FUJI ELECTRIC

FUJI PROGRAMMABLE CONTROLLER

MICREX-F F55 Series

USER'S MANUAL HARDWARE

Safety Precautions

Before mounting, wiring, operation, maintenance and inspection of the device, be sure to read the operating instructions carefully to ensure proper operation. The operating instructions should be furnished to the maintenance supervisors of final users.

- Here, the safety precaution items are classified into "Warning" and "Caution".

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

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

- Even some items indicated by "Caution" may also result in a serious accident.

⚠ WARNING

- Never touch any part of charged circuits as terminals and exposed metal portion while the power is turned ON. It may result in an electric shock to the operator.
- Turn OFF the power before mounting, dismounting, wiring, maintaining or checking, otherwise, electric shock, erratic operation or troubles might occur.
- Place the emergency stop circuit, interlock circuit or the like for safety outside the PC. A failure of PC might break or cause problems to the machine.
- Do not connect in reverse polarity, charge (except rechargeable ones), disassemble, heat, throw in fire or short-circuit the batteries, otherwise, they might burst or take fire.

⚠ CAUTION

- Do not use one found damaged or deformed when unpacked, otherwise, failure or erratic operation might be caused.
- Do not shock the product by dropping or tipping it over, otherwise, it might be damaged or troubled.
- Follow the directions of the operating instructions when mounting the product. If mounting is improper, the product might drop or develop problems or erratic operations.
- Use the rated voltage and current mentioned in the operating instructions and manual. Use beyond the rated values might cause fire, erratic operation or failure.
- Operate (keep) in the environment specified in the operating instructions and manual. High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock might cause electric shock, fire, erratic operation or failure.
- Select a wire size to suit the applied voltage and carrying current, and carry out wiring according to the operating instructions and manual. Poor wiring might cause fire.
- Contaminants, wiring chips, iron powder or other foreign matter must not enter the device when installing it, otherwise, erratic operation or failure might occur.
- Connect the ground terminal to the ground, otherwise, an erratic operation might occur.
- Periodically make sure the terminal screws and mounting screws are securely tightened. Operation at a loosened status might cause fire or erratic operation.
- Put the furnished connector covers on unused connectors, otherwise, failure or erratic operation might occur.
- Install the furnished terminal cover on the terminal block, otherwise, electric shock or fire might occur.
- Sufficiently make sure of safety before program change, forced output, starting, stopping or anything else during a run.
  The wrong operation might break or cause machine problems.
- Replace the fuse with a designated one, otherwise, fire or failure might occur.
- Engage the loader connector in a correct orientation, otherwise, an erratic operation might occur.
- Do not remodel or disassemble the product, otherwise, a failure might occur.
- Follow the regulations of industrial wastes when the device is to be discarded.

This User's Manual explains the system configurations,
specifications, and handling procedure for the
MICREX-F F55 Series. Read this manual thoroughly for
correct handling and normal operation of the
programmable controller.
This manual is an English version based on the
Japanese User's Manual No. FH150a.

CONTENTS

Section 1 General

Section 1 General

1.1 How to Use This Manual

This manual describes the system configuration, specifications, and handling of the MICREX-F F55 Series programmable controller (referred to as PC hereafter) from Fuji Electric.

When using this manual, please read the Sections in the table below according to the type of the work to be performed.

Section	Item	Contents	Type of work				
			System design	Software design	Installation	Test operation	Maintenance
1	General	Describes the features of the F55 series and notes on using it.	●	●	●	●	●
2	System Configuration	Introduces various systems which can be built using the F55 series and discusses components and peripheral devices required.	●	●			
3	Specifications	Explains the format and specifications of each component and notes on use.	●	●	●	●	●
4	Name and Function of Each Part	Describes the name and function of each component.	●		●	●	●
5	Installation and Wiring	Covers the installation and wiring procedures for the F55 series and provides relevant notes.	●		●	●	●
6	Test Operation	Provides the check points and the procedure for test operation.				●	●
7	Troubleshooting	Presents troubles which can occur during operation and possible countermeasures.				●	●
8	Maintenance and Inspection	Provides the information on daily and periodical inspections, parts replacement procedure, and maintenance services.					●

When using the PC, observe the following points in addition to the ones in "Safety Precautions".

■ **Ground the PC**
- Connect the frame ground terminal (FG) of each component to a good ground (grounding resistance of 100Ω or less). Avoid connecting it to a ground line used by any power circuits.

■ **Replace the battery before it runs out**
- Pay attention to the life expectancy of the battery for memory (RAM) backup. If the ROM is used as program memory, the battery is necessary to backup the contents of the data memory.
- It is recommended that the battery be prepared as one of maintenance parts, taking the life expectancy into account. (See Section 7 for details.)

■ **Be aware of wiring dust or other conductive foreign materials**
- Perform wiring work with the main unit covered by the anti-dust paper. When starting operation after wiring, be sure to remove the paper.

■ **Observe the version number of the program loader**
- The following models of program loaders can be used; however, they must be upgraded as required. Use a program loader with the specified version number or later versions.

Loader type	Correct version (F55 basic unit case version: 0001 to 0999)		Correct version (F55 basic unit case version: 1001 or later)	
D10S	V0.11 or later		V0.30 or later	
D20	V7.12 or later		V7.50 or later	
D25 (LITE)	V0.07 or later		V2.50 or later	
PC loader	PC98 disk version	V1.00P or later	PC98 disk version	Not available
	EMS version	V1.00P or later	EMS version	V2.50P1 or later
	FMR disk version	V1.00P3 or later	FMR disk version	Not available
	EMS version	V1.00P3 or later	EMS version	Not available
	IBM PC/AT disk version	V1.00P3 or later	IBM PC/AT disk version	Not available
	EMS version	V1.00P3 or later	EMS version	V2.50P1 or later
	J3100 disk version	V1.00P3 or later	J3100 disk version	Not available
	EMS version	V1.00P3 or later	EMS version	Not available

■ **Notes on using the relay output card**

The relay output card does not use a surge absorbing element (varister) therefore connect an external CR surge absorber (0.1μF + 100Ω) to protect the internal circuit; otherwise, leakage current may occur resulting in malfunction of external output devices.
In such a case, connecting a bleeder resistor is required.
If the load connected does not have a capacity of 12V DC/3 mA or more, the contact reliability may be reduced, resulting in malfunction, e.g., the load does not operate even when the built-in relay is turned on.

■ **Notes on dielectric strength test**

A surge absorber is installed between the power input terminal and the LG terminal on the power supply terminal block. Therefore, when performing dielectric strength test, open the LG terminal, using caution not to damage or burn the surge absorber.

1.3 Features

The MICREX-F F55 series is a PC series in the MICREX-F family which is suitable for small scale system configuration. The series is a high-performance and compact-size version of the F50/50H series.

■ PC with high execution speed
The PC realizes high execution speed of 0.8μs per basic sequence instruction (for basic unit case versions 0001 to 0999) or 0.5μs per basic sequence instruction (for basic unit case version 1001 or later).

■ Large data memory capacity
The capacity of the internal data memory is 4096 words (1 word = 32 bits).

■ Peripheral tool groups used commonly with the MICREX-F series
With the MICREX-F series, unified programming language (FPL) and common programming tools can be used, allowing upward-compatibility of software.

■ Versatile PC
• 76 different data instructions
• Handling of large amount of data:
  Allows operation data format and signed BCD 8-digit data.
• Flexible programming control:
  Multitasking control allows external interrupt and fixed-cycle interrupt programs to interrupt into ordinary cyclic program.
• Calendar function:
  Calendar is built in the T-link master interface card (NV1L-TL1) (basic unit case version 1001 or later).
• Direct access processing
  Allows high-speed I/O response.

■ Compact size
In spite of the built-in power supply, the unit size is 380 x 95 x 97 (mm) allowing one T-link master card and up to 8 other cards to be mounted.

■ T-link available
When the optional T-link master interface card (NV1L-TL1) is implemented, the T-link can be used. The card can be implemented into one of the option card slots of the basic unit.

■ LED indicators
• I/O status LED indicators:
  Indicates I/O status for each unit. I/O statuses for two systems each with 32 points can be displayed.
• Data position LED indicators:
  There are two LEDs for indicating the current data position (slot and slot data position).
• User LED indicators:
  Indicates user information defined in the user display area (W124) to the 8 x 8 LED array and two 7-segment LEDs (basic unit case version 1001 or later).
• Maintenance LED indicators:
  Indicates the detail information on the current failure factors (fatal and nonfatal failures) (basic unit case version 1001 or later).

■ Extension connector
Only one expansion unit can be installed with a cable of up to 1m. The extension cables are available in three lengths: 0.3m, 0.6m and 1m (basic unit case version 1001 or later).

1.4.1 Type number nomenclature

(1) Basic unit

N V1 P - 04 2

- 2 : 100 to 200V AC power supply
- 04 : For 4 cards
- 06 : For 6 cards
- 08 : For 8 cards
- P : Processor rack
- V1 : F55 series
- N : General-purpose PC

(2) Expansion unit

N V1 E - 04 2

- 2 : 100 to 200V AC power supply
- 04 : For 4 cards
- 06 : For 6 cards
- 08 : For 8 cards
- E : Expansion rack
- V1 : F55 series
- N : General-purpose PC

(3) Input card

N V1 X 16 04 - W

- None: Source type
- W : Source and sink common use
- 04 : 12 to 24V DC
- 06 : 24V DC
- 16 : 16 point input
- 32 : 32 point input
- X : Input card
- V1 : F55 series
- N : General-purpose PC

(4) Relay output card

N V1 Y 08 R - 00

- 00 : All point independent
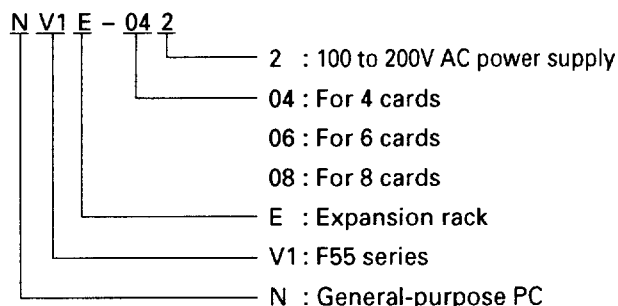- 08 : 8 point common
- R : Relay output
- 08 : 8 point output
- 16 : 16 point output
- Y : Output card
- V1 : F55 series
- N : General-purpose PC

(5) Transistor output card

N V1 Y 16 T 05 P5

- P5 : 0.5A output
- P1 : 0.1A output
- 05 : 12 to 24V DC
- T : Transistor sink output
- 16 : 16 point output
- 32 : 32 point output
- Y : Output card
- V1 : F55 series
- N : General-purpose PC

(6) Special card

N V1 F - HC1

- HC1: High-speed counter (only for direct access)
- HC2: High-speed counter
- F : Special card
- V1 : F55 series
- N : General-purpose PC

(7) Communication card

N V1 L - TL1

- TL1 : T-link master
- TS1 : T-link slave
- RS2 : RS-232C
- L : Communication card
- V1 : F55 series
- N : General-purpose PC

(8) F55 series common supplies

N V1 L - TL1

- SW16 : Simulation input switch for 16 points
- V : Common supplies
- V1 : F55 series
- N : General-purpose PC

(9) EPROM

N V1 L - TL1

- MP-10 : 10.5k steps EPROM
- ME-10 : 10.5k steps EEPROM
- V : Common supplies
- V1 : F55 series
- N : General-purpose PC
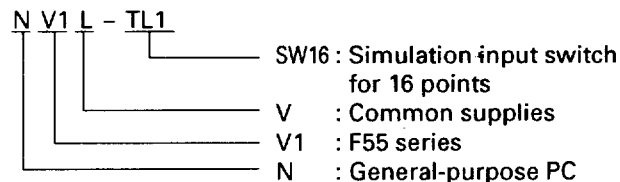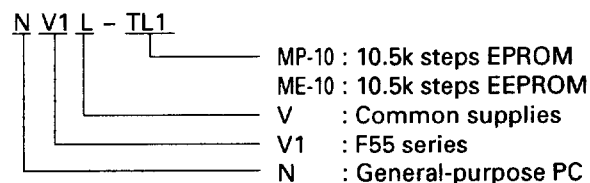
1.4 Type List

1.4.2 Type table

Product name	Type	Description		Supplied accessory	
				Accessory	Qty.

Basic unit (rack type)	NV1P-042	1 T-link master card (option) + 4 I/O cards	• CPU built in
			• Up to 1600 I/O control points
			• Program memory with 10.5k steps
			• EEPROM with 10.5k steps
			  Memory card installed directly
			  (basic unit case version 1001 or later).
				Instruction manual	1

	NV1P-062	1 T-link master card (option) + 6 I/O cards			
	NV1P-082	1 T-link master card (option) + 8 I/O cards			
Expansion unit (rack type)	NV1E-042	4 I/O cards can be installed.	• Can be used as directly connected I/O area Up to 256 words including the basic unit can be used (basic unit case version 1001 or later). *1	Instruction manual Extension cable (NJ-EC0030)	1 1
	NV1E-062 (Under development)	6 I/O cards can be installed.			
	NV1E-082	8 I/O cards can be installed.			
Input card	NV1X1604	12 to 24V DC, 10ms, 3/7mA, 16 points (source type)		Instruction manual	1
	NV1X1604-W	12 to 24V DC, 10ms, 3/7mA, 16 points (for source and sink)		Instruction manual	1
	NV1X3204	12 to 24V DC, 10ms, 2/4mA, 32 points (source type)		Instruction manual Connector Cover	1
	NV1X3204-W	12 to 24V DC, 10ms, 2/4mA, 32 points (for source and sink)			1
	NV1X3206	24V DC, 10ms, 4mA, 32 points (source)			1
Output card	NV1Y08R-00	264V AC maximum (2A/point), 140V DC (0.2A/point), Ry 8 points (all points independent)		Instruction manual	1
	NV1Y16R-08	264V AC maximum (2A/point), 140V DC (0.2A/point), Ry 16 points (8 points common)		Instruction manual	1
	NV1Y16T05P5	12 to 24V DC, 1ms, 0.5A/point, Tr 16 points (16 points common)		Instruction manual	1
	NV1Y32T05P1	5 to 24V DC, 1ms, 0.1A/point, Tr 32 points (32 points common)		Instruction manual Connector Cover	1 1 1
T-link master interface	NV1L-TL1	• One T-link system is configured by installing the T-link master interface into the dedicated slot in the basic unit rack. • The calendar function is built in (basic unit case version 1001 or later).		Instruction manual T-link connector set T-link termination resistor (for connector) T-link termination resistor (for terminal block) Name plate (T-link) Address number seal Screwdriver	1 1 2 1 2 1 1
Function card	T-link slave	NV1L-TS1	I/O: 1/1, 2/2, 4/4, 7/8 words and message communication	Instruction manual T-link connector set T-link termination resistor Cover	1 1 1 1
	High-speed counter	NV1F-HC1	50kHz, 1 channel, 5V/12V/24V DC count input (direct access only)	Instruction manual Connector Cover	1 1 1
		NV1F-HC2	50kHz, 1 channel, 5V/12V/24V DC count input (4 words)	Instruction manual Connector Cover	1 1 1
	General-purpose interface	NV1L-RS2	Mounts RS-232C interface.	Instruction manual	1
	External interrupt	NV1F-YP1 (Under development)	8 channel, 12 to 24V DC input (direct access only)	Instruction manual	1
Option	Simulation input switch	NV1V-SW16	Simulation input switch for 16 point card (24V DC)	Power cord	1
	EPROM card	NV1VMP-10	Mounts EPROM chip for the F55 series. (EPROM chip type: HN27C256AG-15, Hitachi)	Light shield	1
	EEPROM card	NV1VME-10	Mounts EEPROM chip for the F55 series. (Basic unit case version 1001 or later)	Instruction manual	1
	Spare battery	NL8V-BT	Lithium battery (5 years at 25°C)	Operating life seal	1

*1 Note that the following cards cannot be mounted.
   • High-speed counter card (NV1F-HC1)
   • External interrupt card (NV1F-YP1)

■ Combination table

With standard I/O arrangement, the PC can be shipped
with I/O cards installed at the factory.

Type	Description		Supplied accessory	
			Accessory	Qty.
NV0P056R-042	Basic unit (NV1P-042)	56 I/O points (DCI:32, Ry:24) Input card: NV1X1604 x 2 Output card: NV1Y16R-08 x 1 NV1Y08R-00 x 1	Basic unit instruction manual Input card instruction manual Output card instruction manual	1 1 1
NV1P064R-042	Basic unit (NV1P-042)	64 I/O points (DCI:32, Ry:32) Input card: NV1X1604 x 2 Output card: NV1Y16R-08 x 2	Basic unit instruction manual Input card instruction manual Output card instruction manual	1 1 1
NV1P064T-042	Basic unit (NV1P-042)	64 I/O points (DCI:32, Ry:32) Input card: NV1X1604 x 2 Output card: NV1Y16T05P5 x 2	Basic unit instruction manual Input card instruction manual Output card instruction manual	1 1 1
NV1P096R-062	Basic unit (NV1P-062)	96 I/O points (DCI:48, Ry:48) Input card: NV1X1604 x 3 Output card: NV1Y16R-08 x 3	Basic unit instruction manual Input card instruction manual Output card instruction manual	1 1 1
NV1P096T-062	Basic unit (NV1P-062)	96 I/O points (DCI:48, Ry:48) Input card: NV1X1604 x 3 Output card: NV1Y16T05P5 x 3	Basic unit instruction manual Input card instruction manual Output card instruction manual	1 1 1
NV1P128R-082	Basic unit (NV1P-082)	128 I/O points (DCI:64, Ry:64) Input card: NV1X1604 x 4 Output card: NV1Y16R-08 x 4	Basic unit instruction manual Input card instruction manual Output card instruction manual	1 1 1
NV1P128T-082	Basic unit (NV1P-082)	128 I/O points (DCI:64, Tr:64) Input card: NV1X1604 x 4 Output card: NV1Y16T05P5 x 4	Basic unit instruction manual Input card instruction manual Output card instruction manual	1 1 1
NV1P128C-042	Basic unit (NV1P-042)	128 I/O points (DCI:64, Tr:64) Input card: NV1X3204 x 2 Output card: NV1Y32T05P1 x 2	Basic unit instruction manual Input card instruction manual Output card instruction manual Connector cover	1 1 1 4
NV1P192C-062	Basic unit (NV1P-062)	192 I/O points (DCI:96, Tr:96) Input card: NV1X3204 x 3 Output card: NV1Y32T05P1 x 3	Basic unit instruction manual Input card instruction manual Output card instruction manual Connector cover	1 1 1 6
NV1P256C-082	Basic unit (NV1P-082)	256 I/O points (DCI:128, Tr:128) Input card: NV1X3204 x 4 Output card: NV1Y32T05P1 x 4	Basic unit instruction manual Input card instruction manual Output card instruction manual Connector cover	1 1 1 8

■ Extension cable type

Dedicated cable for connecting the basic unit of version
1001 or later and expansion unit.

| Type	Description		Supplied accessory	
			Accessory	Qty.
Extension cable	NJ-EC0030	0.3m cable (straight cord)	Screwdriver	1
	NS-EC0060	0.6m cable (straight cord)	Screwdriver	1
	NS-EC0100	1.0m cable (straight cord)	Screwdriver	1

Section 2 System Configuration

Section 2 System Configuration
2.1 Introducing the F55 Series

The F55 series comes in various forms which are suitable for system expansion, e.g., independent, distribution, and expansion systems. By using the FPL (F-series Programming Language) which is commonly used by the MICREX-F series and the field network system (T-link system) which is developed by Fuji Electric, high-performance systems can be configured with low cost while satisfying customer needs.
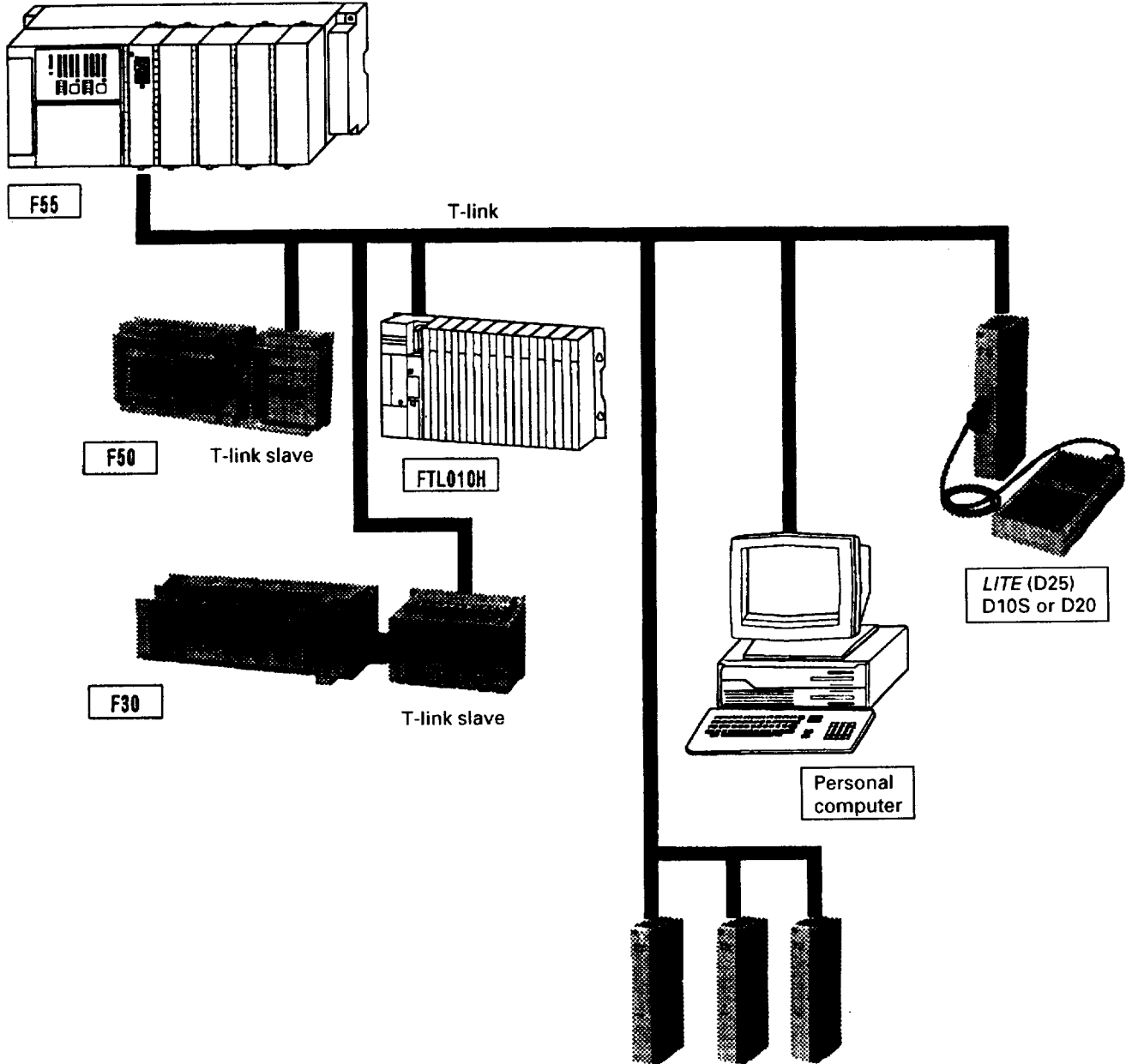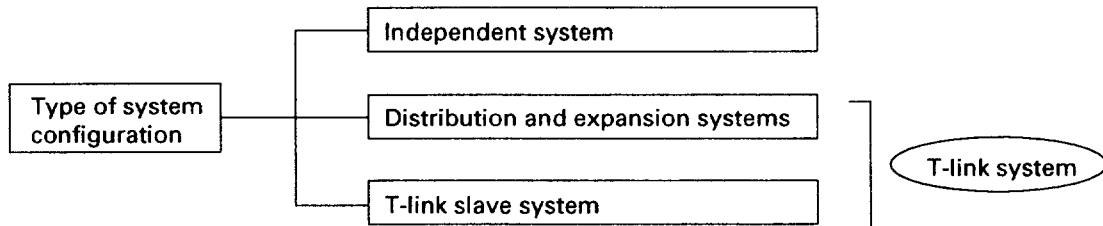

*When configuring a T-link system, the T-link master interface card (NV1L-TL1) must be installed in the basic unit.

In addition to stand-alone system, the F55 series can be configured as a distributed system (T-link system) using the unique field network system. *However, when* *configuring a T-link system, the T-link master card (NV1L-TL1) must be installed in the basic unit interface.*

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                              ┌──────────────────────────────────────┐
                           ┌──│ Independent system                   │
                           │  └──────────────────────────────────────┘
┌─────────────────┐        │  ┌──────────────────────────────────────┐ ┐
│ Type of system  │────────┼──│ Distribution and expansion systems   │ │    ╭───────────────╮
│ configuration   │        │  └──────────────────────────────────────┘ ├──<  T-link system  >
└─────────────────┘        │  ┌──────────────────────────────────────┐ │    ╰───────────────╯
                           └──│ T-link slave system                  │ ┘
                              └──────────────────────────────────────┘
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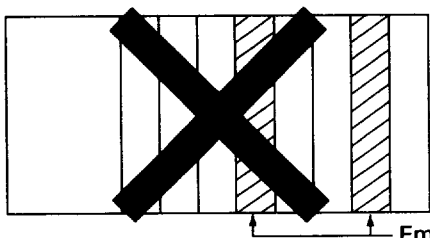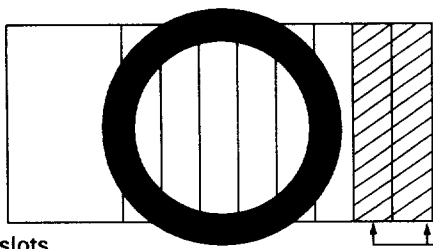
System name	Description
Independent system	Mounts one to eight I/O cards inside the basic unit.
Distribution and expansion system (T-link system)	Allows distribution and expansion of I/O level by connecting I/O units on remote locations and the PC via the T-link. This system allows configuration of remote I/O and T-link slave systems.

Note: With the T-link system, an optical link system (using optical fibers) can be configured by relaying optical converter.

2.2 Types of System Configuration

2.2.1 Independent system

An example stand-alone system and restrictions on the system are shown in the following table.

Basic unit	NV1P-042	NV1P062	NV1P-082
Maximum number of cards mounted	4	6	8
Example system configuration	* The above example shows eight 16-point I/O cards mounted.		
Restrictions	Install I/O cards from the leftmost position toward the right. Avoid making any empty slots between cards. * Presence of empty slots is regarded as a fatal fault when the power is turned on. When the system is diagnosed by means of a loader (D20), the following screen appears. The 5V DC power for internal circuit in each card is supplied from the processor via the rack. For power consumption and other operating conditions of each card, see Section 3, "Specifications".		
Word address assignment for each card	Each of I/O and function cards has different number of occupied words. (See Section 3.) Inside the unit, word address is assigned in order of WB0, WB1, and WB2 from the processor side. (For details, see subsection 2.3.2, "Address Assignment".) When direct access is defined, word addresses from W24 on are occupied. For details, see the user's manual <Instructions> (FEH160).		

2.2.2 Expansion system

An example expansion system and restrictions on the system are shown in the following table. (Basic unit case version 1001 or later)

Basic unit	NV1P-042	NV1P-062	NV1P-082
Expansion unit	NV1E-042	NV1E-062 *Under development*	NV1E-082
Maximum number of cards mounted	4	6	8

Example system configuration	

F55 processor rack / Mount location dedicated for the T-link master card

	WB0	WB1	WB2	WB3	WB4	WB5	WB6	WB7
	B0 to BF	B10 to B1F	B20 to B2F	B30 to B3F	B40 to B4F	B50 to B5F	B60 to B6F	B70 to B7F

(All addresses shown are example addresses for 16-point I/O cards.)

(Basic unit)

Extension cable (1m max.)

F55 expansion unit (with power supply) / Blank cover (unused)

	WB8	WB9	WB10	WB11	WB12	WB13	WB14	WB15
	B80 to B8F	B90 to B9F	B100 to B10F	B110 to B11F	B120 to B12F	B130 to B13F	B140 to B14F	B150 to B15F

(Expansion unit)

* Address assignment is made continuously from the basic unit to expansion unit.

Maximum number of I/O points	512 (Basic unit: 32 x 8 slots, Expansion unit: 32 x 8 slots)
Restrictions	Install I/O cards from the leftmost position toward the right. Avoid making any empty slots between cards. The 5V DC power for internal circuit in each card is supplied from the processor via the rack. For power consumption and other operating conditions of each card, see Section 3, "Specifications". Note that some cards (using interrupt) cannot be mounted on the expansion unit. • High-speed counter card (NV1F-HC1) • External interrupt card (NV1F-YP1) Be sure to turn on the power of the expansion unit first and then the power of the basic unit. (They can be turned on at the same time.) If the power of the basic unit is turned on first, the following conditions result. • The system operates only with the basic unit with the expansion unit not recognized. • In some cases, some I/O slots on the expansion unit are recognized as empty slots, resulting in direct connection I/O failure. • Be sure to turn off the power of the basic unit and then the power of the expansion unit. (They can be turned off at the same time.) If the power of the expansion unit is turned off first, a bus error may occur.
Word address assignment for each card	Each of I/O and function cards has different number of occupied words. (See Section 3.) Inside the unit, word address is assigned in order of WB0, WB1, and WB2 from the processor side. (For details, see subsection 2.3.2, "Address Assignment".) When direct access is defined, word addresses from W24 on are occupied. For details, see the user's manual <Instructions> (FEH160).

2.2 Types of System Configuration

2.2.3 Distribution system (T-link system)

An example distribution system and restrictions on the system are shown in the following table.

When configuring a T-link system, the T-link master interface card (NV1L-TL1) must be installed in the basic unit.

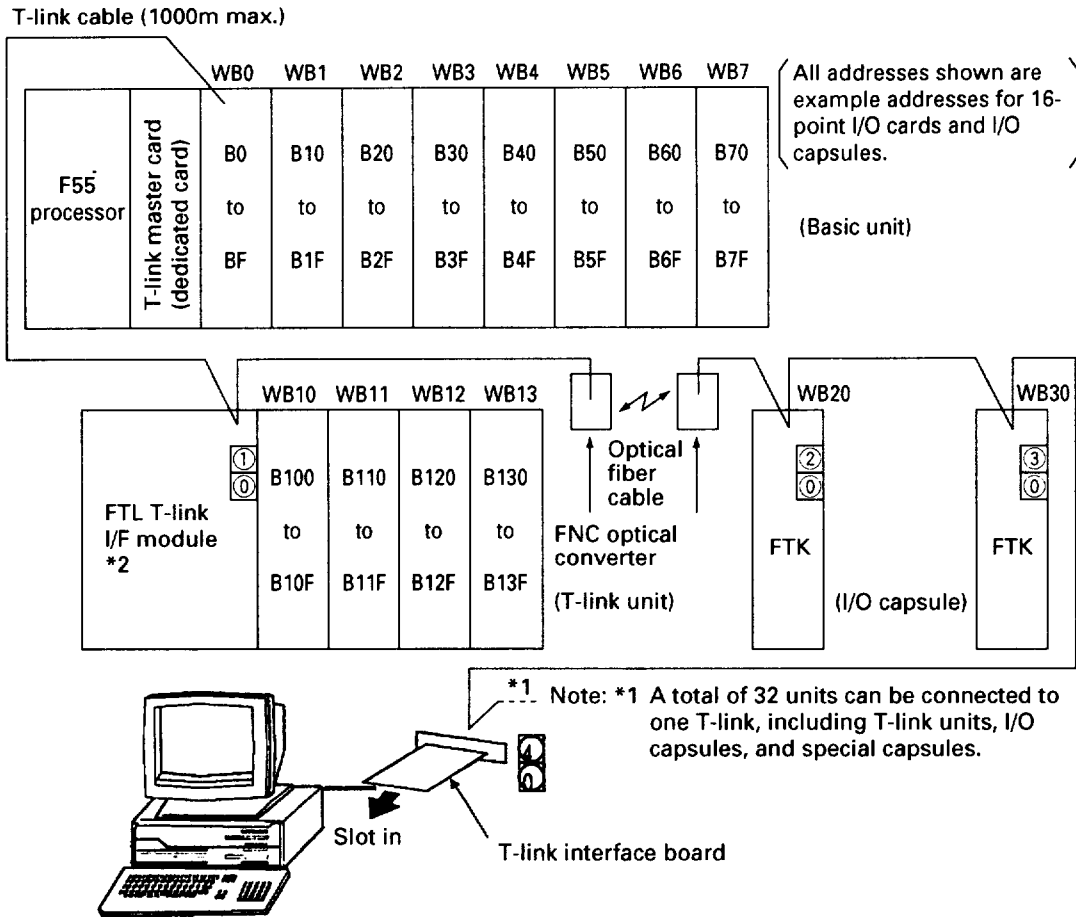| Example system configuration	
	T-link cable (1000m max.) Note: *2 The I/O modules for the F55 series cannot be used on the T-link I/F module base board.
Maximum number of I/O points	1600
Restrictions	Install I/O cards from the leftmost position toward the right. Avoid making any empty slots between cards. The 5V DC power for internal circuit in each card is supplied from the processor via the rack. For power consumption and other operating conditions of each card, see Section 3, "Specifications". Each of I/O and function cards has different number of occupied words. (See Section 3.)
Word address assignment for T-link devices	Inside the unit, word address is assigned in order of WB0, WB1, and WB2 from the processor side. (For details, see subsection 2.3.2, "Address Assignment".) When direct access is defined, word addresses from W24 on are occupied. For details, see the user's manual <Instructions> (FEH160). For T-link devices, the word address consists of the address set by the address setting device and a trailing word address.

2.2.4 T-link slave system

An example T-link slave system and restrictions on the system are shown in the following table.

When configuring a T-link slave system, the T-link slave card (NV1L-TS1) must be installed in the basic unit.

Example system configuration	
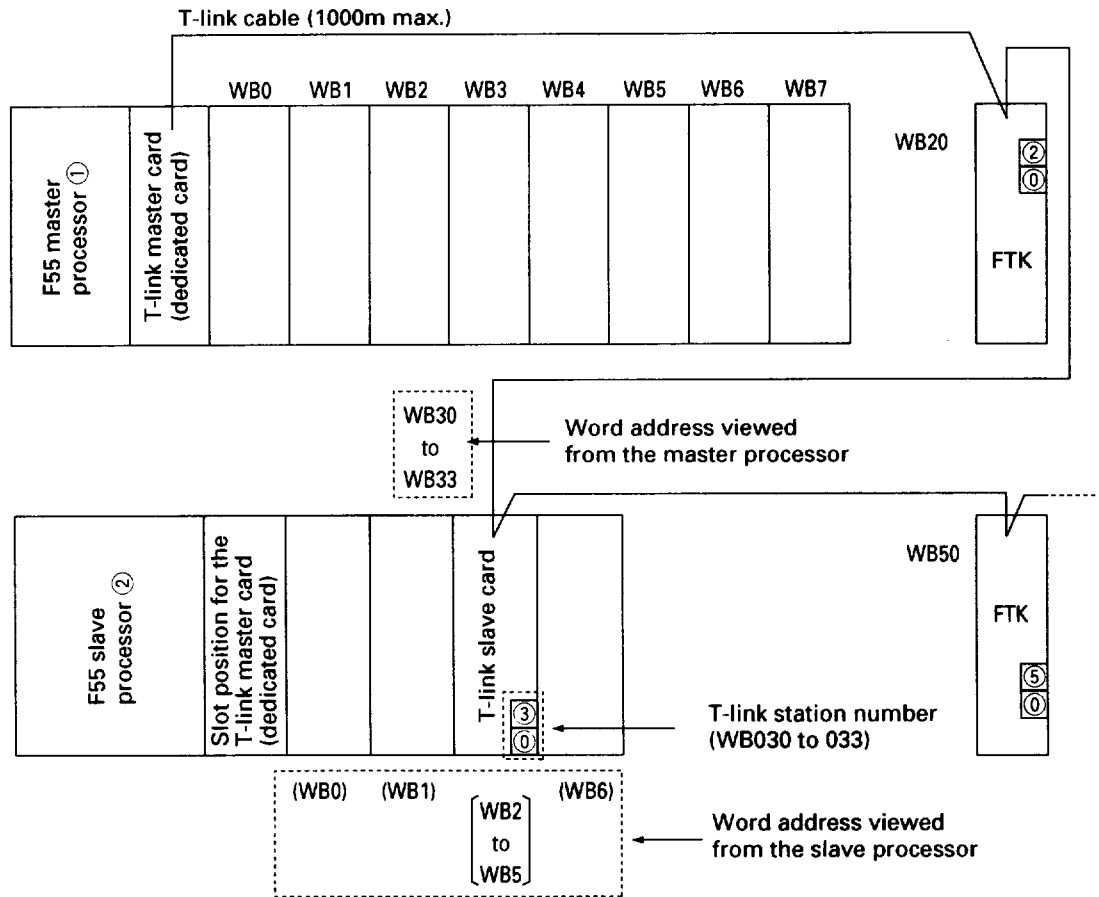
- All addresses shown are example addresses for 16-point I/O cards and I/O capsules.
- Addresses without ( ) are addresses viewed from processor ① and addresses with ( ) are addresses viewed from processor ②.

Word address assignment for T-link devices	On the front side, the T-link slave card is provided with an I/O word address setter for setting addresses viewed from the master processor. The following describes the address assignment for the system configuration above.

- The address for the T-link slave card installed in the rack of processor ② is set to "30".
- With the above example, processor ② is a slave processor and processor ① master processor, and the address relationship is as follows:

Address viewed from the slave processor	Address viewed from the master processor
WB002 (input)	WB032 (output)
WB003 (input)	WB033 (output)
WB004 (output)	WB030 (input)
WB005 (output)	WB031 (input)

- The number of I/O words can be changed by the T-link slave card setting. With the above example, 2 words are set for input and output.
- The address set with the address setter is assigned from the input side viewed from the master processor (or output side viewed from the slave processor).

2.3 Address Assignment

2.3.1 Memory map

The memory map of the F55 series processor is as follows:

Bit data memory	Word data memory	User program memory

Bit data memory

Word address	Signed BCD 4 digit (Binary 16 bit)		
WB000 ⋮ WB099	I/O relay 1600 points *1		
WB100 ⋮ WB399	I/O relay 4800 points *2 "B"	0	
WM000 ⋮ WM255	Auxiliary relay 4096 points "M"	1	
WK000 ⋮ WK063	Keep relay 1024 points "K"	2	
WF000 ⋮ WF069	Special relay 1120 points "F"	3	
WA000 ⋮ WA019	Annunciator relay 320 points "A"	4	
	Differential relay 1024 points "D"	5	
	Timer output (0.01 sec) 256 points "T"		
	Timer output (0.1 sec) 256 points "T"		
	Counter output 256 points "C"		

Data module No. → 0

Identifier → "B"

Unsigned BCD 2 digit

WS00 ⋮ WS99	Step control relay { S00.00 to S99.99 }	8

Word data memory

Address	Signed BCD 8 digit (Binary 16 bit)	
TS000 ⋮ TS255	Timer set value 256 words "TS"	10
TR000 ⋮ TR255	Timer current value 256 words "TR"	11
CS000 ⋮ CS255	Counter set value 256 words "CS"	12
CR000 ⋮ CR255	Counter current value 256 words "CR"	13
W9.0000 ⋮ W9.0255	When 0.1 sec timer is used, this area is used as the current value.	9
BD0000 ⋮ BD0255	Data memory "BD"	14
	Binary 16 bit	"W30~"
	A total of 4096 words when 1 word for data memory	30 to 109
W24.0000 ⋮ W24.0255	Direct connection I/O 256 words "W24"	24 *3
W26.0000 ⋮ W26.63	Differential relay previous value "W26"	26
W124.0 ⋮ W124.5	User display "W124"	124
W125.0 ⋮ W125.5	Calendar "W125"	125 *4

Data module No. →

File No. → 30 to 109

User program memory

Data module No.

System definition
User program 10578 steps

*1 Maximum I/O connections: 1600 points
  Unused memory can be used as auxiliary memory.
*2 Can be used only as auxiliary memory.
*3 Up to 256 words for direct connection I/O area
  Up to 160 words are used for basic unit case versions 0001 to 0999 and 256 words for basic unit case version 1001 or later. The expansion unit is also used as direct connection I/O area.
*4 The calendar function can be used only when the T-link master interface card (NV1L-TL1) is installed on the basic unit.

2.3.2 Address assignment

The F55 series is provided with up to 100 words (WB000 to WB099, 1 word = 16 bits) on the T-link, to each address a card capsule or other PIO (I/O data operating on the F55 processor) is assigned.

(1) Address conventions (on the T-link)

① Address assignment is made automatically from the top of the I/O area, depending on the number of points occupied by each slot. However, it is made on a 16 point (1 word) basis. For 8 point I/O areas, 8 points from bits 8 to F are regarded as empty points.

② When a card occupying two or more words is connected, the address for the next card is shifted by the excessive amount of words.

③ Addresses for the capsule type are set using the setter mounted on the front side. Addresses can be set in an arbitrary way, but address duplication is inhibited.

④ The address for the module to the right of the T-link interface module is equal to the number set in the setter which is mounted on the front side of the T-link interface module. Subsequent address assignment is made in order of installation toward the right.

● Example setting of the address setting switch on the FTK/FTL

Upper dial	⟲	⟳
Lower dial	⟳	⟳
Set value	05	35

⑤ The number of connection words in the I/O area is 1600 points (100 words) maximum.

⑥ The number of connectable capsules is as follows:

Processor	Program loader	I/O capsule T-link interface T-link equipment
1 unit	2 units per link	Up to 32 units

(2) Address assignment in the same unit as processor

① Simultaneous scan mode (Example)

		0	1	2	3	4	5	6	7
F55	T-link master (option)	WB 0	WB 1 . 2	WB 3	WB 4	WB 5 . 6	WB 7 . 8	WB 9	WB 10
		16	32	16	16	32	32	16	16

← Number of I/O points

The B area channel is fixed to "0" and address assignment is made from slot No.0 on.
Address assignment for the expansion unit is made continuously with that for the basic unit (basic unit case version 1001 or later).

② Direct access mode (fixed)

		0	1	2	3	4	5	6	7
F55	T-link master (option)	W24.0 to 15	W24.16 to 31	W24.32 to 47	W24.48 to 63	W24.64 to 79	W24.80 to 95	W24.96 to 111	W24.112 to 127

A total of 16 words are fixed to each slot. Address assignment is made within a range from W24.000 to W24.127. In this case, address assignment for the T-link interface module can be started from WB0.

2-9

2.3 Address Assignment

③ Direct access mode (fixed)
(Basic unit case version 1001 or later)

	T link master (option)	1	2	3	4	5	6	7	8	
F55 (processor rack)		W24.0 to 15	W24.16 to 31	W24.32 to 47	W24.48 to 63	W24.64 to 79	W24.80 to 95	W24.96 to 111	W24.112 to 127	█

Basic unit

Additional 1 unit installed

	Blank cover (unused)	8	9	10	11	12	13	14	15	
F55 (expansion rack)		W24.128 to 143	W24.144 to 159	W24.160 to 175	W24.176 to 191	W24.192 to 207	W24.208 to 223	W24.224 to 239	W24.240 to 255	█

Expansion unit

A total of 16 words are fixed to each slot. Address assignment is made within a range from W24.000 to W24.255. In this case, address assignment for the T-link interface module can be started from WB0.
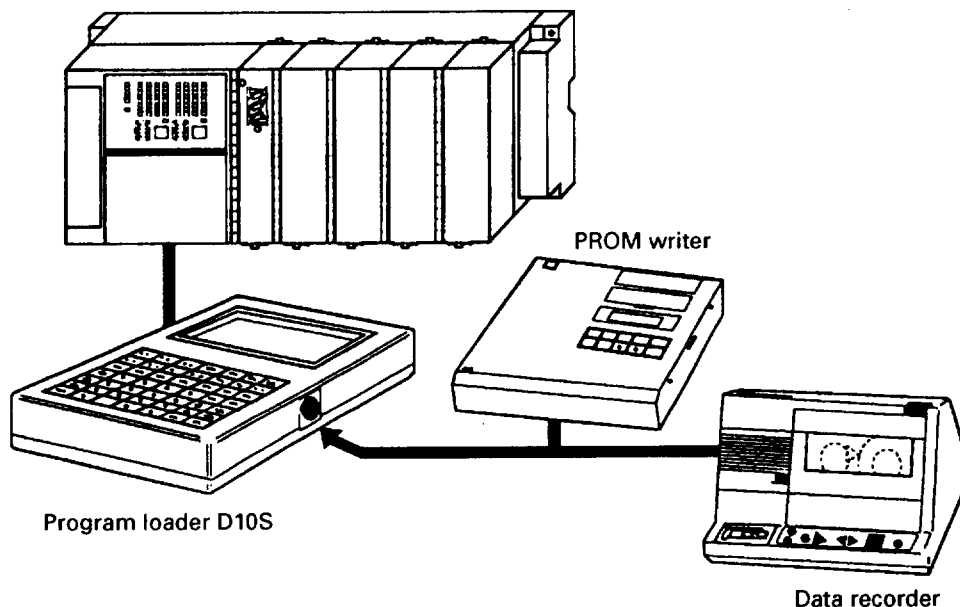
2.4.1 Types of peripheral devices

The following types of program loader are offered for the F55 series. Select a type which best suits your application.

Name	Typical type, ( ) indicates old type	Remarks
D10S	NL1H (FLD010S-A10)	Handy type
D20	NL2H (FLD020A-A10)	Hand-held type
Hardware: LITE Software: D25	NH3H (FLT-SS-A10)	Laptop type
Personal computer loader	NL4N-98SS☐ (FLT-FD98P☐) : NEC PC-98 series NL4N-ATSS☐ (FLT-FDIAT☐) : IBM PC/AT series NL4N-J3SS☐ (FLT-FD31J☐) : Toshiba J3100 series NL4N-FMSS☐ (FLT-FDFM☐) : Fujitsu FMR series	Operates on a personal computer

* For version numbers accommodating each personal computer, see subsection 1.2.

2.4.2 D10S
■System configuration

PROM writer

Program loader D10S

Data recorder

■ Component

Name	Typical type, ( ) indicates old type	Remarks

Data recorder	Use a commercial data recorder.
	Recommended:
	    PQ8030, RQ8030, Matsushita
	    MR-22DR, Sanyo
	    DR-20, Aiwa
		Used to store user programs on CMT (cassette magnetic tape). If the program capacity exceed 5kW, use of floppy disks is recommended.

PROM writer	NL2V-PRW (FRW100A)	Used to write user programs to ROMs.

2.4 Peripheral Devices

2.4.3 D20
■ System configuration

■ Component

Name	Typical type, ( ) indicates old type	Remarks
Data recorder	Use a commercial data recorder. Recommended: PQ8030, RQ8030, Matsushita MR-22DR, Sanyo DR-20, Aiwa	Used to store user programs on CMT (cassette magnetic tape). If the program capacity exceed 5kW, use of floppy disks is recommended.
PROM writer	NL2V-PRW (FRW100A)	Used to write user programs to ROMs.
Printer	NL2V-PRT (FLP100A)	Used to print user programs.
3.5" micro floppy disk unit	NL2V-FFD (FFD100A-A10)	Used to store user programs in floppy disks.

2.4.4 D25 (LITE)
■ **System configuration**

(Front)

(Back)

External CRT

JIS keyboard

Data recorder
(cassette MT)

Serial printer

Printer
(EPSON VP-800, 1000, etc.)
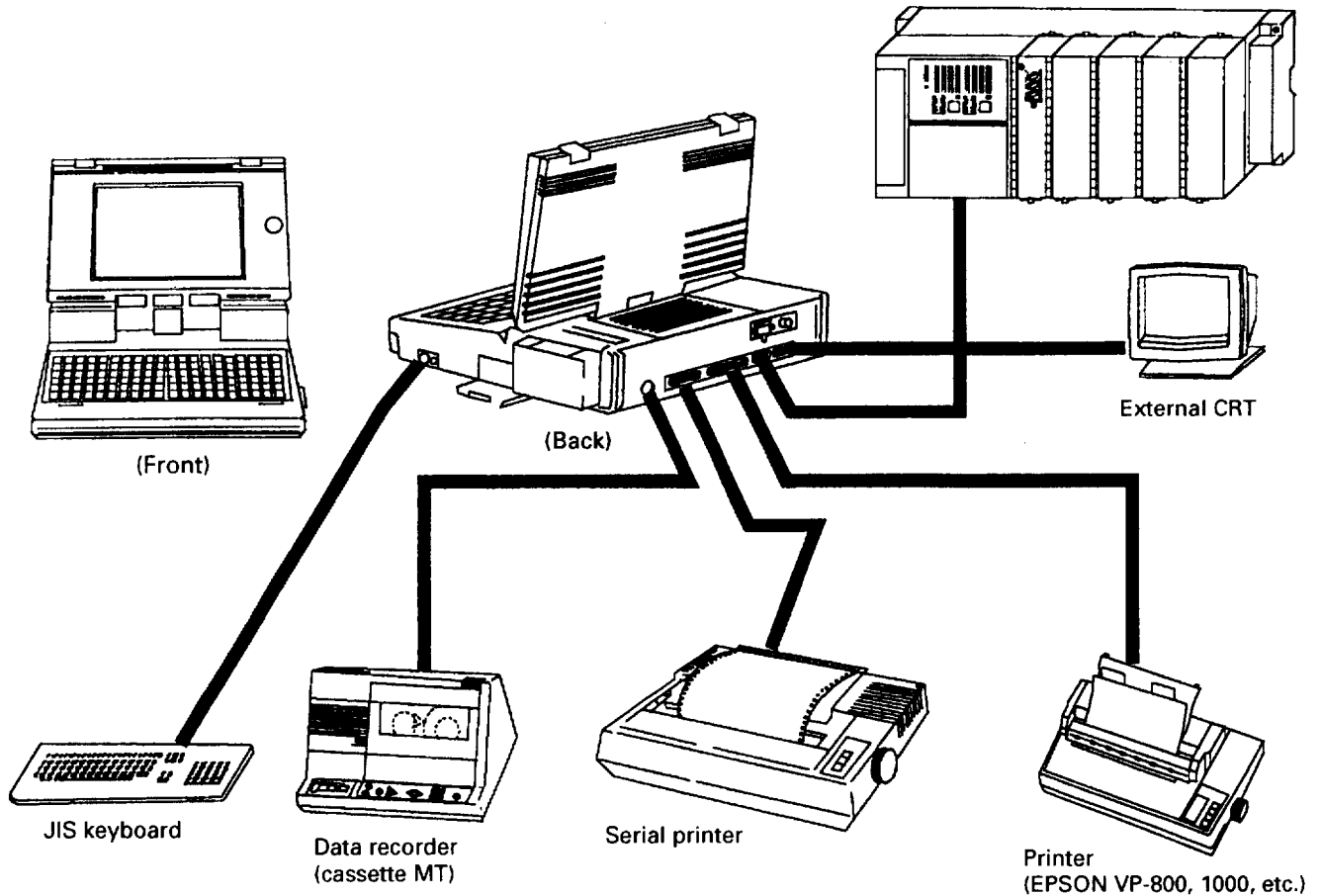
■ **Component**

*PROM writer and floppy disk drive are built in.

Name	Typical type	Remarks
Data recorder	Use a commercial data recorder. Recommended: PQ8030, RQ8030, Matsushita MR-22DR, Sanyo DR-20, Aiwa	Used to store user programs on CMT (cassette magnetic tape). If the program capacity exceed 5kW, use of floppy disks is recommended.
JIS keyboard	Use a commercial product. For details, see the USER'S MANUAL of PROGRAM LOADER LITE <LEH915>.	Used to enter comments from outside the loader.
Printer		Used to print user programs.
External CRT		Used to provide large screen display.

2.4 Peripheral Devices

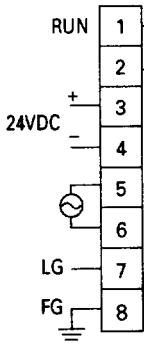| Name	Typical type, ( ) indicates old type	Remarks	
Personal computer	NEC : PC-98 series	For details on personal computers, see each individual user manual.	
	IBM : PC/AT series		
	Toshiba : J3100 series		
	Fujitsu : FMR series		
Personal computer inter-face board	NH3L-TB198H (FFU098B)	For PC-98 series	Installed in an expansion slot of the personal computer to transfer data between the personal computer and the PC via the T-link.
	NH3L-TB1ATH (FFU080A)	For PC/AT series For J3100 series	
	NH3L-TB1FMH (FFU050A)	For FMR series	
General-purpose interface capsule	NH2L-RS1 (FFK120A-C10)	Connected to the personal computer through the RS-232C interface to transfer data between the personal computer and the PC via the T-link.	
Loader conver-sion adapter	NL4V-ADT (FLT-ASFK)	Connected to the personal computer through the RS-232C interface to transfer data between the personal computer and the PC via the T-link.	

Section 3 Specifications

Section 3 Specifications

3.1 Basic Specifications

3.1.1 Power supply specification

Item		Description	
Power supply	Rated voltage (operating voltage range)	100 to 200V AC (85 to 264V AC)	RUN — 1, 2
	Rated frequency (operating frequency range)	50/60Hz (47 to 63Hz)	24VDC +/− 3, 4 — Used to connect 24V DC for relay card driving (19.2 to 26.4V DC) *Be sure to apply this voltage when using the relay card.
	Allowable instantaneous power failure period	AC: 1 cycle or less	
	Waveform distortion	5% or less (square wave not applicable)	5, 6 — 100 to 200V AC
	Power consumption	AC: 40VA max.	
	Inrush current	AC: 40A or less (10ms or less)	LG — 7
	Leakage current	1mA or less	FG — 8

3.1.2 General specifications

The specifications common to the main unit, I/O cards, and function cards are shown in the table below.

Item		Specification
Dielectric strength		1500V AC, 1 minute, between external terminals and ground
Insulation resistance		5MΩ or more with a 500V DC megger, between external terminals and ground
Physical environment	Operating temperature	0 to +55°C
	Storage temperature	-20 to +70°C
	Relative humidity	20 to 90%RH (without condensation)
	Dust	No conductive dust present.
	Corrosive gas	No corrosive gas present. No organic solvent, leaked cutting oil, or water droplets present.
Mechanical conditions	Resistance to vibration	JIS C 0911, crossover frequency 57Hz, 19.6m/s^2 (2G), 2 hours in 3 axis directions*
	Resistance to shock	JIS C 0912, test procedure 1-No. 3, malfunction shock 147 m/s^2 (15G), endurance shock 294 m/s^2 (30G), 2 times in 3 axis directions*
Electrical conditions	Noise immunity	1500V by noise simulator, rising time 1ns, pulse width 1µs, 10 minutes
	Resistance to discharge of static electricity	JIS B 3501 ESD-4, 8kV contact discharge, 16kV gaseous discharge
Installation conditions	Structure	Mounted on a rack or built-in panel
	Cooling system	Self cooling
	Ground	Resistance of 100Ω or less
	Mass	Approx. 2300 g (with 16-point output card x 8 and T-link master card)
	Dimensions	380mm (W) x 95mm (H) x 97mm (D) (with output card x 8) (See subsection 4.2.)

* With the unit mounted on the control panel using mounting screws. When attaching the rail, be careful not to apply vibration or shock.

The capacity of the basic unit, expansion unit, and
T-link master card is shown in the table below.

Unit type	Supply voltage	Output voltage	
		5V DC *1	24V DC external power supply *2
NV1P-042	100 to 200V AC	2.5A	None
NV1P-062			
NV1P-082			
NV1E-042			
NV1E-062			
NV1E-082			

*1 Note that the output current for 5V DC includes the current
consumption of the basic unit and the T-link master interface card.
Take this point into account when calculating the current capacity.

*2 The 24V DC supply is used for a relay output card and other relay
driving devices or input devices (proximity and photoelectric
switches). If this power supply is not present, supply 24V DC power
externally through the dedicated terminal.

Calculating the current capacity that can be supplied to I/O cards

The current capacity that can be supplied to I/O cards is
calculated by subtracting the current consumed by
internal logic of the basic unit and the current con-
sumed by the D10S program loader or NL4V-ADP
loader adapter* from the current capacity of the 5V DC
power supply.
When the D10S program loader or NL4V-ADP loader
adapter is connected to the PC or T-link interface, it is
powered from the processor or T-link. Therefore, if
these devices are not to be used, subtracting the
current consumption is not necessary. A loader LITE or
D20 program is provided with a power supply,
subtraction of current consumption need not be taken
into account. The current consumption of the basic unit
is shown in the table below.

Type	5V DC current consumption
Basic unit NV1P-042/062/082 (case versions 0001 to 0999)	430mA
Basic unit NV1P-042/062/082 (case version 1001 or later)	475mA
Basic unit NV1E-042/062/082 (case version 1001 or later)	400mA
T-link master interface card NV1L-TL1 (basic unit case versions 0001 to 0999)	60mA
T-link master interface card NV1L-TL1 (basic unit case version 1001 or later)	90mA
Program loader NL1H (D10S)	600mA
Loader adapter NL4V-ADP*	300mA

* For connection to a personal computer loader

Selecting power supply

When selecting 5V DC and 24V DC power supply units
and I/O cards to be mounted on the same unit, observe
the following conditions:

(Current consumption of basic unit or expansion unit) + (Current consumption of T-link master interface
card) + (Current consumption of I/O cards) ≤ Current capacity of power supply

3.1 Basic Specifications

The weight of the basic unit, expansion unit, and the
T-link master interface card is as follows:

Unit, card	Mass
Basic unit NV1P-042/062/082 (case versions 0001 to 0999)	Approx. 790/860/930g *1
Expansion unit NV1P-042/062/082 (case version 1001 or later)	Approx. 1000/1170/1340g *1
Expansion unit NV1E-042/062/082	Approx. 860/1230g *2
T-link master card NV1L-TL1	Approx. 80g

*1 With no option or I/O cards mounted on the basic unit
    (blank covers on slots for T-link master interface card and I/O cards)
*2 With no I/O cards mounted on the expansion unit
    (blank covers on slots for T-link master card and I/O cards)
    The NV1E-062 is under development.

Item		Specification	Remarks
Control system		Cyclic operation, fixed-cycle interrupt, external interrupt	Stored program system
I/O connection system		Direct connection I/O, remote I/O (T-link)	
I/O control system		Scan synchronization refresh, direct refresh	
CPU		Processor specialized for sequence, 16 bit general-purpose processor	
Memory type		1M byte CMOS RAM standard 1M byte EPROM for expansion (basic unit case versions 0001 to 0999)	*1
Programming language		Ladder diagram (control-oriented language: FPL)	F-series Programming Language
Instructions		Sequence instructions: 22 Data instructions: 76	Sequence instruction: Used for contacts Data instruction: Used for transfer
Word length of instructions		Sequence instructions (contacts): 1 step/instruction Data instructions (transfer): 3 steps/instruction	
Execution speed		Sequence instructions (contacts): 0.8μs/instruction Data instructions (transfer): 189μs/instruction	*2
Program memory capacity		10578 steps	
Number of I/O points		1600 points maximum (when T-link system is used)	*3
Relay	I/O relay (B)	1600 points (B0000 to B099F) 4800 points (B1000 to B399F)	Can be used as an auxiliary relay. Can be used only as an auxiliary relay.
	Direct I/O (W24)	160 words (basic unit case versions 0001 to 0999)	1 word = 16 bits *4
	Auxiliary relay (M)	4096 points (M0000 to M255F)	
	Keep relay (K)	1024 points (K0000 to K064F)	
	Differential relay (D)	1024 points (D0000 to D064F)	
	Special relay (F)	1120 points (F0000 to F069F)	
	Annunciator relay (A)	320 points (A0000 to A019F)	
	Timer (T)	0.01 sec 256 points (T0000 to T0255) 0.1 sec 256 points (T512 to 767)	BCD 8 digit
	Counter (C)	256 points (C0000 to C0255)	
	Step control relay (S)	100 steps x 100 sets (S00.00 to S99.99)	
	Data memory (BD)	4k double words	1k: 1024 double words 1 double word = 32 bits
	File memory (W30)		
Memory backup		Backup range: program memory and data memory Battery used: Lithium battery (life expectancy 5 years) Backup period: 5 years (at 25°C)	
Available memory		EPROM (ROM card required)	*1
Data type		BCD: -7999 to 7999 (16 bits), -79999999 to 79999999 (32 bits) Binary: -32768 to 32767 (16 bits)	
Diagnostic functions		Execution slow-down monitoring, battery voltage drop detection, program syntax check, system configuration monitoring, module fault monitoring	
Security functions		By password (4 digit number, program monitoring not allowed at setting)	4 digit hexadecimal (0 to F)
Other functions		Calendar function	*5

*1 For basic unit case version 1001 or later, optional EPROM and EEPROM cards can be installed.

*2 The execution time for basic unit case version 1001 or later is 0.5μs/sequence instruction (contact) or 120μs/data instruction (transfer).

*3 For basic unit case versions 0001 to 0999, up to 256 points (32 points x 8 slots) for basic unit only; for basic unit case version 1001 or later, up to 512 points (32 points x 8 slots + 32 points x 8 slots) for basic and expansion units

*4 For basic unit case version 1001 or later, 256 words for basic and expansion units

*5 The calendar function can be used only when the T-link master interface card (NV1L-TL1) is installed on the basic unit. (Basic unit case version 1001 or later)

3.3 I/O Specifications

3.3.1 Notes on selecting I/O devices

The following notes describe the selection of I/O devices of card and capsule types used with the F55 series. I/O devices of the card type are mounted on the rack, and those of the capsule type are installed alone on the T-link.

(1) Notes on selecting input devices (card type and capsule type)

① Input power supply specifications
Because the DC input of the capsule type incorporates a rectifier circuit, it can be used either with positive common or negative common.
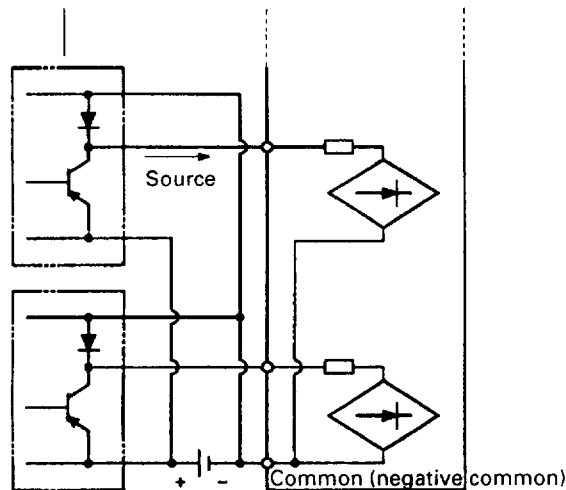
- Example circuit of input devices with sink-type transistor output

- Example circuit of input devices with source-type transistor output
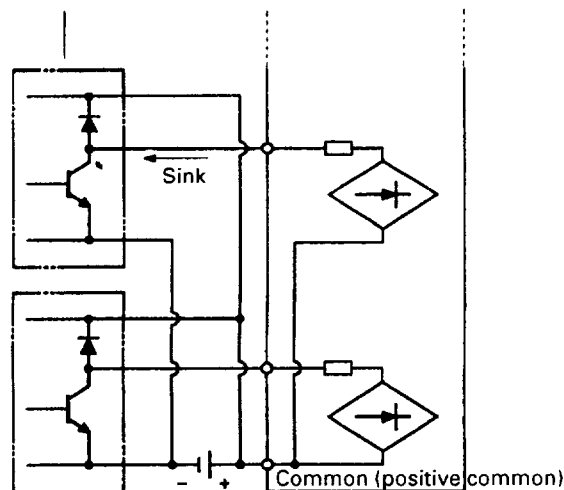
Input devices	PC input
Sink-type (negative common) transistor output	Common (positive common)

Remarks: Commonly used in Japan.

Input devices	PC input
Source-type (positive common) transistor output	Common (negative common)

Remarks: Commonly used in Europe

When the input DC voltage of the PC is 24V DC, the 24V DC power supply mounted on the following I/O capsules can be used.

- Input cards and capsules whose 24V DC power supply can be used

24V DC power supply	Input card/capsule
Power supply mounted	NH2X1613 (FTK110A-C10), NH2X1604 (FTK113A-C10) NH2X3213 (FTK120B-C10), NH2X3204 (FTK123B-C10) NH2W32 (FTK611B-C10), NH2W1613 (FTK616A-C10)
Auxiliary power supply module	All 24V instruments

* With the NH2X3213/3204/NH2W32, the number of ON points is limited when using the 24V power supply mounted on I/O capsules.

• External power supply specifications for input cards and capsules

| Input specifications	Response time	Type	Power supply specifications	DC voltage: average value AC voltage: rms value
12 to 24V AC/DC	10ms	NH2X1613 (FTK110A-C10), NH2X3213 (FTK120B-C10), NH2W1613 (FTK616A-C10)	Smoothing DC power supply Single-phase full-wave rectified DC power AC power supply	9.6 to 26.4 (30)V 9.6 to 26.4 (30)V 9.6 to 26.4 (30)V
12 to 24V DC	3ms	NH2X1604 (FTK113A-C10), NH2X3204 (FTK123B-C10), NH2W32 (FTK611B-C10)	Smoothing DC power supply Note: NHSX1613, NH2W1613, NH2X1694, maximum input voltage for 16-point input is 30V.	9.6 to 26.4 (30)V
	10ms	NV1X1604, NV1X1604-W NV1X3204, NV1X3204-W	Smoothing DC power supply	8.4 to 26.4V
48V AC/DC	10ms	NH2X1614 (FTK130A-C10)	Smoothing DC power supply Single-phase full-wave rectified DC power AC power supply, 50/60Hz	38 to 60V 38 to 60V 38 to 60V
48V DC	3ms	NH2X1607 (FTK133A-C10)	Smoothing DC power supply	38 to 60V
110V AC/DC	10ms	NH2X0816 (FTK140A-C10)	Smoothing DC power supply Single-phase full-wave rectified DC power AC power supply, 50/60Hz	80 to 140V 80 to 140V 80 to 140V
110V DC	3ms	NH2X0809 (FTK143A-C10)	Smoothing DC power supply	80 to 140V
24V DC	10ms	NV1X3206	Smoothing DC power supply	15 to 26.4V

Note: The type in ( ) in the type column indicates the conventional type.

② Input power supply

As shown in the figure below, the AC input circuit is the capacitor-input type for the purpose of reducing heat in the internal circuit. When an external input device is turned on, inrush current flows, which may cause contact welding of lead switches having a small current capacity.
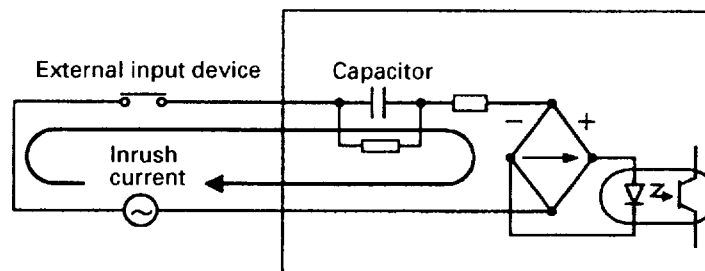
Use switches with an appropriate current capacity, referring to the following table.

• External power supply specifications for input capsules

Input specifications	Type	Input current	
		Nominal current	Inrush current (peak value)
100V AC	NH2X1610 (FTK150A-C10)	Approx. 10mA	150mA or less, time constant of 0.4ms or less (100V AC input)
200V AC	NH2X1611 (FTK160A-C10)	Approx. 10mA	300mA or less, time constant of 0.2ms or less (200V AC input)

Note: The type in ( ) in the type column indicates the conventional type.
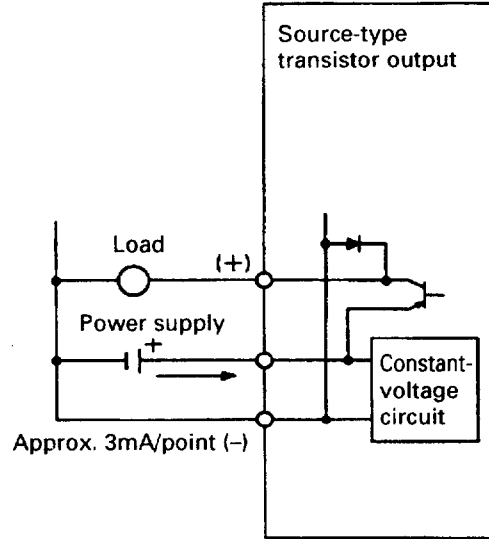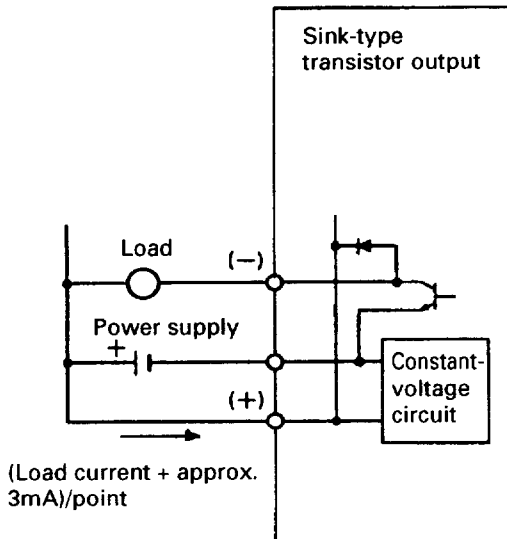
3.3 I/O Specifications

(2) Notes on selecting output devices (card type and capsule type)

① Transistor output

When using transistor output, supply DC power for transistor driving, as shown in the figure below.

• Example circuit of 16-point sink-type transistor output

(Load current + approx. 3mA)/point

When 16 points are all ON: 16 x (load current + 3mA)

• Normally an identical power supply is used both for transistor driving and the load. However, if separate power supply units are used, countermeasures for preventing sneak-circuit formation are required. (See page 3-12.)

• Example circuit of 16-point source-type transistor output

Approx. 3mA/point (–)

• For 32 point transistor output, supply the power externally.
• Specifications of the DC power supply for transistor driving are shown in the table below.

Output specifications		Type *3	Power supply specifications
5 to 12 to 24V DC	Sink	NH2W32 (FTK611B-C10), NV1Y16T05P5, NV1Y32T05P1	Smoothing DC power supply (4.75) 9.6 to 26.4V *1 (Single-phase full-wave rectified DC power supply is not applicable.)
24 to 48V DC	Sink	8NH2Y16T01P2 (FTK210A-C10), NH2Y16T0120 (FTK211A-C10), NH2Y32T (FTK220B-C10)	Smoothing DC power supply (10.2) 19 to 60V *2 Single-phase full-wave rectified DC power supply (10.2) 19 to 60V
	Source	NH2Y16U01P2 (FTK215A-C10), NH2Y16U0120 (FTK216A-C10), NH2Y32U (FTK225B-C10)	Same as above
110V DC	Sink	NH2Y16T02 (FTK240A-C10)	Smoothing DC power supply (40.8) 90 to 140V *2 Single-phase full-wave rectified DC power supply (40.8) 90 to 140V
	Source	NH2Y16U02 (FTK245A-C10)	Smoothing DC power supply (40.8) 90 to 140V *2 (Single-phase full-wave rectified DC power supply is not applicable.)

*1 For 5 to 12 to 24V DC output, the maximum load current becomes 30mA (NH2W32) or 16mA (NV1Y32T05P1) with the voltage in ( ).

*2 Although 24 to 48V DC output and 110V DC output operate on the voltage in ( ), the maximum load current must be reduced as shown in the following section.

*3 The type in ( ) in the type column indicates the conventional type.

② Use with a low-voltage power supply with transistor output

If the maximum load current is reduced, capsule-type transistor output can be used with a low-voltage power supply that supplies voltages lower than the rated operating voltage. (See the following figure and table.)

• Maximum load current when a low-voltage power supply is used

Rated operating voltage and maximum load current		Maximum load current when a low-voltage power supply is used	
24 to 48V (19 to 60V) DC	0.2A	10.2V (12V x 0.85) DC	0.15A
24 to 48V (19 to 60V) DC	2A	10.2V (12V x 0.85) DC	1.5A
110V (90 to 140V) DC	0.2A	40.8V (48V x 0.85) DC	0.15A

• Example of current reduction ratio

Example of 24 to 48V DC, 0.2A

Maximum load current (A)

25% current reduction

External power supply voltage (V DC)
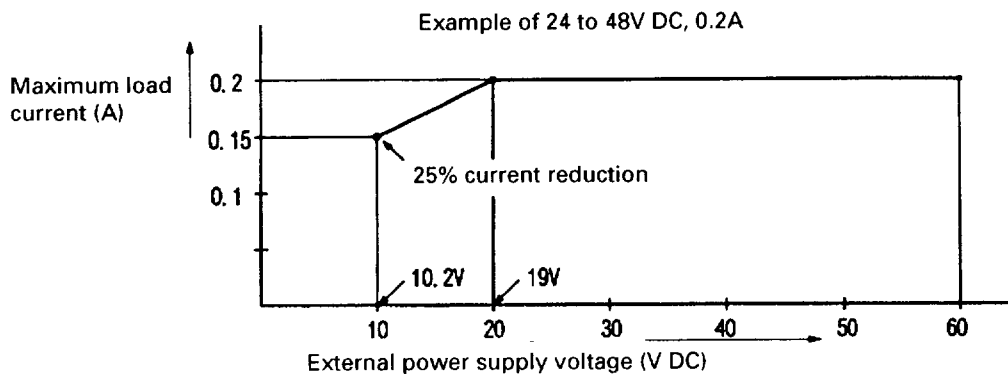
③ High-frequency on/off operation

For applications with high-frequency on/off operation or applications with on/off operation of the inductive load such as operation coil of the electromagnetic contactor, use of triac output is recommended if the operating life of relay output is a crucial factor.

④ Relay output (cards and capsules)

When card-type relay output is used, supply 24V DC externally for relay driving as shown below.

Relay output

Approx. 8.3mA/point

24V DC
(Voltage fluctuation: 24V DC ±10%)
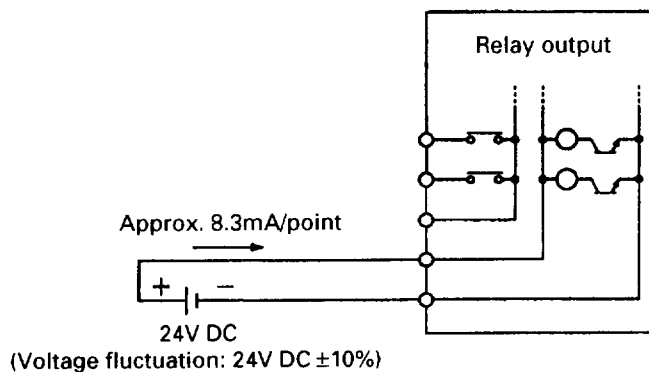
In this case, power must be supplied from the 24V DC input trminal of the basic unit. For capsule-type relay output, supplying this voltage is not necessary because the power supply is built-in.

The relay used for a relay output card is suitable for power driving. With light loads of 12V DC and 3mA or less (low voltage and small current), contact reliability is reduced. In this case use of a DC output card (transistor output type) is recommended.

If relay (contact) output must be used for connection, miniature relays with a contact having high contact reliability (low voltage and small current) are recommended.

Because the relay output card does not incorporate any surge absorbing element (varistor), connect an external CR surge absorber (0.1µF + 100Ω) to protect the internal circuits.

3.3 I/O Specifications

⑤ Common terminal (supply pin)
Because the common terminals for relay output, triac output, DC input, and AC input are electrically isolated, different power supply units can be used for each common terminal.
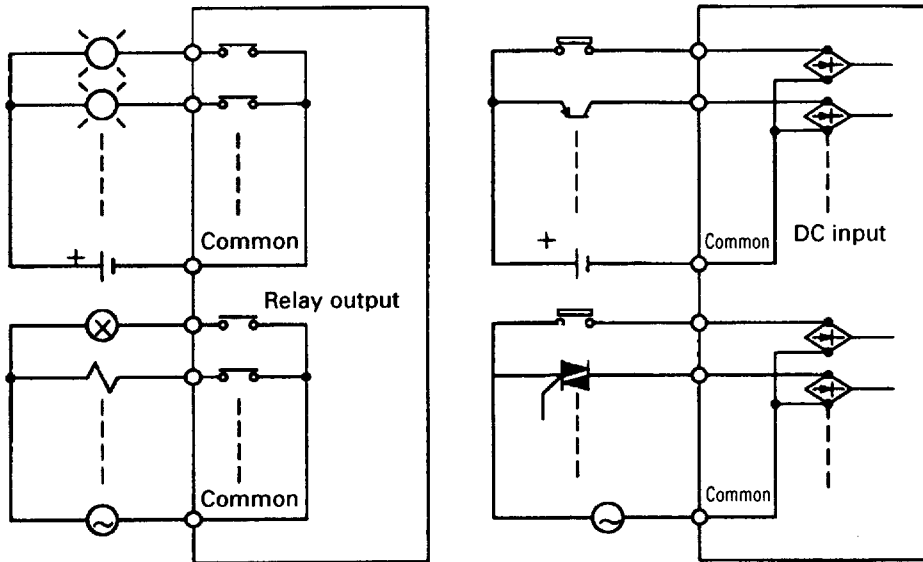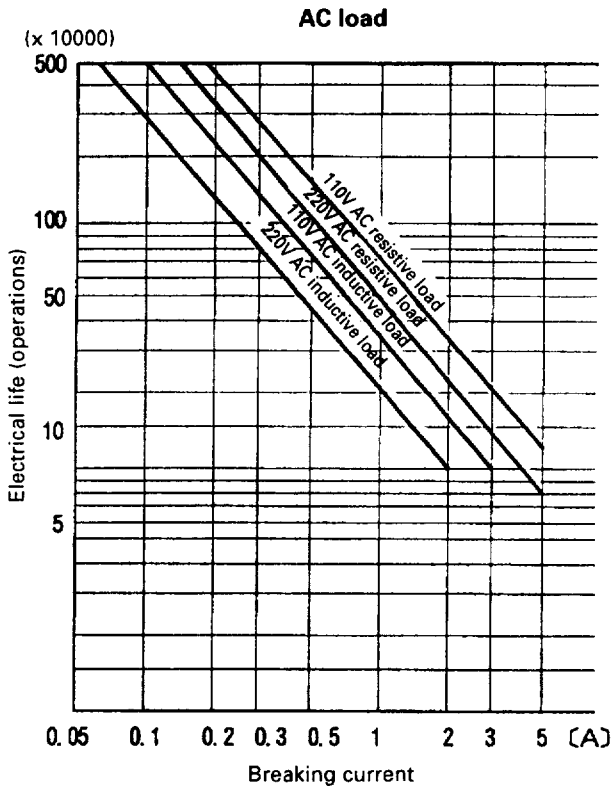

Capsule-type transistor output cannot be used in the same manner as above because the common terminals are not isolated.
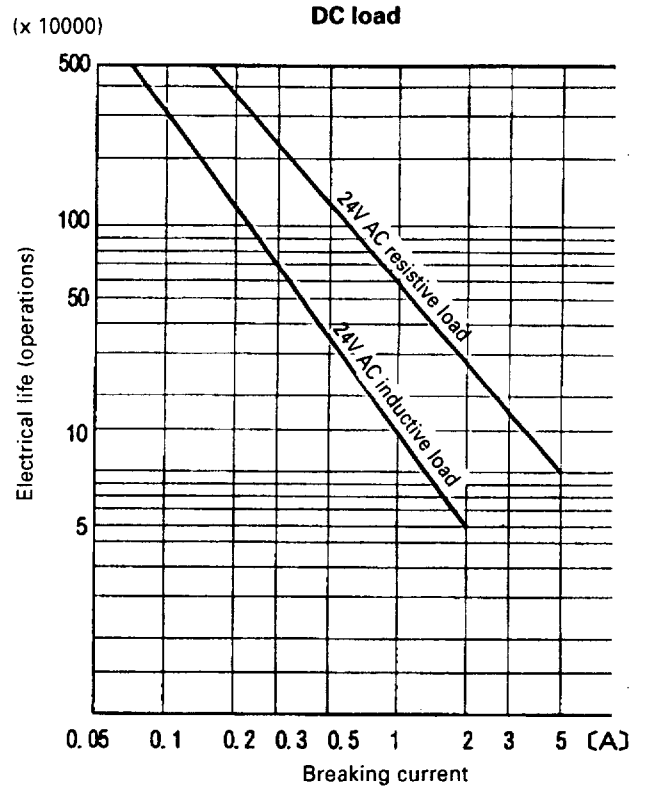
3.3.2 Life curve of relays

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

[Electrical life curve for card relay RB1]

AC load

(x 10000)

Electrical life (operations)

500
100
50
10
5

110V AC resistive load
220V AC resistive load
110V AC inductive load
220V AC inductive load

0.05 0.1 0.2 0.3 0.5 1 2 3 5 [A]

Breaking current

Test conditions

On/off frequency: 1800 times/hour
On load factor: 40%
Time constant L/R=15ms (inductive load)

DC load

(x 10000)

Electrical life (operations)

500
100
50
10
5

24V AC resistive load
24V AC inductive load

0.05 0.1 0.2 0.3 0.5 1 2 3 5 [A]

Breaking current

3.3.3 Load types and inrush current

The load types and inrush current characteristics have remarkable effects on relay contacts. In particular,

- Motors, electromagnetic contactors, and solenoid value
  With these loads, the value of inrush current is 3 to 10 times that of the rated current.
  In addition, when inrush current lasts for a long time, such as under a motor load, breaking of inrush current may cause contact welding.
- Lamp loads
  With lamp loads, the value of inrush current is 5 to 15 times that of the rated current. Because the inrush current may cause contact welding, in particular when a lamp with a large current capacity is to be turned on and off, it is recommended that confirmation test be performed using the actual load.
  The figures as shown at right are examples of the relationship between current waveform and time for each load. (Ip: Inrush current, Io: Rated current)
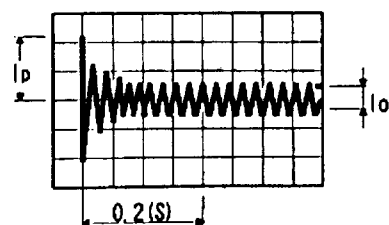
inrush current can cause contact welding, and must be taken into account together with the rated current.

[Relationship between current waveform and time for each load]

- Motor loads
  Ip/Io=5 to 10 times

Ip

Io

0.2 (S)
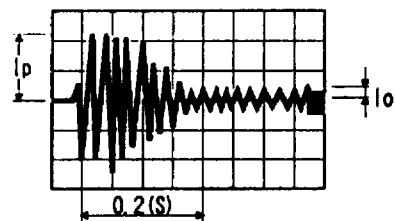
- Halogen lamp loads
  Ip/Io=5 to 15 times

Ip

Io

0.2 (S)

3.3 I/O Specifications
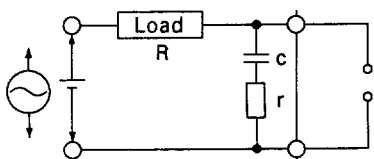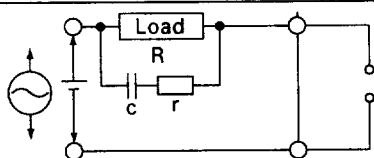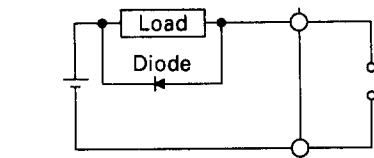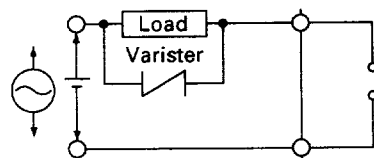
3.3.4 Protection of contacts
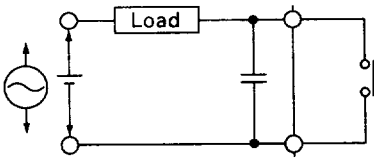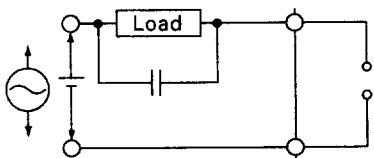
When an inductive load such as motors, clutches, and solenoids is turned off, counter electromotive forces of several hundreds to thousands volts are generated, which may greatly shorten the electrical life of contacts. This is because the energy $1/2Li^2$ accumulated in the coil (L: inductance of coil) is consumed by discharge between contacts when an inductive load is turned off. Therefore, to absorb the counter electromotive force, use of a contact protection circuit is recommended.

The following shows some examples of contact protection circuits; in each case AC or DC voltage must be used appropriately.

Note that using a contact protection circuit may slightly extend the recovery time.

[Contact protection circuit]

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

3.3.5 Contact transfer

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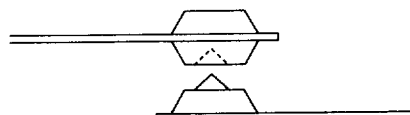
3.3.6 Derating

With input and output cards, the number of points that can be ON simultaneously is restricted by the input voltage and ambient temperature. Therefore, derating is necessary as shown in the figures below.

• 16 point input (NV1X1604/1604-W)

• 32 point input (NV1X3204/3204-W/3206)
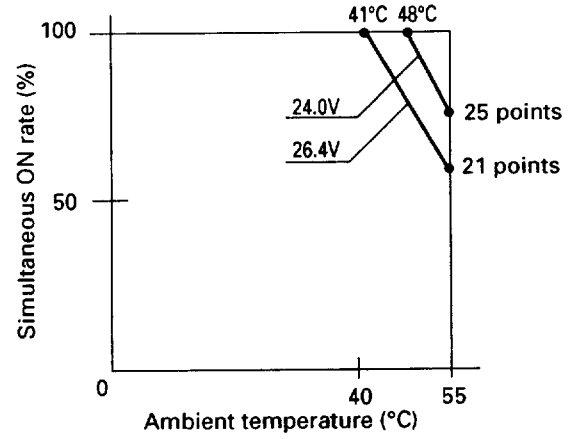
• 8 point output (NV1Y08R-00)

Derating is not necessary.

16 point output (NV1Y16R-08)

* In addition to derating, there are restrictions on 8A/common.
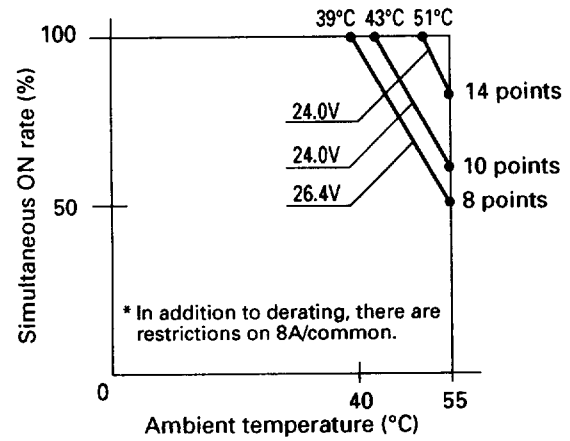
• 16 point output (NV1Y16T05P5)
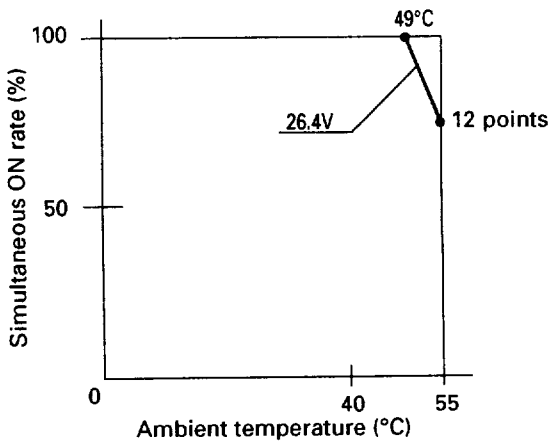
32 point output (NV1Y32T05P1)
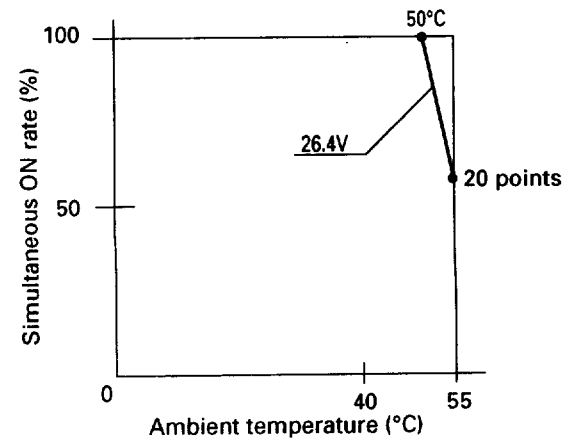
ONE-POINT ADVICE   Tips for Preventing I/O Malfunctions
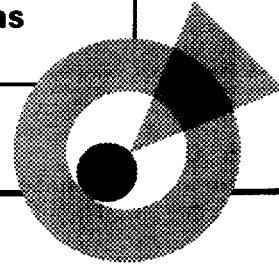
Example of malfunction of I/O circuit and its countermeasure

When digital I/O (DIO) is used, malfunction of the I/O circuit may occur. For example, even if an external input device (such as a sensor) is turned off, the PC input remains turned on; or even if the PC output is turned off, an external output device (such as a lamp) remains turned on.

The following table shows the causes and cuntermeasures for each case of malfunction, which should be taken into account in designing hardware.

(1) Input circuit malfunctions

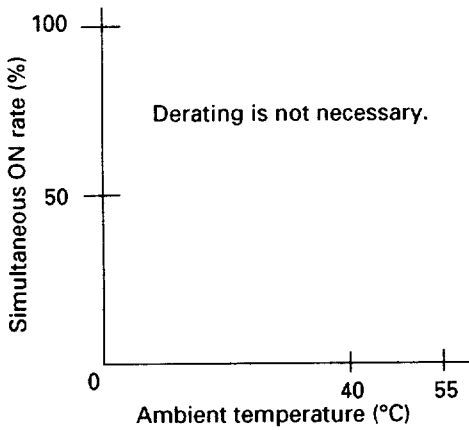| Status	Cause	Countermeasures
—Case 1— The input signal does not go off.	• Leakage current from external equipment (driven by a proximity switch) 	• Connect an appropriate resistor and capacitor so that the voltage between terminals of the input card is lower than the recovery voltage value.
—Case 2— The input signal does not go off. (The neon lamp remains on in some cases.)	• Leakage current from external equipment (driven by a limit switch with a neon lamp) 	• The CR value is determined by the leakage current value. Recommended value C: 0.1 to 0.47µF R: 47 to 120Ω (1/2W) • Alternatively, a display circuit is installed separately as an independent circuit.
—Case 3— The input signal does not go off.	• Leakage current due to stray capacitance between cables 	• Same as case 1. • The power supply is installed outside the external equipment as shown below.
—Case 4— The input signal does not go off.	• Leakage current from external equipment (driven by a switch with an LED indicator) 	• Connect an appropriate resistor so that the voltage between the input card terminal and the common line is higher than the OFF voltage.
—Case 5— The input signal does not go off.	• Sneak-circuit formed by the use of two independent power supplies. • When E1>E2, a sneak-circuit is formed.	• Use only one power supply. • Connect a diode to prevent sneak-circuit formation.

3-14
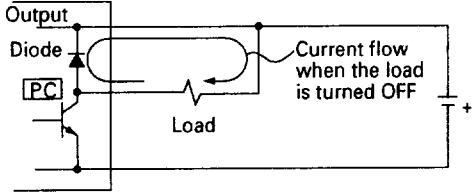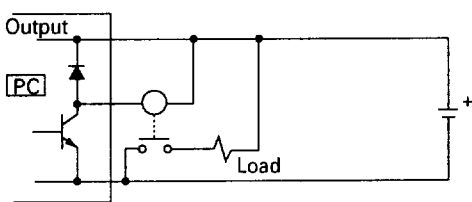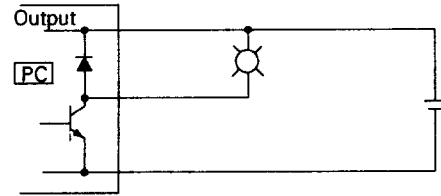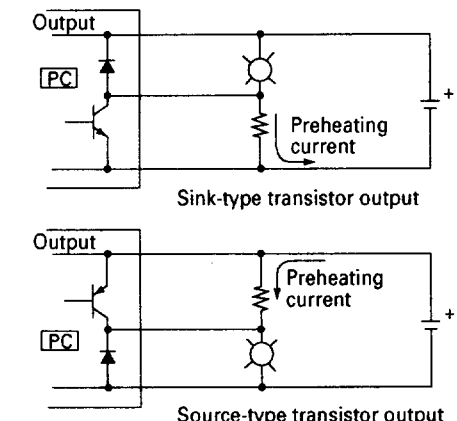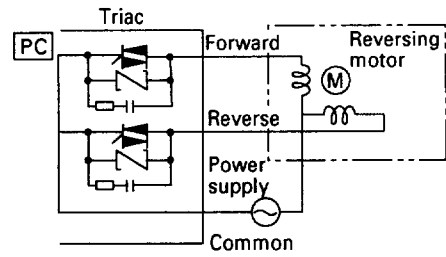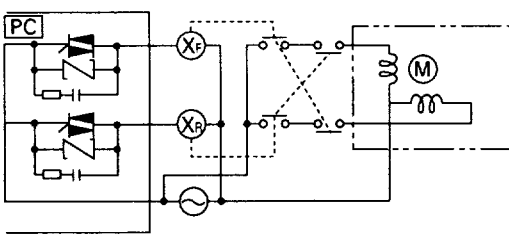
(2) Output circuit malfunctions

Status	Cause	Countermeasures
—Case 1— When the output circuit is turned off, excessive voltage is applied to the load.	• Half-wave rectification is made inside the load, as is the case with solenoids. • When the polarity of the power supply is as in ① below, capacitor C is charged. When it is changed as in ②, the sum of the voltage charged and the power voltage is applied to both sides of diode D_1. In this case the maximum voltage value is about $2\sqrt{2}\,E$. Note: With this usage, the output element has no problem but the diode (D_1) built into the load is deteriorated, which may cause burn or other failures. 	• Connect a resistor with several ten to hundred $k\Omega$ in parallel with the load.
—Case 2— The load does not go off.	• Leakage current due to the surge absorbing circuit being connected in parallel with the output element. 	• Connect a resistor of several ten $k\Omega$ or CR with the same impedance in parallel with the load. Note: When the wiring distance between the output card and the load is long, there may be leakage current due to stray capacitance between leads.
—Case 3— When the load is a CR timer, timer operates uncorrectly.	Same as case 2.	• Drive the CR timer by means of a relay. • Use a timer of other than the CR type. Note: Follow the note in case 1, because some timers perform half-wave rectification.
—Case 4— The load does not go off.	• Loop-back circuit formed by the use of two power supply units • When $E_1 > E_2$, a sneak-circuit is formed. • When E_1 is off and E_2 is on, a sneak-circuit is also formed.	• Use only one power supply. • Connect a diode to prevent sneak-circuit formation. Note: When a relay is used as a load, connect a diode for absorbing counter electromotive force in parallel with the load, as shown by the dotted lines below.

3-15

Status	Cause	Countermeasures
—Case 5— The off response time of the load is excessively long.	• Transient current when the load turned OFF. When a solenoid or other large current inductive load (with a large time constant L/R) is directly driven by transistor output. • When transistor output is off, current flows through the diode and therefore the off response time may be delayed by 1 second or more.	• As shown below, connect a control relay or magnetic contactor having a short time constant to drive the load.
—Case 6— The output transistor is destroyed. (Transistor output)	• Inrush current of an incandescent lamp • When an incaudescent lamp lights up, inrush current more than 10 times rated current may flow.	• To suppress inrush current, allow preheating current that is 1/5 to 1/3 times the rated current of the incandescent lamp to flow. Sink-type transistor output Source-type transistor output
—Case 7— The output triac is destroyed. (SSR output)	• Excessive voltage is applied to the output element. • When the output of the forwarding coil side is on, voltage is induced in the reversing coil, and excessive voltage (induced voltage + power voltage) is applied to the output of the reversing coil side that is off. • Voltage almost two times the power supply voltage may be applied. • The surge absober may burn out before the traiac is damaged.	• Provide a magnetic contactor to drive the load. • External interlock circuit is required.
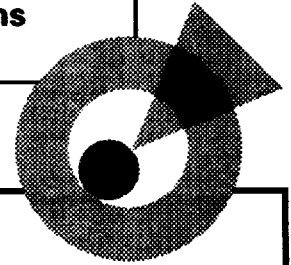
(3) Example of calculating bleeder resistance

The following is example of calculating bleeder resistance, which is provided as a countermeasure
for input malfunction due to leakage current of the LED circuit.

① Example malfunction

Switch with LED
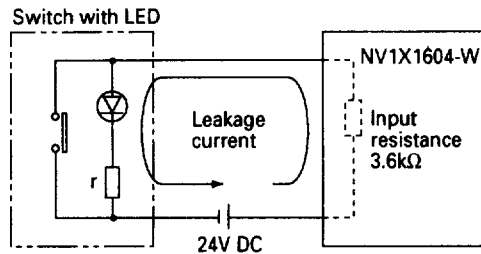
When r=2.6 kΩ, leakage current I is as follows:

$$I = \frac{24}{(2.6 + 3.6) \times 10^3} \fallingdotseq 3.9 \times 10^{-3}(A) \; (= 3.9mA)$$

In this case, the voltage given by the following expression is applied between input terminals of the input
module.

$$3.9 \times 10^{-3} \times 3.6 \times 10^3 \fallingdotseq 14 \; (V)$$

Because the voltage exceeds the OFF voltage of the input module (5.5 V), if a switch with LED is turned off, the
input module remain on.

② Countermeasure

Switch with LED
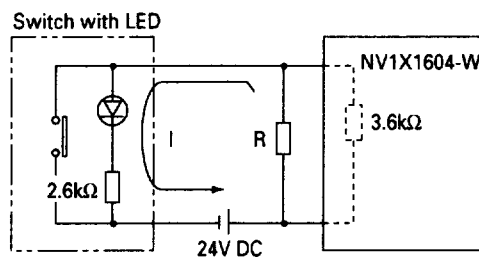
Insert a bleeder resistor (R) between the input terminals of the NV1X1604-W input module so that the voltage
applied between them is reduced to 5.5 V or less.
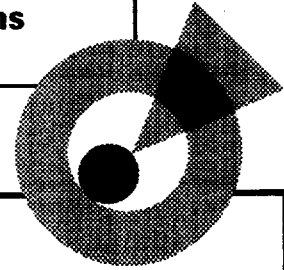
③ Example calculation
- When the voltage applied to the bleeder resistor is 5.5 V, the current given by the following expression flows.

$$I = \frac{24 - 5.5}{2.6 \times 10^3} = 7.1 \times 10^{-3} \text{ (A)} \ (= 7.1 \text{mA})$$

- R can be obtained from the following expression, by taking into account the input resistance and the bleeder resistance.

$$\frac{5.5}{R} > 7.1 \times 10^{-3} - \frac{5.5}{3.6 \times 10^3} \Rightarrow R < 990 \text{ } (\Omega)$$

- When R=820 (Ω), the capacity (P) of the bleeder resistor can be obtained from the following expression. (When a switch with LED is turned on, 24V DC is applied to the bleeder resistor.)

$$P = \frac{24^2}{820} \doteqdot 0.702 \text{ (W)}$$

Assuming a margin that is normally 3 to 4 times the above value, the capacity of the resistor is determined to be 3W.

Conclusion: Connect a bleeder resistor with 820Ω/3W.

Note: Because of the connector terminal, a bleeder resistor cannot be connected to the 32-point type. When a limit switch with LED is to be used for 24V DC power supply, use the NV1X3206, which has a high OFF level (0 to 7.0V). When the input switch is off, the NV1X3204-W, which has a low OFF level (0 to 5.5V), is regarded as ON by the module side because of leakage current.

(1) Digital input (NV1X1604)

Item			Specifications
Type			NV1X1604
Number of input points (common configuration)			16 points (8 points/common, 2 circuits)
Input signal	Rated voltage (allowable voltage range)		12 to 24V DC (10.2 to 26.4V DC)
	Allowable ripple percentage		5% or less
Input circuit characteristics	Input form		Source type
	Rated current		3mA/point (12 V), 7mA/point (24V)
	Input impedance		Approx. 3.6kΩ
	Input operating voltage	OFF→ON	8.4 to 26.4V
		ON→OFF	0 to 5.5V
	Response time	OFF→ON	10ms or less
		ON→OFF	10ms or less
Connections	External connection		Detachable terminal block M3.5 screw (18 poles)
	Applicable wire size (tightening torque)		0.75 mm² or less (0.8 to 0.9 N·m [8 to 9 kgf·cm]) Common terminal: 1.25 mm² or less
Input signal display			When input circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Insulation			Photocoupler
Dielectric strength			1500V AC, 1 minute, between input terminals and ground
Insulation resistance			10MΩ or more between input terminals and ground (at 500V DC megger)
Derating conditions			Maximum simultaneous ON percentage: 75% maximum (26.4V DC/55°C)
Current consumption			5V DC, 25mA or less (when all points are turned on)
Number of words occupied			1 word
Mass			Approx. 100g

Circuit configuration

Internal circuit

(1 to 8) 0 to 7
+ (9) C1 (Common 1)
24V DC
(10 to 17) 8 to F
+ (18) C2 (Common 2)
24V DC

The number in ( ) indicates the terminal number.

External wiring

Terminal number

Note: Common terminals (terminal Nos. 9 and 18) are electrically isolated from each other.

3.4 I/O Card Specifications

(2) Digital input (NV1X1604-W)

Item			Specifications
Type			NV1X1604-W
Number of input points (common configuration)			16 points (8 points/common, 2 circuits)
Input signal	Rated voltage (allowable voltage range)		12 to 24V DC (10.2 to 26.4V DC)
	Allowable ripple percentage		5% or less
Input circuit characteristics	Input form		Source and sink types
	Rated current		3mA/point (12V), 7mA/point (24V)
	Input impedance		Approx. 3.6kΩ
	Input operating voltage	OFF→ON	8.4 to 26.4V
		ON→OFF	0 to 5.5V
	Response time	OFF→ON	10ms or less
		ON→OFF	10ms or less
Connections	External connection		Detachable terminal block M3.5 screw (18 poles)
	Applicable wire size (tightening torque)		0.75mm² or less (0.8 to 0.9 N·m [8 to 9 kgf·cm]) Common: 1.25mm² or less
Input signal display			When input circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Isolation			Photocoupler
Dielectric strength			1500V AC, 1 minute, between input terminals and ground
Insulation resistance			10MΩ or more between input terminals and ground (at 500V DC megger)
Derating conditions			Maximum simultaneous ON percentage: 75% maximum (26.4V DC/55°C)
Current consumption			5V DC, 25mA or less (when all points are turned on)
Number of words occupied			1 word
Mass			Approx. 100g

Circuit configuration

Internal circuit

(1 to 8) 0 to 7
(9) C1 (Common 1)
24V DC

(10 to 17) 8 to F
(18) C2 (Common 2)
24V DC

The number in ( ) indicates the terminal number.

External connections

+C1 (Common 1)

(Common 2)

Terminal number

Note: Common terminals (terminal Nos. 9 and 18) are electrically insulated from each other.

(3) Digital input (NV1X3204)

Item			Specifications
Type			NV1X3204
Number of input points (common configuration)			32 points (32 points/common, 1 circuit)
Input signal	Rated voltage (allowable voltage range)		12 to 24V DC (10.2 to 26.4V DC)
	Allowable ripple percentage		5% or less
Input circuit characteristics	Input form		Source type
	Rated current		2mA/point (12V), 4mA/point (24V)
	Input impedance		Approx. 5.6kΩ
	Input operating voltage	OFF→ON	8.4 to 26.4V
		ON→OFF	0 to 5.5V
	Response time	OFF→ON	10ms or less
		ON→OFF	10ms or less
Connections	External connection		40 pin connector (FCN-361J040-AU)
	Applicable wire size		AWG#23 (0.25mm^2) or less
Input signal display			When input circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Isolation			Photocoupler
Dielectric strength			1500V AC, 1 minute, between input terminals and ground
Insulation resistance			10MΩ or more between input terminals and ground (at 500V DC megger)
Derating conditions			Maximum simultaneous ON percentage: 65% maximum (26.4V DC/55°C)
Current consumption			5V DC, 45 mA or less (when all points are turned on)
Number of words occupied			2 words
Mass			Approx. 80g

Circuit configuration

Internal circuit

(A1) 0

(B16) 1F

+ (A17, 18) C1 (Common)

24V DC

The number in ( ) indicates the terminal number.

External wiring

Terminal (signal) name
Terminal number (FCN361 pin number)

A	No.	B
00	01	10
01	02	11
02	03	12
03	04	13
04	05	14
05	06	15
06	07	16
07	08	17
08	09	18
09	10	19
0A	11	1A
0B	12	1B
0C	13	1C
0D	14	1D
0E	15	1E
0F	16	1F
C1	17	NC
C1	18	NC
NC	19	NC
NC	20	NC
A	No.	B

0 — 00
F — 0F
1F — 1F
+C1
C1 (Common)

Note: NC indicates that the internal circuit is not connected to the terminal.

3.4 I/O Card Specifications

(4) Digital input (NV1X3204-W)

Item			Specifications
Type			NV1X3204-W
Number of input points (common configuration)			32 points (32 points/common, 1 circuit)
Input signal	Rated voltage (allowable voltage range)		12 to 24V DC (10.2 to 26.4V DC)
	Allowable ripple percentage		5% or less
Input circuit characteristics	Input form		Source and sink types
	Rated current		2mA/point (12V), 4mA/point (24V)
	Input impedance		Approx. 5.6kΩ
	Input operating voltage	OFF→ON	8.4 to 26.4V
		ON→OFF	0 to 5.5V
	Response time	OFF→ON	10ms or less
		ON→OFF	10ms or less
Connections	External connection		40 pin connector (FCN-361J040-AU)
	Applicable wire size		AWG#23 (0.25mm²) or less
Input signal display			When input circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Isolation			Photocoupler
Dielectric strength			1500V AC, 1 minute, between input terminals and ground
Insulation resistance			10MΩ or more between input terminals and ground (at 500V DC megger)
Derating conditions			Maximum simultaneous ON percentage: 65% maximum (26.4V DC/55°C)
Current consumption			5V DC, 45mA or less (when all points are turned on)
Number of words occupied			2 words
Mass			Approx. 80g

Circuit configuration

Internal circuit

(A1) 0

(B16) 1F

−‖+ (A17, 18) C1
(Common)
24V DC

The number in ( ) indicates the terminal number.

External wiring

Terminal (signal) name
Terminal number (FCN361 pin number)

A	No.	B
00	01	10
01	02	11
02	03	12
03	04	13
04	05	14
05	06	15
06	07	16
07	08	17
08	09	18
09	10	19
0A	11	1A
0B	12	1B
0C	13	1C
0D	14	1D
0E	15	1E
0F	16	1F
C1	17	NC
C1	18	NC
NC	19	NC
NC	20	NC
A	No.	B

Note: NC indicates that the internal circuit is not connected to the terminal.

(5) Digital input (NV1X3206)
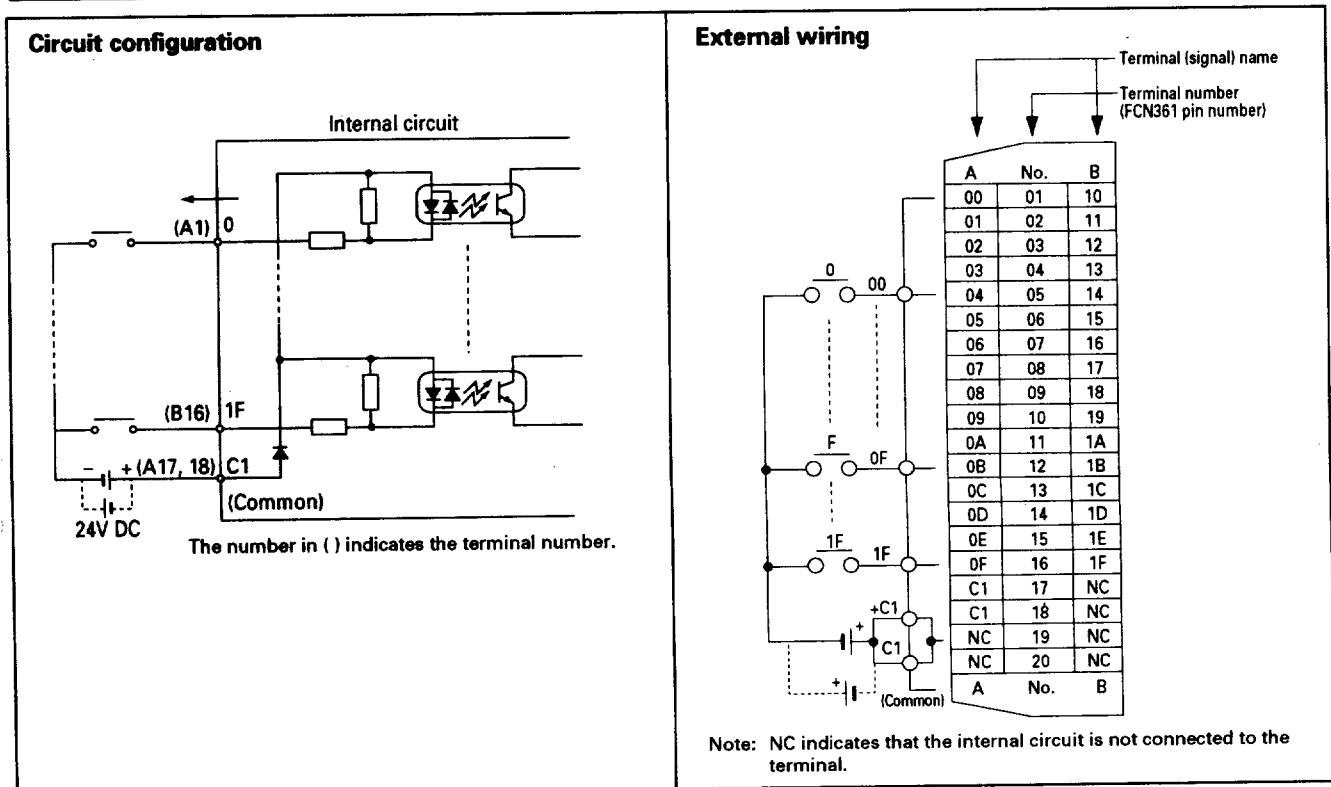
Item			Specifications
Type			NV1X3206
Number of input points (common configuration)			32 points (32 points/common, 1 circuit)
Input signal	Rated voltage (allowable voltage range)		24V DC (19.2 to 26.4V DC)
	Allowable ripple percentage		5% or less
Input circuit characteristics	Input form		Source type
	Rated current		4mA/point (24V)
	Input impedance		Approx. 5.6kΩ
	Input operating voltage	OFF→ON	15 to 26.4V
		ON→OFF	0 to 7V
	Response time	OFF→ON	10ms or less
		ON→OFF	10ms or less
Connections	External connection		40 pin connector (FCN-361J040-AU)
	Applicable wire size		AWG#23 (0.25mm²) or less
Input signal display			When input circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Isolation			Photocoupler
Dielectric strength			1500V AC, 1 minute, between input terminals and ground
Insulation resistance			10MΩ or more between input terminals and ground (at 500V DC megger)
Derating conditions			Maximum simultaneous ON percentage: 65% maximum (26.4V DC/55°C)
Current consumption			5V DC, 45 mA or less (when all points are turned on)
Number of words occupied			2 words
Mass			Approx. 80g

Circuit configuration

Internal circuit

(A1) 0

(B16) 1F

+ (A17, 18) C1

24V DC (Common)

The number in ( ) indicates the terminal number.

External wiring

Terminal (signal) name
Terminal number (FCN361 pin number)

A	No.	B
00	01	10
01	02	11
02	03	12
03	04	13
04	05	14
05	06	15
06	07	16
07	08	17
08	09	18
09	10	19
0A	11	1A
0B	12	1B
0C	13	1C
0D	14	1D
0E	15	1E
0F	16	1F
C1	17	NC
C1	18	NC
NC	19	NC
NC	20	NC
A	No.	B

0 00

F 0F

1F 1F

+C1 C1

(Common)

Note: NC indicates that the internal circuit is not connected to the terminal.

3.4 I/O Card Specifications

(6) Digital output (NV1Y08R-00)

Item		Specifications
Type		NV1Y08R-00
Number of output points (common configuration)		8 points (all points are independent)
Output power	Rated voltage (allowable voltage range)	264V DC or less, 140V DC or less
Output circuit characteristics	Output form and output type	Relay
	Maximum load current	2A/point (30V DC/264V AC), 0.2A/point (110V DC)
	Min. operating voltage and current	5V DC, 1mA
	Response time OFF→ON	10ms or less
	Response time ON→OFF	10ms or less
	Leakage current (OFF state)	0.1mA maximum (200V AC, 60Hz)
Output protection	Built-in fuse	None
	Surge suppression circuit	Varister
Maximum operating frequency		3600 times/hour
Connections	External connection	Detachable terminal block M3.5 screw (18 poles)
	Applicable wire size (tightening torque)	0.75mm² or less (0.8 to 0.9 N·m [8 to 9 kgf·cm]) Common terminal: 1.25mm² or less
Output signal display		When output circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Isolation		Relay
Dielectric strength		1500V AC, 1 minute, between output terminals and ground
Insulation resistance		10MΩ or more between output terminals and ground (at 500V DC megger)
Derating conditions		None
Relay exciting current		70mA (at 24V DC), supplied from the processor power supply terminal
Current consumption		5V DC, 70mA or less (when all points are turned on)
Number of words occupied		1 word
Mass		Approx. 130g

Circuit configuration	External wiring

The number in ( ) indicates the terminal number.

Terminal number

Notes:
1. Output terminals are electrically isolated from each other.
2. NC indicates that the internal circuit is not connected to the terminal.
3. Supply the power for the relay (24V DC) from the processor power terminal.

(7) Digital output (NV1Y16R-08)

Item		Specifications
Type		NV1Y16R-08
Number of output points (common configuration)		16 points (8 points/common, 2 circuits)
Output power	Rated voltage (allowable voltage range)	264V DC or less, 140V DC or less
Output circuit characteristics	Output form and output type	Relay
	Maximum load current	2A/point, 8A/common (30V DC/264V AC), 0.2A/point, 1.6A/common (110V DC)
	Min. operating voltage and current	5V DC, 1mA
	Response time OFF→ON	10ms or less
	Response time ON→OFF	10ms or less
	Leakage current (OFF state)	0.1mA maximum (200V AC, 60Hz)
Output protection	Built-in fuse	None
	Surge suppression circuit	Varister
Maximum operating frequency		3600 times/hour
Connections	External connection	Detachable terminal block M3.5 screw (18 poles)
	Applicable wire size (tightening torque)	0.75mm² or less (0.8 to 0.9 N·m [8 to 9 kgf·cm]) Common terminal: 1.25mm² or less
Output signal display		When output circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Insulation		Relay
Dielectric strength		1500V AC, 1 minute, between output terminals and ground
Insulation resistance		10MΩ or more between output terminals and ground (at 500V DC megger)
Derating conditions		Simultaneous ON percentage: 50% maximum (26.4V DC/ 55°C)
Relay exciting current		140mA (at 24V DC), supplied from the processor power supply terminal
Current consumption		5V DC, 105mA or less (when all points are turned on)
Number of words occupied		1 word
Mass		Approx. 160g

Circuit configuration	External wiring
The number in ( ) indicates the terminal number.	Terminal number Notes: 1. Common terminals (terminal Nos. 9 and 18) are electrically isolated from each other. 2. Supply the power for the relay (24V DC) from the processor power terminal.
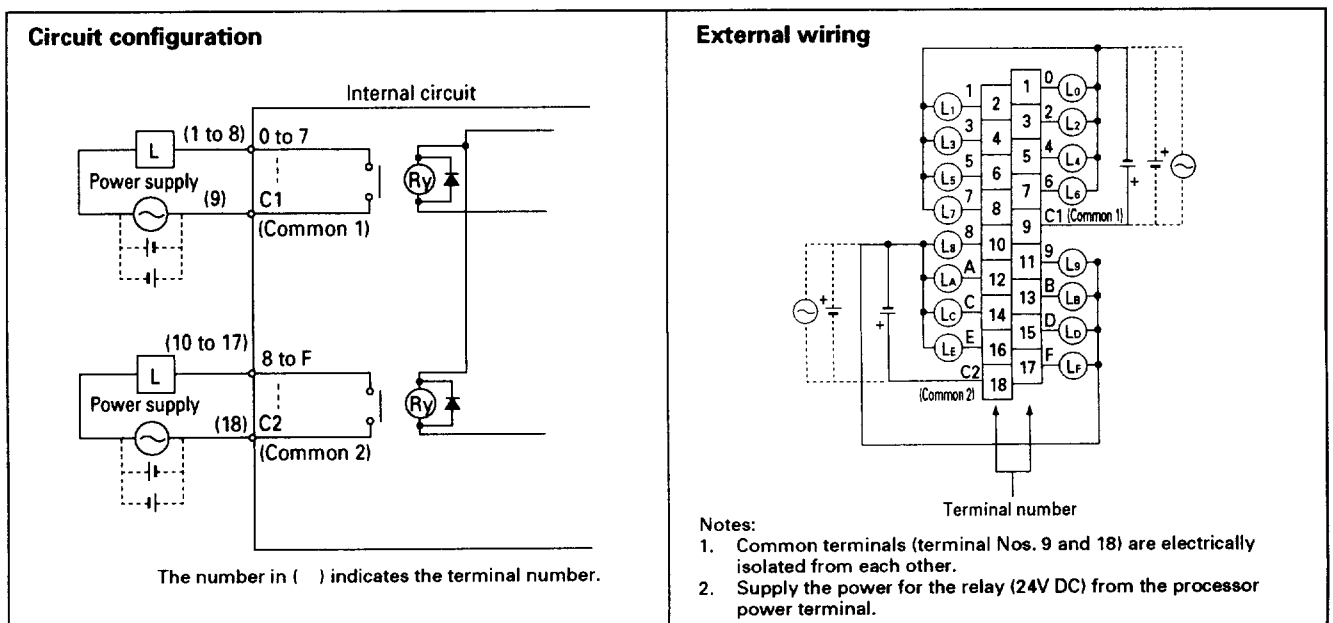
3.4 I/O Card Specifications

(8) Digital output (NV1Y16T05P5)

Item			Specifications
Type			NV1Y16T05P5
Number of output points (common configuration)			16 points (16 pints/common, 1 circuit)
Output power	Rated voltage (allowable voltage range)		12 to 24V DC or less (10.2 to 26.4V DC)
Output circuit characteristics	Output form and output type		Sink-type transistor
	Maximum load current		0.5A/point
	Output voltage drop		1.2V or less (0.5A load)
	Response time	OFF→ON	1ms or less
		ON→OFF	1ms or less
	Leakage current (OFF state)		0.1mA maximum
	Allowable surge current		2A, 10ms
Output protection	Built-in fuse		None
	Surge suppressor		Fly-wheel diode
Connections	External connection		Detachable terminal block M3.5 screw (18 poles)
	Applicable wire size (tightening torque)		0.75mm² or less (0.8 to 0.9 N·m [8 to 9 kgf·cm]) Common terminal: 1.25mm² or less
Output signal display			When output circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Isolation			Photocoupler
Dielectric strength			1500V AC, 1 minute, between output terminals and ground
Insulation resistance			10MΩ or more between output terminals and ground (at 500V DC megger)
Derating conditions			Simultaneous ON percentage: 62% maximum (26.4V DC/55°C)
External power supply			12 to 24V DC, 20mA (for transistor driving)
Current consumption			5V DC, 50mA or less (when all points are turned on)
Number of words occupied			1 word
Mass			Approx. 110g

Circuit configuration

Internal circuit

Note: If the power supply is connected with reverse polarity, short-circuit current flows and the output element may be destroyed.

External wiring

Terminal number

(9) Digital output (NV1Y32T05P1)

Item			Specifications
Type			NV1Y32T05P1
Number of output points (common configuration)			32 points (32 points/common, 1 circuit)
Output power	Rated voltage (allowable voltage range)		5 to 24V DC (4.5 to 26.4V DC)
Output circuit characteristics	Output form and output type		Sink-type transistor
	Maximum load current		16mA/point (4.5V DC), 0.1A/point (26.4V DC)
	Output voltage drop		1.0V or less (16mA load), 1.2V or less (0.1A load)
	Response time	OFF→ON	1ms or less
		ON→OFF	1ms or less
	Leakage current (OFF state)		0.1mA maximum
	Allowable surge current		0.3A, 10ms
Output protection	Built-in fuse		None
	Surge suppressor		Zener diode
Connections	External connection		40 pin connector (FCN-361J040-AU)
	Applicable wire size		AWG#23 (0.25mm²) or less
Output signal display			When output circuit is on, LED lights point by point, logic side (displayed on the processor main unit)
Isolation			Photocoupler
Dielectric strength			1500V AC, 1 minute, between output terminals and ground
Insulation resistance			10MΩ or more between output terminals and ground (at 500V DC megger)
Derating conditions			Simultaneous ON percentage: 62% maximum (26.4V DC/55°C)
External power supply			5 to 24V DC, 40mA (for transistor driving)
Current consumption			5V DC, 70mA or less (when all points are on)
Number of words occupied			2 words
Mass			Approx. 90g

Circuit configuration	External wiring
The number in ( ) indicates the terminal number.	Note: NC indicates that the internal circuit is not connected to the terminal.
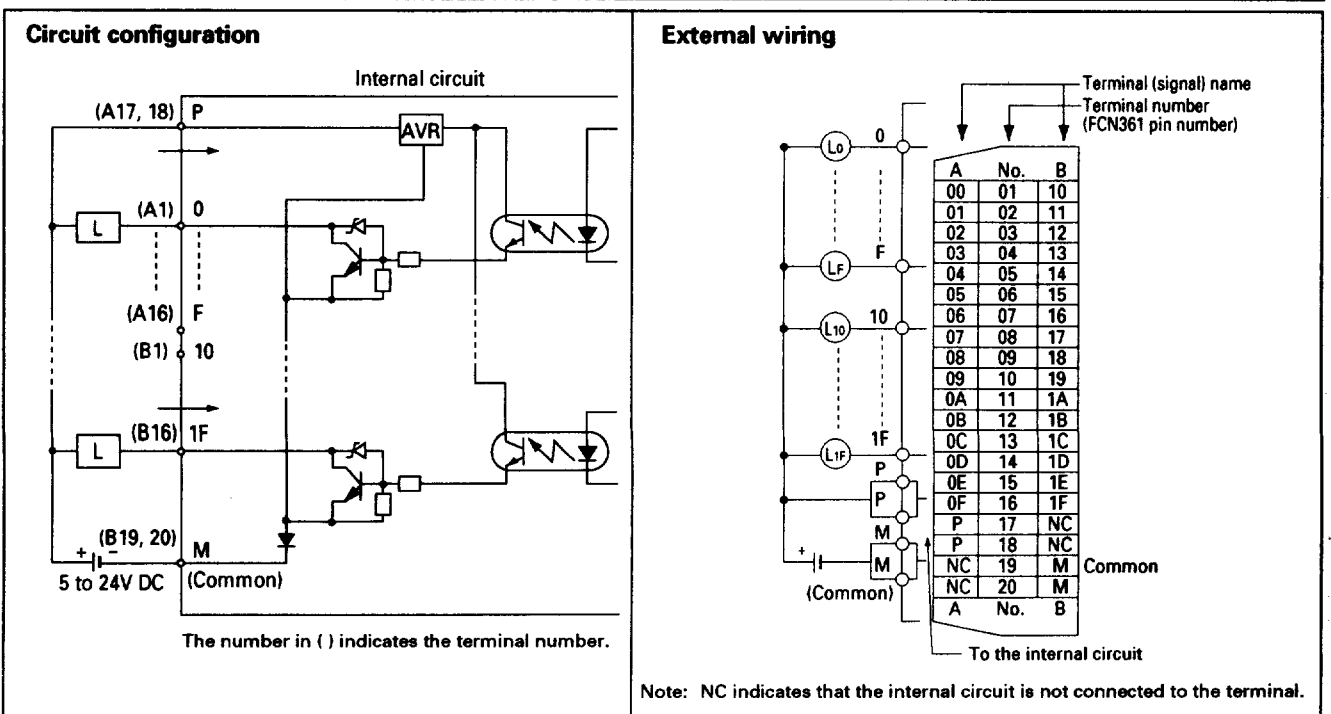
Tips for Connecting 32 Point I/O Card to External Equipment
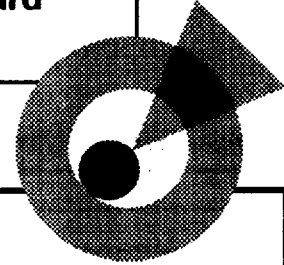
The following introduces how to connect the 32-point I/O card to external equipment.

- The standard connection between the 32-point I/O card to external equipment is made with the supplied 40-pin connector (FCN-365P040-AU from Fujitsu).


```
32 point
I/O card                    Cable
                                        ⟶   External I/O
                                            equipment

Supplied connector component { Connector: FCN-361J040-AU x 1
                              { Cover: FCN-360C040-B x 1
```
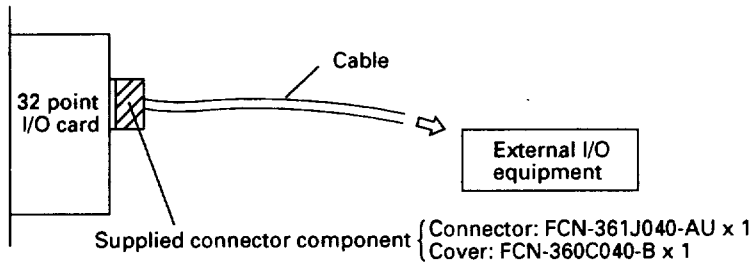
- When connecting cables from external I/O equipment through screw terminals, use of the FUJI relaying connector terminal (AU-CW series) is recommended.


```
                        Screw terminal M3.5

                                                    External I/O
                                                    equipment
```

| Connection cable | FUJI relay connector terminal block |

Multicore cable: AUX011-40[]
Flat cable: AUX021-40[]

□ indicates the length (m)
    1: 1m
    2: 2m
    3: 3m

AU-CW41B1-11 (M3.5 screws with turtle shaped washer)
or
AU-CW41B5-11 (M3.5 screws with spring washer)
(Supplied connector: FCN-364P040-AG)
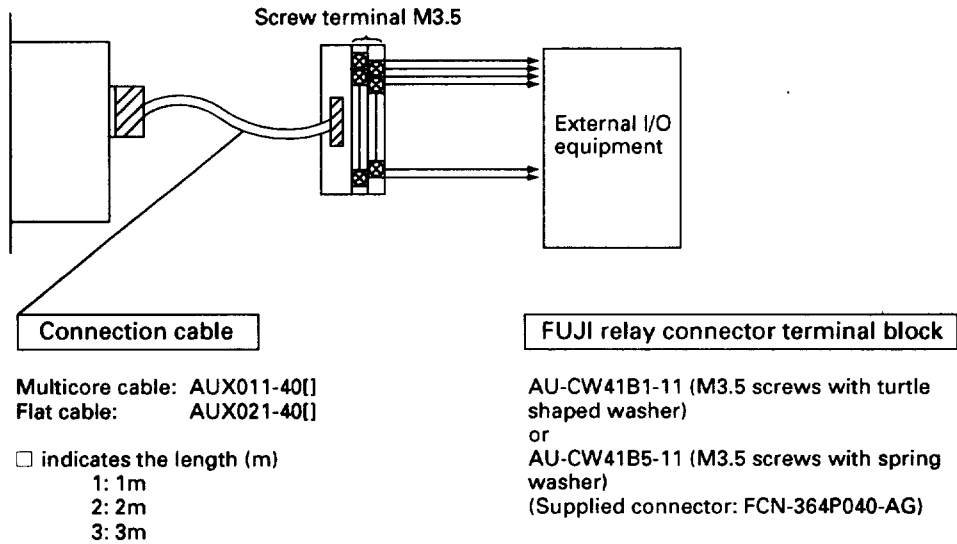
(1) General-purpose interface card (NV1L-RS2: RS-232C interface)

Item		Specifications	
Type		NV1L-RS2	
External interface	Port	RS-232C (1 channel)	
	Transmission mode	Half-duplex/full-duplex (depends on operating mode)	
	Synchronization mode	Start-stop synchronization	
	Transmission speed	300/600/1200/2400/4800/9600/19200 baud	
	Transmission distance	15m or less	
	Number of connectable units	1:1 (1 external device)	
	Connector	D-SUB 25 pin, mounting screw M2.6	
Transmission specifications	Transmission procedure	Start-stop synchronization (non-protocol) / command setting start-stop synchronization (non-protocol)	
	Transmission control code	JIS 7/8 units, EBCDIC 8 units	
	Transmission code system	Binary data (arbitrary)	
	Error control	Hardware	Vertical parity, flaming, overrun
		Software	Horizontal parity
	Extended transmission function	Selection of transparent mode by code conversion	
	Bit transmission order	From the lowest bit upward	
	Message length	Fixed or variable length: 220 bytes maximum (depends on operating mode)	
	Starting code	None, STX, :, or ::	
	Ending code	ETX, CR, LF, CR·LF, or DLE·ETX	
	Character configuration	Start bit: 1 bit, Data bit: 7 or 8 bits, Parity bit: none/odd/even Stop bit: 1/1, 5/2 bits	
Occupied I/O configuration		16 points (1 word), area WB is occupied	
Number of slots occupied		1 slot	
LED display	Operating status display	RUN: Normal operation (data transmission possible) (green) SND: Transmitting data to external device (green) RCV: Receiving data from external device (green) DVE: Module failure (hardware failure) (red)	
Internal current consumption		Approx. 300mA	
Mass		Approx. 150g	

Structure   (Front panel)   (Rear panel)

- ① Operating status display
- ② RS-232C connector
- ④ Character configuration setting switch
- ② Operating mode setting switch

3.5 Specifications of Function Cards

① Status indicator LEDs
Indicates operating status of the NV1L-RS2.

Symbol	Color	Meaning	Description
RUN	Green	Normal operation	Lights when data transmission is possible.
SND	Green	Transmitting	Lights when the RS2 is transmitting data to external equipment.
RCV	Green	Receiving	Lights when the RS2 is receiving data from external equipment.
DVE	Red	Module failure	Lights if a hardware failure occurs (such as RAM failure of the RS2).

② Operating mode setting switch (MODE)
Used to set the transmission mode.

No. 1: Command setting (start-stop synchronization, non-protocol)
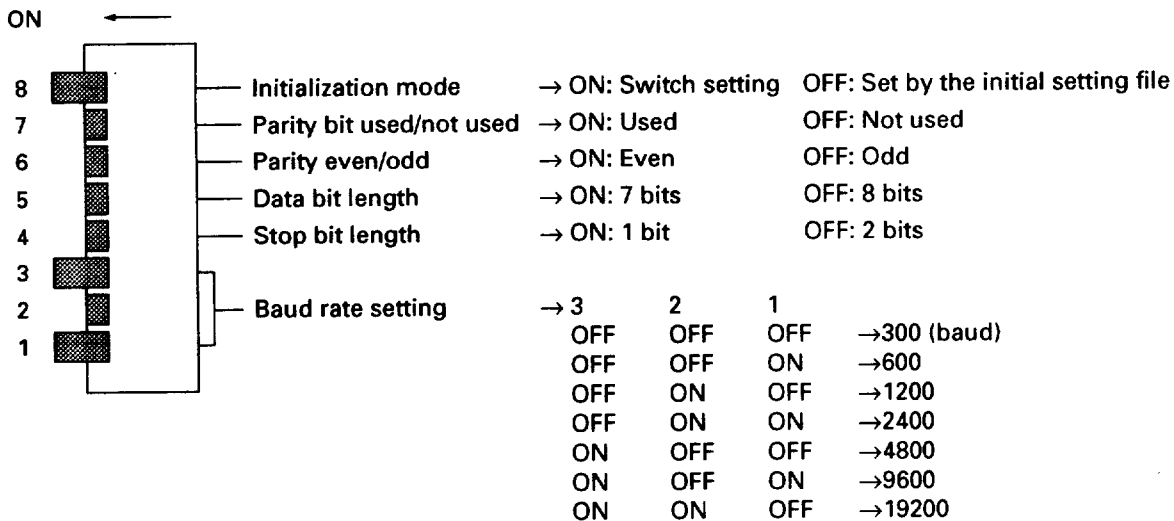No. 4: Start-stop synchronization, non-protocol

Notes:
1. Avoid make setting for other than Nos. 1 and 4.
2. Switch setting is recognized when the power is turned on.

③ RS-232C connector
D-sub 25 pin female connector.

④ Character configuration setting switch

ON

8	Initialization mode	→ ON: Switch setting	OFF: Set by the initial setting file
7	Parity bit used/not used	→ ON: Used	OFF: Not used
6	Parity even/odd	→ ON: Even	OFF: Odd
5	Data bit length	→ ON: 7 bits	OFF: 8 bits
4	Stop bit length	→ ON: 1 bit	OFF: 2 bits
3			
2	Baud rate setting		
1			

| 3	2	1	
OFF	OFF	OFF	→300 (baud)
OFF	OFF	ON	→600
OFF	ON	OFF	→1200
OFF	ON	ON	→2400
ON	OFF	OFF	→4800
ON	OFF	ON	→9600
ON	ON	OFF	→19200

* Each switch setting is recognized when the power is turned on.

Note: Change the switch setting only when the power is turned off. An attempt to remove the card and change the switch setting when the power is on will result in a system error.

· Pin layout and signal name

(Viewed from the front)
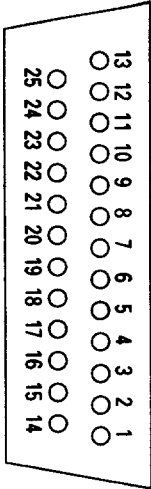
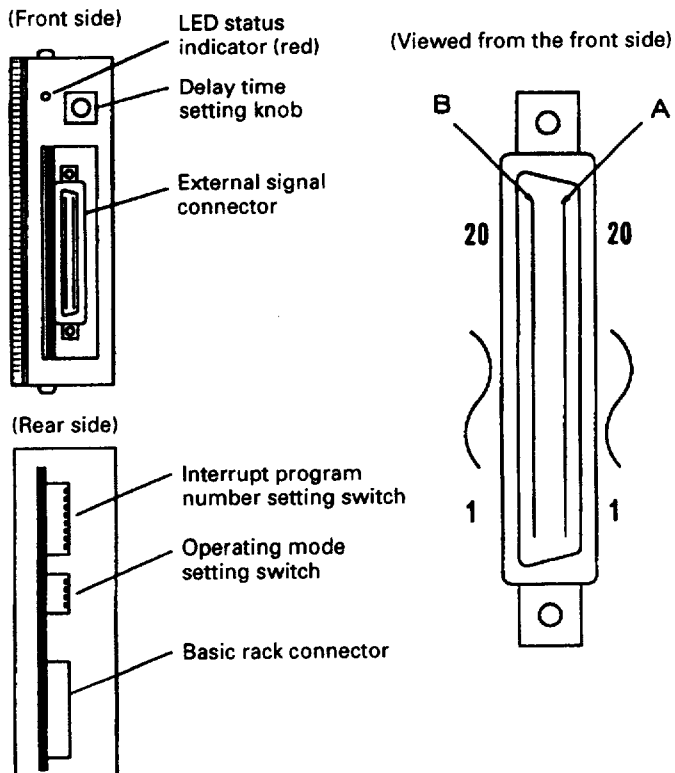| Pin No.	Signal name	Signal direction NV1L-RS2 ◄─► External equipment	Description
1	FG		Protective ground
2	SD	→	Send data
3	RD	←	Receive data
4	RS	→	Request to send
5	CS	←	Clear to send
6	DR	→	Dataset ready
7	SG		Signal ground
8	CD	←	Data channel reception carrier detect
20	ER	→	Data terminal ready

Notes: 1. For the NV1L-RS2, a female connector is used. For the cable, a male connector is used.
2. The RS-232C interface of the NV1L-RS2 uses DTE specifications.
3. Pins No. 9 to 19 and 21 to 25 are not used.

3.5 Specifications of Function Cards

(2) High-speed counter card (NV1F-HC1)

Item		Specifications
Type		NV1F-HC1
Count input signal	Phase	Two-phase signal (90° phase difference), single-phase + directional signal, single-phase addition (substraction) signal (switched by software)
	Level	Square wave. 0/5V, 0/12V or 0/24V (voltage signal)
Counter	Type	Up-down counter (preset possible)
	Number of channels	1
	Counting speed	50kbps (external preset signal: 5kHz)
	Countable range	Signed BCD 4/8-digit (-79999999 to 79999999), signed binary 16/32-bit (80000000 to 7FFFFFFF)
	Multiplication	×1, ×2, ×4 (two-phase signal only)
	Reset (preset) input	By external input signal and software command
Comparison	Number of points	1
	Comparison range	Same as countable range
	Comparison target	<, >, =
	Comparison output	Transistor output (sink type), 12/24V DC, 0.2A, isolated by photocoupler
Special function	Sectional count function	Sectional count by time interval (function to clear the counter automatically after latching it in a resistor using an external signal)
Isolation		Photocoupler
Current consumption		5V DC, 150mA
Number of words occupied		Direct access area (from W24 on): 16 words
Mass		Approx. 140g

Structure

(Front side)
- LED status indicator (red)
- Delay time setting knob
- External signal connector

(Rear side)
- Interrupt program number setting switch
- Operating mode setting switch
- Basic rack connector

(Viewed from the front side)

(Pin layout of external signal connector)

	B	A
20	Phase A (+24V input)	Phase A (+24V input)
19	Phase A (+12V input)	Phase A (+12V input)
18	Phase A (+5V input)	Phase A (+5V input)
17	Phase A (0V input)	Phase A (0V input)
16		
15	Phase B (+24V input)	Phase B (+24V input)
14	Phase B (+12V input)	Phase B (+12V input)
13	Phase B (+5V input)	Phase B (+5V input)
12	Phase B (0V input)	Phase B (0V input)
11		
10	Phase C (+24V input)	Phase C (+24V input)
9	Phase C (+12V input)	Phase C (+12V input)
8	Phase C (+5V input)	Phase C (+5V input)
7	Phase C (0V input)	Phase C (0V input)
6		
5	current value > reference value	current value > reference value
4	current value = reference value	current value = reference value
3	current value < reference value	current value < reference value
2	12/24V DC	12/24V DC
1	0V DC	0V DC

• Function of the interrupt program number setting switch

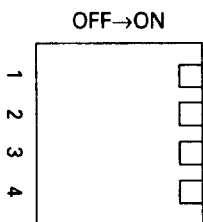When using an interrupt program, this switch is used to set the program number of the interrupt program to be activated within an MICREX-F F55 application program. Only one program number can be set. When no interrupt program is used, set all positions to OFF.

OFF→ON
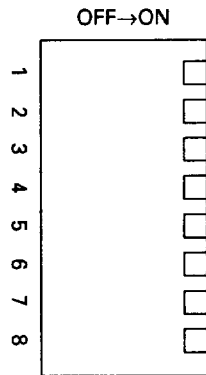
Position	Interrupt program number
1	7 (PROG67)
2	6 (PROG66)
3	5 (PROG65)
4	4 (PROG64)
5	3 (PROG63)
6	2 (PROG62)
7	1 (PROG61)
8	0 (PROG60)

• Function of the operating mode setting switch

This switch is used to set the operating mode of the NV1F-HC1. Each position setting is shown in the table below.

OFF→ON

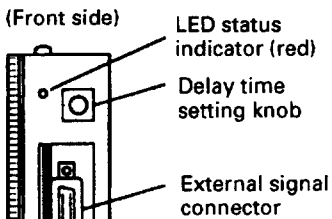| Position	Function	Selection mode	
		OFF	ON
1	Sectional count mode selection	Sectional count mode	Ordinary count mode
2	External output exclusive use selection	Outputs > and < output during matching (=) output	Does not output > and < output during matching (=) output
3	Count range selection	32 bit length	16 bit length
4	Matching output clear timing selection	When comparison result is mismatched	By application (when bit No. 3 of the command resistor rises)

* Cannot be mounted on expansion units for basic unit case version 1001 or later.
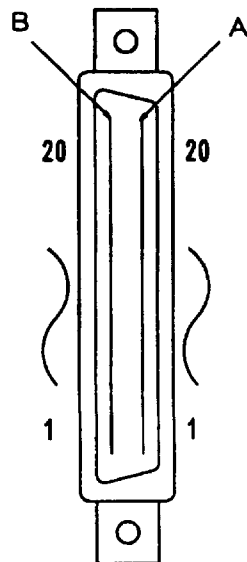
3.5 Specifications of Function Cards

(3) High-speed counter card (NV1F-HC2)

Item		Specifications
Type		NV1F-HC2
Count input signal	Phase	Two-phase signal (90° phase difference), single-phase + directional signal, single-phase addition (substraction) signal (switched by software)
	Level	Square wave 0/5V, 0/12V or 0/24V (voltage signal)
Counter	Type	Up-down counter (preset possible)
	Number of channels	1
	Counting speed	50kHz maximum (reset signal: 5kHz)
	Countable range	Signed BCD 4-digit (-7999 to 7999), signed binary 16-bit (8000H to 7FFFH)
	Multiply	x1, x2, x4 (two-phase signal only)
	Reset (preset) input	By external input signal
Comparison	Number of points	1
	Comparison range	Same as countable range
	Comparison target	<, >, =
	Comparison output	Transistor output (sink type), 12/24V DC, 0.2 A, isolated by photocoupler
Special function	Sectional count function	Sectional count by time interval (function to clear the counter automatically after latching it in a resistor using an external signal)
Isolation		Photocoupler
Current consumption		5V DC, 110 mA
Number of words occupied		4 words
Mass		Approx. 140 g

Structure

(Front side)
LED status indicator (red)
Delay time setting knob
External signal connector

(Rear side)
Pulse mode setting switch
Operating mode setting switch
Basic rack connector

(Viewed from the front side)

(Pin layout of external signal connector)

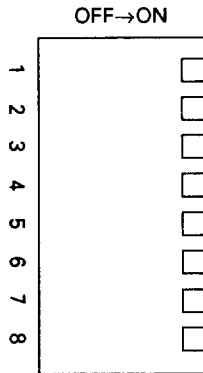|	B	A
20	Phase A (+24V input)	Phase A (+24V input))
19	Phase A (+12V input)	Phase A (+12V input)
18	Phase A (+5V input)	Phase A (+5V input)
17	Phase A (0V input)	Phase A (0V input)
16		
15	Phase B (+24V input)	Phase B (+24V input)
14	Phase B (+12V input)	Phase B (+12V input)
13	Phase B (+5V input)	Phase B (+5V input)
12	Phase B (0V input)	Phase B (0V input)
11		
10	Phase C (+24V input)	Phase C (+24V input)
9	Phase C (+12V input)	Phase C (+12V input)
8	Phase C (+5V input)	Phase C (+5V input)
7	Phase C (0V input)	Phase C (0V input)
6		
5	current value > reference value	current value > reference value
4	current value = reference value	current value = reference value
3	current value < reference value	current value < reference value
2	12/24V DC	12/24V DC
1	0V DC	0V DC

• Function of the input pulse mode setting switch
This switch is used to set the input pulse type, multiply, and reset condition.

• Count mode setting (SW8)
Specifies binary or BCD.
ON : BCD
OFF: Binary

OFF→ON

• Multiplication setting (SW5, 4)
Specifies the multiplication of the input pulse.

SW5	SW4	Multiplication
OFF	—	1
ON	OFF	2
ON	ON	4 (effective only when two-phases)

• Input pulse type setting (SW7, 6)
Specifies the input pulse type.

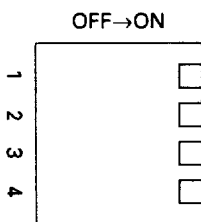| SW7	SW6	Pulse type
OFF	OFF	Single-phase addition
OFF	ON	Single-phase substraction
ON	OFF	Single-phase directional command (Phase B OFF: addition ON: substraction)
ON	ON	Two-phase

• External reset input condition setting (SW3)
Specifies the reset condition.
ON : Falling edge of phase C
OFF: Rising edge of phase C

• External reset (SW2,1)
Specifies the reset timing with respect to issuance of the external reset condition.

SW2	SW1	Reset timing
OFF	OFF	UP count
OFF	ON	DOWN count
ON	OFF	UP/DOWN count
ON	ON	Upon issuance (asynchronous)

• Function of the count external output mode setting switch
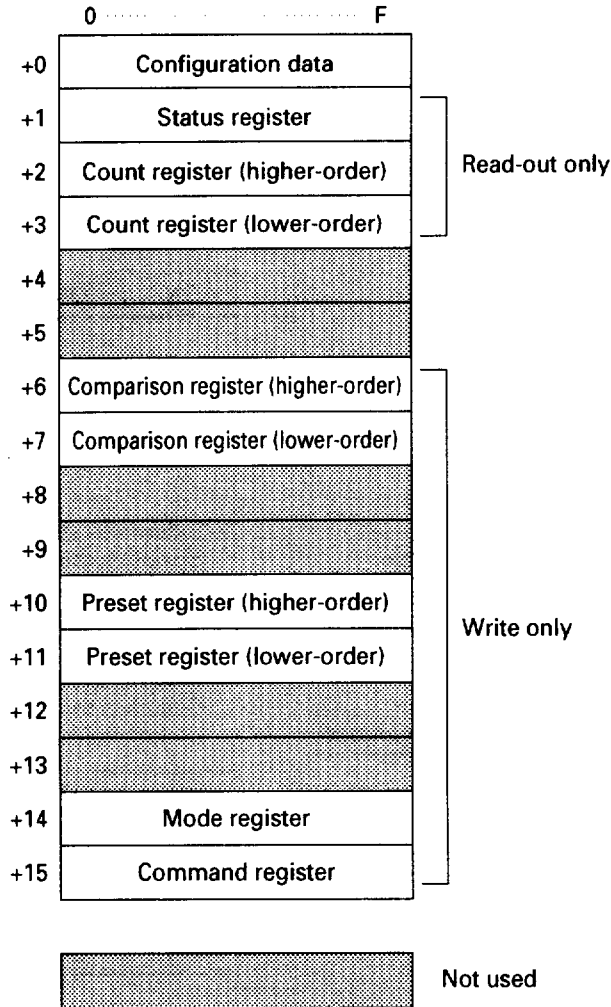This switch is used to set the count mode and comparison external output mode.

OFF→ON

Position	Function	Selection mode	
		OFF	ON
1	Sectional count mode selection	Sectional count mode	Ordinary count mode
2	External output exclusive use selection	Outputs > and < output during matching (=) output	Does not output > and < output during matching (=) output
3	Not used	—	—
4	Not used	—	—

3.5 Specifications of Function Cards

• Register configuration of the NV1F-HC1 and NV1F-HC2

1) NV1F-HC1

Starting address
W24.***

|		
+0	Configuration data	
+1	Status register	⎫
+2	Count register (higher-order)	Read-out only
+3	Count register (lower-order)	⎭
+4	░░░░░░░░░░░	
+5	░░░░░░░░░░░	
+6	Comparison register (higher-order)	⎫
+7	Comparison register (lower-order)	
+8	░░░░░░░░░░░	
+9	░░░░░░░░░░░	
+10	Preset register (higher-order)	Write only
+11	Preset register (lower-order)	
+12	░░░░░░░░░░░	
+13	░░░░░░░░░░░	
+14	Mode register	
+15	Command register	⎭

░░░░░░░░░░░ Not used

Using position 3 of the operating mode switch, 16/32 bit mode switching is possible for the count registers of the NV1F-HC1. In 32 bit mode, 2 words (higher-order and lower-order registers) are used; in 16 bit mode, only 1 word (higher-order register) is used.

Notes: 1. The configuration data is used by the F55 processor and cannot be accessed by the user.
2. When the write only area is used by the source operand of an instruction in a user program, write data cannot be read out or monitored normally during monitoring with the program loader or I/O status indicator.
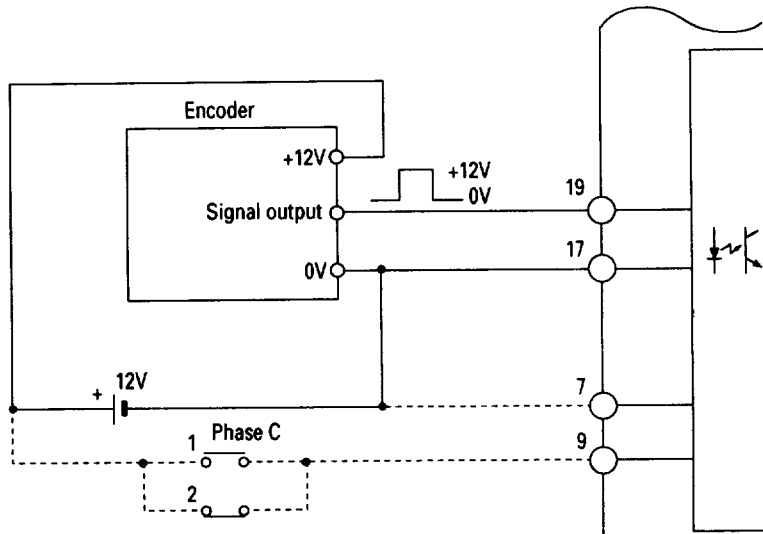
2) NV1F-HC2

Starting address

|	0 ········· F	
0	Count register	→ Read-out only
1	Not used	
2	Count register	← Write only
3	Not used	.
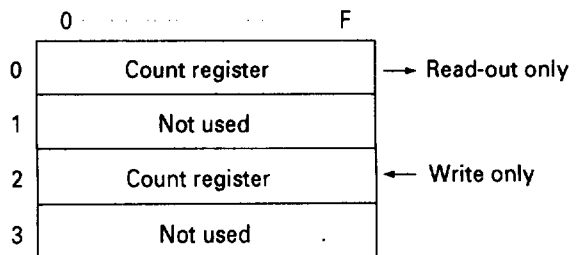
• **Connection example**

① Single-phase pulse (addition) and single-phase pulse (substraction)........ When single-phase encoder is used (example with 12 V signal level)

• When an external reset signal is used, make the connections drawn with dotted lines.
    Phase C SW 1 (rising)
    Phase C SW 2 (falling)
    Reset at rising or falling edge, depending on the input mode setting for phase C.

② Single-phase pulse + directional command signal........... When single-phase encoder and external signal for directional signal are used together (example with 12 V signal level)
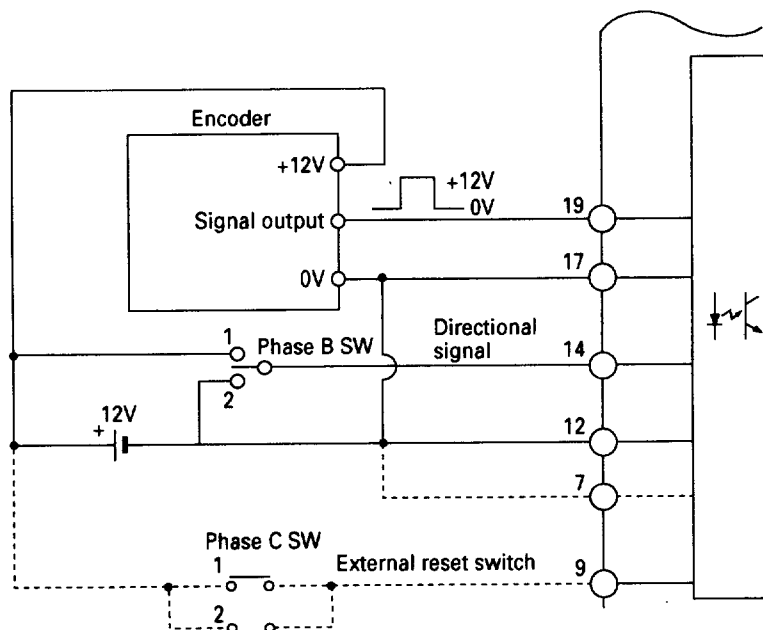

• Directional signal — OFF: Substraction   ON: Addition
• When an external reset signal is used, make the connections drawn with dotted lines.
    Phase B SW1: Substraction
    Phase B SW2: Addition

    Phase C SW 1 (rising)
    Phase C SW 2 (falling)
    Reset at rising or falling edge, depending on the input mode setting for phase C.
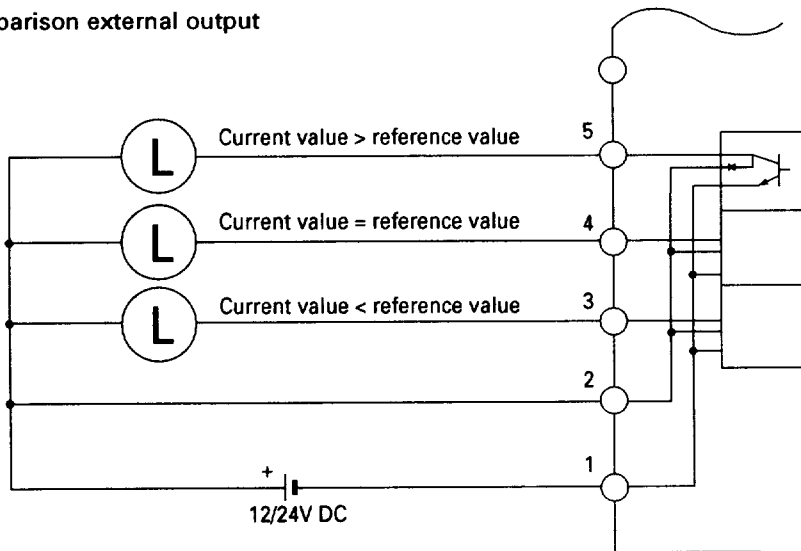
3.5 Specifications of Function Cards

③ Two-phase pulse .... When two-phase encoder is used (example with 12 V signal level)
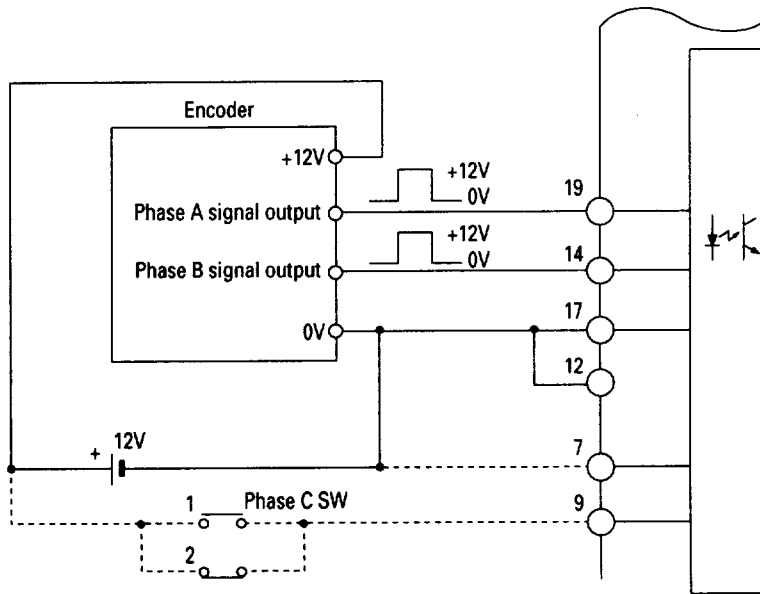
* When an external reset signal is used, make the connections drawn with dotted lines.
   Phase C SW 1 (rising)
   Phase C SW 2 (falling)
   Reset at rising or falling edge, depending on the input mode setting for phase C.

④ Connection of comparison external output

(4) T-link master card (NV1L-TL1)
① Overview
This card, mounted on the basic unit, makes it possible to use various T-link equipment.
With this card, one T-link system can be configured. (It can be mounted on the main unit only; it cannot be mounted on expansion units.) Basic unit case version 1001 or later is provided with a calendar function. (For details, see User's Manual <Instructions> FEH160.)

② Specifications

Item	Specifications
Type	NV1L-TL1
Transmission mode	Half duplex, serial transmission
Data exchange mode	1:N (polling/selecting)
Transmission speed	500kbps
Connections	Up to 35 units Master processor x 1 Capsule or slave module/unit x 32 Program loader x 2] 35 units maximum
Transmission line	Multi-drop
Current consumption	5V DC, 60mA or less
Mass	Approx. 90g

③ Structure

T-link connector
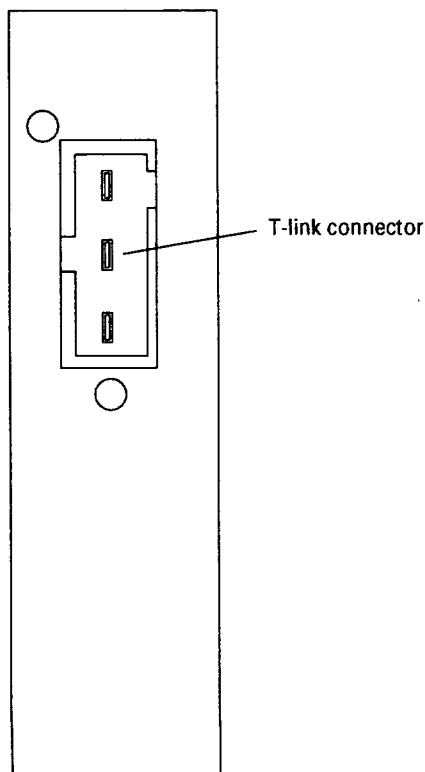
3.5 Specifications of Function Cards

(5) T-link slave card (NV1L-TS1)

① Overview

The NV1L-TS1 is a communication card that is mounted on the basic unit and expansion units of the MICREX-F F55 series. It is connected to another processor (with the T-link master function) via the T-link for data transmission. The card is provided with three transmission modes: I/O transmission which uses I/O area (area B), message communication by means of message module registration (system defined), and message communication using message communication instructions (MSGT, MSGR).
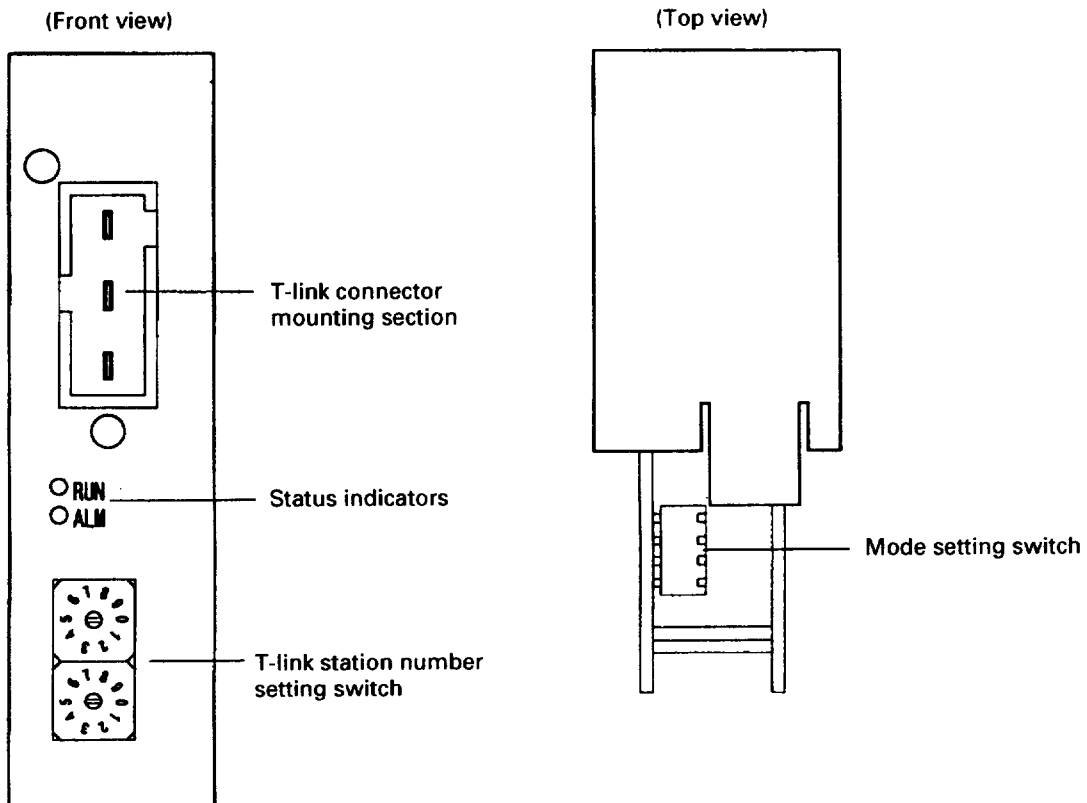
② Specifications

Item	Specifications
Type	NV1L-TS1
Number of T-link I/O points *1	I/O: 1/1, 2/2, 4/4, or 7/8 word mode can be selected by the mode setting switch *2
Message communication function	Message communication (up to 110 words) by message module registration Data exchange (up to 108 words) by message communication instructions (MSGT and MSGR) (Whether this function is used or not is selected by the mode setting switch.)
Status indicators RUN (green)	Normal operation
ALM (red)	Fault occurred.
T-link connection	By the T-link connector
Current consumption	5V DC, 350mA
Number of words occupied *1	Selected by the mode setting switch (1/1=2 words, 2/2=4 words, 4/4=8 words, 7/8=16 words) *3
Number of slots occupied	1 I/O slot
Mass	Approx. 150g

Notes: *1. Depends on the switch setting on the card.
 *2. When 7/8 words are selected as the number of T-link I/O points, data exchange by message communication is not allowed. Set the mode selection switch so that message communication is not performed.
 *3. When 7/8 words are selected as the number of T-link I/O points, TS1 occupies 16 words in the I/O area (area B).

③ Structure

(Front view)   (Top view)

T-link connector mounting section

Status indicators

T-link station number setting switch

Mode setting switch

④ Configuration and example operation
The address of the T-link slave card connected to the slave processor is assigned in the same manner as general I/O modules/cards.

Example)
Connect the one end of the T-link cable to the master processor and the other end to the slave processor.
Then make setting as follows:
1) Set the station number of the slave processor viewed from the master processor to "20".

2) Install the slave module in slot No. 3 on the slave processor.
3) Set the mode setting switch so that message communication is not performed, and set the number of T-link I/O points to 2/2 words.
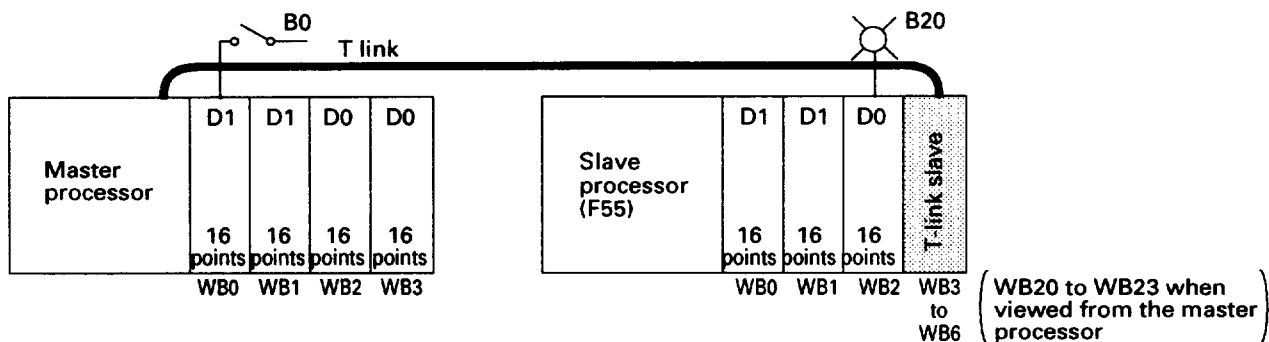

• When the address setting knob is set to "20", assignment of the T-link I/O areas of the slave and master processors is as follows:

Address viewed from the slave processor	Address viewed from the master processor
WB003 (Input)	WB022 (Output)
WB004 (Input)	WB023 (Output)
WB005 (Output)	WB020 (Input)
WB006 (Output)	WB021 (Input)

To connect the B0 switch of the master processor and turn on the lamp connected to B20 of the slave processor using this switch, the program is as follows:

Master processor program
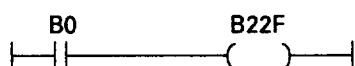
Slave processor program
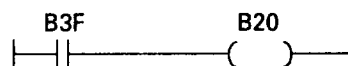
3.6 I/O Capsule (Unit) Specifications

3.6.1 I/O terminal

(1) Overview

This unit is a secondary remote I/O station of the independent type that can be connected to the MICREX-F. The number of I/O points is 16 or 32. It can be mounted easily on the operation panel or terminal box by means of a rail and screws, and used like a terminal block.

(2) Specifications

① General specifications

Item		Specifications
Physical conditions	Operating temperature	0 to +55°C
	Relative humidity	20 to 90%RH (without condensation)
	Storage temperature/humidity	–20 to 70°C/20 to 90%RH (without condensation)
	Dust	No conductive dust present
	Corrosive gas	No corrosive gas present
Mechanical conditions	Resistance to vibration	JIS C 0911, crossover frequency 57Hz, Screw mounting: 19.6m/s² (2G), when relay output is provided: 9.8m/s² (1G)* Rail mounting : 9.8m/s² (1G), including the case when relay output is provided For 2 hours in 3 axis directions *
	Resistance to shock	JIS C 0912, test method 1-No. 3, 2 times in 3 axis directions — Malfunction shock: 147m/s² (15G) * Endurance shock: 294m/s² (30G) *
Electrical conditions	Noise immunity	1500Vp-p by noise simulator, rising time 1ns, pulse width 1µs
	Dielectric strength	1500V AC, 1 minute, between external terminals and ground
	Insulation resistance	10MΩ or more between external terminals and ground (at 500V DC megger)
Installation conditions	Grounding	Ground resistance of 100Ω or less
	Structure	Installed in the panel
	Cooling system	Self cooling
	Mounting method	JIS/IEC standard, by means of 35mm width rail or M4 screws

* When the unit is mounted by means of a rail, be careful not to apply vibration or shock.

② Unit specifications

Item		Specifications			
Unit type		FTT1604-G02	FTT3204-G02	FTT16R0-G02	FTT32R0-G02
Supply voltage		24VDC±20%		24VDC±15%	
Power consumption		5W or less	8W or less	8W or less	10W or less
Inrush current		30A maximum, 10ms or less			
Allowable time of instantaneous power failure		3ms or more (from 24V to 0V)			
Number of I/O points	Input	16 points	32 points	—	—
	Output	—	—	16 points	32 points
Number of words occupied		1 word	2 words	1 word *1	2 words *1
Mass		Approx. 330g	Approx. 460g	Approx. 390g	Approx. 590g

Item		Specifications			
Unit type		FTT16T0-G02	FTT32T0-G02	FTT16T4-G02	FTT32T4-G02
Supply voltage		24VDC±20%			
Power consumption		5W or less	8W or less	5W or less	8W or less
Rush current		30A maximum, 10ms or less			
Allowable time of instantaneous power failure		3ms or more (from 24V to 0V)			
Number of I/O points	Input	—	—	8 points	16 points
	Output	16 points	32 points	8 points	16 points
Number of words occupied		1 word	2 words	1 word *1	2 words *1
Mass		Approx. 330g	Approx. 480g	Approx. 320g	Approx. 460g

*1 See the next page (3-43).

③ Input/output section specifications

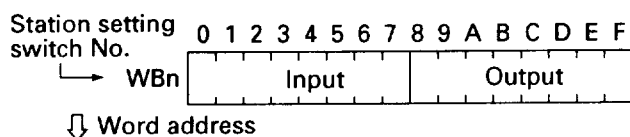| Item		Specifications			
Type		FTT1604	FTT3204	FTT16T4	FTT32T4
Number of points, number of common points		8 point common x 2 circuits	8 point common x 4 circuits	8 point common x 1 circuit	8 point common x 2 circuits
Polarity		Source input			
Rated input voltage		24V DC			
Rated input current		7mA or less/point (24V)			
Operating voltage range		0 to 26.4V DC (single-phase full-wave rectification not available)			
Number of points that can be ON at the same time		See the next page.			
Input operating voltage	ON level	15 to 26.4V			
	OFF level	0 to 5V			
Internal impedance		3.3kΩ			
Input filtering time	ON→OFF	10ms or less			
	OFF→ON	10ms or less			
Number of words occupied		1 word	2 words	1/2 words [*1]	1 word [*1]
Isolation		Photocoupler			
Operating indication		LED (green): Lights when ON.			
External connections		Detachable terminal block			

④ Output section specifications

Item		Specifications					
Type		FTT16T0	FTT32T0	FTT16T4	FTT32T4	FTT16R0	FTT32R0
Output		Transistor (sink type)				Relay	
Number of points, number of common points		8 point common x 2 circuits	8 point common x 4 circuits	8 point common x 1 circuit	8 point common x 2 circuits	8 point common x 2 circuits	8 point common x 4 circuits
Rated voltage (allowable voltage range)		5/12/24 DC (4.75 to 30 V)				264V AC max. 30V DC	
Maximum load current		0.2 A/point, 0.8 A/8 points				2 A/point, 8 A/8 points	
Minimum load current		—				2 mA (5V DC)	
Number of points that can be ON at the same time		—				See the next page.	
Allowable surge current		1 A, 10 ms				—	
Leakage current (OFF state)		1 mA or less (24 V)				—	
Voltage drop when ON		1.5 V or less (0.2 A load)				—	
Response time	OFF→ON	1 ms or less				10 ms or less	
	ON→OFF	1 ms or less				10 ms or less	
Surge suppressor		Zener diode clamp				—	
Operating indication		LED (green): Lights when ON.					
Number of words occupied		1 word	2 words	1/2 words[*1]	1 word[*1]	1 word	2 words
Isolation		Photocoupler				Photocoupler + Relay	
External connections		Detachable terminal block					
Remark		When an inductive load is connected to transistor output, be sure to connect a fly-wheel diode in parallel with the load.					

*1 I/O memory assignment
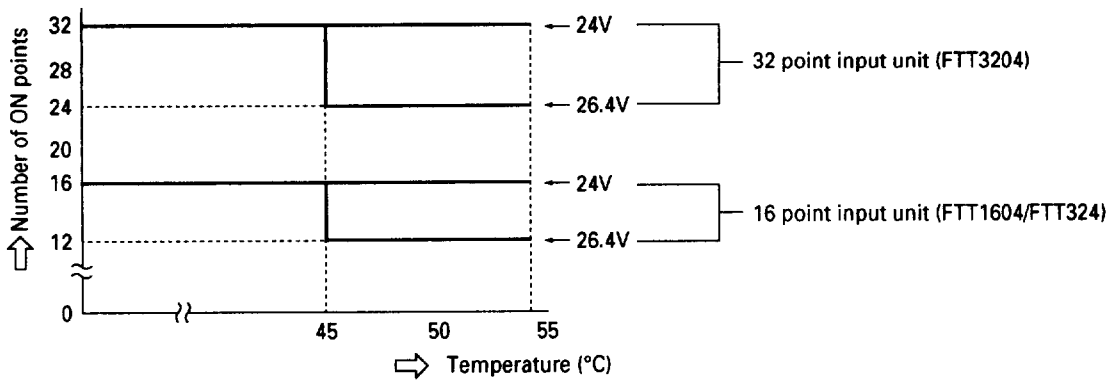
1) 16 point I/O hybrid unit (FTT16T4) ⇨ Bit address

Station setting switch No.
0 1 2 3 4 5 6 7 8 9 A B C D E F
⌊→ WBn | Input | Output |
⇩ Word address

2) 32 point I/O hybrid unit (FTT32T4) ⇨ Bit address

Station setting switch No.
0 1 2 3 4 5 6 7 8 9 A B C D E F
⌊→ WBn | Input |
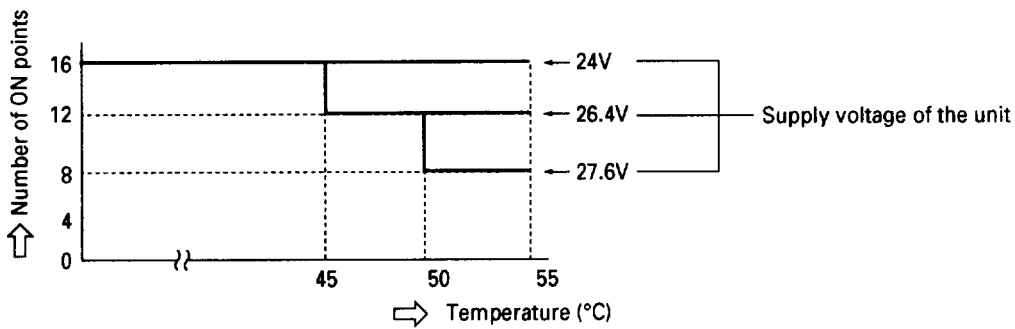WBn + 1 | Output |
⇩ Word address
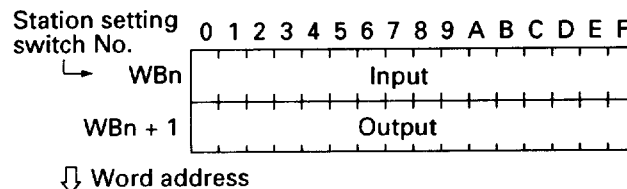
3.6 I/O Capsule (Unit) Specifications
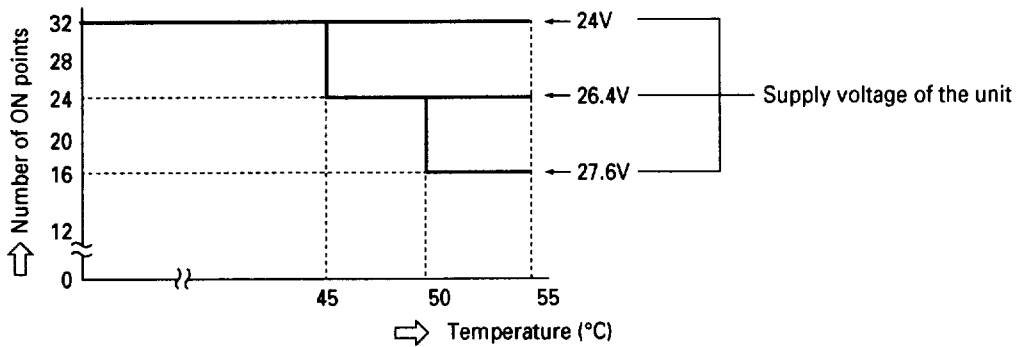
⑤ I/O section derating
   1) Input section (types: FTT1604/FTT3204/FTT32T4)
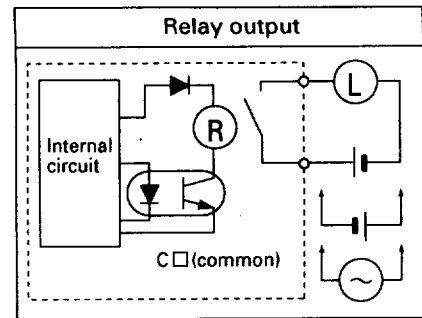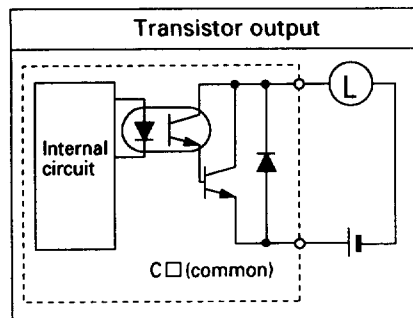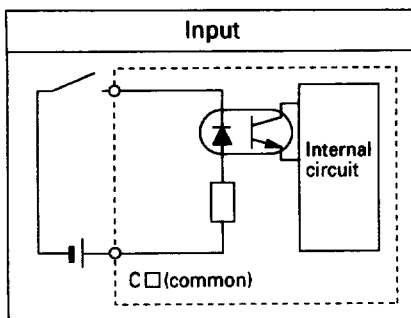

   2) Output section (type: FTT16R0)

   3) Output section (type: FTT32R0)

(3) External wiring diagrams
① Internal circuit configuration
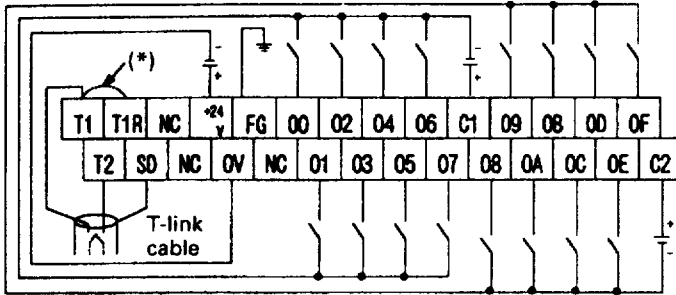
3.6 I/O Capsule (Unit) Specifications

② External wiring diagrams for each type

1) FTT1604-G02
- The size of terminal screws is M3.5. Tighten them with the specified tightening torque (0.8 to 1.0 Nm [8 to 10 kgf·cm]).
- When the unit is used as a T-link termination, short-circuit terminals T1 and T1R indicated by

(*) with a lead. When they are short-circuited, a termination resistor is connected.
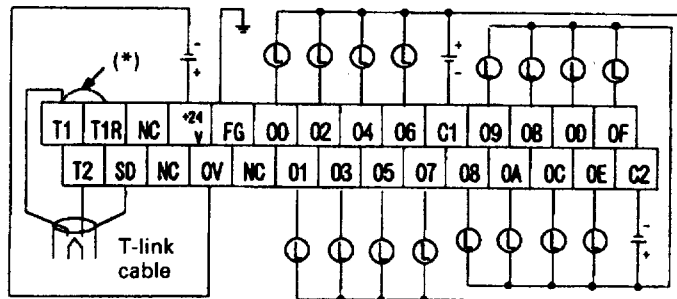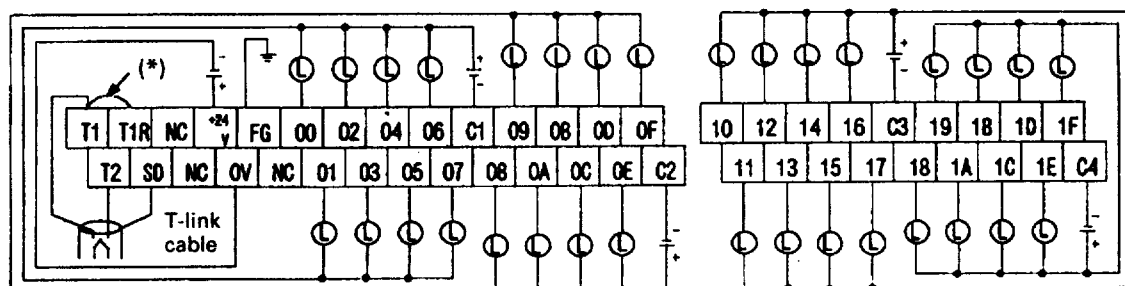- Use the T-link cables recommended by Fuji Electric. (See subsection 1.4.2.)
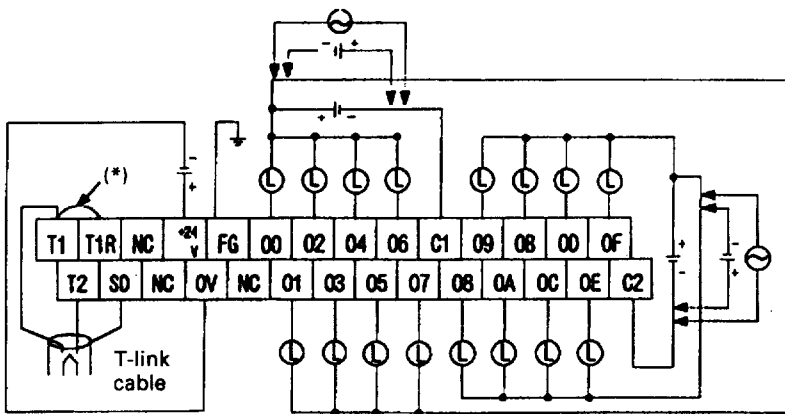

2) FTT3204-G02
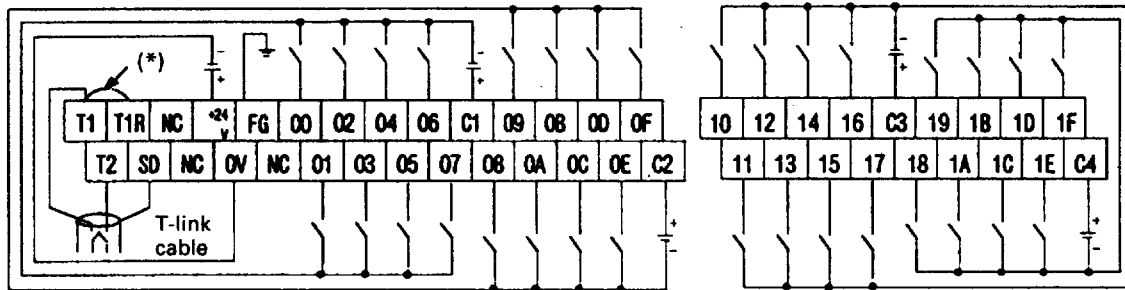
3) FTT16T0-G02

4) FTT32T0-G02

3.6 I/O Capsule (Unit) Specifications

5) FTT16R0-G02

6) FTT32R0-G02
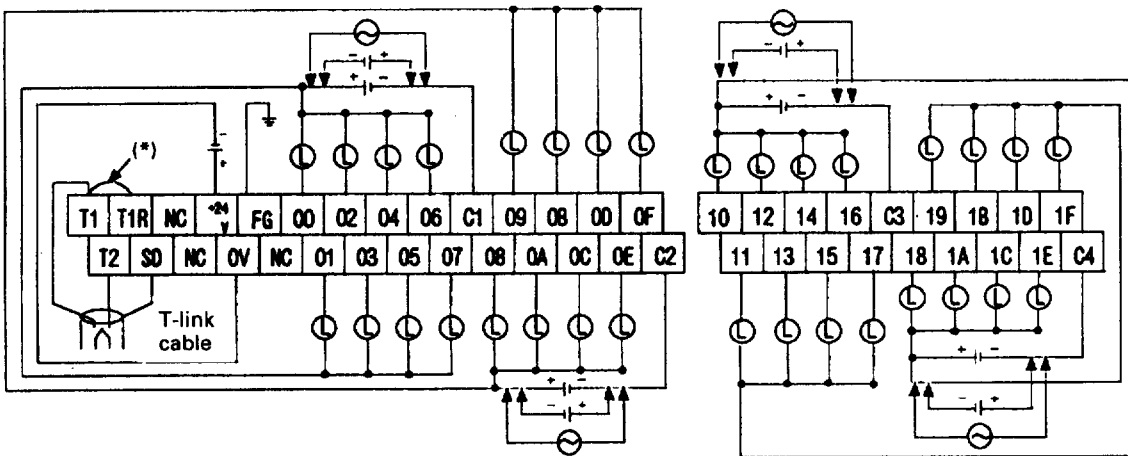
7) FTT16T4-G02
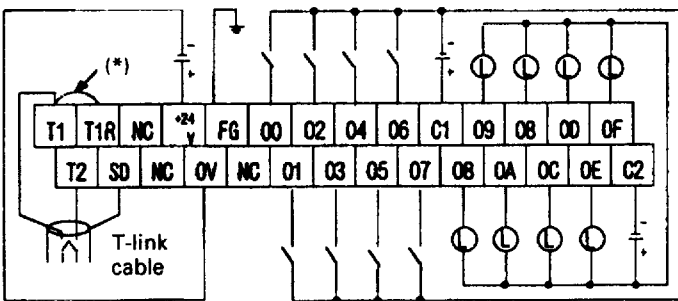
8) FTT32T4-G02
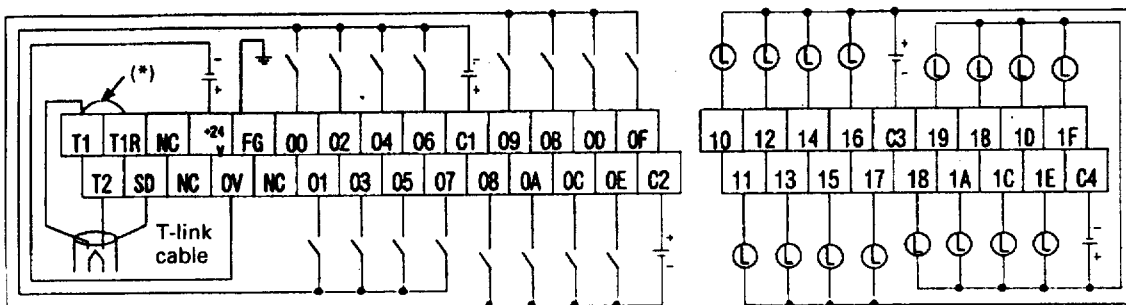
(4) External view and structure
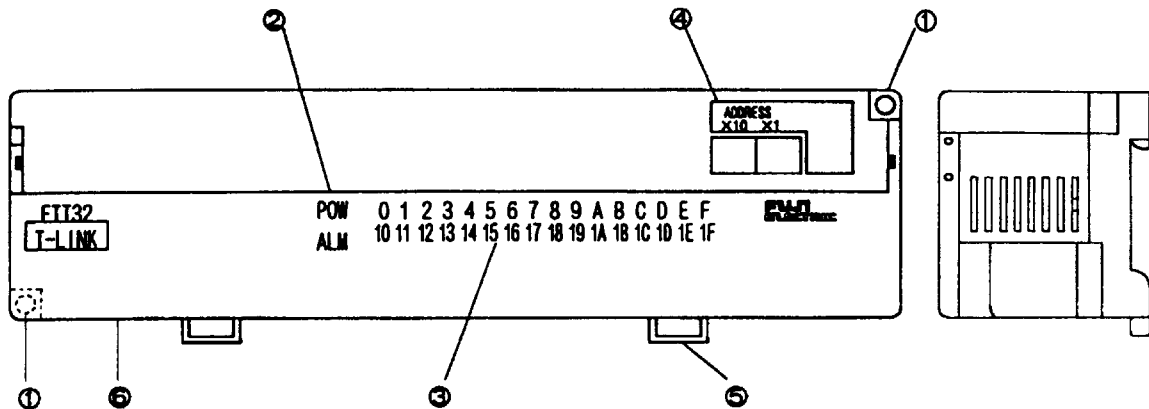
① Mounting hole: Mount the unit with an M4 screw.
② Status indicator LED: Indicates the operating conditions of the I/O terminal.

Name		Status	Color
POW	Normal operation	ON: Normal power supply operation	Green
ALM	Communication error	ON : Transmission error OFF: Normal	Red

③ Input or output indicator LEDs
   Lights when corresponding I/O is on.
④ Station No. setting switch
   Used to set the station No. to the starting address of area WB (I/O relay) to be assigned. The example below shows "WB71".

⑤ JIS/IEC rail mounting hook
   When demounting the I/O terminal, move this hook downward with a screw driver.
⑥ Detachable terminal block
   Open the cover to complete the wiring.
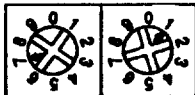
(5) Dimensions, mm
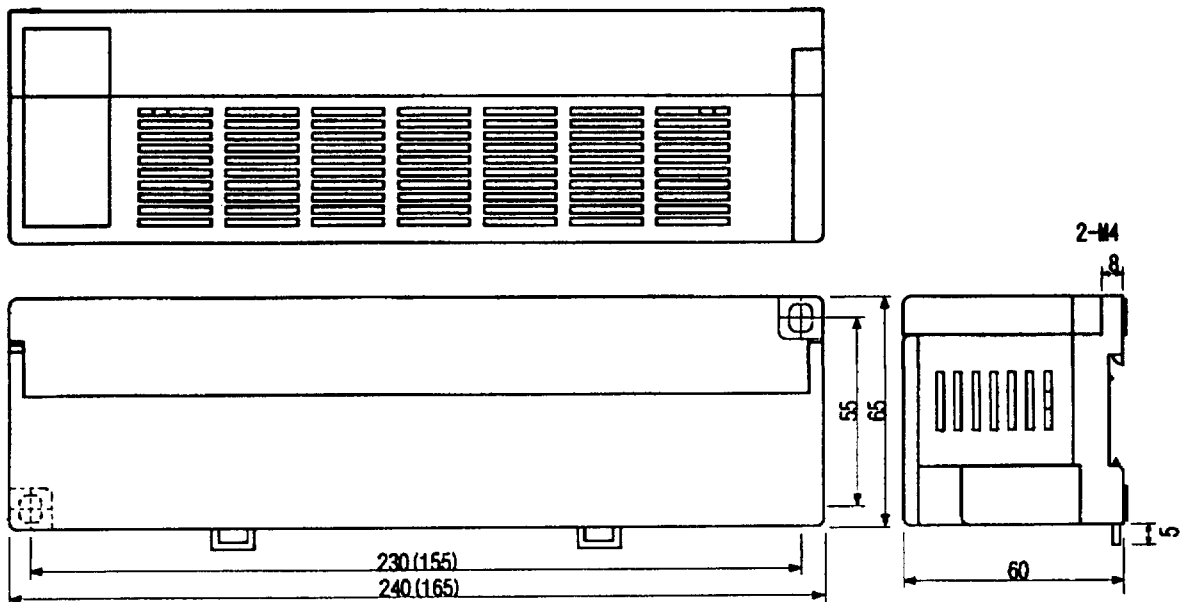
The number in (   ) is the value for 16 point types (FTT16□□-G02).

3.6 I/O Capsule (Unit) Specifications

① Mounting and demounting
The unit can be mounted either with rail or screws.
- When using screws
Mount the unit securely by tightening two M4 screws at mounting holes on a diagonal line.
Tightening torque: 1 to 1.5 Nm [10 to 15 gkf cm]
- When using rail
When a 35 mm width guide rail conforming to the

JIS/IEC standard is used, the unit can be mounted and demounted easily. In this case use special fittings for the rail to mount the unit securely.
Fuji Electric offers the following types:
Mounting rail: TH35-15AL, 7.5, 7.5AL
End clamp kit: TS-XT

Mounting

- Panel
- Hook
- Rail
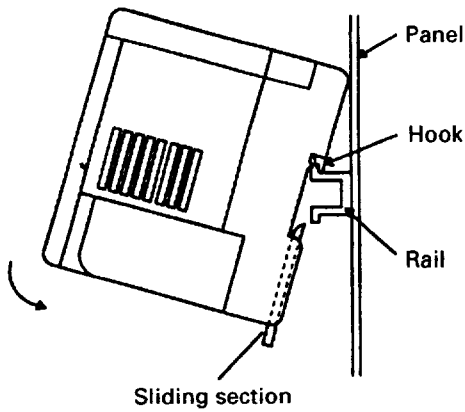
Sliding section

Hook the unit to the rail as shown, and then push the unit in the direction indicated by the arrow.

Demounting
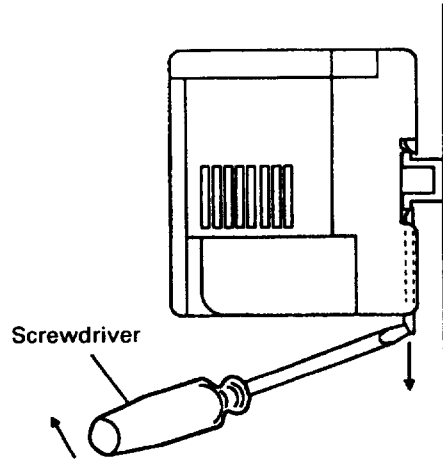
Screwdriver

Insert a screwdriver into the sliding section of the unit, and then move it in the direction indicated by the arrow.

② Mounting direction

Front view

Other equipment

Other equipment

I/O terminal

100mm

100mm   NG

Heat generating appliance

I/O terminal — NG

Allowable if the address switch is located at the bottom

Side view

I/O terminal

NG

Other equipment

I/O terminal

100mm

I/O terminal   NG

The MICREX-F series is provided with an I/O level serial transmission system that allows the processor to be connected to decentralized I/O modules/capsules (remote I/Os) and specialized capsules. This system, called the T-link system, achieves high-speed data transmission at low cost.

When the T-link master interface is mounted on the F55 series, a T-link system can be configured. In addition, by using a single processor and decentralized T-link slave modules/units, data transmission at I/O level is possible between multiple processors.

(1) T-link specifications

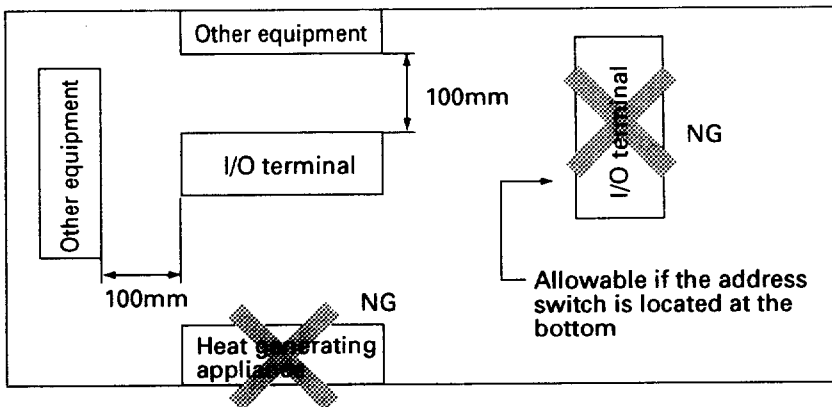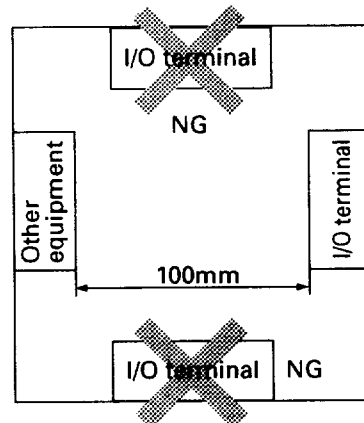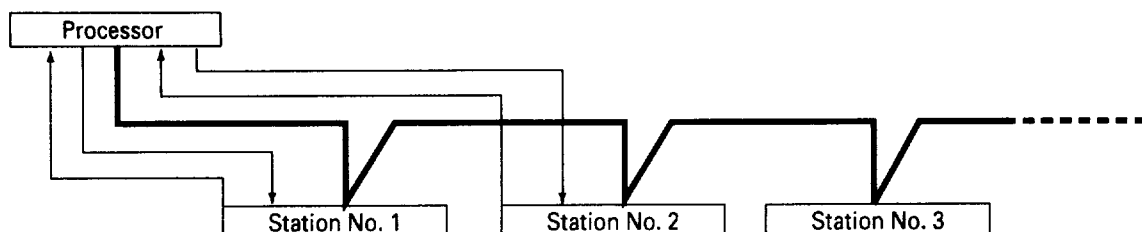| Item		Specification
Transmission mode		Half duplex, serial transmission
Data exchange mode		1:N (polling/selecting)
Transmission speed		500k bits/second
Effective transmission speed		7k bytes/second (digital 512 points/10ms)
Modulation mode		Pulse duration modulation (PDM)
Number of connectable units (capsules)		Program loader: Up to 2 units for each processor T-link capsule: Up to 32 units
Number of I/O points		Digital I/O: Up to 1600 points (for each T-link system)
Transmission line		Bus configuration (multi-drop) Optical loop connection using an optical converter (FNC100C) between busses
Duplication of transmission line		Duplication of optical transmission line using an optical converter is possible.
Cable	Electrical transmission line	Twisted pair cable (Furukawa Electric): KPEV-SB 0.75mm^2 x 1 pair 700m max. Twisted pair cable (Furukawa Electric): KPEV-SB 0.5mm^2 x 1 pair 700m max.
	Optical transmission line	Simulated step index type (SI), crystal fiber (dedicated cable), distance between optical converters 1000m max. Grated index type (GI), crystal fiber (dedicated cable), distance between optical converters 3000m max.
Termination processing		A supplied 100Ω termination resistor is connected at each end of electrical transmission lines.
Diagnostic functions	Error check	FCS (CRC-CCITT: $X^{16}+X^{12}+X^5+1$) Data word check Collision detection
	Status mode	Statuses of T-link capsules and loaders connected to the T-link are collected by the processor and can be used as status flags. The operating mode of each T-link capsule is delivered by the processor to each station. T-link RAS function

Note: For electrical transmission lines, the total line length depends on the cable type used. For cable types, see subsection (3), "T-link cables". For details on T-link operation, see User Manual <Communication> (FEH161).

Glossary

- Multi-drop .... A network in which multiple stations are connected to a single line
- Polling/selecting .... A communication control method

  The processor inquires of other stations in sequence as to presence or absence of a send request (this operation is referred to as polling). Stations having no send request reply with "send request absent" in response to polling; those having a send request reply with "send request present", and then start data transmission.

  When the processor wants to send data to other stations, it specifies the target station (this operation is referred to as selecting), and then starts data transmission.

- FCS: Abbreviation of "frame check sequence", which is one method of data checking.

3.7 T-link Specifications

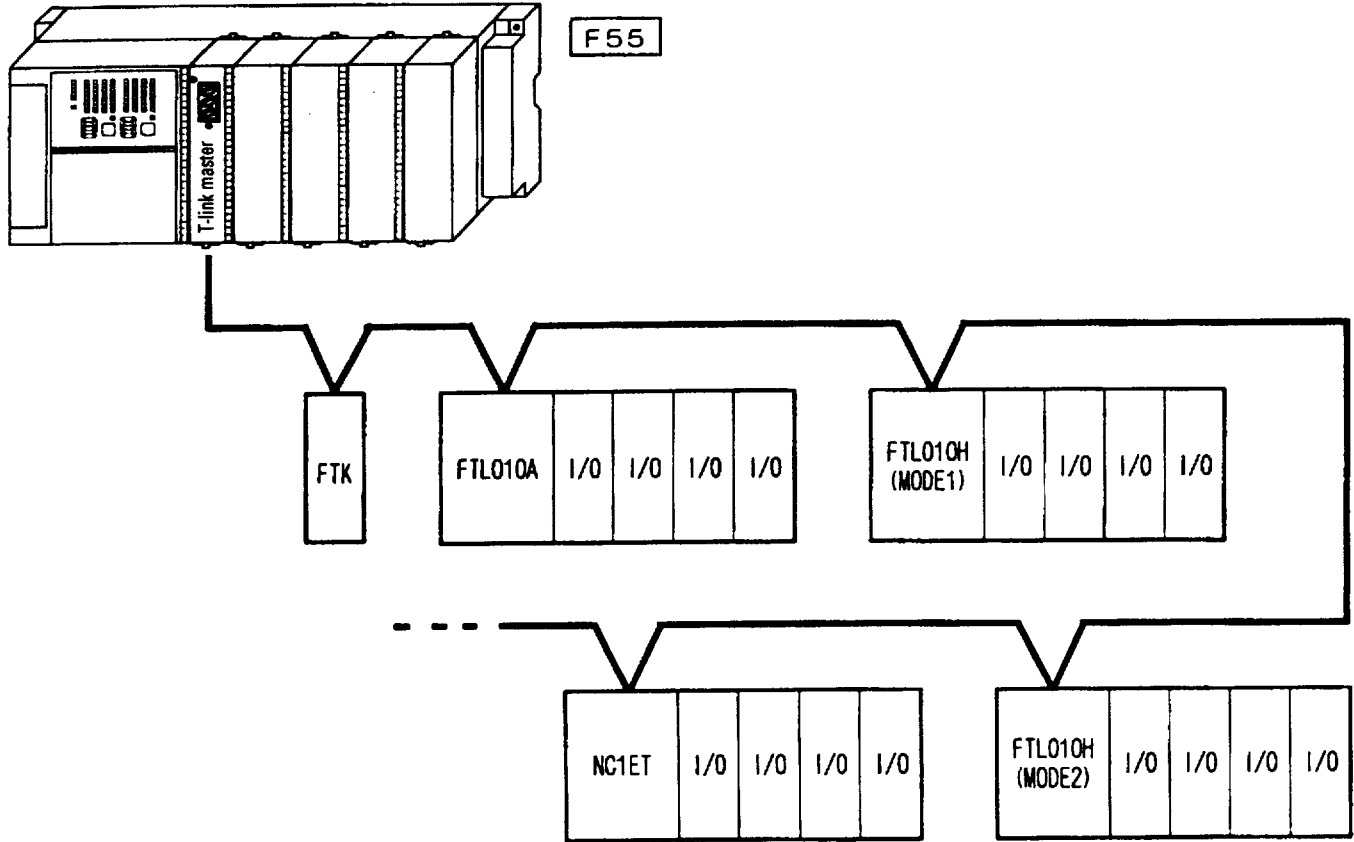**(2) T-link equipment connection**

There are no particular restrictions on T-link equipment that can be connected to the F55 basic unit.

• FTL010A, FTL010H (set to MODE1), FTL010H (set to MODE2), and T-link interface module (NC1ET) for the MICREX-F70 can be connected at the same time, as shown below.

• Mini T-link equipment cannot be connected directly.
Use a T-link converter in this case.

(3) T-link cable (electrical transmission lines)

Use the specified T-link cables (twisted pair cable with shield) shown in the following table. If cables other than the following are used, T-link operation is not guaranteed.

Maker	Cable type		Length		Remark
Furukawa Electric Co., Ltd.	KPEV-SB	1.25mm² X 1	Max. 1km	*1, *2	Twisted pair cable
	KPEV-SB	0.75mm² x 1	Max. 700m	*1	
	KPEV-SB	0.50mm² x 1	Max. 700m	*1	
Daiden Co., Ltd.	RMEV-SB	0.50mm² x 1	Max. 290m	*1	Robot cable
Taiyo Electric Wire & Cable Co., Ltd.	RVV-SB	0.50mm² x 1	Max. 200m	*1	
Hien Denko Co., Ltd.	TTYCYS-1	x 1	Max. 100m	*1	Marine use
	250V-TTYCYS	x 1	Max. 50m	*1	
Sumitomo Electric Industries Ltd.	TWIN-100		Max. 250m	*1	
	DPEV-SB	0.50mm² x 1	Max 700m	*1	
Nihon Electric Wire & Cable Co., Ltd.	KPEV-SB	0.50mm² x 1	Max. 700m	*1	
	KNPEV-SB	0.50mm² x 1	Max. 700m	*1	
Furukura Electric Co., Ltd.	IPEV	0.50mm² x 1	Max. 700m	*1	

*1 The value of the maximum length has been checked by test. Note that the value may be less, depending on operating environment (noise conditions). If the cable is used close to this value, addition of a T-link repeater is recommended.

*2 700m maximum for basic unit versions 0001 to 0999

(4) Optical T-link cable (optical transmission lines)

Category	Type and specifications
Simulated step index type (dedicated cable)	FHC100A-F ☐ ☐ ☐ (indoor type) FHC120A-F ☐ ☐ ☐ (indoor and outdoor type) pulling terminal absent at one end FHC120B-F ☐ ☐ ☐ (indoor and outdoor type) pulling terminal present at one end SI type crystal fiber Core/clad diameter: 100μm/140μm Optical connector: Multi-mode FC type connector (equivalent to C341P100/140 from Furukawa) (For the cable types above, supplied as standard)
Grated index type (GI)	GI type crystal fiber (loss 3dB/km or less, bandwidth 200MHz·km or more) Core/clad diameter: 50μm/125μm Optical connector: Multi-mode FC type connector (equivalent to C411 from Furukawa)

Section 4 Name and Function of Each Part

Section 4 Name and Function of Each Part

4.1 Name and Function of Each Part

4.1.1 Structure of F55 series

(1) Basic unit case versions 0001 to 0999 (basic unit)

② I/O status LED indicator

④ Data position select switch PUSH recognition LED indicator

⑭ Mounting projection

(Front panel)

① Processor status LED indicator

⑰ Mounting hole

⑩ Power supply terminal block

⑤ Data position select switch

⑮ Rail mount

③ Data position LED indicator

⑥ Battery

⑬ Version No. seal

⑪ Optional card slot

⑫ I/O and function card slots

⑧ Program loader connector

⑨ ROM card, battery compartment cover

⑦ EPROM memory card

(2) Basic unit case version 1001 or later (basic unit)

② I/O status LED indicator

④ Data position select switch PUSH recognition LED indicator

⑭ Mounting projection

(Front panel)

① Processor status LED indicator

⑱ User information LED indicator

⑰ Mounting hole

⑩ Power supply terminal block

⑲ Maintenance LED indicator

⑤ Data position select switch

⑮ Rail mount

⑳ Mode select switch

③ Data position LED indicator

⑥ Battery

㉑ Extension cable connector

⑬ Version No. seal

⑪ Optional card slot

⑫ I/O and function card slots

⑧ Program loader connector

⑨ ROM card, battery compartment cover

⑦ EPROM memory card
EEPROM memory card

(3) Basic unit case version 1001 or later (expansion unit)

(Front panel)

① Expansion unit status LED indicator

② I/O status LED indicator

④ Data position select switch PUSH recognition LED indicator

⑭ Mounting projection

⑰ Mounting hole

⑩ Power supply terminal block

⑤ Data position select switch

⑮ Rail mount

③ Data position LED indicator

⑨ ROM card, battery compartment cover (not used)

⑪ Optional card slot (not used)

⑫ I/O and function card slots

㉑ Extension cable connector

(Rear panel)

⑯ Rail mounting locks

4.1 Name and Function of Each Part

4.1.2 Name and function of each part of the F55 series

The F55 series is provided with 7, 6, or 2 status LED indicators, 2 sets of 8 x 4 LED indicators, 2x7-segment LED indicators, and 3 or 2 switches on the basic unit. Using these LED indicators and switches, the following indication is possible:

① I/O status display mode (for (1), (2), and (3) below)
② User status display mode (for (2) only)
③ Maintenance status display mode (for (2) only)

Mode switching is possible only for (2) below and is done by means of the MODE switch and the W124 control word in the user display area. There are two independent sets of 8 x 4 LED indicators, 7-segment LED indicators, and switches.

(1) Basic unit case versions 0001 to 0999 (basic unit)

① Processor status LED indicator

② I/O status LED indicator

④ Data position select switch PUSH recognition LED indicator

③ Data position LED indicator

⑤ Data position select switch

(2) Basic unit case version 1001 or later (basic unit)

① Processor status LED indicator

⑱ User information LED indicators

⑲ Maintenance status LED indicators

⑳ Mode select switch

② I/O status LED indicator

④ Data position select switch PUSH recognition LED indicator

③ Data position LED indicator

⑤ Data position select switch

(3) Basic unit case version 1001 or later (expansion unit)

① Expansion unit status LED indicator

② I/O status LED indicator

④ Data position select switch PUSH recognition LED indicator

③ Data position LED indicator

⑤ Data position select switch

① Processor status LED indicator (basic unit)
Indicates status of the processor with the following conditions:

LED	Color	Name	Description	Built-in contact status during LED indicating
				RUN
POW	Green	Power supply normal operation	Processor power supply circuit output is normal.	ON/OFF (according to RUN indication)
RUN	Green	During operation	User program being executed	ON
ALM1	Red	Fatal fault	Fatal fault occurred (special relay F0010 to F001F is on)	OFF
ALM2	Red	Nonfatal fault	Nonfatal fault occurred (special relay F0020 to F002F is on)	ON
BAT	Red	Battery error	Battery is not installed or battery voltage is too low (special relay F0020 is on)	ON
I/O	Green	I/O status indication	I/O status being indicated	ON

* With basic unit case version 1001 or later, the user and maintenance status LED indicators go out when the I/O status LED indicator is on.

① Expansion unit status LED indicator (expansion unit)
Indicates the status of the expansion unit with the following conditions:

| LED	Color	Name	Description
POW	Green	Power supply normal operation	Expansion unit power supply circuit output is normal.
I/O	Green	I/O status indication	I/O status being indicated

4.1 Name and Function of Each Part

② I/O status LED indicator
Indicates I/O statuses on a unit basis, for 2 sets of 32 points.

* For sets 0 and 1, indication is made in the same manner but independently.
By default, set 0 indicates slot 0 status and set 1 indicates slot 1 status (when I/O card is inserted in slots 0 and 1).
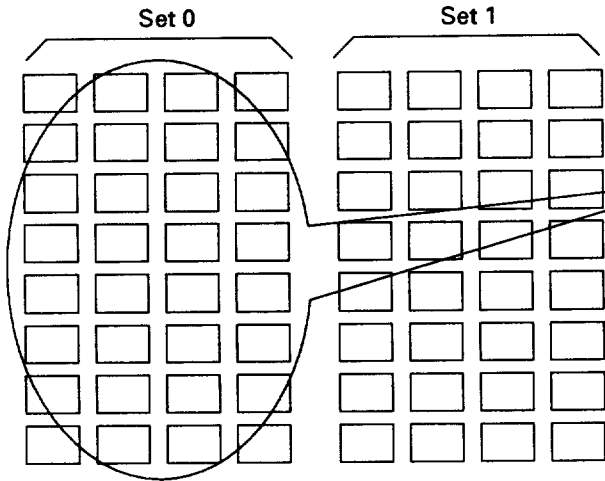
Indicates ON/OFF status of I/O cards in units of 32 points.
Only 16 I/O points of data in the slot are indicated. Lower 16 bits are off.

* Simultaneous scan mode: WB
Direct access mode: W24
Realizes the data monitoring function for each area.

③ Data position LED indicator
Indicates the currently displayed data position (slot position and data position in the slot). When the number of data items in the slot is 32 points (2 words) or less, only the slot position is indicated (for slots No. 0 to 7).

Example:
Displaying words 2 and 3 in slot No. 3
(When 3 or more words are occupied, the following display is made.)

Slot No. (0.8 sec)	Off (0.1 sec)	Word No. (0.3 sec)	Off (0.4 sec)
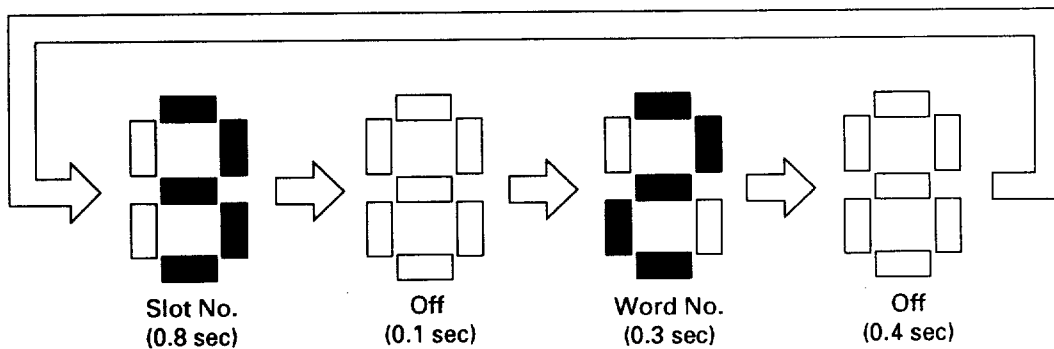
④ Data position select switch PUSH recognition LED indicator
Lights or goes out each time the data position select switch is pressed. (There are two LED indicators corresponding to the two data position select switches.)

⑤ Data position select switch
By pressing this switch, the slot position and data position in the slot can be changed. (Two data position select switches are provided.)

■ ③Example display 1 for data position LED indicator
In this example, the following configuration is assumed.

F55		16 point input	32 point output	T-link slave	16 point output

The T-link slave occupies 2 words for input and 2 words for output.

When power is turned on, the data position LED indicator is as follows:

 CHNG0   CHNG1
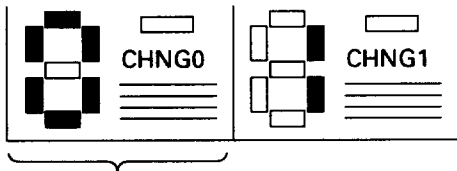
The data position LED indicator and data display switch on the CHNG0 side are to be used.

Number of times the data display switch is pressed and indication:

Data LED indicator at CHNG0

(Displays slot No. 0)

⇩

Once (Displays slot No. 1)

⇩

Twice (Displays the first 2 words of slot No. 2)

⇩

3 times (Displays the last 2 words of slot No. 2)

⇩

4 times (Displays slot No. 3)
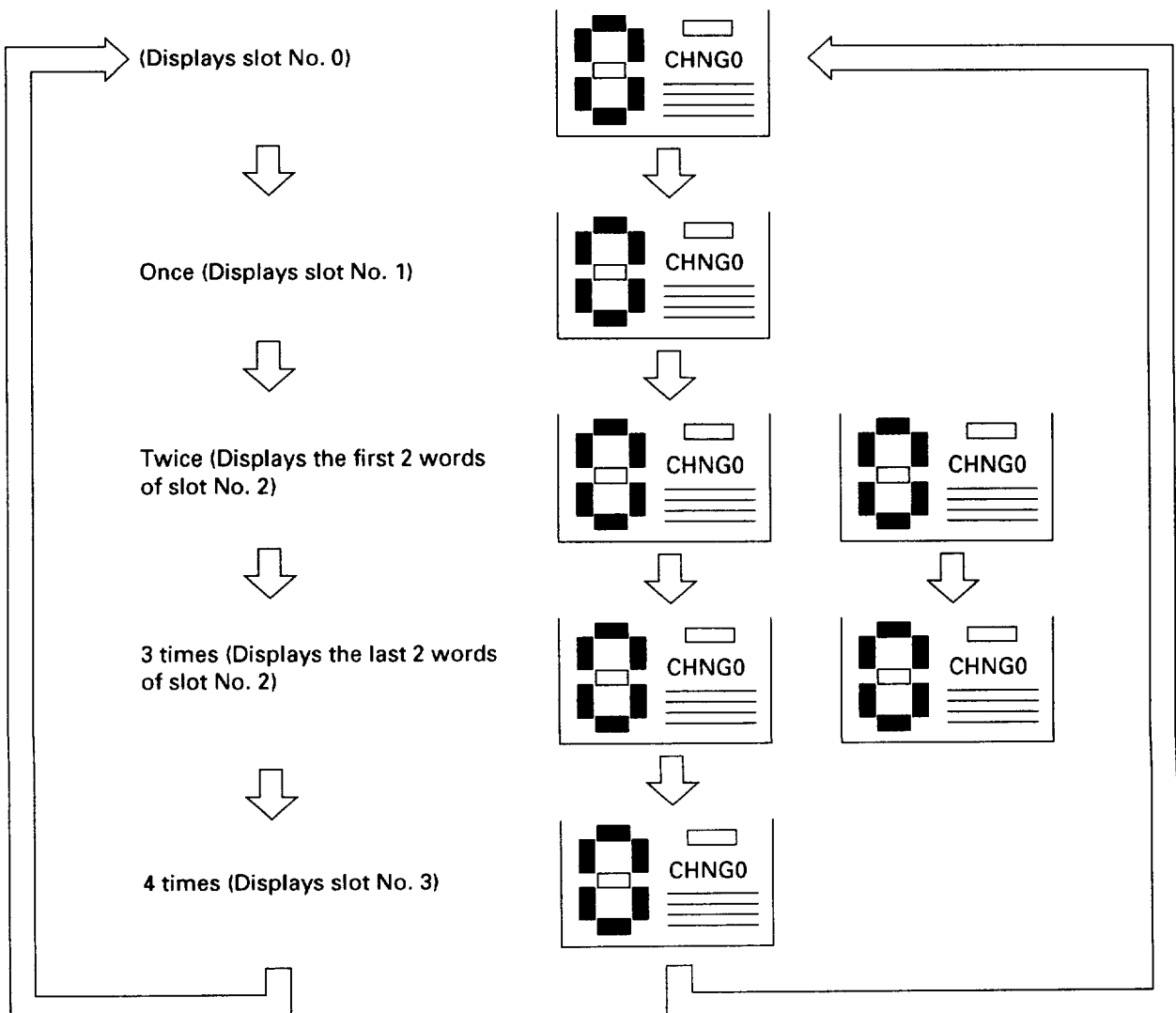
4.1 Name and Function of Each Part

■ ③Example display 2 for data position LED indicator

	Slot No. 0	Slot No. 1	Slot No. 2	Slot No. 3	Slot No. 4	Slot No. 5	Slot No. 6	Slot No. 7
F55	I/O 16 points	I/O 64 points	I/O 32 points (2 slot type)		I/O 32 points	Interrupt	High function 4/4 words	Empty

Data status of display side 0

① I/O status LED indicator	③ Data position LED indicator (7-segment LED)				② I/O ON/OFF LED indicator	⑤Data position select switch PUSH recognition LED indicator	④Data position select switch
	Slot No. (0.8 sec.)	OFF (0.1 sec.)	In-slot word address (0.3 sec.)	OFF (0.4 sec.)			
ON	0	— No flicker	— No flicker	— No flicker	Upper 16 bits: Slot No. 0, word 0 data / Lower 16 bits: All points are turned off	OFF	PUSH
	1	OFF	0	OFF	Upper 16 bits: Slot No. 1, word 0 data / Lower 16 bits: Slot No. 1, word 1 data	ON	PUSH
	1	OFF	2	OFF	Upper 16 bits: Slot No. 1, word 2 data / Lower 16 bits: Slot No. 1, word 3 data	OFF	PUSH
	2	— No flicker	— No flicker	— No flicker	Upper 16 bits: Slots No. 2 and 3, word 0 data / Lower 16 bits: Slots No. 2 and 3, word 1 data	ON	PUSH
	4	— No flicker	— No flicker	— No flicker	Upper 16 bits: Slot No. 4, word 0 data / Lower 16 bits: Slot No. 4, word 1 data	OFF	PUSH
	6	OFF	0	OFF	Upper 16 bits: Slot No. 6, word 0 data / Lower 16 bits: Slot No. 6, word 1 data	ON	PUSH
	6	OFF	2	OFF	Upper 16 bits: Slot No. 6, word 2 data / Lower 16 bits: Slot No. 6, word 3 data	OFF	PUSH
	6	OFF	4	OFF	Upper 16 bits: Slot No. 6, word 4 data / Lower 16 bits: Slot No. 6, word 5 data	ON	PUSH
	6	OFF	6	OFF	Upper 16 bits: Slot No. 6, word 6 data / Lower 16 bits: Slot No. 6, word 7 data	OFF	PUSH
	0	— No flicker	— No flicker	— No flicker	Upper 16 bits: Slot No. 0, word 0 data / Lower 16 bits: All points are turned off	ON	PUSH
	1	OFF	0	OFF	Upper 16 bits: Slot No. 1, word 0 data / Lower 16 bits: Slot No. 1, word 1 data	OFF	PUSH

* With data status of display side 1, starts from slot No. 1, word 0.

- For 2-slot type (32 points), further slot numbers are not displayed.
- For slots into which an interrupt card is installed, the slot number and I/O data are not displayed.
- For empty slots, the slot number and I/O data are not displayed.

4.1 Name and Function of Each Part

■ Operation of the I/O status LED indicator
The following describes the operation of the I/O status LED indicator.
(1) When there are no faults, the LED indicator is operable. (When no I/O device is installed, it is inoperable.)
(2) If a fatal fault (ALM1) occurs, it is inoperable.
(3) If a nonfatal fault (ALM2) occurs, it is basically operable.

If the I/O status LED indicator ① is inoperable, the data position LED indicator (7-segment LED) ② is turned off when the I/O status LED indicator lights.

Detailed LED indicator conditions are shown in the table below.

			① I/O status LED indicator	② I/O ON/OFF status LED indicator	③ Data position LED indicator	④ Data position select switch	⑤ Data position select switch PUSH recognition LED indicator
No fault				Valid	Valid	Valid	Valid
Fault	Fatal fault	Power supply fault BUS error	ON	Invalid OFF	Invalid OFF	Invalid	Invalid OFF
		Memory error					
		User program error					
		Miscellaneous					
	Nonfatal fault	Direct I/O configuration fault					
		Miscellaneous		Valid	Valid	Valid	Valid

4.1 Name and Function of Each Part

⑥ Battery
Used to retain user programs and the contents of the built-in data memory if power supply fault occurs.
Type: NL8V-BT(FBL030A), life expectancy of 5 years (25°C), the guaranteed period is printed on the battery.

⑦ EPROM memory card
ROM memory used to store user programs when ROM operation is performed.
The NV1VMP-10 memory card is provided with EPROM (HN27C256AG-15) from Hitachi. For the NV1VME-10 memory card, which can only be used with basic unit case version 1001 or later, EEPROM is directly mounted. (It is not intended to be replaced by the user.)

⑧ Program loader connector (for basic units only)
Used to connect a program loader (referred to as D10S, D20, LITE, or personal computer loader).

⑨ ROM card, battery compartment cover
This compartment is opened when replacing a battery, mounting a EPROM/EEPROM memory card, or connecting a loader connector. The expansion unit does not store a battery or EPROM/EEPROM memory card and therefore should not be opened.

⑩ Power supply terminal block
This terminal block provides the power supply and ground terminals, and terminals connected to internal contacts used for indication of operating conditions.

RUN ——— Connected to the internal RUN contact.
(Rating: 264V AC 2A, 30V DC 2A)
Expansion unit is not provided with this terminal.

INPUT 24V DC ——— Used to connect 24V DC for relay card driving. (19.2 to 26.4V DC)
* Be sure to supply power when using a relay card.

INPUT 85 to 264V AC ——— Used to connect 100/200V AC.

LG ——— Used to connect a power filter to the ground. (Line ground)
Has voltage that is 1/2 times the input voltage.

FG ——— Used to connect the basic unit to the ground. (Frame ground)
This terminal is connected to the shielding pattern on the printed circuit board.

* Normally, connect both LG and FG to the ground. (Reduces noise immunity.)
If ground connection causes malfunction, disconnect LG, FG, or both from the ground.

⑪ Optional card slot
Used to install the T-link master card (NV1L-TL1). However, for the expansion unit this slot is not used. Do not remove the blank cover of the expansion unit.

⑫ I/O and function card slots
Used to install I/O cards and function cards (for 4, 6, and 8 cards).

⑬ Version No. seal
Indicates the version number of hardware and software.

⑭ Mounting projection
Used to securely mount the card to the basic unit.

⑮ Rail mount
Used to mount the basic unit to IEC, JIS 35mm width rail.

⑯ Rail mounting locks
Used to lock the basic unit to the rail.

⑰ Mounting hole
Used to mount the basic unit to the control panel.
Use 4-M5X20 screws.

⑱ User information LED indicators (basic unit version
1001 or later)
The 8 x 8 LED indicators and two 7-segment LED
indicators are used to display the user information
set in the user display area (W124).
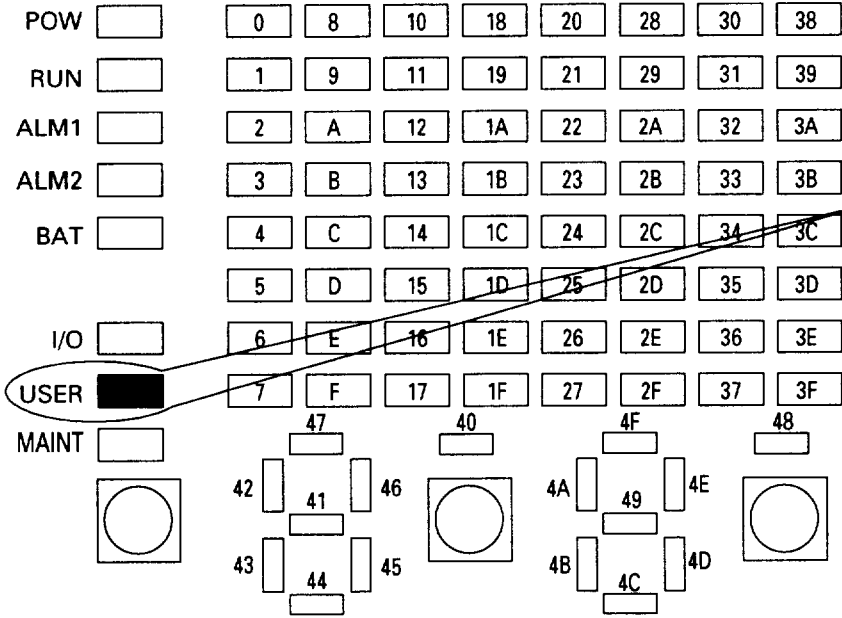
Information can be set only for the
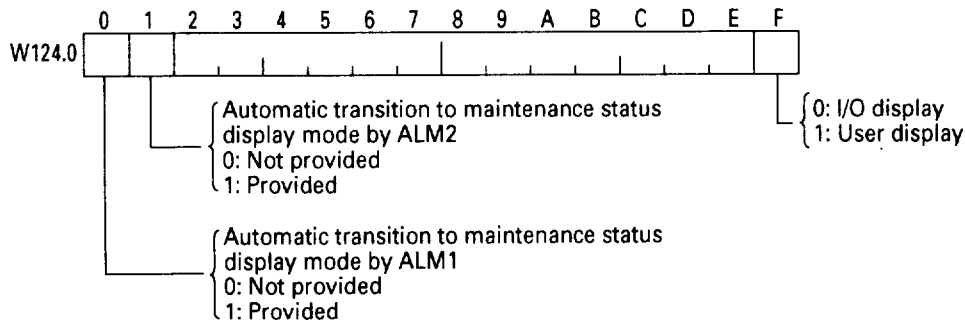numbered LED indicators shown at
left.

● Mode status LED indicator
This LED indicator lights in the
user status display mode. (In this
case the I/O and maintenance LED
indicators go out.)

Module No.: W124 (Attribute: SI, Initial value: all 0)

W124.0	Control word															
W124.1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
W124.2	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
W124.3	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
W124.4	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
W124.5	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F

1: Indicator lights.
0: Indicator goes out.
Can be set from the user program on a
bit basis.

* Control word

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
W124.0																

Automatic transition to maintenance status
display mode by ALM2
0: Not provided
1: Provided

Automatic transition to maintenance status
display mode by ALM1
0: Not provided
1: Provided

0: I/O display
1: User display

Indication by the user program
• Each of bits No. 0 through 4F in user information
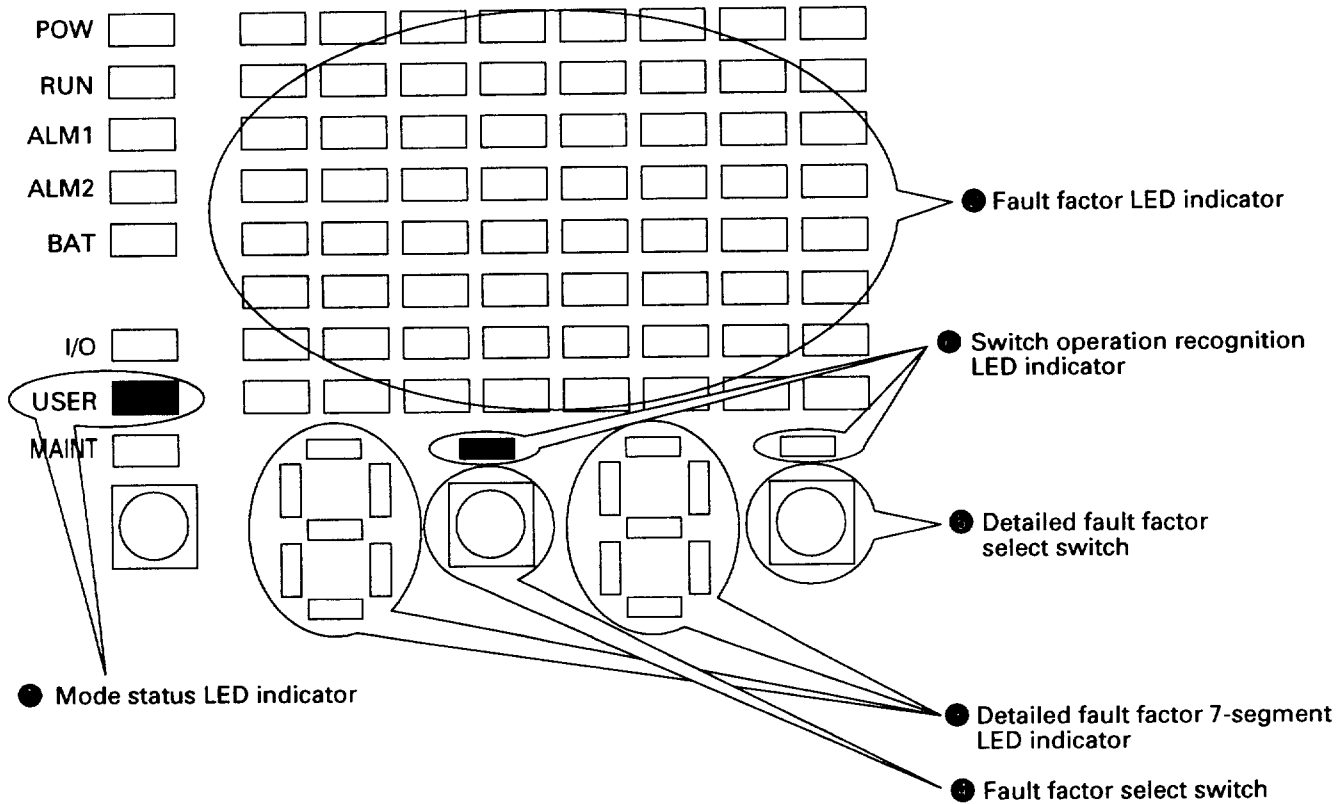display area W124.1 to W124.5 can be set by the
user program.

• When bit No. F in user information display area
W124.0 is set to "1", the LED indicator correspond-
ing to each bit lights.

4.1 Name and Function of Each Part

⑲ Maintenance status LED indicators (basic unit version 1001 or later)

Indicate detailed fault factor on the current fatal or nonfatal faults.

• Function of each section

- Mode status LED indicator
- Fault factor LED indicator
- Switch operation recognition LED indicator
- Detailed fault factor select switch
- Detailed fault factor 7-segment LED indicator
- Fault factor select switch

● Mode status LED indicator
This LED indicator lights in the maintenance status display mode. (In this case the user LED indicator goes out.)

● Fault factor LED indicator
Displays the cause of the fault with a 2-digit code.

● Detailed fault factor 7-segment LED indicator
When the fault indicated by the fault code LED indicator has a detailed fault factor, this indicator displays it with a 2-digit code.

● Fault factor select switch
When there is more than one fault factor, this switch makes it possible to display the corresponding codes in sequence. (Codes are displayed in ascending order.)

● Detailed fault factor select switch
When the fault indicated by the fault code LED indicator has more than one detailed fault factor, this switch makes it possible to display the codes in sequence. (Codes are displayed in ascending order.)

● Switch operation recognition LED indicator
Indicates that switch operation has been recognized by the processor. (The indicator lights or goes out [toggles its condition] each time switch operation is recognized.)

• Fault factors
The following shows the codes displayed by the fault factor LED indicator and the meaning of each code.

Indication of fatal fault factors
(Contents of special relay WF001)

10: Memory error
11: Not used
12: Auxiliary power supply error
13: Power supply fault
14: T-link fault
15: Option fault
16: Not used
17: Not used
18: User program error
19: WDT error
1A: BUS error
1B: Not used
1C: I/O area duplication
1D: Too many capsules on T-link
1E: I/O area over
1F: Plant fault

Indication of nonfatal fault factors
(Contents of special relay WF002)

20: Battery error
21: Not used
22: Option fault
23: Not used
24: Not used
25: Not used
26: T-link configuration fault
27: Not used
28: Not used
29: Direct I/O configuration fault
2A: Not used
2B: Not used
2C: Not used
2D: Not used
2E: Program error
2F: Plant fault

* Failure factors marked with ○ have a detailed failure factor.
* If there is no failure factor, the corresponding LED indicator is off.

• Detailed fault factor
The following shows the codes displayed by the detailed fault factor 7-segment LED indicator.
14: T-link fault
26: Detailed information on T-link configuration fault (Contents of special relays WF020 to WF029) Indicates the station number of the faulted T-link station.
1A: BUS error
29: Detailed information on direct I/O configuration fault (Contents of W165.300 to 360) Indicates the slot number of the faulted slot (including the LED indicator number).
Slot number: "00" to "15"
Basic unit LED: "L1"
Expansion unit LED: "L2"
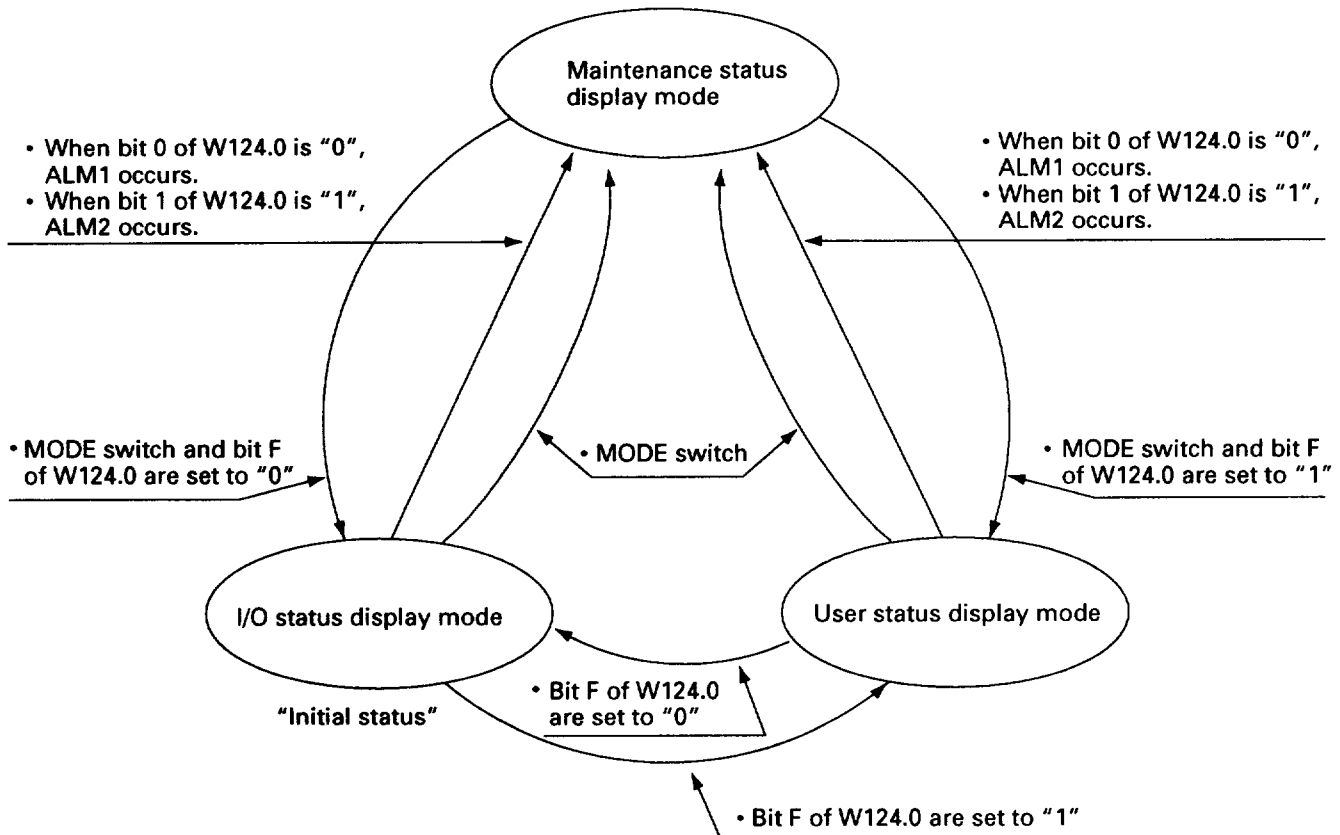Identification not possible: "—"

1C: I/O area duplication (Contents of W165.109) Indicates a duplicated station number (00 to 99).
1F: Plant fault <fatal fault> (Contents of annunciator relay WA000) Indicates an annunciator relay number (01 to 0F).
2F: Plant fault <nonfatal fault> (Contents of annunciator relays WA001 to 003) Indicates an annunciator relay number (11 to 3F).

* When there is no detailed fault factor, the 7-segment LED indicator is off.

4.1 Name and Function of Each Part

⑳ Mode select switch (basic unit version 1001 or later)
When switching between I/O status display mode, user status display mode, and maintenance status display mode, this switch is used to set the control word for the user display area (W124).
The following shows mode transitions.

```
                    ┌────────────────────┐
                    │  Maintenance status │
                    │  display mode       │
                    └────────────────────┘

• When bit 0 of W124.0 is "0",                    • When bit 0 of W124.0 is "0",
  ALM1 occurs.                                       ALM1 occurs.
• When bit 1 of W124.0 is "1",                     • When bit 1 of W124.0 is "1",
  ALM2 occurs.                                        ALM2 occurs.


                         • MODE switch

• MODE switch and bit F                            • MODE switch and bit F
  of W124.0 are set to "0"                           of W124.0 are set to "1"


  ┌────────────────────┐              ┌────────────────────┐
  │ I/O status display │              │ User status display│
  │ mode               │              │ mode               │
  └────────────────────┘              └────────────────────┘
      "Initial status"
                        • Bit F of W124.0
                          are set to "0"

                    • Bit F of W124.0 are set to "1"
```

㉑ Extension cable connector (basic unit version 1001 or later)
Used to connect the basic unit and expansion unit.
This connector is available in three lengths: 0.3m, 0.6m, and 1.0m.
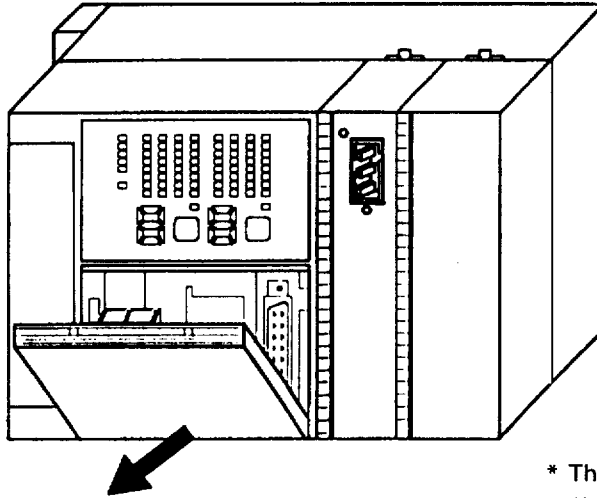
* When installing this connector, the supplied screwdriver can be used.
(For the installation procedure, see subsection 5.4.6 in Section 5.)

4.1.3 Installing and uninstalling optional cards

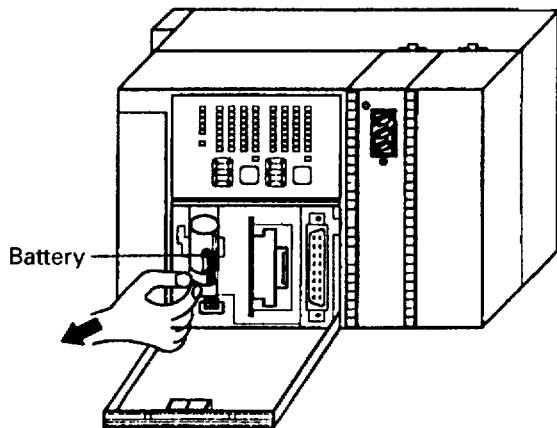**(1) Installing and removing the EPROM/EEPROM memory card and the battery**

① Open the cover of the basic unit.

* The expansion unit is not provided with a memory card or battery. Do not open the cover.

• Installing the battery

② Grasp the pull tab of the battery and pull the battery out.

③ Pull out the connector.
When installing the battery, follow the steps above in reverse order.

• Installing the EPROM/EEPROM memory card

② Grasp the pull tab of the EPROM/EEPROM memory card, and then pull it out.
When installing the card, follow the steps above in reverse order.

Battery

Memory card types available
EPROM : NV1VMP-10
EEPROM: NV1VME-10
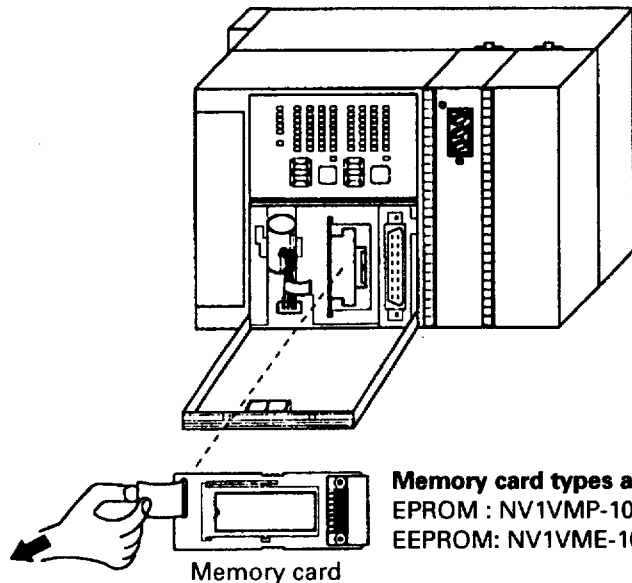
Memory card

* The EEPROM memory card is an option for basic unit case version 1001 or later.
* The EEPROM is directly mounted on the card and is not intended to be replaced by the user.

4.1 Name and Function of Each Part

(2) Name and function of the EEPROM memory card
(type: NV1VME-10)

① Write protect switch

③ Connector

② Pull tab
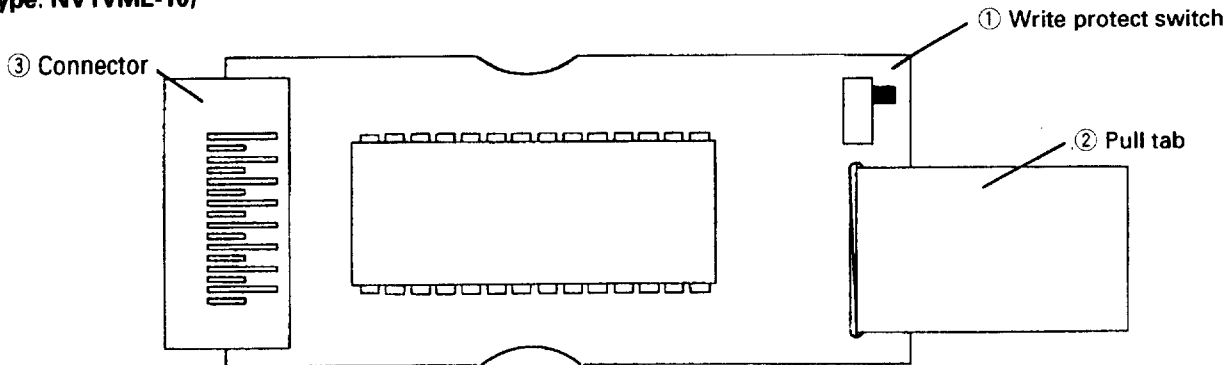
① Write protect switch
Enables and disables write operation for the EEPROM.

Before setting this switch, be sure to turn off the power of the basic unit to avoid malfunction of the processor.
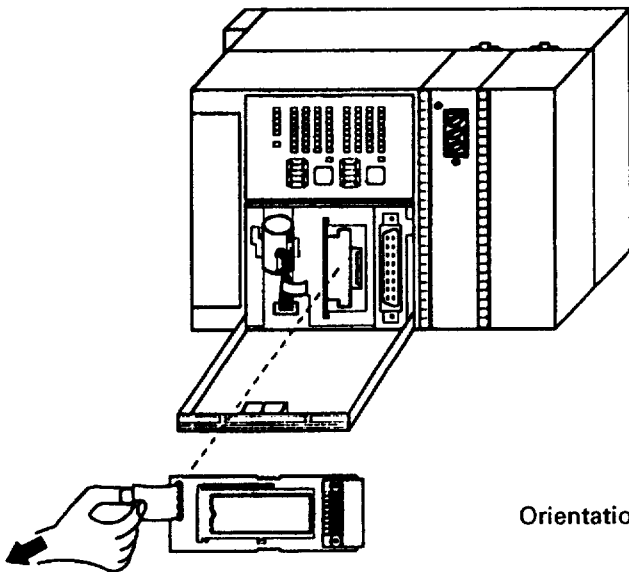
OFF
ON
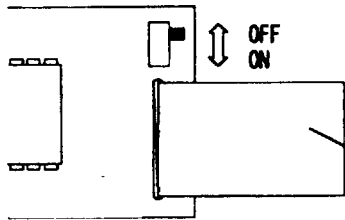
OFF: Write protection is off.
 Enables program write operation.
ON : Write protection is on.
 Disables program write operation.

② Pull tab
When pulling out the EEPROM memory card from the basic unit, grasp this tab firmly, then pull it slowly.

③ Connector
Used to connect the EEPROM memory card to the basic unit.

(3) Handling the EEPROM memory card

<Installing the card>
① Turn off the power of the basic unit. Then confirm the orientation of the card, and insert it into the slot of the basic unit.
② Push the card with your fingers until it fits into position.

<Removing the card>
① Turn off the power of the basic unit, grasp the pull tab, and then pull out the card slowly.

Orientation of the card: When inserting the card, hold it so that the parts mount surface is oriented correctly, as shown in the illustration.


⚠ CAUTION

- Before installing or removing the memory card, turn off the power of the basic unit. Inserting or removing the memory card without turning off the power may cause damage to it or basic unit and/or cause malfunction of the basic unit.
- Before setting the memory setting switches (the write protect switch of the NV1VME-10), turn off the power of the basic unit. Setting a switch without turning off the power may cause malfunction of the basic unit.
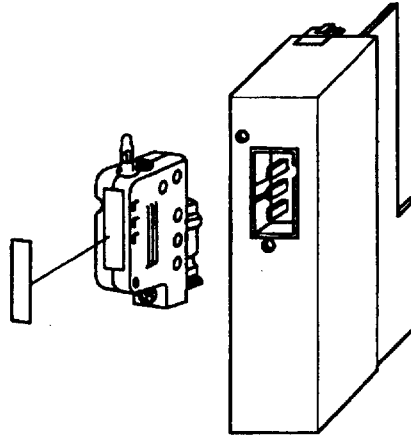
(4) Installing an optional card

① Remove the blank cover for the optional card.

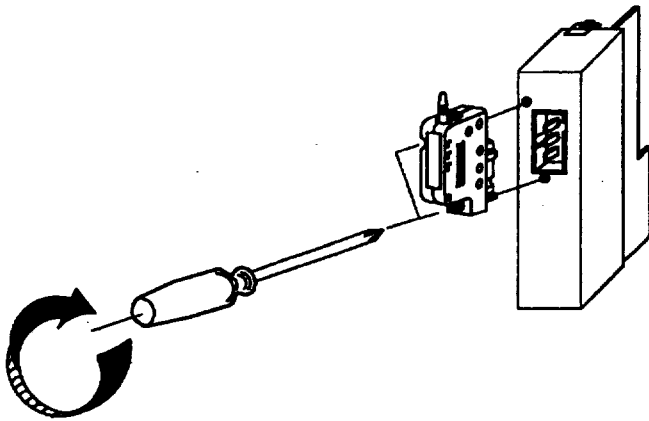Press and hold the mounting projection, then pull out the cover to remove it.
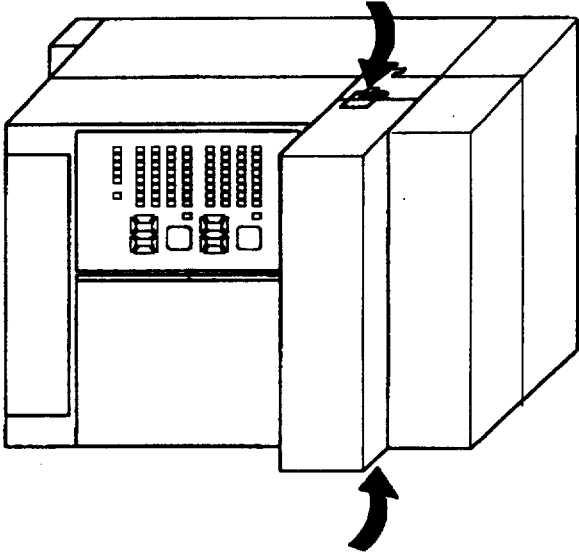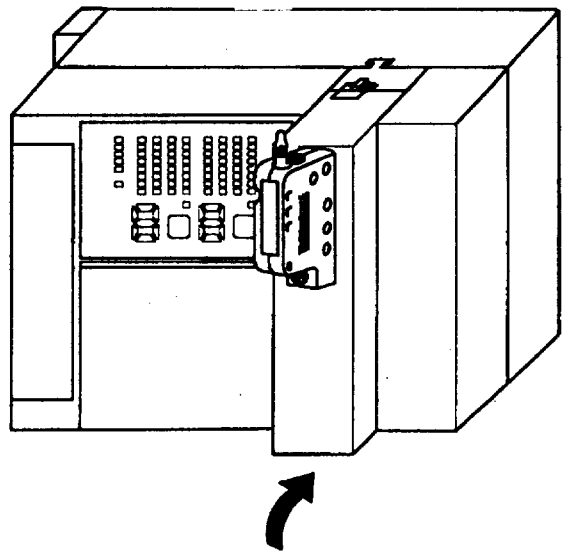
② Apply a character sheet on which the link No. and channel No. are printed.

③ Tighten the two connector screws.

④ Insert the optional card until it clicks into position.

* Steps ②, ③, and ④ can be performed in any order.

Note: Optional cards cannot be used for the expansion unit. Do not remove the blank cover of the expansion unit.

4.1 Name and Function of Each Part

(5) Installing the I/O card
① Remove the blank cover for I/O and function cards.

Press and hold the mounting projection, then pull out the cover to remove it.

② Insert the I/O card until it clicks into position.
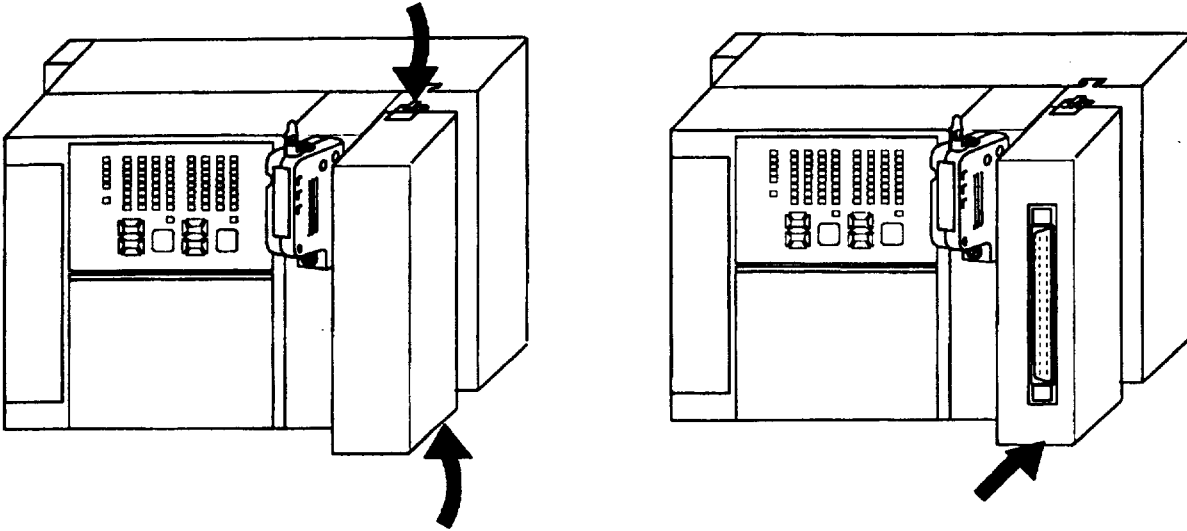
(6) Mounting the basic unit to the rail
① With the rail mounting locks released as shown, attach the basic unit to the rail.

Note
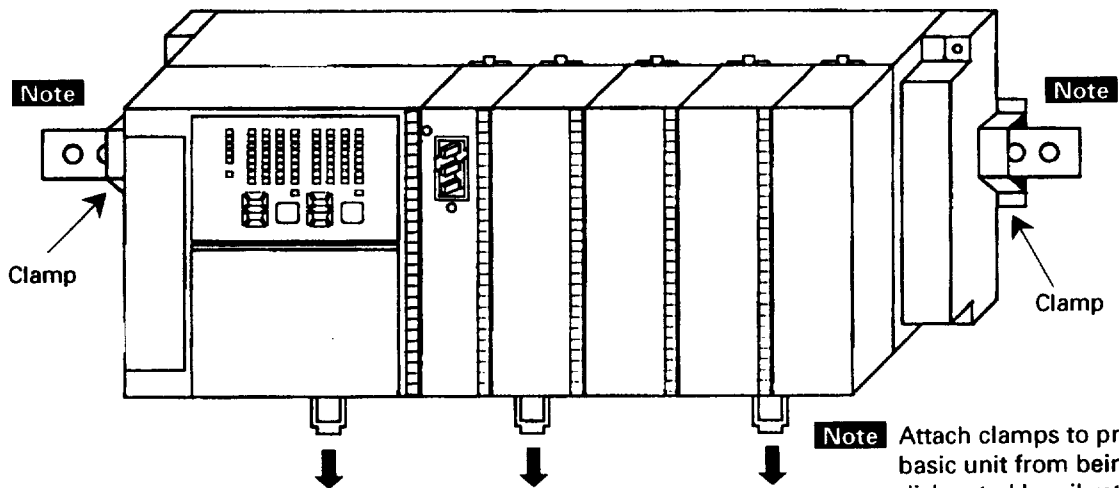
Clamp

Note

Clamp

Note Attach clamps to prevent the basic unit from being dislocated by vibration.

② Press the rail mounting locks upward.

Note

Note
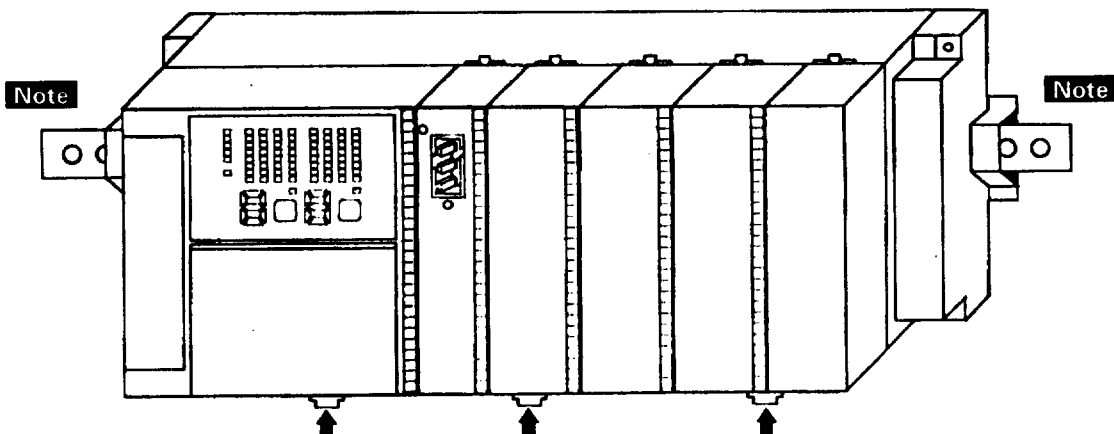
4.1.4 Structure of the I/O card and I/O capsule

There are two types of I/O unit: card type and capsule type. The card type is installed on the rack, and the capsule type is used via the T-link.

I/O card

I/O 8 point, 16 points

I/O 32 points

⑩ Mounting projection

① Cover

④ I/O terminal block connector

⑪ Printed circuit board

④ I/O terminal block connector

I/O capsule

⑦ Mounting screw 2-M3.5

③ Address setting switches

⑨ Status LED indicators

⑧ T-link terminal block

① Cover

② Program loader connector

⑥ I/O status LED indicator

④ I/O terminal block

⑤ Power supply terminal block
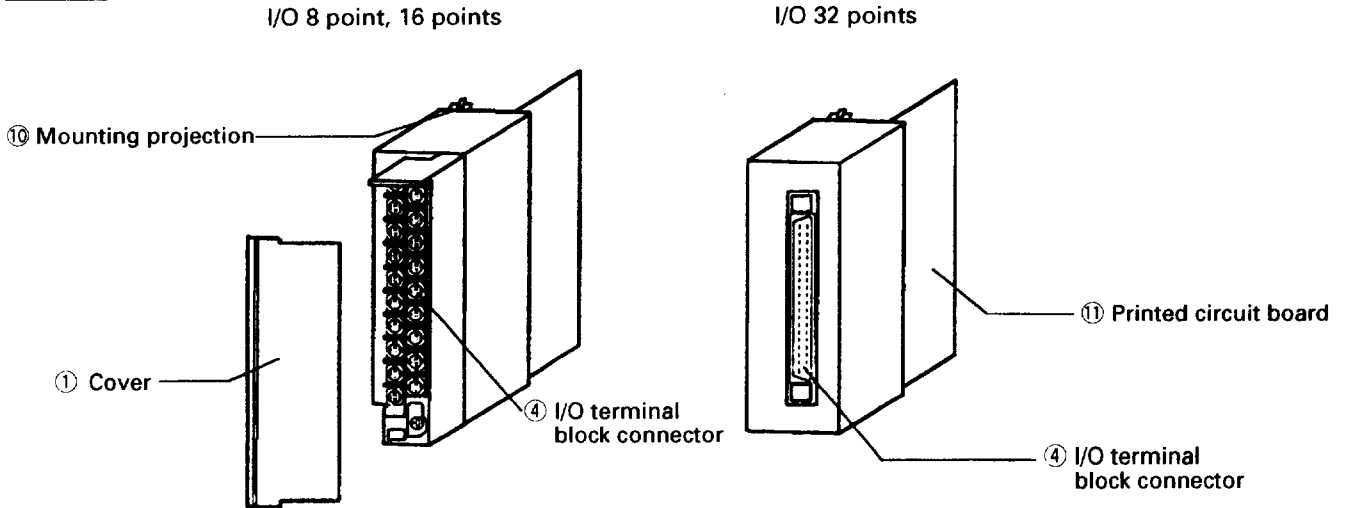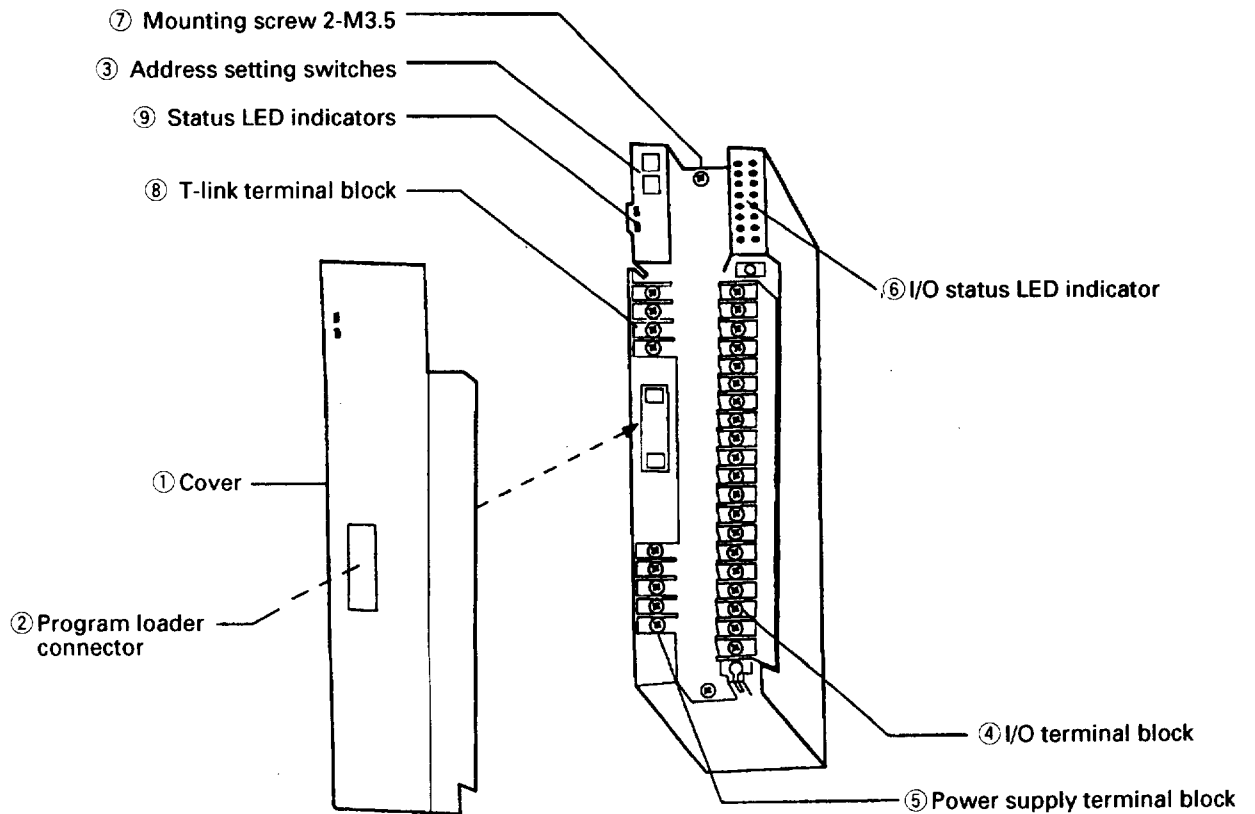
4.1 Name and Function of Each Part

4.1.5 Name and function of each part of the I/O card and capsule

The I/O card and capsule consists of different components depending on the type as shown in the table below.

Type / Name	I/O card (8/16 points)	I/O card (32 points)	I/O capsule
①Cover	○	×	○
②Program loader connector	×	×	○
③Address setting switches	×	×	○
④I/O terminal block	○	×	○
⑤Power supply terminal block	×	×	○
⑥I/O status LED indicator	×	×	○
⑦Mounting screws	×	×	○
⑧T-link terminal block	×	×	○
⑨Status LED indicators	×	×	○
⑩Mounting projection	○	○	×
⑪Printed circuit board	○	○	×

○: Provided as standard   ×: Not provided

① Cover
Protects the terminals and address setting switches.
Removed when:
a) wiring connection for the power supply is performed (I/O capsule only)
b wiring connection for I/O is performed
c) address setting is made (I/O capsule only)
Do not remove this cover during operation.

② Program loader connector (I/O capsule only)
Used to connect a program loader (called D10S, D20, D25, or personal computer loader) to the basic unit.

③ Address setting switches (I/O capsule only)
Used to set the T-link address. The upper switch is used to set the upper digit, and the lower one is used to set the lower digit.

④ I/O terminal block
Used connect external I/O devices to the basic unit. There are the following two types of I/O terminal blocks.
a) Screw type terminal block
With this type, screw terminals are arranged on a single terminal block. Because the terminal block can be attached or detached, if an I/O capsule or I/O module experiences trouble, replacement work can be done without removing wiring connections.
b) Connector type terminal block
This type is used for the 32-point I/O card. Use the supplied connector for wiring connections, referring to the specifications of each I/O device.

⑤ Power supply terminal block (I/O capsule only)
Used to connect the power supply.

⑥ I/O status LED indicator
Displays the ON/OFF status of I/O devices. The
number shown indicates the bit address (0 to F) or
the relay number.

⑦ Mounting screws (I/O capsule only)
When installing the I/O capsule to the control panel,
tighten these screws (2-M3.5).
- Tightening torque: 0.8 to 0.9N·m (8 to 9kgf·cm)

⑧ T-link terminal block (I/O capsule only)
Used to connect the T-link cable (twisted pair cable).

⑨ Status LED indicators (I/O capsule only)
Displays I/O capsule status (POWER and ALARM).
- These LEDs light to indicate the following state.

LED	Description
POWER	The power supply of the I/O capsule is normal.
ALARM	I/O capsule fault, T-link connection fault, processor module or capsule fault, power supply fault

⑩ Mounting projection
Used to install the I/O card to the rack.

⑪ Print circuit board
Before touching the printed circuit board, touch
grounded metal to discharge static electricity.

4.2 Dimensions

■ Demensions, mm
(1) NV1P-0□2, NV1E-0□2
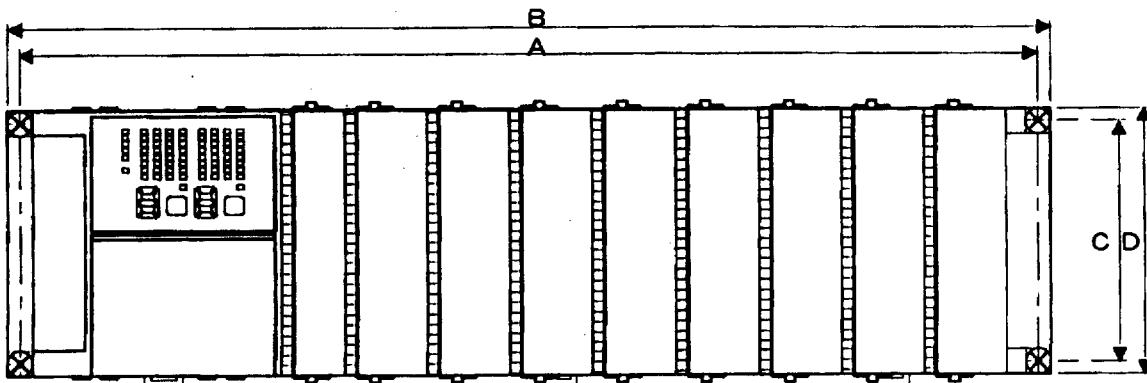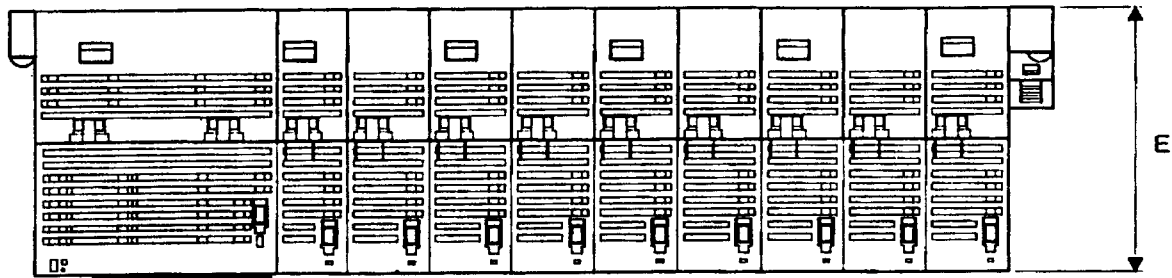
Mounting screw
4-M5x20

• When the T-link connector is installed
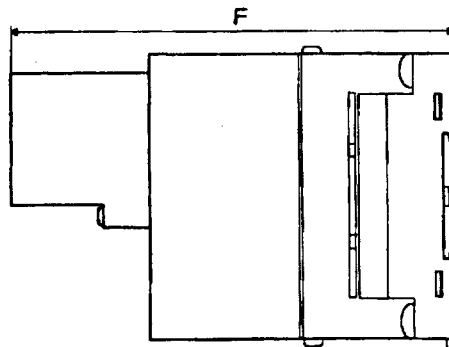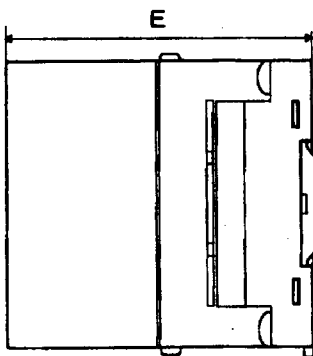
Type	A	B	C	D	E	F	Mass	
							Case versions 0001 to 0999	Case version 1001 or later
NV1P-042 (4 cards can be installed)	250	260					Approx. 790g	Approx. 1000g
NV1P-062 (6 cards can be installed)	310	320					Approx. 860g	Approx. 1170g
NV1P-082 (8 cards can be installed)	370	380	85	95	97	142	Approx. 930g	Approx. 1340g
NV1E-042 (4 cards can be installed)	250	260						Approx. 890g
NV1E-062 (6 cards can be installed)	310	320						Under development
NV1E-082 (8 cards can be installed)	370	380						Approx. 1230g

■ Demensions, mm
(2) 16 point I/O card

80. 4

49. 5   29. 8

95

(3) 32 point I/O card

80. 4

49. 5   46   29. 8

95
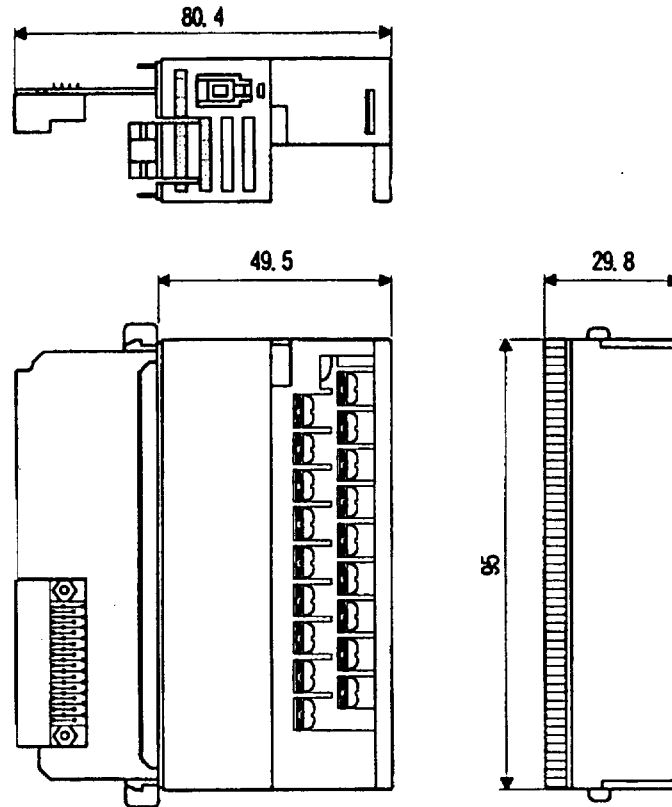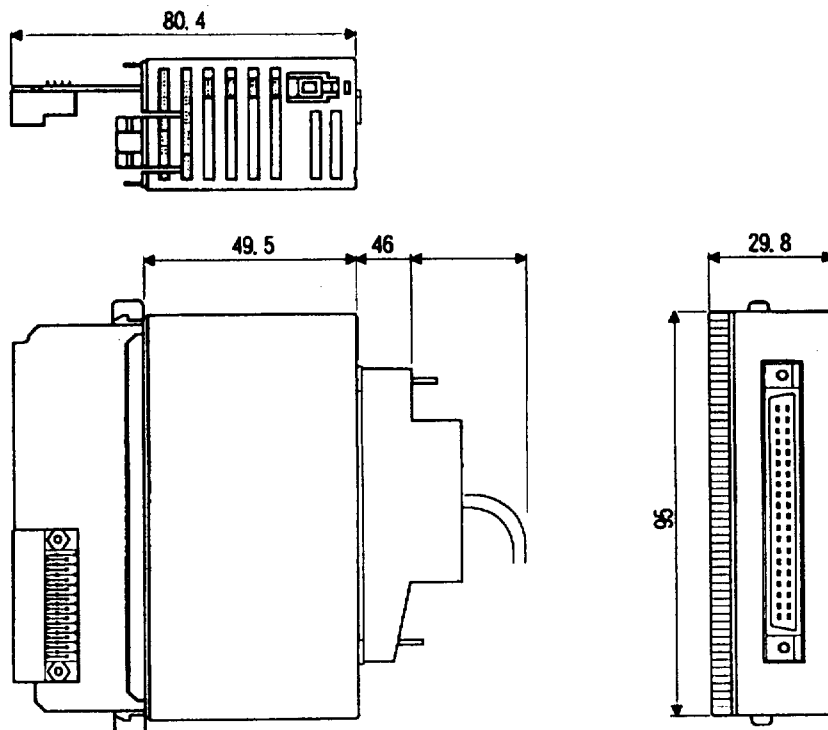
4.2 Dimensions

■ Demensions, mm
(4) T-link master card
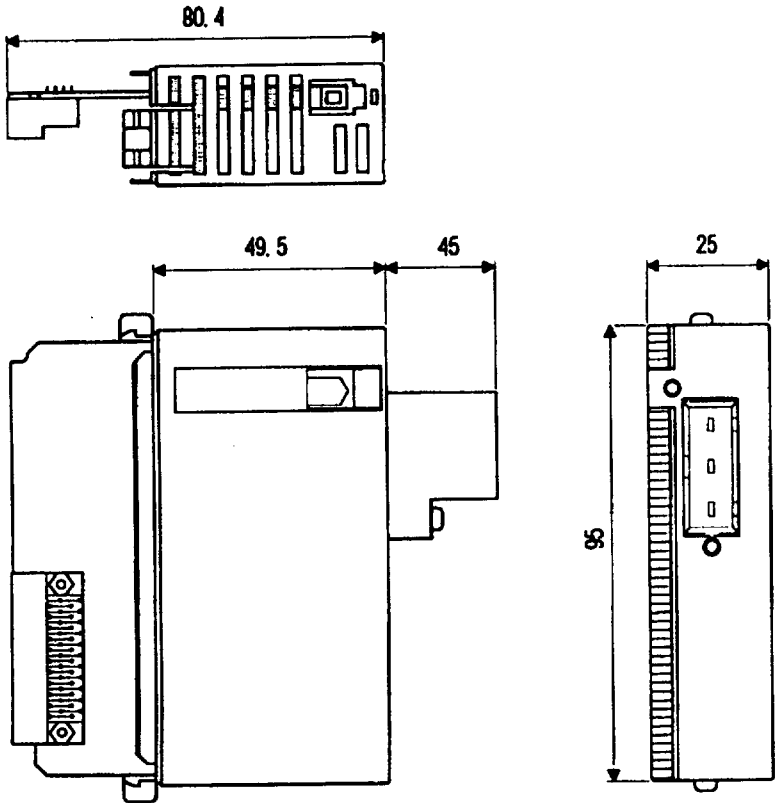
(5) T-link slave card
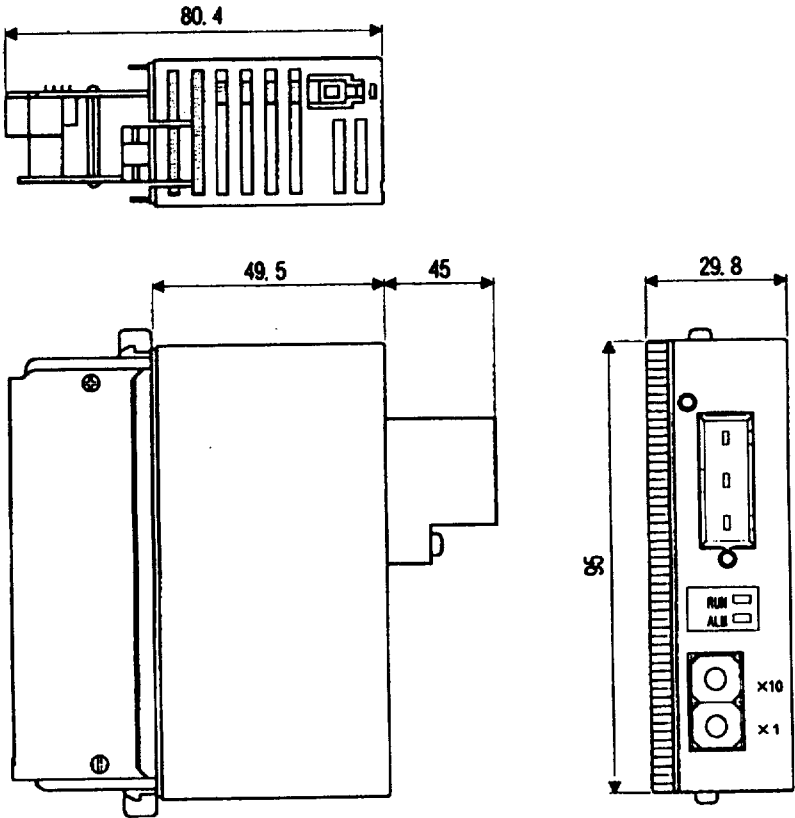
■ Demensions, mm

(6) High-speed counter card
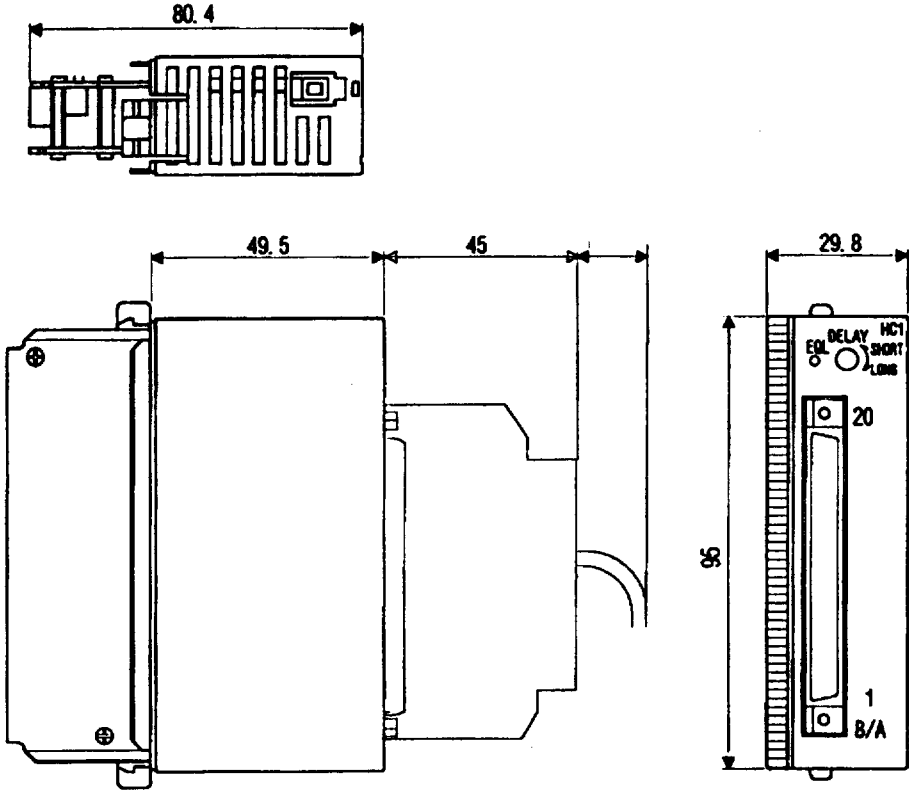
(7) General-purpose interface card
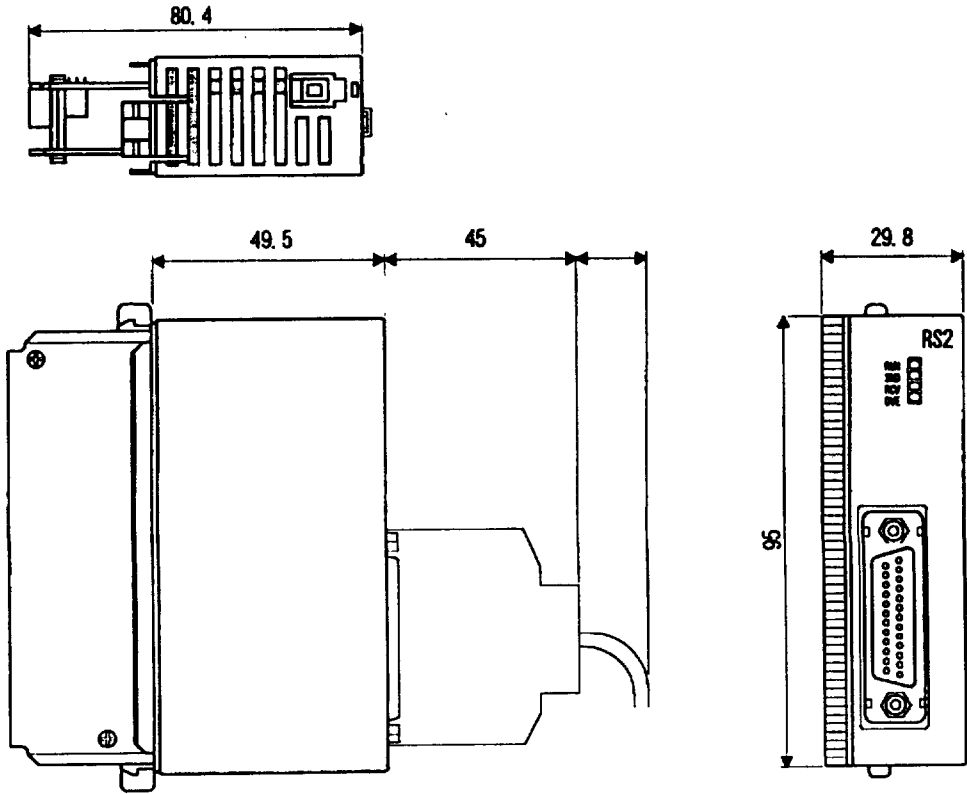
Note: Allowable bending of the cable depends on the cable type.

4.3 Simulated Input Switch

4.3.1 Simulated input switch for the input card

The simulated input switch can be used to perform program debugging and programming exercises using the I/O card.

(1) Specifications

Type		NV1V-SW16
No. of points		16 point input (8 point common x 2 circuits)
Rated voltage		28V AC/DC maximum (20 to 28V AC/DC)
Rated current		0.1A maximum (0.1mA to 0.1A)
Contact resistance		0.05Ω or less (at 20mV 10mA)
Endurance	Mechanical	100,000 operations or more
	Electrical	50,000 operations or more (10,000 times with 28V, 0.1A maximum)
Applicable I/O card		NV1X1604, NV1X1604-W

(2) Structure

NV1V-SW16
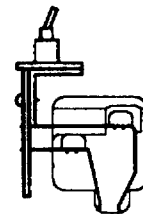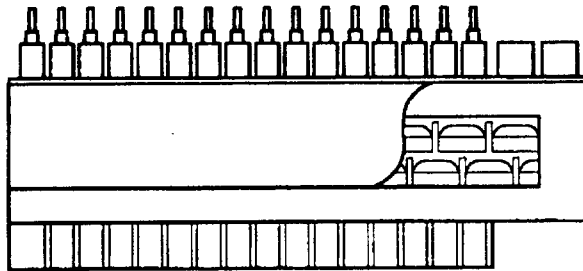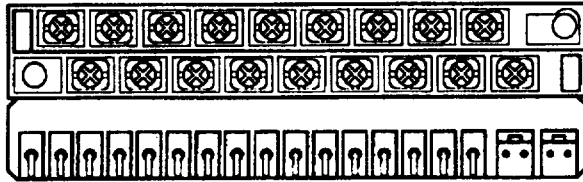
Note: This switch is provided with a power supply connector cord; however, the terminal block for I/O modules is not supplied.

(3) Precautions on use

① The rated voltage is 28V AC/DC maximum and therefore it cannot be used with high voltage (such as 100V AC).

② When installing this switch, the printed circuit board may reach the mounting hole of the I/O case terminal block, depending on the insertion angle. Install the switch so that the pin of the printed circuit board is perpendicular to the terminal board.

4.3 Simulated Input Switch

4.3.2 Simulated input switch for the input capsule

The simulated input switch can be used to perform program debugging and programming exercises using the I/O capsule.

(1) Specifications

Type		NH8V-SW16 (FTX100A-S16)	NH8V-SW32 (FTX100A-S32)
No. of points		16 point input (8 point common x 2 circuits)	32 point input (8 point common x 4 circuits)
Rated voltage		28V AC/DC maximum (20 to 28V AC/DC)	
Rated current		0.1A maximum (0.1mA to 0.1A)	
Contact resistance		0.05Ω or less (ay 20mV 10mA)	
Endurance	Mechanical	100,000 operations or more	
	Electrical	50,000 operations or more	

(2) Structure

NH8V-SW16
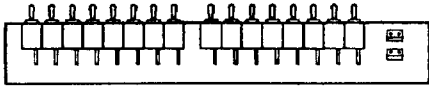
NH8V-SW32

(The terminal block for I/O modules is connected.)

Note: This switch is provided with a power supply connector cord.

Section 5   Installation and Wiring

Section 5 Installation and Wiring
5.1 Precautions on Installation

This section explains how to install MICREX-F Series products on a control panel and connect wiring.

Precautions regarding the handling of these products are also described.

⚠ **CAUTION** Avoid doing the following actions. Doing so may cause damage, malfunction, or failure of the product.

① Do not drop or bring down the product.

② Avoid installing the unit on locations which are subject to excessive vibration.

③ Avoid installing the unit on locations where corrosive gas is present.

④ Avoid mounting the unit on a panel in which high-voltage devices (3000V, 6000V or higher) are mounted.

⑤ Do not use the same power supply which supplies the power to noise generating device

High-voltage device

Noise generating device
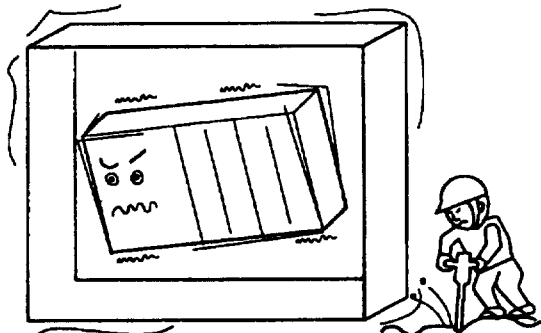
⑥ Avoid using the unit on locations which are subject to high or low temperature or high humidity, or locations where condensation may occur because of rapid temperature change.

Operating temperature: 0 to 55°C
Operating humidity: 20 to 90%RH
(without condensation)

---

(2) When the power supply is turned on, the ALARM indicator may light.
The possible causes are as follows:
1) The memory contents are not written in specified format.
2) Hardware fault

In most cases, the cause of the fault is 1). In this case, delete the memory contents by using the program loader and the resupply power. The ALARM indication will stay OFF.

- ALARM indicators light.

- Delete the memory contents.
  (System definition area, program area, and data area)

ALM1 ⌐
ALM2 ⌐
Goes on

Memory delete (see 4.2.2 for operation)

ALM1 ⌐
ALM2 ⌐
Go off
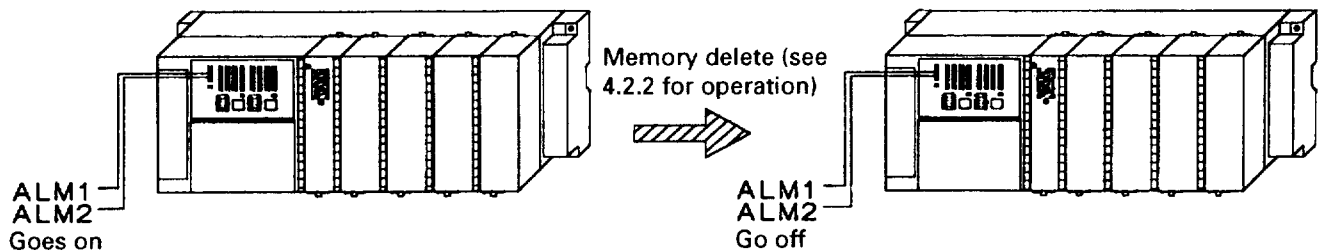
(3) Be sure to turn on the power supply of the expansion unit first and then the power supply of the basic unit. (They can be turned on at the same time.)
If the power supply of the basic unit is turned on first, the following conditions result.
- The system operates only with the basic unit with the expansion unit not recognized.
- I/O slots on the expansion unit are recognized as empty slots, resulting in direct I/O fault.
Be sure to turn off the power supply of the basic unit and then the power supply of the expansion unit. (They can be turned off at the same time.)

(4) 24V DC power supply for relay coil driving
When installing the relay output card, be sure to use a 24V power supply.
Power current capacity:
Approx. 8.3mA/point x (maximum number of ON points)

(5) Use the specified T-link cable. (See subsection 3.7 for details.)
T-link cable: Twisted pair cable, KPEV-SB 1.25mm², 1 pair
T-link cables other than the above can be used if the distance is limited.
(See subsection 3.7.)
In addition, be sure to attach the supplied termination resistors at both ends of the T-link. (See subsection 5.4.2)
Termination resistor for the T-link: 100Ω, 1W or more

5.2 Before Installing the Unit

5.2.1 Checking delivered products

When unpacking the delivered products, make sure the following:

1) The product is exactly the one that you have ordered.
2) No products have been damaged during transportation.
3) There are all the parts. (For the supplied parts, see the type list in subsection 1.4.2.)

5.2.2 Checking normal processor operation

The purpose of the following check procedure is to make sure that the delivered product operates normally before installing it into the control panel. The following check procedure allows early detection of fault.

(1) Assembling a system
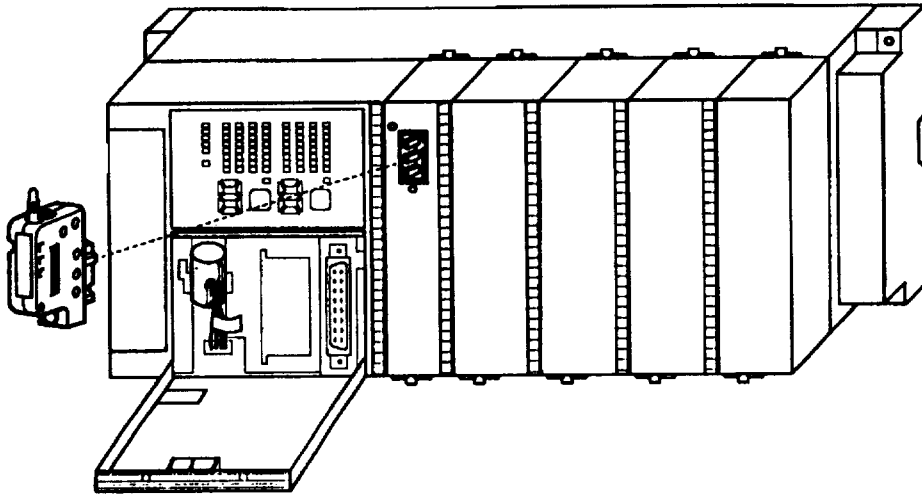
Assembling procedure

1) Install the I/O card into the rack.
2) When the T-link master card is to be used, attach the 100Ω termination resistors, which are supplied on the T-link connector, to both ends of the T-link.

3) Make wiring connection to the power supply terminal and then turn on the power supply of the processor.

In addition to the RUN indicator, the ALM1 or ALM2 indicator may light. The ALM indicator lights if the memory contents are not formatted as specified.
In this case, connect the program loader, delete the memory contents (system definition area, program area, and all data area), turn off the power, and then resupply power to the PC. The ALM indicator goes off.

(2) Memory deleting procedure by the D20 type program loader

No.	Item	Key operation
1	System definition area	AUX F6 F3 ENT *
2	Program area	F3 ENT *
3	All data area	F3 ENT *

*Press the ENT key twice during processor operation (the RUN indicator is on).

(3) Checking normal operation with the test program

Store the following program in the PC memory and execute it. If normal operation results, proceed with the next step (installation to the control panel); otherwise, check the description in (1) "Assembling a system" above again.

Program → ┤├─B000──┤├─B030────( )────┤
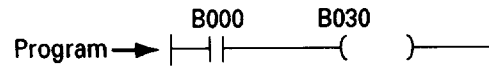
Note: Enter the address according to actual device.

■ **Writing the program**

When writing a new program in the user memory or when the program is updated, it is necessary to read the corresponding memory.

Operation flow	Key operation	Screen display	Remarks
Set the processor in the memory read mode.	MON RD	Read	●When the target memory is the processor, press MON .
Execute read operation.	PAGE/DATA 6 ENT	─▲───── Page 0001 ─────	▲: Read mode cursor
Set the program write mode.	WR	───── Page 0001 ───── ─▼ When the write mode is entered, the shape of the triangle cursor changes.	▼: Write mode cursor
Move the cursor downward.	⇩		
Set input specifications.	┤├ 3 B 7 0 ·	B0 ───── Page 0001 ───── ─▼─┤├─	
Move the cursor and set output specifications.	⇨ ─( )─ D 3 ─ B 7 0 ·	B0 ───── Page 0001 ───── ─┤├───────▼( )─	
Write program to the memory.	LOAD ENT ENT*		

* When the processor is in operation, press the ENT key twice.

■ **Operation check**

After the above program has been written to the memory, if output B0030 goes on when input B0000 is turned on, processor operation is normal. Proceed with the next installation step.

5.3 Installing the Unit on the Control Panel
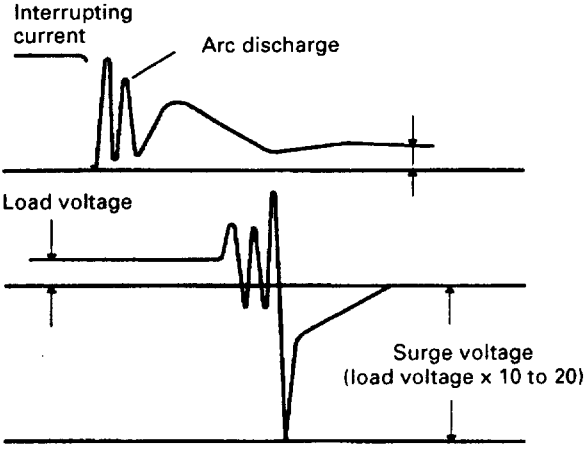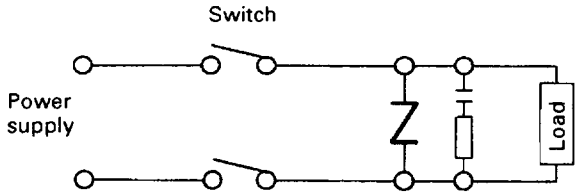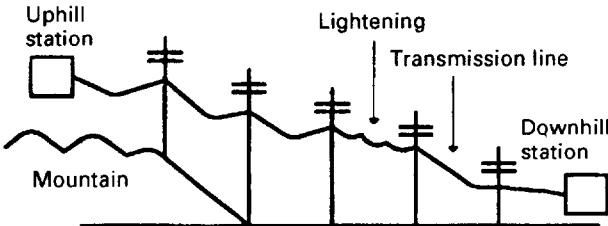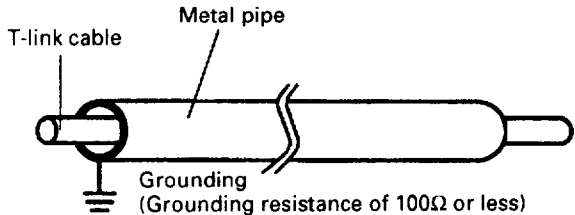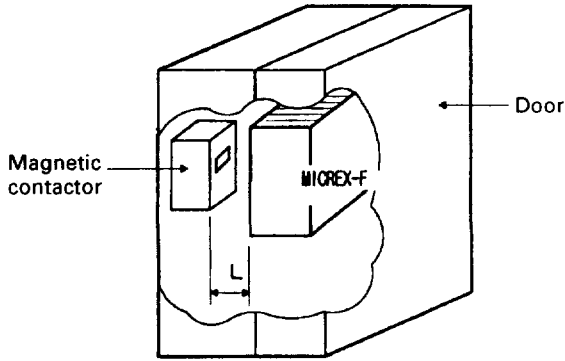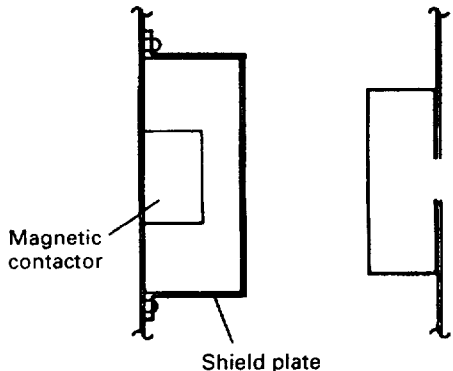
5.3.1 Countermeasures for noise

(1) The MICREX-F series is provided with sufficient noise immunity; however, to further improve the reliability of the system, the following measures are recommended.

No.	Noise source	Countermeasures
1	Noise coming from the power supply terminals • Lightening surge • Internal surge (on/off surge)	1) Use a shield isolation transformer (such as FUJI power filter) Electrostatic shield (Reduces stray capacitance between the primary and secondary windings.) 2) Surge absorbers should be connected to the surge generating device. Device FUJI Z-trap Chassis
2	High frequency noise	1) Use a noise filter. Twisted pair wire should be used between the noise filter and power supply terminals of the processor. Noise filter Power supply Processor (Example: FUJI power filter)
3	Noise due to common grounding	1) Individual grounding shown below is the best. Other device Other device MICREX-F Common grounding not allowed. Other device Other device MICREX-F Grounding (Grounding resistance of 100Ω or less) For details on grounding, see (2) in subsection 5.3.1.
4	Noise coming from the ground for the secondary winding of the transformer	Do not connect the secondary winding of the isolation transformer to the ground.

No.	Noise source	Countermeausres
5	When an inductive load current is switched off, high voltage is induced at both ends of load, causing some effect on PC operation. Interrupting current — Arc discharge — Load voltage — Surge voltage (load voltage x 10 to 20)	1) Connect a diode, varister, or CR circuit to a DC load. 2) Connect a CR circuit to an AC load. (Example) Switch — Power supply — Load
6	The external I/O signal malfunctions in the following cases: If the cable is bounded together with high-voltage or power lines If the cable is wired in proximity of and in parallel with these lines This type of noise is caused by electromagnetic induction or electrostatic induction.	Separate the I/O lines from these lines and avoid wiring them within the same panel or pit. Make separate wiring with duct, wiring with independent cable pipe, or metal pipe (shown below). (See subsection 5.4.1.)
7	Malfunction or damage due to lightening surge to the transmission line (T-link) Uphill station — Lightening — Transmission line — Downhill station — Mountain	T-link cable should be run through underground metal pipes or in an electrical duct. The metal pipes should be grounded. T-link cable — Metal pipe — Grounding (Grounding resistance of 100Ω or less)
8	Malfunction due to grounding with the arc-generating switch Magnetic contactor — MICREX-F — Door — L — When the door of the control panel is closed, if the distance (L) between the rear panel of the MICREX-F and magnetic contactor becomes 50mm or less, the PC malfunctions due to switching arc generated by on/off operation of the contactor.	Change the layout or install shield plate around the magnetic contactor. Magnetic contactor — Shield plate

5.3 Installing the Unit on the Control Panel

(2) The following describes the recommended grounding procedure.

Control panel — T-link master, Processor, FG, T-link slave, Processor, Blank cover, FG, T-link, FG bus (Integrated ground section), 2mm² (ø1.6) or more

Operator panel — I/O capsule, FG, I/O capsule, FG, FG bus, 5mm² (ø2.6) or more, Integrated ground plate, Grounding (Grounding resistance of 100Ω or less)

Control panel — T-link i/f, Power supply, FG, T-link slave, Processor, Blank cover, FG, FG bus, T-link, Integrated ground plate, Grounding (Grounding resistance of 100Ω or less)

■ Description

1. Sufficient noise countermeasures have been made for each card and capsule for the MICREX-F series. Except when there is much noise, each card and capsule can be used without grounding. When grounding is made, follow steps 2 to 8 below.

2. Connect the FG terminal to the integrated ground section of each control panel (FG bus, FG integrated terminal block, or stud) **in branch-type configuration. The thickness** of the ground wire must be **2 mm² (ø1.6) or more.**
   Allocate the grounding point as near the card or capsule as possible to keep the ground wire as short as possible.

3. **Connect** the integrated ground section **to the integrated ground plate for each area in branch-**

type configuration. The **thickness** of the ground wire must be **5.5mm² (ø2.6) or more.**

4. Separate the ground wire as far from the lines of high-voltage circuits and main circuit as possible. In addition, keep the distance at which they run in parallel as short as possible.

5. For grounding of the MICREX-F series, use dedicated ground pole and wire which are separated from those for other power lines.

6. For grounding of the MICREX-F series, grounding resistance is 100Ω or less. Separate the ground pole 10m or more from that for other power lines.

7. If dedicated grounding cannot be made, use ② integrated grounding below.

| PC | Other device | Grounding (Grounding resistance of 100Ω or less) | PC | Other device | Grounding (Grounding resistance of 100Ω or less) | PC | Other device |

① Dedicated grounding ... Best   ② Integrated grounding ... Acceptable   ③ Integrated grounding ... Not acceptable
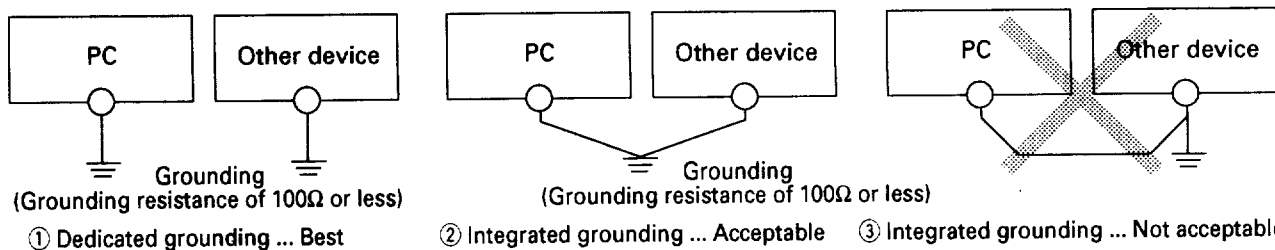
8. When the PC is installed on locations with inferior lightening surge conditions, electrically isolate the basic unit and all I/O capsules and cards from the control panel, and then connect each capsule and card to the ground separately.

5.3.2 Installing the panel

⚠ CAUTION
• Use the control panel under environmental conditions described in the manual. Using the control panel on locations which are subject to high temperature, high humidity, condensation, dust, corrosive gas, or excessive vibration or shock may cause electrical shock, fire accident, malfunction, or failure. (For environmental specifications, see page 3-1 or the table below.)

To further improve the reliability and safety of the system, observe the following points:

Item	Specification	Remark
Operating temperature	• The rated operating temperature range is 0 to 55°C. • Avoid installing the control panel on locations which are exposed to direct sunlight.	• If the ambient temperature is too high, install a fan or air conditioner; if it is too low, install a heater inside the control panel.
Relative humidity	• The relative humidity range is 20 to 90%. • Be careful not to allow condensation due to rapid temperature change.	• In the winter time in particular, turning on or off the room-heater may cause condensation due to rapid temperature change. If there is possibly of condensation, keep the air conditioner turned on even during the night.
Resistance to vibration	• JIS C 0911, crossover frequency 57Hz, 9.8m/s² (1G) * • JIS C 0911, crossover frequency 57Hz, 19.6m/s² (2G) For 2 hours into 3 axis directions	• If the control panel is subject to excessive vibration or shock, use vibration-absorbing rubber to secure the control panel or perform anti-vibration processing for the building or floor.
Resistance to shock	• JIS C 0912, test method 1-No.3, 294 m/s² (30G) * 2 times into 3 axis directions	
Dust	• No conductive dust present	• If excessive gas is present, perform air purification for the control panel.
Corrosive gas	• No corrosive gas present	

Note *: When mounted by the rail, there should be no vibration or shock. Or use end clamps.

5.3 Installing the Unit on the Control Panel

5.3.3 Installing PC units

⚠ CAUTION
• Keep an open space around the PC unit as shown below to obtain sufficient ventilation; otherwise, abnormal temperature rise or failure occurs.

Keep an open space as follows:

① Keep an open space of 110mm (vertical) or 10mm (horizontal) between the PC units, between I/O capsules, and between the PC unit and I/O capsule.

② Keep an open space of 50mm between the PC unit and other device and between the PC unit and the wall to obtain sufficient ventilation.

③ Avoid installing heat generating devices (heaters, transformers, or resistors) underneath the PC unit.

④ Separate or shield the PC unit as far from high-voltage device, high-voltage cables, or power equipment as possible. Avoid installing I/O cables of the PC unit and cables of high-voltage or power equipment in parallel.

⑤ Install the PC unit perpendicular to the panel floor.

5-10
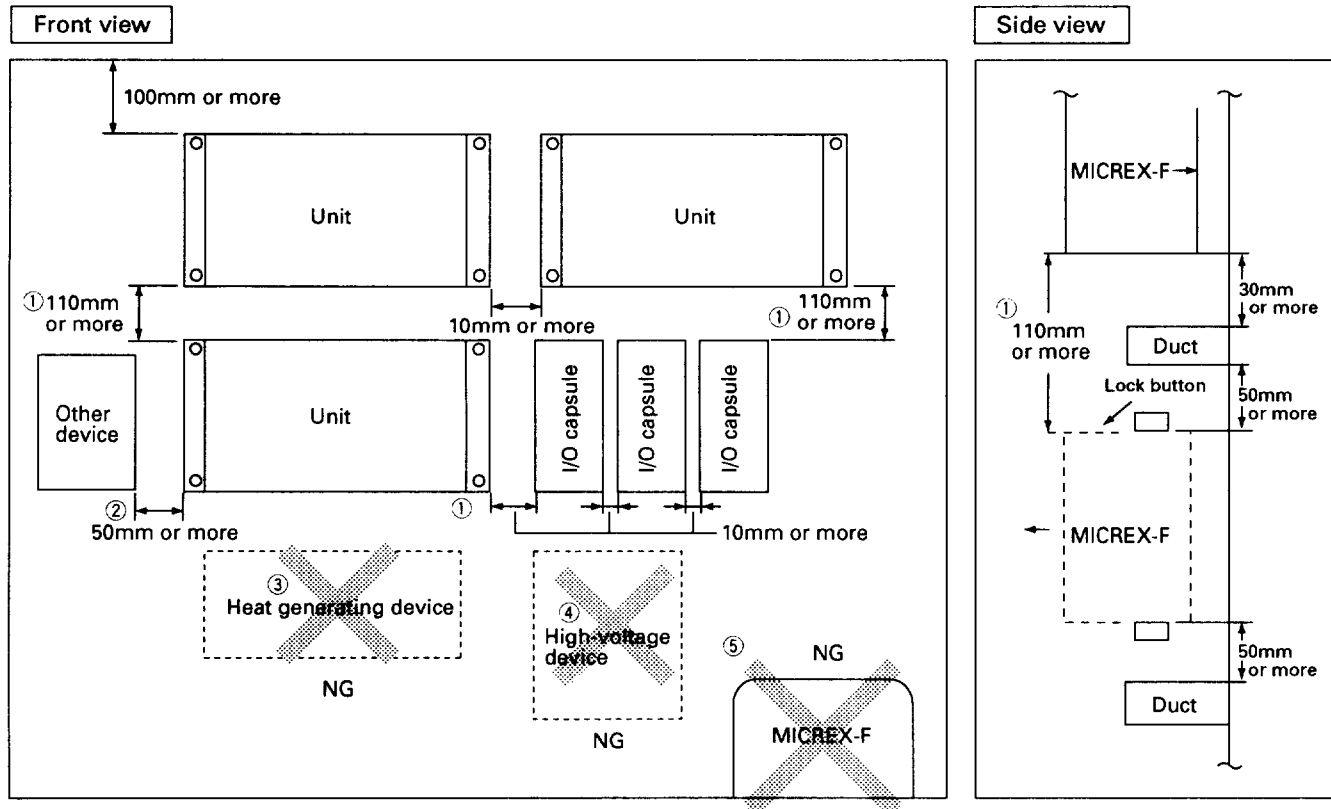
5.3 Installing the Unit on the Control Panel

5.3.4 Address assignment (Setting)

When PC units have been installed on the control panel and operation panel, make address assignment for each capsule and card.

In the following example, 16-point and 32-point digital I/O cards are used.

I/O area (area B) of the F55 series
Bit address

Word address
00 01 02 03

The word address for the leftmost I/O card is assigned to "00" (station No. 0).

5 words

Word address
05   14

• Example settings for the FTK/FTL address setting

Upper dial		
Lower dial		
Set value	05	14

1 word   1 word
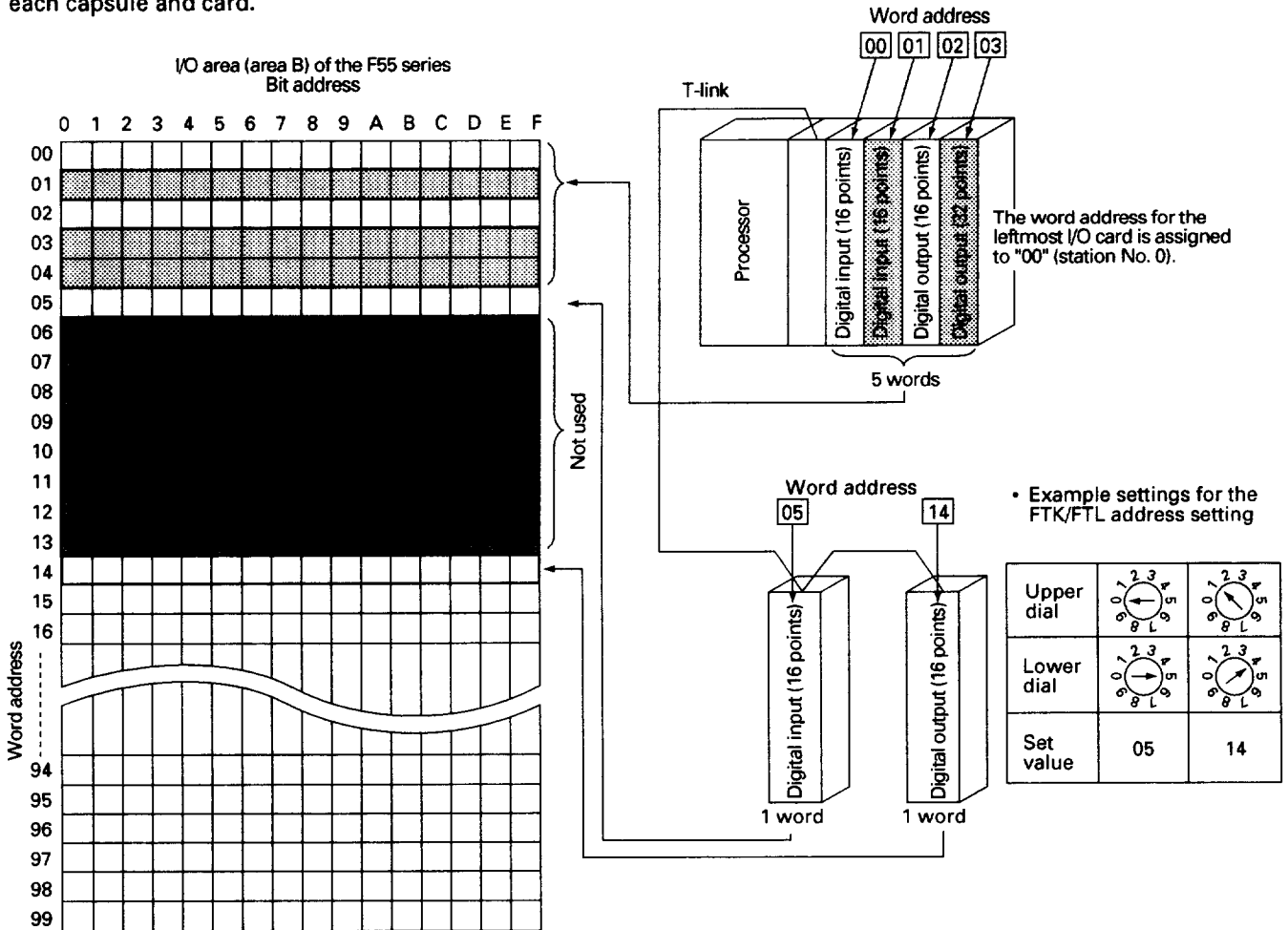
Notes:

1) The address number (station number) of multiple FTK capsules is duplicated, T-link transmission error result, disabling normal transmission.
2) The address setting of the T-link interface module (FTL010H) and the address number of the FTK address (station number) is duplicated, T-link

configuration fault occurs, resulting in a fatal fault of the PC.
3) If duplication occurs in area B (I/O area) with different station numbers, "I/O area overlapping" (F001C) occurs, resulting in a fatal fault of the PC.

Example of incorrect address setting

Station "0" (fixed)

F55   WB0 WB1 WB2 WB3 WB4 WB5 WB6 WB7

RTL010H

WB6 and WB7 are double-assigned. ⇒ I/O area overlapping

Station "6"

FTL   WB6 WB7 WB8 WB9 WB10 WB11 WB12 WB13 Address setting switch

⟵ Upper digit setting dial x 10

⟵ Lower digit setting dial x 1
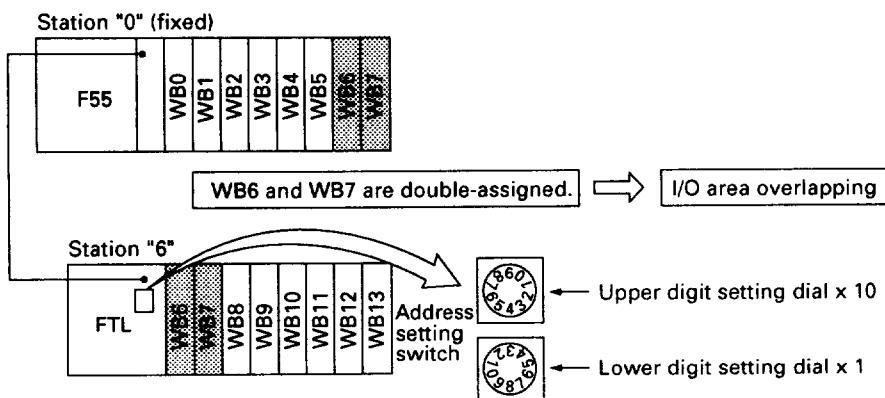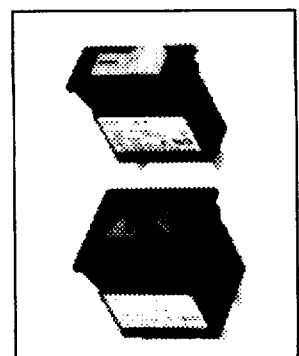
5.3 Installing the Unit on the Control Panel

Basic unit, expansion unit, and I/O capsule

I/O area (area B) of the F55 series
Bit address
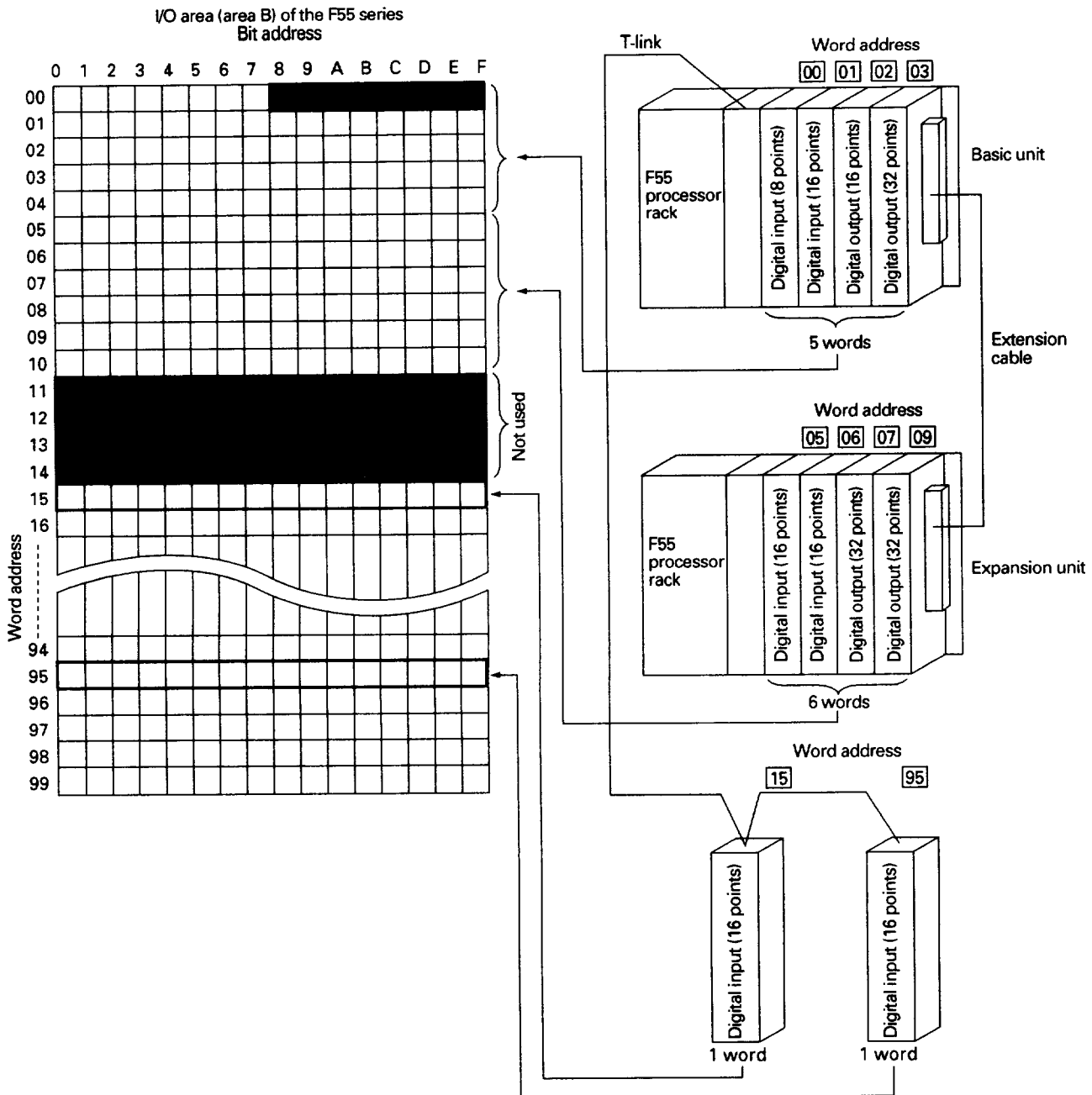
Notes:
1) Address assignment for the I/O area is made from the least significant word and bit addresses. However, for 8 point I/O cards, the upper 8 points are made empty.
2) Address assignment is made continuously for the basic unit and expansion unit.

3) For the basic unit and expansion unit, install I/O cards from left to right. In addition, do not make any blank slots between cards.
4) The following cards (cards using interrupt) cannot be installed in the expansion unit.
   • High-speed counter card (NV1F-HC1)
   • External interrupt card (NV1F-YP1)

When performing wiring works, observe the following points:

(1) Warning on wiring works

⚠ WARNING

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

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(2) Cautions on wiring works

⚠ CAUTION

- Select a wire size to suit the applied voltage and carrying current, and carry out wiring according to the operating instructions and manual. Poor wiring might cause fire.
- Periodically make sure the terminal screws and mounting screws are securely tightened. Operation at a loosened status might cause fire or erratic operation.
- Before touching the PC, touch any metallic object which is connected to the ground to discharge static electricity. Excessive static electricity may cause malfunction or fault.

---

(3) Cautions on wiring check

⚠ CAUTION

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

5.4 Wiring

5.4.1 Wiring and types of wires

Use the following types of cables for MICREX-F systems and the following connections are recommended.

Example 1

Example 2

Control cables must be separated from power cables.

Grounding (ground resistance of 100Ω or less)

Metal plate (iron made)

Grounding (ground resistance of 100Ω or less)
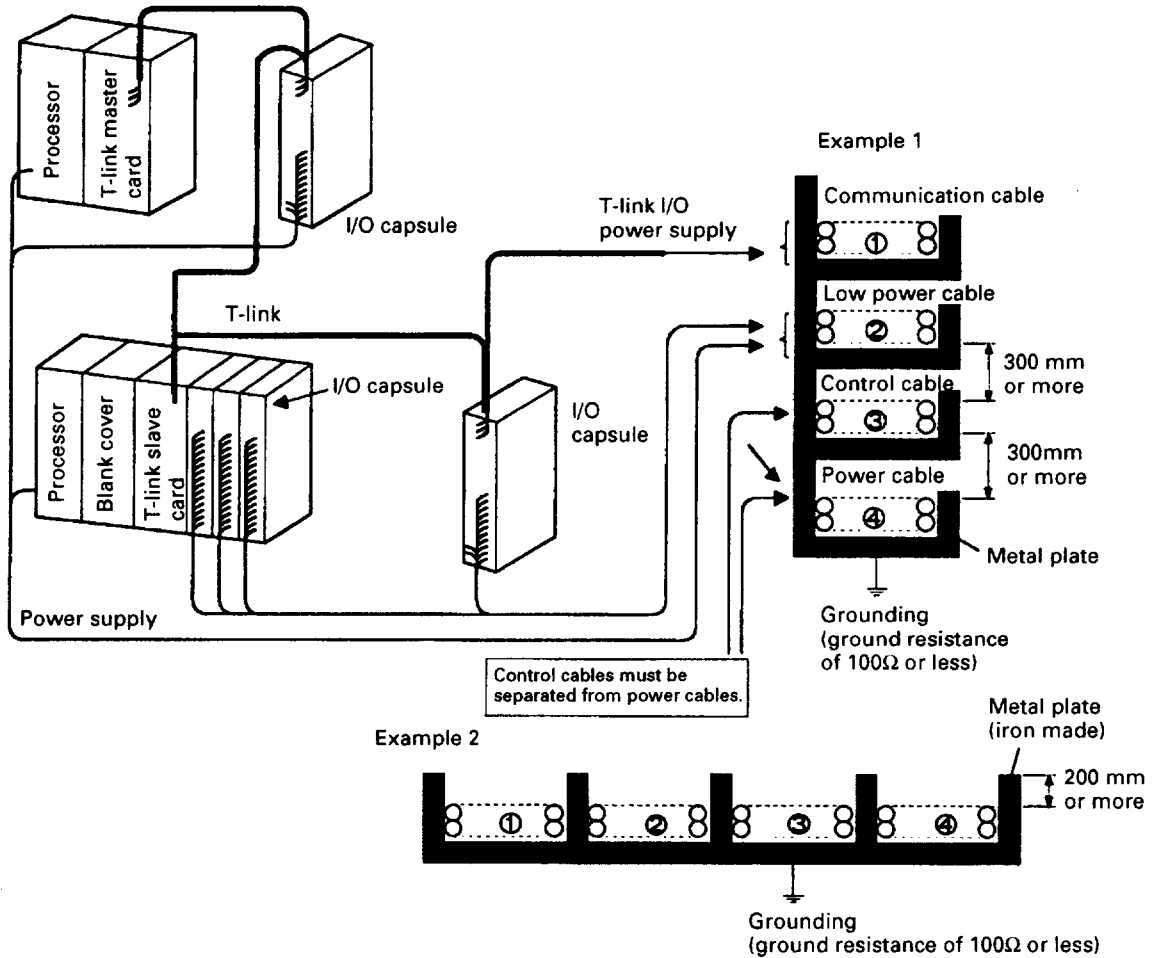
■ Types of cables

Item			Specification
F55 series	T-link cable*		Twisted pair cable: KPEV-SB 0.5mm² (1 pair) up to 700m
	Basic unit (power supply)		2mm² (to be twisted before use)
	8/16 point card	Input device for the input card	0.75mm² or less
		Output device for the output card	0.75mm² or less
	32 point card	Input device for the input card	AWG #23 (0.25mm² or ø0.6) or less
		Output device for the output card	AWG #23 (0.25mm² or ø0.6) or less
I/O capsule	Power supply		2mm² (to be twisted before use)
	I/O capsule	Input device for the input card	0.5 to 1.25mm²
		Output device for the output card	0.75 to 1.25mm²

*If T-link cables not specified in subsection 3.7 "Cable Specifications" are used, the system may malfunction.

5.4 Wiring

5.4.2 Wiring for the T-link

(1) Termination processing

Make termination processing of twisted pair cables and then connect it to the T-link terminal block. In this case, the total length of the T-link twisted pair cable must be 1km or less. (However, the cable can be extended by using of an optical adapter.)

> **Direct wire connection to the terminal block without using crimp terminals may cause contact failure, resulting in T-link transmission errors. Be sure to use crimp terminals.**

① Remove a part of the sheath and internal insulation

Approximately 40
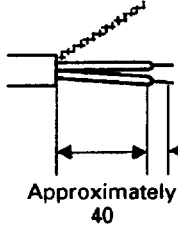
② Attach crimp terminals
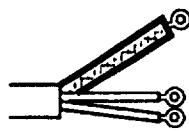
Apply the supplied insulation tube before caulking the terminal.

When the two T-link cables are to be connected to one terminal block, each pair of T-link cables can be connected to one crimp terminal for convenience.

③ Connection

Total length of T-link: 1km or less*

Enlarged view

NH5V1TL1RT

SD   T1   T2
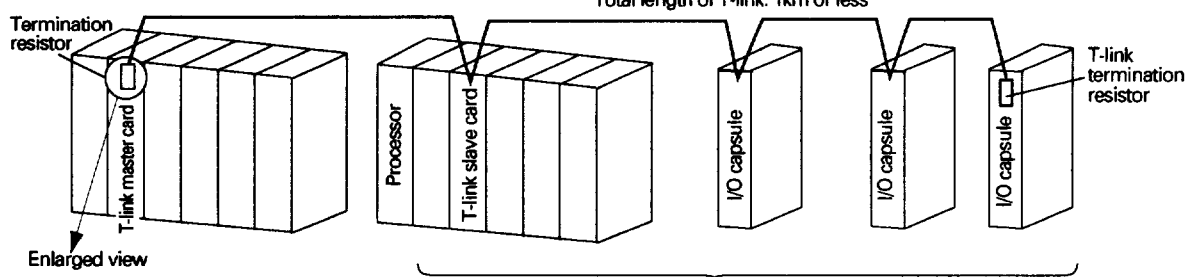
Up to 32 PIO and special capsule units can be connected.

> **At both ends of the T-link, connect a 100Ω termination resistor supplied with the processor.**

> **Connect a termination resistor even for independent systems which do not use the T-link.**

* If the total length exceeds 1km, waveform distortion may be caused by external noise or signal attenuation, making it difficult to perform accurate signal transmission. In this case, the system failure or malfunction may occur.
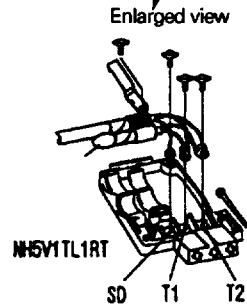
(2) Example incorrect wiring for the T-link

	Correct	Incorrect
T1, T2, and SD terminal	The shield line of the T-link must be connected only to the SD terminals.	Internal parts are not damaged but accurate transmission is not possible. Accurate transmission is not possible even for short distance (without shield lines).
Wiring and other works	T-link connection is made in daisy chain form. The processor can be placed on any position.	Branching is not allowed for T-link connection.

5-15

5.4 Wiring

5.4.3 Wiring for power supply and ground terminals

(1) Notes on wiring

1) If power supply voltage fluctuation of the basic unit and I/O cards exceeds the specified range, connect a voltage stabilizer (an output waveform distortion of the stabilizer must be within 5%) to the power supply.
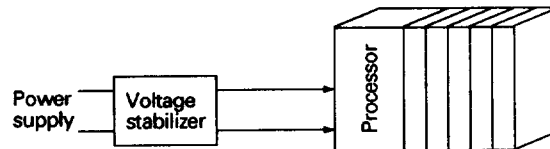
2) Use a power supply with low noise between power lines and between lines and ground.
   For countermeasures against excessive noise, see subsection 4.3.1.

3) The power supply wiring to the basic unit must be separated from wiring for I/O devices and for power equipment.
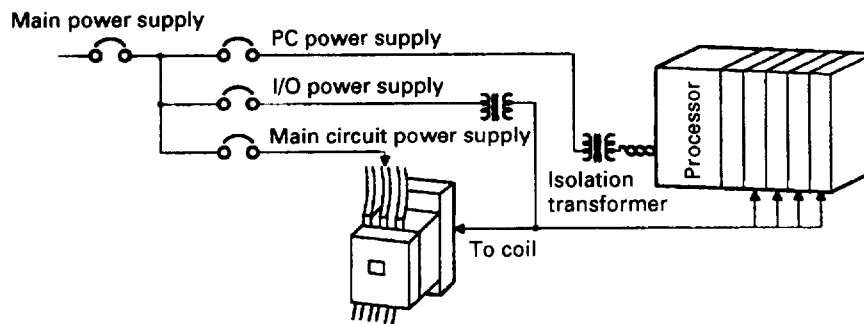
4) Keep the distance between the isolation transformer and the basic unit as short as possible, using twisted pair cables. In addition, to minimize voltage drop, use cables with a thickness of 2mm² or more.

5) The 24V DC I/O cables must be separated from 100V AC and 200V AC cables.

(2) Applicable cable size and crimp terminals

Select crimp terminals, referencing the following table.

⚠ CAUTION
• Select a wire size to suit the applied voltage and carrying current, and carry out wiring according to the operating instructions and manual. Poor wiring might cause fire.   • Periodically make sure the terminal screws and mounting screws are securely tightened. Operation at a loosened status might cause fire or erratic operation.

Connection method	Tightening	Cable size
M3.5 screw (with washer)	0.8 to 0.9N·m (8 to 9kgf·cm)	0.25 to 1.65mm²
		1.04 to 2.63mm²
Connector		AWG#23 or less*

* Accessory cable is FCN 361J040-AU.

Terminal block dimension, mm

M3.5 screw with washer

(3) Example external wiring on independent systems .... (1)
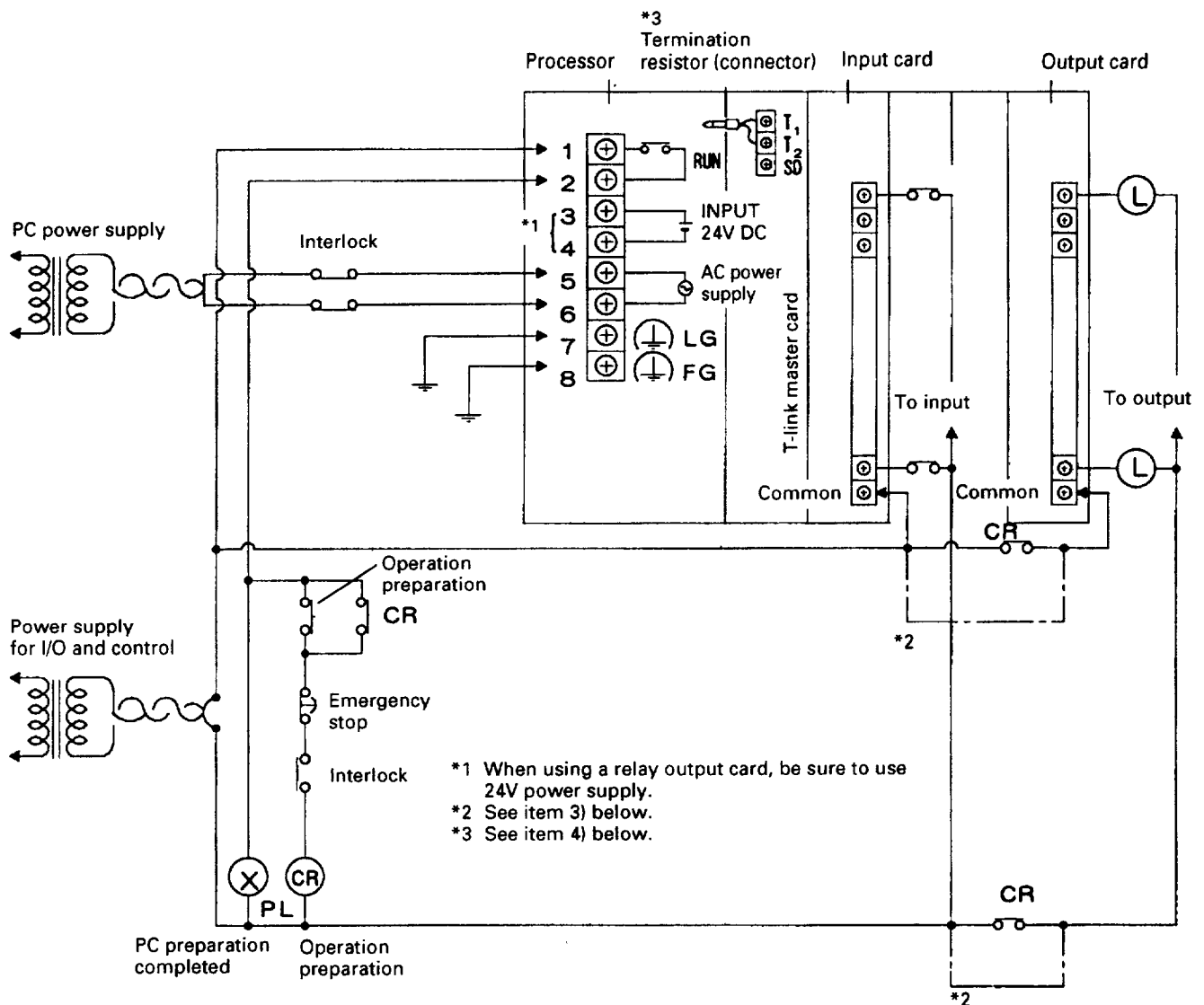
1) Power supply capacity
   - The power consumption is 40VA or less when the maximum configuration (including expansion units) is used. Design the wiring so that voltage drop due to inrush current (40A, 10ms or less at 100V AC) at power on is 15% or less.
   - To prevent voltage drop, use cables with a thickness of 2mm² or more.
2) Noise reduction
   - Although noise reduction device has been incorporated, use of an isolation transformer and twisted pair cables is recommended.
   - Connect the frame ground terminal (FG) of each component to a ground (ground resistance of 100Ω or less). In this case, it is desirable to make independent ground for each capsule. (For details, see (2) in subsection 5.3.1.)

3) When the HOLD station is registered, to supply voltage to the output card without interruption, make wiring indicated by *2. (In case of direct access method)
4) Connect the supplied termination resistor (*3) between terminals T1 and T2 of the T-link connector which is to be installed on the T-link master card.
5) Normally, connect terminals LG and FG. In this case be sure to make grounding (If grounding is not to be made, do not connect these terminals.). Connecting these terminals without grounding may reduce noise immunity. Terminal LG has voltage potential which is 1/2 times the input voltage and therefore touching it may cause electrical shock.

5.4 Wiring

(4) Example external wiring on expansion systems .... (2)
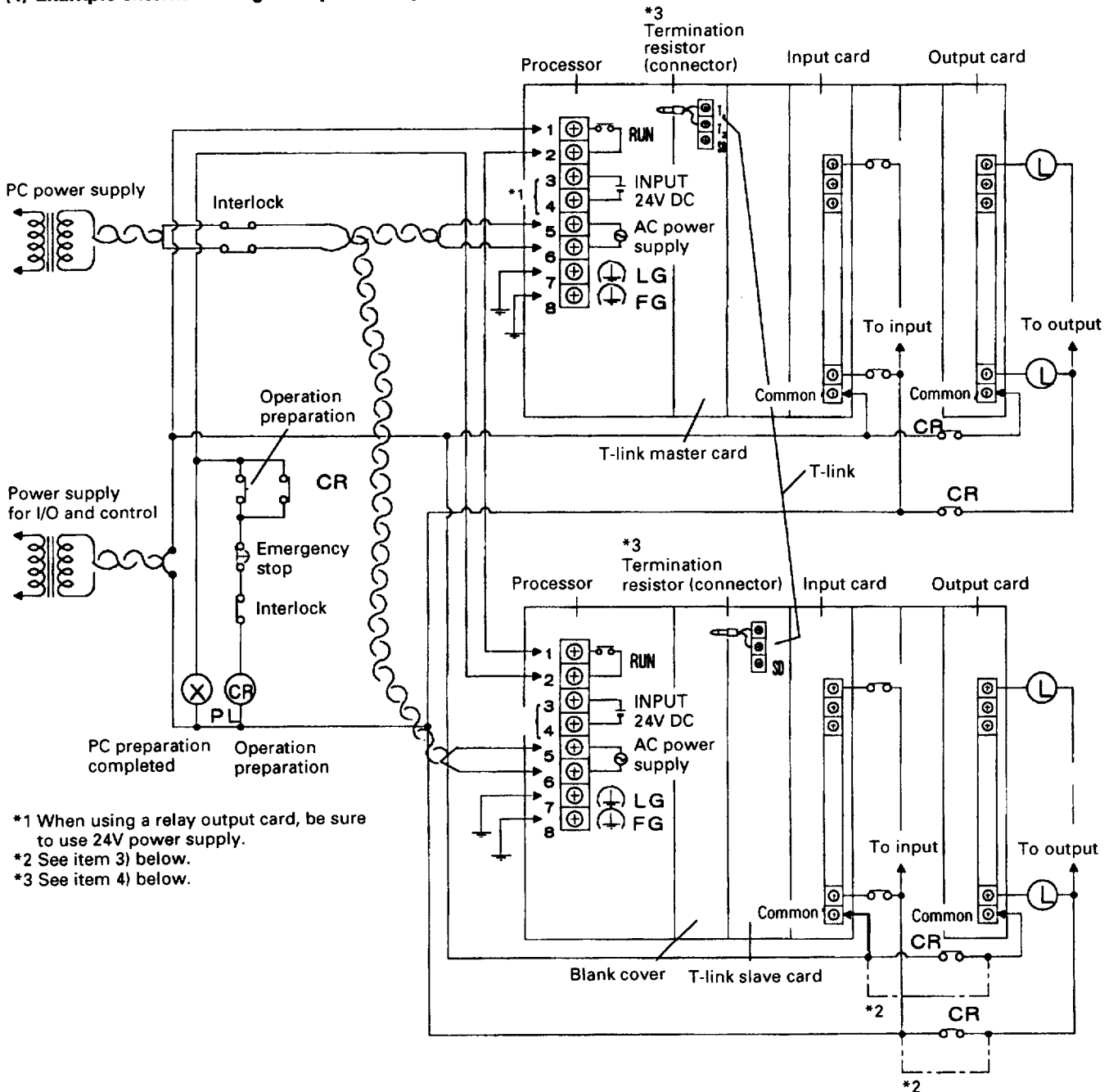
*1 When using a relay output card, be sure
   to use 24V power supply.
*2 See item 3) below.
*3 See item 4) below.

1) Power supply capacity
   • The power consumption of the NV1P-082 is 40VA or
     less with the maximum configuration (with 8 I/O
     cards). Design the wiring so that voltage drop due
     to inrush current (40A, 10ms or less at 100V AC) at
     power on is 15% or less.
   • To prevent voltage drop, use cables with a thick-
     ness of 2mm² or more.
2) Noise reduction
   • Although noise reduction device has been incorpo-
     rated, use of an isolation transformer and twisted
     pair cables is recommended.

   • Connect the frame ground terminal (FG) of each
     component to a ground (ground resistance of 100Ω
     or less).
3) When the HOLD station is registered, to supply
   voltage to the output card without interruption,
   make wiring indicated by *2.
4) Connect the supplied termination resistor (*3)
   between terminals T_1 and T_2 of the T-link connector
   which is to be installed on the T-link master card or
   the T-link slave card.
5) Do not connect the 24V DC output on the basic unit
   and the 24V DC output on the T-link interface
   module (type FTL010) in parallel.

(5) Example external wiring on distributed systems

Processor

T-link master card

Termination resistor (connector)

PC power supply

Interlock

RUN

T₁
T₂
SD

INPUT
24V DC
AC power
supply

LG

FG

PC

T-link

Power on procedure
1. Turn on the power supply of the input and output capsules.
2. Turn on the power supply of the processor.
   *The power supply of the input and output capsules and the processor can be turned on at the same time.

Power off sequence
1. Turn off the power supply of the processor.
2. Turn off the power supply of the input and output capsules.
   *The power supply of the input and output capsules and the processor can be turned off at the same time.

T-link
Total cable length: 1km or less
Termination processing: Connect the supplied termination resistor at both ends of the T-link.
Maximum number of connectable units: 32

Input capsule

Output capsule

Termination resistor

* For I/O connections, see the specifications for each PC type.

T₁
T₂
SD

T₁
T₂
SD

Power supply

1
2
3

1
2
3

Since the PC is provided with sufficient reliability, use of the PC does not result in reduction of system safety. However, like any other electronic appliances and control equipment, the PC is not perfect and has possibilities of failure. To further improve safety, it is necessary to implement a safety circuit which makes it possible to stop system operation in the event of emergency or trouble. The safety circuit should be configured as an external circuit.

(1) Emergency stop

It is necessary to configure an emergency stop circuit as an external circuit and install an emergency stop switch on a location which is easy for the operator to use. This emergency stop circuit normally is integrated into the interlock circuit which disconnects the I/O control power supply in the event of failure.

(2) Interlock relay

The interlock relay (ILR) opens if an emergency or a failure occurs to disconnect the power output. The interlock circuit incorporates a RUN contact in series with the ILR which closes only during PC operation. If a failure is detected by the PC self diagnostic function, the ILR opens.

The configuration of safety circuit differs according to the PC configuration and controlled equipment. The following shows an example.
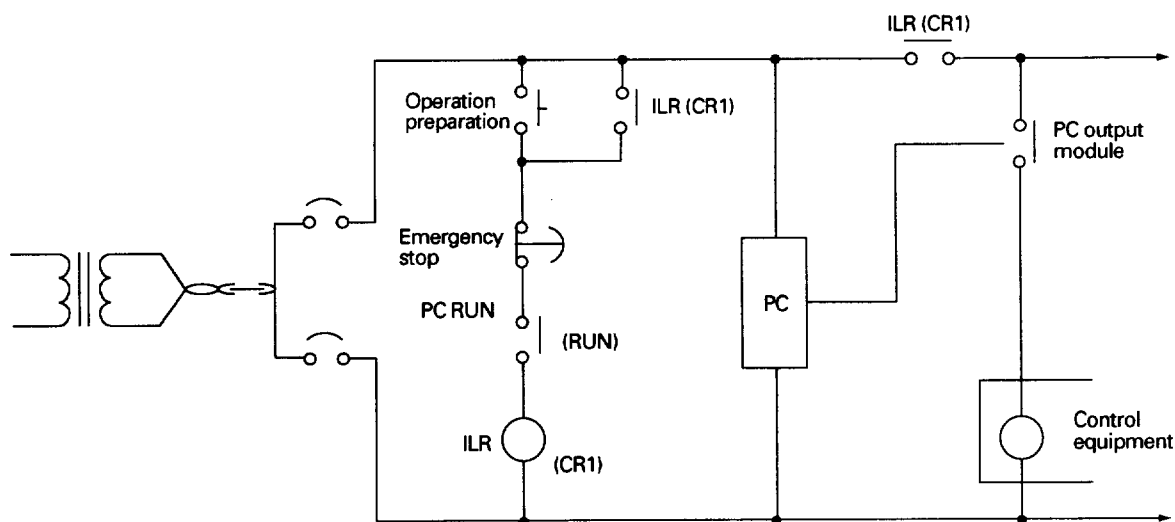
5.4.4 I/O wiring processing

1) Use a crimp terminal to each wire and secure it to the terminal block with a screw. Then make arrangement so that wires be stored inside the duct of the I/O card. The following shows an example wiring processing.
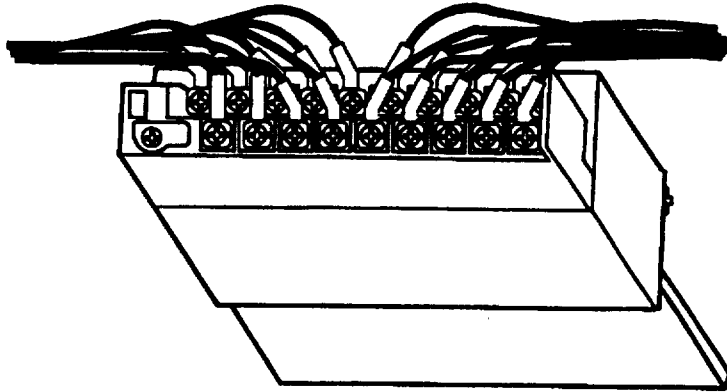
The figure at left shows recommended wiring processing.

2) Because the I/O terminal block is connector type, it can be removed from the case with wiring connections.
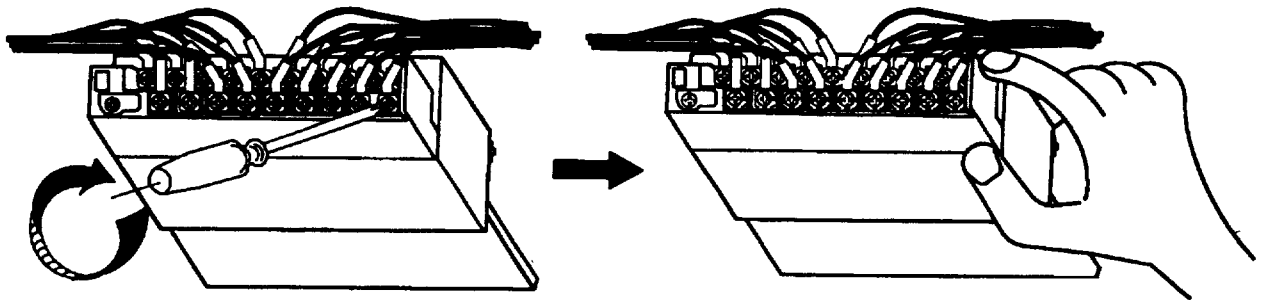
Note: The cable size connectable to the terminal block is 0.75mm² or less (1.25mm² or less for common terminals). If 1.25mm² wires are used for entire connections, the cover of the terminal block cannot be fitted depending on the cable type (diameter with wire sheath). Use the specified cable size.

5.4 Wiring

5.4.5 Checking address settings for external I/O devices

After installation, make sure that every I/O device is connected to the specified address for the I/O capsules and I/O cards. The following describes the procedure for address check.
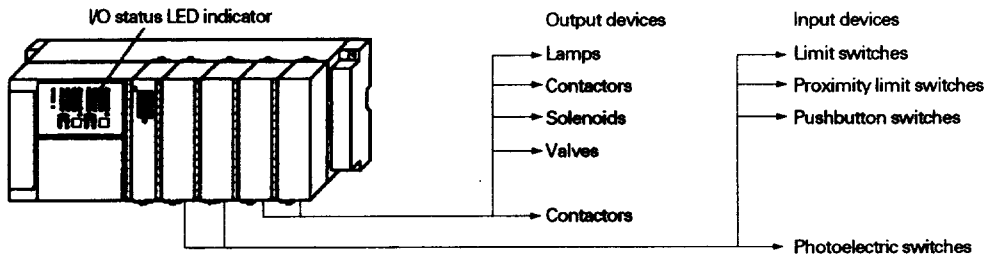
(1) Checking address settings for input devices

1) Turn on the power supply of the processor and the I/O capsules (or T-link interface modules).
2) Set the processor into the stop mode by using the program loader.

(2) Checking address settings for output devices

Follow the steps below to check address settings for output devices. Turn on only control circuits (such as contactors) and turn off the main circuit power supply. (See the figure below.)
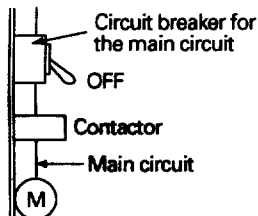
1) Turn on the PC and the program loader.
2) Set the processor into the stop mode by using the program loader.
3) Read out the word address to which the output device is connected.
   For example, word address WB003 is read by the following key operation.

Program loader (D20)

3) Close the contacts of input devices in sequence. Each time a contact is closed, make sure that the address of the input device matches corresponding address indicated by the I/O status LED indicator using the program loader.

4) Set data for the word address to be checked to forcibly set the desired bits on.
   • For example, to forcibly set B003F on, press the following keys.

   Move cursor to BCD.
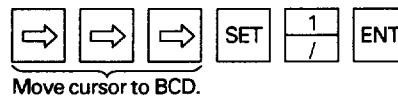
   • To forcibly set B003E on, press the following keys.
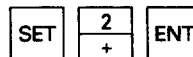
   • To forcibly set B0039 on, press the following keys.
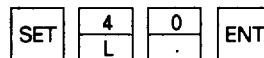
When the above operation is completed, the corresponding LED indicator of the output card/capsule goes on and the output device is turned on. (However, it is assumed that the power of the output circuit is supplied.)

Corresponding value for bit No.

After conforming that I/O devices are allocated to the specified address properly by means of the above procedure, delete the contents of the all memory in the processor and then proceed with the programming steps.
If you have done the above procedure correctly, the debugging time in test operation will be reduced.

5.4.6 Connecting extension cables

The following shows wiring example for extension cables when the expansion unit is used.
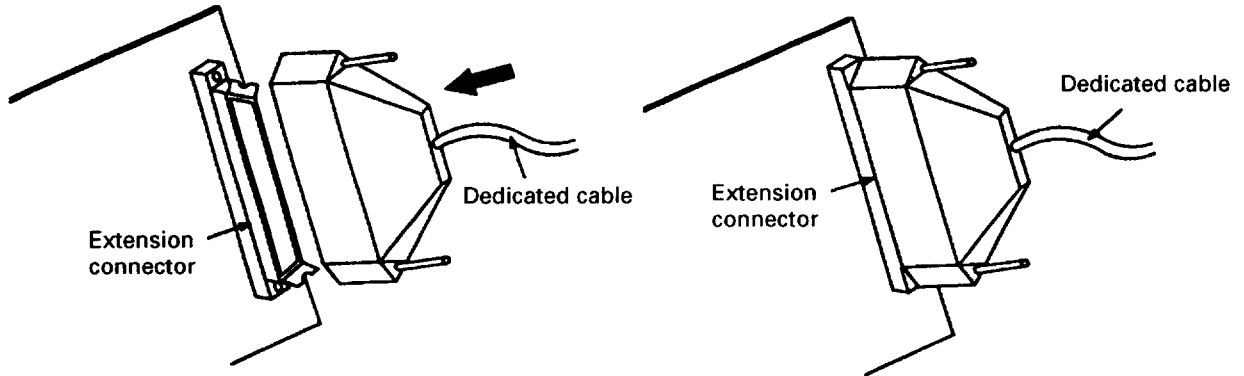
Align the connector position and then press straight the connector until it fits into position.

Securely tighten the screws at both ends of the connector. The supplied screwdriver can be used.

Section 6   Test Operation

Section 6 Test Operation

Prior to test operation, it is recommended that the user program be stored in cassette tape or floppy disks.

When I/O wiring for the PC is completed, turn on the power supply, follow the steps below to perform test operation.
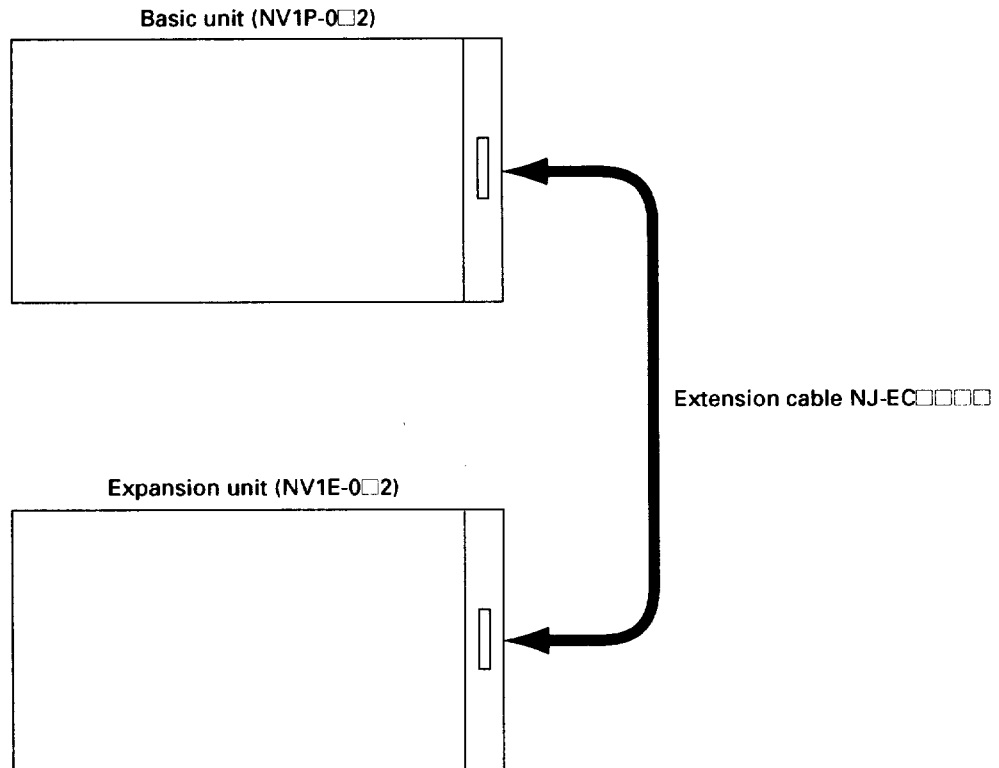
```
           ( Test operation flowchart )
                     |
   1.  ( PC installation condition check )──────┐
                     |                          │
   2.  ( Wiring check prior to power on )       │
                     |                          │  Preliminary check
   3.  ( Insulation resistance and dielectric strength test )
                     |                          │
   4.  ( Power supply voltage measurement )─────┘
                     |
   1.  ( Power on test )──────────────────────┐
                     |                         │
   2.  ( External wiring check )               │
                     |                         │
   3.  ( Safety circuit check )                │  Test operation
                     |                         │
   4.  ( Individual manual operation test )    │
                     |                         │
   5.  ( Automatic operation test )            │
                     |                         │
   6.  ( Abnormal operation test )─────────────┘
                     |
           ( Normal operation )
```
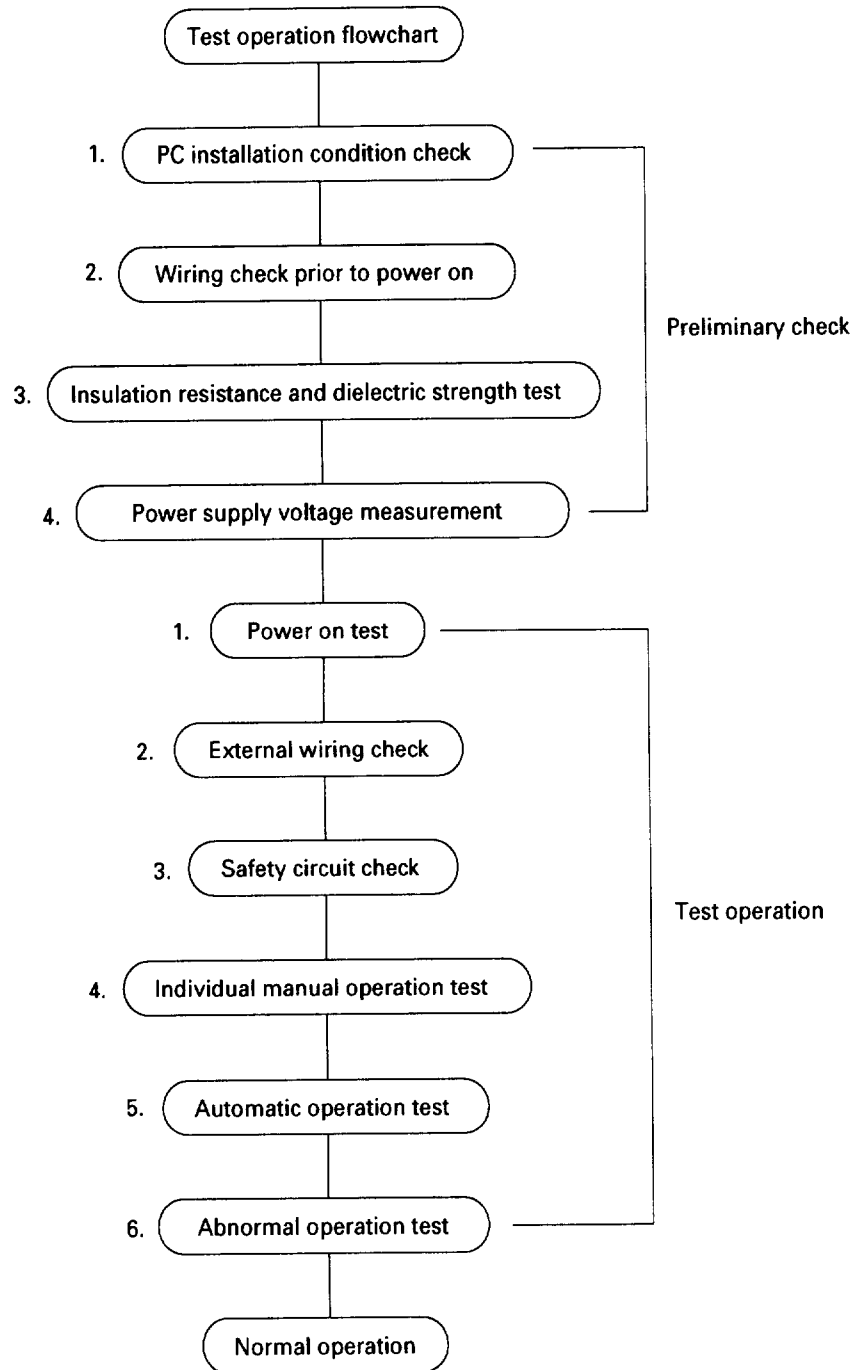
(1) PC installation condition check

1) Structure and environment of the control panel and operation panel
   Check the items in subsection 5.3.2.
2) Others
   Check the following points:
   a) Address assignment and address settings are correct, there is no address duplication, and the address name plate is properly attached.
   b) Dust-proof seals have been removed from the basic and expansion units.
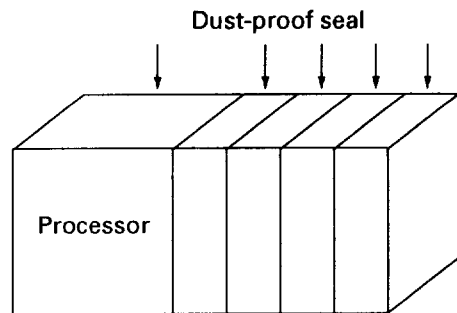
Dust-proof seal

Processor

⚠ CAUTION

- Do not use one found damaged or deformed when unpacked, otherwise, failure or erratic operation might be caused.
- Periodically make sure the terminal screws and mounting screws are securely tightened.
  Operation at a loosened status might cause fire or erratic operation.
- Avoid installing the PC near noise generating devices. Installing the PC near such devices may cause damage, malfunction, or fault.

---

(2) Wiring check prior to power on

⚠ CAUTION

- Installation, wiring, maintenance, and inspection works must done by qualified personnel with electrical knowledge. Incorrect wiring may cause fire accident, malfunction, or fault.

Make sure the following points:
a) The T-link cable and I/O power cables for the PC are securely isolated from power lines.
b) Wiring connections for the power supply, I/O cards, and ground terminal are correct.
c) The T-link cable conforms to the specifications.

T-link cable: Twisted pair cable (KPEV-SB 1.25mm^2 or KPEV-SB 0.5mm^2)
d) T-link wiring conforms to the specifications and correct termination resistors are connected at both ends of the T-link.
Termination resistor: 100Ω, 1W or more

(3) Insulation resistance and dielectric strength tests
The MICREX-F is designed to guarantee the following values:
- 5MΩ or more using 500V DC megger
- 1 minute at 1500V AC

(4) Power voltage measurement

⚠ CAUTION

- Select a wire size to suit the applied voltage and carrying current, and carry out wiring according to the operating instructions and manual. Poor wiring might cause fire.

6.2 Test Operation

(1) Power on test

1) To minimize damage due to incorrect wiring, perform the following processing:
- Turn off the power supply of the power circuits such as magnetic contactors and starters.
- When a compressor is used, close the value.

2) Turn on the power of the PC.
- Power on sequence

• Independent system	• T-link system
• Turn on the power supply to the processor.	• For the T-link system, turn on the power of the T-link interface module and T-link devices first, and then turn on the power of the T-link master card. (The ALARM indicator of T-link devices lights temporarily; when the power of the T-link master card is turned on, it goes off.)
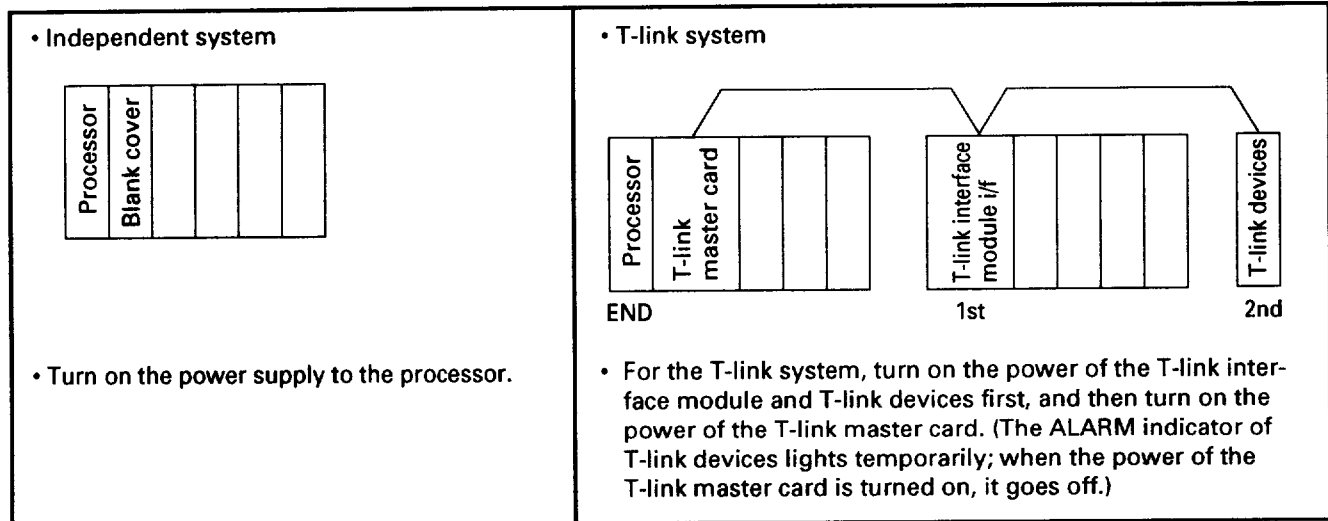
- Make sure that there is no abnormal sound.
- On the processor, only the [POW] and [RUN] indicators light.

| POW |
| RUN |
| ALM1 |
| ALM2 | These indicators do not light when |
| BAT | the processor is normally operating. |
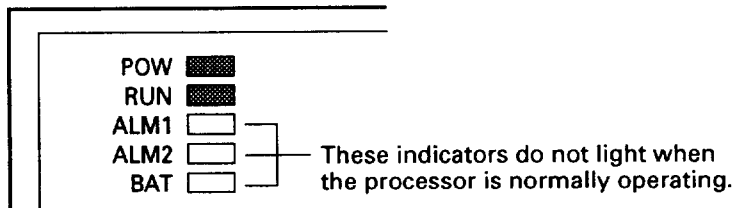
LED	Color	Status	Description
POW	Green		Power supply circuit normal output
RUN	Green	Operating	User program being executed
ALM1	Red	Fatal fault	Fatal fault occurred (Any of special relays F0010 to F001F is on.)
ALM2	Red	Nonfatal fault	Nonfatal fault occurred (Any of special relays F0020 to F002F is on.)
BAT	Red	Battery error	Battery disconnected or voltage drop (Special relay F0020 is on.)

- On the T-link device, only the [POW] and [RUN] indicators light.

(2) External wiring check
See subsection 4.4.

(3) Safety circuit check

> ⚠ **WARNING**
>
> • Place the emergency stop circuit, interlock circuit or the like for safety outside the PC. A failure of PC might break or cause problems to the machine.

Make sure that the emergency stop circuit and interlock circuit operate normally.

(4) Individual manual operation test
Check the operation of each section using the manual circuit.

(5) Automatic operation test
If possible, begin automatic operation with specific system equipment and facilities or by operating individual units. Then, automatic operation for the entire system is performed.
When the "T-link registration" function of the PC is used, only the registered capsules operate. This may be conveniently used to operate specific unit.

(6) Abnormal operation test
This test checks whether the safety circuit of the PC operates normally if the facility does not operate normally and whether it be recovered normally.

* Related check points
1) HOLD station settings are correct and the station operates normally.
2) The plant fault circuit created by the user program operates normally.

Section 7 Troubleshooting

Section 7 Troubleshooting

7.1 Troubleshooting

This section describes how to locate the cause of a fault, and provides possible countermeasures for trouble. If the MICREX-F series incurs trouble during processor operation, the ALM1 or ALM2 LED indicator on the processor lights.

(1) The ALM1 LED indicator lights when the power of the new unit is turned on (before a program is entered)

Possible causes are as follows:
1) Memory contents not formatted as specified.
2) Hardware error

• ALM1 LED indicator lights

Processor

```
POW  □
RUN  □
ALM1 □ ◄──── ALM1  Lights
ALM2 □
BAT  □
```

A common cause of this error is 1). In this case, delete the memory contents using program loaders, and then turn on the power again. The ALM1 LED indicator go off.

• Memory delete
  Memory includes the following areas:
    System definition area
    Program area
    Data area

Processor

```
POW  □
RUN  □
ALM1 □ ◄──── ALM1  Goes off
ALM2 □
BAT  □
```
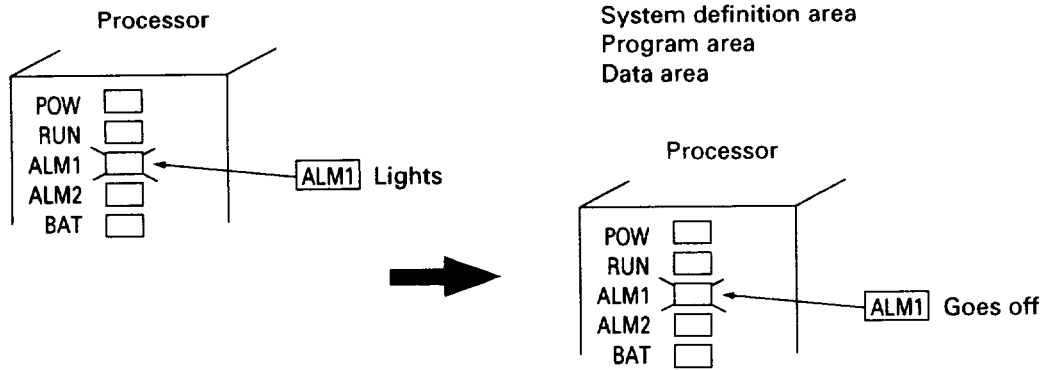
■ Memory deletion procedure

Follow the steps below to delete the contents of memory.

AUX F6

D20 screen

```
          CLEAR MEMORY

    F1              - LOADER SYSTEM DEFINITION AREA

    F2              - LOADER PROGRAM AREA

    F3              - P-CAPSULE SYSTEM DEFINITION AREA

    F4              - P-CAPSULE PROGRAM AREA

    F5              - P-CAPSULE DATA AREA

    OPERAND ID      - P-CAPSULE DATA MODULE

    W MODULE NUMBER - P-CAPSULE DATA MODULE
```

F3 ENT
F4 ENT
F5 ENT
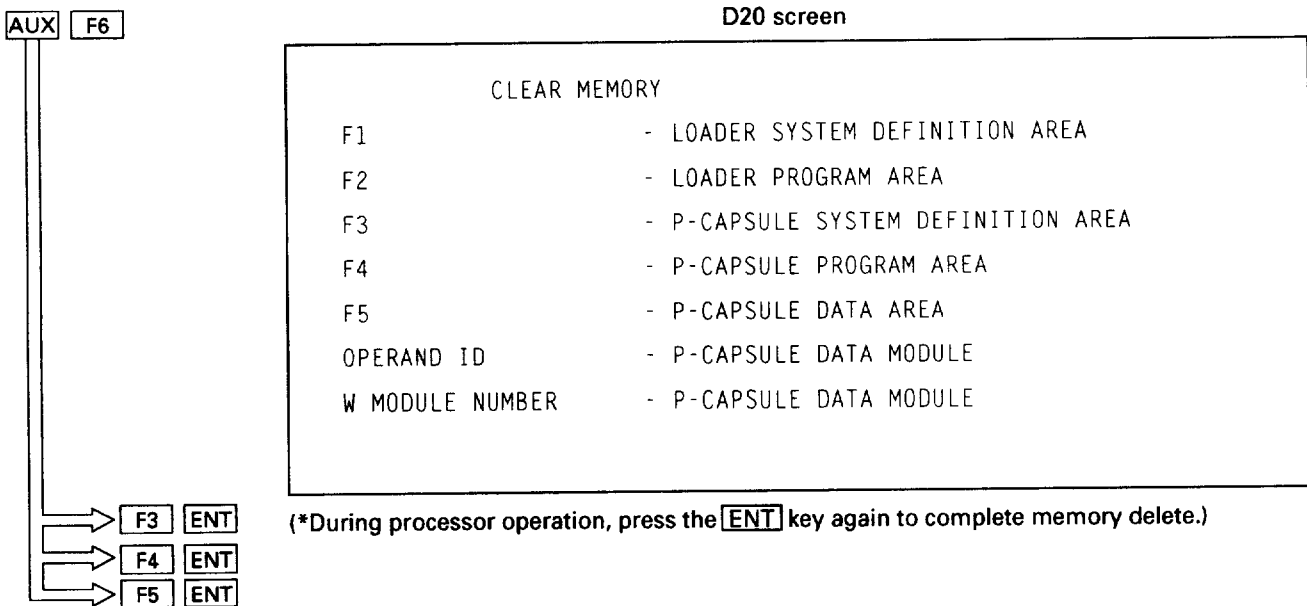
(*During processor operation, press the ENT key again to complete memory delete.)

With the F55 series, if a distributed unit configuration is made using the T-link, the cause of a fault may involve two or more units.

Therefore, it is necessary to know the unit configuration of the system, and to store needed programs and data in advance.

Maintenance to be performed on a daily basis

```
      ( Start )
          |
  ┌───────────────────────────────────────┐
  │ Understand the configuration and location │
  │ of each unit on the T-link.              │
  └───────────────────────────────────────┘
          |
  ┌───────────────────────────────────────┐
  │ Know the settings of the system definition │
  │ area, including:                          │
  │ ⎛ Continue or discontinue of fail-soft operation ⎞ │
  │ ⎜ Set or reset of T-link registration          ⎟ │
  │ ⎝ Set or reset of hold specification           ⎠ │
  └───────────────────────────────────────┘
          |
  ┌───────────────────────────────────────┐
  │ Store the program on floppy disk or      │
  │ cassette tape.                           │
  └───────────────────────────────────────┘
          |
  ┌───────────────────────────────────────┐
  │ Store the settings and contents of the data │
  │ area that are necessary for operation.   │
  └───────────────────────────────────────┘
          |
      ( End )
```

7.3 General Trouble Recovery Procedure

7.3.1 With ALM indication

```
┌─────────────────┐    ┌───────────────────────┐    ┌──────────────────┐
│ Check the ALM   │    │ Check the memory      │    │ Turn the power   │
│ indicator on the│───▶│ contents using the    │───▶│ of the basic unit│
│ basic unit      │    │ program loader        │    │ on and off       │
│                 │    │ diagnostic function   │    │                  │
└─────────────────┘    └───────────────────────┘    └──────────────────┘

      ┌──────────────────┐    ┌───────────────────────┐    ┌──────────────────┐
      │ Check whether    │    │ Check whether system  │    │ As a last resort,│
 ────▶│ cables are       │───▶│ definitions or        │───▶│ replace the unit │
      │ connected securely│   │ required programs     │    │ or card with a   │
      │                  │    │ have been modified    │    │ new one          │
      └──────────────────┘    └───────────────────────┘    └──────────────────┘
```
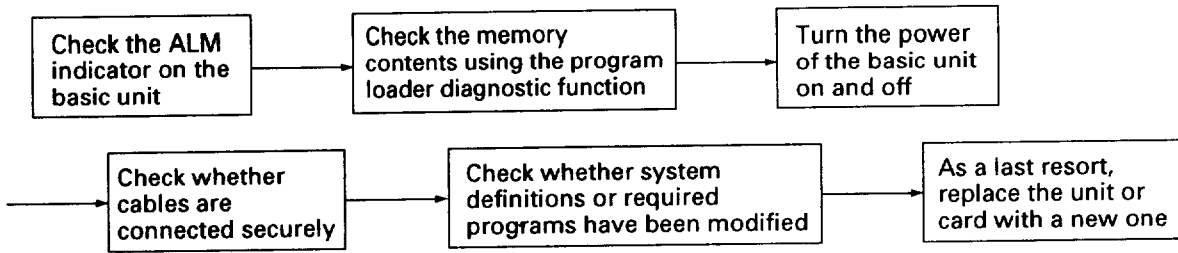
7.3.2 Without ALM indication

```
┌─────────────────┐    ┌──────────────────────┐
│ Check the failure│   │ Monitor I/O data and │
│ condition (machine│──▶│ internal data using  │
│ operation)      │    │ the program loader   │
└─────────────────┘    └──────────────────────┘

      ┌──────────────────┐    ┌──────────────────┐
      │ Turn the power   │    │ As the last resort,│
 ────▶│ of the basic unit│───▶│ replace the unit │
      │ on and off       │    │ or card with a   │
      │                  │    │ new one          │
      └──────────────────┘    └──────────────────┘
```

MLCREX-F F55

POW lights when the power is turned on.

RUN lights during processor operation.
(Goes off if stop operation is performed from the program loader,
if ALM1 lights, or if a hardware fault occurs.)

ALM1 lights if a fatal fault occurs. (Execution is stopped.)

ALM2 lights if a nonfatal fault occurs. (Execution is continued.)

BAT lights if the battery is disconnected or a battery voltage drop occurs.

7.5 Meaning of ALM LED Indication

> ALM1 lights if a fatal fault occurs or special relay F0002 is set on.
> ALM2 lights if a nonfatal fault occurs or special relay F0003 is set on.

ALM1 (fatal fault)
F0010	Memory error
F0013	Power supply fault
F0014	T-link fault (Units or cables on the T-link fault, or on the FTL auxiliary power supply fault)
F0015	Option fault
F0018	User program error
F0019	WDT error
F001A	Bus error
F001C	I/O area duplication
F001D	Too many capsules on T-link
F001E	Too many I/O addresses
F001F	Plant fault (fatal fault)
F0690	0 slot option fault

* F0010, F0012, or F0013 indicate hardware fault of the processor.

ALM2 (nonfatal fault)
F0022	Option fault
F0026	T-link configuration fault
F0029	Direct I/O configuration fault
F002E	Program slow-down
F002F	Plant fault (nonfatal fault)

* Only F002F is caused by user program operation.

> If a fatal fault occurs, all units on the T-link are deactivated. (The RUN indicator goes off.)
> If a nonfatal fault occurs, operation continues and external indication is made by means
> of LED indicators and failure contact output.

If the ALM LED indicator on the basic unit or the FTL/FTK
lights, perform the following diagnostic procedure:

```
                    ┌──────────────────────┐
                    (        Start          )
                    └──────────────────────┘
                               │
                    ┌──────────────────────┐
                    │   Check ALM indication │
                    └──────────────────────┘
                               │
No (POW is off)           ◇ Is ALM1 or ALM2          No (RUN is on)
                            of the basic unit on? ◇
                               │
                              Yes

    ┌──────────────────────────────┐
    │ Using program loader, read out│          ◇ Is ALM on FTL/FTK on? ◇  No
    │ special relay (annunciator    │                    │
    │ relay) area to understand the │                   Yes          ┌──────────────┐
    │ cause of fault                │                                (Normal or other)
    └──────────────────────────────┘                                ( type of failure)
                 │                              ┌──────────────────────┐
    ┌──────────────────────────────┐           │ Using program loader, │
    │ Execute diagnostic function   │           │ read out special relay│
    │ with program loader           │           │ (annunciator relay)   │
    └──────────────────────────────┘           │ area to understand    │
                 │                              │ cause of fault        │
    ┌──────────────────────────────┐           └──────────────────────┘
    │ Read out system definition    │                     │
    │ settings, depending on cause  │           ┌──────────────────────┐
    │ of fault                      │           │ Read out system       │
    └──────────────────────────────┘           │ definition settings,  │
                 │                              │ depending on cause    │
    ┌──────────────────────────────┐           │ of failure            │
    │ Check the status of each      │           └──────────────────────┘
    │ T-link station, depending on  │
    │ cause of fault                │
    └──────────────────────────────┘
                 │
    ┌──────────────────────────────┐
    │ Check program contents,       │
    │ depending on cause of fault   │
    └──────────────────────────────┘
                 │
    ┌──────────────────────────────┐
    │ Check power voltage,          │
    │ depending on cause of fault   │
    └──────────────────────────────┘
                 │
    ┌──────────────────────────────┐
    (            End                )
    └──────────────────────────────┘
```

7.7 Diagnosis of Fatal Faults

7.7.1 Self-diagnosis of ALM1 fatal faults
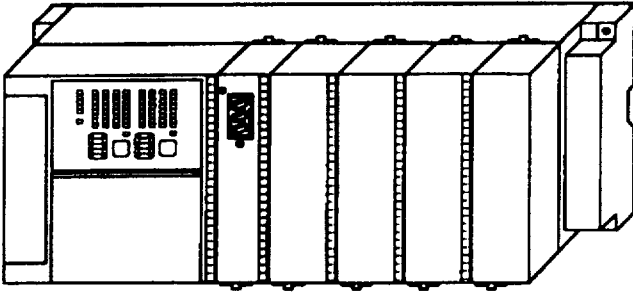
If the ALM1 LED indicator lights during processor operation, the self-diagnostic function of the CPU detects a fatal fault factor, and then stores the fault information in the special relay (F).

■ **Diagnosis flow**

> ALM1 LED indicator of the processor lights.

When the ALM1 LED indicator lights, the RUN indicator goes off.

↓

> Connect the program loader and execute diagnosis.

↓
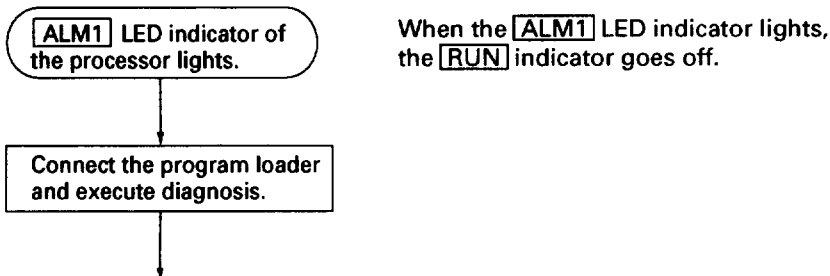
Diagnosis procedure with the D20 loader

<Operation>
Perform the following key operation to call up the following screen.

AUX , F2 , F1 , NEXT FRAME ,

```
                              FATAL FAULT CONDITION

Faulty item
An asterisk (*)        F001
is displayed for  ──►0*   MEMORY ERROR                    8   USER PROGRAM ERROR
faulty location        1   MICROPROGRAM DIAGNOSTIC ERROR   9   WATCHDOG TIMER ERROR
                       2   AUXILIARY POWER SUPPLY FAULT    A   BUS ERROR
Flag relay No.         3   POWER SUPPLY FAULT              B
     F0010             4   T-LINK FAULT                    C   I/O AREA DUPLICATION
     F0011             5                                   D   TOO MANY CAPSULES ON T-LINK
                       6                                   E   TOO MANY I/O POINTS
                       7                                   F   PLANT FAULT
```
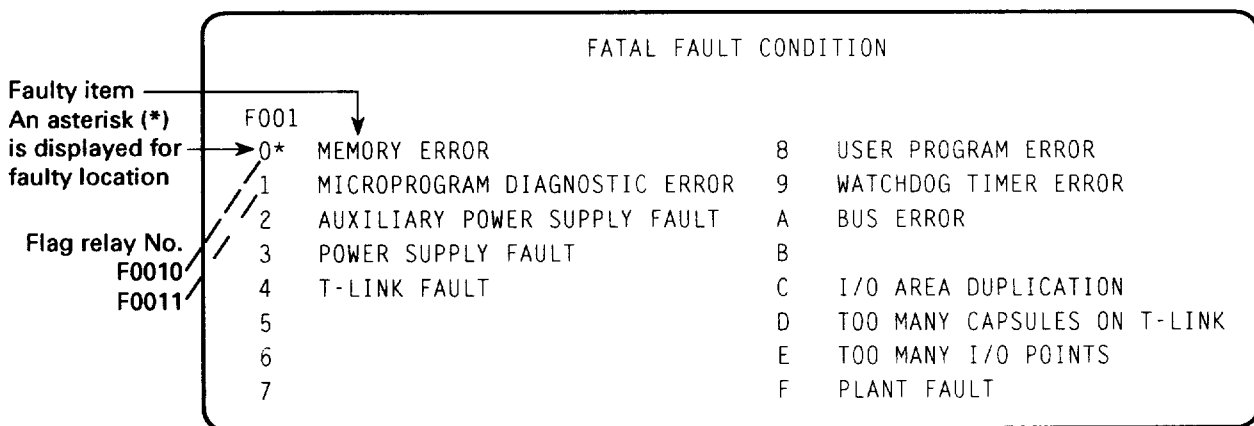
7.7.2 F0010 (Memory error)

Memory error occurs if the processor memory becomes abnormal.
Memory check data is generated as checksum data when written or transferred to the processor from the program loader. Data is always checked when a program is started and during operation.
The following shows possible causes for memory error.

Error	① Memory contents are defective.
Processing	Perform the following key operation to delete the memory contents. <Operation for D25> (from the initial screen) ⬚F5⬚ ⬚F6⬚ ⬚F3⬚ ⬚ENT⬚ ⬚F4⬚ ⬚ENT⬚ ⬚F5⬚ ⬚ENT⬚ ⬚AUX⬚ ⬚F6⬚ ⬚F3⬚ ⬚ENT⬚ ⬚F4⬚ ⬚ENT⬚ ⬚F5⬚ ⬚ENT⬚ <Operation for D20> ⬚AUX⬚ ⬚⬇⬚ ⬚⬇⬚ ⬚⬇⬚ ⬚⬇⬚ ⬚ENT⬚ <Operation for D10S> ⬚ENT⬚ ⬚⬇⬚ ⬚ENT⬚ ⬚⬇⬚ ⬚ENT⬚

Error	② Memory contents destroyed due to battery depletion.
Processing	1) Check the battery connection and replace if necessary. 2) Check the program. Note: Memory backup by battery To detect a memory error, the contents of the program area and system definition area, which are backed up by battery, are monitored based on checksum data. Checksum data is generated when data is written or transferred to the processor from the program loader, and are always monitored during processor operation, as well as at the time of program starting. If the power is turned off with the BATTERY alarm on, or if the battery voltage drops during power off, the memory contents may be destroyed. In this case, a memory error due to checksum error may occur when the power is turned back on.

7.7.3 F0013 "Power failure" (Momentary power failure)

If a power failure lasts for 10ms or longer during processor operation, processing by the processor program is interrupted. (If it lasts for less than 10ms, processor operation is not interrupted.) When the power is recovered, the processor is restarted.
If a power failure occurs, F0013 is set on, and when the processor is started, F0013 is copied to bit 3 of RAS copy area W166.4. Therefore, if zero is set to area W166.4, momentary power failure can be detected by means of this address. Only data monitoring or data setting is possible for area W166.4. This address cannot be used by a program.

7.7 Diagnosis of Fatal Faults

7.7.4 F0014 "T-link fault" (Fatal fault)

This fault indicates that the T-link controller of the CPU has had trouble and that the all T-link function is disabled. In this case, replacement of the CPU may be necessary. If fail-soft operation is not specified and a T-link configuration fault (F0026) such as FK capsule fault or T-link cable disconnection occurs, a T-link fault (nonfatal fault) also occurs. For details on T-link configuration fault, see subsection 7.8.3, "T-link configuration fault".

```
                    ( T-link fault occurred )
                              |
                              |      * Caused by T-link configuration fault
                              ↓
```

Check the station number where the fault occurred, using the program loader.

<Operation for D20>
Press the following key operation to call up the following screen.

```
[AUX] , [F2] , [F1] , [NEXT FRAME] ·········· [NEXT FRAME]
                      └──────────────────┘
                            7 times
```

```
FLAG ( 8/10)                                    F10 MENU
                      T-LK1 CONF/FAULT
              CONFIGURATION                FAULT
        STA NO.0 1 2 3 4 5 6 7 8 9   STA NO.0 1 2 3 4 5 6 7 8 9
  F010     0                            0*              F020
  F011    10*                          10               F021
  F012    20*                          20               F022
  F013    30                           30               F023
  F014    40                           40               F024
  F015    50                           50               F025
  F016    60                           60               F026
  F017    70                           70               F027
  F018    80                           80               F028
  F019    90                           90               F029
```

* Indicates the capsule with station No. 0 is not operating due to fault.

7.7.5 F0015 "Option fault" (Fatal fault)

Option fault occurs when an optional card incurs malfunction.
In this case, both the fatal fault flag (F0015) and the nonfatal fault flag (F0022) are set on. This fault also occurs if a T-link optional card is removed (dislocated) or installed during processor operation, or if the card is missing (uninstalled) but optional card registration has been made.

7.7.6 F0018 "User program error"

This error occurs if a syntax error is detected in a user program.

Display the line on which the error occurred.

<Operation for D20>
Press the following key operation to call up the following screen.

[AUX] , [F2] , [F3]

```
              USER PROGRAM ERROR (1/2)

    CIRCUIT NO.          IMPORT OF ERROR

    P001.0010      TIMER COUNTER DUPLICATE
```

Up to 8 errors are displayed at a time on a single screen. Pressing the [NEXT FRAME] displays the next screen. If there are more than 16 errors, error No. 17 and subsequent errors are displayed when the first 16 errors have been cleared. Correct the program according to the displayed error messages.

7.7.7 F0019 "WDT (Watch-dog timer) error"

The watchdog timer monitors 1 scan of the user program. This error occurs if 1 scan exceeds the WDT setting.

Monitor 1 scan time (execution speed).

<Operation for D20>
Press the following key operation to call up the following screen.

[AUX] , [F5]

```
     SCAN TIME      MAX=0013    (MS) ◄----------  The maximum
                    MIN=0011    (MS)              value is displayed.

  (PRESENT VALUE)
  0011
  0013                                           The execution
  0011                                           speed is displayed
  0012                                           in realtime.
  0011
  0011
```

The watchdog timer is set to 1.5 times the normal execution speed. Confirm the execution speed and timer setting; if the timer setting is not appropriate, correct it. (See "System Definition" in User's Manual <Instructions>.)

7.7 Diagnosis of Major Failures

7.7.8 F001A "Bus error"
This error occurs if an I/O card malfunction during processor operation.

■ **Possible causes of the error**
(1) Contact failure between an I/O card and the processor connector, or falling off the card
(2) I/O module malfunction
(3) Empty slot between cards
(4) Short-circuit in a processor bus line

Display the slot number where the error occurred.

<Operation for D20>
Press the following key operation to call up the following screen.

| AUX | , | F2 | , | F5 | , | F5 |

```
                DIRECT I/O FAULT (BUS ERROR)    (F120)       F10 MENU
                                        MONITORING
                     SLOT NO.      ERR INF
        (-3 TIMES)
        (-2 TIMES)
        (-1 TIMES)
        (0 TIMES)        3         CONTROL SIGNAL ABNORMAL
```

7.7.9 F001C "I/O area duplication"
This error occurs if duplication of occupied address exists between the processor and the expansion unit or capsule on the T-link.
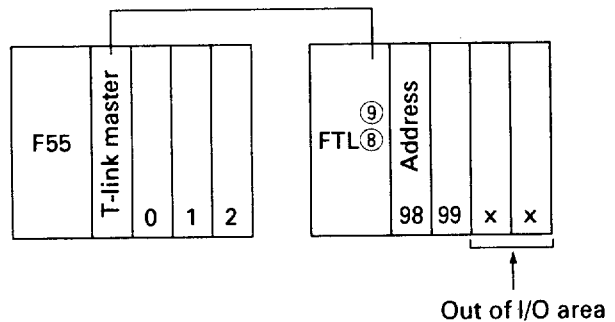
7.7.10 F001D "Too many capsules on T-link"
This error occurs if more than 32 expansion units or capsules are installed on the T-link.

7.7.11 F001E "Too many I/O addresses"
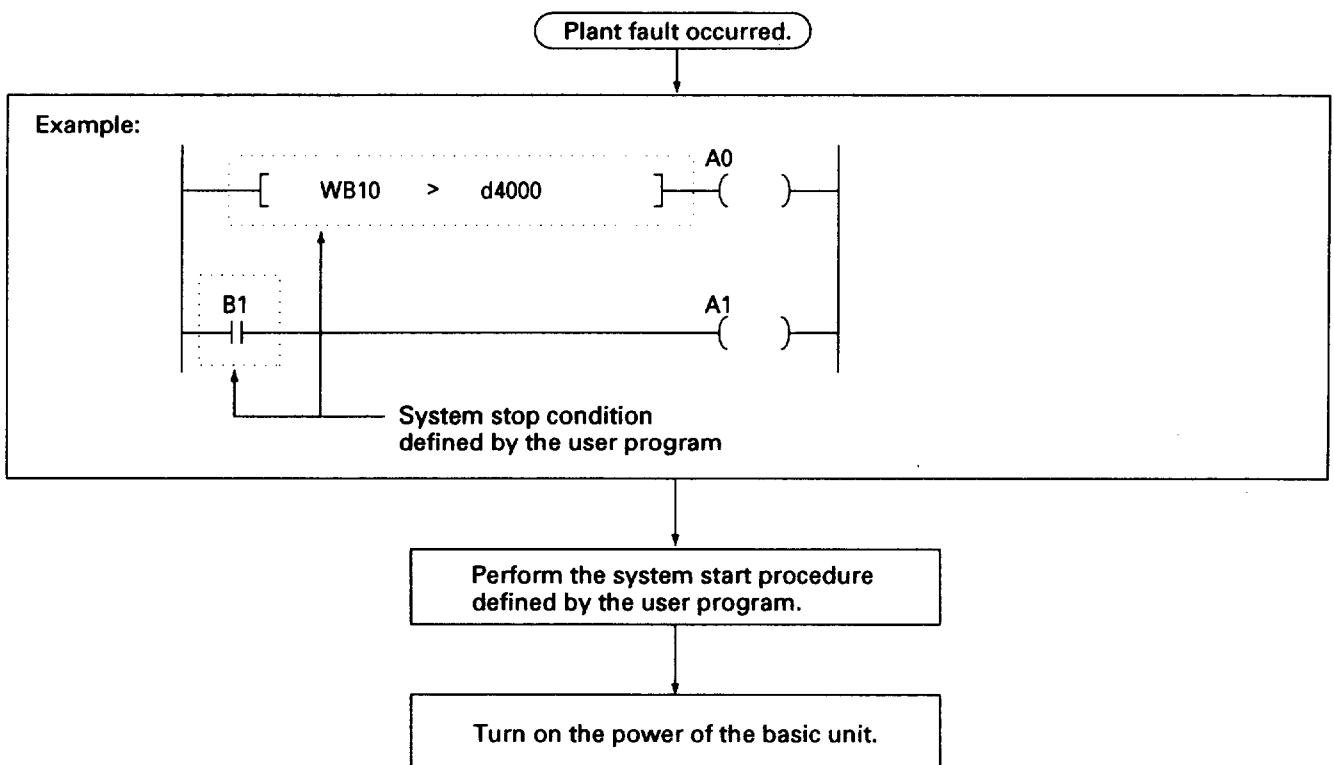This error occurs if the occupied I/O word address exceeds 99 (WB99).

Example:

Out of I/O area

7.7.12 F001F "Plant fault (Fatal fault)"

This fault occurs if one of the annunciator relays from A0000 to A000F is set on during execution of a user program.

```
                                    ( Plant fault occurred. )
                                                │
┌───────────────────────────────────────────────────────────────────┐
│ Example:                                                            │
│                                                        A0           │
│          ┌─[    WB10    >    d4000        ]─┤─(    )─┤              │
│          │                                                          │
│          │                                                          │
│          │     B1                              A1                   │
│          │   ┌─┤ ├─┐────────────                (    )─┤            │
│          │   │     │            │                                   │
│          │   └──▲──┘         ───┘── System stop condition           │
│                               defined by the user program          │
└───────────────────────────────────────────────────────────────────┘
                                                │
                        ┌───────────────────────────────────────┐
                        │ Perform the system start procedure     │
                        │ defined by the user program.           │
                        └───────────────────────────────────────┘
                                                │
                        ┌───────────────────────────────────────┐
                        │ Turn on the power of the basic unit.   │
                        └───────────────────────────────────────┘
```

7.7.13 F0690 "0 slot option fault (Fatal fault)"

(Only basic unit version 1001 or later)
This error occurs under the following conditions.
- If an optional card malfunction or if normal optional card is not installed with optional card registration made
- If a T-link optional card is removed (dislocated) or installed (T-link configuration modified) during processor operation
- If a T-link optional card is missing (uninstalled) with optional card registration made
  In this case, both the fatal fault flag (F0015) and the nonfatal fault flag (F0022) are set on.

7.8 Diagnosis of Nonfatal Faults

7.8.1 Self-diagnosis of ALM2 nonfatal faults
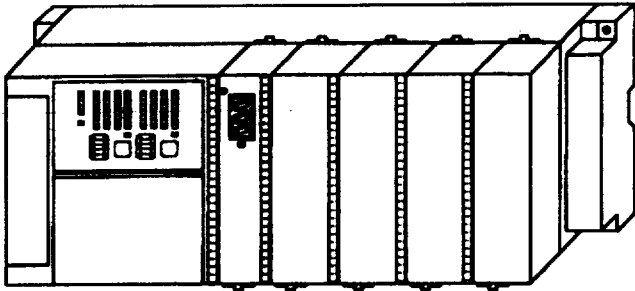
If the ALM2 LED indicator lights during processor operation, the self-diagnostic function of the CPU detects a nonfatal fault factor, and then stores the error information in the special relay (F).

■ **Diagnosis flow**

```
  ┌──────────────────────────┐
 (  ALM2  LED indicator of   )
 (  the processor lights.    )
  └──────────────────────────┘
              │
  ┌──────────────────────────┐
  │ Connect the program loader│
  │ and execute diagnosis.    │
  └──────────────────────────┘
              │
```
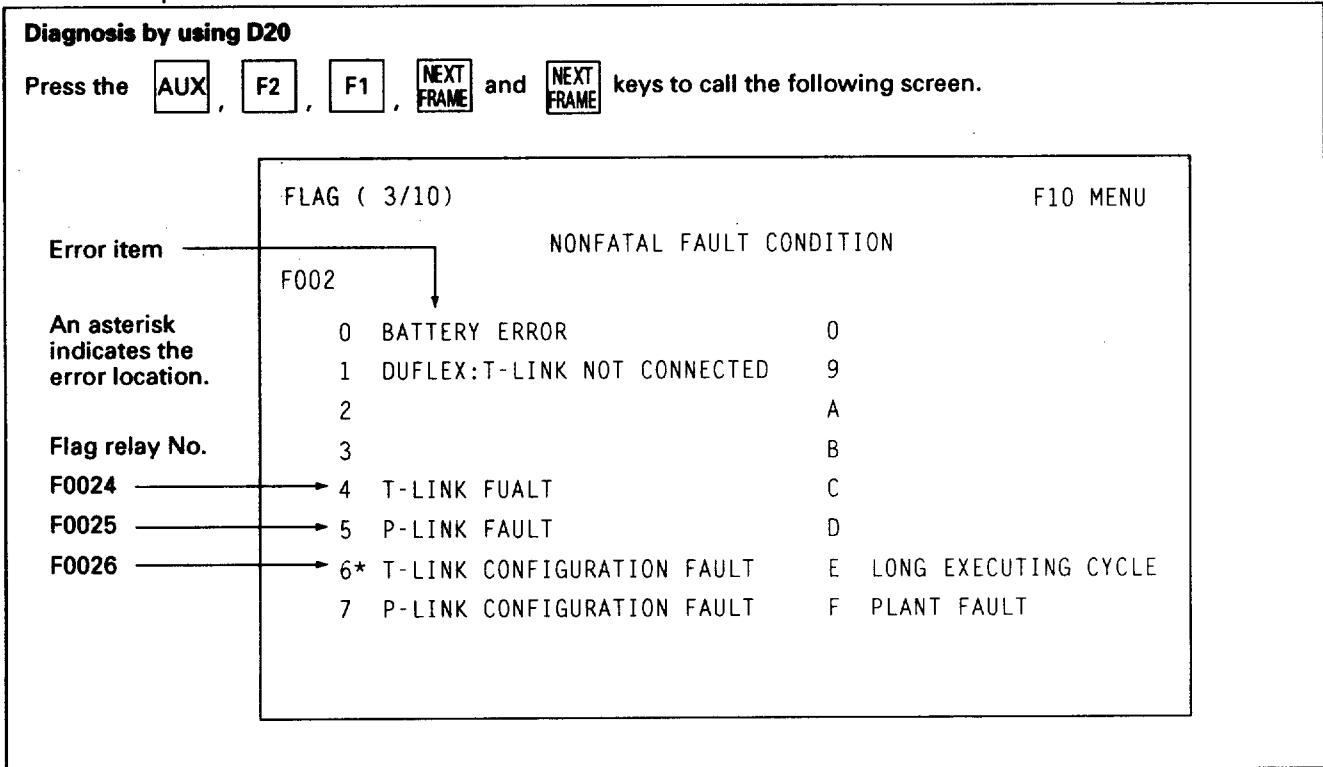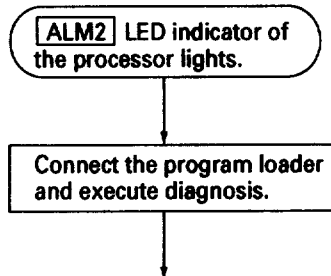
Diagnosis by using D20

Press the AUX , F2 , F1 , NEXT FRAME and NEXT FRAME keys to call the following screen.

```
FLAG ( 3/10)                                        F10 MENU
                    NONFATAL FAULT CONDITION
F002

    0  BATTERY ERROR                   0
    1  DUFLEX:T-LINK NOT CONNECTED     9
    2                                  A
    3                                  B
    4  T-LINK FUALT                    C
    5  P-LINK FAULT                    D
    6* T-LINK CONFIGURATION FAULT      E   LONG EXECUTING CYCLE
    7  P-LINK CONFIGURATION FAULT      F   PLANT FAULT
```

Error item

An asterisk indicates the error location.

Flag relay No.

F0024 ───────→ 4

F0025 ───────→ 5

F0026 ───────→ 6*

7.8.2 F0022 "Option fault (Nonfatal fault)"

This fault occurs if an optional card malfunction.

7.8.3 F0026 "T-link configuration fault"

This fault occurs if the TK capsule is disconnected during processor operation, or if the contents of T-link registration do not match the actual T-link configuration of operating conditions that specified T-link registration.

The possible causes are as follows:

① A destributed I/O capsule fails during operation.
② An address other than the starting address of the I/O module (FTU type) installed on the same base as the T-link interface module (FTL type) is registered for T-link.
Only the address number set by the address setting dials on the FTL can be registered for T-link.

③ The I/O capsules and T-link interface card registered for T-link are not installed on the T-link.

Notes: 1. Fault may occur ① during processor operation regardless of T-link registration. Fault ② and ③ may occur when the power is turned on.
2. For T-link registration, all I/O capsules must be registered. If any of I/O capsules installed is not registered, it is ignored and is not accessible to the processor.

(T-link configuration fault occurred.)

Check the station number where the faults occurred, using the program loader.

<Operation for D20>

Press the [AUX] , [F2] , [F1] , [NEXT FRAME] ·········· [NEXT FRAME] keys to call the following screen.

‎   7 times

```
FLAG ( 8/10)                                    F10 MENU
                    T-LK1 CONF/FAULT
            CONFIGURATION                    FAULT
       STA NO.0 1 2 3 4 5 6 7 8 9      STA NO.0 1 2 3 4 5 6 7 8 9
 F010     0                                 0*            F020
 F011    10*                                10            F021
 F012    20*                                20            F022
 F013    30                                 30            F023
 F014    40                                 40            F024
 F015    50                                 50            F025
 F016    60                                 60            F026
 F017    70                                 70            F027
 F018    80                                 80            F028
 F019    90                                 90            F029
```
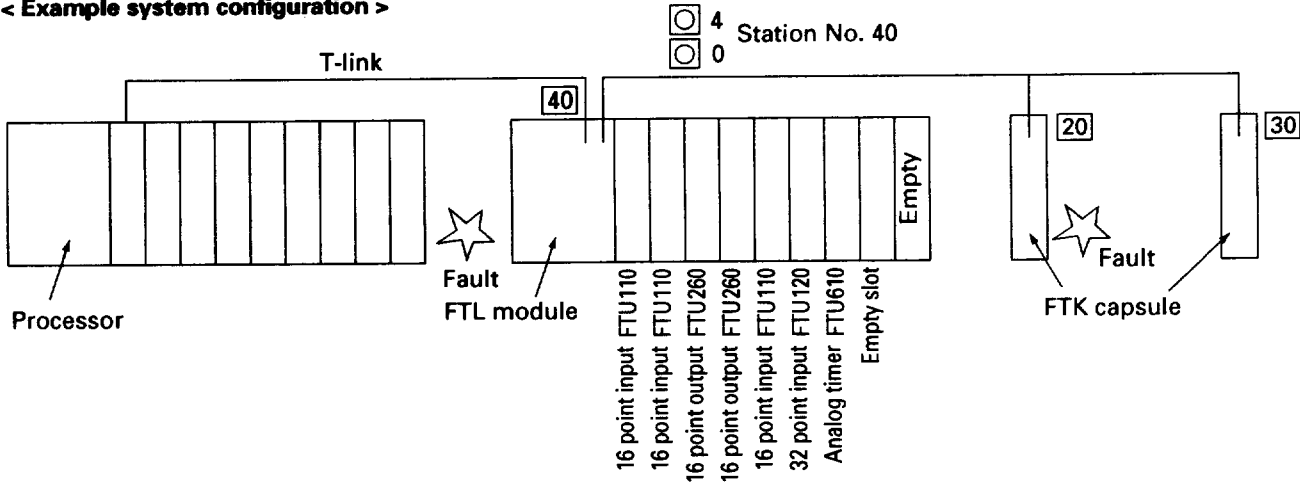
This indicates that the capsule of station No. 0 is inoperative (abnormal).
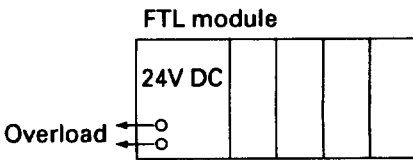
7.8 Diagnosis of Nonfatal Faults

■ FTL unit fault
The following describes the procedure to detect the cause of an FTL unit fault.

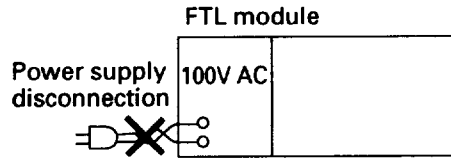### < Example system configuration >
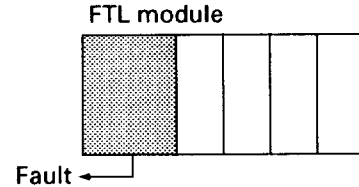

Example of FTL unit faults

① Overloading on the FTL module 24V DC power supply

② Power supply for FTL module disconnected

⑤ FTL fault

③ I/O module fault
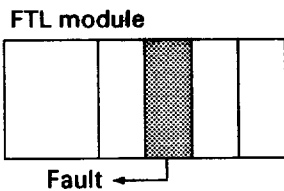
④ Dislocation of the I/O module from the base
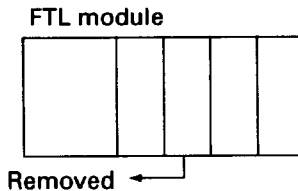
ALM2 nonfatal fault

If any of the above occurs when fail-soft operation setting is specified for the processor, the ALM2 LED indicator of the processor and the ALM1 LED indicator of the FTL module light.

Under operating conditions without fail-soft operation, the ALM1 LED indicator of the processor also lights, and the processor stops operation.
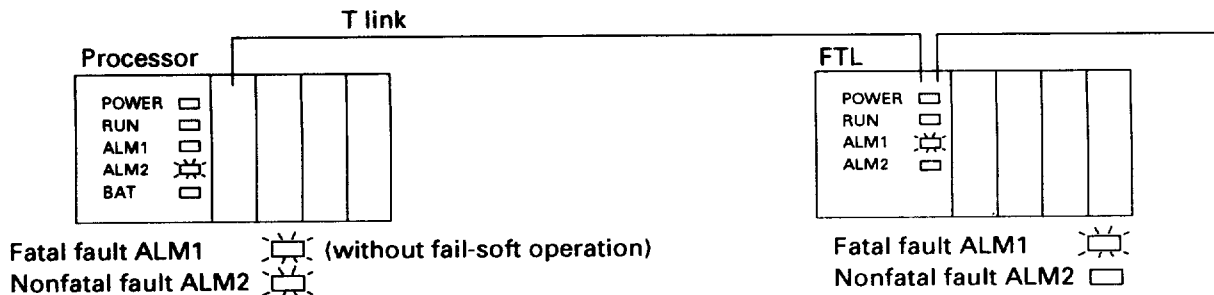
In this case, execute diagnosis using the D20 and press the following key operation to call up the screen shown on next page.

```
FLAG ( 3/11)                                               F10 MENU
                        NONFATAL FAULT CONDITION
F002
    0    BATTERY ERROR                 8
    1                                  9
    2                                  A
    3                                  B
    4    T-LINK FAULT                  C
    5    P-LINK FAULT                  C
    6*   T-LINK CONFIGURATION FAULT    E    LONG EXECUTING CYCLE
    7    P-LINK CONFIGURATION FAULT    F    PLANT FAULT
```

F0026 ──────────→ (arrow pointing to line 6*)
"T-LINK
CONFIGURATION
FAULT"

The T-link configuration information (T-link configuration fault) in the above screen shows the failed address of the FTL unit. Press the [NEXT FRAME] key on the D20 5 times to call up the following screen. The faulty location can be easily identified because an asterisk (*) is displayed at the faulty T-link address of the FTL unit. However, this screen does not indicate the cause of the fault (FTL module fault or I/O module fault). To investigate the cause of the FTL unit fault in detail, use "F4 T-link fault" from the diagnosis screen above.

```
FLAG ( 8/10)                                               F10 MENU
                         T-LK1 CONF/FAULT
              CONFIGURATION                    FAULT
       STA NO.0 1 2 3 4 5 6 7 8 9   STA NO.0 1 2 3 4 5 6 7 8 9
F010      0                            0                        F020
F011     10                           10                        F021
F012     20                           20*                       F022
F013     30*                          30                        F023
F014     40                           40*                       F024
F015     50                           50                        F025
F016     60                           60                        F026
F017     70                           70                        F027
F018     80                           80                        F028
F019     90                           90                        F029
```

The T-link station No. indicates the faulty capsule. (points to 20*)

This indicates that the FTL that has T-link station No. 40 has a fatal fault. (points to 40*)

7.8 Diagnosis of Nonfatal Faults
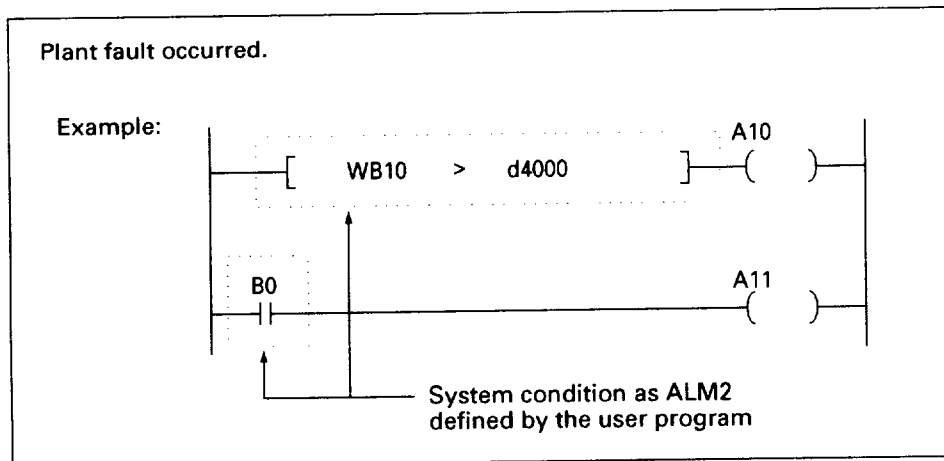
7.8.4 F0029 "Direct I/O fault"

This fault occurs if an I/O error occurs during processor operation, or if an I/O connector is disconnected.

7.8.5 F002E "Program slow-down"

This fault occurs if the wait count of the fixed-cycle program (PROG50) exceeds 32. (This fault occurs during scan.)

7.8.6 F002F "Plant fault (Nonfatal fault)"

This fault occurs if one of the annunciator relays from A0010 to A003F is set on during execution of a user program.

Plant fault occurred.

Example:

```
                                              A10
      ─[   WB10   >   d4000   ]─( )─

    B0                            A11
    ─┤├─────────────────────────( )─
```

System condition as ALM2 defined by the user program

Perform the system start procedure defined by the user program.

When the input conditions are not met, annunciator relays A0010 to A003F go off and the ALM2 LED indicator lights.

Section 8 Maintenance and Inspection

Section 8 Maintenance and Inspection
8.1 General Inspection Items

For use of the MICREX-F series under the best operating conditions, periodic inspection must be performed.

(1) Inspection frequency

The MICREX-F series is a highly-reliable programmable controller, consisting mainly of semiconductor devices. However, because deterioration of devices may occur due to environmental conditions, periodic inspection is recommended. The standard inspection should be done once or twice a year; however, it can be shorter, depending on environmental conditions.

If any inspection result does not match the rated value, check the operating conditions to make sure they are appropriate.

(2) Cautions on using the product

⚠ CAUTION
• Select a wire size to suit the applied voltage and carrying current, and carry out wiring according to the operating instructions and manual. Poor wiring might cause fire. • Operate (keep) in the environment specified in the operating instructions and manual. High temperature, high humidity, condensation, dust, corrosive gases, oil, organic solvents, excessive vibration or shock might cause electric shock, fire, erratic operation or failure. • Contaminants, wiring chips, iron powder or other foreign matter must not enter the device when installing it, otherwise, erratic operation or failure might occur. • Periodically make sure the terminal screws and mounting screws are securely tightened.

(3) Inspection items

When inspecting the MICREX-F series, use the following inspection table.

Inspection item		Inspection contents	Criteria	Inspection method
Basic unit ALARM lamps		Confirmation of ALARM lamps	Lamps must be OFF.	Visual inspection
Basic unit power supply	Voltage	Is the voltage within the normal range when measured at a terminal block?	AC: −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
FTK capsule 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 environment	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 cards 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 it time to replace the battery?	Indication on battery effectiveness label	Visual inspection
Spare parts		Is the designated quantity available? Are storage conditions appropriate?	See the inspection records.	
Program		Were any errors detected through verification?	There must be no errors.	Program verification

- If a fault occurs, replace the entire faulty unit, capsule or module. For this replacement, a minimum amount of spare components should be provided.

- Battery voltage drops even when not being used because of slight self-discharging. Replace old batteries with new ones before their effective service life expires.

8.2 Battery Replacement

Replace the battery with a new one at the determined replacement time even if the battery alarm is not indicated. (The device can ignore the battery alarm for about one week without harmful effects. However, the user should not ignore this alarm status.)
(1) Replacement time: Data indicated on battery (effective service life)
(2) Type of replacement battery: NL8V-BT (FBT030A)

■ Precautions
(1) Do not short across the battery.
(2) Do not discard in a fire.
(3) Do not attempt to recharge the battery.
(4) Do not disassemble the battery.

■ Battery replacement procedure
(1) Turn OFF the processor control power. (Battery can be replaced without disconnecting the control power supply.)
(2) Open the cover.
(3) Remove the battery connector and then remove the old battery by loosening the screws that fix the battery holder. Insert a new battery and secure it.
Replace quickly (within 5 minutes). If the processor is left without battery for a long period, user programs will be lost.
(4) Close the cover.
(5) Turn ON the processor control power.

■ Information on ordering and maintenance services for electrical and control equipment

1. Ordering notes

When ordering electrical and control equipment (or requesting price estimates), the following general notes are to be observed, unless otherwise specified in the estimation paper, contract paper, catalogs, or specifications.

When the product is delivered, check the contents of the package as soon as possible. Even before inspection, use caution on storing and using the product safely.

2. Warranty period and scope of warranty

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

[Scope of warranty]
During the warranty period, if any failure judged to be the responsibility of the manufacturer occurs, replacement and repair of defective parts are performed under the responsibility of the manufacturer.
This warranty does not cover the following failures:

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

3. Service costs

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

(1) Guidance for installation and adjustment, and attendance at a test operation
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education

Materials covered in this document are subject to revision due to the modification of the product.   Issued as FE consolidated edition, June 2011