



MICREX-SX *series*

FUJI PROGRAMMABLE CONTROLLER

SPB

USER'S MANUAL
Hardware

Read this manual carefully to ensure correct operation.

This User's Manual explains the SPB hardware.

In addition to this manual, the following user's manuals, which are related to programming tools, are also available for the SPB. Please read them as needed.

Title	Type	Manual No.	Contents
Instructions	—	FEH400	Explains the command, etc.
Handy Loader	NW0H-NE	FEH402	Explains the operations, etc of the handy loader.
Personal Computer Loader	NN4NWN-SB	FEH403	Explains the operations, etc of the personal computer.
Internal Hi-speed Counter	—	FEH404	Explains of SPB internal Hi-speed counter.
Communication Adapter	—	FEH405	Explains the communication adapter.
Pulse Output Instructions and Functional Instructions	—	FEH406	Explains the pulse output instruction and PID.
Analog Unit	NW0A□□	FEH407	Explains the analog unit

Precautions for using the SPB

- 3 expansion units can be connected to a basic unit only when the version of all basic and expansion units that are combined is as shown in the table below.

If a unit of old version is mixed in basic or expansion units (including analog units) that are combined, the maximum number of expansion units that can be connected to a basic unit is 2.

Type	Version
Basic Unit	NW0P30□-□□
	NW0P40□-□□
	NW0P60□-□□
Expansion Units	NW0E16□-3
	NW0E16□-0
	NW0E16X
	NW0E32□-3

Note: Version is indicated on the left side of main unit.

Analog unit can be used only with the following version of basic unit.

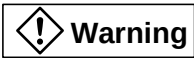
Type	Version
Basic Unit	NW0P30□-□□
	NW0P40□-□□
	NW0P60□-□□

Notes

- This manual may not be reproduced in whole or part in any form without prior written approval by the manufacturer.
- The contents of this manual (including specifications) are subject to change without prior notice.
- 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 precaution items are classified into “Warning” and “Caution.”



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



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

Even some items indicated by “Caution” may also 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 PC. A failure of PC might break or cause problems to the machine.
- ◇ Do not connect in reverse polarity, charge (except rechargeable ones), disassemble, heat, throw in fire or short-circuit the batteries, otherwise, they might burst or take fire.
- ◇ If batteries have any deformation, spilled fluids, or other abnormality, do not use them. The use of such batteries might cause explosion or firing.

Safety Precautions

Caution

- ◇ Do not use one found damaged or deformed when unpacked, otherwise, 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 operating instructions 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 operating instructions and manual. Use beyond the rated values might cause fire, erratic operation or failure.
- ◇ 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.
- ◇ 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, erratic operation or failure might occur.
- ◇ Remove the dust-cover seals of units after wiring, otherwise, fire, accidents, failure or fault might occur.
- ◇ Connect the ground terminal to the ground, otherwise, an 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, failure or erratic operation might occur.
- ◇ Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run.
The wrong operation might break or cause machine problems.
- ◇ Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.
- ◇ Before touching the PC, 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.
- ◇ 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.
- ◇ 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 contact your Fuji Electric agent. When replacing the batteries, correctly and securely connect the battery connectors, otherwise, fire, accidents 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, a failure might occur.
- ◇ Follow the regulations of industrial wastes when the device is to be discarded.
- ◇ The modules covered in these operating instructions 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.
- ◇ If you intend to use the modules covered in these operating instructions for special applications, such as for nuclear energy control, aerospace, medical, or transportation, please consult your Fuji Electric agent.
- ◇ Be sure to provide protective measures when using the module covered in these operating instructions in equipment which, in the event of failure, may lead to loss of human life or other grave results.
- ◇ External power supply (such as 24V DC power supply) which is connected to DC I/O should be strongly isolated from

Revisions

*Manual No. is shown on the cover.

Printed on	*Manual No.	Revision contents
Mar. 2001	FEH401	First edition
Jan. 2002	FEH401a	Addition to specification due to new model
Sep. 2002	FEH401b	• Information of analog unit added (address assignment, specification and outline drawing) • Service life curve of 110V DC added • Combination of versions added • Derating of transistor output added • Address indicated together with terminal No. (Section 4, 4-10 Terminal Layout and External Connection) • Precautions for Ry output added

Preface

Safety Precautions

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Section 1 General

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(1) High-speed signal input

On the basic unit of the SPB, each of the 4 input points (X0 to X3) has the “pulse catch” function which can catch input pulses of minimum 50 μ s width. SPB can detect, by means of a sensor, an object that is moving at high speed to take it in as an input signal.

(2) External interrupt

When you have an external interrupt processing program, you can use external interrupts through the 4 input points (X0 to X3) of the basic unit.

(3) Built-in high-speed counter

By making a program and setting parameters, you can use a high-speed single-phase (two channels) or two-phase (one channel) counter, using the 4 input points (X0 to X3) of the basic unit.

Maximum input pulse frequency is 100 kHz at single-phase (or 50kHz at two-phase).

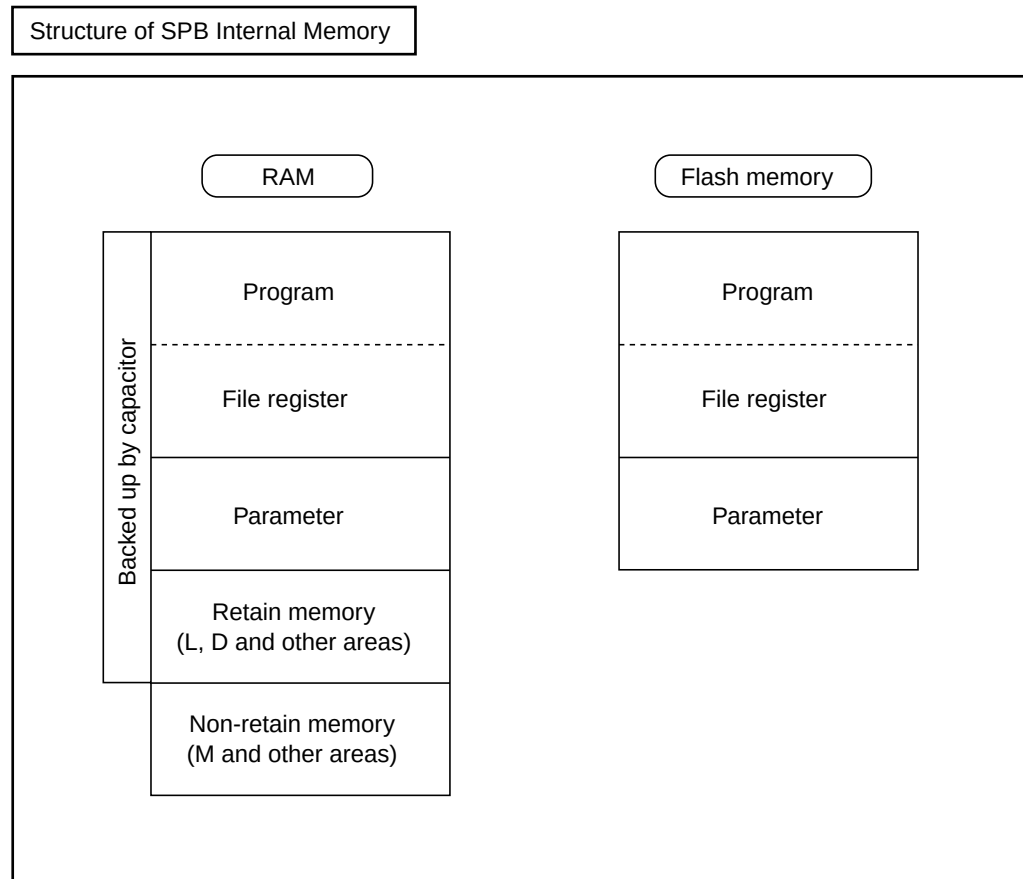
(4) Input filter

Input filtering time can be set by the word (every 16 input points).

1-2-1 Built-in memory

The basic unit has a built-in RAM (hereinafter simply called RAM) that is used as a memory for temporarily retaining programs or internal memory statuses. Content of the RAM is backed up by the built-in capacitor in the case of 20- or 30-I/O point unit while by the built-in battery in the case of 40- or 60-I/O point unit (except for data stored in the Non-retain memory area). If the power switch of the PC is turned off for a long time, the built-in capacitor or a battery will be completely discharged and the RAM data will be lost.

The basic unit also has a built-in flash memory. Because this memory does not require battery backup, its content won't be lost even in a case of long-time power failure. Programs, parameters, and the content of file register are stored in the flash memory.

**(1) Ordinary operation of the memories**

Ordinarily, the content of the RAM is the same as that of the flash memory.

If the power switch of the PC has been turned off for a long time, with the built-in capacitor or a battery completely discharged, the content of the RAM is lost. But when the power switch of the PC is turned on the next time, the CPU will detect this condition and automatically transfer the content of the flash memory to the RAM. The CPU will then start operation.

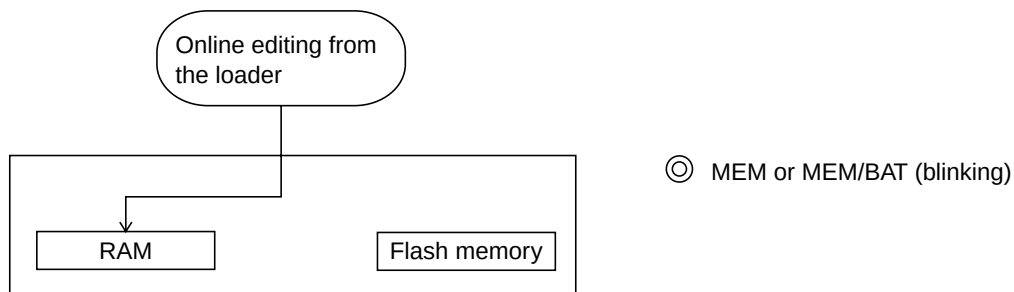
On the other hand, because the data of the retain memory continues to be lost, a "Latch Data Loss" error occurs. The CPU then operates as follows:

- Clears the retain memory area to zero.
- Makes the ALM LED blink.
- Turns on special relays M8001 and M8021.

In this condition, if the M8021 is turned off by a user program or operation from the loader, the ALM LED will go off, canceling the condition of "Latch Data Loss" error.

(2) Operation while editing a program online

When you directly edit a program online with the loader connected to the PC, only the RAM is changed. The content of the flash memory cannot be changed. As a result, the content of the RAM may temporarily not coincide with that of the flash memory, and the MEM or MEM/BAT LED will blink. (If writing is tried while the PC is running, the PC will continue to run.) The blinking prompts you to transfer the content of the RAM to the flash memory. (You can even set parameters so the MEM or MEM/BAT LED does not blink in such cases.)

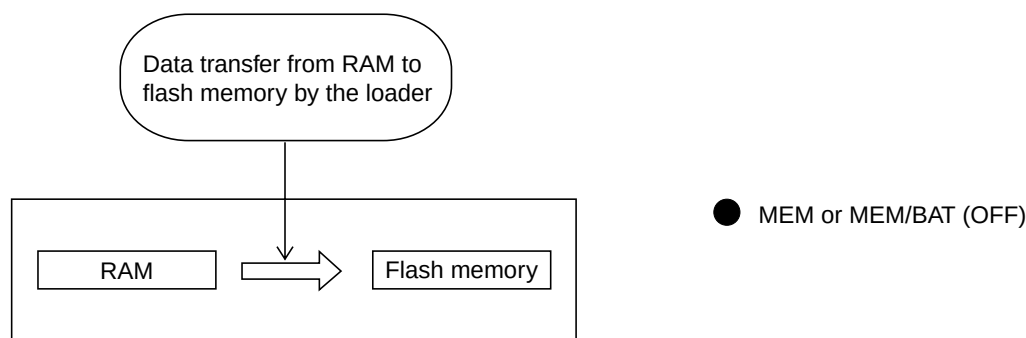


In this case, because no data is backed up by the flash memory, you need to transfer the content of the RAM to the flash memory. When the data transfer is completed, the MEM or MEM/BAT LED will go off.

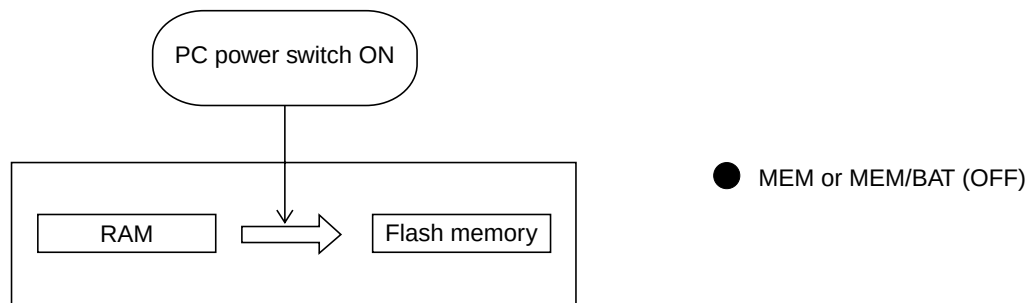
There are two methods for transferring the content of the RAM to the flash memory, as described below:

Method 1: Operation from the loader

You operate the loader to perform “transfer from RAM to flash memory”. This operation is disabled while the PC is running. Stop the PC once to use this method.

**Method 2: Turning off and on the PC power switch**

Turn off and on the PC power switch, and the CPU will detect that the content of the flash memory is not the newest when the PC is supplied with power again. The RAM content will be automatically transferred to the flash memory.



However, if the PC power switch has been turned off for a long time, with the built-in capacitor or a battery fully discharged and the RAM data lost after the program was changed, no data will be transferred. In that case, a “Program Loss” error occurs and the CPU operates as follows:

- Makes the RUN LED go off, and
- Makes the ALM LED blink, and
- Turns on the special relay M8001.

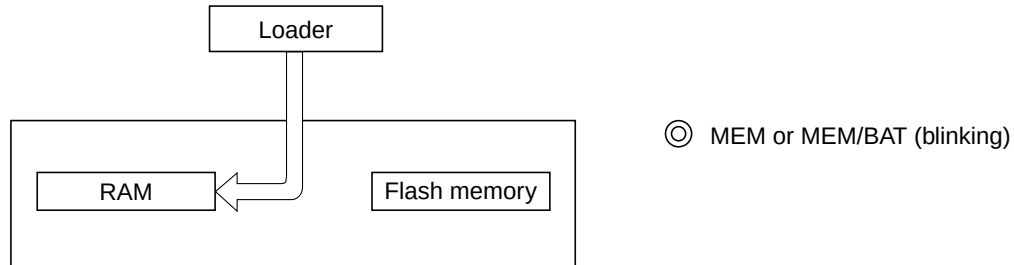
To correct the error, you need to clear the memory data and retransfer the program again from the loader.

Please turn off and on sooner after you changed program.

(3) Operation during program transfer (from loader to PC)

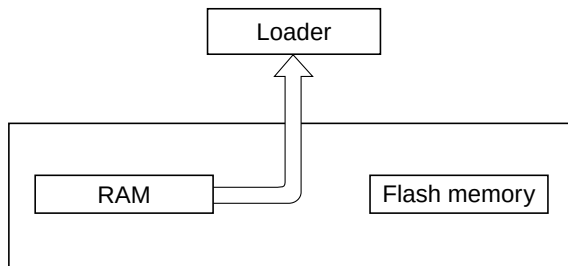
If a program created (offline) with the loader is transferred to the PC, the content of the RAM is changed, but the content of the flash memory is not changed.

This operation, however, is disabled while the PC is running. Stop the PC once to do this operation.



In this condition, no data is backed up by the flash memory. Therefore, it is necessary to transfer the content of the RAM to the flash memory. When the transfer is completed, the MEM or MEM/BAT LED goes out.

On the other hand, when a program is transferred from the PC to the loader, only the content of the RAM is transferred. This operation is possible even when the PC is running.

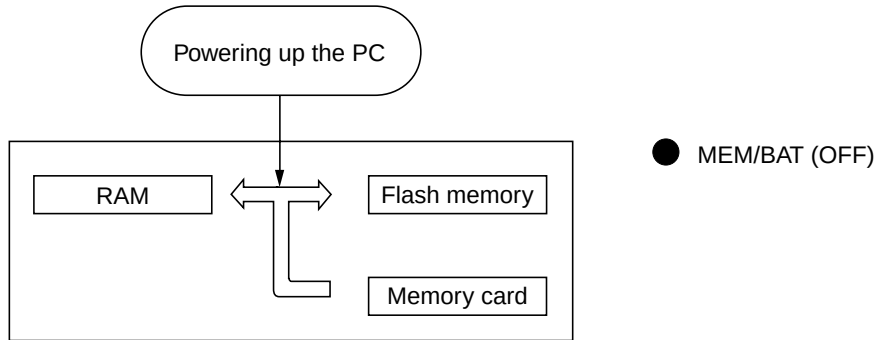


1-2-2 Flash memory card

The basic unit with 40- or 60-I/O points can be installed a flash memory card (hereinafter merely called “memory card”).

(1) Operation when a memory card is installed with the write protect switch turned on

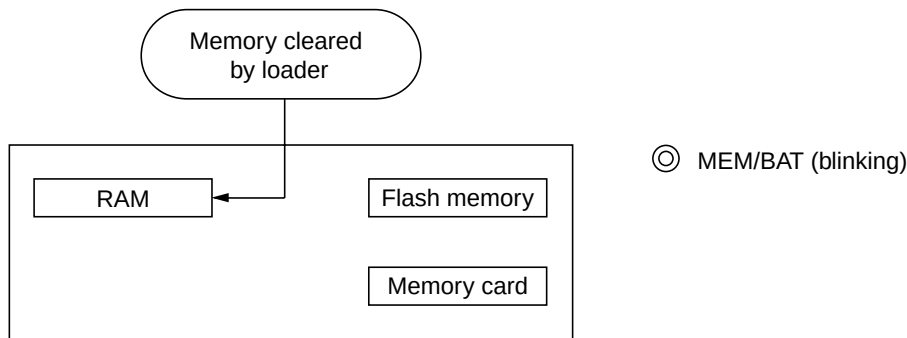
When the PC is powered up, the data (parameters, programs and file registers) stored in the memory card is automatically transferred to the RAM and the flash memory.



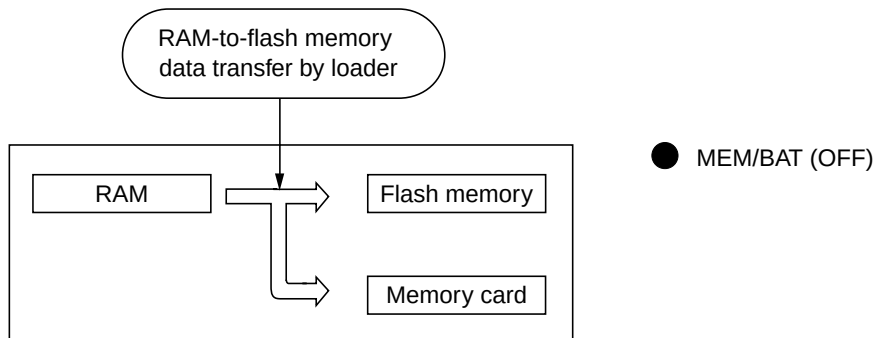
Note: It is possible to write or clear the memory (parameters, programs and file registers) from the loader.

(2) Operation when a memory card is installed with the write protect switch turned off

- 1) When the write protect switch of the memory card is turned off, the content of the memory card is not transferred to the RAM, and the PC operates the same as when no memory card is installed.
- 2) Operation when memory is cleared from the loader
In this case, the content of the RAM is cleared. But the content of the flash memory or the memory card is not cleared. Therefore, the content of the RAM does not coincide with that of the flash memory, and the MEM/BAT LED blinks.



- 3) Operation when data is transferred from the RAM to the flash memory by the loader
The content of the RAM is transferred to the flash memory and the memory card.

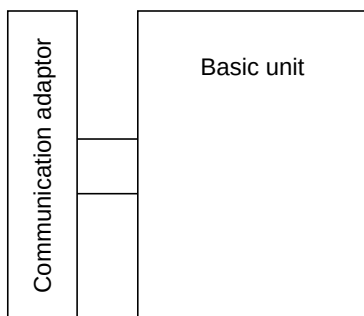


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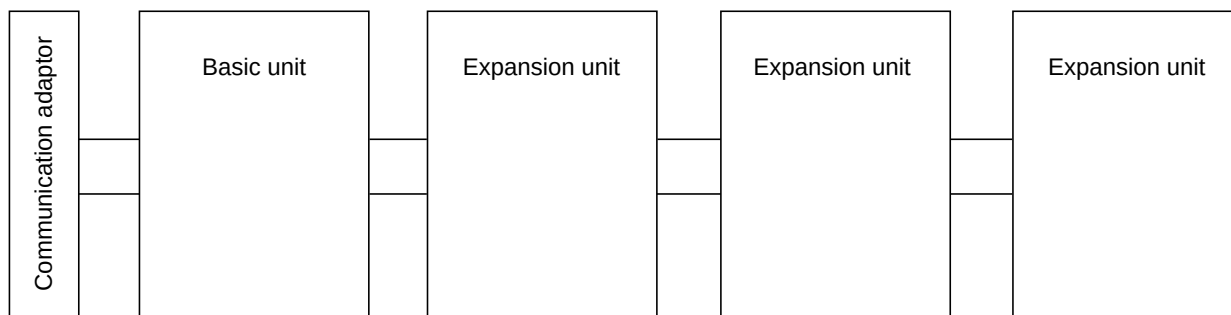
By combining the basic unit with expansion units and a communication adaptor, you can configure the following systems.

(1) For the basic unit with 20 I/O points



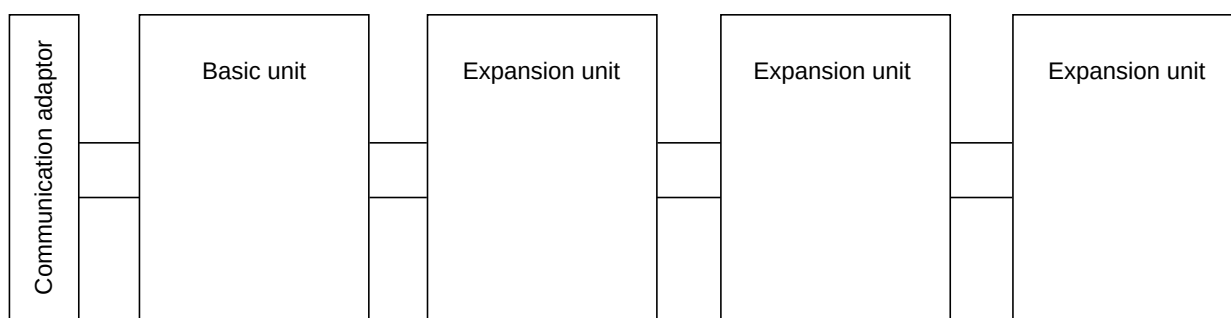
- No expansion unit can be connected.

(2) For the basic unit with 30/40 I/O points



- Maximum of 3 expansion units can be connected. (Including analog units)
- Maximum 64 I/O points can be added. (Maximum two 32-I/O point units can be expanded.)
- For AC power supply specification unit, maximum 40 points of relay output can simultaneously be turned on, in the total of basic and expansion units.
- For AC power supply specification unit, maximum 55 points of transistor output can simultaneously be turned on, in the total of basic and expansion units.

(3) For the basic unit with 60 I/O points



- Maximum of 3 expansion units can be connected. (Including analog units)
- Maximum 64 I/O points can be added. (Maximum two 32-I/O point units can be expanded.)
- For AC power supply specification unit, maximum 56 points of relay output can simultaneously be turned on, in the total of basic and expansion units.

I/O addresses are assigned by word in an order from basic unit to expansion units.

2-2-1 Basic unit

(1) For the basic unit with 20 I/O points

		(Bit address)																
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
WX/WY	0	Free				XB	XA	X9	X8	X7	X6	X5	X4	X3	X2	X1	X0	
	1	Free								Y17	Y16	Y15	Y14	Y13	Y12	Y11	Y10	
	2	Free																
	⋮	⋮																

* No expansion units can be connected.

(2) For the basic unit with 30 I/O points

		(Bit address)																
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
WX/WY	0	XF	XE	XD	XC	XB	XA	X9	X8	X7	X6	X5	X4	X3	X2	X1	X0	
	1	Free		Y1D	Y1C	Y1B	Y1A	Y19	Y18	Y17	Y16	Y15	Y14	Y13	Y12	Y11	Y10	
	2	Assigned to the first expansion unit																
	⋮	⋮																

(3) For the basic unit with 40 I/O points

		(Bit address)																
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
WX/WY	0	XF	XE	XD	XC	XB	XA	X9	X8	X7	X6	X5	X4	X3	X2	X1	X0	
	1	Free								X17	X16	X15	X14	X13	X12	X11	X10	
	2	Y2F	Y2E	Y2D	Y2C	Y2B	Y2A	Y29	Y28	Y27	Y26	Y25	Y24	Y23	Y22	Y21	Y20	
	3	Assigned to the first expansion unit																
	⋮	⋮																

(4) For the basic unit with 60 I/O points

		(Bit address)																
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
WX/WY	0	XF	XE	XD	XC	XB	XA	X9	X8	X7	X6	X5	X4	X3	X2	X1	X0	
	1	X1F	X1E	X1D	X1C	X1B	X1A	X19	X18	X17	X16	X15	X14	X13	X12	X11	X10	
	2	Free												X23	X22	X21	X20	
	3	Y3F	Y3E	Y3D	Y3C	Y3B	Y3A	Y39	Y38	Y37	Y36	Y35	Y34	Y33	Y32	Y31	Y30	
	4	Free								Y47	Y46	Y45	Y44	Y43	Y42	Y41	Y40	
	5	Assigned to the first expansion unit																
	⋮	⋮																

2-2-2 The addresses of the expansion units

As for the addresses of the expansion units, the values of the words that follow the last address of the preceding unit (on the left) are assigned.

In the following figure, 'n' means the top address of the expansion units.

(1) For the expansion units with 16 I/O points

		(Bit address)															
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WX/WY	n	Free								Xn 7	Xn 6	Xn 5	Xn 4	Xn 3	Xn 2	Xn 1	Xn 0
	n+1	Free								Yn+1 7	Yn+1 6	Yn+1 5	Yn+1 4	Yn+1 3	Yn+1 2	Yn+1 1	Yn+1 0
	n+2	Assigned to the next expansion unit (on the right)															
	⋮	⋮															

(2) For the expansion units with 32 I/O points

		(Bit address)															
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WX/WY	n	Xn F	Xn E	Xn D	Xn C	Xn B	Xn A	Xn 9	Xn 8	Xn 7	Xn 6	Xn 5	Xn 4	Xn 3	Xn 2	Xn 1	Xn 0
	n+1	Yn+1 F	Yn+1 E	Yn+1 D	Yn+1 C	Yn+1 B	Yn+1 A	Yn+1 9	Yn+1 8	Yn+1 7	Yn+1 6	Yn+1 5	Yn+1 4	Yn+1 3	Yn+1 2	Yn+1 1	Yn+1 0
	n+2	Assigned to the next expansion unit (on the right)															
	⋮	⋮															

(3) For the expansion units with 16 Input points

		(Bit address)															
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WX/WY	n	Xn F	Xn E	Xn D	Xn C	Xn B	Xn A	Xn 9	Xn 8	Xn 7	Xn 6	Xn 5	Xn 4	Xn 3	Xn 2	Xn 1	Xn 0
	n+1	Assigned to the next expansion unit (on the right)															
	⋮	⋮															

(4) For the expansion units with 16 Output points

		(Bit address)															
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WX/WY	n	Yn F	Yn E	Yn D	Yn C	Yn B	Yn A	Yn 9	Yn 8	Yn 7	Yn 6	Yn 5	Yn 4	Yn 3	Yn 2	Yn 1	Yn 0
	n+1	Assigned to the next expansion unit (on the right)															
	⋮	⋮															

2-2-3 The addresses of the analog units

As for the addresses of the analog units, the values of the words that follow the last address of the preceding unit (on the left) are assigned.

In the following figure, 'n' means the top address of the expansion units.

(1) For the analog input units

		(Bit address)															
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WX	n	Xn F	Xn E	Xn D	Xn C	Xn B	Xn A	Xn 9	Xn 8	Xn 7	Xn 6	Xn 5	Xn 4	Xn 3	Xn 2	Xn 1	Xn 0
	n+1	Xn+1 F	Xn+1 E	Xn+1 D	Xn+1 C	Xn+1 B	Xn+1 A	Xn+1 9	Xn+1 8	Xn+1 7	Xn+1 6	Xn+1 5	Xn+1 4	Xn+1 3	Xn+1 2	Xn+1 1	Xn+1 0
	n+2																
	n+3																
	n+4																
WY	n+5																
	n+6	Yn+6 F	Yn+6 E	Yn+6 D	Yn+6 C	Yn+6 B	Yn+6 A	Yn+6 9	Yn+6 8	Yn+6 7	Yn+6 6	Yn+6 5	Yn+6 4	Yn+6 3	Yn+6 2	Yn+6 1	Yn+6 0
	n+7	Yn+7 F	Yn+7 E	Yn+7 D	Yn+7 C	Yn+7 B	Yn+7 A	Yn+7 9	Yn+7 8	Yn+7 7	Yn+7 6	Yn+7 5	Yn+7 4	Yn+7 3	Yn+7 2	Yn+7 1	Yn+7 0
		Assigned to the next expansion unit (on the right)															

(2) For the analog output units

		(Bit address)															
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WX	n	Xn F	Xn E	Xn D	Xn C	Xn B	Xn A	Xn 9	Xn 8	Xn 7	Xn 6	Xn 5	Xn 4	Xn 3	Xn 2	Xn 1	Xn 0
	n+1	Free															
WY	n+2																
	n+3																
	n+4																
	n+5																
	n+6	Yn+6 F	Yn+6 E	Yn+6 D	Yn+6 C	Yn+6 B	Yn+6 A	Yn+6 9	Yn+6 8	Yn+6 7	Yn+6 6	Yn+6 5	Yn+6 4	Yn+6 3	Yn+6 2	Yn+6 1	Yn+6 0
	n+7	Yn+7 F	Yn+7 E	Yn+7 D	Yn+7 C	Yn+7 B	Yn+7 A	Yn+7 9	Yn+7 8	Yn+7 7	Yn+7 6	Yn+7 5	Yn+7 4	Yn+7 3	Yn+7 2	Yn+7 1	Yn+7 0
		Assigned to the next expansion unit (on the right)															

(3) For the analog I/O units

		(Bit address)															
(Word address)		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
WX	n	Xn F	Xn E	Xn D	Xn C	Xn B	Xn A	Xn 9	Xn 8	Xn 7	Xn 6	Xn 5	Xn 4	Xn 3	Xn 2	Xn 1	Xn 0
	n+1	Xn+1 F	Xn+1 E	Xn+1 D	Xn+1 C	Xn+1 B	Xn+1 A	Xn+1 9	Xn+1 8	Xn+1 7	Xn+1 6	Xn+1 5	Xn+1 4	Xn+1 3	Xn+1 2	Xn+1 1	Xn+1 0
	n+2																
	n+3																
WY	n+4																
	n+5	Free															
	n+6	Yn+6 F	Yn+6 E	Yn+6 D	Yn+6 C	Yn+6 B	Yn+6 A	Yn+6 9	Yn+6 8	Yn+6 7	Yn+6 6	Yn+6 5	Yn+6 4	Yn+6 3	Yn+6 2	Yn+6 1	Yn+6 0
	n+7	Yn+7 F	Yn+7 E	Yn+7 D	Yn+7 C	Yn+7 B	Yn+7 A	Yn+7 9	Yn+7 8	Yn+7 7	Yn+7 6	Yn+7 5	Yn+7 4	Yn+7 3	Yn+7 2	Yn+7 1	Yn+7 0
		Assigned to the next expansion unit (on the right)															

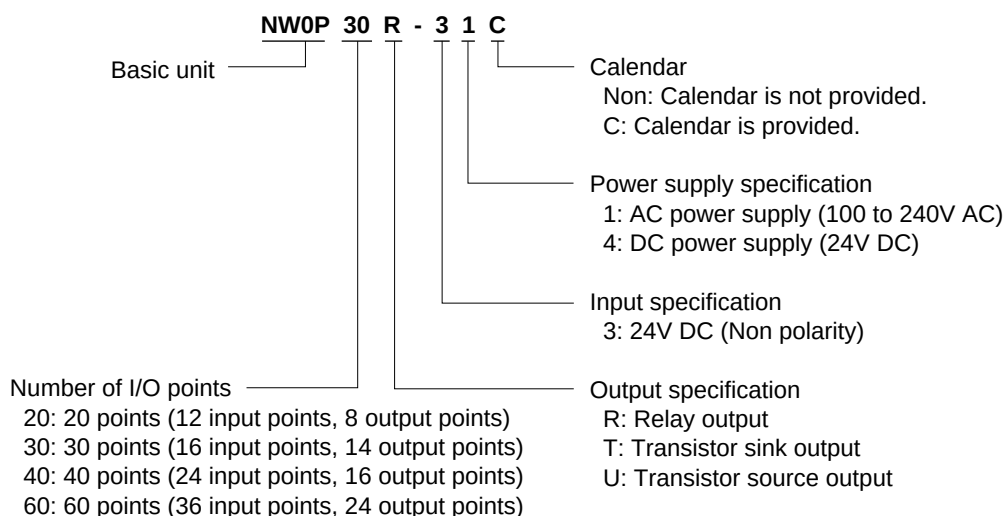
* For more information of the specifications of the analog units, refer to the “User’s Manual, Analog Units” volume (FEH407).

Section 3 Type Numbers

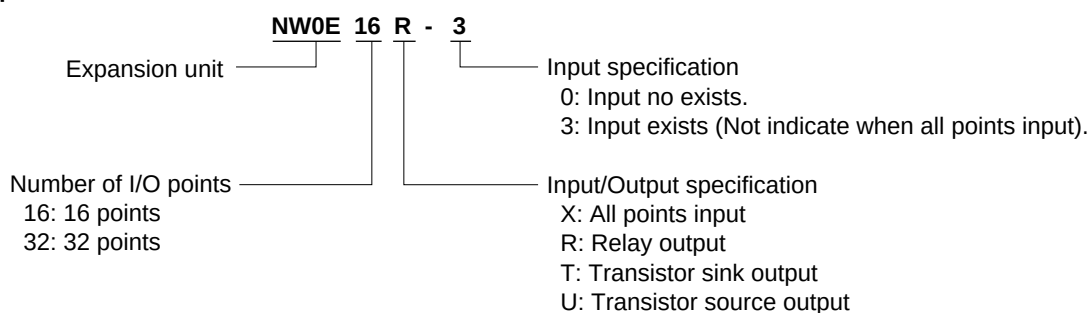
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The coding scheme for type number is as follows:

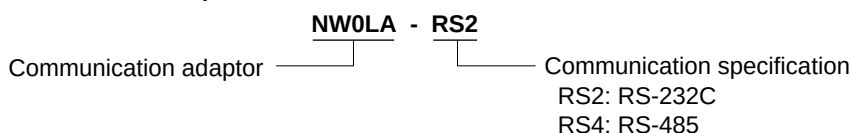
(1) Basic unit



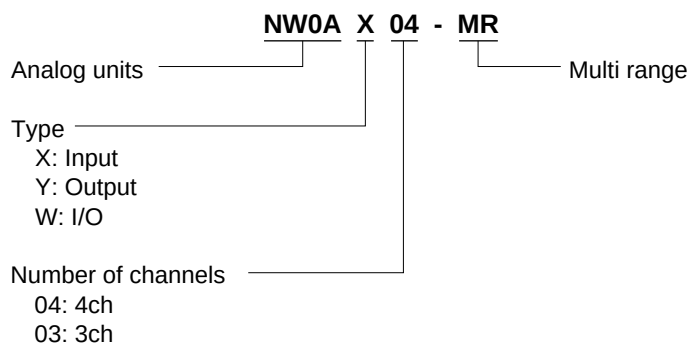
(2) Expansion units



(3) Communication adapter



(4) Analog units



3-2 Type Number List

Type list for the main unit

Type numbers and their outline specifications are shown below. When type number does not coincide with product code, both of them are indicated in the list.

3-2-1 Type list for the main unit

(1) Basic unit

I/O points	Input specification	Output specification	Power supply	Calendar	Type number	Accessory
20	24V DC, 12 points	Relay, 8 points	100 to 240V AC	Non provided	NW0P20R-31	Operating instruction
		Tr sink, 8 points		Non provided	NW0P20T-31	
		Tr source, 8 points		Non provided	NW0P20U-31	
30	24V DC, 16 points	Relay, 14 points		Non provided	NW0P30R-31	
		Tr sink, 14 points		Non provided	NW0P30T-31	
		Tr source, 14 points		Non provided	NW0P30U-31	
40	24V DC, 24 points	Relay, 16 points		Non provided	NW0P40R-31	
				Provided	NW0P40R-31C	
		Tr sink, 16 points		Non provided	NW0P40T-31	
				Provided	NW0P40T-31C	
		Tr source, 16 points		Non provided	NW0P40U-31	
				Provided	NW0P40U-31C	
60	24V DC, 36 points	Relay, 24 points		Non provided	NW0P60R-31	
				Provided	NW0P60R-31C	
		Tr sink, 24 points		Non provided	NW0P60T-31	
				Provided	NW0P60T-31C	
		Tr source, 24 points		Non provided	NW0P60U-31	
				Provided	NW0P60U-31C	
20	24V DC, 12 points	Relay, 8 points	24V DC	Non provided	NW0P20R-34	
		Tr sink, 8 points		Non provided	NW0P20T-34	
		Tr source, 8 points		Non provided	NW0P20U-34	
30	24V DC, 16 points	Relay, 14 points		Non provided	NW0P30R-34	
		Tr sink, 14 points		Non provided	NW0P30T-34	
		Tr source, 14 points		Non provided	NW0P30U-34	
40	24V DC, 24 points	Relay, 16 points		Non provided	NW0P40R-34	
				Provided	NW0P40R-34C	
		Tr sink, 16 points		Non provided	NW0P40T-34	
				Provided	NW0P40T-34C	
		Tr source, 16 points		Non provided	NW0P40U-34	
				Provided	NW0P40U-34C	
60	24V DC, 36 points	Relay, 24 points		Non provided	NW0P60R-34	
				Provided	NW0P60R-34C	
		Tr sink, 24 points		Non provided	NW0P60T-34	
				Provided	NW0P60T-34C	
		Tr source, 24 points		Non provided	NW0P60U-34	
				Provided	NW0P60U-34C	

(2) Expansion units

I/O points	Input specification	Output specification	Type number	Accessory
16	24V DC, 8 points	Relay, 8 points	NW0E16R-3	Operating instruction Expansion cable (50 mm) (type: NW8C-EP50)
		Tr sink, 8 points	NW0E16T-3	
		Tr source, 8 points	NW0E16U-3	
32	24V DC, 16 points	Relay, 16 points	NW0E32R-3	
		Tr sink, 16 points	NW0E32T-3	
		Tr source, 16 points	NW0E32U-3	
16	24V DC, 16 points	-	NW0E16X	
	-	Relay, 16 points	NW0E16R-0	
	-	Tr sink, 16 points	NW0E16T-0	
	-	Tr source, 16 points	NW0E16U-0	

(3) Communication adapter

Function	Type number	Accessory
RS-232C adaptor	NW0LA-RS2	Operating instruction
Simplified CPU link/ RS-485 adaptor	NW0LA-RS4	Operating instruction Terminating resistor (100Ω)

(4) Analog units

Function	Type number	Accessory
Analog input units	NW0AX04-MR	Operating instruction
Analog output units	NW0AY04-MR	
Analog I/O units	NW0AW03-MR	

(5) Option

Function	Type number	Accessory
User ROM card flash memory 8Kstep	NW8PMF-8	Operating instruction
Battery	NP8P-BT	Effective period indication seal
Expansion cable for expansion unit	NW8C-EP50	-

3-2-2 Type number list for the loader

(1) Handy loader

Part name	Specification	Type number (product code)
Handy loader (English)	Handy loader main unit with 1-m-long straight cord for connection to PC	NW0H-NE
Straight cord for connection to PC	Cable length: 0.3 m	NB-EC0030 (NB9C-EP3)
	Cable length: 0.5 m	NB-EC0050 (NB9C-EP5)
	Cable length: 1 m (supplied as standard with handy loader)	NB-EC0100 (NB9C-E01)
	Cable length: 2 m	NB-EC0200 (NB9C-E02)
Curled cord for connection to PC	Cable length: 2 m	N-HLD-C2 (NN1C-02)

(2) Personal computer loader

Part name	Specification	Type number (product code)
Converter connector for personal computer loader software	Personal computer side: D-sub 9-pin PC side: Modular jack	NW0H-CNV
Connection cable	For connecting to the converter connector and the PC (2m)	NW0H-CA3
Personal computer loader software	For windows (English)	NN4NWN-SB (Note)

(Adapted by Version 2 or after when SPB series)

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Item		Specification
Physical environmental conditions	Operating ambient temperature	0 to 55° C
	Storage temperature	-25 to +70° C
	Relative humidity	20 to 95%RH no condensation (Transport condition: 5 to 95%RH no condensation)
	Pollution degree	2 (IEC 61131-2) (Note1)
	Corrosion immunity	Free from corrosive gases. Not stained with organic solvents.
	Operating altitude	2000m or less above sea level (Transport condition: 70kPa or more)
Mechanical service conditions	Vibration	Half amplitude: 0.15mm, Constant acceleration: 19.6m/s ² , Two hours for each of three mutually perpendicular axes, total six hours. (Note2)
	Shock	Acceleration peak: 147m/s ² Three times for each of three mutually perpendicular axes. (Note2)
Electrical service conditions	Noise immunity	1.5kV, rise time 1ns, pulse width 1μs (noise simulator)
	Electrostatic discharge	Contact discharge: ± 6kV Aerial discharge: ± 8kV
	Radioelectromagnetic field	10V/m (80MHz to 1000MHz)
Construction		Panel-mounted type IP30
Cooling		Air cooling
Dielectric property		Dielectric strength and Insulation resistance are described in each section.

Note1: 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.

4-2 Performance/specifications of basic unit

Performance/specifications of basic unit

Item		Specification	Remarks
Control system		Cyclic operation stored program system	
I/O control system		Batched processing, direct access processing	
Programming language		Ladder diagram or mnemonic language	
Program capacity		8K steps (40/60 points), 4K steps (20/30 points)	Built-in RAM and flash memory
No. of I/O points		20, 30, 40 or 60 Max. 124 points when expanded by direct connection. Expandable using the communication block	
No. of instructions	Sequence instructions	45 types	
	Data instructions	166 types	
Execution speed		Sequence instructions : 0.44 to 1.00μs	Contact, coil
		MOV instruction : 2.19 to 2.50μs	Word instruction
		Logical operation instructions : 2.63 to 3.25μs	Word instruction
		Addition and subtraction instructions : 7.13 to 8.38μs	Word instruction
		Multiplication and division instructions : 5.25 to 14.63μs	Word instruction
		Timer and counter instructions : 7.19 to 9.63μs	
I/O relay (X and Y)		1024 points	
Internal relay (M)		1024 points	
Extended internal relay (M)		3072 points	
Latch relay (L)		1024 points	
Extended latch relay (L)		3072 points	
Special relay (M)		512 points	
Timer	10ms base (T)	384 points (T000 to T17F)	
	1ms base (T)	128 points (T180 to T1FF)	
Counter (increment type) (C)		256 words	
Register	Data register (D)	8192 words	
	Special register (D)	256 words	
	File register (R)	Using program loader to specify program memory area to be used	
Pointer	For a branch (P)	256 points	
	For an interrupt pointer (I)	10 points	
Input filtering time-delay		Variable (no filter, 3 ms/3 ms, 10 ms/10 ms)	Default: OFF to ON: 3 ms ON to OFF: 3 ms
High-speed counter		Single-phase 100 kHz pulse input operation: 2 channels (unsigned 16-bit), or Two-phase 50 kHz pulse operation: 1 channel (signed 32-bit)	
Self-diagnosis		Program check, watchdog timer, etc.	
Applicable program loader		Handy program loader Program loader software package for personal computer	
Memory backup		Programs (including file resister), parameters -Built-in RAM + capacitor, built-in flash (20/30 points unit) -Built-in RAM + battery, built-in flash (40/60 points unit) Data memory (power failure retention area) -Built-in RAM + capacitor (20/30 points unit) -Built-in RAM + battery (40/60 points unit) Backup time of Built-in RAM + capacitor; approx. 2 weeks (25° C) Backup time of Built-in RAM + battery; approx. 5 years (25° C) Life in rewrite times of built-in flash memory; approx. 100,000 times	
User ROM card		Attachable to 40/60 points unit	
Calendar		Precision: ± 27s/month (at 25° C, when active)	

4-3-1 AC power supply

Item	Basic unit with 20 I/O points	Basic unit with 30/40 I/O points	Basic unit with 60 I/O points	Remarks
Rated input voltage (tolerance)	100 to 240V AC (85 to 264V AC)			
Rated frequency (tolerance)	50/60Hz (47 to 63Hz)			
Dropout tolerance	1cycle or less. (Note: 1)			1 second or more interval for each dropout. Rated voltage, Rated load
AC waveform distortion factor	5% or less			
Leakage current	0.25mA or less			Between input terminals and ground IEC 950 class II device
Inrush current (Ta=25° C not repeated)	40A _{o-p} or less, 10ms or less			
Power consumption	35VA or less	60VA or less	75VA or less	Rated input voltage Maximum load
Rated output voltage (tolerance)	24V±10% DC (21.6 to 26.4V DC)			
24V DC external power supply	200mA	250mA	300mA	
Insulation method	Transformer			
Dielectric strength	2830Vrms AC, 1 minute, between power input terminals and ground			
Insulation resistance	10MΩ or more (500V DC megger)			

Note: 1 This is a value from rated voltage to 0V and for all phases, rated load.

4-3-2 DC power supply

Item	Basic unit with 20 I/O points	Basic unit with 30/40 I/O points	Basic unit with 60 I/O points	Remarks
Rated input voltage (tolerance)	24V DC (19 to 30V DC)			
Dropout tolerance	5ms or less.			Rated input voltage, Rated load
Ripple distortion factor	Three phase all wave commutation wavefome, 5% or less			
Leakage current	0.25mA or less			
Inrush current	150A _{o-p} or less, 10ms or less			
Power consumption	10W or less	25W or less	30W or less	Rated input voltage Maximum load
Insulation method	Transformer			
Dielectric strength	560Vrms AC, 1 minute, between power input terminals and ground			
Insulation resistance	10MΩ or more (500V DC megger)			

4-4-1 DC input

Item		Hi-speed DC input	Ordinary DC input
Input signal condition	Rated voltage	24V DC	
	Voltage range	24V DC $\pm 10\%$	
	Permissible ripple factor	5%	
Characteristics of input circuit	Input type	Source and sink (common, bi-directional)	
	Rated current	Approx. 5mA (at 24V)	
	Input impedance	Approx. 4.7k Ω	
	Standard operating range	OFF to ON	15-26.4V
		ON to OFF	0-5V
	Input type	DC type 1	
	Input delay time	Hardware delay time: 25 μ s Software filtering time: Selected from "no filter" "3ms/3ms" and "10ms/10ms" (default is "3ms/3ms.")	Hardware delay time: 400 μ s Software filtering time: Selected from "no filter" "3ms/3ms" and "10ms/10ms" (default is "3ms/3ms.")
External connection		M3 screw	
Input indication		LED indicator lights up when output is ON (green). Logic side	
Isolation method		Photocoupler	
Dielectric strength		1500V AC, 1 minute, between input terminals and FG	
Insulation resistance		10M Ω or more with 500V DC megger (between input terminals and FG)	
Derating condition		None	

* Only #0 to #3 terminals of the basic unit are for high-speed DC input; others are for ordinary DC input.

4-5-1 Relay output

Item			Specification
Output power supply condition	Rated voltage		240V AC, 110V DC
	Maximum voltage		264V AC or less, 140V DC or less
Characteristics of output circuit	Output type		Relay
	Max. load current		240V AC/30V DC: 2A/1 point 8A/common 110V DC: 0.2A/1 point 1.6A/common
	Min. make/break current		5V DC, 1mA
	Response time	OFF to ON	10ms or less
		ON to OFF	10ms or less
	Leakage current in OFF state		None
Output protection method	Built-in fuse		None
	Output element		Relay (AC, DC)
	Surge absorb circuit		None
	Others		None
On/off times			Max. 1800 times/hour
Mechanical life			20 million times
Electrical life			See next page
External wire connections			M3 screw
Output indication			LED indicator lights up when output is ON (Green) Logic side
Isolation method			Relay
Dielectric strength			2830V AC/minute (between output terminals and FG)
Insulation resistance			10MΩ or more with 500V DC megger (between output terminals and FG)
Derating condition			None (Note: 1)

* Fuji card relay RB104 (or equivalent part) is used internally. For detailed information on its characteristics, etc., see the next page or the catalog for the card relay.

Note: 1) Due to the restriction on internal current consumption, there is a limit on the number of relay outputs that can simultaneously be turned on. For more information, refer to Section 2-1.

<Life curve of relays>

(1) Electrical life curve of relays

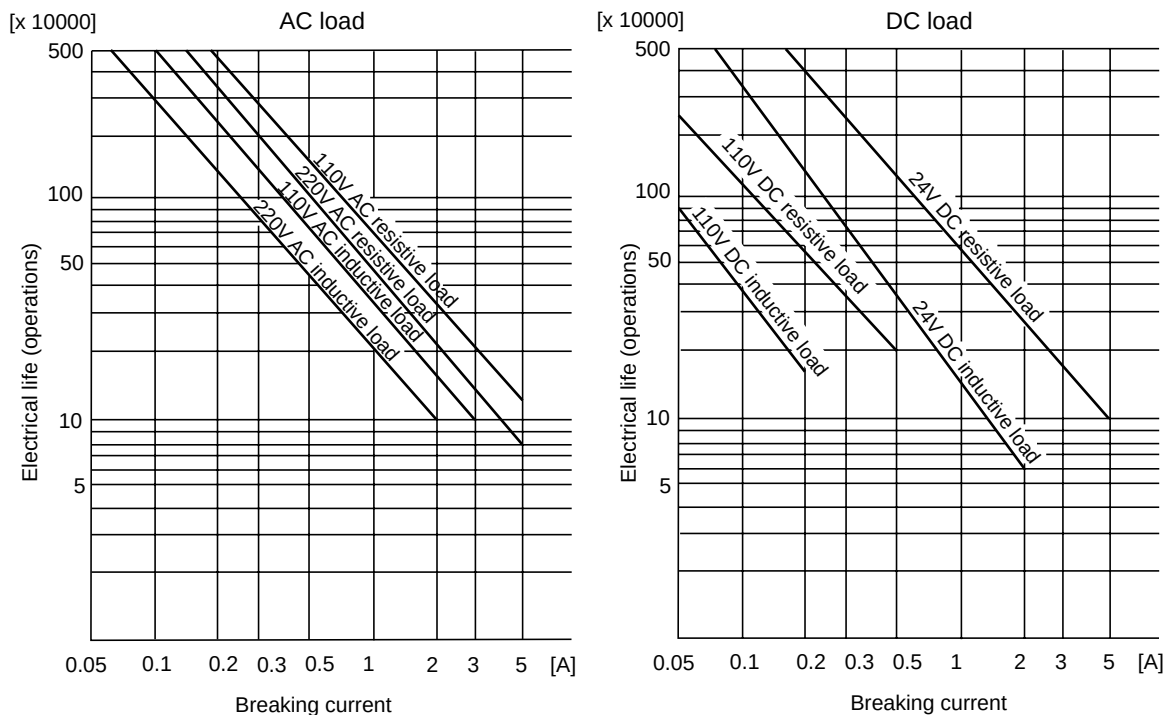
The life expectancy of contacts depends on the voltage, current and the type of load connected. Determine the electrical life of contacts and replacement period of modules by taking the following graphs into account.

<Test conditions>

On/off frequency: 1800 times/hour

On load factor: 40%, Time constant L/R= 15ms (inductive load)

[Electrical life curve for relay output element]



(2) Load types and inrush current

The load types and inrush current characteristics have remarkable effects on relay contacts. In particular, inrush current can cause contact welding, and must be taken into account together with the rated current.

- **Motors, electromagnetic contactors, and solenoid valve**

With these loads, the value of inrush current is 3 to 10 times that of the rated current.

In addition, when inrush current lasts for a long time, such as under a motor load, breaking of inrush current may cause contact welding.

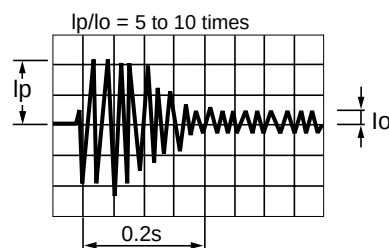
- **Lamp loads**

With lamp loads, the value of inrush current is 5 to 15 times that of the rated current. Because the inrush current may cause contact welding, in particular when a lamp with a large current capacity is to be turned on and off, it is recommended that confirmation test be performed using the actual load.

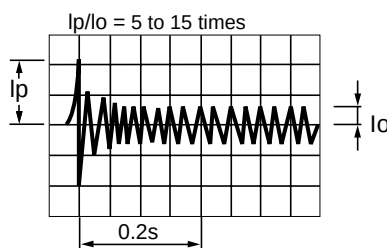
The figure as shown below are examples of the relationship between current waveform and time for each load. (I_p : Inrush current, I_o : Rated current)

[Relationship between current waveform and time for each load]

- **Motor loads**



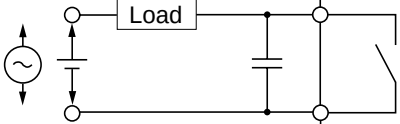
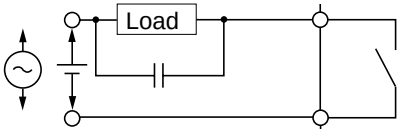
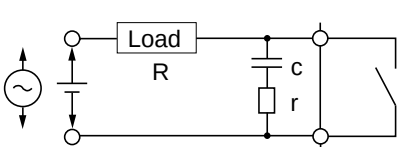
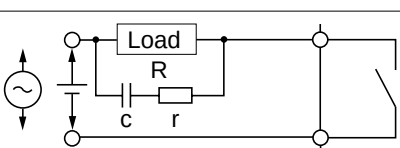
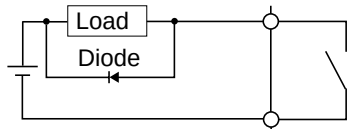
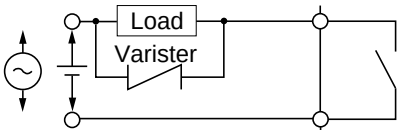
- **Halogen lamp loads**



(3) Protection of contacts

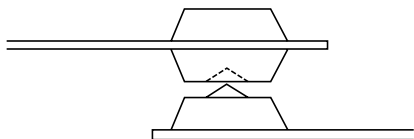
When an inductive load such as motors, clutches, and solenoids is turned off, counter electromotive forces of several hundreds to thousands volts are generated, which may greatly shorten the electrical life of contacts. This is because the energy $1/2Li^2$ accumulated in the coil (L: inductance of coil) is consumed by discharge between contacts when an inductive load is turned off. Therefore, to absorb the counter electromotive force, use of a contact protection circuit is recommended. The following shows some examples of contact protection circuits; in each case AC or DC voltage must be used appropriately.
Note that using a contact protection circuit may slightly extend the recovery time.

[Contact protection circuit]

Example circuit	Judgment	Notes on use
	No good	(1) The contact tends to be welded when the contact is closed. (2) With AC voltage, leakage voltage may occur at the load.
	No good	(1) The contact tends to be welded when the contact is closed.
	Good	(1) C= 0.1 to 1μF, r nearly equals R (2) With AC voltage: • Not applicable if the load impedance (R) is larger than the impedance of c or r • Applicable if the load impedance (R) is sufficiently small compared with the impedance of c or r
	Good	(1) C= 0.1 to 1μF, r nearly equals R (2) AC and DC voltage applicable
	Good	(1) DC voltage only (2) AC voltage not applicable
	Good	(1) AC and DC voltage are applicable

(4) 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.



4-5-2 Transistor output

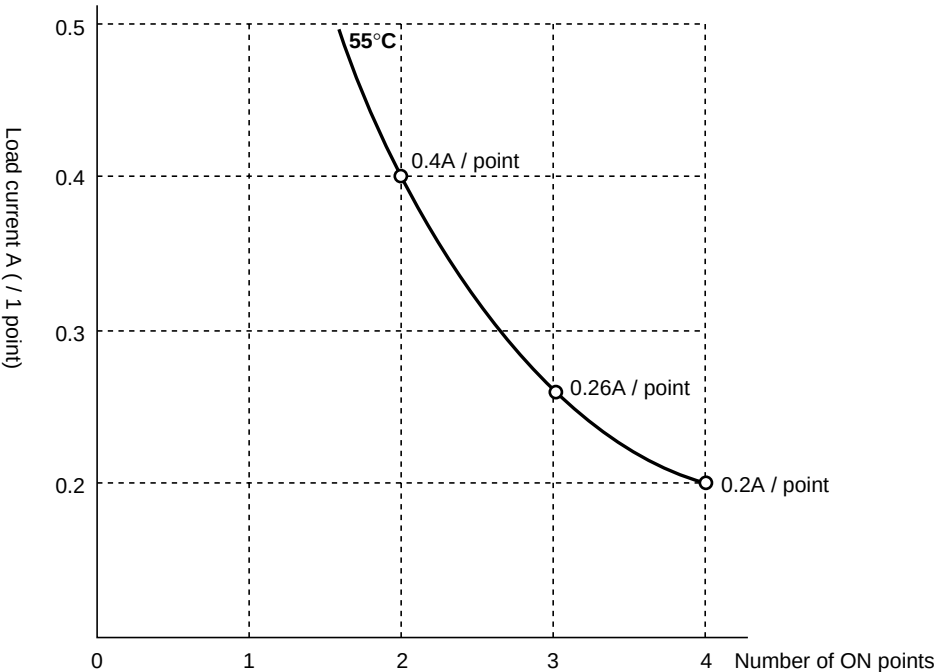
Item				Specification	
				Sink output	Source output
Output power supply condition	Rated voltage			24V DC	
	Maximum voltage			19 to 30V DC (including ripple)	
Characteristics of output circuit	Output type			Sink	Source
	Rated current	Ordinary output		0.5A/1 point 0.8A/4 points common 1.6A/8 points common	
		Hi-speed output		0.1A/1 point	
	Output voltage dropout			1.5V or less (at 0.5A)	
	Response time	Ordinary output	OFF to ON	1ms or less	
			ON to OFF	1ms or less	
		Hi-speed output	OFF to ON	5μs or less	
			ON to OFF	5μs or less	
	Leakage current in OFF state			Max. 0.1mA	
	Output element			Transistor	
	Surge current strength			2A (10ms)	
Output protection method	Built-in fuse			None	
	Surge absorb circuit			Zener diode	
	Others			None	
On/off times				Max. 1800 times/hour (when inductive load)	
External wire connections				M3 screw	
Output indication				LED indicator lights up when output is ON (Green) Logic side	
Isolation method				Photocoupler	
Dielectric strength				1500V AC/minute (between output terminals and FG)	
Insulation resistance				10MΩ or more with 500V DC megger (between output terminals and FG)	

Note: ON / OFF time varies if output frequency is high.

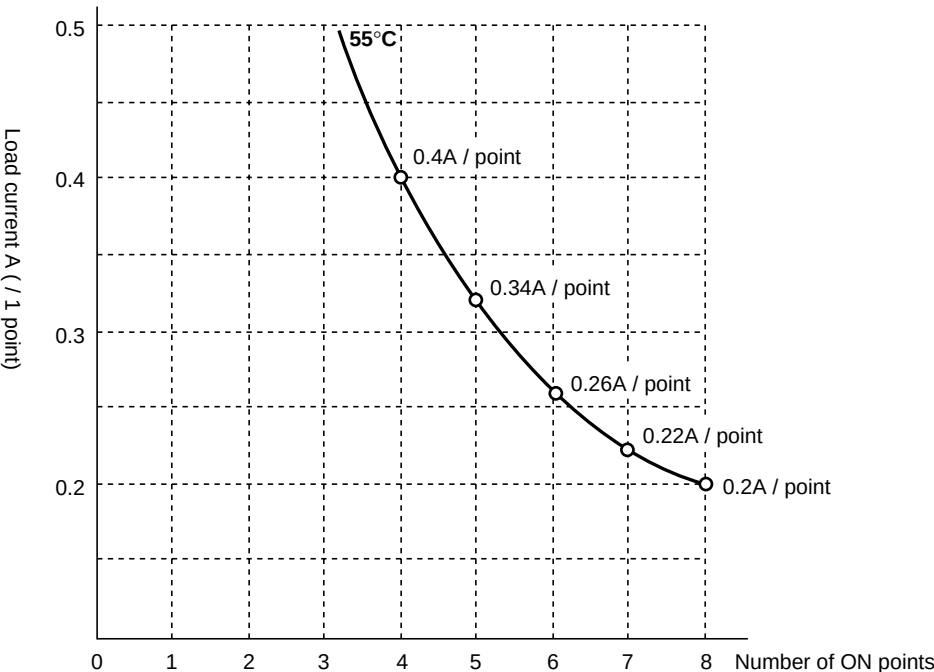
For more information, refer to the "Pulse Output Instructions and Functional Instructions" volume.

Derating of transistor output

(1) for 4-points common



(2) for 8-points common



4-6-1 Communication adapter units (NW0LA-RS2)

Item	Specification
Type	NW0LA-RS2
Port	RS-232C, 1 channel
Transmission method	Half-duplex, serial communication
Synchronization method	Start-stop synchronous transmission
Transmission speed (bps)	1,200/ 2,400/ 4,800/ 9,600/ 19,200/ 38,400 (Note: 1)
Transmission distance	15m or less
No. of connectable units	1: 1 (included external devices)
Connection method	D-sub 9-pins connector (male)
Transmission protocol	· Command setting style communication, · Non-procedural communication
Isolation method	Photocoupler
Dielectric strength	445V AC,1 minute (between I/O connector and FG)
Insulation resistance	10MΩ or more with 500V DC megger (between I/O connector and FG)

* For more information of the specifications and operating method of the communication adapter, refer to the "User's Manual, Communication Adapter" volume (FEH405).

Note 1: When using the communication adapter with a transmission speed of 38,400 bps, the noise immunity level is less than the specified value (1kV).

In this case, attach a ferrite core (ZCAT3035-1330 from TDK) near the connector on the communication adapter side of the communication cable.

4-6-2 Communication adapter units (NW0LA-RS4)

Item	Specification
Type	NW0LA-RS4
Port	RS-485, 1 channel
Transmission method	Half-duplex, serial communication
Synchronization method	Start-stop synchronous transmission
Transmission speed (bps)	1,200/ 2,400/ 4,800/ 9,600/ 19,200/ 38,400 (Note: 1)
Transmission distance	1km or less (19,200 bps or less)
No. of connectable units	1: 31 (max.)
Connection method	European detachable terminal block, 5 pins
Transmission protocol	· Command setting style communication, · Non-procedural communication
Isolation method	Photocoupler
Dielectric strength	445V AC,1 minute (between I/O connector and FG)
Insulation resistance	10MΩ or more with 500V DC megger (between I/O connector and FG)

* For more information of the specifications and operating method of the communication adapter, refer to the "User's Manual, Communication Adapter" volume (FEH405).

Note 1: When using the communication adapter with a transmission speed of 38,400 bps, the noise immunity level is less than the specified value (1kV).

In this case, attach a ferrite core (ZCAT3035-1330 from TDK) near the connector on the communication adapter side of the communication cable.

4-7-1 Analog input units (NW0AX04-MR)

Item		Specification			
Type		NW0AX04-MR			
No. of input channels		4			
Input impedance		1MΩ		250Ω	
Input tolerance		Voltage input: ± 15V		Current input: ± 30mA	
Input range		0 to 5V, 1 to 5V, 0 to 10V	-10 to 10V	-20 to 20mA	0 to 20mA 4 to 20mA
Digital value		0 to 16000 (DEC)			
Max. resolution		When voltage: 1.25mV		When current: 5μA	
Measurement accuracy (Full scale)		± 0.1% or less (23° C ± 5° C)			
		± 0.3% or less (0 to 55° C), 1 to 5V range ± 0.2% or less (0 to 55° C), Other range		± 0.4% or less (0 to 55° C)	
Sampling period		0.27ms x (No. of allowable conversion channels + 1)			
Input filtering time		Approx. 200μs (Hard filter: Primary delay time constant)			
Input delay time		1.5ms or less / 4 points + scan time (ms)			
connection	External connections	Detachable screw terminal (M3) 20 poles			
	Applicable wire size	AWG #22-18 (Analog signal used shielding twist pair cable)			
Isolation method		Photocoupler, not isolated between channels			
Dielectric strength		500V AC, 1 minute (between analog input terminals and frame ground) (Short cut current: 5mA)			
Insulation resistance		10MΩ or more with 500V DC megger (between analog input terminals and frame ground)			
External current consumption (24V DC)		100mA or less 24V DC (+10%, -15%). Full wave rectification power supply cannot be used.			
Rush current		5A or less			
Unused channels		Basically, short-circuit (between V+ and COM)			
Occupied words		8 words (Input: 6 words, Output: 2 words)			

Note: 1) For step response, input filtering time needs to be considered.

Note: 2) Maximum deviation of noise is $\pm 1\%$ of full scale.

* For more information of the specifications and operating method of the analog units, refer to the "User's Manual, Analog Units" volume (FEH407).

4-7-2 Analog output units (NW0AY04-MR)

Item		Specification				
Type		NW0AY04-MR				
No. of output channels		4				
Output range		0 to 5V, 1 to 5V	0 to 10V	-10 to 10V	0 to 20mA	4 to 20mA
External load impedance		1kΩ or more	2kΩ or more	2kΩ or more	500Ω or less	
Digital value		0 to 16000 (DEC)				
Max. resolution		When voltage: 1.25mV			When current: 5μA	
Measurement accuracy (Full scale)		± 0.1% or less (23° C ± 5° C)				
		± 0.3% or less (0 to 55° C), 1 to 5V range ± 0.2% or less (0 to 55° C), Other range			± 0.4% or less (0 to 55° C)	
Sampling period		1.0ms or less / 4 points				
Output delay time		1.0ms or less / 4 points + scan time (ms)				
Protect of load short-circuit		Provided			-	
connection	External connections	Detachable screw terminal (M3) 20 poles				
	Applicable wire size	AWG #22-18 (Analog signal used shielding twist pair cable)				
Isolation method		Photocoupler, not isolated between channels				
Dielectric strength		500V AC, 1 minute (between analog output terminals and frame ground) (Short cut current: 5mA)				
Insulation resistance		10MΩ or more with 500V DC megger (between analog output terminals and frame ground)				
External current consumption (24V DC)		200mA or less			240mA or less	
		24V DC (+10%, -15%). Full wave rectification power supply cannot be used.				
Rush current		5A or less				
Unused channels		Basically, open				
Occupied words		8 words (Input: 2 words, Output: 6 words)				

Note : Maximum deviation of noise is $\pm 1\%$ of full scale.

* For more information of the specifications and operating method of the analog units, refer to the "User's Manual, Analog Units" volume (FEH407).

4-7-3 Analog I/O units (NW0AW03-MR)

Item		Specification	
Type		NW0AW03-MR	
Input	No. of channels	2	
	Input impedance	100k Ω or more	250 Ω
	Input tolerance	Voltage input: $\pm 15V$	Current input: $\pm 30mA$
	Input range	0 to 5V, 1 to 5V, 0 to 10V	0 to 20mA, 4 to 20mA
	Measurement accuracy (Full scale)	$\pm 1\%$ or less (0 to 55° C)	
	Conversion speed (Note: 1)	8ms / 2 channels	
	Input filtering time	Approx. 2.2ms (Hard filter: Primary delay time constant)	
Output	No. of channels	1	
	Output range	0 to 5V, 1 to 5V, 0 to 10V	0 to 20mA, 4 to 20mA
	External load impedance	2k Ω or more	500 Ω or less
	Conversion speed (Note: 2)	8ms / 1 channel	
	Protect of load short-circuit	Provided	—
	Measurement accuracy (Full scale)	$\pm 1\%$ or less (0 to 55° C)	
Digital value		0 to 1000 (DEC)	
Max. resolution		10 bits (When voltage: 4mV, When current: 16 μA)	
connection	External connections	Detachable screw terminal (M3) 20 poles	
	Applicable wire size	AWG #22-18 (Analog signal used shielding twist pair cable)	
Isolation method		Photocoupler, not isolated between channels	
Dielectric strength		500V AC, 1 minute (between analog input/output terminals and frame ground) (Short cut current: 5mA)	
Insulation resistance		10M Ω or more with 500V DC megger (between analog input/output terminals and frame ground)	
External current consumption (24V DC)		200mA or less 24V DC (+10%, -15%). Full wave rectification power supply cannot be used.	
Rush current		5A or less	
Unused channels		Input: Basically, short-circuit (between V+ and COM) Output: Basically, open	
Occupied words		8 words (Input: 4 words, Output: 4 words)	

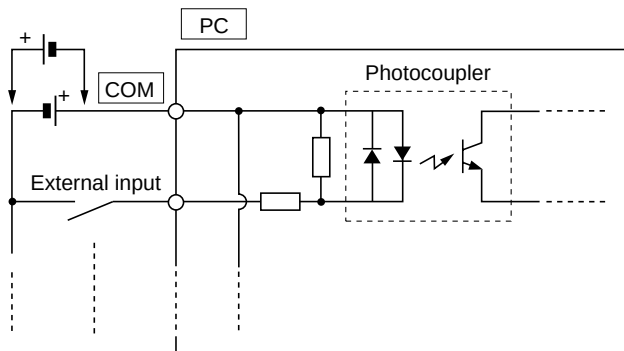
Note: 1) For step response, input filtering time needs to be considered.

Note: 2) Means 0 to 90% response.

Note: 3) Maximum deviation of noise is $\pm 1\%$ of full scale.

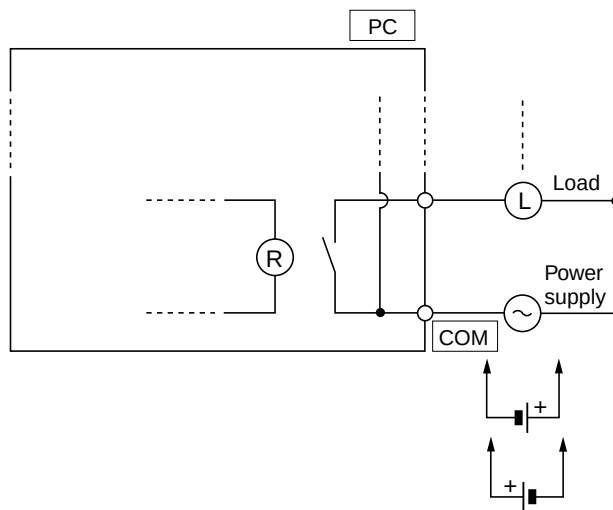
* For more information of the specifications and operating method of the analog units, refer to the "User's Manual, Analog Units" volume (FEH407).

4-8-1 Internal circuit for input

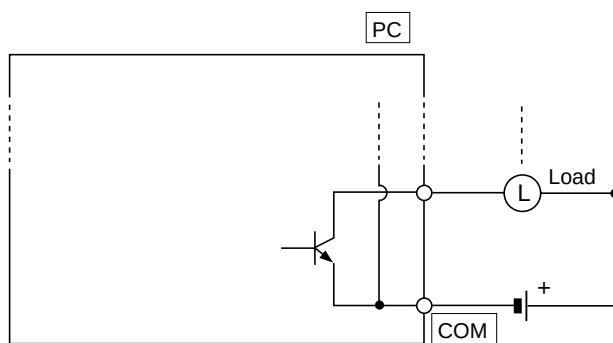


4-8-2 Internal circuit for output

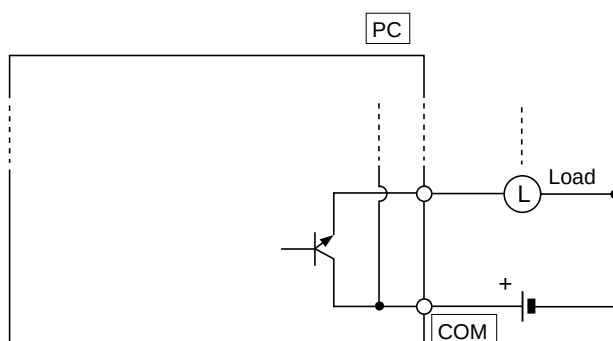
(1) Relay output



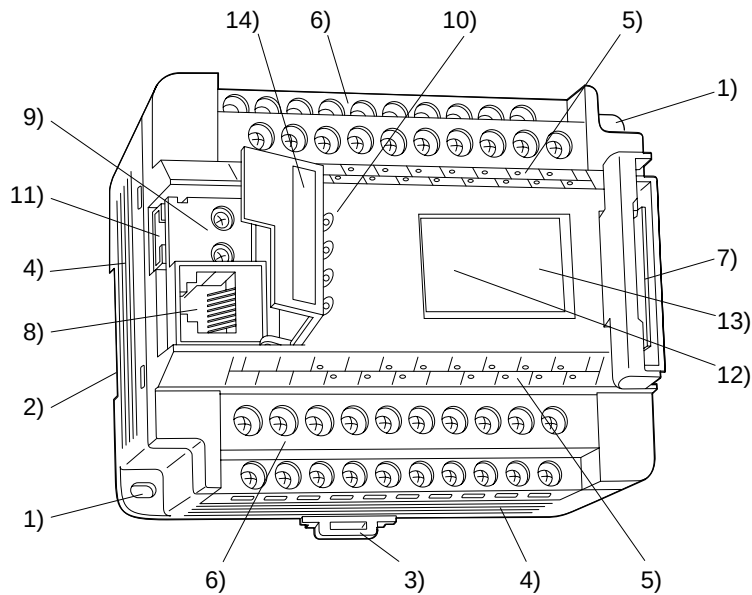
(2) Transistor sink output



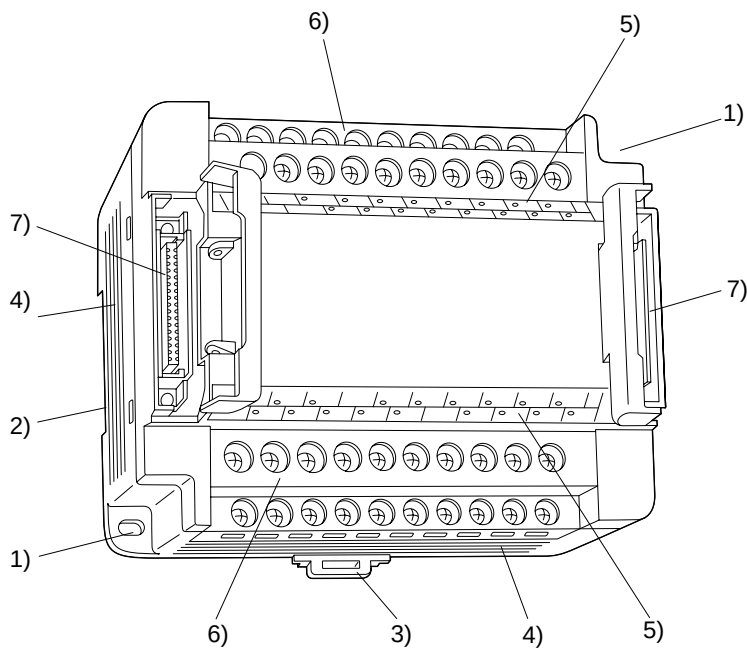
(3) Transistor source output



(1) Basic unit



(2) Expansion unit



Note: For more information about the communication adapter and the analog unit, refer to the following manuals.
 Communication Adapter: FEH405
 Analog Unit: FEH407

1) Mounting holes, $\varnothing 4.5$ (8 mm deep) x 2 pcs.

Use M4 mounting screws. Tightening torque: 1 to 1.5 N·m

2) DIN rail mount

Used to mount the SPB on the JIS/IEC standard 35 mm wide DIN rail.

3) Sliders

With a standard screwdriver or the like, slide this part to mount/remove the SPB on/off the DIN rail.

4) Vents

Vents for heat radiation are provided on the side faces of the SPB. Be careful to prevent dust or other foreign matter from entering through the vents.

5) Terminal name plate and I/O status indicator lamp (green)

Indicates terminal name and input/output signal status. The lamp lights up when the corresponding signal is turned ON, and goes out when the signal is turned off.

6) Terminal blocks

M3 screw mounting type 2-stage terminal blocks are located at the upper and lower parts (2 locations) of the SPB main unit. These terminal blocks are used to connect the power cable (only basic unit) or signal input/output cables. Terminal board of the basic unit with 20 or 30 I/O points or of expansion unit is not removable; terminal board of the basic unit with 40 or 60 I/O points is removable. Tightening torque: 0.5 to 0.6 N·m

7) Connector for expansion unit

Used to connect the expansion unit. This cable is supplied with the expansion unit. The basic unit with 20 I/O points is not equipped with this connector. For cable connecting/disconnecting method, see Section 5-2-3.

8) Loader connector

Used to connect the loader cable.

9) Analog setting volume (2CH)

The setting of this volume is stored in the CPU internal memory. For details, see Appendix 1.

10) Operation status indicator lamp

This LED indicates the current status of the basic unit.

Symbol	Indication color	Name	Lighting conditions
PWR	Green	Power indicator	This lamp lights up when the power supply is turned on (when the internal power supply is normal).
RUN	Green	Operation indicator	This lamp lights up when the CPU is running and goes out when it stops (including fatal fault occurrence).
ALM	Red	Error indicator	This lamp blinks (or lights continuously) when a nonfatal or fatal error occurs on the CPU.
MEM (20/30 points unit)	Red	RAM written	This LED blinks when program, parameter or file register is written. This LED goes out when the content of the built-in RAM is transferred to the built-in flash memory. The data transfer is automatically performed when the basic unit is powered up, and this LED goes out.
MEM/BAT (40/60 points unit)	Red	RAM written / Battery ran down	This LED blinks when program, parameter or file register is written. This LED goes out when the content of the built-in RAM is transferred to the built-in flash memory. The data transfer is automatically performed when the basic unit is powered up, and this LED goes out. This LED lights up continuously when voltage of the battery drops below specified level.

11) Connector for communication adapter

Used to connect the communication adapter. The cable is supplied with the communication adapter.

12) Backup battery

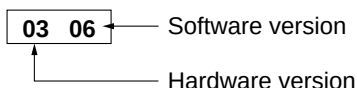
This battery is for the memory backup. (Only 40/60 points units)

13) User ROM card connector

Connector for mounting user ROM card. (Only 40/60 points units)

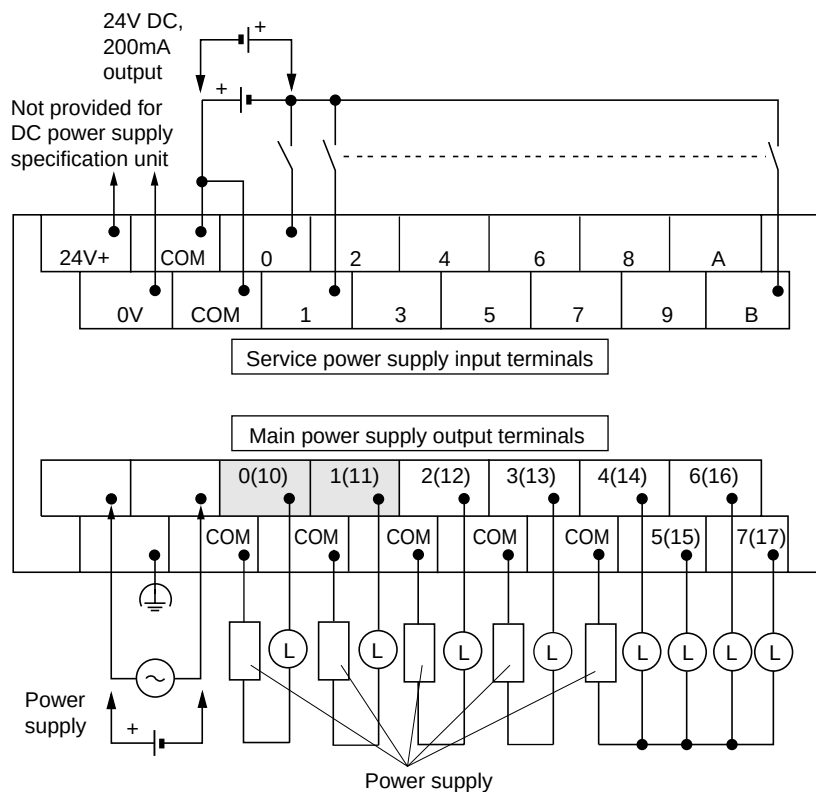
14) Version sticker

Version of the basic unit is indicated on this seal.



4-10-1 Basic unit

(1) For the basic unit with 20 I/O points (12 input points/common, independent common output x 4 circuits, 4 output points/common)

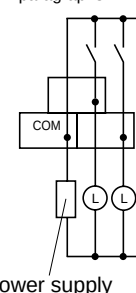


Notes:

- 1) For transistor output type, shaded part () becomes high-speed output terminals. This is also the same with the following paragraphs
- 2) Depending on output types, output terminal becomes as follows:

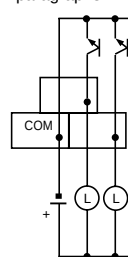
For relays

This is also the same with the following paragraphs



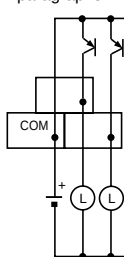
For transistor sink

This is also the same with the following paragraphs



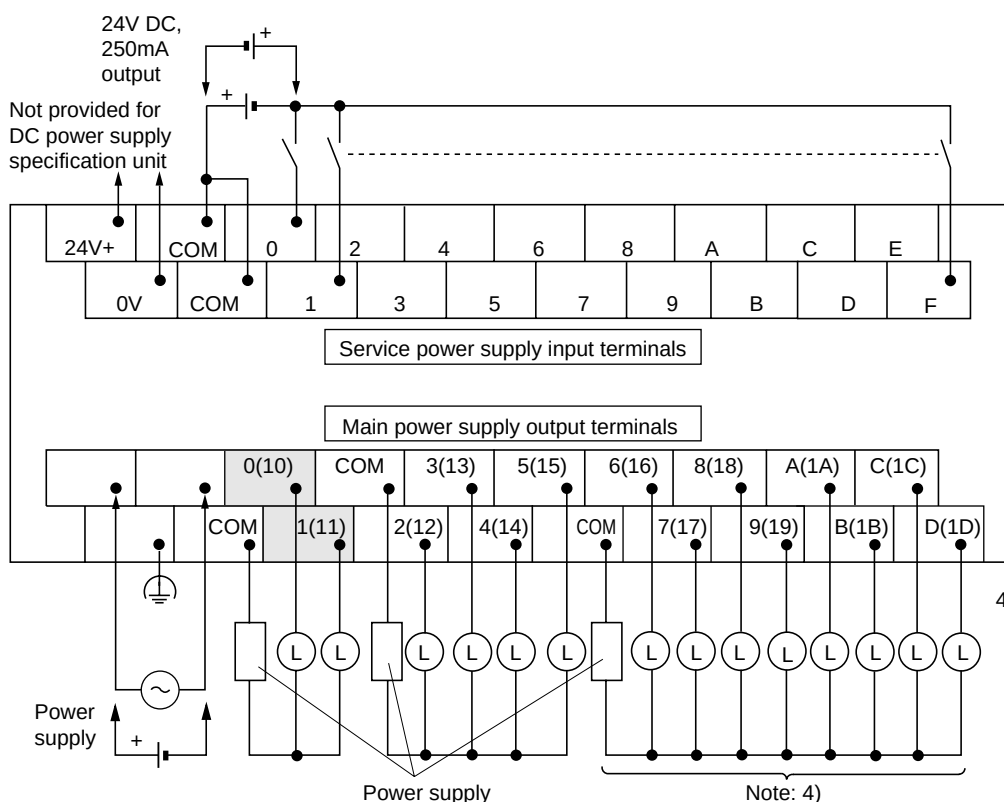
For transistor source

This is also the same with the following paragraphs



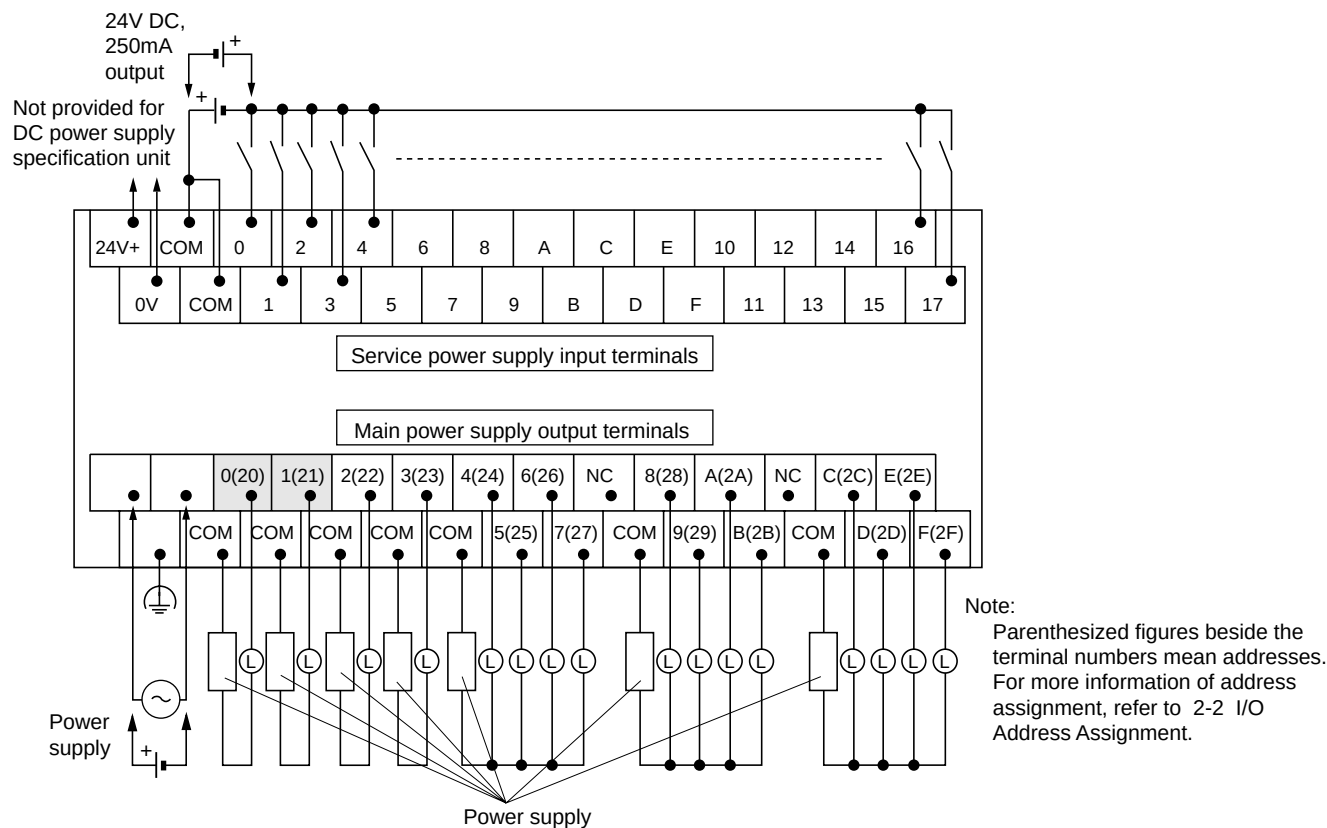
- 3) Parenthesized figures beside the terminal numbers mean addresses. For more information of address assignment, refer to 2-2 I/O Address Assignment.

(2) For the basic unit with 30 I/O points (16 input points/common, 2 output points/common, 4 output points/common, 8 output points/common)

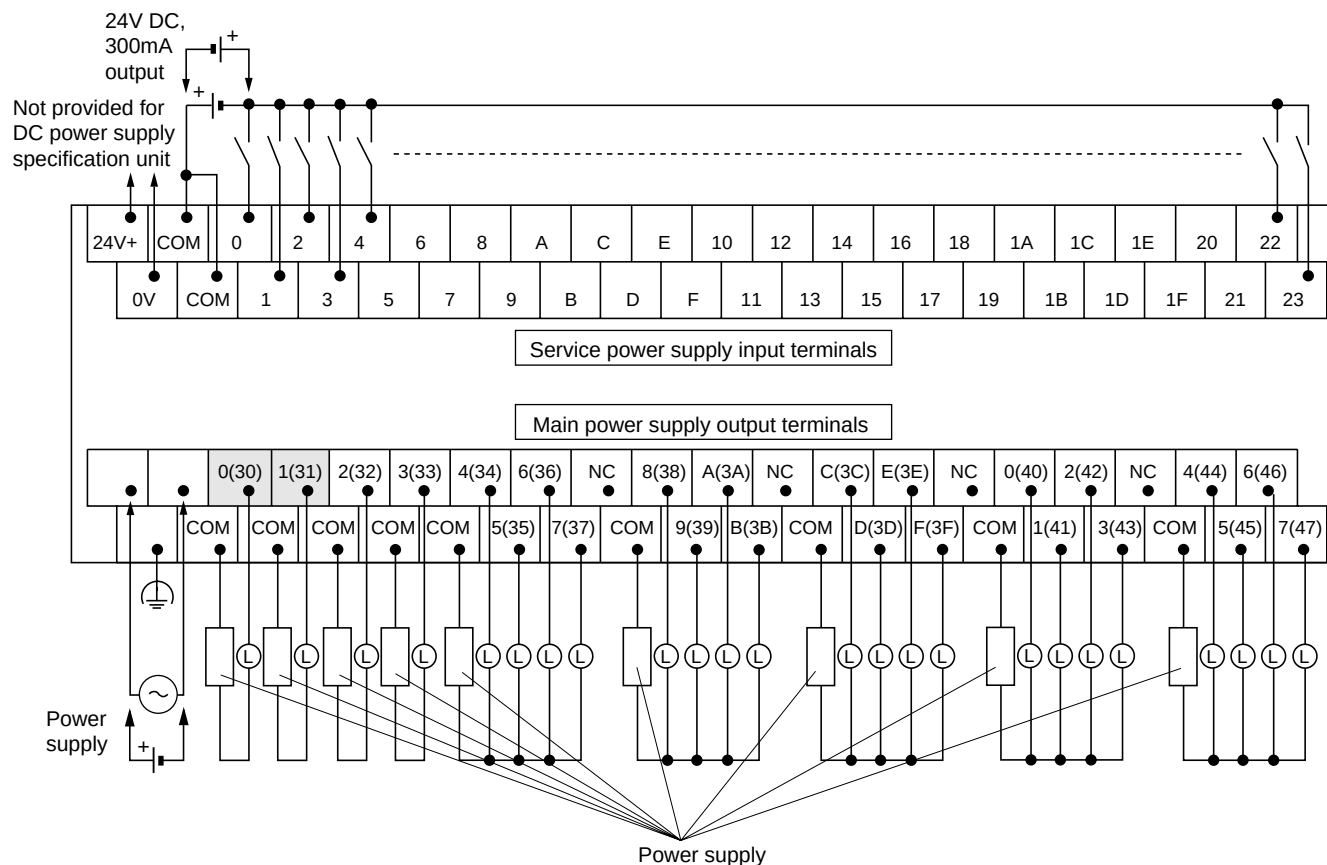


- 4) Because COM current becomes 8 A during Ry output, the maximum output current of terminals 6 to D is 1A. On the other hand, terminals 0 to 5 can output 2A.

(3) For the basic unit with 40 I/O points (24 input points/common, independent common output x 4 circuits, 4 output points/common x 3 circuits)

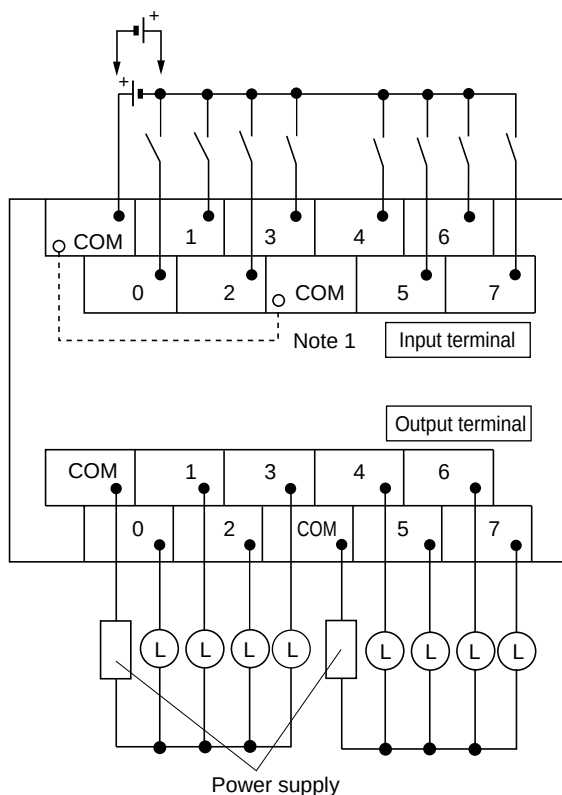


(4) For the basic unit with 60 I/O points (36 input points/common, independent common output x 4 circuits, 4 output points/common x 5 circuits)



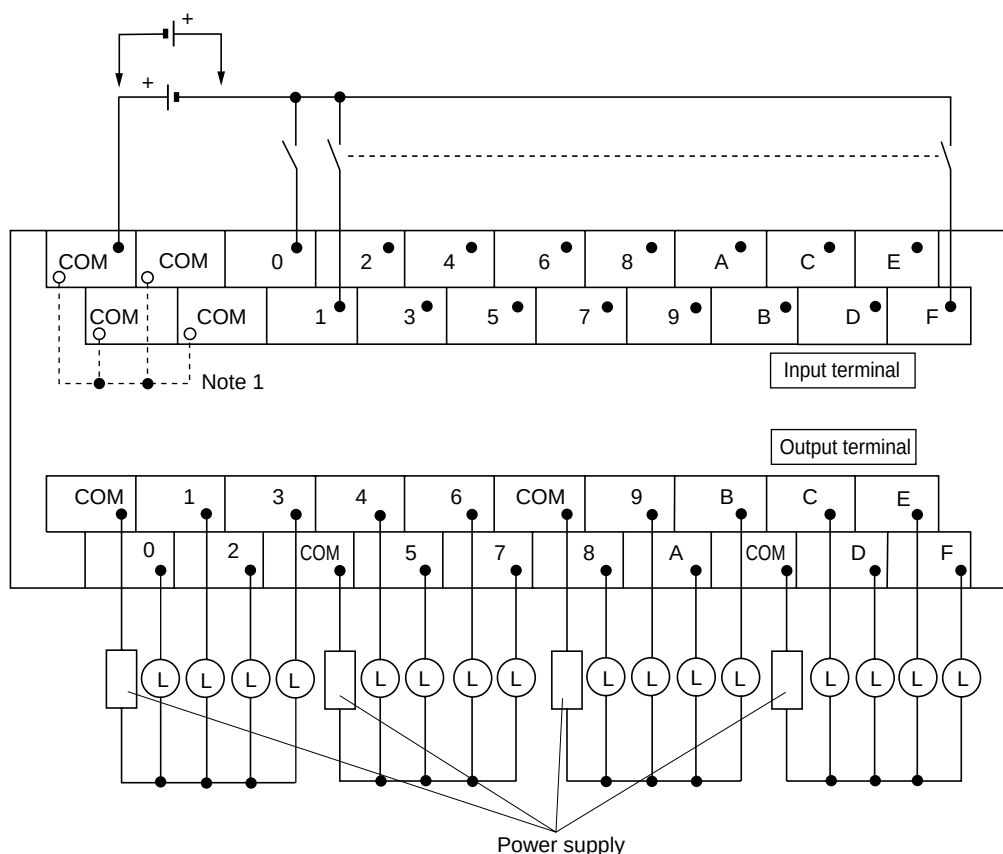
4-10-2 Expansion unit

(1) For the expansion unit with 8 input points and 8 output points (8 input points/common, 4 output points/common x 2 circuits)



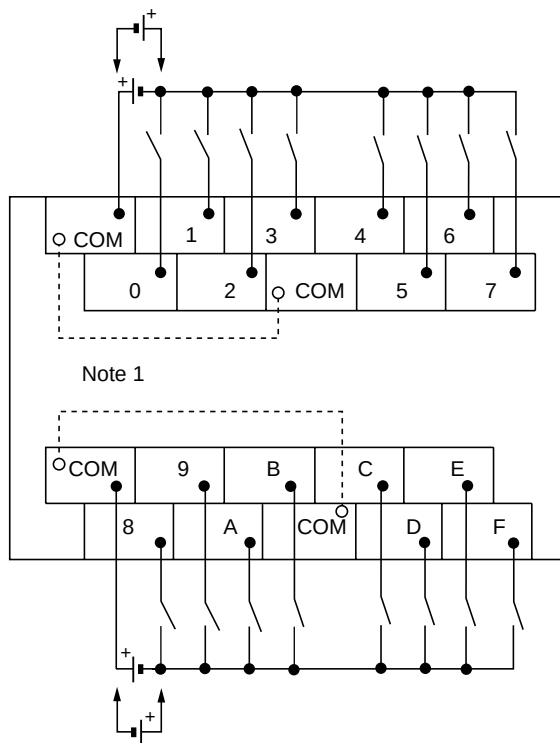
Note 1: The input COMs are connected internally.

(2) For the expansion unit with 16 input points and 16 output points (16 input points/common, 4 output points/common x 4 circuits)



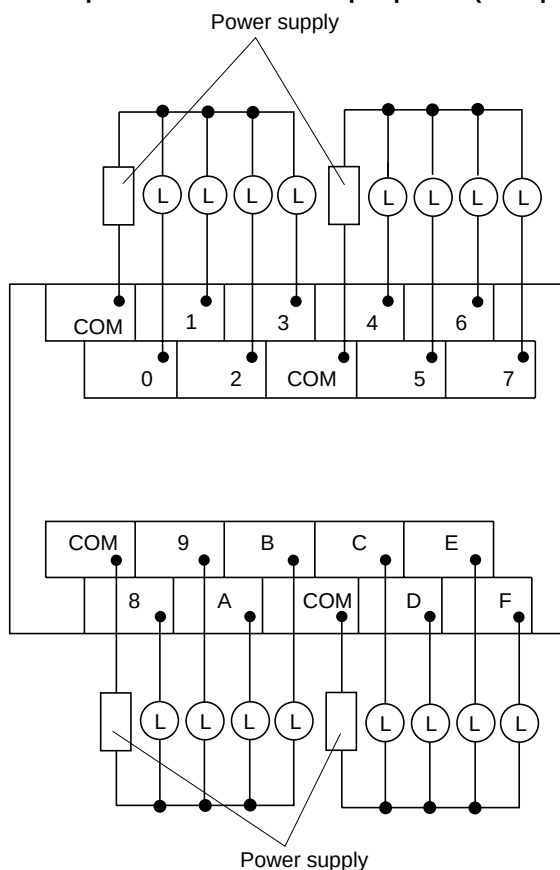
Note 1: The input COMs are connected internally.

(3) For the expansion unit with 16 input points (8 input points/common x 2 circuits)



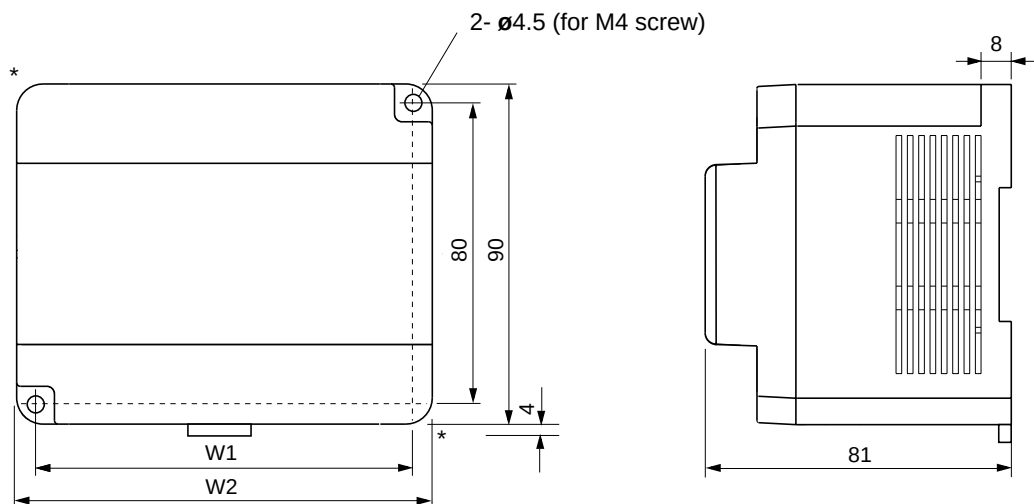
Note 1: The COMs of 0 to 3 and 4 to 7 are connected internally.
The COMs of 8 to B and C to F are connected internally.

(4) For the expansion unit with 16 input points (4 output points/common x 4 circuits)



Unit is mm.

(1) Basic unit and expansion unit

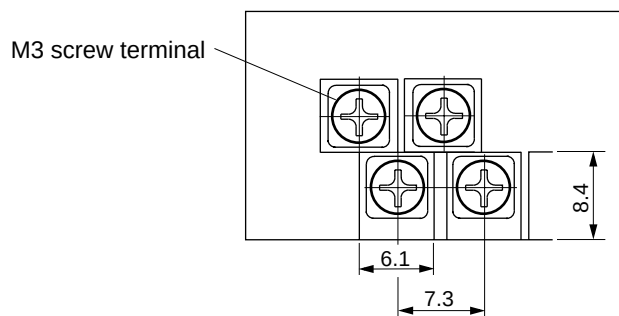


*) The mounting hole of a basic unit of 60 point type is on four corners.
Other units has not the mounting hole on " * " part.

No. of I/O points	W1	W2
20 points basic unit	70	80
30 points basic unit	100	110
40 points basic unit	130	140
60 points basic unit	170	180
16 points expansion unit	54	64
32 points expansion unit	100	110

Tightening torque of mounting screw: 1 to 1.5 N·m

(2) Terminal dimensions

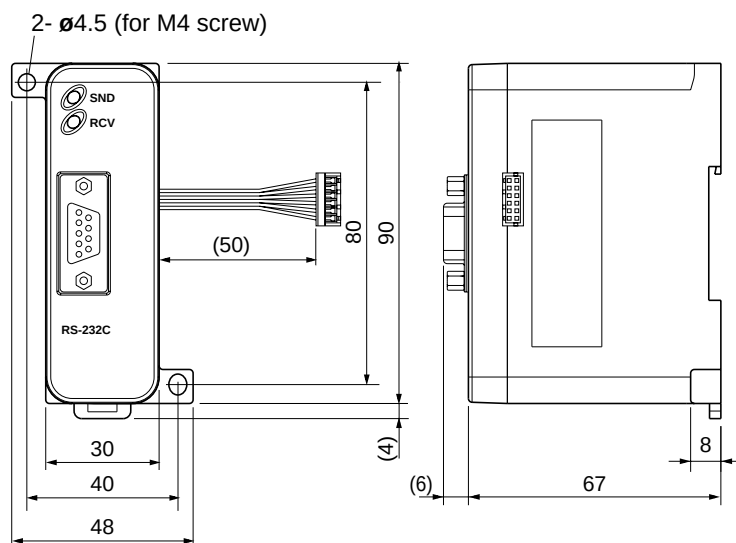


Tightening torque of terminal screw: 0.5 to 0.6 N·m

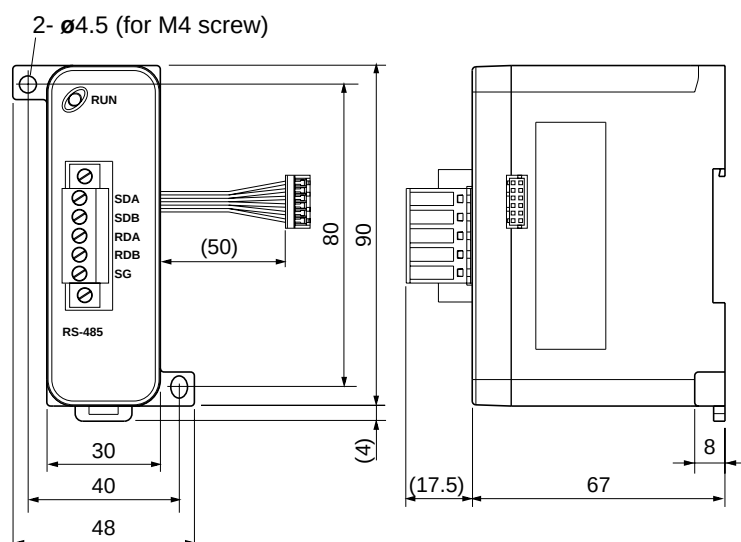
Note: This also applies to the analog units.

(3) Communication adapter

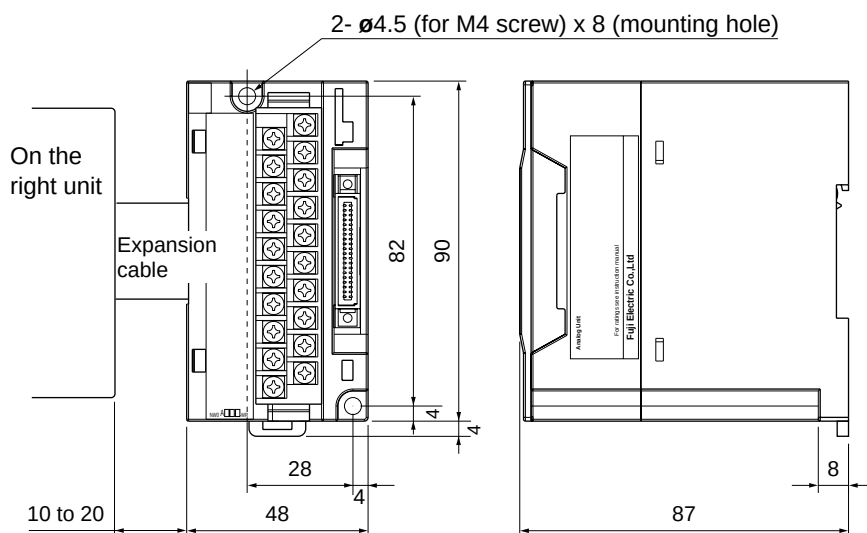
1) RS-232C



2) RS-485



(4) Analog unit



Note: This also applies to the analog input units, the analog output units, and the I/O units.

(1) Basic unit

Type	Mass
Basic unit with 20 I/O points	Approx. 330g
Basic unit with 30 I/O points	Approx. 440g
Basic unit with 40 I/O points	Approx. 550g
Basic unit with 60 I/O points	Approx. 700g

(2) Expansion unit

Type	Mass
Expansion unit with 16 I/O points	Approx. 180g
Expansion unit with 32 I/O points	Approx. 310g

(3) Communication adapter

Type	Mass
RS-232C adaptor	Approx. 100g
Simplified CPU link/RS-485 adaptor	Approx. 100g

(4) Analog unit

Type	Mass
Analog input unit	Approx. 250g
Analog output unit	Approx. 250g
Analog I/O unit	Approx. 250g

(5) Expansion cable

Length (mm)	Mass
50	Approx. 15g

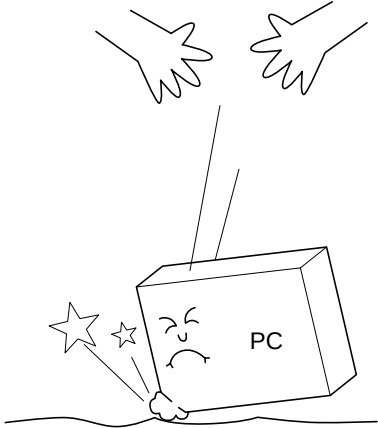
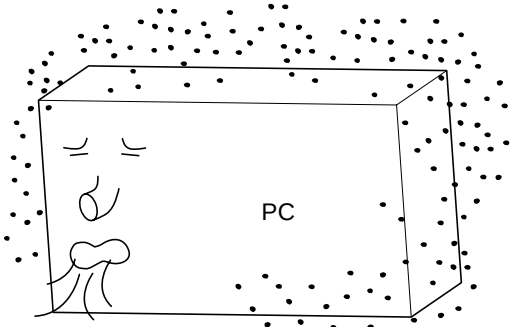
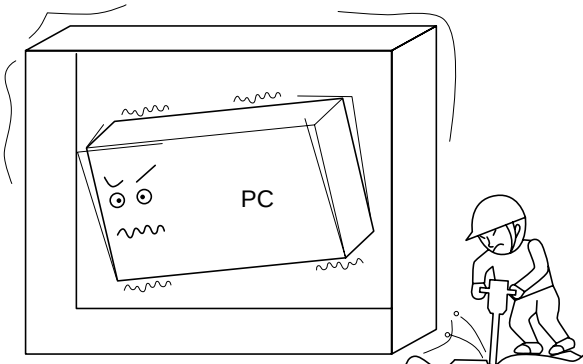
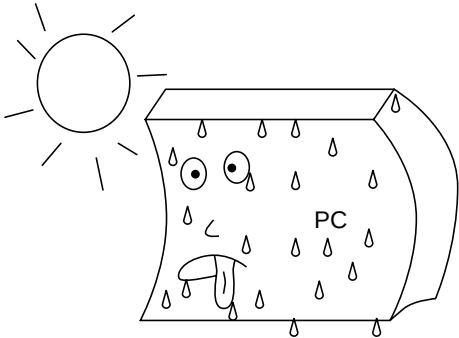
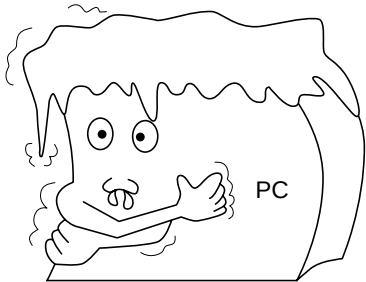
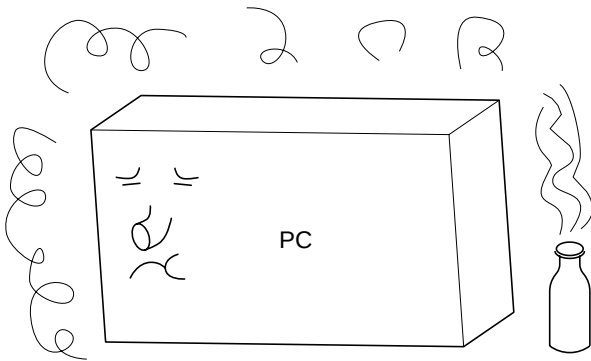
Section 5 Installation and Wiring

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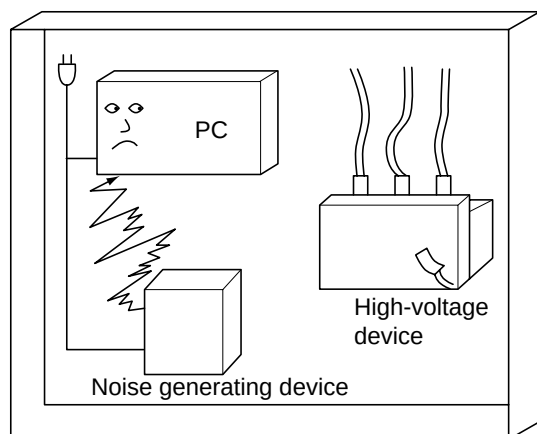
This section describes the precautions related to installation and wiring that must be observed in order to ensure high reliability and performance of this system. Those calling for special attention are indicated below.

5-1-1 Installation environment

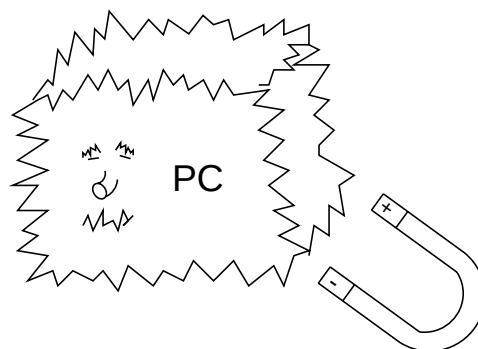
(1) Handle with care

 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. 	4) Avoid installing the unit in locations where there is a lot of dust, conductive particles such as steel particles or oil mist, or high salinity. 
2) Avoid installing the unit in locations which are subject to excessive vibration. 	5) Avoid using 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)  
3) Avoid installing the unit in locations where corrosive or combustible gas is present. 	

- 6) Avoid installing the unit in a panel together with high-voltage (3000V, 6000V or higher) devices.
- 7) Avoid using the same power supply together with other devices that generate strong noise.



- 8) Avoid installing the unit in locations where a strong electric or magnetic field is generated.



5-1-2 Before installation**(1) Check the product**

When you unpack the product, check to see

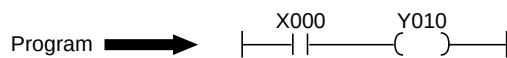
- 1) That the product is as ordered, and
- 2) That the product is not damaged, and
- 3) That accessories are included as specified.

(2) Operation check of the basic 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 PC operation using a test program

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



Note: Specify addresses that conform to the user's PC.

- Writing the test program

Operation flow	Key operation	LCD	Remarks
Initial menu		HANDY LOADER NW0H-NE	
Set the program loader to the write mode	RD/WR RD/WR	W 0 NOP	
Enter input specifications.	LDX LDX NOP0	W 0 L D X 0 0 0	
Write the input specifications to memory.	GO	W 0 L D X 0 0 0 1 NOP	
Enter output specifications.	OUTC LDIY MPS1 NOP0 (Note)	W 0 L D X 0 0 0 1 O U T Y 0 1 0	
Write the output specifications to memory.	GO	W 1 O U T Y 0 1 0 2 NOP	

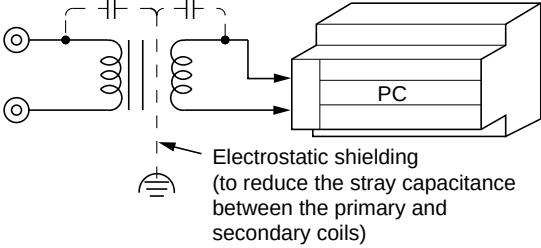
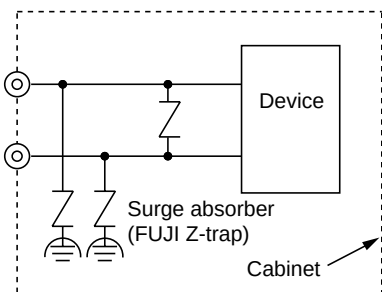
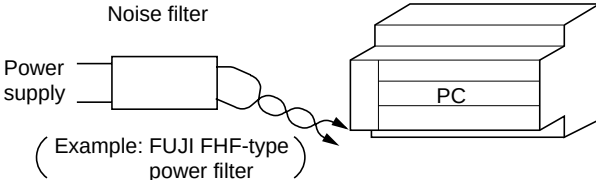
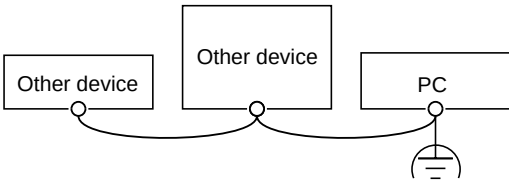
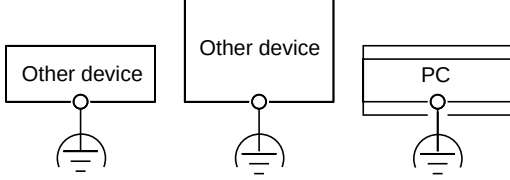
- Checking PC operation

After writing the above program, check that Y010 turns ON when input X000 is set ON. If Y010 turns ON, PC operation is normal. Now, proceed to the next step.

Note: Set in the range from Y20 to Y2F for the basic unit with 40 I/O points; in the range from Y30 to Y47 for the basic unit with 60 I/O points.

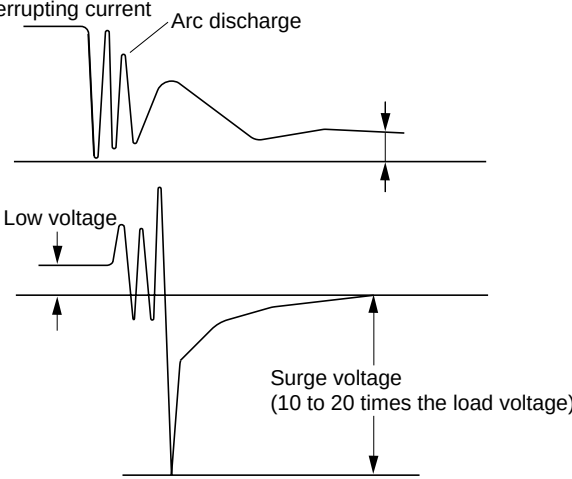
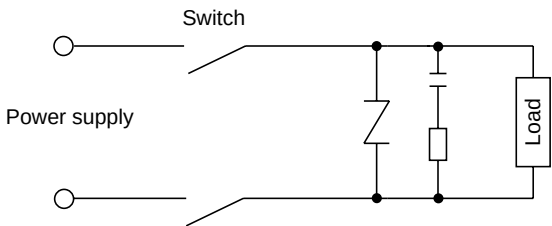
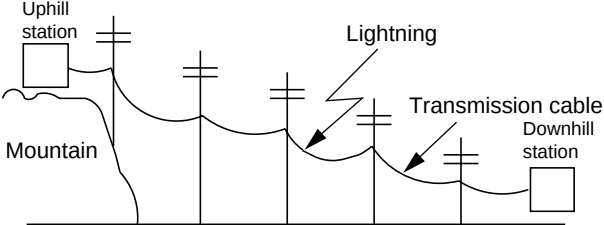
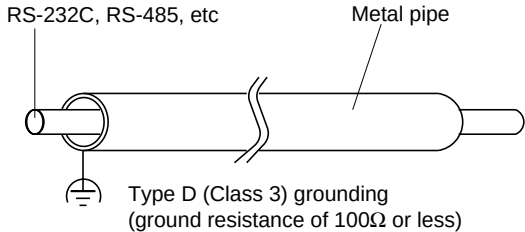
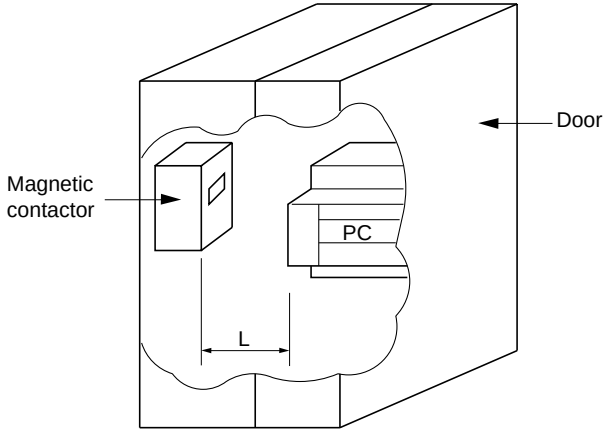
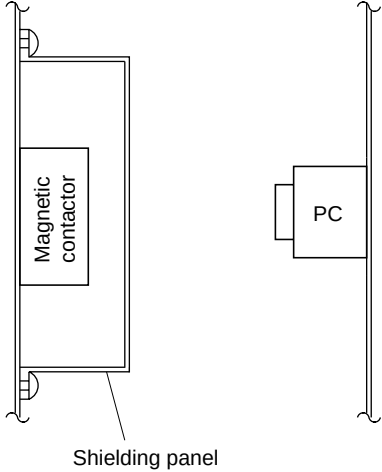
5-1-3 Control panel mounting (protection against noise)

(1) The SPB-series products are especially immune 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.  Electrostatic shielding (to reduce the stray capacitance between the primary and secondary coils) 2) An isolation transformer should be used.  Surge absorber (FUJI Z-trap) Cabinet
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 PC.  Noise filter Power supply PC (Example: FUJI FHF-type power filter)
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.

5-1 Installation Precautions

Control panel mounting (protection against noise)

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 PC. 	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 induction, 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 PC located near device that generates a switching arc  When the control panel door closed, if the distance L between the PC front panel and magnetic contactor is 50mm or less, the PC 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) 

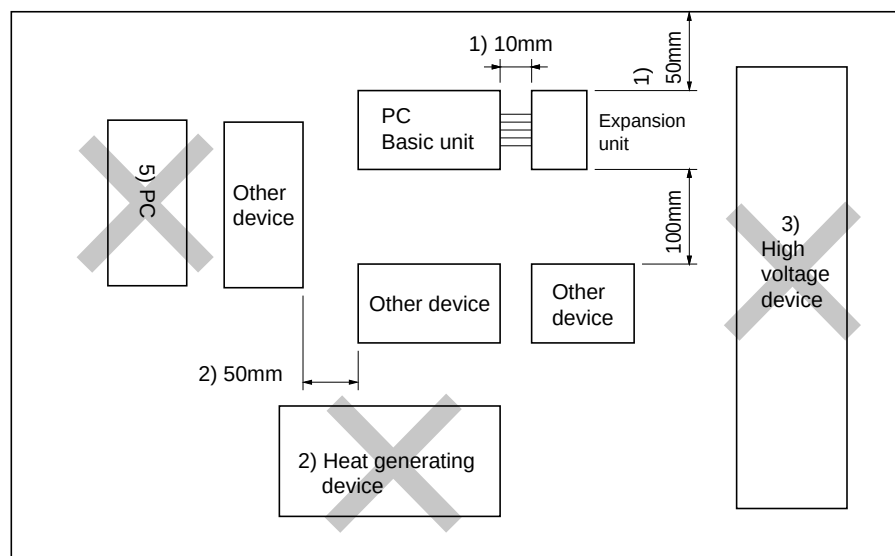
5-1-4 Environmental condition for mounting PC on panel

⚠ Caution	
◇ Use this PC 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 PC as shown below to obtain sufficient ventilation, otherwise, abnormal temperature rise or failure occurs.	

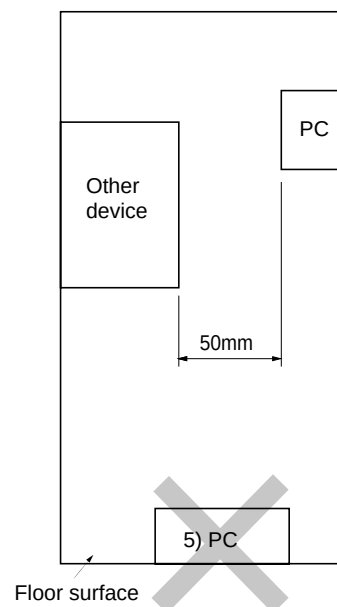
FUJI PCs are reliable because they provide excellent resistance against environmental conditions. Note that system reliability and operational safety can be further improved by observing and introducing the following precautions.

Item	Specifications	Remarks
Temperature	- The PC must be operated in the environment from 0 to 55°C according to specification of components. - The PC 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	147 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-filtration)
PC layout (See below)	- Keep all units at least 100mm apart vertically and at least 10mm apart horizontally. Otherwise, excessive temperature rise may occur. - Keep units at least 50mm away from other devices and the building structure to ensure appropriate ventilation. - Heat-generating devices (heaters, transformers and resistors) must not be installed directly under the PC. - The PC must be isolated (shielded) from high-voltage devices, high-voltage cables and power equipment as far as possible. PC I/O cables must not be run parallel with the cables for those devices. - The PC must be installed in a vertical position. Installing the PC on a level (as shown in illustration below) will cause adverse thermal effects on the device.	

Front view (Dimensions: mm)



Side view (Dimensions: mm)



5-1-5 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) Screw mounting

Insert M4 screws in the 2 mounting holes as shown in the figure below, and firmly tighten them to the following torque.
Tightening torque: 1 to 1.5 N·m

(2) Rail mounting

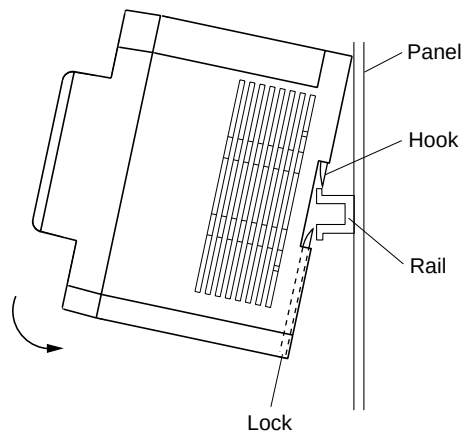
Use JIS/IEC standard 35 mm wide rail.

Fuji type numbers:

Rail: TH35-15AL (15 mm high, aluminum)
TH35-7.5AL (7.5 mm high, aluminum)
TH35-7.5 (7.5 mm high, steel)

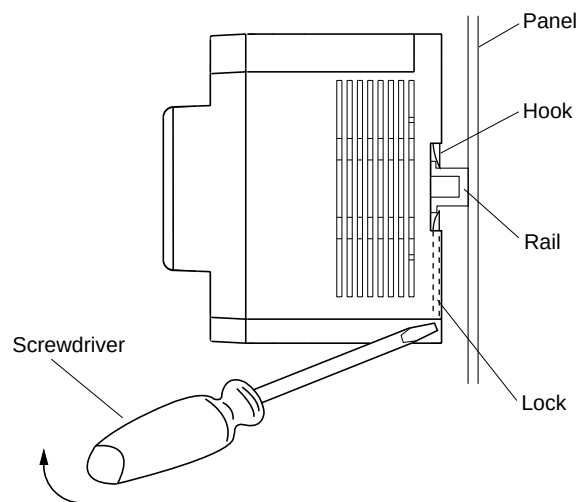
Fastener: TS-XT

Mounting



With the hook of the main unit engaged on the rail, push the unit in the direction of the arrow.

Removal



With a screwdriver inserted in the lock of the main unit, move the screwdriver in the direction of the arrow.

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 PC. A failure of PC 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 PC, 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

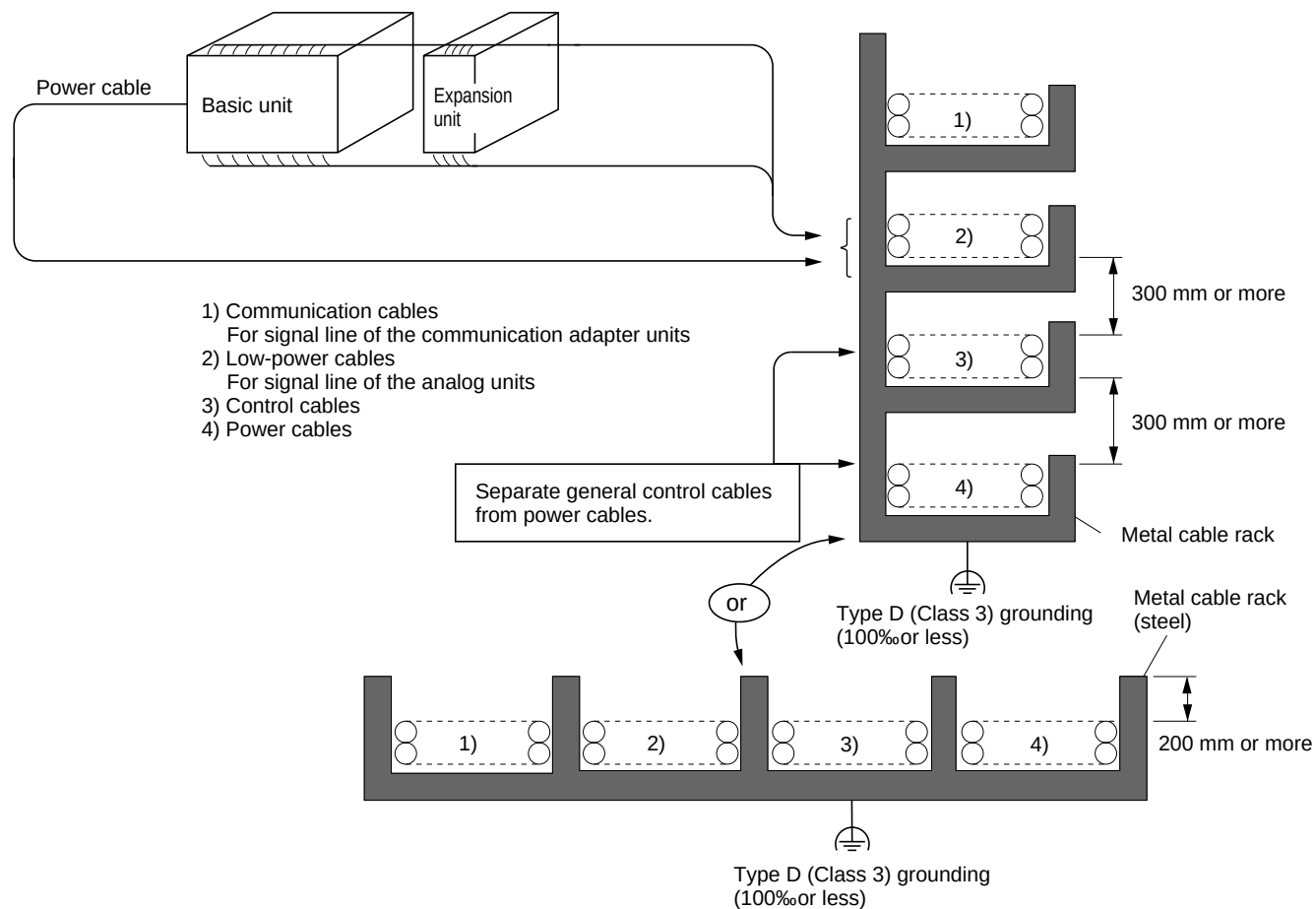
 Caution
◇ Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run. ◇ Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.

(4) Cautions after wiring

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

5-2-1 Wiring and cables

Use the following cables for systems incorporating SPB-series products.



• Cable types

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

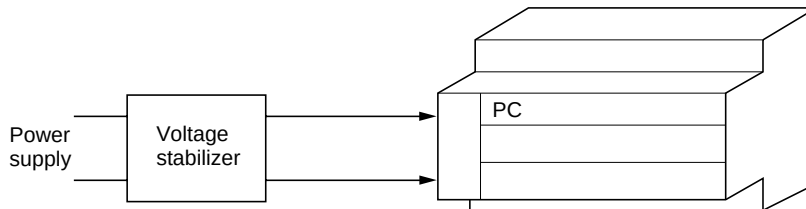
* For more information of the specifications of the communication adapter, refer to the "User's Manual, Communication Adapter" volume (FEH405).

* For more information of the specifications of the analog units, refer to the "User's Manual, Analog Units" volume (FEH407).

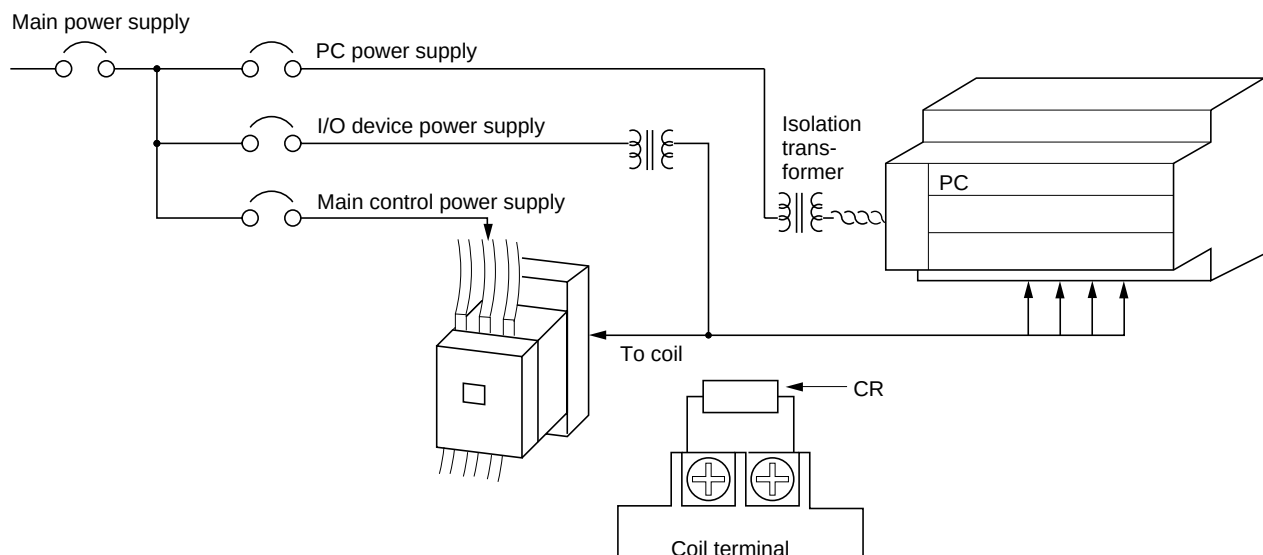
5-2-2 Wiring to power-supply, I/O and ground terminals

(1) Precautions

- 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. See Section 5-1-3 for details on countermeasures against excessive 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 PC 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 basic unit (AC power supply specification).

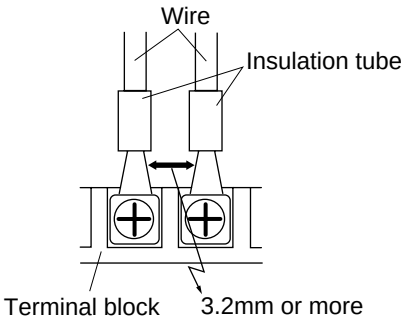
- 1) Make sure that output current is below the level specified.
- 2) Voltage is cut off if the output is short-circuited (overloaded) during operation, and restored when the error is corrected.
(The PC does not detect the error and continues to run, but externally supplied voltage is lost, resulting in a system error.)
- 3) In the short-circuited (overloaded) condition, the PC 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 PC terminal, pay attention to the following items.

- 1) Tightening torque for terminal: 0.5 to 0.6 N·m
- 2) Applicable wire size for terminal is 0.5 to 1.25mm²
Use 60/75°C copper (CU) wire only when apply for UL standard.
- 3) Electrical rating for terminal: 250V AC, 8A
- 4) In case of stranded wire, use crimp terminal with insulation tube.

Also, please keep insulation distance between each terminals more than 3.2mm as shown below.



Following crimp terminal with insulation tube is recommended to use.

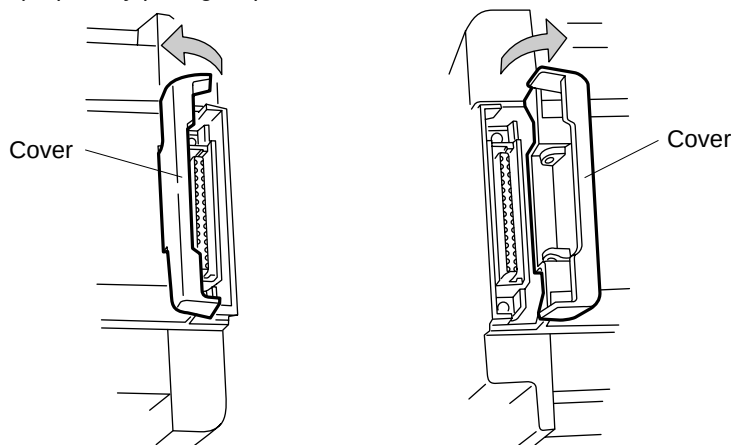
Terminal size	Applicable crimp terminal		
	Manufacturer	Round tongue terminal	Spade tongue terminal
M3 screw	Nichifu	TMEV1.25-3	TMEV1.25Y-3
	JST	FV1.25-MS3	FV1.25-B3A

5-2-3 Connecting/disconnecting the expansion cable

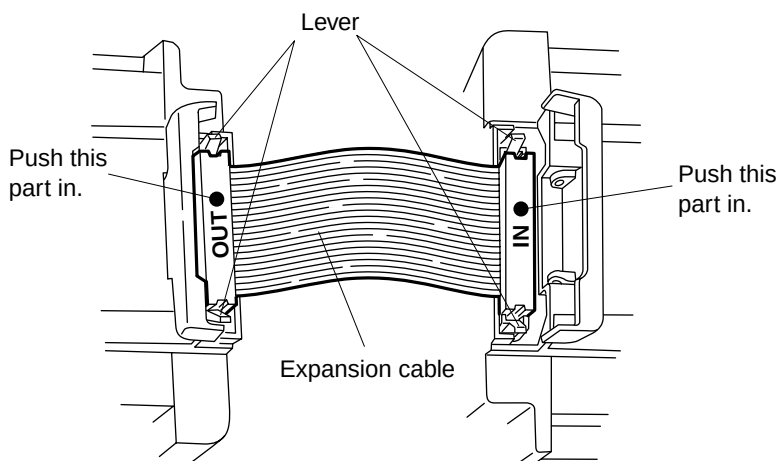
To connect or disconnect the expansion cable, be sure to turn off the control power supplied for the basic unit and expansion units in advance, and then follow the procedures described below.

(1) Connecting the expansion cable

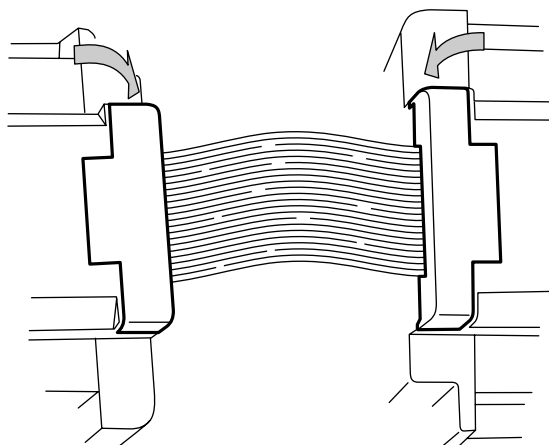
- 1) Open, by pulling it up, the side cover of the basic unit as well as that of the expansion unit.



- 2) Insert the expansion cable connector (plug) in the mating connector (receptacle) on the basic unit or expansion unit side. Push in the expansion cable connector until its upper and lower levers click to open.



- 3) Restore the cover as before.

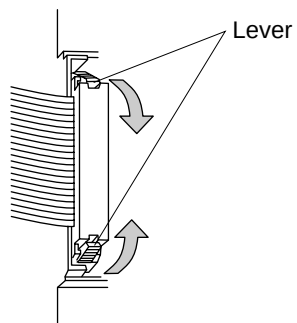


Note: Because the extension cable has a polarity, it must be connected such that the “OUT” marked side comes on the basic unit side.

(2) Disconnecting the expansion cable

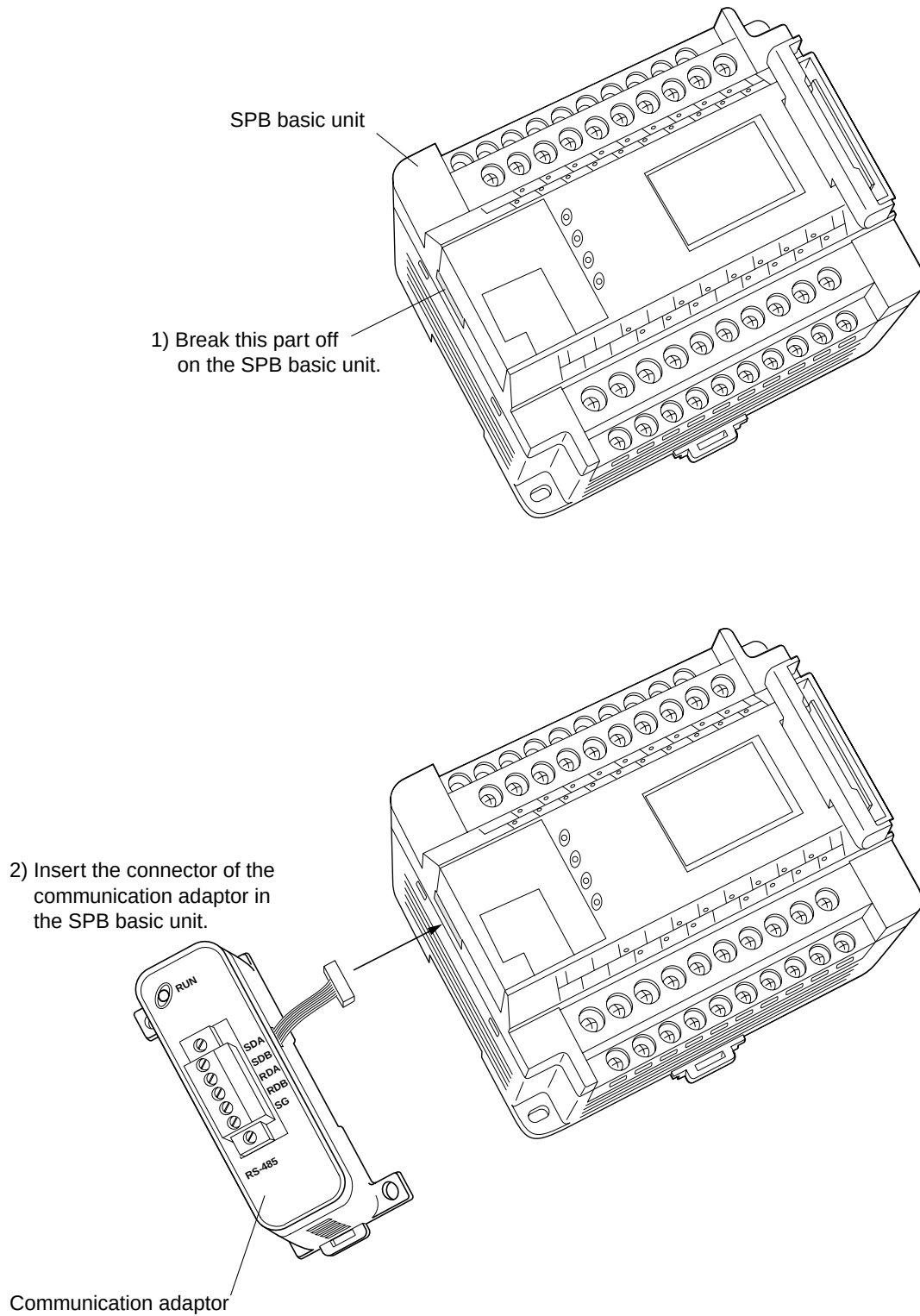
Do this in the reverse order of "(1) Connecting the expansion cable."

To disconnect the expansion cable, press in the upper and lower levers by fingers to unlock them, and pull out the connector.



5-2-4 Mounting and removing the communication adapter

For mounting or removing the communication adapter, first turn off the control power of the basic unit and then following the procedure described below:

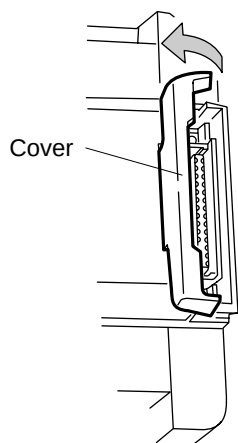


5-2-5 Connecting/disconnecting the analog units

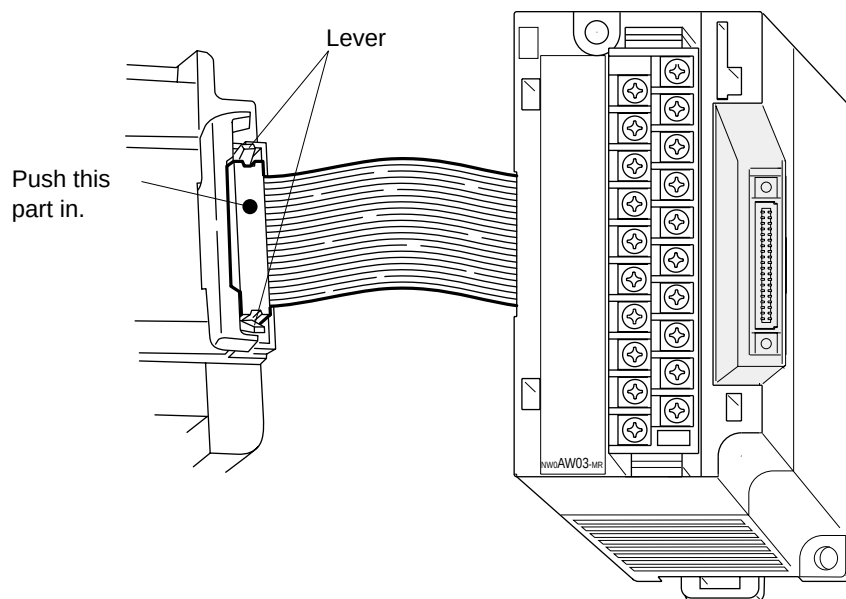
To connect or disconnect the analog units, be sure to turn off the control power supplied for the basic unit in advance, and then follow the procedures described below.

(1) Connecting the analog unit cable

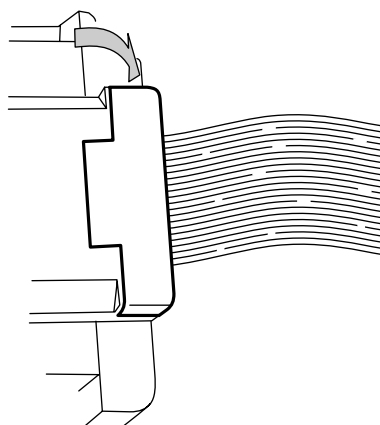
- 1) Open, by pulling it up, the side cover of the basic unit.



- 2) Insert the analog units cable connector (plug) in the mating connector (receptacle) on the analog unit side.
Push in the analog units cable connector until its upper and lower levers click to open.



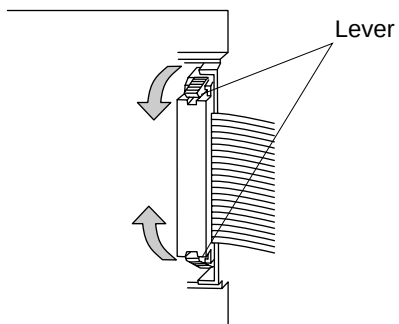
- 3) Restore the cover as before. (basic unit)



(2) Disconnecting the analog unit cable

Do this in the reverse order of “(1) Connecting the analog unit cable.”

To disconnect the analog unit cable, press in the upper and lower levers by fingers to unlock them, and pull out the connector.



Section 6 Maintenance and Inspection

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Section 6 Maintenance and Inspection

6-1 General Inspection Items

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

6-1-1 Inspection frequency

The SPH 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.

6-1-2 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 PC, 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.

6-1-3 Inspection items

When inspecting the equipment, use the following inspection table.

Inspection item		Inspection contents	Criteria	Inspection method
Basic unit		Confirmation of ALM, MEM, MEM/BAT LED	Lamps must be OFF.	Visual inspection
Basic 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: 19.2 to 30V	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
Battery		Is it time to replace the battery ?	Indication on battery effectiveness label	Visual inspection
Spare parts		Is the designated quantity available ? Are storage conditions appropriate ?	See the inspection records.	
Program		Were any errors detected through verification ?	There must be no errors.	Program verification

- Note: 1) If a fault occurs, replace the entire faulty unit or module. For this replacement, a minimum amount of spare components should be provided.
 2) Battery voltage drops even when not being used because of slight self-discharging. Replace old batteries with new ones before their effective service life expires.
 3) For spare power supply modules, power on once every six months.
 (To prevent discharging of aluminium electrolytic capacitor in the power supply module)

Replace the battery with a new one at the determined replacement time even if the battery alarm is not indicated.

If BAT (LED) lights on, replace the battery with a new one immediately. The device can ignore the battery alarm for about one week without harmful effects. However, the user should not ignore this alarm status.

- Replacement time: Data indicated on battery (effective service life)
- Type of replacement battery: NP8P-BT
- Nominal voltage: 3.6V

• Precautions

- Do not short across the battery.
- Do not discard in a fire.
- Do not attempt to recharge the battery.
- Do not disassemble the battery.

• Battery replacement procedure

- (1) Open the CPU front cover. (Battery must be replaced without disconnecting the control power supply.)
- (2) Remove the battery connector and then replace the battery with a new one and fix it.
- (3) Close the front cover.

Note: If the battery is replaced with the power switch turned off, the content of the memory backup function will be lost.
To prevent this, be sure to turn the power switch on when replacing the battery.

6-3-1 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.

6-3-2 Warranty period and scope of warranty

[Warranty period]

This product is covered by a warranty for a period of one year from the date of delivery to the location specified by the customer.

[Scope of warranty]

During the warranty period, if any failure judged to be the responsibility of the manufacturer occurs, replacement and repair of defective parts are performed under the responsibility of the manufacturer.

This warranty does not cover the following failures:

- (1) Failures caused by improper handling or misuse by the customer
 - (2) Failures caused by something other than the delivered product itself
 - (3) Failures caused by modification or repair performed by someone other than the manufacturer
 - (4) Failures caused by natural calamities or environmental disruption
- This warranty covers only the product itself; it does not cover any damages resulting from failures of the product.

6-3-3 Service costs

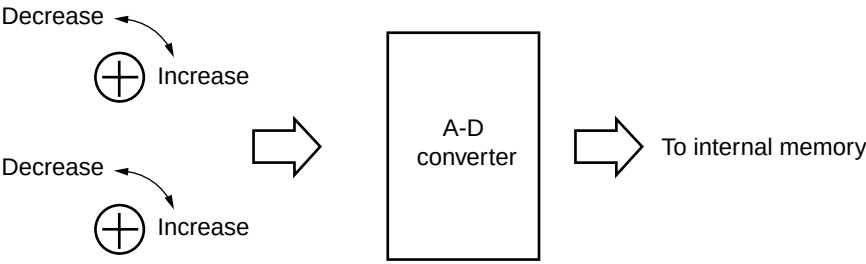
The price of the product does not include maintenance and servicing costs, such as the cost of dispatching an engineer to the customer. The customer will be charged for actual expenses in the following cases.

- (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 About the Analog Timer Setting Volume

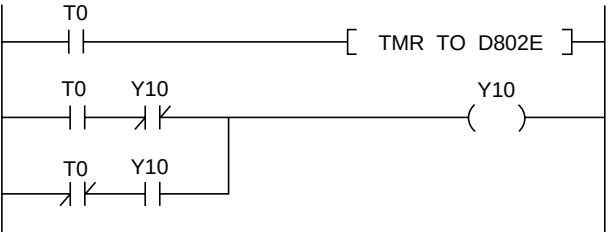
The setting of this volume is stored in the CPU internal memory.

<How is the volume setting stored in the internal memory?>



	Corresponding internal memory	Converted value (hexadecimal)
Volume (upper side)	D802E	00 to FF
Volume (lower side)	D802F	00 to FF

<Example of use>



When the volume (on the upper side) is turned, the frequency of the Y10 flicker changes.
Thus, ON/OFF is repeated at 0 to 2550 ms intervals.

- Notes: 1) If the volume is turned before the time has reached the specified time-up count, the changed value will be processed as a new setting of the timer. Be careful to note that the output may be suddenly turned on as a result of comparing the newly set value and the current value.
- 2) The PC system program writes the setting values of these volumes in special registers just before each scan is started. When you want to extend the timer setting, in addition to changing the counter value as explained above, there is another method available that uses commands that operate the numeric value. For example, you can write the shift command, which rotates leftwards the numeric value of special registers, in a step in front of the step where the timer command is written (one rotation doubles the numeric value, and a maximum of 7 rotations (128-times) are available).

Appendix 2 Input Function Types

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(1) Pulse catch function	App. 2-1
(2) Changing input filtering time	App. 2-1
(3) External interrupt function	App. 2-1
(4) High-speed counter input	App. 2-1
Appendix 2-1 Pulse Catch Function	App. 2-3
(1) Time chart	App. 2-3
Appendix 2-2 Input Filtering Time	App. 2-5
(1) Filtering time specification	App. 2-5
(2) Setting unit	App. 2-5
Appendix 2-3 External Interrupt	App. 2-6
(1) Interrupt circuit configuration	App. 2-6
(2) Interrupt processing	App. 2-7
(3) External interrupt starting time	App. 2-8

Input terminals (X000 to X003) of the basic unit have the following functions, in addition to the ordinary function for external input.

(1) Pulse catch function

The 50 μ s pulse catch function operates continuously, in addition to the ordinary input function, for 4 I/O points of the basic unit (as shown in the figure below). Pulses thus caught are output to special relays.

(2) Changing input filtering time

Input filtering time can be changed by word.

(3) External interrupt function

For 4 points (X000 to X003)

(4) High-speed counter input

4 points (X000 to X003) can be used as the input for pulse counting or current value resetting. For details, refer to the User's Manual (Internal High-Speed Counter).

Notes and precautions:

When the high-speed counter function is used, external interrupt and pulse catch functions are disabled for the corresponding count input terminals.

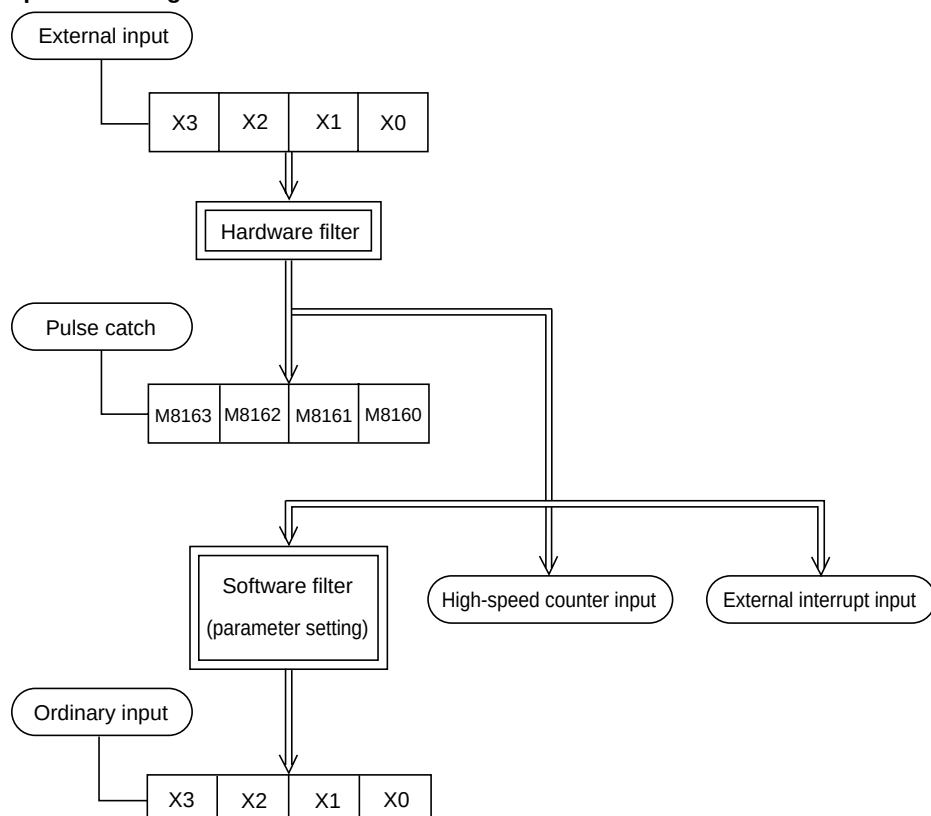
When the high-speed counter function is not used, and for reset signal input terminals, external interrupt and pulse catch functions operate as usually.

Count function setting	Input interrupt and pulse catch functions			
	X0	X1	X2	X3
No counter is used.	o	o	o	o
Only CH0 of one-phase counter is used.	x	o	o	o
Only CH1 of one-phase counter is used.	o	x	o	o
CH0 and CH1 of one-phase counter are used.	x	x	o	o
Two-phase counter is used.	x	x	o	o

o: Enabled

x: Disabled

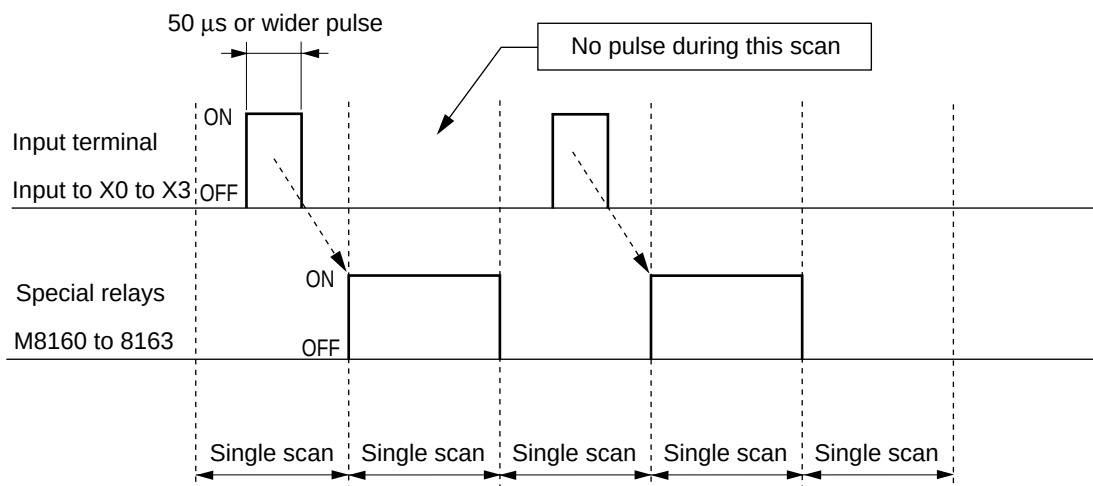
<Conceptual drawing>



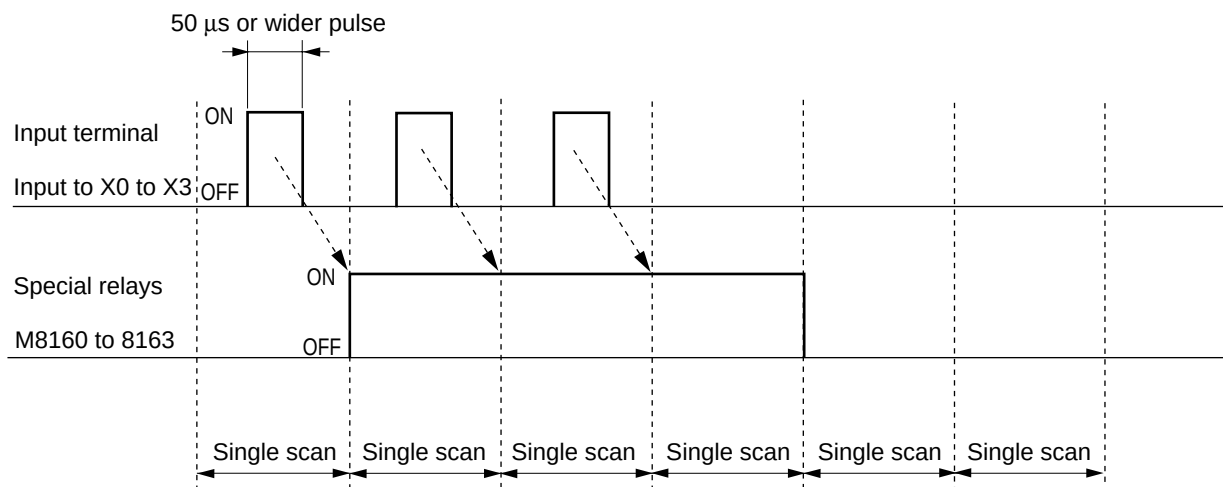
The SPB has the function to catch pulses of minimum 50 μ s width and can detect limit sensor signal, etc., of an object that is moving at high speed. The timing to catch pulses is checked whether or not a pulse is input during a scan, and the result is output to special relays (M8160 to M8163) during the next scan. This function always enabled. (Without software filter operation)

(1) Time chart

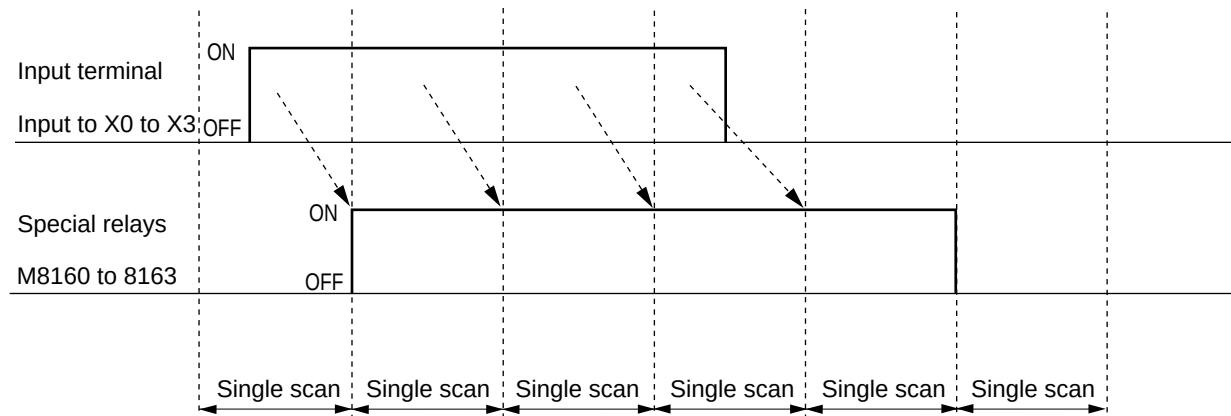
1) Not consecutive when only one pulse occurs during a single scan



2) When pulses occur consecutively



3) When a long pulse occurs



- X areas of X0 to X3 can be used for an ordinary input signal, like other X areas (X4 and after).
- When this input (M8160 to 8163) is used as the input of a counter instruction to count the number of input pulses, the interval between pulses must be longer than two scans.

Input filtering time is a delay that is specified to prevent input errors due to chattering or noise that rides on an external input signal. The user can set input filtering time according to the actual condition of the input signal. To change input filtering time, you only have to change the parameter setting. At shipment, the parameter is set to the initial (default) value, which does not need to be changed for ordinary operation.

(1) Filtering time specification

Following values can be selected for filtering time (OFF-to-ON/ON-to-OFF):

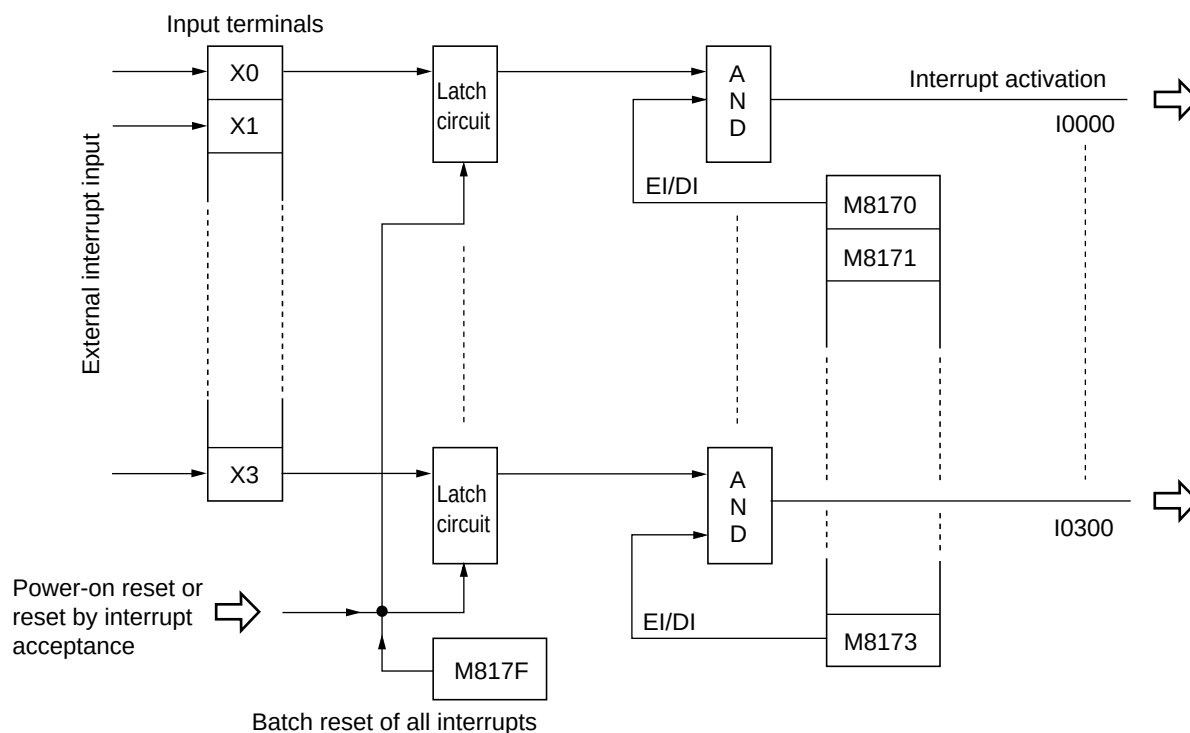
- No filtering (fastest, hardware filter only)
- 3ms/3ms (default)
- 10ms/10ms

When the power supply is turned on with the input kept on, the input will function after the set filtering time has elapsed. Pulse catch, external interrupt, and internal high-speed counter functions operate independently of the setting of filtering time; in other words, as if "no filtering" were set.

(2) Setting unit

Filtering time is set by word for both the basic unit and expansion units.

(1) Interrupt circuit configuration



- Interrupt input is held temporarily by an internal latch circuit. The default of the latch circuit status is "0" (reset).
- Whether or not you should enable interrupt is written in one of the internal relays M8170 to M8173 (EI:1 or DI:0). The default of the relay status is "0" (interrupt disabled), which should not be changed when you do not use the interrupt function.
- If the setting is changed to "1" (EI = enable interrupt) when an interrupt input is already held in an internal latch circuit, the interrupt is activated immediately.
- To reset a latch circuit, set internal relay M817F to "1". Then all the latch circuits will be reset. The latch circuits for internal high-speed counter count-up interrupts are reset at the same time.
- When an interrupt program is started, the interrupt latch circuits are reset automatically.

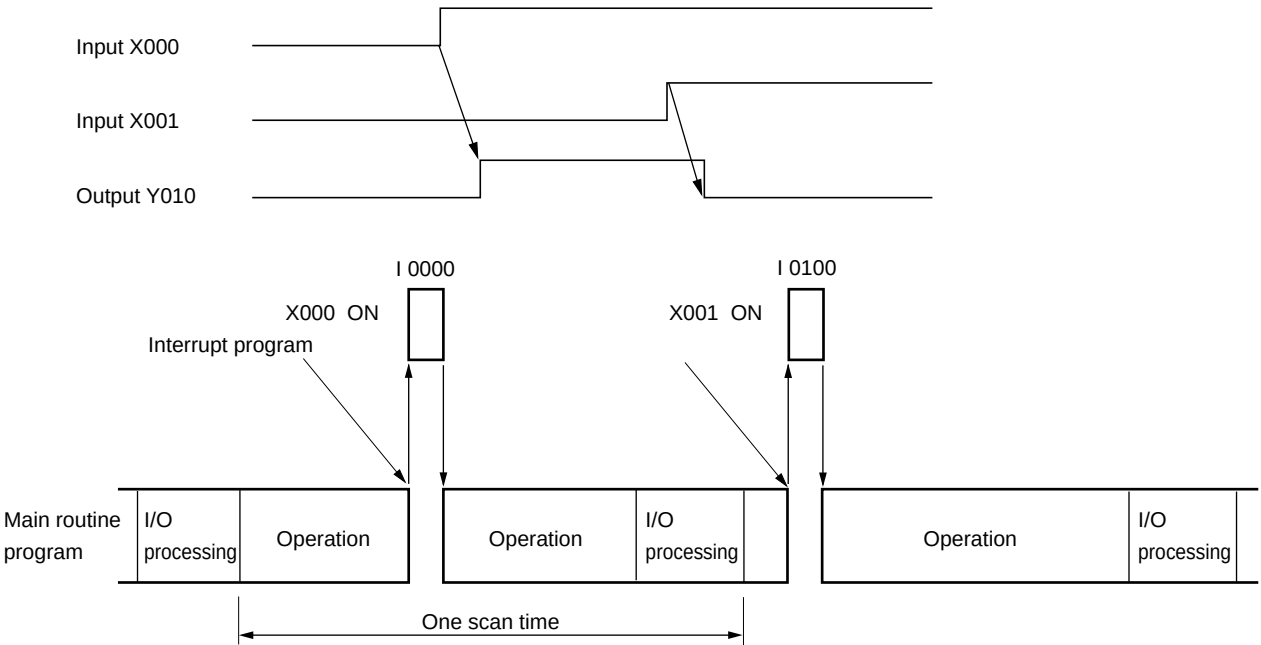
(2) Interrupt processing

This section explains the interrupt processing.

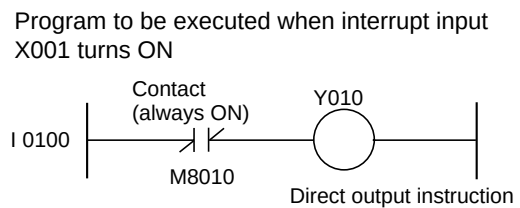
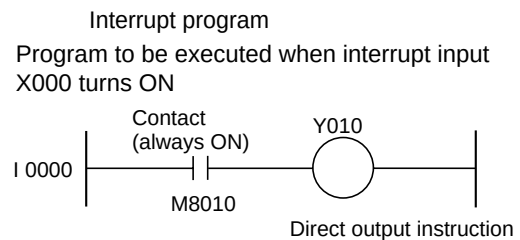
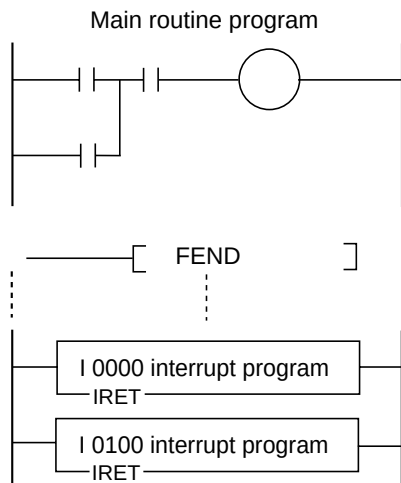
<Operation example>

When interrupt input X000 is set ON, output relay Y010 is set ON. When interrupt input X001 is set ON, output relay Y010 is set OFF. This operation is executed immediately and according to the input status.

<Timing diagram>



<Program example>

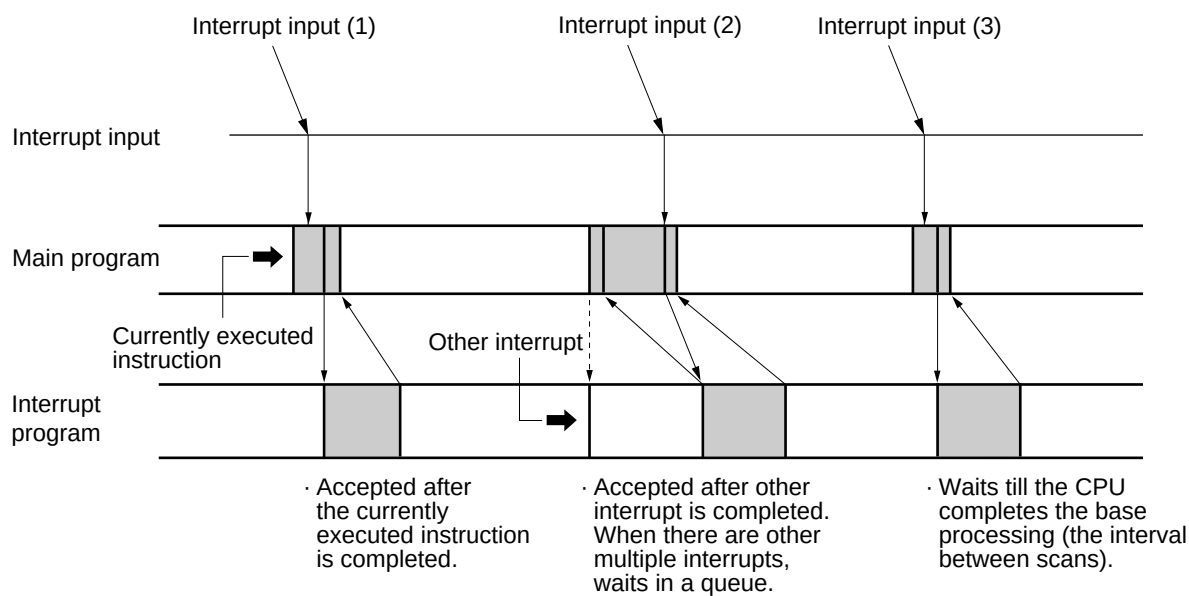


(3) External interrupt starting time

The response time since an interrupt has been accepted and until the interrupt program starts is as follows. (For example, in above (2), the time since input X000 or X001 has been turned on until interrupt program I0000 or I0100 starts)

Interrupts may be masked by the CPU. In such cases, you must wait

- Till the currently executed interrupt is completed, or
- Till the currently executed instruction is completed, or
- While the CPU completes internal processing (the base processing time of a scan).

<Timing of interrupt acceptance>**<Interrupt starting time>**

$$\text{External input response time} + \text{Internal processing time} \leq \text{Starting time} \leq \begin{matrix} \text{External input response time} + \text{CPU base processing time} + \\ \text{Internal processing time} + \text{Currently executed instruction processing time} \end{matrix}$$

- External input response time: The time required to respond to external input (OFF to ON)
- CPU base processing time: Base processing time in the period between scans (approx. 0.29ms)
- Internal processing time: Internal interrupt processing time, which is negligible (approx. 0.04ms)
- External interrupt input signal is accepted when it continues to be ON for 50μs or longer time.

Appendix 3 About Comply to EC Directives

	Page
(1) Installation and operating condition	App. 3-1
(2) Output specifications	App. 3-1
(3) Insulation block diagram	App. 3-2
(4) EMC (Electro-Magnetic Compatibility)	App. 3-3

Appendix 3 About Comply to EC Directives

(1) Installation and operating condition

Item	Specification
Pollution degree	2 (IEC 61131-2)
Overvoltage category	II (IEC 61131-2, IEC 60664-1)
Installation condition	In a enclosure with IP2x or better (IEC 61131-2)

(2) Output specifications

The protection for the output is "Not -protected output".

If a protective device is added externally in order to protect short-circuit.

Use the fuse per point.

Use the following fuse for the following type.

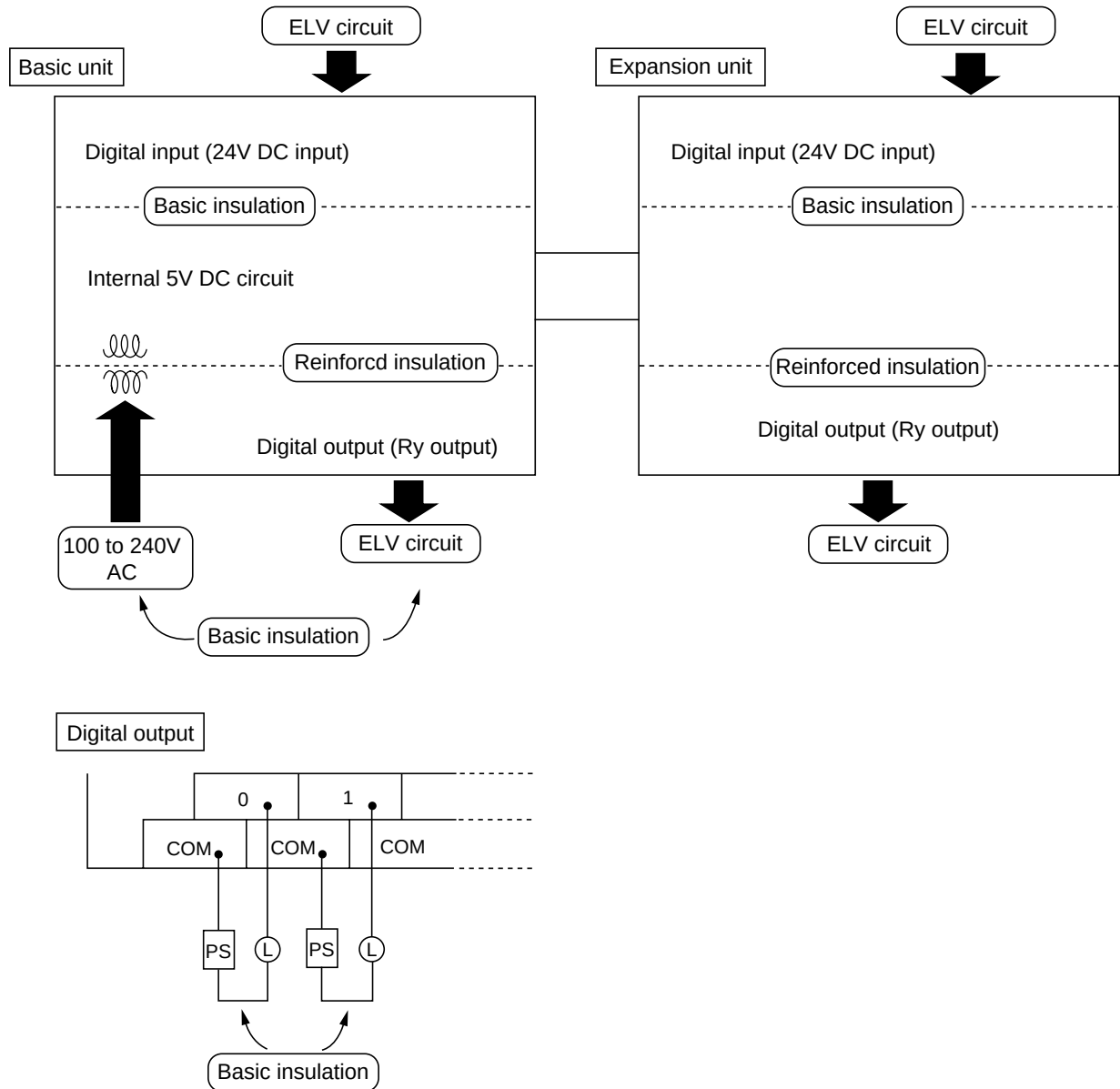
Specification of products	Protective device	Manufacturer of projective device	Specification of projective device
240V AC, 2A/point	GP40	Daito Communication Apparatus Co.,Ltd.	250V AC/DC, 4A

Alarm fuse holder: Type GPH-4S Daito Communication Apparatus Co.,LTD.

In case of load causing rush cuurent, protective fuse may deteriorate and rupture in its early time. Be sure of the time-cuurent characteristic of the fuse.

(3) Insulation block diagram

- 1) Each units shall be connected as indicated below.
- 2) Rated insulation voltage throughout the system is 250V AC r.m.s./350Vpeak.
No phase differences to exist to give rise to higher voltages.
- 3) To a circuit possessing at least basic insulation from primary mains. (100 to 240V AC)



Output are separated in groups by common terminal.
Each output group have basic insulation.

Note) An ELV circuit is a circuit which is of low voltage (not exceed 42.4Vpeak or DC) and isolated from primary mains by basic insulation.

(4) EMC (Electro-Magnetic Compatibility)

- 1) SPB is intended for use in the industrial environment.

Accordingly, SPB shall not be used in the residential, commercial and light-industrial environment unless the machine or installation including SPB conforms to the relevant standards (such as EN 50081-1).

- 2) SPB conforms to the following standards.

Emission	EN 50081-2: 1993
Immunity	EN 61131-2: 1994

Fuji Electric Co.,Ltd.

ED & C · Drive Systems Company

Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome, Shinagawa-ku, Tokyo, 141-0032, Japan

Phone: +81-3-5435-7135 ~ 8

Fax: +81-3-5435-7456 ~ 9

URL <http://www.fujielectric.co.jp/kiki/>