FANUC

GE Fanuc Automation

Computer Numerical Control Products

Series 0 / 00 / 0-Mate

Connection Manual (Hardware)

GFZ-61393E/06 *September 1998*

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warning and Caution according to their bearing on safety. Also, supplementary information is described as a Note. Read the Warning, Caution, and Note thoroughly before attempting to use the machine.

WARNING

Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

CAUTION

Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE

The Note is used to indicate supplementary information other than Warning and Caution.

❍ **Read this manual carefully, and store it in a safe place.**

Table of Contents

1 PREFACE

This manual describes the electrical and structural specifications required for connecting the FANUC Series 0/00/0–Mate to a machine tool. The manual outlines the components commonly used for FANUC CNC control units, as shown in the configuration diagram in Chapter 2, and supplies additional information on using these components with the Series 0/00/0–Mate. Refer to individual manuals for the detailed specifications of each model.
There are different models of the Series 0/00/0–Mate appropriate for different types of machine tools (lathe, machining center, etc.). This manual describes those specifications in common among all Series 0/00/0–Mate models. Whenever one or more models have different specifications, they are noted.

The models covered by this manual, and their abbreviations, are :

Product Name	Abbreviations	
FANUC Series 0–TC	0–TC	Series 0
FANUC Series 0–TF	0–TF	
FANUC Series 0–TTC	0–TTC	
FANUC Series 0–MC	0–MC	
FANUC Series 0–MF	0–MF	
FANUC Series 0–GCC	0–GCC	
FANUC Series 0–GSC	0–GSC	
FANUC Series 0–TD	0–TD	Series 0–D
FANUC Series 0–MD	0–MD	
FANUC Series 0–GCD	0–GCD	
FANUC Series 0–GSD	0–GSD	
FANUC Series 0–TDII	0–TDII	Series 0–DII
FANUC Series 0–MDII	0–MDII	
FANUC Series 0–GCDII	0–GCDII	
FANUC Series 0–GSDII	0–GSDII	
FANUC Series 00–TC	00–TC	Series 00
FANUC Series 00–MC	00–MC	
FANUC Series 00–GCC	00–GCC	
FANUC Series 0–Mate TC	0–Mate TC	Series 0–Mate
FANUC Series 0–Mate MC	0–Mate MC	
FANUC Series 0–Mate MF	0–Mate MF	

Related manuals

The table below lists manuals related to the FANUC Series 0/00/0–Mate. In the table, this manual is marked with an asterisk(*).

- **Series 0/00/0–Mate C**

Table 1 Manuals related to the Series 0/00/0–Mate C

Manual name	Specification number	
FANUC Series 0/00/0–Mate DESCRIPTIONS	B–61392E	
FANUC Series 0/00/0–Mate DESCRIPTIONS (Suppelement for Remote buffer)	B–61392EN–1	
FANUC Series 0/00/0–Mate CONNECTION MANUAL (HARDWARE)	B–61393E	*
FANUC Series 0/00/0–Mate CONNECTION MANUAL (FUNCTION)	B–61393E–2	
FANUC Series 0/00/0–Mate FOR LATHE OPERATOR'S MANUAL	B–61394E	
FANUC Series 0/00/0–Mate FOR MACHINING CENTER OPERATOR'S MANUAL	B–61404E	
FANUC Series 0/00/0–Mate MAINTENANCE MANUAL	B–61395E	
FANUC Series 0/00/0–Mate OPERATION AND MAINTENANCE HANDBOOK	B–61397E	
FANUC Series 0/00/0–Mate FOR LATHE PARAMETER MANUAL	B–61400E	
FANUC Series 0/00/0–Mate FOR MACHINING CENTER PARAMETER MANUAL	B–61410E	
GRAPHIC CONVERSATION FOR MACHINING CENTER (Series 0–MC, Series 0–MF, Series 0–Mate MF) OPERATOR'S MANUAL	B–61434E	
FANUC PMC–MODEL K/L/M PROGRAMMING MANUAL (LADDER LANGUAGE)	B–55193E	
FANUC Series 0/0–Mate PROGRAMMING MANUAL (Macro Compiler / Macro Executer)	B–61393E–1	

- **Series 0–D**

Table 1 Manuals related to the Series 0–D

Manual name	Specification number	
FANUC Series 0–TD/MD DESCRIPTIONS	B–62542EN	
FANUC Series 0/00/0–Mate CONNECTION MANUAL (HARDWARE)	B–61393E	*
FANUC Series 0–TD/MD/GCD/GSD CONNECTION MANUAL (FUNCTION)	B–62543EN–1	
FANUC Series 0–PD CONNECTION MANUAL (FUNCTION)	B–62973EN	
FANUC Series 0/00/0–Mate FOR LATHE OPERATOR'S MANUAL	B–61394E	
FANUC Series 0/00/0–Mate FOR MACHINING CENTER OPERATOR'S MANUAL	B–61404E	
FANUC Series 0–PD OPERATOR'S MANUAL	B–62974EN	
FANUC Series 0/00/0–Mate MAINTENANCE MANUAL	B–61395E	
FANUC Series 0–PD MAINTENANCE MANUAL	B–62975EN	
FANUC Series 0/00/0–Mate FOR LATHE PARAMETER MANUAL	B–61400E	
FANUC Series 0/00/0–Mate FOR MACHINING CENTER PARAMETER MANUAL	B–61410E	

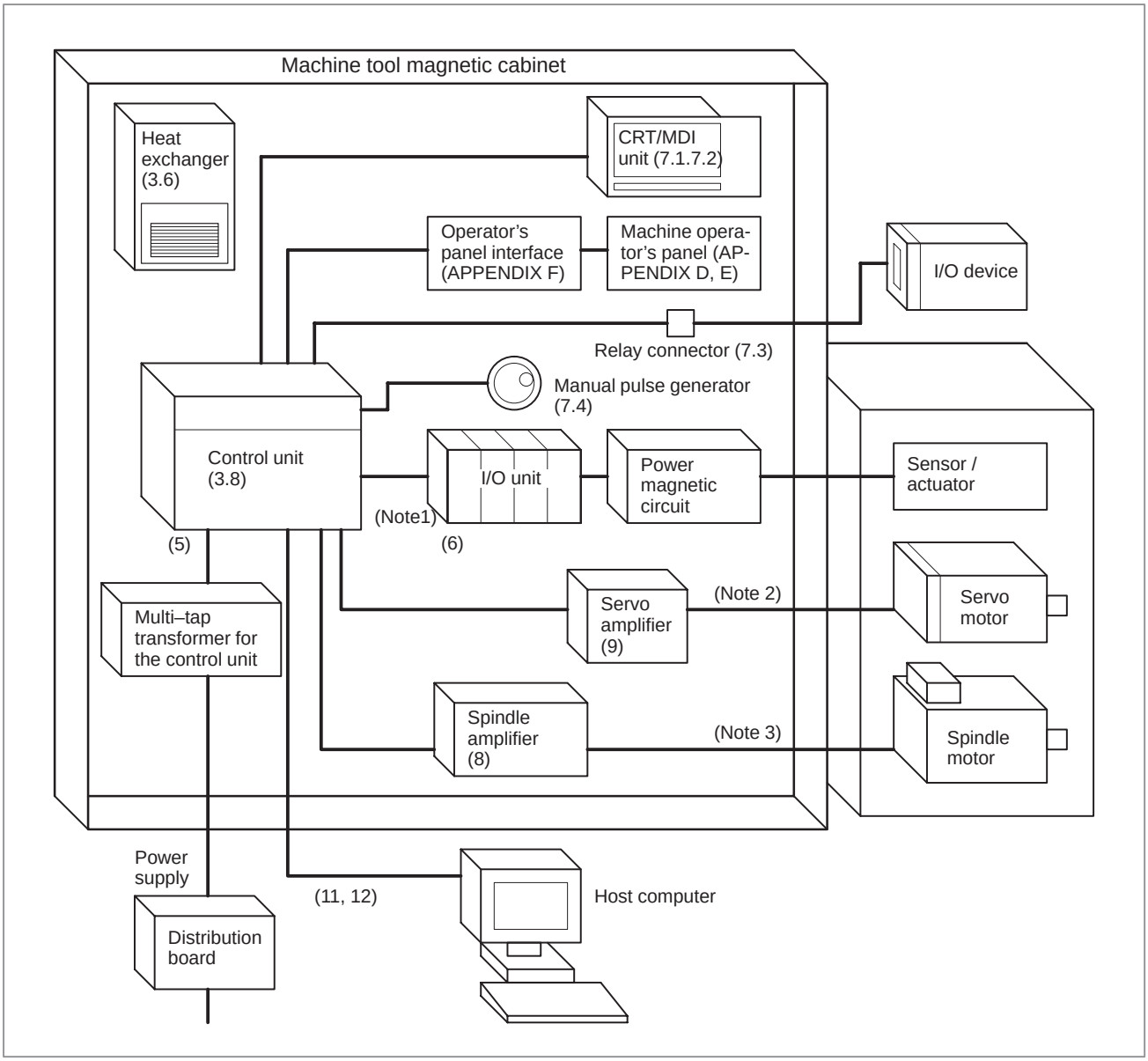
- **Series 0–DII**

Table 1 Manuals related to the Series 0–DII

Manual name	Specification number	
FANUC Series 0/00/0–Mate CONNECTION MANUAL (HARDWARE)	B–61393E	*
FANUC Series 0/00/0–Mate CONNECTION MANUAL (FUNCTION)	B–61393E–2	
FANUC Series 0/00/0–Mate FOR LATHE OPERATOR'S MANUAL	B–61394E	
FANUC Series 0/00/0–Mate FOR MACHINING CENTER OPERATOR'S MANUAL	B–61404E	
FANUC Series 0/00/0–Mate MAINTENANCE MANUAL	B–61395E	
FANUC Series 0/00/0–Mate FOR LATHE PARAMETER MANUAL	B–61400E	
FANUC Series 0/00/0–Mate FOR MACHINING CENTER PARAMETER MANUAL	B–61410E	

2 CONFIGURATION

The following figure shows the configuration of the electrical system of the machine tool with which the Series 0/00/0–Mate is used.
This manual describes how to connect the units illustrated in this diagram. The machine tool body, machine operator's panel, power magnetic circuit, and sensor/actuator are specific to the machine tool and are the builder's responsibility. This manual does not cover the internal connection of these units to the machine tool. The numbers in parentheses shown in the diagram are section references for this manual.



NOTE
1 Refer to the "FANUC I/O Unit Model A Connecting Maintenance Manual (B-61813E)".
2 Refer to the "FANUC AC Servo Motor Series Descriptions (B-65002E)" or "FANUC SERVO AMPLIFIER α series DESCRIPTION (B–65162E)".
3 Refer to the "FANUC AC Spindle Motor Series (Serial interface) Descriptions (B-65042E)".

3 INSTALLATION

3.1 EXTERNAL ENVIRONMENTAL REQUIREMENTS OF CABINET

The peripheral units, such as the control unit and CRT/MDI, have been designed on the assumption that they are housed in closed cabinets. In this manual “cabinet” refers to the following:

- Cabinet manufactured by the machine tool builder for housing the control unit or peripheral units;
- Cabinet for housing the flexible turnkey system provided by FANUC;
- Operation pendant, manufactured by the machine tool builder, for housing the CRT/MDI unit or operator’s panel.
- Equivalent to the above.

The environmental conditions when installing these cabinets shall conform to the following table. Section 3.4 describes the installation and design conditions of a cabinet satisfying these conditions.

Room temperature	In operation	0° to 45°
	In storage or transportation	–20° to 60°
Change in temperature	1.1°C/minute max.	
Relative humidity	Normal	75% or less
	Temporary (within 1 month)	95% or less
Vibration	In operation: 0.5G or less	
Environment	Normal machine shop environment (The environment must be considered if the cabinets are in a location where the density of dust, coolant, and/or organic solvent is relatively high.)	

3.2 INSTALLATION CONDITION OF CNC AND SERVO UNIT

Room temperature	In operation	0°C to +55°C
	In storage or transportation	–20°C to +60°C
Relative humidity	95% RH or less (no condensation)	
Vibration	0.5 G or less	
Environment	The unit shall not be exposed direct to cutting oil, lubricant or cutting chips.	

3.3 POWER CAPACITY

The power capacity of the CNC control unit, which in this section means the specification required for the power supply, is obtained by adding the power capacity of the control section and the power capacity of the servo section.
The power capacity of the control section includes the power capacity of the control unit, CRT/MDI, I/O unit, and operator’s panel interface.

Power capacity of the control section	0.4 kVA
Power capacity of the servo section	Depends on servo motor type. Refer to each DESCRIPTIONS.

3.4 DESIGN AND INSTALLATION CONDITIONS OF THE MACHINE TOOL MAGNETIC CABINET

When a cabinet is designed, it must satisfy the environmental conditions described in Section 3.1. In addition, the magnetic interference on the CRT screen, noise resistance, and maintenance requirements must be considered. The cabinet design must meet the following conditions :

- The cabinet must be fully closed.

  The cabinet must be designed to prevent the entry of airborne dust, coolant, and organic solvent.

  Cabinets that let in air may be designed for the servo amplifier and servo transformer provided that they :

  ❑ Use an air filter on the air inlet ;

  ❑ Place the ventilating fan so that it does not blow air directly toward the unit;

  ❑ Control the air flow so that no dust or coolant enters the air outlet
- The cabinet must be designed to maintain a difference in temperature of 10°C or less between the air in the cabinet and the outside air when the temperature in the cabinet increases.
  See Section 3.5 for the details on thermal design of the cabinet.
- A closed cabinet must be equipped with a fan to circulate the air within.
  The fan must be adjusted so that the air moves at 0.5 m/sec along the surface of each installed unit.

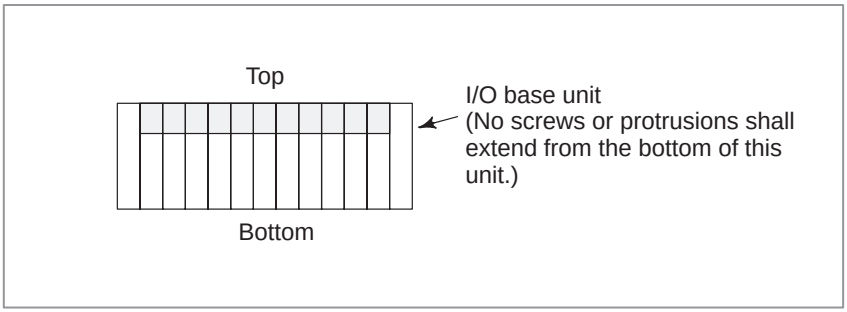
CAUTION
If the air blows directly from the fan to the unit, dust easily adheres to the unit. This may cause the unit to fail.

- For the air to move easily, a clearance of 100 mm is required between each unit and the wall of the cabinet.
- Packing materials must be used for the cable port and the door in order to seal the cabinet.
  Because the CRT unit uses a voltage of approximately 11 kV, airborne dust gathers easily. If the cabinet is insufficiently sealed, dust passes through the gap and adheres to the unit. This may cause the insulation of the unit to deteriorate.
  Acceptable packing materials :

  ❑ Epton sealer No. 686, NITTO INDUSTRY CO., LTD.

  ❑ Polyurethane foam (ester) covered with vinyl chloride, FUJI POLYMERTECH., LTD.
- The CRT/MDI unit must be installed in a location where coolant cannot be poured directly on it. The unit does have a dust–proof front panel.
- Noise must be minimized.
  As the machine and the CNC unit are reduced in size, the parts that generate noise may be placed near noise–sensitive parts in the magnetics cabinet.
  The CNC unit is built to protect it from external noise. Cabinet design to minimize noise generation and to prevent it from being transmitted to the CNC unit is necessary. See section 3.7 for details of noise elimination/management.

- The units must be installed or arranged in the cabinet so that they are easy to inspect and maintain.
- The CRT screen can be distorted by magnetic interference.
  Arranging magnetic sources must be done with care.
  If magnetic sources (such as transformers, fan motors, electromagnetic contactors, solenoids, and relays) are located near the CRT display, they frequently distort the display screen. To prevent this, the CRT display and the magnetic sources generally must be kept 300 mm apart. If the CRT display and the magnetic sources are not 300 mm apart, the screen distortion may be suppressed by changing the direction in which the magnetic sources are installed.
  The magnetic intensity is not constant, and it is often increased by magnetic interference from multiple magnetic sources interacting with each other. As a result, simply keeping the CRT and the magnetic sources 300 mm apart may not be enough to prevent the distortion. If they cannot be kept apart, or if the CRT screen remains distorted despite the distance, cover the screen with a magnetic shield.
- The installation conditions of the I/O unit must be satisfied.
  To obtain good ventilation in the module, the I/O unit must be installed in the direction shown in the following figure. Clearances of 100 mm or more both above and below the I/O unit are required for wiring and ventilation.
  Equipment radiating too much heat must not be put below the I/O unit.



3.5 THERMAL DESIGN OF THE CABINET

The purpose of the thermal design of the cabinet is to limit the difference in temperature between the air in the cabinet and the outside air to 10°C or less when the temperature in the cabinet increases.
The internal air temperature of the cabinet increases when the units and parts installed in the cabinet generate heat. Since the generated heat is radiated from the surface of the cabinet, the temperature of the air in the cabinet and the outside air balance at certain heat levels. If the amount of heat generated is constant, the larger the surface area of the cabinet, the less the internal temperature rises. The thermal design of the cabinet refers to calculating the heat generated in the cabinet, evaluating the surface area of the cabinet, and enlarging that surface area by installing heat exchangers in the cabinet, if necessary. Such a design method is described in the following subsections.

3.5.1 Temperature Rise within the Cabinet

The cooling capacity of a cabinet made of sheet metal is generally 6 W/°C per $1m^2$ surface area, that is, when the 6W heat source is contained in a cabinet having a surface area of 1 m^2, the temperature of the air in the cabinet rises by 1°C. In this case the surface area of the cabinet refers to the area useful in cooling , that is, the area obtained by subtracting the area of the cabinet touching the floor from the total surface area of the cabinet. There are two preconditions : The air in the cabinet must be circuited by the fun, and the temperature of the air in the cabinet must be almost constant.The following expression must then be satisfied to limit the difference in temperature between the air in the cabinet and the outside air to 10°C or less when the temperature in the cabinet rises:

Internal heat loss P [W] ≦
$6[W/m^2 \cdot °C]$ surface area $S[m^2]$ 10[°C] of rise in temperature

For example, a cabinet having a surface area of $4m^2$ has a cooling capacity of 24W/°C. To limit the internal temperature increase to 10°C under these conditions, the internal heat must not exceed 240W. If the actual internal heat is 320W, however, the temperature in the cabinet rises by 13°C or more. When this happens, the cooling capacity of the cabinet must be improved using the heat exchanger described next.

3.5.2 Cooling by Heat Exchanger

If the temperature rise cannot be limited to 10°C by the cooling capacity of the cabinet, a heat exchanger must be added. The heat exchanger forcibly applies the air from both the inside and outside of the cabinet to the cooling fin to obtain effective cooling. The heat exchanger enlarges the surface area. Section 3.7 explains five heat exchangers supplied by FANUC. Select one of these according to the application.
If cooling fin A is used for the cabinet, the total cooling capacity of a cabinet having a surface area of 4 m^2 in the example above is improved as follows :

$6W/m^2 \cdot °C \times 4m^2 + 9.1W/°C = 33.1W/°C$

The calculated value verifies that even if the internal heat is 320 W, the temperature rise can be limited to less than 10°C.
See Section 3.6 for installing the heat exchanger.

3.5.3 Heat Loss of Each Unit

Name		Heat loss	Remarks
Control unit	Basic unit	80W	Included each printed board of master, memory, I/O, axis control and Power supply unit
	Graphic	14W	Included manual pulse 2 or 3 pieces controllers
	PMC–M	14W	
	Increased I/O–B, F	17W	
	SUB CPU	14W	
	5/6 axis control	16W	
	7/8 axis control	15W	
	Analog interface	9W	
	Remote buffer	14W	Same as DNC 2 card
Display	9″ monochrome CRT/MDI	14W	These are not relative to the variation of MDI keys
	9″ color CRT/MDI	40W	
	9″ monochrome EL/MDI	20W	
	9″ monochrome PDP/MDI	20W	
	7.2″ monochrome LCD/MDI	10W	
	8.4″ color LCD/MDI	15W	
	14″ color CRT/MDI	70W	
Operator's panel	Machine operator's panel	8W	Same as the printed board for machine operator's panel controller
	Machine operator's panel	24W	6% of DI/DO for I/O Link is ON

Heat loss of each devices for Series 00 are as follows.

Name		Heat loss	Remarks
Control unit	PMC–M	12W	
	MMC interface	11W	
Display	14″ color CRT/MDI	170W	Included in MMC1 controlled printed board also

3.6 INSTALLING THE HEAT EXCHANGER

Table 3.6 lists the heat exchangers. Cooling fins A, B and C are not provided with a fan. Note that a fan motor is required for any of these cooling fins when it is used as a heat exchanger.

Table 3.6 List of Heat Exchangers

Name	Ordering specification	Cooling capacity	Size
Cooling fin A	A02B–0053–K303	9.1W/°C	196×90×1000mm
Cooling fin B	A02B–0053–K304	10.1W/°C	444×90×650mm
Cooling fin C	A02B–0053–K305	25.2W/°C	560×90×970mm
Heat pipe type heat exchanger	A02B–0094–C901	9.0W/°C	226×132×415mm
Cooling fin for 14″ CRT/MDI unit (Series 00)	A02B–0087–K220	6.5W/°C	450×85×506mm
Cooling fin of inner circulation for 14″ CRT/MDI (Series 00)	A02B–0087–K225		140×60×290mm

3.6.1 Cooling Fin A/B/C

The cooling fin is shown in Fig. 3.6.1(a).

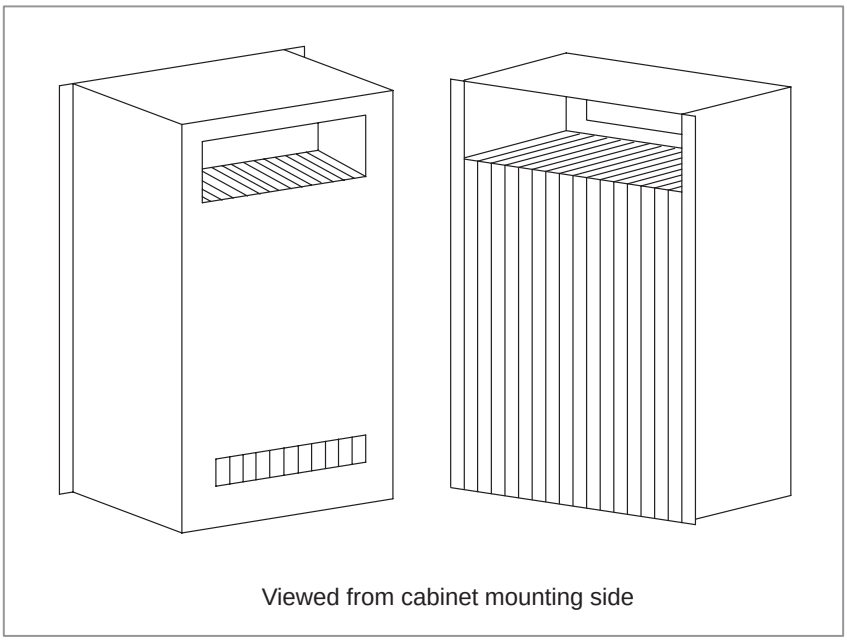


Fig. 3.6.1(a) External view of cooling fin

It is installed in a cabinet made by the machine tool builder.

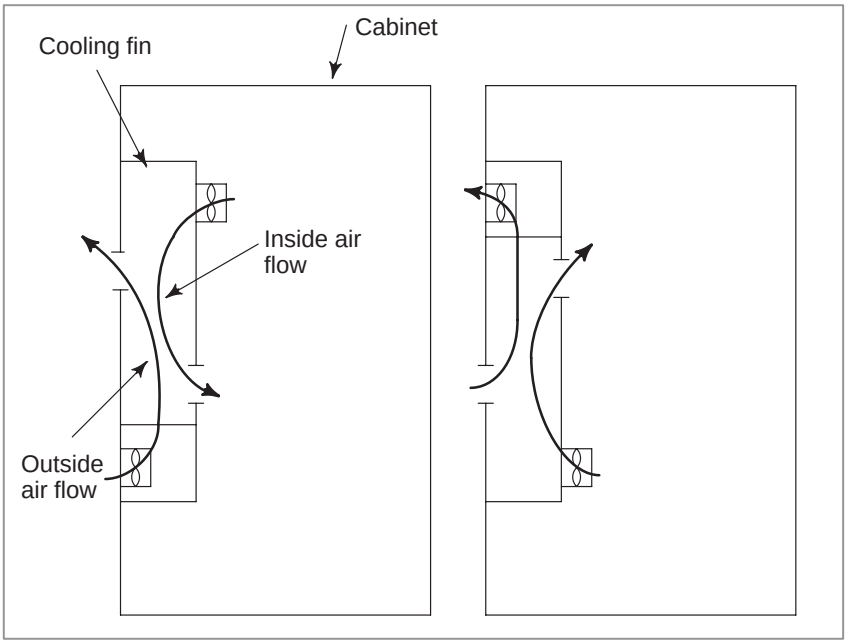
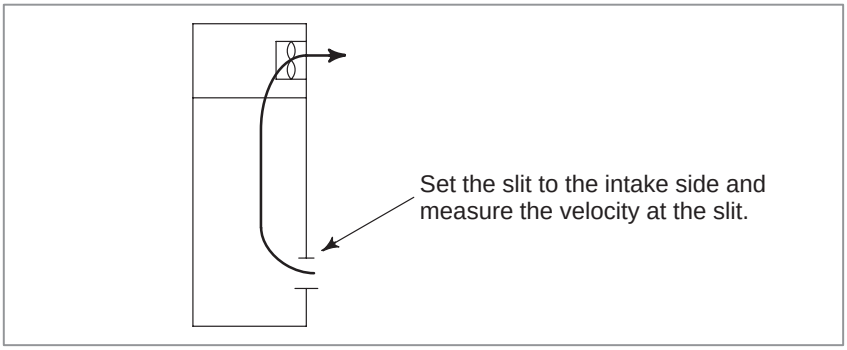


Fig. 3.6.1(b) Internal view of cooling fin

The cooling fin can be installed in two ways, as shown in Fig.3.6.1(b). The following lists the general precautions to be observed when using the cooling fins :

- The fans are not included with the cooling fin. They should be provided by the machine tool builder.
- Bring in the outside air from the bottom and exhaust the hot air from the top.
- The inside air may flow from top to bottom or bottom to top. However, generally decide the direction as follows :
  - ❏ Bring in the air near high heat loss components.
  - ❏ Exhaust the air toward the most important components to be cooled.
- For the cooling fin to display the specified cooling capacity, the air inside the cooling fins must flow at a velocity of 2.5 m/sec or greater.

(velocity of air flow measurement)



- Generally, install the cooling fins to the door. But be sure that the door does not bend when installing the cooling fin. The cooling fins are equipped with packing.

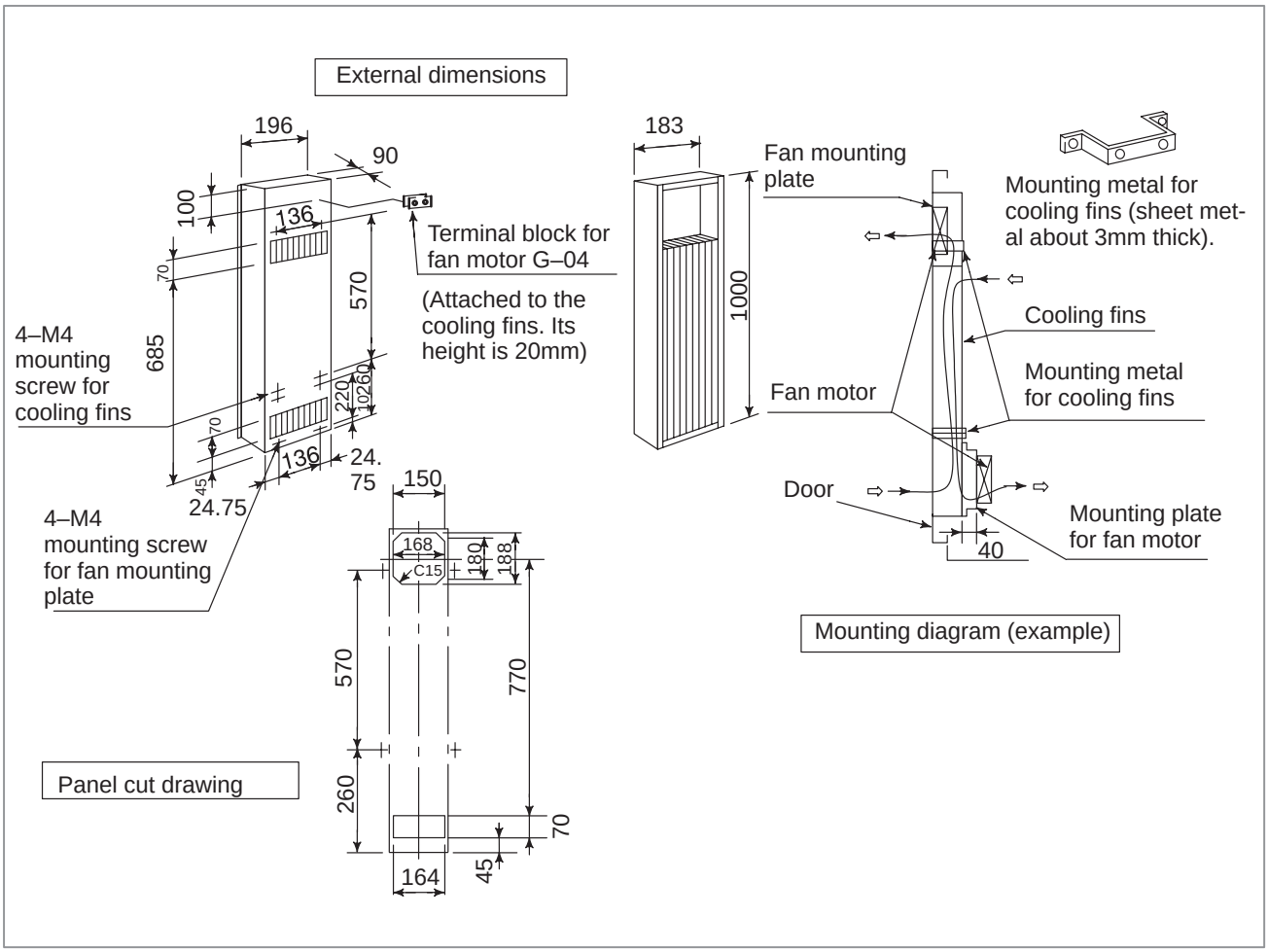


Fig. 3.6.1(c) External dimension and mounting method of cooling fin (A02B–0053–K303)

NOTE

1 Fan motor, mounting plate for fan motor and mounting metal for cooling fins are not attached to the cooling fins.
So, prepare them at the machine tool builder.
2 Use two fan motors with about 50W power.
3 Weight : 6.5kg

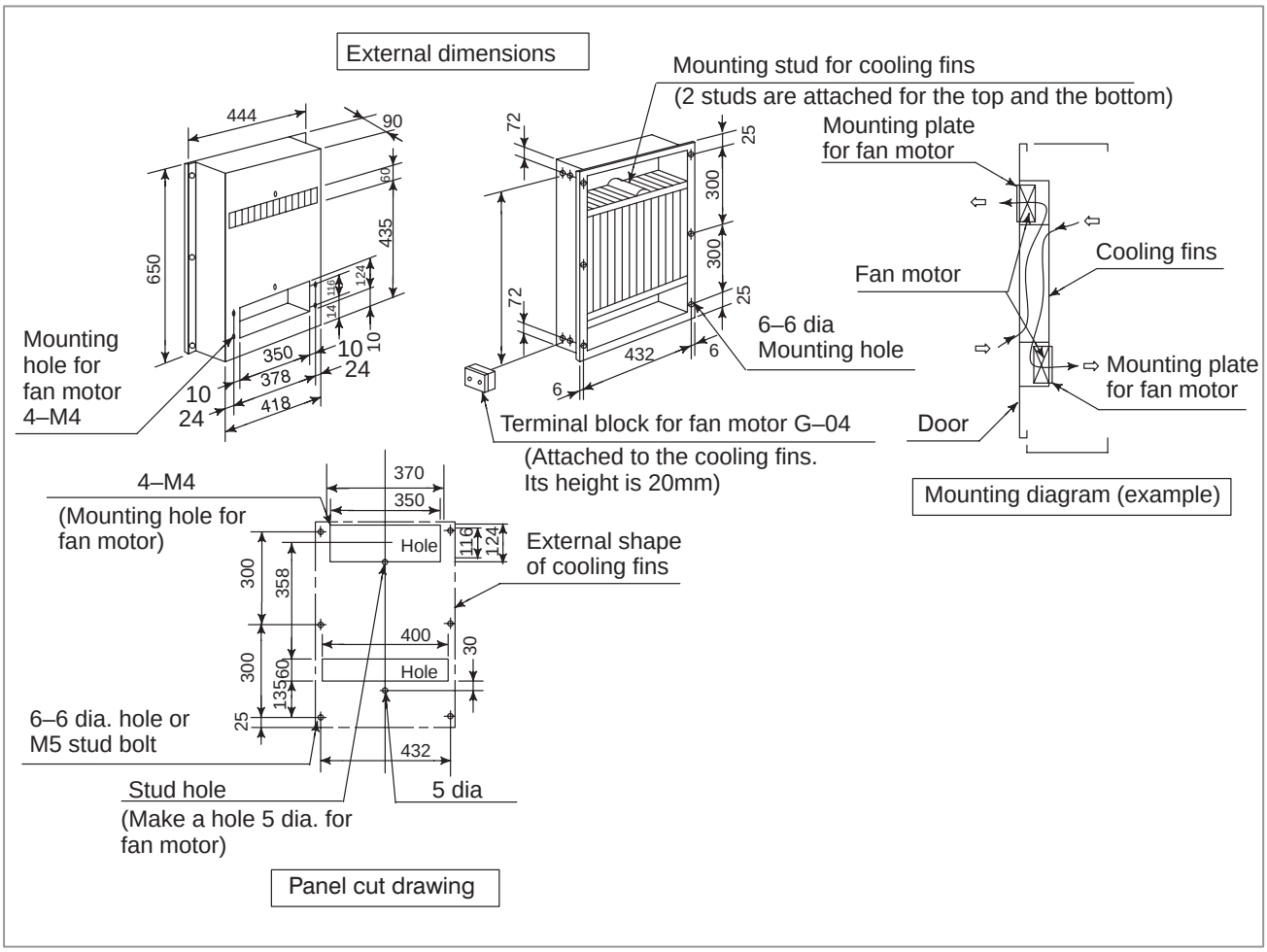


Fig. 3.6.1(d) External dimension and mounting method of cooling fin B (A02B–0053–K304)

NOTE

1 Fan motor and mounting plate are not attached to the cooling fins. So, prepare them, at the machine tool builder.
2 Use four fan motors with about 20W power.
3 Weight : 7.5kg

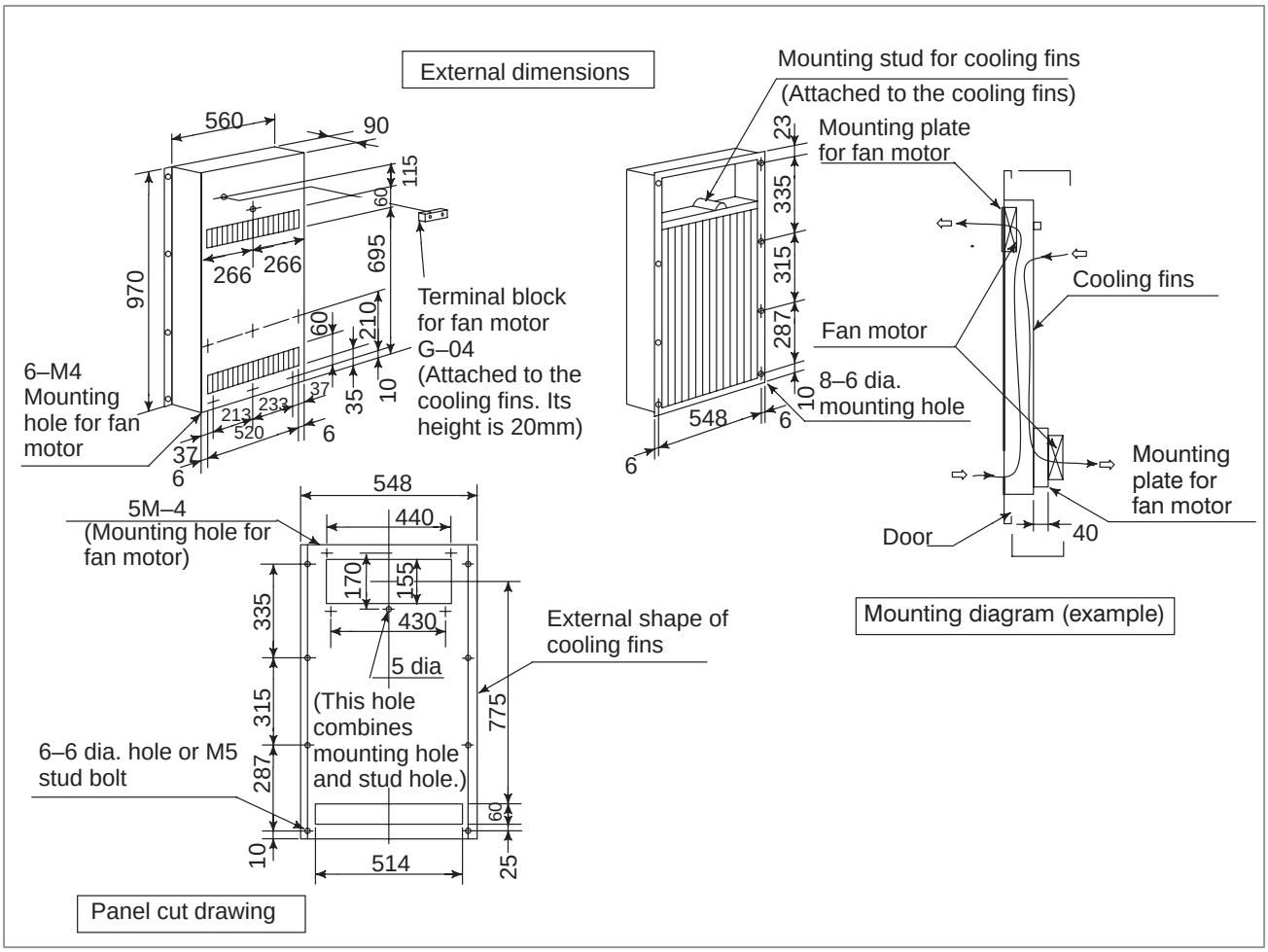


Fig. 3.6.1(e) External dimension and mounting method of cooling fin C (A02B–0053–K305)

NOTE

1 Fan motor and mounting plate for fan motor are not attached to the cooling fins. Prepare them at the machine tool builder.
2 Use two fan motors with about 40W power.
3 Weight : 13.5kg

3.6.2
Heat Exchanger for 14″ CRT/MDI Unit (Series 00)

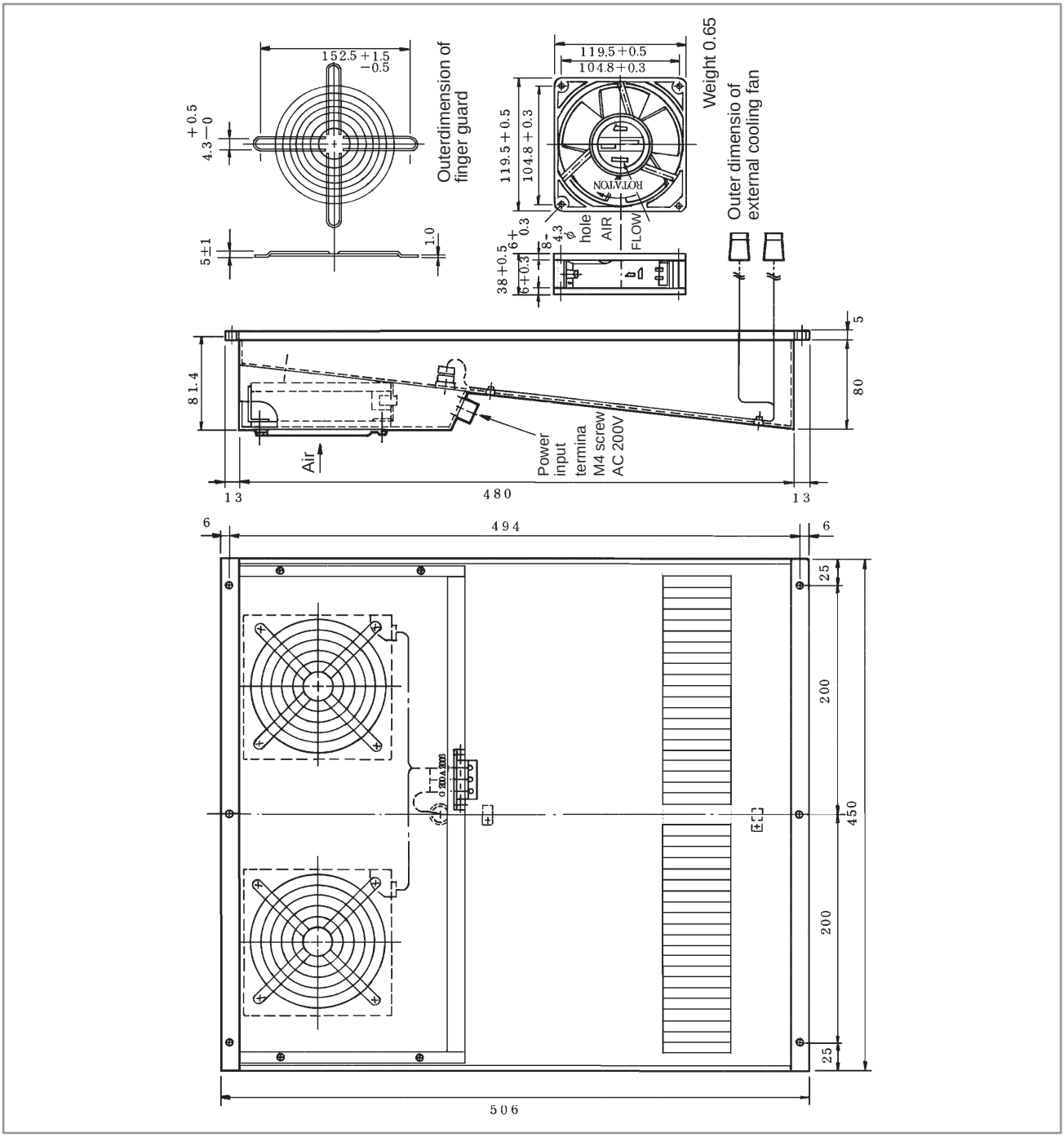


Fig. 3.6.2(a) Outer dimension of fin and external cooling fan for 14″ CRT/MDI for Series 00 (Specification number A02B–0087–K220 2 sets of cooling fin and external cooling fan are provided.)

NOTE
2 sets of external cooling fan and finger guard are provided.

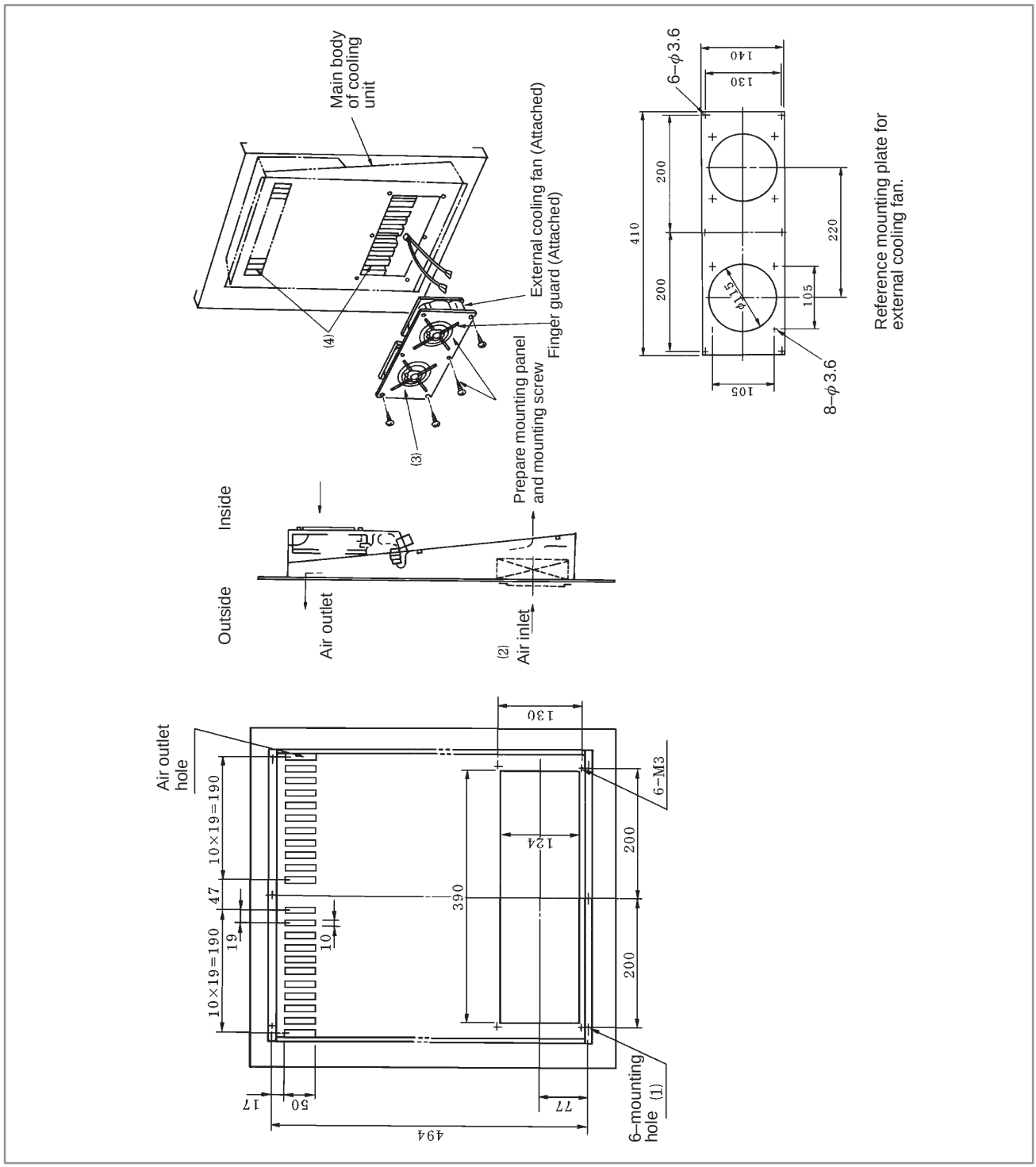


Fig. 3.6.2(b) Mounting methods of cooling unit for CRT/MDI for Series 00

NOTE
(1) Use M5 screws to mount the cooling unit.
(2) Be careful with air flow when securing the external cooling fan.
(3) Prepare a mounting panel for external cooling fan and install the panel where it can be exchanged externally.
(4) Drill mounting holes for external cooling fan and air outlet on cooling unit mounting panel.

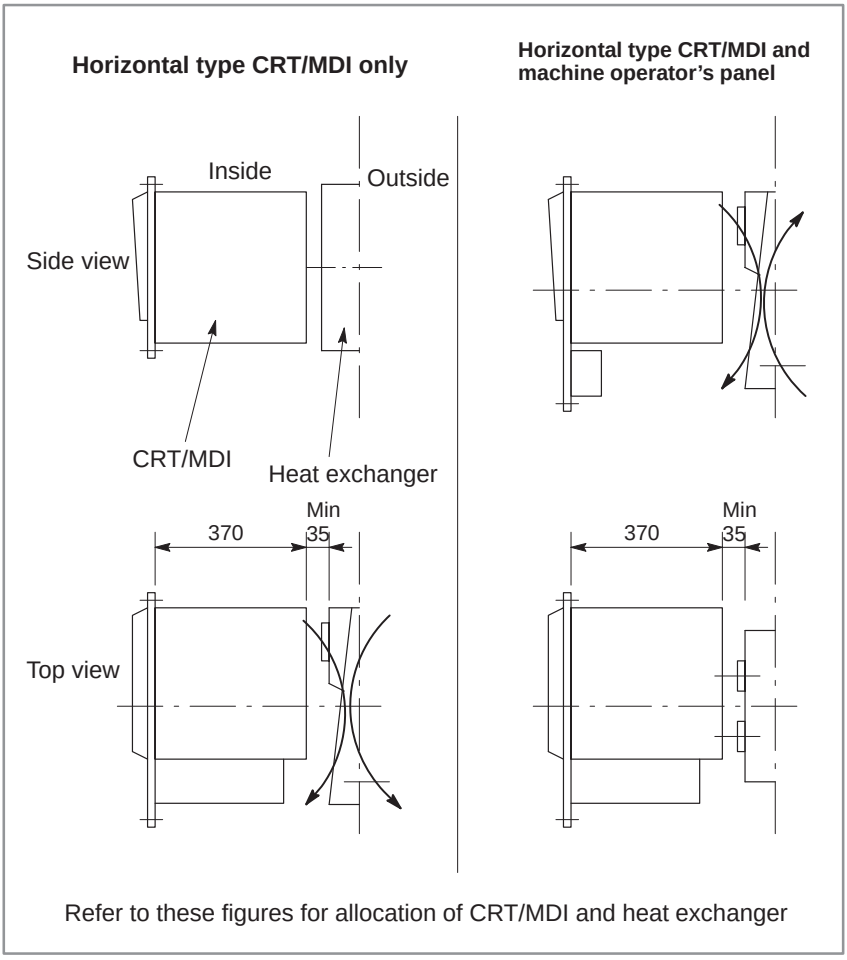


Fig. 3.6.2(c) Allocation of 14″color CRT/MDI and heat exchanger

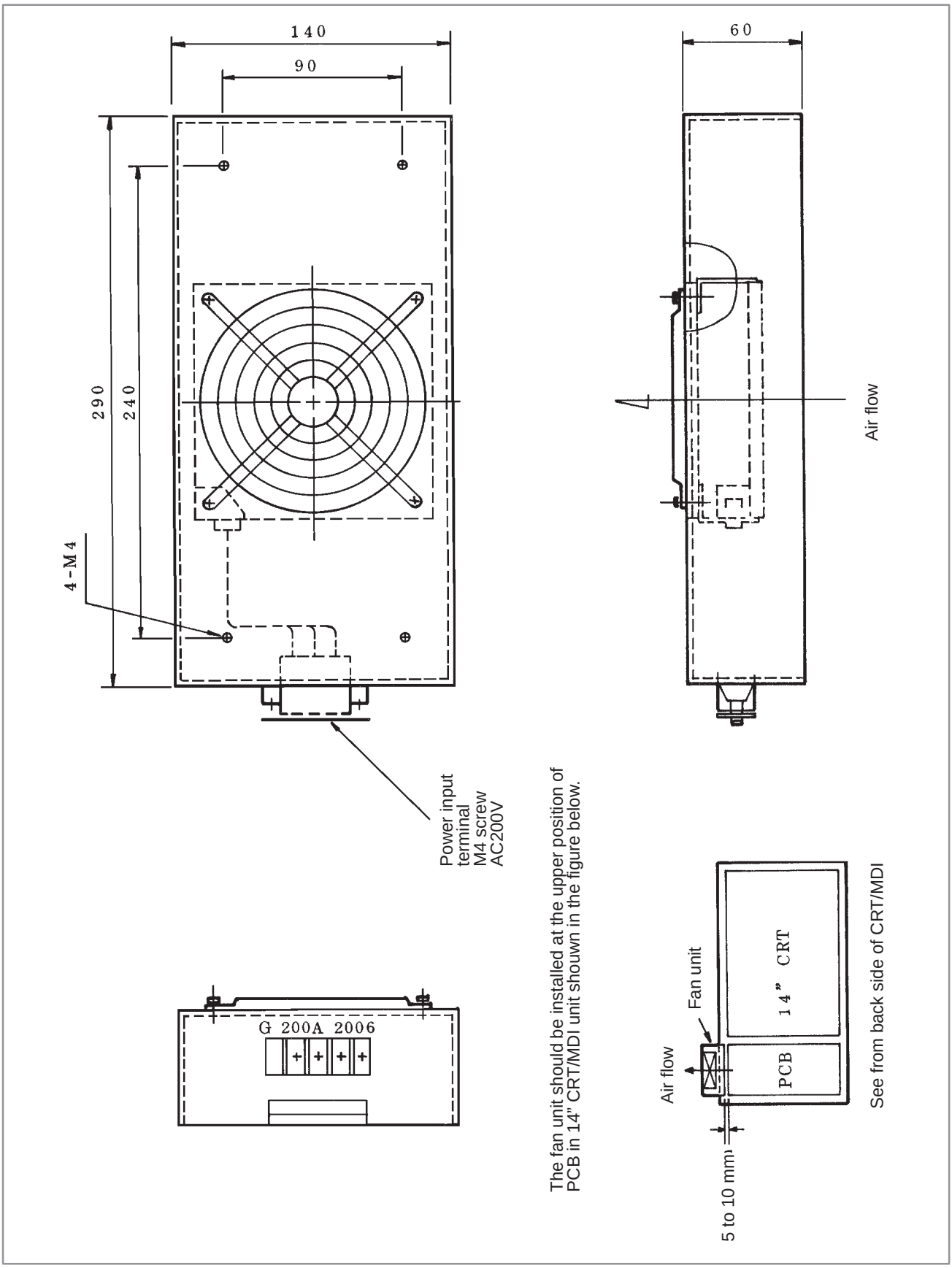


Fig. 3.6.2(d) Outer dimension of fan unit (for inner circulation) of 14″ CRT/MDI for Series 00 (Specification number A02B–0087–K225)

3.6.3 The Heat Pipe Type Heat Exchanger

3.6.3.1 Installation

The heat pipe type heat exchanger is used for cooling the airtight cabinet of small sized electronic devices. It is a compact, lightweight, and heat–efficient unit. Because the fan is built–in, it is used simply by installing it, performing the “panel cut” operation.

Specifications

Installation format		Installation type in board	
Fan specifications	Cooling ability (W/°C)	9 (50Hz when operating)	
	Voltage (V)	200VAC	
	Frequency (Hz)	50	60
	Rating current (A)	0.28	0.24
	Rating input (W)	28	26
Weight (kg)		4	
Color		Munsell signal N 1.5	

Order specifications | Heat exchanger A02B–0094–C901 |

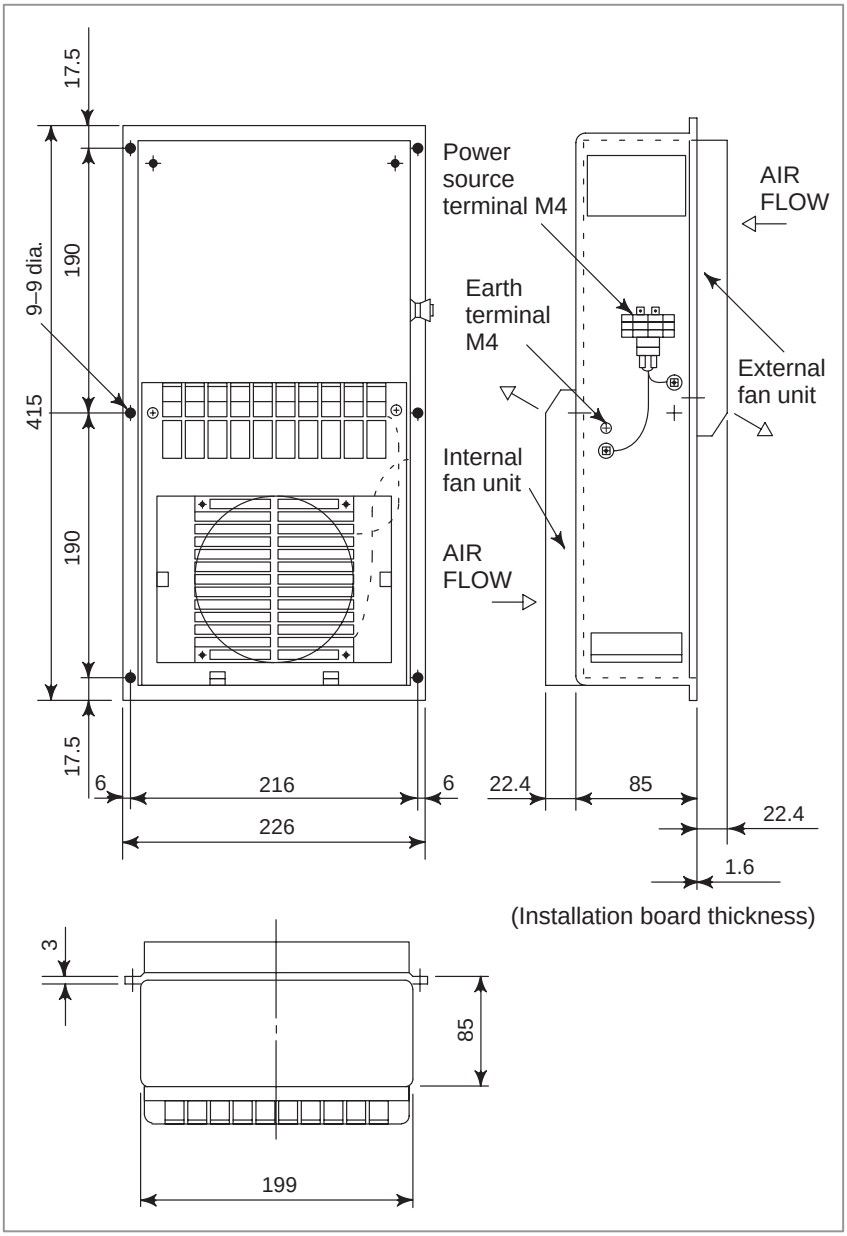
Remarks

- A filter is installed on the outside air inhalation side.
- The installation board thickness is the standard 1.6 t.
- When a fan motor and filter are necessary for maintenance, prepare them separately.

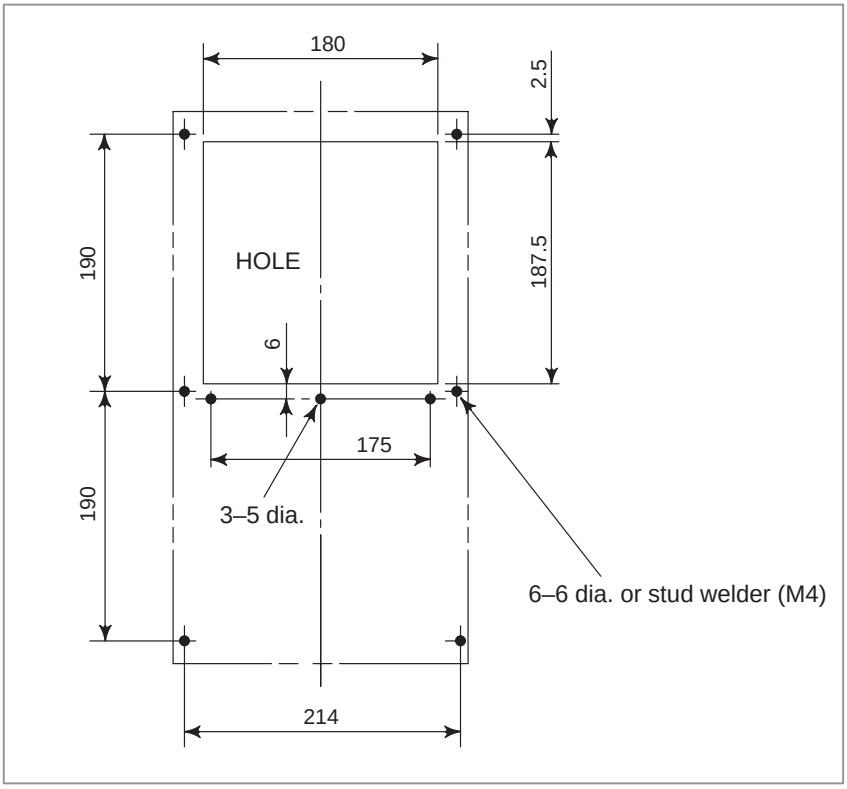
  Fan motor specifications
  A90L–0001–0219#A

  Filter specifications
  A250–0689–X004
- If the heat exchanger is installed near the CRT, screen distortion may occur due to magnetic flux leakage from the fan motor.

External dimensions



Panel cut dimensions



Installation method

Please install the heat exchanger by the following sequence:

1 Take out the external fan unit from the heat exchanger main unit. (Fig. 1)
Detach the external fan unit installation screws A (2 pieces), take out the unit from the main unit by sliding it down, and detach the earth cable and the power cable to the fan. Also detach the installation screw B (1 piece).

2 Install the heat exchanger main unit in the installation section which has been panel cut. (Fig. 2)
When fastening down the heat exchanger main unit with the screws, first, temporarily secure the panel and the heat exchanger main unit with the installation screw B, which was taken out in **1**). After that, secure the main unit by the installation screws. In this case, the external fan unit installation screw holes should be aligned with the main unit screw holes. (Please provide the installation screws for the heat exchanger main unit.)
Because this product is composed of plastic, set the value shown below for the screw tightening torque.

Heat exchanger main unit (M4 screw) : 11 kgf.cm

External fan unit (M3 screw) : 5 kgf.cm

3 Connect the power cable and the earth cable to the external fan unit (the unit detached in **1**), and secure the installation screw A to the main unit from the outside.

The installation is now complete.

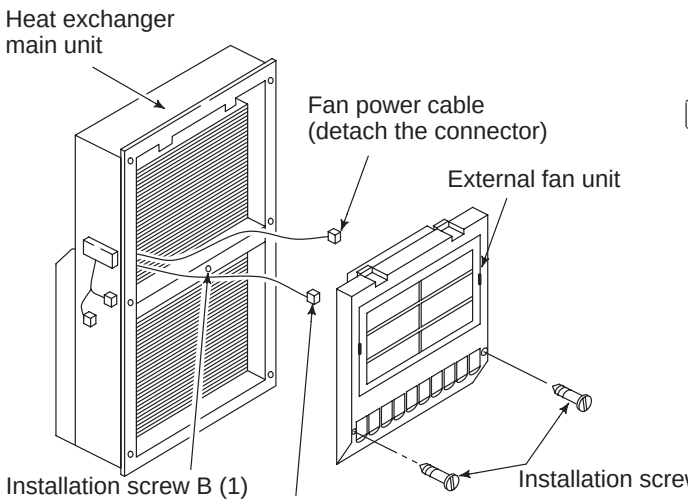


Fig. 1 Take out the external fan unit from the heat exchanger main unit

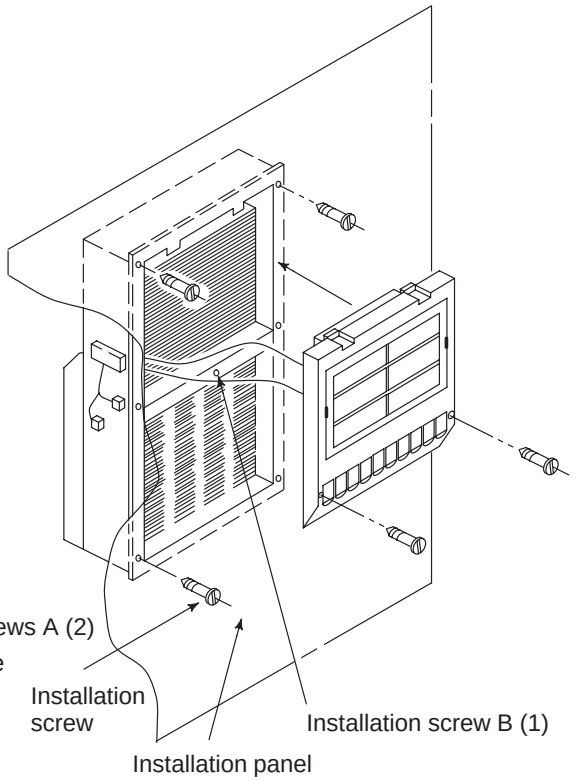


Fig. 2 Install the heat exchanger main unit and the external fan unit

3.7 ACTION AGAINST NOISE

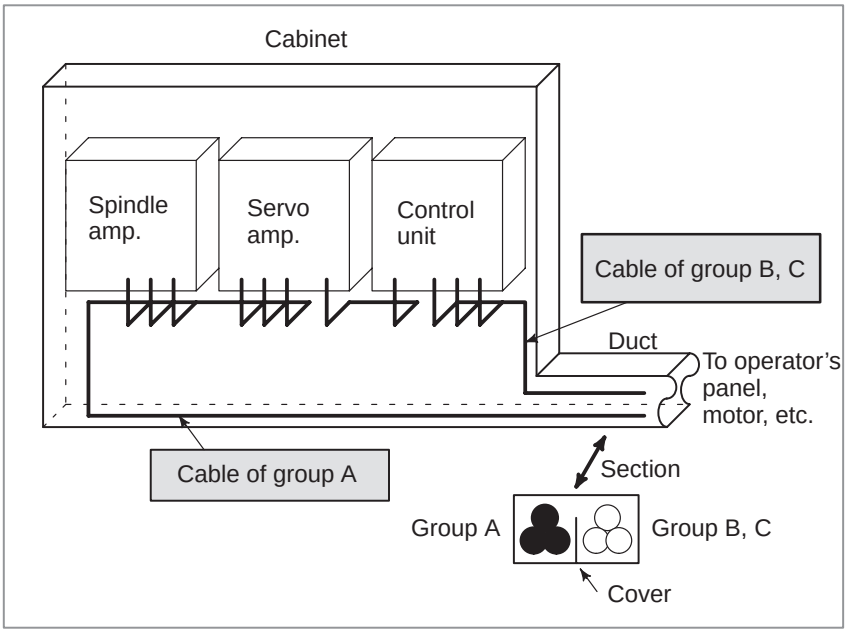
The CNC has been steadily reduced in size using surface–mount and custom LSI technologies for electronic components. The CNC also is designed to be protected from external noise. However, it is difficult to measure the level and frequency of noise quantitatively, and noise has many uncertain factors. It is important to prevent both noise from being generated and generated noise from being introduced into the CNC. This precaution improves the stability of the CNC machine tool system.
The CNC component units are often installed close to the parts generating noise in the power magnetics cabinet. Possible noise sources into the CNC are capacitive coupling, electromagnetic induction, and ground loops.
When designing the power magnetics cabinet, guard against noise in the machine as described in the following section.

3.7.1 Separating Signal Lines

The cables used for the CNC machine tool are classified as listed in the following table:
Process the cables in each group as described in the action column.

Group	Signal line	Action
A	Primary AC power line	Bind the cables in group A separately (Note 1) from groups B and C, or cover group A with an electromagnetic shield (Note 2). See Section 3.7.4 and connect spark killers or diodes with the solenoid and relay.
	Secondary AC power line	
	AC/DC power lines (containing the power lines for the servo and spindle motors)	
	AC/DC solenoid	
	AC/DC relay	
B	DC solenoid (24VDC)	Connect diodes with DC solenoid and relay. Bind the cables in group B separately from group A, or cover group B with an electromagnetic shield. Separate group B as far from Group C as possible. It is more desirable to cover group B with the shield.
	DC relay (24VDC)	
	DI/DO cable between the CNC and power magnetics cabinet	
	DI/DO cable between the CNC and machine	
C	Cable between the CNC and servo amplifier	Bind the cables in group C separately from group A, or cover group C with an electromagnetic shield. Separate group C as far from Group B as possible. Be sure to perform shield processing in Section 3.7.5.
	Cable for position and velocity feedback	
	Cable between the CNC and spindle amplifier	
	Cable for the position coder	
	Cable for the manual pulse generator	
	Cable between the CNC and the CRT/MDI	
	RS–232–C and RS–422 interface cable	
	Cable for the battery	
	Other cables to be covered with the shield	

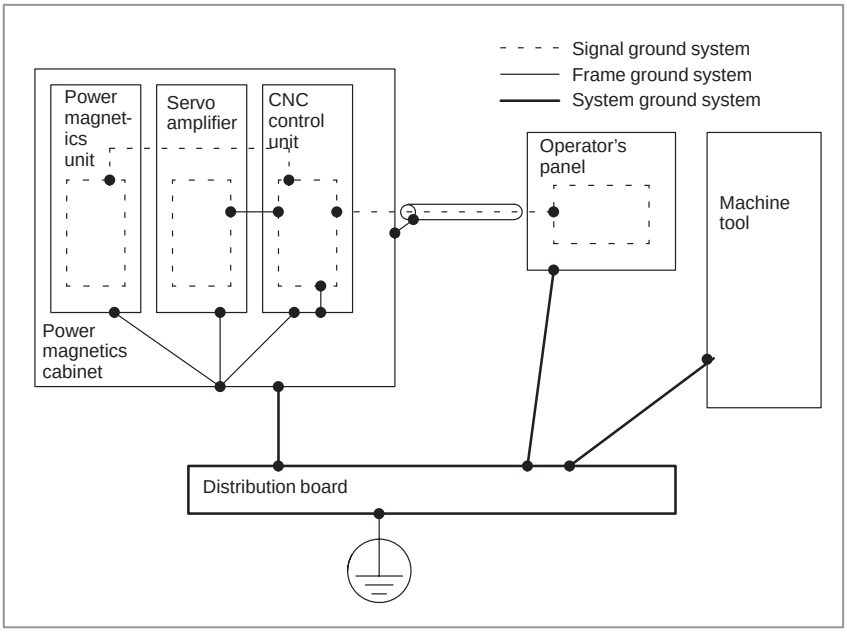
NOTE
1 The groups must be 10 cm or more apart from one another when binding the cables in each group.
2 The electromagnetic shield refers to shielding between groups with grounded steel plates.



3.7.2 Ground

The following ground systems are provided for the CNC machine tool:

- **Signal ground system (SG)**
  The signal ground (SG) supplies the reference voltage (0V) of the electrical signal system.
- **Frame ground system (FG)**
  The frame ground system (FG) is used for safety, and suppressing external and internal noises. In the frame ground system, the frames, cases of the units, panels, and shields for the interface cables between the units are connected.
- **System ground system**
  The system ground system is used to connect the frame ground systems connected between devices or units with the ground.

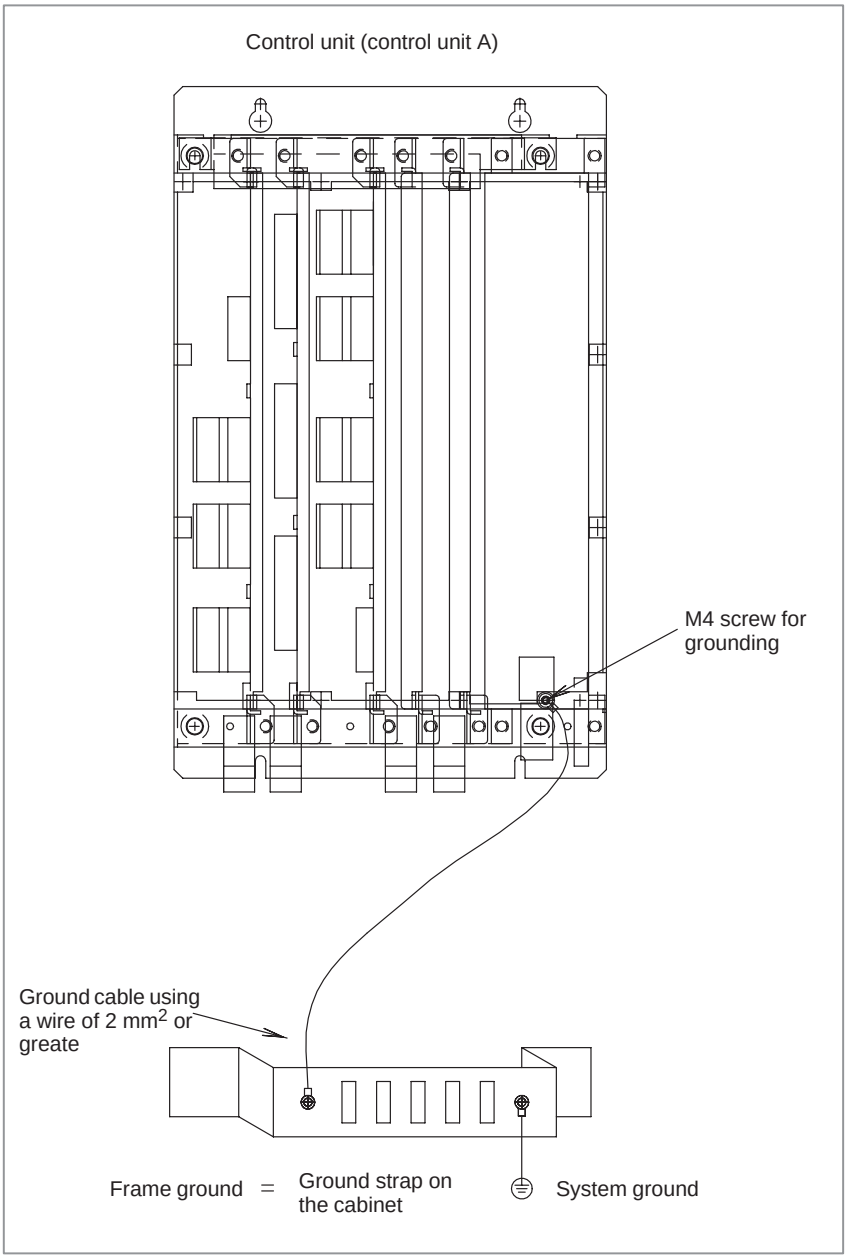


Notes on connecting the ground systems

- Connect the signal ground with the frame ground (FG) at only one place in the CNC control unit.
- The grounding resistance of the system ground shall be 100 ohms or less (class 3 grounding).
- The system ground cable must have enough cross–sectional area to safely carry the accidental current flow into the system ground when an accident such as a short circuit occurs.
  (Generally, it must have the cross–sectional area of the AC power cable or more.)
- Use the cable containing the AC power wire and the system ground wire so that power is supplied with the ground wire connected.

3.7.3 Connecting the Signal Ground (SG) of the Control Unit

Connect the 0 V line of the electronic circuit in the control unit with the ground plate of the cabinet via the signal ground (SG) terminal.
The SG terminal is located on the printed circuit board at the rear of the control unit.



NOTE
This figure shows the grounding of control unit A. The position of the protective grounding of control unit B is different. When connecting control unit B to the ground strap, see the outline drawing of control unit B.

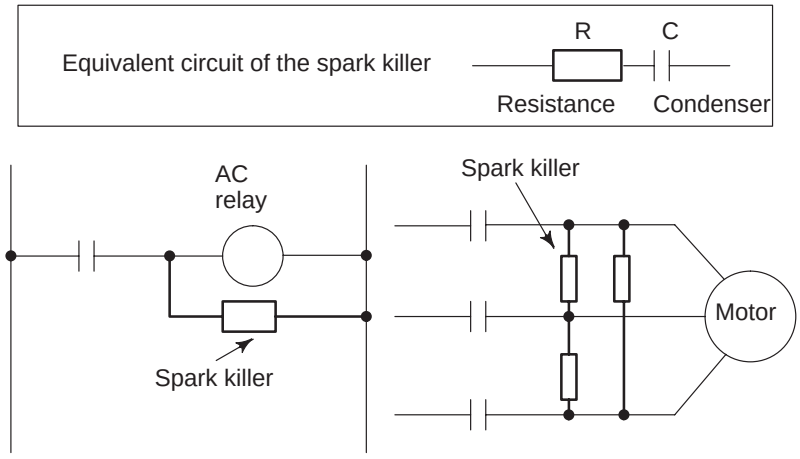
3.7.4 Noise Suppressor

The AC/DC solenoid and relay are used in the power magnetics cabinet. A high pulse voltage is caused by coil inductance when these devices are turned on or off.
This pulse voltage induced through the cable causes the electronic circuits to be disturbed.

Notes on selecting the spark killer

- Use a spark killer consisting of a resistor and capacitor in series. This type of spark killer is called a CR spark killer.(Use it under AC)
  (A varistor is useful in clamping the peak voltage of the pulse voltage, but cannot suppress the sudden rise of the pulse voltage. FANUC therefore recommends a CR spark killer.)
- The reference capacitance and resistance of the spark killer shall conform to the following based on the current (I (A)) and DC resistance of the stationary coil:
  1) Resistance (R) : Equivalent DC resistance of the coil
  2) Capacitance (C) : $\frac{I^2}{10} \sim \frac{I^2}{20}$ (μF)

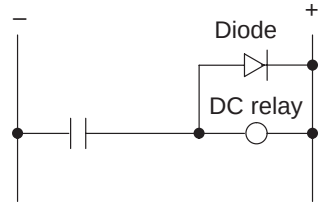
     I : Current at stationary state of the coil



Mount the noise eliminator near a motor or a relay coil.

NOTE
Use a CR–type noise eliminator. Varistor–type noise eliminators clamp the peak pulse voltage but cannot suppress a sharp rising edge.

Diode (used for direct–current circuits)



Use a diode which can withstand a voltage up to two times the applied voltage and a current up to two times the applied current.

3.7.5 Cable Clamp and Shield Processing

The CNC cables that require shielding should be clamped by the method shown below. This cable clamp treatment is for both cable support and proper grounding of the shield. To insure stable CNC system operation, follow this cable clamp method.
Partially peel out the sheath and expose the shield. Push and clamp by the plate metal fittings for clamp at the part. The ground plate must be made by the machine tool builder, and set as follows :

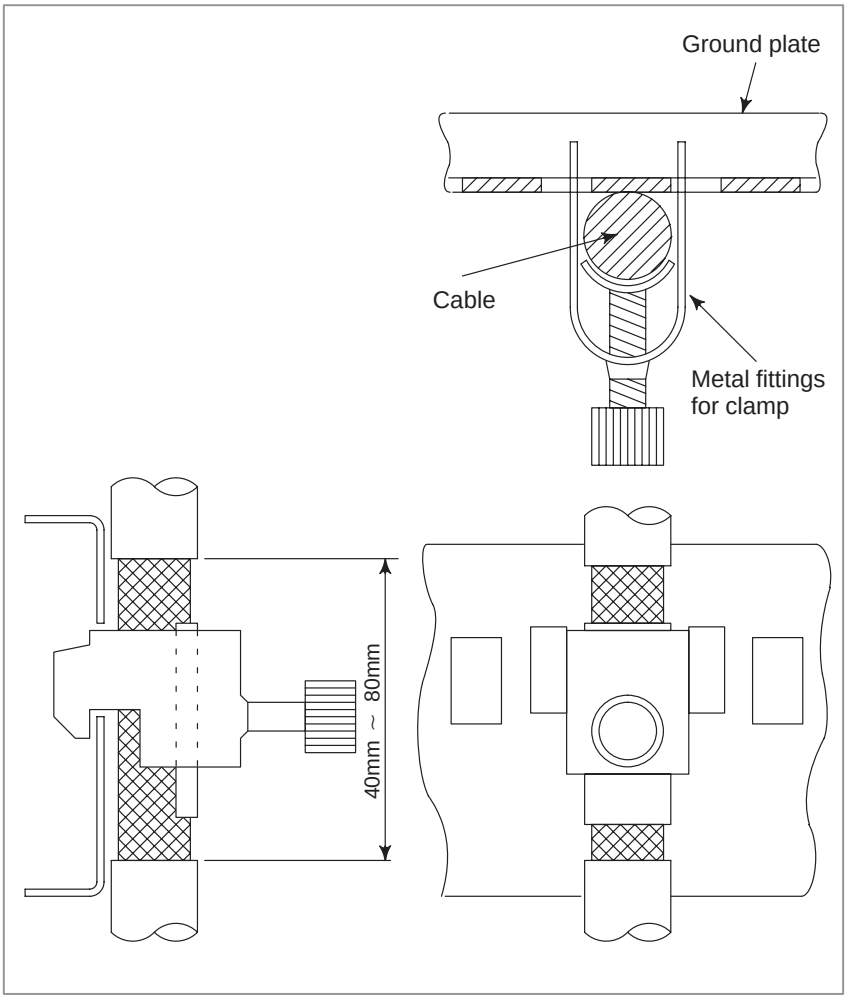


Fig. 3.7.5(a) Cable clamp (1)

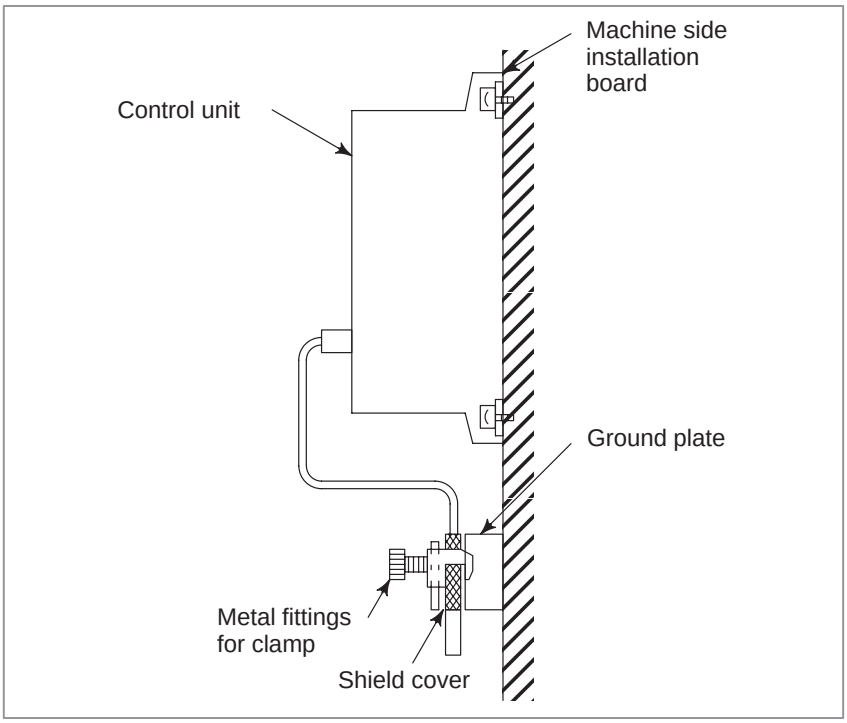


Fig. 3.7.5(b) Cable clamp (2)

Prepare ground plate like the following figure.

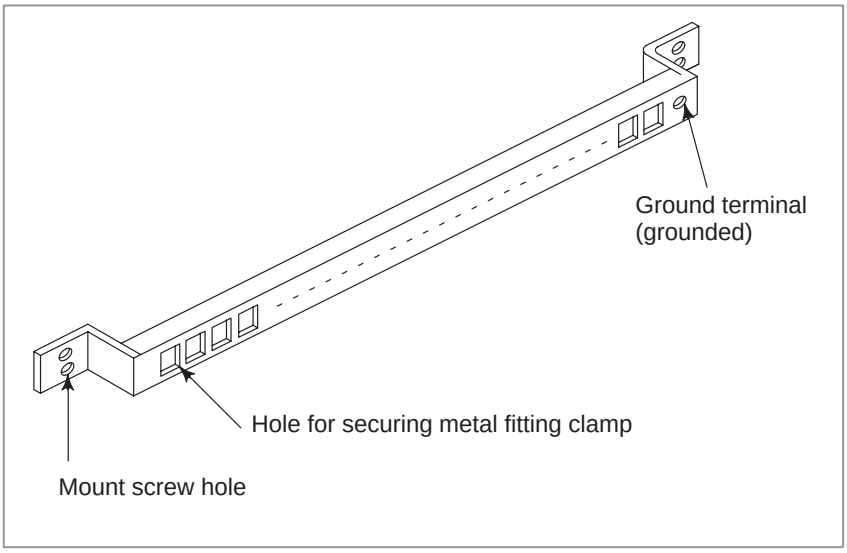


Fig. 3.7.5(c) Ground plate

For the ground plate, use a metal plate of 2 mm or thicker, which surface is plated with nickel.

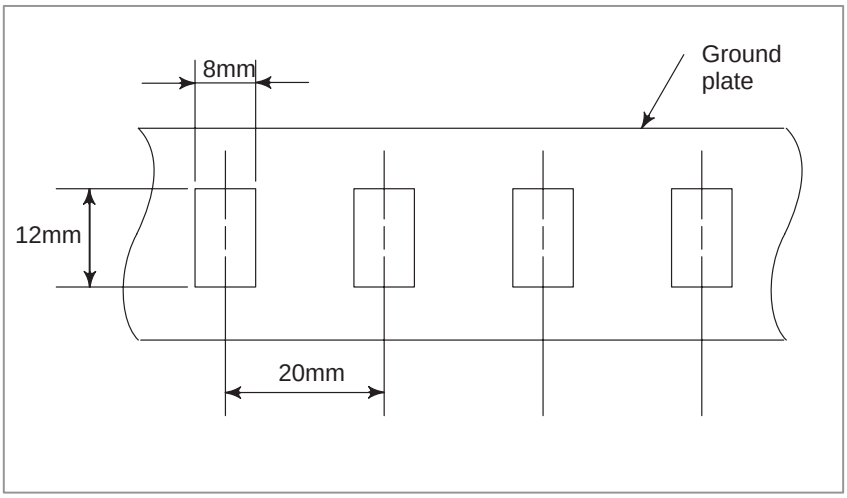


Fig. 3.7.5(d) Ground plate holes

(Reference) Outer drawings of metal fittings for clamp.

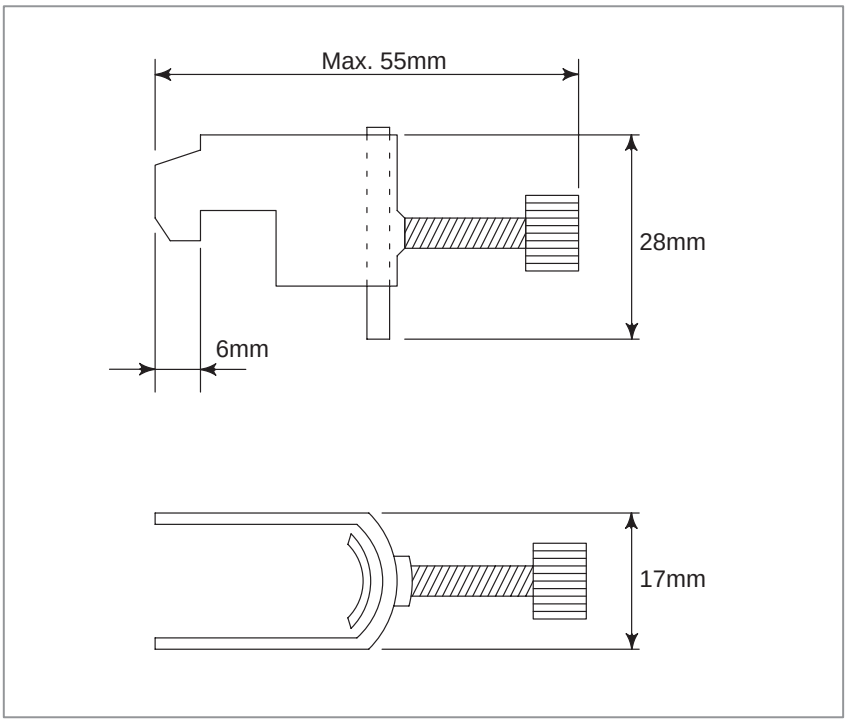


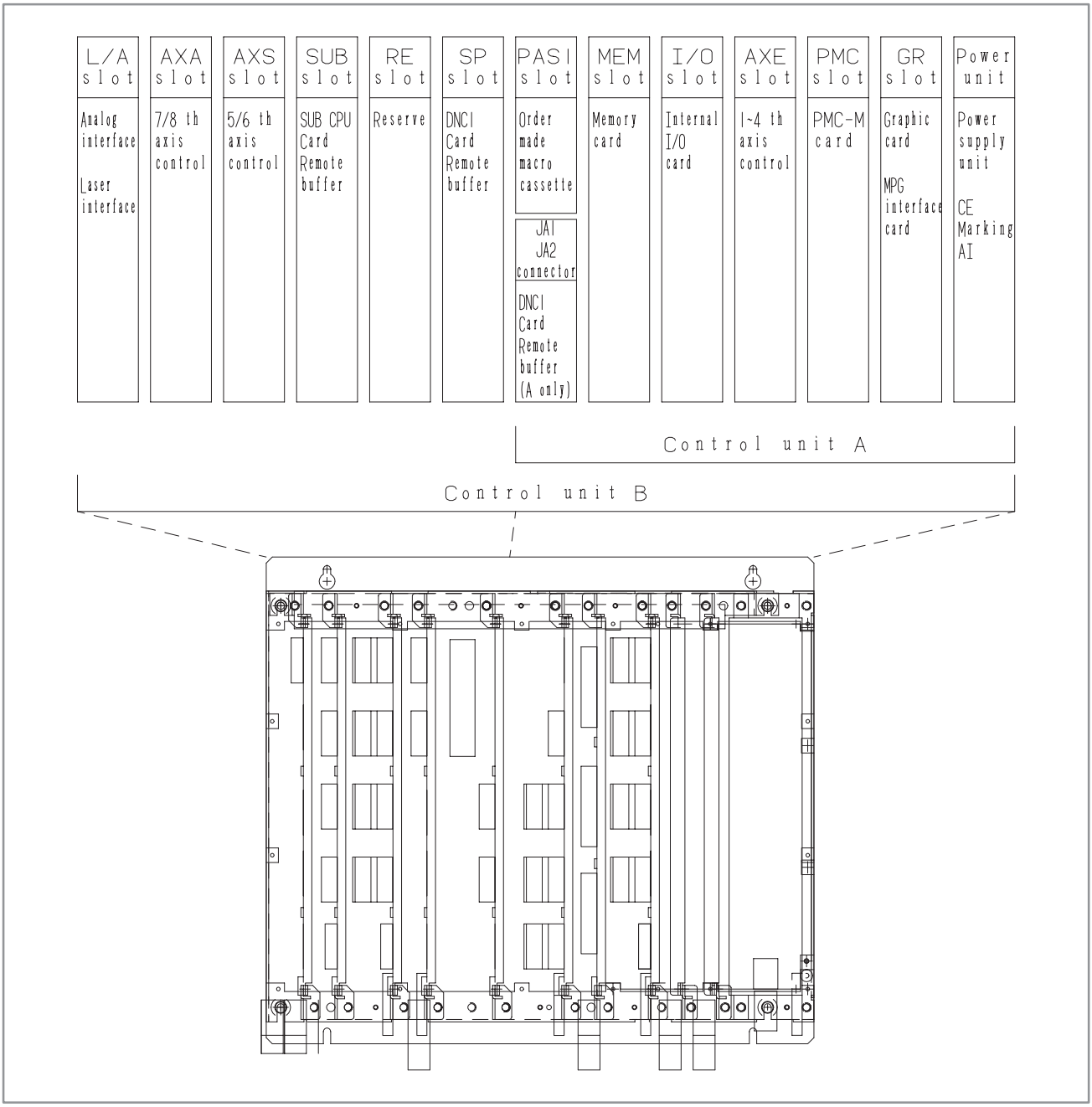
Fig. 3.7.5(e) Outer drawings of metal fittings for clamp

Ordering specification for metal fittings for clamp
A02B–0083–K301 (5 pieces)

3.8 CONTROL UNIT

3.8.1 Configuration of the Control Unit

Each control P.C.B. of Series 0 is mounted in the slot as follows.



NOTE
Connection position of this figure are depended on each printed board.

3.8.2 Battery for Memory Backup

Part programs, offset data, and system parameters are stored in CMOS memory in the control unit.

The program stored in the memory of the control unit is kept after power is cut off. Alcalic electric cells (single × 3 cells) are used for this function. The unit accommodating the dry cells is the battery unit. The cells must be periodically exchanged to new cells once a year at the user's. When exchanging the cells, the power must be always on. (If the cells are removed when the power is off, the parameters and programs stored in the memory goes out.)

The NC is delivered to the machine tool builder with the battery unit set temporarily, so that it should be reset in the cabinet designed at the machine tools builder. Take notes on the following, and reset the battery unit at the cabinet surface. If the machine is delivered to the users with the battery unit still temporarily set, the battery will not be able to be exchanged at the user's, resulting in a fatal maintenance problem.

1) The battery must be able to changed easily with the power on, at the user's side.
2) The battery unit must be away from coolant and chips.

When the voltage of the battery becomes low, alarm message "BAT" blinks on the CRT display and the battery alarm signal is output to the PMC. When this alarm is displayed, replace the battery as soon as possible. In general, the battery can be replaced within one or two weeks, however, this depends on the system configuration.
If the voltage of the battery becomes any lower, memory can no longer be backed up. Turning on the power to the control unit in this state causes system alarm 910 (SRAM parity alarm) to occur because the contents of memory are lost. Clear the entire memory and reenter data after replacing the battery.

The power to the control unit must be turned on when the battery is replaced. If the battery is disconnected when the power is turned off, the contents of memory are lost.

Mounting the battery case

Each control unit is factory–equipped with a battery so that the unit can retain the factory–set parameters. Never disconnect the battery while the unit is turned off, therefore. Mount the battery case containing the battery on the cabinet, by means of the following procedure:

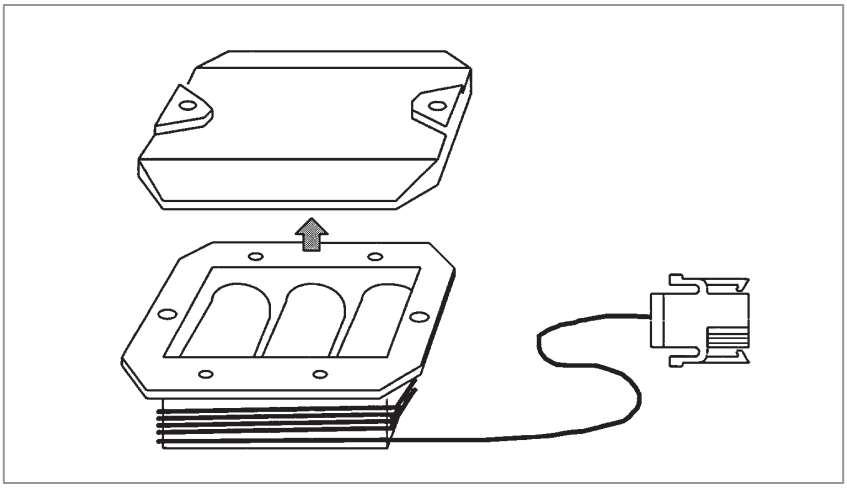
(1) Turn on the control unit.

(2) Leaving the control unit turned on, perform steps 1 to 5:

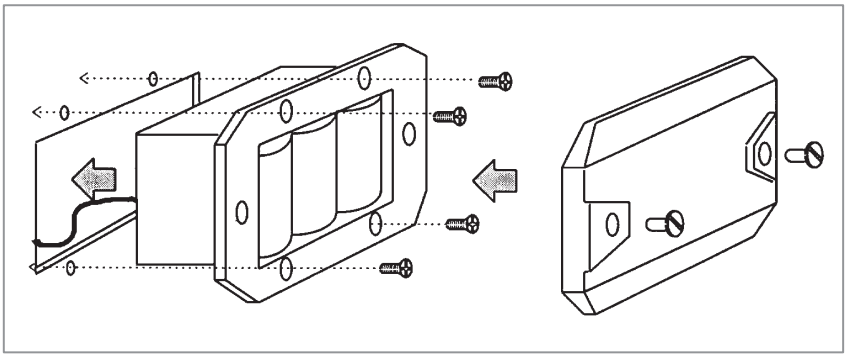
1 Remove the battery connector from the memory PC board. If a sub CPU PC board is mounted, remove the battery connector from the sub CPU PC board. If a remote buffer PC board is mounted, remove the battery connector from the remote buffer PC board (which may be mounted in the same slot as that used for a sub CPU PC board).

2 Remove the battery case and cable from the yellow carton. (Discard the carton.)

3 Remove the lid from the battery case, being careful to keep it horizontal so that the screws do not full out.



4 Screw the battery case onto the cabinet at the predetermined mounting position. Replace the lid removed in step 3 and tighten the screws.



5 Reconnect the connector removed in step 1.

Replacing the battery

Procedure for replacing the battery

1 Have commercially available D–size alkaline cells ready for replacement.

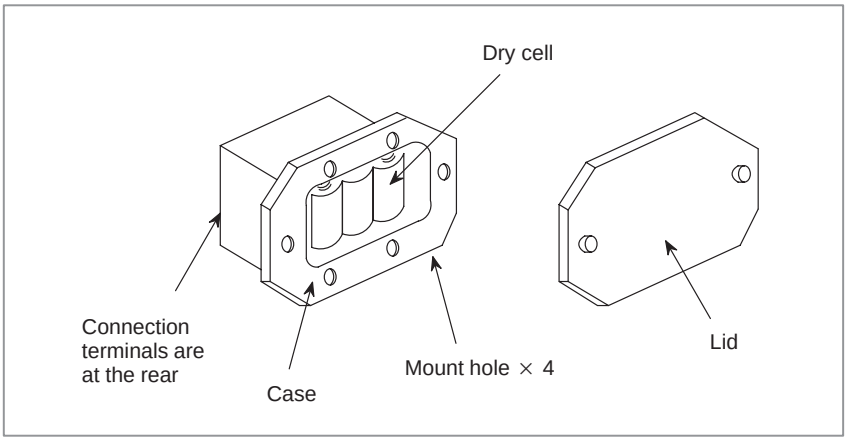
2 Turn on the control unit. Leave the control unit turned on until step 5 is completed.

3 Remove the lid from the battery case.

4 Replace the cells, observing the correct orientation.

5 Replace the lid on the battery case.

6 Turn off the control unit.



3.8.3 Cable Lead–in Diagram

Following diagram shows the grid of connector location.
Control board may not have all connectors as shown above.
For actual connector layout of each board, please see the connector layout diagrams next page or later.

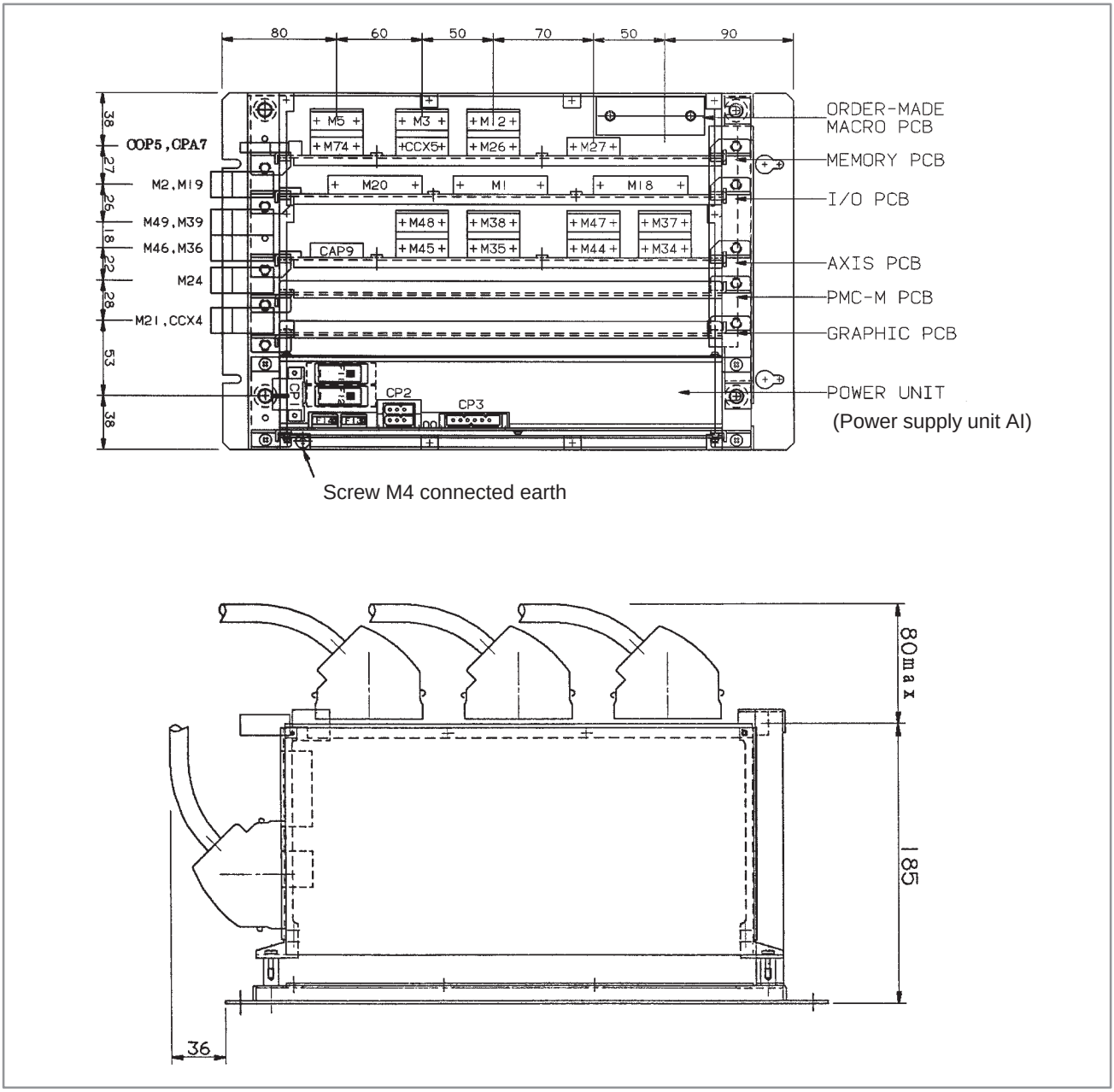


Fig. 3.8.3 (a) Cable lead–in diagram (Control unit: A)

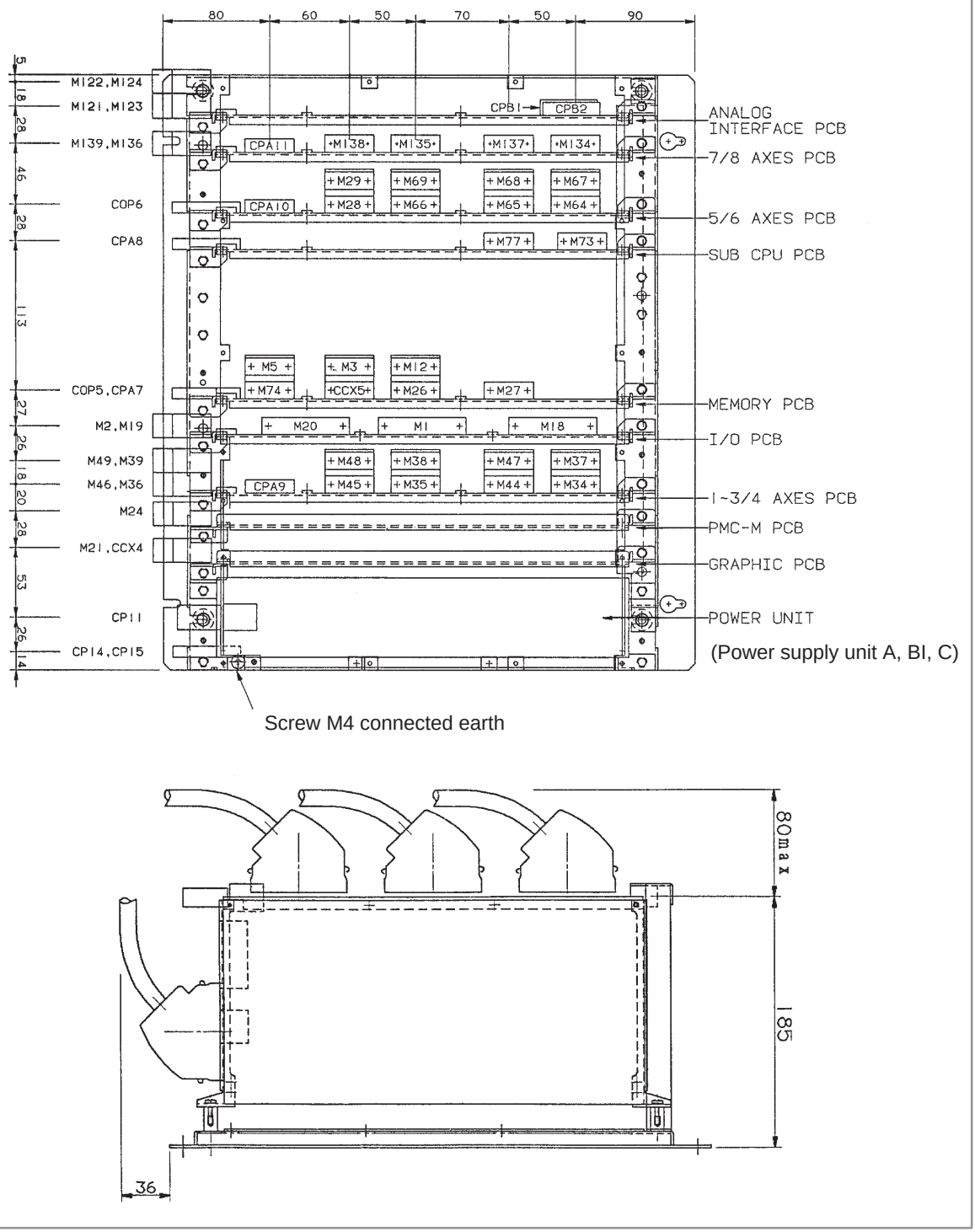


Fig. 3.8.3 (b) Cable lead–in diagram (Control unit: B)

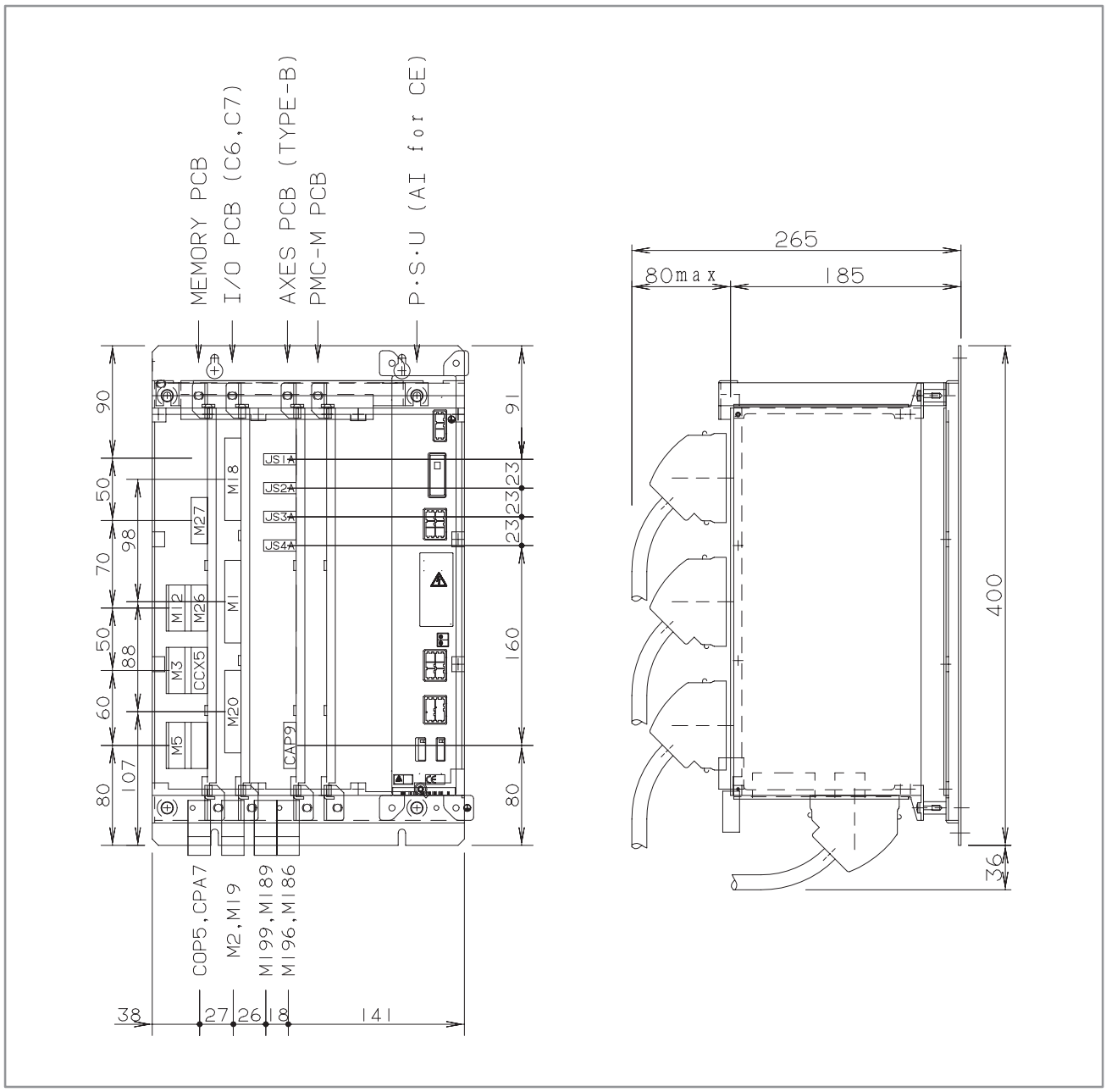
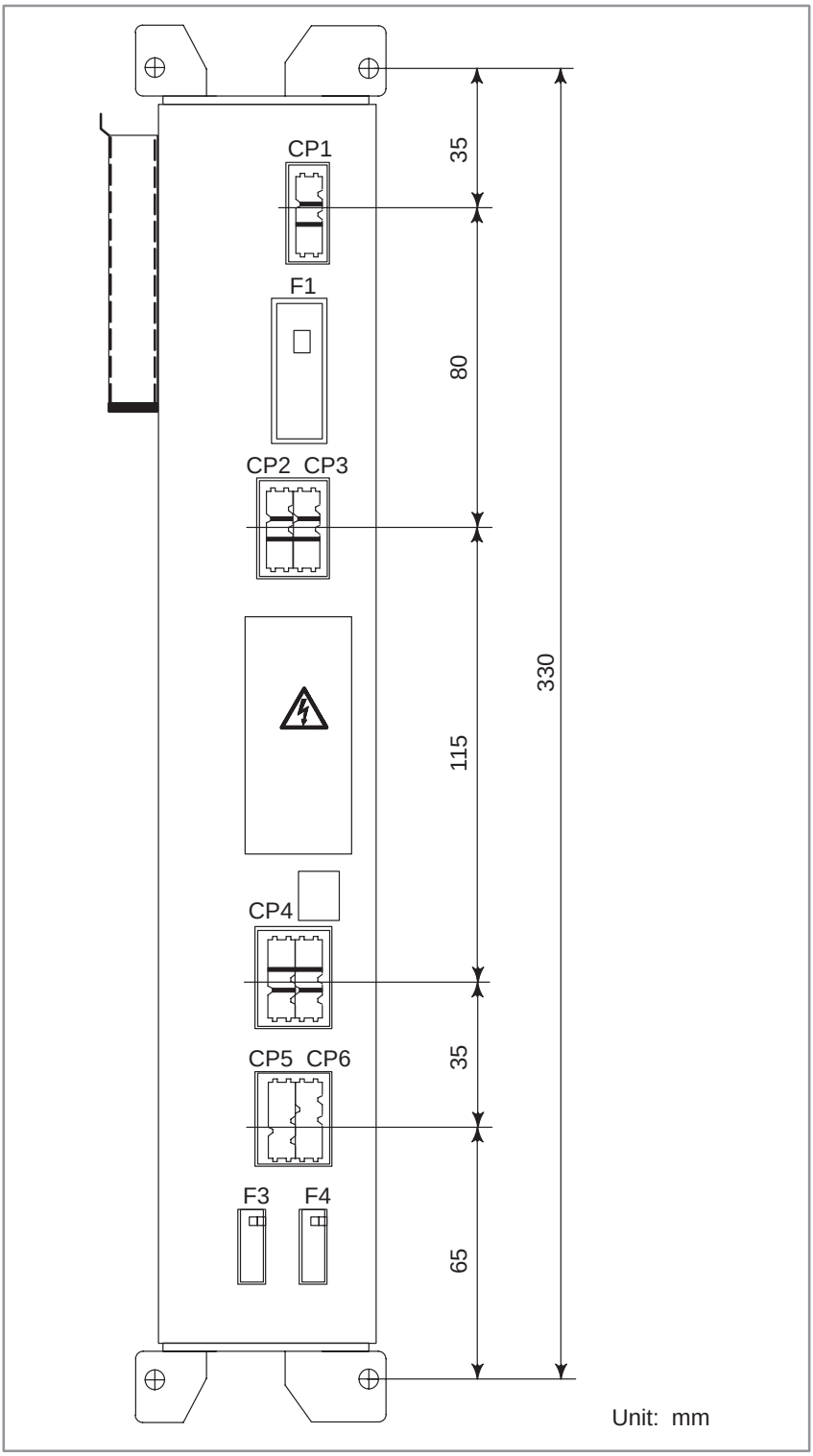


Fig. 3.8.3 (c) Cable lead–in diagram (Type–B axis card, power supply unit AI for CE marking is mounting)

Connector layout of power supply unit for CE marking



4 COMPLETE CONNECTION DIAGRAM

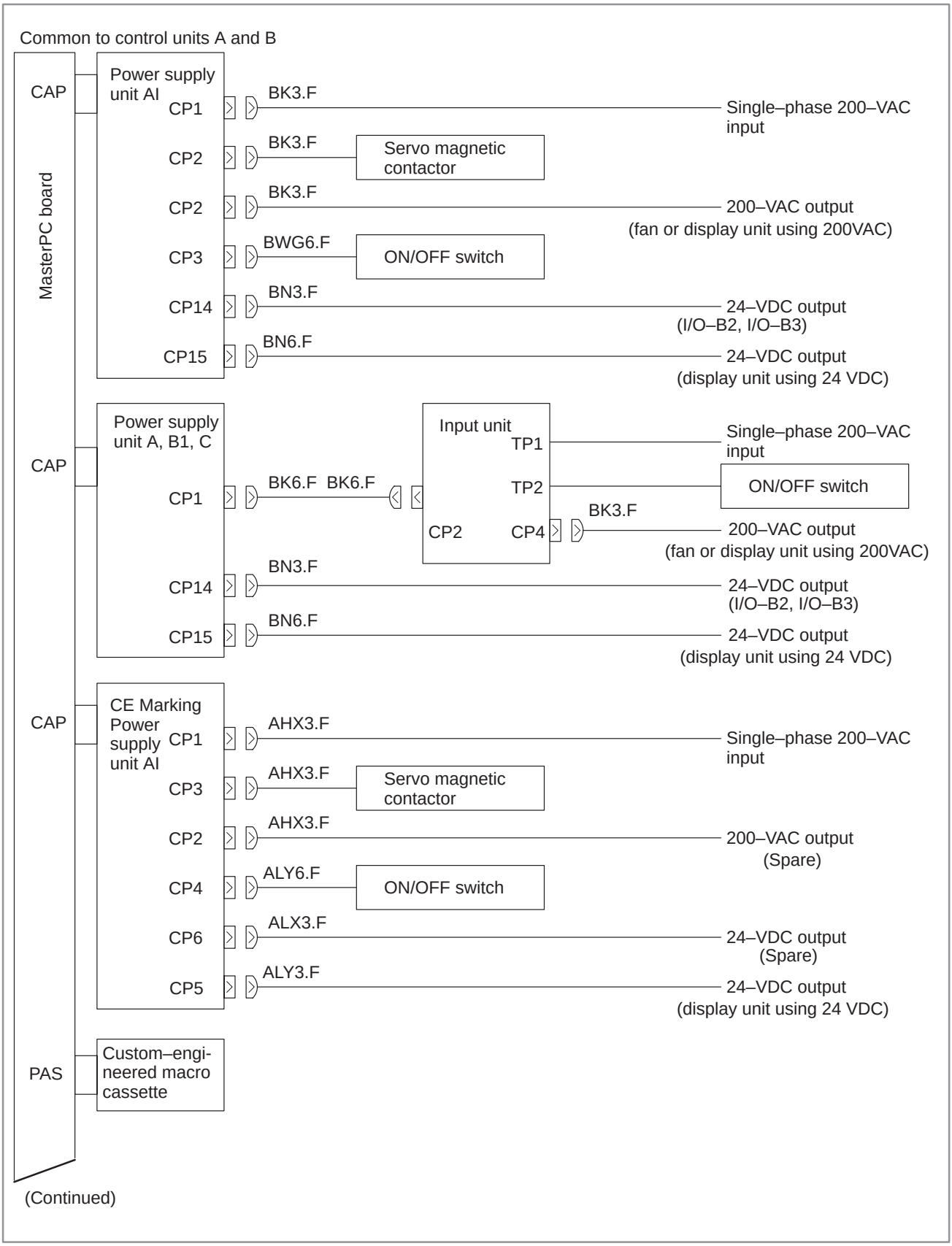
4.1 PRECAUTIONS

The complete connection diagram shows examples of connecting all PC boards that can fit into the slots of the master PC board. Some slots can accept two or more PC boards which are connected to different devices. This drawing shows two or more identical slot names, but actual individual slots on the master PC board have different names. See the connection of each slot according to the PC board to be fitted into the slot.

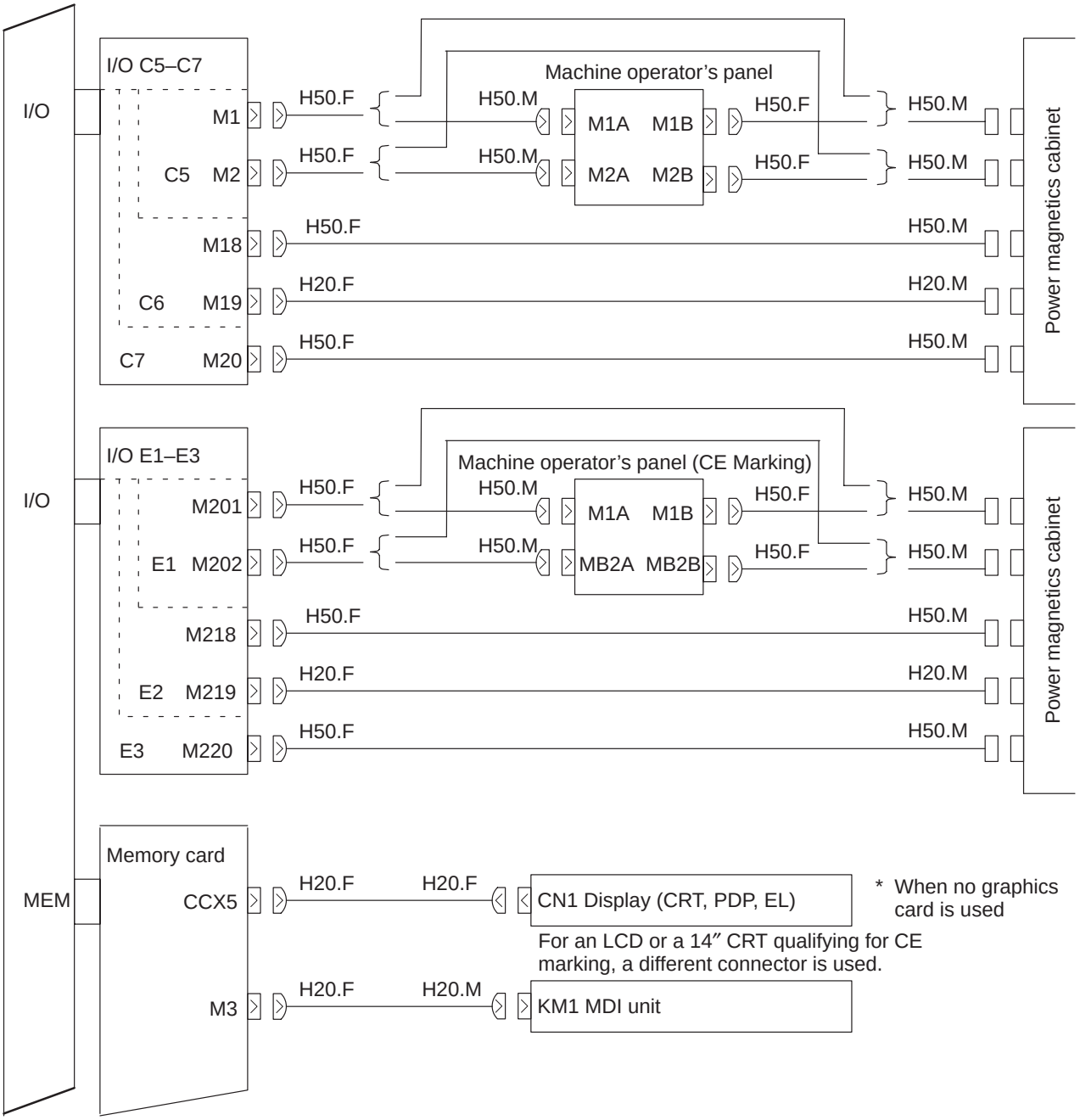
The diagram shows the connection of all PC boards that can be fitted into the slots. In the actual unit, the PC boards to be mounted are determined by the model and optional functions. Note that all the PC boards shown in the diagram are not always mounted.

Symbols of connectors for the following figures

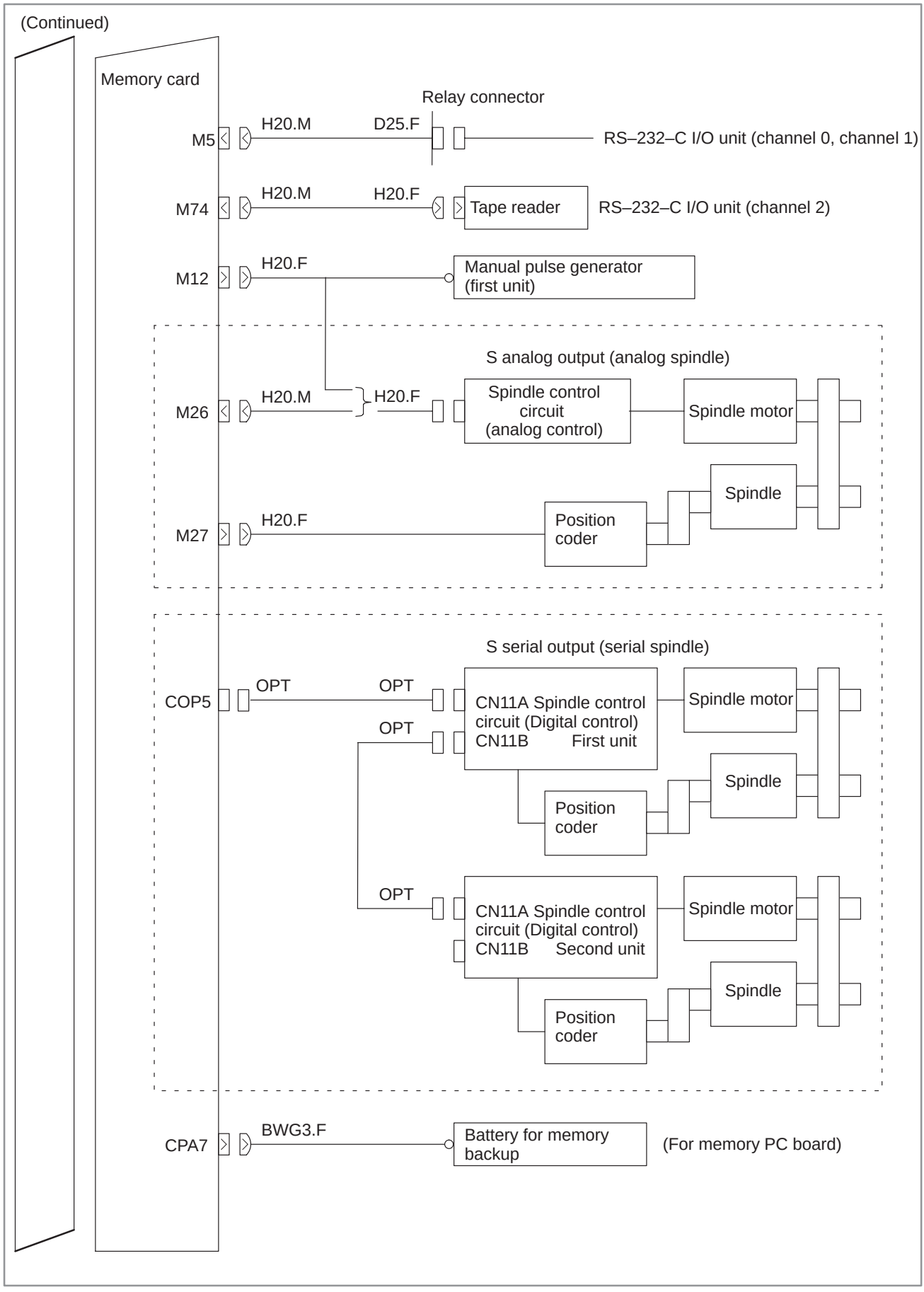
Symbol	Manufacturer	Specification
BK3.F	Japan FCI	3–pin, Black, Female
BWG3.F	Japan FCI	3–pin, White (gilding), Female
BWG6.F	Japan FCI	6–pin, White (gilding), Female
BN3.F	Japan FCI	3–pin, Brown, Female
BN6.F	Japan FCI	6–pin, Brown, Female
BK6.F	Japan FCI	6–pin, Black, Female
AHX3.F	AMP JAPAN, LTD.	3–pin, Black, For high–voltage, Type X, Female
ALY6.F	AMP JAPAN, LTD.	6–pin, Black, For low–voltage, Type Y, Female
ALX3.F	AMP JAPAN, LTD.	3–pin, Black, For low–voltage, Type X, Female
ALY3.F	AMP JAPAN, LTD	3–pin, Black, For low–voltage, Type Y, Female
H20.M	HONDA TSUSHIN KOGYO CO., LTD.	20–pin, MR connector 20–pin, Male
H20.F	HONDA TSUSHIN KOGYO CO., LTD.	20–pin, MR connector 20–pin, Female
H50.M	HONDA TSUSHIN KOGYO CO., LTD.	50–pin, MR connector 50–pin, Male
H50.F	HONDA TSUSHIN KOGYO CO., LTD.	50–pin, MR connector 50–pin, Female
D25.F		D–sub connector, Female
OPT		Optical connector

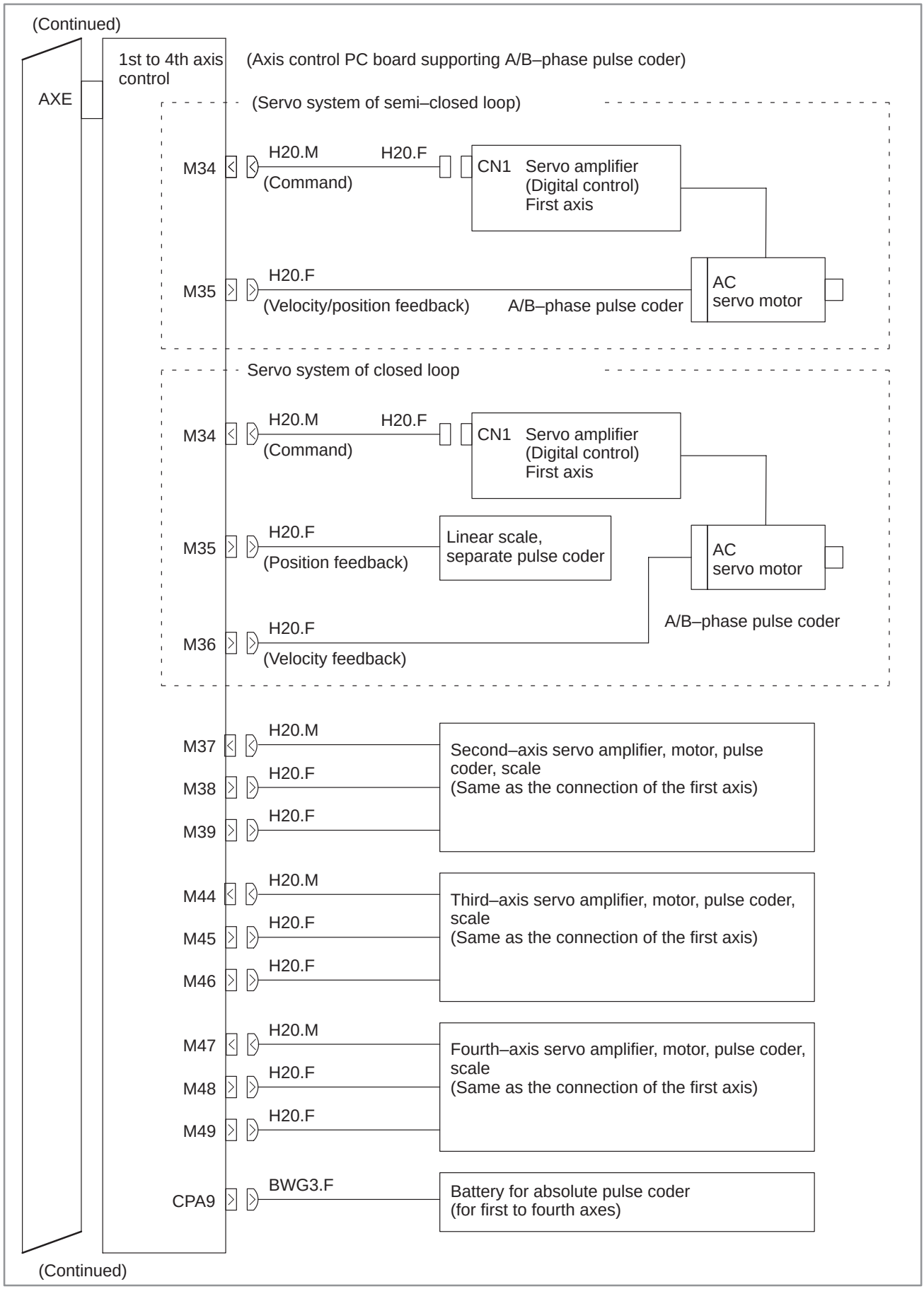

Common to control units A and B
MasterPC board
CAP
Power supply unit AI
CP1
BK3.F
Single–phase 200–VAC input
CP2
BK3.F
Servo magnetic contactor
CP2
BK3.F
200–VAC output
(fan or display unit using 200VAC)
CP3
BWG6.F
ON/OFF switch
CP14
BN3.F
24–VDC output
(I/O–B2, I/O–B3)
CP15
BN6.F
24–VDC output
(display unit using 24 VDC)
CAP
Power supply unit A, B1, C
Input unit
TP1
Single–phase 200–VAC input
TP2
ON/OFF switch
CP1
BK6.F BK6.F
CP2
CP4
BK3.F
200–VAC output
(fan or display unit using 200VAC)
CP14
BN3.F
24–VDC output
(I/O–B2, I/O–B3)
CP15
BN6.F
24–VDC output
(display unit using 24 VDC)
CAP
CE Marking Power supply unit AI
CP1
AHX3.F
Single–phase 200–VAC input
CP3
AHX3.F
Servo magnetic contactor
CP2
AHX3.F
200–VAC output
(Spare)
CP4
ALY6.F
ON/OFF switch
CP6
ALX3.F
24–VDC output
(Spare)
CP5
ALY3.F
24–VDC output
(display unit using 24 VDC)
PAS
Custom–engineered macro cassette
(Continued)

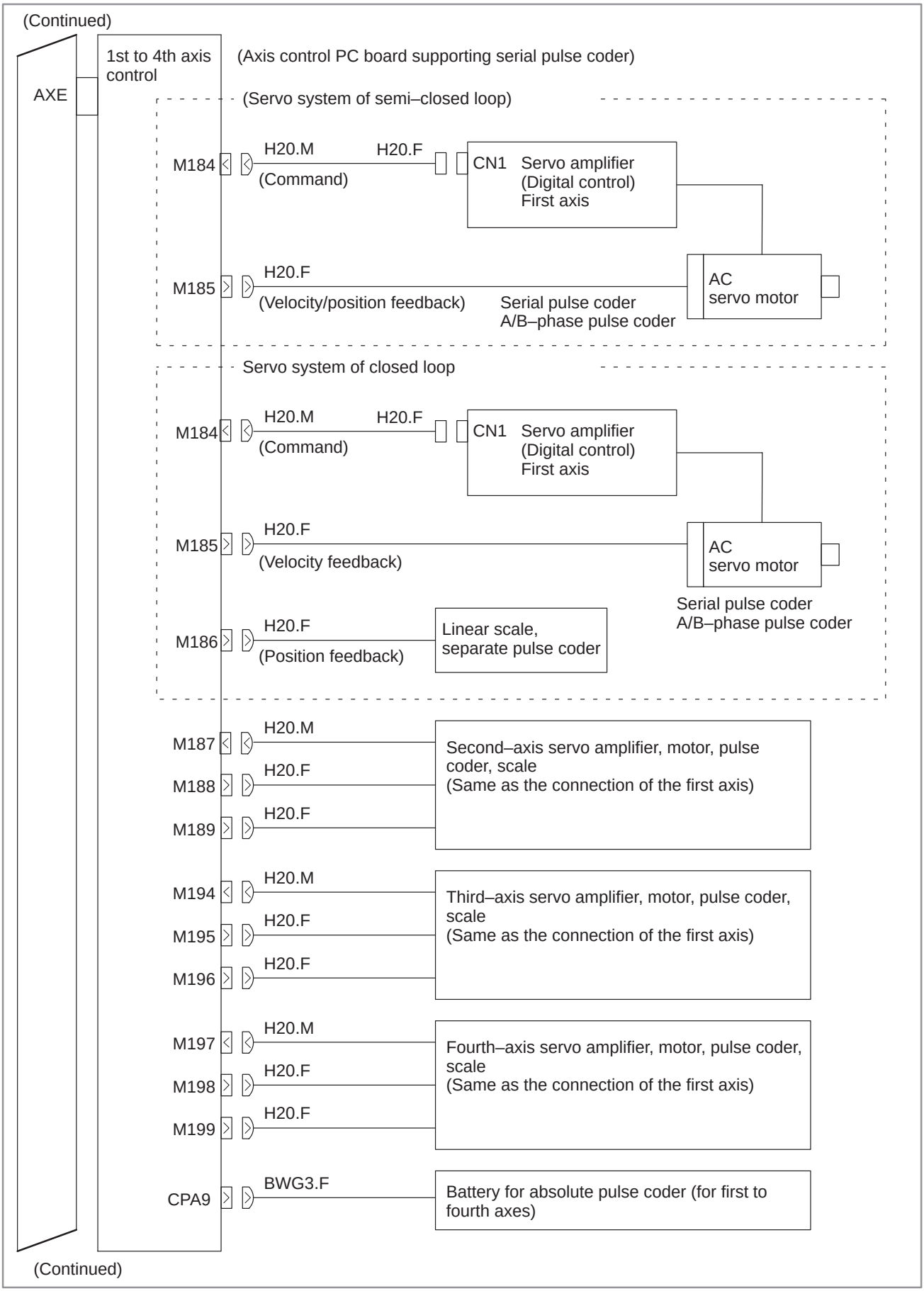
(Continued)

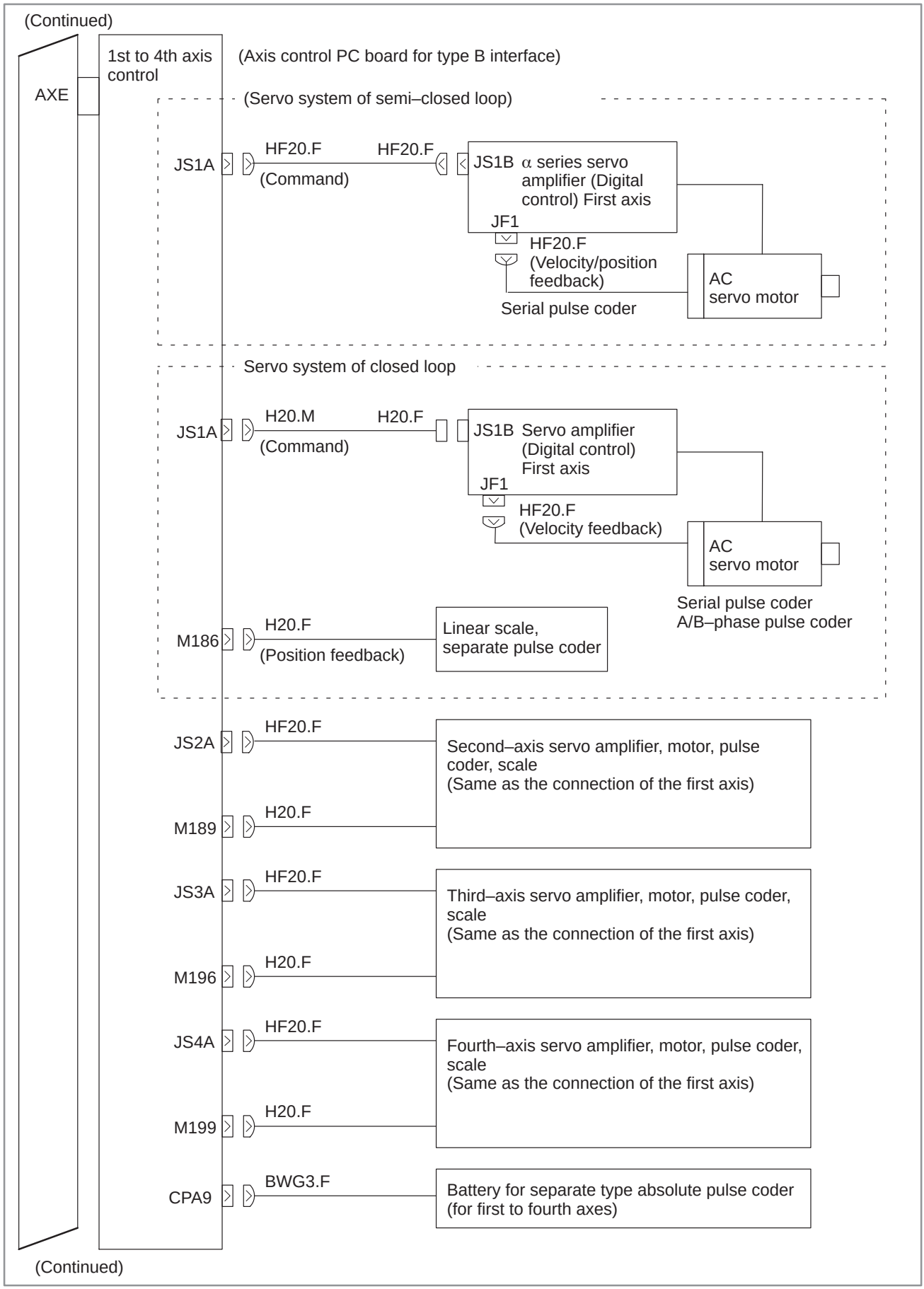


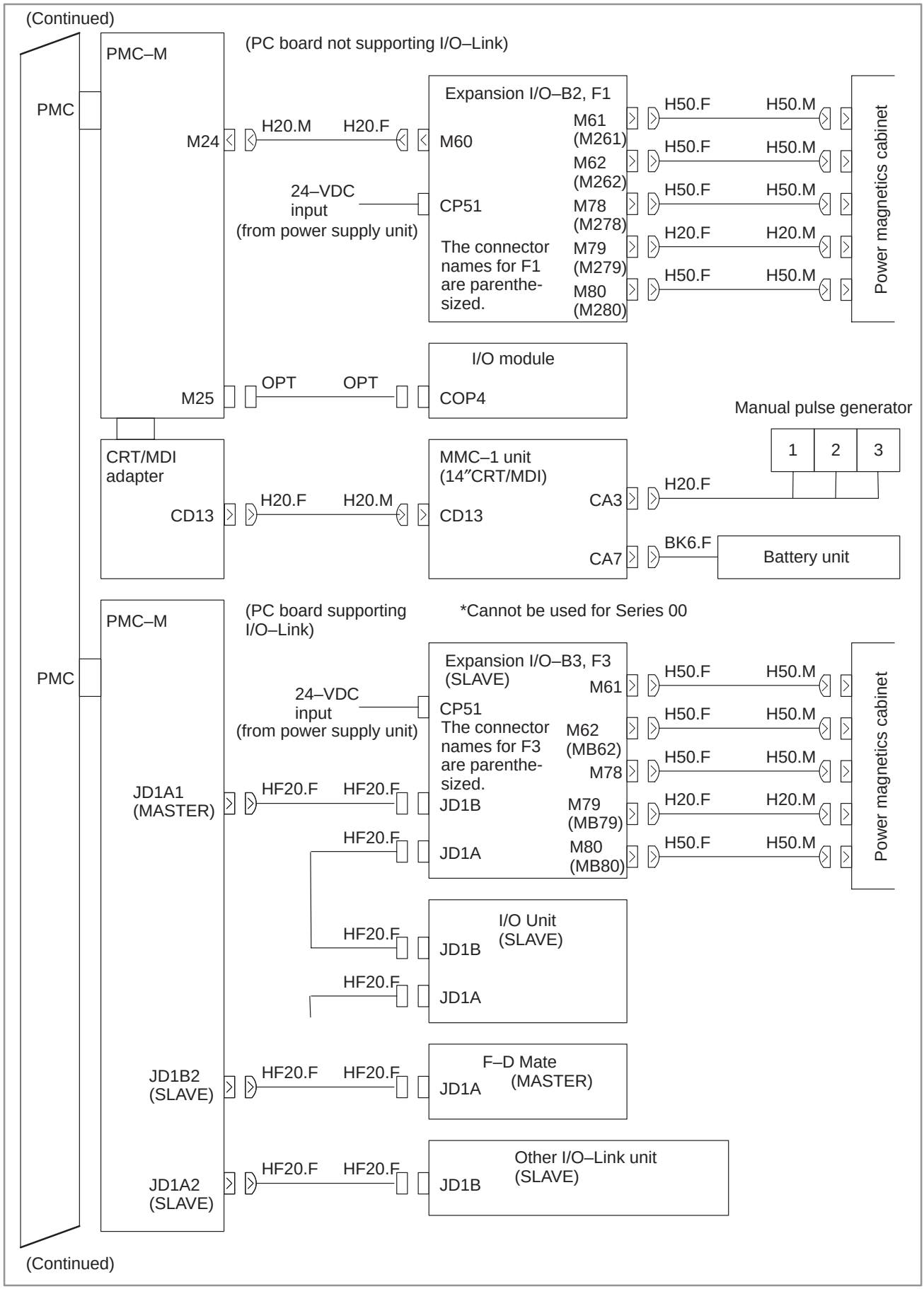
(Continued)

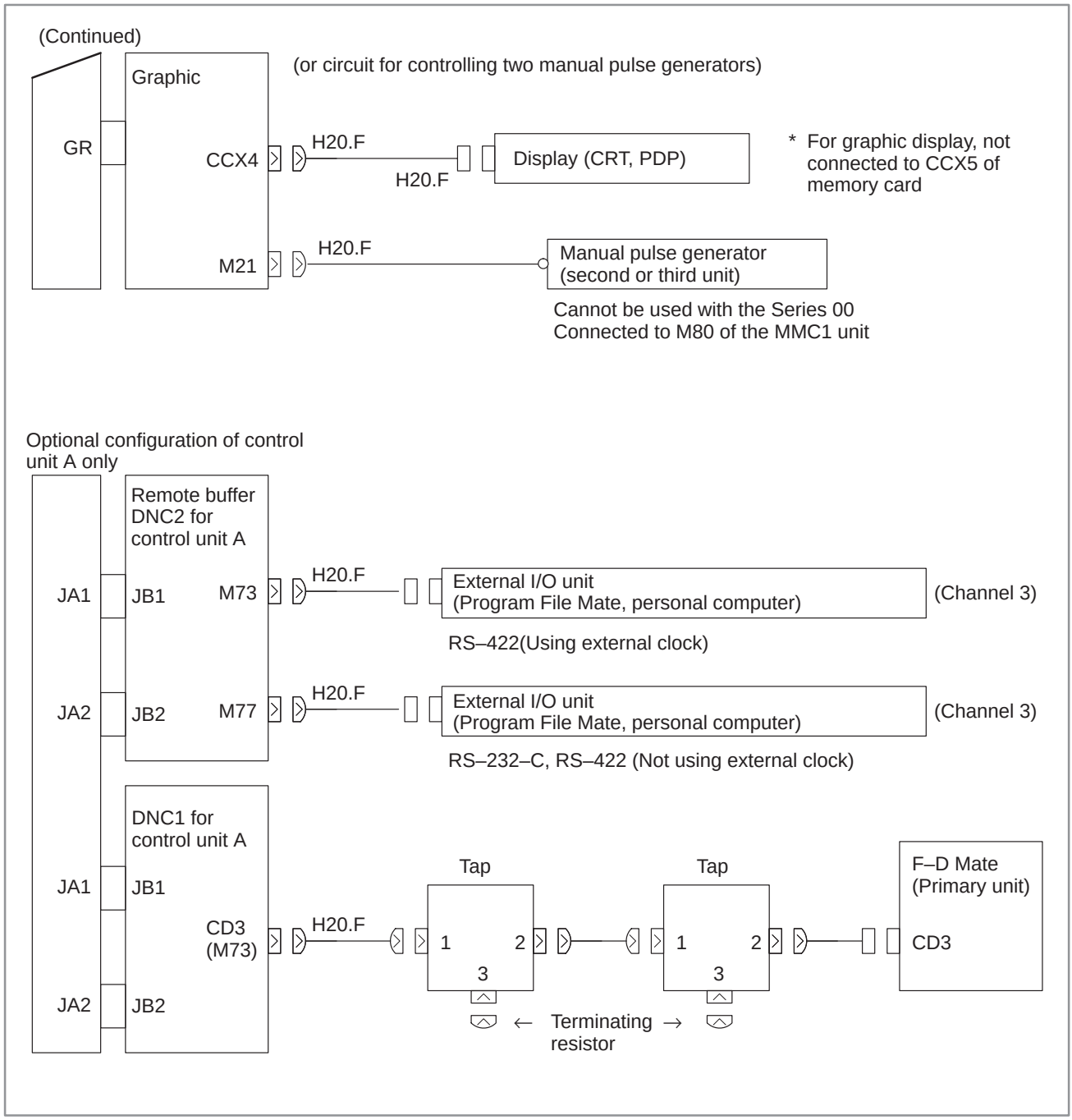

(Continued)
Memory card
Relay connector
M5
H20.M
D25.F
RS–232–C I/O unit (channel 0, channel 1)
M74
H20.M
H20.F
Tape reader
RS–232–C I/O unit (channel 2)
M12
H20.F
Manual pulse generator
(first unit)
S analog output (analog spindle)
M26
H20.M
H20.F
Spindle control
circuit
(analog control)
Spindle motor
Spindle
M27
H20.F
Position
coder
S serial output (serial spindle)
COP5
OPT
OPT
CN11A Spindle control
circuit (Digital control)
CN11B First unit
Spindle motor
OPT
Spindle
Position
coder
OPT
CN11A Spindle control
circuit (Digital control)
CN11B Second unit
Spindle motor
Spindle
Position
coder
CPA7
BWG3.F
Battery for memory
backup
(For memory PC board)

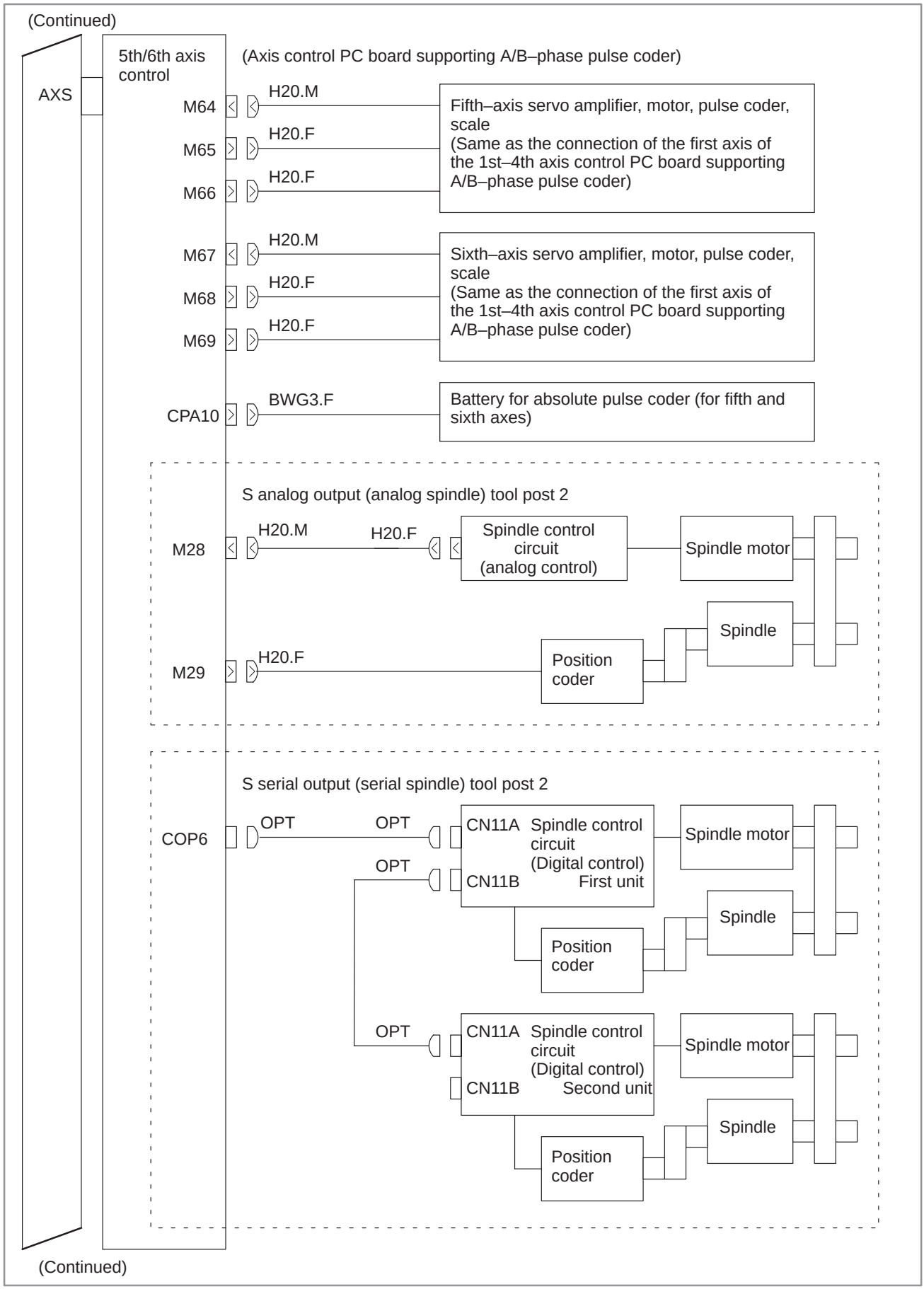

(Continued)
1st to 4th axis control
(Axis control PC board supporting A/B–phase pulse coder)
AXE
(Servo system of semi–closed loop)
M34
H20.M
H20.F
(Command)
CN1 Servo amplifier (Digital control) First axis
M35
H20.F
(Velocity/position feedback)
A/B–phase pulse coder
AC servo motor
Servo system of closed loop
M34
H20.M
H20.F
(Command)
CN1 Servo amplifier (Digital control) First axis
M35
H20.F
(Position feedback)
Linear scale, separate pulse coder
AC servo motor
A/B–phase pulse coder
M36
H20.F
(Velocity feedback)
M37
H20.M
M38
H20.F
M39
H20.F
Second–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M44
H20.M
M45
H20.F
M46
H20.F
Third–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M47
H20.M
M48
H20.F
M49
H20.F
Fourth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
CPA9
BWG3.F
Battery for absolute pulse coder
(for first to fourth axes)
(Continued)

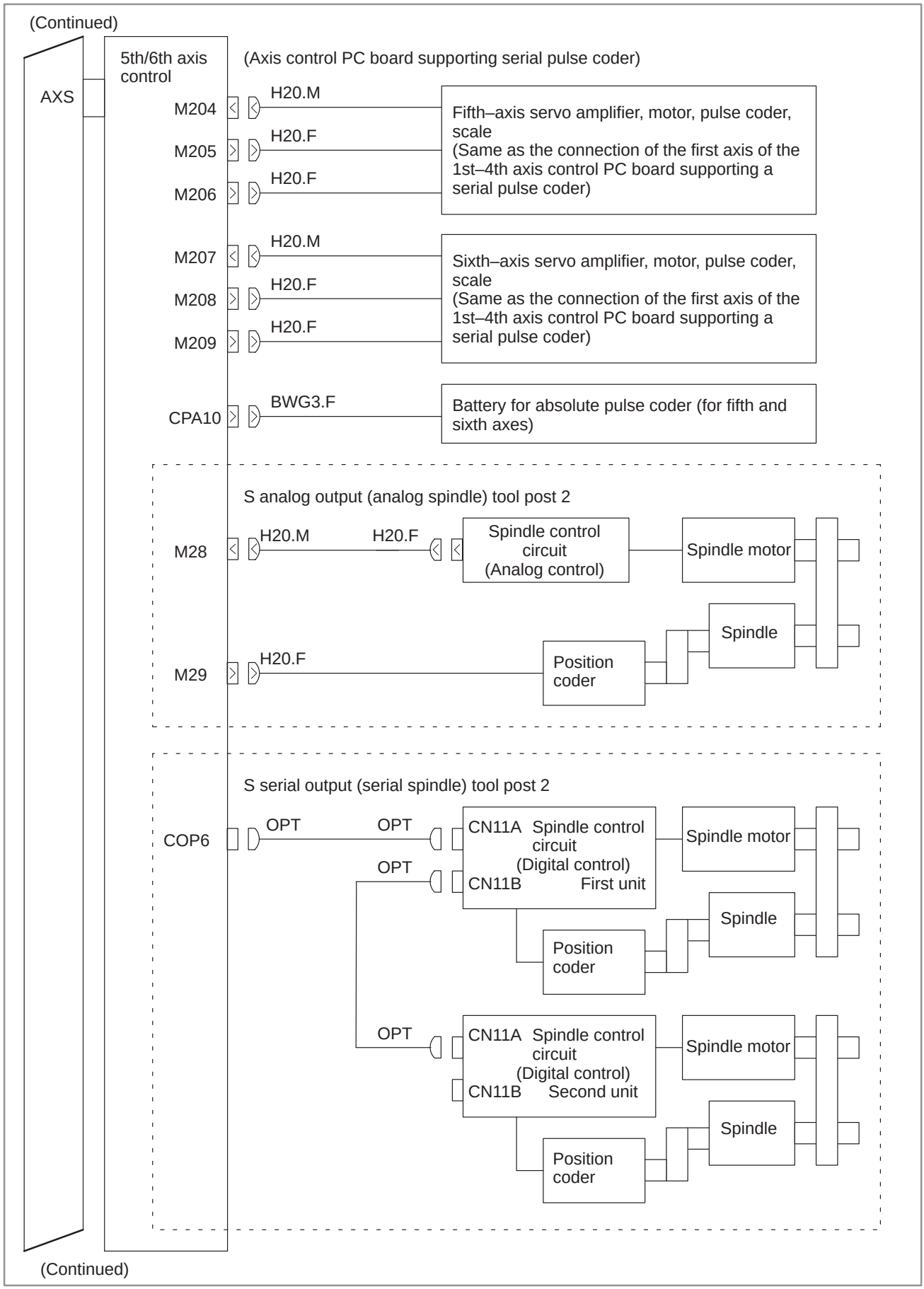

(Continued)
1st to 4th axis control
(Axis control PC board supporting serial pulse coder)
AXE
(Servo system of semi–closed loop)
M184
H20.M
H20.F
(Command)
CN1 Servo amplifier (Digital control) First axis
M185
H20.F
(Velocity/position feedback)
Serial pulse coder A/B–phase pulse coder
AC servo motor
Servo system of closed loop
M184
H20.M
H20.F
(Command)
CN1 Servo amplifier (Digital control) First axis
M185
H20.F
(Velocity feedback)
AC servo motor
Serial pulse coder A/B–phase pulse coder
M186
H20.F
(Position feedback)
Linear scale, separate pulse coder
M187
M188
M189
H20.M
H20.F
H20.F
Second–axis servo amplifier, motor, pulse coder, scale (Same as the connection of the first axis)
M194
M195
M196
H20.M
H20.F
H20.F
Third–axis servo amplifier, motor, pulse coder, scale (Same as the connection of the first axis)
M197
M198
M199
H20.M
H20.F
H20.F
Fourth–axis servo amplifier, motor, pulse coder, scale (Same as the connection of the first axis)
CPA9
BWG3.F
Battery for absolute pulse coder (for first to fourth axes)
(Continued)


(Continued)
1st to 4th axis control
(Axis control PC board for type B interface)
AXE
(Servo system of semi–closed loop)
JS1A
HF20.F
(Command)
HF20.F
JS1B α series servo amplifier (Digital control) First axis
JF1
HF20.F
(Velocity/position feedback)
Serial pulse coder
AC servo motor
Servo system of closed loop
JS1A
H20.M
(Command)
H20.F
JS1B Servo amplifier (Digital control) First axis
JF1
HF20.F
(Velocity feedback)
AC servo motor
Serial pulse coder
A/B–phase pulse coder
M186
H20.F
(Position feedback)
Linear scale, separate pulse coder
JS2A
HF20.F
Second–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M189
H20.F
JS3A
HF20.F
Third–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M196
H20.F
JS4A
HF20.F
Fourth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M199
H20.F
CPA9
BWG3.F
Battery for separate type absolute pulse coder
(for first to fourth axes)
(Continued)


(Continued)
PMC
PMC–M
(PC board not supporting I/O–Link)
M24
H20.M
H20.F
Expansion I/O–B2, F1
M60
M61 (M261)
M62 (M262)
M78 (M278)
M79 (M279)
M80 (M280)
CP51
24–VDC input
(from power supply unit)
The connector names for F1 are parenthesized.
H50.F
H50.M
H20.F
H20.M
Power magnetics cabinet
M25
OPT
OPT
I/O module
COP4
Manual pulse generator
1
2
3
CRT/MDI adapter
CD13
H20.F
H20.M
MMC–1 unit (14″CRT/MDI)
CD13
CA3
CA7
BK6.F
Battery unit
PMC
PMC–M
(PC board supporting I/O–Link)
*Cannot be used for Series 00
Expansion I/O–B3, F3 (SLAVE)
24–VDC input
(from power supply unit)
CP51
The connector names for F3 are parenthesized.
M61
M62 (MB62)
M78
M79 (MB79)
M80 (MB80)
JD1A1 (MASTER)
HF20.F
JD1B
JD1A
I/O Unit (SLAVE)
JD1B2 (SLAVE)
F–D Mate (MASTER)
JD1A2 (SLAVE)
Other I/O–Link unit (SLAVE)
(Continued)

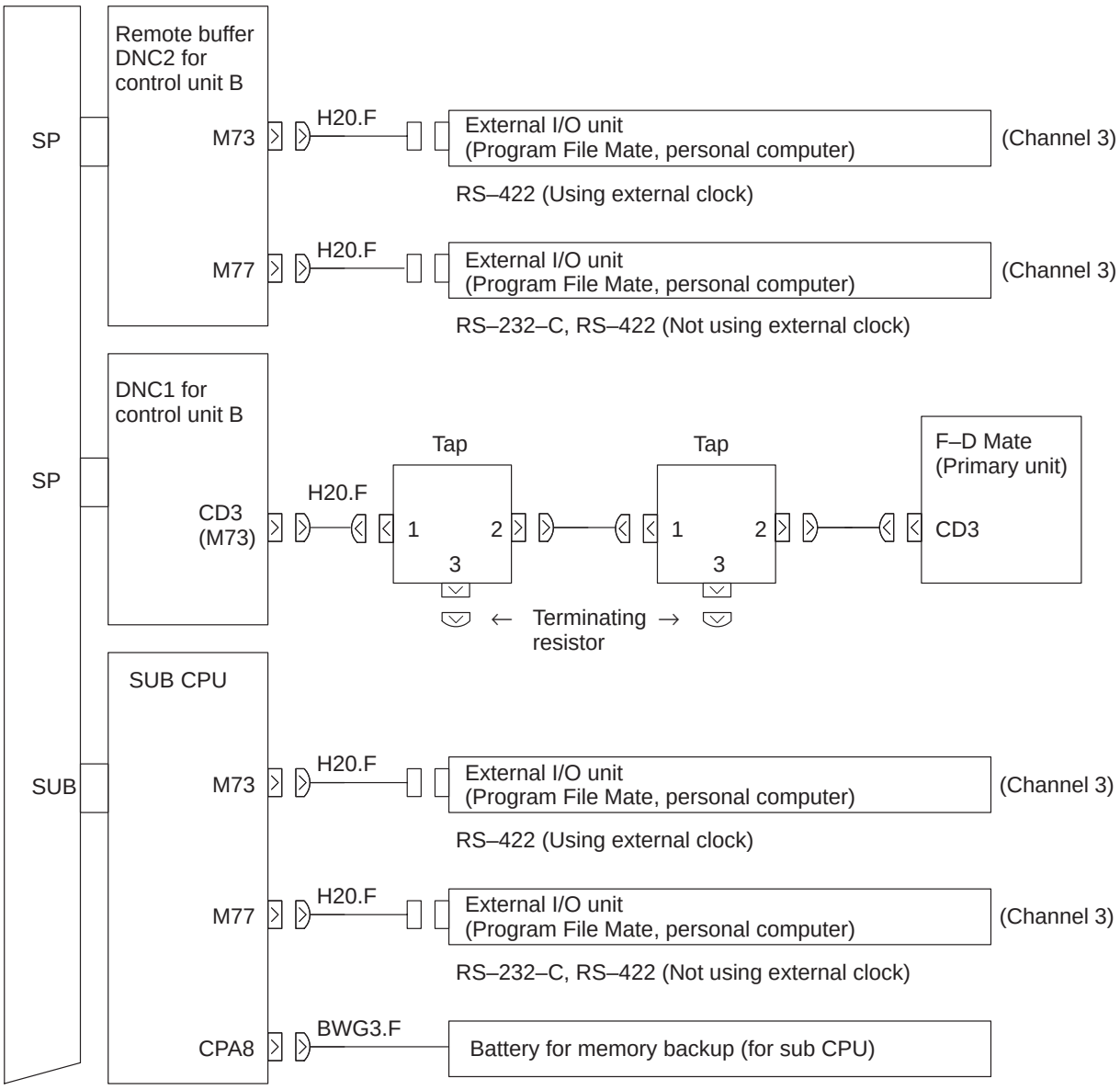

(Continued)
Graphic
(or circuit for controlling two manual pulse generators)
GR
CCX4
H20.F
H20.F
Display (CRT, PDP)
* For graphic display, not connected to CCX5 of memory card
M21
H20.F
Manual pulse generator (second or third unit)
Cannot be used with the Series 00
Connected to M80 of the MMC1 unit
Optional configuration of control unit A only
Remote buffer DNC2 for control unit A
JA1
JB1
M73
H20.F
External I/O unit (Program File Mate, personal computer)
(Channel 3)
RS–422(Using external clock)
JA2
JB2
M77
H20.F
External I/O unit (Program File Mate, personal computer)
(Channel 3)
RS–232–C, RS–422 (Not using external clock)
DNC1 for control unit A
JA1
JB1
CD3 (M73)
H20.F
Tap
Tap
F–D Mate (Primary unit)
1
2
3
1
2
3
CD3
JA2
JB2
← Terminating →
resistor


(Continued)
AXS
5th/6th axis control
(Axis control PC board supporting A/B–phase pulse coder)
M64
H20.M
M65
H20.F
M66
H20.F
Fifth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting A/B–phase pulse coder)
M67
H20.M
M68
H20.F
M69
H20.F
Sixth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting A/B–phase pulse coder)
CPA10
BWG3.F
Battery for absolute pulse coder (for fifth and sixth axes)
S analog output (analog spindle) tool post 2
M28
H20.M
H20.F
Spindle control circuit (analog control)
Spindle motor
Spindle
M29
H20.F
Position coder
S serial output (serial spindle) tool post 2
COP6
OPT
OPT
CN11A
Spindle control circuit (Digital control)
CN11B
First unit
Spindle motor
Spindle
Position coder
OPT
OPT
CN11A
Spindle control circuit (Digital control)
CN11B
Second unit
Spindle motor
Spindle
Position coder
(Continued)


(Continued)
AXS
5th/6th axis control
(Axis control PC board supporting serial pulse coder)
M204
H20.M
M205
H20.F
M206
H20.F
Fifth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting a serial pulse coder)
M207
H20.M
M208
H20.F
M209
H20.F
Sixth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting a serial pulse coder)
CPA10
BWG3.F
Battery for absolute pulse coder (for fifth and sixth axes)
S analog output (analog spindle) tool post 2
M28
H20.M
H20.F
Spindle control circuit (Analog control)
Spindle motor
Spindle
M29
H20.F
Position coder
S serial output (serial spindle) tool post 2
COP6
OPT
OPT
OPT
CN11A Spindle control circuit (Digital control)
CN11B First unit
Spindle motor
Spindle
Position coder
OPT
CN11A Spindle control circuit (Digital control)
CN11B Second unit
Spindle motor
Spindle
Position coder
(Continued)

(Continued)

Optional configuration of control unit B only



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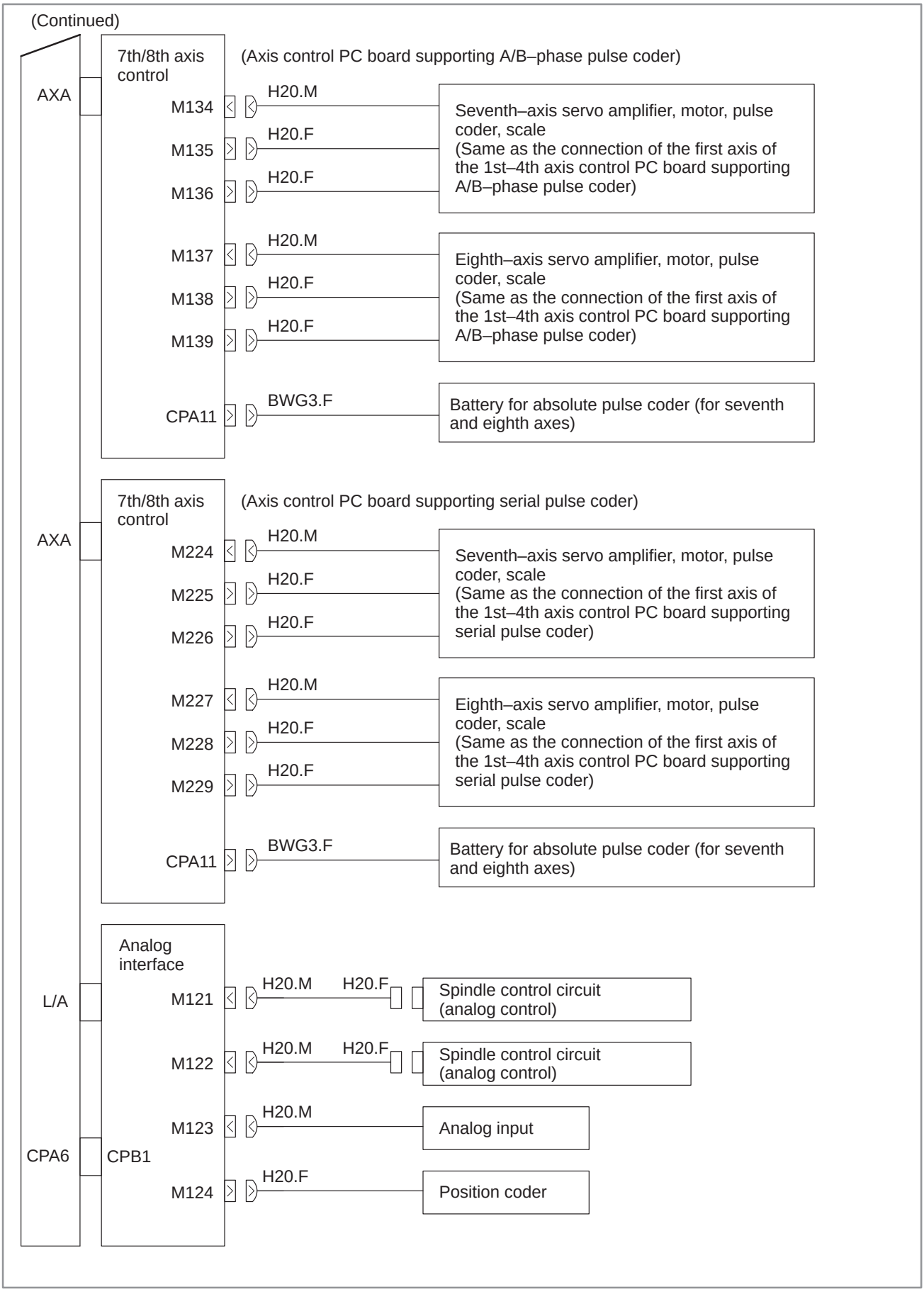

(Continued)
7th/8th axis control
(Axis control PC board supporting A/B–phase pulse coder)
AXA
M134
M135
M136
M137
M138
M139
CPA11
H20.M
H20.F
H20.F
H20.M
H20.F
H20.F
BWG3.F
Seventh–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting A/B–phase pulse coder)
Eighth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting A/B–phase pulse coder)
Battery for absolute pulse coder (for seventh and eighth axes)
7th/8th axis control
(Axis control PC board supporting serial pulse coder)
AXA
M224
M225
M226
M227
M228
M229
CPA11
H20.M
H20.F
H20.F
H20.M
H20.F
H20.F
BWG3.F
Seventh–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting serial pulse coder)
Eighth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st–4th axis control PC board supporting serial pulse coder)
Battery for absolute pulse coder (for seventh and eighth axes)
Analog interface
L/A
M121
M122
M123
CPA6
CPB1
M124
H20.M
H20.F
H20.M
H20.F
H20.M
H20.F
Spindle control circuit (analog control)
Spindle control circuit (analog control)
Analog input
Position coder

5 POWER SUPPLY UNIT

5.1 POWER SOURCE

Select the type of power source with reference to the list below. When the apparatus to be used does not apply to examples 1 to 5, total up the points on the right and select the type of power from that figure.

Printed circuit board	Example 1	Example 2	Example 3	Example 4	Example 5	Points
Master (16Bit)		○				3.1
Master (32Bit)	○		○	○	○	1.3
Graphic card	○	○	○	○	○	2.4
PMC–M card	○		○	○	○	2.8
PMC–M card with I/O link						1.0
Sub CPU card				○	○	2.3
5/6 axis card				○	○	2.1
7/8 axis card			○		○	2.0
DNC1 card	○	○	○	○	○	1.0
Remote buffer card						1.0
Analog interface card			○		○	1.3
Laser interface card						1.5
Manual pulse generator	3	3	3	3	3	0.1 × number of generators
Pulse coder, position coder	5	5	7	8	10	0.35 × number of generators
Total points	9.55	8.55	13.55	15.00	19.00	
Type of power source	Power source A or Power source AI	Power source A or Power source AI	Power source B2	Power source B2	Power source C	

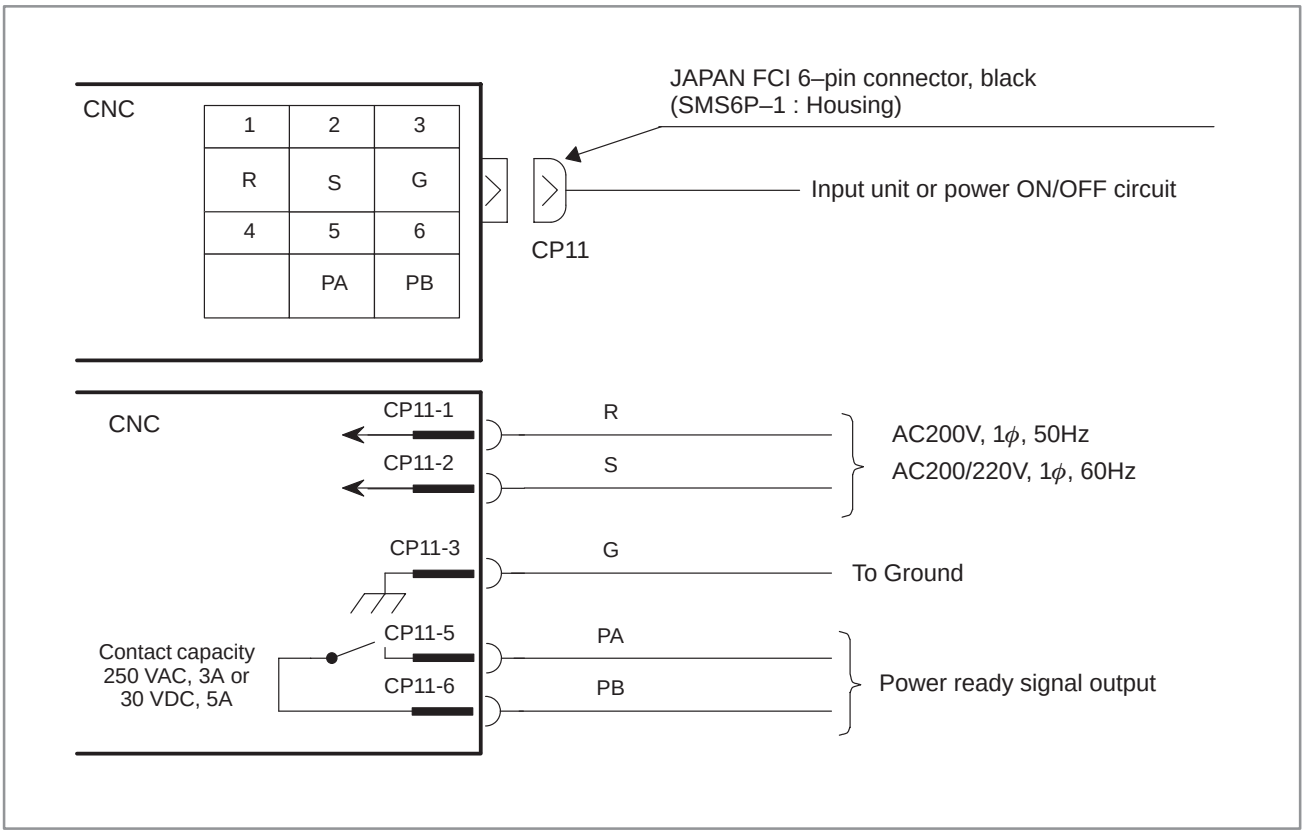
Total points	Total below 10	Total below 15	Over 15
Type of power source	Power source A or Power source AI	Power source B2	Power source C

NOTE

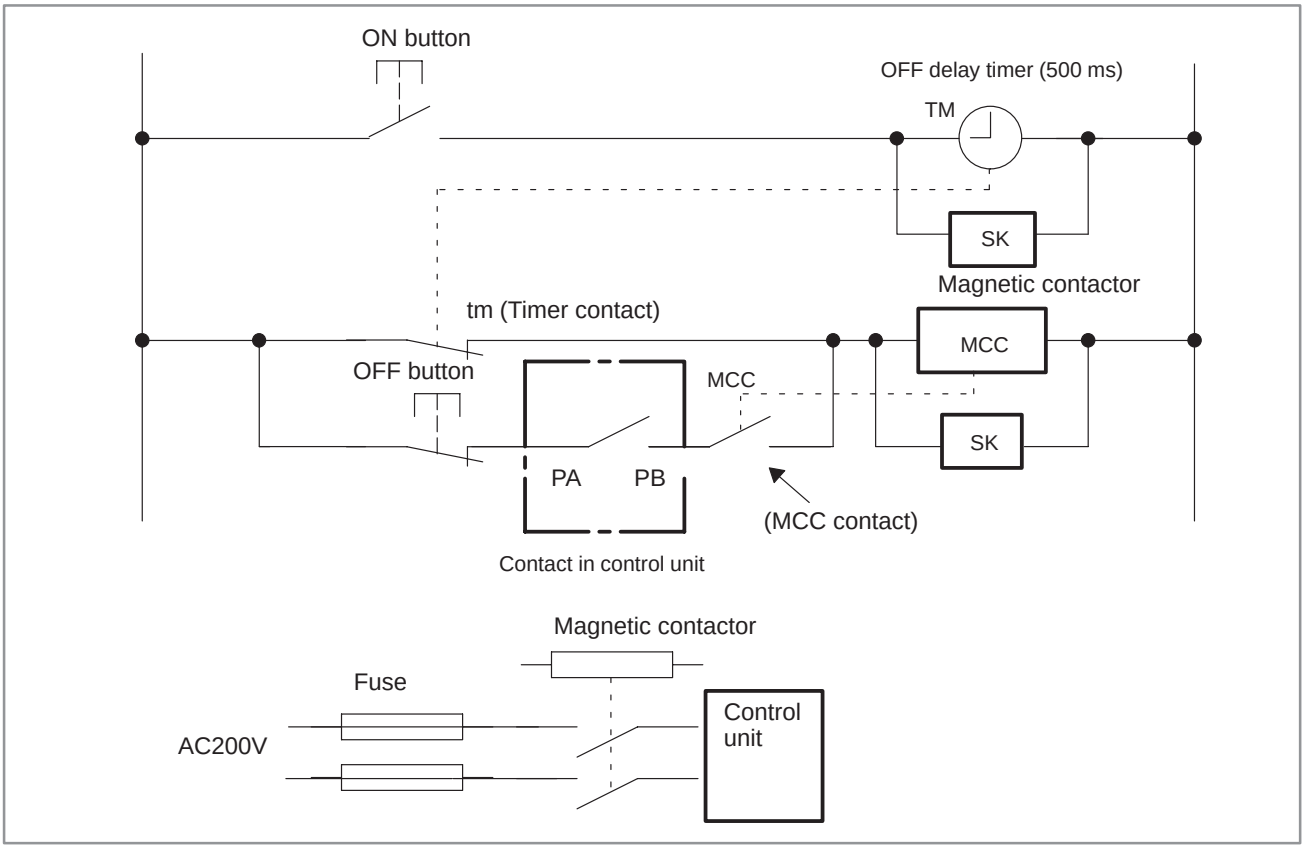
The ○ mark in the table above signifies that a printed circuit board should be assembled on that apparatus. Memory cards, I/O cards, 1–4 axis cards can be disregarded.

5.2 CONNECTION OF THE POWER SUPPLY UNIT A, B1, C (INPUT UNIT SEPARATE TYPE)

5.2.1 Connection of the Power Unit without Using Input Unit



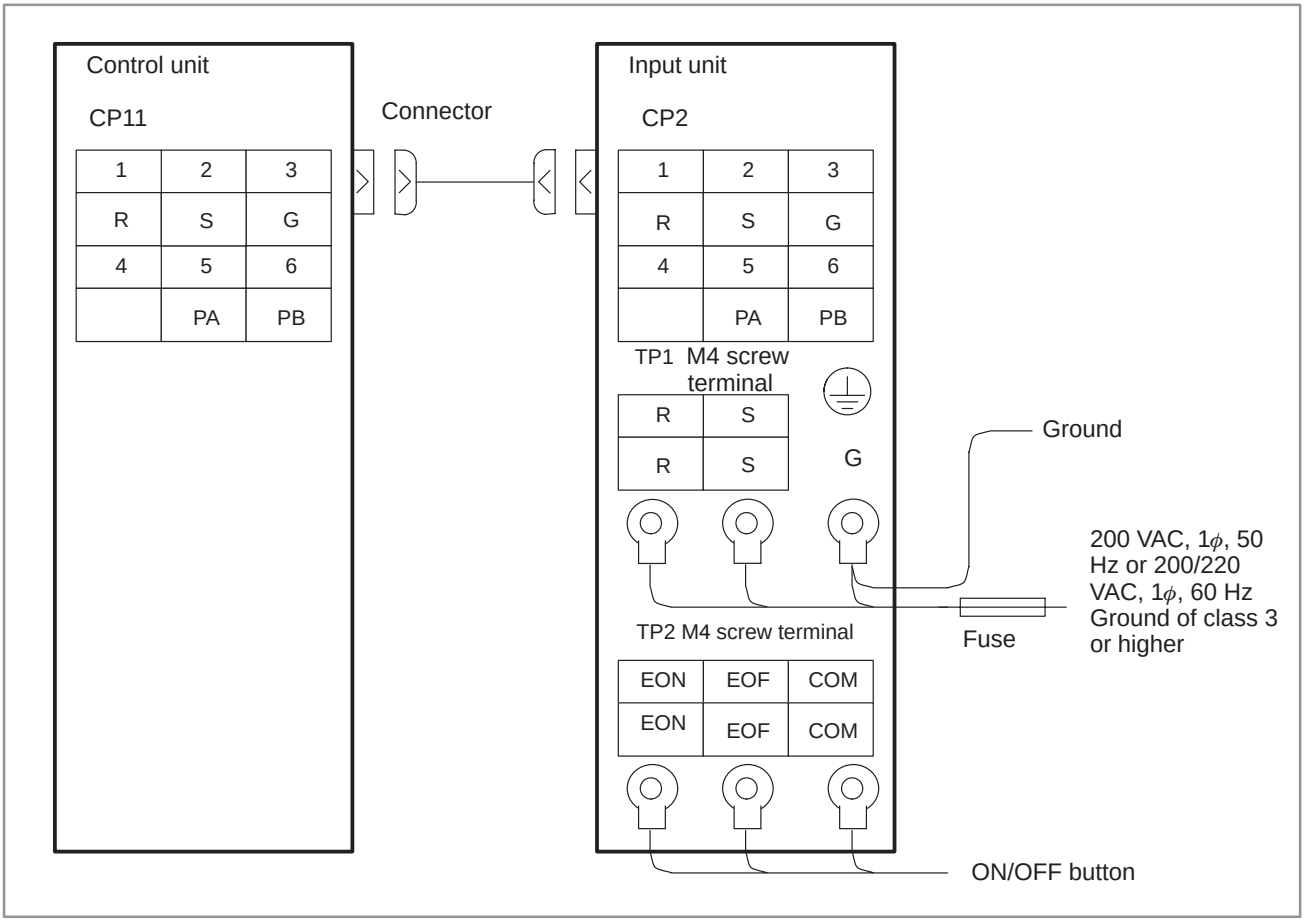
Connect power ON/OFF circuit as shown below.
Optional input unit may be used instead of this circuit. (See 5.2.2)



Use OFF delay timer as shown above so that Magnetic Contactor (MCC) for control unit cannot be turned OFF unit the PA/PB holding circuit operates.

5.2.2 Connection of Power Supply Unit when the Input Unit is Used

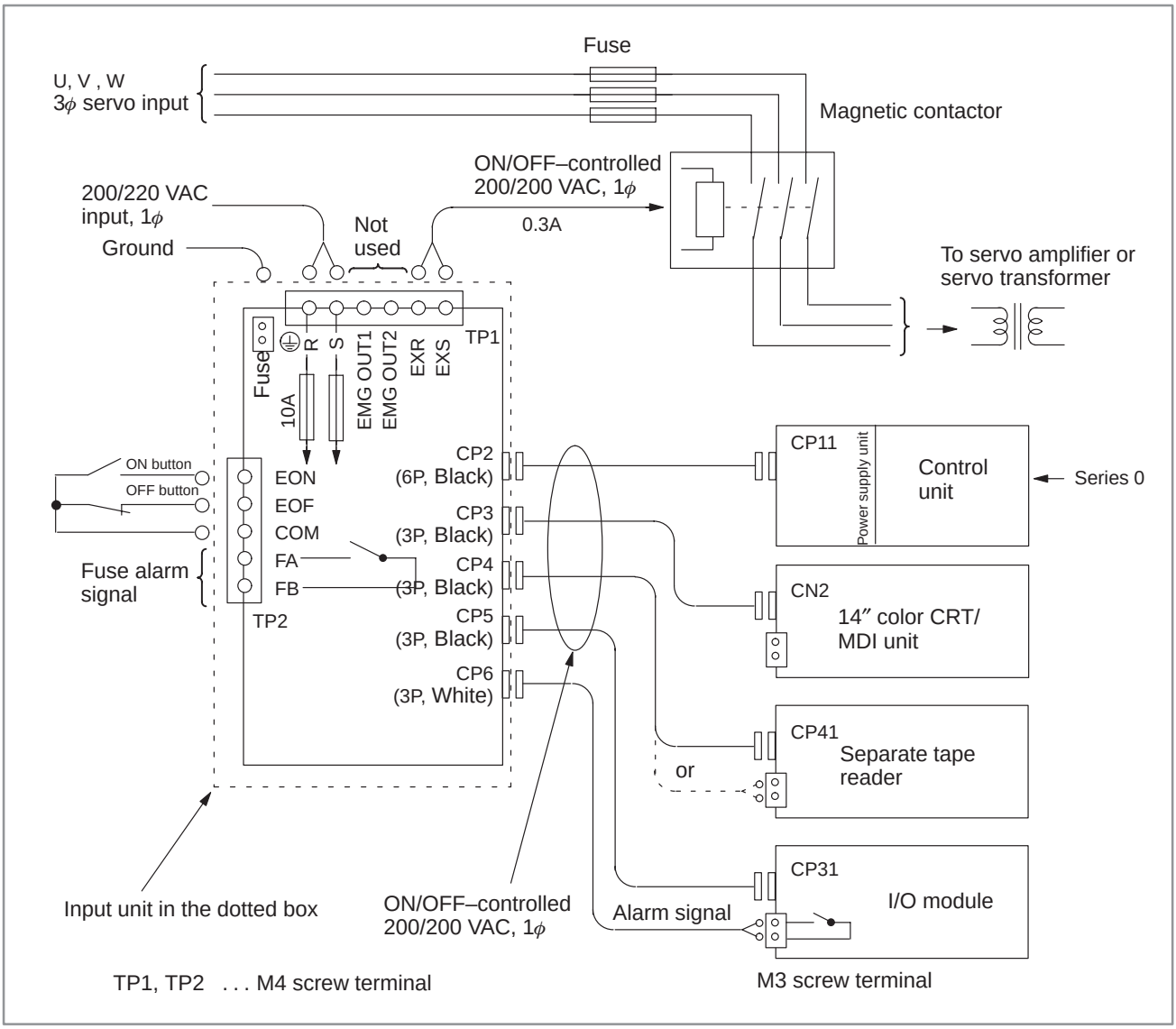
(1) The figure below shows the connection when the input unit is used.



(2) Input unit

The input unit receives input AC power and the ON/OFF button signal and supplies the ON/OFF–controlled AC power to the control unit and peripheral equipment.

(a) Connection diagram



(b) Pin configurations of power–supply connectors

(i) CP2, CP11, CP31: JAPAN FCI 6–pin connector, black
PA and PB: Power ready signals

1	2	3
R	S	G
4	5	6
	PA	PB

(ii) CP3, CP4, CP5, CN2, CP41: JAPAN FCI 3–pin connector, black

1	2	3
R	S	G

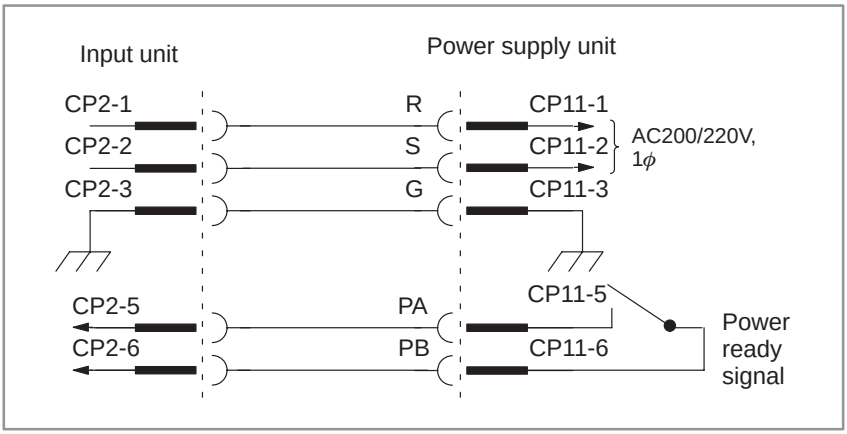
(iii) CP6: JAPAN FCI 3–pin connector, white
ALA and ALB are provided to receive an alarm signal from an I/O module and to turn off the system. Input a contact signal that will close the contact when an alarm state is detected.

1	2	3
ALA	ALB	

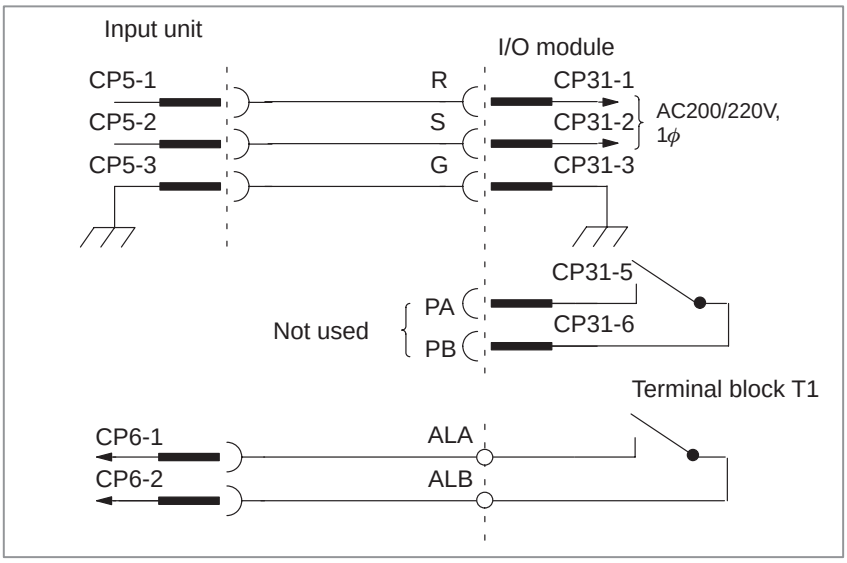
(c) ON/OFF control of the input power to the servo amplifier or servo transformer
As shown in the connection diagram, ON/OFF–controlled 200 or 220 VAC single–phase power can be drawn from the EXR/EXS pin of terminal block TP1. If a magnetic contactor provided by a machine tool builder is connected to this pin, the servo system can be turned on or off in synchronization with the NC. The current should not exceed 0.3 A.

(d) Connection between units

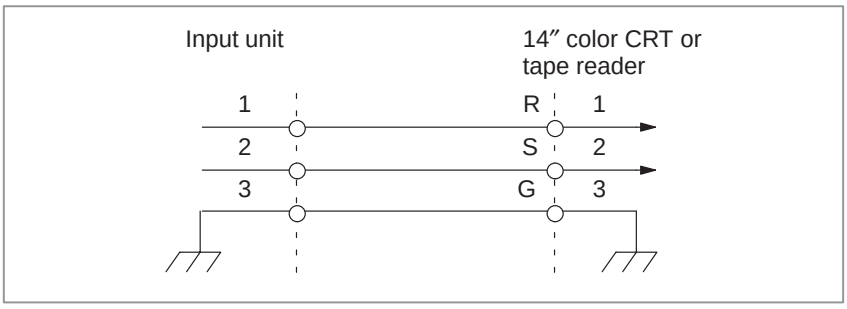
(i) Connection between the input unit and power supply unit



(ii) Connection between the input unit and I/O module

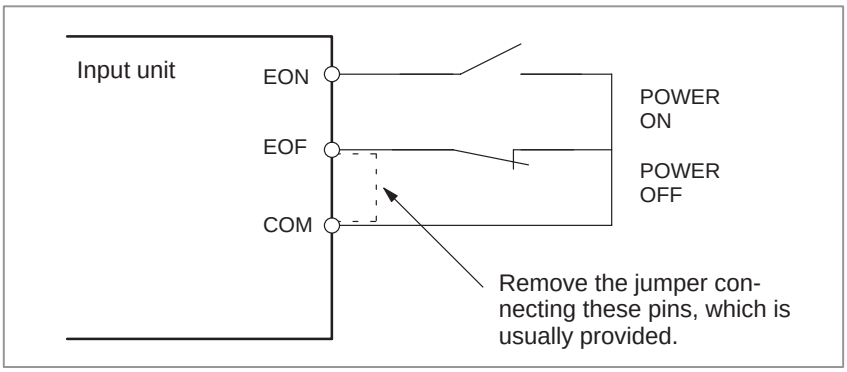


(iii) Connection between the input unit and 14″ color CRT or separate tape reader



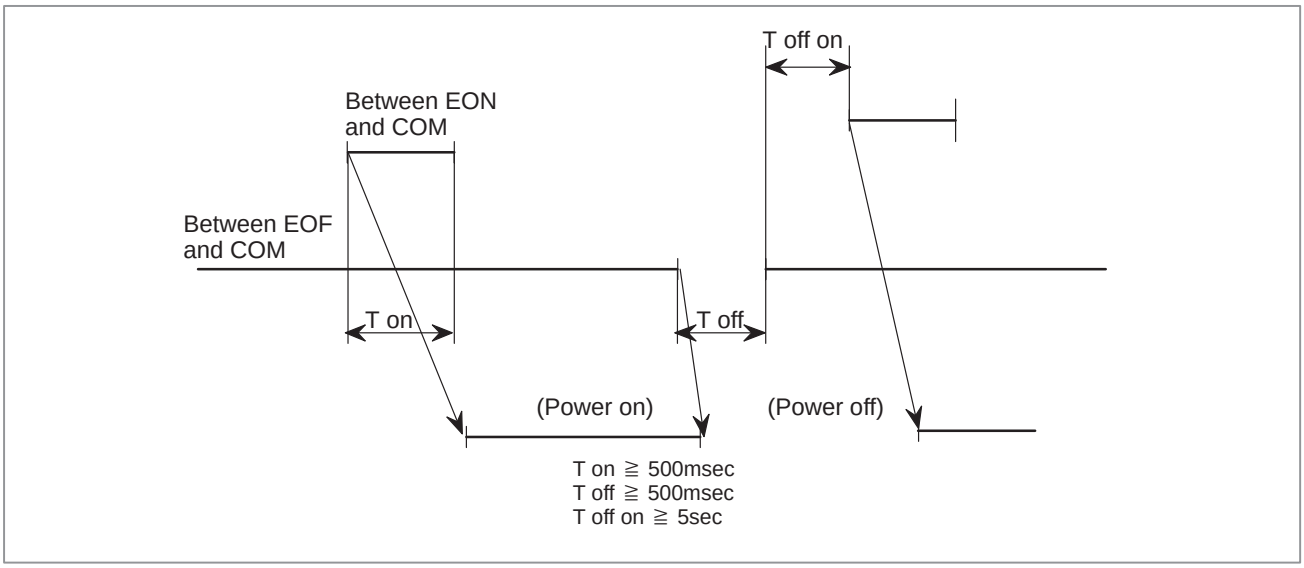
(e) External power ON/OFF pins (EON, EOF, COM)

The external power ON/OFF pin is used to enable the power to be turned on or off from outside the control unit. The pins must be connected as illustrated below:



External Power ON/OFF Signal

The figure below shows the power ON/OFF timing.



ON/OFF Timing Diagram

The external power ON/OFF contact should satisfy the following requirements:

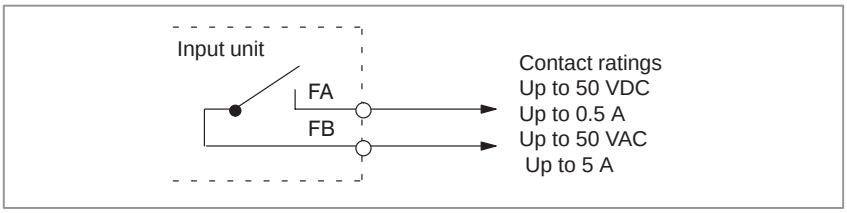
Withstand voltage: 50 VDC or higher (between contacts)

Current: 100 mA or higher (minimum load of up to 2 mA)

(f) Fuse alarm signals FA and FB

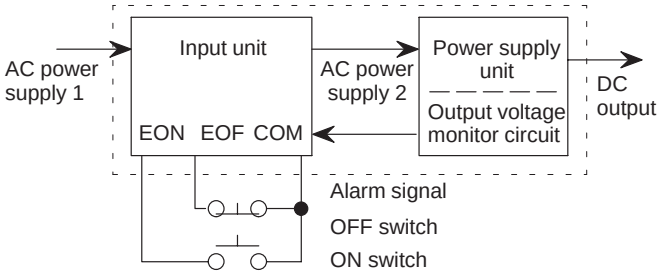
FA and FB are short–circuited when a fuse in the power supply unit of the NC blows or when an error such as excessive voltage or current occurs in the DC output of the power supply unit. If an alarm signal is input from CP6, FA and FB are short–circuited as well. This signal is held until the input power (to the NC) is turned off or until the OFF button is pressed.

When this signal is output, the NC is turned off, disabling the power ON button and external power ON function. The figure below shows the connection.



Fuse Alarm Signal

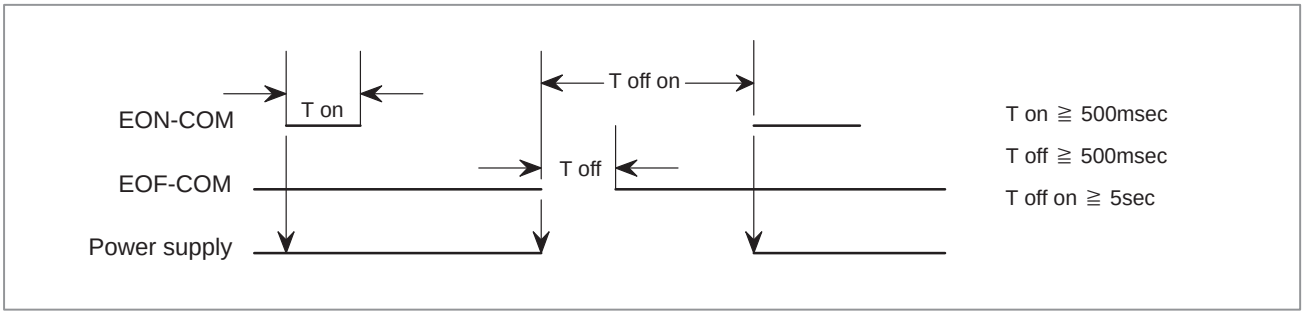
(3) How to use input unit



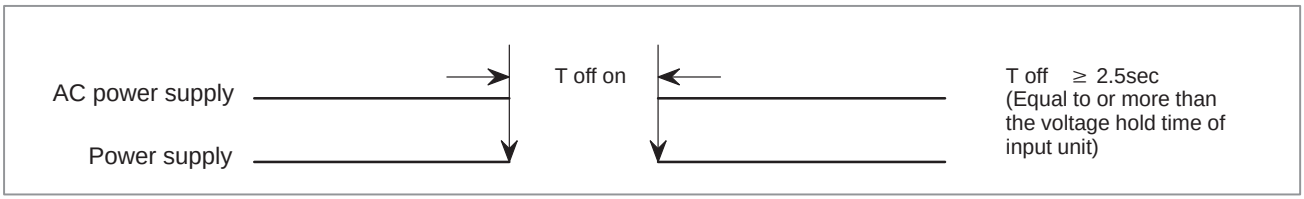
(Reference)
A power supply unit incorporating an input unit is also available. This is a combined unit that incorporates those sections enclosed in broken lines in the above figure.

1. The power supply unit is provided with the output voltage monitor circuit. When the output voltage is found to be improper, an alarm signal is sent to the input unit.
2. In the input unit, this alarm signal is held and the AC power supply 2 which supplies power to the power unit is cut off. (This is the routine to ensure safety since normal operation cannot be assured in abnormal output voltage.)
   Reset the alarm by pressing the OFF switch or cutting off the AC power supply 1 which supplies power to the input unit and then press the ON switch to turn on the power again from the status above.
3. When the temporary power interruption occurs at the AC power supply 1 and as a result the voltage drops, the voltage hold time of input unit is set to a value which is longer than that of power unit to perform detection by the output voltage monitor circuit and to hold an alarm in the input unit. The same operation is also performed in the input unit built–in type power supply unit.
4. There is no problem if the power ON/OFF is performed by the ON/OFF switch. But, when the AC power supply is turned on/off while the EON–CON and EOF–COM remain short–circuited, the status where the power is cut off is the same as that where power interruption occurs (because the power is cut off without pressing the OFF switch) and an alarm is held in the input unit.
   This alarm is canceled after passing the voltage hold time of input unit so that an alarm is held when the AC power supply 1 is turned on again before the pass of voltage hold time of input unit.
   Thus, it is required that the time interval of power–on/off should be set to a value which is longer than the voltage hold time of input unit for proper power–on/off in the above use.
5. It is recommended that the power should be turned on/off using the ON/OFF switch.
   It is required to follow this since there are restrictions as described in 4 in other methods.
   The conditions in terms of time for power–on/off are described below:

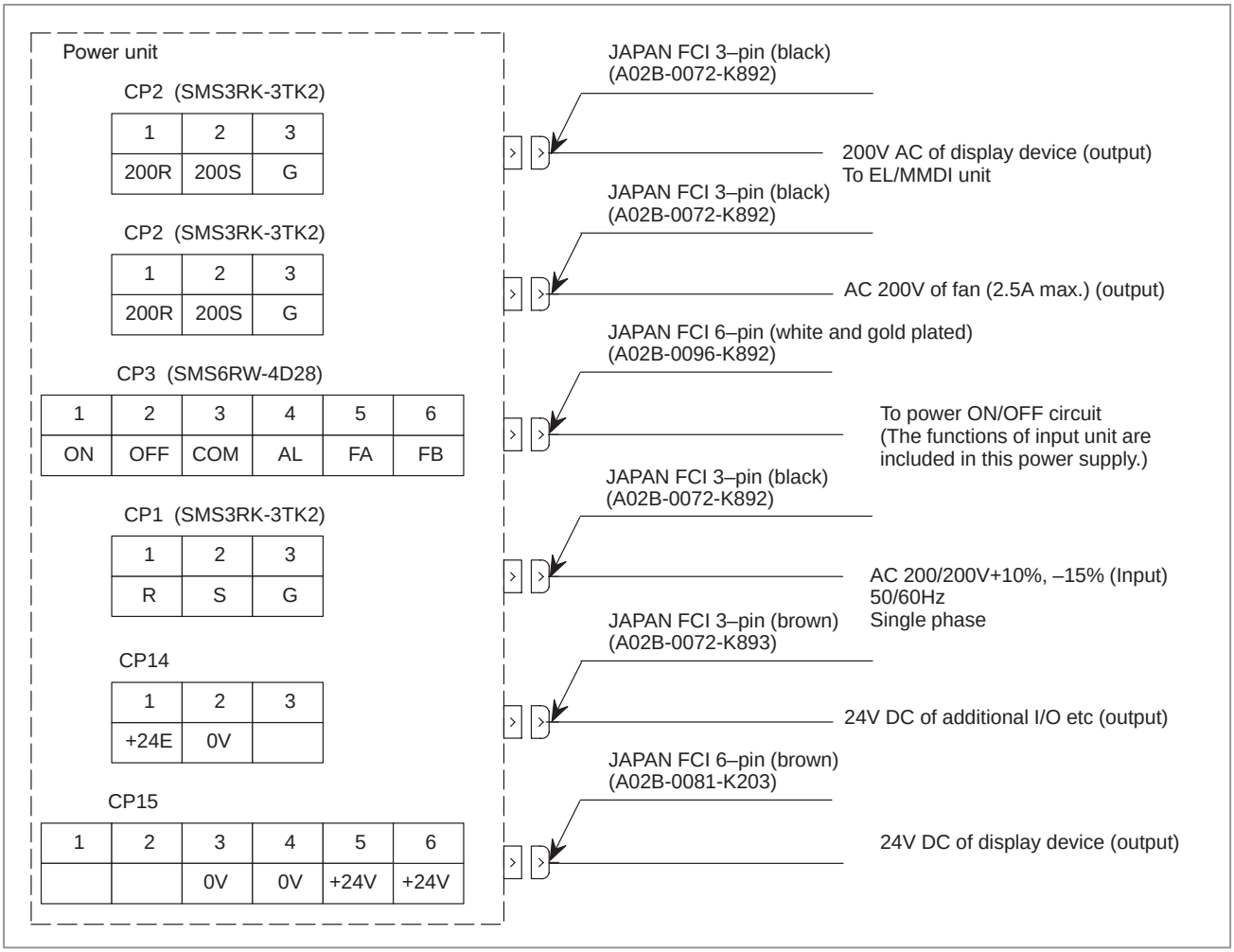
(1) When the ON/OFF switch is used:



(2) When the AC power supply 1 is turned on/off while the EON–COM and EOF–COM remain short–circuited:



5.3 CONNECTION OF INPUT UNIT BUILT–IN TYPE POWER UNIT (POWER SUPPLY UNIT AI)



1) Interface

CP3 : SMS6RW-4D28

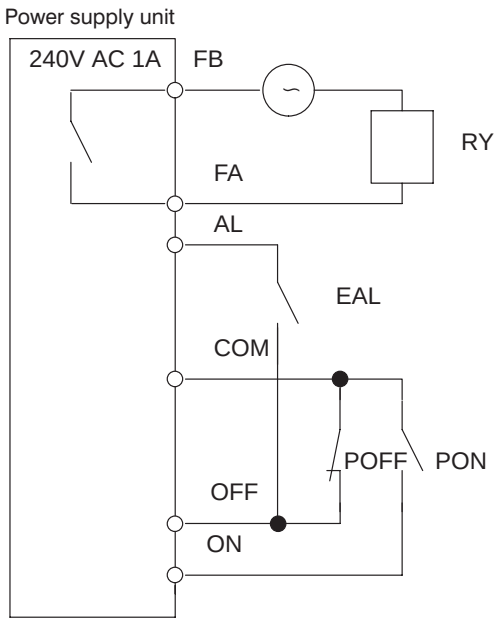
1	2	3	4	5	6
ON	OFF	COM	AL	FA	FB

ON
OFF
COM — Power ON/OFF contact signal input

AL — External alarm contact signal input
When an alarm occurs in any place other than this power supply unit, the contact signal from outside allows this power supply to be turned off.
When the contact EAL is closed in the circuit described in 2) the power output is turned off and the red ALM lamp located at the front panel of power supply unit lights up.
In this status, no power supply can be turned on by closing the contact PON .Open the contact POFF and cancel the alarm.
The external alarm contact signal input should be open in normal status.

FA
FB — Power supply alarm contact signal output
When a fuse is blown and an alarm occurs, these contact signal outputs are closed. On the other hand, they are open in normal status. The alarm display and cancel method are the same as those of external alarm contact signal input above.

2) Connection example

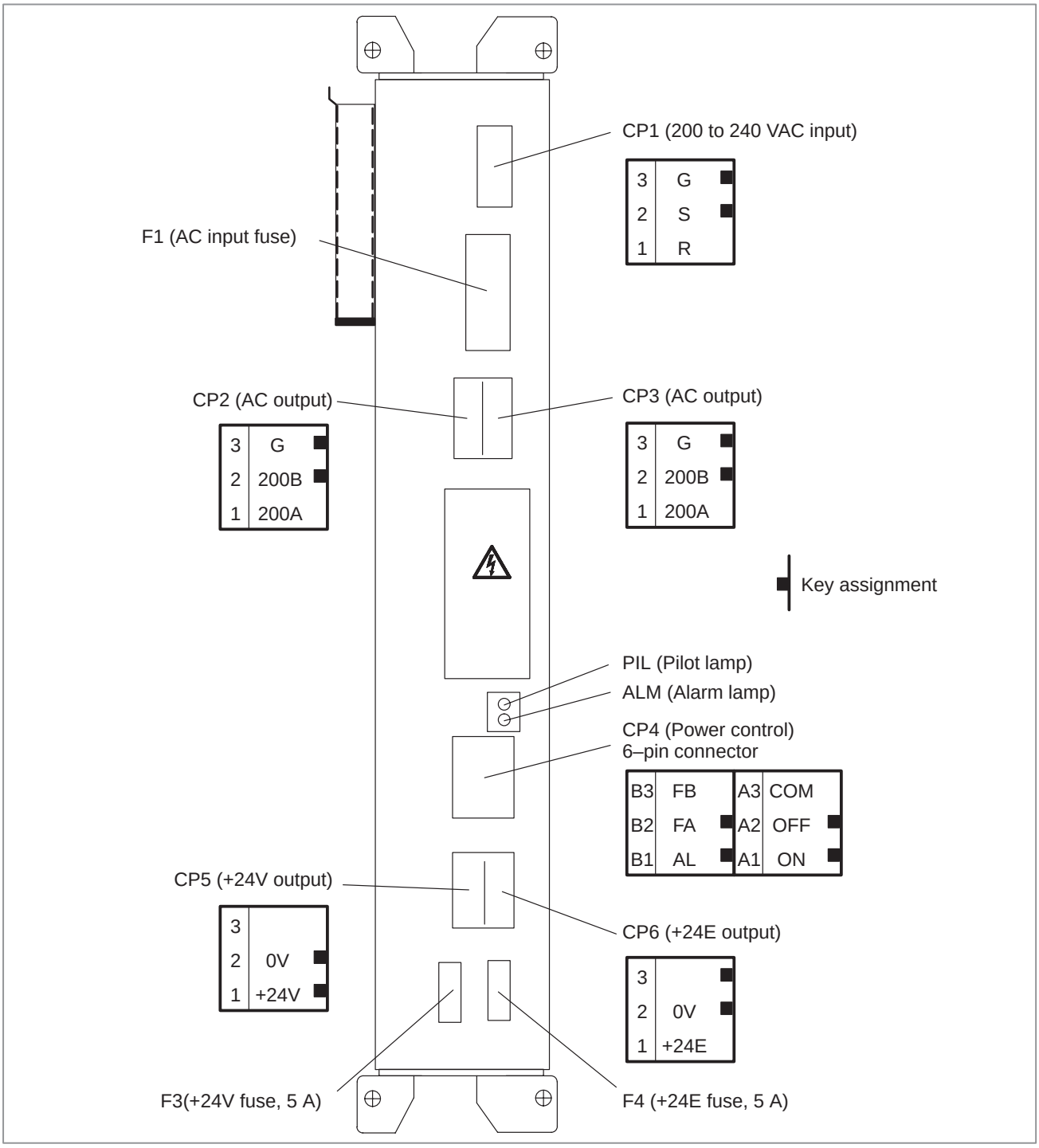


PON : Power–on switch.
POFF: Power–off switch.
EAL : External alarm contact thermostat, power alarm of external unit
RY : It is operated by the NC power alarm.

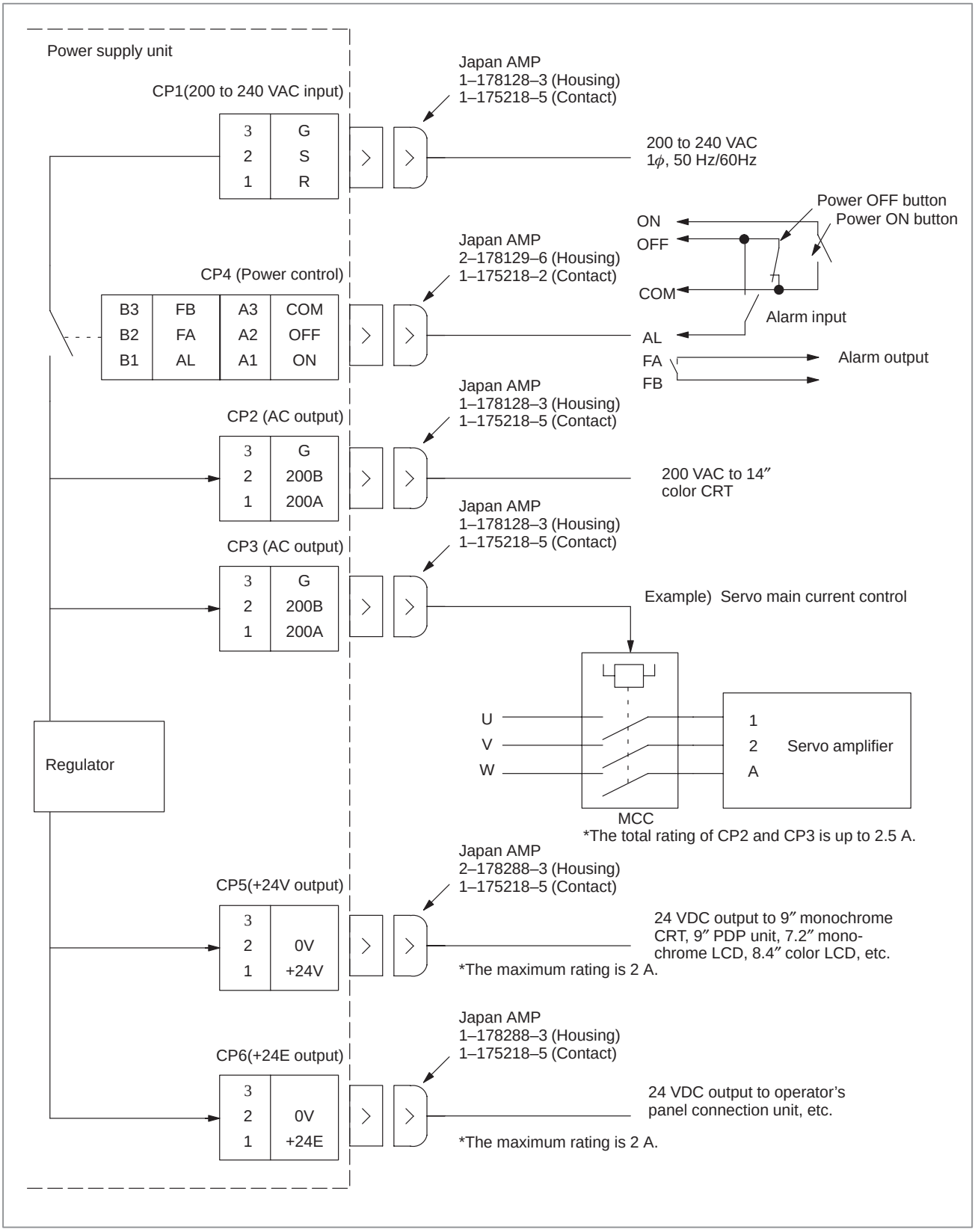
NOTE
1 Neither EAL nor RY is used in general system.
2 The contact capacity of PON, POFF, and EAL is as shown below:
50V DC 0.1A

5.4 CONNECTION OF THE INPUT UNIT BUILT–IN POWER SUPPLY UNIT AI (QUALIFYING FOR CE MARKING)

- **Signal assignment**



● Connection diagram



● Notes on using a power supply unit certified as conforming to safety standards

The power supply unit indicated below is certified as conforming to DIN VDE 0160 (German safety standard for power supplies) by TÜV Rhineland.

- Certified power supply unit

  A16B–1212–0950 (Order number: A02B–0098–H014)

- Operating requirements

  1) The cabinet to house the power supply unit must be of protection class IP54 or higher.
  2) An isolating transformer or surge absorber must be configured in the previous stage of the input power of the power supply unit. Without the isolating transformer or surge absorber, the power supply unit must not be connected to a factory power line.
  3) The power supply unit must be housed in a metal cabinet. A power supply unit or CNC control unit which is not sufficiently shielded by a metal cabinet may cause electromagnetic interference (EMI).

     This certification does not include certification of conformity to EMI standards.

6 CONNECTION OF MACHINE INTERFACE I/O

6.1 OVERVIEW

The Series 0 is provided with an I/O card as the standard machine interface I/O. The internal I/O card is available in six types, which provide different types of output signals and different numbers of I/O signals.

When the required I/O signals outnumber the I/O signals provided by the internal I/O card, an external I/O unit is connected as a supplement. To add I/O signals, an expansion I/O card or other unit is connected via a serial communication interface. This connection requires the use of a PMC–M card.

One serial communication interface is the FANUC I/O Link. The FANUC I/O Link is a serial interface enabling fast I/O signal (bit data) transfer between the CNC, cell controller, I/O Unit–A, Power Mate, and other units. When two or more units are connected to the FANUC I/O Link, one unit functions as a master unit while the other units function as slaves. The input signal statuses of the slave units are transferred to the master unit at regular intervals. The output signal from the master unit is transferred to the slave units. Multiple units can be connected to the FANUC I/O Link. This manual describes those units that can be used with the Series 0. For details of the other units, see the corresponding manual.

6.2 CONNECTION OF THE INTERNAL I/O CARD

The internal I/O card is available in six types, which have different output signals and different numbers of I/O signals.

Table 6.2 Internal I/O cards

	Output signal	Number of input signals	Number of output signals	Connector that can be used
I/O C5	Sink output	40	40	M1, M2
I/O C6		80	56	M1, M2, M18, M19
I/O C7		104	72	M1, M2, M18, M19, M20
I/O E1	DO common output	40	40	M201, M202
I/O E2		80	56	M201, M202, M218, M219
I/O E3		104	72	M201, M202, M218, M219, M220

NOTE
When using the third or fourth controlled axis, an M–series system requires an I/O–C7 or I/O–E3 card. In the case of a T–series system, an I/O–C5 or I/O–E1 card can also be used if the address of the third–axis/fourth–axis reference position return deceleration signal *DEC3 or *DEC4 is changed by specifying the corresponding parameter.

6.2.1 Machine Interface Signal Standard

- **Input signal standard**

(1) Direct current input signal A

The direct current input signal A is the signals transmitted form the machine tool to the CNC; the signals from the buttons, limit switches, relay contracts, or the proximity switches.

(a) The contracts of the machine tools side must satisfy the following conditions.

Capacity of the contracts:
30 VDC, 16mA or more
Leak current between contacts when circuit is open:
1 mA or less (26.4 V voltage)
Voltage fall between contacts when circuit is closed:
2 V or less (8.5 mA current) (including voltage fall of cables)

If the contact cannot obtain a sufficient voltage drop of less than 2V between contacts when closed by such as a 2–line type adjacent switch, if the delay time of the input signal stipulated in Fig. 6.2.1(b) is allowed to extend to a maximum of 30 ms, a voltage drop of less than 3.5V between contacts when closed (current less than 8.5 mA, 1 including voltage drop of cable) can also be used. However, a unit in which operation is guaranteed at a current of 4 mA must be used.

(b) The receiver circuit of this signal is as Fig. 6.2.1 (a).
The time standard of this signal is of Fig. 6.2.1 (b).

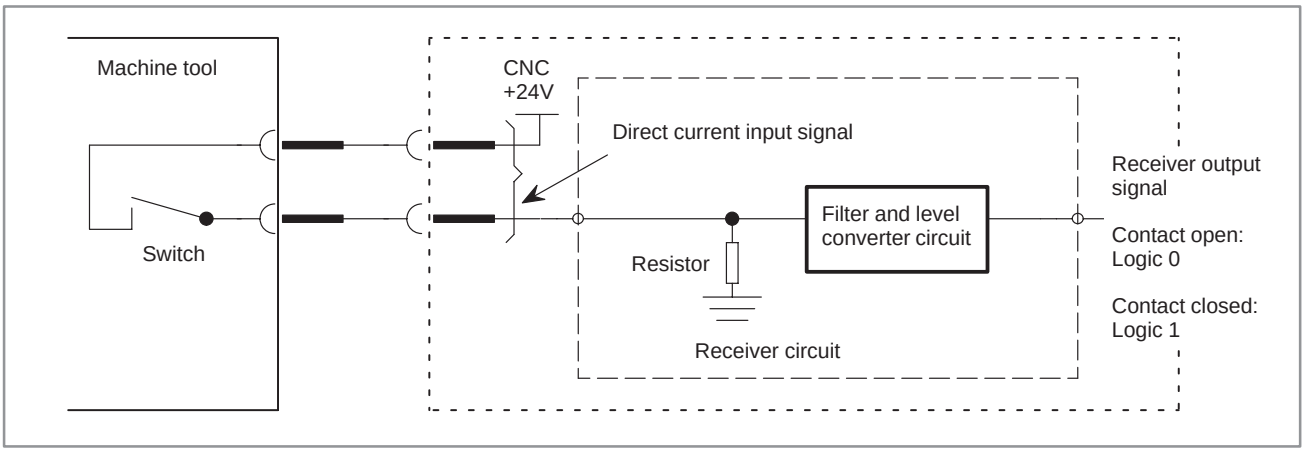


Fig. 6.2.1 (a) Receiver circuit

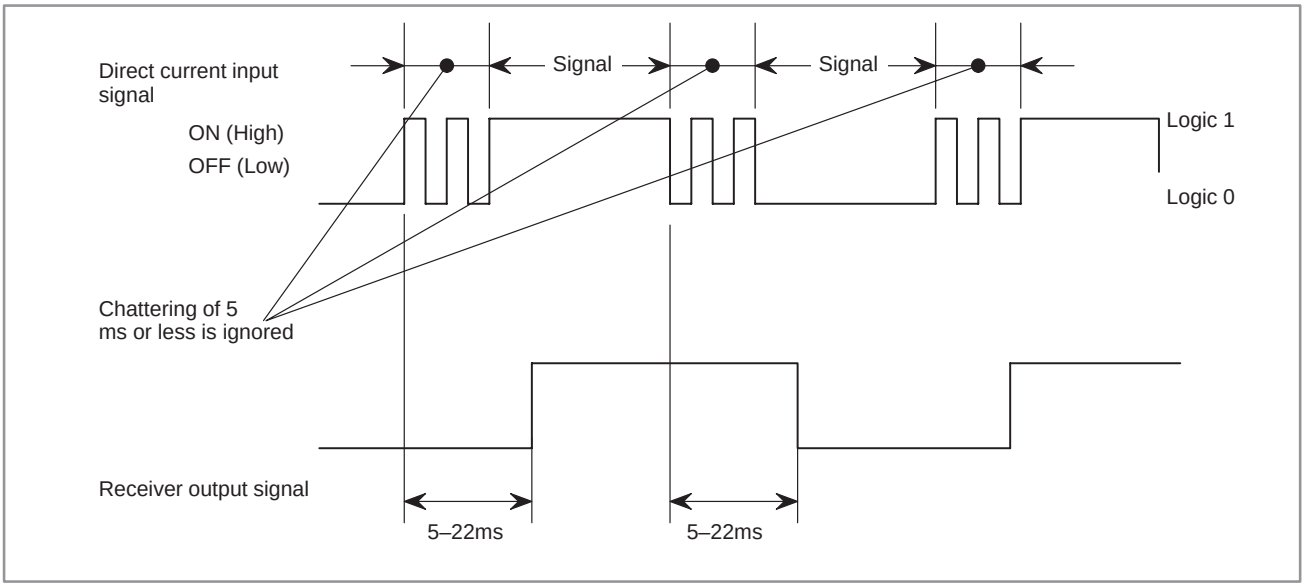


Fig. 6.2.1 (b) Width of input signals and delay time

(2) Direct current input signal B

The direct current input signal B is the signals transmitted from the machine tool to the NC in high speed.

(a) The contracts of the machine tool side must satisfy the following conditions.

Capacity of the contracts:
30VDC, 16mA or more
Leak current between contacts when circuit is open:
1 mA or less (26.4 V voltage)
Voltage fall between contacts when circuit is closed:
2 V or less (8.5 mA current)
(including voltage fall of cables)

(b) The receiver circuit of this signal is as Fig. 6.2.1 (c).

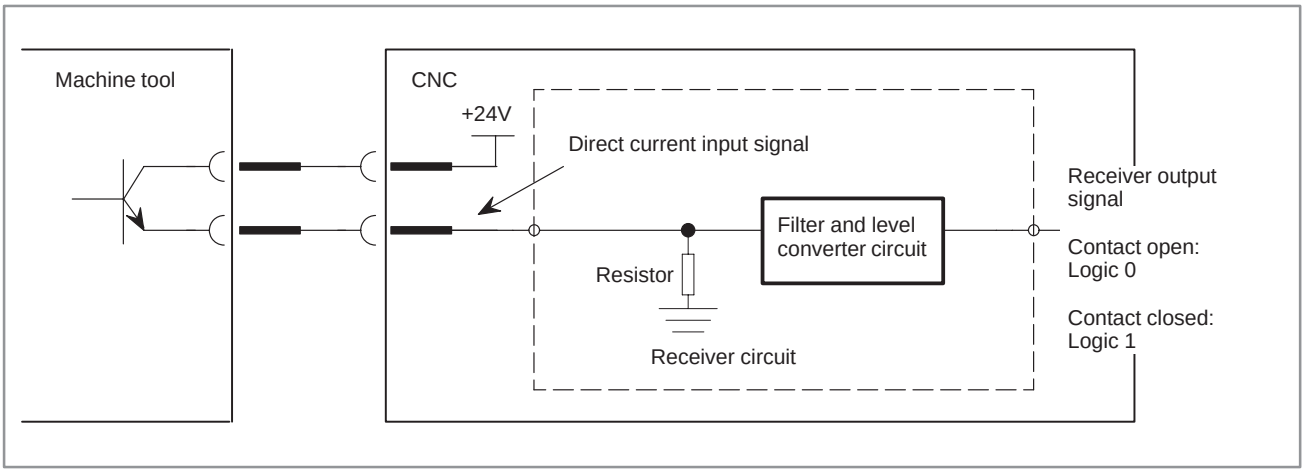


Fig. 6.2.1 (c) Receiver circuit

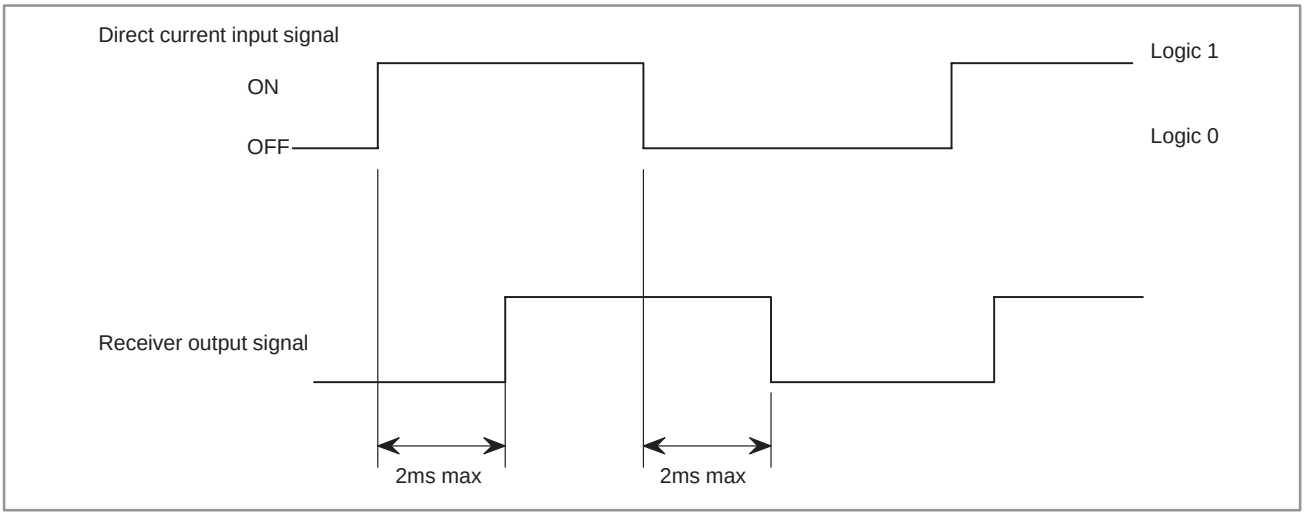


Fig. 6.2.1 (d) Width of input signals and delay time

(3) Selection of common line

There are two types of direct current input signal. Fig. 6.2.1 (e) shows a sample connection for the first type: an input signal fixed to the sink input. Fig. 6.2.1 (f) shows a sample connection for the second type: an input signal which can be set to either sink input or source input according to the wiring in the machine.

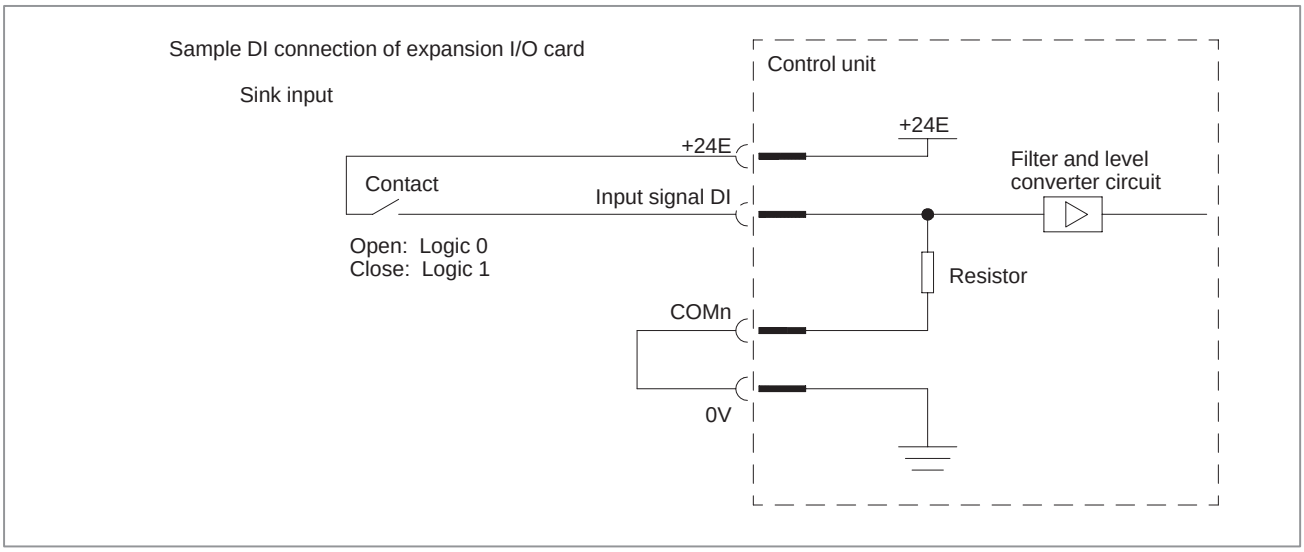


Fig. 6.2.1 (e)

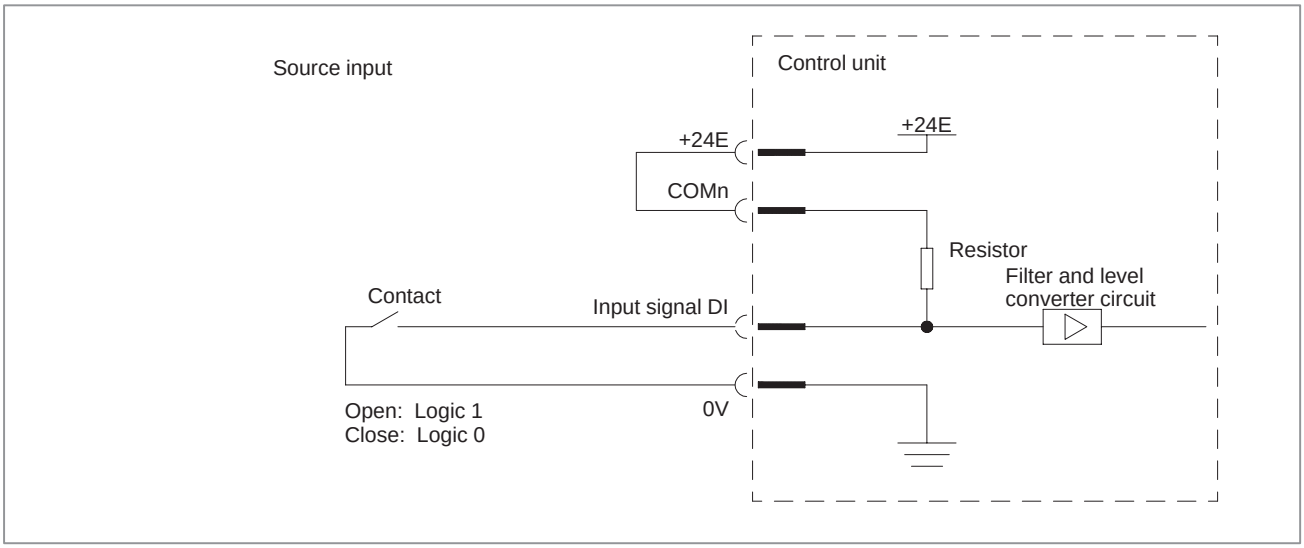


Fig. 6.2.1 (f)

WARNING
The COMn signal must always be connected to 0 V or 24 V. Do not leave it open.

- **Output signal standard**

A direct current output signal is used to drive a light emitting diode (LED) indicator or a relay of a machine. For the direct current output signal, a non–insulation interface (direct current output signal A) and a DO common output interface (direct current output signal B) are supported. The non–insulation interface uses an NPN transistor as a driver, while the DO common output interface uses a semiconductor contact.

(1) Direct current output signal A

(a) Rating of the output transistor

(i) Maximum load current when the output is on

Up to 200 mA, including an instantaneous value

(ii)Saturation voltage when the output is on

1.6 Vmax, 1.0 Vtyp at a load current of 200 mA

(iii)Withstand voltage when the output is off

Up to 24 V +20%, including an instantaneous value

(iv)Leakage current when the output is off

Up to 100 μA

(b) Output circuit

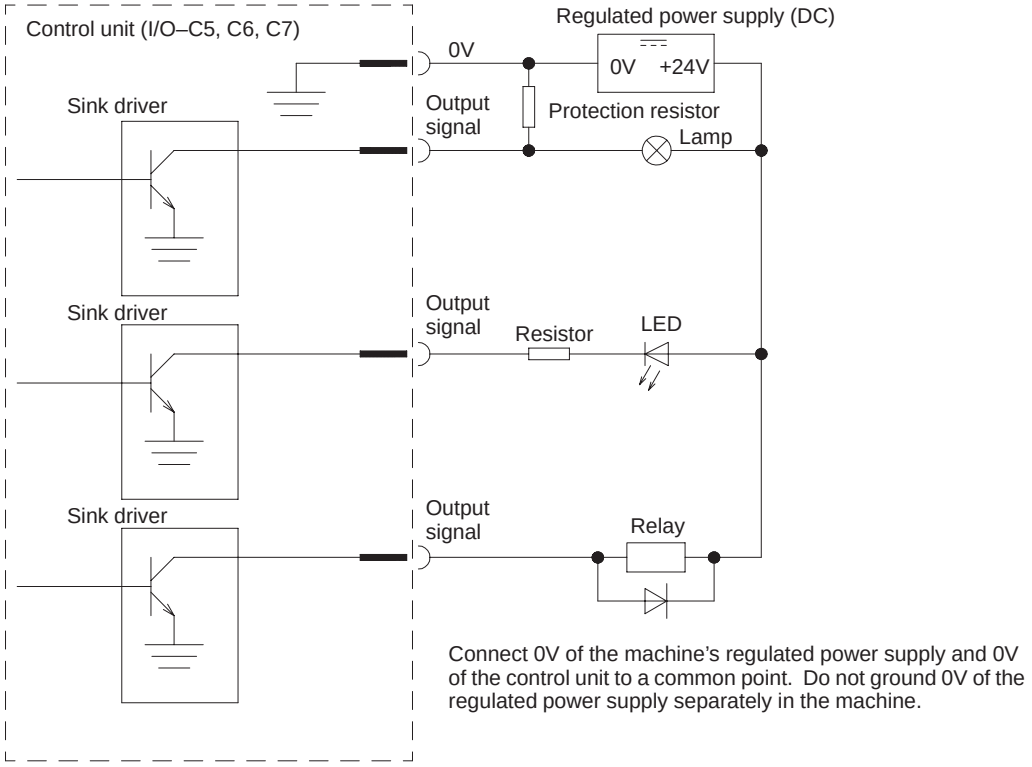


Fig. 6.2.1 (g)

(c) When connecting inductive loads like relays in the machine tool side, a spark killer must be inserted. The spark killer must also be inserted as near as possible (within 20 cm) to the load. When connecting capacitance load in the machine tool side, a resistance for current limit must be inserted in series, and it must be used within the rated current and voltage, including instantaneous current and voltage.

(d) When lighting a lamp directly with a solid state relay output, a rush current may flow to damage the driver. A protection circuit as Fig. 6.2.1 (n) must be inserted and it must be used within the rated voltage and current, including instantaneous current and voltage.

(2) Direct current output signal B

(a)Driver ratings

(i) Maximum load current when the output is on

Up to 250 mA, including an instantaneous value

(ii)Maximum voltage drop when the output is on

6 I_L (volt)

where I_L is a load current

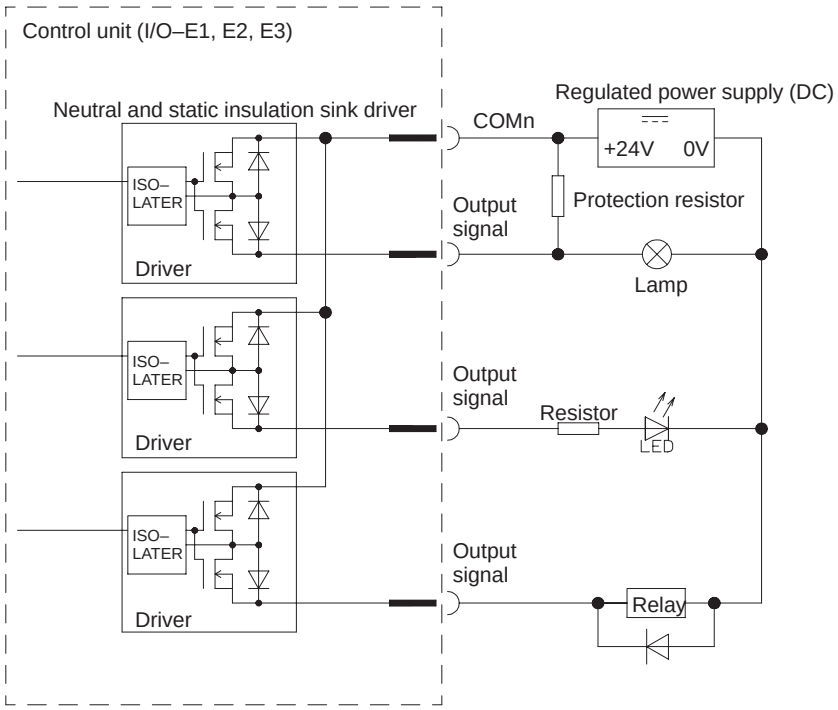
(Example) When I_L is 250 mA, 6 I_L = 6 × 0.25 = 1.5 (V)

(iii)Withstand voltage when the output is off

Up to 50 V, including an instantaneous value

(iv)Leakage current when the output is off

Up to 100 μA



This sample circuit uses I/O cards E1, E2, and E3 as a source DO. The voltage of the regulated power supply can be adjusted from 24 to 48 VDC. The polarity of the regulated power supply is inverted when the I/O card is used as a sink DO. In this case, the orientation of the LED and surge suppression diode must be inverted.

Fig. 6.2.1 (h)

NOTE

1 When connecting inductive loads like relays in the machine tool side, a spark killer must be inserted. The spark killer must also be inserted as near as possible (within 20 cm) to the load. When connecting capacitance load in the machine tool side, a resistance for current limit must be inserted in series, and it must be used within the rated current and voltage, including instantaneous current and voltage.

2 When lighting a lamp directly with a solid state relay output, a rush current may flow to damage the driver. A protection circuit as below must be inserted and it must be used within the rated voltage and current, including instantaneous current and voltage.

6.2.2 System without PMC

- **Signal assignment of the internal I/O card**

The figure below shows the signal assignment of the internal I/O card. The CNC for machining center (M series) systems and that for lathe (T series) systems use different signals.

NOTE
Series 0–PD is in need of PMC. See Subsec. 6.2.5 for machine interface I/O of Series 0–PD.

(1) M–series signals

(a) Signals input from the machine to the CNC (system without PMC)

PMC ADDRESS	DGN NO.	BIT NUMBER #7	#6	#5	#4	#3	#2	#1	#0 (M Series)
X000	000								
		M18–36	M18–21	M18–5	M18–35	M18–20	M18–34	M18–19	M18–33
X002	002								
		M18–24	M18–8	M18–38	M18–23	M18–7	M18–37	M18–22	M18–6
X004	004	4NG							
		M18–11	M18–41	M18–26	M18–10	M18–40	M18–25	M18–9	M18–39
X006	006								
		M18–45	M18–14	M18–44	M18–13	M18–43	M18–12	M18–42	M18–27
X008	008	SKIP		*RILK			ZAE	YAE	XAE
		M18–49	M18–18	M18–48	M18–17	M18–47	M18–16	M18–46	M18–15
X010	010								
		M20–11	M20–41	M20–26	M20–10				
X012	012								
		M20–45	M20–14	M20–44	M20–13	M20–43	M20–12	M20–42	M20–27
X014	014								
		M20–49	M20–18	M20–48	M20–17	M20–47	M20–16	M20–46	M20–15
X016	016	HX/ROV1		*DECX		–X	+X	SBK	BDT
		M1–6		M1–38		M1–20	M1–21	M1–11	M1–12
X017	017	HY/ROV2		*DECY		–Y	+Y	MLK	*ILK
		M1–7		M1–39		M1–22	M1–23	M1–9	M1–10
X018	018	HZ/DRN		*DECZ		–Z	+Z		
		M1–8		M1–40		M1–24	M1–25		
X019	019	H4		*DEC4		–4	+4		
		M20–40		M20–25		M20–9	M20–39		
X020	020	ZRN	*SSTP	SOR	SAR	FIN	ST	MP2	MP1/MINP
		M1–13	M1–37	M1–5	M1–14	M1–15	M1–16	M1–17	M1–18
X021	021	ERS	RT	*SP	*ESP	*OV8	*OV4	*OV2	*OV1
		M1–41	M1–26	M1–27	M1–19	M1–33	M1–34	M1–35	M1–36
X022	0022	PN8	PN4	PN2	PN1	KEY	MD4	MD2	MD1
		M1–42	M1–43	M1–44	M1–45	M1–46	M1–47	M1–48	M1–49

(b) Signals output from the CNC to the machine (system without PMC)

PMC ADDRESS	DGN NO.	BIT NUMBER #7	#6	#5	#4	#3	#2	#1	#0	M Series
Y048	048	OP	SA	STL	SPL		ZPZ/EF	ZPY	ZPX	
		M2–5	M2–6	M2–7	M2–8		M2–27	M2–26	M2–25	
Y049	049	MA			ENB	DEN		RST	AL	
		M2–9			M2–41	M2–22		M2–23	M2–24	
Y050	050			DST		TF	SF		MF	
				M2–10		M2–20	M2–19		M2–21	
Y051	051	M28	M24	M22	M21	M18	M14	M12	M11	
		M2–33	M2–34	M2–35	M2–36	M2–37	M2–38	M2–39	M2–40	
Y052	052	S28	S24	S22	S21	S18	S14/GR30	S12/GR20	S11/GR10	
		M2–11	M2–12	M2–13	M2–14	M2–15	M2–16	M2–17	M2–18	
Y053	053	T28	T24	T22	T21	T18	T14	T12	T11	
		M2–42	M2–43	M2–44	M2–45	M2–46	M2–47	M2–48	M2–49	
Y080	080									
		M19–8	M19–7	M19–6	M19–5	M19–4	M19–3	M19–2	M19–1	
Y082	082									
		M19–16	M19–15	M19–14	M19–13	M19–12	M19–11	M19–10	M19–9	
Y084	084					ZP4				
		M20–36	M20–21	M20–5	M20–35	M20–20	M20–34	M20–19	M20–33	
Y086	086									
		M20–24	M20–8	M20–38	M20–23	M20–7	M20–37	M20–22	M20–6	

(2) T–series signals

(a) Signals input from the machine to the CNC (system without PMC)

PMC ADDRESS	DGN NO.	BIT NUMBER #7	#6	#5	#4	#3	#2	#1	#0	T Series
X000	000									
		M18–36	M18–21	M18–5	M18–35	M18–20	M18–34	M18–19	M18–33	
X002	002									
		M18–24	M18–8	M18–38	M18–23	M18–7	M18–37	M18–22	M18–6	
X004	004									
		M18–11	M18–41	M18–26	M18–10	M18–40	M18–25	M18–9	M18–39	
X006	006									
		M18–45	M18–14	M18–44	M18–13	M18–43	M18–12	M18–42	M18–27	
X008	008	SKIP						ZAE	XAE	
		SKIP			SKIP4	SKIP3	SKIP2	ZAE	XAE	← 0–GCC
		M18–49	M18–18	M18–48	M18–17	M18–47	M18–16	M18–46	M18–15	
X010	010									
		M20–11	M20–41	M20–26	M20–10					

X012	012								
		M20–45	M20–14	M20–44	M20–13	M20–43	M20–12	M20–42	M20–27
X014	014								
		M20–49	M20–18	M20–48	M20–17	M20–47	M20–16	M20–42	M20–15
X016	016	HX/ROV1		*DECX		–X	+X	SBK	BDT
		M1–6		M1–38		M1–20	M1–21	M1–11	M1–12
X017	017	HZ/ROV2		*DECZ		–Z	+Z	MLK	MPI/MINP
		M1–7		M1–39		M1–22	M1–23	M1–9	M1–10
X018	018	DRN		*+LZ		GR2	GR1		
		M1–8		M1–40		M1–24	M1–25		
X019	019	*DEC3		*DEC4					
		M20–40		M20–25		M20–9	M20–39		
X020	020	ZRN	*SSTP	SOR	SAR	FIN	ST	STLK	MIX
		M1–13	M1–37	M1–5	M1–14	M1–15	M1–16	M1–17	M1–18
X021	021	ERS	RT	*SP	*ESP	*OV8	*OV4	*OV2	*OV1
		M1–41	M1–26	M1–27	M1–19	M1–33	M1–34	M1–35	M1–36
X022	022	PN8	PN4	PN2	PN1	KEY	MD4	MD2	MD1
		M1–42	M1–43	M1–44	M1–45	M1–46	M1–47	M1–48	M1–49

(b) Signals output from the CNC to the machine (system without PMC)

PMC ADDRESS	DGN NO.	BIT NUMBER #7	#6	#5	#4	#3	#2	#1	#0 (T Series)
Y048	048	OP	SA	STL	SPL			ZPZ	ZPX
		M2–5	M2–6	M2–7	M2–8		M2–27	M2–26	M2–25
Y049	049	MA			ENB	DEN		RST	AL
		M2–9			M2–41	M2–22		M2–23	M2–24
Y050	050			DST		TF	SF		MF
				M2–10		M2–20	M2–19		M2–21
Y051	051	M28	M24	M22	M21	M18	M14	M12	M11
		M2–33	M2–34	M2–35	M2–36	M2–37	M2–38	M2–39	M2–40
Y052	052	S28	S24	S22	S21	S18	S14	S12	S11
		M2–11	M2–12	M2–13	M2–14	M2–15	M2–16	M2–17	M2–18
Y053	053	T28	T24	T22	T21	T18	T14	T12	T11
		M2–42	M2–43	M2–44	M2–45	M2–46	M2–47	M2–48	M2–49
Y080	080								
		M19–8	M19–7	M19–6	M19–5	M19–4	M19–3	M19–2	M19–1
Y082	082								
		M19–16	M19–15	M19–14	M19–13	M19–12	M19–11	M19–10	M19–9
Y084	084					AP4			
		M20–36	M20–21	M20–5	M20–35	M20–20	M20–34	M20–19	M20–33
Y086	086								
		M20–24	M20–8	M20–38	M20–23	M20–7	M20–37	M20–22	M20–6

6.2.3 Descriptions on Signals

Refer to another function version for the descriptions on signals.

6.2.4 Signal Connection with Power Magnetic Cabinet

Following are signal connection with power magnetic cabinet.

M series power magnetic interface

Control unit

M1(MR–50RMD)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0V	0V	0V	0V	SOR	HX ROV1	HY ROV2	HZ DRN	MLK	*ILK	SBK	BDT	ZRN	SAR	FIN	ST	MP2	MP1 MINP
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	*ESP	–X	+X	–Y	+Y	–Z	+Z	RZ	*SP		+24E	+24E	+24E	+24E			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
*OV8	*OV4	*OV2	*OV1	*SSTP	*DECX	*DECY	*DECZ	ERS	PN8	PN4	PN2	PN1	KEY	MD4	MD2	MD1	

M2(MR–50RMD)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0V	0V	0V	0V	OP	SA	STL	SPL	MA	DST	S28	S24	S22	S21	S18	S14 GR30	S12 GR20	S11 GR10
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	SF	TF	MF	DEN	RST	AL	ZPX	ZPY	ZPZ EF								
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
M28	M24	M22	M21	M18	M14	M12	M11	ENB	T28	T24	T22	T21	T18	T14	T12	T11	

M18(MR–50RMD)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
										4NG				XAE	ZAE		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
													YAE		*RILK	SKIP	

M20(MR–50RMD)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
								–4									
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
		ZP4					*DEC4				CONG						
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
						+4	H4									SKIP	

J1

J2

J30

J32

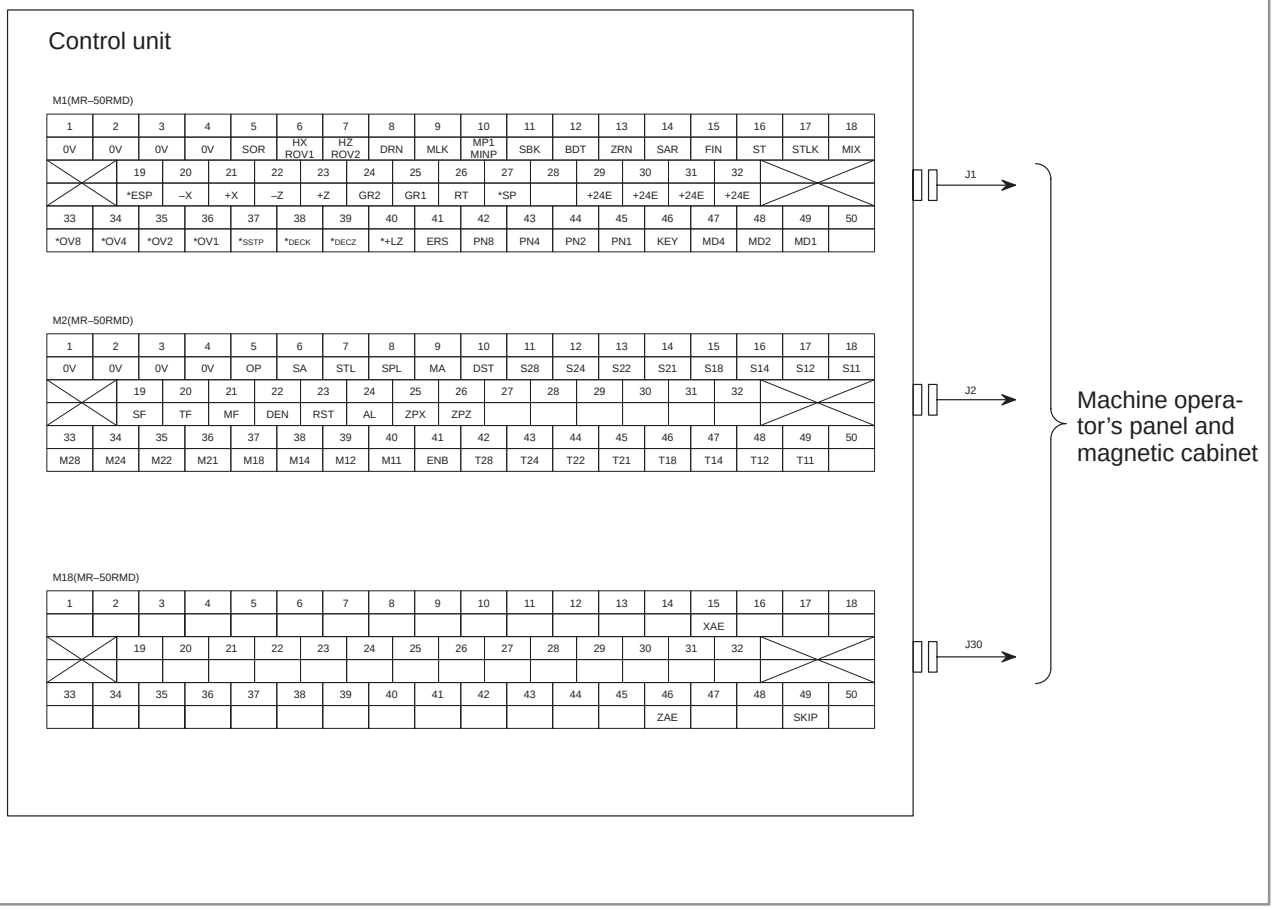
Machine operator's panel and magnetic cabinet

NOTE

Use unified shield cable for signal connection of J1 and J2.

Recommended cable specification A66L–0001–0042 (7/0.18 50 cores)

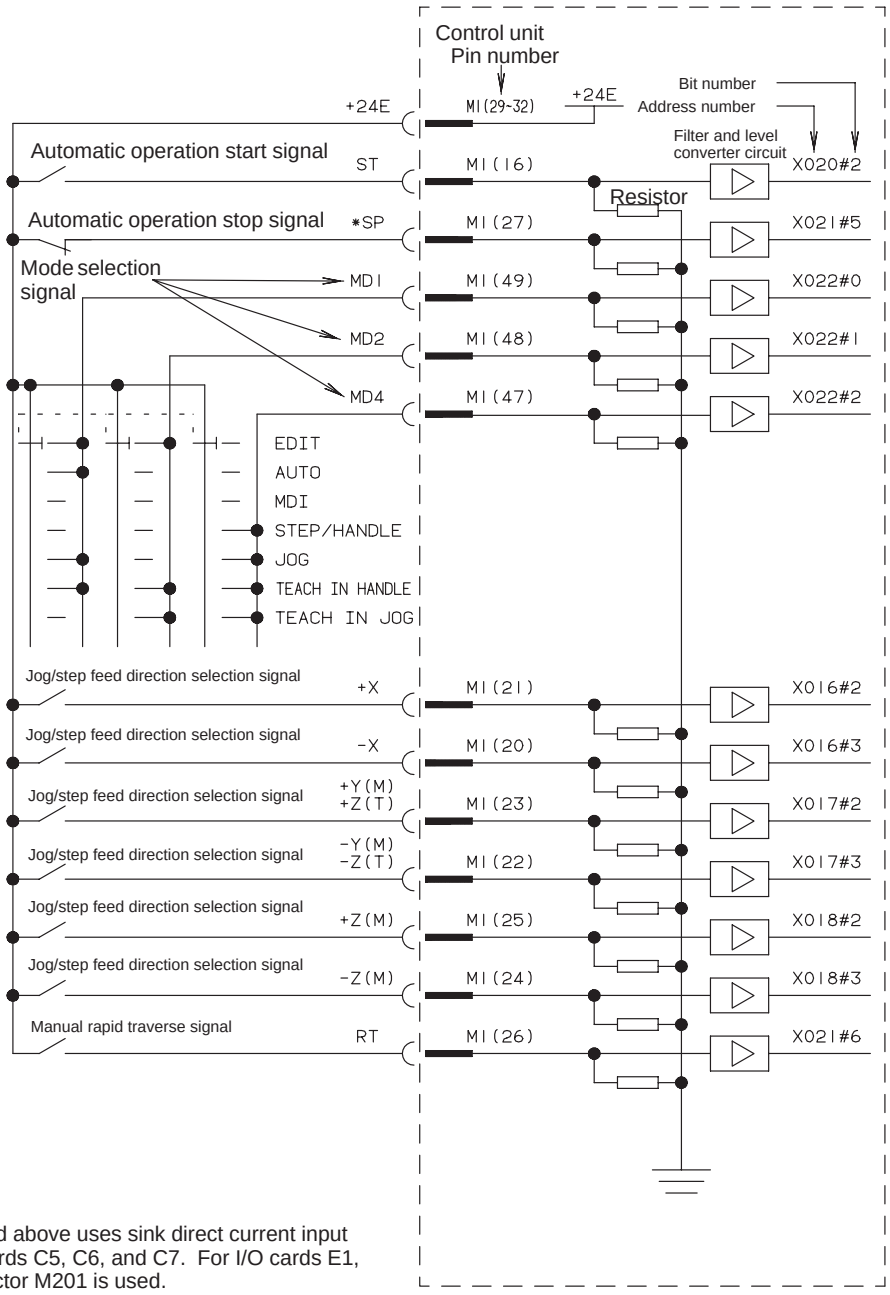
T series power magnetic interface



NOTE

Use unified shield cable for signal connection of J1 and J2.

Recommended cable specification A66L–0001–0042 (7/0.18 50 cores)



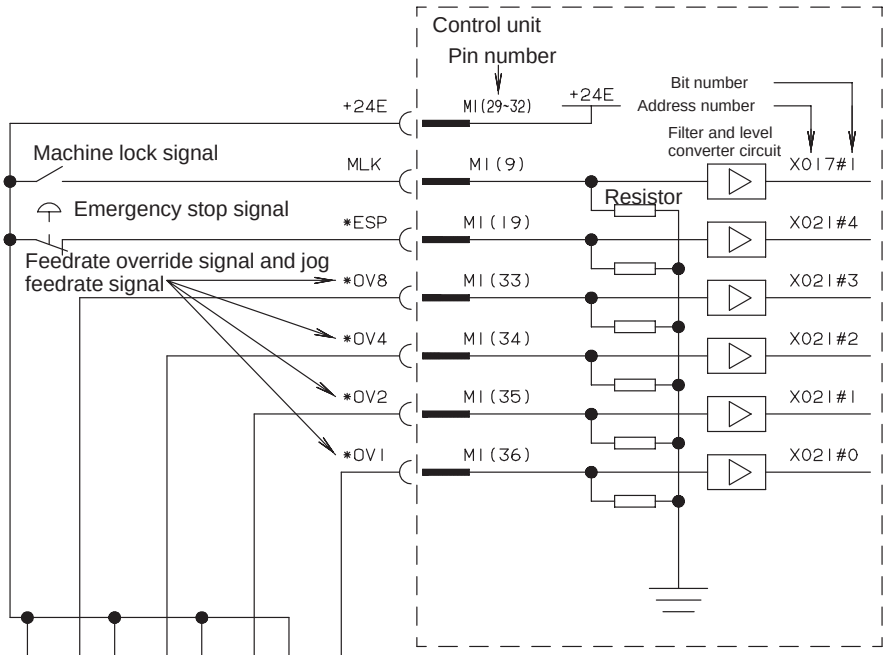
The circuit indicated above uses sink direct current input signal A and I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connector M201 is used.

CAUTION

The mode selection signal uses a gray code. To ensure the correct operation of the NC at mode switching, use a rotary switch with make–before–break contacts.

NOTE

(M) . . . . . M series
(T) . . . . . T series



TYPE A

0	0	0
10	2.0	0.08
20	3.2	0.12
30	5.0	0.2
40	7.9	0.3
50	12.6	0.5
60	20	0.8
70	32	1.2
80	50	2.0
90	79	3.0
100	126	5.0
110	200	8.0
120	320	12
130	500	20
140	790	30
150	1260	50

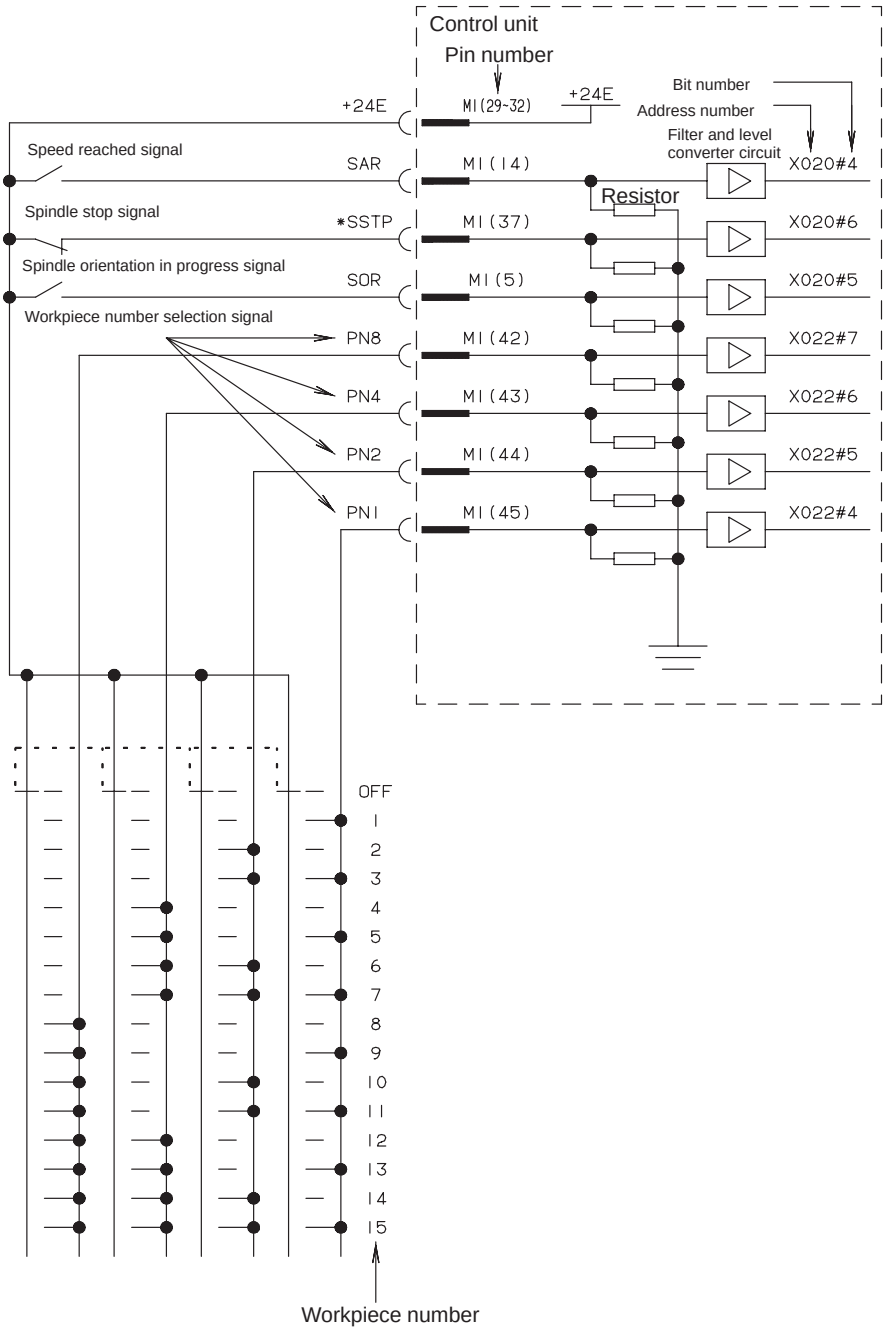
TYPE B

150	1260	50
140	790	30
130	500	20
120	320	12
110	200	8.0
100	126	5.0
90	79	3.0
80	50	2.0
70	32	1.2
60	20	0.8
50	12.6	0.5
40	7.9	0.3
30	5.0	0.2
20	3.2	0.12
10	2.0	0.08
0	0	0

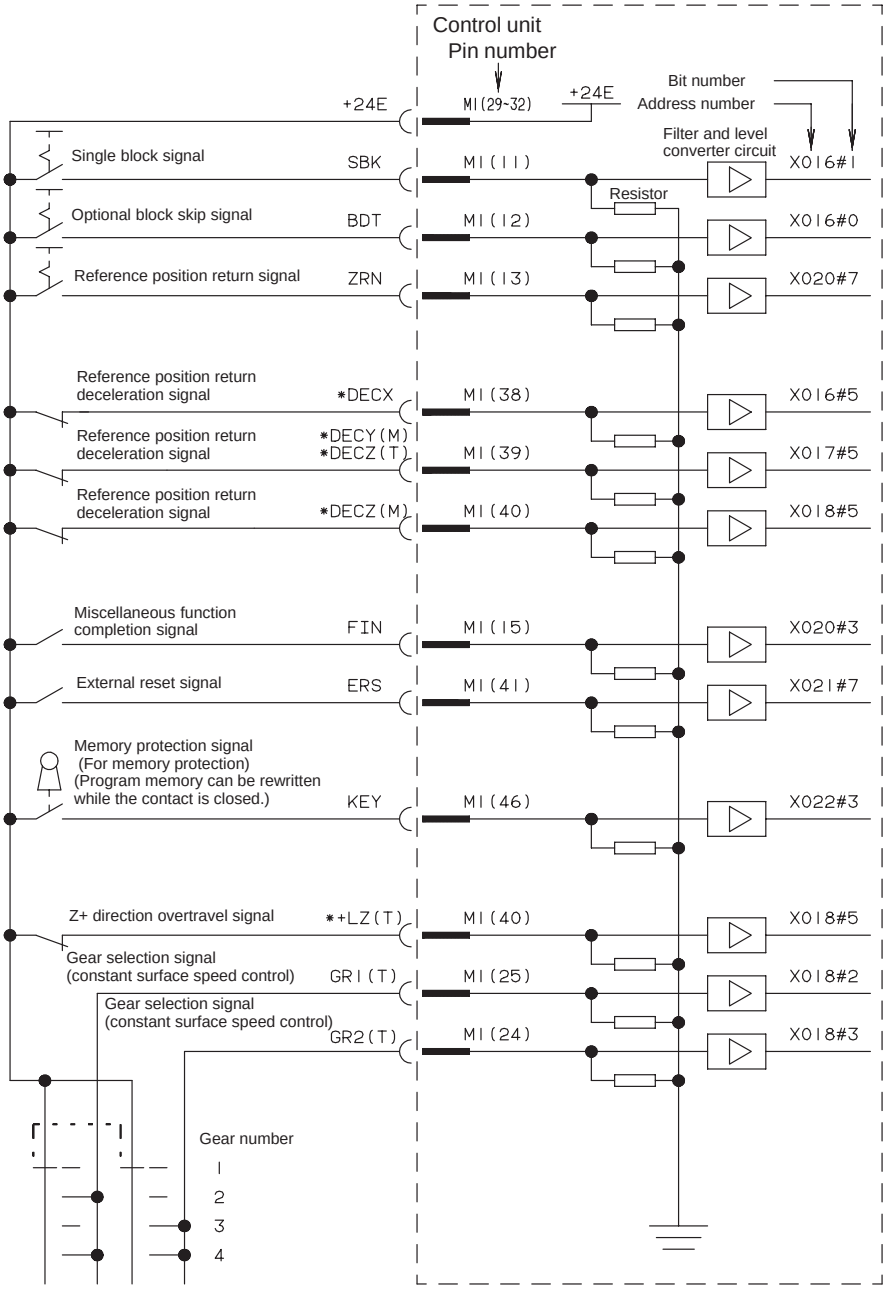
Jog feedrate (inch/min)
Jog feedrate (mm/min)
Override value (%)

Type–A or Type–B setting can be made by specifying the corresponding parameter.

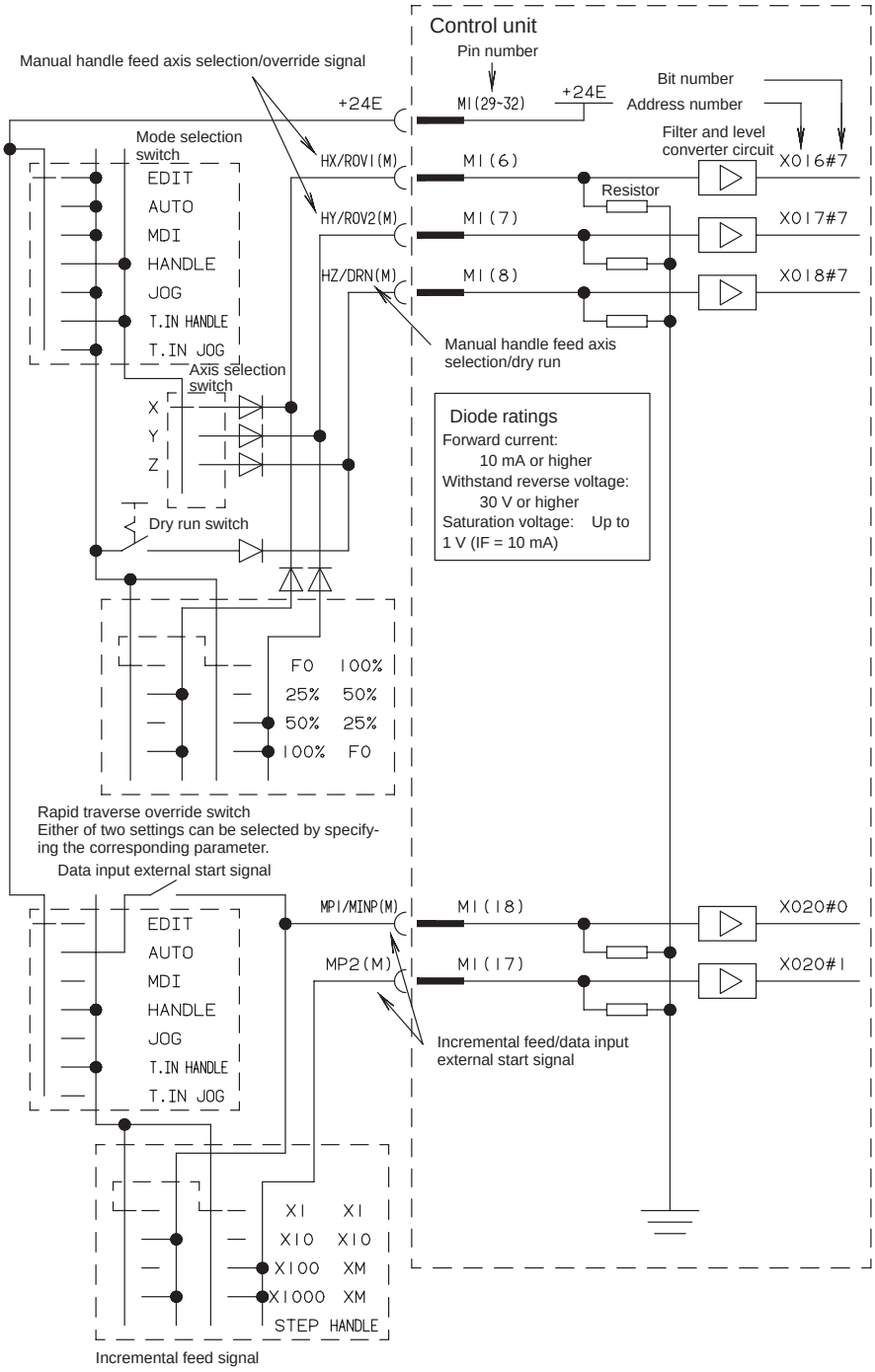
The circuit indicated above uses sink direct current input signal A and I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connector M201 is used.



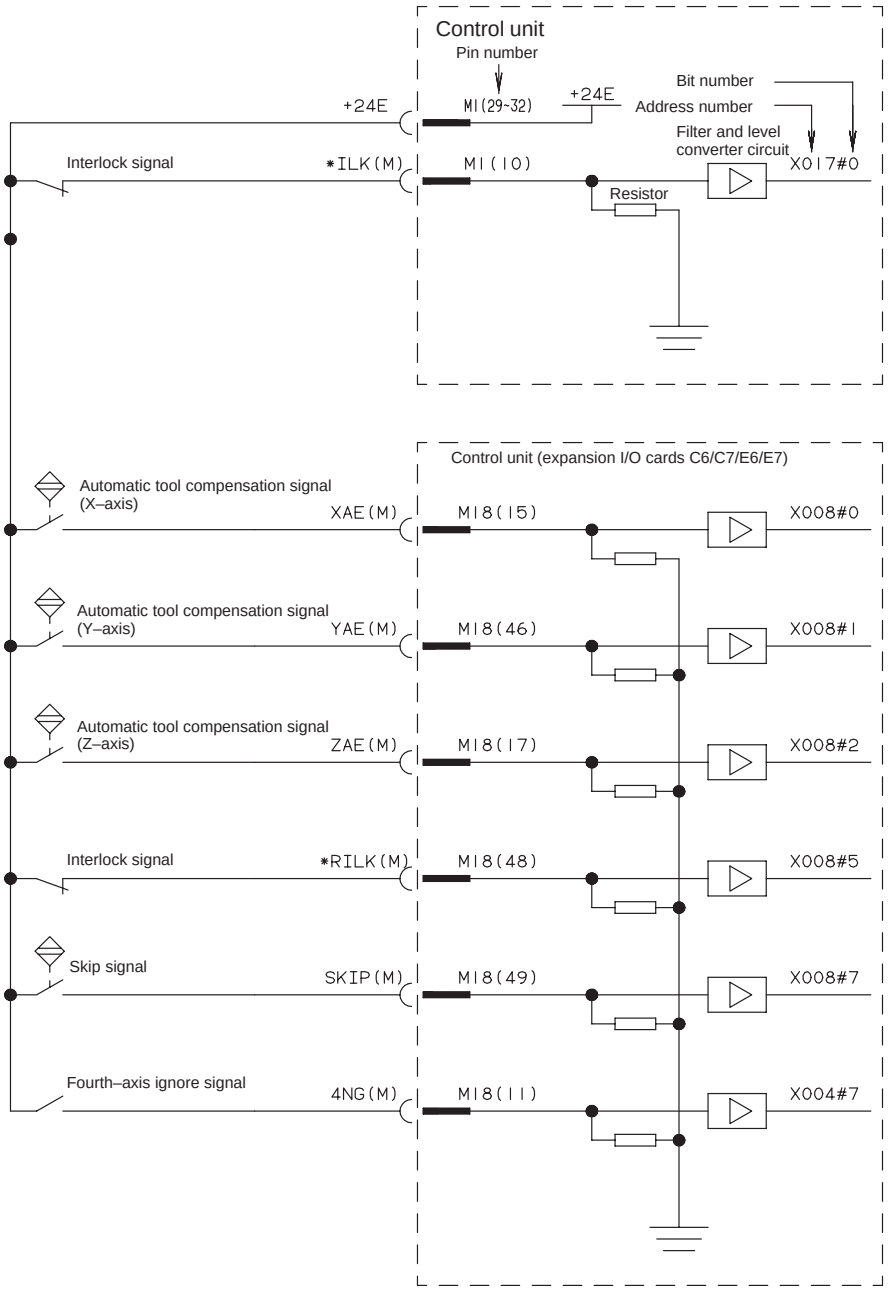
The circuit indicated above uses sink direct current input signal A and I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connector M201 is used.



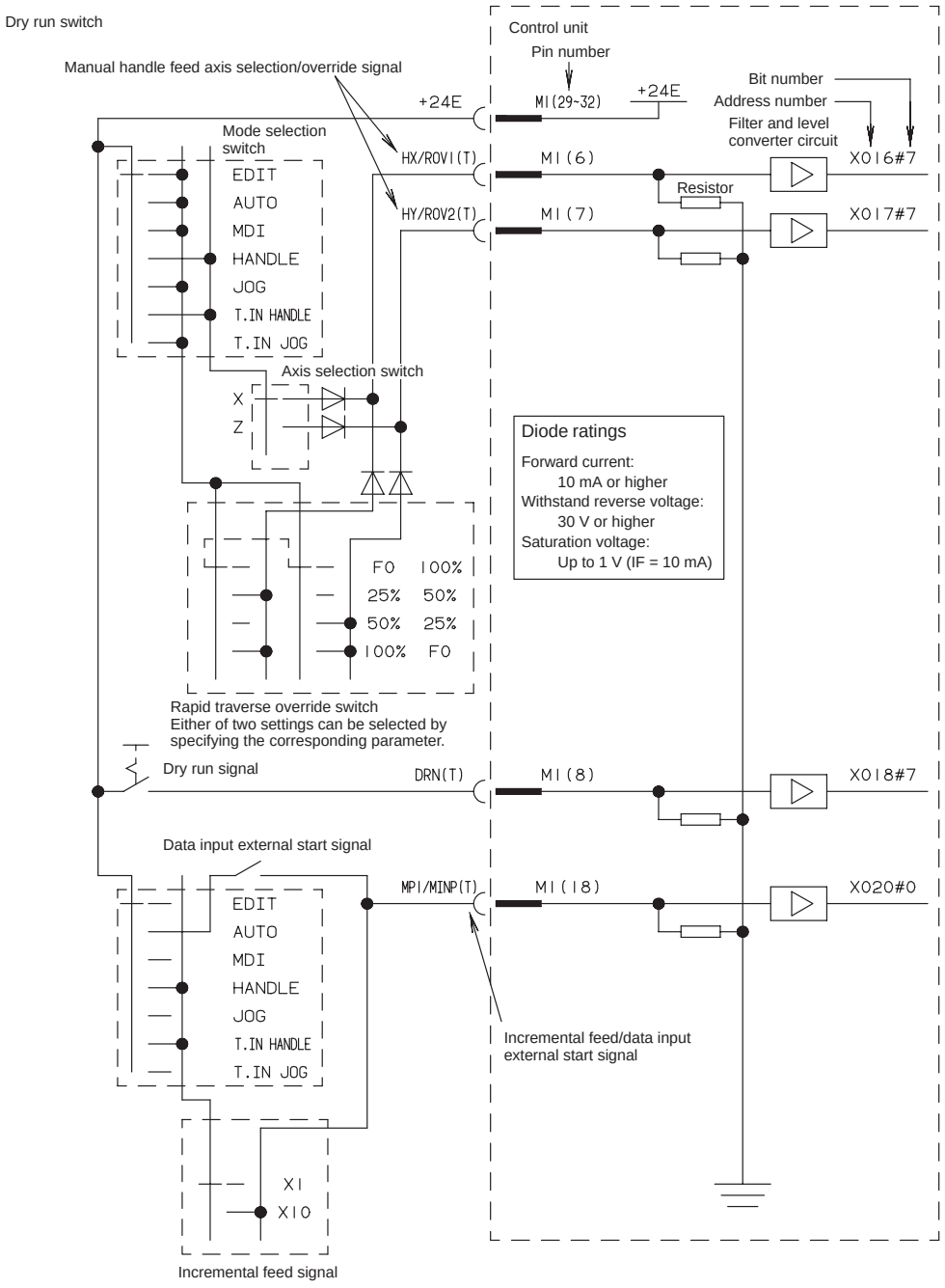
The circuit indicated above uses sink direct current input signal A and I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connector M201 is used.



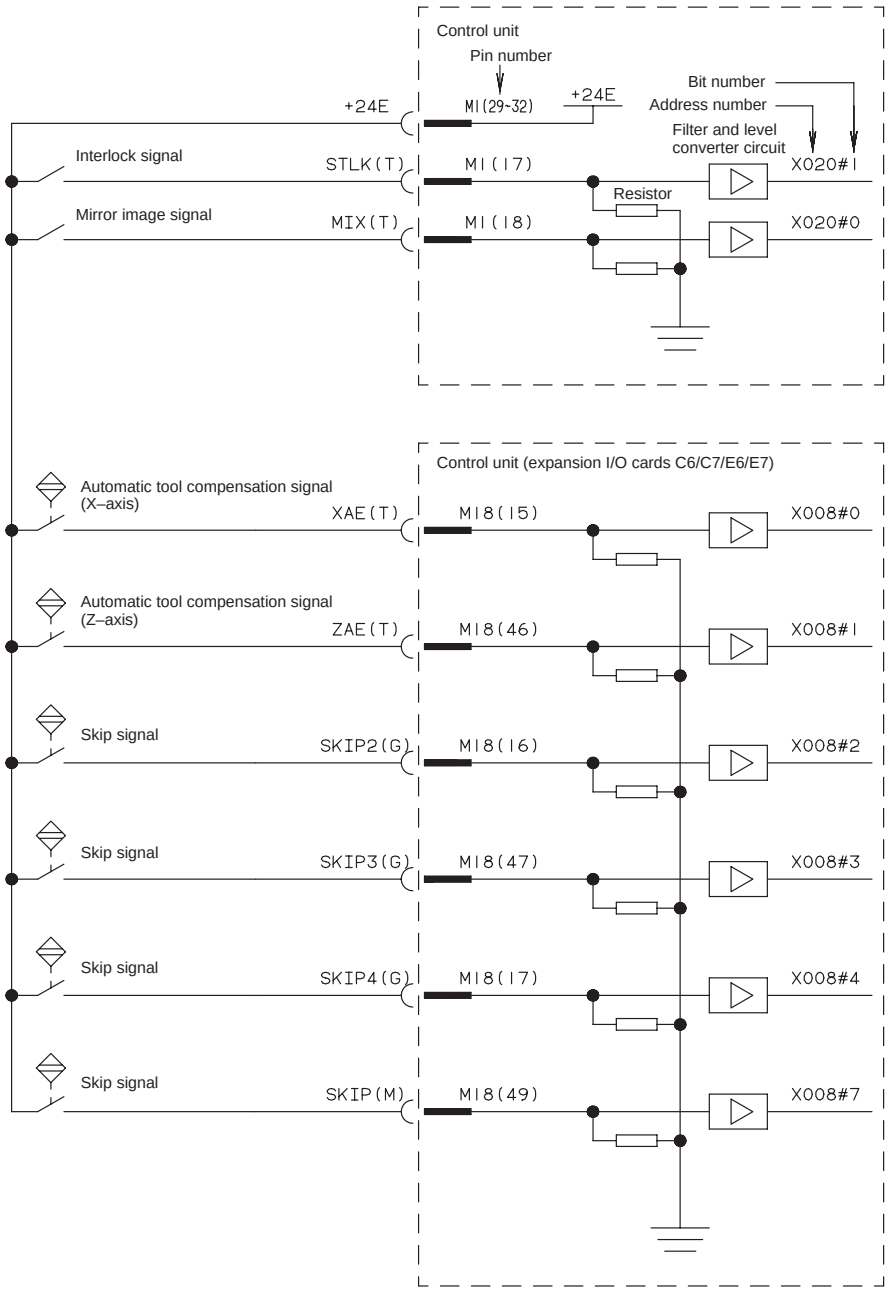
All the signals indicated above are M–series signals. The circuit indicated above uses sink direct current input signal A and I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connector M201 is used.



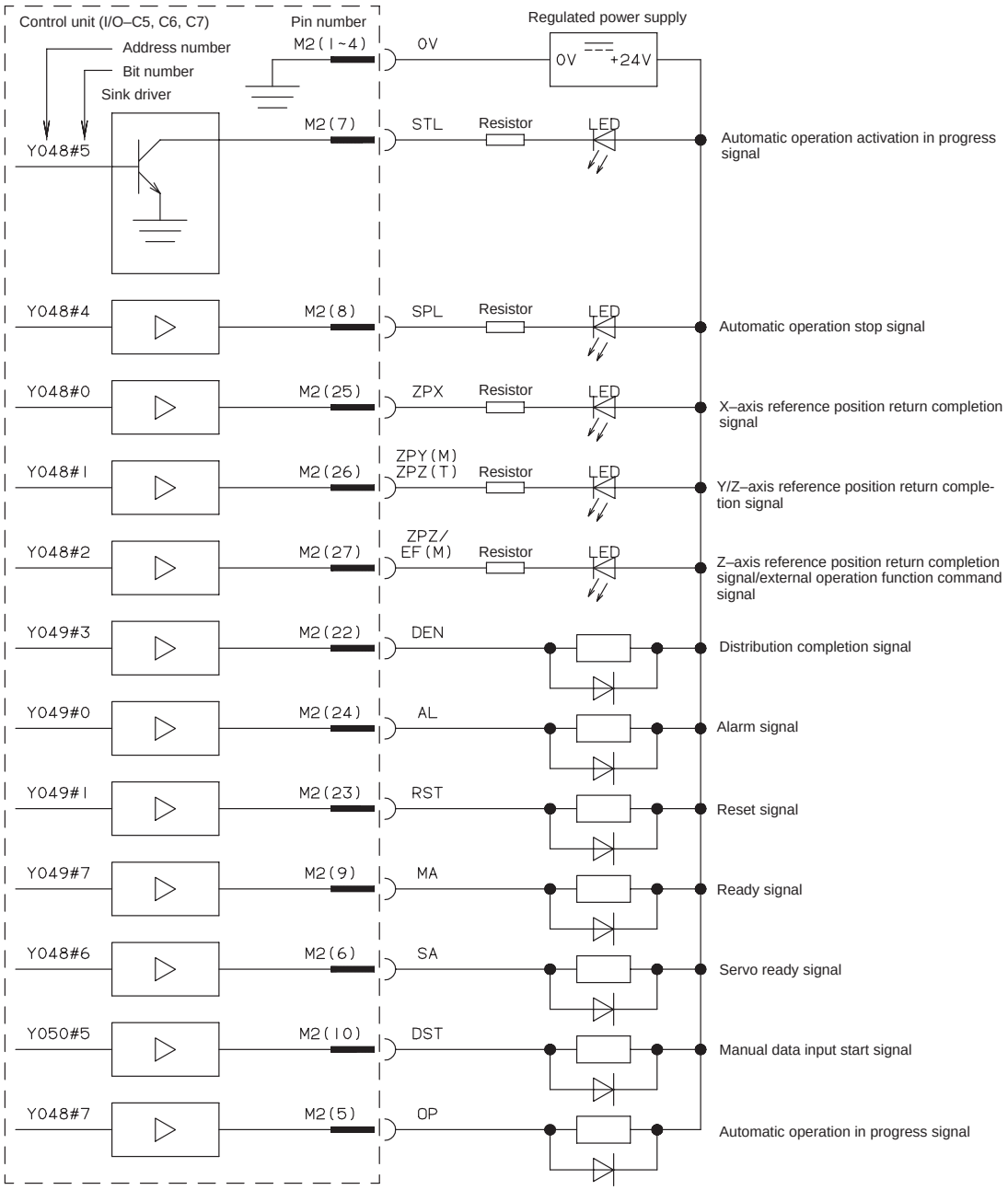
All the signals indicated above are M–series signals. *ILK and 4NG are sink direct current input signals A, and XAE, YAE, ZAE, *RILK, and SKIP are sink direct current input signals B. The circuit indicated above uses I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connectors M1 and M18 should be replaced with M201 and M218, respectively.



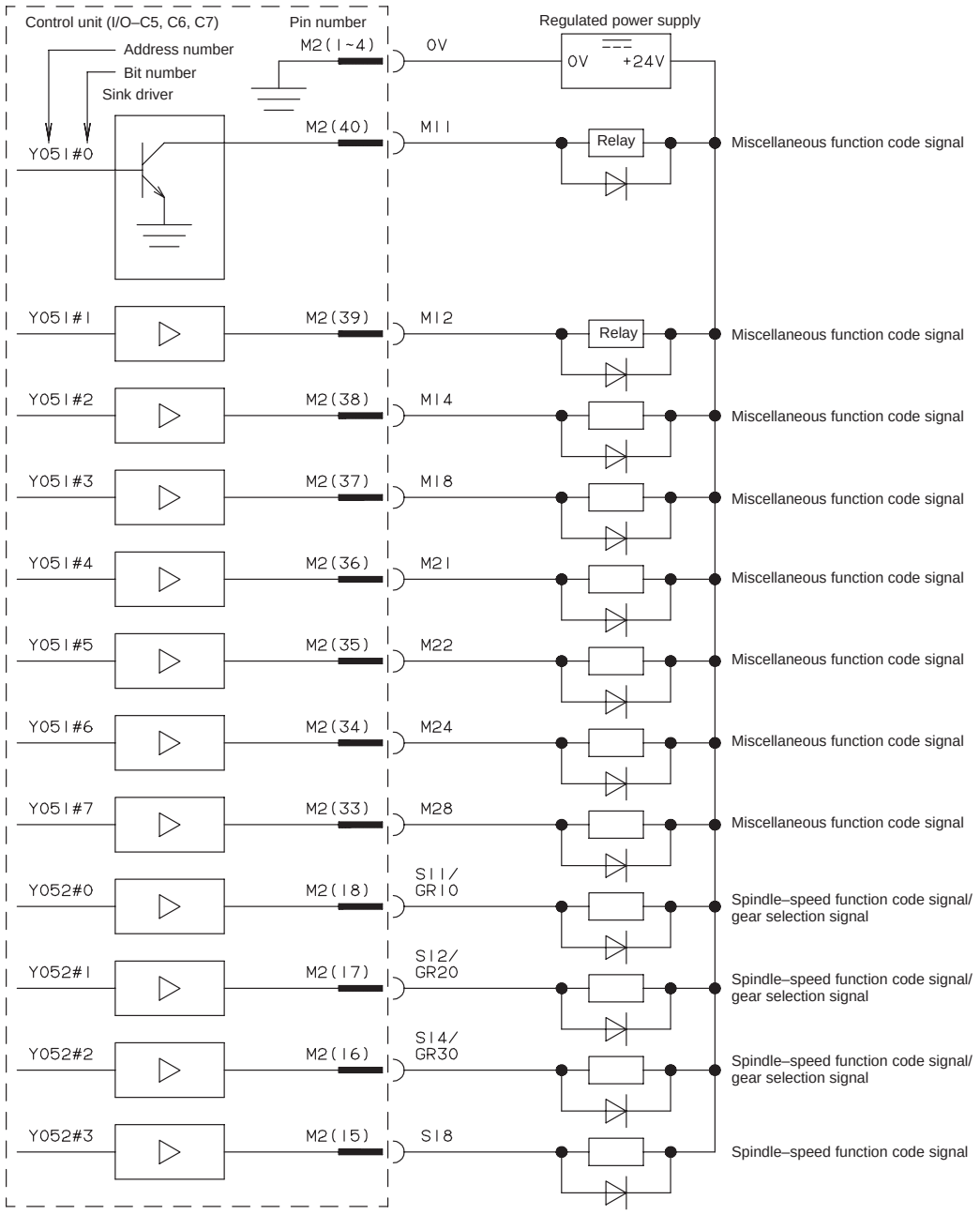
All the signals indicated above are T–series signals. The circuit indicated above uses sink direct current input signal A and I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connector M201 is used.



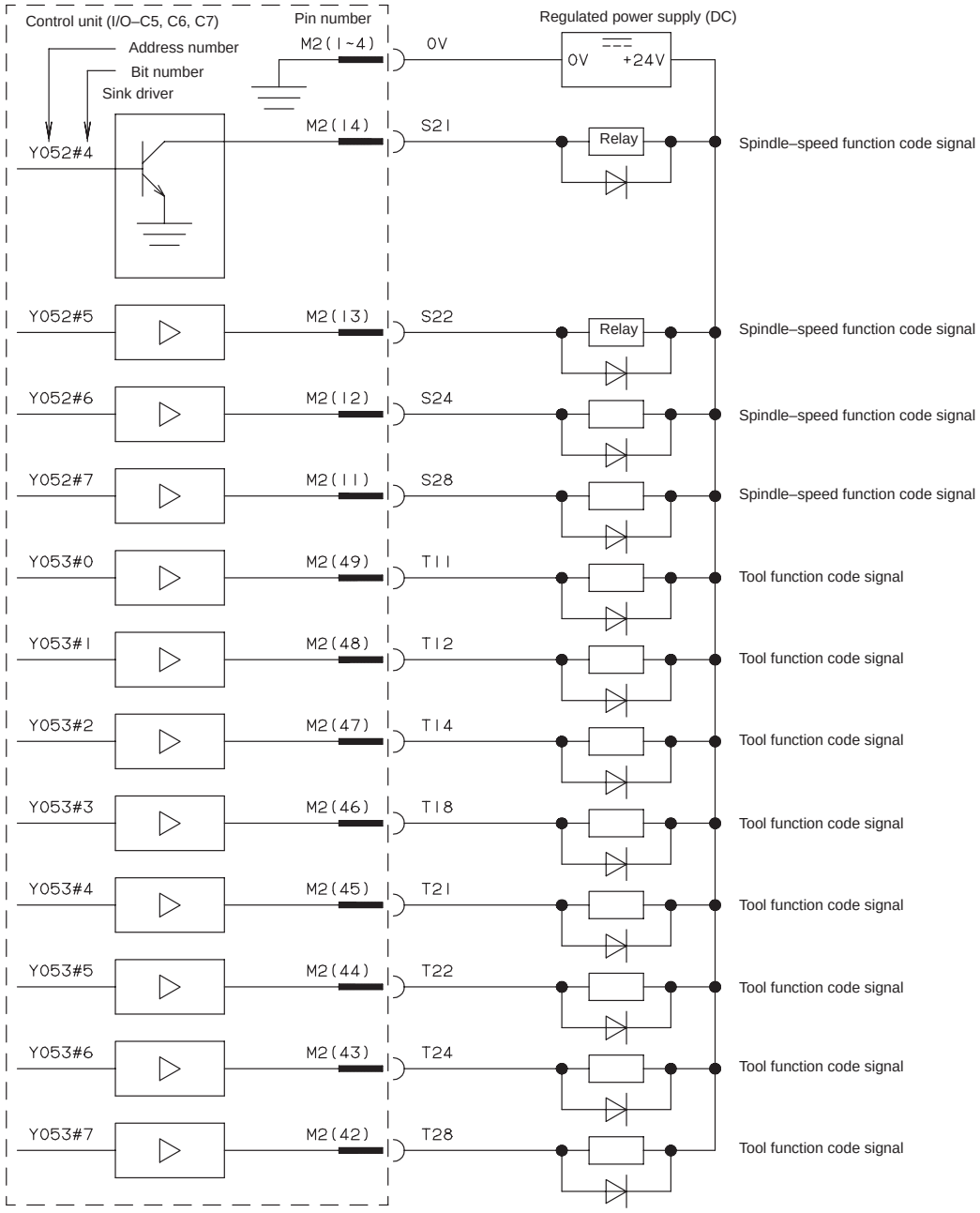
All the signals indicated above are T–series signals. STLK and MIX are sink direct current input signals A, and XAE, ZAE, SKIP2, SKIP3, SKIP4, and SKIP are sink direct current input signals B. The circuit indicated above uses I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connectors M1 and M18 should be replaced with M201 and M218, respectively.



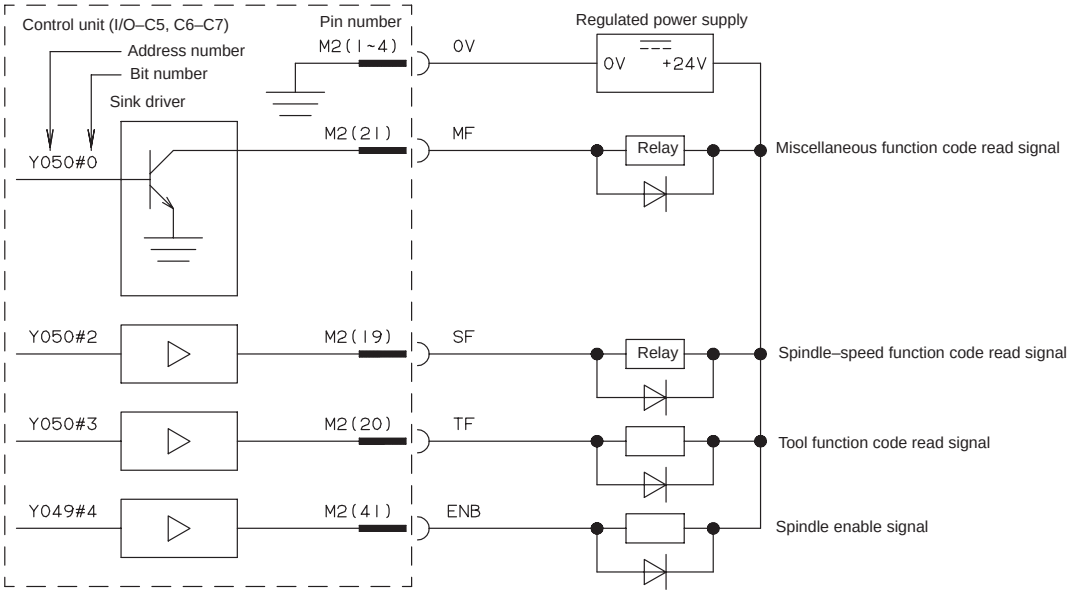
The circuit indicated above uses sink I/O cards C5, C6, and C7.



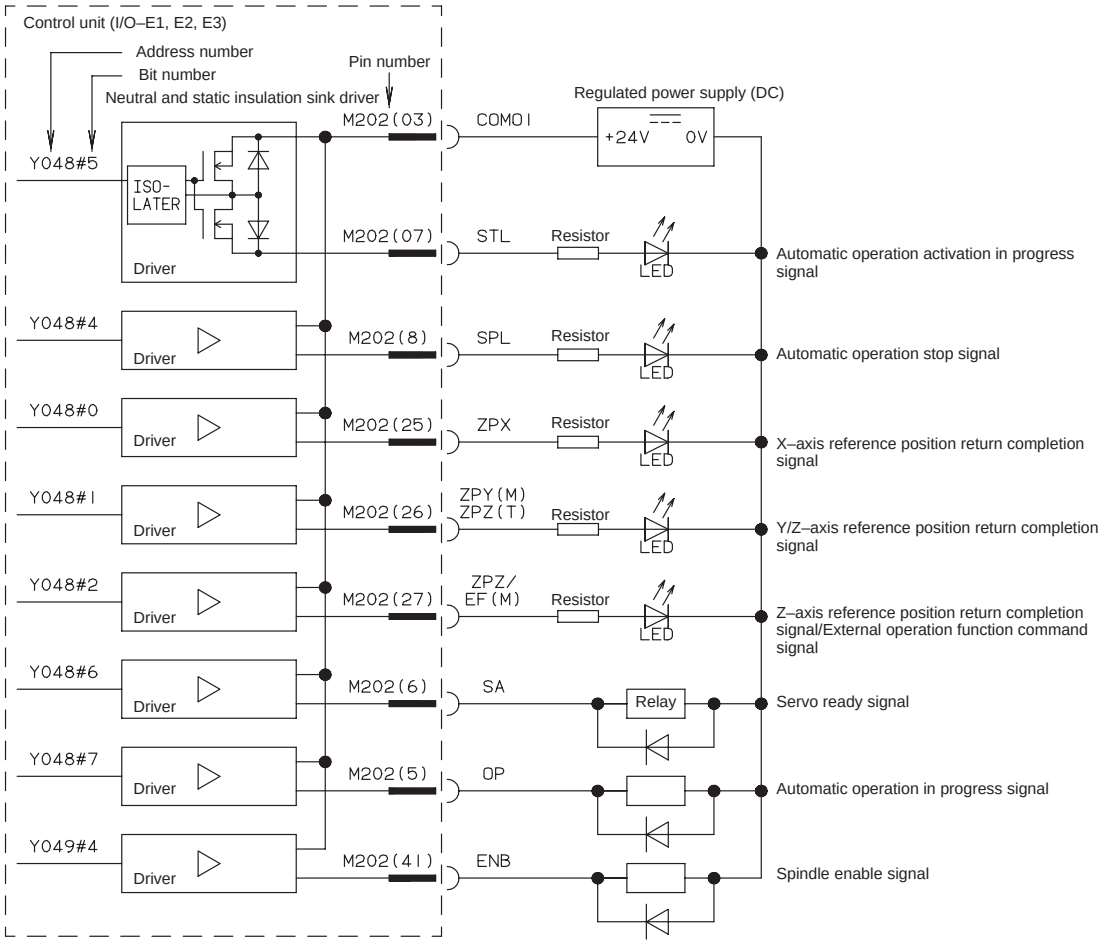
The circuit indicated above uses sink I/O cards C5, C6, and C7.



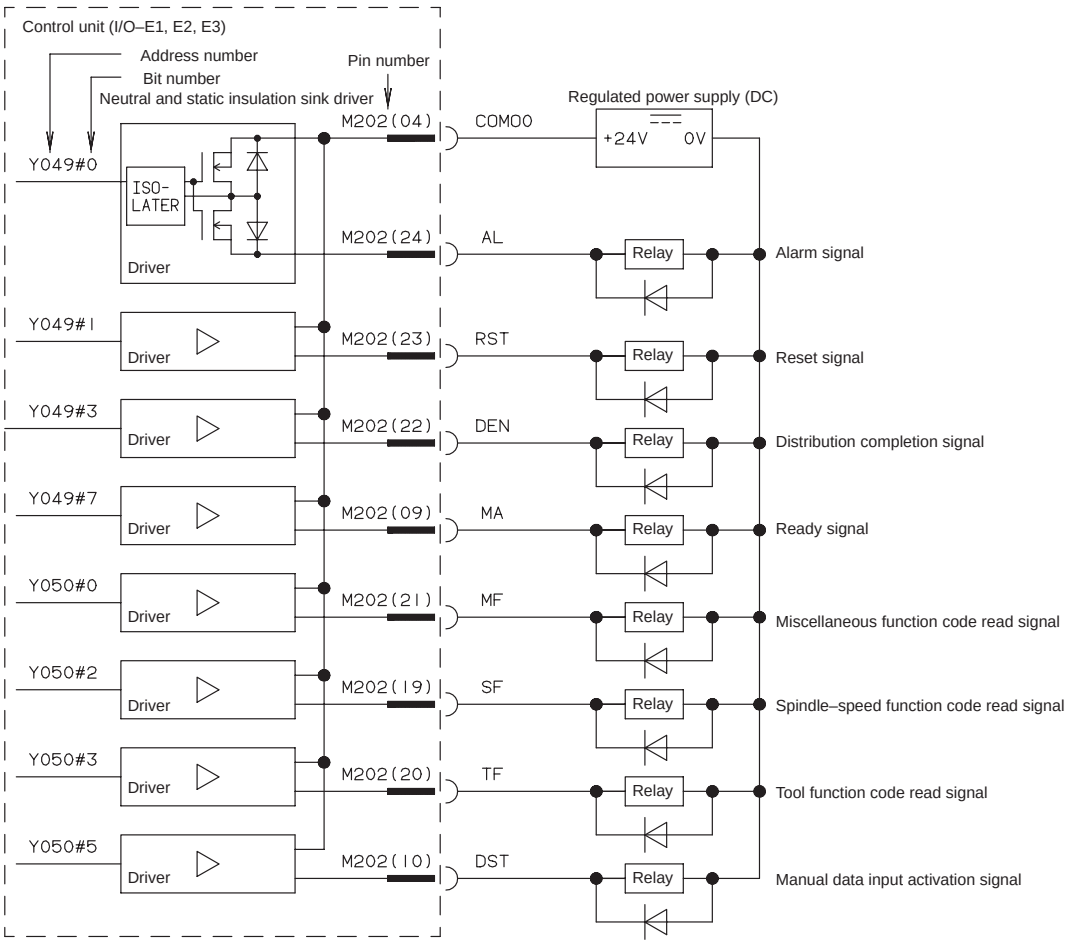
The circuit indicated above uses sink I/O cards C5, C6, and C7.



The circuit indicated above uses sink I/O cards C5, C6, and C7.



The circuit indicated above uses I/O cards E1, E2, and E3 as a source DO. The voltage of the regulated power supply can be adjusted from 24 to 48 VDC. The polarity of the regulated power supply is inverted when the I/O card is used as a sink DO. In this case, the orientation of the LEDs and surge suppression diodes must be inverted.



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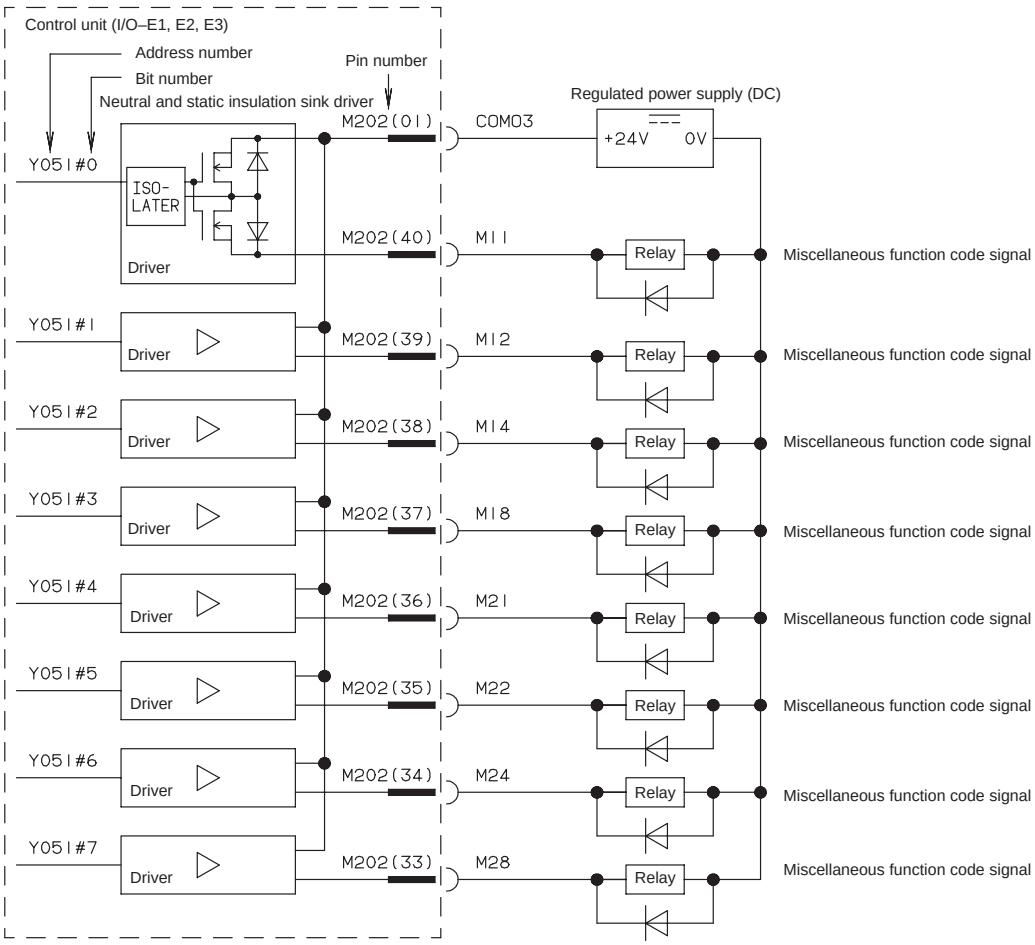
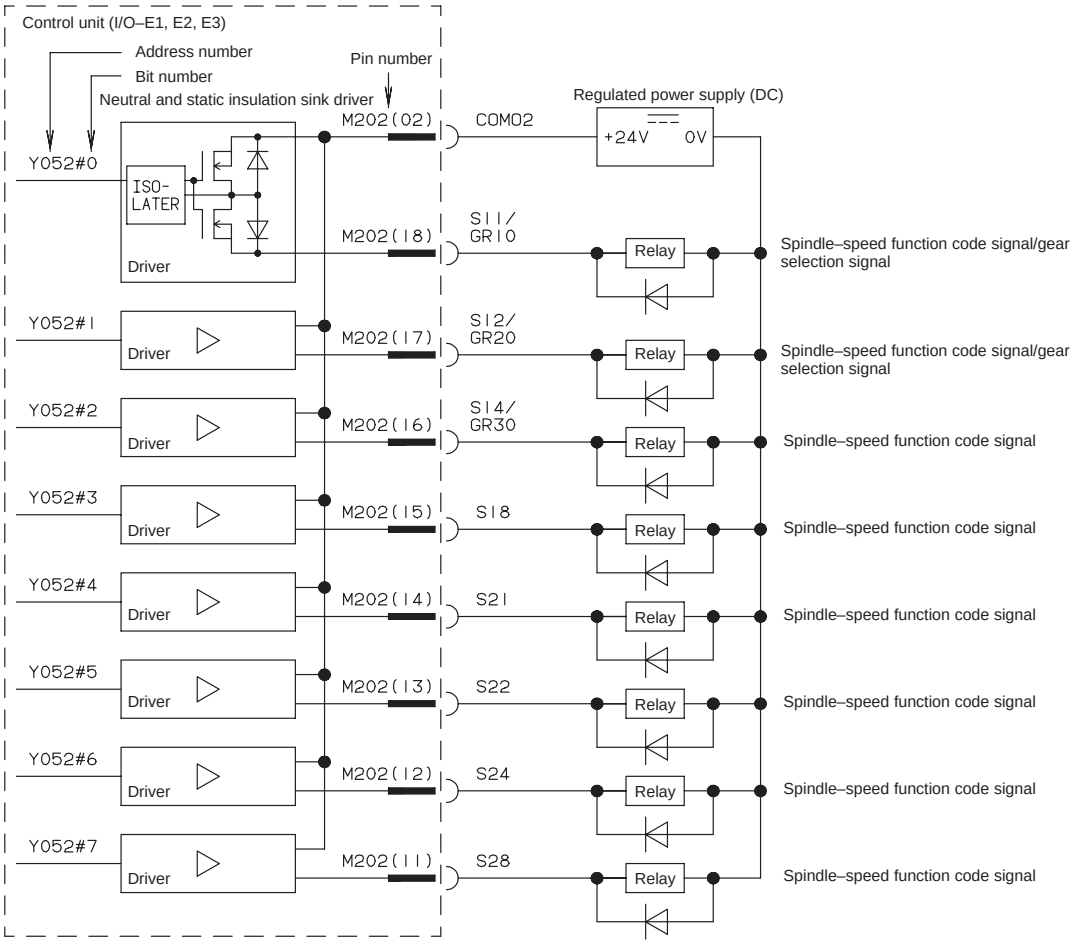
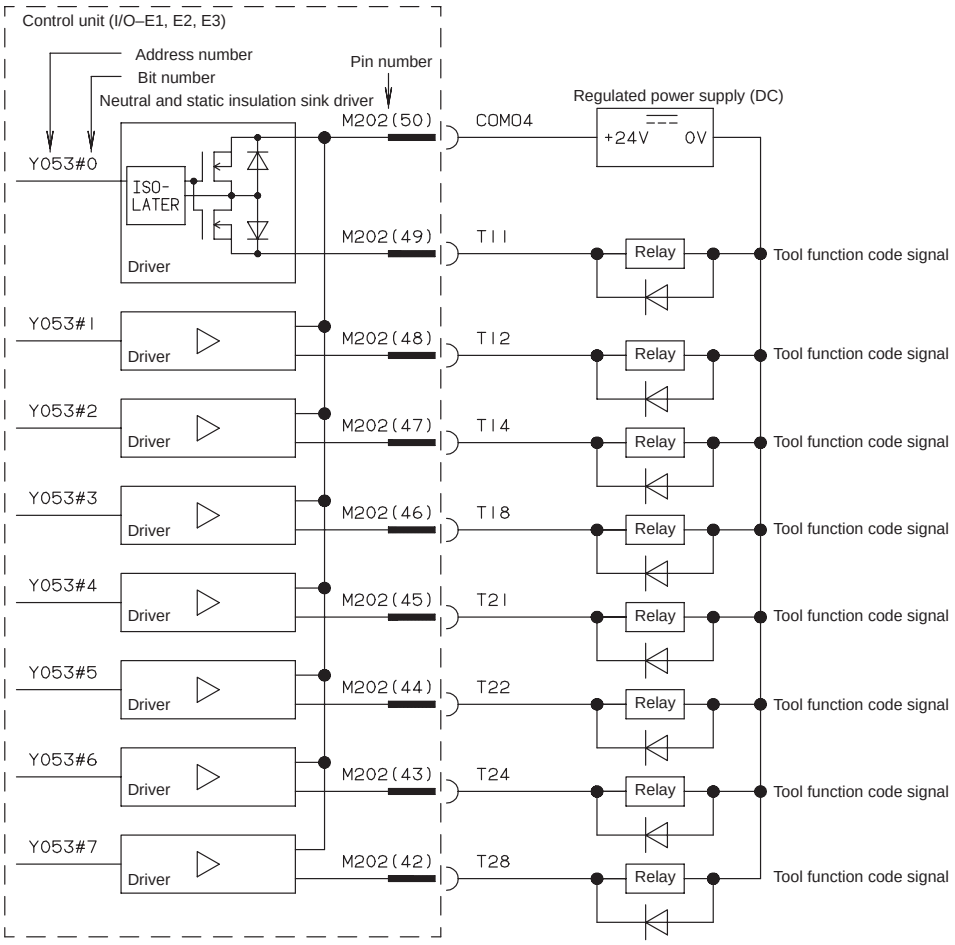


The circuit indicated above uses I/O cards E1, E2, and E3 as a source DO. The voltage of the regulated power supply can be adjusted from 24 to 48 VDC. The polarity of the regulated power supply is inverted when the I/O card is used as a sink DO. In this case, the orientation of the LEDs and surge suppression diodes must be inverted.



The circuit indicated above uses I/O cards E1, E2, and E3 as a source DO. The voltage of the regulated power supply can be adjusted from 24 to 48 VDC. The polarity of the regulated power supply is inverted when the I/O card is used as a sink DO. In this case, the orientation of the LEDs and surge suppression diodes must be inverted.



The circuit indicated above uses I/O cards E1, E2, and E3 as a source DO. The voltage of the regulated power supply can be adjusted from 24 to 48 VDC. The polarity of the regulated power supply is inverted when the I/O card is used as a sink DO. In this case, the orientation of the LEDs and surge suppression diodes must be inverted.

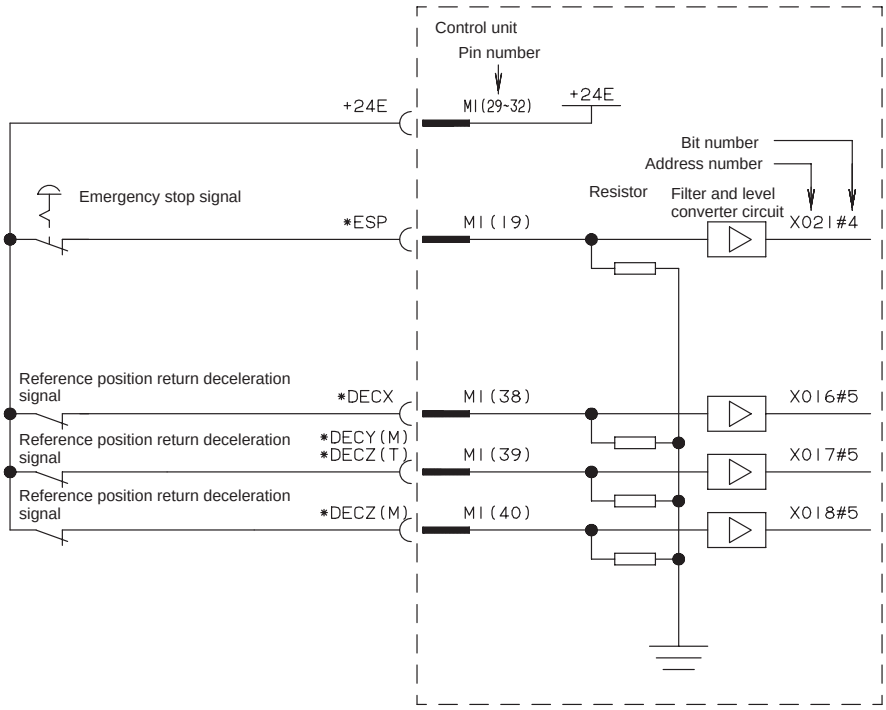
6.2.5 System Using the PMC

Two PMCs are available for the Series 0: the PMC–MODEL L and PMC–MODEL M.

When a PMC is used, a signal input from the machine is input to the PMC, which outputs a signal to the CNC according to the input signal and sequence program. A signal output from the CNC is sent through the PMC to the machine.

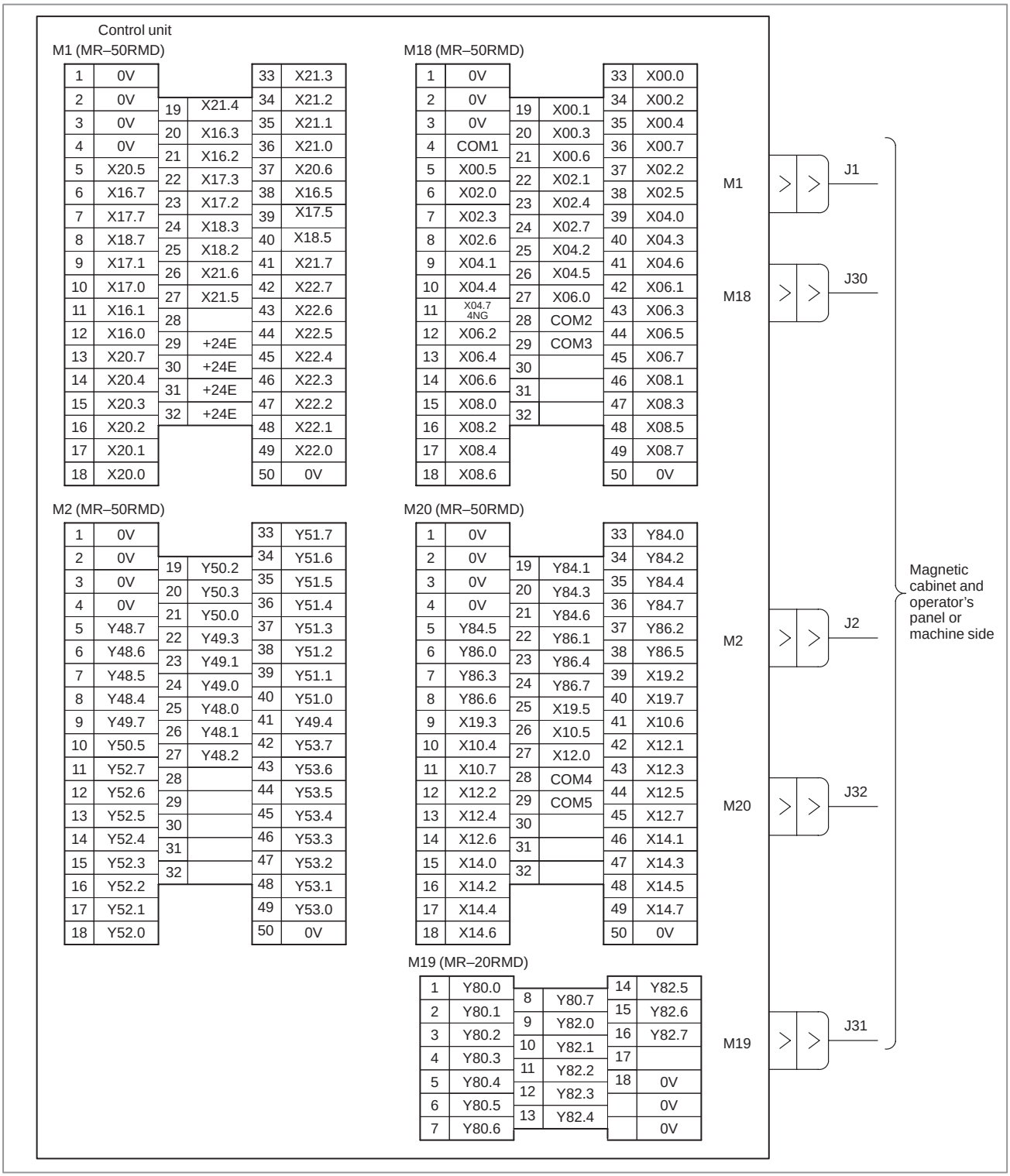
The pins of the internal I/O card can be more flexibly assigned to I/O signals than those of a system without a PMC. Some input signals are, however, monitored directly by the CNC without passing through the PMC.

- **Signals that are directly monitored by the CNC**



The circuit indicated above uses sink direct current input signal A and I/O cards C5, C6, and C7. For I/O cards E1, E2, and E3, connector M201 is used.

● Connector table of built–in I/O C5 to C7



1	0V			33	X21.3
2	0V	19	X21.4	34	X21.2
3	0V	20	X16.3	35	X21.1
4	0V	21	X16.2	36	X21.0
5	X20.5	22	X17.3	37	X20.6
6	X16.7	23	X17.2	38	X16.5
7	X17.7	24	X18.3	39	X17.5
8	X18.7	25	X18.2	40	X18.5
9	X17.1	26	X21.6	41	X21.7
10	X17.0	27	X21.5	42	X22.7
11	X16.1	28		43	X22.6
12	X16.0	29	+24E	44	X22.5
13	X20.7	30	+24E	45	X22.4
14	X20.4	31	+24E	46	X22.3
15	X20.3	32	+24E	47	X22.2
16	X20.2			48	X22.1
17	X20.1			49	X22.0
18	X20.0			50	0V

1	0V			33	X00.0
2	0V	19	X00.1	34	X00.2
3	0V	20	X00.3	35	X00.4
4	COM1	21	X00.6	36	X00.7
5	X00.5	22	X02.1	37	X02.2
6	X02.0	23	X02.4	38	X02.5
7	X02.3	24	X02.7	39	X04.0
8	X02.6	25	X04.2	40	X04.3
9	X04.1	26	X04.5	41	X04.6
10	X04.4	27	X06.0	42	X06.1
11	X04.7 4NG	28	COM2	43	X06.3
12	X06.2	29	COM3	44	X06.5
13	X06.4	30		45	X06.7
14	X06.6	31		46	X08.1
15	X08.0	32		47	X08.3
16	X08.2			48	X08.5
17	X08.4			49	X08.7
18	X08.6			50	0V

1	0V			33	Y51.7
2	0V	19	Y50.2	34	Y51.6
3	0V	20	Y50.3	35	Y51.5
4	0V	21	Y50.0	36	Y51.4
5	Y48.7	22	Y49.3	37	Y51.3
6	Y48.6	23	Y49.1	38	Y51.2
7	Y48.5	24	Y49.0	39	Y51.1
8	Y48.4	25	Y48.0	40	Y51.0
9	Y49.7	26	Y48.1	41	Y49.4
10	Y50.5	27	Y48.2	42	Y53.7
11	Y52.7	28		43	Y53.6
12	Y52.6	29		44	Y53.5
13	Y52.5	30		45	Y53.4
14	Y52.4	31		46	Y53.3
15	Y52.3	32		47	Y53.2
16	Y52.2			48	Y53.1
17	Y52.1			49	Y53.0
18	Y52.0			50	0V

1	0V			33	Y84.0
2	0V	19	Y84.1	34	Y84.2
3	0V	20	Y84.3	35	Y84.4
4	0V	21	Y84.6	36	Y84.7
5	Y84.5	22	Y86.1	37	Y86.2
6	Y86.0	23	Y86.4	38	Y86.5
7	Y86.3	24	Y86.7	39	X19.2
8	Y86.6	25	X19.5	40	X19.7
9	X19.3	26	X10.5	41	X10.6
10	X10.4	27	X12.0	42	X12.1
11	X10.7	28	COM4	43	X12.3
12	X12.2	29	COM5	44	X12.5
13	X12.4	30		45	X12.7
14	X12.6	31		46	X14.1
15	X14.0	32		47	X14.3
16	X14.2			48	X14.5
17	X14.4			49	X14.7
18	X14.6			50	0V

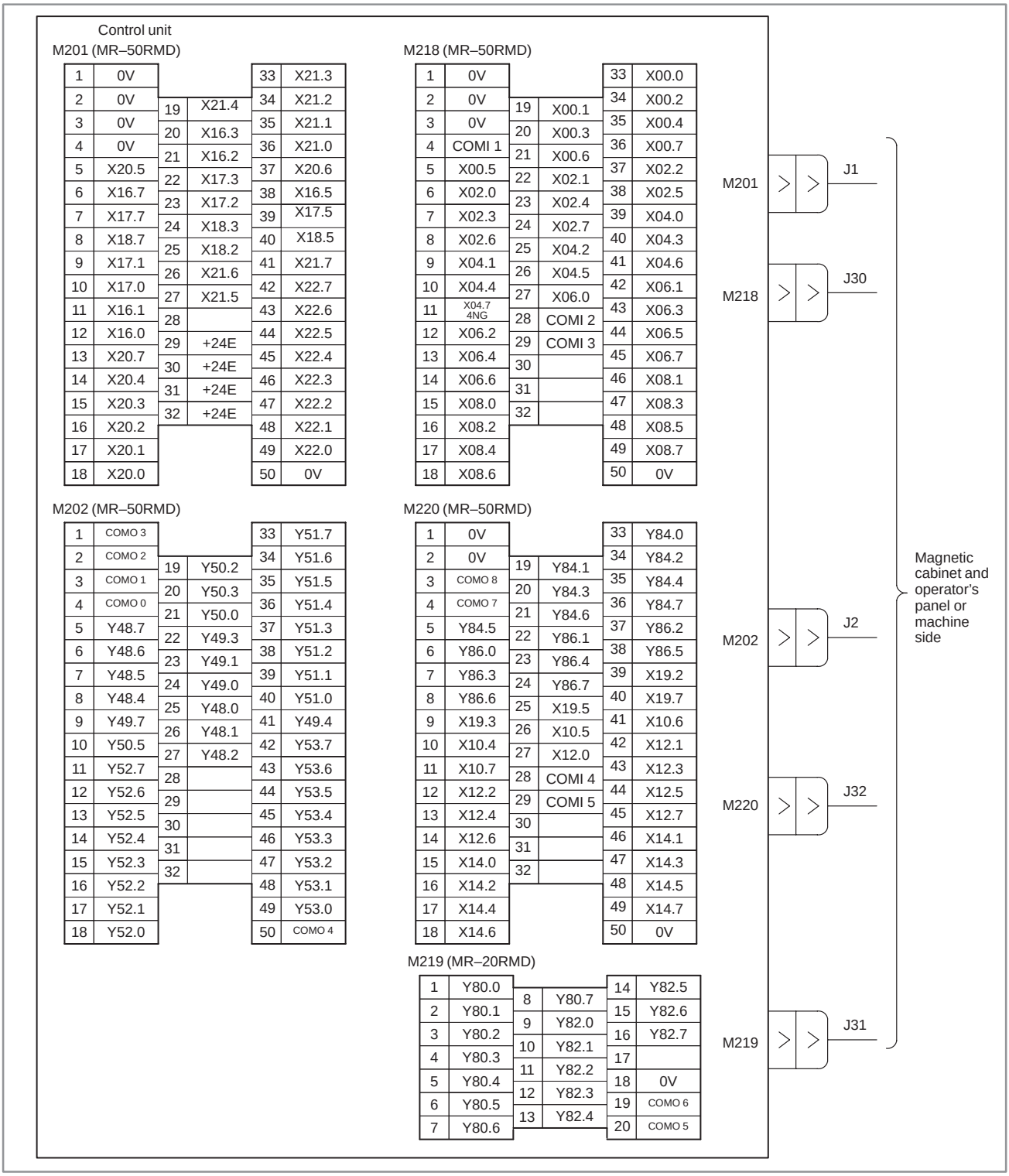
1	Y80.0	8	Y80.7	14	Y82.5
2	Y80.1	9	Y82.0	15	Y82.6
3	Y80.2	10	Y82.1	16	Y82.7
4	Y80.3	11	Y82.2	17	
5	Y80.4	12	Y82.3	18	0V
6	Y80.5	13	Y82.4		0V
7	Y80.6				0V

NOTE

Use unified shielded cable forJ1, J2, J30, J31 and J32.

Recommended cable : A66L–0001–0042 (7/0.18 50 cores)
A66L–0001–0041 (7/0.18 20 cores)

● Connector table of built–in I/O E1 to E3



NOTE

Use unified shielded cable forJ1, J2, J30, J31 and J32.

Recommended cable : A66L–0001–0042 (7/0.18 50 cores)

A66L–0001–0041 (7/0.18 20 cores)

- **Signal pin assignment of internal I/O**

Table 6.2.5 (a) Signal pin assignment and common signal pin assignment for input signals

Signal address	Signal pin assignment			Common signal pin assignment			Signal that is directly monitored by the CNC
	I/O–C	I/O–E	No.	I/O–C	I/O–E	No.	
X00#0	M18	M218	33	M18	M218	04	*+LX (0–PD)
X00#1	M18	M218	19				*–LX (0–PD)
X00#2	M18	M218	34				
X00#3	M18	M218	20				
X00#4	M18	M218	35				
X00#5	M18	M218	05				*DECX (0–PD)
X00#6	M18	M218	21				
X00#7	M18	M218	36				
X02#0	M18	M218	06				*+LY (0–PD)
X02#1	M18	M218	22				*–LY (0–PD)
X02#2	M18	M218	37				
X02#3	M18	M218	07				
X02#4	M18	M218	23				
X02#5	M18	M218	38				*DECY (0–PD)
X02#6	M18	M218	08				
X02#7	M18	M218	24				
X04#0	M18	M218	39	M18	M218	28	*+L3 (0–PD)
X04#1	M18	M218	09				*–L3 (0–PD)
X04#2	M18	M218	25				
X04#3	M18	M218	40				
X04#4	M18	M218	10				
X04#5	M18	M218	26				*DEC3 (0–PD)
X04#6	M18	M218	41				
X04#7	M18	M218	11				(4NG M series)
X06#0	M18	M218	27				*+L4 (0–PD)
X06#1	M18	M218	42				*–L4 (0–PD)
X06#2	M18	M218	12				

+24E: Pins 29, 30, 31, and 32 of M1/M201
0V: Pins 01, 02, and 03 of M18/M218

Signal address	Signal pin assignment			Common signal pin assignment			Signal that is directly monitored by the CNC
	I/O–C	I/O–E	No.	I/O–C	I/O–E	No.	
X06#3	M18	M218	43	M18	M218	28	
X06#4	M18	M218	13	+24E: Pins 29, 30, 31, and 32 of M1/M201 0V: Pins 01, 02, and 03 of M18/M218			
X06#5	M18	M218	44				*DEC4 (0–PD)
X06#6	M18	M218	14				4NG (0–PD)
X06#7	M18	M218	45				
X08#0	M18	M218	15	M18	M218	29	XAE (T, M), *RILK (0–PD)
X08#1	M18	M218	46				YAE (M) /ZAE (T)
X08#2	M18	M218	16				ZAE (M)
X08#3	M18	M218	47	+24E: Pins 29, 30, 31, and 32 of M1/M201 0V: Pins 01, 02, and 03 of M18/M218			
X08#4	M18	M218	17				PFWB (0–PD)
X08#5	M18	M218	48				*RILK (M), *PFIN (0–PD)
X08#6	M18	M218	18				*NFIN (0–PD)
X08#7	M18	M218	49				SKIP (M, T), PE (0–PD)
X10#4	M20	M220	10	M20	M220	28	
X10#5	M20	M220	26				
X10#6	M20	M220	41				
X10#7	M20	M220	11				
X12#0	M20	M220	27				
X12#1	M20	M220	42	+24E: Pins 29, 30, 31, and 32 of M1/M201 0V: Pins 01, 02, 03, and 04 of M20/M220			
X12#2	M20	M220	12				
X12#3	M20	M220	43				
X12#4	M20	M220	13				
X12#5	M20	M220	44				
X12#6	M20	M220	14				
X12#7	M20	M220	45				

X08#0 to X08#7 are direct current input signals B (for fast signal input).

Signal address	Signal pin assignment			Common signal pin assignment			Signal that is directly monitored by the CNC
	I/O–C	I/O–E	No.	I/O–C	I/O–E	No.	
X14#0	M20	M220	15	M20	M220	29	
X14#1	M20	M220	46				
X14#2	M20	M220	16				
X14#3	M20	M220	47				
X14#4	M20	M220	17	+24E: Pins 29, 30, 31, and 32 of M1/M201 0V: Pins 01, 02, 03, and 04 of M20/M220			*ESP (0–PD)
X14#5	M20	M220	48				
X14#6	M20	M220	18				
X14#7	M20	M220	49				
X19#2	M20	M220	39				
X19#3	M20	M220	09				
X19#5	M20	M220	25				
X19#7	M20	M220	40				
X16#0	M1	M201	12	Always sink input			*+EDCX (0–PD)
X16#1	M1	M201	11				*+EDCY (0–PD)
X16#2	M1	M201	21				*+EDC3 (0–PD)
X16#3	M1	M201	20	+24E: Pins 29, 30, 31, and 32 of M1/M201			*+EDC4 (0–PD)
X16#5	M1	M201	38				*DECX
X16#7	M1	M201	06				*–EDCX (0–PD)
X17#0	M1	M201	10				*–EDCY (0–PD)
X17#1	M1	M201	09				*–EDC3 (0–PD)
X17#2	M1	M201	23				*–EDC4 (0–PD)
X17#3	M1	M201	22				
X17#5	M1	M201	39				*DECY (M) /*DECZ (T)
X17#7	M1	M201	07				
X18#2	M1	M201	25				
X18#3	M1	M201	24				
X18#5	M1	M201	40				*DECZ (M) /+LZ (T)
X18#7	M1	M201	08				
X20#0	M1	M201	18				

Signal address	Signal pin assignment			Common signal pin assignment			Signal that is directly monitored by the CNC
	I/O–C	I/O–E	No.	I/O–C	I/O–E	No.	
X20#1	M1	M201	17	Always sink input			
X20#2	M1	M201	16				
X20#3	M1	M201	15	+24E: Pins 29, 30, 31, and 32 of M1/M201			
X20#4	M1	M201	14				
X20#5	M1	M201	05				
X20#6	M1	M201	37				
X20#7	M1	M201	13				
X21#0	M1	M201	36				
X21#1	M1	M201	35				
X21#2	M1	M201	34				
X21#3	M1	M201	33				
X21#4	M1	M201	19				*ESP (T, M)
X21#5	M1	M201	27				
X21#6	M1	M201	26				
X21#7	M1	M201	41				
X22#0	M1	M201	49				
X22#1	M1	M201	48				
X22#2	M1	M201	47				
X22#3	M1	M201	46				
X22#4	M1	M201	45				
X22#5	M1	M201	44				
X22#6	M1	M201	43				
X22#7	M1	M201	42				

Table 6.2.5 (b) Signal pin assignment and common signal pin assignment for output signals Expansion I/O cards C5, C6 and C7 are fixed to sink output. Expansion I/O cards E5, E6, and E7 can be set to sink output or source output, by setting the common signal accordingly.

Signal address	Signal pin		Signal pin		Common signal pin		
	I/O–C	No.	I/O–E	No.	Common	I/O–E	No.
Y48#0	M2	25	M202	25	COMO1	M202	03
Y48#1	M2	26	M202	26			
Y48#2	M2	27	M202	27			
Y48#4	M2	08	M202	08			
Y48#5	M2	07	M202	07			
Y48#6	M2	06	M202	06			
Y48#7	M2	05	M202	05			
Y49#4	M2	41	M202	41			
Y49#0	M2	24	M202	24	COMO0	M202	04
Y49#1	M2	23	M202	23			
Y49#3	M2	22	M202	22			
Y49#7	M2	09	M202	09			
Y50#0	M2	21	M202	21			
Y50#2	M2	19	M202	19			
Y50#3	M2	20	M202	20			
Y50#5	M2	10	M202	10			
Y51#0	M2	40	M202	40	COMO3	M202	01
Y51#1	M2	39	M202	39			
Y51#2	M2	38	M202	38			
Y51#3	M2	37	M202	37			
Y51#4	M2	36	M202	36			
Y51#5	M2	35	M202	35			
Y51#6	M2	34	M202	34			
Y51#7	M2	33	M202	33			

Signal address	Signal pin		Signal pin		Common signal pin		
	I/O–C	No.	I/O–E	No.	Common	I/O–E	No.
Y52#0	M2	18	M202	18	COMO2	M202	02
Y52#1	M2	17	M202	17			
Y52#2	M2	16	M202	16			
Y52#3	M2	15	M202	15			
Y52#4	M2	14	M202	14			
Y52#5	M2	13	M202	13			
Y52#6	M2	12	M202	12			
Y52#7	M2	11	M202	11			
Y53#0	M2	49	M202	49	COMO4	M202	50
Y53#1	M2	48	M202	48			
Y53#2	M2	47	M202	47			
Y53#3	M2	46	M202	46			
Y53#4	M2	45	M202	45			
Y53#5	M2	44	M202	44			
Y53#6	M2	43	M202	43			
Y53#7	M2	42	M202	42			
Y80#0	M19	01	M219	01	COMO5	M219	20
Y80#1	M19	02	M219	02			
Y80#2	M19	03	M219	03			
Y80#3	M19	04	M219	04			
Y80#4	M19	05	M219	05			
Y80#5	M19	06	M219	06			
Y80#6	M19	07	M219	07			
Y80#7	M19	08	M219	08			

Signal address	Signal pin		Signal pin		Common signal pin		
	I/O–C	No.	I/O–E	No.	Common	I/O–E	No.
Y82#0	M19	09	M219	09	COMO6	M219	19
Y82#1	M19	10	M219	10			
Y82#2	M19	11	M219	11			
Y82#3	M19	12	M219	12			
Y82#4	M19	13	M219	13			
Y82#5	M19	14	M219	14			
Y82#6	M19	15	M219	15			
Y82#7	M19	16	M219	16			
Y84#0	M20	33	M220	33	COMO7	M220	04
Y84#1	M20	19	M220	19			
Y84#2	M20	34	M220	34			
Y84#3	M20	20	M220	20			
Y84#4	M20	35	M220	35			
Y84#5	M20	05	M220	05			
Y84#6	M20	21	M220	21			
Y84#7	M20	36	M220	36			
Y86#0	M20	06	M220	06	COMO8	M220	03
Y86#1	M20	22	M220	22			
Y86#2	M20	37	M220	37			
Y86#3	M20	07	M220	07			
Y86#4	M20	23	M220	23			
Y86#5	M20	38	M220	38			
Y86#6	M20	08	M220	08			
Y86#7	M20	24	M220	24			

6.3 ADDING I/O POINTS

When the required I/O signals outnumber the maximum number of I/O signals that can be supported by the internal I/O card, an external I/O unit is connected. Connection can be made with or without FANUC I/O Link.

6.3.1 System without FANUC I/O Link

To add I/O points without FANUC I/O Link, an optional PMC–M PC board must be used. The PMC–M PC board is mounted in the PMC slot (connector name CS3) of the control unit. The PMC–M PC board is connected to the external I/O unit through a serial communication interface. With the serial communication interface, expansion I/O card B2, expansion I/O card F1, or an I/O module can be connected. For details of the I/O module, see the appendix.

- **Connecting expansion I/O card B2 or expansion I/O card F1**

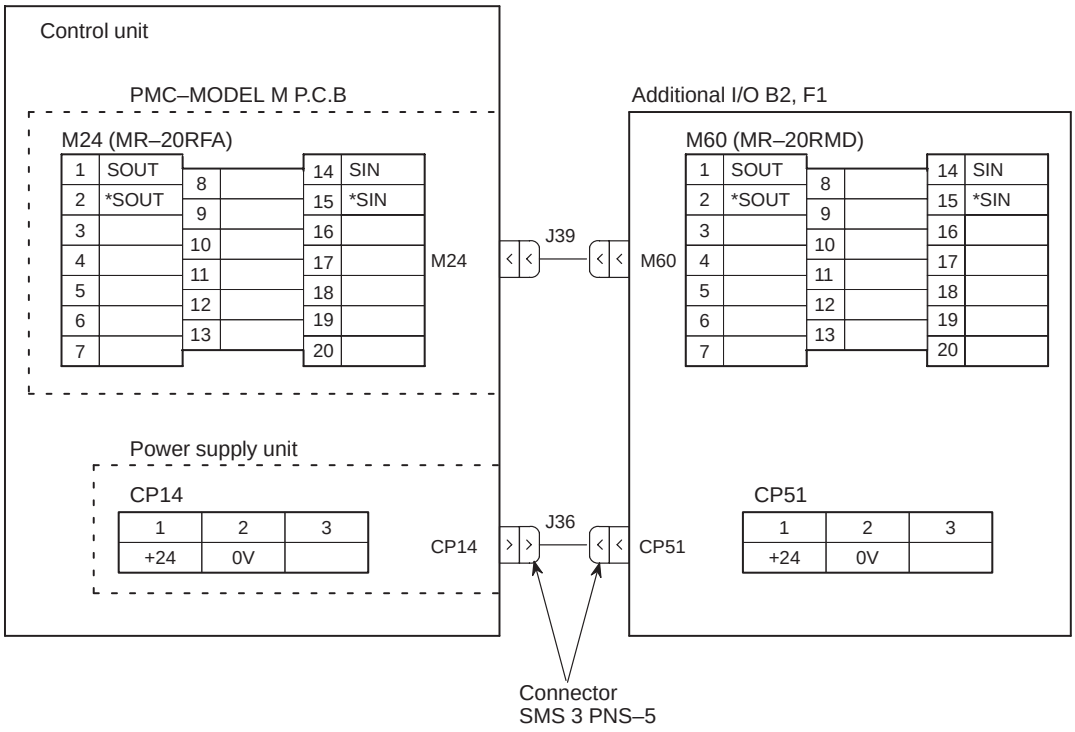
Like the internal I/O card, the expansion I/O card is available in two types: sink output, I/O card B2, and DO common output, I/O card F1.

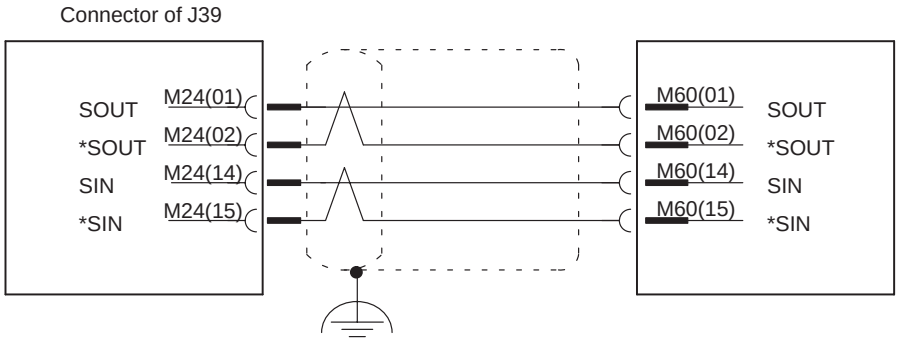
Table 6.3.1 (a) Expansion I/O cards

	Output signal	Number of input signals	Number of output signals
I/O B2	Sink output	104	72
I/O F1	DO common output	104	72

- **Connection**

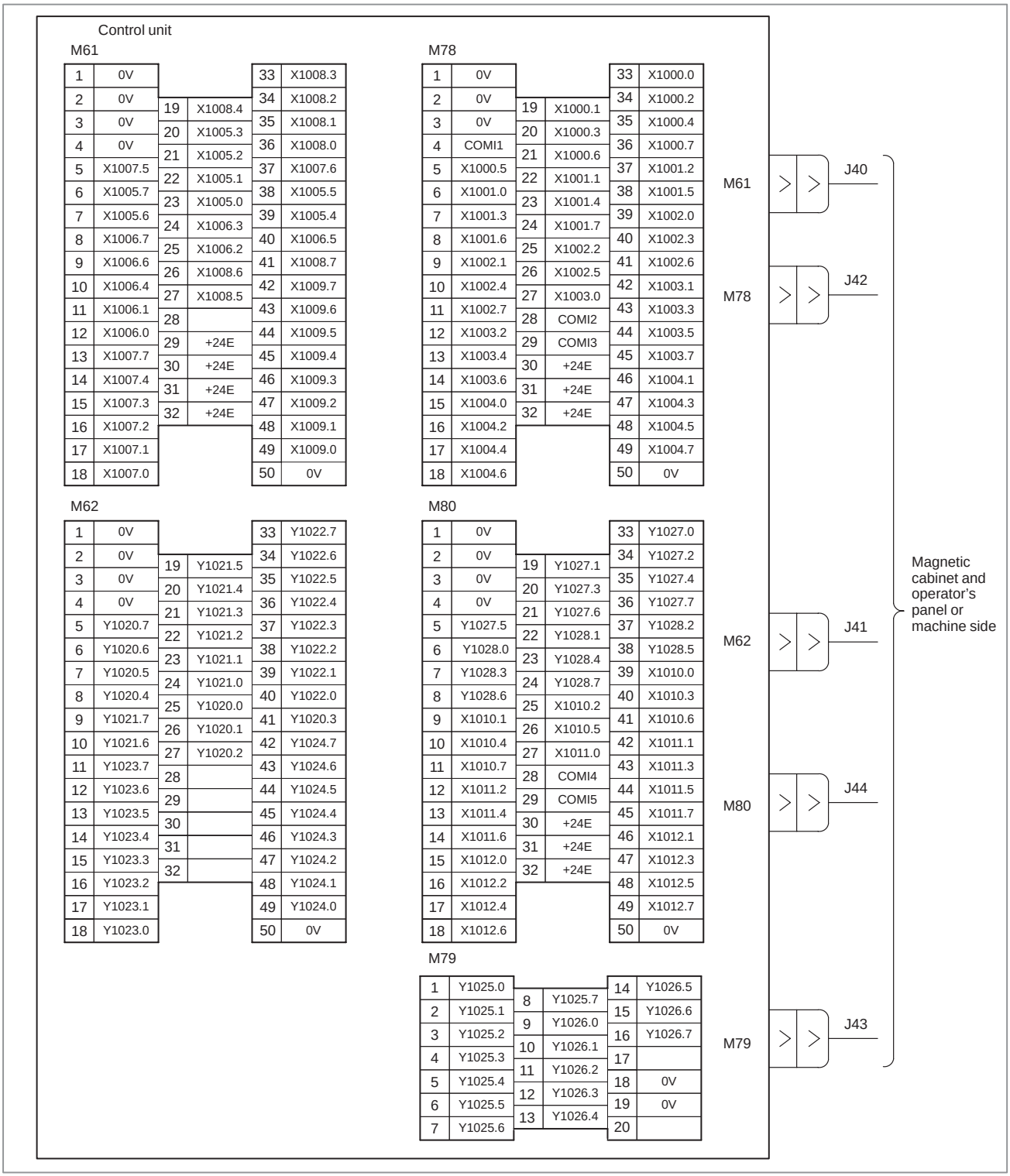
For J36, use a power cable with 30/0.18 (0.75 mm^2) conductors or greater. The voltage drop on the cable should be 1 V or less.





Wire : Twisted pair unified shielded cable and contact at least 7 lines thicker than 0.18mm^2
Recommended cable : A66L–0001–0041

● Connector table additional I/O B2



M61

1	0V	19	X1008.4	33	X1008.3
2	0V	20	X1005.3	34	X1008.2
3	0V	21	X1005.2	35	X1008.1
4	0V	22	X1005.1	36	X1008.0
5	X1007.5	23	X1005.0	37	X1007.6
6	X1005.7	24	X1006.3	38	X1005.5
7	X1005.6	25	X1006.2	39	X1005.4
8	X1006.7	26	X1008.6	40	X1006.5
9	X1006.6	27	X1008.5	41	X1008.7
10	X1006.4	28		42	X1009.7
11	X1006.1	29	+24E	43	X1009.6
12	X1006.0	30	+24E	44	X1009.5
13	X1007.7	31	+24E	45	X1009.4
14	X1007.4	32	+24E	46	X1009.3
15	X1007.3			47	X1009.2
16	X1007.2			48	X1009.1
17	X1007.1			49	X1009.0
18	X1007.0			50	0V

M78

1	0V	19	X1000.1	33	X1000.0
2	0V	20	X1000.3	34	X1000.2
3	0V	21	X1000.6	35	X1000.4
4	COMI1	22	X1001.1	36	X1000.7
5	X1000.5	23	X1001.4	37	X1001.2
6	X1001.0	24	X1001.7	38	X1001.5
7	X1001.3	25	X1002.2	39	X1002.0
8	X1001.6	26	X1002.5	40	X1002.3
9	X1002.1	27	X1003.0	41	X1002.6
10	X1002.4	28	COMI2	42	X1003.1
11	X1002.7	29	COMI3	43	X1003.3
12	X1003.2	30	+24E	44	X1003.5
13	X1003.4	31	+24E	45	X1003.7
14	X1003.6	32	+24E	46	X1004.1
15	X1004.0			47	X1004.3
16	X1004.2			48	X1004.5
17	X1004.4			49	X1004.7
18	X1004.6			50	0V

M62

1	0V	19	Y1021.5	33	Y1022.7
2	0V	20	Y1021.4	34	Y1022.6
3	0V	21	Y1021.3	35	Y1022.5
4	0V	22	Y1021.2	36	Y1022.4
5	Y1020.7	23	Y1021.1	37	Y1022.3
6	Y1020.6	24	Y1021.0	38	Y1022.2
7	Y1020.5	25	Y1020.0	39	Y1022.1
8	Y1020.4	26	Y1020.1	40	Y1022.0
9	Y1021.7	27	Y1020.2	41	Y1020.3
10	Y1021.6	28		42	Y1024.7
11	Y1023.7	29		43	Y1024.6
12	Y1023.6	30		44	Y1024.5
13	Y1023.5	31		45	Y1024.4
14	Y1023.4	32		46	Y1024.3
15	Y1023.3			47	Y1024.2
16	Y1023.2			48	Y1024.1
17	Y1023.1			49	Y1024.0
18	Y1023.0			50	0V

M80

1	0V	19	Y1027.1	33	Y1027.0
2	0V	20	Y1027.3	34	Y1027.2
3	0V	21	Y1027.6	35	Y1027.4
4	0V	22	Y1028.1	36	Y1027.7
5	Y1027.5	23	Y1028.4	37	Y1028.2
6	Y1028.0	24	Y1028.7	38	Y1028.5
7	Y1028.3	25	X1010.2	39	X1010.0
8	Y1028.6	26	X1010.5	40	X1010.3
9	X1010.1	27	X1011.0	41	X1010.6
10	X1010.4	28	COMI4	42	X1011.1
11	X1010.7	29	COMI5	43	X1011.3
12	X1011.2	30	+24E	44	X1011.5
13	X1011.4	31	+24E	45	X1011.7
14	X1011.6	32	+24E	46	X1012.1
15	X1012.0			47	X1012.3
16	X1012.2			48	X1012.5
17	X1012.4			49	X1012.7
18	X1012.6			50	0V

M79

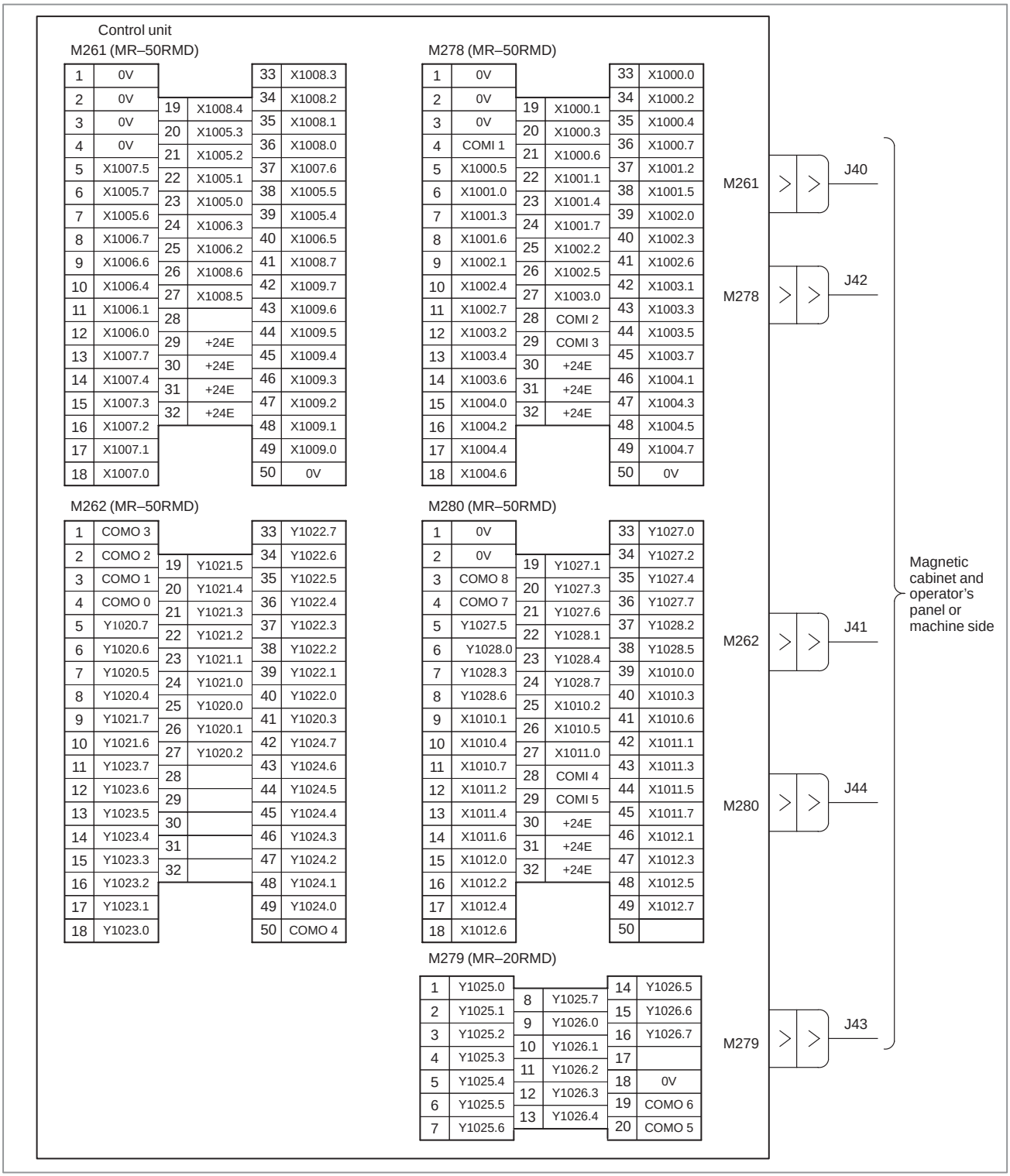
1	Y1025.0	8	Y1025.7	14	Y1026.5
2	Y1025.1	9	Y1026.0	15	Y1026.6
3	Y1025.2	10	Y1026.1	16	Y1026.7
4	Y1025.3	11	Y1026.2	17	
5	Y1025.4	12	Y1026.3	18	0V
6	Y1025.5	13	Y1026.4	19	0V
7	Y1025.6			20	

NOTE

Use unified shielded cable for J40 to J44.

Recommended cable : A66L–0001–0042 (7/0.18, 50 cores)
A66L–0001–0041 (7/0.18 20 cores)

- **Connector table additional I/O F1**



1	0V	19	X1008.4	33	X1008.3
2	0V	20	X1005.3	34	X1008.2
3	0V	21	X1005.2	35	X1008.1
4	0V	22	X1005.1	36	X1008.0
5	X1007.5	23	X1005.0	37	X1007.6
6	X1005.7	24	X1006.3	38	X1005.5
7	X1005.6	25	X1006.2	39	X1005.4
8	X1006.7	26	X1008.6	40	X1006.5
9	X1006.6	27	X1008.5	41	X1008.7
10	X1006.4	28		42	X1009.7
11	X1006.1	29	+24E	43	X1009.6
12	X1006.0	30	+24E	44	X1009.5
13	X1007.7	31	+24E	45	X1009.4
14	X1007.4	32	+24E	46	X1009.3
15	X1007.3			47	X1009.2
16	X1007.2			48	X1009.1
17	X1007.1			49	X1009.0
18	X1007.0			50	0V

1	0V	19	X1000.1	33	X1000.0
2	0V	20	X1000.3	34	X1000.2
3	0V	21	X1000.6	35	X1000.4
4	COMI 1	22	X1001.1	36	X1000.7
5	X1000.5	23	X1001.4	37	X1001.2
6	X1001.0	24	X1001.7	38	X1001.5
7	X1001.3	25	X1002.2	39	X1002.0
8	X1001.6	26	X1002.5	40	X1002.3
9	X1002.1	27	X1003.0	41	X1002.6
10	X1002.4	28	COMI 2	42	X1003.1
11	X1002.7	29	COMI 3	43	X1003.3
12	X1003.2	30	+24E	44	X1003.5
13	X1003.4	31	+24E	45	X1003.7
14	X1003.6	32	+24E	46	X1004.1
15	X1004.0			47	X1004.3
16	X1004.2			48	X1004.5
17	X1004.4			49	X1004.7
18	X1004.6			50	0V

1	COMO 3	19	Y1021.5	33	Y1022.7
2	COMO 2	20	Y1021.4	34	Y1022.6
3	COMO 1	21	Y1021.3	35	Y1022.5
4	COMO 0	22	Y1021.2	36	Y1022.4
5	Y1020.7	23	Y1021.1	37	Y1022.3
6	Y1020.6	24	Y1021.0	38	Y1022.2
7	Y1020.5	25	Y1020.0	39	Y1022.1
8	Y1020.4	26	Y1020.1	40	Y1022.0
9	Y1021.7	27	Y1020.2	41	Y1020.3
10	Y1021.6	28		42	Y1024.7
11	Y1023.7	29		43	Y1024.6
12	Y1023.6	30		44	Y1024.5
13	Y1023.5	31		45	Y1024.4
14	Y1023.4	32		46	Y1024.3
15	Y1023.3			47	Y1024.2
16	Y1023.2			48	Y1024.1
17	Y1023.1			49	Y1024.0
18	Y1023.0			50	COMO 4

1	0V	19	Y1027.1	33	Y1027.0
2	0V	20	Y1027.3	34	Y1027.2
3	COMO 8	21	Y1027.6	35	Y1027.4
4	COMO 7	22	Y1028.1	36	Y1027.7
5	Y1027.5	23	Y1028.4	37	Y1028.2
6	Y1028.0	24	Y1028.7	38	Y1028.5
7	Y1028.3	25	X1010.2	39	X1010.0
8	Y1028.6	26	X1010.5	40	X1010.3
9	X1010.1	27	X1011.0	41	X1010.6
10	X1010.4	28	COMI 4	42	X1011.1
11	X1010.7	29	COMI 5	43	X1011.3
12	X1011.2	30	+24E	44	X1011.5
13	X1011.4	31	+24E	45	X1011.7
14	X1011.6	32	+24E	46	X1012.1
15	X1012.0			47	X1012.3
16	X1012.2			48	X1012.5
17	X1012.4			49	X1012.7
18	X1012.6			50	

1	Y1025.0	8	Y1025.7	14	Y1026.5
2	Y1025.1	9	Y1026.0	15	Y1026.6
3	Y1025.2	10	Y1026.1	16	Y1026.7
4	Y1025.3	11	Y1026.2	17	
5	Y1025.4	12	Y1026.3	18	0V
6	Y1025.5	13	Y1026.4	19	COMO 6
7	Y1025.6			20	COMO 5

NOTE

Use unified shielded cable for J40 to J44.

Recommended cable : A66L–0001–0042 (7/0.18, 50 cores)
A66L–0001–0041 (7/0.18 20 cores)

- **Signal pin assignment of expansion I/O card B2 and expansion I/O card F1**

Table 6.3.1 (b) Signal pin assignment and common signal pin assignment for input signals

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B2	I/O–F1	No.	I/O–B2	I/O–F1	No.
X1000#0	M78	M278	33	M78	M278	04
X1000#1	M78	M278	19			
X1000#2	M78	M278	34			
X1000#3	M78	M278	20			
X1000#4	M78	M278	35			
X1000#5	M78	M278	05			
X1000#6	M78	M278	21			
X1000#7	M78	M278	36			
X1001#0	M78	M278	06			
X1001#1	M78	M278	22			
X1001#2	M78	M278	37			
X1001#3	M78	M278	07			
X1001#4	M78	M278	23			
X1001#5	M78	M278	38			
X1001#6	M78	M278	08			
X1001#7	M78	M278	24			
X1002#0	M78	M278	39	M78	M278	28
X1002#1	M78	M278	09			
X1002#2	M78	M278	25			
X1002#3	M78	M278	40			
X1002#4	M78	M278	10			
X1002#5	M78	M278	26			
X1002#6	M78	M278	41			
X1002#7	M78	M278	11			
X1003#0	M78	M278	27			
X1003#1	M78	M278	42			
X1003#2	M78	M278	12			

+24E: Pins 30, 31, and 32 of M78/M278
0V: Pins 01, 02, and 03 of M78/M278

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B2	I/O–F1	No.	I/O–B2	I/O–F1	No.
X1003#3	M78	M278	43	+24E: Pins 30, 31, and 32 of M78/M278 0V: Pins 01, 02, and 03 of M78/M278		
X1003#4	M78	M278	13			
X1003#5	M78	M278	44			
X1003#6	M78	M278	14			
X1003#7	M78	M278	45			
X1004#0	M78	M278	15	M78	M278	29
X1004#1	M78	M278	46			
X1004#2	M78	M278	16	+24E: Pins 30, 31, and 32 of M78/M278 0V: Pins 01, 02, and 03 of M78/M278		
X1004#3	M78	M278	47			
X1004#4	M78	M278	17			
X1004#5	M78	M278	48			
X1004#6	M78	M278	18			
X1004#7	M78	M278	49			
X1005#0	M61	M261	23	Always sink input		
X1005#1	M61	M261	22			
X1005#2	M61	M261	21			
X1005#3	M61	M261	20			
X1005#4	M61	M261	39	+24E: Pins 29, 30, 31, and 32 of M61/M261		
X1005#5	M61	M261	38			
X1005#6	M61	M261	07			
X1005#7	M61	M261	06			

X1004#0 to X1004#7 are direct current input signals B (for fast signal input).

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B2	I/O–F1	No.	I/O–B2	I/O–F1	No.
X1006#0	M61	M261	12			
X1006#1	M61	M261	11			
X1006#2	M61	M261	25			
X1006#3	M61	M261	24			
X1006#4	M61	M261	10			
X1006#5	M61	M261	40			
X1006#6	M61	M261	09			
X1006#7	M61	M261	08			
X1007#0	M61	M261	18			
X1007#1	M61	M261	17			
X1007#2	M61	M261	16			
X1007#3	M61	M261	15			
X1007#4	M61	M261	14			
X1007#5	M61	M261	05	Always sink input		
X1007#6	M61	M261	37			
X1007#7	M61	M261	13	+24E: Pins 29, 30, 31, and 32 of M61/M261		
X1008#0	M61	M261	36			
X1008#1	M61	M261	35			
X1008#2	M61	M261	34			
X1008#3	M61	M261	33			
X1008#4	M61	M261	19			
X1008#5	M61	M261	27			
X1008#6	M61	M261	26			
X1008#7	M61	M261	41			
X1009#0	M61	M261	49			
X1009#1	M61	M261	48			
X1009#2	M61	M261	47			
X1009#3	M61	M261	46			

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B2	I/O–F1	No.	I/O–B2	I/O–F1	No.
X1009#4	M61	M261	45	Always sink input +24E: Pins 29, 30, 31, and 32 of M61/M261		
X1009#5	M61	M261	44			
X1009#6	M61	M261	43			
X1009#7	M61	M261	42			
X1010#0	M80	M280	39	M80 +24E: Pins 30, 31, 32 of M80/M280 0V: Pins 01, 02 of M80/M280	M280	29
X1010#1	M80	M280	09			
X1010#2	M80	M280	25			
X1010#3	M80	M280	40			
X1010#4	M80	M280	10			
X1010#5	M80	M280	26			
X1010#6	M80	M280	41			
X1010#7	M80	M280	11			
X1011#0	M80	M280	27			
X1011#1	M80	M280	42			
X1011#2	M80	M280	12			
X1011#3	M80	M280	43			
X1011#4	M80	M280	13			
X1011#5	M80	M280	44			
X1011#6	M80	M280	14			
X1011#7	M80	M280	45			
X1012#0	M80	M280	15			
X1012#1	M80	M280	46			
X1012#2	M80	M280	16			
X1012#3	M80	M280	47			
X1012#4	M80	M280	17			
X1012#5	M80	M280	48			
X1012#6	M80	M280	18			
X1012#7	M80	M280	49			

Table 6.3.1 (c) Signal pin assignment and common signal pin assignment for output signals
Expansion I/O card B2 is fixed to sink output.
Expansion I/O card F1 can be set to either sink output or source output by setting the common signal accordingly.

Signal address	Signal pin		Signal pin		Common signal pin		
	I/O–B2	No.	I/O–F1	No.	Common	I/O–F1	No.
Y1020#0	M62	25	M262	25	COMO0	M262	04
Y1020#1	M62	26	M262	26			
Y1020#2	M62	27	M262	27			
Y1020#3	M62	41	M262	41			
Y1020#4	M62	08	M262	08			
Y1020#5	M62	07	M262	07			
Y1020#6	M62	06	M262	06			
Y1020#7	M62	05	M262	05			
Y1021#0	M62	24	M262	24	COMO1	M262	03
Y1021#1	M62	23	M262	23			
Y1021#2	M62	22	M262	22			
Y1021#3	M62	21	M262	21			
Y1021#4	M62	20	M262	20			
Y1021#5	M62	19	M262	19			
Y1021#6	M62	10	M262	10			
Y1021#7	M62	09	M262	09			
Y1022#0	M62	40	M262	40	COMO2	M262	02
Y1022#1	M62	39	M262	39			
Y1022#2	M62	38	M262	38			
Y1022#3	M62	37	M262	37			
Y1022#4	M62	36	M262	36			
Y1022#5	M62	35	M262	35			
Y1022#6	M62	34	M262	34			
Y1022#7	M62	33	M262	33			

Signal address	Signal pin		Signal pin		Common signal pin		
	I/O–B2	No.	I/O–F1	No.	Common	I/O–F1	No.
Y1023#0	M62	18	M262	18	COMO3	M262	01
Y1023#1	M62	17	M262	17			
Y1023#2	M62	16	M262	16			
Y1023#3	M62	15	M262	15			
Y1023#4	M62	14	M262	14			
Y1023#5	M62	13	M262	13			
Y1023#6	M62	12	M262	12			
Y1023#7	M62	11	M262	11			
Y1024#0	M62	49	M262	49	COMO4	M262	50
Y1024#1	M62	45	M262	45			
Y1024#2	M62	47	M262	47			
Y1024#3	M62	46	M262	46			
Y1024#4	M62	48	M262	48			
Y1024#5	M62	44	M262	44			
Y1024#6	M62	43	M262	43			
Y1024#7	M62	42	M262	42			
Y1025#0	M79	01	M279	01	COMO5	M279	20
Y1025#1	M79	02	M279	02			
Y1025#2	M79	03	M279	03			
Y1025#3	M79	04	M279	04			
Y1025#4	M79	05	M279	05			
Y1025#5	M79	06	M279	06			
Y1025#6	M79	07	M279	07			
Y1025#7	M79	08	M279	08			

Signal address	Signal pin		Signal pin		Common signal pin		
	I/O–B2	No.	I/O–F1	No.	Common	I/O–F1	No.
Y1026#0	M79	09	M279	09	COMO6	M279	19
Y1026#1	M79	10	M279	10			
Y1026#2	M79	11	M279	11			
Y1026#3	M79	12	M279	12			
Y1026#4	M79	13	M279	13			
Y1026#5	M79	14	M279	14			
Y1026#6	M79	15	M279	15			
Y1026#7	M79	16	M279	16			
Y1027#0	M80	33	M280	33	COMO7	M280	04
Y1027#1	M80	19	M280	19			
Y1027#2	M80	34	M280	34			
Y1027#3	M80	20	M280	20			
Y1027#4	M80	35	M280	35			
Y1027#5	M80	05	M280	05			
Y1027#6	M80	21	M280	21			
Y1027#7	M80	36	M280	36			
Y1028#0	M80	06	M280	06	COMO8	M280	03
Y1028#1	M80	22	M280	22			
Y1028#2	M80	37	M280	37			
Y1028#3	M80	07	M280	07			
Y1028#4	M80	23	M280	23			
Y1028#5	M80	38	M280	38			
Y1028#6	M80	08	M280	08			
Y1028#7	M80	24	M280	24			

6.3.2 System Using FANUC I/O Link

I/O signals can be added by using FANUC I/O Link. To use FANUC I/O Link, an optional PMC–M PC board with I/O Link is required. The PC board is mounted in the PMC slot (connector name: CS3) of the control unit.

Observe the restrictions and precautions described below.

1) When the PMC–M with I/O Link is fitted it will no longer be possible to use I/O units already linked to the PMC–M. Such units must therefore be replaced with I/O units fitted with the I/O Link.

Table 6.3.2

Name	Non–connectable I/O unit	I/O unit with I/O Link
Expansion I/O	Expansion I/O–B2	Expansion I/O–B3
I/O unit	I/O unit	I/O unit–MODEL A

2) It has been possible to combine an MMC interface with the PMC–M without I/O Link in order to connect MMC units to provide a FANUC Series 00 configuration. It is not possible, however, to use an MMC interface in combination with a PMC–M with I/O Link. It is not therefore possible to configure a FANUC Series 00 with I/O Link.
3) With the FANUC Series 0 MODEL–C, signals monitored directly by the CNC such as ESP, DEC and SKIP should not be used as input signals of I/O units connected by I/O Link. I/O–C (C5, C6, C7) must be used instead.
4) The power supply for the expansion I/O–B3 or F3 can be taken from the CP14 Series 0 power unit. This is only possible, however, in the case of a single expansion and I/O–B3 or F3. If more than one unit is to be added then a separate power supply will be required.
   The power supply from the power supply unit cannot be used in the case of I/O Unit–MODEL A. A separate power supply must always be prepared.
5) When connecting the I/O Unit–MODEL A to Series 0 the number of I/O Units connected must not exceed 2 per group.
6) Each unit connected to the I/O Link must be earthed with the same potential in each case.
7) When other units are connected to the Series 0 via the I/O Link, it is essential to take full account of all connection instructions in the instruction manual of the unit concerned.

6.3.2.1 Connection diagram

(1) Configuration of the I/O Link (Eg)

The figure below illustrates a typical I/O Link configuration.

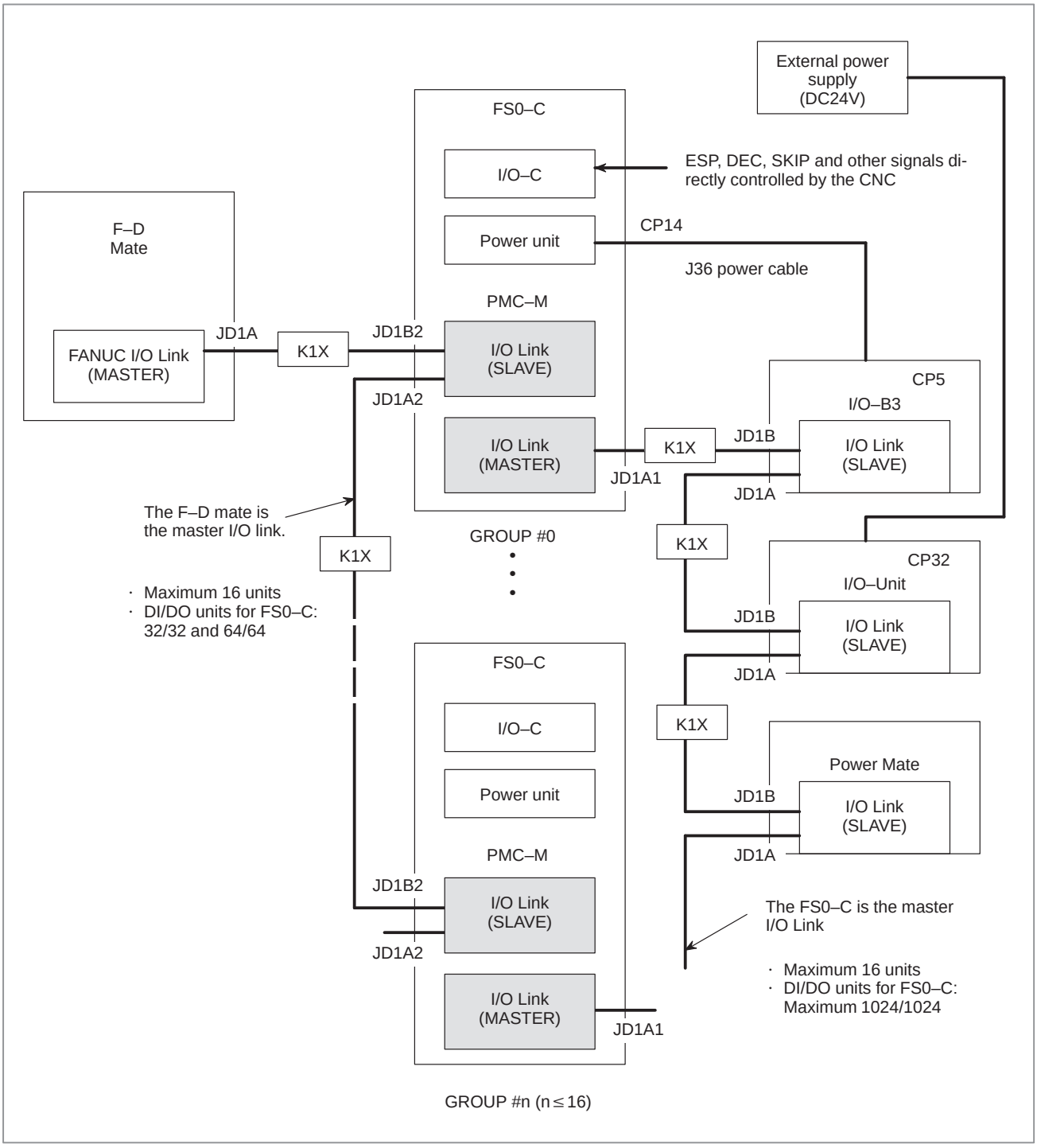
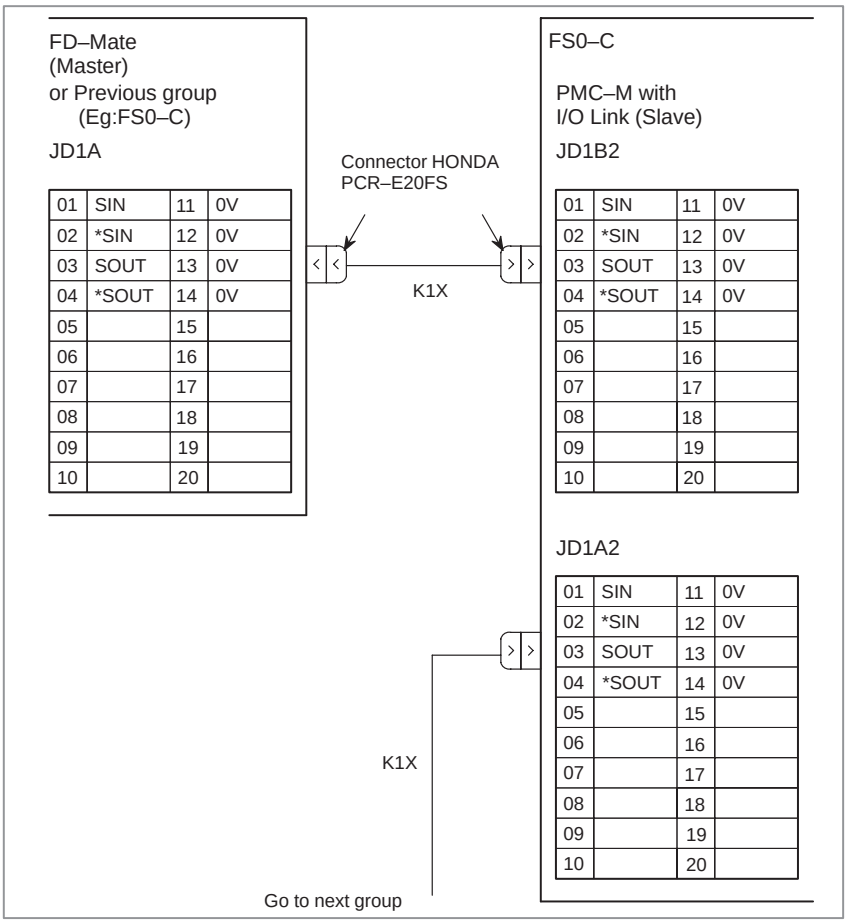


Fig. 6.3.2.1 (a) Typical I/O Link configuration

(2) Signal cable connections

Details of the K1X cable shown in the connection diagram are given below.

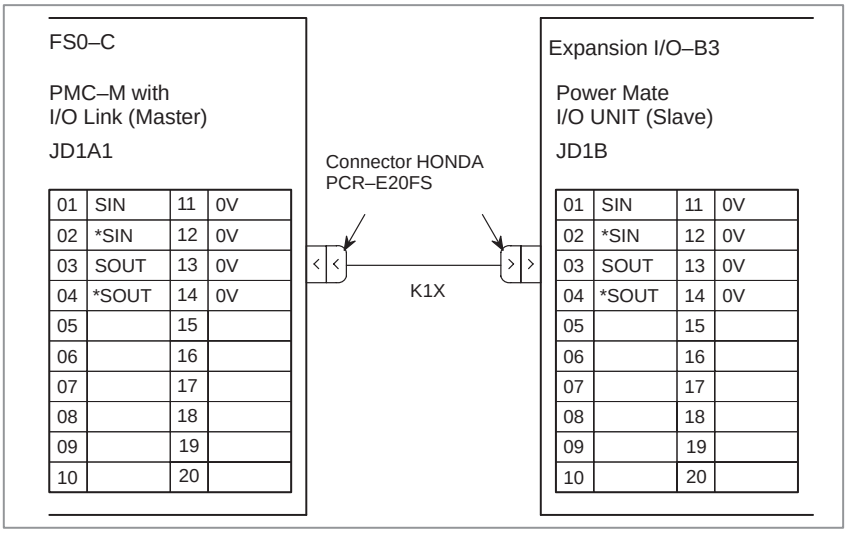
a) When FD–Mate is master and FS0 is slave



01	SIN	11	0V
02	*SIN	12	0V
03	SOUT	13	0V
04	*SOUT	14	0V
05		15	
06		16	
07		17	
08		18	
09		19	
10		20	

Fig. 6.3.2.1 (b)

b) When FS0 is master and I/O–B3, Power Mate and I/O unit are slaves



01	SIN	11	0V
02	*SIN	12	0V
03	SOUT	13	0V
04	*SOUT	14	0V
05		15	
06		16	
07		17	
08		18	
09		19	
10		20	

Fig. 6.3.2.1 (c)

c) Expansion I/O–B3 power cable connection (J36)

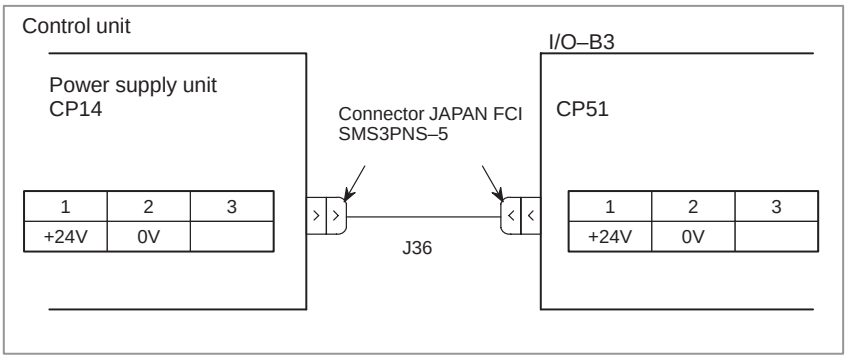


Fig. 6.3.2.1 (d)

NOTE

For a power supply unit that qualifies for CE marking, a different connector is used. For details, see Section 5.4, “Connection of the Input Unit Built–in Power Supply Unit AI (Qualifying for CE Marking).”

d) I/O Unit–MODEL A power cable connection

Prepare a power supply other than the Series 0 power unit and use the interface module (AIF01A) connector CP32 to make the required connections.

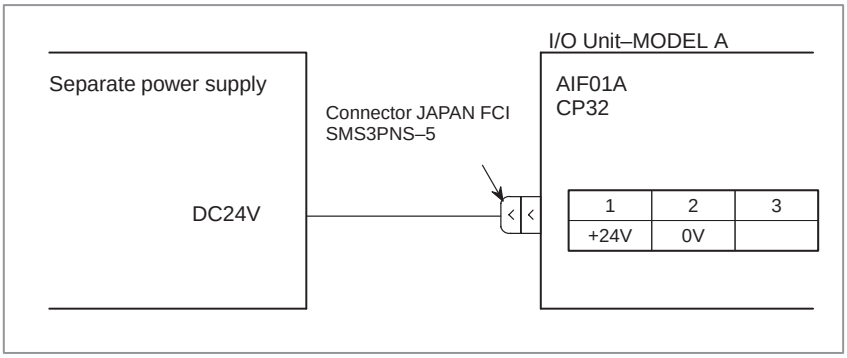


Fig. 6.3.2.1 (e)

e) Cable K1X details

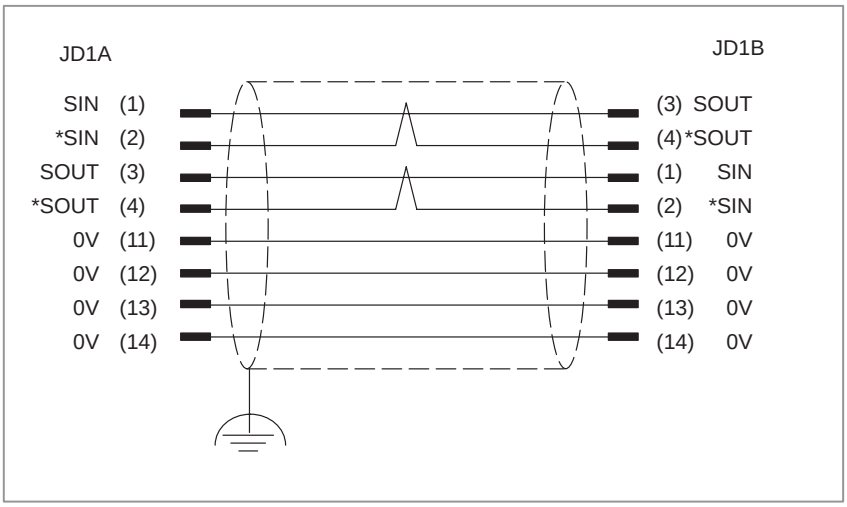


Fig. 6.3.2.1 (f)

- The SIN, *SIN and SOUT, *SOUT signals must be connected by twisted pair cable.
- Recommended cable: A66L–0001–0284#10P (single shield twisted pair)
- The cable shield should be clamped with a cable clamp to the cabinet earth plate on the JD1A side.
- Maximum cable length: 10m

6.3.2.2 Turning the power on and off

(1) To turn the power on

In cases where the FANUC I/O Link slave power supply selected is neither the 24V DC supply used with the Series 0 nor the 200V AC Series 0 power supply input unit, then it is essential that the power be switched on to all slave units before it is switched on to the Series 0. In other words the Series 0, which is in this case the master, must come last.

(2) To turn the power off

If the power supply to any one of the slave units connected by the FANUC I/O Link is cut off then all units connected by the I/O Link, including the Series 0 itself, will assume abnormal status. To restore normal operating status all the units must be switched off and then started up again one by one in the appropriate order.

6.3.2.3 DI/DO addresses

The PMC–M addresses of DI/DO connected via the FANUC I/O Link are as shown in the table below.
Since the expansion I/O–B3 can also be connected to the I/O Link, it also uses the same addresses.
Care must be taken, on the other hand, with the expansion I/O–B2 since this unit uses different addresses.

Table 6.3.2.3

	DI/DO	Address	DGN. No.
Master	DI (128BYTE=1024 points)	X3072～X3199	5072～5199
	DO (128BYTE=1024 points)	Y3200～X3327	5200～5327
Slave	DI (8BYTE=64 points)	X1100～X1107	3100～3107
	DO (8BYTE=64 points)	X1200～X1207	3200～3207

The following parameters should be set when a diagnostic display is required.

	#7	#6	#5	#4	#3	#2	#1	#0
64					IOMDGN			

IOMDGN

1 : I/O Link DI/DO diagnostic display.

0 : No I/O Link DI/DO diagnostic display.

6.3.2.4 I/O module data

I/O module data is required to set in FANUC I/O Link. Refer to FANUC PMC–MODEL K/L/M/P PROGRAMMING MANUAL for details.

6.3.2.5 Optical I/O Link adaptor

The K1X cable shown in the feneral connection diagram can be extended by means of an optical I/O Link adaptor to a maximum of 200m using optical fiber cable.

(1) Dimensions

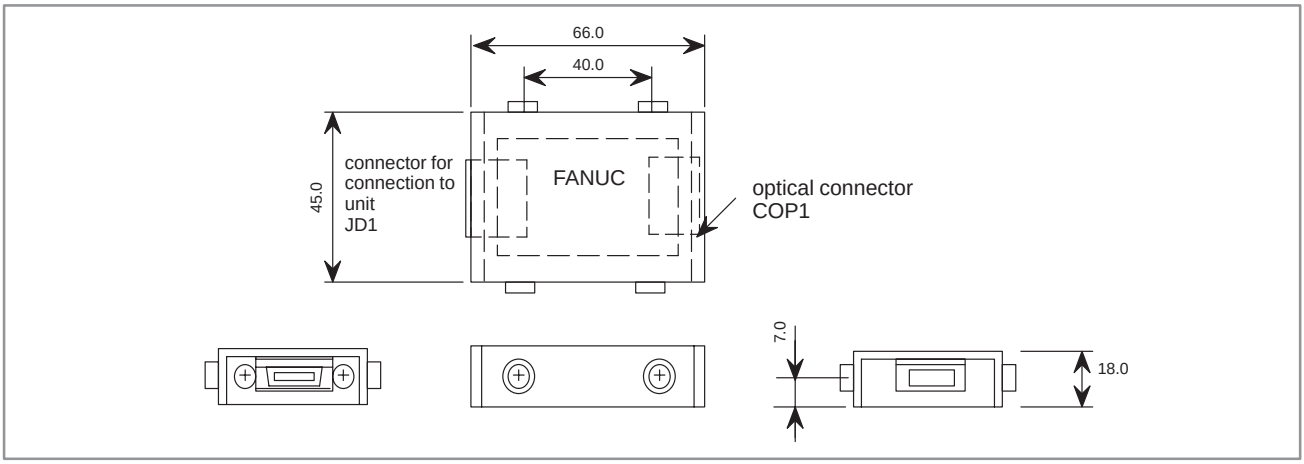


Fig. 6.3.2.5 (a)

(2) Weight

Main unit: Approx. 100g

(3) Connection

(a) Connection diagram

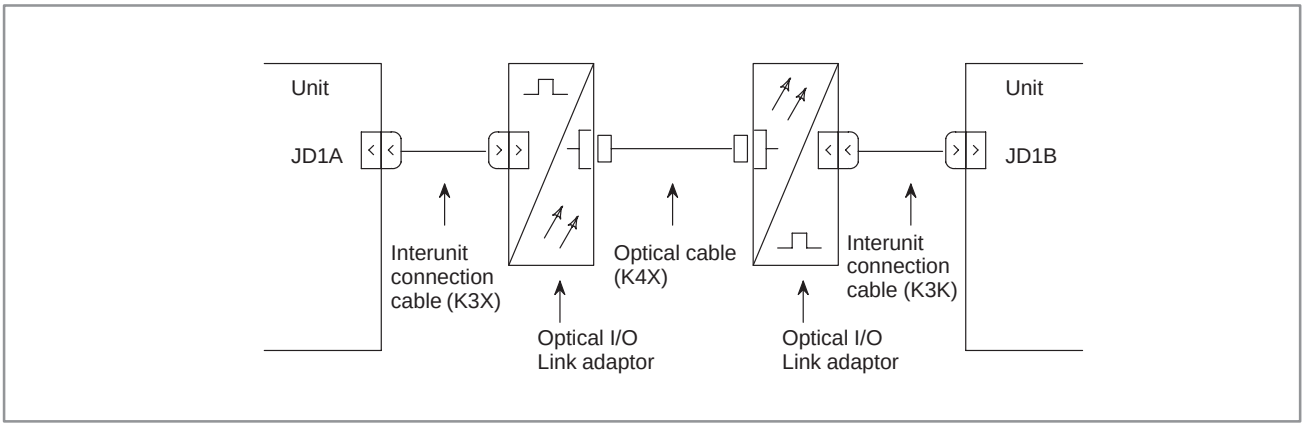


Fig. 6.3.2.5 (b)

(b) Interunit connection cable (K3X)

01	SIN	11	0V
02	*SIN	12	0V
03	SOUT	13	0V
04	*SOUT	14	0V
05		15	0V
06		16	0V
07		17	
08		18	+5V
09	+5V	19	
10		20	+5V

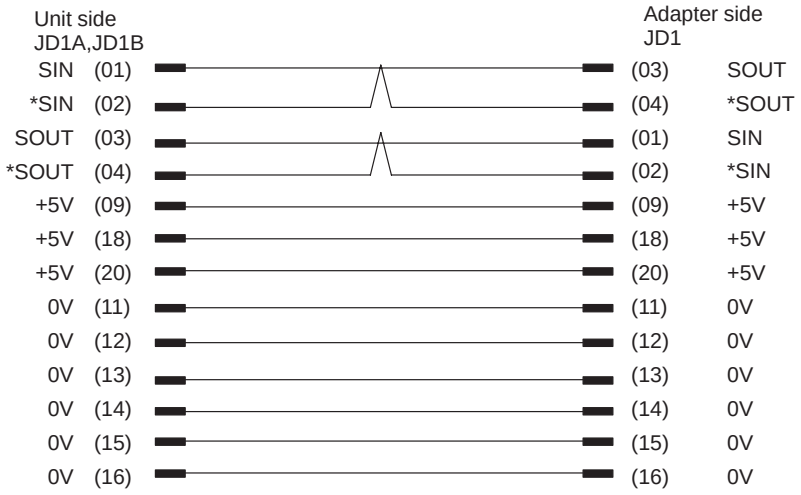


Fig. 6.3.2.5 (c)

- Recommended cable connector : PCR–E20FS (Honda Tsushin)
- Recommended cable (wire) : A66L–0001–0284#10P
- Length of cable : Max. 2m (when using recommended cable)

(c) Optical cable

- Specificatiol : A66L–6001–0009 (it is essential that this cable specification be adhered to)
- Length of cable : Max. 200m

(4) Power supply

- Voltage : 4.75V–5.25V (at input terminal)
- Current consumption : 200mA

(5) Installation conditions

(a) The adaptor itself is not hermetically sealed and should therefore be installed inside a hermetically sealed frame in the same way as an NC.

(b) The adaptor's casing screws must be used to ground the casing. The adaptor earth must have the same electric potential as the earthing of the unit with I/O Link to which it is connected.

(c) The adaptor is only light and does not therefore require screw clamps to hold it in place. Care must be taken, however, to ensure that there is no risk of shorting through contact with other electrical circuits, for example.
If the adaptor is to be fitted to the frame itself then an L bracket and casing screws (M3) should be used to secure it to the frame.

(6) Other information

If this adaptor is used when configuring an I/O Link then the following component parts will be required.

- Optical I/O Link adaptor : ×2
- Interunit connecting cable : ×2
- Optical cable : ×1

7 CONNECTION OF PERIPHERAL EQUIPMENT

7.1 CONNECTING THE DISPLAY UNIT

7.1.1 Outline

The display unit of the CNC is used to display information such as CNC programs and parameters to the operator and to assist the operator in the operation of the machine.

For the Series 0, CRT, PDP, EL, and LCD display units are available. This section describes how to connect these display units to the control unit. Outline drawings are given in the appendix.

Each display unit can be provided as a unit incorporating an MDI keyboard, for example a CRT/MDI unit. The MDI section can be connected in the same way as a separate MDI unit. For an explanation of making this connection, see the subsequent chapter.

Some display units are available either as a standard type or as a type conforming to European safety standards (qualifying for CE marking). Since the type qualifying for CE marking uses a different power supply unit, the connection of the CE marking type differs from that of the standard type in some respects. The unit qualifying for CE marking with the MDI keyboard has keys of different colors, and may use symbolic keys.

The unit qualifying for CE marking has a stud or hole for grounding. Ground the unit to a housing in the vicinity, using a line containing conductors of 2 mm^2 or greater.

Table 7.1.1 Display units qualifying for CE marking

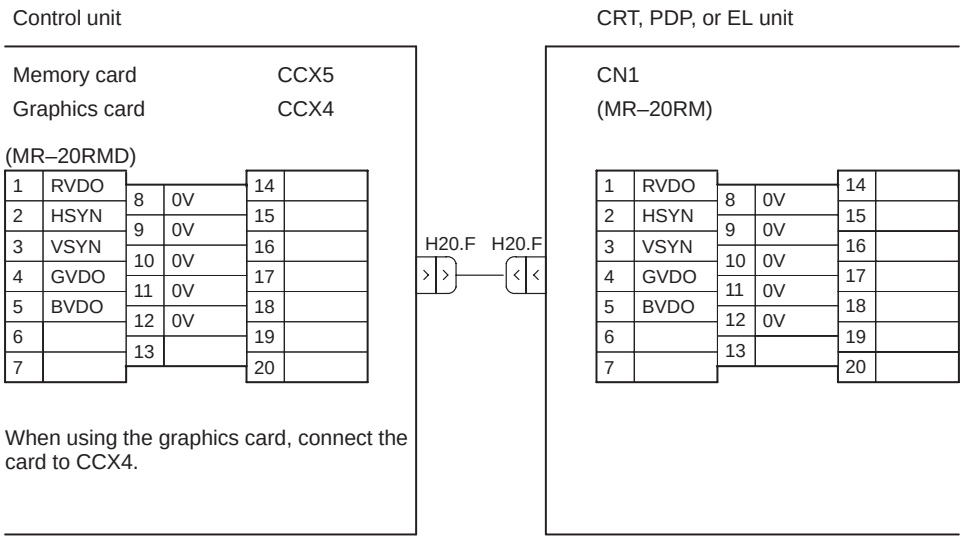
Unit	CE marking type	Comparison with standard type
9″ monochrome CRT	Provided	Connection is the same.
9″ color CRT	Not provided	
14″ color CRT	Provided	The input power connector is different.
PDP	Provided	Supply voltage is not 200 VAC but 24 VDC.
EL	Not provided	
LCD	Provided	Connection is the same.

7.1.2 Video Signal Interface

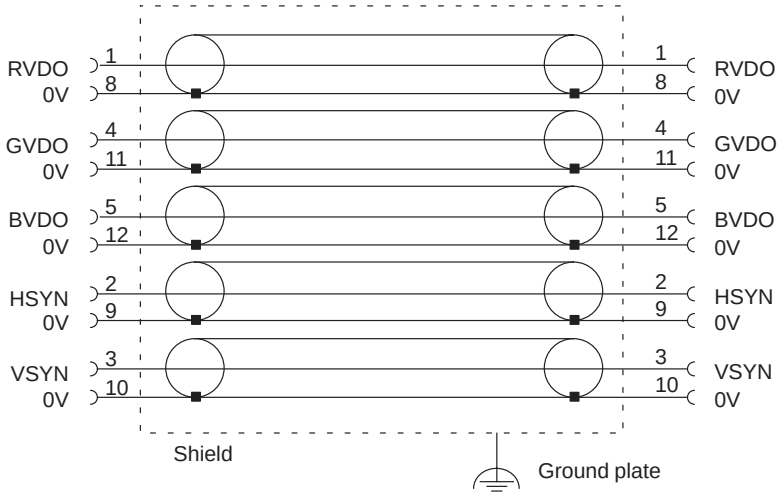
For each display unit, either of the following two video signal interfaces is used:

Type	Display unit
A	CRT unit, PDP unit, EL unit
B	LCD unit, 14″ CRT unit qualifying for CE marking

- **Type A**



Cable wiring

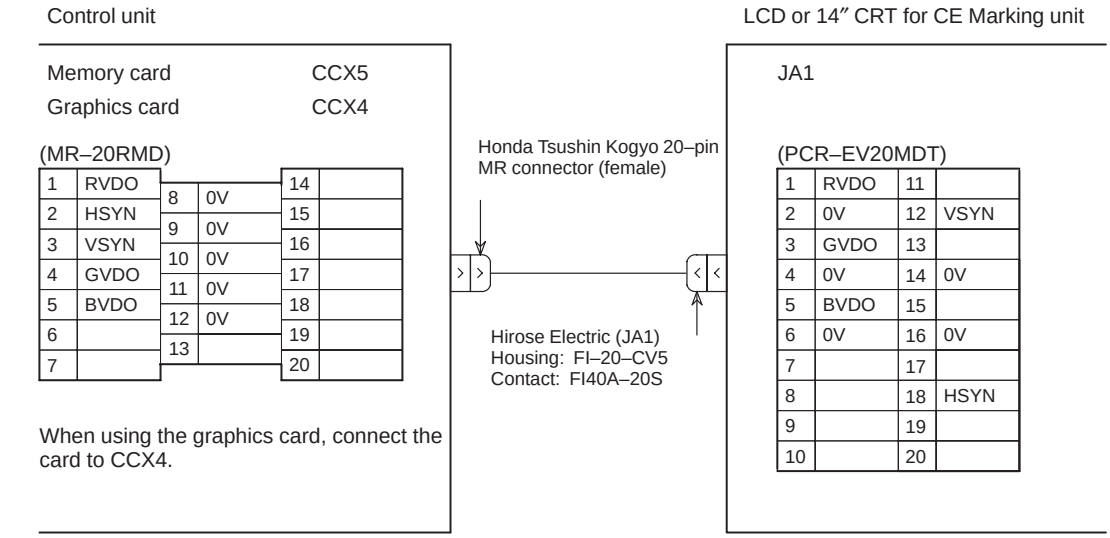


Maximum cable length: 50 m

Recommended cable material : A66L–0001–0371 coaxial cable

Recommended cable order number: A02B–0098–K871 (7 m)

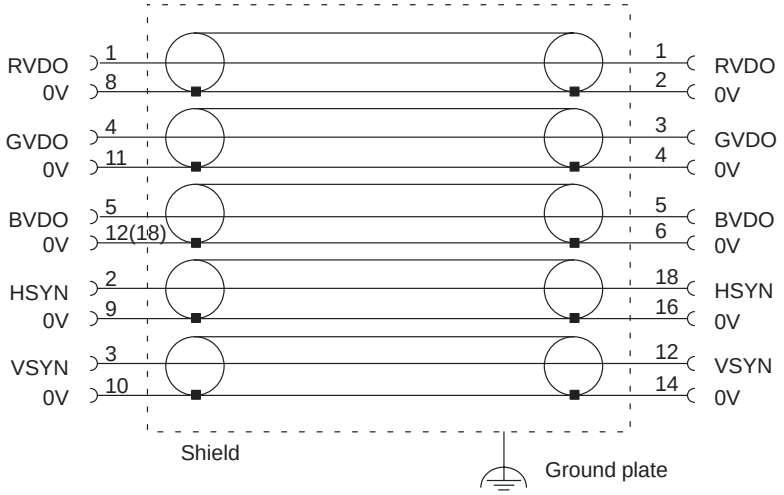
● Type B



Cable wiring

Honda 20–pin MR connector (female)

Hirose FI40A–20S (Connector)
FI–20–CV5 (Housing)



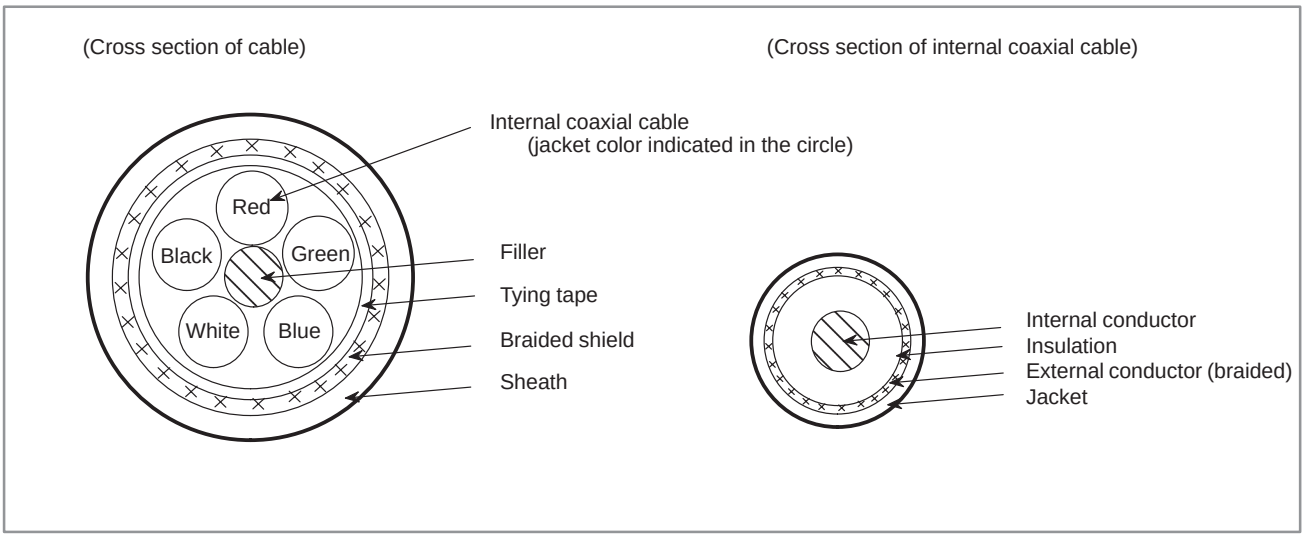
Maximum cable length : 50 m
Recommended cable kit : A02B–0098–K870 (5m)
Recommended cable material : A66L–0001–0371 coaxial cable
Recommended cable order number : A02B–0120–K888 (200m)
The Hirose Electric connector can be provided together with the housing.
Connector kit order number : A02B–0120–K305 (Hirose code: FI40A–20S–CV5)

Cable specifications (A66L–0001–0371)

Item		Unit	Material, specifications
Code		–	A66L–0001–0371
Manufacturer		–	Hitachi Cable, Ltd.
Manufacturer cable code		–	C0–IREFV (0)–CX–75–SB5X0.14SQ
Number of coaxial cables		Cables	5
Internal conductor	Size	mm^2	0.14
	Configuration	Conductors/mm	7/0.16
	Material	–	Tinned soft copper wire
	Approximate outside diameter	mm	0.48
Insulation	Material (color)	–	Crosslinked foamed polyolefin; white; heat resistance: 80°C
	Thickness	mm	0.71
	Approximate outside diameter	mm	1.90
External conductor (braided)	Material	–	Tinned soft copper wire
	Wire diameter	mm	0.08
	Density	%	95 or higher
	Thickness	mm	0.2
Jacket	Material	–	Vinyl; heat resistance: 80°C
	Color	–	Red, green, blue, white, black
	Thickness		0.15
	Approximate outside diameter	mm	2.6
Approximate outside diameter of bundled coaxial cables		mm	7.1
Tying tape thickness		mm	0.05
Braided shield	Wire diameter (material)	mm	0.12 (Tinned soft copper wire)
	Density	%	80 or higher (typ.82%)
	Thickness	mm	0.3
	Outside diameter	mm	7.8
Sheath	Material, color	–	Oil–resistant vinyl (A); black; heat resistance: 80°C
	Standard thickness	mm	0.7 ((Minimum thickness: 0.56)
Finished outside diameter		mm	9.2 ± 0.3
Conductor resistance at 20°C		Ω/km	Up to 143
Withstand voltage (across internal and external conductors)		–	Capable of withstanding 1000 VAC for one minute

Cable specifications (A66L–0001–0371)

Item	Unit	Material, specifications
Insulation resistance at 20°C (between internal and external conductors)	MΩ/km	1000 or higher
Characteristic impedance (10 MHz)	Ω	75 ± 5
Standard capacitance (1 kHz)	nF/km	56
Standard attenuation (10 MHz)	dB/km	53
Estimated mass	Kg/Km	105
Standard length	m	200
Package	–	Bunch

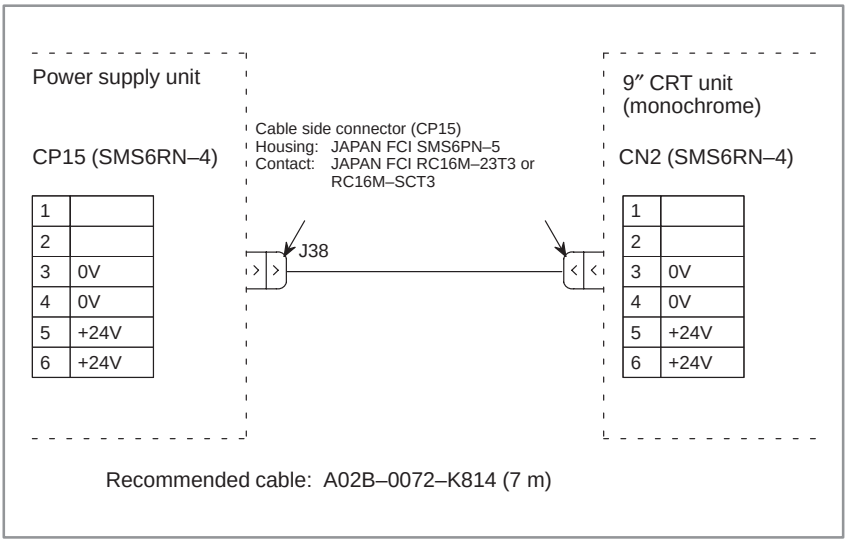


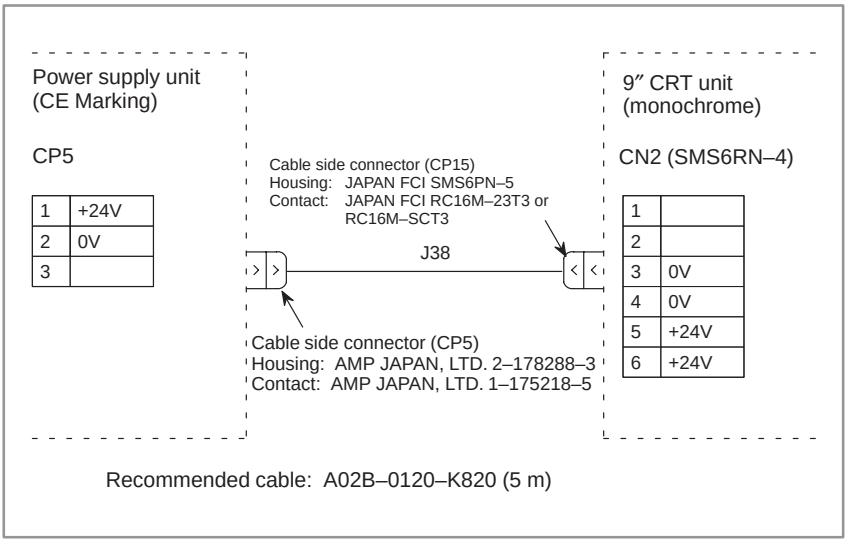
7.1.3 Connecting the Display Unit Power Supply

The required supply voltage varies with the display unit. Also, some display units, while requiring the same supply voltage, may use different connectors.

Use a power cable containing conductors of 30/0.18 (0.8 mm^2) or greater.

(1) 9″ monochrome CRT

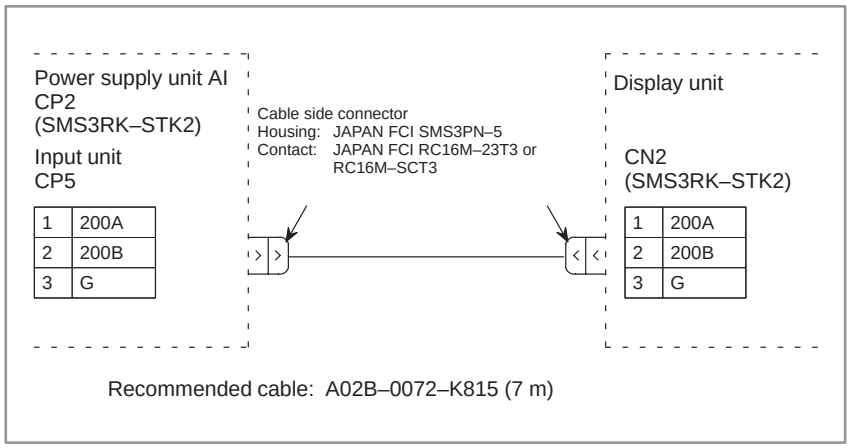




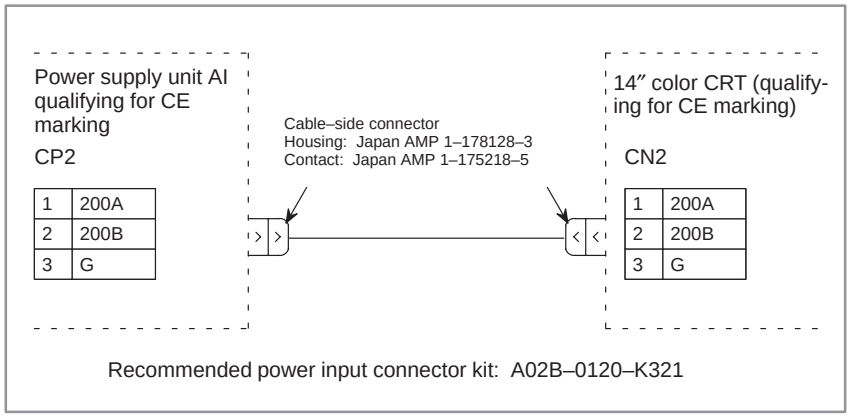
NOTE

When the power supply unit qualifying for CE marking is used, a different connector is used. For details, see Section 5.4, “Connection of the Input Unit Built–in Power Supply Unit AI (Qualifying for CE Marking).”

(2) 9″ color CRT, 14″ color CRT (standard type), PDP (standard type), and EL

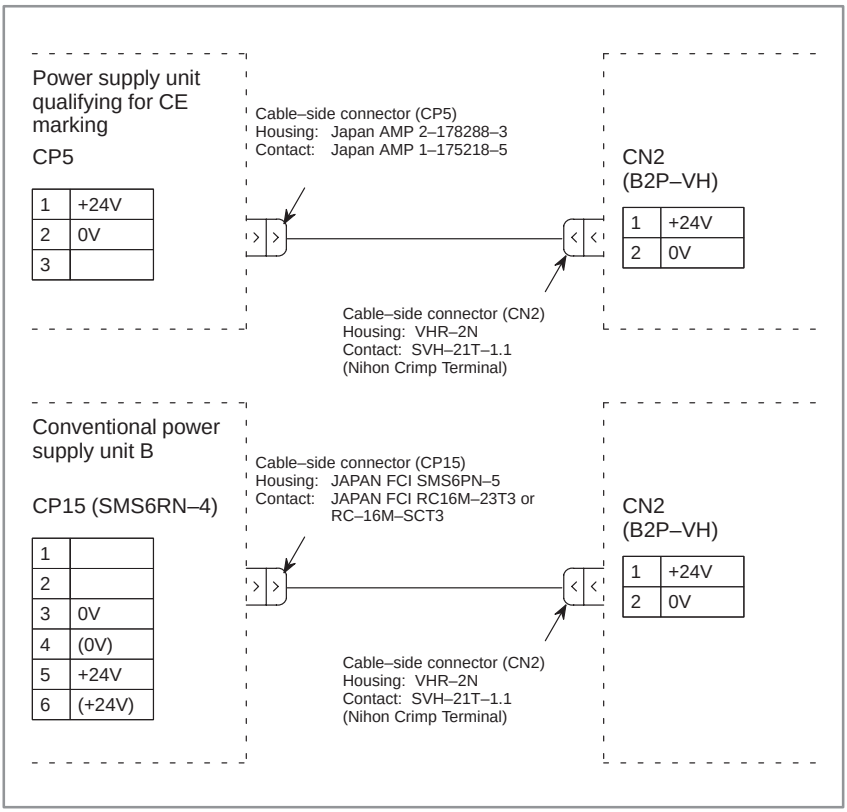


(3) 14″ color CRT (CE marking type)



(4) PDP (CE marking type)

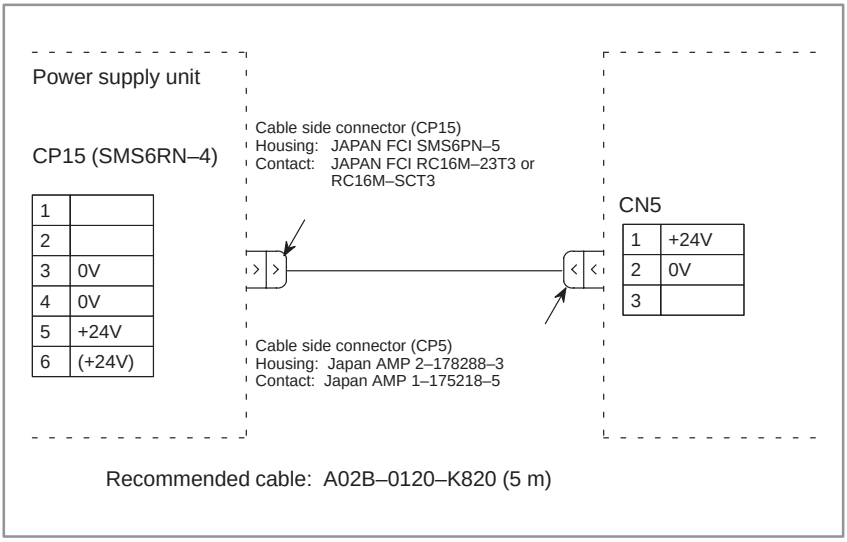
The power supply unit AI qualifying for CE marking, or the power supply unit B2 can be used. The power supply unit A and power supply unit AI cannot be used because they do not provide 24 VDC.



NOTE

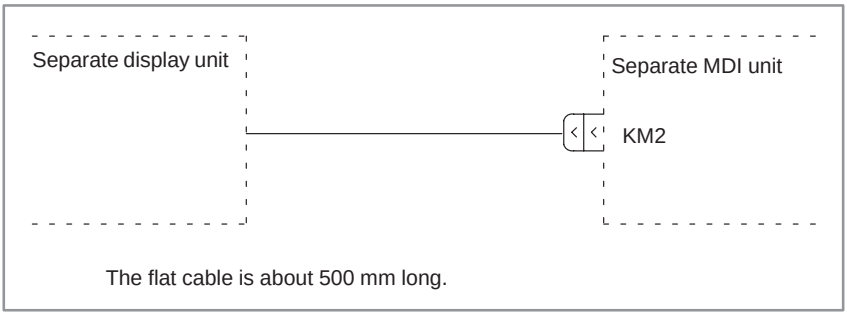
For the cable connector (CN2) on the PDP–unit side, use swaging tool YC–16 available from Nihon Crimp Terminal.

(5) LCD



7.1.4 Connecting the Soft Key Cable of a Separate Display Unit

Some separate display units have soft keys. These units have flat cables for the soft keys. Connect the soft key cable to connector KM2 of a separate MDI unit.

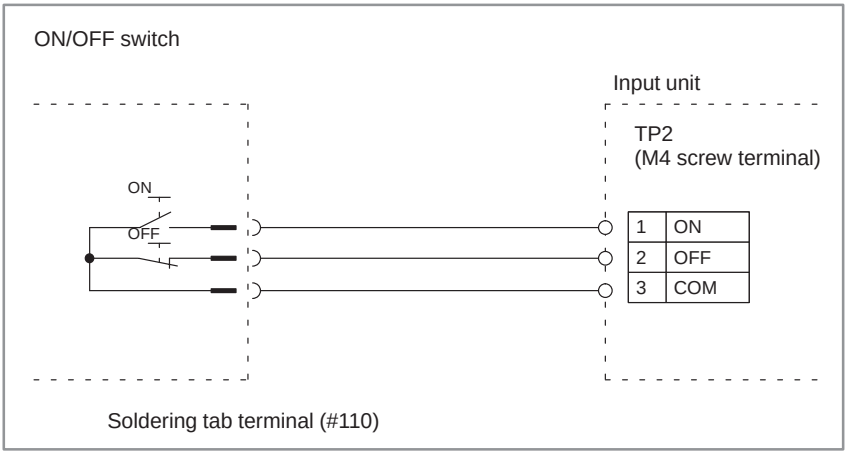


7.1.5 ON/OFF Switch on the Display Unit

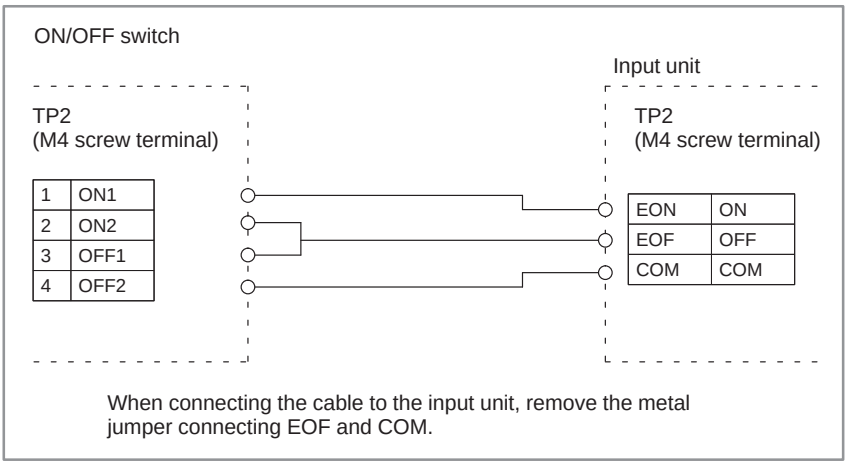
The 9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full–key type, and 14″ CRT/MDI unit all have an ON/OFF switch for turning the control unit on and off. The control unit can be turned on or off by pressing the ON/OFF switch when the switch is connected to the input unit or power supply unit AI (input unit built–in type).

(1) Connecting to the input unit

9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full–key type

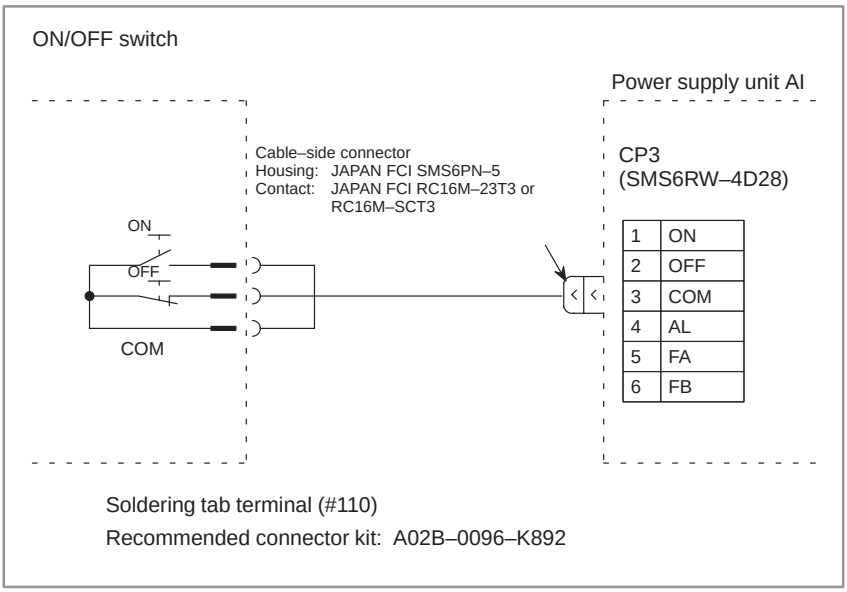


14″ CRT/MDI unit

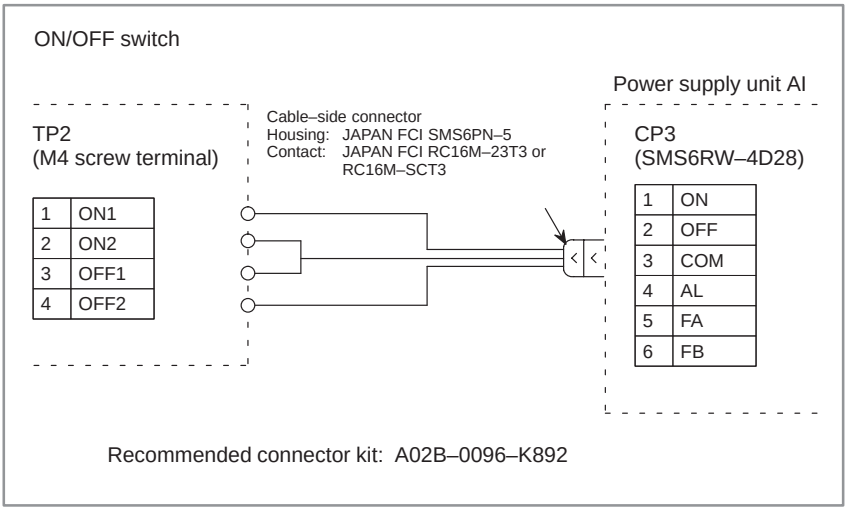


(2) Connecting to the power supply unit AI

9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full–key type

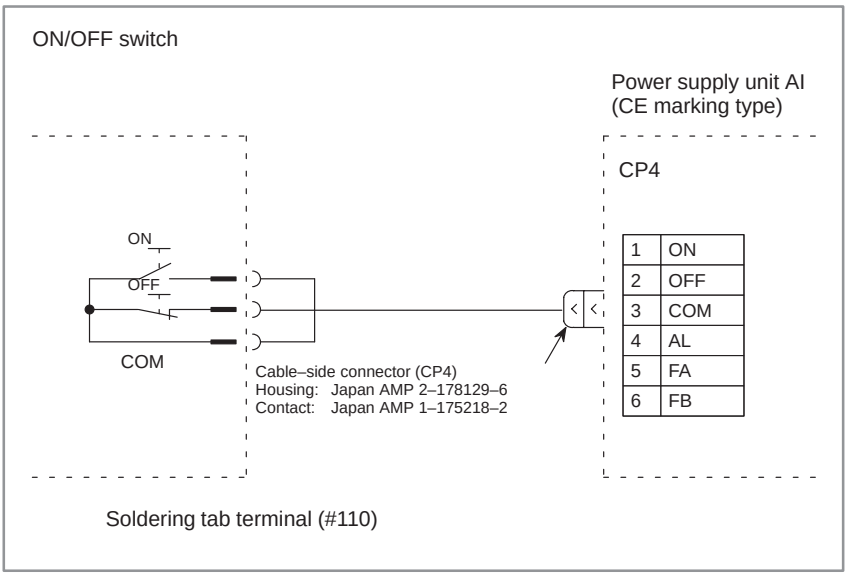


14″ CRT/MDI unit

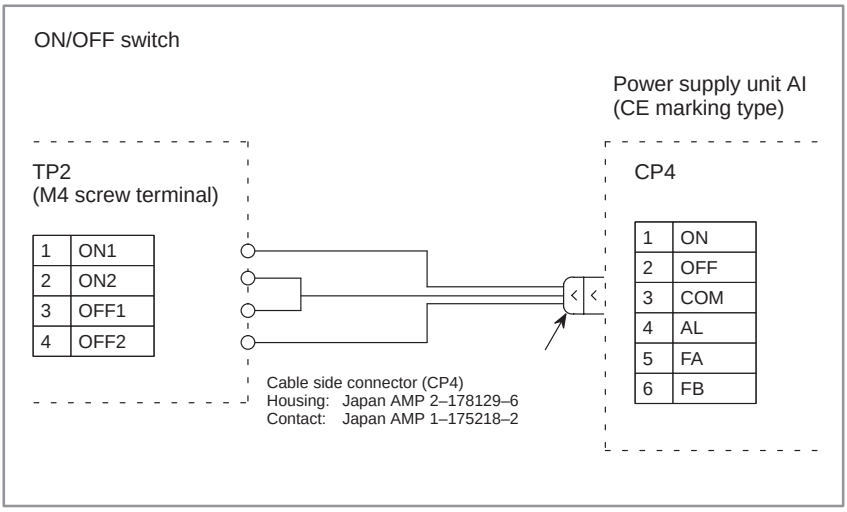


(3) Connecting to the power supply unit AI (CE marking type)

9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full–key type



14″ CRT/MDI unit



7.1.6 Adjusting the LCD

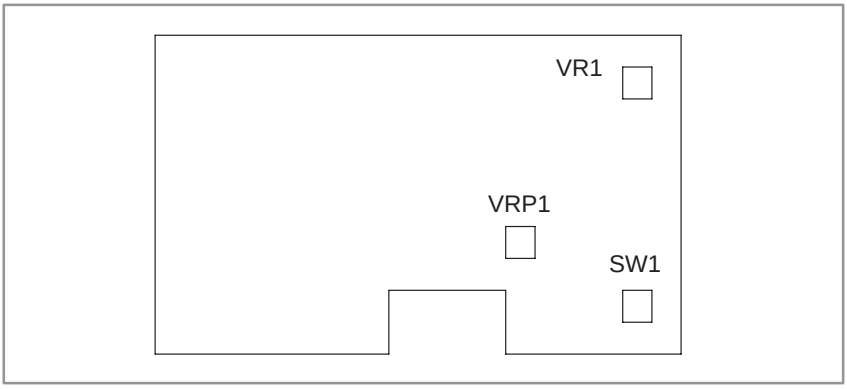
The LCD has controllers for fine adjustment of the video signal.

The controllers are required for eliminating slight disagreements between the NC unit and LCD. The controllers must be adjusted at installation or when the display circuit hardware of the NC, display unit, or cable is replaced to eliminate an error.

Never adjust any controllers other than those described below.

● Adjusting the 7.2″ LCD

(1) Adjustment positions (viewed from the rear of the display)



(2) Adjustment

(a) Setting the mode and the horizontal position

By adjusting SW1, the mode and the horizontal position can be changed as indicated in the table below. In inverted mode, black characters are displayed on a white background. The default setting is 9.

Mode		8–level gray scale	4–level gray scale	Inverted 8–level gray scale	Inverted 4–level gray scale
Horizontal position	1 dot to the right	0	4	8	C
	Standard	1	5	9	D
	1 dot to the left	2	6	A	E
	2 dots to the left	3	7	B	F

(b) Setting the contrast

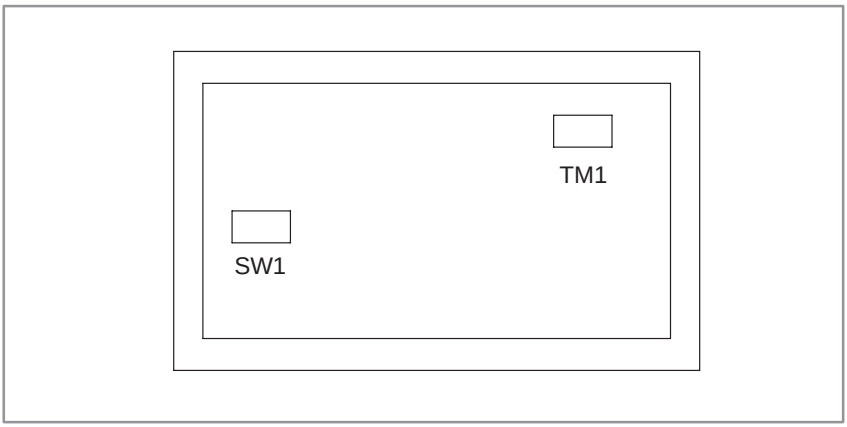
The contrast is adjusted by using VRP1.
When the ambient temperature is low, the brightness of the LCD decreases. (In particular, the LCD screen immediately after power–on is dark) This is not a failure but a property of the LCD. As the ambient temperature rises, the LCD screen becomes brighter.

(c) Eliminating flicker

Flicker eliminated by adjusting VR1. Do not adjust VR1 if no flicker is apparent.

- **Adjusting the 8.4″ LCD**

(1) Adjustment positions (viewed from the rear of the display)



(2) Adjustment

(a) Setting the horizontal position

- By adjusting SW1, the horizontal position can be changed as described below:

  When SW1 is turned to the next position in the + direction, the screen shifts to the right by one dot.

  When SW1 is turned to the next position in the – direction, the screen shifts to the left by one dot.
- The entire screen can be displayed.

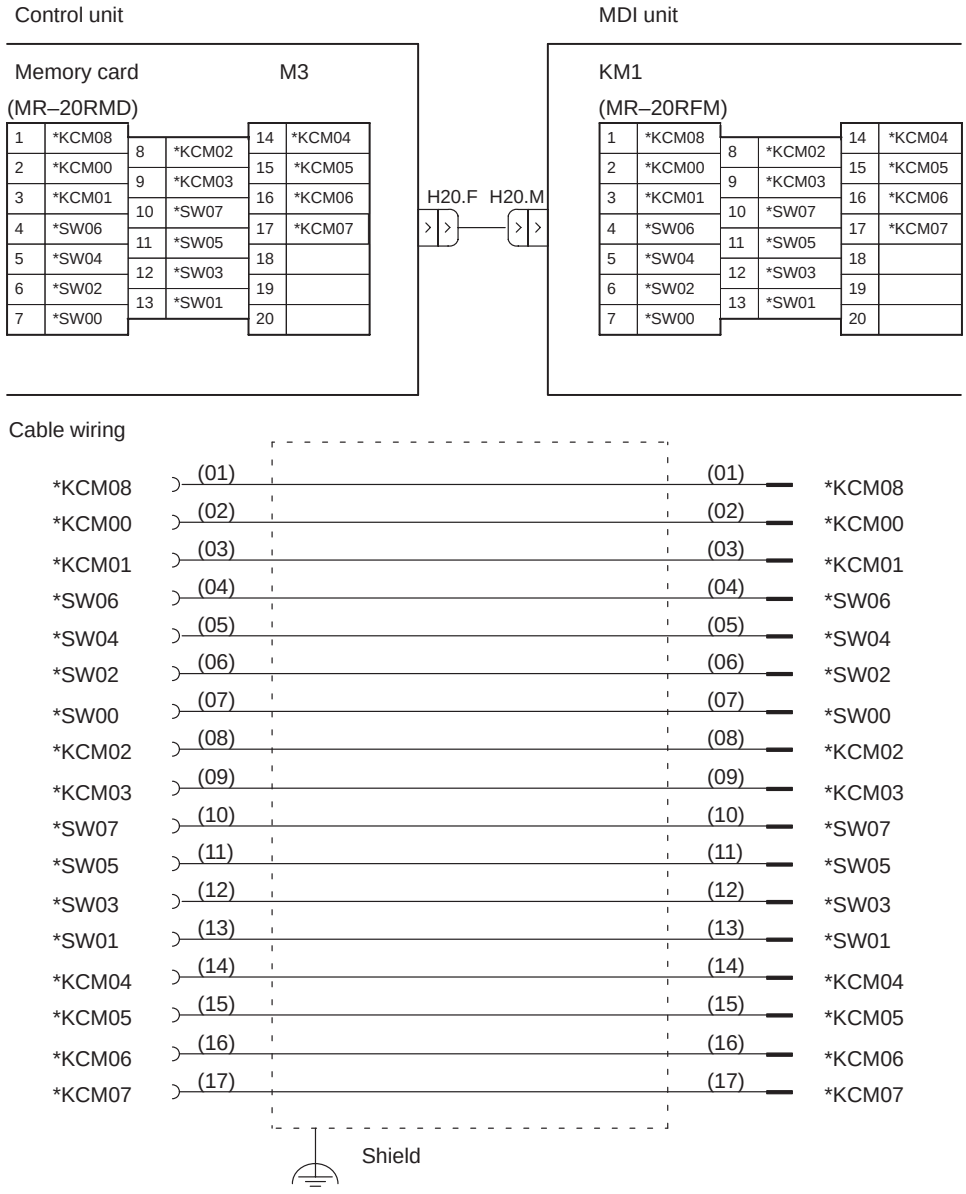
  The entire screen display can be obtained by a single setting.

(b) Eliminating flicker

Flicker adjustment pin TM1 is used. Adjustment pin TM1 can be set to either of positions A and B. Adjustment pin TM1 is factory–set to the B position. If flicker is apparent, set adjustment pin TM1 to the A position.

7.2 CONNECTING THE MDI UNIT

7.2.1 MDI Unit Interface

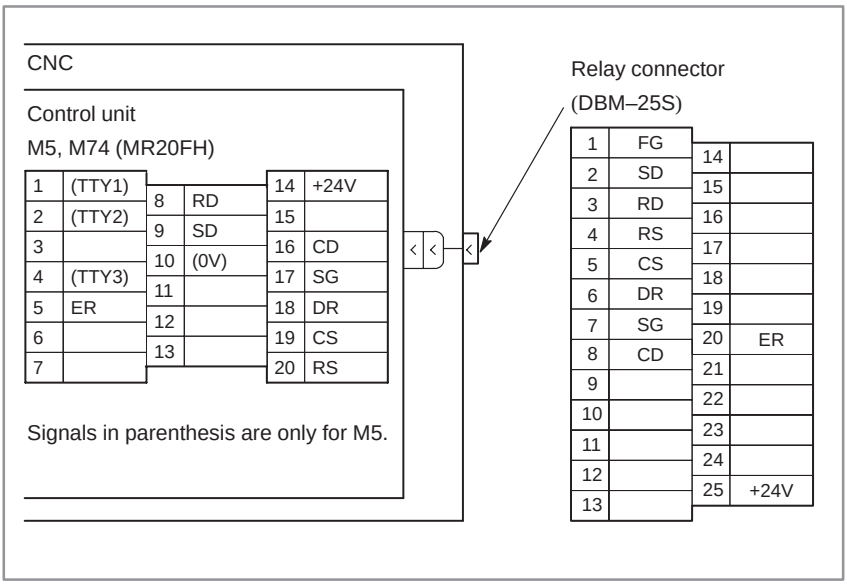


Use a unified shield cable of up to 50 m long.
Recommended cable : A02B–0050–K803 (7 m) or A02B–0098–K803 (7 m)
Recommended cable material : A66L–0001–0041 (7/0.18, 20 cores)

7.3 CONNECTING AN I/O DEVICE

7.3.1 Reader/Punch Interface

A program input/output unit, such as tape reader or FANUC FLOPPY CASSETTE, can be connected to the M5 or M74 connector of the control unit.



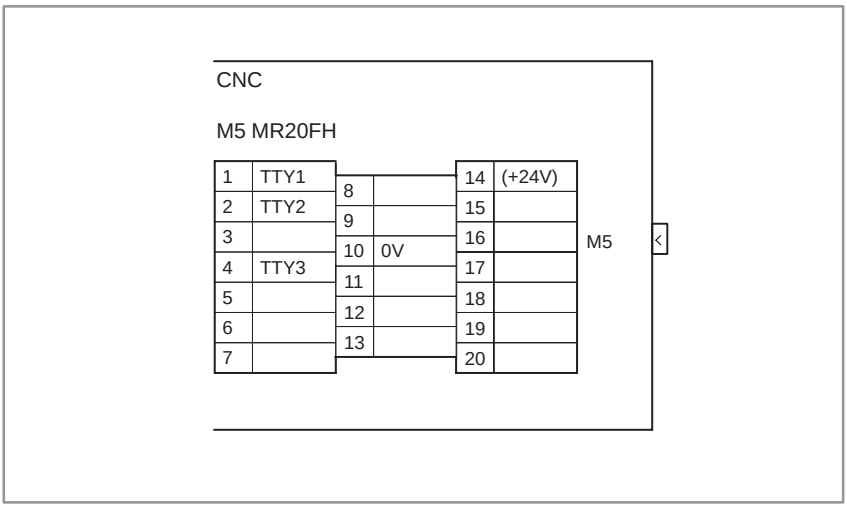
NOTE

The machine tool builder should provide the reader/punch relay board and cable, or use a punch panel. A unified shield cable must be used.

The following sections illustrate the connections to ASR33, PPR, a portable tape reader, and the FANUC FLOPPY CASSETTE.

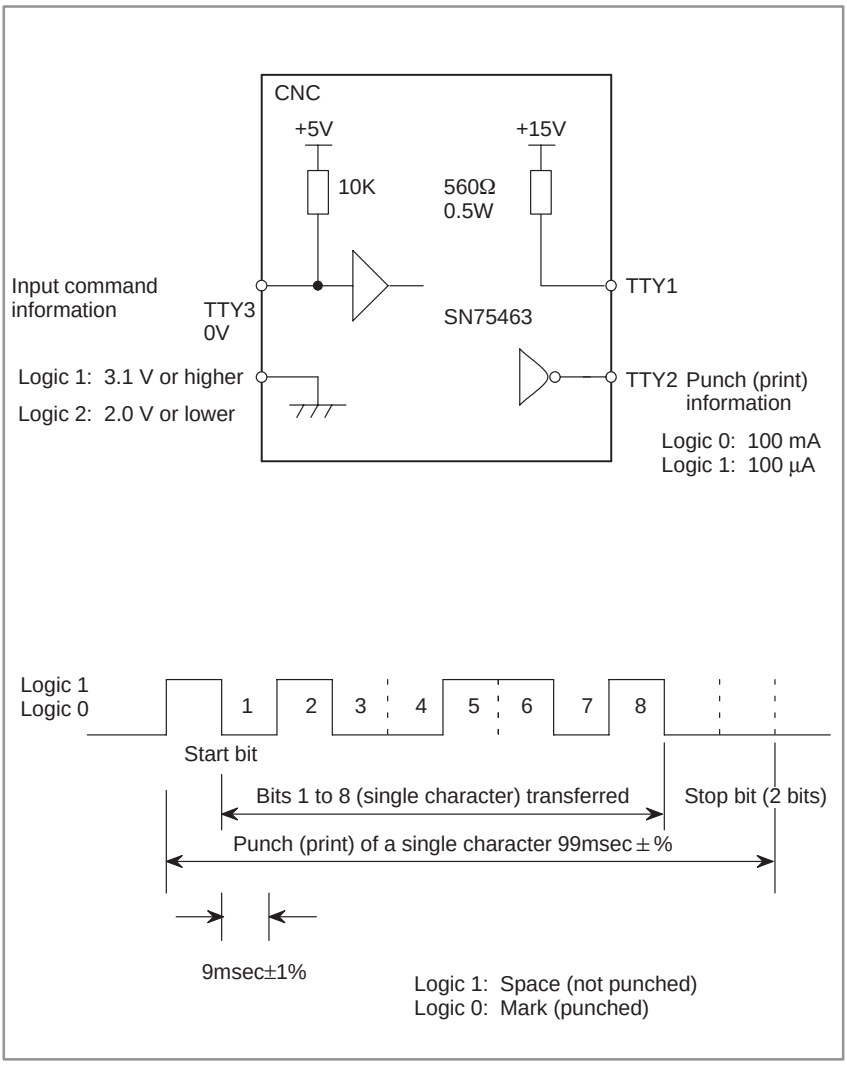
7.3.2 ASR33

(1) Connection between units



NOTE
1 The connection cable is not available as an optional item of the reader/punch interface. Use a unified shield cable.
2 When the ASR33 interface is used, set the reader/punch interface parameters.

(2) Signals


CNC
+5V
+15V
10K
560Ω
0.5W
Input command
information
TTY3
0V
TTY1
SN75463
Logic 1: 3.1 V or higher
Logic 2: 2.0 V or lower
TTY2 Punch (print)
information
Logic 0: 100 mA
Logic 1: 100 μA
Logic 1
Logic 0
1
2
3
4
5
6
7
8
Start bit
Bits 1 to 8 (single character) transferred
Stop bit (2 bits)
Punch (print) of a single character 99msec ± %
9msec±1%
Logic 1: Space (not punched)
Logic 0: Mark (punched)

7.3.3
PPR Connection

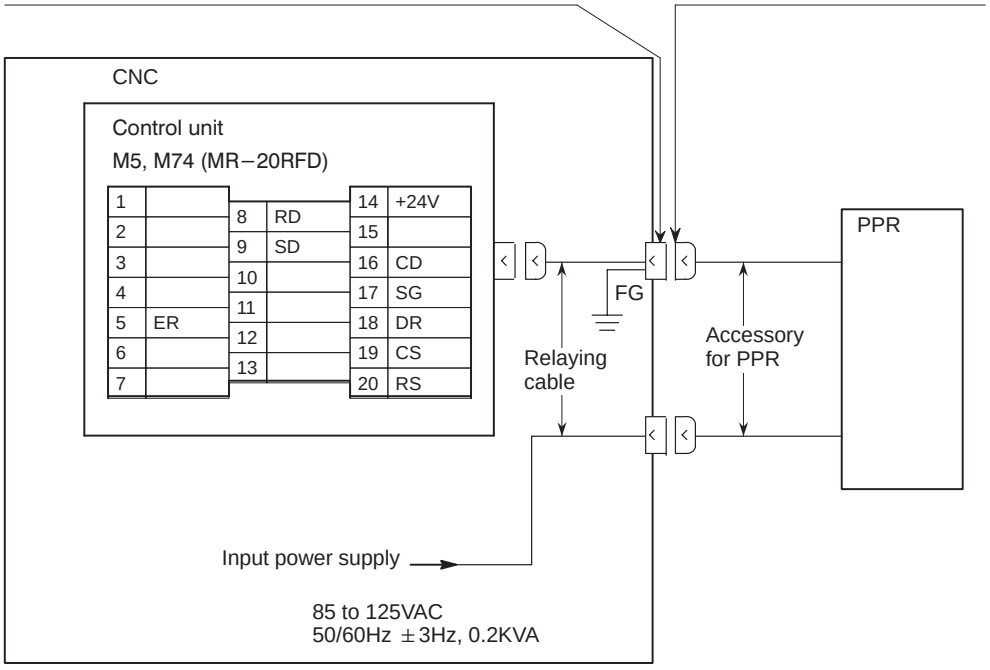
Relaying connector signal layout

1	2	3	4	5	6	7	8	9	10	11	12	13
FG	SD	RD	RS	CS	DR	SG	CD					

14	15	16	17	18	19	20	21	22	23	24	25
						ER					+24V

Relaying connector
Connector : DBM-25S
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)
Lock metal : D20418-J2
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)

Cable side connector
Connector : DBM-25P
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)
Lock metal : DDB–C2–J9
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)



NOTE
1 Prepare the relaying connector, the relaying cable and the plug receptacle at the machine tool builder.
2 Prepare the power supply for PPR at the machine tool builder.
3 Recommended cable specification : A66L-0001-0041
4 When connecting the PPR, set the corresponding parameter to use reader puncher interface (baud rate is 4800 baud).

7.3.4 Portable Tape Reader Connection

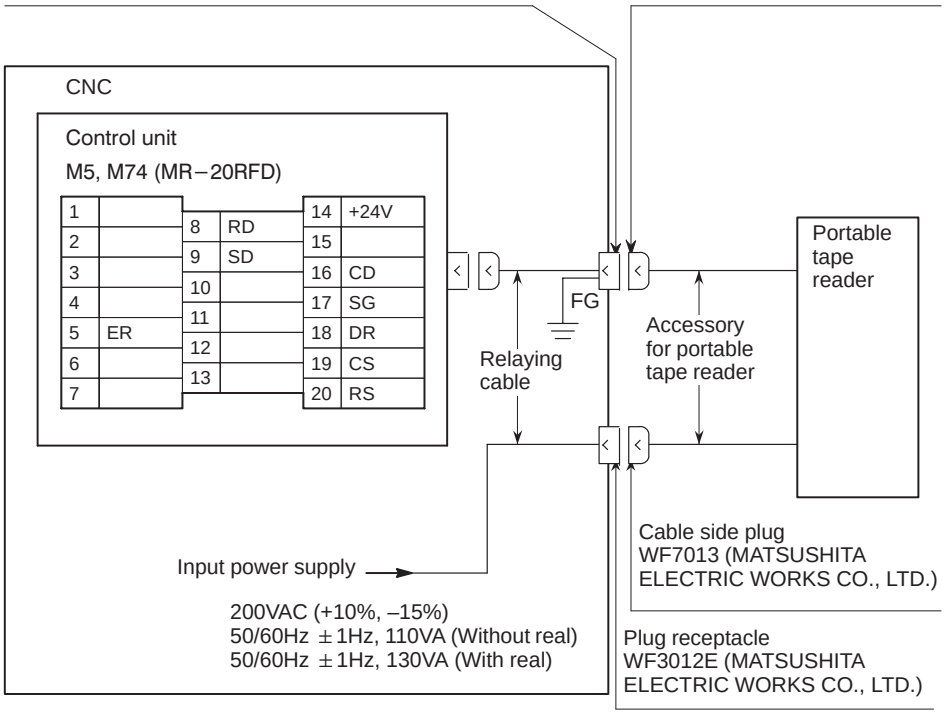
Relaying connector signal layout

1	2	3	4	5	6	7	8	9	10	11	12	13
FG	SD	RD	RS	CS	DR	SG	CD					

14	15	16	17	18	19	20	21	22	23	24	25
						ER					+24V

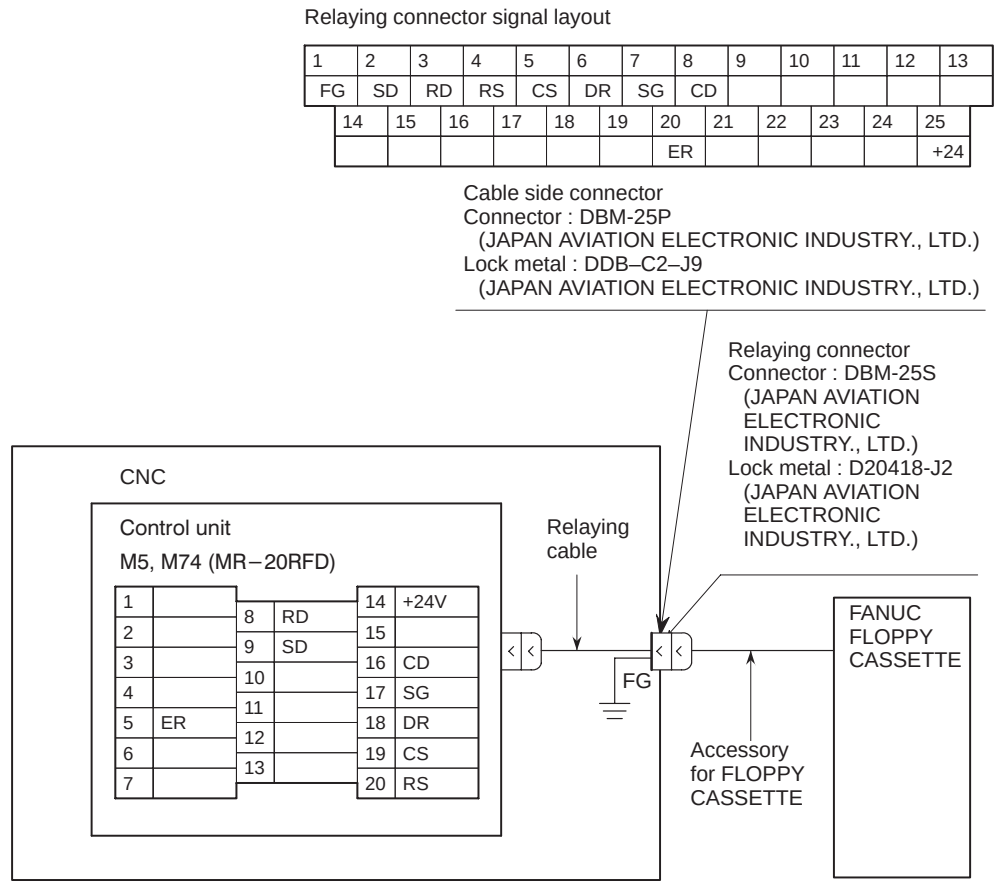
Relaying connector
Connector : DBM-25S
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)
Lock metal : D20418-J2
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)

Cable side connector
Connector : DBM-25P
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)
Lock metal : DB–C2–J9
(JAPAN AVIATION ELECTRONIC INDUSTRY., LTD.)



NOTE
1 Prepare the relaying connector, the relaying cable and the plug receptacle at the machine tool builder.
2 Prepare the power supply for PPR at the machine tool builder.
3 Recommended cable specification : A66L-0001-0041
4 When connecting the portable tape reader, set the corresponding parameter to use reader puncher interface (baud rate is 4800 baud).

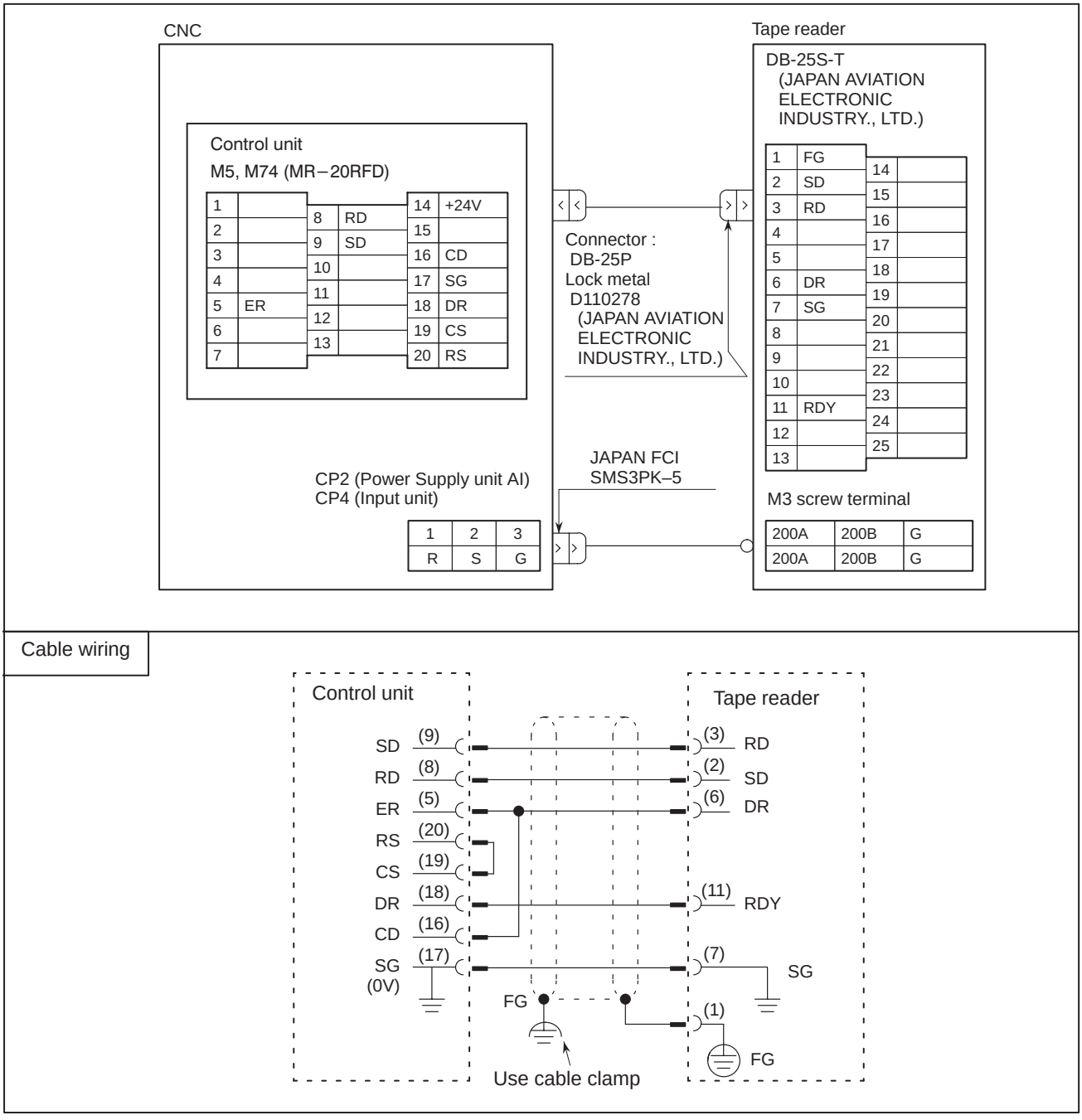
7.3.5 FANUC FLOPPY CASSETTE Connection



NOTE

1 Machine tool builder shall furnish relay connector and relay cable.
2 Use a totally shielded cable for the signal cable.
  Recommended cable specification : A66L-0001-0041
3 Open all terminals other than illustrated.
4 Set a parameter to be able to use reader puncher interface when connecting FANUC cassette.
  The baud rate is 4800 baud.
5 Connect the FANUC cassette to either M5 or M74.
  Do not use both pins; the power capacity may exceed that of +24V and blow the fuse.

7.3.6 Connection of Tape Reader without Reels



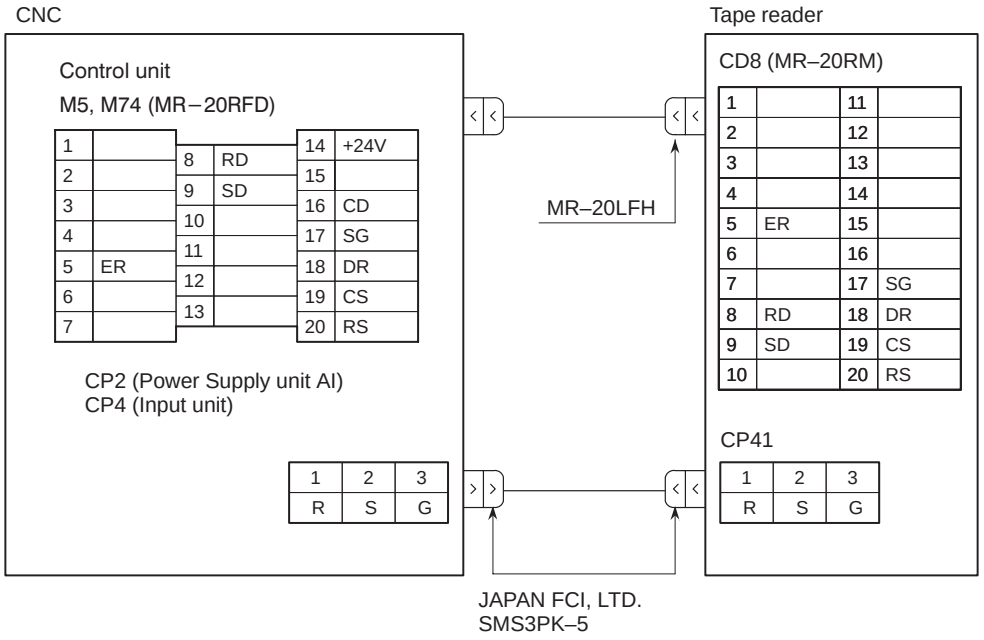
Cable wiring

NOTE

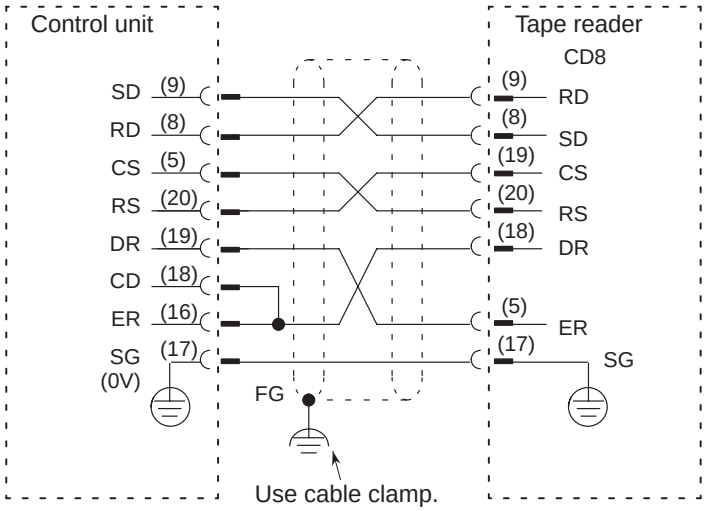
1 Note that cables with the same names on the control unit and the tape reader cannot be connected.

2 Recommended cable specification : A66L-0001-0041

7.3.7 Connection of Tape Reader with Reels



Cable wiring



NOTE

1 Note that cables with the same names on the control unit and the tape reader cannot be connected.

2 Recommended cable specification : A66L-0001-0041

7.3.8 RS–232–C Interface Specification

RS–232–C Interface signals

Generally signals as follows are used in RS–232–C interface.

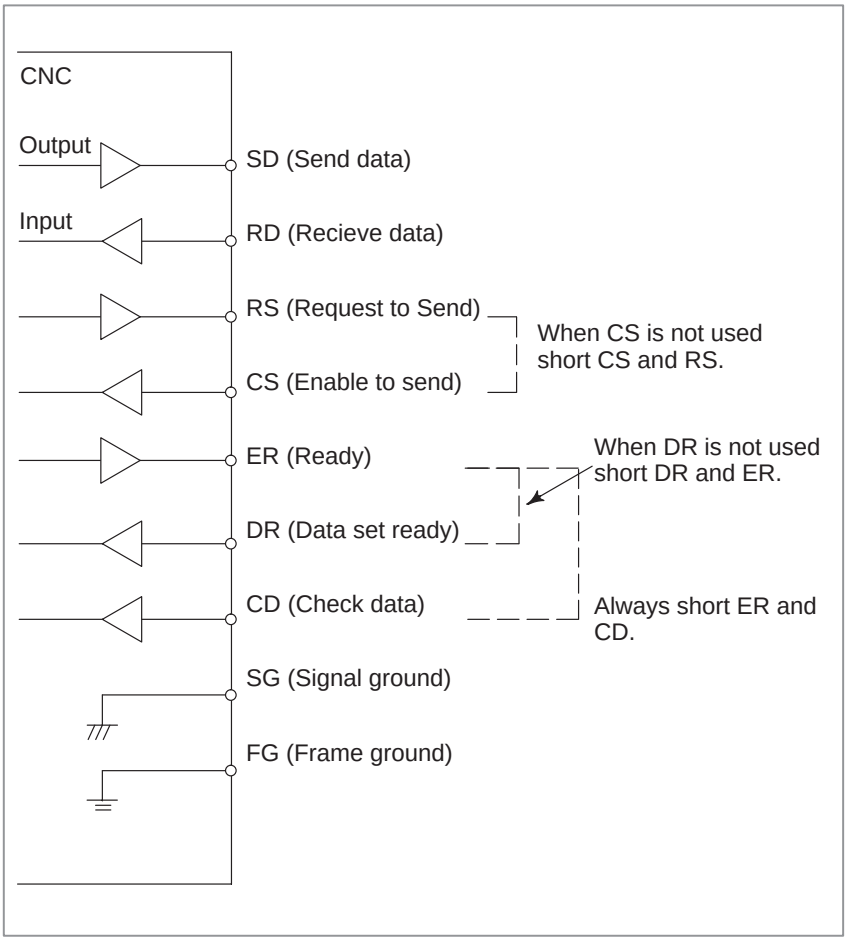
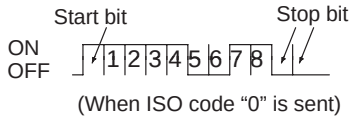


Fig. 7.3.8 RS–232–C interface

Signal description of RS–232–C interface

Signal name	RS–232–C circuit number	I/O	Description	
SD	103	Output	Sending data	 (When ISO code “0” is sent)
RD	104	Input	Receiving data	
RS	105	Output	Sending request	This signal is set to on when NC starts sending data and is turned off when transmission ends.
CS	106	Input	Sending permitted	When both this signal and the DR signal are set, the NC can send data. If external device processing is delayed by a punching operation, etc., NC data sending can be stopped by turning off this signal after sending two characters, including the data being sent currently. If this signal will not be used, make sure to strap this signal circuit to the RS signal circuit.
DR	107	Input	Data set ready	When external device is ready to operate, this signal is set. This signal should usually be connected to the signal indicating external device power supply being on. (ER signal of external device). See Note below. The NC transfers data when this signal is set. If the signals turned off during data transfer, alarm 086 is issued. If the DR signal will not be used, make sure to strap this signal circuit to the ER signal circuit.
ER	108.2	Output	NC ready to operation	This signal is set when the NC is ready to operate. External device should regard the SD signal as being significant when the ER signal is set.
CD	109	Input	Signal quality signal	Since this signal is not used in connections with external device, the signal circuit must be strapped, inside the connecting cable, to the ER signal circuit.
SG	102		Signal grounding	
FG	101		Frame grounding	

NOTE

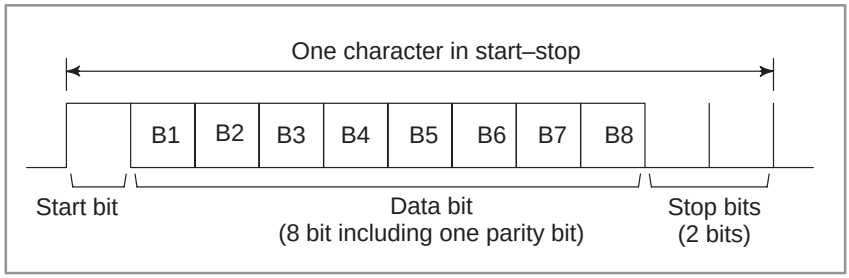
Signal on/off state is defined as follows;

	–3V or lower	+3 or higher
Function	OFF	ON
Signal Condition	Marking	Spacing

Transmission Method of RS–232–C interface

Start–stop

Generally, two transmission methods are available at the serial interface. Series 0 use the start–stop method. With this method, start and stop signals are output before and after each data bit.



Codes

Transmission codes are as follows:

(i) EIA code and Control codes DC1 to DC4.

(ii) ISO code and Control codes DC1 to DC4 (Optional ISO code input is necessary.)

The connected external device must be able to recognize the following control codes, sent from NC.

Control code		8	7	6	5	4		3	2	1
DC1	Tape reader start				○		○			○
DC2	Tape punch designation				○		○		○	
DC3	Tape reader stop	○			○		○		○	○
DC4	Tape punch release				○		○	○		

NOTE
The listed control codes are used for both EIA and ISO.

In this interface, control codes DC to DC4 are used.

(a) NC can control external device by issuing codes DC1 to DC4.

(b) When external processing falls behind the pace of the NC signals (When NC issues data)

(i) External device can temporarily stop NC data output by using the NC's CS signal. Data output stops within two characters including a currently transmitting character when CS OFF signal is input to NC. When CS signal is turned on again, data transmission start.

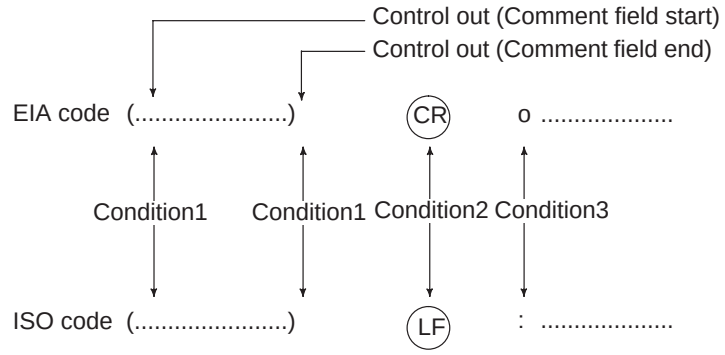
(ii) If control code DC3 is input to NC, NC stops data output within ten characters. When control code DC1 is input to NC, NC starts sending data again.

(c) When the external device is equipped with an ISO/EIA converter, the external device must satisfy the specification shown in Table 7.3.8 (a).

Table7.3.8

ISO code										EIA code										Meaning	
Character	8	7	6	5	4		3	2	1	Character	8	7	6	5	4		3	2	1		
0			○	○		•				0						•					Numeral 0
1	○		○	○		•			○	1						•			○		Numeral 1
2	○		○	○		•		○		2						•		○			Numeral 2
3			○	○		•		○	○	3				○		•		○	○		Numeral 3
4	○		○	○		•	○			4						•	○				Numeral 4
5			○	○		•	○		○	5				○		•	○		○		Numeral 5
6			○	○		•	○	○		6				○		•	○	○			Numeral 6
7	○		○	○		•	○	○	○	7						•	○	○	○		Numeral 7
8	○		○	○	○	•				8					○	•					Numeral 8
9			○	○	○	•			○	9				○	○	•			○		Numeral 9
A		○				•			○	a		○	○			•			○		Address A
B		○				•		○		b		○	○			•		○		?	Address B
C	○	○				•		○	○	c		○	○	○		•		○	○		Address C
D		○				•	○			d		○	○			•	○			?	Address D
E	○	○				•	○		○	e		○	○	○		•	○		○	?	Address E
F	○	○				•	○	○		f		○	○	○		•	○	○			Address F
G		○				•	○	○	○	g			○	○		•	○	○	○		Address G
H		○			○	•				h		○	○		○	•					Address H
I	○	○			○	•			○	i		○	○	○	○	•			○		Address I
J	○	○			○	•		○		j		○		○		•			○	?	Address J
K		○			○	•		○	○	k		○		○		•		○			Address K
L	○	○			○	•	○			l		○				•		○	○	?	Address L
M		○			○	•	○		○	m		○		○		•	○				Address M
N		○			○	•	○	○		n		○				•	○		○		Address N
O	○	○			○	•	○	○	○	o		○				•	○	○			Address O
P		○		○		•				p		○		○		•	○	○	○		Address P
Q	○	○		○		•			○	q		○		○	○	•					Address Q
R	○	○		○		•		○		r		○			○	•			○		Address R
S		○		○		•		○	○	s			○	○		•		○			Address S
T	○	○		○		•	○			t			○			•		○	○		Address T
U		○		○		•	○		○	u			○	○		•	○				Address U
V		○		○		•	○	○		v			○			•	○		○	?	Address V
W	○	○		○		•	○	○	○	w			○			•	○	○			Address W
X	○	○		○	○	•				x			○	○		•	○	○	○		Address X
Y		○		○	○	•			○	y			○	○	○	•				?	Address Y
Z		○		○	○	•		○		z			○		○	•			○		Address Z
DEL	○	○	○	○	○	•	○	○	○	Del		○	○	○	○	•	○	○	○	*	Delete (cancel erroneous hole)
NUL						•				Blank						•				*	No holes. Not used at significant data zone is EIA code.
BS	○				○	•				BS			○		○	•		○		*	Back space
HT					○	•			○	Tab			○	○	○	•	○	○		*	Tabulator
LF or NL					○	•		○		CR or EOB	○					•					End of block
CR	○				○	•	○		○							•				*	Carriage return
SP	○		○			•				SP				○		•				*	Space
%	○		○			•	○		○	ER					○	•		○	○		Absolute rewind stop
(			○		○	•				(2–4–5)				○	○	•		○			Control out (start of comment)
)	○		○		○	•			○	(2–4–7)		○			○	•		○			Control in (end of comment)
+			○		○	•		○	○	+		○	○	○		•				*	Plus sign
–			○		○	•	○		○	–		○	○		○	•				–	Minus sign
:			○	○	○	•		○													Assumed as program number in ISO code.
/	○		○		○	•	○	○	○	/			○	○		•			○		Optional block skip
.			○		○	•	○	○		.		○	○		○	•		○	○		Decimal point
#	○		○			•		○	○											*	Sharp
$			○			•	○													*	Dollar symbol
&	○		○			•	○	○		&					○	•	○	○		*	Ampersand
’			○			•	○	○	○											*	Apostrophe
*	○		○		○	•		○												*	Asterisk
,	○		○		○	•	○			,			○	○	○	•		○	○	*	Comma
;	○		○	○	○	•		○	○											*	Semicolon
<			○	○	○	•	○													*	Left angle bracket
=	○		○	○	○	•	○		○											*	Equal mark
>	○		○	○	○	•	○	○												*	Right angle bracket
?			○	○	○	•	○	○	○											*	Question mark
@	○	○				•														*	Commerical at mark
”			○			•		○												*	Quotation mark

NOTE
1 When the external device is equipped with an ISO/EIA converter, the following items must be noted in Table 7.3.8.



Condition1

Left parenthesis “(”of the ISO code punches holes at bits 2, 4 and 5 when used in the EIA code.
Right parenthesis “)”of the ISO code punches holes at bits 2, 4 and 7 when used in the EIA code.

Condition2

EIA code (CR) is (LF) in ISO code.

Condition3

EIA code O is : in ISO code.

NOTE
2 Control codes DC1 to DC4 are transmission codes output from the NC. So they need not to be punched on the NC tape.

(iii) Transmission rate (Baud rate)

The transmission rate (Baud rate) is the number of bits transferred per second.

The following baud rates are available depending on the system parameter.

50, 100, 110, 150, 200, 300, 600, 1200, 2400, 4800, 9600.

(Example)

Baud rate : 110

When using one start bit and two stop bits (totalling 11 bits per character):

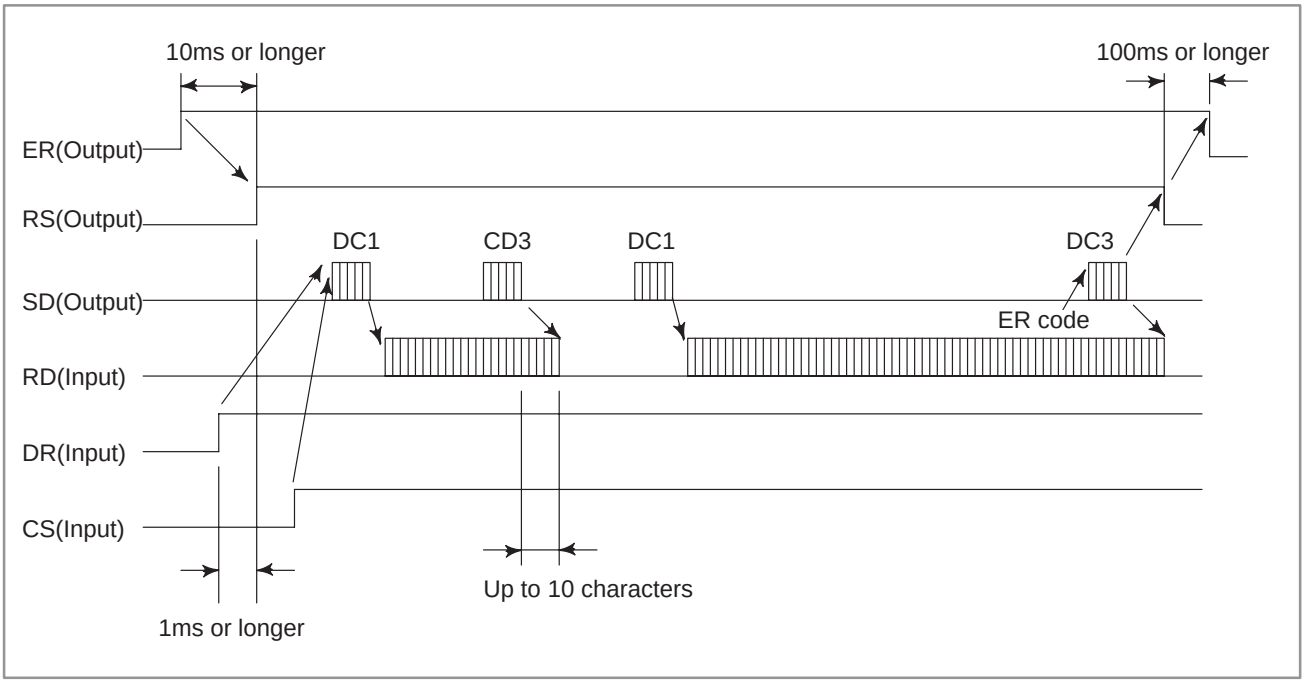
Transmission characters/second= $\frac{110}{11}$ =10 characters/second (Max.)

(iv) Cable length
The cable length depends on the external device type. Consult with the device manufacturers for actual connecting cable lengths.
When cable A (A66L–0001–0041) is used, cable length is as follows by the specification of NC.

for RS–232–C 100m or less ... 4800 bauds or less
60m or less ... 9600 bauds or less

Time chart when the NC receives data (Read into memory)

(1) NC outputs DC1.
(2) The external device starts sending data upon receiving DC1.
(3) NC sends DC3 when NC processing is delayed.
(4) The external device stops sending data to NC after receiving DC3. The device may send up to 10 characters after receiving DC3. If it sends more than 10 characters, alarm 087 will occur.
(5) NC reissues DC1 upon completing delayed processing.
(6) The external device restarts data output upon receiving the DC1 code (the data must be the next data to the preceding.)
(7) NC sends DC3 upon completing data read.
(8) The external device stops sending data.



Time chart when the NC send data (Punch out)

(1) NC output DC2.

(2) NC outputs punch data in succession.

(3) When data processing is delayed at the external device.

(a) Data output stops within two characters including a currently transmitting character when CS signal is turned off.
When CS signal is turned on again, data transmission starts. (See Fig. A)

(b) If control code DC3 is input to NC, NC stops data output within ten characters. When control code DC1 is input to NC, NC starts sending data again. (See Fig. B)

(4) The NC starts sending the next data if the CS signal is turned on after the external device completes data processing.

(5) The NC issues DC4 upon completing data output.

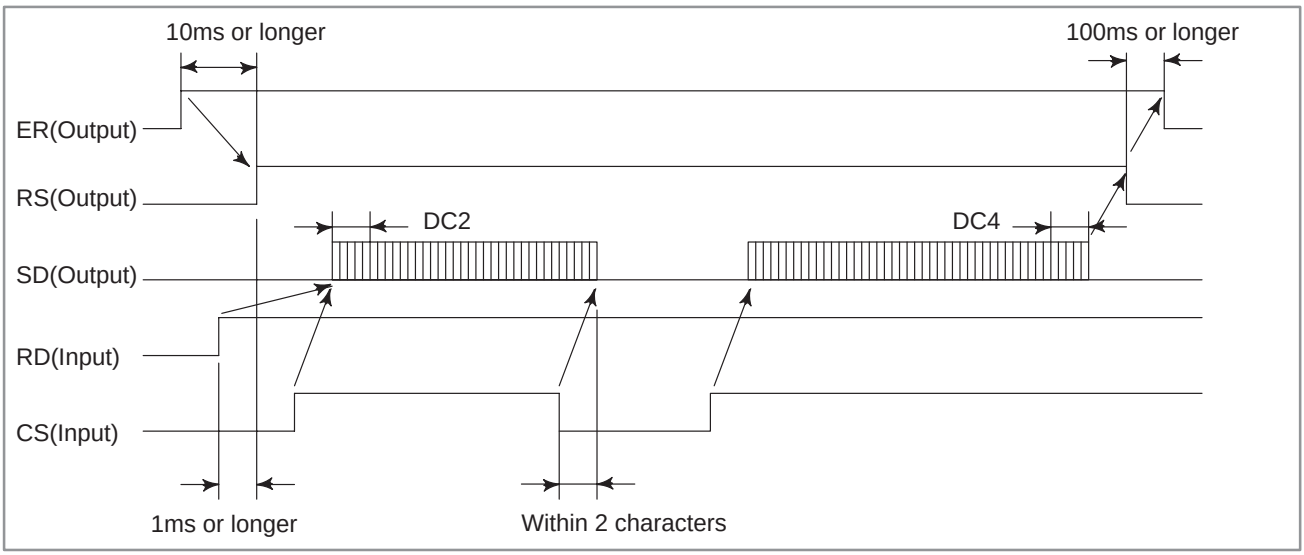


Fig. A

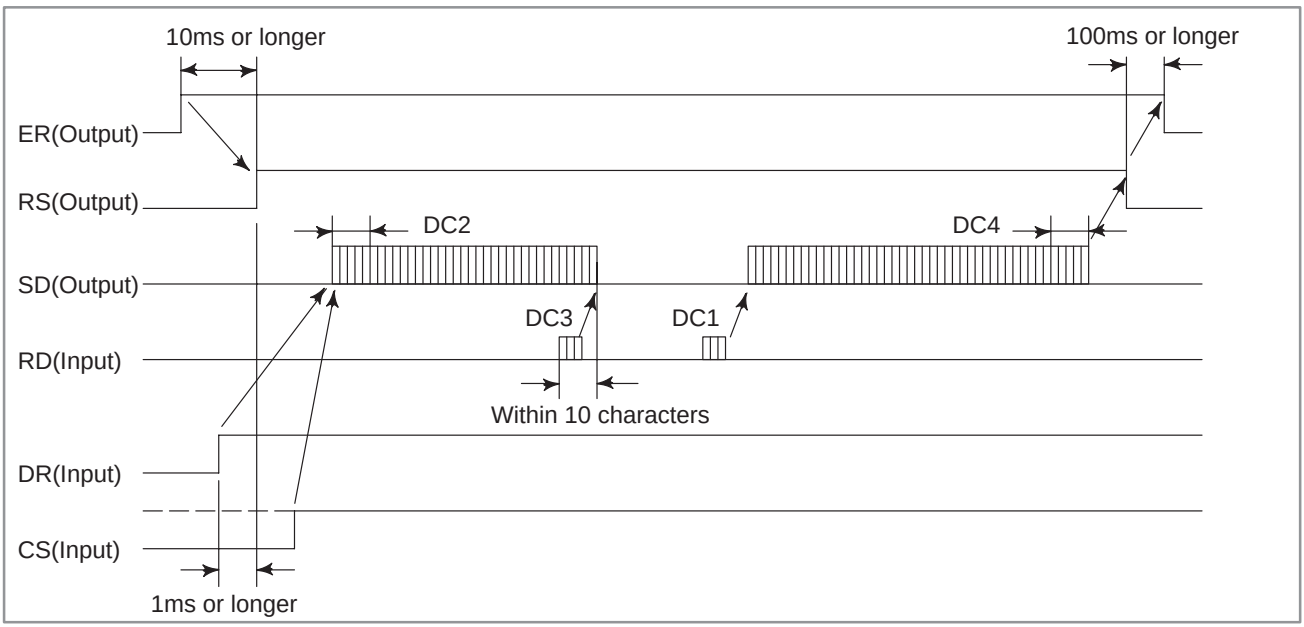
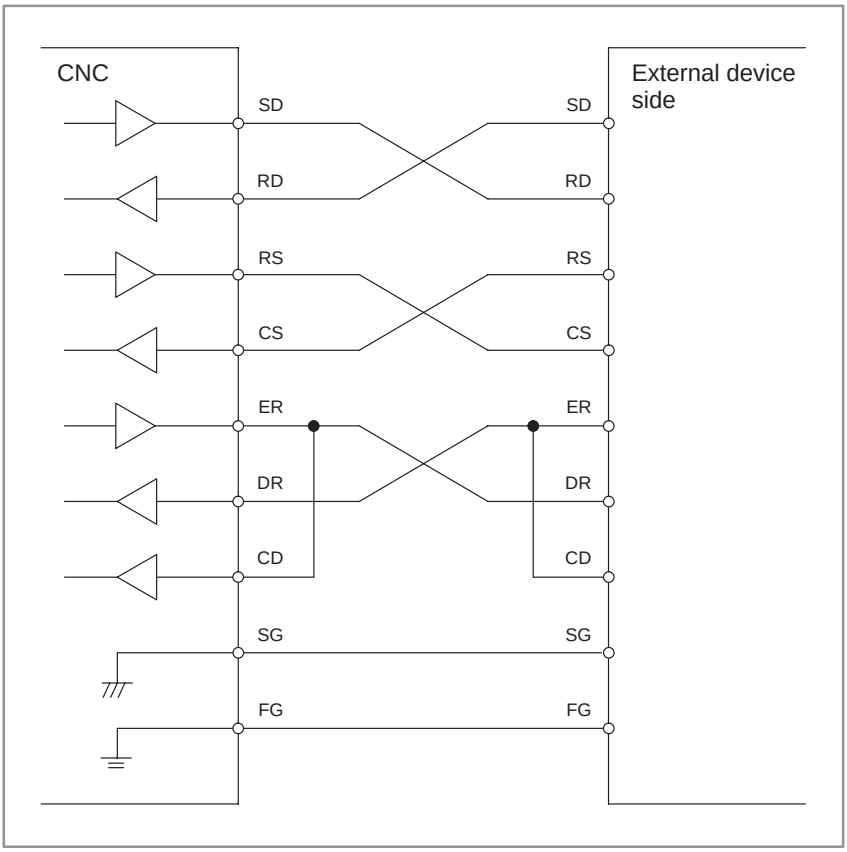
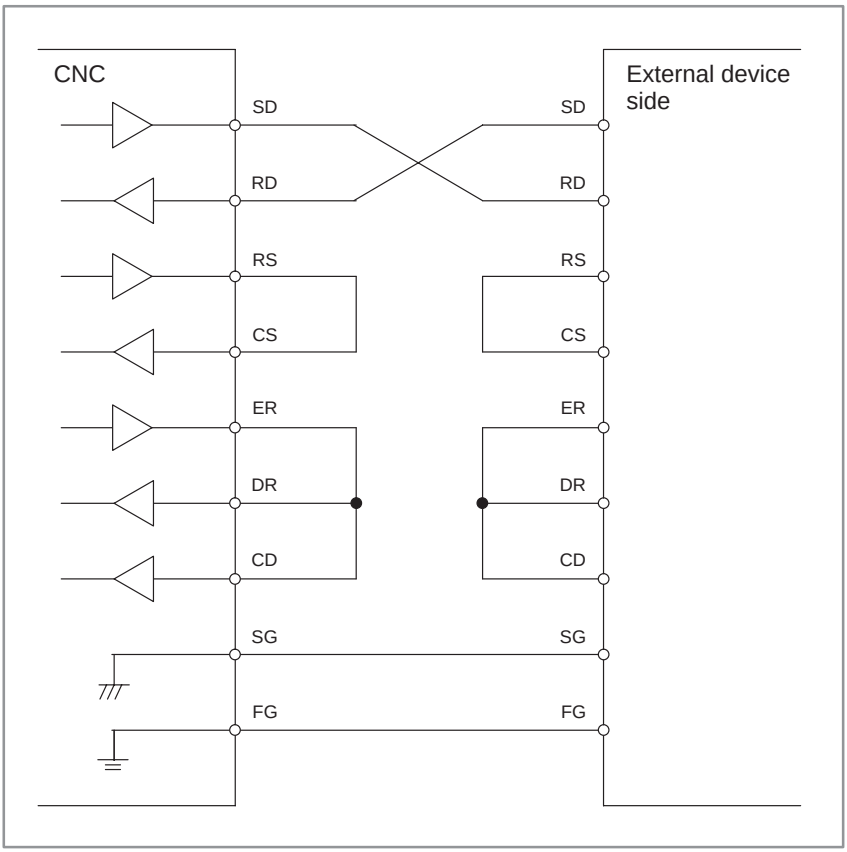


Fig. B

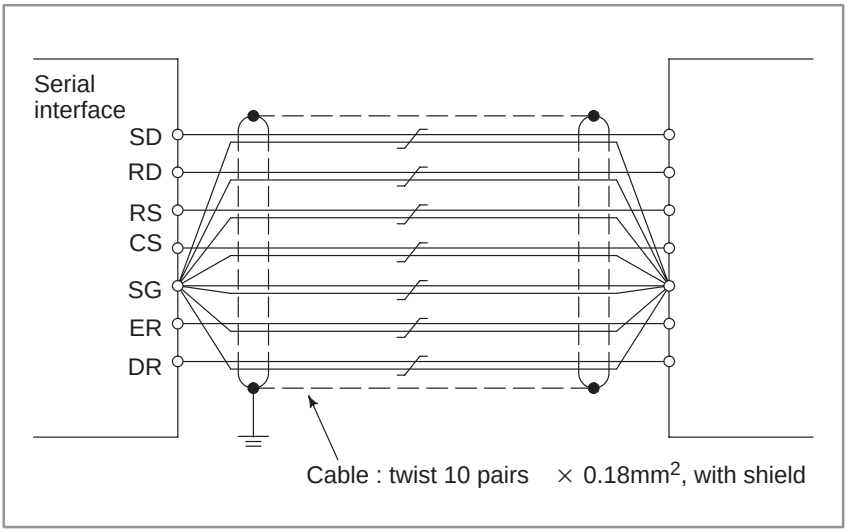
Connection between RS–232–C interface and external device



- The cable for connecting the PG–Mate to the NC should be connected as shown in the below diagram.



Prepare the cable with I/O device as follows :



7.3.9 Parameters Related to the Reader/Punch Interface

SETTING	I/O : Select the I/O unit

Select an I/O unit to or from which a program is input or output through the reader/punch interface.

0 : Uses the unit whose parameters are specified in No.0002 (NFED, ASR33, STP2), No.0552 (BRATE0), and No.0038 (RSCMD1, DEVFL1). (Memory card M5)

1 : Uses the unit whose parameters are specified in No.0012 (NFED, ASR33, STP2), No.0553 (BRATE1), and No.0038 (RSCMD1, DEVFL1). (Memory card M5)

2 : Uses the unit whose parameters are specified in No.0050 (NFED, RSASC1, STP2), No.0250 (BRATE2), and No.0038 (RSCMD2, DEVFL2). (Memory card M74)

3 : Uses the unit whose parameters are specified in No.0051 (NFED, etc.), No.0251 (BRATE3), and No.0038 (RSCMD3, DEVFL3). (Remote buffer M77)

	#7	#6	#5	#4	#3	#2	#1	#0	
0002	NFED					ASR33		STP2	(I/O=0)
0012	NFED					ASR33		STP2	(I/O=1)
0050	NFED				RSASCI			STP2	(I/O=2)

NFED 1 : When a program is output, a feed command is not output before or after the program. (Set this to 1 when a Fanuc disk is used.)

0 : When a program is output, a feed command is output before and after the program.

ASR33 1 : Uses the 20–mA interface.

0 : Uses the Fanuc PPR, Fanuc disk, or portable tape reader.

STP2 1 : Uses two bits as the stop bits.

0 : Uses one bit as the stop bit.

RSASCI 1 : Uses ASCII codes for program input.

0 : Uses ISO/EIA codes for program input.

0552	BRATE0	(I/O=0)
0553	BRATE1	(I/O=1)
0250	BRATE2	(I/O=2)

BRATE0, BRATE1, BRATE2: Baud rate when reader/punch interface is used.

Set value	Baud rate
1	50
2	100
3	110
4	150
5	200
6	300
7	600
8	1200
9	2400
10	4800
11	9600

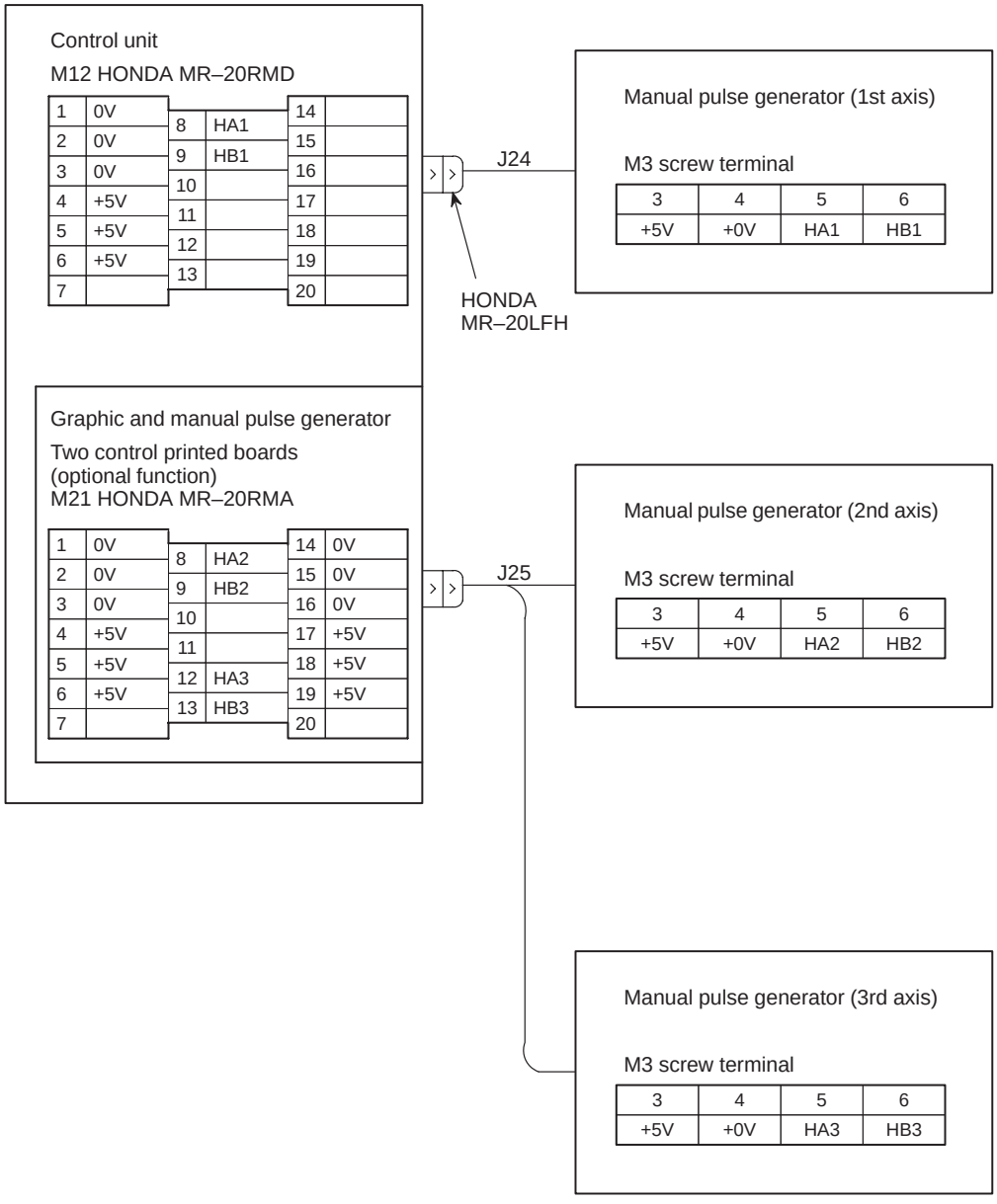
	#7	#6	#5	#4	#3	#2	#1	#0	
0038	RSCMD1	DEVFL1	RSCMD2	DEVFL2					(I/O=0)

RSCMD1, DEVFL1 I/O unit on channel 1 of reader/punch interface

RSCMD2, DEVFL2 I/O unit on channel 2 of reader/punch interface

RSCMD1 (RSCMD2)	DEVFL1 (DEVFL2)	I/O unit to be used
0	0	“Bubble Cassette”
0	1	“Floppy Cassete”
1	0	FANUC PPR, RS232C
1	1	New interface

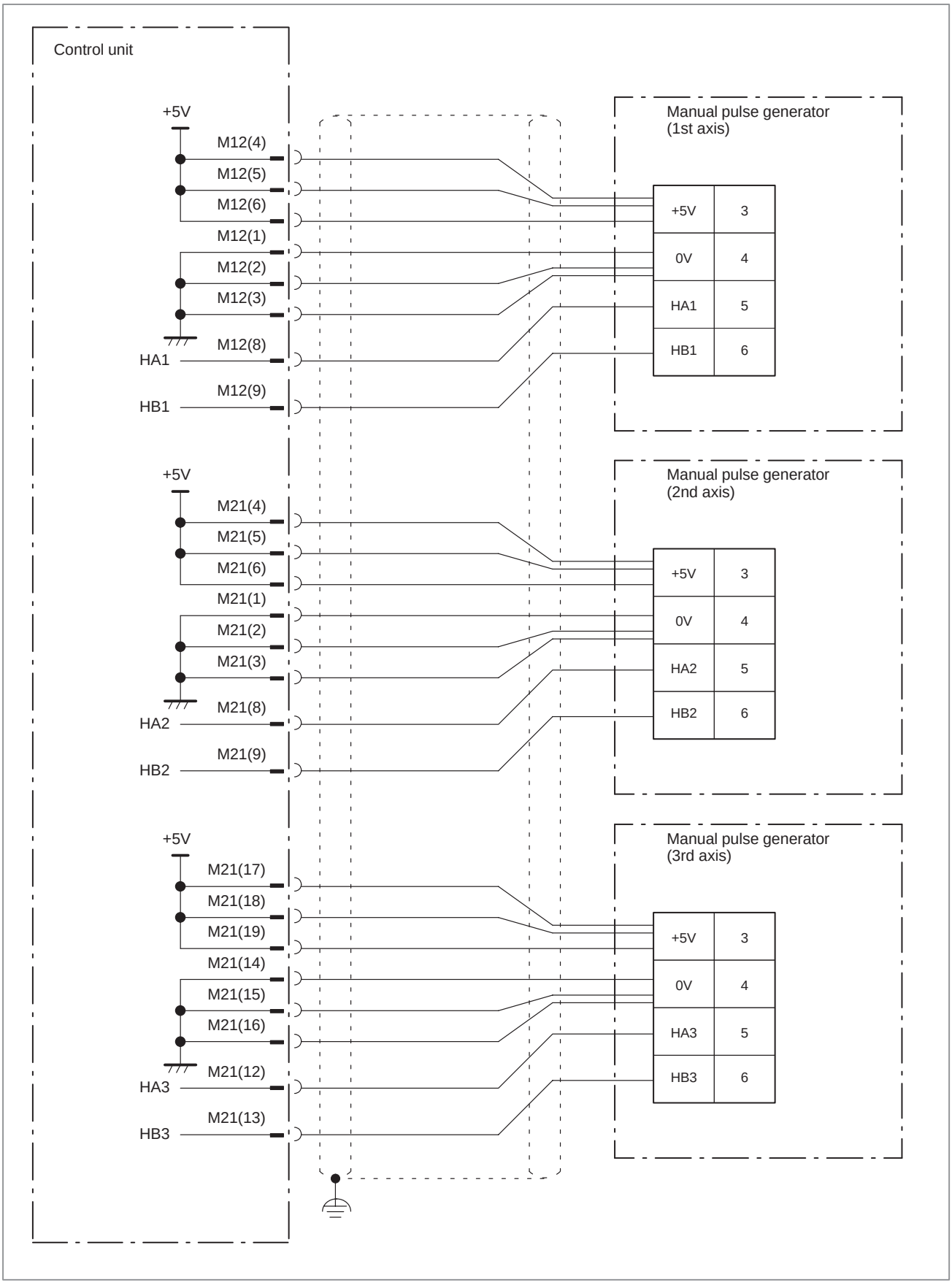
7.4 MANUAL PULSE GENERATOR INTERFACE



Cable spec. : 7/0.18 (0.2mm^2) or more unified shielded cable
Recommended cable spec : A66L–0001–0041

A02B–0050–K802 (7m) can be used for J24.

NOTE
Connection of Series 00 is different from above connection.
See Appendix J.


Control unit
+5V
M12(4)
M12(5)
M12(6)
M12(1)
M12(2)
M12(3)
M12(8)
HA1
M12(9)
HB1
Manual pulse generator
(1st axis)
+5V 3
0V 4
HA1 5
HB1 6
+5V
M21(4)
M21(5)
M21(6)
M21(1)
M21(2)
M21(3)
M21(8)
HA2
M21(9)
HB2
Manual pulse generator
(2nd axis)
+5V 3
0V 4
HA2 5
HB2 6
+5V
M21(17)
M21(18)
M21(19)
M21(14)
M21(15)
M21(16)
M21(12)
HA3
M21(13)
HB3
Manual pulse generator
(3rd axis)
+5V 3
0V 4
HA3 5
HB3 6

Cable connection for the manual pulse generator

The power supply to the manual pulse generator is 5 VDC, same as for the pulse coder. It is therefore necessary to prevent cable resistance from causing the supply voltage to drop more than 0.2V (total for both the 0 V and 5 V lines).
This is written as:

$$0.2 \geqq \frac{0.1 \times R \times 2L}{m}$$

0.1 : 0.1 A power supply current of the manual pulse generator
R : Resistance per unit length of the wire (Ω/m)
m : Number of wires connected in each 0 V and 5 V line
L : Wire length (m)

This can be converted to the following equation:

$$L \leqq \frac{m}{R}$$

7.5 HIGH–SPEED DI SIGNAL INTERFACE

The high–speed DI signal can be used as a high–speed skip signal. The high–speed DI signal is connected as shown below:

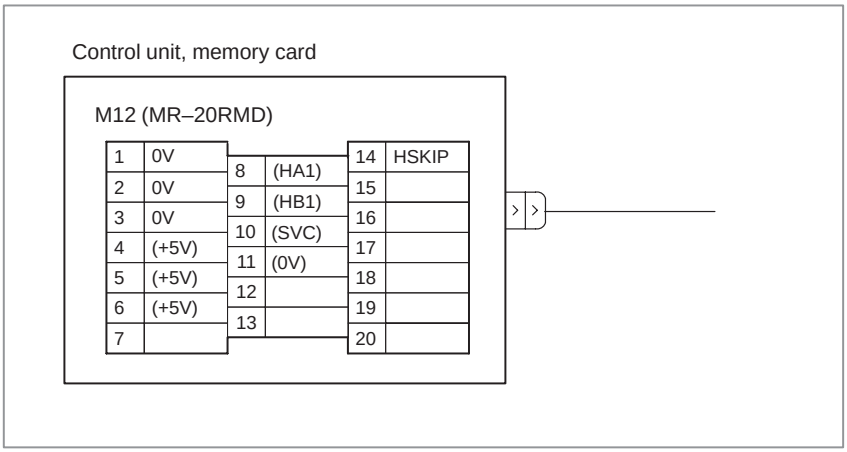


Fig. 7.5 (a)

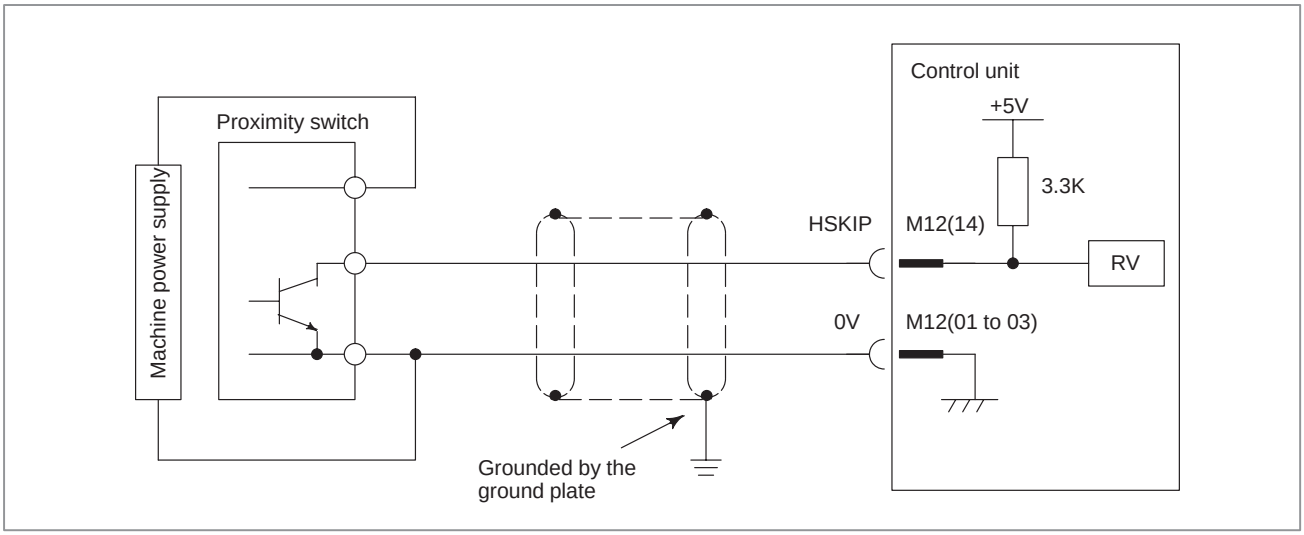


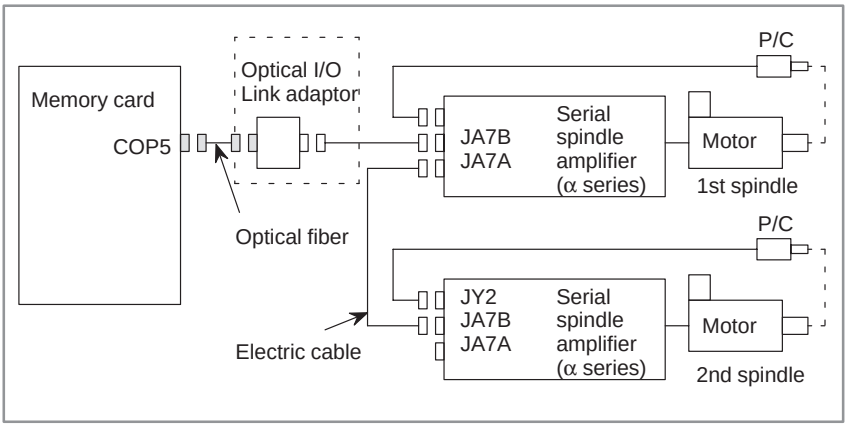
Fig. 7.5 (b) Connection of the HSKIP signal

NOTE
1 The M12 connector is shared by the analog spindle interface and manual pulse generator interface.
2 The function is optional.

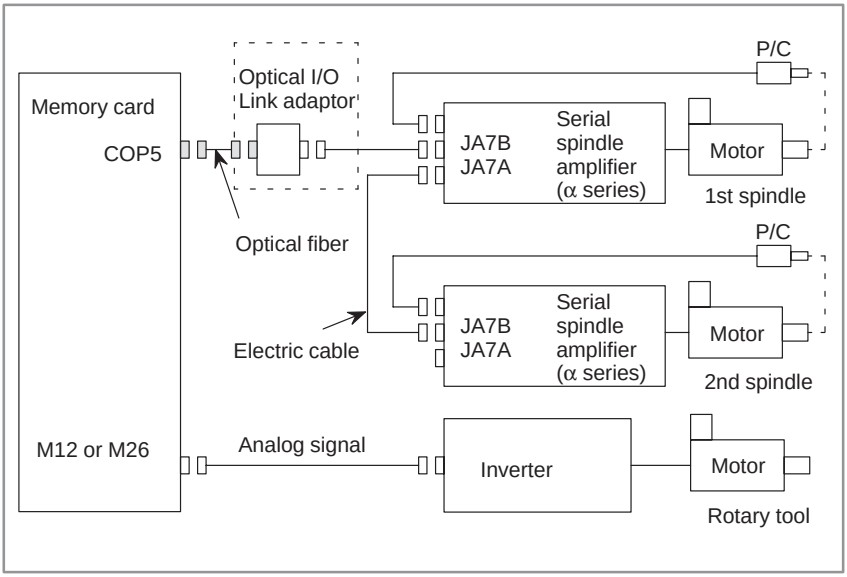
8 CONNECTIONS FOR SPINDLE

Serial spindle

The following three configurations of the spindle interface are available

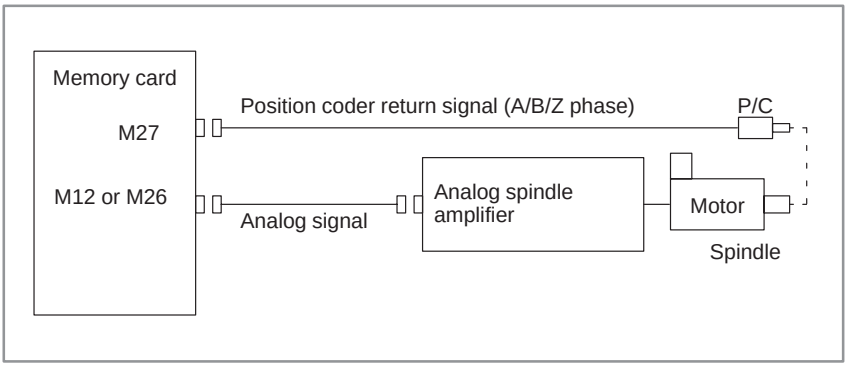


Serial spindle + Rotary tool



NOTE
Optical I/O Link adapter in [ ] is required when serial spindle amplifier is α series.
In other cases it can be connected directly with optical fiber

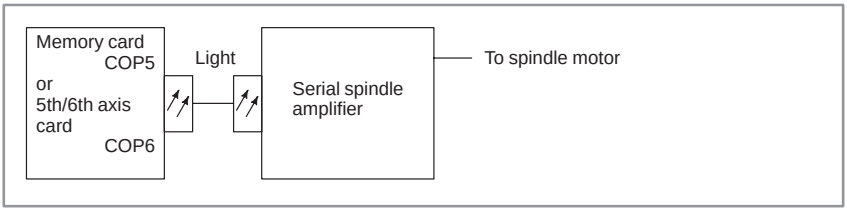
Analog spindle



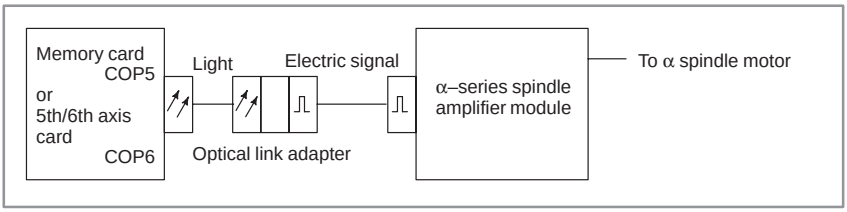
8.1 SERIAL SPINDLE INTERFACE

Connection to the spindle amplifier through optical fiber cable.
When spindle amplifier is α series, electric cable is connected to amplifier through I/O Link adapter

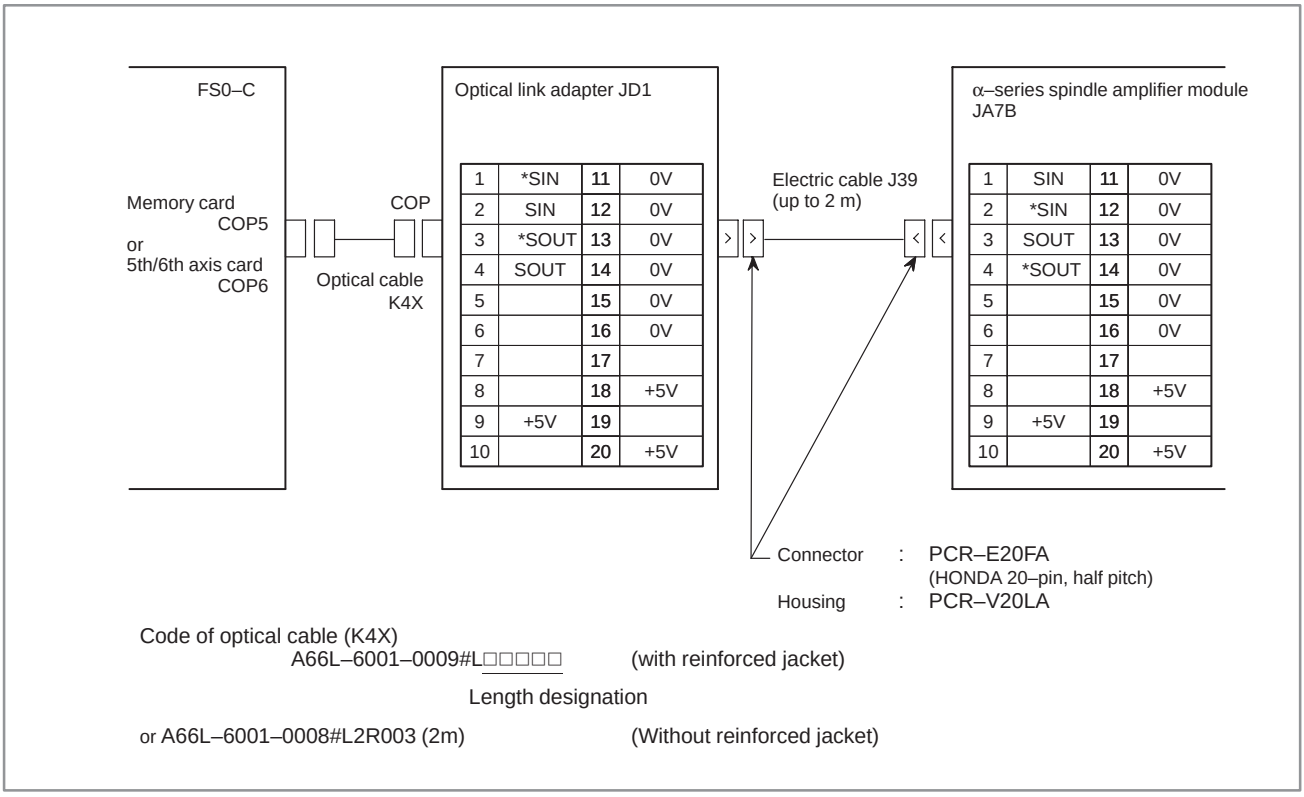
(a) When the serial spindle amplifier is used



(b)When the α–series spindle amplifier module is used



Connection when the α–series spindle amplifier module is used

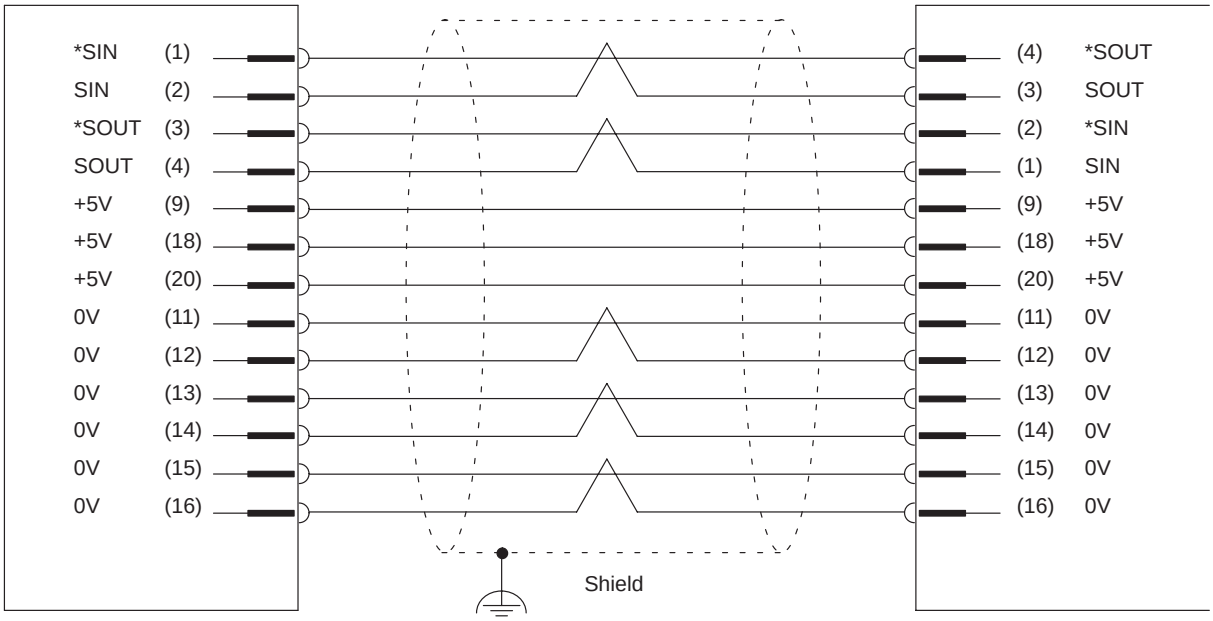


1	*SIN	11	0V
2	SIN	12	0V
3	*SOUT	13	0V
4	SOUT	14	0V
5		15	0V
6		16	0V
7		17	
8		18	+5V
9	+5V	19	
10		20	+5V

1	SIN	11	0V
2	*SIN	12	0V
3	SOUT	13	0V
4	*SOUT	14	0V
5		15	0V
6		16	0V
7		17	
8		18	+5V
9	+5V	19	
10		20	+5V

Code of optical cable (K4X)
A66L–6001–0009#L□□□□□ (with reinforced jacket)
Length designation
or A66L–6001–0008#L2R003 (2m) (Without reinforced jacket)

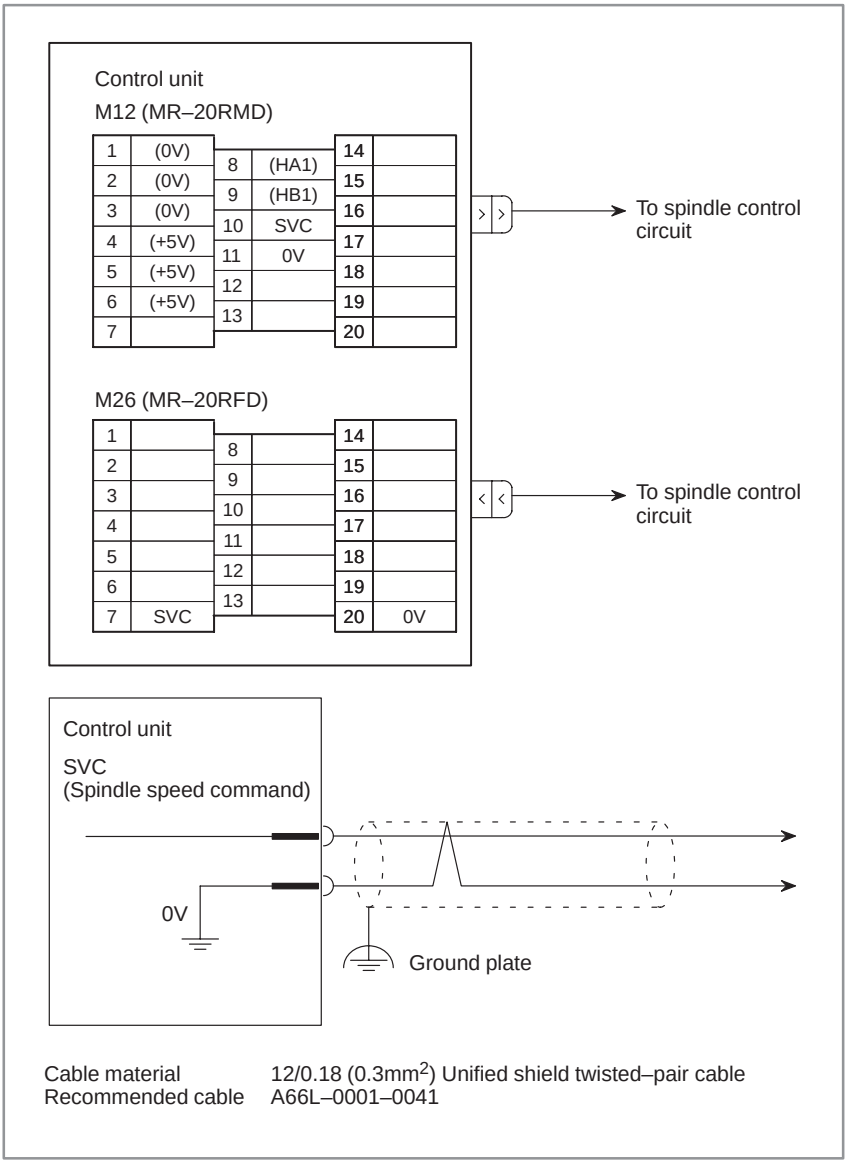
Electric cable connection



Recommended cable material	A66L–0001–0284#10P (#28AWG × 10)
Recommended cable specification	A02B–0120–K844 (1m)

8.2 ANALOG SPINDLE INTERFACE

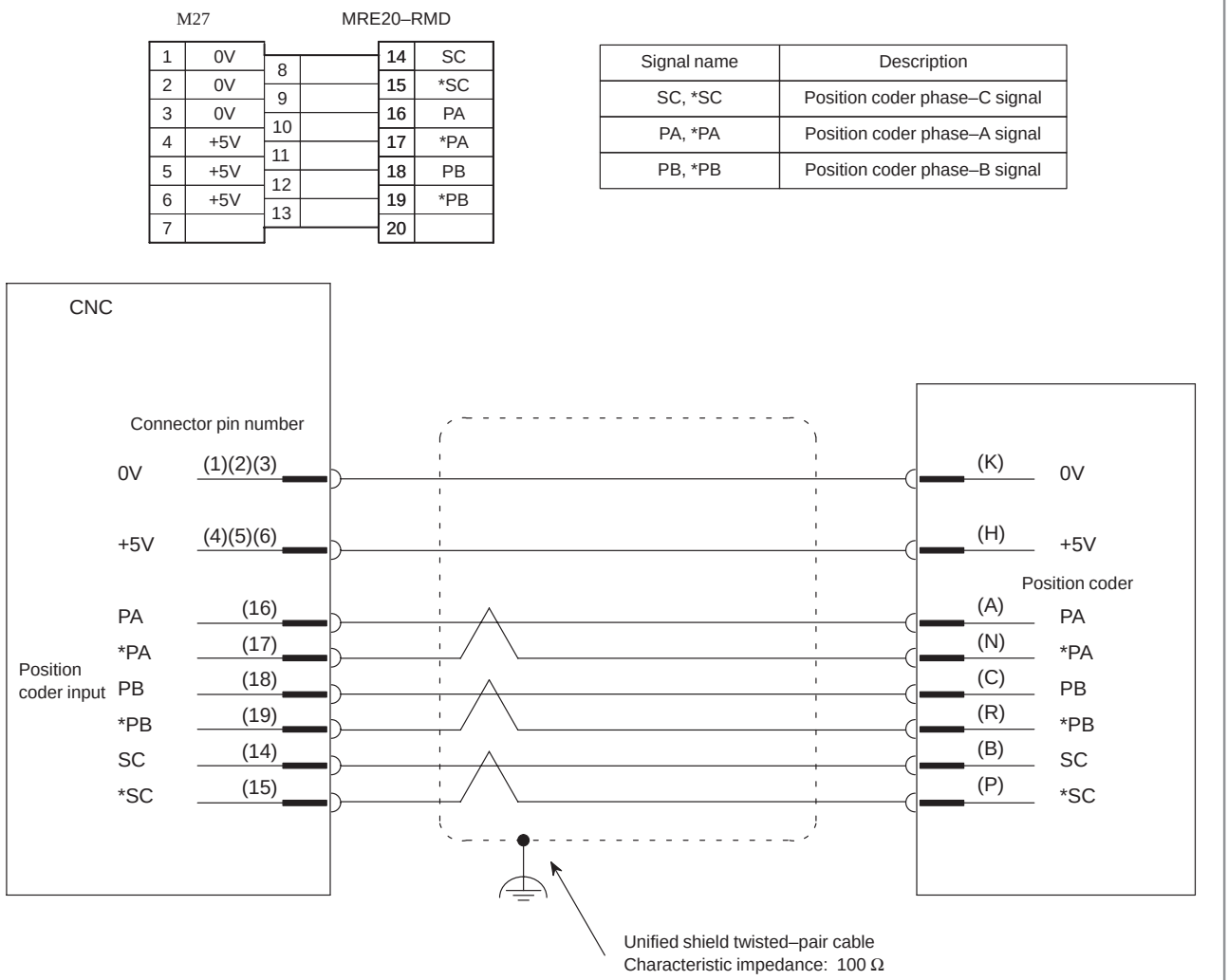
The speed of the analog spindle is specified by analog voltage output. The analog output for the first spindle can be output from pin 10 of M12 or pin 7 of M26. Choose either pin.



Cable material 12/0.18 (0.3mm^2) Unified shield twisted–pair cable
Recommended cable A66L–0001–0041

NOTE
1 M12 is also used as the connector for the first manual pulse generator.
2 In addition to the spindle speed analog voltage signal (SVC), use the spindle enable signal (ENB). Use the same cable as that indicted above.

8.3 POSITION CODER INTERFACE



Signal name	Description
SC, *SC	Position coder phase–C signal
PA, *PA	Position coder phase–A signal
PB, *PB	Position coder phase–B signal

NOTE

1 The current drain of the position coder is 0.35 A. Determine the number of 0V and +5V lines to be connected so that the total voltage drop between the NC and position coder does not exceed 0.2 V, total for both ways.

2 With the 0–TTC, a second position coder can be used. Use the M29 connector of the 5th/6th axis card. The M29 connector has the same pin assignment as the M27 connector.
When the second position coder is not used, connect the first position coder to M27 and M29 in parallel.

9 SERVO CONNECTIONS

9.1 OUTLINE

This section describes the servo interface between the Series 0 and the digital control AC servo amplifier and servo motor.

For an explanation of each servo amplifier unit and servo motor, refer to the relevant manual.

The Series 0 supports three types of axis control cards according to the type of the pulse coder built into the servo motor or type of the servo interface.

- Axis control card for A/B–phase pulse coders (Type A interface)
- Axis control card for serial pulse coders (Type A interface)
- Axis control card for type B interface

Axis control cards for serial pulse coders can also be connected to an A/B–phase pulse coder.

NOTE
In a closed loop system using a separate pulse coder, the axis control cards for the A/B–phase pulse coders and those for serial pulse coders use different connectors for their feedback cables.

- **Connector names**

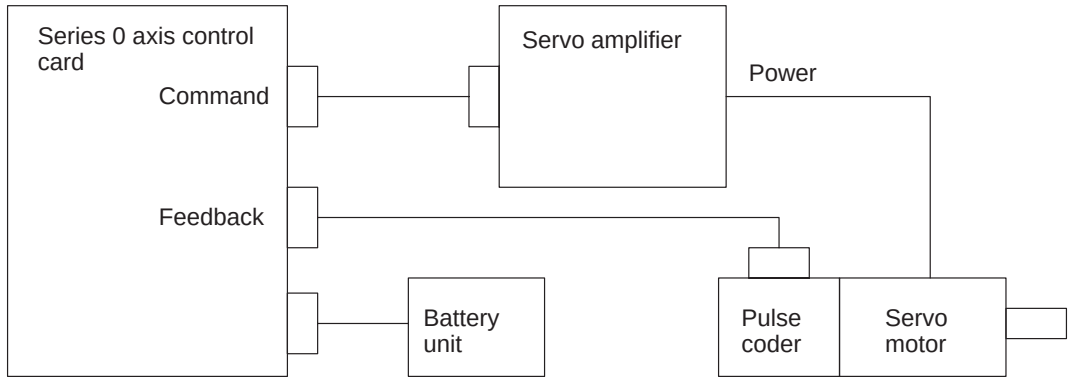
	Axis control card for A/B–phase pulse coders				Axis control card for serial pulse coders			
Axis name	Command	Semi–closed loop	Closed loop		Command	Semi–closed loop	Closed loop	
		Feedback	Position feedback	Velocity feedback		Feedback	Position feedback	Velocity feedback
1st axis	M34	M35	M35	M36	M184	M185	M186	M185
2nd axis	M37	M38	M38	M39	M187	M188	M189	M188
3rd axis	M44	M45	M45	M46	M194	M195	M196	M195
4th axis	M47	M48	M48	M49	M197	M198	M199	M198
5th axis	M64	M65	M65	M66	M204	M205	M206	M205
6th axis	M67	M68	M68	M69	M207	M208	M209	M208
7th axis	M134	M135	M135	M136	M224	M225	M226	M225
8th axis	M137	M138	M138	M139	M227	M228	M229	M228

For the 0–TTC, the first and second axes for tool post 2 correspond to the fifth and sixth axes in the above table.

Axis name	Axis control card for type B interface			
	Command	Semi–closed loop	Closed loop	
		Feedback	Position feedback	Velocity feedback
1st axis	JS1A	JFn	M186	JFn
2nd axis	JS2A	JFn	M189	JFn
3rd axis	JS3A	JFn	M196	JFn
4th axis	JS4A	JFn	M199	JFn
5th axis	Not used type B interface			
6th axis				
7th axis				
8th axis				

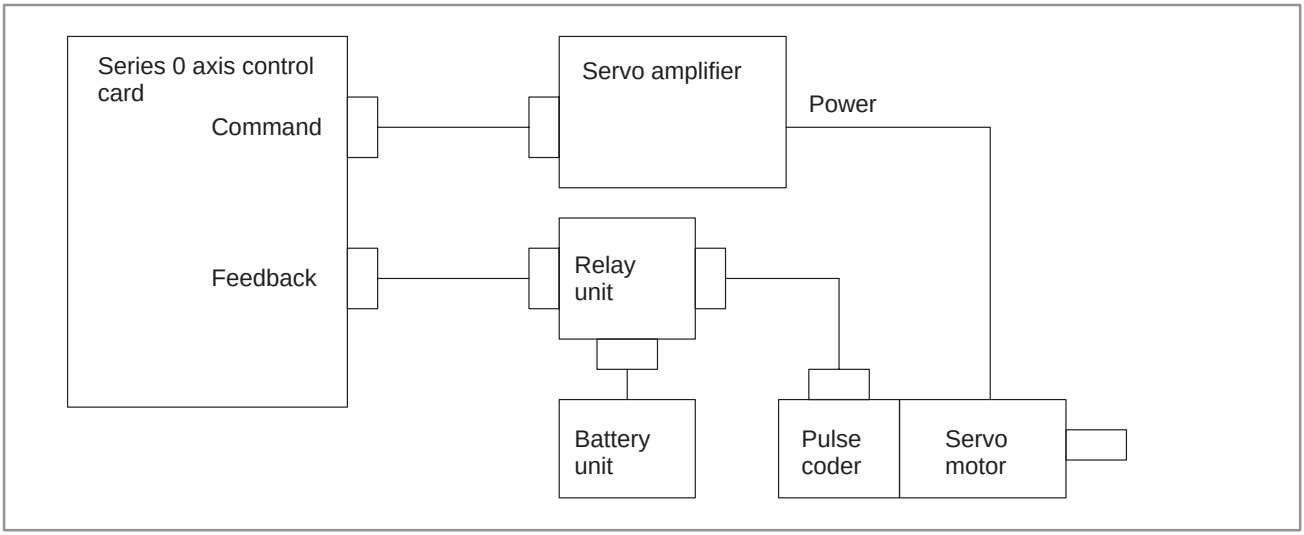
When an axis control card for a type B interface is used, the JFn connector on the servo amplifier side is used as the feedback or velocity feedback connector. n varies with the servo amplifier being used. A type B interface can be used for the first to fourth axes, but not for the fifth to eighth axes.

- **Semi–closed loop system**

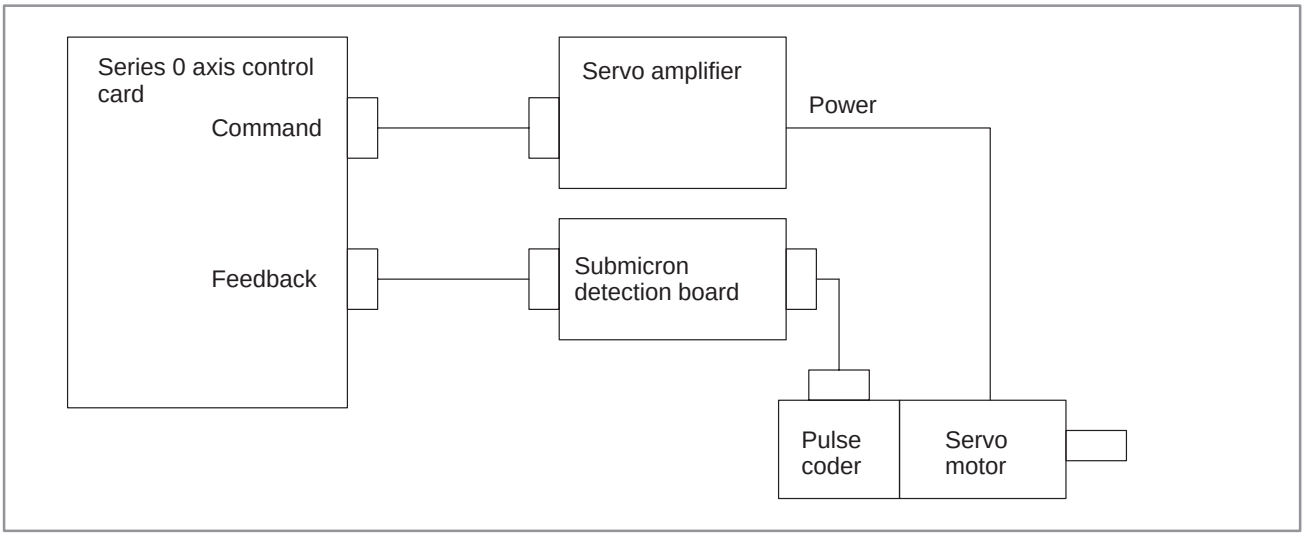


The battery unit is not required when an incremental pulse coder is used.

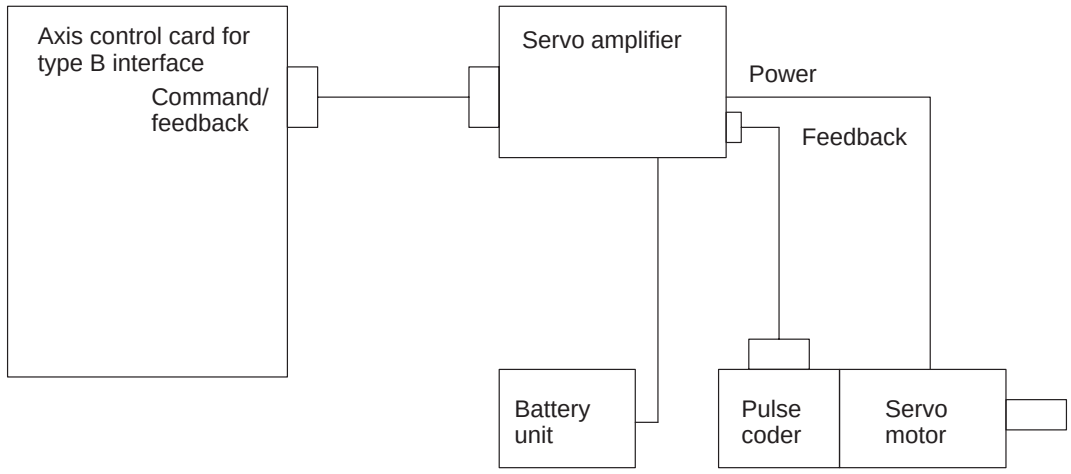
- **Semi–closed loop system** (when an absolute pulse coder and relay unit are used)



- **Semi–closed loop system** (when a high–speed, high–resolution A/B–phase pulse coder is used)



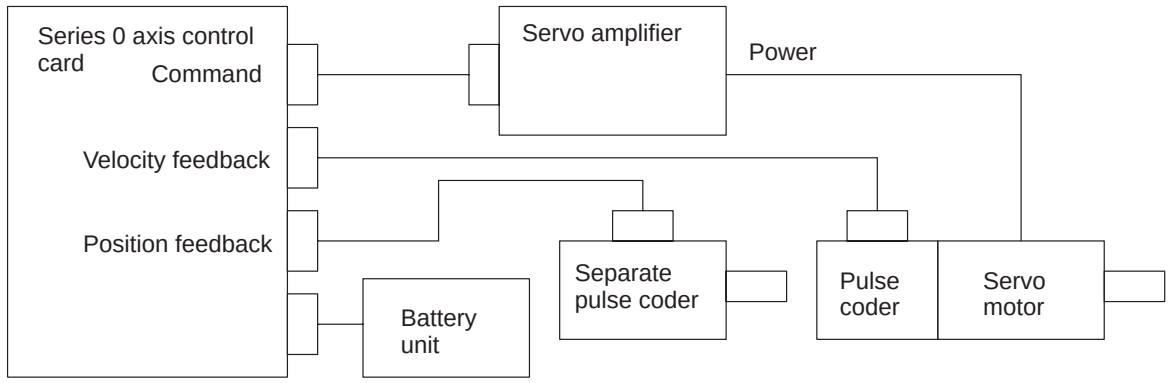
- **Semi–closed loop system** (when a type B interface is used)



The battery unit is not required when an incremental pulse coder is used.

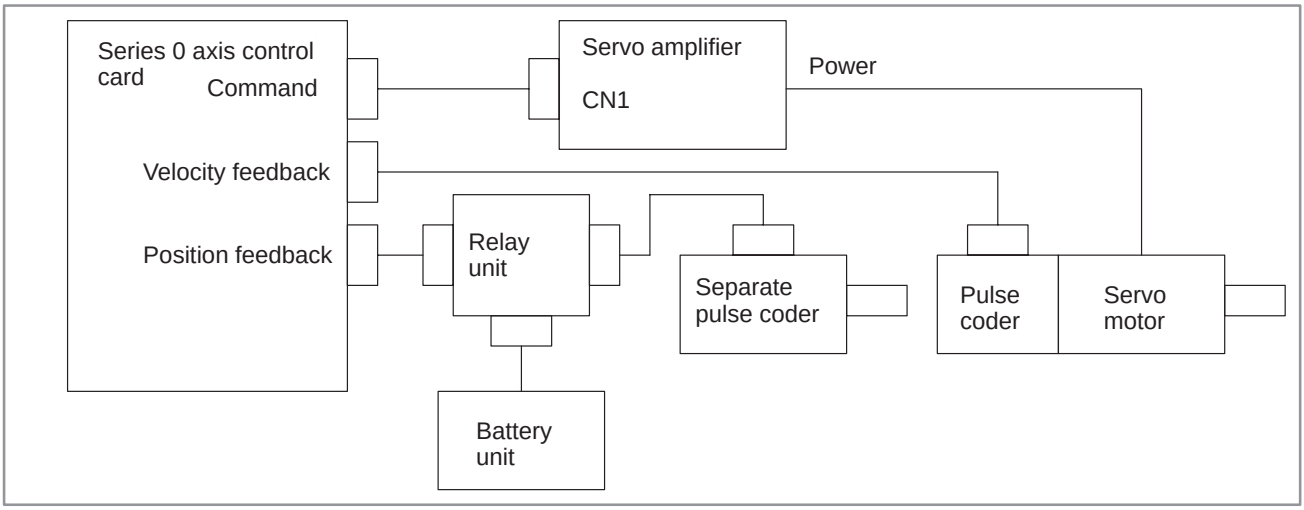
Use a servo amplifier that supports a type B interface. When a servo amplifier which supports both types of interface is used, set it to use the type B interface.

- **Closed loop system**

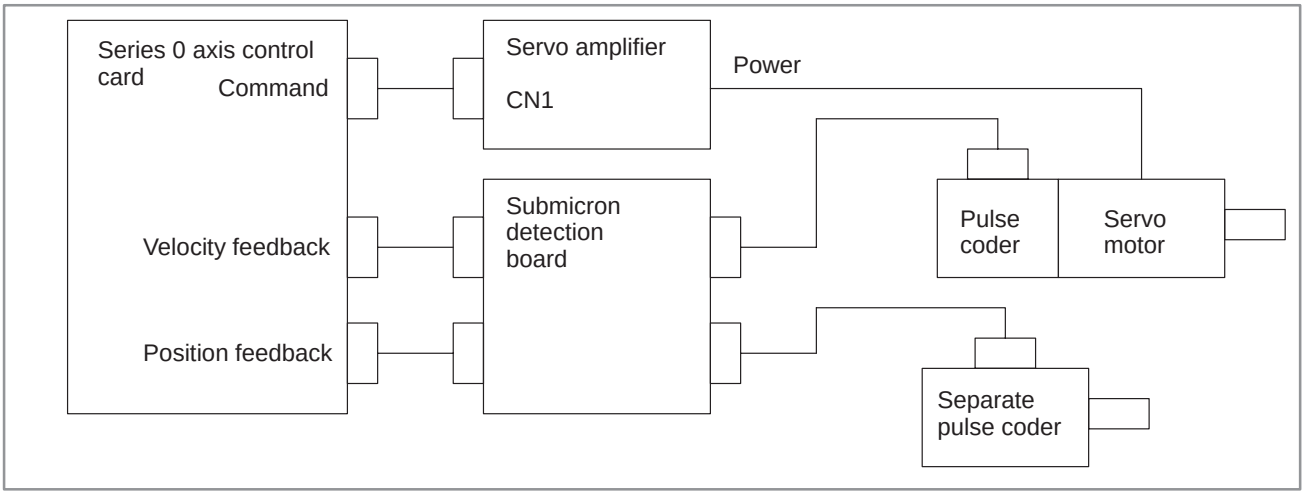


The battery unit is not required when an incremental pulse coder is used.

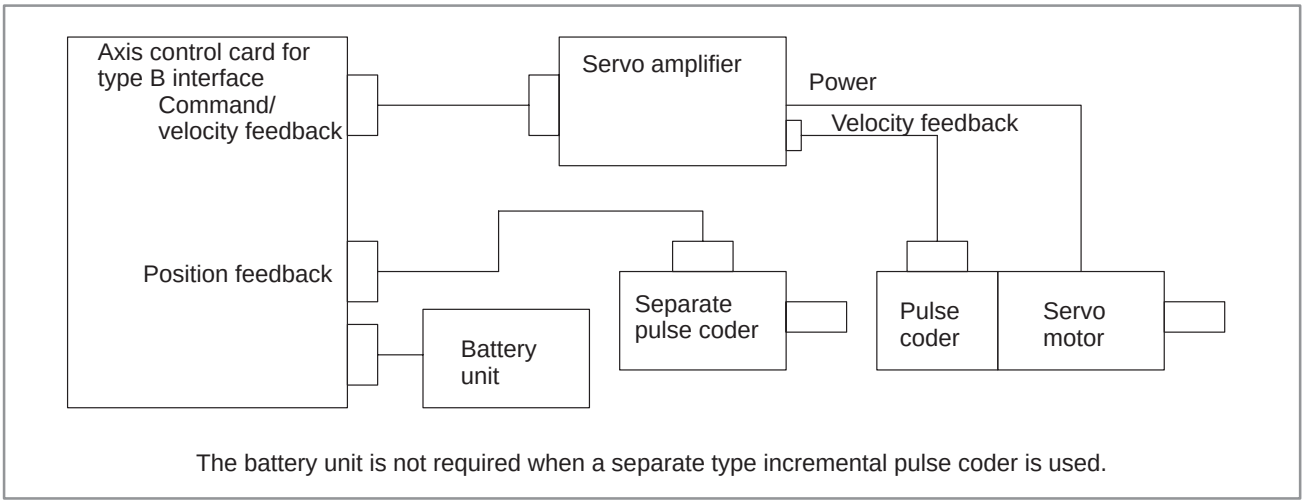
- **Closed loop system** (when an absolute pulse coder and relay unit are used)



- **Closed loop system** (when a high–speed, high–resolution A/B–phase pulse coder is used)



- **Closed loop system** (when a type B interface is used)

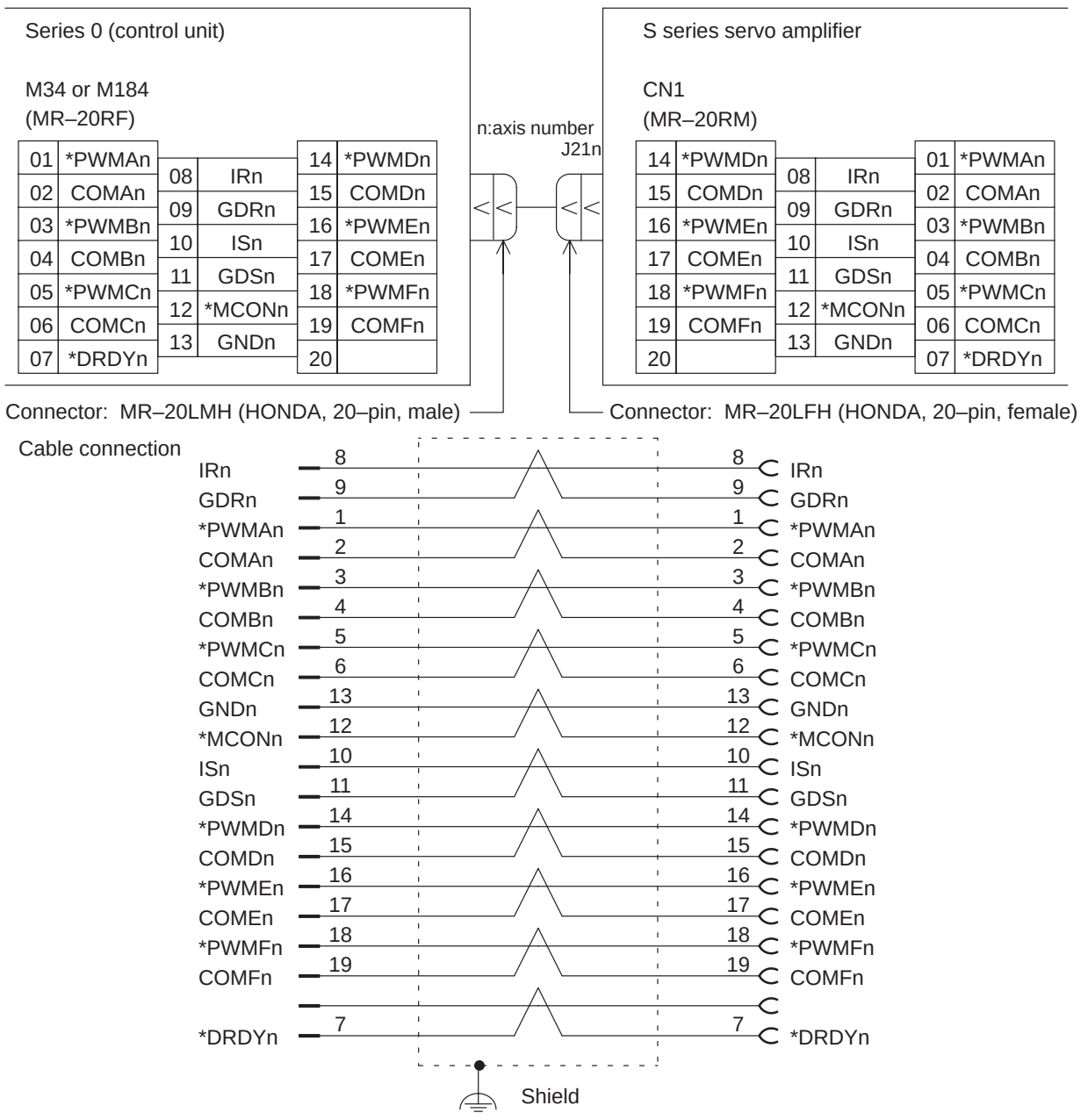


The battery unit is not required when a separate type incremental pulse coder is used.

9.2 SERVO AMPLIFIER INTERFACE

This section describes each servo amplifier interface, taking that for the first axis as an example.

9.2.1 S Series Servo Amplifier



Recommended cable material A66L–0001–0041

Recommended cable specification A02B–0074–K801 (5m) or A02B–0098–K821 (5m)

CAUTION

To protect the signals from external noise, assign the cable's central pairs to each pair of current feedback signal and ground signal (i.e., IRn and GDRn, and ISn and GDSn). Otherwise, external noise may result in uneven feed or abnormal sound.

9.2.2 C Series Servo Amplifier and α Servo Amplifier Module (Type A Interface)

Series 0 (control unit)
M34 or M184
(MR–20RF)

01	*PWMAn	08	IRn	14	*PWMDn
02	COMAn	09	GDRn	15	COMDn
03	*PWMBn	10	ISn	16	*PWMEn
04	COMBn	11	GDSn	17	COMEn
05	*PWMCn	12	*MCONn	18	*PWMFn
06	COMCn	13	GNDn	19	COMFn
07	*DRDYn			20	

n: axis number

α servo amplifier module
JV1B (L–axis), JV2B (M–axis)
C series servo amplifier
CN1

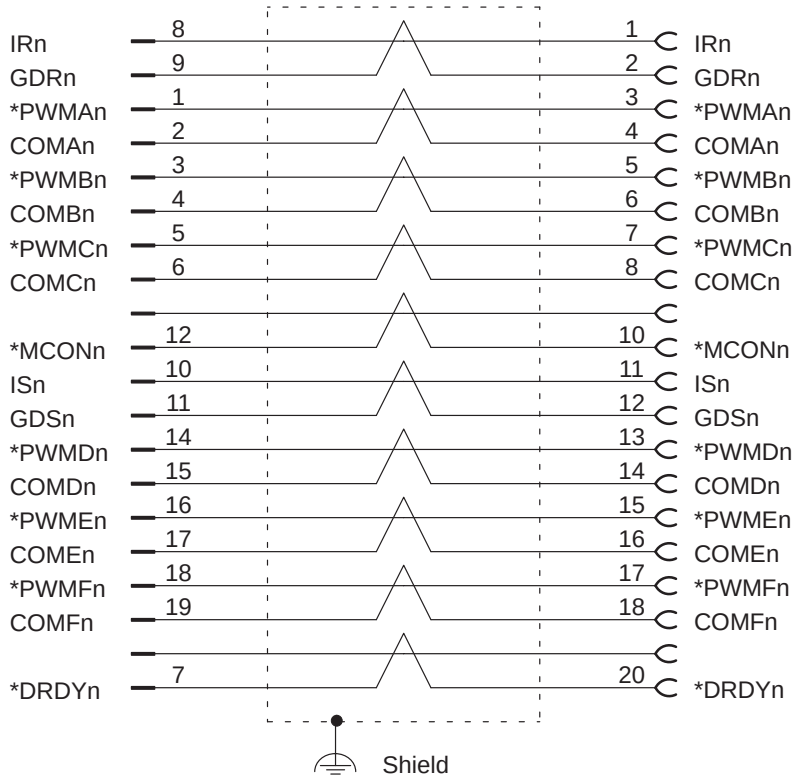
01	IRn	11	ISn
02	GDRn	12	GDSn
03	*PWMAn	13	*PWMDn
04	COMAn	14	COMDn
05	*PWMBn	15	*PWMEn
06	COMBn	16	COMEn
07	*PWMCn	17	*PWMFn
08	COMCn	18	COMFn
09		19	
10	*MCONn	20	*DRDYn

Connector: MR–20LMH (HONDA, 20–pin, male)

Connector: PCR–E20FA (HONDA, 20–pin, half–pitch) or equivalent

For a C series servo amplifier, connect the cable to M34 or M184.
For an α series servo amplifier, connect the cable to M184. It cannot be connected to M34.

Cable connection

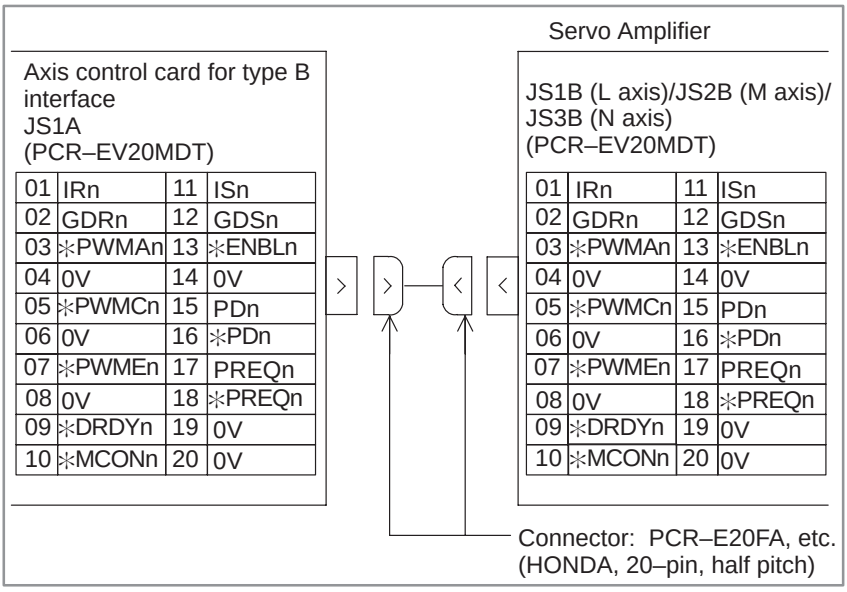


Recommended cable material A66L–0001–0284#10P (#28AWG × 10pairs)
Recommended cable specification A02B–0098–K841 (5m)

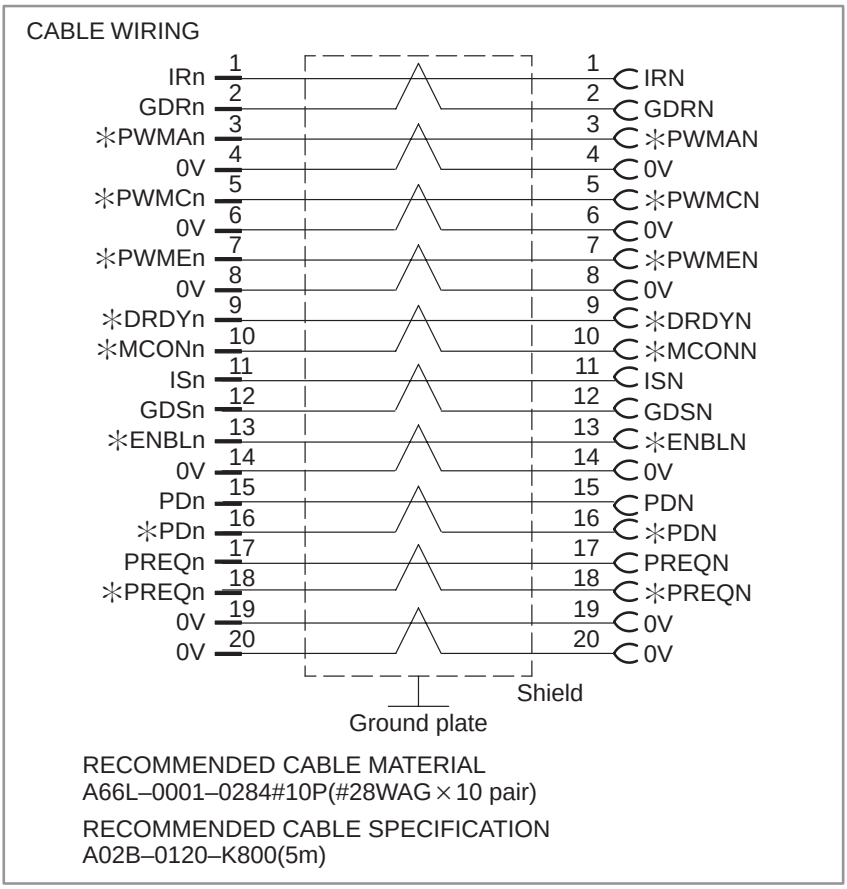
CAUTION

To protect the signals from external noise, assign the cable's central pairs to each pair of current feedback signal and ground signal (i.e., IRn and GDRn, and ISn and GDSn). Otherwise, external noise may result in uneven feed or abnormal sound.

9.2.3 α Servo Amplifier Module (Type B Interface) and β Servo Amplifier Module



01	IRn	11	ISn
02	GDRn	12	GDSn
03	⁎PWMAn	13	⁎ENBLn
04	0V	14	0V
05	⁎PWMCn	15	PDn
06	0V	16	⁎PDn
07	⁎PWMEn	17	PREQn
08	0V	18	⁎PREQn
09	⁎DRDYn	19	0V
10	⁎MCONn	20	0V



RECOMMENDED CABLE MATERIAL
A66L–0001–0284#10P(#28WAG × 10 pair)

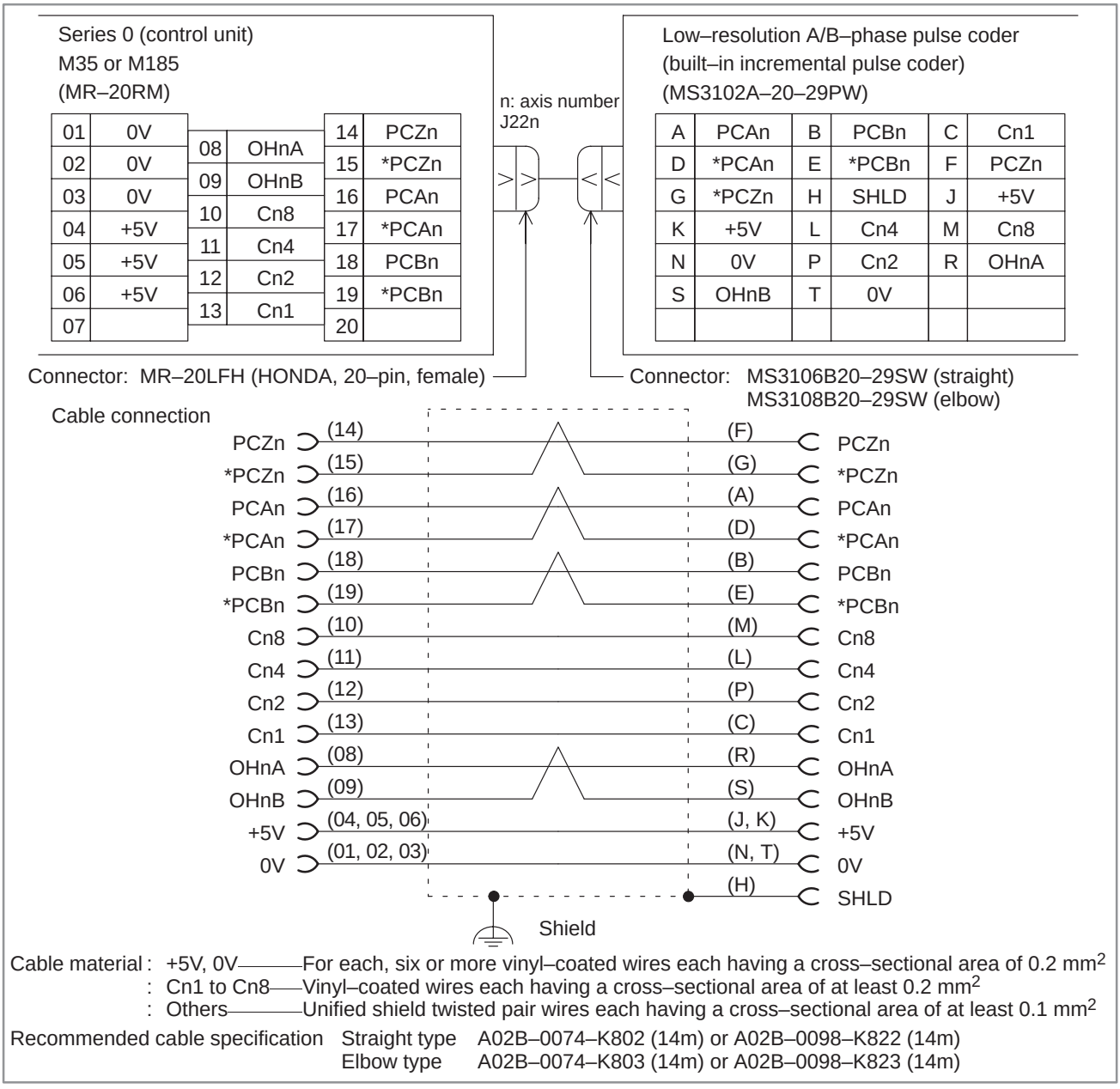
RECOMMENDED CABLE SPECIFICATION
A02B–0120–K800(5m)

NOTE

1 The total length of the cable between the CNC and amplifier and that between the amplifier and motor shall not exceed 50m.
2 As the current feedback lines (IRn and ISn), use the middle twisted pair of the recommended cable. If any other pair is used, abnormal noise or oscillation may occur.
3 Use a servo unit which supports the type–B interface. When using a servo unit which supports both the type–A and type–B interfaces, select the type–B interface. For details, refer to the manual supplied with the servo unit. If the interface setting is incorrect, a servo alarm (AL401 V READY OFF) will be issued.

9.3 A/B PHASE PULSE CODER INTERFACE

9.3.1 Low–Resolution A/B Phase Pulse Coder (2000P to 3000P) (Built–in Incremental Pulse Coder)



01	0V	08	OHnA	14	PCZn
02	0V	09	OHnB	15	*PCZn
03	0V	10	Cn8	16	PCAn
04	+5V	11	Cn4	17	*PCAn
05	+5V	12	Cn2	18	PCBn
06	+5V	13	Cn1	19	*PCBn
07				20	

A	PCAn	B	PCBn	C	Cn1
D	*PCAn	E	*PCBn	F	PCZn
G	*PCZn	H	SHLD	J	+5V
K	+5V	L	Cn4	M	Cn8
N	0V	P	Cn2	R	OHnA
S	OHnB	T	0V		

Cable material : +5V, 0V———For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.2 mm^2
: Others———Unified shield twisted pair wires each having a cross–sectional area of at least 0.1 mm^2

Recommended cable specification Straight type A02B–0074–K802 (14m) or A02B–0098–K822 (14m)
Elbow type A02B–0074–K803 (14m) or A02B–0098–K823 (14m)

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

9.3.2 Low–Speed, High–Resolution A/B Phase Pulse Coder (10000P to 25000P, 12 m/min) (Built–in Incremental Pulse Coder)

Series 0 (control unit)
M35 or M185
(MR–20RM)

01	0V	08	OHnA	14	PCZn
02	0V	09	OHnB	15	*PCZn
03	0V	10	Cn8	16	PCAn
04	+5V	11	Cn4	17	*PCAn
05	+5V	12	Cn2	18	PCBn
06	+5V	13	Cn1	19	*PCBn
07				20	

n:axis number
J22n

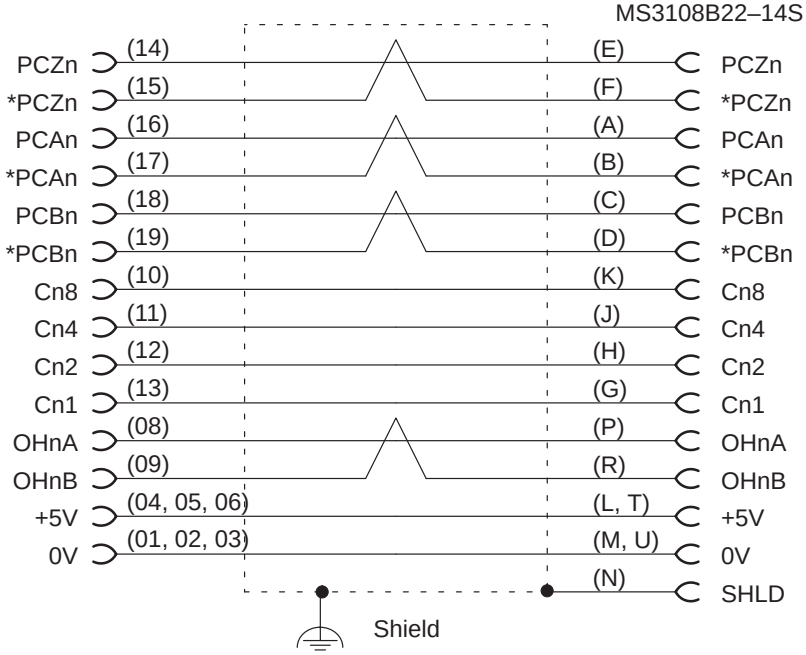
Low–speed, high–resolution A/B–phase pulse coder(built–in incremental pulse coder)
(MS3102A–22–14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	SHLD	P	OHnA	R	OHnB
S		T	+5V	U	0V

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B22–14S (straight)
MS3108B22–14S (elbow)

Cable connection



Cable material : +5V, 0V———For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.2 mm^2
: Others———Unified shield twisted pair wires each having a cross–sectional area of at least 0.1 mm^2

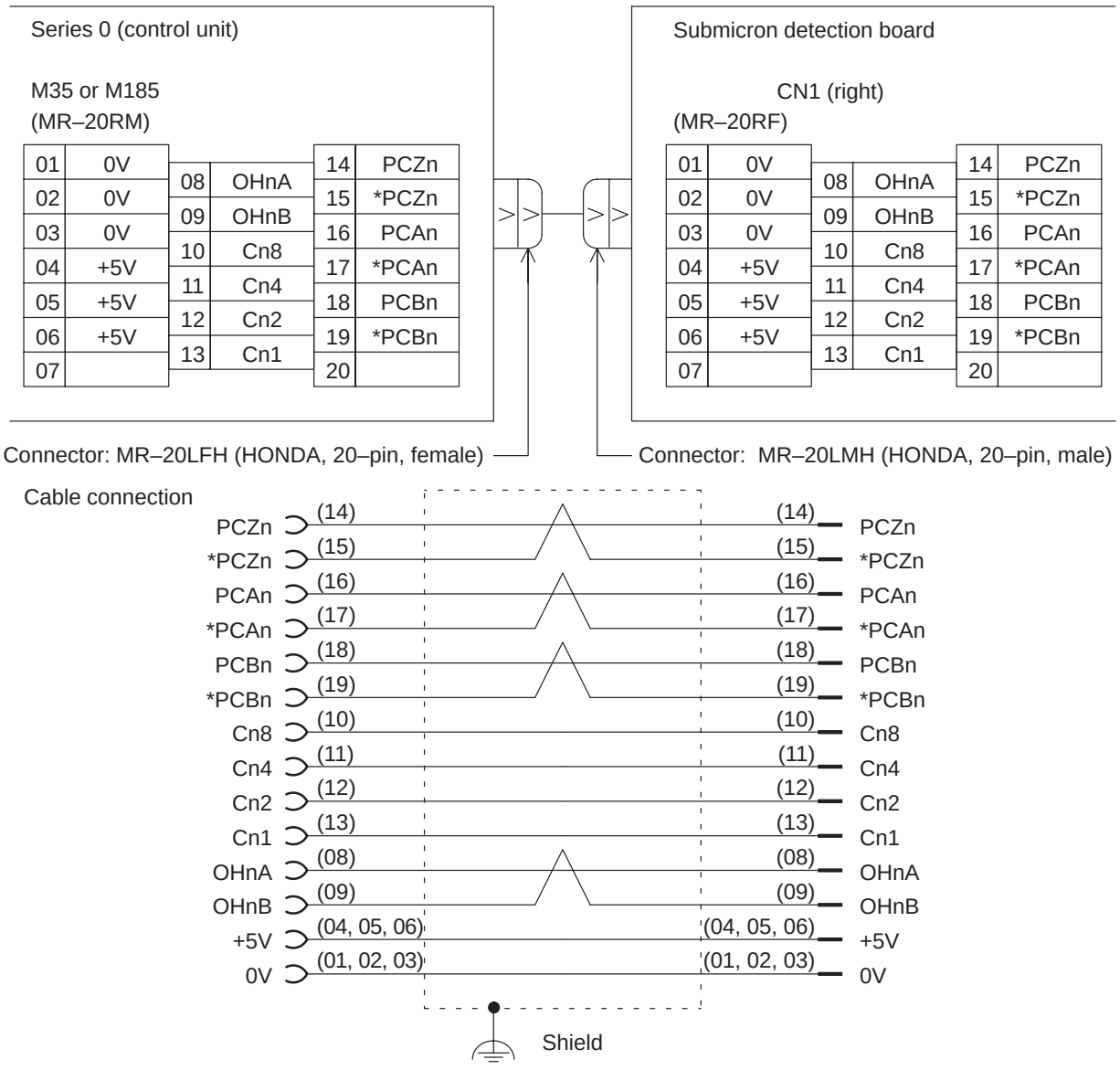
Recommended cable specification Straight type A02B–0074–K807 (14m) or A02B–0098–K827 (14m)
Elbow type A02B–0074–K808 (14m) or A02B–0098–K828 (14m)

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

9.3.3 High–Speed, High–Resolution A/B Phase Pulse Coder (20000P to 30000P, 24 m/min) (Built–in Incremental Pulse Coder)

Connect a high–speed, high–resolution A/B–phase pulse coder via a submicron detection board.

(1) Connection between Series 0 and submicron detection board



Cable material : +5V, 0V———For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.2 mm^2
: Others————Unified shield twisted pair wires each having a cross–sectional area of at least 0.2 mm^2

Recommended cable material A66L–0001–0199

The cable length must not exceed 2 m.

(2) Connection between submicron detection board and high–speed, high–resolution A/B–phase pulse coder

Submicron detection board

CN1 (left)
(MR–20RM)

01	0V	08	OHnA	14	PCZn
02	0V	09	OHnB	15	*PCZn
03	0V	10	Cn8	16	An
04	+5V	11	Cn4	17	*An
05	+5V	12	Cn2	18	Bn
06	+5V	13	Cn1	19	*Bn
07				20	

High–speed, high–resolution A/B–phase pulse coder
(built–in incremental pulse coder)

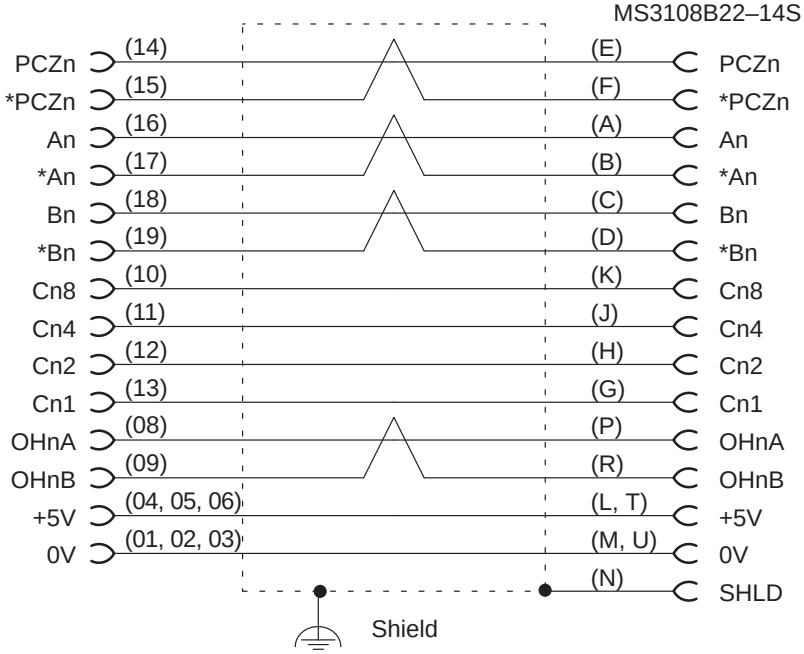
(MS3102A–22–14P)

A	An	B	*An	C	Bn
D	*Bn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	SHLD	P	OHnA	R	OHnB
S		T	+5V	U	0V

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B22–14S (straight)
MS3108B22–14S (elbow)

Cable connection



Cable (when the cable length is 14 m or less)

Cable material : +5V, 0V———For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.2 mm^2
: Others————Unified shield twisted pair wires each having a cross–sectional area of at least 0.2 mm^2

Recommended cable material A66L–0001–0199

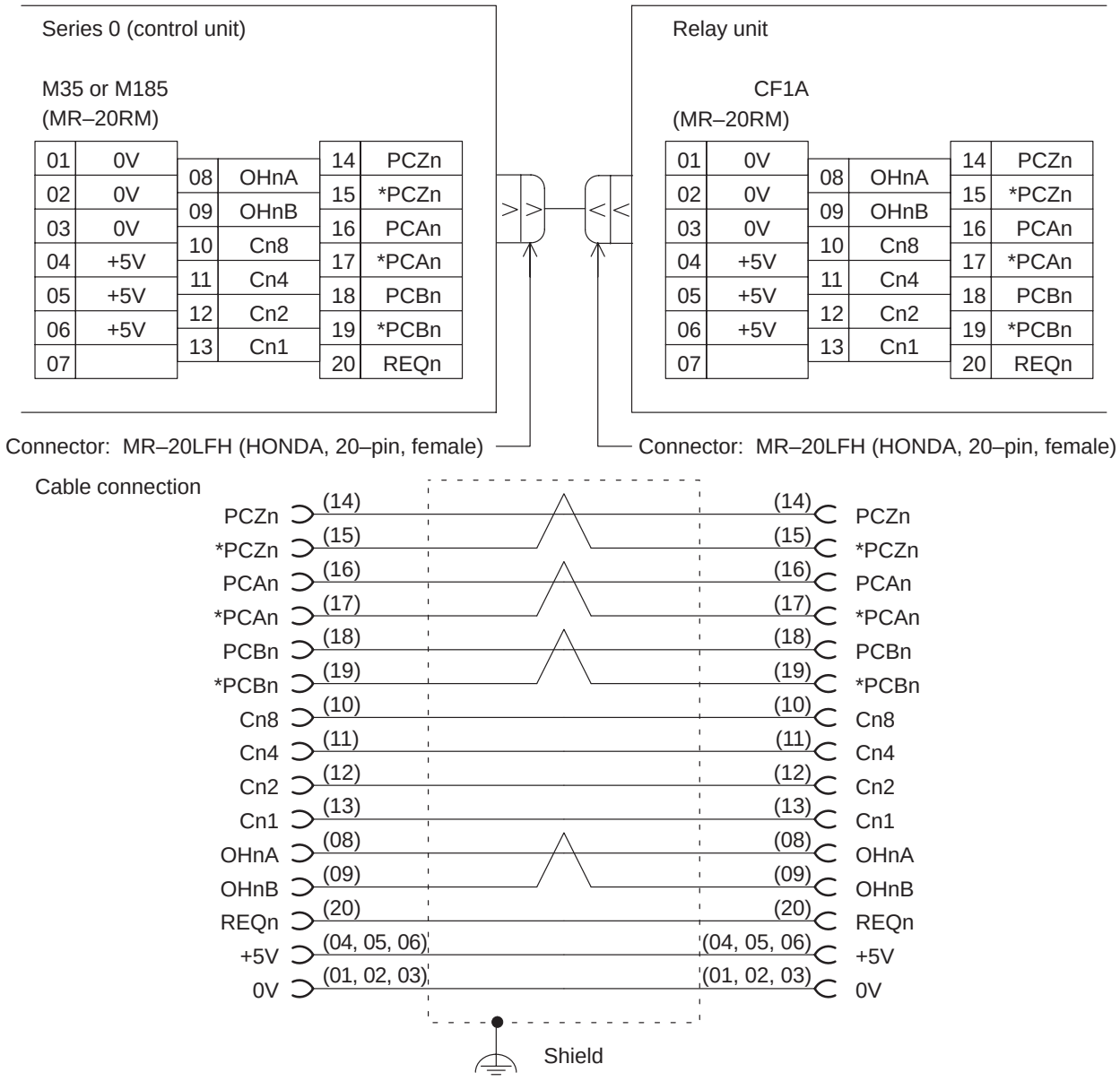
NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

9.3.4 A/B Phase Pulse Coder (Built–in Absolute Pulse Coder)

An A/B–phase absolute pulse coder can be connected to the Series 0 in either of two ways: via the relay unit of the absolute pulse coder battery unit, or directly.

- **When using the relay unit**

(1) Connection between Series 0 and relay unit



Cable material : +5V————Three or more vinyl–coated wires each having a cross–sectional area of 0.5 mm^2
: 0V————Three or more vinyl–coated wires each having a cross–sectional area of 0.5 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.18 mm^2
: Others————Unified shield twisted pair wires each having a cross–sectional area of at least 0.18 mm^2

The cable length must not exceed 2 m.

Recommended cable specification A02B–0074–K804 (2m)

(2) Connection between relay unit and A/B–phase pulse coder

Relay unit

CF1B
(MR–20RM)

01	0V	08	OHnA	14	PCZn
02	0V	09	OHnB	15	*PCZn
03	0VA	10	Cn8	16	PCAn
04	+5V	11	Cn4	17	*PCAn
05	+5V	12	Cn2	18	PCBn
06	+6VA	13	Cn1	19	*PCBn
07				20	REQn

J8n

A/B–phase pulse coder
(built–in absolute pulse coder)

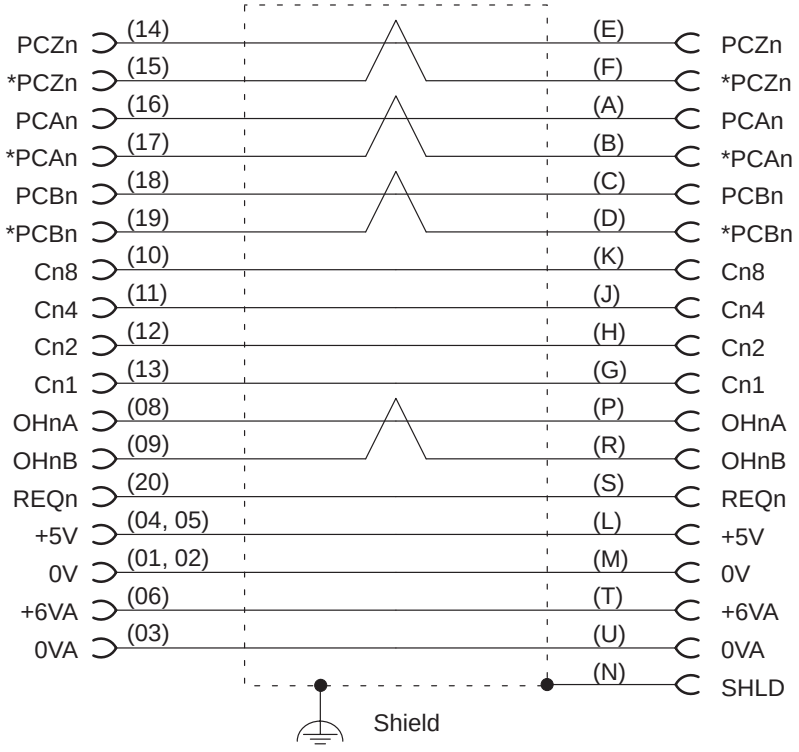
(MS3102A–22–14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	G	P	OHnA	R	OHnB
S	REQn	T	+6VA	U	0VA

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B22–14S (straight)
MS3108B22–14S (elbow)

Cable connection



Cable material : +5V, 0V——For each, two or more vinyl–coated wires each having a cross–sectional area of 0.5 mm^2
: +6VA, 0VA—For each, one or more vinyl–coated wires each having a cross–sectional area of 0.5 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.18 mm^2
: Others————Unified shield twisted pair wires each having a cross–sectional area of at least 0.18 mm^2

Recommended cable specification Straight type A06B–6050–K055 (14m)
Elbow type A06B–6050–K056 (14m)

NOTE

The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways, including the cable between the axis control card and the relay unit.

● Direct connection

Series 0 (control unit)

M35 or M185
(MR–20RM)

01	0V	08	OHnA	14	PCZn
02	0V	09	OHnB	15	*PCZn
03	0VB	10	Cn8	16	PCAn
04	+5V	11	Cn4	17	*PCAn
05	+5V	12	Cn2	18	PCBn
06	+5V	13	Cn1	19	*PCBn
07	+6VB			20	REQn

n: axis number

J22nB

A/B–phase pulse coder
(built–in absolute pulse coder)

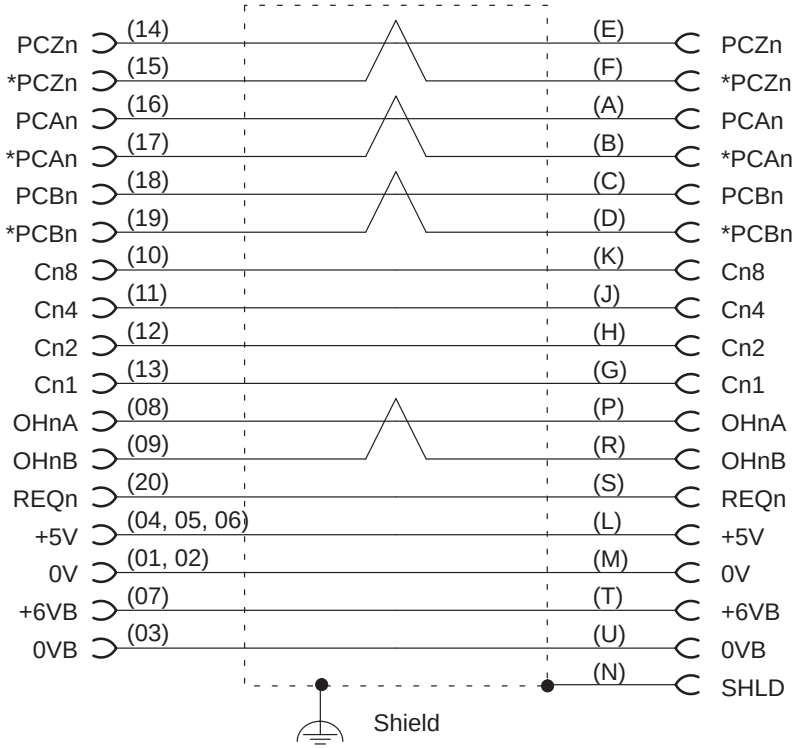
(MS3102A–22–14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	SHLD	P	OHnA	R	OHnB
S	REQn	T	+6VB	U	0VB

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B22–14S (straight)
MS3108B22–14S (elbow)

Cable connection



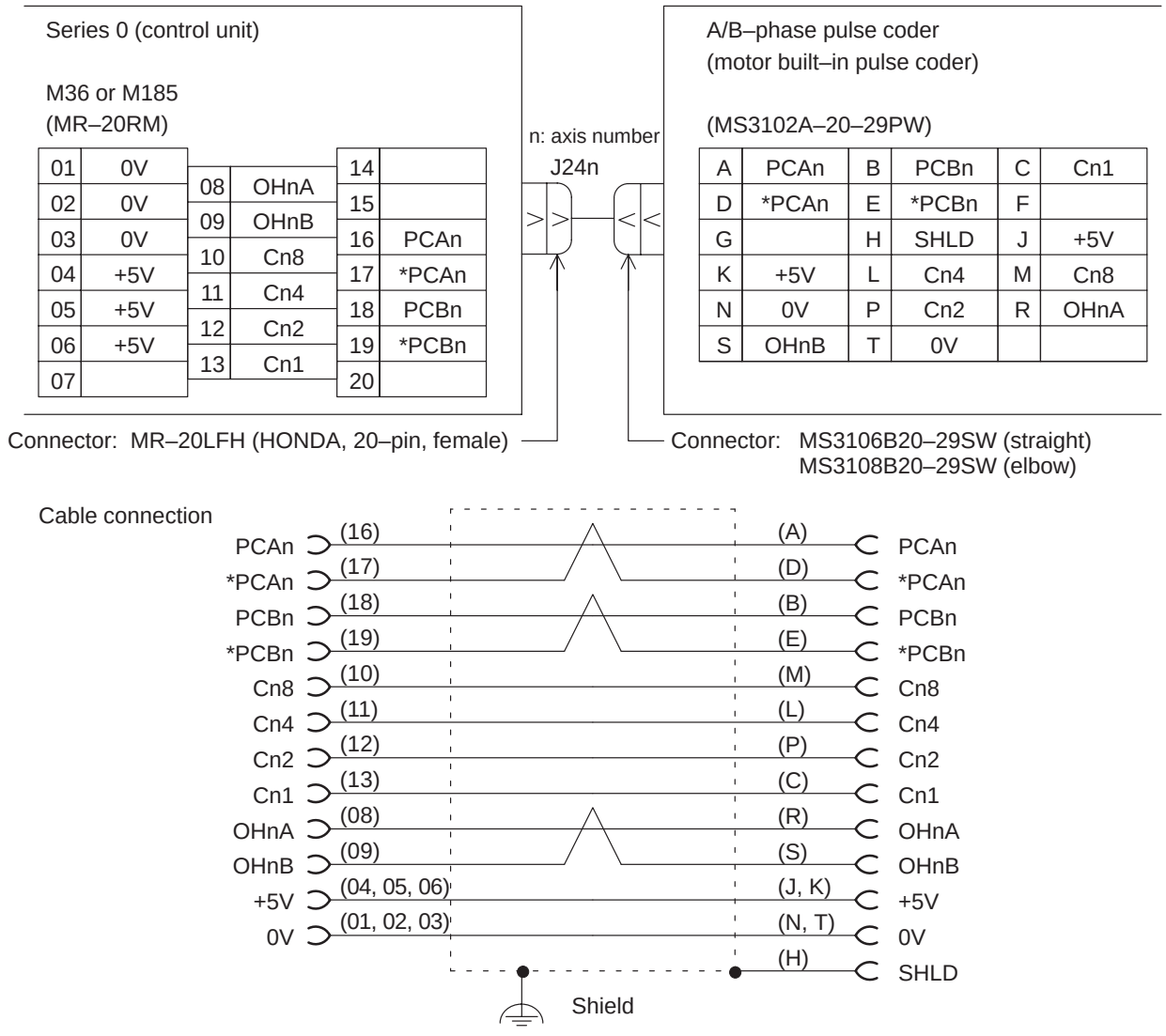
Cable material : +5V,————Two 0.5–mm^2 wires
: +6VB————One 0.5–mm^2 wire
: 0V————Two 0.5–mm^2 wires
: 0VB————One 0.5–mm^2 wire
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.18 mm^2
: Others Unified shield twisted pair wires each having a cross–sectional area of at least 0.18 mm^2

Recommended cable specification Straight type A02B–0096–K801 (14m)
Elbow type A02B–0096–K802 (14m)

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

9.3.5 Low–Resolution A/B Phase Separate Pulse Coder (2000P to 3000P) (Separate Incremental Pulse Coder)

(1) Velocity feedback connection



Cable material : +5V, 0V———For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.2 mm^2
: Others Unified shield twisted pair wires each having a cross–sectional area of at least 0.1 mm^2

NOTE
The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways.

(2) Position feedback connection

Series 0 (control unit)

M35 or M186
(MR–20RM)

01	0V	08		14	PCZn
02	0V	09		15	*PCZn
03	0V	10		16	PCAn
04	+5V	11		17	*PCAn
05	+5V	12		18	PCBn
06	+5V	13		19	*PCBn
07				20	

n: axis number
J23n

Low–resolution A/B–phase separate pulse coder

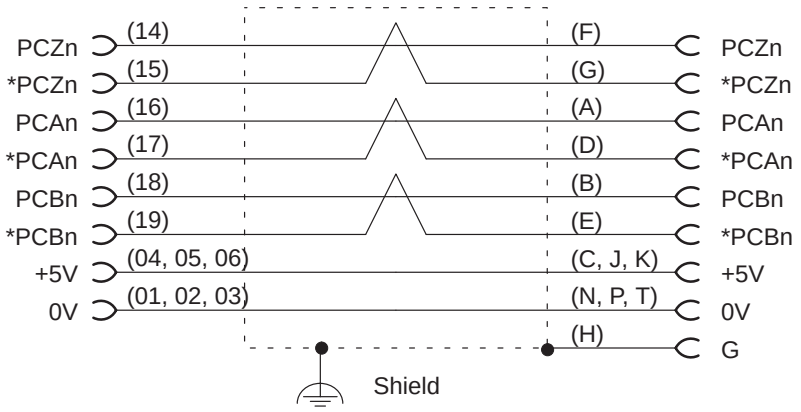
(MS3102A–20–29P)

A	PCAn	B	PCBn	C	+5V
D	*PCAn	E	*PCBn	F	PCZn
G	*PCZn	H	G	J	+5V
K	+5V	L		M	
N	0V	P	0V	R	
S		T	0V		

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B–20–29S or MS3108B–20–29S

Cable connection



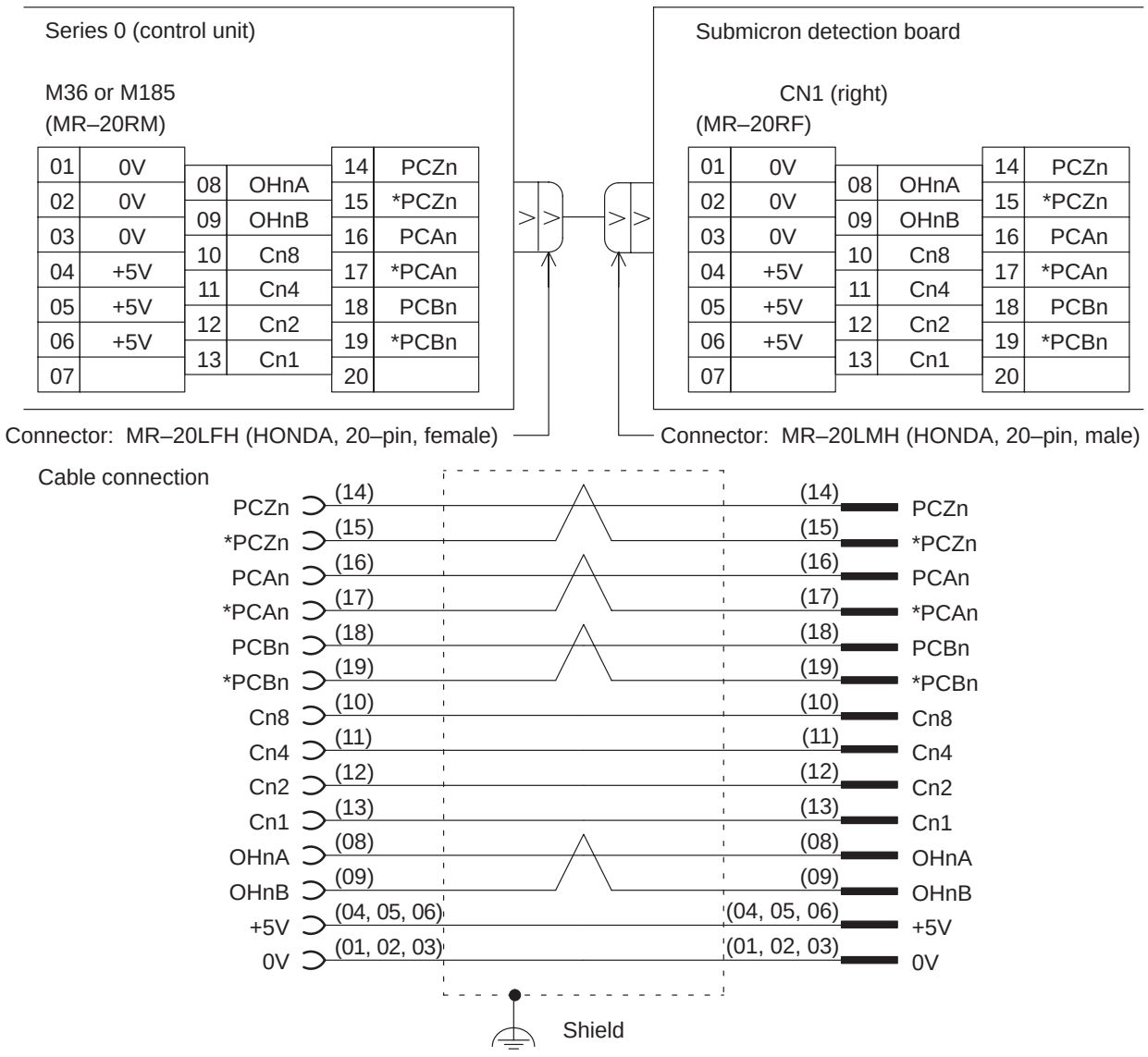
Cable material : +5V, 0V——For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Others——Unified shield twisted pair wires each having a cross–sectional area of at least 0.1 mm^2

NOTE
The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways.

9.3.6 High–Speed, High–Resolution A/B Phase Separate Pulse Coder (20000P to 30000P, 24 m/min) (Separate Incremental Pulse Coder)

Connect a high–speed, high–resolution A/B–phase separate pulse coder via a submicron detection board.

(1) Connection between Series 0 and submicron detection board (velocity feedback connection)

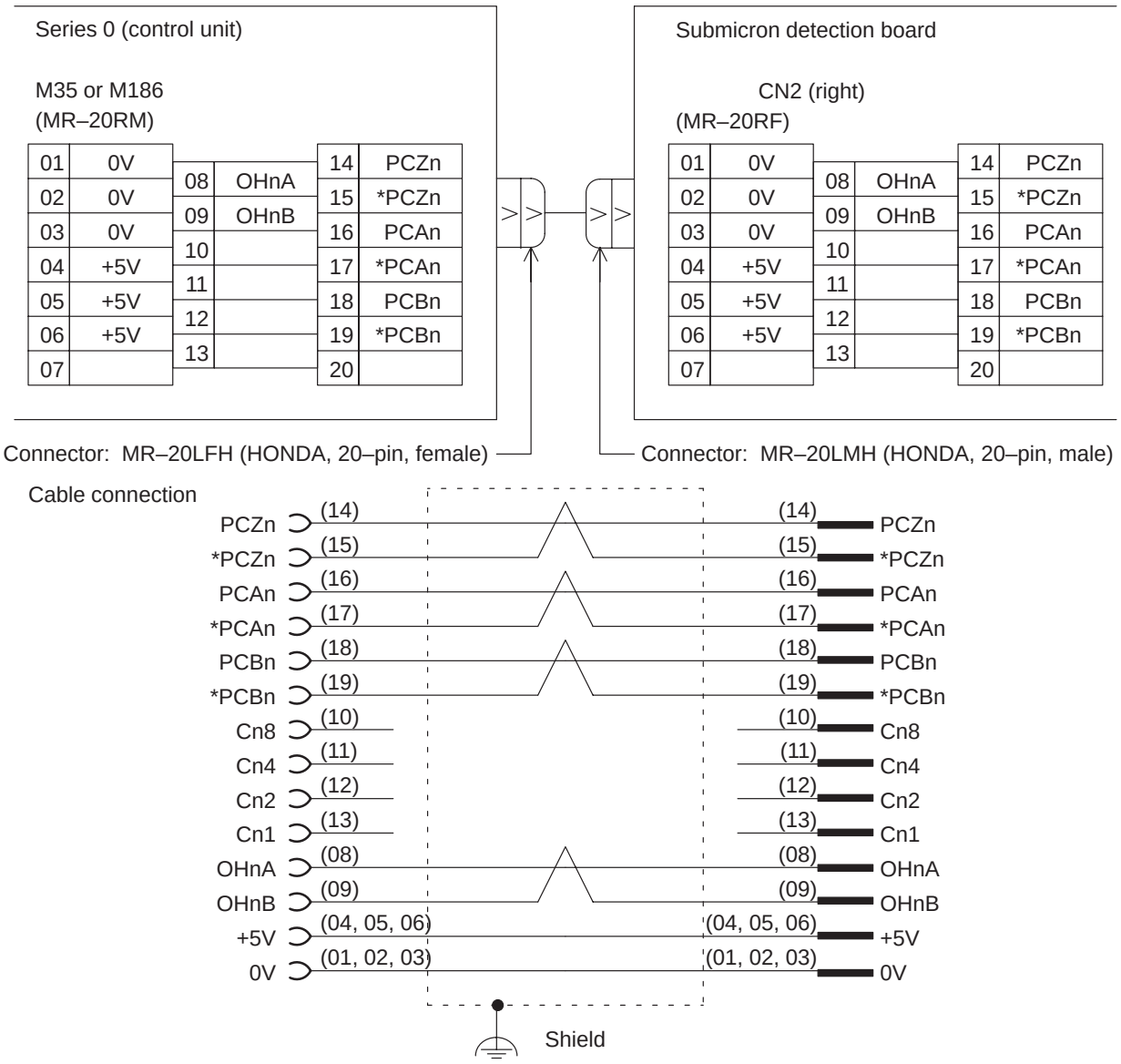


Cable material : +5V, 0V——For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Cn1 to Cn8 Vinyl–coated wires each having a cross–sectional area of at least 0.2 mm^2
: Others Unified shield twisted pair wires each having a cross–sectional area of at least 0.2 mm^2

Recommended cable material A66L–0001–0199

The cable length must not exceed 2 m.

(2) Connection between Series 0 and submicron detection board (position feedback connection)



Cable material : +5V, 0V———For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Others———Unified shield twisted pair wires each having a cross–sectional area of at least 0.2 mm^2

Recommended cable material A66L–0001–0199

The cable length must not exceed 2 m.

(3) Connection between submicron detection board and the motor's built–in pulse coder (for velocity feedback), and high–speed, high–resolution A/B–phase separate pulse coder (for position feedback)

Submicron detection board
CN1 (left) (velocity feedback)
CN2 (left) (position feedback)
(MR–20RM)

01	0V	08	OHnA	14	PCZn
02	0V	09	OHnB	15	*PCZn
03	0V	10	Cn8	16	An
04	+5V	11	Cn4	17	*An
05	+5V	12	Cn2	18	Bn
06	+5V	13	Cn1	19	*Bn
07				20	

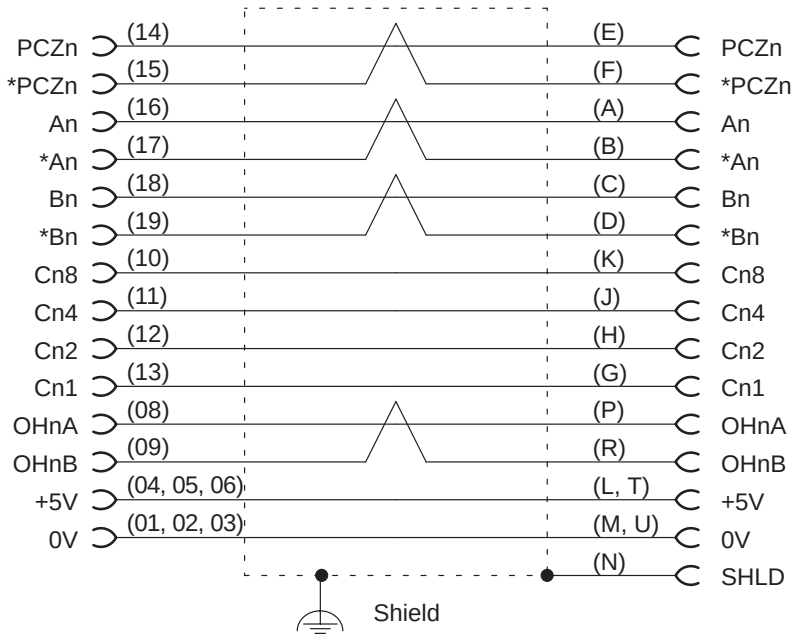
Motor's built–in pulse coder (velocity feedback)
High–speed, high–resolution A/B–phase separate pulse coder (position feedback)
(MS3102A–22–14P)

A	An	B	*An	C	Bn
D	*Bn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	G	P	OHnA	R	OHnB
S		T	+5V	U	0V

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector MS3106B–22–14S or MS3108B–22–14S

Cable connection



When the cable length is 14 m or less

Cable material : +5V, 0V———For each, six or more vinyl–coated wires each having a cross–sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.2 mm^2
: Others————Unified shield twisted pair wires each having a cross–sectional area of at least 0.2 mm^2

Recommended cable material A66L–0001–0199

9.3.7 A/B Phase Separate Pulse Coder (Separate Absolute Pulse Coder)

- **Velocity feedback connection**

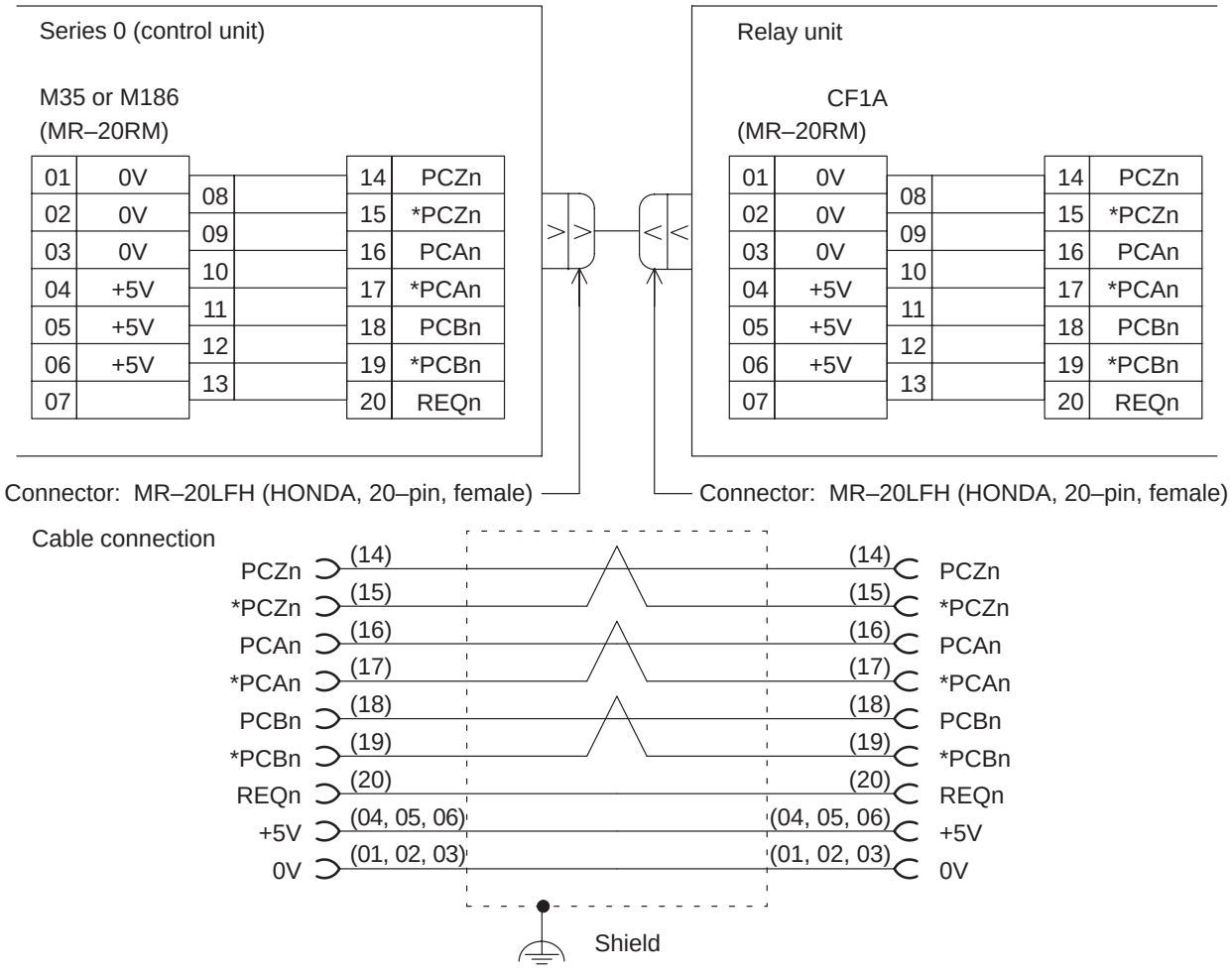
The velocity feedback connection between the motor's built–in pulse coder and the Series 0 is the same as that described in Section 9.3.5.

- **Position feedback connection**

An A/B–phase absolute pulse coder can be connected to the Series 0 in either of two ways: via the relay unit of the absolute pulse coder battery unit, or directly.

- When using the relay unit

(1) Connection between Series 0 and relay unit



Cable material : +5V, 0V———Six or more vinyl–coated wires each having a cross–sectional area of 0.5 mm^2
: Cn1 to Cn8——Vinyl–coated wires each having a cross–sectional area of at least 0.18 mm^2
: Others———Unified shield twisted pair wires each having a cross–sectional area of at least 0.18 mm^2

The cable length must not exceed 2 m.

Recommended cable specification A02B–0074–K804 (2m)

(2) Connection between relay unit and A/B–phase pulse coder

Relay unit

CF1B
(MR–20RM)

01	0V	08		14	PCZn
02	0V	09		15	*PCZn
03	0V	10		16	PCAn
04	+5V	11		17	*PCAn
05	+5V	12		18	PCBn
06	+6VA	13		19	*PCBn
07				20	REQn

A/B–phase separate pulse coder
(separate absolute pulse coder)

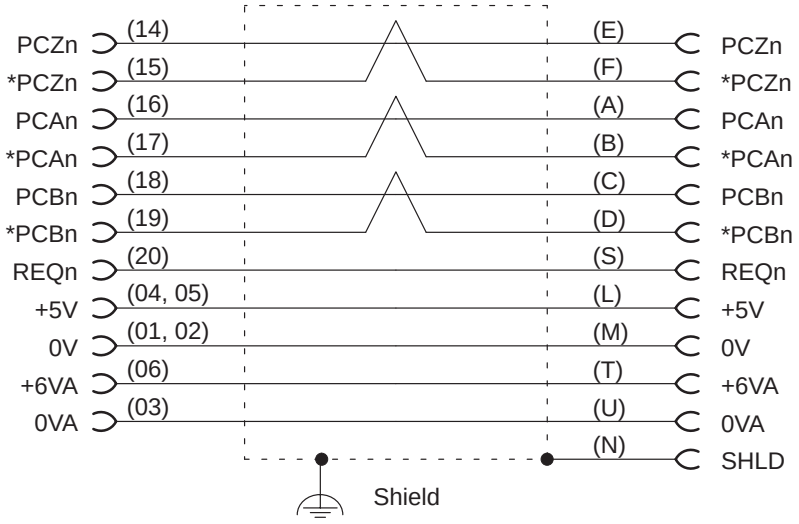
(MS3102A–22–14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G		H		J	
K		L	+5V	M	0V
N	SHLD	P		R	
S	REQn	T	+6VA	U	0VA

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B–22–14S (straight)
MS3108B–22–14S (elbow)

Cable connection



Cable material : +5V, 0V———Two 0.5–mm^2 wires
: +6VA, 0VA———One 0.5–mm^2 wire
: Others———Unified shield twisted pair wires each having a cross–sectional area of 0.18 mm^2

NOTE
The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways, including the cable between the axis control card and the relay unit.

- Direct connection

Series 0 (control unit)

M35 or M186
(MR–20RM)

01	0V	08	14	PCZn
02	0V	09	15	*PCZn
03	0V	10	16	PCAn
04	+5V	11	17	*PCAn
05	+5V	12	18	PCBn
06	+5V	13	19	*PCBn
07	+6VB		20	REQn

A/B–phase separate pulse coder
(separate absolute pulse coder)

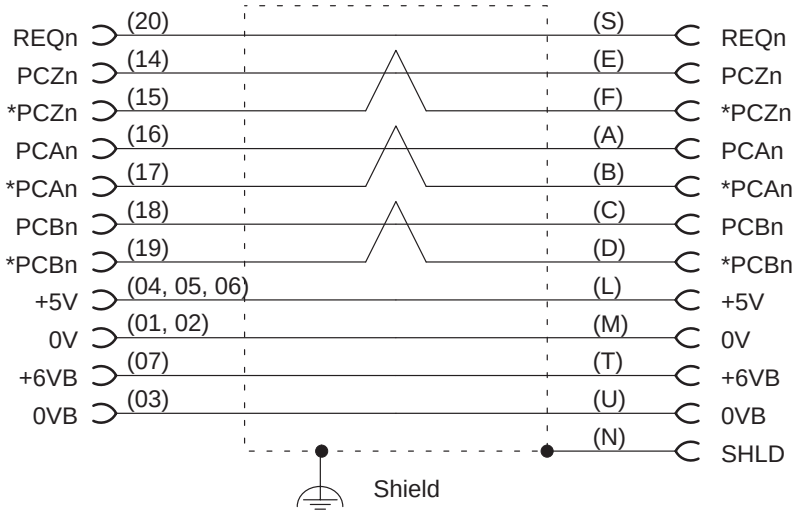
(MS3102A–22–14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G		H		J	
K		L	+5V	M	0V
N	SHLD	P		R	
S	REQn	T	+6VB	U	0VB

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B–22–14S (straight)
MS3108B–22–14S (elbow)

Cable connection



Cable material : +6VB, 0VB —One or more wires each haveing a cross–sectional area of at least 0.5 mm^2
: +5V, 0V———Two or more wires each haveing a cross–sectional area of at least 0.5 mm^2
: Others———Unified shield twisted pair wires each having a cross–sectional area of at least 0.18 mm^2
: REQn———One or more wires each haveing a cross–sectional area of at least 0.18 mm^2

Recommended cable specification A02B–0096–K801 (14m) (straight)
A02B–0096–K802 (14m) (elbow)

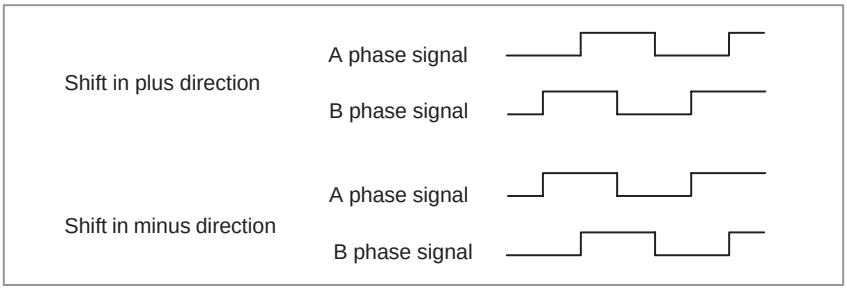
NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

Input signal requirements

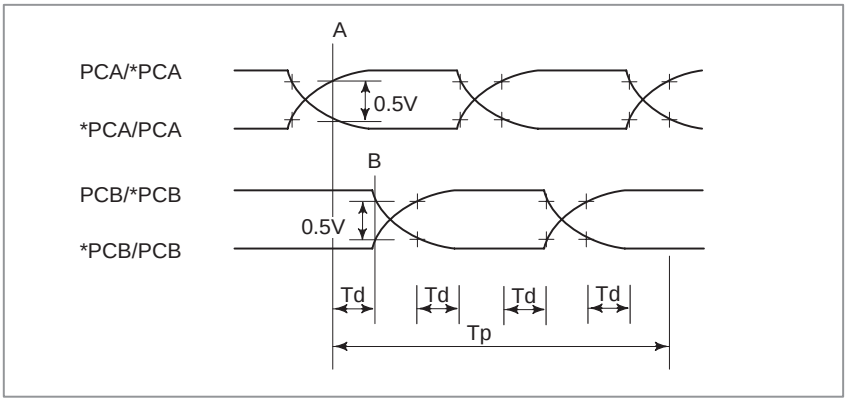
The standard of the feedback signal from the additional detector is as shown below.

(1) A and B phase signal input

This is a method to input position information by the mutual 90 degree phase slip of A and B phase signals.
Detection of the position is performed with the state in which the B phase is leading taken as a shift in the plus direction, and the state in which the A phase is leading as a shift in the minus direction.

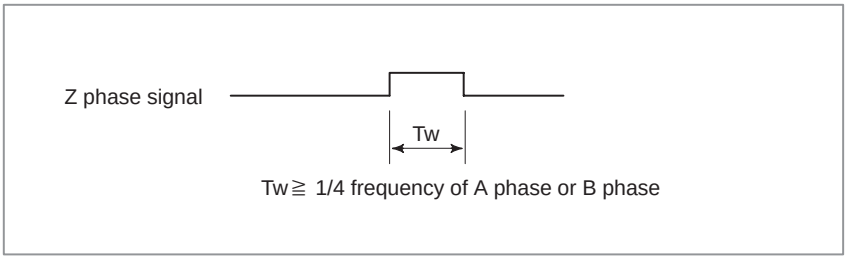


(2) Phase difference and minimum repeat frequency



(3) Z phase signal input

For the Z phase signal (1 rotation signal), a signal width of more than 1/4 frequency of the A phase or B phase signals is necessary.



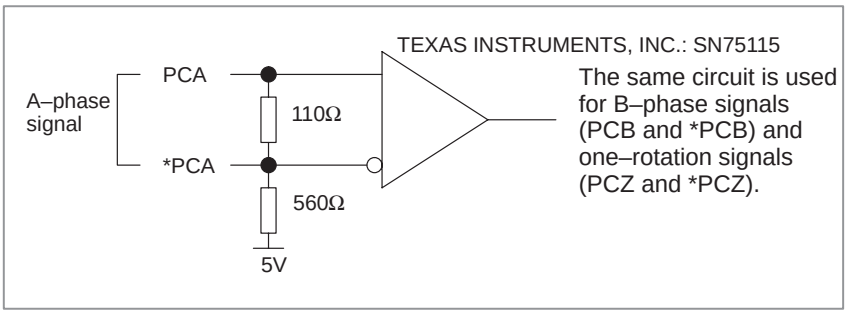
Time requirements

Requirements for the signals at the input pins of input connectors JF21 to JF24

TD ≧ 0.28 μsec

The signals for these connectors are differential input signals with A and B phases. An important factor is time TD from point A, when the potential difference between PCA and *PCA exceeds 0.5V, to point B, when the potential difference between PCB and *PCB becomes lower than 0.5V. The minimum value of TD is 0.15 μs. The period and pulse width of the signals must be long enough to satisfy the above requirements.

Receiver circuit



Relationship between the direction of rotation of the servo motor and that of the separate pulse coder

If the separate pulse coder rotates in the opposite direction to that of the servo motor, reconnect the interface cable of the separate pulse coder as described below.

(1) Exchange signal PCA with signal PCB.

(2) Exchange signal *PCA with signal *PCB.

9.4 SERIAL PULSE CODER INTERFACE

9.4.1 Serial Pulse Coder A or B

Series 0–C (control unit)
Axis control card for serial pulse coder
M185
(MR–20RM)

14	REQ	08	01	0V
15	*REQ	09	02	0V
16	SD	10	03	0VB
17	*SD	11	04	+5V
18		12	05	+5V
19		13	06	+5V
20			07	+6VB

J23n

Pulse coder

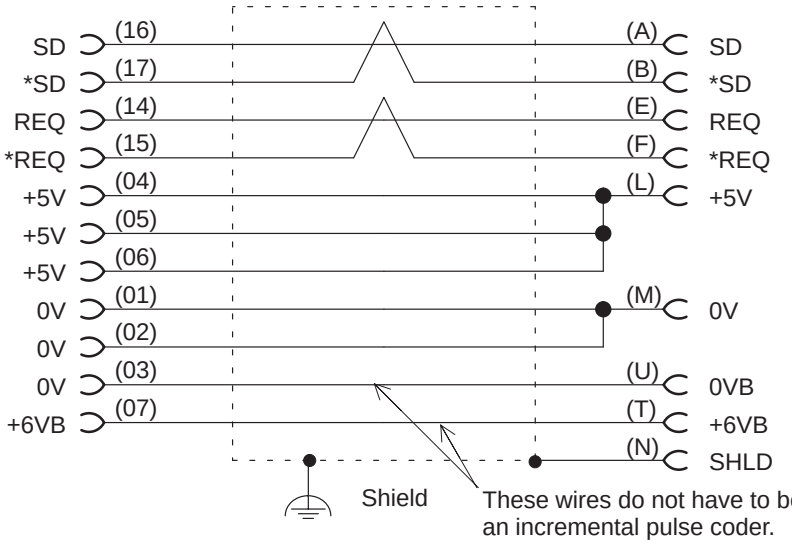
(MS3102A–22–14P)

A	SD	B	*SD	C	
D		E	REQ	F	*REQn
G		H		J	
K		L	+5V	M	0V
N	SHLD	P		R	
S		T	+6VB	U	0VB

Connector: MR–20LFH (HONDA, 20–pin, female)

Connector: MS3106B–22–14S or MS3108B–22–14S

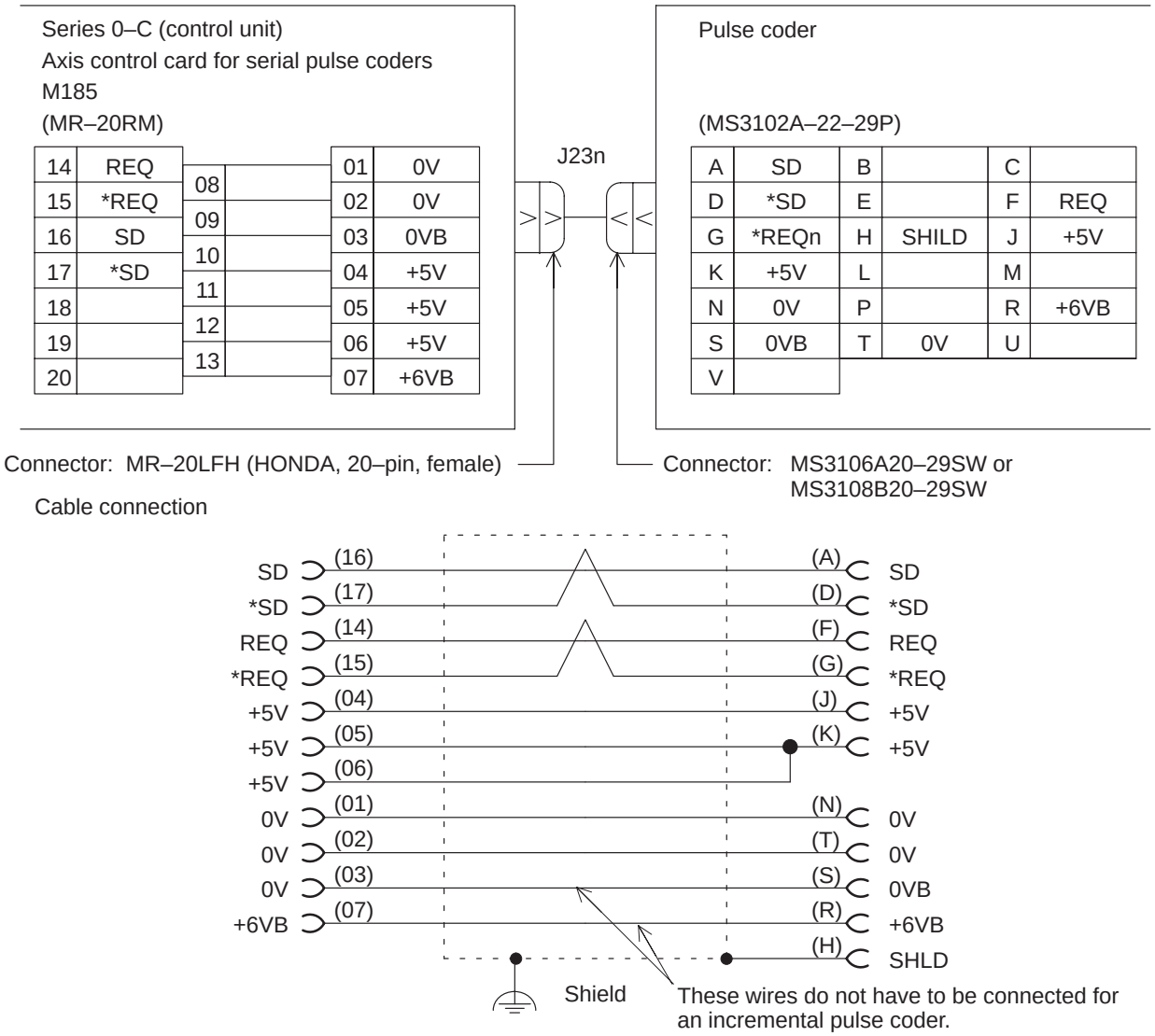
Cable connection



Cable material : +5V, 0V——Two or more wires each having a cross–sectional area of at least 0.5 mm^2 (when the cable length is 14 m or less)
: +6VB, 0VB——One or more wires each having a cross–sectional area of at least 0.5 mm^2
: SD, *SD, REQ, *REQ——Twisted pair wires each having a cross–sectional area of at least 0.18 mm^2

NOTE
The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways.

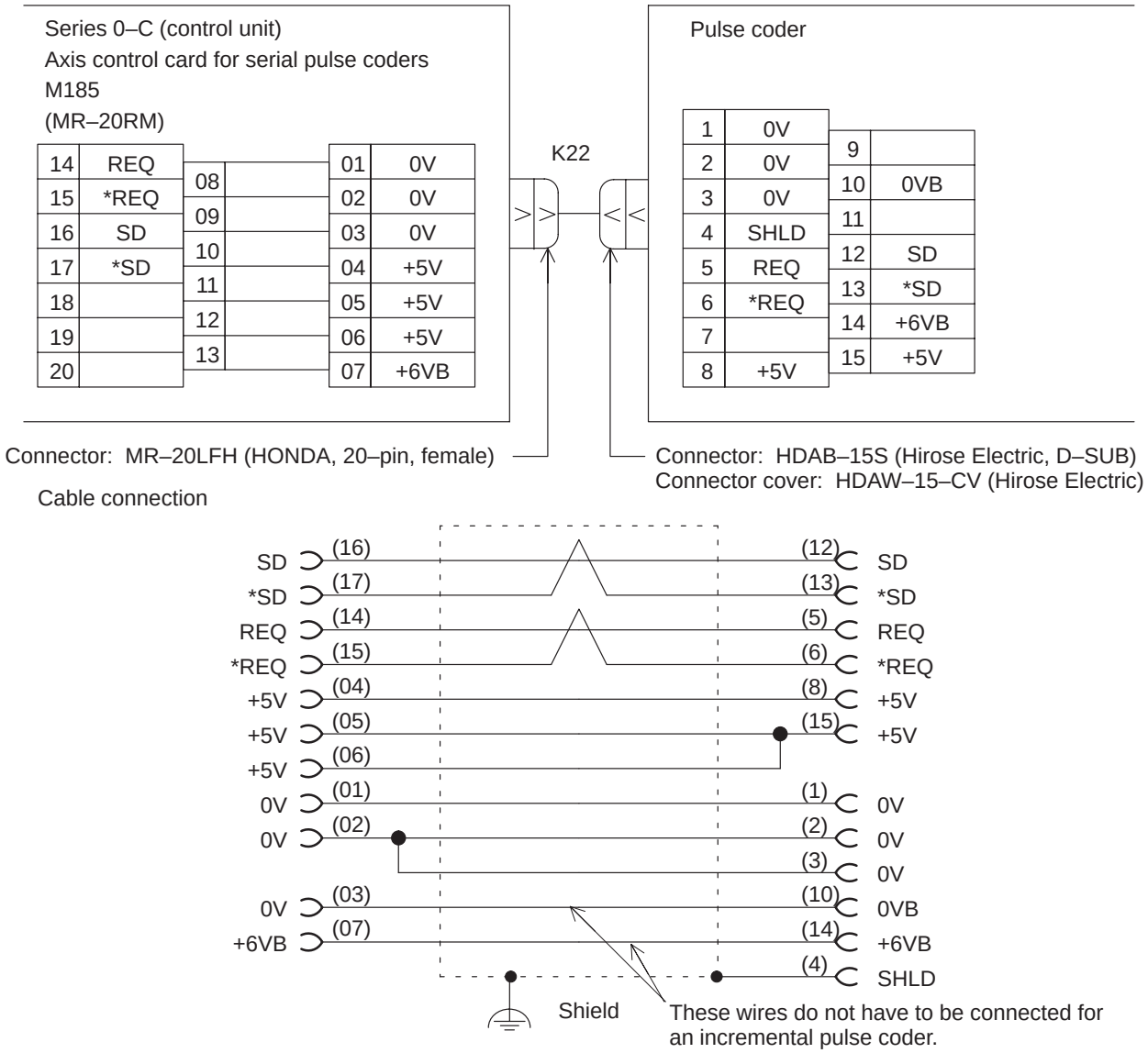
9.4.2 Serial Pulse Coder C (Model 0S or Above) α Series Motor (α3/3000 to α150/2000)



Cable material : +5V, 0V ——— Two or more wires each having a cross–sectional area of at least 0.5 mm^2 (when the cable length is 14 m or less)
: +6VB, 0VB One or more wires each having a cross–sectional area of at least 0.5 mm^2
: SD, *SD, REQ, *REQ Twisted pair wires each having a cross–sectional area of at least 0.18 mm^2

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

9.4.3 Serial Pulse Coder C (Model 1–0S to 0–0SP) α Series Motor (α1/3000, α2/2000, or α2/3000)



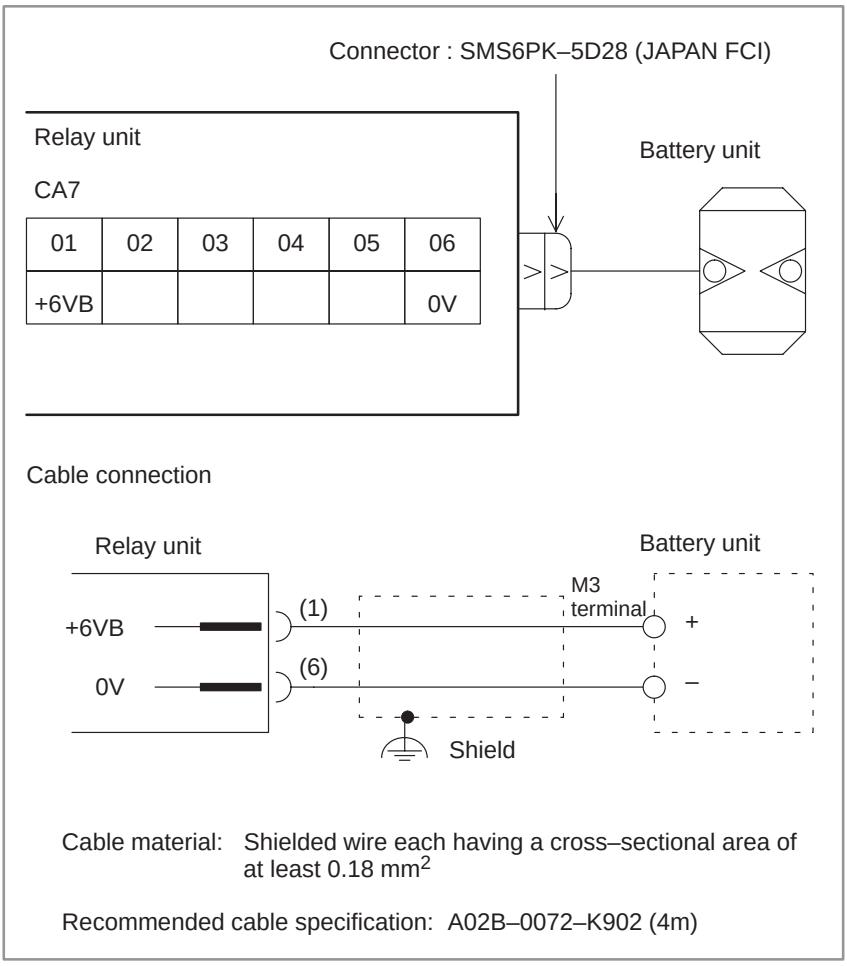
Cable material : +5V, 0V——Two or more wires each having a cross–sectional area of at least 0.5 mm^2 (when the cable length is 14 m or less)
: +6VB, 0VB——One or more wires each having a cross–sectional area of at least 0.5 mm^2
: SD, *SD, REQ, *REQ——Twisted pair wires each having a cross–sectional area of at least 0.18 mm^2

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

9.5 CONNECTION OF THE BATTERY UNIT FOR AN ABSOLUTE PULSE CODER

The battery unit for an absolute pulse coder can be connected to the Series 0 in either of two ways: via a relay unit or directly.

9.5.1 Connection Using the Relay Unit



Cable material: Shielded wire each having a cross–sectional area of at least 0.18 mm^2

Recommended cable specification: A02B–0072–K902 (4m)

NOTE
1 A single relay unit can distribute power from the battery to up to four pulse coders.
2 A single battery unit can supply power to up to six pulse coders.
3 Replace the battery with a new one once a year.

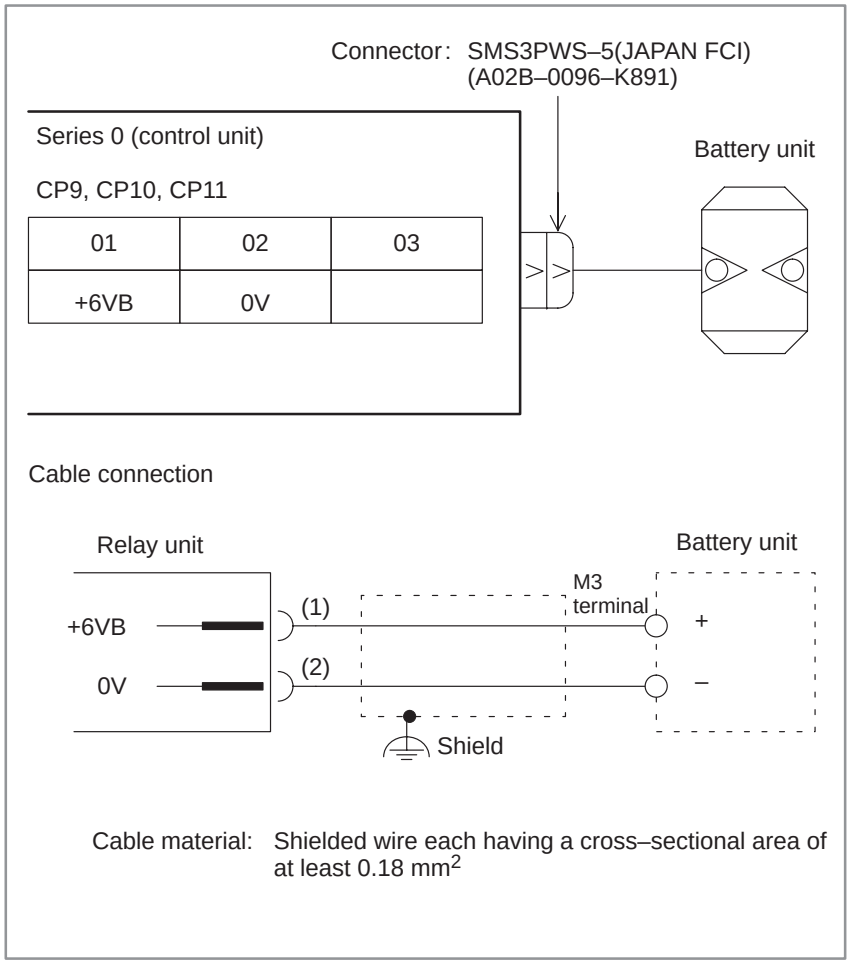
9.5.2 Connection without a Relay Unit

The battery unit can be connected directly to each axis control card, from which the battery power is distributed to each pulse coder.

Battery connector name

	1st–4th axis control card				5th/6th axis control card		7th/8th axis control card	
	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis	7th axis	8th axis
Connector name	CPA9				CPA10		CPA11	

For the Series 0–TTC, the first and second axes for tool post 2 correspond to the fifth and sixth axes in the above table.



NOTE
1 A single battery unit can supply power to up to six pulse coders.
2 Replace the battery with a new one once a year.

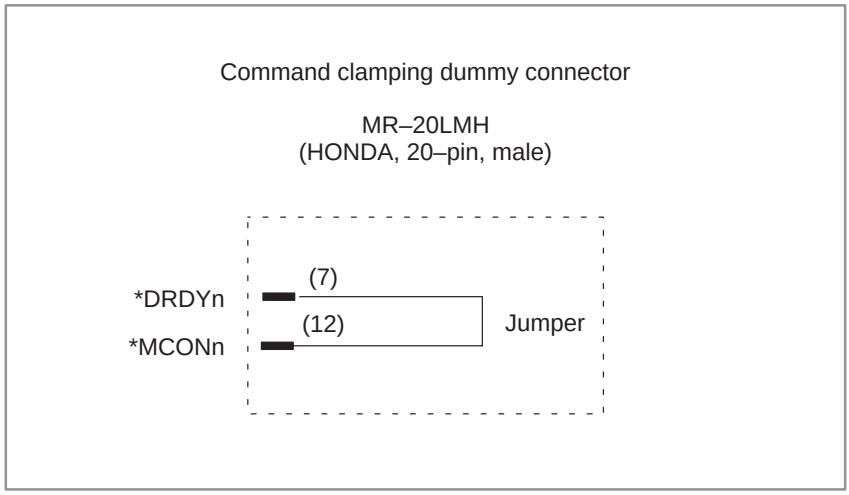
9.6 HANDLING OF UNUSED AXES (CLAMPING)

The user can select any of the supported axes as the axes to be controlled. A cable for a servo amplifier or motor need not be connected to those axes that are not to be used. Leaving the connector for an unused axis open, however, causes the CNC to enter a servo alarm state. This section describes how to handle (clamp) unused axes.

NOTE
Servo parameters must also be set for clamped axes. Set the same servo parameters as those for any axis to be used.

9.6.1 Handling of the Command Connectors of Unused Axes

Connect a command clamping dummy connector to the command connector of each unused axis (for example, M34 or M184 for the first axis).



- **When a type B interface is used**

A dummy connector is not necessary. Set the relevant servo parameters as follows and leave the servo interface connectors open.

Set the axis ignore parameter (bit 0 of No. 8n09 : n is the axis number) for each unused axis to 1. Set flexible feed parameters 8n84 and 8n85 to 1.

9.6.2 Handling of the Feedback Connectors of Unused Axes

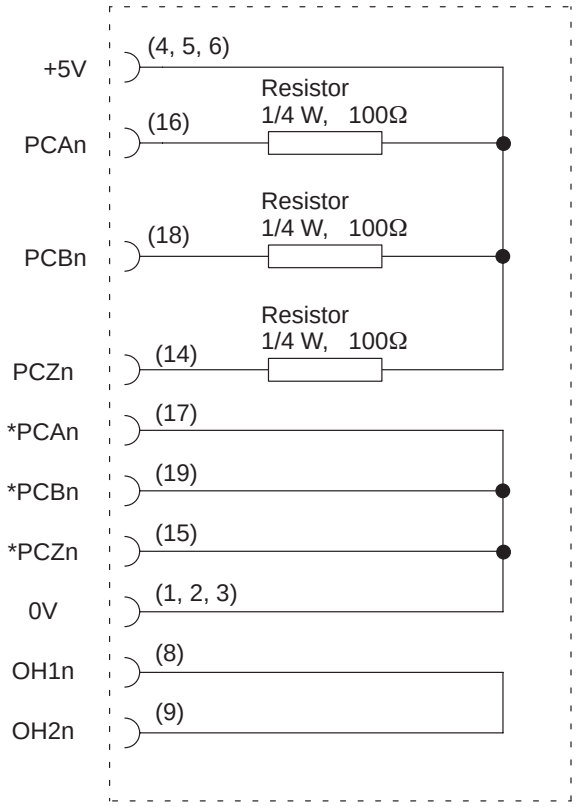
Handling varies depending on whether an series servo motor is used.

- **When an α series servo motor is not used**

Connect a feedback clamping connector to the feedback connector of each unused axis (for example, M35 or M185 for the first axis).

Feedback clamping dummy connector

MR–20LFH
(HONDA, 20–pin, female)



The above example sets PCAn, PCBn, and PCZn to high and *PCAn, *PCBn, and *PCZn to low. The reverse connection is also allowed: PCAn, PCBn, and PCZn to low and *PCAn, *PCBn, and *PCZn to high.

- **When an α series servo motor is used**

A dummy connector is not necessary. Set the relevant servo parameters as follows and leave the feedback connectors open.

Set the axis ignore parameter (bit 0 of No. 8n09: n is the axis number) for each unused axis to 1. Set flexible feed gear parameters 8n84 and 8n85 to 1.

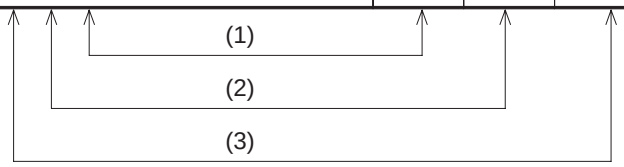
- **When a type B interface is used**

A dummy connector is not necessary.

9.7 COMBINATION OF AXIS CARDS FOR SERIAL PULSE CODERS AND DIGITAL SERVO FUNCTIONS

This section describes the supported combinations of axis cards for serial pulse coders and digital servo functions.

Name	Order specification (PC board drawing number)	Digital servo function		
1st/2nd axis printed circuit board	A02B–0098–H045 (A16B–2200–0391)	9046	9040	9030
3rd/4th axis printed circuit board	A02B–0098–H046 (A16B–2200–0390)			
5th/6th axis printed circuit board	A02B–0098–J030 (A16B–2200–0800)			
5th/6th axis printed circuit board (for 0–TTC)	A02B–0098–J033 (A16B–2200–0800)			
7th axis printed circuit board	A02B–0098–J199 (A16B–2200–0791)			
7th/8th axis printed circuit board	A02B–0098–J198 (A16B–2200–0790)			



<Combination of axis cards for serial pulse coders and digital servo function series 9046 (1)>

Use this combination when using an AC servo motor α series as the servo motor. A motor of the AC servo motor α series cannot be used together with a motor of another series.

<Combination of axis cards for serial pulse coders and digital servo function series 9040 (2)>

Use this combination when using other than an AC servo motor α series as the servo motor. This combination does not, however, apply to those motors listed in (3) below. Serial pulse coders and A/B–phase pulse coders can be used together, provided the motors are used in a valid configuration.

<Combination of axis cards for serial pulse coders and digital servo function series 9030 (3)>

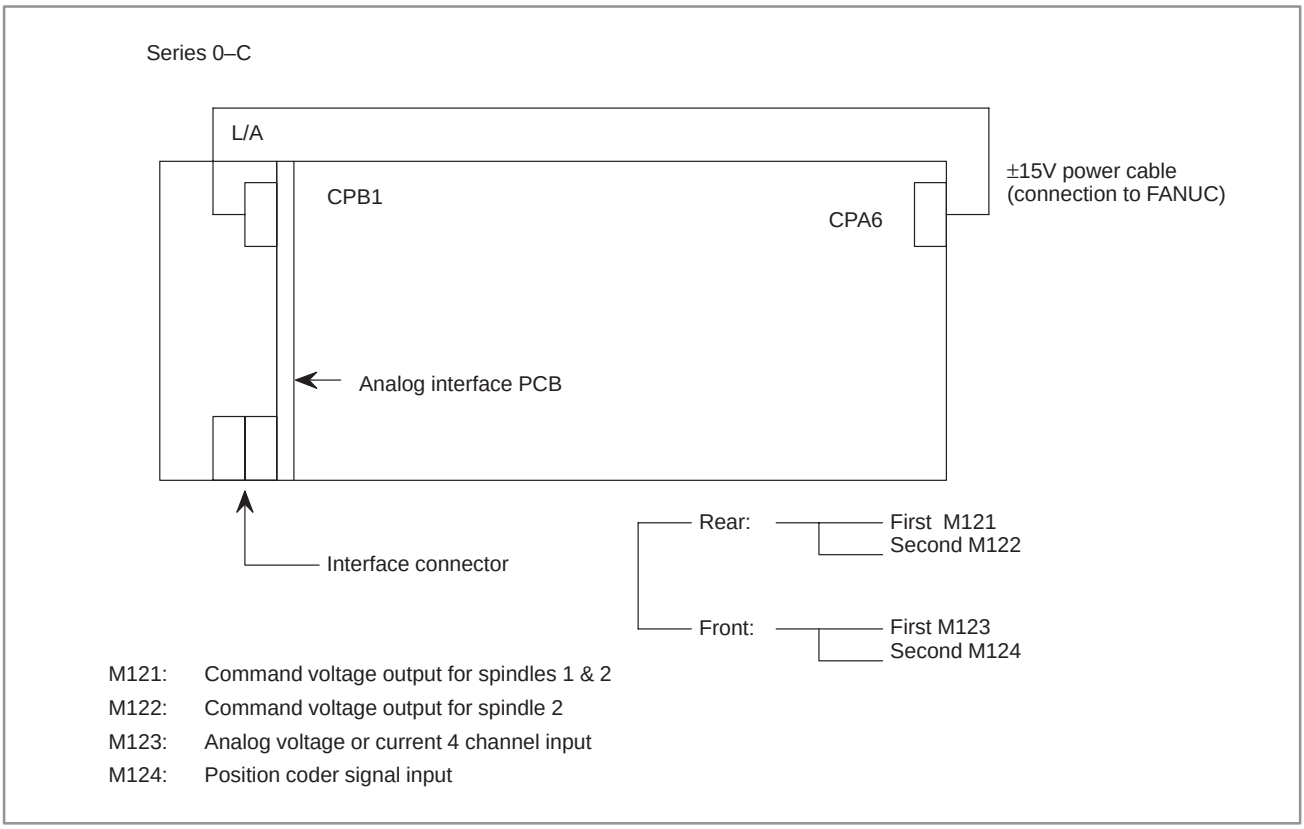
Use this combination when using any of the following motors as the servo motor. These motors cannot be used together with those for serial pulse coders, or with α series motors.

Motor model	2–0	1–0	0	5	10	30	6L(A06B–0563–BXXX)
Motor No.	6	7	8	9	10	13	17

10 ANALOG INTERFACE CARD

10.1 OUTLINE

This describes the connecting with the analog interface card. It is possible to connect 4 analog input channels, 2 spindles and 1 position coder.



M121: Command voltage output for spindles 1 & 2
M122: Command voltage output for spindle 2
M123: Analog voltage or current 4 channel input
M124: Position coder signal input

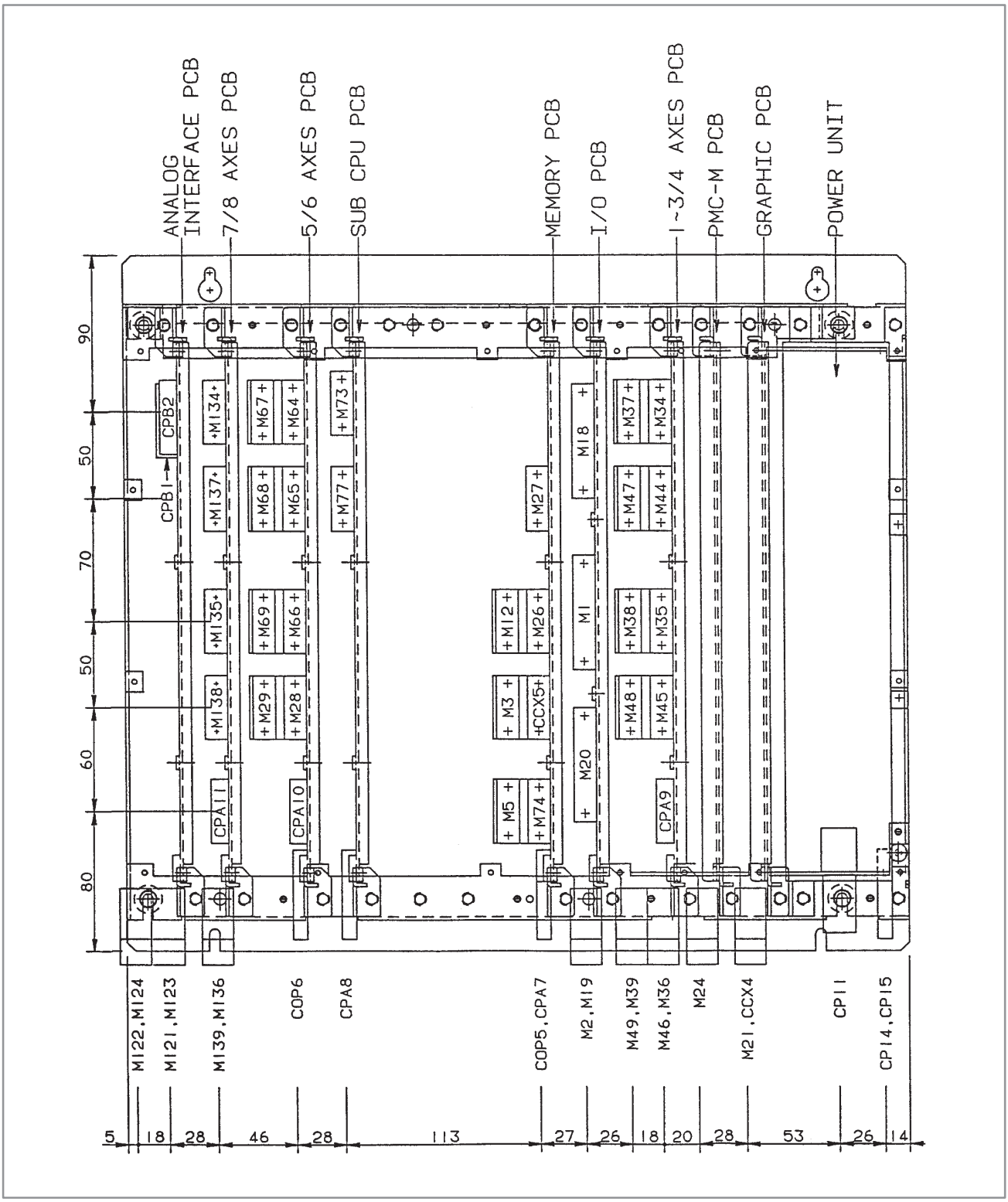
10.2 ANALOG INPUT SPECIFICATIONS

<table>
<tr><th>Item</th><th>Specification</th></tr>
<tr><td>Number of inputs</td><td>4</td></tr>
<tr><td>Analog of input</td><td>DC –10 to +10 V(Input resistance 1MΩ
DC –20 to+20 mA(Input resistance 250Ω)
Selection possible to use</td></tr>
<tr><td>Digital output</td><td>12 bit binary 2 complement expression</td></tr>
<tr><td>Input/output response</td><td><table><tr><th>Analog input</th><th>Digital output</th></tr><tr><td>+10 V</td><td>+2000</td></tr><tr><td>+5 V or +20 mA</td><td>+1000</td></tr><tr><td>0 V or 0 mA</td><td>0</td></tr><tr><td>–5 V or –20 mA</td><td>–1000</td></tr><tr><td>–10 V</td><td>–2000</td></tr></table></td></tr>
<tr><td>Resolution ability</td><td>5 mV, 20μA</td></tr>
<tr><td>Total heat</td><td>Under ±0.5%</td></tr>
<tr><td>Response time Note1)</td><td>Under 1 mS</td></tr>
<tr><td>Maximum input voltage/current</td><td>±15 V, ±40 mA</td></tr>
<tr><td>Insulation</td><td>Noninsulated</td></tr>
<tr><td>External connection method</td><td>Connector</td></tr>
</table>

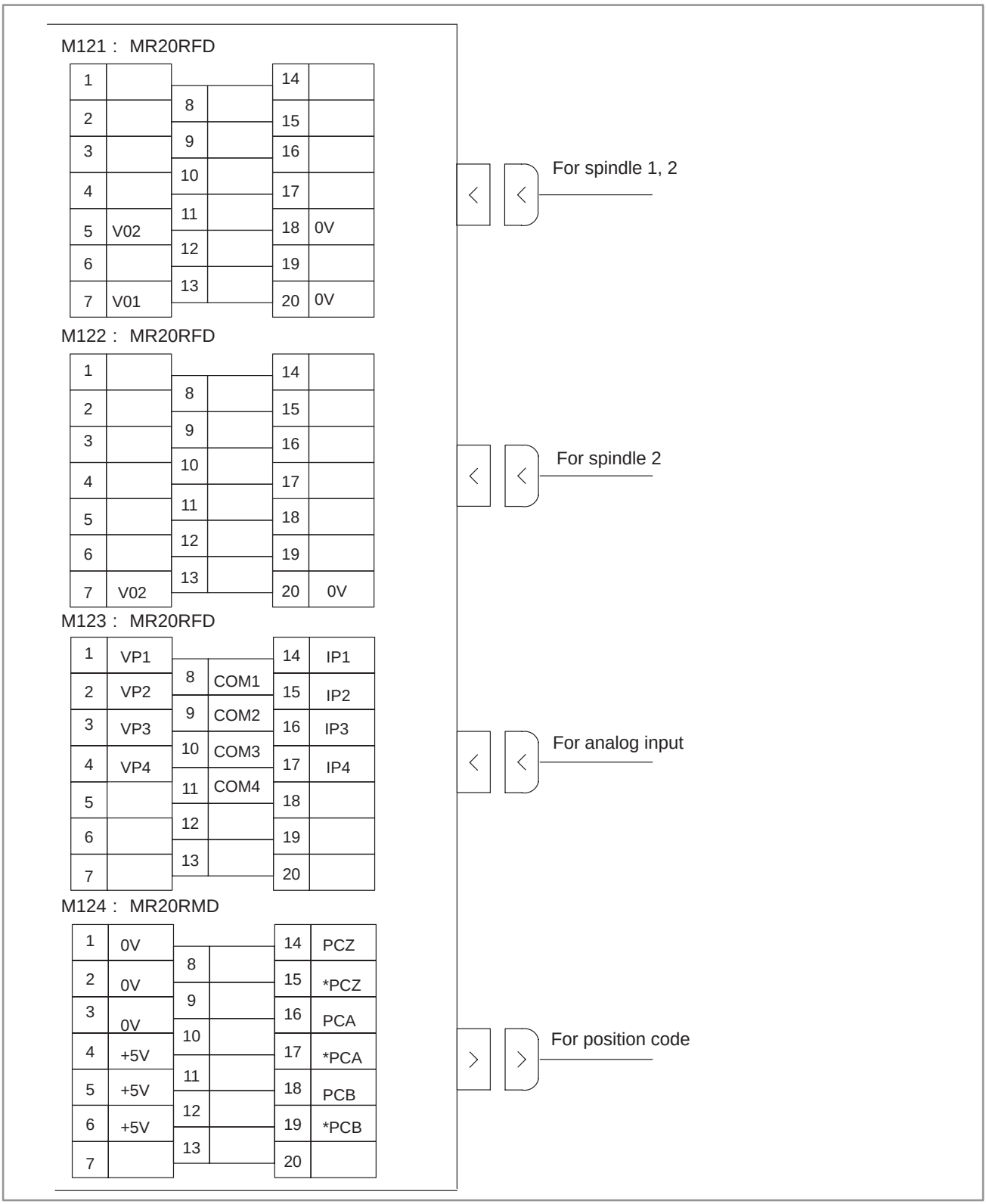
NOTE

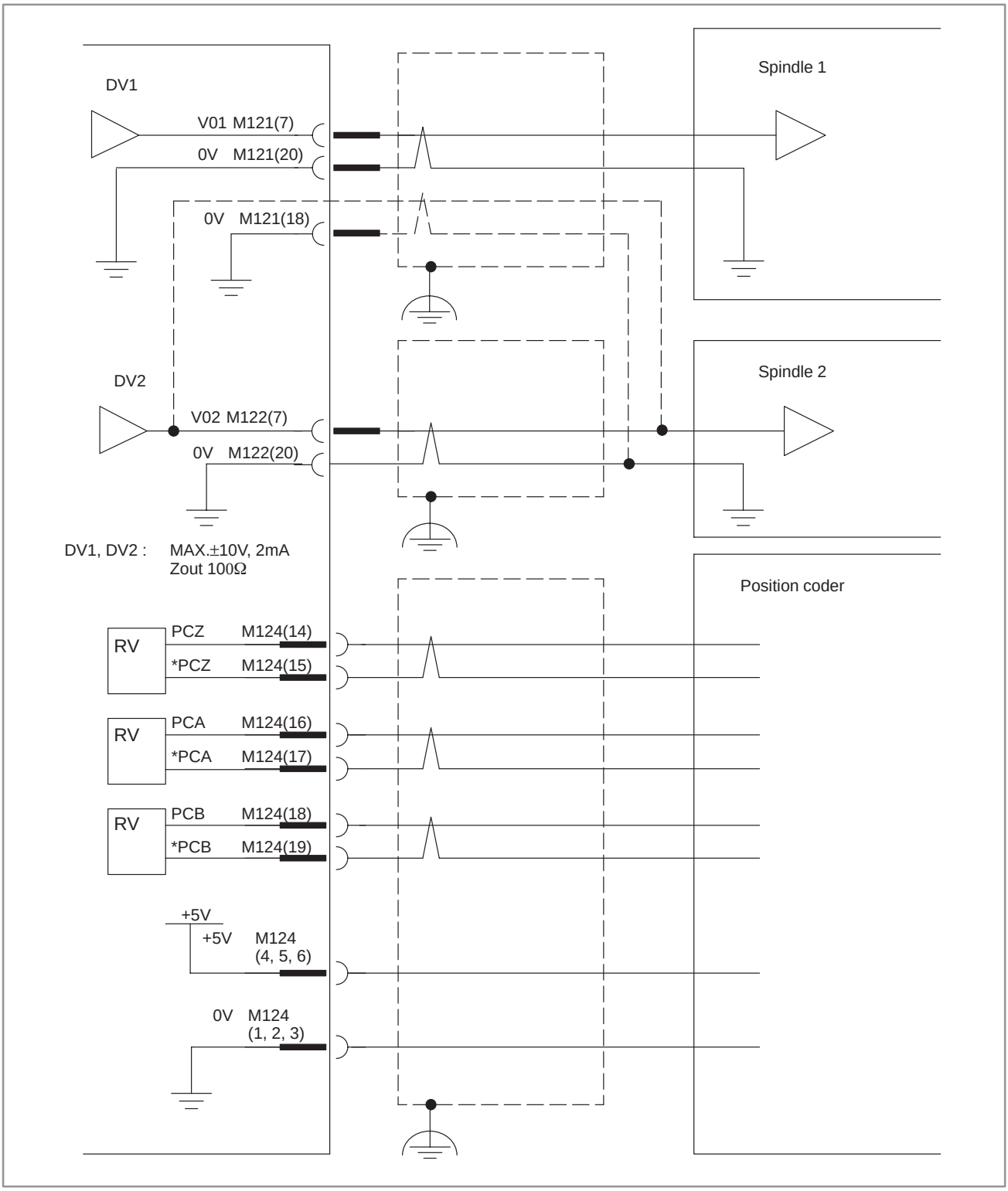
This response time is the delay time of the card only. The actual response time will be the value derived from adding the scan time decided by the system configuration to the above described value.

10.3 INSTALLATION POSITION



10.4 CONNECTION BETWEEN MACHINES

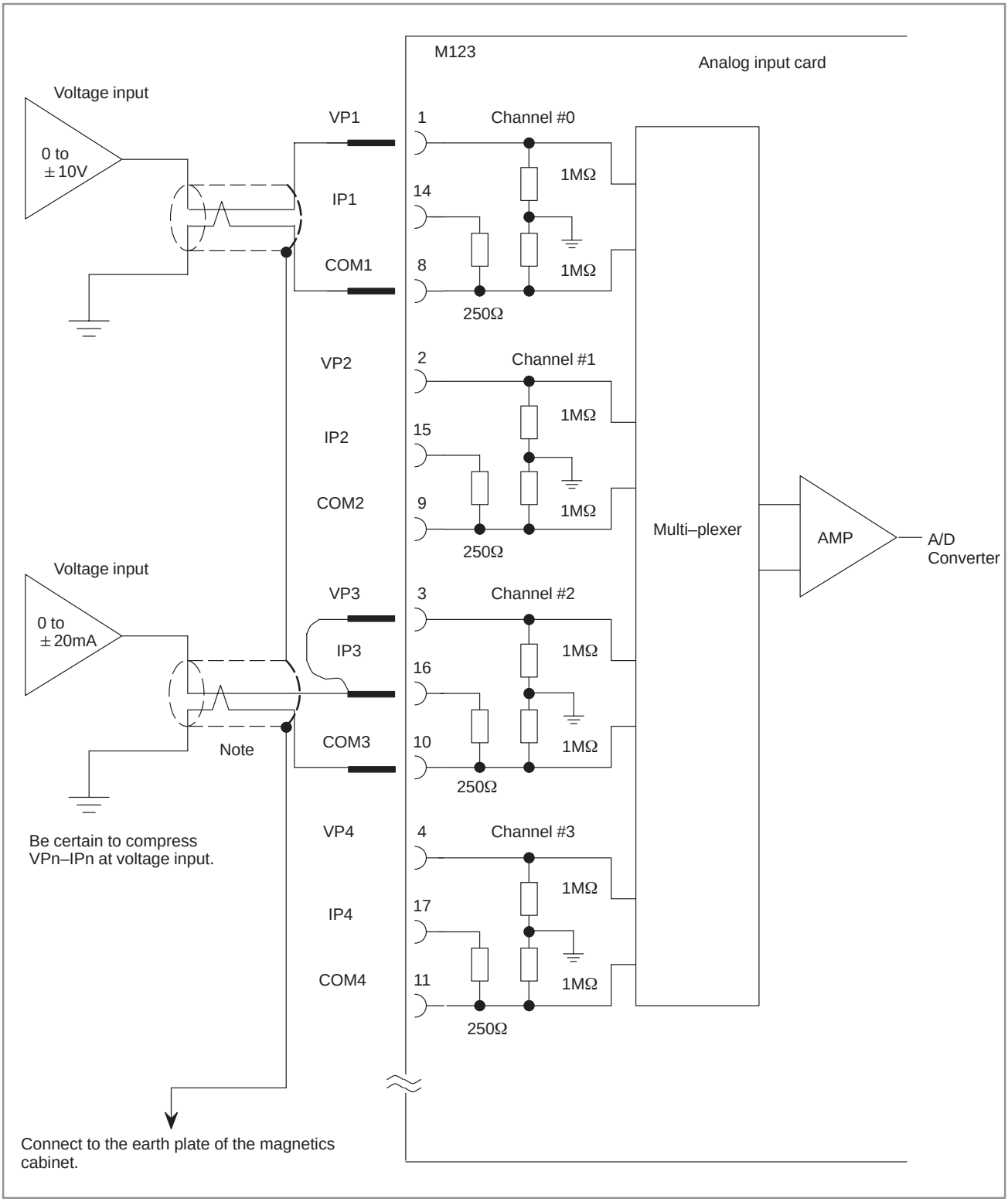




NOTE

It is possible to make the connection cables for spindles 1 and 2 into one cable by including the spindle 1 connection cable so as to destroy the spindle 2 connection cable.

Analog input connection diagram



NOTE

Use a 2 core pair shield cable for the connection cable.

11 REMOTE BUFFER INTERFACE (INCLUDING FANUC DNC2 INTERFACE)

11.1 OUTLINE

The remote buffer is an optional function used to supply a large amount of data to the CNC continuously and at high speed. The remote buffer is connected to the host computer or an input/output device via a serial interface.

Table 11.1 (a) lists the types of remote buffer printed circuit boards. Three types are available, according to their location in the control unit.

Table 11.1 (a) Types of remote buffer printed circuit boards

Type	Name	Remarks	Connection slot
A	SUB CPU card	Included in the multiaxis card. The fifth and sixth axes can be controlled as PMC axes.	SUB
	Remote buffer card for control unit B	The fifth and sixth axes cannot be connected.	
B	Remote buffer card for control unit A	Can also be used for the DNC2 interface.	Expansion connector JA1 or JA2
C	Remote buffer card for control unit B	Can also be used for the DNC2 interface.	SP

Some remote buffer cards can also be used for the FANUC DNC2 interface. FANUC DNC2 is a communication protocol which enables the exchange of a wide range of data between the CNC and a personal computer which is connected to the CNC via the RS–232C interface. Its hardware connection is the same as that for the remote buffer. For its specifications and other information, refer to the FANUC DNC2 Descriptions (B–61992).

Table 11.1 (b) lists three remote buffer software functions.

Table 11.1 (b) Software functions of remote buffer

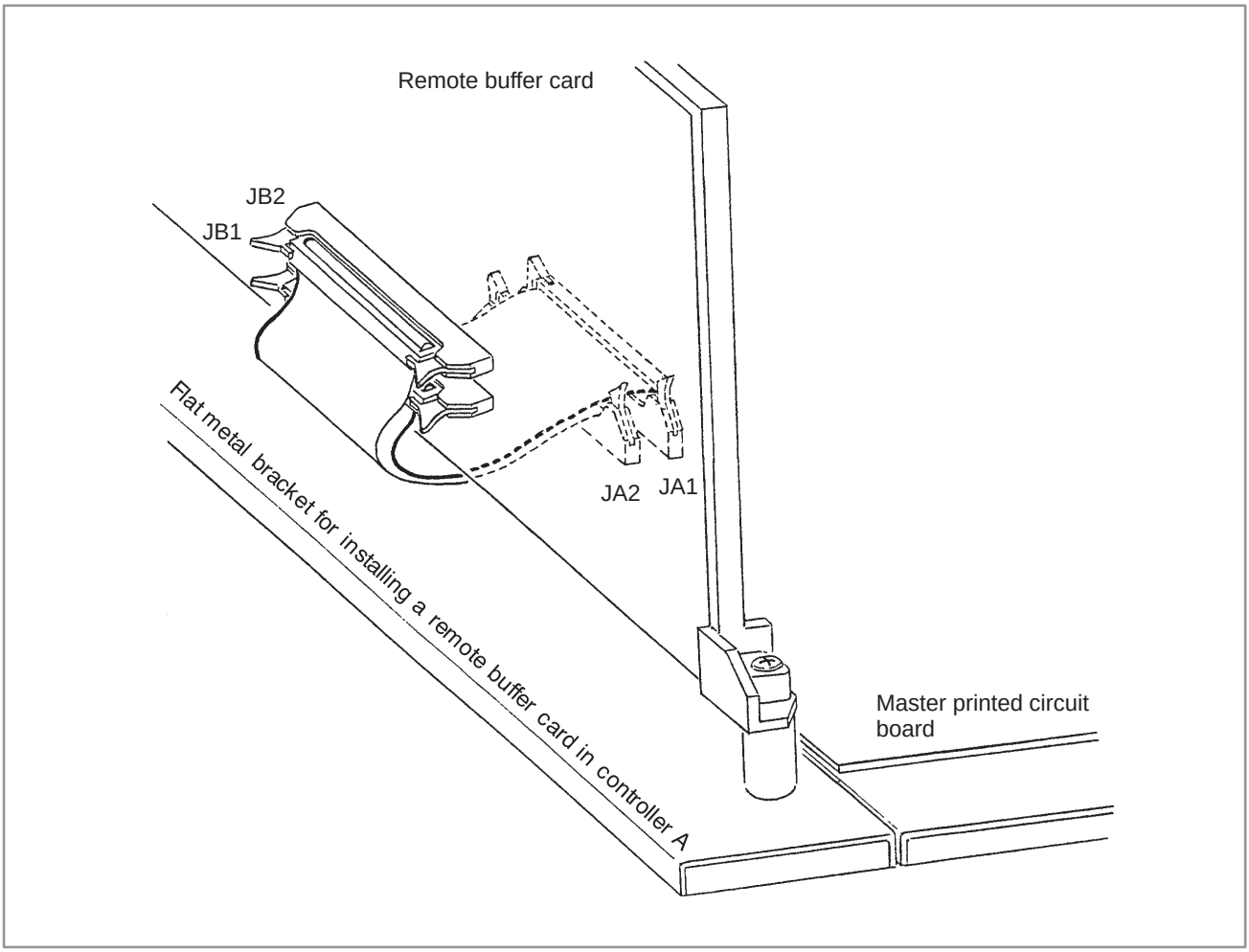
	Remote buffer	High–speed remote buffer A	High–speed remote buffer B
Protocol A	Available	Available	Available
Extended protocol A	Available	Available	Available
Protocol B	Available	Available	Available
Data format	NC format data	Binary data	NC format data
Interface	RS–232–C or RS–422	RS–422	RS–422
RS–232–C baud rate	50 bps to 19.2 kbps		
RS–422 baud rate	50 bps to 76.8 kbps	50 bps to 76.8 kbps	50 bps to 768 kbps
Maximum cable length	For RS–232–C 100m (4800 bps max.) 50m (9600 bps min.) For RS–422 800m (9600 bps max.) 50m (19.2 kbps min.)	For RS–422 800m (9600 bps max.) 50m (19.2 kbps min.)	For RS–422 800m (9600 bps max.) 50m (19.2 kbps min.)
Maximum machining speed (for execution of 1–mm continuous block commands)	Same as the speed when using memory	15m/min	12m/min

NOTE
1 Protocol A is the handshake system that repeats data transfer between two communicating devices.
2 Extended protocol A is almost the same system as protocol A except that it can transfer the NC program at high speed.
3 Protocol B is the system that controls communication between two devices by control codes output from the remote buffer.

11.2 INSTALLING TO THE P.C. BOARD

11.2.1 Installing to the P.C. Board in Case of Control Unit A

As shown in the figure below, install the remote buffer card into the left side of the master printed circuit board. The (A02B–0098–K121) flat metal bracket for the remote buffer card (A02B–0098–K121) contains the two flat cables and bracket.



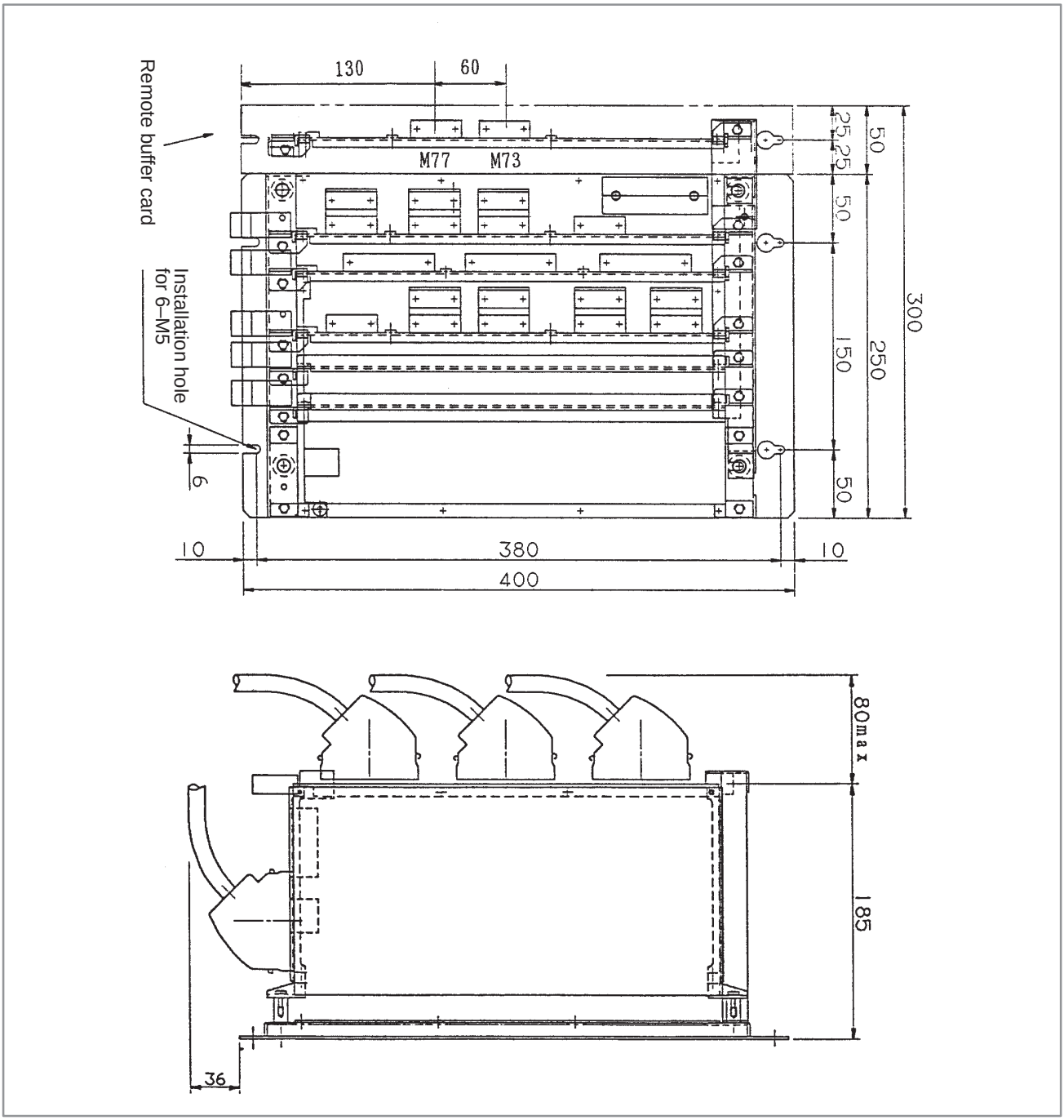
11.2.2 Installing to the P.C. Board in Case of Control Unit B

Install the remote buffer card to the slot SP (CS1) according to above mentioned Table 11.1 (a).

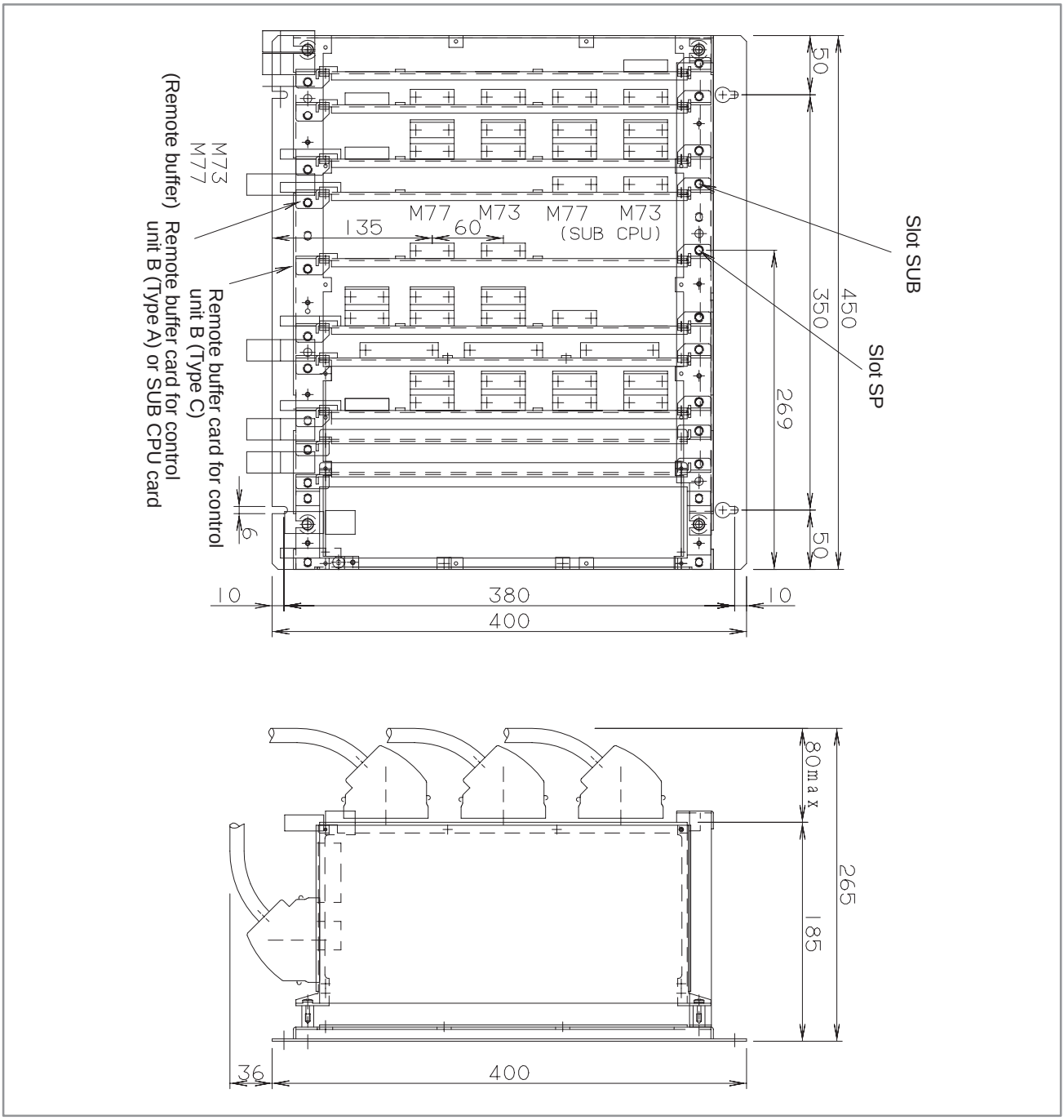
11.3 OUTLINE DRAWING

11.3.1 Outline Drawing in Case of Control Unit A

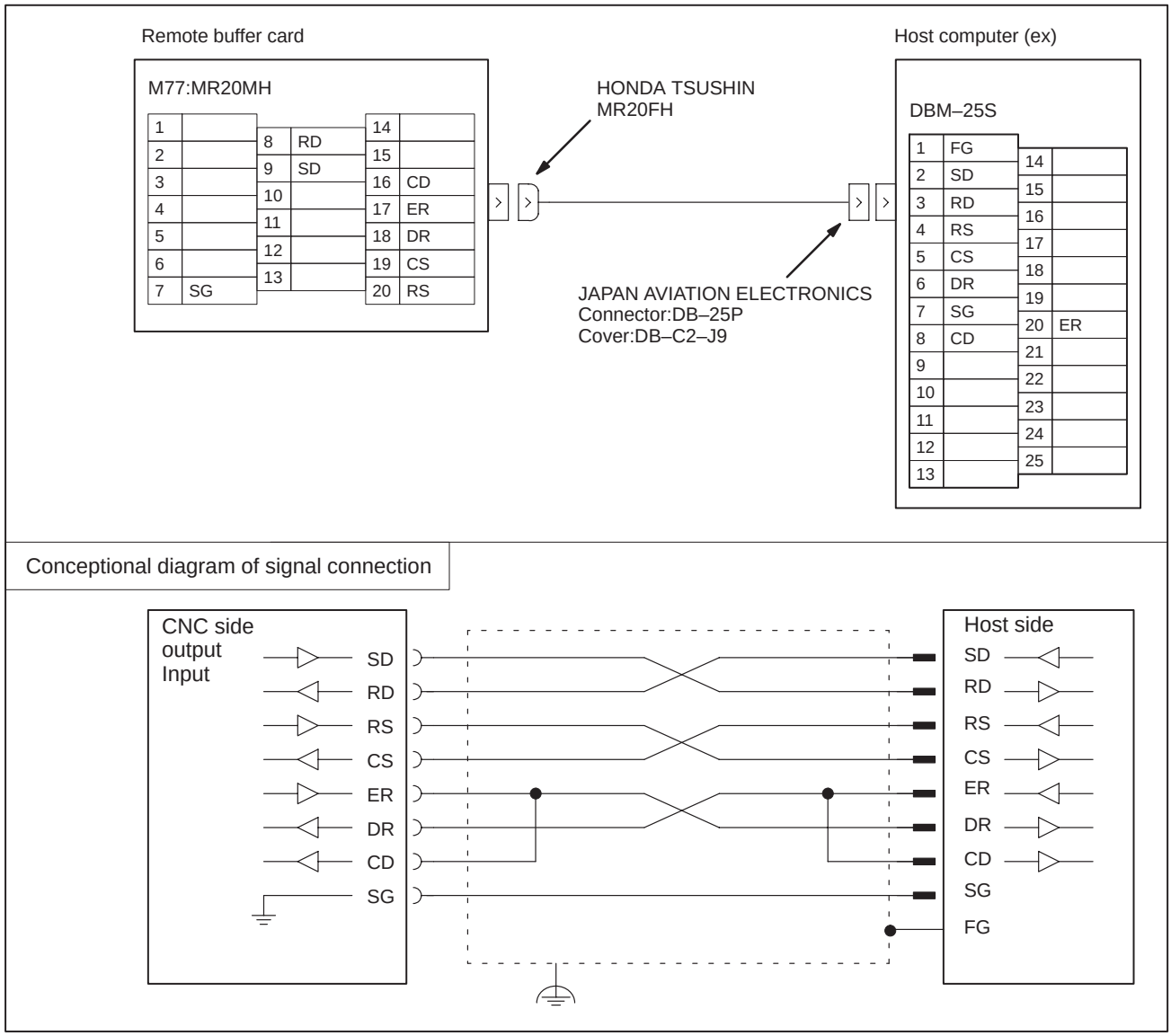
The following illustration is an outline drawing for installing the remote buffer card into controller A.



11.3.2
Outline Drawing in Case of Control Unit B



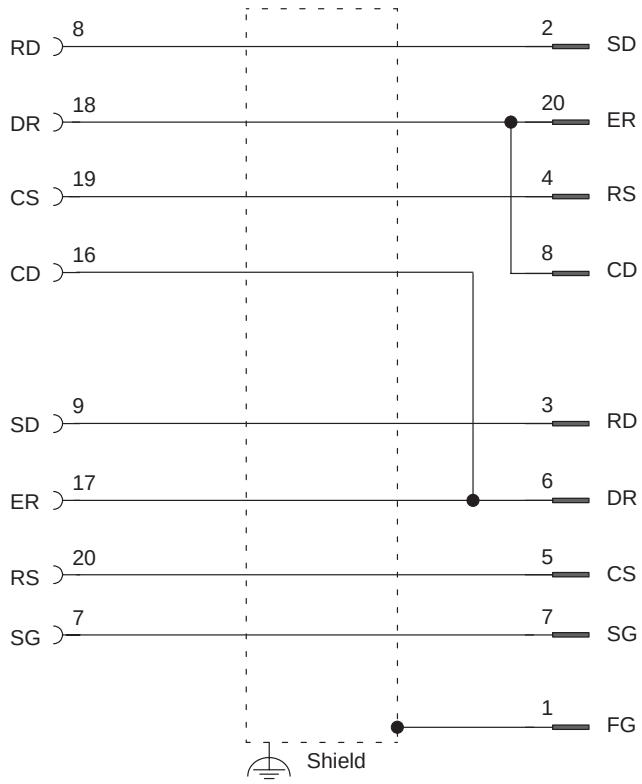
11.4 REMOTE BUFFER INTERFACE (RS–232–C)



NOTE

When using the FANUC DNC2 interface with an IBM PC–AT as the host computer, the host computer negates its RS (to low) upon transition to the reception phase. In this case, therefore, CS on the CNC side must be connected to ER on the CNC side.

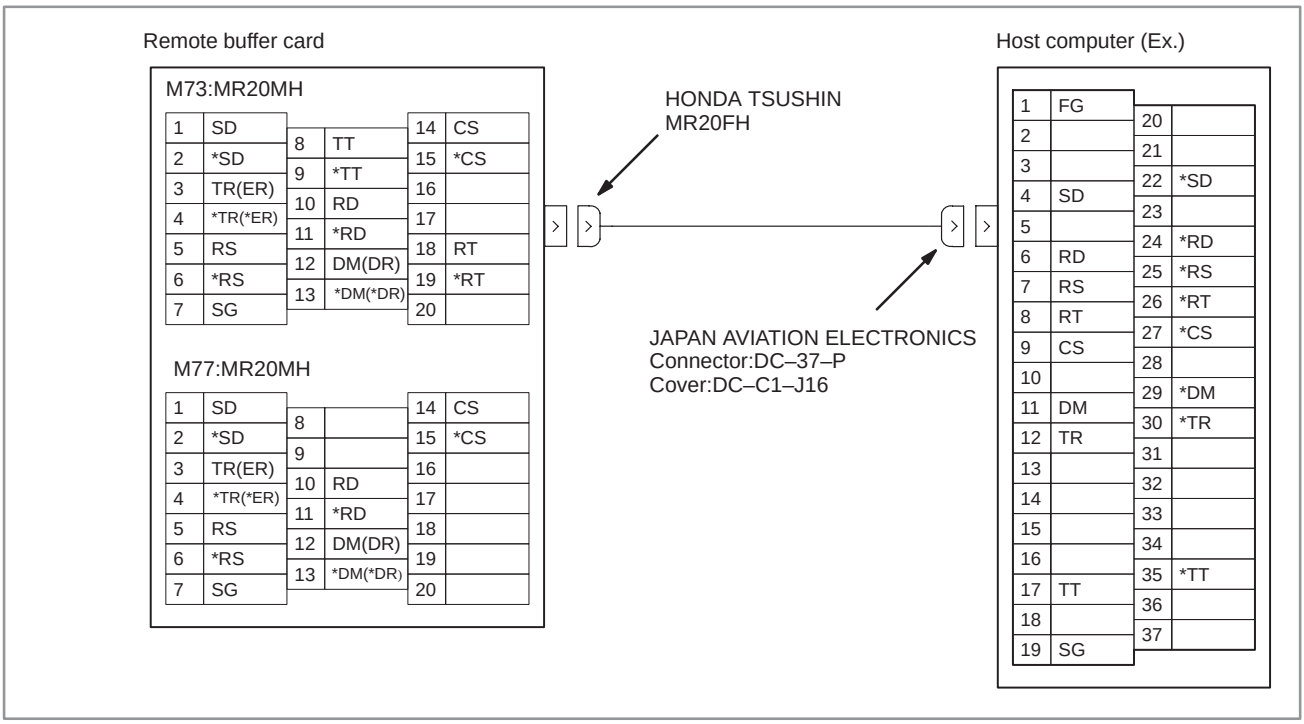
Cable wiring



Connect CS to RS if CS is not used. However, when protocol A or expanded protocol A is used, connect as shown above because CS is used for busy control. Connect DR to ER when DR is not used. Be sure to connect CD to ER.

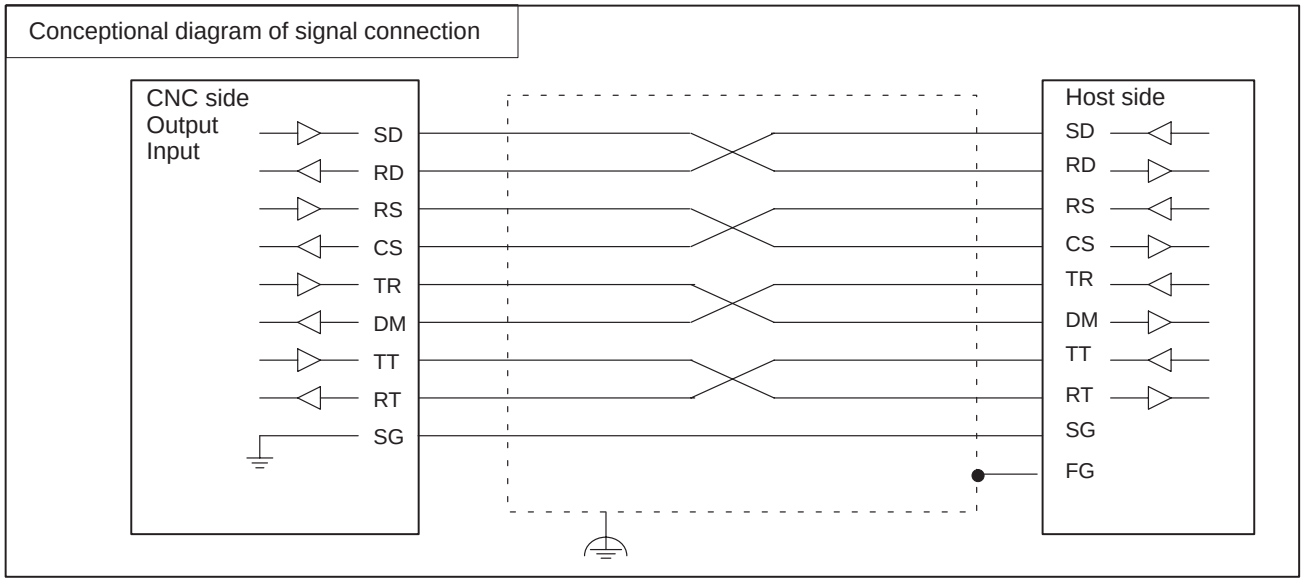
The M77 connector is also used for the RS–422 interface. Those pins for which nothing is indicated in the connector table must be left open.

11.5 REMOTE BUFFER INTERFACE (RS–422)



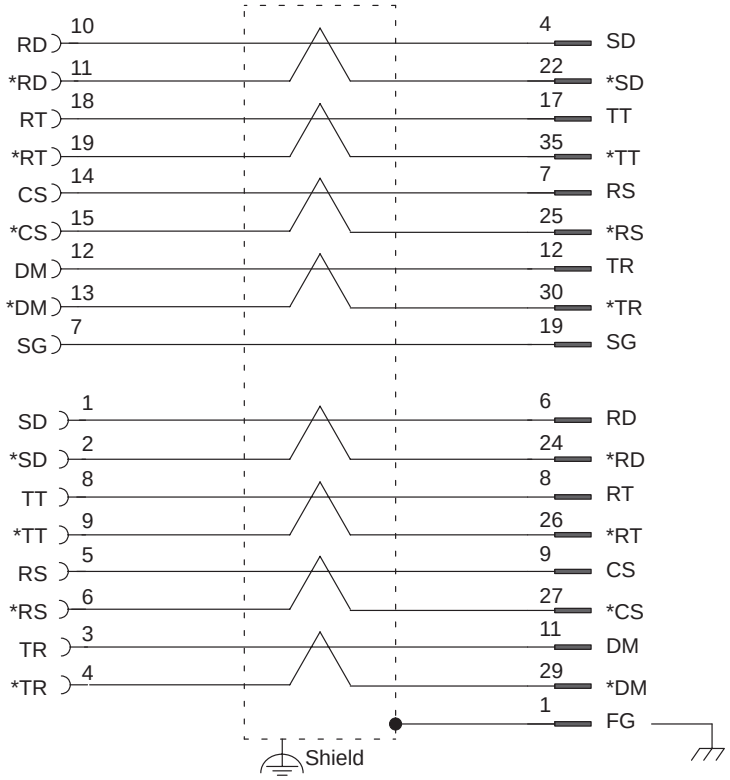
Conceptional diagram of signal connection

The figure below shows a signal connection between CNC and host computer. Since signals other than FG and SG perform differential signal transmission standard RS–422, two wires of signal lines are used for those signals.



Actual example of RS–422 signal wiring

Cable wiring



NOTE

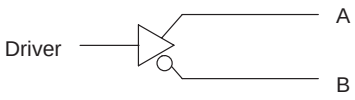
1 Be sure to use twisted pair cable.
2 The connection of TT, *TT, RT, and *RT is required only when an external clock is used.
3 When using an external clock, connect the cable to the M73 connector. Either the M73 or M77 connector can be used if an external clock is not used.
4 The M77 connector is also used for the RS–232C interface. Those pins for which nothing is indicated in the connector table must be left open.

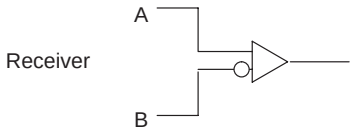
● Description of RS–422 interface signals

Signal name	RS–422 circuit No.	Input/output	Description
SD	103	Output	Transmitted data
RD	104	Input	Received data
RS	105	Output	Request to send The remote buffer uses this signal to post reception enabled status. The remote buffer can receive data while both this signal and the TR signal are set to ON.
CS	106	Input	Clear to send This signal is used to check whether the host computer is busy. The remote buffer assumes that the host computer can receive data if both this signal and the DM signal are set to ON.
TR	108.2	Output	Terminal ready This signal, if set to ON, indicates that the remote buffer is ready for operation. In other words, the SD signal is valid only while this signal is set to ON.
RR	109	Input	Receiver ready This signal, if set to ON, indicates that the host computer can transmit data to the remote buffer. When this signal is not used, always connect it to the TR signal on the remote buffer.
TT	113	Output	Transmission timing The transmission clock for the remote buffer is output using this signal. When a baud rate of 38400 or higher is used, always connect this signal to the RT signal on the host computer.
RT	115	Input	Reception timing The reception clock for the remote buffer is input using this signal. When a baud rate of 38400 or higher is used, always connect this signal to the TT signal on the host computer.
SG	102		Signal ground
FG	101		Protective ground

NOTE
The ON and OFF states of the signals are defined as follows:

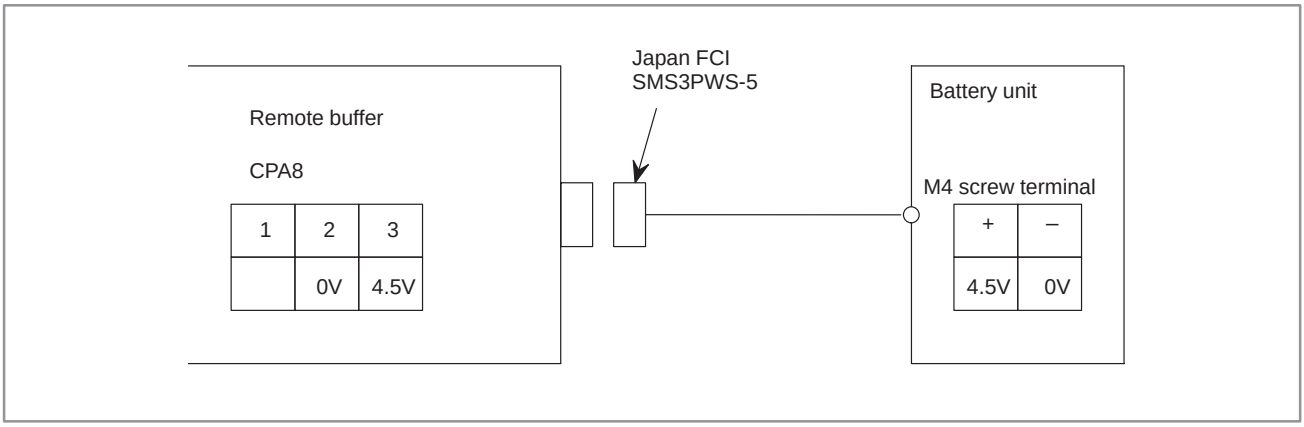
	A < B	A > B
Function	OFF	ON
Signal Condition	Marking	Spacing





11.6 CONNECTION TO BATTERY UNIT

The remote buffer of type A is required to connect to a buttery unit.



Connect the remote buffer to the battery unit on the memory printed circuit board, using the supplied cable.

NOTE

The terminal block on the battery unit uses screw terminals. To connect the battery cable for the remote buffer to these terminals, first disconnect the battery cable for the memory printed circuit board or other components, with the CNC power turned on. Disconnecting the battery cable while the CNC power is turned off will result in the loss of the data, such as memories, stored on the remote buffer.

12 DNC1 INTERFACE

12.1 OUTLINE

DNC1 is a high speed network developed independently by FANUC that combines cell levels. This manual gives hardware details regarding connection etc., when using the FS0–C DNC1 function. This function should be used with reference to the explanations given below.

Name	Drawing number
FANUC DNC1 DESCRIPTIONS	B–61782E

12.2 ORDER SPECIFICATIONS

Name	Order specification	Remarks
Tap (Connector box for cable divergence)	A13B–0156–C100	Set the necessary number.
Terminal resistor unit	A13B–0156–C200	A total of 2 resistors necessary for the whole system.

CAUTION

When mounting the DNC1 card on control unit A, check whether the FANUC Series 0–C uses a 16–bit or 32–bit master PC board.

Avoid connecting a 16–bit DNC1 card to a 32–bit master PC board, or a 32–bit DNC1 card to 16–bit master PC board.

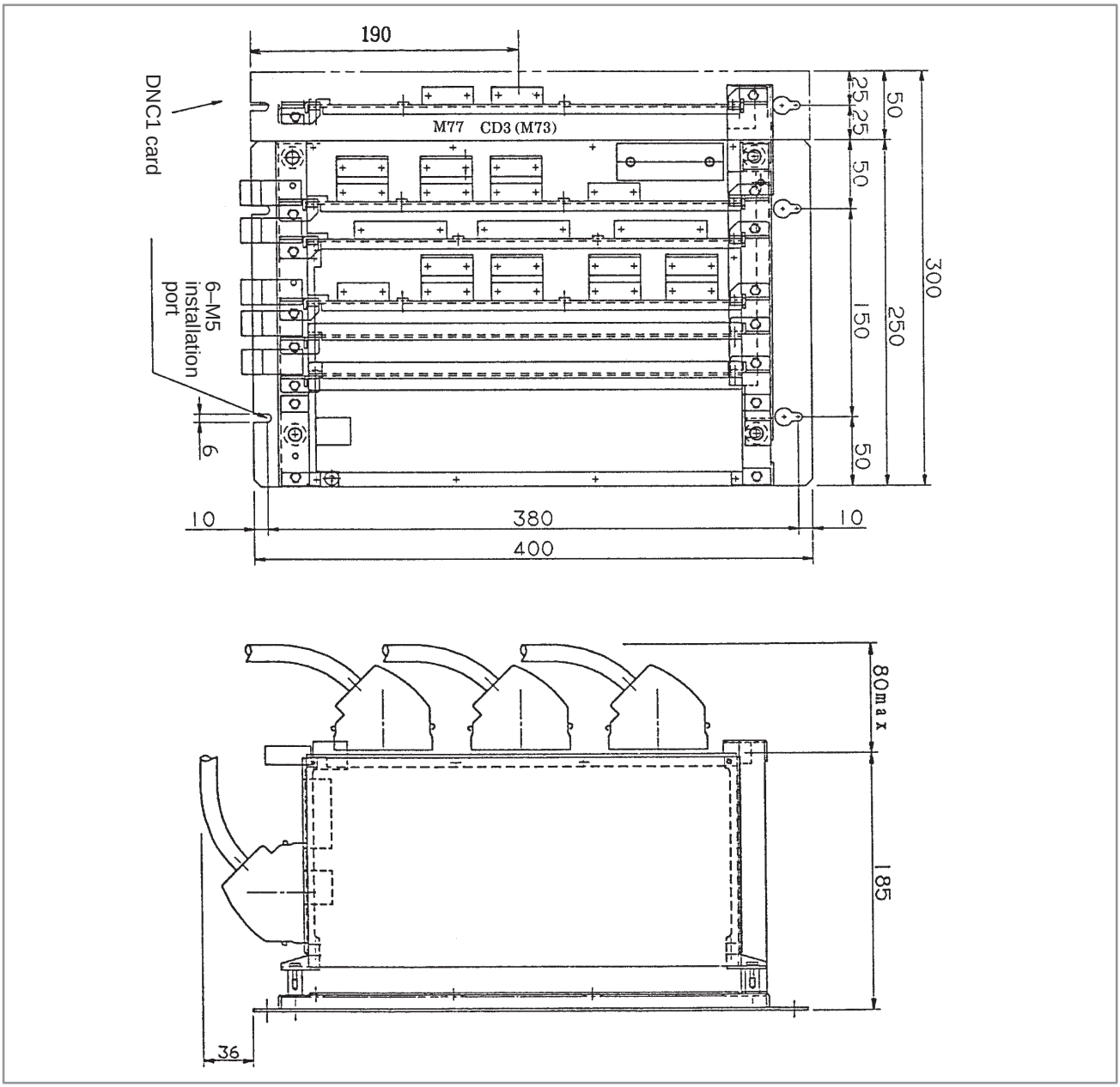
If the control unit is tuned on while the wrong DNC1 card is connected to the master PC board, a short circuit will occur in the control unit. The control unit will be damaged.

NOTE

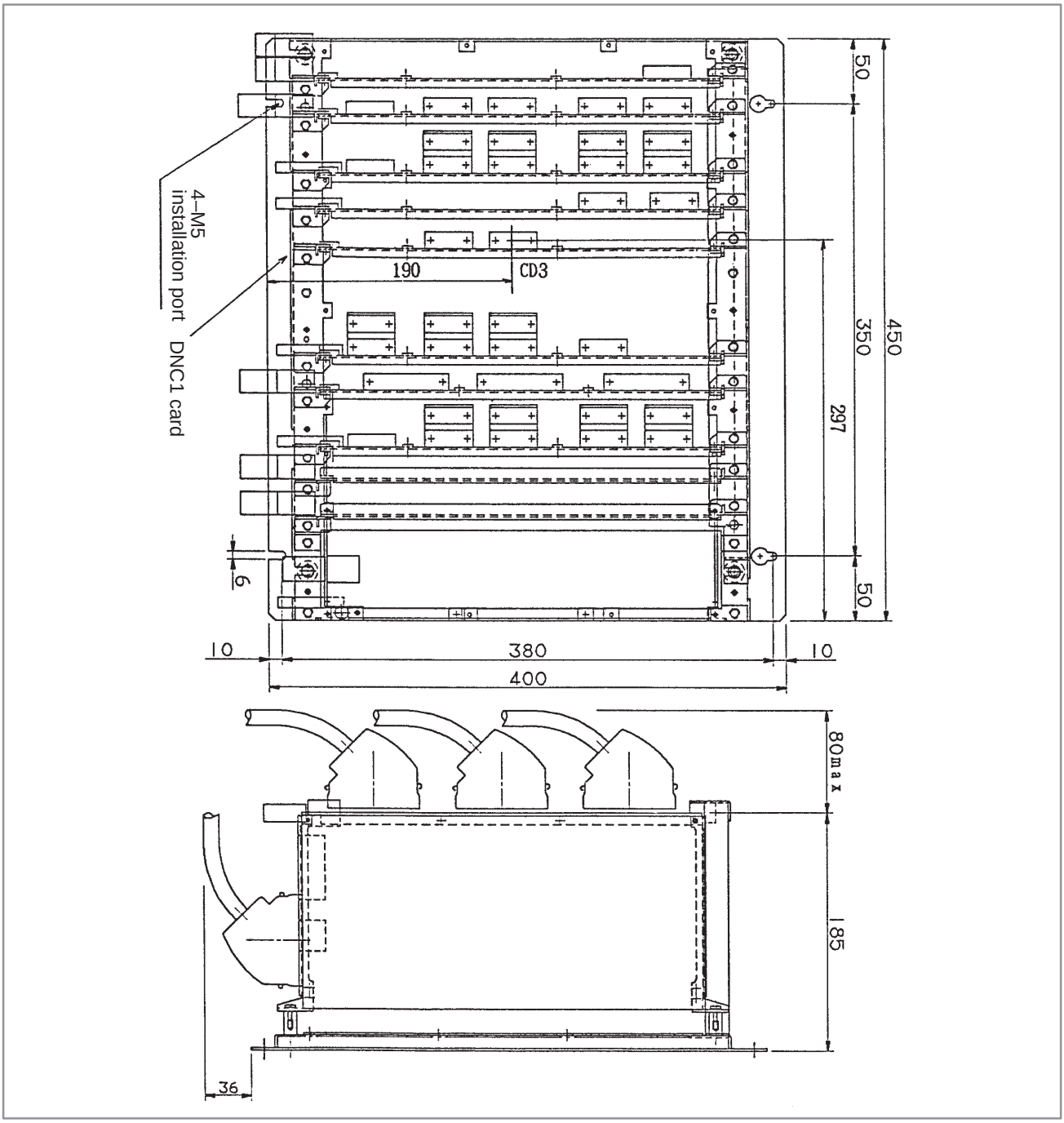
Select an appropriate power supply, referring to Chapter 5, “Power Supply Unit.”

12.3 EXTERNAL CONFIGURATION OF MOUNTING

12.3.1 External Configuration of Mounting for Control Section A



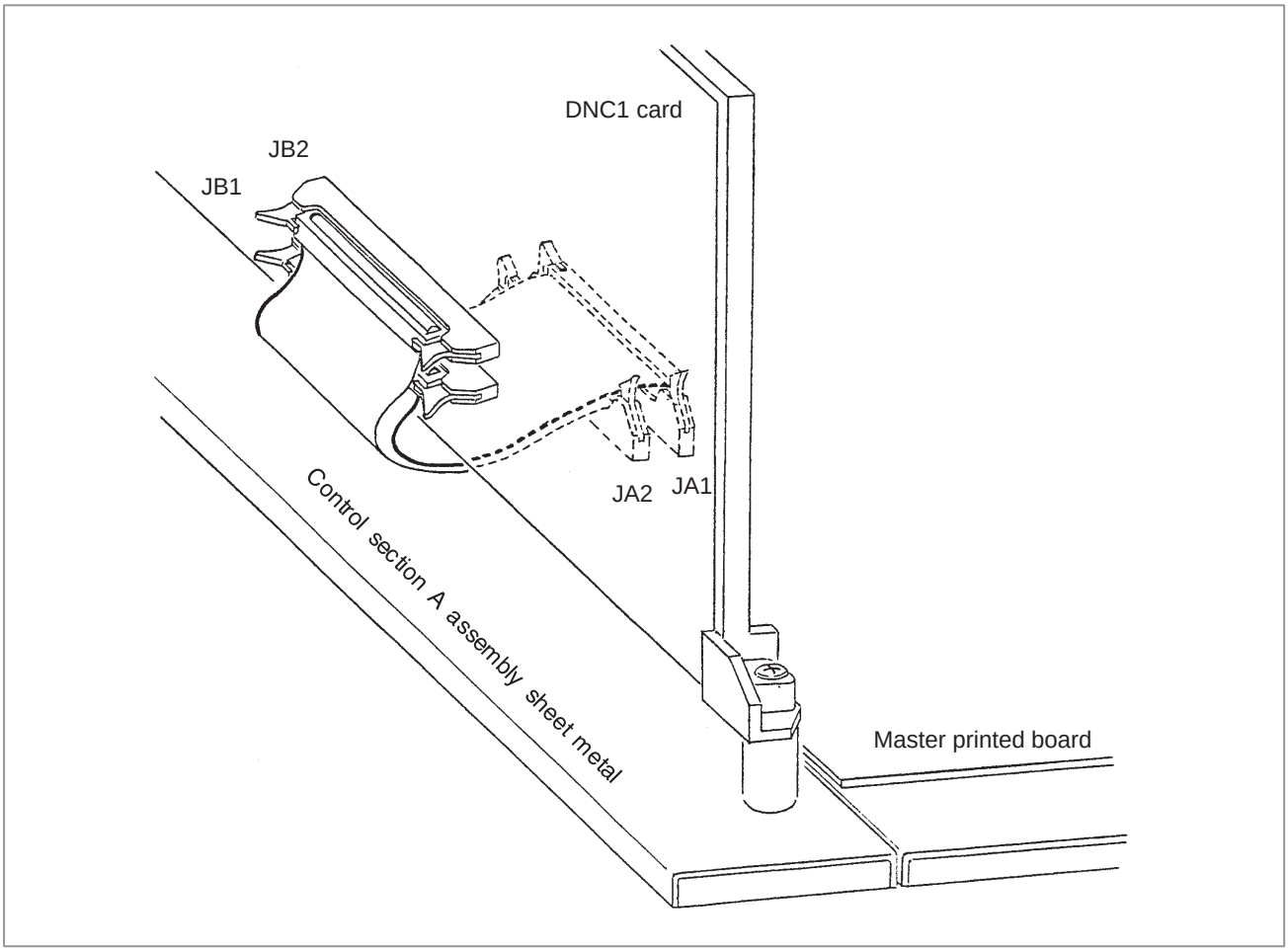
12.3.2 External Configuration of Mounting for Control Section B



12.4 PRINTED BOARD MOUNTING

12.4.1 Printed Circuit Board Mounting for Control Section A

Install the DNC1 card on the left–hand side of the master printed circuit board, as illustrated below. Two plait cables and sheet metal are included in control section A assembly sheet metal (A02B–0098–K121).

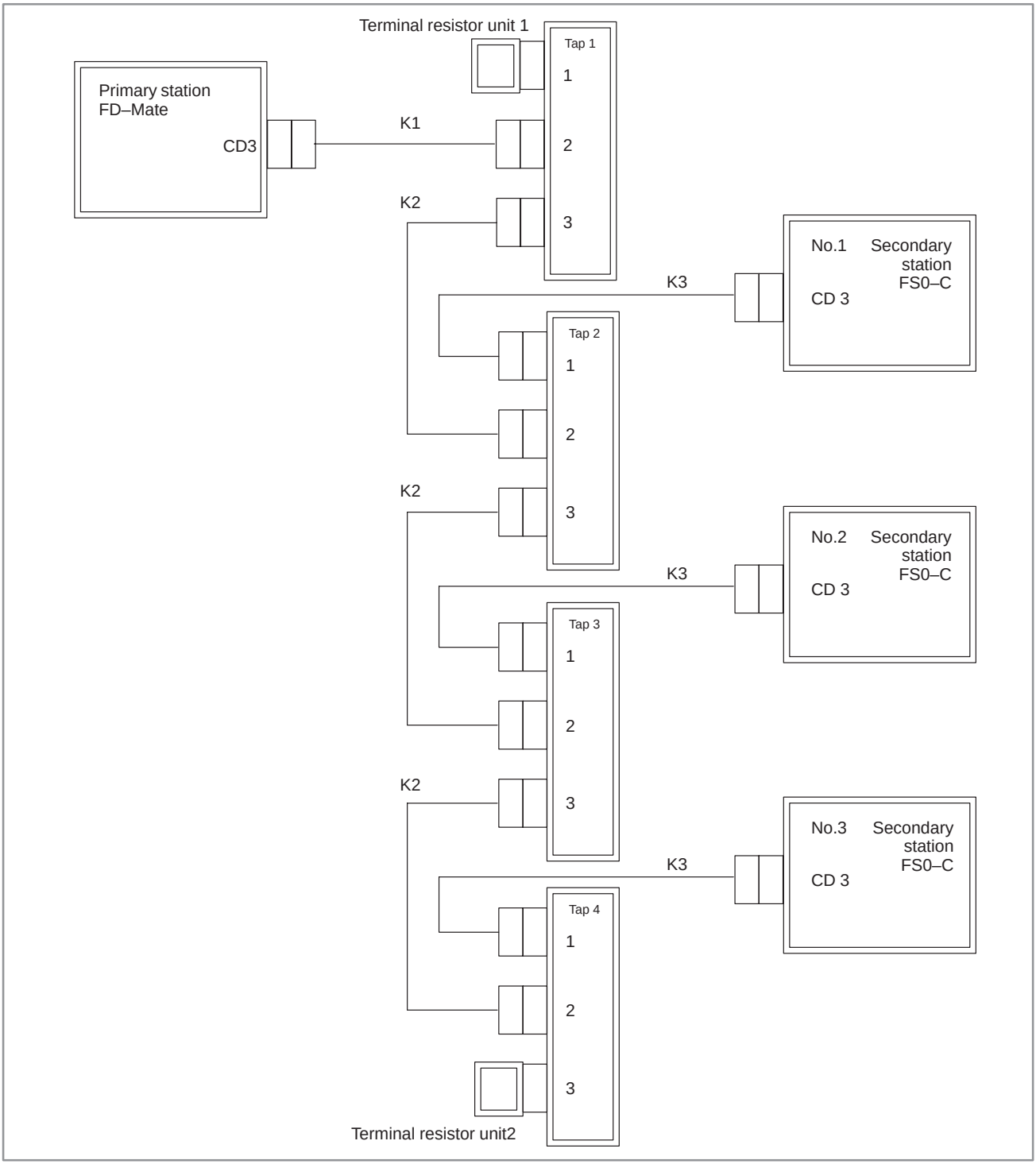


12.4.2 Printed Circuit Board Mounting for Control Section B

Connect the DNC1 card to master printed circuit board connector SP (CS1).

12.5 CONNECTION DRAWING

12.5.1 Overall Connection Example for Mode 1 (Multi–point)



NOTE
1 As shown in the drawing, the number of taps necessary accord with the number of stations.
2 Connectors 1, 2 and 3 in any one tap have the same interface and therefore it does not matter where the connection is made.
3 As shown in the drawing, a terminal resistor unit is necessary at both ends of the tap of the whole system.
4 Signal wiring for cables K2, K3 is the same but differs for cable K1.
Refer to the next page. Note however that the maximum wiring length for K2 and K3 are different.
Refer to FANUC DNC1 DESCRIPTIONS B–61782E.

12.5.2 Detailed Drawing of Connector for Mode 1 (Multi–point)

- **Primary station printed circuit board side connector (CD3)**

MR–20RMD (MALE)

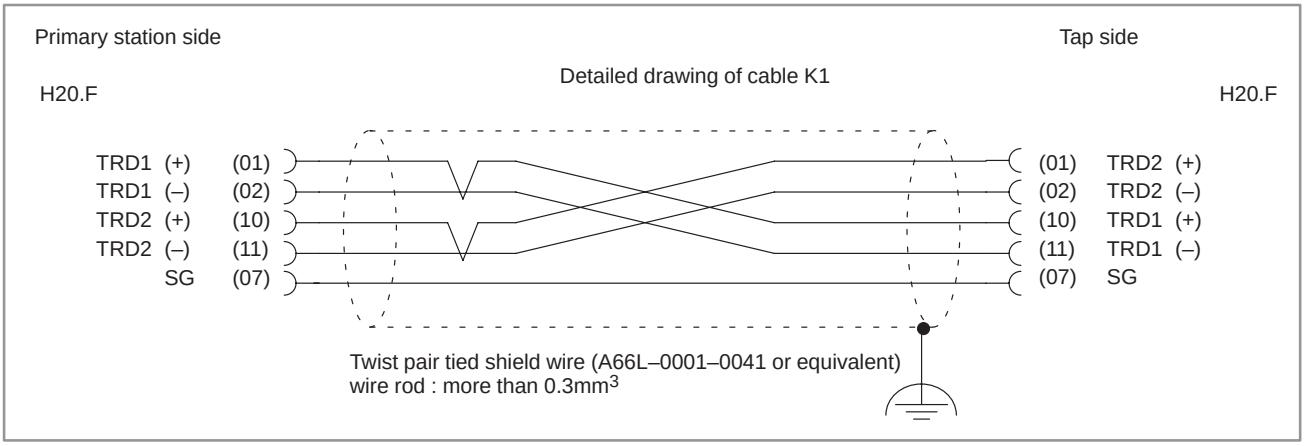
14				01	TRD1(+)
15		08		02	TRD1(−)
16		09		03	
17		10	TRD2(+)	04	
18		11	TRD2(−)	05	
19		12		06	
20		13		07	SG

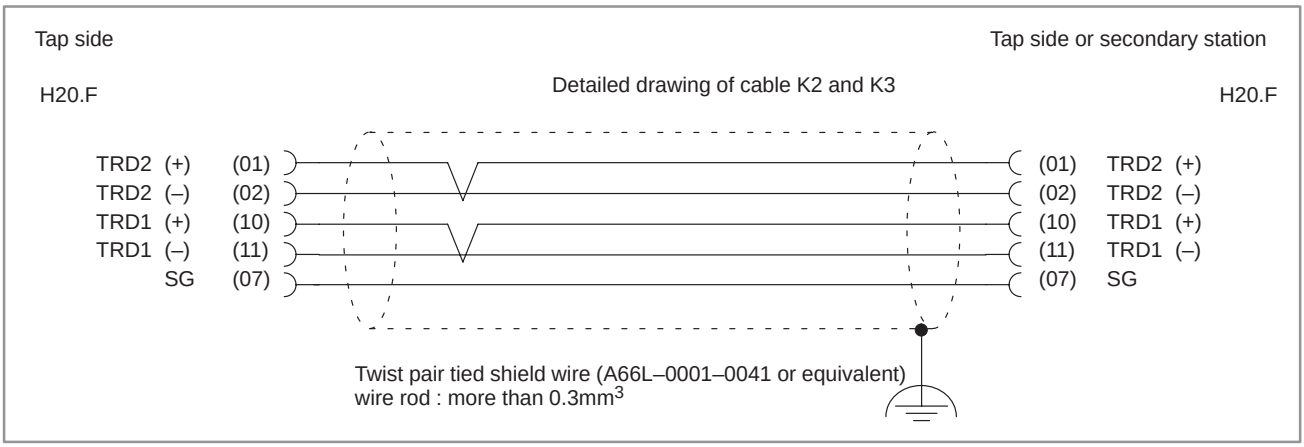
- **Secondary staion printed circuit board side connector (CD3)**
- **Tap connector (1, 2, 3)**

MR–20RMD (MALE)

14				01	TRD2(+)
15		08		02	TRD2(−)
16		09		03	
17		10	TRD1(+)	04	
18		11	TRD1(−)	05	
19		12		06	
20		13		07	SG

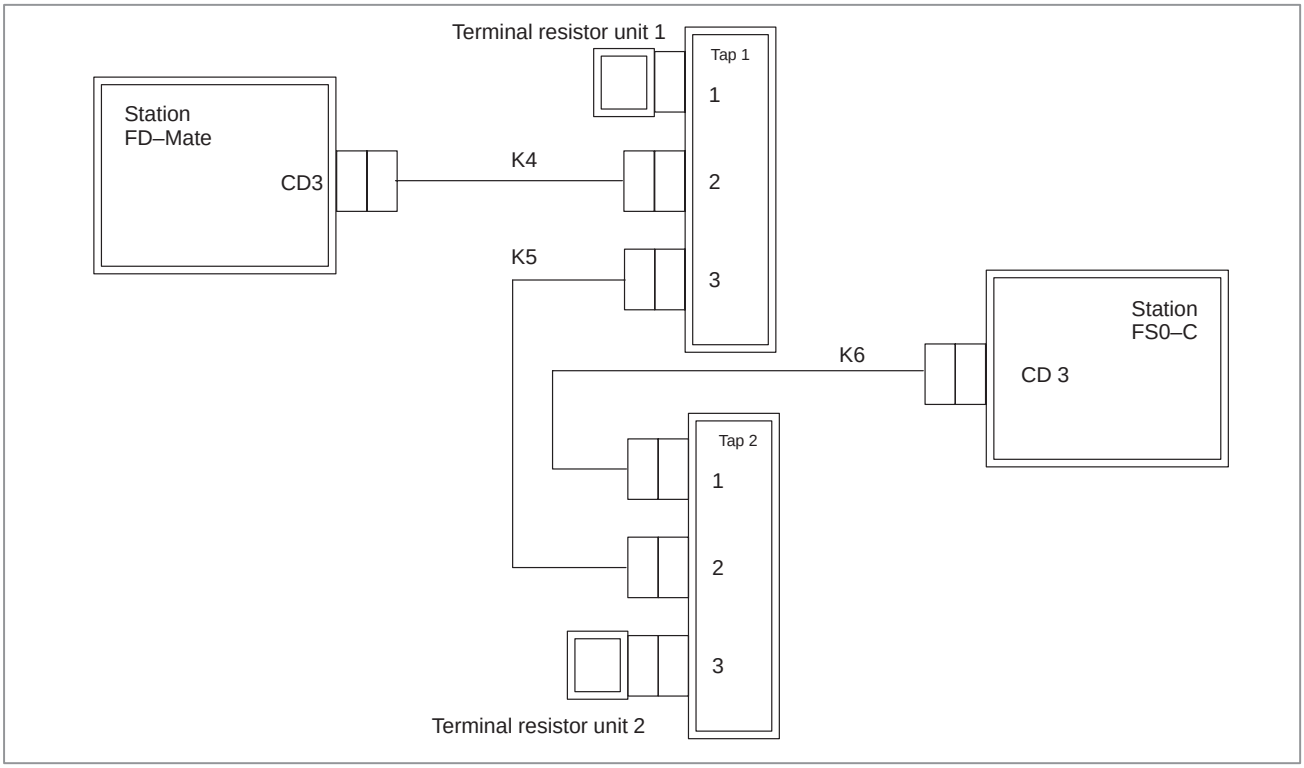
12.5.3 Detailed Drawing of Connection Cable for Mode 1 (Multi–point)





Connect an earth wire more than $5.5m^2$ between the control apparatuses that are connected by the DNC1 signal cable.

12.5.4 Overall Connection Example for Mode 2 (Point–to–point)



NOTE

1 As shown in the drawing, the number of taps necessary accord with the number of stations.
2 Connectors 1, 2 and 3 in any one tap have the same interface and therefore it does not matter where the connection is made.
3 As shown in the drawing, a terminal resistor unit is necessary at both ends of the tap of the station.
4 Signal wiring for cables K5, K6 is the same but differs for cable K4.
Refer to the 12.5.6. Note however that the maximum wiring length for K5 and K6 are different.
Refer to FANUC DNC1 DESCRIPTIONS B–61782E.

12.5.5 Detailed Drawing of Connector for Mode 2 (Point–to–point)

- **Station printed circuit board side connector (CD3)**
- **Tap connector (1, 2, 3)**

MR–20RMD (MALE)

14	CS			01	SD
15	*CS	08	TT	02	*SD
16		09	*TT	03	ER
17		10	RD	04	*ER
18	RT	11	*RD	05	RS
19	*RT	12	DM	06	*RS
20		13	*DM	07	SG

12.5.6 Detailed Drawing of Connection Cable for Mode 2 (Point–to–point)

Station side

Tap side

Detailed drawing of cable K4

H20.F

H20.F

SD	(01)	(01)	SD
*SD	(02)	(02)	*SD
RD	(10)	(10)	RD
*RD	(11)	(11)	*RD
TT	(08)	(08)	TT
*TT	(09)	(09)	*TT
RT	(18)	(18)	RT
*RT	(19)	(19)	*RT
RS	(05)	(05)	RS
*RS	(06)	(06)	*RS
CS	(14)	(14)	CS
*CS	(15)	(15)	*CS
DM	(12)	(12)	DM
*DM	(13)	(13)	*DM
TR	(03)	(03)	TR
*TR	(04)	(04)	*TR
SG	(07)	(07)	SG

Twist pair tied shield wire (A66L–0001–0041 or equivalent)
Wire rod : more than 0.3mm^2

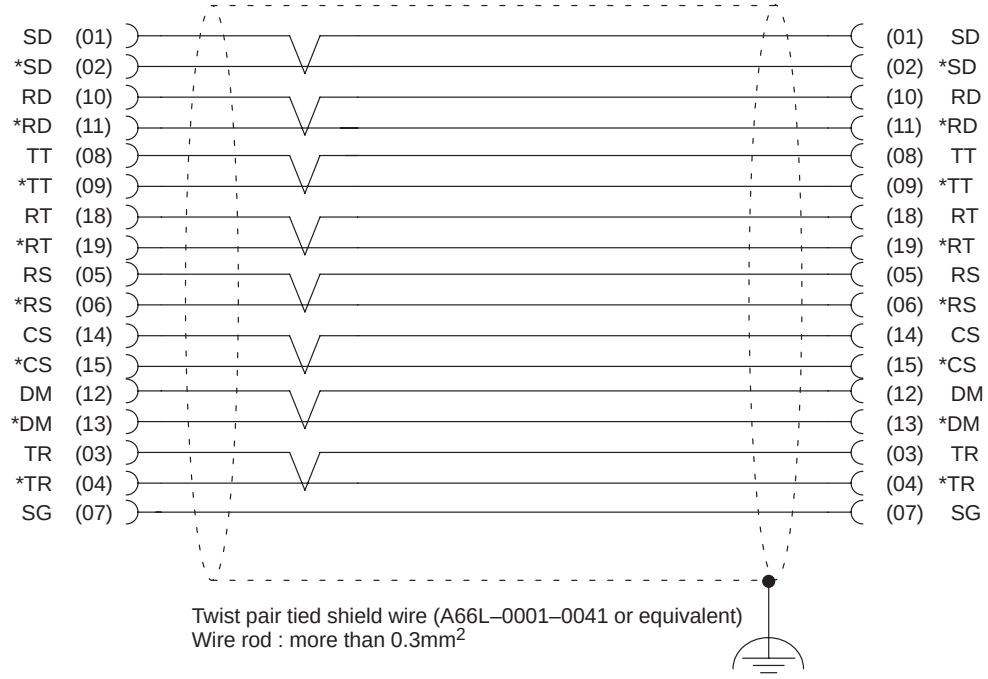
Tap side

Tap or station side

Detailed drawing of cable K5 and K6

H20.F

H20.F



Twist pair tied shield wire (A66L–0001–0041 or equivalent)
Wire rod : more than 0.3mm^2

NOTE

Connect an earth wire more than 5.5m^2 between the control apparatuses that are connected by the DNC1 signal cable.

12.6 EXTERNAL CONFIGURATION OF TAP AND TERMINAL RESISTOR UNIT

As a rule, use standard products regarding necessary taps and terminal resistor units when constructing DNC1 communications circuits.

- **Tap (A13B–0156–C100)**

A divergence connector box to draw together branch wires in order to connect the DNC1 main line with the communication nodes.

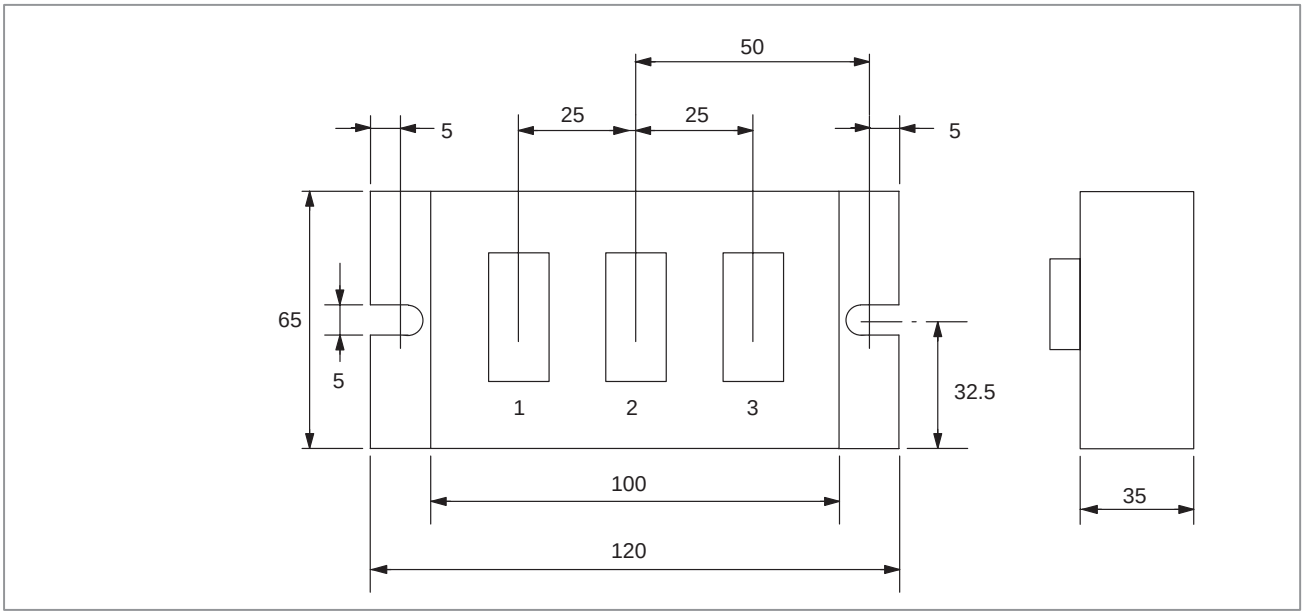


Fig. 12.6 (a) Tap external configuration

- **Terminal resistor unit (A13B–0156–C200)**

Connect a terminal resistor unit at both ends of the main line to compensate for DNC1 transmission characteristics. Consequently 2 terminal resistor units are necessary for each main line circuit.

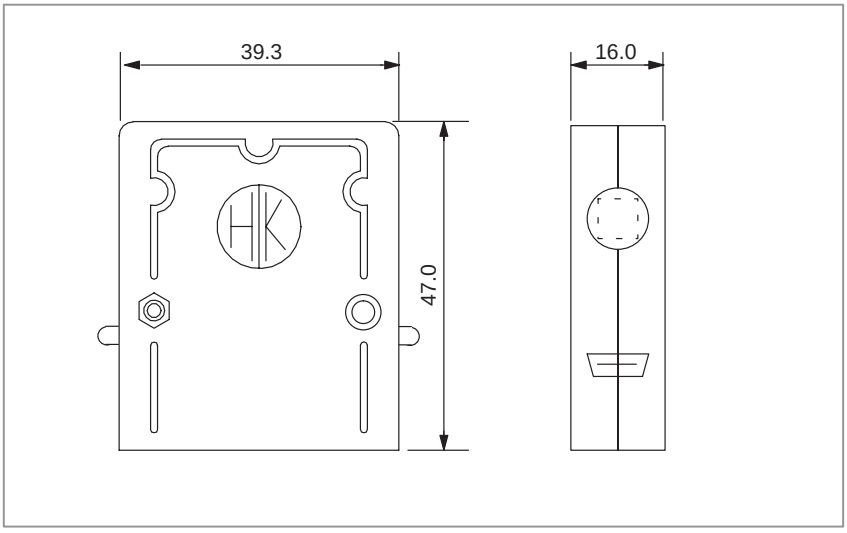


Fig. 12.6 (b) Terminal resistor unit external configuration

13 Series 0–TTC SYSTEM

13.1 OUTLINE

The Series 0–TTC is a CNC which can control two paths. It has been designed for use with lathes which operate two tool posts independently and which cut a workpiece by simultaneously using the two tool posts. One of the two paths is controlled with the same system configuration as that of the 0–TC. The other path is controlled by an added multiaxis card. Here, the former path is referred to as tool post 1 or the main path, while the latter path is referred to as tool post 2 or the subpath.

Basically, the main path controls the axes connected to the 1st to 4th axis printed circuit board and the analog or serial spindle connected to the memory printed circuit board. The subpath controls the axes connected to the 5th/6th axis printed circuit board and the analog or serial spindle.

13.2 RESTRICTIONS

The Series 0–TTC requires the following hardware and software:

(1) PMC–M printed circuit board

(2) PMC–M function (software)

(3) Power supply unit B2 or C, or power supply unit AI, qualifying for CE marking

The following restrictions are imposed on the Series 0–TTC:

(1) No more than eight pulse coders can be used (including separate pulse coders).

(2) The part program storage length is restricted to 320 m for each of the main path and subpath.

(3) Conversational input is not supported for graphics.

13.3 CONNECTION

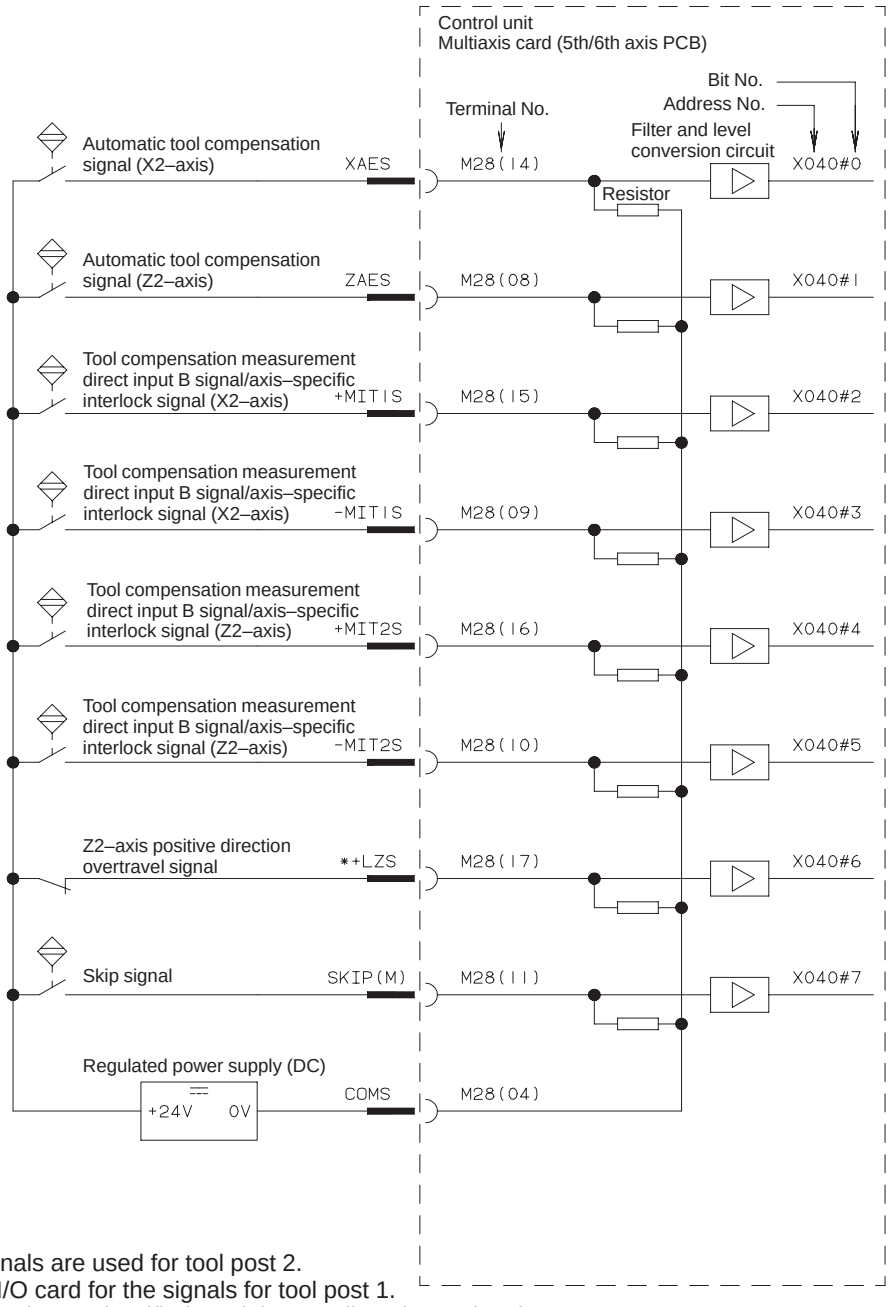
The connection of the Series 0–TTC is basically the same as that of the Series 0–TC with a multiaxis card.

To connect the spindle for tool post 2, use the M28 connector for an analog spindle, or the COP6 connector for a serial spindle. The connection interface is the same as that for tool post 1. To connect the spindle position coder for tool post 2, use the M29 connector. These connectors are located on the 5th/6th axis control printed circuit board. If the second position coder is not used, however, connect the first position coder to the M29 connector, and also to the M27 connector on the memory printed circuit board, in parallel.

In addition, eight input signals from the machine are used for the Series 0–TTC. Use the M28 connector for these signals. This connector is also used for the velocity command for the analog spindle.

M28 (MR–20RFD)

01	0V	08	ZAES	14	XAES
02	0V	09	–MIT1S	15	+MIT1S
03	0V	10	–MIT2S	16	+MIT2S
04	COMS	11	SKIPS	17	*+LZS
05		12		18	
06		13		19	
07	SVCS			20	0V



All the above signals are used for tool post 2.
Use the built–in I/O card for the signals for tool post 1.
All the above signals are classified as sink–type direct input signal B.
For 24 V and 0 V, those output from the connector of the CNC built–in I/O card can also be used.

14 EMERGENCY STOP SIGNAL

WARNING

Using the emergency stop signal effectively enables the design of safe machine tools.

The emergency stop signal is provided to bring a machine tool to an emergency stop. It is input to the CNC controller, servo amplifier, and spindle amplifier. An emergency stop signal is usually generated by closing the B contact of a pushbutton switch.

When the emergency stop signal (*ESP) contact is closed, the CNC controller enters the emergency stop released state, such that the servo and spindle motors can be controlled and operated.

When the emergency stop signal (*ESP) contact opens, the CNC controller is reset and enters the emergency stop state, and the servo and spindle motors are decelerated to a stop.

Shutting off the servo amplifier power causes a dynamic brake to be applied to the servo motor. Even when a dynamic brake is applied, however, a servo motor attached to a vertical axis can move under the force of gravity. To overcome this problem, use a servo motor with a brake.

While the spindle motor is running, shutting off the motor–driving power to the spindle amplifier allows the spindle motor to continue running under its own inertia, which is quite dangerous. When the emergency stop signal (*ESP) contact opens, it is necessary to confirm that the spindle motor has been decelerated to a stop, before the spindle motor power is shut off.

The FANUC control amplifier α series products are designed to satisfy the above requirements. The emergency stop signal should be input to the power supply module (called the PSM). The PSM outputs a motor power MCC control signal, which can be used to switch the power applied to the power supply module on and off.

The CNC controller is designed to detect overtravel by using a software limit function. Normally, no hardware limit switch is required to detect overtravel. If the machine goes beyond a software limit because of a servo feedback failure, however, it is necessary to provide a stroke end limit switch, connected so that the emergency stop signal can be used to stop the machine.

Fig. 10 shows an example showing how to use the emergency stop signal with this CNC controller and α series control amplifier.

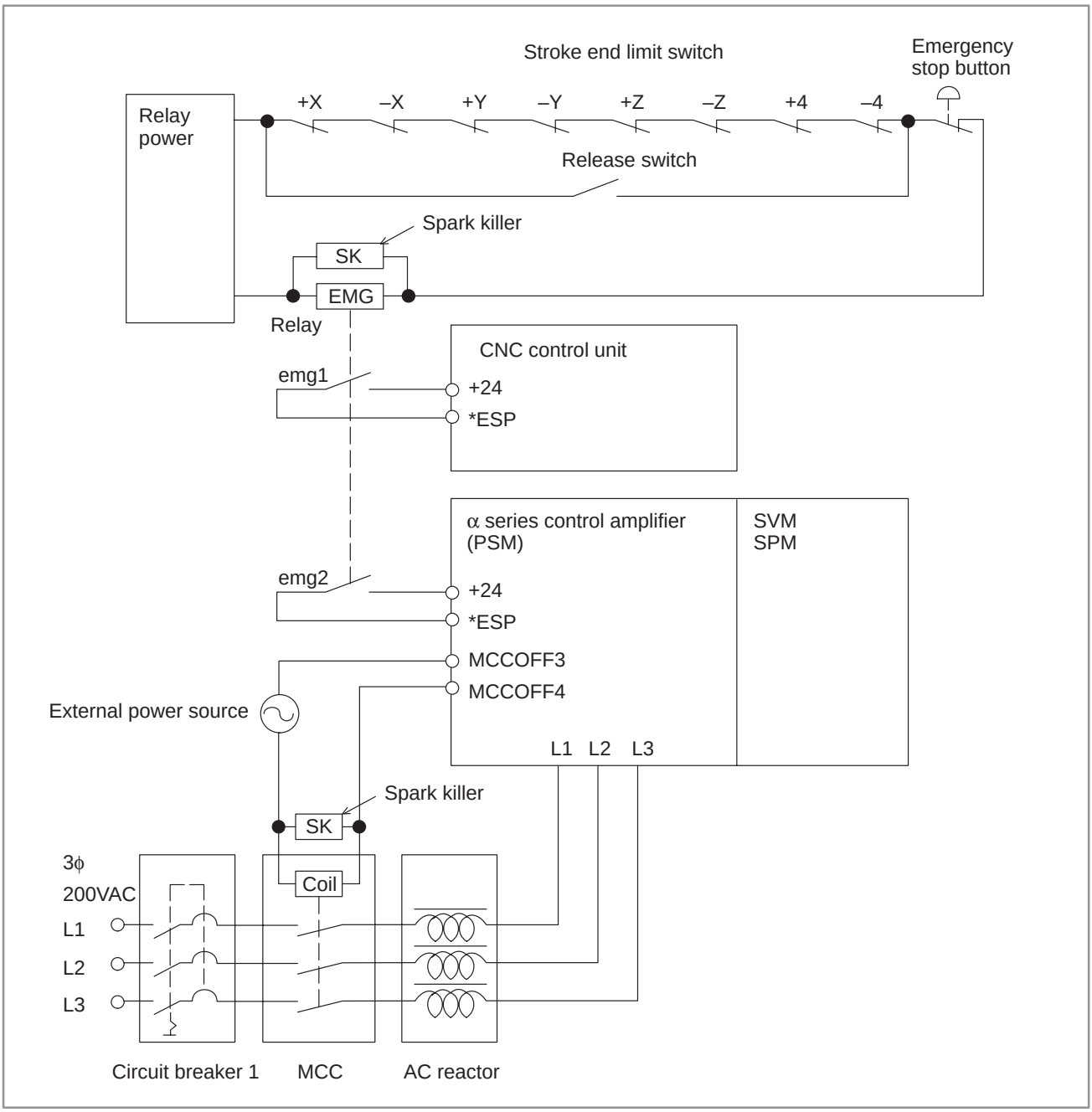


Fig. 14

WARNING

To use a spindle motor and amplifier produced by a manufacturer other than FANUC, refer to the corresponding documentation as well as this manual. Design the emergency stop sequence such that, if the emergency stop signal contact opens while the spindle motor is rotating, the spindle motor is decelerated until it stops.

APPENDIX

A EXTERNAL DIMENSIONS OF VARIOUS UNITS

A.1 UNITS OF CNC

	Name of dimensions					Specifications
Fig. U1 (a)	Control unit (Control unit A)					
Fig. U1 (b)	Control unit (Control unit B)					
		Color	MDI	Key		
Fig. U2 (a)	9″CRT/MDI unit	Monochrome	Small	English	T series	A02B–0091–C041, C042
		Monochrome	Small	English	M series	A02B–0098–C041, C042
		Monochrome	Small	English	T series	A02B–0098–C045#TAR
		Monochrome	Small	English	T series	A02B–0098–C045#TBR
		Monochrome	Small	English	M series	A02B–0098–C045#MAR
		Monochrome	Small	English	M series	A02B–0098–C045#MBR
		Monochrome	Small	Symbolic	T series	A02B–0098–C046#TAR
		Monochrome	Small	Symbolic	T series	A02B–0098–C046#TBR
		Monochrome	Small	Symbolic	M series	A02B–0098–C046#MAR
		Monochrome	Small	Symbolic	M series	A02B–0098–C046#MBR
Fig. U2 (b)	9″CRT/MDI unit	Monochrome	Full key	English	T series	A02B–0091–C052
		Monochrome	Full key	English	M series	A02B–0092–C052
		Monochrome	Full key	English	T series	A02B–0098–C055#TAR
		Monochrome	Full key	English	T series	A02B–0098–C055#TBR
		Monochrome	Full key	English	M series	A02B–0098–C055#MAR
		Monochrome	Full key	English	M series	A02B–0098–C055#MBR
		Monochrome	Full key	Symbolic	T series	A02B–0098–C056#TAR
		Monochrome	Full key	Symbolic	T series	A02B–0098–C056#TBR
		Monochrome	Full key	Symbolic	M series	A02B–0098–C056#MAR
		Monochrome	Full key	Symbolic	M series	A02B–0098–C056#MBR
Fig. U2 (c)	9″CRT/MDI unit	Monochrome	Small	English	0–PD	A02B–0099–C094#PBR
Fig. U2 (d)	9″CRT/MDI unit	Color	Small	English	T series	A02B–0098–C104
		Color	Small	English	M series	A02B–0099–C104
Fig. U2 (e)	9″CRT/MDI unit	Color	Full key	English	T series	A02B–0098–C084
		Color	Full key	English	M series	A02B–0099–C084
Fig. U2 (f)	14″CRT/MDI unit	Color	Full key	English	M series	A02B–0092–C200
Fig. U2 (g)		Color	Full key	English	M series	A02B–0098–C210#MBR
		Color	Full key	Symbolic	M series	A02B–0098–C211#MBR
Fig. U2 (h)	EL/MDI unit	Monochrome	Small	English	T series	A02B–0091–C062
		Monochrome	Small	English	M series	A02B–0092–C062
Fig. U2 (i)	PDP/MDI unit 200VAC input type	Monochrome	Small	English	T series	A02B–0098–C065
		Monochrome	Small	English	M series	A02B–0099–C065
Fig. U2 (j)	PDP/MDI unit 24VDC input type	Monochrome	Small	English	T series	A02B–0098–C068#TBR
		Monochrome	Small	English	M series	A02B–0098–C068#MBR
		Monochrome	Small	Symbolic	T series	A02B–0098–C069#TBR
		Monochrome	Small	Symbolic	M series	A02B–0098–C069#MBR
Fig. U2 (k)	PDP/MDI unit 200VAC input type	Monochrome	Full key	English	T series	A02B–0098–C075
		Monochrome	Full key	English	M series	A02B–0099–C075
Fig. U2 (l)	PDP/MDI unit 24VDC input type	Monochrome	Full key	English	T series	A02B–0098–C078#TBR
		Monochrome	Full key	English	M series	A02B–0098–C078#MBR
		Monochrome	Full key	Symbolic	T series	A02B–0098–C079#TBR
		Monochrome	Full key	Symbolic	M series	A02B–0098–C079#MBR

	Name of dimensions					Specifications
		Color	MDI	Key	Function	
Fig. U2 (m)	7.2″LCD/MDI unit	Monochrome Monochrome Monochrome Monochrome	Small Small Small Small	English English Symbolic Symbolic	T series M series T series M series	A02B–0098–C091#TBR A02B–0098–C091#MBR A02B–0098–C091#TBS A02B–0098–C091#MBS
Fig. U2 (n)	7.2″LCD/MDI unit	Monochrome Monochrome Monochrome Monochrome	Full key Full key Full key Full key	English English Symbolic Symbolic	T series M series T series M series	A02B–0098–C092#TBR A02B–0098–C092#MBR A02B–0098–C092#TBS A02B–0098–C092#MBS
Fig. U2 (o)	Detachable 9″CRT/MDI unit	Monochrome Monochrome	Small Small	English English	T series M series	A02B–0098–C121, C122 A02B–0099–C121, C122
Fig. U3 (a)	Separate type 9″CRT unit	Monochrome	—	—	Common	A02B–0098–C131, C132
Fig. U3 (b)	Separate type 9″CRT unit	Color			Common	A02B–0099–C135
Fig. U3 (c)	Separate type EL unit	Monochrome	—	—	Common	A02B–0091–C138
Fig. U3 (d)	Separate type PDP unit 200VAC input type	Monochrome	—	—	Common	A02B–0098–C135
Fig. U3 (e)	Separate type PDP unit 24VDC input type	Monochrome	—	—	Common	A02B–0098–C136
Fig. U3 (f)	Separate type 7.2″LCD unit	Monochrome	—	—	Common	A02B–0098–C093
Fig. U3 (g)	Separate type 8.4″LCD unit	Color Color	— —	— —	Common M series	A02B–0098–C098 A02B–0098–C099
Fig. U3 (h)	Separate type 8.4″ LCD unit	Color Color	—	—	Common M series	A02B–0098–C088 A02B–0098–C089
Fig. U4 (a)	Separate type MDI unit	— — — — — —	Small Small Small Small Small Small	English English Symbolic English English Symbolic	T series T series T series M series M series M series	A02B–0091–C133 A02B–0098–C145#TAR A02B–0098–C145#TB A02B–0092–C133 A02B–0098–C145#MAR A02B–0098–C145#MB
Fig. U4 (b)	Separate type MDI unit	— — — — — — — —	Full key Full key Full key Full key Full key Full key Full key Full key	English English Symbolic English English Symbolic Englich Symbolic	T series T series T series M series M series M series M series M series	A02B–0091–C135 A02B–0098–C146#TAR A02B–0098–C146#TB A02B–0092–C135 A02B–0098–C146#MAR A02B–0098–C146#MB A02B–0098–C147#MAR A02B–0098–C147#MB
Fig. U5 (a)	Manual pulse generator					A860–0201–T001

	Name of dimensions	Specifications
Fig. U5 (b)	Manual pulse generator (Thin type)	A860–0202–T001
Fig. U5 (c)	Pendant type manual pulse generator	A860–0202–T004 to T015
Fig. U6	Punch panel	A02B–0072–C061 to C069
Fig. U7 (a)	Position coder (Max.4000 rpm) (Max.6000 rpm)	A86L–0027–0001#102 A86L–0027–0001#002
Fig. U7 (b)	α series position coder (Max.10000 rpm)	A860–0309–T302
Fig. U8 (a)	Battery unit for NC	
Fig. U8 (b)	Power supply battery case for absolute pulse coder	A06B–6050–K060
Fig. U9 (a)	Additional I/O B2 Additional I/O F1 (DO common output type)	A20B–1001–0731 A20B–1002–0310
Fig. U9 (b)	Additional I/O B3 (Corresponding to I/O link) Additional I/O F3 (Corresponding to I/O link and DO common output)	A20B–1004–0500 A20B–2001–0880
Fig. U10	Transformer of control unit forshipment	A80L–0001–0176
Fig. U11	Input unit A2	A14B–0076–B001
Fig. U12	FANUC PPR	
Fig. U13	FANUC floppy cassette adaptor (2DD)	
Fig. U14	Integrated type FA card adaptor	
Fig. U15	Integrated type floppy cassette adaptor (2DD)	
Fig. U16	Floppy cassette adaptor (2HD)	
Fig. U17	FA card adaptor	
Fig. U18	Program file mate	
Fig. U19 (a)	Portable tape reader	
Fig. U19 (b)	Tape reader with serial interface/without reels	
Fig. U19 (C)	Tape reader with reels	
See Appendix D.	Machine operator’s panel For samll CRT (PDP or LCD)/MDI	A02B–0091–C141
	Machine operator’s panel For Full key CRT (PDP or LCD)/MDI	A02B–0091–C161
	Machine operator’s panel (smbolic keysheet) For small CRT (PDP or LCD)/MDI	A02B–0098–C170#TB
	Machine operator’s panel (symbolic keysheet) For full key CRT (PDP oR LCD)/MDI	A02B–0099–C161#TB
	Machine operator’s panel For small CRT (PDP or LCD)/MDI	A02B–0092–C141
	Machine operator’s panel For full key CRT (PDP or LCD)/MDI	A02B–0092–C161
	Machine operator’s panel (symbolic keysheet) For small CRT (PDP or LCD)/MDI	A02B–0099–C150#MB
	Machine operator’s panel (symbolic keysheet) For full key CRT (PDP or LCD)/MDI	A02B–0099–C161#MB

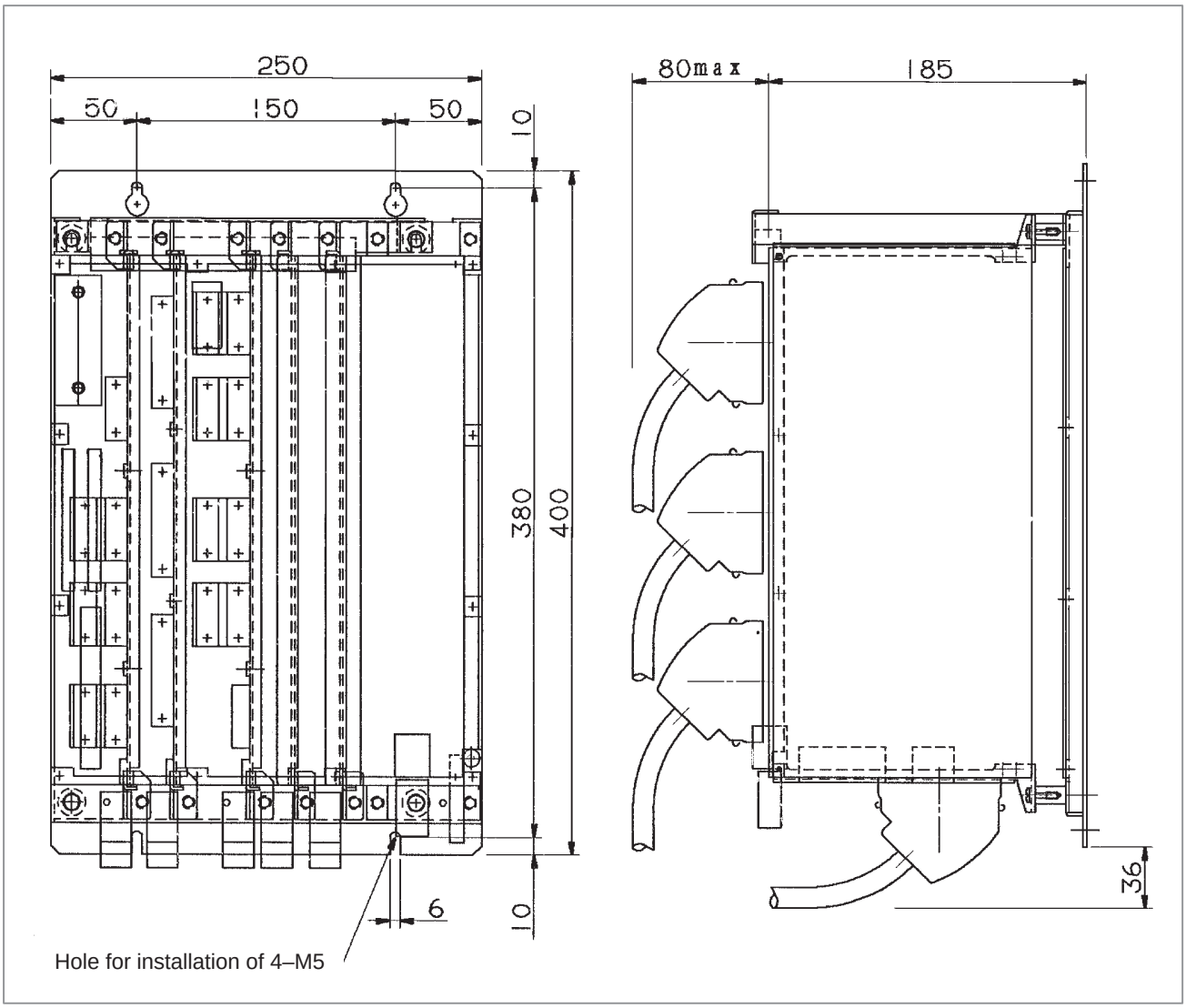


Fig. U1 (a) External dimension of control unit (Control unit A)

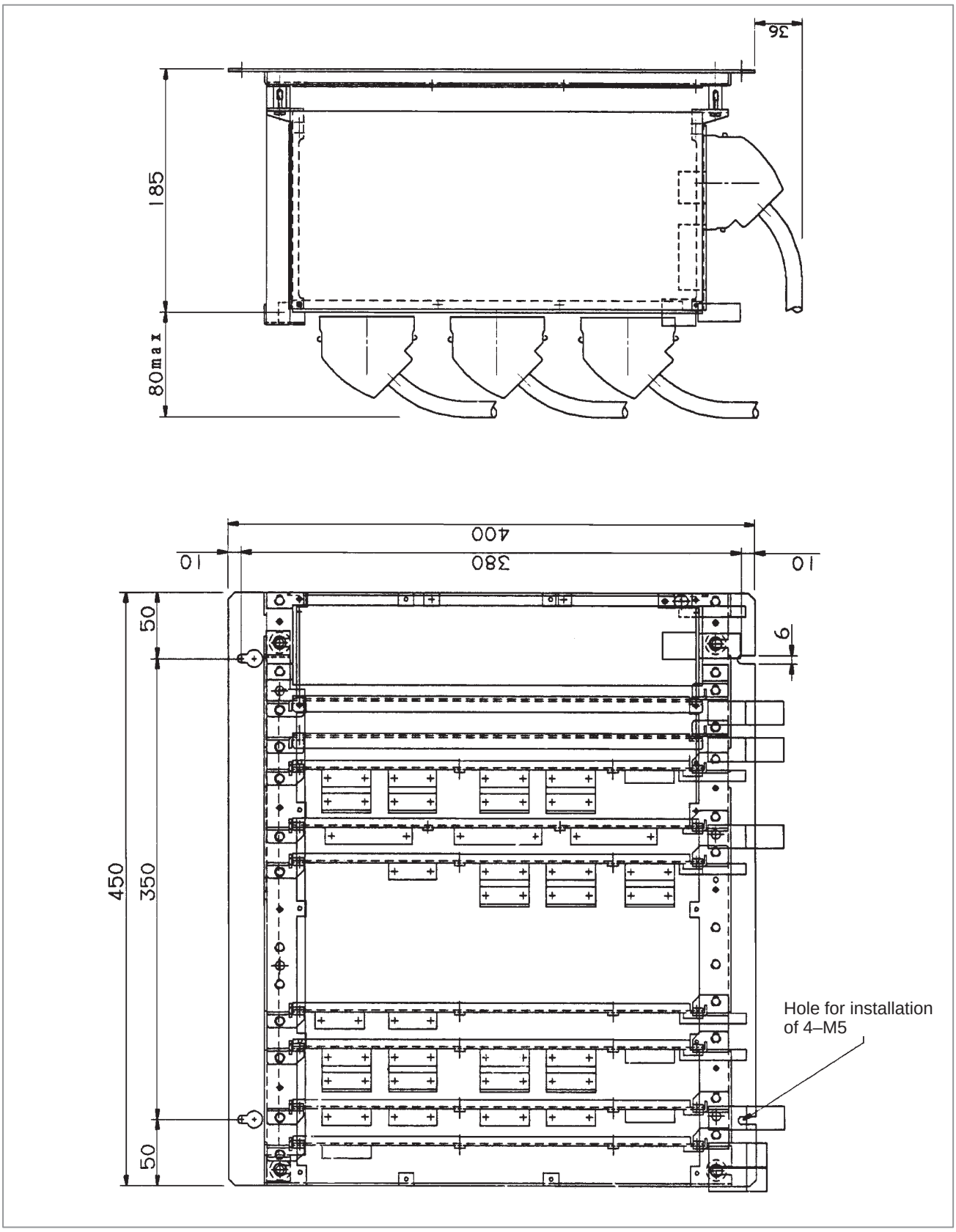
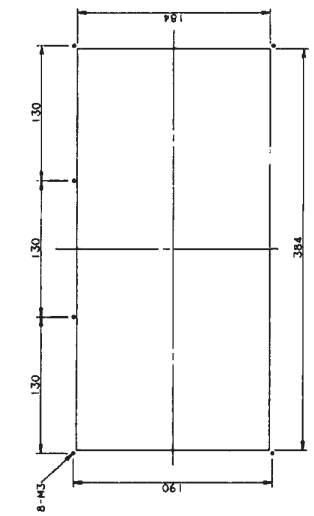
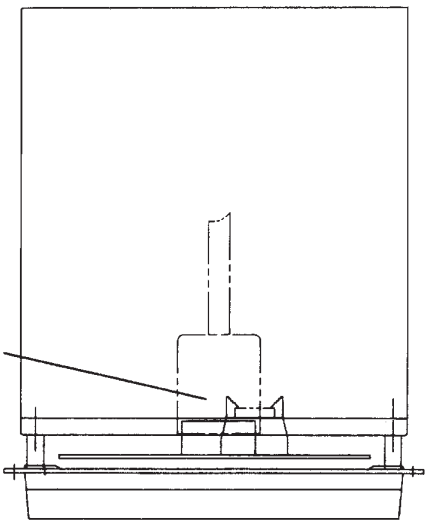


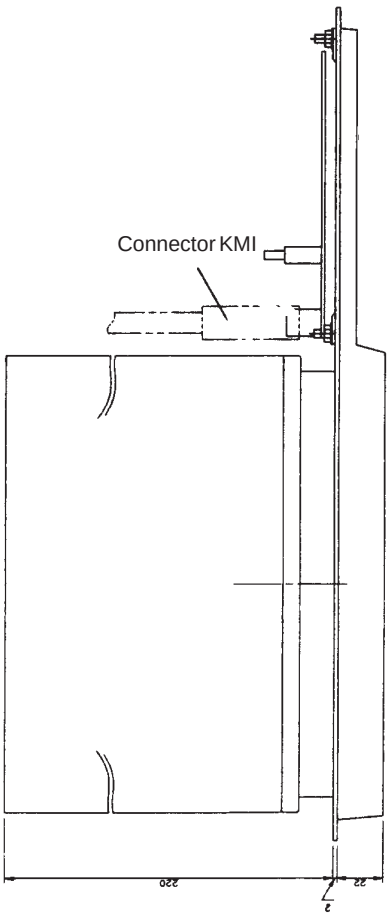
Fig. U1 (b) External dimension of control unit (Control unit B)

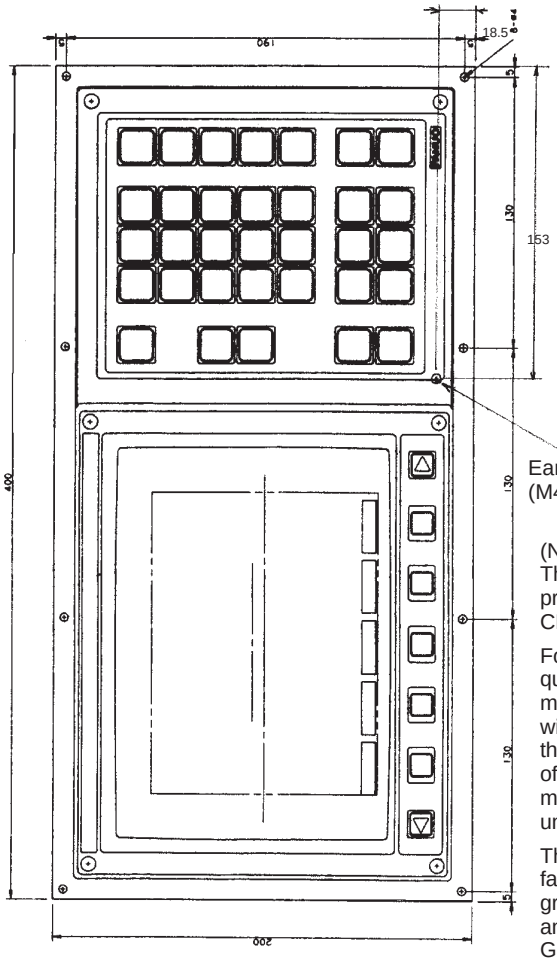


Installation dimension



Weight : 4.2kg





(Note)
The earth stud is prepared only for CE marking

For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U2 (a) 9″ CRT/MDI unit (Monochrome, small key type)

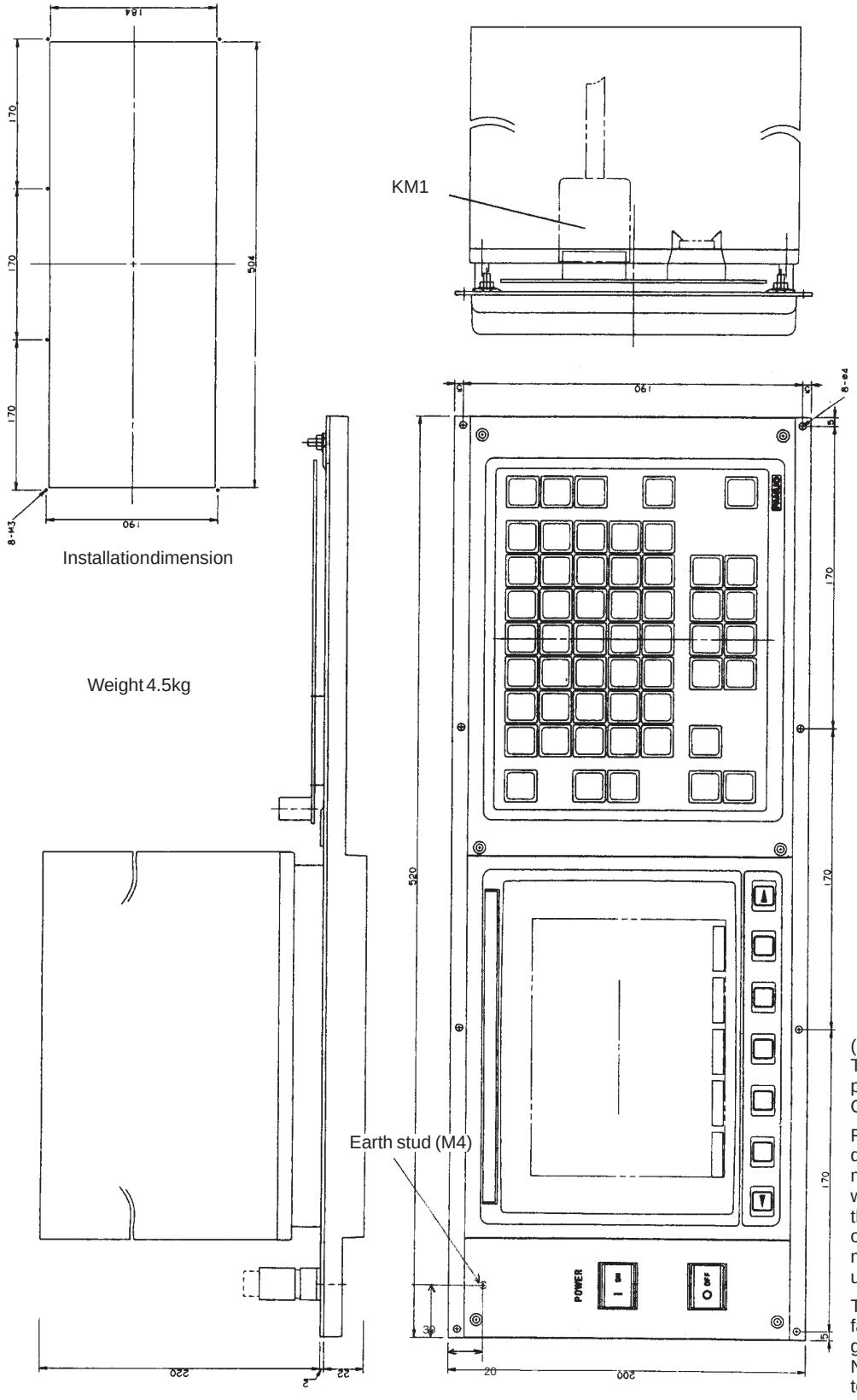


Fig. U2 (b) 9″CRT/MDI unit (Monochrome, full key type) dimension

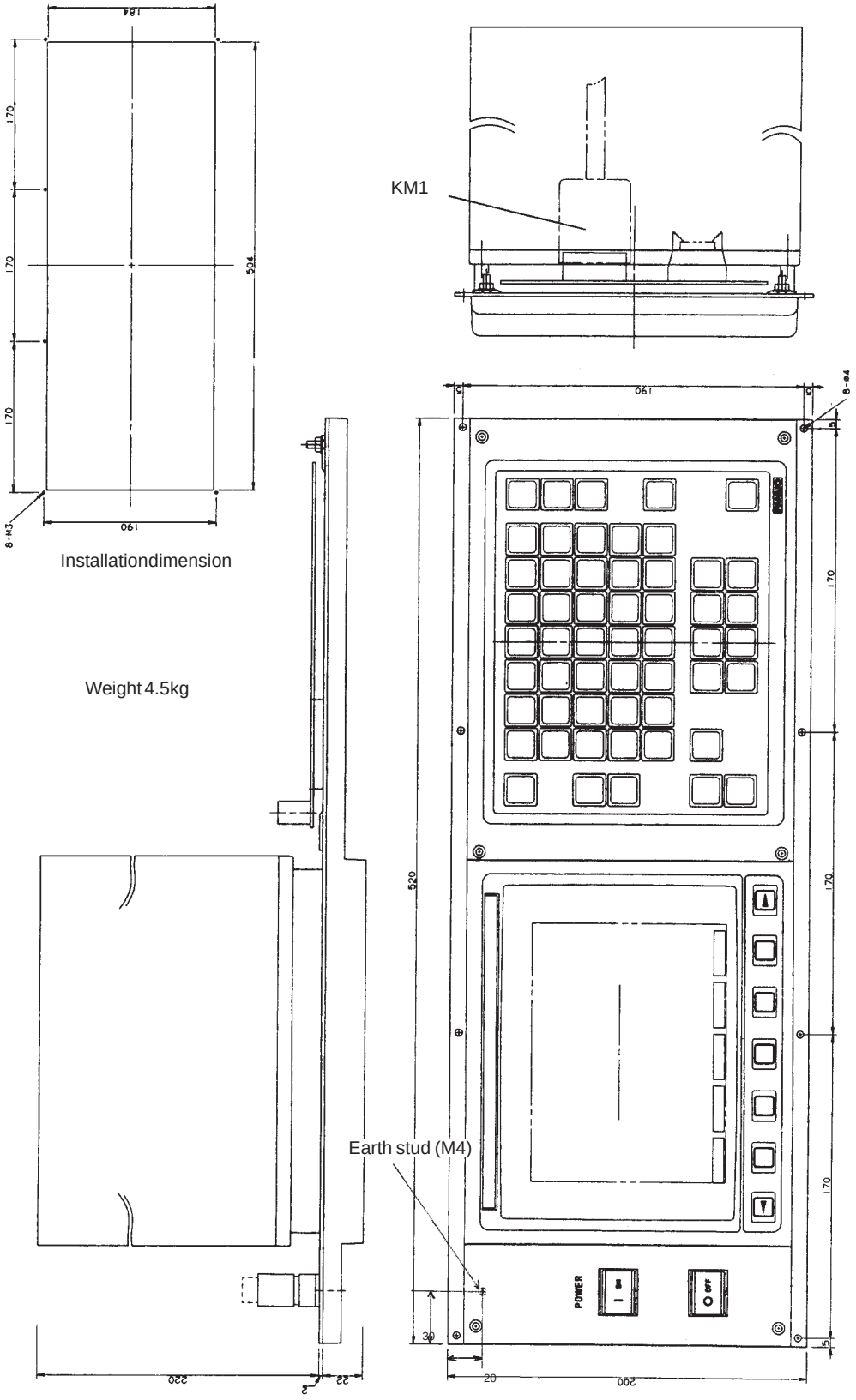
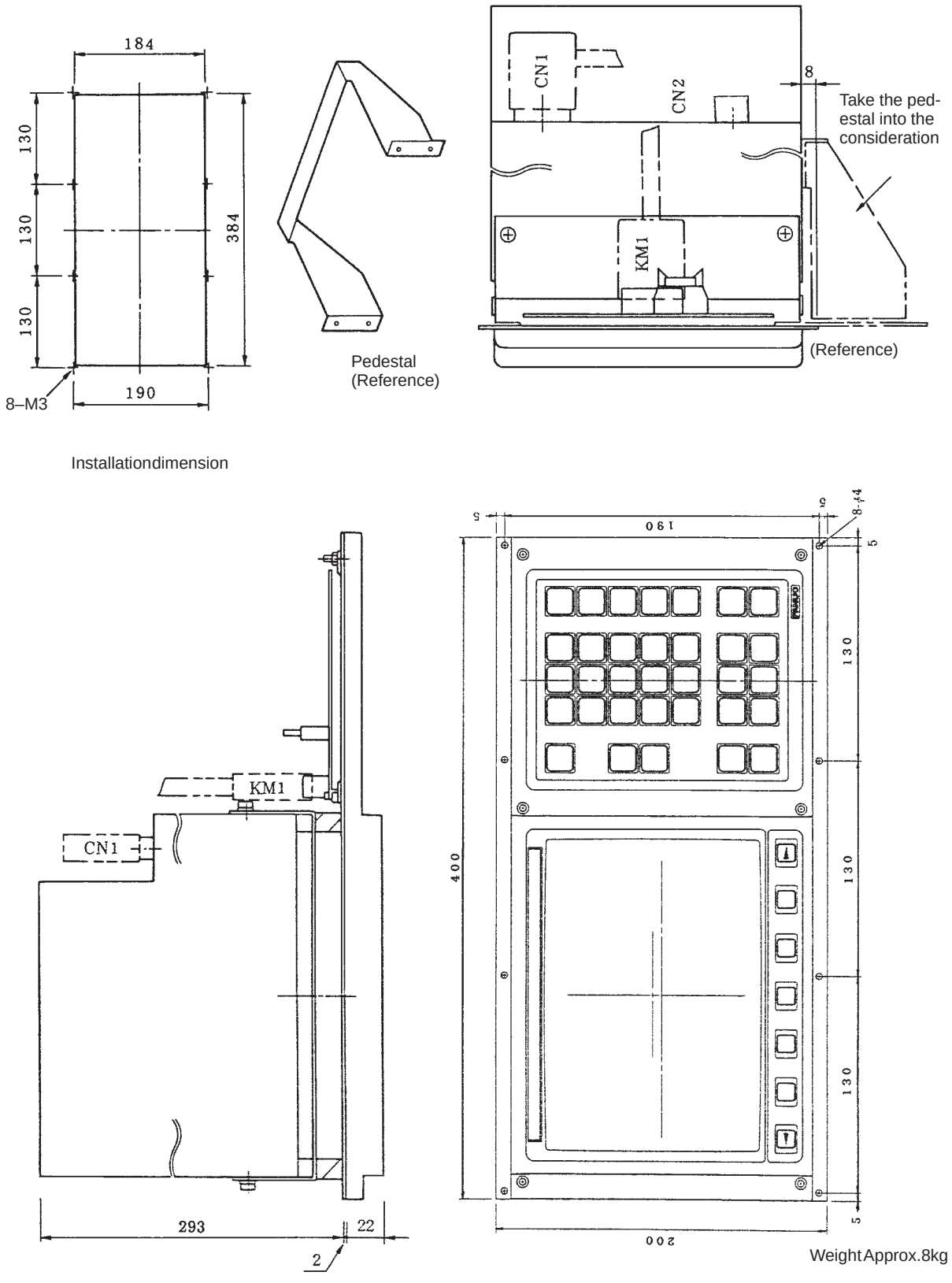
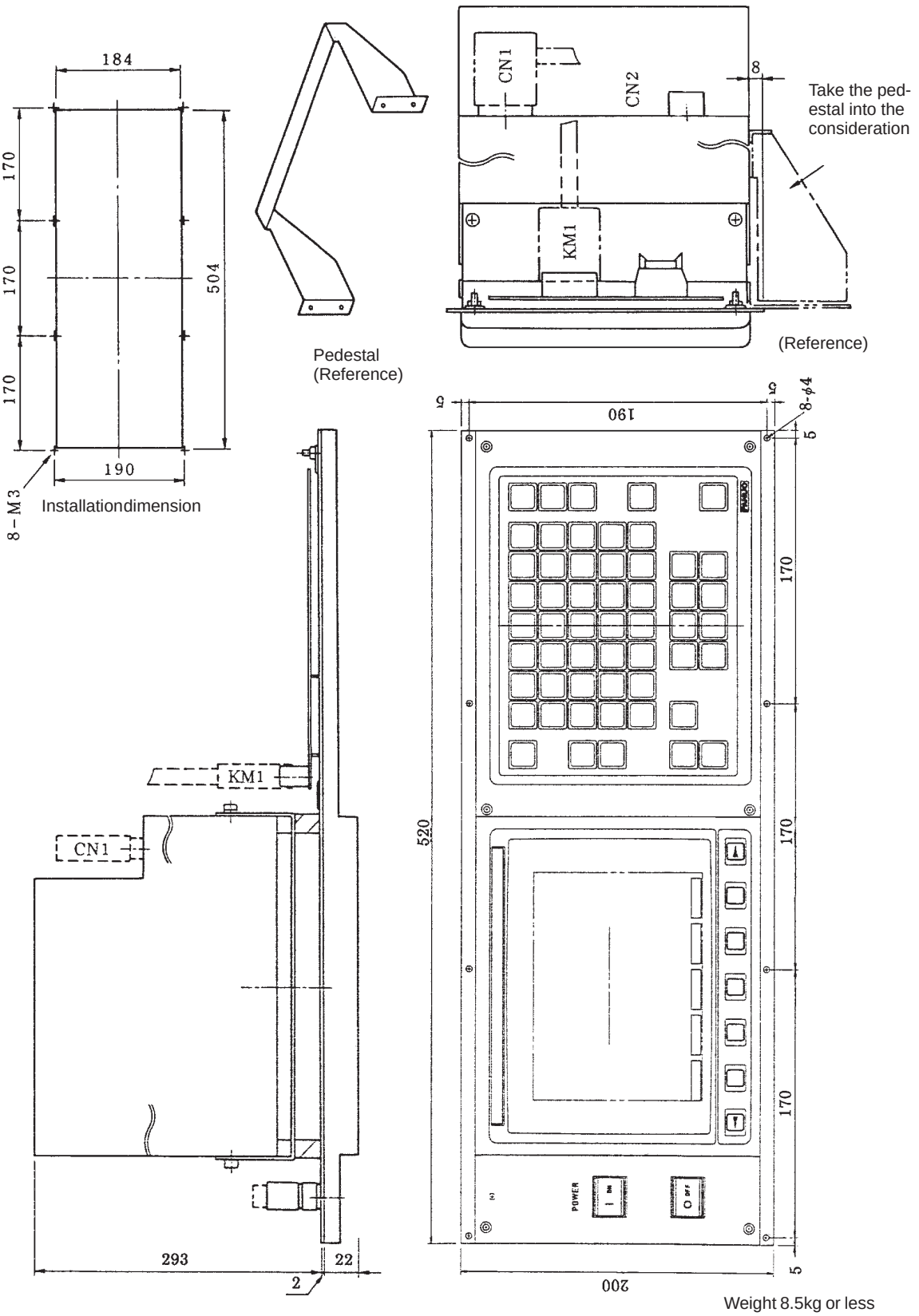


Fig. U2 (c) For 0–PD 9″CRT/MDI unit (Monochrome, full key type) dimension



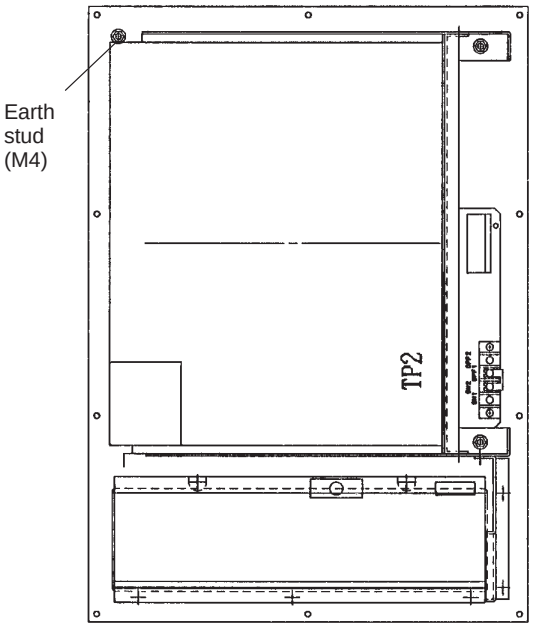
The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U2 (d) 9″CRT/MDI unit (Color, small type key)

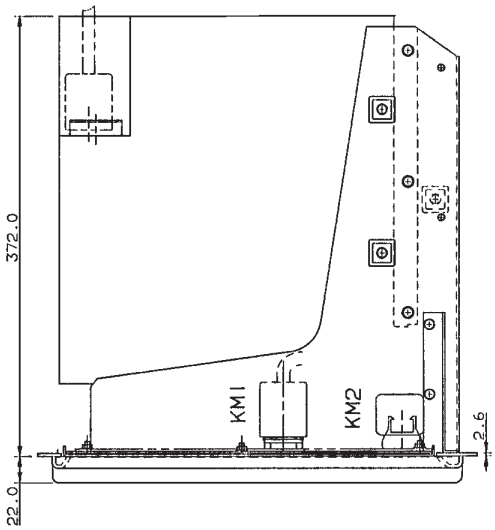


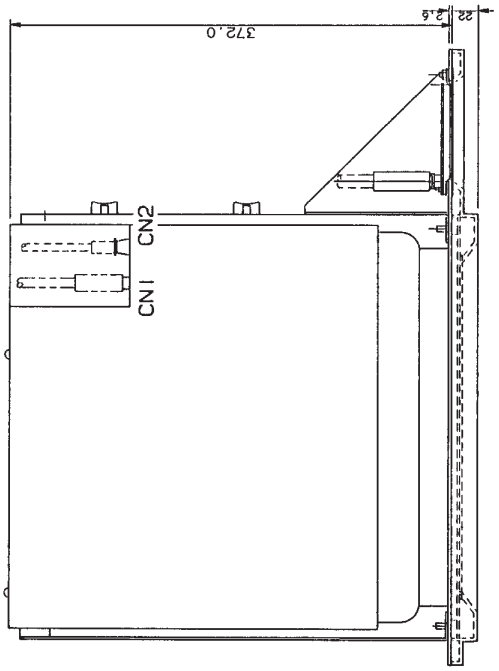
The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

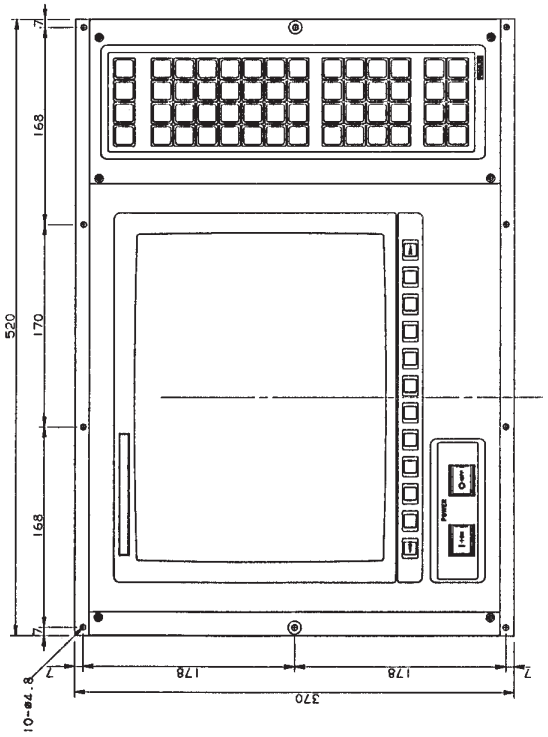
Fig. U2 (e) 9″CRT/MDI unit (Color,full key type)



Weight : 21 kg







For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig.U2(f) 14″CRT/MDI unit

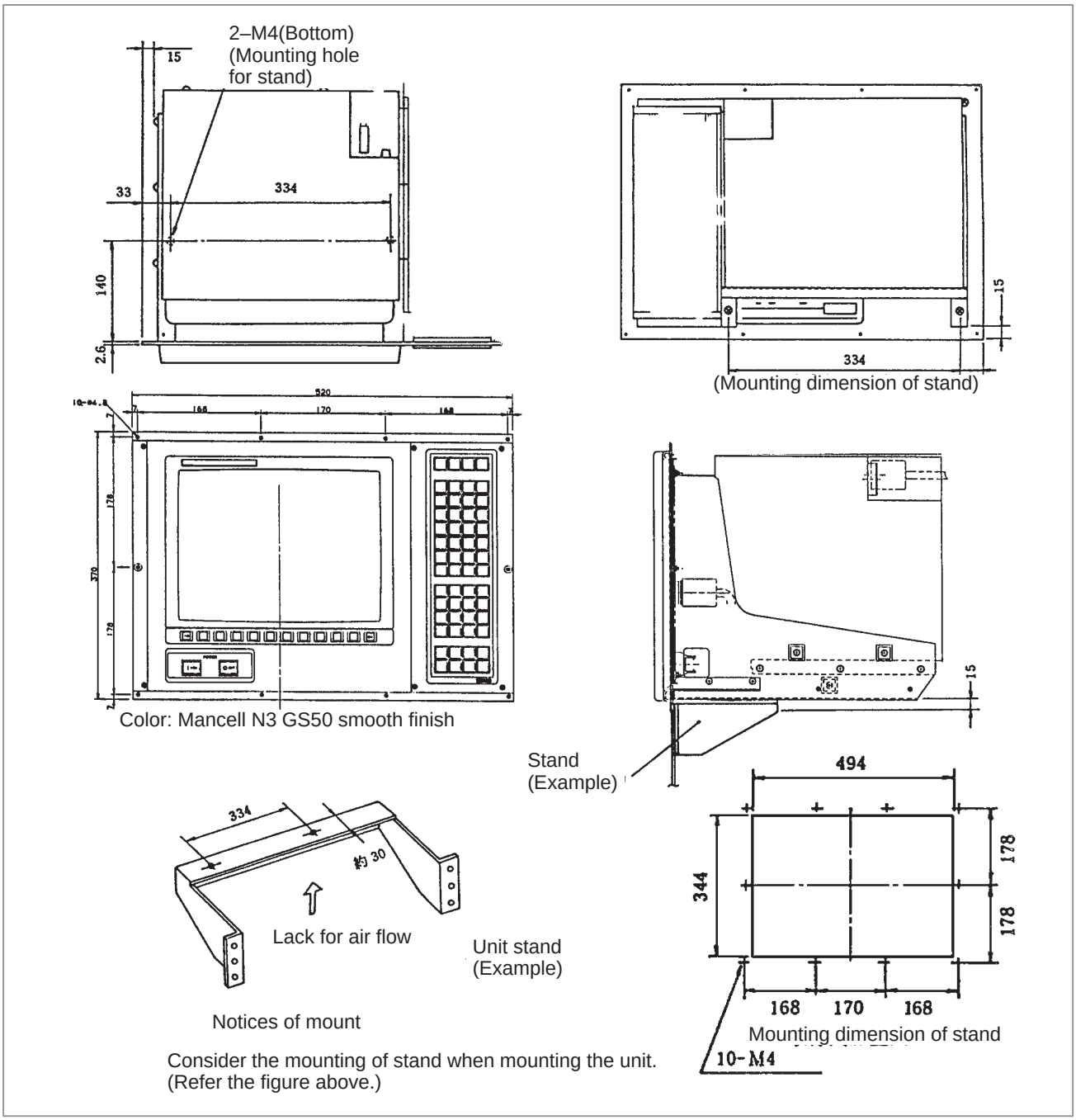
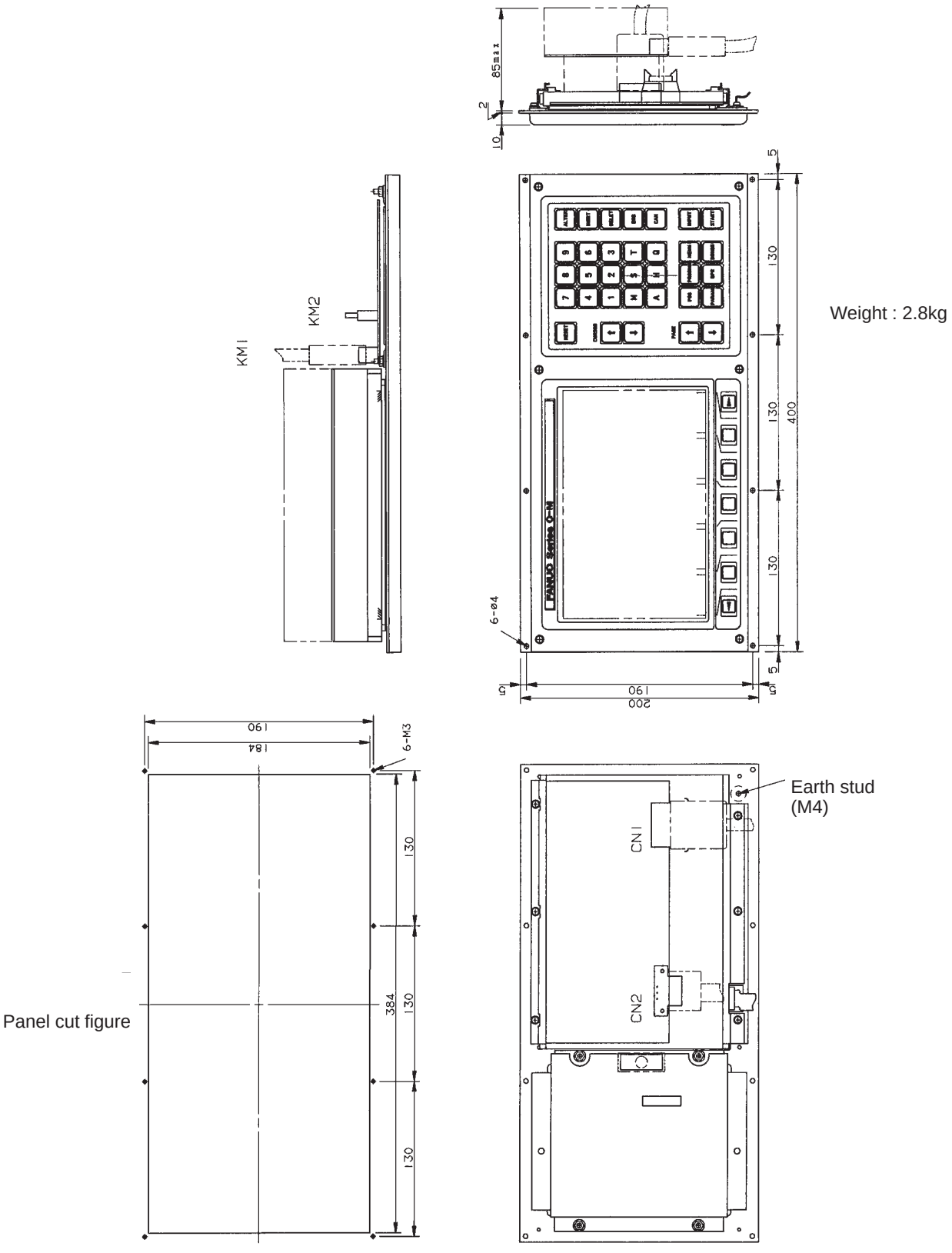


Fig. U2 (g) Installing drawing for 14″CRT/MDI



The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U2 (h) EL/MDI unit (Small key type)

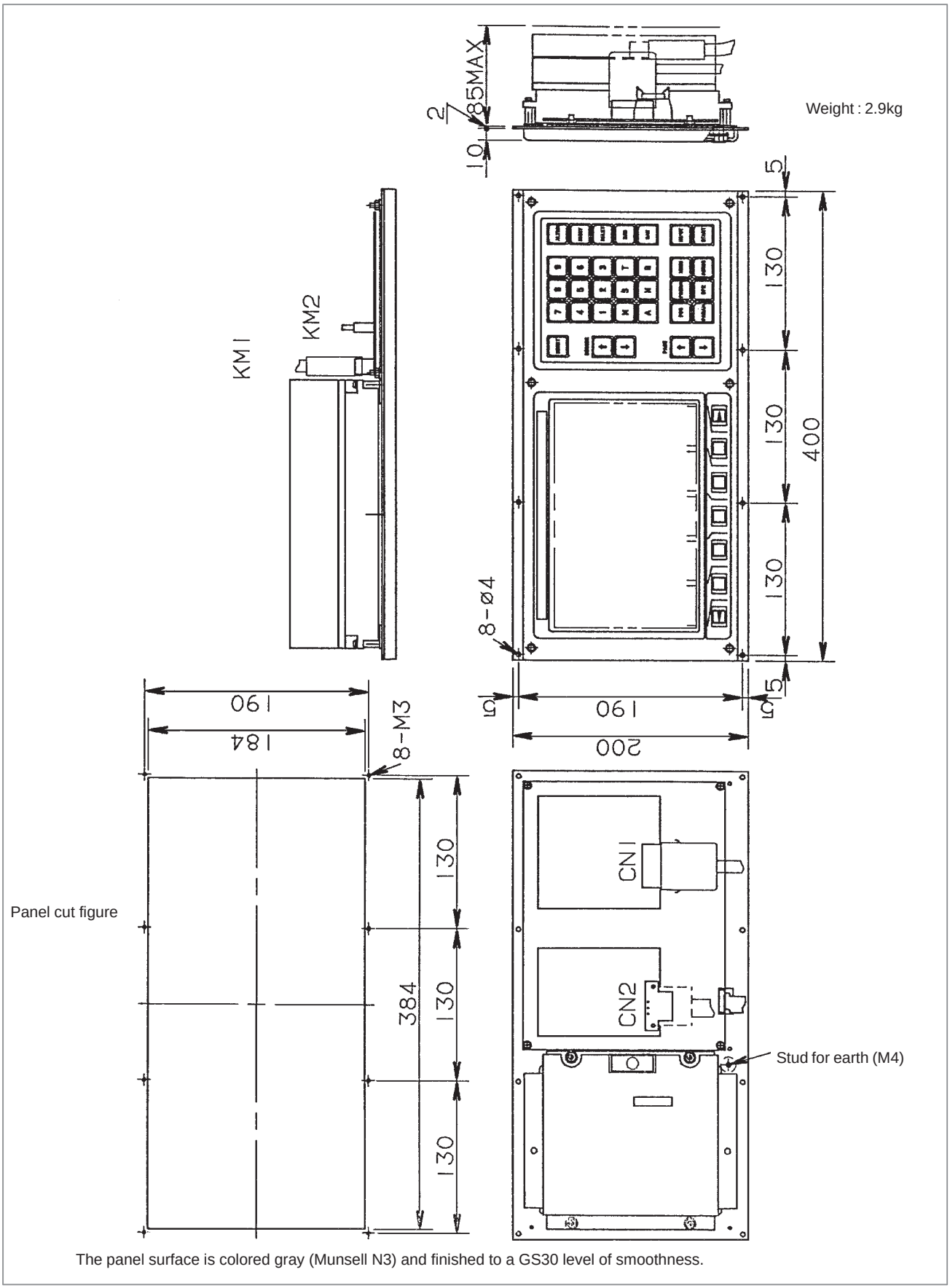


Fig. U2 (i) PDP/MDI unit (Small key type)

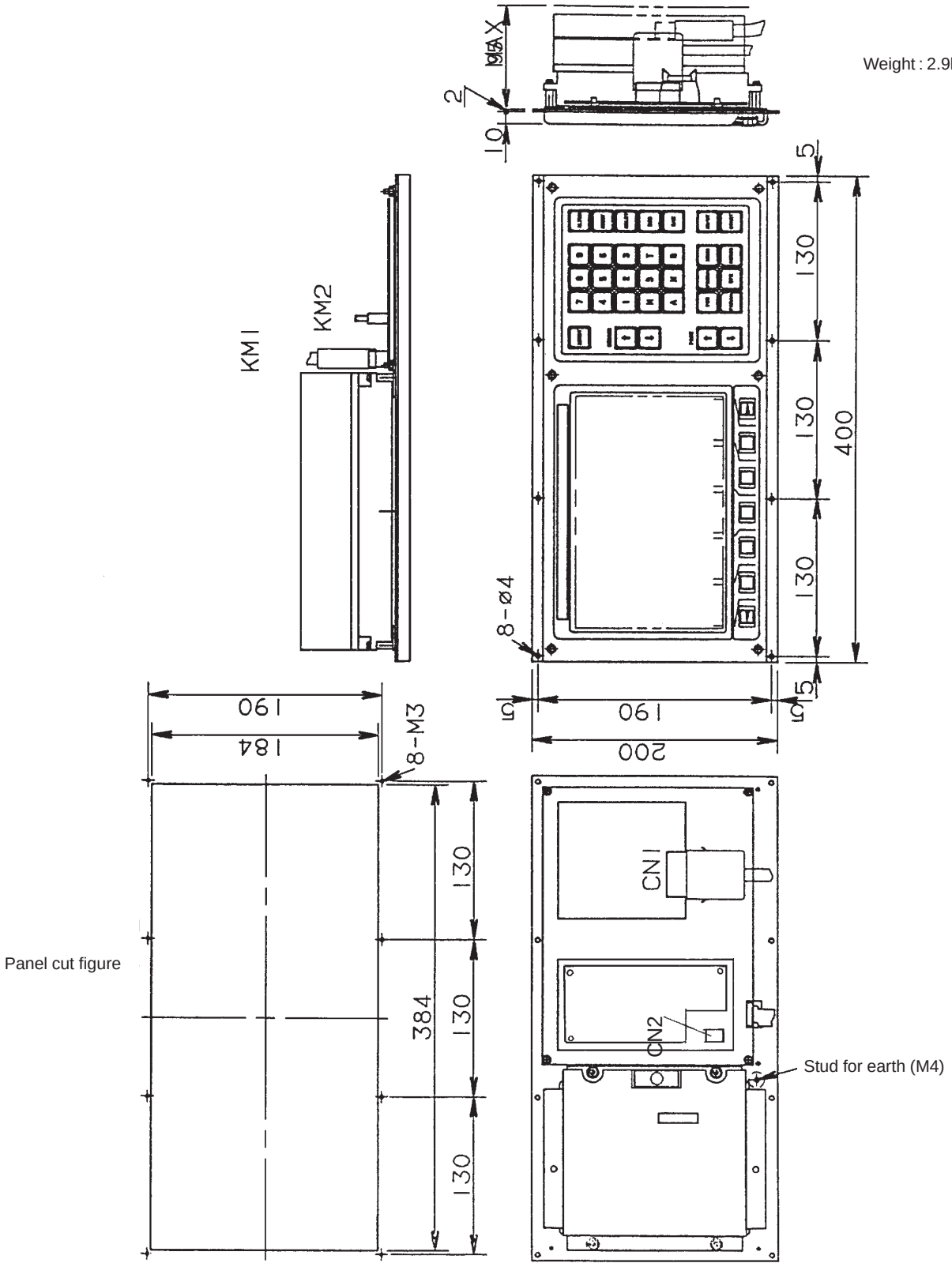
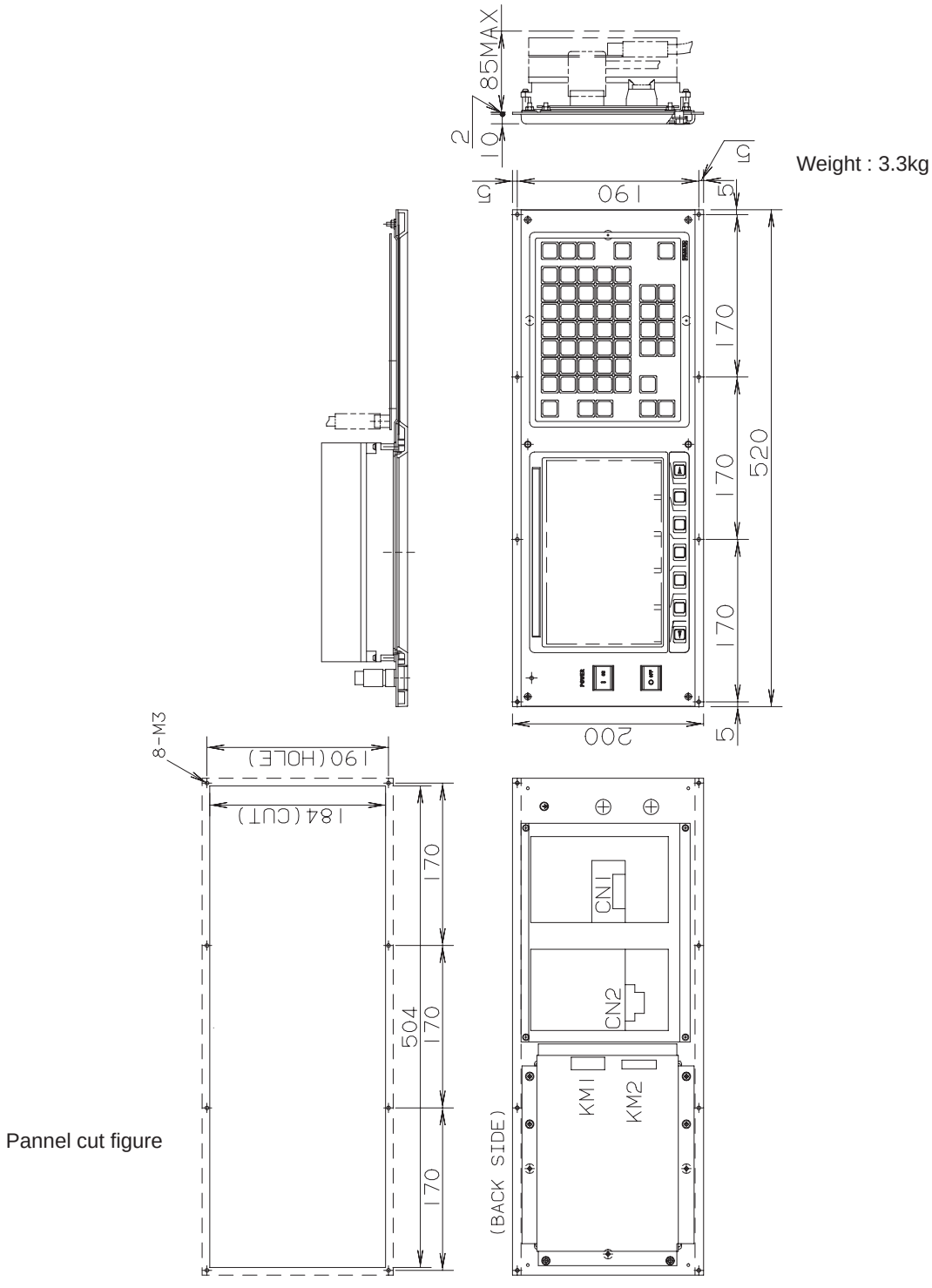
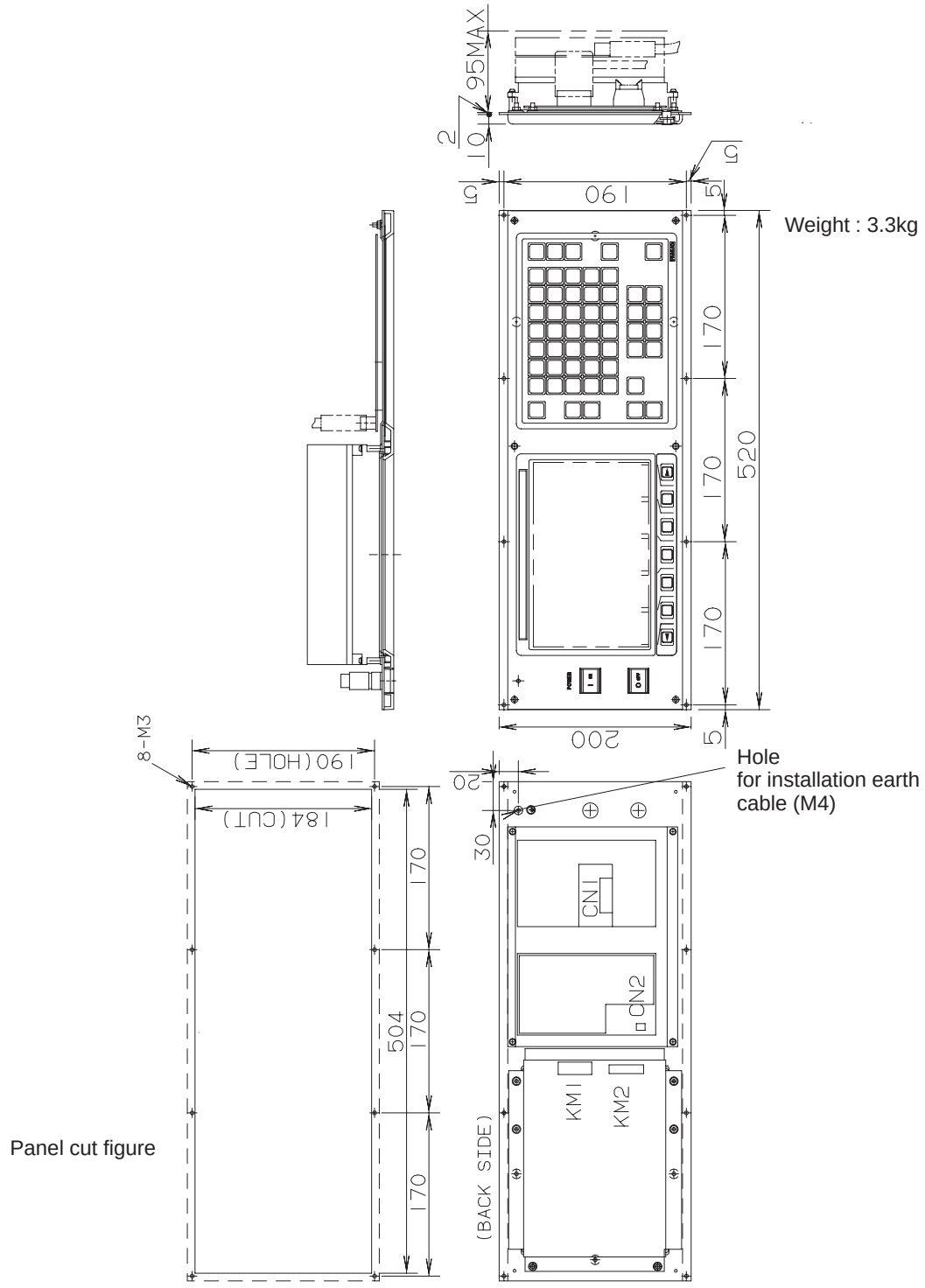


Fig. U2 (j) PDP/MDI unit (Small key type) (A02B–0098–C068) (A02B–0098–C069)



The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U2 (k) PDP/MDI unit (Full key type)



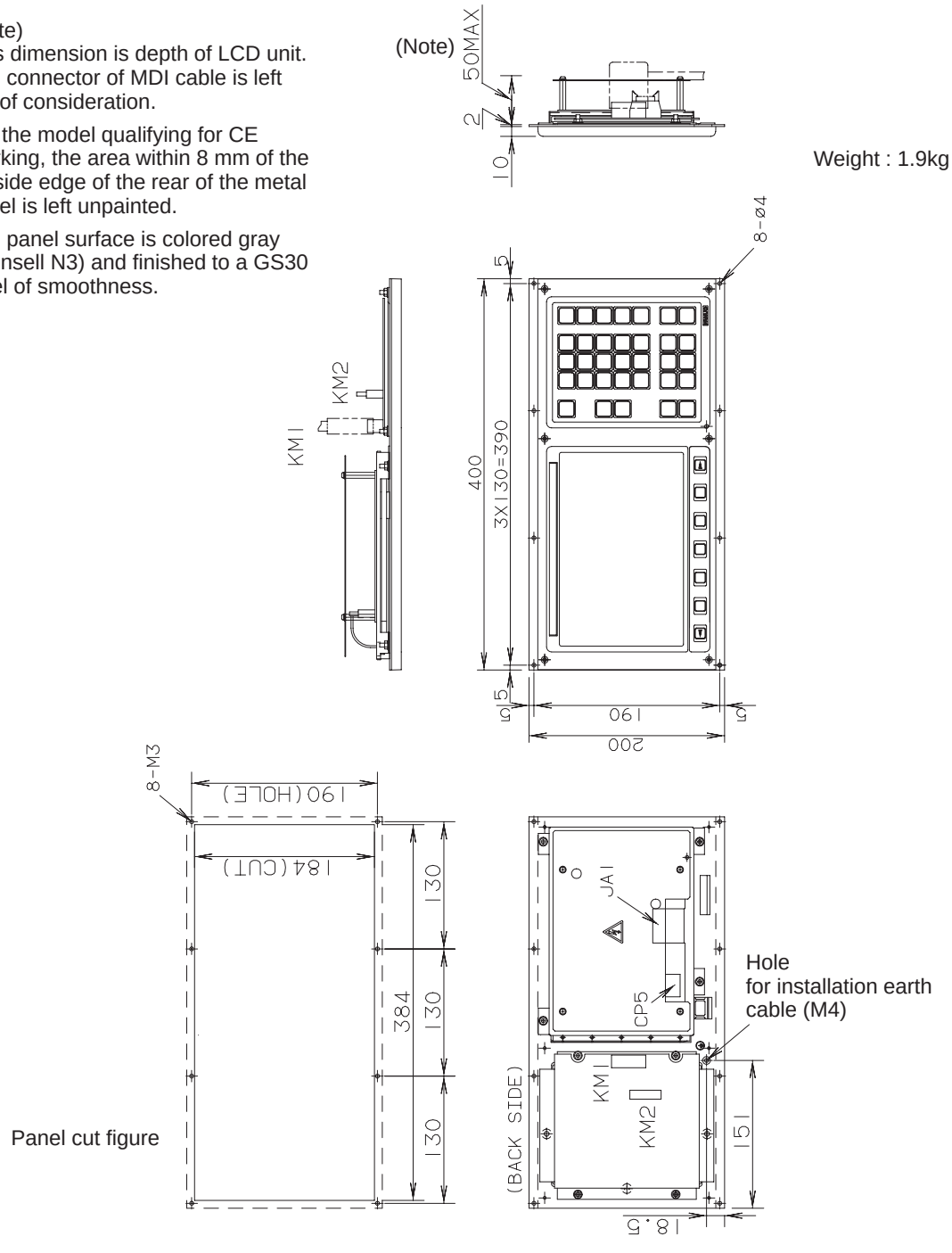
The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U2 (l) PDP/MDI unit (Full key type)

(Note)
This dimension is depth of LCD unit. The connector of MDI cable is left out of consideration.

For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.



Panel cut figure

Fig. U2 (m) 7.2″ LCD/MDI unit (Small key type)

(Note)
This dimension is depth of LCD unit. The connector of MDI cable is left out of consideration.

For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

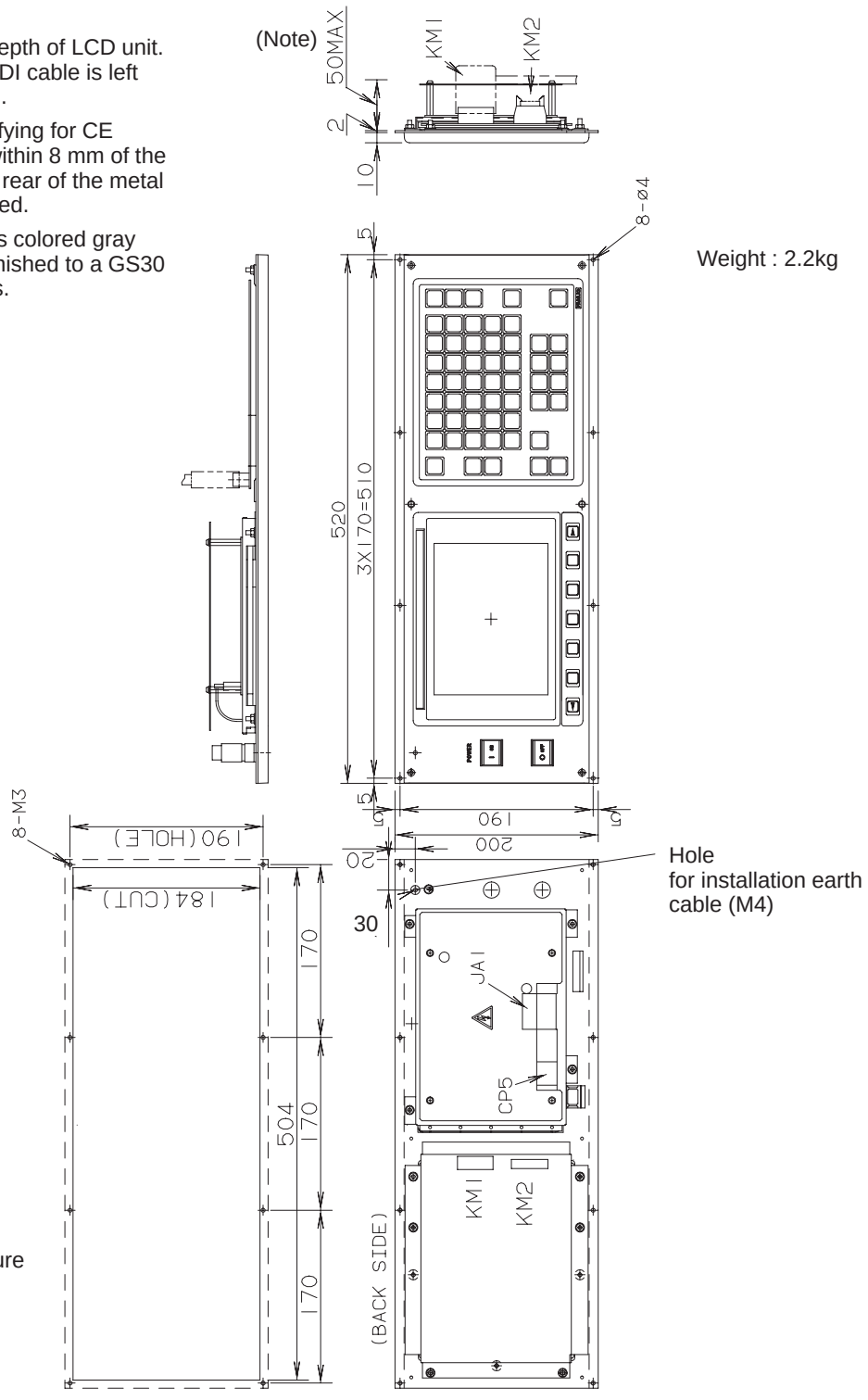


Fig. U2 (n) 7.2″LCD/MDI Unit (Full key type)

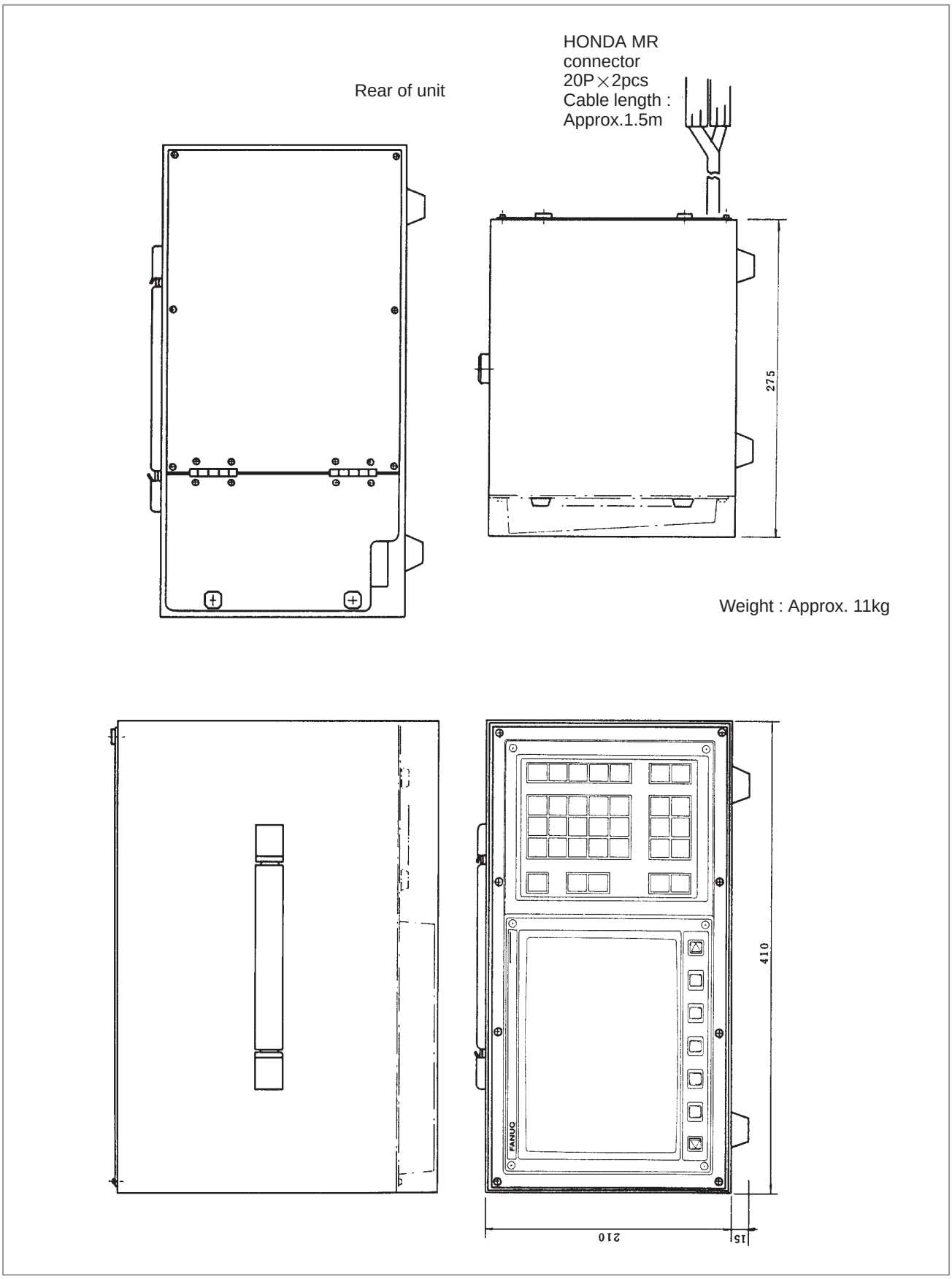
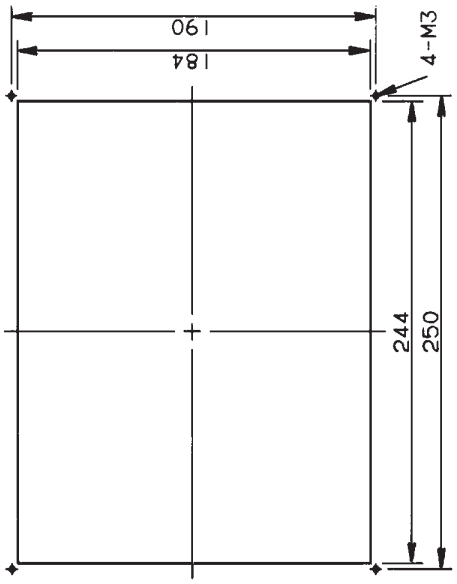
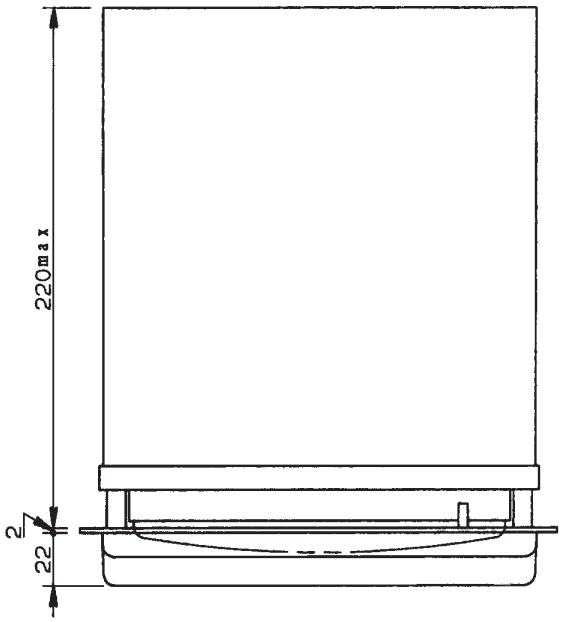


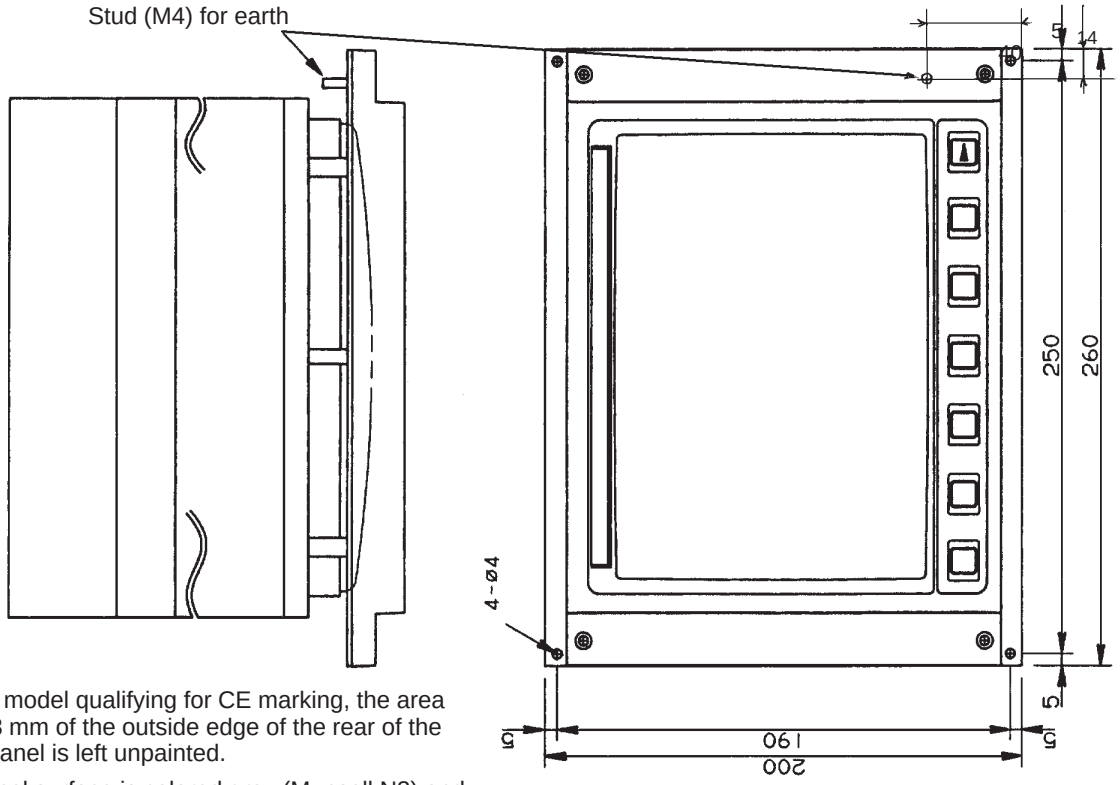
Fig. U2(o) Detachable CRT/MDI unit



Panel cut figure

Weight : 4kg





For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U3 (a) Remote type 9″CRT unit(Monochrome)

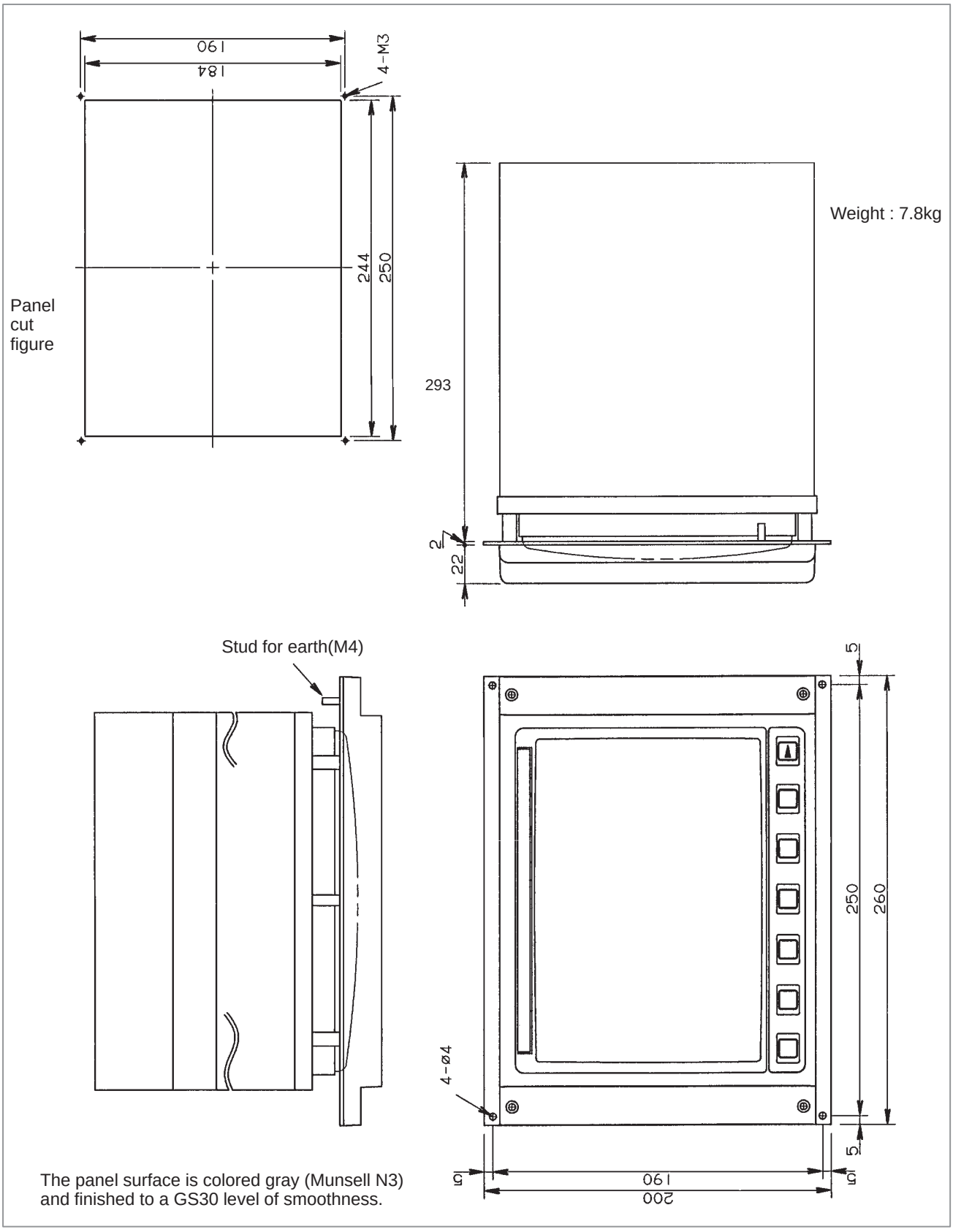


Fig. U3 (b) Remote type 9″ CRT unit (Color)

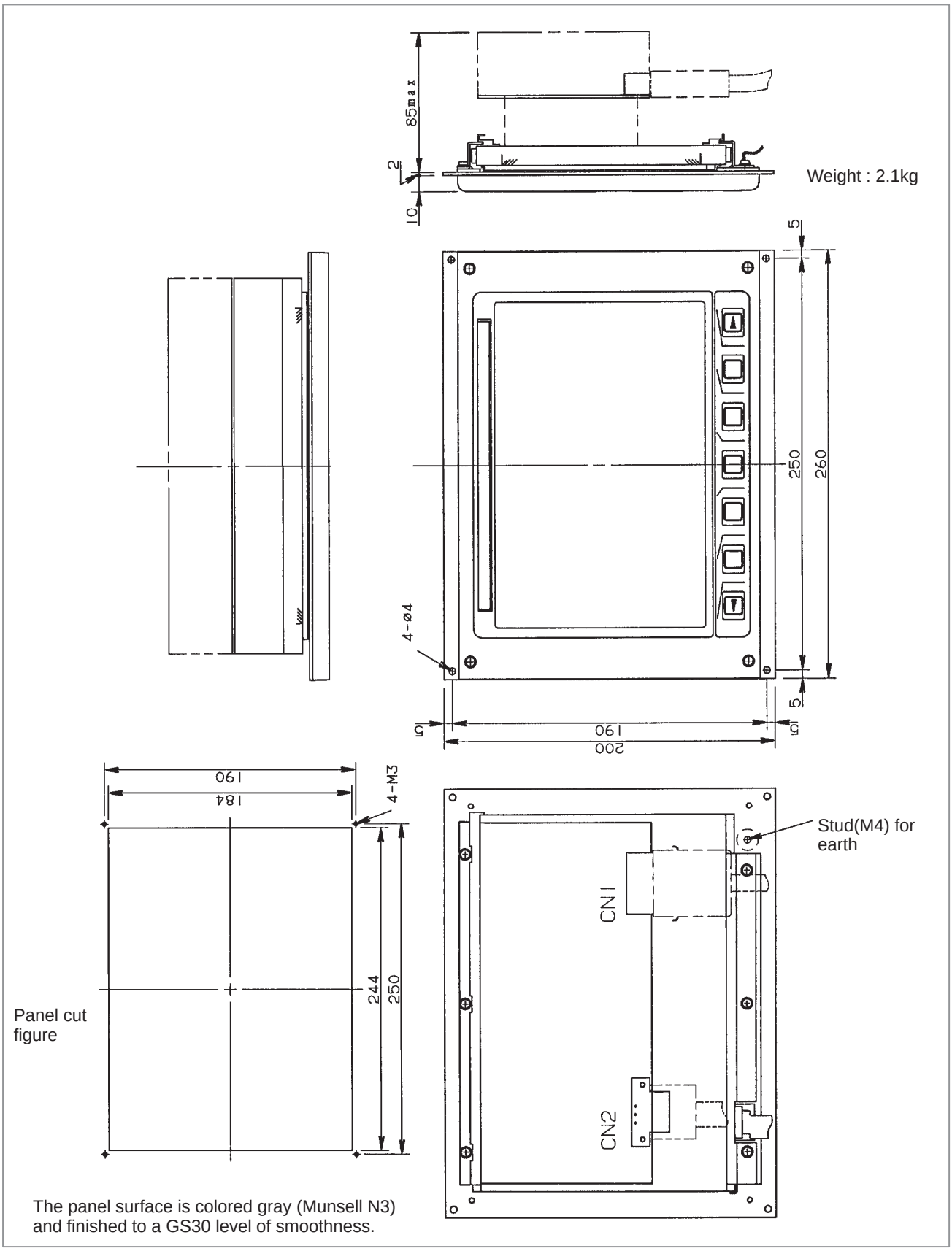


Fig. U3 (c) Remote type EL unit

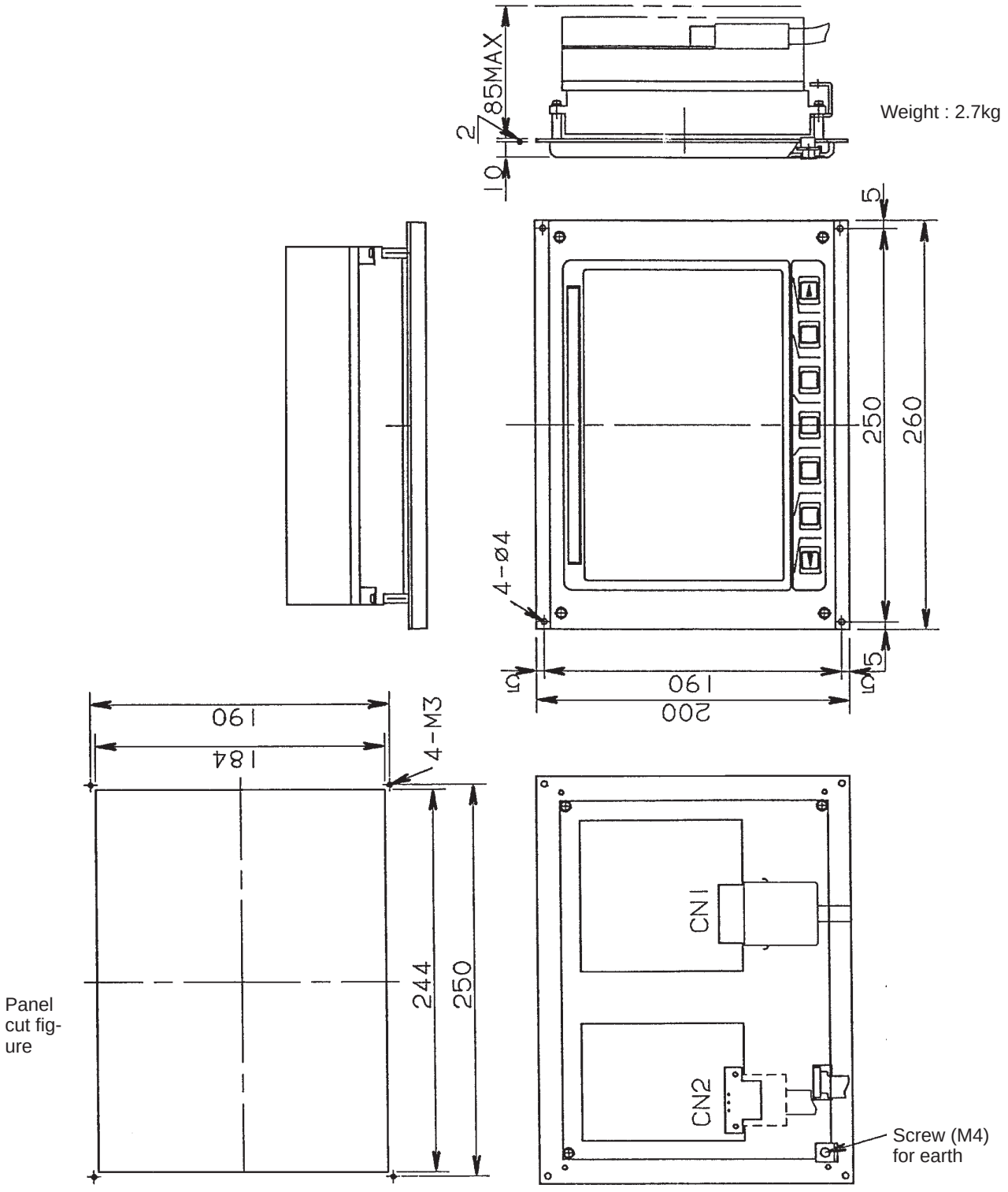


Fig. U3 (d) Remote type PDP unit (A02B–0098–C135)

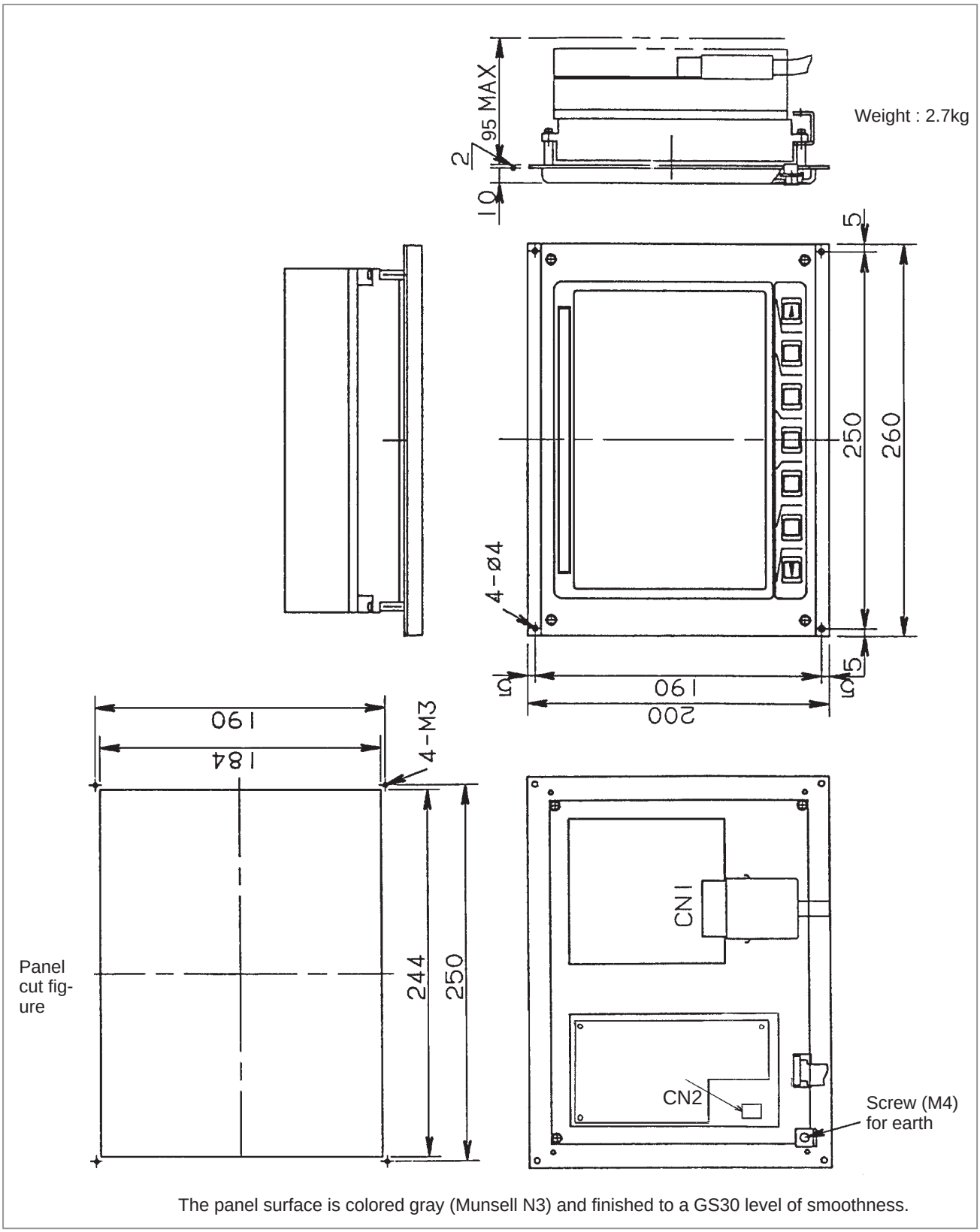
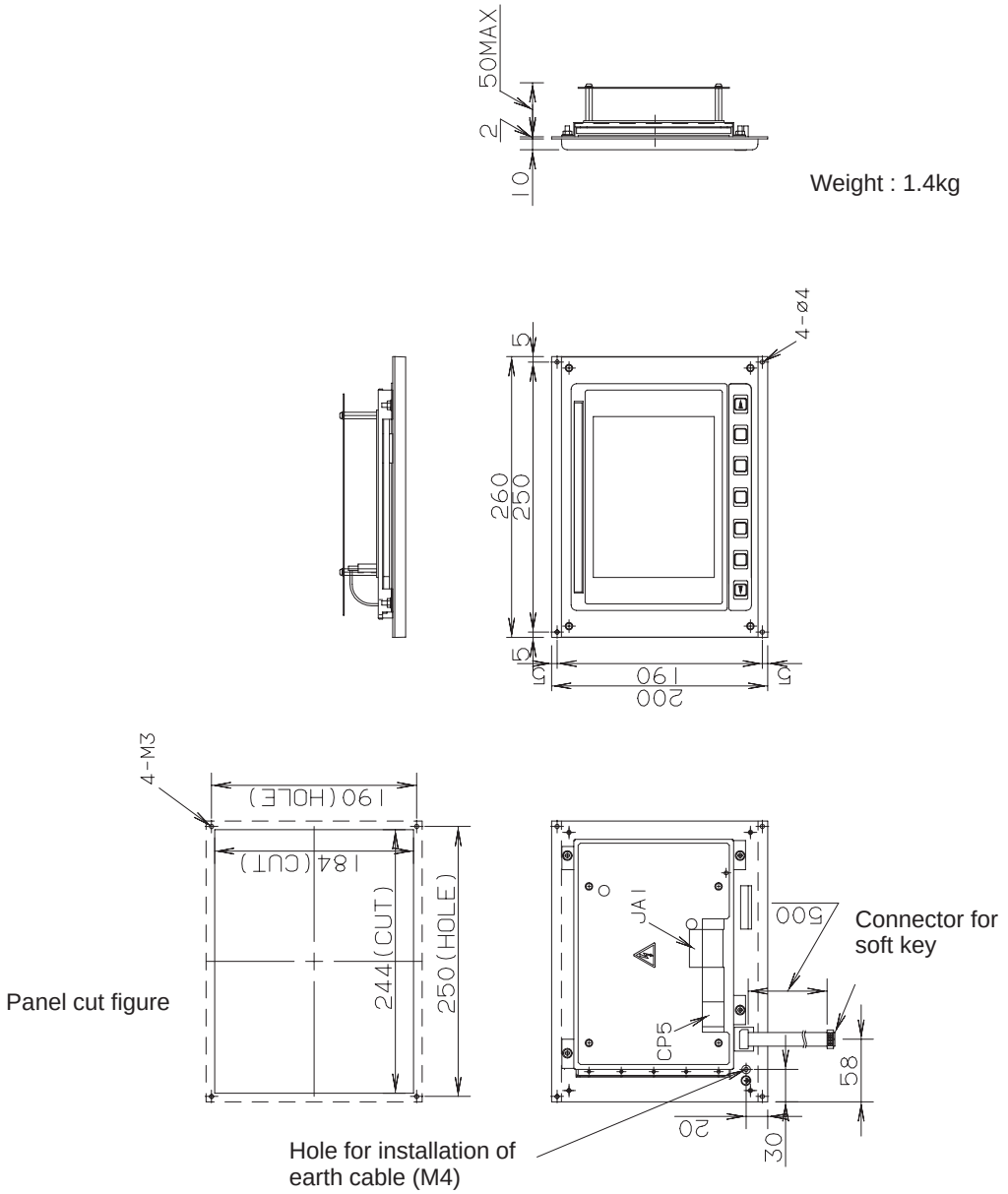


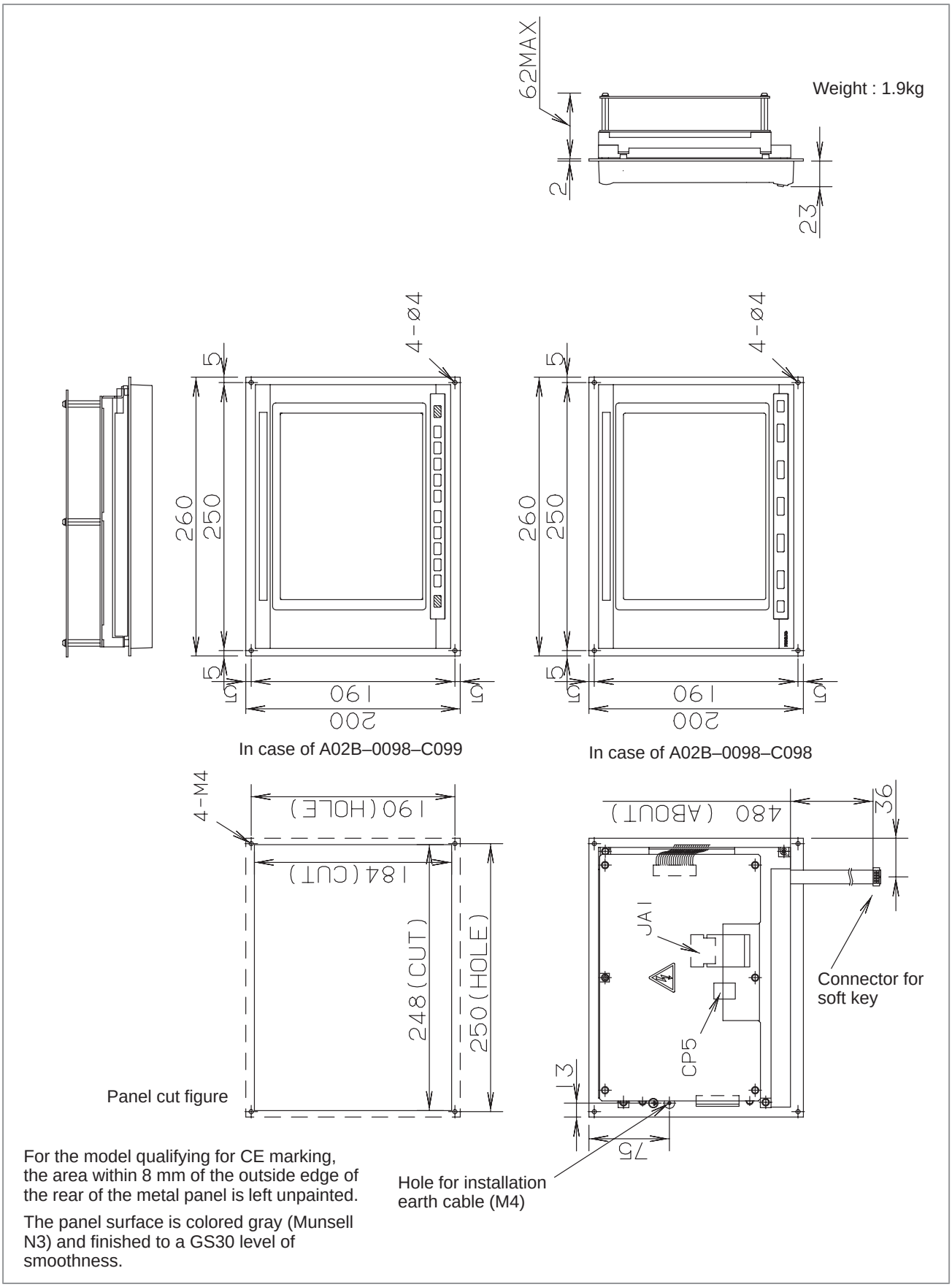
Fig. U3 (e) Remote type PDP unit (A02B–0098–C136)



For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

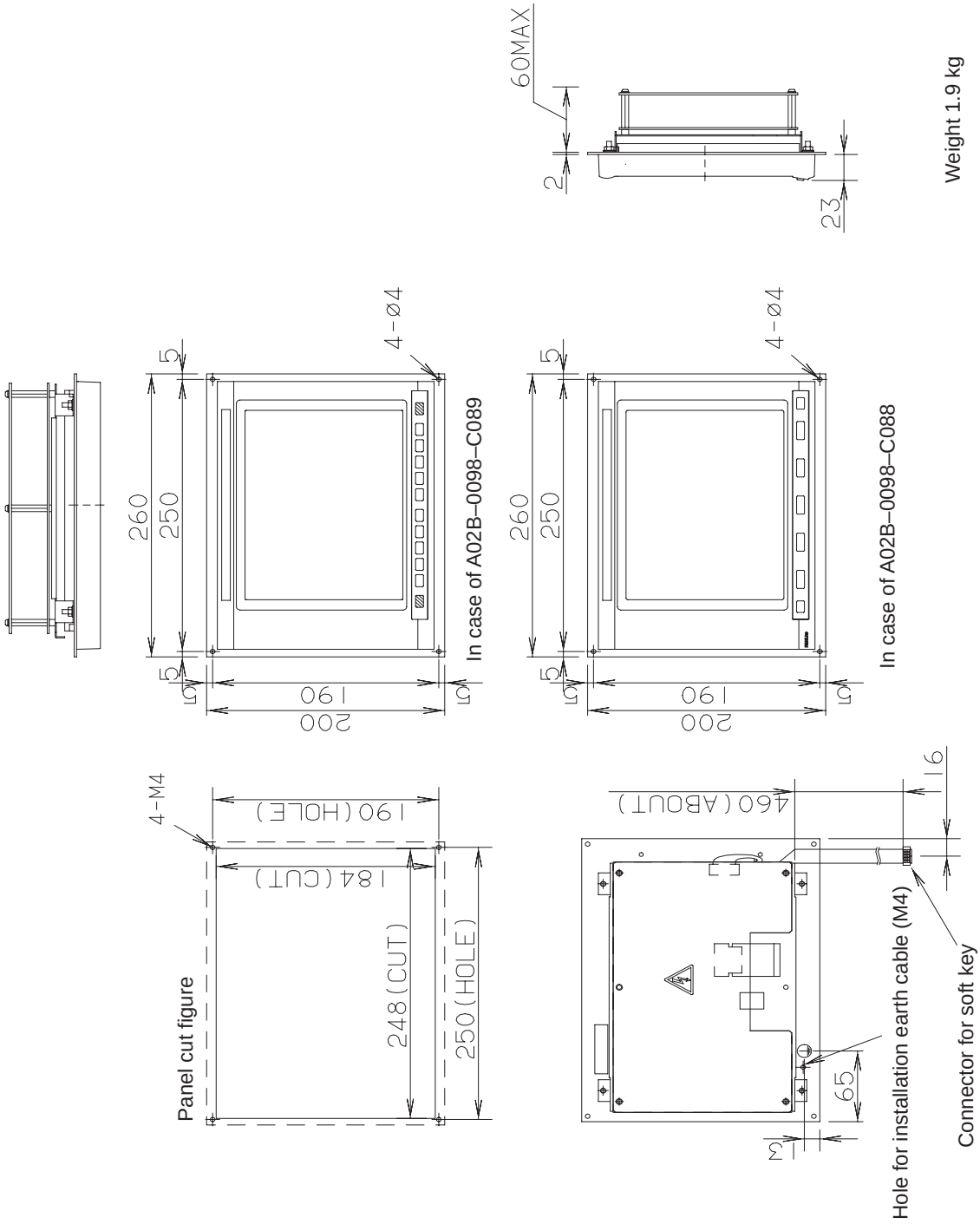
Fig. U3 (f) Remote type 7.2″ LCD unit



For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U3 (g) Remote type 8.4″ LCD unit



For the model qualifying for CE marking, the area within 8 mm of the outside edge of the rear of the metal panel is left unpainted.

The panel surface is colored gray (Munsell N3) and finished to a GS30 level of smoothness.

Fig. U3 (h) Separate type 8.4″ LCD unit

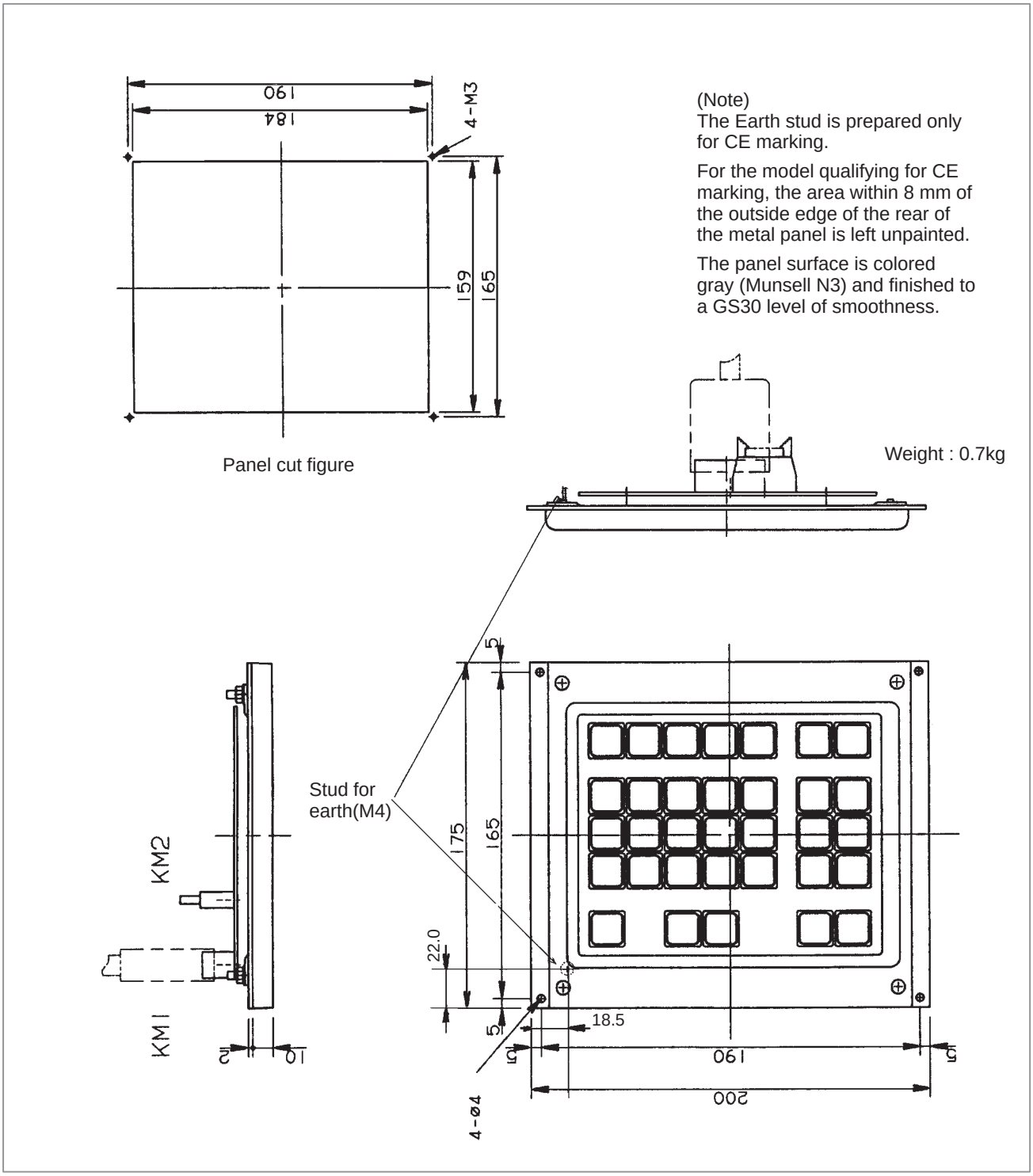


Fig. U4 (a) MDI unit (Small type)

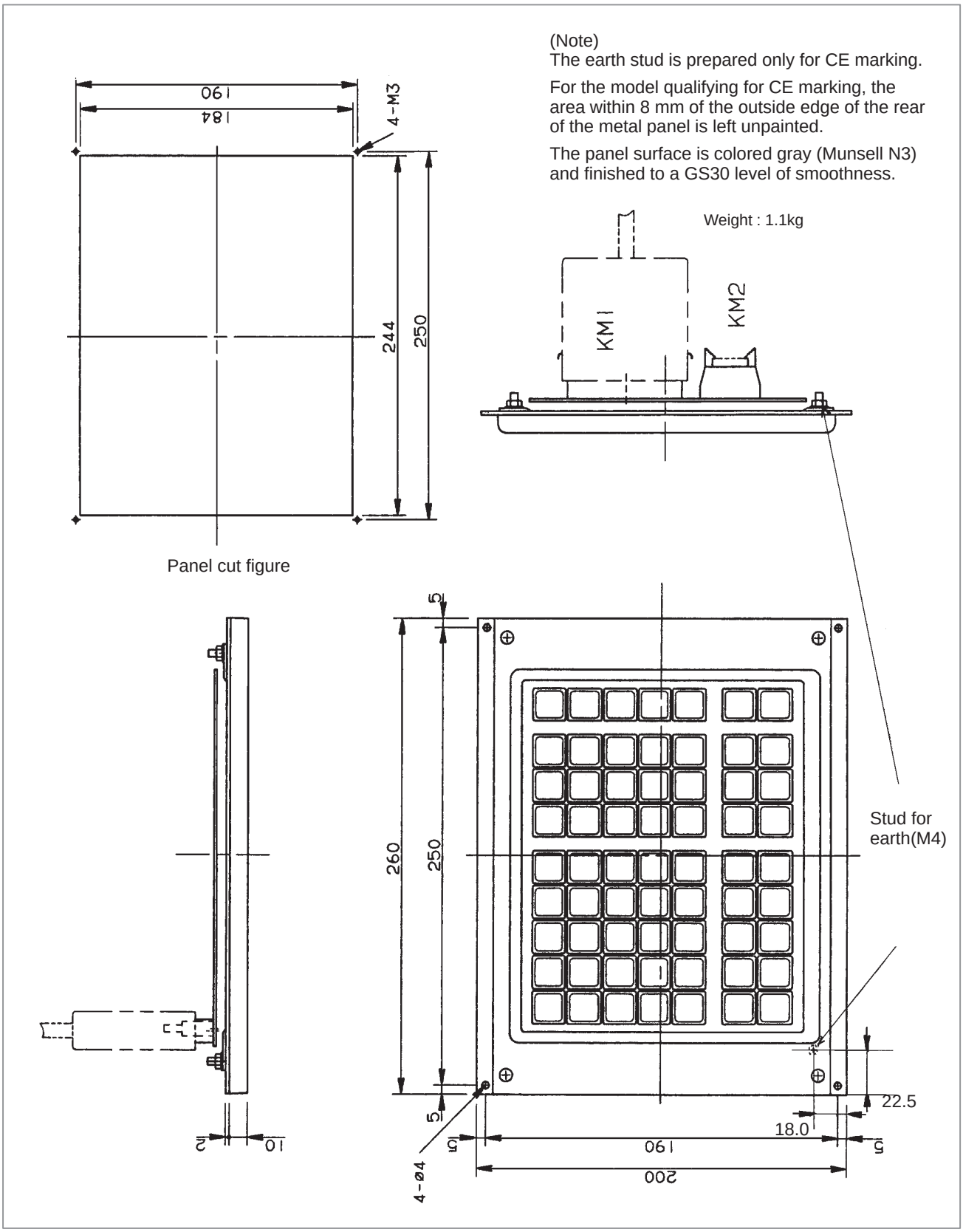


Fig. U4 (b) MDI unit (Full key type)

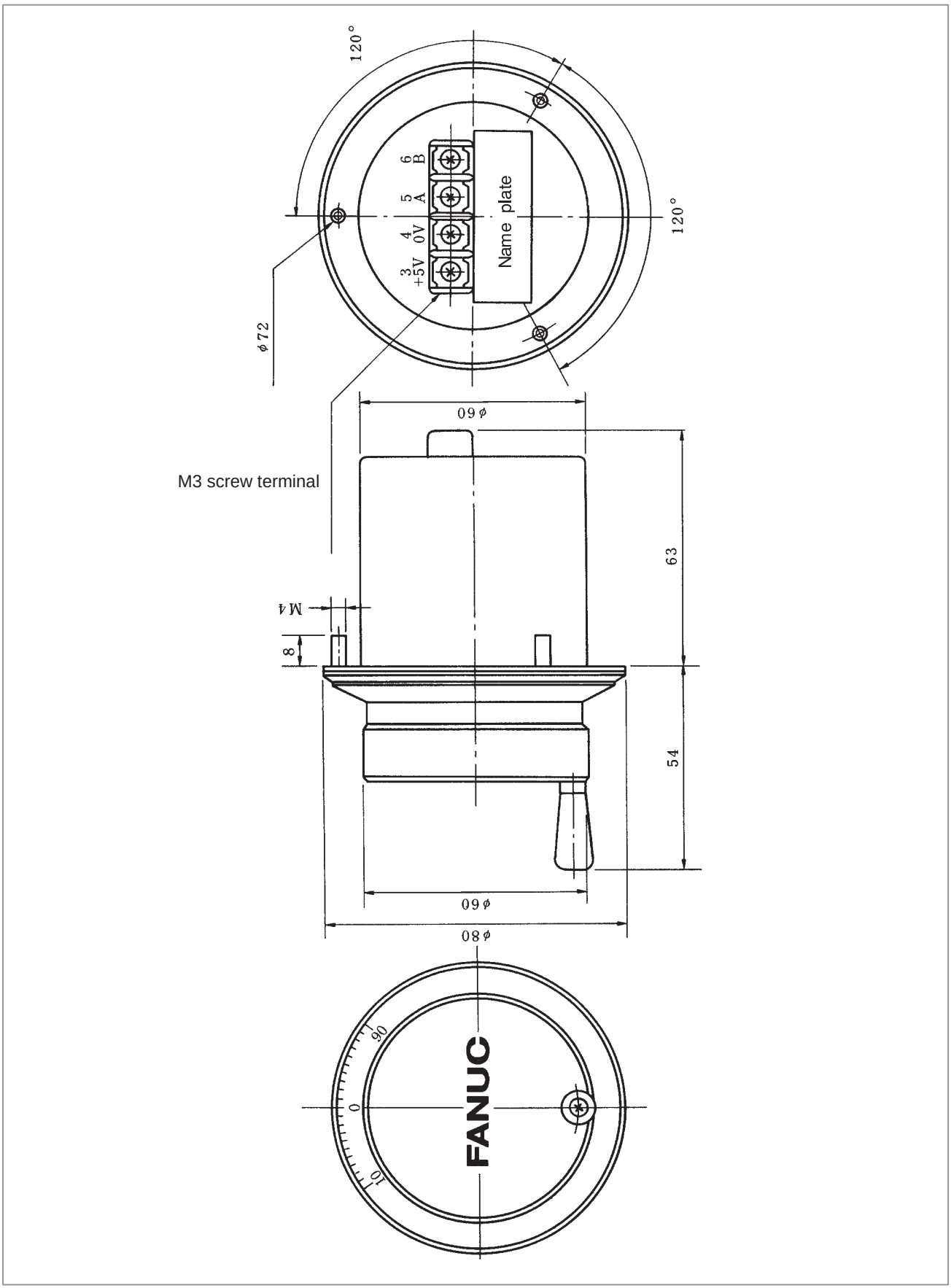


Fig. U5 (a) Manual pulse generator (A–860–0201–T001)

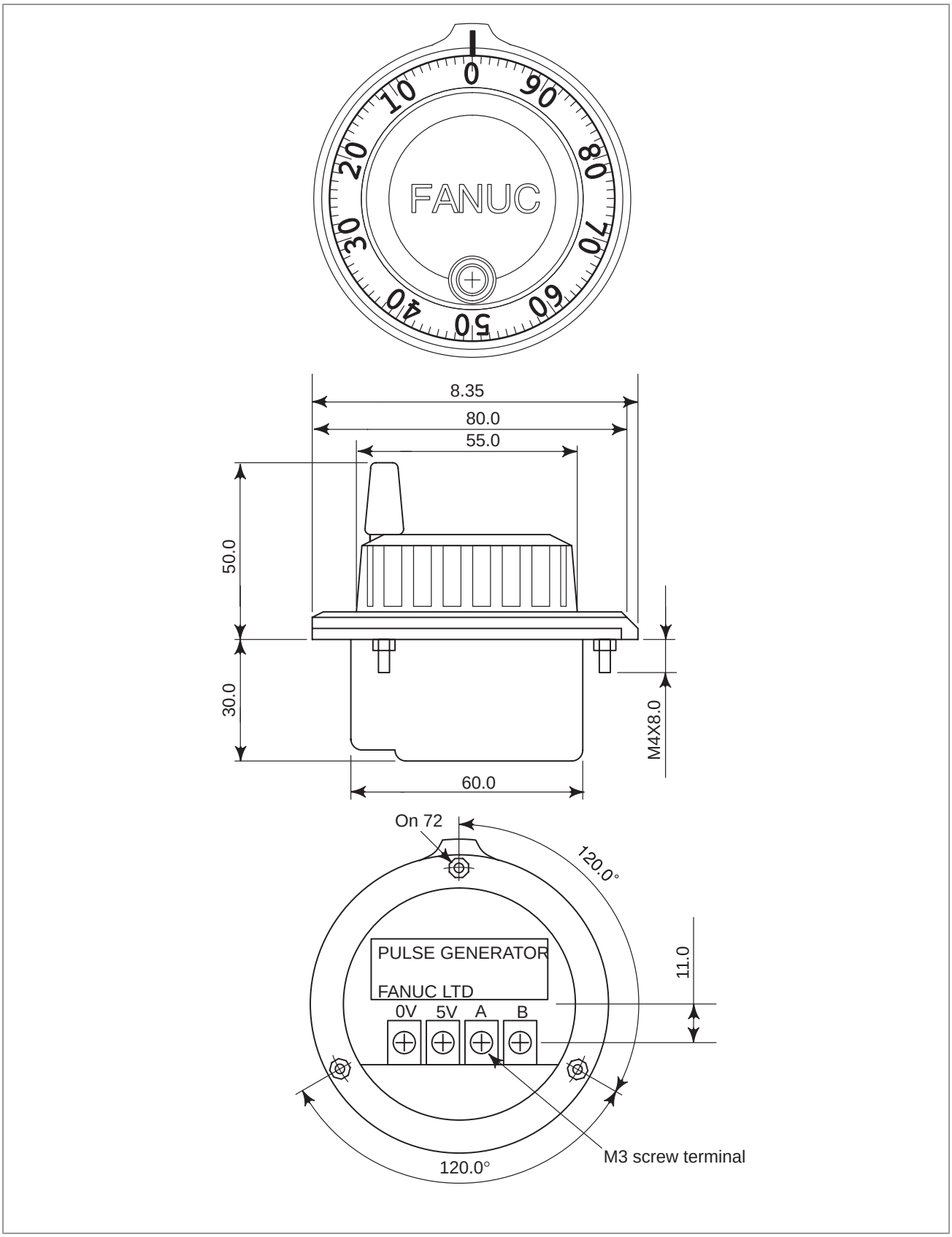


Fig. U5 (b) Manual pulse generator (A860–0202–T001)

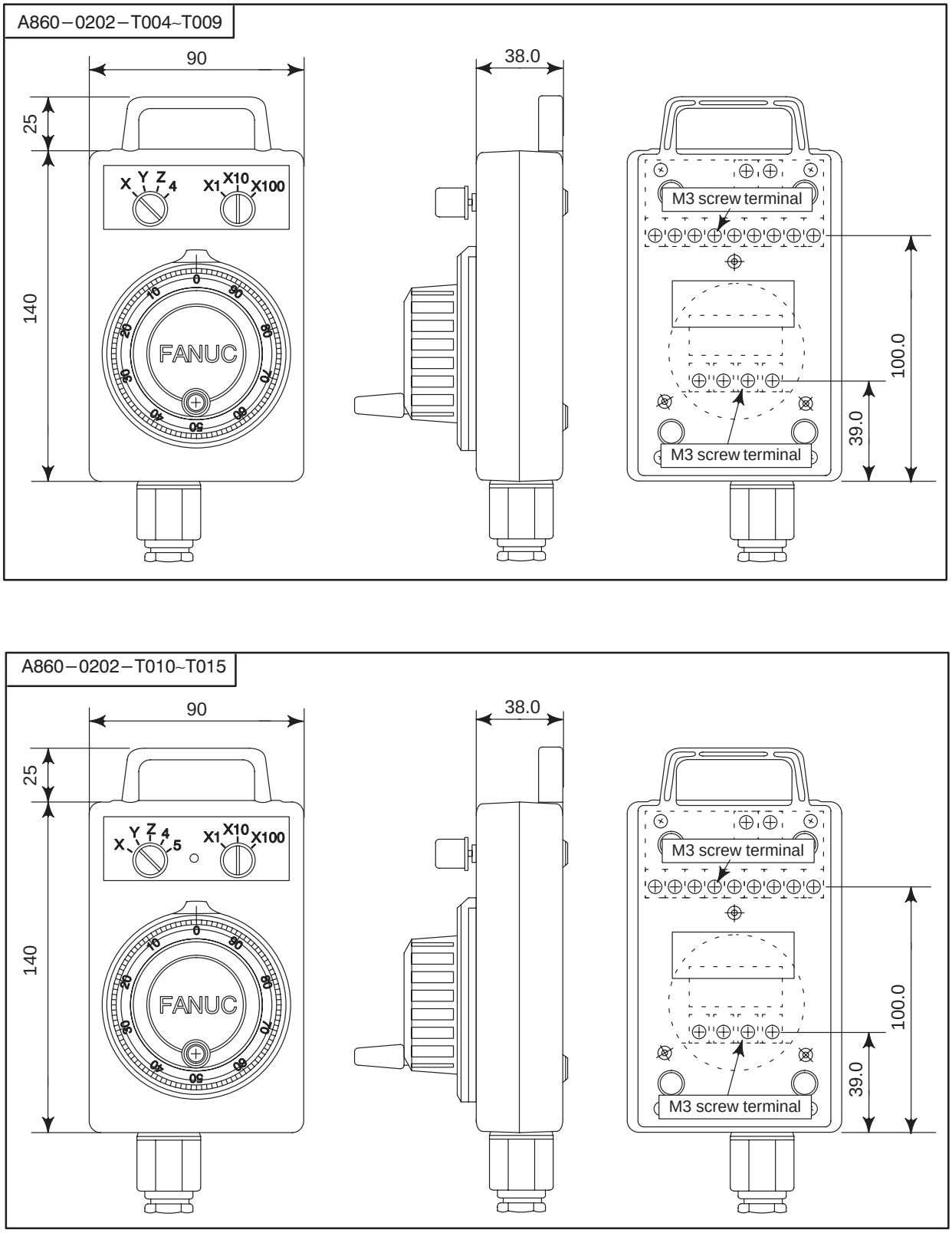


Fig. U5 (c) Pendant type manual pulse generator (A860–0202–T004 to T015)

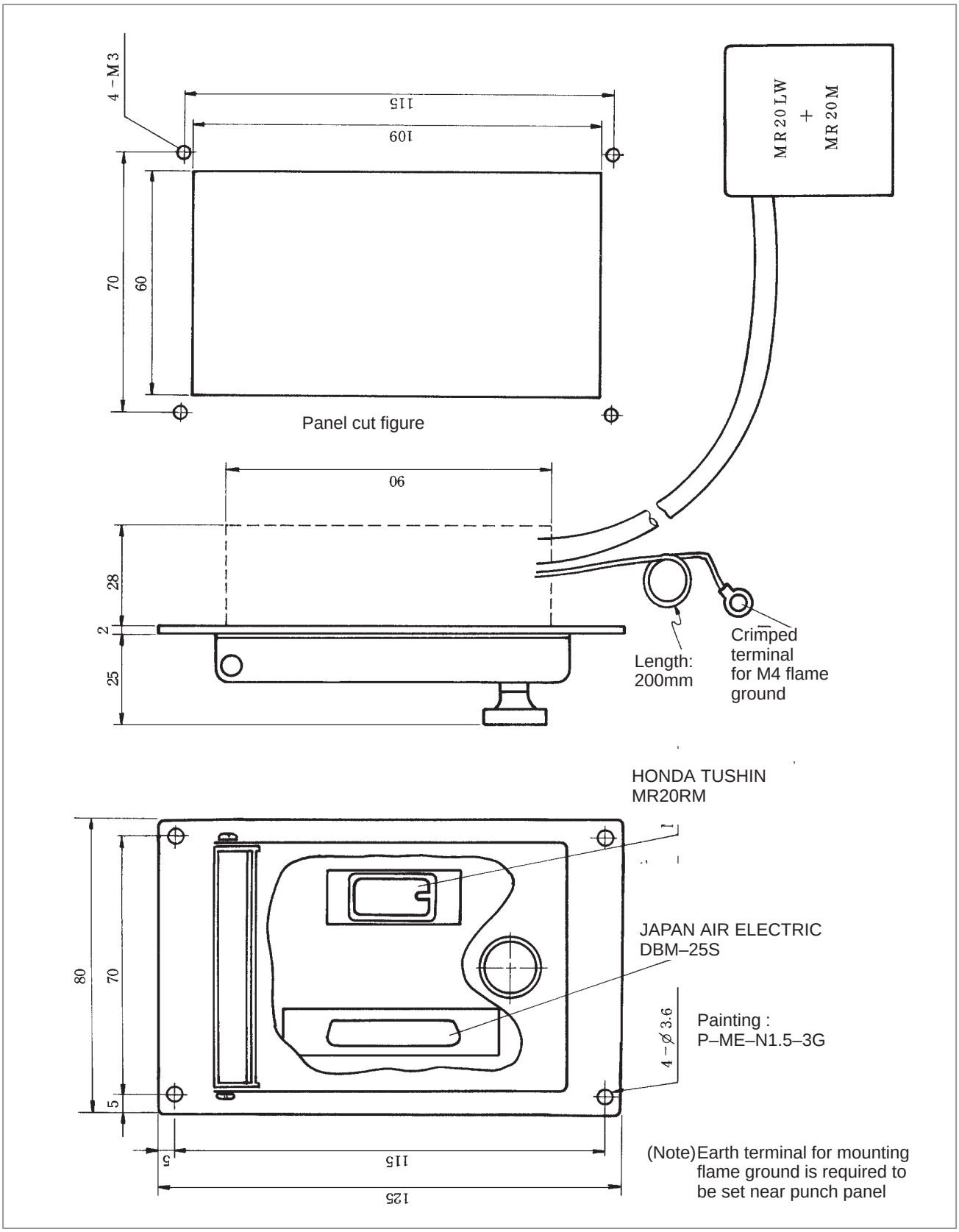


Fig. U6 Punch panel

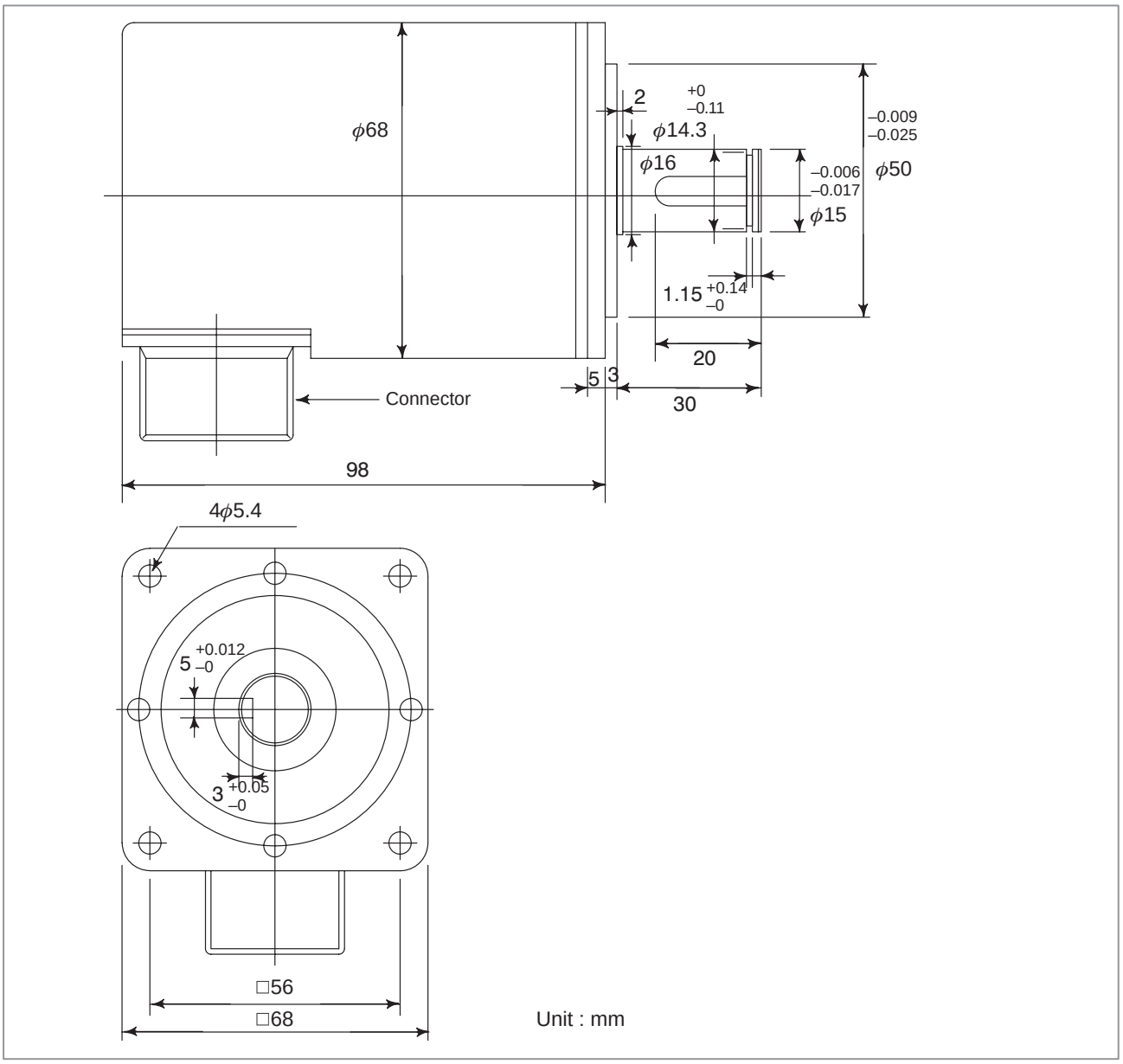


Fig. U7 (a) Diagram of position coder A86L–0027–0001#102 : Max. 4000rpm
A86L–0027–0001#002 : Max. 6000rpm

NOTE

Mechanical specifications of the position coder are as follows :

(1) Input axis inertia 1.0×10^{-3} kg,cm,sec^2 or less

(2) Input axis starting torque 1000g,cm or less

(3) Input axis permissible loads

	Radial	Thrust
Operation	1kg or less	1kg or less
Idle	20kg or less	10kg or less

Attach a pulley directly to the position coder shaft and drive the timing belt. Note that the loads conform with the above allowable value.

(4) Weight 1kg or less

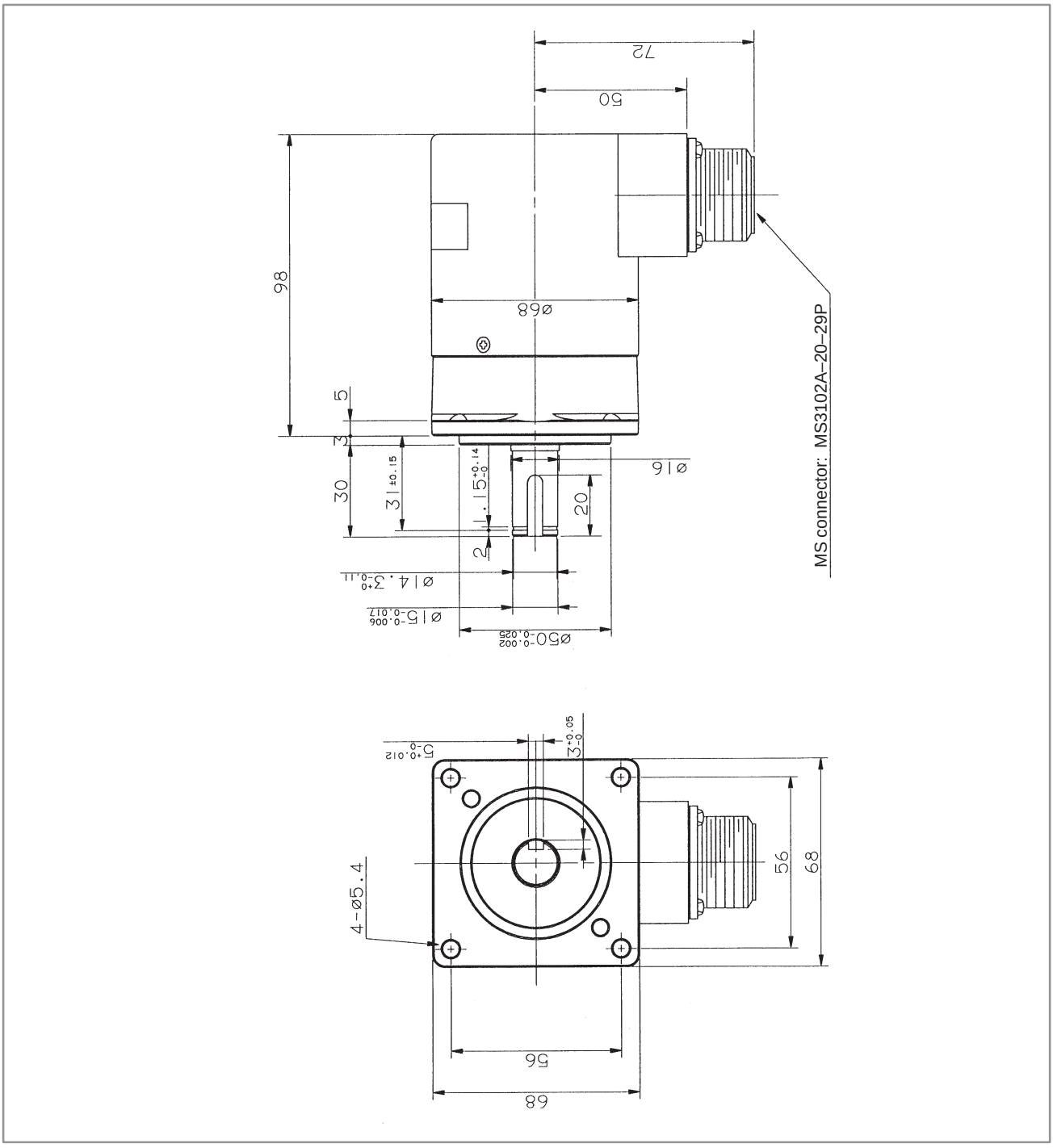


Fig. U7 (b) α **position coder**
Specification No.: A860–0309–T302 (10000 rpm maximum)

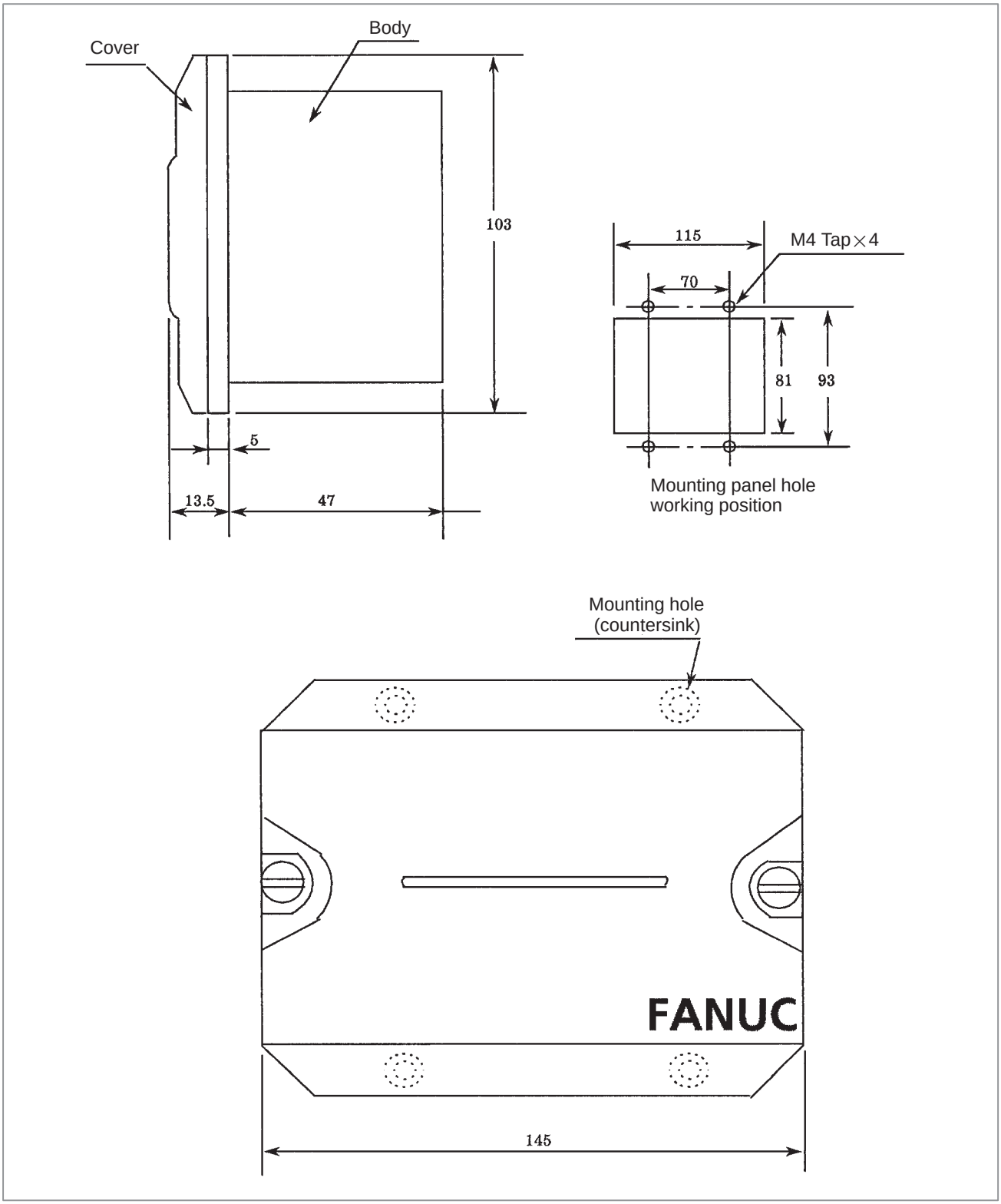


Fig. U8 (a) Battery unit for CNC

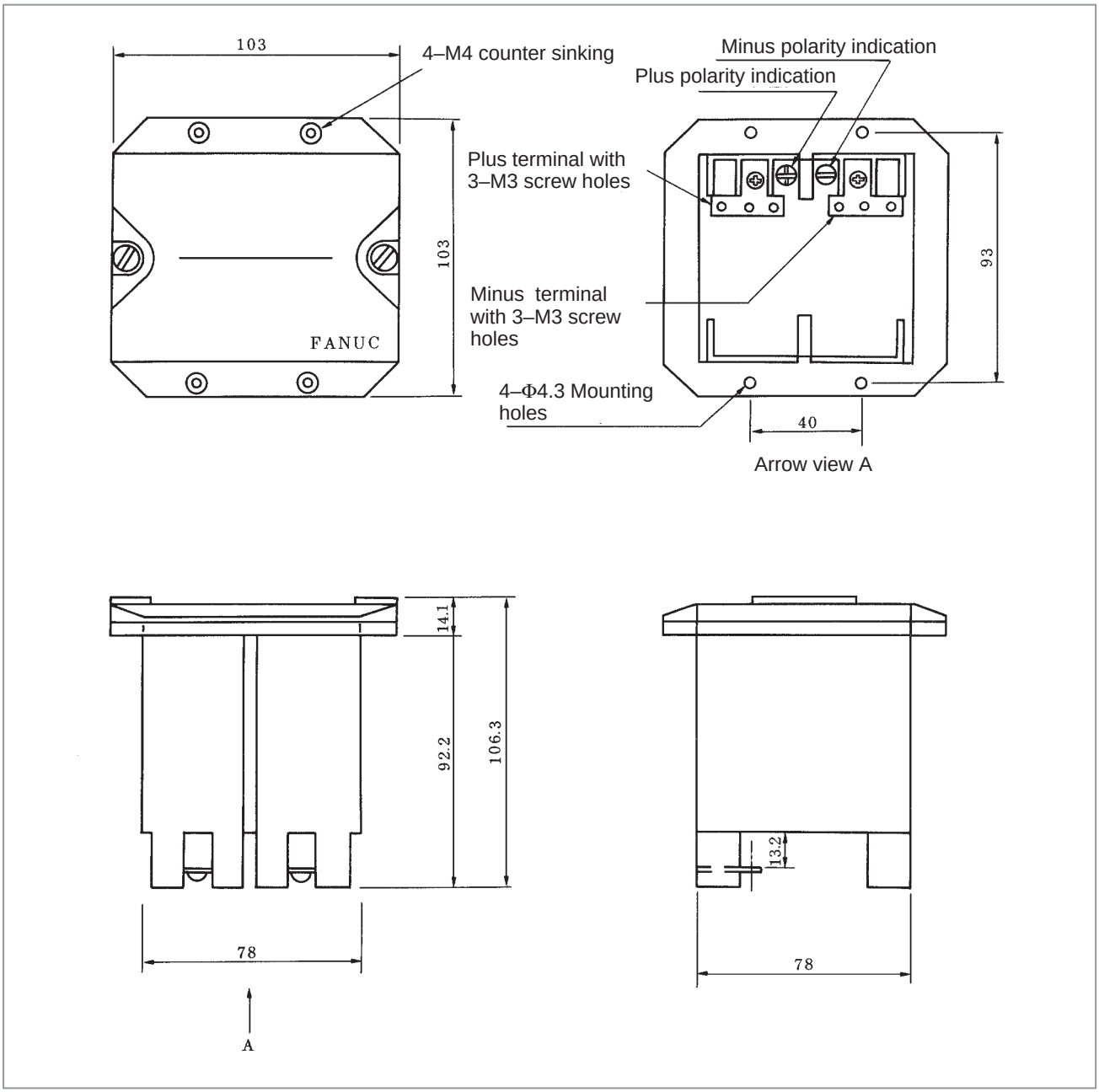
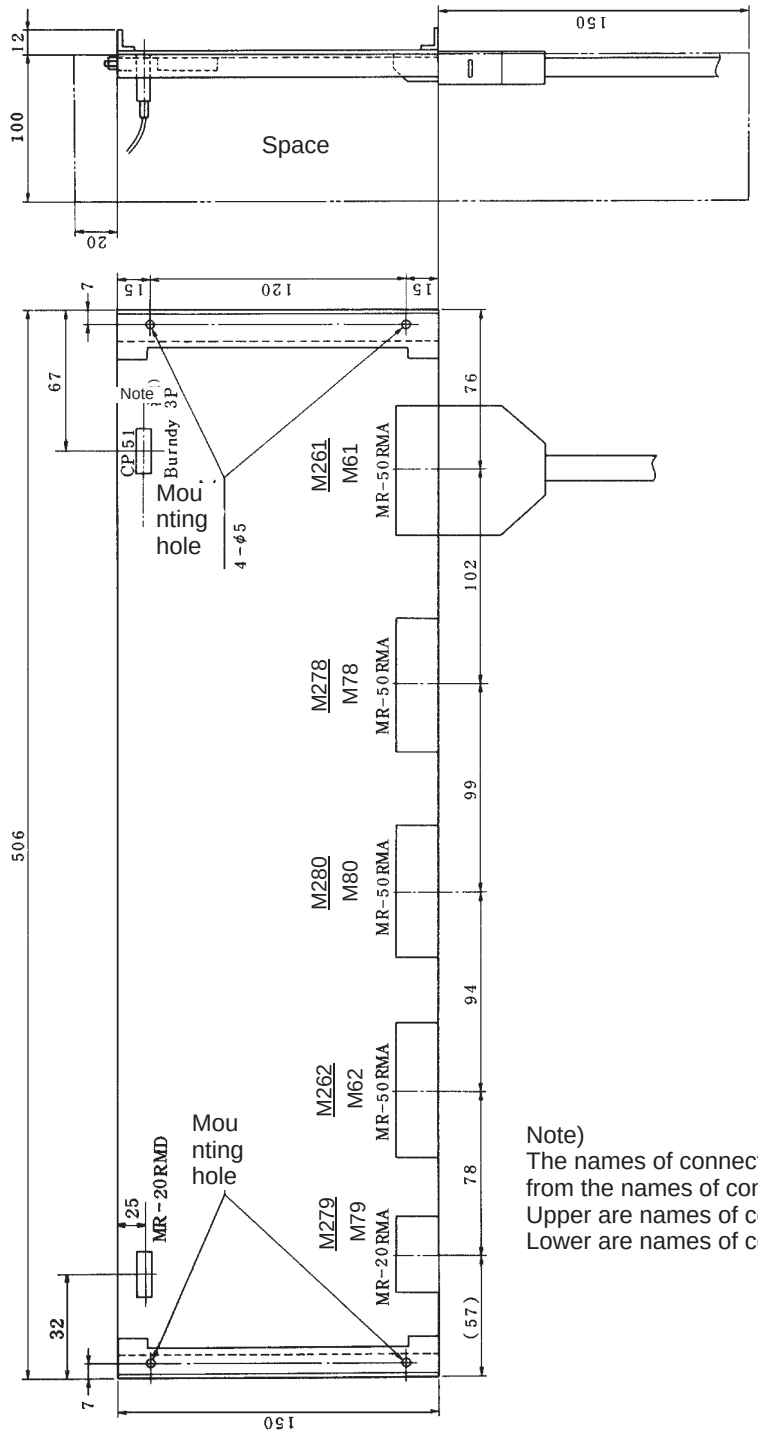
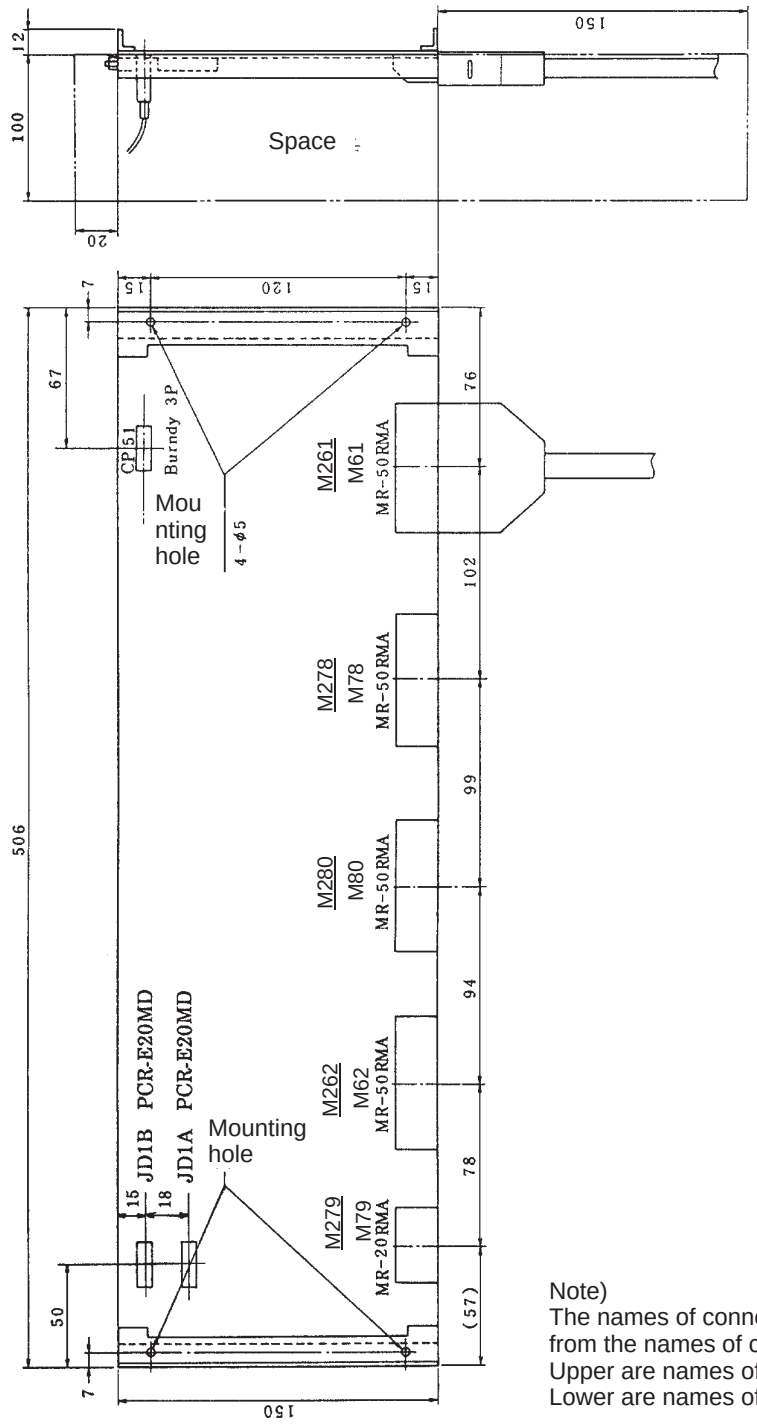


Fig. U8 (b) Battery case for absolute pulse coder



Note)
The names of connector I/O–B2 is different from the names of connector I/O–F1.
Upper are names of connector I/O–F1.
Lower are names of connector I/O–B2.

Fig. U9 (a) Additional I/O B2 and I/O F1



Note)
The names of connector I/O–B3 is different from the names of connector I/O–F3.
Upper are names of connector I/O–F3.
Lower are names of connector I/O–B3.

Fig. U9 (b) Additional I/O–B3 and I/O–F3

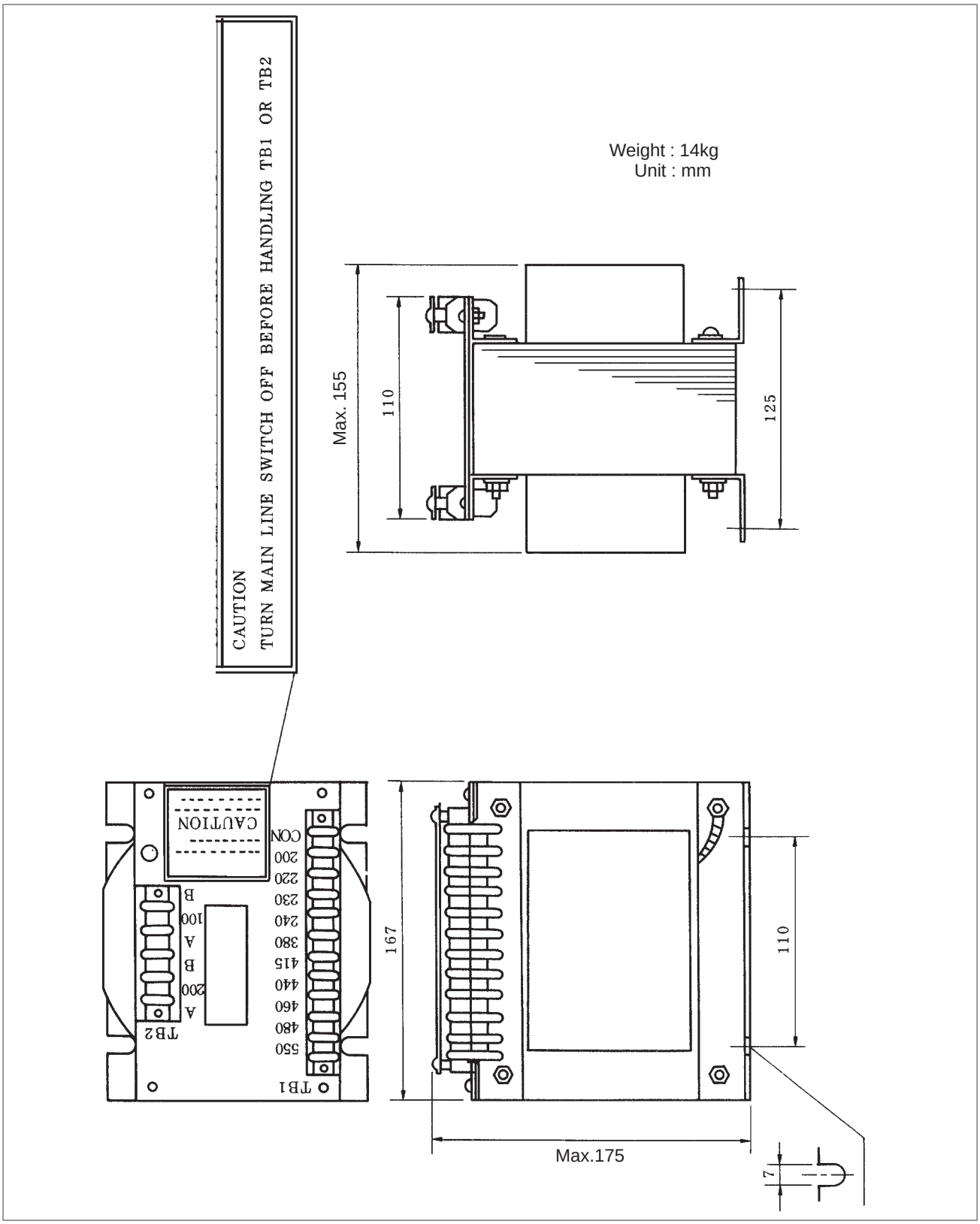


Fig. U10 Control transformer (A80L–0001–0176)

CAUTION
Switch off the main line switch when TB1 and TB2 are touched.

Specification of control transformer

(1) Primary sie rated voltage
AC200V/220V/230V/380V/415V/440V/460V/480V/550V

(2) Voltage fluctuation
Primary sie rated voltage + 10% and –15%

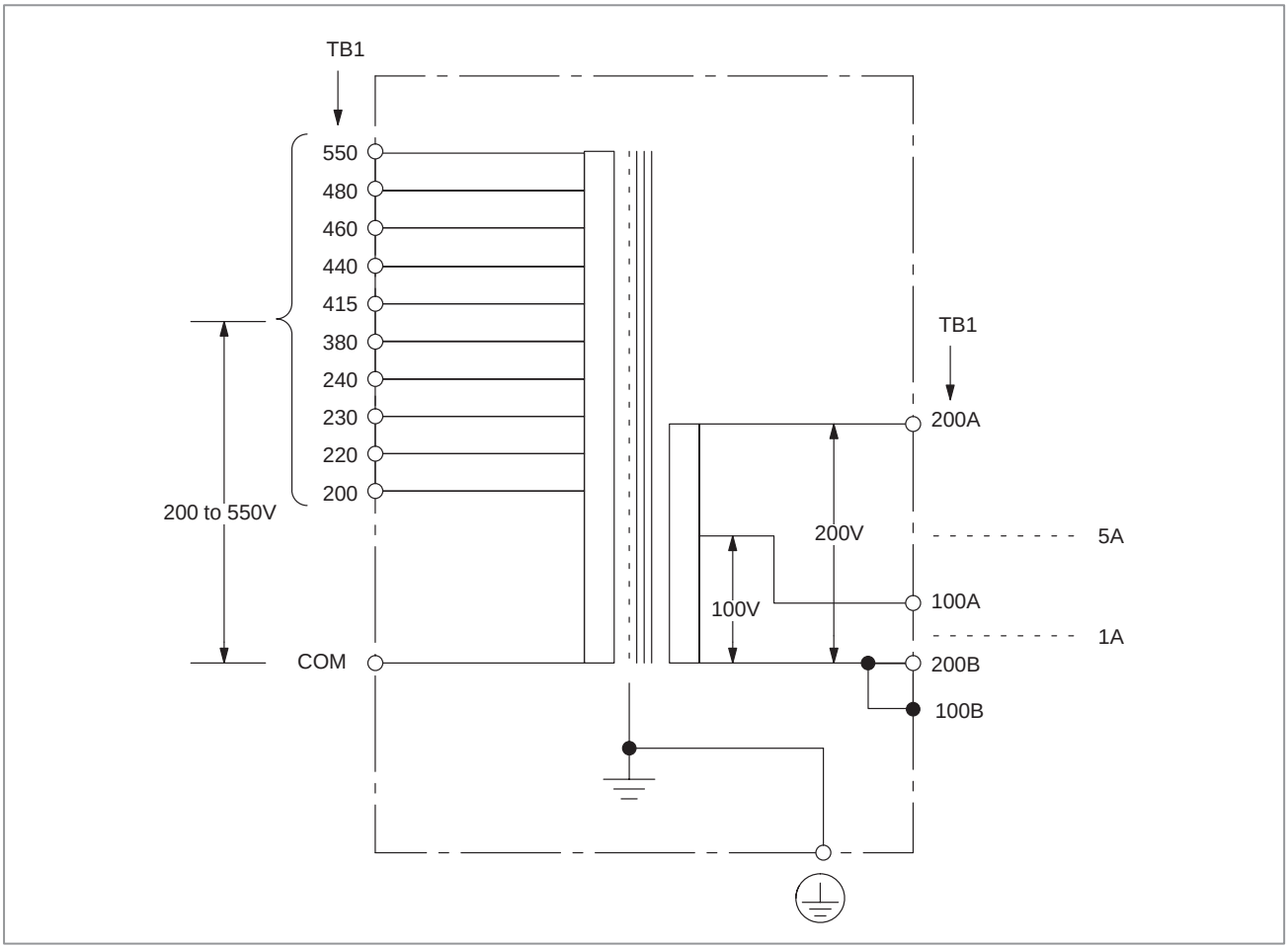
(3) Frequency
50Hz/60Hz±3Hz

(4) Secondary side line voltage

(5) Secondary side voltage deviation
Less than±3%

(6) Secondary side voltage regulation
Less than 7%

(7) Transformer ambient temperature and humidity
–5°C+60°C 10 to95% (Relative humidity)



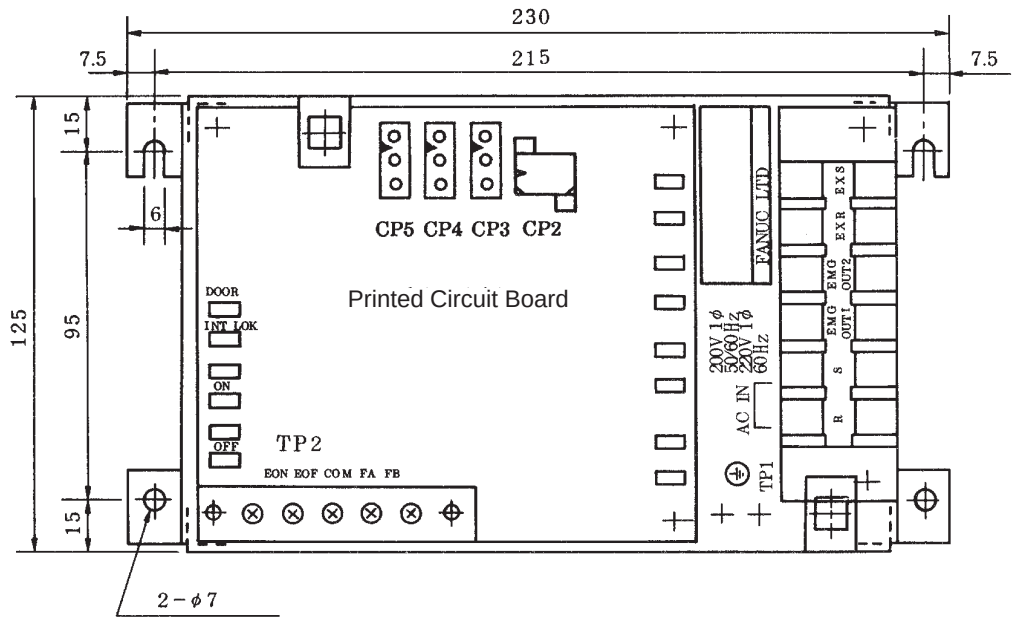
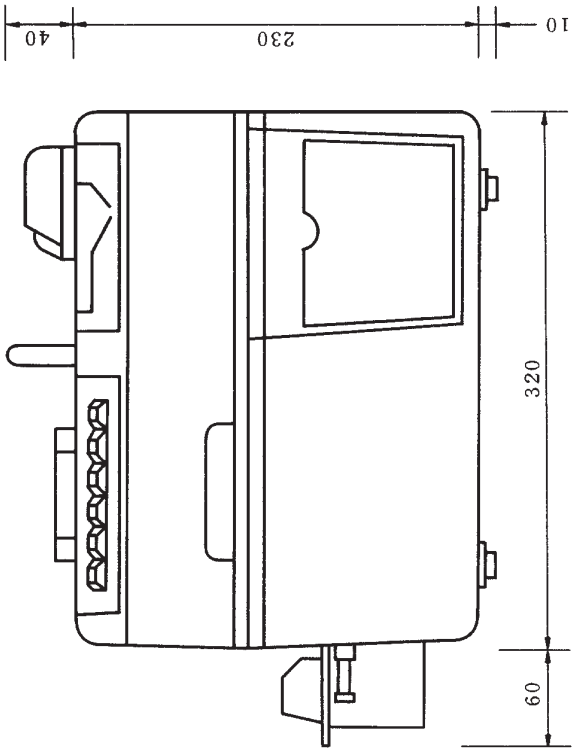


Fig. U11 Input unit



Cable length : 1.5m
Weight : approx. 1.2kg
Unit : mm

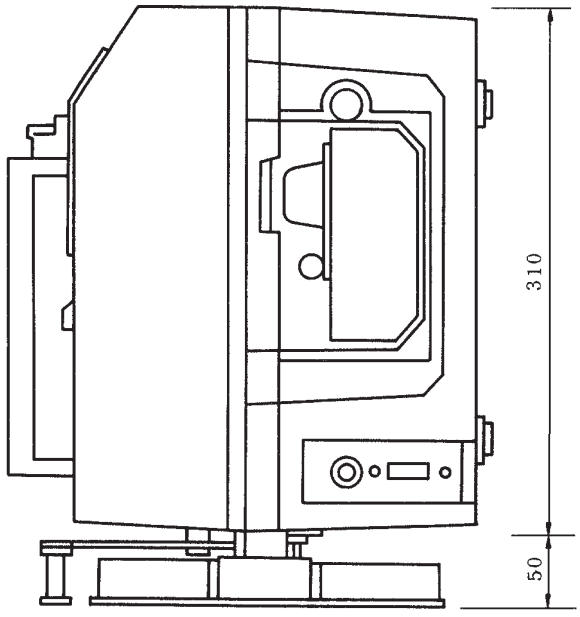
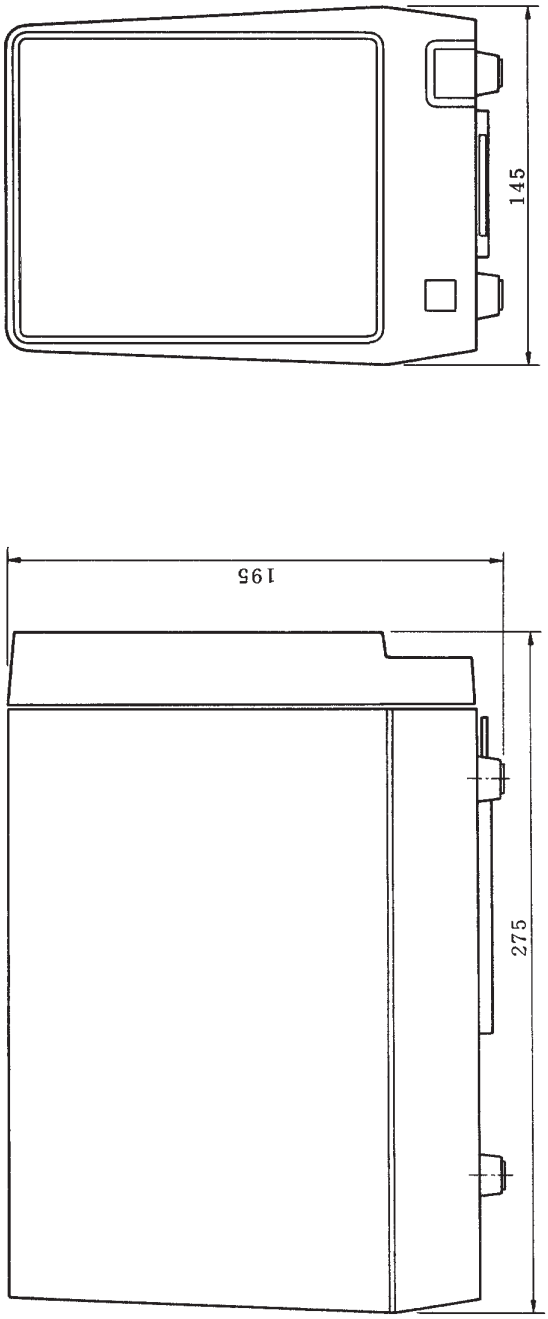


Fig. U12 FANUC PPR



Cable length: 1.5m
Weight : 3.3kg
Unit : mm

Fig. U13 FANUC Floppy Cassette Adapter (2DD)

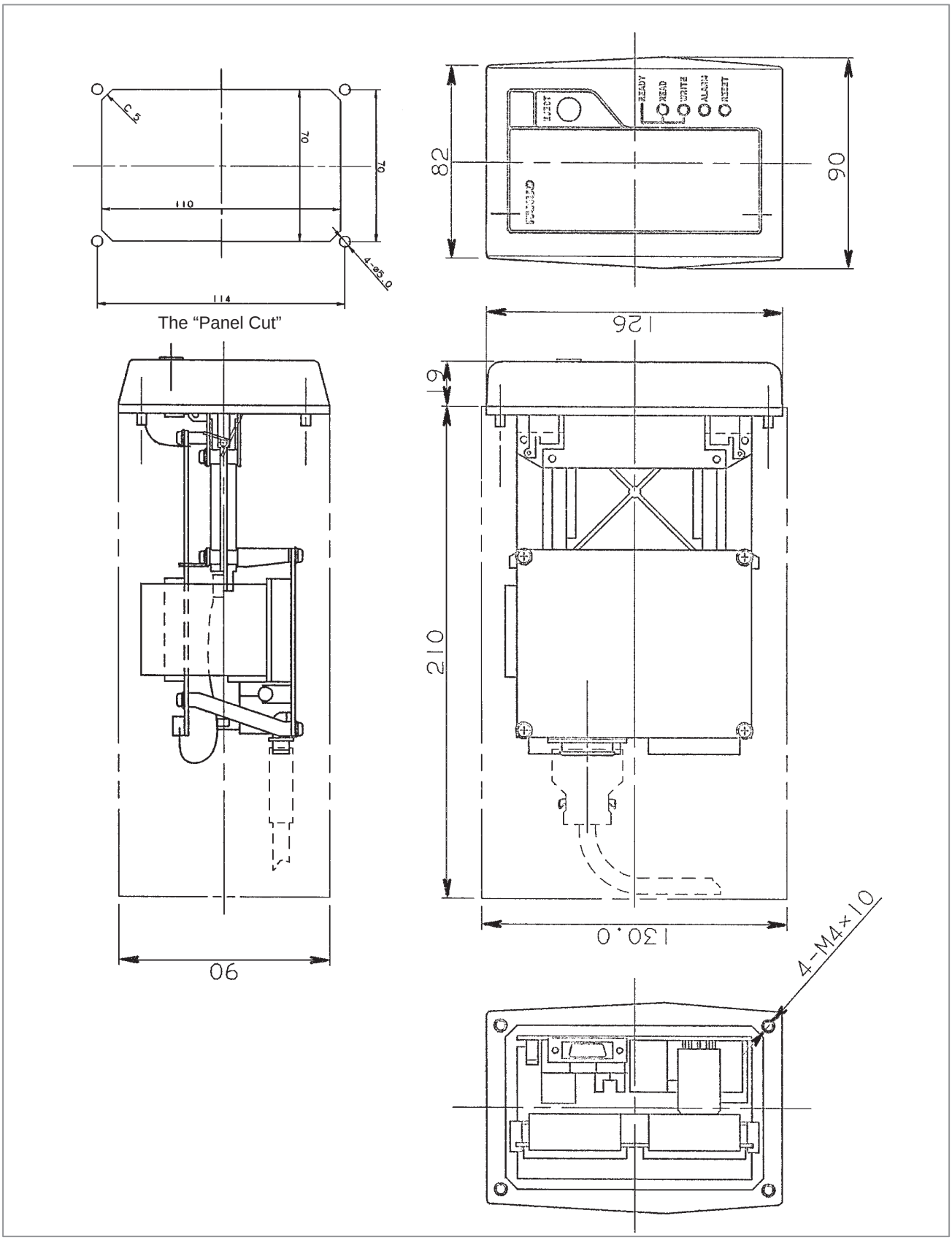


Fig. U14 Integrated type FA card adapter

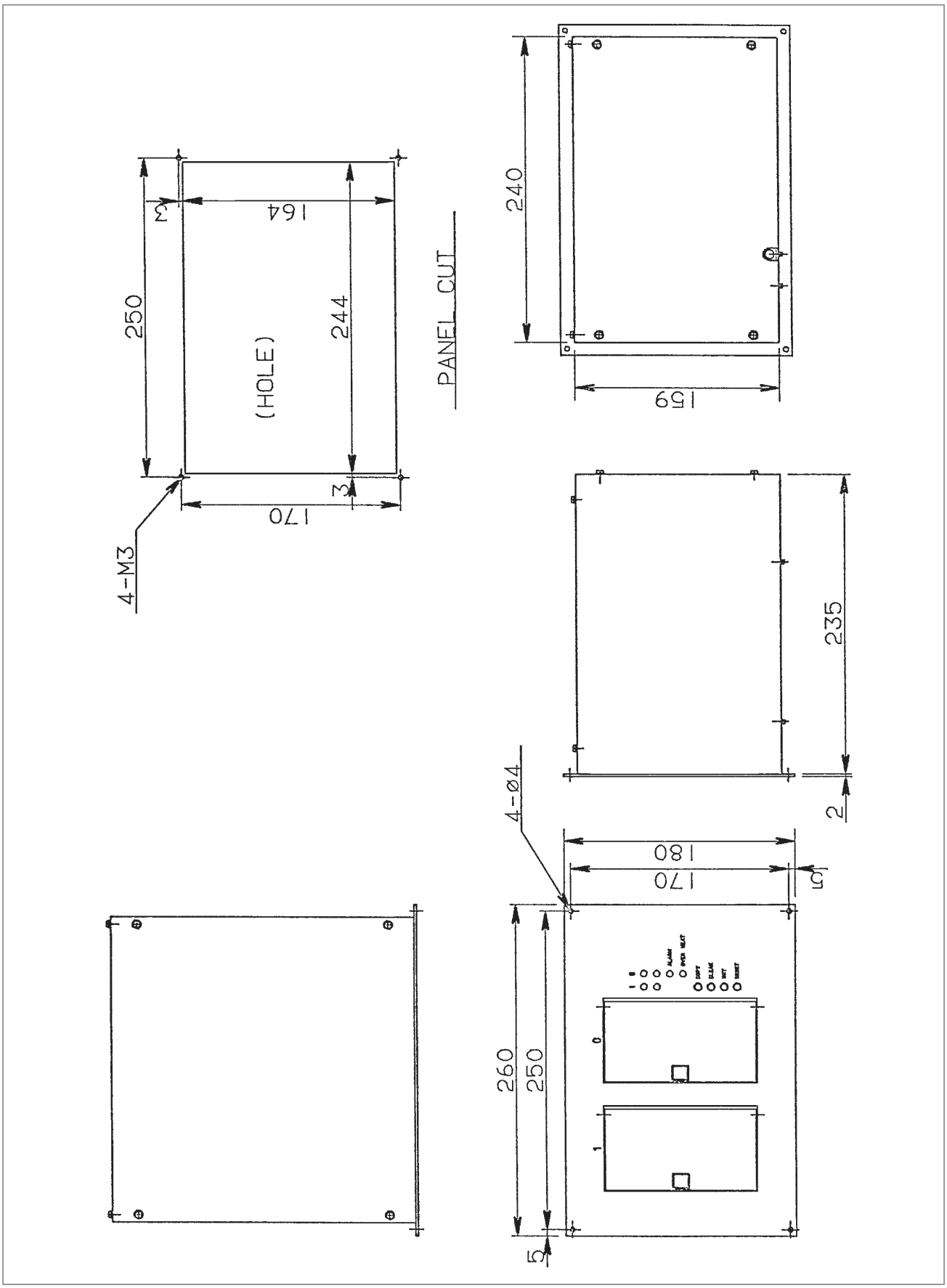


Fig. U15 Integrated type floppy cassette adapter

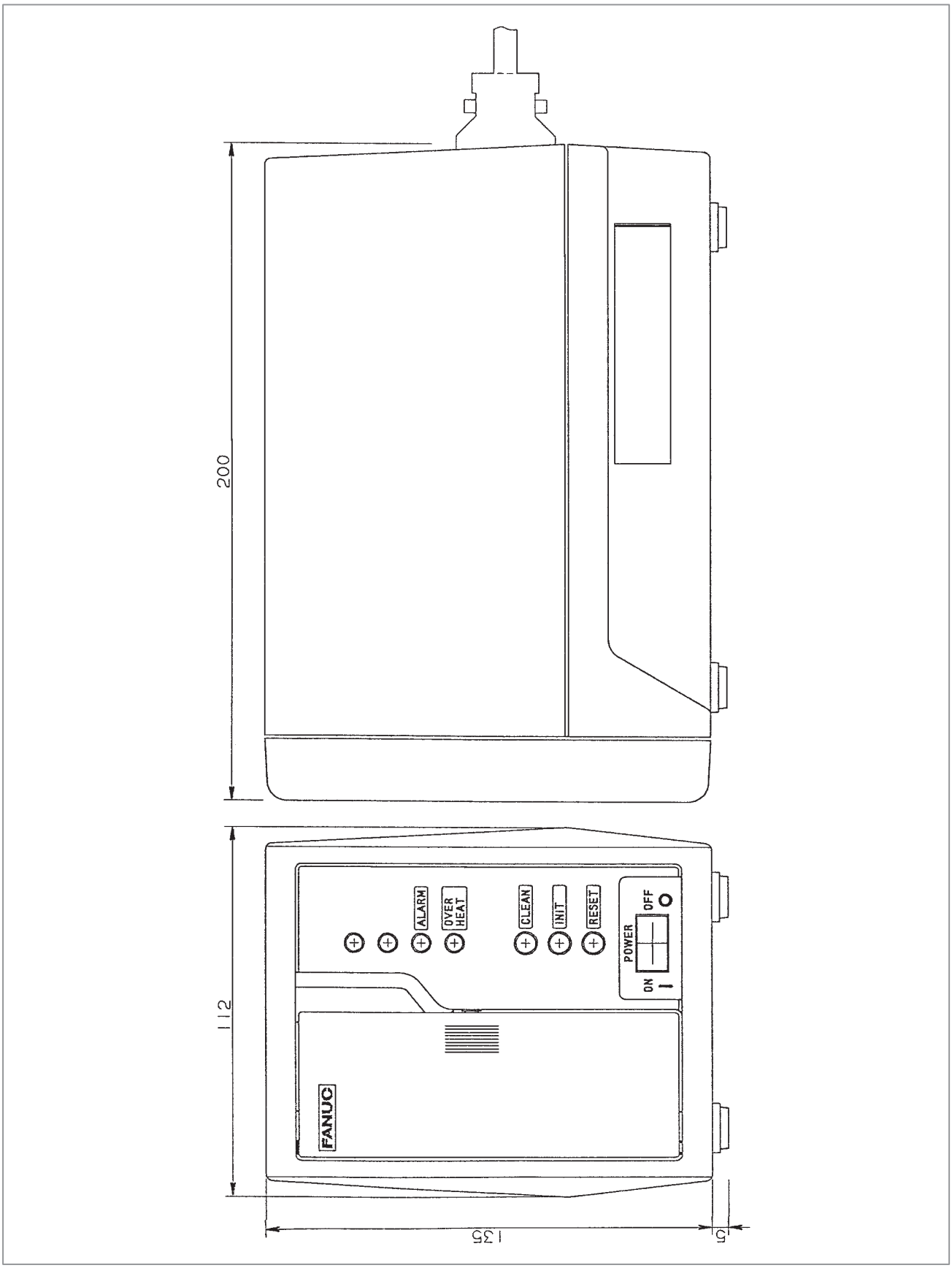


Fig. U16 Floppy Cassette Adapter (2HD)

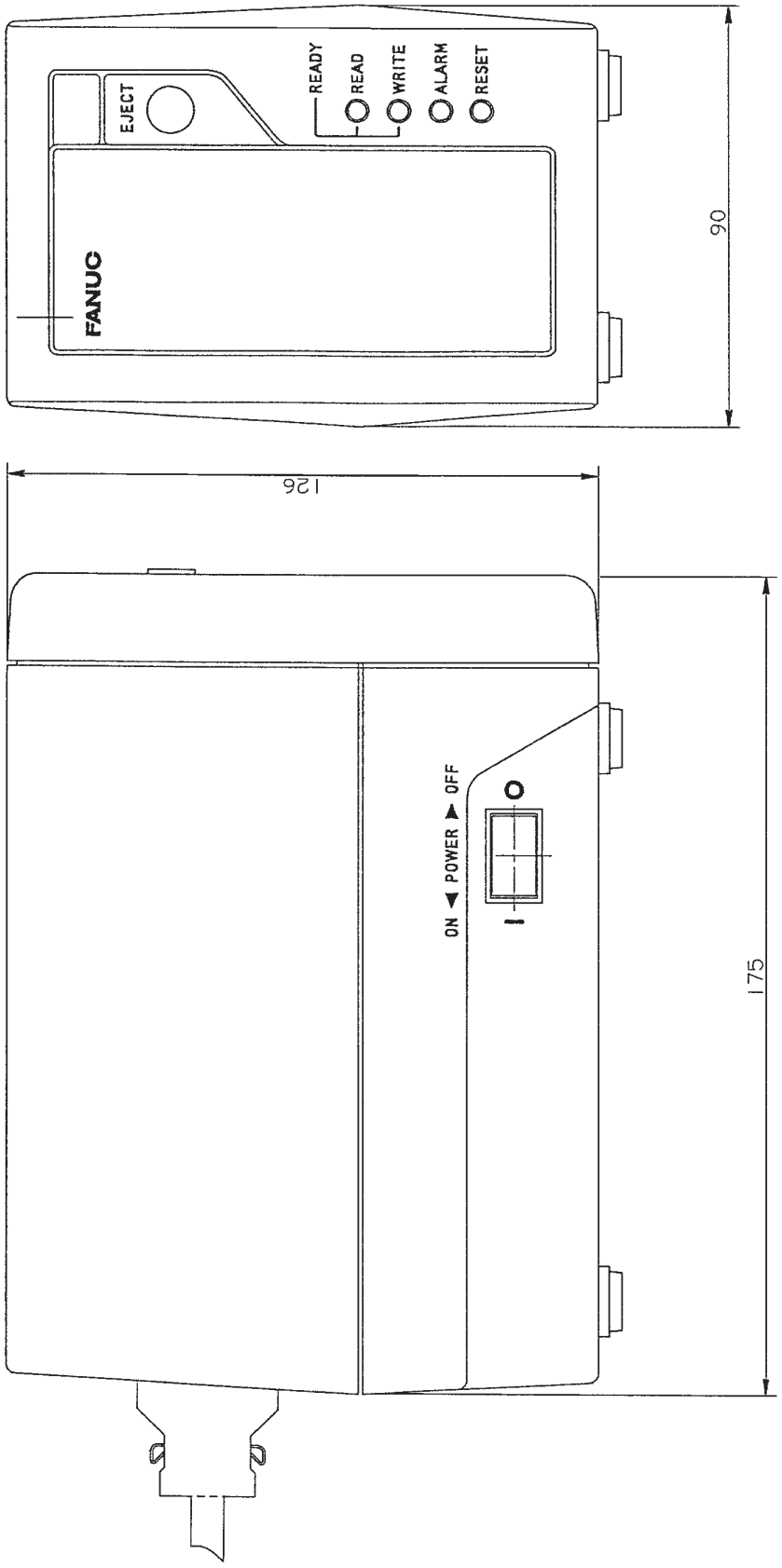
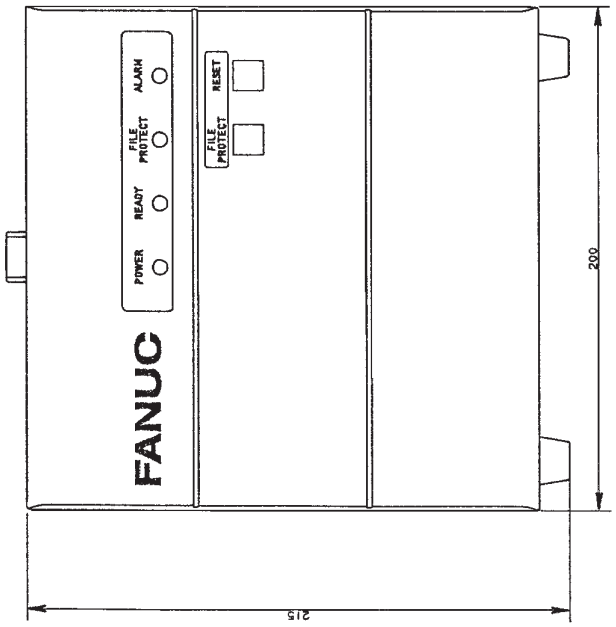


Fig. U17 FA card adapter



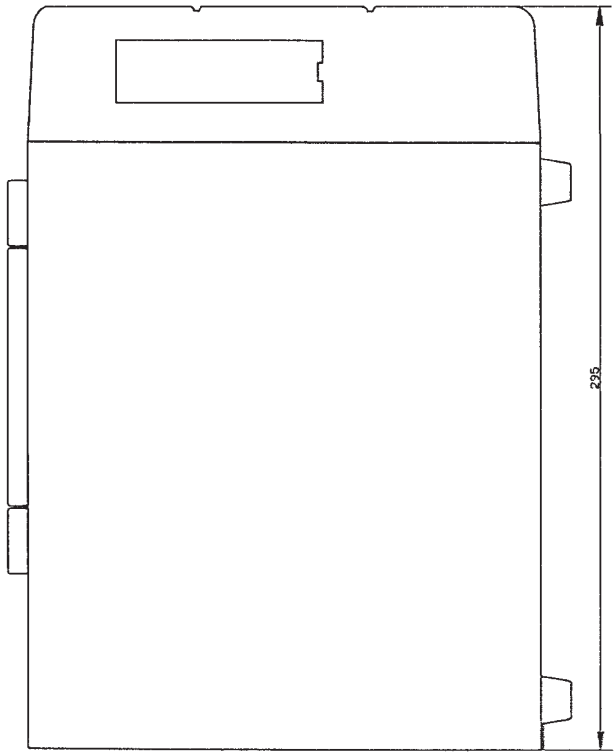
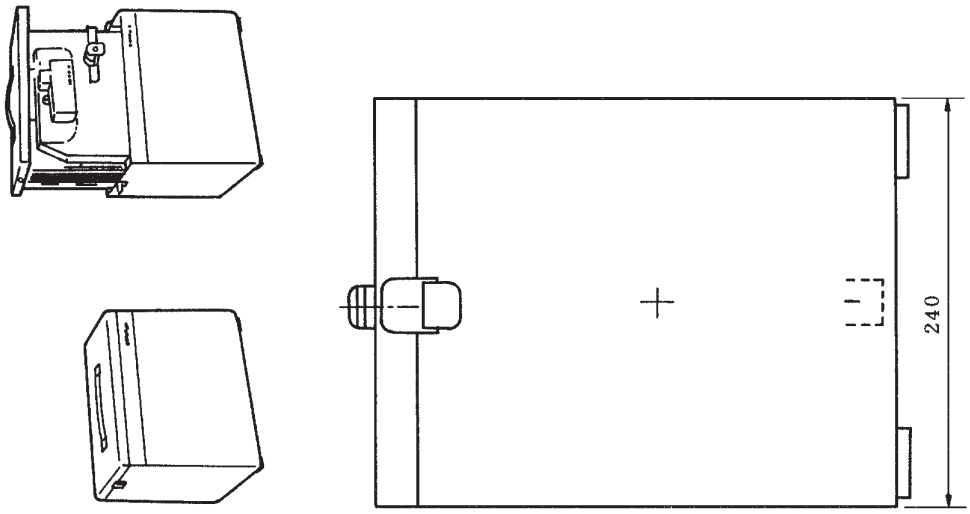


Fig. U18 Program file mate



Painting : Munsell No. 5GY3.5/0.5 leather tone finish
Weight : Approx. 15kg

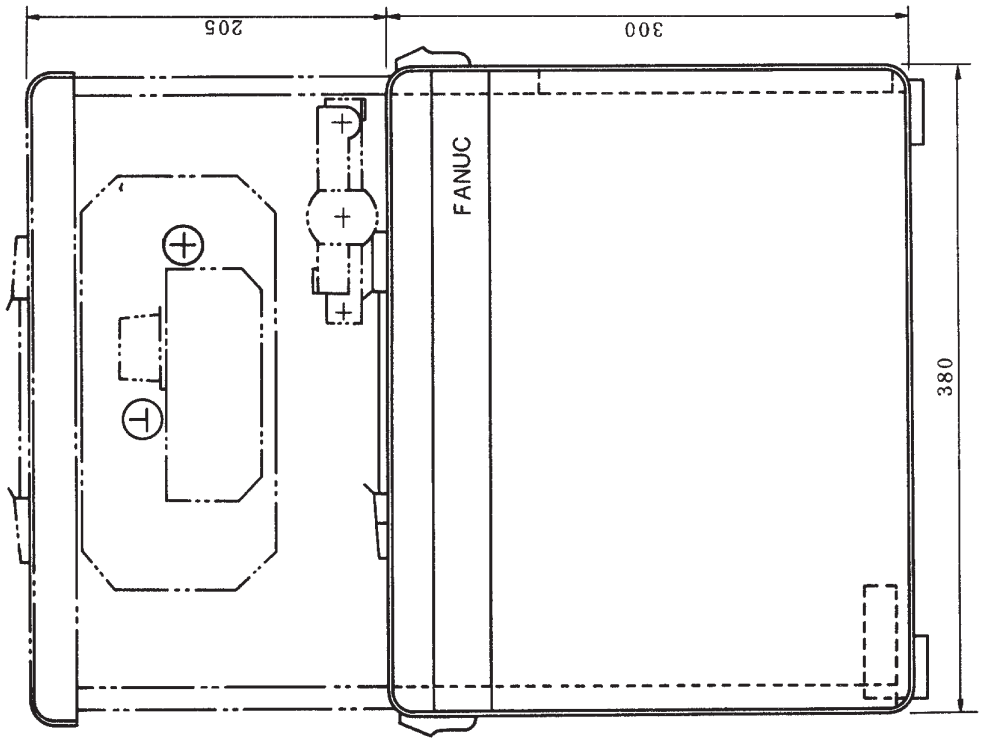


Fig. U19 (a) Portable tape reader

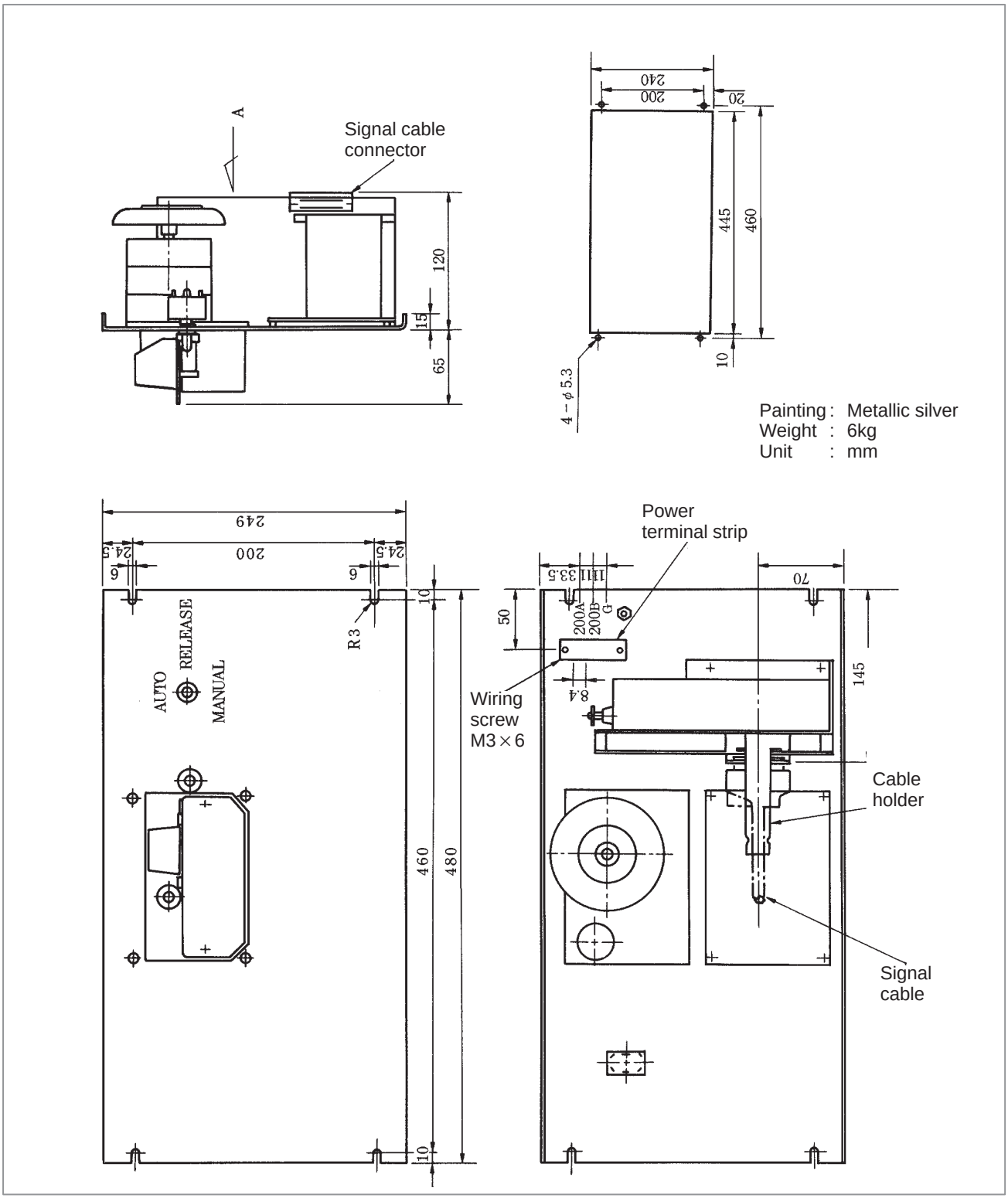


Fig. U19 (b) Tape reader without reels (With serial interface)

NOTE

Set the tape reader into it, from the rear side of panel with holes and secure with screws and nuts. If this is not convinient, attach a M5 stud in Φ5.3 hole and secure with a nut.

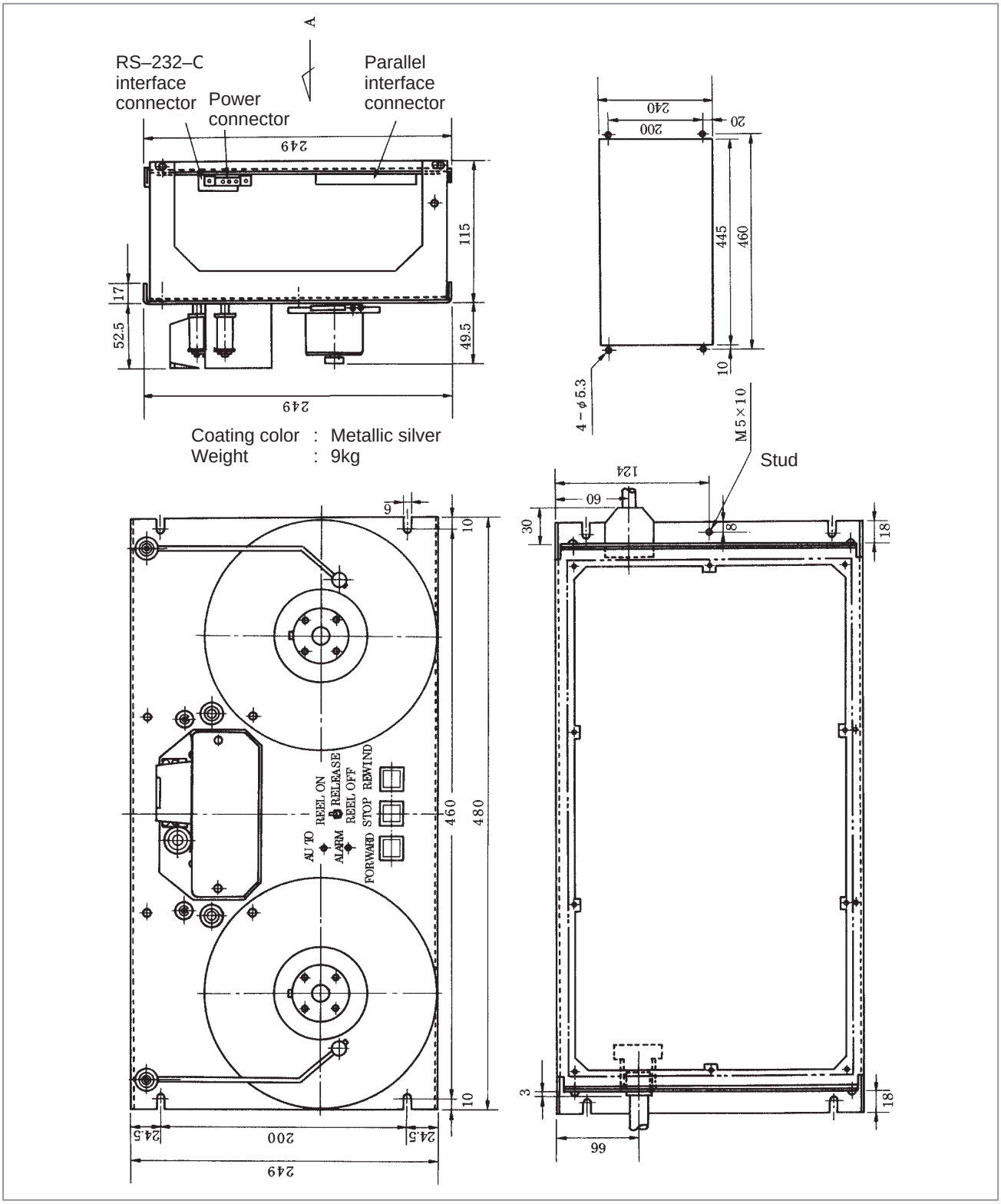


Fig. U19 (c) Tape reader with reels

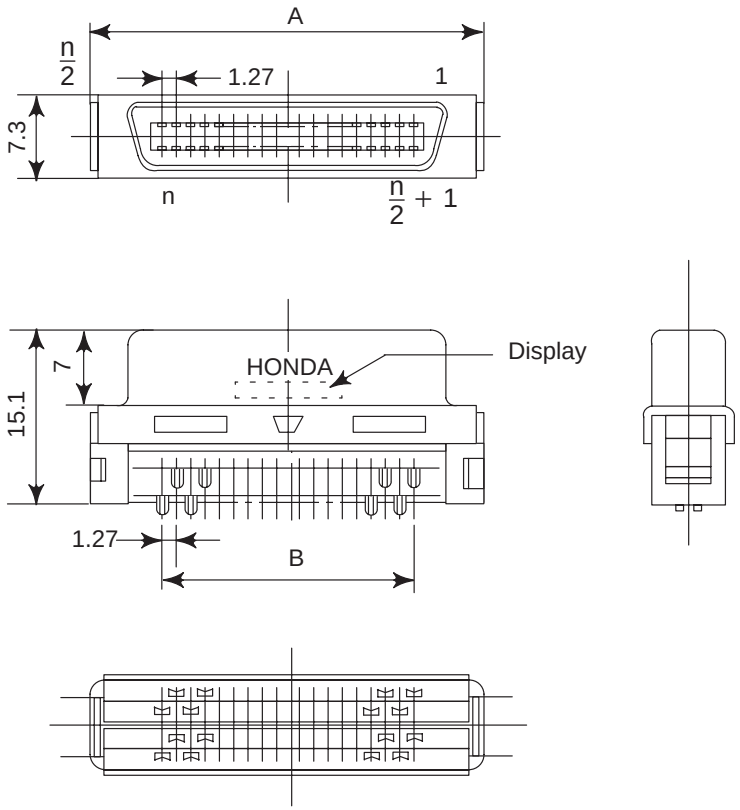
NOTE

Set the tape reader into it, from the rear side of panel with holes and secure with screws and nuts. If this is not convinient, attach a M5 stud in Φ5.3 hole and secure with a nut.

A.2 CONNECTOR

	Name of external dimension	
Fig. C1 (a)	PCR-connector (Soldering type)	PCR–E20FS
Fig. C1 (b)	FI40 connector	FI40–2015S
Fig. C2 (a)	Dimension of connector case (HONDA TUSHIN PCR TYPE)	PCR–V20LA/PCR–V20LB
Fig. C2 (b)	Dimension of connector case (HIROSE FI TYPE)	FI–20–CV
Fig. C2 (c)	Dimension of connector case (FUJITSU FCN)	FCN–240C20–Y/S
Fig. C3 (a)	AMP connector(1)	AMP1–178128–3
Fig. C3 (b)	AMP connector(2)	AMP2–178128–3
Fig. C3 (c)	AMP connector(3)	AMP1–178288–3
Fig. C3 (d)	AMP connector(4)	AMP2–178288–3
Fig. C3 (e)	AMP connector(5)	AMP2–178129–6
Fig. C3 (f)	Contact for AMPconnector	AMP1–175218–2/5 AMP1–175196–2/5
Fig. C4 (a)	HONDA connector (Case)	
Fig. C4 (b)	HONDA connector (Beveled case)	
Fig. C4 (c)	HONDA connector (Male)	
Fig. C4 (d)	HONDA connector (Female)	
Fig. C4 (e)	HONDA connector terminal layout	
Fig. C5 (a)	NIPPON FCI (Old name is Nippon Burndy) connector (3–pins, black)	SMS3PK–5
Fig. C5 (b)	NIPPON FCI (Old name is Nippon Burndy) connector (3–pins,brown)	SMS3PN–5
Fig. C5 (c)	NIPPON FCI (Old name is Nippon Burndy) connector (3–pins,white)	SMS3PW–5
Fig. C5 (d)	NIPPON FCI (Old name is Nippon Burndy) connector (6–pins,brown)	SMS6PN–5
Fig. C5 (e)	NIPPON FCI (Old name is Nippon Burndy) connector (6–pins,white)	SMS6PW–5
Fig. C5 (f)	NIPPON FCI (Old name is Nippon Burndy) connector (6–pins,black rectangle)	SMS6P–1
Fig. C6	Connector for HIROSE flat cable	HIF3BB–50D–2.54R
Fig. C7	Connector forYAMAICHI flat cable	NFP–10A–0124
Fig. C8 (a)	Punch panel connector for reader/puncher interface	
Fig. C8 (b)	Reader/puncher interface metal fitting for lock	
Fig. C9	Power contact for portable tape reader	
Fig. C10 (a)	Contact for 9″ PDP power cable (DC24V input type)	
Fig. C10 (b)	Housing for 9″PDP power cable (DC24V input type)	

Connector body		
HONDA TSUSHIN	PCR–E20FS (Soldering type)	
Usage	General	
Connector cover	HONDA TSUSHIN	PCS–E20LA (Metal)
	HONDA TSUSHIN	PCR–V20L (Plastic)



	A	B
PCR–E20FS	21.65	11.43

Fig. C1 (a) PCR connector (Soldering type)

Connector body	HIROSE FI40–2015S
Usage	For simultaneous axis
Housing	HIROSE FI–20–CV
Dimension	

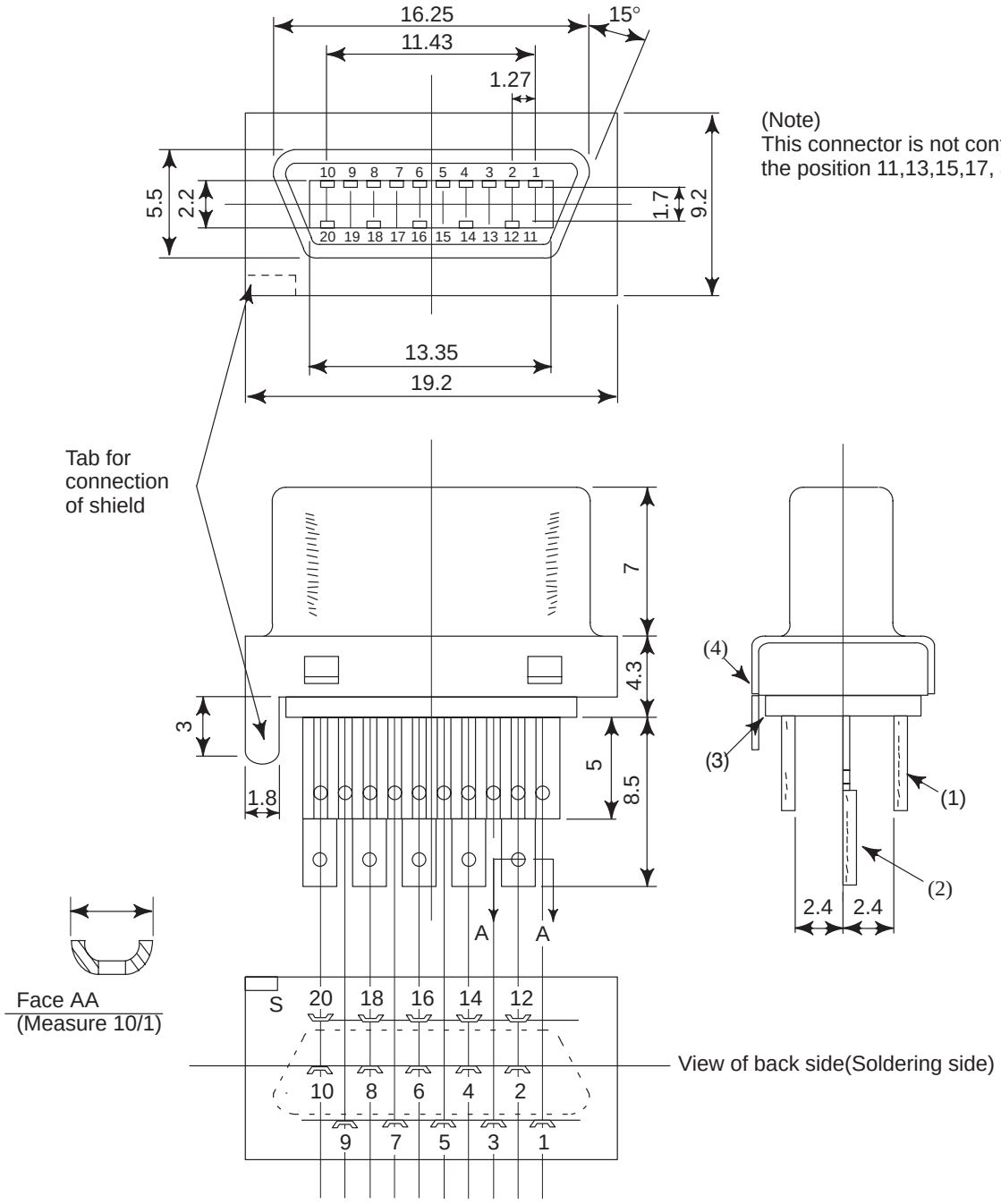
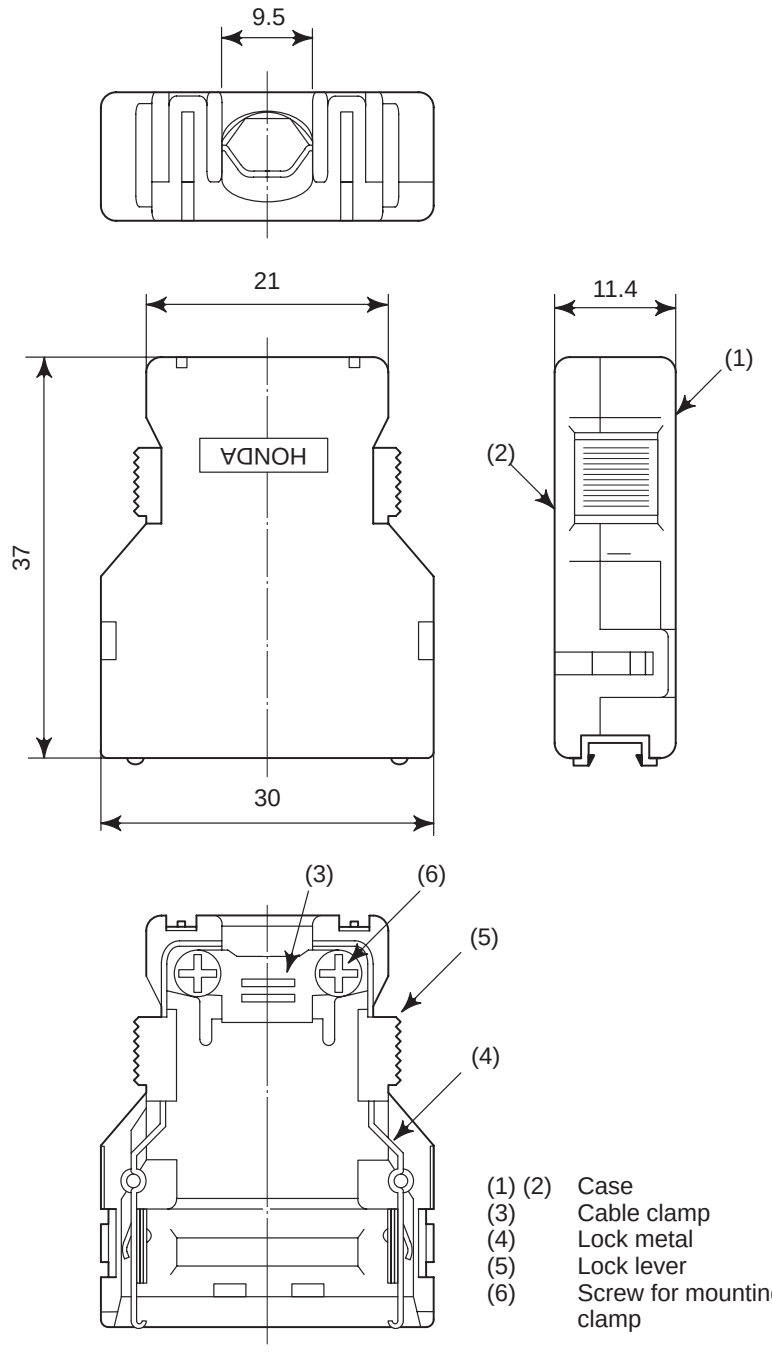


Fig. C1 (b) F140 connector

Connector body HONDA TSUSHIN PCR–V20LA (External cable diameter F6)
PCR–V20LB (External cable diameter F8)

Usage General

Dimension



(1) (2) Case
(3) Cable clamp
(4) Lock metal
(5) Lock lever
(6) Screw for mounting cable clamp

Fig. C2 (a) Connector case (HONDA TSUSHIN PCR)

Connector body HIROSE F1–20–CV
Usage For simultaneous axes cable
Dimension

(1), (2) Case
(3) Lock metal
(4) Lock lever
(5) Cable clamp
(6) Screw for mounting cable clamp

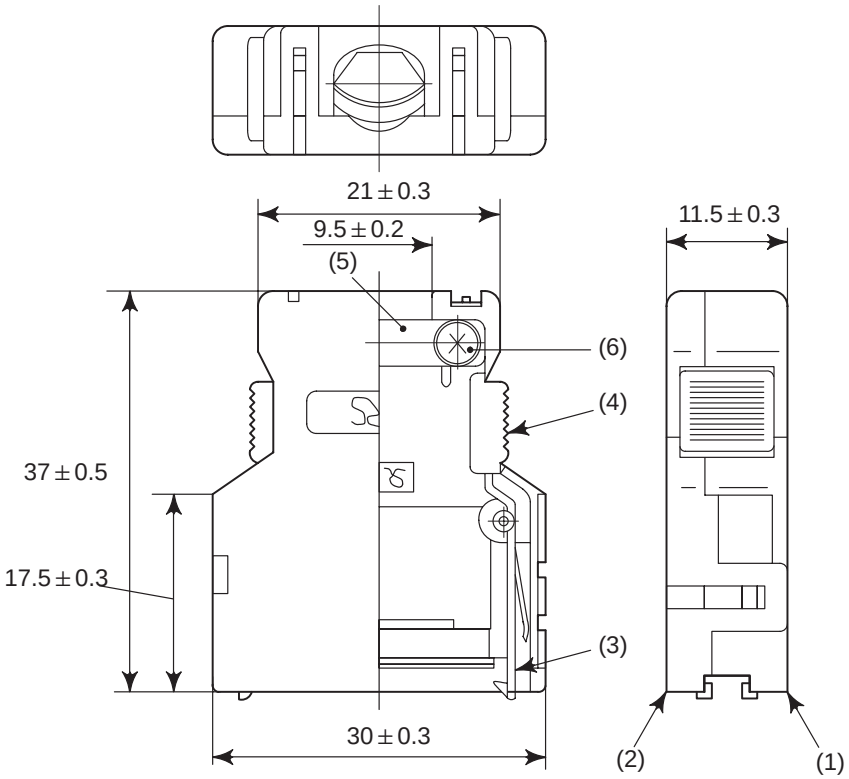


Fig. C2 (b) Connector case (HIROSE F1 type)

Connector body Fujitsu FCN–240C20–Y/S(For External cable diameter Φ5.8)
Usage General
Dimension

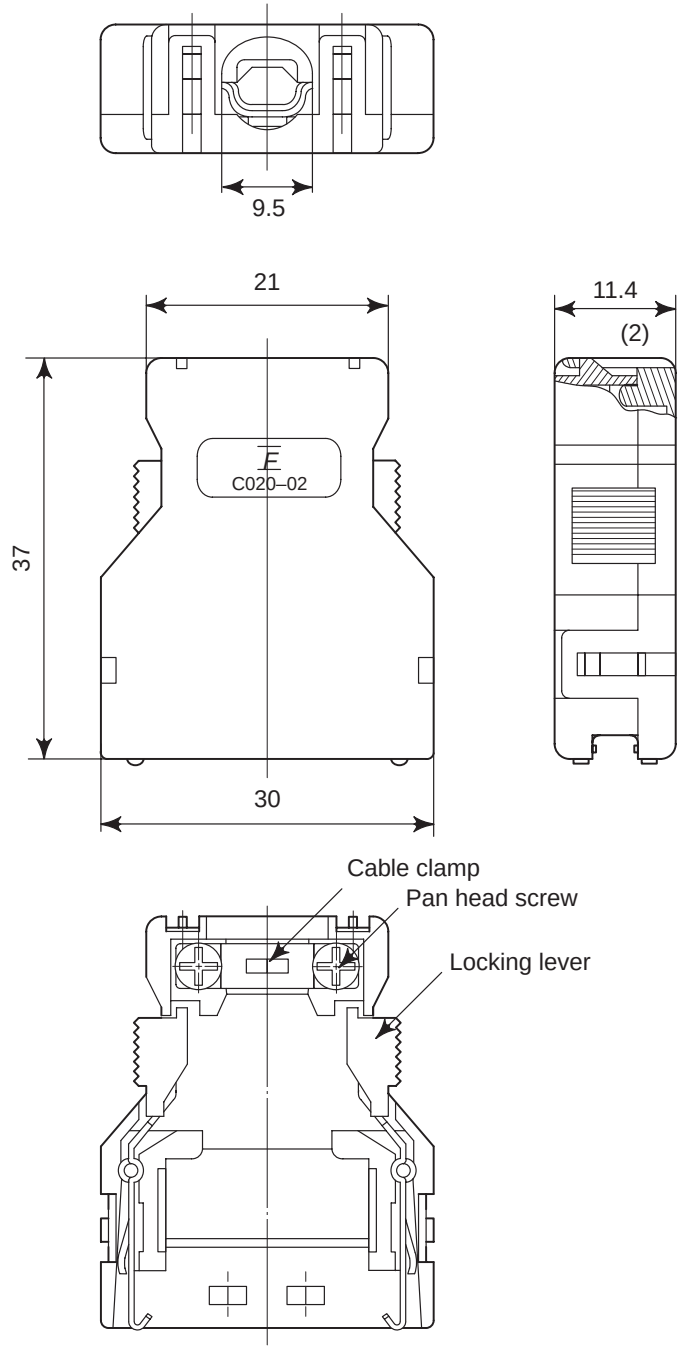


Fig. C2 (c) Connector case (Fujitsu FCN type)

Style AMP1–178128–3

Usage For CE marking
Power supply unit
200VAC input

3	G
2	S
1	R

■ Location of key

For CE marking
Power supply unit
200VAC output

3	G
2	200B
1	200A

Dimension

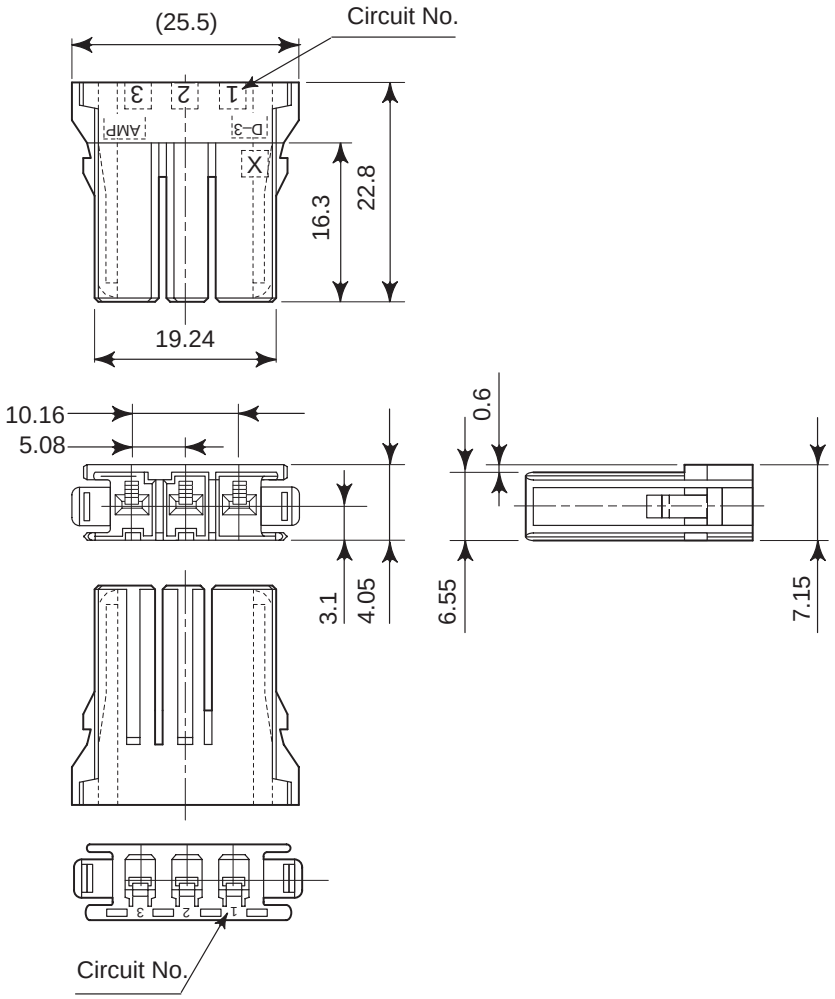


Fig. C3 (a) AMP connector (1)

Style AMP2–178128–3

Dimension

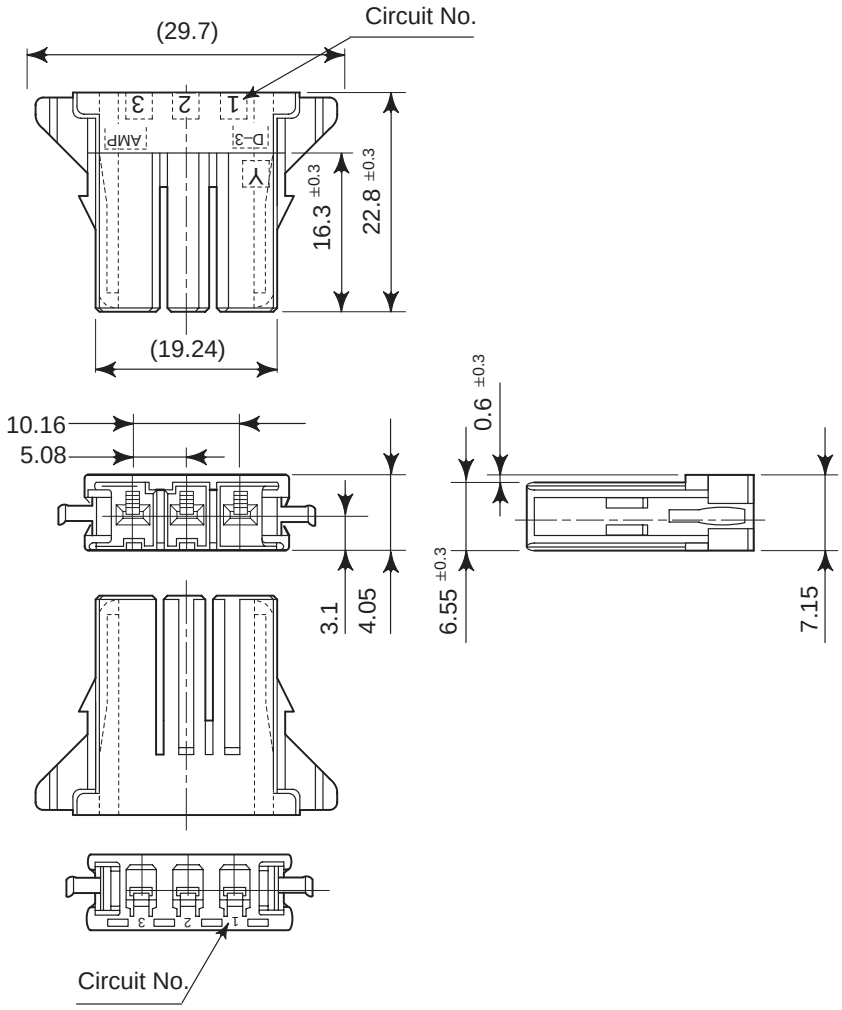


Fig. C3 (b) AMP connector(2)

Style AMP1–178288–3
Usage For CE marking
Power supply unit
+24E Output

Dimension

3	
2	0V
1	+24E

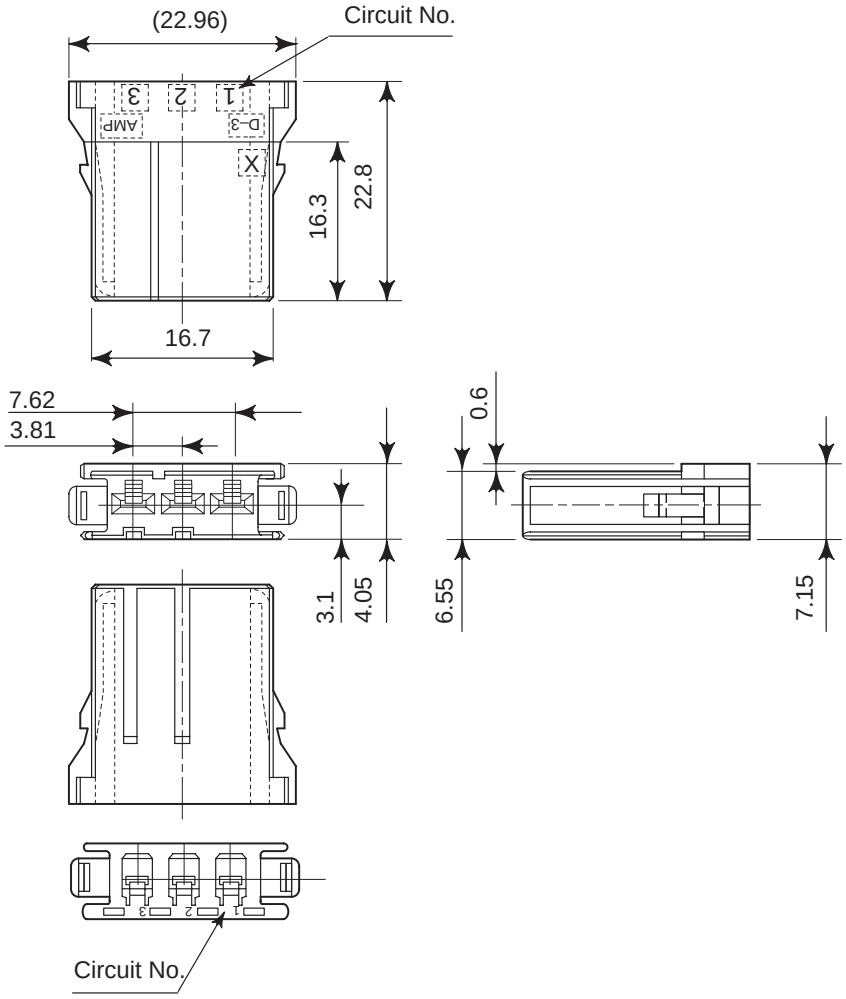


Fig. C3 (c) AMP connector(3)

Style AMP2–178288–3

Usage For CE marking
Power supply unit
+24V output

Dimension

3	
2	0V
1	+24V

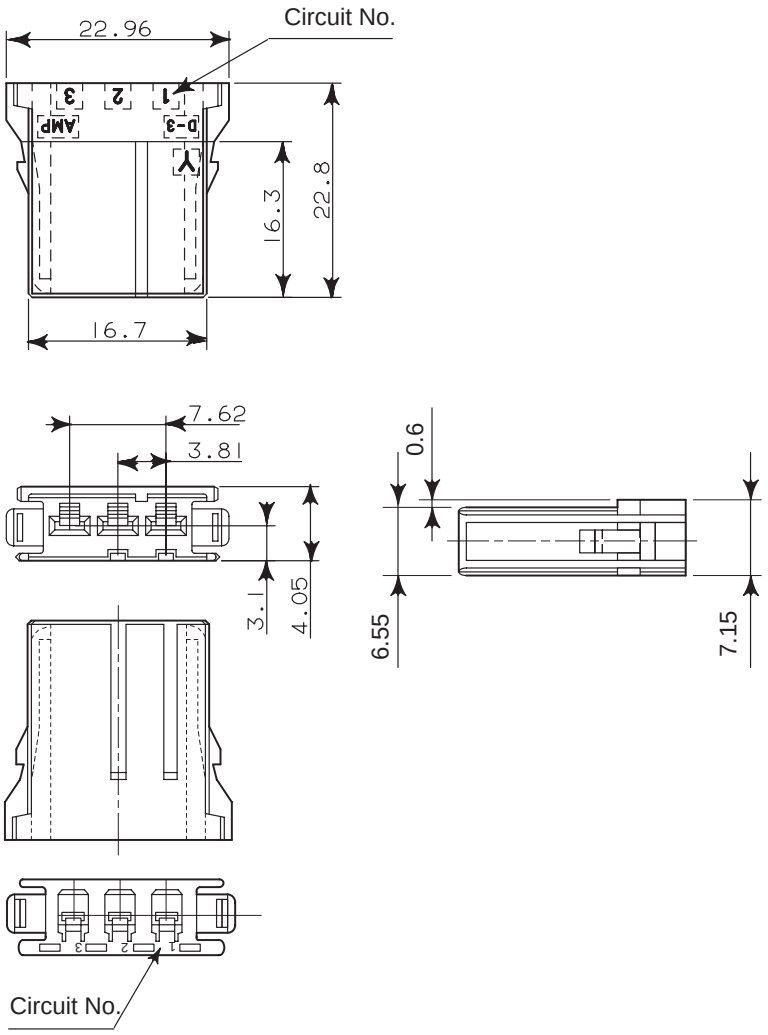


Fig. C3 (d) AMP connector(4)

Style AMP2–178129–6

Usage For CE marking
Power supply unit
ON/OFF control

B3	FB	A3	COM
B2	FA	A2	OFF
B1	AL	A1	ON

Dimension

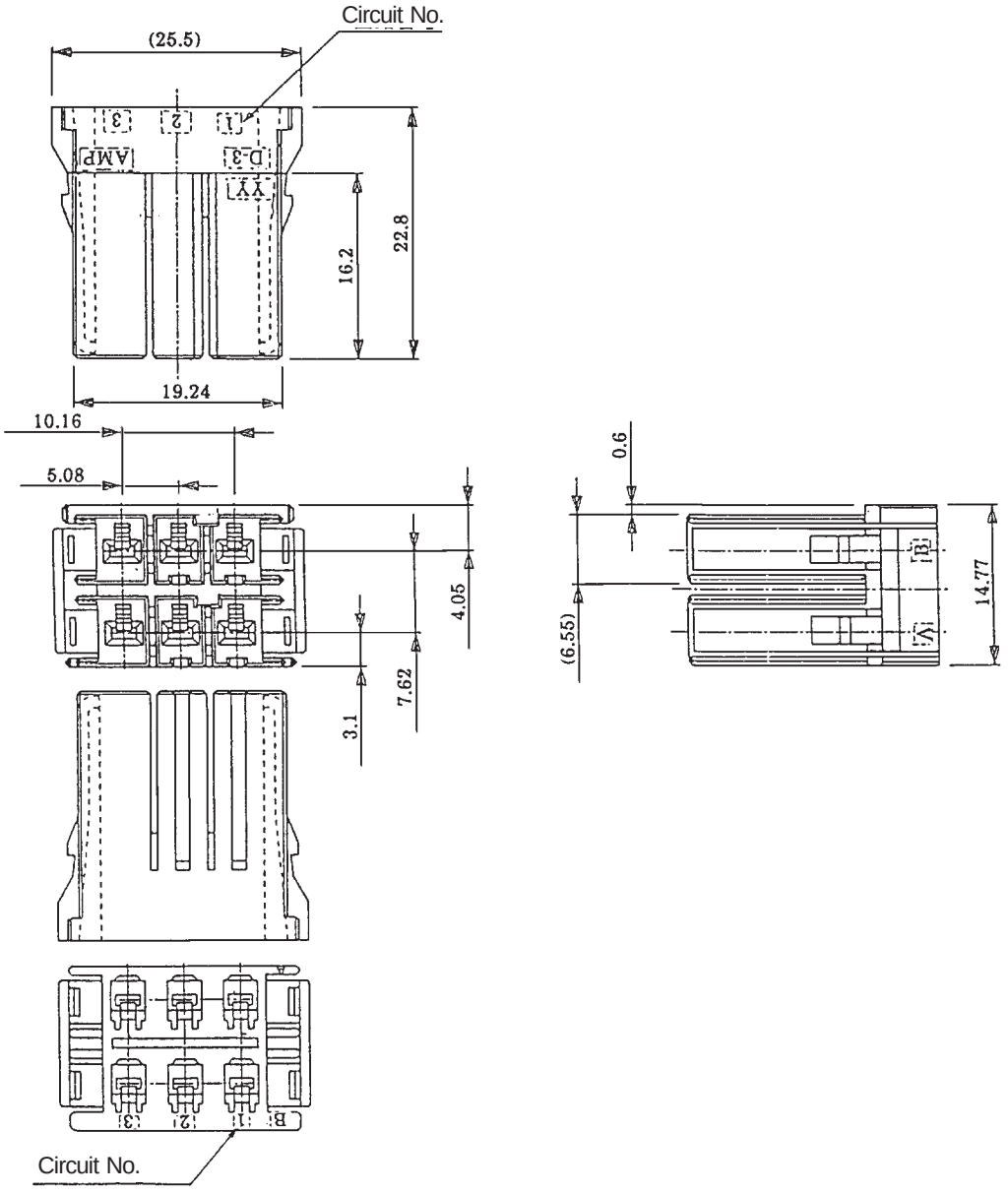


Fig. C3 (e) AMP connector (5)

Style Piece : AMP1–175218–2 (Metal plating) AMP1–175218–5 (Tin plating)
Reel : AMP1–175196–2 (Metal plating) AMP1–175196–5
Connector cable AWG 16, 18, 20
Dimension

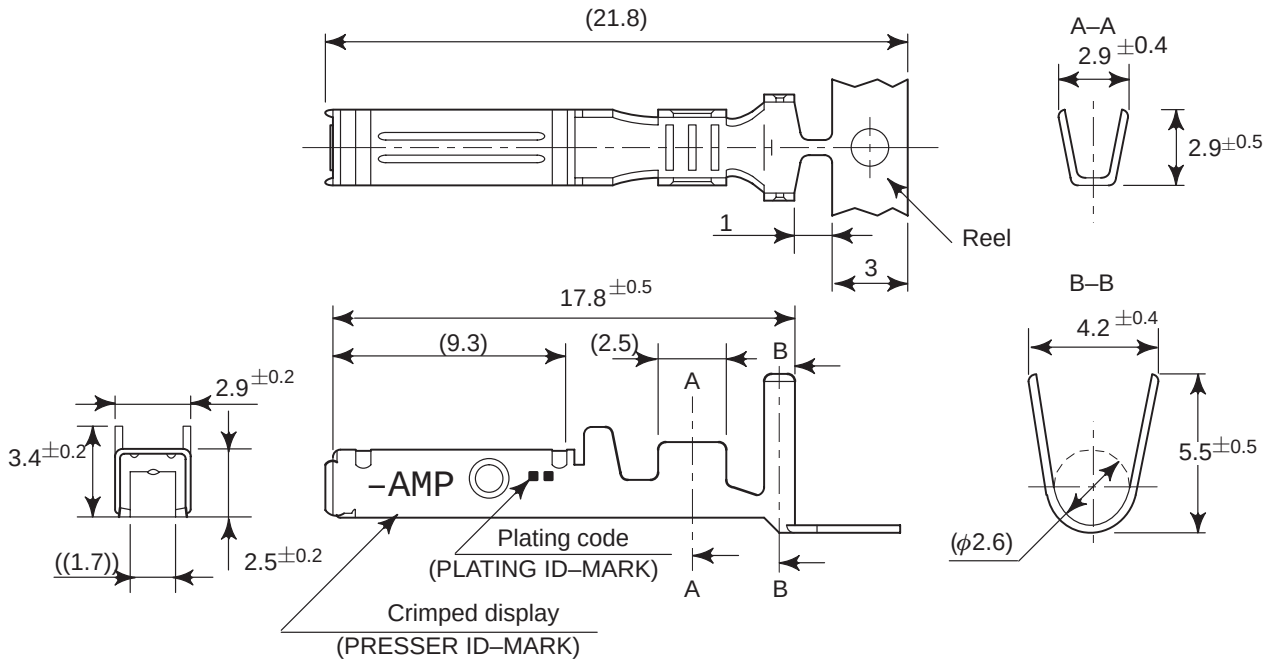
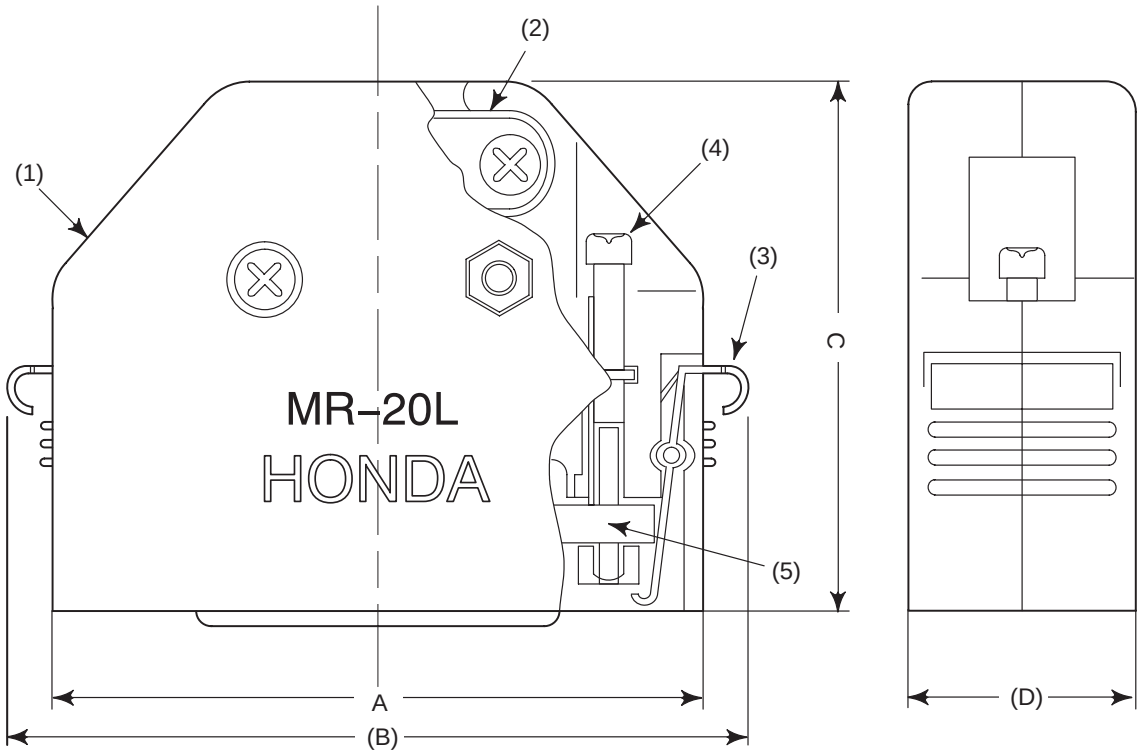


Fig. C3 (f) Contact for AMP connector

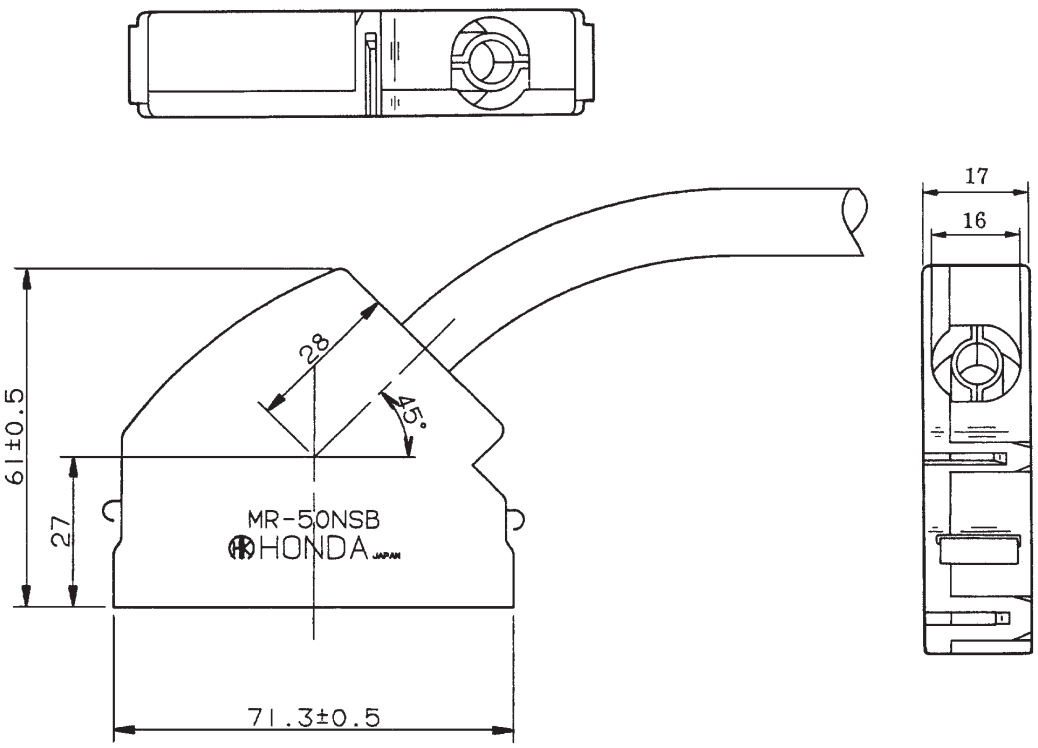


Specification \ Symbol	A	(B)	C	(D)	No. of terminals
MR–20LMH (Plug)	39.3	44.9	39.8	17	20
MR–20LFH (Jack)					
MR–50LMH (Plug)	67.9	73.5	44.8	18	50
MR–50LFH (Jack)					

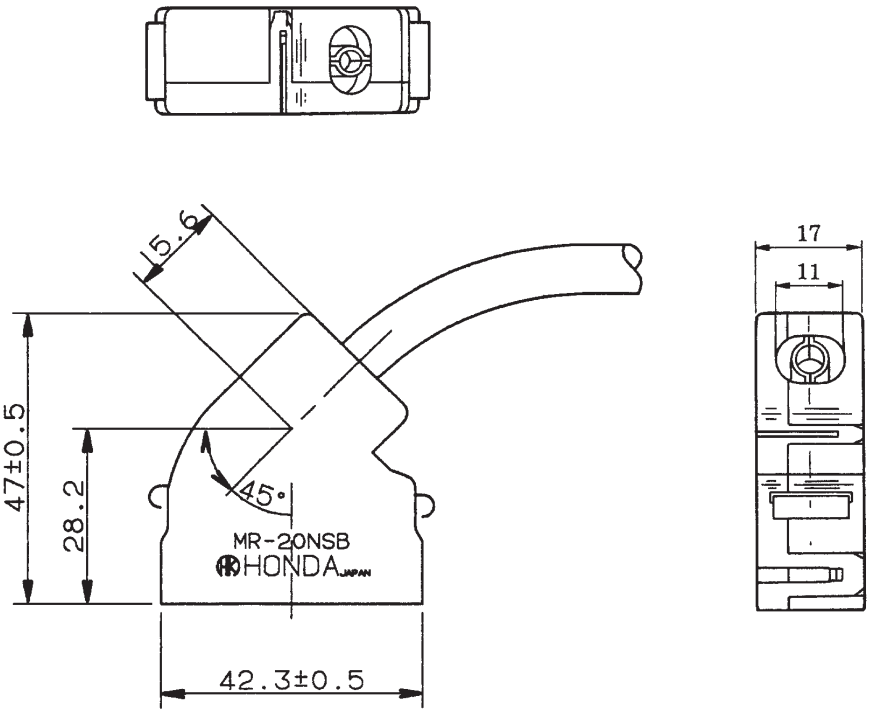
Symbol	Name
(1)	Connector cover
(2)	Cable clamp
(3)	Stopper
(4)	Screw for cable clamp
(5)	Plug connector(MR–20,50MH)
	Jack connector(MR–20,50FH)

Outer diameter of the cable
MR–20L dia.10mm max
MR–50L dia.16mm max

Fig. C4 (a) HONDA connector (case)

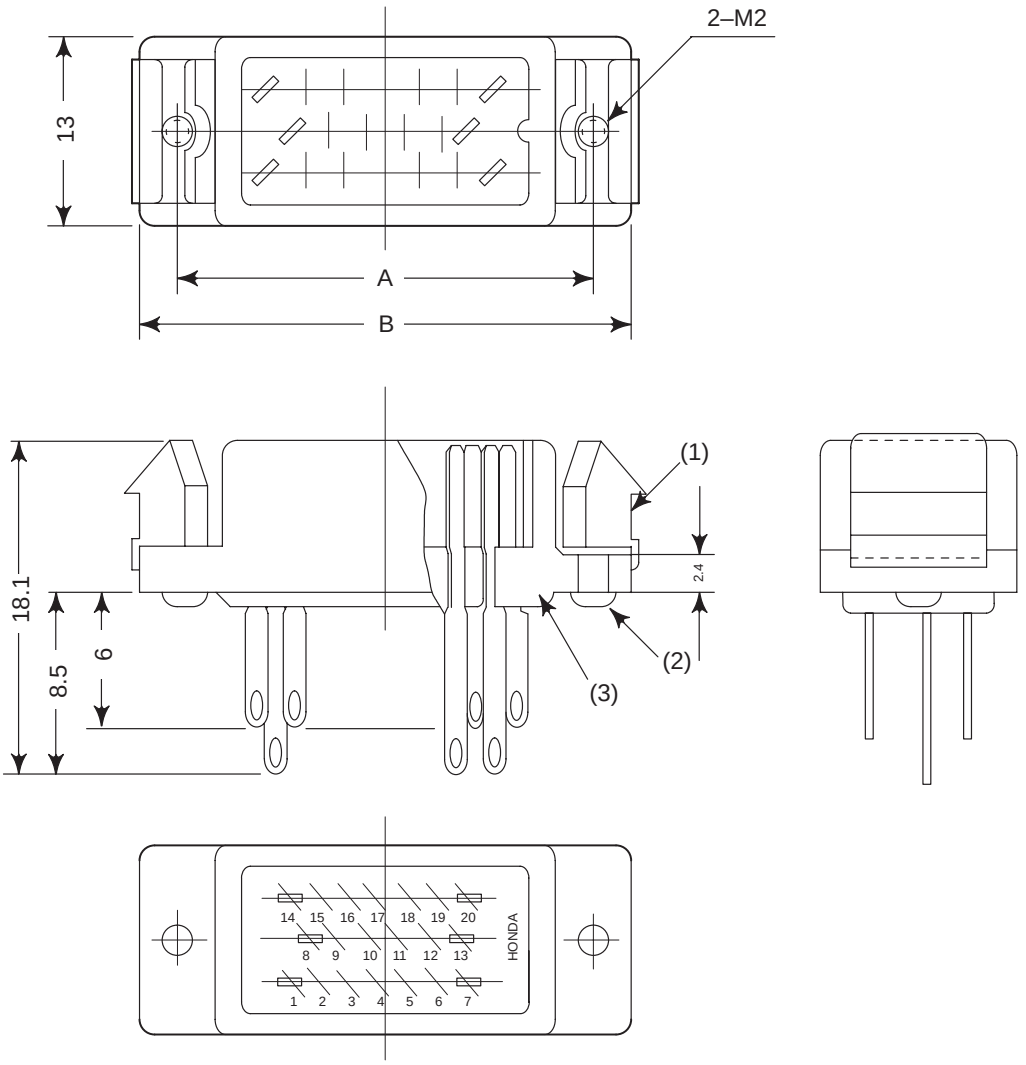


External view of the 50–pin connector housing



External view of the 20–pin connector housing

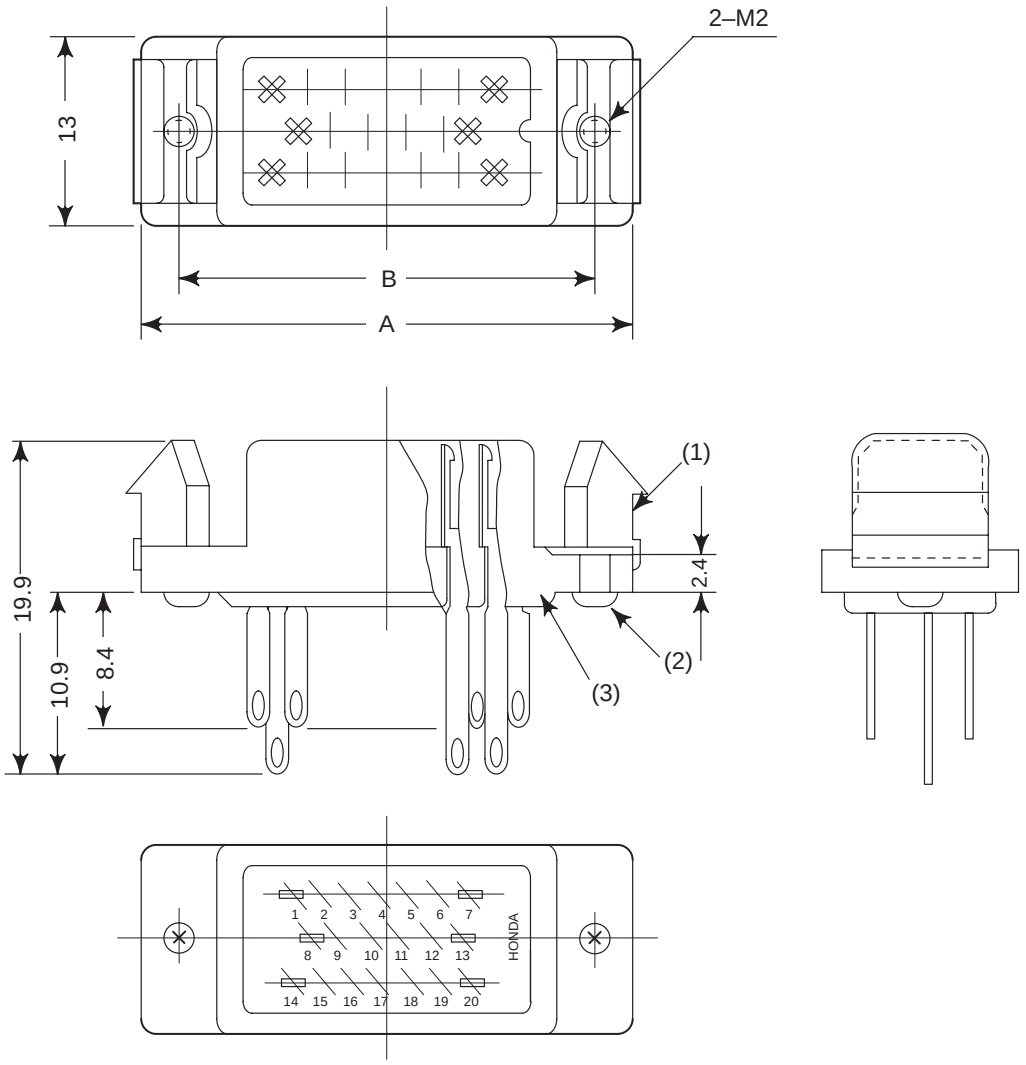
Fig. C4 (b) HONDA connector (Beveled case)



	A	B	No. of terminals
MR–20RMH	32.8	27.8	20
MR–50RMH	61.4	56.4	50

Symbol	Name
(1)	Metal clamp of connector
(2)	Clamp screw Φ2.6×8
(3)	Connector(MR–20, 50MH)

Fig. C4 (c) HONDA connector (Plug connector)



	A	B	No.of terminals
MR–20RFH	32.8	27.8	20
MR–50RFH	61.4	56.4	50

Symbol	Name
1	Metal clamp of connector
2	Screw for mounting $\phi 2.6 \times 8$
3	Connector(MR–20, 50FH)

Fig. C4 (d) HONDA connector (Jack connector)

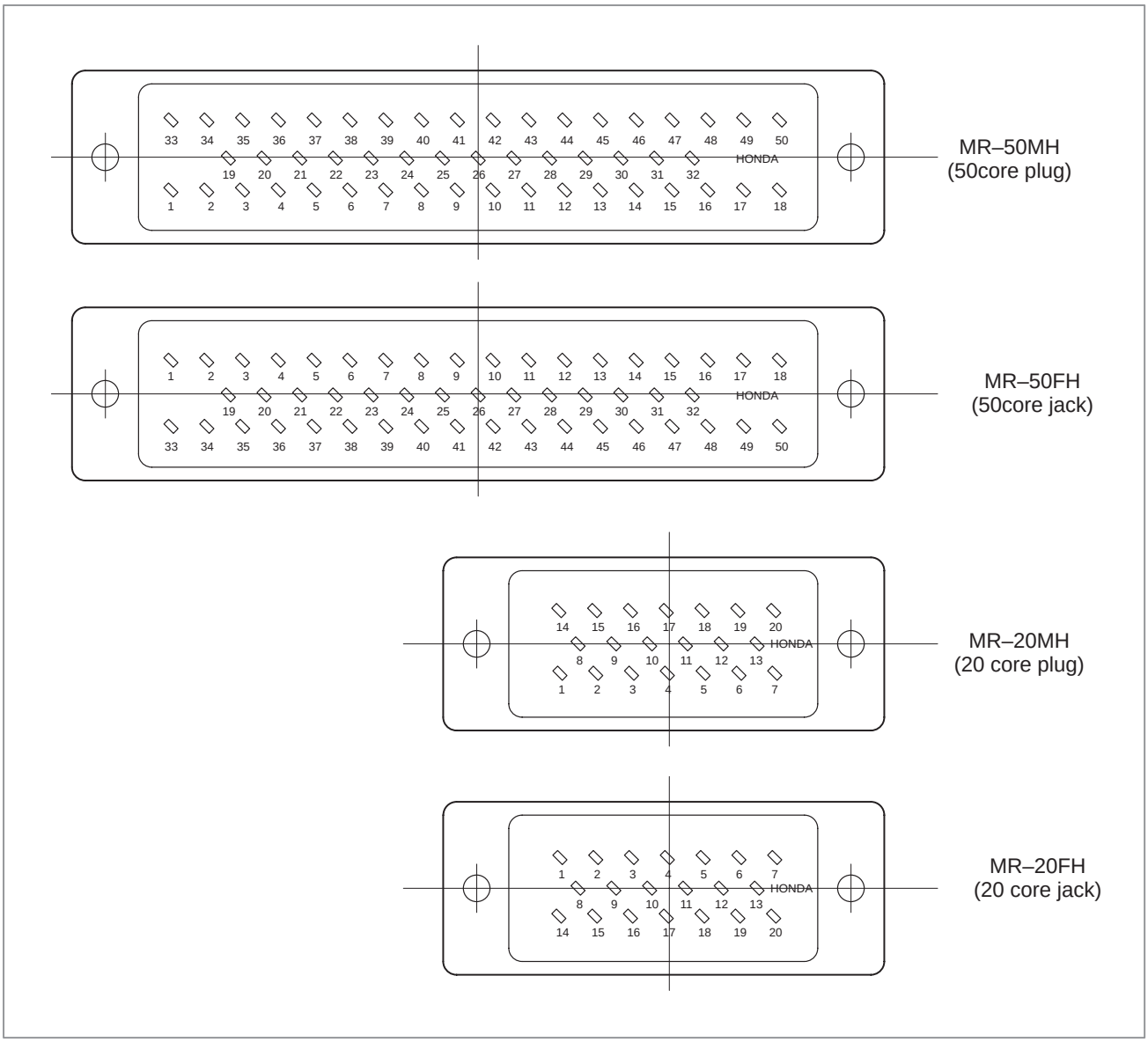
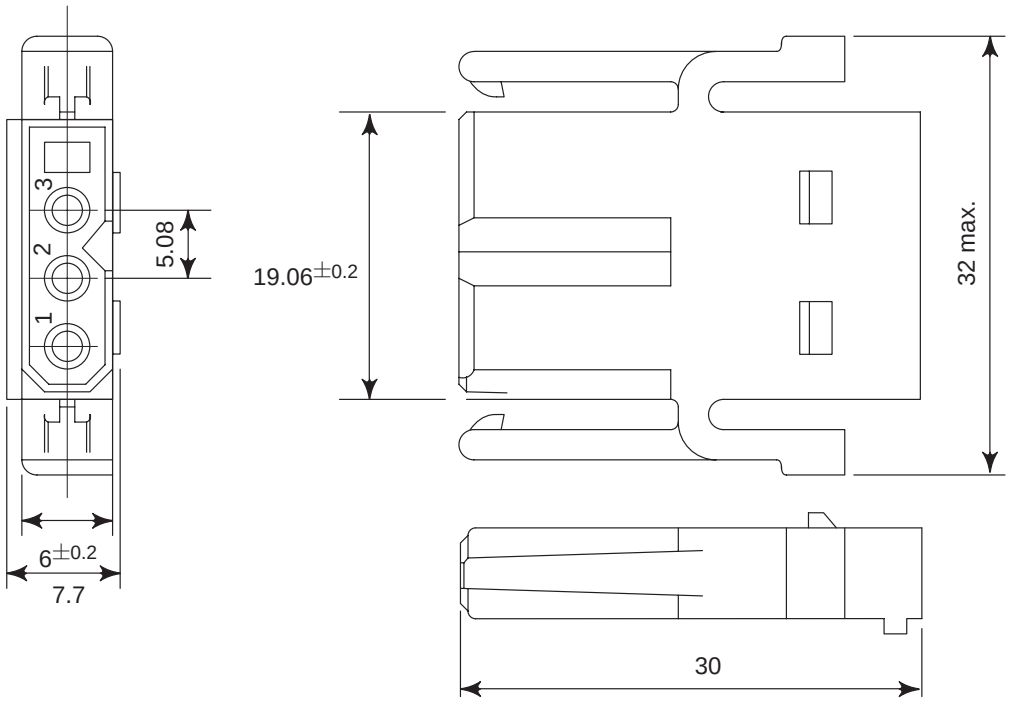


Fig. C4 (e) Terminal layout of HONDA connector



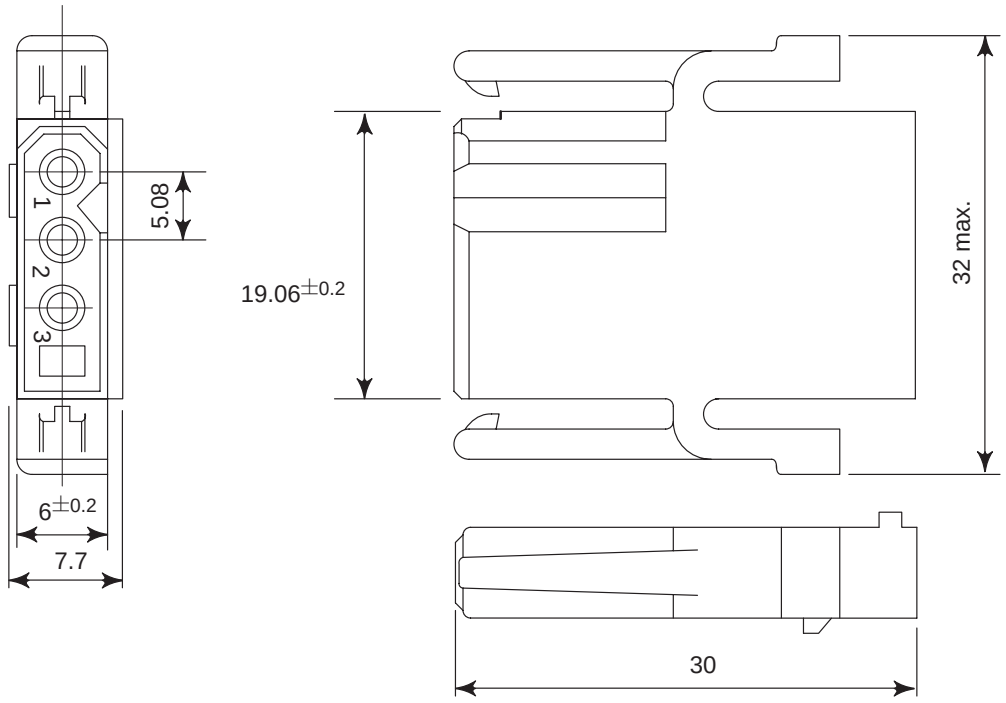
Manufacturer : NIPPON FCI

Name		Specification (Connector maker number)	Remarks
Connector housing for cable		SMS3PK–5	Black
Contact	(Crimp type)	RC16M–23T3	For details on tools required for crimp terminals, contact the manufacturer.
	(Solder type)	RC16M–SCT3	

Cables

Cross sectional area : 0.75mm^2(30/0.18)
Insulation diameter : 2.8mm max
Peeling length : 7.2mm

Fig. C5 (a) NIPPON FCI connector (3–pins,black)



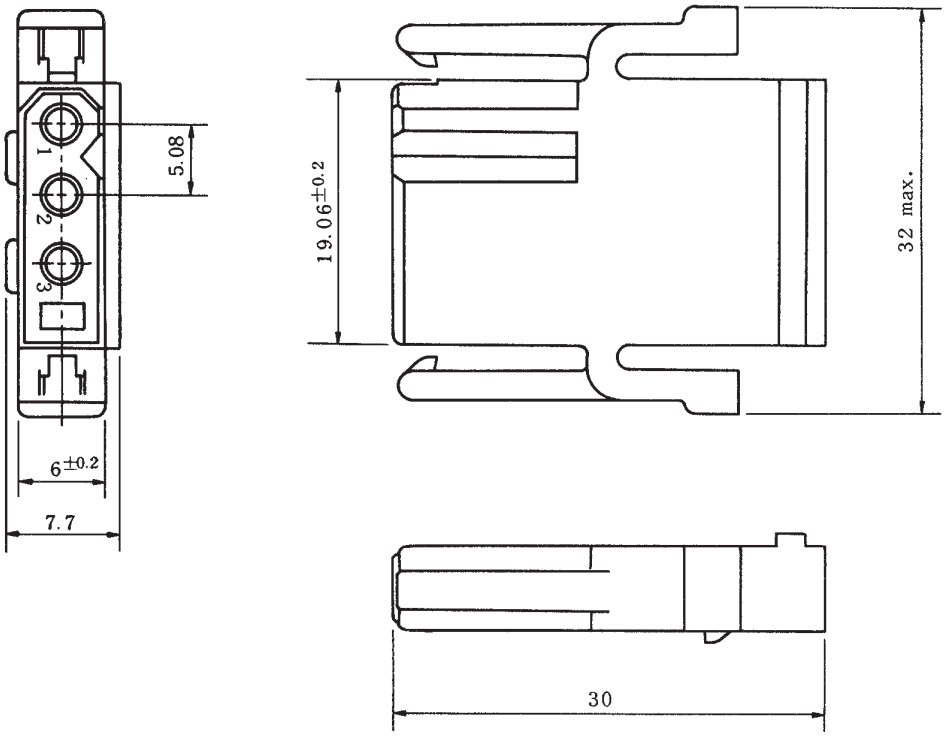
Manufacturer : NIPPON FCI

Name		Specification (Connector maker number)	Remarks
Connector housing for cable		SMS3PNS–5	Brown
Contact	(Crimp type)	RC16M–23T3	For details on tools for crimp terminals, contact the manufacturer.
	(Solder type)	RC16M–SCT3	

Cables

Cross sectional area : 0.75mm^2(30/0.18)
Insulation diameter : 2.8mm max
Peeling length : 7.2mm

Fig. C5(b) NIPPON FCI connector (3–pins,Brown)



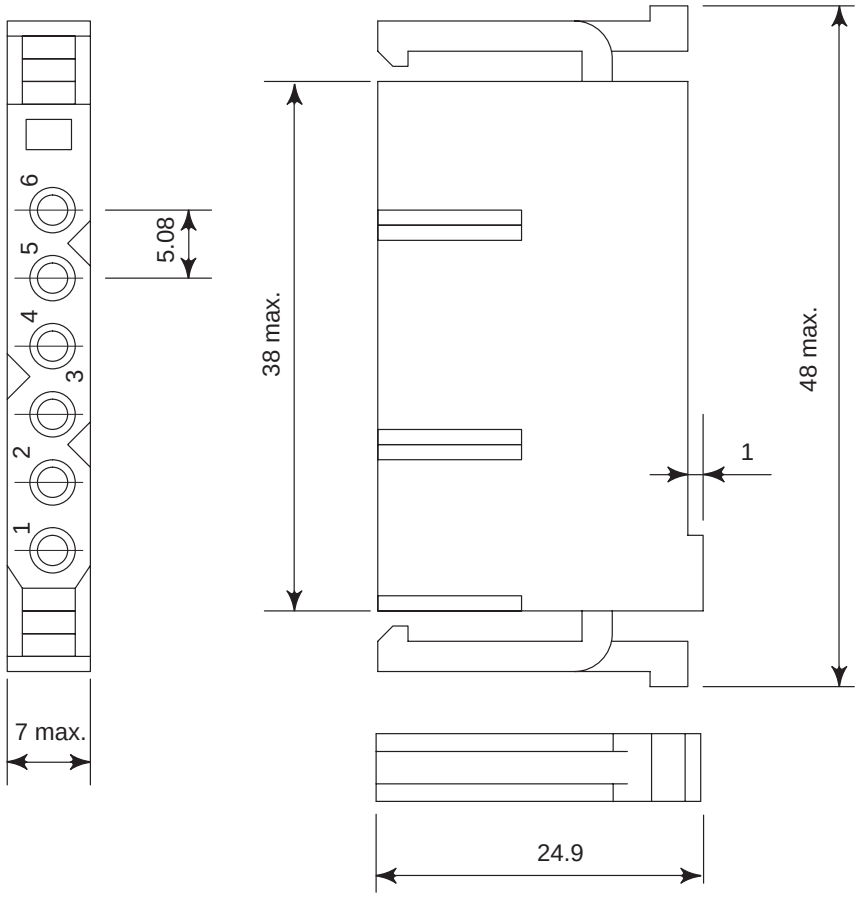
Manufacturer : NIPPON FCI

Name		Specification (Connector maker number)	Remarks
Connector housing for cable		SMS3PWS–5	White
Contact	(Crimp type)	RC16M–23D28	For details on tools for crimp terminals, contact the manufacturer.

Cables

Cross sectional area : 0.75mm^2(30/0.18)
Insulationdiameter : 2.8mm max
Peeling length : 7.2mm

Fig. C5 (c) NIPPON FCI connector (3–pins,white)



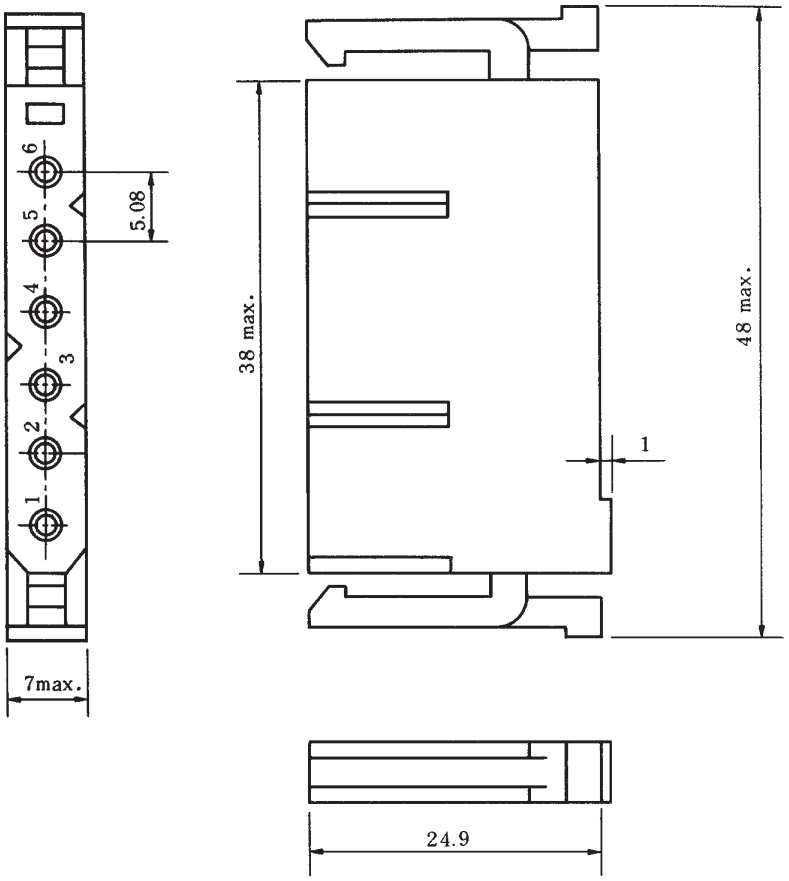
Manufacturer : NIPPON FCI

Name		Specification (Connector maker number)	Remarks
Connector housing for cable		SMS3PN–5	Brown
Contact	(Crimp type)	RC16M–23T3	For details on tools for crimp terminals, contact the manufacturer.
	(Soldering type)	RC16M–SCT3	

Cables

Cross sectional area : 1.27mm^2(50/0.18)
Insulation diameter : 2.8mm max
Peeling length : 7.2mm

Fig. C5 (d) NIPPON FCI connector (6–pins,brown)



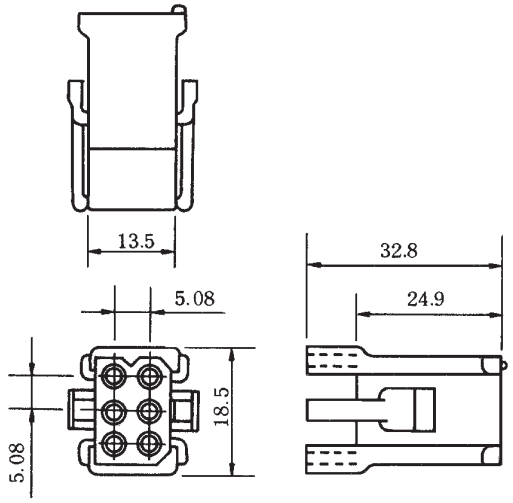
Manufacturer : NIPPON FCI

Name		Specification (Connector maker number)	Remarks
Connector housing for cable		SMS6PW–5	White
Contact	(Crimp type)	RC16M–23D28	For details on tools for crimp terminals, contact the manufacturer.
	(Soldering type)	RC16M–SCD28	

Cables

Cross sectional area : 1.27mm^2 (50/0.18)
Insulation diameter : 2.8mm max
Peeling length : 7.2mm

Fig. C5(e) NIPPON FCI connector (6–pinds,white)



Manufacturer : NIPPON FCI

Name		Specification (Connector maker number)	Remarks
Connector housing for cable		SMS6P–1	Black
Contact	(Crimp type)	RC16M–23T3	For details on tools for crimp terminals, contact the manufacturer.
	(Soldering type)	RC16M–SCT3	

Cables

Cross sectional area : 1.27mm^2(50/0.18)
Insulation diameter : 2.8mm max
Peeling length : 7.2mm

Fig. C5 (f) NIPPON FCI connector (6–pins, Black, Rectangle)

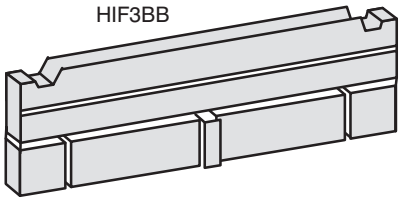
Hirose Electric flat cable connectors

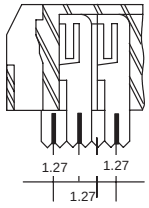
Model Hirose Electric Co., Ltd.

HIF3BB−50D−2. 54R (50contacts)

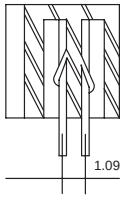
HIF3BA

HIF3BB

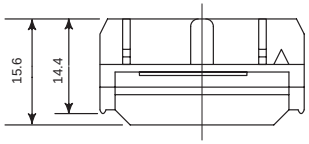




Section A–A'

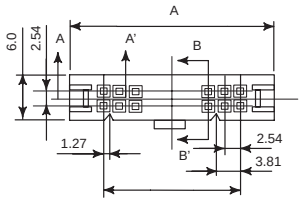


Section B–B'

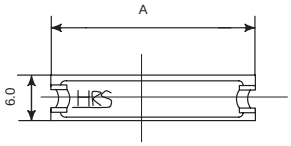


When assembled

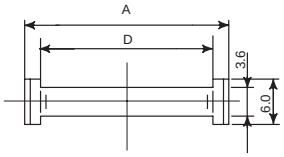
Connector body

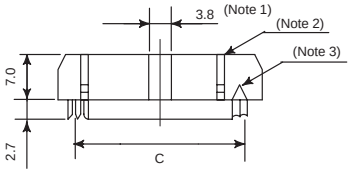


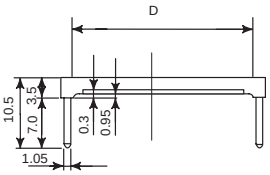
Protector

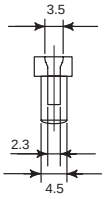


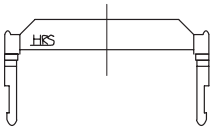
Clamp

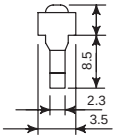








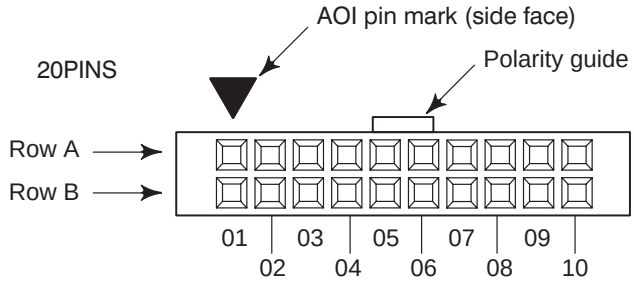




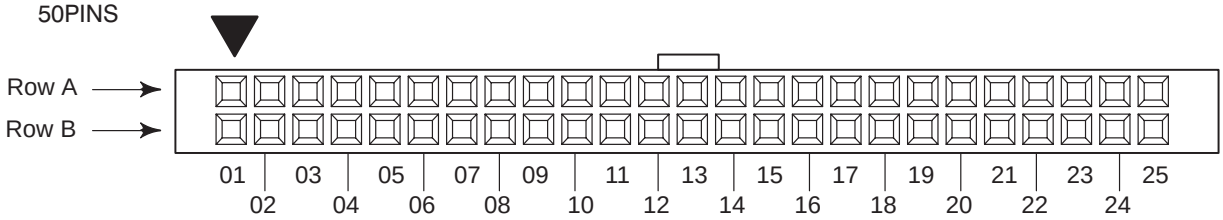
Dimensions

Model	Number of pins	A	B	C	D
HIF3BB–50D–2.54R	50	68.07	60.96	62.23	63.6

Pin assignment for Hirose flat cable connectors

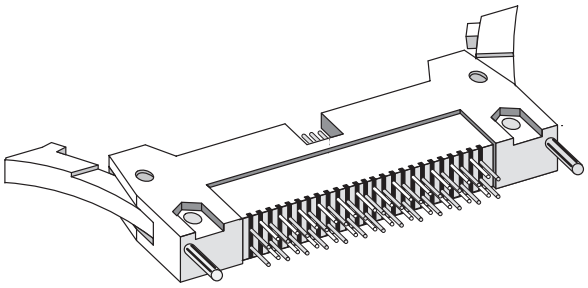


View from connector

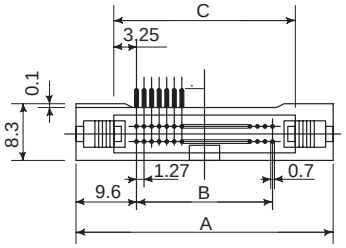


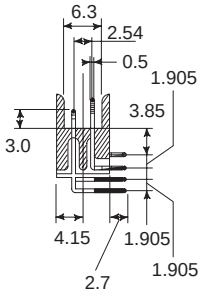
View from connector

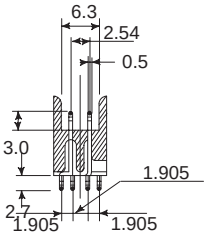
Fig. C6 Hirose Electric flat cable connectors



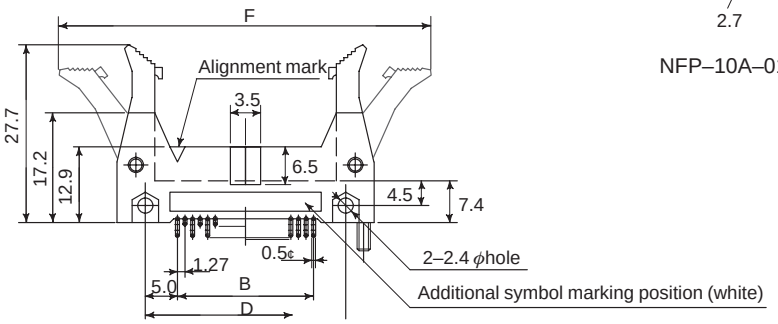
NFP–10A–0122 NFP–10A–0124



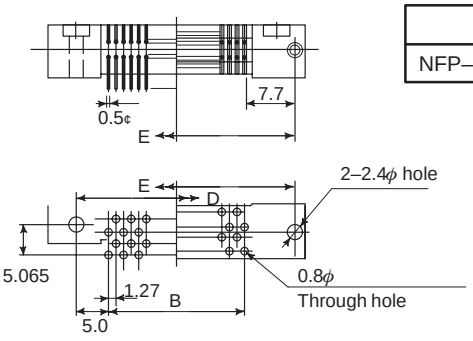




NFP–10A–0122 NFP–10A–0124



Name	A	B	C	D	E	F
NFP–10A–0122&0124	24.28	5.08	11.58	15.08	20.48	40.2



PC board hole dimensions

Fig. C7 Yamaichi Denki flat cable connectors

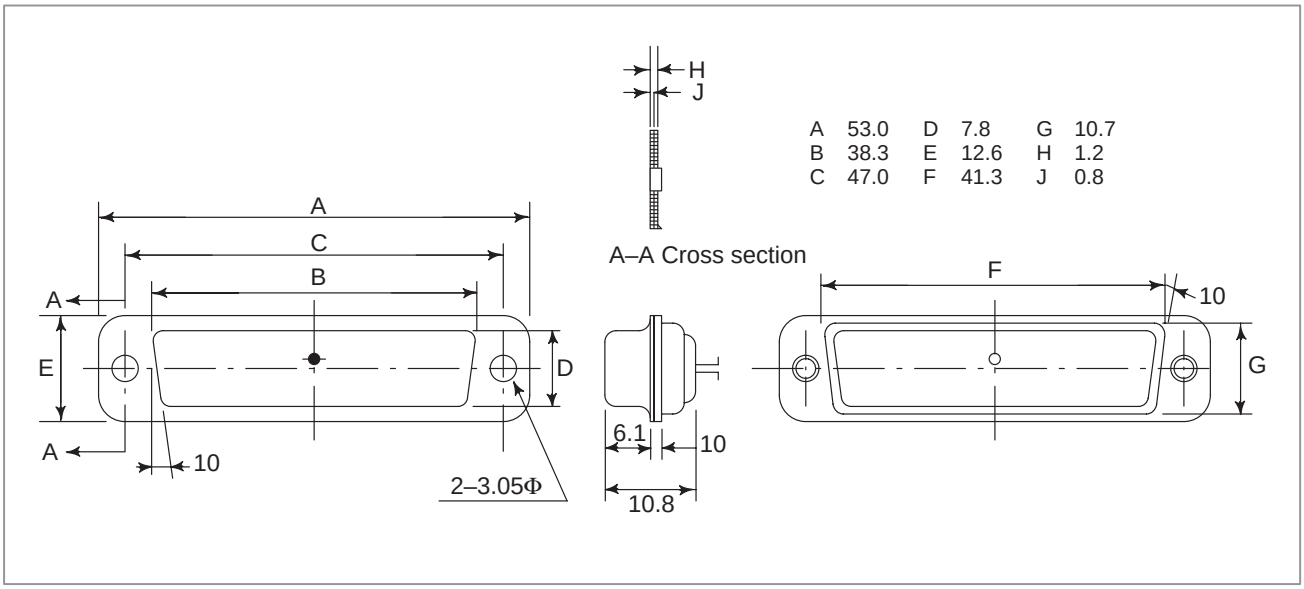


Fig. C8 (a) Punch pannel connector for reader/puncher interface

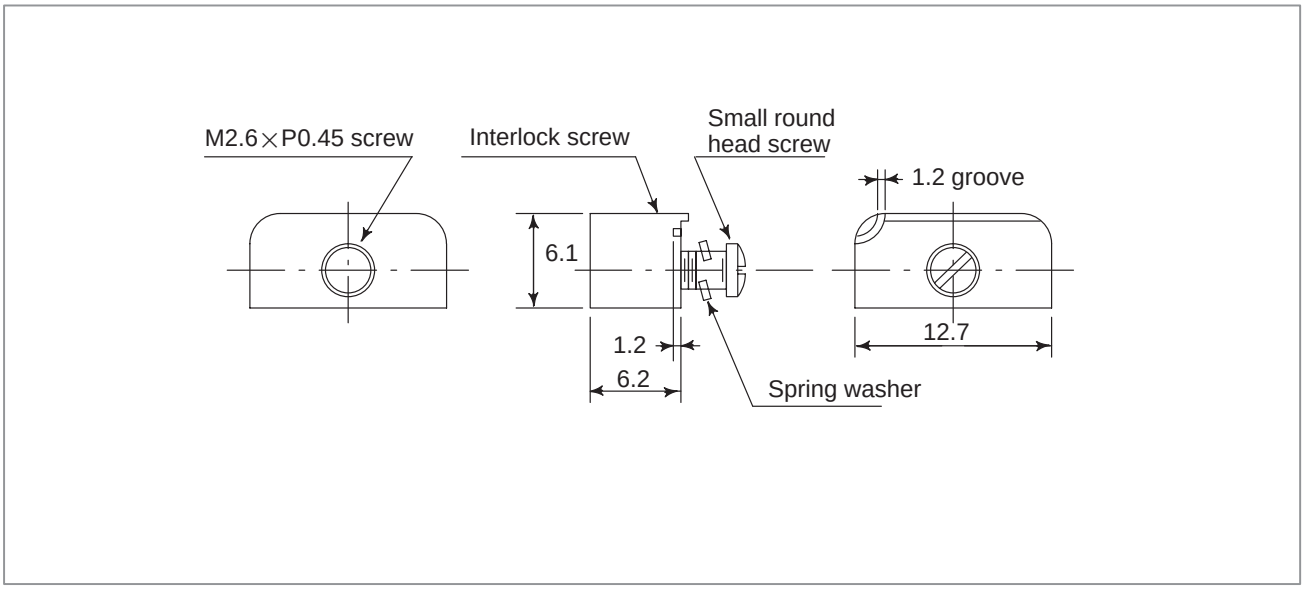
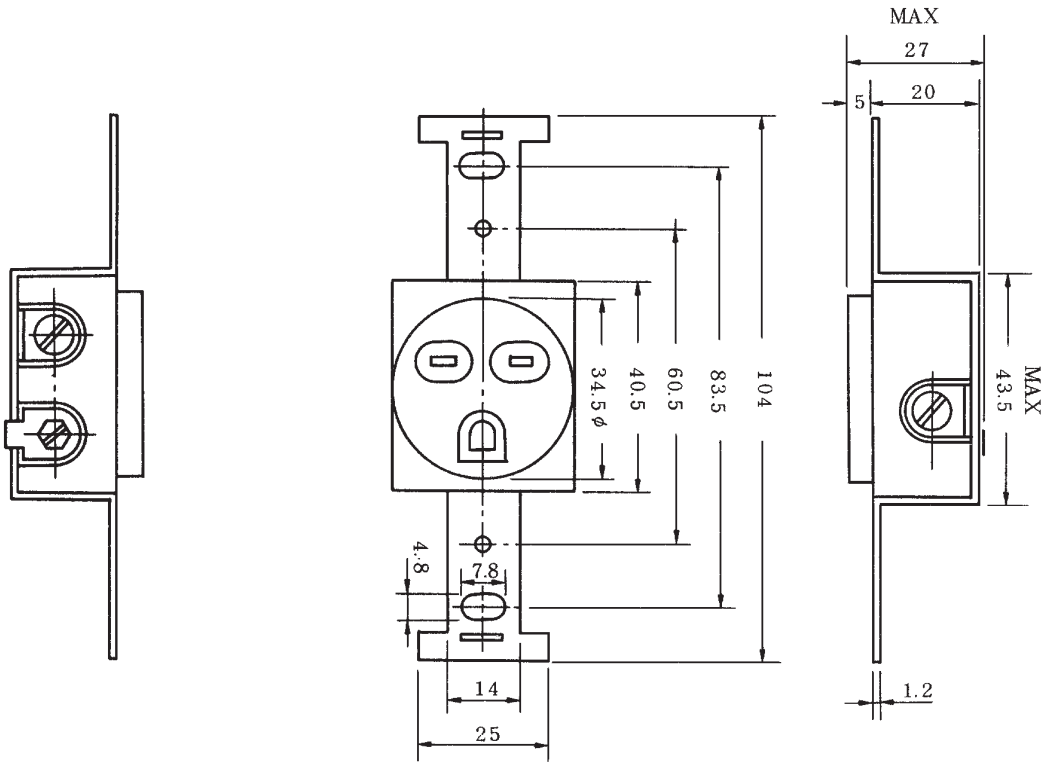
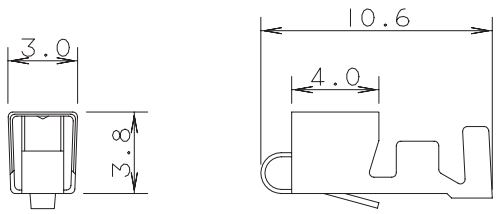


Fig. C8 (b) Reader puncher connector metal fitting for lock



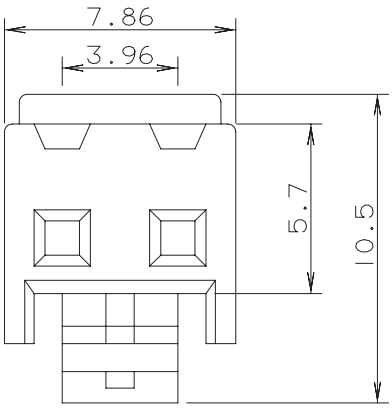
Color : Cream
Note) When connecting with crimp terminal, use M4 terminal (all 3 poles)

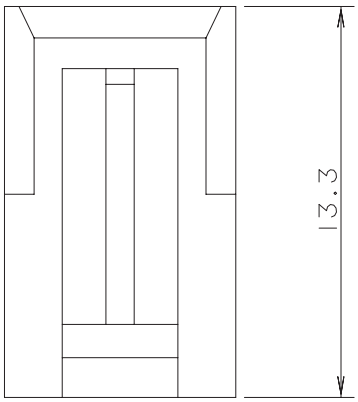
Fig. C9 Power receptacle for portable tape reader



Model	Corresponding wire		Cable diameter including shields (mm)	Material	Surface treatment	Quantity / Reel
	mm^2	AWG#				
SVH–21T1.1	0.33 to 0.83	22 to 18	1.7 to 3.0	Brass Phosphor bronze	Tinning	4500
SVH–21T–P1.1						

Fig. C10 (a) Contact for 9″ PDP power cable (24 VDC input type)





Specification	VHR–2N
Material	Nylon 6 UL94V–0 Natural
Quantity/bag	1000

Fig. C10 (b) Housing for 9″ PDP power cable (24 VDC input type)

B CONNECTING CABLES AND CONNECTORS

B.1
TABLE OF CABLE

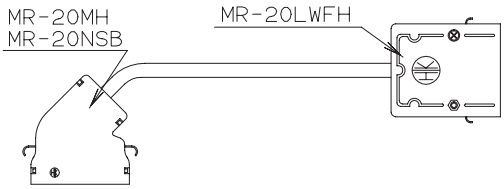
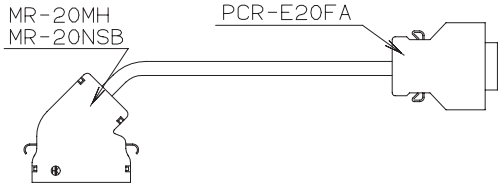
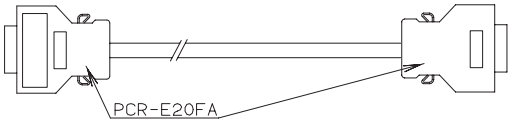
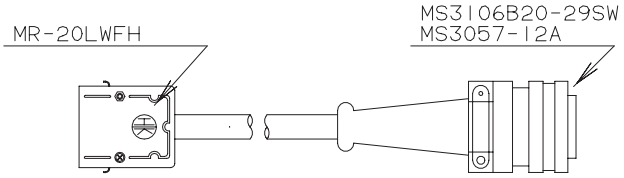
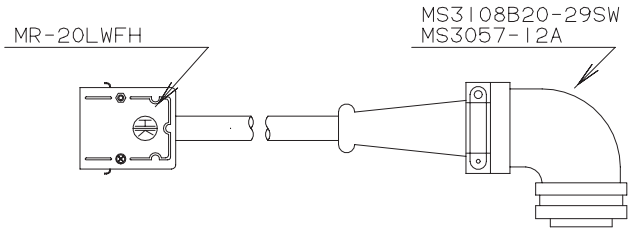
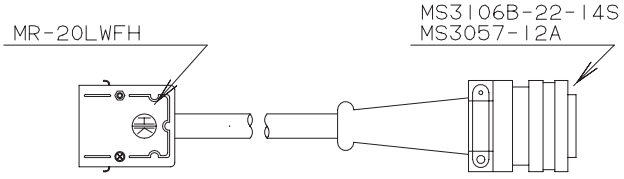
Cable	Usage	Max–length (m)
J1	Machine interface: CNC M1–Magnetic cabinet	50
J2	Machine interface: CNC M2–Magnetic cabinet	50
J15	1st axis motor power line: Velocity control unit motor	50
J16	2nd axis motor power line: Velocity control unit motor	50
J17	3rd axis motor power line: Velocity control unit motor	50
J18	4th axis motor power line: Velocity control unit motor	50
J15A	5th axis motor power line: Velocity control unit motor	50
J16A	6th axis motor power line: Velocity control unit motor	50
J20*	AC input unit CP2–power source CP11	
J23	Position coder CNC, M27–Position coder	50
J23A	Position coder CNC, M29–Position coder	50
J24	Manual pulse generator : CNC M12 or M21–manual pulse generator (For 1st unit)	50
J25	Manual pulse generator : CNC M12 or M21–manual pulse generator (For 2nd/3rd unit)	50
J26	Analog output : CNC, M26–spindle control circuit	50
J26A	Analog output : CNC, M28–spindle control circuit	50
J27	MDI key signal : CNC, M3–CRT/MDI, KM1	50
J28	Reader puncher interface : CNC M5–connecting pin	50 to I/O device
J30	Machine interface CNC: M18–magnetic cabinet	50
J31	Machine interface CNC: M18–magnetic cabinet	50
J32	Machine interface CNC:M18–magnetic cabinet	50
J36	Additional B2 power cable : Power supply unit CP14–additional I/O B2 CP51	Voltage drop is less than 1V
J37	CRT signal : CNC, CCX (CCX2)–CRT/MDI unit, CN1	50
J38	CRT power supply : Power supply unit, CP15–CRT/MDI unit, CN2	50
J39	Additional B2 signal cable : PMC–M PCB, M24–additional I/O B2,M60	10
J40	Machine interface: CNC,M61–magnetic cabinet	50
J41	Machine interface:CNC, M62–magnetic cabinet	50
J42	Machine interface:CNC, M78–magnetic cabinet	50
J43	Machine interface:CNC, M79–magnetic cabinet	50

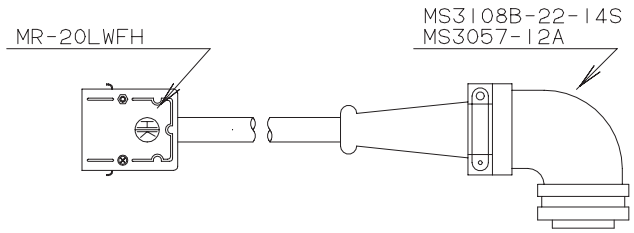
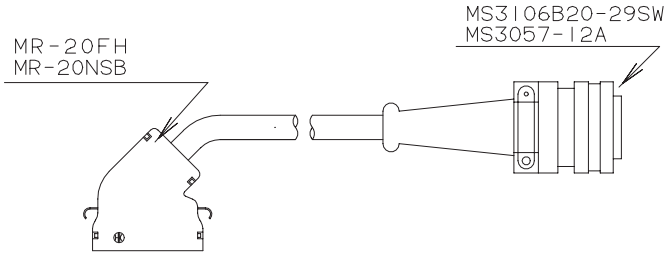
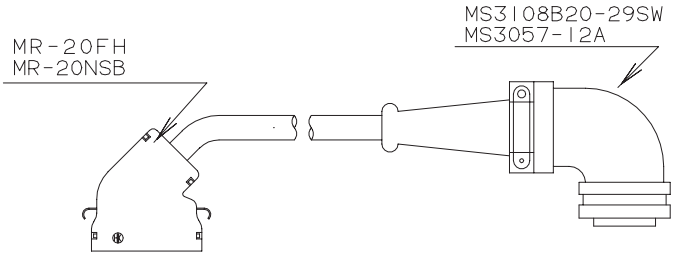
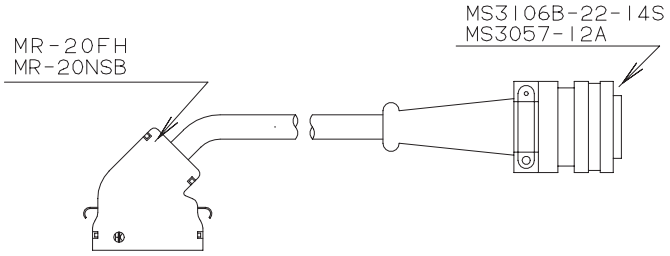
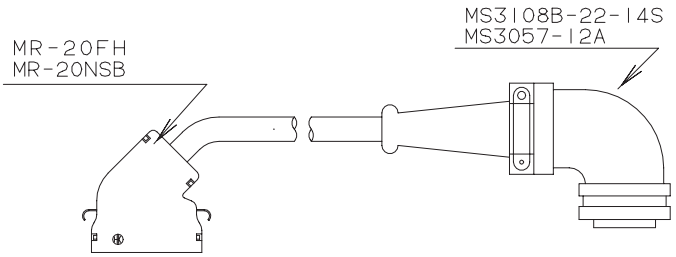
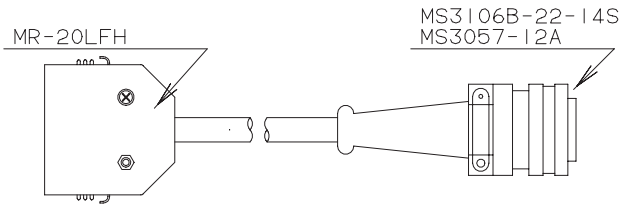
Cable	Usage	Max–length (m)
J44	Machine interface: CNC, M80–magnetic cabinet	50
J51	Servo power : Servo transformer–Velocity control unit	
J52	Power supply for MCC : 100VAC velocity control unit	
J61	Servo transformer input power supply : AC input 3 phases–servo transformer	
J81	Absolute pulse coder relay 1st axis : Integrated relay unit to pulse coder	
J82	Absolute pulse coder relay 2nd axis : Integrated relay unit to pulse coder	
J83	Absolute pulse coder relay 3rd axis : Integrated relay unit to pulse coder	
J84	Absolute pulse coder relay 4th axis : Integrated relay unit to pulse coder	
J85 to J88	Absolute pulse coder relay from 1st to 4th axis : Relay unit to Battery unit	
J89	Absolute pulse coder battery cable : Relay unit to Battery unit	
J141	Operator’s panel interface : CNC,M1–Operator’s panel, M1A	50
J142	Operator’s panel interface : CNC,M1–Operator’s panel, M2A	50
J143	Machine interface : CNC, M1B–magnetic cabinet	50 together with J141
J144	Machine interface: CNC, M2B–magnetic cabinet	50 together with J142
J210 to J217	Servo command 1 axis to 6 axis : CNC to Integrated pulse coder	50
J220 to J227	Position feedback cable 1 axis to 6 axis : CNC to integrated pulse coder	50
J230 to J237	Position feedback cable 1 axis to 6 axis : CNC to remote pulse coder	50
J240 to J247	Velocity feedback cable 1 axis to 6 axis : CNC to servo motor	50

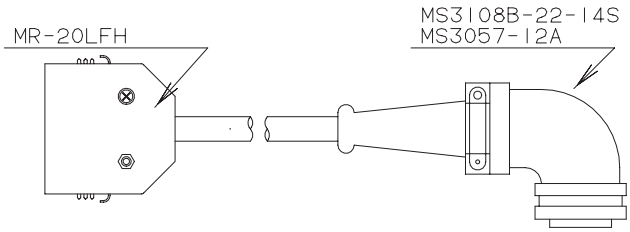
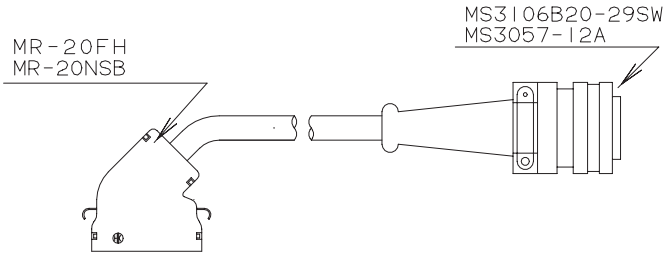
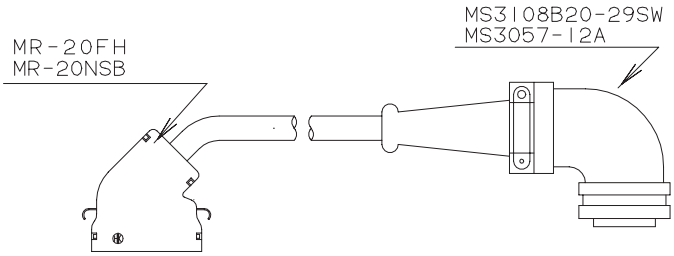
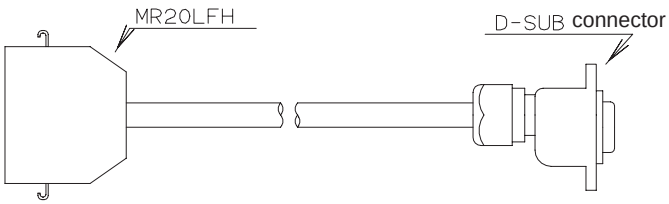
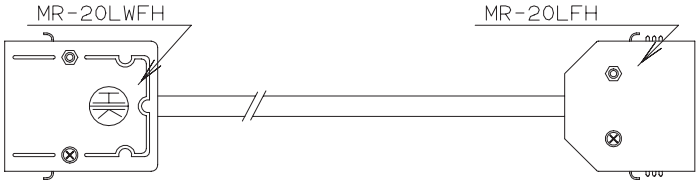
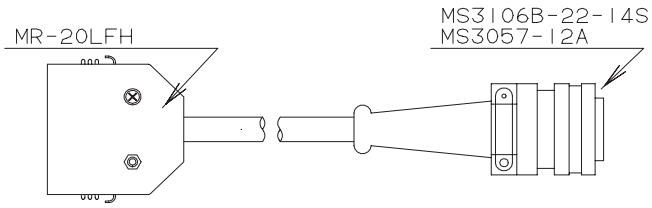
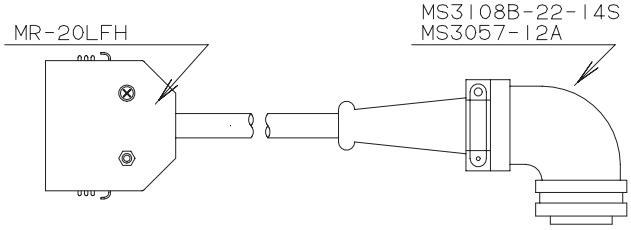
B.2 INTERFACE CABLE (OUR SUPPLY)

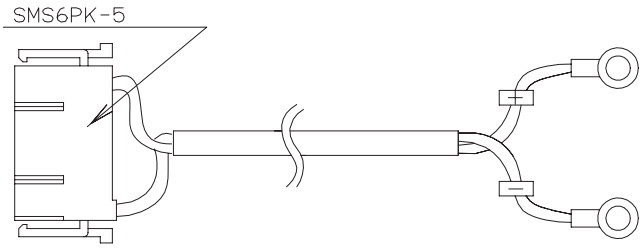
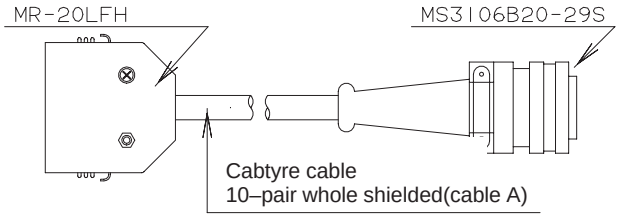
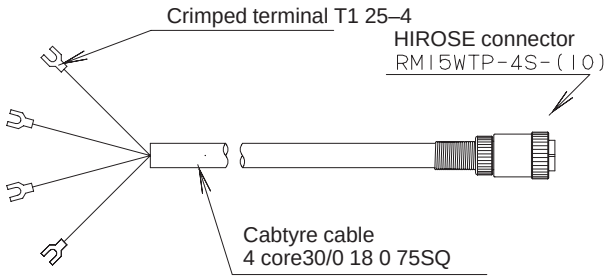
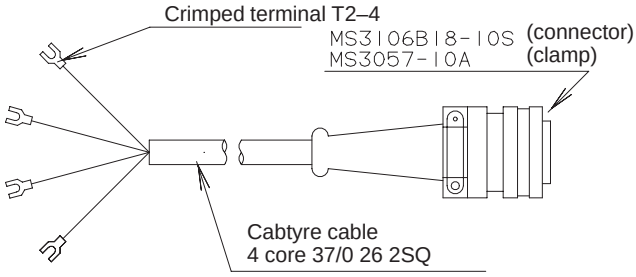
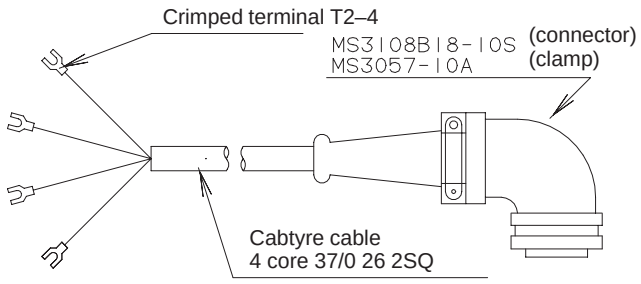
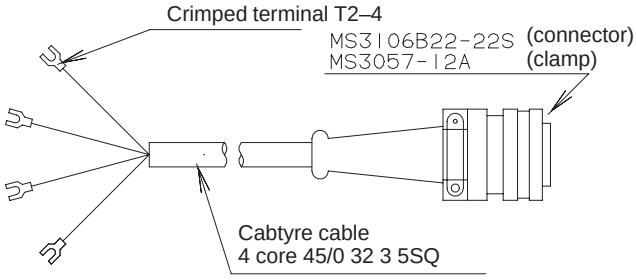
The following interface cables are provided.

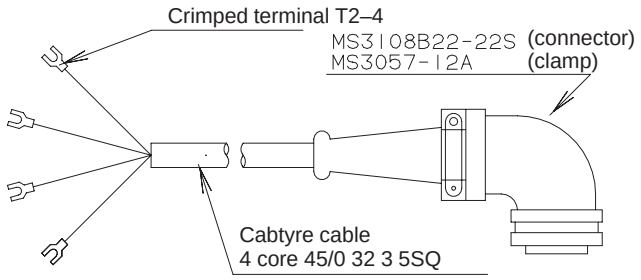
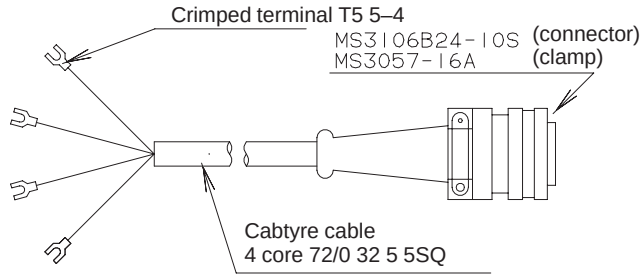
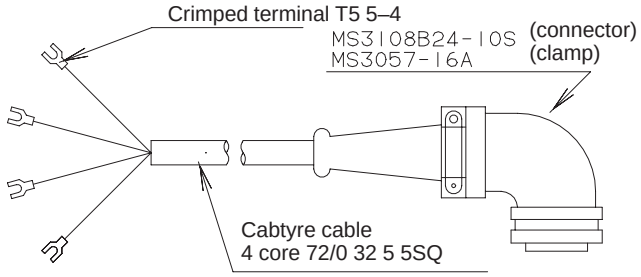
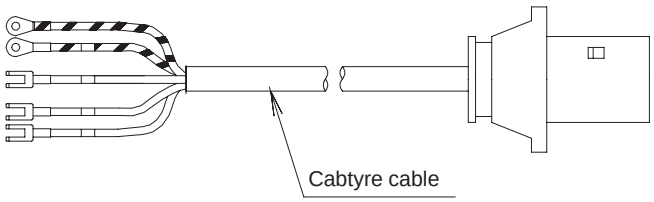
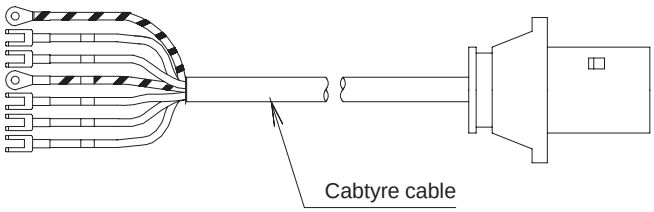
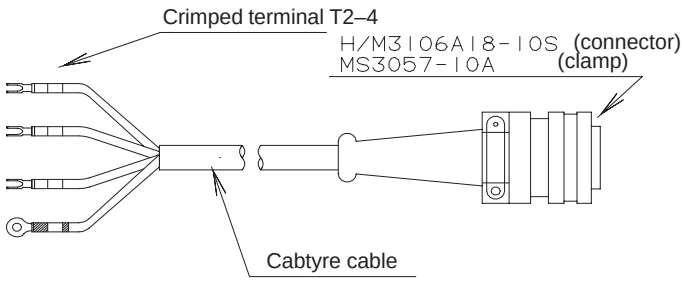
Connection cable for SERVO

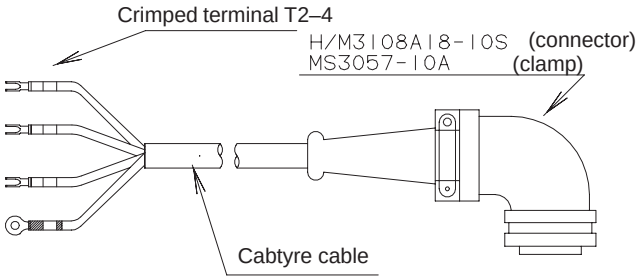
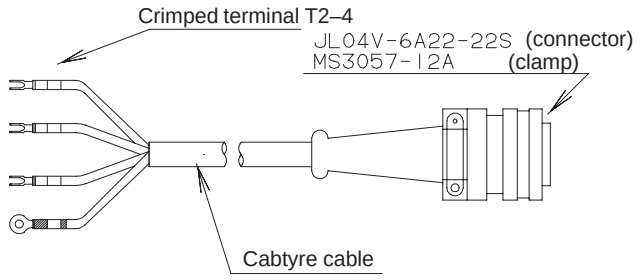
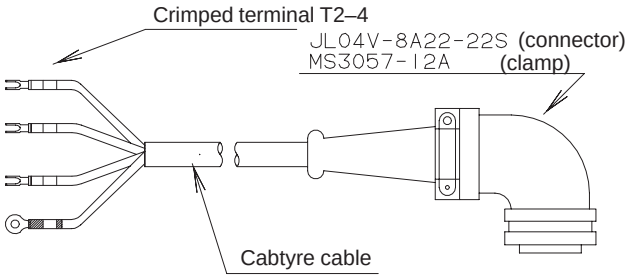
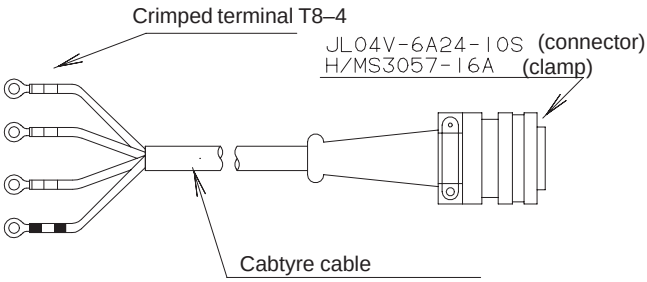
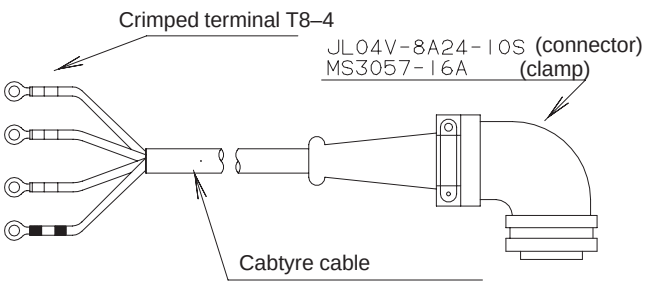
Usage	Name	Specifications	Code	Length
For current command Control unit ⇕ Servo amplifier (S series)	J210 to J217		A02B–0074–K801	5 m
For current command Control unit ⇕ Servo amplifier (S series)	J210 to J217		A02B–0098–K821	5 m
For current command Control unit ⇕ Servo amplifier (C,αseries)	J210 to J217		A02B–0098–K841	5 m
Serial spindle signal cable α series amplifier (JA7B) ⇕ Electric/optical transducer			A02B–0120–K844	1 m
Incremental A/B phase pulse coder Servo amplifiler (S series) ⇕ Control unit	J220 to J227		A02B–0074–K802	14 m
Incremental A/B phase pulse coder Servo amplifiler (S series) ⇕ Control unit	J220 to J227		A02B–0074–K803	14 m
Incremental A/B phase pulse coder High resolution servo motor (S series) ⇕ Control unit	J220 to J227		A02B–0074–K807	14 m

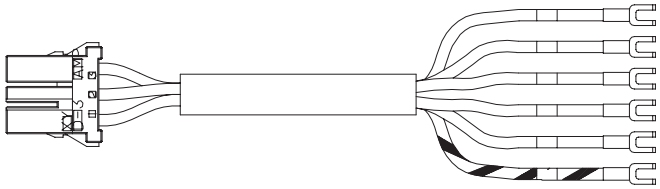
Usage	Name	Specifications	Code	Length
Incremental A/B phase pulse coder High resolution servo motor (S series) ↕ Control unit	J220 to J227		A02B– 0074– K808	14 m
Incremental A/B phase pulse coder Servo motor (S series) ↕ Control unit	J220 to J227		A02B– 0098– K822	14 m
Incremental A/B phase pulse coder Servo motor (S series) ↕ Control unit	J220 to J227		A02B– 0098– K823	14 m
Incremental A/B phase pulse coder High resolution servo motor (S series) ↕ Control unit	J220 to J227		A02B– 0098– K827	14 m
Incremental A/B phase pulse coder High resolution servo motor (S series) ↕ Control unit	J220 to J227		A02B– 0098– K828	14 m
Absolute A/B phase pulse coder High resolution servo motor (S series) ↕ Control unit (Relay unit is not used.)	J220B to J227B		A02B– 0096– K801	14 m

Usage	Name	Specifications	Code	Length
Absolute A/B phase pulse coder High resolution servo motor (S series) ↕ Control unit (Relay unit is not used.)	J220B to J227B		A02B– 0096– K802	14 m
Incremental A/B phase pulse coder Servo motor α3–α150 ↕ Control unit	J220 to J227		A02B– 0098– K860	14 m
Incremental A/B phase pulse coder Servo motor α3–α150 ↕ Control unit	J220 to J227		A02B– 0098– K861	14 m
Incremental A/B phase pulse coder Servo motor α1,α2 ↕ Control unit	J220 to J227		A06B– 6050– K854	14 m
Absolute A/B phase feedback Relay unit ↕ Control unit	J220 to J227A		A02B– 0074– K804	2 m
Absolute A/B phase feedback AC servo motor ↕ Relay unit	J81 to J84		A06B– 6050– K055	14 m
Absolute A/B phase feedback AC servo motor ↕ Relay unit	J81 to J84		A06B– 6050– K056	14 m

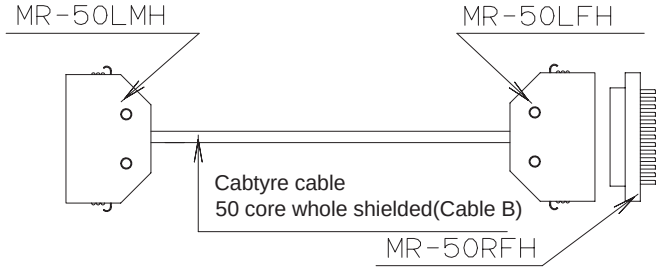
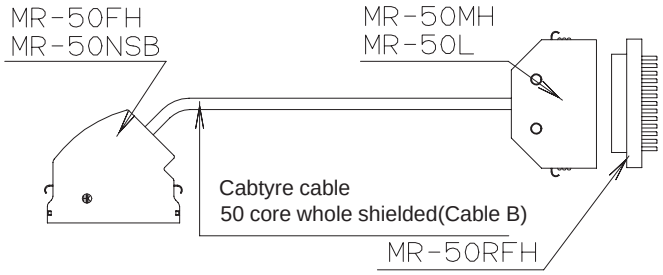
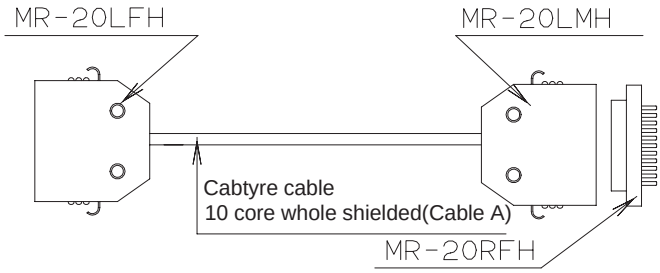
Usage	Name	Specifications	Code	Length
Battery unit for absolute pulse coder ↕ Relay unit	J89		A02B–0072–K902	4 m
Cable for position coder Position coder ↕ Controller	J23		A02B–0050–K801	7 m
AC servo motor drive cable Servo amplifier ↕ Servo motor (For 2–0,1–0)	J15 to J18		A06B–6050–K003	14 m
AC servo motor drive cable Servo amplifier ↕ Servo motor (For 0,5)	J15 to J18		A06B–6050–K005	14 m
AC servo motor drive cable Servo amplifier ↕ Servo motor (For 0,5)	J15 to J18		A06B–6050–K006	14 m
AC servo motor drive cable Servo amplifier ↕ Servo motor (For 10,20,30)	J15 to J18		A06B–6050–K007	14 m

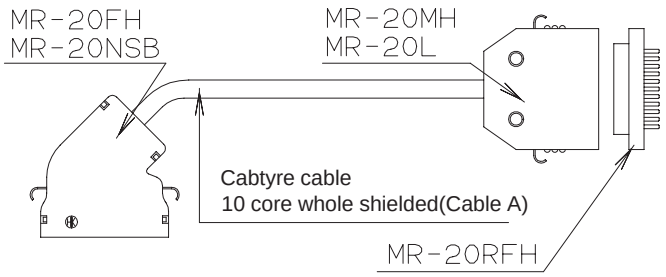
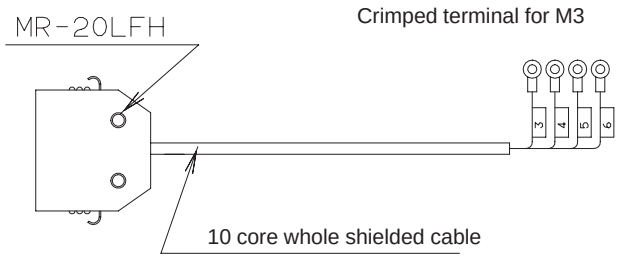
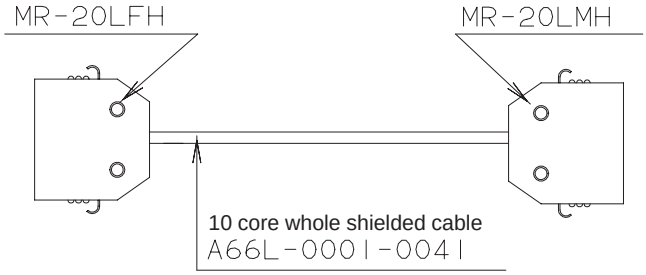
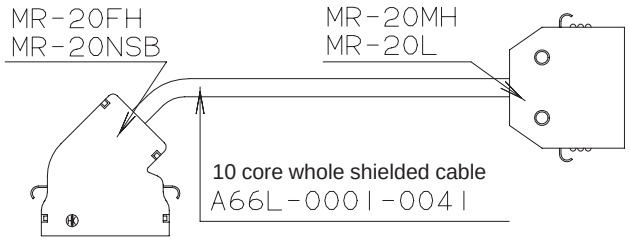
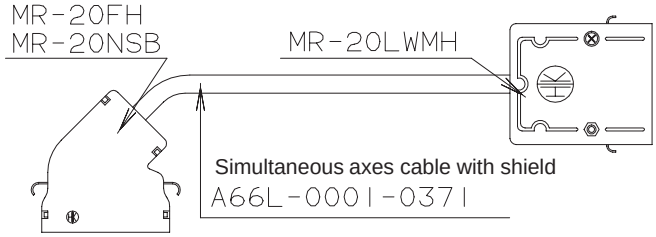
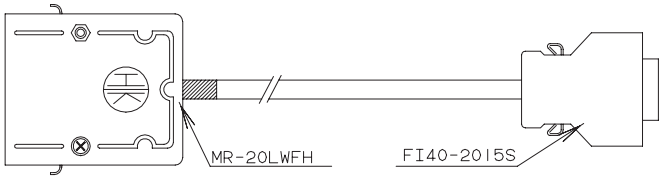
Usage	Name	Specifications	Code	Length
AC motor drive cable Servo amplifier ↕ Servo motor (For 10,20,30)	J15 to J18		A06B– 6050– K008	14 m
AC motor drive cable Servo amplifier ↕ Servo motor (For 30R)	J15 to J18		A06B– 6050– K009	14 m
AC motor drive cable Servo amplifier ↕ Servo motor (For 30R)	J15 to J18		A06B– 6050– K010	14 m
For servo motor drive Servo amplifier ↕ Servo motor α1,α2 (Without brake)	J15 to J18		A06B– 6050– K824	14 m
For servo motor drive Servo amplifier ↕ Servo motor α1,α2 (With brake)	J15 to J18		A06B– 6050– K825	14 m
For servo motor drive Servo amplifier ↕ Servo motor α3,α6,α9 (Straight)	J15 to J18		A06B– 6079– K800	14 m

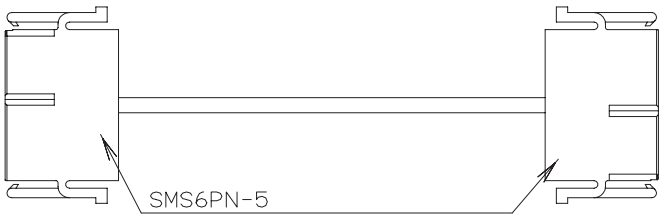
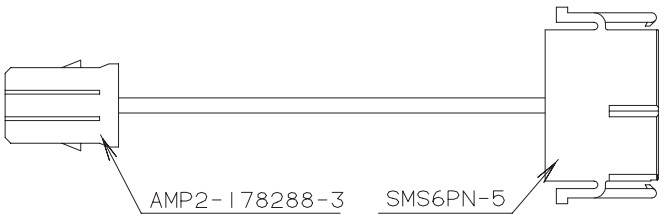
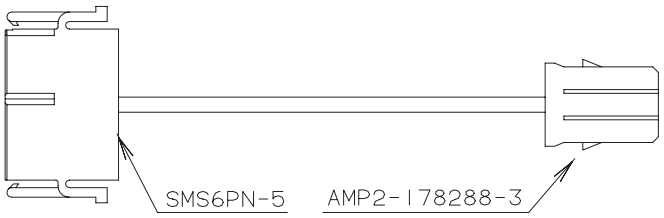
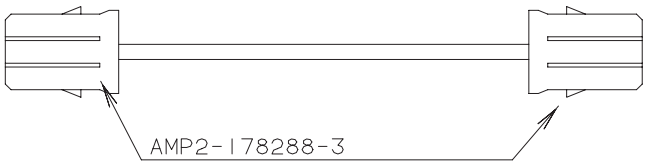
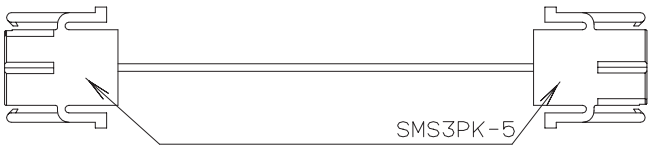
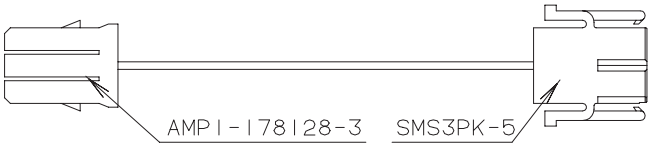
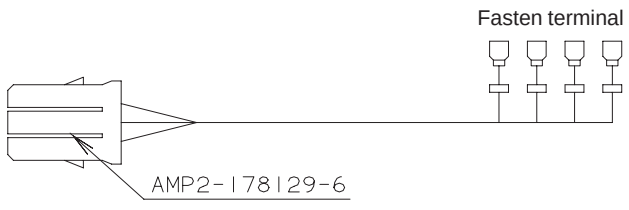
Usage	Name	Specifications	Code	Length
For servo motor drive Servo amplifier ⇕ Servo motor α3,α6,α9 (Elbow)	J15 to J18		A06B–6079–K801	14 m
For servo motor drive Servo amplifier ⇕ Servo motor α12,α22,α30 (Straight)	J15 to J18		A06B–6079–K802	14 m
For servo motor drive Servo amplifier ⇕ Servo motor α12,α22,α30 (Elbow)	J15 to J18		A06B–6079–K803	14 m
For servo motor drive Servo amplifier ⇕ Servo motor α22,α30,α40 (Straight)	J15 to J18		A06B–6079–K804	14 m
For servo motor drive Servo amplifier ⇕ Servo motor α22,α30,α40 (Elbow)	J15 to J18		A06B–6079–K805	14 m

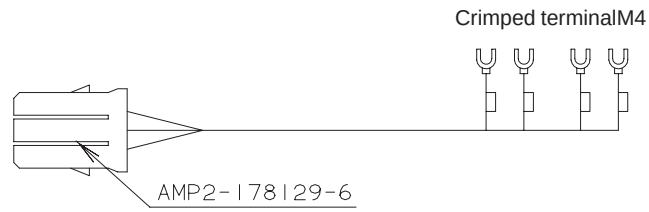
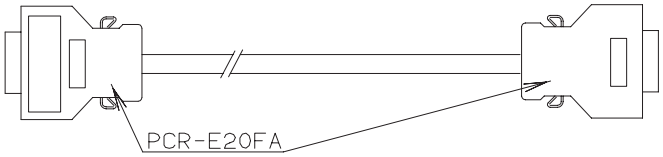
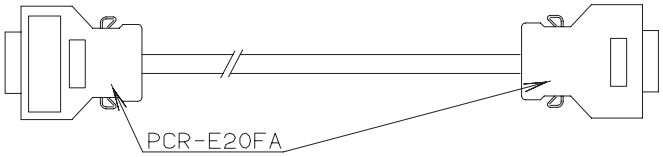
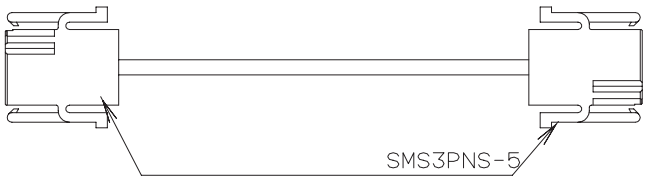
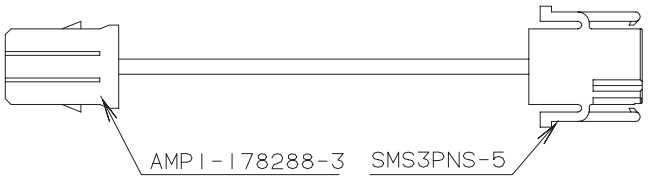
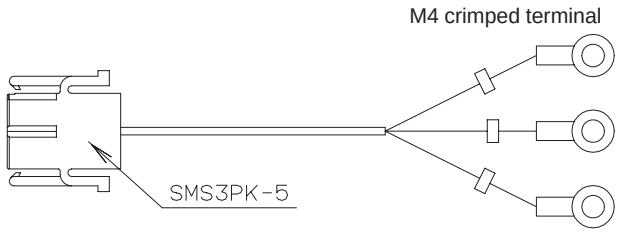
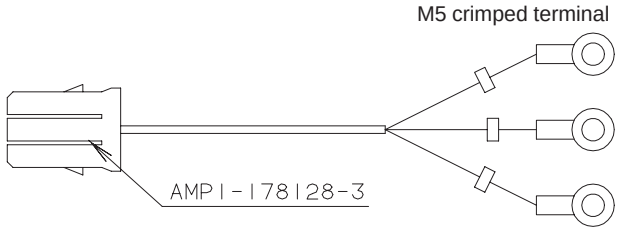
Usage	Name	Specifications	Code	Length
For servo motor drive Servo amplifier ⇕ Servo motor α0.5 (Without brake)	J15 to J18		A06B– 6050– K822	14 m
For servo motor drive Servo amplifier ⇕ Servo motor α0.5 (With brake)	J15 to J18		A06B– 6050– K823	14 m

Connection cable for CNC

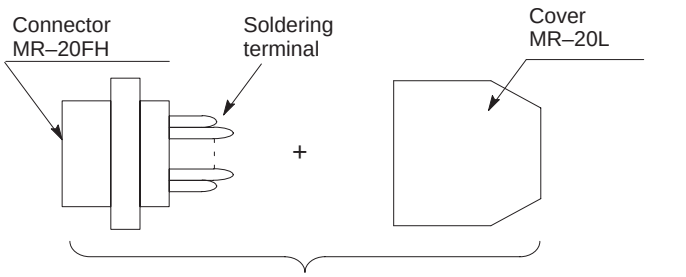
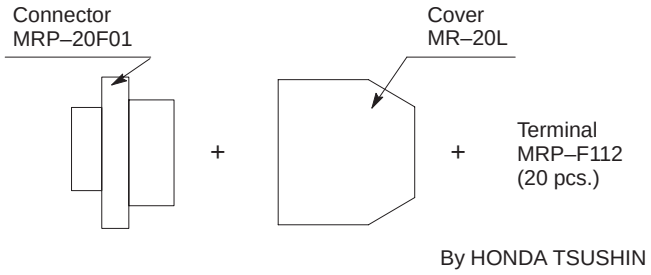
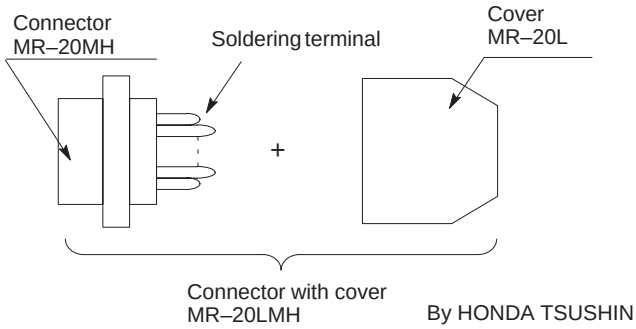
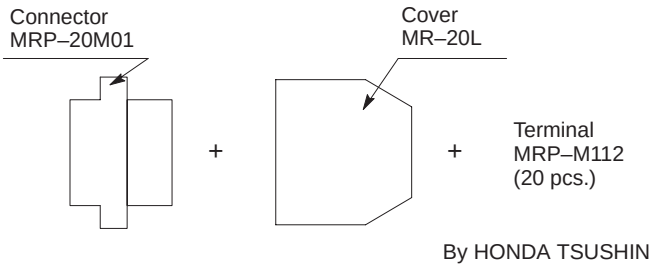
Usage	Name	Specifications	Code	Length
Signal cable for DI/DO Control unit ⇕ Operator's panel or control panel	J1 J2 J30 J32 J40 J41 J42 J44		A02B– 0029– K801	7 m
Signal cable for DI/DO Control unit ⇕ Operator's panel or control panel	J1 J2 J30 J32 J40 J41 J42 J44		A02B– 0098– K801	7 m
Signal cable for DI/DO Control unit ⇕ Operator's panel or control panel	J31 J39 J43		A02B– 0029– K802	7 m

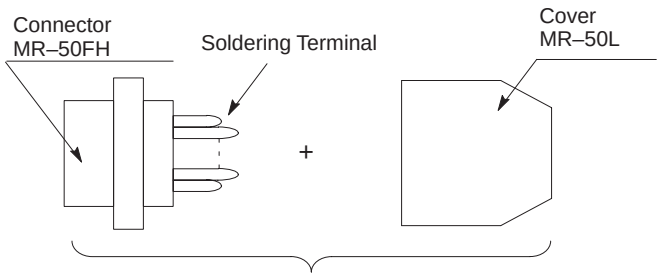
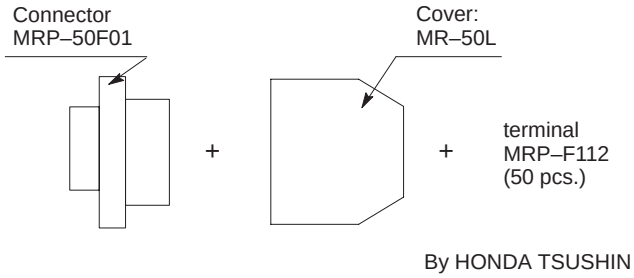
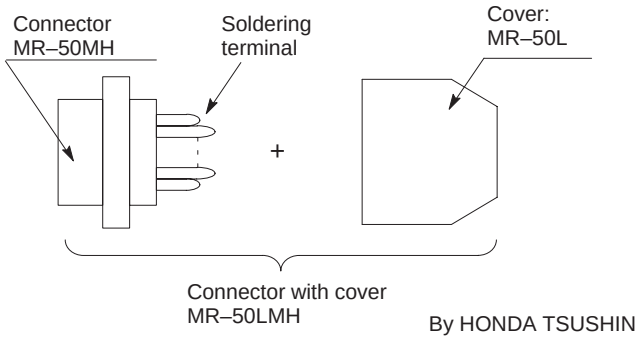
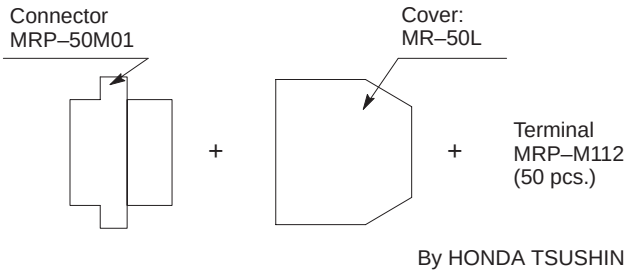
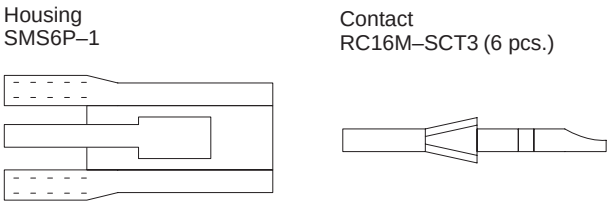
Usage	Name	Specifications	Code	Length
Signal cable for DI/DO Control unit ↕ Operator's panel or control panel	J31 J39 J43		A02B–0098–K802	7 m
Signal cable (For 1 axis) for manual pulse generator Control unit ↕ Manual pulse generator	J24		A02B–0050–K802	7 m
Signal cable for MDI Control unit ↕ MDI unit (Common to both small type and full key type)	J27		A02B–0050–K803	10 m
Signal cable for MDI Control unit ↕ MDI unit (Common to both small type and full key type)	J27		A02B–0098–K803	10 m
Signal cable for VIDEO Control unit ↕ Display (For EMC)	J37A		A02B–0098–K871	7 m
CRT/LCD VIDEO signal cable Control unit ↕ 14″CRT(For CE) LCD unit	J37		A02B–0098–K870	5 m

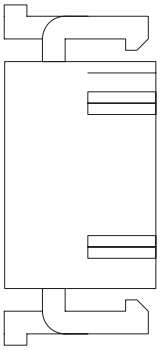
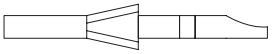
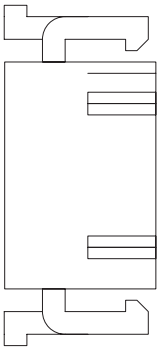
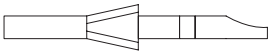
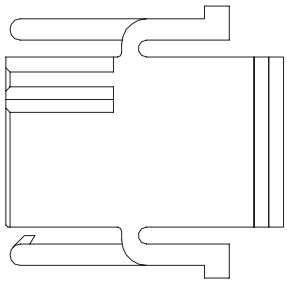
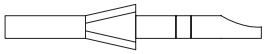
Usage	Name	Specifications	Code	Length
Monochrome CRT Power supply cable Power supply unit ↕ CRT unit	J38		A02B–0072–K814	7 m
Monochrome CRT Power supply cable Power supply unit (For CE) ↕ CRT unit	J38		A02B–0120–K820	5 m
LCD unit Power supply cable Power supply unit ↕ LCD unit	J38		A02B–0120–K820	5 m
LCD unit Power supply cable Power supply unit (For CE) ↕ LCD unit	J38		A02B–0120–K823	5 m
14″color CRT Power supply cable Power supply unit ↕ 14″color CRT unit	J38		A02B–0072–K815	7 m
14″color CRT Power supply cable Power supply unit (For CE) ↕ 14″color CRT unit	J38		A02B–0120–K821	5 m
14″color CRT Power supply cable Power supply unit (For CE) ↕ 14″ color CRT unit (For CE)	J38		A02B–0200–K812	5 m
Power supply ON/OFF cable Power supply unit (For CE) ↕ ON/OFF switch (Except 14″CRT)			A02B–0120–K830	5 m

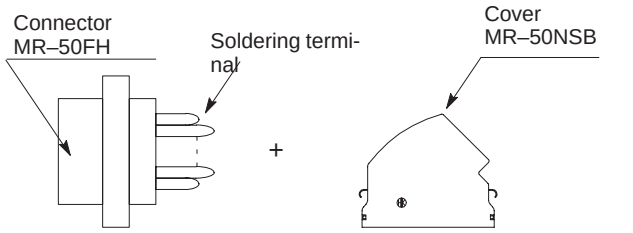
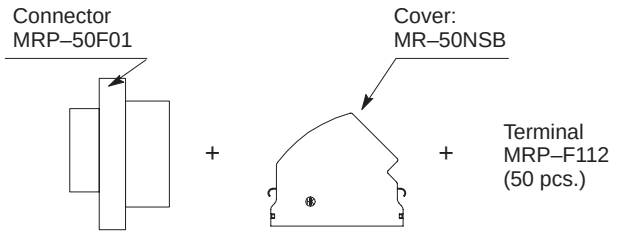
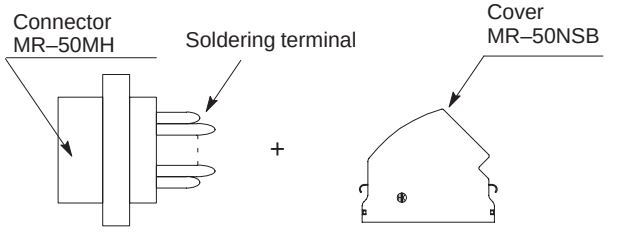
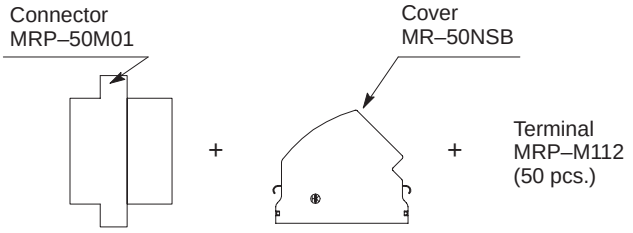
Usage	Name	Specifications	Code	Length
Power supply ON/OFF cable Power supply unit (For CE) ↕ ON/OFF switch (only for 14″CRT)			A02B–0120–K831	5 m
I/O link cable Control unit (JD1A) ↕ I/O unit (JD1B)			A03B–0807–K801 or K802	10 m or 5 m
I/O link cable Control unit (J1A) ↕ Electric/optical transducer			A03B–0807–K803	1 m
Additional I/O or I/O unit power supply cable Power supply unit ↕ Each unit	J36		A02B–0072–K817	7 m
Additional I/O or I/O unit power supply cable Power supply unit (For CE) ↕ Each unit	J36		A02B–0120–K843	5 m
Control unit power supply cable Power supply unit (AI) ↕ Input power supply (200VAC)			A02B–0072–K823	7 m
Control unit power supply cable Power supply unit (For CE) ↕ Input power supply (200VAC)			A02B–0120–K845	7 m

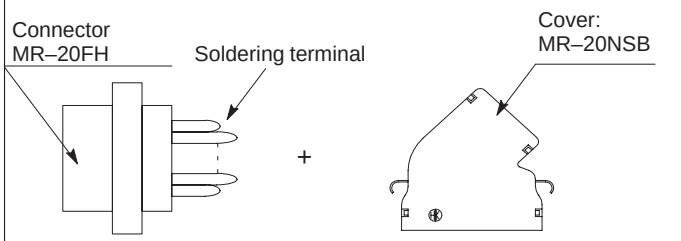
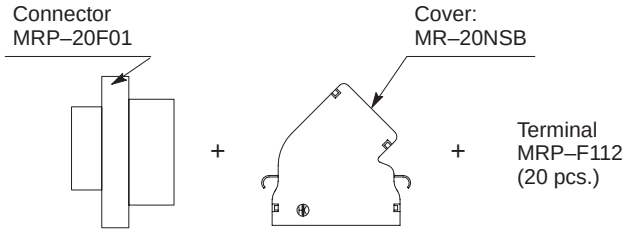
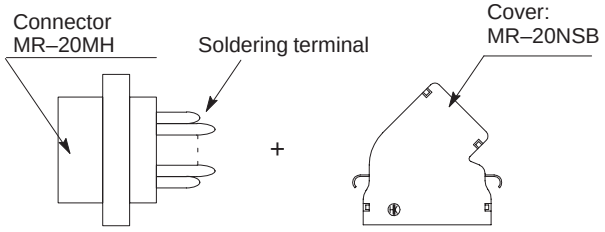
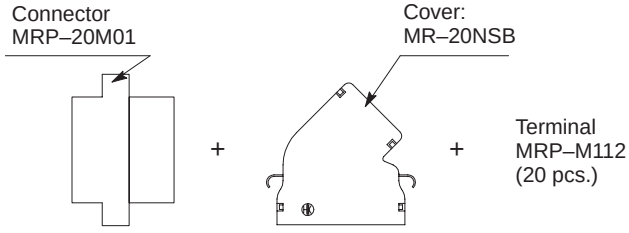
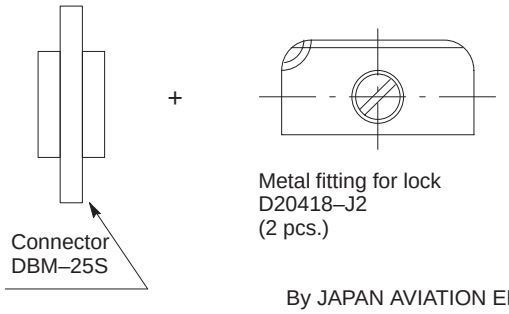
B.3 CONNECTOR FOR INTERFACE (ATTACHED TO CABLES)

Usage (Connector No.)	Name	Specifications	Code	Number
M3 M12 M19 M21 M27 M35 M36 M38 M39 M45 M46 M48 M49 M60 M79 M185 M186 M188 M189 M195 M196 M198 M199 M219 CCX1 to 5 CX1	Connector with cover(20–pin female soldering type)		A02B–0029–K890	
	Connector with cover(20–pin female crimp type)		A02B–0029–K892	
M5 M24 M26 M34 M37 M44 M47 M184 M187 M194 M197 KM1	Connector with cover(20–pin male soldering type)		A02B–0029–K898	
	Connector with cover(20–pin male crimp type)		A02B–0029–K900	

Usage (Connector No.)	Name	Specifications	Code	Number
M1 M2 M18 M20 M61 M62 M78 M80 M1B M2B M201 M202 M218 M220	Connector with cover (50 pin female soldering type)		A02B–0029–K891	
	Connector with cover (50 pin female crimp type)		A02B–0029–K893	
M1 to M2A	Connector with cover (50 pin male soldering type)		A02B–0029–K899	
	Connector with cover (50 pin male crimp type)		A02B–0029–K901	
CP2 CP11	Connector 6 pin square soldering type black		A02B–0072–K891	

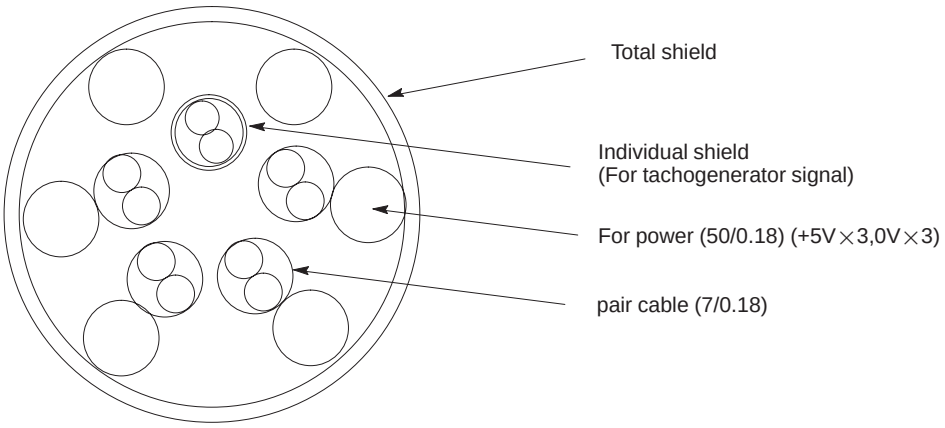
Usage (Connector No.)	Name	Specifications	Code	Number
CP15 CN2 (CRT/MDI)	Connector 6 pin female soldering type brown	Housing SMS6PN–5  + Contact RC16M–SCT3 (6 pcs.)  By JAPAN FCI	A02B–0061–K203	
AC servo (Degital) unit CN2	Connector 6 pin female soldering type white	Housing SMS6PW–5  + Contact RC16M–SCT3 (6 pcs.)  By JAPAN FCI	A06B–6047–H031	
CP14 CP51	Connector 3 pin female soldering type brown	Housing SMS3PN–5  Contact RC16M–SCT3 (3 pcs.)  By JAPAN FCI	A02B–0072–K893	

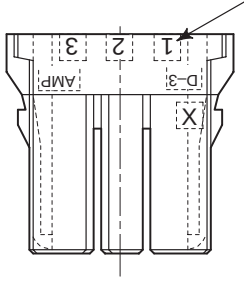
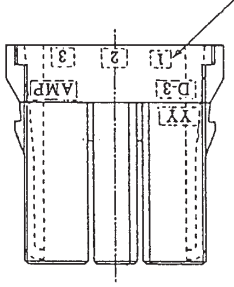
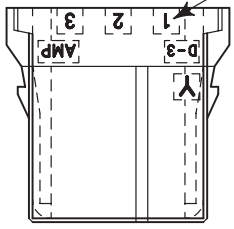
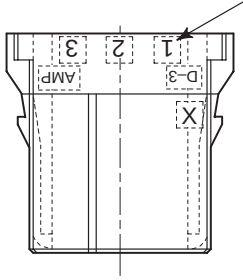
Usage (Connector No.)	Name	Specifications	Code	Number
M1 M2 M18 M20 M61 M62 M78 M80 M1B M2B M201 M202 M218 M220	Connector with cover (50 pin female soldering type)	 By HONDA TSUSHIN	A02B–0098–K891	
	Connector with cover (50 pin female crimp type)	 By HONDA TSUSHIN	A02B–0098–K893	
M1 to M2A	Connector with cover (50 pin male soldering type)	 By HONDA TSUSHIN	A02B–0098–K899	
	Connector with cover (50 pin male crimp type)	 By HONDA TSUSHIN	A02B–0098–K901	

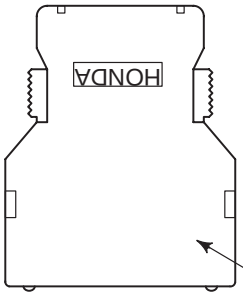
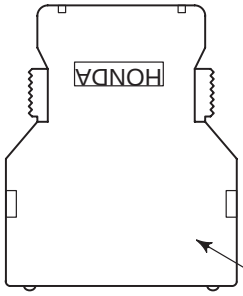
Usage (Connector No.)	Name	Specifications	Code	Number
M3 M12 M19 M21 M27 M35 M36 M38 M39 M45 M46 M48 M49 M60 M79 M185 M186 M188 M189 M195 M196 M198 M199 M219 CCX1 to 5 CX1	Connector with cover (20 pin female soldering type)	 By HONDA TSUSHIN	A02B–0098–K890	
	Connector with cover (20 pin female crimp type)	 By HONDA TSUSHIN	A02B–0098–K892	
M5 M24 M26 M34 M37 M44 M47 M184 M187 M194 M197 KM1	Connector with cover (20 pin male soldering type)	 By HONDA TSUSHIN	A02B–0098–K898	
	Connector with cover (20 pin male crimp type)	 By HONDA TSUSHIN	A02B–0098–K900	
Relay connector for reader/puncher interface	Connector and lock metal	 By JAPAN AVIATION ELECTRIC	A02B–0061–K201	

B.4 CABLE FOR STANDARD INTERFACE

Name	Conductor		Sheath thickness	Total outer dia.	Electric characteristic		Code*
	Diameter	Composition			Conductor resistance	Allowable current	
Cable A (10–pair)	ϕ0.55 mm	7/0.18	1.5 mm	ϕ10.0 mm	110Ω/km	1.6 A	A66L–0001–0041
Cable B (50 core)	ϕ0.55 mm	7/0.18	1.7 mm	ϕ12.5 mm	106Ω/km	1.6 A	A66L–0001–0042
Cable C (5–pair, 6 core)	ϕ0.55 mm	7/0.18	1.0 mm	ϕ11.0 mm	116Ω/km	1.6 A	A66L–0001–0157
	ϕ1.5 mm	50/0.18			16Ω/km	10 A	



Usage (Connector symbol)	Name	Specification	Code	Number
Power supply unit for CE Marking For 200 VAC input/output (CP1, CP2, CP3)	AMP, 3–pin, Black, Type X	AMP1–178128–3  + Terminal AMP1–175218–5 (3 pcs)	A02B–0120–K321	
Power supply unit for CE Marking For ON/OFF control (CP4)	AMP, 6–pin, Black, Type YY	AMP2–178129–6  + Terminal AMP1–175218–2 (6 pcs.)	A02B–0120–K322	
Power supply unit for CE Marking For 24 VDC output (CP5)	AMP, 3–pin, Black, Type Y	AMP2–178288–3  + Terminal AMP1–175218–5 (3 pcs.)	A02B–0120–K323	
Power supply unit for CE Marking For 24 VDC output (CP6)	AMP, 3–pin, Black, Type X	AMP1–178288–3  + Terminal AMP1–175218–5 (3 pcs.)	A02B–0120–K324	

Usage (Connector symbol)	Name	Specification	Code	Number
For I/O Link (JD1A, JD1B) Servo cable or type B interface (JS1A)	Connector with cover (20–pin, half–pitch, female, solder type)	 + Main body of connector PCR–E20FS Cover PCR–V20LA HONDA TSUSHIN KOGYO CO., LTD.	A02B–0120–K301	
	Connector with cover (20–pin, half–pitch, female, crimp type)	 + Main body of connector PCR–E20FA Cover PCR–V20LA HONDA TSUSHIN KOGYO CO., LTD.	A02B–0120–K302	

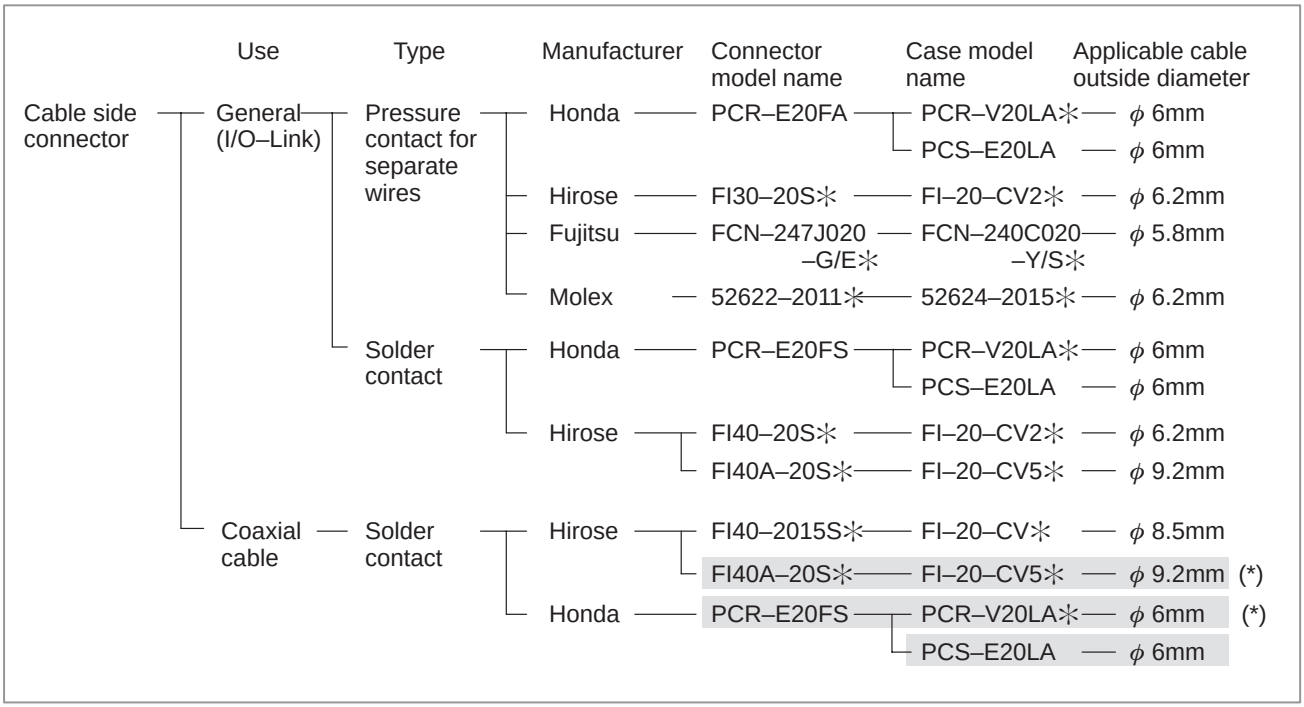
C HALF PITCH 20–PIN INTERFACE CONNECTORS AND CABLES

Connector for the PC board

Model: PCR–EV20MDT manufactured by Honda Tsushin
The connector for the PC board has been specially developed support FANUC's high–mounting density. PCR connectors made by Honda Tsushin are compatible with the mating part of the connector and can be selected for the cable connection.

Cable connector

Several connector manufacturers have developed custom cable side connectors for this purpose.
The cable connector is separated into a body and a housing. The connectors available are shown below. Models marked with (⁎) have been customized for FANUC; those not so marked are mass produced as standard products.



Pressure contact for separate wires

This connector assembles multiple #28AWG wires into a single connection. In comparison with solder contact and crimp contact connectors, this connector enables a cable to be assembled at a much lower cost.

Solder contact

The Honda Tsushin PCR–E20FS is a solder contact type connector used for assembling a small number of cables or for cable assembly on site. The Hirose Electric FI40–20S is equivalent to the PCR–E20FS but has large solder terminals to facilitate soldering.

Hirose Electric has also developed the FI40A–20S, which has the same number of pins as the FI40–20S but a larger solder row pitch to enable easier soldering. Since the applicable cable diameter of the case has been increased, the FI40A–20S can also be used with thick wires (diameter: 9.2 mm).

These connectors enable the soldering of wires of up to around #20AWG. When a large number of #20AWG wires are used, however, the pitch of the solder contacts may be too small to achieve satisfactory workability. To overcome this problem, the Hirose Electric FI40–2015S has been developed. The number of pins has been reduced so that the pitch of the solder contacts is as large as a conventional MR connector.

NOTE

The connectors can also be used for pulse coders and other equipment. In this case, the supported cable outside diameters are 9.2 mm and 6.0 mm, respectively. Either connector can be used, depending on the outside diameter of the cable to be used.

The FANUC–developed cable (A66L–0001–0286) has an outside diameter of 8.5 mm and cannot be used with these connectors.

Recommended connectors and applicable housings

Connector name in Connection Manual	FANUC–authorized connector (manufacturer)	FANUC–authorized housing or case (manufacturer)	FANUC order number of applicable cable (FANUC–developed cable)	Remarks
PCR–E20FA Pressure contact for separate wires	PCR–E20FA (Honda Tsushin)	PCR–V20LA (Honda Tsushin)	A66L–0001–0284#10P (Outside diameter: 6.2 mm)	Plastic housing
		PCS–E20LA (Honda Tsushin)		Metal housing
	FI30–20S (Hirose Electric)	FI–20–CV2 (Hirose Electric)		Plastic housing
	FCN–247J020–G/E (Fujitsu)	FCN–240C020–Y/S (Fujitsu)		Plastic housing
	52622–2011 (Molex)	52624–2015 (Molex)		Plastic housing
PCR–E20FS Solder contact	PCR–E20FS (Honda Tsushin)	PCR–V20LA (Honda Tsushin)	A66L–0001–0284#10P (Outside diameter: 6.2 mm)	Plastic housing
		PCS–E20LA (Honda Tsushin)		Metal housing
	FI40–20S (Hirose Electric)	FI–20–CV2 (Hirose Electric)		Plastic housing
FI40–2015S 15–pin solder contact	FI40–2015S (Hirose Electric)	FI–20–CV (Hirose Electric)	A66L–0001–0286 (Outside diameter: 8.5 mm)	Plastic housing
FI40A–20S Solder contact	FI40A–20S (Hirose Electric)	FI–20–CV5 (Hirose Electric)	A66L–0001–0367 A66L–0001–0368 (Outside diameter: 9.2 mm)	Plastic housing

Specialized tools for assembling pressure contact connector

Connector name in Connection Manual	FANUC–authorized connector (manufacturer)	Wire preparation tool	Pressure tool	Remarks
PCR–E20FA	PCR–E20FA (Honda Tsushin)	PCS–K2A	FHPT–918A	Low price
		JGPS–015–1/1–20 JGPS–014	MFC–K1 PCS–K1	(Note)
		FHAT–918A		
	FI30–20S (Hirose Electric)	FI30–20CAT	FI30–20/ID	Low price
		FI30–20CAT1	HHP–502 FI30–20GP	
	FCN–247J020–G/S (Fujitsu)	FCN–237T–T043/H	FCN–237T–T109/H FCN–247T–T066/H	
		FCN–237T–T044/H		
		FCN–237T–T062/H		
	52622–2011 (Molex)	57829–5000	57830–5000	Low price
		57823–5000	57824–5000	

NOTE
1 The tools in the shaded boxes are available from FANUC (order number: A02B–0120–K391).
2 The tools are designed for use with the connectors of the corresponding manufacturers.

Materials for cable assemblies

Machine tool builders are required to manufacture or procure the materials for the cable assemblies to be used with their products. FANUC recommends the following materials as being suitable for interface connectors. Individual machine tool builders are encouraged to contact each cable manufacturer for themselves, as required.

Material	Use	Constitution	FANUC specification number	Manufacturer	Remark
10–pair cable	General use	0.08mm^2 10–pair	A66L–0001–0284 #10P	Hitachi Cable, Ltd. Oki Electric Cable Co., Ltd.	
6–pair cable	CRT interface (press–mount)	0.08mm^2 6–pair	A66L–0001–0295	Hitachi Cable, Ltd.	20 m or less
6–conductor coaxial cable	CRT interface (long–distance)	6–conductor coaxial	A66L–0001–0296	Hitachi Cable, Ltd.	50 m or less
12–conductor composite cable	Pulse coder, linear scale, manual pulse generator	0.5mm^2 6–conductor 0.18mm^2 3–pair	A66L–0001–0286	Hitachi Cable, Ltd. Oki Electric Cable Co., Ltd.	20 m or less
		0.75mm^2 6–conductor 0.18mm^2 3–pair	A66L–0001–0402	Oki Electric Cable Co., Ltd.	30 m or less Usable on movable parts
		1.25mm^2 6–conductor 0.18mm^2 3–pair	A66L–0001–0403	Oki Electric Cable Co., Ltd.	50 m or less Usable on movable parts

D MACHINE OPERATOR’S PANEL

D.1 OUTLINE

The Series 0 has a machine operator's panel which consists of general operation keys configured as a flat keyboard. The keys and LEDs on the flat keyboard are configured using matrices. Input from the keys and output to the LEDs are performed using encoded signals via the CNC DI/DO interface. The number of DI/DO signals required for the operator's panel can thus be substantially reduced.

Encoding and data transfer are automatically performed by the PMC control software. The user need only create a PMC program according to the bit images for the keys or LEDs. The PMC–MODEL L or PMC–MODEL M is required.

In addition to the flat keyboard, the machine operator's panel features an emergency stop button, override switch, and program protect key switch. The minimum required switches are clustered closely together.

The machine tool builder can also order only the control printed circuit board for the machine operator's panel, and design the operator's panel itself as required.

Machine operator's panels and control printed circuit boards which conform to European safety standards (CE marking) are also available.

Table D.1 (a) Machine operator's panels

Type	Name	Keyboard		Specification drawing number	Connectable I/O card
A	Machine operator's panel	Small–size	T series	A02B–0091–C141	I/O–C5, C6, C7
			M series	A02B–0092–C141	
	Machine operator's panel	Full–key	T series	A02B–0091–C161	
			M series	A02B–0092–C161	
B	Machine operator's panel qualifying for CE marking	Small–size	T series	A02B–0098–C170#TB	I/O–E1, E2, E3
			M series	A02B–0099–C150#MB	
	Machine operator's panel qualifying for CE marking	Full–key	T series	A02B–0099–C161#TB	
			M series	A02B–0099–C161#MB	

Table D.1 (b) Control PC board for machine operator's panels

Type	Name		Specification	Connectable I/O card
A	Control printed circuit board for machine operator's panels (conventional model)	With built–in sneak current prevention circuit	A16B–1310–0380	I/O–C5, C6, C7
		No sneak current prevention circuit	A16B–1310–0381	
B	Control circuit board, qualifying for CE marking, for machine operator's panels	With built–in sneak current prevention circuit	A16B–2300–0110	I/O–E1, E2, E3
		No sneak current prevention circuit	A16B–2300–0111	

D.2 OPERATION

D.2.1 General Description of Operation

The operator's panel is provided with a lot of keys, LEDs, rotary switches, etc. For keys and LEDs, they are coded, and connected to the CNC with smaller number of signal lines than the actual number of keys or LEDs. Since coding and data transfer are executed by the management program of the PMC automatically, it is only necessary to operate the key or bit image by the PMC program. (See Fig. D.2.1.)

Bear in mind that the PMC management only executes the generation of bit image for LED, but not any operation by the significance of bit. When "EDIT" key is depressed, for instance, only one bit (F293.0) corresponding to the EDIT key is turned to "1", but the CNC will not be turned to EDIT mode. It is not turned to the EDIT mode until "1" is transferred to the bit of EDIT mode by the PMC program. The same applies to the LED, and all the ON/OFF operations must be processed by program.

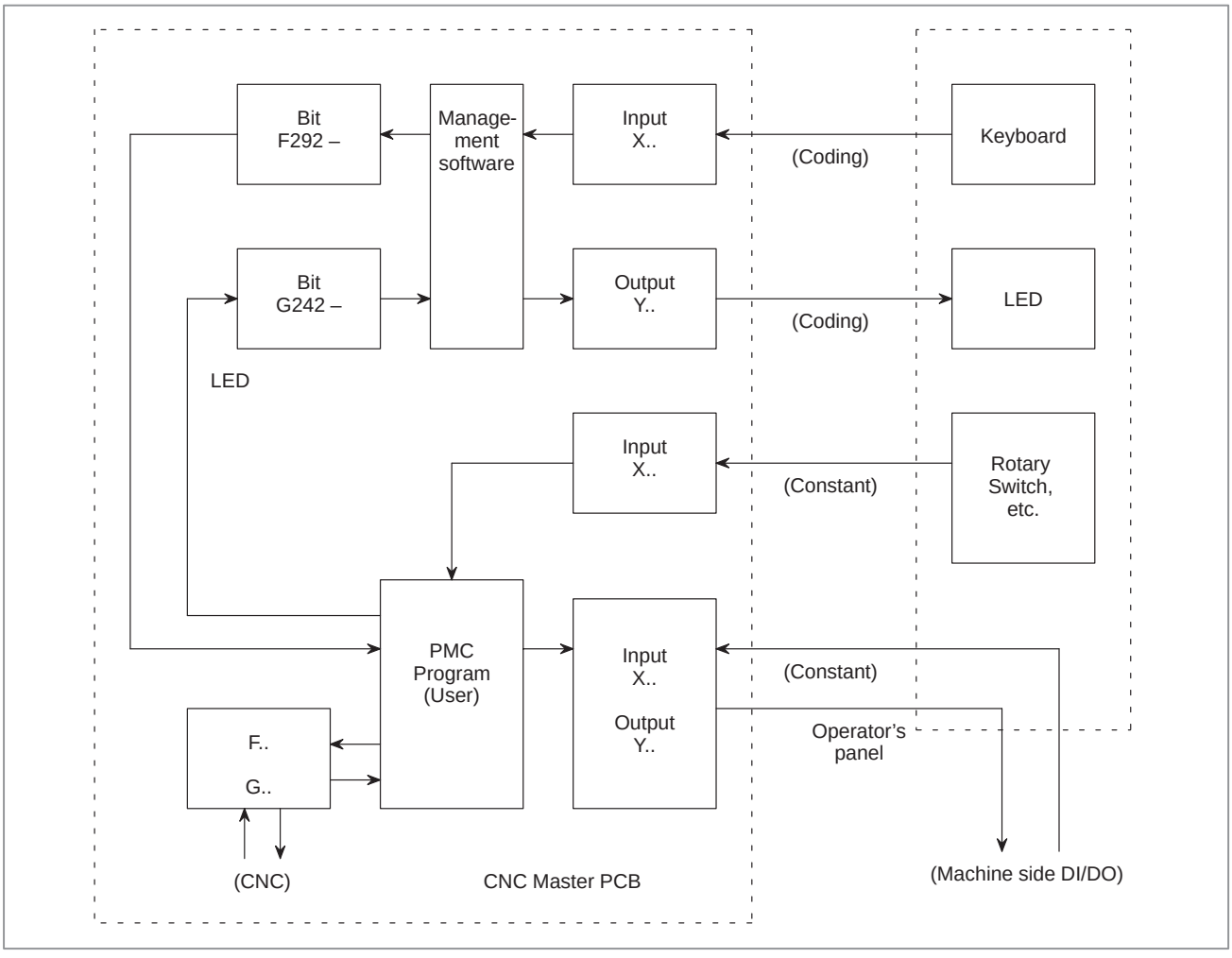


Fig. D.2.1 Connection block diagram of operator's panel

D.2.2 Key Switch Signal

The key switch signal is generated by the bit image at the PMC address (F292 – F299) through the management software of the PMC. Whether the necessary key is depressed can be known by checking the bit image of the key switch by the PMC program of the user. While the key is depressed, the bit corresponding to the key is turned to "1". In addition, the key may be input up to two at the same time. Do not attempt to use in such a manner that more than three keys need to be depressed at the same time in using the keyboard input. If more than three keys are depressed at the same time, the key will not be properly input. It takes a maximum of approx. 60 msec. after depressing the key until the bit of the key is turned to "1" ("0").

D.2.3 LED Signal

Generate the LED signal by the bit image at the PMC address (G242 – G249) through the PMC program of the user. While "1" is written at the bit image of the LED, the corresponding LED is turned on automatically. Similarly when "0" is written at the bit image, the LED is turned off. When the power is turned on, all the "LED" are turned off. It takes a maximum of approx. 200 msec. after "1" ("0") is written in the bit image by the PMC until the LED is actually turned on (of).

D.2.4 Emergency, Over–ride, Protect Key

Since the contact signal of emergency stop button, over–ride rotary switch and protect key is directly input to the PMC, process such signal by the PMC program.

D.3 CONNECTION

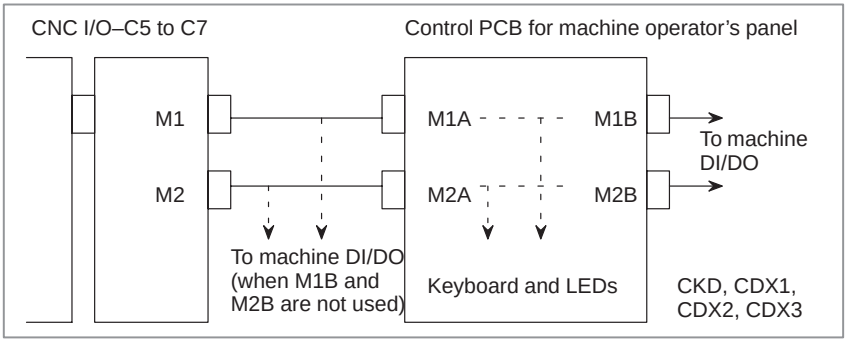
The machine operator's panel has 2 kinds as type–A and type–B. When it is connected with the I/O card which have sink type DO drivers, type–A must be used. And when source type DO drivers, type–B must be used.

- **Type A (does not qualify for CE marking)**

Connect the M1 and M2 connectors of the I/O card (I/O–C5, C6, or C7) to the 22 DI points and eight DO points of the machine. Between the M1A and M1B connectors and the M2A and M2B connectors, signals are relayed on a one–to–one basis within the operator's panel, with the exception of those used in the operator's panel. By connecting M1 to M1A and M2 to M2A using one–to–one cables, therefore, those signals that are not used in the operator's panel can be connected to the general–purpose DI/DO on the machine, through the M1B and M2B connectors. The emergency stop signal (*ESP) is, however, also connected to M1B.

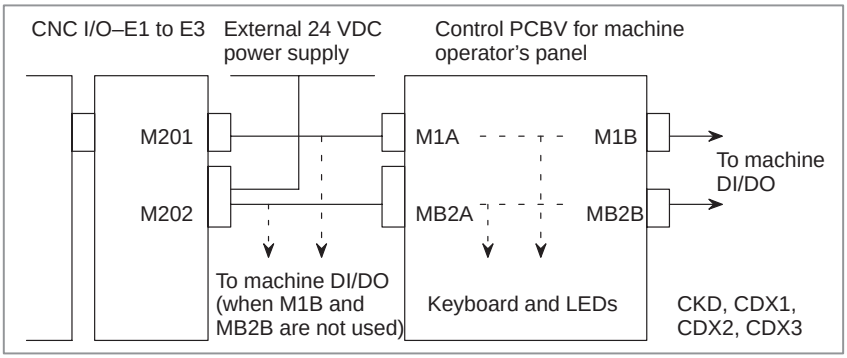
+24 V is used as the power supply common and override common in the operator's panel. 0 V and +24 V of the M1 connector must be connected to the operator's panel. For +24 V operation, the operator's panel consumes approximately 0.5 A. Determine the cable material and number of wires for 0 V and +24 V based on the current rating. If +24 V is also used for DI/DO on the machine, that also must be considered. For 0 V and +24 V, connect all the power supply pins to ensure a reliable connection.

The M1B and M2B connectors are not required when the lines are branched between the I/O card and operator's panel so that only required signals are connected to the operator's panel.



- **Type B (product qualifying for CE marking)**

Connect the M201 and M202 connectors of the I/O card (I/O–E1, E2, or E3) to the 22 DI points and eight DO points of the machine. The connection between the M201 and M1A connectors is the same as that between M1 and M1A for type A. Source–type I/O cards E1 to E3 require the connection of an external 24 V power supply. The connection between the M202 and MB2A connectors, therefore, differs from that between M2 and M2A for type A.



Connector table (Type A)

M1A

1	0V			33	X21.3
2	0V	19	X21.4	34	X21.2
3	0V	20	X16.3	35	X21.1
4	0V	21	X16.2	36	X21.0
5	X20.5	22	X17.3	37	X20.6
6	X16.7	23	X17.2	38	X16.5
7	X17.7	24	X18.3	39	X17.5
8	X18.7	25	X18.2	40	X18.5
9	X17.1	26	X21.6	41	X21.7
10	X17.0	27	X21.5	42	X22.7
11	X16.1	28		43	X22.6
12	X16.0	29	+24V	44	X22.5
13	X20.7	30	+24V	45	X22.4
14	X20.4	31	+24V	46	X22.3
15	X20.3	32	+24V	47	X22.2
16	X20.2			48	X22.1
17	X20.1			49	X22.0
18	X20.0			50	

M1B

1	0V			33	
2	0V	19	X21.4	34	
3	0V	20	X16.3	35	
4	0V	21	X16.2	36	
5		22	X17.3	37	
6	X16.7	23	X17.2	38	X16.5
7	X17.7	24	X18.3	39	X17.5
8	X18.7	25	X18.2	40	X18.5
9	X17.1	26	X21.6	41	
10	X17.0	27		42	
11	X16.1	28		43	X22.6
12	X16.0	29	+24V	44	
13		30	+24V	45	
14		31	+24V	46	
15		32	+24V	47	
16				48	
17				49	
18				50	

M2A

1	0V			33	Y51.7
2	0V	19	Y50.2	34	Y51.6
3	0V	20	Y50.3	35	Y51.5
4	0V	21	Y50.0	36	Y51.4
5	Y48.7	22	Y49.3	37	Y51.3
6	Y48.6	23	Y49.1	38	Y51.2
7	Y48.5	24	Y49.0	39	Y51.1
8	Y48.4	25	Y48.0	40	Y51.0
9	Y49.7	26	Y48.1	41	Y49.4
10	Y50.5	27	Y48.2	42	Y53.7
11	Y52.7	28		43	Y53.6
12	Y52.6	29		44	Y53.5
13	Y52.5	30		45	Y53.4
14	Y52.4	31		46	Y53.3
15	Y52.3	32		47	Y53.2
16	Y52.2			48	Y53.1
17	Y52.1			49	Y53.0
18	Y52.0			50	NC8

M2B

1	0V			33	
2	0V	19	Y50.2	34	
3	0V	20	Y50.3	35	
4	0V	21	Y50.0	36	
5	Y48.7	22	Y49.3	37	
6	Y48.6	23	Y49.1	38	
7	Y48.5	24	Y49.0	39	
8	Y48.4	25	Y48.0	40	
9	Y49.7	26	Y48.1	41	Y49.4
10	Y50.5	27	Y48.2	42	Y53.7
11	Y52.7	28		43	Y53.6
12	Y52.6	29		44	Y53.5
13	Y52.5	30		45	Y53.4
14	Y52.4	31		46	Y53.3
15	Y52.3	32		47	Y53.2
16	Y52.2			48	Y53.1
17	Y52.1			49	Y53.0
18	Y52.0			50	

Hatch marks signals are used in the Machine Operator's Panel Control PCB. Other signals are possible to use for machine side DI/DO through the connectors M1B and M2B.

NOTE

1 X21.4 is an emergency stop signal (*ESP). It is used in the Machine Operator's Panel and also connected to M1B.

2 The same name signals (except 0V) in M1A, M1B, MB2A, M2B are connected point to point through the Machine Operator's Panel Control PCB.

Connector table (Type B)

M1A

1	0V			33	X21.3
2	0V	19	X21.4	34	X21.2
3	0V	20	X16.3	35	X21.1
4	0V	21	X16.2	36	X21.0
5	X20.5	22	X17.3	37	X20.6
6	X16.7	23	X17.2	38	X16.5
7	X17.7	24	X18.3	39	X17.5
8	X18.7	25	X18.2	40	X18.5
9	X17.1	26	X21.6	41	X21.7
10	X17.0	27	X21.5	42	X22.7
11	X16.1	28		43	X22.6
12	X16.0	29	+24V	44	X22.5
13	X20.7	30	+24V	45	X22.4
14	X20.4	31	+24V	46	X22.3
15	X20.3	32	+24V	47	X22.2
16	X20.2			48	X22.1
17	X20.1			49	X22.0
18	X20.0			50	

M1B

1	0V			33	
2	0V	19	X21.4	34	
3	0V	20	X16.3	35	
4	0V	21	X16.2	36	
5		22	X17.3	37	
6	X16.7	23	X17.2	38	X16.5
7	X17.7	24	X18.3	39	X17.5
8	X18.7	25	X18.2	40	X18.5
9	X17.1	26	X21.6	41	
10	X17.0	27		42	
11	X16.1	28		43	X22.6
12	X16.0	29	+24V	44	
13		30	+24V	45	
14		31	+24V	46	
15		32	+24V	47	
16				48	
17				49	
18				50	

MB2A

1	0V			33	Y51.7
2	0V	19	Y50.2	34	Y51.6
3	0V	20	Y50.3	35	Y51.5
4	0V	21	Y50.0	36	Y51.4
5	Y48.7	22	Y49.3	37	Y51.3
6	Y48.6	23	Y49.1	38	Y51.2
7	Y48.5	24	Y49.0	39	Y51.1
8	Y48.4	25	Y48.0	40	Y51.0
9	Y49.7	26	Y48.1	41	Y49.4
10	Y50.5	27	Y48.2	42	Y53.7
11	Y52.7	28	NC3	43	Y53.6
12	Y52.6	29	NC4	44	Y53.5
13	Y52.5	30	NC5	45	Y53.4
14	Y52.4	31	NC6	46	Y53.3
15	Y52.3	32	NC7	47	Y53.2
16	Y52.2			48	Y53.1
17	Y52.1			49	Y53.0
18	Y52.0			50	NC8

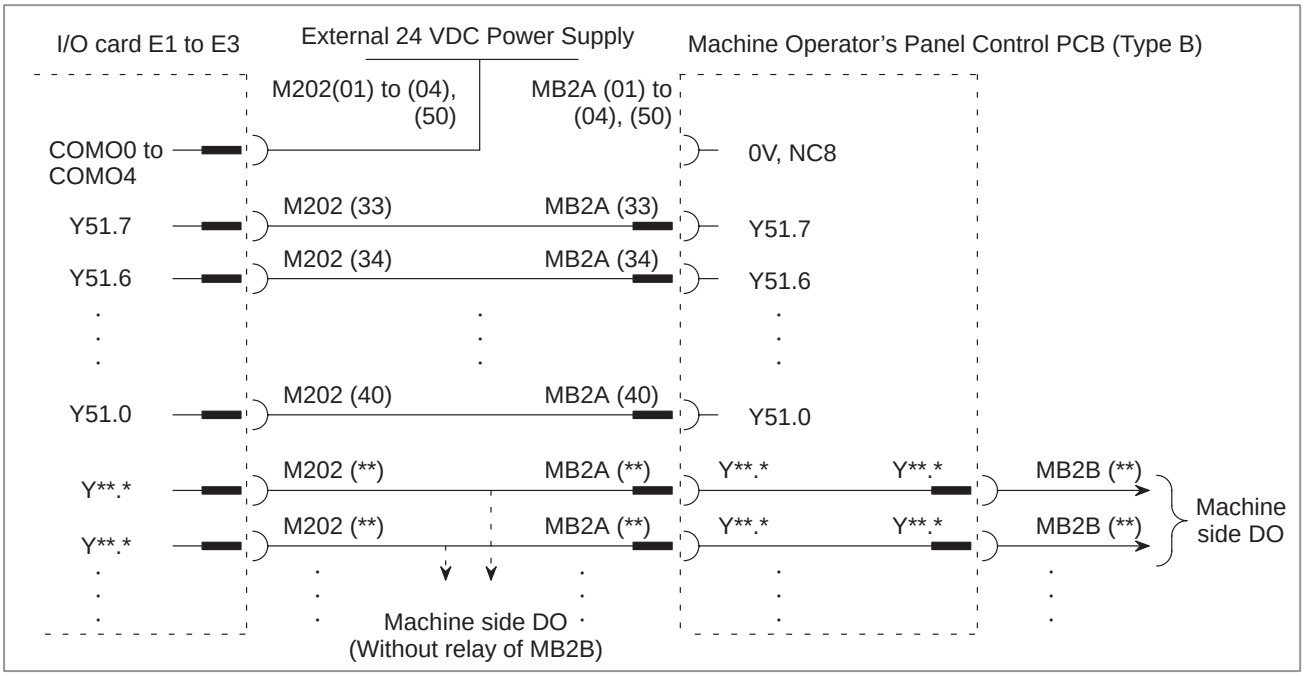
MB2B

1	0V			33	
2	0V	19	Y50.2	34	
3	0V	20	Y50.3	35	
4	0V	21	Y50.0	36	
5	Y48.7	22	Y49.3	37	
6	Y48.6	23	Y49.1	38	
7	Y48.5	24	Y49.0	39	
8	Y48.4	25	Y48.0	40	
9	Y49.7	26	Y48.1	41	Y49.4
10	Y50.5	27	Y48.2	42	Y53.7
11	Y52.7	28	NC3	43	Y53.6
12	Y52.6	29	NC4	44	Y53.5
13	Y52.5	30	NC5	45	Y53.4
14	Y52.4	31	NC6	46	Y53.3
15	Y52.3	32	NC7	47	Y53.2
16	Y52.2			48	Y53.1
17	Y52.1			49	Y53.0
18	Y52.0			50	NC8

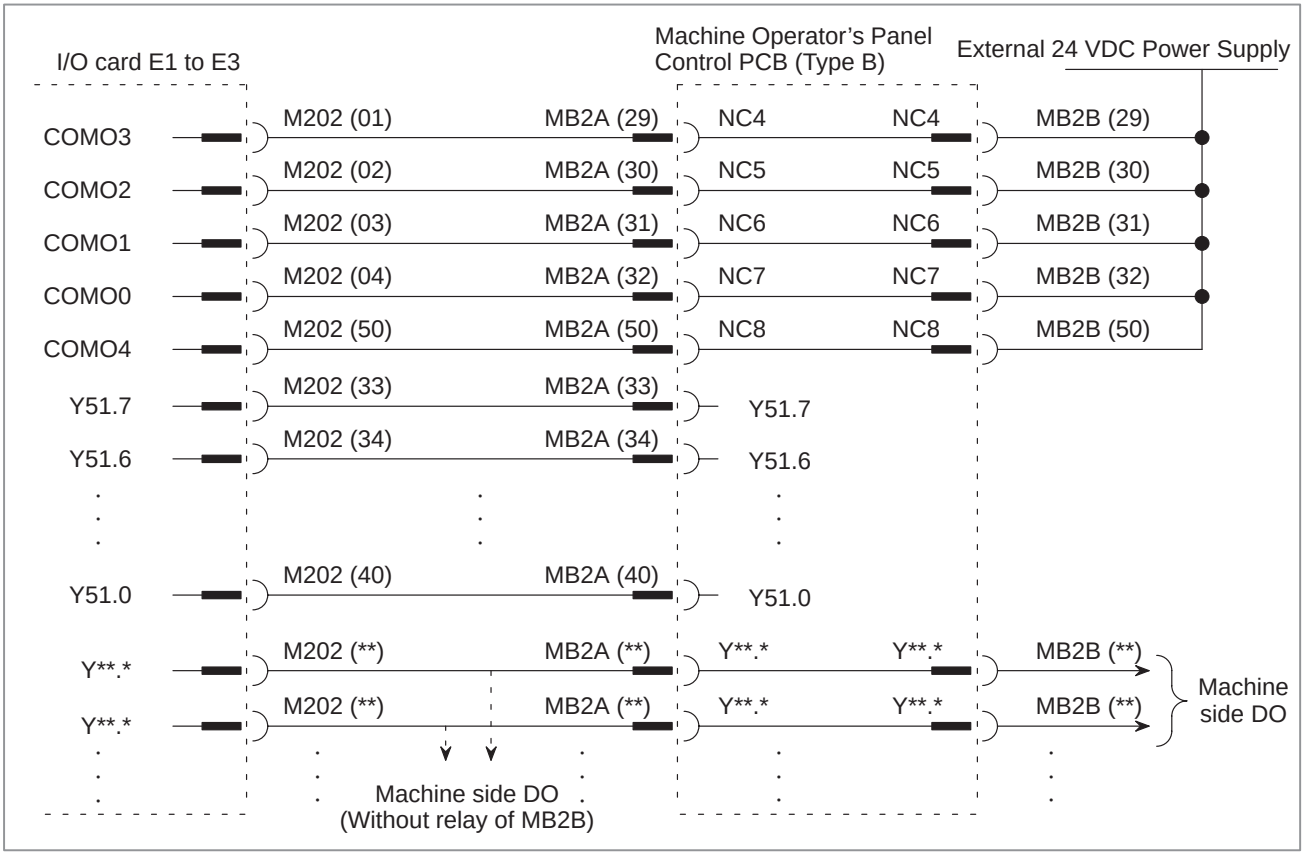
Hatch marks signals are used in the Machine Operator's Panel Control PCB. Other signals are possible to use for machine side DI/DO through the connectors M1B and MB2B.

NOTE
1 X21.4 is an emergency stop signal (*ESP). It is used in the Machine Operator's Panel and also connected to M1B.
2 The same name signals (except 0V) in M1A, M1B, MB2A, MB2B are connected point to point through the Machine Operator's Panel Control PCB.

- **Examples for connections between M202 of I/O card E1 to E3 and MB2A of PCB (Type B) for operator's panel control**



Example connection 1



Example connection 2

D.4 OPERATOR'S PANEL CONNECTION SIGNALS

The DI/DO signals at the following addresses (PMC) are used exclusively for the operator's panel.

- **List of operator's panel**

PMC ADDRESS	#7	#6	#5	#4	#3	#2	#1	#0
X20	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0
X21	KEY		⁎RSV1	⁎ESP	⁎OV8	⁎OV4	⁎OV2	⁎OV1
X22	KST		RSV3	RSV2	KA3	KA2	KA1	KA0
Y51	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0

D.4.1 ⁎ESP (X21.4) Emergency Stop

Contact B of the emergency stop button of the operator's panel is connected in series for output via the No. 19 pin of connector M1B. To use the emergency stop signal on the machine side, therefore, the emergency stop signal should be connected to connector M1B.
If the No. 19 pin of connector M1B is not used (the emergency stop signal is not used on the machine side, etc.), the emergency stop signal common should be connected to +24V inside via the setting pin inside the operator's panel PCB.
The CNC directly monitors this signal.
For the emergency stop button, one circuit of Contact B is available. Install wiring, therefore, so that the servo amplifier MCC is broken at emergency stop. (Contact: Max. AC 220V, 5A).

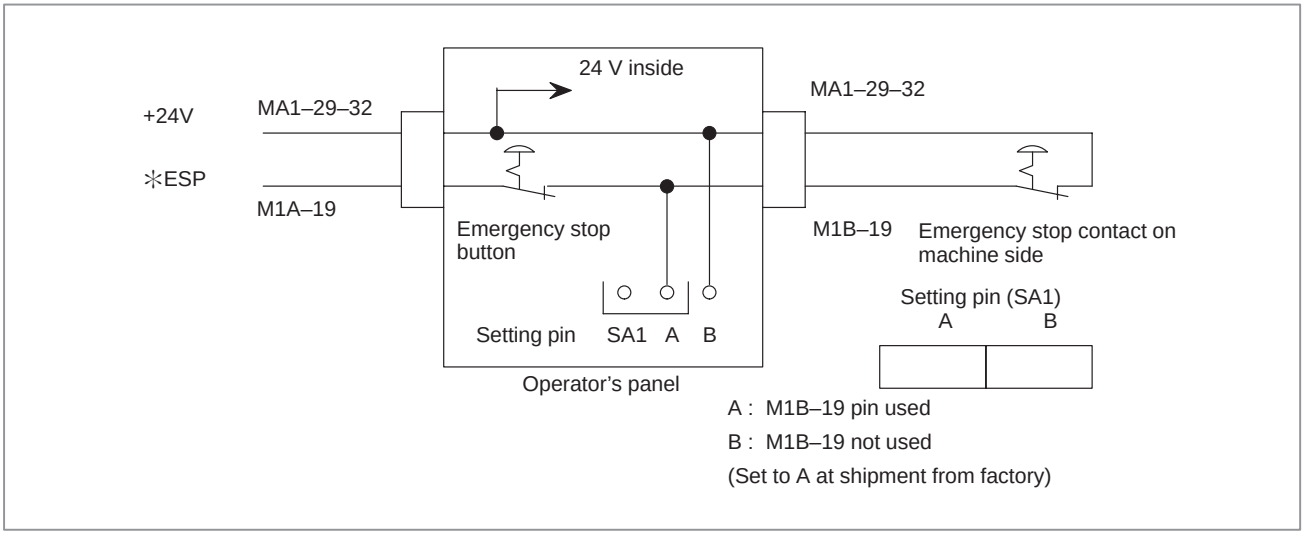


Fig. D.4.1 Emeragency stop signal connection

D.4.2 ∗KEY (X21.7) Program Protect Signal

The key switch signal is input directly. Execute processing by using the PMC so that the protect mode is reset at KEY=1.
On the PC board for controlling the machine operator's panel, the signal can be used as a general–purpose input signal.

D.4.3 ∗OV1–∗OV8 (X21.0–21.3) Override Signal

The override codes are input according to the table below. Execute processing by using the PMC.

Table D.4.3 Override code

Rotary switch dial	∗OV8	∗OV4	∗OV2	∗OV1
0%	1	1	1	1
10%	1	1	1	0
20%	1	1	0	1
30%	1	1	0	0
40%	1	0	1	1
.	.	.	.	.
.	.	.	.	.
150%	0	0	0	0

(Binary code reverse signal)

D.4.4 KD0–KD7 (X20.0–20.7) KA0–KA3 (X22.0–22.3), KST (X22.7) LD0–LD7 (Y51.0–51.7) RSV1–RSV3 (X21.5, X22.4–22.5)

These signals are processed directly by the PMC management software as coded signals of the key switch and the LED. Therefore, they should not be processed (bit operation) in the user's PMC program.

D.4.5 F292–F299, G242–G249

The above PMC addresses are used as bit images for reading the key or turning the LED on/off.
(See items D.2.2 and D.2.3 and Table D.5.3.)

D.5 SELF–DIAGNOSTIC FUNCTION

D.5.1 Status Display LED

The operator's panel PCB (the reverse side of the operator's panel) is equipped with a green status display LED. It indicates the following statuses.

Flashing about every second :	Normal
On (No flashing) :	Test mode
Other than above :	Fault

D.5.2 Test Mode

To set the operator's panel to test mode, turn the power on while holding down the keys corresponding to bits 0 and 1 of PMC address F292.

Bit 0 of F292 corresponds to A1 on the small–size operator's panel and to A6 on the full–key operator's panel. Bit 1 of F292 corresponds to B1 on the small–size operator's panel and to B6 on the full–key operator's panel.

As soon as the test mode is assumed, all the LED's flash seven times simultaneously. By this it is possible to check whether the LED is faulty or not. If any of the keys is depressed thereafter, the LED of the depressed key lights up. By this it is possible to check whether the key is faulty or not. In the test mode, however, neither the depressed key is transferred to the PMC nor is it possible to light the LED from the PMC.

To exit from test mode, press the keys corresponding to bits 0 and 2 of F292 simultaneously.

Bit 2 of F292 corresponds to C1 on the small–size operator's panel and to C6 on the full–key operator's panel.

D.5.3 Key Board Address

The address (equivalent to bit) for key signal read–in or LED ON/OFF is as shown in the table below.

Table D.5.3 (a) Key board address for small type operator's panel

PMC ADDRESS \ BIT	7	6	5	4	3	2	1	0
F292/G242	F3	F2	F1		D1	C1	B1	A1
F293/G243	F4				D2	C2	B2	A2
F294/G244	D4	D3	C4	C3	B4	B3	A4	A3
F295/G245		F6	F5		D5	C5	B5	A5
F296/G246	F8				D6	C6	B6	A6
F297/G247	D8 (Note)		C8		B8 (Note)		A8	A7
F298/G248			F9		D9	C9	B9	A9
F299/G249			F10		D10 (Note)	C10	B10 (Note)	A10

Key coordinates

NOTE
1 This address list is the standard machine operator's panel external diagram for Fig. D.7.1 (a) and (b).
2 The key coordinate keys B8, D8, B10, D10 used in 0–TC are not available.

Table D.5.3 (b) Keyboard address for full–key operator's panel

PMC ADDRESS \ BIT	7	6	5	4	3	2	1	0
F292/G242	E1	C1	A1	E6	D6	C6	B6	A6
F293/G243	E2	C2	A2	E7	D7	C7	B7	A7
F294/G244	E3	C3	A3	E8	D8	C8	B8	A8
F295/G245	E5	C4	A4	E9	D9	C9	B9	A9
F296/G246	D2	C5	A5	E10	D10	C10	B10	A10
F297/G247	D4	D5	B2	E11	D11	C11	B11	A11
F298/G248	D1	B1	B4	E12	D12	C12	B12	A12
F299/G249	D3	B3	B5	E13	D13	C13	B13	A13

Key coordinates

NOTE
This address list is the standard machine operator's panel external diagram for Fig. D.7.1 (c) and (d).

D.6 SETTING OF OPERATOR'S PANEL AVAILABILITY IN REGISTERING PMC LADDER PROGRAM

To use operator's panel, set the OPERATOR PANEL on the Parameter setting screen when PMC ladder program is registered.
When using the operator panel, set the parameter preceded by '02' in Fig. D.6 to 'YES'.

1) At first make the CRT display the parameter setting pattern show in Fig. D.6.
   (Key in '10 NL' immediately after loading the FAPT LADDER system floppy or via the menu pattern.)
2) Key in '02 NL'
   The following is displayed in the lower left part of the screen.
   EXAMPLE 0 : NO, 1 : YES.
   OP. PANEL =
3) Key in '1 NL' when using the operator's panel, and '0 NL' when not using it.
   The set parameter is displayed.

```
KEY IN ONE OF THE FOLLOWING NO. S WHICH YOU WANT TO SET PARA.S

NO. ITEMS                              CURRENT PARAMETER

01    PMC PARAM. (D) SIZE    ;   400BYTES (MAX 400)
02    OPERATOR PANEL         ;   NO
00    NOTHING TO SET

                             ;   PMC TYPE =M
                             ;   R–AREA    =0
NO.=
```

Fig. D.6 Parameter setting pattern

D.7 EXPLANATIONS FOR OPERATOR'S PANEL

D.7.1 Configuration

This operator's panel is operative only on PMC–L/M. The operator's panel is made up of the following keys, LEDs, etc.

- Key switch (Seat key)
- Small type . . . . . 42 key (T series),
  . . . . . 46 key (M series),
  . . . . . full key type
- LEDs (red) . . . . . Prepared for all key switches
- Override rotary switch . . . . . 4 bits
- Emergency stop button . . . . . 1 bits
- Program protect key . . . . . 1 bits
- Manual pulse generator . . . . . 1 pcs (only for full key type)

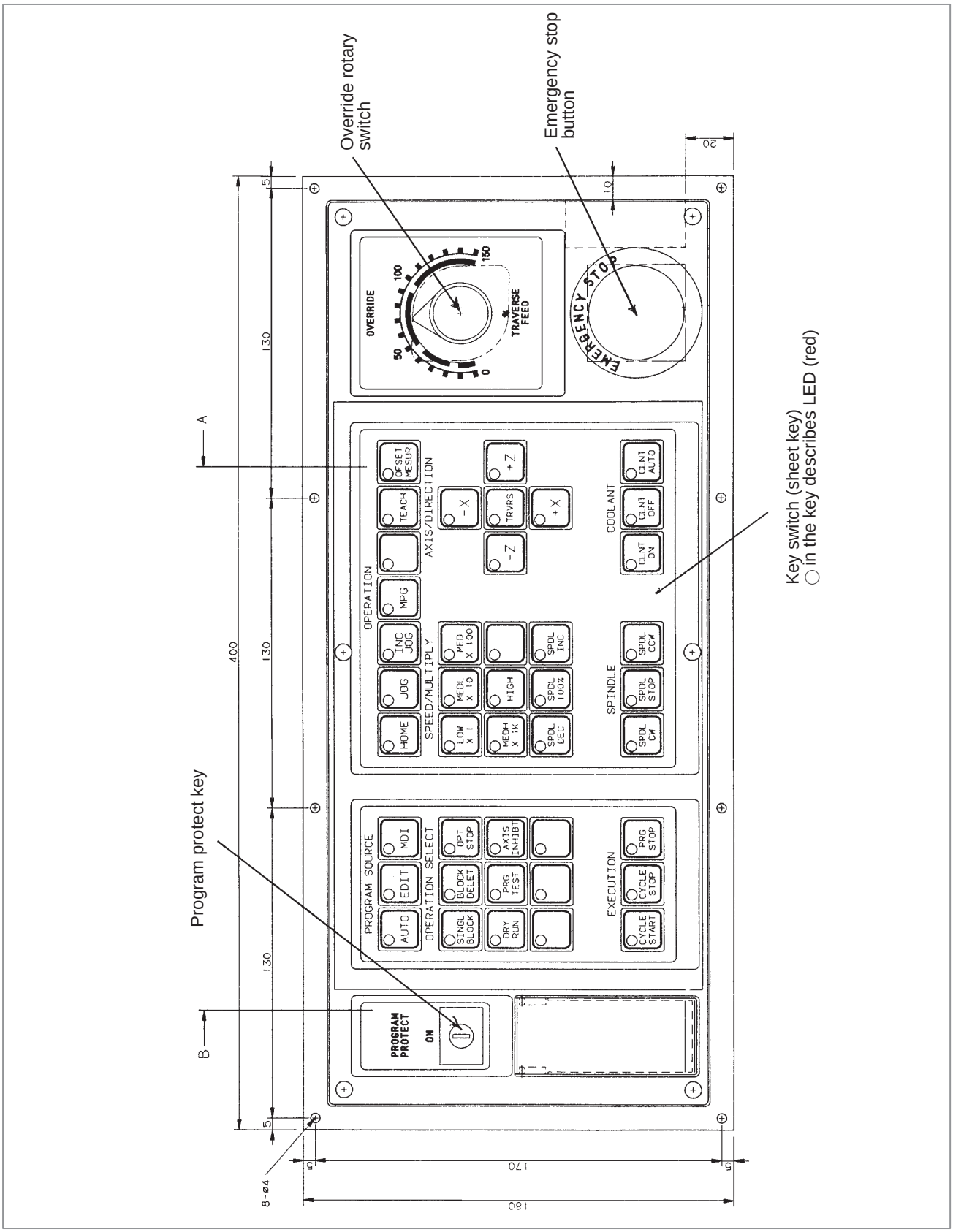


Fig. D.7.1 (a) Front view of operator's panel for 9″ small type CRT/MDI unit (T series)

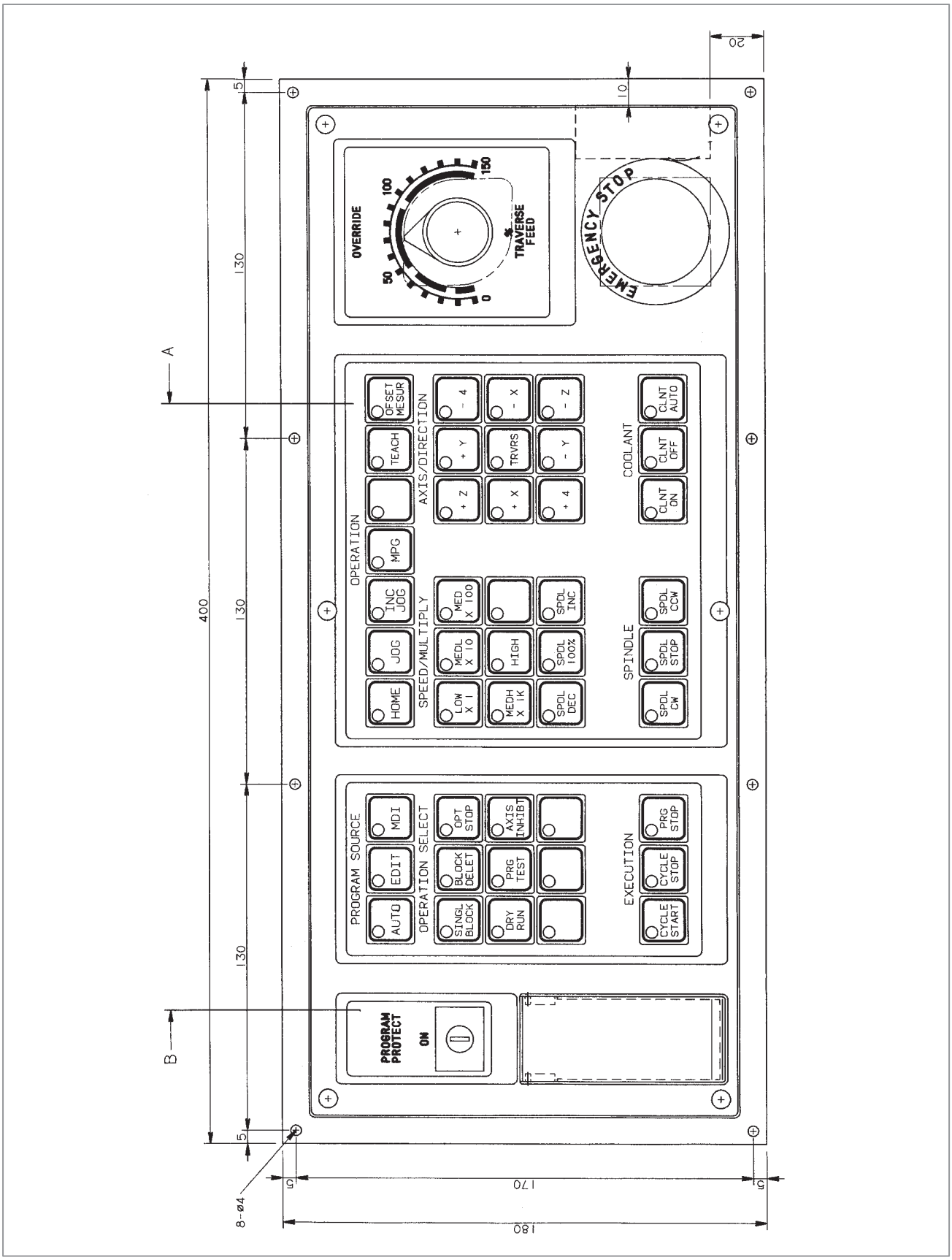


Fig. D.7.1 (b) Front view of operator's panel for 9″ small type CRT/MDI unit (M series)

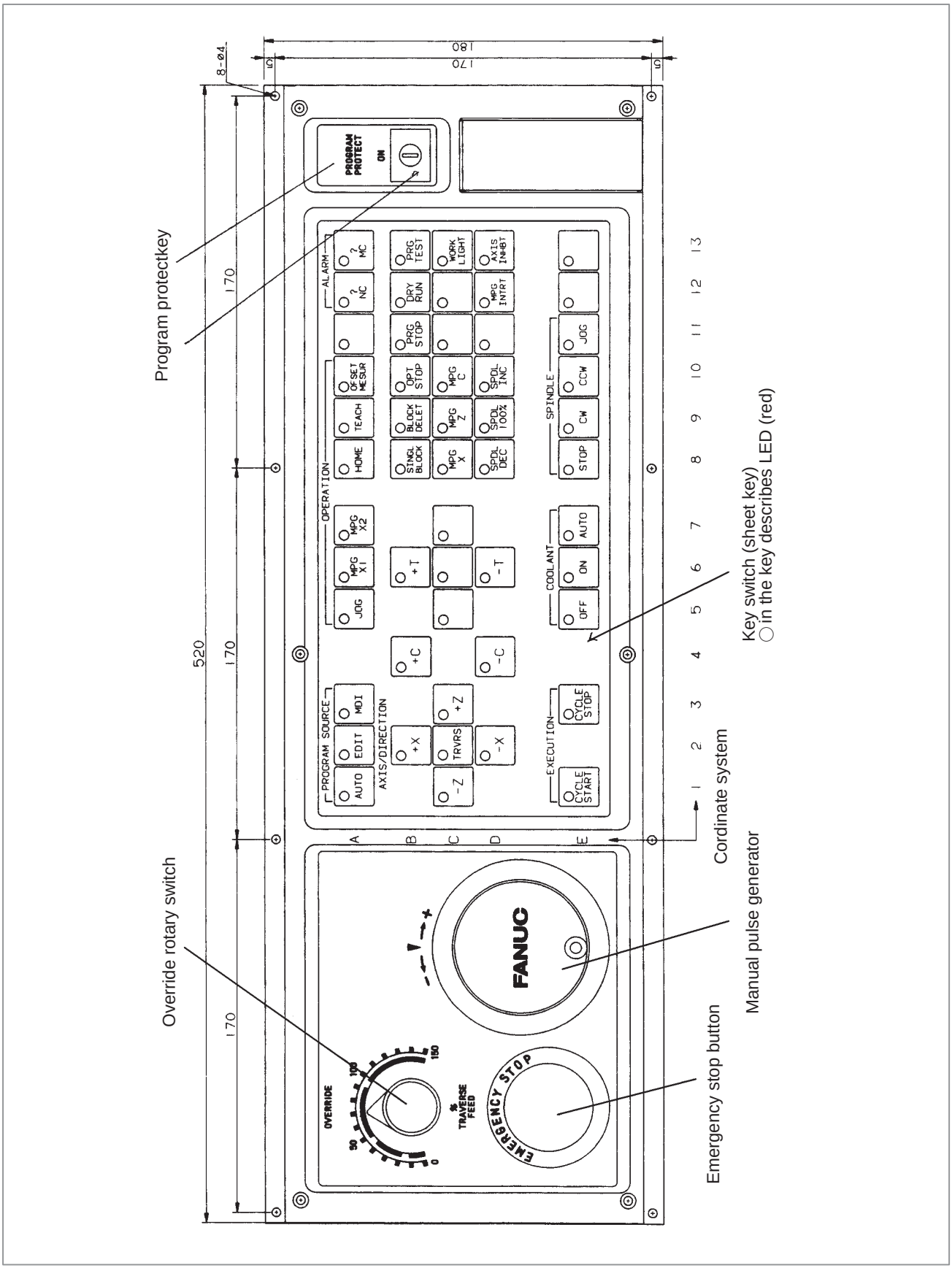


Fig. D.7.1 (c) Front view of operator's panel for full key 9″ CRT/MDI unit (T series)

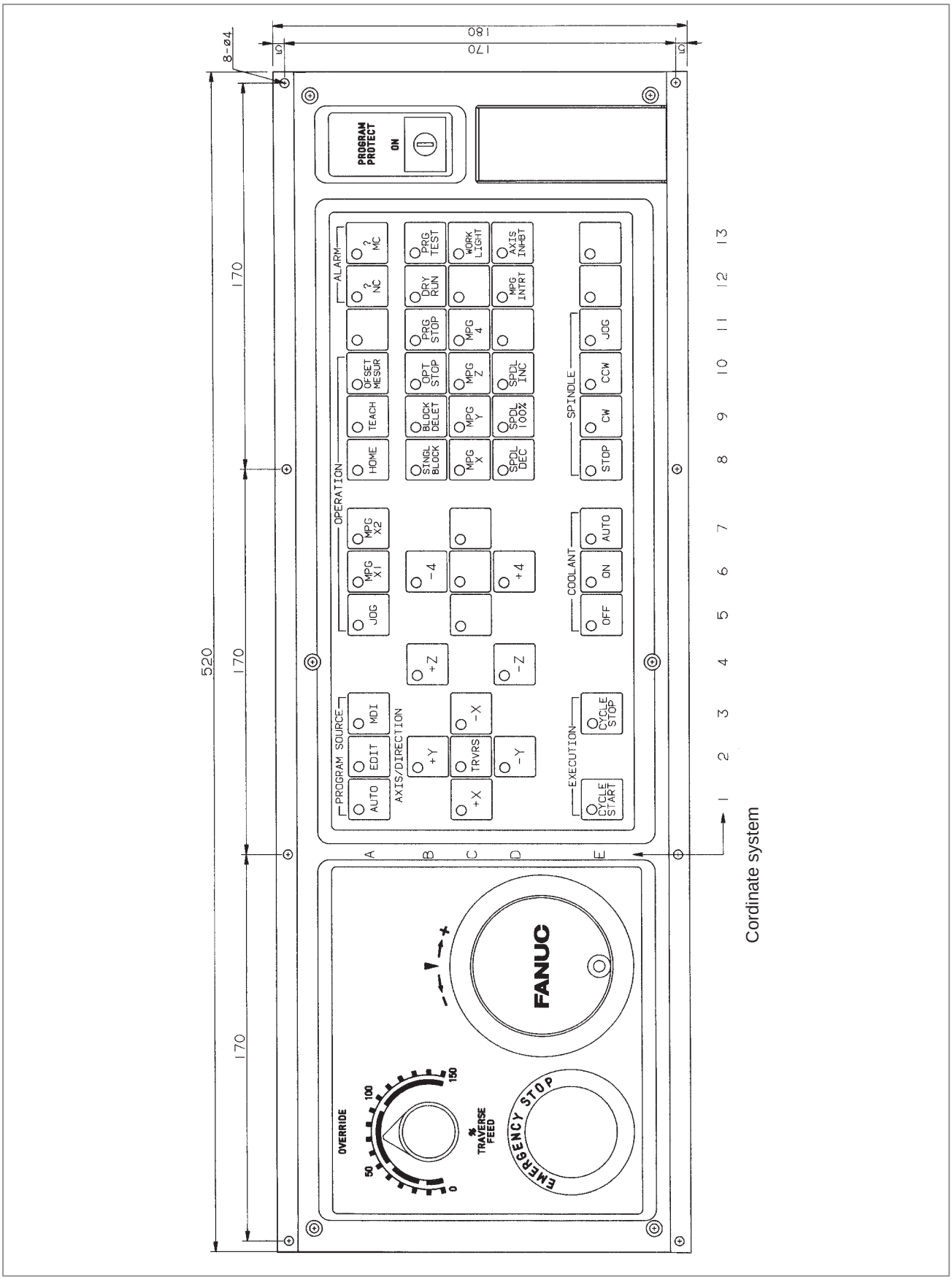


Fig. D.7.1 (d) Front view of operator's panel for full key 9″ CRT/MDI unit (M series)

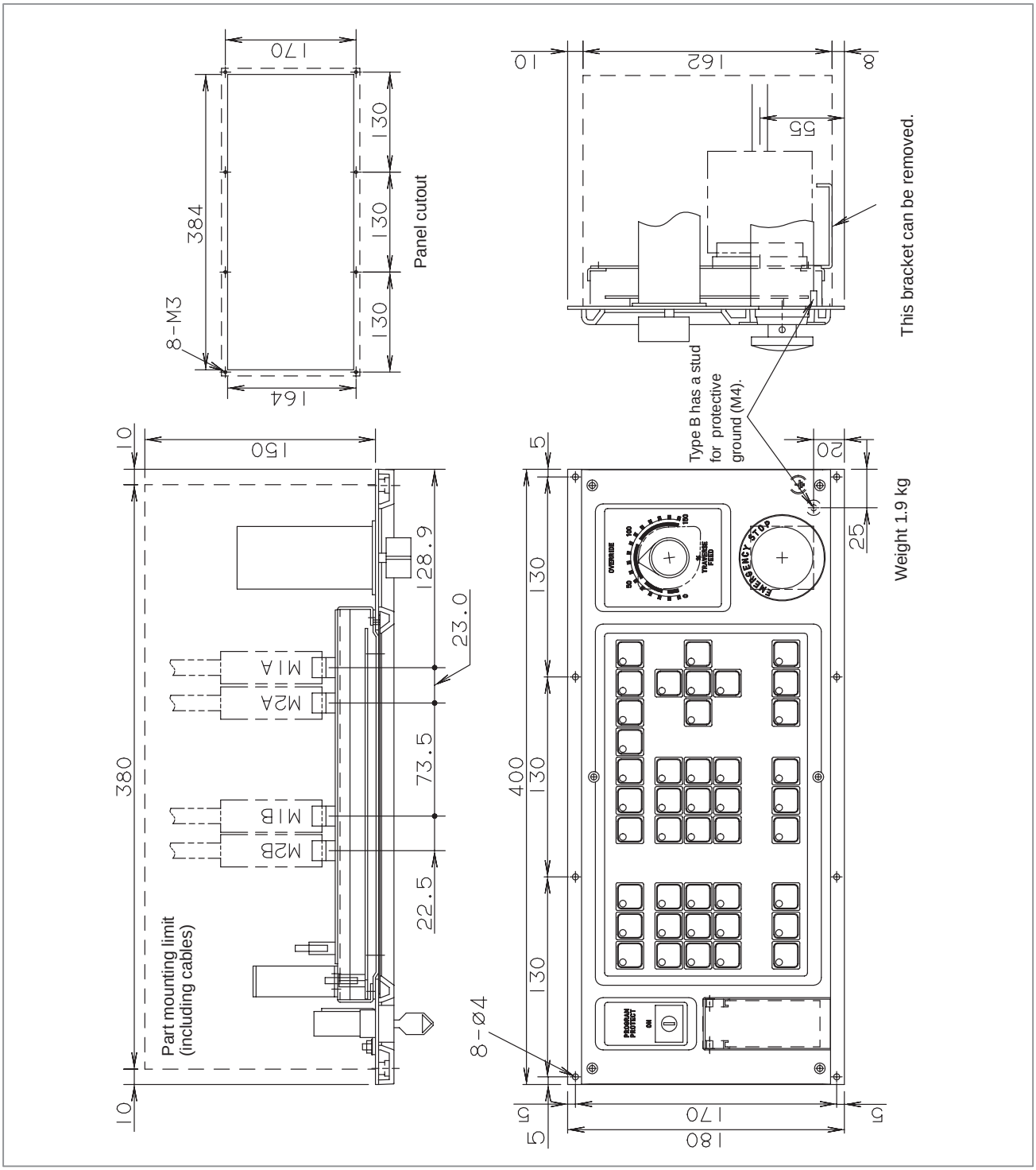


Fig. D.7.1 (e) Operator's panel for 9″ small type CRT/MDI unit

NOTE

The above figure applies to type A. For type B, connector M2A is replaced with MB2A, and M2B with MB2B.

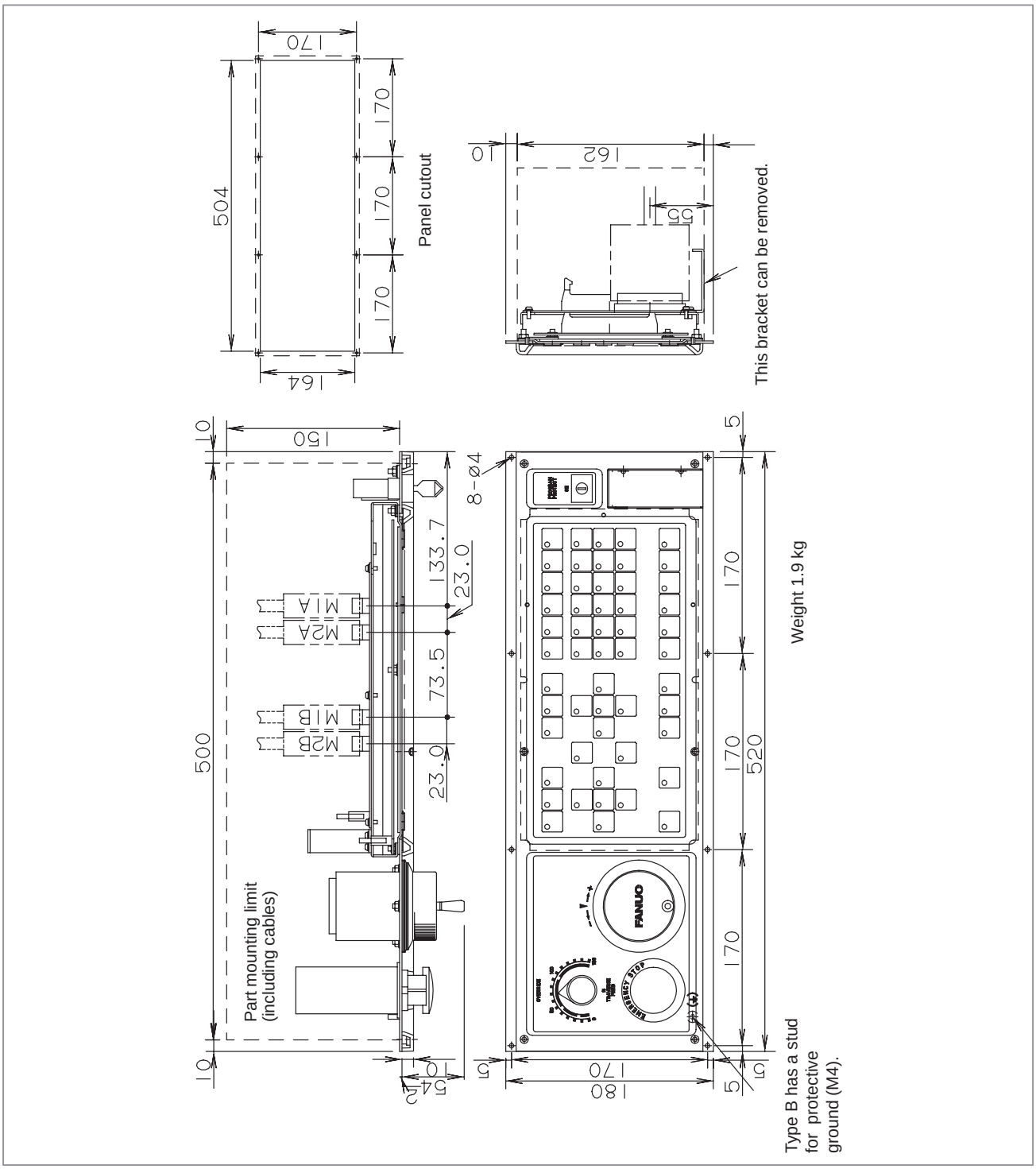
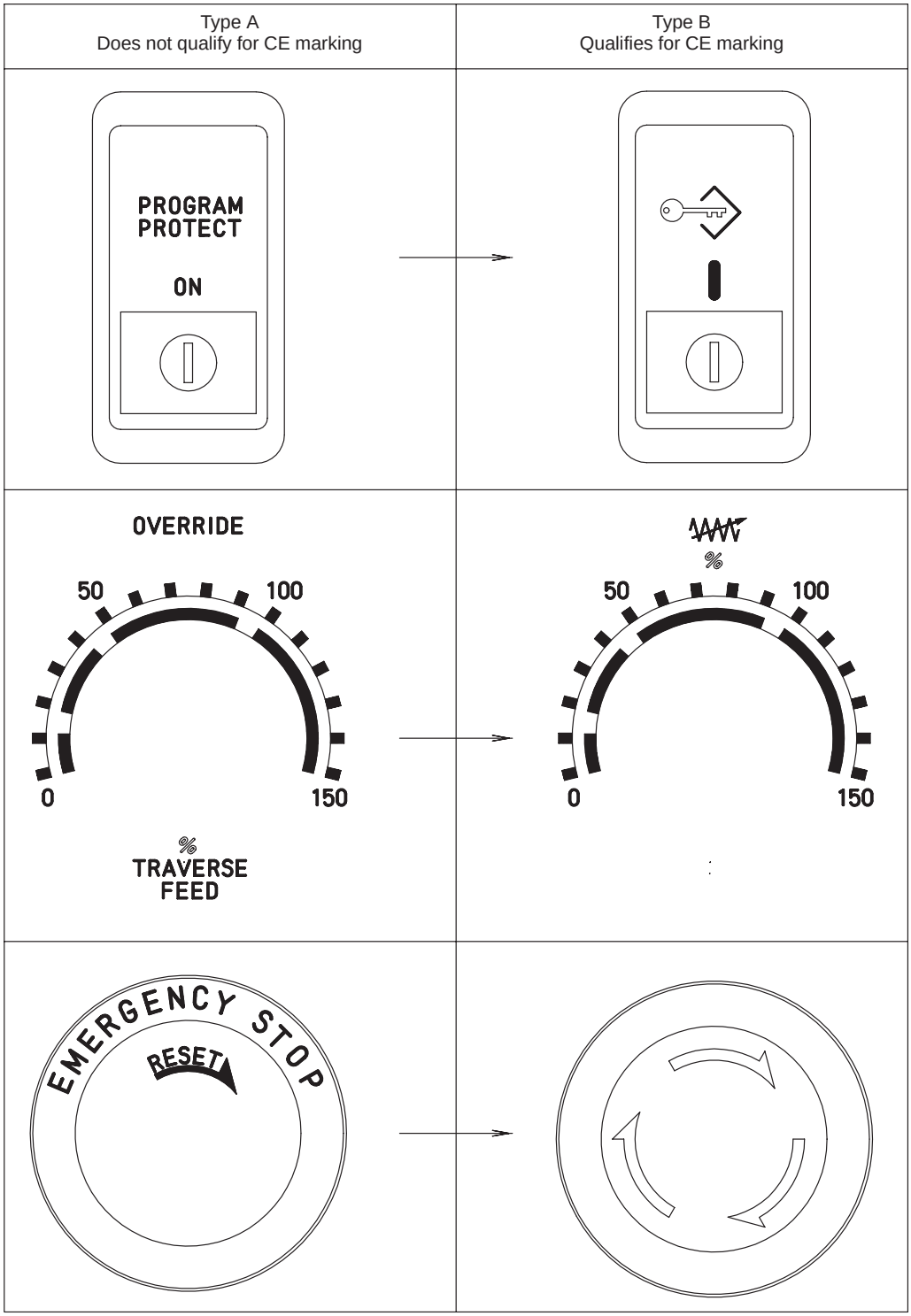


Fig. D.7.1 (f) Operator's panel for 9″ full key CRT/MDI unit

NOTE

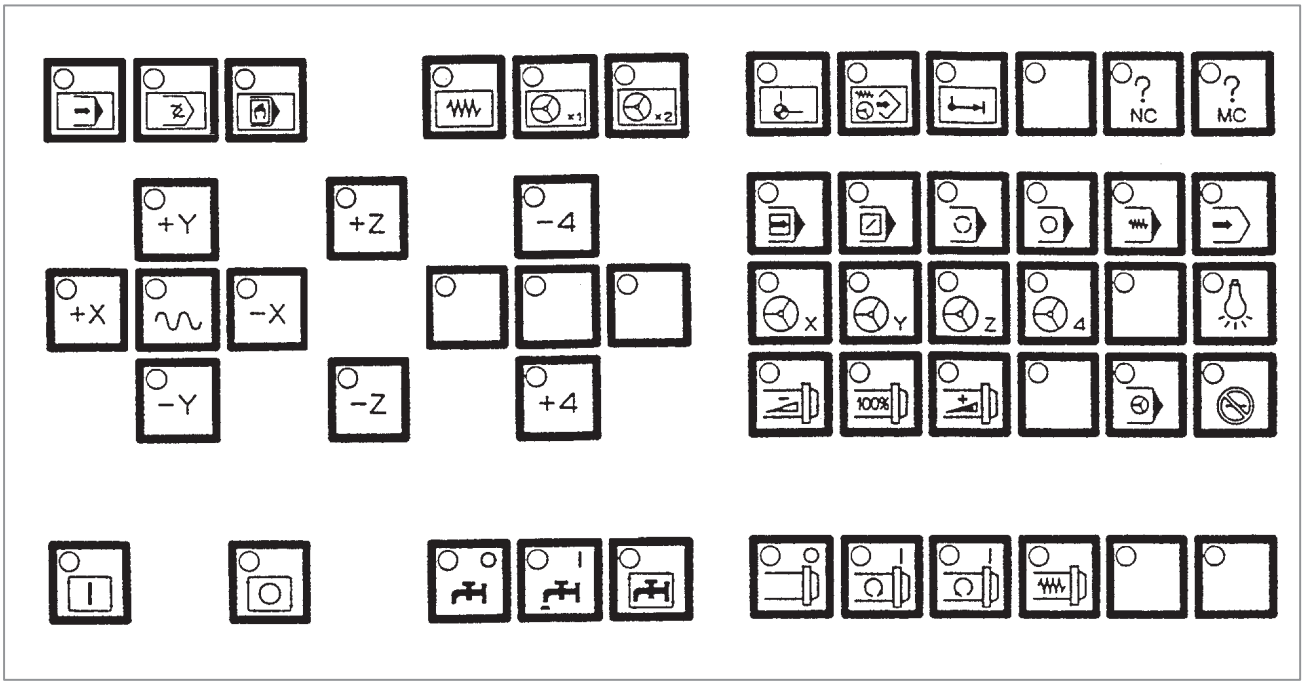
The above figure applies to type A. For type B, connector M2A is replaced with MB2A, and M2B with MB2B.

- **Differences between types A and B**
  Differences in the silk–screen printing on the panel, other than the key sheets

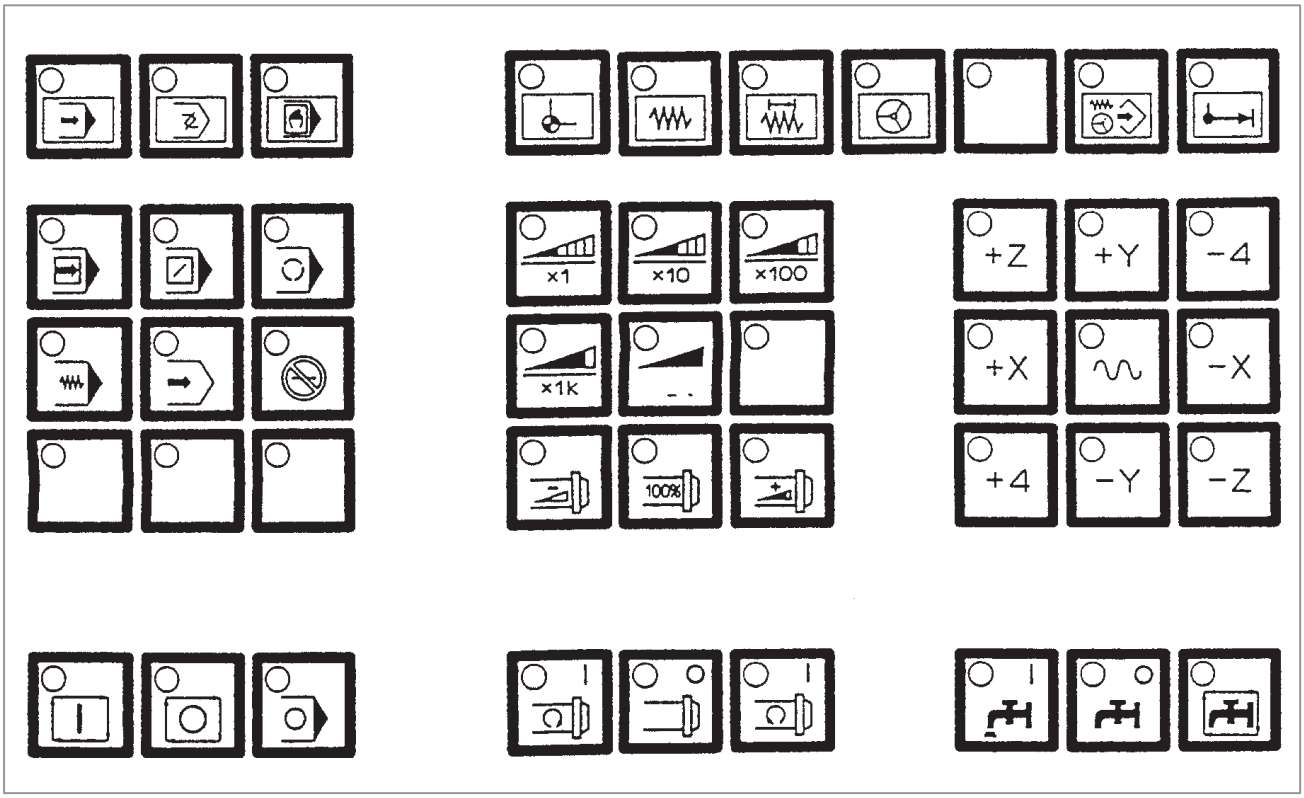


The symbolic design key sheets for type B operator's panel

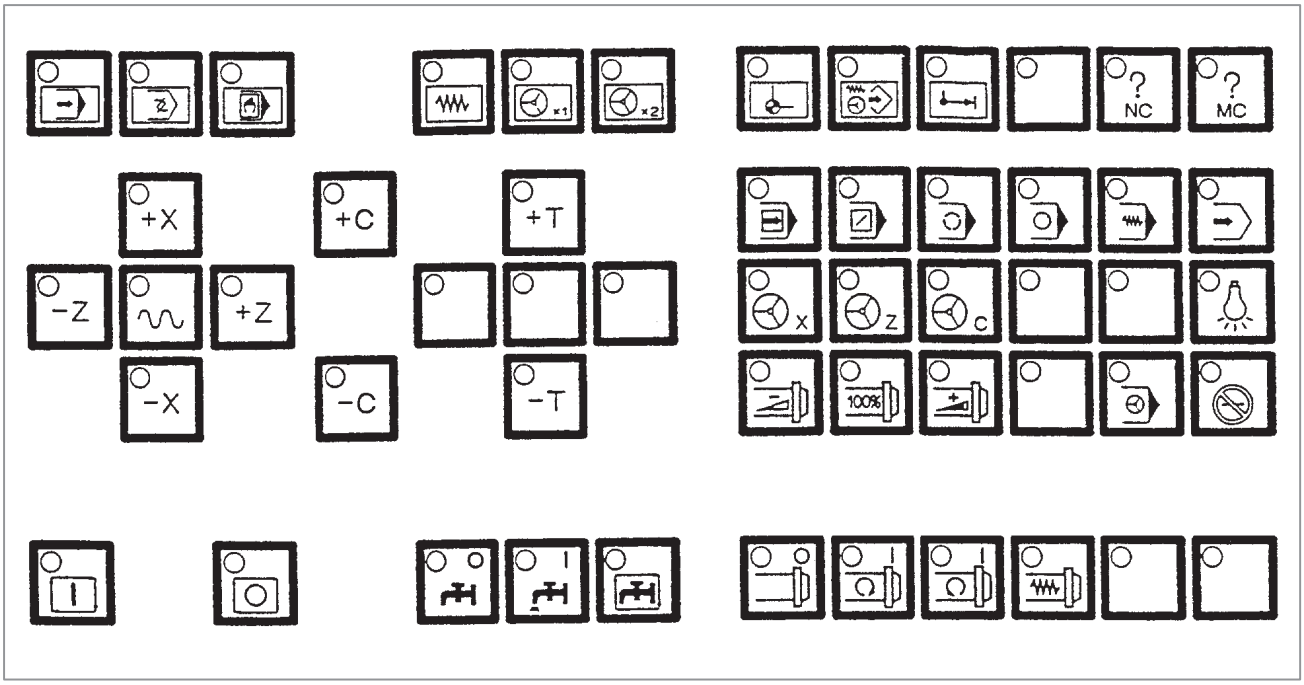
(1) M series full key type



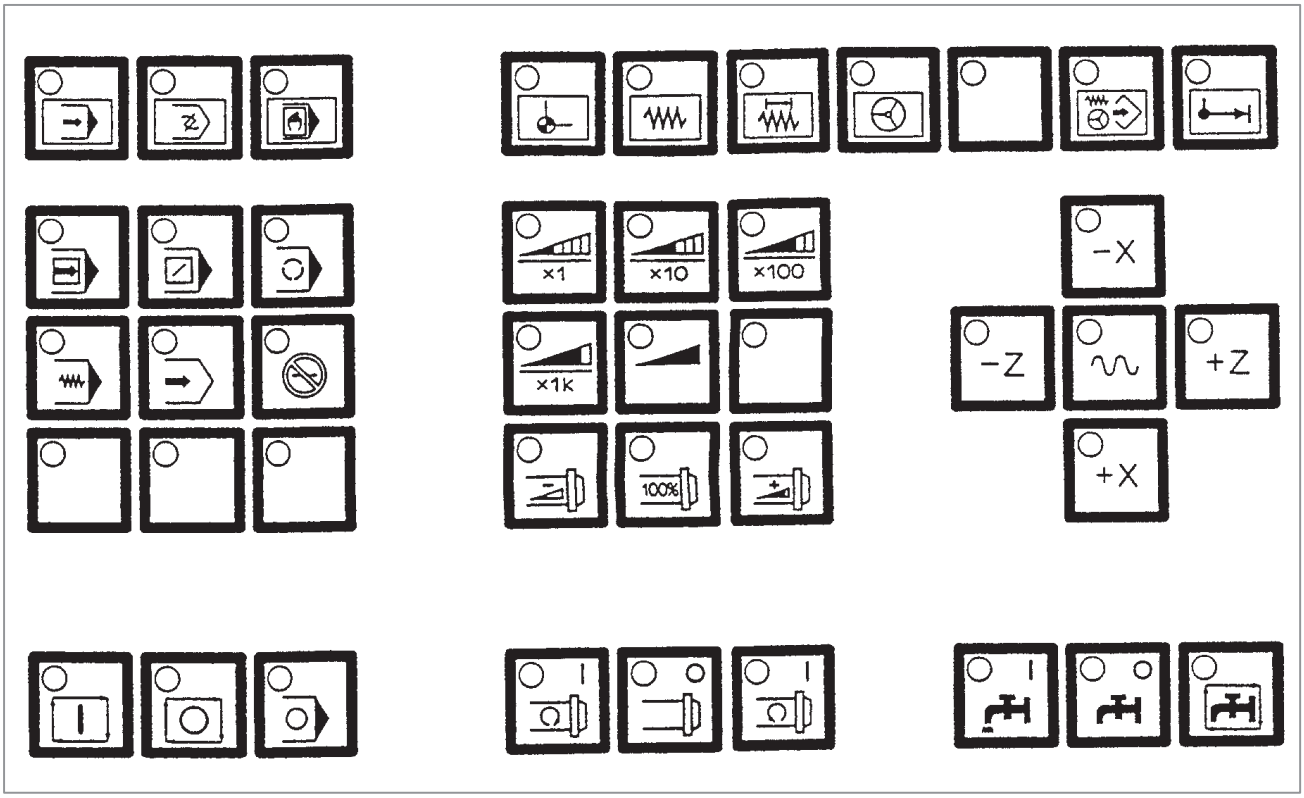
(2) M series small type



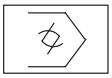
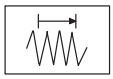
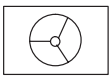
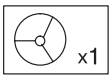
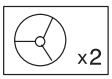
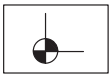
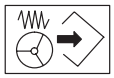
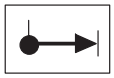
(3) T series full key type

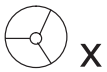
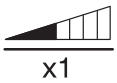
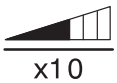
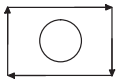


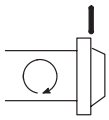
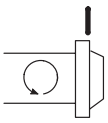
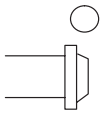
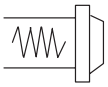
(4) T series small type



Meaning of the keys

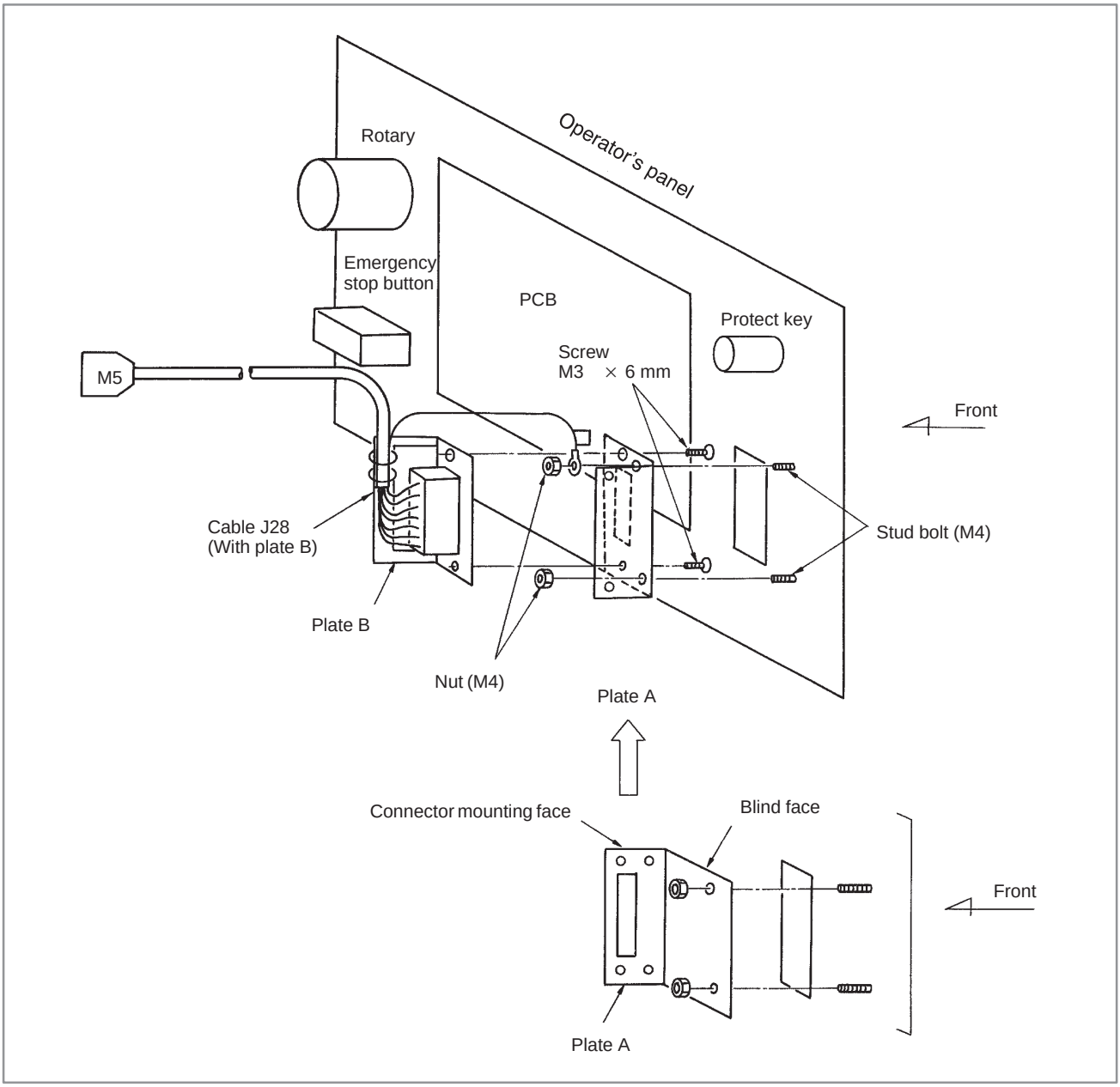
English	Symbol	Meanings
AUTO		AUTO mode selection: Mode is automatic operation.
EDIT		EDIT mode selection: Mode is program edition.
MDI		MDI mode selection: Mode is MDI.
JOG		JOG feed mode selection: Mode is jog feed.
INC JOG		STEP feed mode selection: Mode is step feed.
MPG		HANDLE feed mode selection: Mode is manual handle feed.
MPG ×1		HANDLE feed mode and 1st HANDLE unit selection: Mode is manual handle feed and 1st manual handle is available.
MPG ×2		HANDLE feed mode and 2nd HANDLE unit selection: Mode is manual handle feed and 2nd manual handle is available.
HOME		ZERO return mode selection: Mode is zero return.
TEACH		TEACH in JOG (Teach in HANDLE) mode selection: Mode is teach in jog (teach in handle)
OFSET MESUR		TOOL OFFSET DATA write mode selection: Mode is tool offset setting.
? NC		CNC alarm: LED is turned on when CNC alarm. Key pad does not have an meanings.
? MC		MACHINE alarm: LED is turned on when Machine alarm. Key pad does not have any meanings.
SINGL BLOCK		Single block: Single block program execution for test operation.
BLOCK DELET		Block delete: Execution block is stopped and jump blocks following/to next end of block (;) in AUTO mode (Optional block skip).
PRG STOP		PROGRAM STOP (Output only): When automatic operation is stopped by M00 command in the program, LED on the button is turned on.

English	Symbol	Meanings
OPT STOP		OPTIONAL STOP: When this signal is turned on, auto running operation is stopped after executing M01 block.
DRY RUN		DRY RUN: When this signal is turned on, axes feed speed will be JOG feed speed not command speed on the program. To check the moving of tool without workpiece.
PRG TEST		MACHINE LOCK: When this signal is tuned on and auto running operation, axes are not moved but position screen on CRT is only executed. To check the program.
MPG X		HANDLE feed X axis selection: When manual handle feed mode is selected and turn on this button, X axis is moved by manual handle feed. (Same for Y–axis, Z–axis, C–axis and 4–axis).
WORK LIGHT		WORK LIGHT: WORK LIGHT on/off control
MPG INTRT		HANDLE INTERRUPTION: Selecting this button in automatic operation, the moving value of manual handle feed is added to the moving value of program.
AXIS INHBT		AXES INHIBIT: The specific axis or all axes are stopped to move.
LOW ×1 MEDL ×10 MED ×100	  	JOG (STEP) FEED OVERRIDE UPPER: Set override to the jog feed (or step feed) five steps display. HANDLE FEED MULTIPLY LOWER: Manual handle feed multiply ×1, ×10, ×100, ×1000.
+X		MANUAL FEED DIRECTION: Selecting this button in jog feed (or step feed), selected axis is moved to the selected direction by jog feed (or stop feed). (Same for –X, +Y, –Y and +Z)
TRVRS		TRAVERSE: Executing jog feed in on this button the jog feed is executed in the rapid traverse.
CYCLE START		CYCLE START: Automatic operation is started.
CYCLE STOP		CYCLE STOP: Automatic operation is stopped.

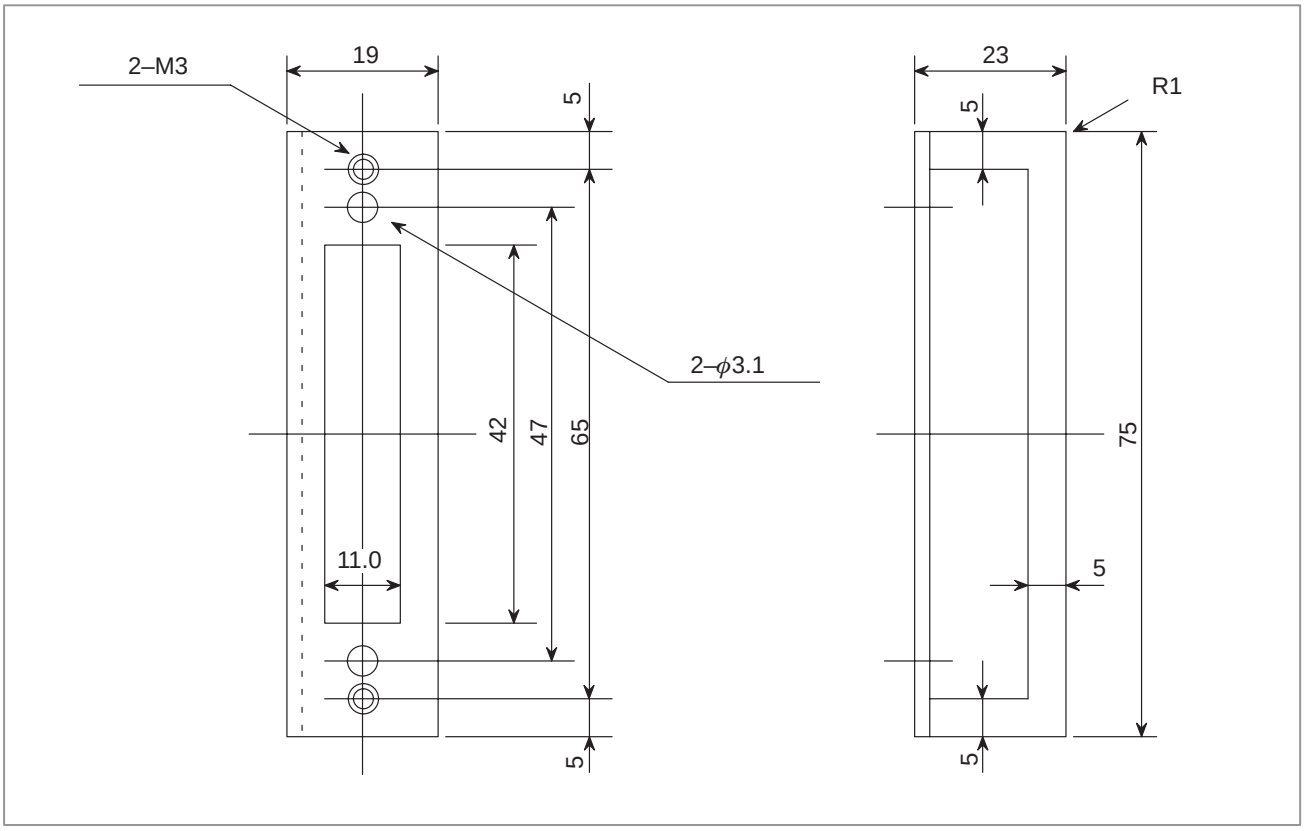
English	Symbol	Meanings
CLNT ON		COOLANT ON: Coolant is started.
CLNT OFF		COOLANT OFF: Coolant is stopped.
CLNT AUTO		COOLANT AUTO: COOLANT ON/OFF control in AUTO operation.
SPDL 100%		SPINDLE OVERRIDE 100%: The rotation of spindle motor is 100% override.
SPDL DEC		SPINDLE SPEED DECELERATION: The rotation of spindle motor is decelerated.
SPDL INC		SPINDLE SPEED ACCELERATION: The rotation of spindle motor is accelerated.
SPDL CW		SPINDLE DIRECTION CW: The rotating direction of spindle motor is clock wise.
SPDL CCW		SPINDLE DIRECTION CCW: The rotating direction of spindle motor is counter clockwise.
SPDL STOP		SPINDLE STOP: The rotation of spindle motor is stopped.
SPDL JOG		SPINDLE MANUAL FEED: SPINDLE FEED is manually.

D.8 MOUNTING OF READER/PUNCHER

Refer to the following figure to mount the reader/puncher interface to the operator's panel.
Plate A is usually mounted so as the blind face is front.
However, when reader/puncher interface is mounted, use it so as the connector mounting face is fronted.



When cable J28 is prepared by the machine tool builder, make the plate B according to the following figure.



Dimensions of plate B

Specification of the connector is as follows.

D–sub connector . . . DBM–25S

Fixture D20418–J2 (2pcs.)
(by JAPAN AVIATION ELECTRONICS)

Specification No. for cable J28.

Name	Specification No.	Remarks
Cable J28	A02B–0083–K801	5m (including plate B)

D.9 PCB FOR MACHINE OPERATOR'S PANEL CONTROL

Increase of maximum I/O numbers

When the PC board for controlling the machine operator's panel is used, the Series 0 supports the number of I/O points indicated in the table below. The numbers in the table do not include the I/O points added by using the FANUC I/O Link.

	A	B	C	D	Maximum number or I/Os E=A+B+C–D
	I/O–C7 or I/O–E3	I/O–B2 or I/O–F1	Number of operator's panel I/Os	Number of control signals	
DI	104	104	64+6	22	256
DO	72	72	64	8	200

Input/output signal regulation

- **Input/output signal regulation**

Set the switch contacts to satisfy the following conditions.

1) *KYD0–KYD7, #KCY0–*KCY7

Contact capacity	DC6V over 2mA
Leak current between contacts when open circuit	Under 0.2mA (DC6V)
Voltage drop between contacts when open circuit	Under 0.9V (current: 1mA) Note 1)

NOTE

When the diode is inserted in series in the contact in order to prevent a current detour, also set within the above described voltage.

When the detour prevention diode is not inserted, up to 2 switches can simultaneously close the contact.

When more than 3 have closed the contact, the data cannot be correctly exchanged.

2) *ESP/KEY/*OV1–*OV8

Contact capacity	DC30V, over 16mA
Leak current between contacts when open circuit	Under 1 mA (DC26.4V)
Voltage drop between contacts when open circuit	Under 2 V (current: 8.5 mA)

- **Output signal regulation**

Ensure that the LEDs satisfy the following conditions.

1) *LD0–*LD15, *T01–*T32

Normal direction voltage	2.4 V max. (If = 5mA)
Normal direction current	30 mA max.
Reverse direction voltage	3V max.

Power supply capacity

DC24V (approx. 0.5A) is supplied to the operator's panel which uses this operator's panel control PCB by the CNC.
This power source can use the items described below.

1) This PCB
2) Keyboard
3) LED
4) General–use input 6 points
5) Other operator's panel lamps, for LED (maximum 0.1A)

External and installation dimensions

- **External dimensions**

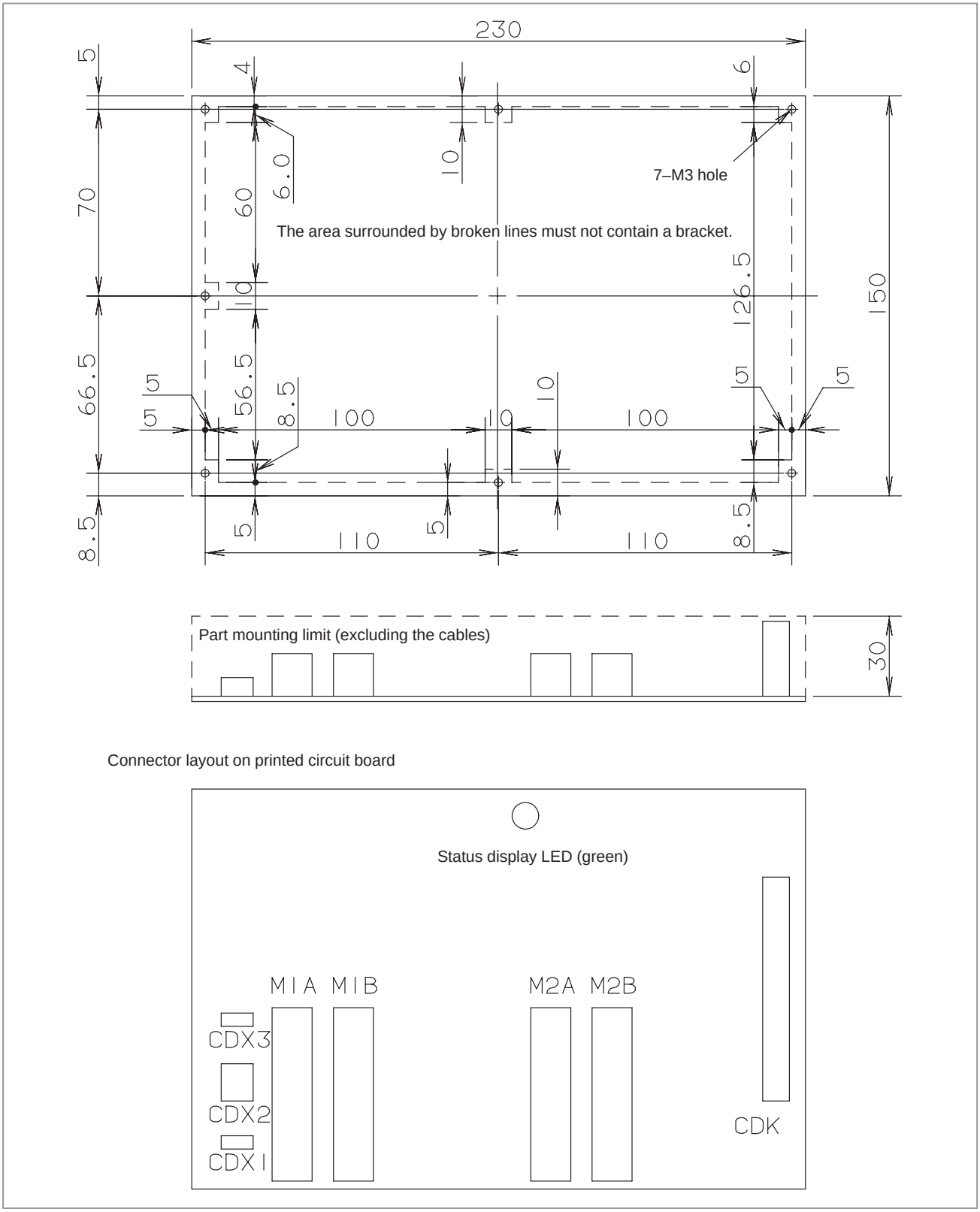


Fig. D.9 (a) External dimensions of printed circuit board and brackets

Interface

- **Connector signal arrangement**

M1A

01	0V			33	X21.3
02	0V	19	X21.4	34	X21.2
03	0V	20	X16.3	35	X21.1
04	0V	21	X16.2	36	X21.0
05	X20.5	22	X17.3	37	X20.6
06	X16.7	23	X17.2	38	X16.5
07	X17.7	24	X18.3	39	X17.5
08	X18.7	25	X18.2	40	X18.5
09	X17.1	26	X21.6	41	X21.7
10	X17.0	27	X21.5	42	X22.7
11	X16.1	28		43	X22.6
12	X16.0	29	+24V	44	X22.5
13	X20.7	30	+24V	45	X22.4
14	X20.4	31	+24V	46	X22.3
15	X20.3	32	+24V	47	X22.2
16	X20.2			48	X22.1
17	X20.1			49	X22.0
18	X20.0			50	

M2A

01	0V			33	Y51.7
02	0V	19	Y50.2	34	Y51.6
03	0V	20	Y50.3	35	Y51.5
04	0V	21	Y50.0	36	Y51.4
05	Y48.7	22	Y49.3	37	Y51.3
06	Y48.6	23	Y49.1	38	Y51.2
07	Y48.5	24	Y49.0	39	Y51.1
08	Y48.4	25	Y48.0	40	Y51.0
09	Y49.7	26	Y48.1	41	Y49.4
10	Y50.5	27	Y48.2	42	Y53.7
11	Y52.7	28		43	Y53.6
12	Y52.6	29		44	Y53.5
13	Y52.5	30		45	Y53.4
14	Y52.4	31		46	Y53.3
15	Y52.3	32		47	Y53.2
16	Y52.2			48	Y53.1
17	Y52.1			49	Y53.0
18	Y52.0			50	

Fig. D.9 (b)

NOTE
The signals within ▭ are the signals used by this operator's panel control P.C.B.

M1B

01				33	
02	0V	19	X21.4	34	
03	0V	20	X16.3	35	
04		21	X16.2	36	
05		22	X17.3	37	
06	X16.7	23	X17.2	38	X16.5
07	X17.7	24	X18.3	39	X17.5
08	X18.7	25	X18.2	40	X18.5
09	X17.1	26	X21.6	41	
10	X17.0	27		42	
11	X16.1	28		43	X22.6
12	X16.0	29	+24V	44	
13		30	+24V	45	
14		31	+24V	46	
15		32		47	
16				48	
17				49	
18				50	

M2B

01				33	
02	0V	19	Y50.2	34	
03	0V	20	Y50.3	35	
04	0V	21	Y50.0	36	
05	Y48.7	22	Y49.3	37	
06	Y48.6	23	Y49.1	38	
07	Y48.5	24	Y49.0	39	
08	Y48.4	25	Y48.0	40	
09	Y49.7	26	Y48.1	41	Y49.4
10	Y50.5	27	Y48.2	42	Y53.7
11	Y52.7	28		43	Y53.6
12	Y52.6	29		44	Y53.5
13	Y52.5	30		45	Y53.4
14	Y52.4	31		46	Y53.3
15	Y52.3	32		47	Y53.2
16	Y52.2			48	Y53.1
17	Y52.1			49	Y53.0
18	Y52.0			50	

Fig. D.9 (c)

CDX1

01	⁎ESP
02	COM1

CDX2

01	COM3
02	⁎OV1
03	⁎OV2
04	⁎OV4
05	⁎OV8
06	

CDX3

01	COM2
02	KEY

Fig. D.9 (d)

CDK

A		B	
01		01	
02	⁎KYD0	02	⁎KYD1
03	⁎KYD2	03	⁎KYD3
04	⁎KYD4	04	⁎KYD5
05	⁎KYD6	05	⁎KYD7
06	⁎KCY0	06	⁎KCY1
07	⁎KCY2	07	⁎KCY3
08	⁎KCY4	08	⁎KCY5
09	⁎KCY6	09	⁎KCY7
10		10	
11		11	
12		12	
13	⁎LD0	13	⁎LD8
14	⁎LD1	14	⁎LD9
15	⁎LD2	15	⁎LD10
16	⁎LD3	16	⁎LD11
17	⁎LD4	17	⁎LD12
18	⁎LD5	18	⁎LD13
19	⁎LD6	19	⁎LD14
20	⁎LD7	20	⁎LD15
21	⁎T01	21	⁎T02
22	⁎T11	22	⁎T12
23	⁎T21	23	⁎T22
24	⁎T31	24	⁎T32
25		25	

Fig. D.9 (e)

Table D.9 (a) shows the connector standard name on the cable side.

Table D.9 (a)

Name	Standard name	Manufacturer
M1A	MR–50LMH	HONDA TSUSHIN
M1B	MR–50LFH	HONDA TSUSHIN
M2A	MR–50LMH	HONDA TSUSHIN
M2B	MR–50LFH	HONDA TSUSHIN
CDK	FAS–50–17	YAMAICHI DENKI
CDX1	5051–02 Housing 2759GL Contact	NIHON MOREX
CDX2	5051–06 Housing 2759GL Contact	NIHON MOREX
CDX3	5051–02 Housing 2759GL Contact	NIHON MOREX

Cable length

The cable connected to CDK must be no longer than 30 cm.

Key switch and PMC address correspondence table

When the detour prevention diode is not inserted, up to 2 key switches can be simultaneously inputted. A0 to H7 in Table D.9 (b) shows the key switch numbers of Figure D.9 (f).

Table D.9 (b)

PMC ADDRESS \ BIT	7	6	5	4	3	2	1	0
F292	A7	A6	A5	A4	A3	A2	A1	A0
F293	B7	B6	B5	B4	B3	B2	B1	B0
F294	C7	C6	C5	C4	C3	C2	C1	C0
F295	D7	D6	D5	D4	D3	D2	D1	D0
F296	E7	E6	E5	E4	E3	E2	E1	E0
F297	F7	F6	F5	F4	F3	F2	F1	F0
F298	G7	G6	G5	G4	G3	G2	G1	G0
F299	H7	H6	H5	H4	H3	H2	H1	H0

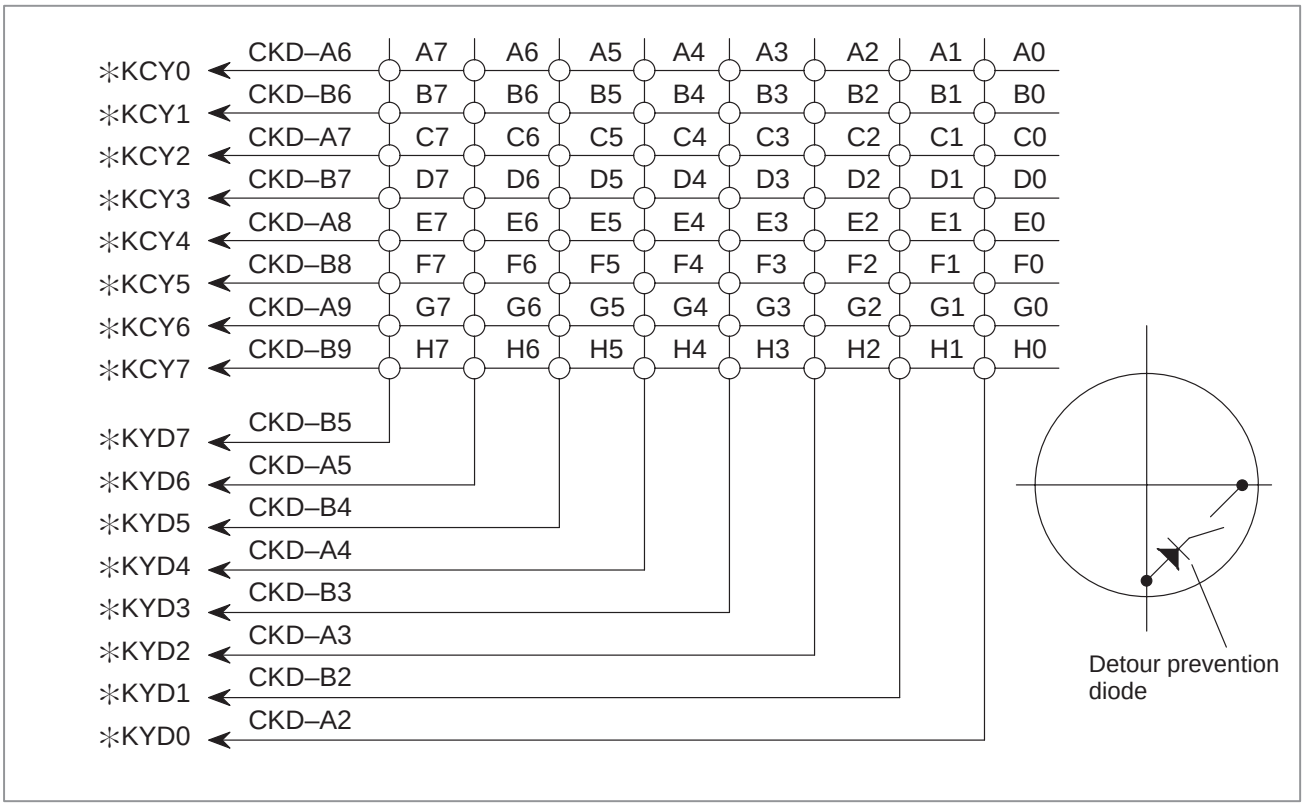


Fig. D.9 (f)

LED–PMC address correspondence table

A0–H7 in Table D.9 (c) shows the LED numbers of Figure D.9 (g) and Figure D.9 (h).

Table D.9 (c)

PMC ADDRESS \ BIT	7	6	5	4	3	2	1	0
F242	A7	A6	A5	A4	A3	A2	A1	A0
F243	B7	B6	B5	B4	B3	B2	B1	B0
F244	C7	C6	C5	C4	C3	C2	C1	C0
F245	D7	D6	D5	D4	D3	D2	D1	D0
F246	E7	E6	E5	E4	E3	E2	E1	E0
F247	F7	F6	F5	F4	F3	F2	F1	F0
F248	G7	G6	G5	G4	G3	G2	G1	G0
F249	H7	H6	H5	H4	H3	H2	H1	H0

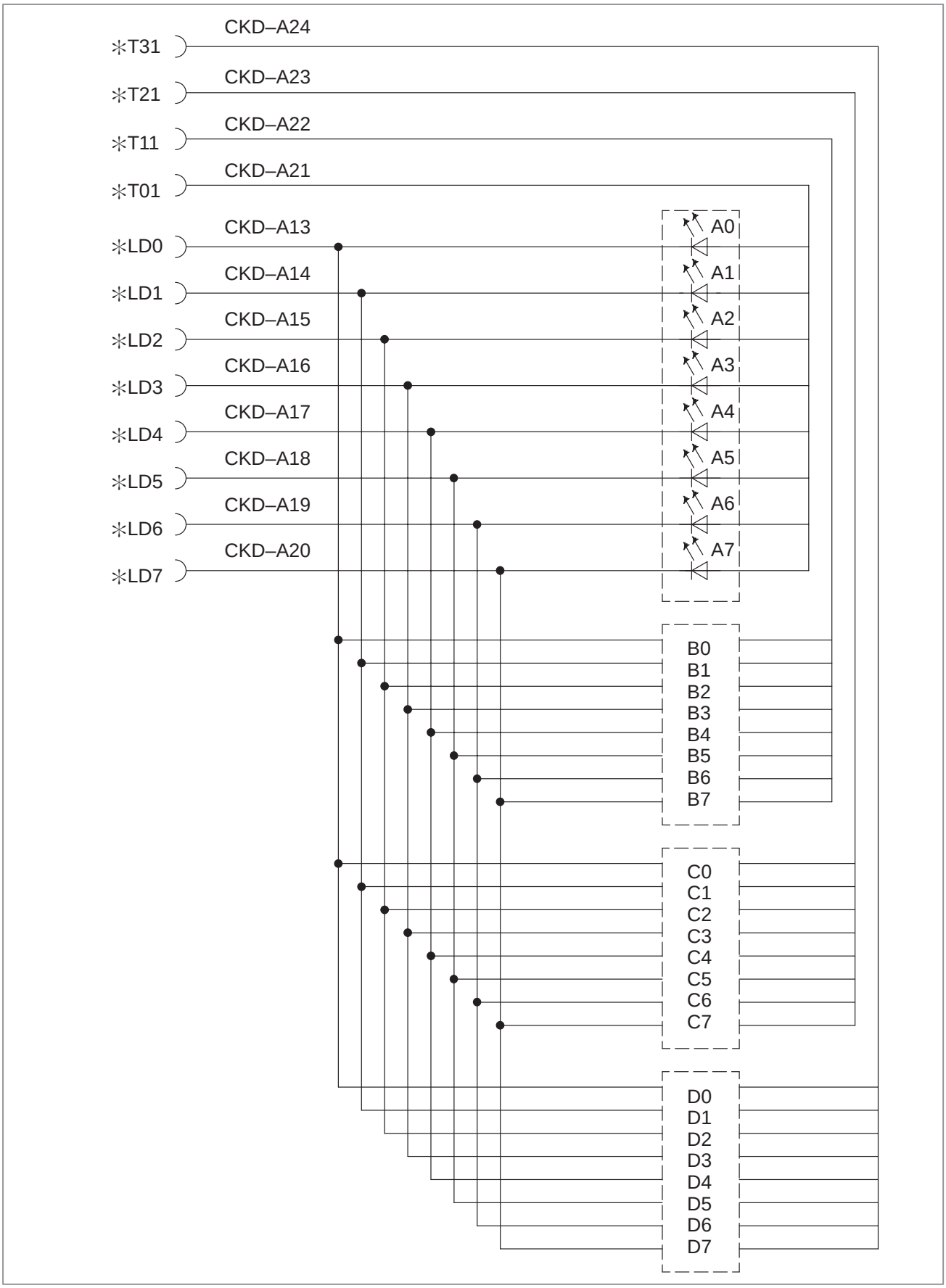

CKD–A24
∗T31
CKD–A23
∗T21
CKD–A22
∗T11
CKD–A21
∗T01
CKD–A13
∗LD0
CKD–A14
∗LD1
CKD–A15
∗LD2
CKD–A16
∗LD3
CKD–A17
∗LD4
CKD–A18
∗LD5
CKD–A19
∗LD6
CKD–A20
∗LD7
A0
A1
A2
A3
A4
A5
A6
A7
B0
B1
B2
B3
B4
B5
B6
B7
C0
C1
C2
C3
C4
C5
C6
C7
D0
D1
D2
D3
D4
D5
D6
D7

Fig. D.9 (g)

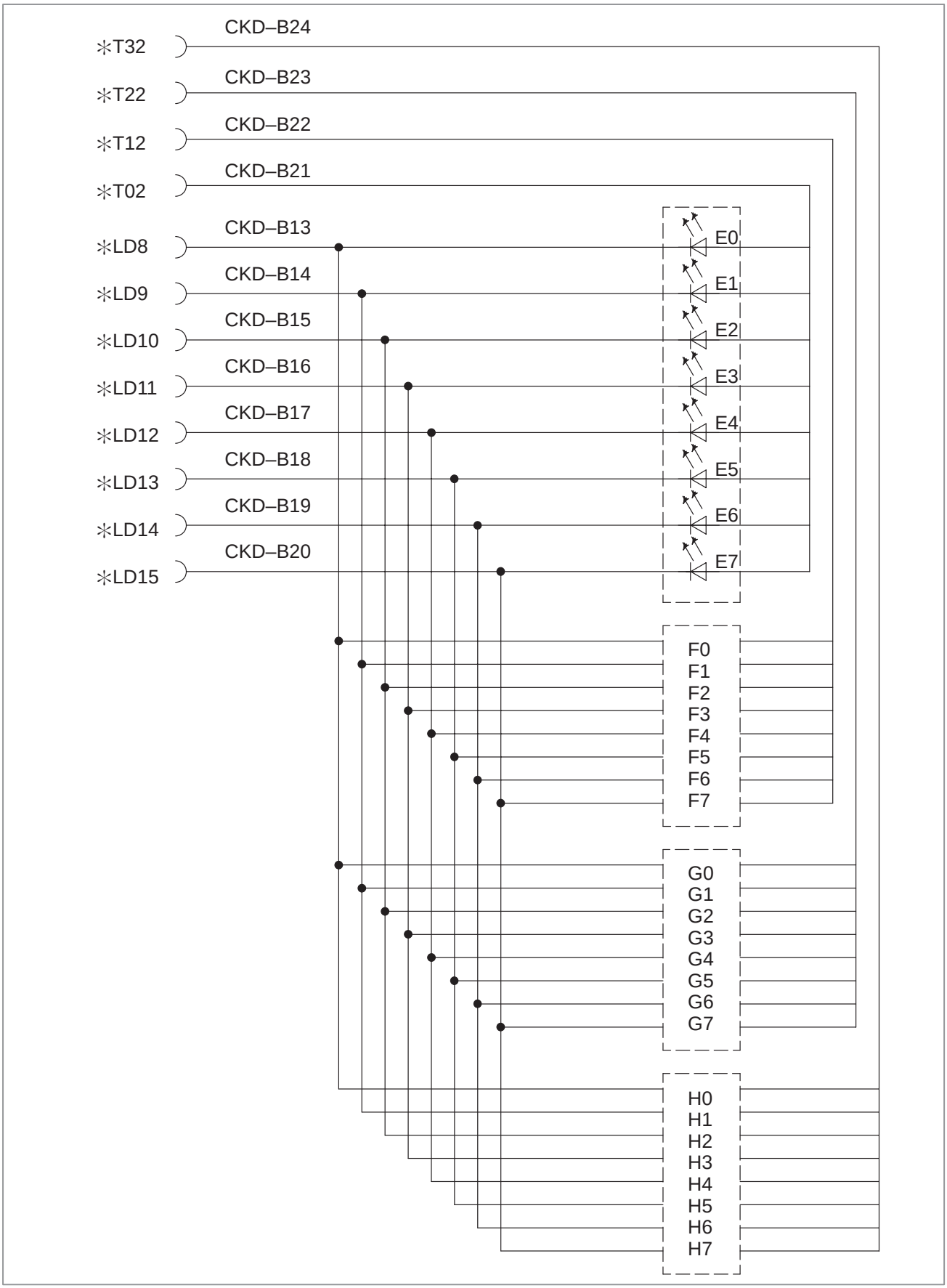
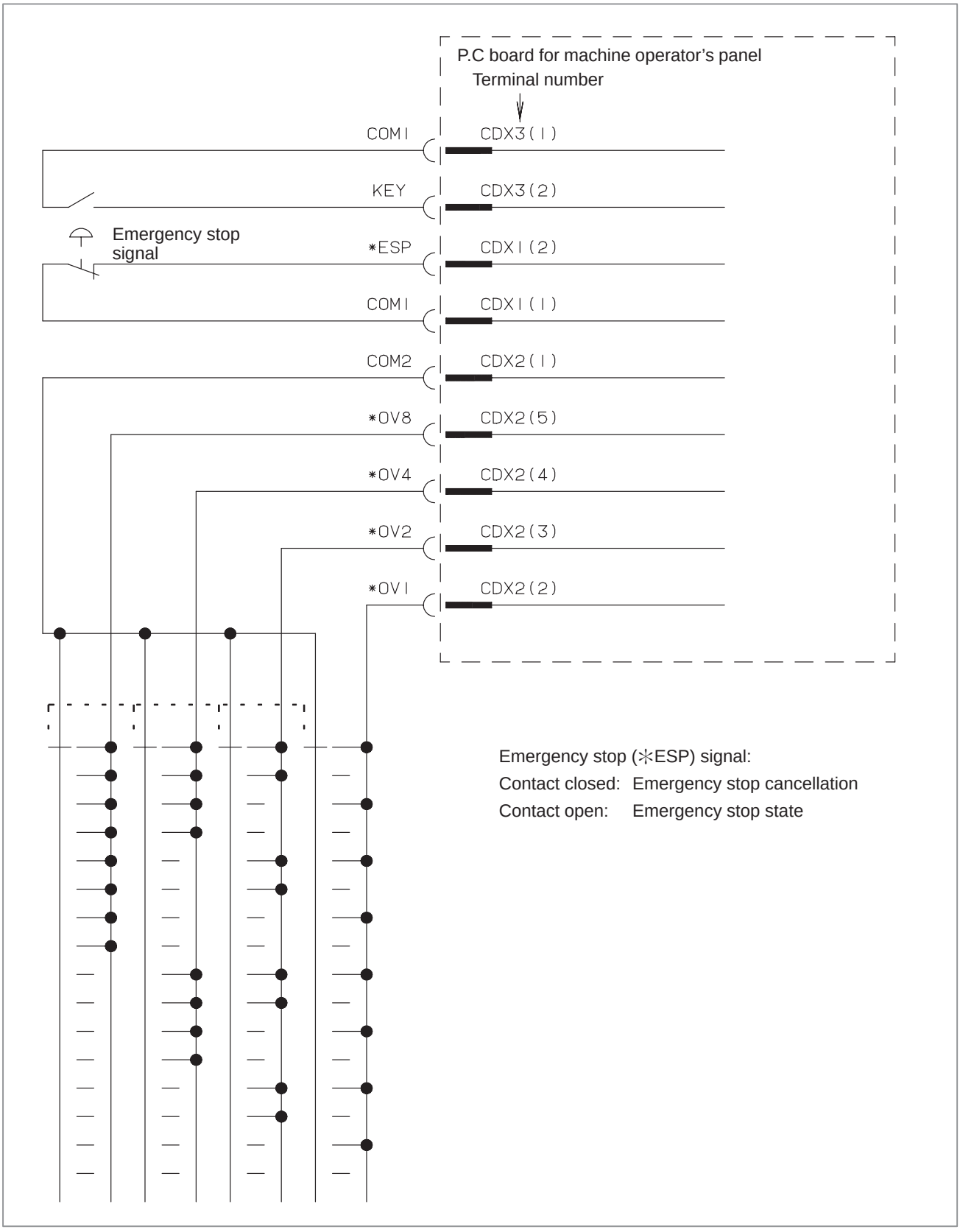

CKD–B24
∗T32
CKD–B23
∗T22
CKD–B22
∗T12
CKD–B21
∗T02
CKD–B13
∗LD8
CKD–B14
∗LD9
CKD–B15
∗LD10
CKD–B16
∗LD11
CKD–B17
∗LD12
CKD–B18
∗LD13
CKD–B19
∗LD14
CKD–B20
∗LD15
E0
E1
E2
E3
E4
E5
E6
E7
F0
F1
F2
F3
F4
F5
F6
F7
G0
G1
G2
G3
G4
G5
G6
G7
H0
H1
H2
H3
H4
H5
H6
H7

Fig. D.9 (h)

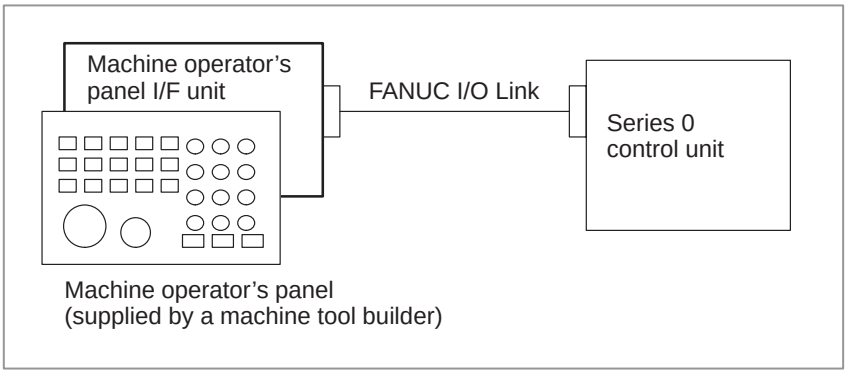
KEY/*ESP/*OV1 to *OV8 connection example



E PRINTED BOARD FOR OPERATOR'S PANEL CONTROLLER (FOR FANUC I/O Link)

E.1 CONNECTION OF MACHINE OPERATOR'S PANEL INTERFACE UNIT

The machine operator's panel interface unit (A16B-2201-0110) is connected to the Series 0 control unit through the I/O link and is used for interfacing with the machine operator's panel.
It features interfaces with matrix key switches and LEDs.



E.1.1 Function Overview

Number of DI/DO points

Operator's panel control PCB allocation to the I/O Link DI/DO (Name of module) / DIor DO	DI/DO=128/128		DI/DO=256/256	
	DI (OC02I)	DO (OC02O)	DI (OC03I)	DO (OC03O)
Number of matrix key switch inputs	64		96	
Number of matrix LED data outputs		64		64
Number of general-purpose switch inputs	32		32	
Number of general-purpose LED data outputs		32		32
Number of total DI/DO points	96	96	128	96

- **Matrix key switch inputs (matrix DI)**

  Ninety-six DI points are provided by a matrix of twelve common signals times eight data signals. Note that I/O link allocation may limit the number of usable key switch inputs.
- **Matrix LED data outputs (matrix DO)**

  Sixty-four DO points are provided by a matrix of eight common signals times eight data signals.
- **General-purpose switch inputs (general-purpose DI)**

  Each general-purpose DI point has an individual interface.
- **General-purpose LED data outputs (general-purpose DO)**

  Each general-purpose DO point has an individual interface.

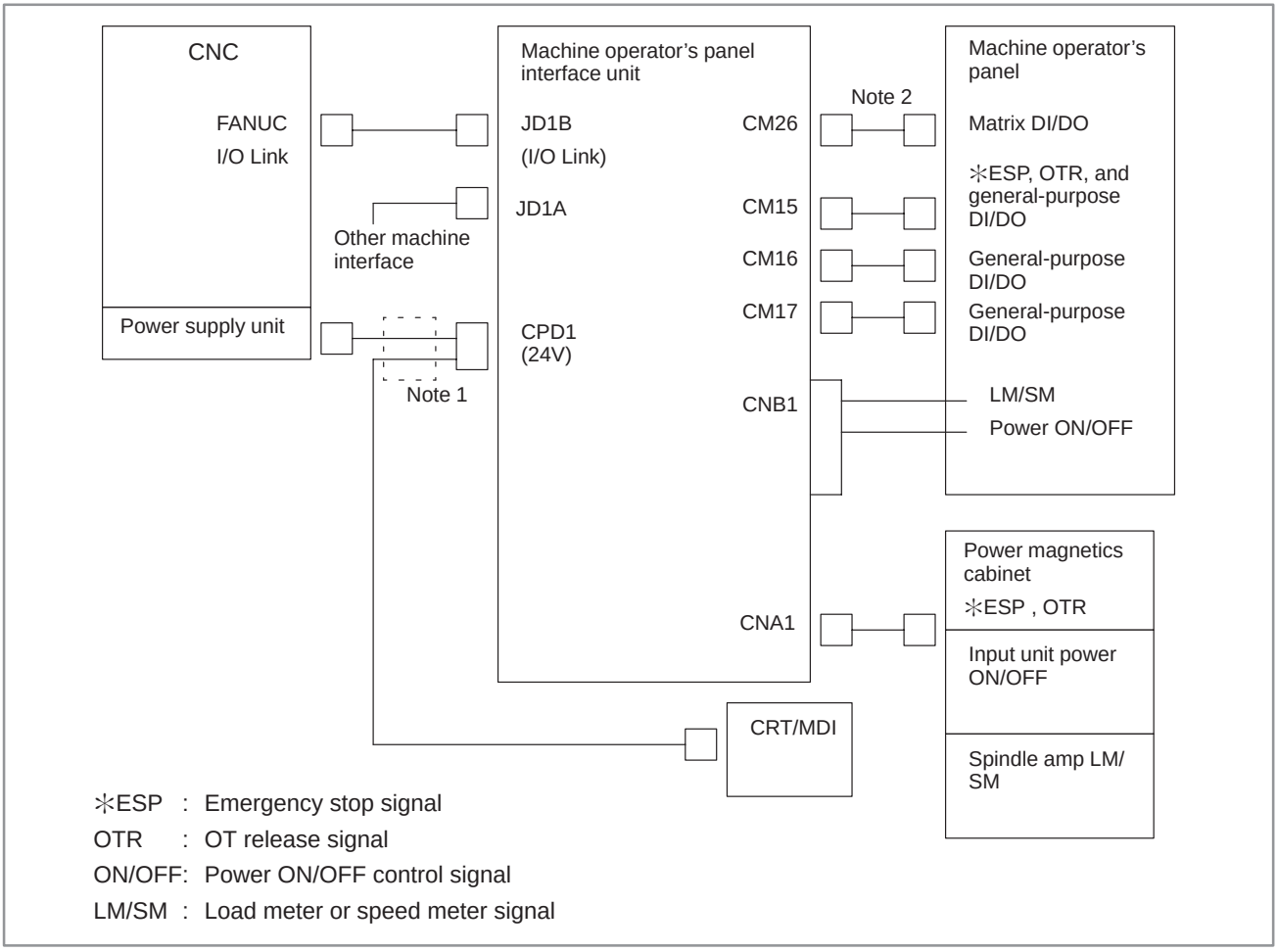
Analog signal inputs

- Two inputs (input voltage: 0 to +10 V)
- Input voltages are converted from analog to digital. The resulting five bits of data are sent to the CNC through the FANUC I/O Link.
- The analog signal input function can be used regardless of whether I/O link allocation is 128/128 or 256/256.

Terminal for signal for warding

- Emergency stop and OT release signals are forwarded without change to the power magnetics cabinet.
- Power ON/OFF control signals are forwarded without change to an input unit.
- Analog signal inputs described in item "Analog signal inputs" can be sent out without being changed.

E.1.2 System Configuration



NOTE

1 Power requirements
When 60% of the DI/DO points are on, this interface unit requires "1.0 A" (not including the current required by the CRT and MDI).

2 The cable connected to CM26 must be no longer than 30 cm.

E.1.3 Signal Assignment

Connector pin signal assignment

CM15 (Matrix DI/DO)

	A	B
01	+5E	DI06
02	0V	DO06
03	+5E	DI07
04	0V	DO07
05	+5E	DI16
06	0V	DO16
07	+5E	DI17
08	0V	D017
09	⁜ESP	ECM1
10	OTR	ECM2
11	DI00	D102
12	DI04	+5E
13	DI03	DI01
14	DI05	DI10
15	DI12	DI14
16	+5E	DI13
17	DI11	DI15

CM16 (Matrix DI/DO)

	A	B
01	DI20	DI22
02	DI24	+5E
03	DI23	DI21
04	DI25	DI26
05	DI27	+5E
06	DO00	0V
07	DI05	+5E
08	DO01	0V
09	DI15	+5E
10	DO02	0V
11	DO03	DO04
12	DO05	0V
13	0V	0V
14	DO10	DO11
15	DO12	DO13
16	DO14	DO15
17	+5E	+5E

CM17 (Matrix DI/DO)

	A	B
01	0V	0V
02	DO20	DO21
03	DO22	DO23
04	DO24	DO25
05	DO26	DO27
06	0V	0V
07	DO30	DO31
08	DO32	DO33
09	DO34	DO35
10	DO36	DO37
11	0V	0V
12	+5E	+5E
13	DI30	DI31
14	DI32	DI33
15	DI34	DI35
16	DI36	DI37
17	+5E	+5E

CNA1 (Connector on the machine side)

9	0M	10	ECM2	19	OTR	20	
7	DO36	8	ECM1	17	⁜ESP	18	
5	SM	6	SM	15	COM	16	
3	0M	4	0M	13	EOF	14	
1	LM	2	LM	11	EON	12	

CNB1 (Connector on the operator's panel side)

01	LM	05	EON	09	
02	SM	06	EOF	10	
03	0M	07	COM	11	+5V
04	0M	08	0V	12	0V

CPD1 (Power supply)

3	2	1
	0V	+24V
6	5	4
	0V	+24V

Pins shaded by ▭ are those for forwarding signals. Pins with the same name are connected directly to one another.

Input/output pins shaded by ▨ are in pairs. Only one in each pair is usable.

NOTE
1 LM and SM also function as input terminals to the A/D converter.
2 OM is connected to 0 V on the PCB.

JD1A (FANUC I/O Link : NEXT SLAVE)

9	+5V	10		19		20	+5V
7		8		17		18	+5V
5		6		15	0V	16	0V
3	TXB	4	⁎TXB	13	0V	14	0V
1	RXB	2	⁎RXB	11	0V	12	0V

JD1B (FANUC I/O Link : BEFORE SLAVE)

9	+5V	10		19		20	+5V
7		8		17		18	+5V
5		6		15	0V	16	0V
3	TXA	4	⁎TXA	13	0V	14	0V
1	RXA	2	⁎RXA	11	0V	12	0V

CM26 (Matrix DI/DO)

	A	B
01	0V	⁎MND1
02	⁎KYD0	⁎KYD1
03	⁎KYD2	⁎KYD3
04	⁎KYD4	⁎KYD5
05	⁎KYD6	⁎KYD7
06	⁎KYC0	⁎KYC1
07	⁎KYC2	⁎KYC3
08	⁎KYC4	⁎KYC5
09	⁎KYC6	⁎KYC7
10	⁎KYC8	⁎KYC9
11	⁎KYCA	⁎KYCB
12	⁎BZMD	0V
13	⁎LD0	⁎LD8
14	⁎LD1	⁎LD9
15	⁎LD2	⁎LD10
16	⁎LD3	⁎LD11
17	⁎LD4	⁎LD12
18	⁎LD5	⁎LD13
19	⁎LD6	⁎LD14
20	⁎LD7	⁎LD15
21	LC1L	LC1H
22	LC2L	LC2H
23	LC3L	LC3H
24	LC4L	LC4H
25	0V	0V

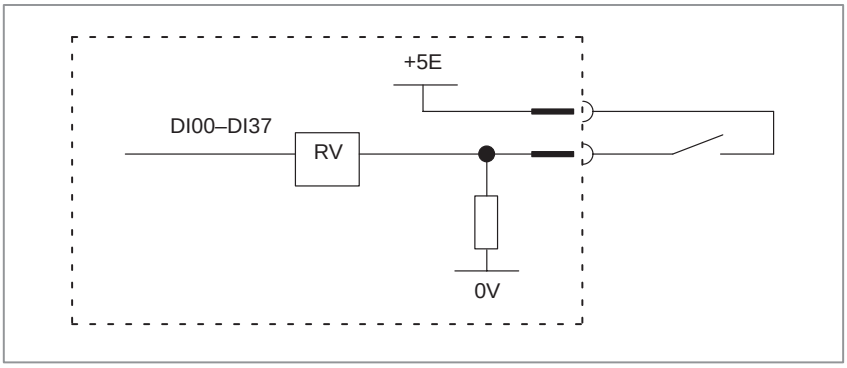
DInx	General-purpose DI	LM	Load meter voltage
DOnx	General-purpose DO	SM	Speed meter voltage
⁎ESP	Emergency stop	0M	LM/SM reference voltage (0V)
ECM1	⁎ESP common signal	⁎KYDx	Matrix DI data signal
OTR	OT release	⁎KYCx	Matrix DI common signal
ECM2	OTR common signal	⁎LDx	Matrix DO data signal
EON/OF	Power ON/OFF control signal	LCnL/H	Matrix DO common signal
COM	EON/EOF common signal	⁎MNDI	Three DI points acceptable
		⁎BZMD	Buzzer off

NOTE

See Subsection E.1.4 for details of connection and signal meanings.

E.1.4 Interface

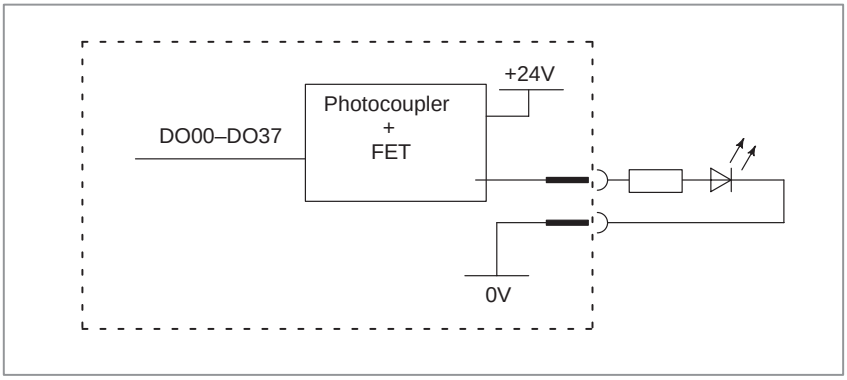
General–purpose DI



Input signal specifications

Contact rating	5VDC, 3.2mA or higher
Leakage current between open contacts	0.2mA or lower (5 VDC)
Voltage drop across closed contacts	0.75V or lower

General–purpose DO



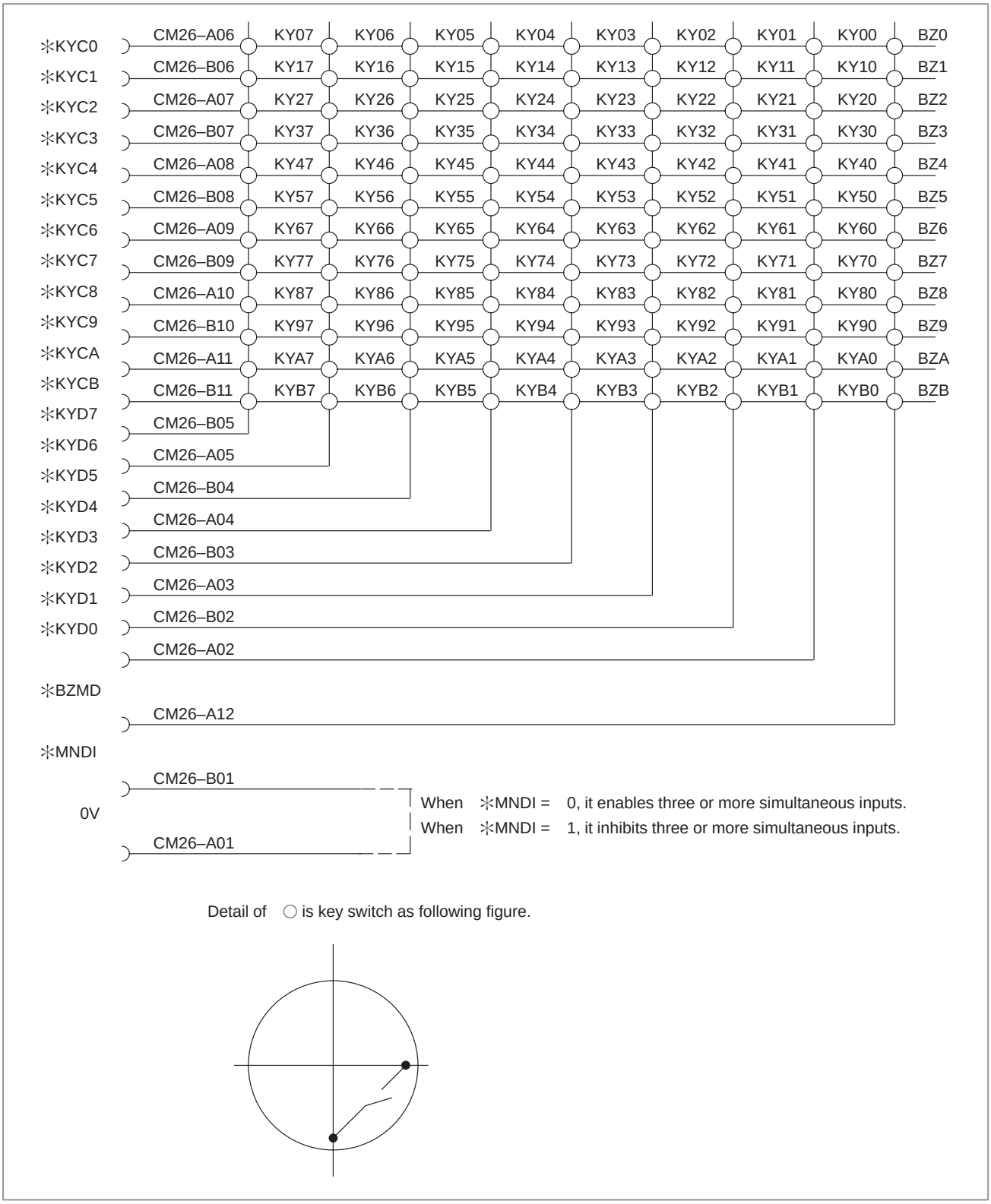
Output signal specifications

Maximum load current	0.03A
Maximum open-circuit leakage current	0.1mA
Maximum closed-circuit voltage drop	0.1V

NOTE
When using an LED at the DO point, connect an external resistor that meets the requirements of the LED.

Matrix DI

- **Key switch addresses** See Section E.1.5 for the corresponding PMC addresses.



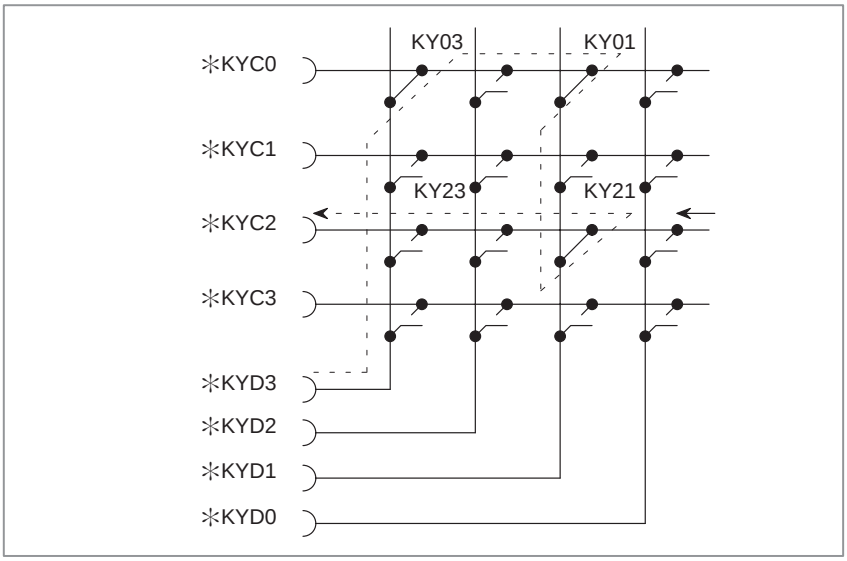
Detail of ○ is key switch as following figure.

● Mode selection

❑ Preventing malfunctions that may be caused by detouring current

When there are three or more matrix DI points, detouring current can cause a nonexistent DI input to be falsely detected as existing.

As shown below, if KY01, KY03, and KY21 are closed simultaneously, current detours through the path indicated with arrows, thus causing a false input of KY23 to be detected because of a current path formed by a combination of common signal ⁎KYC2 and data signal ⁎KYD3.



Two modes are available to prevent this malfunction. One should be selected according to the user applications.

[Method 1]

- Ignoring all occurrences of three or more simultaneous inputs

  Action : Make the ⁎MNDI signal open
  (see item "● Key switch addresses")

NOTE
If there are two inputs and a third is added, all three are ignored. When one of the three inputs is removed, two are accepted.

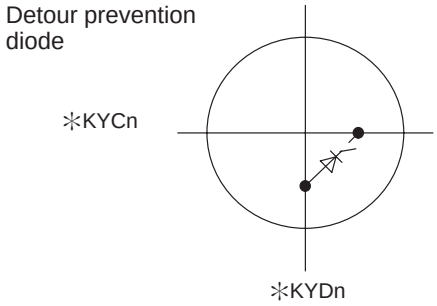
[Method 2]

- Attaching detour prevention diodes to enable three simultaneous inputs

  Action : Connect the ⁎MNDI signal
  (see item "● Key switch addresses") to 0V.

NOTE

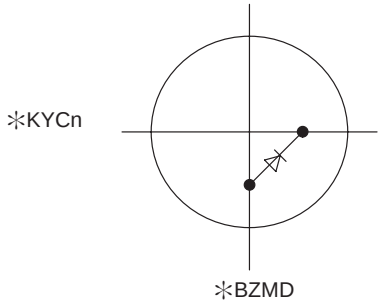
A diode must be connected in series with a switch, as shown below.



❑ This PCB can raise a key input confirmation sound on key inputs. The condition to raise a key input confirmation sound is set in 8-bit units, or in ∗KYCn units. If ∗BZMD and common ∗KYCn are disconnected, a KYnx input causes the key input confirmation sound to sound. If they are connected, a KYnx input does not cause the key input confirmation sound to sound.
To sound the key input confirmation sound, the DO (PMC address DO + 00.7 BIT) "MD07" must have been turned to "1" (see Section E.1.5).

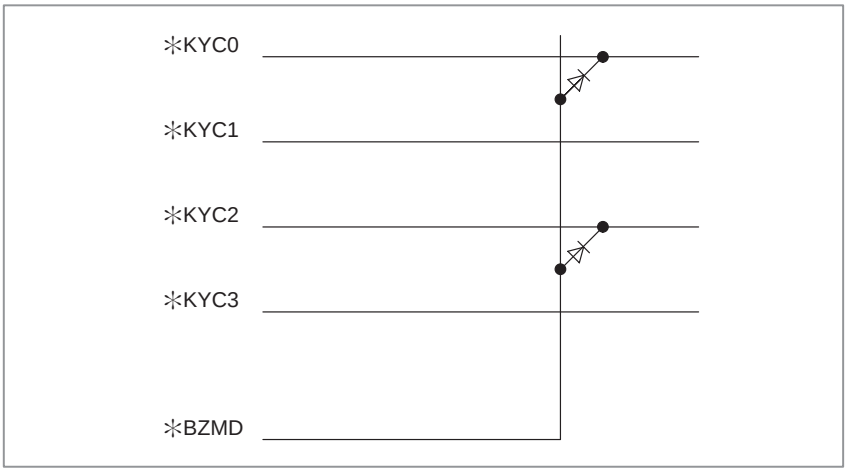
NOTE

1 A diode is necessary to connect ∗BZMD and common, as shown below.
2 This setting cannot be changed when power is supplied.
3 The key input confirmation sound sounds at the moment a current path is formed between common signal ∗KYCn and data signal ∗KYDx. It does not sound when the path is disconnected. If key switches are used, the alarm sounds at the moment a key is pressed. It does not sound when a key is released or when a key is held pressed.



Example

If ＊BZMD is connected to ＊KYC0 and ＊KYC2, but disconnected from ＊KYC1 and KYC3, as shown on the left, closing a switch at key addresses KY10 to KY17 and KY30 to KY37 causes the key input confirmation sound to sound, but closing a switch at key addresses KY00 to KY07 and KY20 to KY27 does not.
See item "● Key switch addresses".



● Signal specification

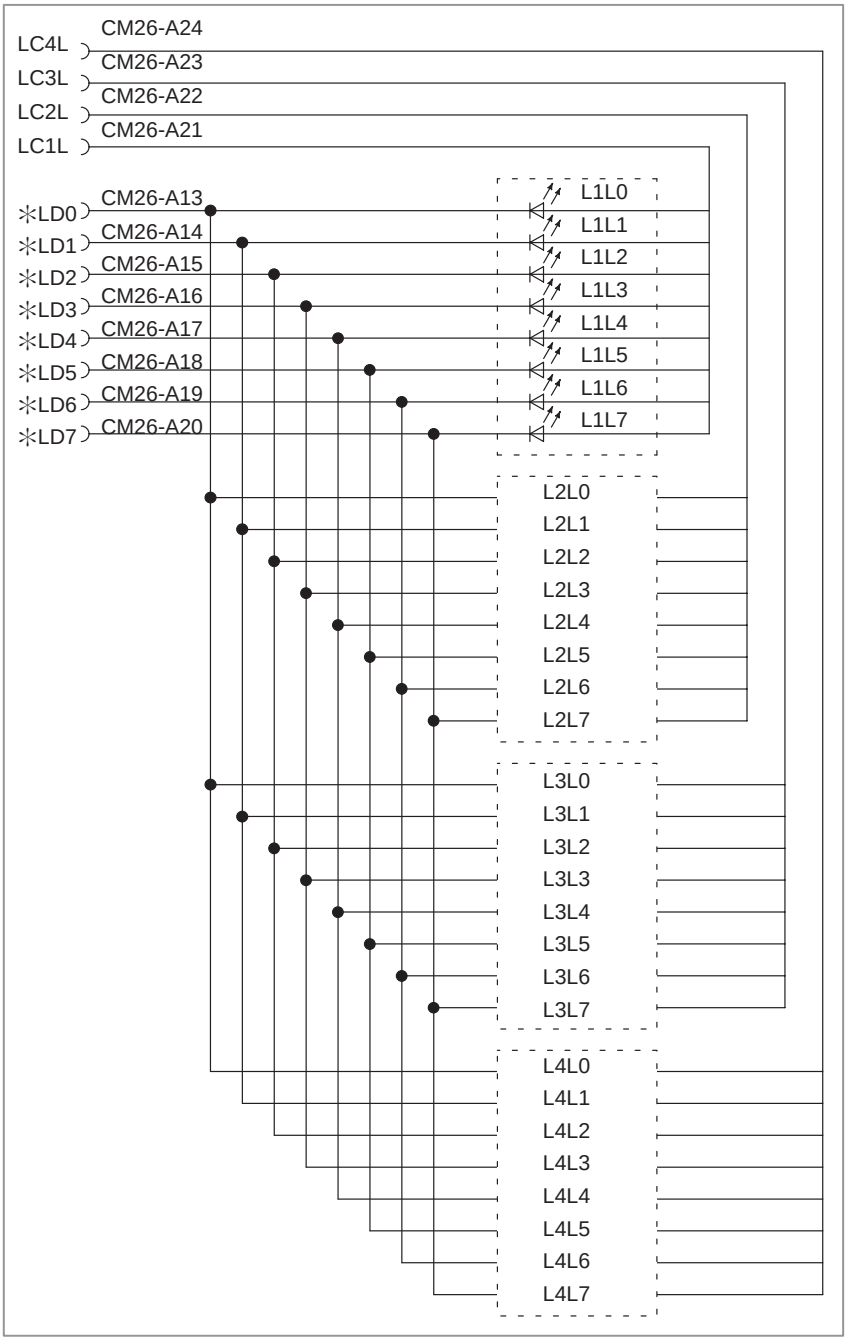
Contact rating	6VDC, 2mA or higher
Leakage current between open contacts	0.2mA or lower (6VDC)
Voltage drop across closed contacts	0.9V or lower (1 mA) Note)

NOTE
This voltage must be maintained even when detour prevention diodes are used.

Matrix DO

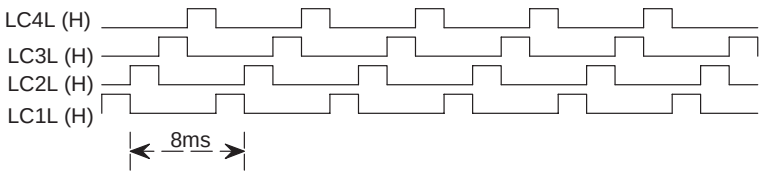
- **LED addresses**

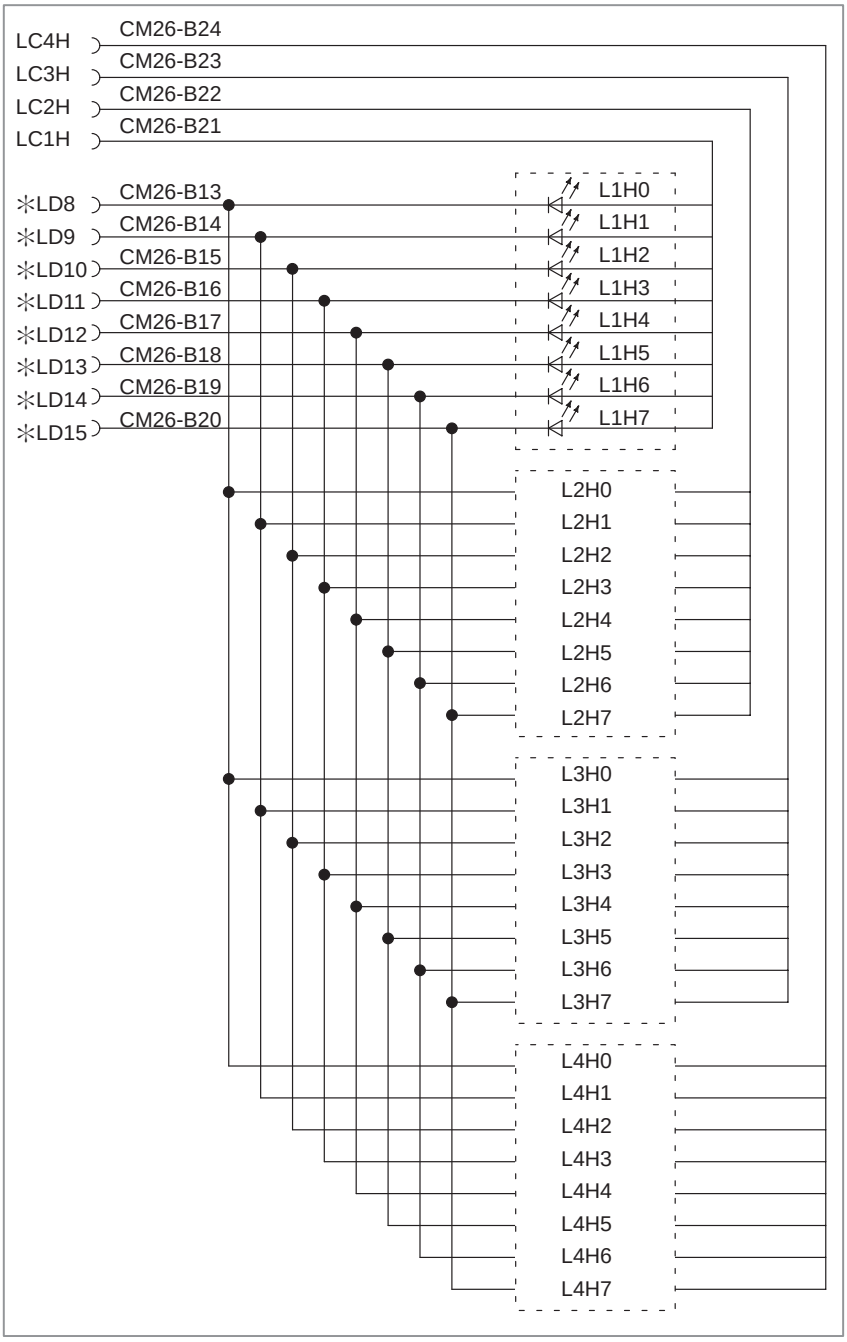
See item E.1.5 for the corresponding PMC addresses.



NOTE

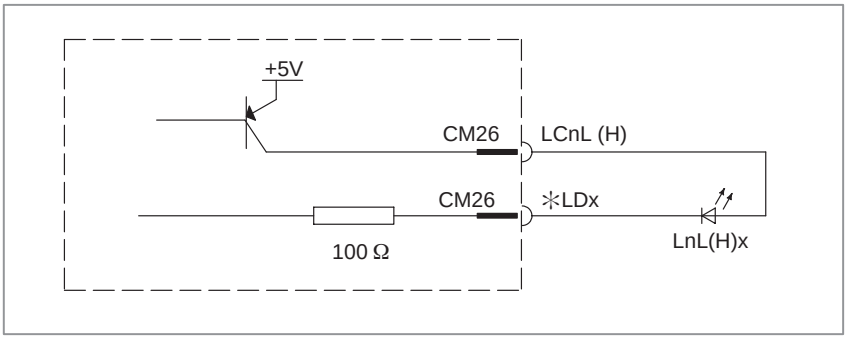
The timing for the common signals are shown below. Their duty cycle is 2 ms for LEDs being on and 6 ms for LEDs being off.





- **Internal circuit**

The circuit contains a 100-ohm resistor, as shown below.
Connecting an LED does not require an external resistor.



- **Signal specifications**

The LEDs must have the following rating

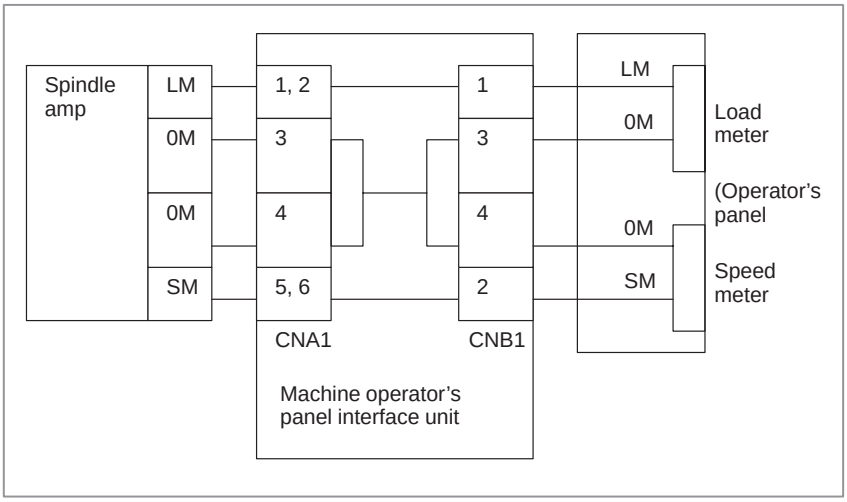
Forward voltage	2.4V max (I_f=5mA)(Typical value)
Forward current	30mA max
Reverse voltage	3V max

Analog signal inputs

Analog inputs received from the outside are forwarded without change to output terminals.

- **Connection diagram (example)**

Analog inputs from the spindle amp being output for load meter and speed meter indications.



- **Sent to the CNC**

Analog inputs received on the Machine operator's panel interface unit are converted to five-bit digital values, which are sent to the CNC though the I/O link.
See Section E.1.5 for PMC addresses.
LM conversion data : "LM03 to LM07"
SM conversion data : "SM03 to SM07"

- **Analog signal specifications**

Acceptable input voltage	0V to +15V
Voltage that can be converted to digital	0V to +10V Note)

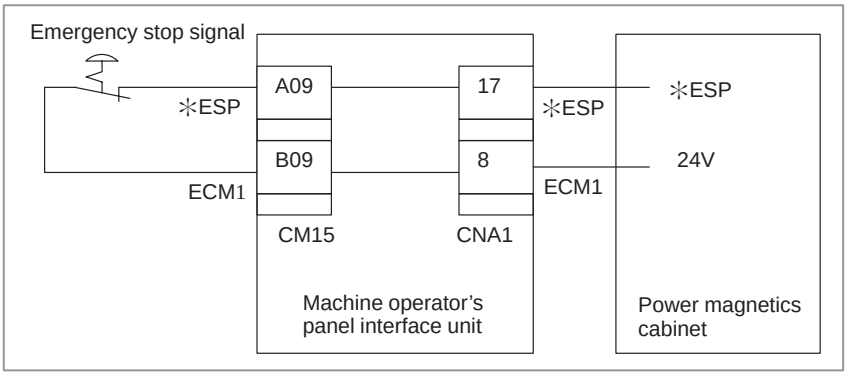
NOTE
Any voltage higher than +10V is converted to the same digital value as +10V is.

- **A/D conversion specifications**

Conversion error	5% (max)
Resolution	5 bit (min)

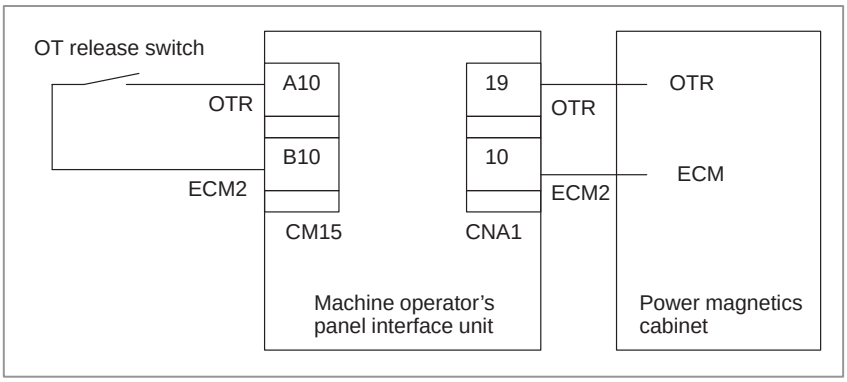
- **Emergency stop**

A signal generated by the emergency stop switch on the machine operator's panel can be sent to the power magnetics cabinet. (This signal cannot be sent to the CNC through the FANUC I/O Link.)



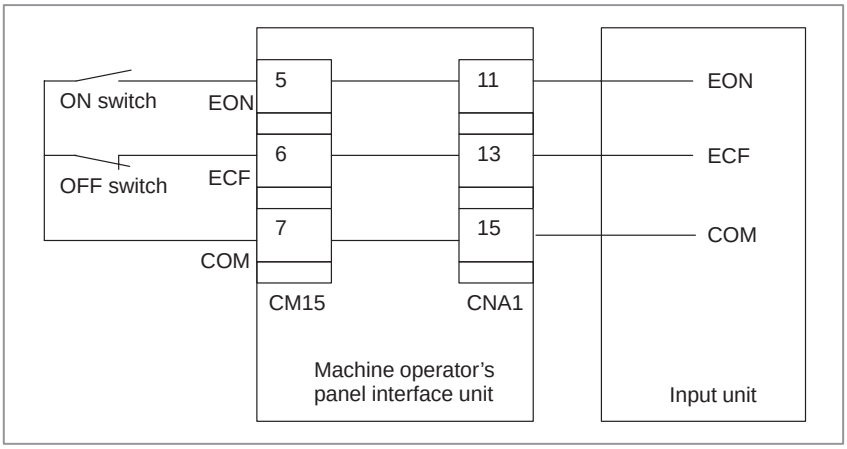
- **OT release**

A signal generated by the OT release switch on the machine operator's panel can be sent to the power magnetics cabinet.
(This signal cannot be sent to the CNC through the FANUC I/O Link.)



- **Power ON/OFF control signal**

Signals generated by the power ON/OFF control switches on the machine operator's panel can be sent to an input unit. (These signals cannot be sent to the CNC through the FANUC I/O Link.)



NOTE

The LM, OM, SM, D036, ECM, EON, EOF, COM, ESP, and OTR signals are all assigned to the pins of one connector (CNA1).

They can be connected to the machine using only one cable.

E.1.5 PMC Addresses

PMC ADDRESS	BIT NUMBER 7	6	5	4	3	2	1	0
DI+00			FUSE					
DI+01	KY07	KY06	KY05	KY04	KY03	KY02	KY01	KY00
DI+02	KY17	KY16	KY15	KY14	KY13	KY12	KY11	KY10
DI+03	KY27	KY26	KY25	KY24	KY23	KY22	KY21	KY20
DI+04	KY37	KY36	KY35	KY34	KY33	KY32	KY31	KY30
DI+05	KY47	KY46	KY45	KY44	KY43	KY42	KY41	KY40
DI+06	KY57	KY56	KY55	KY54	KY53	KY52	KY51	KY50
DI+07	KY67	KY66	KY65	KY64	KY63	KY62	KY61	KY60
DI+08	KY77	KY76	KY75	KY74	KY73	KY72	KY71	KY70
DI+09	DI07	DI06	DI05	DI04	DI03	DI02	DI01	DI00
DI+10	DI17	DI16	DI15	DI14	DI13	DI12	DI11	DI10
DI+11	DI27	DI26	DI25	DI24	DI23	DI22	DI21	DI20
DI+12	DI37	DI36	DI35	DI34	DI33	DI32	DI31	DI30
DI+13	LM07	LM06	LM05	LM04	LM03			
DI+14	SM07	SM06	SM05	SM04	SM03			
DI+15								
DI+16	Reserved for use by FANUC							
DI+17								
DI+18	KY87	KY86	KY85	KY84	KY83	KY82	KY81	KY80
DI+19	KY97	KY96	KY95	KY94	KY93	KY92	KY91	KY90
DI+20	KYA7	KYA6	KYA5	KYA4	KYA3	KYA2	KYA1	KYA0
DI+21	KYB7	KYB6	KYB5	KYB4	KYB3	KYB2	KYB1	KYB0
DO+00	MD07	MD06	FUSE					
DO+01	L1L7	L1L6	L1L5	L1L4	L1L3	L1L2	L1L1	L1L0
DO+02	L2L7	L2L6	L2L5	L2L4	L2L3	L2L2	L2L1	L2L0
DO+03	L3L7	L3L6	L3L5	L3L4	L3L3	L3L2	L3L1	L3L0
DO+04	L4L7	L4L6	L4L5	L4L4	L4L3	L4L2	L4L1	L4L0
DO+05	L1H7	L1H6	L1H5	L1H4	L1H3	L1H2	L1H1	L1H0
DO+06	L2H7	L2H6	L2H5	L2H4	L2H3	L2H2	L2H1	L2H0
DO+07	L3H7	L3H6	L3H5	L3H4	L3H3	L3H2	L3H1	L3H0
DO+08	L4H7	L4H6	L4H5	L4H4	L4H3	L4H2	L4H1	L4H0
DO+09	DO07	DO06	DO05	DO04	DO03	DO02	DO01	DO00
DO+10	DO17	DO16	DO15	DO14	DO13	DO12	DO11	DO10
DO+11	DO27	DO26	DO25	DO24	DO23	DO22	DO21	DO20
DO+12	DO37	DO36	DO35	DO34	DO33	DO32	DO31	DO30

Spcope in which PMC addresses can be used
I/O link allocation
128/128 | 256/256

FUSE : When 1, it indicates the +5E fuse has blown.
Shorting of the general-purpose DI input is considered as a possible cause. Turn off the power at once, check the general-purpose DI input and its vicinity, replace the fuse and turn the power on.

DInx : General-purpose DI

LM0x : Load meter indication

SM0x : Speed meter indication

KYnx : Ky signal (matrix)

LnL (H) x : LED signal (matrix)

DOnx : General-purpose DO

MD07 : Buzzer mode selection (It is possible to sound the buzzer at the matrix DI input by turning this to "1".

MD06 : Buzzer ON/OFF setting (The buzzer sounds as this is turned to "1" and stops as it is turned to "0". This operation is performed irrespective of MD07.)

E.1.6 Major Connection Precautions

- Use flat cables for connectors CM15, CM16, CM17, and CM26. When splitting and connecting flat cables to the machine operator's panel or other equipment, be careful not to break or short the conductors.
- All signals with the same name described in Section E.1.3 are connected to one another.
- One of the holes for mounting the PCB is also used for grounding. Before mounting the PCB, check the location of that hole with the diagram in Section E.1.10.

E.1.7 State of the LEDs on the Machine Operator's Panel Interface Unit

L1 (green) :
Monitors +5E. When on, it indicates that the fuse is intact.
When off, it indicates that the fuse has blown.
L2 (green) :
Monitors key scanning. When blinking, it indicates that the keys are being scanned normally. When on or off, it indicates key scanning is at halt.
L3 (red) :
When on, it indicates that an alarm condition has occurred. When off, it indicates that there is no alarm condition. It monitors ⁎INT0 and ⁎INT1.

E.1.8 Connector (on the Cable Side) Specifications

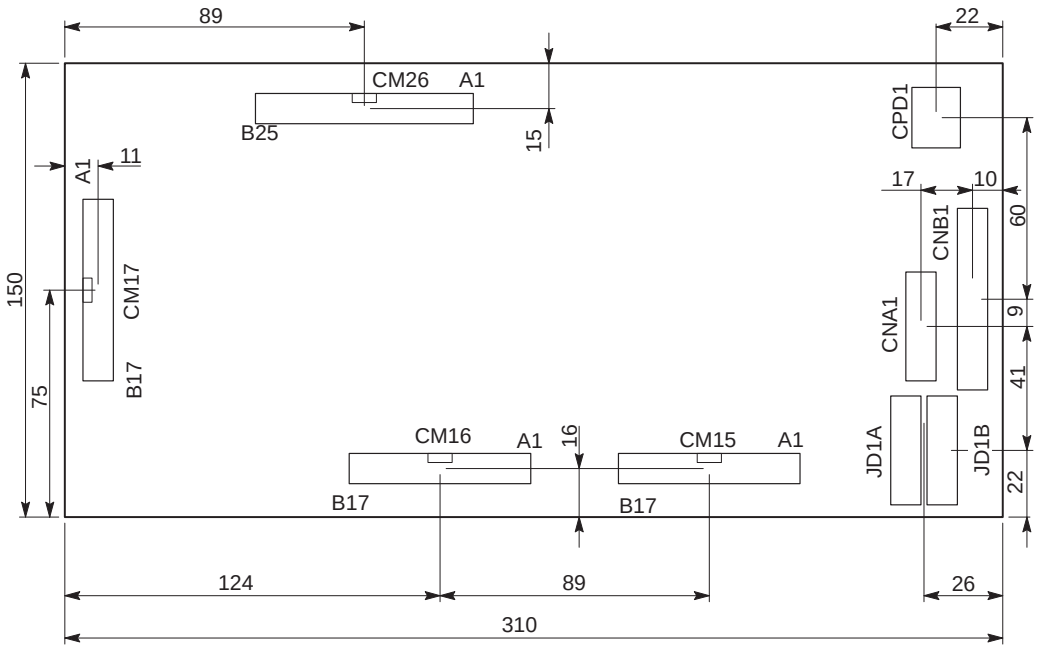
Connector	Major use	Specification
CM15, CM16, CM17	General-purpose DI/DO	HIF3BA-34D-2.54R : Manufactured by HIROSE ELECTRIC CO., LTD.
CNA1	Signal forwarding (to the machine)	PCR-E20FS : Manufactured by HONDA TSUSHIN CO., LTD.
CNB1	Signal forwarding (to the machine operator's panel)	MVSTBR2.5/12-ST-5.08 : Manufactured by PHOENIX CONTACT GmbH & Co.
JD1A, JD1B	FANUC I/O Link	PCR-E20FS : Manufactured by HONDA TSUSHIN CO., LTD.
CPD1	Power supply	Dynamic D3100 (three pins) : Manufactured by AMP JAPAN, LTD. 1-178288-3 : Connector 1-175218-5 : Contact
CM26	Matrix DI/DO	HIF3BB-50D-2.54R : Manufactured by HIROSE ELECTRIC CO., LTD.

NOTE

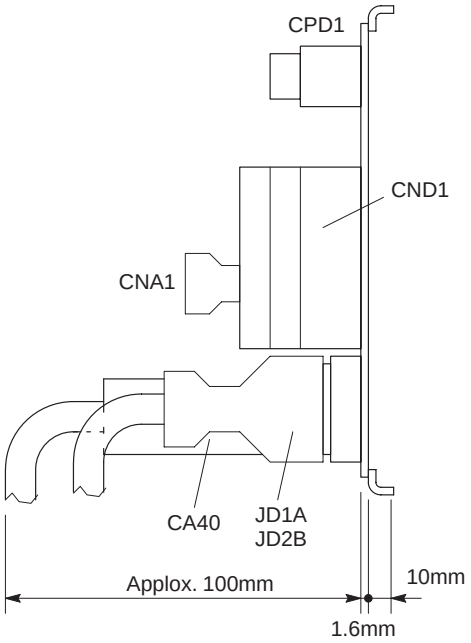
1 Several types of connectors are available for use at the other end of the cable leading to connector CNB1. Refer to brochures of PHOENIX CONTACT GmbH & Co..
The connector used on the machine operator's panel interface unit side is MSTBVA2.5/12-G-5.08.

2 Crimped type cable connector is available for CA40. For purchase from FANUC, please specify as below.
A02B-0029-K890 : Solder type
A02B-0029-K892 : Crimped type

E.1.9 Machine Operator's Panel Interface Unit Dimension Diagram (Including Connector Locations)

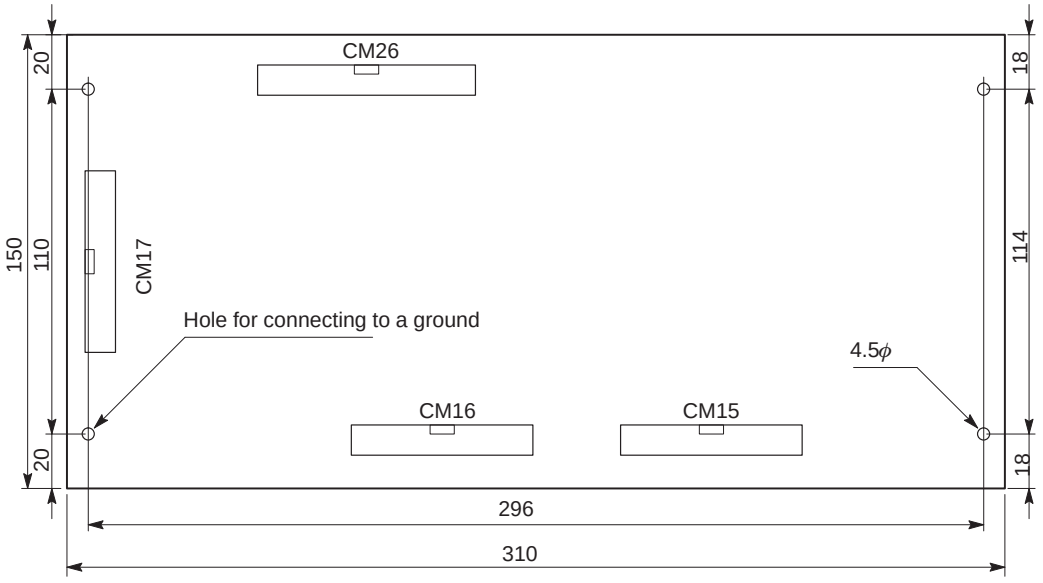


Unit: mm
Tolerance: ±5 (mm)



E.1.10 Machine Operator's Panel Interface Unit Mounting Dimension Diagram

Mounting hole position

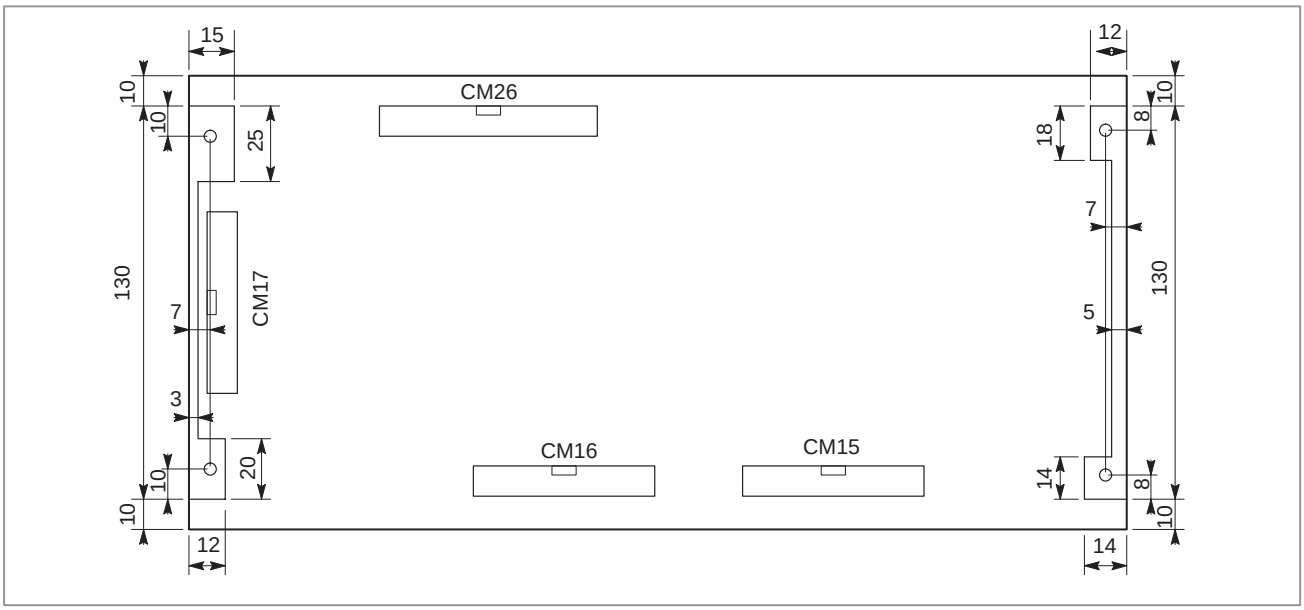


Fasten the PCB with four M4 screws.

Unit : mm

Sheet fixing area (mounting face side)

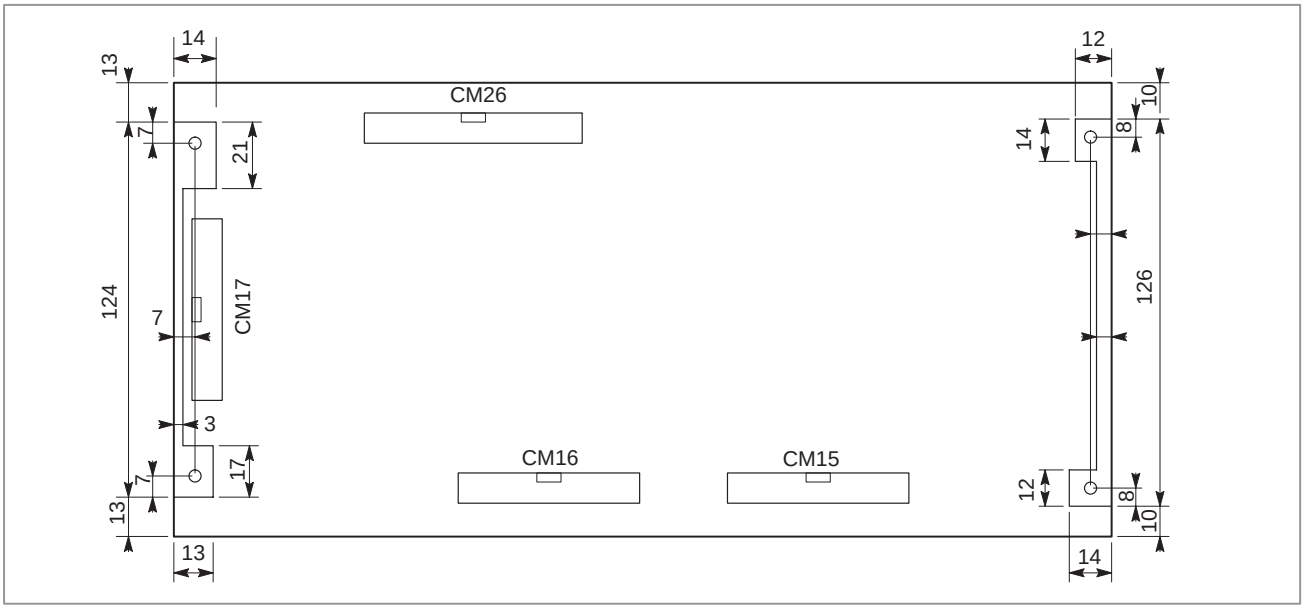
It is possible to fix the sheet, spacer, etc. only in the area shown in the diagram below.



NOTE
Applied to the PCB version number “03A” and beyond.

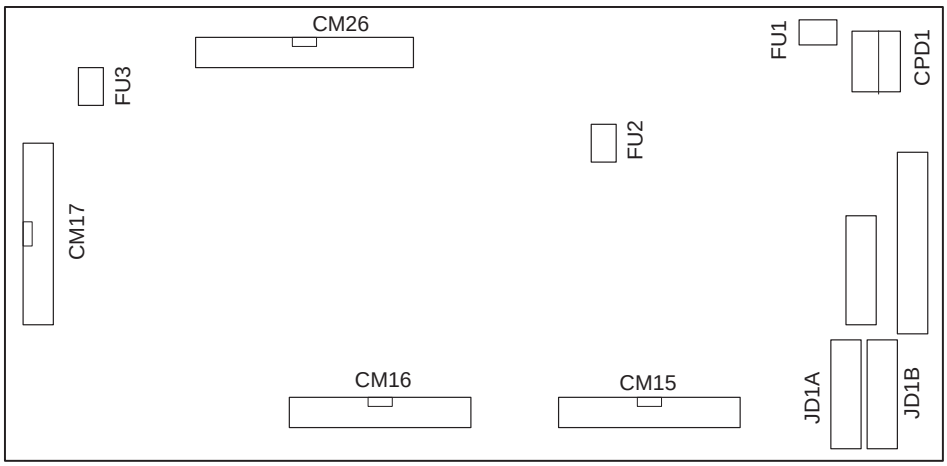
Sheet fixing area (Soldering face side)

It is possible to fix the sheet, spacer, etc. only in the area shown in the diagram below.



NOTE
Applied to the PCB version number “03A” and beyond.

E.1.11 Fuse Mounting Position



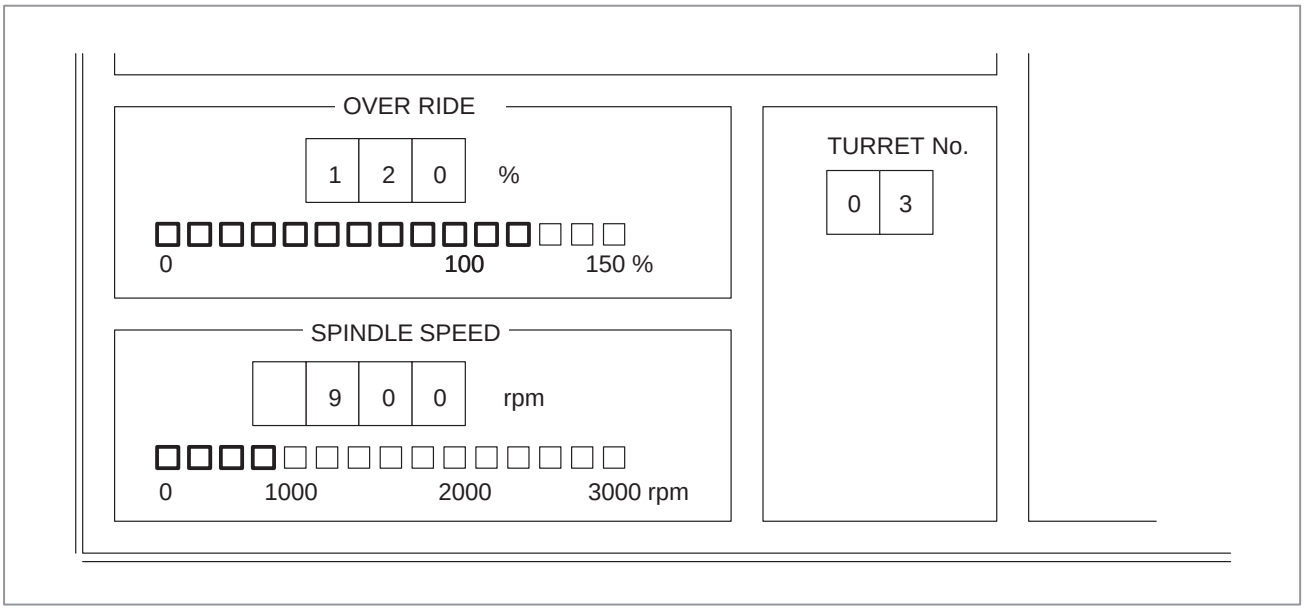
FU1 : +24V fuse (general-purpose DO, this supplies printed board power protection)
FU2 : +5V fuse (IC power, manual pulse generator protection)
FU3 : +5E fuse (general-purpose DI protection)

NOTE
FU2 is not mounted on Revision 05A or later.

E.1.12 Option Card 1

- **Outline**

"Option card 1" is a option PCB for "Machine operator's panel control PCB designed for use with FANUC I/O Link". This PCB can control the 7 segment LEDs to display the turret number, spindle rotating speed, etc. and can control the level–meters to display the percentage of override, spindle rotating speed, etc.



- **Function Overview**

(1) about 7 segment LED

(a) number of LEDs : maximum 20/the number of 7 segment LED is at most 20.

(b) zero–suppress : Zero–suppress (don't display anything on 7 segment LED) is treated by PMC.

(c) display style : Numbers that 7 segment LED displays is as follows.

(2) about level–meter

(a) number of LEDs : maximum 20/The number of LEDs that can be included in one level–meter is at most 20.

(b) number of level–meters : maximum 2

NOTE
Following usage cannot be done.
Use a level–meter which includes 40 LEDs.
Use four level–meter which includes 10 LEDs.

(c) display style : When one LED of a level meter is lighted, all LEDs to the left of the lighted LED are also lighted. A single LED cannot be lighted alone (with the exception of the leftmost LED).

(i) display like this (■ LED on □ LED off)

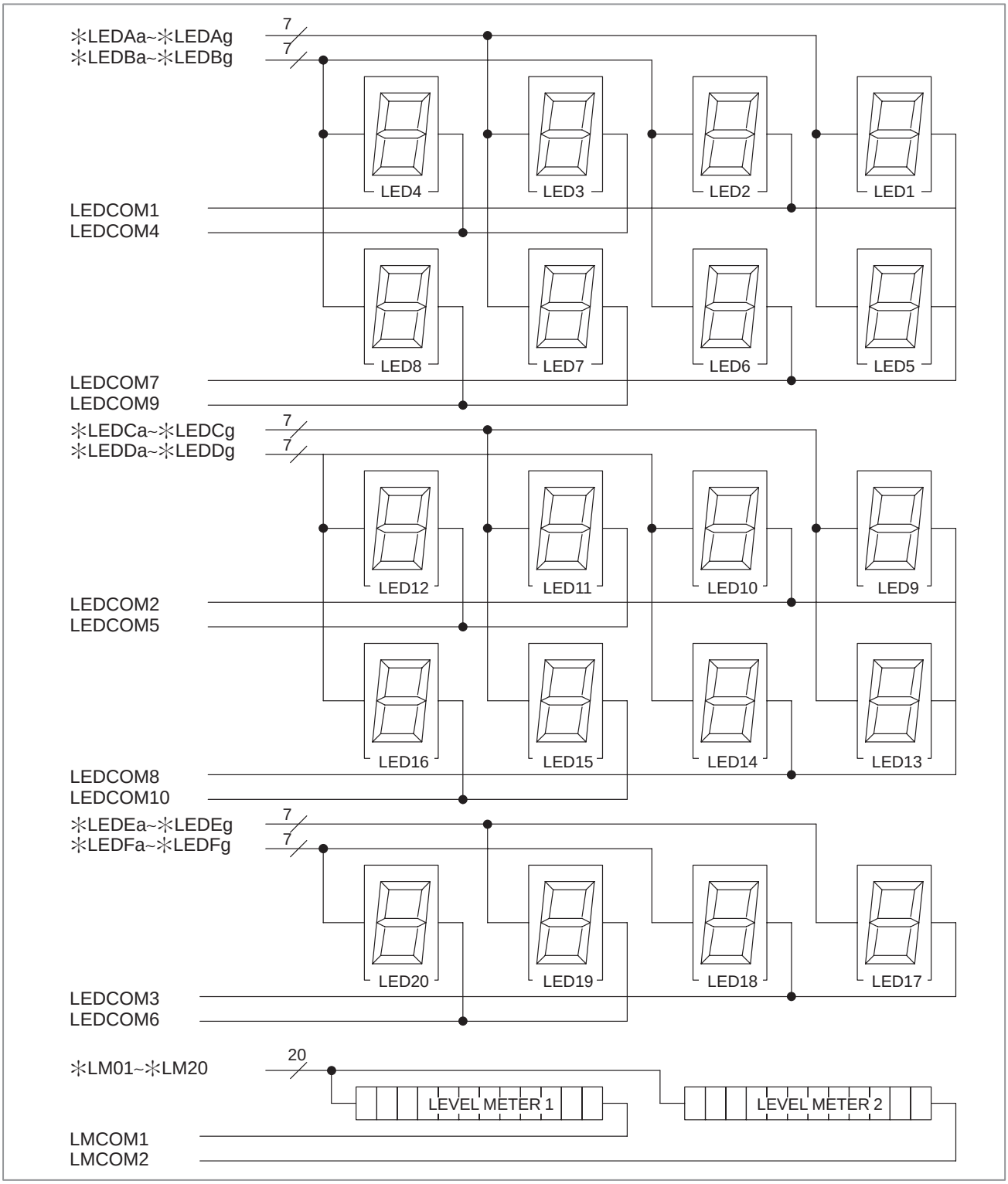
■■■■■■■■■■□□□□□□□□□□

(ii) cannot like this

□□□□□□□□□□■□□□□□□□□□

Block diagram of operator's panel

The connections of 7 segment LEDs and level–meters on machine operator's panel is as follows.
About details, please refer to "2.6 Connector Table" and "Connections of Signal Line".



Address allocation

PMC address, that is allocated for 7 segment LED data and level–meter data, is as follows.

PMC ADDRESS	7	6	5	4	3	2	1	0
DO+00								
DO+01								
• • •								
DO+13	7 segment LED 2 data				7 segment LED 1 data			
DO+14	7 segment LED 4 data				7 segment LED 3 data			
DO+15	7 segment LED 6 data				7 segment LED 5 data			
DO+16	7 segment LED 8 data				7 segment LED 7 data			
DO+17	7 segment LED 10 data				7 segment LED 9 data			
DO+18	7 segment LED 12 data				7 segment LED 11 data			
DO+19	7 segment LED 14 data				7 segment LED 13 data			
DO+20	7 segment LED 16 data				7 segment LED 15 data			
DO+21	7 segment LED 18 data				7 segment LED 17 data			
DO+22	7 segment LED 20 data				7 segment LED 19 data			
DO+23					Level–meter 1 data			
DO+24					Level–meter 2 data			
DO+28								
DO+29								

(DO : The first address of area that allocated for this PCB)

shows the area where this PCB is actuary uses.

Date for display

(1) Data for 7 segment LED

(a) PMC output : BCD

The data for 7 segment LED must be transformed to BCD of 4bit by PMC.

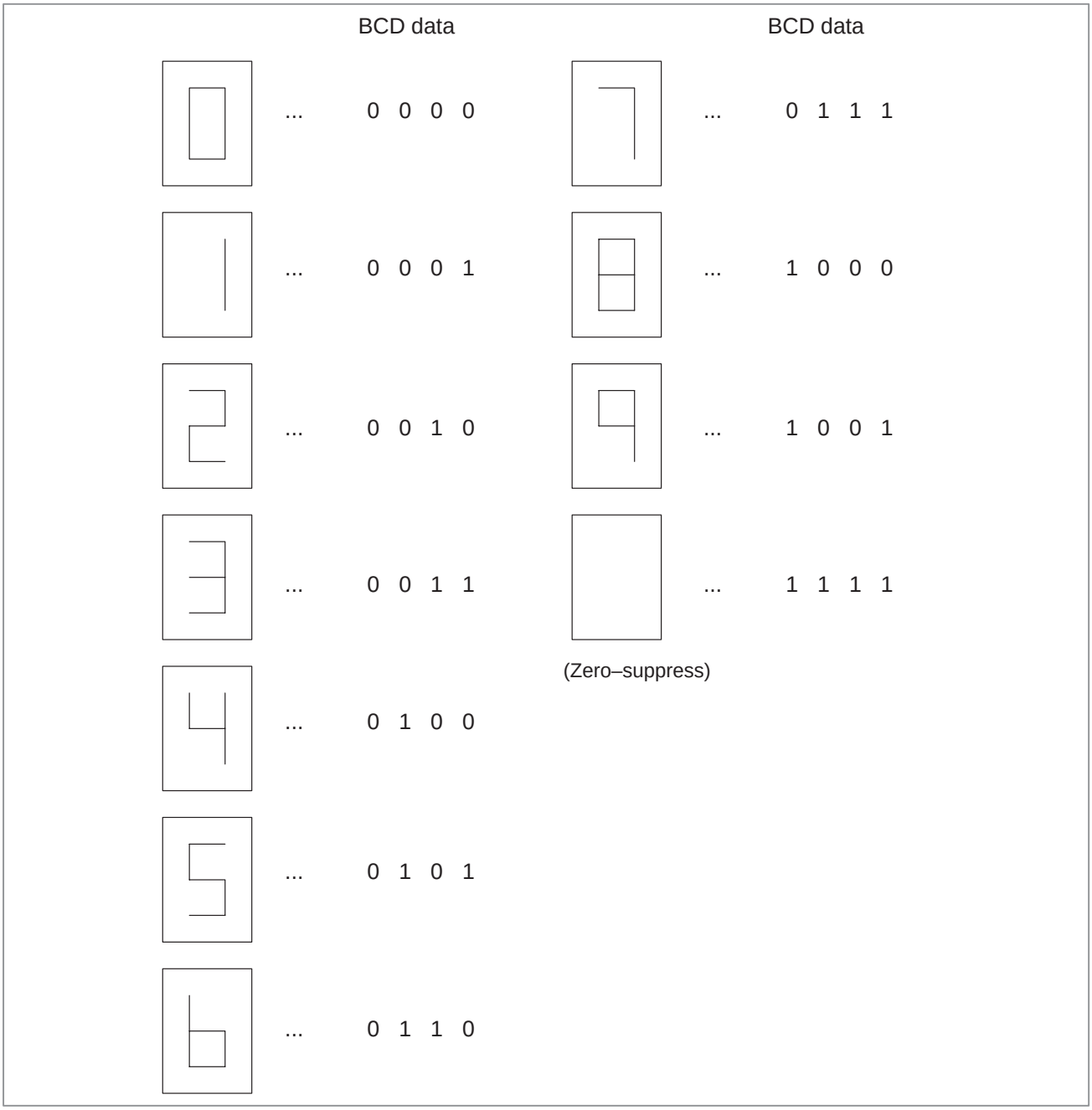
Treated data for 7segment LED is from “0000” to “1001” and “1111”. (When 1111 is written, LED displays nothing.)

Don’t use from 1010 to 1110.

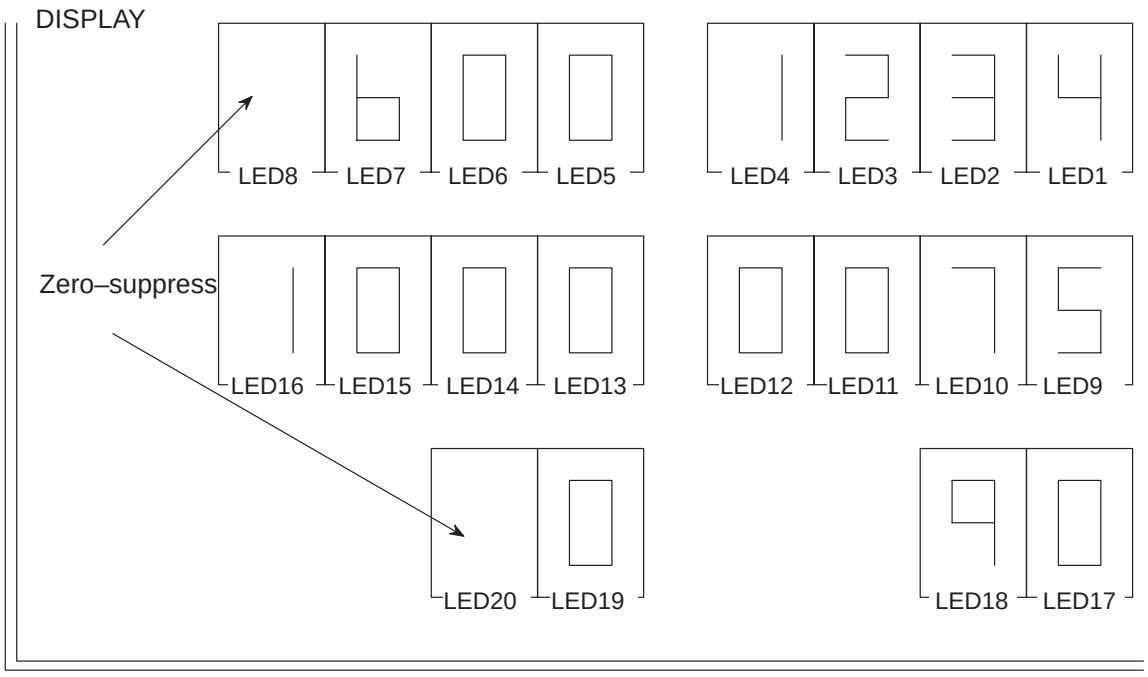
(b) Zero suppression:

Write 1111 to the address corresponding to the LED which does not display a non–significant zero.

BCD (Binary Coded Decimal) data is as follows.



Example The data for following displays of 7 segment LED are as follows.



PMC ADDRESS	7	6	5	4	3	2	1	0
DO+13	0	0	1	1	0	1	0	0
DO+14	0	0	0	1	0	0	1	0
DO+15	0	0	0	0	0	0	0	0
DO+16	1	1	1	1	0	1	1	0
DO+17	0	1	1	1	0	1	0	1
DO+18	0	0	0	0	0	0	0	0
DO+19	0	0	0	0	0	0	0	0
DO+20	0	0	0	1	0	0	0	0
DO+21	1	0	0	1	0	0	0	0
DO+22	1	1	1	1	0	0	0	0

(2) Data for level–meter
PMC output : Binary
The data for level–meter is Binary of 5 bit
The treated data is from "00000" to "10100". Don't use besides them.
Binary data

Level–meter display		Binary data
□□□□□□□□□□□□□□□□□□□□	.....	0 0 0 0 0
■□□□□□□□□□□□□□□□□□□□	.....	0 0 0 0 1
■■□□□□□□□□□□□□□□□□□□	.....	0 0 0 1 0
■■■□□□□□□□□□□□□□□□□□	.....	0 0 0 1 1
■■■■□□□□□□□□□□□□□□□□	.....	0 0 1 0 0
■■■■■□□□□□□□□□□□□□□□	.....	0 0 1 0 1
■■■■■■□□□□□□□□□□□□□□	.....	0 0 1 1 0
■■■■■■■□□□□□□□□□□□□□	.....	0 0 1 1 1
■■■■■■■■□□□□□□□□□□□□	.....	0 1 0 0 0
■■■■■■■■■□□□□□□□□□□□	.....	0 1 0 0 1
■■■■■■■■■■□□□□□□□□□□	.....	0 1 0 1 0
■■■■■■■■■■■□□□□□□□□□	.....	0 1 0 1 1
■■■■■■■■■■■■□□□□□□□□	.....	0 1 1 0 0
■■■■■■■■■■■■■□□□□□□□	.....	0 1 1 0 1
■■■■■■■■■■■■■■□□□□□□	.....	0 1 1 1 0
■■■■■■■■■■■■■■■□□□□□	.....	0 1 1 1 1
■■■■■■■■■■■■■■■■□□□□	.....	1 0 0 0 0
■■■■■■■■■■■■■■■■■□□□	.....	1 0 0 0 1
■■■■■■■■■■■■■■■■■■□□	.....	1 0 0 1 0
■■■■■■■■■■■■■■■■■■■□	.....	1 0 0 1 1
■■■■■■■■■■■■■■■■■■■■	.....	1 0 1 0 0

Connector table

The signal allocation in connector CM18 and CM19 are as follows.

CM18

	A	B
01	⁎LEDAa	⁎LEDAb
02	⁎LEDAc	⁎LEDAd
03	⁎LEDAe	⁎LEDAf
04	⁎LEDAg	
05	⁎LEDBa	⁎LEDBb
06	⁎LEDBc	⁎LEDBd
07	⁎LEDBe	⁎LEDBf
08	⁎LEDBg	
09	⁎LEDCa	⁎LEDCb
10	⁎LEDCc	⁎LEDCd
11	⁎LEDCe	⁎LEDCf
12	⁎LEDCg	
13	⁎LEDDa	⁎LEDDb
14	⁎LEDDc	⁎LEDDd
15	⁎LEDDe	⁎LEDDf
16	⁎LEDDg	
17	⁎LEDEa	⁎LEDEb
18	⁎LEDEc	⁎LEDEd
19	⁎LEDEe	⁎LEDEf
20	⁎LEDEg	
21	⁎LEDFa	⁎LEDFb
22	⁎LEDFc	⁎LEDFd
23	⁎LEDFe	⁎LEDFf
24	⁎LEDFg	
25		

CM19

	A	B
01	⁎LM20	⁎LM19
02	⁎LM18	⁎LM17
03	⁎LM16	⁎LM15
04	⁎LM14	⁎LM13
05	⁎LM12	⁎LM11
06	⁎LM10	⁎LM09
07	⁎LM08	⁎LM07
08	⁎LM06	⁎LM05
09	⁎LM04	⁎LM03
10	⁎LM02	⁎LM01
11		
12	LEDCOM1	LEDCOM2
13	LEDCOM3	LEDCOM4
14	LEDCOM5	LEDCOM6
15	LEDCOM7	LEDCOM8
16	LEDCOM9	LEDCOM10
17	LMCOM1	LMCOM2

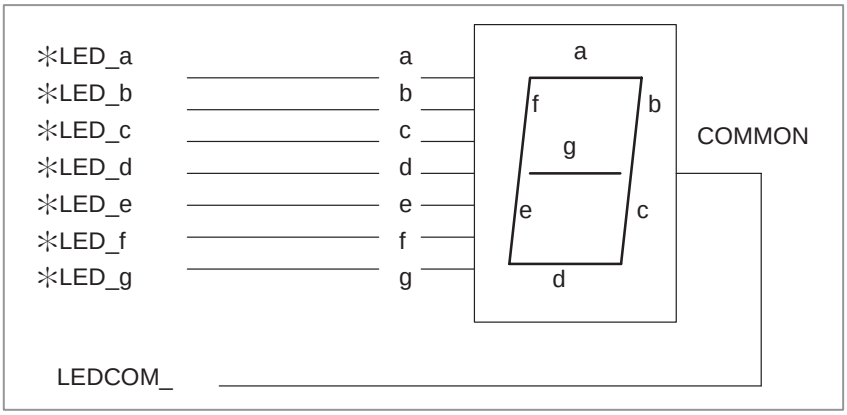
⁎LED_a~⁎LED_g : signal for 7 segment LED data
⁎LM20~⁎LM01 : signal for level–meter data

LEDCOM1~LEDCOM10 : common signal for 7 segment LED
LMCOM1, LMCOM2 : common signal for level–meter

Connection of signal line

(1) 7 segment LED

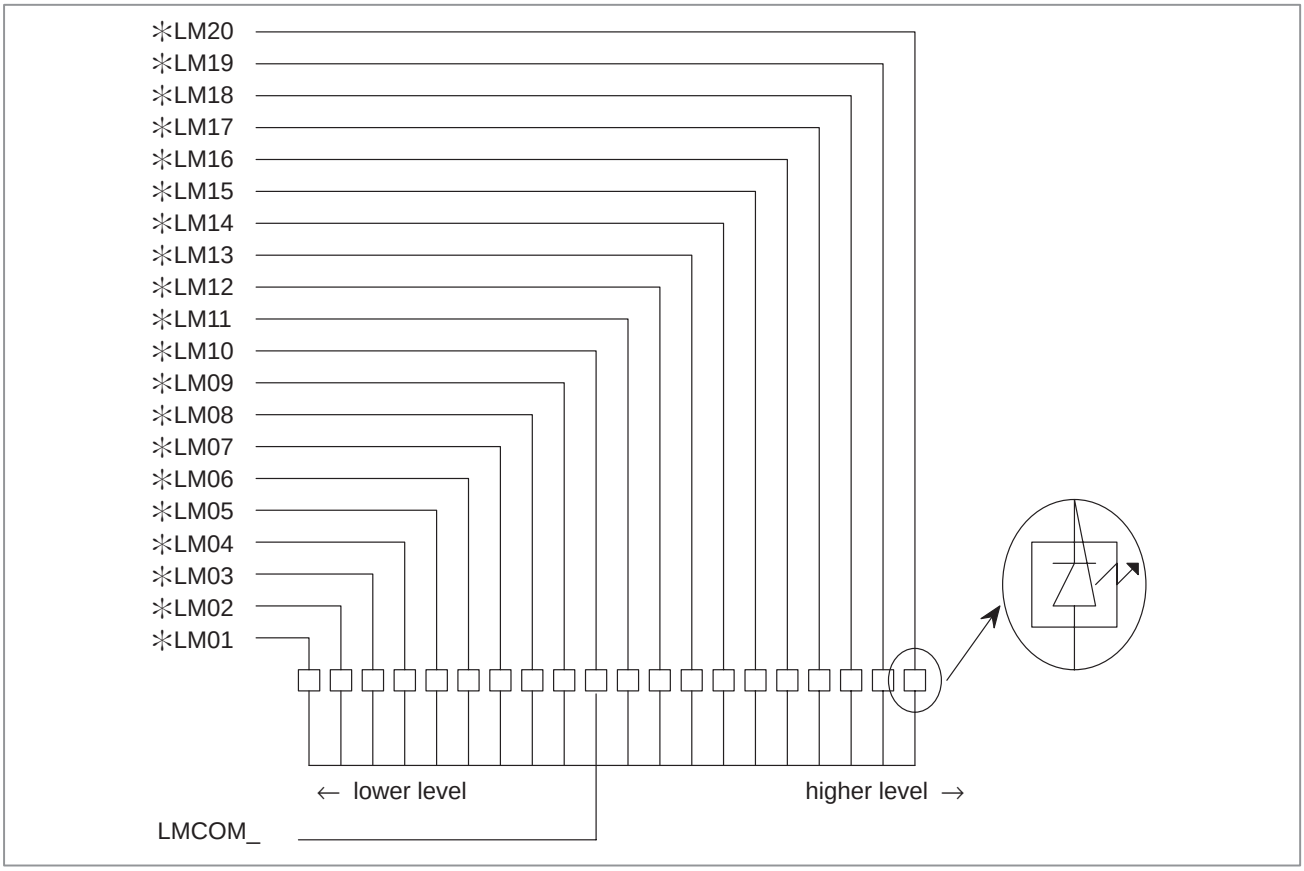
Connect a each of signals (⁎LED_□ and LEDCOM_) with the a ~g terminals and with common terminal of 7 segment LED.



NOTE
Type of 7 segment LEDs must be COMMON ANODE TYPE.

(2) level–meter

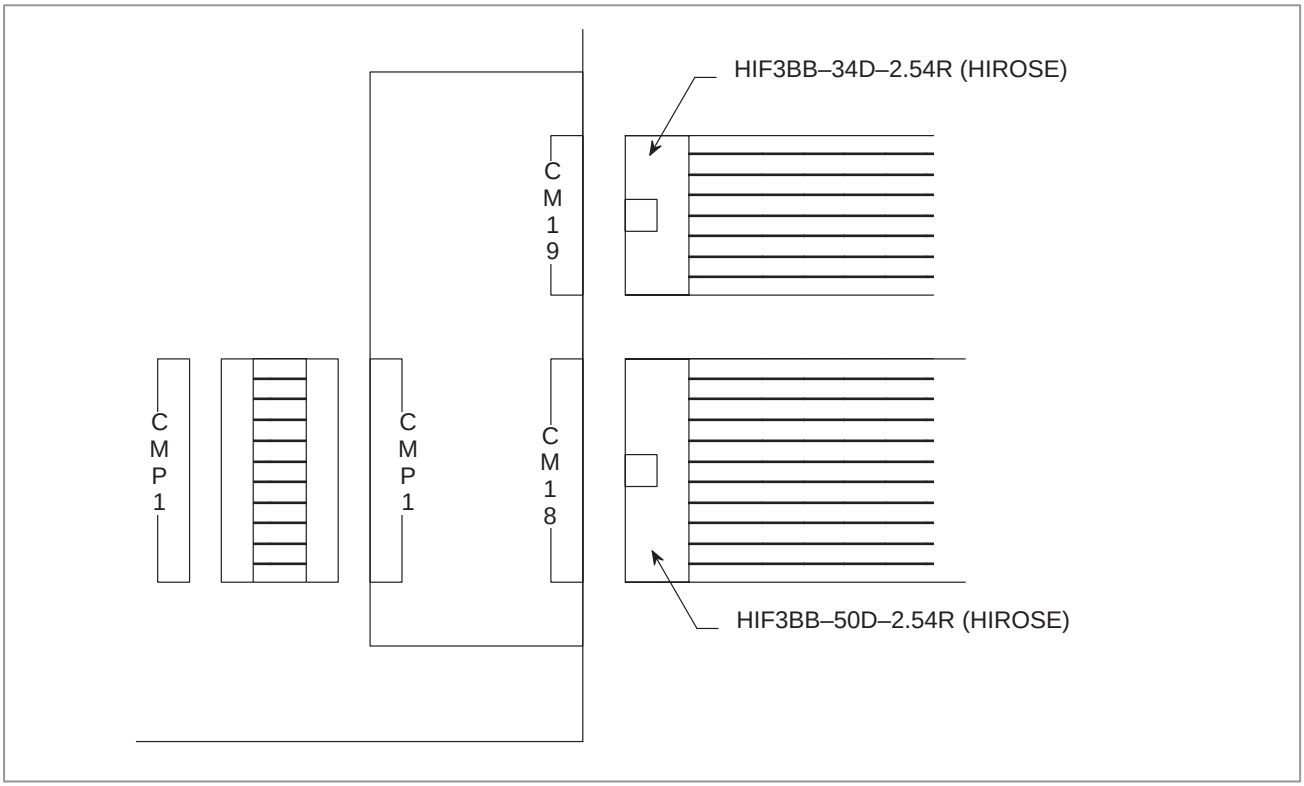
Connect the lowest level LED with signal ⁎LM01, the second level with signal ⁎LM02, · · · ·, the highest level with signal ⁎LM20.



NOTE
Type of LEDs must be COMMON ANODE TYPE.

Connector specification

Specification of connector which is used in flat cable that connects "Option card 1" with Operator's panel is as follows.



Order specification

A02B–0099–J290

Followings are prepared by ordering as this specification.

(1) Option card 1

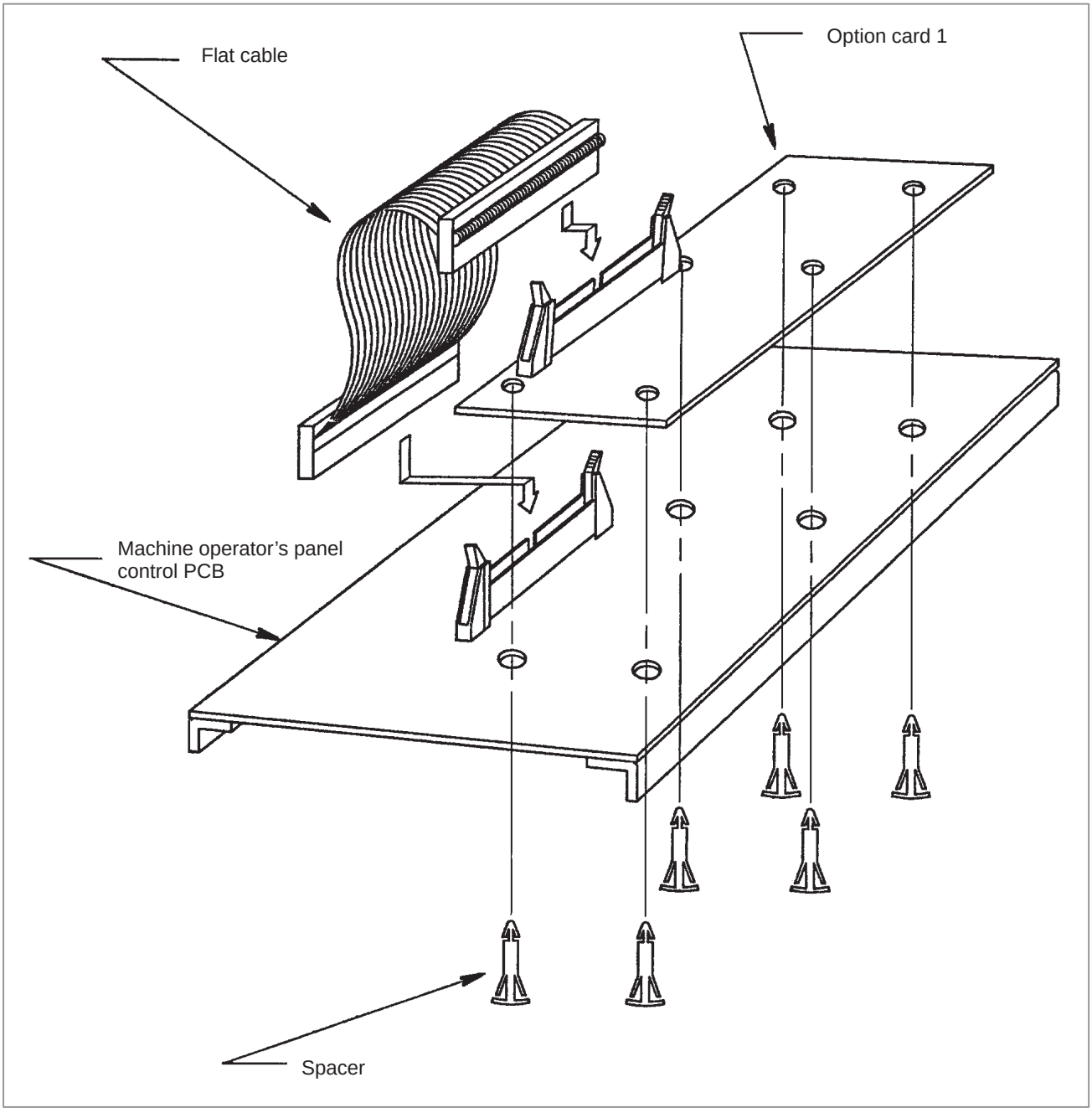
(2) Flat cable which connects "Option card 1" with "Machine operator's panel control PCB".

(3) Spacers that settle "Option card 1" on "Machine operator's panel control PCB".

Assemblage

Settle the "Option card 1" on "Machine operator's panel control PCB" with 6 pieces of spacer.

And connect a connector CMP1 on "Option card 1" with a connector CMP1 on "Machine operator's panel control PCB" with cable A660–2040–T045#50C0050.



F SERIES 0–C OPERATOR'S PANEL CONNECTION UNIT C1

F.1 GENERAL

The operator's panel connection unit C1 is common DI/DO unit having DI: 96 points and DO: 64 points. The operator's panel connection unit C1 can be connected to Series 0 through FANUC I/O Link.

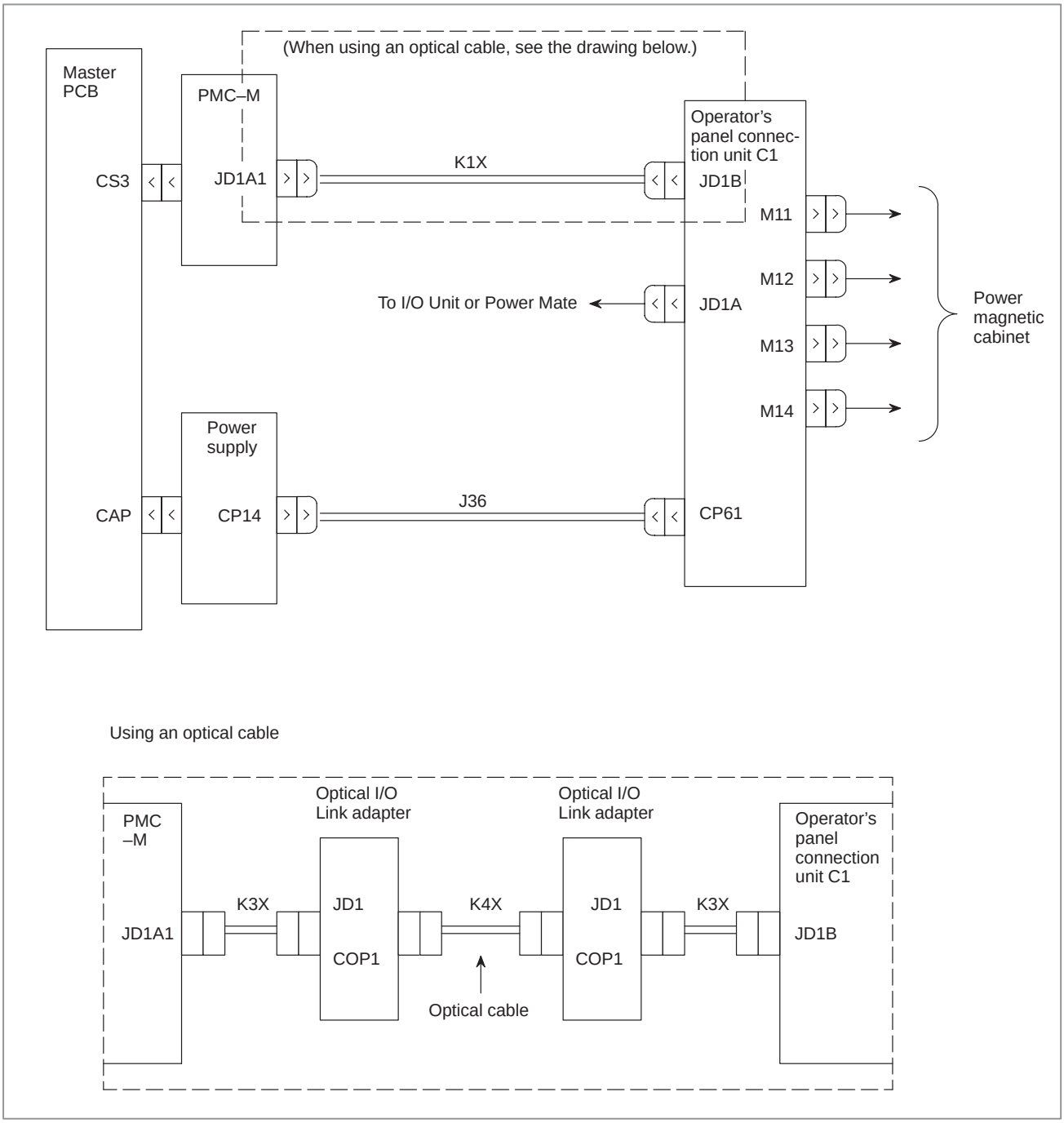
F.2 SETTING OF I/O SIGNALS

For the standard of I/O signals, see 6.2.1 Machine Interface Signal Standard.

F.3 CONNECTION

F.3.1 Connection of the Control Unit and Operator's Panel Connection Unit C1

The connection diagram is shown below. For the details of the signal cable, refer to the FANUC PMC–M with I/O Link.



F.3.2 Signal Connection between Operator's Panel Connection Unit C1 and Machine Side

Operator's panel connection unit C1.

CM11 (FAP–50–07#4)

	A	B
1	Xn+0.0	Xn+0.1
2	Xn+0.2	Xn+0.3
3	Xn+0.4	Xn+0.5
4	Xn+0.6	Xn+0.7
5	Xn+1.0	Xn+1.1
6	Xn+1.2	Xn+1.3
7	Xn+1.4	Xn+1.5
8	Xn+1.6	Xn+1.7
9	Xn+2.0	Xn+2.1
10	Xn+2.2	Xn+2.3
11	Xn+2.4	Xn+2.5
12	Xn+2.6	Xn+2.7
13	Xn+3.0	Xn+3.1
14	Xn+3.2	Xn+3.3
15	Xn+3.4	Xn+3.5
16	Xn+3.6	Xn+3.7
17	Xn+4.0	Xn+4.1
18	Xn+4.2	Xn+4.3
19	Xn+4.4	Xn+4.5
20	Xn+4.6	Xn+4.7
21	Xn+5.0	Xn+5.1
22	Xn+5.2	Xn+5.3
23	Xn+5.4	Xn+5.5
24	Xn+5.6	Xn+5.7
25	0V	

CM12 (FAP–50–07#4)

	A	B
1	Xn+6.0	Xn+6.1
2	Xn+6.2	Xn+6.3
3	Xn+6.4	Xn+6.5
4	Xn+6.6	Xn+6.7
5	Xn+7.0	Xn+7.1
6	Xn+7.2	Xn+7.3
7	Xn+7.4	Xn+7.5
8	Xn+7.6	Xn+7.7
9	Xn+8.0	Xn+8.1
10	Xn+8.2	Xn+8.3
11	Xn+8.4	Xn+8.5
12	Xn+8.6	Xn+8.7
13	Xn+9.0	Xn+9.1
14	Xn+9.2	Xn+9.3
15	Xn+9.4	Xn+9.5
16	Xn+9.6	Xn+9.7
17	Xn+10.0	Xn+10.1
18	Xn+10.2	Xn+10.3
19	Xn+10.4	Xn+10.5
20	Xn+10.6	Xn+10.7
21	Xn+11.0	Xn+11.1
22	Xn+11.2	Xn+11.3
23	Xn+11.4	Xn+11.5
24	Xn+11.6	Xn+11.7
25	0V	

CM13 (FAP–50–07#4)

	A	B
1	+5V	+5V
2	Ym+0.0	Ym+0.1
3	Ym+0.2	Ym+0.3
4	Ym+0.4	Ym+0.5
5	Ym+0.6	Ym+0.7
6	Ym+1.0	Ym+1.1
7	Ym+1.2	Ym+1.3
8	Ym+1.4	Ym+1.5
9	Ym+1.6	Ym+1.7
10	Ym+2.0	Ym+2.1
11	Ym+2.2	Ym+2.3
12	Ym+2.4	Ym+2.5
13	Ym+2.6	Ym+2.7
14	Ym+3.0	Ym+3.1
15	Ym+3.2	Ym+3.3
16	Ym+3.4	Ym+3.5
17	Ym+3.6	Ym+3.7
18	Ym+4.0	Ym+4.1
19	Ym+4.2	Ym+4.3
20	Ym+4.4	Ym+4.5
21	Ym+4.6	Ym+4.7
22	Ym+5.0	Ym+5.1
23	Ym+5.2	Ym+5.3
24	Ym+5.4	Ym+5.5
25	0V	

CM14 (FAP–20–07#4)

	A	B
1	Ym+5.6	Ym+5.7
2	Ym+6.0	Ym+6.1
3	Ym+6.2	Ym+6.3
4	Ym+6.4	Ym+6.5
5	Ym+6.6	Ym+6.7
6	Ym+7.0	Ym+7.1
7	Ym+7.2	Ym+7.3
8	Ym+7.4	Ym+7.5
9	Ym+7.6	Ym+7.7
10	0V	

In J135, J136 and J137, use the connectors for flat cable
FAS–50–17 or FAS–50–18 of Yamaichi Denki on the operator's panel connection unit C1 side.
In J138, use the connectors for flat cable
FAS–20–17 or FAS–20–18 of Yamaichi Denki.

CP61 (Japan FCI), Brown connector for cable: SMS 3PINS–5

3	2	1
	0V	+24V

Addresses of DI/DO in the FANUC PMC–M with I/O Link are as follows:

DI/DO	Address	DGN. NO
DI 128 byte = 1024 point (MAX)	X3072–X3199	5072–5199
DO 128 byte = 1024 point (MAX)	Y3200–Y3327	5200–5327

The point number of DI and DO of the operator's panel connection unit C1 are as follows:

	Number of points
DI	12 byte=96 points
DO	8 byte=64 points

Therefore, the signal names DI (Xn+□.□) and (Ym+□.□) of the operator's panel connection unit C1 can be freely allocated in the range:

$3072 \leqq n \leqq 3188$

$3200 \leqq m \leqq 3320$

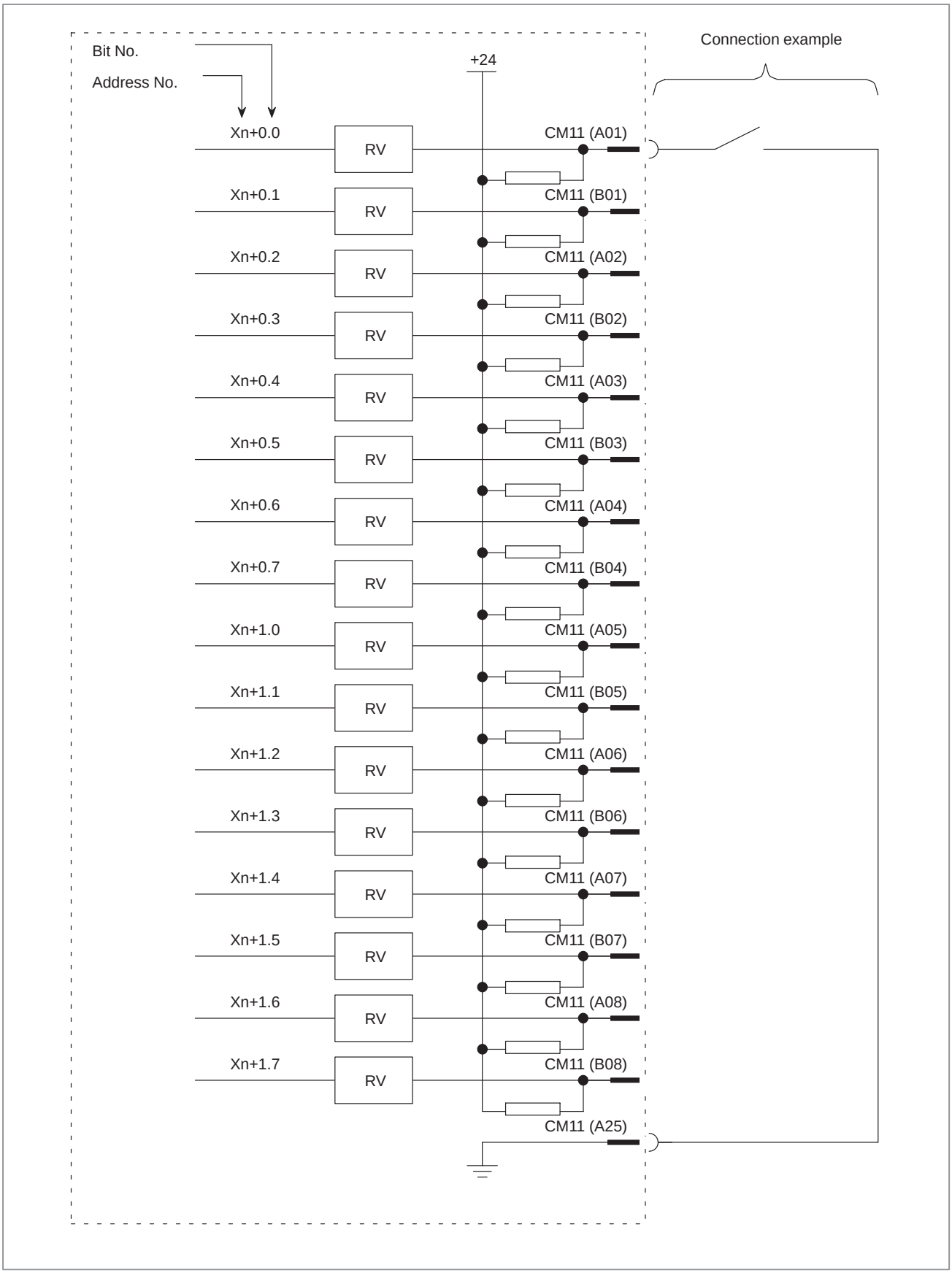
An example of allocation is shown below.

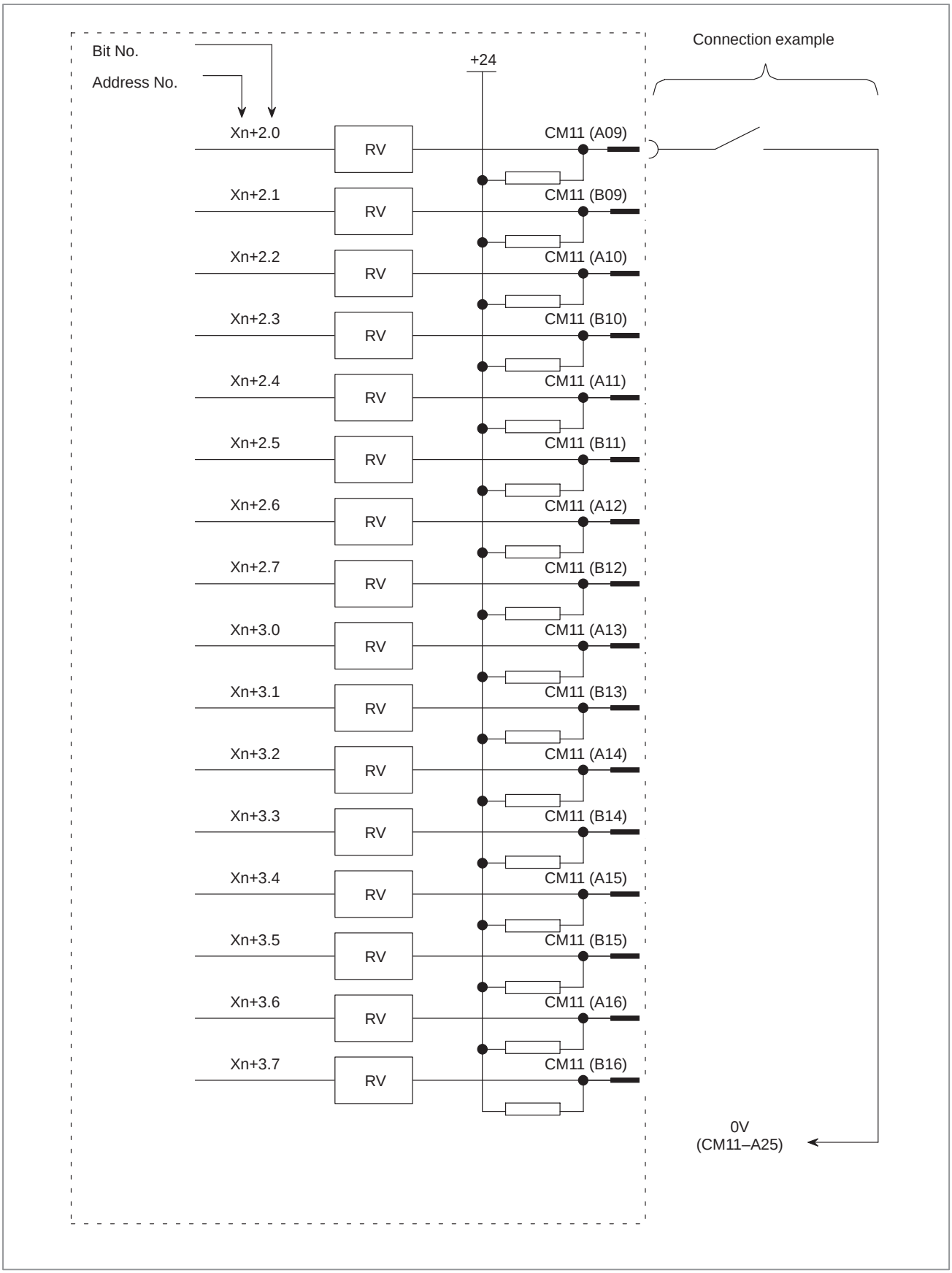
Example

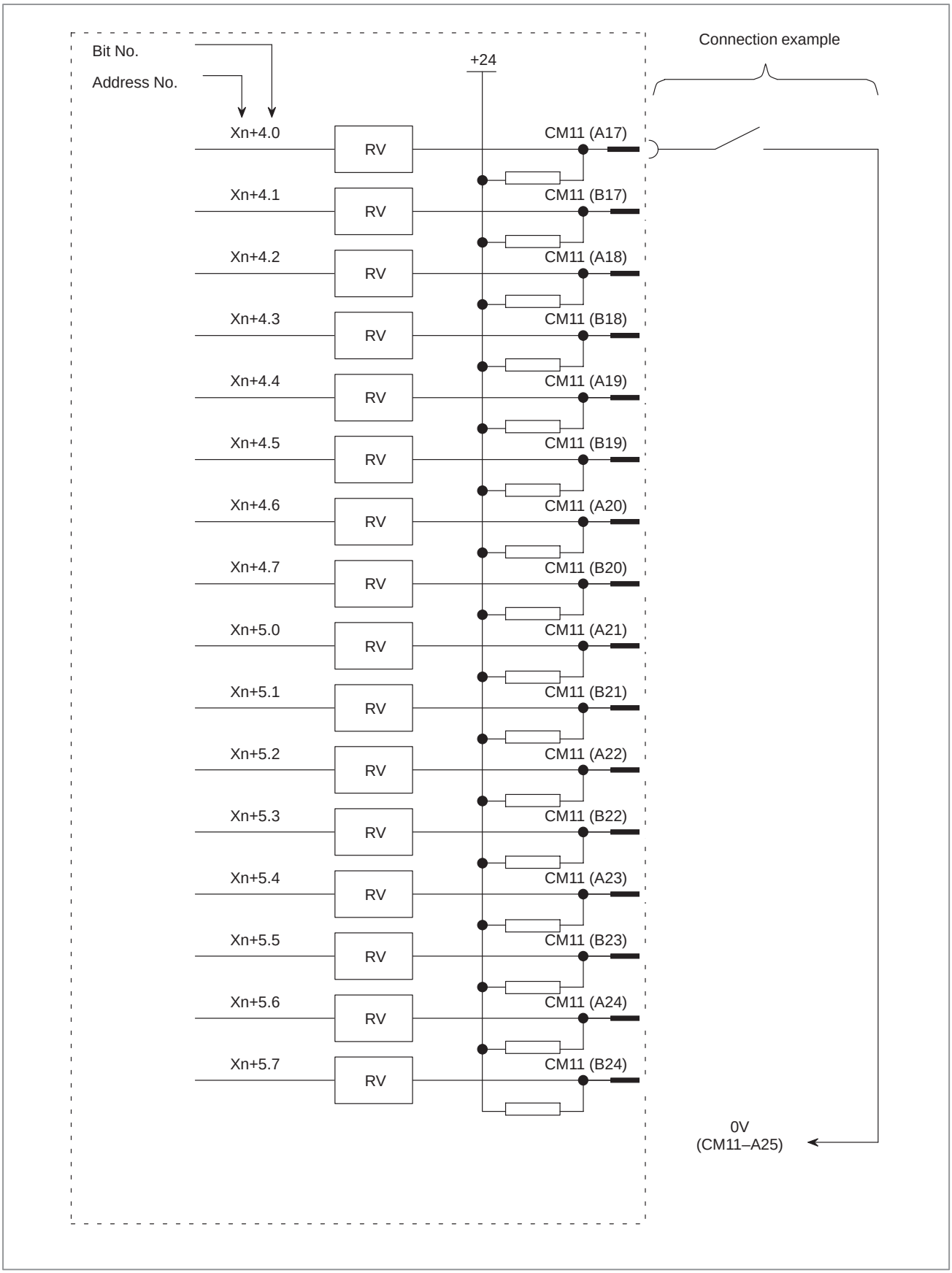
First address n of DI = 3100 and first address m of DO = 3200

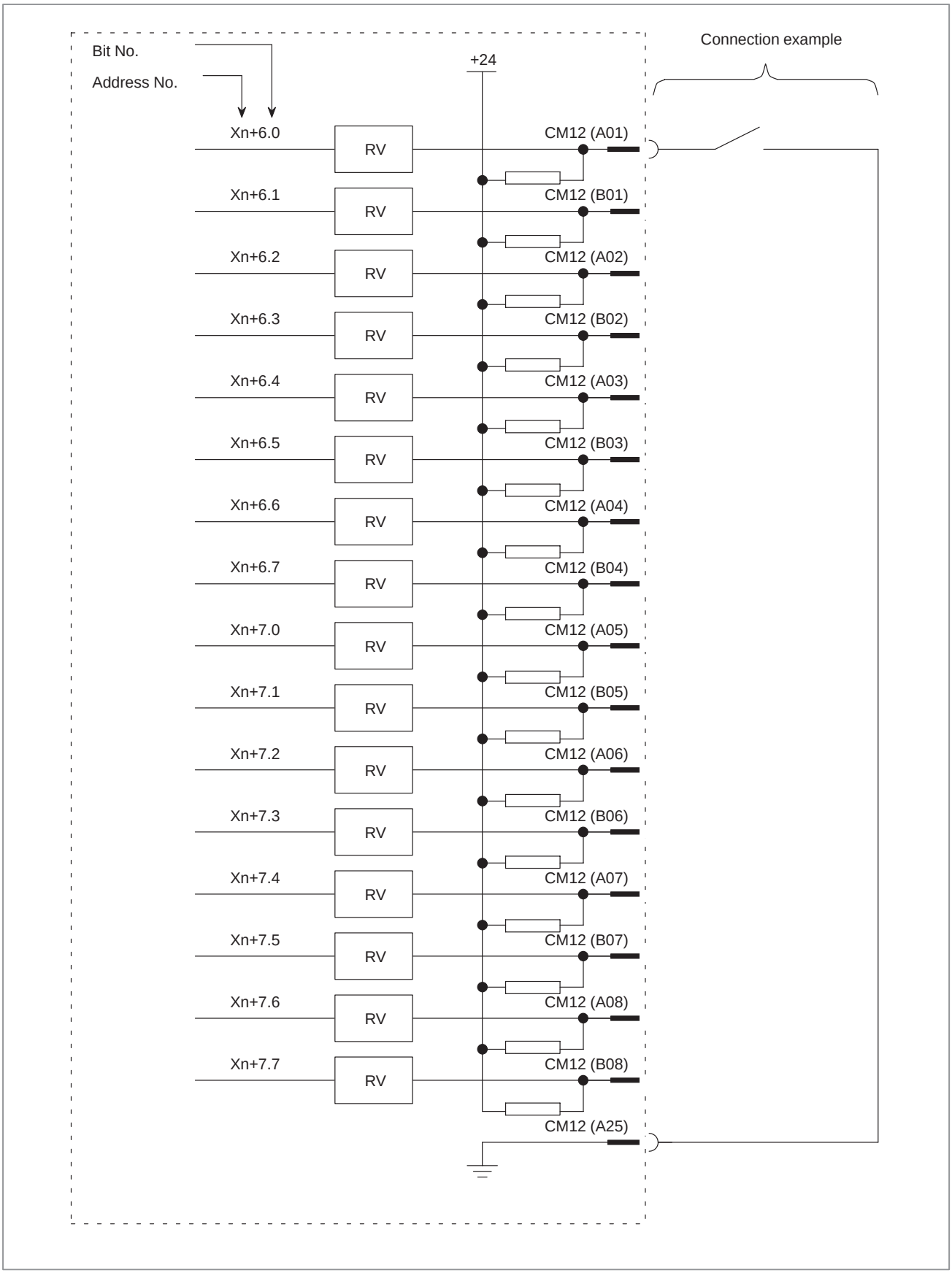
DI/DO	Address	DGN.No.
DI	X3100 – X3111	5100 – 5111
DO	Y3200 – Y3207	5200 – 5207

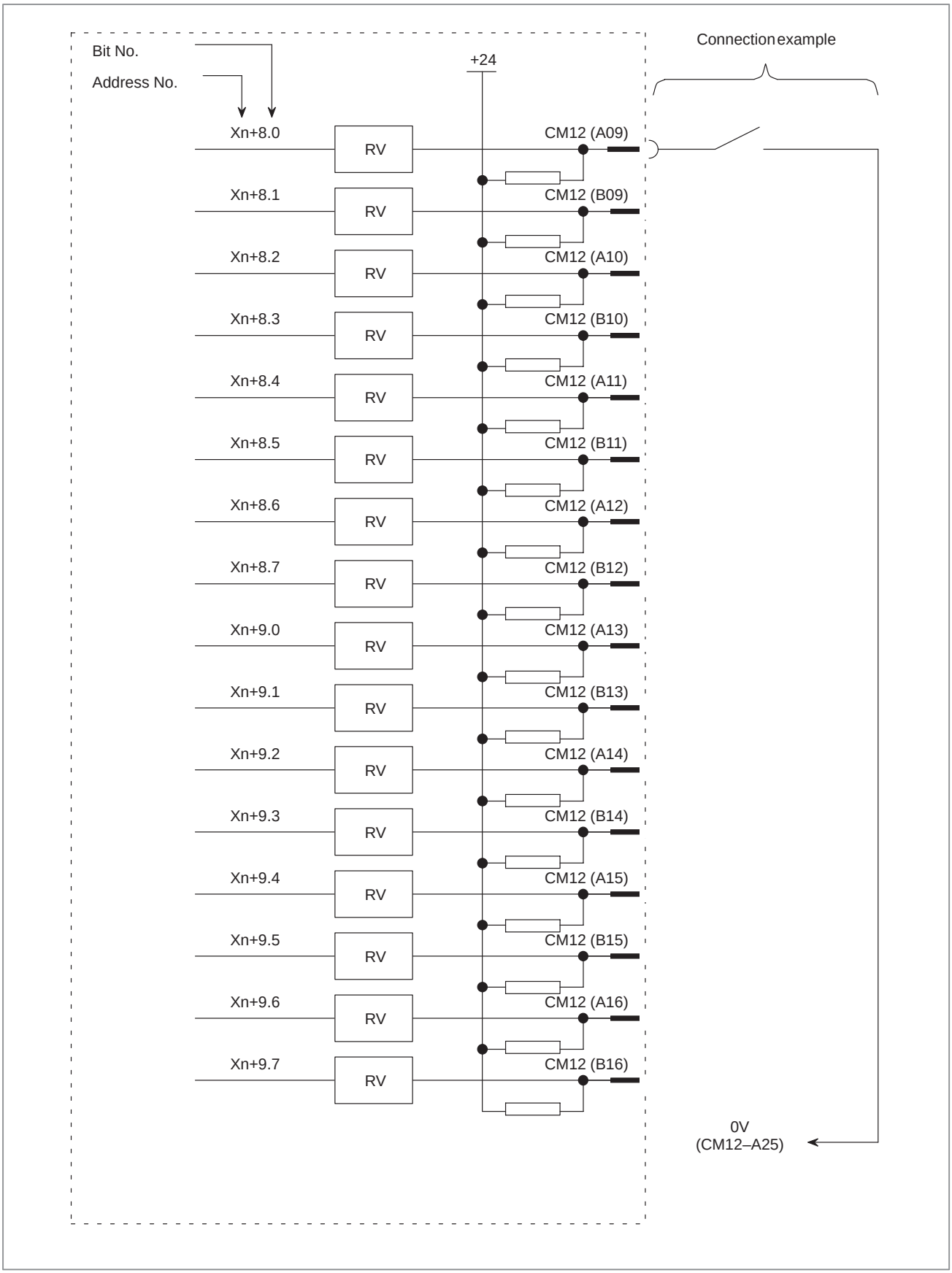
As a concrete example,
DI signal (Xn+6.2) of pin A2 of CM12 connector is X3106. 2.
DO signal (Ym+1.7) of pin B9 of CM13 connector is Y3201.7.

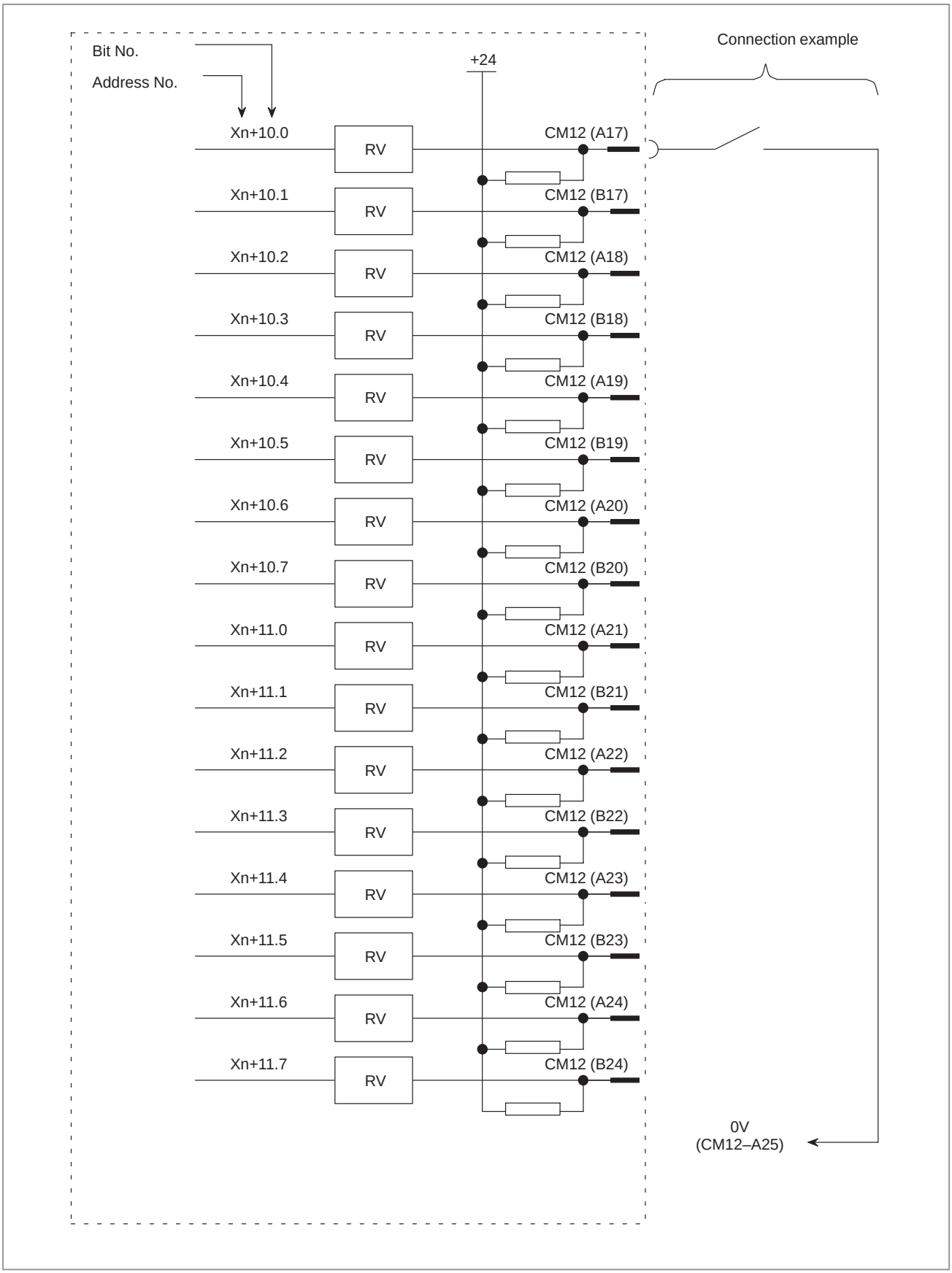

Bit No.
Address No.
+24
Connection example
Xn+0.0
RV
CM11 (A01)
Xn+0.1
RV
CM11 (B01)
Xn+0.2
RV
CM11 (A02)
Xn+0.3
RV
CM11 (B02)
Xn+0.4
RV
CM11 (A03)
Xn+0.5
RV
CM11 (B03)
Xn+0.6
RV
CM11 (A04)
Xn+0.7
RV
CM11 (B04)
Xn+1.0
RV
CM11 (A05)
Xn+1.1
RV
CM11 (B05)
Xn+1.2
RV
CM11 (A06)
Xn+1.3
RV
CM11 (B06)
Xn+1.4
RV
CM11 (A07)
Xn+1.5
RV
CM11 (B07)
Xn+1.6
RV
CM11 (A08)
Xn+1.7
RV
CM11 (B08)
CM11 (A25)

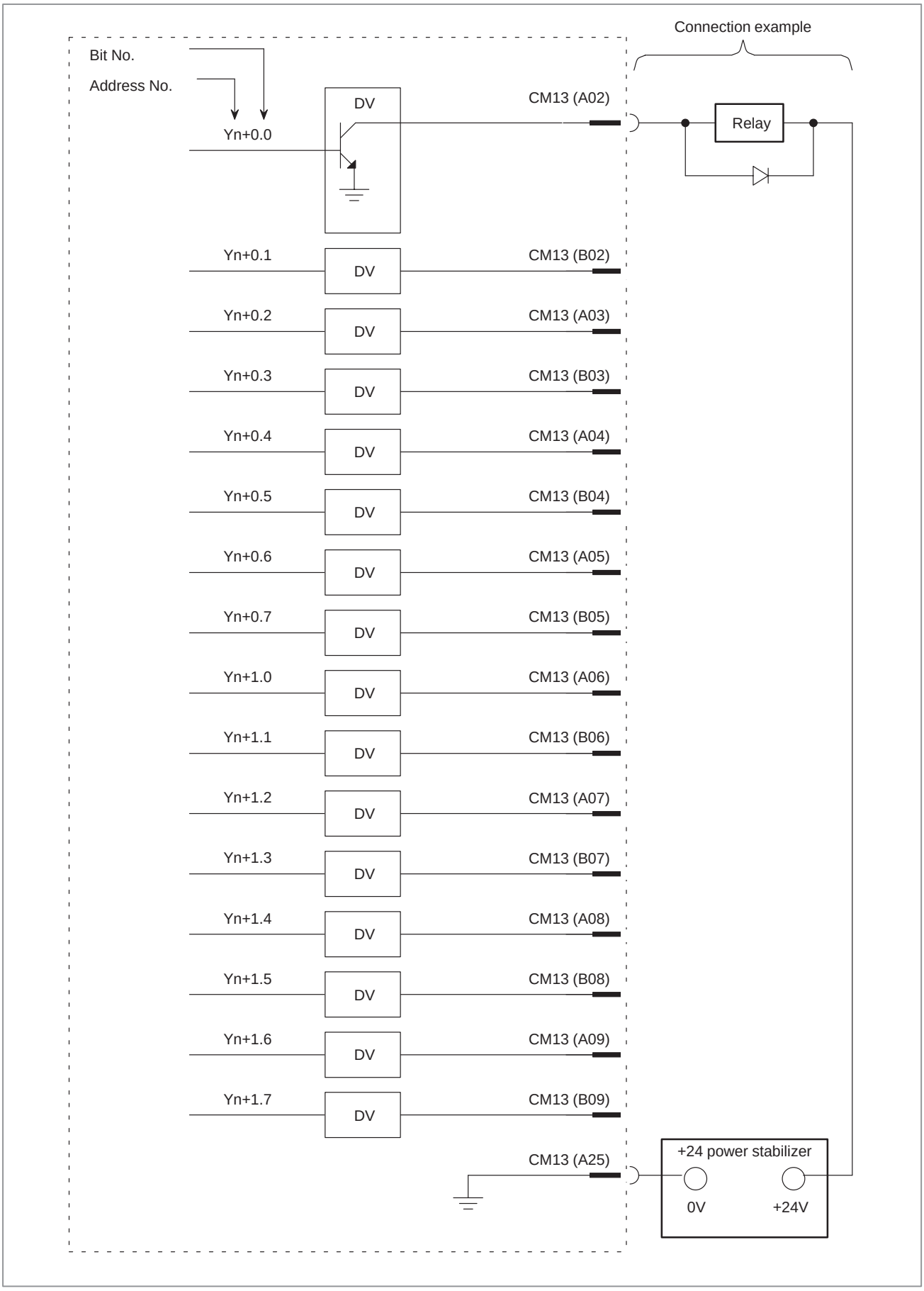

Bit No.
Address No.
+24
Connection example
Xn+2.0
RV
CM11 (A09)
Xn+2.1
RV
CM11 (B09)
Xn+2.2
RV
CM11 (A10)
Xn+2.3
RV
CM11 (B10)
Xn+2.4
RV
CM11 (A11)
Xn+2.5
RV
CM11 (B11)
Xn+2.6
RV
CM11 (A12)
Xn+2.7
RV
CM11 (B12)
Xn+3.0
RV
CM11 (A13)
Xn+3.1
RV
CM11 (B13)
Xn+3.2
RV
CM11 (A14)
Xn+3.3
RV
CM11 (B14)
Xn+3.4
RV
CM11 (A15)
Xn+3.5
RV
CM11 (B15)
Xn+3.6
RV
CM11 (A16)
Xn+3.7
RV
CM11 (B16)
0V
(CM11–A25)

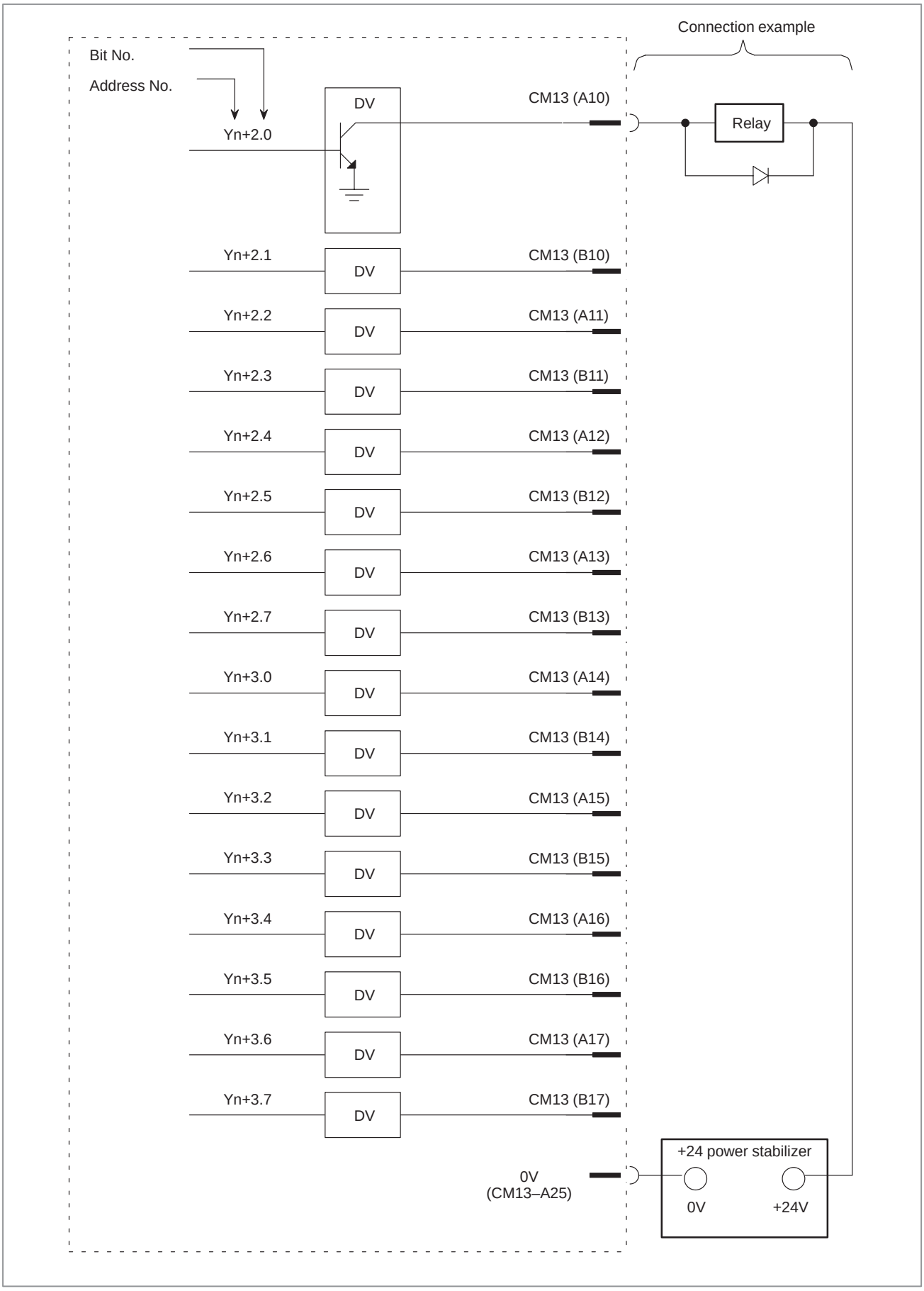

Bit No.
Address No.
+24
Connection example
Xn+4.0
RV
CM11 (A17)
Xn+4.1
RV
CM11 (B17)
Xn+4.2
RV
CM11 (A18)
Xn+4.3
RV
CM11 (B18)
Xn+4.4
RV
CM11 (A19)
Xn+4.5
RV
CM11 (B19)
Xn+4.6
RV
CM11 (A20)
Xn+4.7
RV
CM11 (B20)
Xn+5.0
RV
CM11 (A21)
Xn+5.1
RV
CM11 (B21)
Xn+5.2
RV
CM11 (A22)
Xn+5.3
RV
CM11 (B22)
Xn+5.4
RV
CM11 (A23)
Xn+5.5
RV
CM11 (B23)
Xn+5.6
RV
CM11 (A24)
Xn+5.7
RV
CM11 (B24)
0V
(CM11–A25)

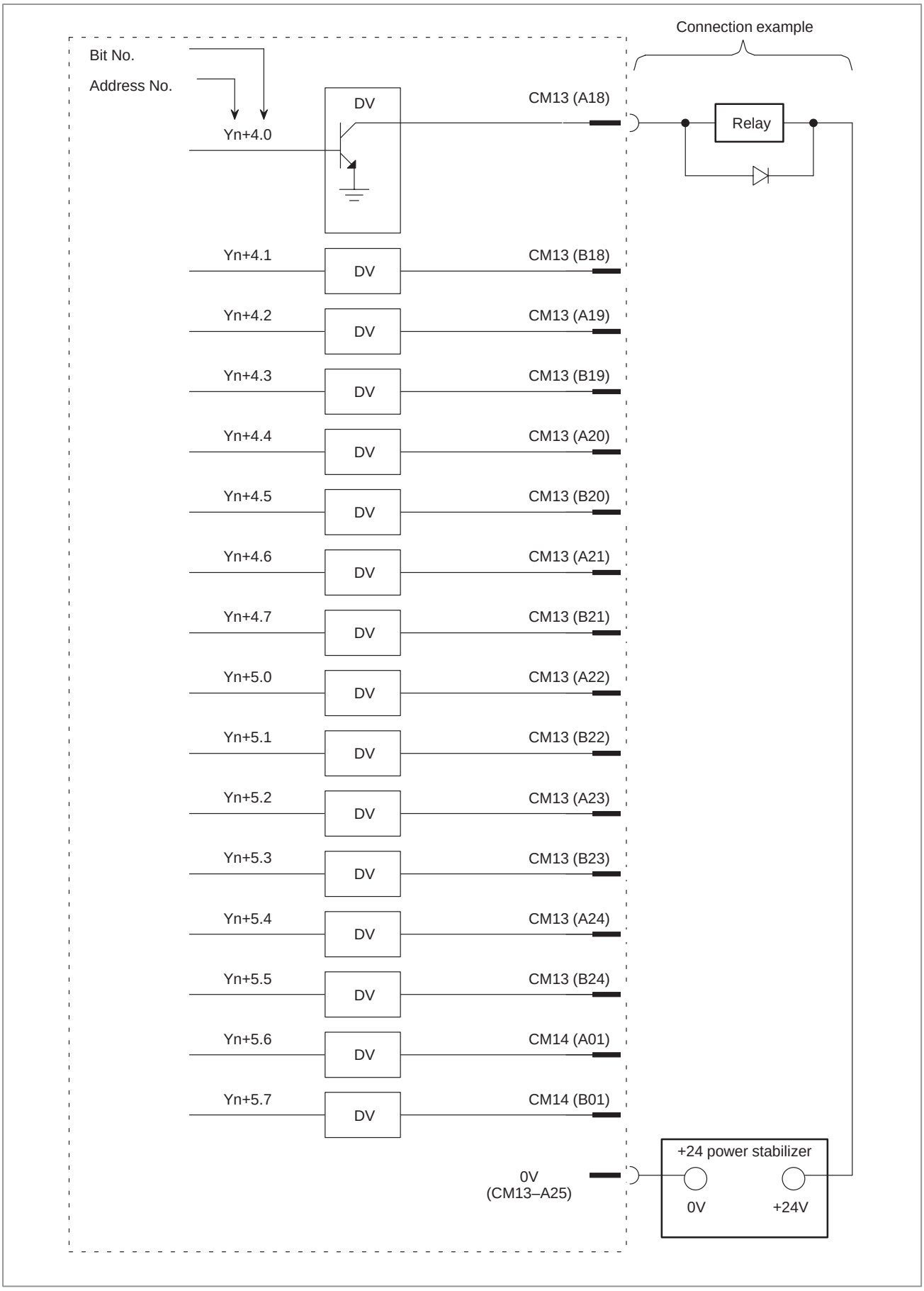

Bit No.
Address No.
+24
Connection example
Xn+6.0
RV
CM12 (A01)
Xn+6.1
RV
CM12 (B01)
Xn+6.2
RV
CM12 (A02)
Xn+6.3
RV
CM12 (B02)
Xn+6.4
RV
CM12 (A03)
Xn+6.5
RV
CM12 (B03)
Xn+6.6
RV
CM12 (A04)
Xn+6.7
RV
CM12 (B04)
Xn+7.0
RV
CM12 (A05)
Xn+7.1
RV
CM12 (B05)
Xn+7.2
RV
CM12 (A06)
Xn+7.3
RV
CM12 (B06)
Xn+7.4
RV
CM12 (A07)
Xn+7.5
RV
CM12 (B07)
Xn+7.6
RV
CM12 (A08)
Xn+7.7
RV
CM12 (B08)
CM12 (A25)

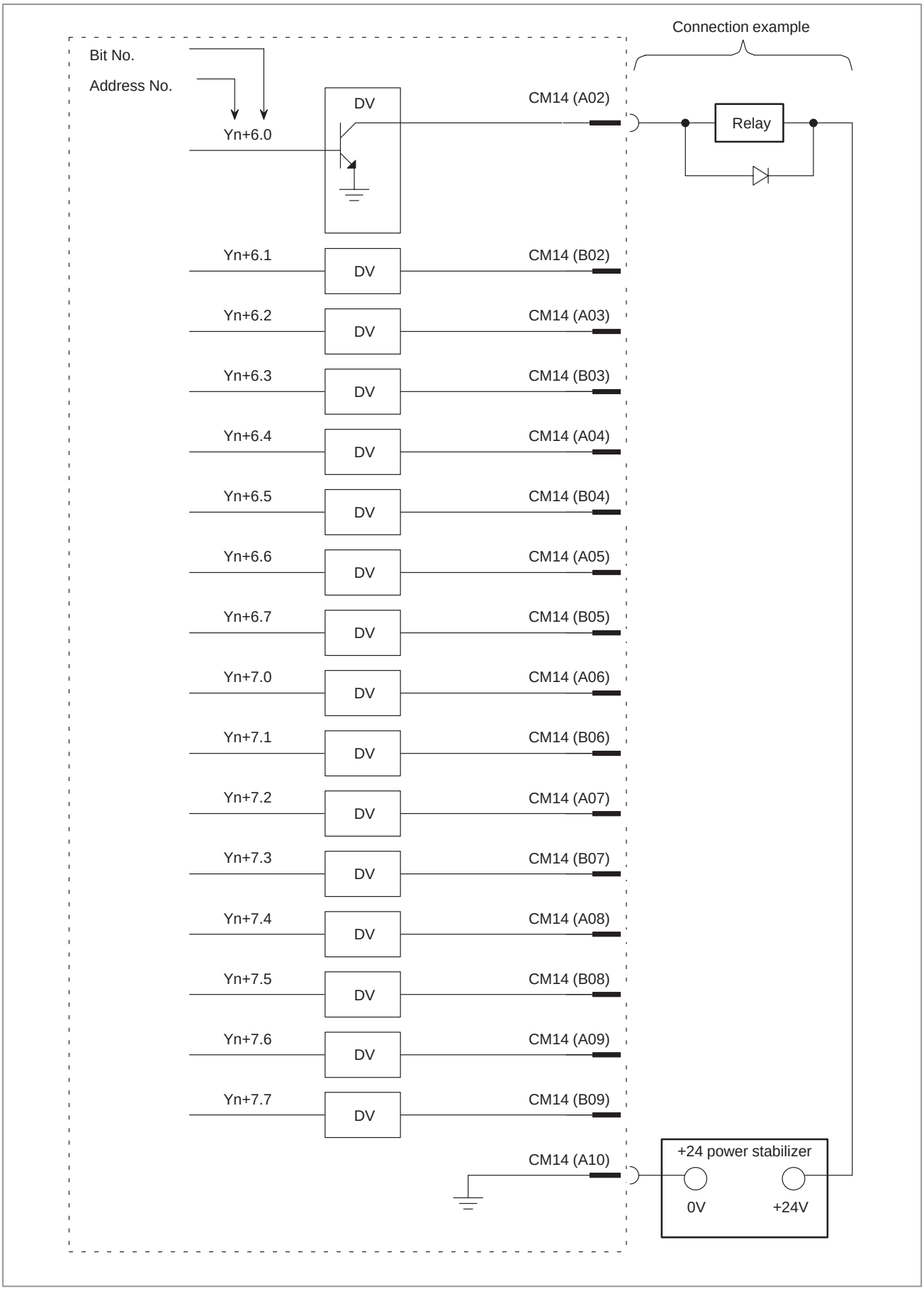

Bit No.
Address No.
+24
Connection example
Xn+8.0
RV
CM12 (A09)
Xn+8.1
RV
CM12 (B09)
Xn+8.2
RV
CM12 (A10)
Xn+8.3
RV
CM12 (B10)
Xn+8.4
RV
CM12 (A11)
Xn+8.5
RV
CM12 (B11)
Xn+8.6
RV
CM12 (A12)
Xn+8.7
RV
CM12 (B12)
Xn+9.0
RV
CM12 (A13)
Xn+9.1
RV
CM12 (B13)
Xn+9.2
RV
CM12 (A14)
Xn+9.3
RV
CM12 (B14)
Xn+9.4
RV
CM12 (A15)
Xn+9.5
RV
CM12 (B15)
Xn+9.6
RV
CM12 (A16)
Xn+9.7
RV
CM12 (B16)
0V
(CM12–A25)


Bit No.
Address No.
+24
Connection example
Xn+10.0
RV
CM12 (A17)
Xn+10.1
RV
CM12 (B17)
Xn+10.2
RV
CM12 (A18)
Xn+10.3
RV
CM12 (B18)
Xn+10.4
RV
CM12 (A19)
Xn+10.5
RV
CM12 (B19)
Xn+10.6
RV
CM12 (A20)
Xn+10.7
RV
CM12 (B20)
Xn+11.0
RV
CM12 (A21)
Xn+11.1
RV
CM12 (B21)
Xn+11.2
RV
CM12 (A22)
Xn+11.3
RV
CM12 (B22)
Xn+11.4
RV
CM12 (A23)
Xn+11.5
RV
CM12 (B23)
Xn+11.6
RV
CM12 (A24)
Xn+11.7
RV
CM12 (B24)
0V
(CM12–A25)

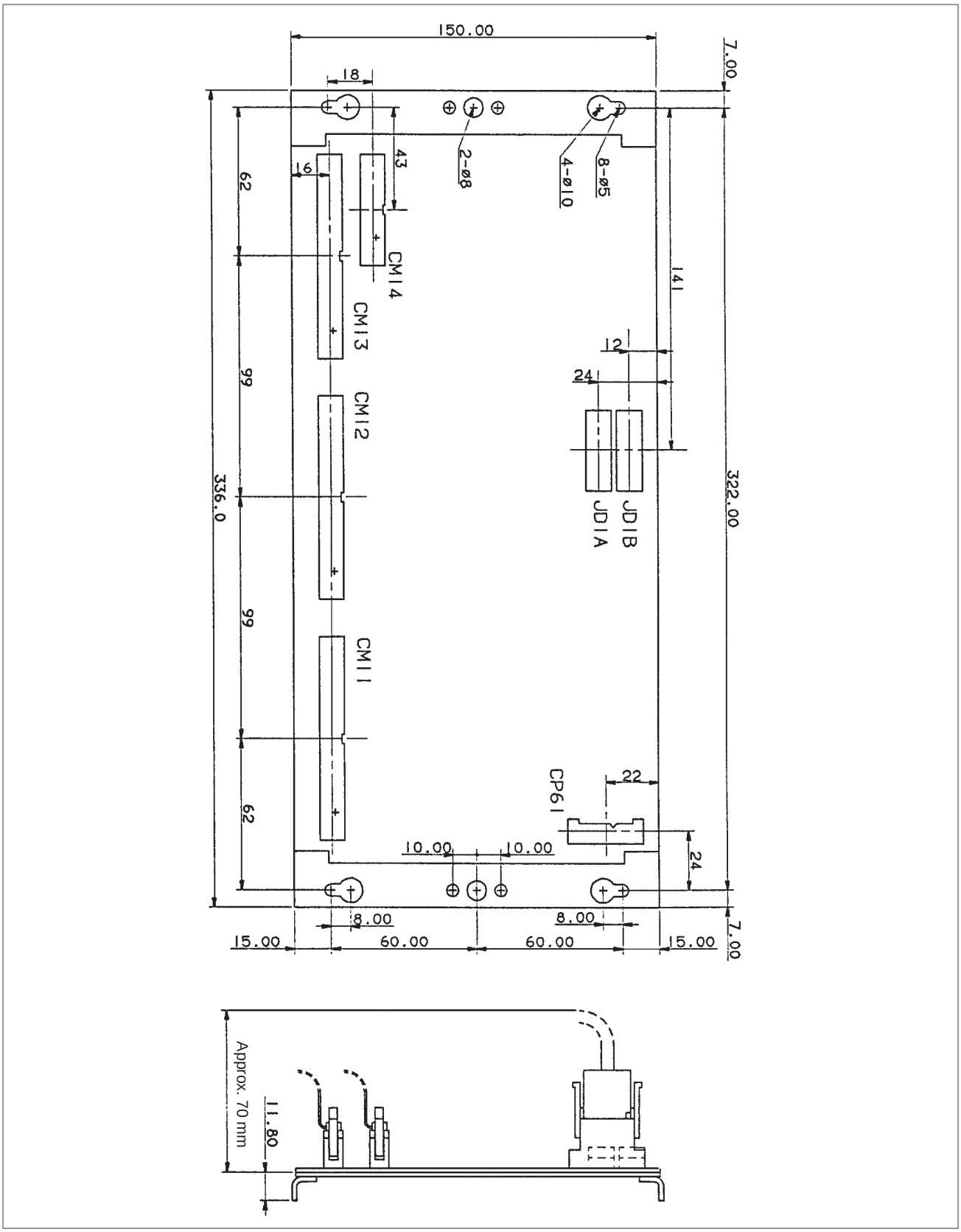

Connection example
Bit No.
Address No.
Yn+0.0
DV
CM13 (A02)
Relay
Yn+0.1
CM13 (B02)
Yn+0.2
CM13 (A03)
Yn+0.3
CM13 (B03)
Yn+0.4
CM13 (A04)
Yn+0.5
CM13 (B04)
Yn+0.6
CM13 (A05)
Yn+0.7
CM13 (B05)
Yn+1.0
CM13 (A06)
Yn+1.1
CM13 (B06)
Yn+1.2
CM13 (A07)
Yn+1.3
CM13 (B07)
Yn+1.4
CM13 (A08)
Yn+1.5
CM13 (B08)
Yn+1.6
CM13 (A09)
Yn+1.7
CM13 (B09)
CM13 (A25)
+24 power stabilizer
0V
+24V


Connection example
Bit No.
Address No.
Yn+2.0
DV
CM13 (A10)
Relay
Yn+2.1
DV
CM13 (B10)
Yn+2.2
DV
CM13 (A11)
Yn+2.3
DV
CM13 (B11)
Yn+2.4
DV
CM13 (A12)
Yn+2.5
DV
CM13 (B12)
Yn+2.6
DV
CM13 (A13)
Yn+2.7
DV
CM13 (B13)
Yn+3.0
DV
CM13 (A14)
Yn+3.1
DV
CM13 (B14)
Yn+3.2
DV
CM13 (A15)
Yn+3.3
DV
CM13 (B15)
Yn+3.4
DV
CM13 (A16)
Yn+3.5
DV
CM13 (B16)
Yn+3.6
DV
CM13 (A17)
Yn+3.7
DV
CM13 (B17)
+24 power stabilizer
0V
(CM13–A25)
0V
+24V


Connection example
Bit No.
Address No.
Yn+4.0
DV
CM13 (A18)
Relay
Yn+4.1
DV
CM13 (B18)
Yn+4.2
DV
CM13 (A19)
Yn+4.3
DV
CM13 (B19)
Yn+4.4
DV
CM13 (A20)
Yn+4.5
DV
CM13 (B20)
Yn+4.6
DV
CM13 (A21)
Yn+4.7
DV
CM13 (B21)
Yn+5.0
DV
CM13 (A22)
Yn+5.1
DV
CM13 (B22)
Yn+5.2
DV
CM13 (A23)
Yn+5.3
DV
CM13 (B23)
Yn+5.4
DV
CM13 (A24)
Yn+5.5
DV
CM13 (B24)
Yn+5.6
DV
CM14 (A01)
Yn+5.7
DV
CM14 (B01)
0V
(CM13–A25)
+24 power stabilizer
0V
+24V


Connection example
Bit No.
Address No.
Yn+6.0
DV
CM14 (A02)
Relay
Yn+6.1
CM14 (B02)
Yn+6.2
CM14 (A03)
Yn+6.3
CM14 (B03)
Yn+6.4
CM14 (A04)
Yn+6.5
CM14 (B04)
Yn+6.6
CM14 (A05)
Yn+6.7
CM14 (B05)
Yn+7.0
CM14 (A06)
Yn+7.1
CM14 (B06)
Yn+7.2
CM14 (A07)
Yn+7.3
CM14 (B07)
Yn+7.4
CM14 (A08)
Yn+7.5
CM14 (B08)
Yn+7.6
CM14 (A09)
Yn+7.7
CM14 (B09)
CM14 (A10)
+24 power stabilizer
0V
+24V

F.4 EXTERNAL DIMENSION



G ADDITIONAL I/O–B3, F3

G.1 OUTLINE

Additional I/O–B3 and F3 are I/O cards featuring a FANUC I/O Link interface. Additional I/O–B3 cards have the same number of input/output signals as those of additional I/O–B2 cards, thus maintaining the compatibility of the interface with the machine.

Additional I/O–B3 cards use sink–type output signals, while additional I/O–F3 cards use source–type output signals. Both have the same number of input/output signals: 104 inputs and 72 outputs.

G.2 INPUT/OUTPUT SIGNAL STANDARDS

The input signals are the same as those of the built–in I/O card. See the input signal standard in Section 6.2.1.
The output signals for sink–type additional I/O–B3 are the same as those of the built–in I/O card. See the description of output signal A in the output signal standard in Section 6.2.1. For source–type additional I/O–F3, the following applies:

- **Output signal definition of additional I/O–F3**

  - Maximum load current when output is “ON”:
    200 mA or less including instantaneous current
    (One power supply pin “DOCOM” must be less than 2.0A.)
  - Saturation voltage when output is “ON”:
    1.0V max. when load current is 200 mA
  - Withstand voltage when output is “OFF”:
    24V + 20% or less including instantaneous voltage
  - Leak current when output is “OFF”:
    100 μA or less

- **External power supply for output signals**

  - Voltage: 24V ±10%
  - Current:
    Max. total load current including instantaneous current +100 mA or more when using I/O–F3.
  - Power on sequence:
    Just or before power on of the control unit
  - Power off sequence:
    Just or after power off of the control unit

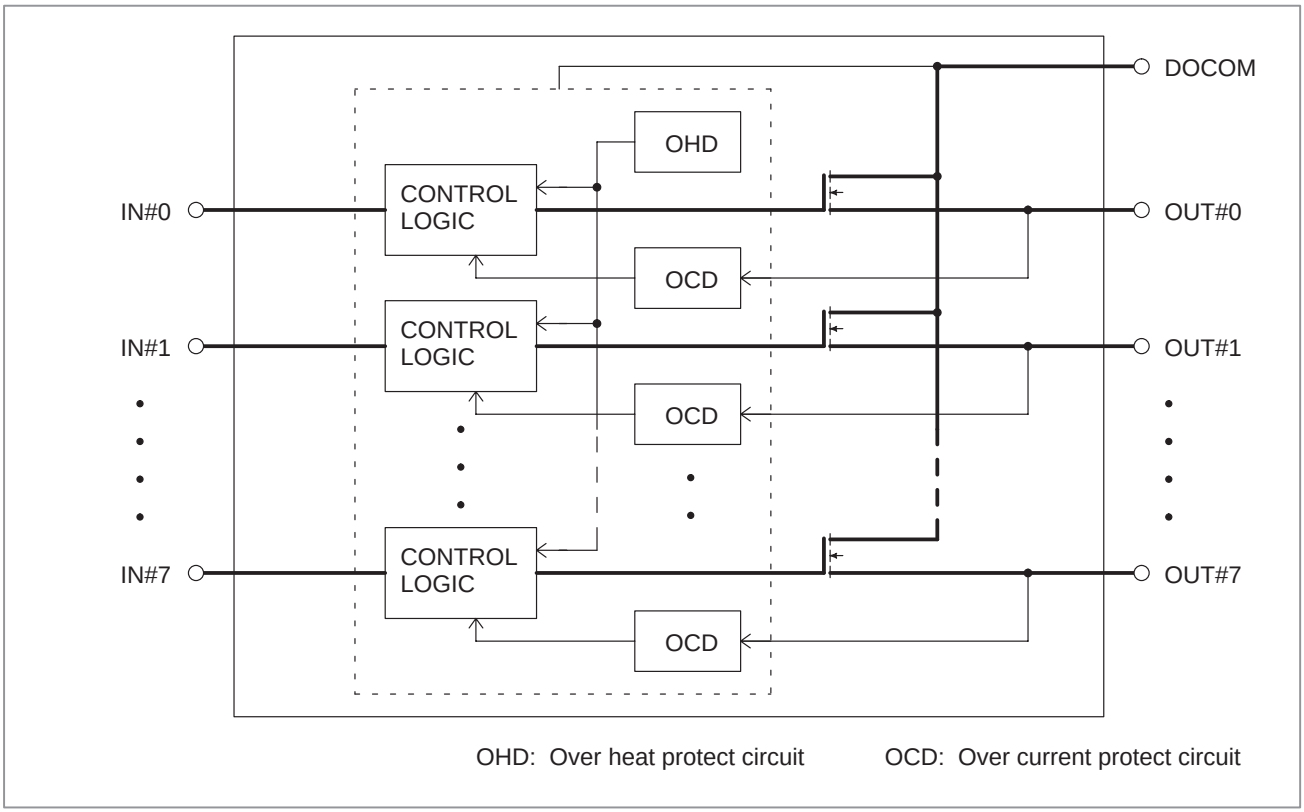
- **Detail of output signal driver for additional I/O–F3**

The device of the output signal driver on this I/O board turns on and off 8 points DO signals per 1 device.
DO driver IC on this board observes and protects a over current. If the protection circuit observes a over current, it works to turn off the output signal, and then output current does not appears and it is not over current condition. So, the driver turns on the output signal again. Therefore, if the signal shorts to the ground or over current condition continuously, the output signal is reperted to turn on and off. This condition may be happen if instantaneous current is more. Further, DO driver IC on this board observes and protects a over heat. If a DO signal shorts to the ground as it must keep a over current condition and the device temperature may be more heat, then over heat protection circuit will be worked and all 8 points DO of the 1 device must be turned off. As the cancellation of protect condition, at once turn off the output signal logically using ladder after device temperature is cool, or at once power off.
A group of the 8 points of the 1 device is followings.

Group #0: Ym+0.0~Ym+0.7, Group#1 : Ym+1.0~Ym+1.7,
Group #2: Ym+2.0~Ym+2.7, Group#3 : Ym+3.0~Ym+3.7,
Group #4: Ym+4.0~Ym+4.7, Group#5 : Ym+5.0~Ym+5.7,
Group #6: Ym+6.0~Ym+6.7, Group#7 : Ym+7.0~Ym+7.7,
Group #8: Ym+8.0~Ym+8.7

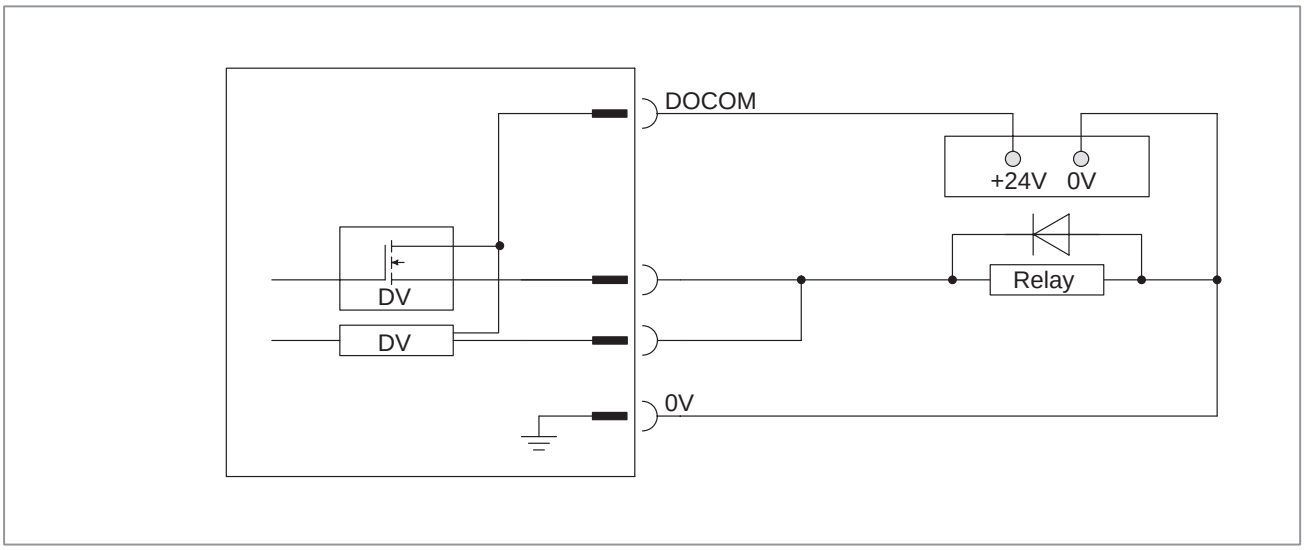
If some DO signal is turned on on the diagnosis screen but the signal is really turned off, it may be turned off by other signal of the same group. It means if one of the DO signals has over heat condition, the other 8 points DO signals of the same group including itself must be turned off. In this case, at once power off and remove a cause of the over load.

[Block diagram of a DO drive IC]

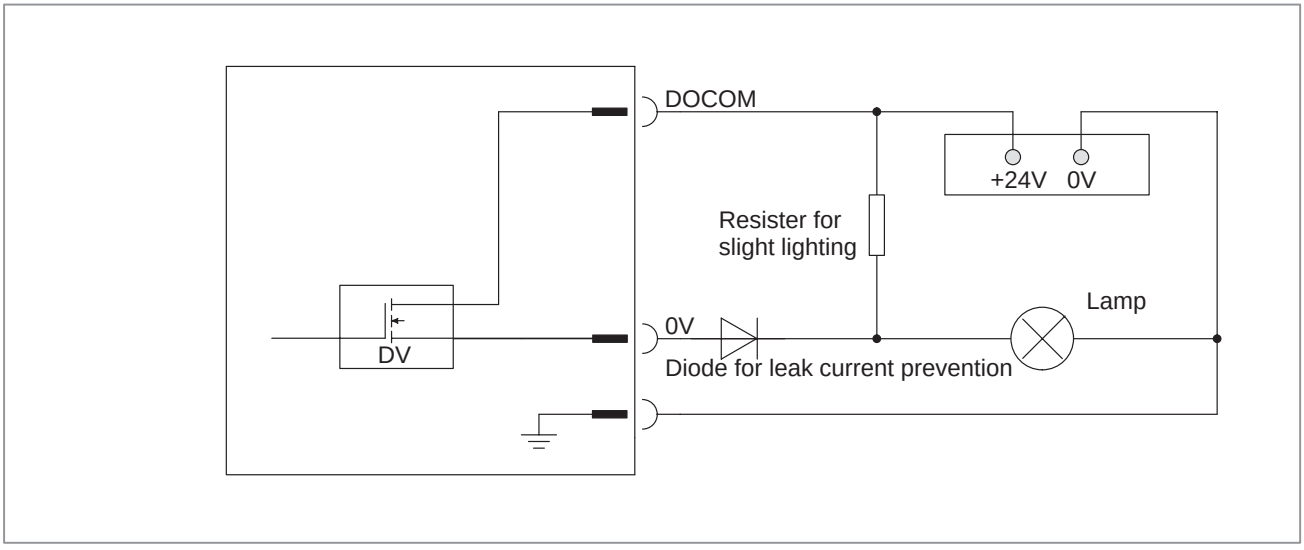


- **Caution of a DO connection**

NOTE
Don’t connect with parallel as followings.



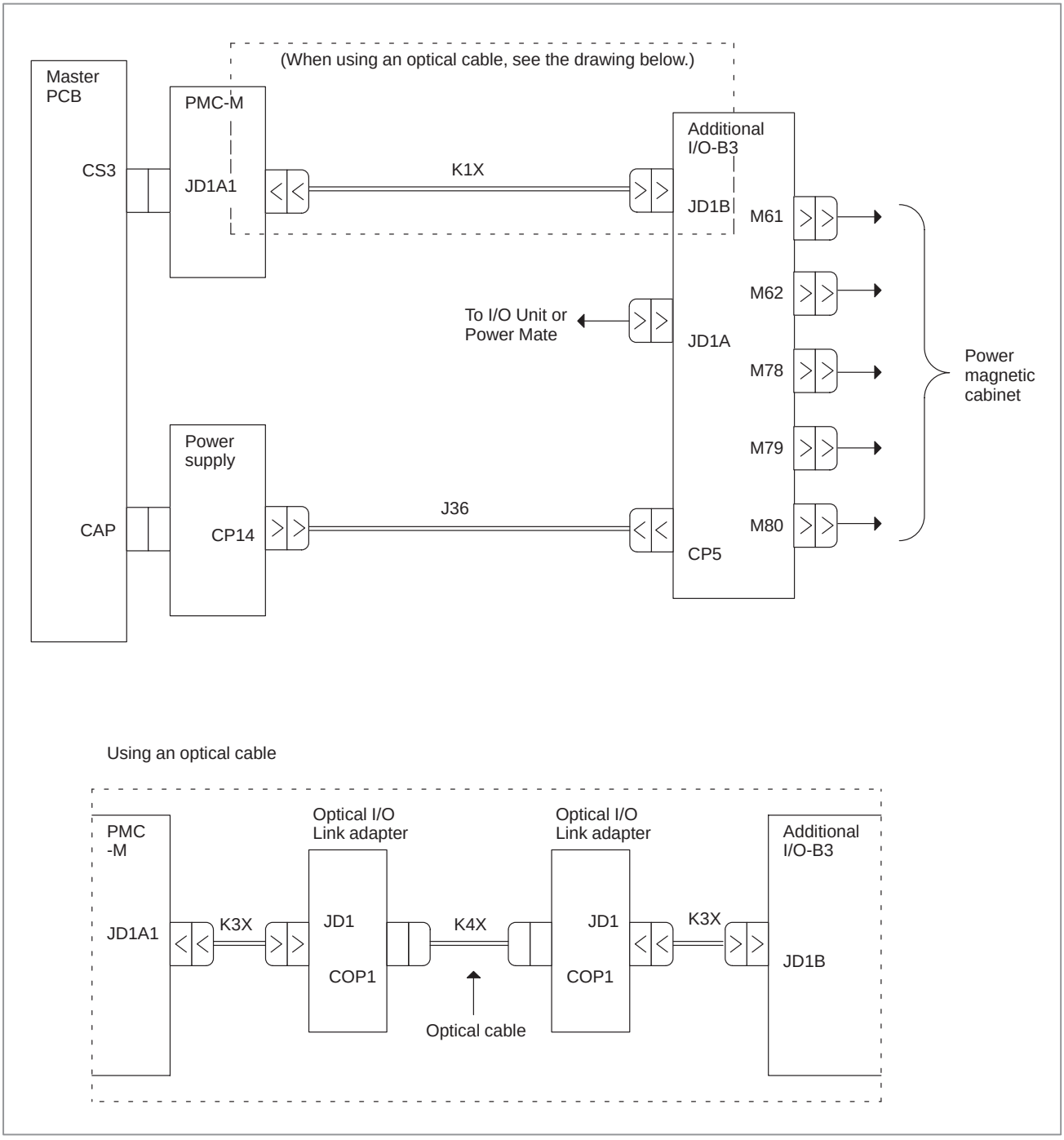
NOTE
If using a resister for slight lighting as followings, connect a diode for leak current prevention.

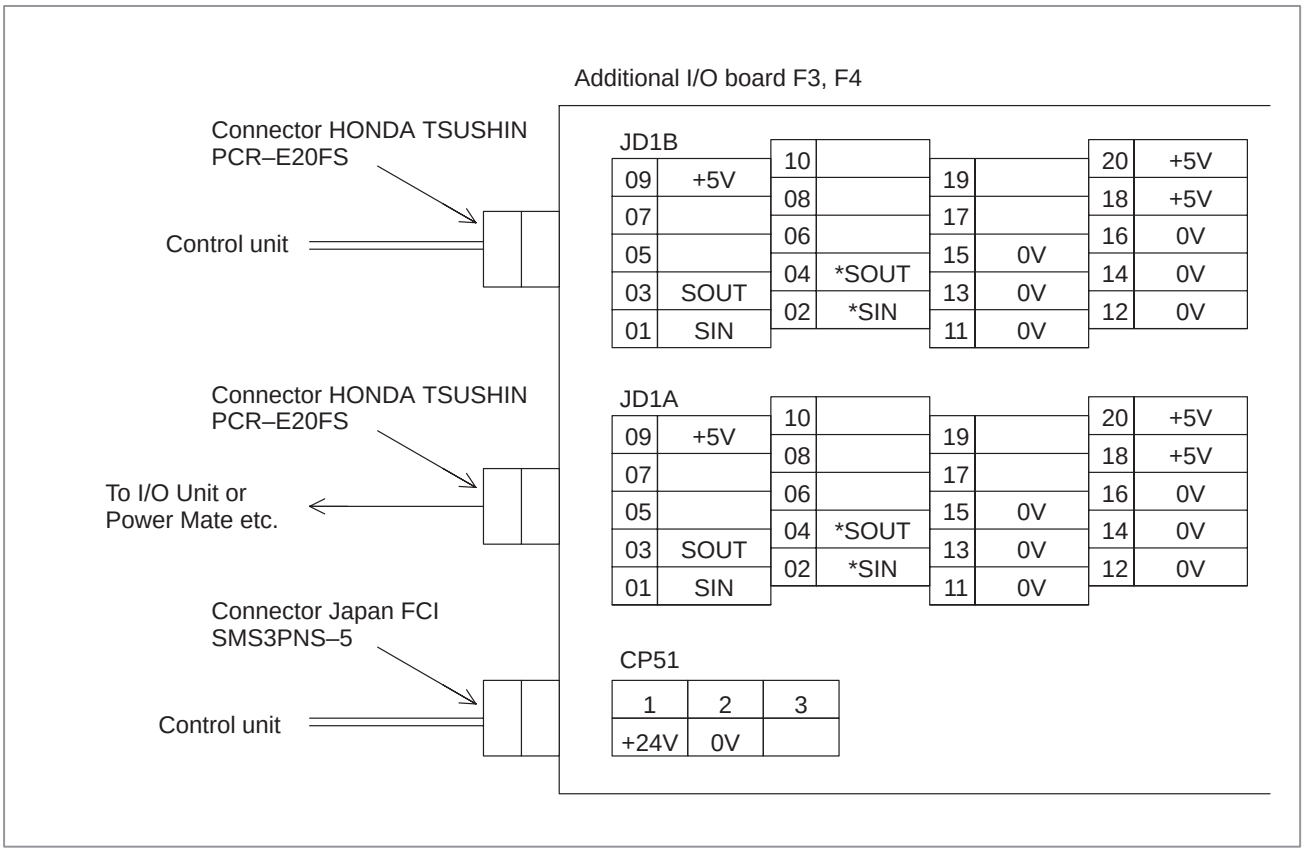


G.3 CONNECTION

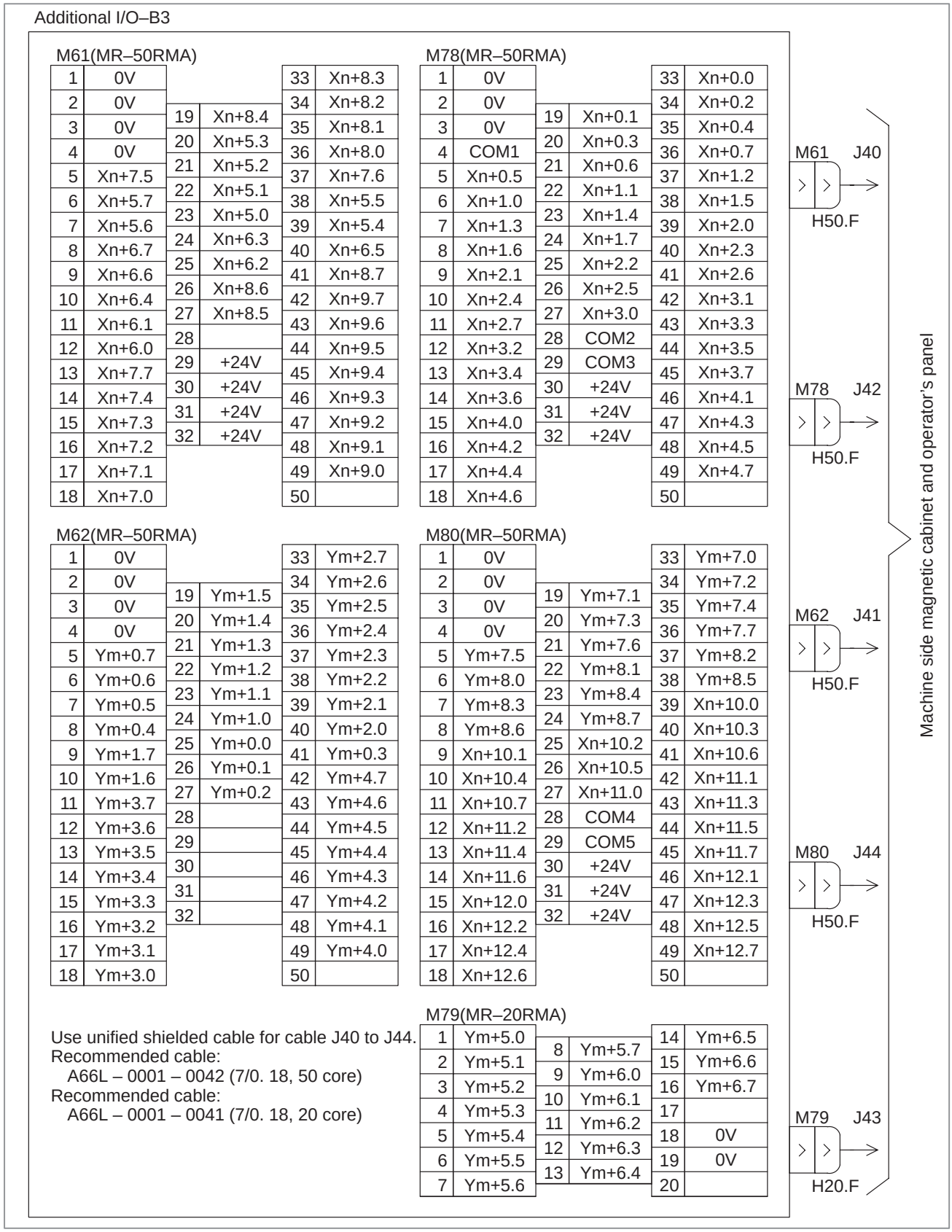
(1) Connection of the control unit and additional I/O–B3 and F3

The connection outline is shown below. For the details of the signal cable, refer to section 6.3.2.

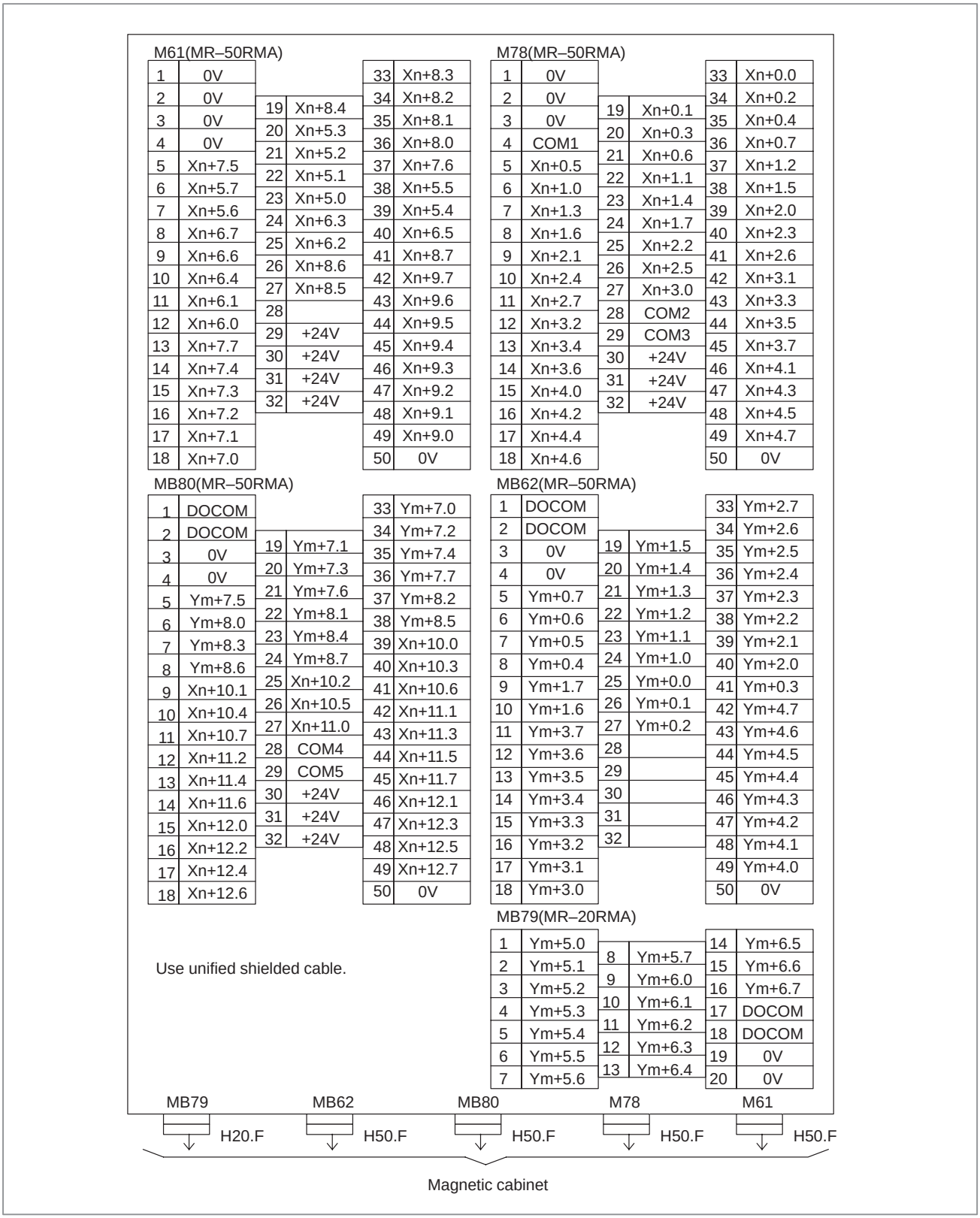



Additional I/O board F3, F4
Connector HONDA TSUSHIN
PCR–E20FS
Control unit
JD1B
09 +5V
07
05
03 SOUT
01 SIN
10
08
06
04 *SOUT
02 *SIN
19
17
15 0V
13 0V
11 0V
20 +5V
18 +5V
16 0V
14 0V
12 0V
Connector HONDA TSUSHIN
PCR–E20FS
To I/O Unit or
Power Mate etc.
JD1A
09 +5V
07
05
03 SOUT
01 SIN
10
08
06
04 *SOUT
02 *SIN
19
17
15 0V
13 0V
11 0V
20 +5V
18 +5V
16 0V
14 0V
12 0V
Connector Japan FCI
SMS3PNS–5
Control unit
CP51
1 2 3
+24V 0V

(2) Connection between additional I/O–B3 and machine side



(3) Connection between additional I/O board F3 and machine side



(4) Input signal pin assignment

Table G.3(a) Pin assignment for input signals and common signal pin assignment for those signals

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B3	I/O–F3	No.	I/O–B3	I/O–F3	No.
Xn+0#0	M78	M78	33			
Xn+0#1	M78	M78	19			
Xn+0#2	M78	M78	34			
Xn+0#3	M78	M78	20			
Xn+0#4	M78	M78	35			
Xn+0#5	M78	M78	05			
Xn+0#6	M78	M78	21			
Xn+0#7	M78	M78	36	M78	M78	04
Xn+1#0	M78	M78	06			
Xn+1#1	M78	M78	22	Use M78 pins 30, 31, and 32 for +24 V. Use M78 pins 01, 02, and 03 for 0 V.		
Xn+1#2	M78	M78	37			
Xn+1#3	M78	M78	07			
Xn+1#4	M78	M78	23			
Xn+1#5	M78	M78	38			
Xn+1#6	M78	M78	08			
Xn+1#7	M78	M78	24			
Xn+2#0	M78	M78	39			
Xn+2#1	M78	M78	09			
Xn+2#2	M78	M78	25			
Xn+2#3	M78	M78	40			
Xn+2#4	M78	M78	10			
Xn+2#5	M78	M78	26			
Xn+2#6	M78	M78	41	M78	M78	28
Xn+2#7	M78	M78	11	Use M78 pins 30, 31, and 32 for +24 V. Use M78 pins 01, 02, and 03 for 0 V.		
Xn+3#0	M78	M78	27			
Xn+3#1	M78	M78	42			
Xn+3#2	M78	M78	12			
Xn+3#3	M78	M78	43			
Xn+3#4	M78	M78	13			

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B3	I/O–F3	No.	I/O–B3	I/O–F3	No.
Xn+3#5	M78	M78	44	M78	M78	28
Xn+3#6	M78	M78	14	Use M78 pins 30, 31, and 32 for +24 V. Use M78 pins 01, 02, and 03 for 0 V.		
Xn+3#7	M78	M78	45			
Xn+4#0	M78	M78	15			
Xn+4#1	M78	M78	46			
Xn+4#2	M78	M78	16			
Xn+4#3	M78	M78	47	M78	M78	29
Xn+4#4	M78	M78	17	Use M78 pins 30, 31, and 32 for +24 V. Use M78 pins 01, 02, and 03 for 0 V.		
Xn+4#5	M78	M78	48			
Xn+4#6	M78	M78	18			
Xn+4#7	M78	M78	49			
Xn+5#0	M61	M61	23			
Xn+5#1	M61	M61	22			
Xn+5#2	M61	M61	21			
Xn+5#3	M61	M61	20			
Xn+5#4	M61	M61	39			
Xn+5#5	M61	M61	38			
Xn+5#6	M61	M61	07			
Xn+5#7	M61	M61	06	Always sink input		
Xn+6#0	M61	M61	12			
Xn+6#1	M61	M61	11	Use M61 pins 29, 30, 31, and 32 for +24 V.		
Xn+6#2	M61	M61	25			
Xn+6#3	M61	M61	24			
Xn+6#4	M61	M61	10			
Xn+6#5	M61	M61	40			
Xn+6#6	M61	M61	09			
Xn+6#7	M61	M61	08			

Xn+4#0 to Xn+4#7 are direct input signal B (for high–speed signal input).

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B3	I/O–F3	No.	I/O–B3	I/O–F3	No.
Xn+7#0	M61	M61	18			
Xn+7#1	M61	M61	17			
Xn+7#2	M61	M61	16			
Xn+7#3	M61	M61	15			
Xn+7#4	M61	M61	14			
Xn+7#5	M61	M61	05			
Xn+7#6	M61	M61	37			
Xn+7#7	M61	M61	13			
Xn+8#0	M61	M61	36			
Xn+8#1	M61	M61	35			
Xn+8#2	M61	M61	34			
Xn+8#3	M61	M61	33			
Xn+8#4	M61	M61	19	Always sink input Use M61 pins 29, 30, 31, and 32 for +24 V.		
Xn+8#5	M61	M61	27			
Xn+8#6	M61	M61	26			
Xn+8#7	M61	M61	41			
Xn+9#0	M61	M61	49			
Xn+9#1	M61	M61	48			
Xn+9#2	M61	M61	47			
Xn+9#3	M61	M61	46			
Xn+9#4	M61	M61	45			
Xn+9#5	M61	M61	44			
Xn+9#6	M61	M61	43			
Xn+9#7	M61	M61	42			

Signal address	Signal pin assignment			Common signal pin assignment		
	I/O–B3	I/O–F3	No.	I/O–B3	I/O–F3	No.
Xn+10#0	M80	MB80	39			
Xn+10#1	M80	MB80	09			
Xn+10#2	M80	MB80	25			
Xn+10#3	M80	MB80	40			
Xn+10#4	M80	MB80	10			
Xn+10#5	M80	MB80	26			
Xn+10#6	M80	MB80	41			
Xn+10#7	M80	MB80	11			
Xn+11#0	M80	MB80	27			
Xn+11#1	M80	MB80	42			
Xn+11#2	M80	MB80	12			
Xn+11#3	M80	MB80	43			
Xn+11#4	M80	MB80	13	M80	MB80	29
Xn+11#5	M80	MB80	44	Use M80/MB80 pins 30, 31, and 32 for +24 V. Use M80/MB80 pins 01 and 02 for 0 V.		
Xn+11#6	M80	MB80	14			
Xn+11#7	M80	MB80	45			
Xn+12#0	M80	MB80	15			
Xn+12#1	M80	MB80	46			
Xn+12#2	M80	MB80	16			
Xn+12#3	M80	MB80	47			
Xn+12#4	M80	MB80	17			
Xn+12#5	M80	MB80	48			
Xn+12#6	M80	MB80	18			
Xn+12#7	M80	MB80	49			

Table G.3 (b) Pin assignment for output signals and common signal pin assignment for those signals

The additional I/O–B3 card is capable only of sink–type output.
The additional I/O–F3 card is capable only of source–type output.

Signal address	Signal pin		Signal pin	
	I/O–B3	No.	I/O–F3	No.
Ym+0#0	M62	25	MB62	25
Ym+0#1	M62	26	MB62	26
Ym+0#2	M62	27	MB62	27
Ym+0#3	M62	08	MB62	08
Ym+0#4	M62	07	MB62	07
Ym+0#5	M62	06	MB62	06
Ym+0#6	M62	05	MB62	05
Ym+0#7	M62	41	MB62	41
Ym+1#0	M62	24	MB62	24
Ym+1#1	M62	23	MB62	23
Ym+1#2	M62	22	MB62	22
Ym+1#3	M62	09	MB62	09
Ym+1#4	M62	21	MB62	21
Ym+1#5	M62	19	MB62	19
Ym+1#6	M62	20	MB62	20
Ym+1#7	M62	10	MB62	10
Ym+2#0	M62	40	MB62	40
Ym+2#1	M62	39	MB62	39
Ym+2#2	M62	38	MB62	38
Ym+2#3	M62	37	MB62	37
Ym+2#4	M62	36	MB62	36
Ym+2#5	M62	35	MB62	35
Ym+2#6	M62	34	MB62	34
Ym+2#7	M62	33	MB62	33

Signal address	Signal pin		Signal pin	
	I/O–B3	No.	I/O–F3	No.
Ym+3#0	M62	18	MB62	18
Ym+3#1	M62	17	MB62	17
Ym+3#2	M62	16	MB62	16
Ym+3#3	M62	15	MB62	15
Ym+3#4	M62	14	MB62	14
Ym+3#5	M62	13	MB62	13
Ym+3#6	M62	12	MB62	12
Ym+3#7	M62	11	MB62	11
Ym+4#0	M62	49	MB62	49
Ym+4#1	M62	45	MB62	45
Ym+4#2	M62	47	MB62	47
Ym+4#3	M62	46	MB62	46
Ym+4#4	M62	45	MB62	45
Ym+4#5	M62	44	MB62	44
Ym+4#6	M62	43	MB62	43
Ym+4#7	M62	42	MB62	42
Ym+5#0	M79	01	MB79	01
Ym+5#1	M79	02	MB79	02
Ym+5#2	M79	03	MB79	03
Ym+5#3	M79	04	MB79	04
Ym+5#4	M79	05	MB79	05
Ym+5#5	M79	06	MB79	06
Ym+5#6	M79	07	MB79	07
Ym+5#7	M79	08	MB79	08

Signal address	Signal pin		Signal pin	
	I/O–B3	No.	I/O–F3	No.
Ym+6#0	M79	09	MB79	09
Ym+6#1	M79	10	MB79	10
Ym+6#2	M79	11	MB79	11
Ym+6#3	M79	12	MB79	12
Ym+6#4	M79	13	MB79	13
Ym+6#5	M79	14	MB79	14
Ym+6#6	M79	15	MB79	15
Ym+6#7	M79	16	MB79	16
Ym+7#0	M80	33	MB80	33
Ym+7#1	M80	19	MB80	19
Ym+7#2	M80	34	MB80	34
Ym+7#3	M80	20	MB80	20
Ym+7#4	M80	35	MB80	35
Ym+7#5	M80	05	MB80	05
Ym+7#6	M80	21	MB80	21
Ym+7#7	M80	36	MB80	36
Ym+8#0	M80	06	MB80	06
Ym+8#1	M80	22	MB80	22
Ym+8#2	M80	37	MB80	37
Ym+8#3	M80	07	MB80	07
Ym+8#4	M80	23	MB80	23
Ym+8#5	M80	38	MB80	38
Ym+8#6	M80	08	MB80	08
Ym+8#7	M80	24	MB80	24

G.4 INPUT/OUTPUT SIGNAL ASSIGNMENT ON FANUC I/O LINK

To use additional I/O–B3 or F3 cards, input/output signals must be assigned by means of I/O module assignment using a PMC–M ladder program. For details, refer to the FANUC PMC–MODEL K/L/M/P Programming Manual.

Make the following settings for the additional I/O–B3 or F3 cards.

Address of DI/DO in the FANUC PMC–M with I/O Link are as follows:

DI/DO	Address	DGN. NO
DI 128byte=1024 point (MAX)	X3072 ~ X3199	5072~5199
DO 128byte=1024 point (MAX)	Y3200~Y3327	5200~5327

The point number of DI and DO of the additional I/O–B3 and F3 are as follows:

DI/DO of additional I/O–B3	Number of points
DI	13byte=104 point
DO	9byte=72 point

Therefore, the signal names DI (Xn + □.□) and DO (Ym + □.□) of the additional I/O–B3 and F3 can be freely allocated in the range:

$3072 \leqq n \leqq 3187$
$3200 \leqq m \leqq 3319$

An example of allocation is shown below.

Example

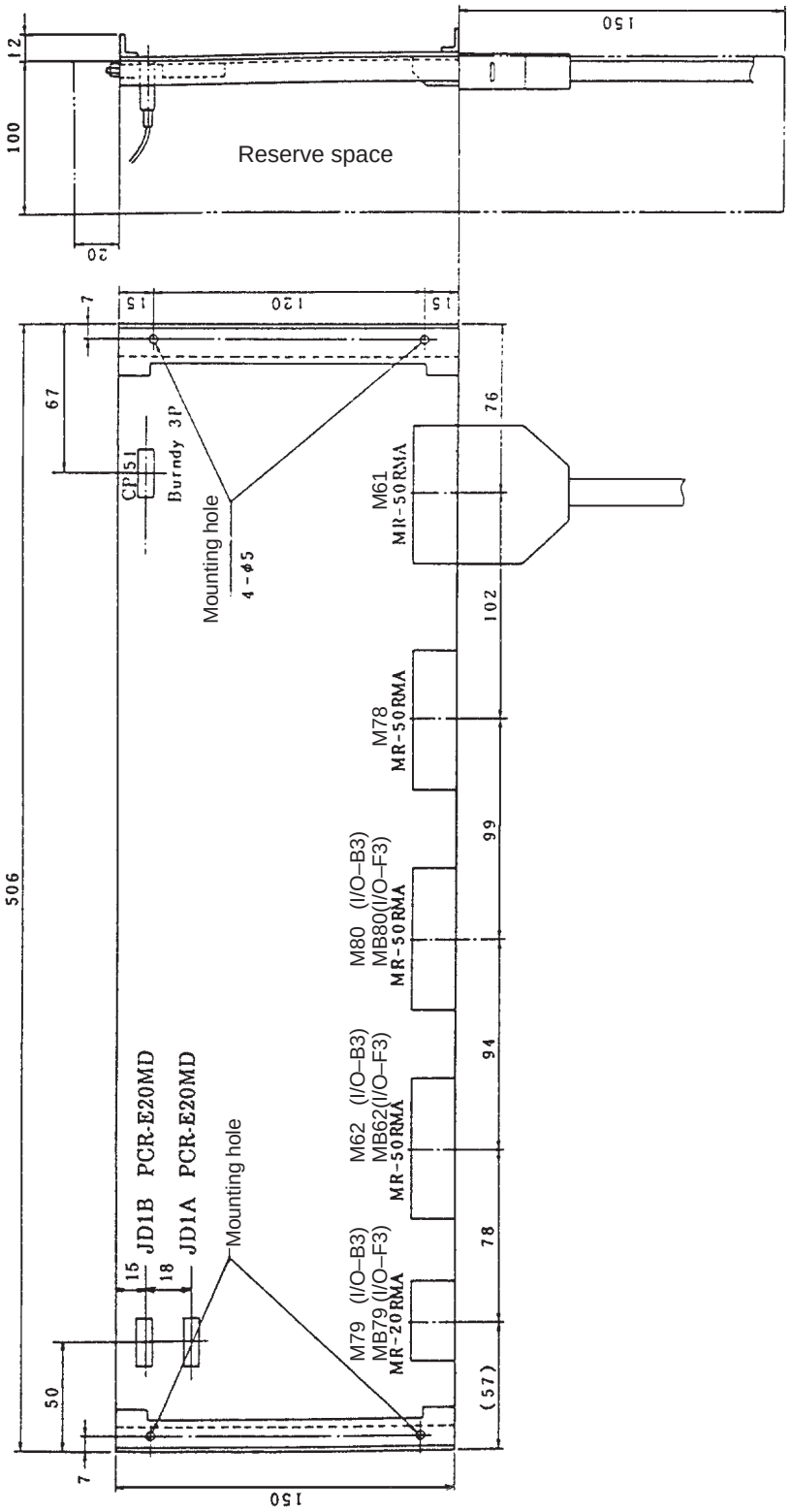
First address n of DI = 3100 and first address m of DO = 3200

DI/DO of additional I/O–B3	Address	DGN. NO
DI	X3100~X3112	5100~5112
DO	Y3200~Y3208	5200~5208

As a concrete example,

DI signal (Xn + 11.2) of pin 12 of M80 connector is X3111.2.
DO signal (Ym + 4.7) of pin 42 of M62 connector is Y3204.7.

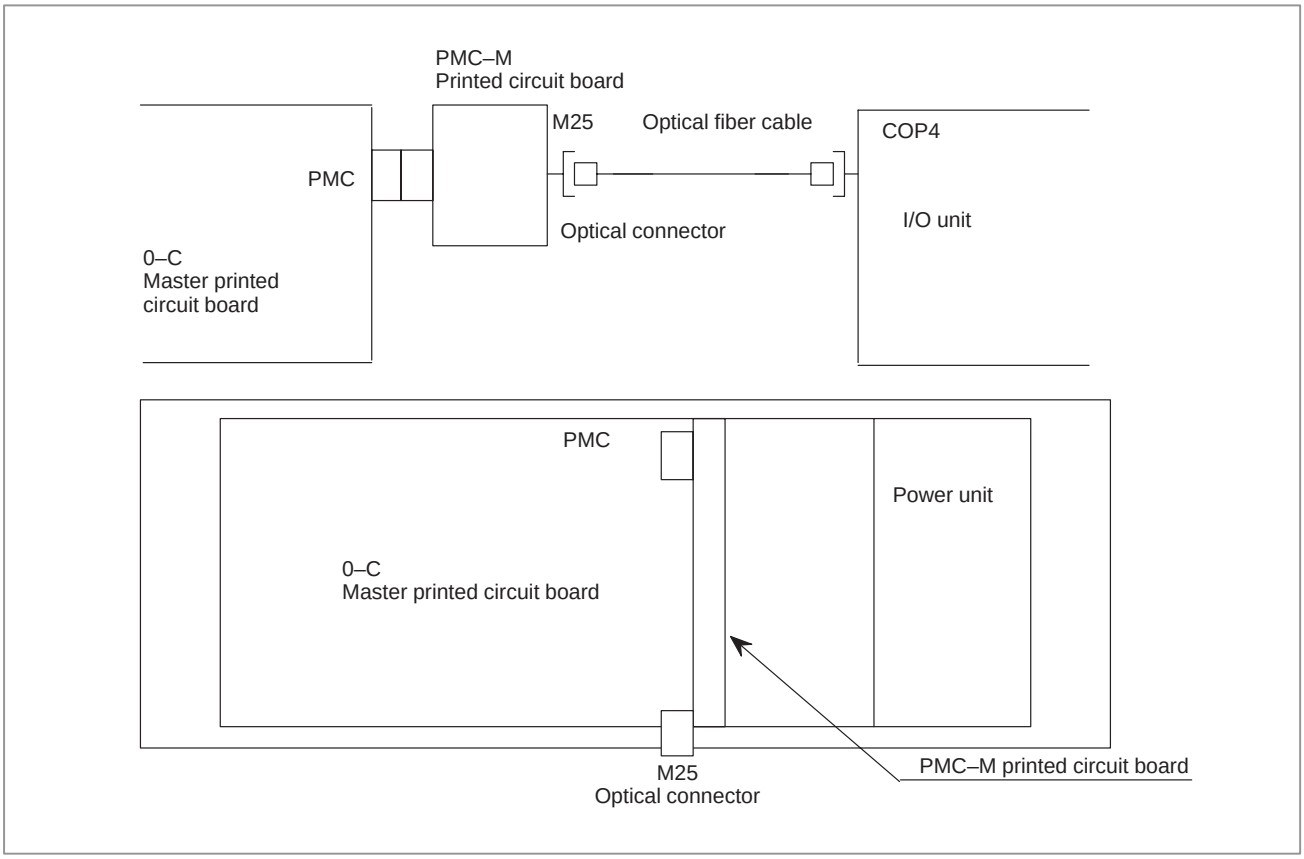
G.5
DIMENSIONS



H DESCRIPTION OF I/O MODULE CONNECTION

H.1 OUTLINE

In this chapter, the required electrical and structural specification on connecting I/O module for Series 0–C is described.
In order to connect the I/O module, a PMC–M with optical interface is necessary.



H.2 CONFIGURATION OF THE I/O UNIT

H.2.1 Configuration of the I/O Unit

The I/O unit is a unit for mounting the I/O modules, with the following components.

- I/O base unit
  A motor board to mount various modules. Four types of I/O base units are offered with I/O module mount capacity of 4, 6, 8 and 10 modules.
- I/O Interface module
  A module is for controlling I/O module. One of IF01A or IF01B is always necessary. IF01A is connected to the NC control unit with an optical fiber cable to control the I/O module. It can control up to 3 other I/O units. When expanding the I/O unit, IF01B is connected with the IF01A mounted on I/O unit with an electric cable to control the I/O module. Up to three IF01Bs can be connected to one IF01A. IF04C can also be mounted to expand the I/O unit. The IF04C is connected to the NC control unit with an optical fiber cable to control up to four IF01As.
- I/O module
  Various I/O modules are prepared for the input/output control of the PMC. Details are described in after the next section.

Fig. H.2.1 (a) is an example of the I/O unit construction (maximum components).

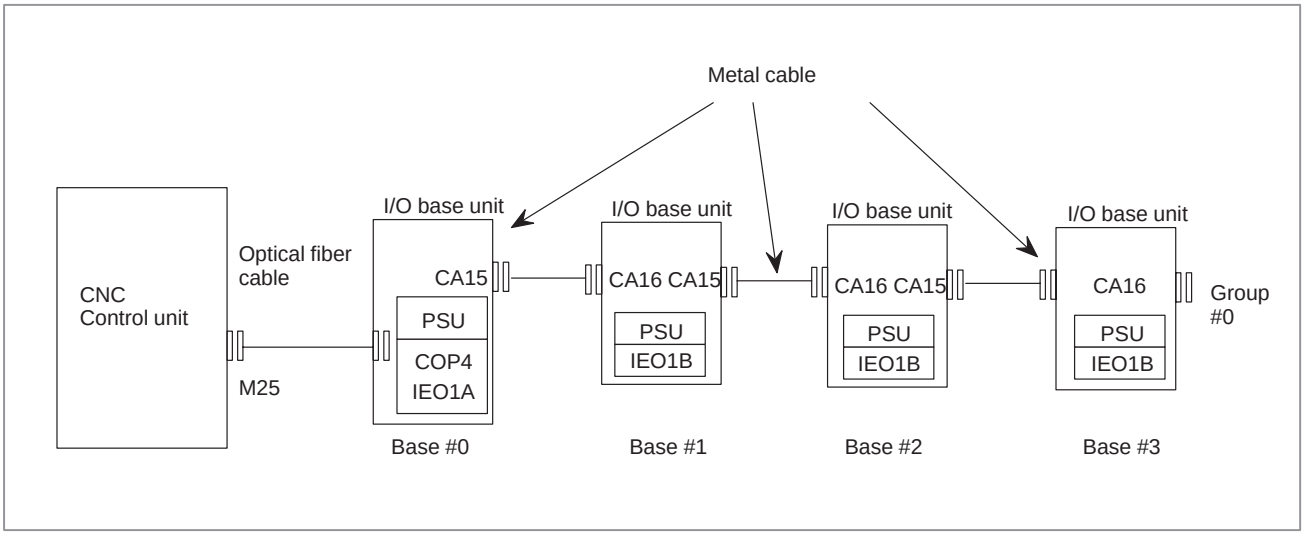


Fig H.2.1 (a) Example of the I/O unit construction

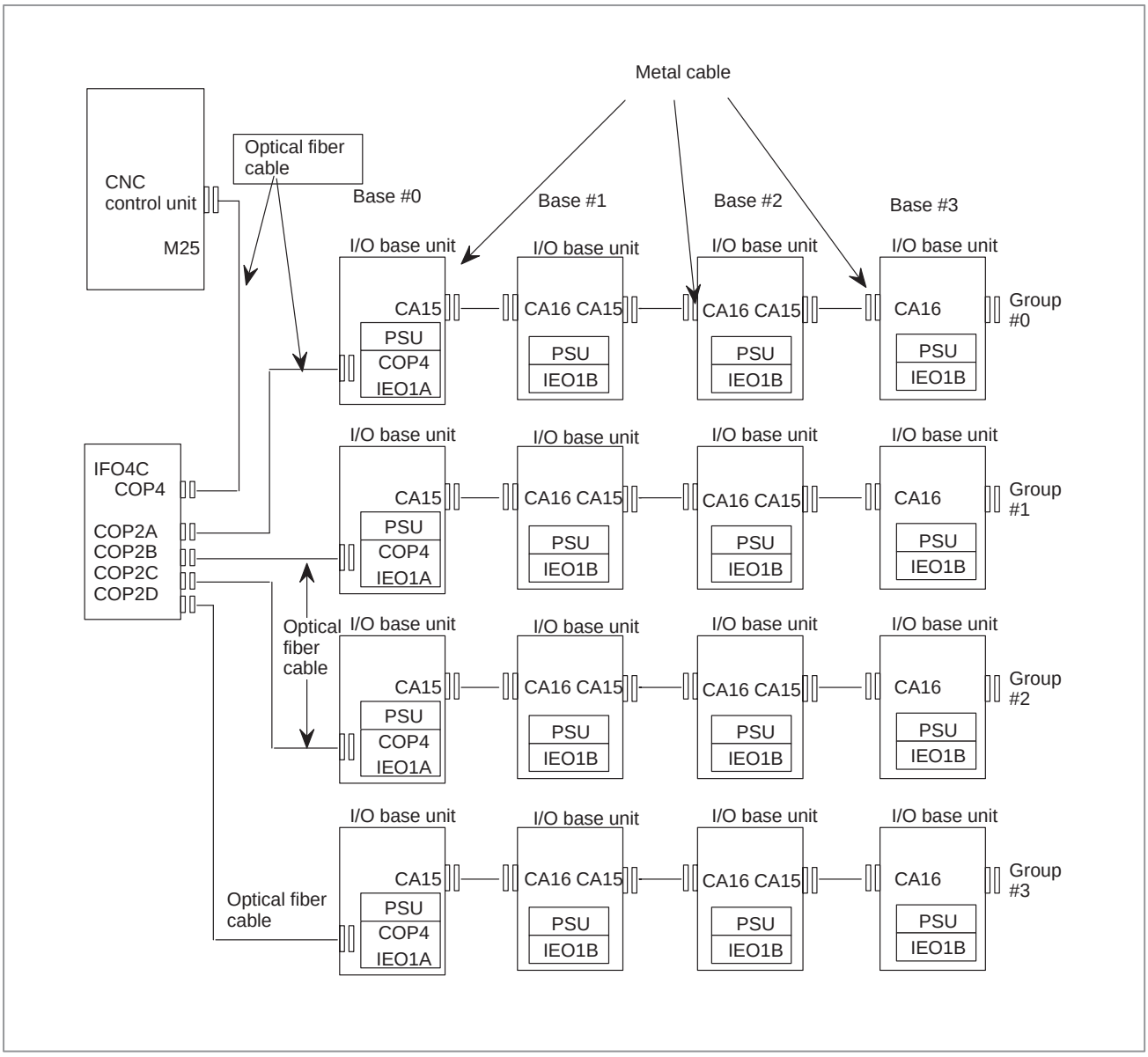


Fig. H.2.1(b) Example of I/O unit construction

The number of I/O modules mountable on the I/O unit is limited according to the slots on the I/O base unit, maximum DI/DO points, and the power capacity of the power supply module.

NOTE
The I/O interface module IF04C can be mounted on any I/O base unit. Every I/O base units can be used.

- **The slot number limit**

I/O Base unit name	Slots numer
BU10A	10
BU08A	8
BU06A	6
BU04A	4

NOTE
When using the interface module IF04C, one more slot is necessary for the IF04C, so I must be subtracted from the slots number of the I/O base unit mounted with IFG04Cs in the above table.

- **Maximum DI/DO Points**

DI : 752 points (X1100–X1193)
DO: 496 points (Y1200–Y1261)

For the DI/DO points occupied by each DI/DO modules, see Table H.2.1.

- **Limits according to the power capacity**

Calculate the necessary value of voltage A, B, and C according to Table H.2.1 for each I/O unit, and decide the mountable number of I/O modules so that it is within the limits.

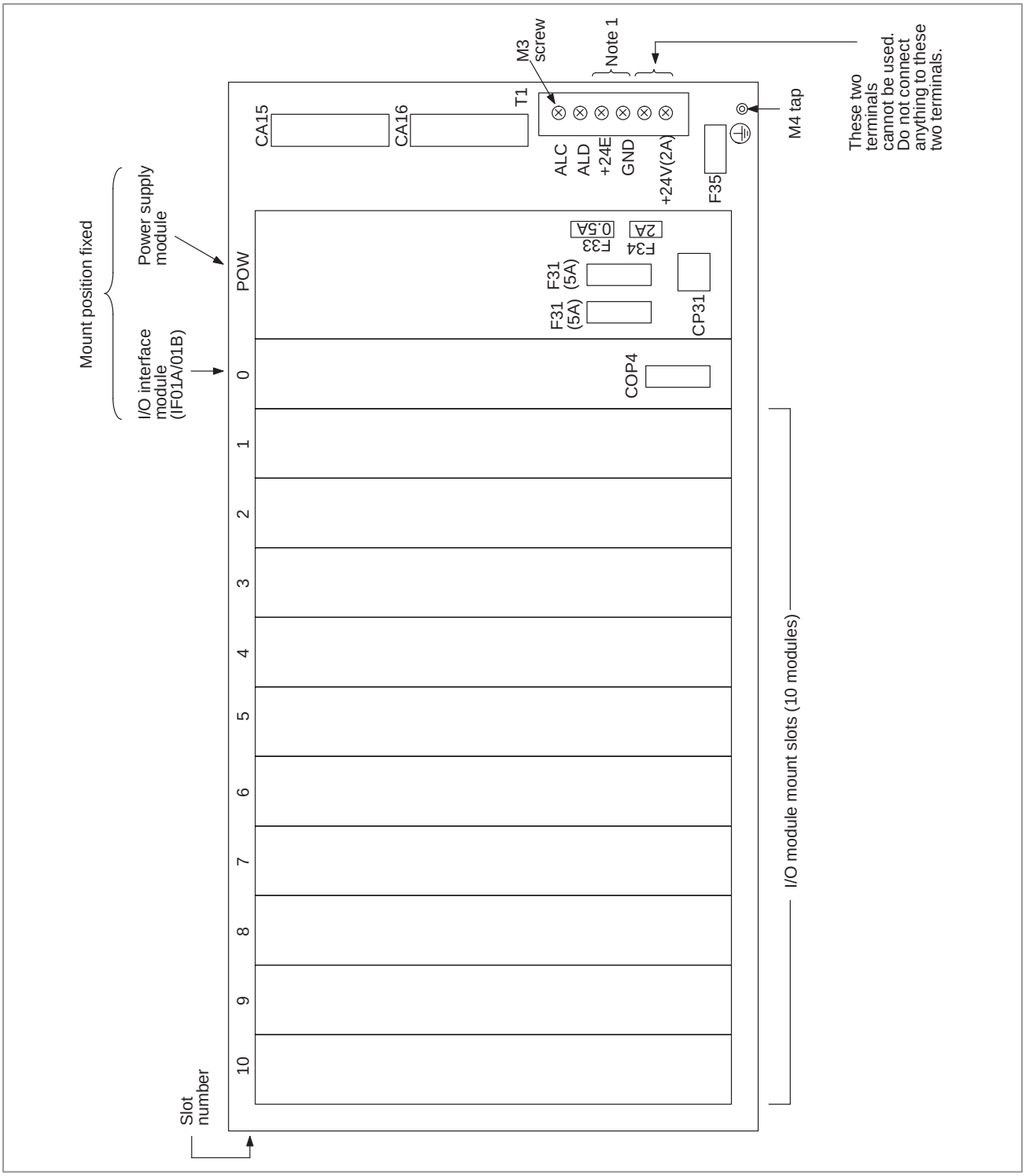
Table H.2.1 Power supply capacity of the I/O unit calculation list

Module name		Power supply			Occupied DI/DO points	
		Voltage A	Voltage B	Voltage C	DI	DO
I/O interface module	IF01A	1.8			–	–
I/O interface module	IF01B	1.6			–	–
I/O interface module	IF01C	1.6			–	–
Output module	OD64A	2.1				64
Output module	OD32A	1.2				32
Output module	OD64B	2.1				64
Output module	OD32B	1.2				32
Output module	OD16B	0.8				16
Output module	OD08B	0.5				8
Output module	OD16C	0.8				16
Output module	OD08C	0.5				8
Output module	OD16D	0.6				16
Output module	OD08D	0.4				8
Output module	OD16E	0.6				16
Output module	OD08E	0.4				8
Input module	ID64A/B	0.6	0.7		64	
Input module	ID32A/B	0.4	0.35		32	
Input module	ID16A/B	0.5	0.2		16	
Input module	ID08A/B	0.4	0.15		8	
Input module	ID64C/D	0.6			64	
Input module	ID32C/D	0.4			32	
Input module	ID16C/D	0.5			16	
Input module	ID08C/D	0.4			8	
Input module	IA16E	0.5			16	
Output module	IA08E	0.4			8	
Analog input module	AD04A	0.7		0.6	64	
Analog output module	AD03A	0.5	0.35	1.1		48
Analog output module	AD02A	0.4	0.25	0.8		32
Limit value		12 (15)*	3	4	752	496

NOTE

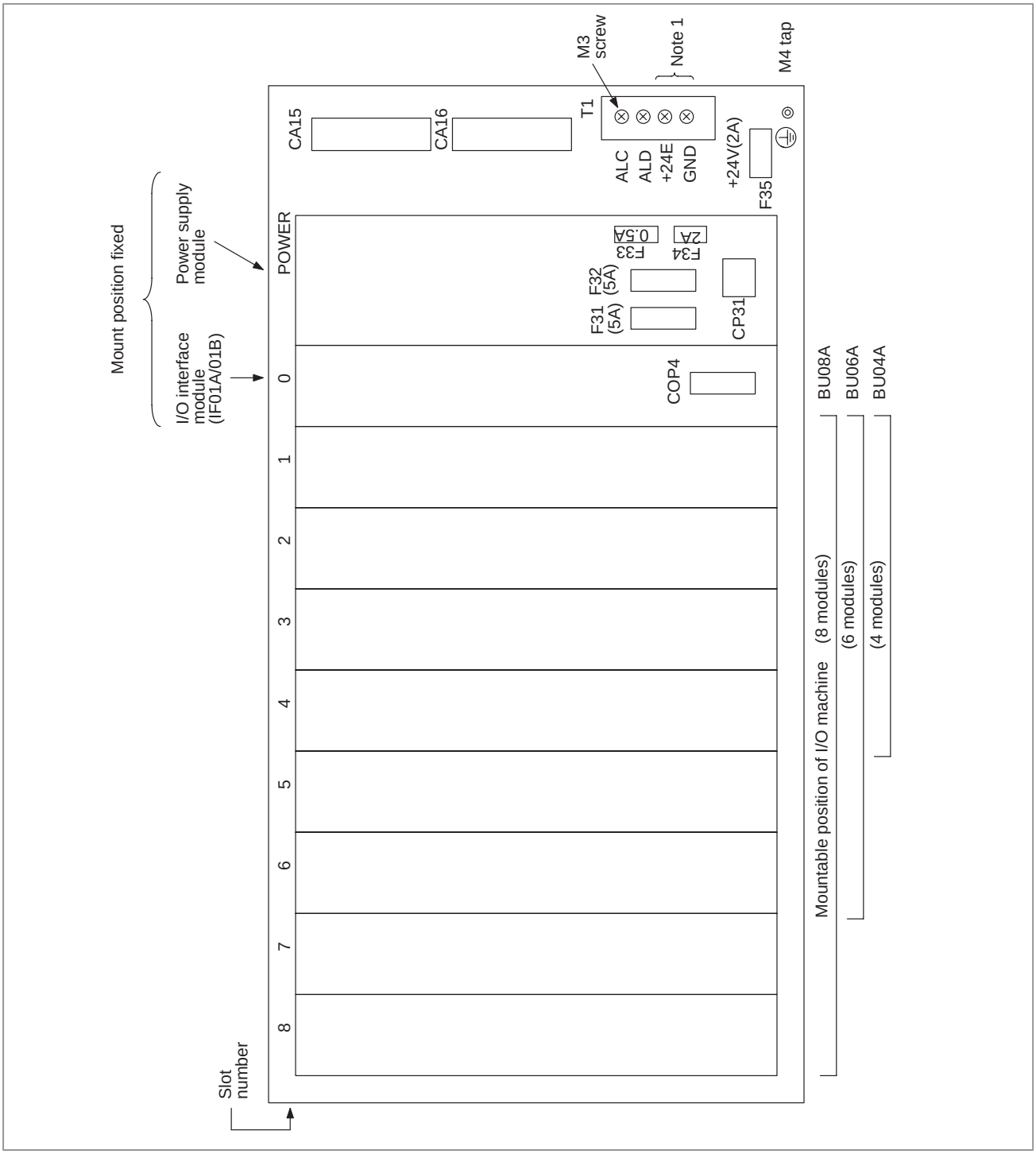
The limit of voltage A is normally 12, but when not using the input modules ID64A/B, 32A/B, 16A/B, 08A/B the limit will become 15. (In this case the +24E output from the I/O base unit cannot be used.)

- Mount position of the two modules at the right are fixed.
- Optional I/O modules can be mounted on mount positions 1 to 10.
- The I/O interface module (IF04C) can be mounted on any mount position 1 to 10.



NOTE
When using a non–insular type input module, use these terminal to supply power to the external contacts. Be careful not to connect short with the +24E of other base units.

- Mount position of the two modules at the right are fixed.
- Optional I/O modules can be mounted on mount positions 1 to 8.
- The I/O interface module (IF04C) can be mounted on optional position of mount positions 1 to 8.



NOTE
When using a non–insular type input module, use these terminal to supply power to the external contacts. Be careful not to connect short with the +24E of other base units.

H.2.2 Types of I/O Modules

The I/O unit offers abundant I/O modules so that optional systems can be constructed according to the machine tool specifications.

- **Digital input module**

Input form	Module name	Specification			Points (bytes)	External connection terminal	LED input display
		Rated voltage	Rated current	Response time			
Non–insulated DC input	ID08A	24VDC	7.5mA	20mS	8(1)	Terminal board	Provided
	ID16A				16(2)	Terminal board	Provided
	ID32A				32(4)	One connector	None
	ID64A				64(8)	Two connectors	None
	ID08B			2mS	8(1)	Terminal board	Provided
	ID16B				16(2)	Terminal board	Provided
	ID32B				32(4)	One connector	None
	ID64B				64(8)	Two connectors	None
Insulated DC input	ID08C	24VDC	9mA	20mS	8(1)	Terminal board	Provided
	ID16C				16(2)	Terminal board	Provided
	ID32C				32(4)	One connector	None
	ID64C				64(8)	Two connectors	None
	ID08D			2mS	8(1)	Terminal board	Provided
	ID16D				16(2)	Terminal board	Provided
	ID32D				32(4)	One connector	None
	ID64D				64(8)	Two connectors	None
AC input	IA08E	100V to 120VAC	9mA	50mS	8(1)	Terminal board	Provided
	IE16E				16(2)	Terminal board	Provided

● Digital output module

Output form	Module name	Specification			Points (bytes)	External connection terminal	LED input display	Fuse
		Rated voltage	Rated current	Response time				
Non–insulated DC input	OD32A	24V to 48VDC	0.125A	0.2mS	32(4)	One connector	None	None
	OD64A				64(8)	Two connectors	None	None
Polarity non–contact DC output	OD08B	24V to 48VDC	0.5A	0.3mS	8(1)	Terminal board	Provided	Provided
	OD16B				16(2)	Terminal board	Provided	Provided
	OD32B		0.25A		32(4)	One connector	None	None
	OD64B				64(8)	Two connectors	None	None
	OD08C		2A	0.4mS	8(1)	Terminal board	Provided	Provided
	OD16C				16(2)	Terminal board	Provided	Provided
AC output	OA08D	100V to 120VAC	1.6A	1/2 cycles	8(1)	Terminal board	Provided	Provided
	OA16D				16(2)	Terminal board	Provided	Provided
	OA08E	200V to 240VAC	1.6A	1/2 cycles	8(1)	Terminal board	Provided	Provided
	OA16E				16(2)	Terminal board	Provided	Provided

● Analog input/output module

Type	Module name	Specification			Analog input/ output points	Occupying input/output points (bytes)	External connection terminal
		Analog signal range	Resolu-tion	General accuracy			
Analog input module	AD04A	–10 to +10VDC –20 to +20mADC	12 bit	0.5%	4 inputs	64 input points (8 bytes)	Terminal board
Analog output module	DA02A	–10 to +10VDC 0 to +20mADC	12 bit	0.5%	2 outputs	32 input points (4 bytes)	Terminal board
	DA03A				3 inputs	48 input points (6 bytes)	Terminal board

H.2.3 Module Addresses

Address of the modules in the sequence program must be decided by machine tool builder. Set the memory using the PMC–M programmer. The address information set in the programmer must also be written when writing the sequence program in the EPROM.
After written in the EPROM, the I/O addresses cannot be changed. Elements to decide this address are, connection position of the I/O unit (group number and base number), position of the modules (slot number) mounted on the I/O unit, and the names of the modules.

- **Group number**

As described in section H.2.1, I/O unit can be extended up to four units using additional I/O interface modules IF01As with the I/O interface module IF01A as its base. Up to four I/O units extended from one IF01A are called groups. If a single group cannot accommodate the necessary I/O modules, or when multiple I/O base units are dispersed somewhere away from the machine tool connected with optical fiber cables, the I/O interface module IF04C can be used to branch the optical fiber cable connecting the NC and the I/O units. Thus, maximum 4 I/O unit groups can be connected. When IF04C is not used, the group number of the I/O unit is 0. When using the IF04C, the group connected to the optical connector COP2A is group number 0, COP2B group number 1 COP2C group number 2, COP2D group number 3. (See Fig. H.2.1 (a).)

- **Base number**

The maximum 4 I/O base units are in one group. The I/O unit mounted with I/O interface module IF01A is base number 0, and the other units are numbered base #1, base #2, base #3 as it goes away from base #0.

- **Slot number**

Maximum 4 (BU04A), 6 (BU06A), 8 (BU08A), 10 (BU10A) I/O modules can be mounted on one I/O base unit, according to the type of I/O base units. The mount position of the modules on the I/O base unit is expressed with slot numbers. The mount position of the I/O interface module is numbered 0, and the others are numbered 1, 2, 3 ..... form the right in order. the I/O modules can be mounted on optional slots. It is also not necessary to mount the slots in right order without space. See Fig. H.2.1 (b) and Fig. H.2.1 (c).

- **Module name**

See Section H.2.2 and Table H.2.1 for module names.

- **How to set address to each module**

The character and the mount position of each module is now decided with the group number, base number, slot number, and module name, so the address of each module can now be decided, corresponding these data and the input/output addresses. After display the I/O unit address screen as shown below on the PMC–M programmer's CRT, set necessary data on the screen. the module address is now decided. The occupying DI/DO points (bytes) of each module are stored in the PMC–I programmer, so just decide the address of the head byte of each module, and the addresses of the other bytes in the module are automatically decided by the programmer.

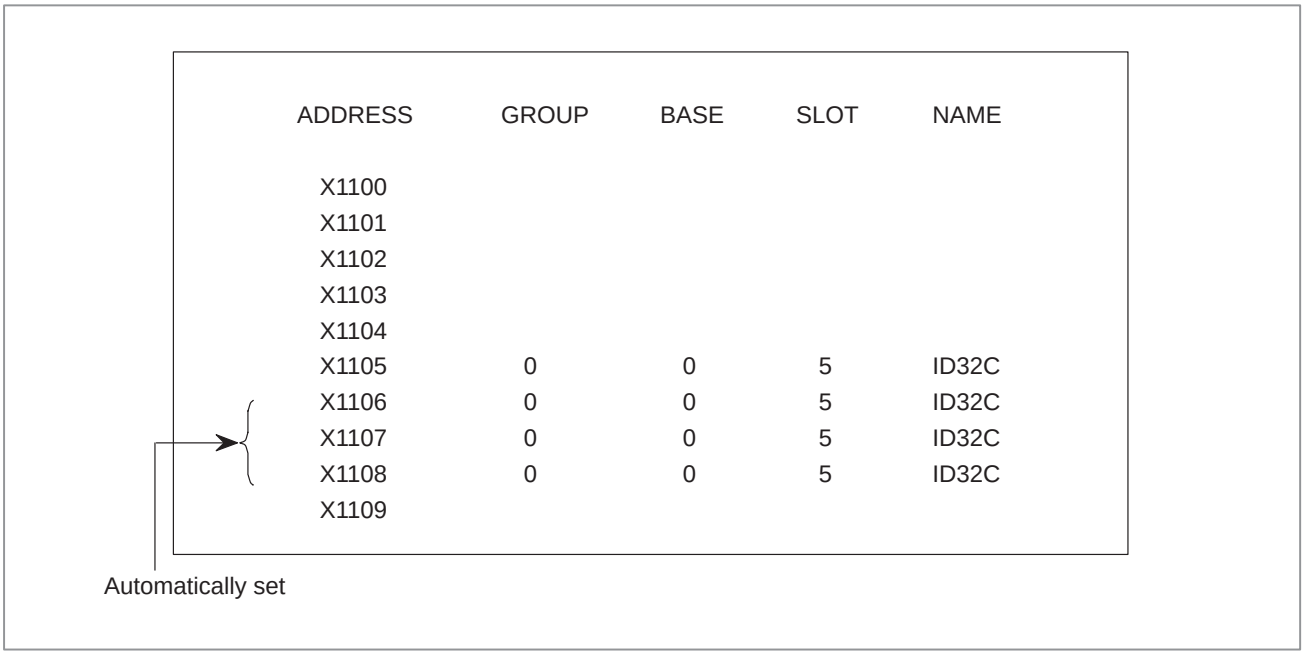
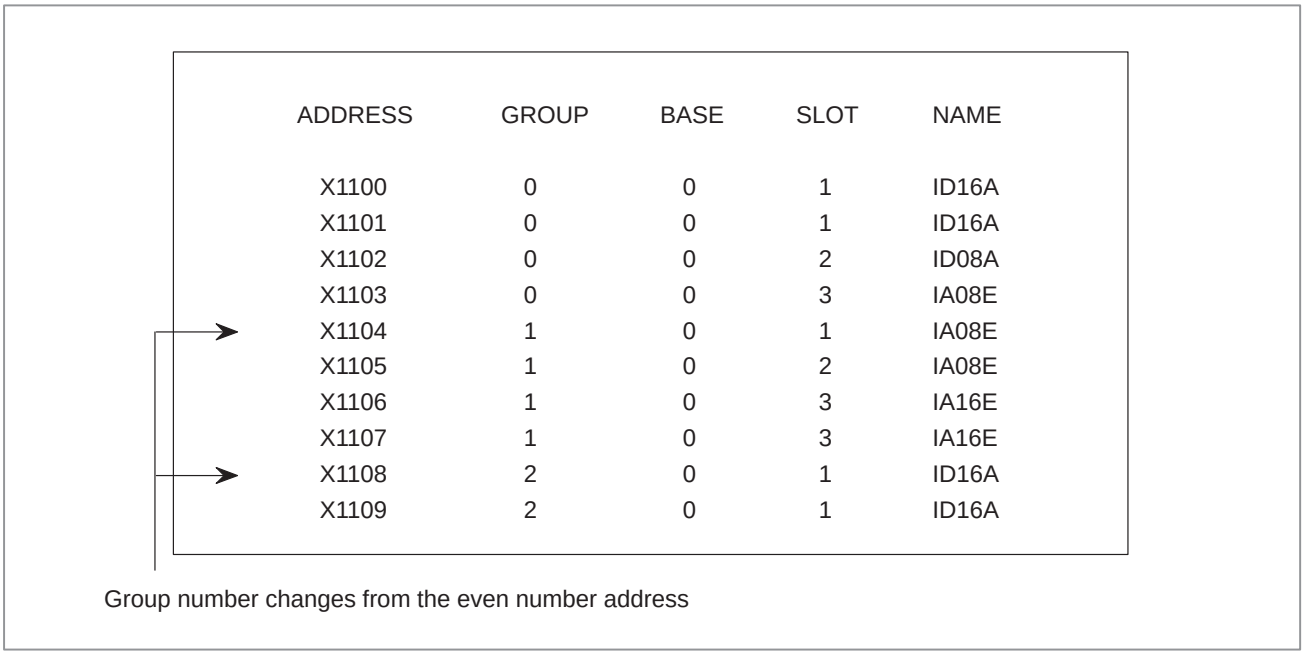


Fig. H.2.3 I/O unit address screen

For instance, when the module ID32C is assigned address X5 as in Fig. H.2.3, the necessary 4 bytes are automatically secured. For details on operation, see PMC–M programming manual. The input/output addresses of each module can be freely decided in this method at the machine tool builder, so the address can be decided when making the ladder diagram, as long as it does not duplicate with the addresses of each module.

- **Notes when setting addresses**

- When assigning I/O modules of different group number to the input/output addresses in series, using the I/O interface module IP04C, the address where the group number changes, must be an even number address.



- The head bytes of the analog input module (AD04A) and analog output module (DA02A, 03A) must be assigned to even number addresses of input address (X □□□), and output address (Y □□□) each.When reading the A/D–converted digital value from the input address (X □□□), or wen writing the D/A–converting value to the output address (Y □□□), readout and write–in must always be done in word (16 bits) units.

H.2.4
Digital Input Module

(1) Specifications Digital input module specifications are shown at Table H.2.4 (a) – (c).

Table H.2.4 (a) DC input specifications (non–insulation type)

Item \ Module		ID08A/B	ID16A/B	ID32A/B	ID64A/B
Points/module		8	16	32	64
Rated input voltage		24VDC			
Max. input voltage		30VDC			
Operation voltage (Note 1)	ON	18V or more			
	OFF	6V or less			
Operation current (Note 1)	ON	6mA or more			
	OFF	1.5mA or less			
Input current		Approx.7.5mA			
Input impedance		Approx. 3.3kΩ			
Response time (Note 2)	OFF→ON	IDxxA : 20mS max / IDxxB : 2mS max			
	ON→OFF	IDxxA : 20mS max / IDxxB : 2mS max			
Operation display		LED lights when input is ON.		None	
Eternal connection method		Terminal board (M3)		Connector	
Common points (Note 3)		1 common per 4 points input		2 commons per 8 points	
Dielectric strength		Non–insulation type input			

NOTE
1 When voltage between input terminal and common terminal is 18V or more, or when current flowing into input terminal is 6 mA or more, the input signal (contact point) is regarded as ON. When input terminal voltage is 6V or less, or when input current is 1.5 mA or less, input signal (contact point) is regarded as OFF.
When using proximity switches or photo electric switches, be careful of current leakage when contact point is off. In case current leakage is 1.5 mA or more, it will not be regarded as OFF.
2 Response times shown here is the delay time from module input to output. The actual response time is the above value plus the scanning time which is different in each system configuration.
3 The commons are not connected in the module.
4 This module is a non–insular type, so the 24 VDC applied to the external contact point is provided from the I/O unit. However, as only 1.2 A or less can be externally supplied, maximum contact points per one I/O unit which can be set ON, is limited to 140 points (when calculated with the worst value of contact point current).

Table H.2.4 (b) DC input specifications (insulation type)

Item \ Module		ID08C/D	ID16C/D	ID32C/D	ID64C/D
Points/module		8	16	32	64
Rated input voltage		24VDC			
Max. input voltage		30VDC			
Operation voltage (Note 1)	ON	15V or more			
	OFF	8V or less			
Response time (Note 2)	ON	4.5mA or more			
	OFF	2mA ore less			
Input current		9mA or less			
Input impedance		Approx. 2.2kΩ			
Response time (Note 2)	OFF→ON	IDxxC : 20mS max / IDxxD : 2mS max			
	ON→OFF	IDxxC : 20mS max / IDxxD : 2mS max			
Operation display		LED lights when input is ON.		None	
External connection method		Terminal board (M3)		Connector	
Common points (Note 3)		1 common per 4 points input		2 commons per 8 points	
Dielectric strength		1 minute under 100 VAC			

NOTE

1 When voltage between input terminal and common terminal is 15V or more, or when current flowing into input terminal is 4.5 mA or more, the input signal (contact point) is regarded as ON. When input terminal voltage is 8V or less, or when input current is 2 mA or less, input signal (contact point) is regarded as OFF.
When using proximity switches or photo–electric switches, be careful of current leakage when contact point is off. In case current leakage is 2 mA or more, it will not be regarded as OFF.

2 Response time shown here is the delay time from module input to output. The actual response time is the above value plus the scanning time which is different in each system configuration.

3 The commons are not connected to each other in the module.

Table H.2.4 (c) AC input specifications

Item \ Module		IA08E	IA16E
Points/module		8	16
Rated input voltage		100~120VAC, 50/60Hz	
Max. input voltage		140VAC	
Operation voltage (Note 1)	ON	70V or more	
	OFF	20V or less	
Operation current (Note 1)	ON	5mA or more	
	OFF	2mA or less	
Input current		9mA type (100VDC)	
Input impedance		Approx. 12.5kΩ	
Response time (Note2)	OFF→ON	50mS max	
	ON→OFF	50mS max	
Operation display		LED lights when input is ON.	
External connection method		Terminal board (M3)	
Common points (Note 3)		1 common per 4 points input	
Dielectric strength		1 minute under 100 VAC	

NOTE

1 When voltage between input terminal and common terminal is 70V or more, or when current flowing into input terminal is 5 mA or more, the input signal (contact point) is regarded as ON. When input terminal voltage is 20V or less, or when input current is 2 mA or less, input signal (contact point) is regarded as OFF.
When using proximity switches or photo electric switches, be careful of current leakage when contact point is off. In case current leakage is 2 mA or more, it will not be regarded as OFF.

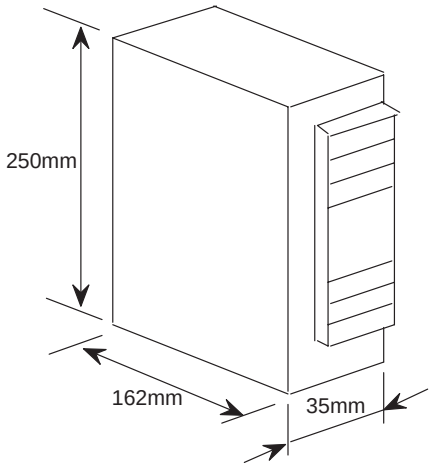
2 Response times shown here is the delay time from module input to output. The actual response time is the above value plus the scanning time which is different in each system configuration.

3 Commons are not connected in the module.

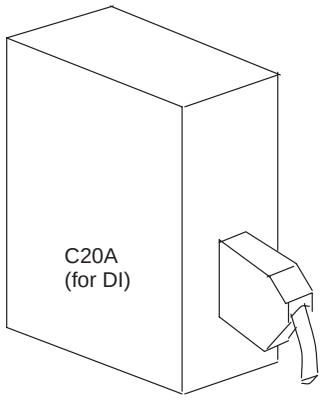
- **Connection with the digital input module**

(1) Outer view of the digital input module

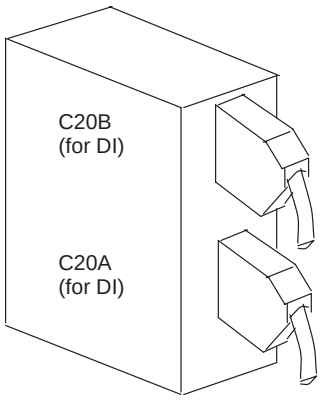
The digital input module is housed in a plastic case. It has three types according to the connection method of the signal cable.



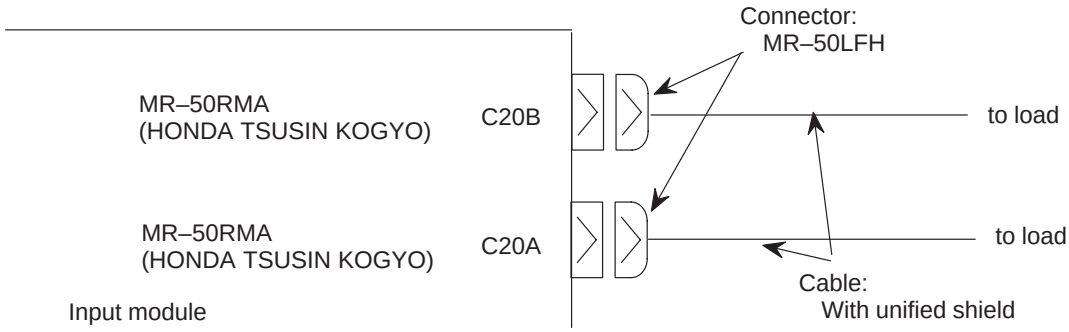
(i) Terminal board type
ID08A/B, ID16A/B
ID08C/D, ID16C/D
IA08E, IA16E



(ii) Single connector type
ID32A/B
ID32C/D



(iii) Double connectors type
ID64A/B
ID64C/D

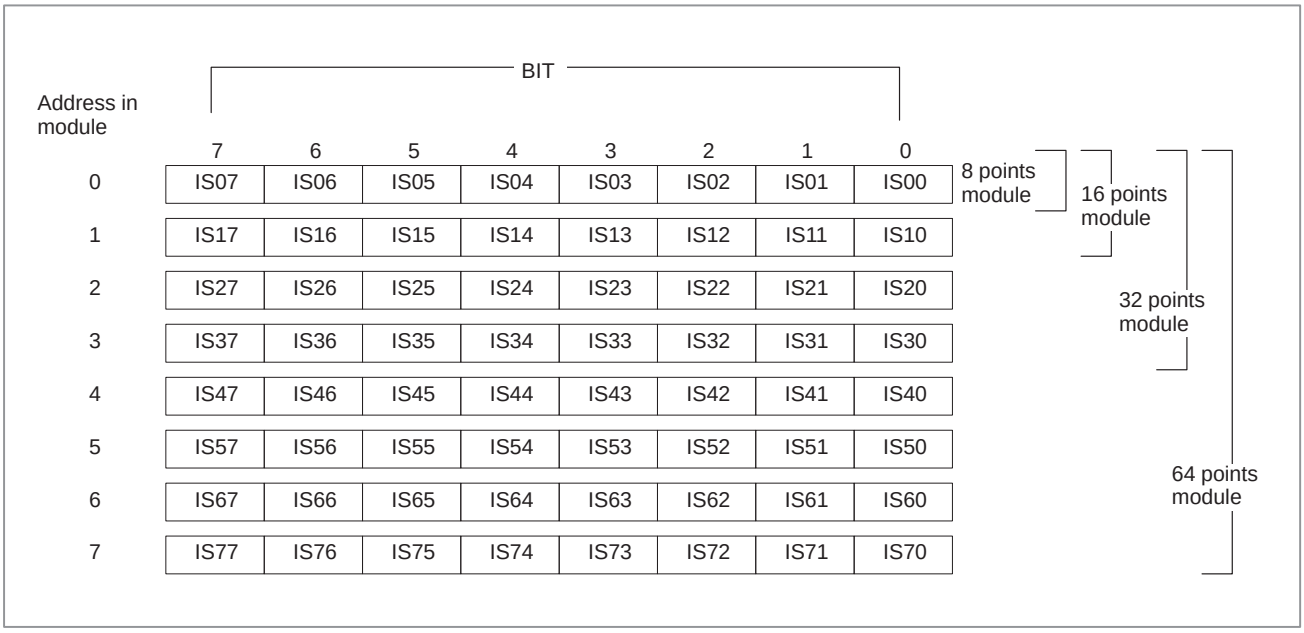


The connection cables to the connector and load used in the above type (ii) and (iii) are described in details in the above figure. When working with the shield wire, fasten the shield casing to the ground plate with metal fitting.

The terminal board in the above figure (i), can freely be mounted/ dismounted , so it is not necessary to remove the wiring when exchanging the module.

(2) Correspondence of the input signals and the addresses in the module

The following figure shows the correspondence of the input signals of the digital input module and the addresses in the module and the bits. The address in module are relative address taken in each module, and the head address of the module is “0”. The actual address in the sequence program is decided as in the section H.2.3 (Module address) by setting the correspondence of the module and the input/output address. The input signal to PC–I is “1” when the contact connected to the digital input module is ON, and “0” when OFF. In the non–insulated type DC input module (IDxxA, IDxxB), it is “1” when ON and “0” when off, without relations to the polarity of the common.



Connection drawing of the digital input module

Fig. H.2.4 (a):
Connecting drawing of ID08A, ID16A, ID08B, ID16B

Fig. H.2.4 (b)–(e):
Connecting drawing of ID32A, ID64A, ID32B, ID64B

Fig. H.2.4 (f):
Connecting drawing of ID08C, ID16C, ID08D, ID16D

Fig. H.2.4 (g)–(j):
Connecting drawing of ID32C, ID64C, ID32D, ID64D

Fig. H.2.4 (k):
Connecting drawing of IA08E, IA16E

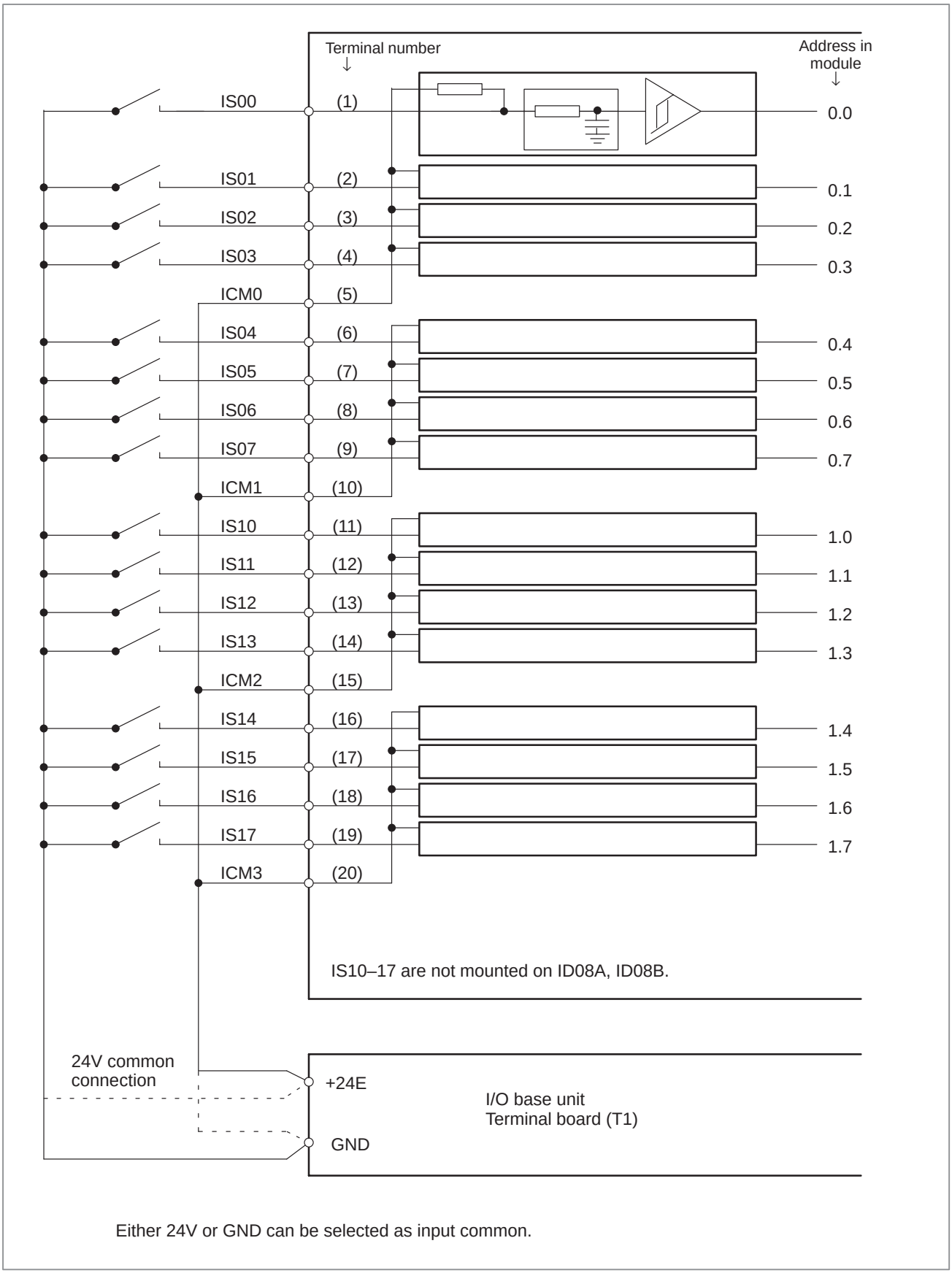


Fig. H.2.4 (a) Input module ID16A, ID08A, ID16B, ID08B

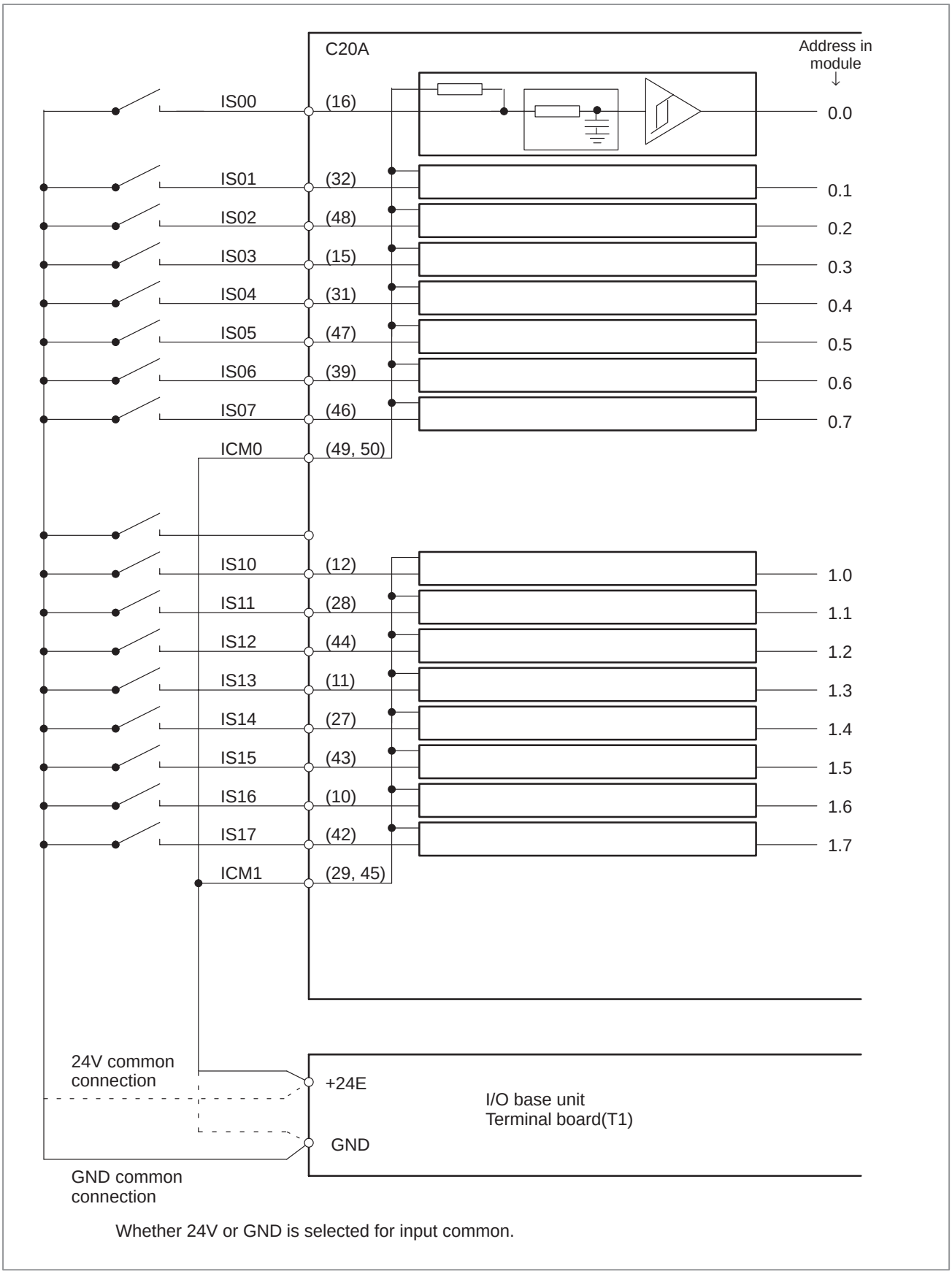


Fig. H.2.4 (b) Input module ID64A, ID32A, ID64B, ID32B (1)

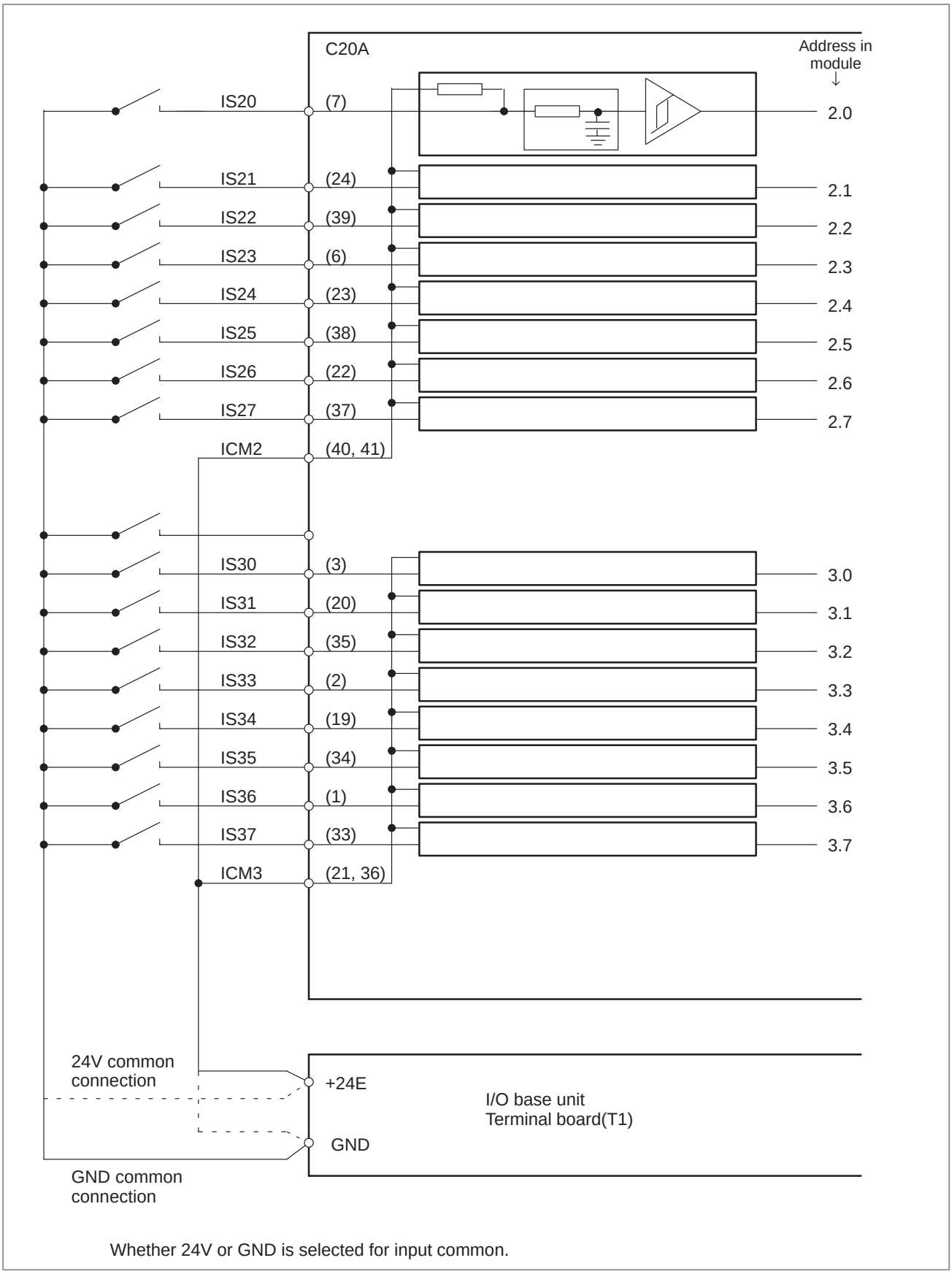


Fig. H.2.4 (c) Input module ID64A, ID32A, ID64B, ID32B (2)

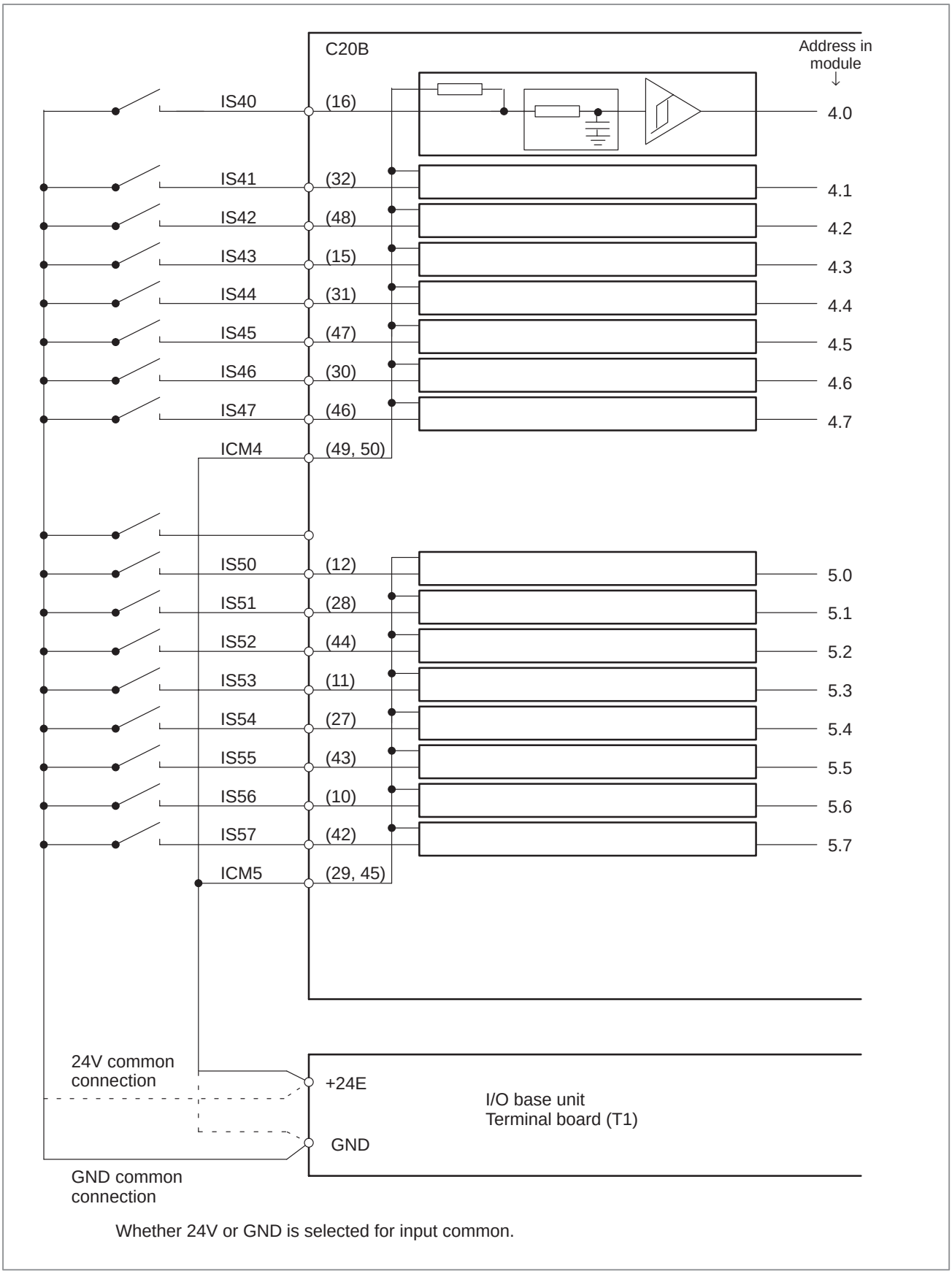


Fig. H.2.4 (d) Input module ID64A, ID64B (3)

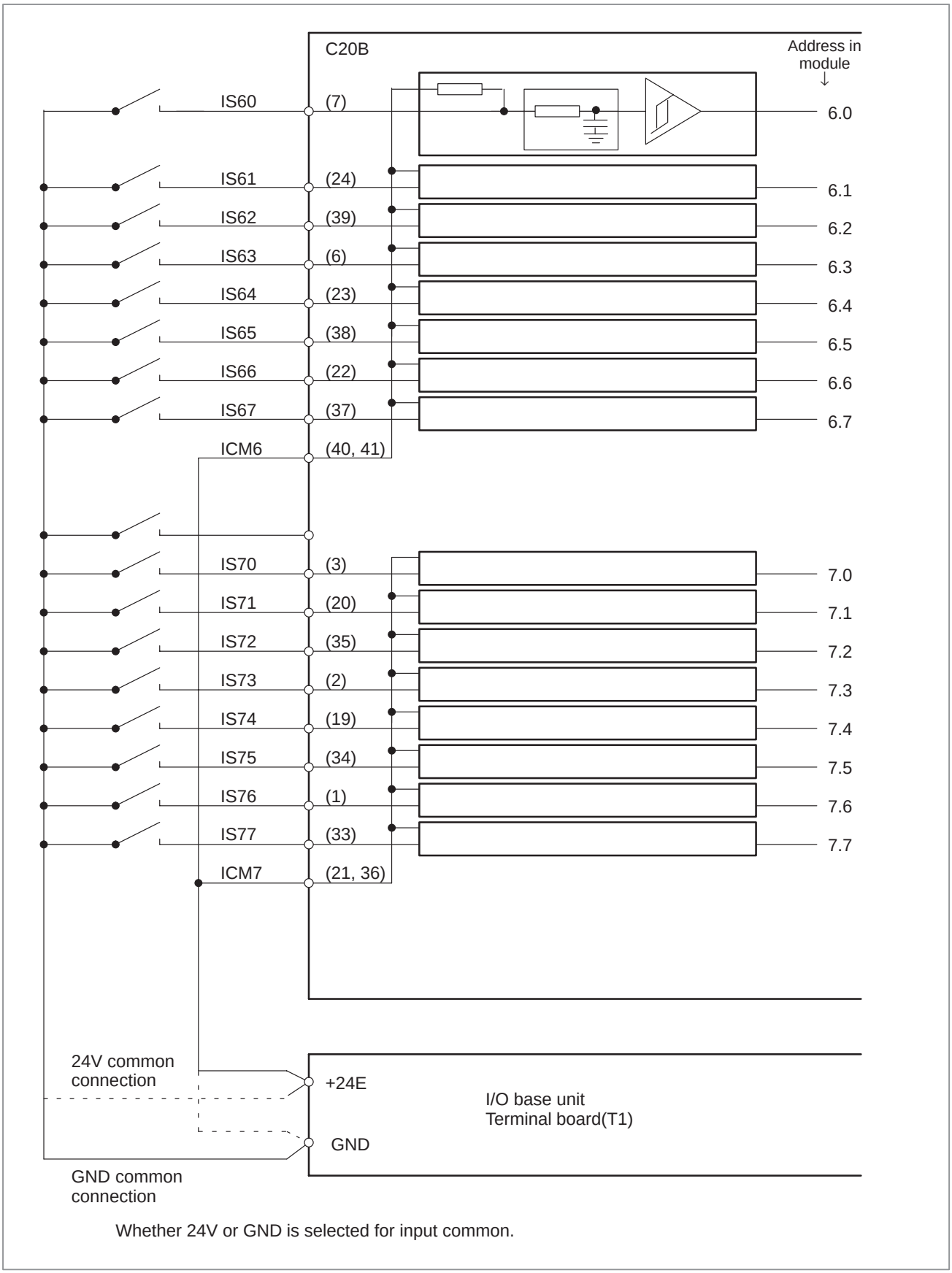


Fig. H.2.4 (e) Input module ID64A, ID64B (4)

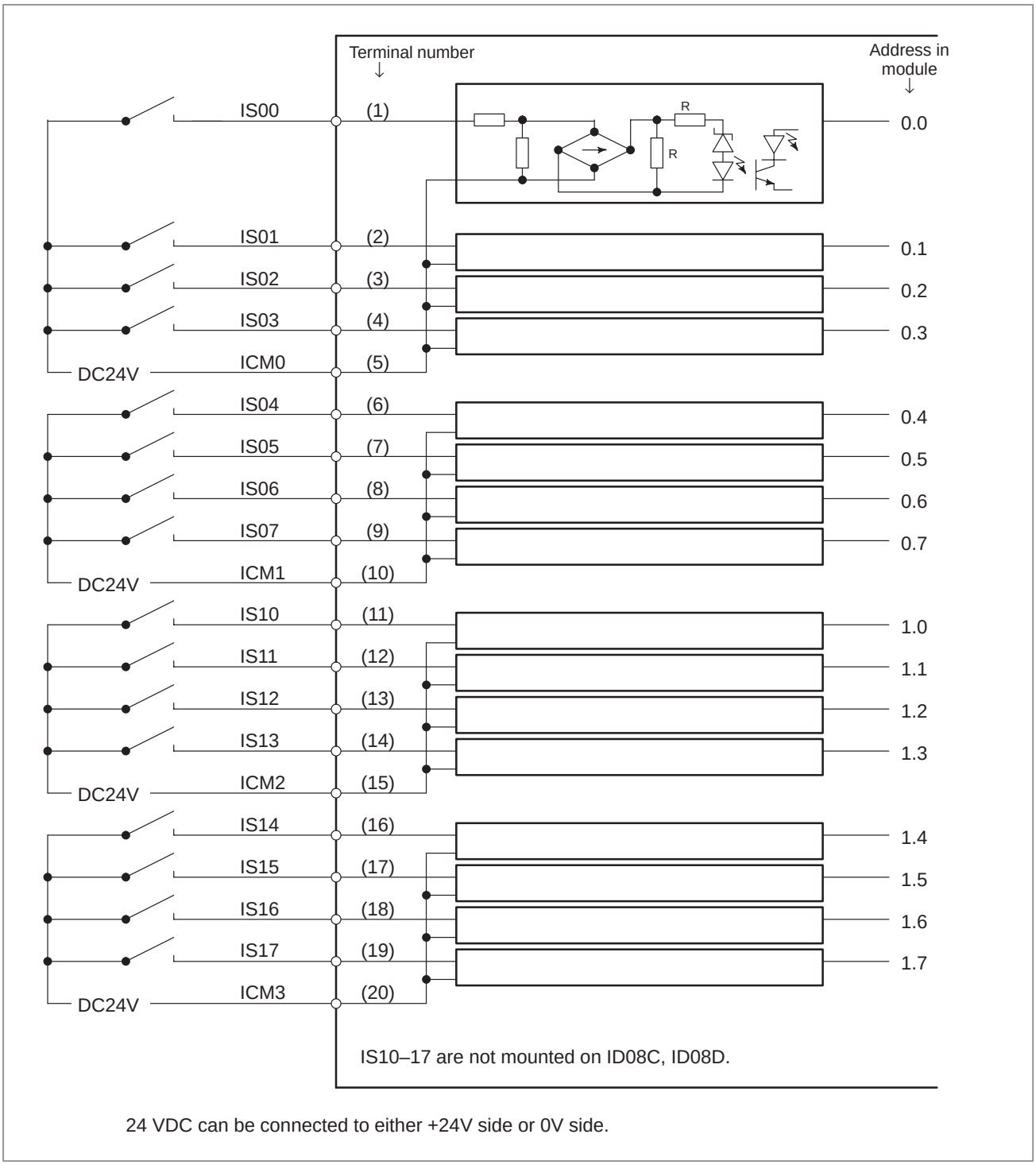
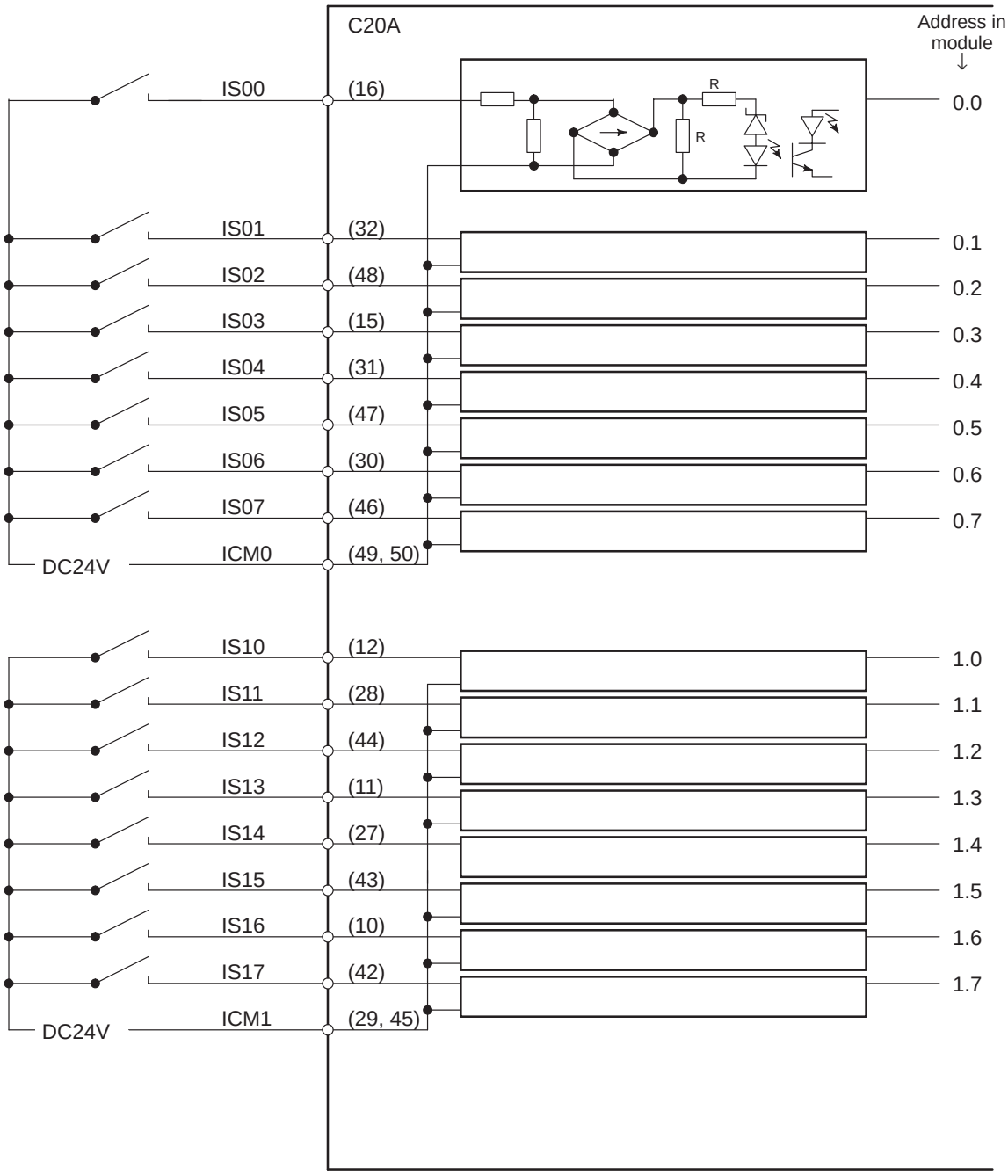


Fig. H.2.4 (f) Input module ID16C, ID08C, ID16D, ID08D



24VDC can be connected to either +24V side or 0V side.

Fig. H.2.4 (g) Input module ID64C, ID32C, ID64D, ID32D (1)

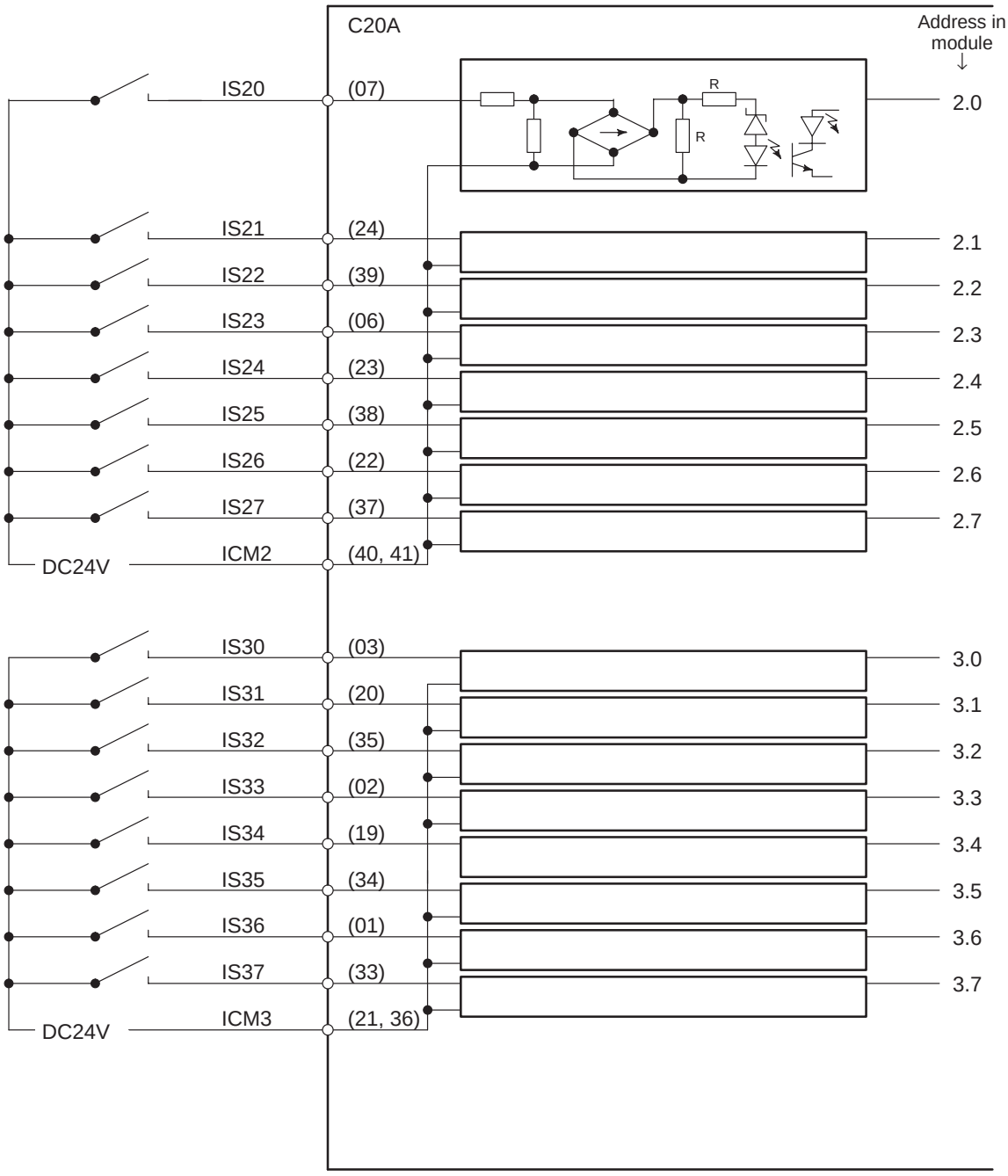
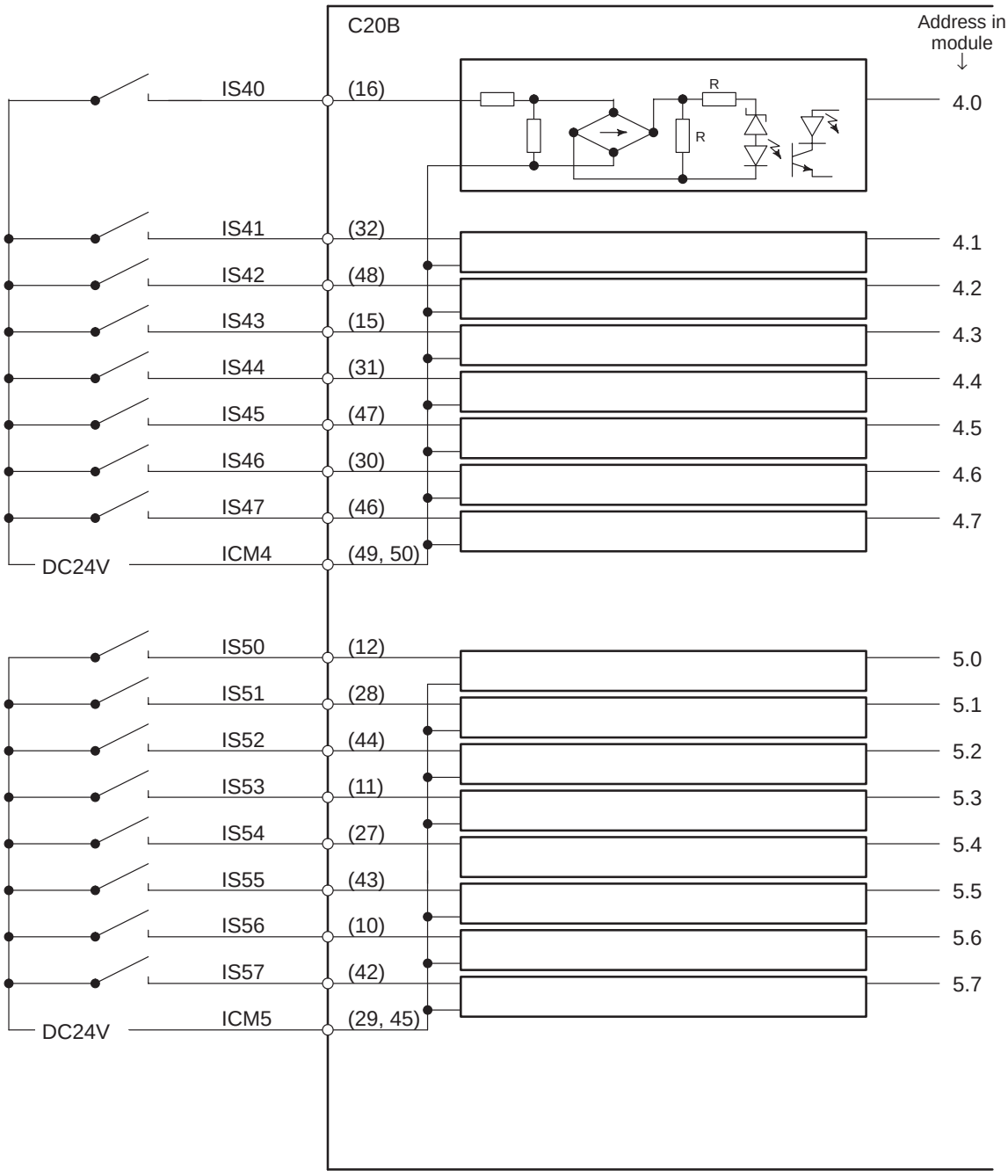


Fig. H.2.4 (h) Input module ID64C, ID32C, ID64D, ID32D (2)



24 VDC can be connected to either +24V side or 0V side.

Fig. H.2.4 (i) Input module ID64C, ID64D (3)

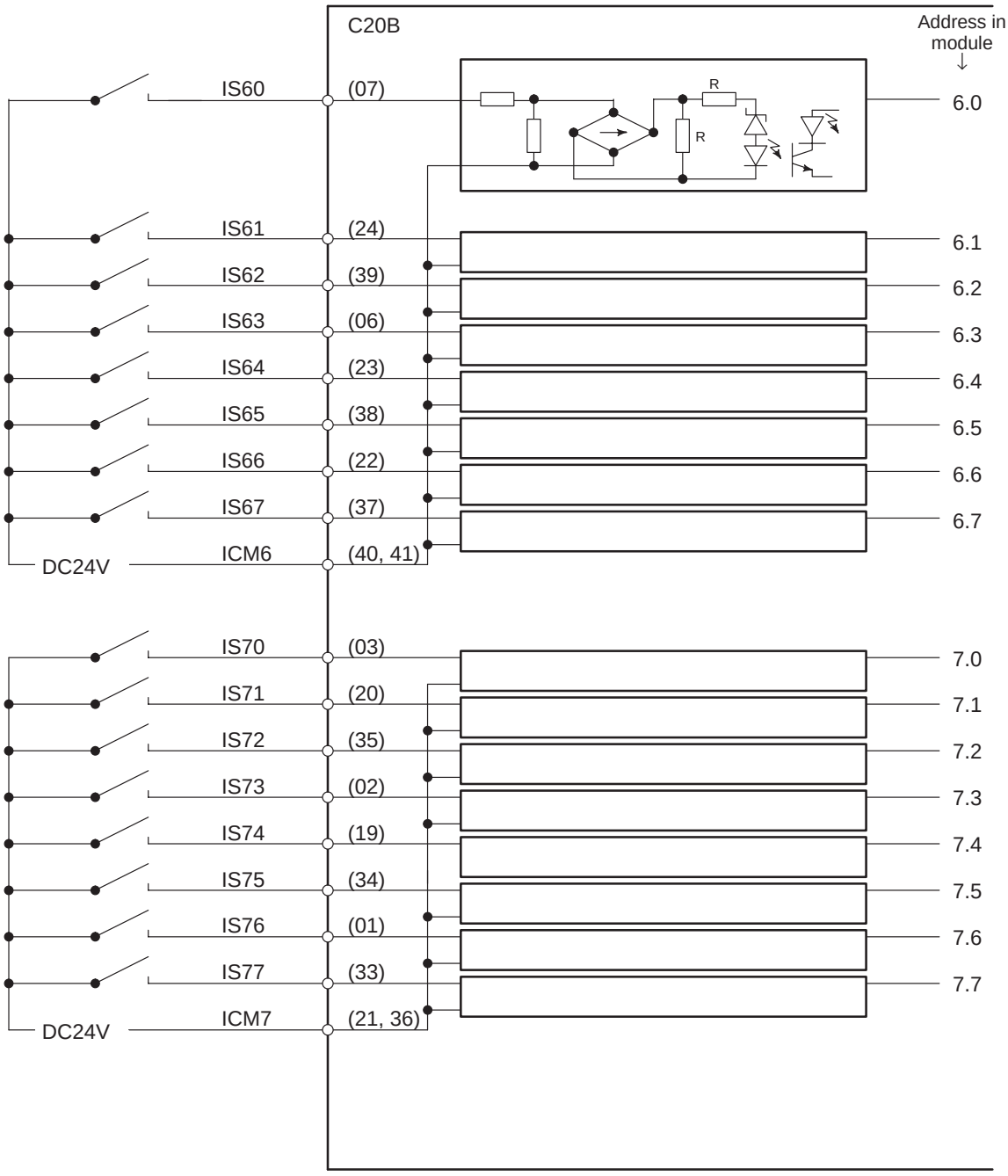


Fig. H.2.4 (j) Input module ID64C, ID64D (4)

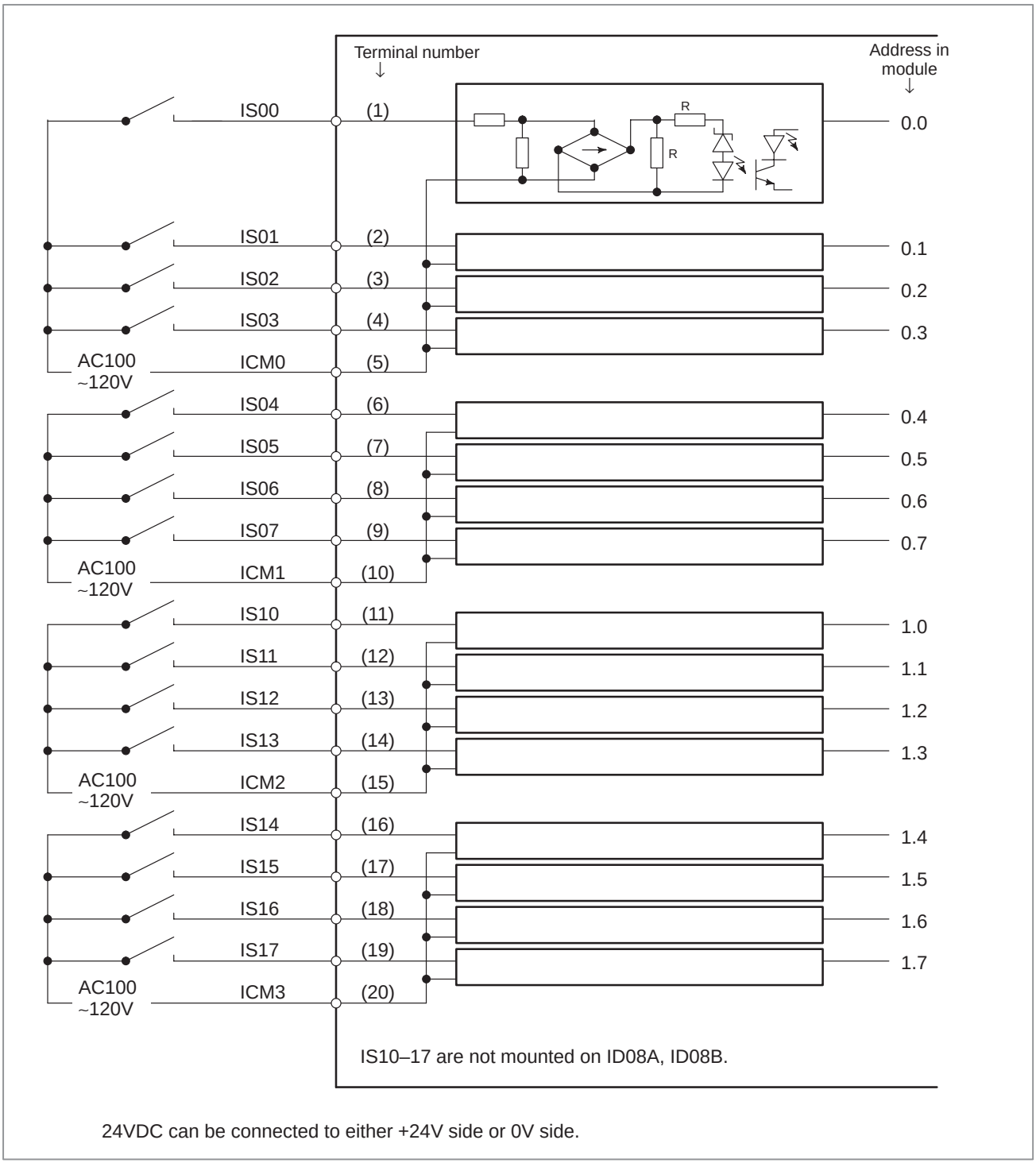


Fig. H.2.4 (k) Input module IA16E, IA08E

H.2.5
Digital Output Module

- **Specification** Digital input module specifications are shown at Table H.2.5 (a) – (e).

Table H.2.5 (a) DC output specifications (polarized non–contact type)

Item \ Module		OD32A	OD64A
Points/module		32	64
Rated output voltage		24 – 48 VDC	
Rated output voltage range		50 VDC or less (Note 1)	
Max. output current	Per point	0.125A	
	Per common	0.5A	
	Total	4A	8A
Surge–on current		—	
Output voltage fall at ON (Note 3)		0.75V max	
Current leakage at OFF		0.1mA max	
Response time (Note 2)	OFF→ON	0.2mS max (Resistance load)	
	ON→OFF	0.2mS max (Resistance load)	
Operation display		None	
External connection method		Connectors	
Common points		2 commons per 8 points output	
Fuse		None	
Polarity		None	
Dielectric strength		100 VAC, 1 min.	

CAUTION

In case of connecting inductive loads (like relays) to the output, do not fail to connect a diode to both sides of the load.

In case of connecting a lamp load, insert dark lightening resistances in parallel between the output terminals to decrease current flow to within the standard.

NOTE

1 There is no lower limit in output voltage for the output operation.

2 Respoinse time shown here is the delay time from module input to output. The actual response time is the above value plus the scanning time which is different to each system configuration.

3 The output voltage drop at power ON depends on a load current. It is represented by following equation.

Vsat = 6 $\times$ I_L (Vsat : Output voltage drop I_L : Load current)

Table H.2.5 (b) DC output specifications (polarized non–contact type)

Item \ Module		OD08B	OD16B	OD32B	OD64B
Points/module		8	16	32	64
Rated output voltage		24 –48 VDC			
Output voltage range		50 VDC or less (Note 1)			
Max. output current	Per point	0.5A		0.25A	
	Per common	2A		1A	
	Total	4A	8A	8A	16A
Surge–on current		—			
Output voltage fall at ON		1V max		0.5V max	
Current leakage at OFF		0.1mA max			
Response time (Note 2)	OFF→ON	0.2mS max (Resistance load)			
	ON→OFF	0.2mS max (Resistance load)			
Operation display		LED lights when output is ON.		None	
External connection method		Terminal board (M3)		Connectors	
Common points		1 common per 4 points output		2 commons per 8 points output	
Fuse (Note 3)		3.2A/common		None	
Polarity		Exists (the common is the “–” side)			
Dielectric strength		100 VAC, 1 min.			

CAUTION

1 The commons are mutually connected in the modules of types OD08B and OD16B, but load current cannot be sent in the internal pattern. The common must always be connected to the minus side (0V) of the load current.
2 In case of connecting inductive loads (like relays) to the output, do not fail to connect a diode to both sides of the load.
In case of connecting a lamp load, insert dark lightening resistances in parallel between the output terminals to decrease current flow to within the standard.

NOTE

1 There is no lower limit in output voltage for the output operation, but the operation display LED of the modules with operation display will become dark if the output voltage is 24 VDC or less.
2 Response time shown here is the delay time from module input to output. The actual response time is the above value plus the scanning time which is different to each system configuration.
3 Fuse are inserted to each common. The red LED at the bottom of the module front will light if any of the fuse breaks.

Table H.2.5 (c) DC output specifications (polarized non–contact type)

Item \ Module		OD08C	OD16C
Points/module		8	16
Rated output voltage		24–48 VDC	
Output voltage range		50 VDC or less (Note 1)	
Max. output current	Per point	2A	
	Per common	4A (Note 4)	
	Total	8A	16A
Surge–on current		—	
Output voltage fall at ON (Note 5)		1.0V max	
Current leakage at OFF		0.5mA max	
Response time (Note 2)	OFF→ON	0.4mS max (Resistance load)	
	ON→OFF	0.4mS max (Resistance load)	
Operated display		LED lights when Output is ON.	
External connection method		Terminal board connectors (M3)	
Common points		1 common per 4 points output	
Fuse (Note 3)		None	
Polarity		Exists (the common is the “–” side)	
Dielectric strength		100 VAC, 1 min.	

CAUTION

1 The commons are mutually connected in the modules, but load current cannot be sent in the internal pattern. The common must always be connected to the minus side (0V) of the load current.
2 In case of connecting inductive loads (like relays) to the output, do not fail to connect a diode to both sides of the load.
In case of connecting a lamp load, insert dark lightening resistances in parallel between the output terminals to decrease current flow to within the standard.

NOTE

1 There is no lower limit in output voltage for the output operation, but the operation display LED will become dark if the output voltage is 24 VDC or less.
2 Response time shown here is the delay time from module input to output. The actual response time is the above value plus the scanning time which is different to each system configuration.
3 A fuse is inserted between the following two points of outputs.
(00, 01) (02, 03) (04, 05) (06, 07)
(10, 11) (12, 13) (14, 15) (16, 17)
4 The output current is limited to 2A per above fuse (group of two points).
5 The output voltage drop at power ON depends on a load current. It is represented by following equation.
Vsat = 2 $\times$ I_L (Vsat : Output voltage drom I_L : Load current)

Table H.2.5 (d) DC output specifications (polarized non–contact type)

Item \ Module		OD08D	OD16D
Points/module		8 outputs	16 outputs
Rated output voltage		100-120VAC, 50/60Hz	
Output voltage range		85-132VAC	
Maximum output current	Per point	1.6A	
	Per common	3.2A (Note 3)	
	Total	6.4A	12.8A
Surge–on current		10A (1 cycle)	
Output voltage fall at ON		1.5V max	
Current leakage at OFF		1.5mA max	
Response time (Note 1)	OFF→ON	0.2mS max	
	ON→OFF	1/2 cycle max	
Operation display		LED lights when outputs is turned on.	
External connection method		Terminal bord connectors (M3)	
No. of common points		1 common/4 outputs	
Fuse (Note 2)		6.3A/common	
Polarity		None	
Dielectric strength		1500VAC, 1min	

CAUTION

1 The common lines are interconnected inside the module. However, no load current is applicable to internal patterns. Connect each common to one end of the load power supply without fail.
2 In case of connecting inductive loads (like relays) to the output, do not fail to connect a diode to both side of the load.
In case of connecting a lamp load, insert dark lightening resistances in parallel between the output teminal to decrease current flow to within the standard.
3 It shows maximum of surge–on current which can be sent to one fuse. When plural loads are turned to ON at the same time, total surge–on current which sends to one fuse should be under the above value.

NOTE

1 The response time shows a delay time from an input to an output of the module. Actual response time is obtained by adding the scan time determined by the system configuration to the value shown in the above table.
2 A fuse is inserted every common line. If one of these fuses is blown out, the red LED lights at the bottom part of the front panel of the module.
3 In addition to the above limitation, the output current is limited to 1.6A every 2–output group shown below.
(00, 01) (02, 03) (04, 05) (06, 07)
(10, 11) (12, 13) (14, 15) (16, 17)
Example, during the load current is sent to output [00], the load current cannot be sent to output [01].

Table H.2.5 (e) DC output specifications (polarized non–contact type)

Item \ Module		OA08E	OA16E
Points/module		8 outputs	16 outputs
Rated output voltage		200 - 240VAC, 50/60Hz	
Output voltage range		160 - 264VAC	
Maximum output current	Per point	1.6A	
	Per common	3.2A (Note 3)	
	Total	6.4A	12.8A
Surge–on current		10A (1 cycle)	
Output voltage drop at turn–on		1.5V max.	
Current leakage at OFF		3 mA max.	
Response time (Note 1)	OFF→ON	0.2mS max.	
	ON→OFF	1/2 cycle max.	
Operation display		LED lights when output is turned on.	
External connection method		Terminal board connectors (M3)	
No. of common points		1 common/4 outputs	
Fuse (Note 2)		3.2A × 2 pcs/common	
Polarity		None	
Dielectric strength		1500V AC, 1 min.	

CAUTION

1 The common lines are interconnected inside the module. However, no load current is applicable to internal patterns. Connect each common to one end of the load power supply without fail.
2 In case of connecting inductive loads (like relays) to the output, do not fail to connect a diode to both side of the load.
In case of connecting a lamp load, insert dark lightening resistances in paralle between the output terminals to decrease current flow to within the standard.
3 It shows maximum of surge–on current which can be sent to one fuse. When plural loads are turned to ON at the same time, total surge–on current which sends to one fuse should be under the above value.

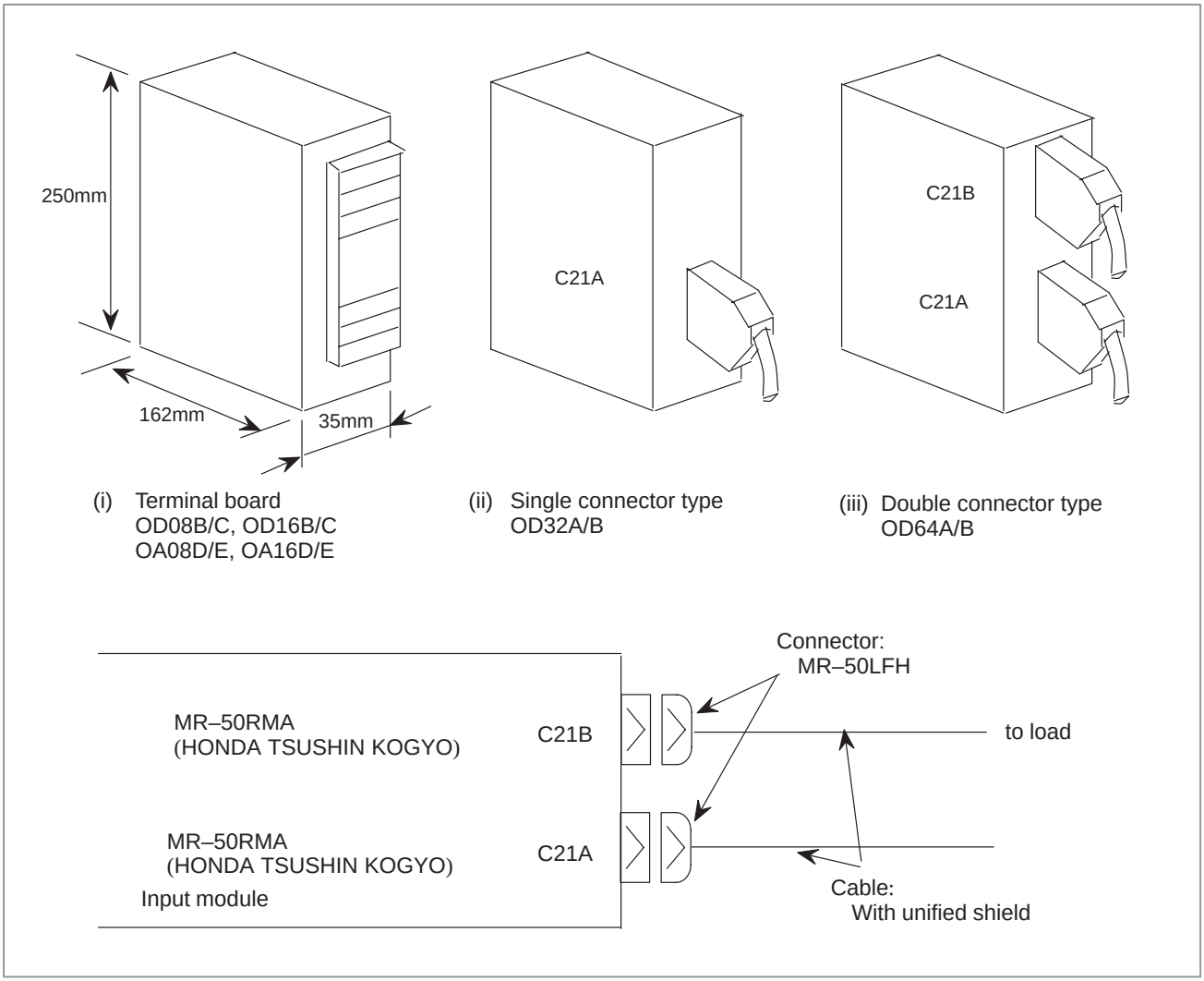
NOTE

1 The response time shows a delay time from an input to an output of the module. Actual response time is obtained by adding the scan time determined by the system configuration to the value shown in the above table.
2 Two fuses are inserted every common line. One red LED is mounted every two fuses, and a corresponding LED lights, if a fuse is blown out.
3 In addition to the above limitation, the output current is limited to 1.6A every 2–output group shown below.
(00, 01) (02, 03) (04, 05) (06, 07)
(10, 11) (12, 13) (14, 15) (16, 17)
Example, during the load current 2A is sent to output [00], the load current cannot be sent to output [01].

- **Connection with the digital output module**

(1) Outer view of the digital output module

The digital output module is housed in a plastic case. It has three types according to the connection method of the signal cable.



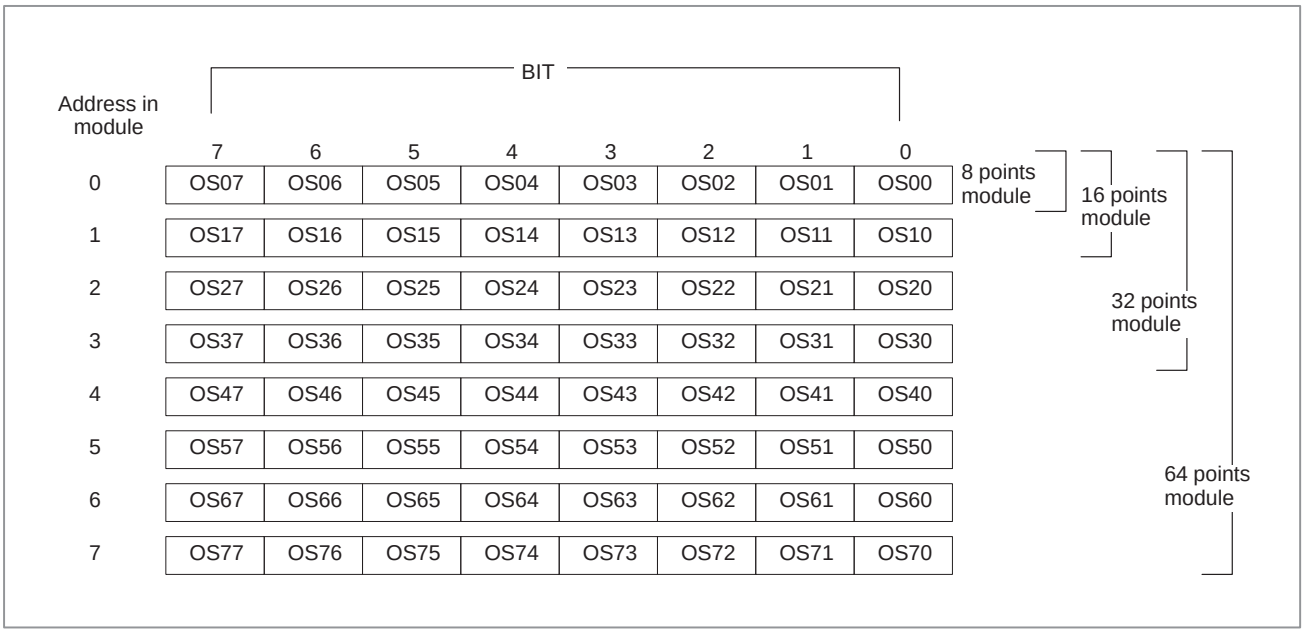
The connection cables to the connector and load used in the above type (ii) and (iii) are described in details in the above figure. See section 3.7.5 for details on shield treatment. The terminal board in the above figure (i), can freely be mounted/dismounted, so it is not necessary to remove the wiring when exchanging the module.

(2) Correspondence of the output signals and the addresses in the module

The following figure shows the correspondence of the output signals of the digital output module and the addresses in the module and the bits.

The in–module address is an address assigned within a module or an address defined in relation to the first address 0 of the module.

The actual address in the sequence program is decided as in section H.2.3 (Module address) by setting the correspondence of the module and the input/output address. When the output signal from the PMC–0M is “1” , the output contact of the digital output module is ON, and OFF when “0”.



(3) Connecting drawing of the digital output module

Fig. H.2.5 (a) – (d) : Connecting drawing of OD32A, OD64A
Fig. H.2.5 (e) : Connecting drawing of OD08B, OD16B
Fig. H.2.5 (f) – (i) : Connecting drawing of OD32B, OD64B
Fig. H.2.5 (j) : Connecting drawing of OA08C, OD16C
Fig. H.2.5 (k) : Connecting drawing of OD08D, OD16D
Fig. H.2.5 (l) : Connecting drawing of OA08E, OD16E

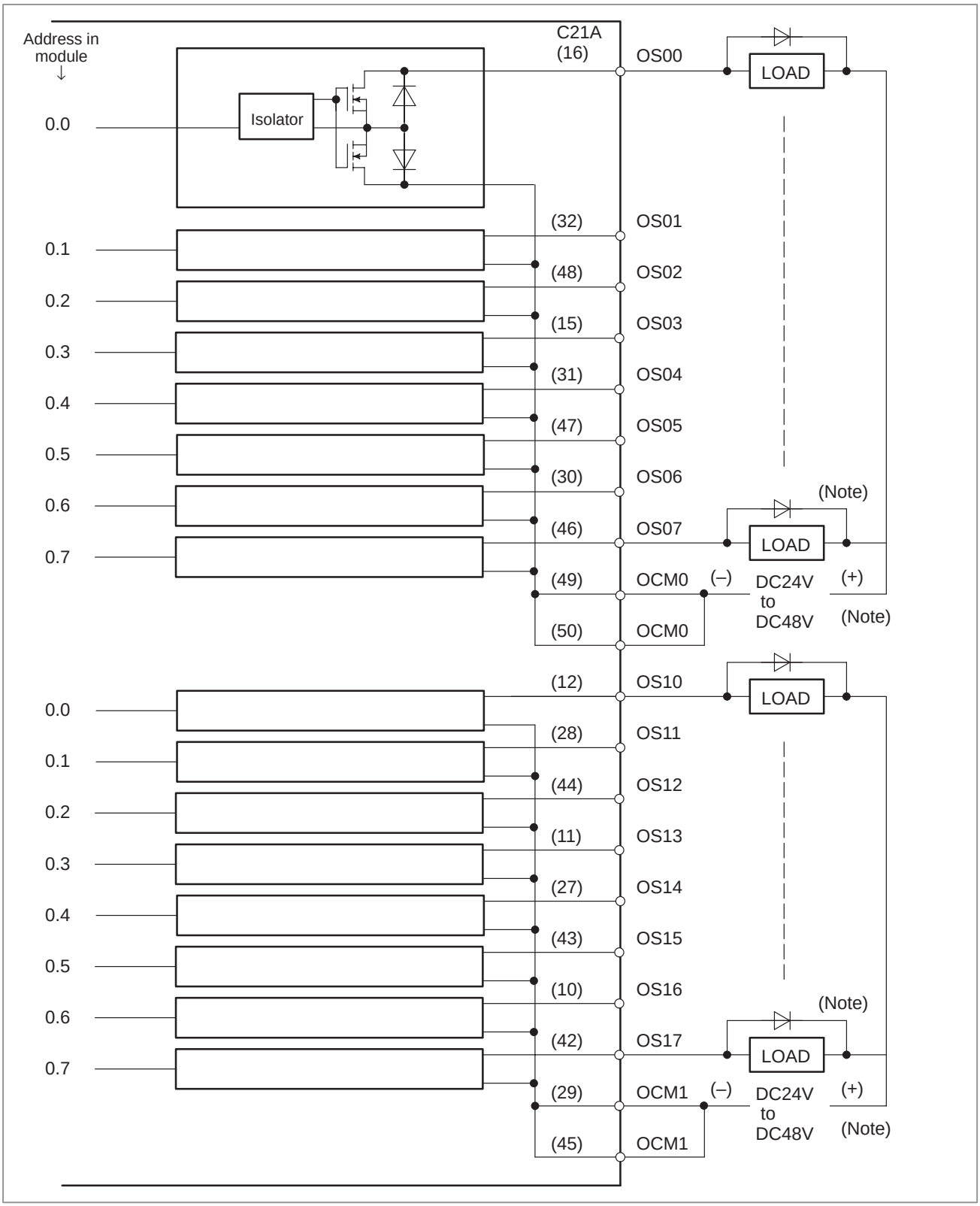


Fig. H.2.5 (a) Digital output module OD32A, OD64A (1)

NOTE
The polarity of the power supply can be the opposite. In this case, the direction of the surge proof diode must also be set opposite.

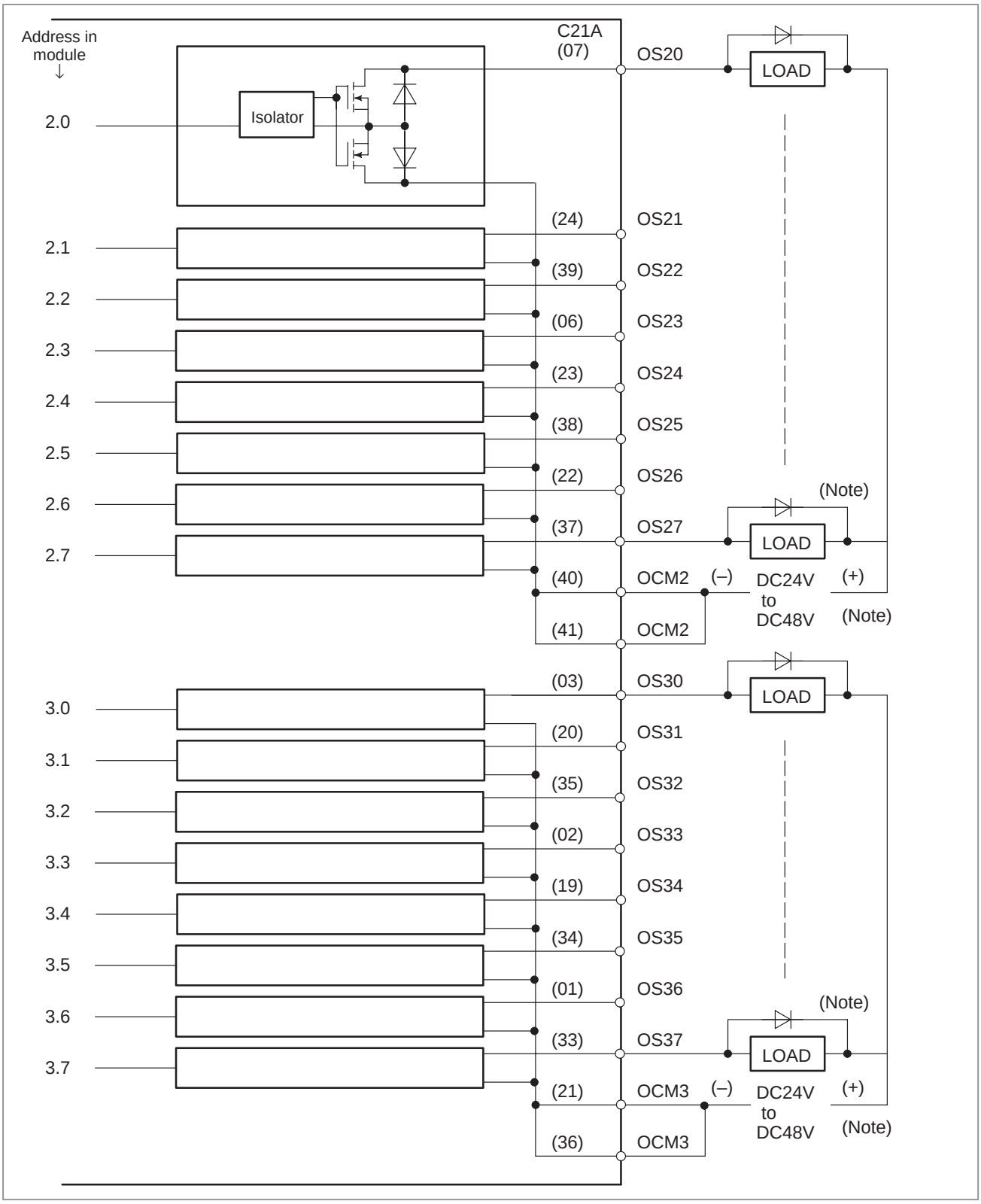


Fig. H.2.5 (b) Digital output module OD32A, OD64A (2)

NOTE
The polarity of the power supply can be the opposite. In this case, the direction of the surge proof diode must also be set opposite.

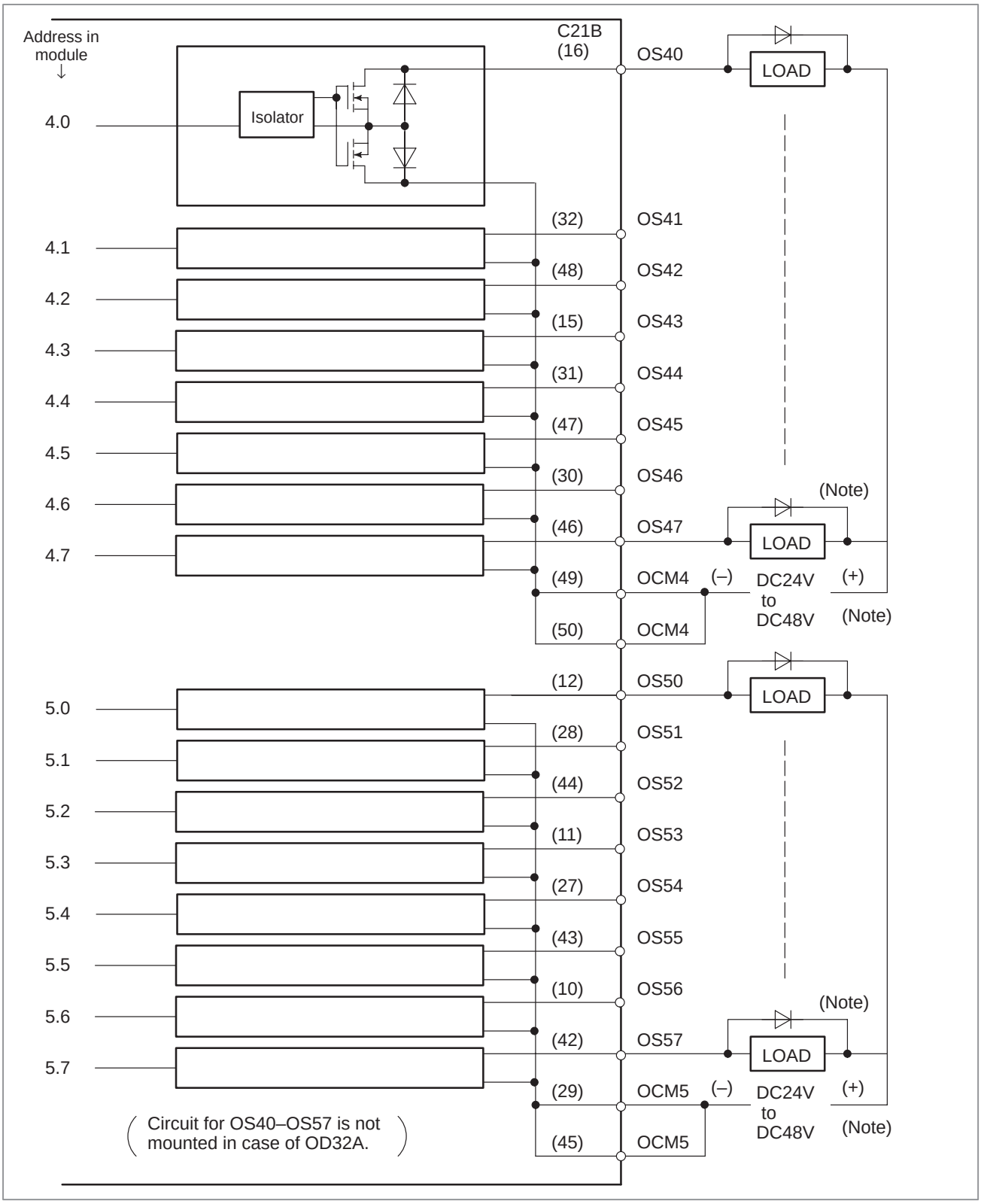


Fig. H.2.5 (c) Digital output module OD64A (3)

NOTE
The polarity of the power supply can be the opposite.
In this case, the direction of the surge proof diode must also be set opposite.

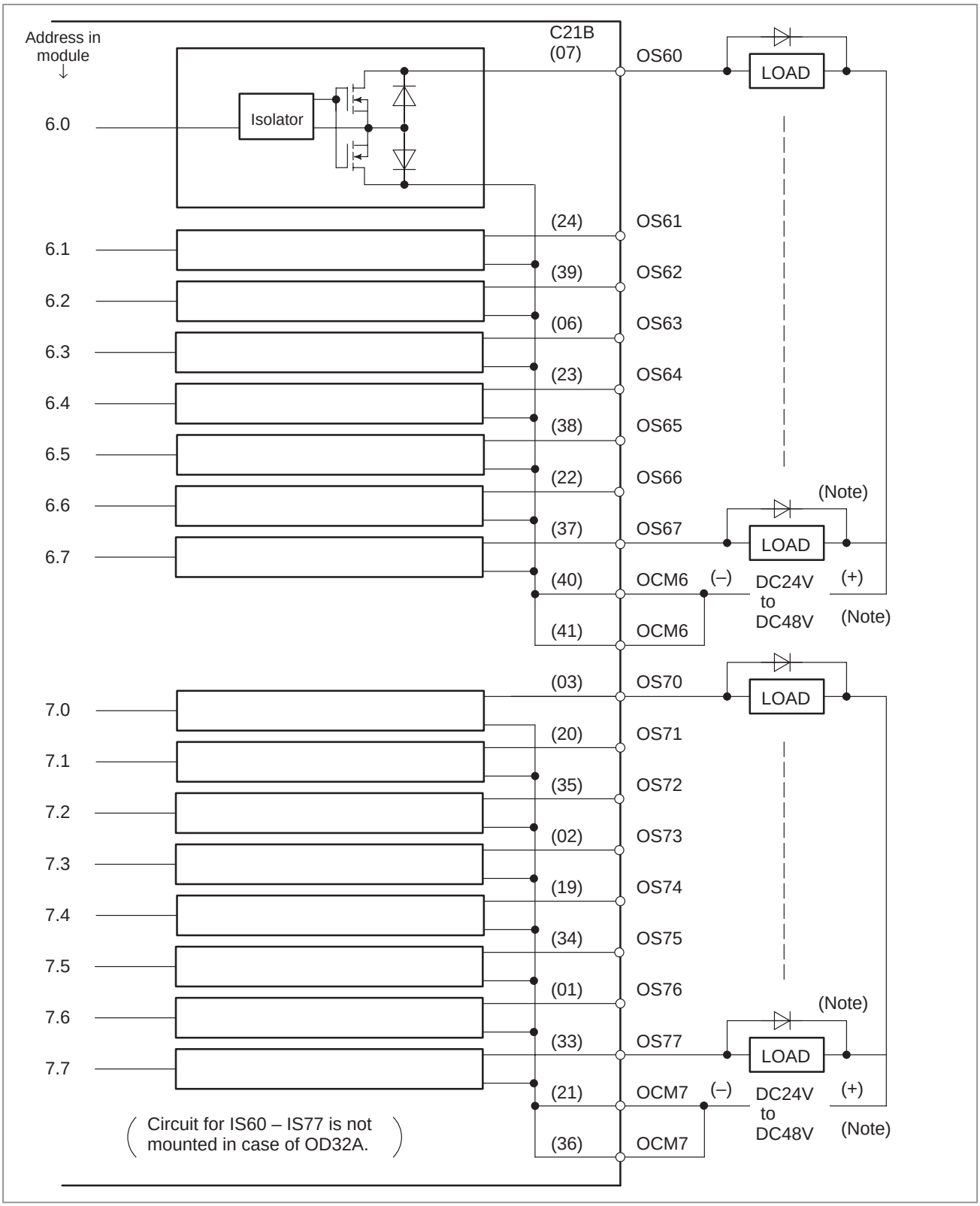


Fig. H.2.5 (d) Digital output module OD32A, OD64A (4)

NOTE
The polarity of the power supply can be the opposite.
In this case, the direction of the surge proof diode must also be set opposite.

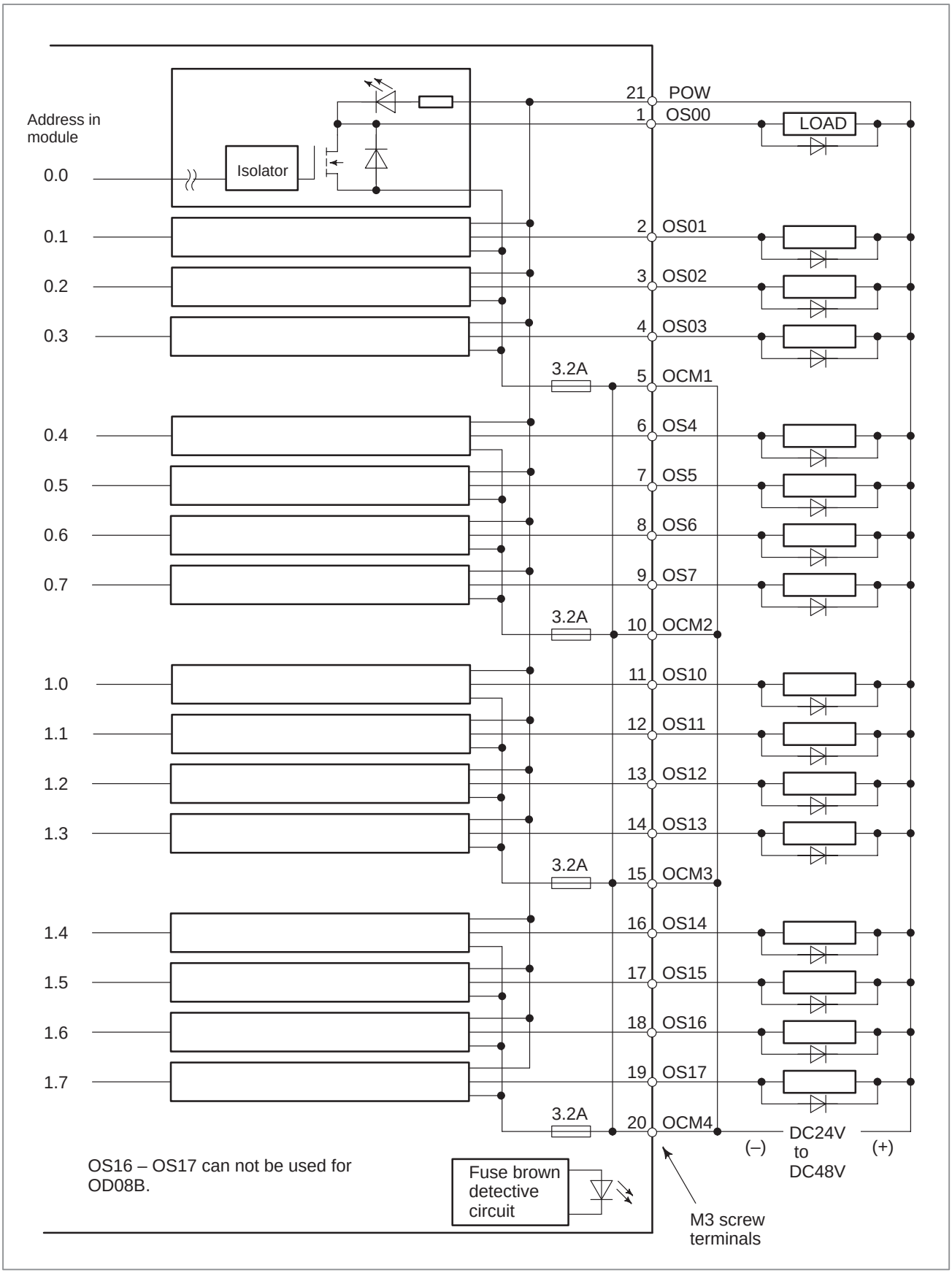


Fig. H.2.5 (e) Digital output module OD08B, OD16B

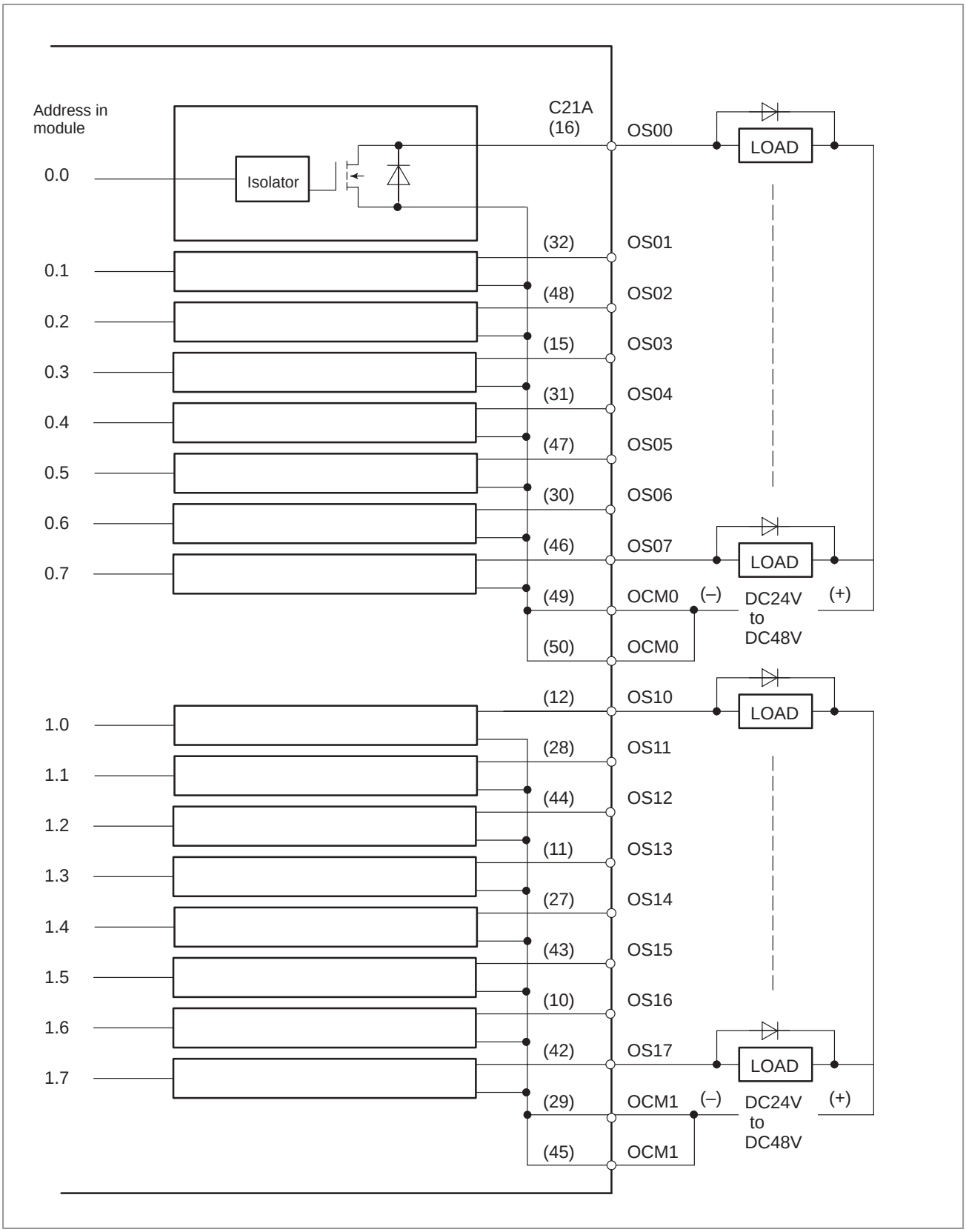


Fig. H.2.5 (f) Digital output module OD32B, OD64B (1)

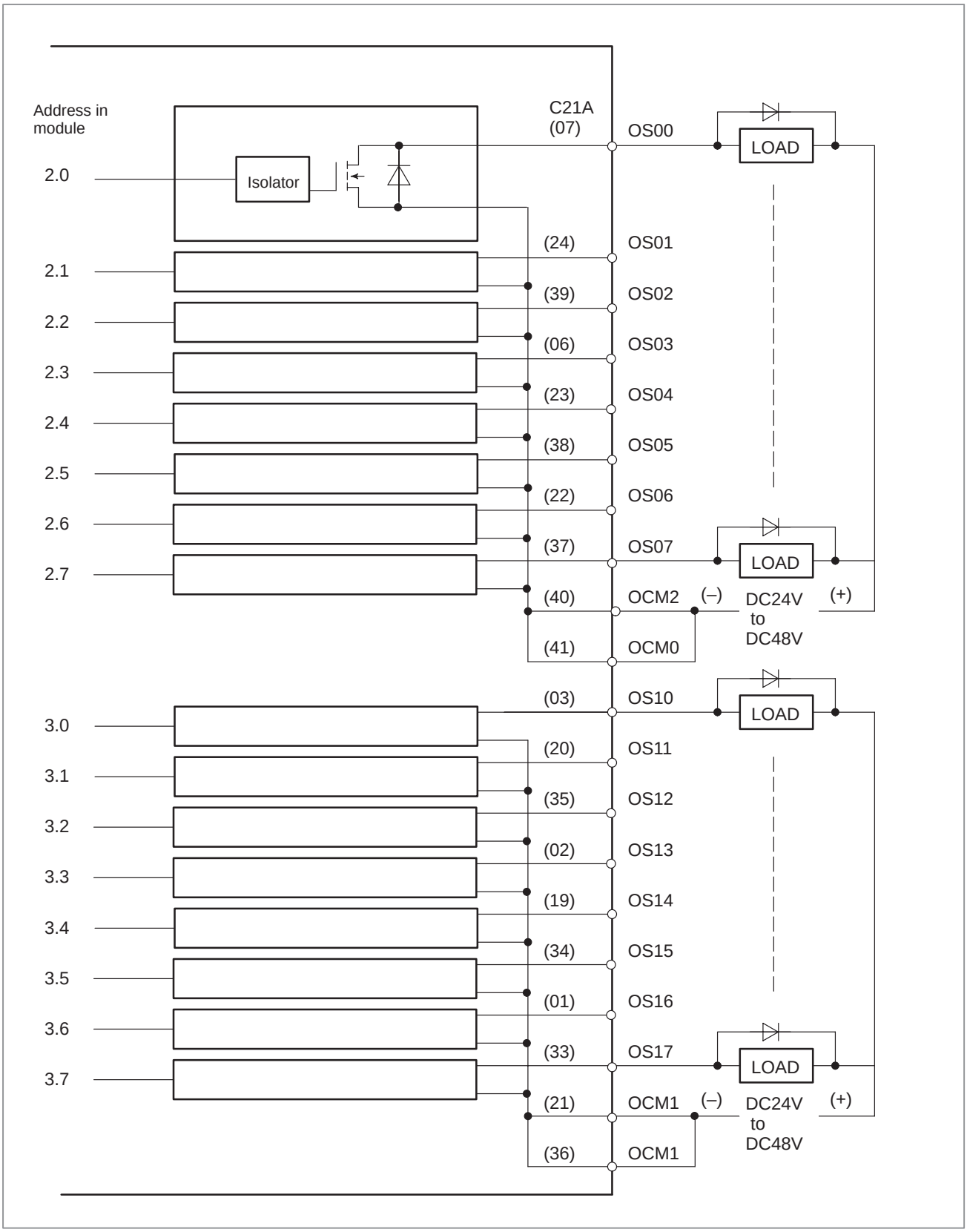


Fig. H.2.5 (g) Digital output module OD32B, OD64B (2)

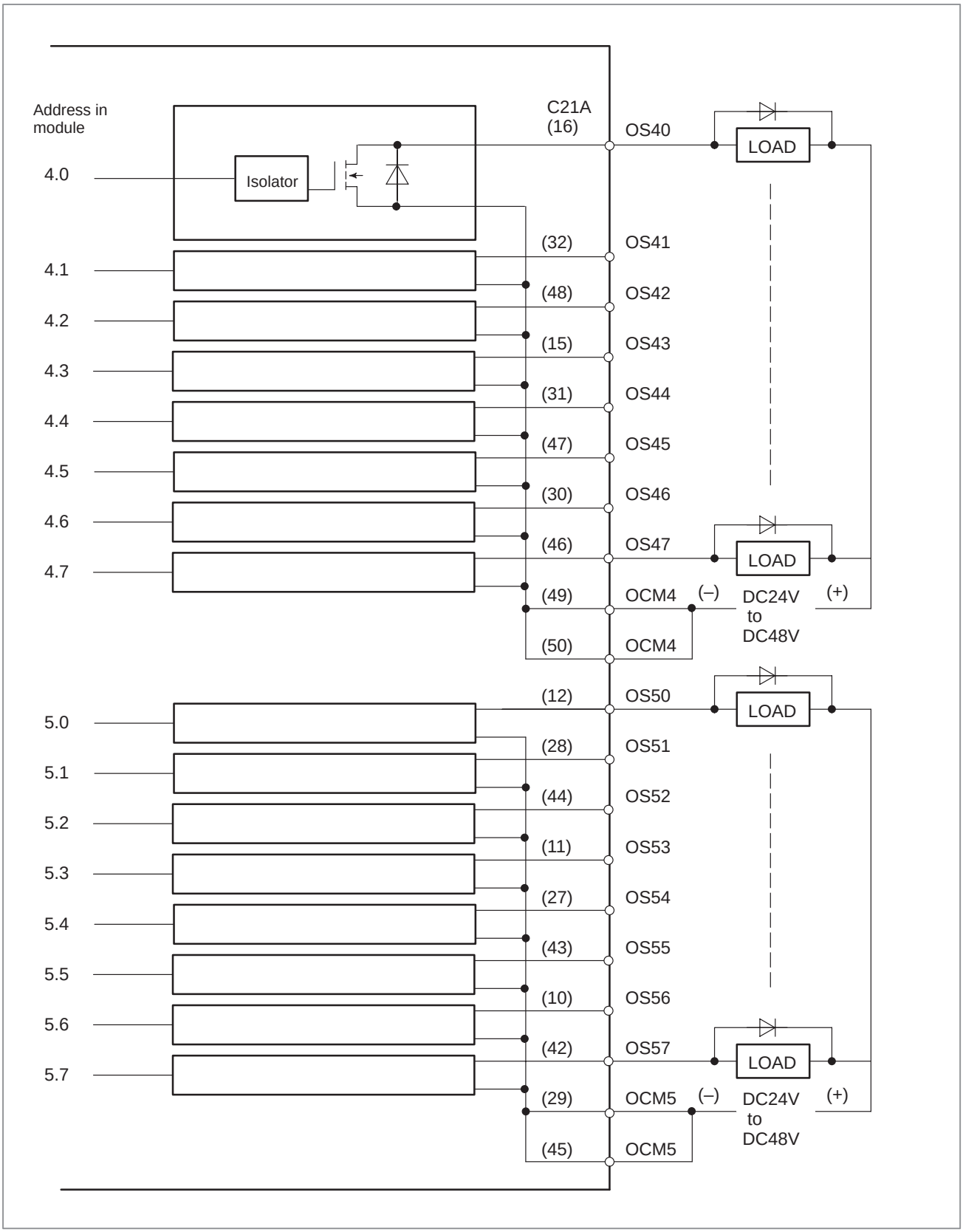


Fig. H.2.5 (h) Digital output module OD64B (3)

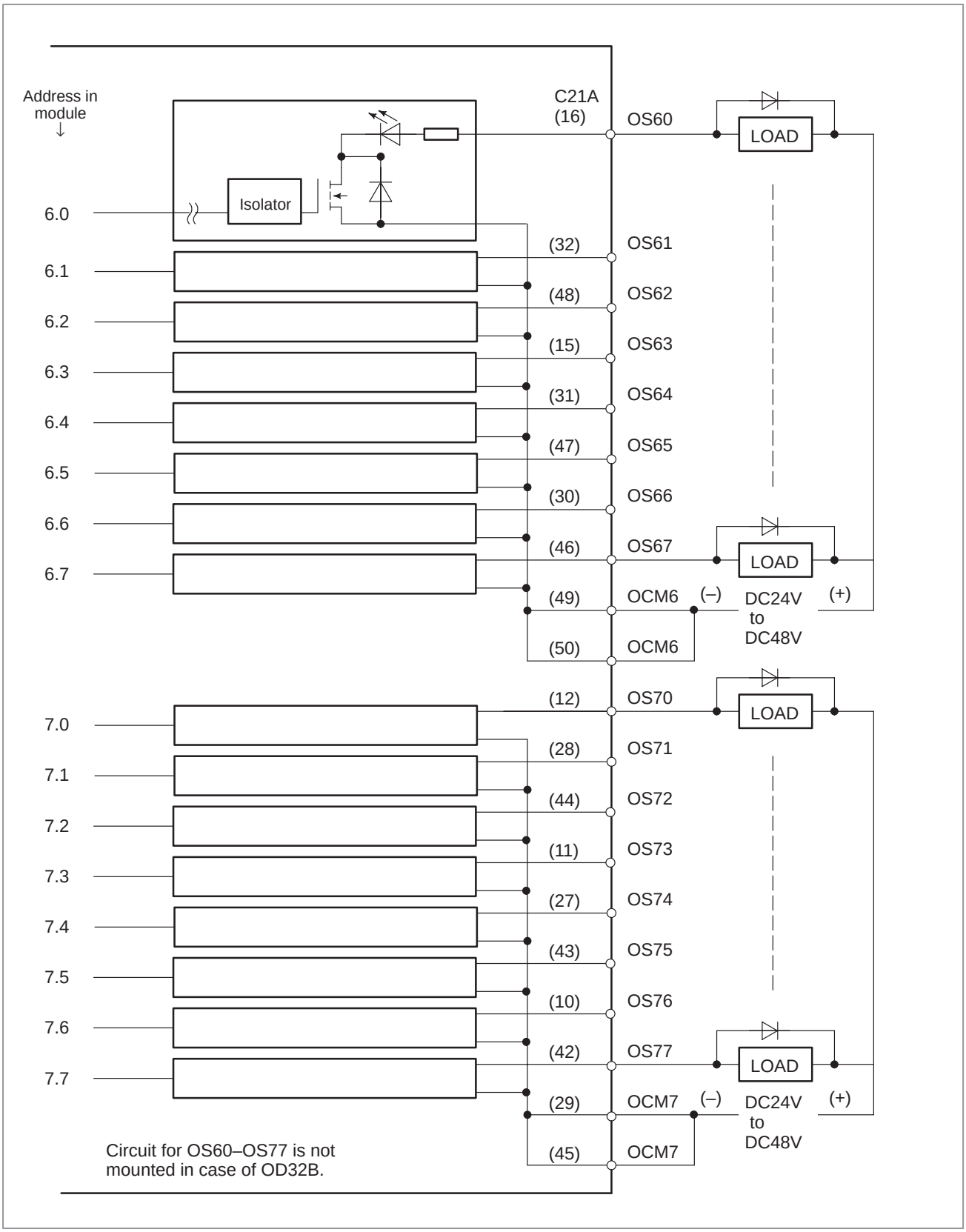


Fig. H.2.5 (i) Digital output module OD64B (4)

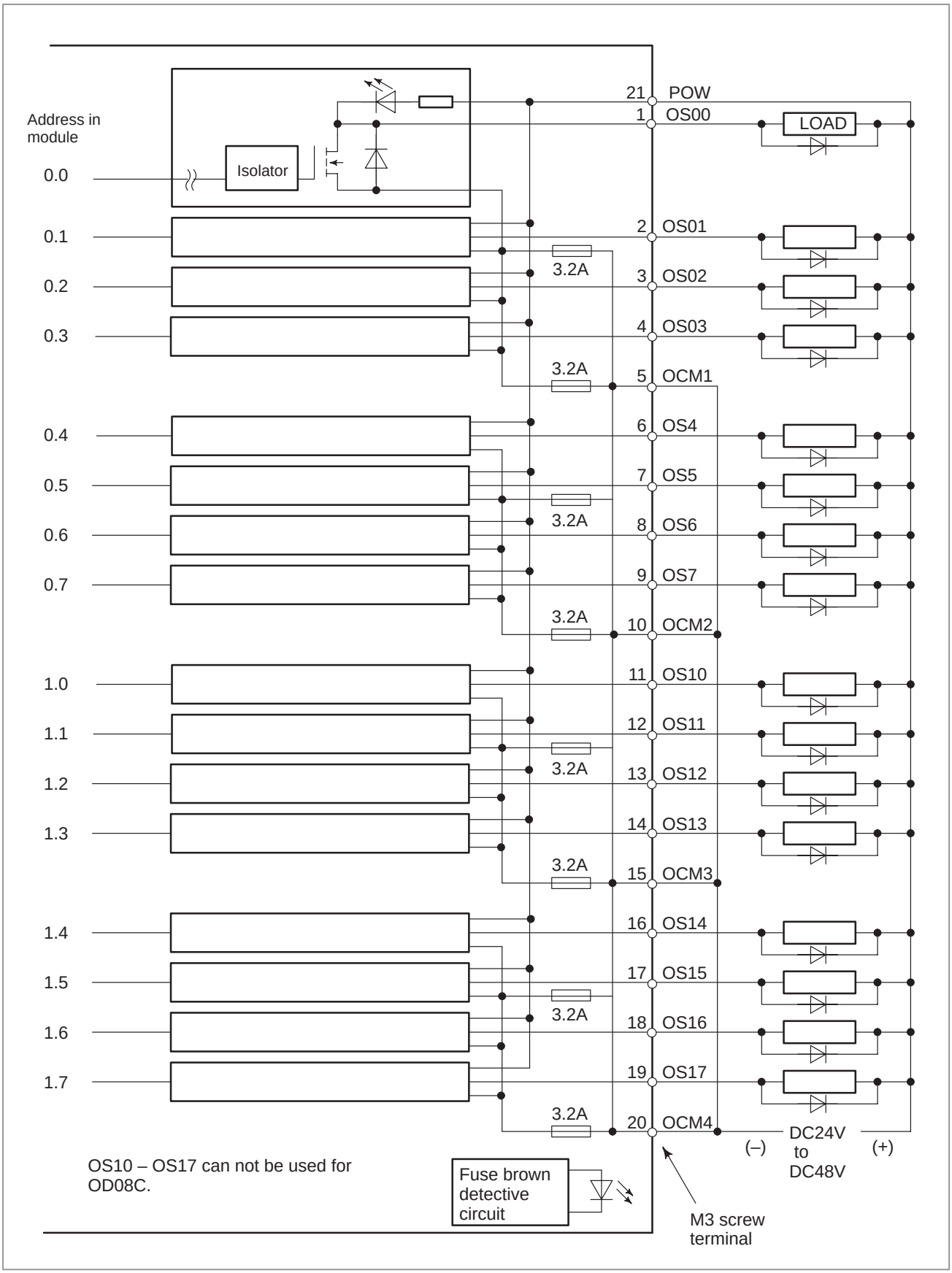


Fig. H.2.5 (j) Digital output module OA08C, OD16C

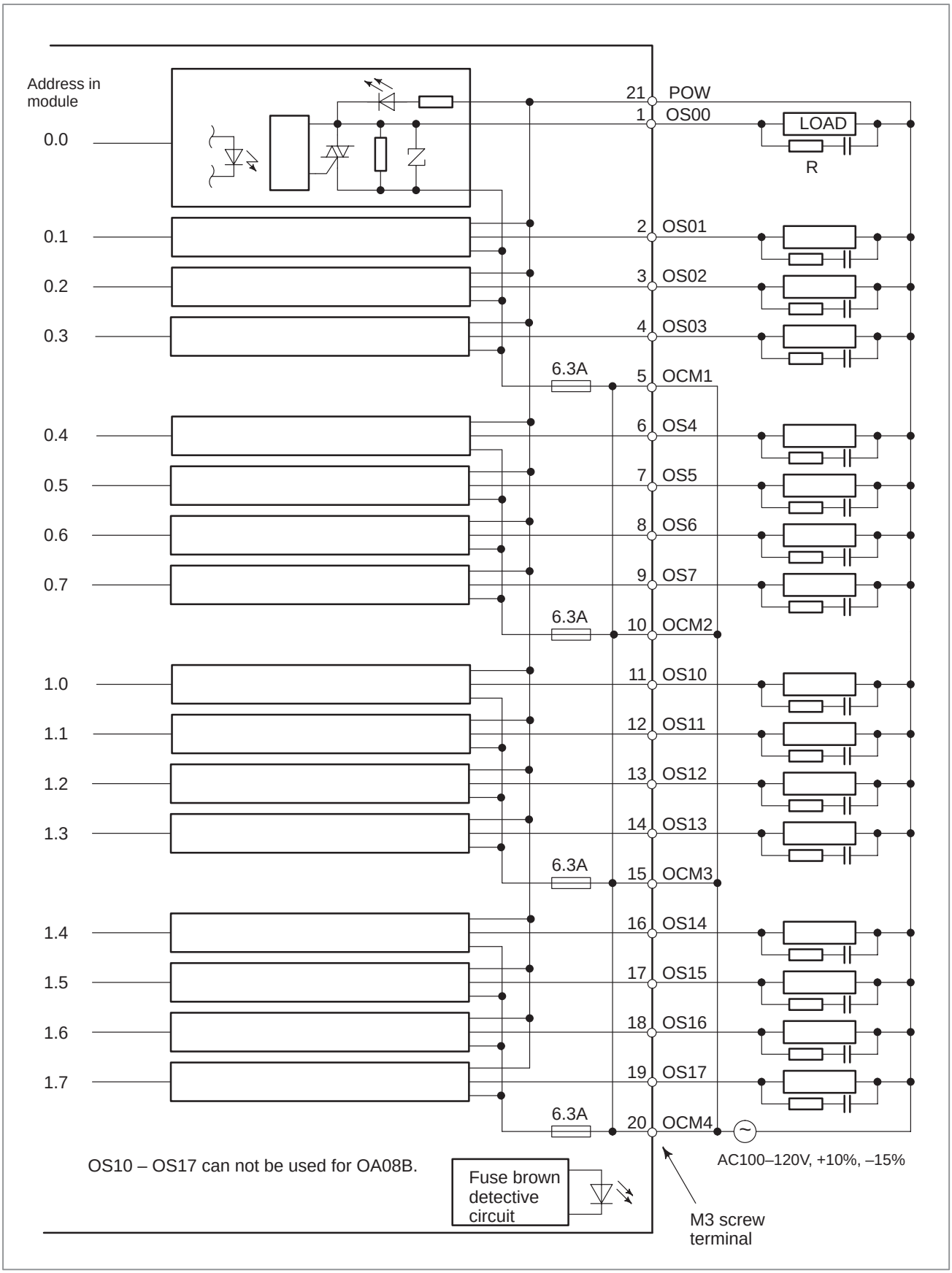


Fig. H.2.5 (k) Digital output module OD08D, OD16D

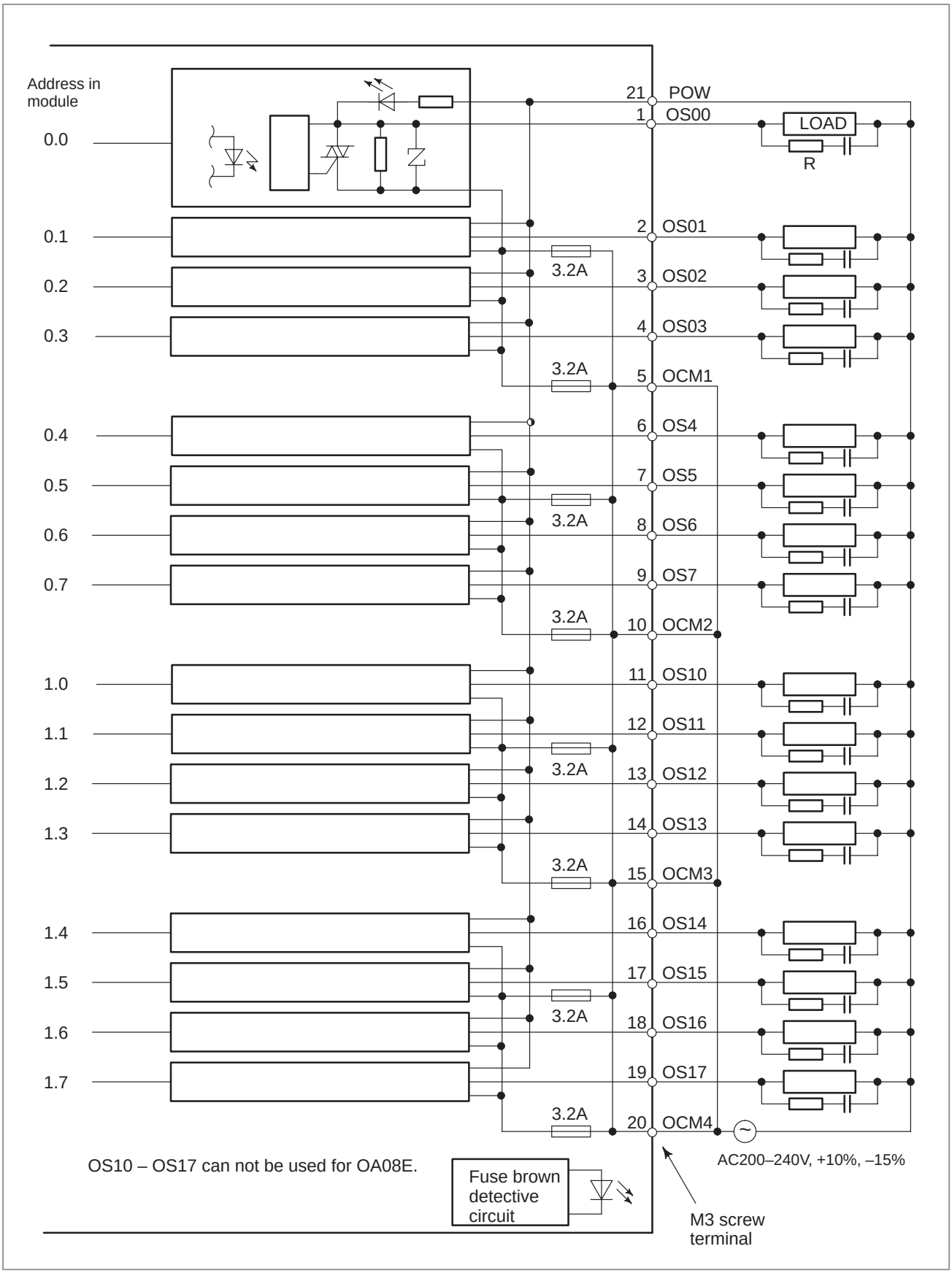


Fig. H.2.5 (l) Digital output module OA08E, OD16E

H.2.6 Analog Input Module

(1) Specification

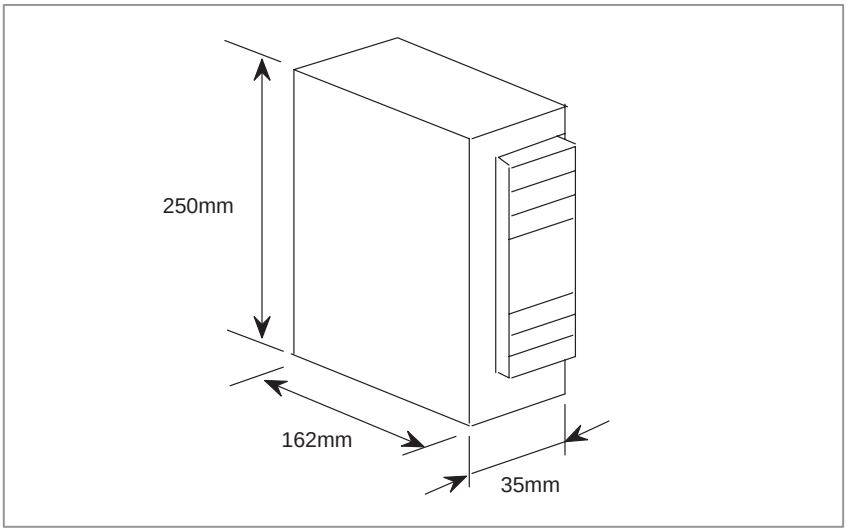
Item \ Module	AD04A
Input points	4 points/module
Analog inpout	DC–10 to + 10V (Inpout resister 1MΩ) DC–20 to + 20 mA (Input resister 250Ω) can be selected.
Digital output	12 bit binary (complement of 2)
I/O correspondence	Analog input / Digital output +10V / +2000 +5V or +20mA / +1000 0V or 0mA / 0 –5V or –20mA / –1000 –10V / –2000
Resolution	5mV, 20μA
Accuracy	±0.5% or less
Response time (Note)	1mS or less
Max. inpout voltage/current	±15%, 40 mA
Insulated	Non–insulated
External connection method	Terminal board (M3)
Exclusive input points	64 points (8 byte)

NOTE
Response time shown here is the delay time of module only. The actual response time is the above value plus the scanning time which is different in each system configuration.

- **Connection with analog input module**

(1) Outer view of analog input module

Analog input module is terminal board type, being housed in a plastic case.



(2) Correspondence between analog input signal and address in the module

In analog input unit AD04A, 4–channel analog input signals are sequentially and cyclically A–D converted, and digital signals thus obtained are written into the following addresses. Accordingly, each analog input signal value can be known at any time by referring to the following addresses in PMC program.

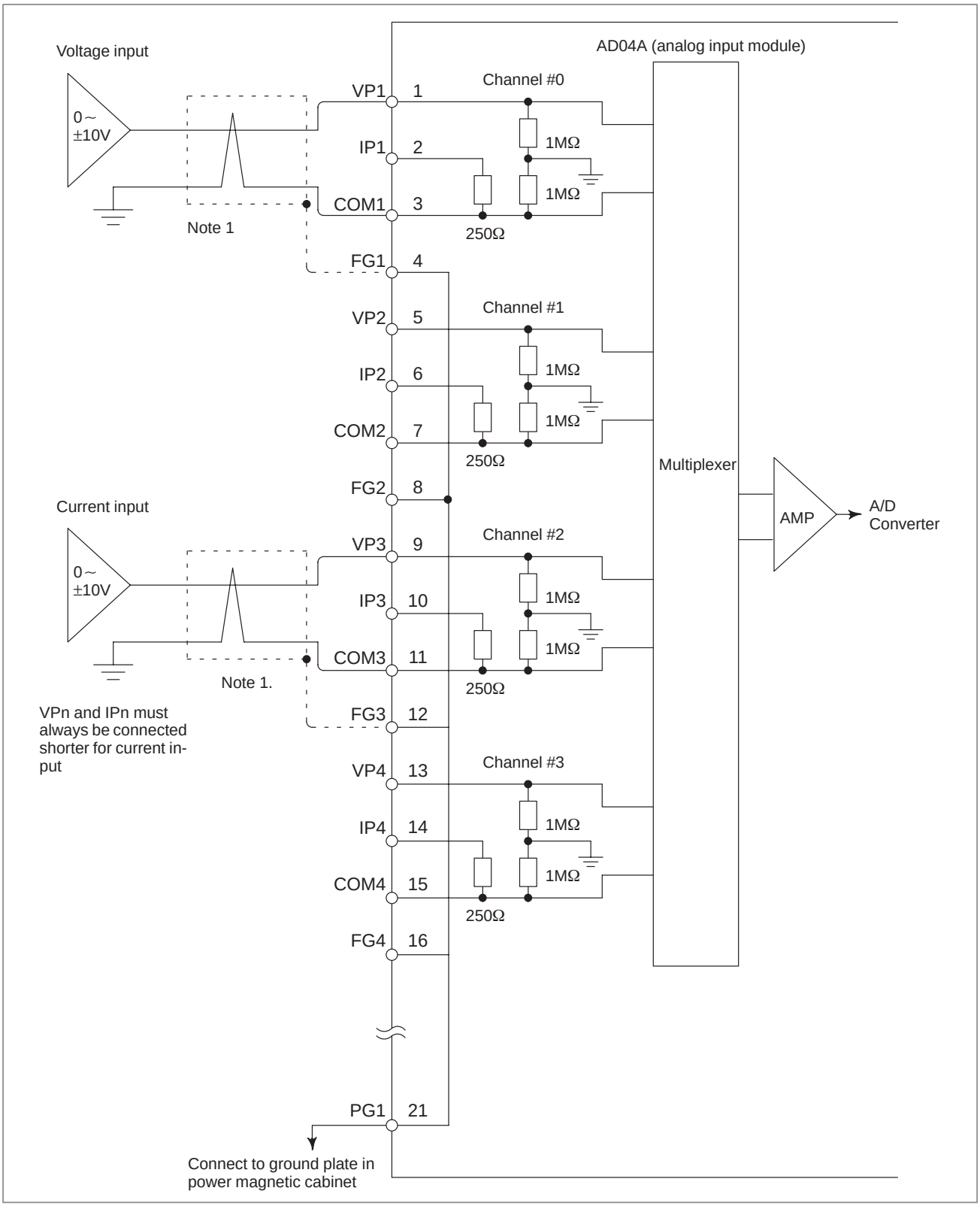
Address in module ↓	7	6	5	4	3	2	1	0
1	—	—	—	—	IA11–0	IA10–0	IA09–0	IA08–0
0	IA07–0	IA06–0	IA05–0	IA04–0	IA03–0	IA02–0	IA01–0	IA00–0
3	—	—	—	—	IA11–1	IA10–1	IA09–1	IA08–1
2	IA07–1	IA06–1	IA05–1	IA04–1	IA03–1	IA02–1	IA01–1	IA00–1
5	—	—	—	—	IA11–2	IA10–2	IA09–2	IA08–2
4	IA07–2	IA06–2	IA05–2	IA04–2	IA03–2	IA02–2	IA01–2	IA00–2
7	—	—	—	—	IA11–3	IA10–3	IA09–3	IA08–3
6	IA07–3	IA06–3	IA05–3	IA04–3	IA03–3	IA02–3	IA01–3	IA00–3

- IA00–X corresponds to the weight of 20 and IA11–x corresponds to the weight 211; provided that IA11–x corresponds to the sign bitin two's–compliment notation.
- Internal addresses correspond to analog input channels as follows:

  Channel #0 . . . . Addresses 0 and 1
  Channel #1 . . . . Addresses 2 and 3
  Channel #2 . . . Addresses 4 and 5
  Channel #3 . . . Addresses 6 and 7

NOTE
1 The same value as bit 3 value is written into bits 7–4 of evenbytes in the above figure.
2 The start address of this module must be allocated to even addresses when setting I/O module addresses.
When A/D converted values are referred to by a user program, they should be read in the unit of word (16 bits) without fail.

(3) Connecting drawing of analog input module



NOTE
Shielded twist pair cables (2 cores) are required as connecting cables.

H.2.7
Analog Output Module

- **Specifications**

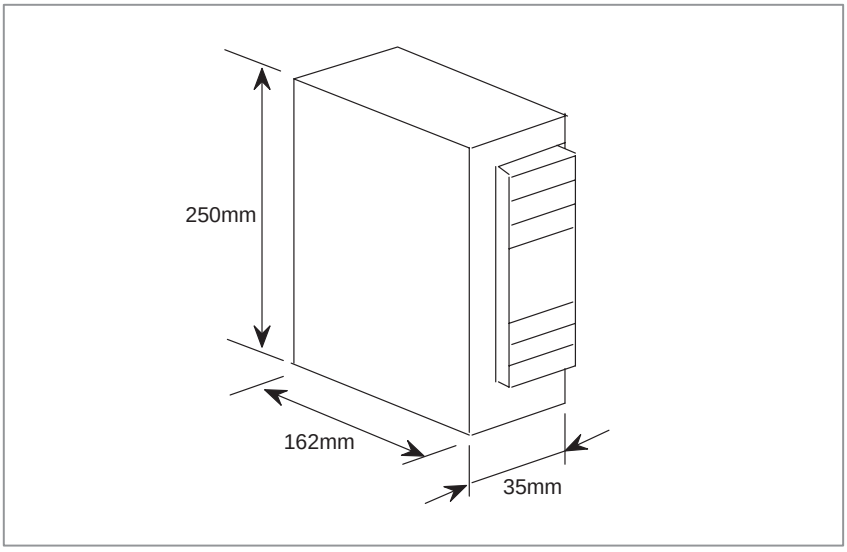
Item \ Module	DA02A	DA03A
Input points	2 points/module	3 points/module
Analog input	–10 to + 10V DC (External load resistance more than 10 kMΩ) 0 to +20mA DC (External load resistance 0 to 500 Ω) Selectively employable	
Digital output	12–bit binary (Two's–compliment notation)	
I/O correspondence	Digital input / Analog input +2000 / +10V +1000 / +5V or +20mA 0 / 0V or 0mA –1000 / –5V or –20mA –2000 / –10V	
Resolution	5mV, 20μA	
Accuracy	Less than ±0.5%	
Response time (Note)	Shorter than 1mS	
No. of occupied output points	±15%, 40 mA	
Insulated	Non–insulated	
External connection method	Terminal board (M3)	
No. of occupied output points	32 points (4 byte)	48 points (6 byte)

NOTE
The response time shows the delay time of the module only. Actual response time is obtained by adding the scan time determined by the system configuration to the above value.

- **Connection with the analog output module**

(1) Outer view of the analog output module

The analog output module is a terminal board type module housed in a plastic case.



(2) Correspondence of the output signals and the analog address in the module

In the analog output unit DA02A and DA03A by writing a 12–bit digital value in the following address, the desired voltage or current is output to the corresponding analog output. The assignment of the digital output signal and its address is as follows:

Address in module ↓

	7	6	5	4	3	2	1	0
1	—	—	—	—	OA11–0	OA10–0	OA09–0	OA08–0
0	OA07–0	OA06–0	OA05–0	OA04–0	OA03–0	OA02–0	OA01–0	OA00–0
3	—	—	—	—	OA11–1	OA10–1	OA09–1	OA08–1
2	OA07–1	OA06–1	OA05–1	OA04–1	OA03–1	OA02–1	OA01–1	OA00–1
5	—	—	—	—	OA11–2	OA10–2	OA09–2	OA08–2
4	OA07–2	OA06–2	OA05–2	OA04–2	OA03–2	OA02–2	OA01–2	OA00–2

- OA00–x corresponds to the weight of 20, and OA11–x to 211. Note that OA11–x corresponds to the sign bit in two's–compliment expression.
- The correspondence of the internal address and the analog output channel is as follows:

  Channel #0 . . . . . Address 0 and 1

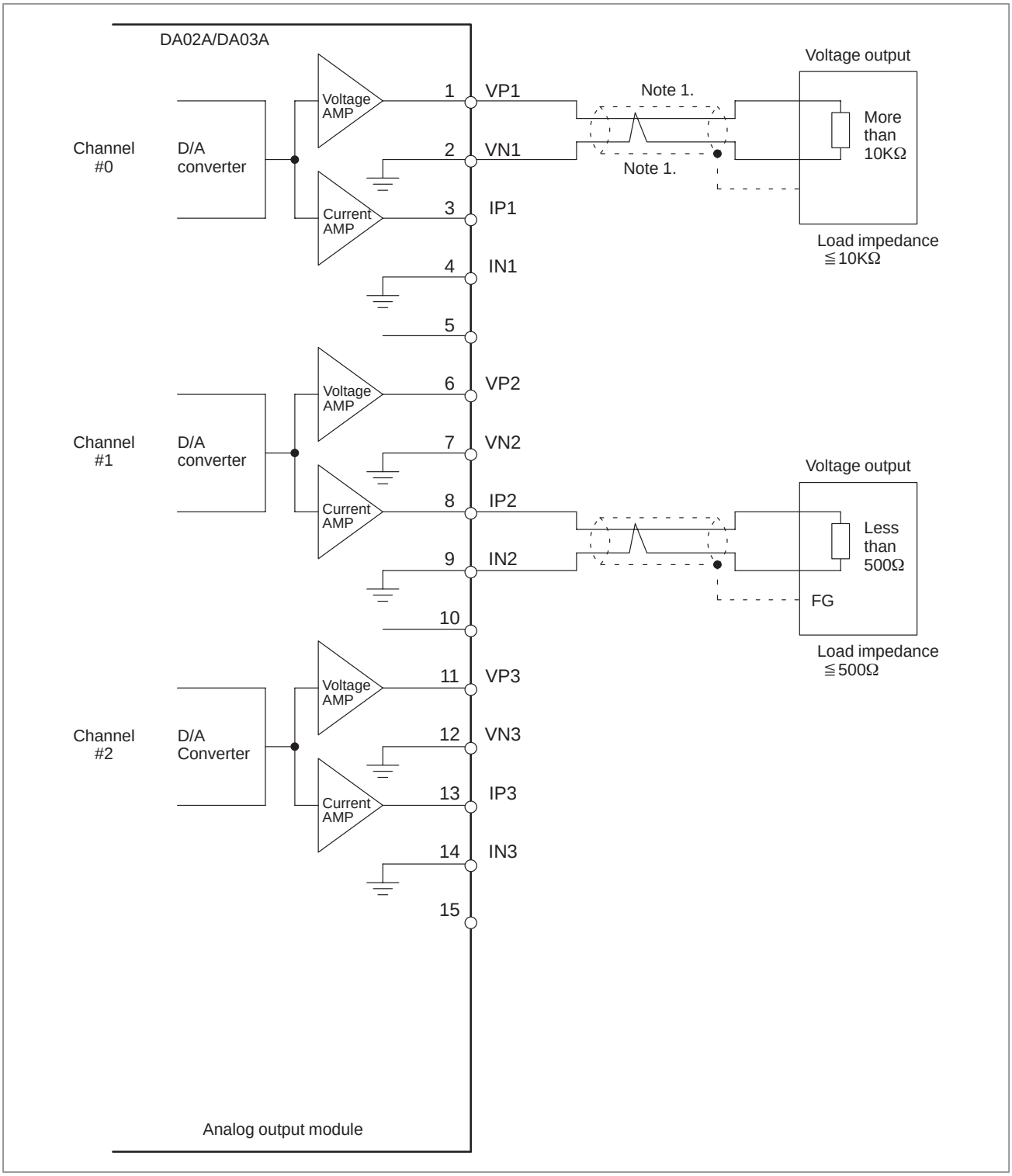
  Channel #1 . . . . . Address 2 and 3

  Channel #2 . . . . . Address 4 and 5

NOTE

1 When setting address of the I/O module, the head address of this module must be assigned and even number address. When writing the D/A–converting value from the user program, writing must always be done in word (16 bits) unit.
2 In analog output module DA02A, the channel #2 cannot be used.

(3) Connecting drawing of analog output module



NOTE
1 A 2 pair shielded cable must be used as connection cable. The shield must be connected to the ground at the load side.
2 Channel #2 cannot be used in DA02A.

H.3 NC AND I/O UNIT CONNECTION

H.3.1 I/O Unit Signal Connection Diagram

Fig. H.3.1 (a) shows connection when only one group of I/O unit is used and Fig. H.3.1 (b) shows connection when two or more groups of I/O units are used. It is necessary to set the group number of interface module IF01A according to the H.3.3.

H.3.2 I/O Unit Power Connection Diagram

Fig. H.3.2 (a) shows power connection when one I/O unit is used and Fig. H.3.2 (b) shows power connection when two or more units are used. When two or more I/O units are used, one power input unit may not have capacity enough to supply power to all I/O units. In such case it is required to use an additional power input unit and additional number of power connectors as shown in Fig. H.3.2 (b). The additional power input unit should be mounted to the magnetic cabinet power on the machine side. Fig. H.3.2 (c) shows signal cable connection between I/O unit.

NOTE

1 Use optical cables listed below.

Name	Specification	Length
Optical fiber cable	A02B–0072–K801	5m
Optical fiber cable	A02B–0072–K802	10m
Optical fiber cable	A02B–0072–K803	15m

2 Max. length between NC and I/O unit is 200 m.

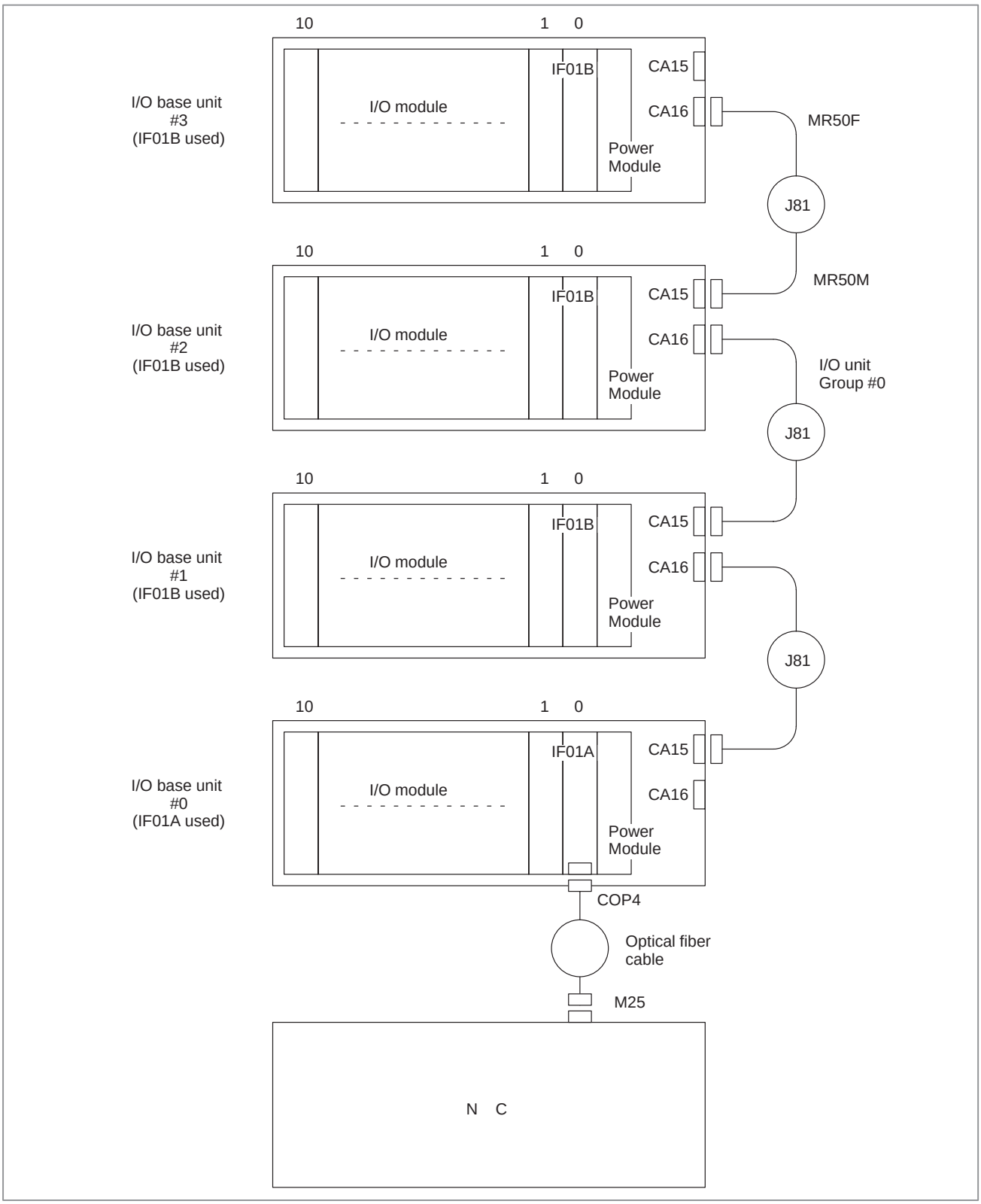


Fig. H.3.1 (a) I/O unit signal connection diagram (1) (In case of one group)

NOTE

Cable J81 must be 1.5 m or shorter.

Run wiring separately from the power supply and I/O module input signals.

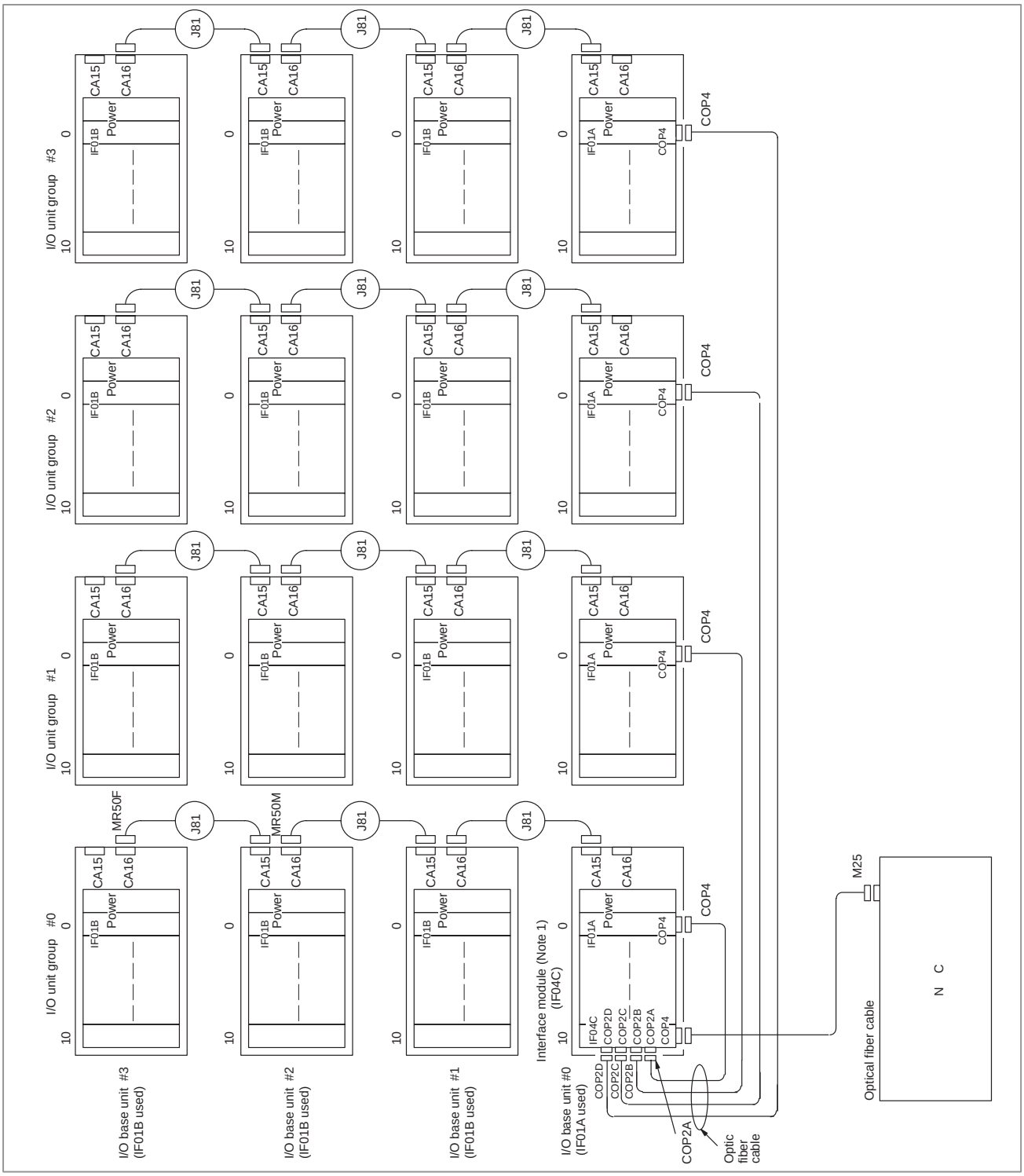


Fig. H.3.1 (b) I/O unit signal connection diagram (2) (When several groups are employed)

NOTE

1 Interface module (IF04C) for optical interface expansion is mounted on base unit #0 in group 0 as example. Actually it can be mounted on any type of base unit and on arbitrary slot NO other than No. 0.

2 Cable J81 should be shorter than 1.5 m. It should be separated from I/O signal of power I/O module in wiring.

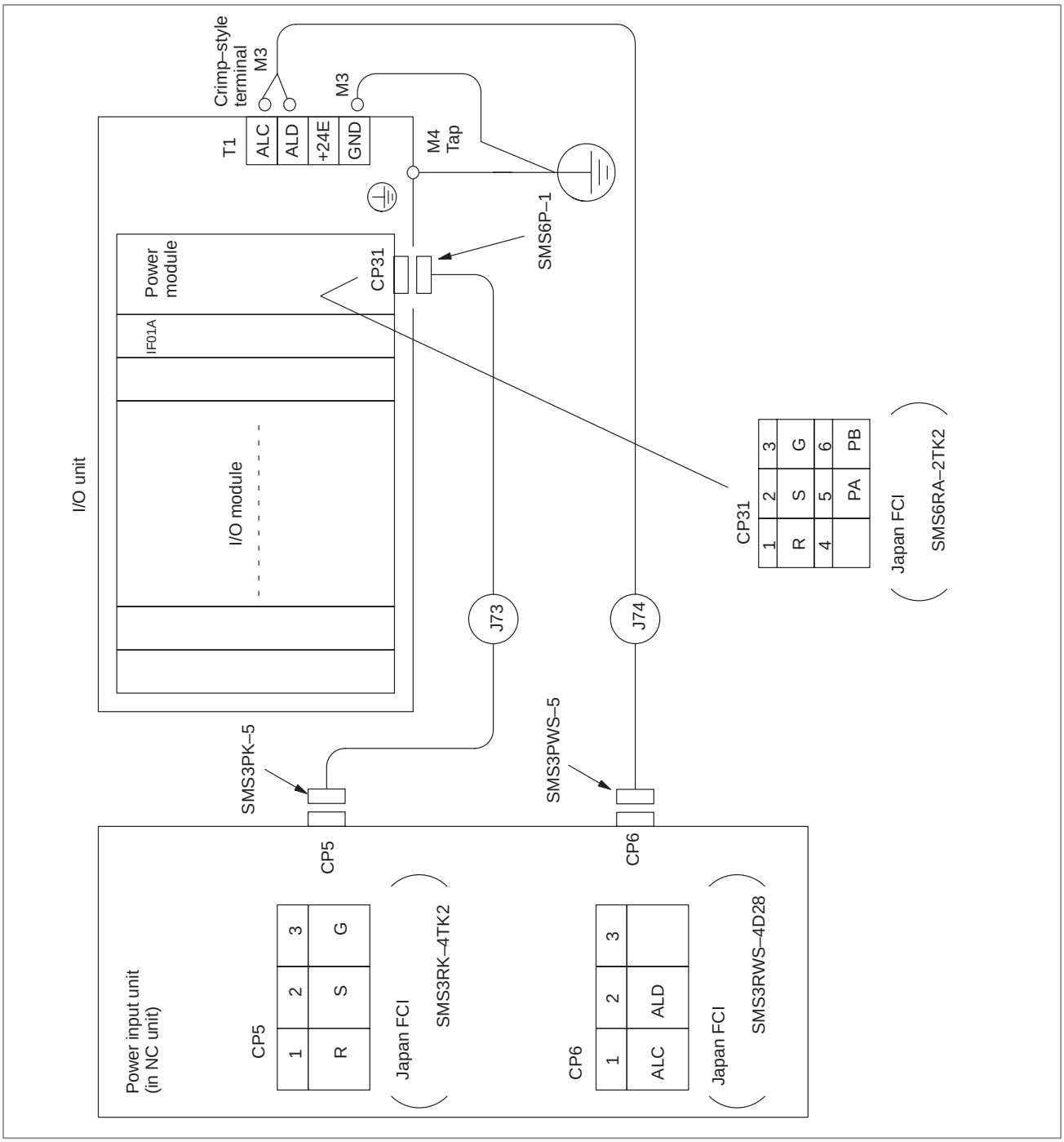


Fig. H.3.2 (a) I/O unit power connection diagram (In case of one I/O unit)

CAUTION
Use 1.25 mm^2 or larger wire to ground for GND terminal of T1.

NOTE
1 PA and PB of CP31 are not used.
2 Use 30/0.18 (0.75 mm) or larger wire for J73 and J74.
3 When the power unit containing the input unit is used, connect J73 to CP2, ALD of J74 to AL of CP3 (SMS6RW–4D28), and ALC of J74 to OFF.

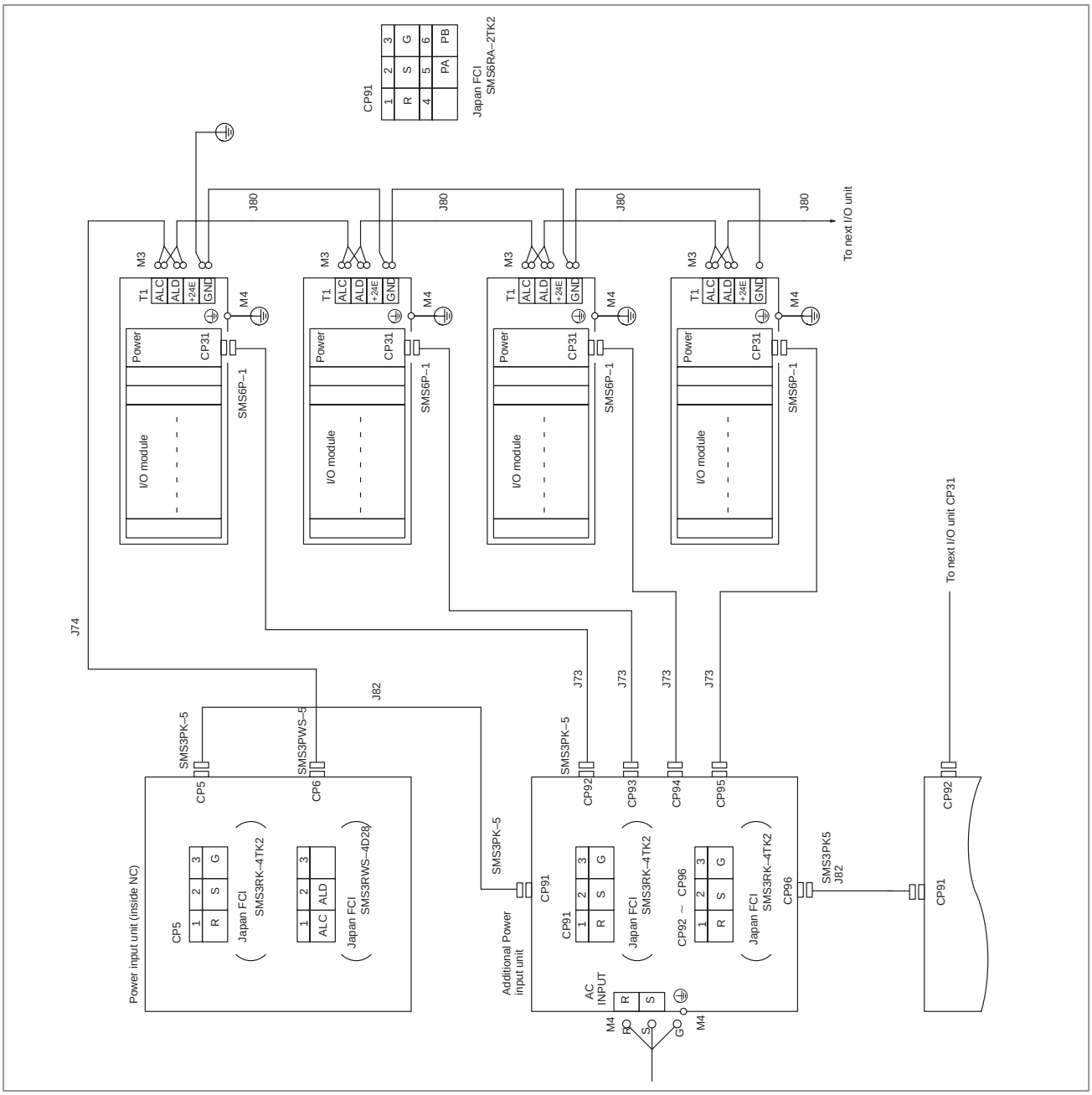


Fig. H.3.2. (b) I/O unit power connection diagram (When several I/O units are employed)

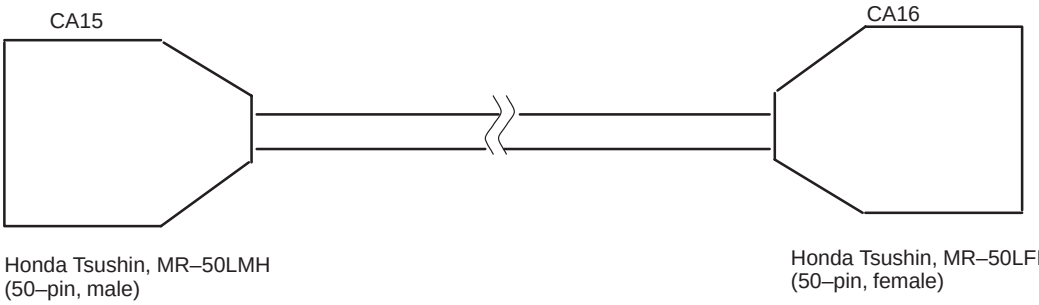
CAUTION

GND terminal (T1) of I/O unit (max. 4 sets) in one group is connected by the wire with cross section more than 1.25 mm^2.

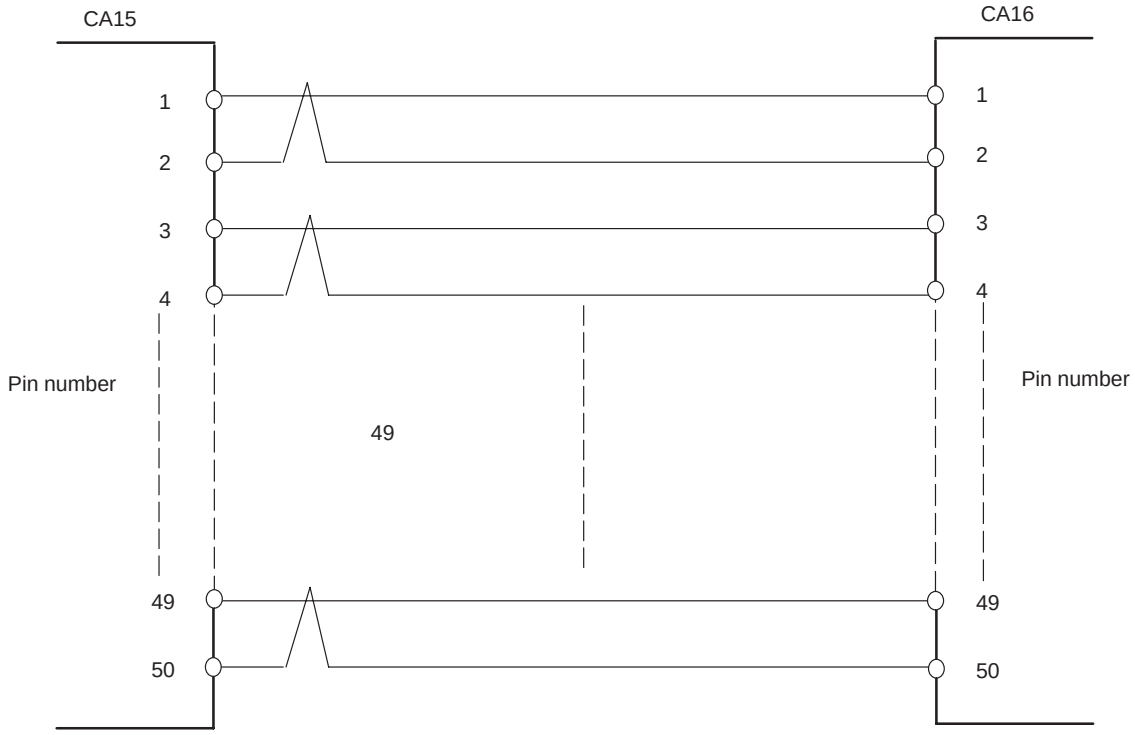
NOTE

1 PA and PB in CP31 are not used.
2 Wires more than 30/0.18 (0.75 mm^2) are used for J73, 74 and 80.
3 One additional power input unit can control I/O unit power input. (Max. 4 sets)
4 Connector contact specification (made in Burndy)
  1 Other than CP6 . . RC16M–SCT3
  2 CP6 . . . . . RC16M–23D28

(1) Connector



(2) Connection



- Use twist pair wires for (1,2) , (3,4), (5,6), (7,8) ··· ··· ··· and (49,50).

(3) Wiring materials

25 pairs, vinyl coated cable, 7/0.18

(Reference) Specification of cable used by FANUC (A66L–0001–0066)

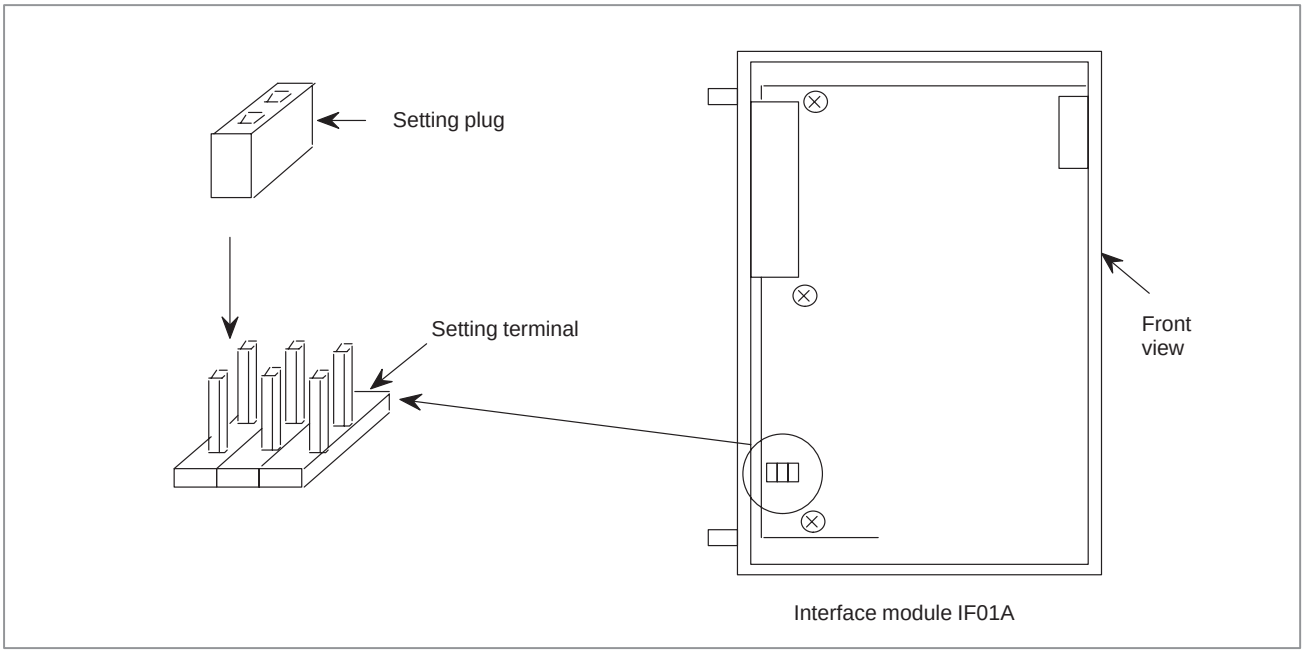
No. of cores	Conductor		Finished O.D.	Electric characteristics Conductor resistance
	Dia. (incl. insulator)	Construction		
25 pairs	ϕ1.05 mm	7/0.18	ϕ14 mm	110 Ω/km

H.3.3 Interface Module Setting

● IF01A Setting

I/O unit can be expanded to maximum 4 groups by a combination of the interface module IF01A and IF04C. The setting terminal inside of the IF01A should be set as follows according to the group number of IF01A.

(1) Position of setting terminal



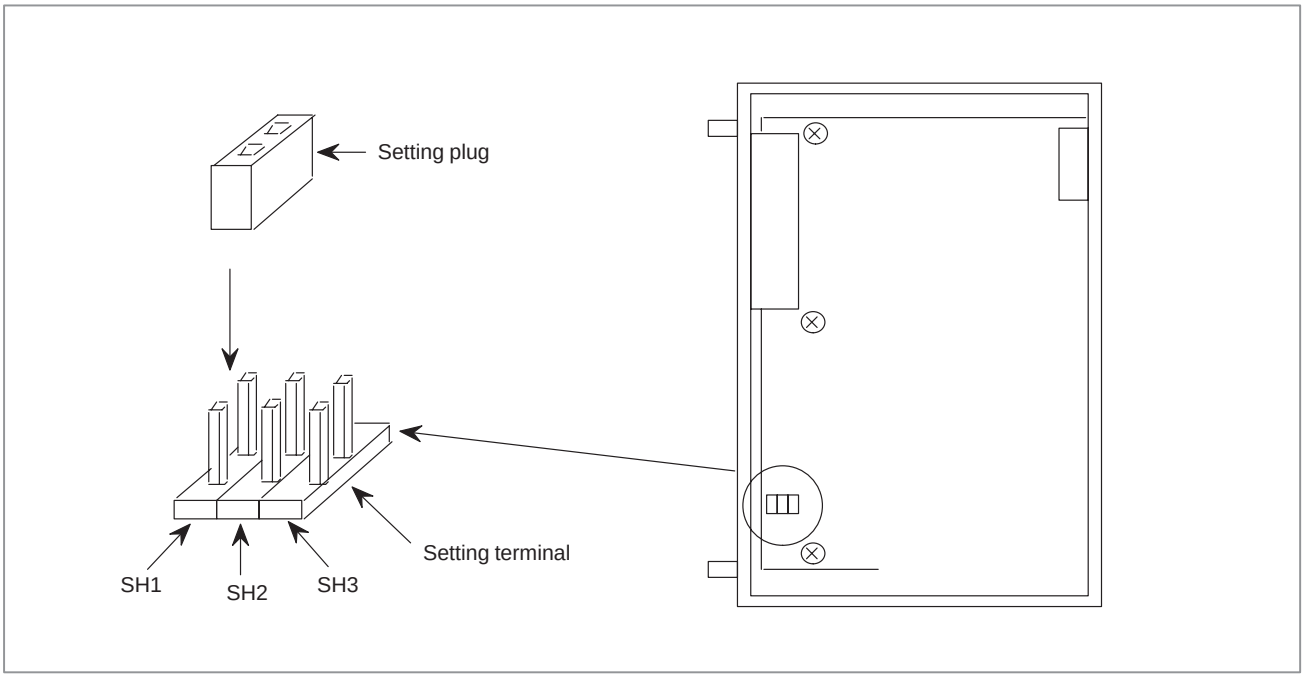
(b) Setting method

IF04C	IF01A group number	Setting		
		SH3	SH2	SH1
When IF04C is not used	Group 0	○	○	
When IF04C is used	Group 0	○		○
	Group 1	○		
	Group 2		○	○
	Group 3		○	

Insert a setting plug to the setting terminals marked with ○.
Other terminals without ○ should be open.

- **IF04C setting**

IF04C has the same type of setting as IF01A should be set as follows without fail. (Already set as follows at FANUC before shipment.)



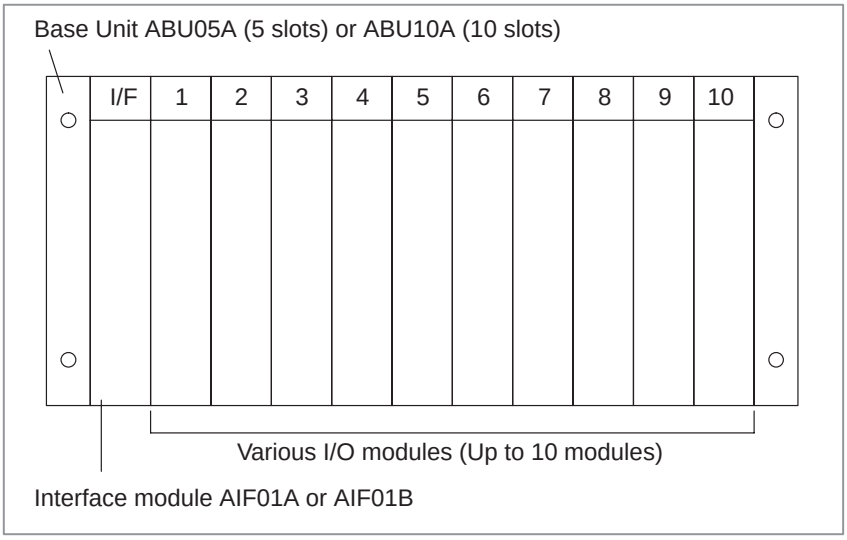
Setting method
Insert SH2 and SH3 to the setting plug. (SH1 is open.)

I/O Unit–MODEL A

I.1 CONNECTION OF THE FANUC I/O Unit–MODEL A

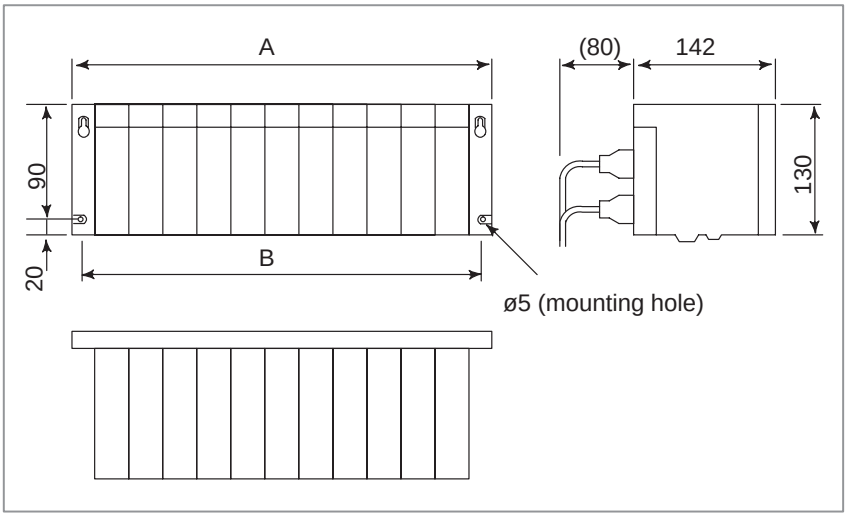
The FANUC I/O Unit–MODEL A (“I/O Unit”) is a modular–type I/O unit. It interfaces the Series 0 with the machine via the I/O Link. One I/O unit can be configured by mounting the I/O modules required for either the 5– or 10–slot base unit. A variety of I/O modules are provided so appropriate modules can be selected according to the use, points, voltage level, current capacity, and signal specifications.

I.1.1 Structure of FANUC I/O Unit–MODEL A



AIF01A is used for connection to FANUC I/O Link
AIF01B expands I/O Units in the same group.

I.1.2 Outer Dimensions

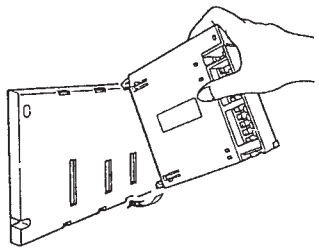


	A	B
For 5–slot base unit (ABU05A)	253	238
For 10–slot base unit (ABU10A)	430	415

I.1.3 Mounting and Dismounting Modules

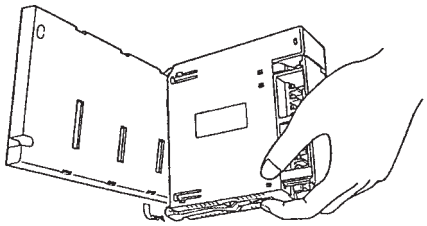
Interface modules and various types of I/O modules can be mounted to and dismounted from the base unit easily as shown below.

Mounting



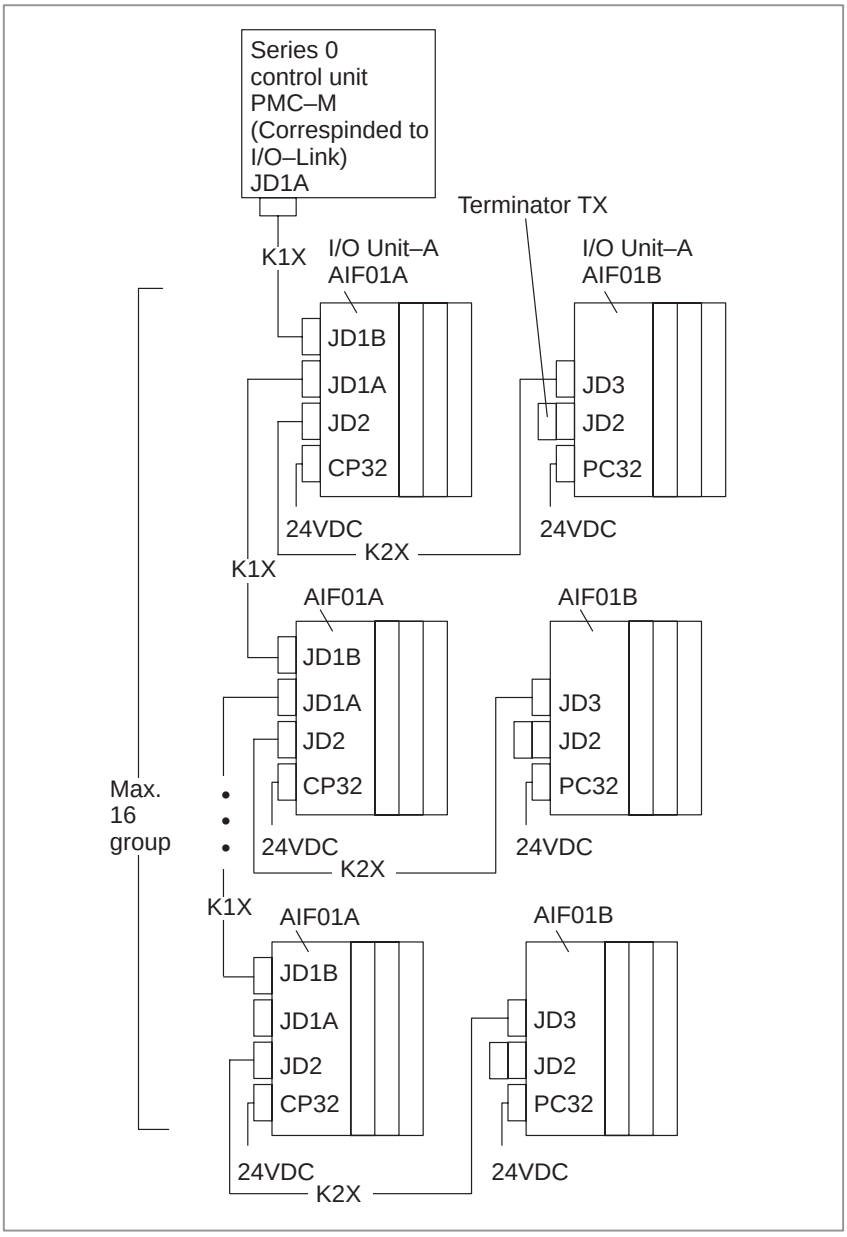
1 Hang the hook at the top of the module on the groove in the upper side of the base unit.
2 Make the connector of the module engage with that of the base unit.
3 Push the module in the lower groove of the base unit till the stopper in the lower side of the module stops.

Dismounting



1 Release the stopper by pushing the lever at the bottom of the module.
2 Push the module upwards.

I.1.4
Connection Diagram

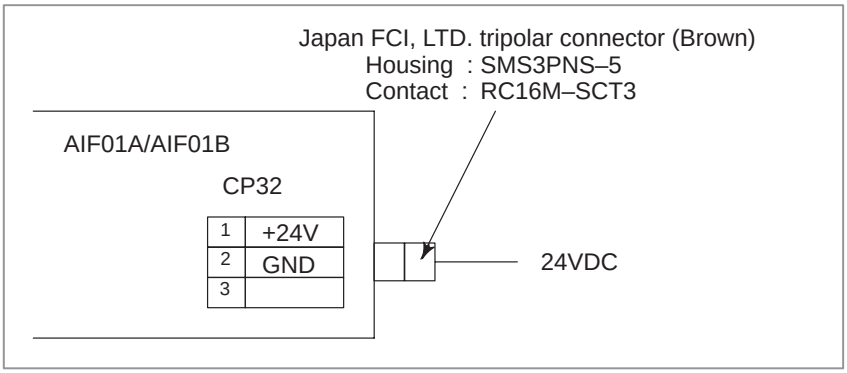


NOTE
1 Number of I/O Units and connecting method are restricted depending on the allocation of the I/O points.
2 Cable K1X can be an optical fiber cable by using the optical I/O link adapter.

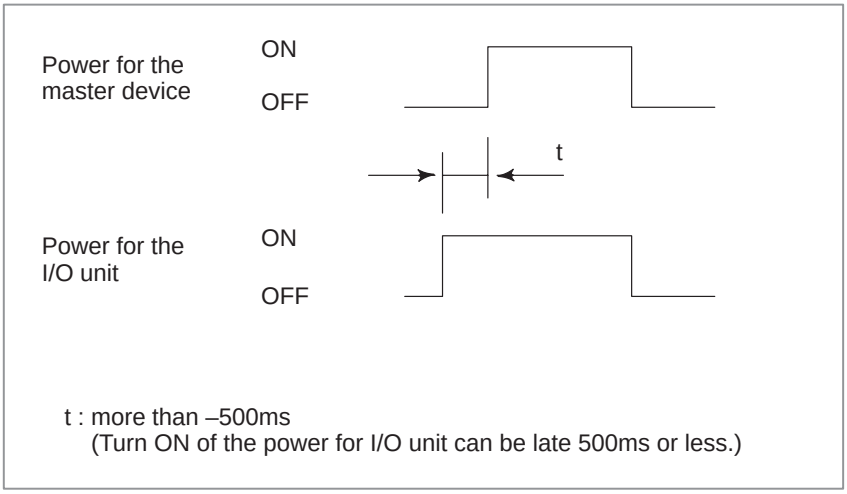
I.1.5 Connecting Input Power Source

Connect the following power source to the connector CP32 of the interface module (AIF01A or AIF01B).

- Voltage : 24VDC ± 10%
- Current : Determine from Table I.1.6.



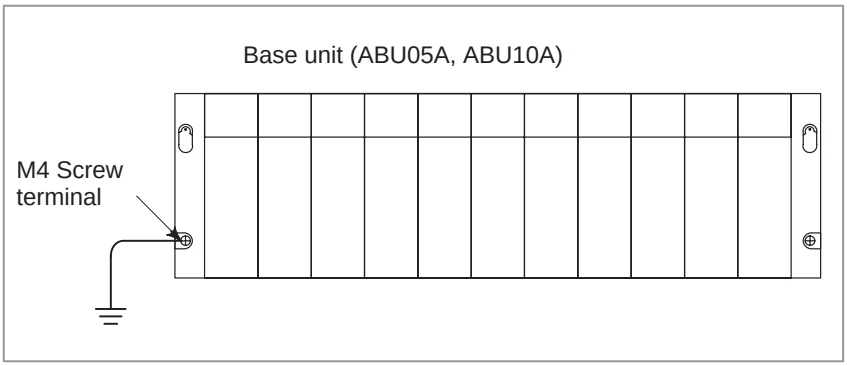
NOTE
Turn ON the power for the I/O unit just before or when the power for the CNC is turned ON. When the CNC power is turned OFF, make sure to turn the power to the I/O unit OFF as well.



t : more than –500ms
(Turn ON of the power for I/O unit can be late 500ms or less.)

I.1.6 Grounding

- Ground the base unit (ABU05A, ABU10A) by its grounding terminal



- When the cable K1X (see connection diagram in section I.1.4) runs between different cabinets, make sure to connect the cabinets with a grounding wire more than 5.5 mm^2.

Table I.1.6 Required current of each module

Module name	Required current (mA) of +24V	
	A	B
AIF01A	50	
AIF01B	50	
AIF32A	20+0.5×n	30+7.5×n
AIF32B	20+0.5×n	30+7.5×n
AIF16C	5	
AIF16D	5	
AIF32E	5	
AIF32F	5	
AIA16G	5+1.5×n	
AOD08C	5+2×n	
AOD08D	5+2×n	
AOD16C	5+2×n	
AOD16D	5+2×n	
AOD32C	5+0.5×n	
AOD32D	5+0.5×n	
AOA05E	5+5.5×n	
AOA08E	5+5.5×n	
AOA12F	5+4.5×n	
AOR08G	5	10×n
AOR16G	5	10×n
AAD04A	5	130

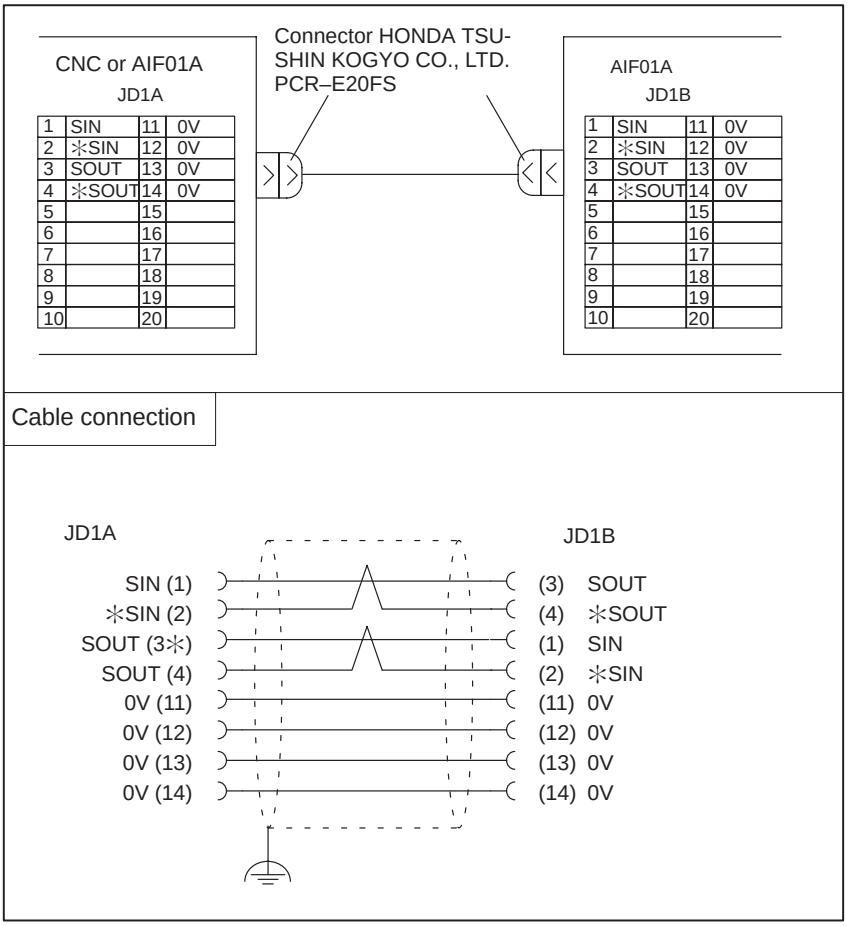
n : Number of the input and output points (for each module) which turn ON simultaneously

- The rating (mA) of the module to be used can be obtained by adding the corresponding values in the A and B columns.
- The current sum requirement for modules used in Column A should not exceed 500 mA.
- The current sum requirement for modules used in Column B should not exceed 1500 mA.

I.1.7 Connecting Signal Cables

Details of the cables K1X, K2X and the terminator shown in the general connection diagram are as follows.

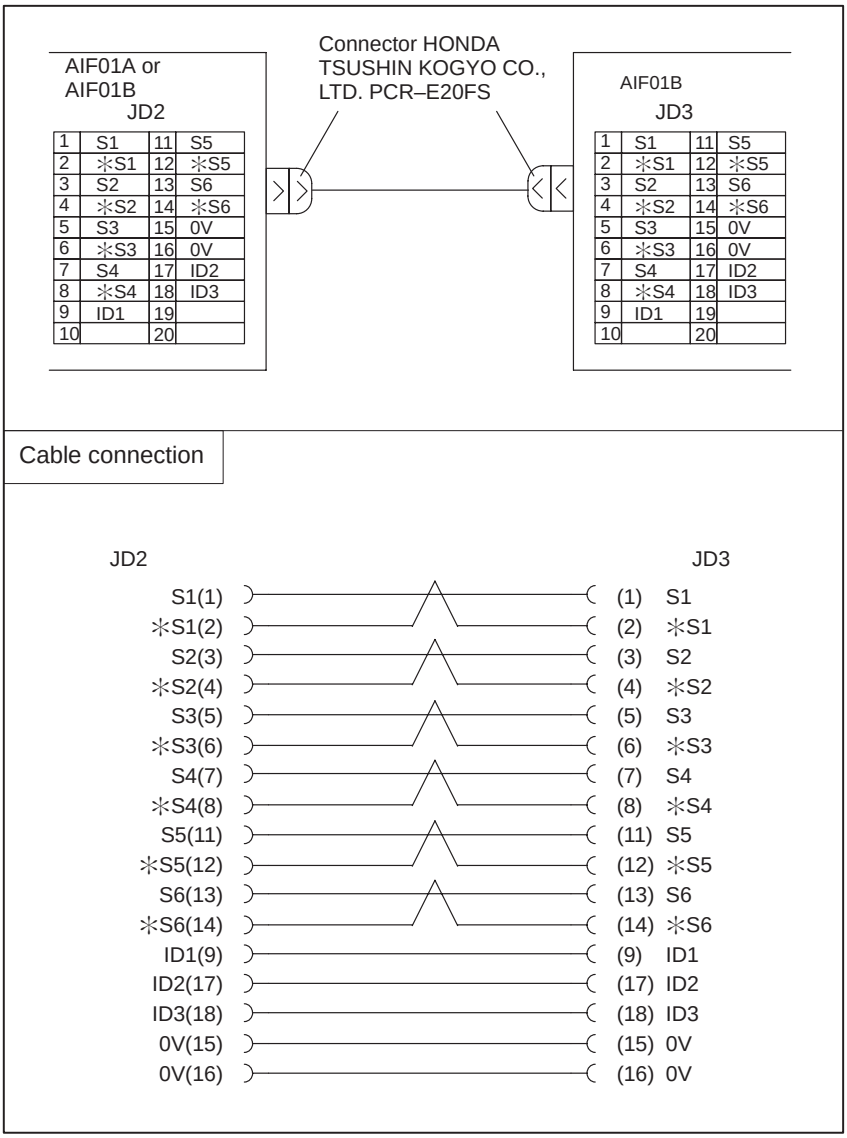
Cable K1X



1	SIN	11	0V
2	⁎SIN	12	0V
3	SOUT	13	0V
4	⁎SOUT	14	0V
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

- Use twisted pair wires for signal SIN and *SIN, and signals SOUT and *SOUT.
- Recommended cable material : A66L–0001–0284#10P
  (twisted pair/shielded)
- Shielding wires should be connected with the grounding plate of the cabinet at the JD1A side using a cable clamp.
- Maximum cable length: 10 m
- Do not make any wire connections to the connector spare pins.
- Use an optical I/O link adapter and an optical fiber cable, [in the following cases] :
  - ❑ When the cable is more than 10 meters long.
  - ❑ When the cable runs between different cabinets and there is no appropriate ground wire between the cabinets.
  - ❑ When there is concern that the cable is influenced by strong noise.

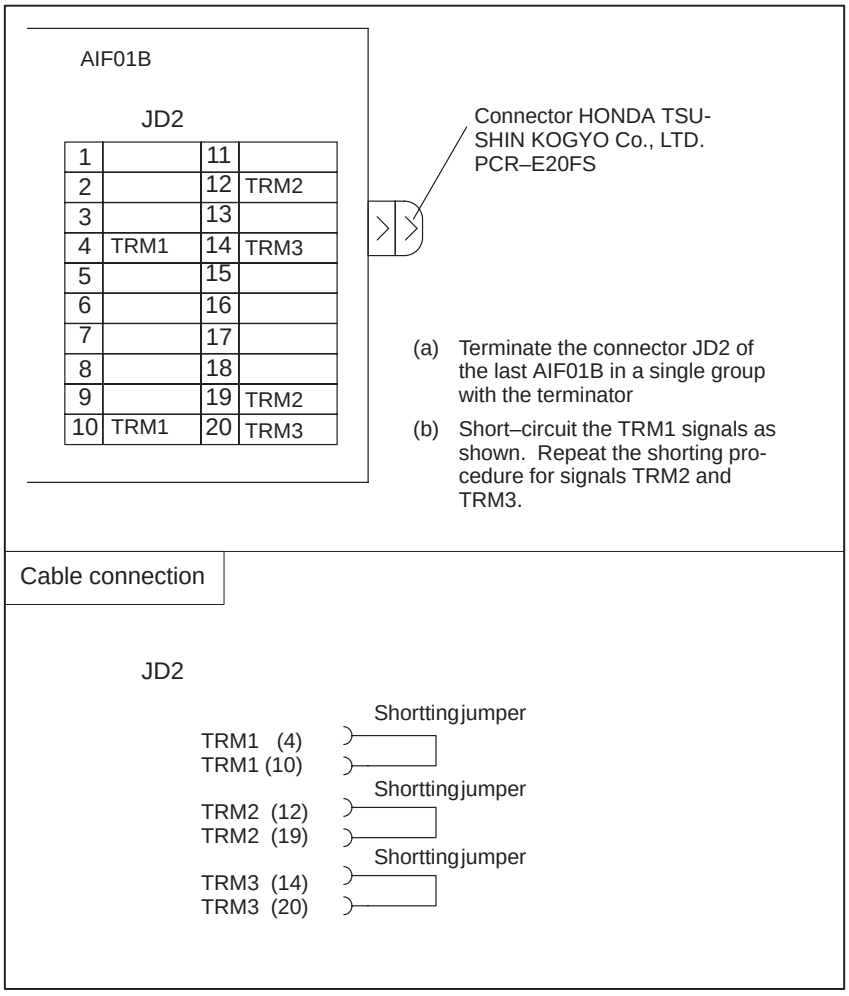
Cable K2X



1	S1	11	S5
2	∗S1	12	∗S5
3	S2	13	S6
4	∗S2	14	∗S6
5	S3	15	0V
6	∗S3	16	0V
7	S4	17	ID2
8	∗S4	18	ID3
9	ID1	19	
10		20	

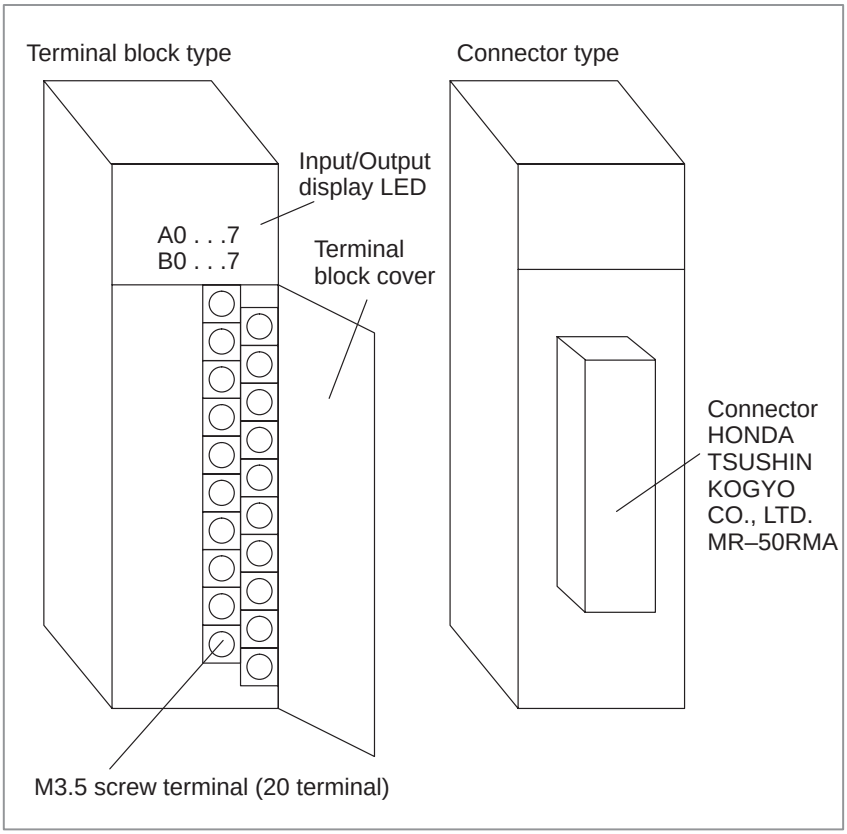
- Connect the signals with the same name.
- Make sure to use twisted pair wires for the following signals:
  S1 and *S1, S2 and *S2, S3 and *S3
  S4 and *S4, S5 and *S5, S6 and *S6
- Do not connect the pins No. 10, No. 19 and No. 20, as they are used internally.
- Recommended cable material : A66L – 0001 – 0284#10P
  (twisted pair/shielded)
- Maximum cable length : 2 m

Terminator TX

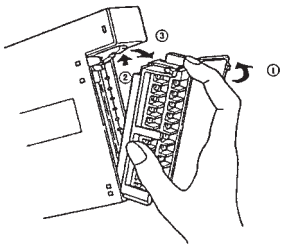


I.1.8 Connecting with I/O Modules

For an external connecting method, there are two types of I/O modules : one with a terminal block, and one with a connector.
The terminal block is a removable type.

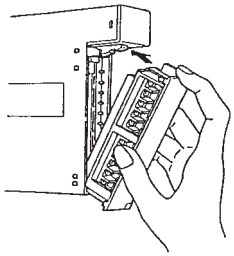


Dismounting the terminal block



1 Open the cover of the terminal block.
2 Push up the latch at the top of the terminal block.
3 Drag out the tab at the top of the terminal block and pull it out.
The terminal block will be removed from the module.

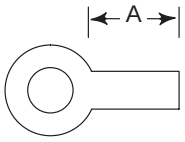
Mounting the terminal block



1 Insert the protruding portion at the bottom of the terminal block in the groove of the module side.
2 Push the terminal block using the engaging point of the protruding portion and the groove as an axis and mount it in the module firmly.
3 Open the cover of the terminal block and check to make sure the latch at the top of the terminal block is firmly set.

Cautionary points when wiring terminal block type

- Wiring material : AWG22 – 18 (0.3 – 0.75mm^2)
  A wire as thin as possible is recommended.
- Crimp style terminal : M3.5
  Crimp style terminal with no insulation sleeve and a short distance “A”, as illustrated in the drawing below, is recommended.



DAIDO SOLDERLESS TERMINAL MFG. CO., LTD	1.25–S3.5
NICHIFU EUROPE B.V NICHIFU AMERICA, INC.	1.25–3.5S, etc.

- Mark tube : As short a mark tube as possible ; cover crimped part with the mark tube.

I.1.9 Digital Input/Output Module

Digital input modules

Input type	Module name	Rated voltage	Rated current	Polarity	Response time	Points	External connection	LED display
Non–insulation DC input	AID 32A	24VDC	7.5mA	Both	Maximum 20ms	32	Connector	not provided
	AID 32B	24VDC	7.5mA	Both	Maximum 2ms	32	Connector	not provided
Insulation type DC input	AID 16C	24VDC	7.5mA	NEG	Maximum 20ms	16	Terminal block	provided
	AID 16D	24VDC	7.5mA	POS	Maximum 20ms	16	Terminal block	provided
	AID 32E	24VDC	7.5mA	Both	Maximum 20ms	32	Connector	not provided
	AID 32F	24VDC	7.5mA	Both	Maximum 2ms	32	Connector	not provided
AC input	AIA 16G	100–120VAC	10.5mA (120V AC)	ON Max 35ms OFF Max 45ms		16	Terminal block	provided

NOTE

1 Polarity
  Negative : 0 V common (current source type)
  – The input is defined as ON when at a low level
  Positive : 24 V common (current sink type)
  – The input is defined as ON when at a high level

2 For the details of the specifications for each module, refer to FANUC I/O Unit–MODEL A Connection·Maintenance Manual (B–61813E).

Digital output modules

Input type	Module name	Rated voltage	Rated current	Polarity	Points	Points /common	External connection	LED display	Fuse
Insulation type DC output	AOD 08C	12–24VDC	2A	NEG	8	8	Terminal block	provided	provided
	AOD 08D		2A	POS	8	8	Terminal block	provided	provided
	AOD 16C		0.5A	NEG	16	8	Terminal block	provided	not provided
	AOD 16D		0.5A	POS	16	8	Terminal block	provided	not provided
	AOD 32C		0.3A	NEG	32	8	Connector	not provided	not provided
	AOD 32D		0.3A	POS	32	8	Connector	not provided	not provided
AC output	AOD 05E	100–240V AC	2A	–	5	1	Terminal block	provided	provided
	AOD 08E		1A	–	8	4	Terminal block	provided	provided
	AOD 12F	100–120V AC	0.5A	–	12	6	Terminal block	provided	provided
Relay output	AOR 08G	Maximum 250VAC/ 30VDC	4A	–	8	1	Terminal block	provided	not provided
	AOR 16G		2A	–	16	4	Terminal block	provided	not provided

NOTE

1 Polarity

Negative : 0 V common (current sink type)

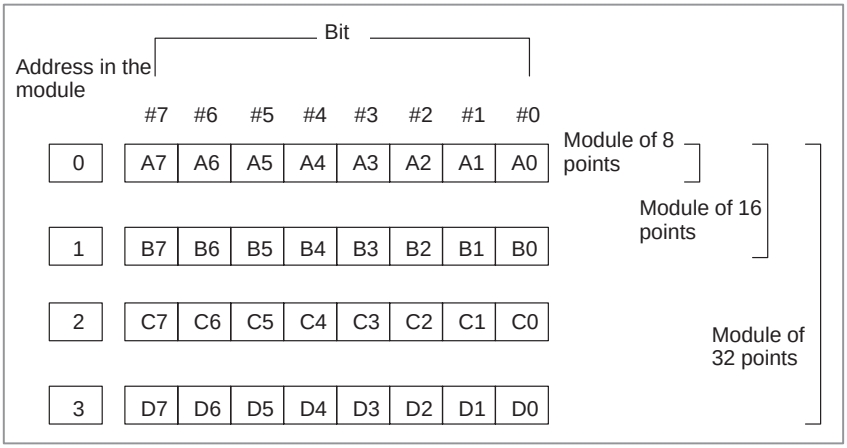
– Output is at low level when ON.

Positive : 24 V common (current source type)

– Output is at high level when ON.

2. For the details of the specifications for each module, refer to FANUC I/O Unit–MODEL A Connection·Maintenance Manual (B–61813E).

I.1.10 Correspondence between I/O Signals and Addresses in a Module



Addresses in a module are defined relatively, with the beginning address as 0. Real addresses viewed by the sequence program of the PMC are set by the programmer.
For input modules, an input signal becomes “1” when the contact point connected with the input is turned ON. For output modules, an output contact point (or transistor) is turned ON when the output signal is “1”.

I.1.11 Number of Points for I/O Unit–MODEL A

Determine the number of I/O points for the I/O Unit –MODEL A using the following.

- **Output points**

Sum of the actual output points in a group		Occupied output points
0 to 32	→	32 points
40 to 64	→	64 points
72 to 128	→	128 points
136 to 256	→	256 points

NOTE
Count AOA05E as 8 points and AOA12F as 16 points.

- **Input points**

Sum of the actual input points in a group		Occupied input points
0 to 32	→	32 points
40 to 64	→	64 points
72 to 128	→	128 points
136 to 256	→	256 points

As a result of the calculation above, when the number of input points is smaller than that of the output points in a single group, the number of input points is assumed to be equal to that of the output points.

Example 1:

When the following modules are used in the group No. 0

AOD32C 3
AOA12F 2
AID32A 5
AIA16G 3

[Input points]

$32 \times 5+16 \times 3 = 208 \rightarrow 256$ points

[Output points]

$32 \times 3+16 \times 2 = 128 \rightarrow 128$ points

Example 2:

When the following modules are used in the group No. 2.

AOD16C 7
AOA05F 9
AID16A 4
AIA16G 3

[Input points]

$16 \times 4+16 \times 3 = 112 \rightarrow 128$ points

[Output points]

$16 \times 7+8 \times 9 = 184 \rightarrow 256$ points

In this case, as the number of input points is smaller than that of the output points, the number of input points is assumed to be equal to that of the output points, in other words, 256 points.

J CONNECTION OF CRT/MDI UNIT FOR Series 00

J.1 INSTALLATION

The installation conditions and method for the CRT/MDI for the Series 00 are basically the same as in 9″ CRT/MDI unis. Therefore, refer to item 3 in the text. Follow this reference material, however, for the following items.

- **Cautions about heating value**

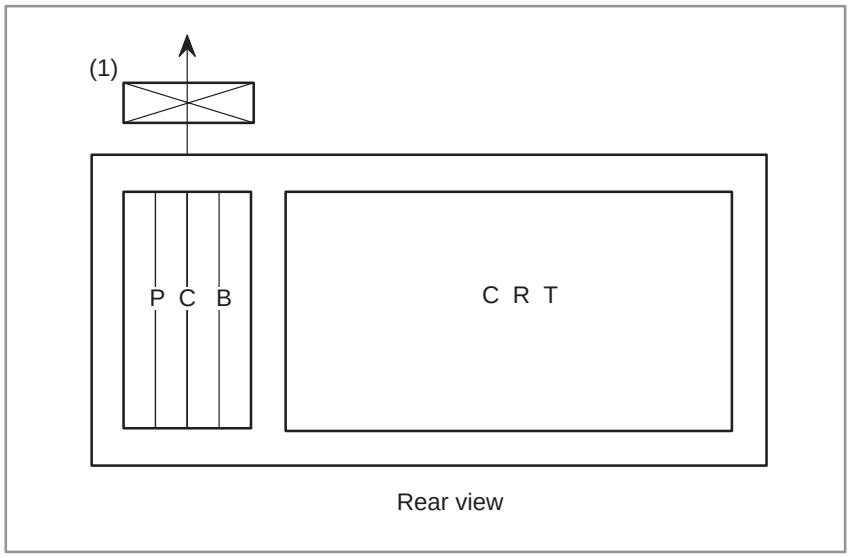
This unit's heating value is about 170 W. The pendant, etc. on which to mount this unit should be designed as follows so that the inside temperature does not rise more than 15°C above the outside temperature.

(1) Heat absorber

The conventional 14″ CRT/MDI unit heat absorber has insufficient radiation. A special heat absorber is available for this unit. (It is a little different from the conventional 14″ CRT/MDI unit heat absorber in size.)

(2) Air agitation fan in cabinet

An air agitation fan (1) should be installed at the position shown in the figure below so that air flows between the printed circuit boards at 0.5m/sec. (A special fan unit is available.)

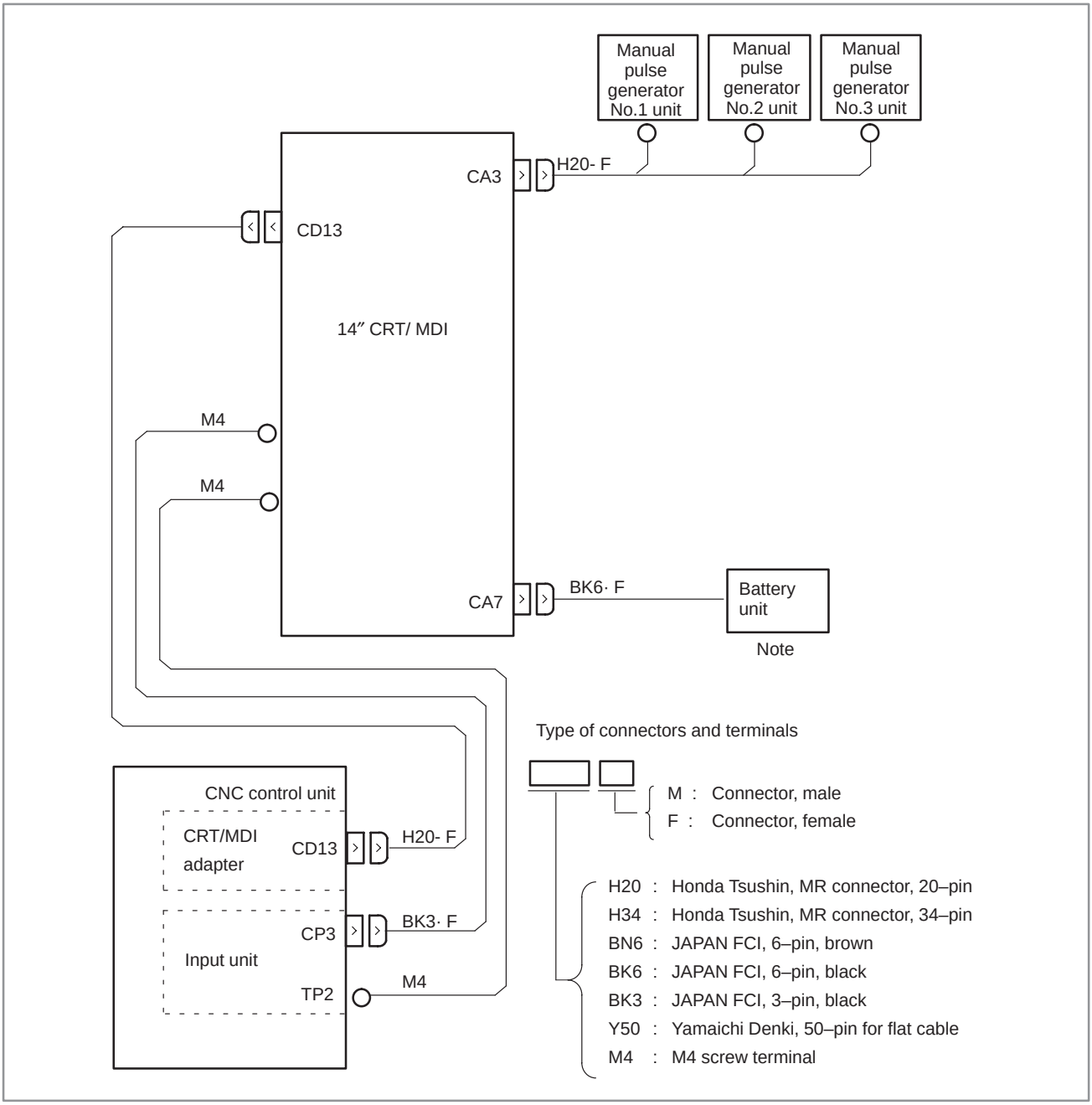


- **The unit's supporting attachments should be procured.**

(See section J.3 for external dimension.)

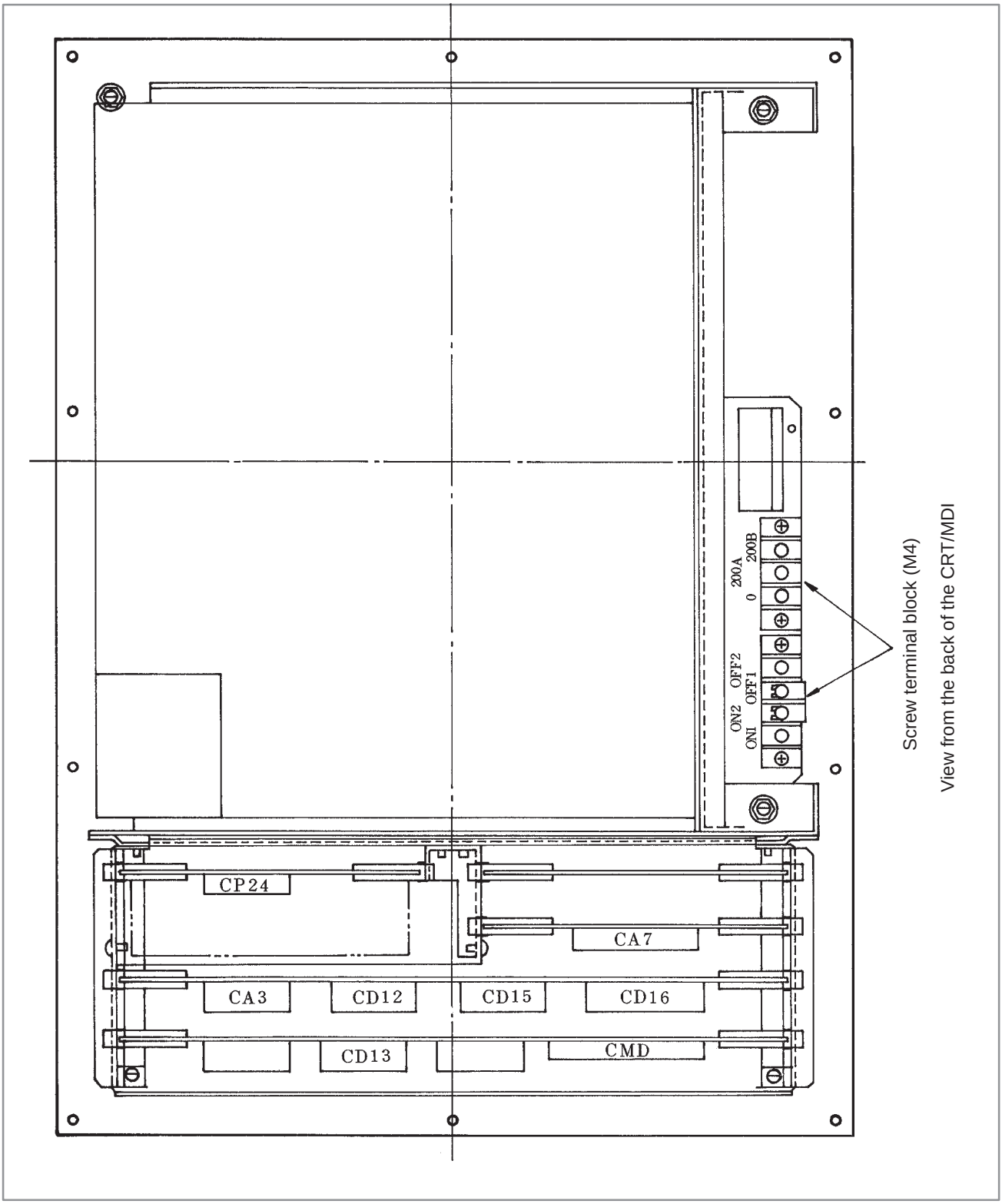
J.2 CONNECTION

J.2.1 General Connection Diagram

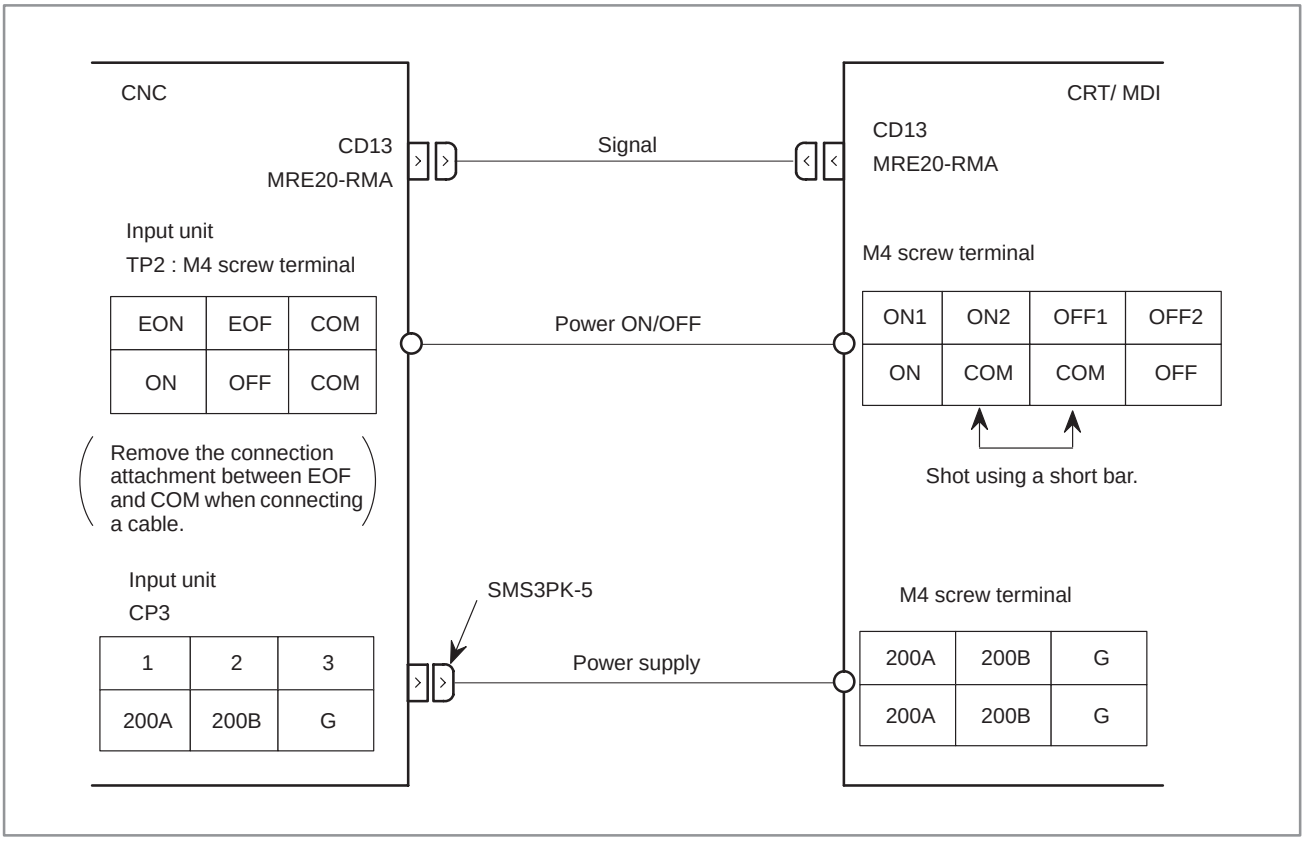


NOTE
Connection with the battery unit is necessary when using RAM file.
Connection with the battery unit on the CNC side is also possible.

J.2.2 Connector Layout Drawing

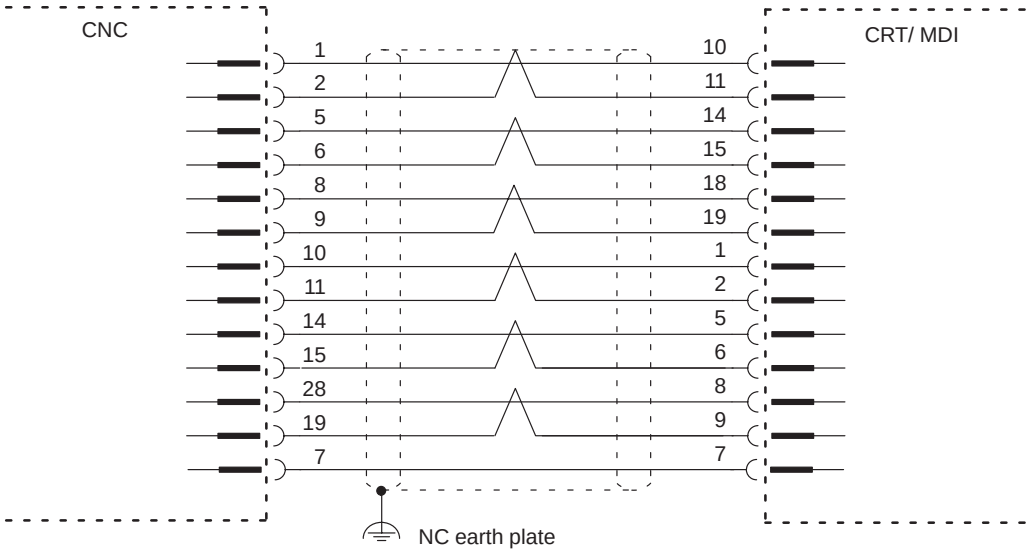


J.2.3 Connection of the CNC and the CRT/MDI



CAUTION
A power cable 30/0.18 (0.75mm^2) and over in gauge should be used.

NOTE
For the signal cable, see the next page.

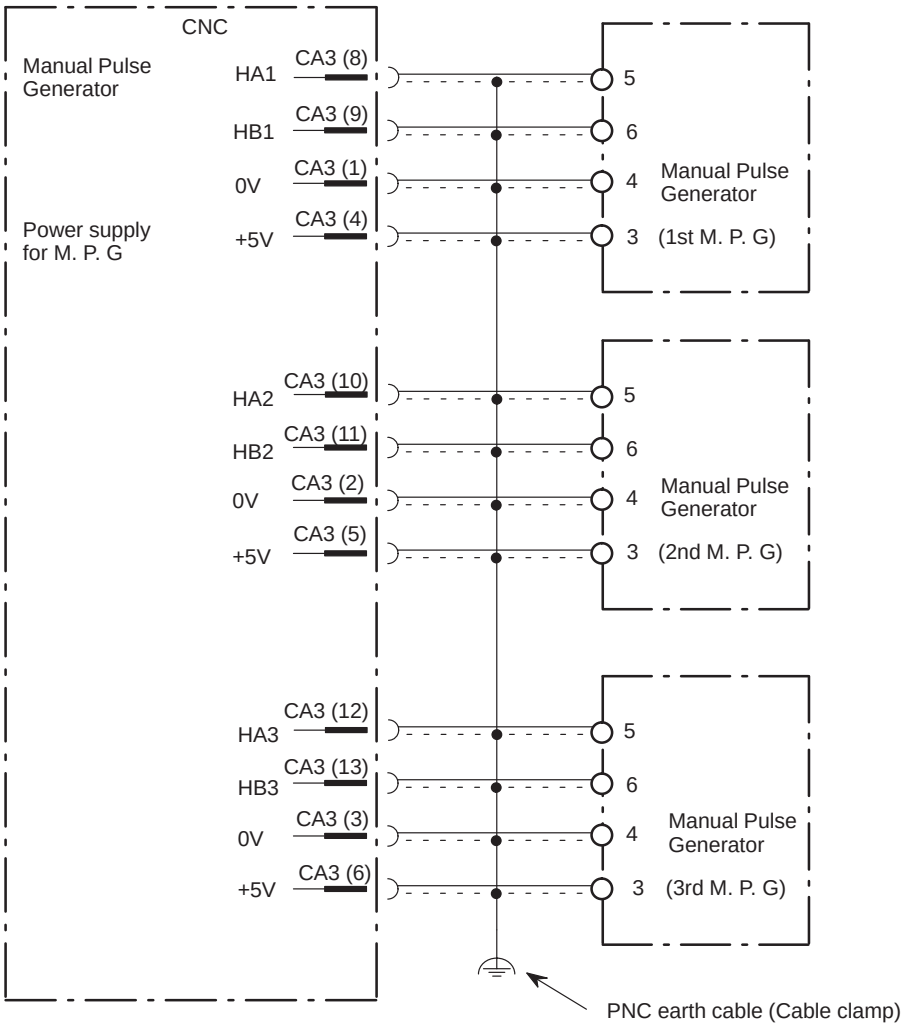


Wiring gauge : 7/0.18 (0.18mm^2), twist pairl, entire shielding
Specification : A66L–0001–0041

J.2.4 Connection of the CRT/MDI and Manual Pulse Generators

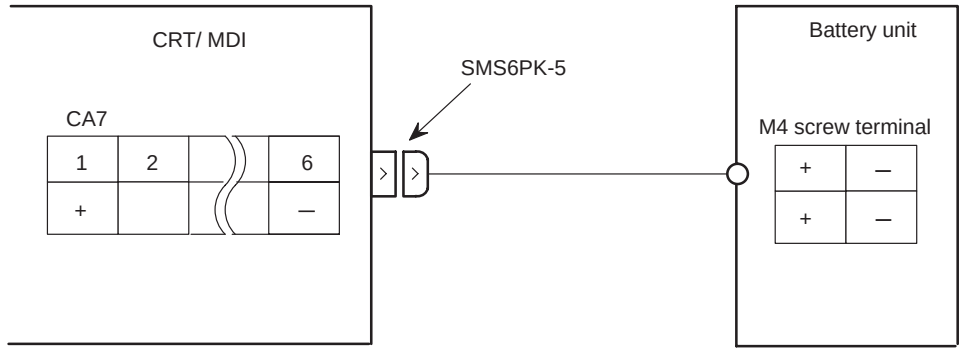
CA3		MRE20-RMD			
1	0V			14	
2	0V	8	HA1	15	
3	0V	9	HB1	16	
4	+5V	10	HA2	17	
5	+5V	11	HB2	18	
6	+5V	12	HA3	19	
7		13	HB3	20	

Name of signal	Description
HA1 to 3	Manual pulse generator, Phase A signal
HB1 to 3	Manual pulse generator, Phase B signal



NOTE
The manual pulse generator's current drain is 95mA per unit. The +5–V and 0–V wire gauges should be decided on so that the two–way voltage drop between the CRT/MDI and the manual pulse generator is not over 0.25V.

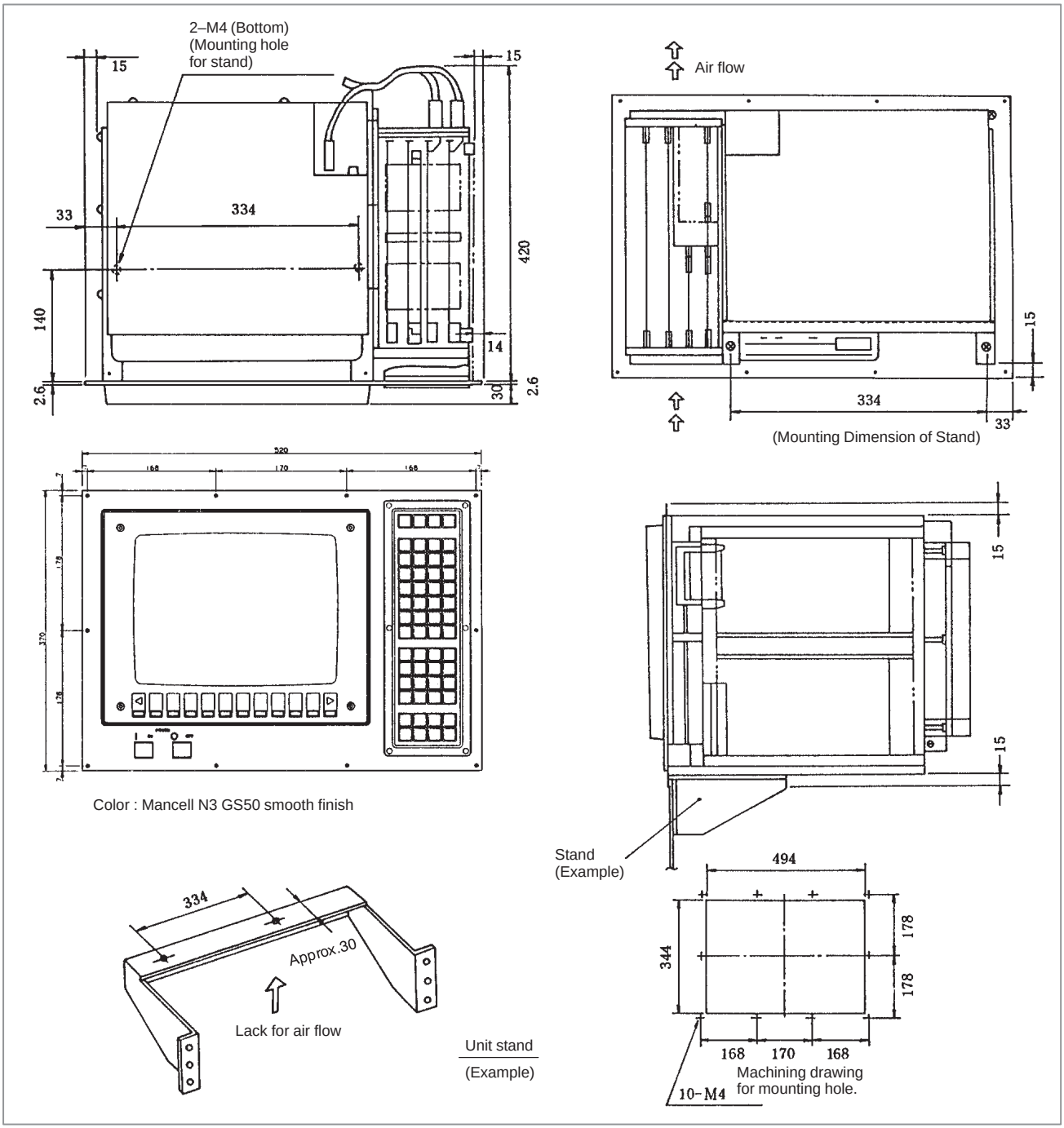
J.2.5 Connection of the CRT/MDI and the Battery Unit



NOTE
1 Connection with the battery unit is necessary only when using RAM file.
2 A cable (3.4m) is attached to the battery unit for CRT/MDI.
3 Connection with the battery unit on the CNC side is also possible. In this case, the cable should be manufactured by the machine tool builder.
Wire gauge : 30/0.18 (0.75mm^2) and over twist pair, shielding
Connector contact : Gold–plated
4 The cable shielding should be shorted to the earth plate.

J.3 OUTER VIEW

J.3.1 Outer View of CRT/MDI Unit



- **Notices of mount**

1) The calorific value of this unit is 170 W. Give careful consideration to cooling at design. Specially, air is made flow at section with ↑ Mark in above drawings.
2) Consider the mounting of stand when mounting the unit.

K CRT/MDI SWITCHING CIRCUIT

K.1 CRT/MDI SWITCHING CIRCUIT

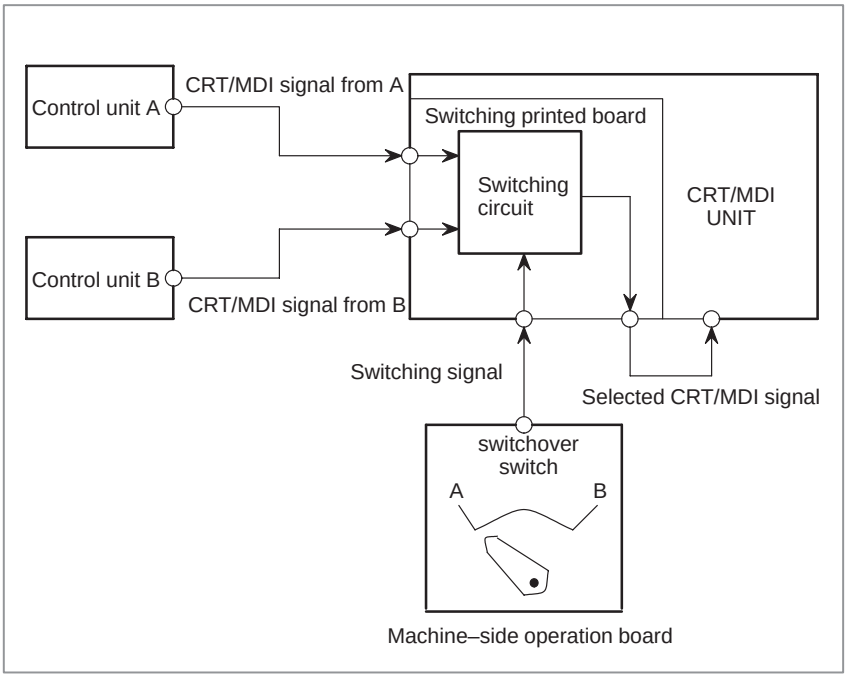
K.1.1 Overview

When a CRT/MDI switching circuit is used in a system featuring two Series 0–C (Series 0–Mate C) control units, the single CRT/MDI unit can be switched between the two control units.
With the CRT/MDI switching circuit, a single control unit can be switched between two CRT/MDI units. Section K.1.2 describes the former use, while Section K.1.3 describes the latter use.

K.1.2 When Connecting Two Control Unit with One CRT/MDI Unit

This operating manual describes the switching circuit connections when used to switch one CRT/MDI unit in a system using 2 control units.

- **Block diagram**



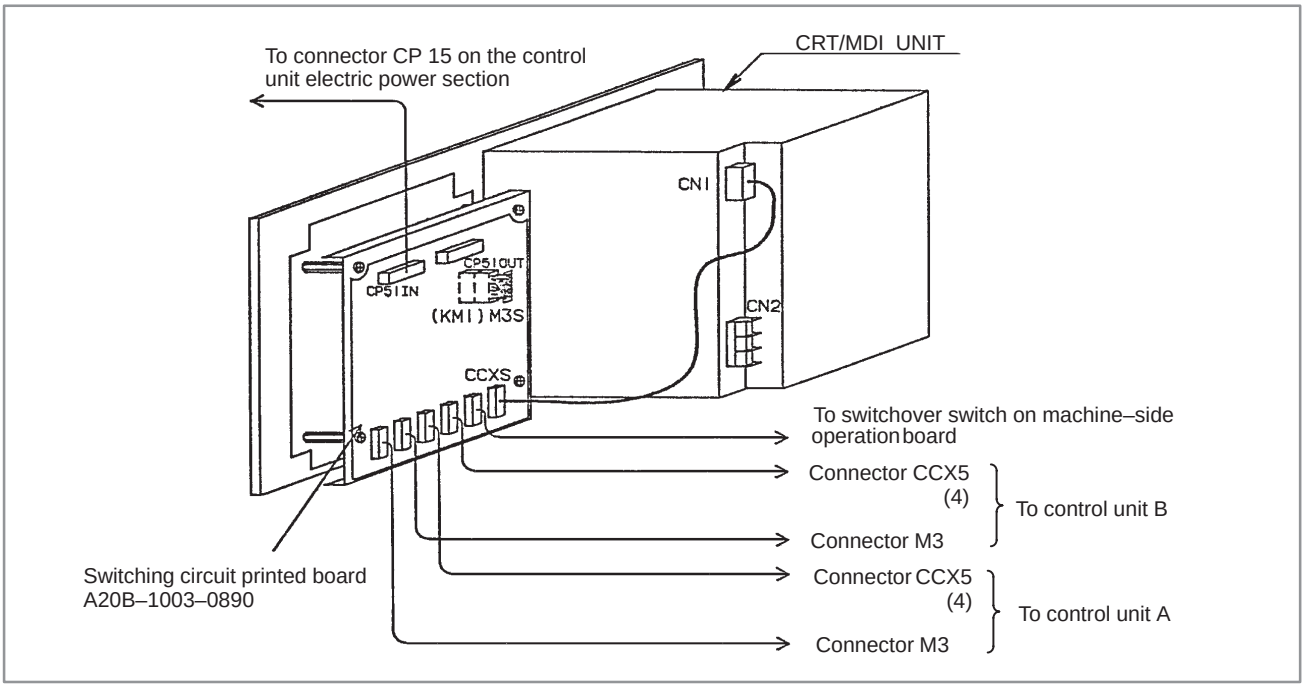
- **Operation**

The CRT/MDI switching is performed by the switchover switch shown above.

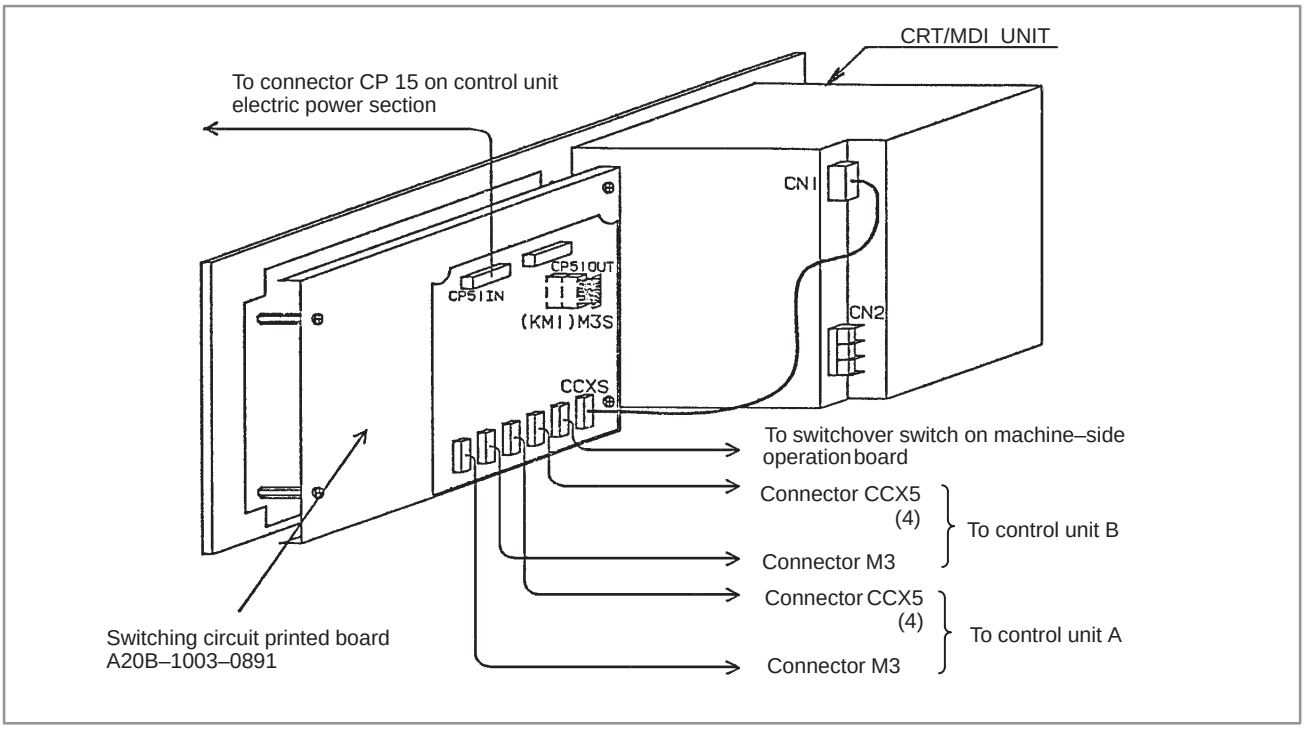
- **Connection**

The switching printed board is installed in the CRT/MDI unit. There are 2 kinds of printed board for use with the small–size MDI and for use with the full key MDI.

● **Installation diagram** (1) For small–size MDI

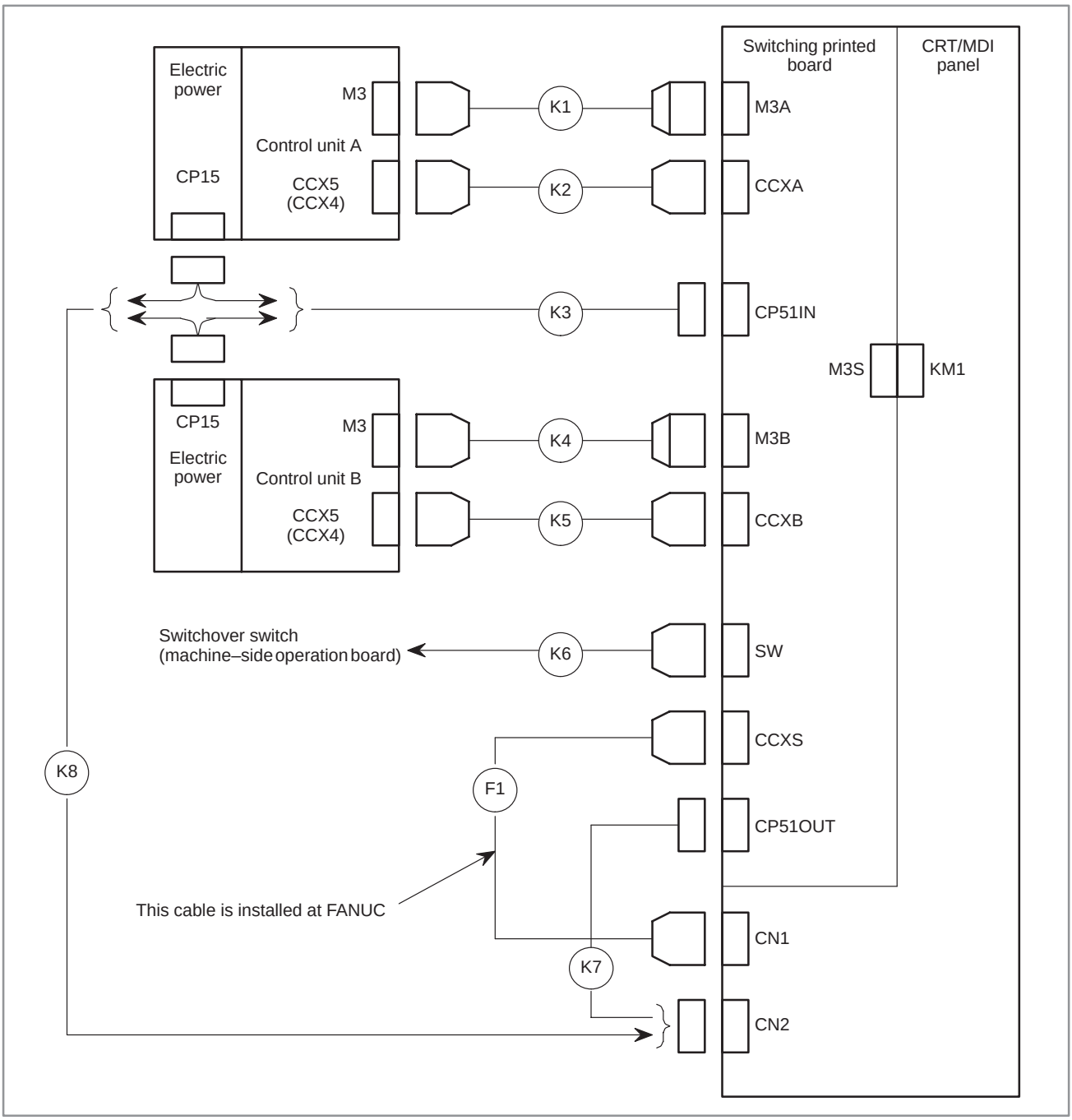


(2) For full–key MDI



NOTE
Above is color CRT.

● **Connection diagram** (1) For monochrome CRT



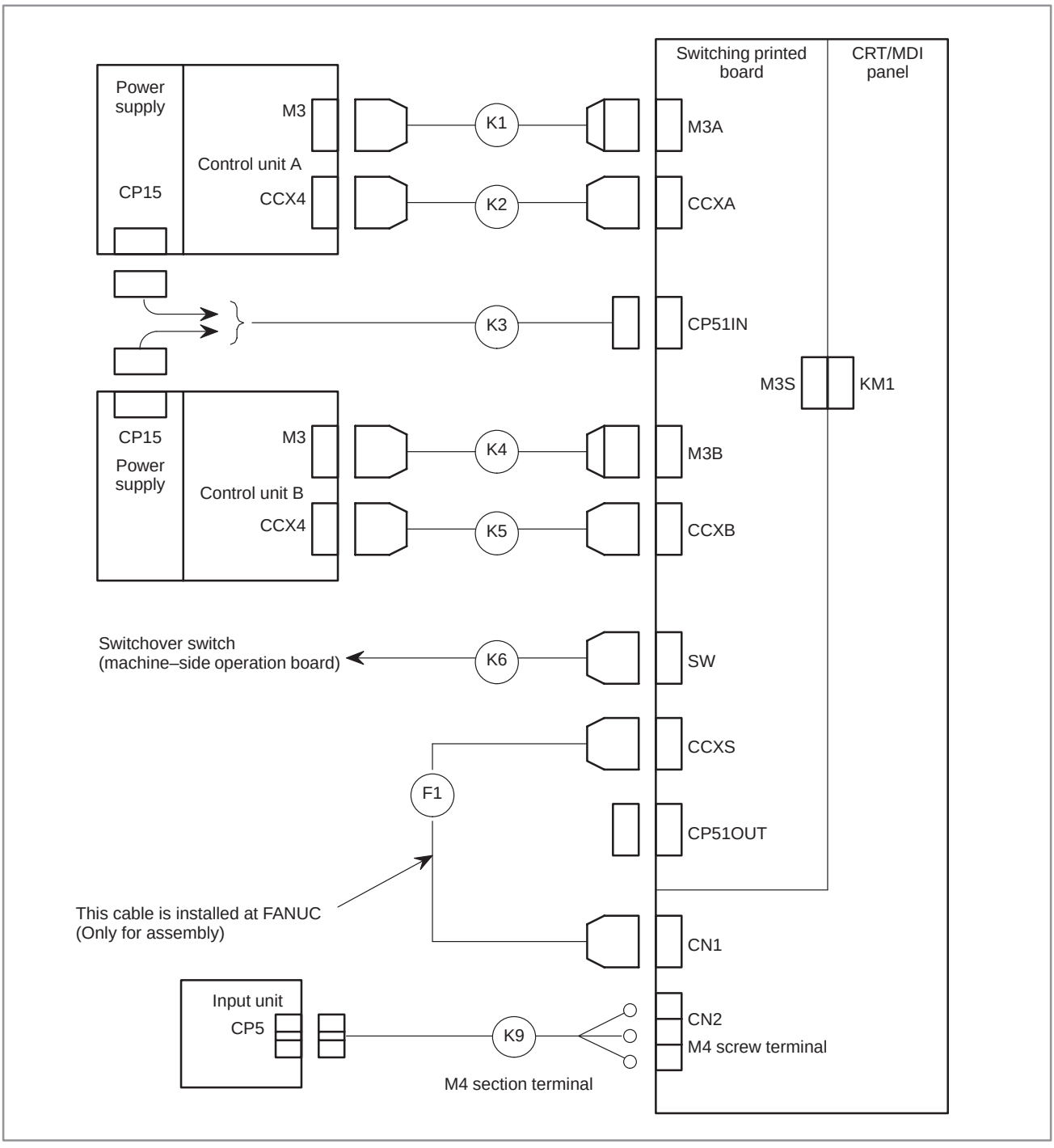
NOTE

1 Connect [CCX4] when using graphic card.

2 Select either (K7) or (K8). When selecting (K7), specify either electric power unit B2 or electric power unit C for the electric power of the control unit connected to CP51ITN.

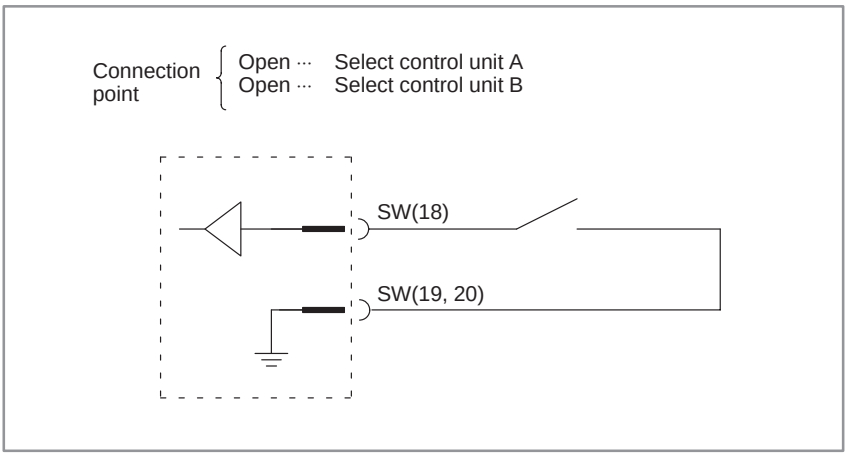
3 In the case of 0–Mate C, be sure to select (K8).

(2) For color CRT



- **Points of caution about connection**

(1) The relationship between the switchover switch connection point and the selected control unit is as shown below.



(2) Prepare all the cables below at the machine manufacture

(K1) (K4)	According to J27 (signal cable) in B. CONNECTION CABLES AND CONNECTORS. Cable length less than 50m.
(K2) (K5)	According to J37 (signal cable for CRT) in B. CONNECTION CABLES AND CONNECTORS. Cable length less than 50m.
(K3) (K7) (K8)	Use vinyl cable of more than 30/0.18 (0.8mm2). Set according to J38 (input electric power cable) in B. CONNECTION CABLES AND CONNECTORS. Cable length 50m.
(K6)	Use vinyl cable of more than 30/0.18 ($0.8mm^2$). Use a cable length of less than 10m.
(K9)	Use vinyl cable of more than 30/0.18 (0.8mm2). Set according to J40 (input electric power cable) in B. CONNECTION CABLES AND CONNECTORS. Cable length less than 50m.

(3) Kind of connector

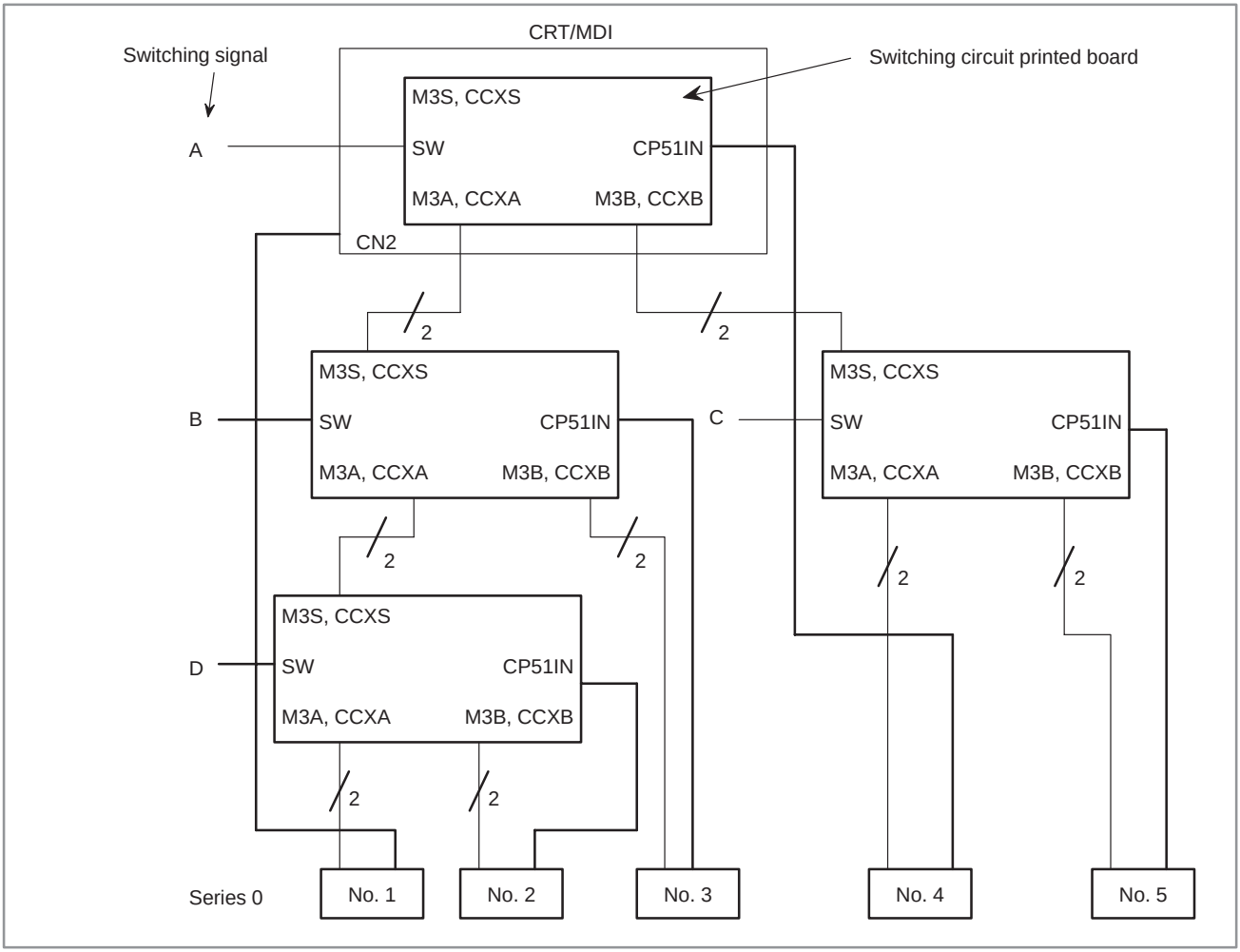
MR–20LFH (HONDA 20 pin female)	SMS6PN–5(JAPAN FCI)
MR–20LMH(HONDA 20 pin male)	SMS3PK–5(JAPAN FCI)

(4) Connet (K3) to the electric power of either control unit A or B.

(5) When (K8) is selected, connect to the electric power which is not being used by the (K3) cable.

- **Application example**

When connecting one CRT/MDI unit with many Series 0–C or Series 0 Mate–C units.
When using the CRT/MDI switching circuit, it is possible to connect one CRT/MDI unit or many Series 0–C or Series 0 Mate–C units. An example is shown below of the connection for 5 units.



NOTE

1 /2 means the 2 signal cables (MDI key signal and CRT video signal)

2 The switching signal A, B, C and D are as shown in the below.

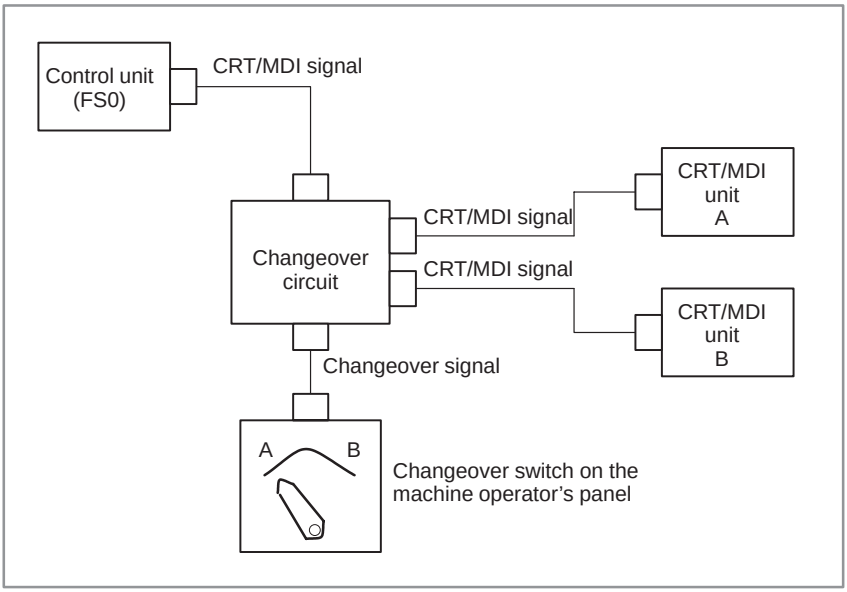
Switching signal	No. 1	No. 2	No. 3	No. 4	No. 5
A	×	×	×	○	○
B	×	×	○	×	×
C	×	×	×	×	○
D	×	○	×	×	×

○ : close
× : open

K.1.3 When Connecting One Series 0–C with Two CRT/MDI Units

- **Overview**

The following figure shows an example of connecting the Series 0–C (Series 0 Mate–C) and two CRT/MDI units when using the units by switching between them.



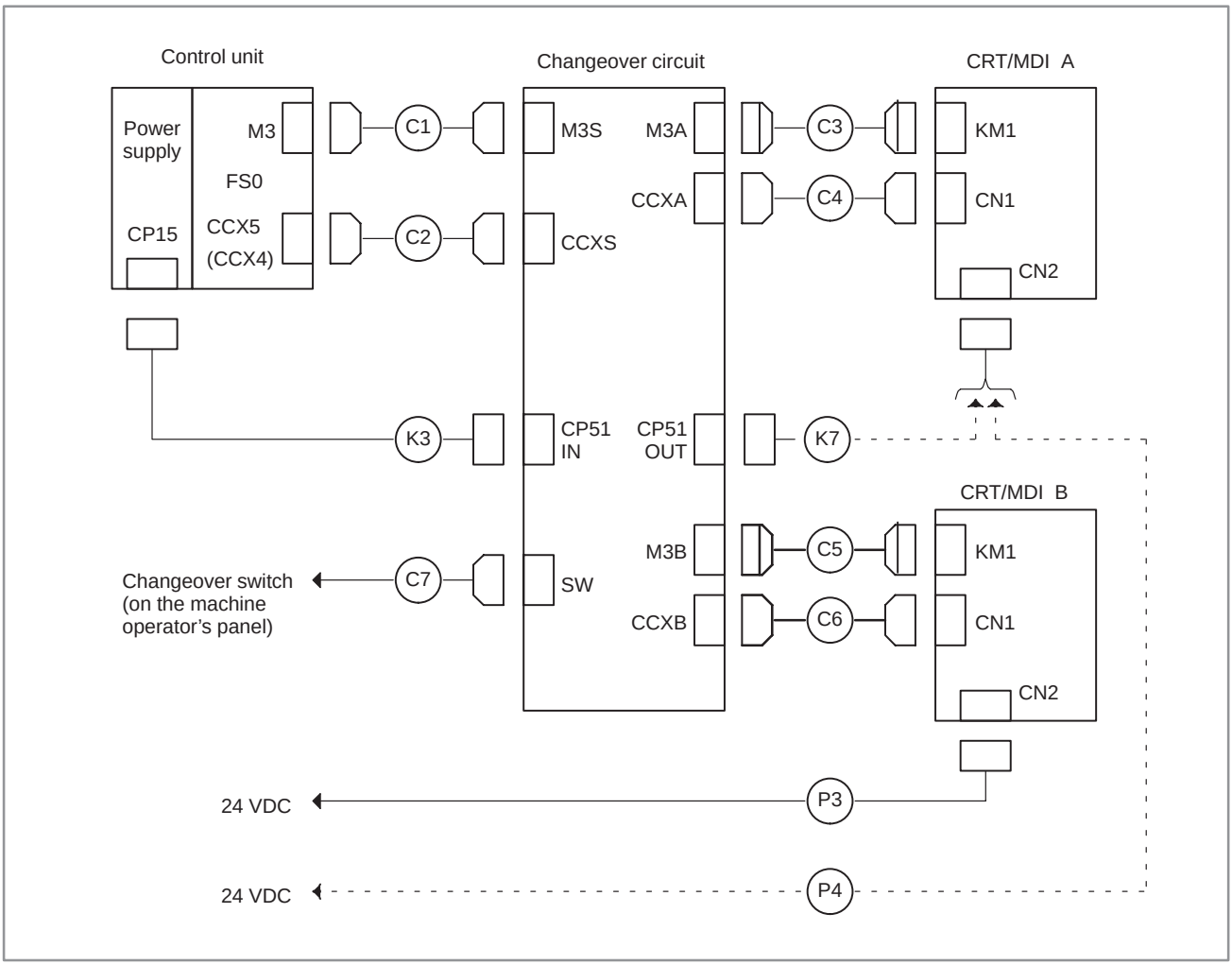
NOTE
Order a changeover circuit for use with a small MDI unit.

- **Operation**

The output of the CRT/MDI signal can be changed to either CRT/MDI unit A or CRT/MDI unit B by using the above changeover switch.

NOTE
Only the CRT/MDI unit selected by the changeover switch is enabled.
The unselected CRT display shows nothing, and no data can be input from the MDI.

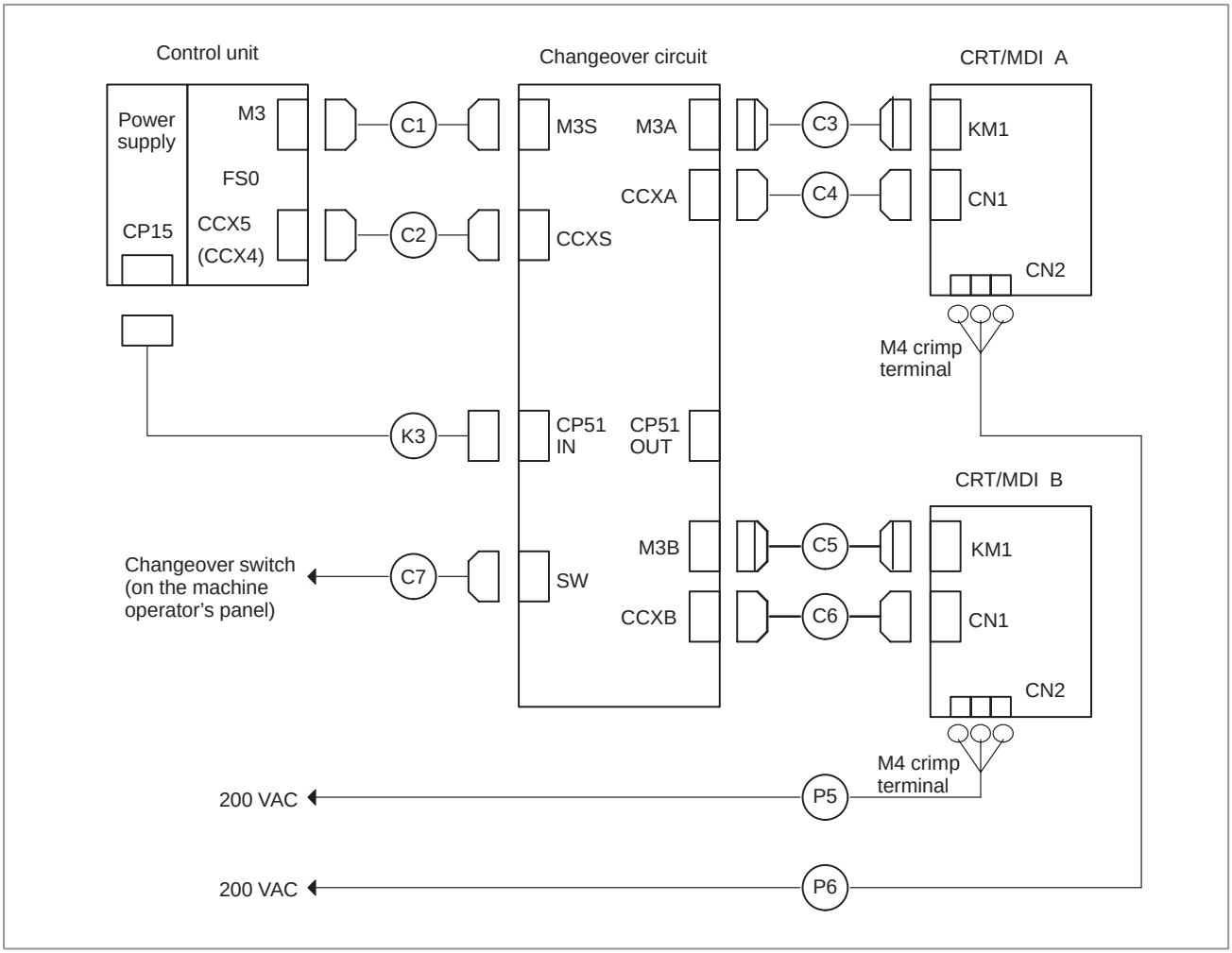
- **Connection** (1) Example of Connection for 9–inch monochrome CRTs



CAUTION
Be sure to select (P4) for the FS0–Mate C.

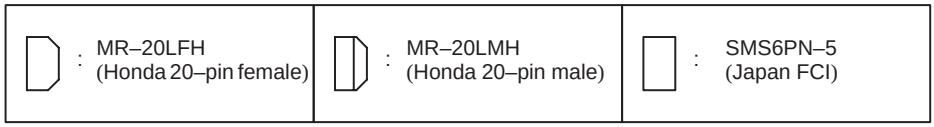
NOTE
1 Connect CCX4 when the graphic card is used.
2 Select either (K7) or (P4) . If (K7) is selected, specify power supply unit B2 or C as the power supply to be used for the control unit.

(2) Example of Connection for color CRTs



NOTE
Connect CCX4 when the graphic card is used.

(3) Connectors

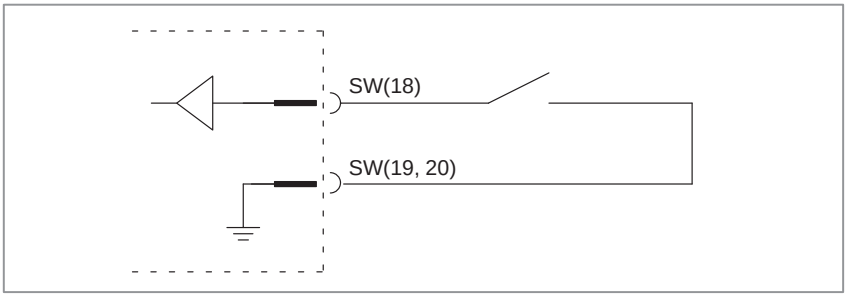


(4) Changeover switch

(a) The following table shows the relationship between the contact state of the changeover switch and selected CRT/MDI unit.

Contact	Selection
Open	CRT/MDI unit A is selected.
Close	CRT/MDI unit B is selected.

(b) Contact circuit

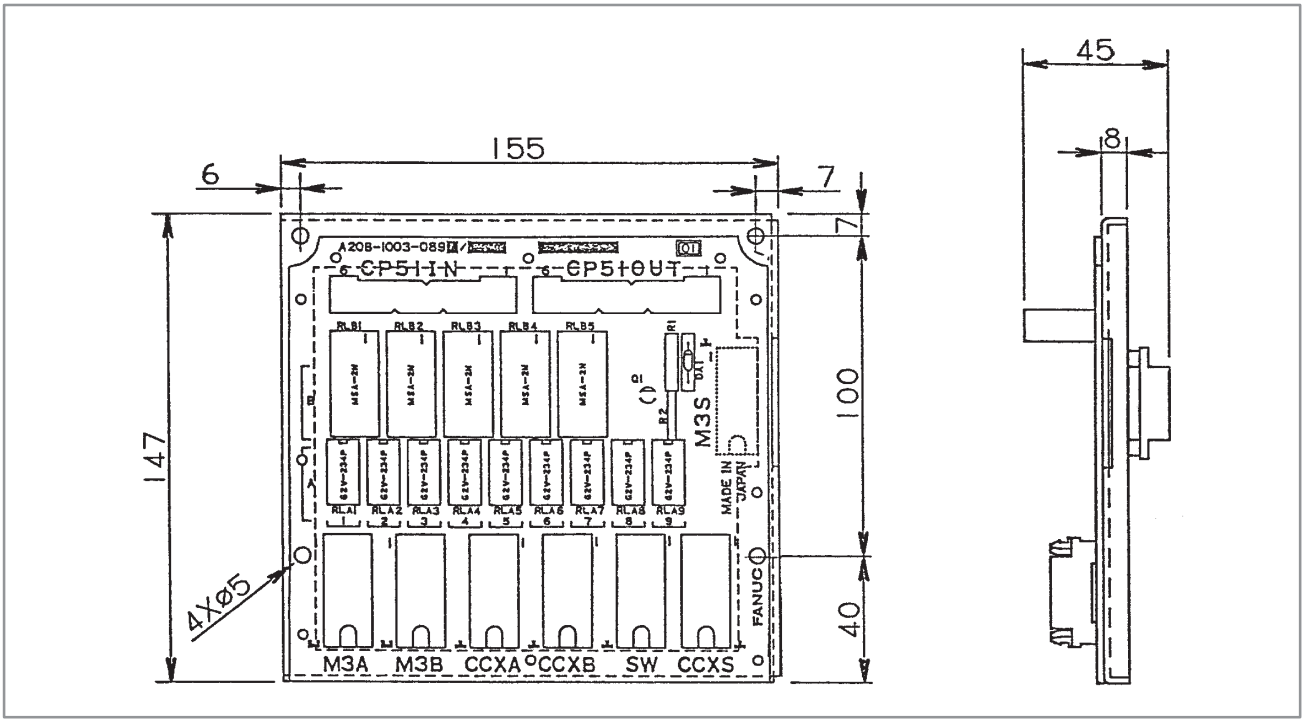


(5) Cables

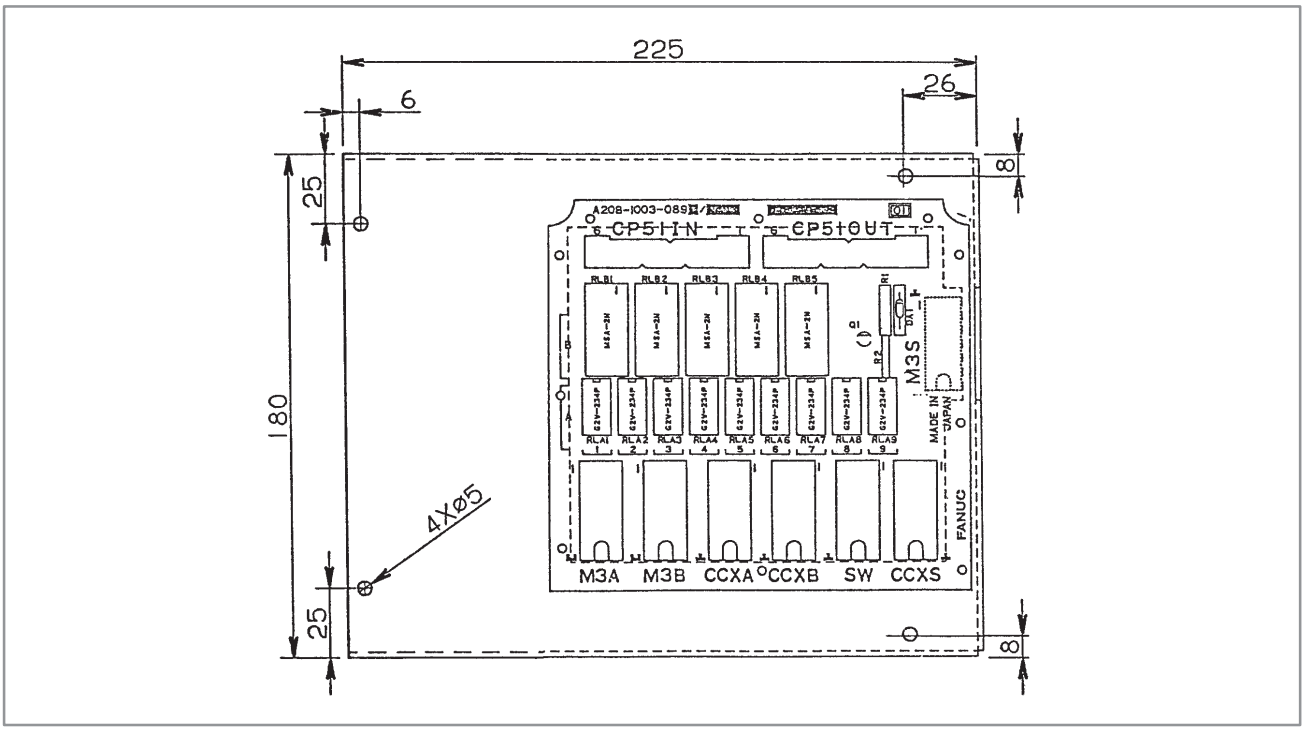
The machine tool builder must prepare all the following cables.

C1 C3 C5	Conform to J27 (signal cable) in B. CONNECTION CABLE AND CONNECTORS. Each cable should be less than 50m long. Note that only C1 has female connectors.
C2 C4 C6	Conform to J37 (CRT signal cable) in B. CONNECTION CABLE AND CONNECTORS. Each cable should be less than 50m long.
C7	Polyvinyl chloride wire of 30/0.18 ($0.8mm^2$). This cable should be less than 10 m long.
P3 P4	Polyvinyl chloride wire of 30/0.18 ($0.8mm^2$). Conform to J38 (input power cable) in B. CONNECTION CABLE AND CONNECTORS. Each cable should be less than 50 m long. Note that the power supply connectors (terminals) may be different.
P5 P6	Three polyvinyl chloride wires of 30/0.18 ($0.8mm^2$). Conform to J40 (input power cable) in the FS0 CONNECTING MANUAL (B–61393E). Each cable should be less than 50 m long.

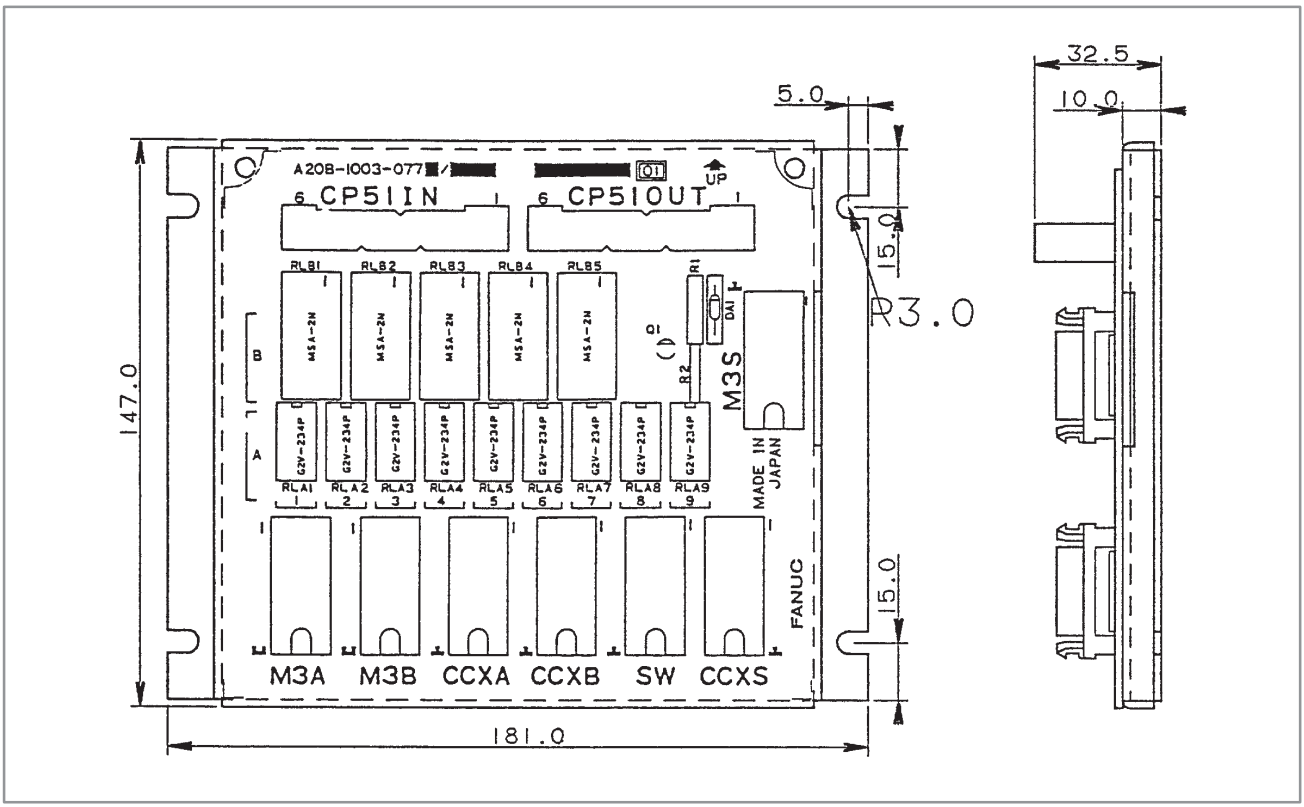
- **External view diagram** (1) MDI : Small–size



(2) MDI : Full–key



(3) Floor mounting type



- **Arrangement specification**

There are 2 kinds of CRT/MDI switching circuit arrangement specifications for the MDI small–size type and full–key type. When 2 control units are connected to one CRT/MDI unit being used normally, set according to the MDI type. Other than this, when the earlier menitinoned application example is used, arrange the necessary number.

	MDI	Arrangement specifications
CRT/MDI SWITCHER	Small–size	A02B–0098–J122
CRT/MDI SWITCHER	Full key	A02B–0098–J123
Printed board unit	Small–size	A20B–1003–0890
Printed board unit	Full key	A20B–1003–0891
Floor mounting type	Common to Small and Full key	A20B–1003–0770

- **Precautions**

1) Arrange the CRT/MDI unit according to the standard order list.
2) When the CRT and switching circuit electric power is taken from on electric power unit by the (K7) cable, specify either the electric power unit B2 and C.

   Electric power unit B2 :
   A02B–0098–H012

   Electric power unit C :
   A02B–0098–H013

3) Do not use the CRT/MDI switching printed board when it is leaning more than 30° from the vertical.

K.2 PDP/MDI SWITCHING CIRCUIT

K.2.1 Overview

This PDP/MDI switching circuit corresponds to the switch of not only the Plasma display but also CRT, EL and PDP display.
Following are the examples of connection and adjustment for PDP.

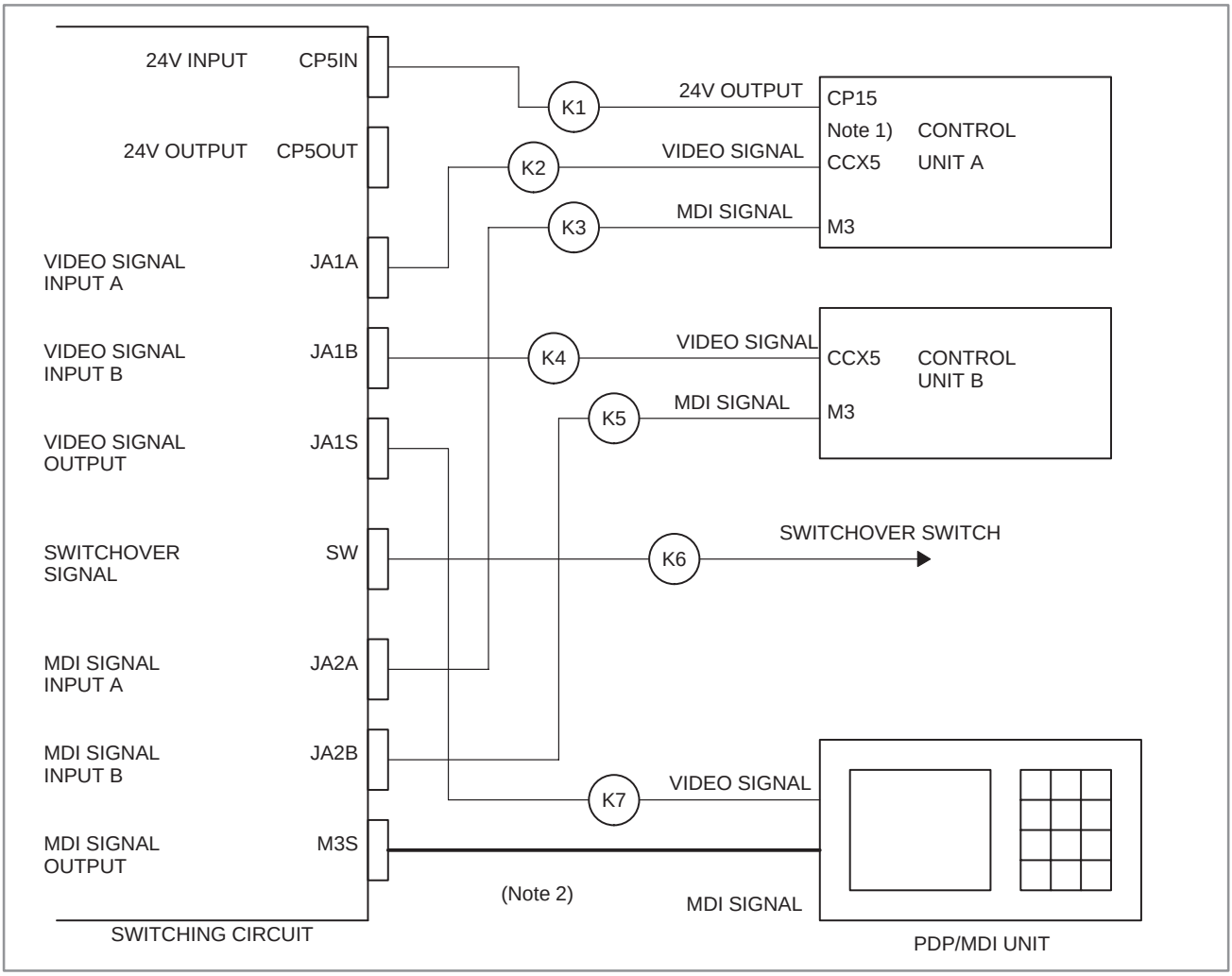
K.2.2 Connection

Attach the switching circuit to the PDP/MDI unit. There are two kinds of switching circuit for small MDI and full–key MDI.

K.2.2.1 Installation diagram

The PDP/MDI switching circuit is assembled to the back side of the MDI unit as well as the case of CRT/MDI switching circuit.

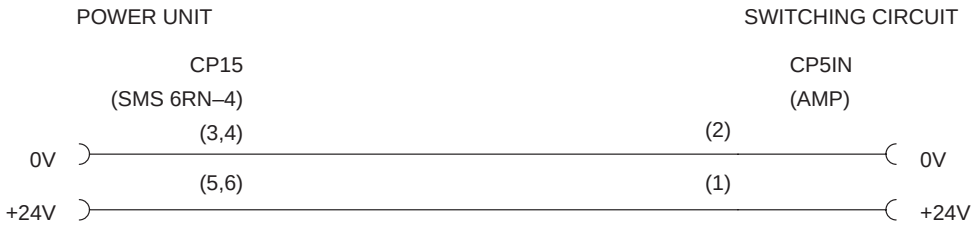
K.2.2.2 Connection diagram



NOTE
1 When a graphic card is used, the connector name is different. (CCX4)
2 This connection does not use the cable. Directly connect the switching circuit to MDI unit.

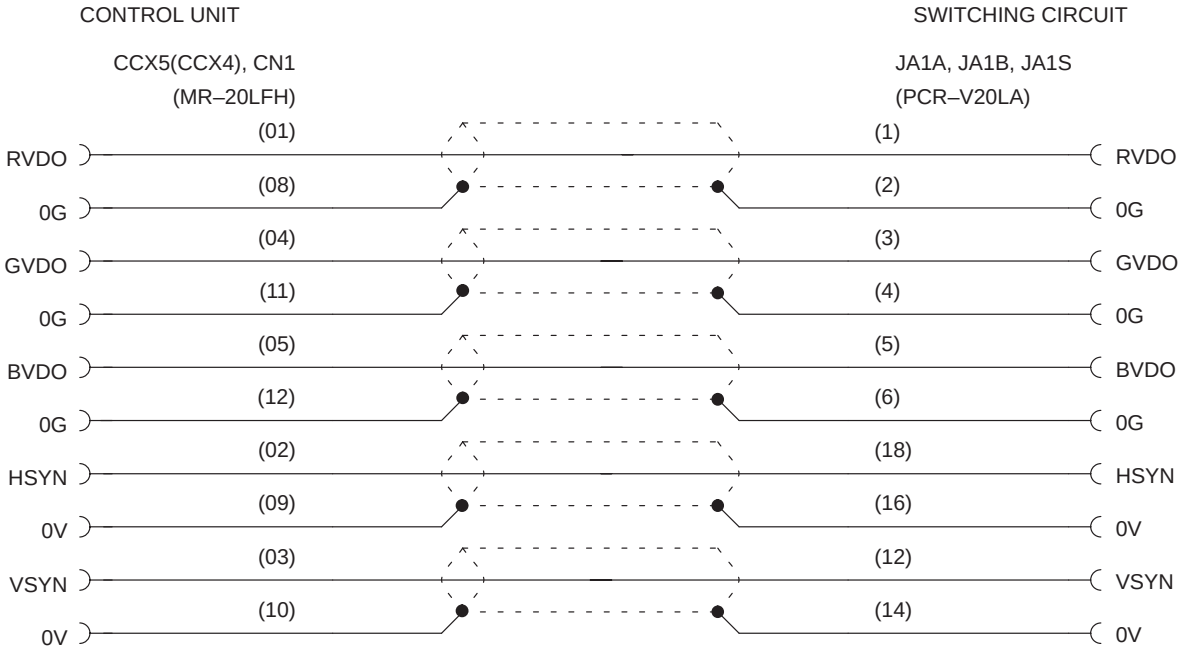
K.2.2.3
Diagram of cable details

(1) K1



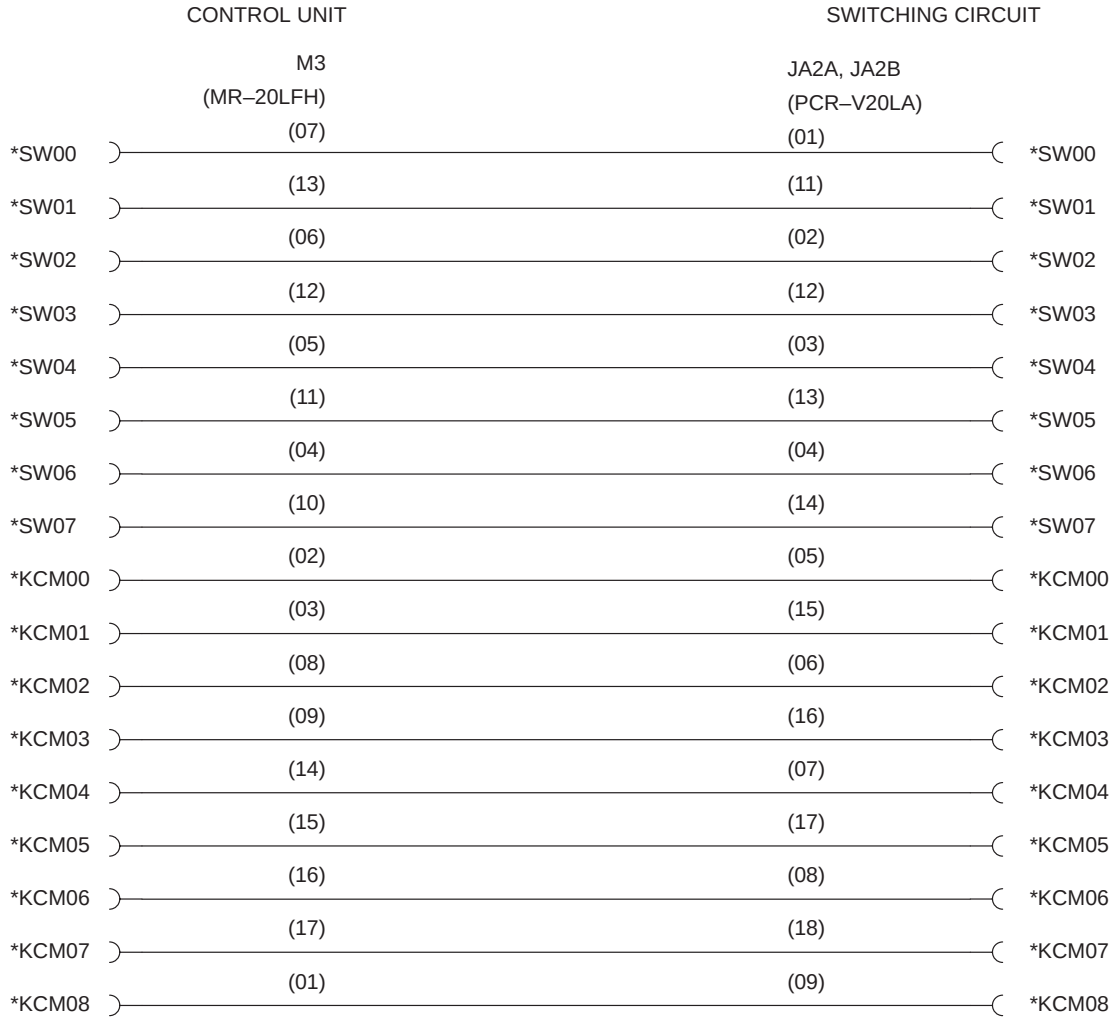
Use two cables which are equal to or larger than 30/0.18 (0.8mm^2).
Cable lenth to be 50m or shorter.

(2) K2, K4, K7



Recommended cable
A66L–0001–0295 (20m or less in length) ····· small–capacity twist pair cable (IDC)
A66L–0001–0296 (20m or more in length) ····· coaxial cable
or A66L–0001–0371
A66L–0001–0371 is best.

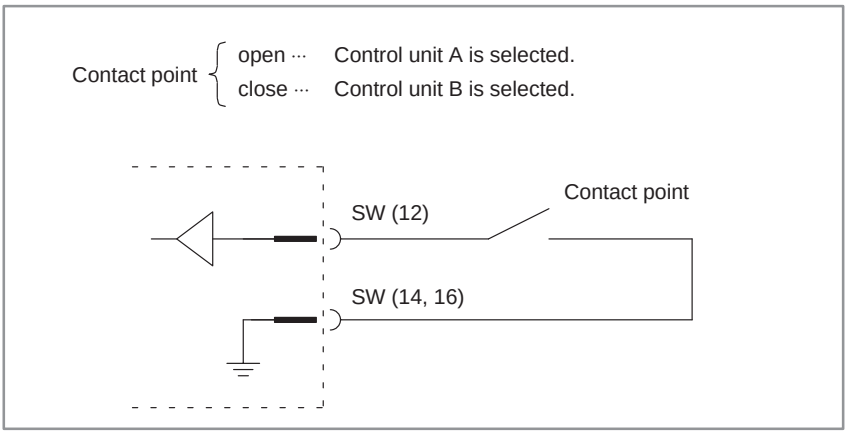
(3) K3 , K5



Recommended cable
A66L–0001–0284#10P(#28AWGX10 pair)

K.2.3 Selection Method

The relation between state of the contact point of the switchover switch and selected control units is as follows.



K.2.4 Connector Table

JA1A, JA1B, JA1S (PCR–20P FEMALE)

9		10		19		20	
7		8		17		18	HSYN
5	BVDO	6	0G	15		16	0V
3	GVDO	4	0G	13		14	0V
1	RVDO	2	0G	11		12	VSYN

JA2A, JA2B (PCR–20P FEMALE)

9	*KCM08	10		19		20	
7	*KCM04	8	*KCM06	17	*KCM05	18	*KCM07
5	*KCM00	6	*KCM02	15	*KCM01	16	*KCM03
3	*SW04	4	*SW06	13	*SW05	14	*SW07
1	*SW00	2	*SW02	11	*SW01	12	*SW03

SW (PCR–20P FEMALE)

9		10		19		20	
7		8		17		18	
5		6		15		16	0V
3		4		13		14	0V
1		2		11		12	SELECT

CP5IN,CP5OUT (AMP D–3000 3P Y–KEY)

1	+24V
2	0V
3	

M3S (MR–20P MALE)

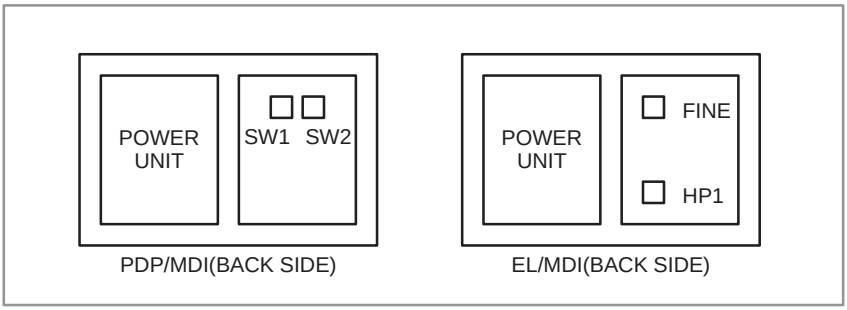
14	*KCM04	08	*KCM02	01	*KCM08
15	*KCM05	09	*KCM03	02	*KCM00
16	*KCM06	10	*SW07	03	*KCM01
17	*KCM07	11	*SW05	04	*SW06
18		12	*SW03	05	*SW04
19		13	*SW01	06	*SW02
20				07	*SW00

K.2.5 Adjustment Method

(1) Select control unit A side. (switchover switch “open”)

(2) Adjust a flat display.
(It is necessary this adjustment of PDP and EL unit to absorb a slight difference of control unit and the utilization cable at use.)

A) Adjustment place



B) Adjustment method

a) Adjustment of flicker

1. PDP : Set switch SW1 or TM1
2. EL : Set switch FINE

Change setting. And, search for the range not generating the flicker.
Set the switch at the center within the range when there are several set values not generating the flicker in the screen.

b) Position setting of horizontal direction

1. PDP : Set switch SW2
2. EL : Set switch HP1

It is possible to move to the horizontal direction by every one dot.
Please set the switch in the place where all displays can be done. There is only one–placebest position. You need not change setting when shipping usually.

c) Please do not change setting not listed above and volume, etc.

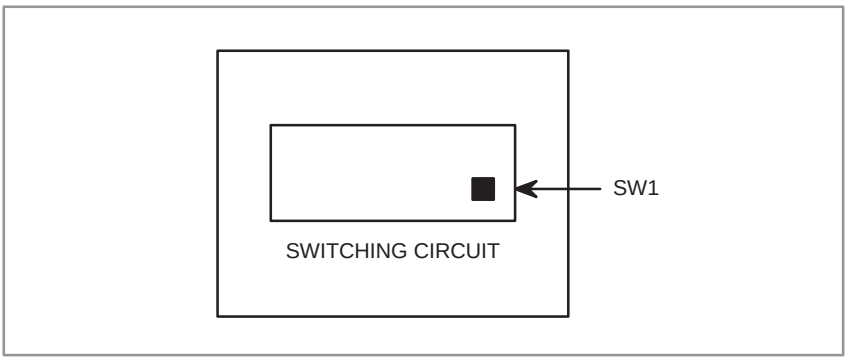
(3) Select control unit B side. (switchover switch “close”)

(4) Turn set switch SW1 of the this switching circuit. And, search for the range not generating the flicker.

(5) Set switch at the center within the range of setting where the flicker is not generated.

Example

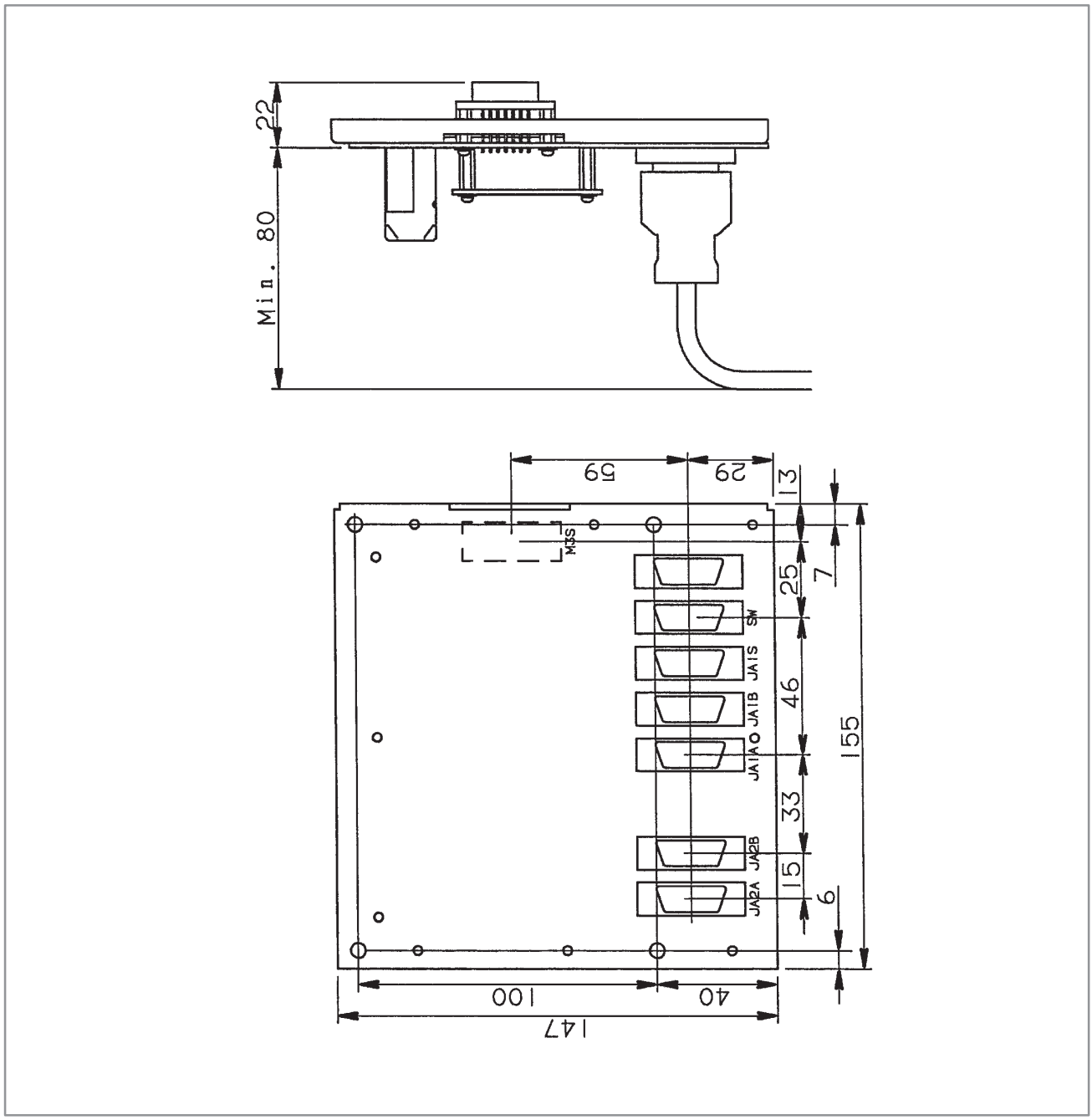
If you set and do not generate the flicker by 5–9, assume setting to be ‘‘7”.



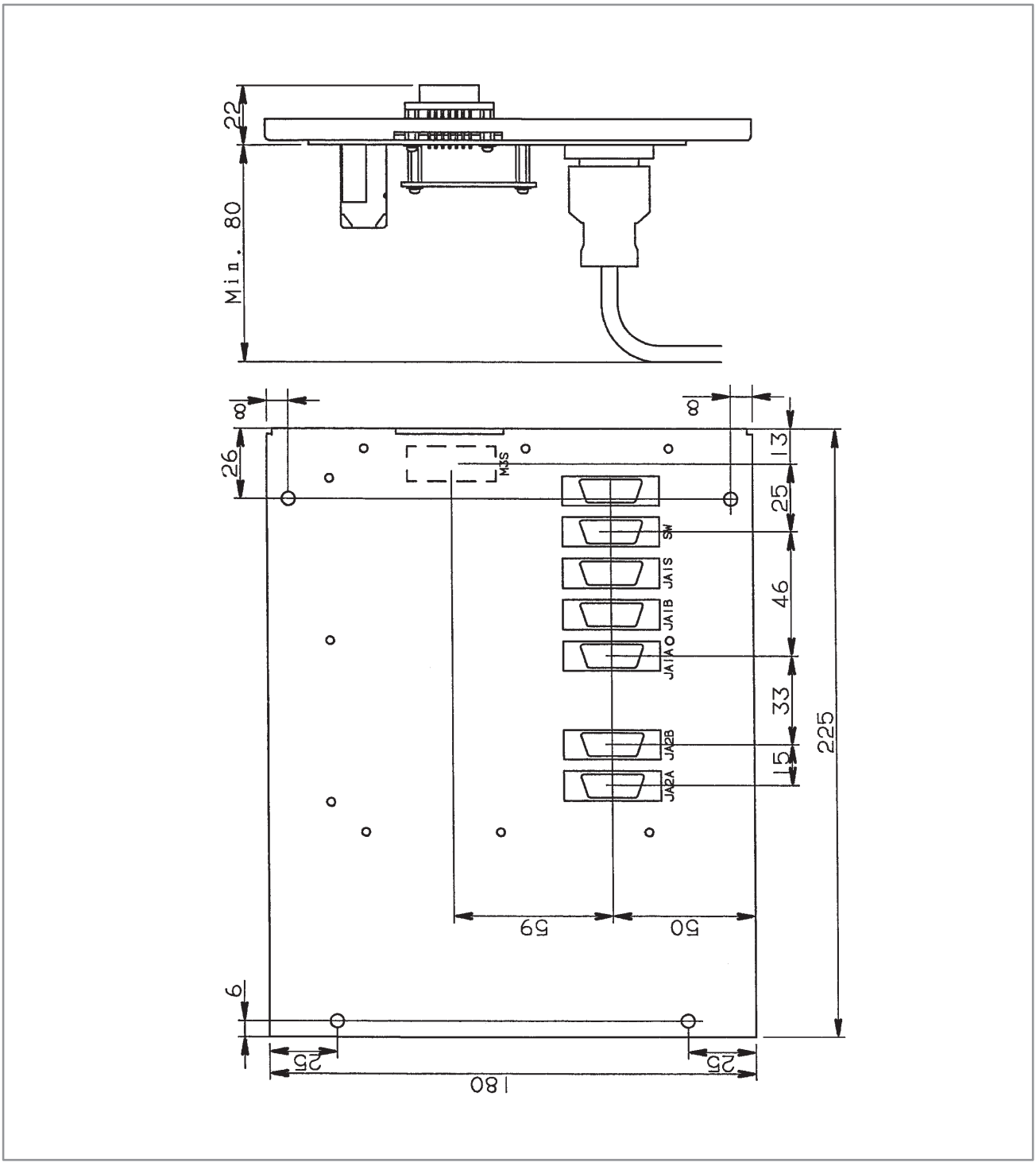
NOTE
It is not necessary to adjust when use this switching circuit to switch CRT.

K.2.6
External View

K.2.6.1
MDI : small



K.2.6.2
MDI : full key



K.2.7 Order Specification

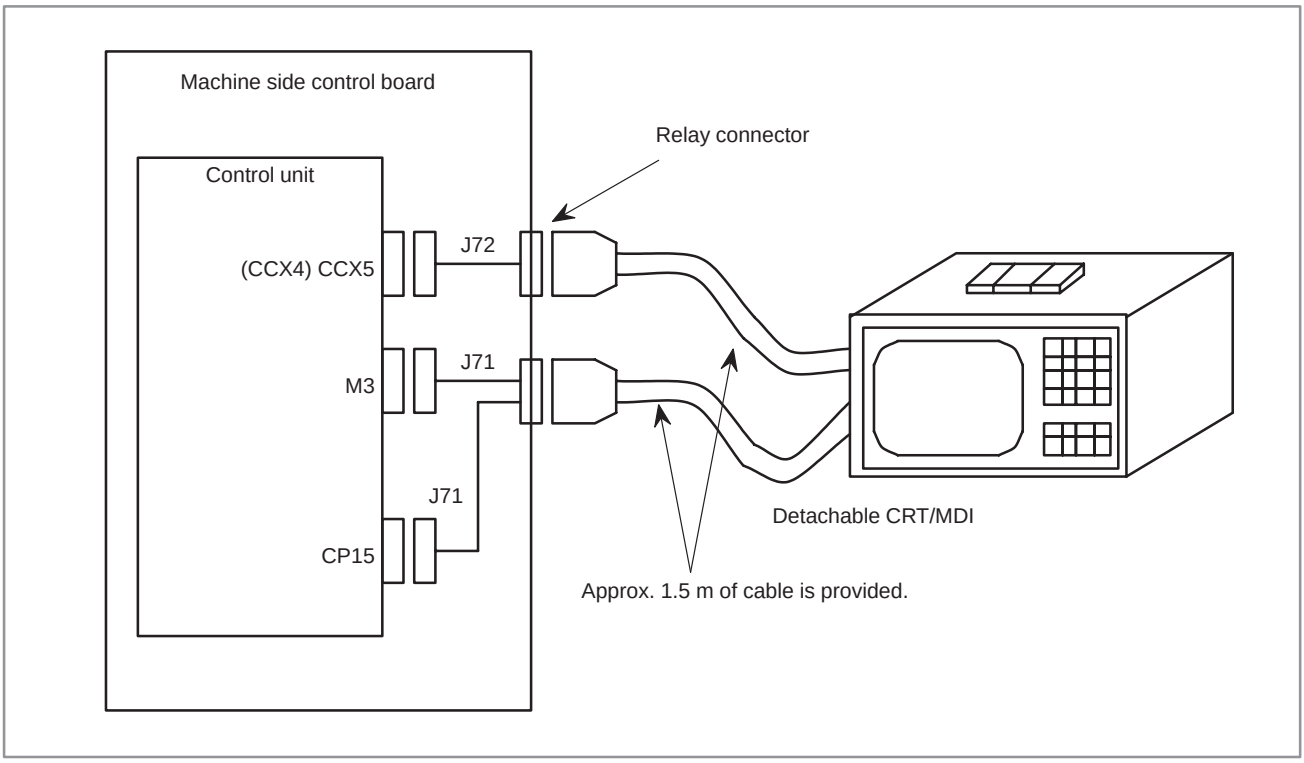
There is two kinds of order specification of the PDP/MDI switching circuit (small MDI type and full key MDI type). And it has the one attached to the back side of MDI unit individually and the one arranged with the unit.

	MDI	ORDER SPECIFICATION
ATTACHED TYPE	small	A02B–0098–J124
ATTACHED TYPE	full key	A02B–0098–J125
UNIT	small	A02B–0098–C194
UNIT	full key	A02B–0098–C195

L DETACHABLE CRT/MDI

L.1 OUTLINE

The detachable CRT/MDI panel is a portable type CRT/MDI panel. Normally it is detached, and when necessary it uses a cable connection to the relay connector which is installed in the control panel on the machine side.



CAUTION

Set the position of the relay connector in a location which does not require cutting liquid or cutting power.

NOTE

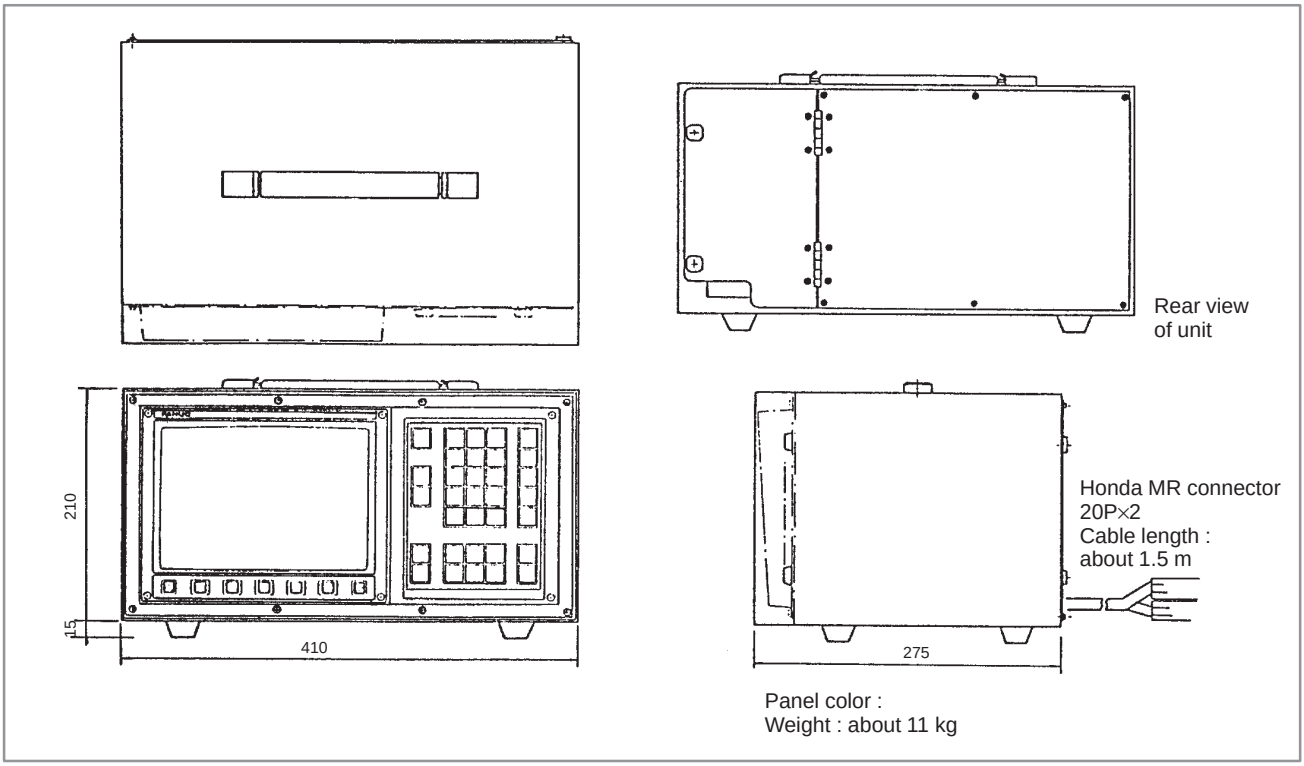
When not using the CRT/MDI panel, set so as to be able to protect the relay connector with the protective cover.

L.2 ARRANGEMENT SPECIFICATIONS

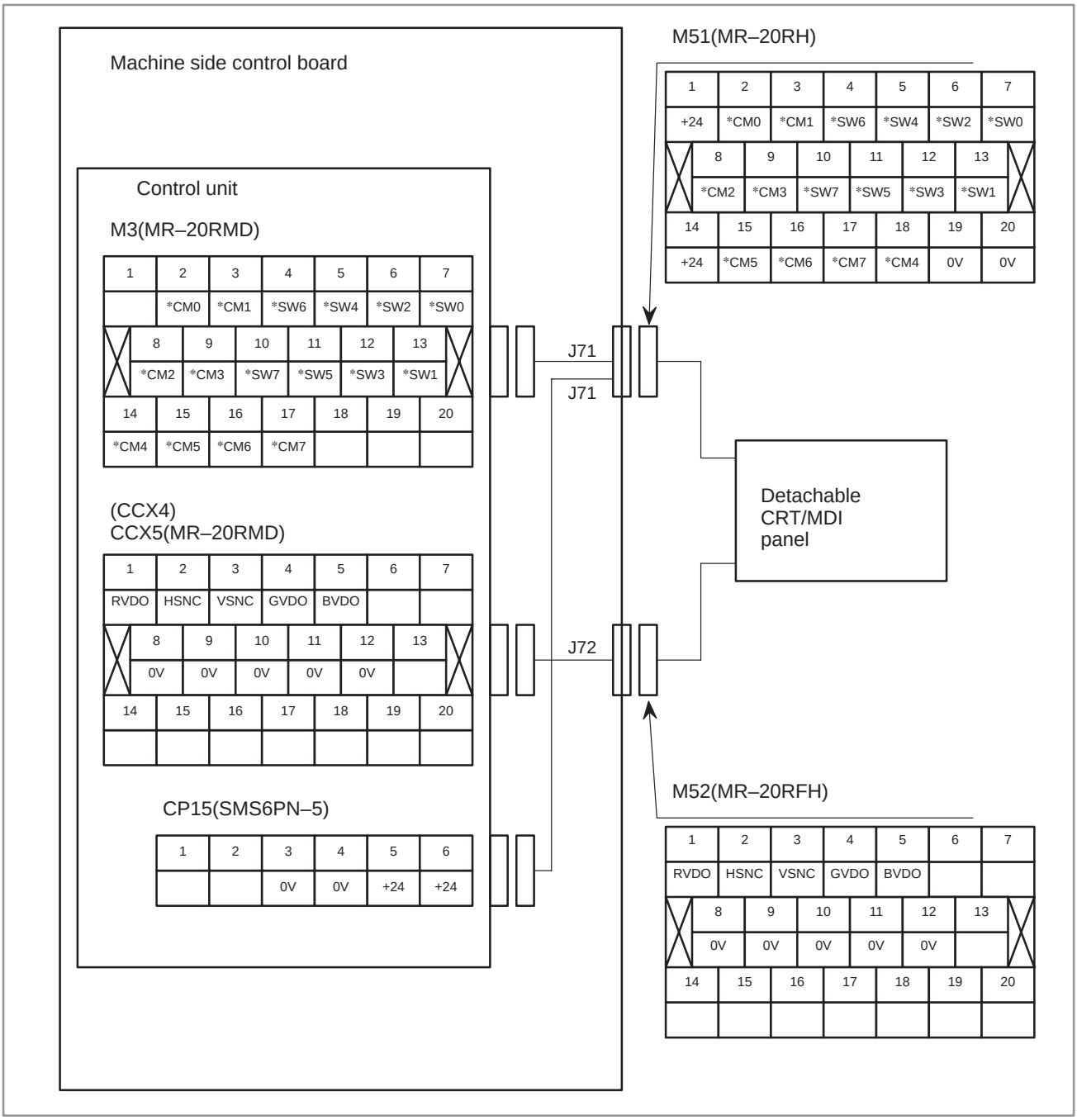
Detachable monochrome CRT/MDI unit

Item	Arrangement specifications	Remarks
1	A02B–0098–C121	Without software key for Series 0–TC
2	A02B–0098–C122	With software key for Series 0–TC
3	A02B–0099–C121	Without software key for Series 0–MC
4	A02B–0099–C122	With software key for Series 0–MC

L.3 EXTERNAL DIMENSIONS DIAGRAM

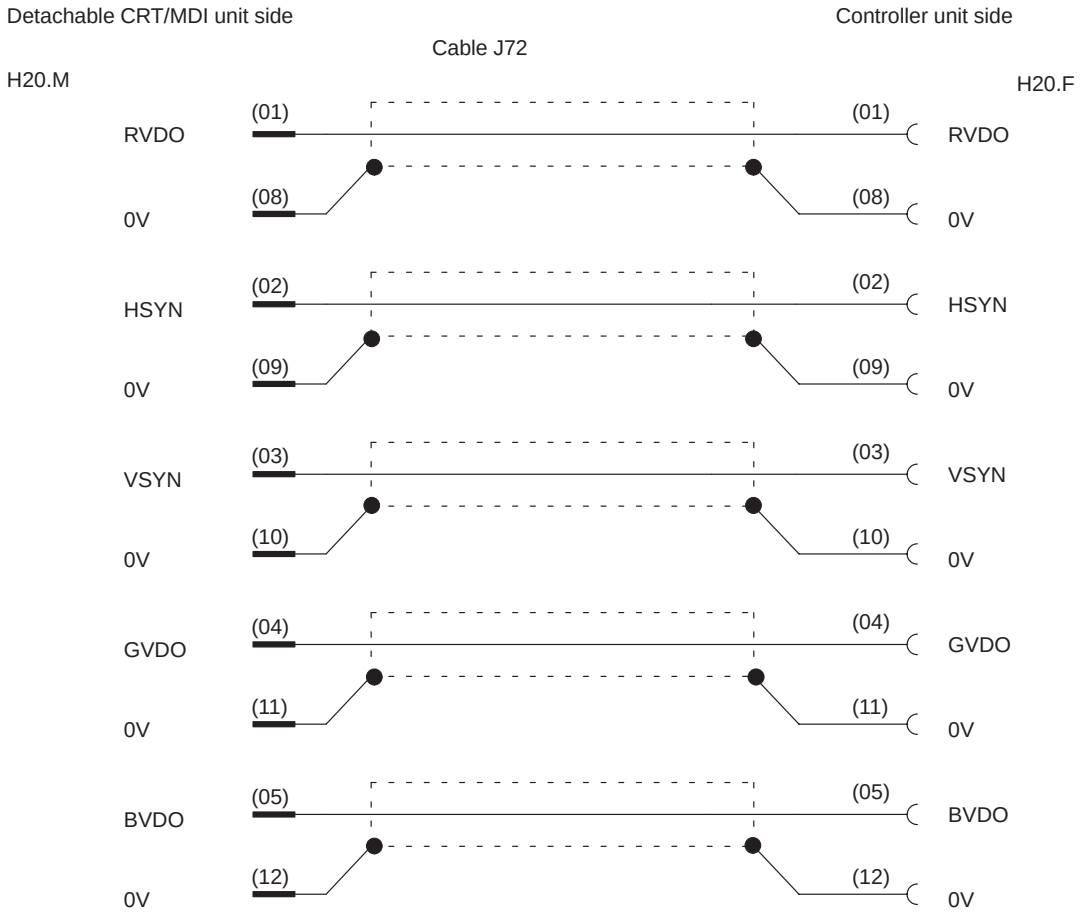


L.4 CONNECTION DIAGRAM



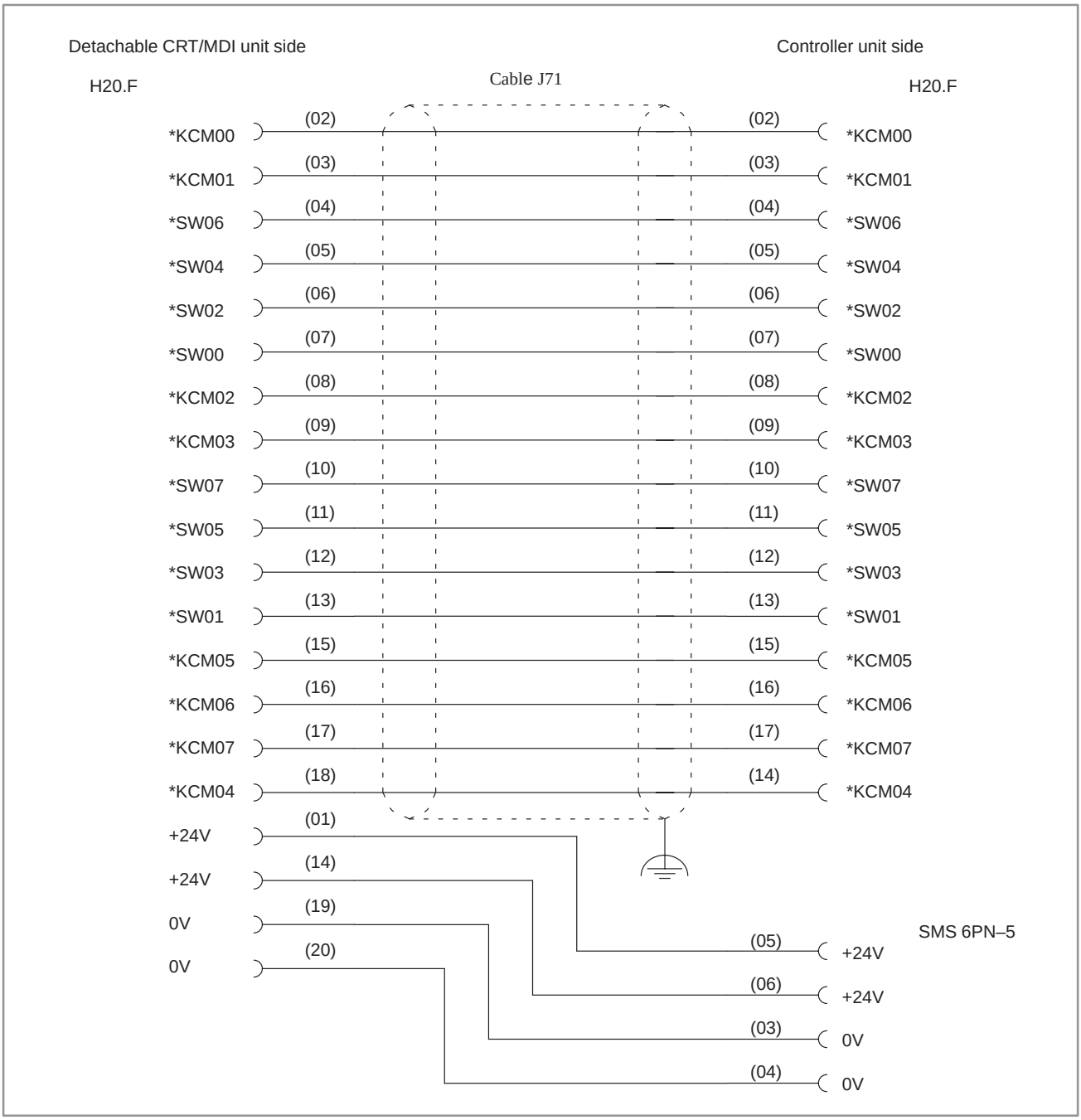
NOTE
1 The J71 and J72 cables in the above diagram are produced by the machine manufacture.
2 Connect cable J72 to CCX4 when a graphic card is connected, and to CCX5 when there is no graphic card.

L.5 DIAGRAM OF CABLE DETAILS



NOTE

For the J72 cable use a coaxial cable and set the cable length under 48 m. Recommended cable specifications : A66L–0001–0219 or A66L–0001–0371 A66L–0001–0371 is the best. Refer to L.6 DIAGRAM OF MATERIAL DETAILS.



CAUTION

For the 0V and +24V power lines. use material greater than 30/0.18 (0.8 mm^2) and set the cable length under 48 m.

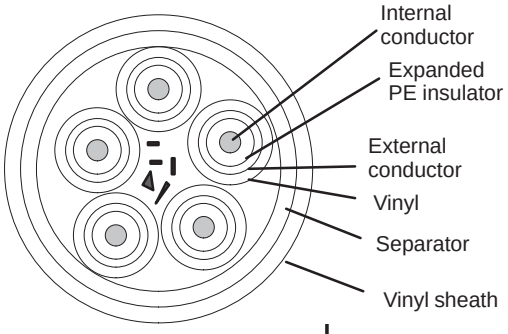
NOTE

For the J71 cable, with the exception of the 0V and +24V power lines, use a collective shield cable and set the cable length under 48m.
Recommended cable specifications : A66L–0001–0041
Refer to L.6 DIAGRAM OF MATERIAL DETAILS.

L.6 DIAGRAM OF MATERIAL DETAILS

Details of cable material of A66L–0001–0219 Manufacture Hitachi Densen

Item		unit	Material and standard value
Cable type		–	C0–CX–75–5C
Number of cable cores		Core	5
Conductor	Size	mm^2	0.18
	Composition	Cable/mm	7/0.18 (Tinplate soft steel cable)
	External diameter (approx.)	mm	0.54
Insulator	Material	–	Expanded polyethylene White color
	Thickness	mm	0.93
	External diameter (approx.)	mm	2.40
Shield braiding	Inner diameter	mm	0.1 (Tinplate soft steel cable)
	Density	%	90
	Thickness	mm	0.25
	Outer diameter (approx.)	mm	2.90
Jacket	Material	–	Vinyl
	Color	–	Black, white, red, green, and blue
	thickness	mm	0.25
	Outer diameter (approx.)	mm	3.40
Cabling outer diameter		mm	9.2
Press rolling		mm	0.25
Sheath	Material	–	Vinyl
	Color	–	Black
	Thickness	mm	0.5
Finishing outer diameter		mm	10.3
Maximum Finishing outer diameter		mm	11.0
Conductor resistance (20°C)		Ω/km	110
Resistance voltage (A.C)		V/1 min	1000
Insulator resistance (20°C)		MΩ–km	1000
Characteristic impedance (10MHz)		Ω	75 ± 3
Static electricity capacity (1kHz)		nF/km	56
Standard attenuation capacity (10MHz)		dB/km	46



Detail of cable material of A66L–0001–0041

Name	Conductor		Sheath thickness	Finishing outer diameter	Electrical characteristics	
	Diameter	Composition			Dynamic resistance	Permissible current
Collective shield 20 core cable (10 pairs)	∅0.55mm	7/0.18	1.5mm	∅10.0mm	110Ω/km	1.6A

M POSITION CODER SWITCHING CIRCUIT

M.1 OUTLINE

The position coder switching circuit is the circuit which can freely switch the connections between a maximum of four position coder units and a maximum of four CNC units.

Switching is performed by giving a 2 bit switching signal indicating which position coder is to be connected to each CNC.

Therefore, there are a total of 8 switching signals.

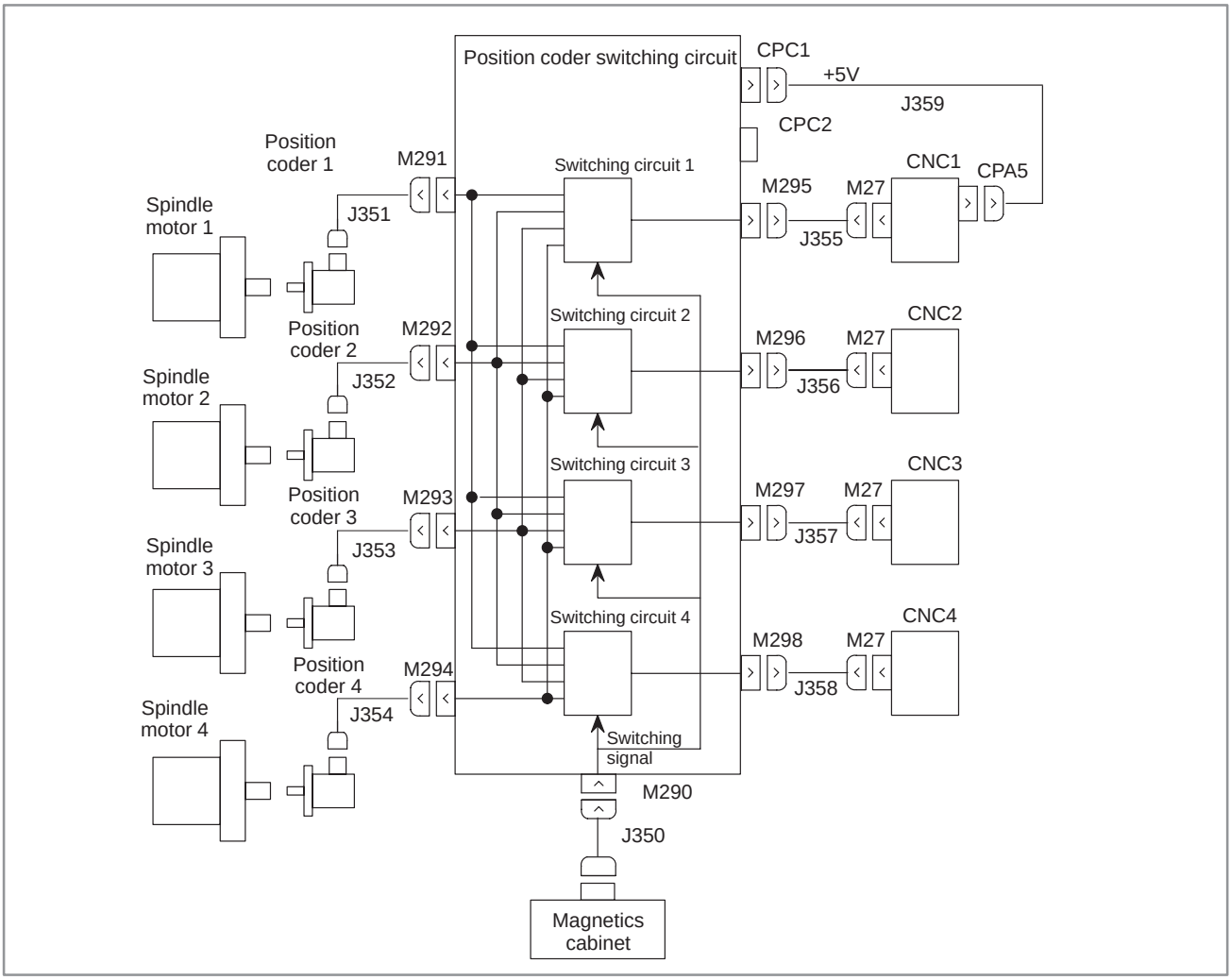
WARNING

The switching is performed at such times as when the spindle stop when the CNC is not using the position coder signal.

Otherwise, the spindle may run out of control, resulting in injury or damage to a tool or the machine.

When a cable disconnection has occurred between the switching circuit and the position coder, the cable disconnection is detected in the CNC by making the signal between the CNC selected by this position coder and the switching circuit one of high impedance.

M.2
BLOCK DIAGRAM



M.3 CONNECTION EXPLANATION

M.3.1 Connection Signal Arrangement of Position Coder

(Specifications of connector is printed board side.)

M290 : MRH–20RFA(Switching signal)

01	SL1A	08	0V	14	SL3A
02	SL1B	09	0V	15	SL3B
03	SL2A	10	0V	16	SL4A
04	SL2B	11	0V	17	SL4B
05		12		18	
06		13		19	
07				20	

M291 : MRH–20WRMA(Position coder 1)

14	PCI1	08	OHI1	01	0V
15	*PCI1	09	OHB1	02	0V
16	PAI1	10	C8I1	03	0V
17	*PAI1	11	C4I1	04	+5V
18	PBI1	12	C2I1	05	+5V
19	*PBI1	13	C1I1	06	+5V
20	OREQ1			07	

M292 : MRH–20WRMA(Position coder 2)

14	PCI2	08	OHI2	01	0V
15	*PCI2	09	OHB2	02	0V
16	PAI2	10	C8I2	03	0V
17	*PAI2	11	C4I2	04	+5V
18	PBI2	12	C2I2	05	+5V
19	*PBI2	13	C1I2	06	+5V
20	OREQ2			07	

M293 : MRH–20WRMA(Position coder 3)

14	PCI3	08	OHI3	01	0V
15	*PCI3	09	OHB3	02	0V
16	PAI3	10	C8I3	03	0V
17	*PAI3	11	C4I3	04	+5V
18	PBI3	12	C2I3	05	+5V
19	*PBI3	13	C1I3	06	+5V
20	OREQ3			07	

M295 : MRH–20WRMA(CNC1)

14	PC1	08	MOHO1	01	0V
15	*PC1	09	OHB1	02	0V
16	PA1	10	C8O1	03	0V
17	*PA1	11	C4O1	04	+5V
18	PB1	12	C2O1	05	+5V
19	*PB1	13	C1O1	06	+5V
20	REQI1			07	

M296 : MRH–20WRMA(CNC2)

14	PC2	08	MOHO2	01	0V
15	*PC2	09	OHB2	02	0V
16	PA2	10	C8O2	03	0V
17	*PA2	11	C4O2	04	
18	PB2	12	C2O2	05	
19	*PB2	13	C1O2	06	
20	REQI2			07	

M297 : MRH–20WRMA(CNC3)

14	PC3	08	MOHO3	01	0V
15	*PC3	09	OHB3	02	0V
16	PA3	10	C8O3	03	0V
17	*PA3	11	C4O3	04	
18	PB3	12	C2O3	05	
19	*PB3	13	C1O3	06	
20	REQI3			07	

M294 : MRH–20WRMA(Position coder 4)

14	PCI4	08	OHI4	01	0V
15	*PCI4	09	OHB4	02	0V
16	PAI4	10	C8I4	03	0V
17	*PAI4	11	C4I4	04	+5V
18	PBI4	12	C2I4	05	+5V
19	*PBI4	13	C1I4	06	+5V
20	OREQ4			07	

M298 : MRH–20WRMA(CNC4)

14	PC4	08	MOHO4	01	0V
15	*PC4	09	OHB4	02	0V
16	PA4	10	C8O4	03	0V
17	*PA4	11	C4O4	04	
18	PB4	12	C2O4	05	
19	*PB4	13	C1O4	06	
20	REQI4			07	

CPC1 : SMS6RN–3TK2(Power supply)

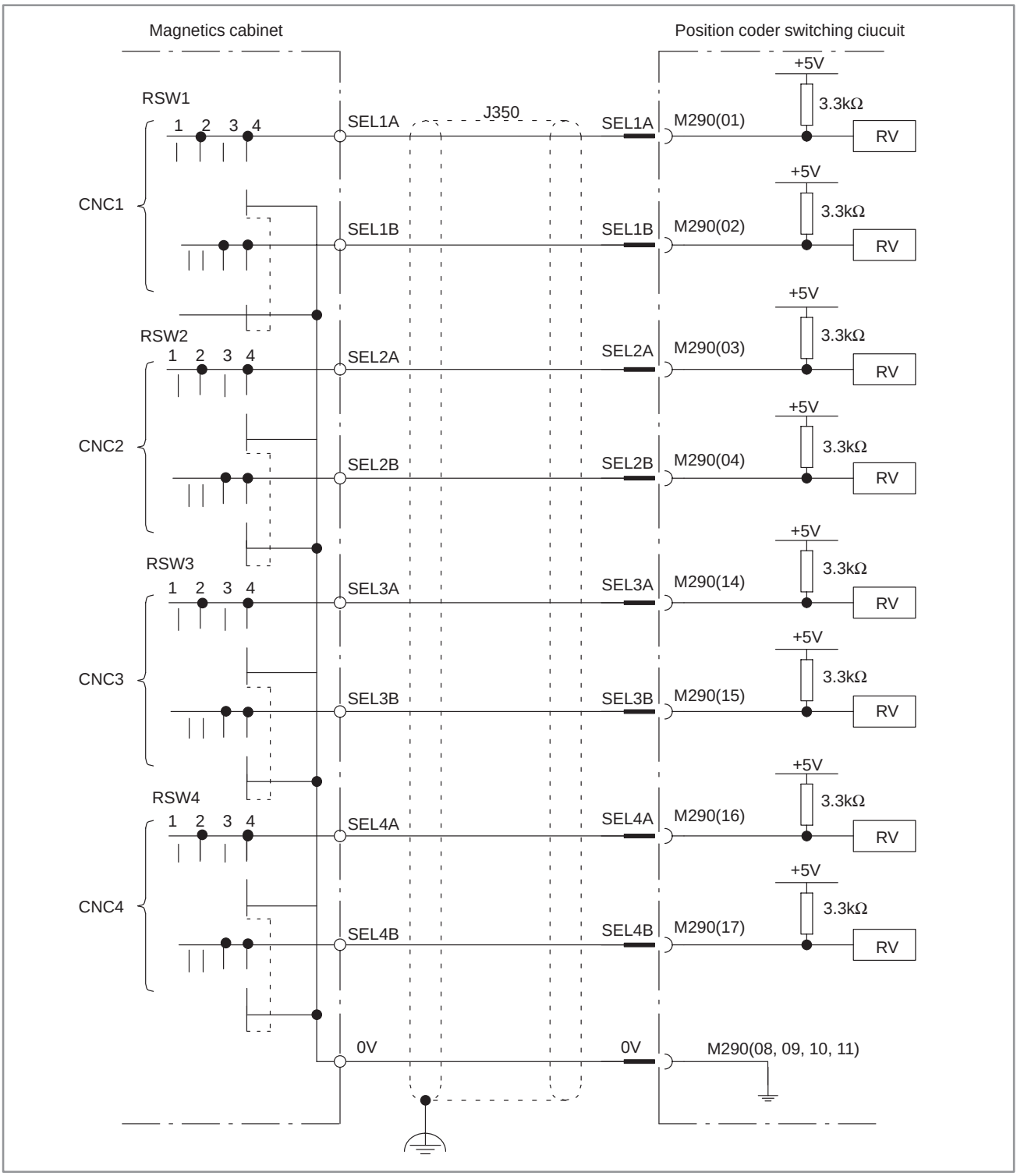
6	5	4	3	2	1
+24V	+24V	0V	0V	+5V	+5V

CPC2 : SMS6RN–3TK2(Power supply)

6	5	4	3	2	1
+24V	+24V	0V	0V	+5V	+5V

M.3.2 Switching Signal

The switching signal specifies which position coder is to be connected to each CNC.



NOTE
Each the shield casing of the cable using the earth plate.

The relationship between the connection state and the switching signal is shown in the table below.

CNC	Position coder	SEL1B	SEL1A
CNC1 (M295)	Position coder 1 (M291)	–	–
	Position coder 2 (M292)	–	○
	Position coder 3 (M293)	○	–
	Position coder 4 (M294)	○	○

CNC	Position coder	SEL2B	SEL2A
CNC2 (M296)	Position coder 1 (M291)	–	–
	Position coder 2 (M292)	–	○
	Position coder 3 (M293)	○	–
	Position coder 4 (M294)	○	○

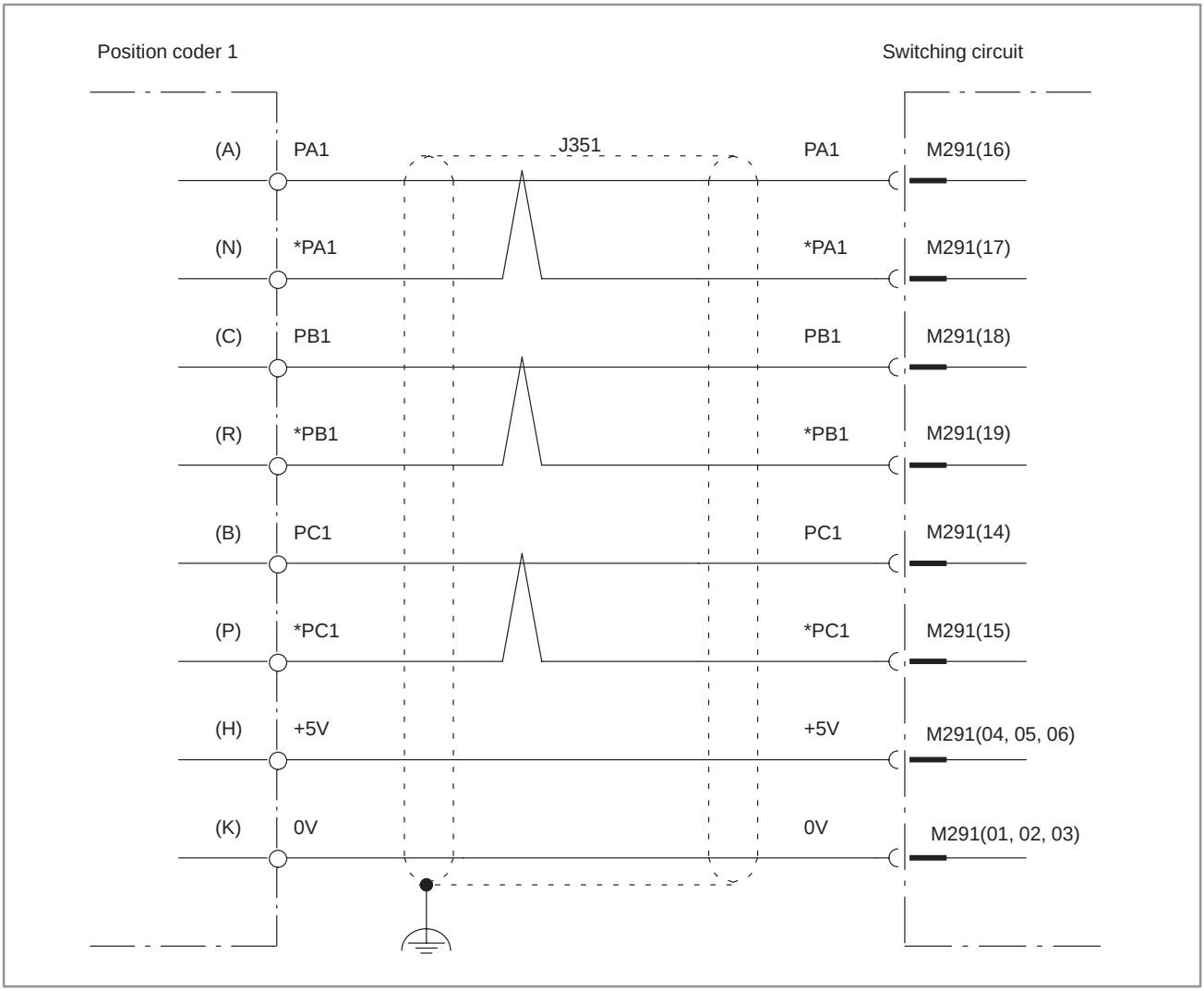
CNC	Position coder	SEL3B	SEL3A
CNC3 (M297)	Position coder 1 (M291)	–	–
	Position coder 2 (M292)	–	○
	Position coder 3 (M293)	○	–
	Position coder 4 (M294)	○	○

CNC	Position coder	SEL4B	SEL4A
CNC4 (M298)	Position coder 1 (M291)	–	–
	Position coder 2 (M292)	–	○
	Position coder 3 (M293)	○	–
	Position coder 4 (M294)	○	○

– : released

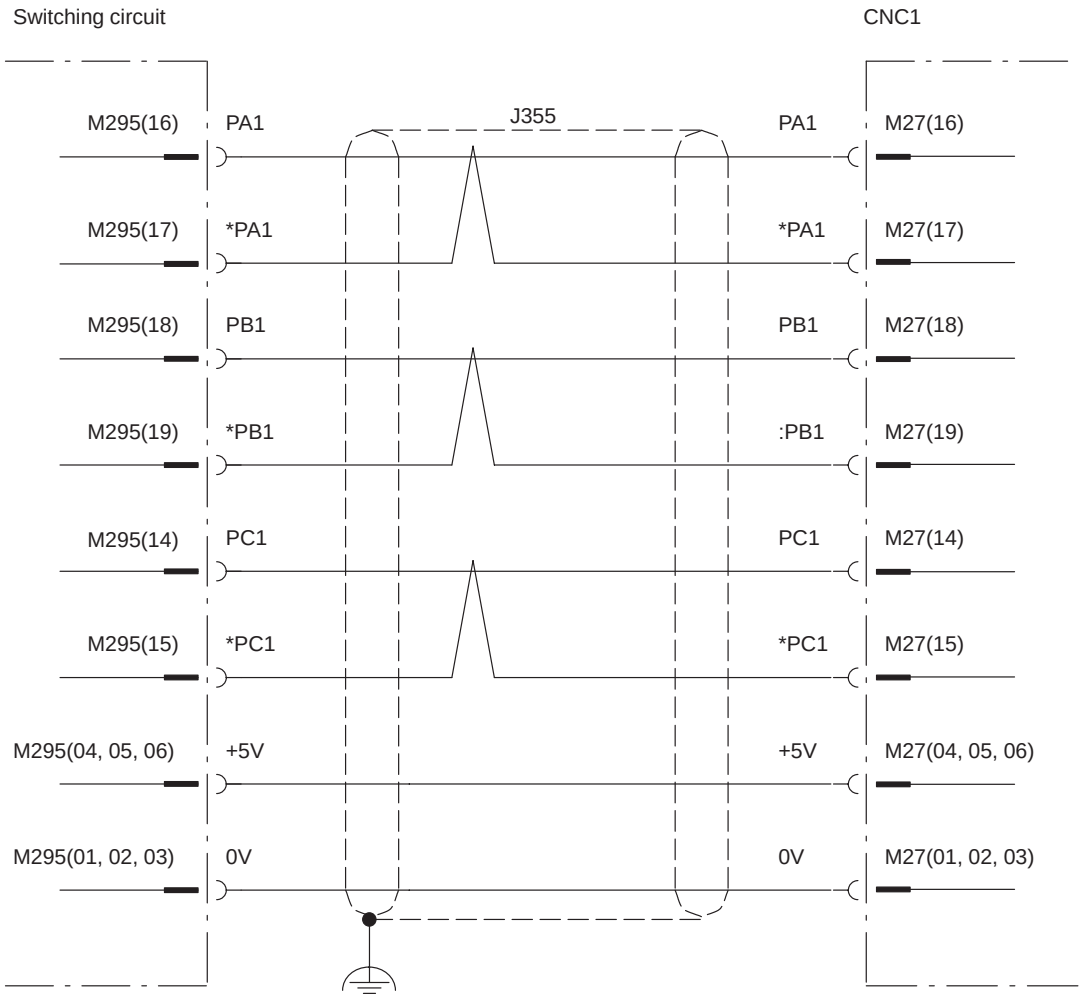
○ : abbreviation of 0V

M.3.3
Connection between Position Coder and Switching Circuit



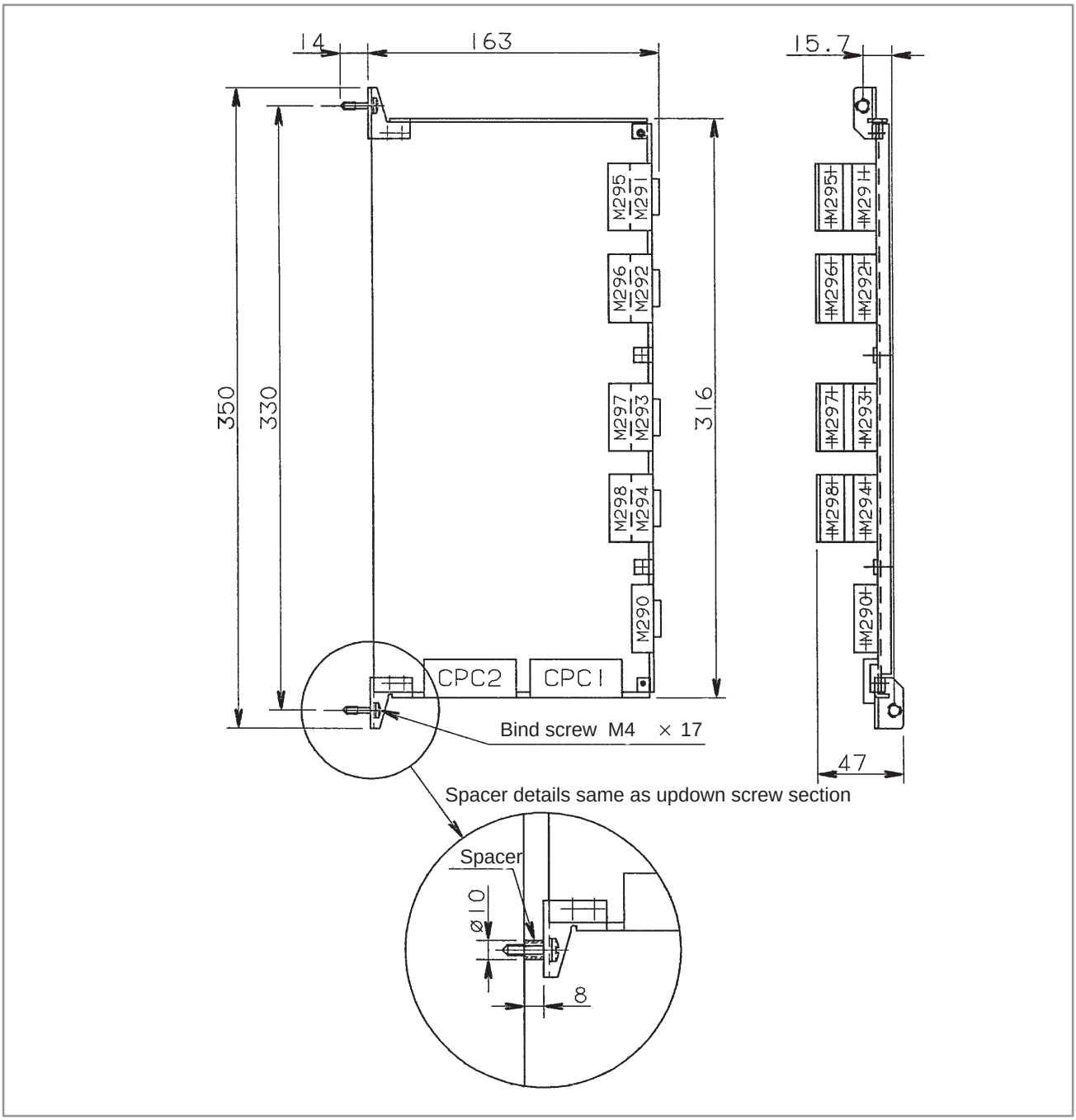
NOTE
1 Also connect the position coder 2–4 and the switching circuits M292–M294 in accordance with the above diagram.
2 Earth the shield casing of the cable using the earth plate.
3 Refer to the precautionary note in item M.5.2 concerning the cable material for +5V and 0V.

M.3.4 Connection between Switching Circuit and CNC



NOTE
1 Also connect the position coder 2–4 and the switching circuit M296–M298 in accordance with the above diagram.
2 Earth the shield casing of the cable using the earth plate.
3 Refer to the precautionary note in item M.5.2 concerning the cable material for +5V and 0V.

M.4
EXTERNAL VIEW



NOTE
1 The position coder switching circuit is in the form of an option printed board as shown in the above diagram. Install in the magnetics cabinet using the spacer in the vertical direction.
2 It can be installed in the CNC master printed board and, when other option printed boards which have vacant slots and cables do not interfere, in master printed boards.

M.5 PRECAUTION

M.5.1 Power Unit

This supplies the +5V power source from the CNC1 (M295) for the position coder switching circuit and the position coders (1–4).

Therefore, specify power supply B2 or power supply C for the CNC1 power unit.

M.5.2 Cable Power Supply Voltage Drop

The position coder switching circuit and the potions coder (1–4) +5V power source are supplied from the CNC1 (295).

Select the cable material such that the voltage drop in the cables (J351–J355) in the current circulation is under 0.2V.

However, because the conditions for J355 are strict, the +5V supply cable J359 can also be specially installed.

In this case, connect the connector CPA5 in the CNC1 power unit lower section master printed card and the CPC1.

The following shows the calculation method for the voltage drops in the various position coders.

$$V_D = \frac{(2\ [A] + 0.35\ [A] \cdot N) \cdot R_{J355}\ [\Omega]}{\text{Items common to position coders 1–4}} + \frac{0.35\ [A] \cdot RJ\ [\Omega]}{\text{Items to be calculated for each position coder}}$$

VD : Voltage drop [V]

N : Number of position coders

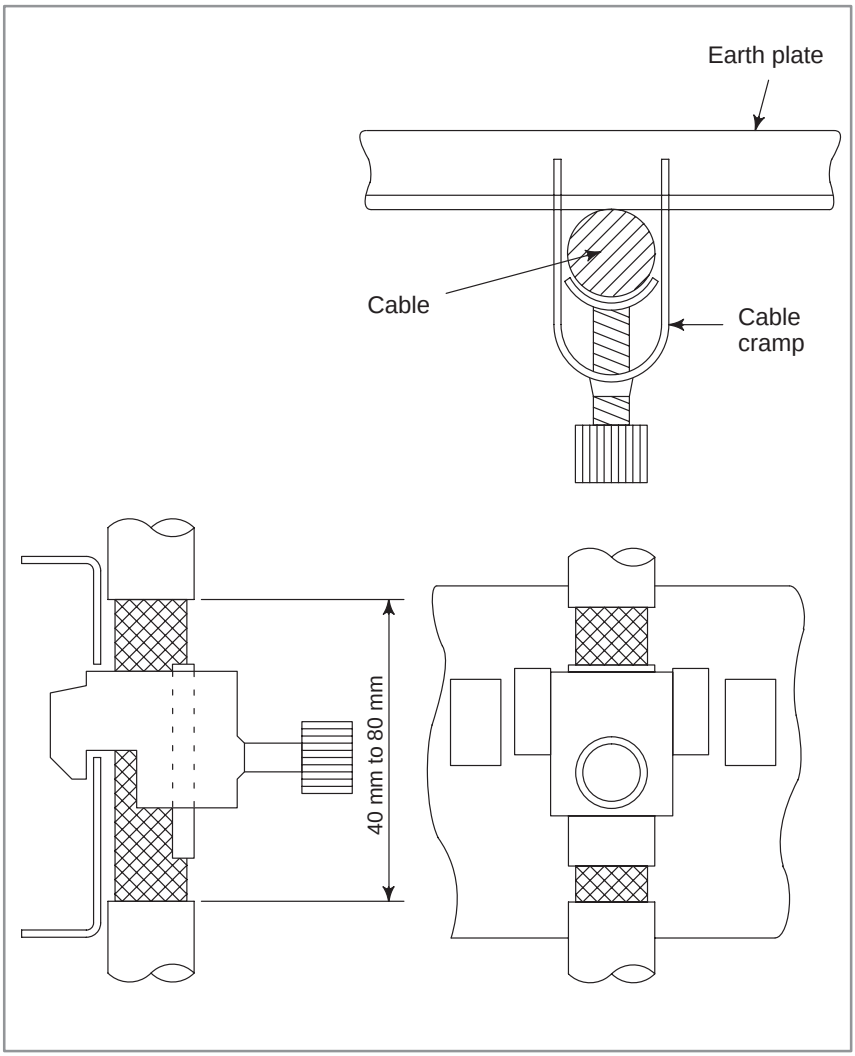
R_{J355} : Circulation resistance value for circulation of +5V, 0V of cable J355, or circulation resistance value of +5V, 0V of cable J359 when installing J359 [Ω]

R_J : Circulation resistance value [Ω] for circulation of +5V, 0V of cable J351 or J354

M.5.3 Noise Countermeasure

As a noise countermeasure, separate the position coder switching circuit and cables J350–J359 by over 100 mm from the cables with over DC 50V or in which AC power is impressed, or from the components.

Further, be certain to earth the signal cable shields using the earth plate as shown in the diagram below.



N MDI DESIGN FOR Series 0

N.1 OUTLINE

MDI key sheets, used with the CRT/MDI units of the Series 0–C, are available in two types: the standard type and that qualifying for CE marking (machine directive). The two types differ in their colors and characters. This section summarizes the differences.

NOTE
Some Series 0 models qualify for CE marking while other do not. The use of an MDI qualifying for CE marking does not, therefore, always guarantee that the machine tool itself will qualify for CE marking.

N.2 CHARACTERS

Both English–language and symbolic key sheets are supported by the types qualifying for CE marking. See the table below and the figures on the subsequent pages.

N.3 COLORS

The colors of those MDI key sheets that qualify for CE marking differ from those of the standard MDI key sheets. See the table below and the figures on the subsequent pages.

Item				Reference
Small–size MDI	For lathes	Standard		N1
		CE marking	English–language	N2
			Symbolic	N3
	For machining centers	Standard		N4
		CE marking	English–language	N5
			Symbolic	N6
Small–size MDI color scheme		Standard		N7
		CE marking		N8
Full–key MDI	For lathes	Standard		N9
		CE marking	English–language	N10
			Symbolic	N11
	For machining centers	Standard		N12
		CE marking	English–language	N13
			Symbolic	N14
Full–key MDI color scheme		Standard		N15
		CE marking		N16
MDI for 14″ CRT	For machining centers	Standard		N17
		CE marking	English–language	N18
			Symbolic	N19
Color scheme of MDI for 14″ CRT		Standard		N20
		CE marking		N21

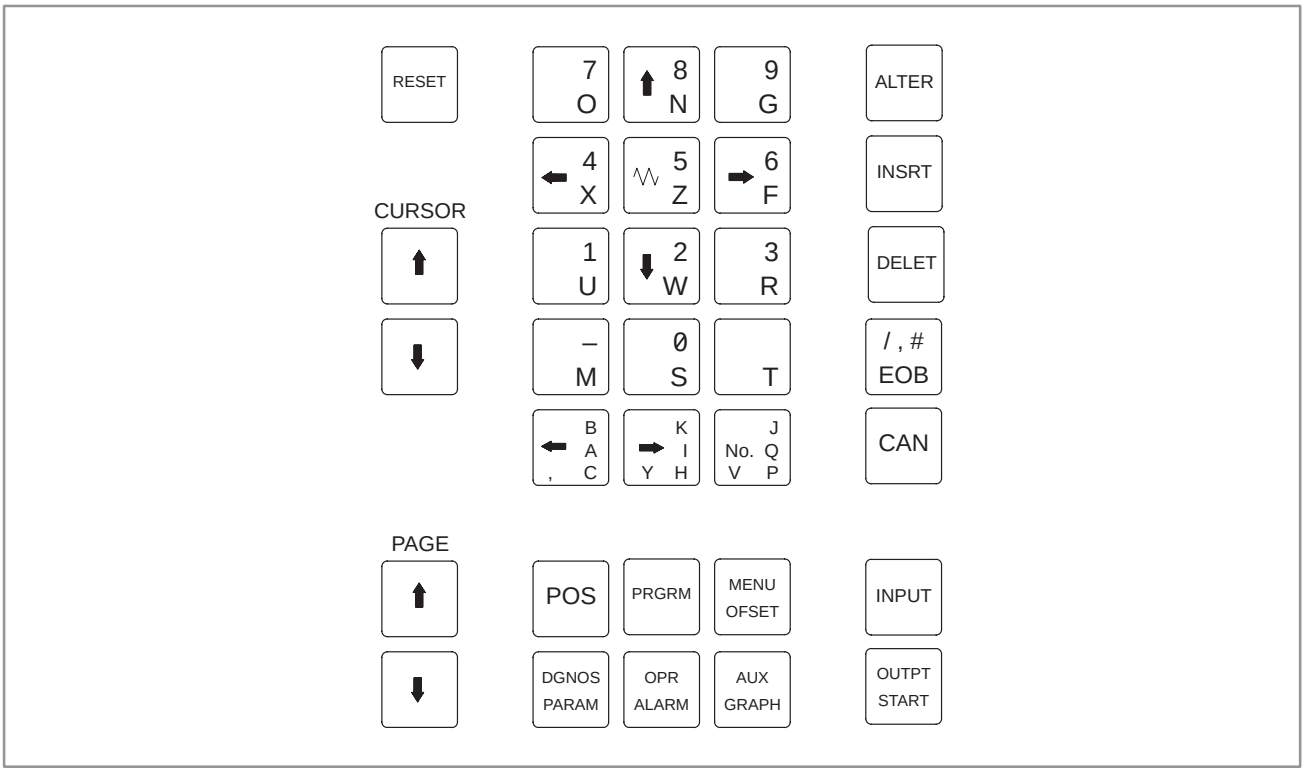


Fig. N1 Standard key sheet for small–size MDI for lathes

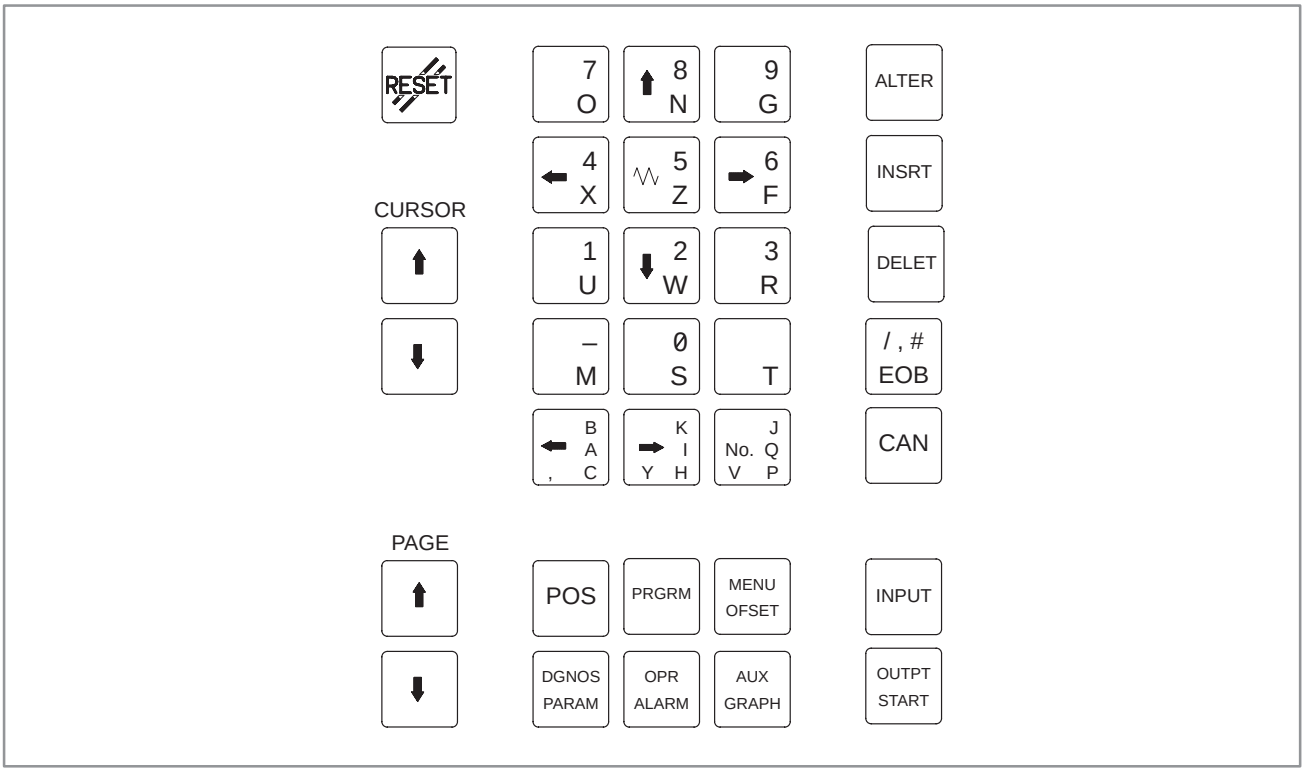


Fig. N2 English–language key sheet for small–size MDI for lathes

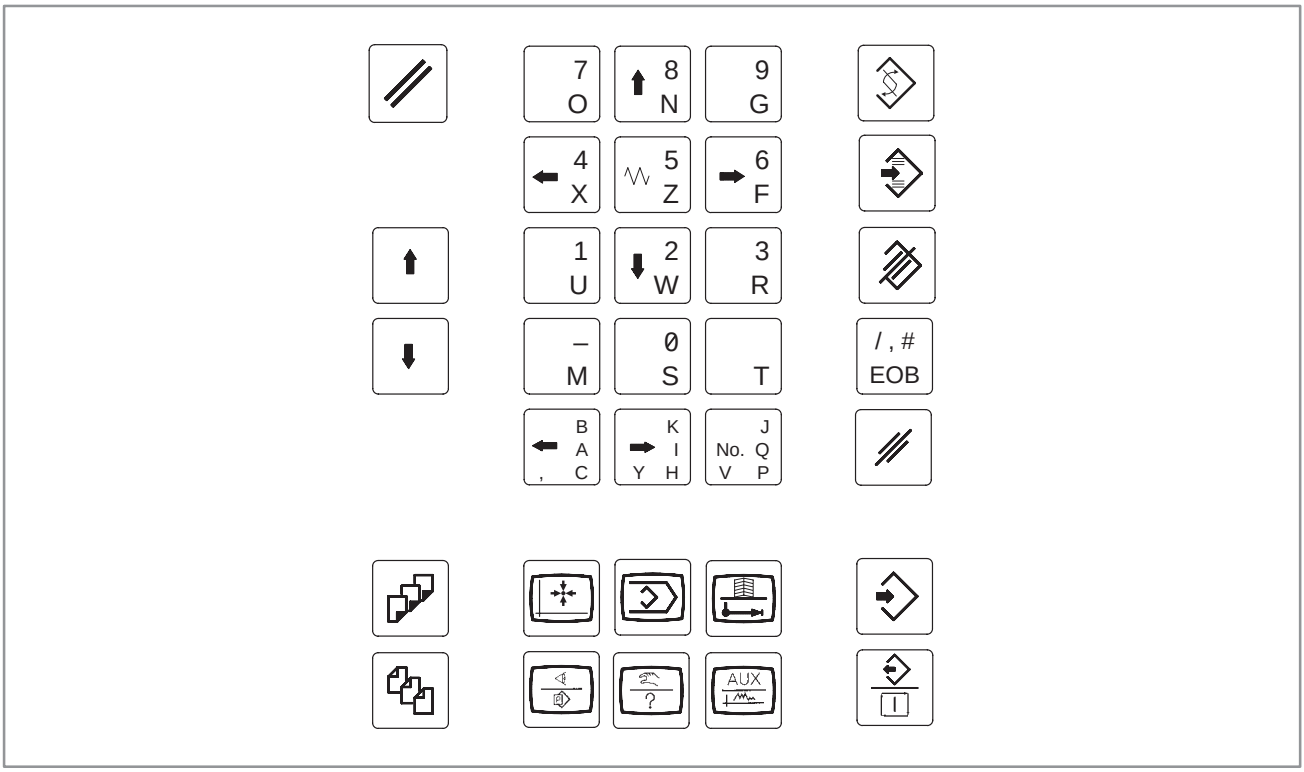


Fig. N3 Symbolic key sheet for small–size MDI for lathes

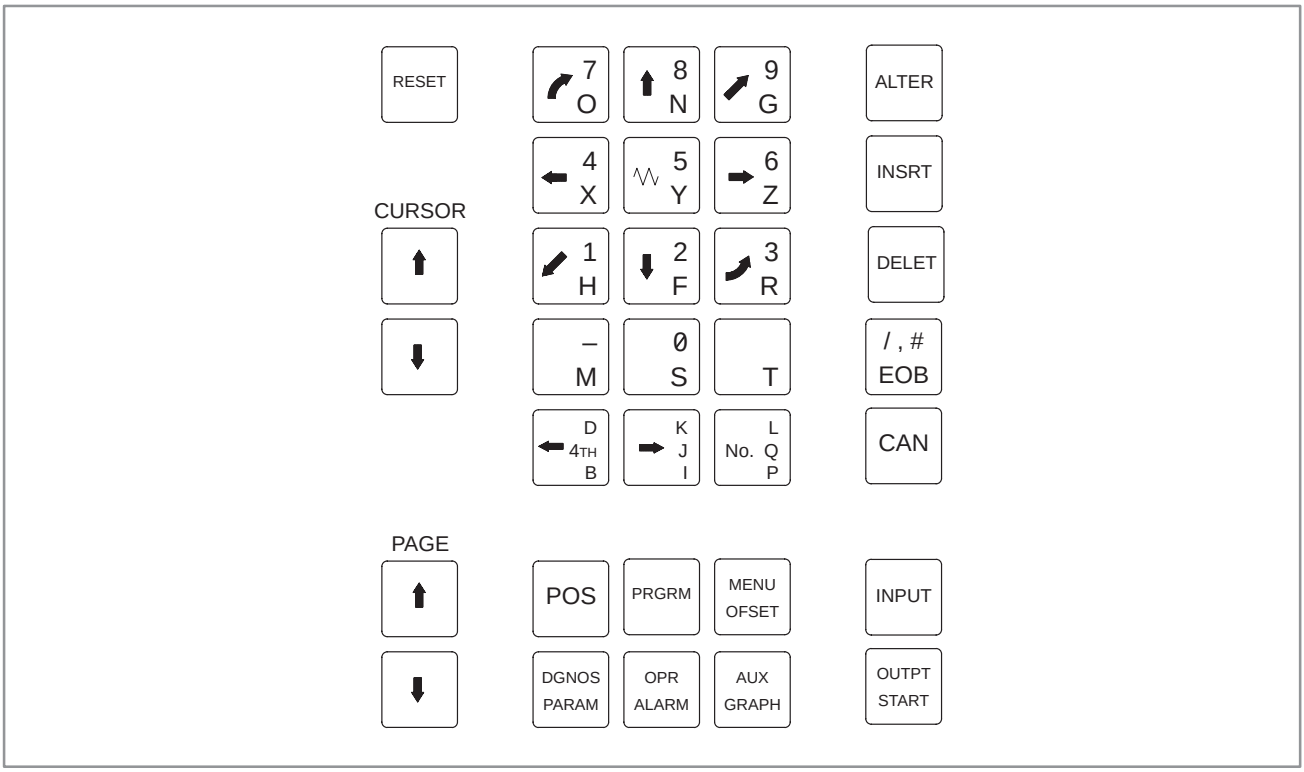


Fig. N4 Standard key sheet for small–size MDI for machining centers

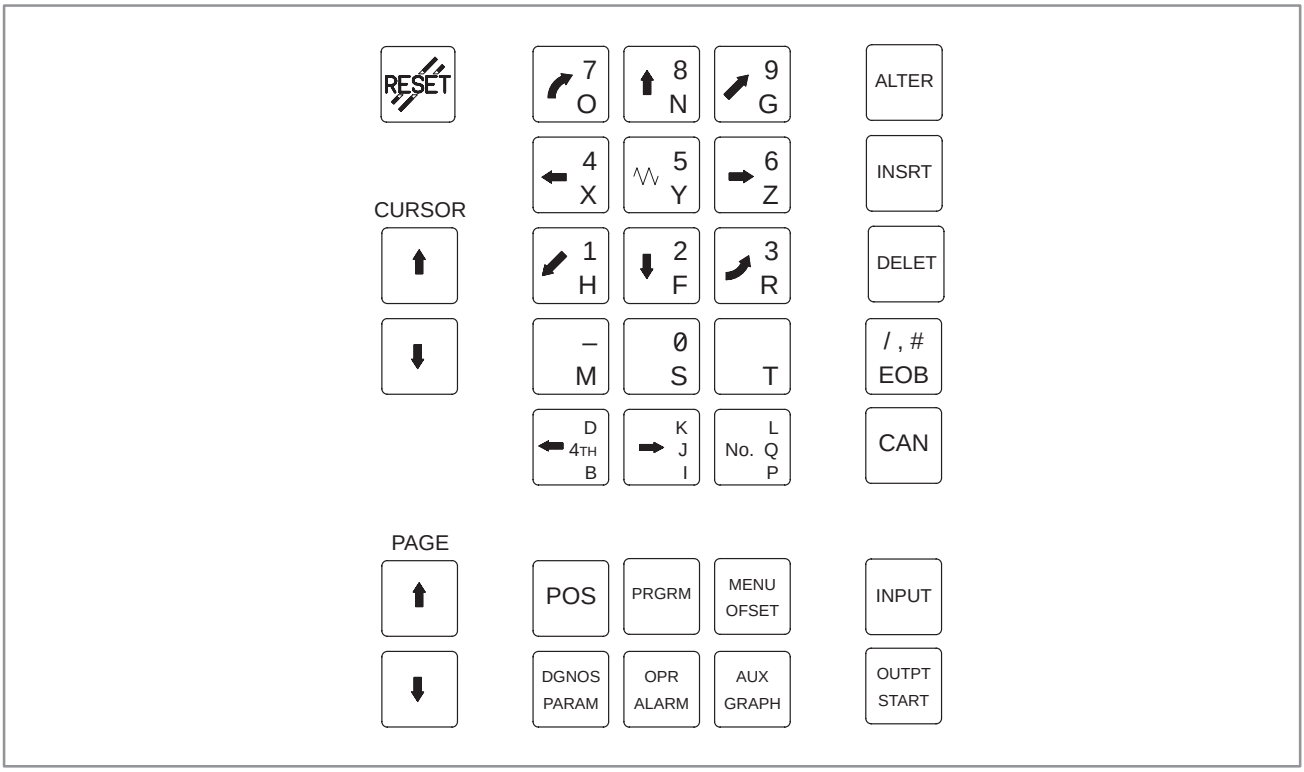


Fig. N5 English–language key sheet for small–size MDI for machining centers

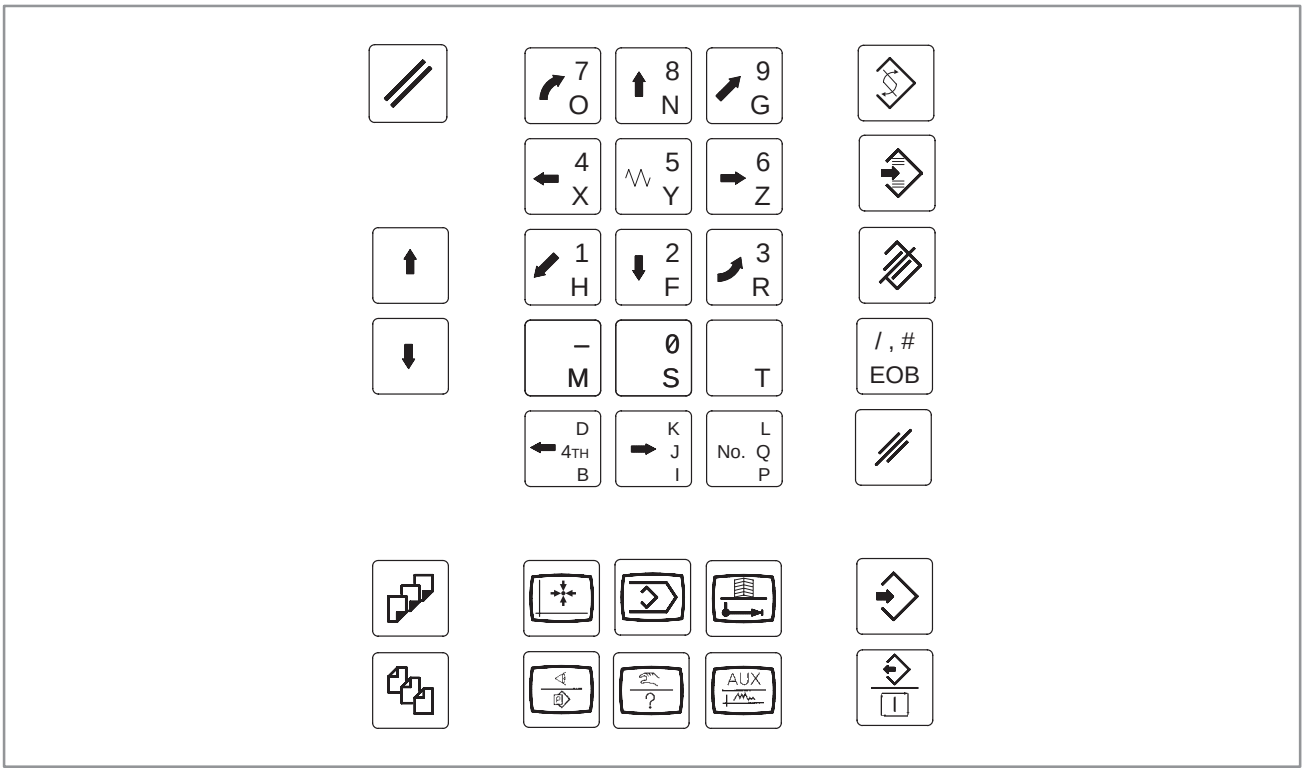
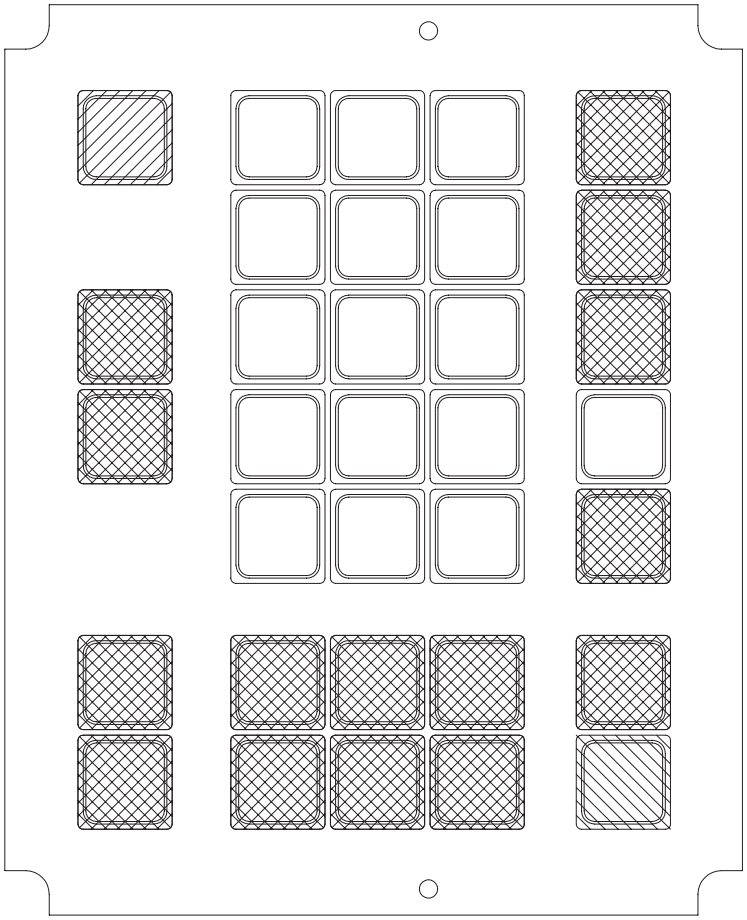


Fig. N6 Symbolic key sheet for small–size MDI for machining centers



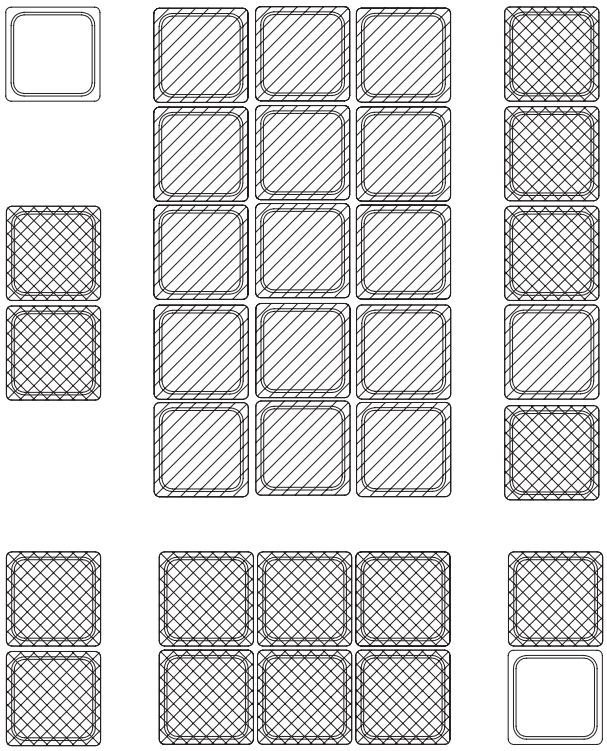
MARK	KEY TOP	TEXT
	RED MANSELL 5R4/14	IVORY DIC 946
	BLUE DIC 102	IVORY DIC 946
	GREEN DIC 173	IVORY DIC 946
	IVORY DIC 946	BLACK DIC 514

Colors of other than key tops

Base: Black (DIC 514)

Characters: Ivory (DIC 946)

Fig. N7 Small–size MDI color scheme (standard)



MARK	KEY TOP	TEXT
	COOL GRAY DIC 442	BLACK DIC 514
	WARM GRAY DIC 518	BLACK DIC 514
	WHITE MANSELL 2.5Y 8.3/0.4	BLACK DIC 514

Colors of other than key tops

Characters: White (Mansell 2.5Y 8.3/0.4)

Base: Black (DIC 514)

Fig. N8 Small–size MDI color scheme (CE marking)

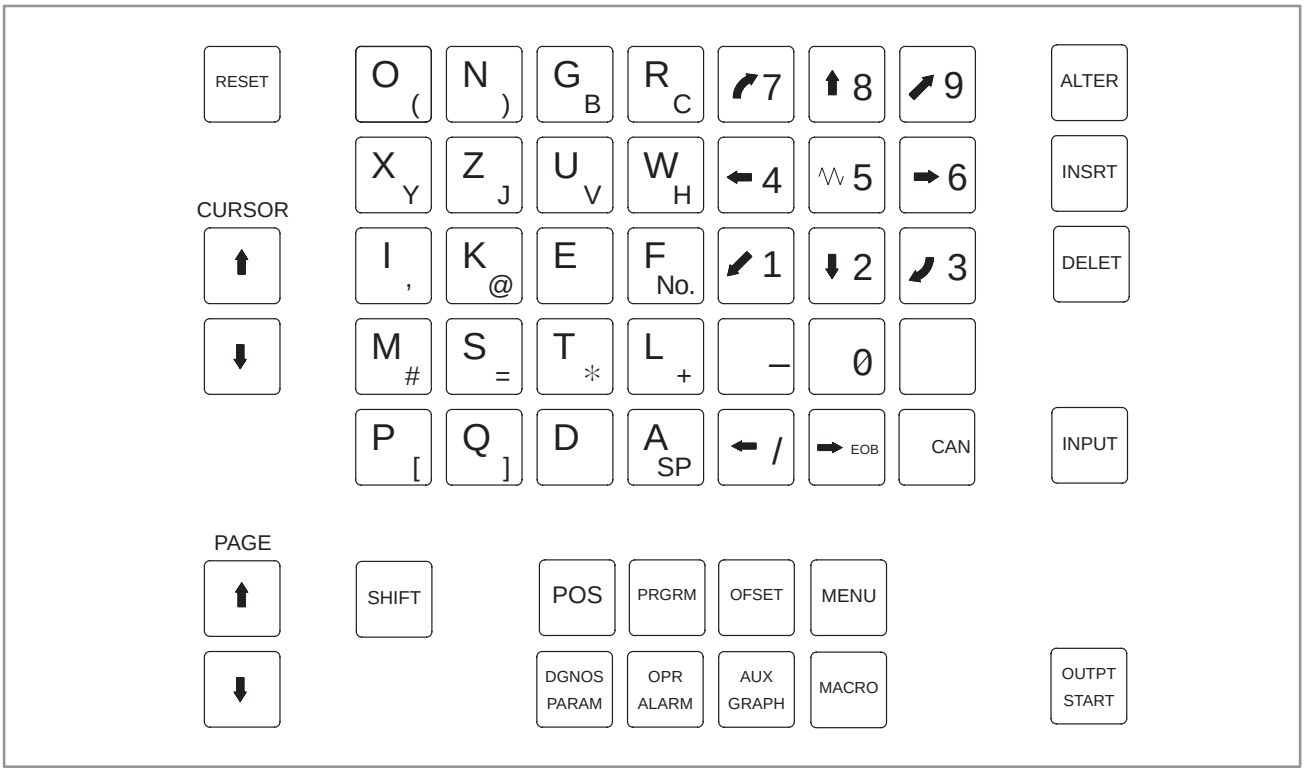


Fig. N9 Standard key sheet for full–key MDI for lathes

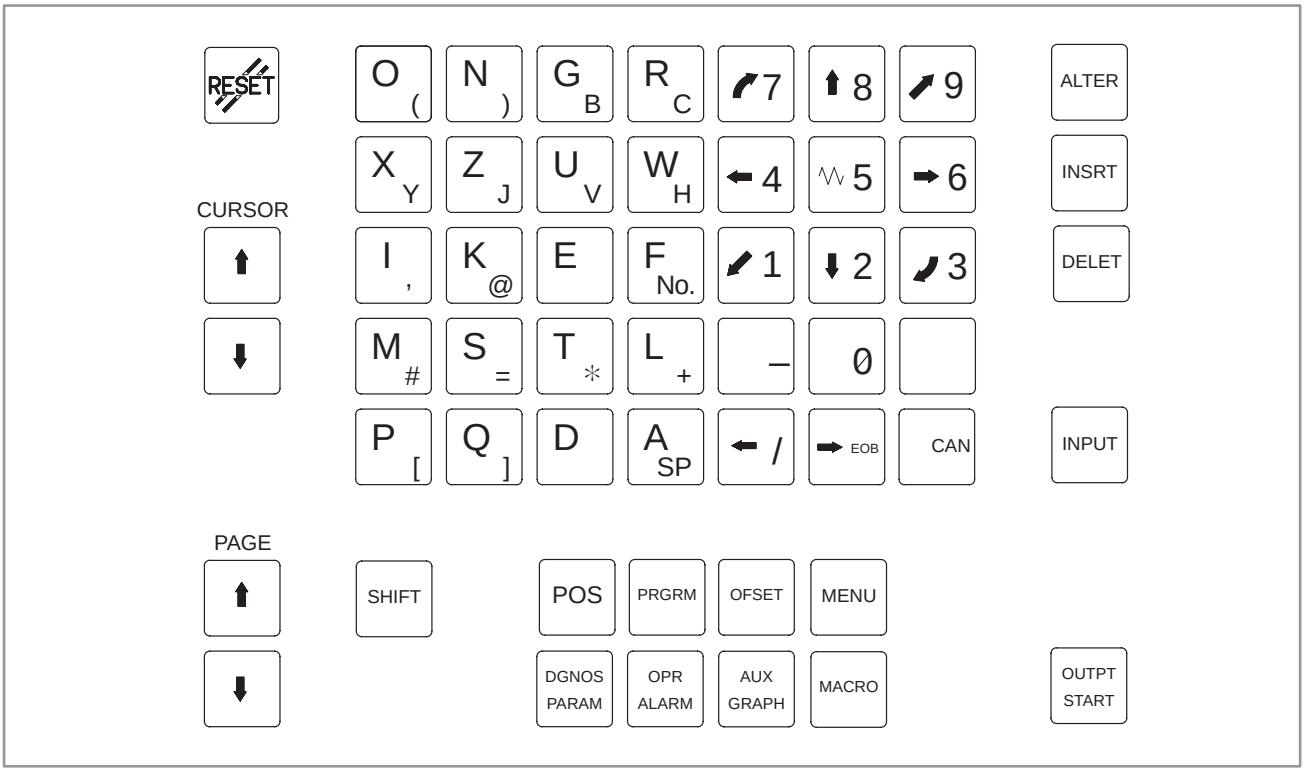


Fig. N10 English–language key sheet for full–key MDI for lathes

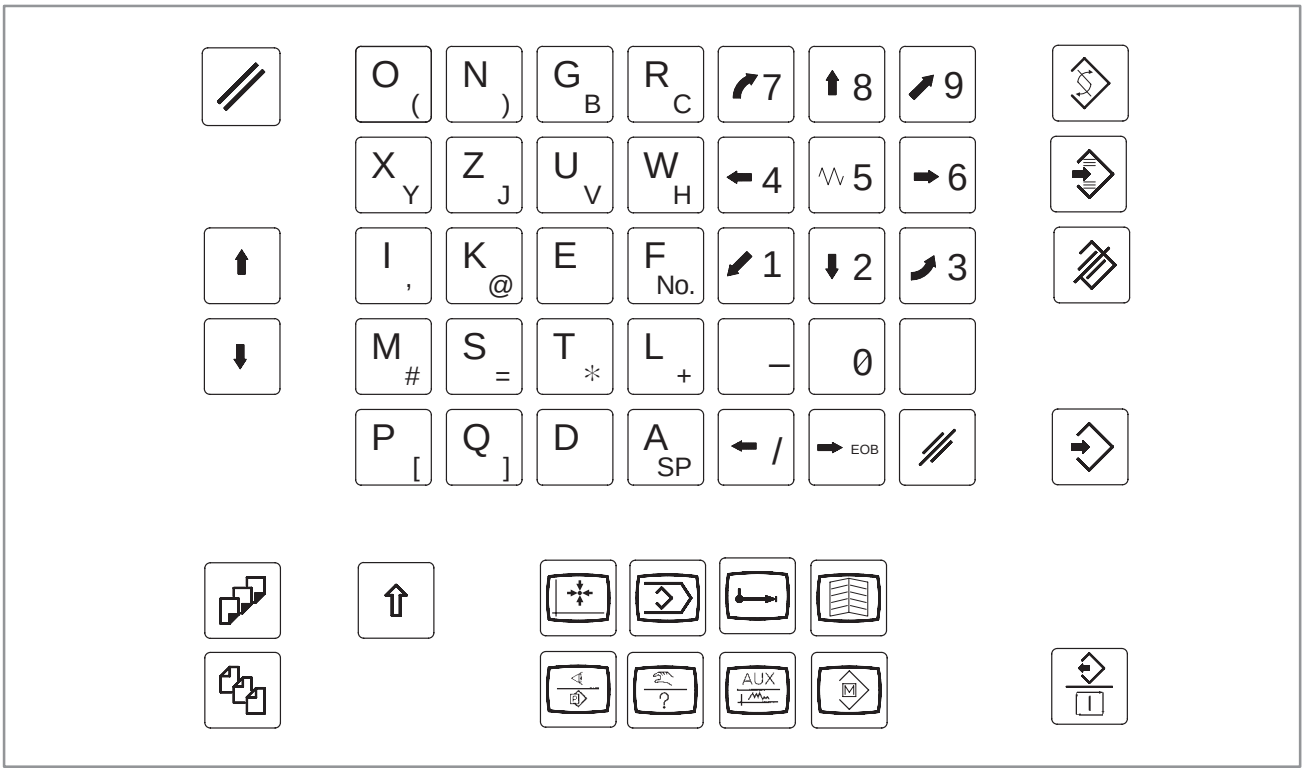


Fig. N11 Symbolic key sheet for full–key MDI for lathes

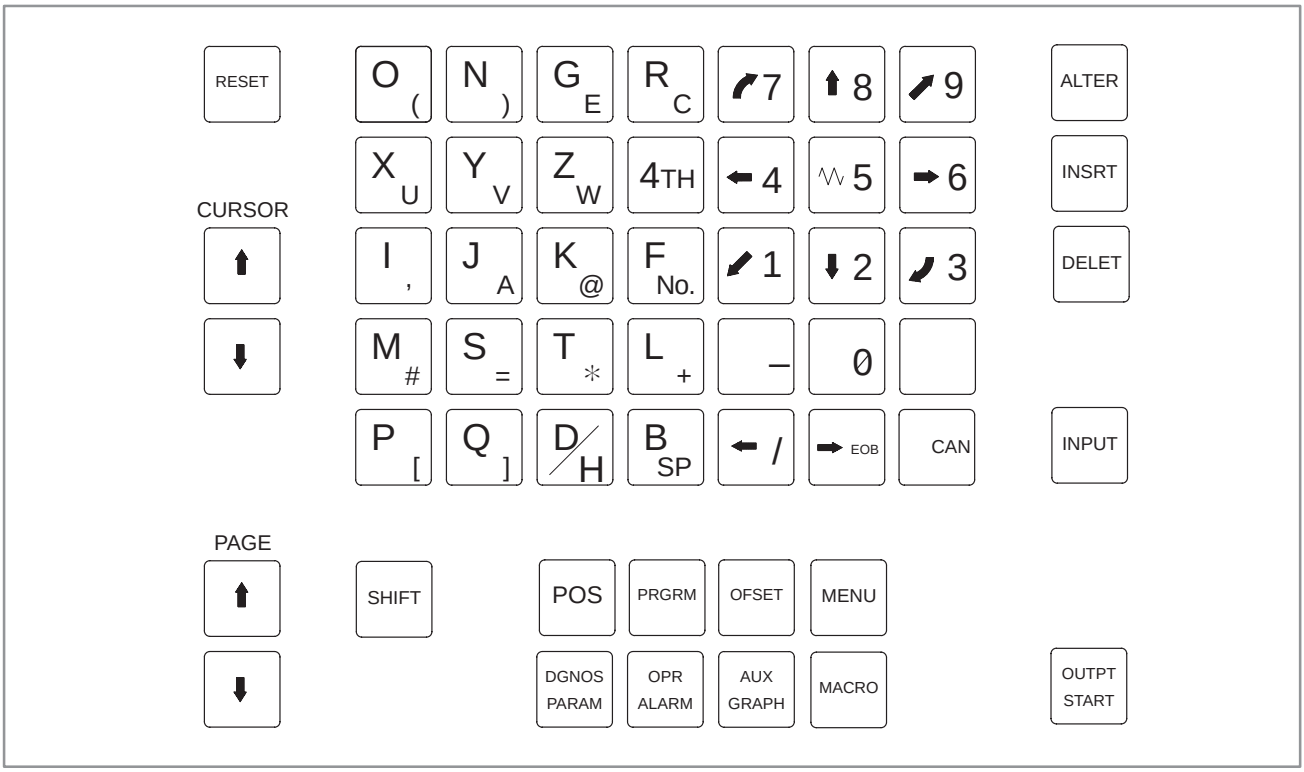


Fig. N12 Standard key sheet for full–key MDI for machining centers

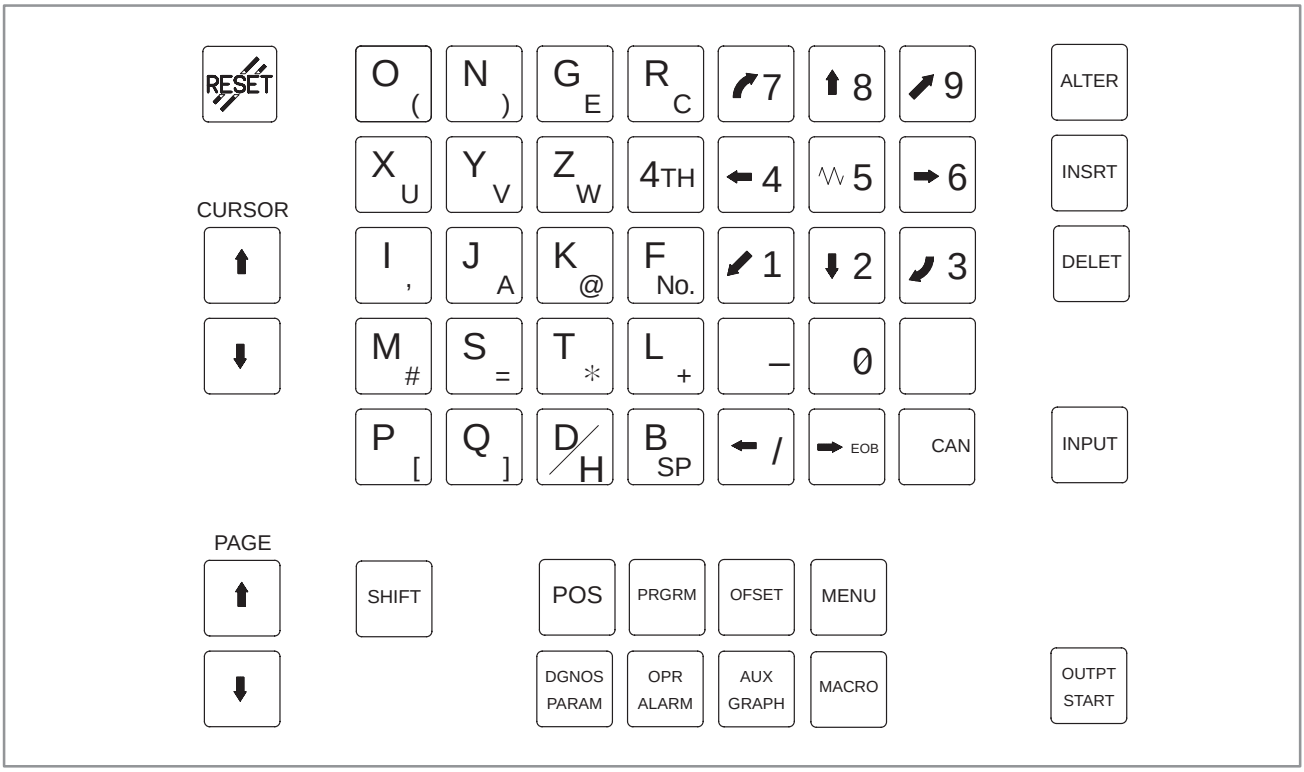


Fig. N13 English–language key sheet for full–key MDI for machining centers

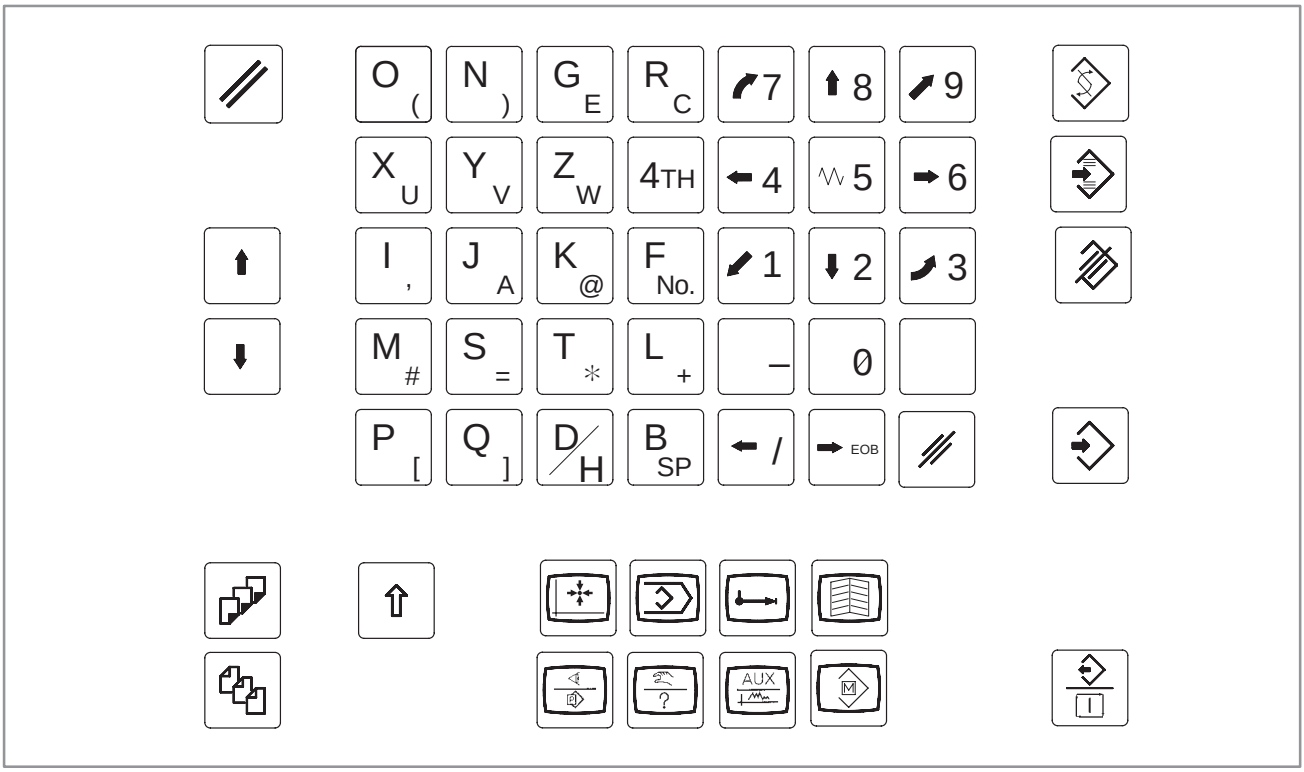
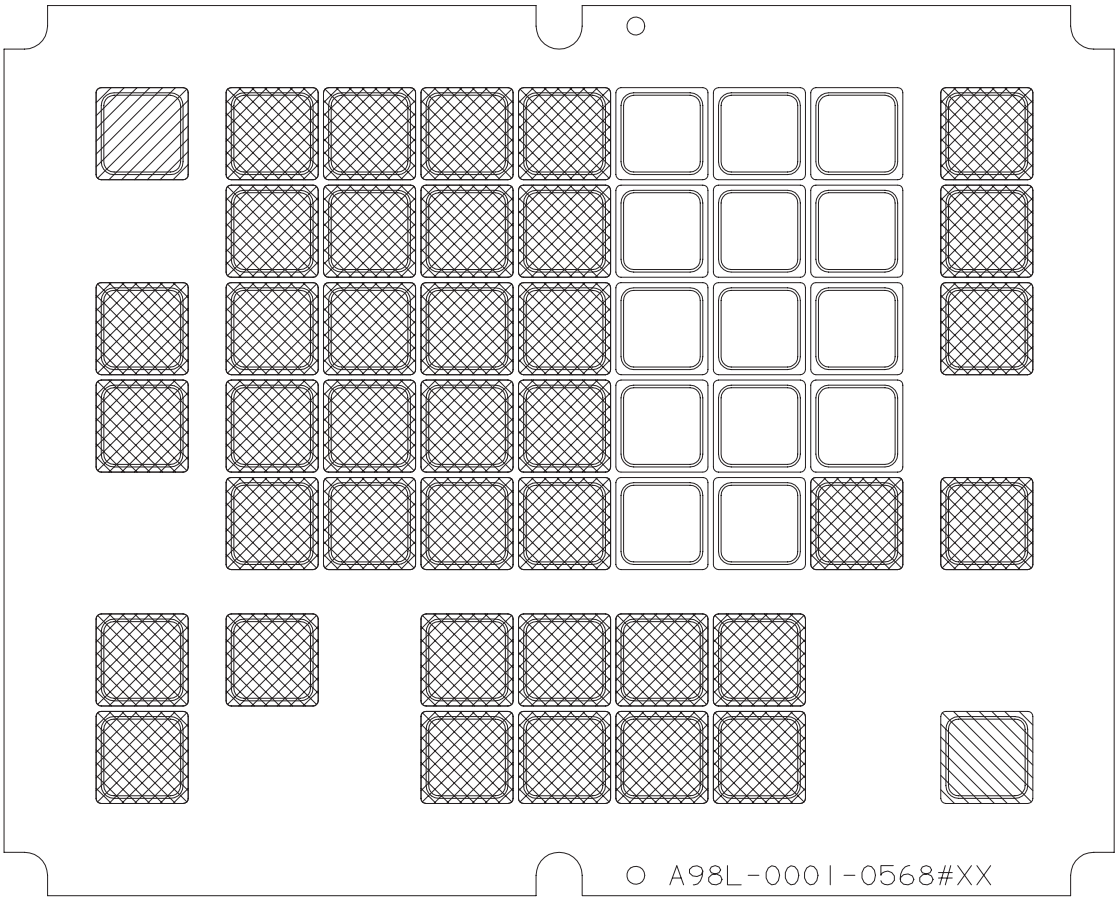


Fig. N14 Symbolic key sheet for full–key MDI for machining centers



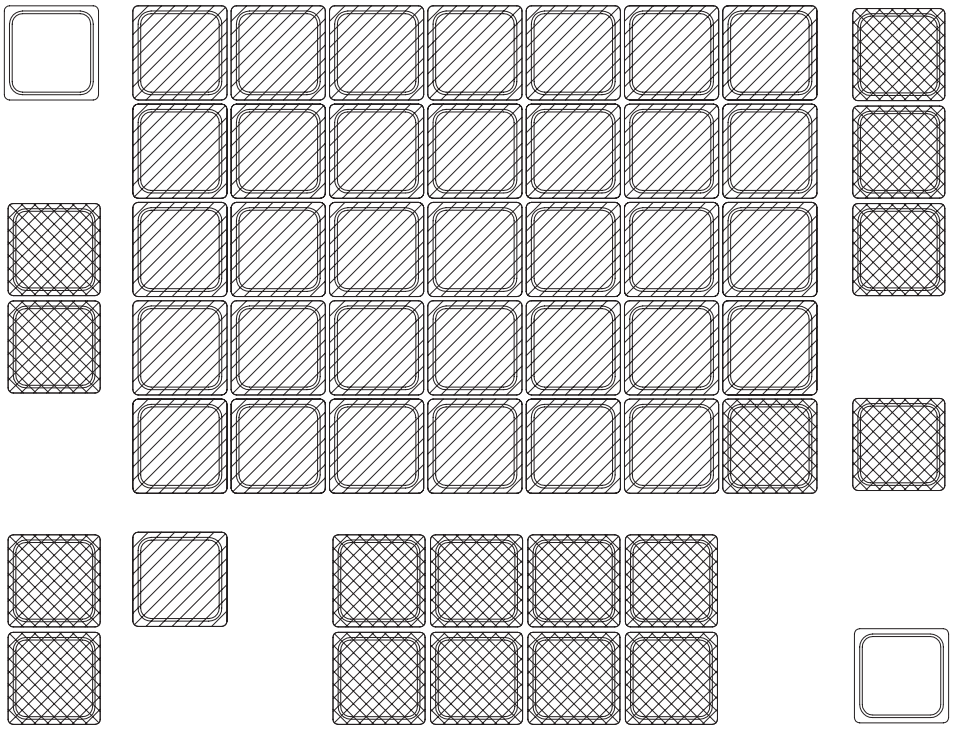
MARK	KEY TOP	TEXT
	RED MANSELL 5R4/14	IVORY DIC 946
	BLUE DIC 102	IVORY DIC 946
	GREEN DIC 173	IVORY DIC 946
	IVORY DIC 946	BLACK DIC 514

Colors of other than key tops

Base: Black (DIC 514)

Characters: Ivory (DIC 946)

Fig. N15 Full–key MDI color scheme (standard)



MARK	KEY TOP	TEXT
	COOL GRAY DIC 442	BLACK DIC 514
	WARM GRAY DIC 518	BLACK DIC 514
	WHITE MANSELL 2.5Y 8.3/0.4	BLACK DIC 514

Colors of other than key tops

Base: Black (DIC 514)

Characters: White (Mansell 2.5Y 8.3/0.4)

Fig. N16 Full–key MDI color scheme (CE marking)

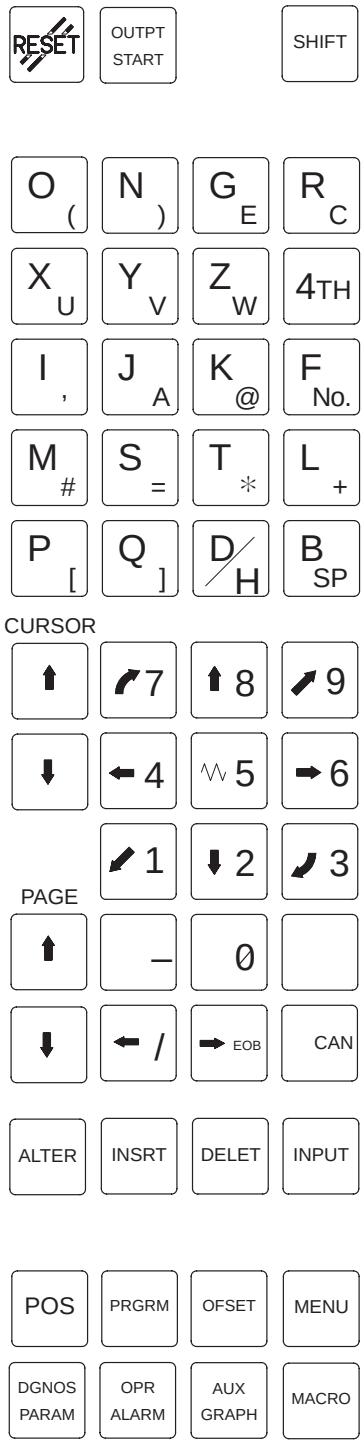


Fig. N17 MDI for 14″ CRT for machining centers (standard)

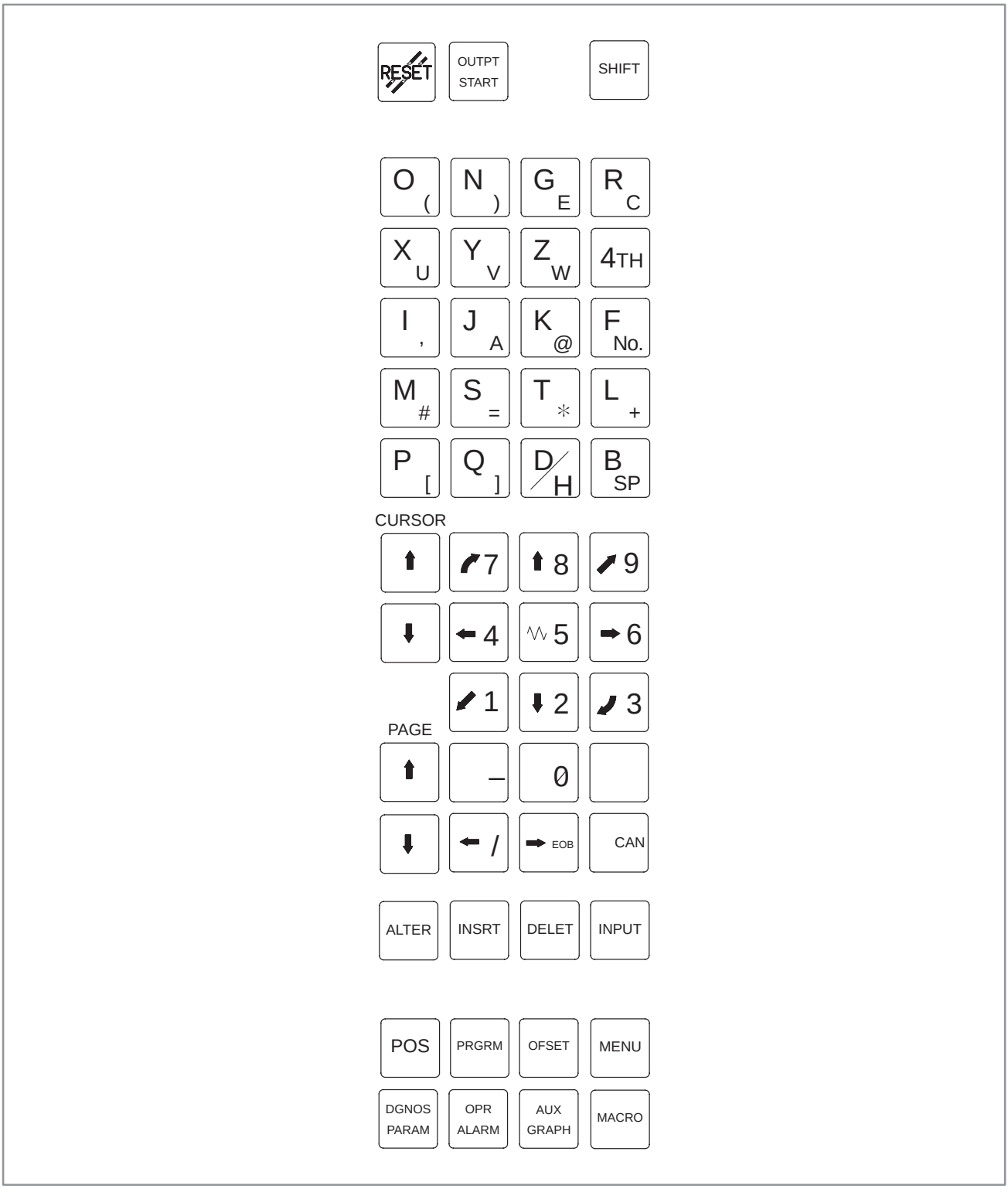


Fig. N18 MDI for 14″ CRT for machining centers (English–language)

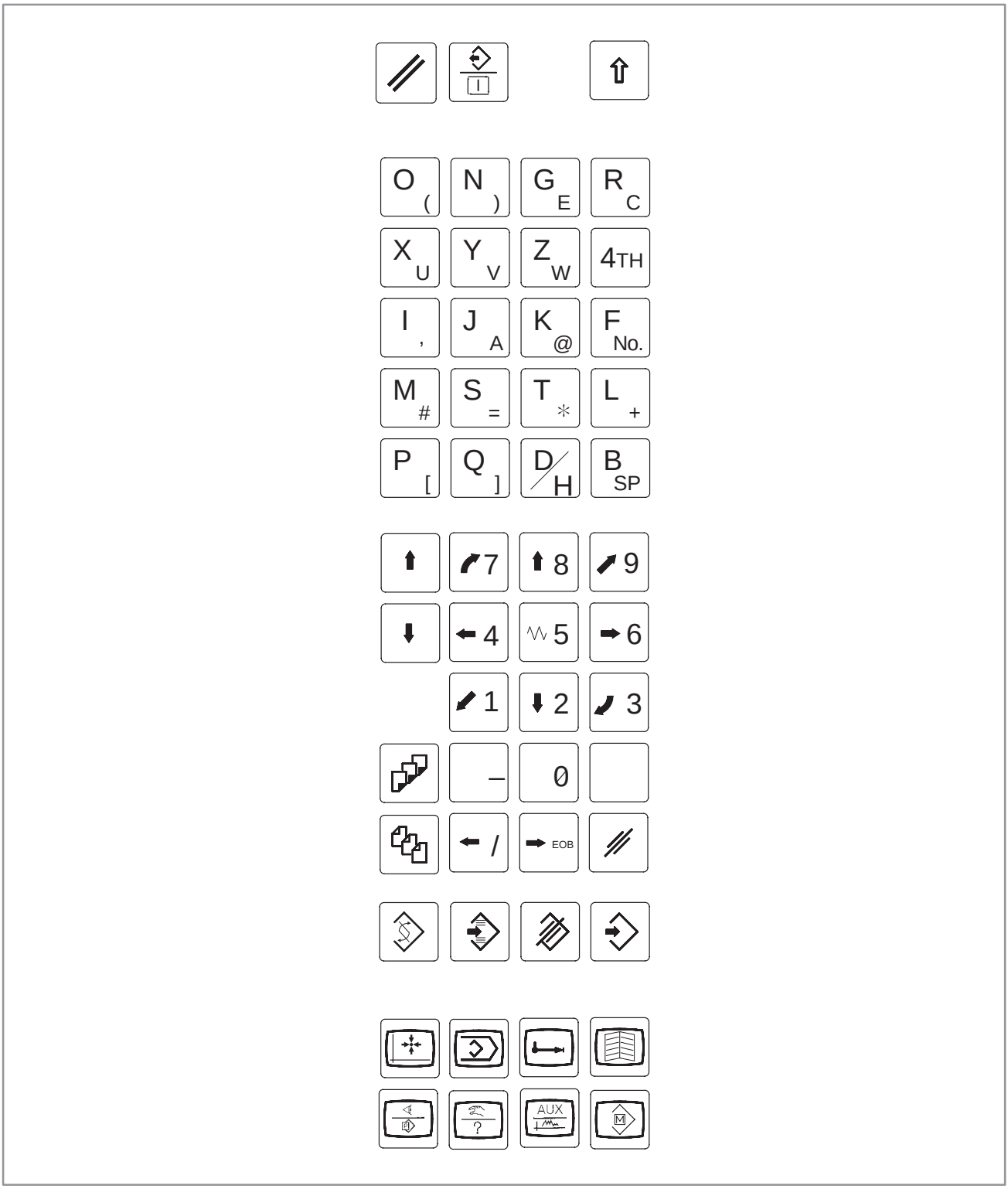
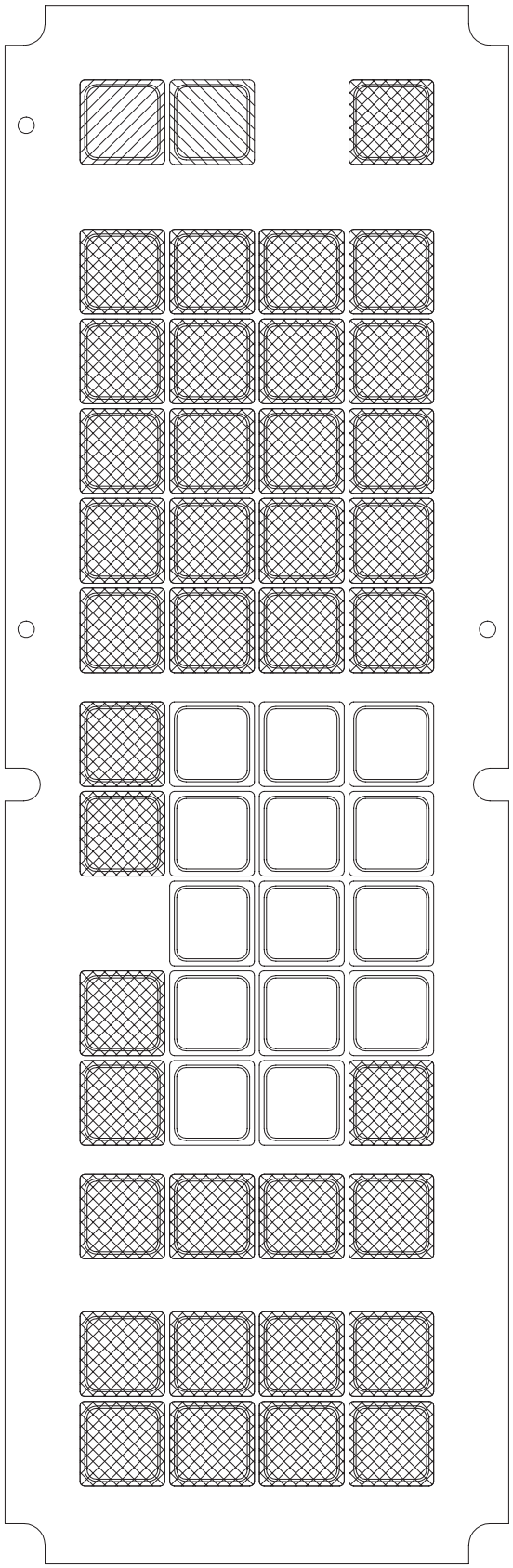


Fig. N19 MDI for 14″ CRT for machining centers (symbolic)



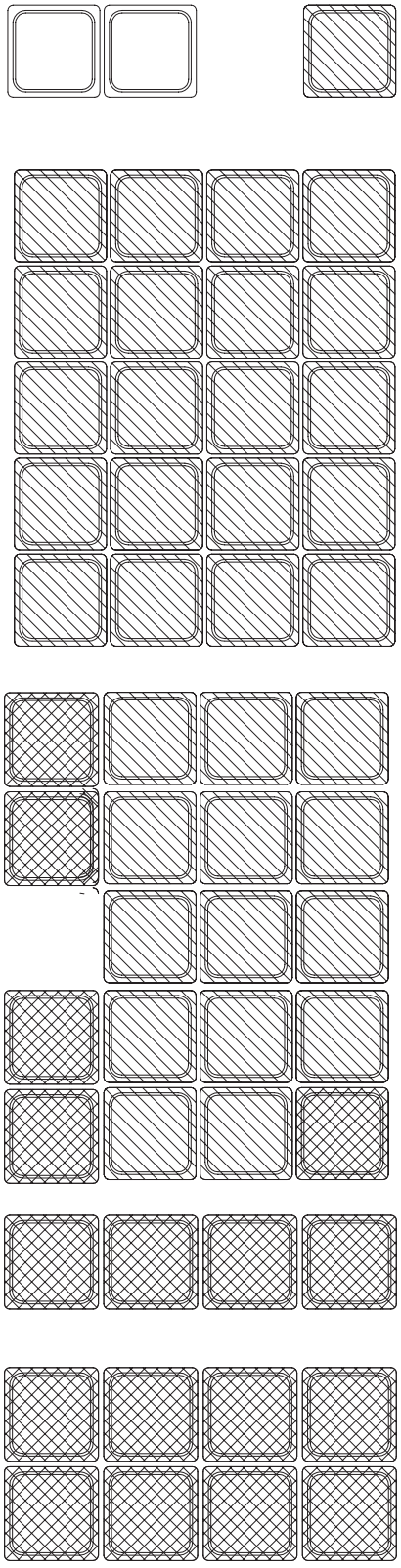
MARK	KEY TOP	TEXT
	RED MANSELL 5R4/14	IVORY DIC 946
	BLUE DIC 102	IVORY DIC 946
	GREEN DIC 173	IVORY DIC 946
	IVORY DIC 946	BLACK DIC 514

Colors of other than key tops

Base: Black (DIC 514)

Characters: Ivory (DIC 946)

Fig. N20 Color scheme for MDI for 14″ CRT (standard)



MARK	KEY TOP	TEXT
	COOL GRAY DIC 442	BLACK DIC 514
	WARM GRAY DIC 518	BLACK DIC 514
	WHITE MANSELL 2.5Y 8.3/0.4	BLACK DIC 514

Colors of other than key tops

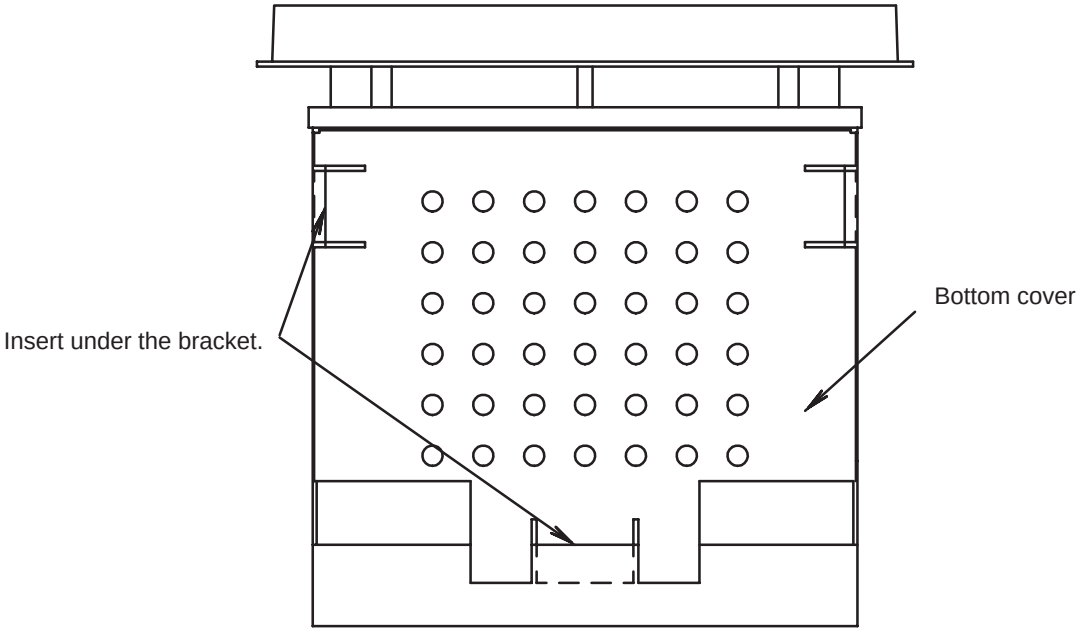
Base: Black (DIC 514)

Characters: White (Mansell 2.5Y 8.3/0.4)

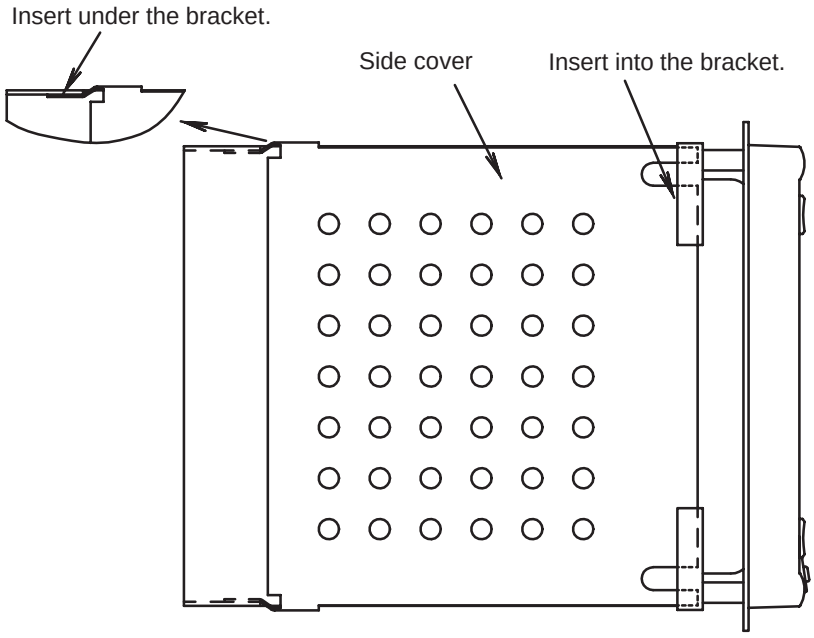
Fig. N21 Color scheme for MDI for 14″ CRT (CE marking)

O INSTALLING CRT PROTECTION COVERS

Qualification for CE marking (machine directive) requires the installation of CRT protection covers for the 9″ monochrome CRT. The top and rear covers are installed at the factory. This section shows how to install the bottom and side covers.



Installing the bottom cover (bottom view)



Installing the side cover (side view)

CRT protection covers

≪Symbols≫

≪A≫

≪B≫

≪C≫

≪D≫

≪E≫

≪F≫

≪G≫

≪H≫

≪I≫

≪K≫

≪L≫

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≪N≫

≪O≫

≪P≫

≪R≫

≪S≫

≪T≫

≪U≫

≪V≫

≪W≫

Revision Record

Series 0/00/0 Mate CONNECTION MANUAL (HARDWARE) (B–61393E)

Edition	Date	Contents
03	Sep., ’91	Errors in writing were corrected.
02	Nov., ’89	Addition • APPENDIX 12 CRT/MDI SWITCHING CIRCUIT • APPENDIX 13 Series 0–C DETACHABLE CRT/MDI • APPENDIX 14 PCB FOR MACHINE OPERATOR’S PANEL CONTROL • APPENDIX 15 ANALOG INTERFACE • APPENDIX 16 Series 0 REMOTE BUFFER • APPENDIX 17 POSITION CODER SWITCHING CIRCUIT • APPENDIX 18 HIGH–SPEED CYCLE MACHINING FUNCTION • APPENDIX 19 SERIAL SPINDLE COUPLING EXPLANATION
01	Oct., ’88	—

Edition	Date	Contents
06	Sep., ’98	Addition • Series 0–D/0–DII Correction of errors
05	Jul., ’97	All pages are changed.
04	Feb., ’92	Addition • 9″ superfine color CRT/MDI unit • PMC–M with FANUC I/O Link • Additional I/O–B3 • Operator’s panel connection unit C1 • PDP/MDI switching circuit • New cables and connectors • APPENDIX 20 AXIS CONTROL PCBs FOR SERVO MOTOR WITH SERIAL PULSE CODER • APPENDIX 21 DNC1 CONNECTION • APPENDIX 22 REMOTE BUFFER FOR CONTROL UNIT A • APPENDIX 23 SERIES 0–C OPERATOR’S PANEL CONNECTION UNIT C1 • APPENDIX 24 MACHINE OPERATOR’S PANEL CONTROL PCB (DESIGNED FOR USE WITH A FANUC I/O LINK)