Fuji Electric

Innovating Energy Technology

MICREX-SX *series*

SPF

USER'S MANUAL

Hardware

FEH526f

Preface

Thank you for purchasing Fuji Electric Programmable Controller MICREX-SX SPF Series.
This User's Manual describes the hardware specifications of the SPF series.
Read this manual carefully to ensure correct operation and also read the corresponding user's manuals listed below.

Title	Manual No.	Contents
User's Manual Instructions (Standard), MICREX-SX series SPF	FEH524	Describes the memory specifications and instructions specific to the SPF series (Standard).
User's Manual Instructions (Standard), MICREX-SX series SPH	FEH588	Describes the memory, language and system definitions of the MICREX-SX series SPH (Standard).
User's Manual Instructions (Expert), MICREX-SX series SPF	FEH525	Describes the memory specifications and instructions specific to the SPF series (Expert).
User's Manual Instructions (Expert), MICREX-SX series SPH	FEH200	Describes the memory, language and system definitions of the MICREX-SX series SPH (Expert).
User's Manual Analog Unit, MICREX-SX series SPF	FEH527	Describes the specifications and operations of analog input/ output units of the MICREX-SX series SPF.
User's Manual Built-in High-Speed Counter, MICREX-SX series SPF	FEH534	Describes the specifications and operations of the high-speed counter built in the main unit of the MICREX-SX series SPF.
User's Manual General Purpose Communication, MICREX-SX series SPF	FEH528	Describes the specifications of general purpose communication (RS-232C/RS485) units/boards of the MICREX-SX series SPF and how to create applications.
User's Manual Pulse Output Instructions, MICREX-SX series SPF	FEH529	Describes the specifications and operations of the high-speed pulse output and high-speed positioning functions built in the main unit of the MICREX-SX series SPF.
User's Manual High-precision Load Cell Unit, MICREX-SX series SPF	FEH530	Describes the specifications and application creation method of the high-precision load cell unit of the MICREX-SX series SPF.
User's Manual Ethernet communication, MICREX-SX series SPF	FEH630	Describes the specifications and application creation method of the Ethernet communication board/unit of the MICREX-SX series SPF.
User's Manual SX-Programmer Standard <Reference>, MICREX-SX series	FEH598	Describes the functions and the operations of SX-Programmer Standard V3.
User's Manual SX-Programmer Expert (D300win) <Reference>, MICREX-SX series	FEH257	Describes the functions and the operations of SX-Programmer Expert (D300win) V3.

* In addition to the above manuals, the following Fuji Electric Co.,Ltd.site offers various manuals and technical documents associated with MICREX-SX series.
URL http://www.fujielectric.com

Notes

1. This manual may not be reproduced in whole or part in any form without prior written approval by the manufacturer.
2. The contents of this manual (including specifications) are subject to change without prior notice.
3. If you find any ambiguous or incorrect descriptions in this manual, please write them down (along with the manual No. shown on the cover) and contact FUJI.

Safety Precautions

Be sure to read the "Safety Precautions" thoroughly before using the module.
Here, the safety precautions items are classified into "Warning" and "Caution".

Warning : Incorrect handling of the device may result in death or serious injury.

Caution : Incorrect handling of the device may result in minor injury or physical damage.

Even some items indicated by "Caution" may result in a serious accident.
Both safety instruction categories provide important information. Be sure to strictly observe these instructions.

Warning

- Never touch any part of charged circuits as terminals and exposed metal portion while the power is turned ON. It may result in an electric shock to the operator.
- Turn OFF the power before mounting, dismounting, wiring, maintaining or checking, otherwise, electric shock, erratic operation or troubles might occur.
- Place the emergency stop circuit, interlock circuit or the like for safety outside the PLC. A failure of the PLC might break or cause problems to the machine.
- When using an expansion right side unit, be sure to mount a healthy unit to stop the SPF system with a fatal fault if the expansion right side unit is dropped. Unless a healthy unit is mounted, a dropout of the expansion right side unit is not detected and the SPF system continues operation in the state where the expansion right side unit is dropped.

Safety Precautions

⚠ Caution

- Do not use one found damaged or deformed when unpacked, otherwise, fire, failure or erratic operation might be caused.
- Do not shock the product by dropping or tipping it over, otherwise, it might be damaged or troubled.
- Follow the directions of the instruction manual and user's manual when mounting the product.
  If mounting is improper, the product might drop or develop problems or erratic operations.
- Use the rated voltage and current mentioned in the instruction manual and user's manual. Use beyond the rated values might cause fire, erratic operation or failure.
- Operate (keep) in the environment specified in the instruction manual and user's manual. High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock, might cause electric shock, fire, erratic operation or failure.
- Select a wire size to suit the applied voltage and carrying current. Tighten the wire terminals to the specified torque. Inappropriate wiring or tightening might cause fire, malfunction, failure or might cause the product to drop from its mounting.
- Contaminants, wiring chips, iron powder or other foreign matter must not enter the device when installing it, otherwise, fire, accident, erratic operation or failure might occur.
- Remove the dust-cover seals of modules after wiring, otherwise, fire, accident, erratic operation or failure might occur.
- Connect the ground terminal to the ground, otherwise, electric shock or erratic operation might occur.
- Periodically make sure the terminal screws and mounting screws are securely tightened.
  Operation at a loosened status might cause fire or erratic operation.
- Put the furnished connector covers on unused connectors, otherwise, erratic operation or failure might occur.
- Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run. Wrong operation might break or cause problems to the machine
- Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.
- Before touching the PLC, discharge any static electricity that may have been collected on your body. To discharge it, touch a grounded metallic object. Static electricity might cause erratic operation or failure.
- Be sure to install the electrical wiring correctly and securely, observing the directions of the instruction manual and user's manual. Wrong or loose wiring might cause fire, accident or failure.
- When disengaging the plug from the outlet, do not pull the cord, otherwiase, break of cable might cause fire or failure.
- Do not attempt to change system configurations (such as installing or removing expansion block) while the power is ON, otherwise, failure or erratic operation might occur.
- Do not attempt to repair the module by yourself, but contact your Fuji Electric agent, otherwise, fire, accident or failure might occur.
- To clean the module, turn power off and wipe the module with a cloth moistened with warm water. Do not use thinner or other organic solvents, as the module surface might become deformed or discolored.
- Do not remodel or disassemble the product, otherwise, failure might occur.
- Follow the regulations of industrial wastes when the device is to be discarded.
- The products covered in this user's manual have not been designed or manufactured for use in equipment or systems which, in the event of failure, can lead to loss of human life.
- Do not use the products covered in this user's manual for special applications, such as power plant, radiation facilities, railroad, space/flight equipments, lifeline facilities, or medical equipments, where a great effect on human life, body, society, major property or rights may be anticipated and high degree of safety is required.
- Be sure to provide protective measures when using the products covered in this manual in equipment which, in the event of failure, can lead to loss of human life or other grade results.
- External power supply (such as 24 V DC power supply) which is connected to DC I/O should be strongly isolated from AC power supply, otherwise, accident or failure might occur. (Use of EN60950 conforming power supply is recommended.)
- Do not use the peoducts covered in this user's manual in a residential environment.

Revision

* The manual No. is printed at the bottom right of the cover of this manual.

Printed on	* Manual No.	Revision contents
Jan. 2017	FEH526	First edition (preliminary edition)
Jan. 2017	FEH526a	Official edition
June 2017	FEH526b	• The specifications of new models were added. (NA0E08T-3, NA0E08T-0, NA0E16R-0, NA0AX02-TC, NA0AX16-TC, NA0AX06-PT, NA3AY02-MR, NA3AW03-MR, NA0LA-RS3) • The structure of the manual was altered.
Oct. 2017	FEH526c	• The specifications of new models were added. (NA3LA-ET1, NA0LA-ET1, NA0FA-LC1) • The description of a memory pack was added. • The contents were revised.
Mar. 2018	FEH526d	• The index was added.
Dec. 2018	FEH526e	• The description of the loader connecting cable with lock was added. • Some errors were corrected.
Apr.2019	FEH526f	• New product specifications were added. (NA0PB24R-31C, NA0PB32R-31C, NA0PB40R-31C, NA0PB40R-34C, NA0PB60R-31C) • According to change in the maximum number of connectable expansion right side units (max. 32), the descriptions were added. • External connection diagrams were added to “3-10 Terminal Arrangement.” • Some errors were corrected.

Contents

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Section 1 Overview

Section 1 Overview

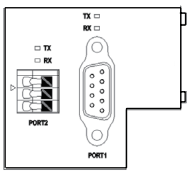
1-1 Features

1-1-1 Overview of system configuration

The SPF series units are small controllers equipped with excellent functions comparable to medium-sized controllers and maximum five communication ports.
Various types of expansion units are available. One unit can be connected on the front of or on the left side of the main unit and 6 or 32 units on the right side. In addition, interface options such as RS-232C, RS-485, and Ethernet enable you to use peripheral communication devices.

Front board

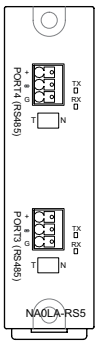
* Mounted on the front of the main unit.



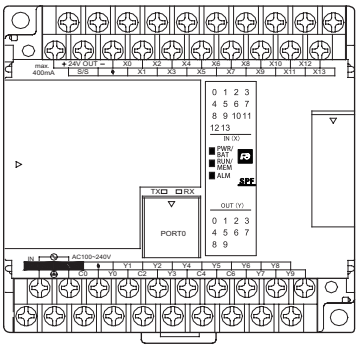
- Communication board
- Analog board

Main unit

Expansion left side unit

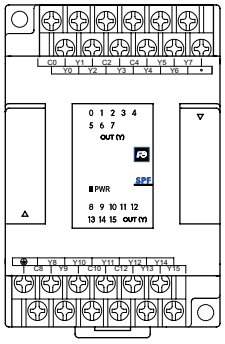


- Communication unit
- High-accuracy load cell unit



- Advance main unit
  (High-speed counter, positioning function)
- Basic main unit
  (High-speed counter)

Expansion right side unit



- Digital input/output unit
- Analog unit
- Temperature measuring unit
- Load cell unit
- Expansion power supply unit

1-1-2 Function list

Item		Specification
External interrupt input function		Max. 16 points (Rising edge / falling edge / both edges)
Pulse catch function		Max. 36 points (Rising edge / falling edge)
High-speed counter	No. of channels	Max. 8 channels (single phase)
	Count frequency	Max. 200kHz (Advance main unit) Max. 100kHz (Basic main unit)
	Count mode	U/D, U/D×2, P/R, P/R×2, A/B, A/B×2, A/B×3, A/B×4 (Note 1)
0.1ms high-speed timer		When using high-speed counter in high-speed timer mode
High-speed pulse output & High-speed positioning	No. of axes	Max. 4 axes
	Output frequency	Max. 200kHz
	Output pulse mode	U/D, P/R, A/B, PLS, PWM (Note 1) (Note 2)
	Pulse output instruction	By SPF-specific instruction
Communication port	PORT0 (RS-232C)	Loader port built in main unit
	PORT1, PORT2 (Communication board)	Communication mode: Loader communication, general-purpose communication, simplified CPU link communication (only one port among them), Modbus RTU master communication Communication speed: 1200/2400/4800/9600/19200/38400/57600/115200 bps
	PORT3, PORT4 (Communication unit)	
Diagnostic function		Self-diagnosis (memory check, ROM sum check), System configuration supervising
Security function		Password (Set by the support tool)
Calendar function		Available up to 31 Dec. 2069 23:59:59 Precision: ±20 sec/day (at 25°C)
Backup (Note 2)	Program memory, system definition	Built-in RAM: Built-in primary lithium battery Built-in flash memory (Note 4)
	ZIP file	Built-in flash memory
	Data memory	Built-in RAM: Built-in lithium primary battery
	Calendar	Calendar IC: Built-in lithium primary battery
User ROM function		Programs, system definitions, and zipped files can be stored in the external memory pack (NA8PMF-20).

Notes:

1) U/D: Up/Down pulse mode, P/R: Pulse / Direction signal mode, A/B: A/B phase mode, x2: 2 multiplication, x3: 3 multiplication, x4: 4 multiplication
2) PLS: Single pulse output mode, PWM: PWM output mode
3) The backup time is 10 years or more (ambient temperature: 55°C)
4) Notes on rewriting programs
   When rewriting the program in the main unit from the loader while the PLC is running, the built-in RAM is changed, however, the built-in flash memory is unchanged. As a result, the contents of the RAM does not match those of the flash memory and the RUN/MEM LED blinks to prompt the user to transfer the contents of the RAM to the flash memory. After rewriting the program, be sure to transfer the contents of the RAM to the flash memory. When the transfer is completed normally, the RUN/MEM LED turns OFF.

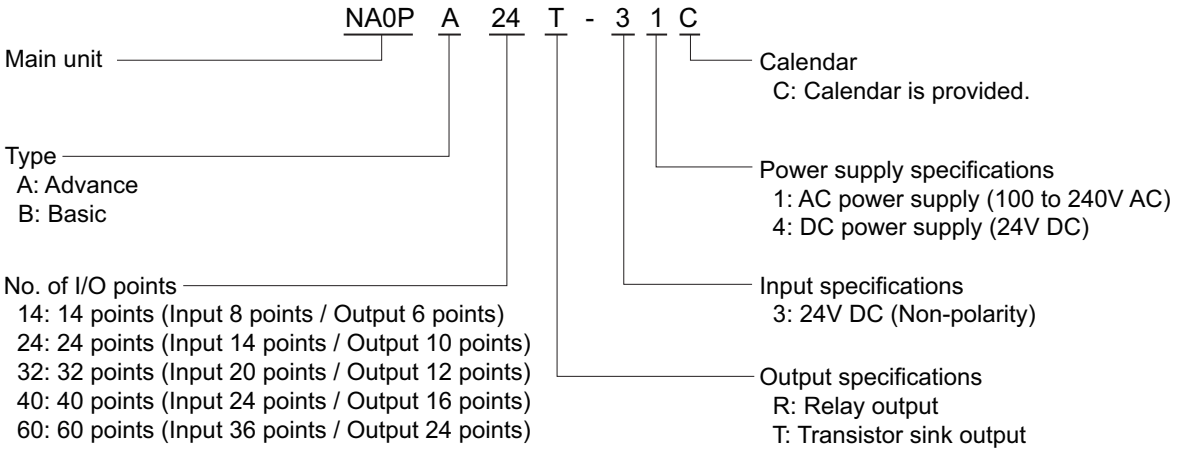
   <Method 1>
   Perform transfer by using the loader.

   <Method 2>
   After rewriting the program, turn OFF the main unit and then ON again. When the power supply is turned ON, the contents of the RAM is automatically transferred to the flash memory.

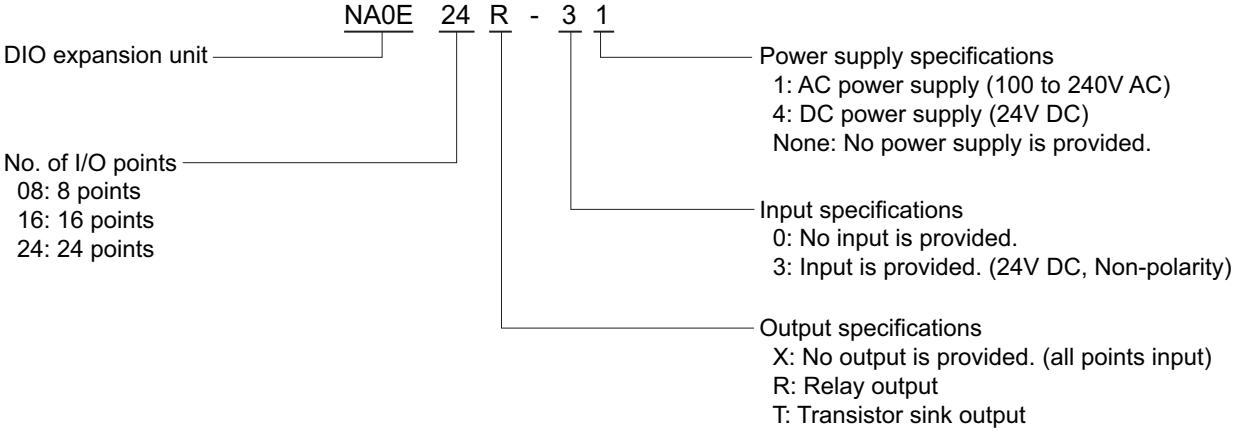
1-2 Type Code

This subsection describes the rule of type codes.

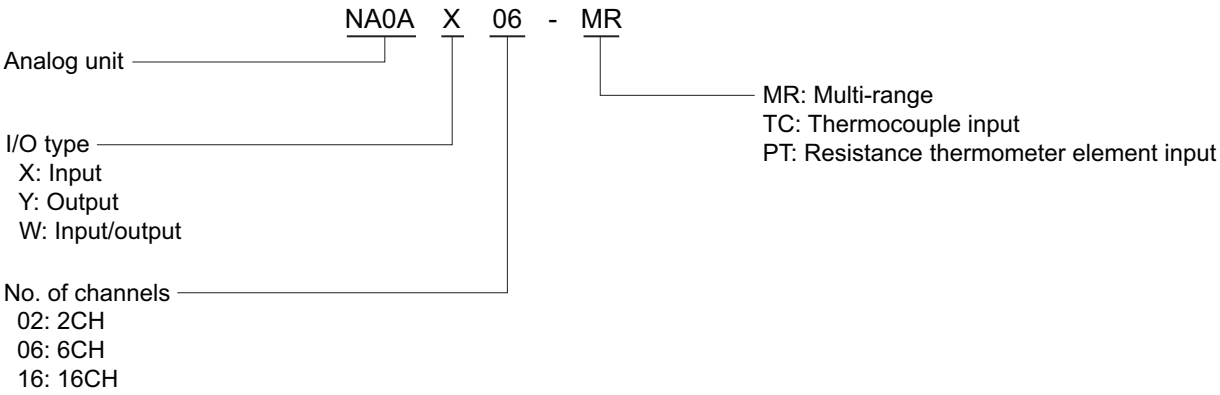
(1) Main unit



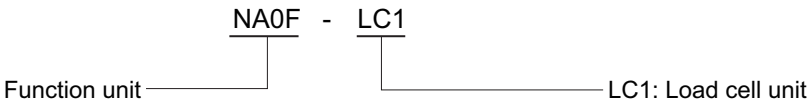
(2) DIO expansion unit (expansion right side unit)



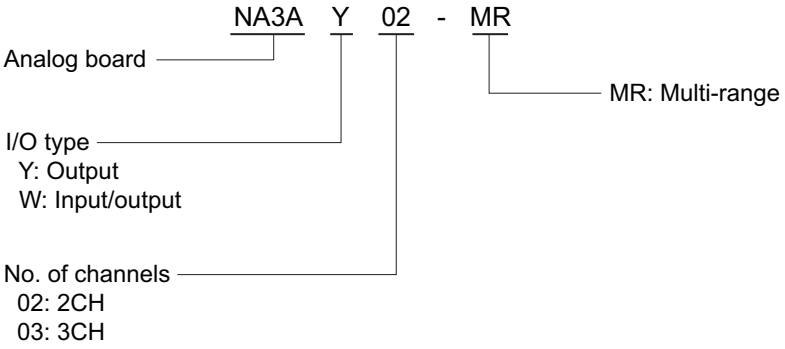
(3) Analog unit (expansion right side unit)



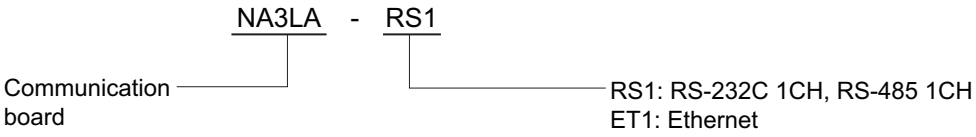
(4) Function unit (expansion right side unit)



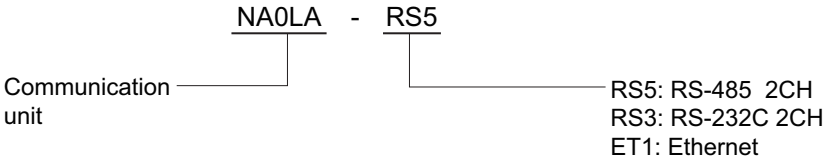
(5) Analog board



(6) Communication board



(7) Communication unit (expansion left side unit)



(8) Function unit (expansion left side unit)

(9) Expansion power supply unit

1-3 Product Type List

Product name	Type	Specification
Advance main unit (NA0PB***)	NA0PB14R-34C	24V DC power supply, 24V DC digital input 8 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 6 points), Ry output 6 points
	NA0PB24R-34C	24V DC power supply, 24V DC digital input 14 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 12 points), Ry output 10 points
	NA0PB32R-34C	24V DC power supply, 24V DC digital input 20 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 14 points), Ry output 12 points
	NA0PB40R-34C	24V DC power supply, 24V DC digital input 24 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 14 points), Ry output 16 points
	NA0PB60R-34C	24V DC power supply, 24V DC digital input 36 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 14 points), Ry output 24 points
	NA0PB24R-31C	100 to 240V AC power supply, 24V DC digital input 14 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 12 points), Ry output 10 points
	NA0PB32R-31C	100 to 240V AC power supply, 24V DC digital input 20 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 14 points), Ry output 12 points, Detachable terminal block
	NA0PB40R-31C	100 to 240V AC power supply, 24V DC digital input 24 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 14 points), Ry output 16 points, Detachable terminal block
	NA0PB60R-31C	100 to 240V AC power supply, 24V DC digital input 36 points (High-speed: 100kHz, 2 points; Medium-speed: 20kHz, 14 points), Ry output 24 points, Detachable terminal block
Basic main unit (NA0PA***)	NA0PA14T-34C	24V DC power supply, 24V DC digital input 8 points (High-speed: 200kHz, 2 points; Medium-speed: 20kHz, 6 points;), Tr sink output 6 points (High-speed: 200kHz, 4 points; Medium-speed: 20kHz, 2 points), Detachable terminal block
	NA0PA24T-34C	24V DC power supply, 24V DC digital input 14 points (High-speed: 200kHz, 4 points; Medium-speed: 20kHz, 10 points;), Tr sink output 10 points (High-speed: 200kHz, 4 points; Medium-speed: 20kHz, 4 points), Detachable terminal block
	NA0PA32T-34C	24V DC power supply, 24V DC digital input 20 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 10 points;), Tr sink output 12 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 2 points), Detachable terminal block
	NA0PA40T-34C	24V DC power supply, 24V DC digital input 24 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 10 points;), Tr sink output 16 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 2 points), Detachable terminal block
	NA0PA60T-34C	24V DC power supply, 24V DC digital input 36 points (High-speed: 200kHz, 8 points; Medium-speed: 20kHz, 8 points;), Tr sink output 24 points (High-speed: 200kHz, 8 points), Detachable terminal block
	NA0PA24T-31C	100–240V AC power supply, 24V DC digital input 14 points (High-speed: 200kHz, 4 points; Medium-speed: 20kHz, 10 points;), Tr sink output 10 points (High-speed: 200kHz, 4 points; Medium-speed: 20kHz, 4 points), Detachable terminal block
	NA0PA32T-31C	100–240V AC power supply, 24V DC digital input 20 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 10 points;), Tr sink output 12 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 2 points), Detachable terminal block
	NA0PA40T-31C	100–240V AC power supply, 24V DC digital input 24 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 10 points;), Tr sink output 16 points (High-speed: 200kHz, 6 points; Medium-speed: 20kHz, 2 points), Detachable terminal block
	NA0PA60T-31C	100–240V AC power supply, 24V DC digital input 36 points (High-speed: 200kHz, 8 points; Medium-speed: 20kHz, 8 points;), Tr sink output 24 points (High-speed: 200kHz, 8 points), Detachable terminal block
DIO expansion unit (with power supply)	NA0E24R-34	24V DC power supply, 24V DC digital input 14 points, Ry output 10 points
	NA0E24T-31	100–240V AC power supply, 24V DC digital input 14 points, Tr sink output 10 points

Product name	Type	Specification
DIO expansion unit (no power supply)	NA0E08R-3	24V DC digital input 4 points, Ry output 4 points
	NA0E08T-3	24V DC digital input 4 points, Tr sink output 4 points
	NA0E08X-3	24V DC digital input 8 points
	NA0E08T-0	Tr sink output 8 points
	NA0E16R-0	Ry output 16 points
	NA0E16T-0	Tr sink output 16 points
AIO expansion unit (no power supply)	NA0AX06-MR	Analog input unit, 6 channels: 14-bit analog input (-10 to 10V, 0 to 10V, -20 to 20mA, 0 to 20mA)
	NA0AY02-MR	Analog output unit, 2 channels: 14-bit analog output (-10 to 10V, 0 to 10V, -20 to 20mA, 0 to 20mA)
	NA0AW06-MR	Analog input/output unit 4 channels: 14-bit analog input (-10 to 10V, 0 to 10V, -20 to 20mA, 0 to 20mA) + 2 channels: 14-bit analog output (-10 to 10V, 0 to 10V, -20 to 20mA, 0 to 20mA)
Temperature measurement unit (no power supply)	NA0AX02-TC	Thermocouple input unit: 2 channels, resolution 0.1°C
	NA0AX06-TC	Thermocouple input unit: 6 channels, resolution 0.1°C
	NA0AX16-TC	Thermocouple input unit: 16 channels, resolution 0.1°C
	NA0AX06-PT	Resistance thermometer element input unit: 6 channels, resolution 0.1°C
Load cell unit	NA0F-LC1	Load cell unit, 1 channel
AIO board (Front board type)	NA3AY02-MR	Analog output board, 2 channels: 12-bit analog output (0 to 10V, 0 to 20mA)
	NA3AW03-MR	Analog input/output board, 2 channels: 12-bit analog input (0 to 10V, 0 to 20mA) + 1 channel: 12-bit analog output (0 to 10V, 0 to 20mA)
Communication board (Front board type)	NA3LA-RS1	Communication board, RS232C (Port 1) + RS-485 (Port 2)
	NA3LA-ET1	Ethernet communication board, 1 channel
Communication unit (Expansion left side unit)	NA0LA-RS3	Communication unit, 2 ports RS-232C (Port 3 + Port 4)
	NA0LA-RS5	Communication unit, 2 ports RS-485 (Port 3 + Port 4)
	NA0LA-ET1	Ethernet communication unit, 1 channel
High-precision load cell unit (Expansion left side unit)	NA0FA-LC1	High-precision load cell unit, 1 channel
Expansion power supply unit	NA0S-2	Input voltage: 100–240V AC, Output: internal 5V DC; internal 24V DC Service power supply output: 24V DC; 21W
	NA0S-4	Input voltage: 24V DC, Output: internal 5V DC; internal 24V DC Service power supply output: 24V DC, 14W
Healthy unit (Terminating connector)	NA8P-HE	Unit for detecting a dropout/fault of expansion right side units
Memory pack	NA8PMF-20	Memory for storing a project and data
Loader connecting cable	NA0H-CUV	RS-232C/USB conversion cable for loader connection port (Port 0), 1.8m (Note 1)
Personal computer loader	NP4H-SEDBV3	SX-Programmer Expert (D300win)
	NP4H-SWN	SX-Programmer Standard

Notes:

1) You need to install the USB driver into the personal computer.
   See “Appendix 1 Installing USB Driver.”

1-4 Supported Versions

1-4-1 Program loader version

1) Program loader versions that support the SPF series
   - SX-Programmer Expert (D300win) : V3.6.11.* or later
   - SX-Programmer Standard : V3.0.16.* or later

2) Program loader versions that support Ethernet communication board (Type: NA3LA-ET1), Ethernet communication unit (Type: NA0LA-ET1) and High-precision load cell unit (Type: NA0FA-LC1)
   - SX-Programmer Expert (D300win) : V3.6.12.* or later
   - SX-Programmer Standard : V3.0.17.* or later

3) Program loader versions that support the maximum number of connectable expansion right side units (max. 32)
   - SX-Programmer Expert (D300win) : V3.6.13.* or later
   - SX-Programmer Standard : V3.0.19.* or later

1-4-2 Main unit version

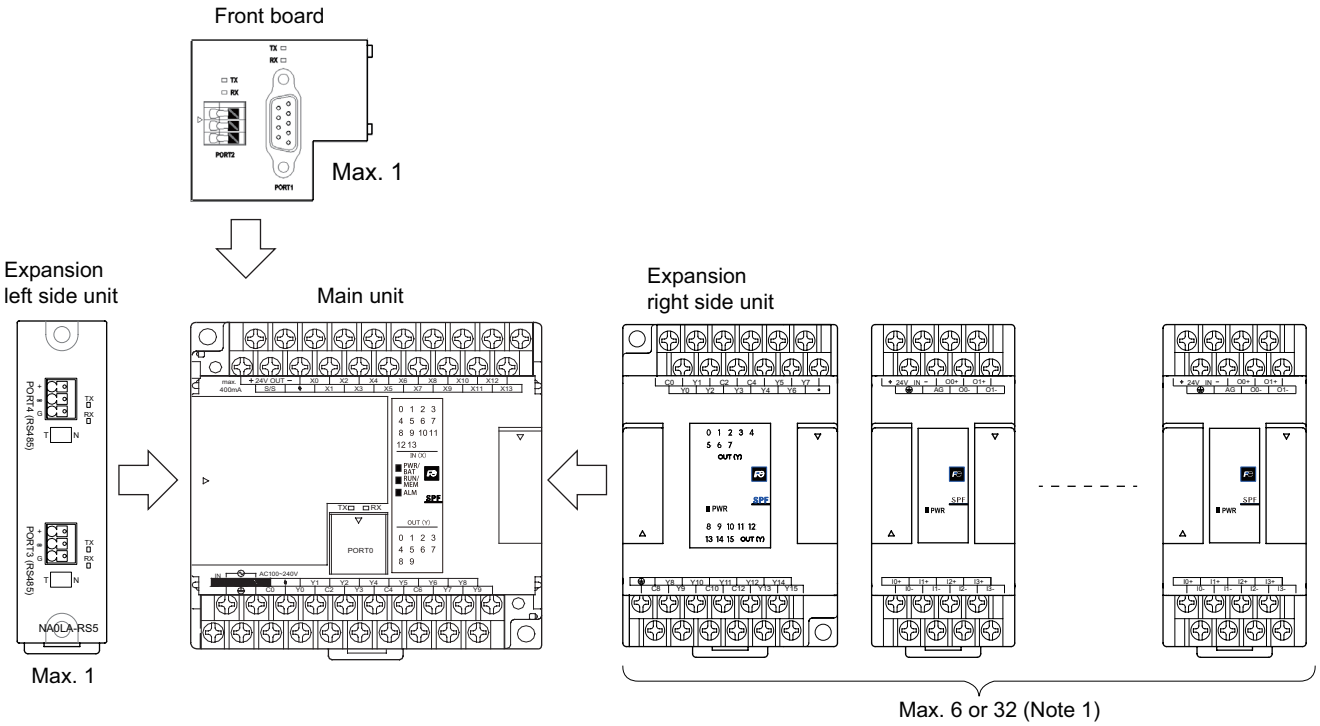
1) V03 or later software version of main units support analog boards that are connected on the front of them (Type: NA3AY02-MR, NA3AW03-MR). Analog boards cannot be used with a main unit the software version of which is earlier than V03.
2) V04 or later software version of main units support Ethernet communication board (Type: NA3LA-ET1) and Ethernet communication unit (Type: NA0LA-ET1). Ethernet communication board/unit cannot be used with a main unit the software version of which is earlier than V04.
3) When the hardware of the main unit supports the maximum number (32) of connectable expansion right side units and the software version is V06 or later, up to 32 units can be connected. The “32 expansion right side units supported flag” (%MX10.42.2 / SM422) of the system memory turns ON.

Section 2 System Configuration

Section 2 System Configuration

2-1 System Configuration Specifications

You can connect up to 6 or 32 expansion units on the right side, one expansion uint on the left side, and one front board on the front of the SPF series main unit, respectively.



Notes:

1) When a maximum of 32 expansion right side units can be connected, the “32 expansion right side units supported flag” (%MX10.42.2 / SM422) of the system memory turns ON. (When this flag is OFF, the maximum number of connectable expansion right side units is 6.)
   The maximum number of connectable AIO units is 3. A healthy unit is excluded from the number of connectable units (max. 6).
   The maximum number of connectable expansion right side units (max. 32) is not limited by the unit types. A healthy unit is included in 32.
   Expansion power supply units are excluded from the limitation on the number of connectable expansion right side units.

2-1-1 Expansion specifications

The table below shows the connectable expansion units.

Classification	Product name	Type	Specification
Expansion right side unit	DIO expansion unit (with power supply)	NA0E24R-34	Input 14 points, Ry output 10 points, DC power supply
		NA0E24T-31	Input 14 points, Tr sink output 10 points, AC power supply
	DIO expansion unit (without power supply)	NA0E08R-3	Input 4 points, Ry output 4 points
		NA0E08T-3	Input 4 points, Tr sink output 4 points
		NA0E08X-3	Input 8 points
		NA0E08T-0	Tr sink output 8 points
		NA0E16R-0	Ry output 16 points
		NA0E16T-0	Tr sink output 16 points
	AIO expansion unit (without power supply)	NA0AX06-MR	Analog input 6 channels
		NA0AY02-MR	Analog output 2 channels
		NA0AW06-MR	Analog input 4 channels, Analog output 2 channels
		NA0AX02-TC	Thermocouple input 2 channels
		NA0AX06-TC	Thermocouple input 6 channels
		NA0AX16-TC	Thermocouple input 16 channels
		NA0AX06-PT	Resistance thermometer element input 6 channels
		NA0F-LC1	Load cell unit, 1 channel
	Expansion power supply unit	NA0S-2	Input 100 to 240V AC
		NA0S-4	Input 24V DC
	Healthy unit (Terminating connector)	NA8P-HE	Unit for detecting a dropout/fault of expansion right side units (Note 1)
Expansion left side unit	Communication unit	NA0LA-RS2	RS-232c: 2 ports (Note 2)
		NA0LA-RS5	RS-485: 2 ports (Note 2)
		NA0LA-ET1	Ethernet 1 channel (Note 2)
	Function unit	NA0FA-LC1	High-precision load cell unit, 1 channel (Note 2)
Front board	AIO board	NA3AY02-MR	Analog output 2 channels
		NA3AW03-MR	Analog input 2 channels, Analog output 1 channel
	Communication board	NA3LA-RS1	RS-232C: 1 port, RS-485: 1 port (Note 2)
		NA3LA-ET1	Ethernet 1 channel (Note 2)

Notes:

1) A healthy unit is used to detect a dropout of expansion right side units.
   Be sure to mount a healthy unit to stop the SPF system with a fatal fault when an expansion right side unit is dropped.
   Unless a healthy unit is mounted, a dropout of the expansion right side unit is not detected and the SPF system continues operation in the state where the expansion right side unit is dropped.
   Connect a healthy unit to the expansion connector (OUT) of the rightmost expansion right side unit after removing the cover.
   When mounting a healthy unit, register it in the system definition.
   When the maximum number of connectable expansion right side units is 6, a healthy unit is excluded from 6. However, when the maximum number of connectable expansion right side units is 32, a healthy unit is included in 32.
2) A dropout of the communication unit/board and high-precision load cell unit is not detected.

2-1-2 Calculation of current consumption

(1) Suppliable current

Type		Internal 5V DC	Internal 24V DC	Externally supplied 24V DC
Main unit	NA0P□□□□-□□C	1000mA	400mA (Note 1) (Note 2)	400mA (Note 1) (Note 2)
Expansion unit with power supply	NA0E24T-31	948mA	350mA	337mA
	NA0E24R-34	948mA	Total 337mA	
Expansion power supply	NA0S-2 / NA0S-4	400mA	250mA	250mA

Notes:

1) When using an AC power supply type unit at a power supply voltage of 120V AC or less, the total of the internal 24V DC and externally supplied 24V DC becomes 575mA.
2) For AC power supply type of relay output, the total of internal 24V DC and external 24V DC becomes 275mA.

(2) Current consumption of main unit

Type		Internal 5V DC	Internal 24V DC	Externally supplied 24V DC (Note 3)
Advance main unit	NA0PB14R-34C	360mA	65mA	60mA
	NA0PB24R-□□C	435mA	85mA	105mA
	NA0PB32R-□□C	520mA	110mA	138mA
	NA0PB40R-□□C	530mA	125mA	156mA
	NA0PB60R-□□C	555mA	200mA	210mA
Basic main unit	NA0PA14T-34C	360mA	65mA	60mA
	NA0PA24T-□□C	435mA	85mA	105mA
	NA0PA32T-□□C	520mA	110mA	138mA
	NA0PA40T-□□C	530mA	125mA	156mA
	NA0PA60T-□□C	555mA	200mA	210mA

(3) Current consumption of expansion unit

Type		Internal 5V DC	Internal 24V DC	Externally supplied 24V DC (Note 3)
DIO expansion unit	NA0E08R-3	30mA	34mA	18mA
	NA0E08T-3	30mA	34mA	18mA
	NA0E08X-3	30mA	–	36mA
	NA0E08T-0	29mA	68mA	–
	NA0E16R-0	40mA	136mA	–
	NA0E16T-0	40mA	136mA	–
AIO expansion unit	NA0AX06-MR	25mA	–	53mA
	NA0AY02-MR	33mA	–	90mA
	NA0AW06-MR	35mA	–	103mA
	NA0AX02-TC	30mA	–	21mA
	NA0AX06-TC	30mA	–	29mA
	NA0AX16-TC	30mA	–	58mA
	NA0AX06-PT	32mA	–	16mA
Load cell unit	NA0F-LC1	32mA	–	48mA
AIO board	NA3AY02-MR	223	–	–
	NA3AW03-MR	158	–	–
Communication board	NA3LA-RS1	55mA	–	–
	NA3LA-ET1	110mA	–	–
Communication unit	NA0LA-RS3	18mA	–	–
	NA0LA-RS5	95mA	–	–
	NA0LA-ET1	160mA	–	–
High-precision load cell unit	NA0FA-LC1	120mA	–	48mA
Healthy unit	NA8P-HE	10mA	–	–

Notes:

3) These values show consumed current when externally supplied 24V DC power supply is used for input/output power supply. When not using externally supplied 24V DC power supply for input/output power supply, the current consumption of externally supplied 24V DC becomes 0mA.

<Example of current consumption calculation>
Whether or not to use an expansion power supply is determined by the total current consumption of all the units. You need to calculate the total current consumption and mount an expansion power supply unit if the current is insufficient.
Referring the tables on the previous page, calculate the current consumption.

Subtract the total current consumption of the main unit, additionally connected front board, expansion left side unit, and expansion right side units from the current supplied from the main unit. When the result is minus, you need to mount an expansion power supply. Thus mount an expansion power supply unit if the current is insufficient for the expansion units that are connected on the right.
Expansion power supply units are excluded from the number of connectable expansion units.

- **Main calculation formula**
  [Supplied current] - [Current consumption]
  = [Current supplied from main unit] - [Current consumption of main unit]
  - [Current consumption of front board]
  - [Current consumption of expansion left side unit]
  - [Total current consumption of expansion right side units]
  >= 0

- **Calculation formula for current consumption on the right of the expansion unit with power supply**
  (Expansion unit with power supply is referred to as “Exp_powunit” here.)
  Exp_powunit receives the remaining current of the main unit on the left side and adds it to the current that Exp_powunit supplies to supply expansion units connected on the right.

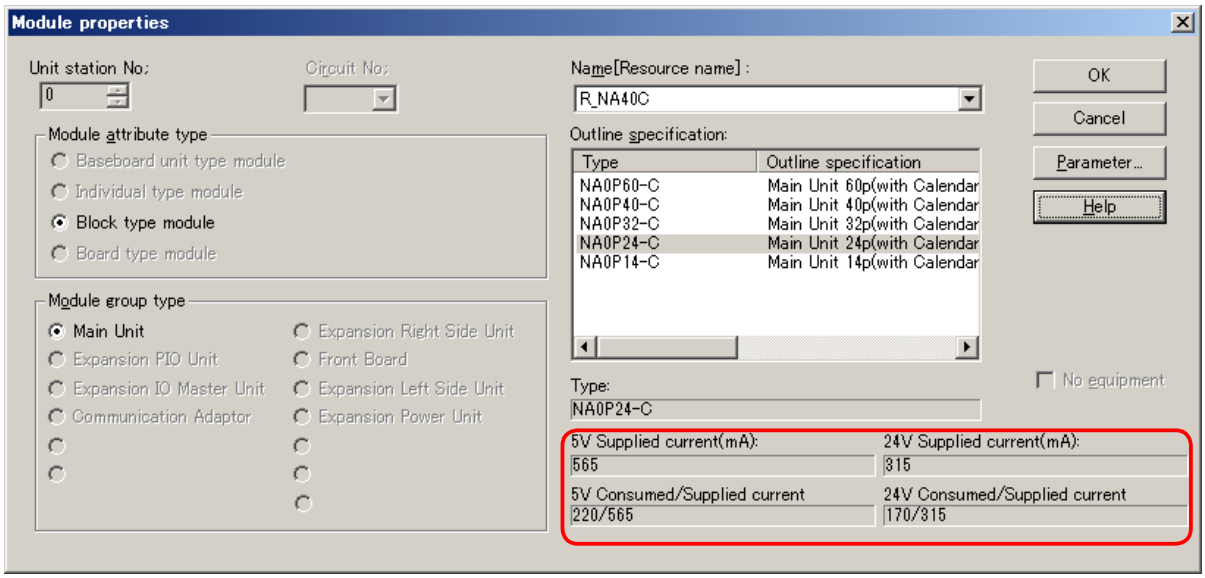
  I_MainR + I_Exp_powunit - I_Exp >= 0

  • I_MainR (Remaining current of main unit)
  = [Current supplied from main unit] - [Current consumption of expansion left side unit]
  - [Current consumption of expansion right side units]
  - [Current consumption of front board]
  • I_Exp_powunit (Current supplied from Exp_powunit)
  • I_Exp (Total current consumption of expansion units that are connected on the right of Exp_powunit)

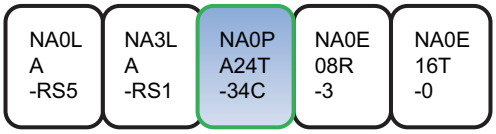
- **Calculation formula when using an expansion power supply unit**
  Use the above calculation formula by replacing Exp_powunit with the expansion power supply unit.

<Calculation of current consumption by using the loader function>

When registering units in the system definition by using the loader, you can check the total current consumption of the units and the supplied current value.
(Since externally supplied 24V DC is not calculated by the loader, you need to calculate it.)



- **Case 1**
  When the main unit can supply sufficient current

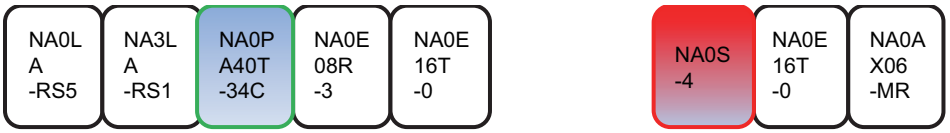


						Result
Internal 5V DC	-95	-55	+565	-30	-40	+345 (OK)
Internal 24V DC			+315	-34	-136	+145 (OK)
Externally supplied 24V DC			+295	-18		+277 (OK)

- **Case 2**
  When the main unit cannot supply sufficient current

								Result
Internal 5V DC	-95	-55	+470	-30	-40	-40	-25	+185 (OK)
Internal 24V DC			+275	-34	-136	-136		-31 (overload)
Externally supplied 24V DC			+244	-18			-53	+173 (OK)

- **Case 3**
  When an expansion power supply unit is mounted in the case 2

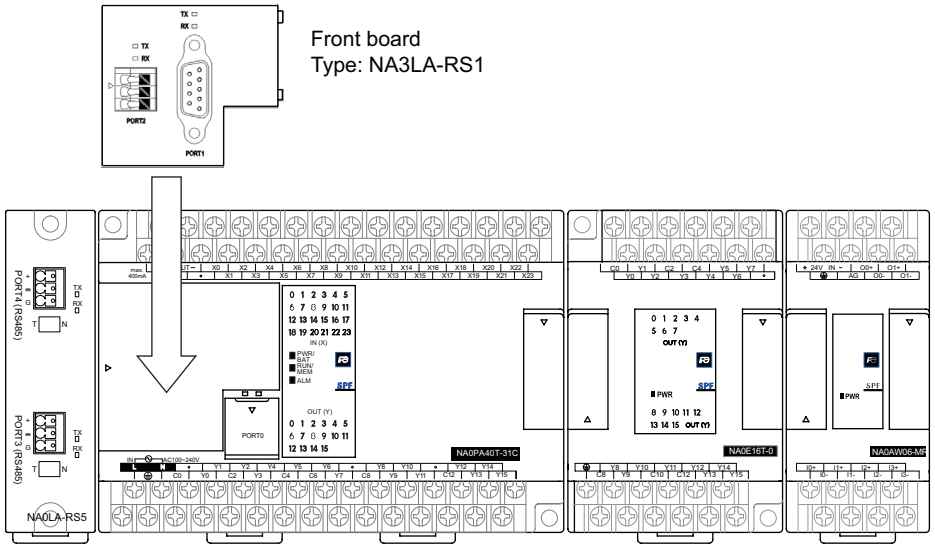


						Result				Result
Internal 5V DC	-95	-55	+470	-30	-40	+250 (OK)	400	-40	-25	+585 (OK)
Internal 24V DC			+275	-34	-136	+105 (OK)	250	-136		+219 (OK)
Externally supplied 24V DC			+244	-18		+226 (OK)	250		-53	+423 (OK)

2-2 System Definition

When using SPF series, you need to register the actual unit configuration in a project.

<Example of system configuration>



Expansion left side unit
Type: NA0LA-RS5

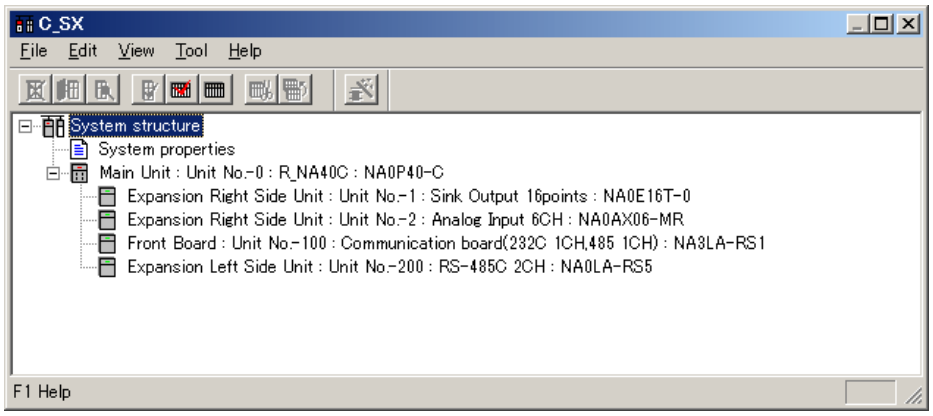
Main unit
Type: NA0PA40T-31C

Expansion right side unit
Type: NA0E16T-0

Expansion right side unit
Type: NA0AX06-MR

<System configuration definition tree window>

The system configuration definition tree for the above system configuration is shown below.



<Rules for defining system configuration>

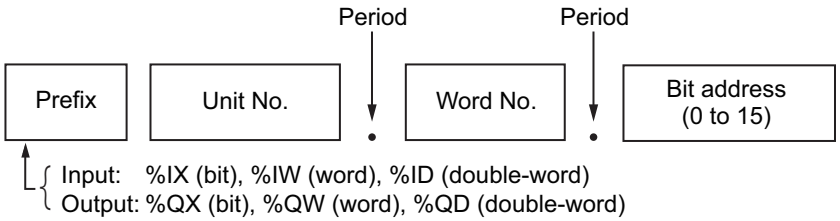
- For system definition, the unit on the right of the main unit is registered just below the main unit. As for the unit station Nos. of units, the main unit is always assigned “0” (zero), and numbers beginning with 1 (one) are assigned to expansion right side units, in their connected order.
- The front board is connected on the front of the main unit and registered below the expansion right side unit in the configuration definition tree. The unit station No. is fixed to “100.”
- The expansion left side unit is connected to the left of the main unit and registered at the lowermost location in the configuration definition tree. The unit station No. is fixed to “200.”

2-3 I/O Address Assignment

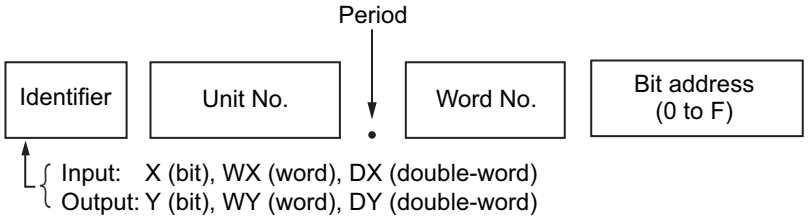
2-3-1 Rules for assigning I/O addresses

In MICREX-SX series SPF, follow the rules below to assign I/O addresses.

<For Expert (D300win)>



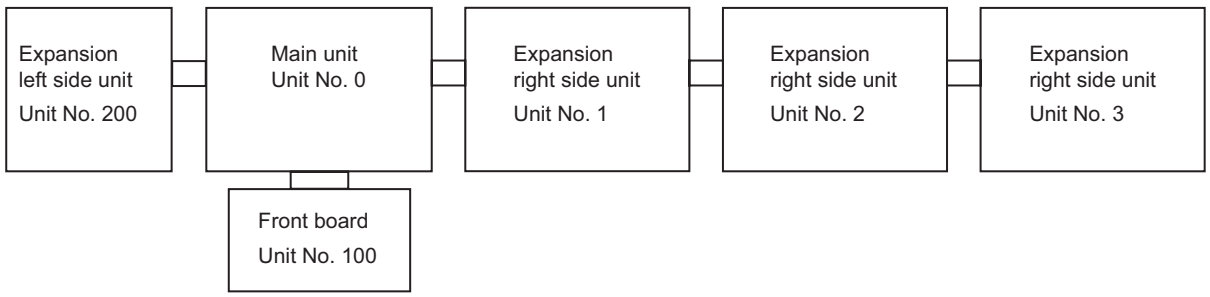
<For Standard>



1) Unit No.

A number (1 to 32) is assigned to SPF expansion right side units, in their connected order. The number assigned to the main unit is always “0” (zero). The front board is assigned “100” (fixed) as an independent unit and the expansion left side unit with “200” (fixed).

<Example of unit No. assignment>



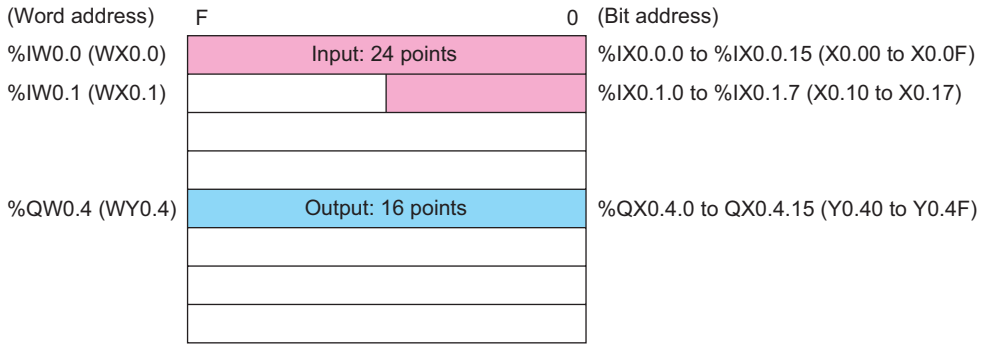
2) Word No. and bit address

To each SPF unit, words starting from the word 0 (zero) are assigned for the number of words that the unit occupies. No same word is assigned to both input and output. Therefore, for main unit and expansion units with both inputs and outputs, words are assigned first to inputs and then to outputs. All types of main units (regardless of the No. of I/O points provided) occupy eight words of the I/O area (input: four words, output: four words).

2-3-2 Example of address assignment

1) Example of a system consisting only of a main unit with 40 points

Main unit with 40 points
Unit No. 0
Input: 24 points
output: 16 points



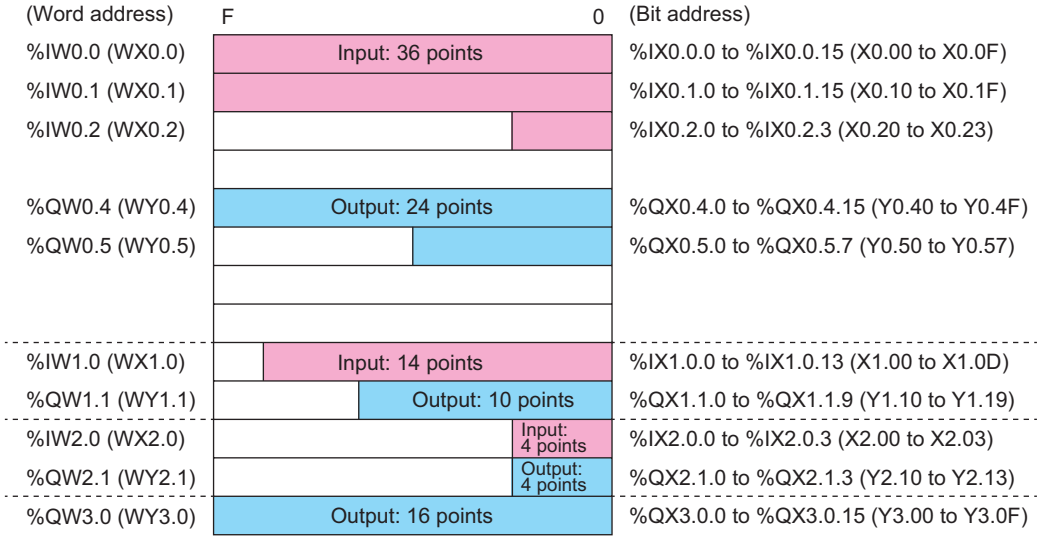
2) Example of a system in which expansion units are connected to a main unit with 60 points

Main unit with 60 points
Unit No. 0
Input: 36 points
output: 24 points

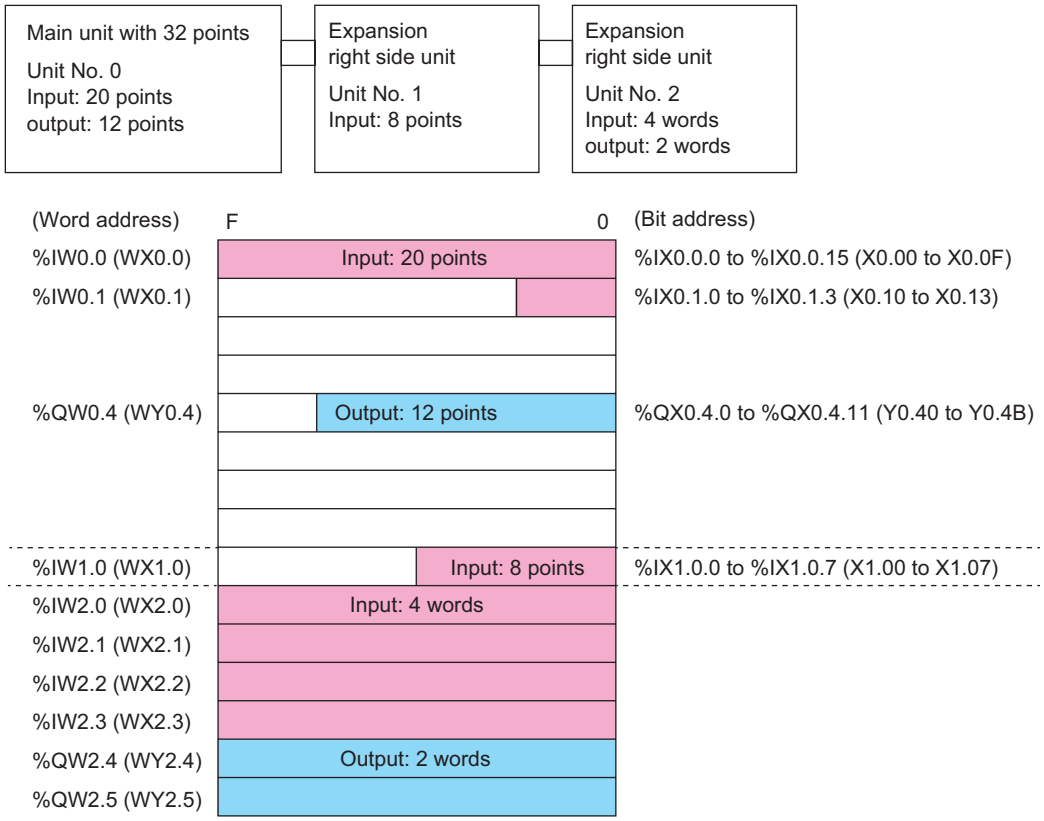
Expansion
right side unit
Unit No. 1
Input: 14 points
output: 10 points

Expansion
right side unit
Unit No. 2
Input: 4 points
output: 4 points

Expansion
right side unit
Unit No. 3
Output: 16 points



3) Example of a system in which expansion units are connected to a main unit with 32 points



Section 3 Specifications

Section 3 Specifications

3-1 General Specifications

Item		Specification	Remark
Physical environmental conditions	Operating ambient temperature	0 to +55°C (Note 4)	IEC 61131-2
	Storage (transportation) temperature	-25 to +70°C	
	Relative humidity	20 to 95%RH, no condensation (Transport condition: 5 to 95%RH, no condensation)	
	Pollution degree	2 (Note 1)	
	Corrosion immunity	Free from corrosive gases. Not stained with organic solvents	
	Operating altitude	2000 m or less above sea level (Transport condition: 70 kPa or more)	
Mechanical service conditions	Vibration	Half amplitude: 0.15mm, Constant acceleration: 19.6 m/s^2 Two hours for each of three mutually perpendicular axes, Total six hours (Note 2) (Note 3)	
	Shock	Acceleration peak: 98 m/s^2 Three times for each of three mutually perpendicular axes	
Electrical service conditions	Electrostatic discharge	Contact discharge: ±4kV, Aerial discharge: ±8kV	IEC 61000-4-2
	Radiated, radio-frequency, electromagnetic field	80 to 1000MHz (10V/m) 1.4 to 2.0 GHz (3V/m) 2.0 to 2.7 GHz (1V/m)	IEC 61000-4-3
	EFT/B (Electrical fast transient/burst)	Equipment power, I/0 power, AC I/O (unshielded): ±2kV Data communication, digital and analog I/O s' (except AC unshielded I/O): ±1kV	IEC 61000-4-4
	Lightning impulse surge	AC equipment power: ±2kV common mode, ±1kV differential mode DC equipment power: ±0.5kV common mode, ±0.5kV differential mode	IEC 61000-4-5
	Conducted radio frequency	150kHz to 80MHz, 10V	IEC 61000-4-6
	Power frequency magnetic field	50Hz, 30A/m	IEC 61000-4-8
Construction		Panel-mounted type (open equipment)	
Cooling		Air cooling	

Notes:

1) Pollution degree 2: This pollution does not conduct usually, but under certain circumstances temporary conductivity occurs due to condensation.
2) The unit is fixed by screws to the control panel. When the unit is mounted to the DIN rail, care must be taken that vibrations or shocks will not occur.
3) In an environment where repetitive or continuous vibration occurs, be sure to take vibration-proofing measures.
4) See "3-9 Temperature Derating of Main Unit."

3-2 Main Unit Performance Specifications

3-2-1 Performance specifications

Item			Specification	
			Main unit with 14/24 points	Main unit with 32/40/60 points
Control system			Stored program, Cyclic scanning system (default task), periodic task, event task	
Input/output connection method			Direct input/output (local bus)	
I/O control system			Whole: Scan batch refresh system Digital I/O: Task synchronized refresh system	
CPU			16-bit processor	
Memory types			Program memory, data memory, temporary memory	
Programming language			<When using D300win> IL language (Instruction List) ST language (Structured Text) LD language (Ladder Diagram) FBD language (Function Block Diagram) SFC elements (Sequential Function Chart)	<When using Standard Loader> Original ladder language ST language (Structured Text)
Length of instructions			Variable length (depending on language)	
Program memory capacity (Note 2)			8192 steps	20480 steps
Program steps in a POU			8192 steps	16384 steps
Memory (Note 1)	I/O memory		512 words	
	Standard memory		4096 words	8192 words
	Retain memory		2048 words	4096 words
	User FB memory		4096 words	8192 words
	User FB memory Initial value setting memory		4608 words	9216 words
	System FB memory		5632 words	11264 words
		Timer	256 points	512 points
		Integrating timer	0 point	0 point
		Counter	256 points	512 points
		Edge detection	1024 points	2048 points
		Others	512 words	1024 words
	System memory		512 words	
	Special relay/register (standard)		4096 words	
	Special relay/register (retain)		4096 words	
No. of tasks			Default tasks (Cyclic scanning): 1 Fixed cycle tasks + Event tasks: 15 in total	
No. of programs			64 / Default task 8 / Fixed cycle task, Event task	

Notes:

1) You can freely increase or decrease the area sizes of the standard memory, retain memory, user FB memory, and system FB memory. The above table shows the default values.
2) The initial value setting area of the standard memory and retain memory is included.

3-2-2 Memory backup and internal battery specifications

The primary battery built in the main unit cannot be replaced. When a voltage drop of the battery is detected, you need to replace the main unit.
The battery connection switch is set to OFF at the factory shipment to save battery consumption. When you start using the main unit, set the battery connection switch to ON to enable memory backup by the built-in battery.
For the details of the battery connection switch, see “3-11 Names and Functions” and “3-11-1 Main unit.”

Item	Specification	Remark
Backup area	Retain memory, retain attributed memory of user FB and System FB instance memory, RAS history, Calendar	Backup target parts: SRAM, RTC
Battery	Graphite fluoride lithium primary battery	Built-in battery, 1000mA/h, Unreplaceable
Backup time	10 years or more	Ambient temperature: 55°C
Battery voltage drop detection function	Provided (Updated approximately every 10 minutes while the main power is ON.)	• When a voltage drop of the battery is detected (*1), the PWR/BAT LED blinks alternately in red and orange. The battery error in the system memory is set ON. • When detected that the battery voltage is normal (*2), the PWR/BAT LED lights up in red. The battery error in the system memory is set OFF. *1 2.4V or less (battery voltage A/D conversion value 492) *2 2.4V or more (battery voltage A/D conversion value 493)
Battery voltage read function	Provided (Updated approximately every 10 minutes while the main power is ON.)	• Battery voltage A/D conversion value is stored in the special register “%MW1.61450 (WM61450).” • Battery voltage = Battery voltage A/D conversion value * 4.883 [mV] * Battery voltage drop can be detected by an application.
Battery life	Life of primary battery: 10 years	

<Notes on battery connection switch>

When the battery connection switch is OFF, the battery voltage drop detection LED also blinks. Check the switch status.

<Notes on detection of battery voltage drop and primary battery life>

- The built-in graphite fluoride lithium primary battery has a characteristic that its voltage is increased under a high ambient temperature. Therefore, even if the battery voltage drop detection LED blinks at power-on of the main unit, it may turn OFF as the temperature in the main unit rises while running.
- The remaining capacity of a graphite fluoride lithium primary battery never recovers even if the ambient temperature is high. If the ambient temperature is high and the battery remaining capacity is low, the battery voltage may rapidly drop as the remaining capacity is consumed.
  In addition, as a result of moisture absorption for a long period, self discharge of a graphite fluoride lithium primary battery may rapidly increase from some point to cause a rapid drop of the battery voltage.
- For the above reasons, if you confirm that the battery voltage drop detection LED blinks or when more than ten years have passed since the date of shipment, promptly replace the main unit following the steps described in “5-2 Actions to be Taken When Battery Voltage Drop is Detected” without turning off the power.
- If the battery voltage continues to decrease with the main power OFF, more and more data of the built-in SRAM can be easily lost, which causes a memory backup error (retain memory loss) after the main power is turned ON. In addition, the calendar may be stopped or delayed.

3-2-3 Calendar specifications

Item	Specification	Remark
Range	Up to 31 Dec. 2069 23:59:59	
Precision	±232 ppm (temperature: 25°C)	±20 sec/day
Time setting/change	Loader, user application	

3-3 Power Supply Specifications

3-3-1 AC power supply type

Item		Specification		
		Main unit NA0PA□□T-31C	**Expansion unit with power supply NA0E24T-31**	**Expansion power supply NA0S-2**
Rated input voltage (tolerance)		100 to 240V AC (85 to 264V AC)		
Rated frequency (tolerance)		50/60Hz (47 to 63Hz)		
Dropout tolerance		20ms or less		
Power consumption		36W, 65VA		21W, 40VA
Inrush current		20A at 264V AC		
Built-in fuse specification		2A, 250V AC (unreplaceable by users)		
Power supply output	Internal 5V DC	5V DC ±5%, 1A (max.)	5V DC ±5%, 948mA (max.)	5V DC ±5%, 400mA (max.)
	Internal 24V DC	24V DC ±10%, 400mA (max.)	24V DC ±10%, 350mA (max.)	24V DC ±10%, 250mA (max.)
	Externally supplied 24V DC	24V DC ±10%, 400mA (max.)	24V DC ±10%, 337mA (max.)	24V DC ±10%, 250mA (max.)
Insulation method		Transformer/photocoupler		
Dielectric strength		1500V AC, 1 minute		
Insulation resistance		10MΩ or more (500V DC megger)		

3-3-2 DC power supply type

Item		Specification		
		Main unit NA0P□□□□-34C	**Expansion unit with power supply NA0E24R-34**	**Expansion power supply NA0S-4**
Rated input voltage (tolerance)		24V DC (20.4 to 28.8V DC)		
Dropout tolerance		10ms or less		
Power consumption		36W		21W
Inrush current		20A at 24V DC		
Built-in fuse specification		2.5A, 125V (unreplaceable by the user)		1.5A, 125V (unreplaceable by users)
Power supply output	Internal 5V DC	5V DC ±5%, 1A (max.)	5V DC ±5%, 948mA (max.)	5V DC ±5%, 400mA (max.)
	Internal 24V DC	24V DC ±10%, 400mA (max.)	24V DC ±10%, 337mA in total (max.)	24V DC ±10%, 250mA (max.)
	Externally supplied 24V DC	24V DC ±10%, 400mA (max.)		24V DC ±10%, 250mA (max.)
Insulation method		Transformer/photocoupler		
Dielectric strength		500V DC, 1 minute		
Insulation resistance		10MΩ or more (500V DC megger)		

Notes:

The external 24V DC power supply output is not insulated from the internal 5V DC and the internal 24V DC. If you need an insulated I/O power supply, externally prepare 24V DC power supply.

Section 3 Specifications

3-4 Input Specifications

3-4-1 DC input specifications

(1) Specifications

Function			High-speed DC input	Medium-speed DC input	Low-speed DC input	Expansion DC input
Input signal conditions	Rated voltage		24V DC			
	Voltage (tolerance)		26.4V DC			
	Ripple factor tolerance		5%			
Input circuit characteristic	Input type		Source, sink common (by external wiring)			
	Input current (at 24V DC)		Approx. 9mA	Approx. 6.5mA	Approx. 4mA	
	Input impedance		Approx. 2.7kΩ	Approx. 3.7kΩ	Approx. 5.9kΩ	
	Operating voltage	OFF to ON	18.5 to 26.4V	19.5 to 26.4V	20.5 to 26.4V	
		ON to OFF	0 to 5V	0 to 5V	0 to 5V	
	Input type		DC type 1			
	Input delay time	Hardware	1µs or less	22µs or less	0.55ms or less	5.5ms or less
		Digital filter	You can select any of the following values in the system definition: "No set," 0.5µs, 1µs, 1.5µs (default), 2µs, 2.5µs, 3µs, 3.5µs, 10µs, 30µs, 100µs, 300µs, 1ms, 3ms, 3ms/10ms, 10ms, or 15ms * Recommended to set at 1.5µs or more			–
	Maximum input frequency /operating time (Note 1)		200kHz/2.5µs (Advance main unit) 100kHz/5µs (Basic main unit)	20kHz/25µs	0.83kHz/0.6ms	–
External wire connections			Terminal block (M3 screw)			
Input indication			LED indicator turns on when input is "ON" and turns off when input is "OFF".			
Isolation method			Photocoupler			
Dielectric strength			1500V AC 1 minute (between input terminals and frame ground)			
Insulation resistance			10MΩ or more with 500V DC megger (between input terminals and frame ground)			
Derating condition			Specified (Note 2)			None
Corresponding terminal No.	NA0PA14T-34C		X0, 1	X2 to 7	–	–
	NA0PA24T-3□C		X0, 1, 4, 5	X2, 3, 6 to 13	–	–
	NA0PA32T-3□C		X0, 1, 4, 5, 8, 9	X2, 3, 6, 7, 10 to 15	X16 to 19	–
	NA0PA40T-3□C		X0, 1, 4, 5, 8, 9	X2, 3, 6, 7, 10 to 15	X16 to 23	–
	NA0PA60T-3□C		X0, 1, 4, 5, 8, 9, 12, 13	X2, 3, 6, 7, 10, 11, 14, 15	X16 to 35	–
	NA0PB14R-34C		X0, 1	X2 to 7	–	–
	NA0PB24R-3□C		X0, 1	X2 to 13	–	–
	NA0PB32R-3□C		X0, 1	X2 to 15	X16 to 19	–
	NA0PB40R-3□C		X0, 1	X2 to 15	X16 to 23	–
	NA0PB60R-3□C		X0, 1	X2 to 15	X16 to 35	–
	Expansion unit		–	–	–	All inputs

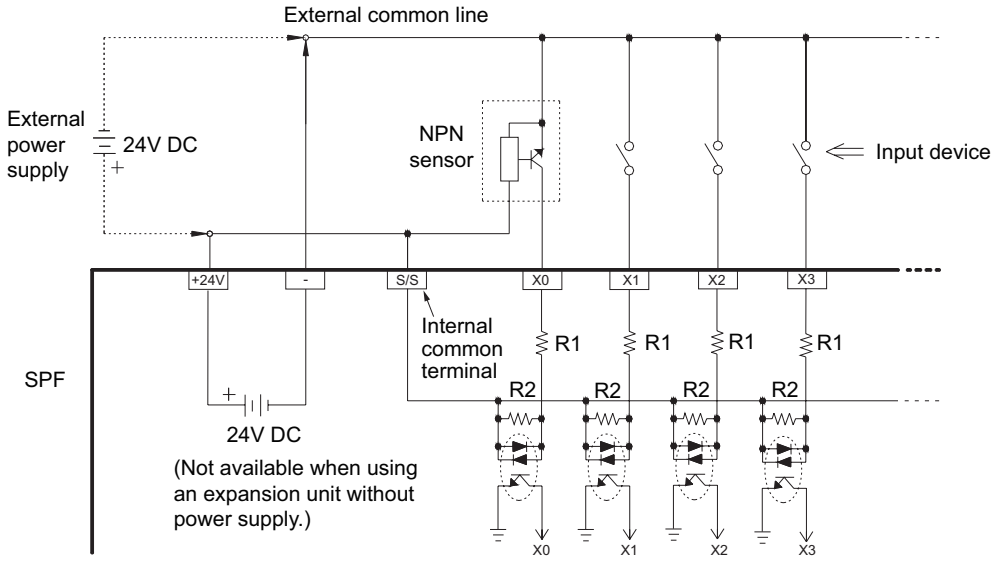
Notes:

1) In A/B-phase input mode, the maximum input frequency becomes half.
2) See "3-9 Temperature Derating of Main Unit."

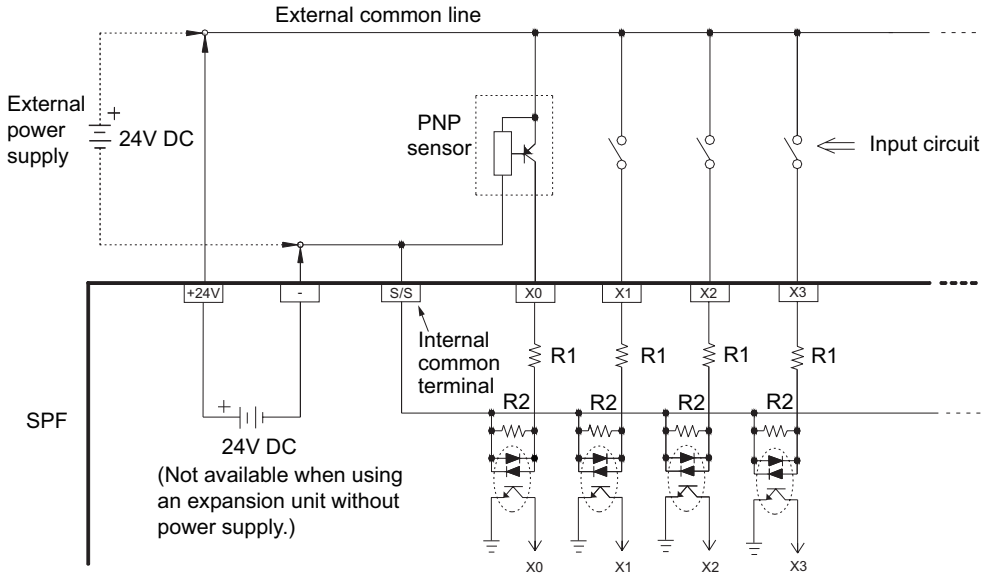
(2) Input circuit configuration and external connection

The 24V DC digital input circuits are available for high, medium and low speed. They all have the similar circuit structures but with different response speeds. When making the connection of external digital input devices, the one ends of all input devices (e.g. buttons and switches) are connected together and called the external common wire, while the other ends of input circuits are connected to the input terminals X0, X1, X2, etc., of SPF. Then finish it by connecting the external common wiring and internal common terminal S/S to the 24VDC power. When connecting the internal common terminal S/S to 24V+ (positive) and the external common wire to 24V- (negative), then the circuit serves as a sink input. On the contrary, while exchange the wiring of the above internal and external common will serve as a source input. The above wiring schemes can illustrated below:

• Wiring of source input



• Wiring of sink input



Section 3 Specifications

3-5 Output Specifications

3-5-1 Transistor output specifications

(1) Specifications

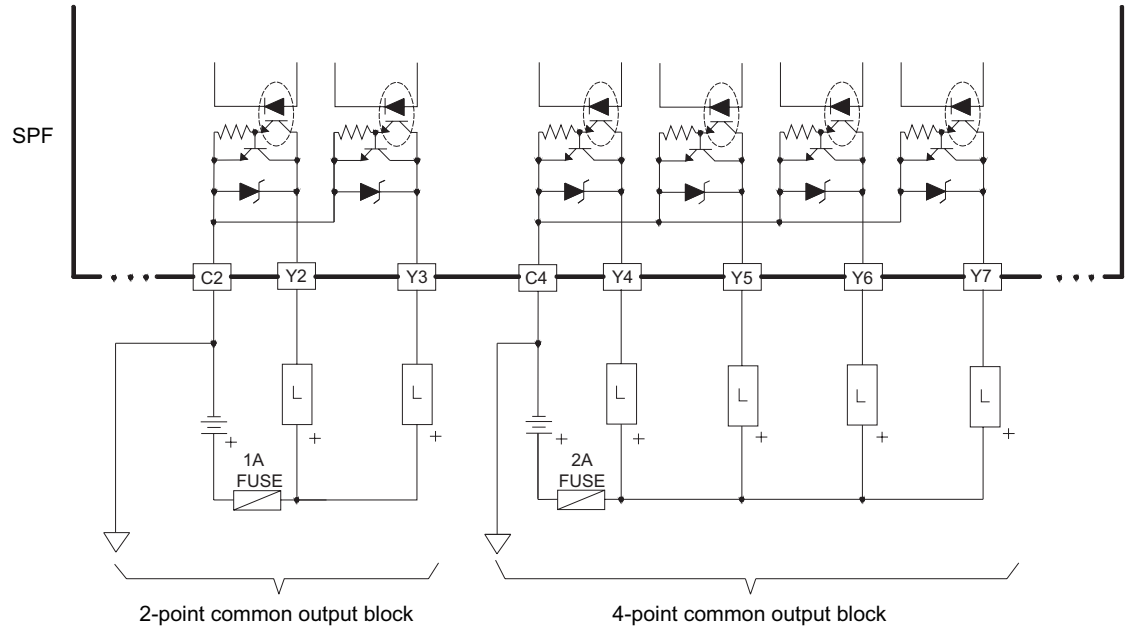
Item			High-speed output	Medium-speed output	Low-speed output	Expansion output
Output power supply conditions	Rated voltage		12 to 24V DC			
	Rated voltage (tolerance)		5 to 30V DC			
Output circuit characteristic	Output type		Sink output			
	Max. load current		0.5A/point (Note 1)			0.5A/point (Note 2)
	Voltage drop		0.6V	2.2V	2.2V	
	Response time	ON to OFF	2μs	30μs	30 to 32μs	
		OFF to ON	2μs	15μs	15 to 17μs	
	Pulse output frequency		Max. 200kHz (Note 3)	Max. 20kHz (Note 4)	–	–
	Leakage current in OFF state		Max. 0.1mA / 30V DC			
	Output element		Transistor output			
Output protection method	Built-in fuse		None			
	Surge absorption circuit		Zener diode			
	Others		None			
External wire connections			Terminal block (M3 screw)			
Output indication			LED indicator turns on when input is “ON” and turns off when output is “OFF”.			
Isolation method			Photocoupler			
Dielectric strength			500V AC 1 minute (between output terminals and frame ground)			
Insulation resistance			10MΩ or more with 500V DC megger (between output terminals and frame ground)			
Derating condition			Specified (Note 5)			None
Corresponding terminal No.	NA0PA14T-34C		Y0 to 3	Y4, 5	–	–
	NA0PA24T-3□C		Y0 to 3	Y4 to 7	Y8, 9	–
	NA0PA32T-3□C		Y0 to 5	Y6, 7	Y8 to 11	–
	NA0PA40T-3□C		Y0 to 5	Y6, 7	Y8 to 15	–
	NA0PA60T-3□C		Y0 to 7	–	Y8 to 23	–
	Expansion unit		–	–	–	All outputs

Notes:

1) The total of all points is “0.1A x No. of output points” or less.
   Example: In the case of a unit with 40 points (No. of output points: 16 points), the total is 1.6A or less.
2) 0.1A/point for an expansion unit with 24 points (NA0E24T-31)
3) 100kHz for A/B-phase output mode
4) 8kHz for A/B-phase output mode
5) See “3-9 Temperature Derating of Main Unit.”

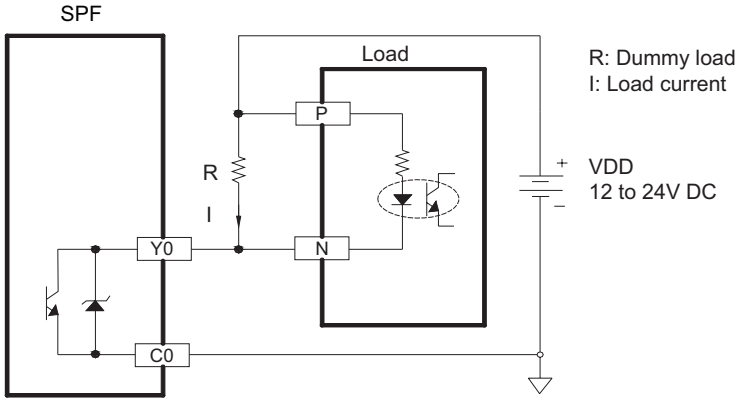
(2) Output circuit configuration and external connection

Transistor sink output



(3) Speeding up transistor output circuits

With the sink structure in a transistor circuit, when the transistor switches from ON to OFF, the junction capacitor between transistor CE electrodes should be charged to near the load voltage VDD before it can stop the current running through the photocoupler inside the load, which increase the OFF time and decrease the response speed. This problem can be solved by adding a Dummy load to accelerate charging rate and speed up the working frequency of transistor output. For the transistor output, Dummy load that are added to the high and medium-speed transistor output and generate a load current of 20 to 50mA is adequate. For low speed transistor where its driving capability (0.5A) but speed is concerned, adding a Dummy load only decreases its driving capability without any significant improvement and hence is not recommended. The following diagram shows how to add a Dummy load to transistor sink output.



$$I = \frac{VDD}{R} = 20 \text{ to } 50mA$$

3-5-2 Relay output specifications

(1) Specifications

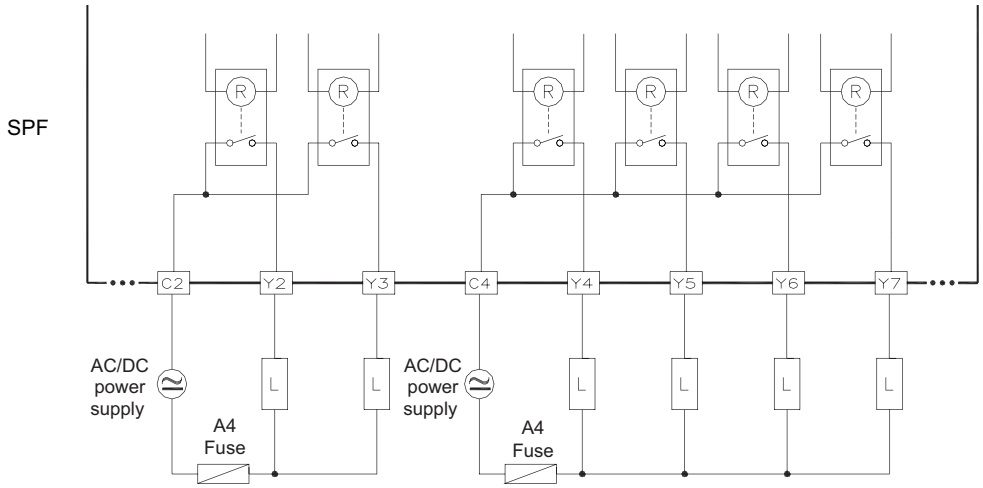
Item			Specification
Output power supply conditions	Rated voltage (tolerance)		250V AC or less / 30V DC or less
Output circuit characteristic	Output type		Relay output
	Max. load current		2A/common, 4A/common (resistive load) 80VA (AC) / 24VA (DC) (inductive load)
	Response time	ON to OFF	10ms or less
		OFF to ON	10ms or less
	Min. make/break current		5V DC, 2mA
	Output element		Relay output
	On/off times		Max. 1800 times/hour
Output protection method	Built-in fuse		None
	Surge absorption circuit		None
	Others		None
External wire connections			Terminal block (M3 screw)
Output indication			LED indicator turns on when input is “ON” and turns off when output is “OFF”.
Isolation method			Relay
Dielectric strength			1500V AC 1 minute (between output terminals and frame ground)
Insulation resistance			10MΩ or more with 500V DC megger (between output terminals and frame ground)
Derating condition			Specified (Note 1)

Notes:

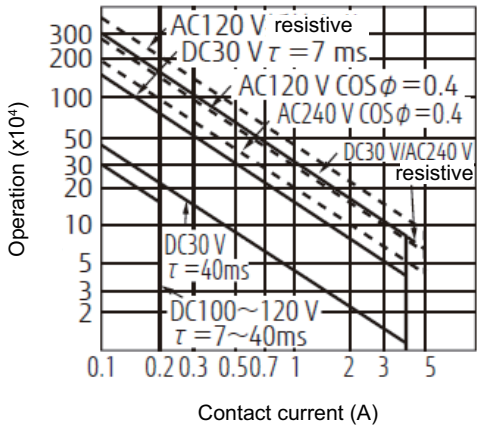
1) See “3-9 Temperature Derating of Main Unit.”

(2) Output circuit configuration and external connections

Each relay can provide current up to 2A. The maximum rated current in all output commons of SPF is 4A. Its mechanical lifetime can reach up to 2 million times. The lifetime also varies depending on working voltage, load type (power factor cosψ) and contact current. In the case of pure resistive load (cosψ=1.0) at 120VAC and 2A, the lifetime of contacts is about 250 thousand times. While for high inductive or capacitive load with cosψ up to 0.2 and current within 1A, the lifetime decreases rapidly to about 50 thousand times (AC200V) or 80 thousand times (AC120V).



Life curve



3-5-3 Output device protection and noise suppression in DO circuit

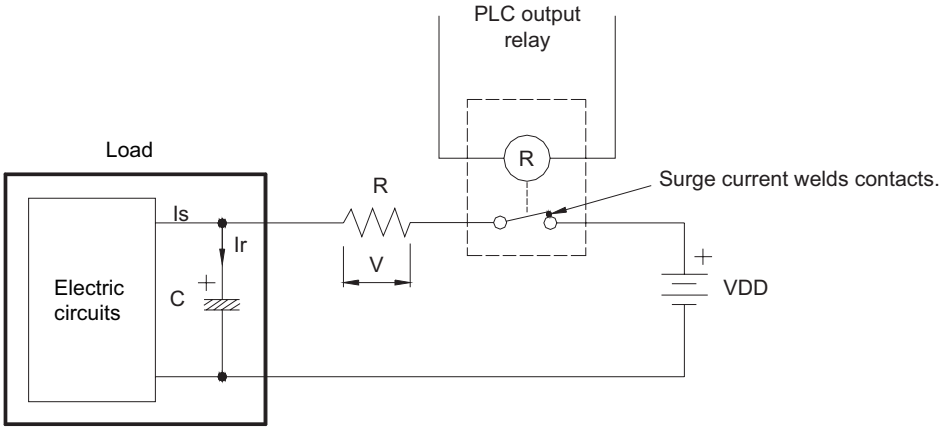
Since the digital output circuits are mainly used for the ON/OFF switching operation, the output components such as relays, transistors and TRIAC can be deemed as kinds of switch components. Normally, surge currents or counter-electromotive force voltages are generated during the ON/OFF operation of these switch components. The effect of surge currents or counter-electromotive force voltages is particularly serious when heavy capacitive or inductive loads are incorporated, which may cause damage to the output components or generate noises in other electronic circuits and equipment. Special consideration should be given to relays and transistors when they are used in high power applications or connected with capacitive or inductive loads and are described in the following:

(1) Protection of relay contacts and noise suppression

Because the relay contacts are used to contact switch components having extremely low resistance, the surge current IR generated instantly upon turning on the relay is normally pretty strong (even if the steady load current is very small). Under such strong surge, the contact tends to melt and stick due to extreme temperature in such a way that the relay cannot trip when it is disconnected. In addition, when the relay connections are OFF, large di/dt is generated because of the instantaneous change from low resistance to open circuit (∞) soon after following the tripping of contact. As a result, an extremely strong counter-electromotive force voltage is induced, which creates sparks between the electrodes of two relay contacts and results in poor contact due to carbon deposits. Among those three output components, either in ON or OFF state, very serious interference can be caused by the surge current or the counter-electromotive of the relay. The solutions to this problem are listed as follows:

1) Suppression of surge current

Connect a small resistor R in series to lower the surge current, but note that too large R will affect the driving capability or cause too much voltage drop.

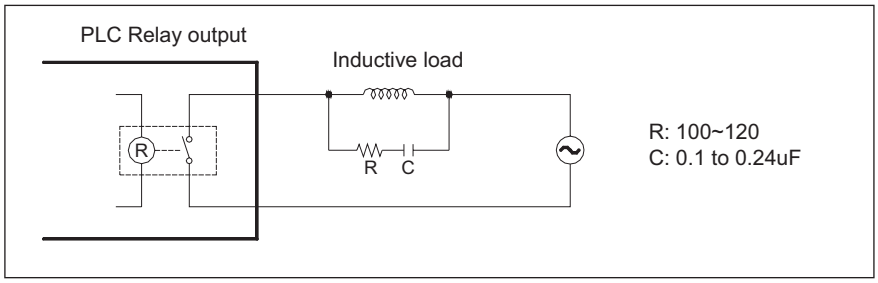


$$R \geqq \frac{VDD}{Ir\ max}$$ (note power dissipation $P = Is^2R$ and voltage drop $V = IsR$)

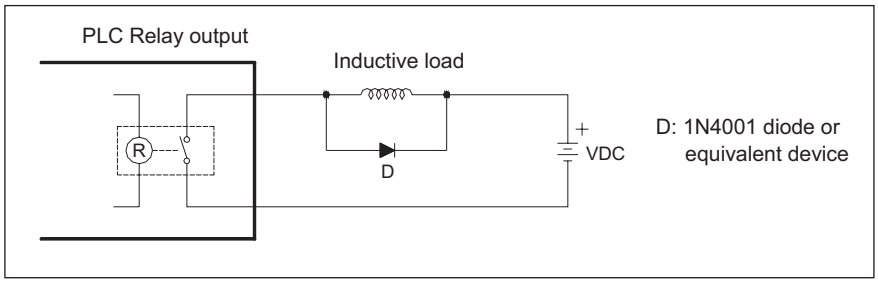
Ir max of relay in SPF = 5A

2) Suppression of counter-electromotive force

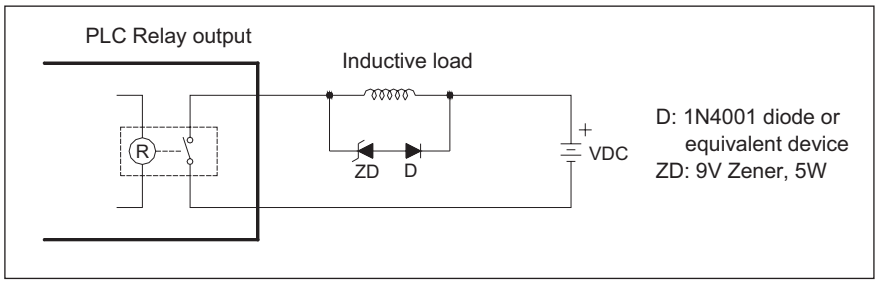
For the inductive load, whether in AC or DC power, suppression devices must be connected in parallel to both its ends to protect the relay contacts and lower noise interference. The schematic diagrams for AC and DC powers are shown below, respectively:



Scheme of AC power load



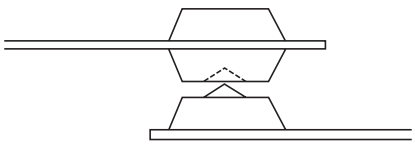
Suppress by a diode in DC power load (for low power)



Suppress by a diode + Zener in DC power load (for high power and frequent ON/OFF)

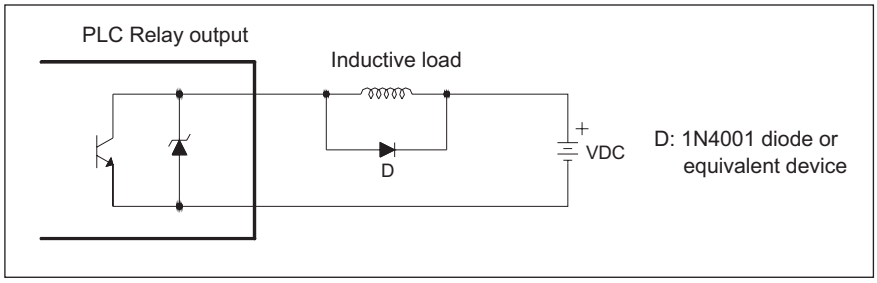
(2) Contact transfer

Contact transfer refers to a phenomena in which one side of contact melts or evaporates and is transferred to the other side because of on/off operation of the DC load. As the number of on/off times increases, the protruded portion on one contact grows and the embossed portion on other contact becomes correspondingly large. Eventually the two contacts are locked as if contact melting occurred. This phenomena may occur within the ratings of relay contacts. In particular, when a relay is used to turn on and off a capacitive load, this phenomena may occur. In this case, use a resistor to suppress inrush current.

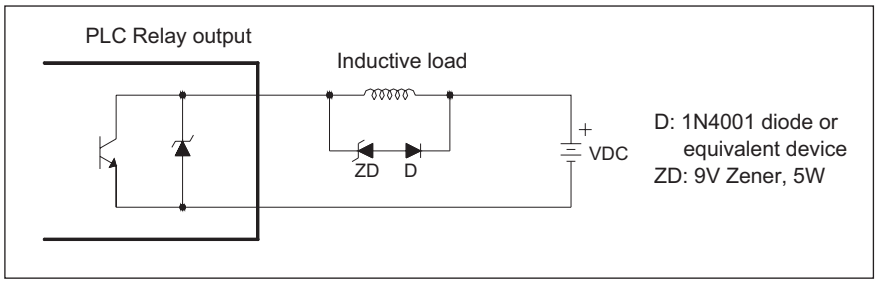


(3) Protection of transistor output and noise suppression

The transistor output in SPF already includes Zener diode for counter-electromotive force, which is sufficient for low power inductive load and medium frequency of ON/OFF application. In conditions of high power or frequent ON/OFF, please construct another suppression circuit to lower noise interference and prevent voltage from exceeding the limit or overheating that may damage the transistor output circuit.



Suppress by a diode (for low power)



Suppress by a diode + Zener (high power and frequent ON/OFF)

3-6 Analog Unit/Board Specifications

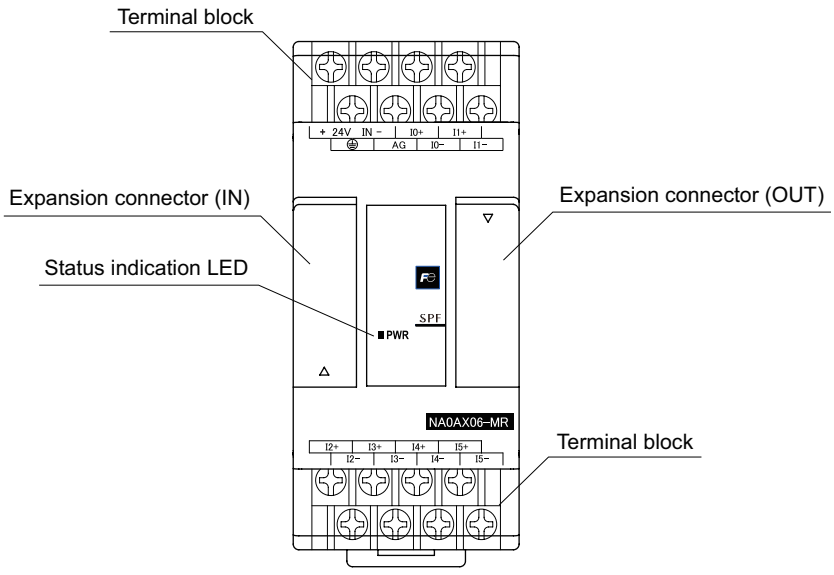
3-6-1 Analog input unit (NA0AX06-MR)

(1) Specifications

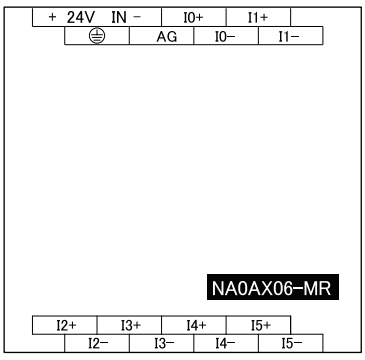
Item	Specification
Type	NA0AX06-MR
No. of input channels	6 channels
Input impedance	Voltage: 63.2 kΩ, Current: 250 Ω
Maximum allowable input	Voltage: ±15V, Current: 30mA
Input range	-10 to +10V, -5 to +5V, 0 to 10V, 0 to 5V -20 to 20mA, -10 to 10mA, 0 to 20mA, 0 to 10mA (Collectively set for all channels by the jumper pin in the unit)
Resolution	12 bits or 14 bits (Set for individual channels by the program loader.)
Overall accuracy	±1% *1
A/D conversion value	INT type
Sampling period	Synchronized with the scan of the main unit.
Moving average	1 to 16 times (Set for individual channels by the program loader.)
External wire connections	8-pole terminal block (M3) x 2, Tightening torque: 0.59 to 0.78 N·m
Applicable wire size	AWG#22-18 * Be sure to use shielded twisted pair cables.
Status indication	5V power supply display, ON when normal (red)
Isolation method	Not isolated
Occupied words	6 words
External power supply	24V DC, 53mA *Wiring length: 10m or less
Internal current consumption	5V DC, 25mA
Dimensions	40 (W) x 90 (H) x 80 (D) (mm)

*1 The overall accuracy is the specification for when noise described in “Electrical service conditions” is not applied. If noise is applied, the overall accuracy may exceed the above specification.

(2) Names



<Signal assignment>



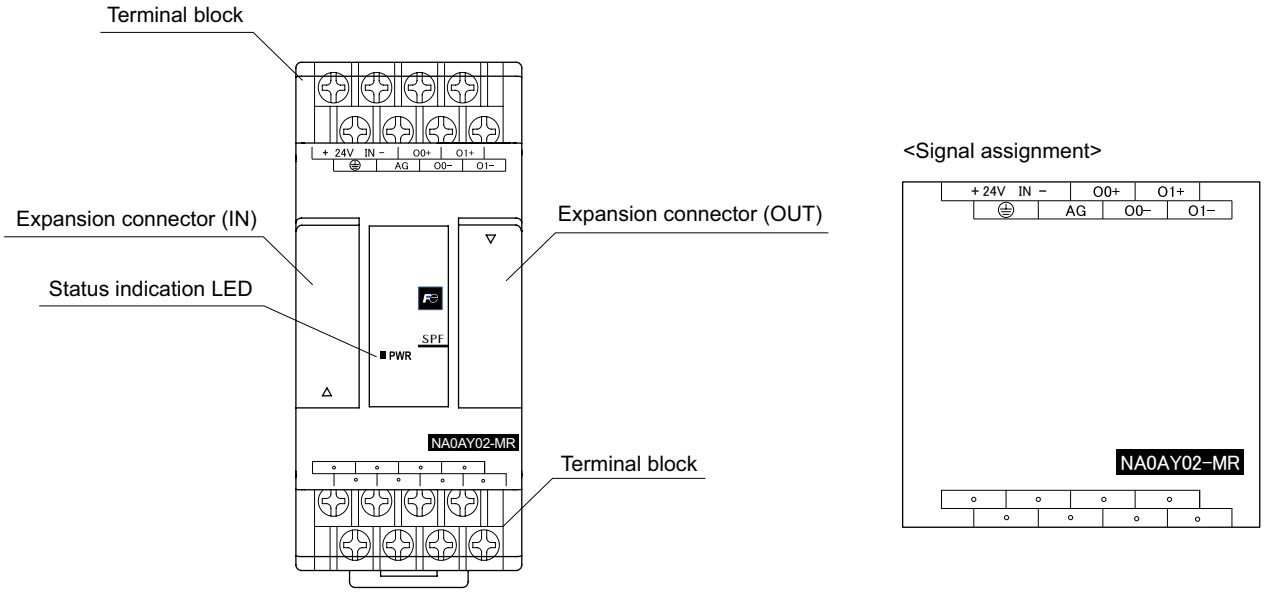
* For the detailed specifications of and how to use the analog input unit (Type: NA0AX06-MR), refer to the user’s manual “Analog Unit (FEH527).”

3-6-2 Analog output unit (NA0AY02-MR)

(1) Specifications

Item	Specification
Type	NA0AY02-MR
No. of output channels	2 channels
External load resistance	Voltage output: 500 Ω to 1 MW, Current output: 0 to 500 Ω or less
Analog output range	-10 to +10V, -5 to +5V, 0 to 10V, 0 to 5V -20 to 20mA, -10 to 10mA, 0 to 20mA, 0 to 10mA (Collectively set for all channels by the jumper pin in the unit)
Resolution	14 bits
Overall accuracy	±1%
Data type of digital output value	INT type
Output period	Synchronized with the scan of the main unit.
External wire connections	8-pole terminal block (M3) x 2, Tightening torque: 0.59 to 0.78 N·m
Applicable wire size	AWG#22-18 * Be sure to use shielded twisted pair cables.
Status indication	5V power supply display, ON when normal (red)
Isolation method	Not isolated
Occupied words	2 words
External power supply	24V DC, 90mA *Wiring length: 10m or less
Internal current consumption	5V DC, 33mA
Dimensions	40 (W) x 90 (H) x 80 (D) (mm)

(2) Names



* For the detailed specifications of and how to use the analog output unit (Type: NA0AY02-MR), refer to the user's manual "Analog Unit (FEH527)."

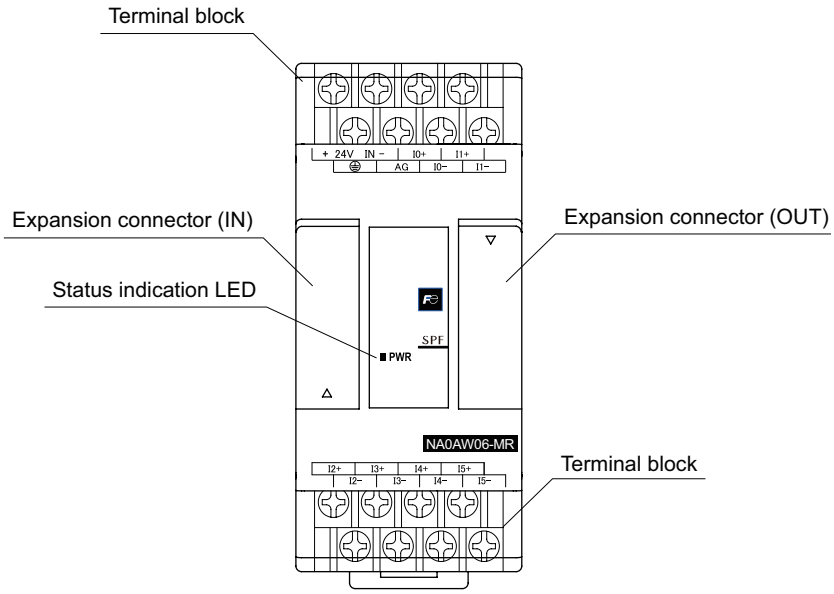
3-6-3 Analog input/output unit (NA0AW06-MR)

(1) Specifications

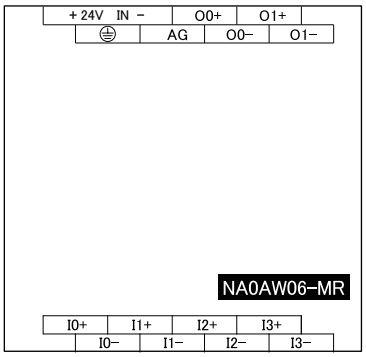
Item	Specification
Type	NA0AW06-MR
No. of input channels	4 channels
Input impedance	Voltage: 63.2 kΩ, Current: 250 Ω
Maximum allowable input	Voltage: ±15V, Current: 30mA
Input range	-10 to +10V, -5 to +5V, 0 to 10V, 0 to 5V -20 to 20mA, -10 to 10mA, 0 to 20mA, 0 to 10mA (Collectively set for all channels by the jumper pin in the unit)
Resolution	12 bits or 14 bits (Set for each channel by the program loader.)
Overall accuracy	±1% *1
A/D conversion value	INT type
Sampling period	Synchronized with the scan of the main unit.
Moving average	1 to 16 times (Set for individual channels by the program loader.)
No. of output channels	2 channels
External load resistance	Voltage output: 500 Ω to 1 MΩ, Current output: 0 to 500 Ω or less
Analog output range	-10 to +10V, -5 to +5V, 0 to 10V, 0 to 5V -20 to 20mA, -10 to 10mA, 0 to 20mA, 0 to 10mA (Collectively set for all channels by the jumper pin in the unit)
Resolution	14 bits
Overall accuracy	±1%
Data type of digital output value	INT type
Output period	Synchronized with the scan of the main unit.
External wire connections	8-pole terminal block (M3) x 2, Tightening torque: 0.59 to 0.78 N·m
Applicable wire size	AWG#22-18 * Be sure to use shielded twisted pair cables.
Status indication	5V power supply display, ON when normal (red)
Isolation method	Not isolated
Occupied words	6 words
External power supply	24V DC, 103mA *Wiring length: 10m or less
Internal current consumption	5V DC, 35mA
Dimensions	40 (W) x 90 (H) x 80 (D) (mm)

*1 The overall accuracy is the specification for when noise described in “Electrical service conditions” is not applied. If noise is applied, the overall accuracy may exceed the above specification.

(2) Names



<Signal assignment>



* For the detailed specifications of and how to use the analog input/output unit (Type: NA0AW06-MR), refer to the user's manual "Analog Unit (FEH527)."

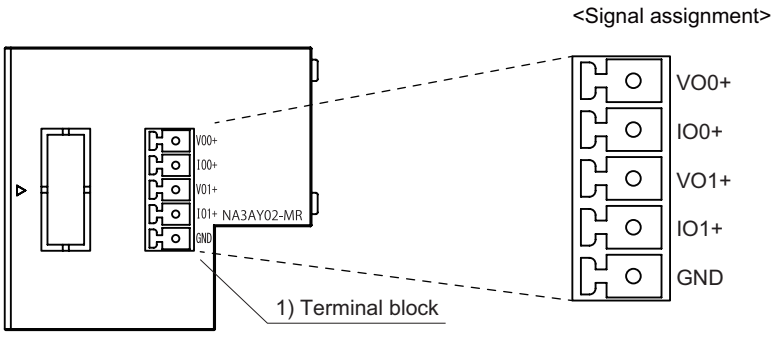
3-6-4 Analog output board (NA3AY02-MR)

(1) Specifications

Item	Specification
Type	NA3AY02-MR
No. of output channels	2 channels
External load resistance	Voltage output: 1k Ω to 1MΩ, Current output: 0 to 500 Ω or less
Analog output range	0 to +10V 0 to 20mA * Selectable by wiring of the terminal block.
Resolution	12 bits
Overall accuracy	±1%
Data type of digital output value	INT type
Output period	Synchronized with the scan of the main unit.
External wire connections	5-pole European-style terminal block (M2) x 1, Tightening torque: 0.2 N·m
Applicable wire size	AWG#28-16 * Be sure to use shielded twisted pair cables.
Status indication	None
Isolation method	Not isolated
Occupied words	2 words
Internal current consumption	5V DC, 223mA

*1 Screw tightening torque for mounting the board on a main unit: 0.2 N·m

(2) Names



* For the detailed specifications of and how to use the analog output board (Type: NA3AY02-MR), refer to the user's manual "Analog Unit (FEH527)."

3-6-5 Analog input/output board (NA3AW03-MR)

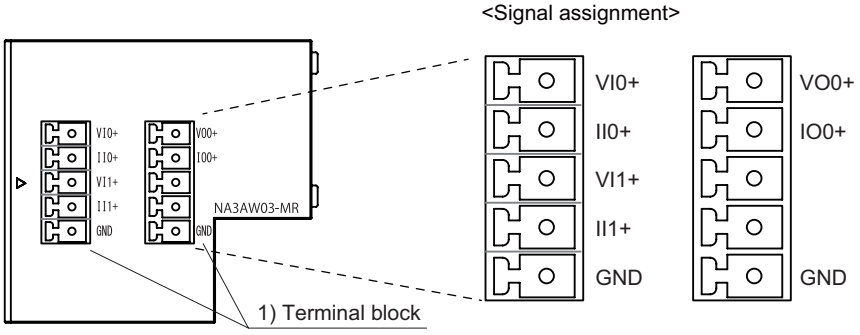
(1) Specifications

Item	Specification
Type	NA3AW03-MR
No. of input channels	2 channels
Input impedance	Voltage input: 100 kΩ, Current input: 125 Ω
Maximum allowable input	Voltage: ±15V, Current: 30mA
Analog input range	0 to +10V 0 to 20mA * Selectable by wiring of the terminal block.
Resolution	14 bits (Set for each channel by the program loader.)
Overall accuracy	±1% *1
A/D conversion value	INT type
Sampling cycle	Synchronized with the scan of the main unit.
Moving average	1 to 16 times (Set for individual channels by the program loader.)
No. of output channels	1 channel
External load resistance	Voltage output: 2 kΩ to 1 MΩ, Current output: 0 to 500 Ω or less
Analog output range	0 to +10V 0 to 20mA * Selectable by wiring of the terminal block.
Resolution	12 bits
Overall accuracy	±1%
Data type of digital output value	INT type
Output cycle	Synchronized with the scan of the main unit.
External wire connections	5-pole European-style terminal block (M2) x 1, Tightening torque: 0.2 N·m
Applicable wire size	AWG#28-16 * Be sure to use shielded twisted pair cables.
Status indication	None
Isolation method	Not isolated
Occupied words	3 words
Internal current consumption	5V DC, 158mA

*1 The overall accuracy is the specification for when noise described in “Electrical service conditions” is not applied. If noise is applied, the overall accuracy may exceed the above specification.

*2 Screw tightening torque for mounting the board on a main unit: 0.2 N·m

(2) Names



* For the detailed specifications of and how to use the analog input/output board (Type: NA3AW03-MR), refer to the user’s manual “Analog Unit (FEH527).”

3-6-6 Thermocouple input unit (NA0AX02-TC/NA0AX06-TC/NA0AX16-TC)

(1) Specifications

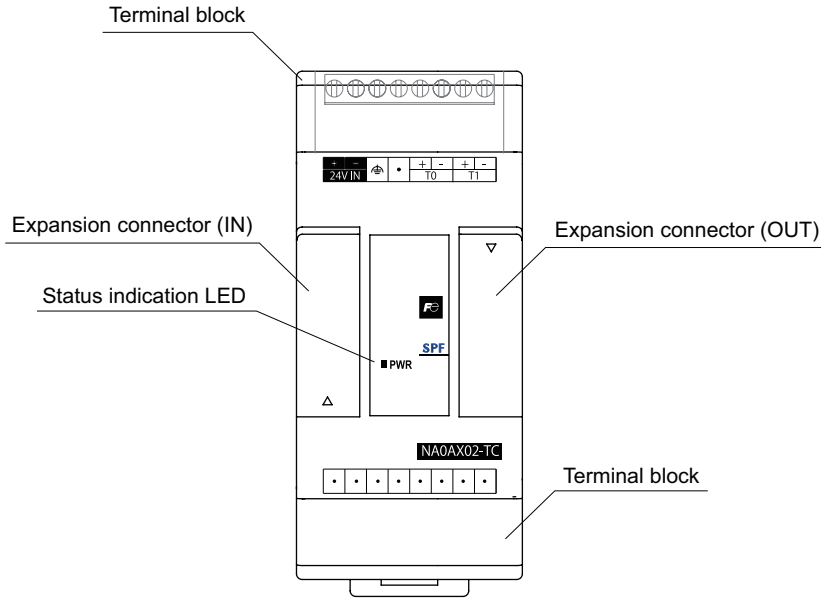
Item	Specification		
Type	NA0AX02-TC	NA0AX06-TC	NA0AX16-TC
No. of input channels	2 channels	6 channels	16 channels
Resolution	0.1°C or 1°C *1		
Thermocouple type	J, K, R, S, E, T, B, N (Collectively set for all channels by the program loader)		
Temperature measurement range	J: -200.0 to 1200.0°C -328.0 to 2192.0°F K: -200.0 to 1200.0°C -328.0 to 2192.0°F T: -190.0 to 380.0°C -310.0 to 716.0°F E: -190.0 to 1000.0°C -310.0 to 1832.0°F N: -200.0 to 1000.0°C -328.0 to 1832.0°F B: 350.0 to 1800.0°C 622.0 to 3272.0°F R: 0.0 to 1800.0°C 32.0 to 3272.0°F S: 0.0 to 1700.0°C 32.0 to 3092.0°F		
Cold junction automatic compensator	Built in the unit		
Overall accuracy	± (1% + 1°C) *2		
Data type of A/D conversion value	INT type		
Sampling period	1 second (high speed) or 2 seconds (low speed)	2 seconds (high speed) or 4 seconds (low speed)	3 seconds (high speed) or 6 seconds (low speed)
	(Collectively set [high speed or low speed] for all channels by the program loader.)		
Moving average	No moving average / 2 / 4 / 8 times (Collectively set for all channels by the program loader.)		
External wire connections	8-pole European-style terminal block (M2) x 2, Tightening torque: 0.2 N·m		18-pole terminal block (M3) x 2, Tightening torque: 0.59 to 0.78 N·m
Applicable wire size	AWG#28-16		AWG#22-18
Status indication	5V power supply display, ON when normal (red)		
Isolation method	Transformer (power supply) and photocoupler (signal)		Not isolated
Occupied words	2 words	6 words	16 words
External power supply	24V DC, 21mA	24V DC, 29mA	24V DC, 58mA
	*Wiring length: 10m or less		
Internal current consumption	5V DC, 30mA		
Dimensions	40 (W) x 90 (H) x 80 (D) (mm)		90 (W) x 90 (H) x 80 (D) (mm)

*1 The resolution is determined by the setting of the “sampling period” in the parameter.
When the resolution is 1°C: Set to “high speed.”
When the resolution is 0.1°C: Set to “low speed.”

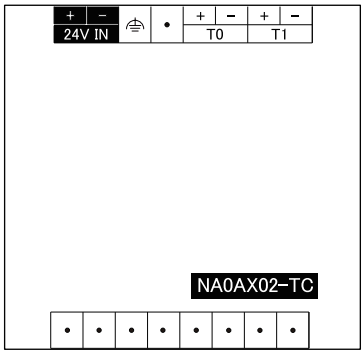
*2 The overall accuracy is the specification for when noise described in “Electrical service conditions” is not applied.
If noise is applied, the overall accuracy may exceed the above specification.

(2) Names

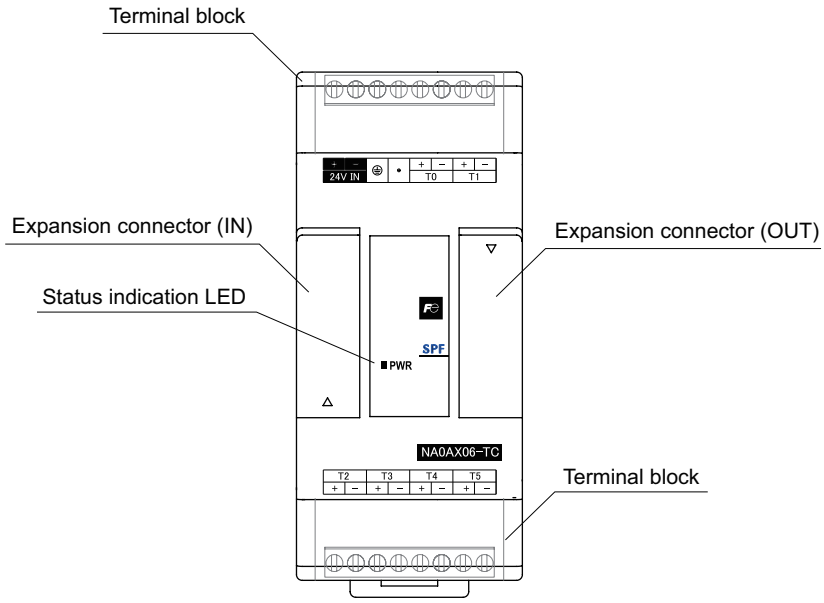
1) NA0AX02-TC



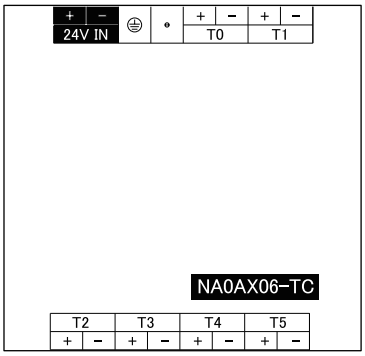
<Signal assignment>



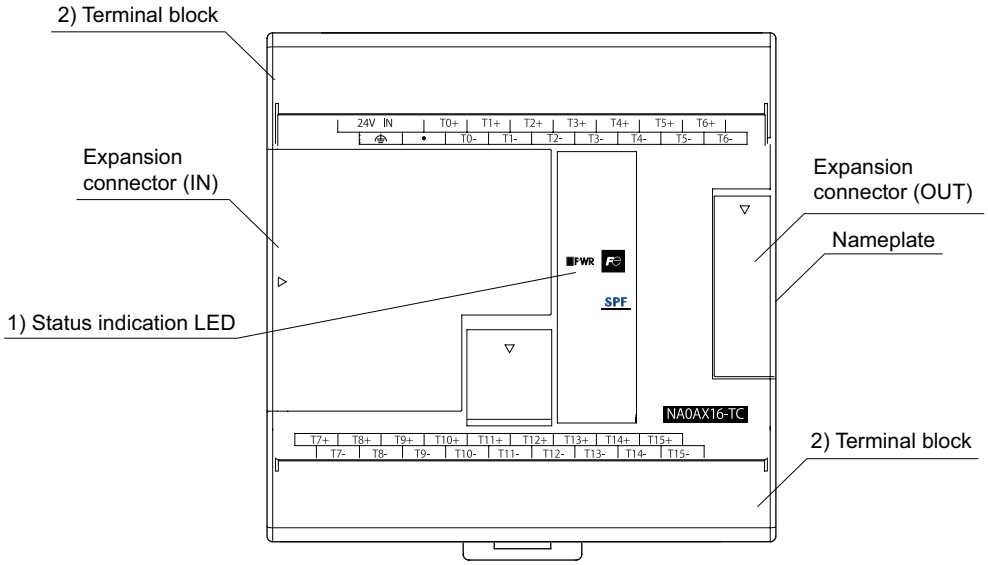
2) NA0AX06-TC



<Signal assignment>



3) NA0AX16-TC



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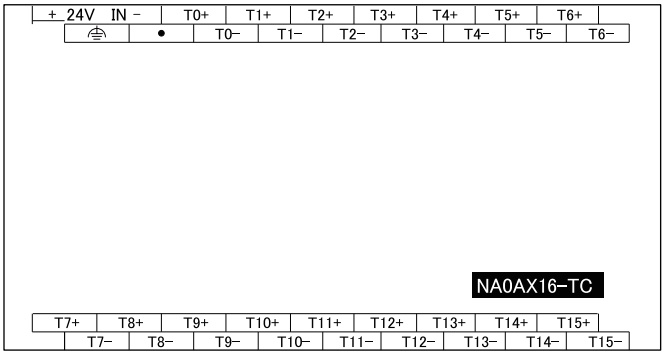


* For the detailed specifications of and how to use the thermocouple input unit (Type: NA0AX02-TC/NA0AX06-TC/NA0AX16-TC), refer to the user's manual "Analog Unit (FEH527)."

3-6-7 Resistance thermometer element input unit (NA0AX06-PT)

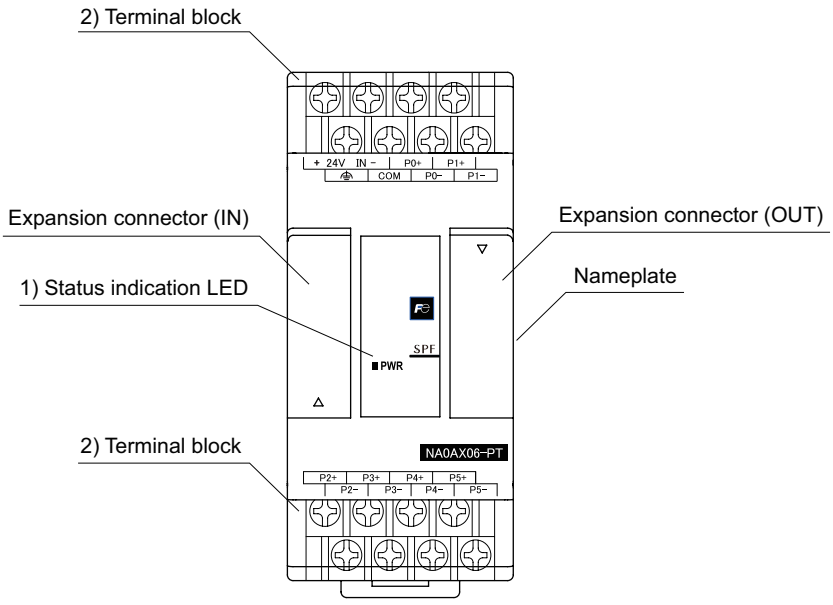
(1) Specifications

Item	Specification
Type	NA0AX06-PT
No. of analog input channels	6 channels
Resolution	0.1°C or 1°C *1
Applicable resistance thermometer element	Pt100, Pt1000 (JIS or DIN)
Temperature measurement range	Pt100: -200.0 to 850.0°C (-328.0 to 1562.0°F) Pt1000: -200.0 to 600.0°C (-328.0 to 1112.0°F)
Overall accuracy	±1% *2
Resistance of input wiring	20Ω or less
Data type of A/D conversion value	INT type
Sampling period	1 second (high speed) or 2 seconds (low speed) (Collectively set for all channels by the program loader.)
Moving average	No moving average / 2 / 4 / 8 times (Collectively set for all channels by the program loader.)
External wire connections	8-pole terminal block (M3) x 2, Tightening torque: 0.59 to 0.78 N·m
Applicable wire size	AWG#22-18 * Be sure to use shielded twisted pair cables.
Status indication	5V power supply display, ON when normal (red)
Isolation method	Not isolated
Occupied words	6 words
External power supply	24V DC, 16mA *Wiring length: 10m or less
Internal current consumption	5V DC, 32mA
Dimensions	40 (W) x 90 (H) x 80 (D) (mm)

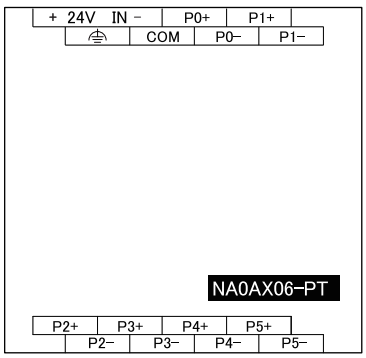
*1 The resolution is determined by the setting of the “sampling period” in the parameter.
When the resolution is 1°C: Set to “high speed.”
When the resolution is 0.1°C: Set to “low speed.”

*2 The overall accuracy is the specification for when noise described in “Electrical service conditions” is not applied.
If noise is applied, the overall accuracy may exceed the above specification.

(2) Names



<Signal assignment>



* For the detailed specifications of and how to use the resistance thermometer element input unit (Type: NA0AX06-PT), refer to the user’s manual “Analog Unit (FEH527).”

3-7 Communication Unit/Board Specifications

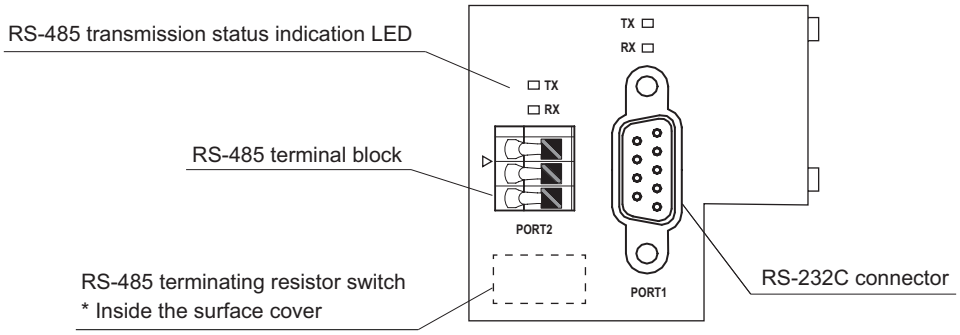
3-7-1 RS-232C/RS-485 general purpose communication board (NA3LA-RS1)

(1) Specifications

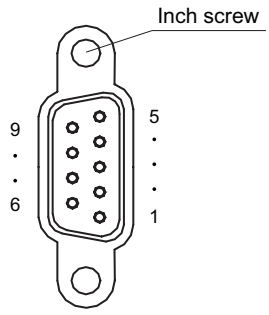
Item		Specification	
Interface		RS-232C 1 channel (PORT1)	RS-485 1 channel (PORT2)
Synchronization method		Start-stop synchronous transmission	
Transmission speed		1200/2400/4800/9600/19200/38400/57600/115200	
Transmission distance		Max. 15m	Max. 1km (19200bps or less)
No. of connectable units		1:1	1:15 (Max.)
Connection method		D-sub, 9-pin connector (female)	3-pole European-style terminal block
Transmission code		Binary (without code conversion) or ASCII (with code conversion), EBCDIC (with code conversion)	
Error control	Hardware	Vertical parity (parity bit), framing, overrun error	
	Software	Horizontal parity (BCC)	
Bit send sequence		From the lower-order bit (from LSB to MSB)	
Data length which can be transmitted or received at one time (viewed from the PLC)		Max. 512 bytes (Depending on the mode)	
Internal current consumption		5V DC, 55mA	
Occupied words		0 word	

* Screw tightening torque for mounting the board on a main unit: 0.2 N·m

(2) Names

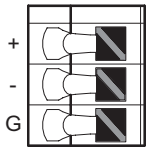


<RS-232C connector pin arrangement>



Pin No.	Signal name	Description
1	–	Not connected
2	TXD	Send data
3	RXD	Receive data
4	–	Not connected
5	SG	Signal ground
6	–	Not connected
7	CTS	Clear to send
8	RTS	Request to send
9	–	Not connected

<RS-485 terminal block arrangement>



Signal name	Description
+ (D+)	RS-485 send/receive +
- (D-)	RS-485 send/receive -
G (SG)	Signal ground

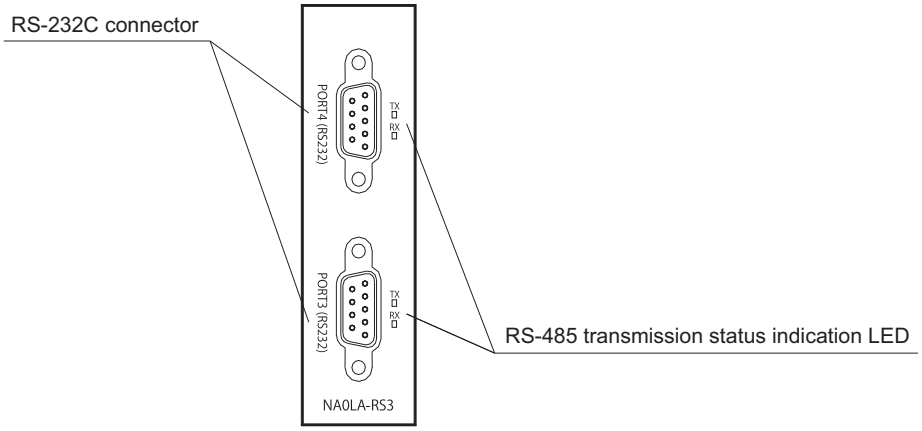
* For the detailed specifications of and how to use the RS-232C/RS-485 general purpose communication board (Type: NA3LA-RS1), refer to the user's manual "General Purpose Communication (FEH528)."

3-7-2 RS-232C general purpose communication unit (NA0LA-RS3)

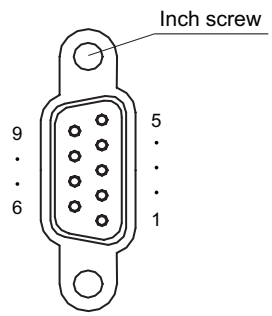
(1) Specifications

Item		Specification
Interface		RS-232C 2 channels (PORT3, PORT4)
Synchronization method		Start-stop synchronous transmission
Transmission speed		1200/2400/4800/9600/19200/38400/57600/115200
Transmission distance		Max. 15km
No. of connectable units		1:1
Connection method		D-sub, 9-pin connector (female)
Transmission code		Binary (without code conversion) or ASCII (with code conversion), EBCDIC (with code conversion)
Error control	Hardware	Vertical parity (parity bit), framing, overrun error
	Software	Horizontal parity (BCC)
Bit send sequence		From the lower-order bit (from LSB to MSB)
Data length which can be transmitted or received at one time (viewed from the PLC)		Max. 512 bytes (Depending on the mode)
Internal current consumption		5V DC, 18mA
Occupied words		0 word

(2) Names



<RS-232C connector pin arrangement>



Pin No.	Signal name	Description
1	–	Not connected
2	TXD	Send data
3	RXD	Receive data
4	–	Not connected
5	SG	Signal ground
6 to 9	–	Not connected

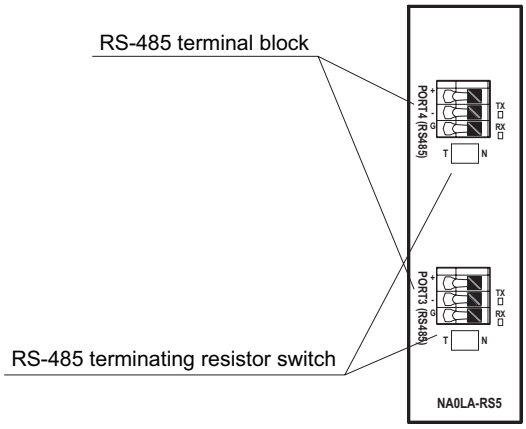
* For the detailed specifications of and how to use the RS-232C general purpose communication unit (Type: NA0LA-RS3), refer to the user's manual "General Purpose Communication (FEH528)."

3-7-3 RS-485 general purpose communication unit (NA0LA-RS5)

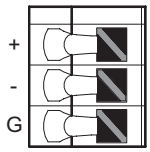
(1) Specifications

Item		Specification
Interface		RS-485 2 channels (PORT3, PORT4)
Synchronization method		Start-stop synchronous transmission
Transmission speed		1200/2400/4800/9600/19200/38400/57600/115200
Transmission distance		Max. 1km (19200bps or less)
No. of connectable units		1:15 (Max.)
Connection method		3-pole European-style terminal block
Transmission code		Binary (without code conversion) or ASCII (with code conversion), EBCDIC (with code conversion)
Error control	Hardware	Vertical parity (parity bit), framing, overrun error
	Software	Horizontal parity (BCC)
Bit send sequence		From the lower-order bit (from LSB to MSB)
Data length which can be transmitted or received at one time (viewed from the PLC)		Max. 512 bytes (Depending on the mode)
Internal current consumption		5V DC, 95mA
Occupied words		0 word

(2) Names



<RS-485 terminal block arrangement>



Signal name	Description
+ (D+)	RS-485 send/receive +
- (D-)	RS-485 send/receive -
G (SG)	Signal ground

* For the detailed specifications of and how to use the RS-485 general purpose communication unit (Type: NA0LA-RS5), refer to the user's manual "General Purpose Communication (FEH528)."

3-7-4 Ethernet communication board (NA3LA-ET1) / Ethernet communication unit (NA0LA-ET1)

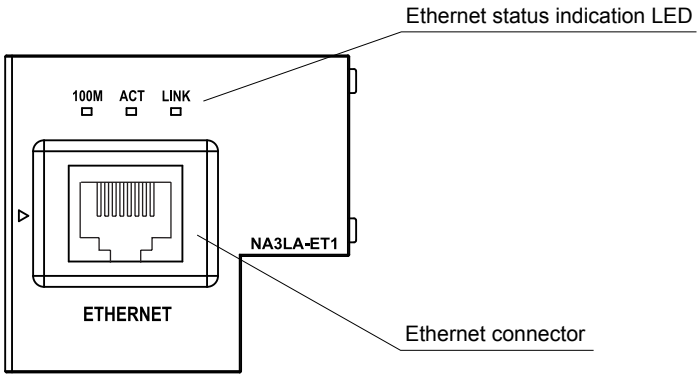
(1) Specifications

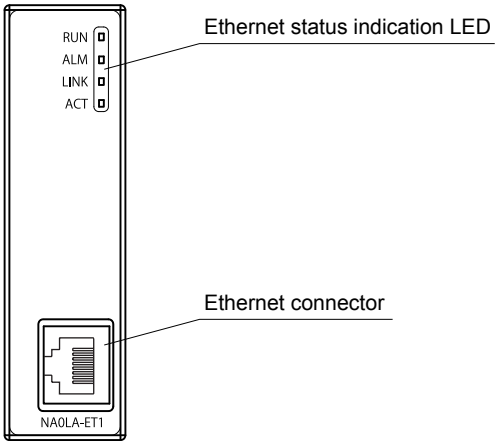
Item		Specifications	
Interface		10BASE-T	100BASE-TX
Transmission speed		10 Mbps	100 Mbps
Medium (physical specification)		IEEE802.3u	
AUTO MDI/MDI-X		Not supported	
Interface changeover system		Auto negotiation (automatic changeover)	
Transmission medium		Twisted pair cable	
Max. segment length		100m	
Max. number of nodes		1 node / segment	
Communication function	General purpose communication	Communication between the PLC and other nodes is performed by using TCP/IP or UDP/IP protocol. Because of free data format, it is possible to communicate with all kinds of nodes.	
	Loader communication (Server operation)	Communication with a POD or loader, host PC is performed by a loader command. No communication program is required on the PLC side.	
	Loader communication (Client operation)	The data memory in the target device (another SPH or SPF) is read or written. "R_READ" (for reading data) and "R_WRITE" (for writing data) FBs are used for communication. Start these FBs to send or receive a loader command from the self station to the target device.	
Access method		CSMA/CD	
Transmission protocol		TCP/IP, UDP/IP, ICMP (TYPE = 0, 3, 8), ARP	
Max. number of simultaneous communicable nodes (number of communication ports)		8 stations / physical port Notes: The maximum number of communication ports that one CPU can simultaneously open is 16 when using both an Ethernet front board and a left side unit. However, responses of communication deteriorate as the number of communication ports per CPU increases.	
Transmission code		Binary only	
Internal current consumption		NA3LA-ET1: DC5V **mA, NA0LA-ET1: DC5V **mA	
Occupied words		0 word	

* Screw tightening torque for mounting the board on a main unit: 0.2 N·m

(2) Names

<NA3LA-ET1>





* For the detailed specifications of and how to use the Ethernet communication board (NA3LA-ET1) and Ethernet communication unit (NA0LA-ET1), refer to the user's manual "SPF Ethernet Communication (FEH630)."

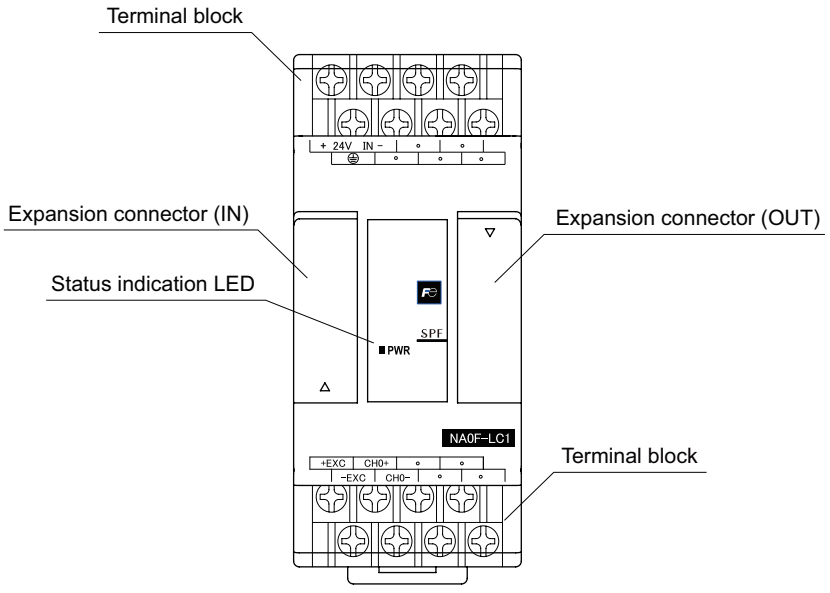
3-8 Function Unit Specifications

3-8-1 Load cell unit (NA0F-LC1)

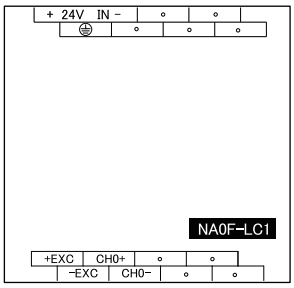
(1) Specifications

Item		Specification
No. of input channels		1 channel
Input range		0 to 2mV/V, 0 to 5mV/V, 0 to 10mV/V, 0 to 20mV/V (Set by the program loader.)
Resolution		16 bits (including a sign bit)
Digital conversion value		0 to 25,000 (INT type)
Load cell applied voltage		5V DC, 100 Ω
Sampling period (A/D conversion cycle)		5/10/25/30/60/80Hz (Set by the program loader.)
Moving average		No moving average / 2 / 4 / 8 times (Set by the program loader.)
Accuracy	Nonlinearity	0.01% for full scale (at an ambient temperature of 25°C)
	Zero drift	0.2μV/°C
	Gain drift	10ppm/°C
External wire connections		8-pole terminal block (M3) x 2, Tightening torque: 0.59 to 0.78 N·m
Status indication		5V power supply display, ON when normal (red)
Isolation method		Transformer (power supply) and photocoupler (signal)
Occupied words		1 word
External power supply		24V DC, 48mA
Internal current consumption		5V DC, 32mA

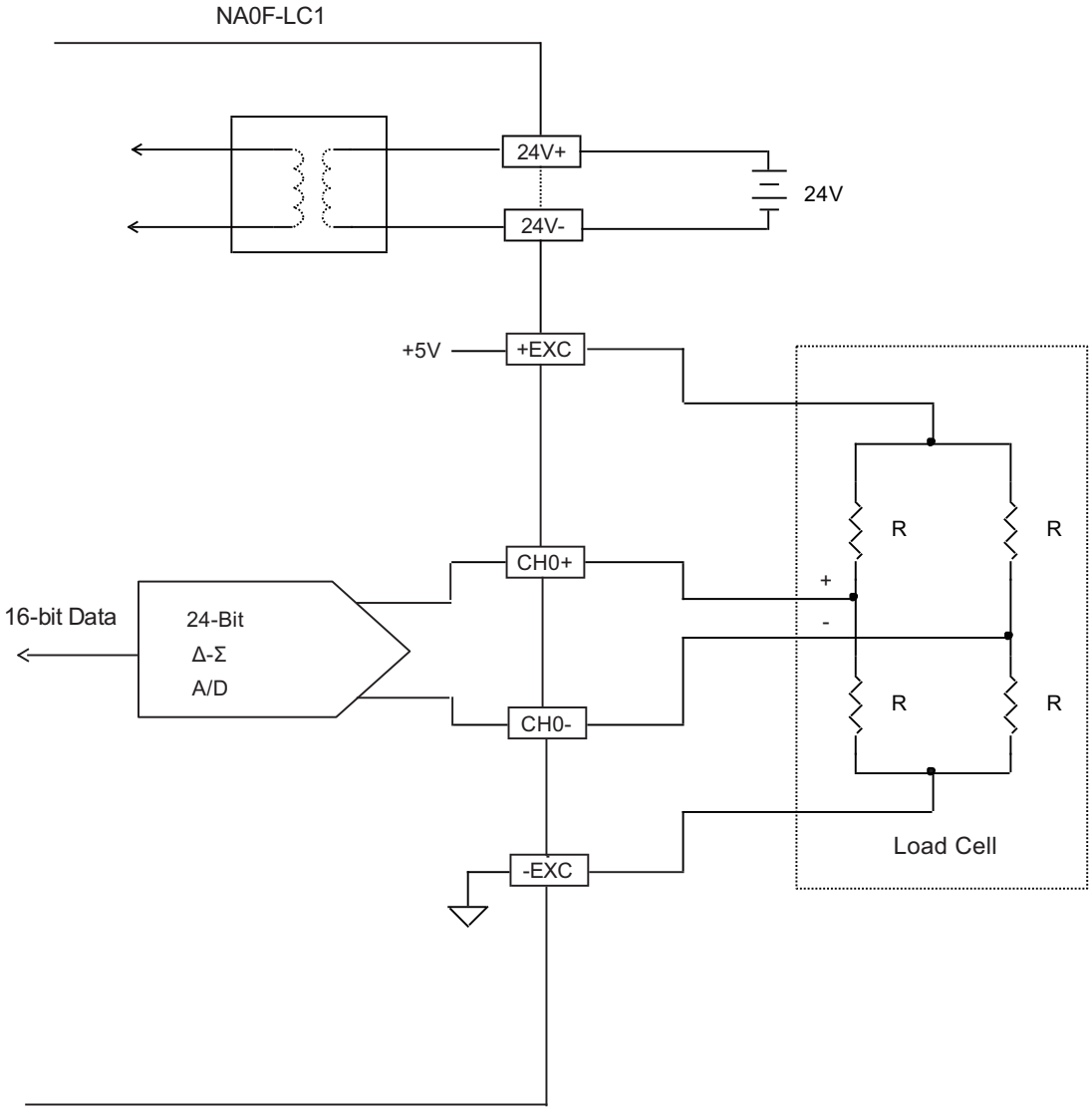
(2) Names



<Signal assignment>



(3) External connection

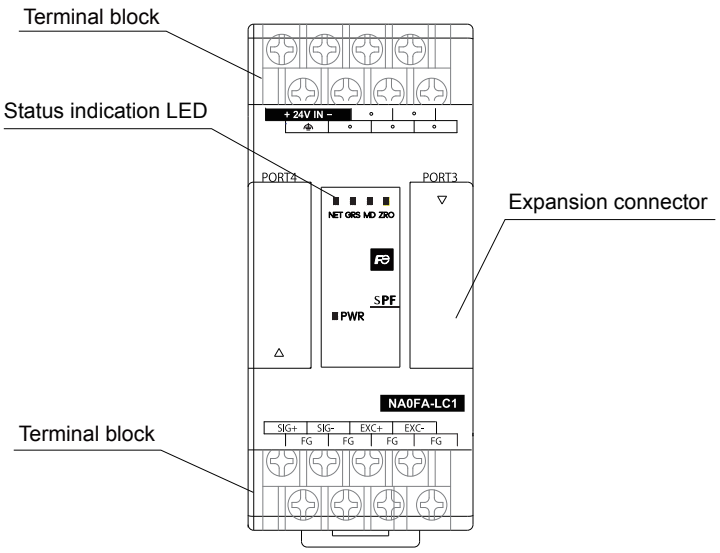


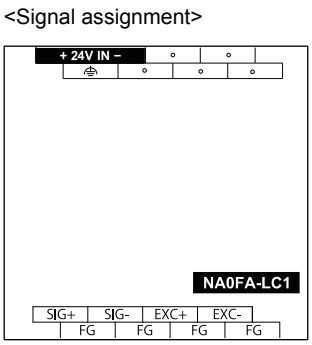
3-8-2 High-precision load cell unit (NA0FA-LC1)

(1) Specifications

Item	Specification
No. of input channels	1 channel
Resolution	24 bits (including a sign bit)
Data type of digital conversion value	INT type, DINT type
Load cell applied voltage	5V DC, 350 Ω
Sampling period (A/D conversion cycle)	100 times/second
Max. measured voltage	-1mV to 39mV
Input sensitivity, resolution	0.15μV/d or more (d = minimum scale) 1/60000
External wire connections	8-pole terminal block (M3) x 2, Tightening torque: 0.59 to 0.78 N·m
Applicable wire size	AWG#22-18 * Be sure to use shielded twisted pair cables.
Status indication	5V power supply display, ON when normal (red) Stable indicator (MD), Zero-point indicator (ZRO), Net weight indicator (NET), Gross weight indicator (GRS)
Isolation method	Transformer (power supply) and photocoupler (signal)
Occupied words	0 word
Parameter storage area	Calibration parameters and set values are saved in the internal EEPROM.
External power supply	24V DC, 48mA *Wiring length: 10m or less
Internal current consumption	5V DC, 120mA

(2) Names





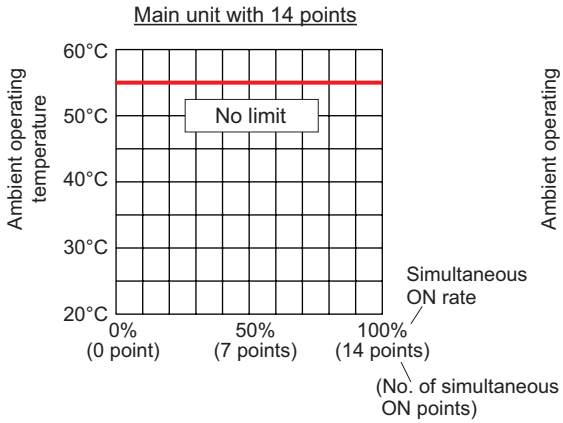
* For the detailed specifications of and how to use the high-precision load cell unit (Type: NA0FA-LC1), refer to the user's manual "High-precision Load Cell Unit (FEH530)."

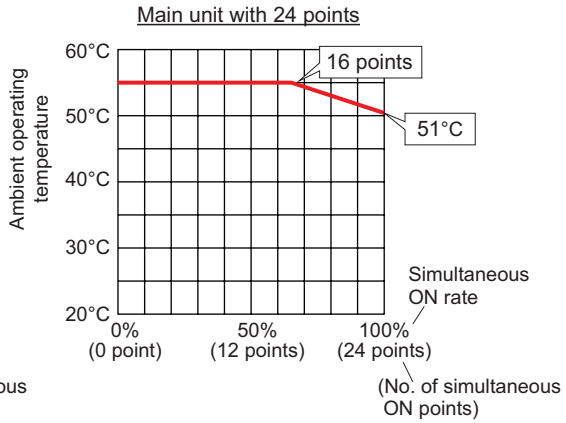
3-9 Temperature Derating of Main Unit

SPF main units have temperature derating limits for the No. of simultaneous ON points.
Expansion units have no temperature derating limits.

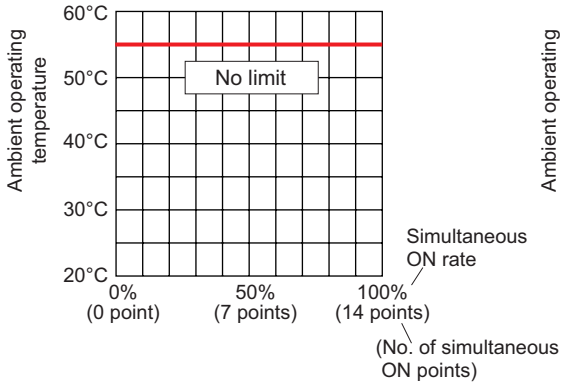
(1) Main unit with 14/24 points

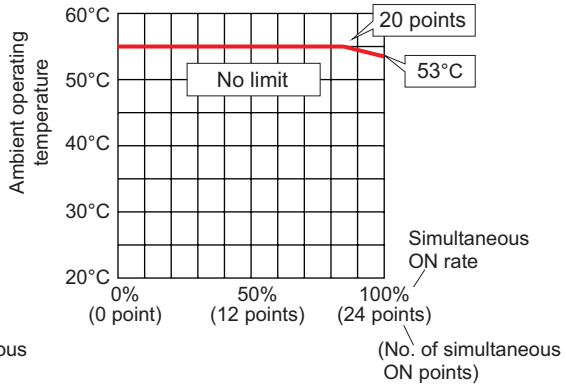
Advance main unit
(AC power supply/
24V DC power supply,
transistor output [0.1A])





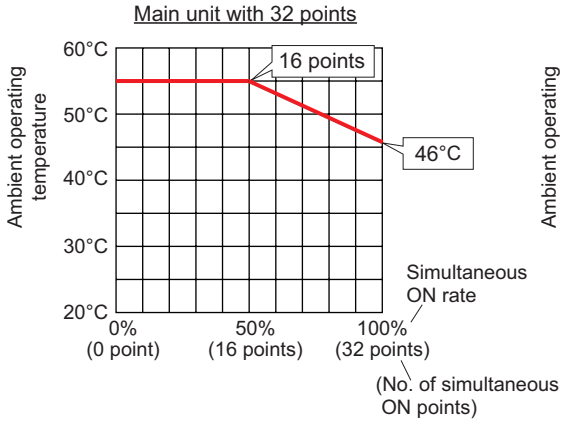
Basic main unit
(AC power supply/
24V DC power supply,
relay output [1A])

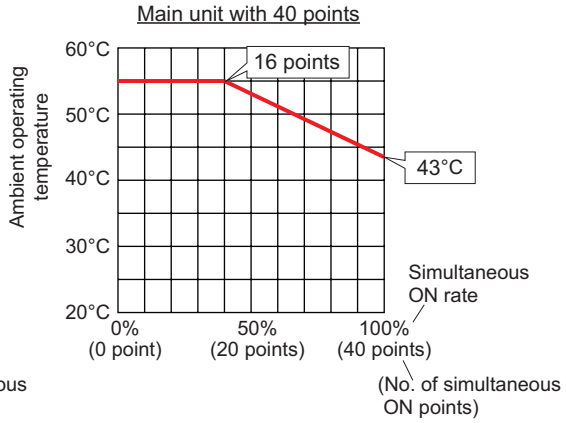




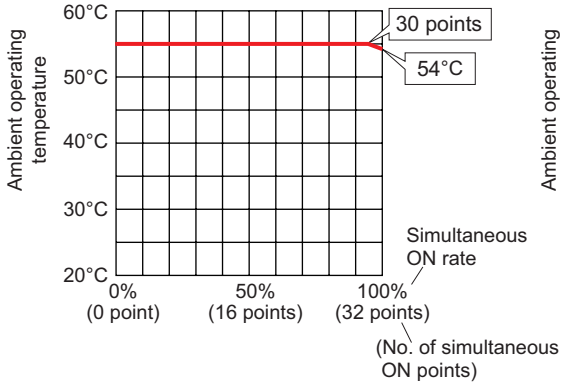
(2) Main unit with 32/40 points

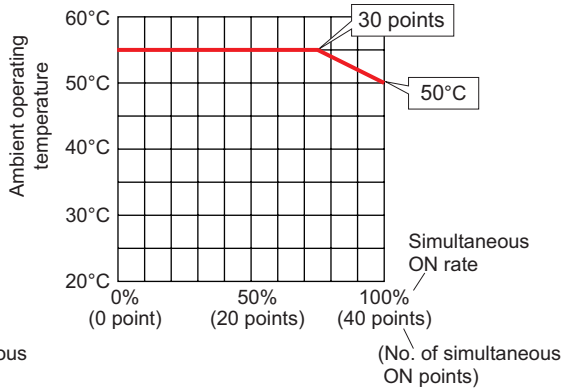
Advance main unit
(AC power supply/
24V DC power supply,
transistor output [0.1A])





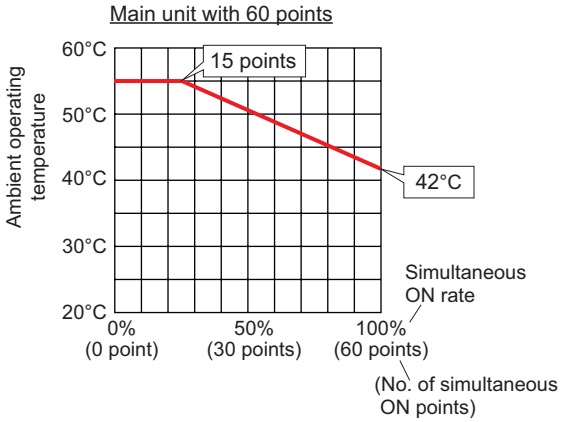
Basic main unit
(AC power supply/
24V DC power supply,
relay output [1A])



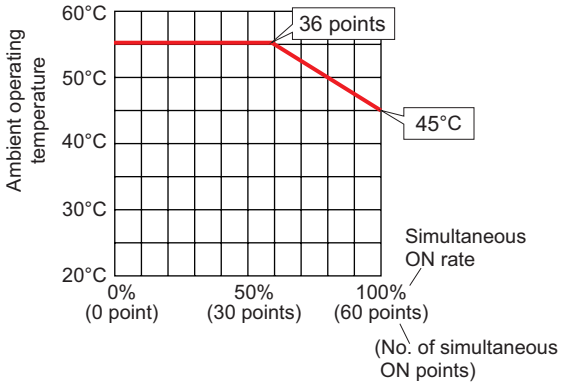


(3) Main unit with 60 points

Advance main unit
(AC power supply/
24V DC power supply,
transistor output [0.1A])



Basic main unit
(AC power supply/
24V DC power supply,
relay output [1A])

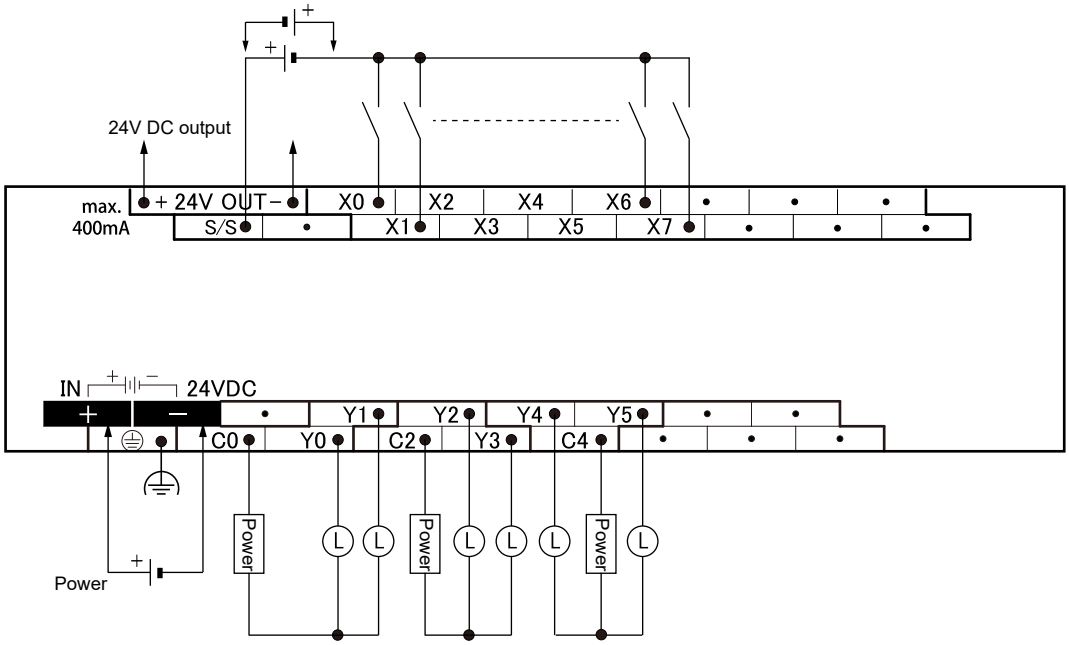


3-10 Terminal Arrangement and External Connection

3-10-1 Main unit

(1) Main unit with 14 points (8 points input / common, 2 points output / common x 3 circuits)

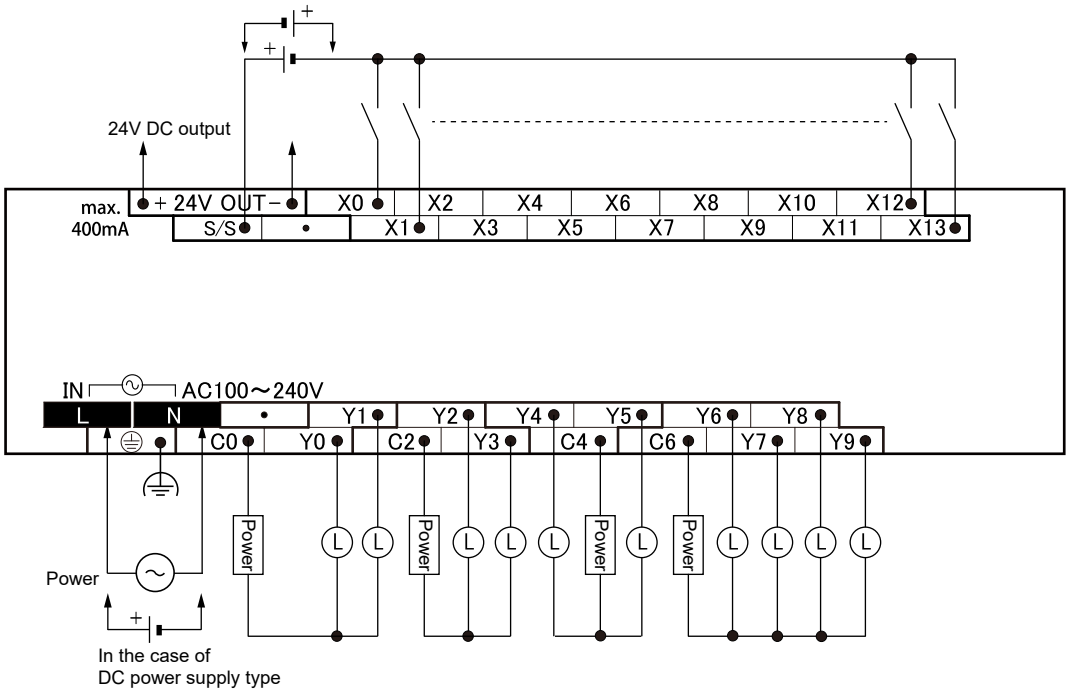
1) DC power supply type (NA0PA14T-34C, NA0PB14R-34C)



(2) Main unit with 24 points
(14 points input / common, 2 points output / common x 3 circuits, 4 points output / common)

1) AC power supply type (NA0PA24T-31C, NA0PB24R-31C)

2) DC power supply type (NA0PA24T-34C, NA0PB24R-34C)



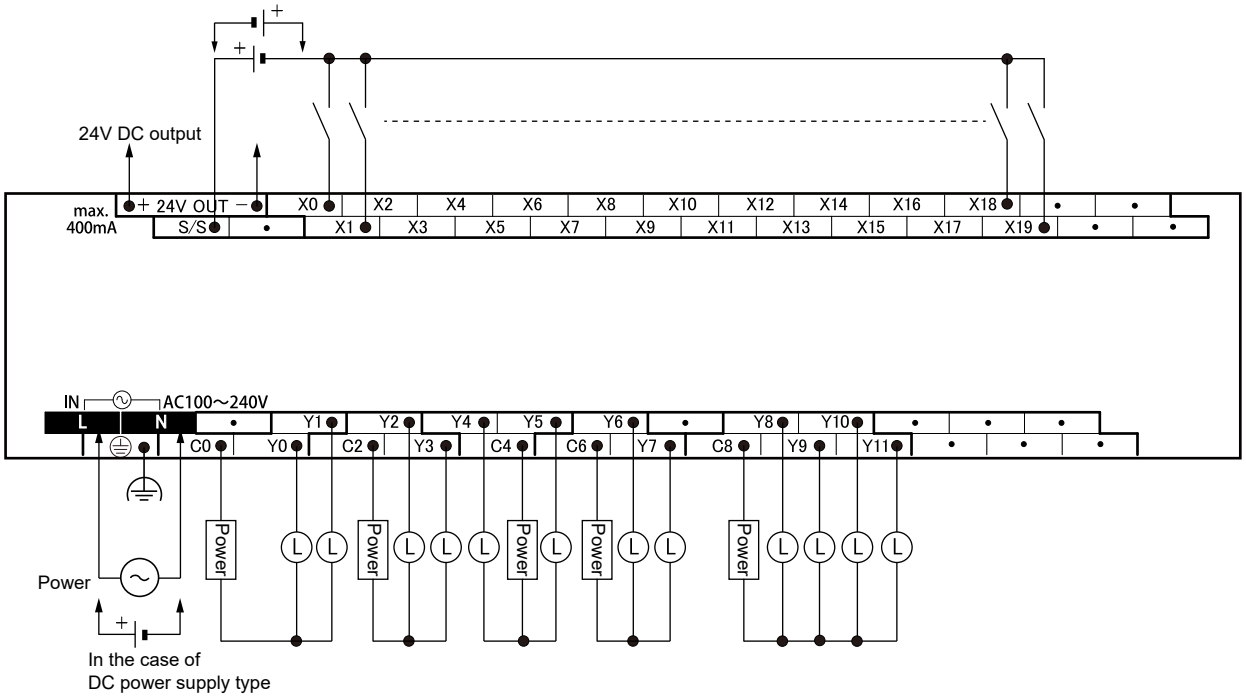
Notes:

"•" indicates an NC terminal, which cannot be wired to maintain necessary safety standards and prevent damage to the unit.

(3) Main unit with 32 points
(20 points input / common, 2 points output / common x 4 circuits, 4 points output / common)

1) AC power supply type (NA0PA32T-31C, NA0PB32R-31C)

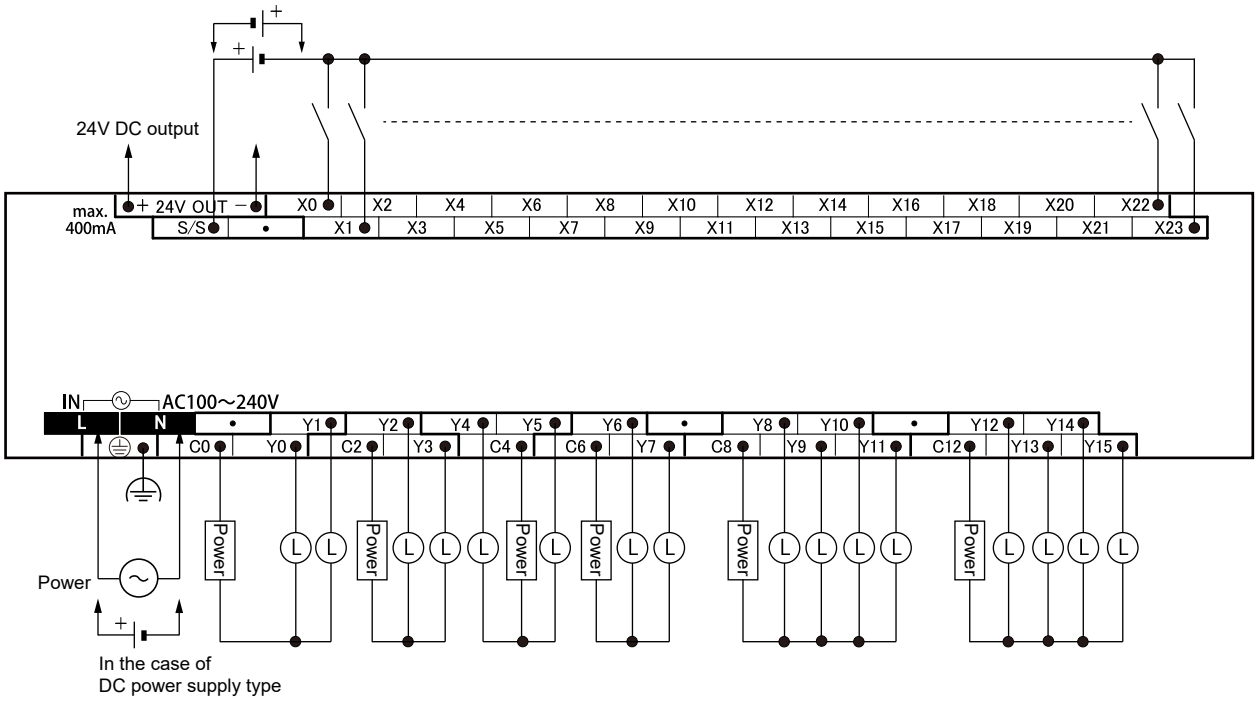
2) DC power supply type (NA0PA32T-34C, NA0PB32R-34C)



(4) Main unit with 40 points
(24 points input / common, 2 points output / common x 4 circuits, 4 points output / common x 2 circuits)

1) AC power supply type (NA0PA40T-31C, NA0PB40R-31C)

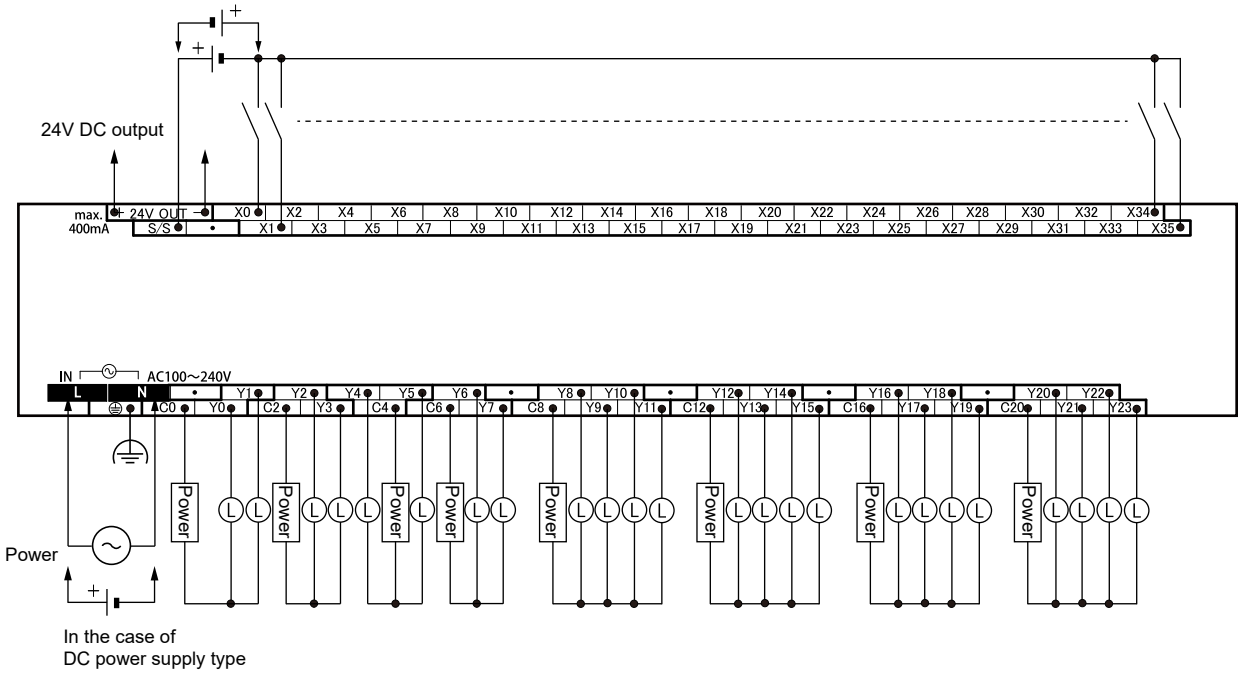
2) DC power supply type (NA0PA40T-34C, NA0PB40R-34C)



(5) Main unit with 60 points
(36 points input / common, 2 points output / common x 4 circuits, 4 points output / common x 4 circuits)

1) AC power supply type (NA0PA60T-31C, NA0PB60R-31C)

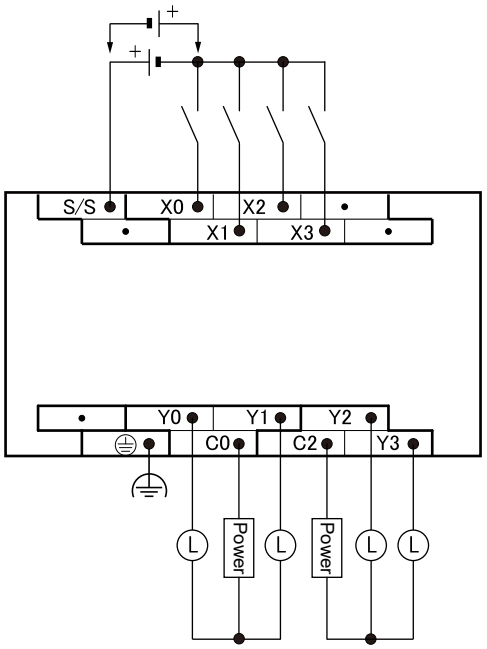
2) DC power supply type (NA0PA60T-34C, NA0PB60R-34C)



3-10-2 Expansion unit

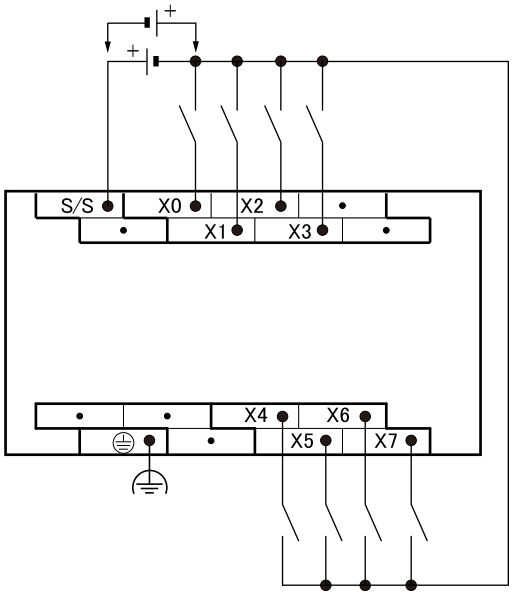
(1) Expansion unit with 8 points (4 points input / common, 2 points output / common x 2 circuits)

1) No power supply type (NA0E08R-3, NA0E08T-3)



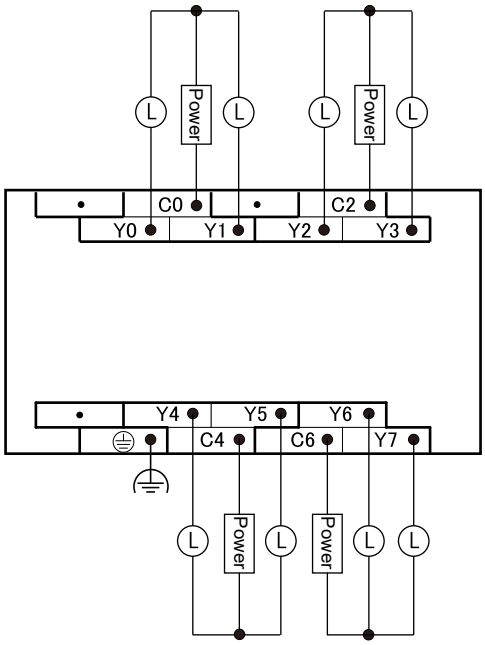
(2) Expansion unit with input 8 points (8 points input / common)

1) No power supply type (NA0E08X-3)



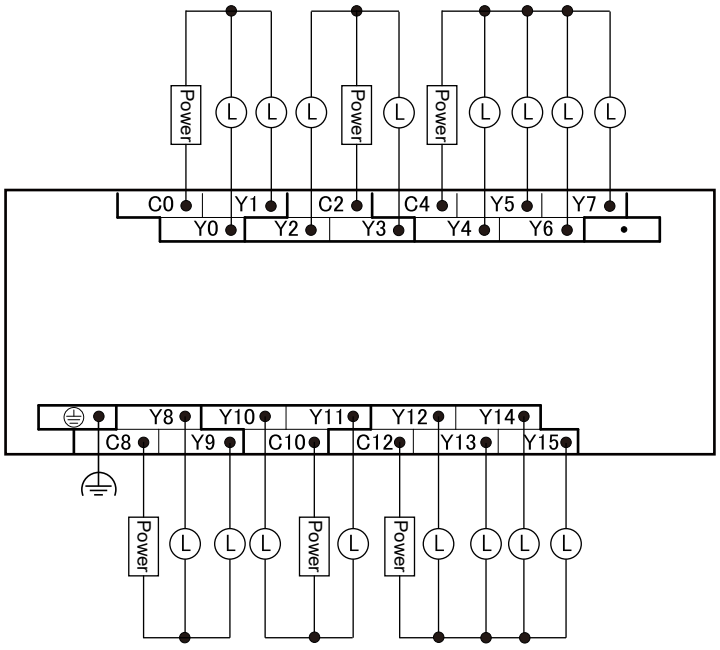
(3) Expansion unit with output 8 points (2 points output / common x 4 circuits)

1) No power supply type (NA0E08T-0)



(4) Expansion unit with output 16 points
(2 points output / common x 4 circuits, 4 points output / common x 2 circuits)

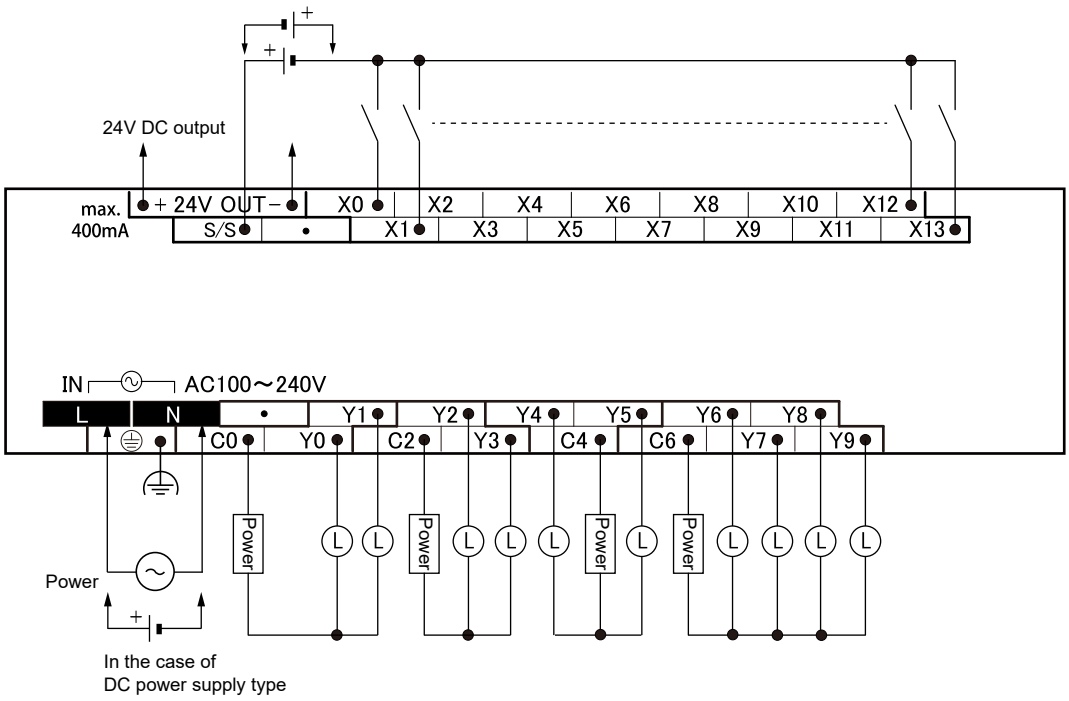
1) No power supply type (NA0E16R-0, NA0E16T-0)



(5) Expansion unit with 24 points
(14 points input / common, 2 points output / common x 3 circuits, 4 points output / common)

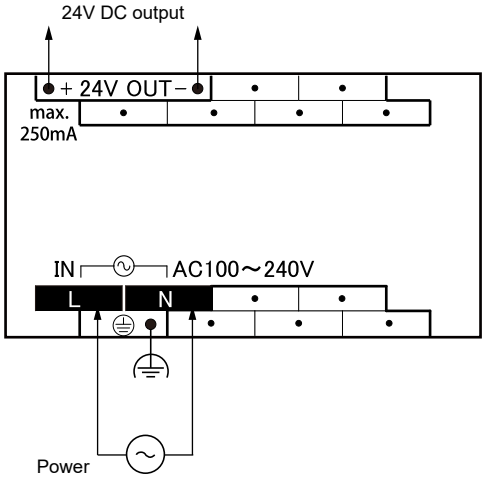
1) AC power supply type (NA0E24T-31)

2) DC power supply type (NA0E24R-34)

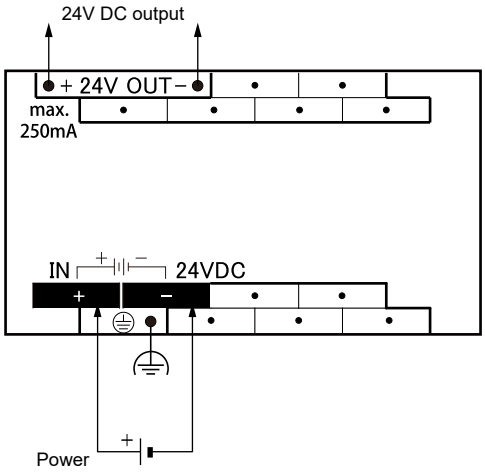


(6) Expansion power supply unit

1) AC power supply type (NA0S-2)



2) DC power supply type (NA0S-4)



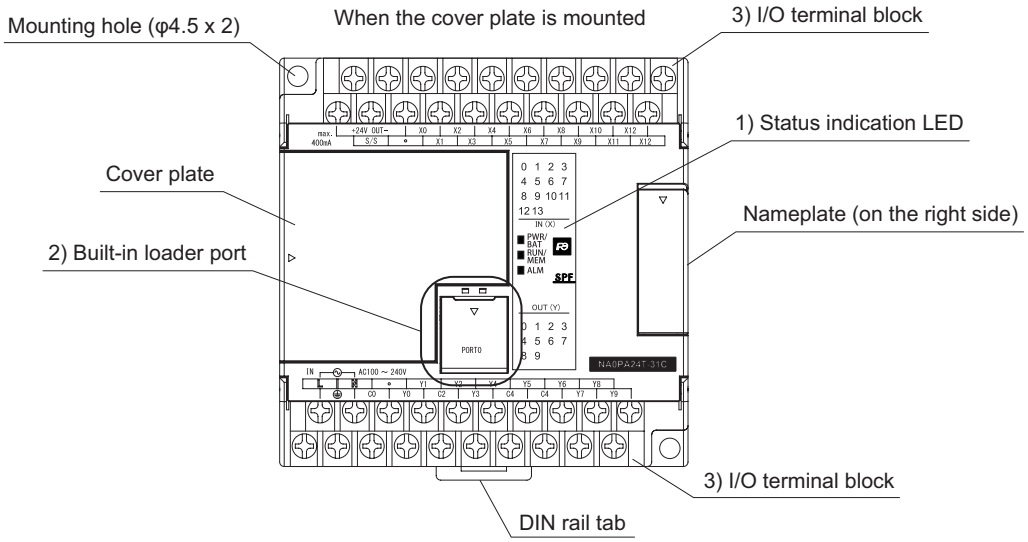
Section 3 Specifications

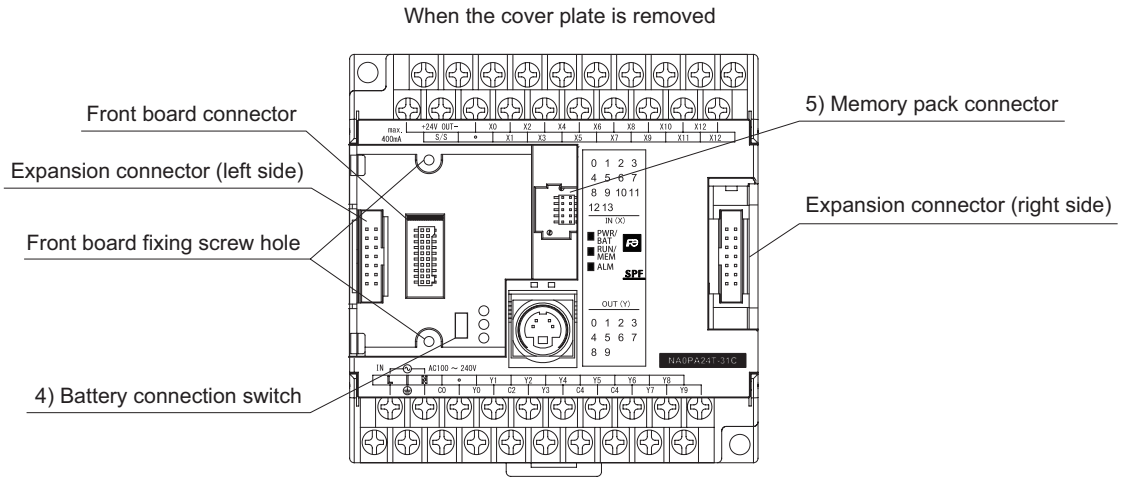
3-11 Names and Functions

3-11-1 Main unit

The following figure describes the names and functions of the main unit using a main unit with 24 points (Type: NA0PA24T-31C) as an example.

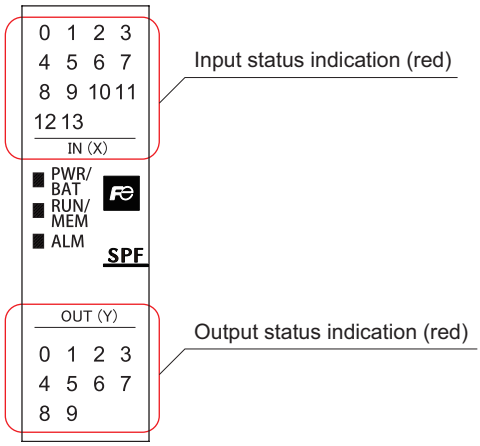
(1) Names





(2) Functions

1) Status indication LED



* The left figure shows the status indication LED of the main unit with 24 points.

PWR/BAT (red/orange)	RUN/MEM (green)	ALM (red)	Status
ON (red)	ON	OFF	The CPU is running normally.
ON (red)	OFF	OFF	The CPU is stopped normally.
ON (red)	Blinks	OFF	A program is being downloaded. (A program is being downloaded while the PLC is stopped or being rewritten while the PLC is running)
ON (red)	ON	Blinks	The CPU is running in a nonfatal fault condition.
ON (red)	Blinks	Blinks	A program is being rewritten while the PLC is running when the CPU is running in a nonfatal fault condition.
ON (red)	Blinks	Blinks	A program is being downloaded when the CPU is stopped in a fatal fault condition.
ON (red)	OFF	Blinks	The CPU is stopped in a fatal or nonfatal fault condition.
Blinks alternately in red and orange	–	–	Battery voltage is low or the battery connection switch is OFF
ON (red)	OFF	Blinks at high speed	A unit fault has occurred. (system ROM or system RAM error)

2) Built-in loader port (PORT 0)

The built-in loader port is used to connect a personal computer loader.
Use a dedicated cable (Type: NA0H-CUV [1.8m]) to connect a personal computer loader.

* For the loader connecting cable (NA0H-CUV), the lock function has been added to the connector on the SPF side. Shipment of loader connecting cables with lock is scheduled to begin in December 2018 (Note 1).

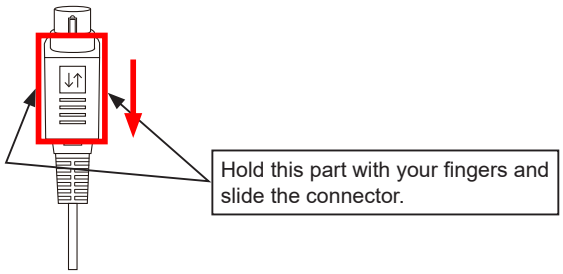
Loader connecting cable with lock (current product)		Loader connecting cable with no lock (old-type product)	
(Connector surface)	(Connector side view)	(Connector surface)	(Connector side view)
			

Notes:

1) The timing of the change to loader connecting cables with lock may slightly vary.

<How to remove a connector with lock>

To remove a loader connecting cable with lock from the SPF unit, hold the connector of the cable, and then slide and pull it out.



Notes:

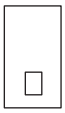
2) When removing a loader connecting cable inserted to an SPF unit, be sure to slide the connector to pull it out. Otherwise, the cable and the connector part of the SPF unit may be damaged.

3) I/O terminal block

Upper side: Terminals for external power supply (24V DC, 400mA) and input terminals
Lower side: Terminals for power supply to control the unit and output terminals

* The tightening torque: 0.59 to 0.78N·m.
* For the details of the signal assignment and wiring method, see “3-10 Terminal Arrangement and External Connection.”
* The terminal blocks of advance main units (NA0PA***) are detachable.
  The terminal blocks of basic main units (NA0PB***) are not detachable.
  However, for NA0PB32R-31C, NA0PB40R-31C, and NA0PB60R-31C, the terminal block is detachable.

4) Battery connection switch



ON (upper side) : The battery is internally connected to the PLC.
OFF (lower side): The battery is internally disconnected from the PLC (factory default setting).

* When you start using the main unit, set the battery connection switch to ON.
  For details, “3-2-2 Memory backup and internal battery specifications.”

5) Memory pack connector

A memory pack for user ROM operation and data storage is connected.

• Memory pack (Type: NA8PMF-20)

Protect switch

ON (upper side): Write protected
OFF (lower side): Write enabled

(Right side face when mounted)

• Operation when a memory pack is mounted

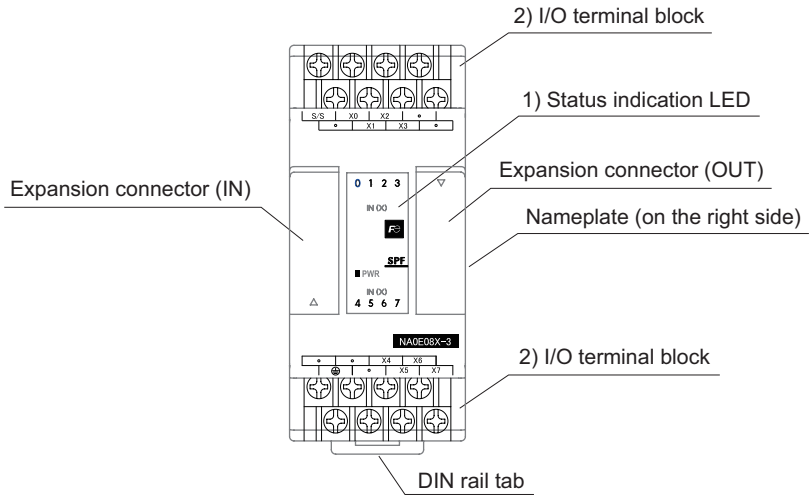
Item	Protect switch OFF	Protect switch ON
When the main unit is powered on	Operation is performed with the project in the built-in flash memory	Operation is performed with the project in the memory pack
Execution of project downloading	The project is also stored in the memory pack.	Not possible (CPU memory access error)
Execution of resource initialization	The project in the memory pack is also cleared.	Not possible (Clearing failed.)
Data writing to the memory pack	Data can be written.	Data can be written.

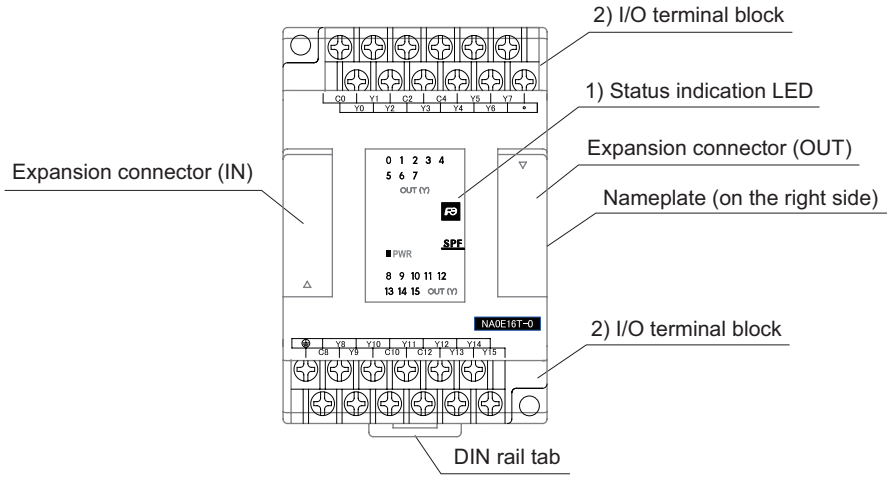
• How to perform operation with a project in the memory pack (user ROM operation)

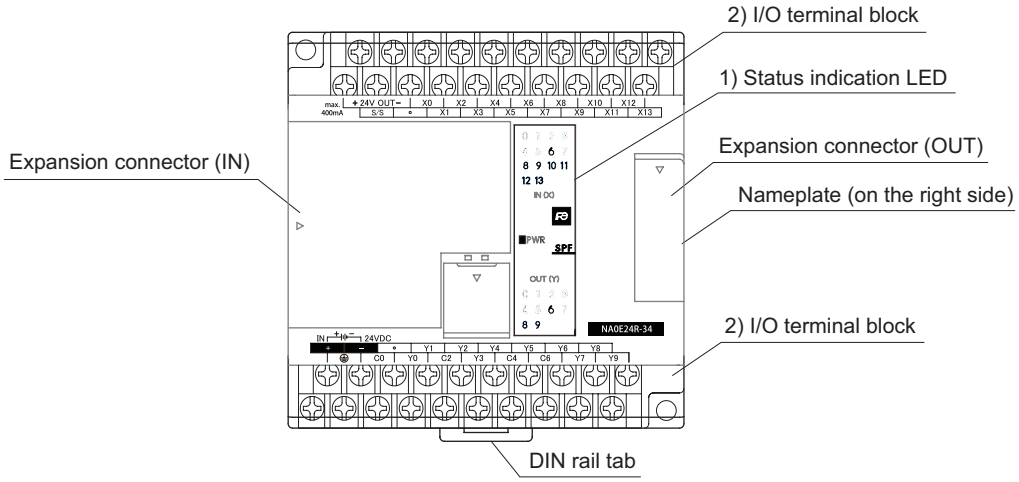
1) Power off the main unit.
2) Turn off the protect switch of the memory pack and mount it on the main unit.
3) Power on the main unit and download a project from the loader.
4) Power off the main unit.
5) Remove the memory pack from the main unit, turn on the protect switch, and then mount it on the main unit again.
6) Power on the main unit.
   (Operation starts with the project in the memory pack.)

3-11-2 Expansion unit

(1) Names

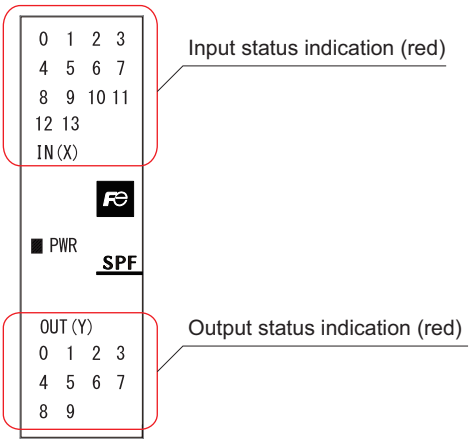






(2) Functions

1) Status indication LED



* The left figure shows the status indication LED of the expansion unit with 24 points.

PWR (red)	Status	
ON (red)	Power is being supplied normally.	
OFF	Unit with power supply:	The power supply of the main unit is OFF or the expansion cable is disconnected.
	Unit without power supply:	The power supply is OFF.

3) I/O terminal block

* The tightening torque: 0.59 to 0.78N·m.
* For the details of the signal assignment and wiring method, see “3-10 Terminal Arrangement and External Connection.”
* The terminal blocks of expansion units are not detachable.

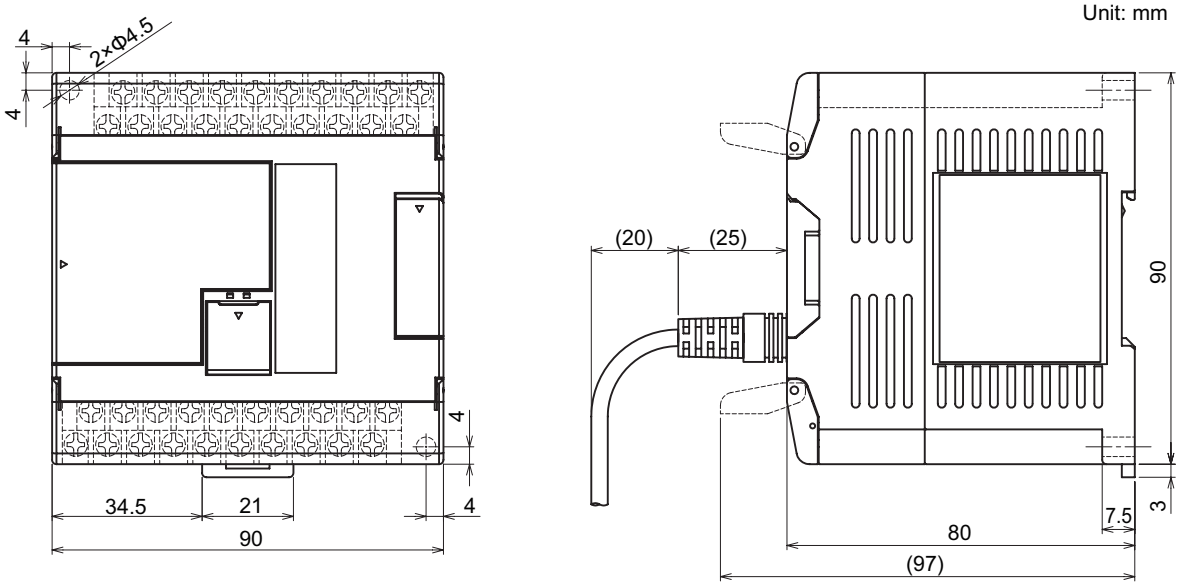
3-12 Dimensions

3-12-1 Main unit

(1) Main unit with 14/24 points

The main unit with 14 points and the main unit with 24 points have the same dimensions.
Target type: NA0PA14T-34C, NA0PB14R-34C
: NA0PA24T-34C, NA0PA24T-31C, NA0PB24R-34C, NA0PB24R-31C

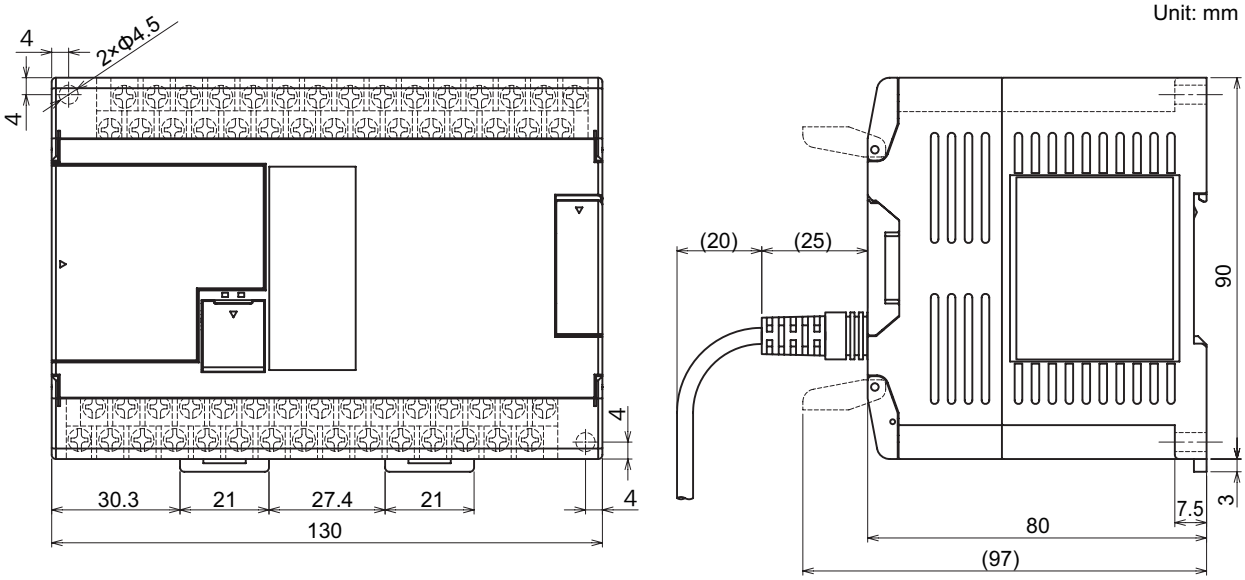
Unit: mm



(2) Main unit with 32/40 points

The main unit with 32 points and the main unit with 40 points have the same dimensions.
Target type: NA0PA32T-34C, NA0PA32T-31C, NA0PB32R-34C, NA0PB32R-31C
: NA0PA40T-34C, NA0PA40T-31C, NA0PB40R-34C, NA0PB40R-31C

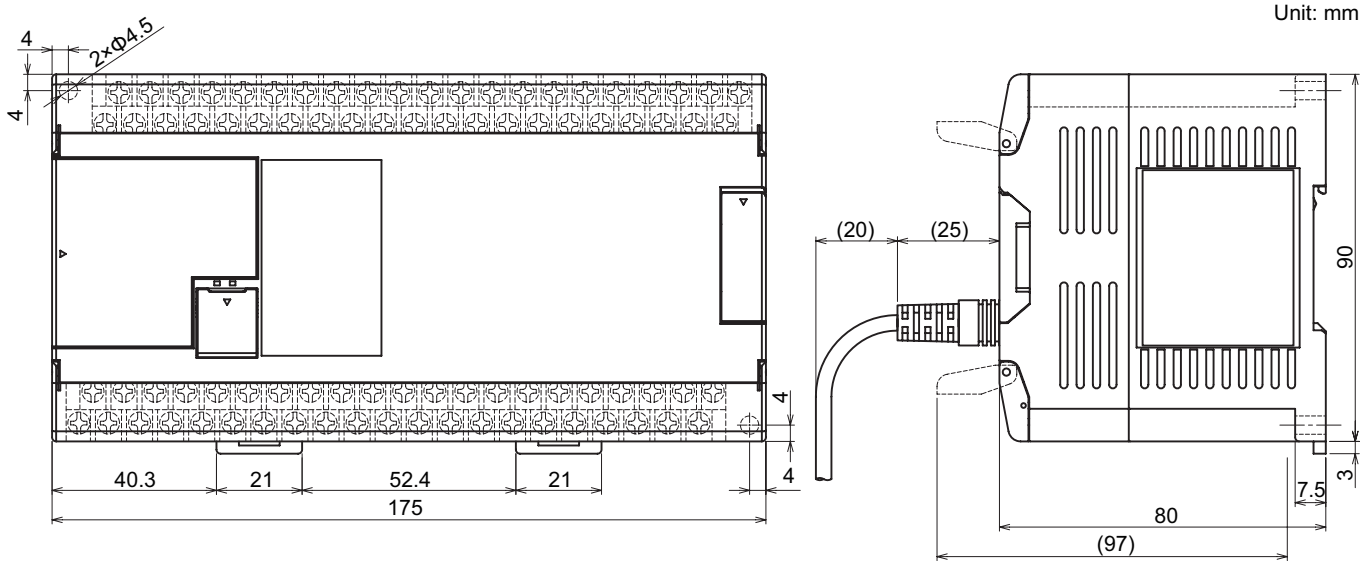
Unit: mm



(3) Main unit with 60 points

Target type: NA0PA60T-34C, NA0PA60T-31C, NA0PB60R-34C, NA0PB60R-31C

Unit: mm

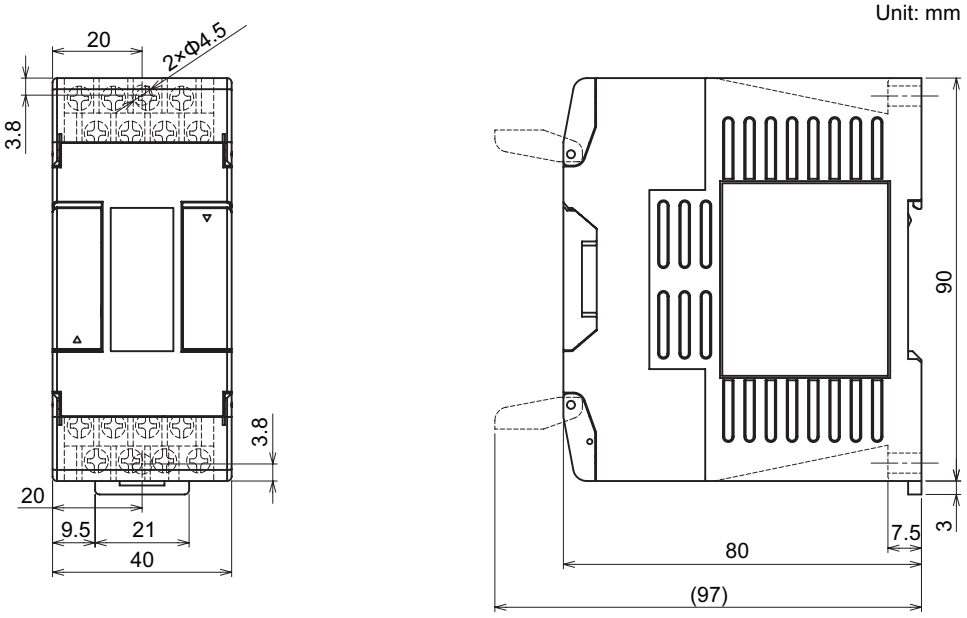


3-12-2 Expansion unit

(1) Expansion unit with 8 points, AIO expansion unit, Load cell unit, Expansion power supply unit, High-precision load cell unit

Target type: NA0E08R-3, NA0E08T-3, NA0E08X-3, NA0E08T-0,
NA0AX06-MR, NA0AY02-MR, NA0AW06-MR, NA0AX02-TC, NA0AX06-TC, NA0AX06-PT,
NA0F-LC1, NA0S-2, NA0S-4, NA0FA-LC1

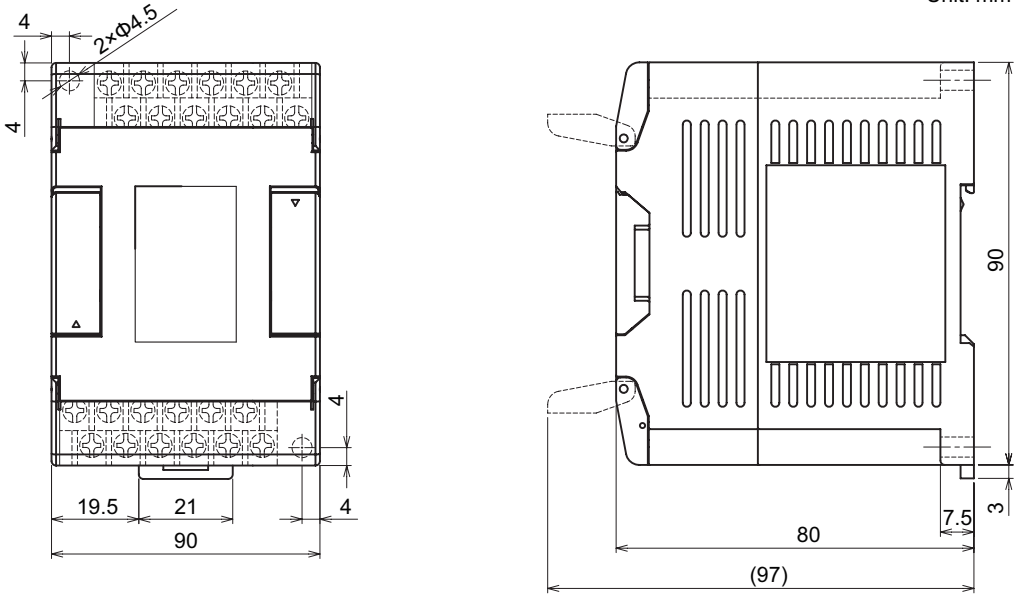
Unit: mm



(2) Expansion unit with 16 points

Target type: NA0E16R-0, NA0E16T-0

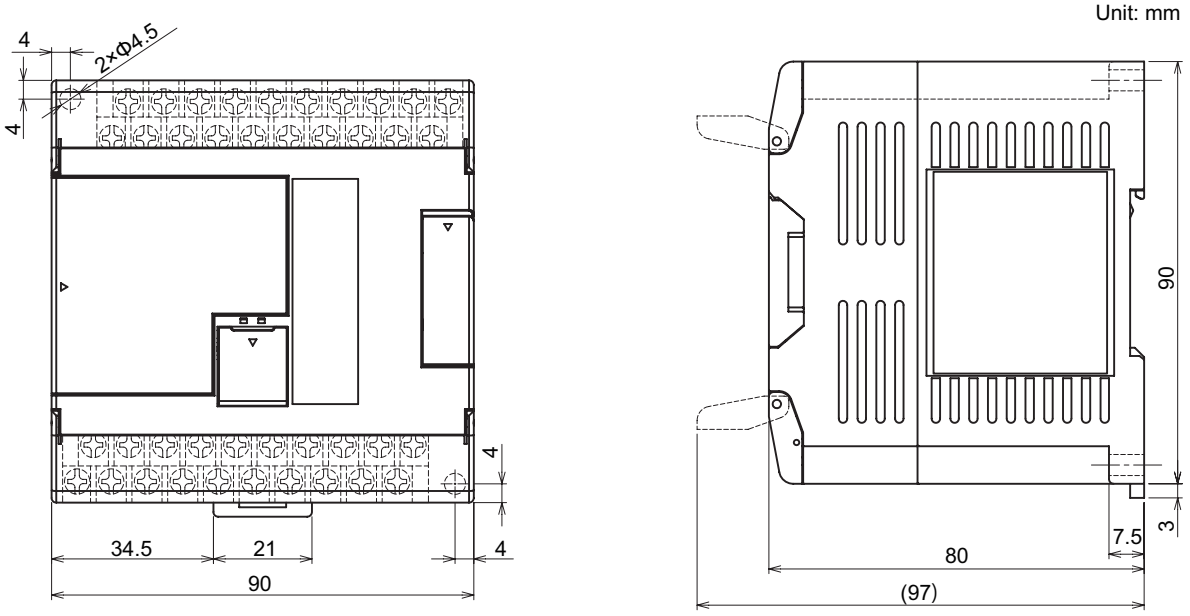
Unit: mm



(3) Expansion unit with 24 points, Temperature measurement unit 16CH

Target type: NA0E24R-34, NA0E24T-31, NA0AX16-TC

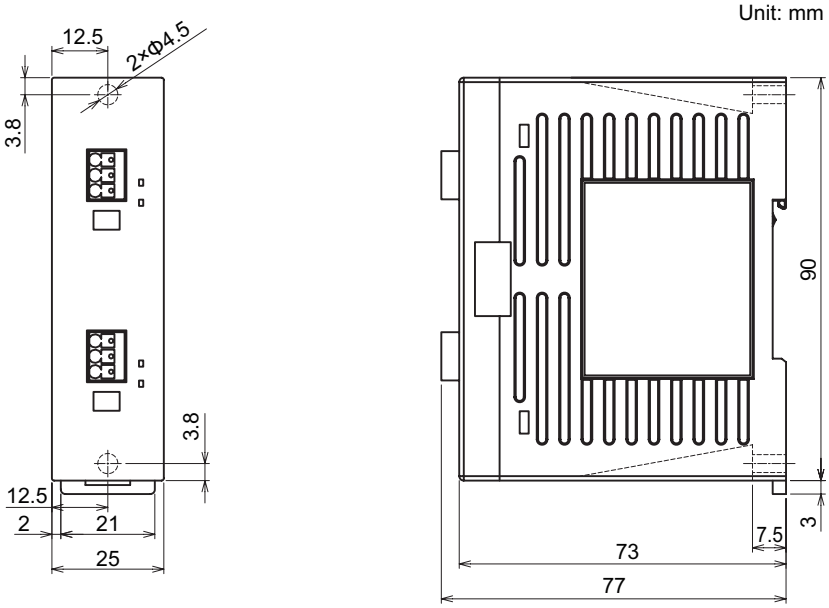
Unit: mm



(4) Communication unit

Target type: NA0LA-RS5, NA0LA-RS3, NA0LA-ET1

Unit: mm

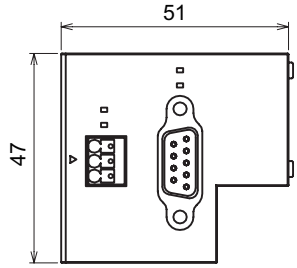


* The above figure shows the appearance of NA0LA-RS5. NA0LA-RS3 has the same dimensions.

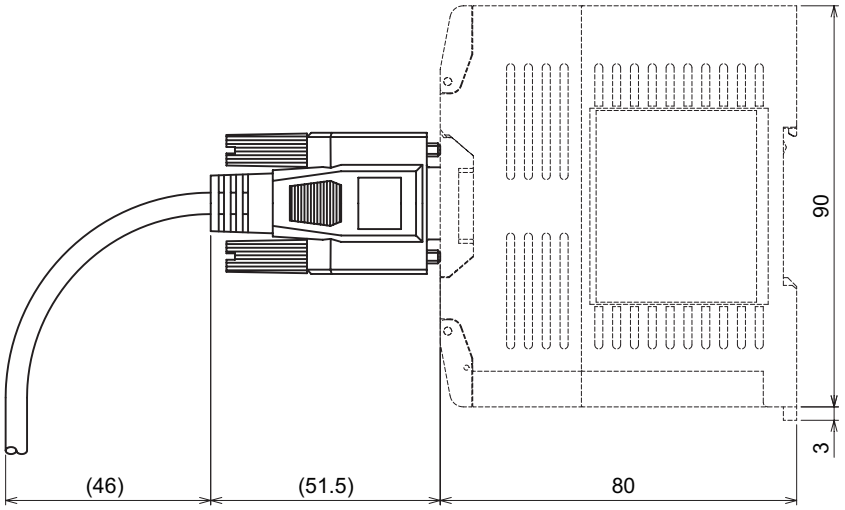
(5) Communication board, AIO board

Target type: NA3LA-RS1, NA3LA-ET1, NA3AY02-MR, NA3AW03-MR

Unit: mm



* The above figure shows the appearance of NA3LA-RS1. NA3AY02-MR and NA3AW03-MR have the same dimensions.



(6) Healthy unit

Target type: NA8P-HE

Unit: mm

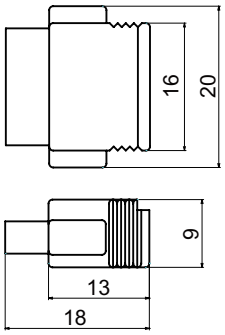
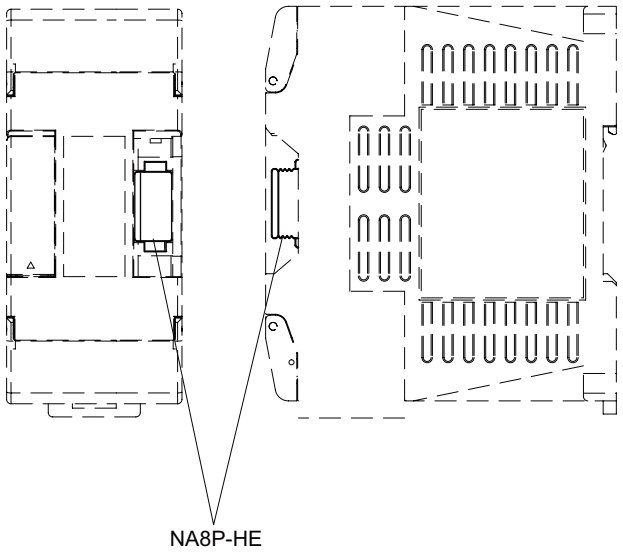


Diagram for when healthy unit is mounted



3-13 Mass

(1) Main unit

Type	Mass
NA0PB14R-34C	Approx. 400g
NA0PB24R-34C	Approx. 420g
NA0PB32R-34C	Approx. 450g
NA0PB40R-34C	Approx. 480g
NA0PB60R-34C	Approx. 680g
NA0PB24R-31C	Approx. 400g
NA0PB32R-31C	Approx. 500g
NA0PB40R-31C	Approx. 540g
NA0PB60R-31C	Approx. 660g
NA0PA14T-34C	Approx. 450g
NA0PA24T-34C	Approx. 460g
NA0PA32T-34C	Approx. 580g
NA0PA40T-34C	Approx. 580g
NA0PA60T-34C	Approx. 730g
NA0PA24T-31C	Approx. 440g
NA0PA32T-31C	Approx. 560g
NA0PA40T-31C	Approx. 560g
NA0PA60T-31C	Approx. 710g

(2) Expansion unit

Type	Mass
NA0E24R-34	Approx. 310g
NA0E24T-31	Approx. 390g
NA0E08R-3	Approx. 150g
NA0E08X-3	Approx. 140g
NA0E16T-0	Approx. 220g

(3) Expansion power supply unit

Type	Mass
NA0S-2	Approx. 210g
NA0S-4	Approx. 200g

(4) Analog board/unit

Type	Mass
NA0AX06-MR	Approx. 160g
NA0AY02-MR	Approx. 140g
NA0AW06-MR	Approx. 160g
NA0AX02-TC	Approx. 130g
NA0AX06-TC	Approx. 140g
NA0AX16-TC	Approx. 310g
NA0AX06-PT	Approx. 140g
NA3AY02-MR	Approx. 20g
NA3AW03-MR	Approx. 20g

(5) Communication unit/board

Type	Mass
NA3LA-RS1	Approx. 30g
NA3LA-ET1	Approx. 20g
NA0LA-RS3	Approx. 80g
NA0LA-RS5	Approx. 50g
NA0LA-ET1	Approx. 80g

(6) Function unit

Type	Mass
NA0F-LC1	Approx. 150g
NA0FA-LC1	Approx. 140g

Section 4 Installation and Wiring

Section 4 Installation and Wiring

4-1 Installation Precautions

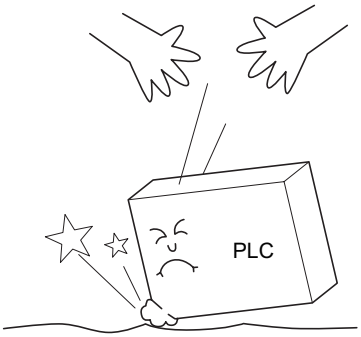
This section describes the precautions related to installation and wiring that must be observed in order to ensure high reliability and performance of this system. Those calling for special attention are indicated below.

4-1-1 Installation Environment

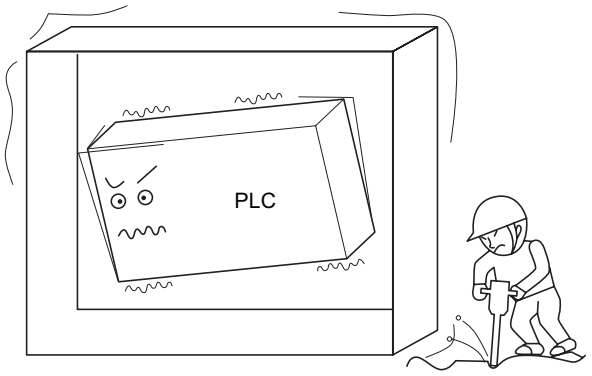
Handle with care.

⚠ Caution — Do not install or use the product as shown below.
Doing so may cause damage, malfunction, or failure of the product.

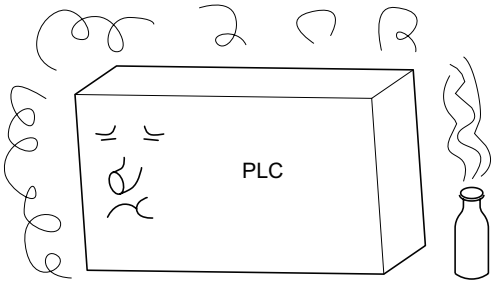
1) Do not drop or bring down the product.



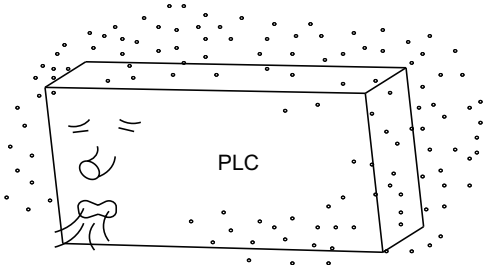
2) Do not install the unit in locations which are subject to excessive vibration.



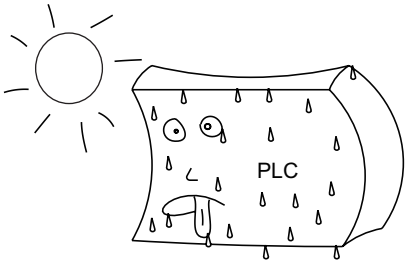
3) Do not install the unit in locations where corrosive gas is present.

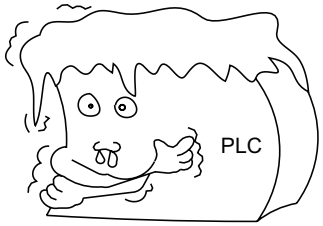


4) Do not install the unit in locations where there is a lot of dust, conductive particles such as steel particles or oil mist, or high salinity.



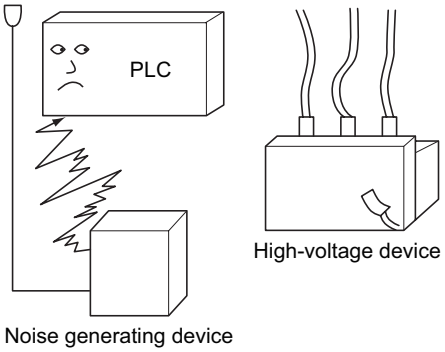
5) Do not use the unit in places with high temperature and high humidity or with temperature too low.
(Locations where condensation may occur because of rapid temperature changes.)
{Operating temperature: 0 to 55°C
Operating humidity: 20 to 95%RH (without condensation)}



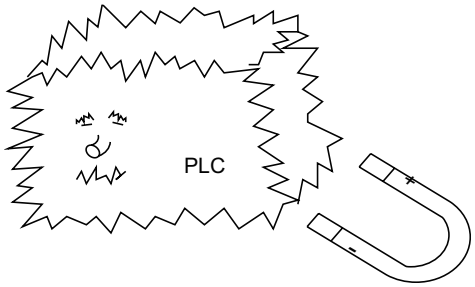


6) Do not mount the unit on a panel in which high-voltage devices (3000V, 6000V or higher) are mounted.

7) Do not use the same power supply which supplies the power to a noise generating device.



8) Do not install the unit in locations where a strong electric or magnetic field is generated.



4-1-2 Before installation

(1) Check the product

When you unpack the product, check to see
1) That the product is as ordered, and
2) That the product is not damaged, and
3) That accessories are included as specified.

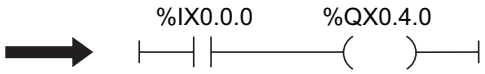
(2) Operation check of the main unit

This check is performed to see that the product you received operates normally before it is installed in the control panel. The purpose of this check is to detect as early as possible any defects that might have occurred in the product during transportation. Therefore, it is recommended that you perform this check for sure.
1) Wiring the power terminals
2) Checking PLC operation using a test program

Load the following program into PLC internal memory and test PLC operation. If the PLC operates normally, proceed to the next step (installing the PLC in a control panel). If the PLC does not operate normally, ensure the power supply connection, power voltage, and the program are correct.

Ladder representation

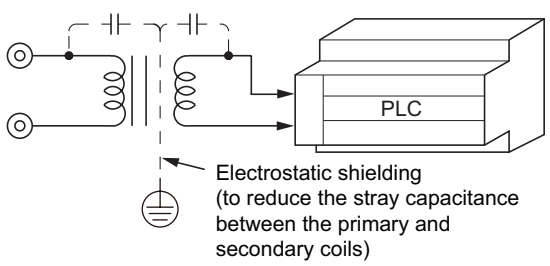
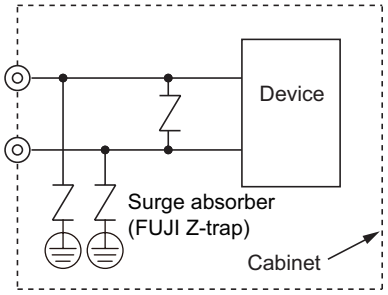
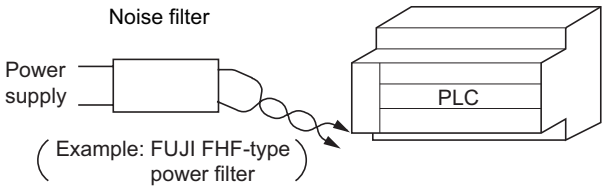
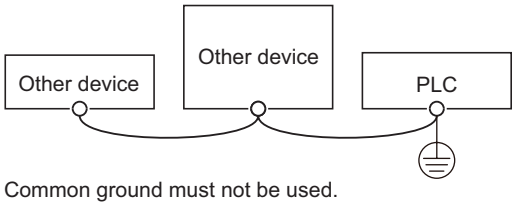
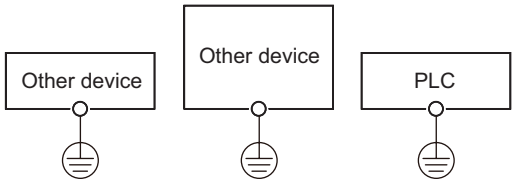
Program

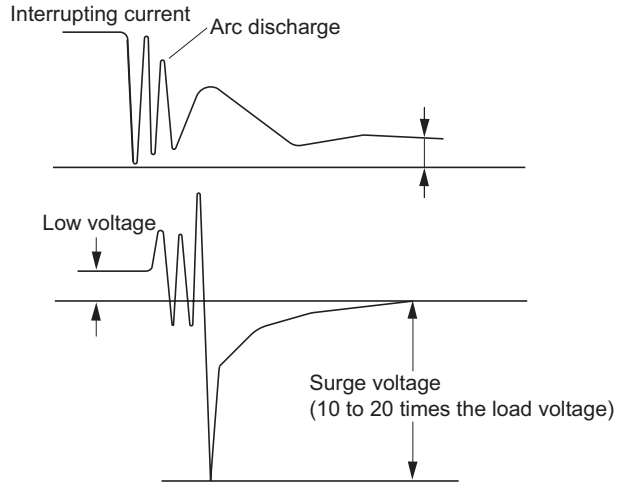
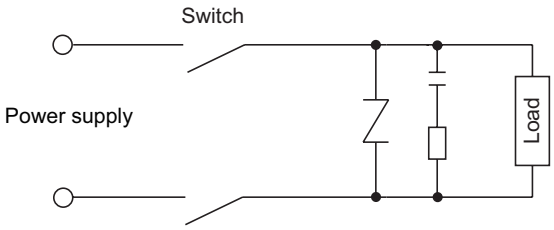
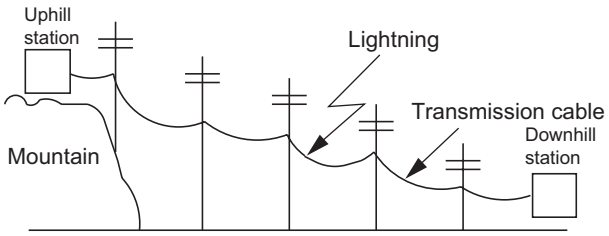
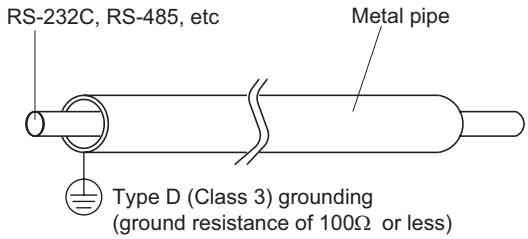
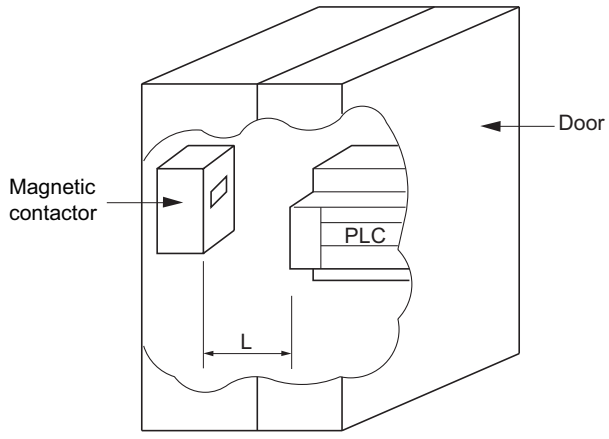
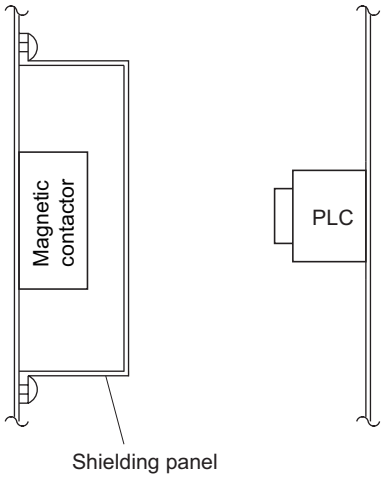


Notes:
Specify addresses that conform to the user's PLC.

4-1-3 Control panel mounting (protection against noise)

The SPF series products are especially immure to noise pickup. However, it is always recommended to take the following measures to further enhance system reliability.

No.	Cause of noise	Countermeasure
1	Noise via power-supply terminals • Lightning surge • Internal surge (switching surge)	1) An isolation transformer should be used.  2) An isolation transformer should be used. 
2	High-frequency noise	○A noise filter should be used. Twisted pair wires should be used between the noise filter and power-supply terminals of the PLC. 
3	Noise input via common ground line  Common ground must not be used.	○The following figure shows optimum individual grounds.  Type D (Class 3) grounding (ground resistance of 100Ω or less)
4	Noise via ground of the secondary coils of a transformer	• The secondary side of the isolation transformer should not be grounded as shown in the above Item 1.

No.	Cause of noise	Countermeasure
5	When inductive load current is interrupted by a switch, high voltage is induced between the two ends of the load, which may affect the PLC. 	1) A diode, varistor or RC should be connected to the DC load. 2) A RC should be connected to the AC load. (Example) 
6	Malfunction due to external I/O signal lines bound together with or installed near a high-voltage cable or power cable (Electromagnetic inducation, electrostatic induction)	○ I/O lines should be separated from other cables and should not be wired in the same panel or pit. Duct, independent cable pipe or metal pipe (as shown below) should be used for isolation.
7	Transmission cable malfunction or damage caused by lightning surge 	○ Transmission cables should run through underground metal pipes or in an electrical duct. The metal pipes should be grounded. 
8	Malfunction of PLC located near device that generates a switching arc  When the control panel door closed, if the distance L between the PLC front panel and magnetic contactor is 50mm or less, the PLC malfunctions due to the switching arc generated by the magnetic contactor.	○ The device layout should be changed or a shielding panel should be installed. (Example) 

4-1-4 Environmental condition for mounting PLC on panel

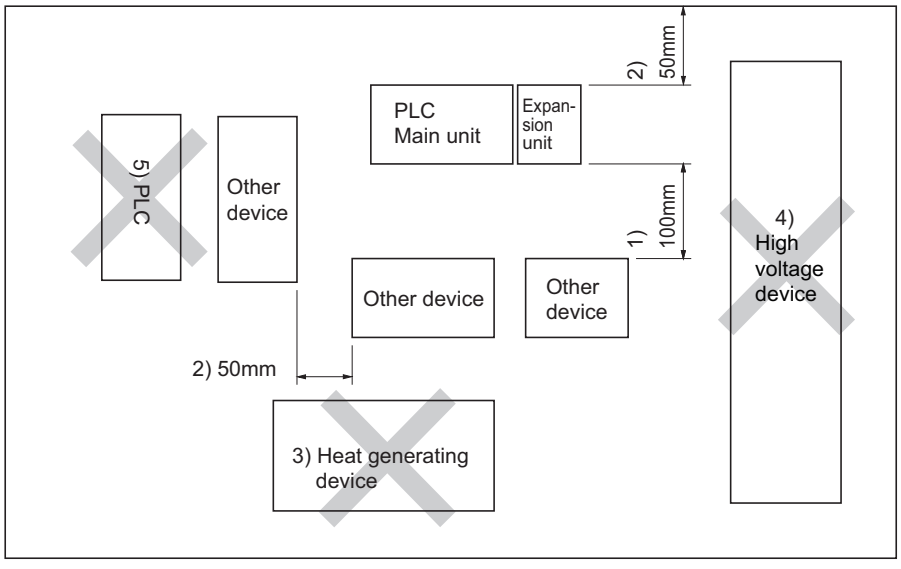
⚠ Caution

- Use this PLC in the environment described below.
  High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock might cause electric shock, fire, erratic operation or failure.
- Keep an open space around the PLC as shown below to obtain sufficient ventilation, otherwise, abnormal temperature rise or failure occurs.

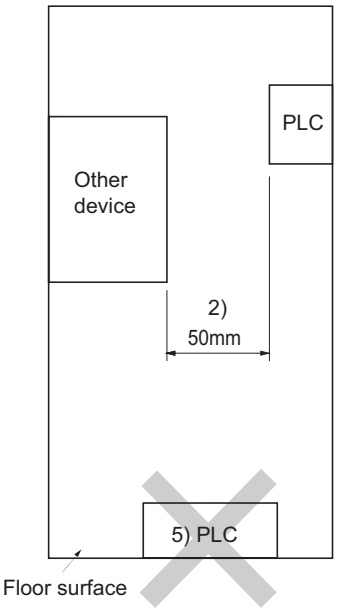
FUJI PLCs are reliable because they provide excellent resistance against environmental conditions. Note that system reliability and operational safety can be further improved by observing the following precautions.

Item	Specifications	Remarks
Temperature	• The PLC must be operated in the environment from 0 to 55°C according to specification of components. • The PLC should not be installed where it will be exposed to direct sunlight.	• To maintain the ambient temperature within the specified range, a fan or air-conditioner must be introduced in case of excessively high ambient temperature or a heater must be installed in the panel in case of excessively low ambient temperature.
Humidity	• The relative humidity must be from 20 to 95%. • Condensation due to sudden temperature changes must be avoided.	• In winter, condensation may be caused by temperature change when a room-heater is turned ON and OFF. This condition must be avoided by leaving the room-heater on even during the night or by other measures.
Vibration	• 19.6 m/s^2 (screw mounting)	• In case of excessive vibration, secure the panel with vibration-absorbing rubber or reduce vibration by improving the building structure and floor strength.
Shock	• 98 m/s^2 (rail mounting)	
Atmosphere	• Corrosive gases must be prevented.	• If there are harmful gases, air-purging inside the panel must be introduced. (air-filteration)
PLC layout	1) Keep all units at least 100mm apart vertically. Otherwise, excessive temperature rise may occur. 2) Keep units at least 50mm away from other devices and the building structure to ensure appropriate ventilation. 3) Heat-generating devices (heaters, transformers and resistors) must not be installed directly under the PLC. 4) The PLC must be isolated (shielded) from high-voltage devices, high-voltage cables and power equipment as far as possible. PLC I/O cables must not be run parallel with the cables for those devices. 5) The PLC must be installed in a vertical position. Installing the PLC on a level (as shown in illustration below) will cause adverse thermal affects on the device.	

Front view



Side view

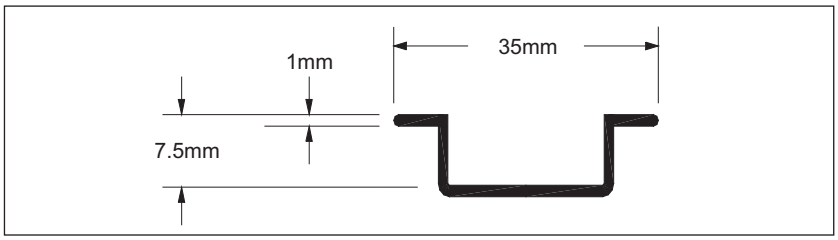


4-1-5 Mounting methods

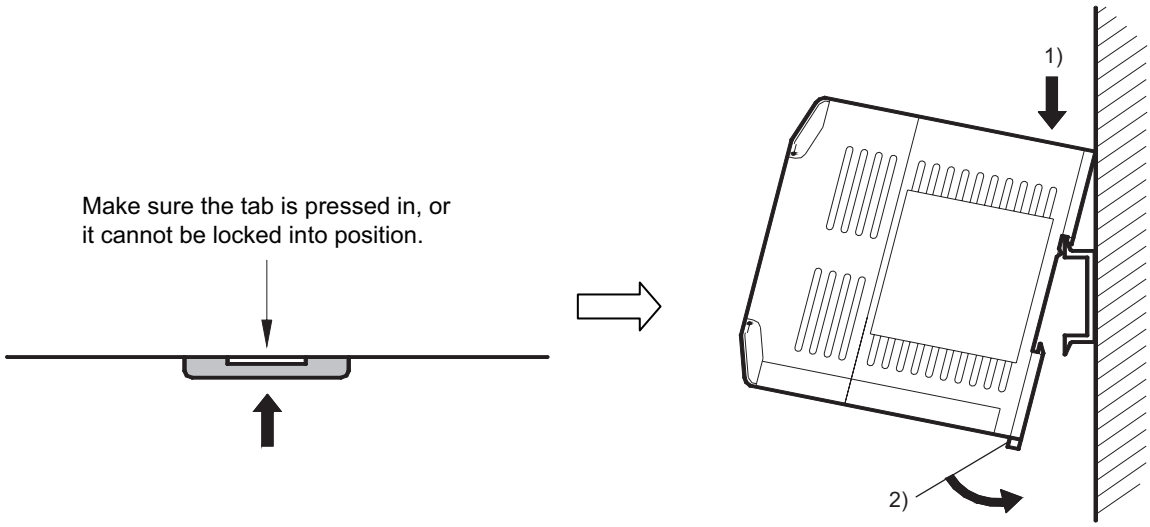
There are two methods for mounting the unit in the panel: screw mounting and rail mounting. Be careful to note that, as compared with screw mounting, rail mounting is, on the one hand, advantageous in ease of mounting and removal, but on the other hand has the disadvantage of being vulnerable to vibration or shock.

(1) Mounting with a DIN rail

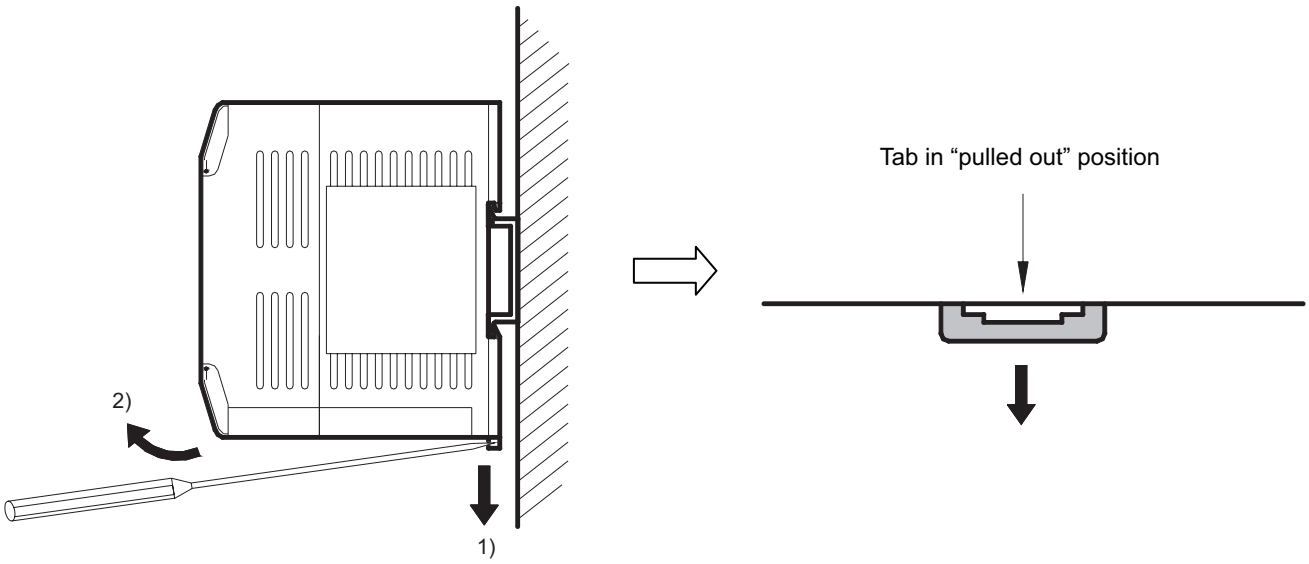
You can use a DIN rail to mount a unit in locations not to subject to a vibration of 0.5G or more. As shown in the figure below, use DIN EN50022 DIN rail.



Mounting a unit ⇨ Hold the unit facing its front, press it down with a 15 degree tilt onto the DIN RAIL. Swing it down until the upper edge of DIN RAIL groove on the unit back touches the upper tab of DIN RAIL. Then use this locked-in point as a pivot to press the unit forward on the bottom and lock it in position. The procedure is illustrated below:



Dismounting a unit ⇨ Use a long screwdriver to reach in the hole on the DIN RAIL tab. Pull out the tab to “pulled out” position to remove the unit, as shown in the figure below.

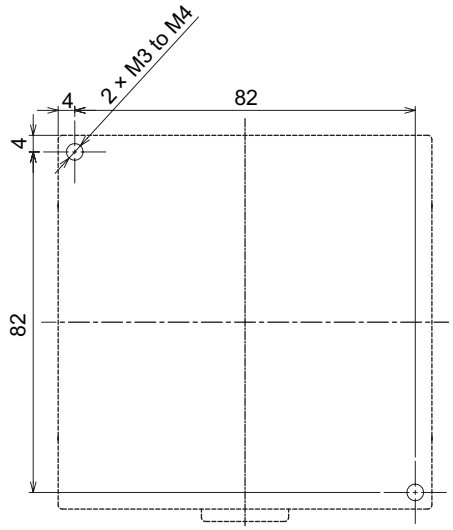


(2) Mounting with screws

In locations subject to larger vibration (more than 0.5G), the unit must be secured by M3 or M4 screws. The positions and sizes of the screw holes of each SPF unit are illustrated below.

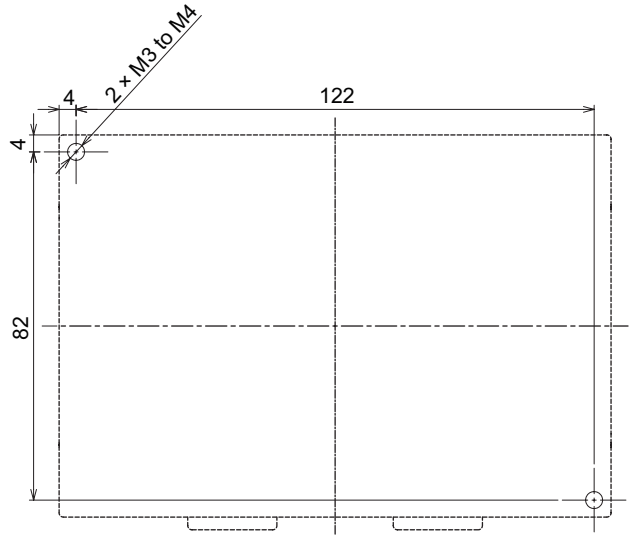
◆ Size A

Unit: mm



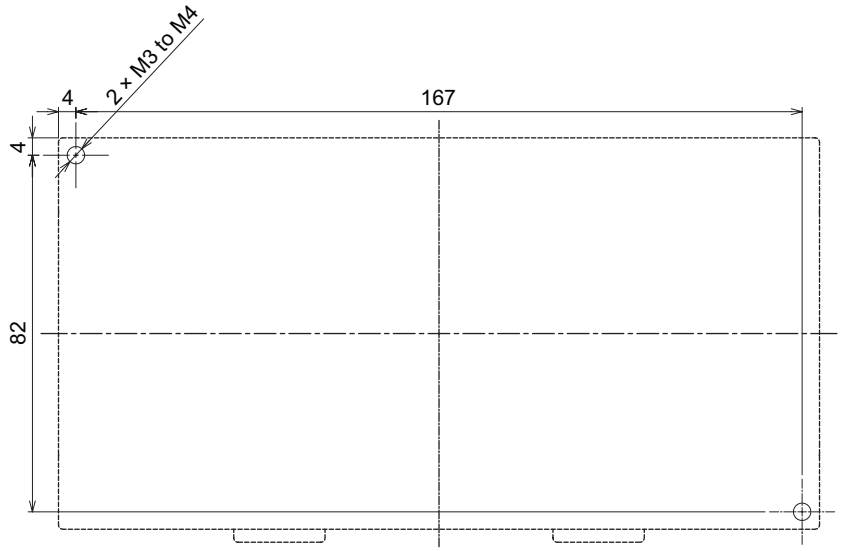
Target type: NA0PA14T-34C
NA0PB14R-34C
NA0PA24T-34C
NA0PA24T-31C
NA0PB24R-34C
NA0PB24R-31C
NA0E24R-34
NA0E24T-31
NA0AX16-TC

◆ Size B



Target type: NA0PA32T-34C
NA0PA32T-31C
NA0PB32R-34C
NA0PB32R-31C
NA0PA40T-34C
NA0PA40T-31C
NA0PB40R-34C
NA0PB40R-31C

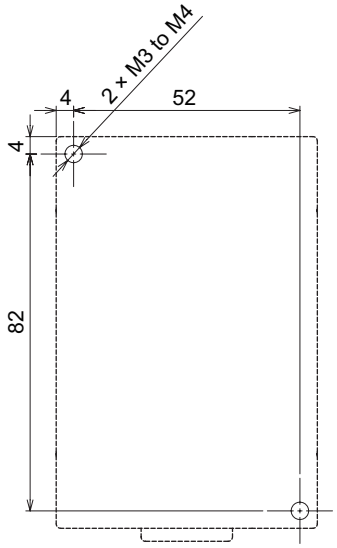
◆ Size C



Target type: NA0PA60T-34C
NA0PA60T-31C
NA0PB60R-34C
NA0PB60R-31C

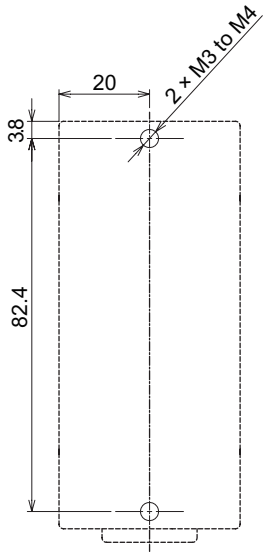
◆ Size D

Unit: mm



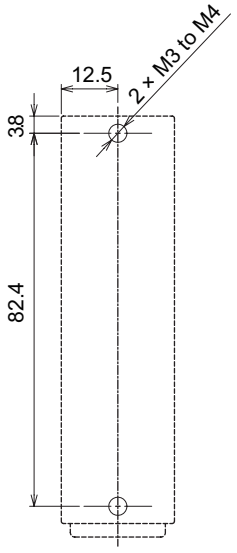
Target type: NA0E16R-0
NA0E16T-0

◆ Size E



Target type: NA0E08R-3, NA0E08T-3
NA0E08X-3, NA0E08T-0
NA0AX06-MR, NA0AY02-MR
NA0AW06-MR, NA0AX02-TC
NA0AX06-TC, NA0AX06-PT
NA0F-LC1, NA0FA-LC1
NA0S-2, NA0S-4

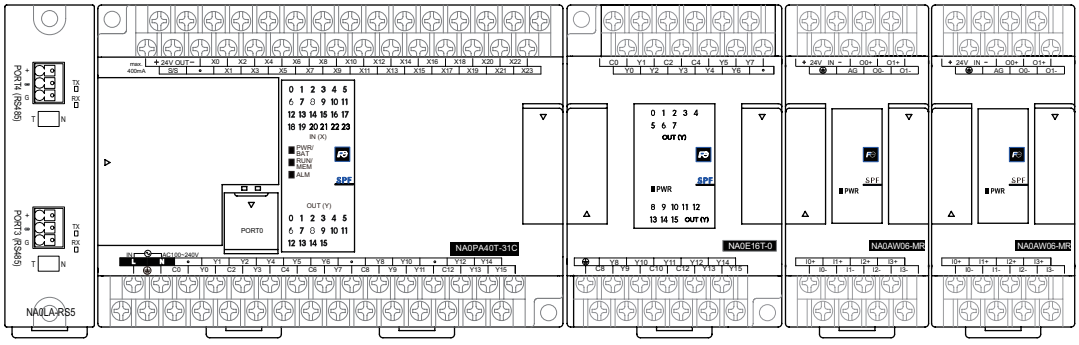
◆ Size F



Target type: NA0LA-RS3
NA0LA-RS5
NA0LA-ET1

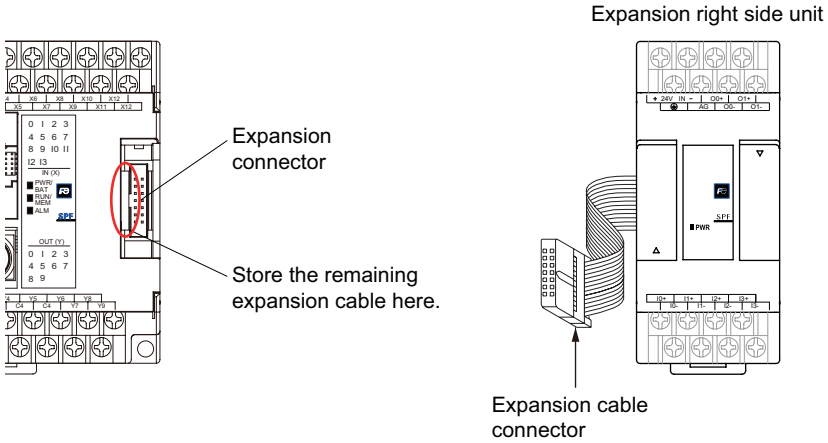
(3) Mounting an expansion unit

Expansion units connected to the main unit can be mounted without gaps.



<How to connect an expansion right side unit>

1) Remove the connector cover of the expansion connector (right side) of the main unit or that of the expansion connector (OUT) of the expansion unit that is mounted on the left of the expansion right side unit to be connected.
2) Connect the expansion cable connector equipped with the expansion right side unit to be connected to the expansion connector described in the step 1).
3) After the connector is connected, store the remaining cable inside the connector housing of the unit on the left side.
4) Attach the connector cover removed in the step 1).

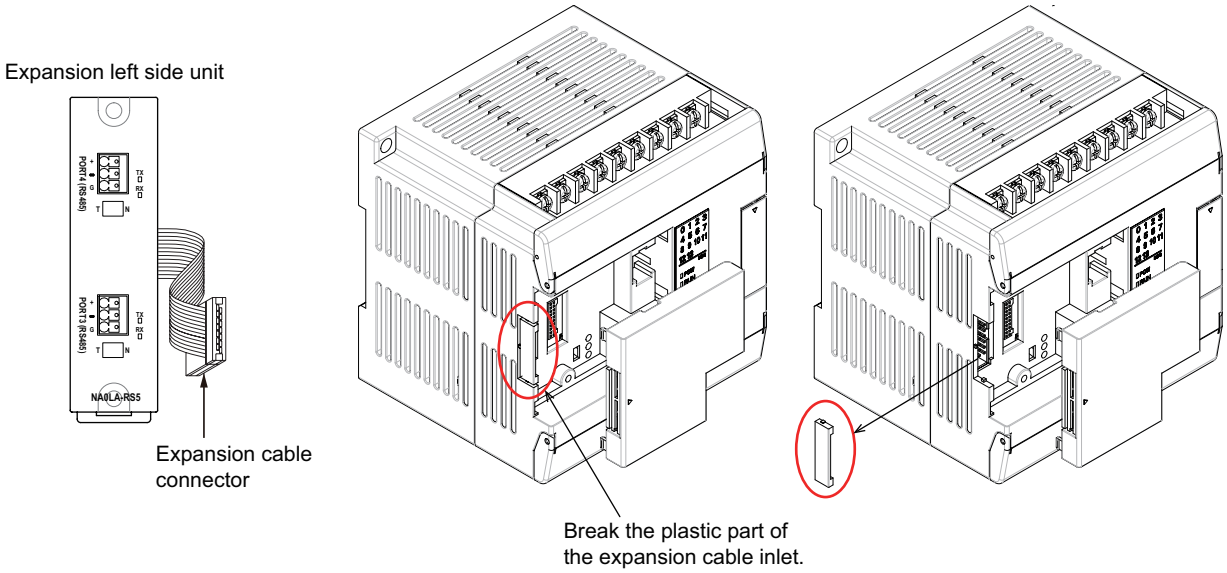


<How to connect a healthy unit>

1) Remove the connector cover of the expansion connector (OUT) of the rightmost expansion right side unit.
2) Mount a healthy unit to the expansion connector described in the step 1).
   (The connector cover removed in the step 1) is not used.)

<How to connect an expansion left side unit>

1) To connect an expansion left side unit, break the plastic part of the expansion cable inlet of the main unit.
   - Remove the cover plate on the front of the main unit.
   - If a front board is already mounted, remove it once.
   - Break the plastic part of the expansion cable inlet on the side of the main unit.
2) Connect the expansion cable connector equipped with the expansion left side unit to the expansion connector (left side) of the main unit.
3) After the connector is connected, store the remaining cable inside the connector housing of the expansion left side unit.
4) If the front board has been removed, reattach it.
5) Attach the cover plate removed in the step 1).



<How to mount a front board>

1) Remove the cover plate on the front of the main unit.
2) Mount a front board and fix it with the supplied screws (Tightening torque: 0.2 N·m)
3) Attach the cover for the front board.

4-2 Wiring

When performing wiring, observe the following points:

1) Warning for wiring

⚠ Warning

- Never touch any part of charged circuits as terminals and exposed metal portion while the power is turned ON. It may result in an electric shock to the operator.
- Turn OFF the power before mounting, dismounting, wiring, maintaining or checking, otherwise, electric shock, erratic operation or troubles might occur.
- Place the emergency stop circuit, interlock circuit or the like for safety outside the PLC. A failure of PLC might break or cause problems to the machine.

2) Cautions for wiring and mounting

⚠ Caution

- Follow the directions of the operating instructions when mounting the product. If mounting is improper, the product might drop or develop problems or erratic operations.
- Be sure to install the electrical wiring correctly and securely, observing the operating instructions and manual. Wrong or loose wiring might cause fire, accidents, or failure.
- Select a wire size to suit the applied voltage and carrying current, and carry out wiring according to the operating instructions and manual. Poor wiring might cause fire, erratic operation or failure.
- Periodically make sure the terminal screws and mounting screws are securely tightened. Operation at a loosened status might cause fire or erratic operation.
- Before touching the PLC, touch any metallic object which is connected to the ground to discharge static electricity. Excessive static electricity may cause malfunction or fault.

3) Cautions for checking wiring

⚠ Caution

- Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run.
- Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.

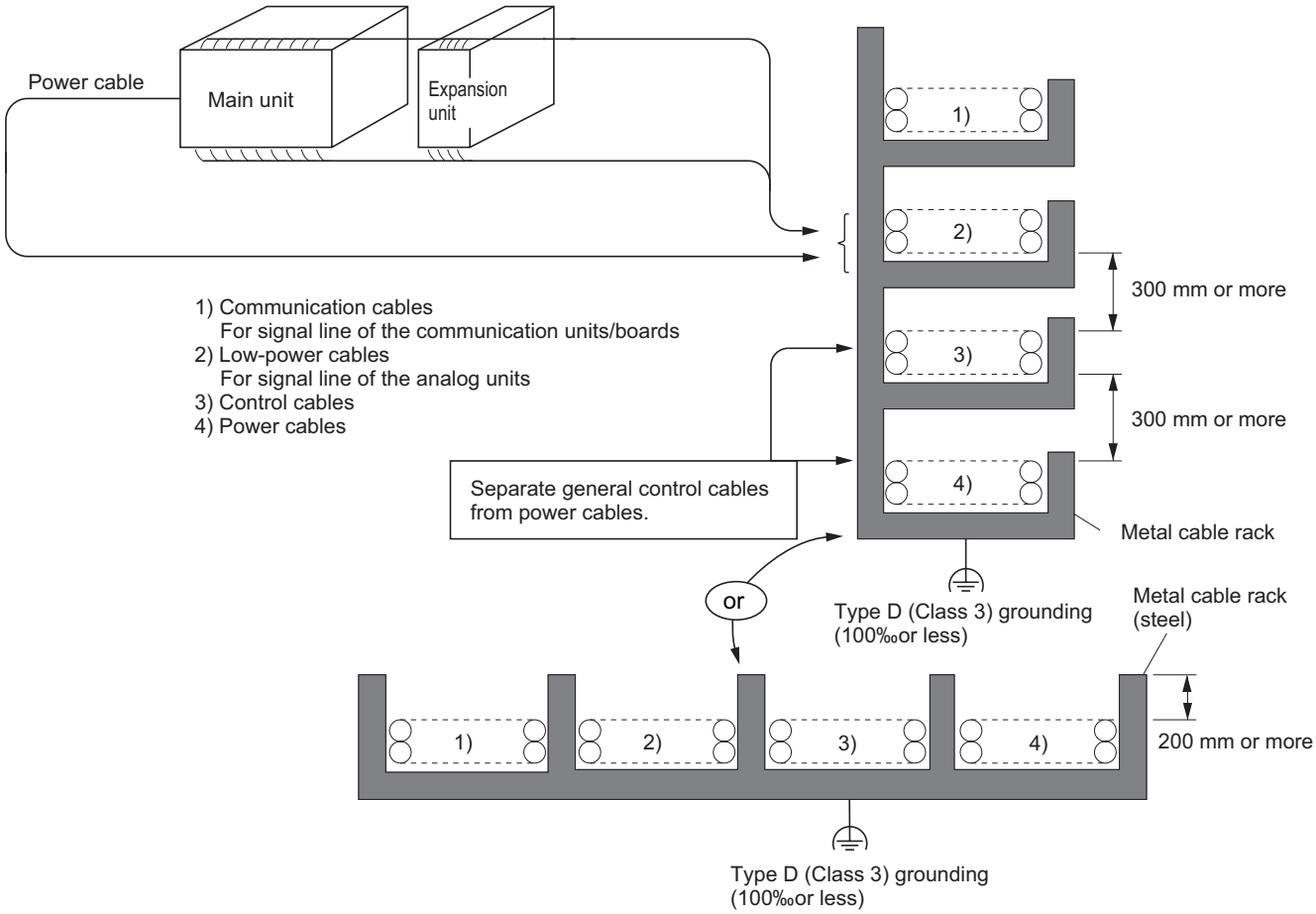
4) Cautions after wiring

⚠ Caution

- Remove the dust-cover seals of modules after wiring, otherwise, fire, accidents, failure or fault might occur.

4-2-1 Wiring and cables

Use the following cables for systems incorporating SPF series products.



◆ Cable types

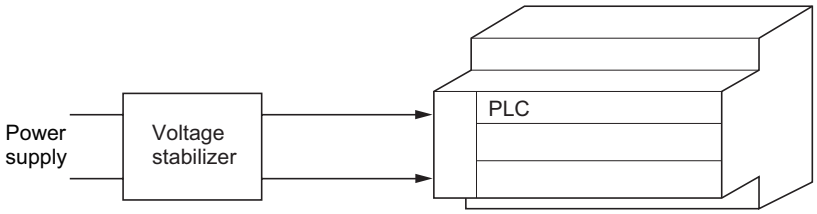
Item	Specifications	Remarks
Power supply cable for main and expansion unit	Twisted cables 1.25mm^2	
Input device connection cable for main and expansion unit	0.5 to 1.25mm^2	
Output device connection cable for main and expansion unit	0.75 to 1.25mm^2	

* For the details of the communication unit/board, refer to the user's manual "General Purpose Communication (FEH528)".
* For the details of the analog unit, refer to the user's manual "Analog Unit (FEH527)".

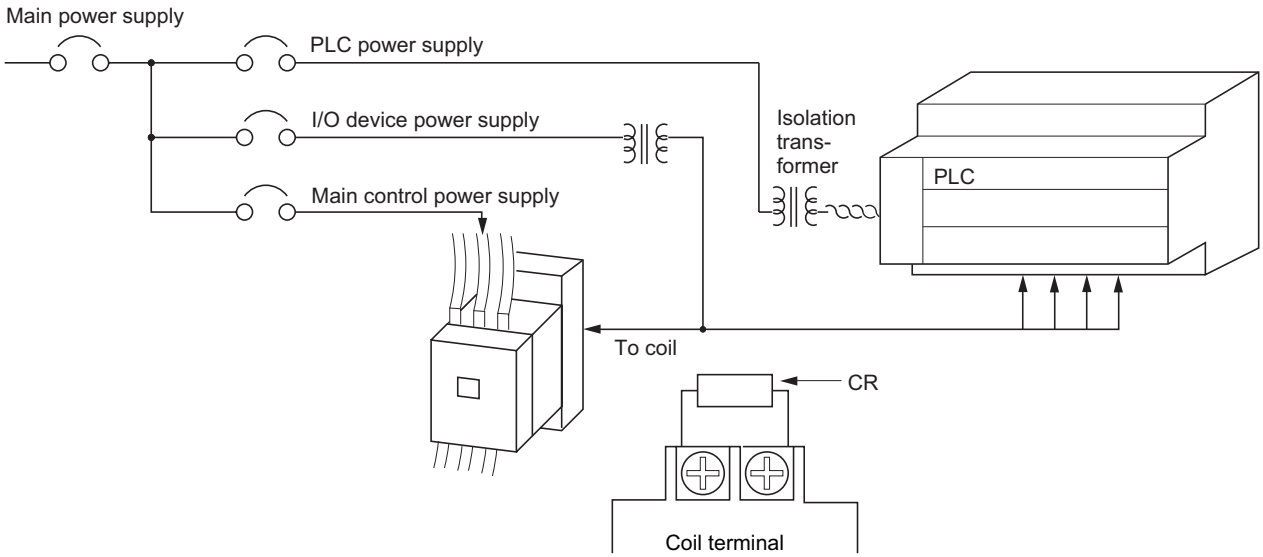
4-2-2 Wiring to power-supply, I/O and ground terminals

(1) Precautions for wiring

• If the power supply to be used for the processor module has voltage fluctuations that exceed the specified range, a voltage stabilizer must be used.



• The power supply must not generate excessive noise between power lines or between lines and ground. For details on countermeasures against excessive noise, see “4-1-3 Control panel mounting (protection against noise).”
• The power supply wiring to the processor module must be separate from wiring for I/O devices and for power equipment.



• The distance between the isolation transformer and the processor must be as short possible and the wire size must be twisted. To minimize voltage drops, the wire size must be as large as possible (1.25mm2)
• If I/O wiring cannot be separated from the main circuit cables or power cables, bound shielded cables must be used for each I/O unit and the shield must be grounded at the PLC end.
• The 24V DC I/O cables must be separated from 100V AC and 200V AC cables.

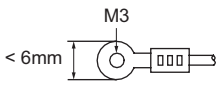
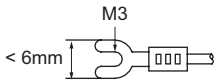
CAUTION

Be careful of the following items when you connect the external power supply (service power) cable of the main unit (AC power supply specification).
1) Make sure that output current is below the level specified.
2) Voltage is cut off if the output is short-circuited (overloaded) during operation, and restored when the error is corrected. (The PLC does not detect the error and continues to run, but externally supplied voltage is lost, resulting in a system error.)
3) In the short-circuited (overloaded) condition, the PLC won’t start even when the power supply is turned on.
4) The power supply is a switching regulator. When you connect a high-sensitivity sensor or the like, be sure to check for any influence from switching noise.

(2) Wiring to terminal

When wiring to PLC terminal, pay attention to the following items.

1) When performing wiring of SPF series PLCs, comply with national and local laws and regulations about installation.
2) Use AWG24 to AWG12 copper wire for the SPF series I/O wire. According to the current loads, select a proper wire.
3) Shorter wires are preferred. It is recommended that the length of I/O wiring does not exceed 100m (10m for high-speed input).
4) Input wiring must be separated from output or power wiring (at least 30 to 50mm apart). In case separation is not possible, adopt vertical crossing, no parallel wiring is allow.
5) The pitch of an SPF series terminal block is 7.62mm. The torque for screws and recommended terminals are shown below:

7.62 mm terminal block	 	Torque: 0.59 to 0.78N·m

(3) Emergency stop circuit and interlock circuit

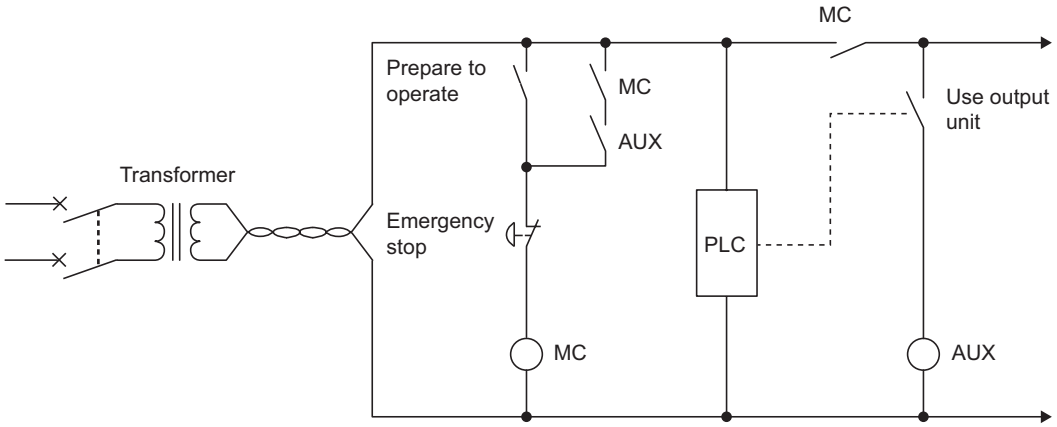
• To improve operational safety, it is necessary to include an emergency stop circuit which can stop the system operation in an emergency or at fault occurrence.
The emergency stop circuit should be implemented in a PLC external circuit.

a) Emergency stop circuit

• Configure it in an external circuit.
A normal emergency stop circuit is built into an interlock circuit that detaches an I/O control power at failure.

b) Interlock circuit

• An interlock relay (MC) opens to interrupt the power supply in an emergency or at fault occurrence.
For the interlock circuit, contacts of a relay which works only during normal operation of PLC are inserted into a maintained circuit.
It is necessary to create PLC application software to turn the contacts of the relay off when a fault is detected.
An emergency stop circuit varies depending on the configuration of the PLC used or controlled object. The example circuit is shown below.



Section 5 Maintenance and Inspection

Section 5 Maintenance and Inspection

5-1 General Inspection Items

For use of the SPF under the best operating conditions, periodic inspection must be performed.

5-1-1 Inspection frequency

The SPF is a highly-reliable programmable controller, consisting mainly of semiconductor devices. However, because deterioration of devices may occur due to environmental conditions, periodic inspection is recommended. The standard inspection should be done once or twice a year; however, it can be shorter, depending on environmental conditions. If any inspection result does not match the rated value, check the operating conditions to make sure they are appropriate.

5-1-2 Cautions on using the product

⚠ Caution

- Select a wire size to suit the applied voltage and carrying current, and carry out wiring according to the operating instructions and manual. Poor wiring might cause fire.
- Operate (keep) in the environment specified in the operating instructions and manual. High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock might cause electric shock, fire, erratic operation or failure.
- Contaminants, wiring chips, iron powder or other foreign matter must not enter the device when installing it, otherwise, erratic operation or failure might occur.
- Periodically make sure the terminal screws and mounting screws are securely tightened.
- Before touching the PLC, discharge any static electricity that may have been collected on your body. To discharge it, touch a grounded metallic object. Static electricity might cause erratic operation or failure of the module.

5-1-3 Inspection items

When inspecting the equipment, use the following inspection table.

Inspection item		Inspection contents	Criteria	Inspection method
Main unit		Confirmation of PWR/BAT, RUN/MEM, ALM LED	LED must not be blinking.	Visual inspection
Main unit Expansion unit Power supply	Voltage	Is the voltage within the normal range when measured at a terminal block ?	AC: 100V: 85 to 132V 240V: 170 to 264V DC: 24V: 20.4 to 28.8V	Voltmeter
	Voltage fluctuation	Are there frequent momentary power failures or abrupt voltage rises or drops ?	Voltage fluctuations must be within the above range.	Oscilloscope
Ambient environment	Temperature	Is the temperature within the specified range ? (temperature in the panel when installed inside the panel)	0 to +55°C	Max./min. thermometer
	Humidity	Is there condensation or extreme discoloration or corrosion ?	20 to 95%RH	Visual inspection, hygrometer
	Vibration	Is there any vibration ?	There must be no vibration.	Check by touching
	Dust	Is there any dirt or other foreign matter ?	There should be no dirt or other matter.	Visual inspection
Installation status		Are all modules mounted securely ?	No looseness	Visual inspection
		Are there any loose screws on the external wiring terminals ?	No looseness	Screwdriver
		Are cable connectors inserted securely ?	No looseness	Visual inspection, Screwdriver
		Are any external wiring cables damaged ?	No abnormal appearance	Visual inspection
Spare parts		Is the designated quantity available ? Are storage conditions appropriate ?	See the inspection records.	
Program		Were any errors detected through verification ? Is the source program stored appropriately?	There must be no errors.	Program verification

Notes:

1) If a fault occurs, replace the entire faulty unit or board. For this replacement, a minimum amount of space components should be provided.
2) For spare main units and expansion units, power on once every six months.
   (To prevent discharging of aluminum electrolytic capacitor in the power supply module)

5-2 Actions to be Taken When Battery Voltage Drop is Detected

The primary battery built in the main unit cannot be replaced. When a voltage drop of the battery is detected, you need to replace the main unit.
If you confirm that the “PWR/BAT” LED of the main unit blinks alternately in red and orange, promptly replace the main unit with a new one.

■ **Main unit replacement procedure**

(1) Stop the SPF system and save necessary user data (such as retain memory and user FB / system FB instance memory) in a backup file in the personal computer with the backup function of the SX control utility of the loader.
(2) Turn OFF the power supply of the SPF system, and then replace the main unit.
(3) Turn ON the power supply of the SPF system. After stopping the main unit, download the backup file to the new main unit with the SX control utility.
(3) Reset the main unit. Then, the main unit starts up.

Section 5 Maintenance and Inspection

5-3 Maintenance Services

5-3-1 Ordering notes

When ordering electrical and control equipment (or requesting price estimates), the following general notes are to be observed, unless otherwise specified in the estimation paper, contract paper, catalogs, or specifications.
When the product is delivered, check the contents of the package as soon as possible. Even before inspection, use caution on storing and using the product safely.

5-3-2 Free-of-charge warranty period and scope of warranty

[Free-of-charge warranty period]

(1) This product is covered by a warranty for a period of one year from the date of purchase or 18 months from the date of manufacture described in the nameplate, whichever comes earlier.
(2) This warranty period may not be applied if the operating environment, operating condition, operating frequency, or number of operations affects the operating life of the product.
(3) The warranty period for the product section repaired by Fuji Electric service sector is six (6) months from the date of completion of repair.

[Warranty period]

(1) If a failure judged to be the responsibility of Fuji Electric occurs during the warranty period, please contact the Fuji sales agent. By sending back the failed product, it is repaired or the replacement product is delivered on a free-of-charge basis. However, the following failures are not covered by this warranty.
   1) Failures occurring through inappropriate condition, environment, operation, or use not described in the catalog, operating manual, or specification.
   2) Failures occurring through cause other than the purchased product or delivered product.
   3) Failures occurring through customer's equipment or software design, or cause other than products from Fuji Electric.
   4) Failures occurring through programs not developed by Fuji Electric as for programmable products
   5) Failures occurring through modification or repair not performed by Fuji Electric
   6) Failures occurring through failure to perform correctly maintenance or replacement of the consumables described in the operating manual or catalog
   7) Failures occurring through cause which cannot be forecasted by science and technologies practically used at the time of purchase or delivery
   8) Failures occurring through use of the product which is not intended by Fuji Electric
   9) Failures occurring through natural calamities, disasters, or other cause judged not to be the responsibility of Fuji Electric
(2) The warranty is limited only to a single purchased product and a single delivered product.
(3) The upper limit of the warranty period is (1). Any damages caused by failures of the purchased product and delivered product (damages to or loss of machinery and equipment, or passive damages) are not covered by this warranty.

[Failure diagnosis]

Temporary failure diagnosis is intended to be performed by the customer. However, upon request from the customer, Fuji Electric or Fuji Electric service network offers surrogate services on a fee basis. The fee is borne by the customer according to the fee code of Fuji Electric.

[Exclusion of responsibility of warranty such as opportunity loss]

Regardless of the free-of-charge warranty period, damages judged not to be the responsibility of Fuji Electric, opportunity loss on the customer side caused by failure of products from Fuji Electric, passive damages, damages caused by exceptional circumstances regardless of forecast by Fuji Electric, secondary damages, accident compensation, damages to products not from Fuji Electric, and damages to other business are not covered by this warranty.

[Repair period after production stoppage and supply period of spare parts (maintenance period)]

As for retired models (products), Fuji Electric performs repair work within seven (7) years from the date of retirement. As for major spare parts for repair, Fuji Electric also performs repair work within seven (7) years from the date of retirement.
With electronic parts, however, difficulty in procurement or production may be anticipated because of short life cycles and therefore repair or spare parts supply may be difficult even during the warranty period. For details, please contact Fuji Electric sales office or service sector.

5-3-3 Service costs

The price of the product does not include maintenance and servicing costs, such as the cost of dispatching an engineer to the customer. The customer will be charged for actual expenses in the following cases.
(1) Guidance for installation and adjustment, and attendance at a test operation
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education

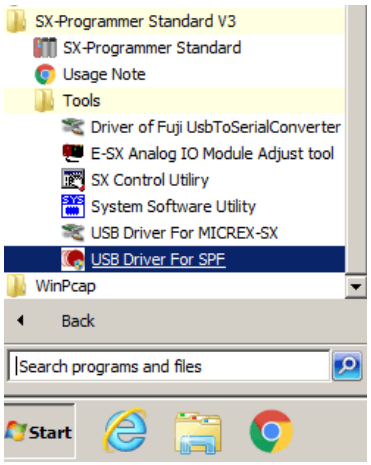
Appendix 1 Installing USB Driver

Appendix 1　Installing USB Driver

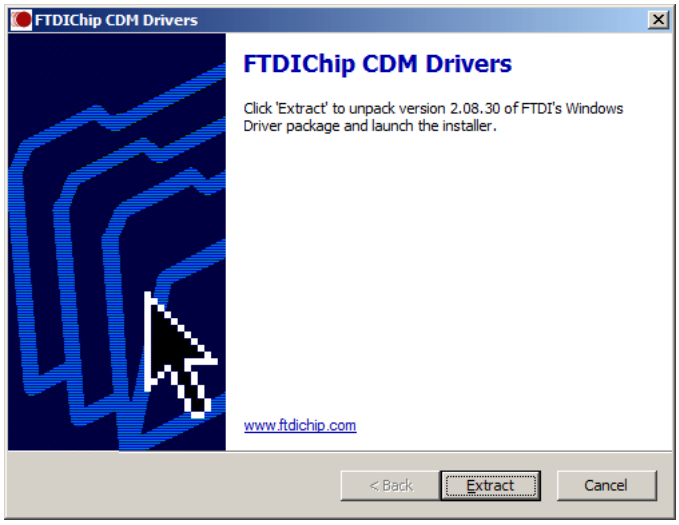
When connecting an SPF series PLC and personal computer using a loader connecting cable (Type: NA0H-CUV), you need to install the USB driver for SPF into the personal computer. Before connecting the loader connecting cable, be sure to install the USB driver. If you connect the loader connecting cable before installing the USB driver, remove the cable once, install the USB driver, and then reconnect the cable.

<Installation procedure>

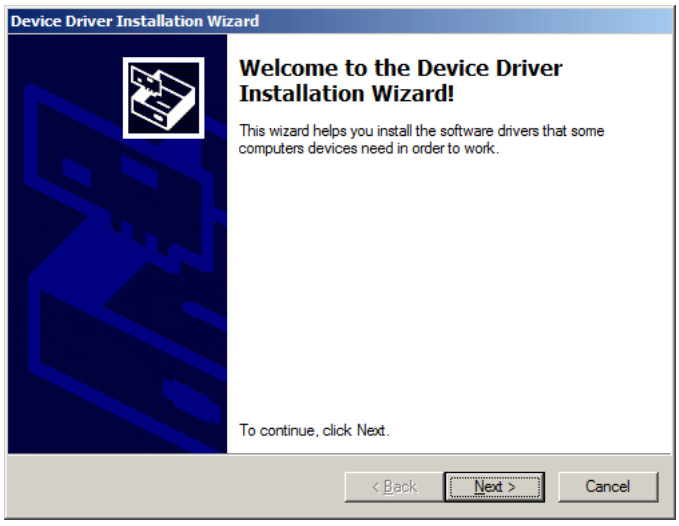
◆ Click [Start] of Windows > [All Programs] > [SX-Programmer Standard V3] > [Tools] > [USB Driver For SPF].



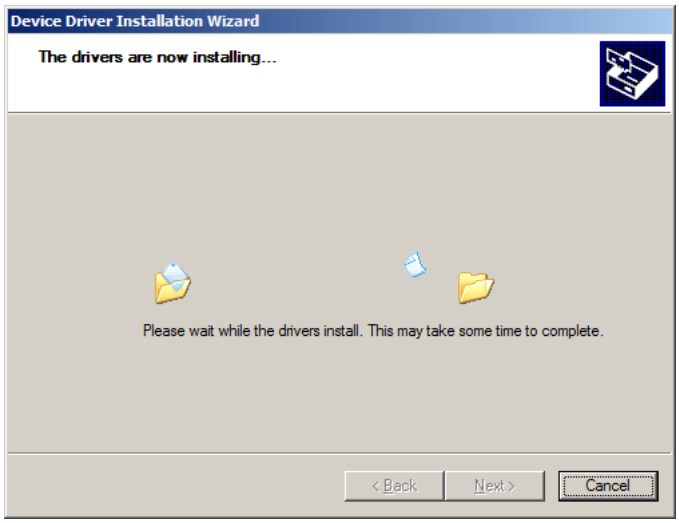
* The installation procedure is the same for SX-Programmer Expert (D300win).



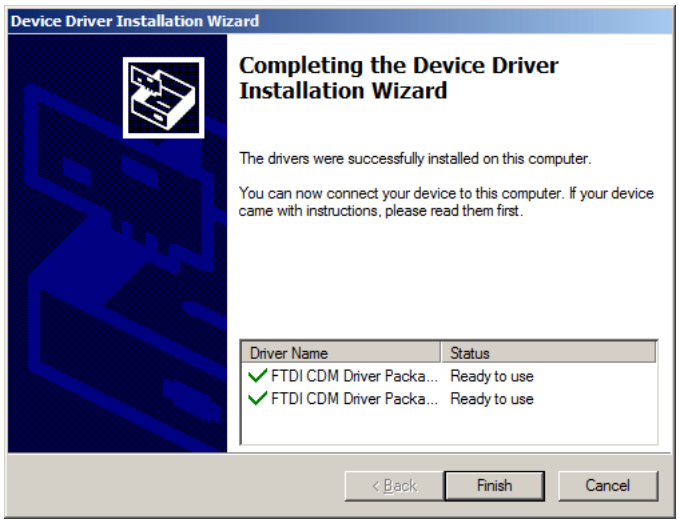
◆ On the following dialog box, click the [Next] button.



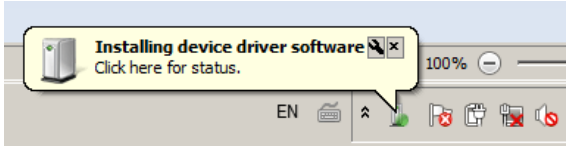
Appendix 1 Installing USB Driver

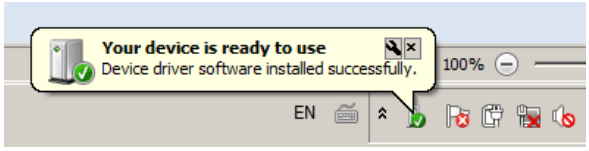


◆ The screen appears saying “Completing the Device Driver Installation Wizard.” Click the [Finish] button. The offline installation is now complete.



The actual setup of the driver in the computer is executed when connecting the PLC to the personal computer using a loader connecting cable. The progress of the setup is displayed on the bottom right of the computer screen.



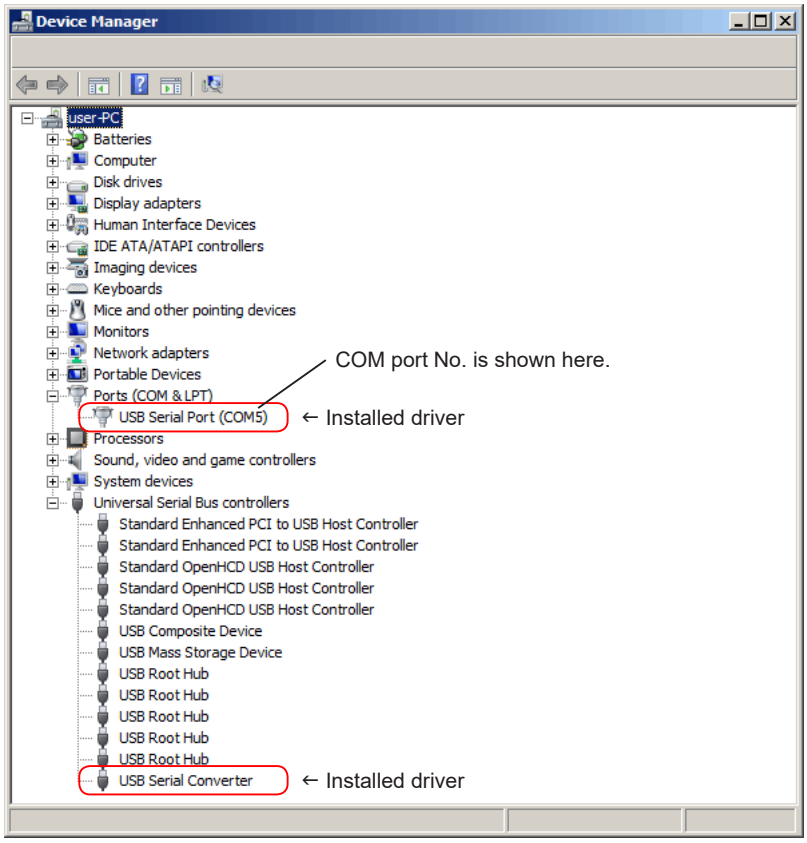


Appendix 1 Installing USB Driver

<Checking COM port No.>

Check to which COM port the installed communication port is assigned. The operation procedure for Windows 7 is described below.

◆ Click [Start] of Windows > [Control Panel]. Select “Large icons” from the “View by” drop-down list. Then, click “Device manager”. You can check to which COM port the installed communication port is assigned as shown in the figure below.



Appendix 2
Automatic Update of System Software

Appendix 2 Automatic Update of System Software

The SPF series has the automatic update function of system software. To use a newly added expansion unit, front board or functions, you need to update the SPF system software to the latest version using this function.

<Operation overview>

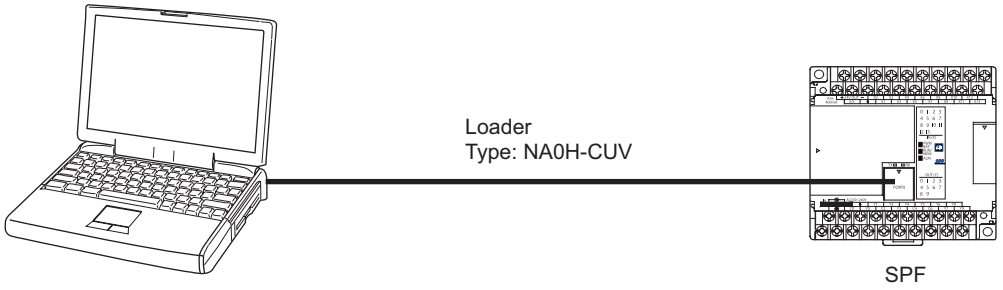
A loader supporting the SPF series stores the latest version of SPF system software.
It operates as follows when connected to the SPF series. Update the system software as needed.

(1) When displaying the “Control” dialog box on the loader, the system software version of the connected SPF and that of the loader are automatically compared.
(2) If the system software version of the SPF is older than that of the loader, a screen appears prompting you to update it.
(3) Update the system software of the SPF following the procedure.

Notes:

1) During update, do not power off the SPF system and do not disconnect the loader cable.
2) Applications are not deleted even if the system software is updated. However, back them up in advance as needed. The backup procedure is the same as “Main unit replacement procedure” described in 5-2. See “5-2 Actions to be Taken When Battery Voltage Drop is Detected.”
3) Applications in operation will be stopped. Stop the system in advance as needed.

<System configuration>



SX-Programmer Expert (D300win) : V3.6.11.* or later
SX-Programmer Standard : V3.0.16.* or later

Appendix 2 Automatic Update of System Software

<Update procedure>

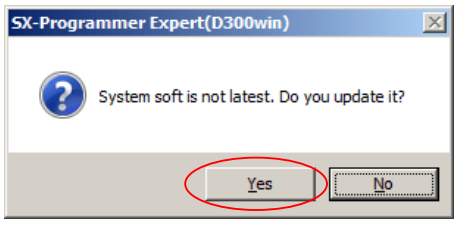
◆ On the loader screen, display the “Control” dialog.
If the monitor mode is selected, set it off.

a) For SX-programmer Expert (D300win)
While an SPF project is open, click the [Online] menu > [Project Control].

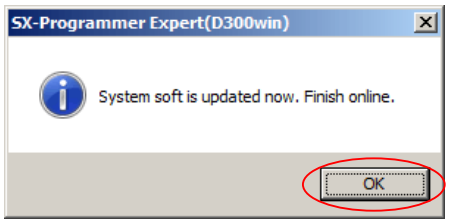
b) For SX-Programmer Standard
While an SPF project is open, click the [Online] menu > [PLC Operation (Run/Stop, Load)].

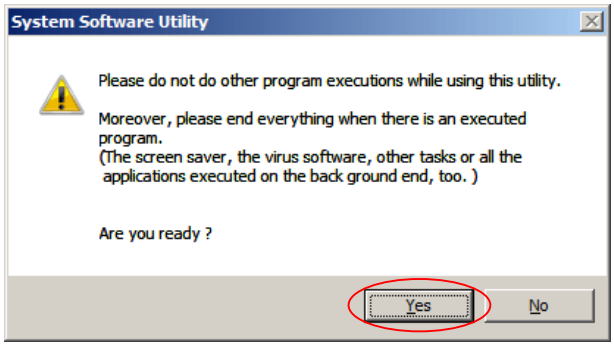
*When the system software version of the SPF matches that of the loader, the “Control” dialog box opens.

◆ If the system software version of the SPF is older than that of the loader, the following dialog box appears.



◆ Click the “Yes” button to display the following dialog box. After confirming that the monitor mode is off, click the “OK” button.
The system software utility starts up.

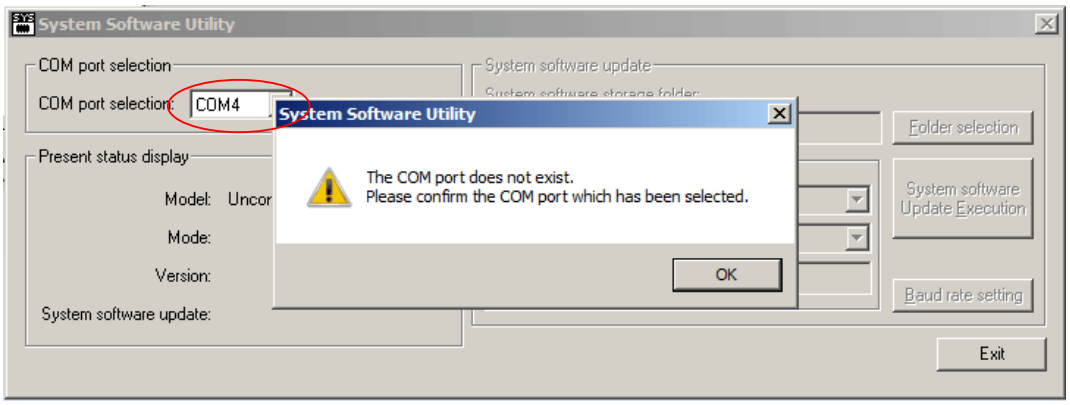


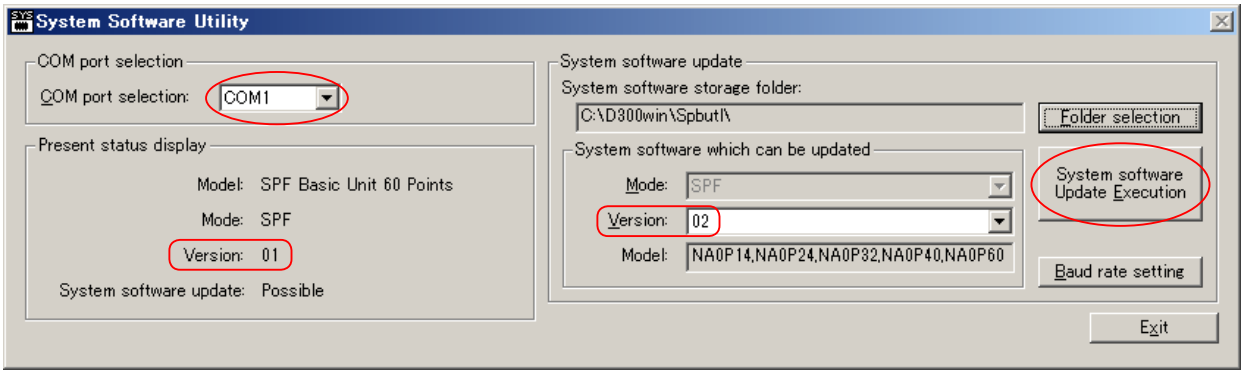


Notes:

To start up the system software utility, be sure to close the other application programs.

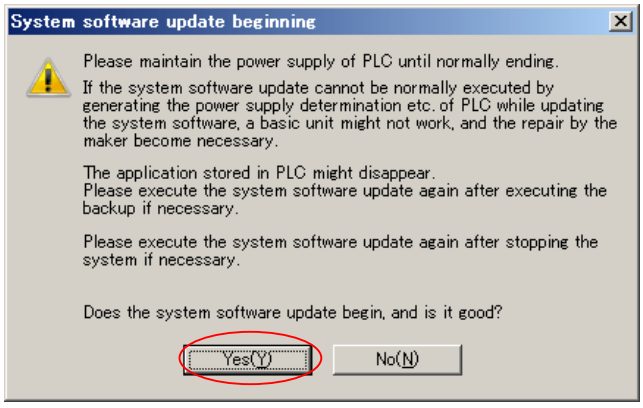
◆ Close the application programs, and then click the “Yes” button. The following dialog box appears.
• If the dialog box appears saying that the COM port does not exist, click the [OK] button and select the COM port connected to the loader for the “COM port selection.”



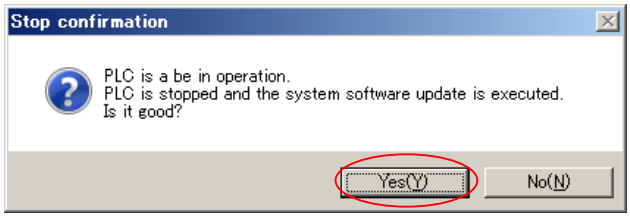


* In this example, the software version is updated from 01 to 02.

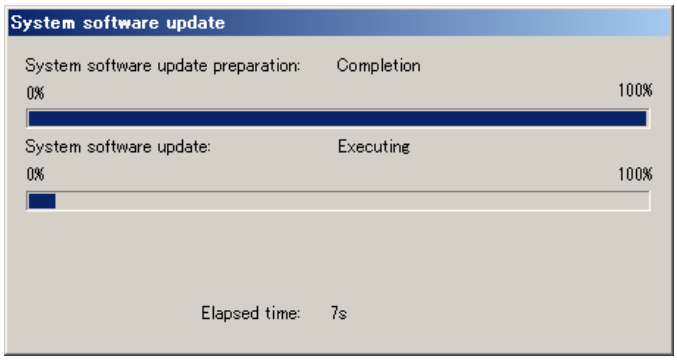
◆ Click the [System software Update Execution] button. The following confirmation dialog box appears.
If applications exist in the SPF, back them up as needed.



◆ Click the [Yes] button to start update of the system.
• If the SPF is operating, the following dialog box appears. After confirming that the PLC can be stopped, click the [OK] button.

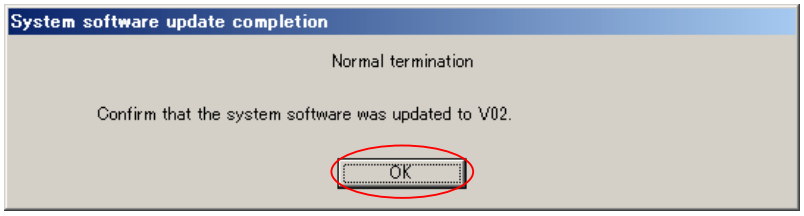


• The system software update starts. When the progress bar reaches 100%, the update is complete.

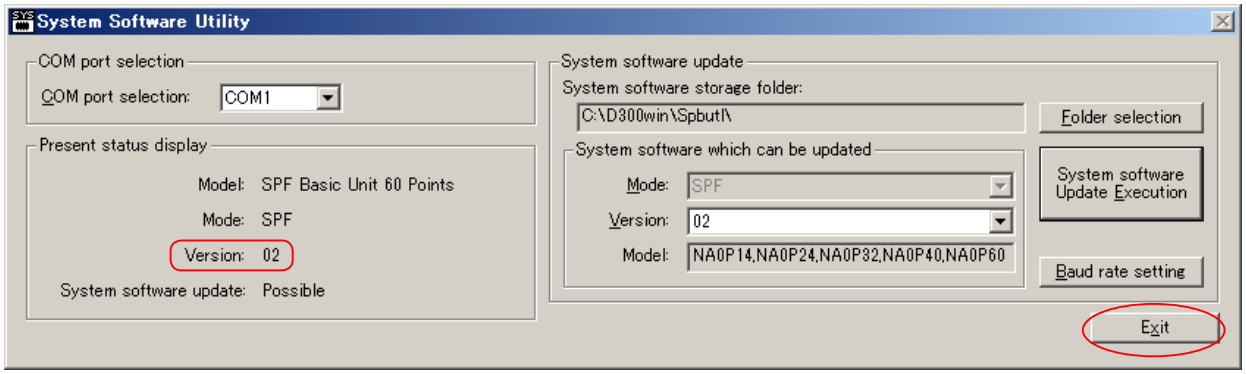


Notes:
Do not power off the SPF or do not disconnect the loader cable before the system software update is complete.

◆ When the update of system software is complete, the following dialog box appears.



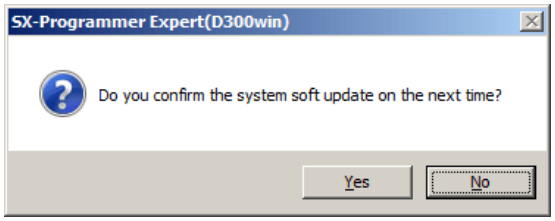
◆ Click the [OK] button and confirm that the SPF has been updated to the latest version.



◆ Click the [Exit] button to power off the SPF.

<When selecting "No" on the dialog box saying "System software is not latest. Do you update?">

◆ When selecting "No" on the dialog box saying "System software is not latest. Do you update?", the following dialog box appears.

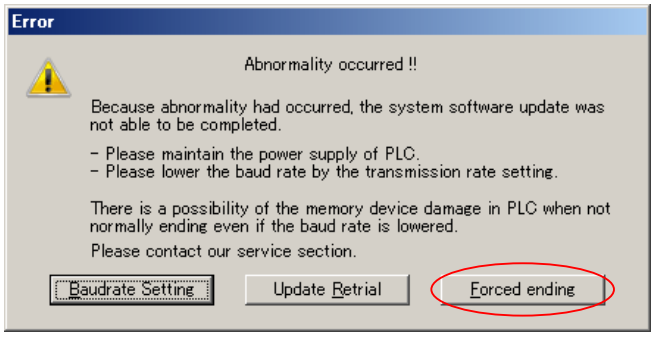


- When "Yes" is selected: When you attempt to display the "Control" dialog box next time, the update confirmation dialog box appears again. If you want to update the system software later, click the [Yes] button.
- When "No" is selected: The update confirmation dialog box will not appear from the next time. (To display it again, reinstall the loader.)

Appendix 2 Automatic Update of System Software

<Measures when an abnormality occurs>

◆ If an abnormality occurs during update by the system software utility because “the SPF is powered off” or “the loader cable is disconnected,” the following dialog box appears.
Perform update again following the procedure below.



(1) Click the [Forced ending] button to close the system software utility.
(2) Power off the SPF once.
(3) Check the connection of the loader cable.
(4) Power on the SPF again.
(5) Open the explorer and start up the system software utility “SPFUtl.exe”.
The folder where “SPFUtl.exe” is stored depends on the loader and installation destination.
• Example of SX-Programmer Expert (D300win)
C:\D300win\Spbutl\SPFUtl.exe
• Example of SX-Programmer StandardV3
C:\Program Files\Fuji Electric\SX-Programmer Standard\Spbutl\SPFUtl.exe
(6) Following the <Update procedure>, perform update again.

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Materials covered in this document are subject to revision due to the modification of the product.