



Changes for the Better

MITSUBISHI CNC

EZMotion-NC E60/E68 Series

**CONNECTION AND
MAINTENANCE MANUAL**

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Introduction

This manual is called MITSUBISHI EZMotion-NC Series CONNECTION AND MAINTENANCE MANUAL and covers the items related to installation, connection and maintenance of this NC unit. Read this manual thoroughly before using. To safely use this NC unit, thoroughly study the "Precautions for Safety" on the next page before use.

Details described in this manual

CAUTION

-  For items described as "Restrictions" or "Usable State" in this manual, the instruction manual issued by the machine tool builder takes precedence over this manual.
-  Items not described in this manual must be interpreted as "not possible".
-  This manual is written on the assumption that all option functions are added. Confirm with the specifications issued by the machine tool builder before use.
-  Refer to the Instruction Manual issued by each machine tool builder for details on each machine tool.
-  Some screens and functions may differ depending on the NC system (or its version), and some functions may not be possible. Please confirm the specifications before use.

Precautions for Safety

Always read the specifications issued by the machine maker, this manual, related manuals and enclosed documents before starting installation, operation, programming, maintenance or inspection to ensure correct usage. Thoroughly understand the basics, safety information and precautions of this numerical controller before using the unit.

This manual ranks the safety precautions into "**DANGER**", "**WARNING**" and "**CAUTION**".



DANGER

When there is a great risk that the user could be subject to fatalities or serious injuries if handling is mistaken.



WARNING

When the user could be subject to fatalities or serious injuries if handling is mistaken.



CAUTION

When the user could be subject to injuries or when physical damage could occur if handling is mistaken.

Note that even if the items is ranked as "**CAUTION**", incorrect handling could lead to serious results. Important information is described in all cases, so please observe the items.



DANGER

Not applicable in this manual.



WARNING

1. Items related to prevention of electric shocks

-  Do not operate the switches with wet hands, as this may lead to electric shocks.
-  Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.

⚠ CAUTION

1. Items related to noise

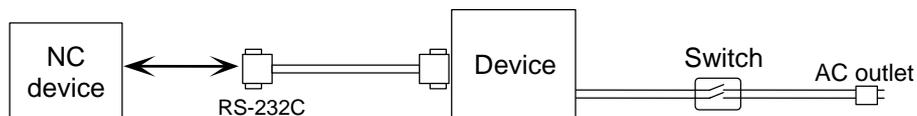
- ⚡ Always treat the shield cables indicated in this manual with grounding treatment such as cable clamps.
- ⚠ Separate the signal wire from the drive line/power line when wiring.

2. Items related to installation

- ⚠ Install the NC Card on noncombustible material. Installation directly on or near combustible material may lead to fires.
- ⚠ Always observe the installation direction.
- ⚠ Do not install or operate an NC Card that is damaged or that have missing parts.
- ⚠ Do not allow conductive foreign matter such as screws or metal chips or combustible foreign matter such as oil enter the NC Card.
- ⚠ The NC Card are precision devices so do not drop or apply strong impacts on them.
- ⚠ Do not install the NC Card where it may be subject to cutting oil.

3. Items related to connection

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⚡ When using an inductive load such as relays, always connect a diode in parallel to the load as a noise measure.
- ⚡ When using a capacitive load such as a lamp, always connect a protective resistor serially to the load to suppress rush currents.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⊘ Do not connect or disconnect the PCBs while the power is ON.
- ⚠ Pay more attention to connecting or disconnecting connectors when RS-232C is used as peripheral devices. On the device side, the type of the AC power supply switch must be the one that shuts off the both lines of the power supply. Make sure that the AC power supply of the device side is OFF when connect or disconnect the connectors.



4. Items related to battery

- ⚡ If the battery voltage drop warning alarm occurs, save the programs, tool data and parameters with the input/output device before exchanging batteries.
- ⚠ Do not short-circuit, charge, overheat, incinerate or disassemble the battery.
- ⚠ Dispose the spent battery according the local laws.

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I. CONNECTION MANUAL

1. OUTLINE

This manual explains the configurations/electrical specifications/connection methods required for installing and connecting the NC device.

This manual assumes that all functions are added, but the actually delivered device may not have all the functions.

Refer to the following documents for explanations on the functions.

EZMotion-NC E60/E68 Series Specifications Manual:	IB-1500171
EZMotion-NC E60/E68 Series PLC Interface Manual:	IB-1500176
AC Servo/Spindle MDS-C1 Series Specifications Manual:	BNP-C3000
AC Servo/Spindle MDS-C1 Series Instruction Manual:	BNP-B2365
AC Servo/Spindle MDS-C1 Series Specifications Manual:	BNP-C3040
AC Servo MDS-SVJ2 Specification Manual:	BNP-B3937
AC Servo MR-J2-CT Series (with built-in indexing function) Specifications Manual:	BNP-B3944
AC Spindle MDS-B-SPJ2 Series Specification Manual:	BNP-B2164
AC Servo MDS-R Series Specifications and Instruction Manual:	BNP-C3045

Refer to the following manual on the EMC Instructions for the European CE Marking.

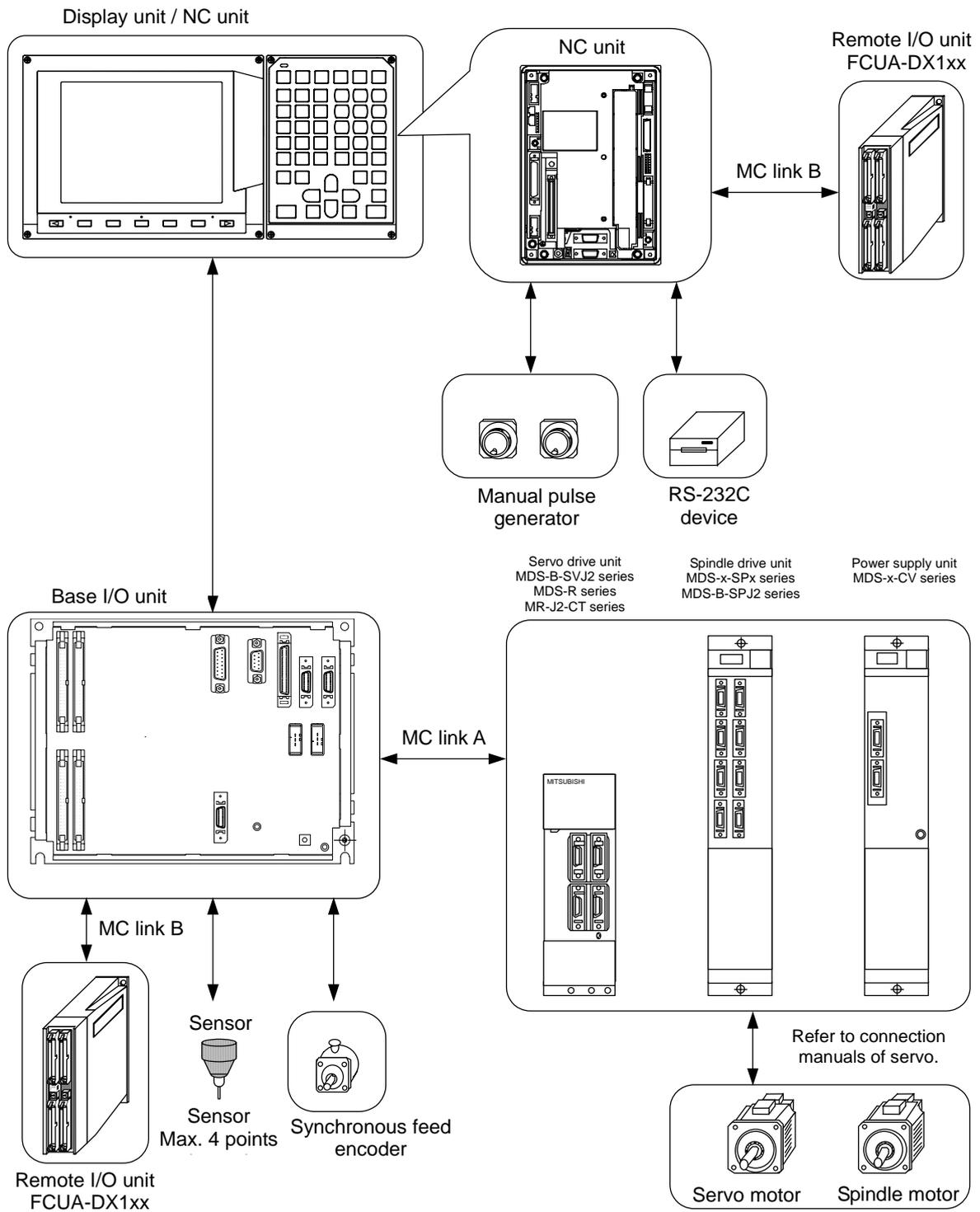
EMC Installation Manual:	BNP-B2230
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Refer to the following manual on compliance with UL/c-UL Standards.

Instruction Manual for Compliance with UL/c-UL Standard:	BNP-A2993-81
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2. CONFIGURATION

2.1 System Configuration



2.2 Lists of Components

(1) NC unit

Model	Configuration module model	Function
FCU6-MU071 (E60)	HR761/HR763 card	Main card
	HR741 card	Memory card
	Q6-BAT	Battery
	Base plate	
	Cover	
FCU6-MU072 (E68)	HR761/HR763 card	Main card
	HR742 card	Memory card
	Q6-BAT	Battery
	Base plate	
	Cover	

(2) Option for NC unit

Configuration module model	Function
HR753 card (E60)	E60 spindle connection option
HR751 card (E68)	PLC accelerator card

(3) Front IC card I/F unit

Model	Configuration module model	Function
FCU6-EP105-1 (E68)	HR253	Front IC card
	HR551	Bus extension card
	F161 cable	Bus cable
	Installation plate	

(4) Display unit

Model	Configuration module model	Function
FCU6-DUE71 /FCU6-DUE71-1 (Note 1) (E60)	MDT962B-4A	9-type monochrome CRT
	FCUA-R100 cable	CRT power supply cable
	F590 cable	Between HR761 and CRT
	Menu key	
	Escutcheon	
	Base plate	
FCU6-DUT11 /FCU6-DUT11-1 (Note 1) (E60)	LTBLDT168G6C	7.2-type monochrome LCD
	HR721 card	Power supply for backlight
	F090 cable	Between HR761 and HR721
	NZ24-4 cable	Between HR721 and LCD
	Menu key	
	Escutcheon	
FCU6-DUN24 (Note 2) (E68)	AA084VC06	8.4-type color LCD
	HR722 card	LCD relay card
	CXA-L0605-VJL	Backlight inverter
	F090 L0.1M cable	Between HR761 and HR722
FCU6-DUN26 (E60) (Note 3)	F098 cable	Between HR722 and LCD
	F484 L0.25M cable	Inverter cable
	Menu key	
	Escutcheon	
	Base plate	

(Note 1) The units with the name FCU6-xxxx-1 are provided with an adapter for mounting on the front of the units.

(Note 2) With E68 standard, the display unit is mounted from the front.

(Note 3) Escutcheon of FCU6-DUN26 differs from that of FCU6-DUN24.

(5) Keyboard unit

Model	Configuration module model	Function
FCU6-KB071 /FCU6-KB071-1 (Note 1) (E60)	Housing	Sheet attached for machining center
	KS-6MB911A-P	Keyboard switch
	F053 cable	Between HR761 and keyboard
	Base plate	
FCU6-KB024 (Note 2) (E60/E68)	Housing	Sheet attached for machining center
	KS-6MB911B-P	Keyboard switch
	F054 cable	Between HR761 and keyboard
	Base plate	

(6) Base I/O unit

Model		Configuration module model	Function
FCU6-HR341	Sink/Source input 64 points Sink output 48 points Analog output 1 point I/O share line (Note 5)	HR341 card	DI64/DO48/AO1
		FCUA-R-TM	Terminal resistor
		Aluminum die-cast	
FCU6-HR351	Sink/Source input 64 points Sink output 48 points Analog output 1 point I/O share line (Note 5)	HR351 card	DI64/DO48/AO1
		FCUA-R-TM	Terminal resistor
		Aluminum die-cast	
FCU6-DX220 (E68)	Sink/Source input 64 points Sink output 64 points I/O share line (Note 3)(Note 4)	HR327 card	DI64/DO64
		FCUA-R-TM	Terminal resistor
		Aluminum die-cast	
FCU6-DX221 (E68)	Sink/Source input 64 points Source output 64 points I/O share line (Note 3)(Note 4)	HR337 card	DI64/DO64
		FCUA-R-TM	Terminal resistor
		Aluminum die-cast	

(Note 1) The units with the name FCU6-xxxxx-1 are provided with an adapter for mounting on the front of the units.

(Note 2) With E68 standard, the keyboard unit is mounted from the front.

(Note 3) DI/O is a cable with no strain relief.

(Note 4) The 5th to 8th channels of SKIP and 2nd channel of RIO cannot be used.

(Note 5) I/O share line is the interface with servo drive unit, remote I/O, skip signal input and synchronous feed encoder.

(7) Remote I/O unit

Model		Component module model	Function
FCUA-DX100	Sink/Source input 32 points Sink output 32 points	RX311 card	DI32/DO32
		Case	
FCUA-DX101	Sink/Source input 32 points Sink output 32 points	RX312 card	DI32/DO32
		Case	
FUCA-DX110	Sink/Source input 64 points Sink output 48 points	RX311 card	DI32/DO32
		RX321-1 card	DI32/DO16
		Case	
FCUA-DX111	Sink/Source input 64 points Sink output 48 points	RX312 card	DI32/DO32
		RX322-1 card	DI32/DO16
		Case	
FUCA-DX120	Sink/Source input 64 points Sink output 48 points Analog output 1 point	RX311 card	DI32/DO32
		RX321 card	DI32/DO16/AO1
		Case	
FUCA-DX121	Sink/Source input 64 points Sink output 48 points Analog output 1 point	RX312 card	DI32/DO32
		RX322 card	DI32/DO16/AO1
		Case	
FCUA-DX140	Sink/Source input 32 points Sink output 32 points Analog input 4 points Analog output 1 point	RX311 card	DI32/DO32
		RX341 card	AI4/AO1
		Case	
FCUA-DX141	Sink/Source input 32 points Sink output 32 points Analog input 4 points Analog output 1 point	RX312 card	DI32/DO32
		RX341 card	AI4/AO1
		Case	

(8) Peripheral devices

Model		Component module model	Function
PD25	Input: 200VAC Output: 24VDC		With the power supply ON/OFF function
HD60	Manual pulse generator		Manual pulse generator for 12VDC (25pulse/rev) Use F320/F321 cable. Without MELDAS logo.
HD60-1	Manual pulse generator		Manual pulse generator for 12VDC (25pulse/rev) Use F320/F321 cable. With MELDAS logo.
UFO-01-2Z9	Manual pulse generator		Manual pulse generator for 5VDC (100pulse/rev) Use F023/F024 cable. Without MELDAS logo.
FCUA-R-TM	Terminal connector		Terminal for remote I/O communication
FCUA-A-TM	Terminal connector		Terminal for drive part communication
Ground plate D		A complete set of ground plate D	Appendix 1.9
Ground plate E		A complete set of ground plate E	Appendix 1.9
OSE-1024-3-15-68	Synchronous feed encoder		

3. INSTALLATION

3.1 General Specification

(1) Environment conditions in control part

(a) E60: Color display

Unit name		NC unit	Display unit	Keyboard unit
Model		FCU6-MU071	FCU6-DUN26	FCU6-KB024
General specification	Ambient temperature	During operation	0 to 55°C	
		During storage	-20 to 60°C	
	Ambient humidity	Long term	10 to 75% RH (With no dew condensation)	
		Short term	10 to 95% RH (With no dew condensation) (Note 1)	
	Vibration resistance		4.9m/s ² or less	
	Shock resistance		29.4m/s ² or less	
	Working atmosphere		No corrosive gas, dust or oil mist	
Power supply specification	Power supply voltage		24VDC ±5% Ripple 200mV max.	
	Instantaneous stop tolerance time		Depends on the specifications of 24VDC power supply unit used. (Use more than 20ms)	
	Current consumption (max.)		2A (NC unit + display unit + keyboard unit)	
	Heating value (max.)		50W	
Mass		3.2kg (with FUC6-DUN26)	1.0kg	
Outline dimension		Refer to Appendix 1.1		

(Note 1) Short term refers to within one month.

(b) E60: Monochrome display

Unit name		NC unit	Display unit	
Model		FCU6-MU071	FCU6-DUE71	FCU6-DUT11
General specification	Ambient temperature	During operation	0 to 55°C	
		During storage	-20 to 60°C	
	Ambient humidity	Long term	10 to 75% RH (With no dew condensation)	
		Short term	10 to 95% RH (With no dew condensation) (Note 2)	
	Vibration resistance		4.9m/s ² or less	
	Shock resistance		29.4m/s ² or less	
	Working atmosphere		No corrosive gas, dust or oil mist	
Power supply specification	Power supply voltage		Single phase 100VAC -15% to +10% 50/60Hz	—
	Instantaneous stop tolerance time		20ms (with an external power supply unit PD25)	
	Current consumption (max.)		2A (NC unit + display unit)	100VAC 0.4A
Heating value (max.)		80W (with FCU6-DUE71), 50W (with FCU6-DUT11)		
Mass		5.5kg (with FCU6-DUE71), 2.5 kg (with FCU6-DUT11)		
Outline dimension		Refer to Appendix 1.1		

(Note 1) If it is hotter than 45°C, the quality of the LCD (contrast ratio) deteriorates.

(Note 2) Short term refers to within one month.

(c) E68

Unit name		NC unit	Display unit	Keyboard unit
Model		FCU6-MU072	FCU6-DUN24	FCU6-KB024
General specification	Ambient temperature	During operation	0 to 55°C	
		During storage	-20 to 60°C	
	Ambient humidity	Long term	10 to 75% RH (With no dew condensation)	
		Short term	10 to 95% RH (With no dew condensation) (Note 1)	
	Vibration resistance		4.9m/s ² or less	
	Shock resistance		29.4m/s ² or less	
	Working atmosphere		No corrosive gas, dust or oil mist	
Power supply specification	Power supply voltage		24VDC ±5% Ripple 200mV max.	
	Instantaneous stop tolerance time		Depends on the specifications of 24VDC power supply unit used. (Use more than 20ms)	
	Current consumption (max.)		2A (NC unit + display unit + keyboard unit)	
Heating value (max.)		50W		
Mass		3.2kg (with FCU6-DUN24)	1.0kg	
Outline dimension		Refer to Appendix 1.2		

(Note 1) Short term refers to within one month.

(2) Environment conditions in electric cabinet

Unit name		Base I/O unit			
Model		FCU6-HR341	FCU6-HR351	FCU6-DX220	FCU6-DX221
General specification	Ambient temperature	During operation	0 to 55°C		
		During storage	-20 to 60°C		
	Ambient humidity	Long term	10 to 75% RH (With no dew condensation)		
		Short term	10 to 95% RH (With no dew condensation) (Note 1)		
	Vibration resistance		4.9m/s ² or less		
	Shock resistance		29.4m/s ² or less		
	Working atmosphere		No corrosive gas, dust or oil mist		
Power supply specification	Power supply voltage		24VDC ±5% Ripple 200mV max.		
	Instantaneous stop tolerance time		Depends on the external power supply used. (Use more than 20ms)		
	Current consumption (max.)		0.8A (Note 2)		
Heating value (max.)		40W (Note 3)			
Mass		0.6kg			
Outline dimension		Refer to Appendix 1.4.			

(Note 1) Short term refers to within one month.

(Note 2) This value is only of the control circuit part (DCIN connector). For the current value of the I/O circuit, calculate with the number of points used and load.

(Note 3) When all DI/DO points are ON.

Unit name		Remote I/O unit			
Model		FCUA-DX10x	FCUA-DX11x	FCUA-DX12x	FCUA-DX14x
General specification	Ambient temperature	During operation	0 to 55°C		
		During storage	-20 to 60°C		
	Ambient humidity	Long term	10 to 75% RH (With no dew condensation)		
		Short term	10 to 95% RH (With no dew condensation) (Note 1)		
	Vibration resistance		4.9m/s ² or less		
	Shock resistance		29.4m/s ² or less		
	Working atmosphere		No corrosive gas, dust or oil mist		
Power supply specification	Power supply voltage		24VDC ±5% Ripple 200mV max.		
	Instantaneous stop tolerance time		Depends on the external power supply used. (Use more than 20ms)		
	Current consumption (max.)		0.4A (Note 2)	0.7A (Note 2)	0.8A (Note 2)
Heating value (max.)		25W (Note 3)	40W (Note 3)	40W (Note 3)	30W (Note 3)
Mass		470g	570g	590g	550g
Outline dimension		Refer to Appendix 1.5.			

(Note 1) Short term refers to within one month.

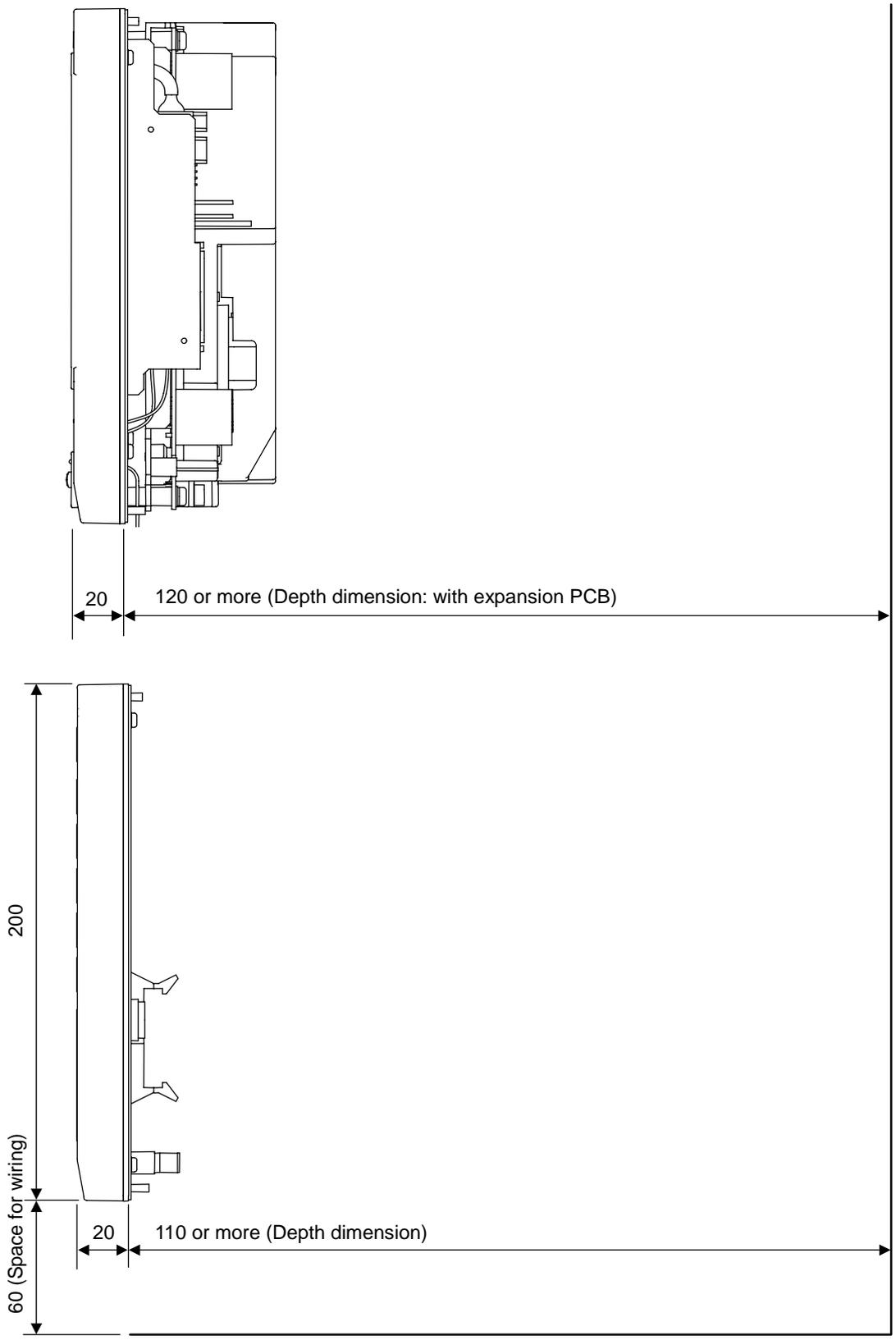
(Note 2) This value is only of the control circuit part (DCIN connector). For the current value of the I/O circuit, calculate with the number of points used and load.

(Note 3) When all DI/DO points are ON.

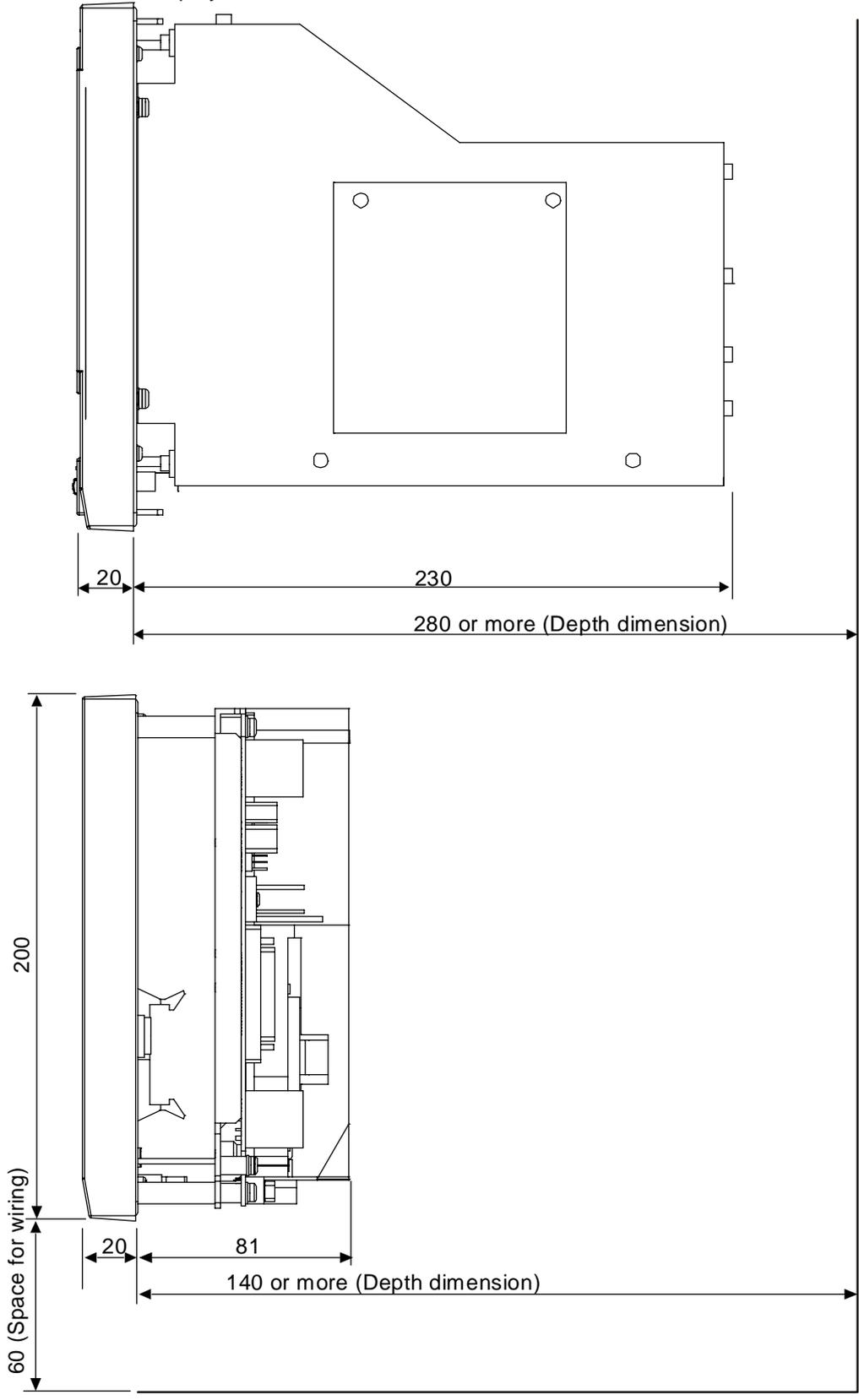
3.2 Designing Conditions for Cabinet

3.2.1 Depth dimension of cabinet

(1) E60: Color display



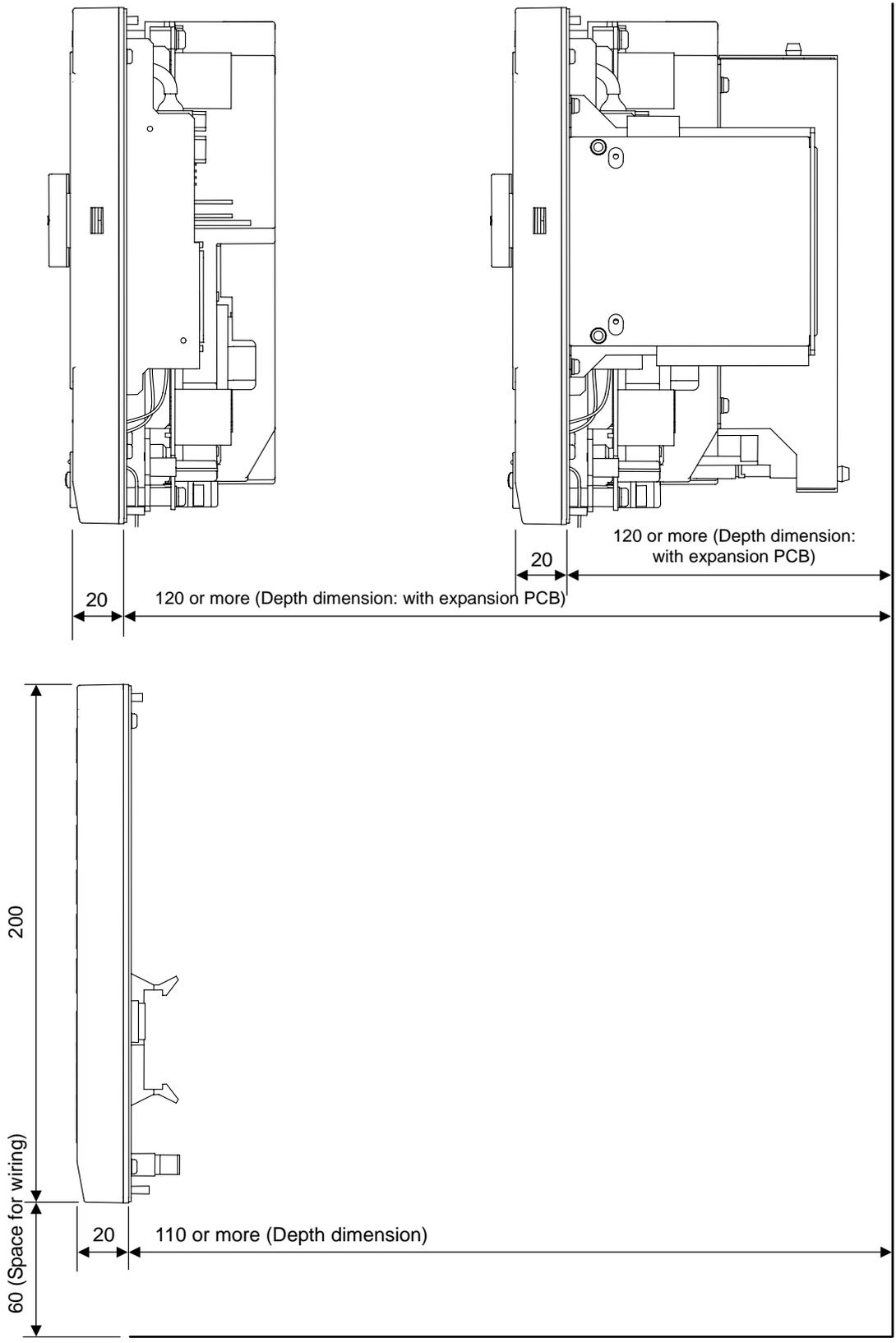
(2) E60: Monochrome display



(Note 1) When the display unit is FCU6-DUT11 (LCD), apply the depth dimension of the figure above.

(Note 2) Depth dimension includes the space for wiring. Refer to "3.4 Installation" also.

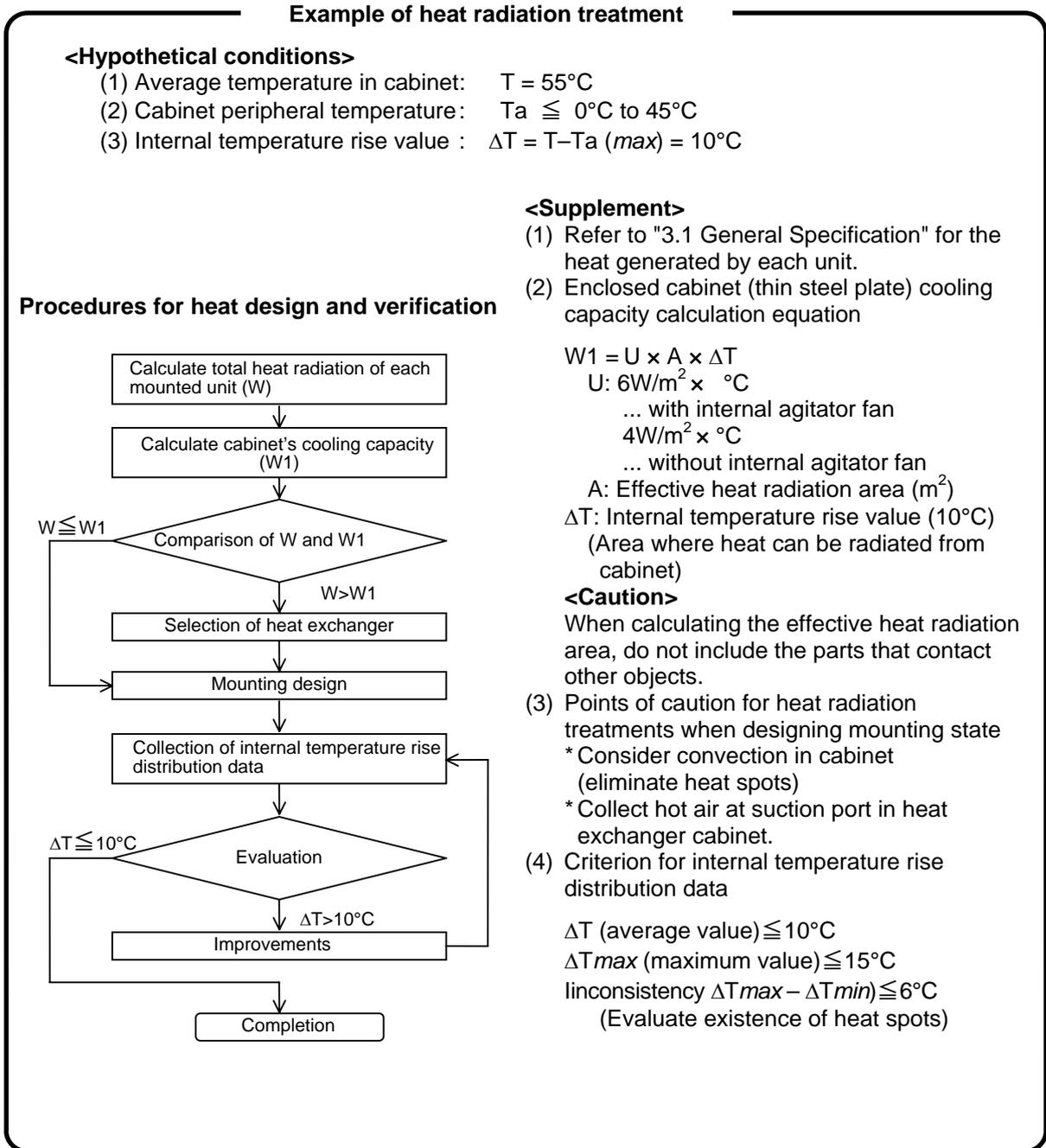
(3) E68



(Note 1) Depth dimension includes the space for wiring. Refer to "3.4 Installation" also.

3.2.2 Heat radiation treatment of cabinet

Refer to the following method for heat radiation treatment.



For heat radiation value of each unit, refer to "3.1 General Specification".
 If heat won't escape from the upper part of the NC unit, equip an agitator fan.

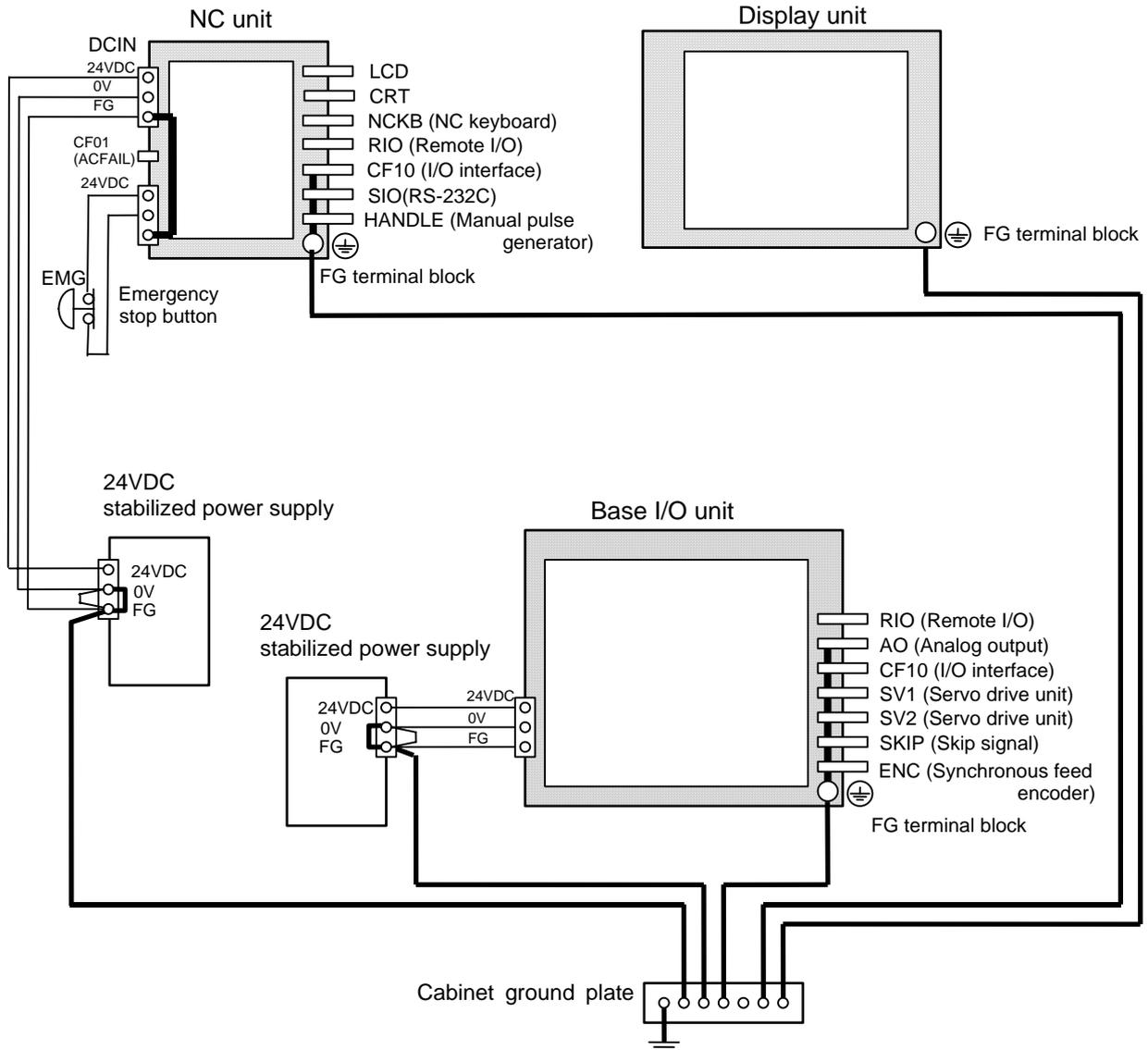
If the conditions below are not satisfied, equip an agitator fan in the cabinet.
 Criterion for internal temperature rise distribution data
 ΔT (average value) $\leq 10^{\circ}\text{C}$
 ΔT_{max} (maximum value) $\leq 15^{\circ}\text{C}$

3.3 Noise Prevention

3.3.1 Frame ground connection (FG connection)

To avoid coupling caused by the common impedance among each unit, the frame should basically be grounded at one ground point. However, as in the case of a type of machine whose operation part is pendant box type, if the NC unit and display unit are equipped away from the cabinet, ground the ground terminal of the NC unit and display unit to the ground plate of the operation part, and from the ground plate of the operation part, ground to the ground plate of the cabinet.

(1) The NC unit and display unit are in or near the cabinet

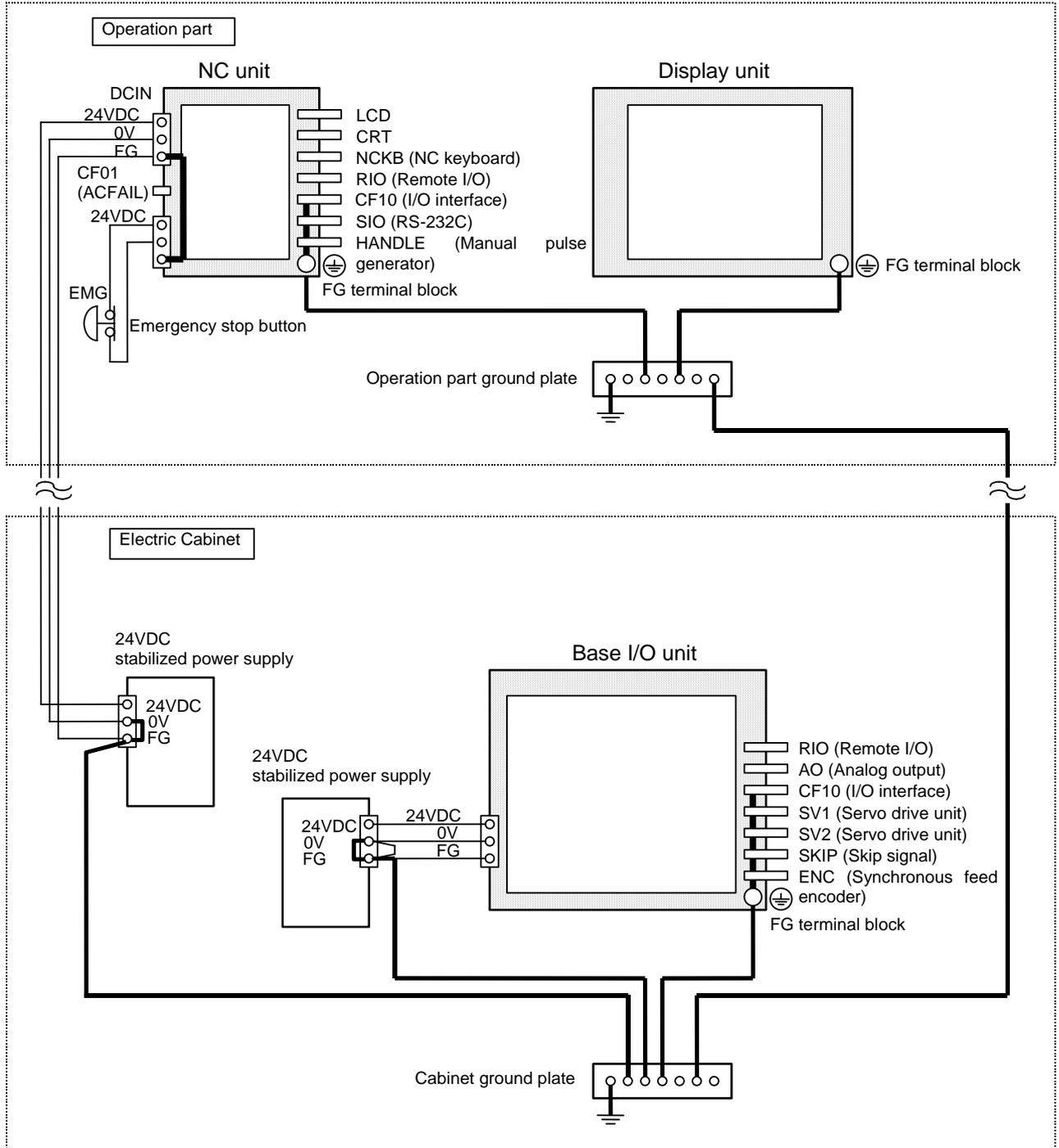


(Note 1)  means that the metal case of the connector is connected to the FG terminal block by the FG pattern on the board.

(Note 2) The figure above shows the case when more than one 24VDC stabilized power supply are used.

(Note 3) The E68 control unit and display unit share the same FG terminal block.

(2) The NC unit and display unit are away from the cabinet



(Note 1)  means that the metal case of the connector is connected to the FG terminal block by the FG pattern on the board.

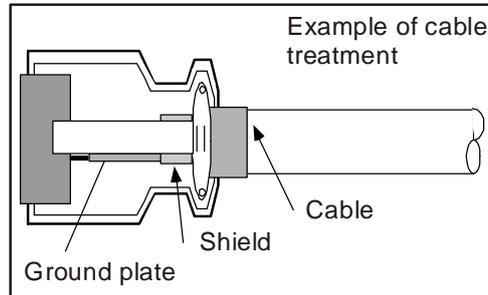
(Note 2) The figure above shows the case when more than one 24VDC stabilized power supply are used.

(Note 3) The E68 control unit and display unit share the same FG terminal block.

3.3.2 Shield clamping of cables

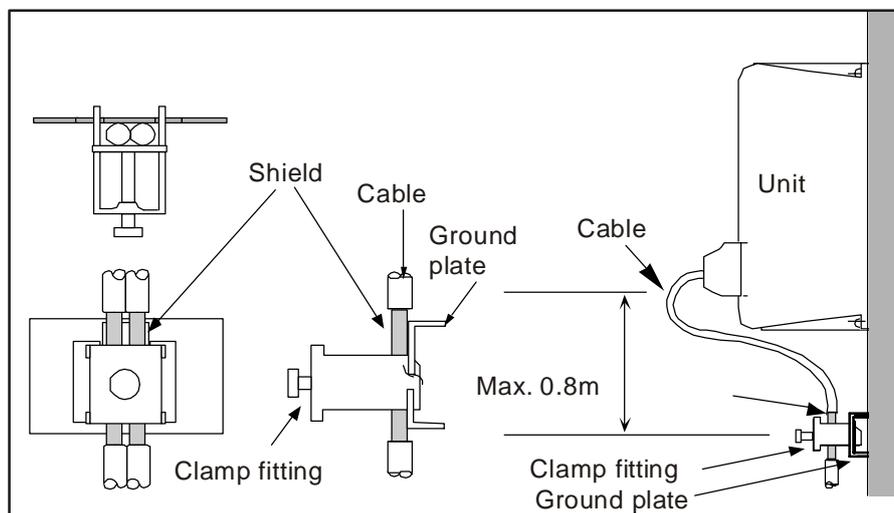
The shield cable connected to the NC unit, servo drive unit and spindle drive unit must be connected to the ground plate to stabilize operation while preventing malfunctioning due to noise. The shield can be connected to the ground plate with GND plate or clamp fittings. Refer to the following drawings to treat the shield cable.

(1) Example of connection with ground plate of connector



Fold the wire material shield over the sheath, and wrap copper foil tape over it. Then clamp it with the connector's GND plate.

(2) Example of connection with clamp fitting



1. Peel a part of the cable sheath and expose the shield as shown in the drawing. Press the exposed part against the grounding plate with the cable clamp fittings.
2. If the cable is thin, clamp several together in a bunch.
3. Use adequate force when tightening the cable so that the wire material is not damaged.
4. Connect each grounding plate together and ground them at one point. For outline drawings of clamp fittings and ground plates, refer to Appendix 1.9.

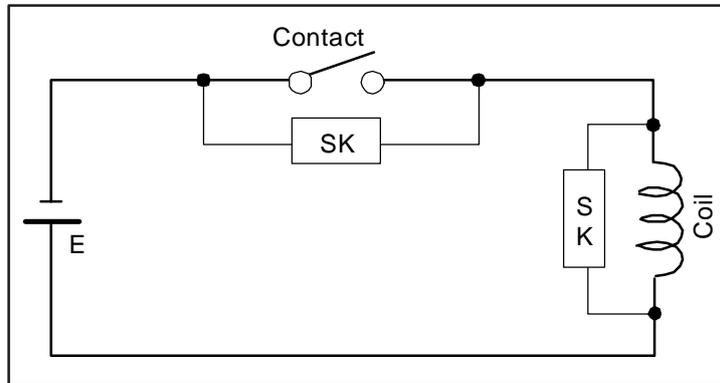
Grounding method of each cable is as in the table below.

Unit name	Connector name	Usage/Function	Grounding method
NC unit	CF10	I/O interface	Ground plate in the connector
	HANDLE	Manual pulse generator	Ground plate in the connector
	SIO	RS-232C	Ground plate in the connector
Base I/O unit	CF10	I/O interface	Ground plate in the connector
	SV1	Servo drive unit Spindle drive unit	Ground plate in the connector
	SV2	Servo drive unit (Auxiliary axis)	Ground plate in the connector
	ENC	Synchronous feed encoder	Ground plate in the connector
	SKIP	Skip signal input	Ground plate in the connector
	AO	Analog output	Ground plate in the connector

3.3.3 Connecting spark killer

Get rid of noises during coil/contact operating.

To get rid of noises, connect a spike killer parallel to the coil/contact.



The CR compound element is effective to remove noises caused by electromagnetic induction.

Spark killer	C: 0.033 to 0.1 μ F
	R: 10 to 120 Ω

3.3.4 Lightning surge protection

Generally, the lightning surge enters the control power supply of the device via the power supply line, which may damage the internal circuits through the control power supply or the control power supply itself.

In the case of our NC devices, surge absorbers are added to the control part and control power supply of the drive part. However, if the lightning surge protection is not done to all parts that require the protection in the control cabinet (refer to the figure below), the lightning surge may run via signal lines, which may damage the other devices.

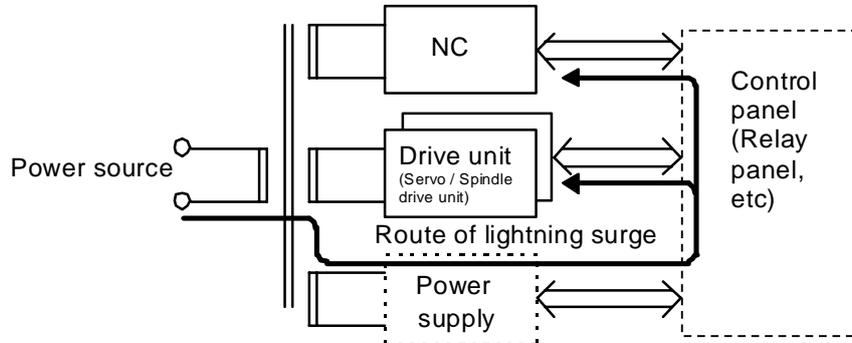


Figure 1. Damage route by lightning surge

(1) Protection method

Add a surge absorber to the power supply line of power supply devices prepared separately. (Refer to the figure below.)

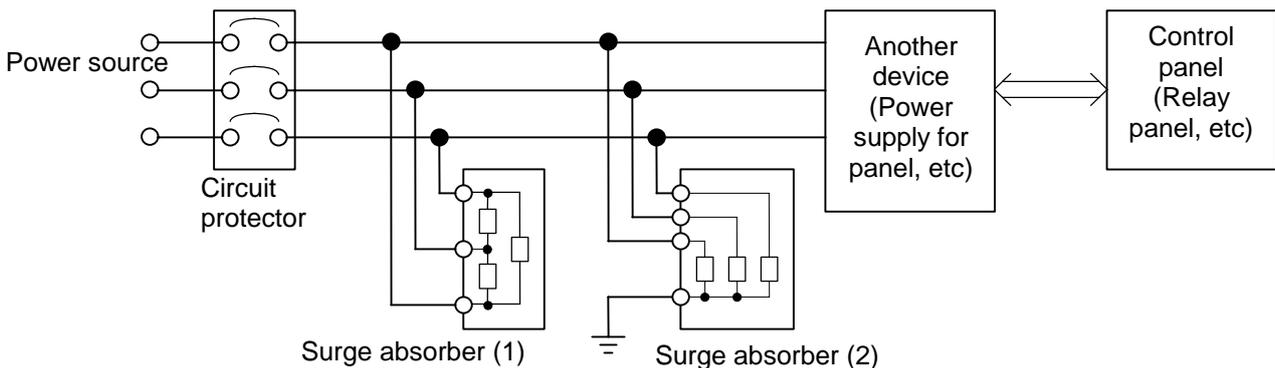


Figure 2. Lightning surge measurement in the case of three-phase power supply

(2) Example of surge absorber

In the case of surge absorbers of OKAYA ELECTRIC INDUSTRIES CO., LTD.

	Model	Circuit voltage 50/60Hz [Vrms]	Max. tolerance circuit voltage	Clamp voltage [V] ±10%	Surge resistance value 8/20µs[A]	Surge withstand pressure (Voltage when discharge starts) 1.2/50µs[V]
(1)	RAV-781BYZ-2	250 3Φ	300	783	2500	20k
(2)	RAV-781BXZ-4	250 3Φ	500	700	2500	2k

(Note) For outline drawings, refer to Appendix 3.6.3 Surge absorber.

For characteristics, outline dimension and connection method of surge absorber, refer to your surge absorber manufacturer's catalogue.

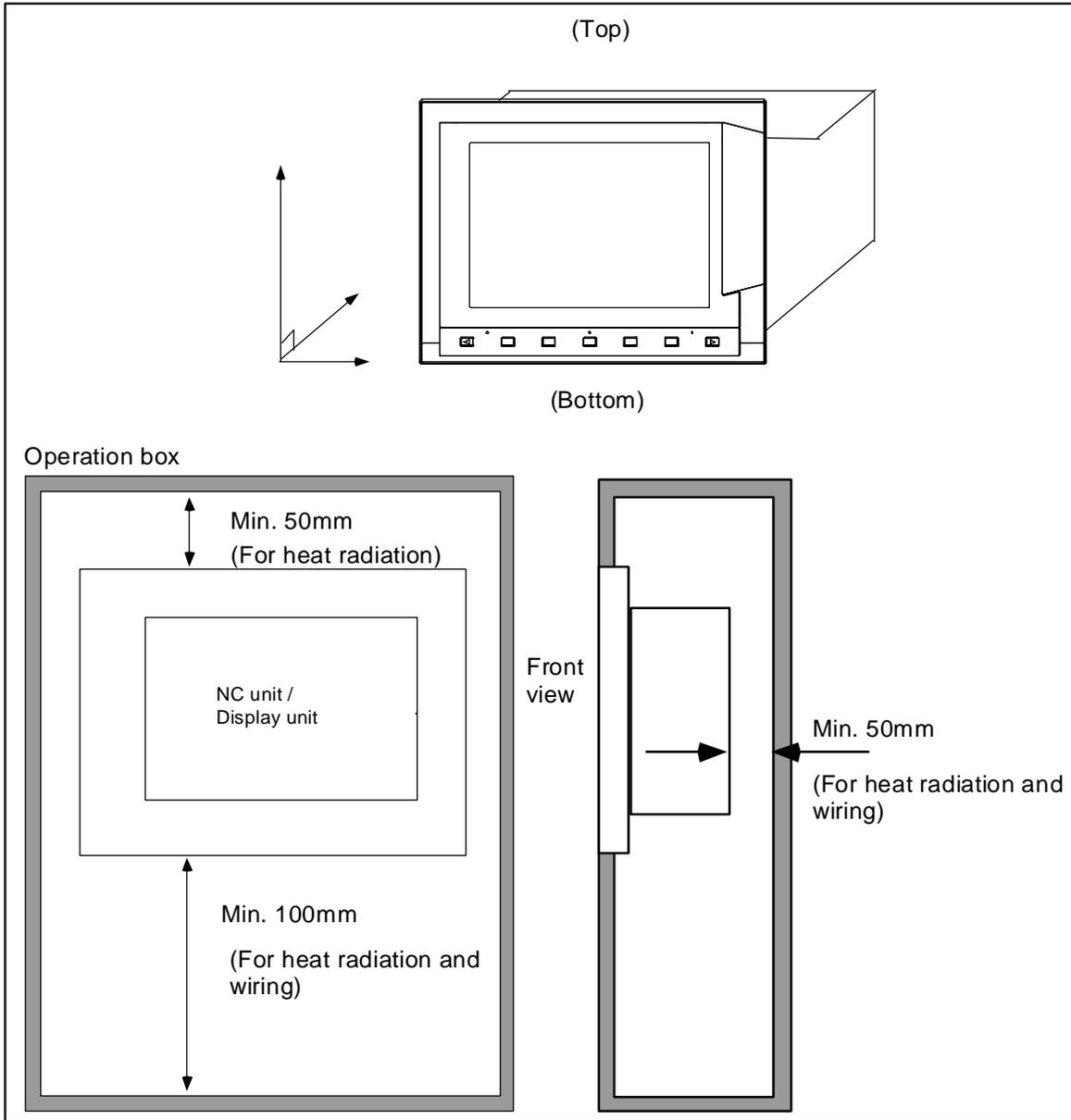
(3) Installation example of surge absorber

Refer to Appendix 3.6.3 Surge absorber.

3.4 Installation

In principle, install the NC unit and display unit in the sealed structure cabinet.
In the case when they are installed in cabinet, pay attention to the points below.

- (1) Install the NC unit and display unit vertically.
- (2) Refer to the following drawing to consider the NC unit's heat dissipation wiring and ventilation, and secure enough space.

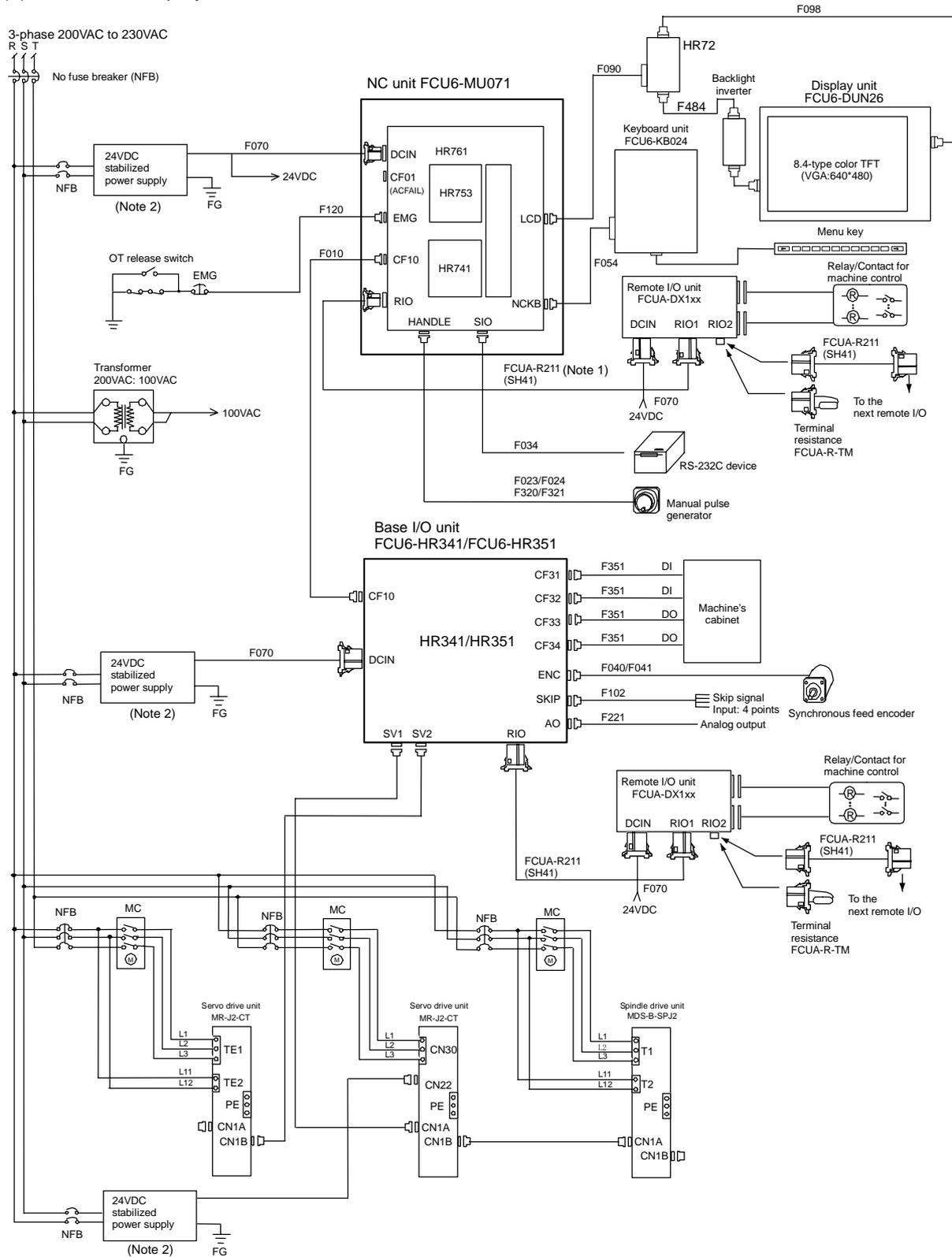


4. CONNECTION AMONG COMPONENTS

4.1 General View

4.1.1 E60 General connection diagram

(1) E60: Color display



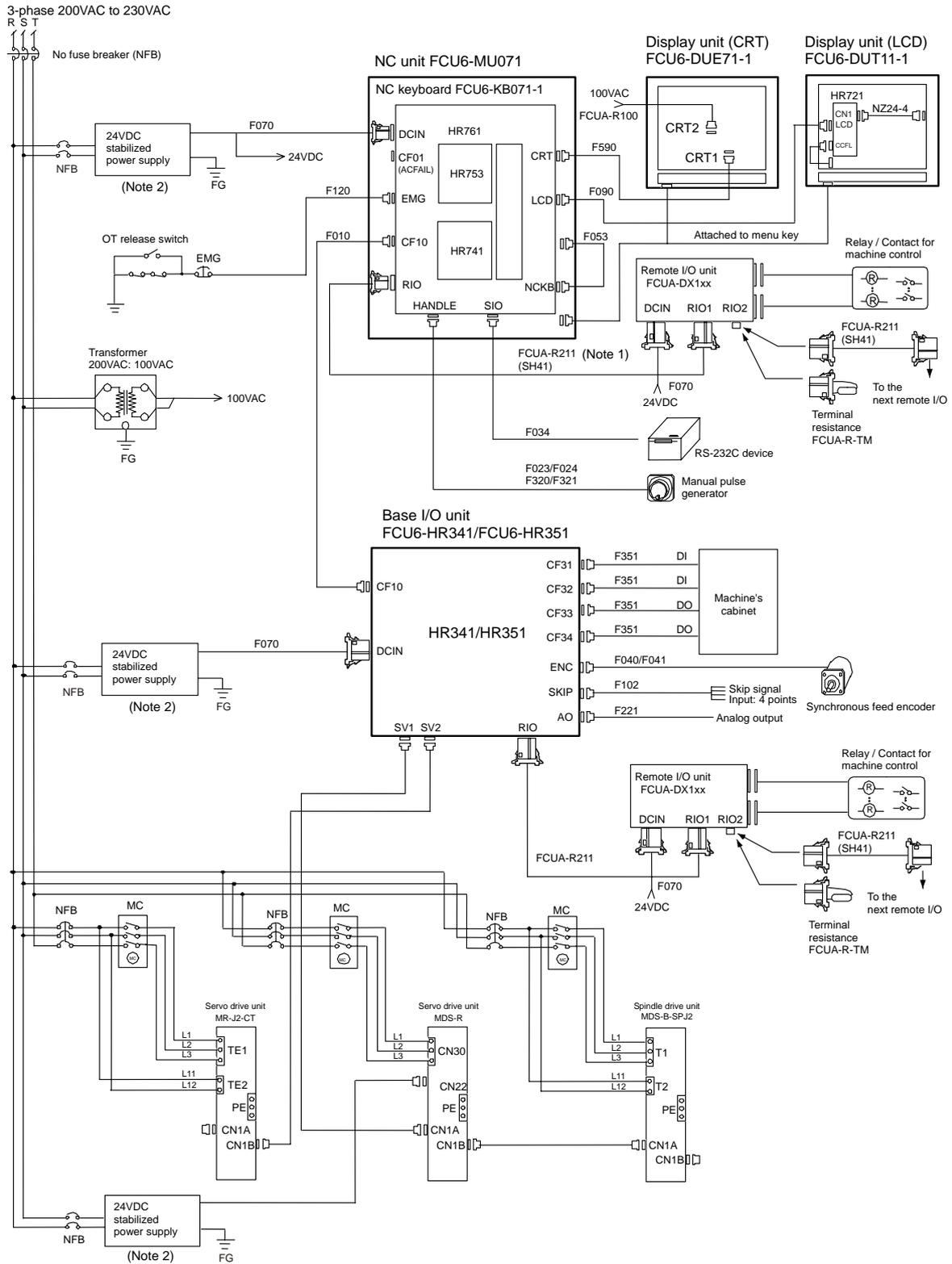
(Note 1) For the remote I/O cable, use FCUA-R211 normally.

If the cable length is short (such as a bridge among units in the cabinet), SH41 cable can be used.

(Note 2) 24VDC stabilized power supply must be installed on each control unit, base I/O unit and MDS-R.

(Note 3) Refer to "4.4.2 Power supply PD25" for using the power supply PD25.

(2) Monochrome display

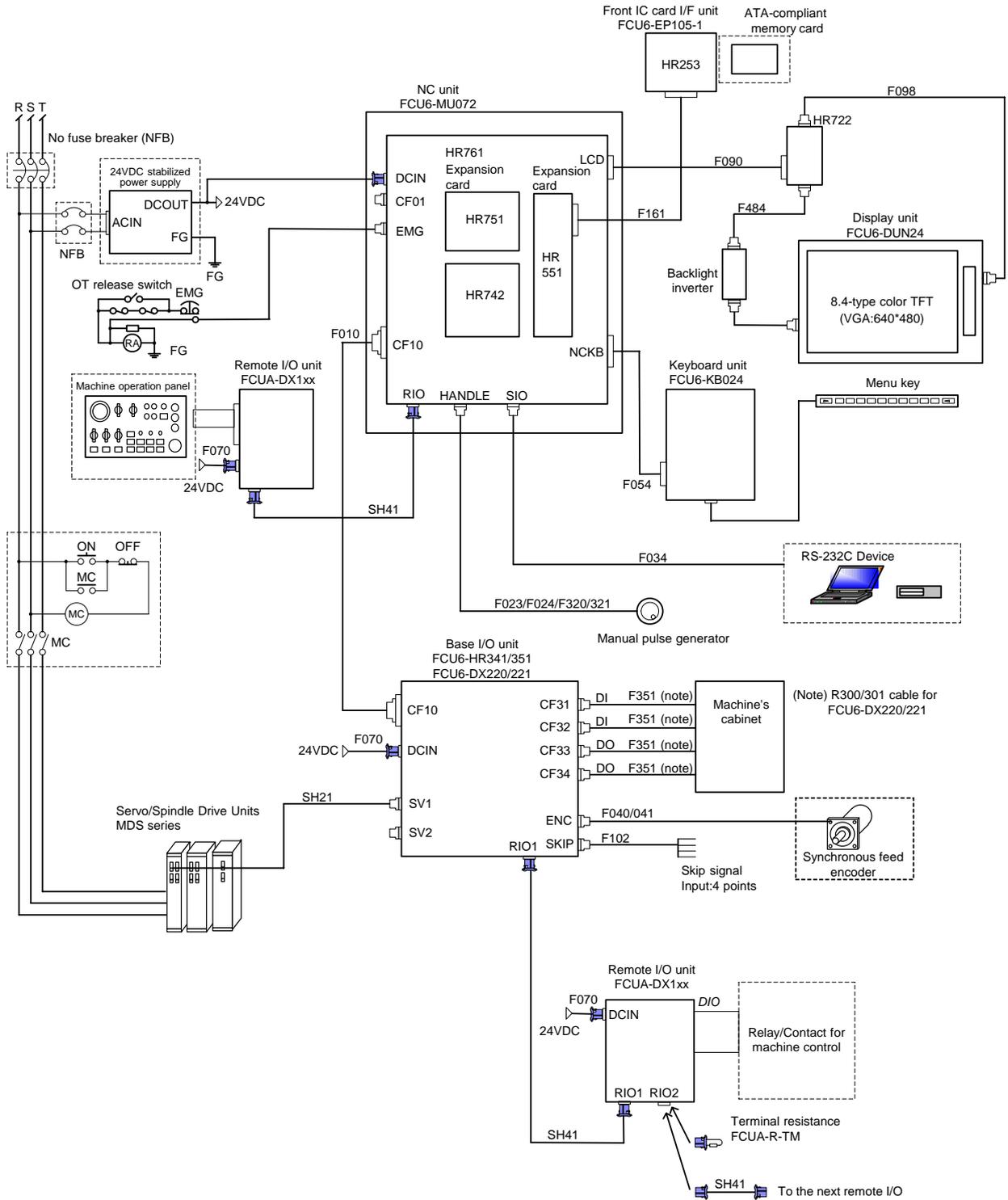


(Note 1) For the remote I/O cable, use FCUA-R211 normally.
If the cable length is short (such as a bridge among units in the cabinet), SH41 cable can be used.

(Note 2) 24VDC stabilized power supply must be installed on each control unit, base I/O unit and MDS-R.

(Note 3) If the power supply PD25 is not used, refer to "4.4.1 Stabilized power supply for general purpose".

4.1.2 E68 General connection diagram



(Note 1) If the power supply PD25 is used, refer to "4.4.2 Power supply PD25".

(Note 2) For the remote I/O cable, use FCUA-R211 normally.

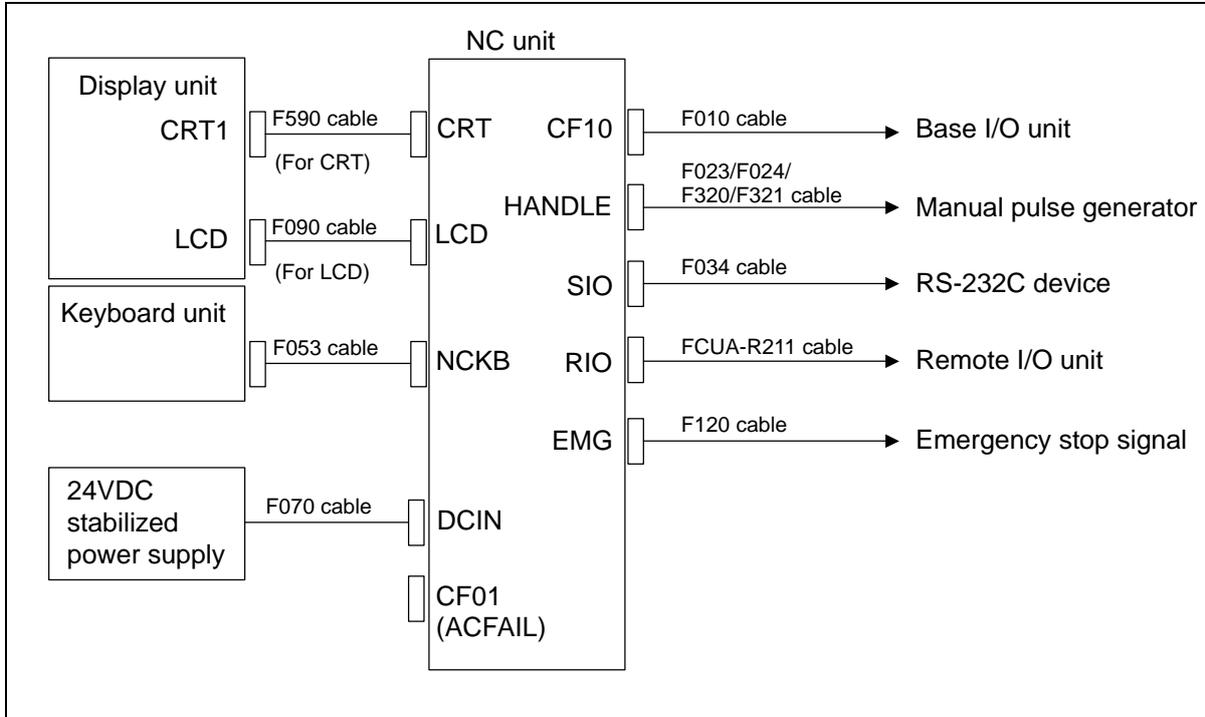
If the cable length is short (such as a bridge among units in the cabinet), SH41 cable can be used.

4.2 Connecting NC unit

Connect the display unit, keyboard unit, base I/O unit, remote I/O unit, manual pulse generator, RS-232C devices to the NC unit.

4.2.1 NC unit connection system drawing

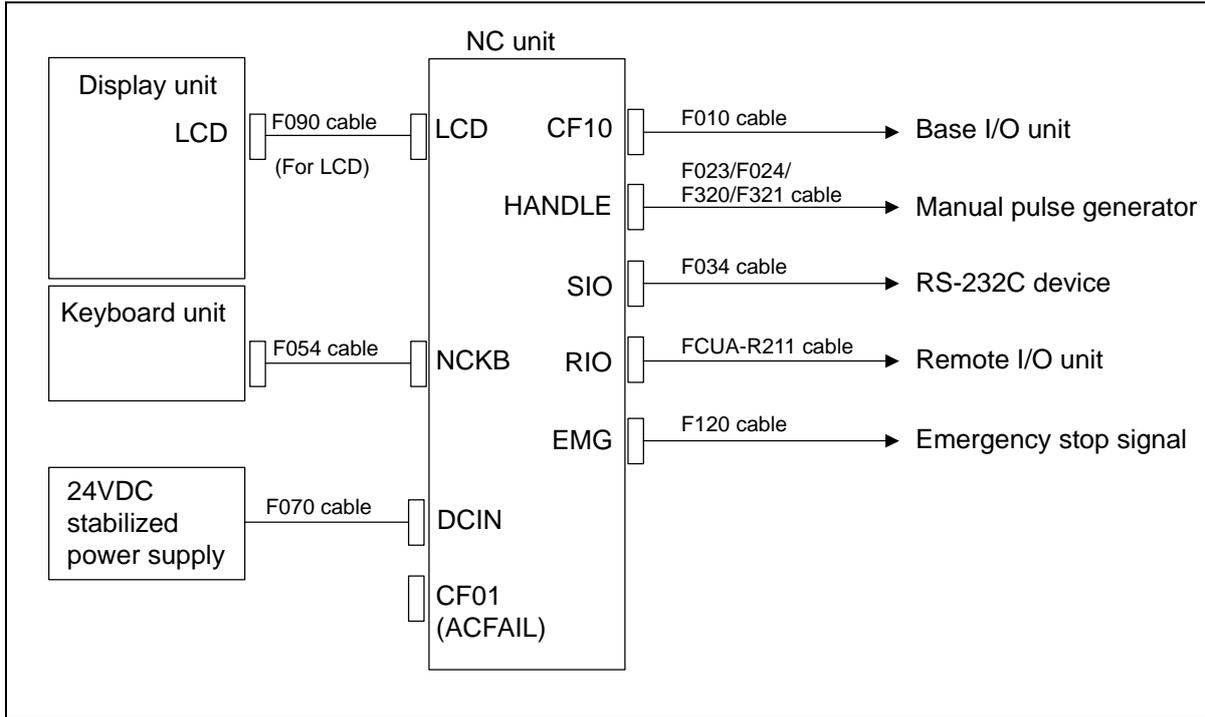
(1) E60



Connector description

FCU6-MU071	
CF10	Connect with base I/O unit.
HANDLE	Connect with manual pulse generator.
SIO	Connect with RS-232C devices.
RIO	Connect with remote I/O unit.
EMG	Connect with emergency stop signal.
CRT	Connect with display unit. (Connect when FCU6-DUE71 is used.)
LCD	Connect with display unit. (Connect when FCU6-DUN26/FCU6-DUT11 is used.)
NCKB	Connect with keyboard unit.
DCIN	Connect with the 24VDC power supply.
CF01	Connect with power supply failure signal. (ACFAIL) (Open during using general purpose power supply)

(2) E68

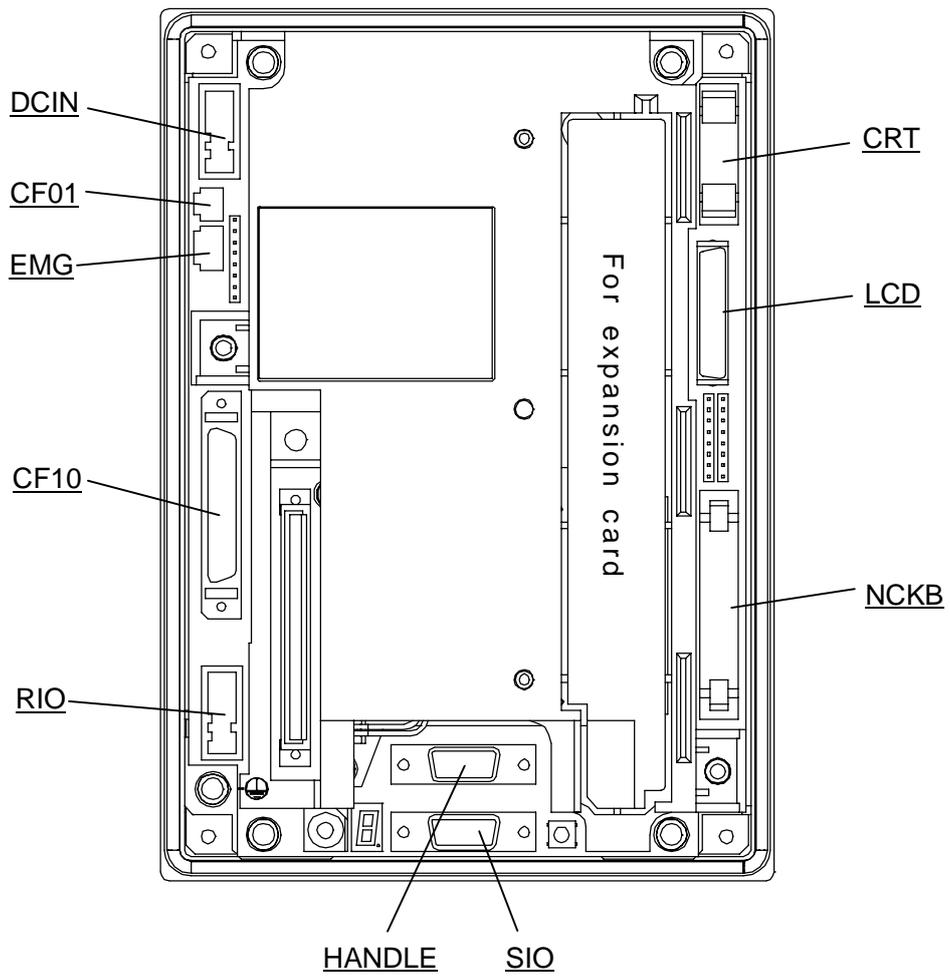


Connector description

FCU6-MU072	
CF10	Connect with base I/O unit.
HANDLE	Connect with manual pulse generator.
SIO	Connect with RS-232C devices.
RIO	Connect with remote I/O unit.
EMG	Connect with emergency stop signal.
LCD	Connect with display unit. (Connect when FCU6-DUN24 is used.)
NCKB	Connect with keyboard unit.
DCIN	Connect with the 24VDC power supply.
CF01	Connect with power supply failure signal. (ACFAIL) (Open during using general purpose power supply)

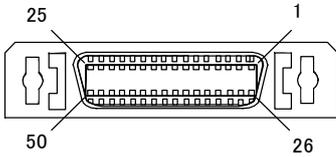
4.2.2 Layout drawing of NC unit

Appearance of back of NC unit



4.2.3 Connector pin assignment of NC unit

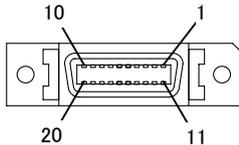
(1) CF10 connector
I/O interface



<Cable side connector Type (recommended)>
Plug: 10150-6000EL
Shell: 10350-3210-000
Recommended manufacturer: 3M

1	I/O	TXRX1	26	I/O	TXRX1*
2		reserve	27		reserve
3		GND	28		GND
4	I	SKIP1	29	I	SKIP1*
5	I	SKIP2	30	I	SKIP2*
6	I	SKIP3	31	I	SKIP3*
7	I	SKIP4	32	I	SKIP4*
8		reserve	33		reserve
9		reserve	34		reserve
10		reserve	35		reserve
11		reserve	36		reserve
12		GND	37		GND
13	I	ENC1A	38	I	ENC1A*
14	I	ENC1B	39	I	ENC1B*
15	I	ENC1Z	40	I	ENC1Z*
16		GND	41		GND
17	O	SVTXD2	42	O	SVTXD2*
18	I	SVALM2	43	I	SVALM2*
19	I	SVRXD2	44	I	SVRXD2*
20	O	SVEMG2	45	O	SVEMG2*
21		GND	46		GND
22	O	SVTXD1	47	O	SVTXD1*
23	I	SVALM1	48	I	SVALM1*
24	I	SVRXD1	49	I	SVRXD1*
25	O	SVEMG1	50	O	SVEMG1*

(2) SIO connector
RS-232C



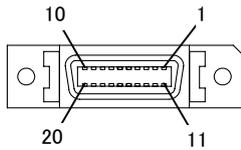
<Cable side connector Type (recommended)>
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M

1		GND	11		GND
2	I	RXD1	12	O	TXD1
3	I	CTS1	13	O	RTS1
4	I	DSR1	14	O	DTR1
5		GND	15		GND
6		reserve	16		reserve
7	I	RCSD2	17	O	TXD2
8	I	CTS2	18	O	RTS2
9	I	DSC2	19	O	DTR2
10		reserve	20		reserve

⚠ CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

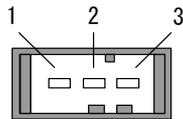
(3) HANDLE connector
Manual pulse generator



1		GND	11		GND
2		reserve	12		reserve
3	I	2HA	13	I	2HB
4	I	1HA	14	I	1HB
5		GND	15		GND
6	O	12VDC	16	O	12VDC
7		reserve	17		reserve
8		reserve	18		reserve
9		reserve	19		reserve
10	O	5VDC	20	O	5VDC

<Cable side connector type (recommended)>
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M

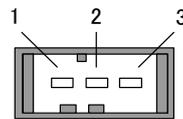
(4) RIO connector
Remote I/O



1	I/O	TXRX2
2	I/O	TXRX2*
3		GND

<Cable side connector type (recommended)>
Connector: 1-178288-3
Contact: 1-175218-2
Recommended manufacturer: Tyco Electronics AMP

(5) DCIN connector
24VDC input



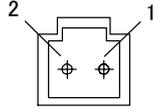
1	I	24VDC
2		0V(RG)
3		FG

<Cable side connector type (recommended)>
Connector: 2-178288-3
Contact: 1-175218-5
Recommended manufacturer: Tyco Electronics AMP

⚠ CAUTION

- ⚠ **Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.**
- ⚠ **Incorrect connections may damage the devices, so connect the cables to the specified connectors.**
- ⊘ **Do not connect or disconnect the connection cables between each unit while the power is ON.**

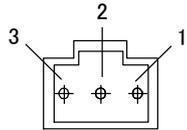
(6) CF01 connector
Power supply failure detection (ACFAIL)



1		GND
2	I	ACFAIL

<Cable side connector type (recommended)>
Connector: 51030-0230
Contact: 50084-8160
Recommended manufacturer: MOLEX

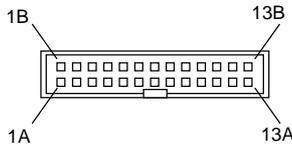
(7) EMG connector
Emergency stop



1		FG
2	I	EMG IN
3	O	COM

<Cable side connector type (recommended)>
Connector: 51030-0330
Contact: 50084-8160
Recommended manufacturer: MOLEX

(8) NCKB connector
Keyboard



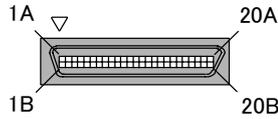
A			B		
1	O	KBCS0*	1	O	KBCS1*
2	O	KBCS2*	2	O	KBCS3*
3	O	KBAD0	3	O	KBAD1
4	O	KBAD2	4	O	BUZOUT*
5	O	RDYOUT*	5	O	SPOUT*
6	I	KBRES*	6		reserve
7	I	KBD0	7	I	KBD1
8	I	KBD2	8	I	KBD3
9		GND	9		GND
10		GND	10		GND
11		GND	11		GND
12	O	5VDC	12	O	5VDC
13	O	5VDC	13	O	5VDC

<Cable side connector type (recommended)>
Connector: 7926-6500SC
Strain relief: 3448-7926
Recommended manufacturer: 3M

⚠ CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

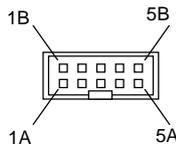
(9) LCD connector
Relay board for LCD



A			B		
1		GND	1		GND
2	O	FPD0	2	O	FPD1
3	O	FPD2	3	O	FPD3
4	O	FPD4	4	O	FPD5
5	O	FPD6	5	O	FPD7
6	O	FPD8	6	O	FPD9
7		GND	7		GND
8	O	FPD10	8	O	FPD11
9	O	FPD12	9	O	FPD13
10	O	FPD14	10	O	FPD15
11	O	LCDDRDY	11	O	LCON0
12	O	LCON1	12	O	LCON2
13	O	FPD16	13	O	FPD17
14	I	LCDID3	14	I	LCDID2
15	O	LCDFRAM E	15	O	LCDLINE
16	O	LCDSHIFT	16	O	5VON*
17	I	LCDID1	17	O	DISPOFF
18	O	CLFOFF	18	I	LCDID0
19	O	5VDC	19	O	5VDC
20	O	5VDC	20	O	5VDC

<Cable side connector type (recommended)>
Connector: DHD-RB40-20AN
Recommended manufacturer: DDK

(10) CRT connector
CRT



A			B		
1	O	HSYNC	1		GND
2	O	VSYNC	2		GND
3		reserve	3		GND
4	O	VIDEO(G)	4		GND
5		reserve	5		GND

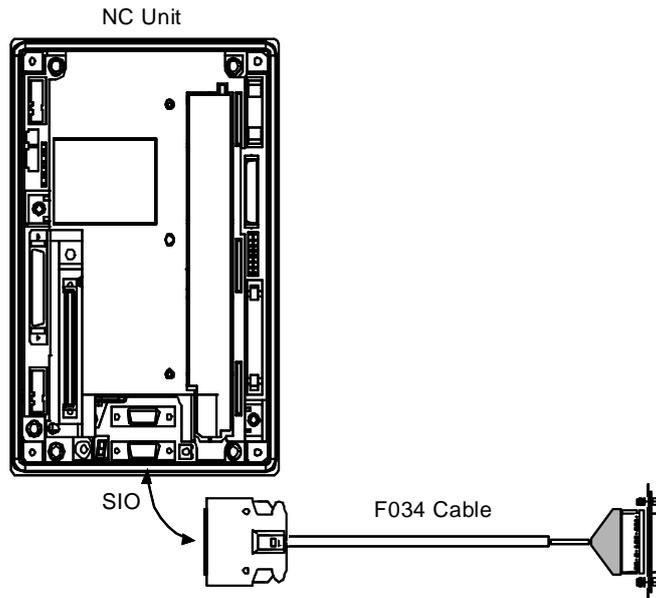
<Cable side connector type (recommended)>
Connector: UFS-10B-04
Contact: 66-1-BF
Recommended manufacturer: YAMAICHI ELECTRONICS

CAUTION

- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- Do not connect or disconnect the connection cables between each unit while the power is ON.

4.2.4 Connection of RS-232C cable

Connect the RS-232C cable to the SIO connector.



<Related items>

Cable drawing: Appendix 2 (F034 cable)

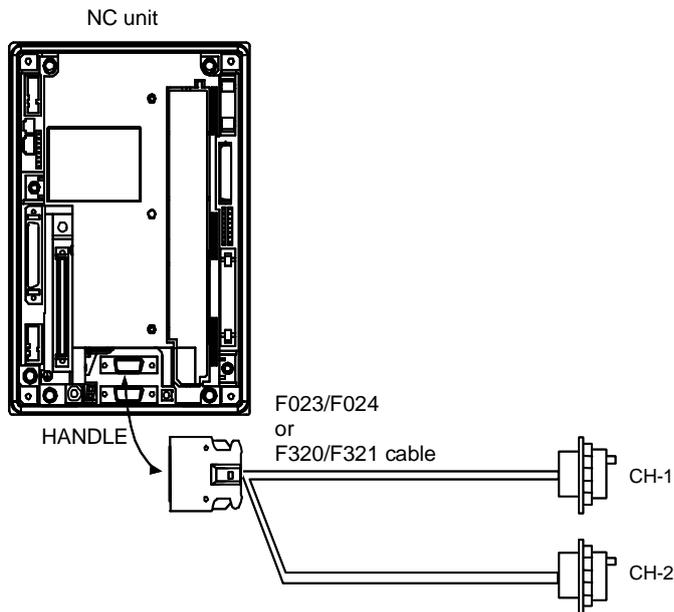
Connector pin assignment: "4.2.2 Connector pin assignment of NC unit (2)"

4.2.5 Connection of manual pulse generator

Connect a manual pulse generator to the HANDLE connector of the NC unit.

To this unit, it is possible to connect the 5VDC power supply type and 12VDC power supply type.

The maximum number of manual pulse generators is 2.



Manual pulse generator cable

		Channel	
		1	2
F023 cable	5VDC spec	OK	
F024 cable		OK	OK
F320 cable	12VDC spec	OK	
F321 cable		OK	OK

OK: Available channel

<Related items>

Outline drawing: Appendix 1.6 Manual pulse generator outline drawing

Cable drawing: Appendix 2 (F023 cable)

Connector pin assignment: "4.2.2 Connector pin assignment of NC unit (3)"

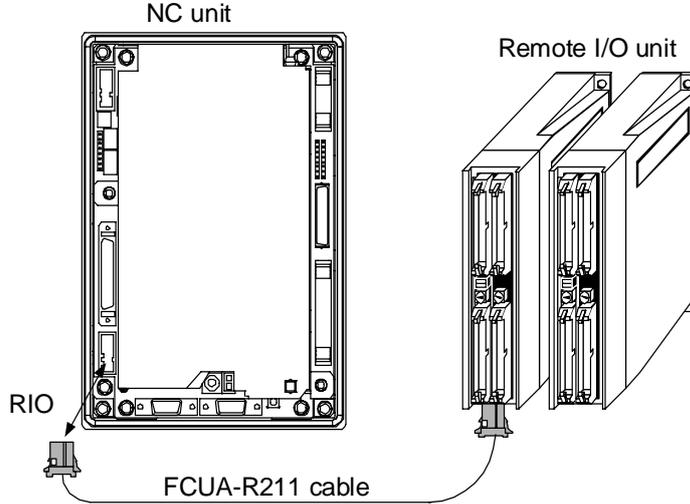


Incorrect connection may damage the devices, so connect the cables to the specified connectors.

Do not connect or disconnect the connection cables between each unit while the power is ON.

4.2.6 Connection of operation board I/O

Connect the operation board I/O to the RIO connector of the NC unit.
 Normally, connect the remote I/O unit to the RIO connector, and configure the number of I/O points suitable for your machine tool builder's specifications.
 Operation board I/O can be used up to four channels by channel setting. (In the case of FCUA-DX11x, possible to connect two units).
 Also note that analog input/output units cannot be used (FCUA-DX12x, FCUA-DX14x).
 As for remote I/O unit, refer to "6. CONNECTION OF REMOTE I/O UNIT".



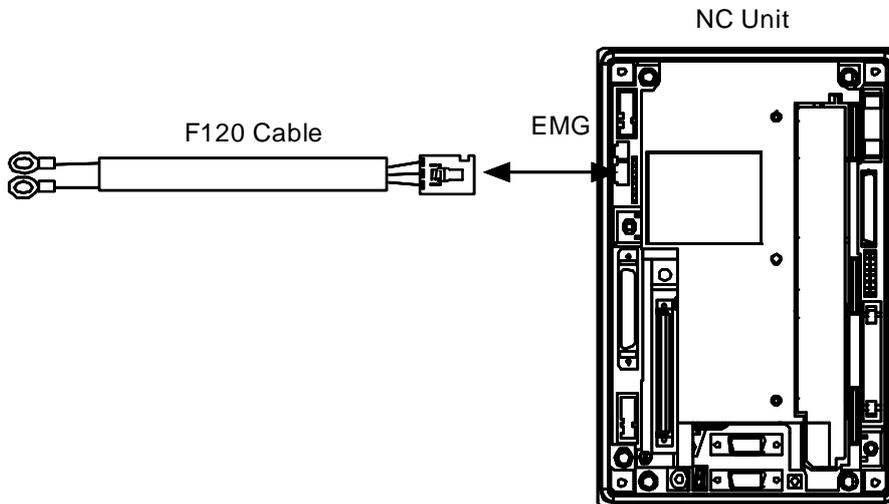
<Related items>

Cable drawing: Appendix 2 (FCUA-R211 cable)

Connector pin assignment, refer to "4.2.2 Connector pin assignment of NC unit (4)"

4.2.7 Connection of emergency stop (EMG)

Connect the emergency stop button to the EMG connector of the NC unit. For wiring of the emergency stop button, refer to the next page.
 Do not use the EMG connector other purposes than the emergency stop signal.



<Related items>

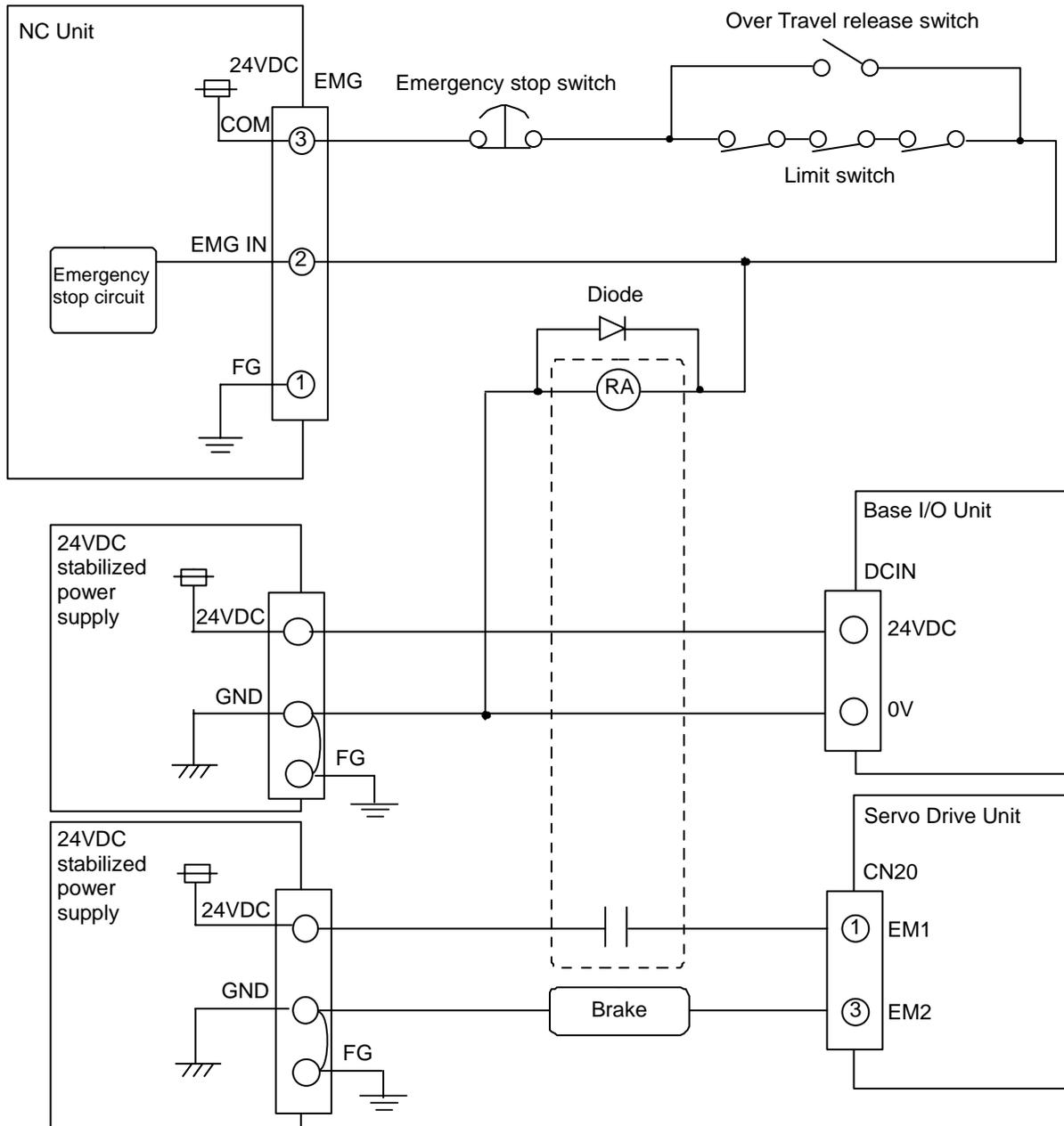
Cable drawing: Appendix 2 (F120 cable)

Connector pin assignment: "4.2.2 Connector pin assignment of NC unit (7)"

CAUTION

- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.**
- Incorrect connection may damage the devices, so connect the cables to the specified connectors.**
- Do not connect or disconnect the connection cables between each unit while the power is ON.**

Wiring of emergency stop button



⚠ CAUTION

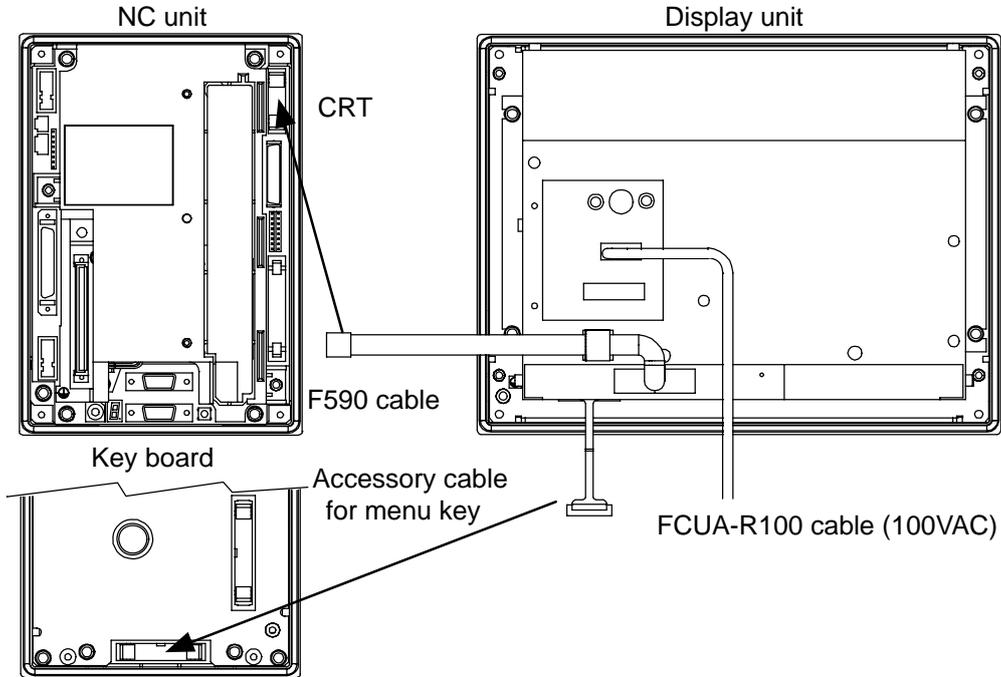
The connection above won't shut off the power supply of the drive unit directly.

4.3 Connection of Display Unit and Keyboard Unit

As each unit is separated from one another, the connection below is necessary.

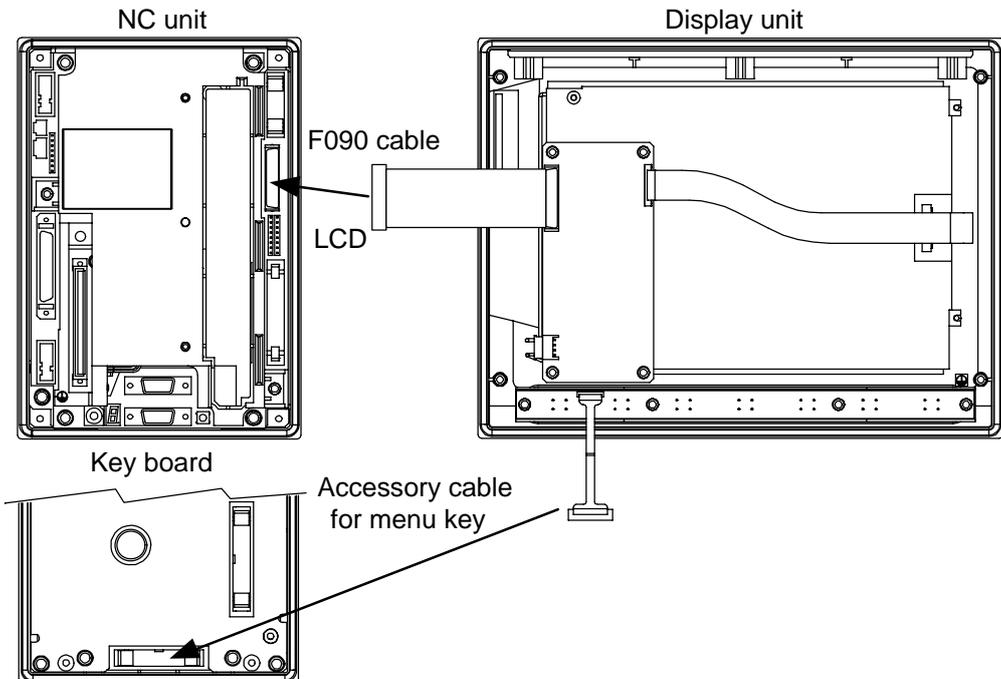
4.3.1 Connection of FCU6-DUE71

Connect the F590 cable to the CRT connector of the NC unit, and cable for menu keys to the connector of the bottom of the NC unit's keyboard unit. It is necessary to supply AC100V to the CRT2 connector of the display unit by the FCUA-R100 cable.



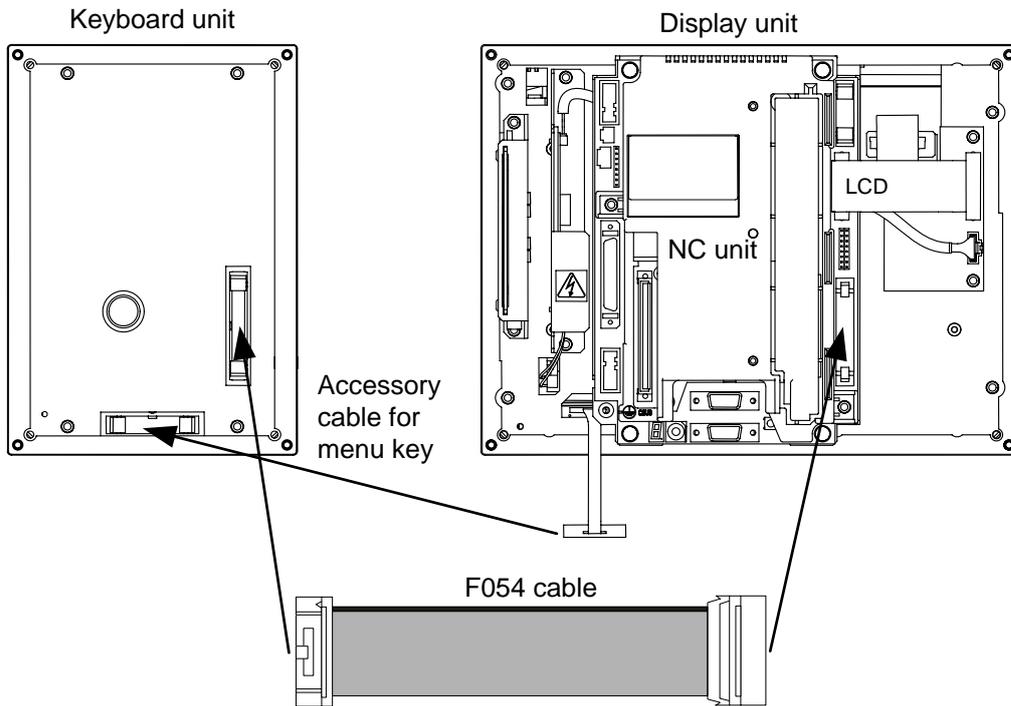
4.3.2 Connection of FCU6-DUT11

Connect the cable F090 to the LCD connector of the NC unit, and cable for menu keys to the connector of the bottom of the NC unit's keyboard unit.



4.3.3 Connection of FCU6-DUN24/FCU6-DUN26

Connect the cable F054 to the connector of the keyboard unit, and cable for menu keys to the connector of the bottom of the NC unit's keyboard unit.

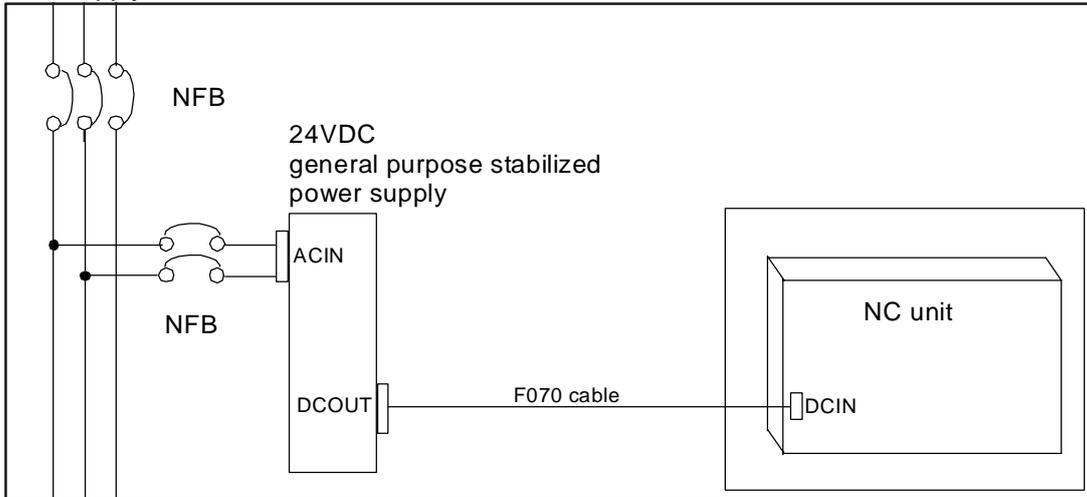


4.4 Connection of Power Supply

4.4.1 Stabilized power supply for general purpose

Choose the stabilized power supply for general purpose that satisfies the specifications below.

(1) Power supply connection



(2) Power supply specification

	External power supply unit
Output voltage	24VDC $\pm 5\%$
Ripple	200mV max.
Output current	3A or more

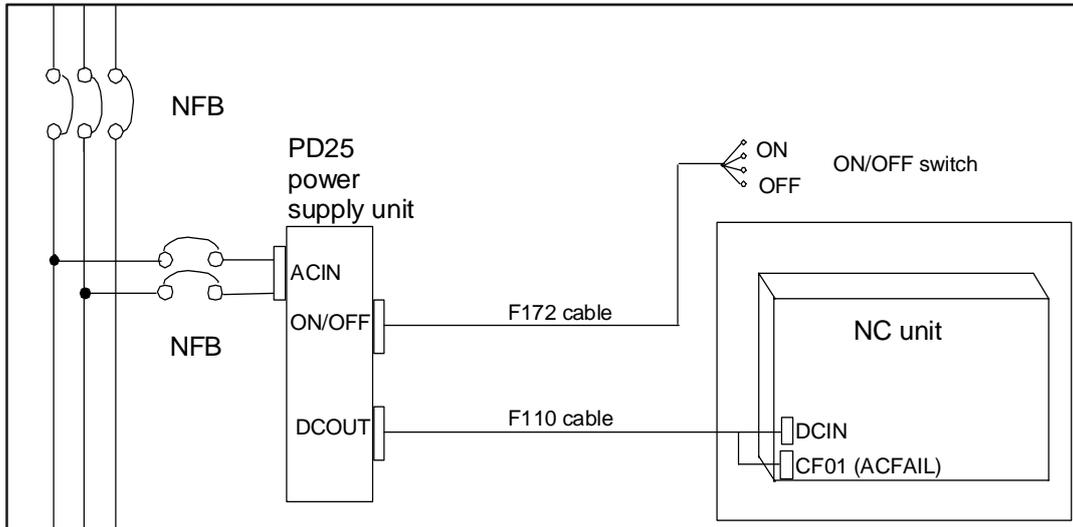
(Note 1) For the connection of the NC unit's DCIN connector, refer to "4.2.2 Connector pin assignment of NC unit (5)".

(Note 2) Leave the ACFAIL connector of the NC unit open.

4.4.2 Power supply PD25

Use the PD25 unit for the system whose NC unit requires the power supply failure detection signal (ACFAIL).

(1) Connection of PD25

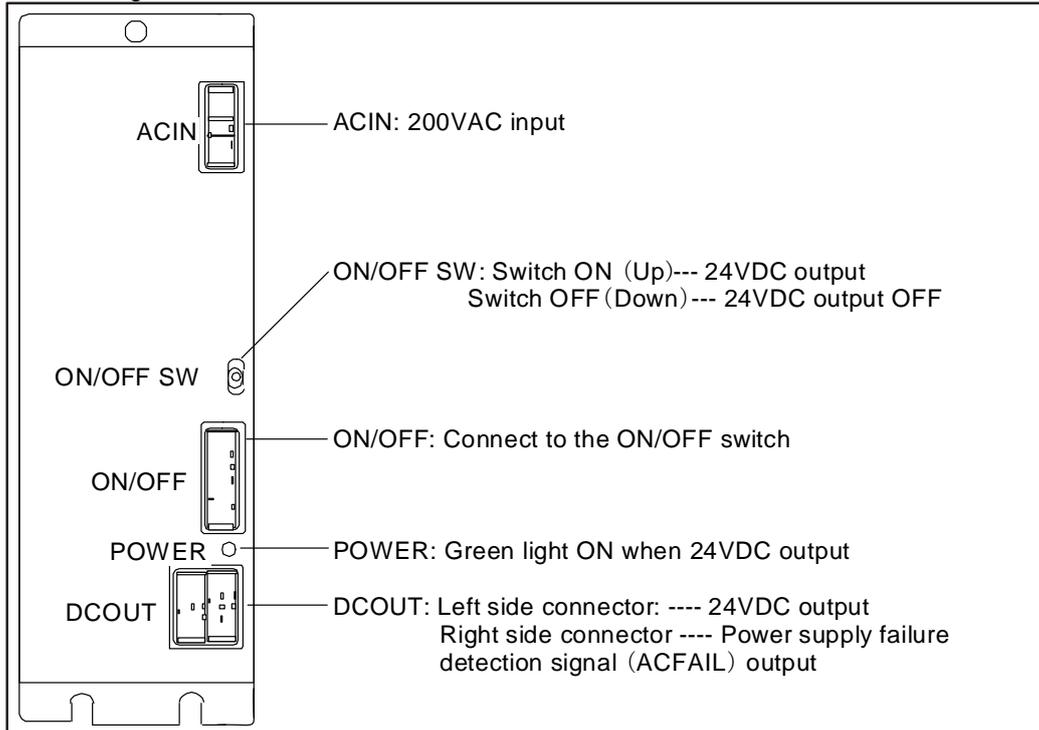


(2) Power supply specification

	External power supply unit
Input voltage	200VAC to 230VAC (-15%, +10%)
Output voltage	24VDC 3A max
Unit size	130 × 65 × 230(mm) Refer to Appendix 1.3.
Output holding time	300ms

(Note) Do not turn the PD25 ON immediately after turning it OFF. Turn the power ON after about 2 seconds.

(3) Layout drawing of connectors



(Note) For usual turning ON/OFF, use the ON/OFF switch of the operation board.

(4) Connector pin assignment of PD25 unit

(1) ACIN connector
200VAC input

<Cable side connector type (recommended)>
Connector: 2-178128-3
Contact: 1-175218-5
Recommended manufacturer: Tyco Electronics AMP

1	I	ACIN
2	I	ACIN
3		FG

(2) DCOUT connector
24VDC output / power supply failure notice

<Cable side connector type (recommended)>
Connector: 3-178127-6
Contact: 1-175218-5
Recommended manufacturer: Tyco Electronics AMP

		A(X)	B(Y)
1	O	ACFAIL	24VDC
2		GND	0V
3		FG	FG

(3) ON/OFF connector
ON/OFF control

<Cable side connector type (recommended)>
Connector: 1-178288-5
Contact: 1-175218-5
Recommended manufacturer: Tyco Electronics AMP

1		NC
2	I	P-OFF
3		GND
4		GND
5	I	P-ON

CAUTION

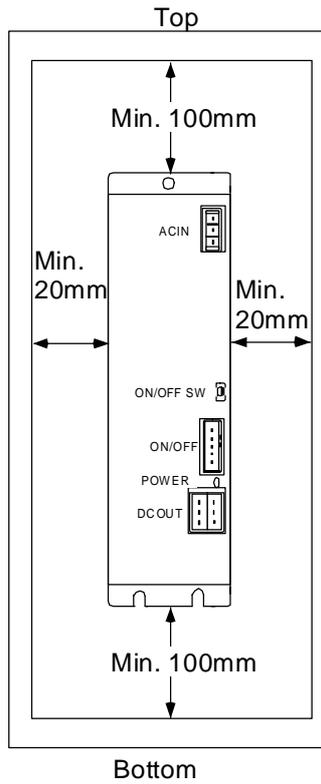
⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.

⚠ Incorrect connection may damage the devices, so connect the cables to the specified connectors.

(5) Installation direction and space

Install the PD25 unit vertically so that it can be seen from the front.

Keep the spaces shown in the figure below around the unit for heat radiation / ventilating.



⚠ WARNING

⚠ Do not damage, apply excessive stress, place heavy thing on or sandwich the cables, as this may lead to electric shocks.

⚠ CAUTION

⚠ Separate the signal wire from the drive line/power line when wiring.

⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

5. I/O INTERFACE CONNECTION

5.1 Outline of I/O Interface

5.1.1 Variations of I/O interfaces

There are two types of I/O interfaces.

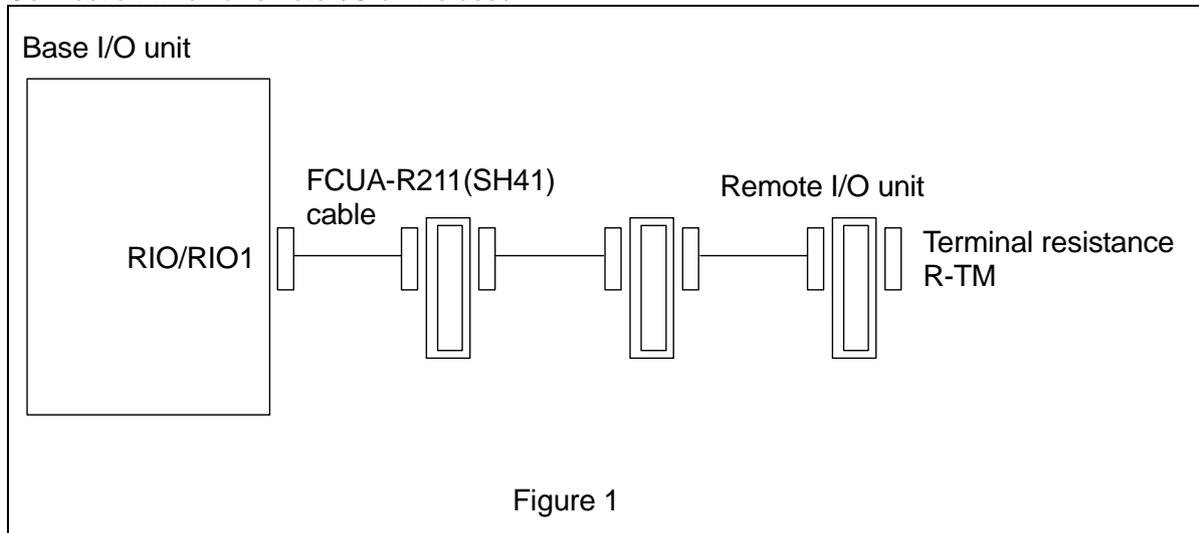
Type	Detail	Connection	Detail of configuration
1 Base I/O	Used for connecting DI/DO, servo drive unit, synchronous feed encoder, skip signal, remote I/O unit. Each NC unit needs one base I/O.	Refer to "5.2 Connection of Base I/O unit".	Refer to "2.2 Lists of configuration unit (6)".
2 Remote I/O	Used for connecting connector RIO of base I/O unit and NC unit. Other than DI/DO, analog input and output is possible.	Refer to "6. CONNECTION OF REMOTE I/O UNIT".	Refer to "2.2 Lists of configuration unit (7)".

5.1.2 Example of I/O unit connection

Normally, use one base I/O unit. If one is not enough, connect remote I/O units to the connector RIO to compose the number of I/O points that is suitable for the machine tool builder's specifications. (Refer to the figure below.)

For remote I/O unit, refer to "6. REMOTE I/O UNIT CONNECTION".

Connection when a remote I/O unit is used



Connect the terminal resistor to the terminal end of the remote I/O unit connected to the connector RIO.

Model name of the terminal resistor: FCUA-R-TM

If a remote I/O unit isn't connected to a base I/O unit, connect the terminal resistor to the connector RIO.

5.1.3 Station number setting of I/O unit

Base I/O unit occupies two stations, whose station numbers are assigned to be "0" and "1". It is not possible to change the station numbers in the case with FCU6-HR341/HR351.

In the case you connect a remote I/O unit, set from among "2" to "7" as "0" and "1" are already used for base I/O unit.

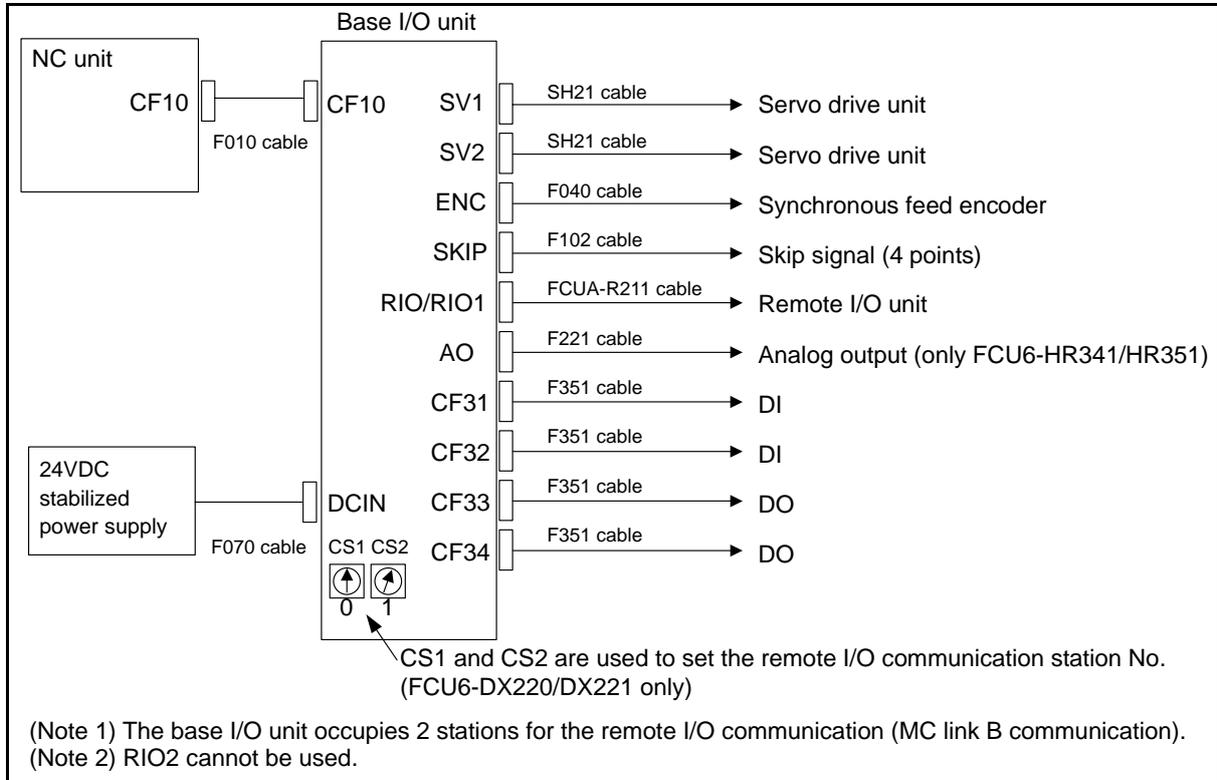
For station number setting of remote I/O unit, refer to "6.12 Station Number Setting When Using Multiple Remote I/O Units".

5.2 Connection of Base I/O Unit

Base I/O units is used for connecting DI/DO, servo drive unit, synchronous feed encoder, skip signal and remote I/O unit.

Each NC unit needs one base I/O unit.

5.2.1 Base I/O unit connection system drawing



Connector description

	FCU6-HR341	FCU6-HR351	FCU6-DX220	FCU6-DX221
SV1	Connect with Part system 1 of servo drive unit.			
SV2	Connect with Part system 2 of servo drive unit.			
ENC	Connect with synchronous feed encoder.			
SKIP	Connect with skip signal input. (Max: Four points)			
RIO/ RIO1	Connect with remote I/O unit. (As base I/O unit has two occupied stations, the other six stations can be used. As for the number of stations to occupy, refer to "6.12 Station Number Setting When Using Multiple Remote I/O Units".)			RIO2 cannot be used.
AO	Connect with the analog output signal. (One point)		-	
CF31	DI32 (Sink/Source)	DI32 (Sink/Source)	DI32 (Sink/Source)	DI32 (Sink/Source)
CF32	DI32 (Sink/Source)	DI32 (Sink/Source)	DI32 (Sink/Source)	DI32 (Sink/Source)
CF33	DO32 (Sink)	DO32 (Source)	DO32 (Sink)	DO32 (Source)
CF34	DO16 (Sink)	DO16 (Source)	DO32 (Sink)	DO32 (Source)
CF10	Connect with the NC unit.			
DCIN	Connect with the 24VDC stabilized power supply.			

Explanation of rotary switch

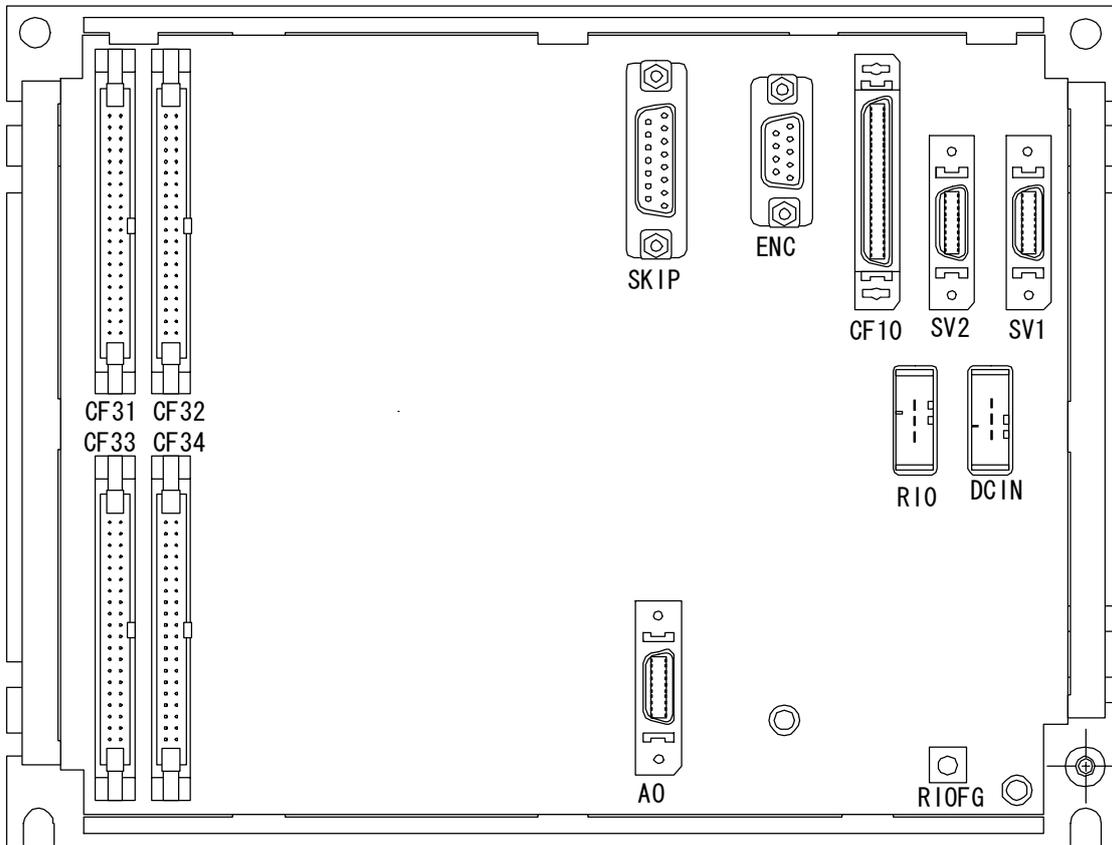
	FCU6-DX220	FCU6-DX221
CS1	Rotary switch CS1: Set the station No. for DI:X0-X1F (32 points)and DO:Y0-Y1F (32 points) of the remote I/O communication 1CH. Normally, this is used at "0".	
CS2	Rotary switch CS2: Set the station No. for DI:X20-X3F (32 points) and DO:Y20-Y3F (32 points) of the remote I/O communication 1CH. Normally, this is used at "1".	

* The setting of rotary switch CS1 and CS2 may be differed depending on the machine configuration or the status as to whether the other remote I/O units are used. Set within the range from 0 to 7.

5.2.2 Connector layout of base I/O unit

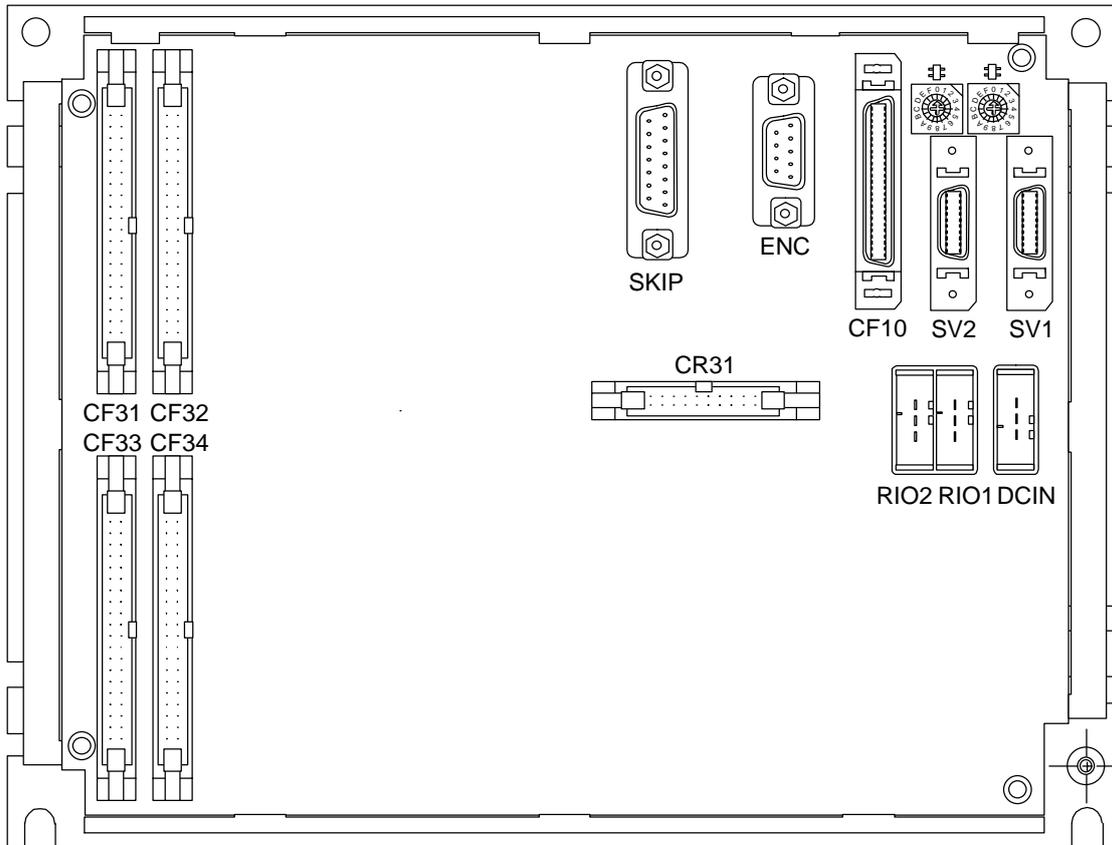
(1) FCU6-HR341/HR351

Appearance of base I/O unit



(2) FCU6-DX220/DX221

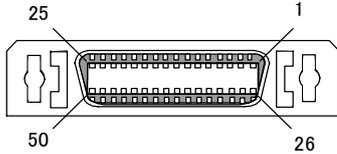
Appearance of base I/O unit



5.2.3 Connector pin assignment of base I/O unit

(1) CF10 connector
I/O interface

For connector pin assignment, refer to "4.2.3 Connector pin assignment of NC unit (1)".



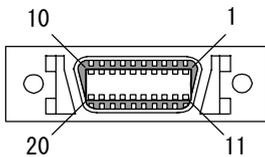
<Cable side connector type (recommended)>

Plug: 10150-6000EL

Shell: 10350-3210-000

Recommended manufacturer: 3M

(2) SV1 connector
Servo drive unit



<Cable side connector type (recommended)>

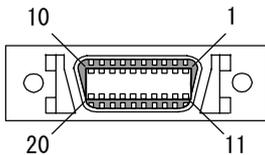
Plug: 10120-6000EL

Shell: 10320-3210-000

Recommended manufacturer: 3M

1		GND	11		GND
2	O	SVTXD1	12	O	SVTXD1*
3	I	SVALM1	13	I	SVALM1*
4	I	SVRXD1	14	I	SVRXD1*
5		GND	15		GND
6		reserve	16		reserve
7	O	SVEMG1	17	O	SVEMG1*
8		reserve	18		reserve
9		reserve	19		reserve
10		reserve	20		reserve

(3) SV2 connector
Servo drive unit



<Cable side connector type (recommended)>

Plug: 10120-6000EL

Shell: 10320-3210-000

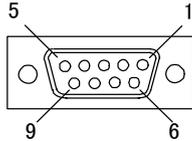
Recommended manufacturer: 3M

1		GND	11		GND
2	O	SVTXD2	12	O	SVTXD2*
3	I	SVALM2	13	I	SVALM2*
4	I	SVRXD2	14	I	SVRXD2*
5		GND	15		GND
6		reserve	16		reserve
7	O	SVEMG2	17	O	SVEMG2*
8		reserve	18		reserve
9		reserve	19		reserve
10		reserve	20		reserve

⚠ CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

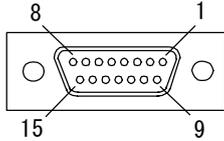
(4) ENC connector
Synchronous feed encoder



1	I	ENC1A	6	I	ENC1A*
2	I	ENC1B	7	I	ENC1B*
3	I	ENC1Z	8	I	ENC1Z*
4		GND	9	O	5VDC
5		GND			

<Cable side connector type (recommended)>
Connector: CDE-9PF
Contact: CD-PC-111
Case: HDE-CTH
Recommended manufacturer: Hirose Electric

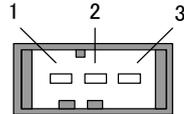
(5) SKIP connector
Skip signal input



1		GND	9		GND
2	I	SKIP IN1	10	I	SKIP IN2
3	I	SKIP IN3	11	I	SKIP IN4
4		reserve	12		reserve
5		reserve	13		reserve
6		reserve	14		reserve
7		reserve	15		GND
8		GND			

<Cable side connector type (recommended)>
Connector: CDA-15P
Contact: CD-PC-111
Case: HDA-CTH
Recommended manufacturer: Hirose Electric

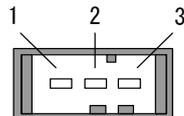
(6) DCIN connector
24VDC input



1	I	24VDC
2		0V(RG)
3		FG

<Cable side connector type (recommended)>
Connector: 2-178288-3
Contact: 1-175218-5
Recommended manufacturer: Tyco Electronics AMP

(7) RIO/RIO1 connector
Remote I/O



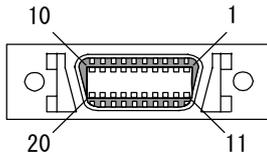
1	I/O	TXRX2
2	I/O	TXRX2*
3		GND

<Cable side connector model (recommended)>
Connector: 1-178288-3
Contact: 1-175218-2
Recommended manufacturer: Tyco Electronics AMP

CAUTION

- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- Do not connect or disconnect the connection cables between each unit while the power is ON.

(8) AO connector (Only FCU6-HR341/HR351)
Analog output



<Cable side connector type (recommended)>
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M

1		GND	11		GND
2		reserve	12		reserve
3		reserve	13		reserve
4		reserve	14		reserve
5		GND	15		GND
6		reserve	16		reserve
7	○	AO	17		reserve
8		reserve	18		reserve
9		reserve	19		reserve
10		reserve	20		reserve

CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

(9) CF31/CF32/CF33/CF34 connector

(a) FCU6-HR341/HR351

DI/DO

DI: CF31/CF32
DO: CF33/CF34

CF31						CF32					
B			A			B			A		
20	I	X0	20	I	X10	20	I	X20	20	I	X30
19	I	X1	19	I	X11	19	I	X21	19	I	X31
18	I	X2	18	I	X12	18	I	X22	18	I	X32
17	I	X3	17	I	X13	17	I	X23	17	I	X33
16	I	X4	16	I	X14	16	I	X24	16	I	X34
15	I	X5	15	I	X15	15	I	X25	15	I	X35
14	I	X6	14	I	X16	14	I	X26	14	I	X36
13	I	X7	13	I	X17	13	I	X27	13	I	X37
12	I	X8	12	I	X18	12	I	X28	12	I	X38
11	I	X9	11	I	X19	11	I	X29	11	I	X39
10	I	XA	10	I	X1A	10	I	X2A	10	I	X3A
9	I	XB	9	I	X1B	9	I	X2B	9	I	X3B
8	I	XC	8	I	X1C	8	I	X2C	8	I	X3C
7	I	XD	7	I	X1D	7	I	X2D	7	I	X3D
6	I	XE	6	I	X1E	6	I	X2E	6	I	X3E
5	I	XF	5	I	X1F	5	I	X2F	5	I	X3F
4		reserve	4		reserve	4		reserve	4		reserve
3	I	COM(Note1)	3	I	COM(Note1)	3	I	COM(Note1)	3	I	COM(Note1)
2	O	24VDC	2		0V(RG)	2	O	24VDC	2		0V(RG)
1	O	24VDC	1		0V(RG)	1	O	24VDC	1		0V(RG)

(Note 1) Different connection is applied depending on sink or source.

To COM, supply the voltages below.

Sink: 24VDC
Source: 0V(RG)

CF33						CF34					
B			A			B			A		
20	O	Y0	20	O	Y10	20	O	Y20	20		
19	O	Y1	19	O	Y11	19	O	Y21	19		
18	O	Y2	18	O	Y12	18	O	Y22	18		
17	O	Y3	17	O	Y13	17	O	Y23	17		
16	O	Y4	16	O	Y14	16	O	Y24	16		
15	O	Y5	15	O	Y15	15	O	Y25	15		
14	O	Y6	14	O	Y16	14	O	Y26	14		
13	O	Y7	13	O	Y17	13	O	Y27	13		
12	O	Y8	12	O	Y18	12	O	Y28	12		
11	O	Y9	11	O	Y19	11	O	Y29	11		
10	O	YA	10	O	Y1A	10	O	Y2A	10		
9	O	YB	9	O	Y1B	9	O	Y2B	9		
8	O	YC	8	O	Y1C	8	O	Y2C	8		
7	O	YD	7	O	Y1D	7	O	Y2D	7		
6	O	YE	6	O	Y1E	6	O	Y2E	6		
5	O	YF	5	O	Y1F	5	O	Y2F	5		
4		reserve	4		reserve	4	O	AO	4	O	AO*
3		reserve	3		reserve	3		reserve	3		reserve
2	I	24VDC	2		0V(RG)	2	I	24VDC	2		0V(RG)
1	I	24VDC	1		0V(RG)	1	I	24VDC	1		0V(RG)

<Cable side connector type (recommended)>

Connector: 7940-6500SC

Strain relief: 3448-7940

Recommended manufacturer: 3M

For details of assignment number of signals, refer to the PLC Interface Manual.

(b) FCU6-DX220/DX221
DI/DO

DI: CF31/CF32
DO: CF33/CF34

CF31					
B			A		
20	I	X0	20	I	X10
19	I	X1	19	I	X11
18	I	X2	18	I	X12
17	I	X3	17	I	X13
16	I	X4	16	I	X14
15	I	X5	15	I	X15
14	I	X6	14	I	X16
13	I	X7	13	I	X17
12	I	X8	12	I	X18
11	I	X9	11	I	X19
10	I	XA	10	I	X1A
9	I	XB	9	I	X1B
8	I	XC	8	I	X1C
7	I	XD	7	I	X1D
6	I	XE	6	I	X1E
5	I	XF	5	I	X1F
4		reserve	4		reserve
3	I	COM(note1)	3	I	COM(note1)
2	O	24VDC	2		0V(RG)
1	O	24VDC	1		0V(RG)

CF32					
B			A		
20	I	X20	20	I	X30
19	I	X21	19	I	X31
18	I	X22	18	I	X32
17	I	X23	17	I	X33
16	I	X24	16	I	X34
15	I	X25	15	I	X35
14	I	X26	14	I	X36
13	I	X27	13	I	X37
12	I	X28	12	I	X38
11	I	X29	11	I	X39
10	I	X2A	10	I	X3A
9	I	X2B	9	I	X3B
8	I	X2C	8	I	X3C
7	I	X2D	7	I	X3D
6	I	X2E	6	I	X3E
5	I	X2F	5	I	X3F
4		Reserve	4		reserve
3	I	COM(note1)	3	I	COM(note1)
2	O	24VDC	2		0V(RG)
1	O	24VDC	1		0V(RG)

(Note 1) Different connection is applied depending on sink or source.

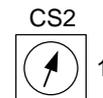
To COM, supply the voltages below.

Sink: 24VDC

Source: 0V(RG)

CF33					
B			A		
20	O	Y0	20	O	Y10
19	O	Y1	19	O	Y11
18	O	Y2	18	O	Y12
17	O	Y3	17	O	Y13
16	O	Y4	16	O	Y14
15	O	Y5	15	O	Y15
14	O	Y6	14	O	Y16
13	O	Y7	13	O	Y17
12	O	Y8	12	O	Y18
11	O	Y9	11	O	Y19
10	O	YA	10	O	Y1A
9	O	YB	9	O	Y1B
8	O	YC	8	O	Y1C
7	O	YD	7	O	Y1D
6	O	YE	6	O	Y1E
5	O	YF	5	O	Y1F
4		reserve	4		reserve
3		reserve	3		reserve
2	I	24VDC	2		0V(RG)
1	I	24VDC	1		0V(RG)

CF34					
B			A		
20	O	Y20	20	O	Y30
19	O	Y21	19	O	Y31
18	O	Y22	18	O	Y32
17	O	Y23	17	O	Y33
16	O	Y24	16	O	Y34
15	O	Y25	15	O	Y35
14	O	Y26	14	O	Y36
13	O	Y27	13	O	Y37
12	O	Y28	12	O	Y38
11	O	Y29	11	O	Y39
10	O	Y2A	10	O	Y3A
9	O	Y2B	9	O	Y3B
8	O	Y2C	8	O	Y3C
7	O	Y2D	7	O	Y3D
6	O	Y2E	6	O	Y3E
5	O	Y2F	5	O	Y3F
4		reserve	4		reserve
3		reserve	3		reserve
2	I	24VDC	2		0V(RG)
1	I	24VDC	1		0V(RG)



<Cable side connector type (recommended)>
Connector: 7940-6500SC
Recommended manufacturer: 3M

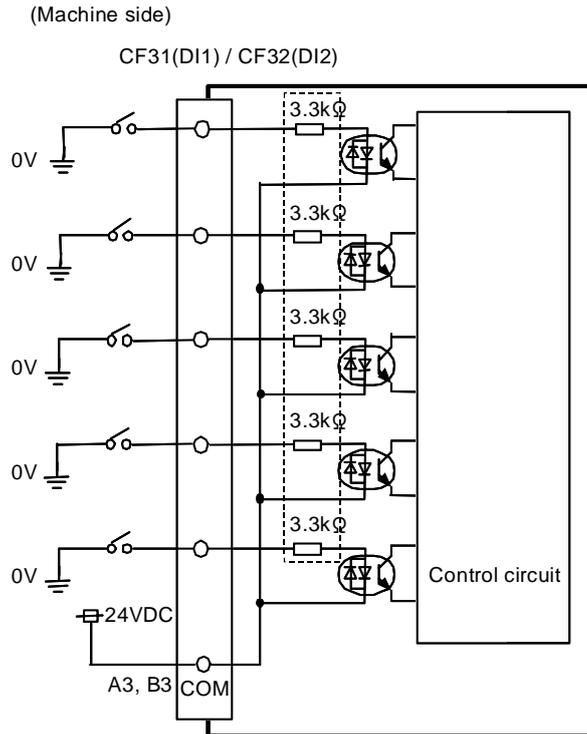
In this example, CS1 is set to "0", CS2 is set to "1".
For details, refer to the PLC Interface Manual.

5.2.4 Outline of digital signal input circuit

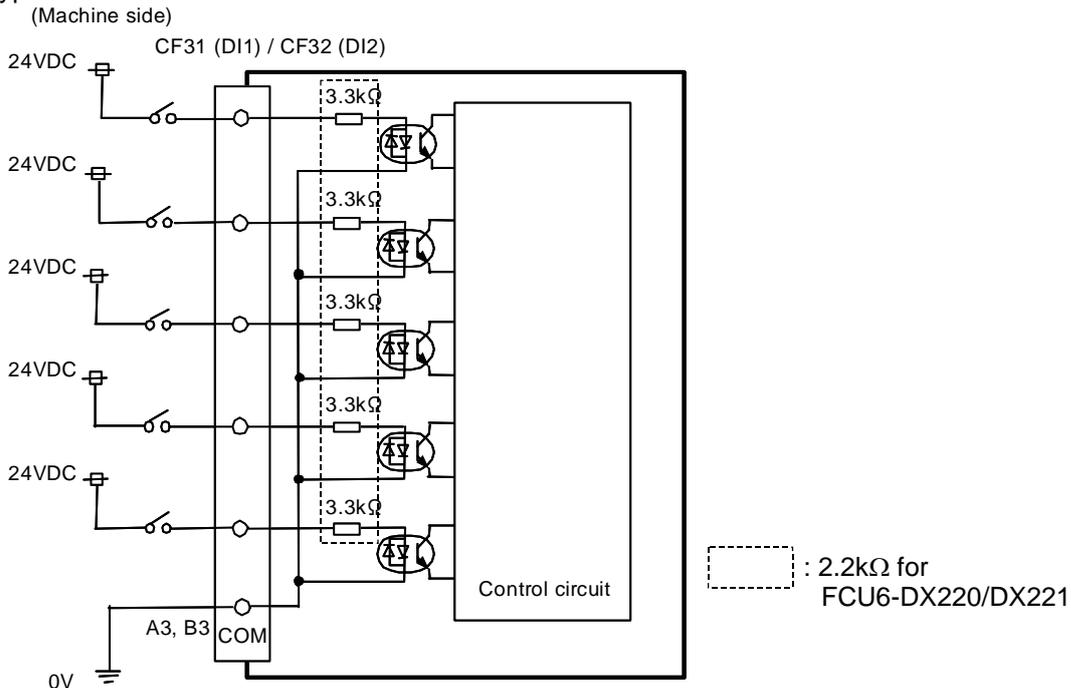
The digital signal input circuit can be selected from the sink type or source type for each connector of each unit.

Unit name	FCU6-HR341	FCU6-HR351	FCU6-DX220	FCU6-DX221
Card name	HR341	HR351	HR327	HR337
Input type	Sink/Source	Sink/Source	Sink/Source	Sink/Source
COM pin connection	24VDC/GND	24VDC/GND	24VDC/GND	24VDC/GND
The number of input points	64 points	64 points	64 points	64 points
Pin for input	X0 to X3F	X0 to X3F	X0 to X3F	X0 to X3F

(1) Input circuit Source type



Sink type



(2) Conditions for input

The input signals must be used within the following condition ranges.

Sink type

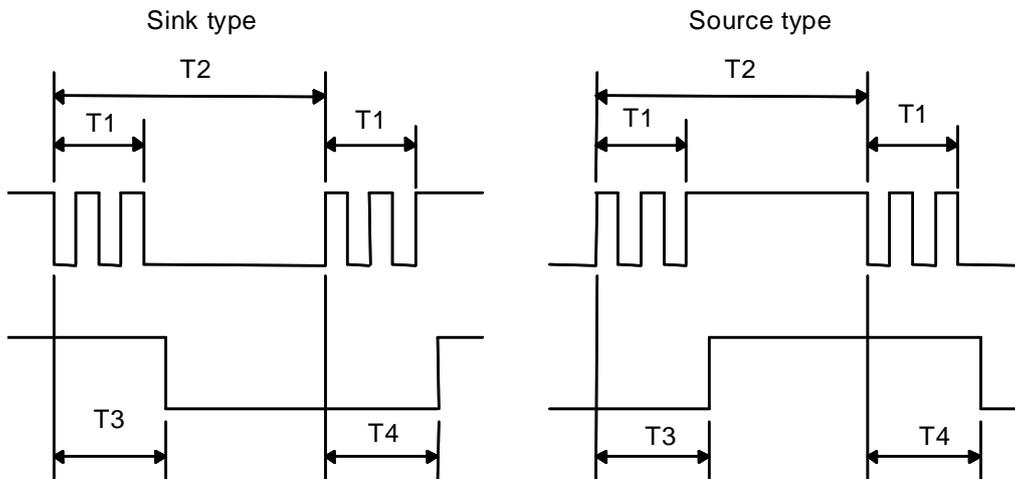
Input voltage at external contact ON	6V or less
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	20V or more, 25.2V or less
Input current at external contact OFF	2mA or less
Tolerable chattering time	3ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2 below) (Note 1)
Input circuit operation delay time	$3\text{ms} \leq T3 \div T4 \leq 16\text{ms}$
Machine side contact capacity	30V or more, 16mA or more

(Note 1) "40ms or more" is a rough standard. An input signal cannot be recognized unless it lasts longer than the period of the process cycle of the ladder.

Source type

Input voltage at external contact ON	18V to 25.2V
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	4V or less
Input current at external contact OFF	2mA or less
Tolerable chattering time	3ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2 below) (Note 1)
Input circuit operation delay time	$3\text{ms} \leq T3 \div T4 \leq 16\text{ms}$
Machine side contact capacity	30V or more, 16mA or more

(Note 1) "40ms or more" is a rough standard. An input signal cannot be recognized unless it lasts longer than the period of the process cycle of the ladder.



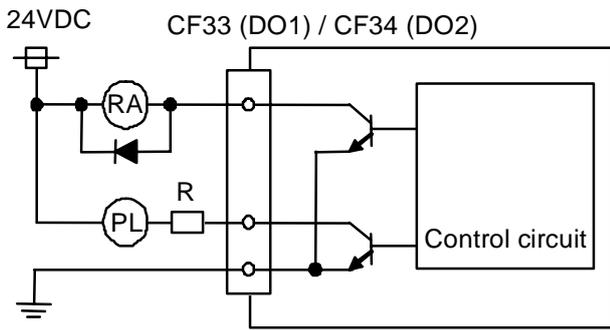
5.2.5 Outline of digital signal output circuit

The digital signal output circuit has the sink type and source type. Use within the specification ranges shown below.

Unit name	FCU6-HR341	FCU6-HR351	FCU6-DX220	FCU6-DX221
Card name	HR341	HR351	HR327	HR337
Output type	Sink	Source	Sink	Source
Output current	60mA/Point	60mA/Point	60mA/Point	60mA/Point
The number of output points	48 points	48 points	64 points	64 points
Pin for output	Y0 to Y2F	Y0 to Y2F	Y0 to Y3F	Y0 to Y3F

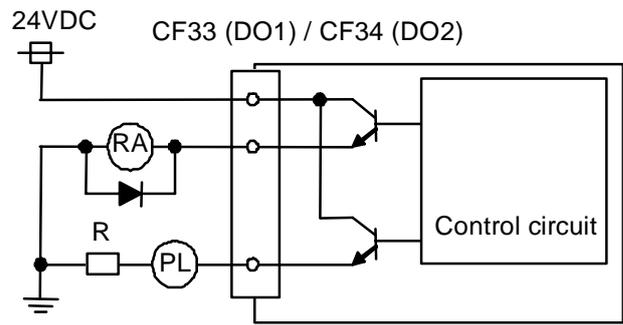
(1) Output circuit

(Machine side)



Sink type

(Machine side)



Source type

(2) Conditions for output

Insulation method	Non-insulation
Rated load voltage	24VDC
Max. output current	60mA/Point
Output delay time	40μs

(3) Setting of rotary switch (CS1, CS2) (For FCU6-DX220/DX221)

CS1	Rotary switch CS1: Set the station No. for DI:X0-X1F (32 points) and DO:Y0-Y1F (32 points) of the remote I/O communication 1CH. Normally, this is used at "0".
CS2	Rotary switch CS2: Set the station No. for DI:X20-X3F (32 points) and DO:Y20-Y3F (32 points) of the remote I/O communication 1CH. Normally, this is used at "1".

The number of occupied stations for this card is 2.

-CAUTION-

1. When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, 100mA or more) in parallel to the load.
2. When using a capacitive load such as a lamp, always connect a protective resistor (R=150Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)



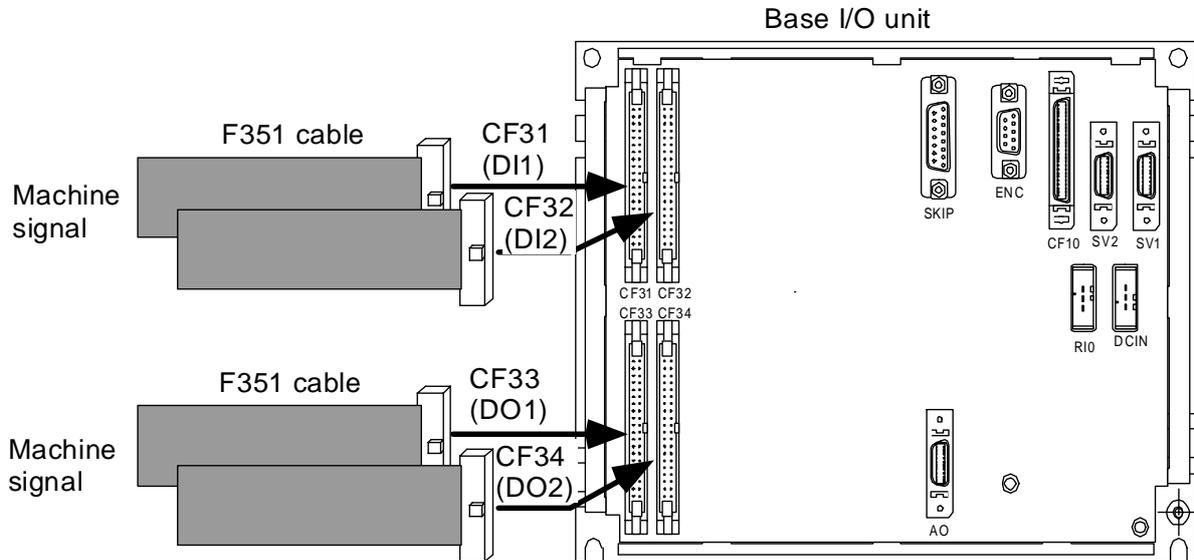
- ❗ When using an inductive load such as a relay, always connect a diode in parallel to the load.
- ❗ When using a capacitive load such as a lamp, always connect a protective resistor serially to the load to suppress rush currents.

5.2.6 Connection of machine control signal

(1) FCU6-HR341/HR351

Connect the machine control signal from CF34 to CF31 of base I/O unit.

Using the input 64 points and output 48 points requires four cables (all F351, single-end connector).

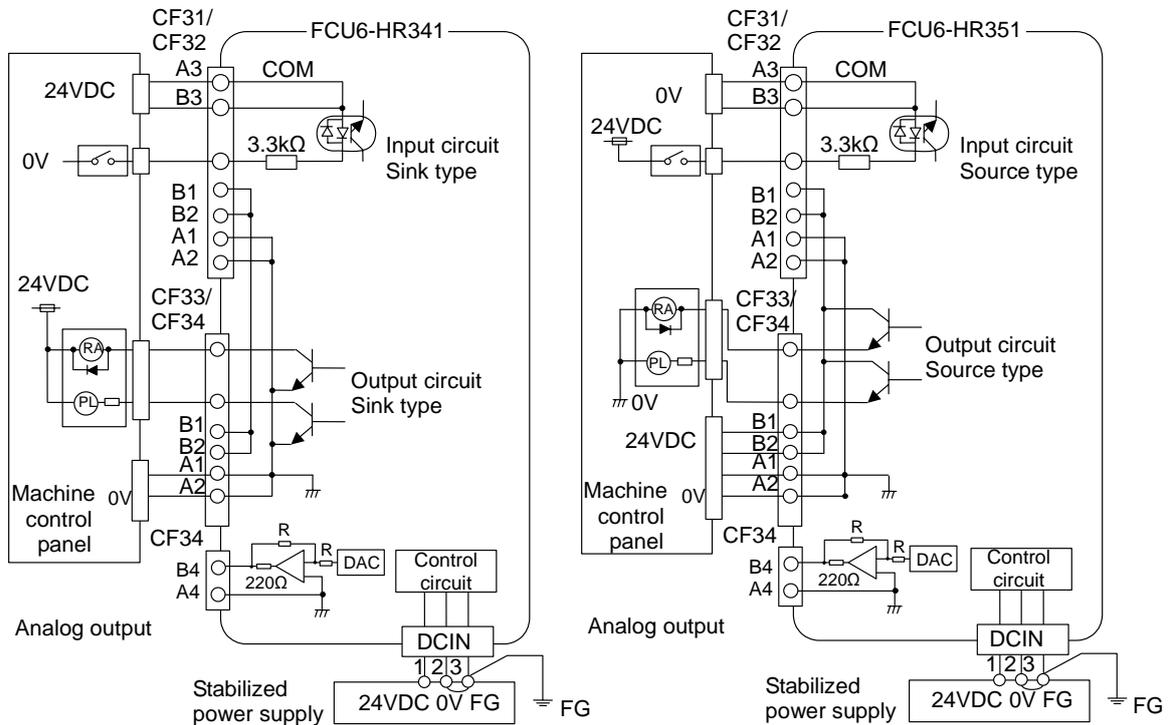


<Related items>

Cable drawing: Appendix 2: F351 cable

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit. (9)(a)"

(a) Outline of connection



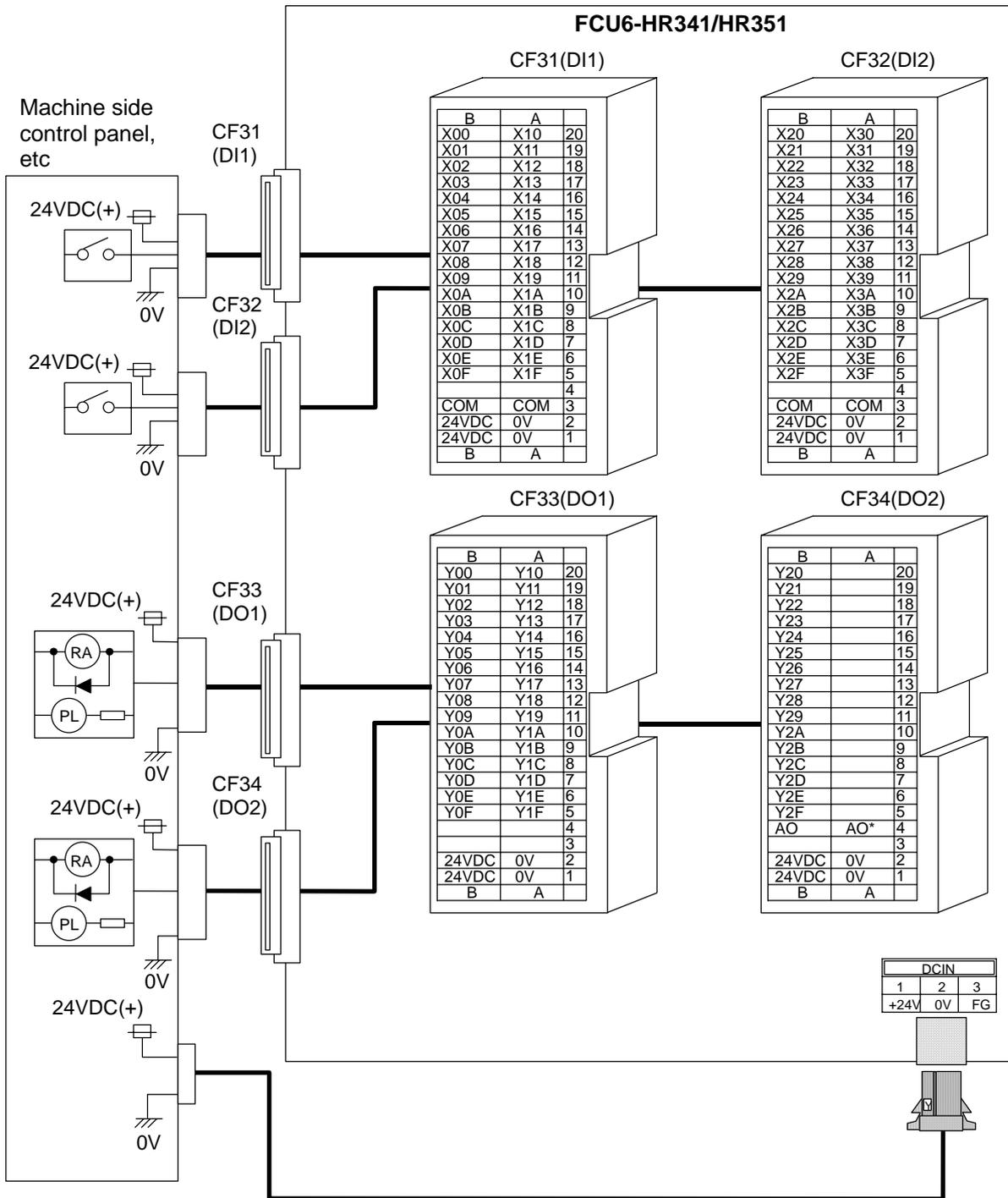
Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.

Incorrect connections may damage the devices, so connect the cables to the specified connectors.

Do not connect or disconnect the connection cables between each unit while the power is ON.

(b) Signal assignment table

For details of signal assignment, refer to the PLC Interface Manual.



(c) Adaptive connector



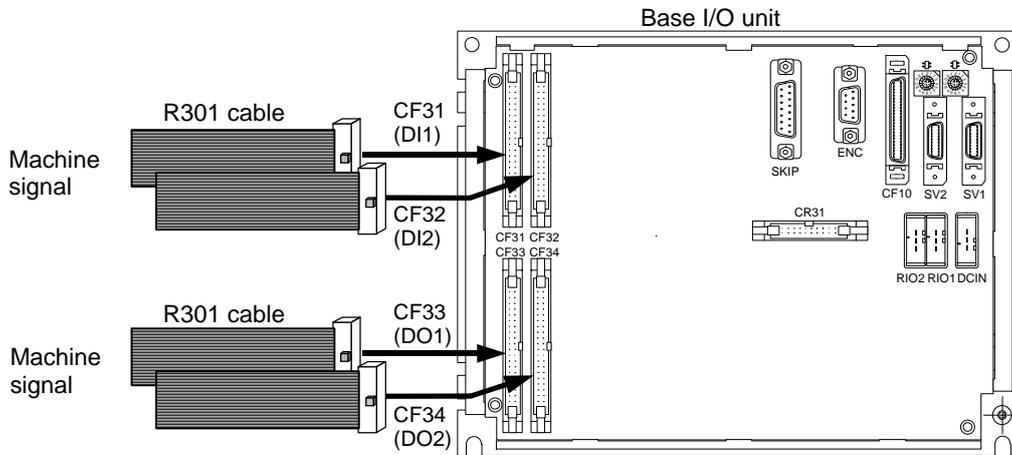
DCIN
 Connector: 2-178288-3
 Contact: 1-175218-5
 Manufacturer: Tyco Electronics AMP



CF31/CF32/CF33/CF34
 Connector: 7940-6500SC
 Strain relief: 3448-7940
 Manufacturer: 3M

(2) FCU6-DX220/DX221

Connect the machine control signal from CF34 to CF31 of base I/O unit.
 Four FCUA-R300/R301 cables are required when using 64 points each for both input and output.

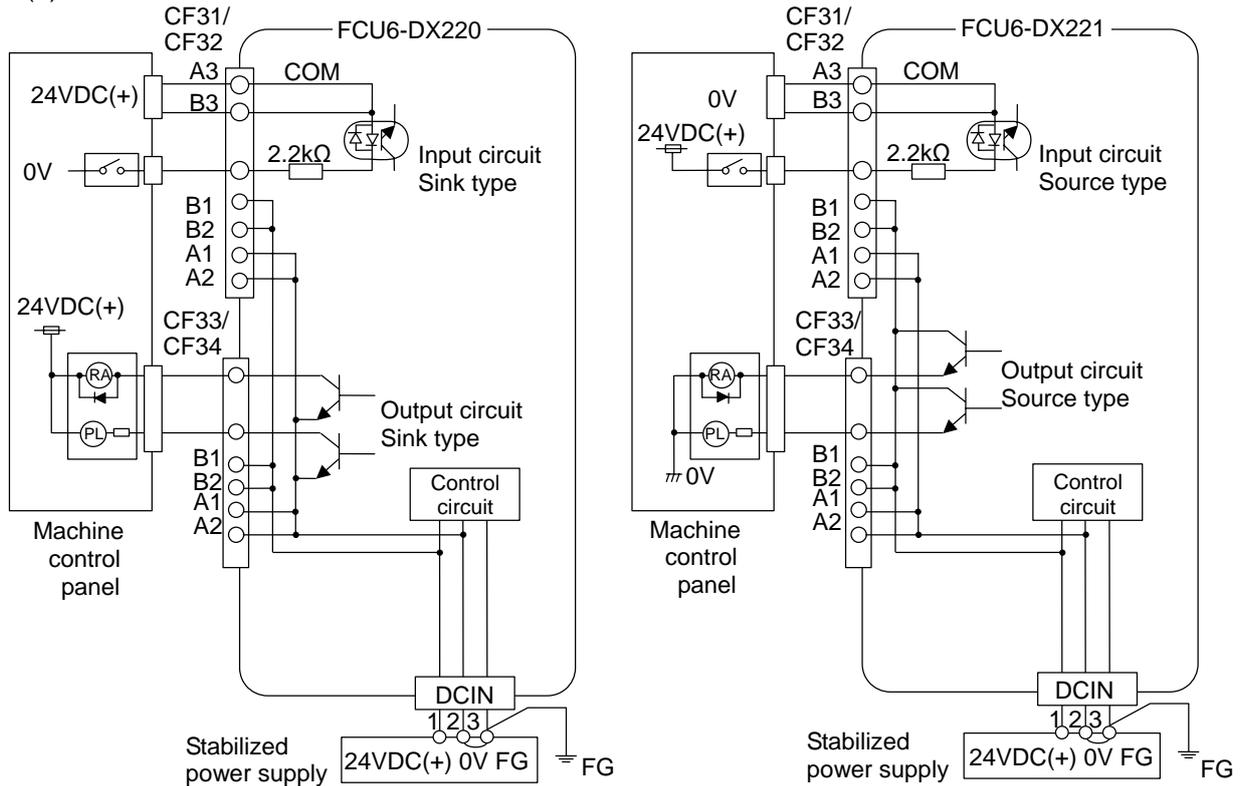


<Related items>

Cable drawing: Appendix 2: FCUA-R300/R301 cable

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit. (9)(b)"

(a) Outline of connection

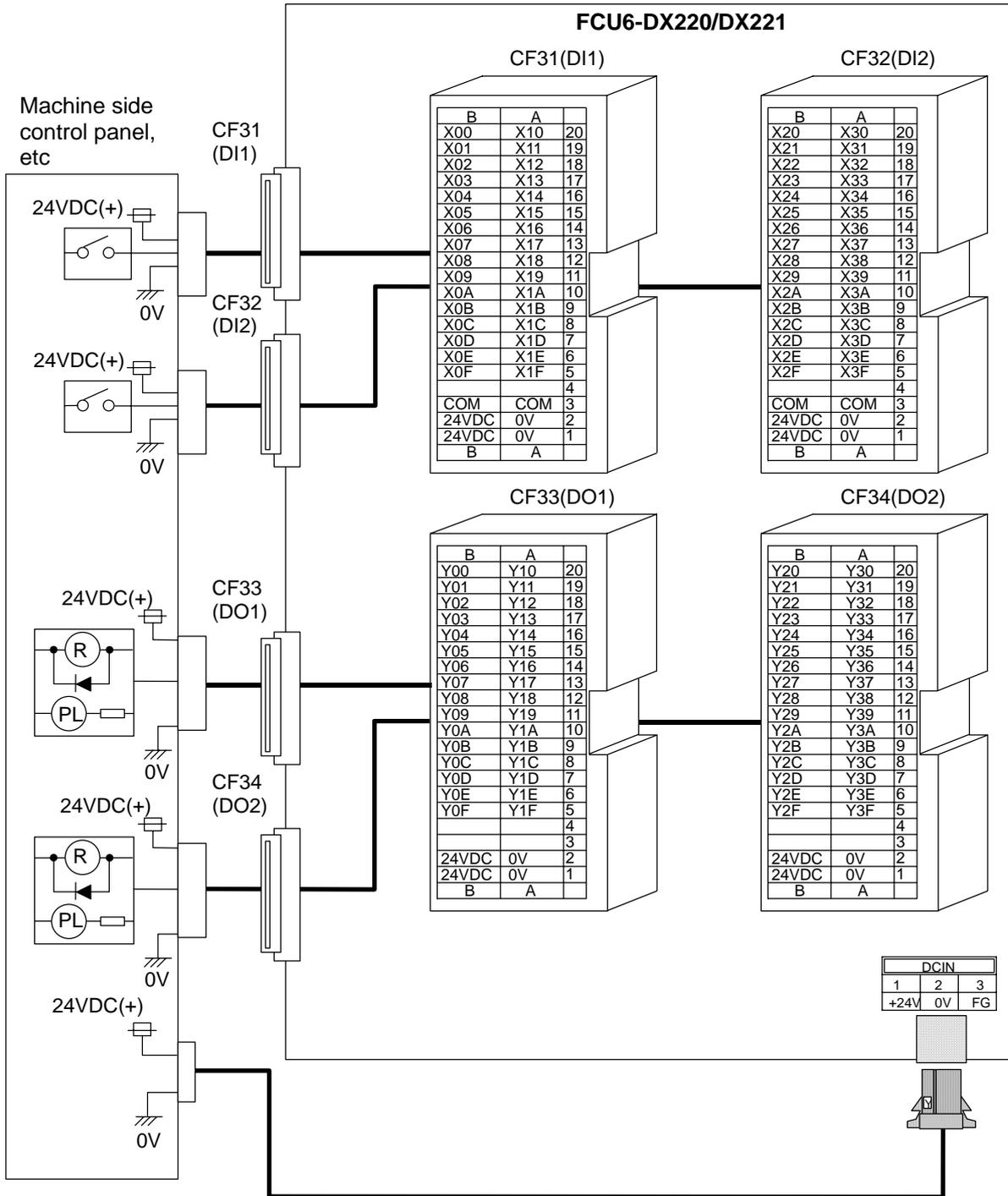


CAUTION

- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- Do not connect or disconnect the connection cables between each unit while the power is ON.

(b) Signal assignment table

For details of signal assignment, refer to the PLC Interface Manual.



(c) Adaptive connector



DCIN
 Connector: 2-178288-3
 Contact: 1-175218-5
 Manufacturer: Tyco Electronics AMP

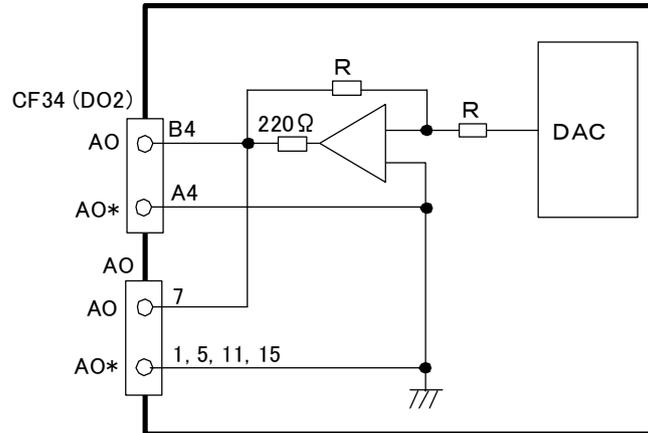


CF31/CF32/CF33/CF34
 Connector: 7940-6500SC
 Manufacturer: 3M

5.2.7 Outline and connection of analog signal output circuit (Only FCU6-HR341/HR351)

Analog signals are output to the CF34 connector or AO connector, so connect either of the connectors which is easier to connect.

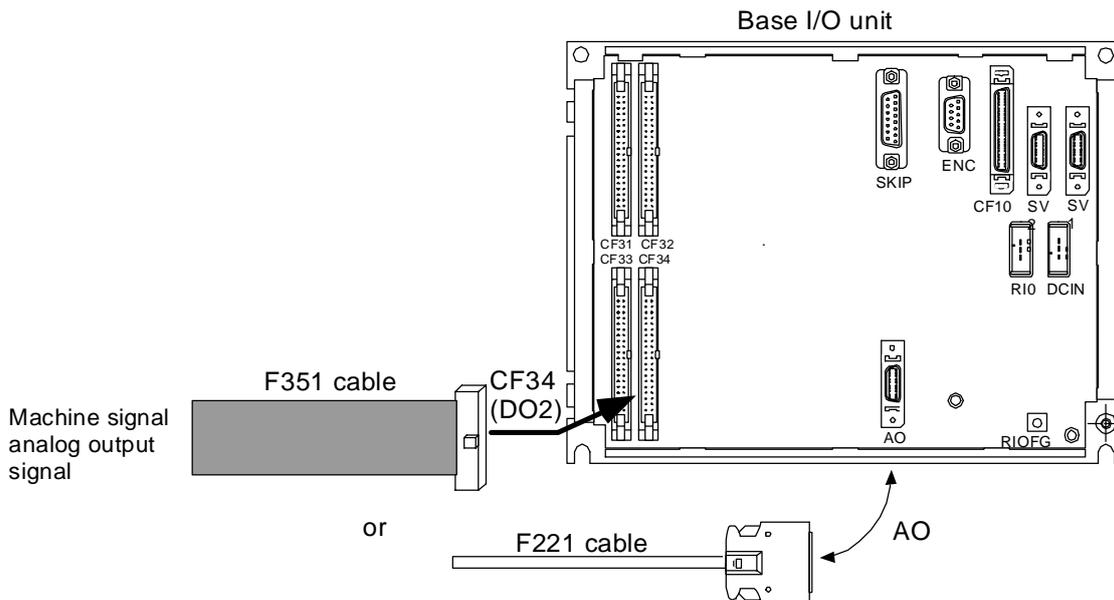
(1) Output circuit



(2) Conditions for output

Output voltage	0V to ±10V(±5%)
Resolution	12bits (±10V × n/4096) (n=2 ⁰ to 2 ¹¹)
Load condition	10kΩ load resistance
Output impedance	220Ω

(3) Connection



<Related items>

Cable drawing: Appendix 2: F221 cable

Connector pin assignment: Refer to "5.2.3 Connector pin assignment of base I/O unit (8)".

CAUTION

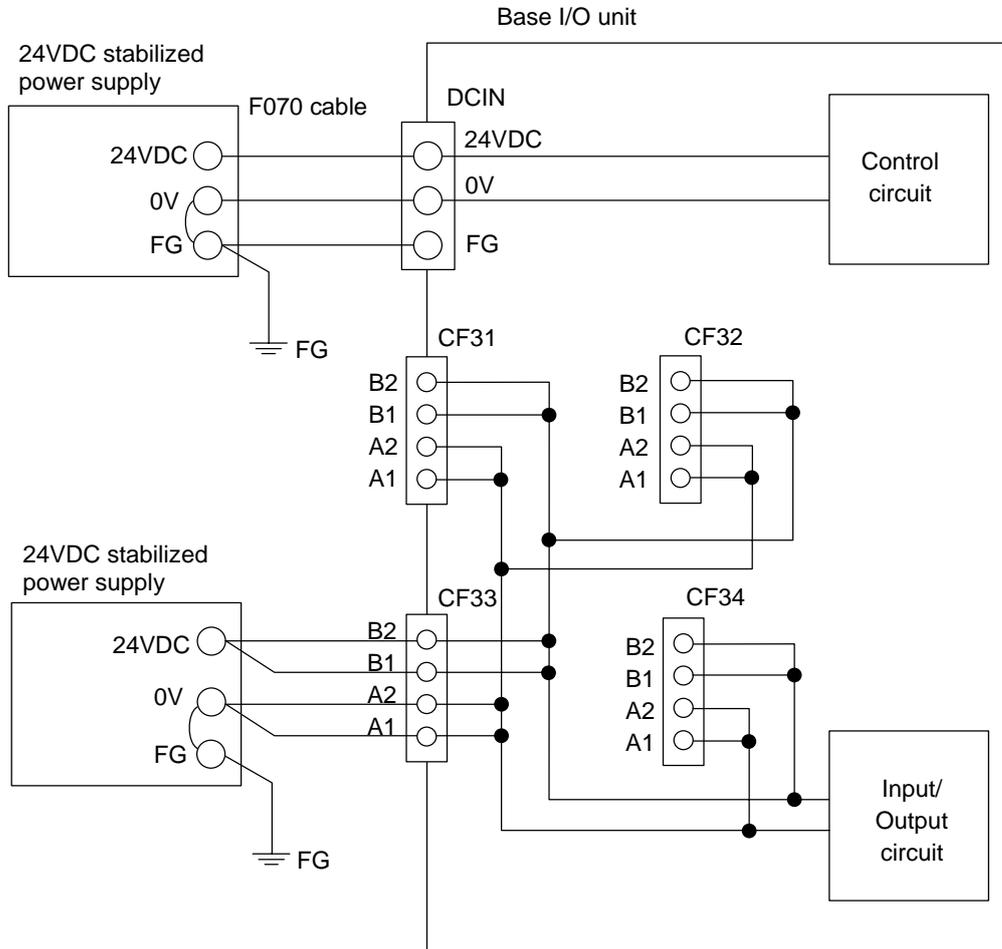
- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- Do not connect or disconnect the connection cables between each unit while the power is ON.

5.2.8 Connection of power supply

Supply the power supply 24VDC to the base I/O unit by the connector DCIN.

The power supply for the input/output circuit of the unit FCU6-HR341/HR351 is a different system, so wire power supply and ground which are necessary for the connectors CF31 to CF34. The power supply and ground pin of the connectors CF31 to CF34 are connected internally.

(1) FCU6-HR341/HR351



<Related items>

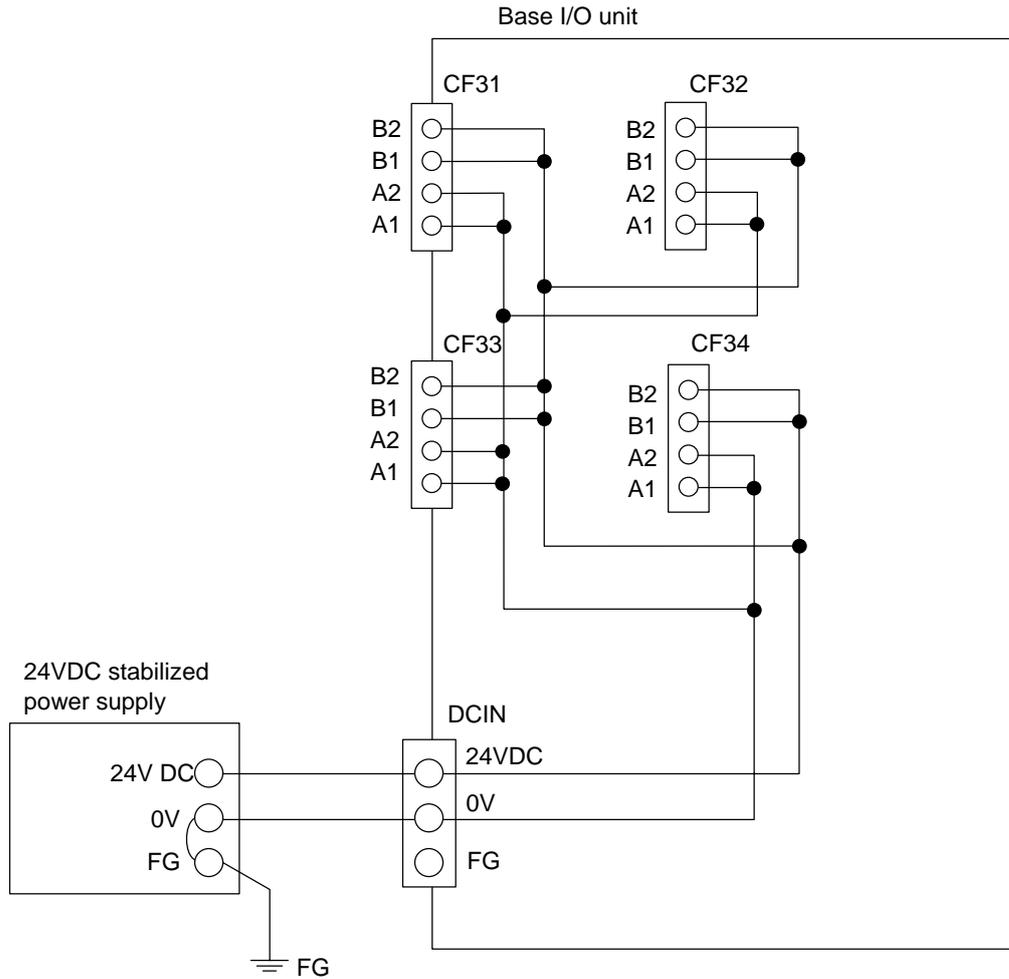
Cable drawing: Appendix 2 (F070 cable)

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit" (6) and (9).

CAUTION

-  **Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.**
-  **Incorrect connections may damage the devices, so connect the cables to the specified connectors.**
-  **Do not connect or disconnect the connection cables between each unit while the power is ON.**

(2) FCU6-DX220/DX221



<Related items>

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit" (6) and (9).

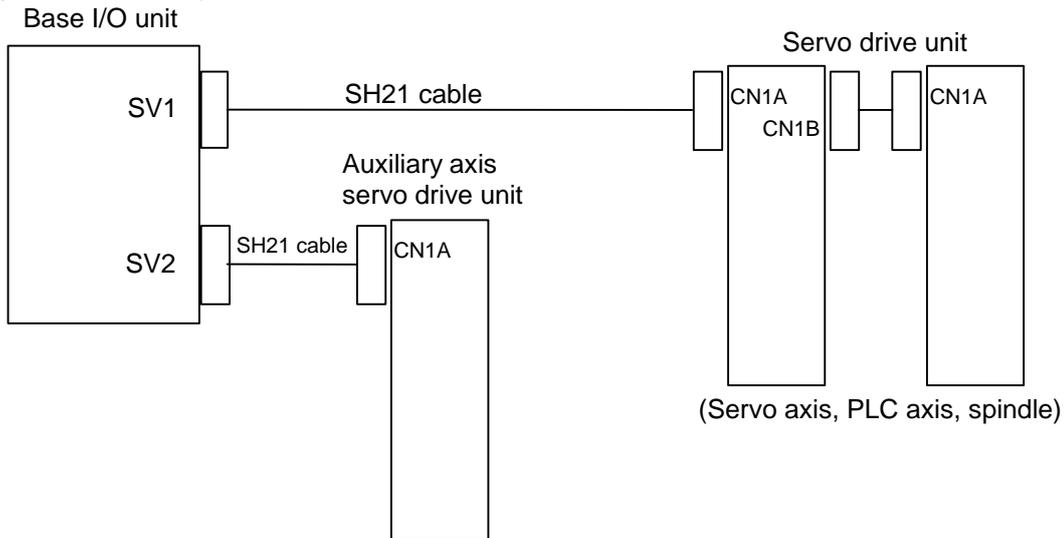
(Note) For both sink type and source type, 24VDC stabilized power must be supplied from the DCIN connector.

CAUTION

-  **Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.**
-  **Incorrect connections may damage the devices, so connect the cables to the specified connectors.**
-  **Do not connect or disconnect the connection cables between each unit while the power is ON.**

5.2.9 Connection of servo drive unit

Connect the servo drive unit to the SV1 connector (servo axis, PLC axis, spindle) and SV2 connector (Auxiliary axis MR-J2-CT) of the base I/O unit.



Connect the terminal resistor (FCUA-A-TM) to the terminal end of the servo drive unit.

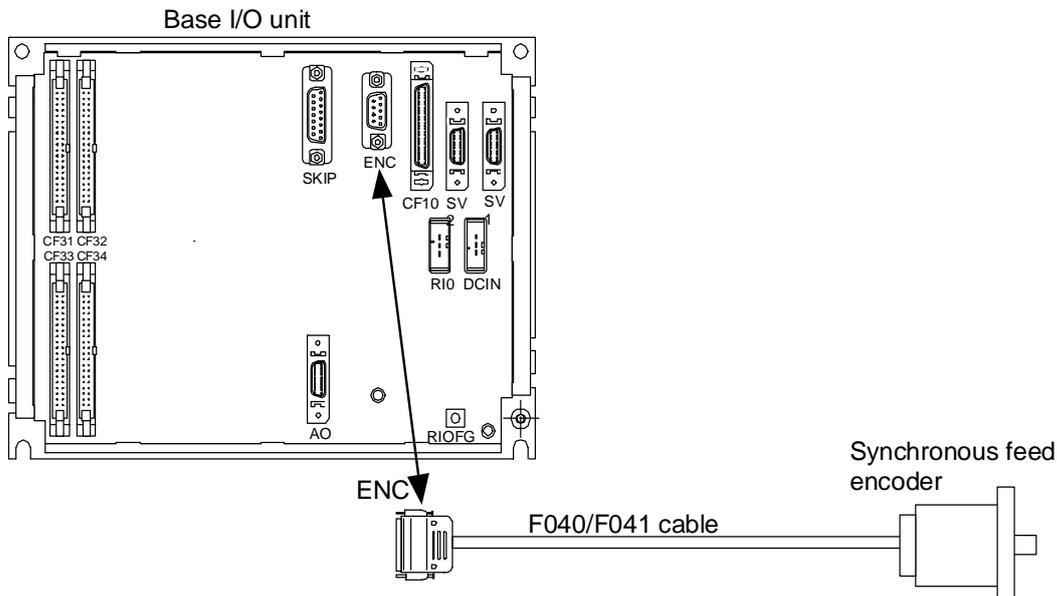
<Related items>

Cable drawing: Appendix 2 (SH21 cable)

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit (2) (3)"

5.2.10 Connection of synchronous feed encoder

Connect the synchronous feed encoder to the connector ENC of the base I/O unit..



<Related items>

Cable drawing: Appendix 2 (F040/F041 cable)

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit (4)"

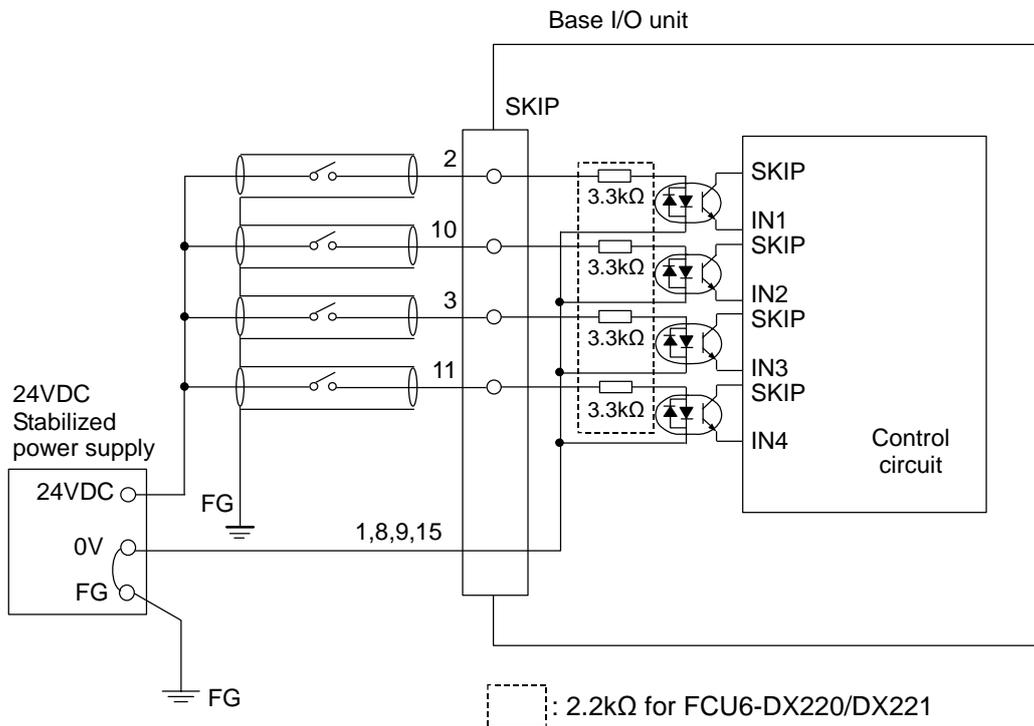
CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

5.2.11 Connection of skip signal

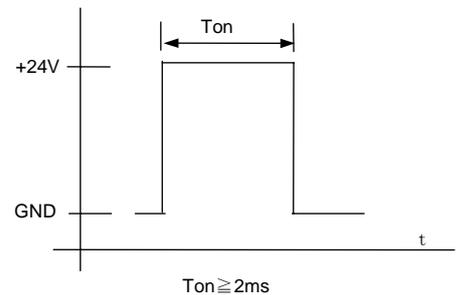
Connect the skip signal to the connector SKIP of the base I/O unit. The skip signal is used for processing high-speed signal. Ground the cable.

(1) Connection of skip signal cable



(2) Conditions for input
Use the input signal within the following condition ranges.

Input voltage at external contact ON	18V to 25.2V
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	4V or less
Input current at external contact OFF	1mA or less
Input signal holding time (Ton)	2ms or more
Internal response time	0.08ms or less
Machine side contact capacity	+30V or more, 16mA or more



<Related items>

Cable drawing: Appendix 2 (F102 cable)

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit (5)"

-CAUTION-

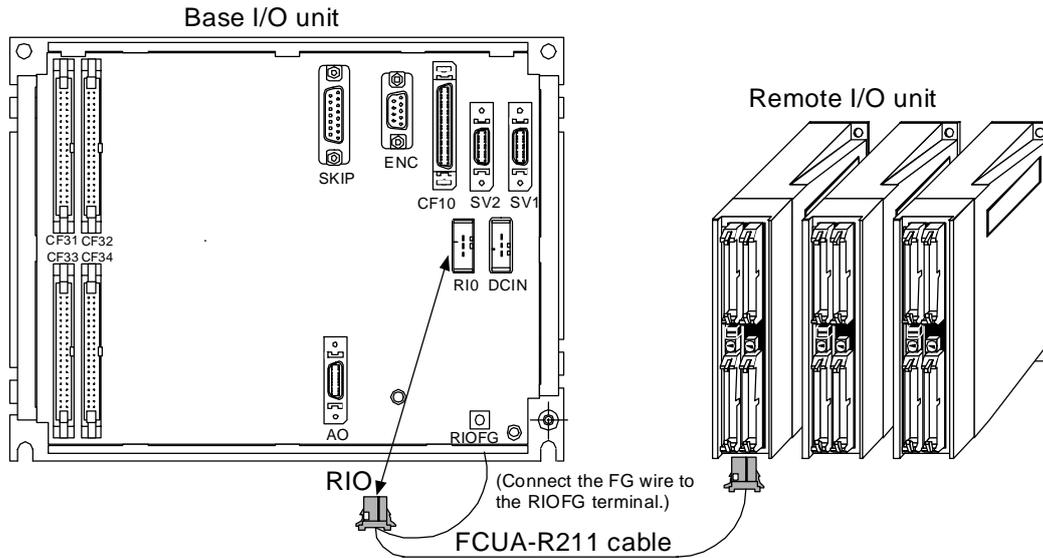
The skip signal recognizes an input signal longer than 2ms as valid. Using machine contact (such as relay) causes erroneous operation by chattering, so use semi-conductor contact such as transistor.



- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- Do not connect or disconnect the connection cables between each unit while the power is ON.

5.2.12 Connection of remote I/O unit

Connect the remote I/O unit to the connector RIO of the base I/O unit.
For remote I/O unit, refer to "6. REMOTE I/O CONNECTION".



<Related items>

Cable drawing: Appendix 2 (FCUA-R211 cable)

Connector pin assignment: "5.2.3 Connector pin assignment of base I/O unit (7)"

(Note) The 2nd channel of the FCU6-DX220/DX221 RIO cannot be used.

CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

6. REMOTE I/O CONNECTION

6.1 Outline of Remote I/O Unit

We have ten types of remote I/O units (FCUA-DXxxx) according to signal types possible to input/output and the number of contacts. Use serial link connections (MC link B) to connect the unit with the NC unit or the NC keyboard.

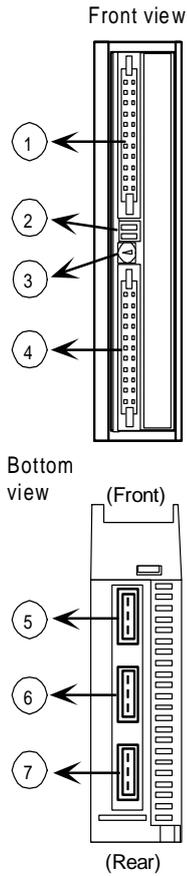
When the remote I/O unit is connected with serial links, multiple units can be used as long as the total No. of occupied stations (channels) is within 8.

(Refer to Section "6.12 Setting of Channel No. When Using Multiple Remote I/O Units" for details.)

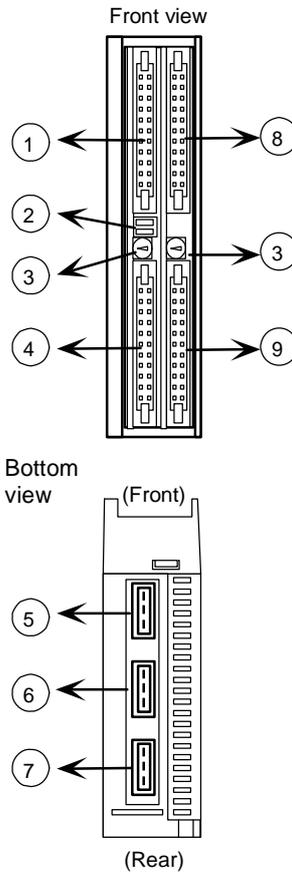
Unit name	Digital input			Digital output			Analog input	Analog output	# of stations occupied
	# of points	Insulation	Type	# of points	Insulation	Type			
FCUA-DX110	32	Photo-coupler insulation	Sink/Source	32	Non-insulation	Sink	-	-	1
FCUA-DX101	32	Photo-coupler insulation	Sink/Source	32	Non-insulation	Source	-	-	1
FCUA-DX110	64	Photo-coupler insulation	Sink/Source	48	Non-insulation	Sink	-	-	2
FCUA-DX111	64	Photo-coupler insulation	Sink/Source	48	Non-insulation	Source	-	-	2
FCUA-DX120	64	Photo-coupler insulation	Sink/Source	48	Non-insulation	Sink	-	1	2
FCUA-DX121	64	Photo-coupler insulation	Sink/Source	48	Non-insulation	Source	-	1	2
FCUA-DX140	32	Photo-coupler insulation	Sink/Source	32	Non-insulation	Sink	4	1	2
FCUA-DX141	32	Photo-coupler insulation	Sink/Source	32	Non-insulation	Source	4	1	2

6.2 Names of Each Remote I/O Unit Section

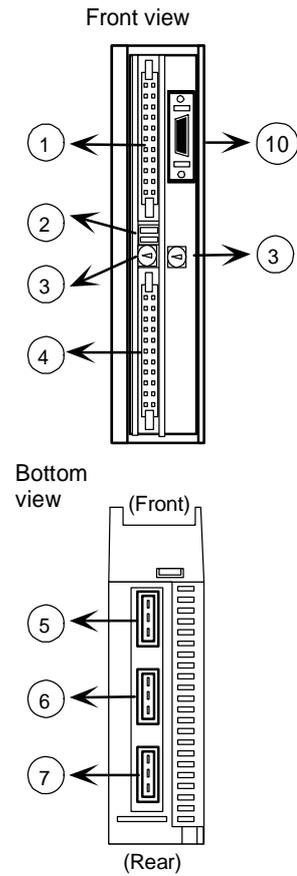
FCUA-DX10x



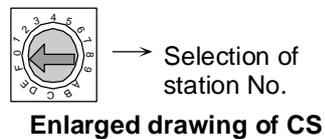
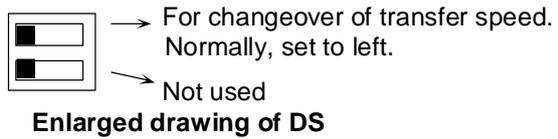
FCUA-DX11x
FCUA-DX12x



FCUA-DX14x



- ① DI-L (Machine input signal connector)
- ② DS (Transfer speed changeover switch)
- ③ CS (Station No. changeover switch)
- ④ DO-L (Machine output signal connector)
- ⑤ RIO1 (Serial connection connector #1)
- ⑥ RIO2 (Serial connection connector #2)
- ⑦ DCIN (24VDC (+) power input connector)
- ⑧ DI-R (Machine input signal connector)
- ⑨ DO-R (Machine output signal connector)
- ⑩ AIO (Analog signal input/output connector)

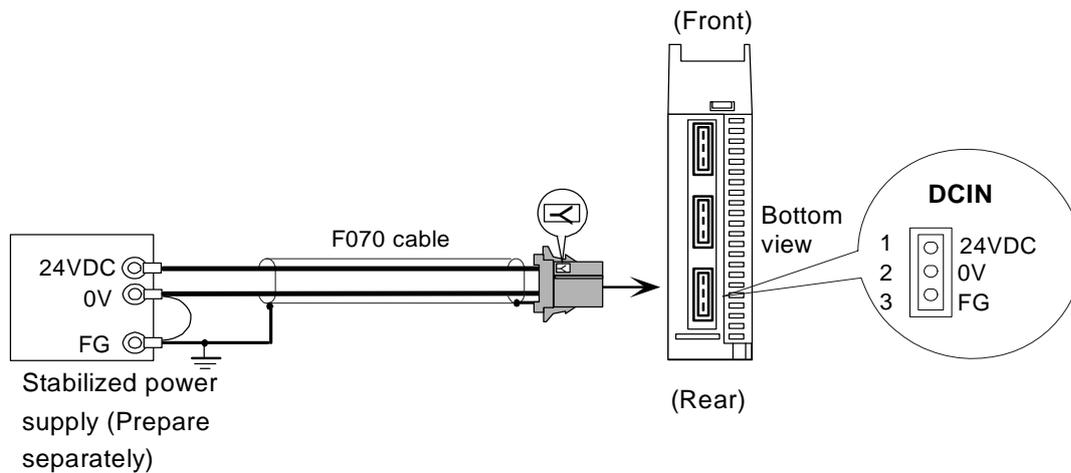


6.3 Connection of Remote I/O Power Supply

24VDC is required to run the remote I/O unit. Prepare a stabilized power supply that satisfied the following conditions.

Output voltage	24VDC \pm 5%	
Ripple	200mV max.	
Max output current	FCUA-DX10x	2.4A or more
	FCUA-DX11x	3.8A or more
	FCUA-DX12x	3.8A or more
	FCUA-DX14x	3.4A or more

Supply the 24VDC power for the control circuit from the DCIN connector on the bottom of the unit. When manufacturing the R300 cable, use the one-end CN300 connector (optional, with one end). When manufacturing the R301 cable, use the CS301 connector set (optional, with both ends).



CAUTION

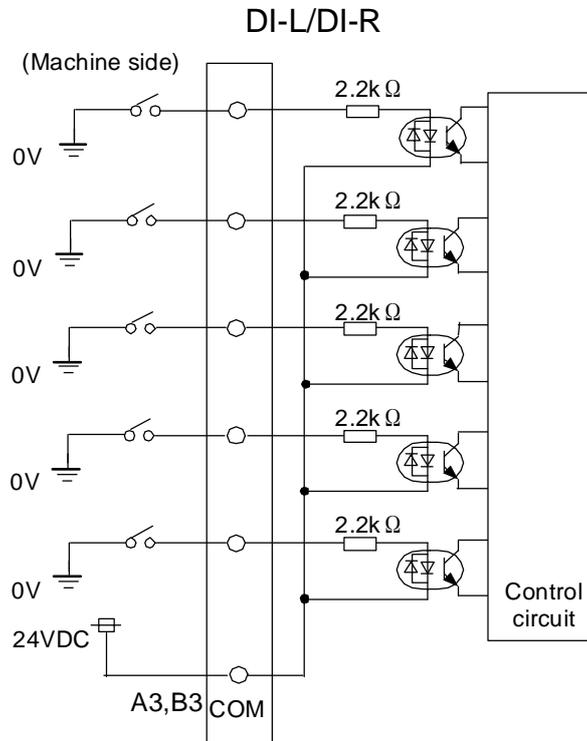
- Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- Do not connect or disconnect the connection cables between each unit while the power is ON.

6.4 Outline of Digital Signal Input Circuit

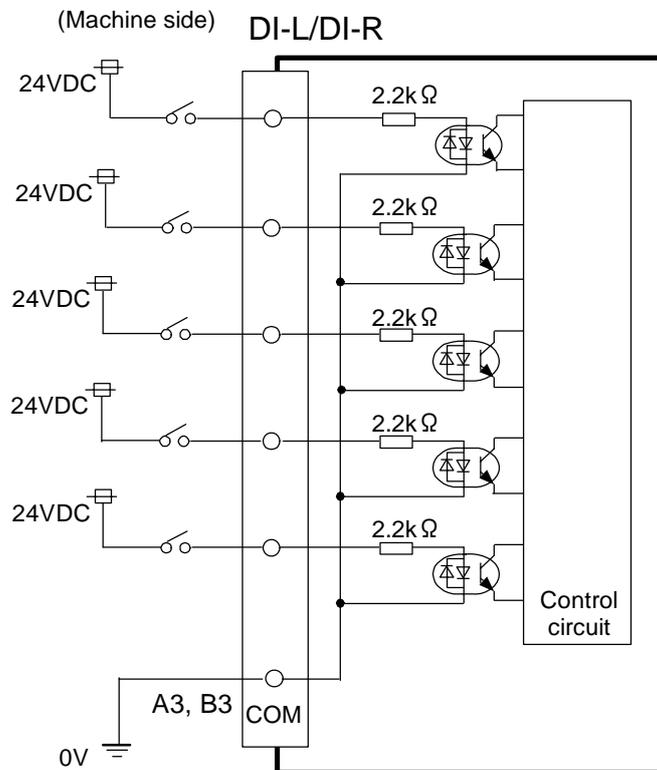
The digital signal input circuit can be selected from sink type or source type for each connector of units.

(1) Input circuit

Source type



Sink type



(2) Input conditions

The input signals must be used within the following condition ranges.

Sink type

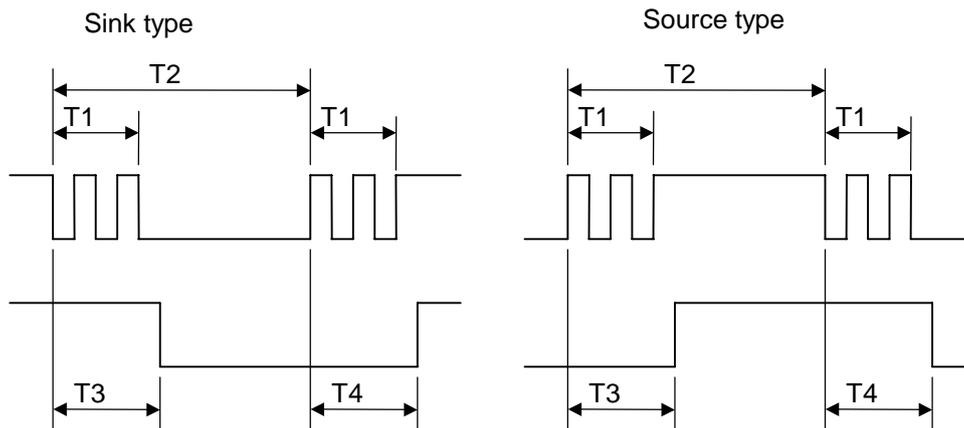
Input voltage at external contact ON	6V or less
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	20V or more, 25.2V or less
Input current at external contact OFF	2mA or less
Tolerable chattering time	3ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2) (Note1)
Input circuit operation delay time	$3\text{ms} \leq T3 \leq T4 \leq 16\text{ms}$
Machine side contact capacity	30V or more, 16mA or more

(Note 1) "40ms or more" is a rough standard. An input signal cannot be recognized unless it lasts longer than the period of the process cycle of the ladder.

Source type

Input voltage at external contact ON	18V or more, 25.2V or less
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	4V or less
Input current at external contact OFF	2mA or less
Tolerable chattering time	3ms or less (Refer to T1 below)
Input signal holding time	40ms or more (Refer to T2) (Note1)
Input circuit operation delay time	$3\text{ms} \leq T3 \leq T4 \leq 16\text{ms}$
Machine side contact capacity	30V or more, 16mA or more

(Note 1) "40ms or more" is a rough standard. An input signal cannot be recognized unless it lasts longer than the period of the process cycle of the ladder.

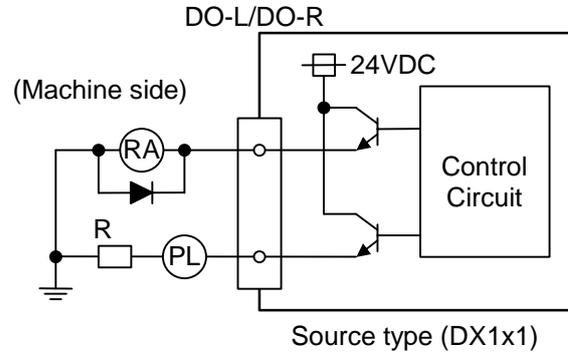
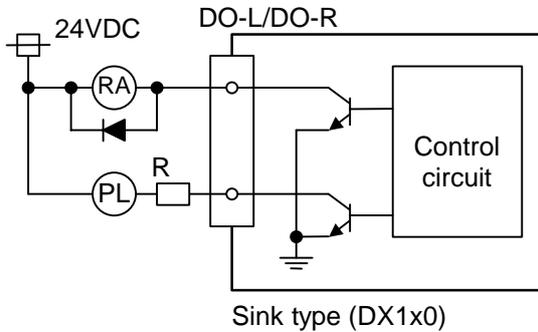


6.5 Outline of Digital Signal Output Circuit

The digital signal output circuit uses a sink type (DX1x0) or source type (DX1x1). Use within the specification ranges shown below.

(1) Output circuit

(Machine side)



(2) Output conditions

Insulation method	Non-insulation
Rated load voltage	24VDC
Max. output current	60mA / 1 point
Output delay time	40 μ s

-CAUTION-

1. When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, 100mA or more) in parallel to the load.
2. When using a capacitive load such as a ramp, always connect a protective resistor ($R=150\Omega$) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)

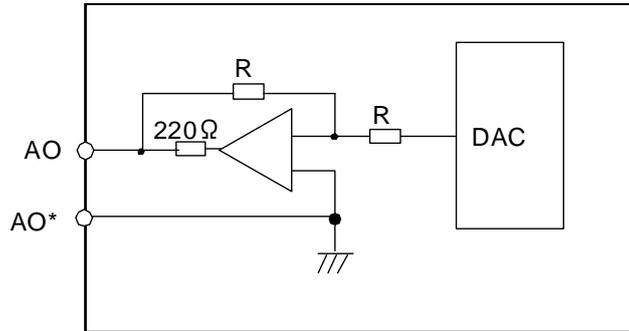
⚠ CAUTION

- ❗ When using an inductive load such as a relay, always connect a diode in parallel to the load.
- ❗ When using a capacitive load such as a ramp, always connect a protective resistor serially to the load to suppress rush currents.

6.6 Outline of Analog Signal Output Circuit

The analog signal output circuit can be used only for the FCUA-DX120/DX121/DX140/DX141.

(1) Output circuit



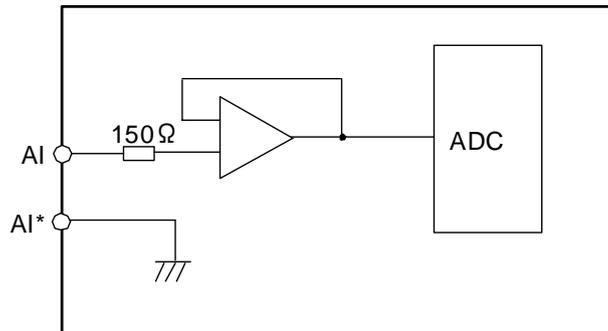
(2) Output conditions

Output voltage	0V to $\pm 10\text{V}(\pm 5\%)$
Resolution	12bits ($\pm 10\text{V} \times n/4096$) ($n=2^0$ to 2^{11})
Load conditions	10k Ω load resistance
Output impedance	220 Ω

6.7 Outline of Analog Signal Input Circuit

The analog signal input circuit can be used only for the FCUA-DX140/DX141.

(1) Input circuit



(2) Input conditions

Max. input rating	$\pm 15\text{V}$
Resolution	10V/2000 (5mV)
Accuracy	Within $\pm 25\text{mV}$
AD input sampling time	14.2ms (AI0) ,42.6ms (AI1 to AI3)

6.8 Connection of FCUA-DX10x/DX14x Unit and Machine Control Signal

When using a unit with 32 input points and 32 output points, you need two of the R300 cable (one-end connector) or R301 cable (both-end connector).

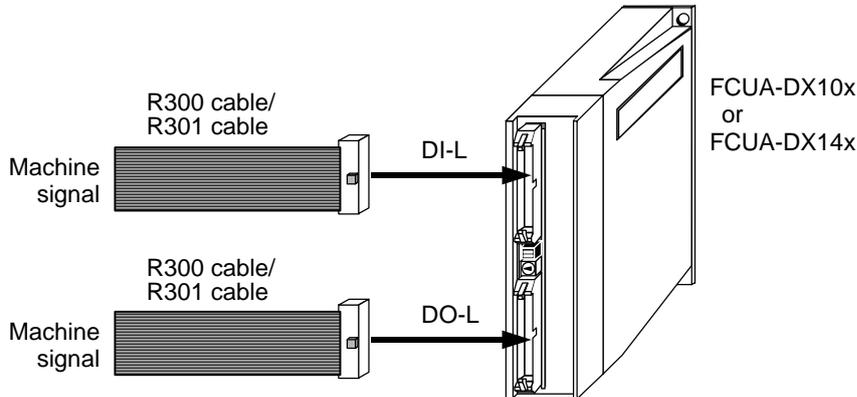
For the R300 cable, refer to APPENDIX 2 (FCUA-R300 cable).

To manufacture the R300 cable, use the connector set FCUA-CN300 (optional).

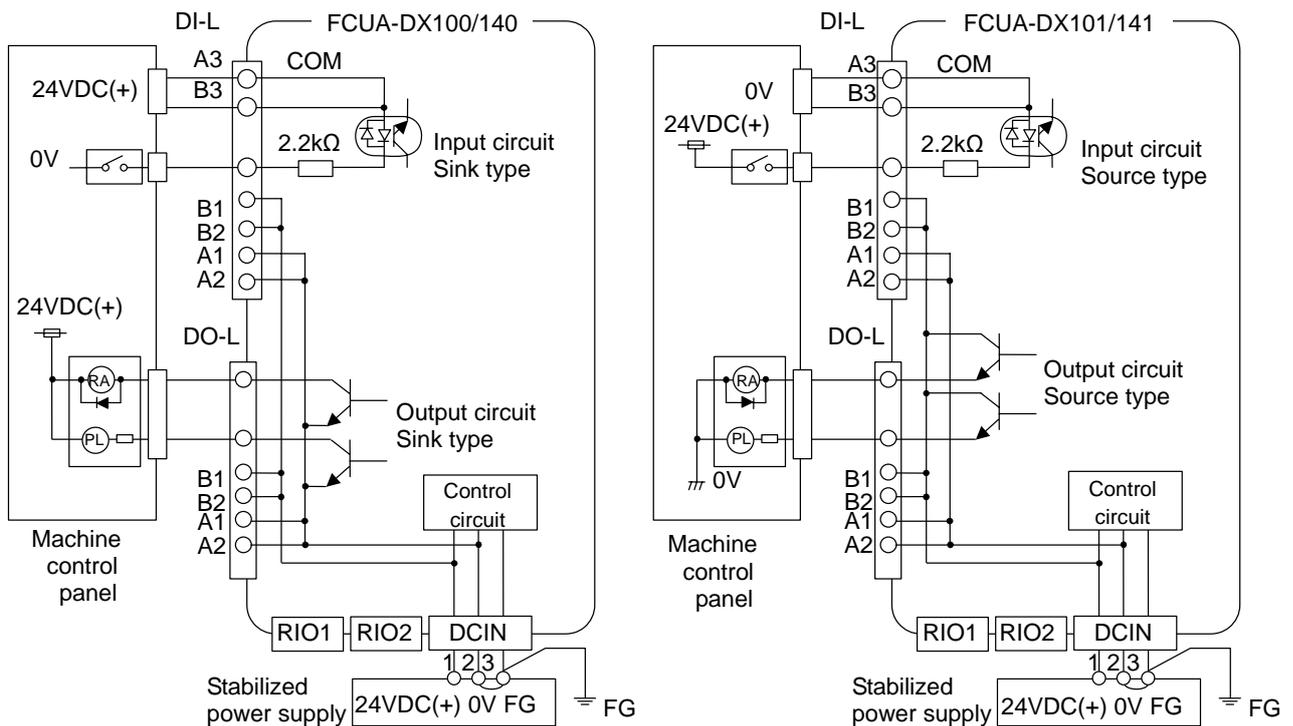
For the R301 cable, refer to APPENDIX 2 (FCUA-R301 cable).

To manufacture the R301 cable, use the connector set FCUA-CS301 (optional).

The terminal block that applies the R301 cable is the I/O terminal BX1F-T40 by IDEC Corporation.



(1) Outline of connection



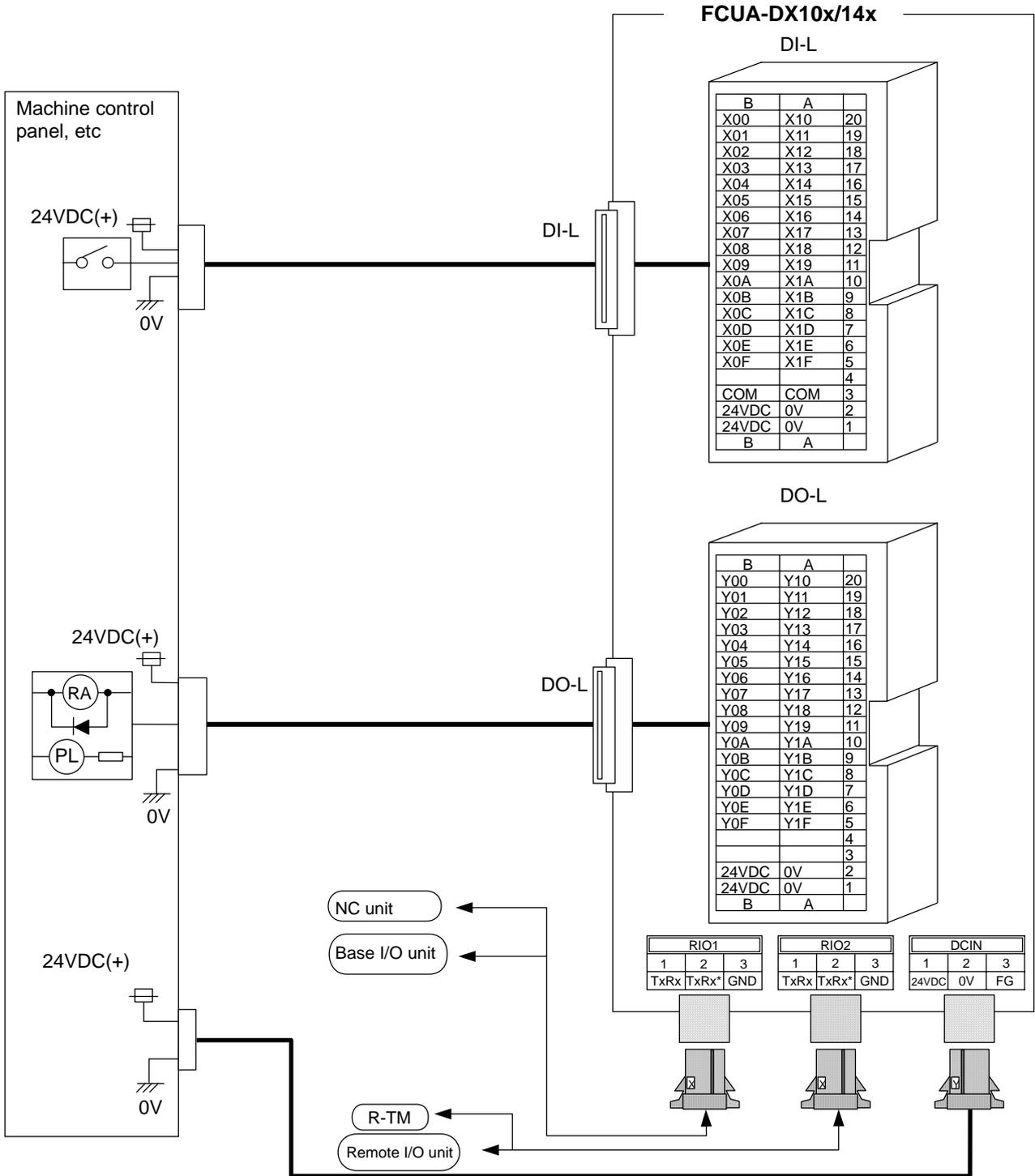
CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

(2) Signal assignment table

When using two or more remote I/O units or when connecting to the NC keyboard, the signal assignment will differ.

Refer to the "PLC Interface Manual" for details.



(3) Adaptive connector

1. DCIN

Connector set name: FCUA-CN220



2. RIO1/RIO2

Connector set name: FCUA-CN211



3. DI-L/DO-L

Connector set name: FCUA-CN300,FCUA-CS301



(4) Others

1. Terminator

FCUA-R-TM



6.9 Connection of FCUA-DX11x Unit and Machine Control Signal

When using a unit with 64 input points and 48 output points, you need four of the R300 cable (one-end connector) or R301 cable (both-end connector).

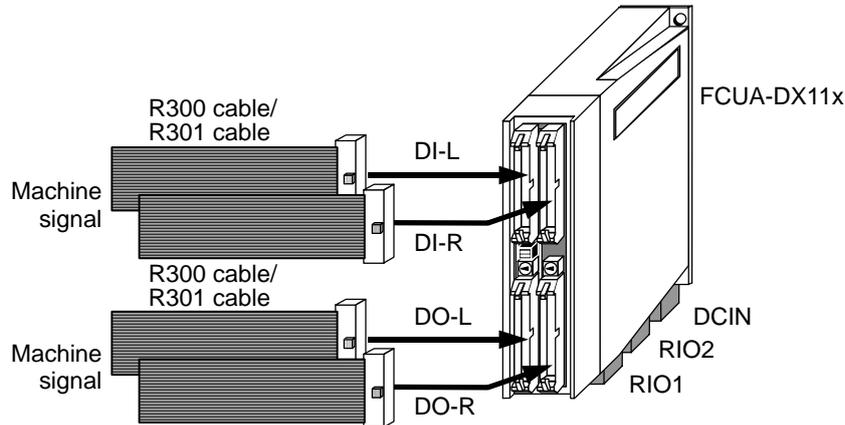
For the R300 cable, refer to APPENDIX 2 (FCUA-R300 cable).

To manufacture the R300 cable, use the connector set FCUA-CN300 (optional).

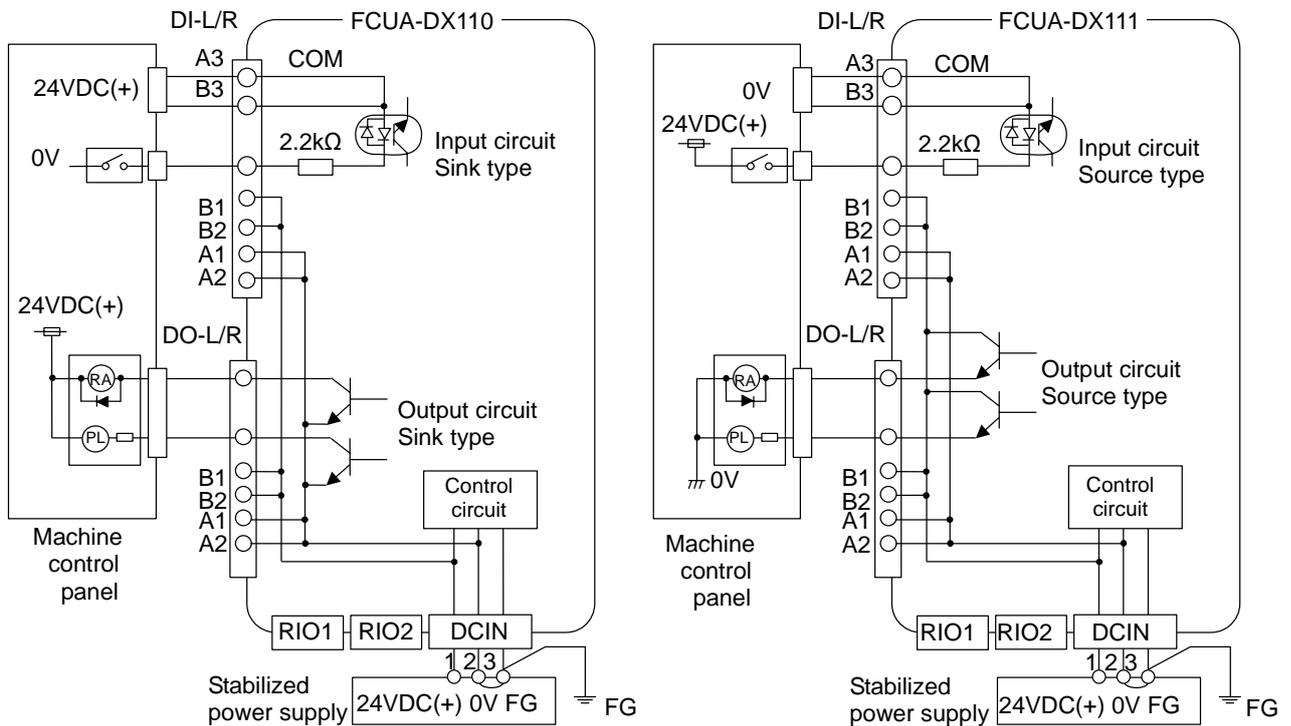
For the R301 cable, refer to APPENDIX 2 (FCUA-R301 cable).

To manufacture the R301 cable, use the connector set FCUA-CS301 (optional).

The terminal block that applies the R301 cable is the I/O terminal BX1F-T40 by IDEC Corporation.



(1) Outline of connection



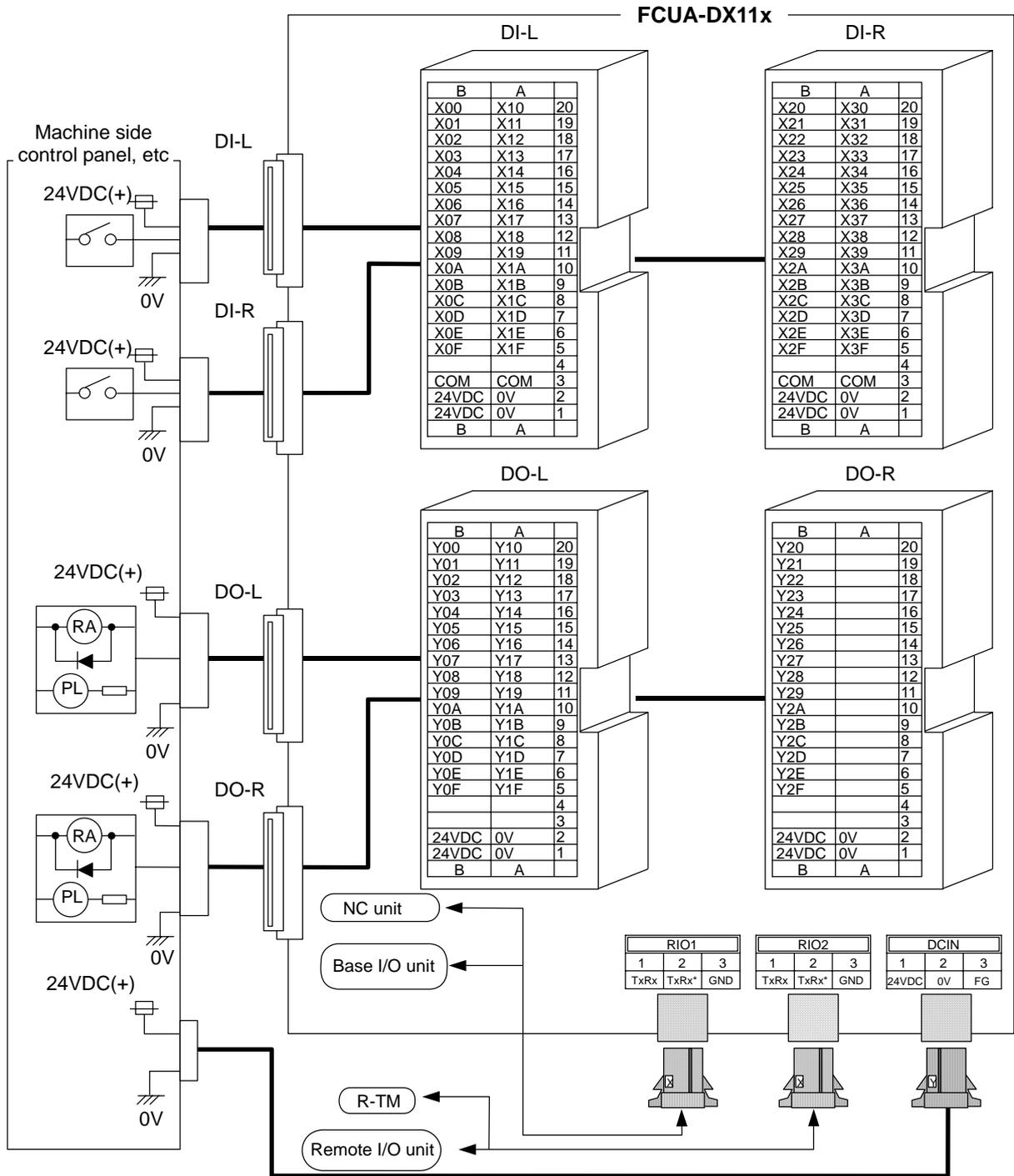
⚠ CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

(2) Signal assignment table

When using two or more remote I/O units or when connecting to the NC keyboard, the signal assignment will differ.

Refer to the "PLC Interface Manual" for details.



(3) Adaptive connector

1. DCIN

Connector set name: FCUA-CN220



2. RIO1/RIO2

Connector set name: FCUA-CN211



3. DI-L/DO-L

Connector set name: FCUA-CN300,FCUA-CS301



(4) Others

1. Terminator

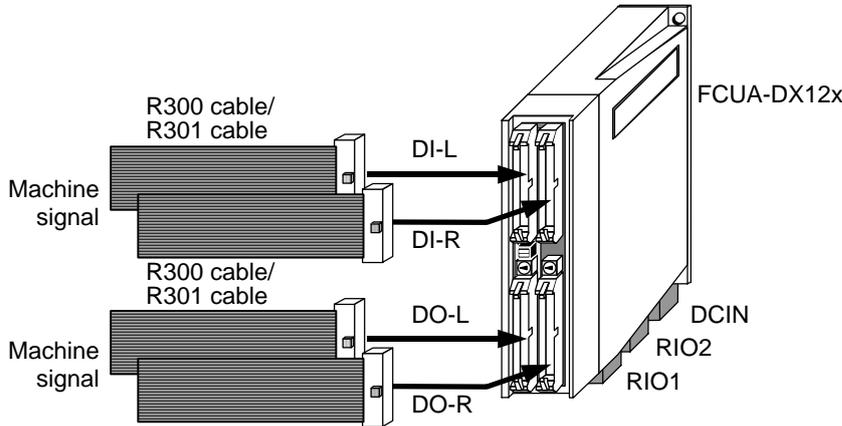
FCUA-R-TM



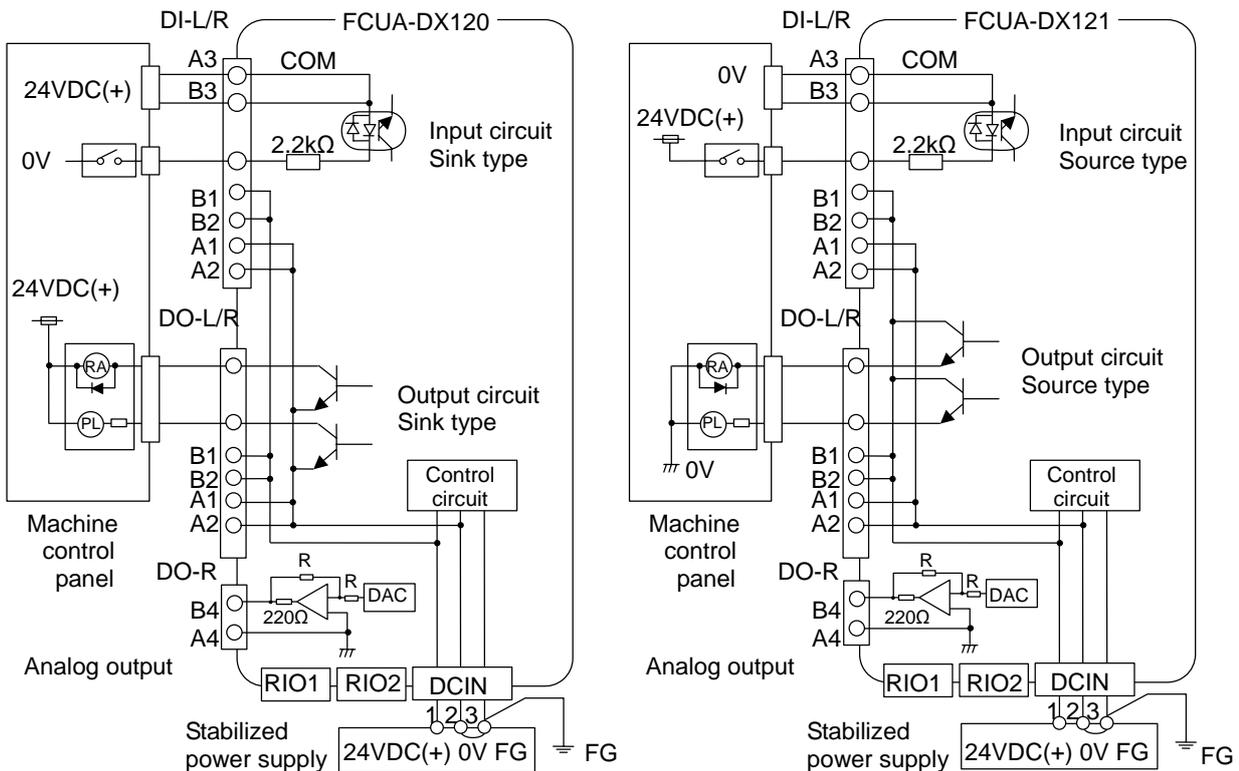
6.10 Connection of FCUA-DX12x Unit and Machine Control Signal

When using a unit with 64 input points, 48 output points and 1 analog output, you need four of the R300 cable (one-end connector) or R301 cable (both-end connector).
 For the R300 cable, refer to APPENDIX 2 (FCUA-R300 cable).
 To manufacture the R300 cable, use the connector set FCUA-CN300 (optional).

For the R301 cable, refer to APPENDIX 2 (FCUA-R301 cable).
 To manufacture the R301 cable, use the connector set FCUA-CS301 (optional).
 The terminal block that applies the R301 cable is the I/O terminal BX1F-T40 by IDEC Corporation.



(1) Outline of connection



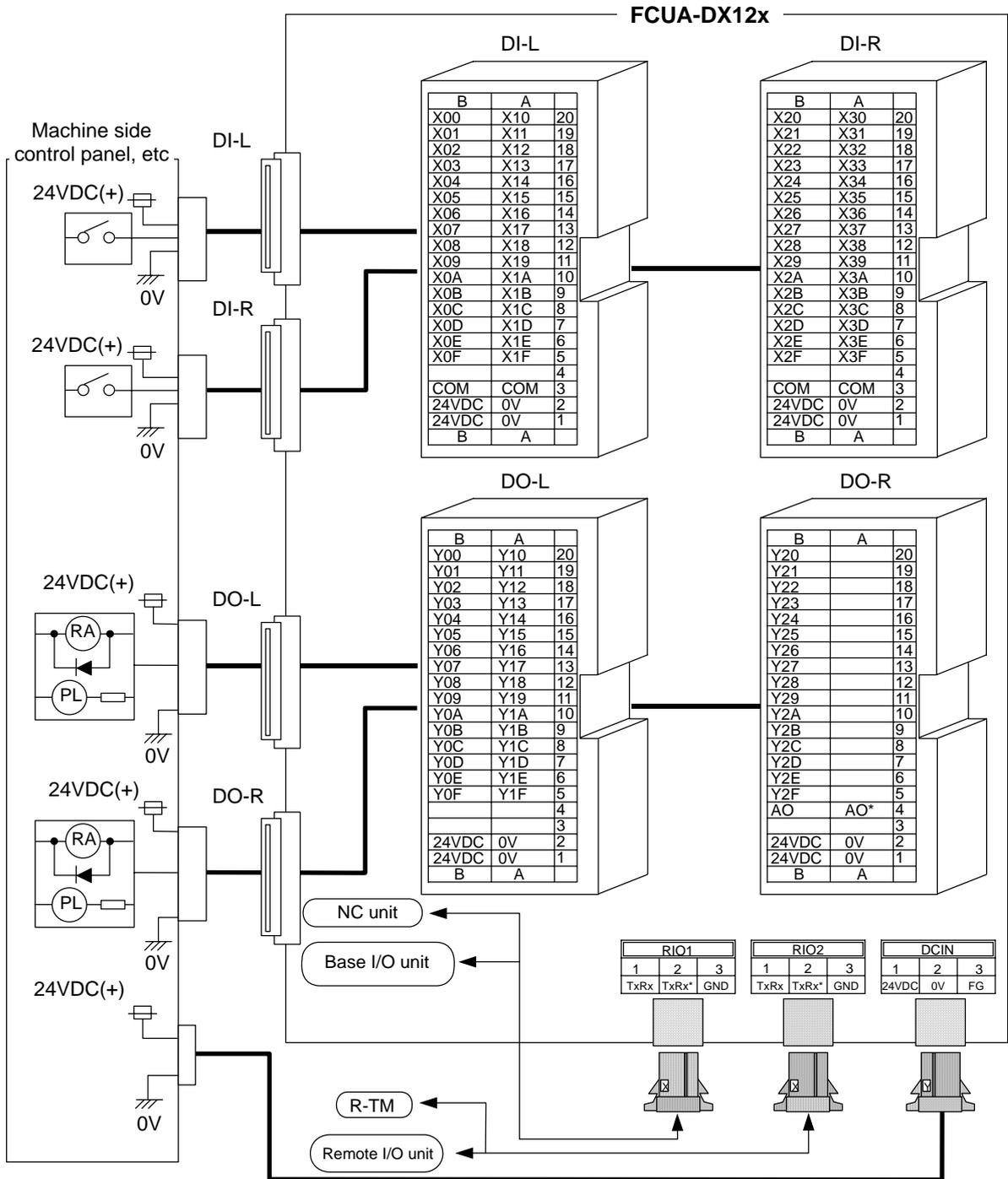
CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

(2) Signal assignment table

When using two or more remote I/O units or when connecting to the NC keyboard, the signal assignment will differ.

Refer to the "PLC Interface Manual" for details.



(3) Adaptive connector

1. DCIN

Connector set name: FCUA-CN220



2. RIO1/RIO2

Connector set name: FCUA-CN211



3. DI-L/DO-L

Connector set name: FCUA-CN300,FCUA-CS301



(4) Others

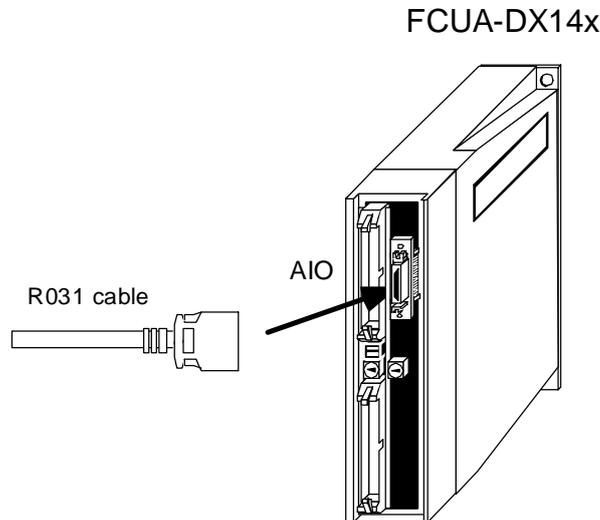
1. Terminator

FCUA-R-TM

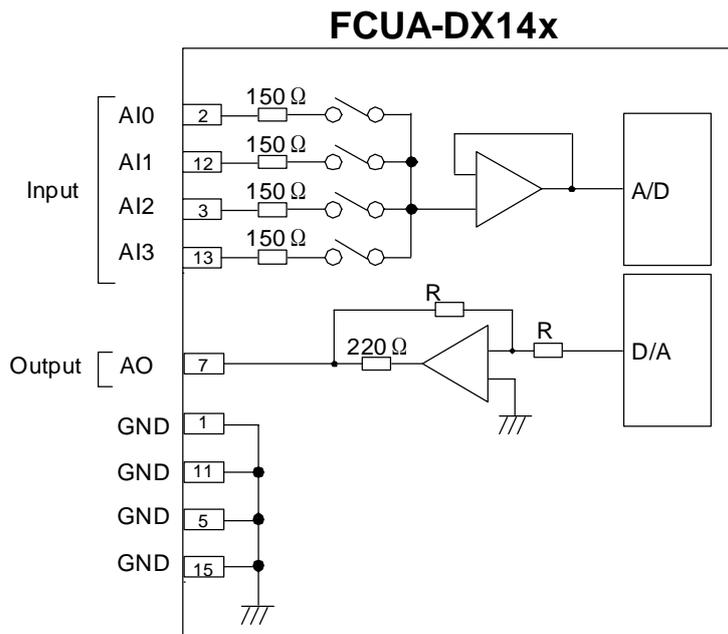


6.11 Connection of FCUA-DX14x Unit and Analog Input/Output Signal

For the analog input/output signal, connect the R031 cable to the connector AIO. Up to four input points and one output of the analog input/output signal can be connected. For the R301 cable, refer to APPENDIX 2 (FCUA-R301 cable). To manufacture the R301 cable, use the connector set FCUA-CS301 (optional).



(1) Input/Output circuit



CAUTION

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

6.12 Setting of Station No. When Using Multiple Remote I/O Units

When the remote I/O unit is connected with serial links (MC link B), multiple units can be used as long as the total No. of occupied stations is within 8 stations.

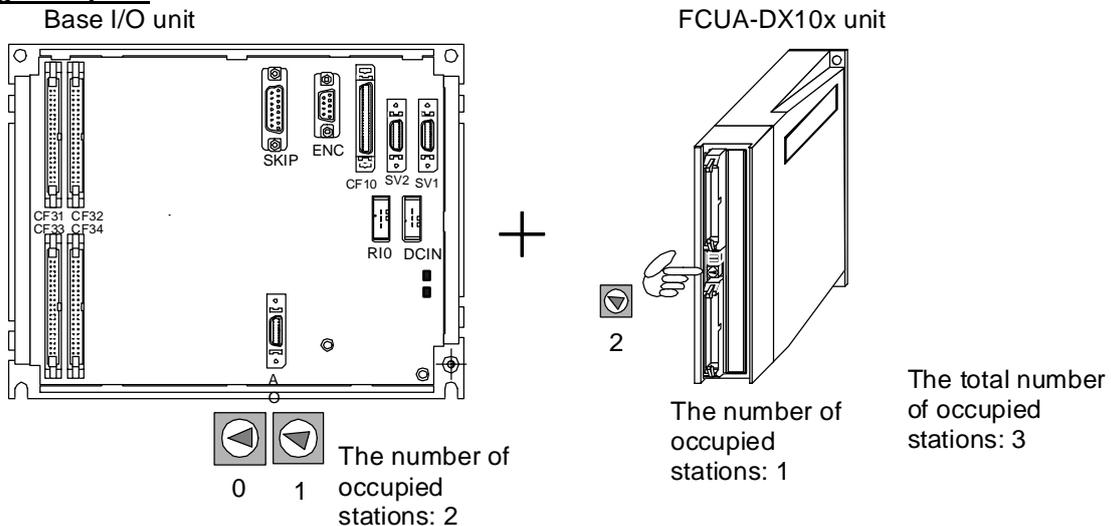
In the case of a remote I/O unit that is connected to the connector RIO of the base I/O unit, as the base I/O unit occupies two stations, No. of stations is 6.

When using multiple remote I/O units, a characteristic station No. must be set for each unit. The FCUA-DX10x unit has one station No. switch, and FCUA-DX11x, DX12x and DX14x units have two switches.

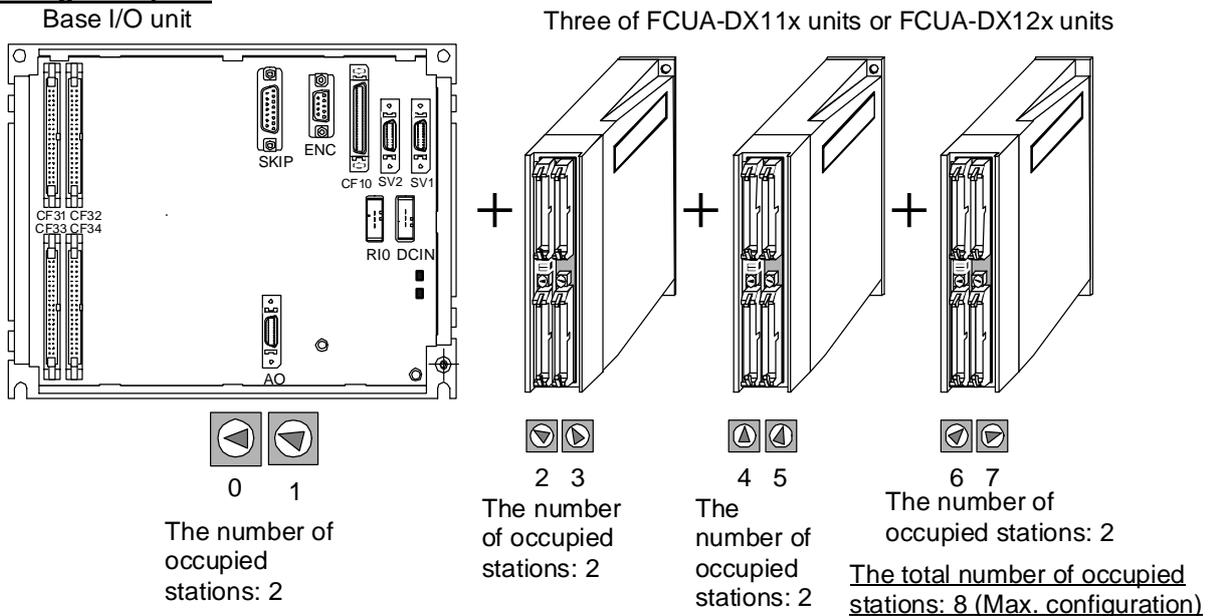
The No. of stations that each unit occupies is as follows.

Unit name	No. of occupied serial link stations
FCUA-DX10x	1
FCUA-DX11x	2
FCUA-DX12x	2
FCUA-DX14x	2

Setting example 1



Setting example 2



-CAUTION-

The assignment of each unit's input/output signal address will change with the setting of the channel No.

Refer to "PLC Interface manual" for details.

7. OPTION CARD

7.1 HR751

PLC accelerator card: This speeds up PLC operation.

7.2 HR753

E60 spindle drive unit connection card: This enables a connection with MITSUBISHI spindle drive unit MDS-□ series.

7.3 FCU6-EP105-1

E68 front IC card I/F unit: The card configuration is HR253, HR551, F161.
PC Card Standard ATA specifications.

- (1) Dedicated for the ATA-compliant memory card (supports FLASH_ATA IC memory card only). I/O card, such as LAN card, cannot be used.
- (2) Supports 5V compatible IC card only. (3.3V compatible products cannot be used.)
- (3) Maximum consumption current for the ATA-compliant memory card has to be 220mA/5V or less.
- (4) Either one of the IC card types, Type I or Type II, can be structurally used. Note that Type III cannot be used.
- (5) A CardBus compliant unit cannot be used. (However, CardBus compatible cables are used.)

II. MAINTENANCE MANUAL

1. DAILY MAINTENANCE AND PERIODIC INSPECTION AND MAINTENANCE

1.1 Maintenance Tools

1.1.1 Measuring instruments

The following measuring instruments are used to confirm that the voltage is being supplied correctly to the NC unit, to confirm that the wiring to the NC unit is correct and to carry out simple trouble shooting.

Tool	Condition	Application
Tester		To check that the wiring to the NC unit is correct before turning the power ON.
AC voltmeter	Tolerable error is $\pm 2\%$ or less.	To measure the AC power voltage being supplied to the external 24VC power supply unit.
DC voltmeter	Tolerable error is $\pm 2\%$ or less.	To measure the DC power voltage. Supply voltage to the connector DCIN (control unit, base IO unit) Battery voltage
Synchroscope		General measurement and simple troubleshooting.

(Note) Currently, a high-accuracy digital multi-meter is commonly used as a tester. This digital multi-meter can be used as both an AC voltmeter and a DC voltmeter.

1.1.2 Tools

- Screwdriver (large, medium, small)
- Radio pliers

1.2 Maintenance Items

Maintenance is categorized into daily maintenance items (items to be carried at set intervals) and periodic maintenance items (replacement of parts when life is reached).

Some functions do not work when the life is reached, so these should be replaced before the life is reached.

Class	Name	Life	Inspection/replacement	Remarks
Daily maintenance	Cleaning escutcheon and keyboard		Once in two months (Accordingly when dirty)	
Periodic maintenance	Battery	Data holding time 50,000 hr	When battery voltage drop caution alarm occurs	
	CRT (FCU6-DUE71 when using display unit)	7,000 hr	When the screen becomes darker	
	LCD (FCU6-DUT11 when using display unit)	20,000 hr	When the screen becomes darker	Backlight cannot be replaced individually.
	LCD (FCU6-DUN24 /FCU6-DUN26 when using display unit)	40,000 hr	When the screen becomes darker	Backlight can be replaced individually.

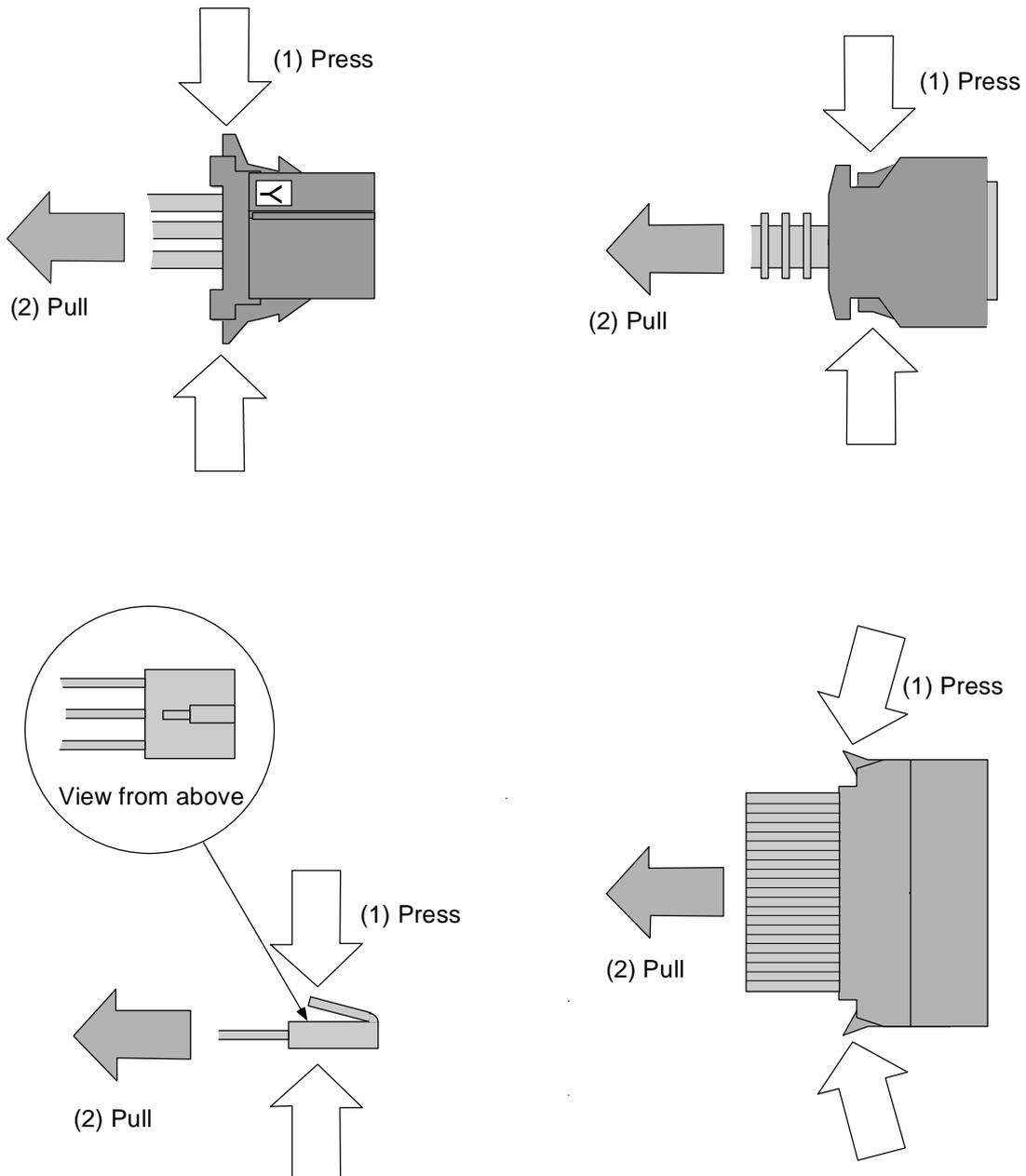
1.3 Replacement Methods

1.3.1 How to connect and disconnect cable

Before connecting or disconnecting the cable, make sure to turn the power OFF. If the cable is replaced with keeping the power ON, the normal unit or peripheral devices could be damaged, and additionally, risks could be imposed.

Disconnect each cable with the following procedures.

- (1) For the following type of connector, press the tab with a thumb and foreigner in the direction of the arrow, and pull the connector off.



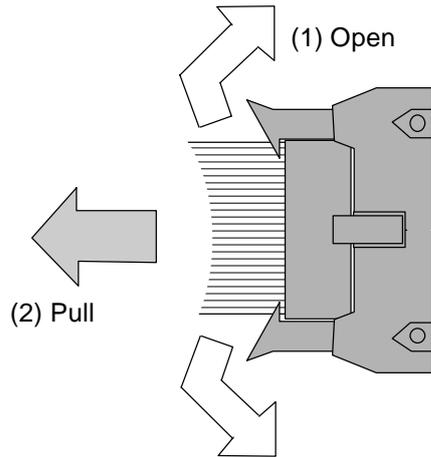
CAUTION

⚠ If the cables are connected incorrectly, machine could be damaged. Make sure to connect cables with correct connectors.

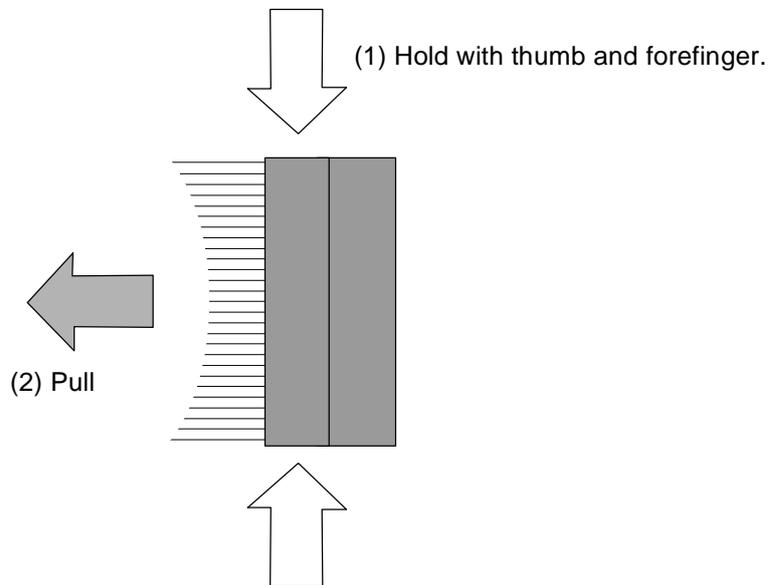
⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

⊘ Do not connect or disconnect the cable by pulling on the cable.

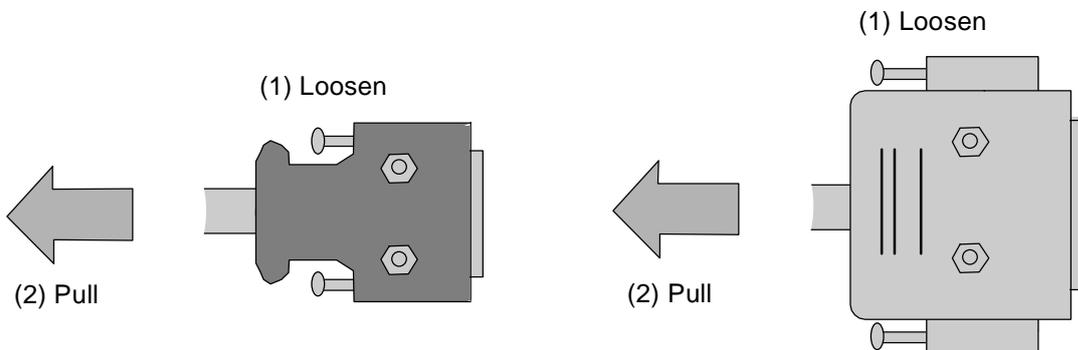
(2) For a flat cable type connector with latches, in the direction of the arrows, and pull the connector off.



(3) For a flat cable type connector without latches, hold the connector with a thumb and forefinger, and pull the connector off.



(4) For the screw fixed type connector, loosen the two fixing screws, and pull the connector off.



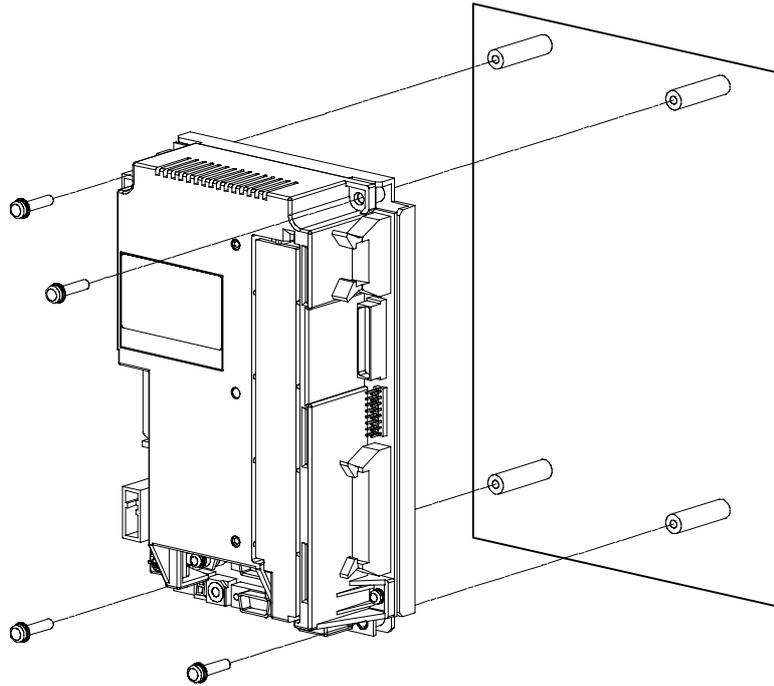
CAUTION

-  If the cables are connected incorrectly, machine could be damaged. Make sure to connect cables with correct connectors.
-  Do not connect or disconnect the connection cables between each unit while the power is ON.
-  Do not connect or disconnect the cable by pulling on the cable.

1.3.2 Replacing control unit

Always replace the control unit with the electric cabinet power turned OFF.

- (1) Confirm that electric cabinet power is turned OFF.
- (2) Open the electric cabinet door.
- (3) Disconnect all cables connected to the control unit.
- (4) Remove the 4 screws fixing the control unit, and remove the control unit. At this time, handle with care not to drop the control unit.
- (5) Replace with a new control unit, and fix the control unit with 4 fixing screws.
- (6) Connect all cables that were connected with the control unit before the replacement.
- (7) Confirm the connection omissions or faulty connections etc. of cables and wires, then close the electric cabinet door.



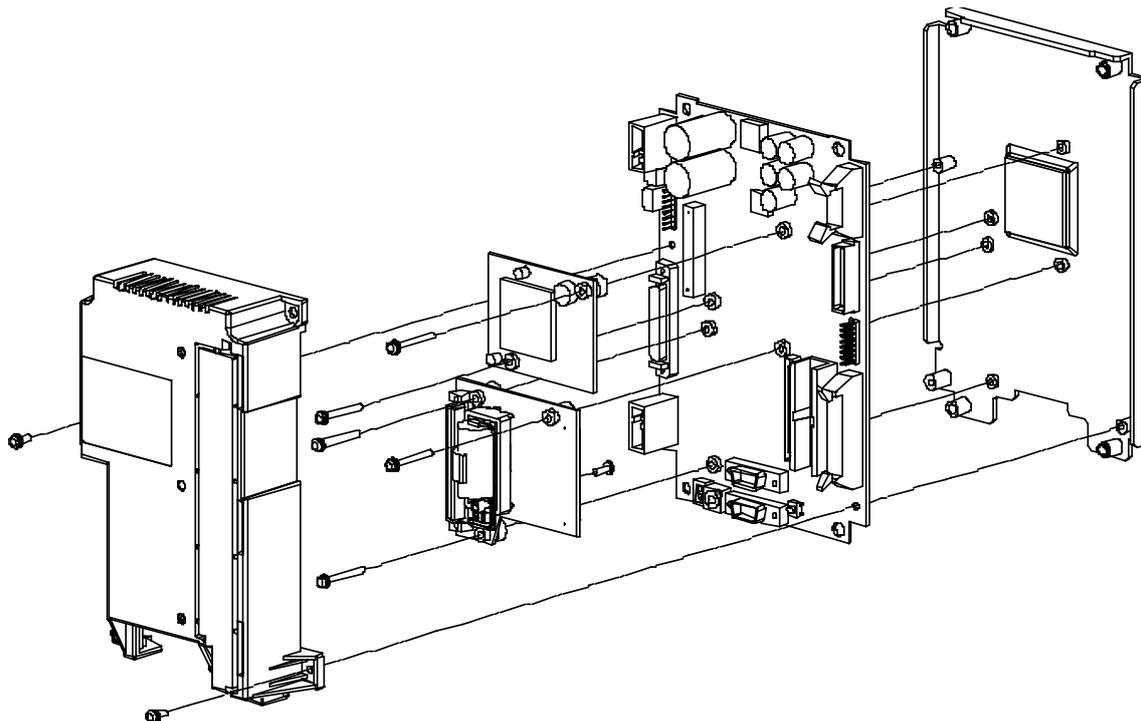
⚠ CAUTION

- ⚠ If the cables are connected incorrectly, machine could be damaged. Make sure to connect cables with correct connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⊘ Do not connect or disconnect the cable by pulling on the cable.

1.3.3 Replacing control PCBs mounted inside of the control unit

Before replacing the control PCBs including memory PCB (HR741/HR742), external PLC PCB (HR751), E60 spindle serial connection PCB (HR753) and main PCB (HR761/HR763), always remove the control unit according to the procedures described in [1.3.3 Control unit replacement] to prevent the fitting screws etc. from dropping.

- (1) Remove 2 screws fixing the case and remove the case from control unit.
- (2) In case of replacing memory PCB (HR741/HR742), remove 3 screws fixing the memory PCB and disconnect the cable connecting the main PCB with the connector.
- (3) In case of replacing external PLC PCB (HR751)/E60 spindle serial connection PCB (HR753), remove 2 screws fixing PCB and disconnect the cable connecting the main PCB. (These PCBs are option items and are not installed under the basic configuration.)
- (4) In case of removing the memory PCB (HR761/HR763), remove the screws fixing the memory PCB and external PLC PCB/E60 spindle serial connection PCB so that the memory PCB can be removed from the base plate. To remove from the base plate, remove with force as heat conduction rubber is attached between the main PCB and base PCB.
- (5) In case of replacing memory PCB (HR741/HR742) or external PLC PCB (HR751)/E60 spindle serial connection PCB (HR753) only, connect a new module with the connector of the PCB and fix with screws.
- (6) In case of replacing the main PCB (HR761/HR763), confirm that the heat conduction rubber remains on base plate side, mount a new PCB, connect the main PCB and external PLC PCB with the connector of main PCB and fix with screws.
- (7) Fix the case with 2 screws.
- (8) Attach the control unit to the keyboard unit/display unit following the procedures described in [1.3.3 Control unit replacement].



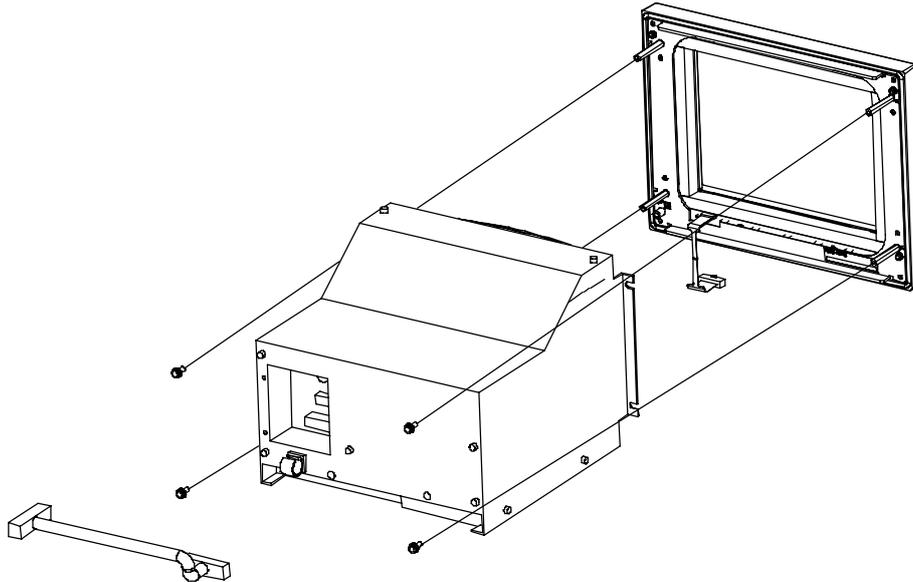
⚠ CAUTION

- ⚠ If the cables are connected incorrectly, machine could be damaged. Make sure to connect cables with correct connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⊘ Do not connect or disconnect the cable by pulling on the cable.
- ⊘ Do not connect or disconnect each PCB module while the power is ON.

1.3.4 Replacing CRT

Always replace the CRT with the electric cabinet power turned OFF.

- (1) Confirm that the electric cabinet power is turned OFF.
- (2) Open the electric cabinet door.
- (3) Disconnect all cables connected to CRT.
- (4) Remove 4 screws fixing the CRT onto base plate and remove CRT. At this time, handle with care not to drop the CRT.
- (5) Replace with a new CRT and fix it with 4 screws onto the base plate.
- (6) Connect all the cables that were connected to the CRT before the replacement.
- (7) Confirm the connection omissions or faulty connections etc. of cables and wires, then close the electric cabinet door.



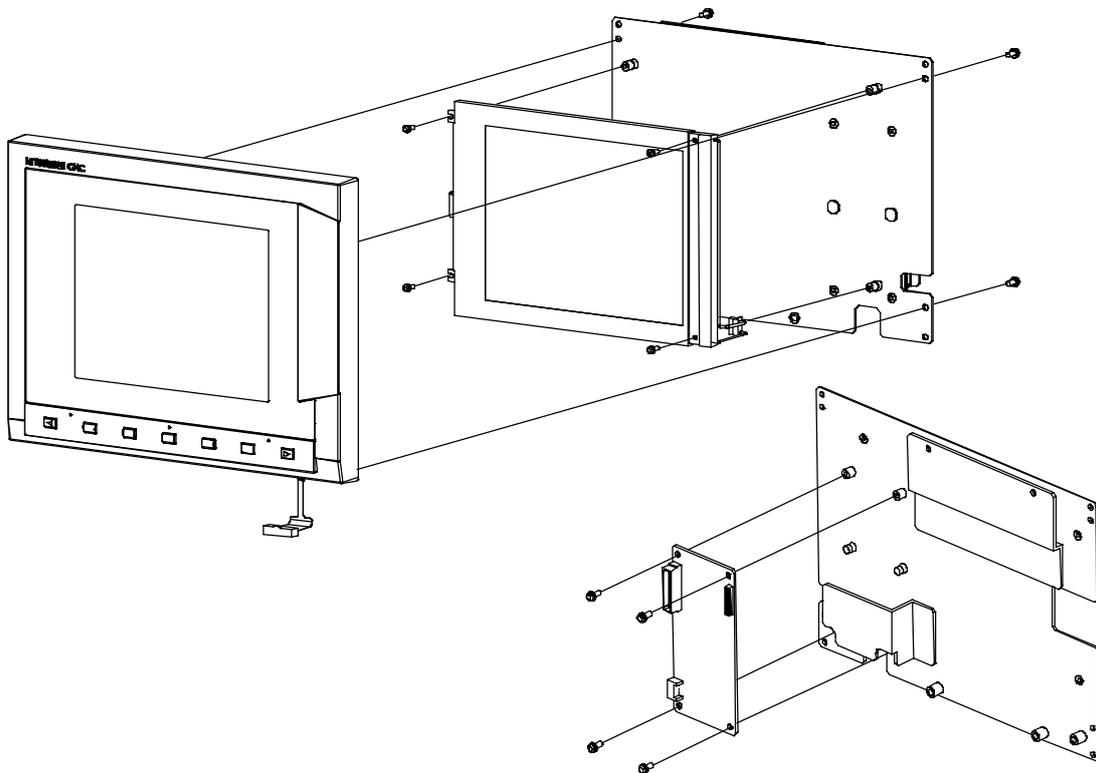
⚠ CAUTION

- ⚠ If the cables are connected incorrectly, machine could be damaged. Make sure to connect cables with correct connectors.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⊘ Do not connect or disconnect the cable by pulling on the cable.

1.3.5 Replacing LCD

Always replace the LCD with the electric cabinet power turned OFF.

- (1) Confirm that the electric cabinet power is turned OFF.
- (2) Open the electric cabinet door.
- (3) From the back of the display unit, disconnect the cable of menu key on keyboard side and 2 cables connected to LCD panel.
- (4) Remove the 4 screws fixing the escutcheon from the back of the display unit.
- (5) From the front of display unit, remove 4 screws fixing the LCD panel as LCD panel appears at the surface. At this time, handle with care not to drop the LCD.
- (6) Attach a new LCD panel and fix onto the base plate with 4 screws.
- (7) Attach an escutcheon and fix with 4 screws from the back of the display unit.
- (8) Connect all cables that were connected to the LCD panel before the replacement. Connect the menu key cable with the keyboard unit.
- (9) Confirm the connection omissions or faulty connections etc. of cables and wires, then close the electric cabinet door.



In case of replacing the back light power supply PCB (HR721) at the back of the display unit, turn the electric cabinet power OFF before the replacement.

- (1) Confirm that the electric cabinet power is turned OFF.
- (2) Open the electric cabinet door.
- (3) From the back of the display unit, disconnect the 3 cables connected to the backlight power supply PCB.
- (4) Remove the screws fixing onto the base plate.
- (5) Attach a new backlight power supply PCB and fix onto the base plate with 4 screws.
- (6) Connect all the cables that were connected to the backlight power supply PCB before the replacement.
- (7) Confirm the connection omissions or faulty connections etc. of cables and wires, then close the electric cabinet door.

CAUTION

⚠ If the cables are connected incorrectly, machine could be damaged. Make sure to connect cables with correct connectors.

⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

⊘ Do not connect or disconnect the cable by pulling on the cable

1.4 Cleaning and Handling

1.4.1 Escutcheon

Wipe surface of the escutcheon and keyboard with a soft, clean and dry cloth. If cleaning still required, put some neutral detergent on a cloth and wipe. Do not use alcohol, thinner etc. Make sure that the liquid does not infiltrate inside as the escutcheon and the keyboard are not specified as waterproof.

1.4.2 Handling CRT

(1) Influence of the magnetic field

CRT displays the screen by scanning the electric beam with magnetic field, therefore, the display is affected by the external magnetic field. Mind the external magnet field as it causes "screen distortion" or "screen blurring".

In case that the cabinet to contain the CRT with is made of iron plate, magnetizing could occur by attaching the magnetic stand. Note that the "screen distortion" can be caused in such case also. In this case, the magnetic field caused by the motor, transformer and magnetized workpiece will affect.

(2) Cathode-ray tube life

Generally, it is said that the life of the cathode-ray tube is approx. 7,000 hours.

However, this means the time for the emission rate to become lower than 70% of the initial emission rate (though this percentage depends on each cathode-ray tube makers) and it does not mean that the cathode-ray tube cannot be used any more. Although the brightness of the screen will be darker as for the phenomenon, the cathode-ray tube can be used continuously.

(3) Adjustment

CRT has already been adjusted at the factory before the shipment, thus, no adjustment is required.

1.4.3 Handling the LCD

(1) Precautions for use

- (a) Polarizing plate (display surface) of the LCD panel surface can be easily scratched, so be careful during handling.
- (b) Glass is used in the LCD panel. Be careful not to drop the LCD panel or allow it to hit hard objects, as the glass may chip or break.
- (c) The polarizing plate may be stained or discolored if drops of water, etc., adhere to it for long periods, so be sure to wipe off any moisture immediately.
- (d) Wipe off any dirt, dust, etc., on the polarizing plate using absorbent cotton or other soft cloth.
- (e) A COMS LSI is used in the LCD panel, so be careful of static electricity when handling.
- (f) Never disassemble the LCD panel. Doing so will damage the panel.

(2) Precautions for storage

- (a) Do not storage the LCD panel in locations having a high unit temperature or humidity. (Store within the storage temperature range)
- (b) When storing panel as an individual unit, be sure that other projects do not touch or hit the polarizing plate (display surface).
- (c) When storing the LCD panel for long periods, be sure to store in a dark place away from exposure to direct sunlight or fluorescent light.

(3) Backlight life

The life of the backlight is 20,000 hours for the FCU6-DUT11 and 40,000 hours for the FCU6-DUN24/FUC6-DUN26 (ambient temperature 25°C). (Time for luminance to drop to 50% of initial value.)

The backlight life depends on the temperature. The life tends to be shorter when used continuously at lower temperatures.

The backlight cannot be replaced as an individual unit. When the backlight life is over, LCD panel has to be changed.

(4) Luminance start

Due to the characteristics of the backlight, the luminance could drop slightly at lower temperatures. It will take approx. 10 to 15 minutes for the luminance to reach the rated value after the power is turned ON.

(5) Unevenness, luminescent spots and irregularities

Uneven brightness, small luminescent spots or small dark spots may appear on LCD, but this is not a fault.

1.4.4 ATA Memory Card

(1) Handling the PCMCIA card

The general handling methods for the PCMCIA card are described below.

Refer to the instruction manual of the PCMCIA card used for details.

(a) Precautions for use

- 1) Insert the card in the correct direction.
- 2) Do not touch the connector area with the hands or metal.
- 3) Do not apply excessive force to the connector area.
- 4) Do not subject the card to bending or strong impacts.
- 5) Do not open the cover or disassemble the card.
- 6) Do not use the card in dusty locations.

(b) Precautions for storage

- 1) Do not store the card in locations having a high temperature or humidity.
- 2) Do not store the card in dusty locations.

1.5 Durable Parts

1.5.1 Replacing battery

All data, such as the parameters and machining programs that need to be backed up when the power is turned OFF, are saved by lithium battery installed in the control unit's battery holder.

Replace the battery when the battery voltage drop caution alarm appears on the NC screen. The internal data could be damaged if the battery voltage drop warning alarm appears.

Battery -----	Q6BAT (CR17335SE-R produced by SANYO with MITSUBISHI specifications)
Initial battery voltage -----	3V
Voltages at which voltage -- drop is detected	2.7V (Battery voltage drop caution alarm screen display) 2.5V (Battery voltage drop warning alarm screen display + control unit LED)
Battery cumulative data -----	50,000 hours (At room temperature. The life will be shorter if the holding time temperature is high.)
Battery life -----	Approx. 5 years (from date of battery manufacture)
Discharge current -----	40μA or less

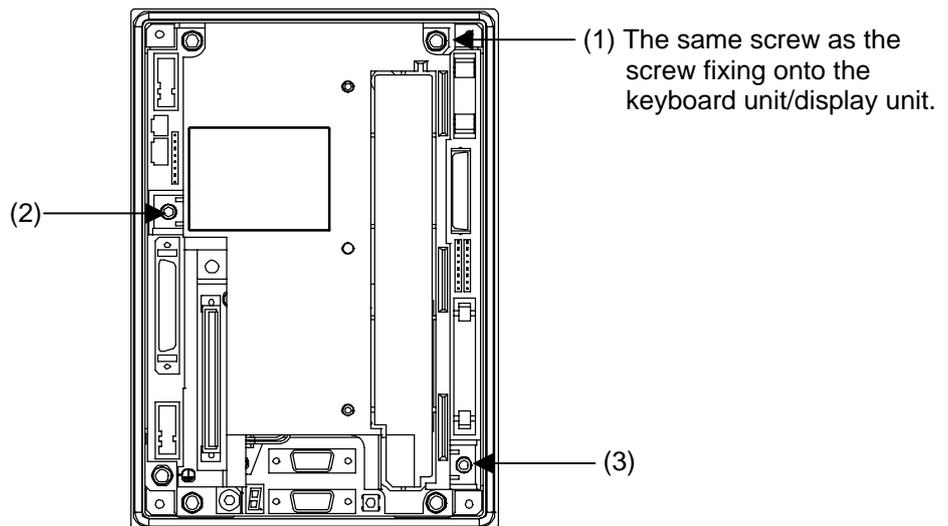
Always replace the battery with the control unit power turned OFF.

Complete the replacement within 30 minutes after turning the power OFF. (If the battery is not connected within 30 minutes, the data being backed up will be destroyed.)

- (1) Turn the machine power OFF.
- (2) Open the machine control panel door and confirm that the control unit is OFF.
- (3) Remove the 3 screws fixing the cover onto the control unit, and remove the cover.
- (4) Remove the battery from the battery holder.
- (5) Pull the connector connected to the battery out from the memory PCB.
- (6) Replace the battery with the new one. Insert connector connected to a new battery into connector orientation, being careful not to insert backwards.
- (7) Fit the battery into the battery holder.
- (8) Attach the cover of the control unit and fix with 3 screws. At this time, make sure to use the correct type of screws.
- (9) Close the door of the machine control panel.

How to remove the control unit cover

Remove the screw (1) to (3).



CAUTION

! If the battery voltage drop warning alarm occurs, replace the battery after saving the programs, tool data and parameters with input/output device after replacing the battery.

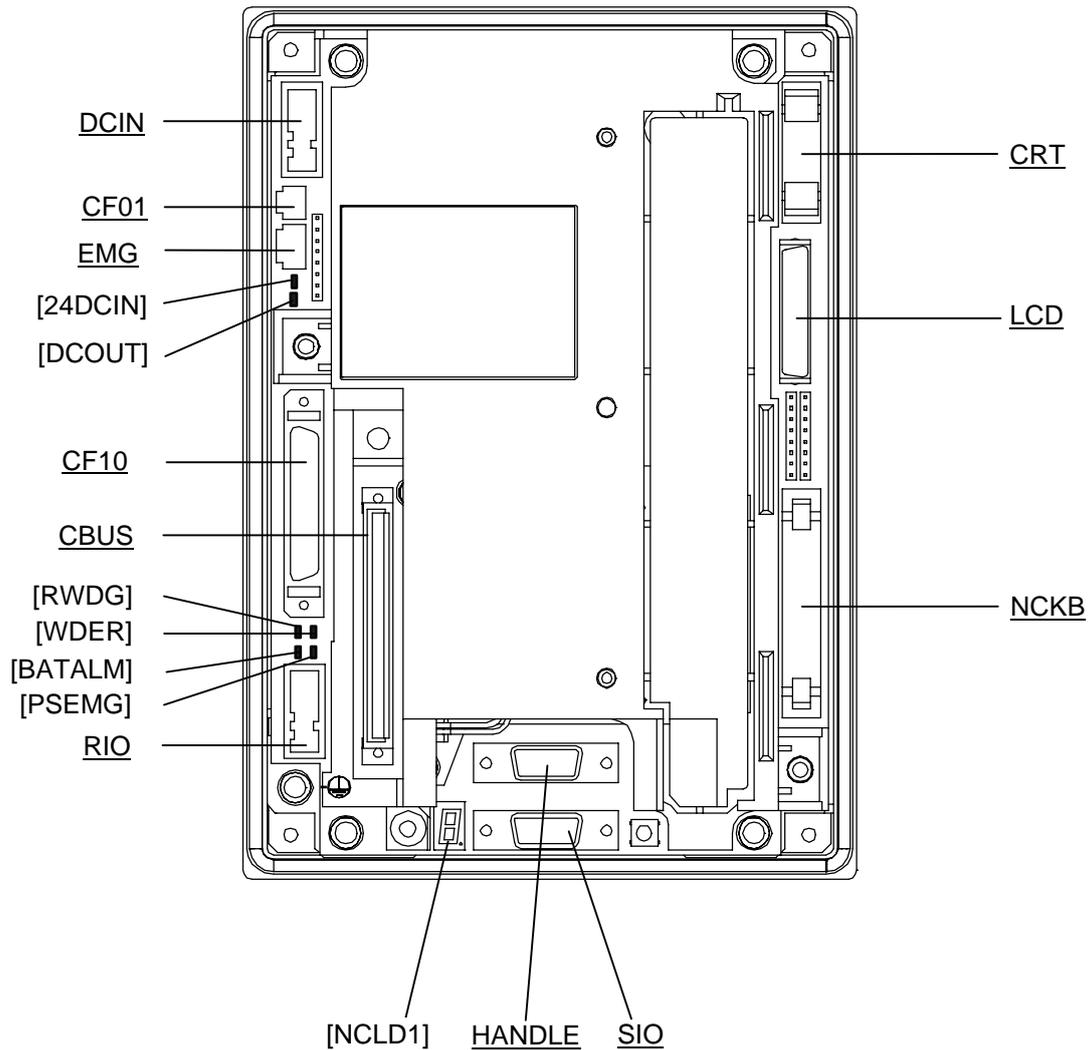
! Do not short circuit, charge, overheat, incinerate or disassemble the battery.

! Dispose the spent battery according to local laws.

2. TROUBLESHOOTING

2.1 List of Unit LEDs

2.1.1 List of control unit LED

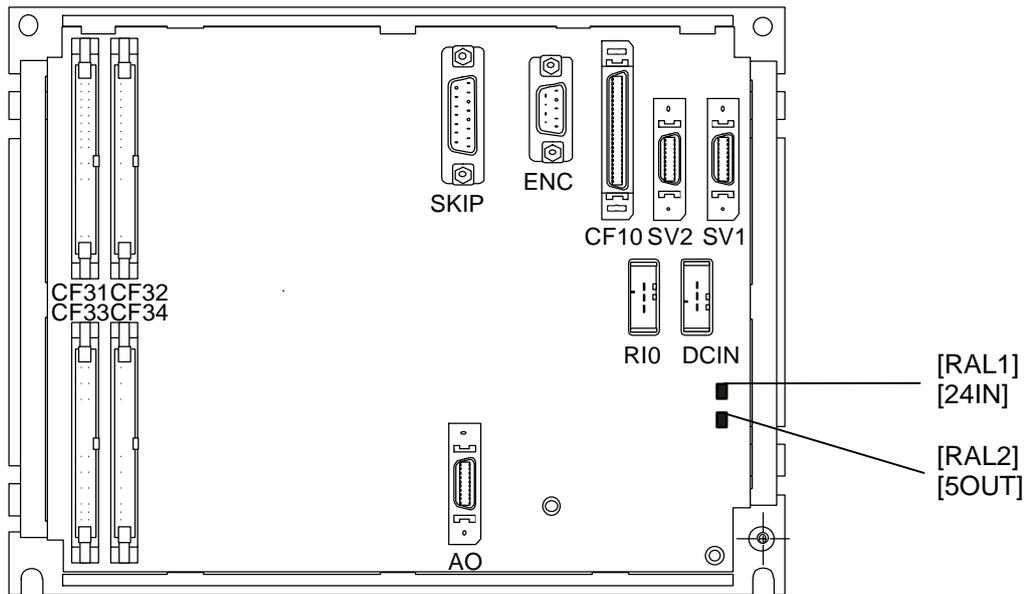


(Note) The underlined names are names of connectors.

[Explanation of LED functions]

Name	Function	Color	Status		Correspondence for error
			When normal	During error	
24DCIN	During DC24V supply	Green	Lit	Not lit	Refer to 2.2.2 (1)
DCOUT	During internal power output	Green	Lit	Not lit	
RWDG	Remote IO watchdog error	Red	Not lit	Lit	Refer to 2.2.2 (2)
WDER	Watchdog error	Red	Not lit	Lit	
PSEMG	Emergency stop	Red	Not lit	Lit	
BATARM	Battery drop warning	Red	Not lit	Lit	
NCLD1	System status display	Red	System status is displayed.		

2.1.2 List of base IO unit LED



[Explanation of LED functions]

Name	Function	Color	Status		Correspondence for error
			When normal	During error	
RAL1	Remote IO 1st station communication error	Red	Not lit	Lit	Refer to 2.2.2 (5)
24IN	During DC24V supply	Green	Lit	Not lit	
RAL2	Remote IO 1st station communication error	Red	Not lit	Lit	
5OUT	During internal power supply outputted	Green	Lit	Lit	

2.2 Trouble shooting

2.2.1 Confirmation of trouble state

Confirm "when", "when doing what", and "what kind of" trouble occurred.

(1) When?

What time did the trouble occur?

(2) When doing what?

What was the NC operation mode?

-During automatic operation --- Program No., sequence No. and program details when the trouble occurred.

-During manual operation ----- What was the manual operation mode?

What was the operation procedure?

What were the previous and next steps?

-What was the setting display unit screen?

-Did the trouble occur during input/output operations?

-What was the machine side state?

-Did the trouble occur while replacing the tools?

-Did hunting occur in the control axis?

(3) What kind of trouble?

-What was displayed on the setting display unit's Alarm Diagnosis screen?

Display the Alarm Diagnosis Screen, and check the alarm details.

-What was displayed for the machine sequence alarm?

-Is the CRT and LCD screen normal?

(4) How frequently?

-When did the trouble occur? What was the frequency? (Does it occur when other machines are operating?) If the trouble occurs infrequently or if it occurs during the operation of another machine, there may be an error in the power voltage or the trouble may be caused by noise etc.

Check whether the power is normal (does it drop momentarily when other machines are operating?), and whether the noise measures have been taken?

-Does the trouble occur during the specific mode?

-Does the trouble occur when the overhead crane is operating?

-What is the frequency in the same workpiece?

-Check whether the same trouble can be repeated during the same operation.

-Check whether the same trouble occurs when the conditions are changed.

(Try changing the override, program details, and operation procedures, etc.)

-What is the ambient temperature?

(Was there a sudden change in the temperature? Was the fan at the top of the control unit rotating?)

-Is there any contact defect or insulation defect in the cables?

(Has any oil or cutting oil splattered onto the cables?)

2.2.2 When in trouble

If the system does not operate as planned or if there is any trouble in the operation, confirm the flowing points and then contact the Mitsubishi Service Center.

[Examples of trouble]

-The power does not turn ON.

-The power turns off suddenly.

-Nothing appears on the screen.

-The operation keys do not function.

-Machining operation is not possible.

(1) Problem related to the power supply

The power does not turn ON.	
Cause	Remedy
The external power supply is faulty.	Check that the power can be turned ON with just the external power supply. Check also that the input voltage is within 200V to 230VAC and output voltage is 24VDC±5%.
24VDC power supply cable is connected incorrectly.	Check the cables and wires again. Check also that the output voltage is 24VDC±5% at the connector end on control unit side.
The ON/OFF cable is short-circuited. (when using PD25 power supply unit)	Check the cables and wires again.
The external power turns ON but the power supply of the control unit does not turn ON.	
Cause	Remedy
The external power supply output is not correct.	Check that the output voltage is 24VDC±5% at the connector end on control unit side.
24VDC power supply connector is pulled off or disconnected.	Insert the connector on control unit side firmly. Check the cables and wires again.
The cable connected from the NC unit to the peripheral device is short-circuited.	Disconnect the cable connected to the peripheral device one at a time and check that the external power supply output is normal.
The control unit is broken.	Check whether the "DCOUT" (green) LED on control unit is lit without connecting the cables to the peripheral device. If the "24DCIN" (green) LED turns ON and "DCOUT" does not turn ON, internal power supply circuit is damaged.
The power turns OFF.	
Cause	Remedy
There is a problem in the power socket.	Check whether the voltage fluctuates at certain time zones. Check whether an instantaneous power failure has occurred.
A problem occurs when peripheral device starts operating.	Check whether voltage drop instantaneously when the peripheral device operation starts.

(2) Problems related to the control unit

The NC does not start-up correctly.	
Phenomenon	Remedy
8 is displayed on the control unit's 7-segment LED "NCLD1".	Check that the rotary switch NCSYS is set to 0. If not set to 0, set to 0 and restart.
E or F is displayed on the control unit's 7-segment LED "NCLD1".	The control unit is possibly broken.
The "BATALM" (red) LED on control unit is lit.	
Cause	Remedy
"BATALM" is lit when the voltage of the battery connected to the control unit becomes less than 2.5V.	Replace the battery.
The "PSEMG" (red) LED on control unit is lit.	
Cause	Remedy
The external emergency stop switch is the emergency stop status. Or, the connector "EMG" is disconnected.	In case that the emergency stop status cannot be canceled with the external emergency stop switch, check the cables and wires.
The "WDER" (red) LED on control unit is lit.	
Cause	Remedy
The system processing is not completed within the timeout time.	The control unit is possibly broken.

The "RWDG" (red) LED on control unit is lit.	
Cause	Remedy
Remote IO system processing is not completed within the timeout time.	The control unit is possibly broken.

(3) Problems related to display unit

CRT screen is not displayed.	
Cause	Remedy
The CRT power supply (100VAC) is not supplied.	Check the cables and wires again.
F590 cable is not connected to the control unit.	Check the cables and wires again.
Other problems	Control unit or CRT is possibly broken.
CRT screen is disturbed.	
Cause	Remedy
CRT screen is affected by the external magnetic field.	Reconsider the installation so that the screen is not affected by the magnetic field.
F590 cable is defect.	Check the cables and wires again.
Other problems	Control unit or CRT is possibly broken.
LCD screen is not displayed.	
Cause	Remedy
F090 is not connected to the control unit.	Check the cables and wires again.
The cable connected from HR721/HR722 cable to LCD panel is disconnected.	Check the cables and wires again.
Other problems	HR721/HR722 card or the control unit is possibly broken.
LCD screen is disturbed.	
Cause	Remedy
Cable is defect.	Check the cables and wires again.
Other problems	HR721/HR722 card or the control unit is possibly broken.
LCD screen is dark and not easy to see.	
Cause	Remedy
The surface of LCD is exposed to the direct rays of the sun and the screen looks darker.	Shut the direct rays of the sun.
The backlight life has been reached.	LCD panel has to be replaced. (The backlight cannot be replaced individually.)

(4) Problems related to the keyboard unit

The input with menu keys is not input.	
Cause	Remedy
The attached cable of the menu key is not connected.	Check the cables and wires again.
The input with NC keys is not input.	
Cause	Remedy
F053/F054 cable is not connected.	Check the cables and wires again.

(5) Problems related to the base IO unit

The external power supply turns ON but the power supply of the base IO unit does not turn ON.	
Cause	Remedy
The external power supply output is not correct.	Check that the output voltage is 24VDC±5% at the connector end on base IO unit side.
The 24VDC power supply cable is pulled out or disconnected.	Insert the connector on base IO unit side firmly. Check the cables and wires again.
The cable connected from the base IO unit to the peripheral device is short-circuited.	Disconnect the cable connected to the peripheral device one at a time, and check that the external power supply output is normal. Check that there are no short circuited cables.
Base IO unit is broken.	Check whether the "5OUT" (green) LED on base IO unit is lit without connecting the cables to the peripheral device. If the "24DCIN" (green) LED turns ON and "5OUT" does not turn ON, internal power supply circuit is damaged.
The power supply of the base IO unit turns ON but the machine input/output signal is not inputted nor outputted.	
Cause	Remedy
The power for the machine input/output is not supplied.	The control power supply of base IO unit is separated from that for machine input/output. Thus, the machine input/output power supply has to be supplied separately.
Cable is not connected to the connector CF31 to CF34. Or, the connected connector is not correct.	Check the cables and wires again.
Sink connection or source connection is incorrect.	2 types of base IO unit are used. One is FCU6-HR341/DX220 for sink connection and FCU6-HR351/DX221 for source connection. Check whether the correct unit is used.
Other problems	Base IO unit is possibly broken.
The "RAL1" "RAL2" (red) LED turns ON.	
Cause	Remedy
Remote IO cable (FCUA-R211, SH41) is not connected. Or the cable is snapped.	Check the cables and wires again.
The station number setting of the remote IO unit to be connected with base IO unit is not correct.	Set the station number of remote IO unit to 2 to 7 as 0 and 1 are used by base IO unit.
Other problems	Base IO unit is possibly broken.

⚠ CAUTION

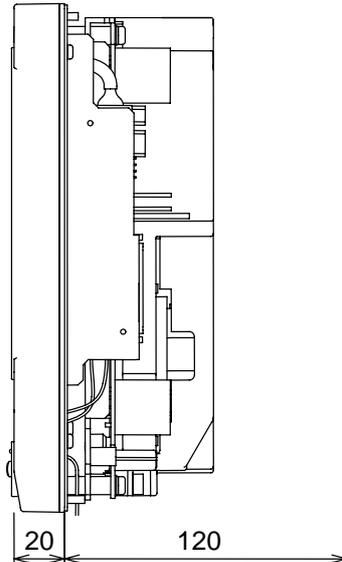
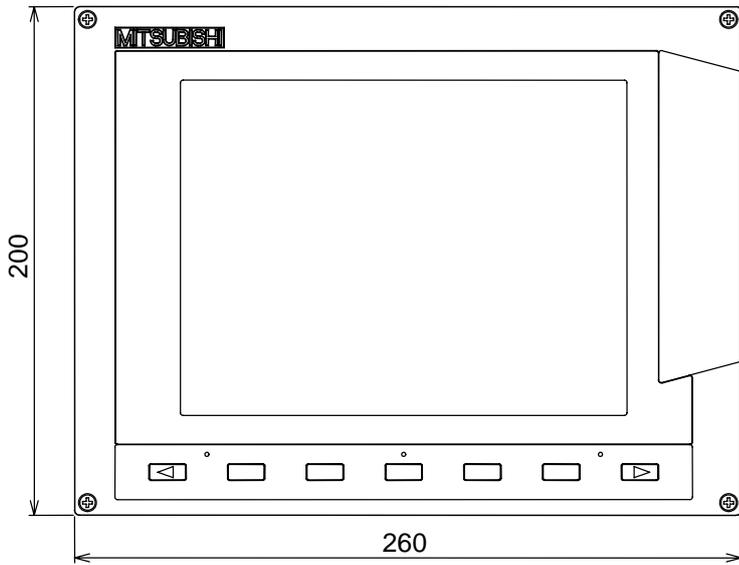
-  **Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.**
-  **If the cables are connected incorrectly, machine could be damaged. Make sure to connect cables with correct connectors.**
-  **Do not connect or disconnect the connection cables between each unit while the power is ON.**
-  **Do not connect or disconnect the cable by pulling on the cable.**

III. APPENDIX

APPENDIX 1. OUTLINE DRAWING

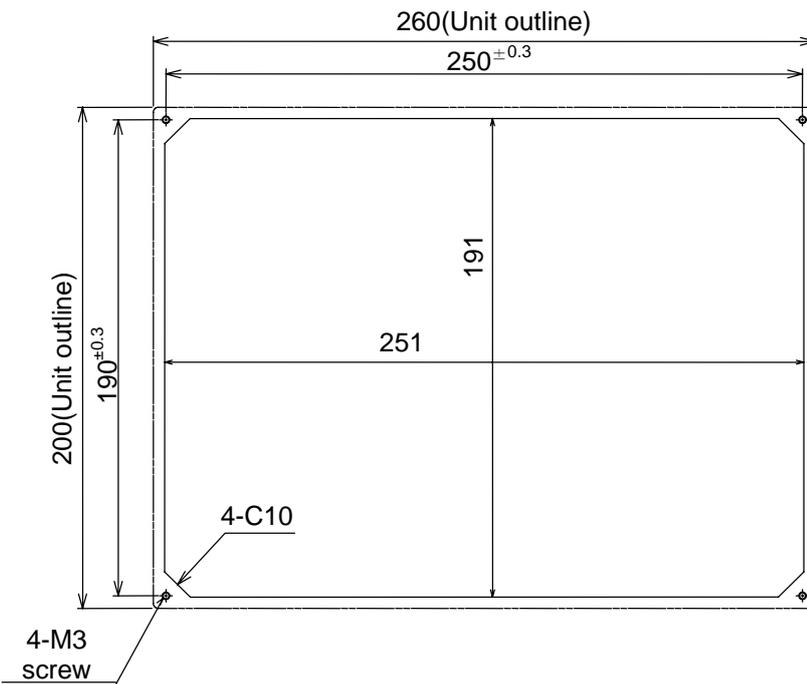
Appendix 1.1 E60 Control Unit, Display Unit, Keyboard Unit Outline Drawing

Appendix 1.1.1 Control unit, display unit (FCU6-MU071, FCU6-DUN26) outline drawing

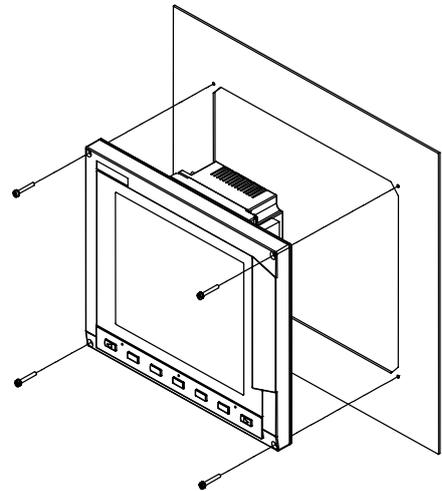


(Space required for wiring:
with expansion PCB)

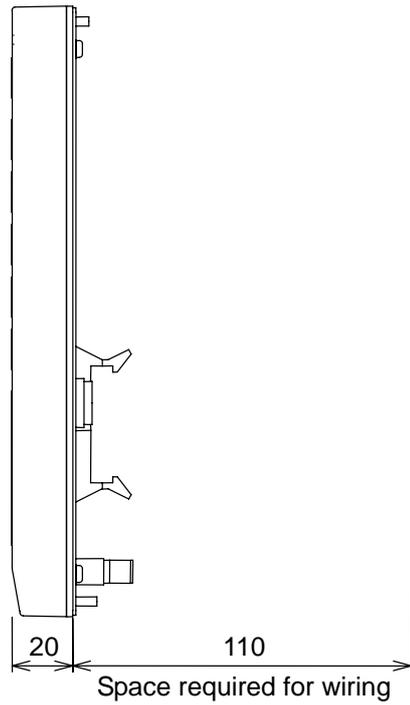
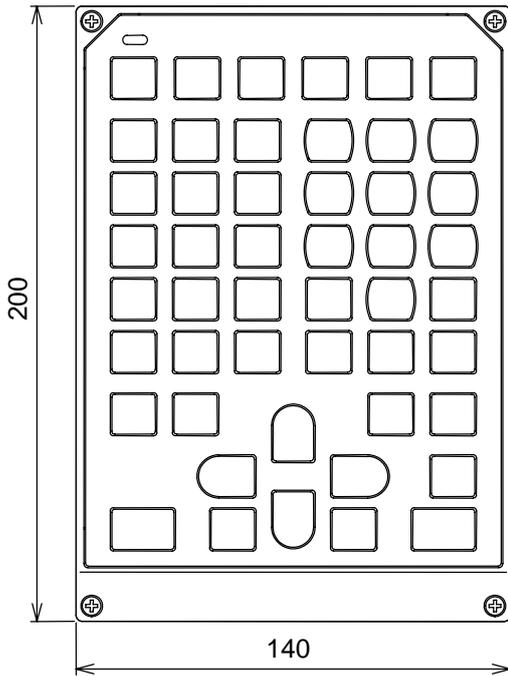
Panel-cut drawing



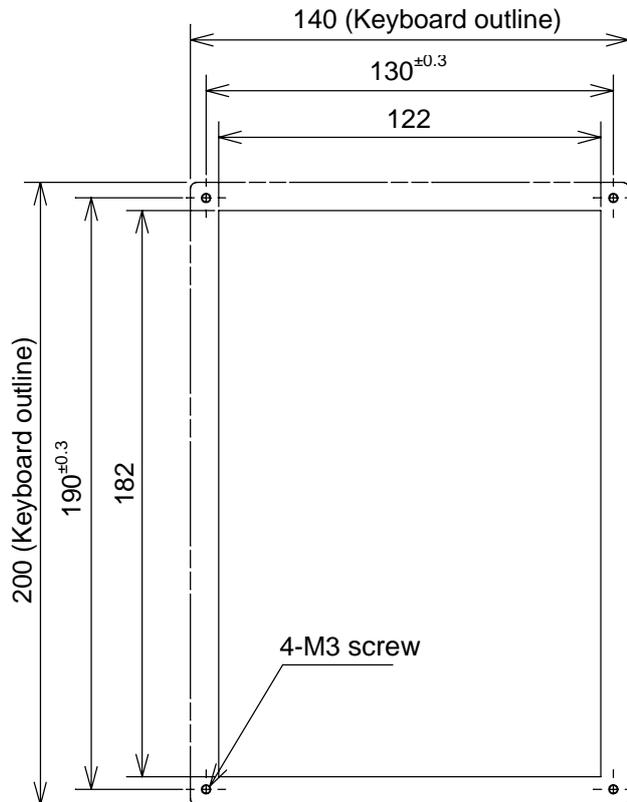
How to fix with screws
from the front of the unit (Reference)



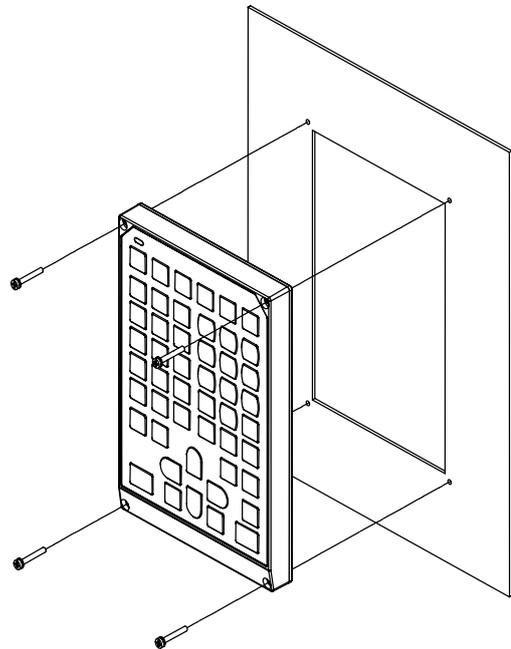
Appendix 1.1.2 Keyboard unit (FCU6-KB024) outline drawing



Panel-cut drawing

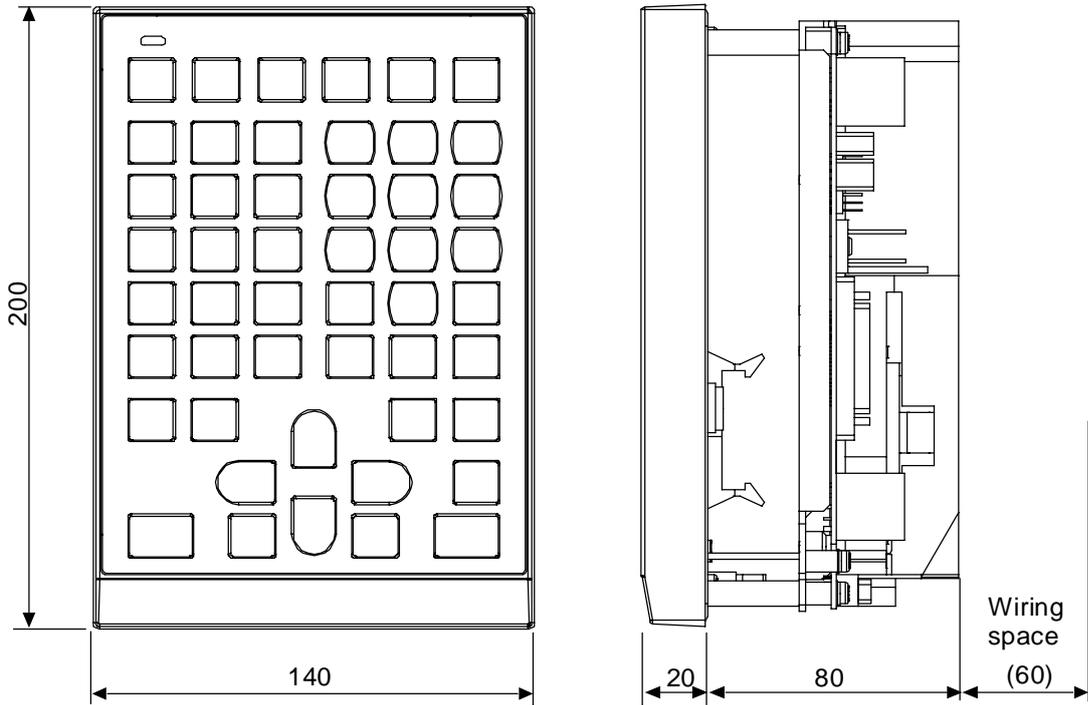


How to fix with screws from the front of the unit (Reference)

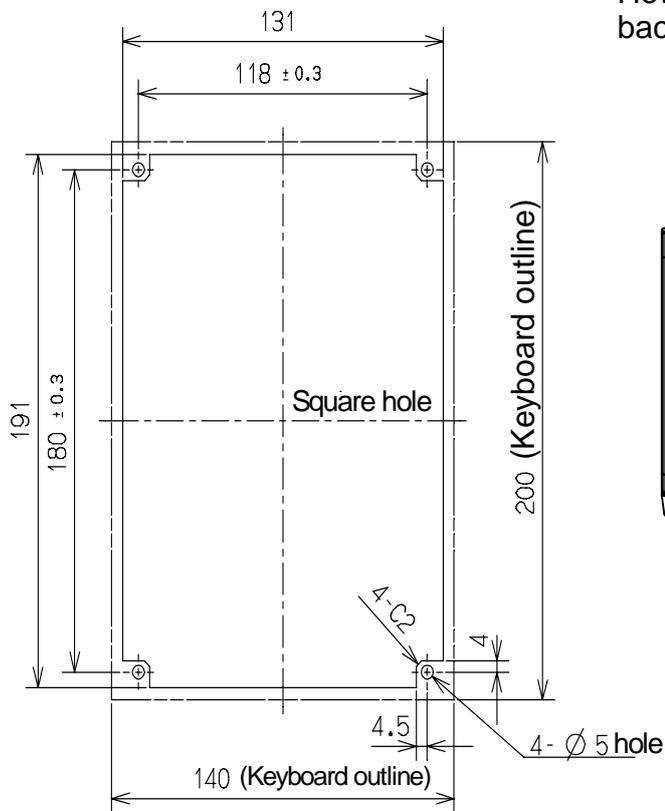


Appendix 1.1.3 Control unit (FCU6-MU071, FCU6-KB071) outline drawing

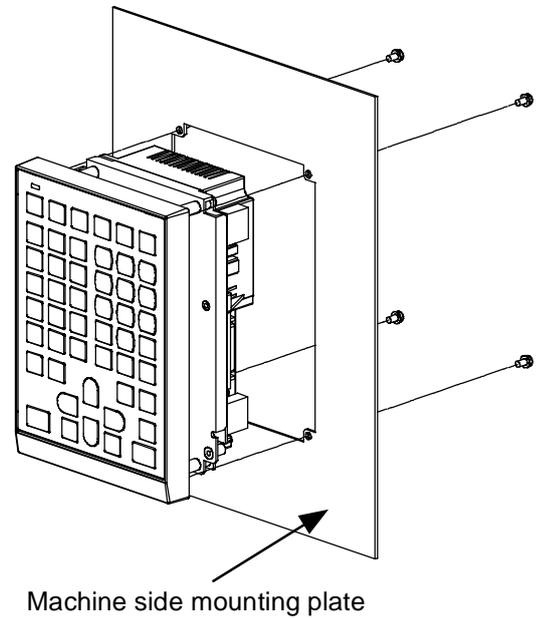
(1) In the case of FCU6-KB071 (Fix with screws from the back of the unit)



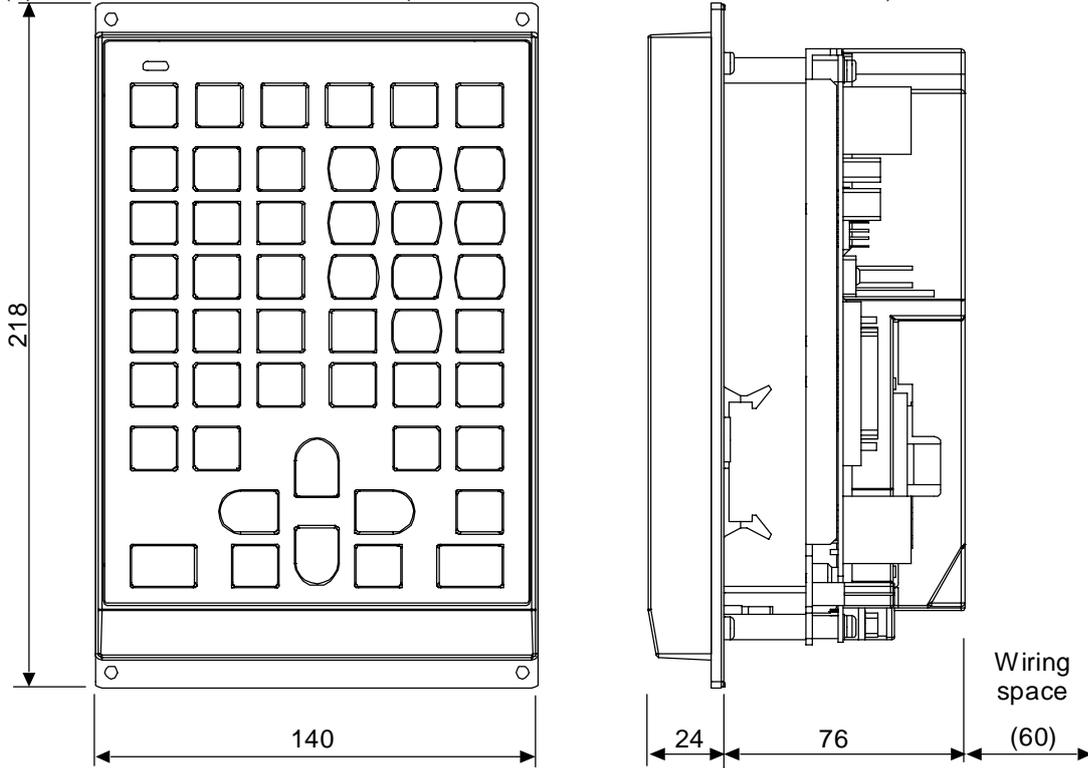
Panel-cut drawing



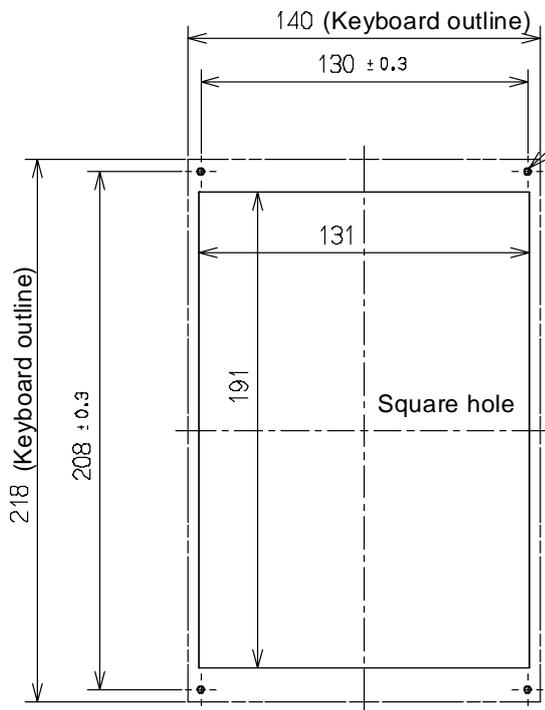
How to fix with screws from the back of the unit (Reference)



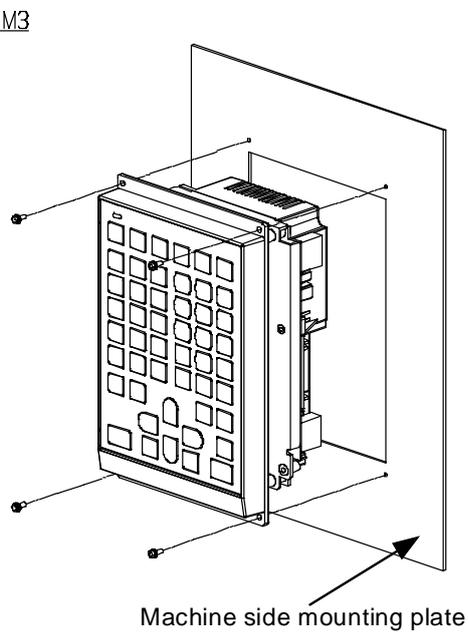
(2) In the case of FCU6-KB071-1 (Fix with screws from the front of the unit)



Panel-cut drawing

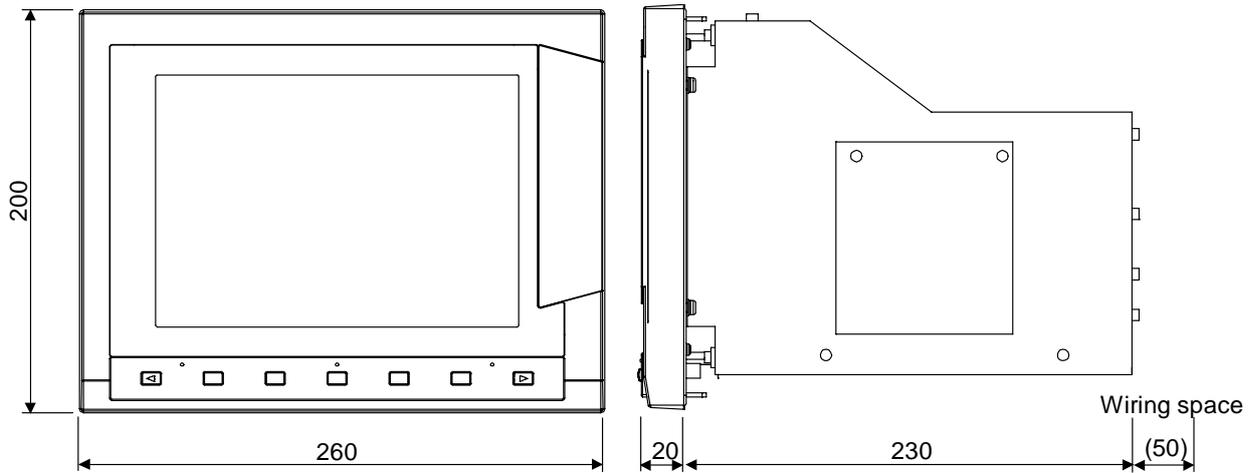


How to fix with screws from the front of the unit
(Reference)

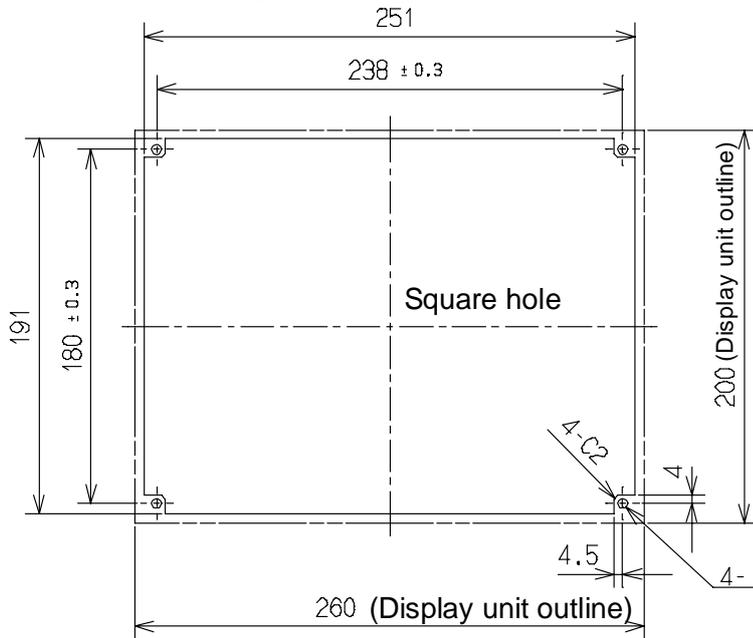


Appendix 1.1.4 Display unit (FCU6-DUE71) outline drawing

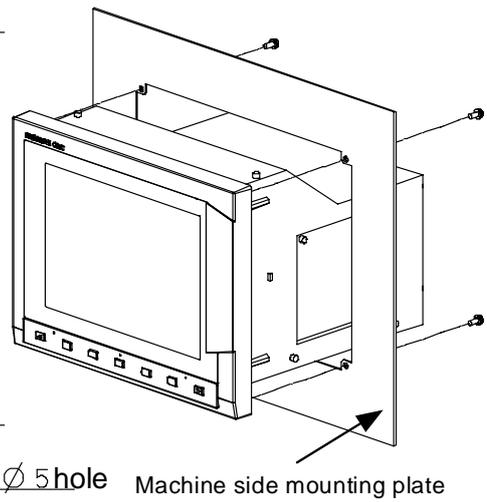
(1) In the case of FCU6-DUE71 (Fix with screws from the back of the unit)



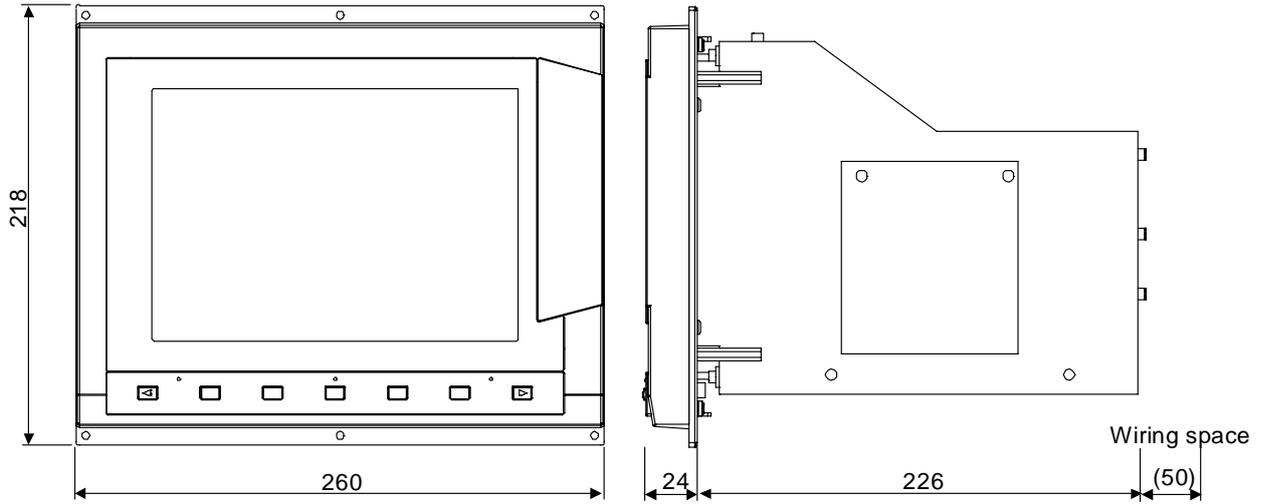
Panel-cut drawing



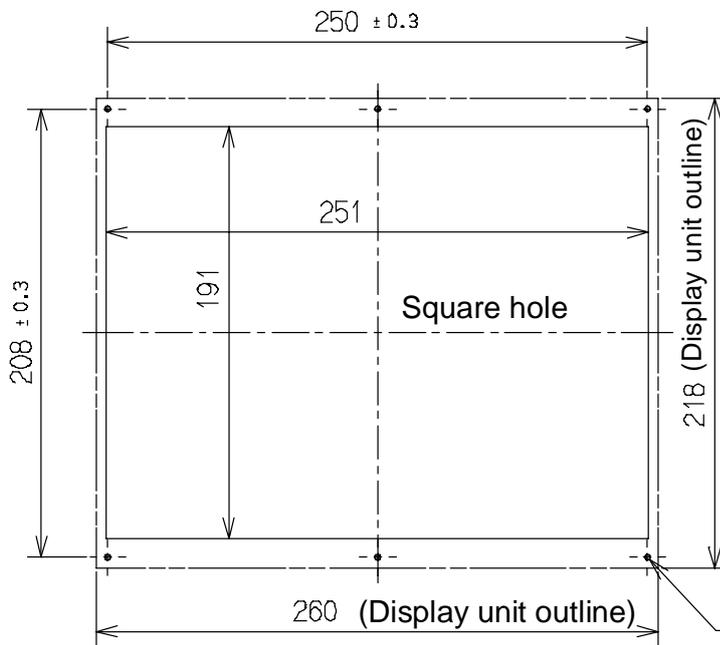
How to fix with screws from the back of the unit (Reference)



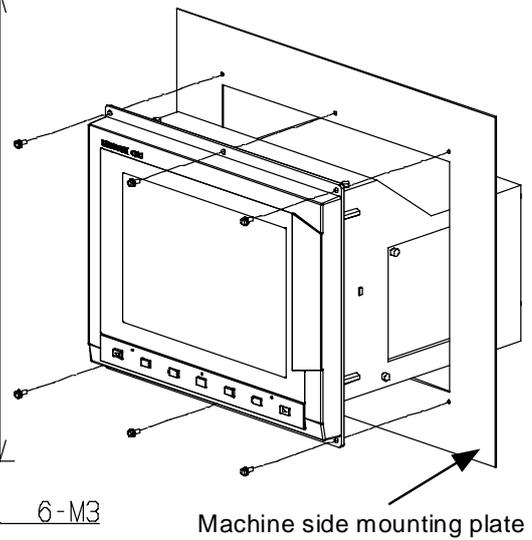
(2) In the case of FCU6-DUE071-1 (Fix with screws from the front of the unit)



Panel-cut drawing

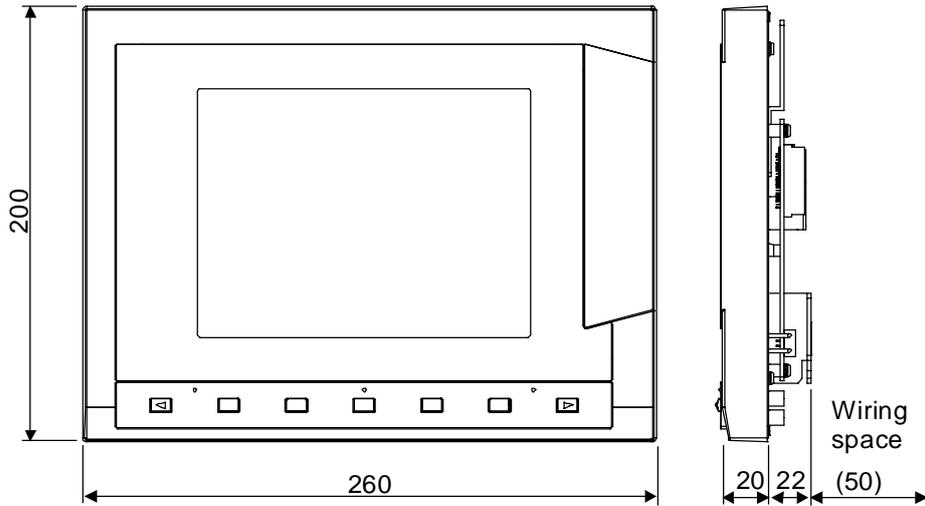


How to fix with screws from the front of the unit (Reference)

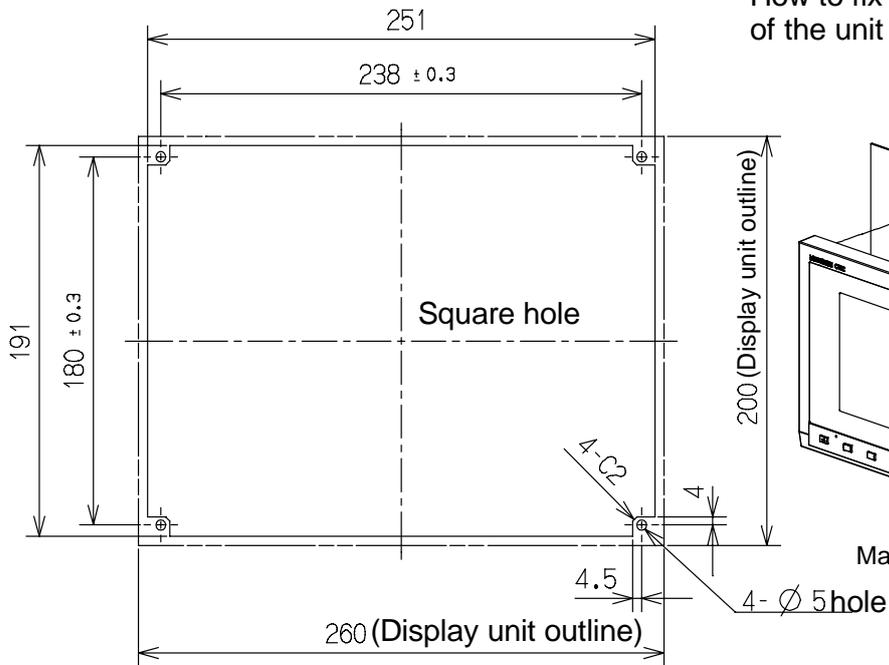


Appendix 1.1.5 Display unit (FCU6-DUT11) outline drawing

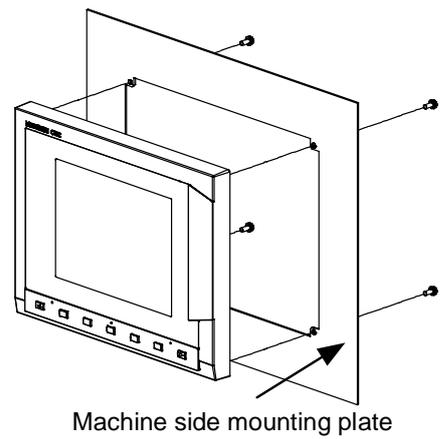
(1) In the case of FCU6-DUT11 (Fix with screws from the back of the unit)



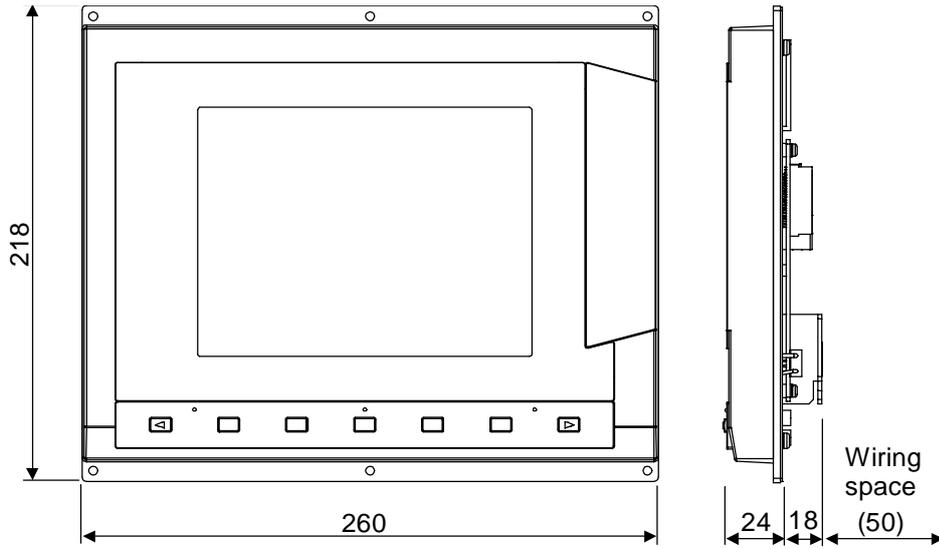
Panel-cut drawing



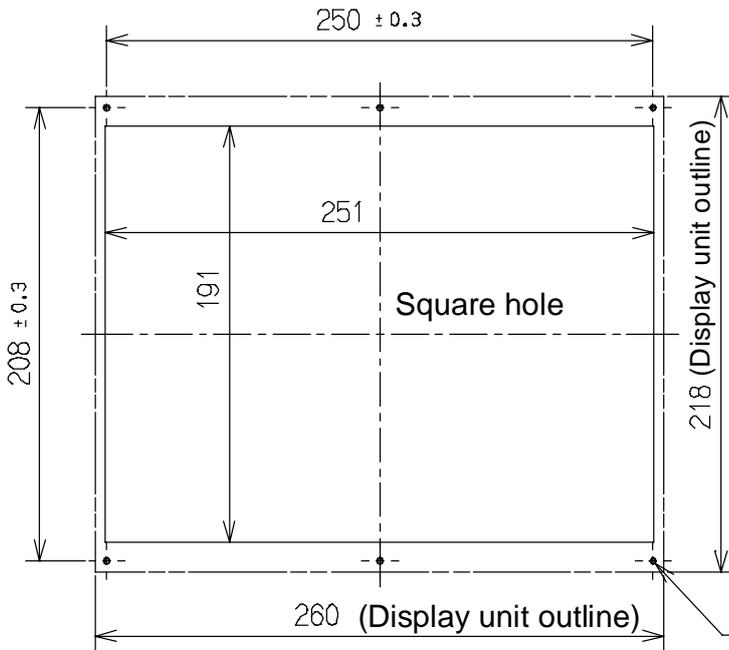
How to fix with screws from the back of the unit (Reference)



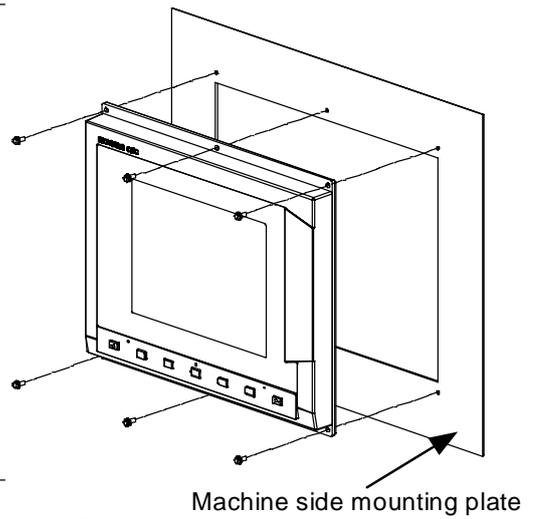
(2) In the case of FCU6-DUT11-1 (Fix with screws from the back of the unit)



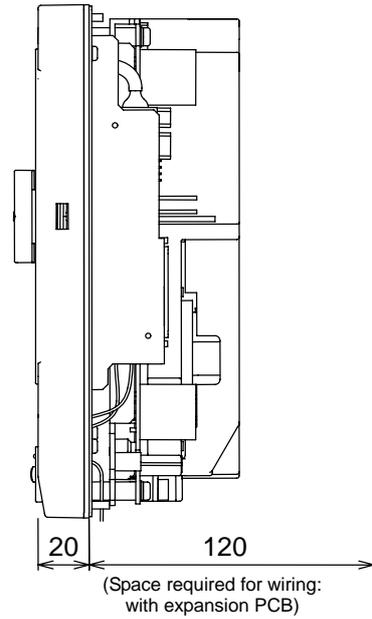
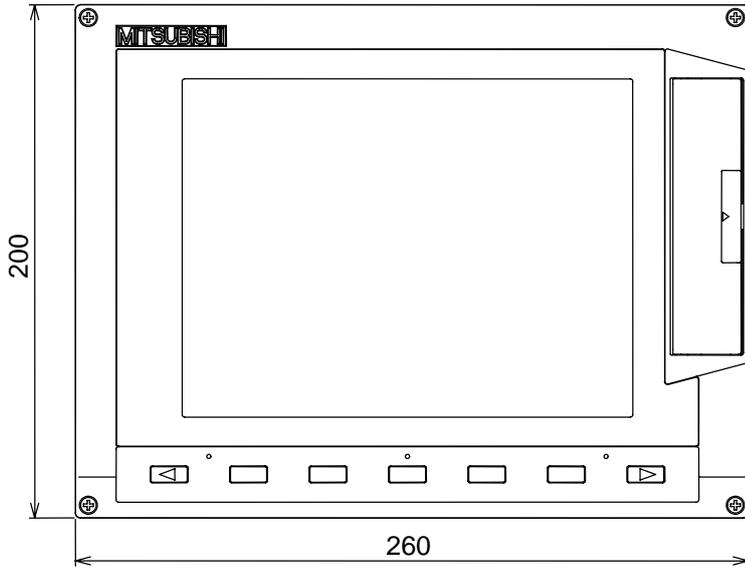
Panel-cut drawing



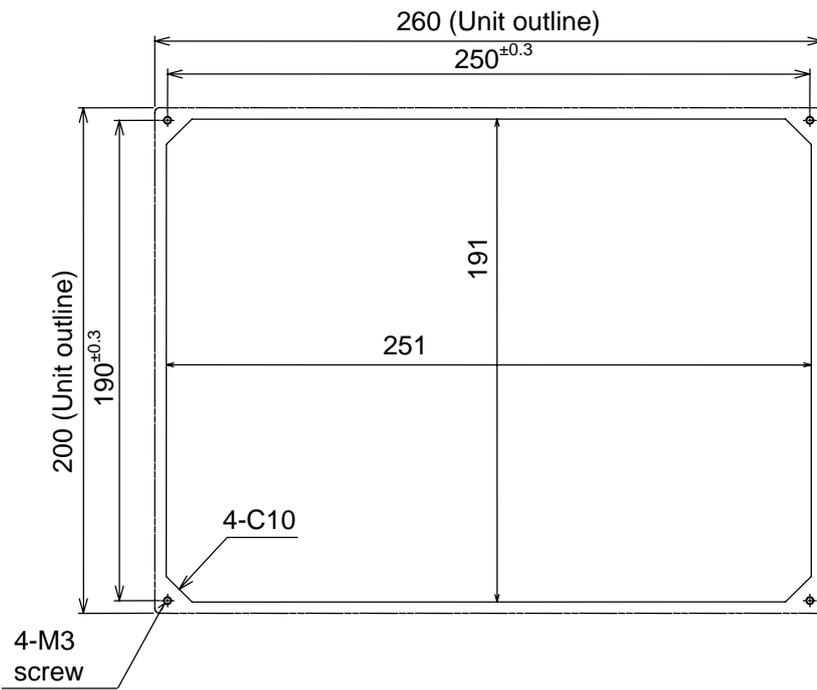
How to fix with screws from the front of the unit (Reference)



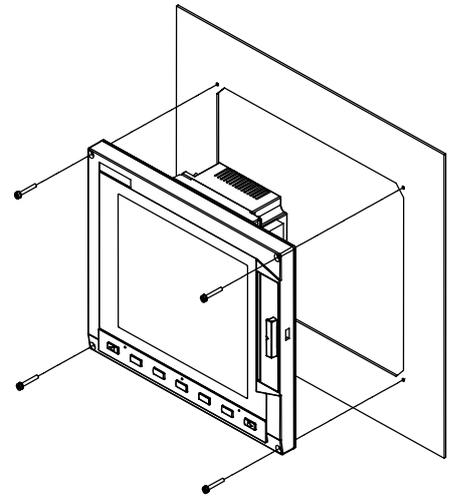
Appendix 1.2 E68 Control Unit, Display Unit, Keyboard Unit Outline Drawing
 Appendix 1.2.1 Control unit, display unit (FCU6-MU072,FCU6-DUN24) outline drawing



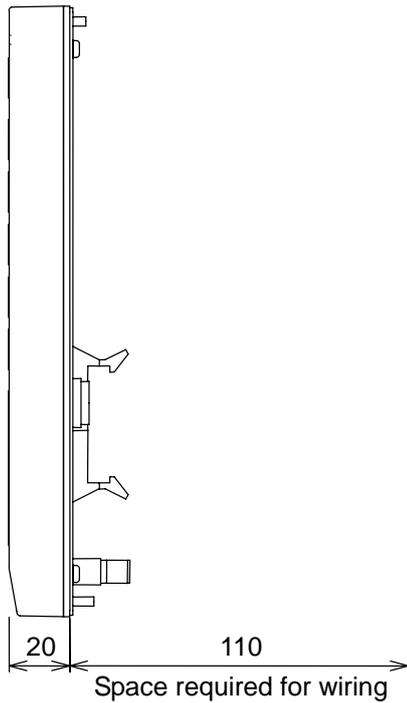
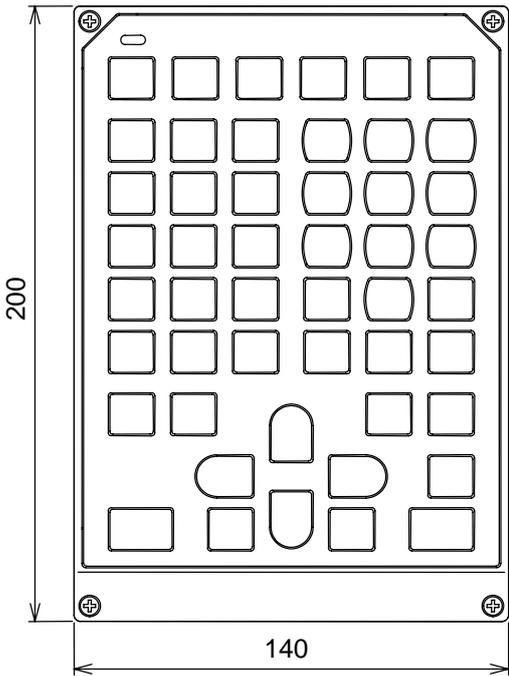
Panel-cut drawing



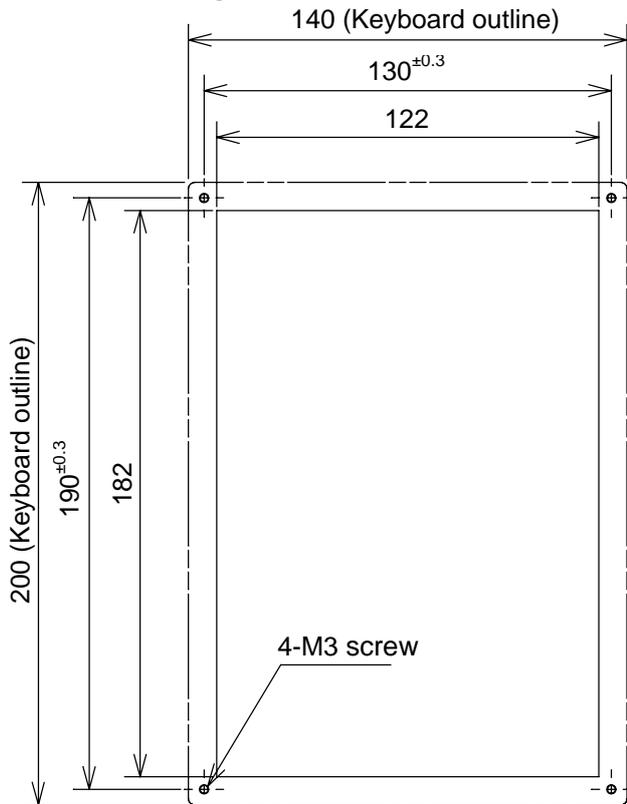
How to fix with screws from the front of the unit (Reference)



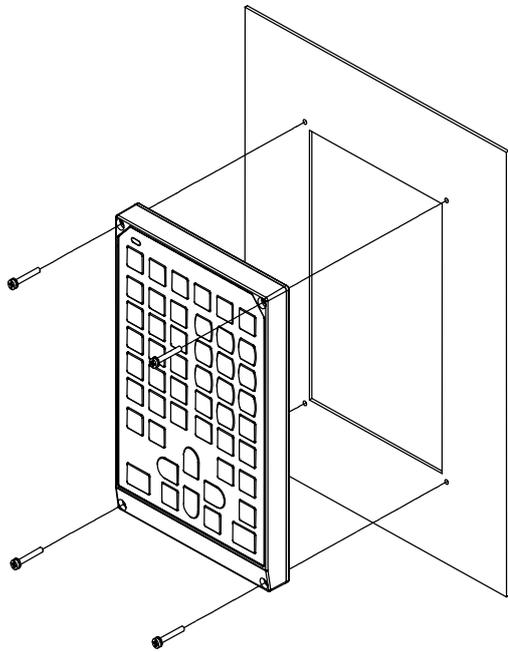
Appendix 1.2.2 Keyboard unit (FCU6-KB024) outline drawing



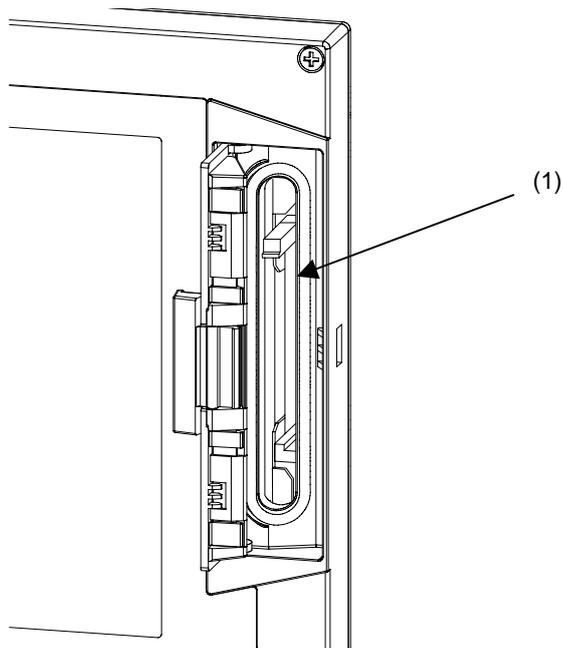
Panel-cut drawing



How to fix with screws from the front of the unit (Reference)



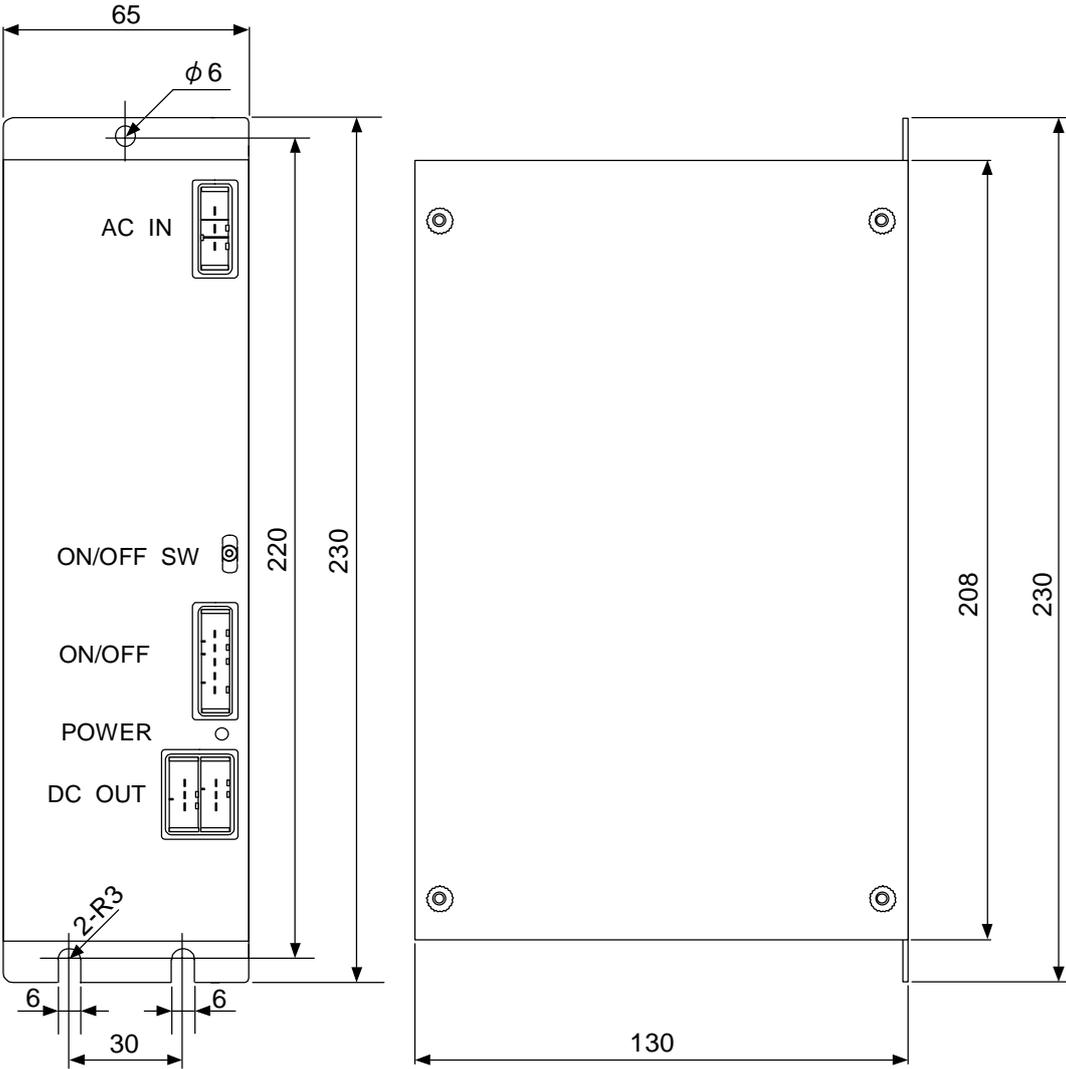
Appendix 1.2.3 Front IC card I/F unit (FCU6-EP105-1) outline drawing



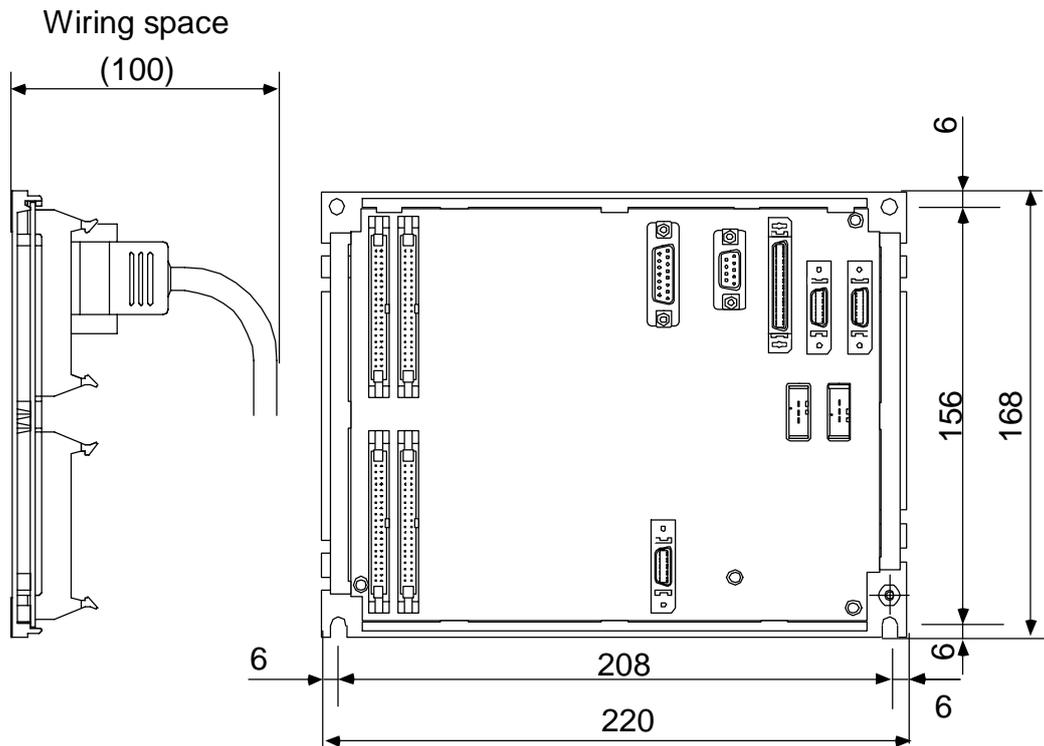
Explanation of the front IC card I/F unit/connector functions

No.	Connector	Function
(1)	Memory Card I/F	PC Card Standard ATA-compliant CF card TYPEI, TYPEII only (5VDC : max 220mA)

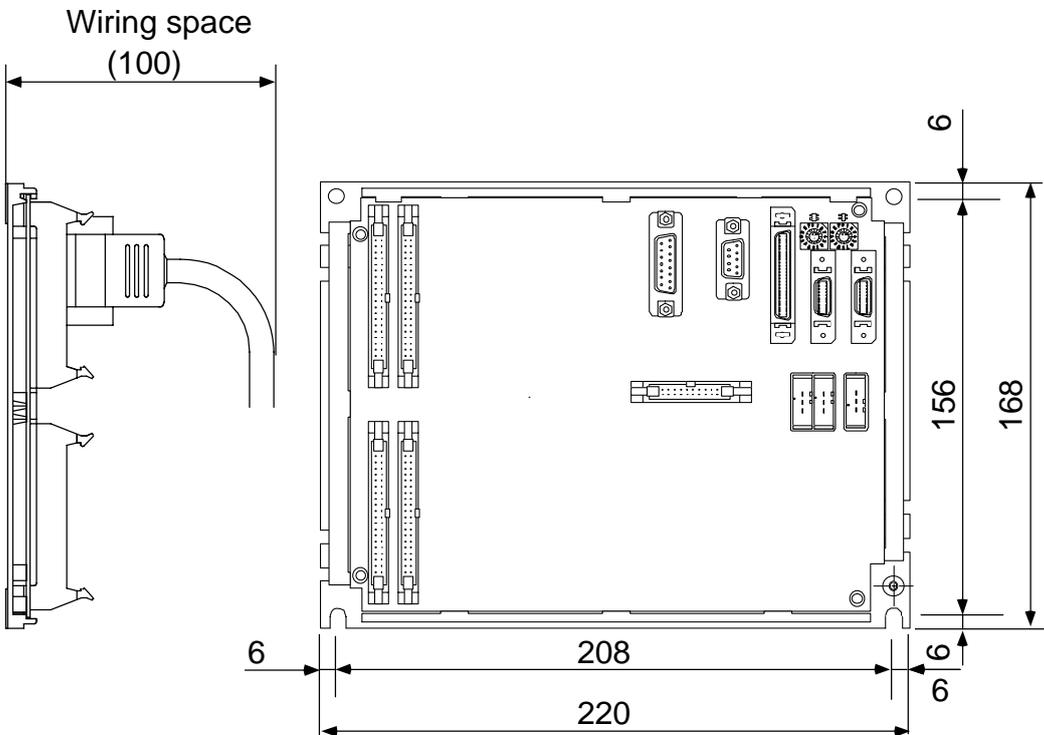
Appendix 1.3 External Power Supply Unit (PD25) Outline Drawing



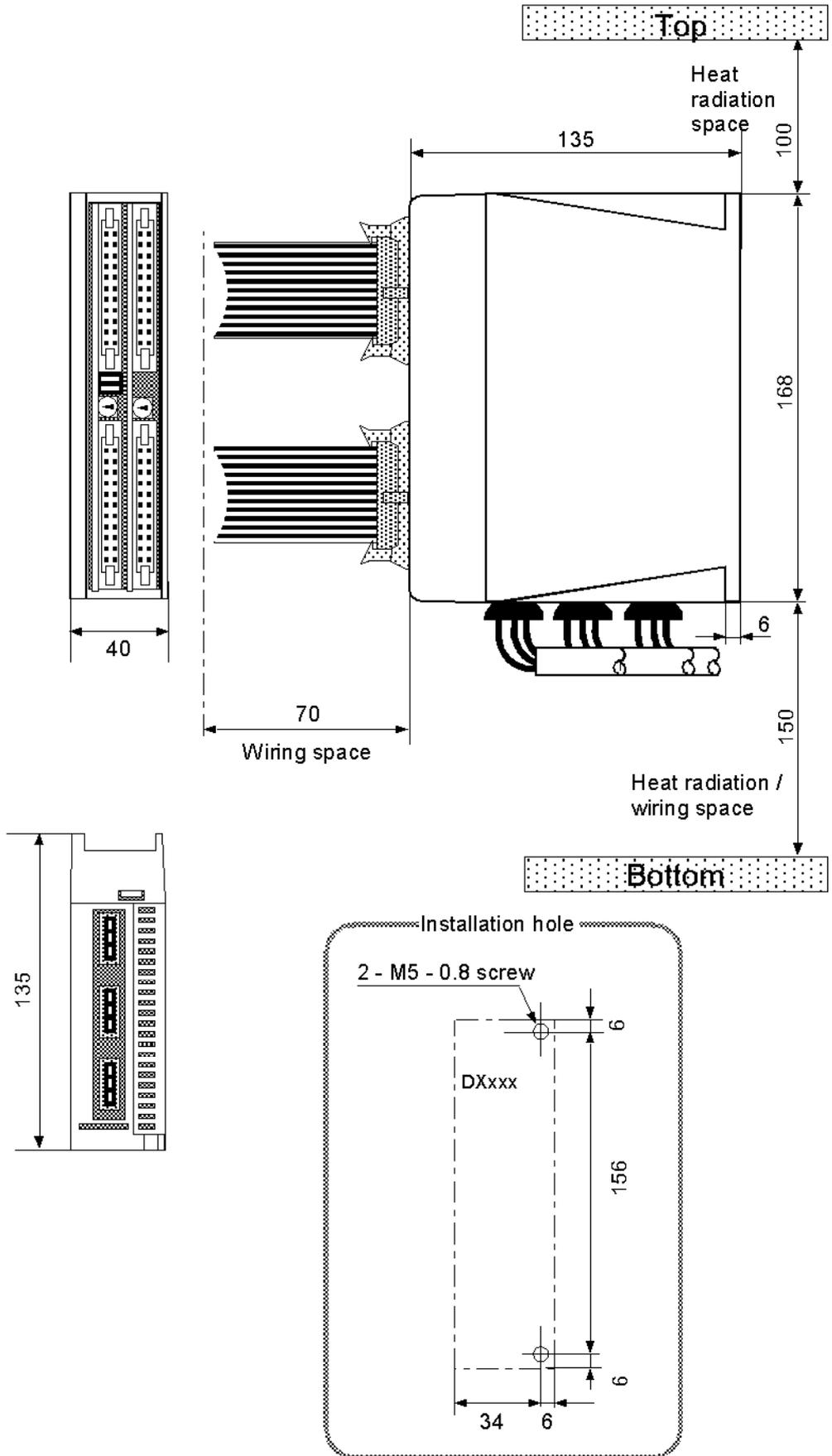
Appendix 1.4 Base I/O Unit Outline Drawing
Appendix 1.4.1 FCU6-HR341/HR351 outline drawing



Appendix 1.4.2 FCU6-DX220/DX221 outline drawing

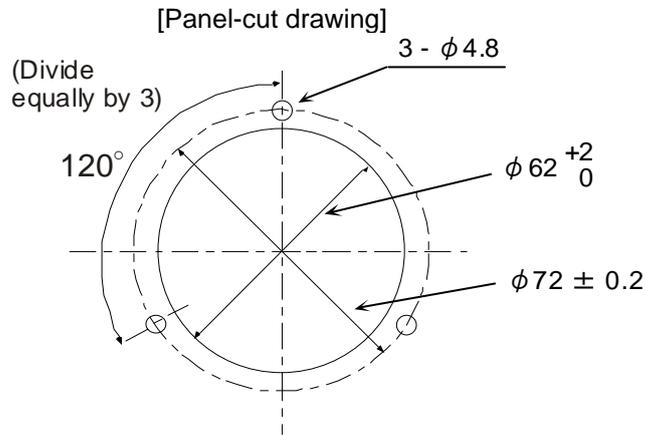
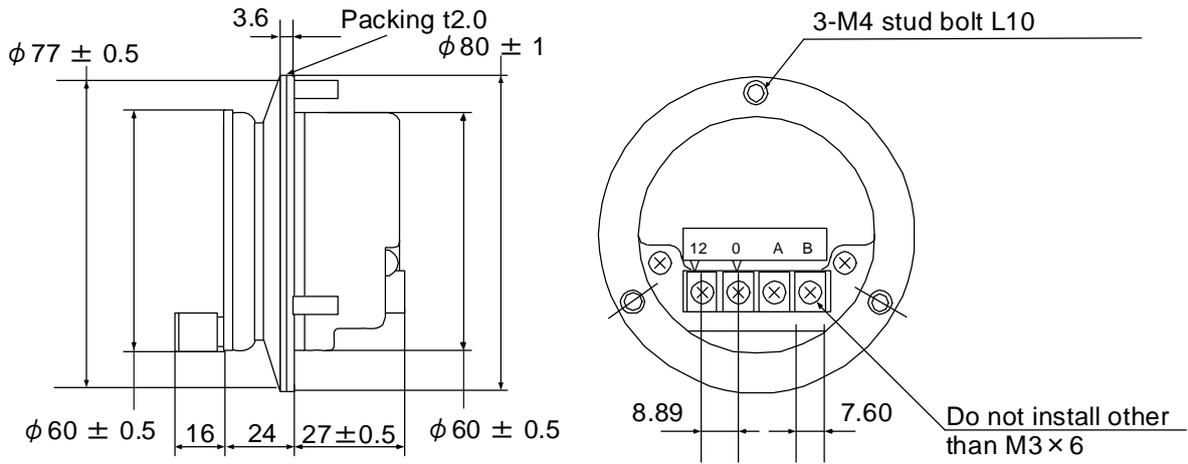


Appendix 1.5 Remote I/O Unit (FCUA-DX1xx) Outline Drawing

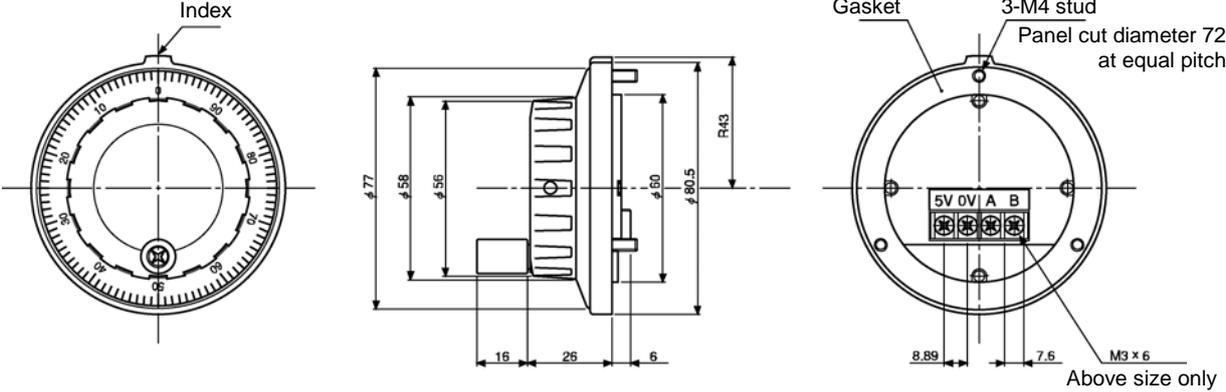


Appendix 1.6 Manual Pulse Generator Outline Drawing

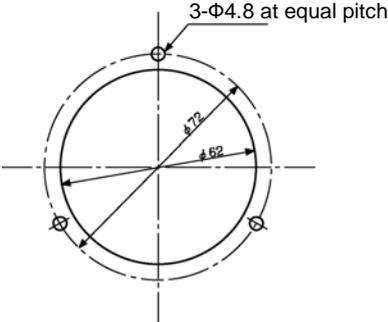
Appendix 1.6.1 HD60/HD60-1 outline drawing



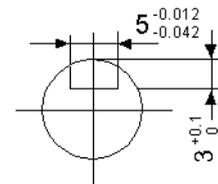
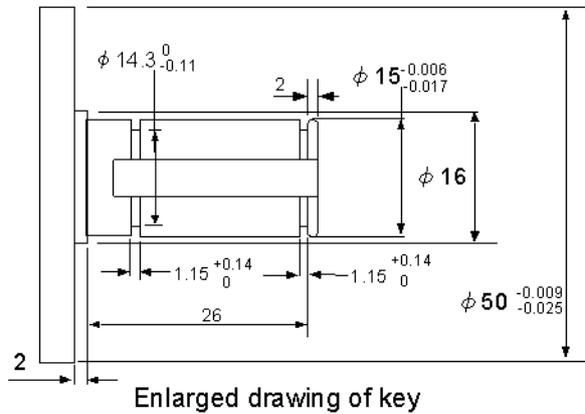
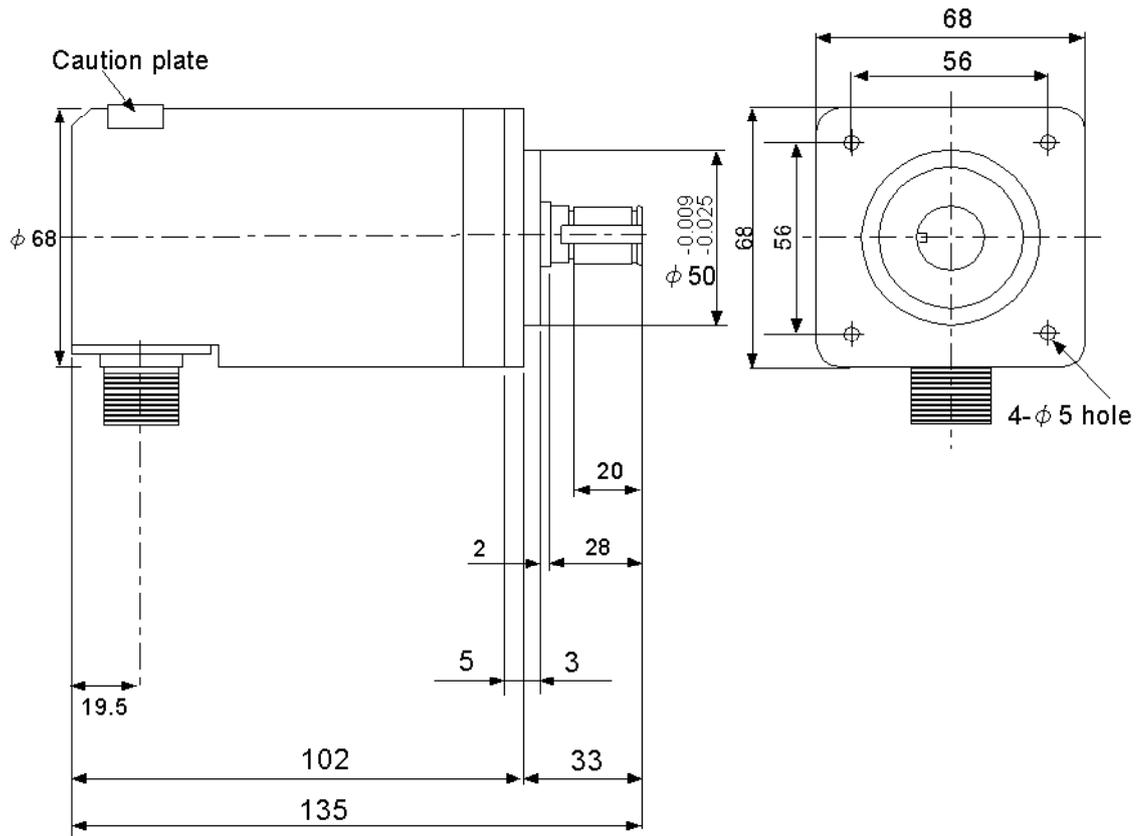
Appendix 1.6.2 UFO-01-2Z9 outline drawing



[Panel-cut drawing]



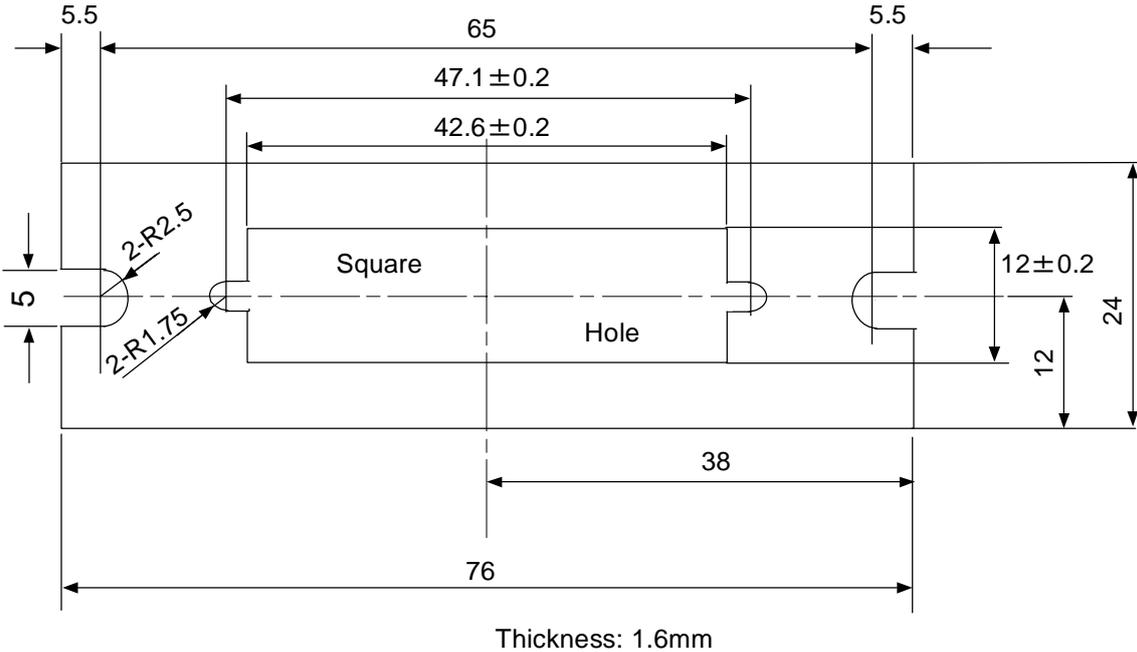
Appendix 1.7 Synchronous Feed Encoder (OSE-1024-3-15-68) Outline Drawing



Cross section BB

Valid depth of key groove is 21mm

Appendix 1.8 F Installation Plate Outline Drawing

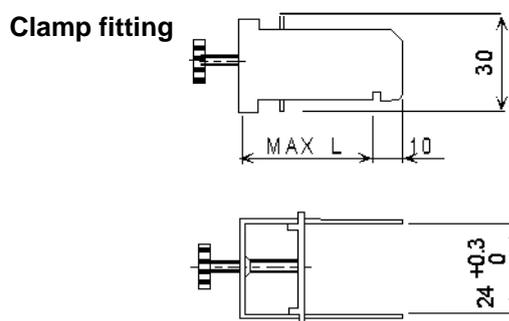
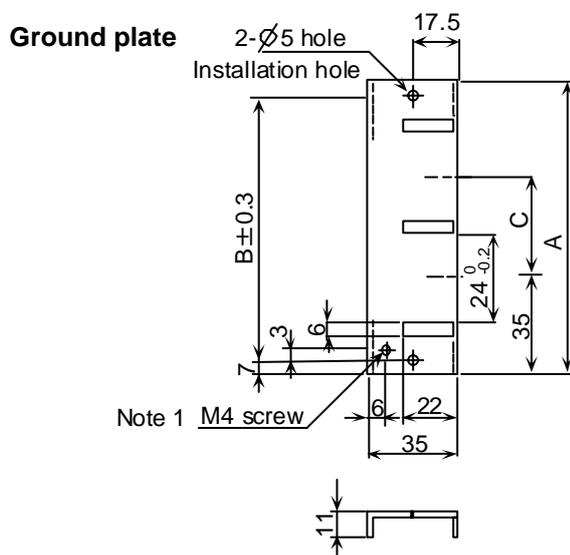


Appendix 1.9 Ground Plate, Clamp Fitting Outline Drawing

The shield wire generally only needs to be grounded to the connector's case frame. However, the effect can be improved by directly grounded to the grounding plate as shown on the right. Install the ground plate near each unit. Peel part of the cable sheath as shown on the right to expose the shield sheath. Press that section against the ground plate with the clamp fitting. Note that if the cable is thin, several can be clamped together. (For details, refer to Appendix 3.6.1 Shield clamp fitting.) Install the ground plate directly onto the cabinet or connect a ground wire so that sufficient frame ground is achieved.

If a complete set of a ground plate and clamp fitting is required, contact Mitsubishi.

	Ground plate	Attached fitting
A complete set of ground plate D	Ground plate D	Two clamp fittings A
A complete set of ground plate E	Ground plate E	One clamp fitting B



	L
Clamp fitting A	70mm
Clamp fitting B	45mm

(Note 1) Screw hole for wiring to ground plate of cabinet.

(Note 2) The thickness of the ground plate is 1.6mm.

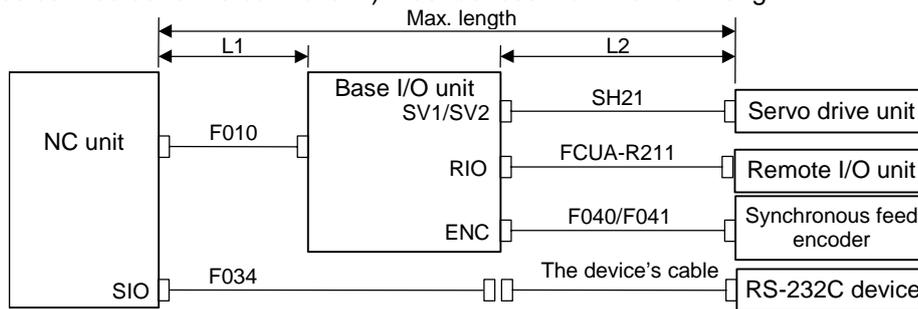
	A	B	C	Note
Ground plate D	100mm	86mm	30mm	Two clamp fittings
Ground plate E	70mm	56mm	-	One clamp fitting

APPENDIX 2. CABLE DRAWING

No	Appendix No	Cable model	Application	Max length	Remarks
1	2.1	F070	24VDC input	30m	For general purpose power supply
2	2.2	F110	24VDC input, Power supply failure detection	15m	For PD25
3	2.2	F170	ON/OFF switch	15m	For PD25
4	2.3	F120	Emergency stop	30m	
5	2.4	F053/F054(★)	NC keyboard	1m	
6	2.5	FCUA-R100(★)	CRT power supply	10m	
7	2.5	F590(★)	CRT	1m	Between HR761 - CRT
8	2.6	F090(★)	LCD	0.5m	Between HR761 - HR721
				0.1m	Between HR761 - HR722
9	2.7	F023	Manual pulse generator: 1ch	20m	For power supply 5VDC
10	2.7	F024	Manual pulse generator: 2ch	20m	For power supply 5VDC
11	2.7	F320	Manual pulse generator: 1ch	50m	For power supply 12VDC
12	2.7	F321	Manual pulse generator: 2ch	50m	For power supply 12VDC
13	2.8	F034	RS232C: 1ch	**15m	
14	2.9	F010	I/O interface	20m	
15	2.10	SH21	Servo drive unit	*30m	
16	2.11	F221	Analog output	30m	
17	2.12	F351	DI/DO: Single end connector	50m	For unit HR341/HR351
18	2.13	F102	SKIP signal input	50m	
19	2.14	F040	Synchronous feed encoder: Straight	*50m	
20	2.14	F041	Synchronous feed encoder: Right angle	*50m	
21	2.15	ENC-SP1	Synchronous feed encoder	*50m	Between NC - Spindle drive unit
22	2.15	ENC-SP2	Synchronous feed encoder	*50m	Among NC - FR - TK
23	2.16	FCUA-R211	Remote I/O	*50m	
24	2.16	SH41	Remote I/O	1 m	For wiring in the same cabinet
25	2.17	FCUA-R301	DI/DO: Double-end connector	50m	For unit DX1xx/DX22x
26	2.17	FCUA-R300	DI/DO: Single-end connector	50m	For unit DX1xx/DX22x
27	2.18	FCUA-R031	Analog input/output	30m	For unit DX14x

(Note 1) Cables marked with (★) are included in display unit we supply.

(Note 2) For cable lengths marked with *, make sure that the total length (L1 + L2) of the length from the control unit to base I/O unit (L1), and the length from the base I/O unit to each unit (L2) (in the case of more than one unit, length to the terminal unit) must be less than the max. length. For cable lengths marked with **, make sure that the total cable length (including cables of devices connected to the control unit) must be less than the max. length.



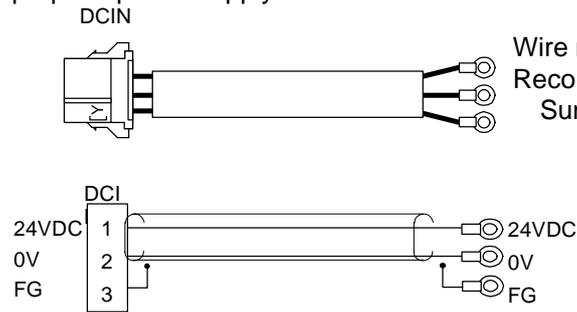
(Note 3) Symbols in the cable drawings are as follows.

1. indicated twist.
2. indicates shield sheath.
3. indicates shield clamping to the grounding plate.
4. In the cable drawings, the partner of the twisted pair cable is given a priority, so the pin No. of the connectors at both ends are not necessarily in number of order.
5. Equivalent parts can be used for the connector, contact and wire material.

Appendix 2.1 F070 cable

Usage: 24VDC input, general purpose power supply

DCIN
 Connector: 2-178288-3
 Contact: 1-175218-5
 Recommended manufacturer: Tyco Electronics AMP



Wire material: B-18(19)U × 2SJ-1 × 9
 Recommended manufacturer: Sumitomo Electric Industries

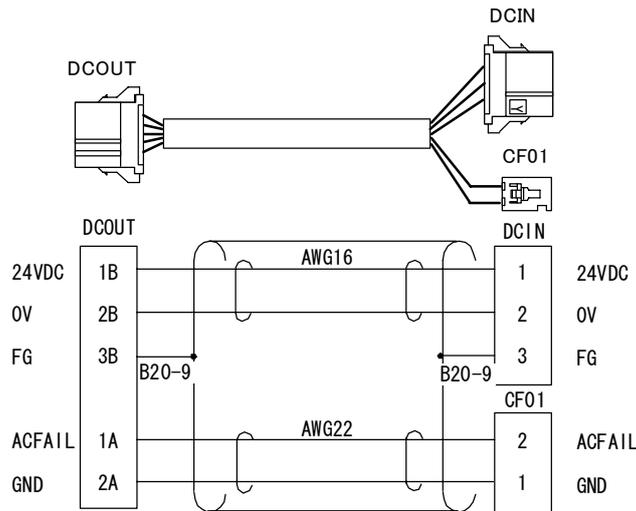
Crimp terminal: V1.25-3 or V1.25-4
 Recommended manufacturer: JST

(NOTE)

If the cable is 15m or longer, use 16AWG (1.25mm²).
 Select the crimp terminal suitable for the terminal block and external power supply you use.

Appendix 2.2 F110 / F170 cable

(1) F110 cable
 Usage: 24VDC input, power supply failure detection for PD25



DCOUT
 Connector: 3-178127-6
 Contact: 1-175218-5 (For AWG16)
 : 1-175217-5 (For AWG22)
 Recommended manufacturer: Tyco Electronics AMP

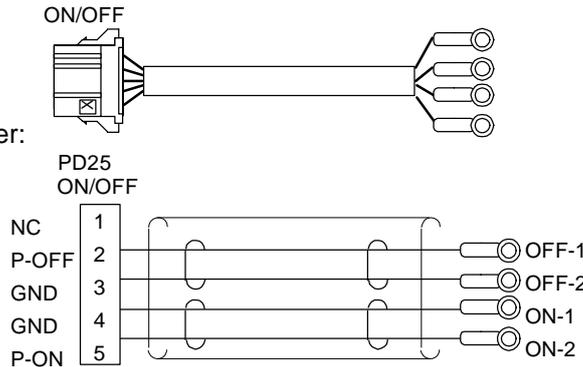
DCIN
 Connector: 2-178288-3
 Contact: 1-175218-5
 Recommended manufacturer: Tyco Electronics AMP

Wire material: UL2464 2 × 22AWG+2 × 16AWG SS-95138
 Recommended manufacturer: Bando Electric Wire

CF01
 Connector: 51030-0230
 Contact: 50084-8160
 Recommended manufacturer: MOLEX

(2) F170 cable
Usage: ON/OFF switch
for PD25

ON/OFF
Connector: 1-178288-5
Contact: 1-175218-5
Recommended manufacturer:
Tyco Electronics AMP



Crimp terminal: V1.25-3 or
V1.25-4
Recommended manufacturer:
JST

Wire material: DPVVS3 3P
× 0.3mm²
Recommended
manufacturer:
Bando Electric Wire

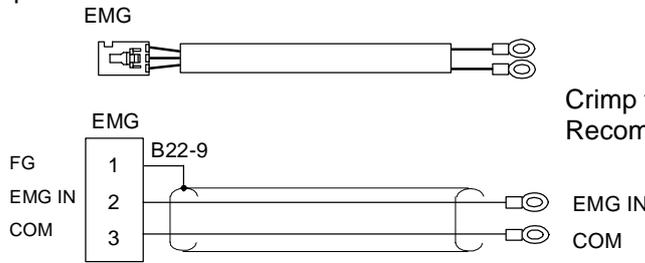
(NOTE)

Select the crimp terminal suitable for the terminal block and external power supply you use.

Appendix 2.3 F120 cable

Usage: Emergency stop input

EMG
Connector: 51030-0330
Contact: 50084-8160
Recommended
manufacturer: MOLEX



Crimp terminal: V1.25-3 or V1.25-4
Recommended manufacturer: JST

Wire material: B-22(19)U × 2SJ-1 × 9
Recommended manufacturer: Sumitomo Electric Industries

(NOTE)

Select the crimp terminal suitable for the terminal block and emergency stop button you use.

Appendix 2.4 F053/F054 cable

(1) F053 cable

Usage: NC keyboard



Connector: 7926-6500SC
Strain relief: 3448-7926
Recommended
manufacturer: 3M

Wire material: B26-B
Recommended manufacturer:
Oki Electric Cable

Connector: 7926-6500SC
Strain relief: 3448-7926
Recommended manufacturer: 3M

(2) F054 cable

Usage: NC keyboard



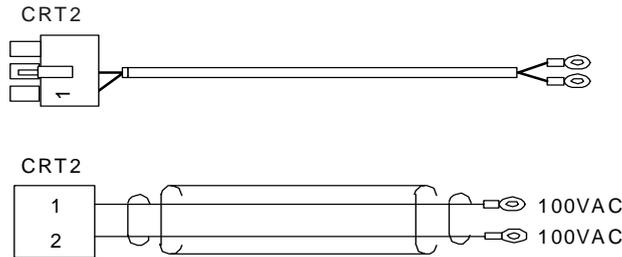
Connector: 7926-6500SC
Strain relief: 3448-7926
Recommended
manufacturer: 3M

Wire material: B26-B
Recommended manufacturer:
Oki Electric Cable

Connector: 7926-6500SC
Strain relief: 3448-7926
Recommended
manufacturer: 3M

Appendix 2.5 FCUA-R100 / F590 cable

(1) FCUA-R100 cable
Usage: CRT power supply



Connector: 3191-03R1
Contact: 1381TL
Recommended manufacturer:
MOLEX

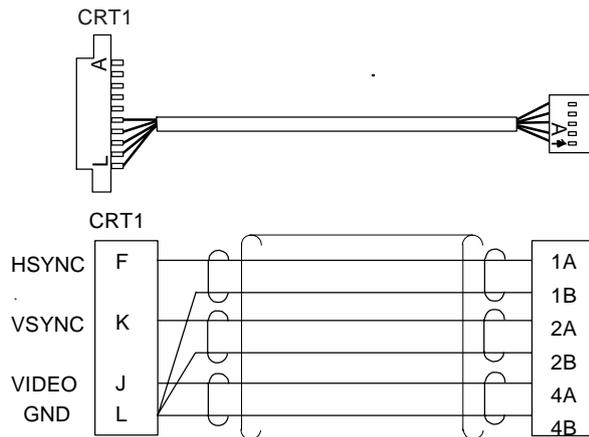
Wire material: DPVVS-1P ×
0.3SQ
Recommended manufacturer:
Bando Electric Wire

Crimp terminal: V1.25-3
Recommended manufacturer: JST

(NOTE)

Select the crimp terminal suitable for the terminal block you use.

(2) F590 cable
Usage: CRT signal



Connector: CR7E-20DA-3.96E
Recommended manufacturer:
Hirose Electric

Wire material: DPVVS-6P × 0.2SQ
Recommended manufacturer:
Bando Electric Wire

Connector: UFS-10B-04
Contact: 66-1-BF
Recommended manufacturer:
YAMAICHI ELECTRONICS

Appendix 2.6 F090 cable

Usage: LCD signal



Connector: DHD-RB40-20AN
Recommended manufacturer:
DDK

Wire material: UL20528-50 ×
28AWG(7/0.127)
Recommended manufacturer:
Fujikura

Connector: DHD-RB40-20AN
Recommended manufacturer:
DDK

- Caution -

The maximum length of cable is 50cm for FCU6-DUT11, 10cm for FCU6-DUN024.

Appendix 2.7 F023 / F024 / F320 / F321 cable

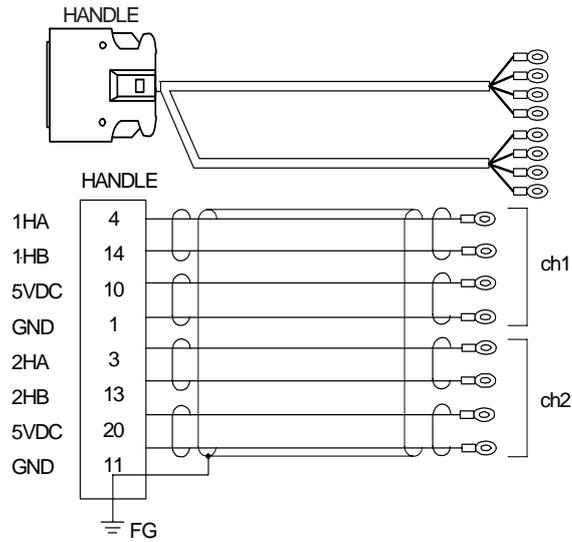
(1) F023 / F024 cable

Usage: Manual Pulse Generator (5VDC spec)

Connector: 10120-3000VE
 Case: 10320-52F0-008
 Recommended manufacturer: 3M

Wire material: UL1061-2464 AWG22 × 6P
 Recommended manufacturer:
 Oki Electric Cable

Crimp terminal: V1.25-3
 Recommended manufacturer: JST



(NOTE)

Fold the wire material shield over the sheath, and wrap copper foil tape over it.
 Connect the copper foil tape to the connector's GND plate.

Manual pulse generator cable

	Channel	
	1	2
Cable F023	OK	
Cable F024	OK	OK

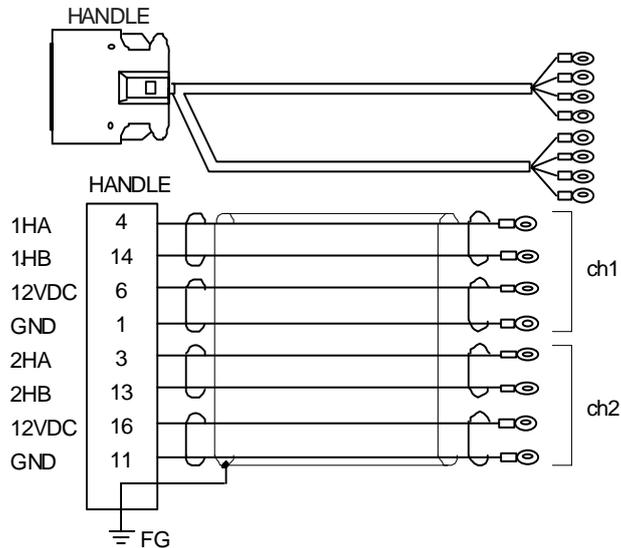
(2) F320 / F321 cable

Usage: Manual pulse generator (12VDC spec)

Connector: 10120-3000VE
 Case: 10320-52F0-008
 Recommended manufacturer: 3M

Wire material: UL1061-2464 AWG22 × 6P
 Recommended manufacturer:
 Oki Electric Cable

Crimp terminal: V1.25-3
 Recommended manufacturer: JST



(NOTE)

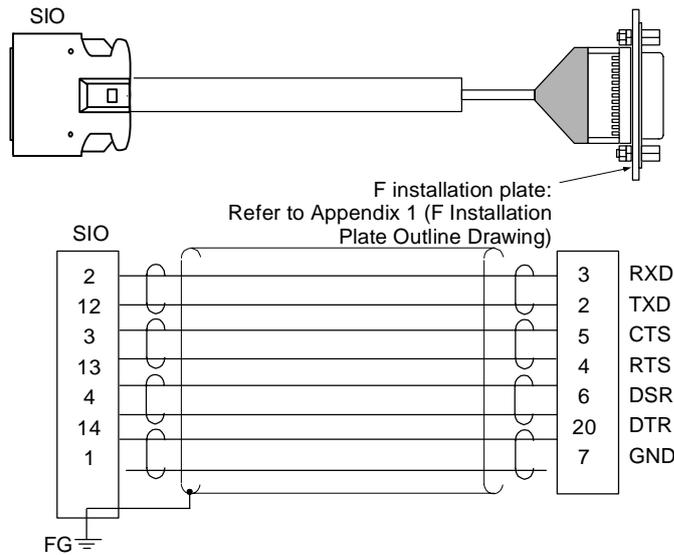
Fold the wire material shield over the sheath, and wrap copper foil tape over it.
 Connect the copper foil tape to the connector's GND plate.

Manual pulse generator cable

	Channel	
	1	2
Cable F320	OK	
Cable F321	OK	OK

Appendix 2.8 F034 cable

Usage: RS-232C



F installation plate:
Refer to Appendix 1 (F Installation
Plate Outline Drawing)

Connector: CDB-25S
Contact: CD-SC-111
Lock nut: HD-LNA
Recommended
manufacturer:
Hirose Electric

Connector: 10120-3000VE
Case: 10320-52F0-008
Recommended manufacturer: 3M

Wire material: UL1061-2464 AWG22 × 6P
Recommended manufacturer:
Oki Electric Cable

(NOTE)

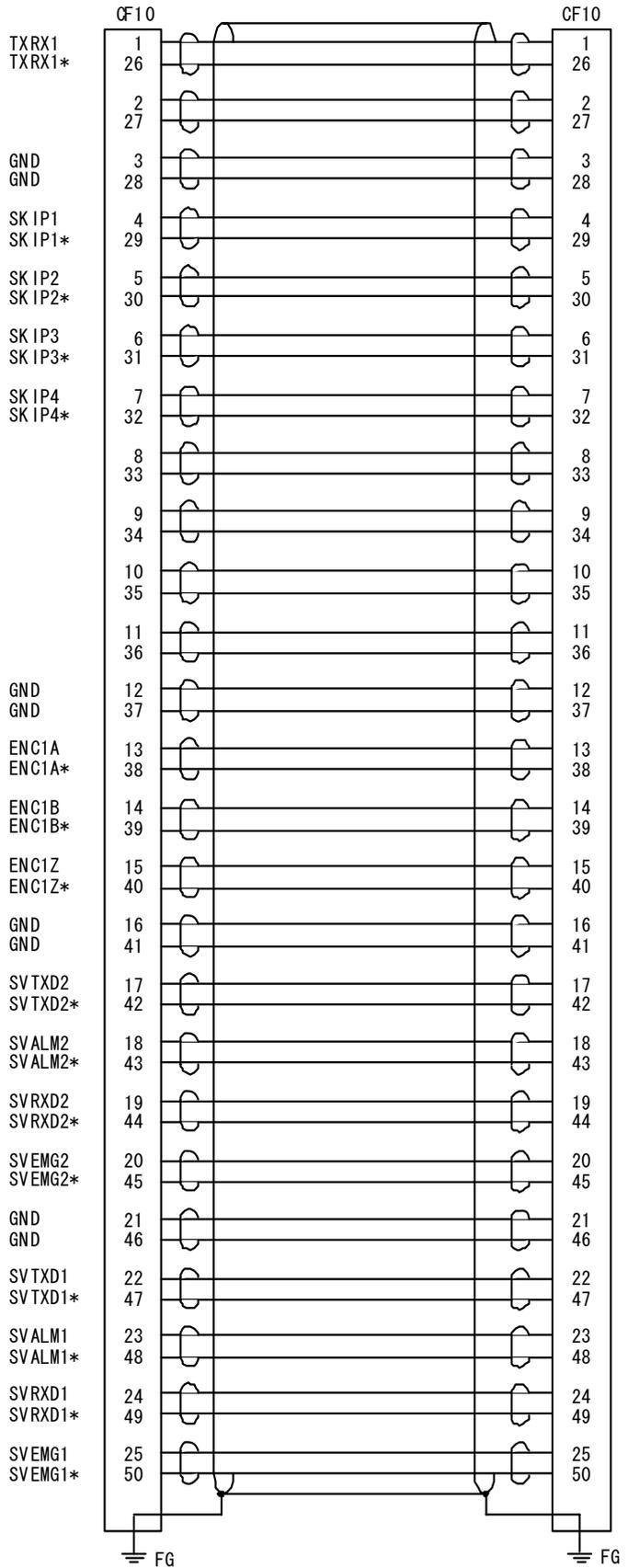
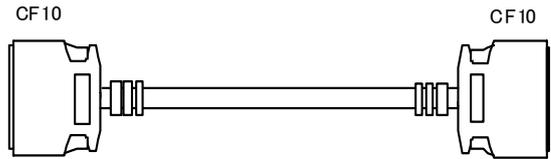
Fold the wire material shield over the sheath, and wrap copper foil tape over it.
Connect the copper foil tape to the connector's GND plate.

Appendix 2.9 F010 cable

Usage: I/O interface
 CF10
 Plug: 10150-6000EL
 Shell: 10350-3210-000
 Recommended manufacturer: 3M

Wire material: UL20276 AWG28x25P
 Recommended manufacturer:
 Toyokuni Electric Cable

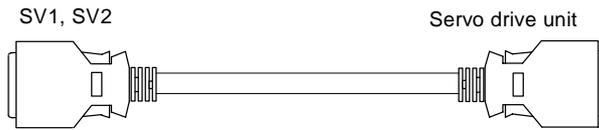
(NOTE)
 Fold the wire material shield over the sheath, and
 wrap copper foil tape over it.
 Connect the copper foil tape to the connector's
 GND plate.



Appendix 2.10 SH21 cable

Usage: Servo drive unit

SV1,SV2
 Plug: 10120-6000EL
 Shell: 10320-3210-000
 Recommended manufacturer: 3M



Wire material: UL20276 AWG28 × 10P
 Recommended manufacturer: Toyokuni Electric Cable

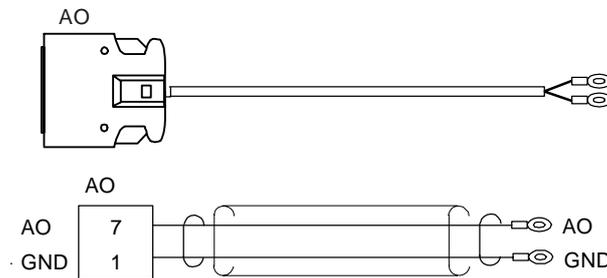
Servo drive unit
 Plug: 10120-6000EL
 Shell: 10320-3210-000
 Recommended manufacturer: 3M

(NOTE)

Fold the wire material shield over the sheath, and wrap copper foil tape over it. Connect the copper foil tape to the connector's GND plate.

Appendix 2.11 F221 cable

Usage: Analog output



Crimp terminal: V1.25-3
 Recommended manufacturer: JST

Connector: 10120-3000VE
 Case: 10320-52F0-008
 Recommended manufacturer: 3M

Wire material: B-22(19) × 2SJ-1 × 9
 Recommended manufacturer: Sumitomo Electric Industries.

(NOTE)

Follow the instruction of the machine side in connecting the shield. Do not connect on the base I/O unit side.
 Select the crimp terminal suitable for the terminal block used.

Appendix 2.12 F351 cable

Usage: DI/DO (For unit FCU6-HR341/HR351)

CF31, CF32, CF33, CF34



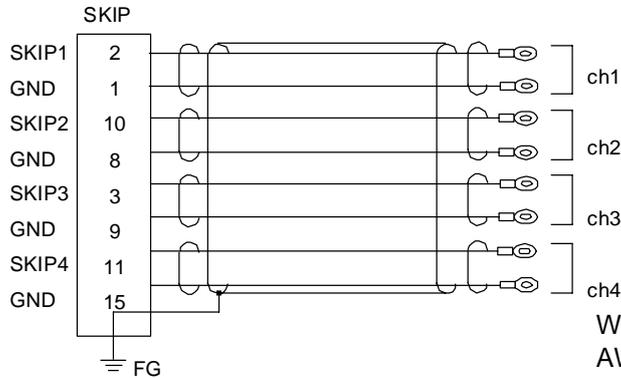
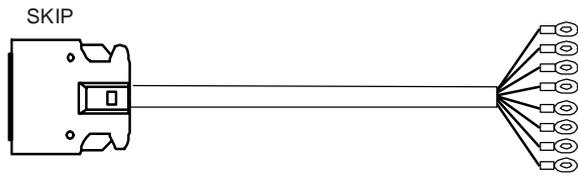
Connector: 7940-6500SC
 Strain relief: 3448-7940
 Recommended manufacturer: 3M

Wire material: B40-S
 Recommended manufacturer: Oki Electric Cable

Appendix 2.13 F102 cable

Usage: Skip signal input

Connector: CDA-15P
 Contact: CD-PC-111
 Case: HDA-CTH
 Recommended manufacturer: Hirose Electric



Crimp terminal: V1.25-3
 Recommended manufacturer: JST

Wire material: UL1061-2464
 AWG22 × 6P

Recommended manufacturer: Oki Electric Cable

(NOTE)

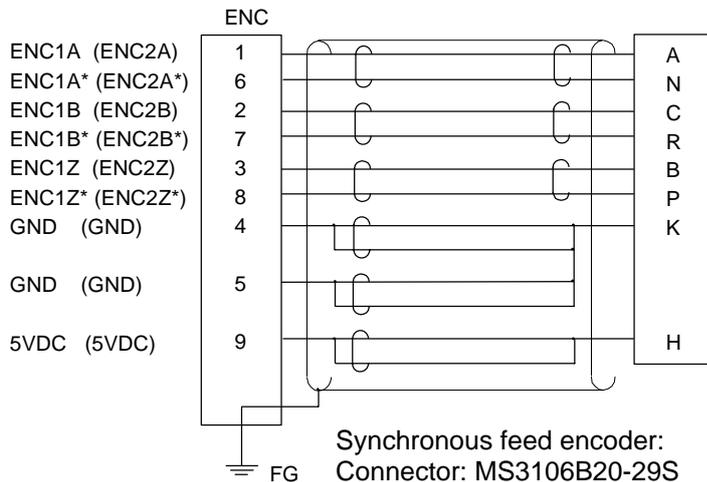
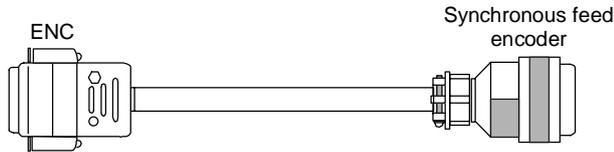
Fold the wire material shield over the sheath, and wrap copper foil tape over it. Connect the copper foil tape to the connector's GND plate.

Appendix 2.14 F040 / F041 cable

(1) F040 cable

Usage: Synchronous feed encoder (Straight)

Connector: CDE-9PF
 Contact: CD-PC-111
 Case: HDE-CTF/HDE-CTH
 Recommended manufacturer: Hirose Electric



Synchronous feed encoder:
 Connector: MS3106B20-29S
 Cable clamp: MS3057-12A
 Recommended manufacturer: ITT Cannon

Wire material: DPVVS6 6P × 0.2mm²
 Recommended manufacturer: Bando Electric Wire

(NOTE)

To prevent EMI / foreign noise, if HDE-CTH is used for case, fold the wire material shield over the sheath, and wrap copper foil tape over it.

(2) F041 cable

Usage: Synchronous feed encoder (Right angle)

Connector: CDE-9PF

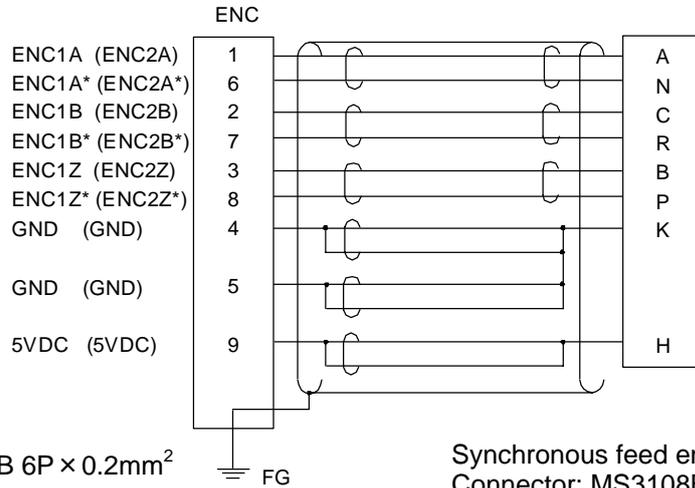
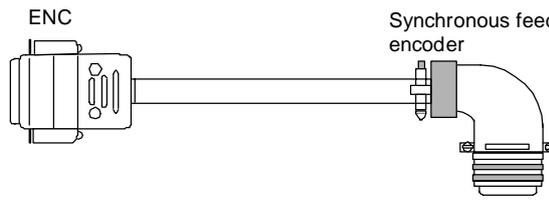
Contact: CD-PC-111

Case: HDE-CTF/HDE-CTH

Recommended

manufacturer:

Hirose Electric



Wire material: DPVVS_B 6P × 0.2mm²

Recommended manufacturer:

Bando Electric Wire

Synchronous feed encoder:

Connector: MS3108B20-29S

Cable clamp: MS3057-12A

Recommended manufacturer: ITT Cannon

(NOTE)

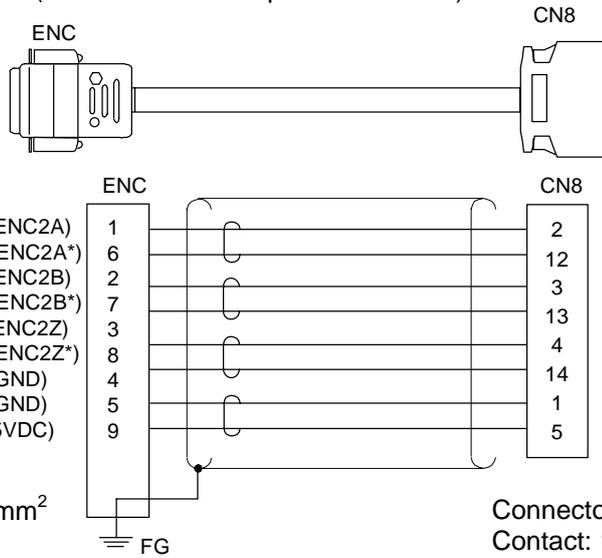
To prevent EMI / foreign noise, if HDE-CTH is used for case, fold the wire material shield over the sheath, and wrap copper foil tape over it.

Appendix 2.15 ENC-SP1 / ENC-SP2 cable

(1) ENC-SP1

Usage: Synchronous feed encoder (Between NC and spindle drive unit)

Connector: CDE-9PF
 Contact: CD-PC-111
 Case: HDE-CTF/HDE-CTH
 Recommended manufacturer:
 Hirose Electric



Wire material: DPVVS_B 6P × 0.2mm²
 Recommended manufacturer:
 Bando Electric Wire

Connector: 10120-6000EL
 Contact: 10320-3210-000
 Case: HDA-CTF
 Recommended manufacturer: 3M

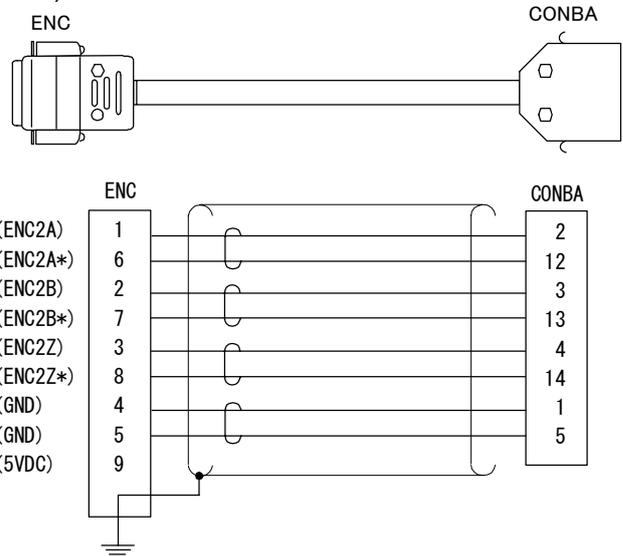
(NOTE)

Do not connect the power supply (5VDC).
 To prevent EMI / foreign noise, if HDE-CTH is used for case, fold the wire material shield over the sheath, and wrap copper foil tape over it.

(2) ENC-SP2 cable

Usage: Synchronous feed encoder (Between NC and FR-TK)

Connector: CDE-9PF
 Contact: CD-PC-111
 Case: HDE-CTF/HDE-CTH
 Recommended manufacturer:
 Hirose Electric



Connector: MRP-20F01
 Contact: MRP-F102
 Case: MR20L
 Recommended manufacturer:
 HONDA TSUSHIN
 Wire material: DPVVS_B 6P × 0.2mm²
 Recommended manufacturer:
 Bando Electric Wire

ENC1A (ENC2A)
 ENC1A* (ENC2A*)
 ENC1B (ENC2B)
 ENC1B* (ENC2B*)
 ENC1Z (ENC2Z)
 ENC1Z* (ENC2Z*)
 GND (GND)
 GND (GND)
 5VDC (5VDC)

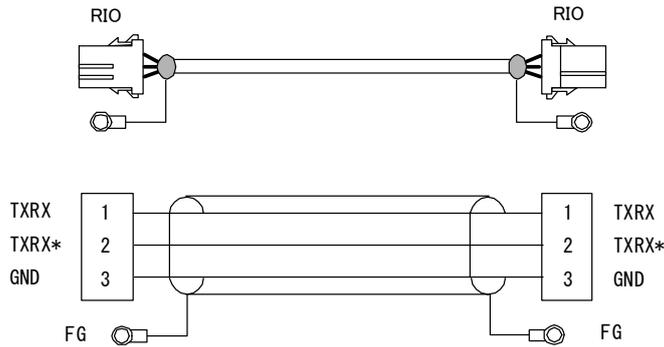
(NOTE)

Do not connect the power supply (5VDC).
 To prevent EMI / foreign noise, if HDE-CTH is used for case, fold the wire material shield over the sheath, and wrap copper foil tape over it.

Appendix 2.16 FCUA-R211 / SH41 cable

(1) FCUA-R211 cable
Usage: Remote I/O

Connector:
1-178288-3
Contact:
1-175218-2
Recommended
manufacturer:
Tyco Electronics
AMP

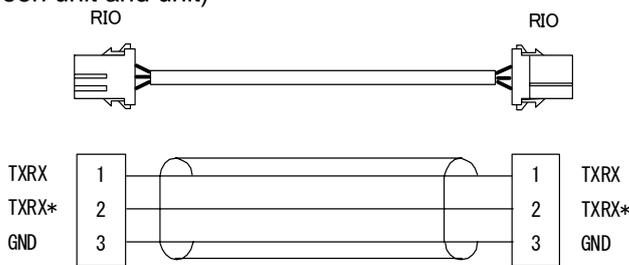


Wire material: MVVS $3C \times 0.3mm^2$ (MIC $3C \times 0.3mm^2$)
Recommended manufacturer: Takeuchi Densen

(NOTE)

1. Protect both ends of the wire material with insulation bushing.
2. Available both for the unit side and base I/O unit side.

(2) SH41 cable
Usage: Remote I/O (Between unit and unit)



Wire material: MVVS $3C \times 0.3mm^2$ (MIC $3C \times 0.3mm^2$)
Recommended manufacturer: Takeuchi Densen

Connector: 1-178288-3
Contact: 1-175218-2
Recommended manufacturer:
Tyco Electronics AMP

(NOTE)

1. Protect both ends of the wire material with insulation bushing.
2. Use this cable for a short bridge such as between remote I/O units in the same cabinet.
Normally, use the cable FCUA-R211 with the high noise resistance.

Appendix 2.17 FCUA-R300 / R301 cable

(1) R300 cable

Usage: DI/DO (For unit FCUA-DX1xx,FCU6-DX22x)
DI-L/DI-R/DO-L/DO-R



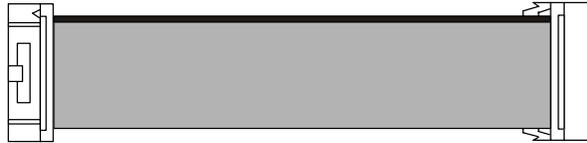
Connector: 7940-6500SC
Recommended manufacturer: 3M

Wire material: B40-S
Recommended manufacturer: Oki Electric Cable

(2) R301 cable

Usage: DI/DO (For unit FCUA-DX1xx,FCU6-DX22x)
DI-L/DI-R/DO-L/DO-R

Wire material: B40-S
Recommended manufacturer: Oki Electric Cable

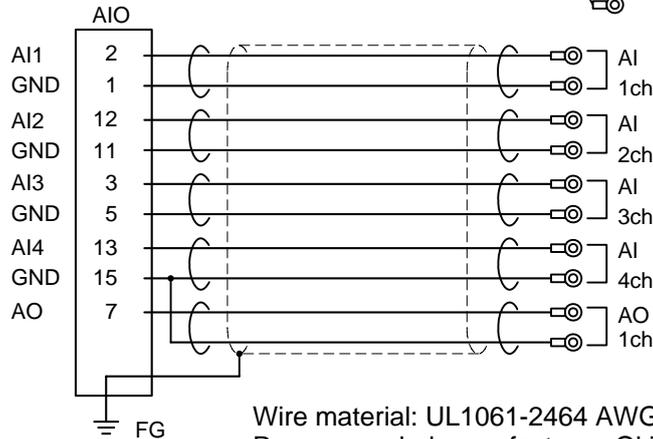
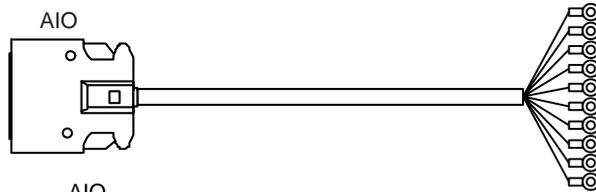


Connector: 7940-6500SC
Recommended manufacturer: 3M

Connector: 7940-6500SC
Strain relief: 3448-7940
Recommended manufacturer: 3M

Appendix 2.18 FCUA-R031 cable

Usage: Analog input/output (For unit FCUA-DX14x)



Wire material: UL1061-2464 AWG22x6P
Recommended manufacturer: Oki Electric Cable

Connector: 10120-3000VE
Case: 10320-52F-008
Recommended manufacturer: 3M

Crimp terminal: V1.25-3
Recommended manufacturer: JST

(Note)

Fold the wire material shield over the sheath, and wrap copper foil tape over it.
Connect the copper foil tape to the connector's GND plate.

APPENDIX 3. EMC INSTALLATION GUIDELINES

This section is an extract from "EMC Installation Guidelines BNP-B2230" for EZMotion-NC E60/E68 series.

For drive units (servo/spindle), refer to "EMC Installation Guidelines BNP-B8582-45".

Appendix 3.1 Introduction

EMC Directives became mandatory as of January 1, 1996. The subject products must have a CE mark attached indicating that the product complies with the Directives.

As the NC unit is a component designed to control machine tools, it is believed that it is not a direct EMC Directives subject. However, we would like to introduce the following measure plans to back up EMC Directives compliance of the machine tool as the NC unit is a major component of the machine tools.

- (1) Methods of installation in control/operation panel
- (2) Methods of wiring cables to outside of panel
- (3) Introduction of members for measures

Mitsubishi is carrying out tests to confirm the compliance to the EMC Directives under the environment described in this manual. However, the level of the noise will differ according to the equipment type and layout, control panel structure and wiring lead-in, etc. Thus, we ask that the final noise level be confirmed by the machine manufacturer.

Refer to "EMC Installation Guidelines BNP-B2230" for details.

Appendix 3.2 EMC Directives

The EMC Directives largely regulate the following two items.

- Emission: Capacity to prevent output of obstructive noise that adversely affects external devices.
- Immunity: Capacity to not malfunction due to obstructive noise from external source.

The details of each level are classified in the table below.

It is assumed that the Standards and test details required for a machine tool are the same as these.

Class	Name	Details	EN Standards	
Emission				
	Radiated noise	Restriction of electromagnetic noise radiated through the air	EN61000-6-4 (General industrial machine)	EN55011 (CLASS: A)
	Conductive noise	Restriction of electromagnetic noise discharged from power supply line	EN61800-3 (Motor control unit)	
Immunity				
	Static electricity electrical discharge	(Example) Regulation of withstand level of static electricity electrical discharge accumulated in human body	EN61000-6-2 (General industrial machine) EN61800-3 (Motor control unit)	EN61000-4-2
	Radiation immunity	(Example) Simulation of immunity from digital wireless telephones		EN61000-4-3
	Burst immunity	(Example) Regulation of withstand level of noise from relay or plug and play		EN61000-4-4
	Conductive immunity	(Example) Regulation of withstand level of noise flowed from power supply wires, etc.		EN61000-4-6
	Power supply frequency magnetic field	(Example) Regulation of electromagnetic noise of 50/60Hz power supply frequency		EN61000-4-8
	Power supply dip (fluctuation)	(Example) Regulation of power voltage drop withstand level		EN61000-4-11
	Surge	(Example) Regulation of withstand level of noise caused by lightning		EN61000-4-5

Appendix 3.3 EMC Measures

The main items relating to EMC measures include the following.

- (1) Store the device in a sealed metal panel.
- (2) Ground all conductors that are floating electrically. Decrease the impedance.
- (3) Increase the distance between the drive line and signal wire.
- (4) Shield the cables wired outside of the panel.
- (5) Install a noise filter.

Take care to the following items to suppress the noise radiated outside of the panel.

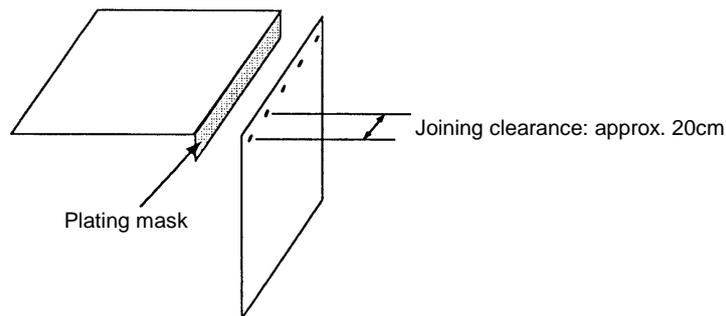
- (1) Accurately ground the devices.
- (2) Use shielded cables.
- (3) Increase the electrical seal of the panel. Reduce the gaps and holes.

Appendix 3.4 Panel Structure

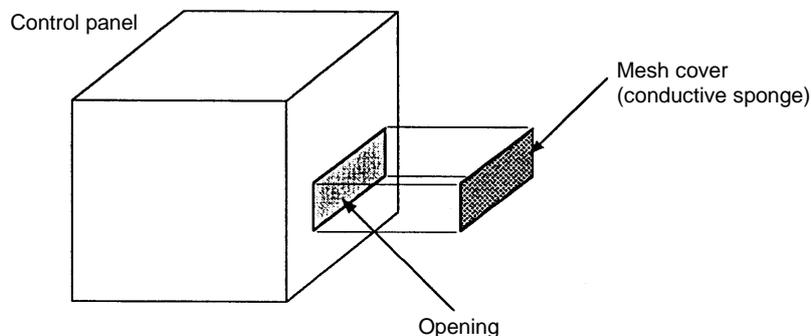
The design of the panel is a very important factor for the EMC measures, so take the following measures
Appendix 4.4.1 Measures for Control Panel Body

Appendix 3.4.1 Measures for door

- (1) Use metal for all members configuring the panel.
- (2) When joining the metal plate, treat the welded or contacting sections so that the impedance is reduced, and then fix with screws.



- (3) Note that if the plate warps due to the screw fixing, etc., by that creating a clearance, noise could leak from that place.
- (4) Plate (nickel, tin) the metal plate surface at the grounding plate, and connect the connections with a low impedance.
- (5) If there is a large opening, such as ventilation holes, make sure to close the hole.

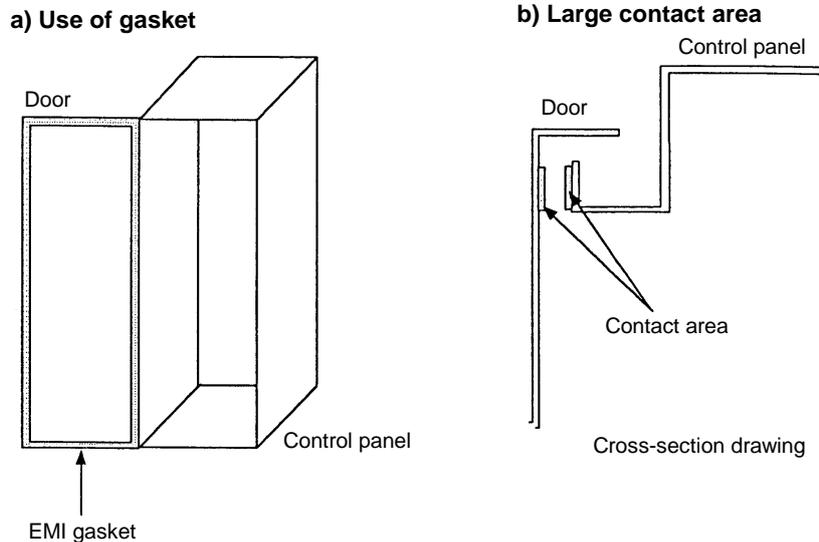


-CAUTION-

Using screws to fix the plates that have been painted is the same as an insulated state. Peel the paint and fix the screws.

Appendix 3.4.2 Measures for door

- (1) Use metal for all members configuring the door.
- (2) When joining the door, use a gasket to lower the impedance of the contacting sections, or use a structure with a large contact area as shown below.



-CAUTION-

The EMI gasket or conductive packing must contact the metal surface uniformly and at the correct position.

When not using a gasket, ground the control panel grounding with a grounding wire to lower the door's impedance.

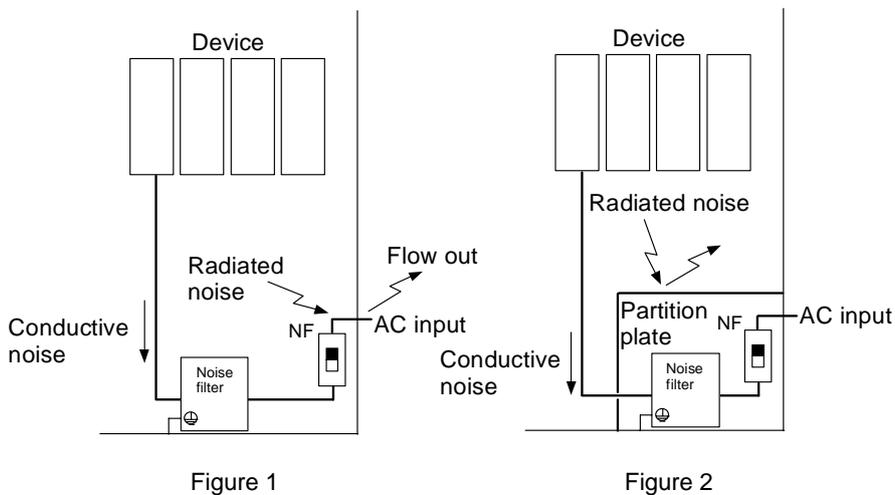
Using screws to fix the plates that have been painted (attachment of packing) is the same as an insulated state. Peel the paint and fix the screws.

Appendix 3.4.3 Measures for power supply

Shield the power supply section and insert a filter to prevent the noise from flowing in or out.

The conductive noise can be suppressed just by inserting a noise filter, but the radiated noise will flow out.

The conductive and radiated noise can both be suppressed by adding a partition plate to the noise filter.



-CAUTION-

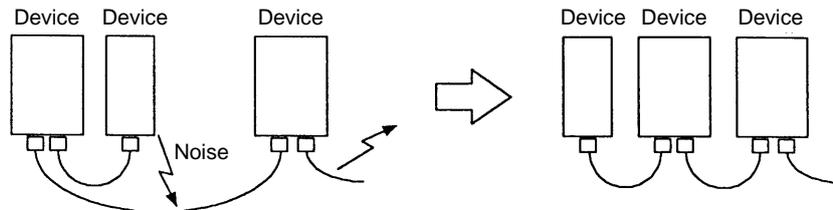
Selection of the noise filter capacity will differ according to the drive amplifier and devices being used. Refer to the "EMC Installation Guidelines" NC Servo Amplifier Section [BNP-B8582-45].

Appendix 3.5 Measures for Wiring in Panel

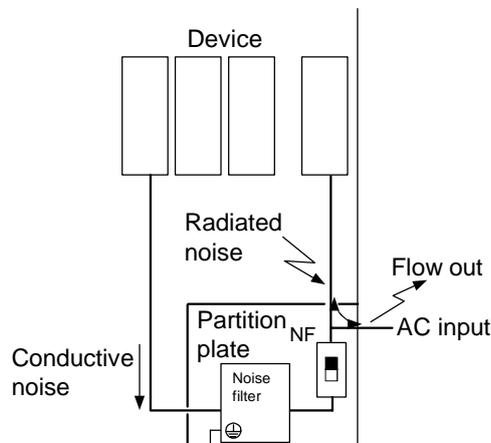
Cables act as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated. The following measures must be sufficiently considered for the cables (SH21/F010/FCUA-R211) that carry out high-speed communication.

Appendix 3.5.1 Precautions for wiring in panel

- (1) If the cables are led unnecessary in the panel, they will pick up noise. Thus, keep the wiring length as short as possible.



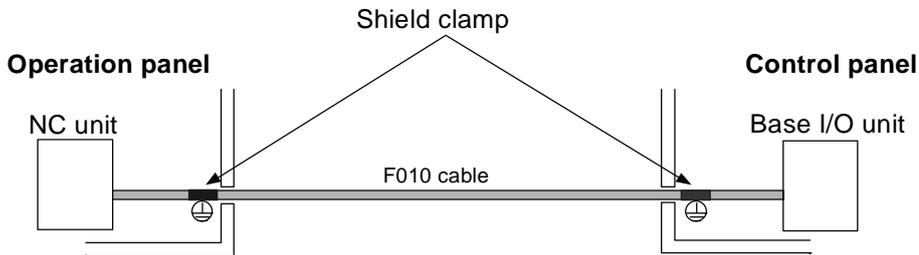
- (2) Always connect the grounding wire to the FG terminal indicated on the device.
- (3) Keep the distance between the drive line and detector cable to the drive section motor as far apart as possible when wiring.
- (4) Do not lead the power supply wire around the panel without using a filter.



Appendix 3.5.2 Shield treatment of cables

Use shielded cables for the cables wired outside the panel in the M64/M65/M66 Series.
Use a shield clamp within 10cm of the lead-out port from the panel.

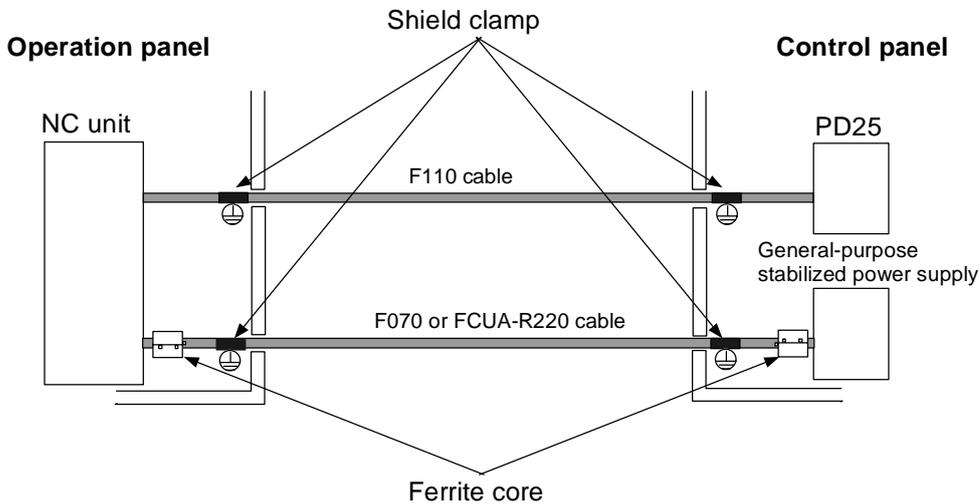
(1) I/O interface cable [F010 cable]



-CAUTION-

Always use the shield clamp on both ends of the connected units.
The shield clamp is not required if the control unit and base I/O unit are wired in the same panel.

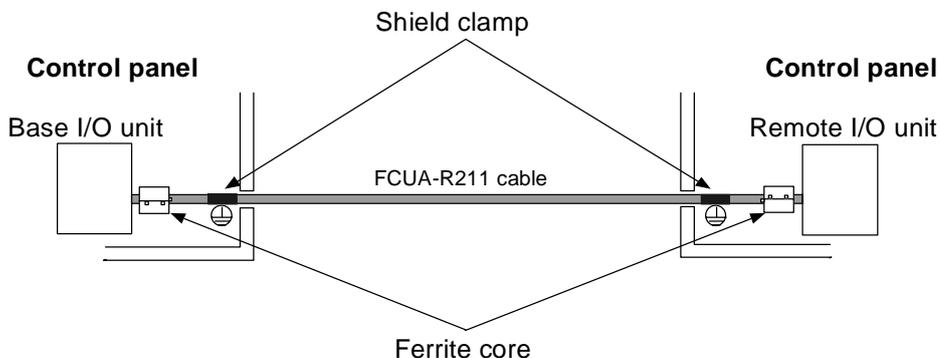
(2) DC power supply cable [F110/F070/FCUA-R220 cable]



-CAUTION-

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units. (Refer to "Appendix 3.6.2 Ferrite Core".)
- Always install a ferrite core on the general-purpose stabilized power supply. (The ferrite core may not be required depending on the selected power supply.)

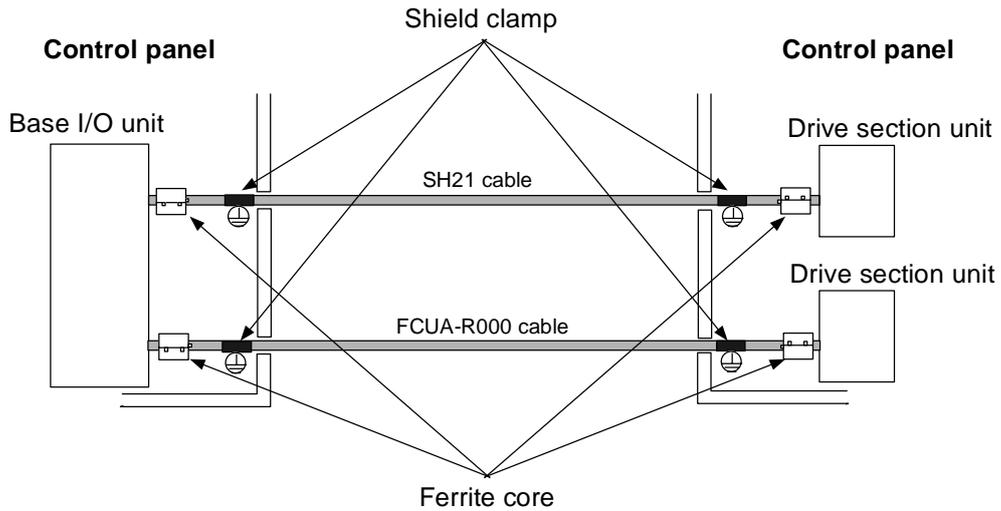
(3) Remote I/O cable [FCUA-R211 cable]



-CAUTION-

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- The shield clamp and ferrite core are not required if the control unit and base I/O unit are wired in the same panel.

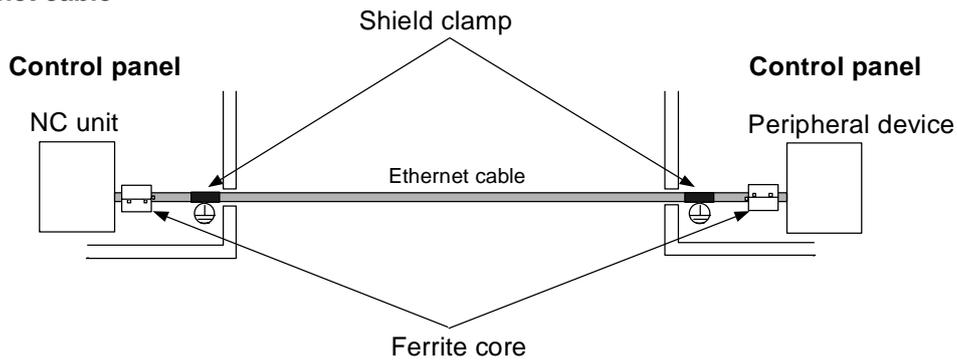
(4) Servo communication cable [SH21/FCUA-R000 cable]



-CAUTION-

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- The shield clamp and ferrite core are not required if the drive section unit and base I/O unit are wired in the same panel.

(5) Ethernet cable



-CAUTION-

- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- Depending on peripheral devices, shield clamp and ferrite core are not necessary.

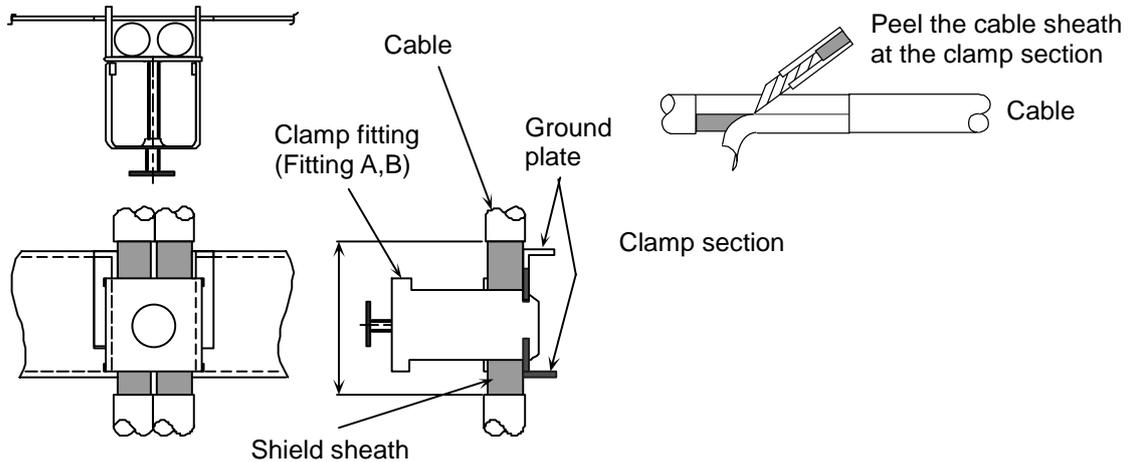
Appendix 3.6 Parts for EMC Measures

Appendix 3.6.1 Shield clamp fitting

The ground can be directly connected to the grounding plate as shown below to increase the effect. Install the grounding plate near the outlet (within 10cm) of each panel, and press against the grounding plate with the clamp fitting. If the cables are thin, several can be bundled and clamped together.

To provide sufficient frame ground, install the grounding plate directly on the cabinet or connect with a grounding wire.

If the grounding plate and clamp fitting set AERSBAN-□SET is required, please contact Mitsubishi.



As for the outline drawings of ground plate and clamp fitting, refer to Appendix 1.9 Outline drawing of ground plate and clamp fitting.

Appendix 3.6.2 Ferrite core

The ferrite core is mounted integrally with the plastic case.

This can be installed with one touch without cutting the interface cable or power supply cable.

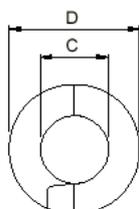
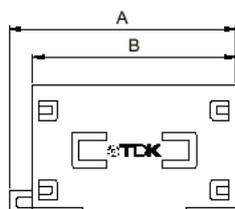
This ferrite core is effective against common mode noise, allowing measures against noise without affecting the quality of the signal.

Recommended ferrite core

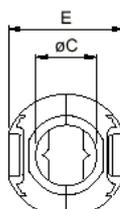
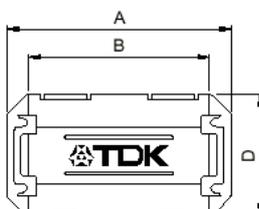
TDK ZCAT Series

ZCAT3035-1330(-BK)

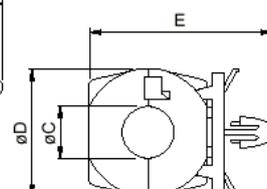
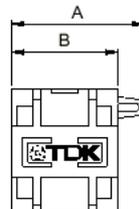
ZCAT type



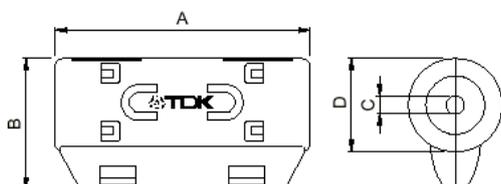
ZCAT-A, ZCAT-AP type



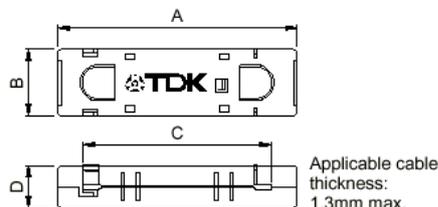
ZCAT-B type



ZCAT-C type



ZCAT-D type



Unit: mm

Part name	A	B	øC	øD	E	Applicable cable outer diameter	Weight (g)
ZCAT1518-0730-M(-BK) ^{*1}	22±1	18±1	7±1	15±1	—	7max.	6
ZCAT1518-0730(BK) ^{*2}	22±1	18±1	7±1	15±1	—	7max.	6
ZCAT2017-0930-M(-BK)	21±1	17±1	9±1	20±1	—	9max.	11
ZCAT2032-0930-M(-BK) ^{*1}	36±1	32±1	9±1	19.5±1	—	9max.	22
ZCAT2032-0930(-BK) ^{*2}	36±1	32±1	9±1	19.5±1	—	9max.	22
ZCAT2132-1130-M(-BK) ^{*1}	36±1	32±1	11±1	20.5±1	—	11max.	22
ZCAT2132-1130(-BK) ^{*2}	36±1	32±1	11±1	20.5±1	—	11max.	22
ZCAT3035-1330-M(-BK) ^{*1}	39±1	34±1	13±1	30±1	—	13max.	63
ZCAT3035-1330(-BK) ^{*2}	39±1	34±1	13±1	30±1	—	13max.	63
ZCAT1525-0430AP-M(-BK)	25±1	20±1	4±1	15±1	11.5±1	2.5 to 4(USB)	7
ZCAT1325-0530A-M(-BK) ^{*1}	25±1	20±1	5±1	12.8±1	11.2±1	3 to 5(USB)	7
ZCAT1325-0530A(-BK)	25±1	20±1	5±1	12.8±1	11.2±1	3 to 5(USB)	7
ZCAT1730-0730A-M(-BK)	30±1	23±1	7±1	16.5±1	15±1	4 to 7(USB/IEEE1394)	12
ZCAT2035-0930A-M(-BK) ^{*1}	35±1	28±1	9±1	19.5±1	17.4±1	6 to 9	22
ZCAT2035-0930A(-BK)	35±1	28±1	9±1	19.5±1	17.4±1	6 to 9	22
ZCAT2235-1030A-M(-BK)	35±1	28±1	10±1	21.5±1	20±1	8 to 10	27
ZCAT2436-1330A-M(-BK)	36±1	29±1	13±1	23.5±1	22±1	10 to 13	29
ZCAT2017-0930B-M(-BK)	21±1	17±1	9±1	20±1	28.5±1	9max.	12
ZCAT2749-0430C-M(-BK)	49±1	27±1	4.5±1	19.5±1	—	4.5max.	26
ZCAT4625-3430D(-BK)	45.5±1	24.5±1	34±1	12±1	—	26 (For core flat cable)	32
ZCAT4625-3430DT(-BK) ^{*3}	45.5±1	24.5±1	34±1	13±1	—	26 (For core flat cable)	32
ZCAT6819-5230D(-BK)	67.5±1	18.5±1	52±1	16±1	—	40 (For core flat cable)	58
ZCAT6819-5230DT(-BK) ^{*3}	67.5±1	18.5±1	52±1	17±1	—	40 (For core flat cable)	58

ZCAT-C type ZCAT-D type

*1 The M stamp is attached.

*2 Fixing band is attached at shipment.

*3 With double-faced tape. (Tape attached at shipment.)

● ZCAT-B type: Cabinet fixing type installation hole ø4.8 to 4.9mm, plate thickness 0.5 to 2mm

● ZCAT-AP, ZCAT-C type: Has the structure that prevents easy opening once case is closed.

Appendix 3.6.3 Surge protector

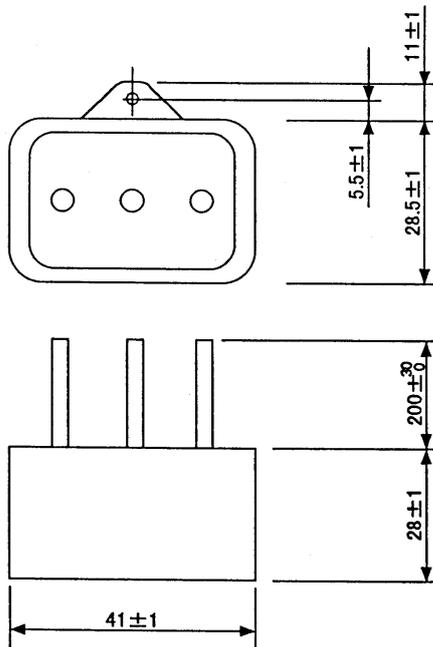
(1) Surge absorber

Make sure that surge does not directly enter the AC line of the general-purpose stabilized power supply (prepared by user) supplied to the control unit and DIO. The following product or equivalent is recommended for the surge killer.

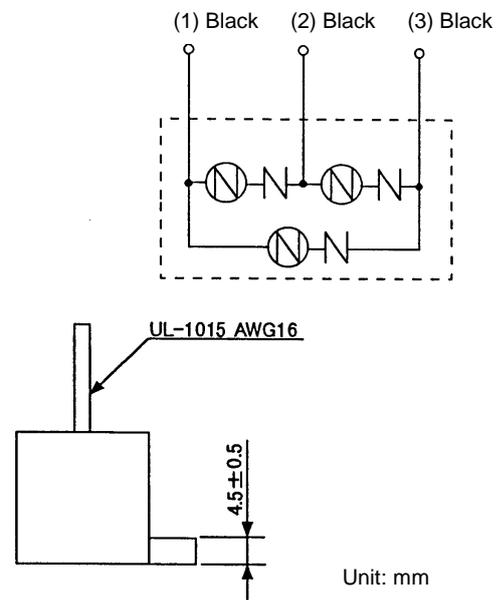
- 1) Part name : RAV-781BYZ-2
 Manufacturer : OKAYA ELECTRIC INDUSTRIES

Circuit voltage 50/60Hz [Vrms]	Max. tolerable circuit voltage [V]	Clamp voltage [V] ± 10%	Surge resistance level 8/20µs [A]	Surge withstand voltage 1.2/50µs [V]	Electro-static capacity [pF]	Working temperature range [°C]
250 3ø	300	783	2500	20k	75	-20 to +70

Outline drawing



Circuit drawing



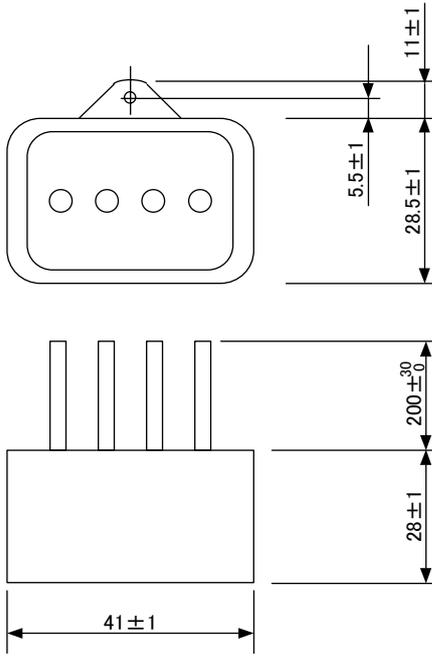
-CAUTION-

Refer to the manufacturer's catalog for detailed characteristics, outline and connection methods of the surge absorber.

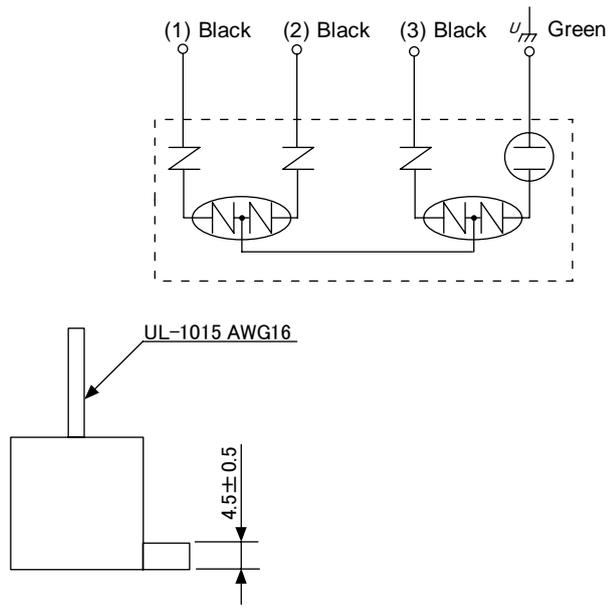
- 2) Part name : RAV-781BXZ-4
 Manufacturer : OKAYA ELECTRIC INDUSTRIES

Circuit voltage 50/60Hz [Vrms]	Max. tolerable circuit voltage [V]	Clamp voltage [V] ± 10%	Surge resistance level 8/20µs [A]	Surge withstand voltage 1.2/50µs [V]	Electro-static capacity [pF]	Working temperature range [°C]
250 3ø	300	700	2500	2k	75	-20 to +70C

Outline drawing



Circuit drawing

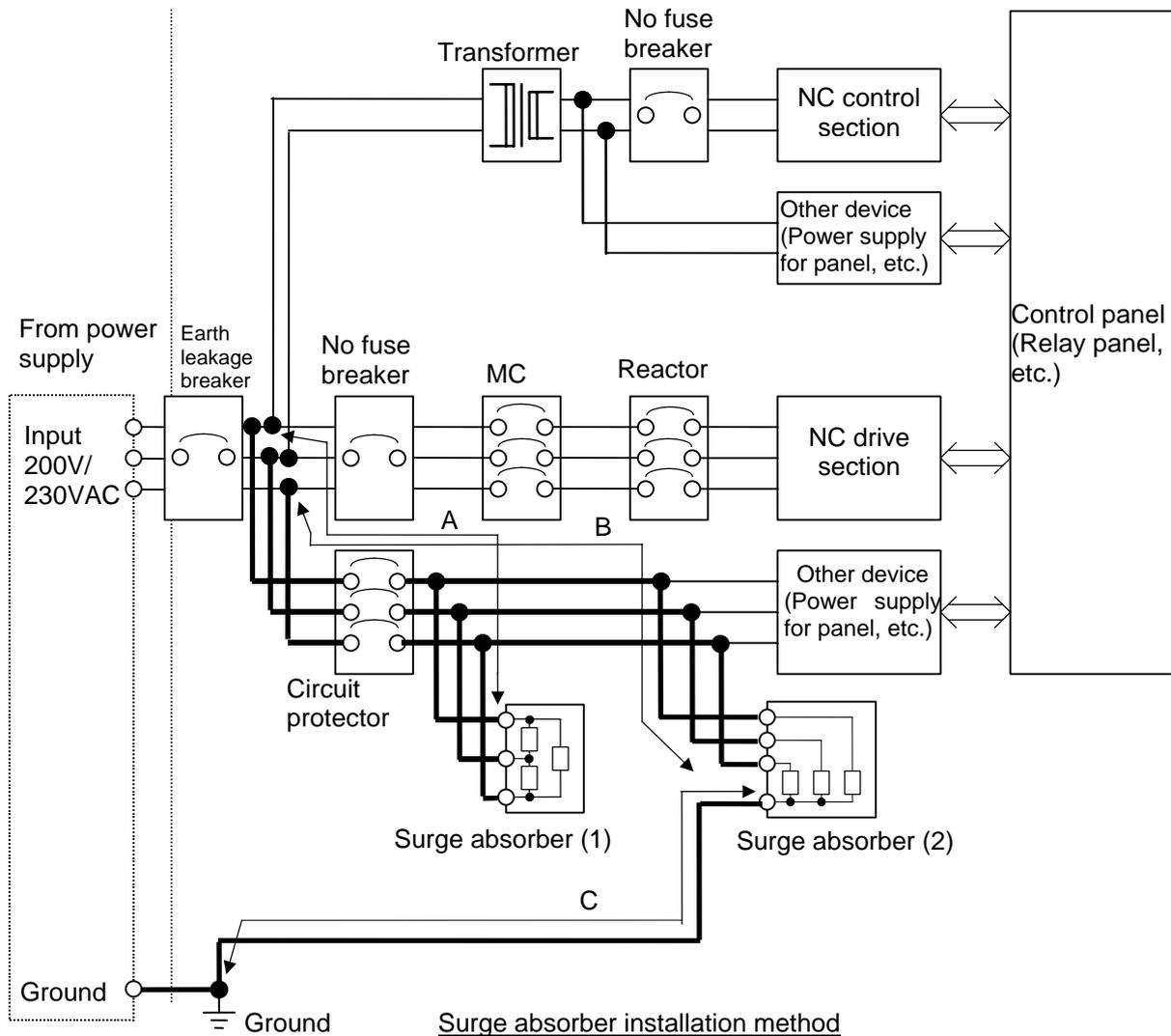


Unit: mm

-CAUTION-

Refer to the manufacturer's catalog for detailed characteristics, outline and connection methods of the surge absorber.

(2) Example of surge absorber installation



Surge absorber installation method

-CAUTION-

- (1) Thick wires enhance the lightning surge absorption effect, so use as thick and short a wire as possible.
 Wire material: Wire diameter 2mm² or more
 Wire length: Connection wire length A to surge absorber (1): 2m or less.
 Connection wire length B to surge absorber (2): 2m or less.
 Ground wire length C to surge absorber (2): 2m or less.
- (2) When carrying out an insulation withstand voltage test on the power supply line, remove surge absorber (2) as it will activate with the applied voltage.
- (3) A short-circuit fault will occur if a surge exceeding the tolerance is applied on the surge absorber. Thus, always insert a circuit protector to protect the power supply line.
 A current does not flow to surge absorber (1) and (2) during normal use, so the circuit protector can be shared with other devices.

Appendix 3.6.4 Selection of stabilized power supply

Consider the following characteristics when selecting the stabilized power supply (prepared by user).
Use a power supply that complies with CE Marking or that follows the Safety Standards given below.

Stabilized power supply selection items

Item			Conditions
Out-put	Voltage fluctuation	±5%	±5% or less of 24VDC
	Ripple noise	max 120mV	±5% or less of 24VDC
	Spike noise	max 500mV	
Output current		-	Refer to Connection Manual.
Output holding time		min 20ms	Instantaneous OFF time

Standards

Safety Standards : UL1950, CSA C22.2 No. 234 approved, IEC950 compliant
Noise Terminal Voltage : FCC Class A, VCCI-1 Class
Higher Harmonics Current Restrictions : IEC1000-3-2

APPENDIX 4. TRANSPORTATION RESTRICTIONS FOR LITHIUM BATTERIES

Appendix 4.1 Restriction for Packing

The United Nations Dangerous Goods Regulations "Article 12" became effective from 2003. When transporting lithium batteries with means subject to the UN Regulations, such as by air transport, measures corresponding to the Regulations must be taken. The UN Regulations classify the batteries as dangerous goods (Class 9) or not dangerous goods according to the lithium content.

To ensure safety during transportation, lithium batteries (battery unit) directly exported from Mitsubishi are packaged in a dedicated container (UN package) for which safety has been confirmed. When the customer is transporting these products with means subject to the UN Regulations, such as air transport, the shipper must follow the details explained in the section "Appendix 4-1-2 Handling by user".

Appendix 4.1.1 Target products

The following Mitsubishi NC products use lithium batteries. The UN Regulations classify the batteries as dangerous goods (Class 9) or not dangerous goods according to the lithium content. If the batteries subjected to hazardous materials are incorporated in a device and shipped, a dedicated packaging (UN packaging) is not required. However, the item must be packed and shipped following the Packing Instruction 912 specified in the IATA DGR (Dangerous Goods Regulation) book.

Also, all lithium battery products incorporated in a machinery or device must be fixed securely in accordance with the Packing Instruction 900 and shipped with protection in a way as to prevent damage or short-circuits.

(1) Products requiring dedicated packaging (Materials falling under Class 9)

Mitsubishi type (Type for arrangement)	Battery type	Lithium metal content	Application	Battery class
MDS-A-BT-4	ER6-B4-11	2.6g	For servo	Battery
MDS-A-BT-6	ER6-B6-11	3.9g	For servo	
MDS-A-BT-8	ER6-B8-11	5.2g	For servo	
FCU6-BT4-D1	Combination of ER6-B4D-11 and ER6	2.6g+0.65g	For NC/ servo	Battery cell
CR23500SE-CJ5 (Note1)	CR23500SE-CJ5	1.52g	For NC(M500)	

(2) Products not requiring dedicated packaging (Materials not falling under Class 9)

Mitsubishi type (Type for arrangement)	Battery type	Lithium metal content	Application	Battery class
MDS-A-BT-2	ER6-B2-12	1.3g	For servo	Battery
FCU6-BTBOX	2CR5	1.96g	For NC/ servo	
CR2032 (for built-in battery)	CR2032	0.067g	For NC	Battery cell
CR2450 (for built-in battery)	CR2450	0.173g	For NC	
ER6, ER6V series (for built-in battery)	ER6, ER6V	0.7g	For NC/servo	
MR-BAT	MR-BAT	0.48g	For servo	
Q6BAT	Q6BAT	0.49g	For NC	

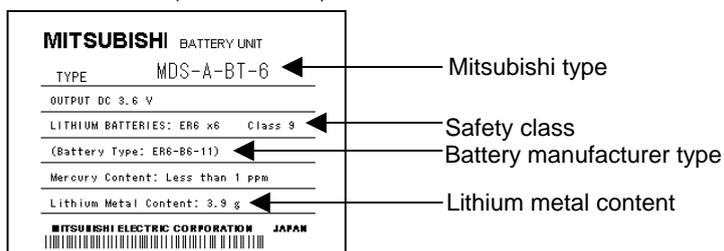
(Note 1) When CR23500SE-CJ5 is incorporated in the unit, this battery is not subject to the regulation.

(Note 2) Dedicated packaging is required if the shipment exceeds 12 batteries/24 battery cells. Package the batteries so that this limit is not exceeded.

(Note 3) The battery units labeled as "FCUA-" instead of "MDS-A-" also use the same battery.

(Note 4) Always use the cell battery (MR-BAT) in combination with the dedicated case (MDS-BTCASE). Maximum 8 (either 2, 4, 6 or 8) cell batteries can be installed to the dedicated case (MDS-BTCASE).

Example) Rating nameplate for battery units



Appendix 4.1.2 Handling by user

The following technical opinion is solely Mitsubishi's opinion. The shipper must confirm the latest IATA Dangerous Goods Regulations, IMDG Codes and laws and orders of the corresponding export country. These should be checked by the company commissioned for the actual transportation.

- IATA : International Air Transport Association
- IMDG Code : A uniform international code for the transport of dangerous goods by seas determined by IMO (International Maritime Organization).

■ When shipping isolated lithium battery products (Packing Instruction 903)

(1) Reshipping in Mitsubishi UN packaging

Mitsubishi packing applies the isolated battery's safety test and packaging specifications complying with the UN Regulations (Packing Instruction 903).

The user only needs to add the following details before shipping. (Consult with the shipping company for details.)

(a) Indication of container usage mark on exterior box (Label with following details recorded.)

- Proper shipping name (Lithium batteries)
- UN NO. (UN3090 for isolated battery, UN3091 for battery incorporated in a device or included)
- Shipper and consignee's address and name

Example of completing form			
SHIPPER:		CONSIGNEE:	
	Shipper information		Consignee information
<p>PROPER SHIPPING NAME LITHIUM BATTERIES</p> <p>UN NO. : UN3090 CLASS: 9 SUBSIDIARY RISK</p> <p>PACKING GROUP: II PACKING INST. : 903</p>			

(b) Preparation of shipping documents (Declaration of dangerous goods)

(Refer to the section "Appendix 4-3 Example of hazardous goods declaration list")

(2) When packaged by user

The user must follow UN Regulations when packing, preparing for shipping and preparing the indications, etc.

(a) Packing a lithium battery falling under Class 9

- Consult with The Ship Equipment Inspection Society of Japan for details on packaging.
- Prepare for shipping as explained in "(1) Reshipping in Mitsubishi UN packaging".

The Ship Equipment Inspection Society of Japan
 Headquarters Telephone: 03-3261-6611 Fax: 03-3261-6979

(b) Packing a lithium battery not falling under Class 9

- Cells and batteries are separated so as to prevent short circuits and are stored in a strong outer packaging. (12 or less batteries, 24 or less cells.)
- Prepare for the certificates or test results showing compliance to battery safety test. The safety test results have been obtained from the battery manufacturer. (Consult with Mitsubishi when the safety test results are required.)
- Prepare for shipping as explained in "(1) Reshipping in Mitsubishi UN packaging".

■ **When shipping lithium batteries upon incorporating in a machinery or device (Packing Instruction 900)**

Pack and prepare for shipping the item in accordance with the Packing Instruction 900 specified in the IATA DGR (Dangerous Goods Regulation) book. (Securely fix the batteries that comply with the UN Manual of Tests and Criteria to a machinery or device, and protect in a way as to prevent damage or short-circuit.)

Note that all the lithium batteries provided by Mitsubishi have cleared the UN recommended safety test; fixing the battery units or cable wirings securely to the machinery or device will be the user's responsibility.

Check with your shipping company for details on packing and transportation.

■ **When shipping a device with lithium batteries incorporated (Packing Instruction 912)**

A device incorporating lithium batteries does not require a dedicated packaging (UN packaging). However, the item must be packed, prepared for shipping and labeled following the Packing Instruction 912 specified in the IATA DGR (Dangerous Goods Regulation) book.

Check with your shipping company for details on packing and transportation.

The outline of the Packing Instruction 912 is as follows:

- All the items in the packing instructions for shipping the isolated lithium battery products (Packing Instruction 903) must be satisfied, except for the items related to container, short-circuit, and fixation.
- A device incorporating lithium batteries has to be stored in a strong water-proofed outer packaging.
- To prevent an accidental movement during shipment, securely store the item in an outer packaging.
- Lithium content per device should be not more than 12g for cell and 500g for battery.
- Lithium battery mass per device should be not more than 5kg.

Appendix 4.1.3 Reference

Refer to the following materials for details on the regulations and responses.

Guidelines regarding transportation of lithium batteries and lithium ion batteries (Edition 2)
.....Battery Association of Japan

Appendix 4.2 Issuing Domestic Law of the United States for Primary Lithium Battery Transportation

Federal Aviation Administration (FAA) and Research and Special Programs Administration (RSPA) announced an additional regulation (interim final rule) for the primary lithium batteries transportation restrictions item in "Federal Register" on Dec.15 2004. This regulation became effective from Dec.29, 2004.

This law is a domestic law of the United States, however it also applies to the domestic flight and international flight departing from or arriving in the United States. Therefore, when transporting lithium batteries to the United State, or within the United State, the shipper must take measures required to transport lithium batteries.

Refer to the Federal Register and the code of Federal Regulation ("Appendix 4-2-4 Reference") for details.

Appendix 4.2.1 Outline of regulation

- (1) Transporting primary lithium battery by passenger aircraft is forbidden.
 - Excluding primary lithium battery for personal use in a carry-on or checked luggage (Lithium metal content should be not more than 5g for cell and 25g for battery. For details on the lithium metal content, refer to "Appendix 4-1-1 Target products".)
- (2) When transporting primary lithium battery by cargo aircraft, indicate that transportation by passenger aircraft is forbidden on the exterior box.

Appendix 4.2.2 Target products

All NC products for which the lithium batteries are used are subject to the regulation. (Refer to the table "Appendix 4-1-1 Target products".)

Appendix 4.2.3 Handling by user

The "Appendix 4-2-1 Outline of regulation" described above is solely Mitsubishi's opinion. The shipper must confirm orders of "Appendix 4-2-4 Reference" described below for transportation method corresponding the regulation. Actually, these should be checked by the company commissioned for the actual lithium battery transportation.

(1) Indication of exterior box

When transporting primary lithium battery by cargo aircraft, indicate that transportation by passenger aircraft is forbidden on the exterior box.

Display example

PRIMARY LITHIUM BATTERIES FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT.

- The character color must be displayed with contrast. (black characters against white background, black characters against yellow background, etc.)
- The height (size) of characters to be displayed is prescribed depending on the packaging weight.
 - When the total weight is over 30kg: at least 12mm
 - When the total weight is less than 30kg: at least 6mm

Appendix 4.2.4 Reference

- (1) Federal Register (Docket No. RSPA-2004-19884 (HM-224E)) PDF format
<http://www.regulations.gov/fredpdfs/05-11765.pdf>
- (2) 49CFR (Code of Federal Regulation, Title49) (173.185 Lithium batteries and cells.)
http://www.access.gpo.gov/nara/cfr/waisidx_00/49cfr173_00.html
- (3) DOT regulation body (Department of Transportation)
<http://hazmat.dot.gov/regs/rules/final/69fr/docs/69fr-75207.pdf>

Appendix 4.3 Example of Hazardous Goods Declaration List

This section describes a general example of the hazardous goods declaration list. For details, please inquire each transportation company.

This will be applied only to the batteries described in "Appendix 4-1 Restriction for Packing".

(1) Outline of hazard

Principal hazard and effect	Not found.
Specific hazard	As the chemical substance is stored in a sealed metal container, the battery itself is not hazardous. But when the internal lithium metal attaches to human skin, it causes a chemical skin burn. As a reaction of lithium with water, it may ignite or forms flammable hydrogen gas.
Environmental effect	Not found.
Possible state of emergency	Damages or short-circuits may occur due to external mechanical or electrical pressures.

(2) First-aid measure

Inhalation	If a person inhales the vapor of the substance due to the battery damage, move the person immediately to fresh air. If the person feels sick, consult a doctor immediately.
Skin contact	If the content of the battery attaches to human skin, wash off immediately with water and soap. If skin irritation persists, consult a doctor.
Eye contact	In case of contact with eyes due to the battery damage, rinse immediately with a plenty of water for at least 15 minutes and then consult a doctor.
Ingestion	If swallowed, consult a doctor immediately.

(3) Fire-fighting measure

Appropriate fire-extinguisher	Dry sand, dry chemical, graphite powder or carbon dioxide gas
Special fire-fighting measure	Keep the battery away from the fireplace to prevent fire spreading.
Protectors against fire	Fire-protection gloves, eye/face protector (face mask), body/skin protective cloth

(4) Measure for leakage

Environmental precaution	Dispose of them immediately because strong odors are produced when left for a long time.
How to remove	Get them absorbed into dry sand and then collect the sand in an empty container.

(5) Handling and storage

Handling	Cautions for safety handling	Do not peel the external tube or damage it. Do not dispose of the battery in fire or expose it to heat. Do not immerse the battery in water or get it wet. Do not throw the battery. Do not disassemble, modify or transform the battery. Do not short-circuit the battery.
	Storage	Appropriate storage condition Avoid direct sunlight, high temperature and high humidity. (Recommended temp. range: +5 to +35 °C, humidity: 70%RH or less)
	Material to avoid	Flammable or conductive material (Metal: may cause a short-circuit)

(6) Physical/chemical properties

Appearance	Physical form	Solid
	Shape	Cylinder type
	Smell	Odorless
	pH	Not applicable (insoluble)
	Boiling point/Boiling range, Melting point, Decomposition temperature, Flash point	No information

(7) Stability and reactivity

Stability	Stable under normal handling condition.
Condition to avoid	Do not mix multiple batteries with their terminals uninsulated. This may cause a short-circuit, resulting in heating, bursting or ignition.
Hazardous decomposition products	Irritative or toxic gas is emitted in the case of fire.

(8) Toxicological information

As the chemical substance is stored in a sealed metal container, the battery has no harmfulness. Just for reference, the table below describes the main substance of the battery.

(Lithium metal)

Acute toxicity	No information
Local effect	Corrosive action in case of skin contact

(9) Ecological information

Mobility, Persistence/Decomposability, Bio-accumulation potential, Ecological toxicity	Not found.
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(10) Caution for disposal

Dispose of the battery following local laws or regulations.
Pack the battery properly to prevent a short-circuit and avoid contact with water.

APPENDIX 5. PRECAUTIONS FOR COMPLIANCE TO UL/C-UL STANDARDS

Observe the following matters to comply with UL/c-UL Standards.

Refer to "UL/c-UL Standards Compliance Unit Instruction Manual" (BNP-A2993-81) for details.

- (1) Selection of external 24VDC power supply unit (The unit shall be prepared by the machine tool builder.)

MITSUBISHI EZMotion-NC Series numerical control unit complies with the UL Standards on the condition that the stabilized power supply unit supplying 24VDC to each unit is a UL-approved part. Use a UL-approved part for the stabilized power supply unit supplying 24VDC to each unit.

- (2) Unit ambient temperature

MITSUBISHI EZMotion-NC Series numerical control unit complies with the UL Standards on the condition that the unit is used at a temperature less than the maximum ambient temperature given in chapter 3.

Make sure that the maximum ambient temperature of each unit does not exceed the temperature given in chapter 3.

APPENDIX 6. PRECAUTIONS FOR USE OF PERIPHERAL DEVICES AND COMMERCIALLY AVAILABLE DEVICES

Peripheral device	Precautions
CF card	Commercially available CF cards may not be compatible with MITSUBISHI units or suitable for FA environment for temperature- or noise-wise. In the case of using it, careful performance check must be required by the machine tool builder.
	When inserting/removing a commercially available CF card, preferably, turn the MITSUBISHI device's power OFF to avoid any troubles. When inserting/removing a card while the power is ON, make sure to have sufficient time (approx. ten seconds or more) in between.
	Do not pull out the card or turn OFF the power during access to the CF card. Failure to observe this could cause the memory contents to be erased. In case of emergency, always perform backups by having your important data duplicated, etc. as MITSUBISHI will not guarantee the broken or lost data. Be sure to inform this matter to the end users.
	<p>Recommended products are the SanDisk products listed below:</p> <p>64MB SDCFB-64-J60 (JAN: 4523052000294)</p> <p>128MB SDCFB-128-J60 (JAN: 4523052000300)</p> <p>256MB SDCFB-256-J60 (JAN: 4523052000317)</p> <p>512MB SDCFB-512-J60 (JAN: 4523052000324)</p> <p>PCCARD adapter SDAD-38-J60 (JAN: 4523052000645)</p> <p>The performance of the above recommended products were checked under given conditions. The same performance may not be attained at the end-user side because of the difference in system environment. Also, no absolute performance guarantee can be provided even for the same type name as its constituent parts may differ.</p> <p>Some products may have been discontinued. Contact the respective manufacturer or distributor for inquiries about orders.</p>

APPENDIX 7. COMPLIANCE WITH CHINA COMPULSORY PRODUCT CERTIFICATION (CCC CERTIFICATION) SYSTEM

Appendix 7.1 Outline of China Compulsory Product Certification System

The Safety Certification enforced in China included the "CCIB Certification (certification system based on the "Law of the People's Republic of China on Import and Export Commodity Inspection" and "Regulations on Implementation of the Import Commodities Subject to the Safety and Quality Licensing System" enforced by the State Administration of Import and Export Commodity Inspection (SACI) on import/export commodities, and the "CCEE Certification" (certification system based on "Product Quality Certification Management Ordinance" set forth by the China Commission for Conformity Certification of Electrical Equipment (CCEE) on commodities distributed through China.

CCIB Certification and CCEE Certification were merged when China joined WTO (November 2001), and were replaced by the "China Compulsory Product Certification" (hereinafter, CCC Certification) monitored by the State General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) of the People's Republic of China.

The CCC Certification system was partially enforced from May 2002, and was fully enforced from May 2003. Target commodities which do not have CCC Certification cannot be imported to China or sold in China. (Indication of the CCIB or CCEE mark has been eliminated from May 1, 2003.)

CCIB : China Commodity Inspection Bureau

CCEE: China Commission for Conformity Certification of Electrical Equipment

CCC : China Compulsory Certification

Appendix 7.2 First Catalogue of Products Subject to Compulsory Product Certification

The First Catalogue of Products subject to Compulsory Product Certification, covering 132 items (19 categories) based on the CCIB products (104 items), CCEE products (107 items) and CEMC products (Compulsory EMC Certification products) was designated on December 3, 2001.

Class	Product catalogue	
1	Electric Wires and Cables (5 items)	
2	Switches, Installation protective and connection devices (6 items)	
3	Low-voltage Electrical Apparatus (9 items)	Compulsory Certification Regulations
	Circuit-breakers (including RCCB, RCBO, MCB)	
	Low-voltage switchers (disconnectors, switch-disconnectors, and fuse-combination devices.	
	Other protective equipment for circuits (Current limiting devices, circuits protective devices, over current protective devices, thermal protectors, over load relays, low-voltage electromechanical contactors and motor starters)	
	Relays (36V < Voltage ≤ 1000V)	
	Other switches (Switches for appliances, vacuum switches, pressure switches, proximity switches, foot switches, thermal sensitive switches, hydraulic switches, push-button switches, position limit switches, micro-gap switches, temperature sensitive switches, travel switches, change-over switches, auto-change-over switches, knife switches)	
	Other devices (contactors, motor starters, indicator lights, auxiliary contact assemblies, master controllers, A.C. Semiconductor motor controllers and starters)	
	Earth leakage protectors	
	CNCA -01C -011: 2001 (Switch and Control Equipment) CNCA -01C -012: 2001 (Installation Protective Equipment)	
Fuses		
Low-voltage switchgear		
	CNCA-01C-010:2001 (Low-voltage switchgear)	
4	Small power motors (1 item)	CNCA-01C-013:2001 (Small power motors)
(Note)		

Class	Product catalogue	
5	Electric tools	(16 items)
6	Welding machines	(15 items)
7	Household and similar electrical appliances	(18 items)
8	Audio and video equipment	(16 items)
9	Information technology equipment	(12 items)
10	Lighting apparatus	(2 items)
11	Telecommunication terminal equipment	(9 items)
12	Motor vehicles and Safety Parts	(4 items)
13	Tyres	(4 items)
14	Safety Glasses	(3 items)
15	Agricultural Machinery	(1 item)
16	Latex Products	(1 item)
17	Medical Devices	(7 items)
18	Fire Fighting Equipment	(3 items)
19	Detectors for Intruder Alarm Systems	(1 item)

(Note) When the servomotor or the spindle motor of which output is 1.1kW or less (at 1500 r/min) is used, NC could have been considered as a small power motor. However, CQC (China Quality Certification Center) judged it is not.

Appendix 7.3 Precautions for Shipping Products

As indicated in Appendix 7.2, NC products are not included in the First Catalogue of Products subject to Compulsory Product Certification. However, the Customs Officer in China may judge that the product is subject to CCC Certification just based on the HS Code.^{Note 2}

NC cannot be imported if its HS code is used for the product subject to CCC Certification. Thus, the importer must apply for a "Certification of Exemption" with CNCA.^{Note 3} Refer to Appendix 7.4. Application for Exemption for details on applying for an exemption.

(Note 1) The First Catalogue of Products subject to Compulsory Product Certification (Target HS Codes) can be confirmed at <http://www.cqc.com.cn/Center/html/60gonggao.htm>.

(Note 2) HS Code: Internationally unified code (up to 6 digits) assigned to each product and used for customs.

(Note 3) CNCA: Certification and Accreditation Administration of People's Republic of China (Management and monitoring of certification duties)

Appendix 7.4 Application for Exemption

Following "Announcement 8" issued by the Certification and Accreditation Administration of the People's Republic of China (CNCA) in May 2002, a range of products for which application for CCC Certification is not required or which are exempt from CCC marking has been approved for special circumstances in production, export and management activities.

An application must be submitted together with materials which prove that the corresponding product complies with the exemption conditions. Upon approval, a "Certification of Exemption" shall be issued.

<Range of products for which application is exempt>

Range of products not requiring application	<ul style="list-style-type: none"> (a) Items brought into China for the personal use by the foreign embassies, consulates, business agencies and visitors (Excluding products purchased from Service Company for Exporters) (b) Products presented on a government-to-government basis, presents (c) Exhibition products (products not for sale) (d) Special purpose products (e.g., for military use) <p>Products not requiring application for CCC Certification are not required to be CCC marked or certified.</p>
Range of products for which application is exempted	<ul style="list-style-type: none"> (e) Products imported or manufactured for research and development and testing purposes (f) Products shipped into China for integration into other equipment destined for 100% re-export to a destination outside of China (g) Products for 100% export according to a foreign trade contract (Excluding when selling partially in China or re-importing into China for sales) (h) Components used for the evaluation of an imported product line (i) The products imported or manufactured for the service (service and repairs) to the end-user. Or the spare parts for the service (service and repairs) of discontinued products. (j) Products imported or manufactured for research and development, testing or measurements (k) Other special situations

The following documents must be prepared to apply for an exemption of the "Import Commodity Safety and Quality License" and "CCC Certification".

(1) Formal Application

- (a) Relevant introduction and description of the company.
- (b) The characteristics of the products to be exempted.
- (c) The reason for exemption and its evidence (ex. customs handbook).
- (d) The name, trademark, quantity, model and specification of the products to be exempted. (Attach a detail listing of these items for a large quantity of products. When importing materials for processing and repair equipments, submit a list of the importing materials for each month and repair equipments.)
- (e) Guarantee for the safety of the products; self-declaration to be responsible for the safety during the manufacturing and use.
- (f) To be responsible for the authenticity and legitimacy of the submitted documents. Commitment to assist CNCA to investigate on the authenticity of the documents (When CNCA finds it necessary to investigate on the authenticity of the documents.)

(2) Business license of the company (Copy)

(3) Product compliance declaration

Indicate which standard's requirements the products comply with or submit a test report (Copy is acceptable. The report can be prepared in a manufacturer's laboratory either at home or overseas.)

(4) Import license (Only if an import license is needed for this product. Copy is acceptable.)

(5) Quota certificate (Only if a quota certificate is needed for this product. Copy is acceptable.)

(6) Commercial contract (Copy is acceptable.)

(7) If one of item (4), (5) or (6) cannot be provided, alternative documents, such as bill of lading, the invoice, and other evidential documents must be submitted.

Appendix 7.5 Mitsubishi NC Product Subject to/Not Subject to CCC Certification

The state whether or not Mitsubishi NC products are subject to the CCC Certification is indicated below, based on the "First Catalogue of Products subject to Compulsory Product Certification" issued by the State General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) of the People's Republic of China and the Certification and Accreditation Administration of the People's Republic of China (CNCA) on July 1, 2002.

Model	China HS Code (Note 1)	Judgment on whether or not subject to CCC Certification
Power supply unit	85044090	Not subject to CCC Certification
Servo/spindle drive unit	85371010	
Servo/spindle	85015100 85015200	Not subject to CCC Certification
NC	–	Not subject to CCC Certification
Display unit	–	Not subject to CCC Certification

(Note 1) The China HS Code is determined by the customs officer when importing to China. The above HS Codes are set based on the HS Codes used normally when exporting from Japan.

(Note 2) Reference IEC Standards are used as the actual IEC Standards may not match the GB Standards in part depending on the model.

Whether or not the NC products are subject to CCC Certification was judged based on the following five items.

- (a) Announcement 33 (Issued by AQSIQ and CNCA in December 2001)
- (b) HS Codes for the products subject to CCC Certification (Export Customs Codes)
 - * HS Codes are supplementary materials used to determine the applicable range. The applicable range may not be determined only by these HS Codes.
- (c) GB Standards (This is based on the IEC Conformity, so check the IEC. Note that some parts are deviated.)
- (d) Enforcement regulations, and products specified in applicable range of applicable standards within
- (e) "Products Excluded from Compulsory Certification Catalogue" (Issued by CNCA, November 2003)

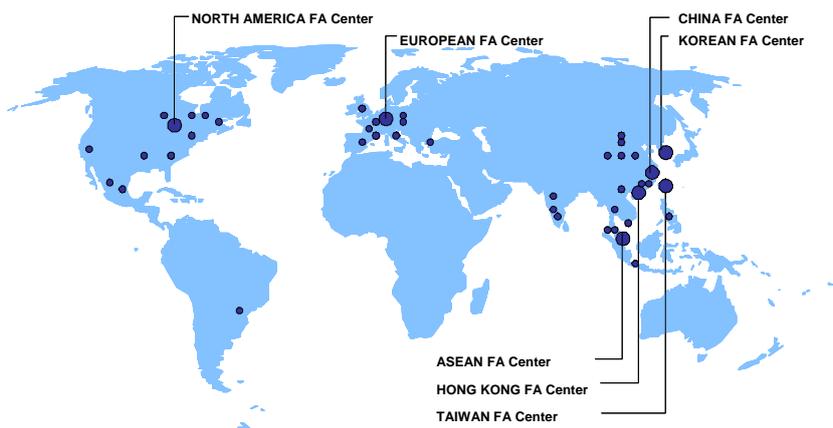
Reference

- Outline of China's New Certification System (CCC Mark for Electric Products), Japan Electrical Manufacturers' Association
- Outline of China's New Certification System (CCC Mark for Electric Products) and Electric Control Equipment, Nippon Electric Control Equipment Industries Association

Revision History

Date of revision	Manual No.	Revision details
Mar. 2006	IB(NA)1500159-A	First edition created.
Aug. 2006	IB(NA)1500159-B	<ul style="list-style-type: none">• FCU6-DUN26, color display for E60 was added.• Mistakes were corrected.

Global service network



North America FA Center (MITSUBISHI ELECTRIC AUTOMATION INC.)

Illinois CNC Service Center
500 CORPORATE WOODS PARKWAY, VERNON HILLS, IL. 60061, U.S.A.
TEL: +1-847-478-2500 (Se) FAX: +1-847-478-2650 (Se)

California CNC Service Center
5665 PLAZA DRIVE, CYPRESS, CA. 90630, U.S.A.
TEL: +1-714-220-4796 FAX: +1-714-229-3818

Georgia CNC Service Center
2810 PREMIERE PARKWAY SUITE 400, DULUTH, GA., 30097, U.S.A.
TEL: +1-678-258-4500 FAX: +1-678-258-4519

New Jersey CNC Service Center
200 COTTONTAIL LANE SOMERSET, NJ. 08873, U.S.A.
TEL: +1-732-560-4500 FAX: +1-732-560-4531

Michigan CNC Service Satellite
2545 38TH STREET, ALLEGAN, MI., 49010, U.S.A.
TEL: +1-847-478-2500 FAX: +1-269-673-4092

Ohio CNC Service Satellite
62 W. 500 S., ANDERSON, IN., 46013, U.S.A.
TEL: +1-847-478-2608 FAX: +1-847-478-2690

Texas CNC Service Satellite
1000, NOLEN DRIVE SUITE 200, GRAPEVINE, TX. 76051, U.S.A.
TEL: +1-817-251-7468 FAX: +1-817-416-1439

Canada CNC Service Center
4299 14TH AVENUE MARKHAM, ON. L3R 0J2, CANADA
TEL: +1-905-475-7728 FAX: +1-905-475-7935

Mexico CNC Service Center
MARIANO ESCOBEDO 69 TLALNEPANTLA, 54030 EDO. DE MEXICO
TEL: +52-55-9171-7662 FAX: +52-55-9171-7698

Monterrey CNC Service Satellite
ARGENTINA 3900, FRACC. LAS TORRES, MONTERREY, N.L., 64720, MEXICO
TEL: +52-81-8365-4171 FAX: +52-81-8365-4171

Brazil MITSUBISHI CNC Agent Service Center (AUTOMOTION IND. COM. IMP. E EXP. LTDA.)
ACESSO JOSE SARTORELLI, KM 2.1 18550-000 BOITUVA – SP, BRAZIL
TEL: +55-15-3363-9900 FAX: +55-15-3363-9911

European FA Center (MITSUBISHI ELECTRIC EUROPE B.V.)

Germany CNC Service Center
GOTHAER STRASSE 8, 40880 RATINGEN, GERMANY
TEL: +49-2102-486-0 FAX: +49-2102486-591

South Germany CNC Service Center
KURZE STRASSE. 40, 70794 FILDERSSTADT-BONLANDEN, GERMANY
TEL: +49-711-3270-010 FAX: +49-711-3270-0141

France CNC Service Center
25, BOULEVARD DES BOUVETS, 92741 NANTERRE CEDEX FRANCE
TEL: +33-1-41-02-83-13 FAX: +33-1-49-01-07-25

Lyon CNC Service Satellite

U.K CNC Service Center
TRAVELLERS LANE, HATFIELD, HERTFORDSHIRE, AL10 8XB, U.K.
TEL: +44-1707-282-846 FAX: +44-1707-278-992

Italy CNC Service Center
ZONA INDUSTRIALE VIA ARCHIMEDE 35 20041 AGRATE BRIANZA, MILANO ITALY
TEL: +39-039-60531-342 FAX: +39-039-6053-206

Spain CNC Service Satellite
CTRA. DE RUBI, 76-80 -APDO. 420 08190 SAINT CUGAT DEL VALLES, BARCELONA SPAIN
TEL: +34-935-65-2236 FAX:

Turkey MITSUBISHI CNC Agent Service Center (GENEL TEKNIK SISTEMLER LTD. STI.)
DARULACEZE CAD. FAMAS IS MERKEZI A BLOK NO.43 KAT2 80270 OKMEYDANI ISTANBUL, TURKEY
TEL: +90-212-320-1640 FAX: +90-212-320-1649

Poland MITSUBISHI CNC Agent Service Center (MPL Technology Sp. z. o. o.)
UL SLICZNA 34, 31-444 KRAKOW, POLAND
TEL: +48-12-632-28-85 FAX:

Wroclaw MITSUBISHI CNC Agent Service Satellite (MPL Technology Sp. z. o. o.)
UL KOBIERZYCKA 23, 52-315 WROCLAW, POLAND
TEL: +48-71-333-77-53 FAX: +48-71-333-77-53

Czech MITSUBISHI CNC Agent Service Center (AUTOCOUNT CONTROL SYSTEM S.R.O.)
NEMOCNICNI 12, 702 00 OSTRAVA 2 CZECH REPUBLIC
TEL: +420-596-152-426 FAX: +420-596-152-112

ASEAN FA Center (MITSUBISHI ELECTRIC ASIA PTE. LTD.)

Singapore CNC Service Center
307 ALEXANDRA ROAD #05-01/02 MITSUBISHI ELECTRIC BUILDING SINGAPORE 159943
TEL: +65-6473-2308 FAX: +65-6476-7439

Thailand MITSUBISHI CNC Agent Service Center (F. A. TECH CO., LTD)
898/19,20,21,22 S.V. CITY BUILDING OFFICE TOWER 1 FLOOR 12,14 RAMA III RD BANGPONGPANG, YANNAWA, BANGKOK 10120. THAILAND
TEL: +66-2-682-6522 FAX: +66-2-682-6020

Malaysia MITSUBISHI CNC Agent Service Center (FLEXIBLE AUTOMATION SYSTEM SDN. BHD.)
60, JALAN USJ 10/1B 47620 UEP SUBANG JAYA SELANGOR DARUL EHSAN MALAYSIA
TEL: +60-3-5631-7605 FAX: +60-3-5631-7636

JOHOR MITSUBISHI CNC Agent Service Satellite (FLEXIBLE AUTOMATION SYSTEM SDN. BHD.)
NO. 16, JALAN SHAHBANDAR 1, TAMAN UNGKU TUN AMINAH, 81300 SKUDAI, JOHOR MALAYSIA
TEL: +60-7-557-8218 FAX: +60-7-557-3404

Indonesia MITSUBISHI CNC Agent Service Center (PT. AUTOTEKNINDO SUMBER MAKMUR)
WISMA NUSANTARA 14TH FLOOR JL. M.H. THAMRIN 59, JAKARTA 10350 INDONESIA
TEL: +62-21-3917-144 FAX: +62-21-3917-164

India MITSUBISHI CNC Agent Service Center (MESSUNG SALES & SERVICES PVT. LTD.)
B-36FF, PAVANA INDUSTRIAL PREMISES M.I.D.C., BHOASRI PUNE 411026, INDIA
TEL: +91-20-2711-9484 FAX: +91-20-2712-8115

BANGALORE MITSUBISHI CNC Agent Service Satellite (MESSUNG SALES & SERVICES PVT. LTD.)
S 615, 6TH FLOOR, MANIPAL CENTER, BANGALORE 560001, INDIA
TEL: +91-80-509-2119 FAX: +91-80-532-0480

Delhi MITSUBISHI CNC Agent Parts Center (MESSUNG SALES & SERVICES PVT. LTD.)
1197, SECTOR 15 PART-2, OFF DELHI-JAIPUR HIGHWAY BEHIND 32ND MILESTONE GURGAON 122001, INDIA
TEL: +91-98-1024-8895 FAX:

Philippines MITSUBISHI CNC Agent Service Center (FLEXIBLE AUTOMATION SYSTEM CORPORATION)
UNIT No.411, ALABANG CORPORATE CENTER KM 25, WEST SERVICE ROAD SOUTH SUPERHIGHWAY, ALABANG MUNTINLUPA METRO MANILA, PHILIPPINES 1771
TEL: +63-2-807-2416 FAX: +63-2-807-2417

Vietnam MITSUBISHI CNC Agent Service Center (SA GIANG TECHNO CO., LTD)
47-49 HOANG SA ST. DAKAO WARD, DIST.1 HO CHI MINH CITY, VIETNAM
TEL: +84-8-910-4763 FAX: +84-8-910-2593

China FA Center (MITSUBISHI ELECTRIC AUTOMATION (SHANGHAI) LTD.)

China CNC Service Center
2/F, BLOCK 5 BLDG. AUTOMATION INSTRUMENTATION PLAZA, 103 CAOBAO RD. SHANGHAI 200233, CHINA
TEL: +86-21-6120-0808 FAX: +86-21-6494-0178

Shenyang CNC Service Center
TEL: +86-24-2397-0184 FAX: +86-24-2397-0185

Beijing CNC Service Satellite
9/F, OFFICE TOWER1, HENDERSON CENTER, 18 JIANGUOMENNEI DAJIE, DONGCHENG DISTRICT, BEIJING 100005, CHINA
TEL: +86-10-6518-8830 FAX: +86-10-6518-8030

China MITSUBISHI CNC Agent Service Center (BEIJING JIAYOU HIGHTECH TECHNOLOGY DEVELOPMENT CO.)
RM 709, HIGH TECHNOLOGY BUILDING NO.229 NORTH SI HUAN ZHONG ROAD, HAIDIAN DISTRICT, BEIJING 100083, CHINA
TEL: +86-10-8288-3030 FAX: +86-10-6518-8030

Tianjin CNC Service Satellite
RM909, TAIHONG TOWER, NO220 SHIZILIN STREET, HEBEI DISTRICT, TIANJIN, CHINA 300143
TEL: +86-22-2653-9090 FAX: +86-22-2635-9050

Shenzhen CNC Service Satellite
RM02, UNIT A, 13/F, TIANAN NATIONAL TOWER, REMMING SOUTH ROAD, SHENZHEN, CHINA 518005
TEL: +86-755-2515-6691 FAX: +86-755-8218-4776

Changchun Service Satellite
TEL: +86-431-50214546 FAX: +86-431-5021690

Hong Kong CNC Service Center
UNIT A, 25/F RYODEN INDUSTRIAL CENTRE, 26-38 TA CHUEN PING STREET, KWAI CHUNG, NEW TERRITORIES, HONG KONG
TEL: +852-2619-8588 FAX: +852-2784-1323

Taiwan FA Center (MITSUBISHI ELECTRIC TAIWAN CO., LTD.)

Taichung CNC Service Center
NO.8-1, GONG YEH 16TH RD., TAICHUNG INDUSTRIAL PARK TAICHUNG CITY, TAIWAN R.O.C.
TEL: +886-4-2359-0688 FAX: +886-4-2359-0689

Taipei CNC Service Satellite
TEL: +886-4-2359-0688 FAX: +886-4-2359-0689

Tainan CNC Service Satellite
TEL: +886-4-2359-0688 FAX: +886-4-2359-0689

Korean FA Center (MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD.)

Korea CNC Service Center
DONGSEO GAME CHANNEL BLDG. 2F. 660-11, DEUNGCHON-DONG KANGSEO-KU SEOUL, 157-030 KOREA
TEL: +82-2-3660-9607 FAX: +82-2-3663-0475

Notice

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible.

Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

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