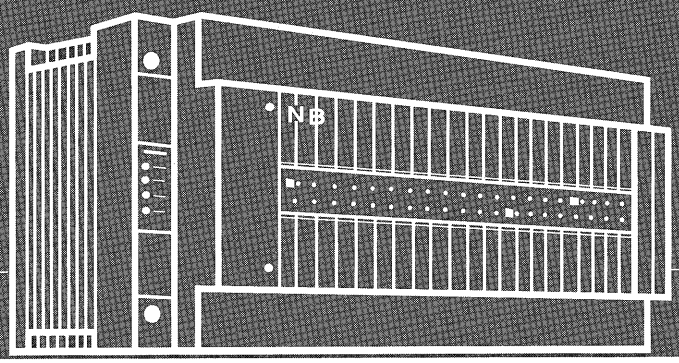
FUJI ELECTRIC

FUJI PROGRAMMABLE CONTROLLER
N BLOCK SERIES

FLEX-PC NB Series



USER'S MANUAL HARDWARE

LEH 922

PREFACE

How to use this manual

This manual describes the system configurations, specifications, handling, and programming of the FUJI NB Series Programmable Controller (PC). The following table lists this manual's sections and their contents.

Section		Content
Section 1	General	Overviews and features of the PC and notes and precautions on its use
Section 2	System Configuration	System design procedure, system configuration, and I/O address assignment
Section 3	Specifications	Unit and device specifications, and unit and device functions
Section 4	Unit Functions and Components	Unit specifications and functionse and I/O specifications and functions
Section 5	I/O Reays	I/O relay specifications and use
Section 6	Installation and Wiring	PC installation and wiring
Section 7	Operation by ROM	Handling of EPROM and EEPROM cassettes and writing data to EPROM and EEPROM
Section 8	Programming Tool	Introduction, connection, and functions of programming tools
Section 9	Test Operation	Debugging and test operation
Section 10	Maintenance and Inspection	Battery replacement, maintenance, and inspection
Section 11	Troubleshooting	Troubleshooting procedure, RAS function, RAS configuration Fault diagnosis function

Reference

The contents of the NB Series User's Manual: Software (LEH923) are as follows:

Section		Contents
Section 1	Specifications	Processor performance and specifications, memory map and I/O address assignment
Section 2	Programming	Programming languages, program types, parameter setting and data handing
Section 3	Instructions	Overview instructions and programming
Section 4	Operation by ROM	Operation by ROM

Remarks:

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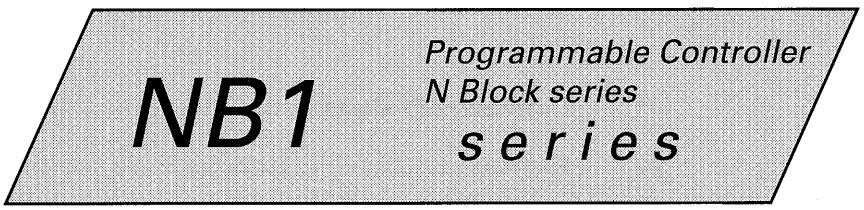
2. The contents of this manual are subject to changes without prior notice.
3. If you find any ambiguous or incorrect descriptions in this manual, please write them down with manual No. shown on the cover and contact FUJI.

CONTENTS

Section 1 General

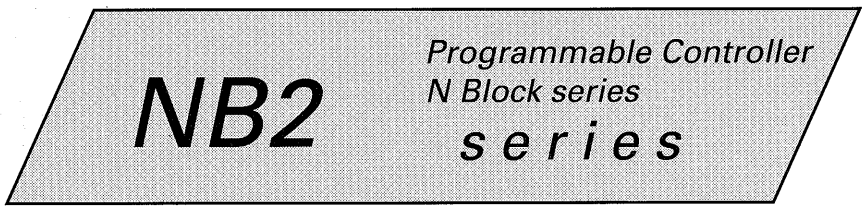
Section 1 General
1-1 Overview of Products

The FLEX-PC NB Series consists of two models, the NB1 and NB2. The NB1 PC allows the user to freely select the number of I/O points in units of one point to meet various system needs. The NB2 PC is a compact PC that can accommodate about 1.5 times as many I/O points as the NB1. Although it is designed to be compact, the NB series features upgraded functions, a larger number of I/O points, and flexibility.



The NB1 PC meets the customer's control needs in units of one I/O point.

The FLEX-PC NB1 series is an unconventional block-type PC that can adapt its the specifications depending on the machine to be controlled. The NB1 is designed to be general purpose. It allows the user to freely select or specify the number of I/O points, input voltage, input filtering time, and output voltage and current. As part of its software, the NB1 has macrocommand and customization features. These features simplify the control of complex processes specific to each user or controlled machine.



The NB2 PC is a compact, economical model that can accommodate about 1.5 times as many I/O points as the NB1.

The FLEX-PC NB2 was specifically designed to be compact and economical. The NB2 PC uses Fuji Electric's own ultra-small RB1 relays developed especially for these PCs. Because it uses RB1 relays, the NB2 PC can have about 1.5 times as many fixed I/O points as the NB1. This is remarkable because the NB2 has the same frame size as the NB1. To ensure flexibility of use, the NB2 PC has the same features as the NB1 and can use all expansion units and cassettes designed for the NB1.

1-2-1 Easy operation and convenient layout

■ I/O relays can be allocated and replaced in units of one point (NB1)

Our new I/O relays are installed in the input-output section to enable input and output points to be allocated in units of one point. The number of input and output points and the I/O specifications can be chosen as required by the user. Furthermore, the I/O relays can be replaced quickly and easily.

■ Economical NB2 model and high-speed, highly-functional NB1 model

■ Convenient peripheral device

The NB series PC can be connected to the compact Handy Program Loader. These peripheral device can be also used with upper-level PCs, such as the NS and NJ series, allowing future system expansion.

■ Maintenance-free battery

The rechargeable lithium backup battery is maintenance free.

1-2-2 Advanced and powerful functions

■ High-speed signal input

On the basic unit of the NB series PC, each of the 16 input points can be specified for pulse inputs and the input filtering time constants of all points can be varied. High-speed input signals can be processed with an appropriate filtering delay.

■ High-speed operation

The NB1 basic unit and NB2 basic units (56- and 90-point types) execute instructions very quickly at 0.7 μs per step.

■ High-speed response to an external interrupt input (8 points)

The NB series basic unit has a standard function of high-speed response to external interrupt inputs.

■ Various easy-to-use counter functions

The NB series PC has built-in single-phase counters (eight channels) or two-phase counters (four channels). These counters feature the following functions for convenience and practicality of use.

- Reading and writing of both current and set values
- Automatic reset
- Interrupt generated by equality to a preset value
- Switching between single- and two-phase pulse input operation
- Comparison of the current value and up to eight values
- Count enable and count disable
- Output of comparison results (conditions: "<", "=", and ">")

1-2-3 Economical and compact

■ Compact and space-saving, 35% smaller than other Fuji Electric PCs

The NB series PC is designed to be a compact unit that occupies only a small area of a control panel. The control panel itself can be made smaller for greater economy.

■ Wide compatible power supply voltage range

All models in the NB series can use power supplies ranging from 100V to 240V AC.

■ Built-in 24V DC power supply

External power supplies for input sensors, such as proximity limit switches, are not needed. The built-in power supply of the basic or expansion unit can be used for this purpose.

■ Economical and easy-to-use I/O relays

A variety of I/O modules enable users to setup economical control systems that match the user's requirements.

■ Compact but powerful

Although the NB series PC is economical and compact, it can be used to control up to 368 I/O points.

■ PC standardization

The I/O section of the NB series PC is divided into blocks in units of points and detachable I/O relays. This allows the control panel to be standardized by using only a few types PC.

1-3 Notes and Precautions

Note the following precautions on using these PC.

■ Handling I/O relays
- I/O relays are small devices. Handle I/O relays carefully, dropping or stepping on relays may bend their connector pins.
- Do not force an I/O relay with bent pins into a PC socket, since the socket may be damaged.

■ Connection of I/O relays
- Each I/O relay is independent. Confirm the type (input or output) of relay, polarity, and terminal connections before connecting each relay.
- Confirm that mounted I/O relays match the I/O address assignment in the program. (Confirm that input and output relays are correctly distinguished and mounted at the correct addresses.)

■ Current derating of output relays
- There are limitations on output current for some output relays those with (transistor or SSR outputs) according to their mounting conditions. For these output relays, follow the instructions for derating the output current.

■ Mounting on a rail
- The PC can be mounted on a 35mm-wide rail that meets JIS or IEC standards. If the PC is mounted on a support rail, its vibration resistance may be degraded. Follow the instructions given for the use of each rail.

■ Mounting and removal of an EPROM or EEPROM cassette
- Be sure to turn the PC OFF before mounting or removing an EPROM or EEPROM cassette. If you do not do this, memory contents may be destroyed and the PC may not operate correctly.

■ Use of an external relay circuit for emergency-stop
- Use external relay circuits for all fail-safe circuits, including the emergency-stop circuit for the machine to which the PC is connected. Use a relay contact which is closed when the PC is running. Connect the contact to the external fail-safe circuits for the system emergency stop. (See Section 2-4-3, "Fail-safe circuit.")

■ Dust-proof paper
- After completing the PC wiring , remove the dust-proof paper from the PC before turning the PC ON.

■ Avoid installation in the following environmental conditions
- Direct sunlight and ambient temperatures below 0°C or above 55°C
- Relative humidity below 20% or above 90%, and condensation due to sudden temperature changes
- Presence of corrosive or flammable gas
- Presence of excessive amounts of dust or conductive fine particles, such as iron powder, oil mist, salt breeze and organic solvents
- Strong electric or magnetic fields
- Excessive vibration or shock that may be directly applied to the PC body

■ Tighten all screws securely
- Securely tighten the mounting screws for the components and terminals to prevent them from becoming loose and to prevent equipment malfunction. (See Section 6 for details.)

■ Securely lock the connection cable connectors
- Securely lock the connectors of all connection cables.

■ Supply the correct power voltage
- Set the power supply voltage to the component devices correctly according to the specifications. (In particular, confirm whether setting of power-supply voltage with jumper plate is required or not.)

■ Use a separate grounding
(ground resistance of 100Ω or less)
- Do not connect the ground terminal FG of components to the same ground used for other power circuits. Connect FG terminals to a separate grounding (ground resistance of 100Ω or less).

■ Be careful to avoid static electricity
- Static electricity is a force that may be harmful for all electronic parts. Because a large amount of static electricity may be produced in a dry environment, use a grounded metal object to discharge static electricity from your body before touching the PC.

■ Use lukewarm water or alcohol for cleaning
- Do not use thinner or organic solvents to clean the exterior of the equipment. These will damage the finish.
- Lukewarm water or cleaning alcohol should be used for cleaning.
- Do not use alcohol to clean I/O relay surfaces since alcohol may erase relay surface markings.

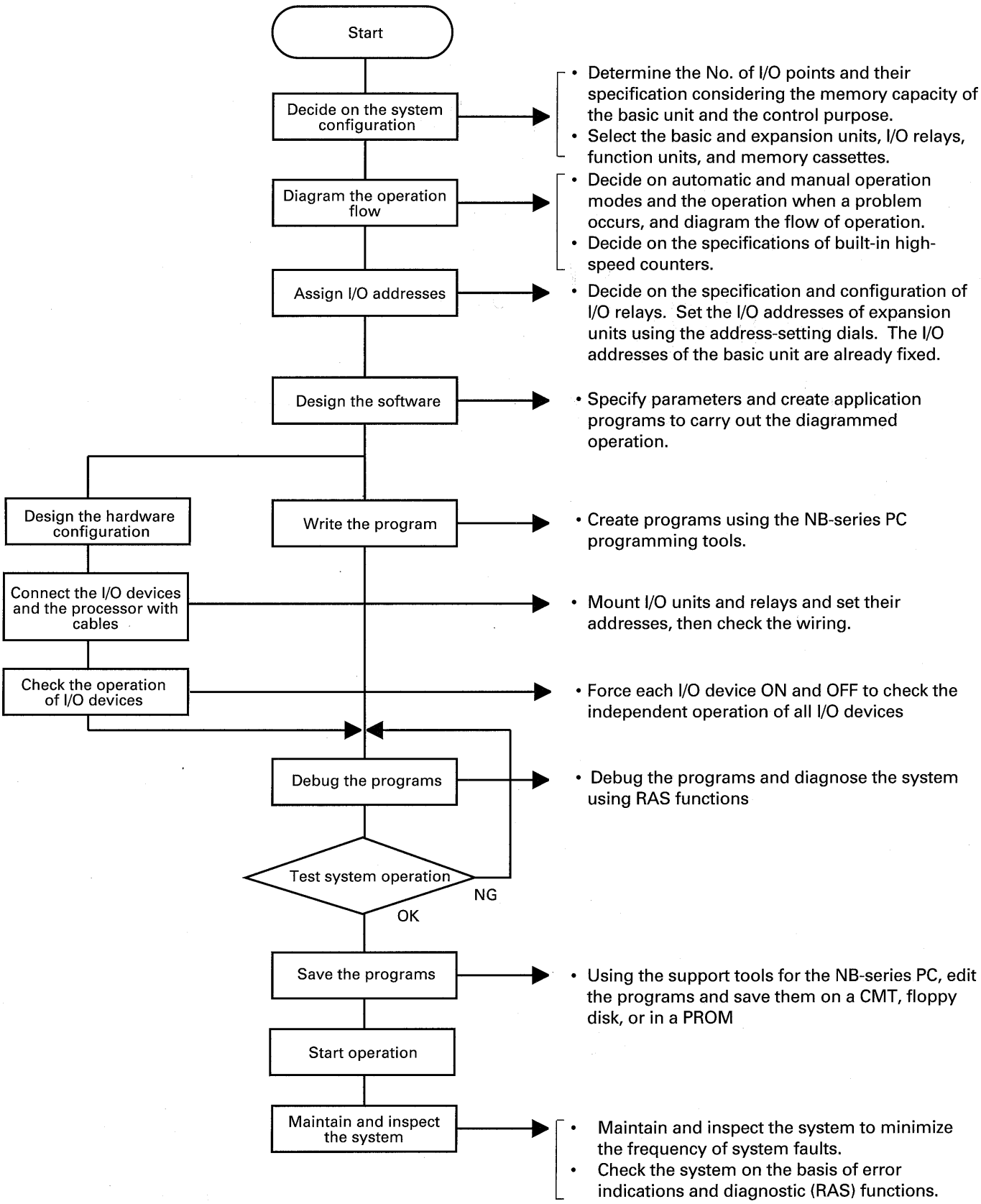
■ Be careful to avoid improper storage temperatures
- Because the processor contains a backup battery for the memory it must not be stored in an environment subject to high temperatures and excessive humidity. (The ambient temperature for storage must be –20 to +70°C.)
- Note that battery life is drastically reduced under extremely high temperatures.

■ Memory backup
- A rechargeable lithium battery is used to back up program memory (RAM). Even if EPROM is used, the backup battery is required to retain the contents of data memory during power-off time and power failure.

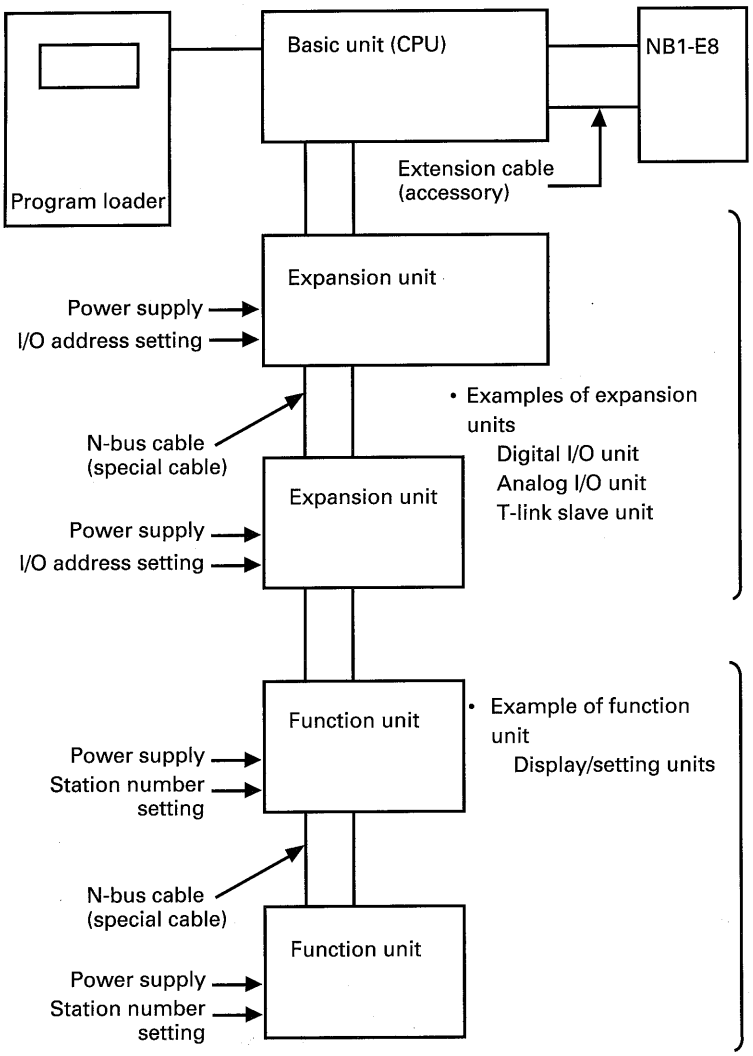
Section 2 System Configuration

Section 2 System Configuration
2-1 System Design Procedure

The following figure is an example of a design procedure for a system using the PC.



An NB series PC system consists of a basic unit, expansion units (cassettes), and function units, which can be combined as required.



- One 8-point expansion cassette can be connected to the basic unit.
- The NB2-P24 and NB2-P36 models cannot be expanded using the N bus.

- Up to three expansion units can be connected. (The total number of I/O points must be 368 or less).
- All types of NB series expansion unit can be used.
- I/O addresses are specified using the address-setting dials on each expansion unit. (Two-digit word addresses range from 04 to 1F.)

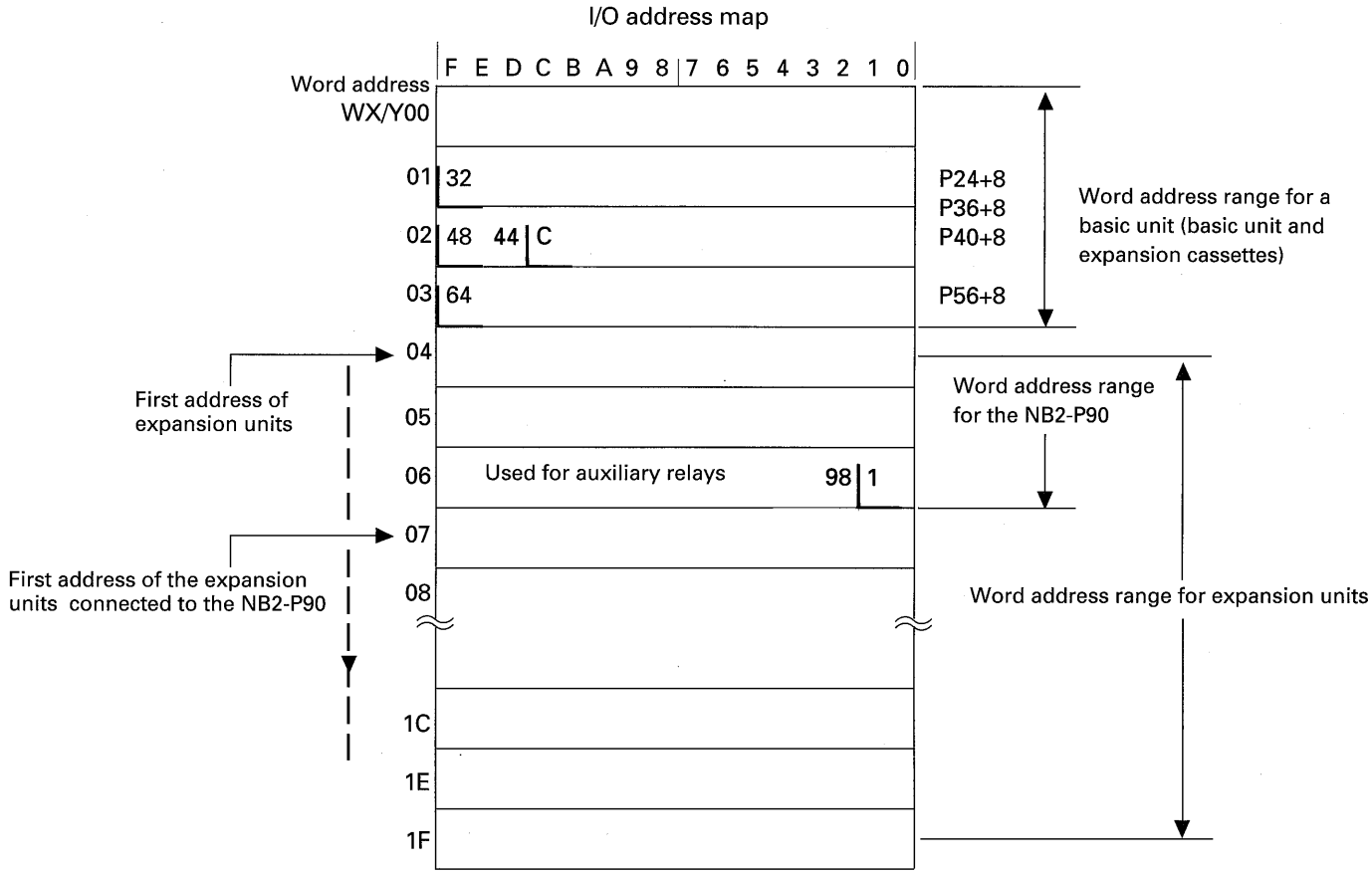
- Up to four function units can be connected.
- Specify the station Nos of function units (from 1 to 4). The station numbers are held in the data register area (D0018 to D0037) of the CPU.

- A power supply must be connected to each unit.
- Any unit can be connected to the N bus at any position, there are no restrictions.
- Standard extension cables for expansion and function units are supplied as accessories. If a longer extension cable is required, the cable must be prepared or purchased by the user. The total length of N-bus cable must be 10m or less.
- An address sheet is supplied for the assignment of I/O addresses.
- A function unit (i.e., display/setting unit) has a special function and transfers signals to and from the CPU via data registers. The function unit is given a station number but does not use I/O areas (X and Y areas).

2-3 Address Assignment

2-3-1 I/O address assignment

This section explains I/O address assignment for the basic and expansion units.



■ I/O addresses of the basic unit

- The basic unit uses the first four words (64 points) (WX/Y00 to WX/Y03) as I/O addresses. These addresses are fixed.
  The basic unit of the NB2-P90 uses the first seven words (WX/Y00 to WX/Y06 for 112 points) as I/O addresses.
- The address range for the basic unit includes the I/O addresses of expansion cassettes (eight points). I/O addresses of expansion cassettes follow I/O addresses of the basic unit.
- The bits of word addresses are assigned in ascending order to the basic unit and expansion cassettes. The remaining bits in the address range are used for internal auxiliary relays.
- On the NB1 series PC, input and output relays are mounted for these I/O addresses. An input or output point is assigned to each input or output relay. On the NB2 series PC, the I/O addresses are fixed.
- These I/O addresses of the basic unit can be specified for direct I/O instructions.

■ I/O addresses of expansion units

- The I/O addresses of expansion units follow word address WX/Y04 (WX/Y07 for the NB2-P90). The I/O addresses of expansion units are assigned in word units.
- The bits of word addresses are assigned to the I/O devices in ascending order of expansion units. Bits not used for the number of assigned I/O points are used for auxiliary relays.
- The first word address is specified using the address-setting switches (two digits, hexadecimal) on each expansion unit. A number of words corresponding to the built-in I/O points of the expansion unit are allocated from the specified first word address.
- Word address WX/Y04 (WX/Y07 for the NB2-P90) and onwards can be freely assigned as I/O addresses of expansion units. The I/O addresses assigned to different expansion units must not overlap.

2-3-2 I/O addresses of function units

The I/O addresses of function units, including display and setting unit, are not allocated in I/O (WX/Y) areas but in data register areas. The I/O address of a function unit is specified using the station number selection switch on the function unit.

Station No.	Data register
1	D0018 to D001F
2	D0020 to D0027
3	D0028 to D002F
4	D0030 to D0037

2-4-1 Parameter setting

Parameters need to be set to complete the hardware configuration, system operation conditions, and other system functions. If special parameters are not needed, the user can skip parameter setting. Because defaults are already set for all parameters, the system can be used for ordinary purposes without the user setting parameters. If the following operations and functions are required, the user must set the corresponding parameters using the program loader.

- Defining the files to be used
- Changing the watchdog timer (WDT) time for program execution. (default is 250ms.)
- Setting a fixed-cycle scan time
- Using an EEPROM
- Stopping battery error monitoring
- Resetting latch relays at power-ON
- Stopping the PC when a nonfatal fault occurs
- Holding I/O status when the PC is stopped
- Using remote control for running and stopping the PC
- Changing the specification of the relay and register areas to be latched
- Using high-speed counters
- Changing the filtering time for external input signals (The default is 3ms/10ms (OFF-to-ON/ON-to-OFF).)

2-4-2 Parameters

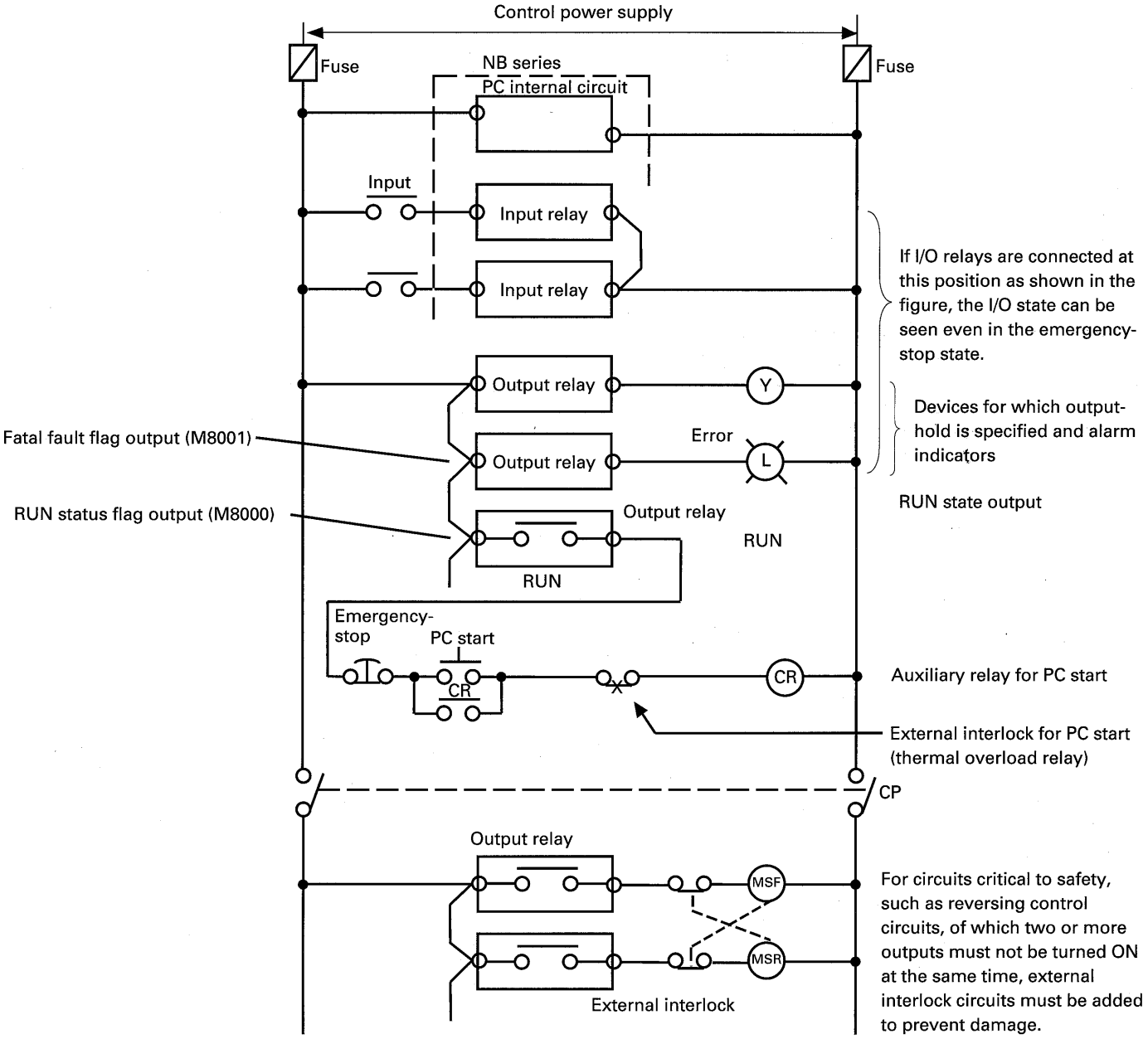
Parameters enable the user to use the N-series PC flexibly for various purposes. The user can use the PC without setting parameters (using the defaults). However, if the default settings of parameters do not meet the user's requirements, the user must specify parameters. Parameters can be set by using a program loader. The following table lists the parameters of the N-series PC.

Address	Item		Default	Setting range	Description
00H	File register capacity (1 word)		0: No file register	N x 256 words N: 0 to 1FH (0 to 31)	File area is for read-only. Data can be written in the file area only by using a program loader.
01H	User watchdog timer (1 word)		0: "250ms"	N x 10ms N: 0 to 25 ("0": 250ms)	The user watchdog timer monitors the execution time of application programs.
02H	Fixed-cycle scanning time (1 word)		0: Normal scan	N x 1ms N: 0 to 255 ("0": Normal scan)	Fixed scan time can be specified.
03H	PC operation mode (1 word)	EEPROM-based operation mode	0: Enable EEPROM rewriting	"Enable EEPROM rewriting" or "Disable EEPROM rewriting"	If the N-series PC user an EEPROM as the program memory, an operation mode can be selected.
		Backup battery error monitoring	0: Monitor battery error	"Monitor battery error" or "Do not monitor battery error".	Whether to monitor memory backup battery errors can be specified.
		Data latch clearance	0: Do not clear	Clear or Do not clear	Whether to clear the data in the memory having backup battery at power-on canbe specified.
		System stop at nonfatal fault	0: No stop	"No stop" or "Stop"	Whether to stop the PC when a nonfatal fault occurs can be specified.
		I/O status latch	0: Turn OFF outputs and refresh inputs	"Turn OFF outputs and refresh inputs" or "Stop I/O hold"	
04H	Remote RUN (1 word)		0: No remote RUN	"No remote RUN" or "Remote "RUN"	An arbitrary external input can be specified as the input signal to start the PC.
05H	Remote STOP (1 word)		0: No remote STOP	"No remote STOP" or "Remote STOP"	An arbitrary external input can be specified as the signal to stop the PC.
06H to 09H	Relay/register latch range (4 words)		0: Not specified	"Not specified" or Specified" (Areas M, L, and D)	Memory backup can be set for a device that does not have backup, or memory backup for a device can be cancelled.
0AH 0BH	Reserved				
0CH to 0EH	High-speed counter		Unused	Counters to be used and counter operation mode	
0FH to 27H	Input filtering time		OFF→ON 3ms ON→OFF 10ms	Input filtering time for the 98 input points of the basic unit in units of one bit	Setting OFF→ON / ON→OFF: No filtering, 3ms/3ms, 10ms/10ms, 30ms/30ms, 0.1s/0.1s, 0.3s/0.3s, 1s/1s
28H to 2EH	Input filtering time		OFF→ON 3ms ON→OFF 10ms	Input filtering time of an expansion unit in units of one word	

2-4-3 Fail-safe circuit

If a fault occurs in the PC, the PC output may also malfunction. For this reason, external backup circuits must be installed for important control circuits, including the emergency-stop circuit.

An example of an external backup circuit is shown below. Because the NB series PC does not have a RUN output contact, a RUN status output contact must be programmed using an ordinary output point.



Section 3 Specifications

Section 3 Specifications
3-1 Type Numbers

3-1-1 Type number list
The following tables list the types, typical specifications, and accessories of the NB series PC.

1. NB1 basic units

Type	I/O specification	Power supply	Type number	Accessories
Input and output relays are installed. Input: 24V DC Output: Relay contact	12 input points mounted on an upper row and 12 output points mounted on a lower row	100V to 240V AC 24V DC	NB1-P24-AC NB1-P24-DC	Instruction manual, terminal number seals (one for the upper row and one for the lower row), and program loader mounting screws (2-M3×10)
	20 input points mounted on an upper row and 20 output points mounted on a lower row	100V to 240V AC 24V DC	NB1-P40-AC NB1-P40-DC	
	28 input points mounted on an upper row and 28 output points mounted on a lower row	100V to 240V AC 24V DC	NB1-P56-AC NB1-P56-DC	Instruction manual and terminal number seals (2 seals for the upper row and 2 seals for the lower row)
Input and output relays are not installed (only sockets are installed)	A total of 24 input and output points mountable	100V to 240V AC 24V DC	NB1-P24X-AC NB1-P24X-DC	Instruction manual, terminal number seals (one for the upper row and one for the lower row), and program loader mounting screws (2-M3×10)
	A total of 40 input and output points mountable	100V to 240V AC 24V DC	NB1-P40X-AC NB1-P40X-DC	
	A total of 56 input and output points mountable	100V to 240V AC 24V DC	NB1-P56X-AC NB1-P56X-DC	Instruction manual and terminal number seals (2 seals for the upper row and 2 seals for the lower row)

An 8K-step RAM is mounted as standard program memory. An EPROM or EEPROM can be mounted to provide additional memory.

2. NB1 expansion units

Type	I/O specification	Power supply	Type number	Accessories
Input and output relays are installed. Input: 24V DC Output: Relay contact	12 input points mounted on an upper row and 12 output points mounted on a lower row	100V to 240V AC 24V DC	NB1-E24-AC NB1-E24-DC	Instruction manual, terminal number seals (one for the upper row and one for the lower row), screwdriver Vessel No.1990, and extension cable NB-EC0030.
	20 input points mounted on an upper row and 20 output points mounted on a lower row	100V to 240V AC 24V DC	NB1-E40-AC NB1-E40-DC	
	28 input points mounted on an upper row and 28 output points mounted on a lower row	100V to 240V AC 24V DC	NB1-E56-AC NB1-E56-DC	Instruction manual, terminal number seals (2 seals for the upper row and 2 seals for the lower row),screwdriver Vessel No.1990, and extension cable NB-EC0030
Input and output relays are not installed (only sockets are installed)	A total of 24 input and output points mountable	100V to 240V AC 24V DC	NB1-E24X-AC NB1-E24X-DC	Instruction manual, terminal number seals (one for the upper row and one for the lower row), screwdriver Vessel No.1990, and extension cable NB-EC0030.
	A total of 40 input and output points mountable	100V to 240V AC 24V DC	NB1-E40X-AC NB1-E40X-DC	
	A total of 56 input and output points mountable	100V to 240V AC 24V DC	NB1-E56X-AC NB1-E56X-DC	Instruction manual, terminal number seals (2 seals for the upper row and 2 seals for the lower row),screwdriver Vessel No.1990, and extension cable NB-EC0030

3. NB1 8-point expansion cassettes

Type	I/O specification	Type number	Accessories
Input and output relays are installed	24V DC relays (4 input points) (4 output points)	NB1-E8	Instruction manual, terminal number seals (for upper and lower rows), terminal nameplates (1 set), address sheets (1 set), and extension cable NB-EC0005
Input and output relays are not installed	A total of 8 input and output points mountable	NB1-E8X	

4. NB2 basic units

Input specification	Output specification	Power supply	Type number	Accessories
24V DC (12 points)	Relay contacts (12 points)	100V to 240V AC 24V DC	NB2-P24R3-AC NB2-P24R3-DC	Instruction manual, program loader mounting screws (2-M3×10), and terminal number seals (one seal for the upper row and one seal for the lower row)
24V DC (18 points)	Relay contacts (18 points)	100V to 240V AC 24V DC	NB2-P36R3-AC NB2-P36R3-DC	
24V DC (28 points)	Relay contacts (28 points)	100V to 240V AC 24V DC	NB2-P56R3-AC NB2-P56R3-DC	
24V DC (48 points)	Relay contacts (42 points)	100V to 240V AC 24V DC	NB2-P90R3-AC NB2-P90R3-DC	Instruction manual, program loader mounting screws (2-M3×10), and terminal number seals (2 seals for the upper row and 2 seals for the lower row)

An EPROM or EEPROM cassette can be mounted to provide additional memory.

5. NB2 expansion units

Input specification	Output specification	Power supply	Type number	Accessories
24V DC (12 points)	Relay contacts (12 points)	100V to 240V AC 24V DC	NB2-E24R3-AC NB2-E24R3-DC	Instruction manual, terminal number seals (one for the upper row and one for the lower row), screwdriver Vessel No.1900, and extension cable NB-EC0030
24V DC (18 points)	Relay contacts (18 points)	100V to 240V AC 24V DC	NB2-E36R3-AC NB2-E36R3-DC	
24V DC (28 points)	Relay contacts (28 points)	100V to 240V AC 24V DC	NB2-E56R3-AC NB2-E56R3-DC	
24V DC (48 points)	Relay contacts (42 points)	100V to 240V AC 24V DC	NB2-E90R3-AC NB2-E90R3-DC	Instruction manual, terminal number seals (2 seals for the upper row and 2 seals for the lower row), screwdriver Vessel No.1990, and extension cable NB-EC0030

6. NB1 I/O relays

	Specification (case size)		Type number
Input	5V DC	(1S)	SQ-ID005
	12V DC	(1S)	SQ-ID012
	24V DC	(1S)	SQ-ID024
	12V DC (high speed)	(1S)	SQ-IHD012
	100V to 120V AC	(2S)	SQ-ID120
	200V to 240V AC	(2S)	SQ-ID240
Output	Relay, 240V AC or 30V DC, 2A	(1S)	RJ-OA240-002
	Triac, 100V to 240V AC, 0.5A	(1S)	SQ-OA240-R50
	Triac, 100V to 240V AC, 2A	(4S)	SQ-OA240-002
	Transistor, 5V DC, 50mA	(1S)	SQ-OD005-R05
	Transistor, 24V DC, 0.5A	(1S)	SQ-OD024-R50
	Transistor, 24V DC, 2A	(2S)	SQ-OD024-002
	Transistor, 48V DC, 0.5A	(1S)	SQ-OD048-R50
	Transistor, 48V DC, 2A	(2S)	SQ-OD048-002

7. Extension cables

Length	Type number	Remarks
50mm	NB-EC0005	Expansion cassette accessory
300mm	NB-EC0030	Expansion unit accessory
500mm	NB-EC0050	
1000mm	NB-EC0100	
2000mm	NB-EC0200	

8. Memory cassettes

Type	Capacity	Type number
EPROM	1K steps	N-MP1
	4K steps	N-MP4
	8K steps	N-MP8
EEPROM	1K steps	N-ME1
	4K steps	N-ME4
	8K steps	N-ME8

9. Function units

Name	Description	Type number
Display/data setting unit	Display and setting unit	N-DSET
Analog I/O unit	Analog input (2 channels) and analog output (2 channels) AC or DC power supply	NB-AXY4-11AC (AC power supply) NB-AXY4-11DC (DC power supply)
T-link slave unit	I/O unit connection to the T-link	NB-TLS
General-purpose communication unit (RS-232C/485)		NB-RS1

10. Jumper plate

Name	Type number	Remarks
Jumper plate	NB-SB	For wiring common circuits on the NB1

11. Spare part

Name	Type number	Remarks
Battery	NB-BAT1	

12. Handy program loader

Name	Description	Type number
Main unit	Equipped with a 1m straight cord for connection to the PC	N-HLD011E
Curled cord for connection to the PC	1 m 2 m	N-HLD-C1 N-HLD-C2
PROM writer	Writing data to and reading data from a memory cassette	N-HLD-PRW
CMT interface	Data saving to and loading from audio tape	N-HLD-CMT

13. Simulation switch

Type	Type number	Remarks
4 points	NB-SW4	
12 points	NB-SW12	
16 points	NB-SW16	
20 points	NB-SW20	

3-2 Common Specifications

3-2-1 General specifications

Item	Specification		
	AC power supply	DC power supply	
Structure	Panel-mount type		
Cooling	Self-cooled		
Operating temperature and humidity	0 to 55°C and 20% to 90% (RH) (non-condensing)		
Storage temperature	-20 to +70°C		
Atmosphere	Free from dust and corrosive gases		
Vibration resistance	Conforms to JIS C0911, crossover frequency 57Hz, 2G (1G for the NB2)		No vibration or shock to the PC when mounted on rails
Shock resistance	Conforms to JIS C0912 (test method: 1-No.3)		
Dielectric strength and insulation resistance	1500V AC for 1 minute (between each terminal and ground) and 5MΩ or more (500V DC megger)		
Noise immunity	1500Vp-p, rise time of 1ns, pulse width of 1μs (generated by a noise simulator)		
Static electricity discharge noise resistance	8kV		
Surge resistance	5kV 1.2 × 50μs	———	
Grounding	Ground resistance of 100Ω or less (If the PC cannot be grounded, grounding may be omitted.)		
Mounting method	Mounting orientation: Vertical (longitudinally or laterally) Securing method: Using screws or mounting on a 35mm rail conforming to the JIS or IEC standard		

3-2-2 Power Supply Module Specifications

Type number	AC power supply			DC power supply		
Type number	NB1-P24-AC NB1-E24-AC	NB1-P40-AC NB1-E40-AC	NB1-P56-AC NB1-E56-AC	NB1-P24-DC NB1-E24-DC	NB1-P40-DC NB1-E40-DC	NB1-P56-DC NB1-E56-DC
	NB2-P24-AC NB2-P36-AC NB2-E24-AC NB2-E36-AC	NB2-P56-AC NB2-E56-AC	NB2-P90-AC NB2-E90-AC	NB2-P24-DC NB2-P36-DC NB2-E24-DC NB2-E36-DC	NB2-P56-DC NB2-E56-DC	NB2-P90-DC NB2-E90-DC
Input power voltage	85 to 264V AC, 50/60HZ			19 to 30V DC		
Power consumption	Approx. 42VA	Approx. 72VA		Approx. 15W	Approx. 23W	
Inrush current	Approx. 30A at 100V AC			Approx. 150A		
Maximum permissible input power failure time	20ms			5ms		
Auxiliary power supply for external devices	24V DC, 0.16A	24V DC, 0.34A		None		
Net weight (g)	850	1200	1600	850	1200	1600

3-2-3 Basic Specification

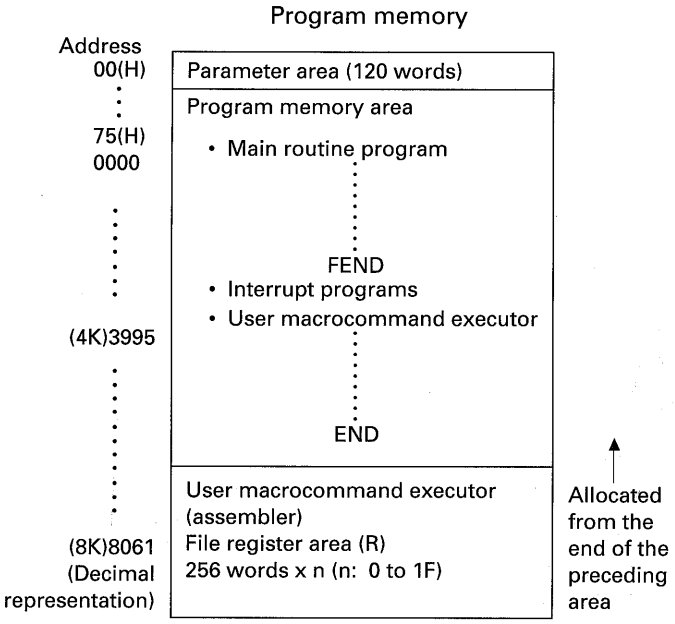
Item \ Type		NB1-P24 -P40 -P56	NB2-P24 -P36	NB2-P56 -P90	Remarks
Control system		Cyclic operation stored program system			
I/O control system		Batched processing, direct access processing (only for the basic unit)			
Programming language		Ladder diagram or mnemonic language			
Program capacity		8K steps	1K steps	8K steps	Built-in RAM accommodates the maximum program capacity.
No. of I/O points (*2)		24, 40, or 56 (Expandable to up to 334 points.)	24 to 44	56 to 368	The NB1 PC has sockets for 24, 40, and 56 points.
No. of instructions	Sequence instructions	43	43	43	
	Data instructions	47	14	47	
Execution speed	Sequence instruction	0.7μs/step	10μs/step	0.7μs/step	
	Data instruction	100μs/step (average)	100μs/step (average)	100μs/step (average)	
Program memory device and capacity		RAM, 8K steps	RAM, 1K steps	RAM, 8K steps	Memory backed-up by a lithium battery
		EPROM or EEPROM, 4K or 8K steps	EPROM or EEPROM, 1K steps	EPROM or EEPROM, 4K or 8K steps	
Data memory device		CMOS-RAM			Memory backed-up by a lithium battery (*1)
I/O relay (X and Y)		512 points	64 points	512 points	
Auxiliary relay	General relay (M)	1024 points	1024 points	1024 points	
	Latch relay (L)	1024 points	512 points	1024 points	
	Special relay (M)	512 points	512 points	512 points	
Step relay (S)		1024 points	256 points	1024 points	
Timer (10ms base) (T)		512 points	32 points	512 points	
Counter (increment type) (C)		256 points	32 points	256 points	
Register	Data register (D)	1024 words	64 words	1024 words	
	Special register (D)	256 words	256 words	256 words	
	File register (R)	Using program loader to specify program memory area to be used	——	Using program loader to specify program memory area to be used	
Pointer	For a branch (P)	256 points	256 points	256 points	
	For an interrupt pointer (I)	20 points	16 points	20 points	
I/O module		I/O relays to be mounted	Already mounted	Already mounted	
I/O expansion		Expansion of 8 points per expansion cassette (NB1-E8)			Up to three expansion units can be connected via an N bus. The maximum cable length is 10m.
		N bus	——	N bus	
IInput filtering time-delay		Variable			Default: OFF → ON: 3ms ON → OFF: 10ms
High-speed counter		8 channels (single-phase pulse input operation) or 4 channels (two-phase pulse input operation), 16/32-bit binary counter			(*3)
Function unit		Connectable	Not connectable	Connectable	Up to four units can be connected via an N bus.
Self-diagnosis		Program check, watchdog timer, and battery voltage check			
Applicable program loader		Handy Program Loader N-HLD011E			Up to four units can be connected via an N bus.

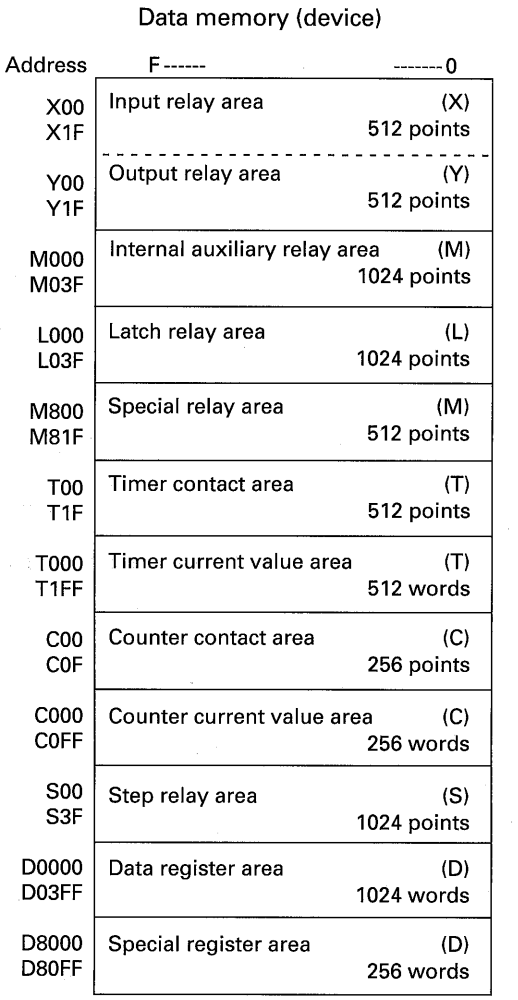
*1 If an EPROM or EEPROM is used, the memory is back-up by the electric charge in a capacitor (for two weeks at 25°C or three days at 55°C).
*2 On the NB1 PC, the number of I/O points depends on the I/O relay mounted.
*3 Response frequency
NB1 For single-phase operation: 10 kHz 8-channel, For two-phase operation: 10 kHz 4-channel
NB2 For single-phase operation: 5 kHz 2-channel, 1.2 kHz 6-channel
For two-phase operation: 5 kHz 1-channel, 1.2 kHz 3-channel

3-2-4 Memory maps

1. Memory map I

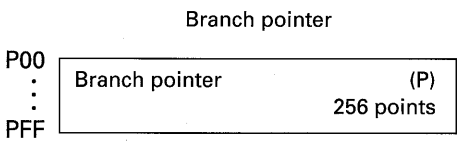
The memory map for the NB1, NB2-P56, and NB2-P90 is as follows:

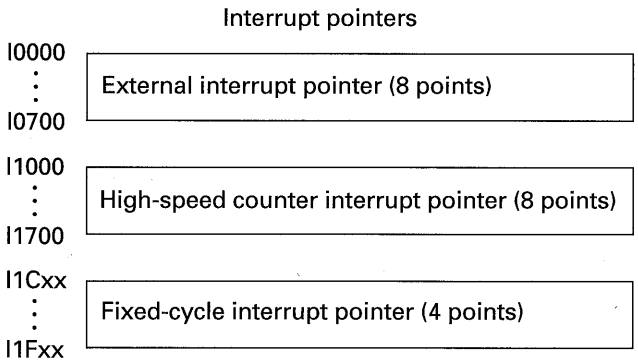




X and Y must not have the same address.

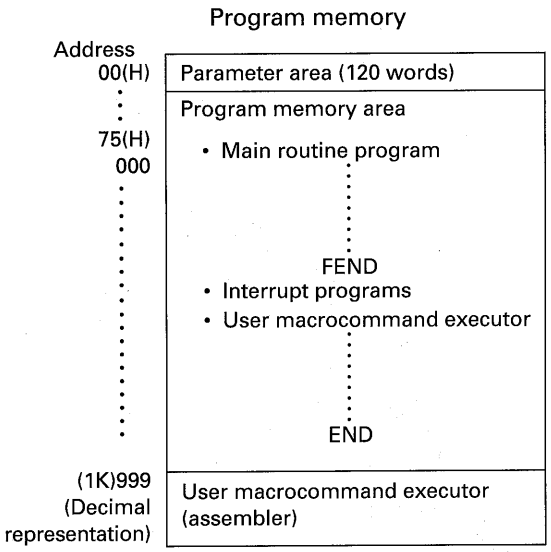
- The file register area is allocated from the end of the preceding area and depends on the parameters specification. The program memory area is reduced by the size of allocated file register area.
- The program memory capacities of memory cassettes are as follows:
  4K-step memory cassette: 3996 steps
  8K-step memory cassette: 8062 steps
- Data units require the following amount of memory:
  1 point = 1 bit
  1 word = 16 bits
  1 step = 1 word



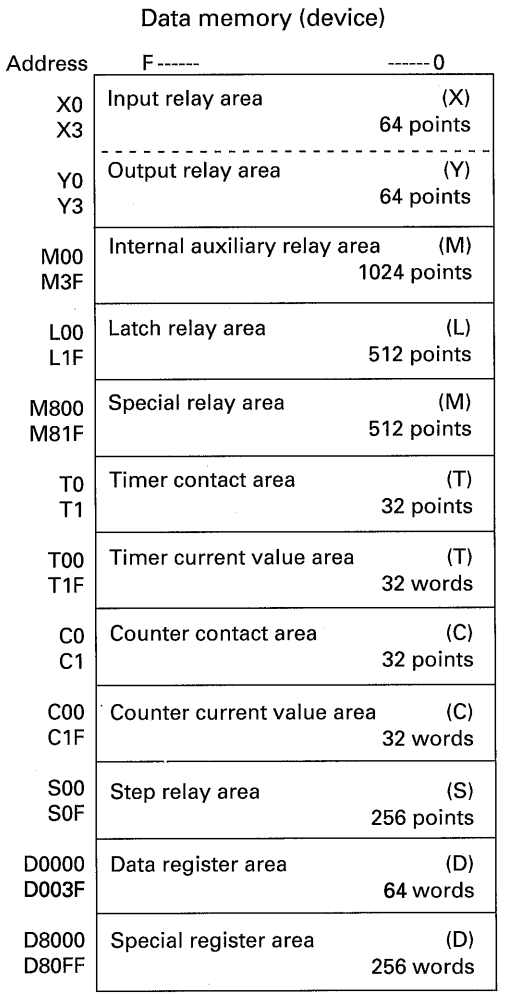


2. Memory map II

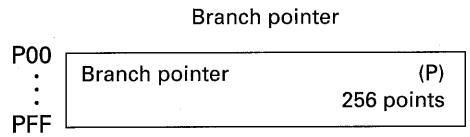
The memory map for the NB2-P24 and NB2-P36 is as follows:

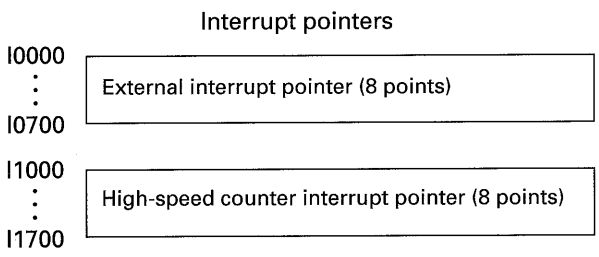


- The program memory area is 1000 steps long.
- Data units require the following amount of memory:
  1 point = 1 bit
  1 word = 16 bits
  1 step = 1 word



X and Y must not have the same address.





3-2-5 Device list

The following table lists the capacities and initial values of devices that can be specified in application programs for the NB-series PCs.

1. Devices for the NB1, NB2-P56, and NB2-P90

Device		Memory address range	Capacity	Access by instruction		Initial value
Identifier	Name			Bit	Word	
X	Input relay	X000 to X1FF	Total of 512 points	O	O	Latest data
Y	Output relay	Y000 to Y1FF				OFF
M	Internal relay	M0000 to M03FF	1024 points	O	O	OFF
L	Latch relay	L0000 to L03FF	1024 points	O	O	Preceding state retention
M	Special relay	M8000 to M81FF	512 points	O	O	OFF
S	Step relay	S000 to S3FF	1024 points	O	–	Preceding state retention
T	Timer	T000 to T1FF	512 points	O	–	OFF
C	Counter	C000 to C0FF	256 points	O	–	Preceding state retention
D	Data register	D0000 to D03FF	1024 words	O	O	Preceding state retention
D	Special register	D8000 to D80FF	256 words	O	O	Preceding state retention
R	File register	R0 to □□□	Depends on the specification (*1)	–	(*2)	Preceding state retention
P	Branch pointer	P00 to PFF	256 points	–	–	Depends on the program
I	Interrupt pointer	I 0000 to I 1Fxx (*3)	20 points	–	–	Depends on the program
T	Timer current value	T000 to T1FF	512 words	–	O	OFF
C	Counter current value	C000 to C0FF	256 words	–	O	Preceding state retention

Notes: *1 The file register area (R) is allocated from the end of the program area. The size of the area is specified by a parameter.
*2 Because the file register area is read-only, data cannot be written in this area by programs. A block transfer instruction must be used to access the file register area.
*3 The memory address ranges for interrupt pointers are as follows:
I0000 to I0700: External interrupt pointer (8 points)
I1000 to I1700: High-speed counter interrupt pointer (8 points)
I1CXX to I1FXX: Fixed-cycle interrupt pointer (4 points)
"XX" depends on the set cycle time. (Set value x 5ms)

2. Devices for the NB2-P24 and NB2-P36

Device		Memory address range	Capacity	Access by instruction		Initial value
Identifier	Name			Bit	Word	
X	Input relay	X000 to X03F	64 points	O	O	Latest data
Y	Output relay	Y000 to Y03F	64 points			OFF
M	Internal relay	M0000 to M03FF	1024 points	O	O	OFF
L	Latch relay	L0000 to L01FF	512 points	O	O	Preceding state retention
M	Special relay	M8000 to M81FF	512 points	O	O	OFF
S	Step relay	S000 to S0FF	256 points	O	–	Preceding state retention
T	Timer	T000 to T01F	32 points	O	–	OFF
C	Counter	C000 to C01F	32 points	O	–	Preceding state retention
D	Data register	D0000 to D003F	64 words	O	O	Preceding state retention
D	Special register	D8000 to D80FF	256 words	O	O	Preceding state retention
P	Branch pointer	P00 to PFF	256 points	–	–	Depends on the program
I	Interrupt pointer	I 0000 to I 1700 (*1)	16 points	–	–	Depends on the program
T	Timer current value	T000 to T01F	32 words	–	O	OFF
C	Counter current value	C000 to C01F	32 words	–	O	Preceding state retention

Notes: *1 Memory address ranges for interrupt pointers are as follows:
I0000 to I0700: External interrupt pointer (8 points)
I1000 to I1700: High-speed counter interrupt pointer (8 points)

3-2-6 Relay number and memory number

To specify memory areas in a user program, the numbers given to the areas must be specified. Relay numbers are used to specify areas in units of one bit (contact or coil).

1. Specification in units of one bit (contact or coil): Relay No.

An I/O area is represented by a device identifier. This identifier indicates bit specification, it has a word address which indicates a word position, and a bit address which indicates a bit position.

Example:

X 0 1 3

- 3 — Bit address (hexadecimal 0 to F)
- 1 — Word address (hexadecimal 00 to 1F) (hexadecimal 00 to 03 in the NB2-P24 and NB2-P36)
- X — Identifier (each device identifier) (Examples: X for an input relay, and Y for an output relay.)

2. Specification in units of one word (data): Relay No.

An I/O area is represented by a device identifier. The identifier includes a word specification and a word address which indicates a word position.

Example:

W X 0 3

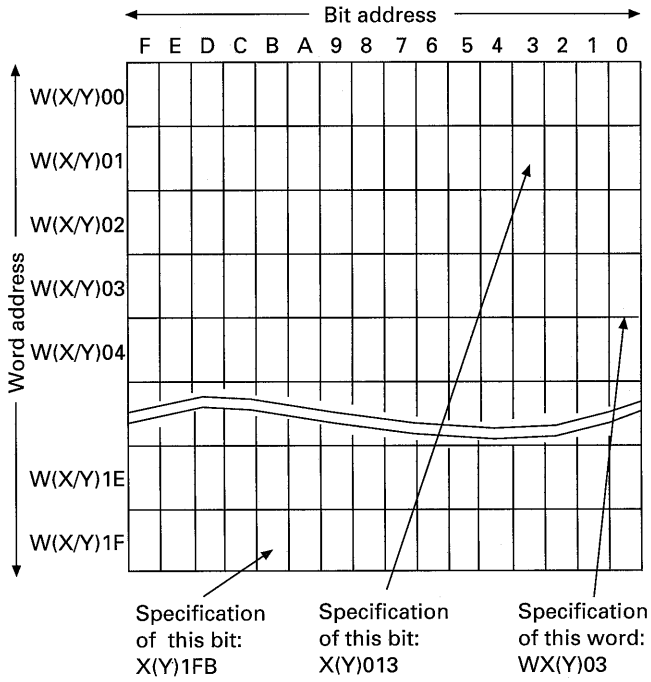
- 03 — Word address (hexadecimal 00 to 1F) (hexadecimal 00 to 03 in the NB2-P24 and NB2-P36)
- WX — Identifier (The character W is added to each device identifier.) (Examples: WX for an input relay, and WY for an output relay.)

Notes: 1. With the NB1 series PC, input and output bits may be combined in a word. If input and output bits are combined in a word, masking must be done by AND instructions.

2. An instruction to access a device area may be in units of bits, words, or both bits and words. An I/O or auxiliary relay area may be accessed in units of both bits and words. For details, see Section 3-2-5, "Device list."

Memory numbers are used to specify areas in units of one word (16 bits).

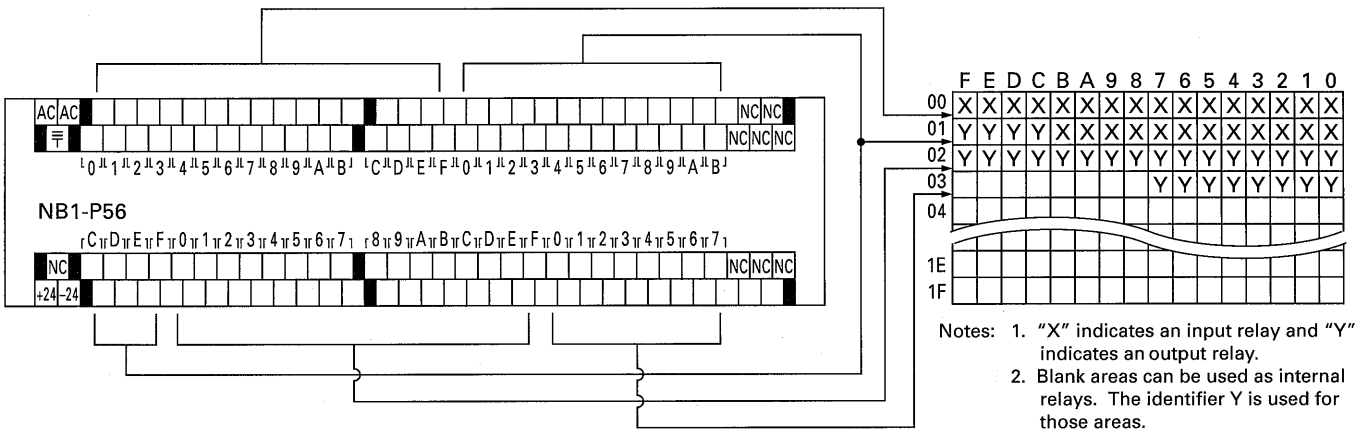
I/O relay areas are represented as shown below.



3-2-7 Examples of I/O address assignment

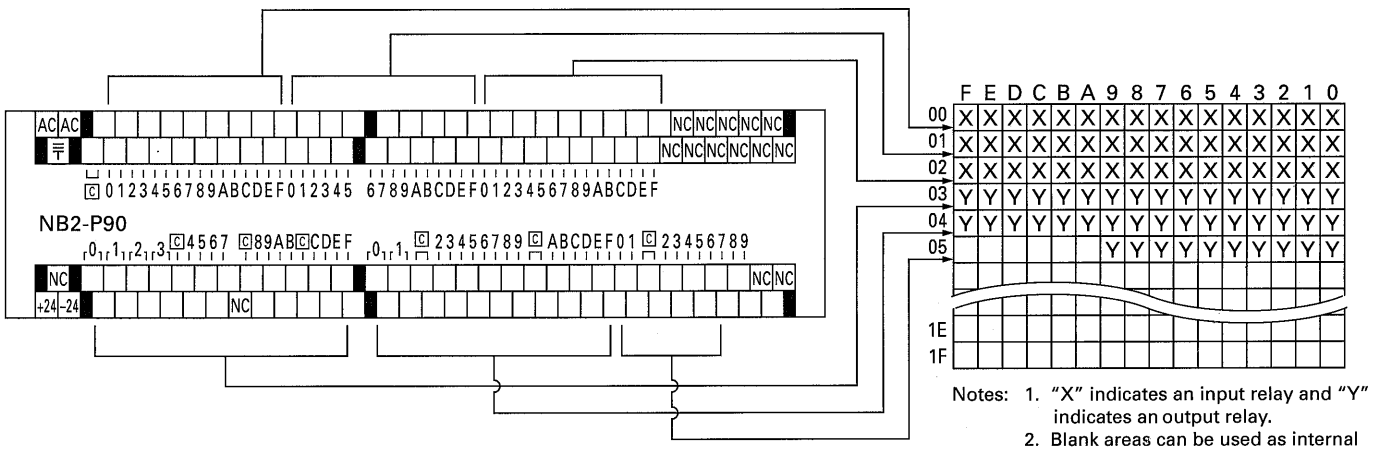
On the NB-series basic unit, I/O addresses are assigned as serial numbers beginning with 000. The basic unit terminal numbers correspond to the basic unit bit addresses. If an eight-point expansion cassette is mounted, the I/O addresses following those of the basic unit are assigned to the expansion cassette. On an expansion unit, I/O addresses are specified by using the address setting dials of the expansion unit.

1. I/O address assignment on the NB1-P56 (with I/O relays)



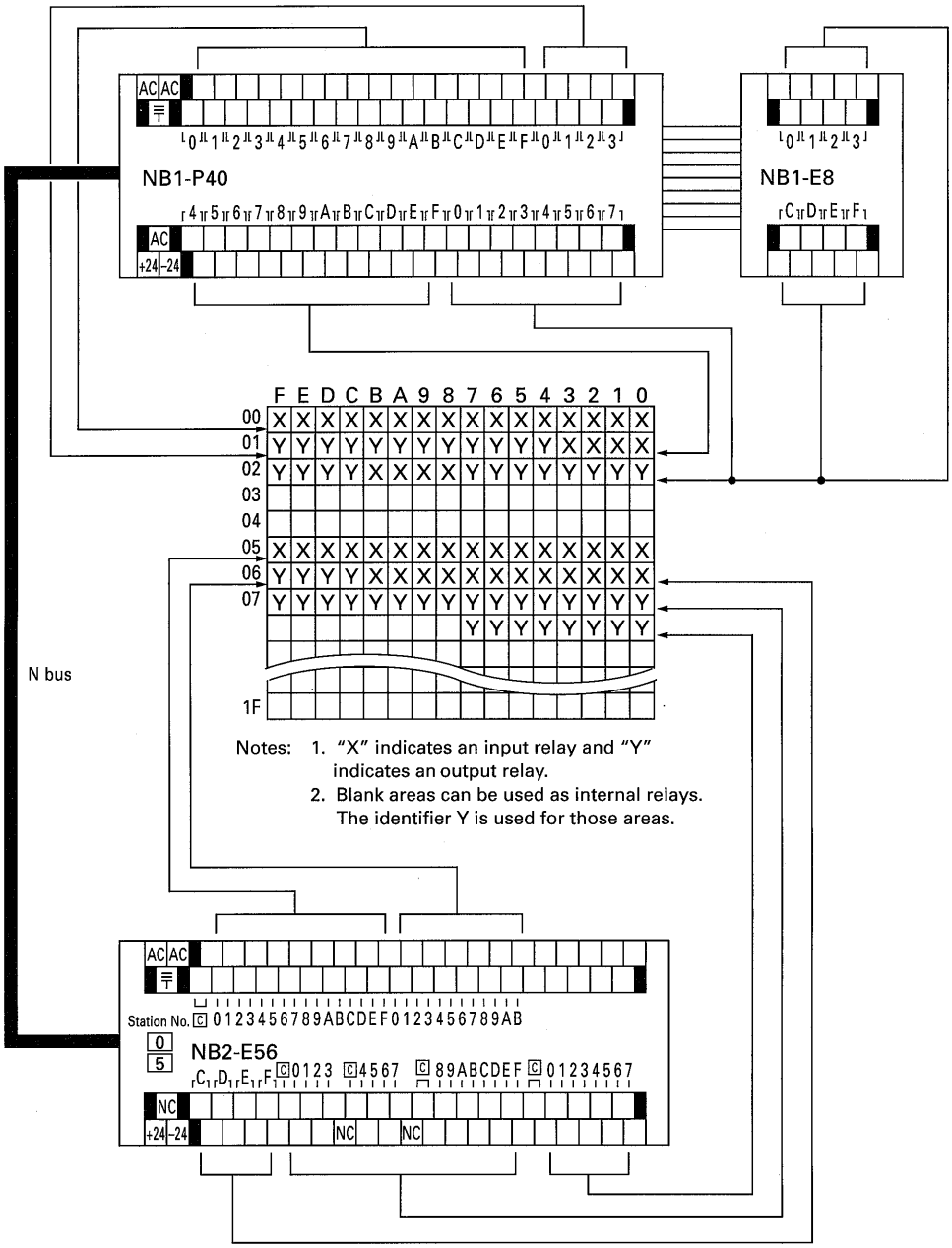
Notes: 1. "X" indicates an input relay and "Y" indicates an output relay.
2. Blank areas can be used as internal relays. The identifier Y is used for those areas.

2. I/O address assignment on the NB2-P90



Notes: 1. "X" indicates an input relay and "Y" indicates an output relay.
2. Blank areas can be used as internal relays. The identifier Y is used for those areas.

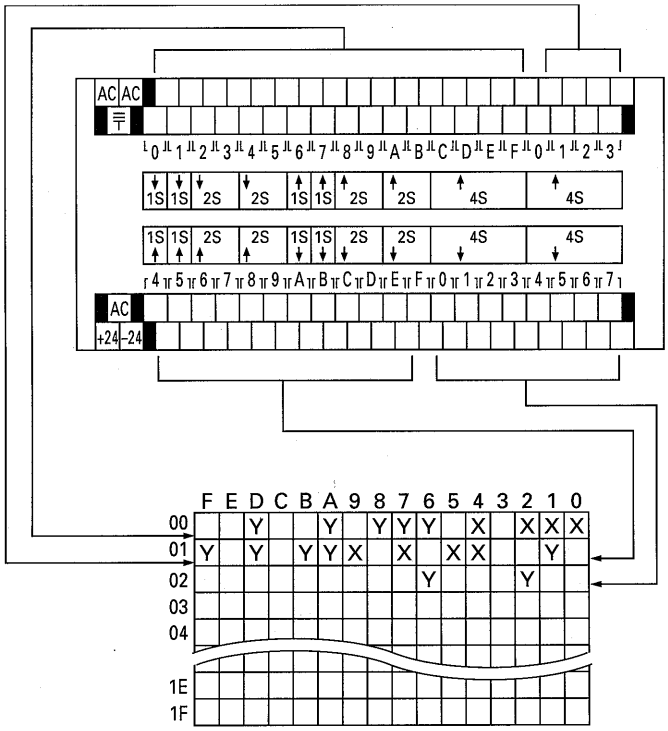
3. I/O address assignment of a system combining the NB1-P40, NB1-E8, and NB2-E56



Notes: 1. "X" indicates an input relay and "Y" indicates an output relay.
2. Blank areas can be used as internal relays. The identifier Y is used for those areas.

4. I/O address assignment on the basic unit using I/O relays of 2S (2 bit) and 4S (4 bit) sizes

On the NB1 basic unit, the arrow of each I/O relay indicates the address of the I/O relay. If a 2S- or 4S-size I/O relay is used, the addresses other than the one indicated by the arrow are not used.

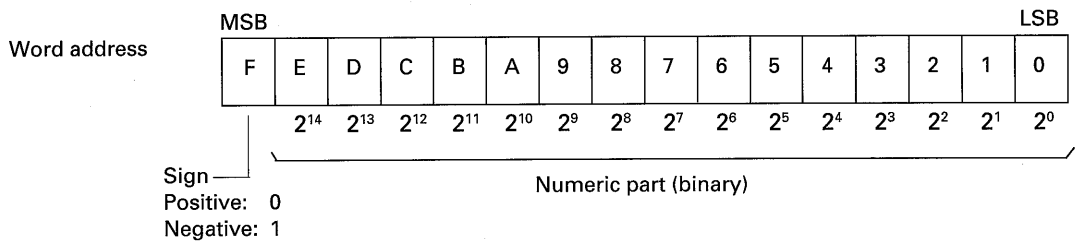


Notes: 1. "X" indicates an input relay and "Y" indicates an output relay.
2. Blank areas can be used as internal relays. The identifier Y is used for those areas.

3-2-8 Data handling

In internal memory and registers, numeric values are handled as shown below.

Numeric value are represented as 16-digit binary numbers (ranging from decimal -32768 to 32768).



Example of representation

Binary

	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	
Decimal: 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Hexadecimal: 0000
Decimal: 11	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	Hexadecimal: 000B
Decimal: 32767	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Hexadecimal: 7FFF
Decimal: -1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Hexadecimal: FFFF
Decimal: -32767	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Hexadecimal: 8001
Decimal: -32768	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Hexadecimal: 8000

- To represent a negative number, each bit of the corresponding positive number is inverted and binary 1 is added to the binary number obtained.
- The current value of a timer and counter is from decimal 0 to 32767. The most-significant bit (MSB) of a counter and timer value is always 0.

3-3 Input Function Types

The NB-series PC has not only functions for ordinary external inputs but also the other functions shown below.

1. Pulse-catch function

On the basic unit, a pulse-catch circuit (16 points) for 500µs pulses (see the following figure) is added to the ordinary input circuits. The pulse-catch circuit without a filter always catches pulse signals regardless of the input type.

2. Input filtering time delay specification

For the basic unit and expansion cassettes, the input filtering time delay can be specified for each input point. For expansion units, the input filtering time delay can be specified for each input word (16 points). A short input filtering time must be specified for a high-speed feature such as a high-speed counter input.

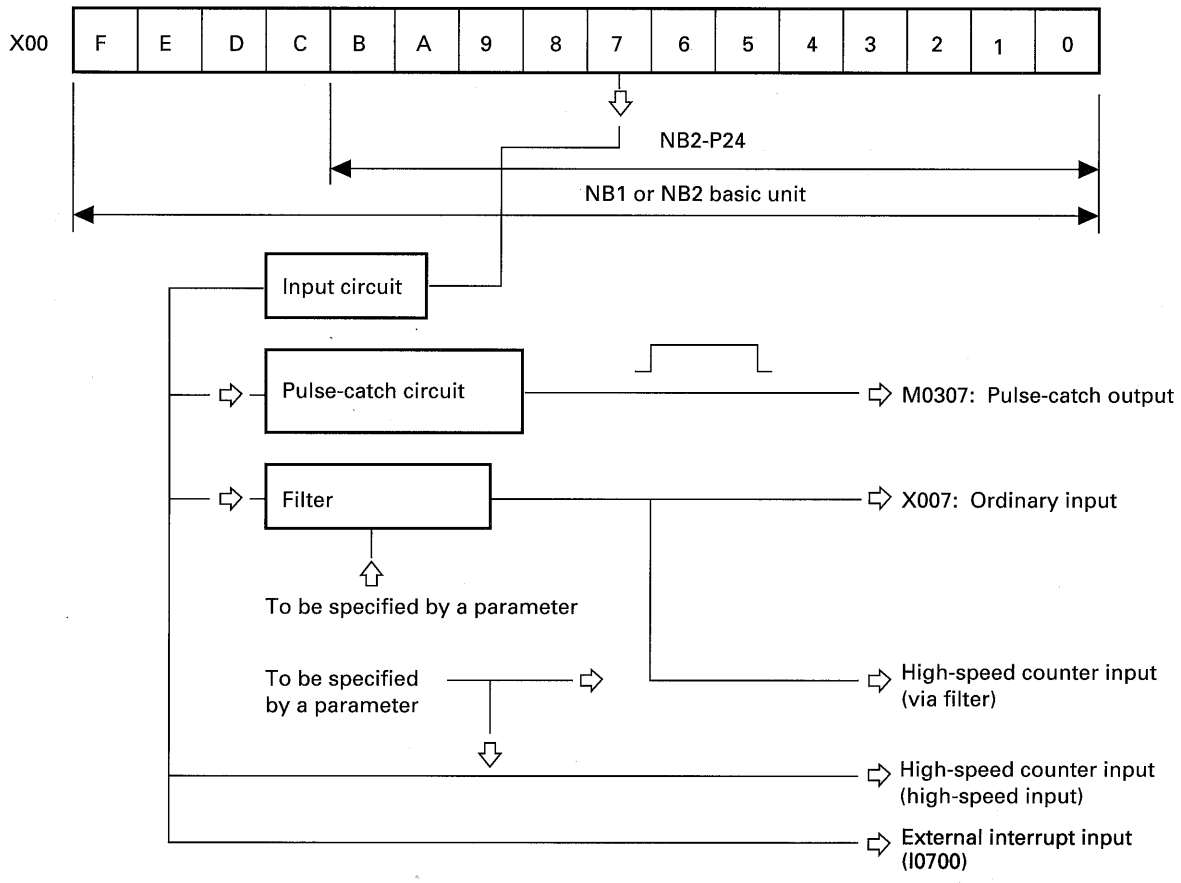
3. External interrupt function

Eight input points at addresses X0 to X7 are used for the external interrupts. For details, see Section 3-4, "Interrupt Processing."

4. High-speed counter input

Input points X0 to XF (16 points) are used for input count pulses (phases A and B), count stop, and current value reset signals.

I/O addresses of the basic unit

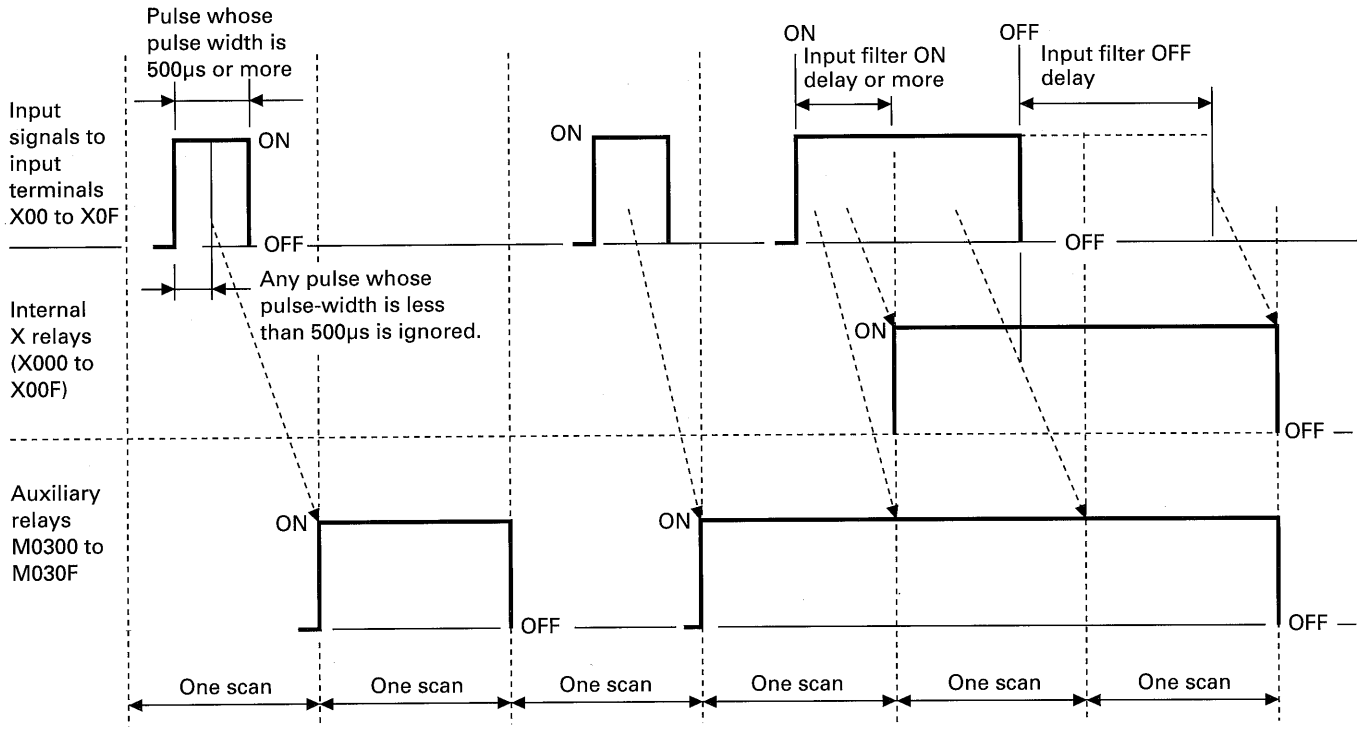


3-3-1 Explanation of input functions

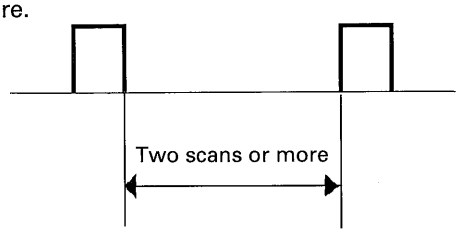
1. Pulse-catch function

The NB-series PC has a function to detect input pulse signals which are at least 500μs wide. This function can be used to detect the limit signals for objects that move at high speed. An input pulse signal is detected during a scan and the detection result is passed to an auxiliary relay in the next scan.

Timing diagram



- Input terminal addresses:
  On the NB1 basic unit, input terminal addresses are 00 to 0F where input relays are installed.
  On the NB2 basic unit, input terminal addresses are 00 to 0F (00 to 0B on the NB2-P24).
- The input pulse signals are fetched into the internal relays allocated in X area (000 to 00F) after the specified filtering delay. These internal relays can also be used for ordinary input signals.
- Output signals of pulse-catch circuits are assigned, and always passed to specific internal relays (M0300 to M030F). These relay areas cannot be used for other internal output relays.
- If this input pulse is used for the counters in a program, the interval between the pulse signals must be two scan-times or more.



3-3-2 Input filtering time

Input filtering time is delay that is specified to remove input signal bounce and noise from external signals. The input filtering time is specified using a parameter according to the input signal specifications. For ordinary input operation, the parameter default need not be changed.

1. Filtering time specification

The range of filtering time (OFF-to-ON/ON-to-OFF) is as shown on the right.

Default is 3ms/10ms.

3ms/3ms, 3ms/10ms, 10ms/10ms, 30ms/30ms, 0.1s/0.1s, 0.3s/0.3s, 1s/1s, and no filtering

- The default for input filtering time is common to AC input and DC input modules.
- For AC input modules, values other than the default must not be specified.
- If "no filtering" is specified, input delay depends on I/O relays and input circuit hardware.

2. Setting addresses

- In a system comprising the basic unit and expansion cassettes, an input filtering time can be specified for each input point.
  On the NB1 PC, the input filtering time applies to the addresses in which input relays are installed. On the NB2 PC, input filtering time applies to all input addresses (X000 to X061).
- On an expansion unit, the input filtering time can be specified for each input word (WXxx) (16 points).
  On an expansion unit of the NB1 series PC, the input filtering time is specified for each word address (WX04 to WX1F) at which I/O relays are installed.

3. Specification method

The following table lists the specified values corresponding to parameter addresses. These values can be entered using the program loader.

Parameter address		Bit address			
		F ····C	B ····8	7 ····4	3 ····0
Specification in units of a point	0F	X003	X002	X001	X000
	10	007	006	005	004
	11	00B	00A	009	008
	12	00F	00E	00D	00C
	13	013	012	011	010
	14	017	016	015	014
	15	01B	01A	019	018
	16	01F	01E	01D	01C
	17	023	022	021	020
	18	027	026	025	024
	19	02B	02A	029	028
	1A	02F	02E	02D	02C
	1B	033	032	031	030
	1C	037	036	035	034
	1D	03B	03A	039	038
	1E	03F	03E	03D	03C
	1F	043	042	041	040
	20	047	046	045	044
	21	04B	04A	049	048
	22	04F	04E	04D	04C
	23	053	052	051	050
	24	057	056	055	054
	25	05B	05A	059	058
	26	05F	05E	05D	05C
	27	—	—	061	060
Specification in units of words	28	WX07	WX06	WX05	WX04
	29	0B	0A	09	08
	2A	0F	0E	0D	0C
	2B	13	12	11	10
	2C	17	16	15	14
	2D	1B	1A	19	18
	2E	1F	1E	1D	1C

Specification for the 64 points of the basic unit

Specification for the 98 points of the basic unit (*1)

Specification for the 28 words (448 points) of the expansion unit (*2)

Example of specifying for input bit X004

3	2	1	0
7	6	5	4
B	A	9	8
F	E	D	C
1	0	1	1

Specification indicator
1: Specified
0: Not specified

Filtering time (*3)
OFF → ON/ON → OFF
001: 3ms/3ms
010: 3ms/10ms
011: 10ms/10ms
100: 30ms/30ms
101: 0.1s/0.1s
110: 0.3s/0.3s
111: 1s/1s
000: No filtering time specified

This is the specification for input word WX04 (16 points).
Specifications for other words are the same as above.

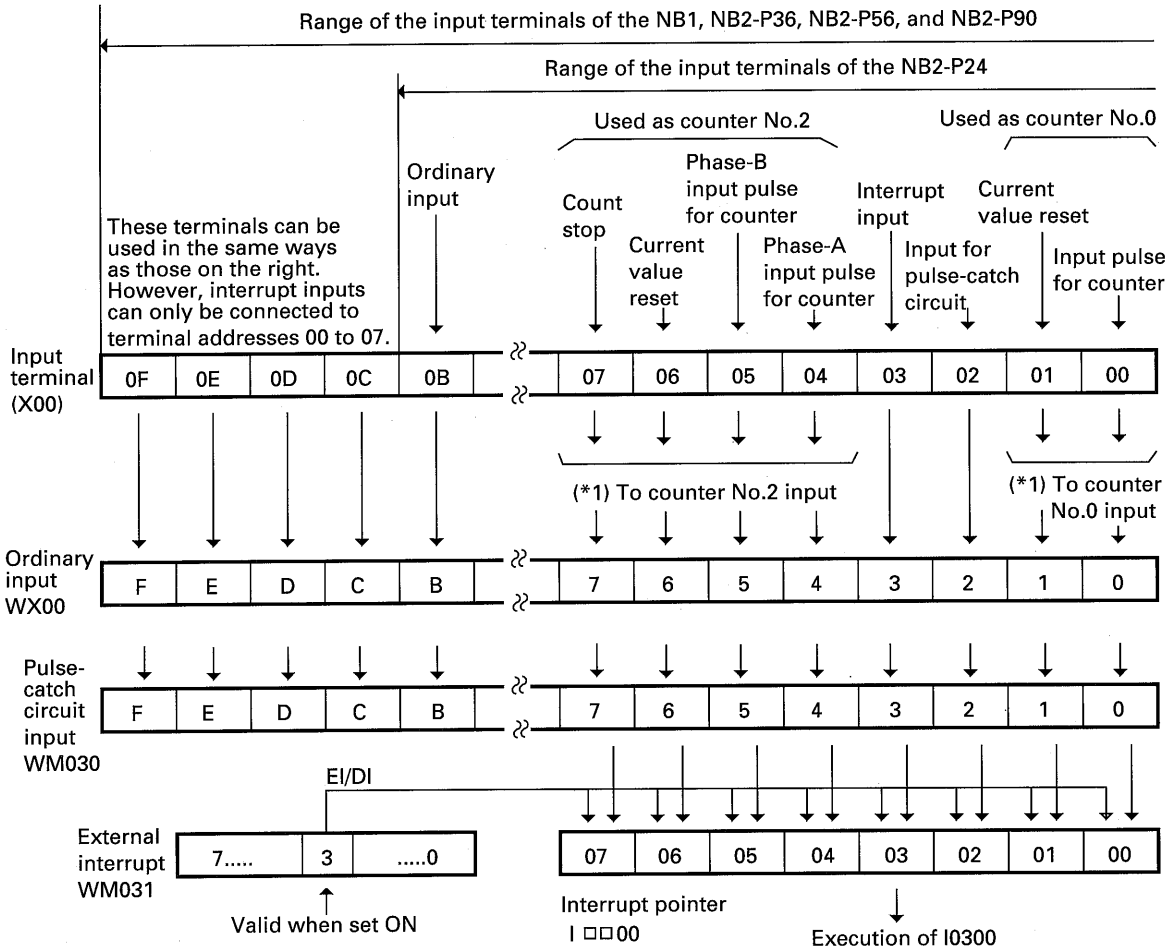
Notes: *1 If an expansion unit is installed at these I/O addresses (WX04 to WX06), parameter specification (addresses 1F to 27) in units of bits is ignored.

*2 For the NB2-P90 basic unit, parameter specification (addresses WX04 to WX06) in units of words is ignored.

*3 If the specification indicator is "1" (specified), filtering time specification becomes valid. If "0" (not specified), filtering time specification is ignored and the default (3ms/10ms) is used.

3-3-3 Example of using input terminals (Functions)

Input terminals can be used for many purposes including ordinary input, pulse input, external interrupt input, and high-speed counter input. An example of input use is shown below.



- Even if input terminals are used for various input signals, outputs corresponding to ordinary input (WX00) and pulse-catch output (WM030) are obtained. However, there is no output response to a high-speed input.
- On the NB1 PC, input relays must be installed for the above terminals. For high-speed input signals, such as input signals for a counter, a high-speed I/O relay (SQ-IHD012) must be installed.
- On the NB2 PC, the input addresses are fixed. Input addresses X00 to X03 (four points) are used for high-speed inputs.

*1 If a counter is specified using a parameter, an external input is internally connected to a counter automatically.

3-4 Interrupt Processing

The NB-series PC has three types of interrupt functions which can be combined with direct I/O instructions to give a high-speed response.

Interrupt type	No. of interrupts	Description
External interrupt input	8	Interrupt input addresses are fixed at X000 to X007. Internal relays M0310 to M0317 are used to specify whether an interrupt is to be enabled.
High-speed counter internal interrupt	8	This interrupt is enabled when the current value of the counter reaches a preset value.
Fixed-cycle interrupt	4	The cycle time is specified as 5ms x N (N: 00 to FF).

The NB2-P24 and NB2-P36 do not have the fixed-cycle interrupt function.

3-4-1 Interrupt pointers

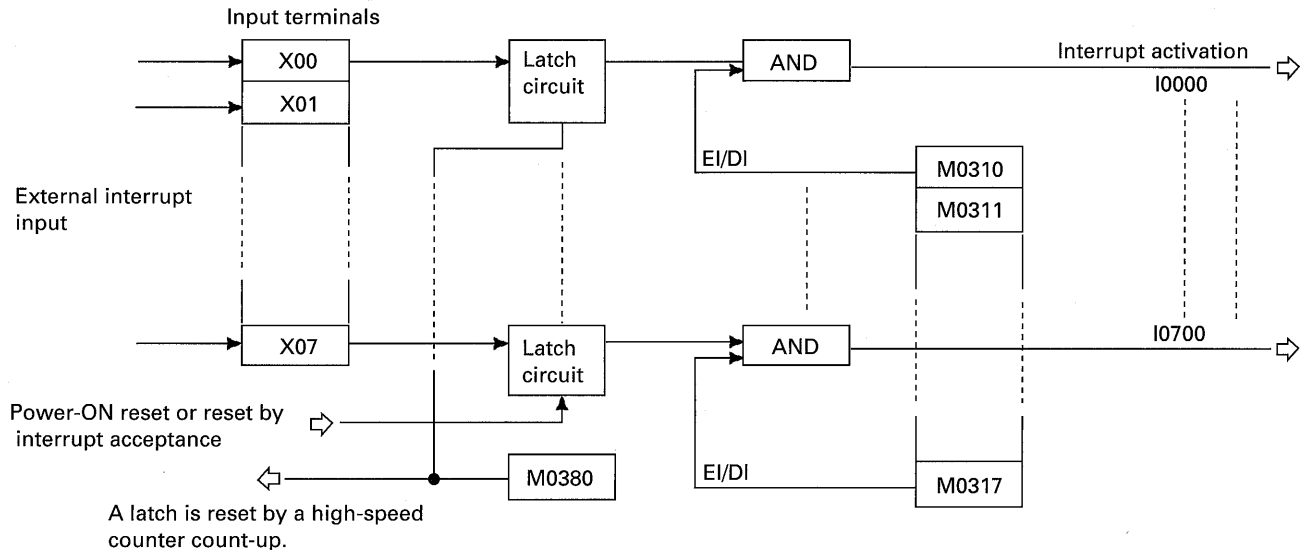
When one of the above three types of interrupts occur, the PC processor executes an interrupt program in the main routine program. The interrupt program to be executed has an interrupt pointer number corresponding to the purpose of the requested interrupt. The following table lists interrupt pointers.

Interrupt pointer		Activated device	Interrupt-acceptance relay (EI/DI)	Remarks
Priority	I 00 00 ⋮ I 07 00	X000 ⋮ External input X007	M0310 ⋮ M0317	When M0380 is set ON, all interrupt-acceptance relays are reset.
	I 10 00 ⋮ I 17 00	High-speed counter (when the current value reaches the preset value)	M0323 M032B ⋮ ⋮ M0353 M035B	When one of M0378 to M037F is set ON, the corresponding interrupt-acceptance relay is reset. When M0380 is set ON, all interrupt-acceptance relays are reset.
	I 1C XX ⋮ I 1F XX	Fixed-cycle activation by the processor		

Interrupt No. — Interrupt cycle (XX: 00 to FF) ("00" disables the interrupt.)
"XX" is "00" for an external or high-speed counter interrupt.

- For interrupt execution, a lower interrupt pointer number has the priority over higher interrupt pointer numbers. If many interrupts are generated consecutively, each interrupt is executed only after the execution of the preceding interrupt program ends.
- An external interrupt is accepted and executed each time an external interrupt input relay is set ON.
- All interrupts are ignored while the processor is stopped.

3-4-2 Interrupt circuit configuration



- The interrupt input is held temporarily by an internal latch circuit. The default of the latch circuit status is "0" (reset state).
- Whether an interrupt is enabled is written in one of the internal relays M0310 to M0317 (EI: 1 or DI: 0). The default of the relay status is "0" (interrupt disabled).
- If an interrupt input is already held when the relay is set to the EI state ("1"), the interrupt is activated immediately.
- The latch circuits are reset when internal relay M0380 is set to "1". Then, all latch circuits are reset. The latch circuits for 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.

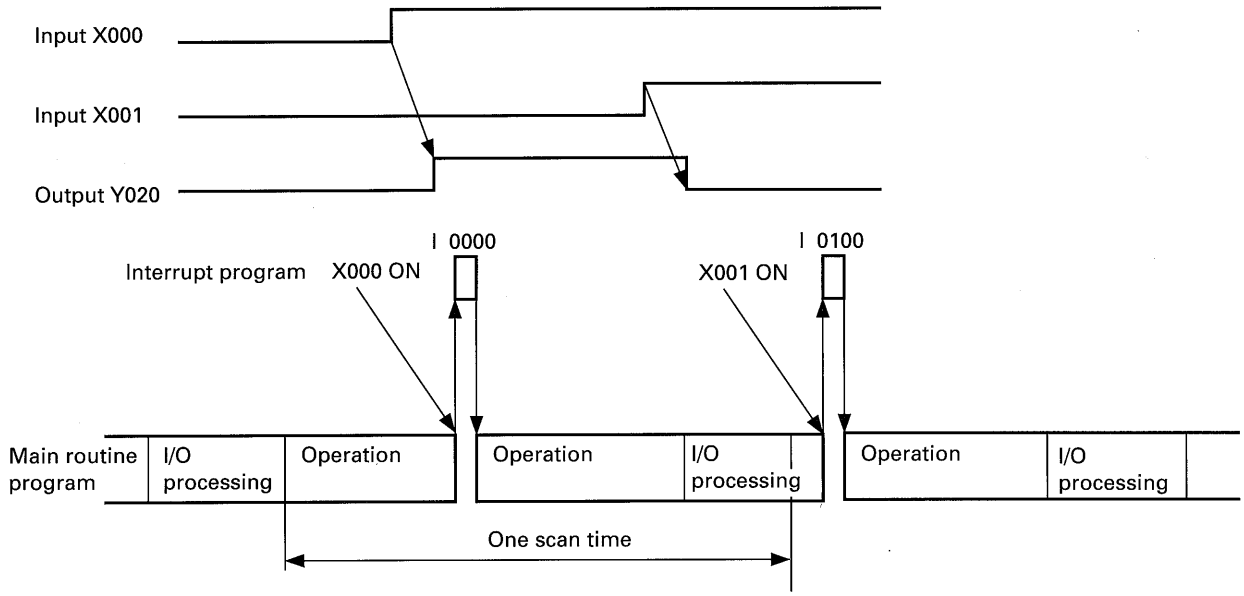
3-4-3 Interrupt processing

This section explains the interrupt processing.

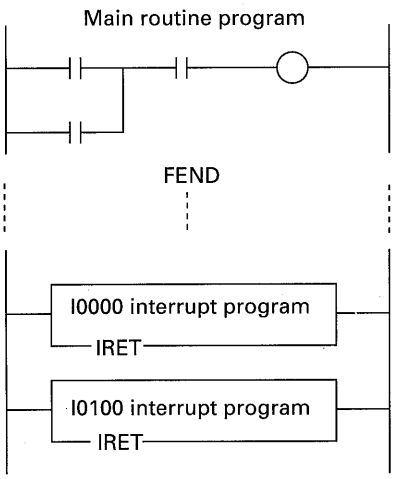
Operation example

When interrupt input X000 is set ON, output relay Y020 is set ON. When interrupt input X001 is set ON, output relay Y020 is set OFF. This operation is executed immediately and according to the input status.

Timing diagram

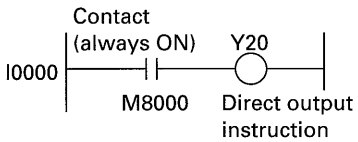


Program example

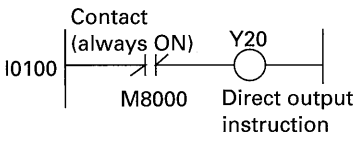


Interrupt program

Program to be executed when interrupt input X000 turns ON



Program to be executed when interrupt input X001 turns ON



3-5 Special Registers

Part of the register area (D) is allocated to special data and signals. The special area is available for common use by the NB, NJ and NS series models or the specific use of the NB series.
The special area cannot usually be used for ordinary registers. However, the special area can be used for ordinary registers if the following conditions are satisfied.

- There are no expansion units connected.
- The PC is not connected to another system.
- Built-in high-speed counters are not used.

Any future upgrading of a PC system and program compatibility with upper-level models must be considered. For this reason, we recommend using the following addresses for ordinary registers.

- Data registers: D0080 to D03FF

Special registers common to the NB, NJ, and NS series PCs

Address	Name	Description	Remarks
D8000	Current value of the scan time	Scan time is measured and stored in units of 1ms. The initial values at power-ON or the start of PC are as follows: Maximum value: 00 Minimum value: 00 Current value: 00	Each register uses one-word of memory and contains a binary value.
D8001	Minimum value of scan time		
D8002	Maximum value of scan time		
D8003 ⋮ D8007	Reserved for upper-level models		
D8008	Scan time increment for a user macrocommand/timer	Holds the scan time of the preceding scan.	
D8009 ⋮ D800F	Unused		
D8010 ⋮ D801F	Word input for a user macrocommand (16 words)	Stores parameters to be transferred from the main routine program to user macrocommands.	If user macrocommands are not used, these areas can be used for ordinary registers.
D8020 ⋮ D802F	Word output for user macrocommands (16 words)	Stores parameters to be transferred from user macroinstructions to the main routine program.	

Registers specific to the NB series

Address	Name	Description	Remarks
D0000 ⋮ D0007	Current values of high-speed counters No.0 to No.7	Stores the accumulated values of counters which are sampled in synchronization with scan timing. These areas are read-only.	• If these areas are not used for high-speed counters, they can be used for ordinary registers.
D0008 ⋮ D000F	Set values of high-speed counters No.0 to No.7	Holds the values to be compared with the current values of corresponding counters. If a counter is not used, the resister which corresponds to the unused counter is used for holding the value to be compared with the current value of another counter.	
D0010 ⋮ D0017	Preset current values of high-speed counters No.0 to No.7	Holds the counter values used to preset the current values of counters. The preset values are placed in the corresponding counters when a preset operation is executed. (See the reference on next page.)	

Registers specific to the NB series (Continued)

Address	Name	Description	Remarks
D0018 ⋮ D001F	Function unit No.1 link area	Data area for the function unit in station No.1 CPU←: D0018 to D001B CPU→: D001C to C001F	• The function units exchange signals with the CPU via these areas. • If function units are not connected, the corresponding areas can be used for ordinary registers. • For the data contents, refer to the user's manual of each function unit.
D0020 ⋮ D0027	Function unit No.2 link area	Data area for the function unit in station No.2 CPU←: D0020 to D0023 CPU→: D0024 to C0027	
D0028 ⋮ D002F	Function unit No.3 link area	Data area for the function unit in station No.3 CPU←: D0028 to D002B CPU→: D002C to C002F	
D0030 ⋮ D0037	Function unit No.4 link area	Data area for the function unit in station No.4 CPU←: D0030 to D0033 CPU→: D0034 to C0037	

Reference

To preset the current value or value for comparison of a high-speed counter, the corresponding special relay must be set ON.

	Preset current value	Preset value for comparison
High-speed counter No.0	M0327	M0326
High-speed counter No.1	M032F	M032E
High-speed counter No.2	M0337	M0336
High-speed counter No.3	M033F	M033E

	Preset current value	Preset value for comparison
High-speed counter No.4	M0347	M0346
High-speed counter No.5	M034F	M034E
High-speed counter No.6	M0357	M0356
High-speed counter No.7	M035F	M035E

Registers specific to the NB series

The following registers are used when expansion or function units are connected to the PC. These registers hold the RAS state of a signal exchanged between the basic unit and a connected expansion or function unit. If there are no expansion or function units connected, these register areas can be used for ordinary registers.

Address	Name		Description	Remarks
D0038	F to 8 The number of connected units	7 to 0 Station numbers of disconnected units	Holds the number of connected expansion and function units and the station numbers of disconnected units are indicated.	
D0039 D003A D003B	Indication of expansion unit addresses (in ascending order of address)	Current values of retry counters (binary)	Holds the retry count for communication between the CPU and each expansion or function unit. Unit representation: Expansion unit: 04 to 1F Function unit No.1: 40 Function unit No.2: 48 Function unit No.3: 50 Function unit No.4: 58	Holds the count for up to three expansion units
D003C D003D D003E D003F	Holds the station numbers of function units (in ascending order of station number)			Holds the station number of up to four function units

- Registers at addresses at which expansion or function units are not connected contain the data "00".
- The data stored in the above areas is lost when the PC power supply is turned OFF. When the PC power supply is turned ON, the state detected at that time is stored in the above areas.
- The stored number of connected units is binary (decimal 00 to 07) and is the total number of expansion and function units connected.
- The station numbers of disconnected units are indicated in ascending order of address.

3-6 Special Relays

Address	Name	Description	Remarks
M8000	Run state	This relay is ON while the PC is running. This relay is set OFF when a fatal fault occurs. This relay is not set OFF when a nonfatal fault is detected. If stopping the PC with a non-fatal fault is specified by the relevant parameter, this relay is set OFF.	
M8001	Error	This relay is set ON when an error occurs. (This relay is set OFF for both nonfatal and fatal faults when the PC fault is cleared.) This relay is not set ON even when a battery or operation error occurs.	
M8002 ⋮ M801F	Reserved for upper-level models		
M8010	Power-ON	This relay is ON while the power supply of the basic unit is operating normally.	
M8011	Initial scan	This relay is ON while the first scan is being executed.	
M8012	Scan clock	This relay is set ON and OFF during each scan.	This relay is initially in the OFF state.
M8013 M8014	Unused		
M8015	10ms clock	This relay is set ON and OFF in 10ms cycles.	• At the beginning of the first scan, this relay is OFF. • The state of these relays change synchronized with the scan cycle.
M8016	0.1s clock	This relay is set ON and OFF in a 0.1s cycle.	
M8017	1.0s clock	This relay is set ON and OFF in a 1.0s cycle.	
M8018 ⋮ M801F	Unused		
M8020	User watchdog timer (WDT) error (nonfatal fault)	This relay is set ON when the application program execution time reaches the watchdog timer time set by the user.	
M8021	Error of data to be ratained even during power failure (nonfatal fault)	This relay is set ON when keep relay data cannot be retained because of a long power failure or other reason. If this relay is set ON, all retained data in these areas is cleared to zero.	
M8022 ⋮ M8025	Reserved for upper-level models		
M8026	User program nonfatal fault	This relay is set ON when a user program nonfatal fault relay (M8110 to M812F) is set ON. This relay can be set ON and OFF under program control.	See Section 11.
M8027	User program fatal fault	This relay is set ON when a user program fatal fault relay (M8130 to M814F) is set ON.	See Section 11.
M8028	Battery error (nonfatal fault)	This relay is set ON when the battery is disconnected or the battery voltage is too low. This relay is set OFF when the PC battery error is remedied. The state of this relay can be changed by the program loader or by a program.	
M8029	Battery error memory	This relay retains the state of the above battery error relay. The relay can be reset by a PC power-ON, program loader, or by a program.	
M802A	Operation error memory	This relay retains the state of the operation error relay. This relay can be reset by a PC power-ON, by the program loader, or by a program.	
M802B ⋮ M803F	Unused		
M8040 ⋮ M807F	Reserved for the upper-level models		
M8080 ⋮ M80FF	Reserved for the upper-level models		
M8100	Batch reset of nonfatal fault relays	When this relay is set ON, all nonfatal fault relays are reset. If a nonfatal fault has not been remedied yet, the corresponding nonfatal fault relay is set ON again.	
M8101 M8102	Reserved for the upper-level models		
M8103 ⋮ M810F	Reserved		
M8110 ⋮ M812F	User nonfatal fault relays (32 relays)	If one or more of these relays is set ON by the user, relays M8001 and M8026 are set ON to indicate a nonfatal fault. Even if this happens, the PC will not stop.	See Section 11.
M8130 ⋮ M814F	User fatal fault relays (32 relays)	If one or more of these relays is set ON by the user, relays M8001 and M8027 are set ON to indicate a fatal fault. The PC will stop.	

Continued

Address	Name	Description	Remarks
M8150 ⋮ M81CF	Reserved		
M81D0 ⋮ M81DF	Bit input for user macrocommands (16 relays)	These relays store the parameters to be transferred from the main routine program to user macrocommands.	
M81E0 ⋮ M81EF	Bit output for user macrocommands (16 relays)	These relays store the parameters to be transferred from user macrocommands to the main routine program.	
M81F0 ⋮ M81E7	Unused		
M81F8	Zero flag	This relay is used as a flag and set ON when the zero state is caused by a data instruction. This relay can be set ON by a user program.	
M81F9	Carry flag	This relay is used as a flag and set ON when a carry is generated by a data instruction. This relay can be set ON by a user program.	
M81FA	Borrow flag	This relay is set ON when a borrow is generated by a data instruction on the borrow flag. This relay can be set ON by a user program.	
M81FB ⋮ M81FE	Reserved for upper-level models		
M81FF	Operation error	This relay is set ON when an operation error is caused by a data instruction. The PC will not stop. This relay indicates a state that is neither a nonfatal fault nor a fatal fault. This relay can be set ON by a user program.	

Special relays specific to the NB series

Address	Name	Description	Remarks
M0300 ⋮ M030F	Pulse input relay number 0 ⋮ pulse input relay number F	These relays indicate the pulse-catch result of signals input to the basic unit input addresses X00 to X0F.	See the description of the pulse-catch function in Section 3-3.
M0310 ⋮ M0317	External interrupt relay number 0 ⋮ external interrupt relay number 7	These relays are used to control the masking of external interrupts (EI and DI).	See the description of external interrupt processing in Section 3-4.
M0320 ⋮ M037F	High-speed counter relays	These relays are used as commands and flags for high-speed counters.	
M0380	Batch reset of interrupt latches	This relay is used to reset all internal latch circuits for external interrupts and latch circuits for interrupts from high-speed counters.	See the description of interrupt processing in Section 3-4.
M0381 ⋮ M038F	Unused		

Section 4 Unit Functions and Components

Section 4 Unit Functions and Components

4-1 Structures of NB1 Series Units

This section describes the structures of the basic and expansion units, and names and functions of the PC components.

Applicable PCs: NB1 -P24(X) / E24(X)
-P40(X) / E40(X)
-P56(X) / E56(X)
- E8(X)

4-1-1 Configuration of the I/O section

When configuring each unit's I/O section, I/O relays must be selected to suit the I/O specifications of the user's system as will be explained later. The selected I/O relays must be mounted on the sockets of each unit.

I/O section / Type number	Input section	Output section
	Number of mounted SQ-ID024 24V DC input relays	Number of mounted RJ-OA240-002 output relays
NB1-E8	4	4
NB1-P24/E24	12	12
NB1-P36/E36	18	18
NB1-P56/E56	28	28

The following table lists the PC types on which I/O relays are mounted before shipment and the configuration of the mounted I/O relays.

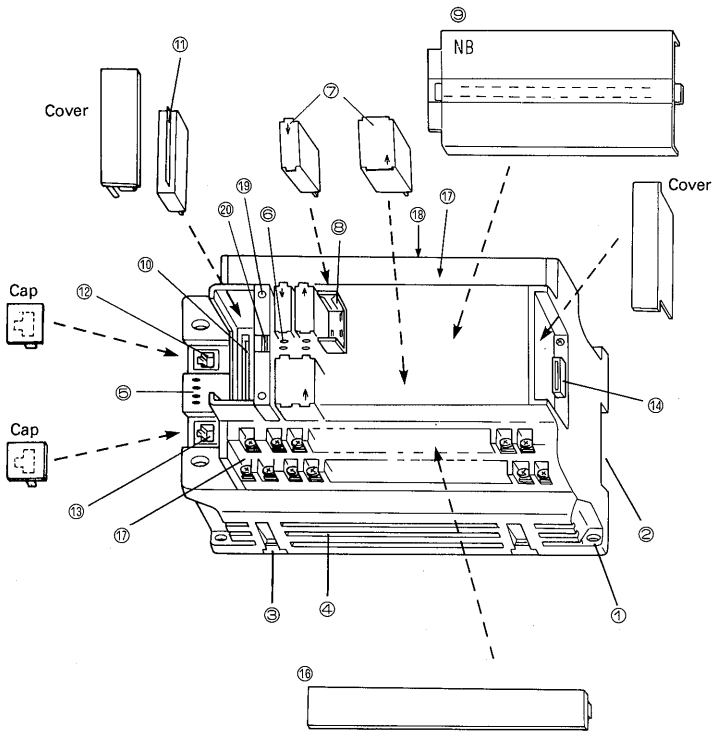
- Input relays are mounted on the upper row of each unit. Output relays are mounted on the lower row of each unit.
- PC type number NB1-□□□X is not shipped with I/O relays, it has sockets only.
- Every input and output circuit (terminal) is electrically isolated from all others.
- The terminals of unused sockets can be used as relay terminals. (Unused sockets are those to which I/O relays are not connected or which are unused because I/O relays of size 2S or more are mounted over the sockets.)
- Indicator lamps corresponding to unused relay sockets are turned ON when the corresponding addresses are used for output. These addresses are assigned to auxiliary relays by a user program.

4-1-2 Structure of the basic and expansion units

Component names

For a description of the components, see Section 4-1-3.

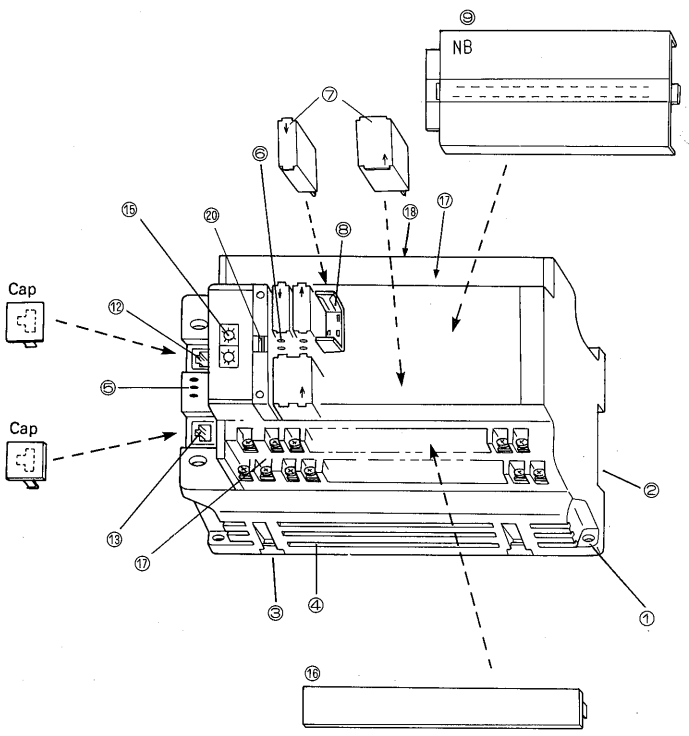
Applicable PCs: NB1 -P24(X)
-P40(X)
-P56(X)



Component names

For a description of the components, see Section 4-1-3.

Applicable PCs: NB1 -E24(X)
-E40(X)
-E56(X)



4-1-3 Component names and functions (basic unit and expansion unit)

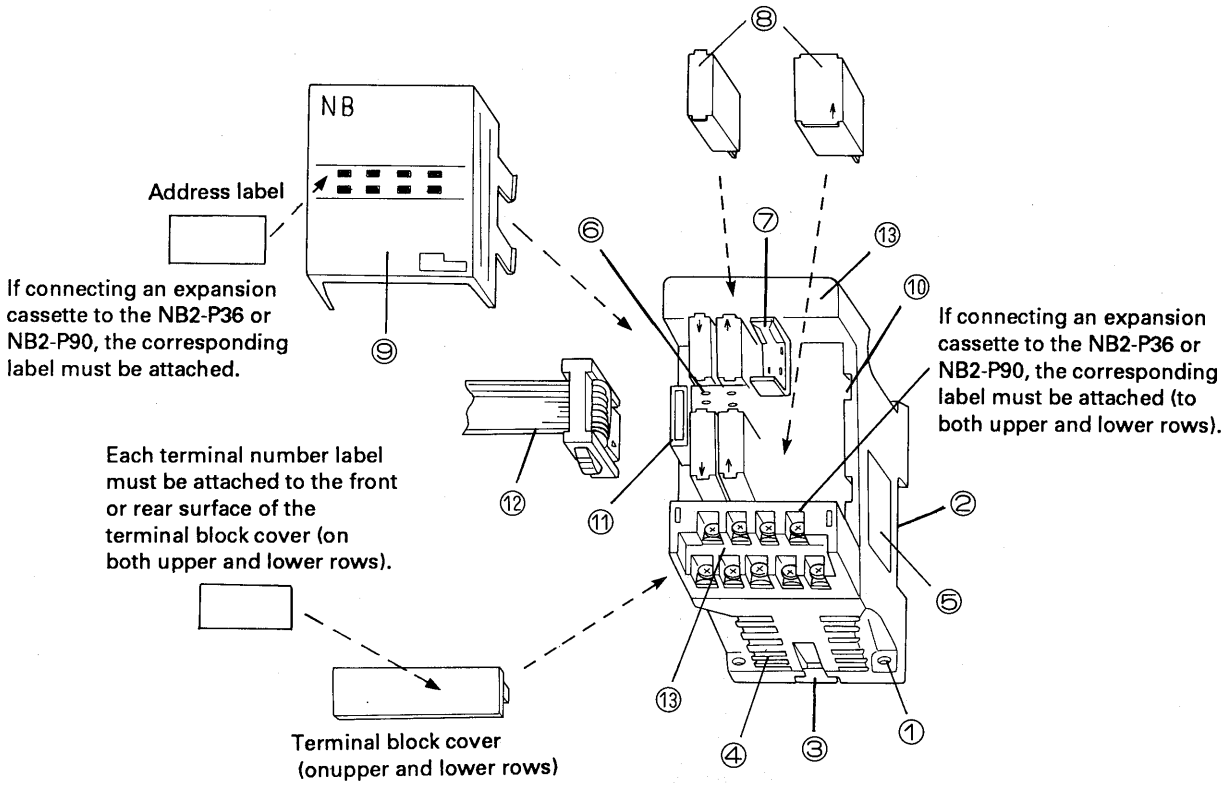
No.	Component name	Description (basic unit)	Description (expansion unit)	Remarks
①	Mounting holes (4 holes)	These holes are used to mount the unit on a panel. M4x16 mounting screws (to be supplied by the user) fit these mounting holes. For the dimensions of the mounting holes, see Section 4-3-2.		
②	Rail mount	The basic and expansion units can be mounted on a 35mm-wide JIS or IEC standard rail.		
③	Sliders	The PC unit can be removed from the mounting rail by pressing down these two sliders with the tip of a screwdriver.		
④	Vents	The PC unit has vents on its top and bottom sides. Care should be taken to prevent dust and foreign matter entering the unit through these vents. The vents are covered with a dust-protection paper when the unit is shipped. This protective paper must be removed before the power supply of the unit is turned ON.		
⑤	Operation status indicators			
	PWR: Power indicator (green)	This lamp lights when the power supply to the unit is normal.		
	RUN: Operation indicator (green)	This lamp lights when a user program is being executed. The lamp goes OFF when a fatal fault occurs.		
	ERR: Error indicator (red)	This lamp blinks when an error (nonfatal or fatal fault) occurs.		
	BAT.E: Battery error indicator (red) Low-voltage indicator (for the basic unit)	This lamp lights when the battery is disconnected or the battery voltage is too low. The lamp goes OFF when the battery error is remedied. For operation by ROM for example, this indicator can be disabled by the user. For details, see Section 2-4.		The operation of this indicator can be controlled using parameters.
⑥	I/O state indicators (red)	These indicator lamps show the signal state in I/O relays. Number of these indicators correspond to the number of I/O points of each unit. I/O state indicators are arranged in two rows (upper and lower) and each row has the same number of indicators. The I/O address corresponding to each indicator can be seen from the marking on the front cover ⑨ of the unit.		
⑦	I/O relays	Selected I/O relays are mounted on the sockets ⑧ . A large I/O relay (case size 2 and 4) requires more than one socket ⑧ for mounting. Mounting a large I/O relay will reduce, the number of available I/O points. Also, some terminals ⑬ and indicators ⑥ will not be usable.		The power supply must be turned OFF before I/O relays are mounted or removed.
⑧	I/O relay sockets	I/O relay sockets are used to mount I/O relays. The number of I/O relay sockets corresponds to the maximum number of I/O points of each unit. The I/O relay sockets are arranged in two rows (upper and lower) and each row has the same number of sockets.		
⑨	Front cover	The front cover must be attached to the unit after the I/O relays are mounted. The I/O address and I/O state indicators can be seen through the cover.		
⑩	Battery and memory cassette connector (basic unit only)	This connector is used to mount a battery, EPROM, or EEPROM cassette.		The power supply must be turned OFF before the battery, EPROM, or EEPROM cassette is mounted or removed.
⑪	Battery cassette (basic unit only)	This battery cassette is mounted as a standard component for ordinary PC operation using RAM as program memory. This battery is rechargeable. If the BAT.E indicator lights, ensure the battery is connected correctly. To use EPROM or EEPROM as program memory, program the EPROM or EEPROM cassette and mount it in place of the battery cassette.		
⑫	Programming tool connector (basic unit only)	Used to connect a programming tool cable. This connector has the same shape as an N-bus connector, take care not to confuse these connectors.	———	
	N-bus connector (upper) (basic unit only)	———	The two N-bus connectors are on the upper and lower sides of the unit. One connector is used to connect the N-bus cable from the basic unit or an expansion unit. The other connector is used to connect the N-bus cable to a further expansion unit. The upper and lower connectors are identical. (Expansion unit only)	N-bus cables must not be disconnected while the PC is operating. If an N-bus cable is disconnected during the PC operation, a fatal fault occurs and the PC will stop.
⑬	N-bus connector (lower)	This N-bus connector is used to connect the N-bus cable to an expansion unit. (Basic unit only)		
⑭	Expansion cassette connector (basic unit only)	This connector is used for an expansion cassette (NB1-E8), the connection cable required is supplied with the expansion cassette. The basic unit power supply must be turned OFF before an expansion cassette is connected or disconnected.		
⑮	I/O address setting dials (expansion unit only)	The I/O address setting dials are used to set the first I/O address of each expansion unit. The high-order digit (0 or 1) and low-order digit (0 to F) of the I/O address are set independently by the two dials. The power supply must be turned OFF before setting an I/O address. Use the screwdriver supplied as an accessory to turn the dials.		
⑯	Terminal block covers	The two accessory terminal number seals must be affixed to the front or back surface of these covers.		
⑰	Terminal blocks (upper and lower)	Terminal blocks, with M3.5 screws, are arranged in upper and lower row. These terminal blocks are used to connect the cables to the external power supply and external I/O devices.		
⑱	Nameplate (top side)			
⑲	Handy program loader mounting holes	These holes (upper and lower) are used to attach a handy program loader to the basic unit.	———	Accessory screws (M3x10) must be screwed into the holes on the PC when the loader is to be mounted on the PC.
⑳	Cover lock	The front cover ⑨ can be mounted or removed by sliding this cover lock to the left.		

4-1 Structures of NB1 Series Units

4-1-4 Structure of an expansion cassette

Applicable PC: NB1-E8(X)

Component structure



Component names and functions

① Mounting holes (5mm diameter, 4 holes)
These mounting holes are used to mount an expansion cassette on a panel using M4x16 screws.

② Rail mount
The expansion cassette can be mounted on a 35mm-wide the JIS or IEC standard rail.

③ Slider
The expansion cassette can be removed from the rail by pressing this slider down with the tip of a screwdriver.

④ Vents
Care should be taken to prevent dust and foreign matter entering the cassette through these vents. The dust-protection paper must be removed before the power supply of the unit is turned ON.

⑤ Nameplate

⑥ I/O state indicators
The expansion cassette has a total of eight I/O state indicators arranged in upper and lower rows.

⑦ I/O relay sockets
The expansion cassette has a total of eight sockets for mounting I/O relays. The I/O relay sockets are arranged in two (upper and lower) rows.

⑧ I/O relays
Connect the selected I/O relays to these sockets ⑦. On the NB1-E8, I/O relays are mounted before shipping.

⑨ Front cover
After mounting the I/O relays, attach the front cover by inserting the four claws of the front cover into the slots ⑩.

⑩ Front cover slots

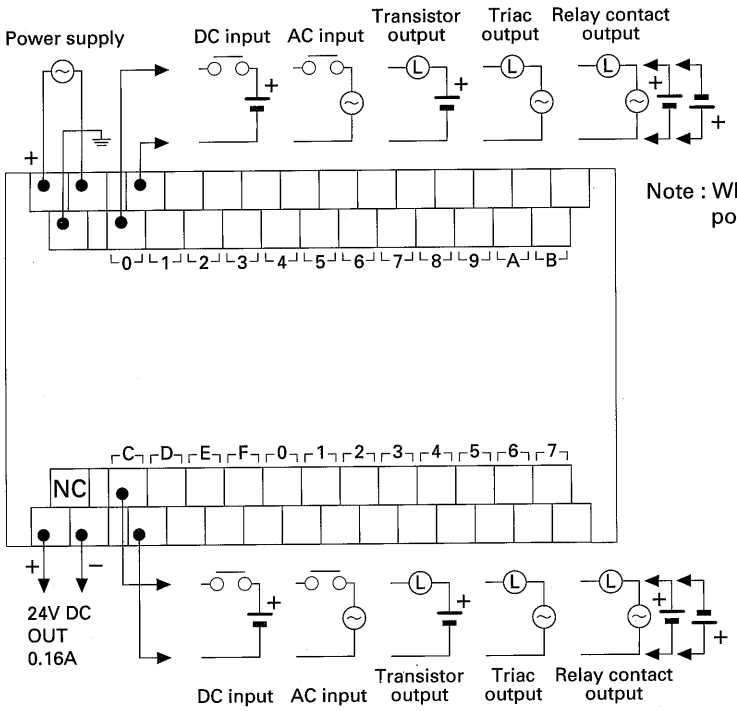
⑪ Extension cable connector.

⑫ Extension cable
The extension cable is a special cable used to connect an expansion cassette to the basic unit and is supplied with the expansion cassette. The cable allows the basic unit and the expansion cassette to be from 10mm to 50mm apart. The extension cable has the same connectors at both ends and is reversible between the expansion cassette and basic unit.

⑬ Terminal blocks (upper and lower)
Terminal blocks, with M3.5 screws, are arranged in upper and lower rows.

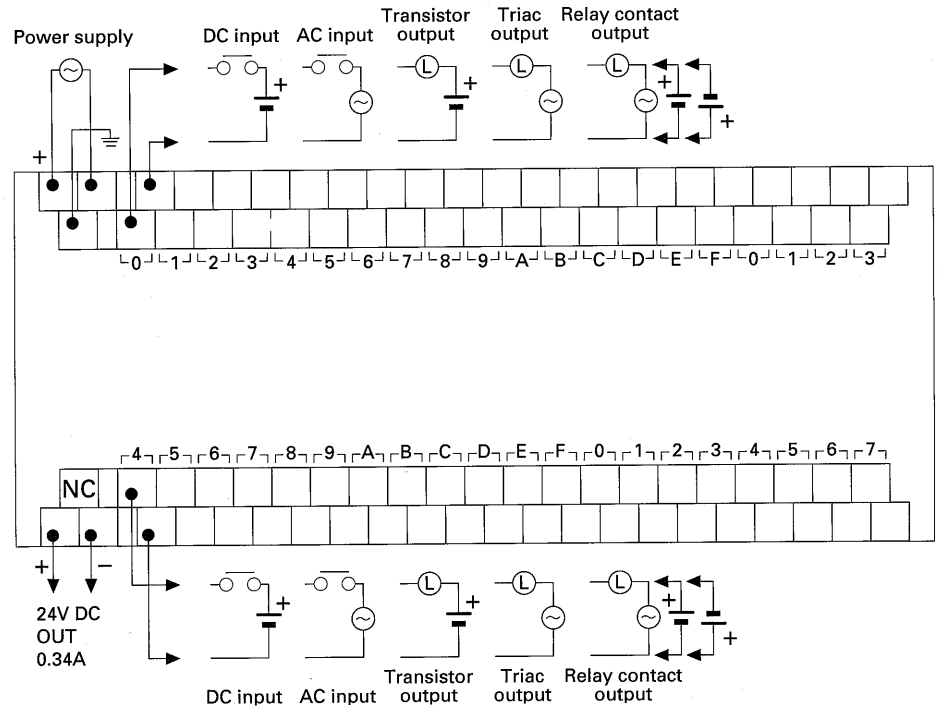
4-1-5 I/O connection

1. NB1-P24 and NB1-E24



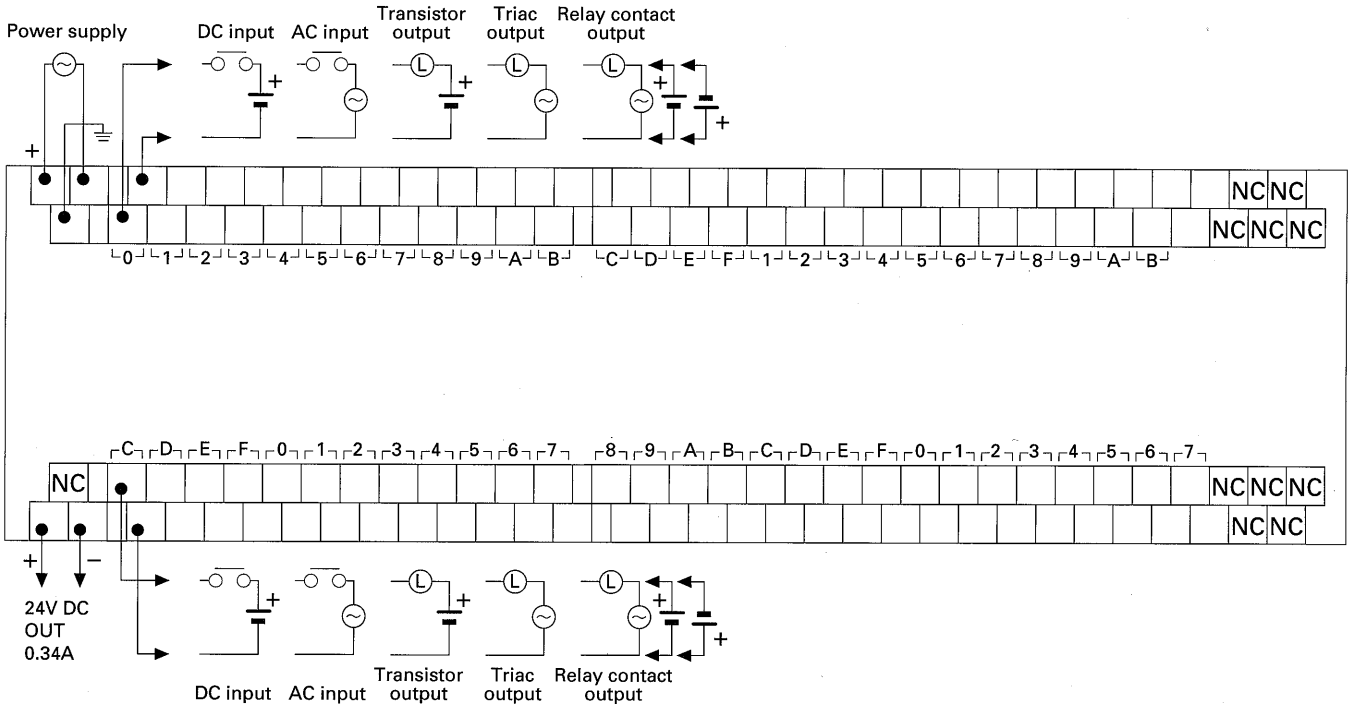
Note : When a DC power supply is used, the positive power supply terminal is on the left.

2. NB1-P40 and NB1-E40

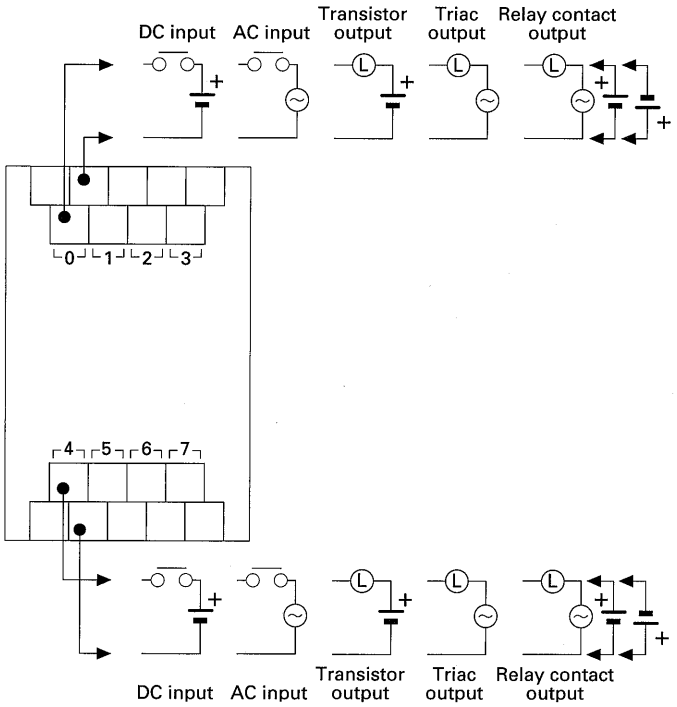


4-1 Structures of NB1 Series Units

3. NB1-P56 and NB1-E56



4. NB1-E8

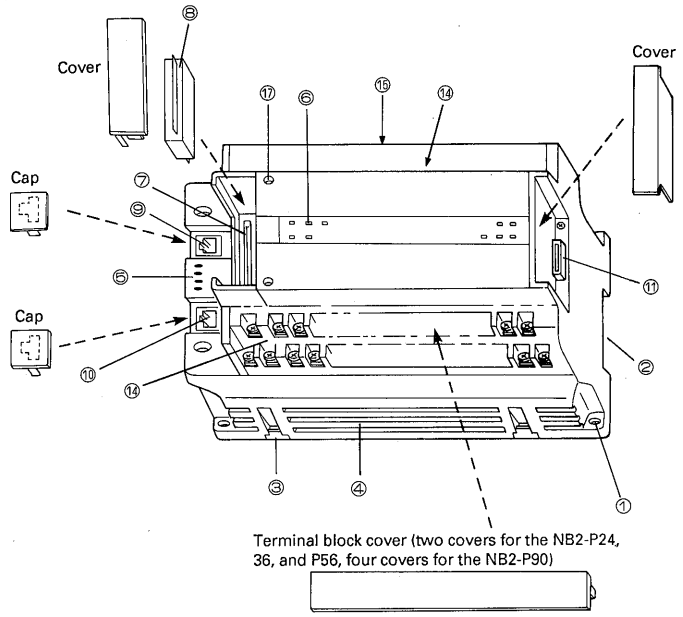


This section explains the structures of the basic and expansion units, and names and functions of the PC components.

Applicable PCs: NB2 -P24(R3)
-P36(R3)
-P56(R3)
-P90(R3)

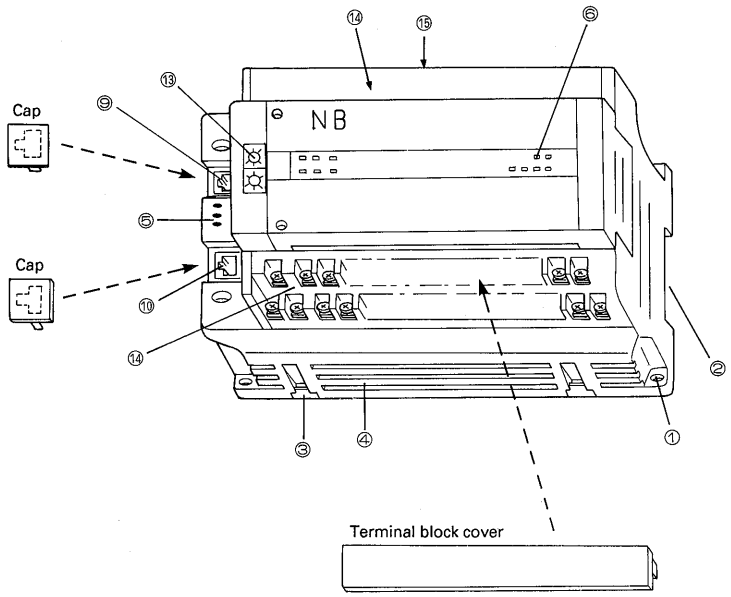
4-2-1 Structure of the basic and expansion units

Component names
For a description of the components, see Section 4-2-2.



Component names
For a description of the components, see Section 4-2-2.

Applicable PCs: NB2 -E24(R3)
-E36(R3)
-E56(R3)
-E90(R3)



4-2-2 Component names and functions (basic and expansion units)

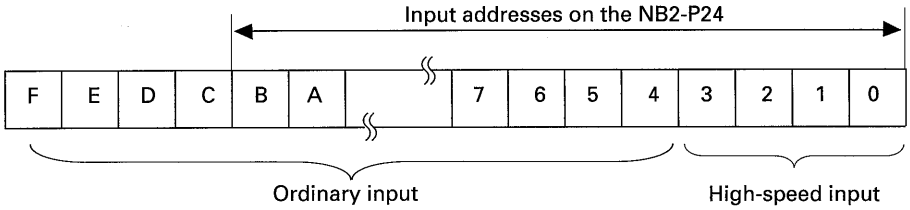
No.	Component name	Description (basic unit)	Description (expansion unit)	Remarks
①	Mounting holes (4 holes)	These holes are used to mount the unit on a panel. M4 mounting screws (to be supplied by the user) are required for these mounting holes. For the dimensions of the mounting holes, see Section 4-3-2.		
②	Rail mount	The basic and expansion units can be mounted on a 35mm-wide JIS or IEC standard rail.		
③	Sliders	The PC unit can be removed from the rail by pressing down these two sliders with the tip of a screwdriver.		
④	Vents	The PC unit has vents on both sides of the unit. Care should be taken to prevent dust and foreign matter entering the unit through these vents. The vents are covered with dust-protection paper when the unit is shipped. The protective paper must be removed before the unit power supply is turned ON.		
⑤	Operation status indicator lamp			
	PWR: Power indicator (green)	This lamp lights when the power supply to the unit is normal.		
	RUN: Operation indicator (green)	This lamp lights when a user program is being executed. The lamp goes OFF when a fatal fault occurs.		
	ERR: Error indicator (red)	This lamp blinks when an error (nonfatal or fatal fault) occurs.		
	BAT.E: Battery error indicator (red) Low-voltage indicator (for the basic unit)	This lamp lights when the battery is disconnected or the battery voltage is too low. The lamp goes OFF when the battery error is remedied. For operation by ROM for example, the user can disable operation of this indicator. For details, see Section 2-5.		Operation of this indicator can be controlled using parameters.
⑥	I/O state indicators (red)	These indicator lamps show the signal state in I/O relays. Number of these indicators correspond to the number of I/O points of each unit. I/O state indicators are arranged in two rows (upper and lower) and each row has the same number of indicators. The I/O address corresponding to each indicator can be seen from the marking on the front cover ⑨ of the unit.		
⑦	Battery and memory cassette connector (basic unit only)	This connector is used to mount a battery, EPROM, or EEPROM cassette.		The power supply must be turned OFF before the battery, EPROM, or EEPROM cassette is mounted or removed.
⑧	Battery cassette (basic unit only)	This battery cassette is mounted as a standard component for ordinary PC operation using RAM as program memory. This battery is rechargeable. If the BAT.E indicator lights, ensure the battery is connected correctly. To use EPROM or EEPROM as program memory, program the EPROM or EEPROM cassette and mount it in place of the battery cassette.		The power supply must be turned OFF before the battery cassette is mounted or removed.
⑨	Programming tool connector (basic unit only)	Used to connect a programming tool cable. This connector has the same shape as an N-bus connectors. Take care not to confuse these connectors.	———	
	N-bus connector (upper) (basic unit only)	———	The two N-bus connectors are on the upper and lower sides of the unit. One connector is used to connect the N-bus cable from the basic unit or an expansion unit. The other connector is used to connect the N-bus cable to a further expansion unit. The upper and lower connectors are identical. (Expansion unit only)	N-bus cables must not be disconnected while the PC is operating. If an N-bus cable is disconnected during PC operation, a fatal fault occurs and the PC will stop.
⑩	N-bus connector (lower)	This N-bus connector is used to connect the N-bus cable to an expansion unit. (Basic unit only)		
⑪	Expansion cassette connector (basic unit only)	This connector is used for an expansion cassette (NB1-E8) the connection cable required is supplied with the expansion cassette. The basic unit power supply must be turned OFF before an expansion cassette is connected or disconnected.		
⑬	I/O address setting dials (expansion unit only)	The I/O address setting dials are used to set the first I/O address of each expansion unit. The high-order digit (0 or 1) and low-order digit (0 to F) of the I/O address are set independently by the two dials. The power supply must be turned OFF before setting an I/O address. Turn the address setting dials with the screwdriver supplied.		
⑭	Terminal blocks (upper and lower)	Terminal blocks, with M3.5 screws, are arranged in upper and lower rows. These terminal blocks are used to connect the cables to the external power supply and I/O devices.		
⑮	Nameplate (top side)			
⑰	Handy program loader mounting holes	These holes (upper and lower) are used to attach a handy program loader to the basic unit.	———	Accessory screws (M3x10) must be screwed into the holes on the PC when the handy program loader is to be mounted on the PC.

4-2-3 Numbers and configuration of I/O points

Type		Input section	Output section	Remarks
No. of points	NB2-P24	12 (12 points with a common circuit) (including the 4 high-speed input points)	12 (12 points are independent; electrically isolated from each other).	
	NB2-E24	12 (12 points with a common circuit)		
	NB2-P36	18 (18 points with a common circuit) (including the 4 high-speed input points)	18 (2 independent contacts and 4 circuits of 4 contacts with a common)	Each group of output points with a common circuit is electrically isolated from each other group of output points.
	NB2-E36	18 (18 points with a common circuit)		
	NB2-P56	28 (28 points with a common circuit) (including the 4 high-speed input points)	28 (4 independent contacts and 2 circuits of 4 contacts with a common, and 2 circuits of 8 contacts with a common)	The current per common line is limited. 4-point common line: 4A 8-point common line: 8A
	NB2-E56	28 (28 points with a common circuit)		
	NB2-P90	48 (48 points wiht a common circuit) (including the 4 high-speed input points)	42 (6 independent contacts and 3 circuits of 4 contacts with a common and 3 circuits of 8 contacts with a common)	
	NB2-E90	48 (48 points with a common circuit)		

High-speed input addresses

The addresses of the four high-speed input points on the NB2 basic unit are as follows:



- As with the ordinary input filtering time, the default of the high-speed input filtering time is 3ms(OFF→ON)/10ms (ON→OFF).
- To use an input for high-speed response, a short filtering time or "no filtering" must be specified using a parameter. If "no filtering" is specified, the input response will depend on the processing time of the input circuit. For filtering times, see Section 4-2-4.
- With "no filtering" specified a high-speed input point can repond to inputs of up to 5kHz, an ordinary input point can respond to inputs of up to 1.2kHz.

4-2-4 I/O specifications

The following I/O specifications are common to all types of NB2 series PC.

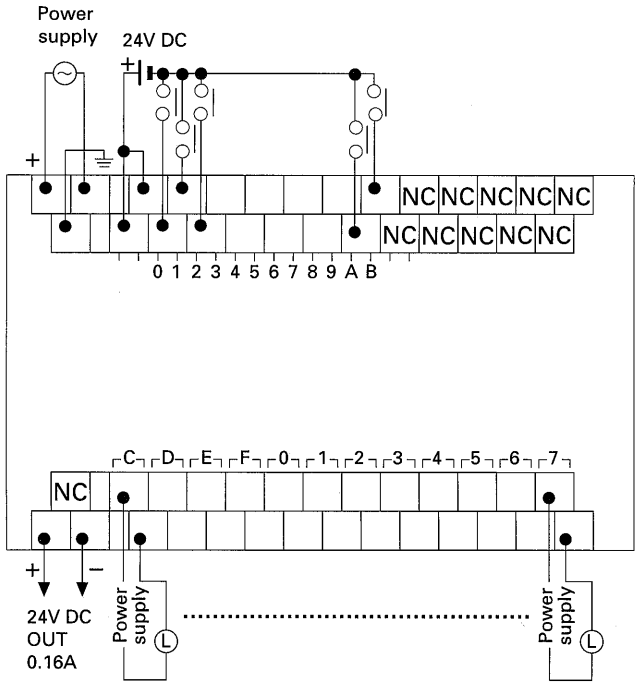
Item		Input		Output	Remarks
		24V DC	24V DC (high-speed (X00 to X03)	Relay contact	
Rated voltage (operating voltage range)		24V DC (19V to 30V)		240V AC or 30V DC	
Operating voltage	ON level	19V or less		———	
	OFF level	3V or more		———	
Input current (impedance)		7mA at 24 V (approx. 3.4 kΩ)		———	
Output current (at rated voltage)		———		2A per point (*2)	
Minimum load current		———		5V, 2mA	
Response time (OFF→ON/ON→OFF)		3ms/10ms (*1)		10ms or less/10ms or less	
		0.4ms/0.4ms (no filtering)	50μs/50μs (no filtering)		
Input terminal polarity		Input terminals have polarity.		———	
Switching device		———		Dry contact	
Operation indicator		LED indicators for all points			
External wire connection		Screw-type terminal block (M3.5 screws with washers)			

Notes: *1 These values are the defaults of response time. The response time (OFF-to-ON/ON-to-OFF) can be selected from 3ms/3ms, 10ms/10ms, 30ms/30ms, 0.1ms/0.1ms, 0.3ms/0.3ms, 1s/1s, and "no filtering" by parameters.

*2 The output current is derated to keep within the common current limit.

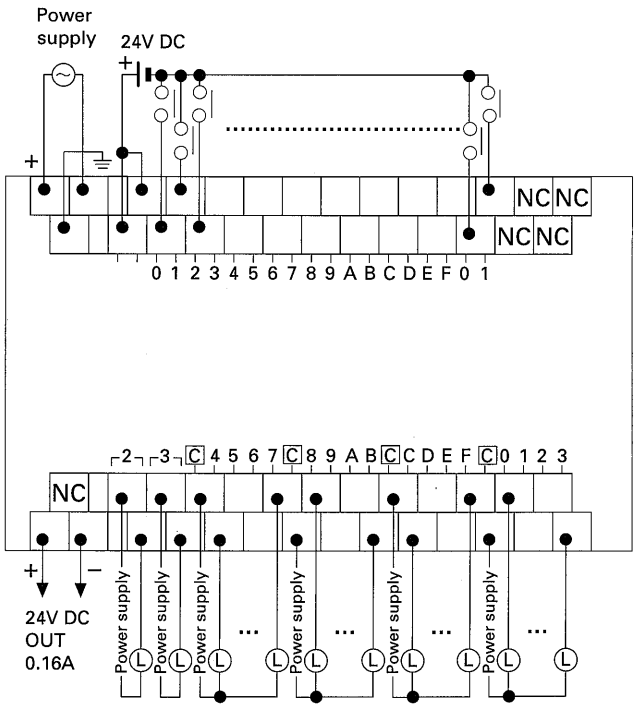
4-2-5 I/O connection

1. NB2-P24R3 and NB2-E24R3

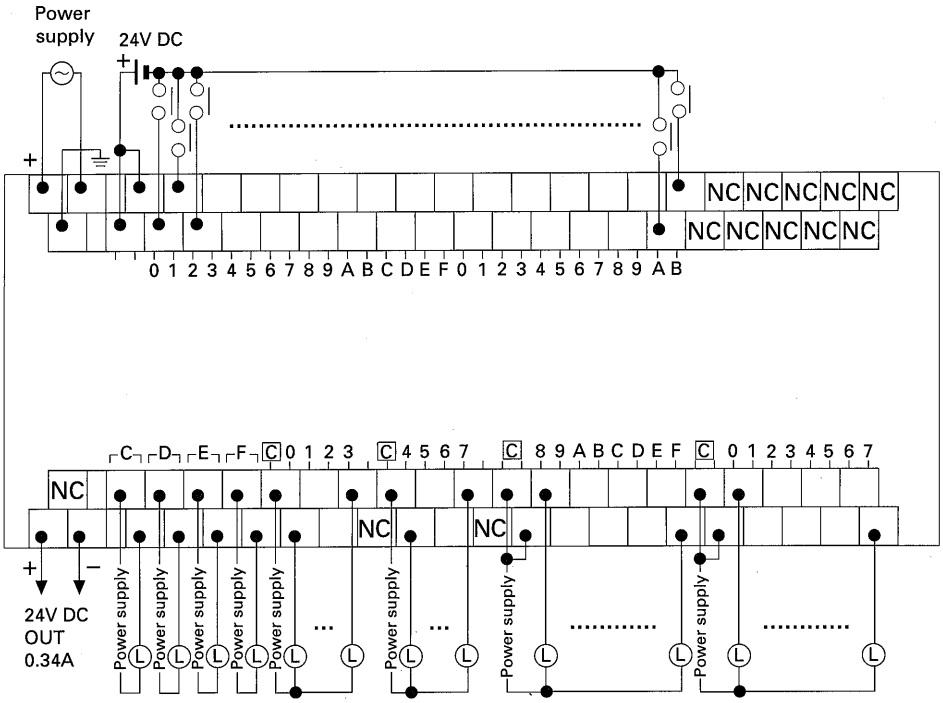


Note : When a DC power supply is used, the positive power supply terminal is on the left.

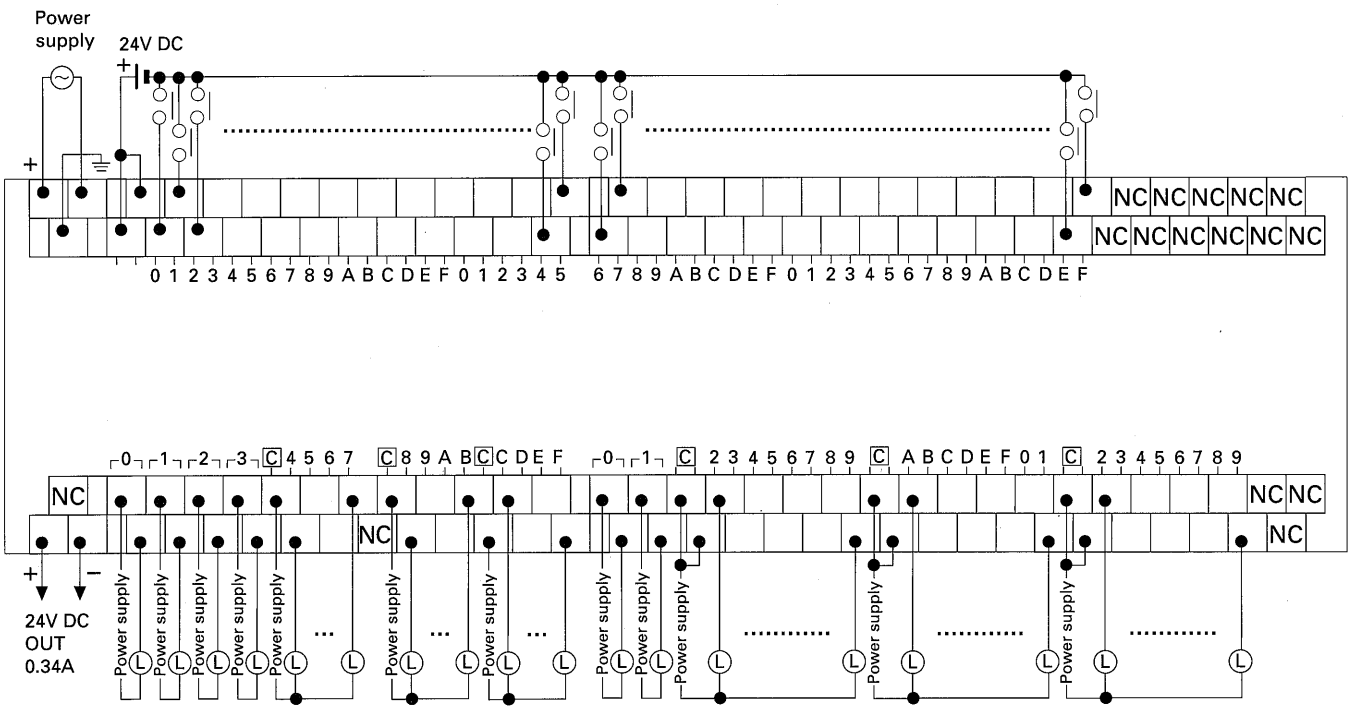
2. NB2-P36R3 and NB2-E36R3



3. NB2-P56R3 and NB2-E56R3



4. NB2-P90R3 and NB2-E90R3



4-3 Dimensions

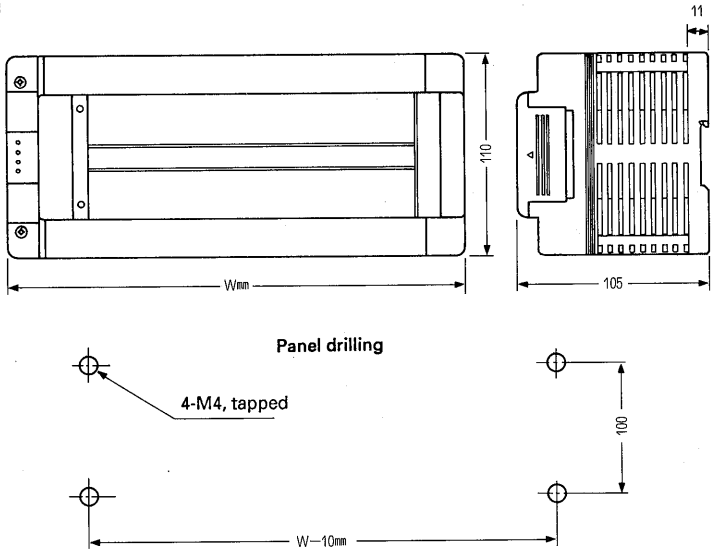
The basic and expansion units of the NB1 and NB2 series use standard frame sizes. The dimensions of standard frame sizes A to D and the corresponding PC types are given in the table below.

4-3-1 Frame sizes

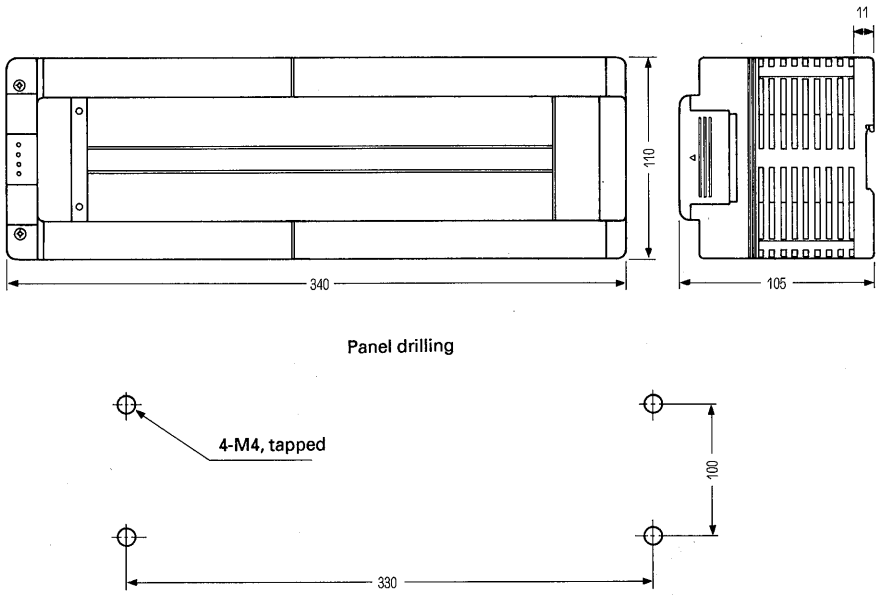
Frame size	Dimension W	Corresponding type		Remarks
		NB1 series	NB2 series	
A	165mm	NB1P24(X)/E24(X)	NB2-P24/P36 -E24/E36	
B	250mm	NB1-P40(X)/E40(X)	NB2-P56/E56	
C	340mm	NB1-P56(X)/E56(X)	NB2-P90/E90	
D	60mm	NB1-E8(X)		

4-3-2 Dimensions, mm

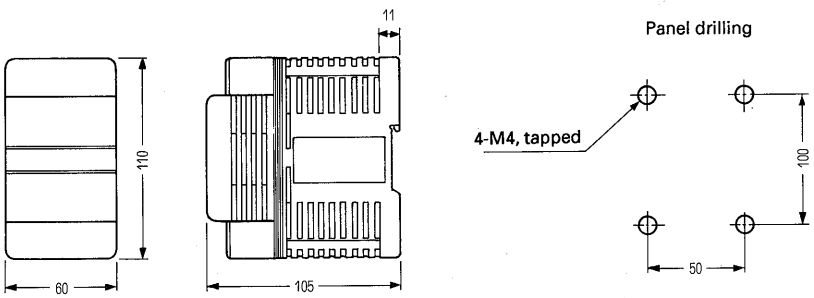
1. A and B frames



2. C frame



3. D frame



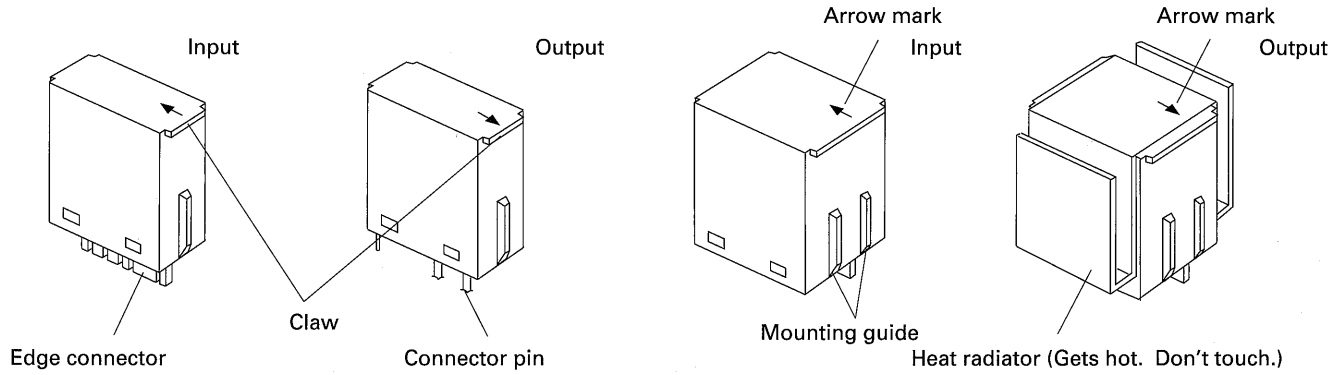
Section 5 I/O Relays

Section 5 I/O Relays
5-1 Component Names and Functions

This section gives the specifications of I/O relays available for the NB1 series units.

1. Case sizes and appearance

Case size (1S) (1S) (2S) (4S)



- The arrow mark on the top indicates the relay module type. On an input relay, the arrow mark points inwards. On an output relay, the arrow mark points outwards. When a relay is mounted on a socket, the relay must be so oriented that the arrow mark is closest to the terminal block.

- I/O relays must be handled carefully to prevent the edge connectors and pins being strained or bent.

2. Case colors and dimensions

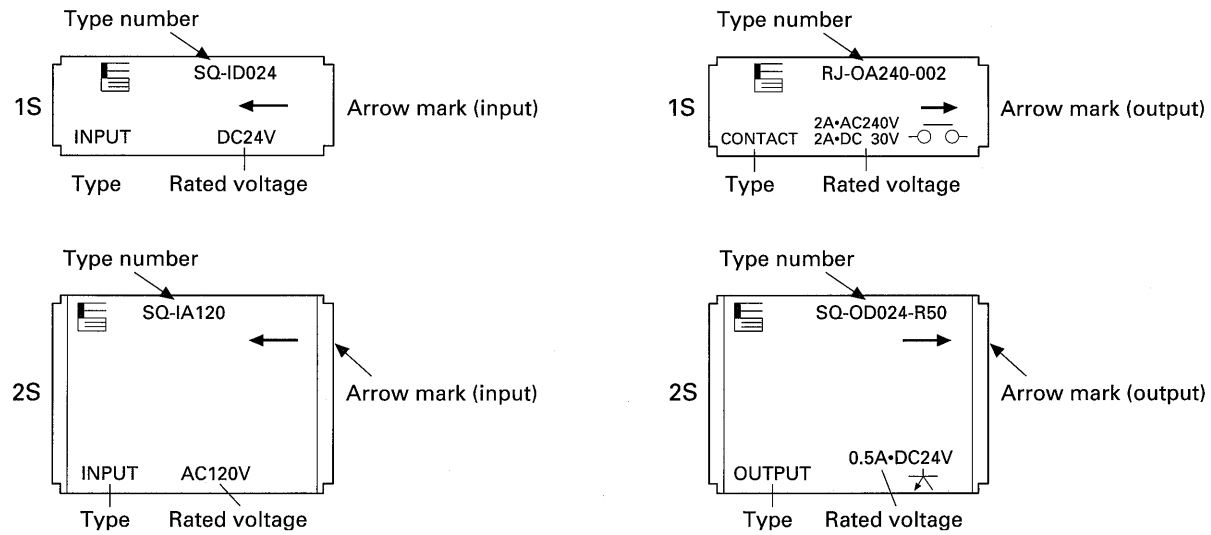
[Case colors]

Input relay: Blue
Output relay: Pink

[Dimensions, mm]

1S: W 8.5 × H26.2 × D23
2S: W17.4 × H26.2 × D23
4S: W35.2 × H26.2 × D23

3. Markings on the relay top



Note: If the top of the case is stained, the top surface must be cleaned with a cloth dipped in lukewarm water. If alcohol is used for cleaning, the markings may be erased.

1. DC input

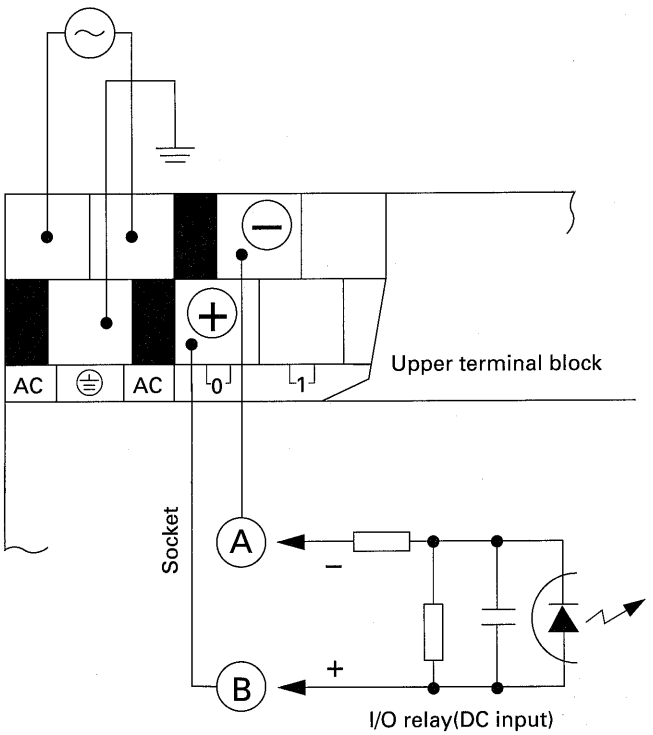
Item \ Type		SQ-ID005	SQ-ID012	SQ-IHD012	SQ-ID024
Rated voltage		5V DC	12V DC		24V DC
Operating voltage	ON level	4.25V or less	10.2V or less		20.4V or less
	OFF level	0.5V or more	1.2V or more		2.4V or more
Response time (*1) (OFF → ON/ ON → OFF)		Approx. 0.4ms/0.4ms		Approx. 15μs/15μs (response time for up to 15kHz inputs)	Approx. 0.4ms/0.4ms
Input current (at rated voltage) (impedance)		10 ± 2mA (approx. 0.5k Ω)	10 ± 2mA (approx. 1.2kΩ)	15 ± 2mA (approx. 0.8k Ω)	10 ± 2mA (approx. 2.4k Ω)
Input terminal polarity		Input terminals have polarity. (Input relays can be used as both current sinking input circuits and current sourcing input circuits according to circuit connections.)			
Relay size (width)		1 unit (1S)			
Weight		Approx. 3g			

Note: *1 When a relay is mounted on the main unit, the response time (OFF → ON/ON → OFF) is set to 3ms/10ms (initial value). If "no filtering" is specified using a parameter, the response time is 3ms/10ms. The response time can be selected from 3ms/3ms, 10ms/10ms, 30ms/30ms, 0.1s/0.1s, 0.3s/ 0.3s, and 1s/1s.

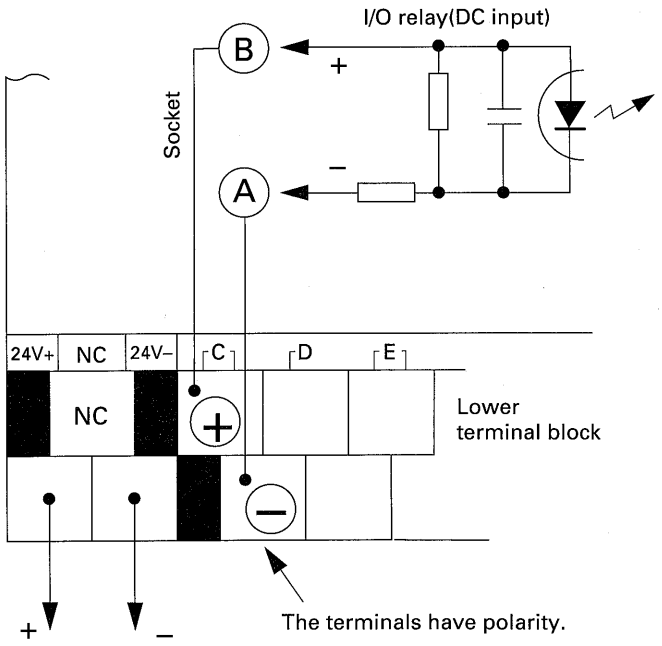
Connection to the main unit

The following figures show the connections between I/O relays mounted on the sockets and the terminal block.

Connection between an I/O relay and the upper terminal block



Connection between an I/O relay and the lower terminal block



5-2 Digital Input Relays

2. AC input

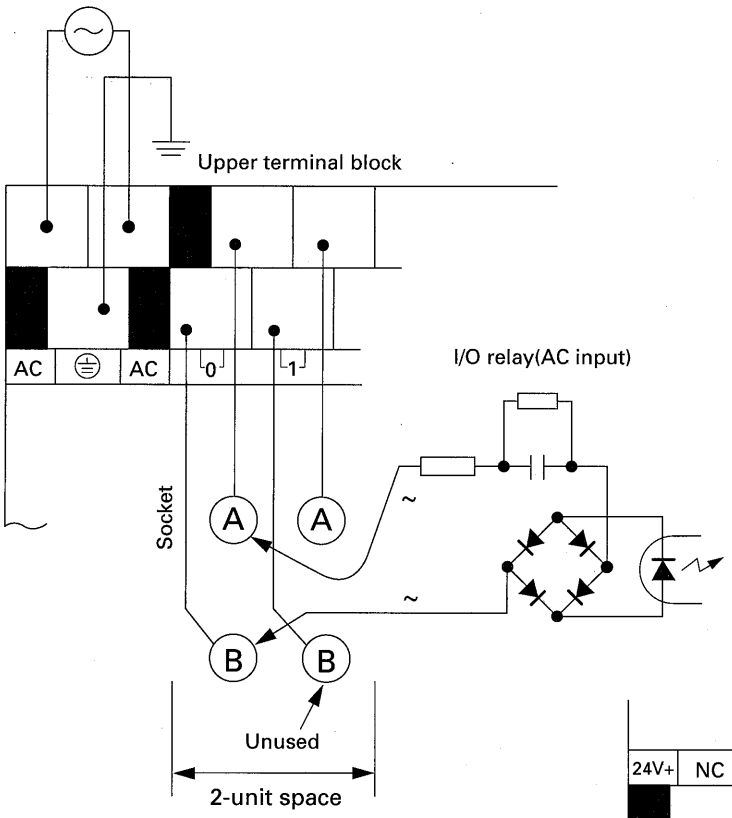
Item \ Type		SQ-IA120	SQ-IA240
Rated voltage		100V to 120V AC	200V to 240V AC
Operating voltage	ON level	85V or less	170V or less
	OFF level	30V or more	60V or more
Response time (*1) (OFF → ON/ ON → OFF)		Approx. 3ms/10ms	
Input current (at rated voltage) (impedance)		10 ± 2mA (at 100V) (approx. 10k Ω)	10 ± 2mA (at 200V) (approx. 20kΩ)
Relay size (width)		2 units (2S)	
Weight		Approx. 6g	

Note: *1 When a relay is mounted on the main unit, the response time (OFF → ON/ON → OFF) is set to 3ms/30ms. The response time cannot be changed by parameters.

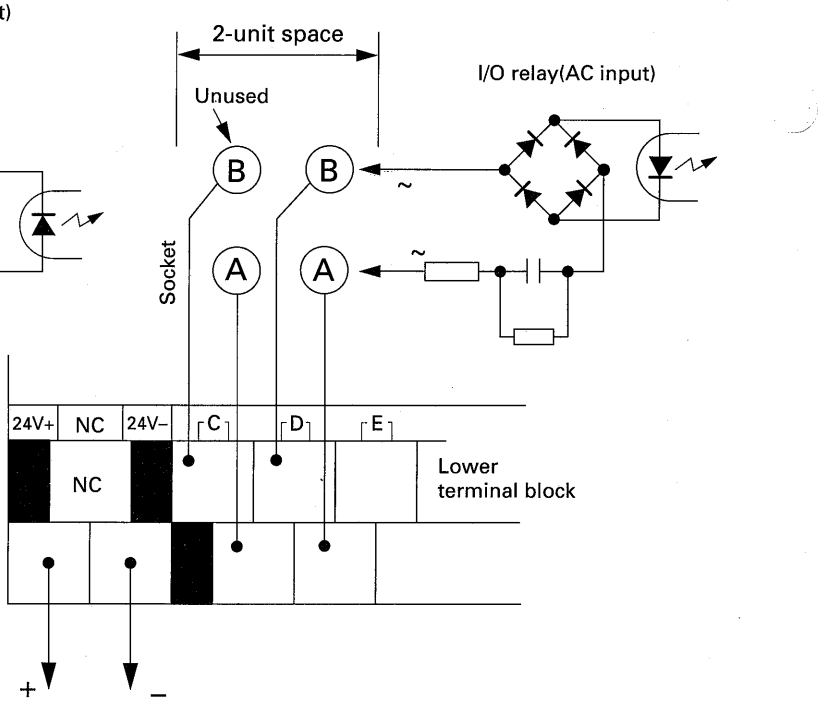
Connection to the main unit

The following figures show the connections between I/O relays mounted on the sockets and the terminal block.

Connection between an I/O relay and the upper terminal block



Connection between an I/O relay and the lower terminal block



1. DC output

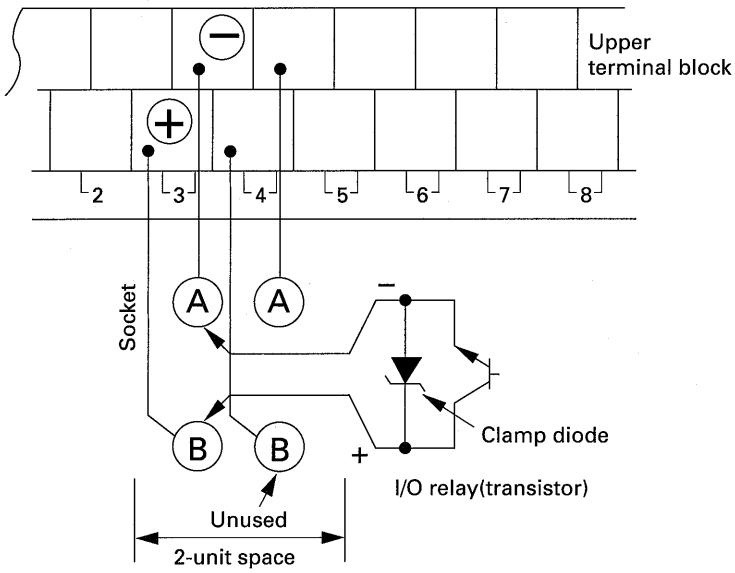
Item \ Type	SQ-OD005	SQ-OD024		SQ-OD048	
	-R05	-R50	-002	-R50	-002
Rated voltage	5V DC	24V DC		48V DC	
Rated output current (*1)	50mA	*0.5A	2A	*0.5A	2A
Minimum load current	1mA				
Input terminal polarity	Input terminals have polarity. (Output relays can be used as both current sinking output circuits and current sourcing output circuit according to circuit connections.)				
Response time (OFF → ON/ON → OFF)	Approx. 1ms/1ms or less				
Switching device	Transistor (FET)	Transistor	Transistor (FET)	Transistor	Transistor (FET)
Switching device protection	Clamped with a zener diode				
	Clamped at approx. 24V	Clamped at approx. 63V	Clamped at approx. 80V	Clamped at approx. 63V	Clamped at approx. 80V
Voltage drop (ON state)	0.4V or less (30mA)	1V or less (at rated current)			
Leakage current (OFF state)	0.1mA or less (rated voltage)				
Relay size (width)	1 unit (1S)		2 units (2S)	1 unit (1S)	2 units (2S)
Weight	Approx. 6g	Approx. 6g	Approx. 12g	Approx. 6g	Approx. 12g

Note: *1 A current marked with asterisk (*) must be derated depending on the ambient temperature and mounting conditions on the main unit. For details of derating, see Section 5-4-1.

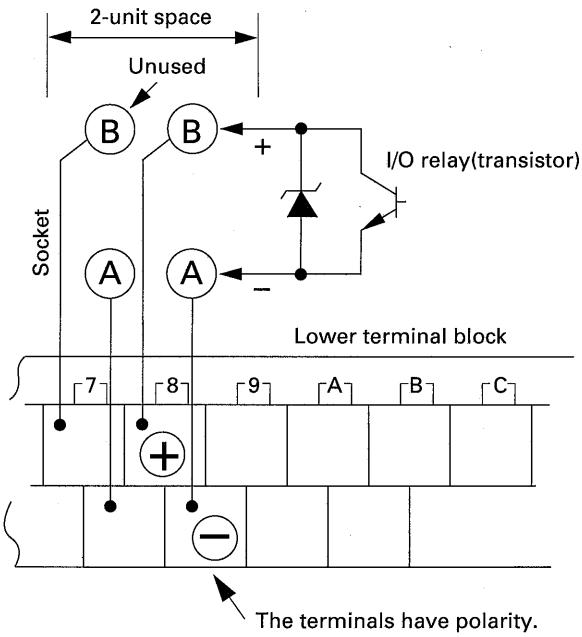
Connection to the main unit

The following figures show the connections between I/O relays mounted on the sockets and the terminal block.

Connection between an I/O relay and the upper terminal block



Connection between an I/O relay and the lower terminal block



5-3 Digital Output Relays

2. Relay contact or triac output

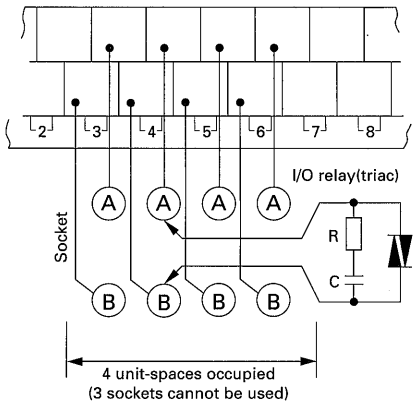
Item \ Type	RJ-OA240-002	SQ-OA240	
		-R50	-002
Rated voltage	240V AC or 30V DC	100V to 240V AC (85% to 110%)	
Rated output current (*1)	2A	*0.5A	*2A
Minimum load current	5V, 1mA	20mA	100mA
Response time (OFF → ON/ON → OFF)	Approx. 10ms/10ms or less	Approx. 1ms/10ms or less	
Switching device	Dry contact	Triac	
Switching device protection	–	C (0.001μF) + R (5.6 Ω) and surge absorber	
Voltage drop (ON state)	–	1.6V or less (at rated current)	
Leakage current (OFF state)	–	1mA or less (at rated voltage)	
Relay size (width)	1 unit (1S)	1 unit (1S)	4 units (4S)
Weight	Approx. 6.5g	Approx. 6g	Approx. 22g

Note: *1 The current marked with asterisk (*) must be derated depending on the ambient temperature and the mounting conditions on the main unit. For the details of derating, see Section 5-4-1 and 5-4-2.

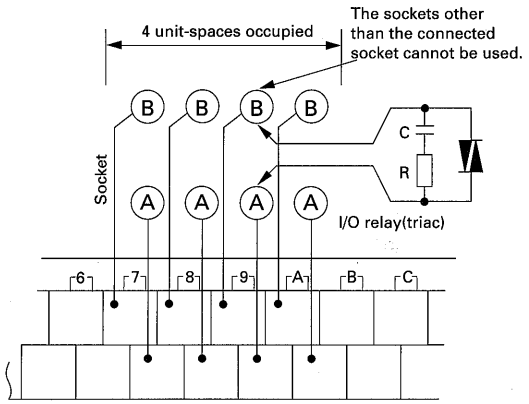
Connection to the main unit

The following figures show the connections between I/O relays mounted on the sockets and the terminal block. For the connection of a relay occupying one unit-space, see the preceding section.

Connection between an I/O relay and the upper terminal block

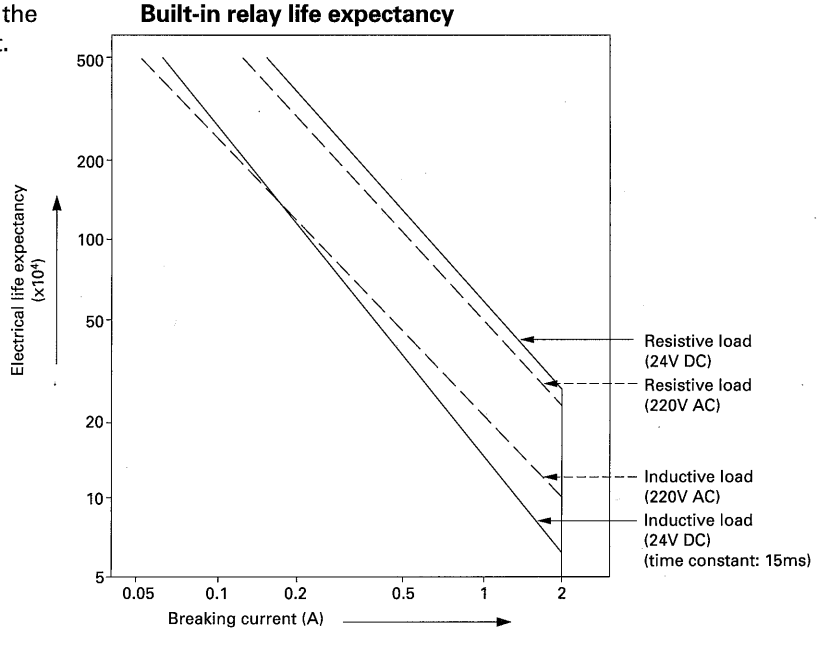


Connection between an I/O relay and the lower terminal block



For reference, the life expectancy of the relay built-in the RJ-OA240-002 output relay unit is shown on the right.

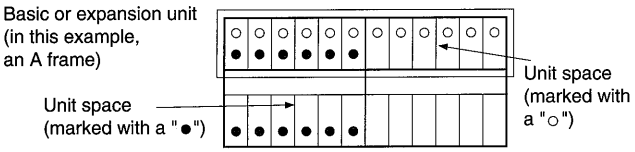
Built-in relay life expectancy



This section explains the derating of the output current of output relays.

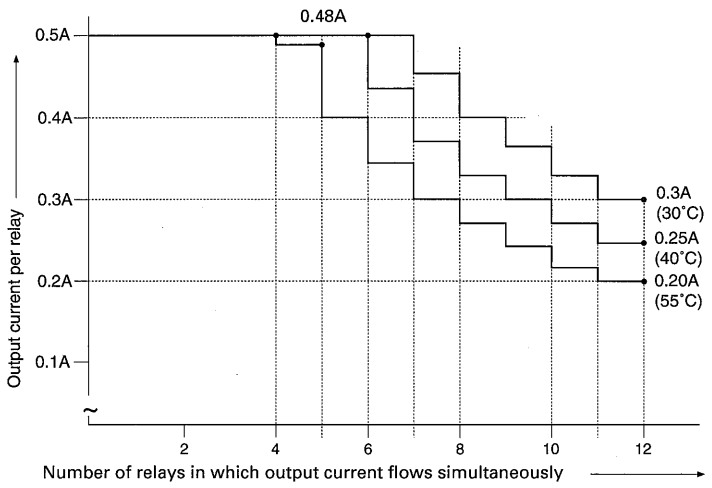
5-4-1 Derating of a 0.5A output relay

- Types
  SQ-OD024-R50 (24V DC, 0.5A)
  SQ-OD048-R50 (48V DC, 0.5A)
  SQ-OA240-R50 (SSR, 0.5A)
  } These relays must be derated as shown below.
- The maximum total output current of output relays is determined by the ambient temperature of a group (unit) of 12 successive I/O relay spaces (12S). The figure on the right shows the current derating curve for each relay.
- Output relays that will be turned ON at the same time should not be mounted in adjacent positions. If such relays are mounted adjacent positions, together, output current must be derated for 12 relays turned ON at the same time.



Maximum total output current for one unit-space

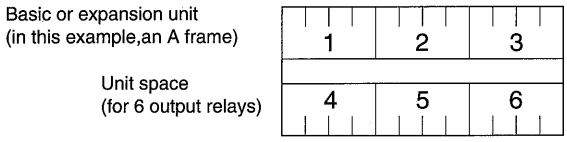
55°C: 2.4A
40°C: 3.0A
30°C: 3.6A



Notes:
1. The figure above shows maximum current versus the number of relays which are ON simultaneously. The different graphs are for different ambient temperatures.
2. Output relays which will be ON simultaneously must be mounted with one-relay space reserved between them. (The reserved space can be used to mount a relay which is OFF while the adjacent relay is ON.)
3. The current derating above also applies to output relays mounted on 8-point expansion cassette.

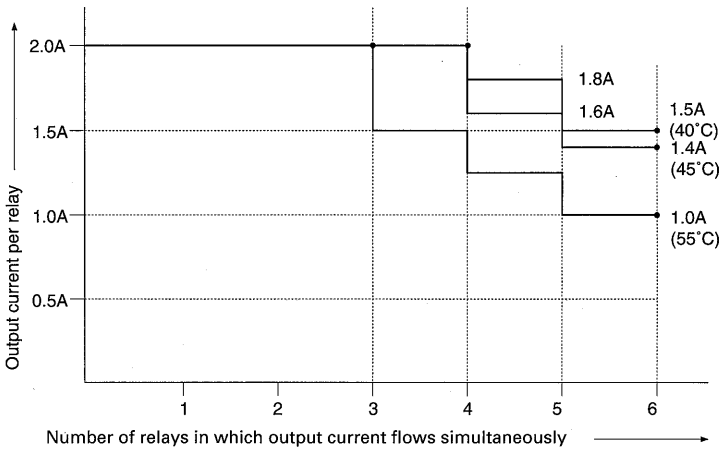
5-4-2 Derating of a 2.0A output relay

- Type
  SQ-OA240-002 (SSR, 2A)
  This relay must be derated as shown below.
- The maximum total output current of output relays for a variety of temperatures applies to groups of 6 successive I/O points (24S). The figure on the right shows current derating graphs for one relay.
- Output relays that will be turned ON simultaneously should not be mounted in adjacent positions. If such relays are mounted together, output current must be derated for 6 relays turned ON at the same time.



Maximum total output current for one unit-space

55°C: 6A
40°C: 9A
30°C: 12A



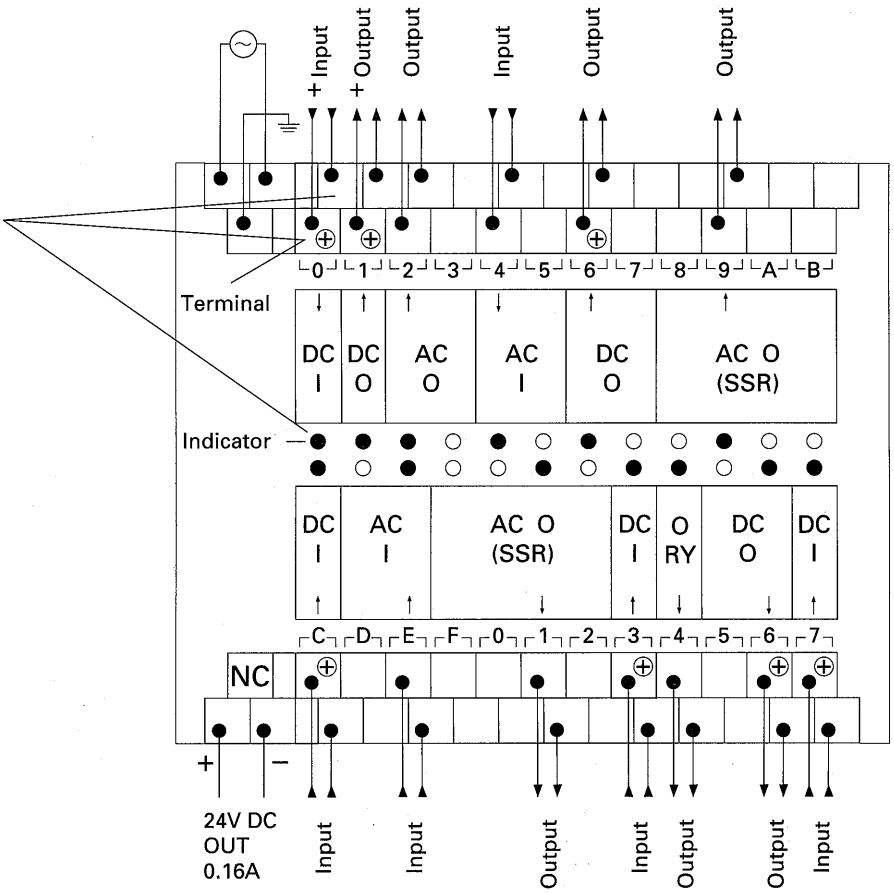
Notes:
1. The figure above shows maximum current versus the number of relays which are ON simultaneously. The different graphs are for different ambient temperatures.
2. Output relays which will be ON simultaneously must be mounted with one-relay space reserved between them. (The interval space can be used to mount a relay which is OFF while the adjacent relay is ON.)

5-5 Terminal Connection and Address Assignment for I/O Relays

This section describes terminal connection and I/O address assignment for I/O relays mounted on the basic unit.

1. Mounting example: NB1-P24 (A frame)

- The terminals, their addresses, and indicators correspond to the location of the arrow mark of each I/O relay.
- For DC I/O relays, the polarities of connected terminals must be correct. The inner terminals have positive polarity.
- Unused terminals can be used freely for wiring,
- I/O addresses where no I/O relays are connected can be used for auxiliary relays in the program memory.
  When a signal is output to an auxiliary relay, the corresponding indicator lights.



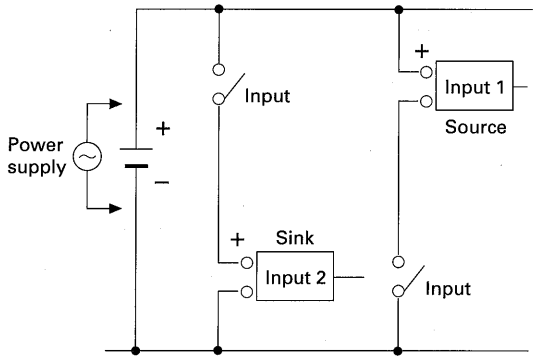
2. I/O address assignment

Address	Description				Address	Description			
000	DC input	X	000	(1S)	00C	DC input	X	00C	(1S)
001	DC output	Y	001	(1S)	00D	Unused			(2S)
002	AC output	Y	002	(2S)	00E	DC input	X	00E	
003	Unused				00F	Unused			(4S)
004	AC input	Y	004	(2S)	010	Unused			
005	Unused				011	AC output	Y	011	
006	DC output	Y	006	(2S)	012	Unused			
007	Unused				013	DC input	X	013	(1S)
008	Unused				014	Output relay contacts	Y	014	(1S)
009	AC output	Y	009	(4S)	015	Unused			(2S)
00A	Unused				016	Output	Y	016	
00B	Unused				017	DC input	X	017	(1S)

Because each of input circuit of an input relay or output circuit of an output relay is electrically isolated from each other, it can be connected as if it is an ordinary relay

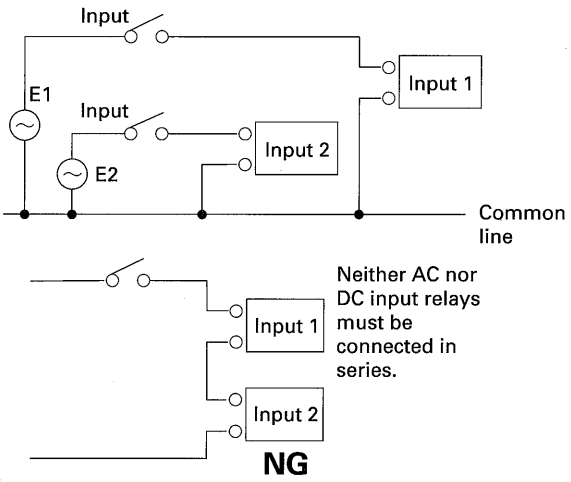
Input relay circuit connection

Input relays can be connected as shown below.
The use of a common line for connecting on one terminal is recommended to prevent a snake circuit being formed.



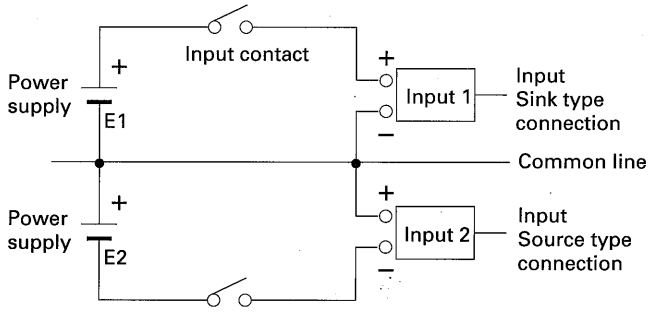
Although the input circuit of a DC input relay has polarity, input relays can be connected in the same circuit with plus input terminals connected to a plus common line, or minus input terminals connected to a minus common line as shown above. This is because the relay input circuits are electrically isolated from each other.

An example of using a common line to connect one side of input terminal pairs.



Input circuits must not be connected in series.

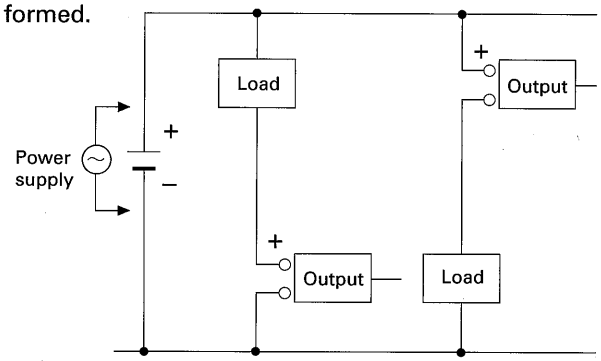
Voltages E1 and E2 can differ.



contact. However, note the following points regarding I/O relay connection.

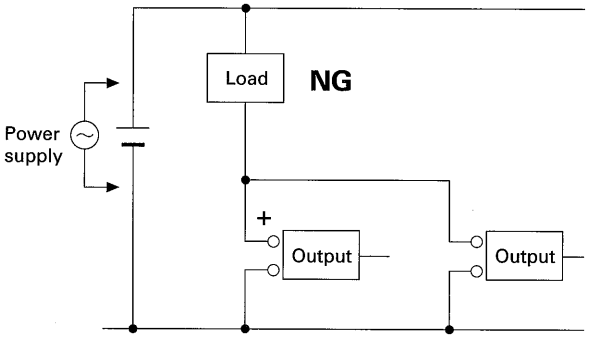
Output relay circuit connection

Output relays can be connected as shown below. The use of a common line to connect one terminal of each terminal pair is recommended to prevent a snake circuit being formed.



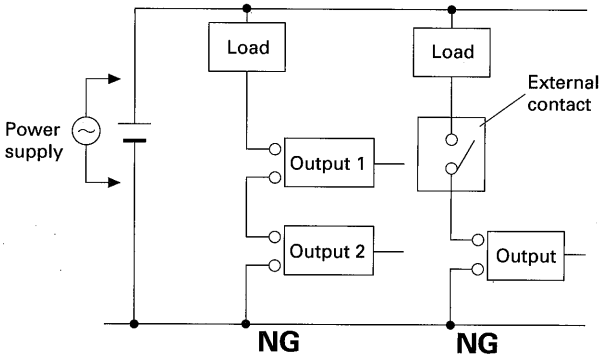
Although the output circuits of DC output relays have polarity, they can be connected as shown above. In another words, output relays can be used as both current sinking output circuit and current sourcing output circuit. This connection is possible because relay output circuits are electrically isolated from each other.

Relay output circuits must not be connected in parallel. The output relay contacts of RJ-OA240-002 relays can be connected in parallel but current capacity is not increased by parallel connection.



If output relay circuits other than relay contacts are connected in parallel, the leakage current in the OFF state increases. The increase in leakage current adversely affects the connected load.

Relay output circuits, including external ON-OFF switches, must not be connected in series. However, RJ-OA240-002 output relay contacts can be connected in series.



The output circuits must not be connected as shown above.

Section 6 Installation and Wiring

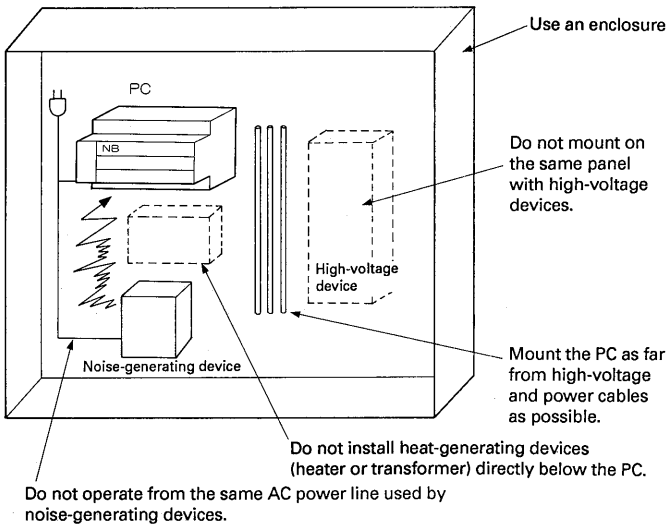
Section 6 Installation and Wiring
6-1 Installation and Wiring

This section provides NB-series product installation details to maintain system reliability and capabilities.

6-1-1 Installation environment

Note the following when installing NB-series products.

- Avoid installation where exposed to direct sunlight or temperatures below 0°C or over 55°C.
- Avoid installation where subject to relative humidities below 20% or over 90% or condensation due to sudden temperature changes.
- Avoid installation where exposed to excessive dust, metallic filings, oil mist, salt, or organic solvents. (The NB-series are not dust-and water-proofed.)
- Avoid installation near strong electric or magnetic fields.
- Avoid installation where subject to strong, direct vibration and shock.
- Avoid mounting on the same panel with high-voltage devices (3000V or more).
- Do not operate from the same AC power line used by noise-generating equipment.



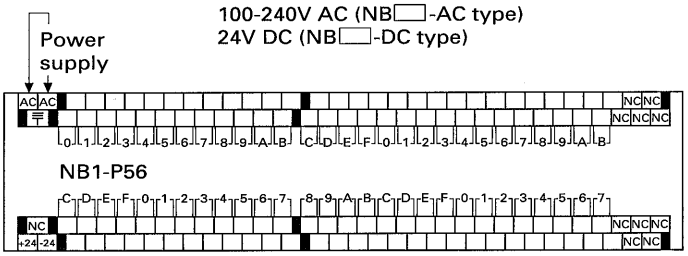
6-1-2 Checking the PC before installation

■ Checking at delivery

The following items must be checked after the delivered product is unpacked.

(1) Check that the device is what you ordered.
(2) Check that the product is not damaged.
(3) Check that all necessary accessories are present.

1. Wiring to power supply terminals



■ Checking the operation of the basic unit

Check that the delivered device operates normally before installing it in a control panel. This check is required to uncover any product malfunctions caused by transportation as early as possible.

When the power supply of the PC is turned ON, the PWR, RUN, and also the ERR lamps may light on the basic unit. If the ERR lamp lights, memory contents may be incorrect. In this case, the program loader must be connected and the memory contents (parameter, program, and data areas) must be erased. Having done this, the ERR lamp will not light when the power supply of the PC is turned ON again. All memory contents are erased when the PC is shipped.

2. Erasing the memory using the Handy Program Loader

No.	Item	Key operation
1	Parameter area	AUX. ↓ GO GO GO (Press this key eight times.)
2	Program area	CLR ↓ GO GO
3	Data area	CLR ↓ GO GO

3. 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.

Program ⟹

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

• Writing the test program

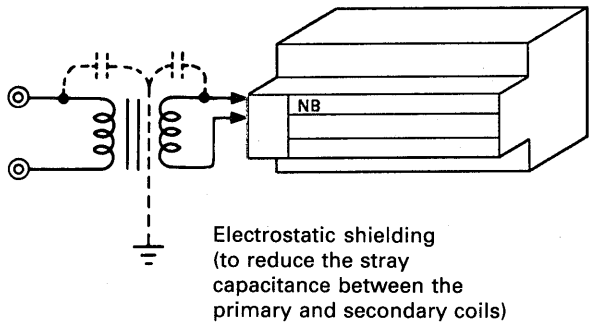
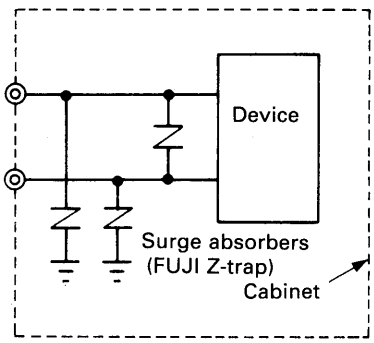
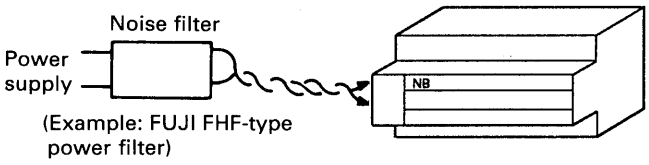
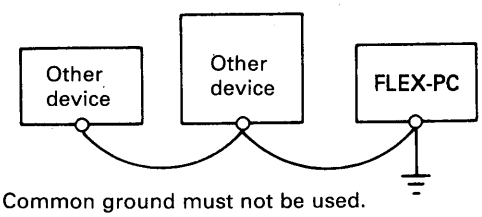
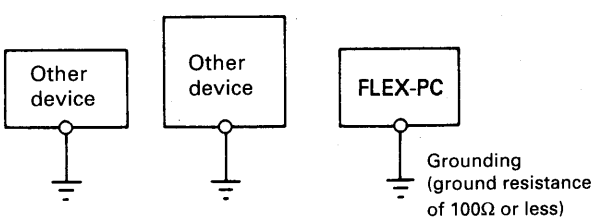
Operation flow	Key operation	LCD	Remarks
Initial menu		HANDY LOADER N-HLD011E V0.6	
Set the program loader to the write mode.	RD/WR RD/WR	W O N O P	
Enter input specifications.	LD X LD X NOP 0	W O L D X 0 0 0	
Write the input specifications to memory.	GO	W 0 L D X 0 0 0 1 N O P	
Enter output specifications.	OUT C LDI Y MPP 3 NOP 0	W 0 L D X 0 0 0 1 O U T Y 0 3 0	
Write the output specifications to memory.	GO	W 1 O U T Y 0 3 0 2 N O P	

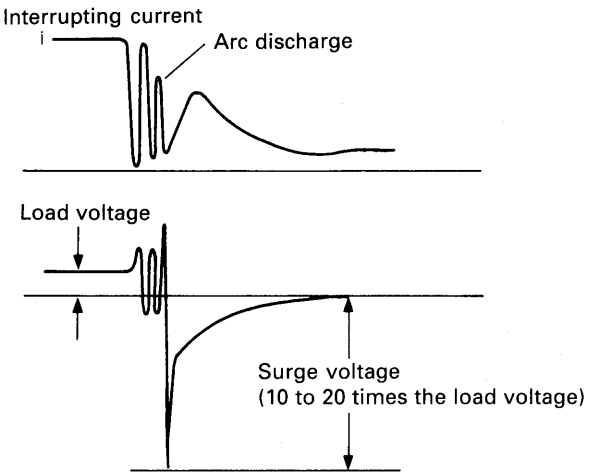
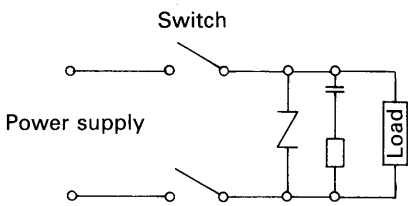
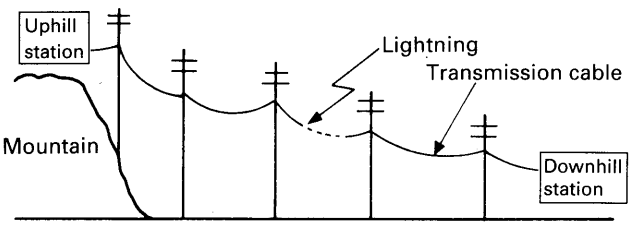
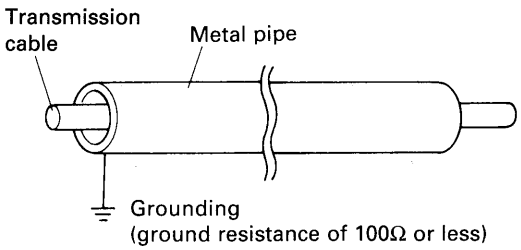
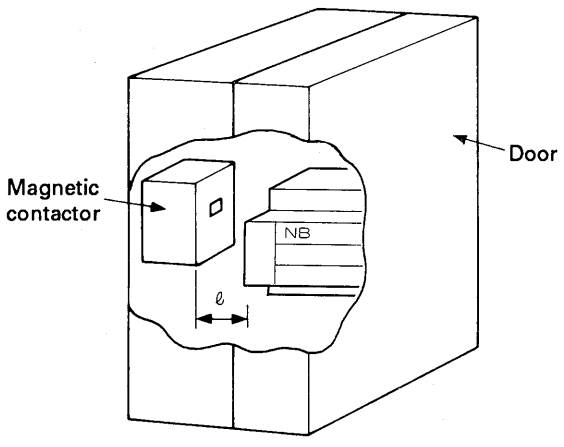
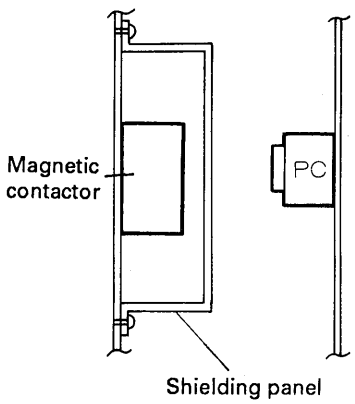
• Checking PC operation

After writing the above program, check that Y030 turns ON when input X000 is set ON. If Y030 turns ON, PC operation is normal. Now, proceed to the next step.

6-1-3 Control panel mounting (protection against noise)

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

No.	Cause of noise	Countermeasure
1	Noise via power-supply terminals (1) Lightning surge	(1) An isolation transformer should be used. 
	(2) Internal surge (switching surge)	(2) Surge absorbers should be connected to the surge-generating device. 
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 FLEX-PC. 
3	Noise input via common ground line 	The following figure shows optimum individual grounds. 
4	Noise via ground of the secondary coils of a transformer	The secondary side of the isolation transformer should not be grounded as shown in the above Item 1 .

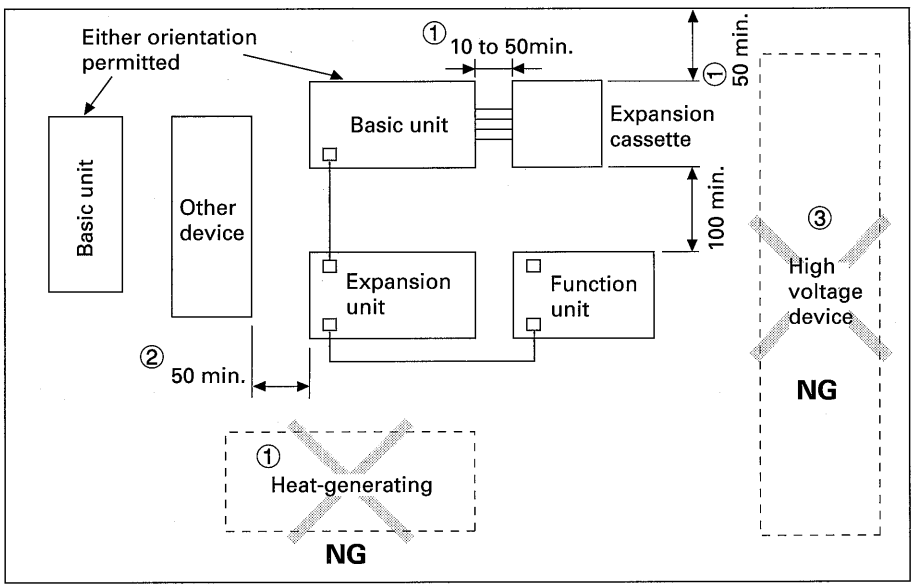
No.	Cause of noise	Countermeasure
5	When inductive load current is interrupted by a switch, high voltage is induced between the two ends of the load, which may affect the PC. 	(1) A diode, varistor or RC should be connected to the DC load. (2) A RC should be connected to the AC load. (Example) 
6	Malfunction 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 FLEX-PC located near device that generates a switching arc  When the control panel door closed, if the distance ℓ between the FLEX-PC front panel and magnetic contactor is 50mm or less, the FLEX-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) 

6-1-4 Environmental condition for mounting base unit on panel

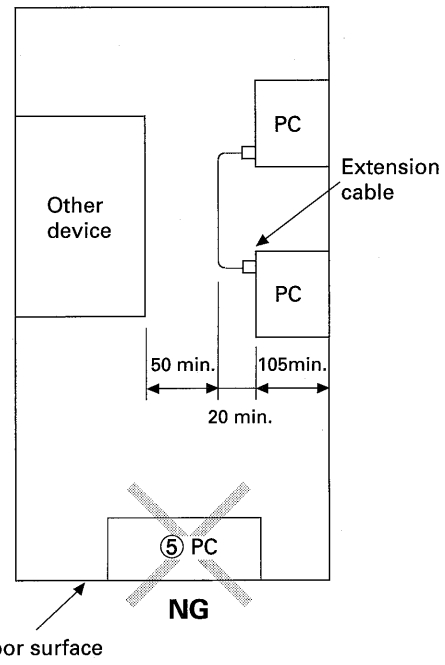
FUJI PCs are reliable because they provide excellent resistance against environmental conditions. Note that system reliability and operational safety can be further improved by observing and introducing the following precautions.

Item	Specifications	Remarks
Temperature	The PC must be operated in the environment from 0 to 55°C according to the temperature restrictions 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 90%. 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	JIS C 0911 (crossover frequency of 57Hz, 2G)	In case of excessive vibration, secure the panel with vibration-absorbing rubber or reduce vibration by improving the building structure and floor strength.
Shock	JIS C 0912 test method 1-No.3 (test conditions)	
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)	① Keep all base units and FTK capsules at least 100mm apart vertically and at least 10mm apart horizontally. Otherwise, excessive temperature rise may occur. ② Keep base units and FTK capsules at least 50mm away from other devices and the building structure to ensure appropriate ventilation. ③ Heat-generating devices (heaters, transformers and resistors) must not be installed directly under the PC. ④ 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. ⑤ The PC must be installed in a vertical position. Installing the PC on a level (as shown in illustration below) will cause adverse thermal affects on the device.	

Front view (Dimensions: mm)



Side view (Dimensions: mm)



6-1-5 Mounting and removing I/O relays

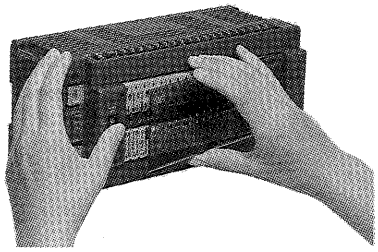
The NB1 series PC allows the user to mount and remove I/O relays in units of one point. Use the following procedure to mount and remove an I/O relay.

① Turn OFF the power supply to the basic unit.

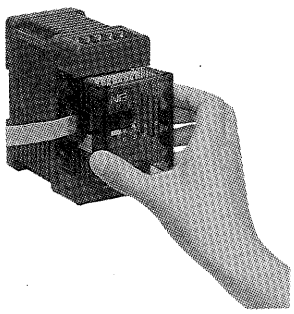
② Remove the cover of the relevant unit.

- **Basic or expansion unit**
  Release the cover by moving the cover lock on the left of the cover towards the left.

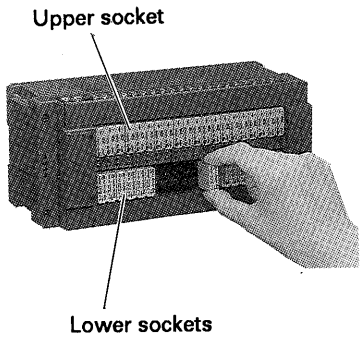
Move the cover lock.



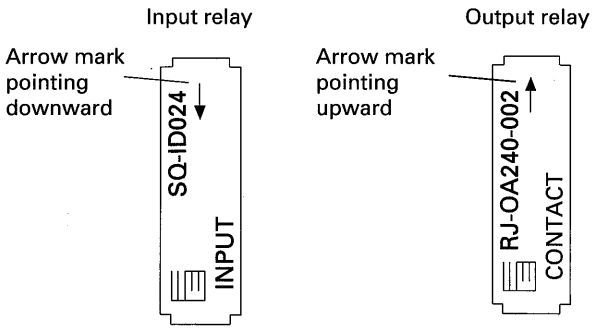
- **Expansion cassette**
  Hold the sides of the cover and pull.



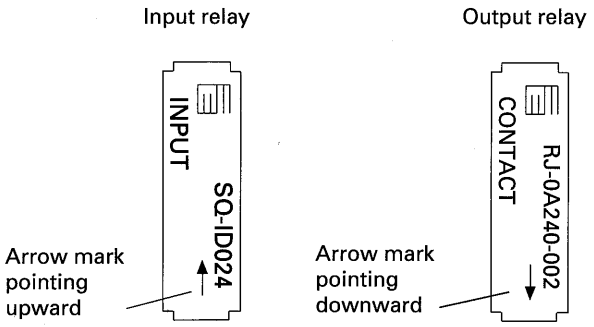
③ Ensure the I/O relay to be mounted is correctly orientated, and insert the I/O relay into the socket. (For removal, hold the top and bottom of the I/O relay as shown in the photograph below and pull.)



- **Relay mounting orientation for upper sockets**

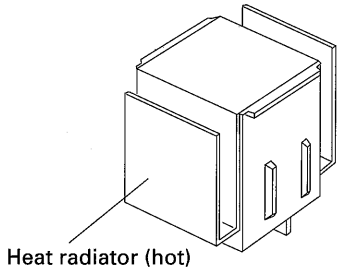


- **Relay mounting orientation for lower sockets**



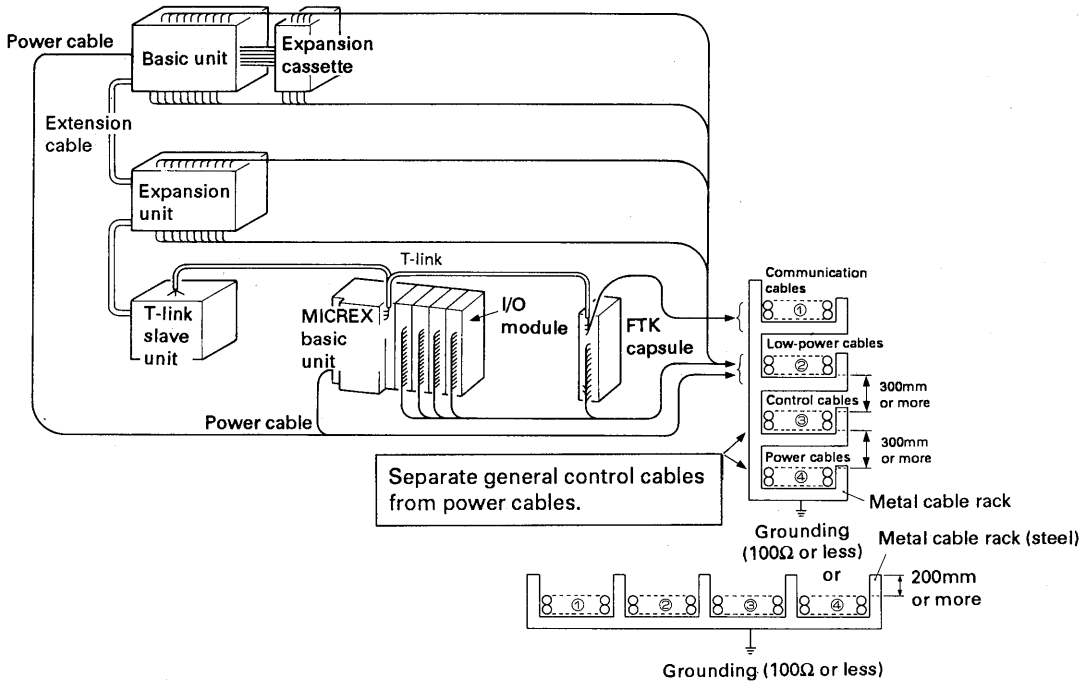
Notes:
1. Before an I/O relay is mounted or removed, the power supply to the relevant unit must be turned OFF.
2. The triac output relay heat radiator gets hot. The heat radiator must not be touched.

(Triac output relay)



6-1-6 Wiring and cables

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



• Cable types

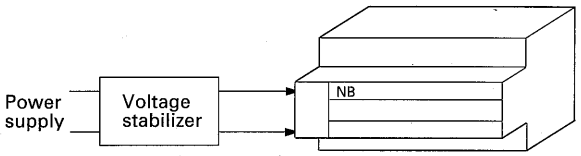
Item	Specification			Remarks
Power supply cable for basic and expansion units	Twisted cables 2mm²			
Input device connection cable for basic and expansion units	0.5mm² to 1.25mm²			
Output device connection cable for basic and expansion units	0.75mm² to 1.25mm²			
Expansion cable	Special cable			Accessory 50mm-long cable for an expansion cassette and accessory 300mm-long cable for an expansion or function unit
T-link cable (*1)	CPEV-SB 0.9mm diameter, 1 pair	Equivalent to the Furukawa Electric Co. products	1000m	(Specified cable) Twisted-pair cable
	KPEV-SB 1.25mm², 1 pair		1000m	
	KPEV-SB 0.75mm², 1 pair		700m	
	KPEV-SB 0.5mm², 1 pair		700m	

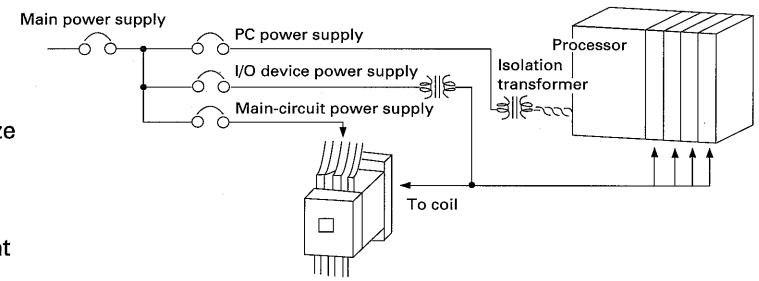
Note: *1 The maximum cable length marked with an asterisk (*) has been determined by tests.
If cables other than those listed above are used, the system may not operate normally.

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

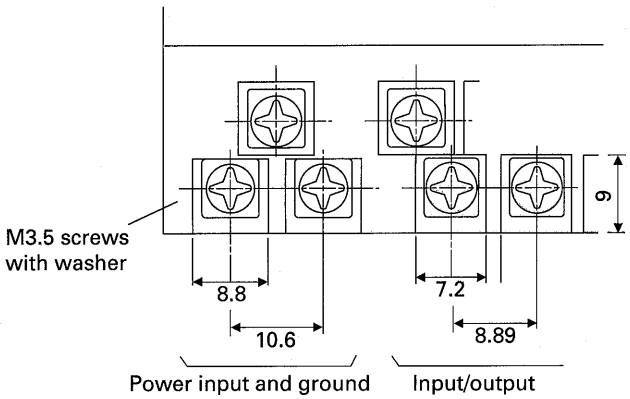
1. Precautions

- 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 output waveform distortion of the stabilizer must be within 5%.)
- The power supply must not generate excessive noise between power lines or between lines and ground. See Section 6-1-3 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 as possible and the wires must be twisted. To minimize voltage drops, the wire size must be as large as possible (at least 2mm^2).
- 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.





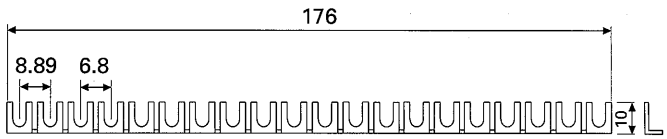
2. Dimensions of terminals, mm



3. Jumper plate

Using the following jumper plate is a convenient way to wire terminals on the I/O terminal block of the NB1 PC to a common line. The jumper plate can be cut to the required length. The jumper plate must be prepared by the user to suit his requirements.

- **Dimensions, mm (20 terminals)**

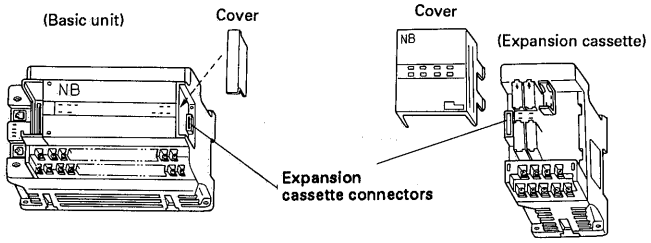


Type: NB-SB

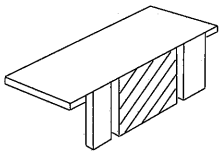
■ Connecting an expansion cassette

Only one eight-point expansion cassette can be connected to a basic unit regardless of its type. NB-EC0005 (50mm) extension cable must be used for the connection.

① Remove the expansion cassette connection cover from the basic unit and the cover from the expansion cassette.



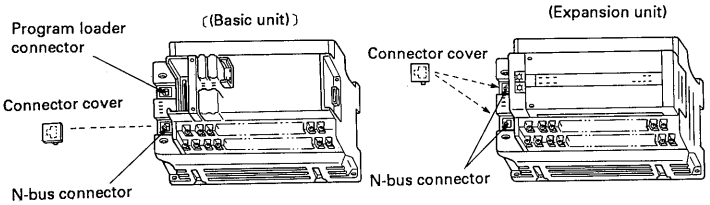
③ Before mounting the cover of the basic unit, break OFF the part indicated by hatching in the following figure.



■ Connecting expansion and function units

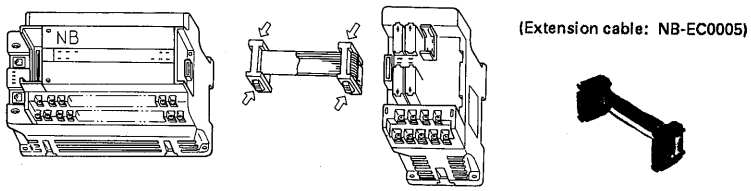
The basic unit of the NB series, excluding the NB2-P24 and NB2-P36, allows the user to connect up to three expansion units and up to four function units.

① Remove the N-bus connector, covers from the basic unit and the expansion or function unit to be connected.



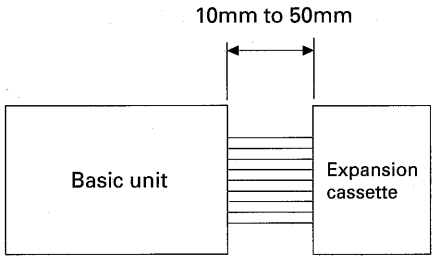
(The extension cable is included with the expansion cassette.) The following procedure must be used to connect an expansion cassette.

② Insert each end of the expansion cassette connection cable (NB-EC0005) into each expansion cassette connector until it is locked (you will hear a click).



Note: To disconnect the cable, pull the cable connector while pressing the parts indicated by arrows.

- **Connection distance**

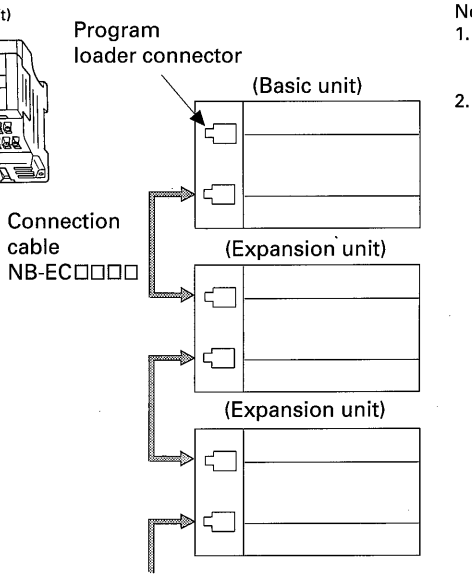


The extension cables required to connect the above units are as follows:

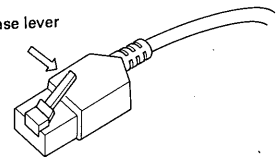
NB-EC0030 (300mm) ..... Included with expansion and function units

NB-EC0050 (500mm)
NB-EC0100 (1000mm)
NB-EC0200 (2000mm)
} To be prepared by the user to meet his requirements

② Insert each end of the extension cable into each N-bus connector until it is locked (you will hear a click).



Notes:
1. Either the upper or lower N-bus connector on the expansion unit can be used.
2. To disconnect the extension cable, pull the cable while pressing down the release lever on the cable's connector.



Section 7 Operation by ROM

Section 7 Operation by ROM
7-1 Operation by ROM

The NB-series PC is generally operated from RAM (standard). The NB-series can also be operated by using a EPROM or EEPROM (memory cassette is optional). This section explains PC operation by using a ROM.

7-1-1 What is operation by ROM?

PC operation by ROM is to operate the PC according to the user programs or data stored in ROM. Because the ROM retains memory contents even after the power supply is turned OFF, the stored programs and data are protected. The stored programs and data are not changed unless the ROM is rewritten. For this purpose, data must be written in the file area of the ROM.
Operation by ROM can be conveniently used for the following purposes:

(1) Replacing programs quickly when changing system setup
(2) Preventing existing programs and data from being rewritten
(3) Using the PC for the facility that is not operated often (Because a ROM requires no backup battery.
(4) ROM is also used for saving the master program for the system.

7-1-2 Types of operation using ROM

PC operation using ROM can be classified into the following types:

1. Operation by EPROM
When the power supply of the PC is turned ON, the EPROM contents are transferred to the PC built-in RAM. The PC then operates according to the transferred memory contents. The ROM writer is required to write user programs in to EPROM. An eraser is required to delete EPROM contents.
Data memory processing to be executed when PC errors occur can be specified using parameters.

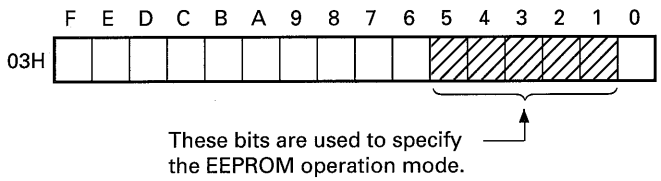
2. Operation by EEPROM
An EEPROM can be used for the NB-series PC according to the following three methods. Each method of use can be specified by a combination of parameter setting and the protection switch setting on EEPROM cassette.

Methods of using EEPROM:
① Using an EEPROM as nonvolatile RAM
Programs can be read from and written to the EEPROM. (The protection switch of the EEPROM cassette must be set to OFF.)
② Using an EEPROM as an ROM
Programs can only be read from the EEPROM. (The protection switch of the EEPROM cassette must be set to ON.)
③ Changing the operation program without reprogramming the EEPROM
The parameter for EEPROM operation must be set for this purpose. (The protection switch of the EEPROM cassette must be set to OFF.) A new program can be transferred from the connected program loader to the PC by using an auxiliary function of the program loader.

7-1-3 Parameter setting

Parameters are prepared to enable flexible tailoring of the NB-series PC to the user's application. The parameters for the use of EEPROM are allocated to address 03H. These parameters are used to specify the use of EEPROM and the PC operations to be executed when errors occur.

Contents of parameter address 03H



1. EEPROM operation mode parameters

Bit address	Mode			Use				Valid memory
		Protection switch of EEPROM cassette	Parameter setting	Copying EEPROM contents into RAM at power-ON	Rewriting EEPROM when rewriting program partially	Batched transfer by auxiliary function of program loader		EEPROM
						RAM → EEPROM	EEPROM → RAM	
1	①	Writing enabled	0: Default	Copying	Rewriting both RAM and EEPROM	Enabled	Enabled	
	②	Writing enabled	1	Not copying	Not rewriting EEPROM but rewriting only RAM	Enabled	Enabled	
	③	Writing disabled	0/1	Copying	Not rewriting RAM and EEPROM	Disabled	Enabled	Built-in RAM of PC

2. Parameters specifying the PC operations at the occurrence of errors

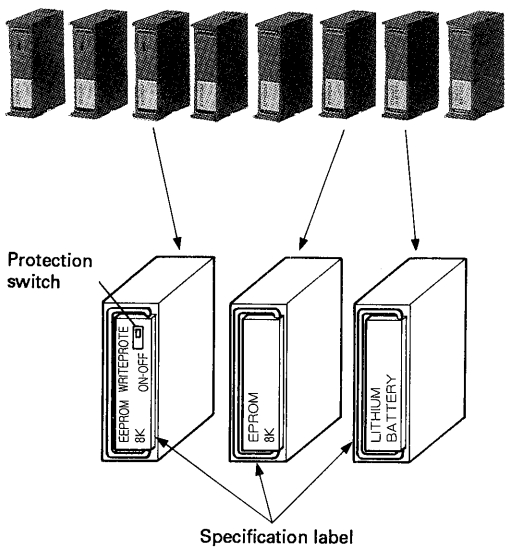
Bit address	Item	Description
2	Battery error alarm mode selection	This parameter specifies whether to output a battery error alarm when a battery error occurs during PC operation (by ROM) without using the battery. 0: Battery error alarm is output. The battery error indicator LED lights, and the battery error relay is turned ON. (Default setting) 1: Battery error alarm is not output. The battery error indicator LED does not light and the battery error relay is not turned ON even when a battery error occurs.
3	Keep relay resetting mode selection	This parameter specifies whether to reset the nonvolatile data memory (keep relays) at power-ON for the operation by ROM. 0: Keep relays are not reset. (Default setting) (If data memory contents have been destroyed by a battery error or another cause, keep relays are reset. In such a case, a special relay "data memory destroyed" is turned ON.) 1: Keep relays are reset.
4	Nonfatal fault stop-mode selection	The N-series PC does not stop when a nonfatal fault occurs but stops when a fatal fault occurs. This parameter can be used to let the PC stop when a nonfatal fault occurs. 0: The PC does not stop when a nonfatal fault occurs. (Default setting) 1: The PC stops when a nonfatal fault occurs. (The operation execution errors, including division by zero, and battery errors are excluded.)
5	Memory-hold stop-mode selection	All outputs are turned OFF when the N-series PC stops. This parameter can be used to let the PC hold all I/O status when the PC stops. 0: All outputs are turned OFF when the PC stops (default setting). All inputs are refreshed. 1: All I/O states are held when the PC stops. Data memory contents are also held. If the PC is restarted before the power supply is turned OFF, PC operation is started with the held I/O status. (This function corresponds to the hold-stop mode of PC operation.) Application to simplified sampling trace: Abnormal contacts of external input switches are problem that cannot be monitored easily. By using this function, a program can turn ON a fatal fault relay at the error. And this function can be used to monitor all I/O status on occurrence of the error.

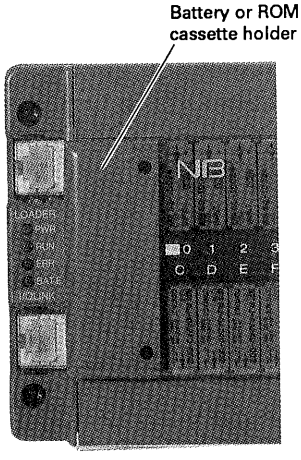
7-1-4 ROM Cassette Installation

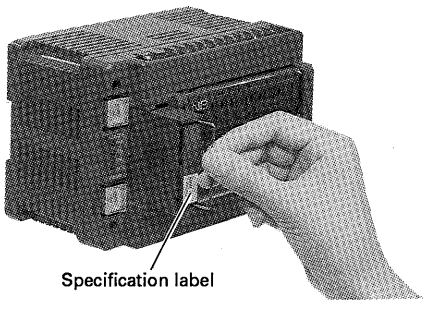
When mounting a ROM cassette on the basic unit the following procedure must be used.

① Turn OFF the basic unit power supply.
② Remove the battery or ROM cassette holder cover.
③ Remove the battery cassette. (Hold the lever of the battery cassette and pull it out.)
④ Insert the ROM cassette into the battery or ROM cassette holder while fitting the cassette onto the connector.

Notes:
1. The ROM cassette must be inserted with its specification label pointing down wards.
2. Before mounting an EEPROM cassette, the protection switch of the cassette must be set to the required position. (The protection switch is OFF at shipment.)
3. To remove the mounted ROM cassette, turn OFF the power supply and remove the ROM cassette by pulling the cassette lever.







Section 8 Programming Tools

Section 8 Programming Tools
8-1 How to Use the Programming Tools

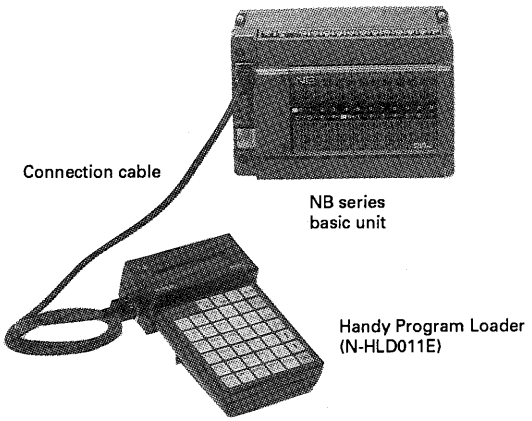
Handy Program Loader (N-HLD011E)

1. Handy Program Loader

Major functions:
- Programming instruction words
- Monitoring
- Modifying set and current values
- Audio CMT interface *
- Programming PROM or EEPROM *

* The following special modules are required.

2. Connection to the CPU module



3. Handy Program Loader functions

The Handy Program Loader (N-HLD011E) has the following functions.

- Programming
  - Program read
    - From 0 step
    - Specified step number
    - Instruction
    - Circuit element
  - Program write
    - Instruction write
    - Operand change
    - Instruction insert
    - Instruction delete
    - NOP delete
    - Specified program area delete
    - NOP write
  - Monitor
    - ON/OFF check
    - Circuit element
    - Timer/counter read
  - Test
    - Forced ON/OFF
    - Data memory change
    - Timer/counter (read, set) change
- Auxiliary functions
  - Auxiliary functions
    - Starting and stopping of the PC
    - Parameter setting
      - File register capacity
      - Watchdog timer setting
      - Fixed-cycle scan time
      - PC operations on the occurrence of error
      - Remote RUN address
      - Remote STOP address
      - Relay/register latch range
      - Input filtering time
    - Program checking
    - Batched change of relay numbers
    - Data memory clearance
    - Password checking
    - Message display
    - Buzzer ON/OFF
    - Transfer of memory cassette data
  - RAS functions
  - PROM writer function
  - Audio CMT function

Section 9 Test Operation

Section 9 Test Operation

9-1 Preliminary Check and Test Operation

After the I/O wiring of the PC, check the following items before turning the PC ON.

9-1-1 Preliminary checks

Test operation flowchart

1 Check the PC mounting status

2 Check the wiring before power-ON

3 Test the insulation and dielectric strength

4 Measure the AC line voltage

Preliminary checks

Continued to next page

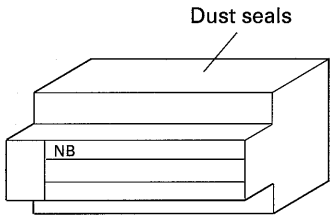
1. PC mounting status check

① Recheck the structures of control and operation panels and the environmental requirements described before.

② Check of other items

Confirm the following:

- The PC is not damaged.
- All screws are tight.
- Devices which generate electric noise are not located near the control panel.
- Addresses are assigned and set correctly without duplication.
- Dust seals have been removed from the power supply, CPU, and I/O modules.



2. Wiring check before power-ON

① Check that the communication, control signal, and PC I/O power cables are separated from the power cables correctly.

② Recheck the cable connections for power supply, I/O, and ground terminals.

③ Check that the specified communication cables are used.

3. Insulation/dielectric strength test

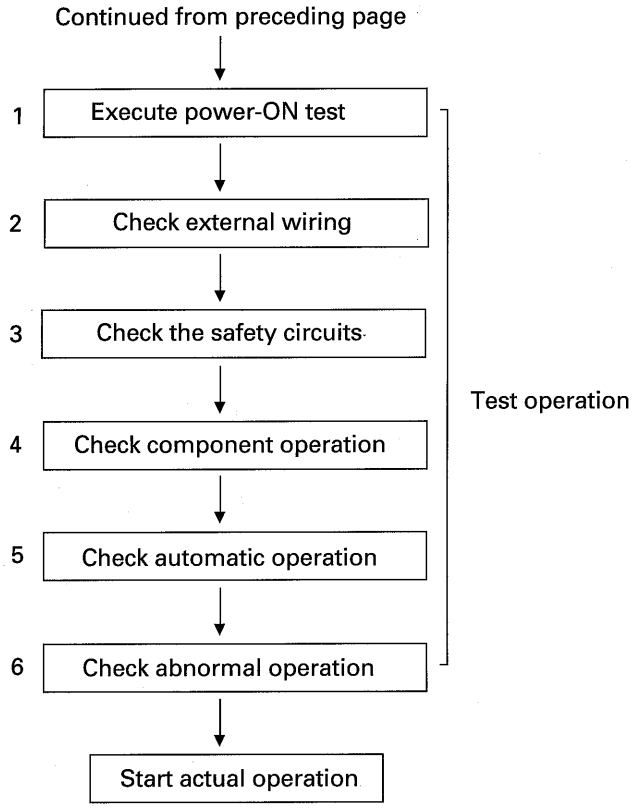
The NB-series PC guarantees the following standard values:

- Insulation resistance: 10MΩ or more (measured with 500V DC megger)
- Dielectric strength: 1500V AC, 1 minute

4. AC line voltage measurement

Before applying power, measure the AC line voltage and ensure that the voltage meets the NB-series specification.

9-1-2 Test operation



1. Power-ON test

① Execute the following operations to minimize damage due to incorrect wiring.
- Disconnect power from the main circuits for magnetic contactors and staters.
- Tighten the valves of compressors if used.

② Turn the power supply of the PC ON.
- For stand-alone system, supply power to the power supply module. The POWER indicator on the processor lights.
- For a system having an expansion unit or function unit, turn ON the power to the expansion unit or function unit first. Turn the CPU module on last. (The ALARM indicator of the expansion unit or the terminals lights, but it goes OFF when the power is applied to the processor module.
- Check that no abnormal sound is produced.
- Check that the status indicators on the CPU are normal.

Indicator LED	Status
PWR	This lamp lights while the power supply is ON.
RUN	This lamp lights while the PC is running and goes OFF when the PC is stopped.
ERR	This lamp lights when an error occurs and goes OFF when the PC error is remedied.
BAT. E	This lamp lights when the voltage of the backup battery is low.

*If an error indicator lights, diagnose the PC by using a program loader and take a recovery action according to the diagnosis result.

2. External wiring check

Check external wiring with reference to the module wiring diagrams.

3. Safety circuit check

Check that the interlock and emergency-stop circuits operate normally.

4. Component (manual) operation test

Use the manual operation circuit and check that each component operates normally.

*Related checks:

① Check that parameter settings and corresponding PC operations are correct.

② Check that those PC operations for detected fatal and nonfatal faults which are specified by user program are executed correctly. Also check that the circuits operate correctly as specified by the user's program.

5. Automatic operation test

If possible, begin this test with the automatic operation test for specific machines or that for an independent machine. Then proceed to the automatic test for the whole system.

6. Abnormal-operation test

Finally, execute the abnormal-operation test. This test is performed to check that the safety circuits of the PC operate normally when the machines and facility malfunction. Also, whether the system can be recovered from an abnormal state is checked.

Section 10 Maintenance and Inspection

Section 10 Maintenance and Inspection

10-1 General Inspection Items

N-Series PC should be periodically inspected to ensure optimum operating conditions.

1. Inspection frequency

Because N-Series PC is mainly consists of semiconductor devices, it has a long service life. Note that the these devices may deteriorate under extreme environmental conditions. Therefore, this equipment should be periodically inspected. Standard inspections should be done once or twice a year. However, the period between inspections should be shortened as required according to environmental conditions. If any inspection result does not satisfy the inspection criteria, corrective action must be taken.

2. Inspection items

Inspection item		Inspection contents	Criteria	Inspection method
Basic unit ALARM lamps		Confirmation of ALARM lamps	Lamps must be OFF.	Visual inspection
Basic unit and expansion I/O unit power supply	Voltage	Is the voltage within the normal range when measured at a terminal block ?	AC: –15 to +10% DC: –15 to +20%	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 environmant	Temperature	Is the temperature within the specified range ? (temperature in the panel when installed inside the panel)	0°C to +55°C	Max./min. thermometer
	Humidity	Is there condensation or extreme discoloration or corrosion ?	20% to 90%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 foreign matter.	Visual inspection
Installation status		Are all units mounted securely ?	No looseness	Screwdriver
		Are there any loose screws on the external wiring terminals ?	No looseness	Screwdriver
		Are cable connectors inserted securely ?	No looseness	Visual inspection
		Are any external wiring cables damaged ?	No abnormal appearance	Visual inspection
Battery		Is the battery still within the battery term?	Check the battery term 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

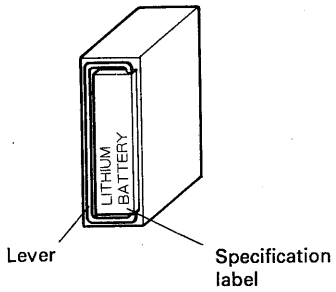
- If a fault occurs, replace the entire faulty unit, capsule or module. For this replacement, a minimum amount of spare components should be provided.
- Although the battery is rechangeable, replace the mounted battery when the battery error indicator (BAT. E)

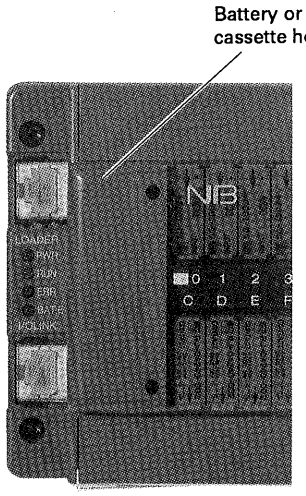
Battery Replacement

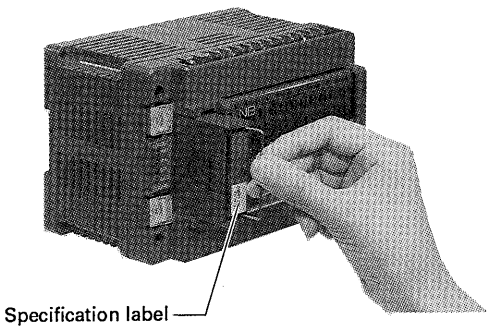
The NB series PC uses a rechargeable backup battery. If the BAT.E lamp of the basic unit with the battery mounted lights, the battery must be replaced. Use the following procedure to replace the battery.

(1) Do not turn OFF the control power supply of the basic unit.
(2) Remove the cover of the battery or ROM cassette holder.
(3) Hold the lever of the old battery cassette and pull it.
(4) Insert a new battery cassette while fitting it onto the connector.

Note: The battery cassette must be inserted with its specification label pointing downwards.





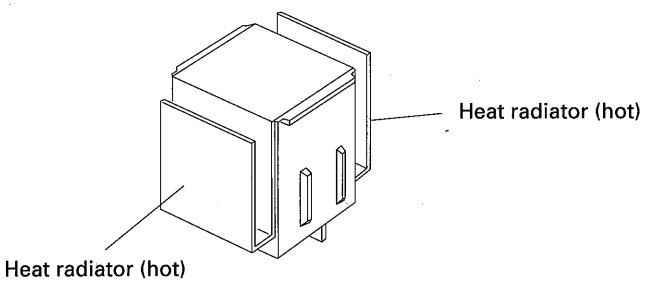


I/O Relay Replacement

The NB1 series PC allows the user to replace I/O relays in units of one point. For the replacement procedure, see the I/O relay mounting and removal procedures in Section 6-1-5. When replacing I/O relays, note the following points:

Notes:
1. Before I/O relays are replaced, turn OFF the PC power supply.
2. The triac output relay heat radiator gets hot. Do not touch this heat radiator. Do not touch this heat radiator.

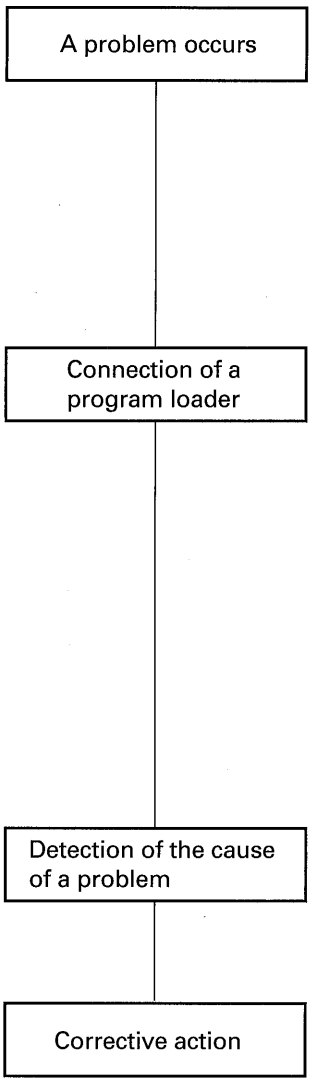
(Triac output relay)



Section 11 Troubleshooting (RAS)

Section 11 Troubleshooting (RAS)
11-1 Troubleshooting Procedure

The NB-series PC is provided with various diagnostic or RAS (*1) functions. The user can locate problems using the status indicators on the basic and expansion units and the monitoring on the program loader.



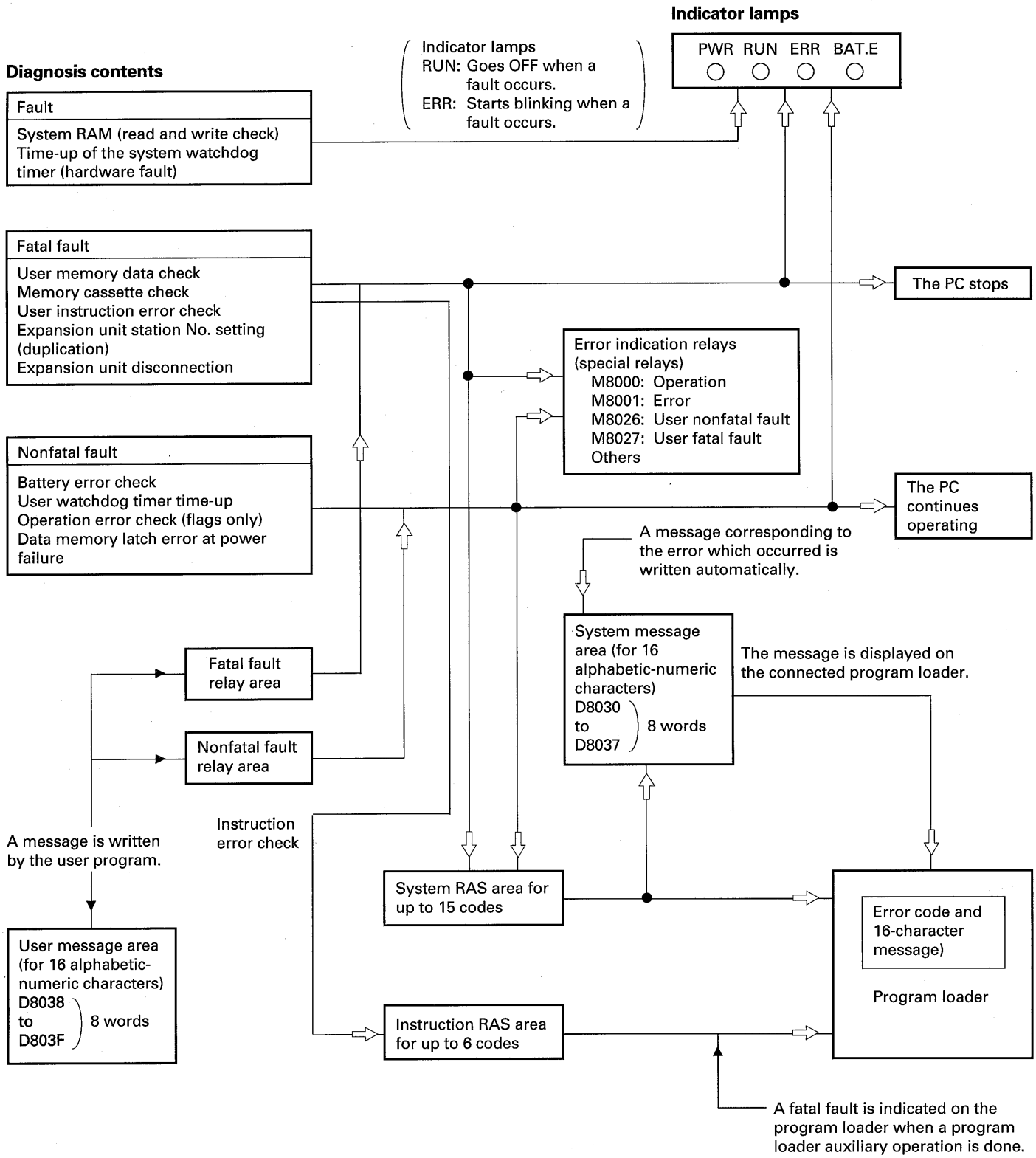
- On the basic unit, indicator lamps operate. (The ERR lamp is blinking, and the RUN lamp goes OFF.)
  The PC operations to be done when a problem occurs must be determined beforehand.
  - The PC continues operating or stops.
  - The special relays indicating problems are available. Relay operations can be specified in programs.
  - PC operation can be stopped by an external fault diagnosis program (fatal and nonfatal fault relays).

- Display of error contents
  - The result of external fault diagnosis is displayed as registered characters (user messages).
  - Errors detected by self-diagnosis are displayed as characters (system messages).
  - The error history of self-diagnostic functions can be monitored as a list of error codes (system RAS).
  - Instruction errors can be monitored as error codes as the result of a program check (instruction RAS).

- Correcting the program
- Replacing faulty parts

*1 RAS: Reliability, availability, and serviceability

This section explains the diagnostic (RAS) functions of the NB-series PC. If a problem occurs, the relevant indicator lamp on the basic unit will go ON and PC operation will stop if required. Also special internal relays are set ON and a message is displayed on the program loader. (See Section, 11-5, "Fault Diagnosis Functions of the NB Series".)



11-3 Diagnostic Memory Areas

The following table lists memory areas related to diagnosis.

① Characters are displayed automatically when the program loader is connected.
② An error code is displayed when the program loader is used.
③ Data is monitored when the program loader is used.
④ Characters are displayed when the program loader is used.

Memory area (address)	Function	Display format	Initial value and writing method	Remarks (clearance)
System message area Special register D8038 to D803F (8 words)	Error contents are displayed on the program loader as a 16-character message of alphabetic numeric (AN) characters.	16 characters ①, ④	• Initial value: 00 • Written by the processor when an error occurs	• Cleared at power-ON • Cleared by program or program loader operation • Cleared when an error is corrected
User message area Special register D8030 to D8037 (8 words)	The 16-character AN messages are registered by the user beforehand. When an error occurs, the corresponding message is displayed on the connected program loader.	16 characters ①	• Initial value: 00 • Written by the user	• Cleared by program or program loader operation • Cleared at power-ON
System RAS area (for 15 codes)	Errors detected by self diagnosis are stored as codes.	Code ②	• Nonvolatile area • Written by the processor	• Cleared by an auxiliary operation of the program loader
Instruction RAS area (for 6 codes)	Program check results are stored as codes. The stored result is updated after each program check.	Code ②	• Nonvolatile area • Written by the processor	• Cleared when instruction errors are not detected by a program check
Error indication relay area Special relay area	The special relays indicating errors are set ON when the corresponding errors occur. these special relays can be specified in programs.	Bit ③	• Initial value: OFF	• Cleared at power-ON
Nonfatal fault relay area M8110 to M812F (for 32 points)	A relay is set ON when the corresponding nonfatal fault is detected by the external diagnosis program created by the user.	Bit ③	• Initial value: OFF • Written by the user program	• Cleared when external faults are corrected • Cleared by the program at power-ON
Fatal fault relay area M8130 to M814F (for 32 points)	Each relay is set ON when the corresponding fatal fault is detected by the external diagnosis program created by the user.	Bit ③	• Initial value: OFF • Written by the user program	• Cleared when external faults are corrected • Cleared at power-ON

Contents of system message and user message areas

System message	User message	Bit F.....8	Bit 7.....0	Remarks
D8038	D8030	2	1	• System messages are the same as the messages displayed on the program loader listed in Section 11-5. A system message is written by the processor when the corresponding error occurs. • Alphabetic-numeric characters are used for messages. • The 16 characters of each message are displayed in the order indicated by the arrows on the program loader. • User message can be written by the user program.
D8039	D8031	4	3	
D803A	D8032	6	5	
⋮	⋮	⋮	⋮	
D803E	D8036	14	13	
D803F	D8037	16	15	

RAS functions consist of self-diagnosis, user instruction check, and external fault diagnosis. The self-diagnosis function diagnoses the PC itself. The external fault diagnosis function stops or continues PC operation according to the results of the external diagnosis program.

11-4-1 Self-diagnosis

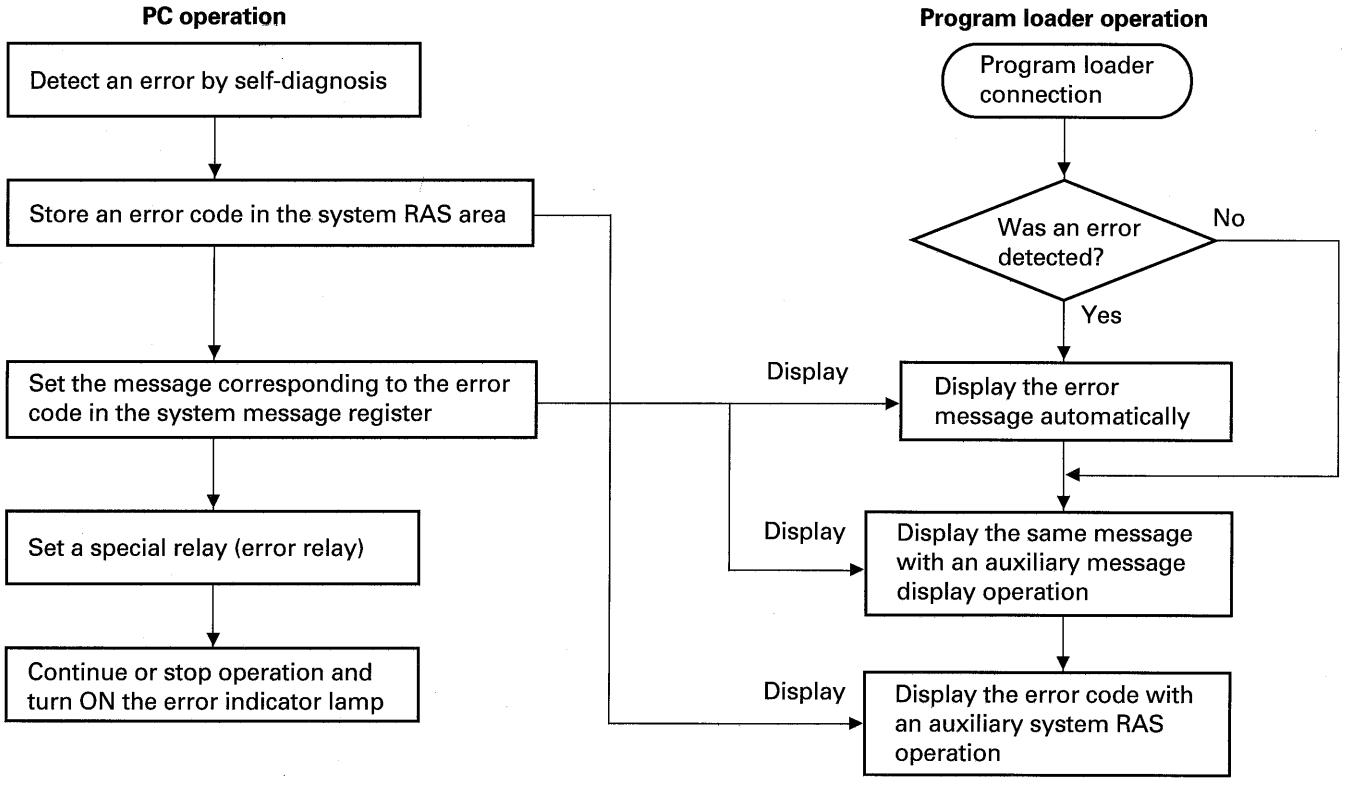
1. To diagnose the processor hardware, read and write checks of system RAM are performed at power-ON. If an error is detected, PC operation will not start. In addition, processor operation is always monitored by the system watchdog timer. If a time-up occurs, processor operation is stopped. At this point programming tools cannot be used. If the error recurs after the power supply is turned OFF and ON, the basic unit must be replaced.

2. Self-diagnosis is preformed before the processor starts operating and when a program check is done on the program loader. If an error is detected, the error is classified as fatal or nonfatal fault and an error indicator goes ON. PC operation can then either stop or continue. The nature of an error is indicated by an error code written in the system RAS area and the corresponding message written in the system message area.
Up to 15 error codes are stored sequentially, and the error history of the PC can be read from the stored error codes. Only one message corresponding to the latest error can be stored. The error is written to the error indication relay (special relay) area where the flag corresponding to the error is set. The flag data can be read by the program loader for confirmation and can also be used by the user program.

Contents of the system RAS area

Address (No.)		Content		Remarks
Hexadecimal No.	0	Total No. of errors	Latest RAS position	• Total No. of errors: 00 to FF • Latest RAS position: Address (No.) of the area in which the latest RAS data is stored. (If RAS data is not stored, this address No. is 0.) • For error codes,see Section 11-5. • A code is written by the processor each time an error occurs. Up to 15 codes can be stored. If the codes overflow the area, the code for the next error is written at address No. 1 thus storing the latest 15 codes. • A power-ON code (11) is stored to enable power-ON timing to be recognized.
	1	Error code		
	2	Error code		
	3	Power-ON code		
	4	Error code		
	⋮	⋮		
	D	Error code		
	E	Error code		
	F	Error code		

3. Self-diagnosis flow



11-4-2 Instruction error check

After a program is transferred (entered), the program is checked when program check is requested or PC operation is started using the program loader. The result of the check is stored in the instruction RAS area.

1. Contents of the instruction RAS area (error codes and error-occurrence step Nos.)

Error No.	Word No.	Content	Remarks
	0	Error count (0 to 6)	No. of errors
1	1. 2	Error code and error-occurrence step No.	• The data on the error is stored by the processor.
2	3. 4	Error code and error-occurrence step No.	• When the sixth error is detected, the program check is stopped. The stored data is updated each time program check is requested on the program loader.
3	5. 6	Error code and error-occurrence step No.	
4	7. 8	Error code and error-occurrence step No.	
Storage order 5	9. A	Error code and error-occurrence step No.	
6	B. C	Error code and error-occurrence step No.	• PC operation will not start until all errors are corrected.

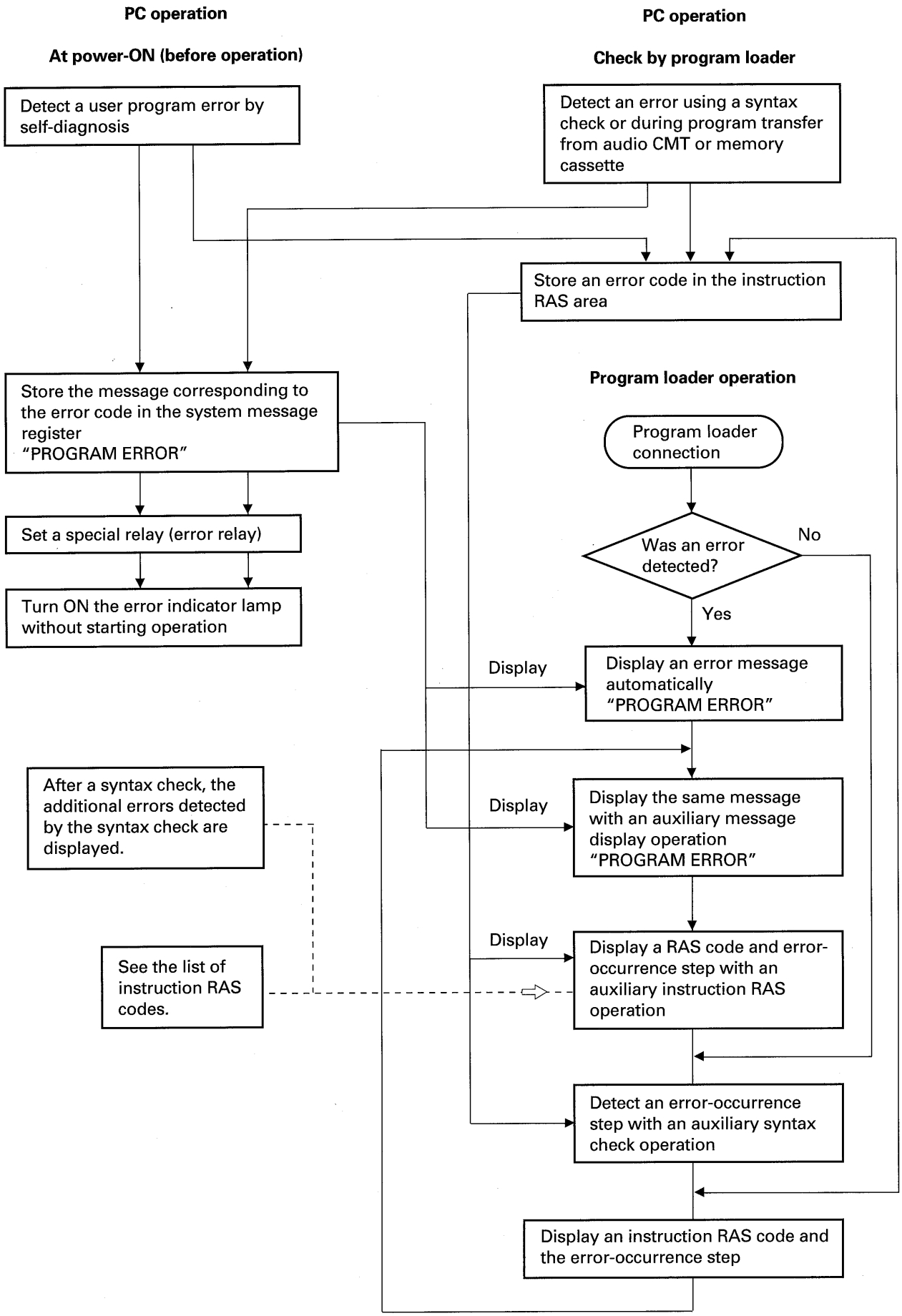
2. Instruction RAS error codes

The following table lists the error codes to be stored in the instruction RAS area and their contents. Note that these error codes are independent of the codes to be stored in the system RAS area.

Instruction RAS code	Content
00	Normal
01	A nonexecutable instruction is found. The instructions for upper-level models and the instructions reserved for future use are nonexecutable.
02	The type or size of an operand is out of the valid range. The operands of the instructions for upper-level models cannot be used.
07	In a program, a duplicate address No. (xx) is used for Xxx and Yxx. (Example: Both X000 and Y000 are found.)
13	Interrupt program errors ① An interrupt program No. (Ixxxx) is duplicated ② The most significant two digits of an interrupt program No. are 20 or more. Interrupt program Nos. for the NB2-P24 or NB2-P36: I0000 to I0700 or I1000 to I1700 Interrupt program Nos. for the NB1, NB2-P56, or NB2-P90: I0000 to I0700, I1000 to I1700, or I1Cxx to I1Fxx ③ An IRET instruction is specified before the corresponding FEND instruction.
14	Jump errors ① JMP Pxx is specified, but Pxx is not found. ② A No. (xx) is used for multiple Pxx. ③ The total No. of pointers is more than the specified No. Total No. of pointers for the NB2-P24 or NB2-P36: 16 Total No. of pointers for the BN1, NB2-P56, or NB2-P90: 256
18	User macrocommand (UM) errors ① The CALL UMxx, UMEXE, and UMEND commands are not programmed in this order. ② The UMxx or URET command is specified before the FEND instruction. ③ A CALL UMxx instruction is specified, but the corresponding UMxx command is not found. ④ The total No, of UM commands is more than the maximum No. Maximum No. of UM commands for the NB2-P24 or NB2-P36: 8 Maximum No. of UM commands for the BN1, NB2-P56, or NB2-P90: 32 ⑤ Multiple UMxx commands having the same No. (xx) are found.
20	MPS, MRD, and MPP errors ① Although the MPS instruction is not specified, the MPP or MRD instruction is specified. ② Too many MPP instructions are specified and a stack error results. (11 rows)
23	Too many ANB or ORB instructions are specified, and a stack error results. (8 rows)
24	MC and MCR errors ① A URET, IRET, END, or FEND instruction is specified between the MC and MCR instructions. ② An MC instruction is specified, but the corresponding MCR instruction is not found.
26	The first program does not begin with an LD or LDI instruction.

(The program step at which a user program error is detected can be monitored.)

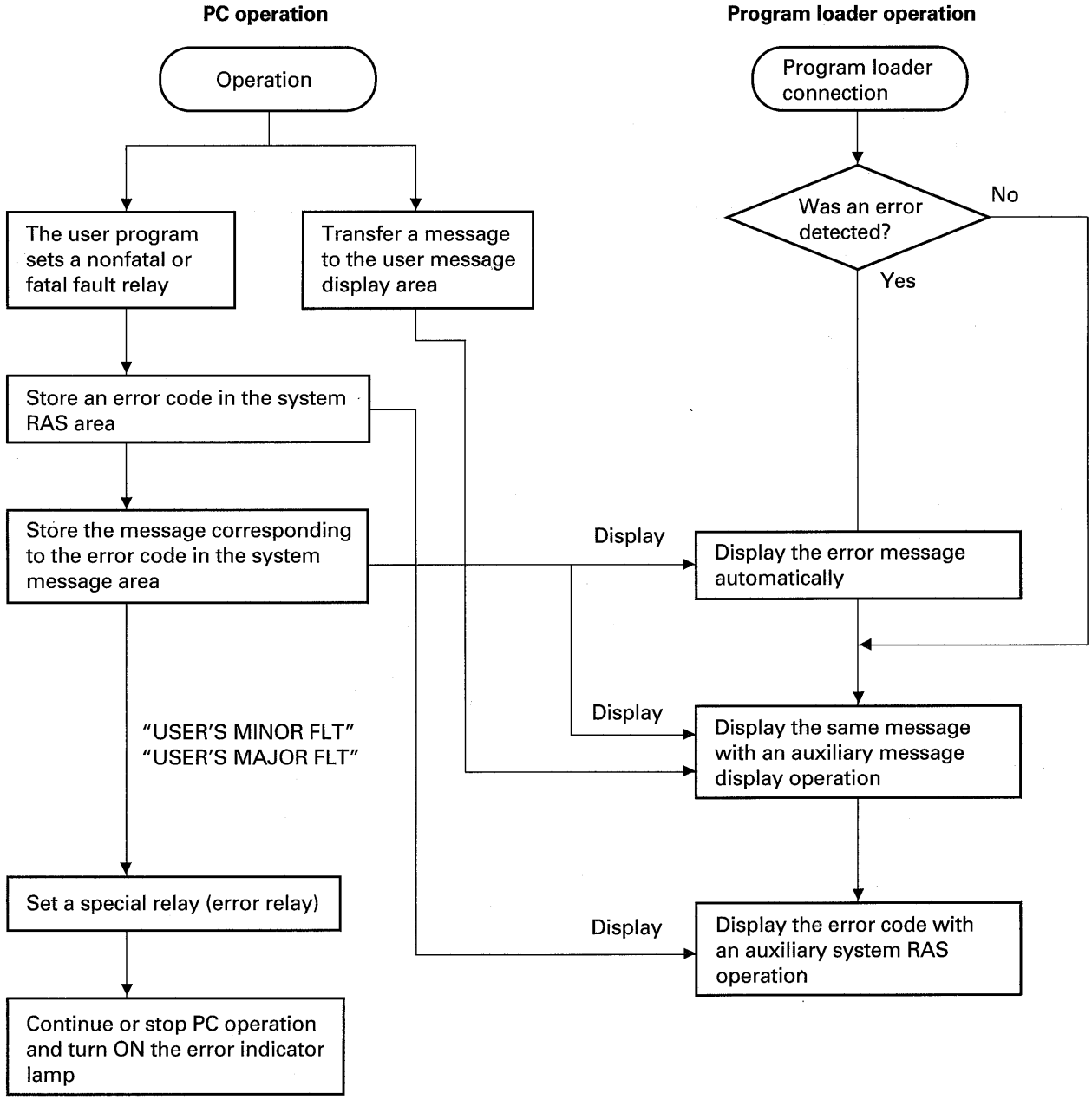
3. Instruction diagnosis flow



11-4-3 External error check

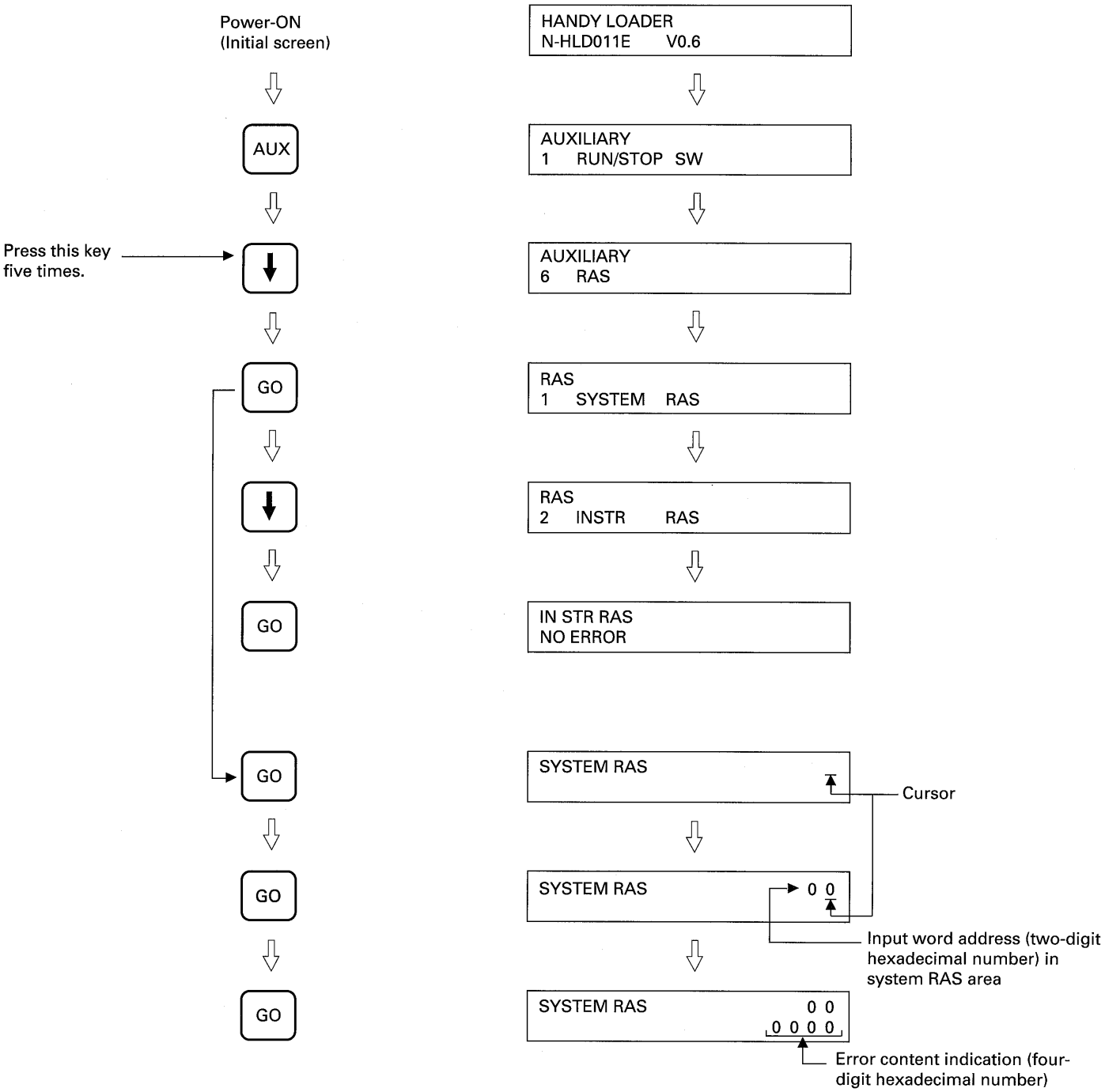
An external diagnostic program can be created as a user program. If the diagnostic program detects a fatal or nonfatal fault, it can stop or continue PC operation in the same manner as in self-diagnosis. User messages registered beforehand can be displayed using the program loader.

1. The following fault relay areas where data is written by the user program are handled in units of bits.
   - Fatal fault relay area (M8110 to M812F) (32 points): Stops PC operation
   - Nonfatal fault relay area (M8130 to M814F) (32 points): Continues PC operation
2. User messages must be stored beforehand by the user program. The messages will be displayed on the connected program loader. Each message can be of up to 16 alphabetic-numeric characters. the messages are stored in an eight-word area from D8030 to D8037.
3. External error check flow



11-4-4 Monitoring errors using the Handy Program Loader

The section gives an example of how to monitor errors on the connected N-HLD011E Handy Program Loader. For details, refer to the Handy Program Loader User's Manual.



○ : Turned ON ● : Turned OFF ◎ : Blinking –: No change

Item	Check content and method	Fault level	Operation state	Output	LED indicator PWR	LED indicator RUN	LED indicator ERR	LED indicator BAT	Message display on the program loader	RAS code	Special relay to be set	Check timing	Cause	Corrective action
Normal operation	No error found by self-diagnosis	Normal	Running	ON	○	○	●	●	–	00				
CPU error	Time-up of system watchdog timer	Fatal	Stopped	OFF	○	○	○	○	–	–		Always	Malfunction due to noise	Turn OFF and ON the power supply.
System RAM error	Read and write checks	Fatal	Stopped	OFF	○	●	○	–	–	–		At power-ON	Defective system RAM	Replace the processor.
Operation delay monitoring	Time-up of the user watchdog timer	Nonfatal	Running	ON	○	○	◎	–	WDT UP	35	M8001 M8020	During operation	Operation delay because of too many loops	Recheck the program or extend the WDT time.
User RAM error	Sum check: Program parameters and user macro file	Fatal	Stopped	OFF	○	●	◎	–	PROGRAM MEM ERR PRMTR MEM ERROR USER MACRO ERROR FILE RGTR ERR	21 26 28 27	M8001	At the beginning of or during operation	Program deletion because of long power failure or malfunction due to noise	Write the program again or delete the whole program.
User program error	Program check (to find circuit or syntax errors)	Fatal	Stopped	OFF	○	●	◎	–	PROGRAM ERROR	Instruction RAS code	M8001	At the beginning of operation or during a program check using the program loader	Programming error	Correct the program.
Memory cassette error	• Whether memory content is destroyed • Whether the program is for an upper-level model (NS or NJ)	Fatal	Stopped	OFF	○	●	◎	–	CST DATA ERROR MEM CST MISMATCH	2A 2F	M8001	At power-ON	Memory cassette contents deleted Program nonexecutable because it is designed for an upper-level PC (NS or NJ)	Replace the memory cassette with a normal, working one.
Operation execution error	Division by 0 or other error	Nonfatal	Running	ON	○	○	–	–	–	–	M81FF M802A	During operation	Sequence programming error by user	Correct the sequence.
Expansion unit disconnection	Disconnection of operating expansion unit	Fatal	Stopped	OFF	○	●	◎	–	EXPNDER DISCONN	45	M8001 M8023	During operation	Incorrect handling by the user	Turn OFF and ON the power supply.
													Defective expansion unit	Replace the expansion unit.

○ : Turned ON ● : Turned OFF ◎ : Blinking –: No change

Item	Check content and method	Fault level	Operation state	Output	LED indicator				Message display on the program loader	RAS code	Special relay to be set	Check timing	Cause	Corrective action
					PWR	RUN	ERR	BAT						
Expansion unit station No. error	I/O area overflow on the expansion unit I/O area duplication on the expansion unit	Fatal	Stopped	OFF	○	●	◎	–	I/O POINT OVER I/O AREA OVERLAP	46 4A	M8001	At power-ON	Incorrect handling by the user	Correct the setting of expansion unit station Nos.
	Excessive No. of expansion units								EXPANDERS OVER	4B	M8001	At power-ON	Too many expansion units connected	Check the No. of expansion units.
Battery error	Battery voltage is too low Battery disconnected	Nonfatal	Running	ON	○	○	–	○	(NO MESSAGE IS DISPLAYED.)	22 25	M8001 M8028 M8029	At power-ON Always	Battery expired or battery disconnected	Replace the battery.
Data latch error during power failure	Latch relay data deleted	Nonfatal	Running	ON	○	○	◎	–	LATCH DATA ERROR	29	M8001 M8021	At power-ON	Data deleted because of a long power failure	
User nonfatal fault	Turn ON the user nonfatal fault relay	Nonfatal	Running	ON	○	○	◎	–	USER'S MINOR FLT	37	M8001 M8110~ M812F	During operation	External fault	Correct the external fault.
User fatal fault	Turn ON the user fatal fault relay	Fatal	Stopped	OFF	○	●	◎	–	USER'S MAJOR FLT	36	M8001 M8130~ M814F	During operation	External fault	Correct the external fault.

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