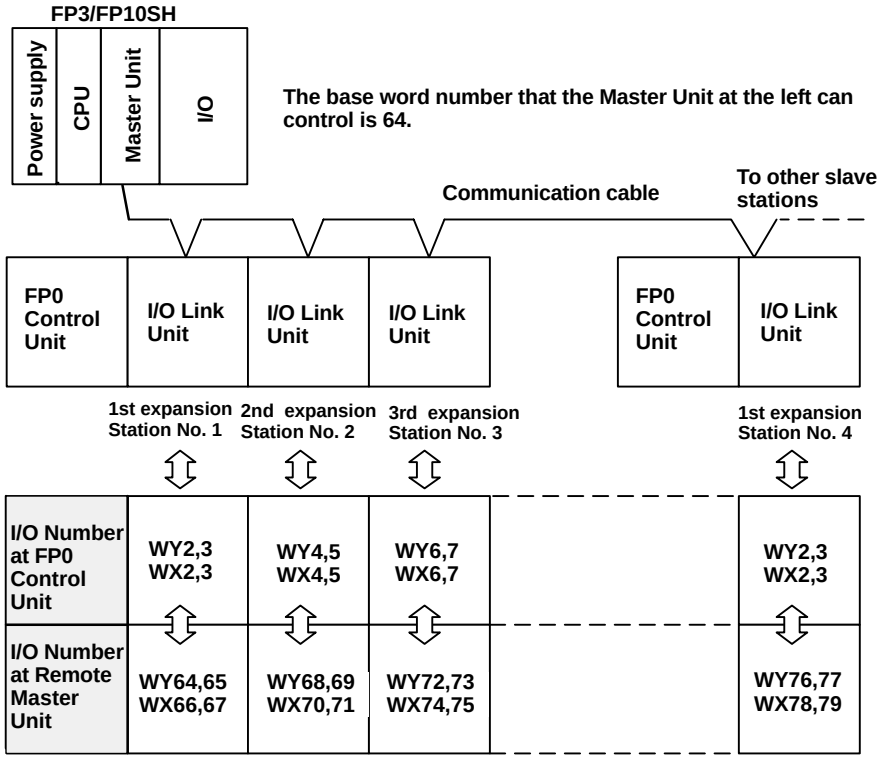
The relationship of Inputs/Outputs between FP3/FP10SH and FP0 in the above figure is shown below.



As this X3F is allocated as the I/O Link error flag in the FP0 I/O map, Y67F and Y71F in the FP3/FP10SH I/O map are invalid.

Example 3:

Remote I/O system in which the FP0 Control Unit has 3 FP0 I/O Link Units.



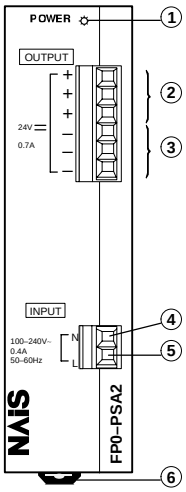
Here the Remote I/O Master Unit recognizes I/O numbers such that 2 words of input are allocated first. A total of 4 words are allocated per station.

Each FP0 Control Unit can be expanded by three FP0 I/O Link Units. All exchanges between the Master Unit and FP0 I/O Link Unit are carried out via allocated Inputs and Outputs.

Chapter 6

Power Supply Unit

6.1 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

6.2 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 10 - 2.

Chapter 7

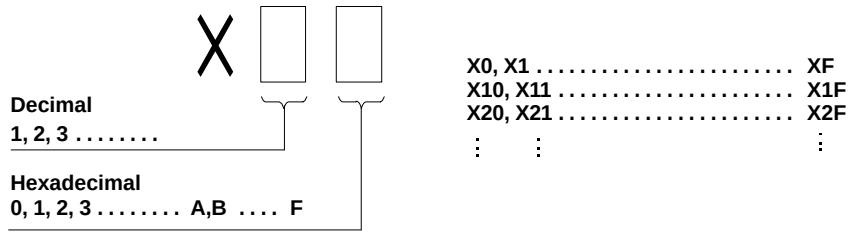
I/O Allocation

7.1 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

7.2 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	**Input: 16 points**	X0 to XF
	Output: 16 points	Y0 to YF

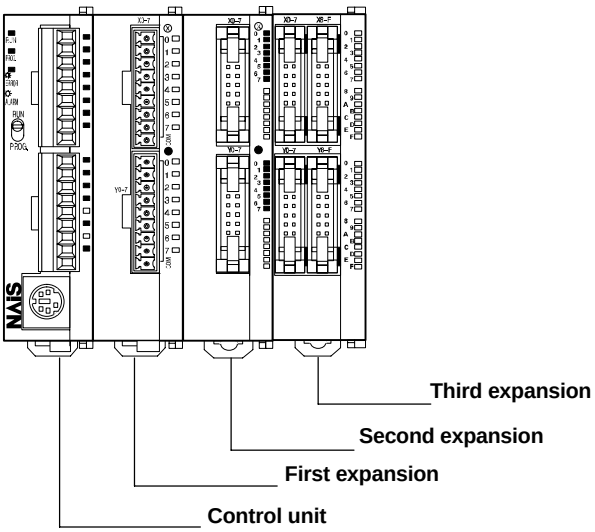
7.3 Expansion I/O Unit

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	Input: 16 points	X20 to X2F	X40 to X4F	X60 to X6F
	Output: 16 points	Y20 to Y2F	Y40 to Y4F	Y60 to Y6F

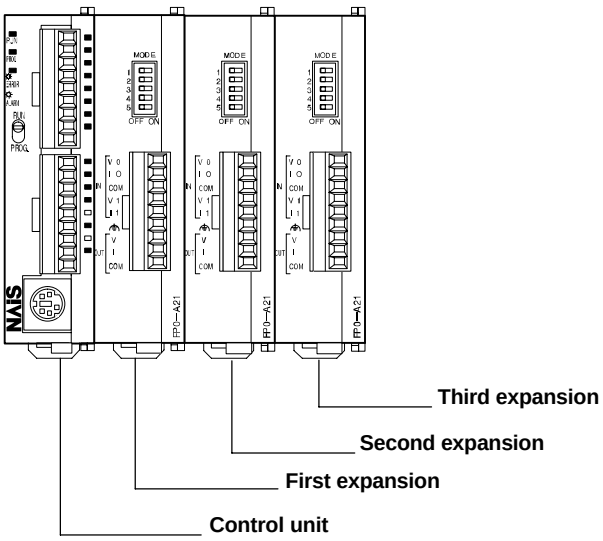


7.4 Analog I/O Unit

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

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

Type		I/O number		
		First expansion	**Second expansion**	**Third expansion**
A21	**Input channel 0: 16 points**	WX2 (X20 to X2F)	WX4 (X40 to X4F)	WX6 (X60 to X6F)
	Input channel 1: 16 points	WX3 (X30 to X3F)	WX5 (X50 to X5F)	WX7 (X70 to X7F)
	Output: 16 points	WY2 (Y20 to Y2F)	WY4 (Y40 to Y4F)	WY6 (Y60 to Y6F)



7.5 Link Unit

For explanations and examples on I/O allocation for the FP0 I/O Link Unit, see page 5-11.

Chapter 8

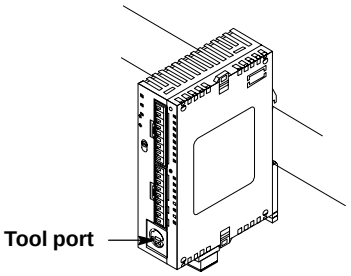
Installation

8.1 Important Notes

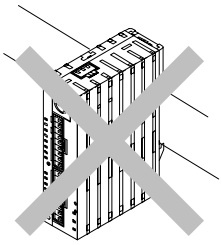
Please, read the following notes carefully before installing your FP0.

Notes

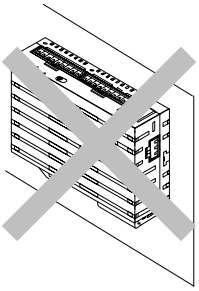
- **Avoid installing the unit in the following locations:**
  - **Ambient temperatures outside the range of 0°C to 55°C/32°F to 131°F**
  - **Ambient humidity outside the range of 30% to 85% RH**
  - **Sudden temperature changes causing condensation**
  - **Inflammable or corrosive gases**
  - **Excessive airborne dust or metal particles**
  - **Benzine, 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 insolated 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.**



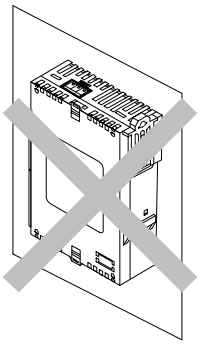
– **Do not install the FP0 control unit as shown below.**



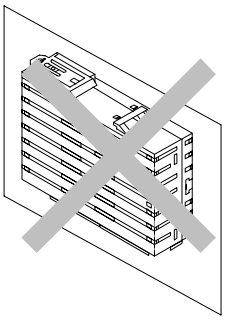
Upside-down



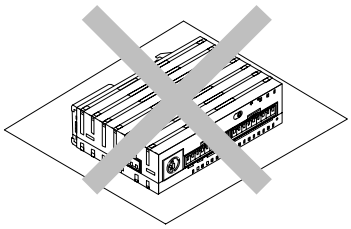
I/O connectors or I/O terminals on top



Installation which blocks the air duct



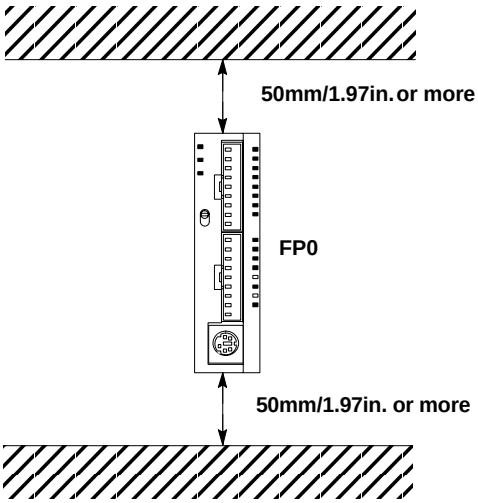
Installations such that the I/O connectors or I/O terminals face down



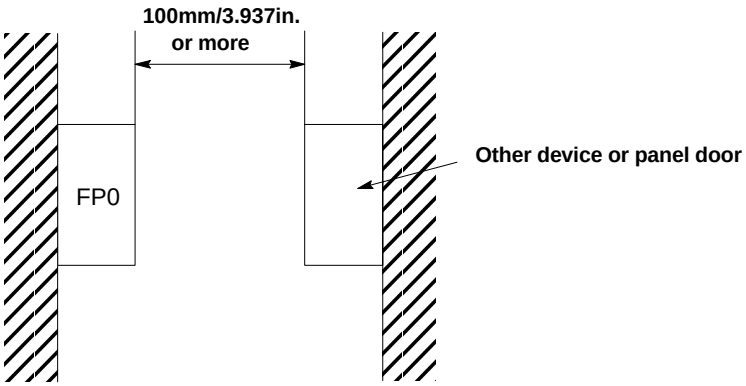
Horizontal installation of the unit

– **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.**

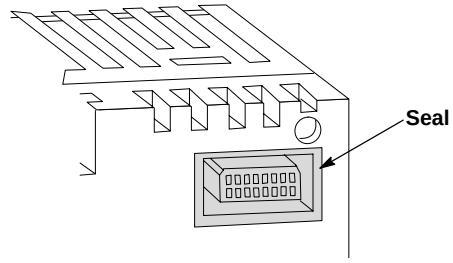


– **Keep the first 100mm/3.937in. from the front surface of the FP0 control unit open in order to allow room for programming tool connections and wiring.**

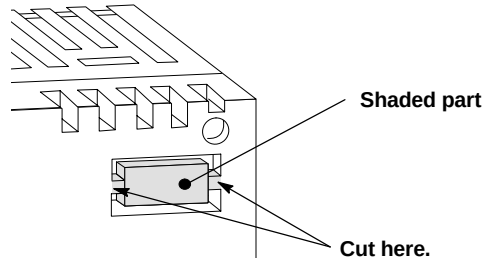
8.2 Adding Expansion Units

Procedure:

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

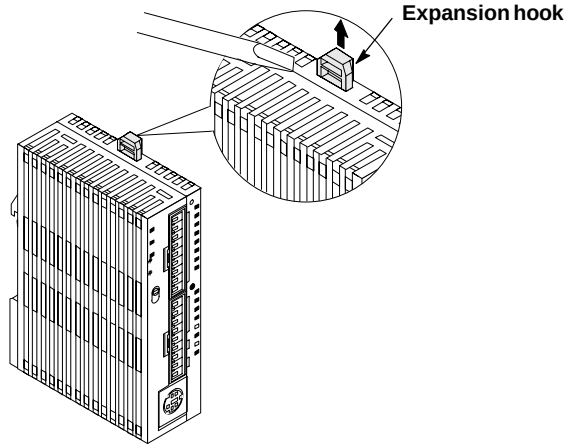


When peeling the seal on the side of the initial lot products, the shaded part is exposed. Cut off the shaded part with a pair of nippers or similar tool so that the internal connector is exposed.

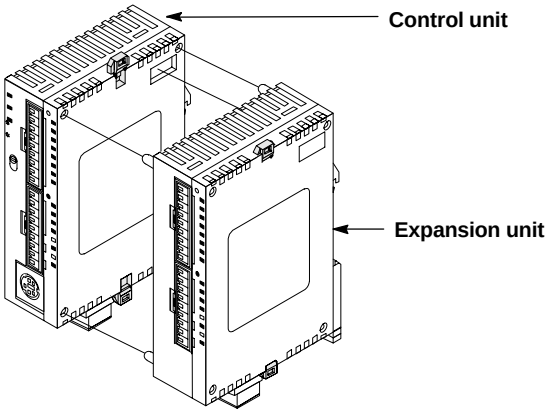


When removing the shaded part, use a sharp cutting object, making sure that the shaded part is removed leaving a smooth surface. Note that failure to remove the shaded part completely can result in damage to the connector.

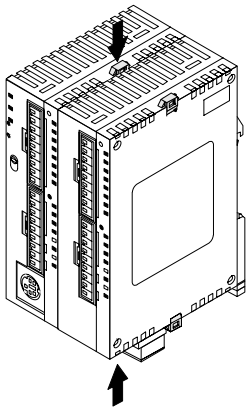
2. Raise the expansion hooks on the top and bottom sides of the unit with a screwdriver.



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.

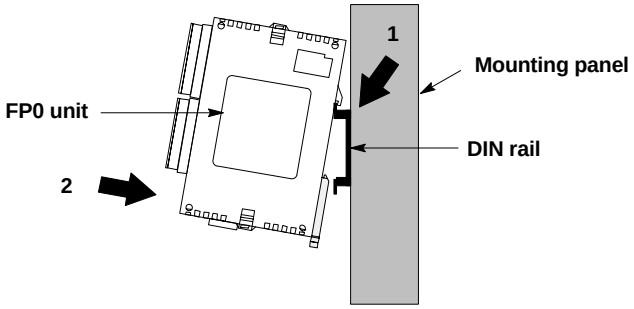


8.3 Attachment to DIN Rails

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

Procedure:

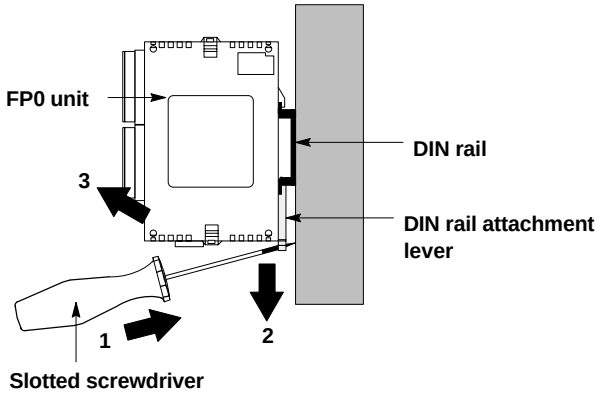
1. **Fit the upper hook of the FP0 unit onto the DIN rail.**
2. **Without moving the upper hook, press on the lower hook to fit the FP0 unit into position.**



You can easily remove the FP0 unit as described below.

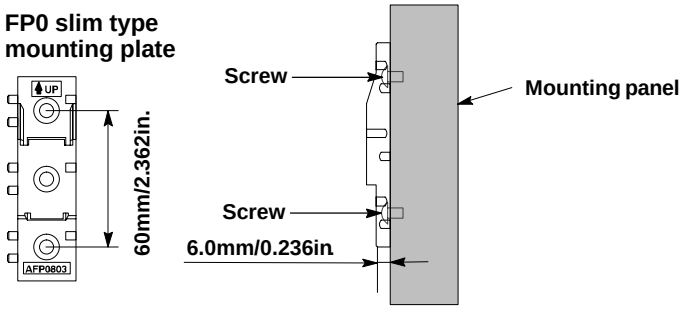
Procedure:

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.**



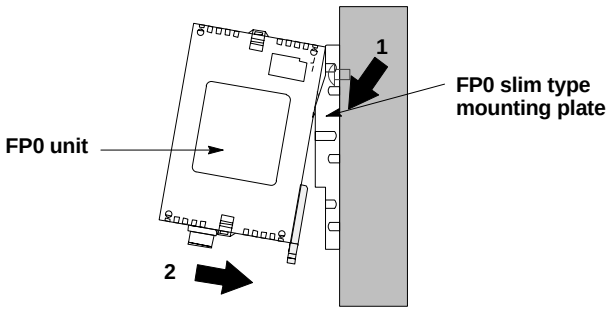
8.4 Installation Using FP0 Slim Type Mounting Plate

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 D - 9.



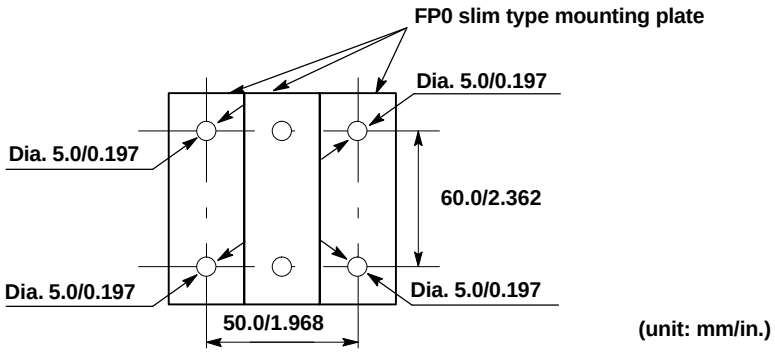
Procedure:

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.

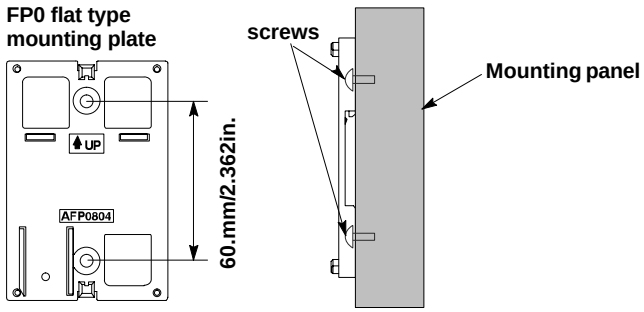
Example: Two expansion units



8.5 Installation Using FP0 Flat Type Mounting Plate

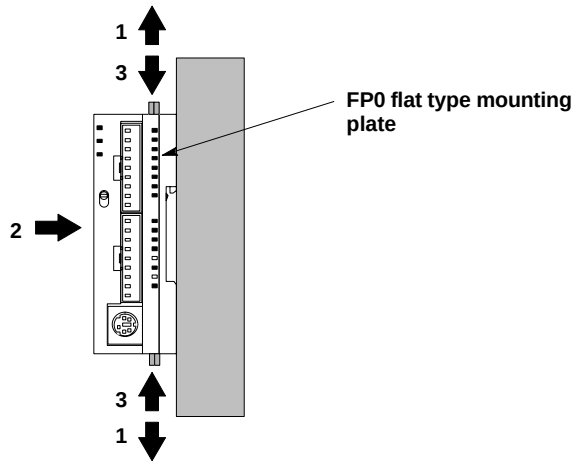
Use M4 size pan–head screws to attach FP0 flat type mounting plate (AFP0804) and install according to the dimensions shown below.

For a diagram showing detailed dimensions of the FP0 flat type mounting plate, see page D - 11.



Procedure:

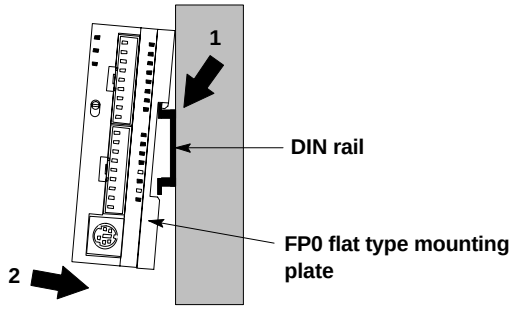
1. **Raise the expansion hooks on the top and bottom of the unit.**
2. **Install the FP0 unit on the FP0 flat type mounting plate.**
3. **Align the expansion hooks with the plate and press the hooks back down.**



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 9

Wiring

9.1 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:

9.1.1 Interlock Circuit

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.

9.1.2 Emergency Stop Circuit

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

9.1.3 Start Up Sequence

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.

9.1.4 Momentary Power Failures

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.

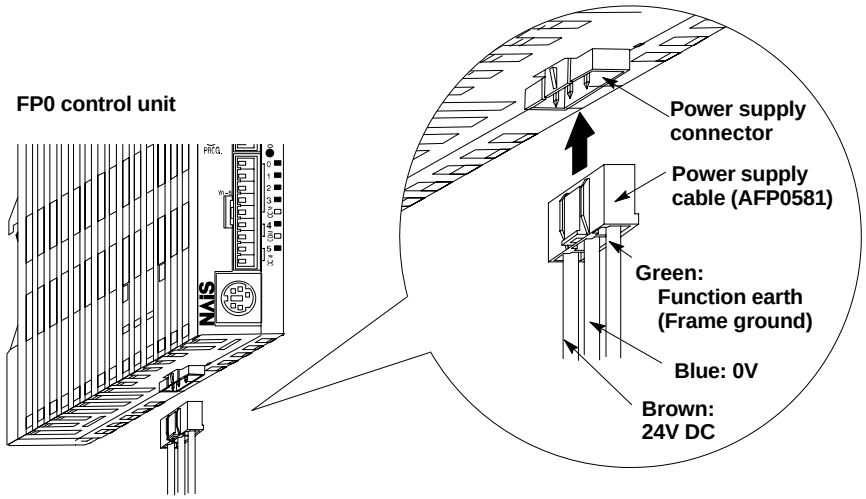
9.1.5 Protecting Power Supply and Output Sections

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.

9.2 Wiring the Power Supply to the Control Unit

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

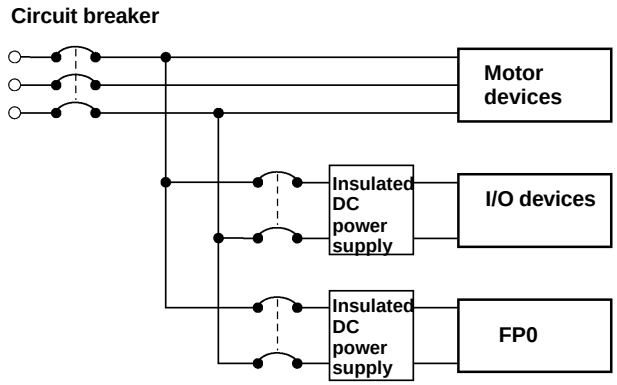


Item	Descriptions
Rated voltage	24V DC
Operating voltage range	21.6 to 26.4V DC

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.**

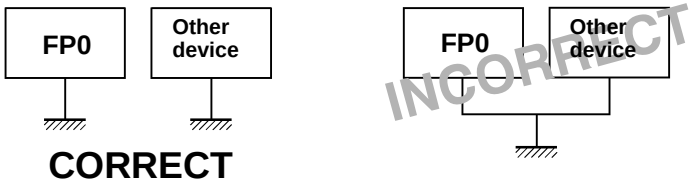


- **The power supply sequence should be set up so that power to the control unit is turned OFF before the input/output power supplies.**
- **If the input/output power supplies are turned OFF before the power to the control unit, the FP0 control unit may detect a drop in the input level, and malfunction.**
- **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.**

9.3 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^2**. The grounding connection should have a resistance of **less than 100Ω**.



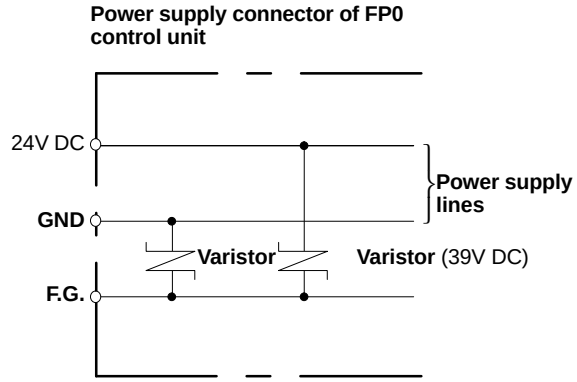
CORRECT

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.



9.4 Input Wiring

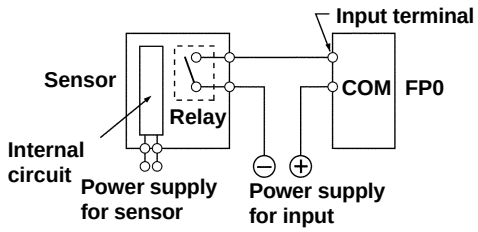
Notes

- **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.**

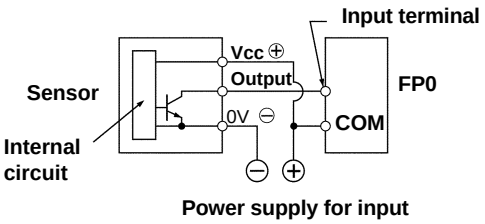
In this section you find some examples for wiring sensors, an LED-equipped reed switch, a two-wire type sensor and a LED-equipped limit switch.

9.4.1 Sensors

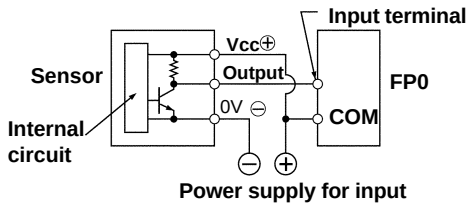
Relay output type



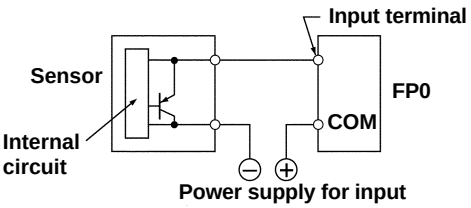
NPN open collector output type



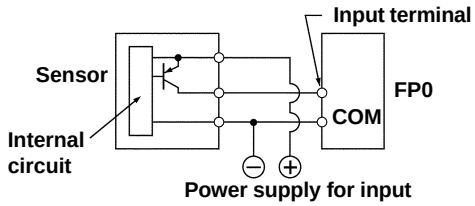
Universal output type



Two-wire type (☛ next page)

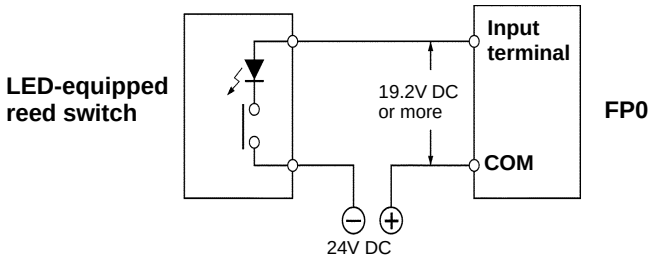


PNP open collector output type



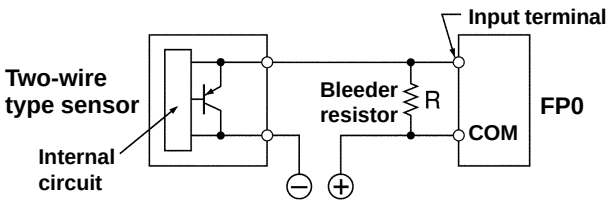
9.4.2 LED-Equipped Reed Switch

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.



9.4.3 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.

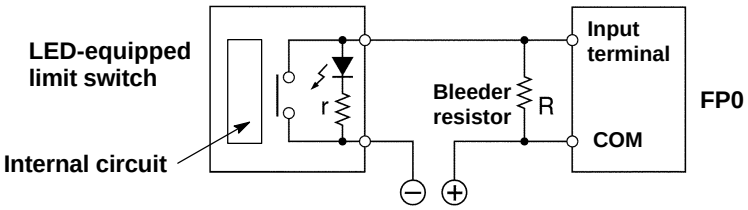
The resistance R of the bleeder resistor is: $R \leq \dfrac{13.44}{5.6 \times I - 2.4}$ (kΩ)

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

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

9.4.4 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 (kΩ)

R: Bleeder resistor (kΩ)

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: $R \leq \frac{13.44}{5.6 \times I - 2.4}$ (kΩ)

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.

9.5 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.**

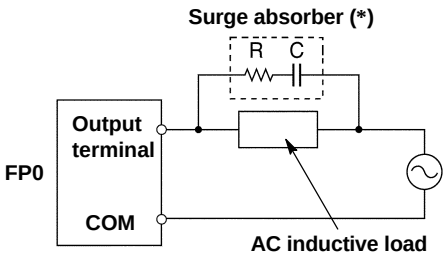
Protect the outputs as described below.

9.5.1 Protective Circuit for Inductive Loads

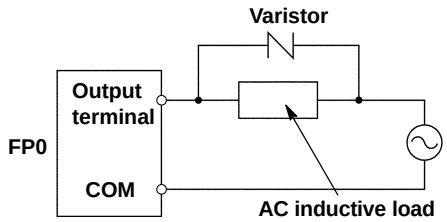
With an inductive load, a protective circuit should be installed in parallel with the load.

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

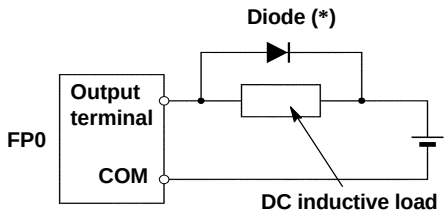
When using an AC inductive load



Example of surge absorber:
[R: 50Ω, C: 0.47μF]



When using a DC inductive load

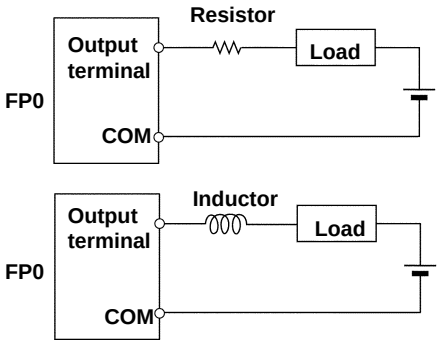


(*) Diode:

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

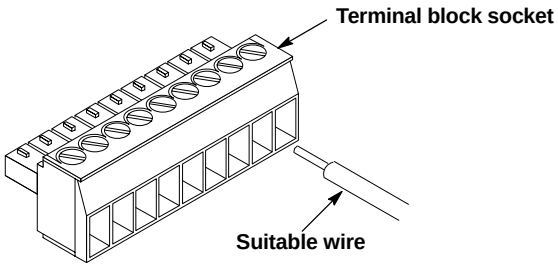
9.5.2 Precautions for Using Capacitive Loads

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



9.6 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^2
Analog I/O unit	Size: AWG #28 to 16
	Conductor cross-sectional area: 0.08 to 1.25mm^2

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^2)	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

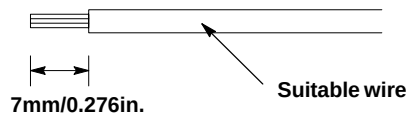
Pressure welding tool for pole terminals

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

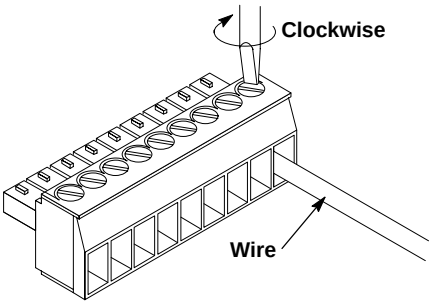
When tightening the terminals of the terminal block socket, use a screwdriver (Phoenix Contact Co., Product no. 1205037) with a blade size of 0.4 × 2.5. The tightening torque should be 0.22 to 0.25Nm (2.3 to 2.5kgfcm) or less.

Procedure:

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

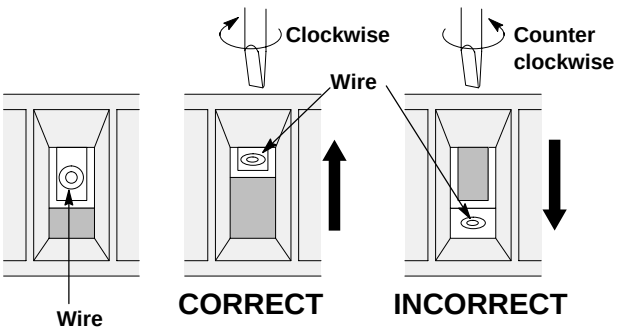


2. **Insert the wire into the terminal block socket until it contacts the back of the block socket, and then tighten the screw clockwise to fix the wire in place.**



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.**



9.7 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)

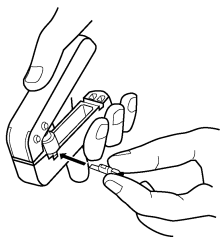
Size	Conductor cross-sectional area	Insulation thickness	Rated current
AWG#22	0.3mm^2	dia. 1.5 to dia. 1.1	3A
AWG#24	0.2mm^2		

Pressure connection toolorder number: AXY52000

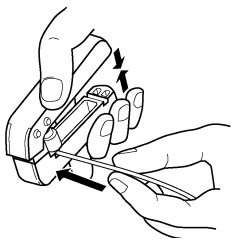
The wire end can be directly crimped without removing the wire's insulation, saving labor.

Procedure:

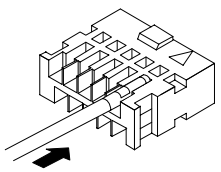
1. **Bend the welder (contact) back from the carrier, and set it in the pressure connection tool.**



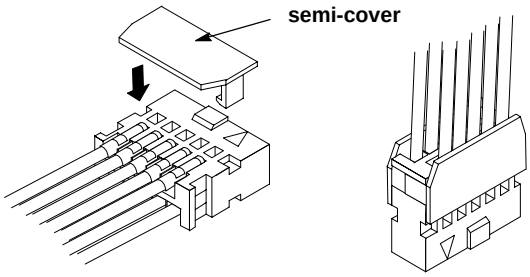
2. **Insert the wire without removing its insulation until it stops, and lightly grip the tool.**



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



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

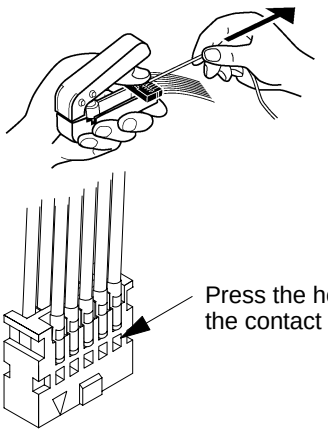


Note

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

9.7.1 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.

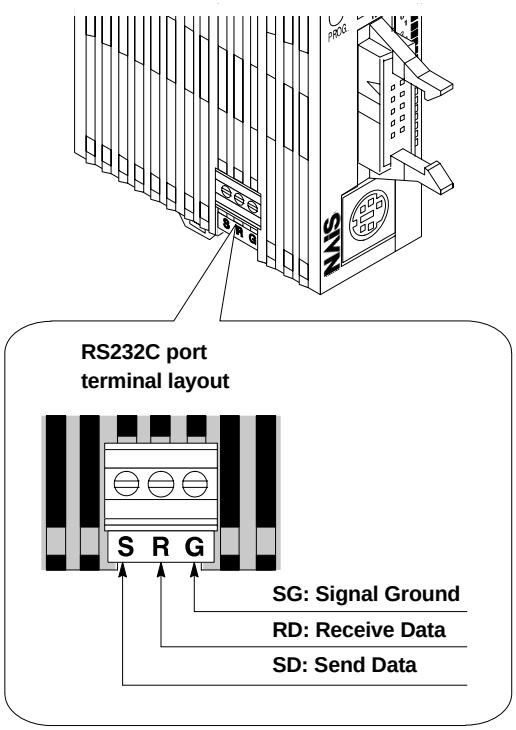


Press the housing against the pressure connection tool so that the contact puller pin comes in contact with this section.

9.8 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)

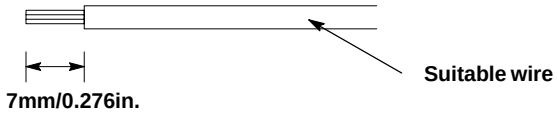
- Size: AWG #28 to 16
- Conductor cross-sectional area: 0.08 to 1.25mm^2

Use a shielded wire of the above wiring. We recommend grounding the shield section. Also, if using a pole terminal,see page 9-12.

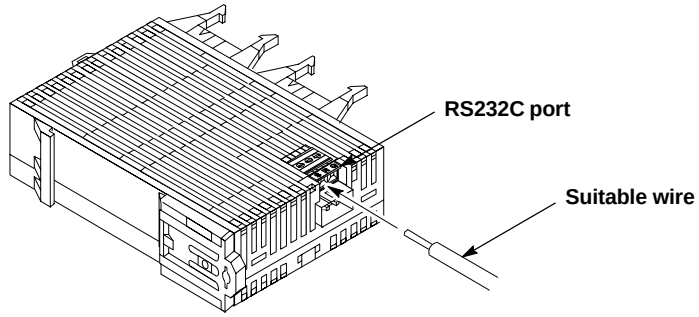
When tightening the RS232C port, use a screwdriver (Phoenix Contact Co., Product no. 1205037) with a blade size of 0.4 × 2.5. The tightening torque should be 0.22 to 0.25 Nm (2.3 to 2.5kgfcm) or less.

Procedure:

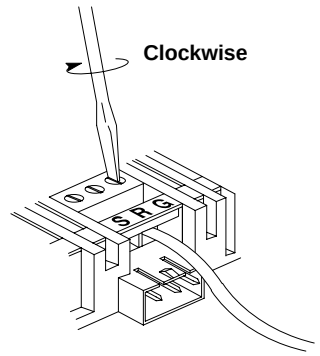
1. Remove a portion of the wire's insulation.



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

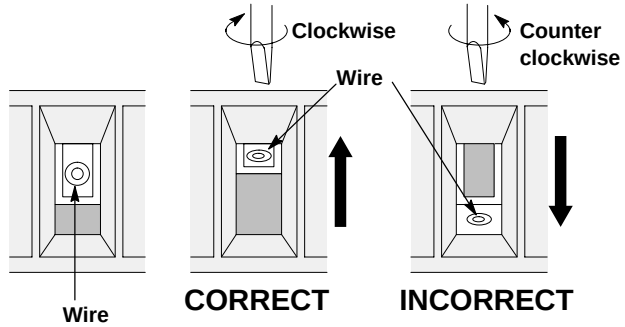


3. **Tighten the screw clockwise to fix the wire in place.**



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 10

Trial Operation

10.1 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	• Does the unit type match the device list during the design stage? • Are all of the units firmly attached?
Power supply	• Is operating voltage supplied correctly? • Is the power supply cable properly connected? • Are both voltage and polarity connected correctly for each connection? • 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) • 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) • Attaching additional power supply units in parallel is not allowed! It may destroy internal elements and the load of the power supply. (see note)
Check input/output terminals	• Does the wiring of connector and terminal match? • Is the operating voltage of I/O correct? • Are the connectors of I/O properly connected? • Is the wire size correct?
Setting of control unit	• Is the mode switch set to the PROG. mode?

Note

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

10.2 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**

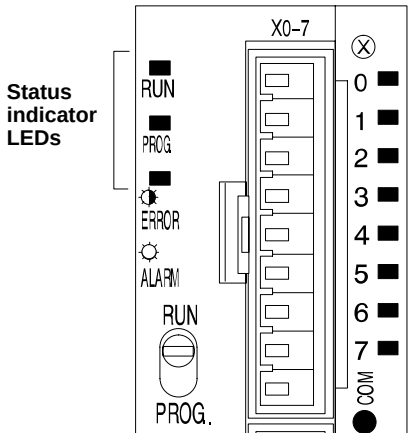
    We highly recommend to save the newly created program onto a floppy disk.

Chapter 11

Self-Diagnostic and Troubleshooting

11.1 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.

The user may select whether operation is to be continued or stopped if a duplicate output error or operation error occurs by setting the system registers.

11.1.1 Allowing Duplicated Output

When you change system register 20 settings (“ENAB”) using the programming software, duplicated output is not regarded as an error and the FP0 continues to operate.

11.1.2 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.

11.2 Troubleshooting

11.2.1 ERROR/ALARM LED is Flashing

<Condition>
The self-diagnostic error occurs.

<Procedure 1 >
Check the error code using the programming tool.

Using NPST-GR software

In the ONLINE mode, select “STATUS DISPLAY.” At the bottom of the “STATUS DISPLAY” window, you can find the error code.

SLF DIAGN ERR CD ( ) [ ]

Error code — Content of error

Using FPWIN GR

In the ONLINE mode, select “Monitor” from the menu bar. And then select “Status Display”. At the “PLC Error Flag” field, self-diagnostic error code is displayed.

Using FP programmer II

Press the keys on the FP programmer II as shown on the right.

When self-diagnostic error occurs, the screen shown on the right is displayed.

```
OP–  110
FUNCTION ERR E45
```

Using FPWIN Pro

In the online mode, Monitor –> PLC Status

Error code is 1 to 9

<Condition>
There is a syntax error in the program.

<Procedure 1 >
Change to PROG. mode and clear the error.

<Procedure 2>
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.

Error code is 20 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 NPST-GR software

Press the **<F3>** key in the status display menu described on the previous page. Error code 43 and higher can be cleared.

Using FPWIN GR

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

Using FP programmer II

Press the keys as shown on the right.

Error code 43 and higher can be cleared.

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)**.

<Procedure 2>

Follow the procedures described in the table of error codes (see page 11-12).

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.

11.2.2 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 11.2.1.

<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.

11.2.3 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.

11.2.4 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.

11.2.5 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 NPST-GR software baud rate setting

<If you are using MENU 1 screen type>

Open [NPST MENU] by pressing **<Esc>**, then select “NPST CONFIGURATION” to skip to the [NPST CONFIGURATION] subwindow. In the [NPST CONFIGURATION] subwindow, select “1. NPST CONFIGURATION.”

<If you are using MENU 2 screen type>

Open [NPST FUNCTION MENU] by pressing **<Esc>**, then select “Z. NPST CONFIGURATION.”

In this window, you can find the baud rate as shown below:

TRNS RATE (bps) [115k / 57k / 38k /19200 / 9600 / 4800 / 2400]

Select a baud rate (9600), press **<F1>** and select “SAVE DISK? YES” to register this change onto the disk.

Using FPWIN GR

Option –> Communication Settings

Using FPWIN Pro

Online –> Communication Parameters

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.

11.2.6 PROTECT ERROR is Displayed

When a password is set for the programmable controller

<Procedure >

Enter a password in the password setting menu.

Using NPST-GR software

Open [NPST MENU] by pressing **<Esc>**, and then select “PLC CONFIGURATION” to skip to the [PLC CONFIGURATION] window. In the [PLC CONFIGURATION] window, select “SET PLC PASSWORD”

Enter the password and select enable (ENAB).

Using FPWIN GR

Tool –> Set PLC Password

Using FPWIN Pro

Online –> PLC Password

11.2.7 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.

11.3 Error Codes

11.3.1 Total-Check Function

When the ERROR/ALARM LED on the FP0 control unit is blinking, a self-diagnostic error or syntax check error has occured. 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 11-3.
2. **Check the error contents in the error code list of section 11.3.2 and 11.3.3 using the error code ascertained above.**

11.3.1.1 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.

11.3.1.2 Self-Diagnostic Error

This error occurs when the contoller's self-diagnostic function detects the occurence 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 resister 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 11-3.
- 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 11-12.

11.3.2 Syntax Check Error Codes

Error code	Name of error	Operation status	Description and steps to take
E1	**Syntax error (SYNTAX)**	Stops	A program with a syntax error has been written. **Change to PROG. mode and correct the error.**
E2	**Duplicated output error (DUP USE)**	Stops	Two or more **OT(Out)** instructions and **KP(Keep)** instructions are programmed using the same relay. This error also occurs if you have the same timer/counter numbers. **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.**
E3	**Not paired error (PAIR)**	Stops	For instructions which must be used in a pair such as jump (**JP** and **LBL**), one instruction is either missing or in an incorrect position. **Change to PROG. mode and enter the two instructions which must be used in a pair in the correct positions.**
E4	**System register parameter error (Mismatch)**	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. **Change to PROG. mode, check the system register settings, and adjust so that the settings and the program agree.**
E5	**Program area error (PRG AREA)**	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 **SUB** to **RET** is placed before an **ED** instruction). **Change to PROG. mode and enter the instruction into the correct area.**

Error code	Name of error	Operation status	Description and steps to take
E8	**Operand error (OPR COMBI)**	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). **Enter the correct combination of operands.**

11.3.3 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. **Turn OFF the power and check the noise conditions.**
E32	**Interrupt error 2**	Stops	An interrupt occurred without an interrupt request. A hardware problem or error due to noise is possible. **Turn OFF the power and check the noise conditions.**
			There is no interrupt program for an interrupt which occurred. **Check the number of the interrupt program and change it to agree with the interrupt request.**
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. **Clear the error based on the set detection conditions**
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 NPST–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 NPST-GR software Ver. 4

Procedure:

1. **Set the mode of the FP0 control unit to PROG.**
2. **Select the "1. SYSTEM REGISTER" in "PLC CONFIGURATION" option from the NPST menu.**
3. **Select the function to be set in the "1. SYSTEM REGISTER" in "PLC CONFIGURATION" screen. The value set in the selected system register will appear.**
4. **To change a set value, write the new value as indicated in the system register table.**
5. **Execute [Register] (f1) to write the data to the PC.**

Using FPWIN GR

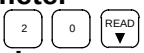
For more details about system register settings, see "Control FPWIN GR Operational Guide Book."

Using FP programmer II

Procedure:

1. **Set the mode of the FP0 control unit to PROG.**
2. **Press the keys on the FP programmer II, as shown on the right.**

3. **Specify the register number (e.g. No.20) for the parameter to be set and read the parameter. The value set in the selected register will be displayed.**



4. **To change the set value, press the <CLR (clear)> key and write the new value as indicated in the system register table.**

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

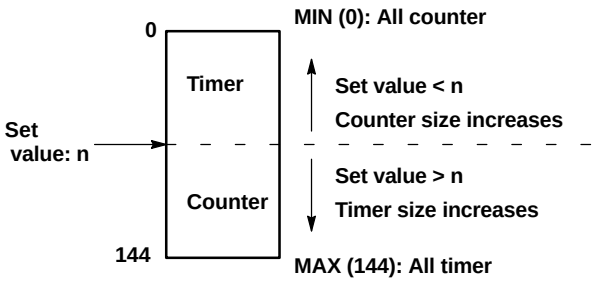
Setting the timers and counters (System register 5)

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.

Timer	100 points (No. 0 to No. 99)
Counter	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

Timer	Non-hold type: All points
Counter	Non-hold type: From the set value to C139
	Hold type: 4 points (elapsed values) C140 to C143
Internal relay	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)
Data register	Non-hold type: 1652 words (DT0 to DT1651)
	Hold type: 8 words (DT1652 to DT1659)

C32 series

Timer	Non-hold type: All points
Counter	Non-hold type: From the set value to C127
	Hold type: 16 points (elapsed values) C128 to C143
Internal relay	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)
Data register	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 unit, ☛ see page 2-8.

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 NPST–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.

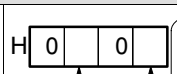
Address		Name of system register	Default value	Set value (parameter)
Allocation of user memory	**0**	**Sequence program area capacity**	——	The set values are fixed and cannot be changed. The stored values vary depending on the model and type. K3: 3 K words (FP0 C10, C14, C16) K5: 5 K words (FP0 C32)
	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 A-4.
	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**	**Unused**	——	——
	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 NPST–GR, enter the time (a number divisible by 2.5). In FP Programmer II, enter the set value (equal to the time divided 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 NPST–GR, enter the time (a number divisible by 2.5). In FP Programmer II, enter the set value (equal to the time divided by 2.5).

Address		Name of system register		Default value	Set value (parameter)	
Input setting	**400**	**High-speed counter mode settings (X0 to X2)**	**Setting by FPWIN Pro, NPST-GR Ver. 4, or FPWIN GR**	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)**	**Setting by FP programmer II**	H0	CH0/ CH1	

0: Do not use 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 dicision (X0, X1)
A: Direction dicision (X0, X1), Reset input (X2)

0: Do not use 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)

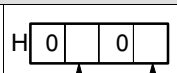
Notes

- **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	**401**	**High-speed counter mode settings (X3 to X5)**	**Setting by FPWIN Pro, NPST-GR Ver. 4, or FPWIN GR**	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)

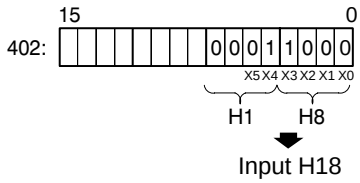
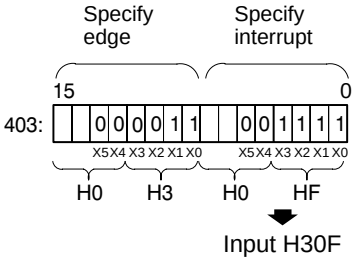
Notes

- **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	**401**	**High-speed counter mode settings (X3 to X5)**	**Setting by FP programmer II**	H0	CH2/ CH3	 0: Do not use 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 dicision (X3, X4) A: Direction dicision (X3, X4), Reset input (X5) 0: Do not use 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

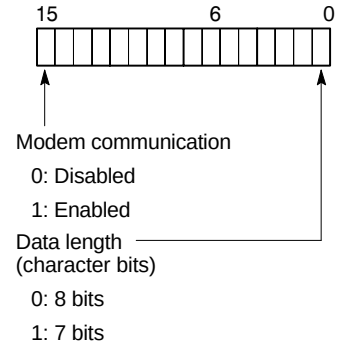
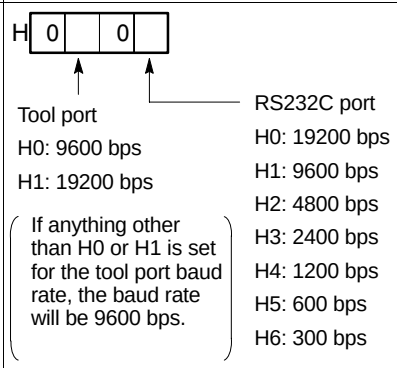
- **If the operation mode is set to 2–phase, individual, or direction differentiation, the setting for CH3 is invalid.**
- **If reset input settings overlap, the setting of CH3 takes precedence.**
- **If system register 400 to 403 have been set simultaneously for the same input relay, the following precedence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

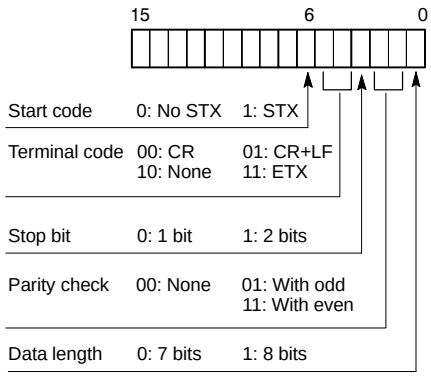
Address		Name of system register	Default value	Set value (parameter)
Input setting	**402**	**Pulse catch input function settings**	H0	X5 X4 X3 X2 X1 X0 0 0 0 0 0 0 0: Standard input 1: Pulse catch input In **FPWIN Pro**, select items from the menu. In **FP Programmer II**, enter the above settings in hexadecimal. When X3 and X4 are set to pulse catch input  In the case of FP0, settings X6 and X7 are invalid.
	403	**Interrupt input settings**	H0	Using **NPST–GR** ver. 4 X5 X4 X3 X2 X1 X0 Specify the input contacts used as interrupt inputs in the upper byte. (0: Standard input/1: Interrupt input) X5 X4 X3 X2 X1 X0 Specify the effective interrupt edge in the lower byte. (When 0: on/When 1: off) In **FPWIN Pro**, select items from the menu. **FP programmer II**: When setting inputs X0, X1, X2, and X3 as interrupts, and X0 and X1 are set as interrupt inputs when going from on to off. 
	404 to 407	**Unused**	——	With the FP0, values set with the programming tool become invalid.

Notes

- **With the NPST–GR, “0” or “1” is set for each bit on the screen in the setting for system register 403.**
- **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 **FPWIN Pro** or **NPST–GR** Select items from the menu. Using FP programmer II Specify the setting contents using H constants.  When connecting a modem, set the unit number to 1 with system resister 410.
	414	**Baud rate setting for tool port**	**Setting by FPWIN Pro or NPST–GR ver. 4**	H0	0: 9600 bps 1: 19200 bps
Tool port/ RS232C port setting	**414**	**Baud rate setting for tool port and RS232C port**	**Setting by FP programmer II**	H1	 If 19,200 bps is set for both the tool port and RS232C port –> H100 should be written.

Address		Name of system register		Default value	Set value (parameter)
RS232C port setting	**412**	**Communication method setting for RS232C port**		K0	Using **FPWIN Pro** or **NPST–GR**, select items from the menu. Using **FP programmer II**: K0: RS232C port is not used. K1: Computer link mode (when connecting C–NET) K2: Serial data communication mode (general port)
	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	Using **FPWIN Pro** or **NPST–GR**, select items from the menu. Using **FP programmer II**: Specify the setting contents using H constants. 
	414	**Baud rate setting for RS232C port**	**Setting by FPWIN Pro or NPST–GR ver. 4**	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	Using **FPWIN Pro** or **NPST–GR**, select items from the menu. Using **FP programmer II**. H0: Modem disabled H8000: Modem enabled
	417	**Starting address setting for reception buffer**		K0	C10C/C14C/C16C type: K0 to K1660 C32C type: K0 to K6144
RS232C port setting	**418**	**Capacity setting for reception buffer**	**C10C/ C14C/ C16C type**	K1660	K0 to K1660
			C32C/ T32CP type	K6144	K0 to K6144

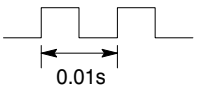
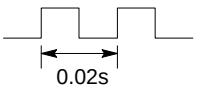
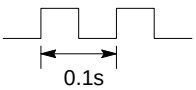
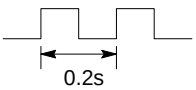
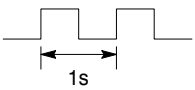
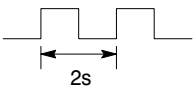
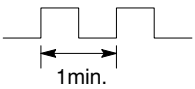
Appendix B

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.

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 occured 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.

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

Note

Used by the system.

Address	Name	Description
R902C to R902F	———	Not used
R9030, R9031	———	Not used
R9032	**RS232C port mode flag**	When “General–use port” is selected, ”K2” goes on.
R9033	**Printout instruction flag**	Turns on while a **F147 (PR)** instruction is executed. Turns off when a **F147 (PR)** instruction is not executed.
R9034	**Rewrite during RUN flag**	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	**RS232C communication error flag**	Turns on when the serial data communication error occurs.
R9038	**RS232C reception completed flag**	Turns on when a terminator is received during the serial data communicating.
R9039	**RS232C transmission completed flag**	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	**High-speed counter control flag for ch0**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903B	**High-speed counter control flag for ch1**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903C	**High-speed counter control flag for ch2**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903D	**High-speed counter control flag for ch3**	Turns on while the high-speed counter instruction “**F166 (HC1S)** to **F170 (PWM)**” is executed.
R903E, R903F	———	Not used

Appendix C

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.

Addresses		Description
T32CP	**Other Types**	
DT90000	**DT9000**	**Self–diagnostic error code** 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 11-10.
DT90010	**DT9010**	**I/O verify error unit** The position of the I/O for which an error occurred is stored in bits 0 to 3.
DT90014	**DT9014**	**Auxiliary register for operation** One shift-out hexadecimal digit is stored in bit positions 0 to 3 when an **F105 (BSR)** or **F106 (BSL)** instruction is executed.
DT90015	**DT9015**	**Auxiliary register for operation** The divided remainder (16-bit) is stored in DT9015 when an **F32 (%)** or **F52 (B%)** instruction is executed.
DT90016	**DT9016**	The divided remainder (32-bit) is stored DT9015 and DT9016 when an **F33 (D%)** or **F53 (DB%)** instruction is executed.
DT90017	**DT9017**	**Operation error address (hold)** After commencing operation, the address where the first operation error occurred is stored. Monitor the address using decimal display.
DT90018	**DT9018**	**Operation error address (non-hold)** 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**	**2.5 ms ring counter** 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.

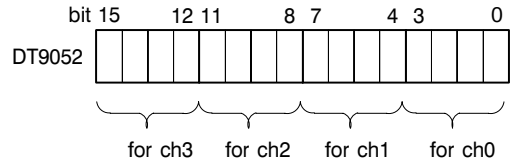
Addresses		Description
T32CP	**Other Types**	
DT90022	**DT9022**	**Scan time (current value) (☛ see note 1)** The current scan time is stored here. Scan time is calculated using the formula: Scan time (ms) = stored data (decimal) × 0.1 K50 indicates 5 ms.
DT90023	**DT9023**	**Scan time (minimum value) (☛ see note 1)** 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**	**Scan time (maximum value) (☛ see note 1)** 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**	**Mask condition monitoring register for interrupts(INT 0 to 5)** The mask conditions of interrupts using **ICTL** instruction can be monitored here. Monitor using binary display. 15 11 7 3 0 (Bit No.) 23 19 16 (INT No.) 0: interrupt disabled (masked) 1: interrupt enabled (unmasked)
DT90026	**DT9026**	Not used
DT90027	**DT9027**	**Periodical interrupt interval (INT 24)** 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)**	**Message 0** **Message 1** **Message 2** **Message 3** **Message 4** **Message 5** The contents of the specified message are stored in these special data registers when an **F149 (MSG)** 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**	**Work 1 for F96 (SRC) instruction** The number of data that match the searched data is stored here when an **F96 (SRC)** instruction is executed.

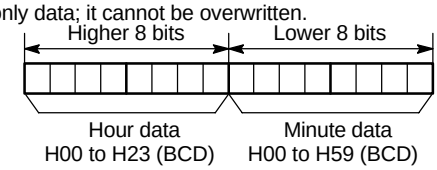
Notes

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.**

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

<table>
<tr><th colspan="2">Addresses</th><th>Description</th></tr>
<tr><th>T32CP</th><th>Other Types</th><th></th></tr>
<tr><td>DT90052</td><td>DT9052</td><td>High-speed counter control flag
A value can be written with an MV (F0) instruction to reset the high-speed counter, disable counting, stop high-speed counter instruction (F168), and clear the high-speed counter.
Control code setting
Control code = □□□□ (Binary)
Software reset
0: Yes / 1: No
Count
0: Enable / 1: Disable
Hardware reset
0: Enable / 1: Disable
High–speed counter clear
0: Continue / 1: Clear
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)

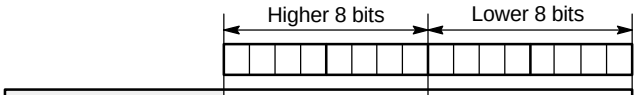
The 16 bits of DT9052 are allocated in groups of four to high-speed channels 0 to 3 as shown below.
 

A hardware reset disable is only effective when using the reset inputs (X2 and X5). In all other cases it is ignored.
When using pulse output, a hardware reset input is equivalent to an home point proximate input.</td></tr>
<tr><td>DT90053
(see note)</td><td></td><td>Clock/calendar monitor (hour/minute)
Hour and minute data of the clock/calendar are stored here. This data is read-only data; it cannot be overwritten.
 
</td></tr>
</table>

Note

An expansion memory unit is necessary.

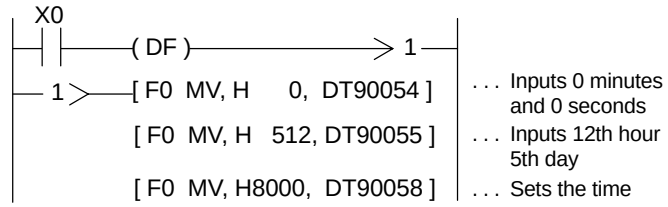
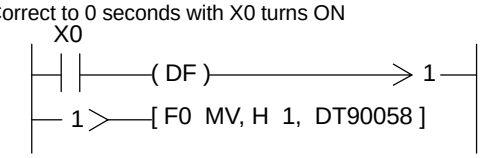
Addresses		Description
T32CP	**Other Types**	
DT90054 (see note)		**DT90054, Clock/calendar monitor and setting (minute/second)** **DT90055, Clock/calendar monitor and setting (day/hour)** **DT90056, Clock/calendar monitor and setting (year/month)** **DT90057, Clock/calendar monitor and setting (day-of-the-week)** 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 **F0 (MV)** transfer instruction.
DT90055 (see note)		
DT90056 (see note)		
DT90057 (see note)		



DT90054	Minute H00 to H59 (BCD)	Second H00 to H59 (BCD)
DT90055	Day H01 to H31 (BCD)	Hour H00 to H23 (BCD)
DT90056	Year H00 to H99 (BCD)	Month H01 to H12 (BCD)
DT90057	_____	Day-of-the-week H00 to H06 (BCD)

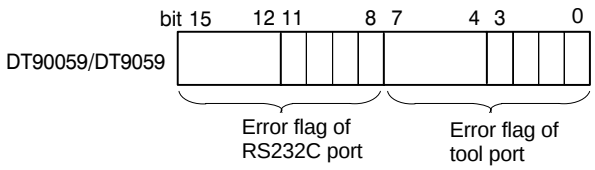
Note

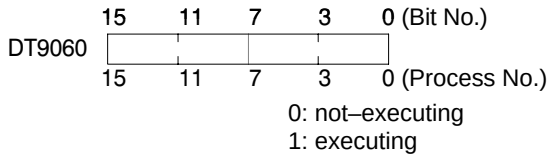
An expansion memory unit is necessary.

Addresses		Description
T32CP	Other Types	
DT90058 (see note)		**Clock/calendar time setting and 30s correction** The clock/calendar is adjusted as follows. **When setting the clock/calendar by program that uses F0 (MV) instructions** By setting the the highest bit of DT90058 to 1, the time becomes that written to DT90054 to DT90057 by **F0 (MV)** instruction. After the time is set, DT90058 is cleared to 0. (Cannot be performed with any instruction other than **F0 (MV)** instruction.) **Example: FPWIN GR** Set the time to 12:00:00 on the 5th day when the X0 turns ON.  **Note** **If you changed the values of DT90054 to DT90057 with the data monitor functions of NPST-GR software, the time will be set when the new values are written. Therefore, it is unnecessary to write to DT90058.** **When the correcting times less than 30 seconds** 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. **Example: FPWIN GR** Correct to 0 seconds with X0 turns ON  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.

Note

An expansion memory unit is necessary.

Addresses		Description
T32CP	**Other Types**	
DT90059	**DT9059**	**Serial communication error code**  • Tool port bit 0 = 1: Over run error bit 1 = 1: Framing error bit 2 = 1: Parity error • RS232C port bit 8 = 1: Over run error bit 9 = 1: Framing error bit 10 = 1: Parity error

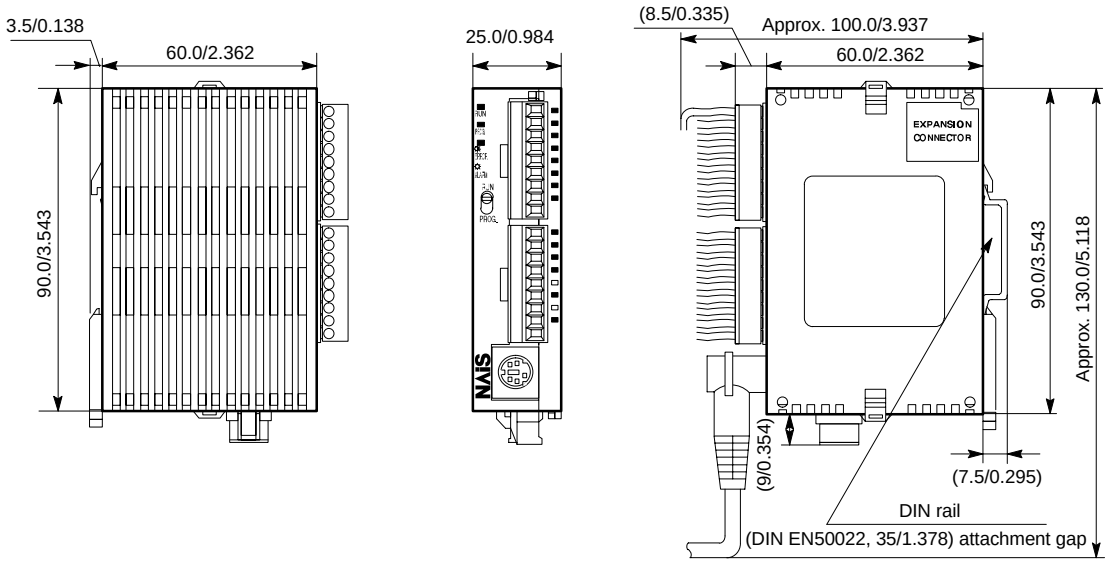
<table>
<tr><th colspan="2">Addresses</th><th colspan="2">Description</th></tr>
<tr><th>T32CP</th><th>Other Types</th><th colspan="2"></th></tr>
<tr><td>DT90060</td><td>DT9060</td><td>Process number: 0 to 15</td><td rowspan="8">Step ladder process
Indicates the startup condition of the step ladder process. When the proccess starts up, the bit corresponding to the process number turns on “1”.
Monitor using binary display.
 

A programming tool can be used to write data.</td></tr>
<tr><td>DT90061</td><td>DT9061</td><td>Process number: 16 to 31</td></tr>
<tr><td>DT90062</td><td>DT9062</td><td>Process number: 32 to 47</td></tr>
<tr><td>DT90063</td><td>DT9063</td><td>Process number: 48 to 63</td></tr>
<tr><td>DT90064</td><td>DT9064</td><td>Process number: 64 to 79</td></tr>
<tr><td>DT90065</td><td>DT9065</td><td>Process number: 80 to 95</td></tr>
<tr><td>DT90066</td><td>DT9066</td><td>Process number: 96 to 111</td></tr>
<tr><td>DT90067</td><td>DT9067</td><td>Process number: 112 to 127</td></tr>
<tr><td>DT90104</td><td>DT9104</td><td colspan="2" rowspan="2">High-speed counter elapsed value area for ch2
The elapsed value (24–bit data) for the high–speed counter is stored here. Each time the ED instruction is executed, the elapsed value for the high–speed counter is automatically transferred to the special registers DT9104 and DT9105.
The value can be written by executing a DMV (F1) instruction.</td></tr>
<tr><td>DT90105</td><td>DT9105</td></tr>
<tr><td>DT90106</td><td>DT9106</td><td colspan="2" rowspan="2">High-speed counter target value area for ch2
The target value (24–bit data) of the high–speed counter specified by the high–speed counter instruction is stored here.
Target values have been preset for the various instructions, to be used when the high–speed counter related instruction F166 to F170 is executed. These preset values can only be read, and cannot be written.</td></tr>
<tr><td>DT90107</td><td>DT9107</td></tr>
<tr><td>DT90108</td><td>DT9108</td><td colspan="2" rowspan="2">High-speed counter elapsed value area for ch3
The elapsed value (24–bit data) for the high–speed counter is stored here. Each time the ED instruction is executed, the elapsed value for the high–speed counter is automatically transferred to the special registers DT9108 and DT9109.
The value can be written by executing a DMV (F1) instruction.</td></tr>
<tr><td>DT90109</td><td>DT9109</td></tr>
<tr><td>DT90110</td><td>DT9110</td><td colspan="2" rowspan="2">High-speed counter target value area for ch3
The target value (24–bit data) of the high–speed counter specified by the high–speed counter instruction is stored here.
Target values have been preset for the various instructions, to be used when the high–speed counter related instruction F166 to F170 is executed. These preset values can only be read, and cannot be written.</td></tr>
<tr><td>DT90111</td><td>DT9111</td></tr>
</table>

Appendix D

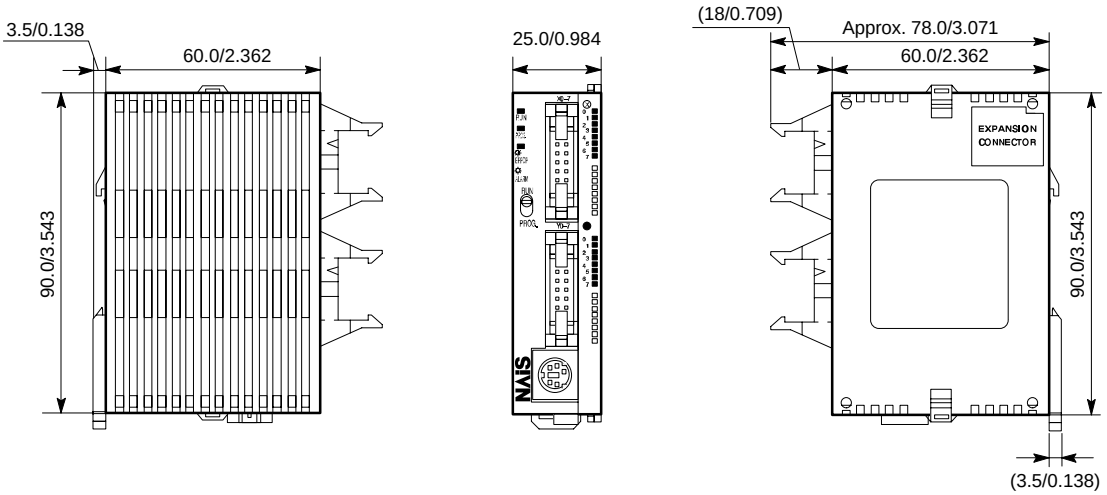
Dimensions

D.1 C10RS–10CRS–14RS–14CRS/E8RS–16RS



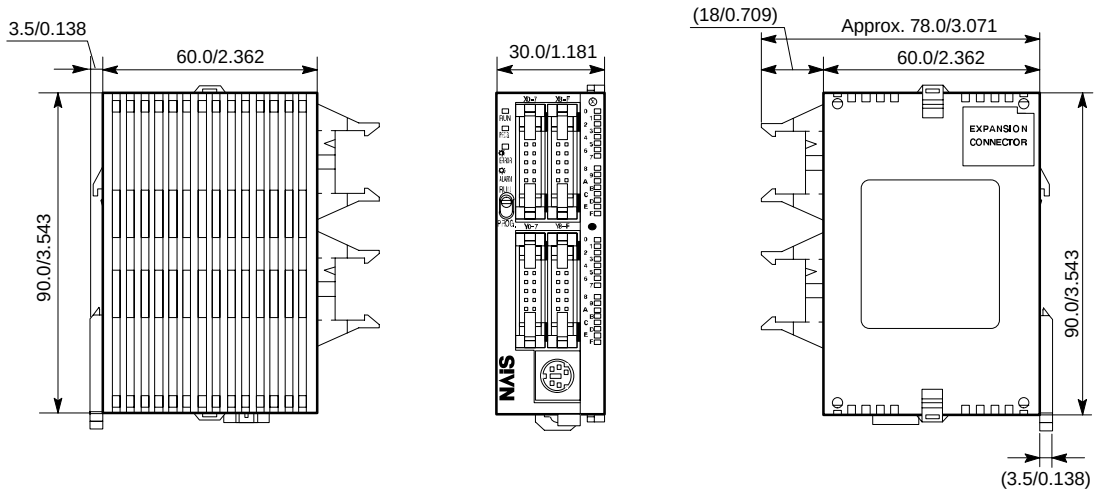
(unit: mm/in.)

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



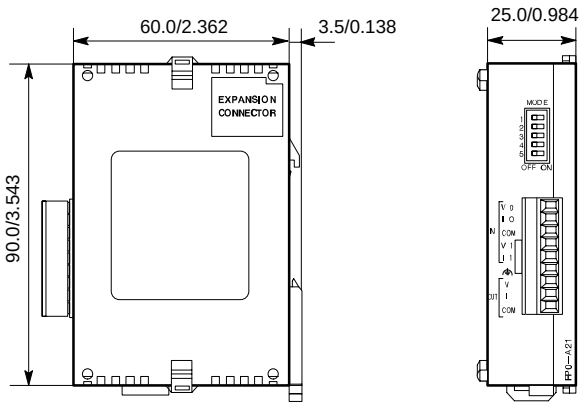
(unit: mm/in.)

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



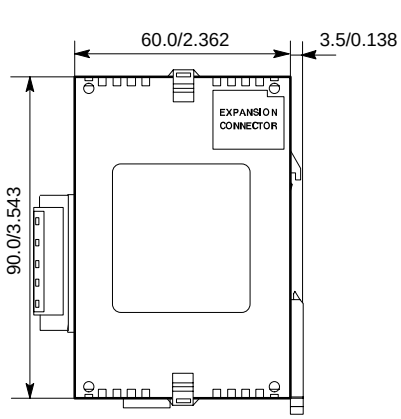
(unit: mm/in.)

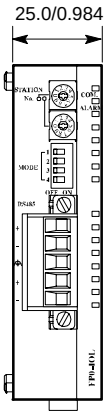
D.4 Analog I/O Unit



(unit: mm/in.)

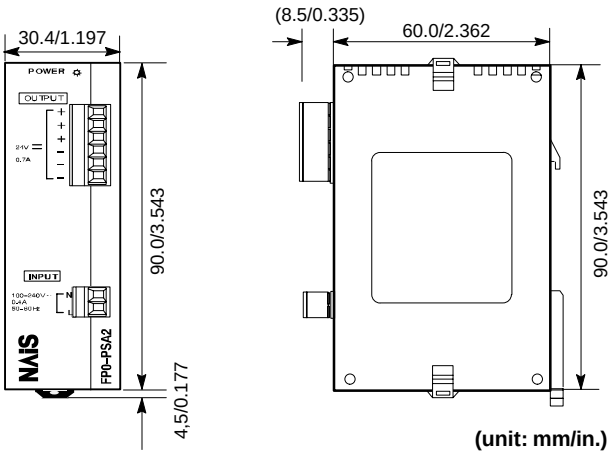
D.5 I/O Link Unit





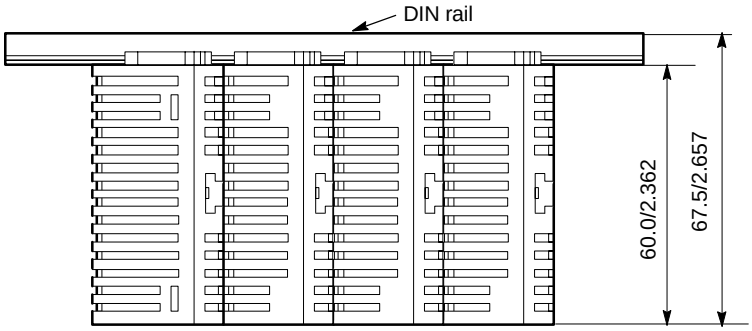
(unit: mm/in.)

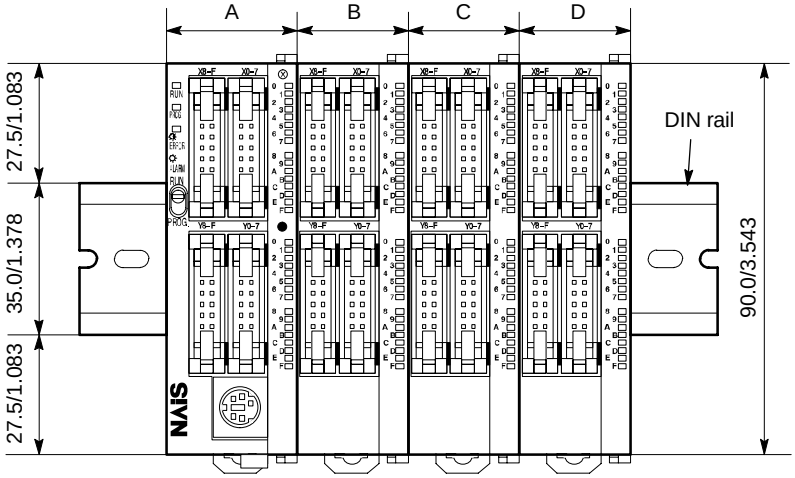
D.6 Power Supply Unit



(unit: mm/in.)

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

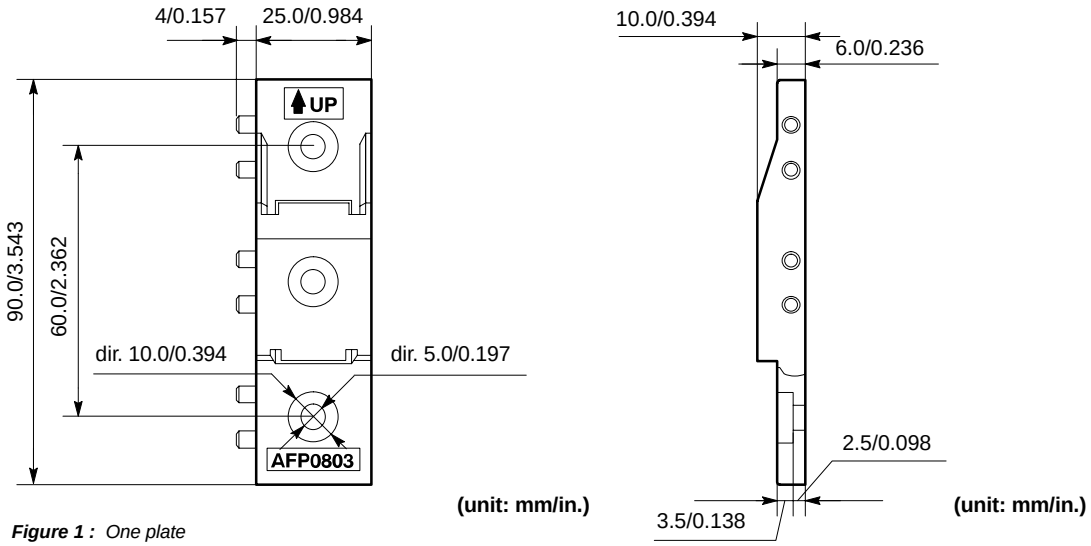


Figure 1 : *One plate*

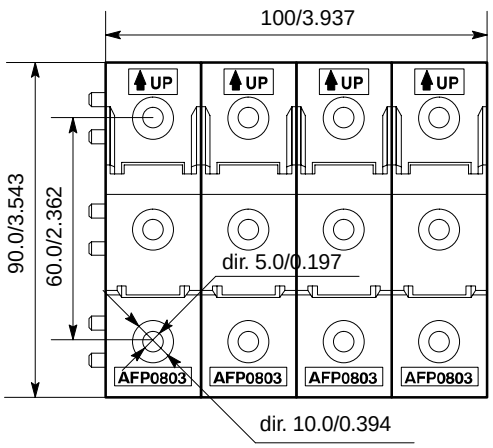


Figure 2 : *Four plates in series*

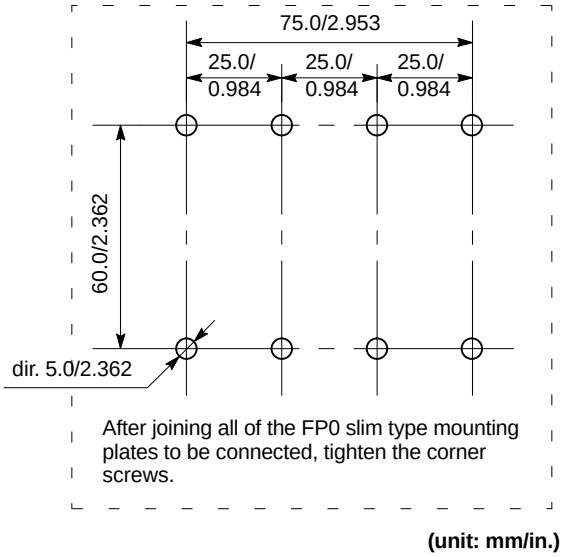
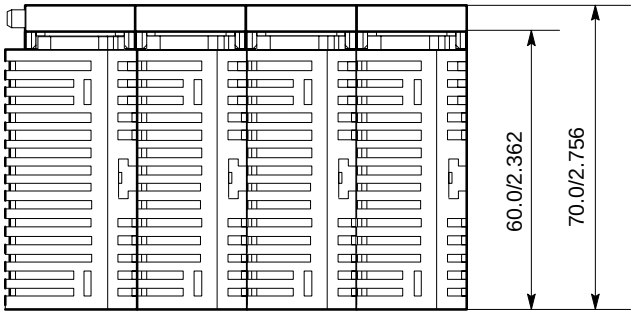


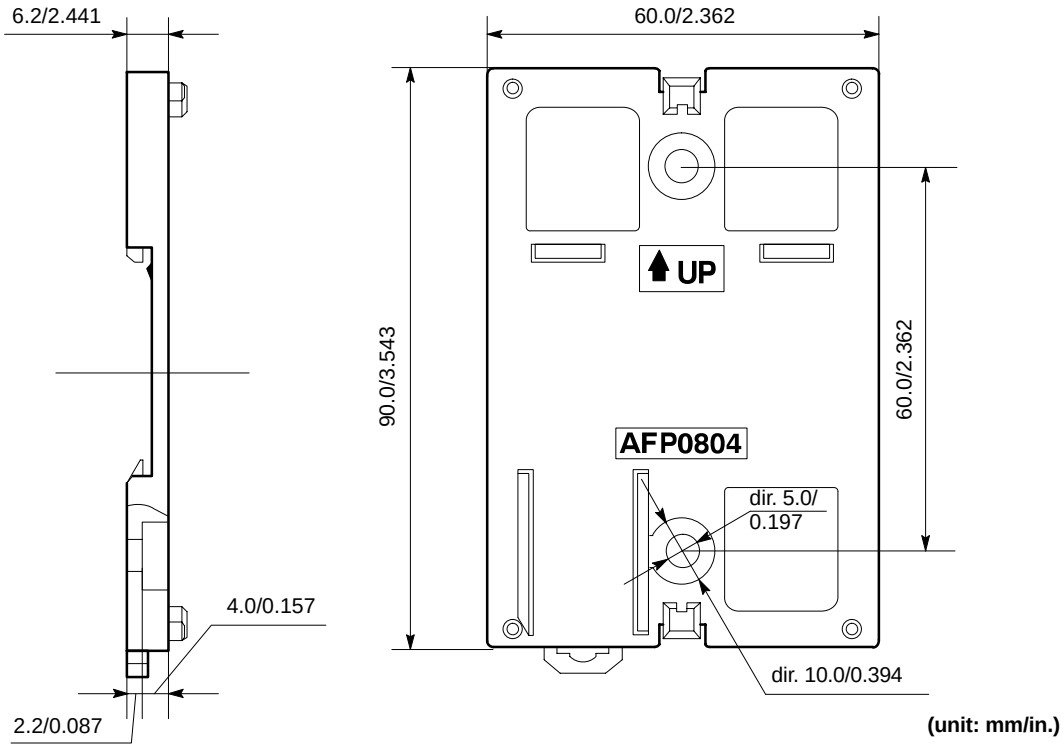
Figure 3 : *Mounting hole dimensions*

D.8.1 Dimensions When Using FP0 Slim Type Mounting Plate



(unit: mm/in.)

D.9 FP0 Flat Type Mounting Plate



(unit: mm/in.)

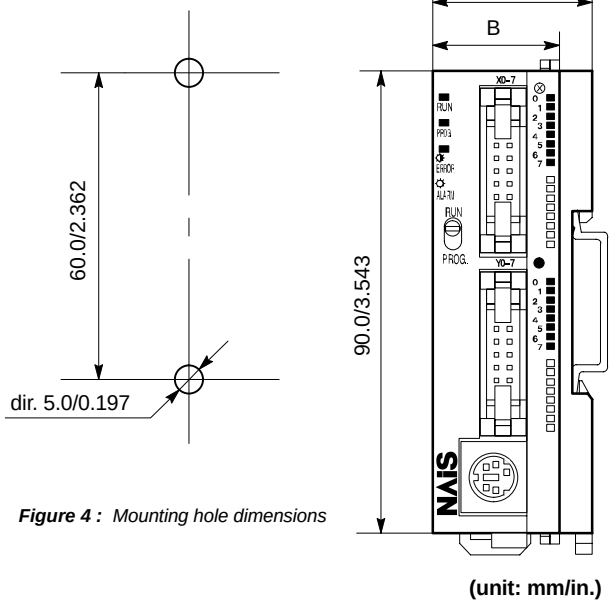


Figure 4 : *Mounting hole dimensions*

(unit: mm/in.)

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

Figure 5 : *Dimensions when mounted on rail*

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 (☛ see page 4-3).

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