

# **MITSUBISHI CNC**

## **MELDAS 600 Series**

### **CONNECTION MANUAL**

## 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**".



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






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



When the user could be subject to injuries or when physical damage



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.

 <b>DANGER</b>
Not applicable in this manual.







 <b>WARNING</b>
<b>1. Items related to prevention of electric shocks</b> <ul style="list-style-type: none"><li> Do not operate the switches with wet hands, as this may lead to electric shocks.</li><li> Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.</li></ul>

## CAUTION







### 1. Items related to noise

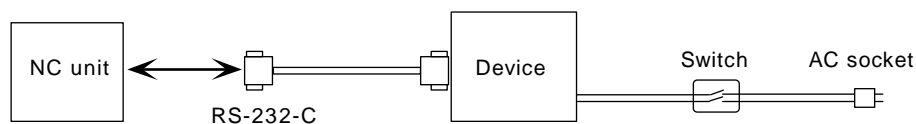
-  Always treat the shield cables indicated in this manual with grounding measures such as cable clamps.
-  Separate the signal wire from the drive line/power line when wiring.

### 2. Items related to installation

-  Install the control unit and operation board on noncombustible material. Installation directly on or near combustible material may lead to fires.
-  Always observe the installation direction.
-  Do not install or operate a control unit or operation board 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 control unit and operation board.
-  The control unit and operation board are precision devices so do not drop or apply strong impacts on them.
-  Do not install the operation board 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.
-  When using an RS-232-C device as a peripheral devices, caution will be required when connecting and disconnecting the connector.  
Always use a double-OFF type AC power supply switch on the device side, and connect/disconnect the connector with the AC power supply on the device side OFF.



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## CHAPTER 1 OUTLINE

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### CHAPTER 1 OUTLINE

This manual explains the structure, electrical specifications and connection methods required when connecting the NC unit and a machine.

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

Refer to the following documents for explanations on the functions.

- |  |               |
|--|---------------|
| • M6 Specifications Manual                                   | BNP-B2236     |
| • M6 PLC Interface Manual                                    | BNP-B3950-003 |
| • MELDAS AC Servo/Spindle MDS-B Series Specifications Manual | BNP-B3759     |
| • MELDAS MDS-SVJ2 Specifications Manual                      | BNP-B3937     |

Refer to the following documents for explanations on the EMC Directives for the European CE Marking.

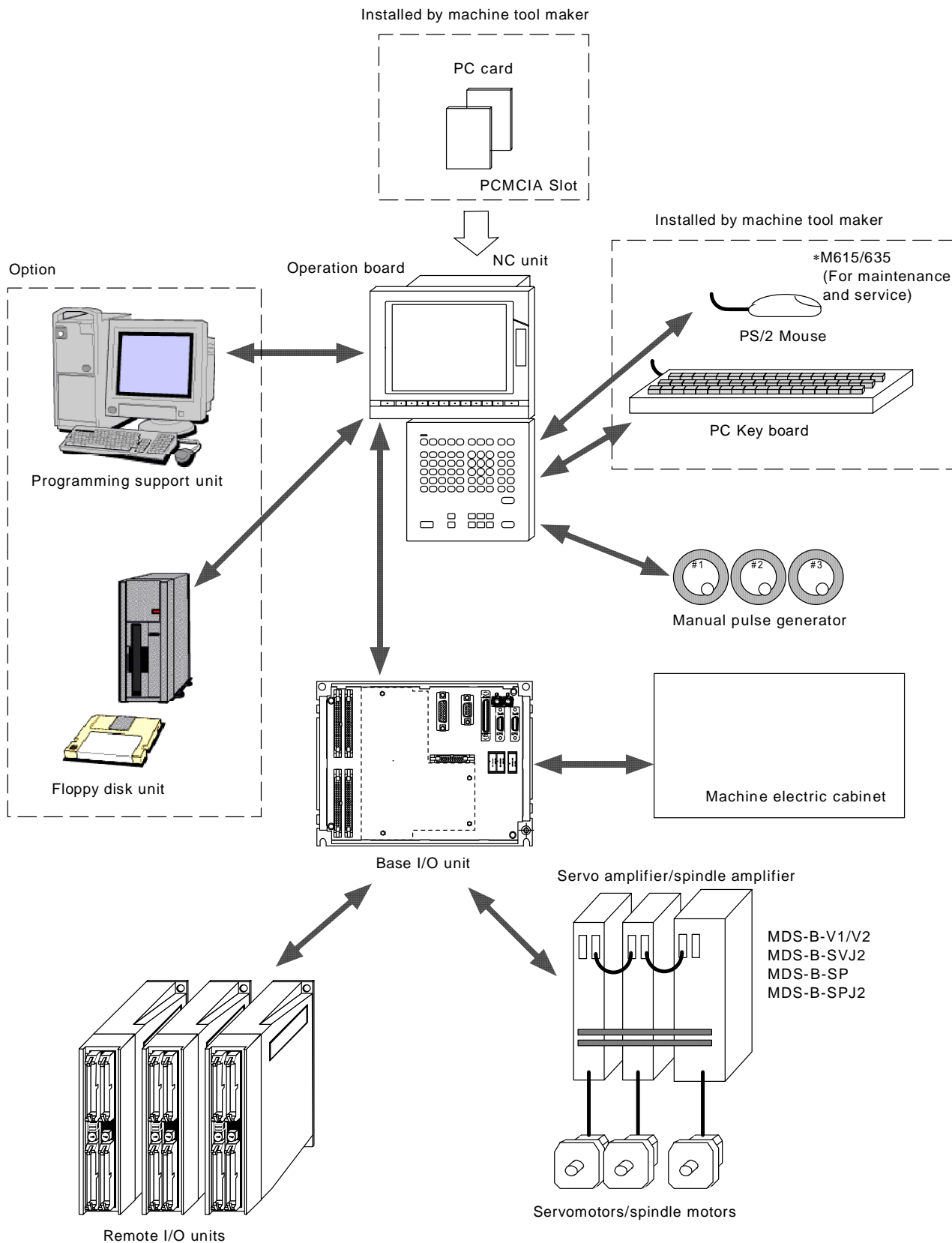
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| • EMC Installation Guideline | BNP-B2230 |
|------------------------------|-----------|

Before connecting a peripheral device of a commercial personal computer to the NC unit, fully comprehend the structure, electrical specifications and connection method of the peripheral device.

CHAPTER 2 CONFIGURATION  
2.1 System Configuration

CHAPTER 2 CONFIGURATION

2.1 System Configuration





**CHAPTER 2 CONFIGURATION**  
**2.2 List of Configuration Units**

## 2.2 List of Configuration Units

### 1. M615/M635 Control unit

Type		Configuration elements	Details
FCU6-MU501	Control unit built in personal computer (for display unit STN)	HR081/082 card	Power supply card
		HR111 card	CPU card
		HR121 card	PC base card
		Card PC	PC001
FCU6-MU511	Control unit built in personal computer (for display unit STN)	HR082 card	Power supply card
		HR113 card	CPU card
		HR121 card	PC base card
		Card PC	PC001
FCU6-MU512	Control unit built in personal computer (for display unit TFT)	HR082 card	Power supply card
		HR113 card	CPU card
		HR121 card	PC base card
		Card PC	PC002
FCU6-MU513	Control unit built in personal computer (for display unit STN)	HR082 card	Power supply card
		HR113 card	CPU card
		HR121 card	PC base card
		Card PC	PC005
FCU6-MU514	Control unit built in personal computer (for display unit TFT)	HR082 card	Power supply card
		HR113 card	CPU card
		HR121 card	PC base card
		Card PC	PC004
FCU6-MU515	Control unit built in personal computer (for display unit TFT)	HR083 card	Power supply card
		HR113 card	CPU card
		HR122 card	PC base card
		HR123 card	
Card PC	PC004		
FCU6-MU515-12	Control unit built in personal computer (for display unit TFT)	HR083 card	Power supply card
		HR113 card	CPU card
		HR122 card	PC base card
		HR123 card	
Card PC	PC010		
FCU6-MU515-23	Control unit built in personal computer (for display unit TFT)	HR083 card	Power supply card
		HR113 card	CPU card
		HR122 card	PC base card
		HR123 card	
Card PC	PC020		
FCU6-MU516	Control unit built in personal computer (for display unit STN)	HR083 card	Power supply card
		HR113 card	CPU card
		HR122 card	PC base card
		HR123 card	
Card PC	PC005		
FCU6-MU516-12	Control unit built in personal computer (for display unit STN)	HR083 card	Power supply card
		HR113 card	CPU card
		HR122 card	PC base card
		HR123 card	
Card PC	PC011		
FCU6-MU516-23	Control unit built in personal computer (for display unit STN)	HR083 card	Power supply card
		HR113 card	CPU card
		HR122 card	PC base card
		HR123 card	
Card PC	PC021		

### 2. M615/M635 Control unit option

Type		Configuration elements	Details
FCU6-EP201-1	PCMCIA interface	HR841 card	PCMCIA slot card
		F150 cable	
FCU6-EP101-1	IC card interface	HR251 card	IC card interface
		F160 cable	
HR553	Base card for IC card interface	HR553 card	Expansion card (used as a set with FCU6-EP101-1)

## CHAPTER 2 CONFIGURATION

### 2.2 List of Configuration Units

#### 3. M610/M630 Control unit

	Type	Configuration elements	Details
FCU6-MU013	Control unit without personal computer	HR082 card	Power supply card
		HR113 card	CPU card
		HR132 card	Display control card

#### 4. M610/M630 Control unit option

	Type	Configuration elements	Details
FCU6-EP101-1	IC card interface	HR251 card	IC card interface
		F160 cable	
HR553	Base card for IC card interface	HR553 card	Expansion card (used as a set with FCU6-EP101-1)

#### 5. Operation unit (display unit/NC keys)

	Type	Configuration elements	Details
FCU6-DUC32	10.4" color STN	10.4" color STN LCD	
		HR273 card	Connector conversion card
		KCI-04	Power for back light
		F082 cable	
		Menu key/escutcheon	Backlight power supply cable
FCU6-DUN31	10.4" color TFT	10.4" color TFT LCD	
		HR274 card	Connector conversion card
		104PWBR1	Power for back light
		F083 cable	Backlight power supply cable
		Menu key/escutcheon	
FCU6-DUT31	10.4" monochrome STN	10.4" monochrome STN LCD	
		HR275 card	Connector conversion card
		CXA-L0612-VMR	Power for back light
		F084 cable	Backlight power supply cable
		Menu key/escutcheon	
FCU6-KB004	NC keyboard (for type with HDD unit) Dedicated for FCU6-101-1	NC keyboard	Common for machining center/lathe
		HR292 card	
FCU6-KB014	NC keyboard (for type with HDD unit)	NC keyboard	Common for machining center/lathe
		HR293 card	
FCU6-KB005	NC keyboard (for type without HDD unit)	NC keyboard	Common for machining center/lathe

#### 6. Peripheral devices

	Type	Configuration elements	Details
FCU6-HD101-1	External HD unit (HDD: 2.5" IDE 540MB) With heater	HDD	2.5" IDE 540MB
		With F140 cable (50cm)	
		Heater	HDD HEATER *BKO-NC9069H03
		With installation plate/damper cushion	
FCU6-HD201-1	External HD unit (HDD: 2.5" IDE 540MB) With heater	HDD	2.5" IDE 540MB
		With F140 cable (50cm)	
		Heater	HDD HEATER *BKO-NC9069H04
		With installation plate/damper cushion	
FCU6-HD211-1	External HD unit (HDD: 2.5" IDE 2GB) With heater	HDD	2.5" IDE 2GB
		With F140 cable (50cm)	
		Heater	HDD HEATER *BKO-NC9069H04
		With installation plate/damper cushion	
FCU6-FD121-1	External FD unit	FD unit	
		With F130 cable (1m)	
		Plate	
FCU6-FD221-1	FD unit for pendant box	FD unit	
		With F130 cable (1m)	
		Plate	
PD25A	Input 200VAC, output 24VDC, power supply ON/OFF function	PD25A	
HD60B/HD60C	Manual pulse generator		Without MELDAS logo
HD60B-1/HD60C-1	Manual pulse generator		With MELDAS logo
Grounding plate D			Grounding plate D set
Grounding plate E			Grounding plate E set

## CHAPTER 2 CONFIGURATION

### 2.2 List of Configuration Units

#### 7. Base I/O unit

Type		Configuration elements	Details
FCU6-DX210	DI (sink/source)/DO (sink)=48/48 With servo, RIO, SKIP ENC I/F	HR325	DI (sink/source)/DO (sink)=48/48
		Aluminum die cast	
FCU6-DX211	DI (sink/source)/DO (sink)=48/48 With servo, RIO, SKIP ENC I/F	HR335	DI (sink/source)/DO (source)=48/48
		Aluminum die cast	
FCU6-DX220	DI (sink/source)/DO (sink)=64/64 With servo, RIO, SKIP ENC I/F	HR327	DI (sink/source)/DO (sink)=64/64
		Aluminum die cast	
FCU6-DX221	DI (sink/source)/DO (sink)=64/64 With servo, RIO, SKIP ENC I/F	HR337	DI (sink/source)/DO (source)=64/64
		Aluminum die cast	
FCU6-DX310	DI (sink/source)/DO (sink)=80/64 With servo, RIO, SKIP ENC I/F	HR325	DI (sink/source)/DO (sink)=48/48
		RX323-1	DI (sink/source)/DO (sink)=32/16
		Aluminum die cast	
FCU6-DX311	DI (sink/source)/DO (sink)=80/64 With servo, RIO, SKIP ENC I/F	HR335	DI (sink/source)/DO (source)=48/48
		RX324-1	DI (sink/source)/DO (source)=32/16
		Aluminum die cast	
FCU6-DX320	DI (sink/source)/DO (sink)=80/64 Analog output 1 point With servo, RIO, SKIP ENC I/F	HR325	DI (sink/source)/DO (sink)=48/48
		RX323	DI (sink/source)/DO (sink)=32/16 Analog output 1 point
		Aluminum die cast	
FCU6-DX321	DI (sink/source)/DO (sink)=80/64 Analog output 1 point With servo, RIO, SKIP ENC I/F	HR335	DI (sink/source)/DO (source)=48/48
		RX324	DI (sink/source)/DO (source)=32/16 Analog output 1 point
		Aluminum die cast	
FCU6-DX330	DI (sink/source)/DO (sink)=48/48 Manual pulse generator 2ch With servo, RIO, SKIP ENC I/F	HR325	DI (sink/source)/DO (sink)=48/48
		RX331	Manual pulse generator 2ch
		Aluminum die cast	
FCU6-DX331	DI (sink/source)/DO (sink)=48/48 Manual pulse generator 2ch With servo, RIO, SKIP ENC I/F	HR335	DI (sink/source)/DO (source)=48/48
		RX331	Manual pulse generator 2ch
		Aluminum die cast	
FCU6-DX340	DI (sink/source)/DO (sink)=48/48 Analog input 4 points, analog output 1 point With servo, RIO, SKIP ENC I/F	HR325	DI (sink/source)/DO (sink)=48/48
		RX341	Analog input 4 points, analog output 1 point
		Aluminum die cast	
FCUA-DX341	DI (sink/source)/DO (sink)=48/48 Analog input 4 points, analog output 1 point With servo, RIO, SKIP ENC I/F	HR335	DI (sink/source)/DO (source)=48/48
		RX341	Analog input 4 points, analog output 1 point
		Aluminum die cast	
FCU6-DX410	DI (sink/source)/DO (sink)=96/80 With servo, RIO, SKIP ENC I/F	HR327	DI (sink/source)/DO (sink)=64/64
		RX323-1	DI (sink/source)/DO (sink)=32/16
		Aluminum die cast	
FCU6-DX411	DI (sink/source)/DO (sink)=96/80 With servo, RIO, SKIP ENC I/F	HR337	DI (sink/source)/DO (source)=64/64
		RX324-1	DI (sink/source)/DO (source)=32/16
		Aluminum die cast	
FCU6-DX420	DI (sink/source)/DO (sink)=96/80 Analog output 1 point With servo, RIO, SKIP ENC I/F	HR327	DI (sink/source)/DO (sink)=64/64
		RX323	DI (sink/source)/DO (sink)=32/16 Analog output 1 point
		Aluminum die cast	
FCU6-DX421	DI (sink/source)/DO (sink)=96/80 Analog output 1 point With servo, RIO, SKIP ENC I/F	HR337	DI (sink/source)/DO (source)=64/64
		RX324	DI (sink/source)/DO (source)=32/16 Analog output 1 point
		Aluminum die cast	
FCU6-DX430	DI (sink/source)/DO (sink)=64/64 Manual pulse generator 2ch With servo, RIO, SKIP ENC I/F	HR327	DI (sink/source)/DO (sink)=64/64
		RX331	Manual pulse generator 2ch
		Aluminum die cast	
FCU6-DX431	DI (sink/source)/DO (sink)=64/64 Manual pulse generator 2ch With servo, RIO, SKIP ENC I/F	HR337	DI (sink/source)/DO (source)=64/64
		RX331	Manual pulse generator 2ch
		Aluminum die cast	
FCU6-DX440	DI (sink/source)/DO (sink)=64/64 Analog input 4 points, analog output 1 point With servo, RIO, SKIP ENC I/F	HR327	DI (sink/source)/DO (sink)=64/64
		RX341	Analog input 4 points, analog output 1 point
		Aluminum die cast	
FCU6-DX441	DI (sink/source)/DO (sink)=64/64 Analog input 4 points, analog output 1 point With servo, RIO, SKIP ENC I/F	HR337	DI (sink/source)/DO (source)=64/64
		RX341	Analog input 4 points, analog output 1 point
		Aluminum die cast	

## CHAPTER 2 CONFIGURATION

### 2.2 List of Configuration Units

#### 8. Card size I/O

Type		Configuration elements	Details
HR361	DI (sink)/DO (sink)=16/16	HR361	
HR371	DI (source)/DO (source)=16/16	HR371	
HR381	AO 1ch	HR381	
HR383	AO 1ch/AI 4ch	HR383	

#### 9. Scan I/O

Type		Configuration elements	Details
HR347	Scan I/O (sink)	HR347	Scan DI/DO=64/64 DI (sink)/DO (sink)=32/32
HR357	Scan I/O (sink)	HR357	Scan DI/DO=64/64 DI (source)/DO (source)=32/32

#### 10. Remote I/O unit

Type		Configuration elements	Details
FCUA-DX100	DI (sink/source)/DO (sink)=32/32	RX311	Base PCB: DI (sink/source)/DO (sink)=32/32
		Case	
FCUA-DX110	DI (sink/source)/DO (sink)=64/48	RX311	Base PCB: DI (sink/source)/DO (sink)=32/32
		RX321-1	Add-on PCB: DI (sink/source)/ DO (sink)=32/16
		Case	
FCUA-DX120	DI (sink/source)/DO (sink)=64/48 Analog output 1 point	RX311	Base PCB: DI (sink/source)/DO (sink)=32/32
		RX321	Add-on PCB: DI (sink/source)/ DO (sink)=32/16 Analog output 1 point
		Case	
FCUA-DX130	DI (sink/source)/DO (sink)=32/32 Manual pulse 2ch	RX311	Base PCB: DI (sink/source)/DO (sink)=32/32
		RX331	Add-on PCB: Manual pulse generator 2ch
		Case	
FCUA-DX140	DI (sink/source)/DO (sink)=32/32 Analog input 4 points, Analog output 1 point	RX311	Base PCB: DI (sink/source)/DO (sink)=32/32
		RX341	Add-on PCB: Analog input 4 points, Analog output 1 point
		Case	
FCUA-DX101	DI (sink/source)/ DO (source)=32/32	RX312	Base PCB: DI (sink/source)/DO (source)=32/32
		Case	
FCUA-DX111	DI (sink/source)/ DO (source)=64/48	RX312	Base PCB: DI (sink/source)/DO (source)=32/32
		RX322-1	Add-on PCB: DI (sink/source)/ DO (source)=32/16
		Case	
FCUA-DX121	DI (sink/source)/ DO (source)=64/48 Analog output 1 point	RX312	Base PCB: DI (sink/source)/DO (source)=32/32
		RX322	Add-on PCB: DI (sink/source)/ DO (source)=32/16 Analog output 1 point
		Case	
FCUA-DX131	DI (sink/source)/ DO (source)=32/32 Manual pulse 2ch	RX312	Base PCB: DI (sink/source)/DO (source)=32/32
		RX331	Add-on PCB: Manual pulse generator 2ch
		Case	
FCUA-DX141	DI (sink/source)/ DO (source)=32/32 Analog input 4 points, Analog output 1 point	RX312	Base PCB: DI (sink/source)/DO (source)=32/32
		RX341	Add-on PCB: Analog input 4 points, Analog output 1 point
		Case	

**CHAPTER 3 INSTALLATION**  
**3.1 General Specification**

## CHAPTER 3 INSTALLATION

### 3.1 General Specification

#### (1) Environment conditions in operation box

Type name		MCU6-MU□□□		MCU6-DUN3□/DUC3□/ DUT3□	
Unit name		Control unit		Display unit	
General specifications	Ambient temperature	During operation	0~55°C (*1: Working temperature 5~55°C)	0~50°C (Display unit surface temperature)(*2)	
		During storage	-20~60°C		
	Ambient humidity	During operation	45~75% RH (with no dew condensation)		
		During storage	45~80% RH (with no dew condensation)		
	Vibration resistance		0.5G or less (during operation)		
	Shock resistance		3G or less (during operation)		
Working atmosphere		No corrosive gas, dust and oil mist			
Power specifications	Power voltage		24VDC±5% Ripple ±5% (P-P)		
	Momentary stop tolerance time		20ms (when using external power supply unit)		
	Current consumption		3A (max.)		
Heating value		31W (typ.) 72W (max.)			
Weight		3.5kg			
Unit size		Refer to appendix.			

(\*1) When using the model with built-in hard disk (FCU6-MU5□□), the hard disk will not start up if the temperature in the panel is 5°C or less when the power is turned ON.

The hard disk will start up automatically after the hard disk temperature has risen to 5°C with the heater.

(\*2) The display quality (contrast/hues) will drop at 45°C and above.

With the FCU6-DUC3□ (color STN) model, the surface temperature is up to 40°C.

#### (2) Environment conditions in electric cabinet

Type name		HR361/HR371		PD25	
Unit name		Card size I/O		External power supply unit	
General specifications	Ambient temperature	During operation	0~55°C		
		During storage	-20~60°C		
	Ambient humidity	During operation	45~75% RH (with no dew condensation)		
		During storage	45~80% RH (with no dew condensation)		
	Vibration resistance		0.5G or less (during operation)		
	Shock resistance		3G or less (during operation)		
Working atmosphere		No corrosive gas, dust and oil mist			
Power specifications	Power voltage		24VDC±5% Ripple ±5% (P-P)	200~230VAC +10% -15% 50/60Hz ±1Hz	
	Current consumption		5V 0.4A 24V 1.2A (*1)	0.6A	
Heating value		15W (*3)		35W	
Weight		300g		1.5kg	
Unit size		Refer to appendix.			

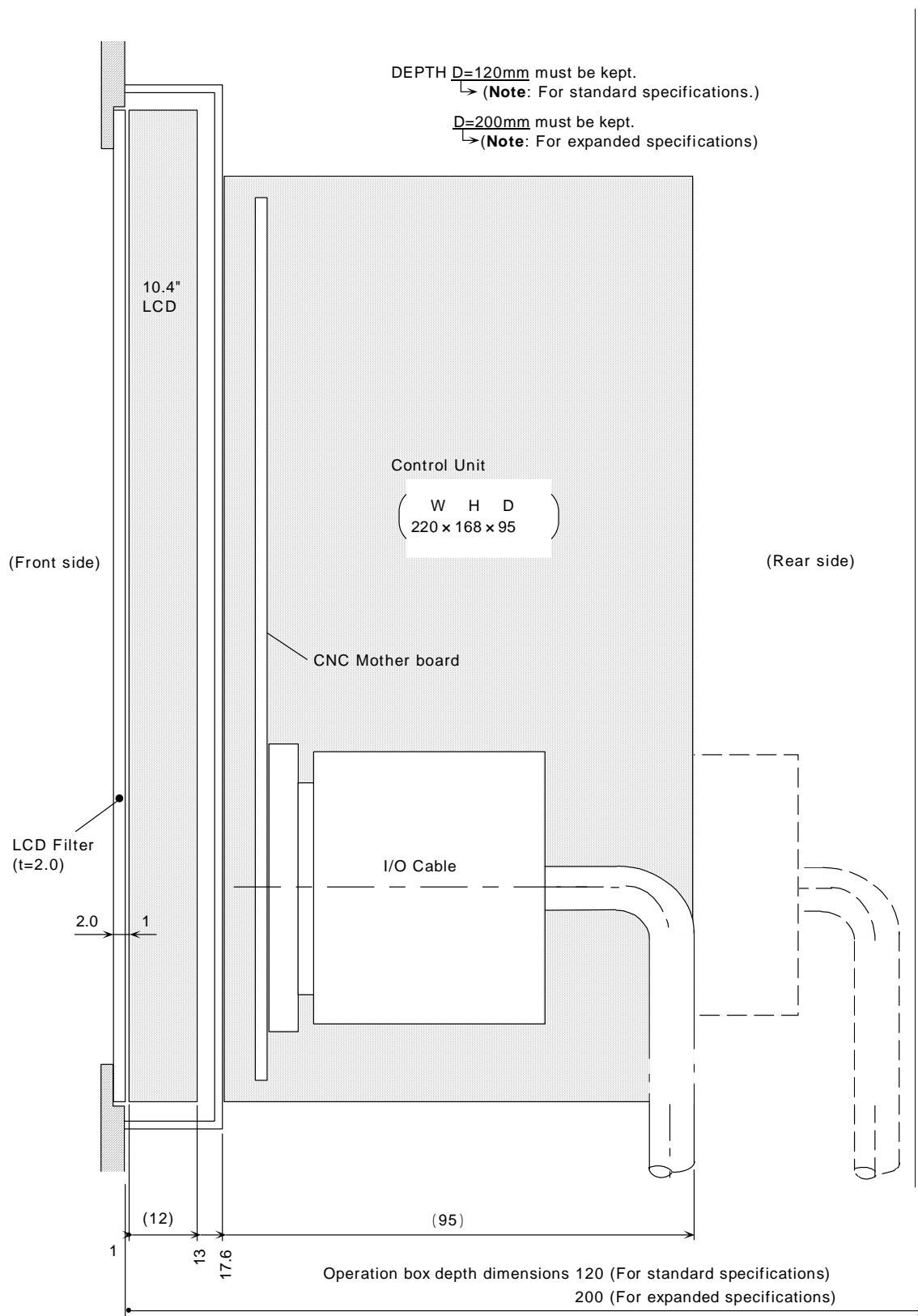
**CHAPTER 3 INSTALLATION**  
**3.1 General Specification**

<b>Type name</b>		FCU6-DX210 FCU6-DX211 FCU6-DX330 FCU6-DX331 FCU6-DX340 FCU6-DX341	FCU6-DX220 FCU6-DX221 FCU6-DX430 FCU6-DX431 FCU6-DX440 FCU6-DX441	FCU6-DX310 FCU6-DX311 FCU6-DX320 FCU6-DX321	FCU6-DX410 FCU6-DX411 FCU6-DX420 FCU6-DX421
<b>Unit name</b>		<b>Base I/O unit</b>			
General specifications	Ambient temperature	During operation	0~55°C		
		During storage	-20~60°C		
	Ambient humidity	During operation	45~75% RH (with no dew condensation)		
		During storage	45~80% RH (with no dew condensation)		
	Vibration resistance		0.5G or less (during operation)		
	Shock resistance		3G or less (during operation)		
Working atmosphere		No corrosive gas, dust and oil mist			
Power specifications	Power voltage	24VDC±5% Ripple ±5% (P-P)			
	Current consumption	3.6A	4.8A	5.0A	6.2A
Heating value (max.)		35W (*3)	45W (*3)	50W (*3)	60W (*3)
Weight		2.0kg			
Unit size		Refer to appendix.			

(\*3) Heating value for when all DI/DO points are ON.

### 3.2 Designing Conditions of Operation Box

#### 3.2.1 Depth of Operation Box

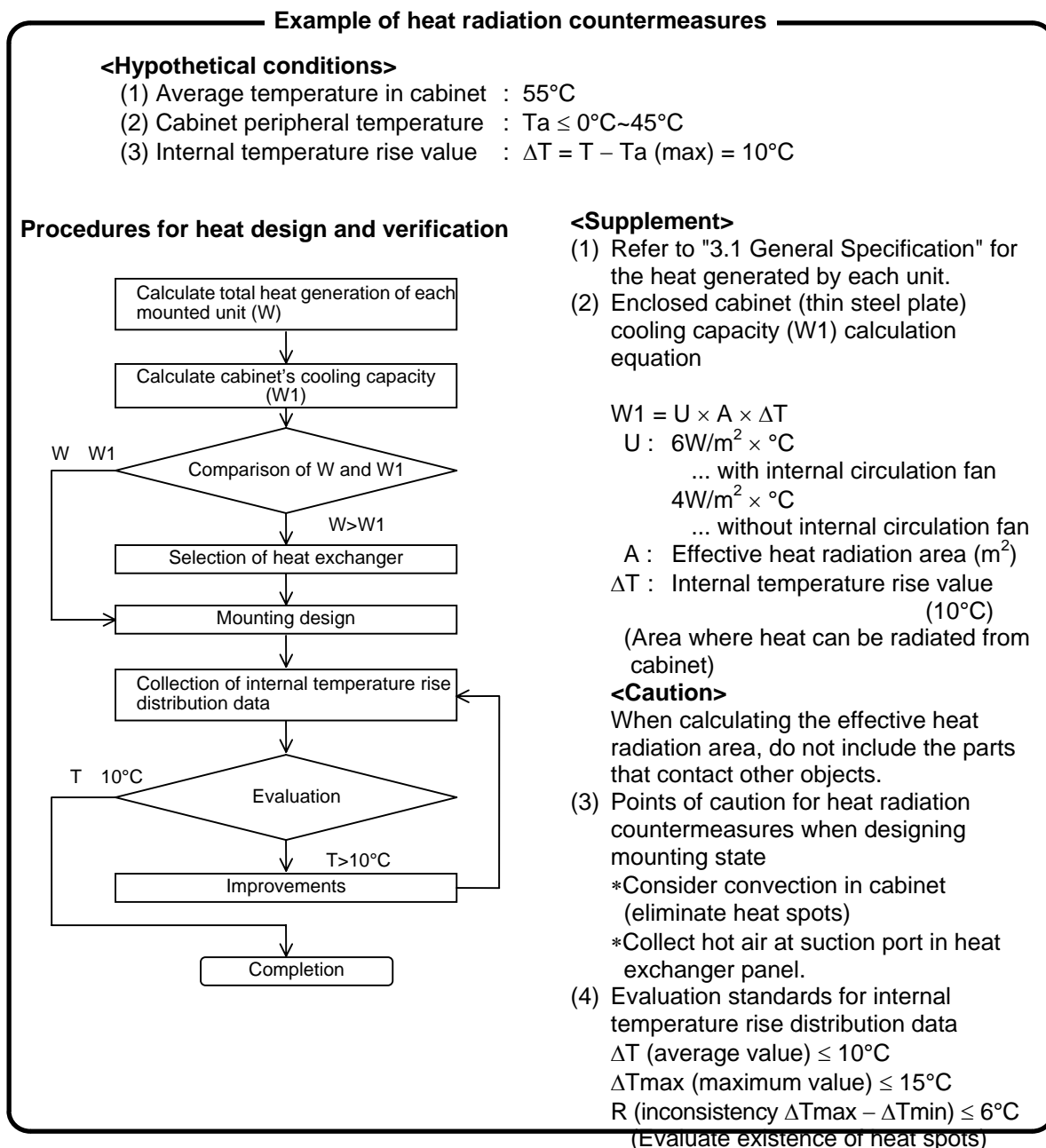


**Note 1:** Provide a structure that allows the control unit cover to be opened and closed.

**Note 2:** With the FCU6-MU515/516, the fan cover is 5mm higher, and the height is 173mm.

### 3.2.2 Operation Box Heat Radiation Countermeasures

Please refer to following method for heat radiation countermeasures method.



Refer to "Section 3.1 General Specifications" for the heating value of each unit.

With the operation box, heat could accumulate at the top of the control unit, so install a circulation fan.

Install a circulation fan in the panel when the following conditions are not satisfied.

Evaluation standards for internal temperature rise distribution data

$\Delta T$  (average value)  $\leq 10^\circ\text{C}$

$\Delta T_{\text{max}}$  (maximum value)  $\leq 15^\circ\text{C}$

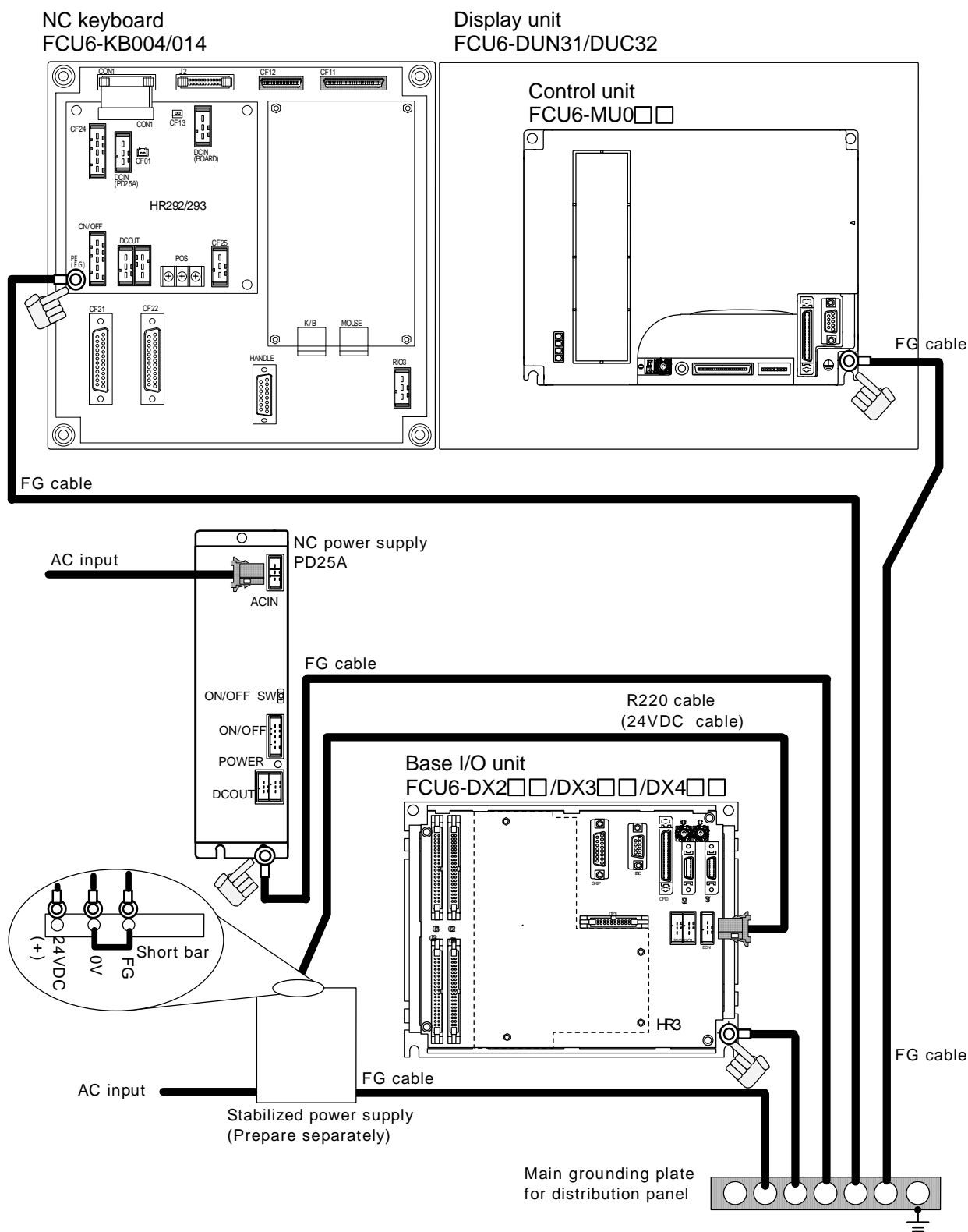


### 3.3 Noise Countermeasures

#### 3.3.1 Connection of Frame Ground (FG)

The frame should basically be grounded at one earth point.

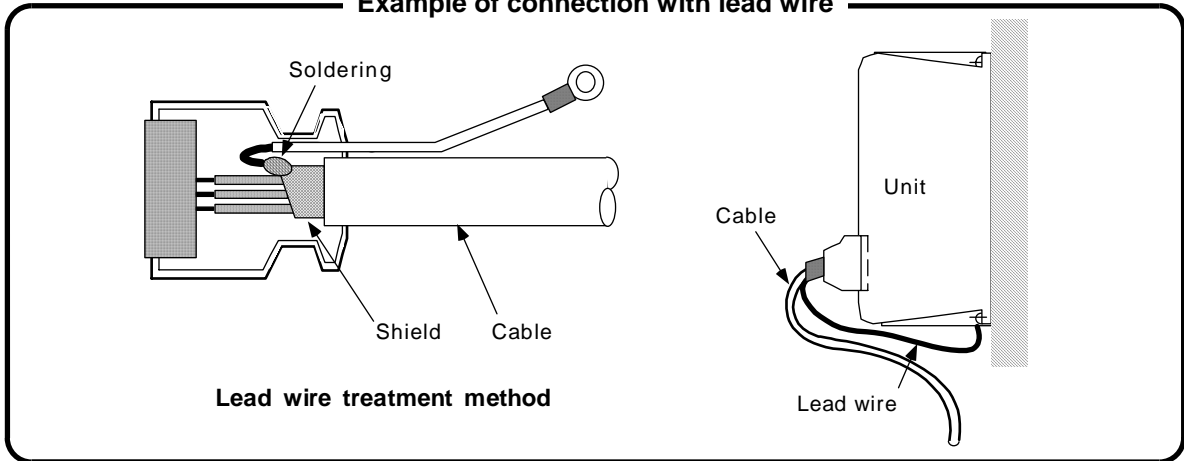
The GND of the base I/O unit and device GND connected to the stabilized power supply should be connected to the FG.



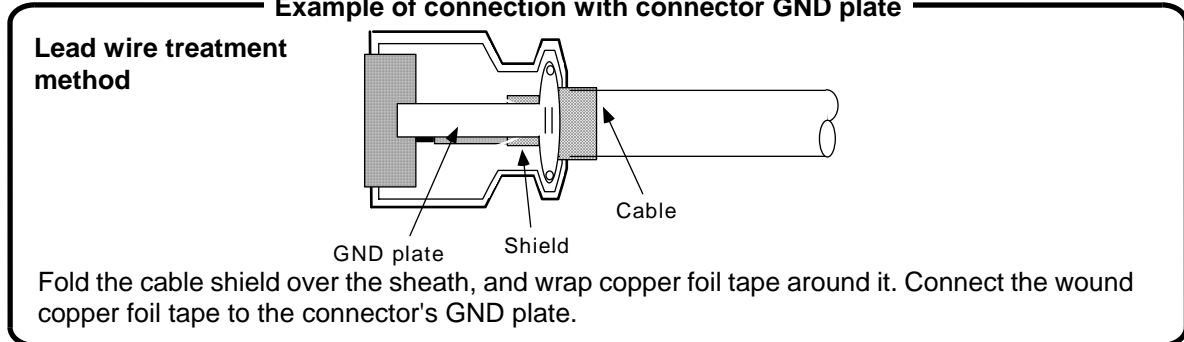
### 3.3.2 Shield Clamping of Cables

The shield cable connected to the control unit, servo amplifier and spindle amplifier must be connected to the grounding plate to stabilize operation while preventing malfunctioning due to noise. The shield can be connected to the grounding plate with lead wires, with clamp fittings or with the connector GNP plate. Refer to the following drawings to treat the shield cable.

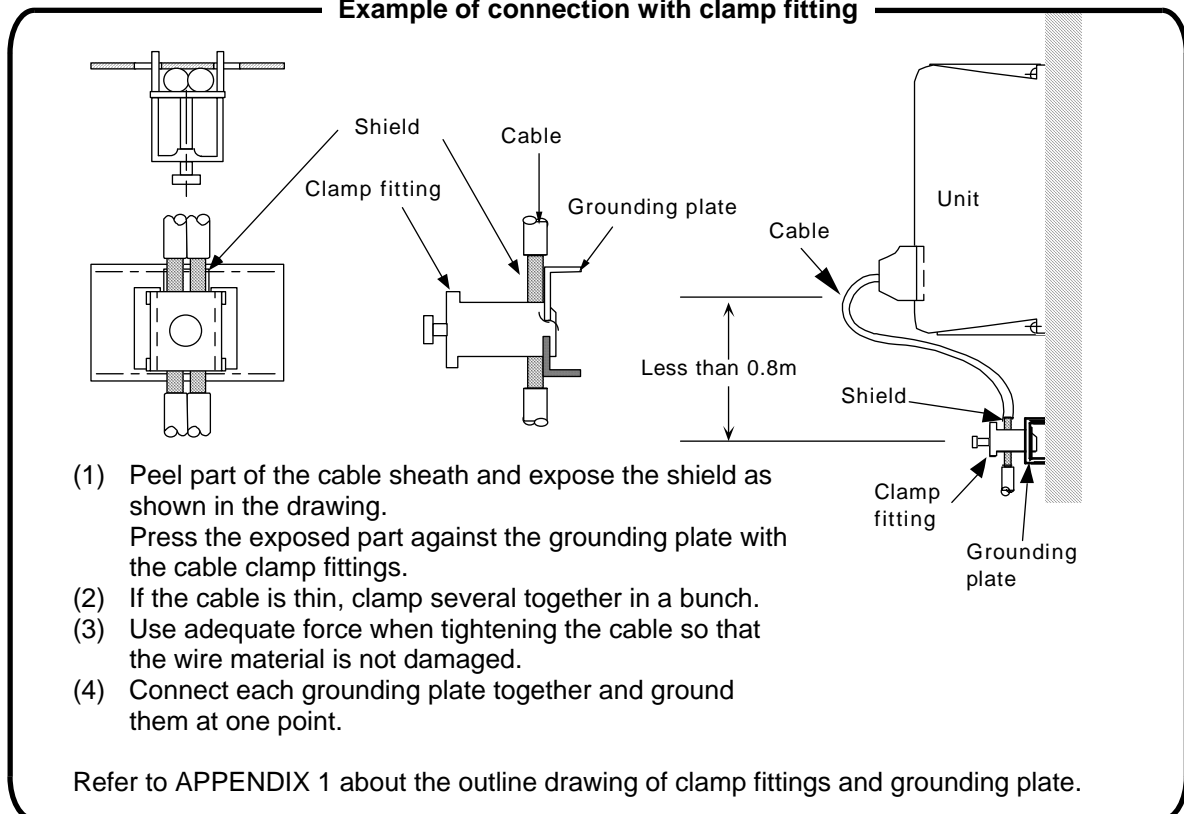
#### Example of connection with lead wire



#### Example of connection with connector GND plate



#### Example of connection with clamp fitting



**CHAPTER 3 INSTALLATION**  
**3.3 Noise Countermeasures**

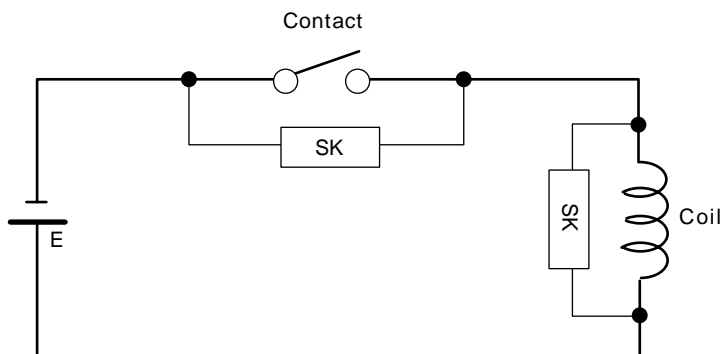
All connected cable must be connected to the FG.

Refer to "Section 3.3.2 Shield Clamping of Cables" or "Appendix 2. Cable drawings" for the details on the connection methods.

Unit name	Connector name	Application/function	Cable shield treatment
Control unit (FCU6-MU□□□)	CF10 ENC2	I/O INTERFACE Encoder	Required Required
NC keyboard (FCU6-KB□□□)	HANDLE CF21 CF22 K/B MOUSE	Manual pulse generator RS-232-C (CH1, 2) RS-232-C (CH3, 4) PS/2 keyboard PS/2 mouse	Required Required Required Required Required
Base I/O unit (FCU6-DX2□□□) (FCU6-DX3□□□) (FCU6-DX4□□□)	CF10 SV1 SV2 ENC1 SKP RIO1 RIO2	I/O interface Servo/spindle amplifier Servo/spindle amplifier Spindle encoder Skip Remote I/O unit Remote I/O unit	Required Required Required Required Required Required Required

### 3.3.3 Connecting Spark Killers

The generated noise must be removed when the coil/contact operates. As a measure, connect a spark killer in parallel with the coil/contact.



The CR compound element is useful for eliminating noise generated by magnetic induction.

Spark killer	C: 0.033 ~ 0.1 $\mu$ F R: 10 ~ 120 $\Omega$
--------------	--

### 3.3.4 Protective Measures against Lightning Surge

Generally, lightning surge infiltrates the control power supply from the power supply line. Then the internal circuit is damaged by this control power supply, or via this control power supply. The Mitsubishi NC unit has a surge absorber on the control power supply for the NC control section and NC control section. However, this measure is not taken through the control panel, as shown in Fig. 1, so the lightning surge could flow over the signal line and damage the other devices.

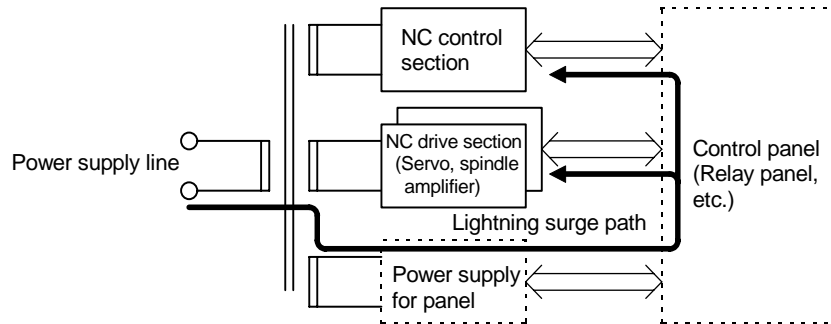


Fig. 1 Path of damage caused by lightning surge

#### (1) Methods of protective measures

Install the surge absorber on the power supply line for the separately prepared power supply units, etc., as shown in Fig. 2 and Fig. 3.

The following two measures are required as protection against general damage.

- 1) Installation of surge absorber
- 2) Installation of circuit protector

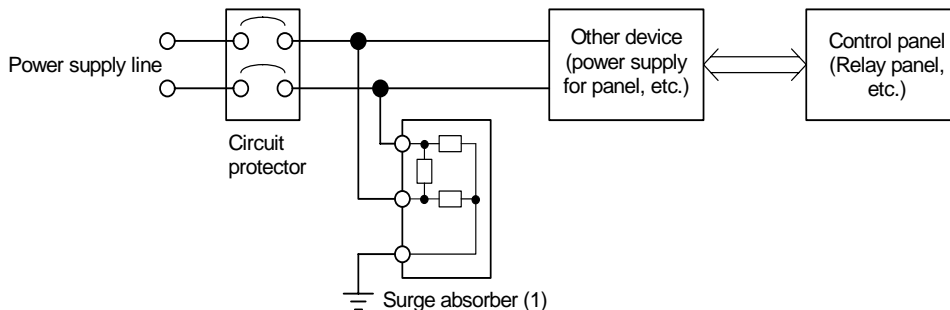


Fig. 2 Lightning surge measures for single-phase power supply line

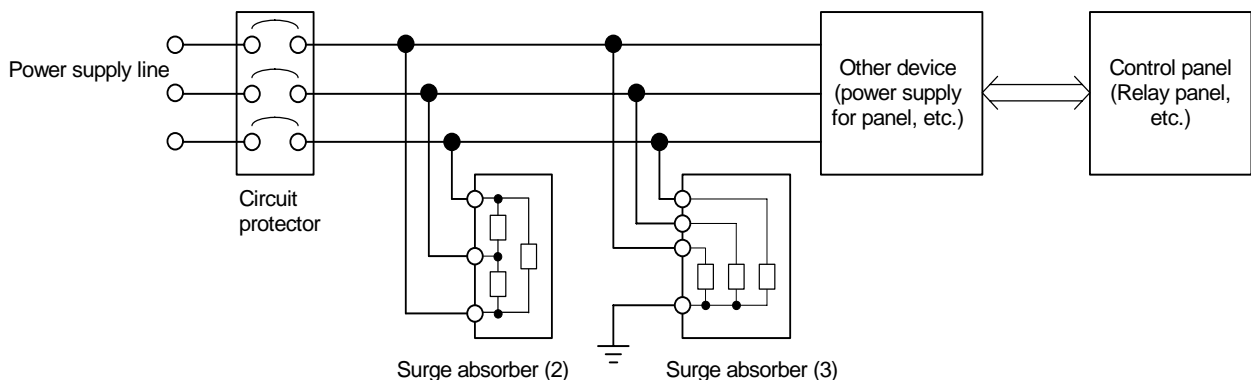


Fig. 3 Lightning surge measures for 3-phase power supply line

## CHAPTER 3 INSTALLATION

### 3.3 Noise Countermeasures

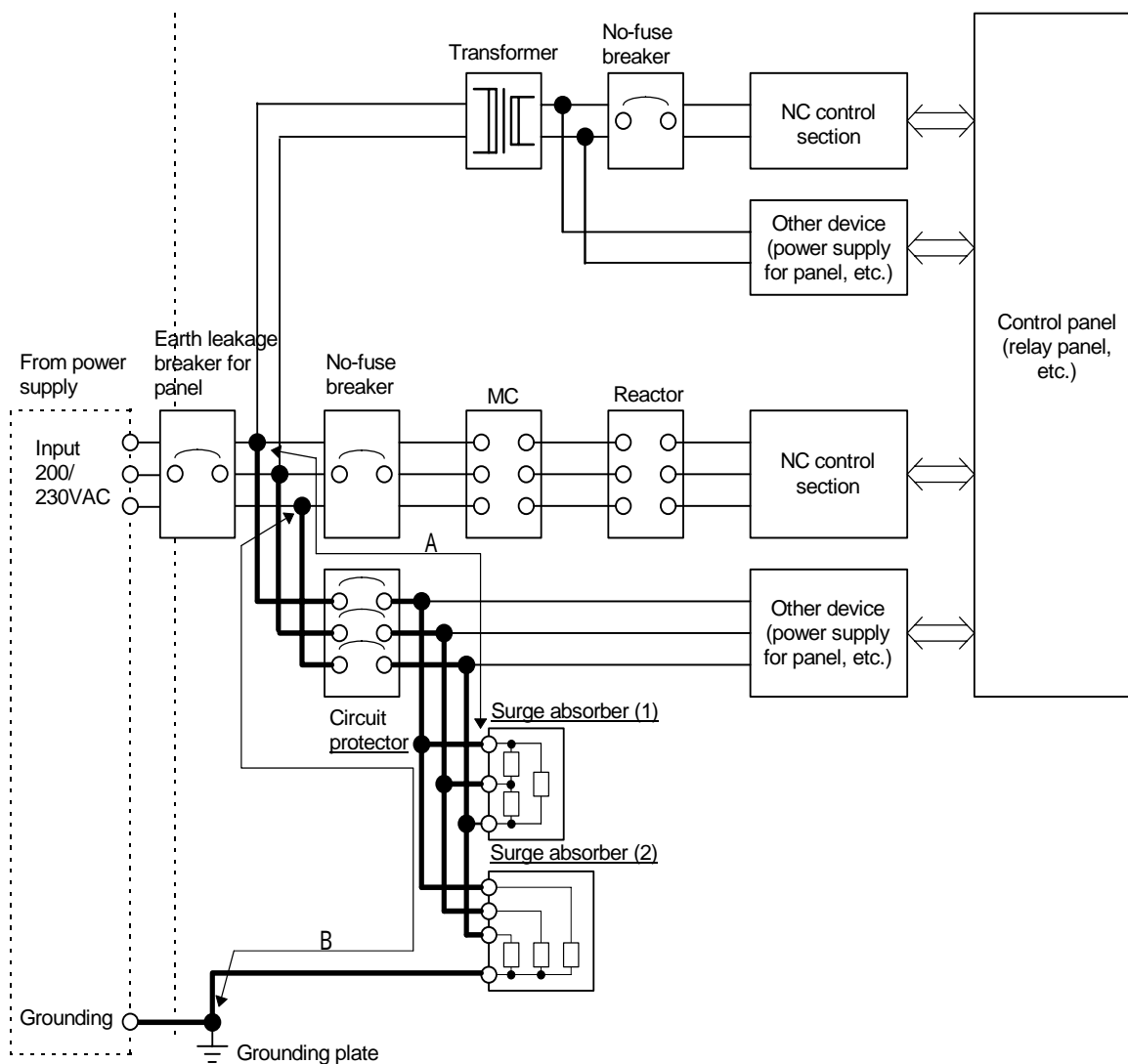
#### (2) Examples of surge absorbers

Types of Okaya Denki Sangyo Co., Ltd. surge absorbers

Surge absorber	Type	Circuit voltage [Vrms]	Max. tolerable circuit voltage [Vrms]	Clamp voltage [V]±10%	Surge resistance level 8/20μ S [A]	Surge withstand voltage (Electrical-discharge start voltage) 1.2/50μ S [V]
(1)	RAV-781BWZ-4	250	500	700	2500	2K
(2)	RAV-781BYZ-2	250	300	783	2500	20K
(3)	RAV-781BXZ-4	250	500	700	2500	2K

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

#### (3) Surge absorber installation method



#### Surge absorber installation method

##### Precautions

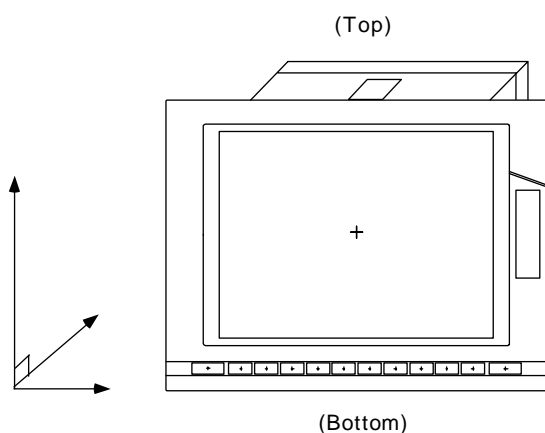
- Thick wires will enhance the lightning surge absorption effect, so keep the wire as short as possible.  
 Wire material: Wire diameter 2mm<sup>2</sup> or more  
 Wire length : Connection length (A) to surge absorber (1) is 2m or less  
 For connection length (B) to surge absorber (2), and  
 Connection length (C) to surge absorber (3), the total wire length must be 2m or less.
- When carrying out a withstand voltage test, while applying an overvoltage (100VAC, 1500VAC) on the power supply line, remove surge absorbers (1) and (3) as the surge absorber will function with the applied voltage.
- A short-circuit accident 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.  
 The current does not flow constantly to surge absorbers (1), (2) and (3), so the circuit protector can also be used for the other devices.

### 3.4 Installation

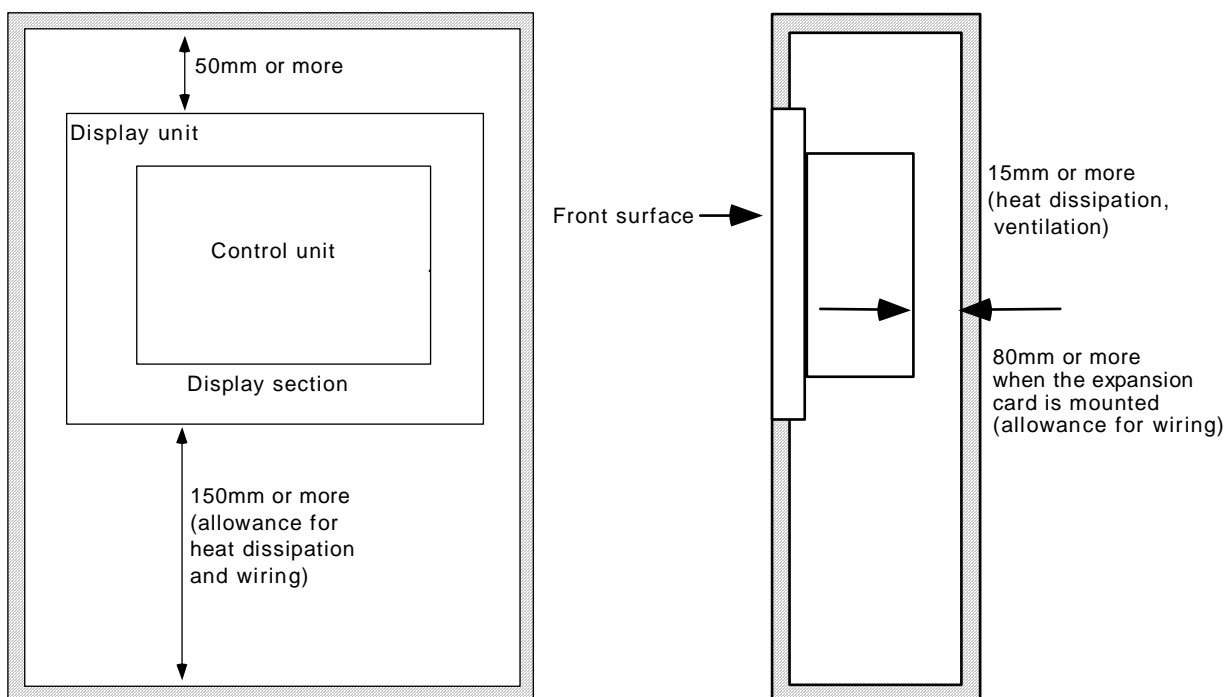
The control unit with display and each unit are installed in a sealed structure cabinet as a principle. Observe the following points when installing into the cabinet.

#### 3.4.1 Installation of Control Unit with Display

- (1) To stably operate the hard disk drive, install the control unit with display vertically.
- (2) Secure the space shown below for ventilation in consideration of the control unit's heat dissipation and wiring.
- (3) When using the PCMCIA option, provide sufficient wiring allowance at the top of the control unit to wire the Ethernet communication cable and SCSI cable.



#### Operation pendant



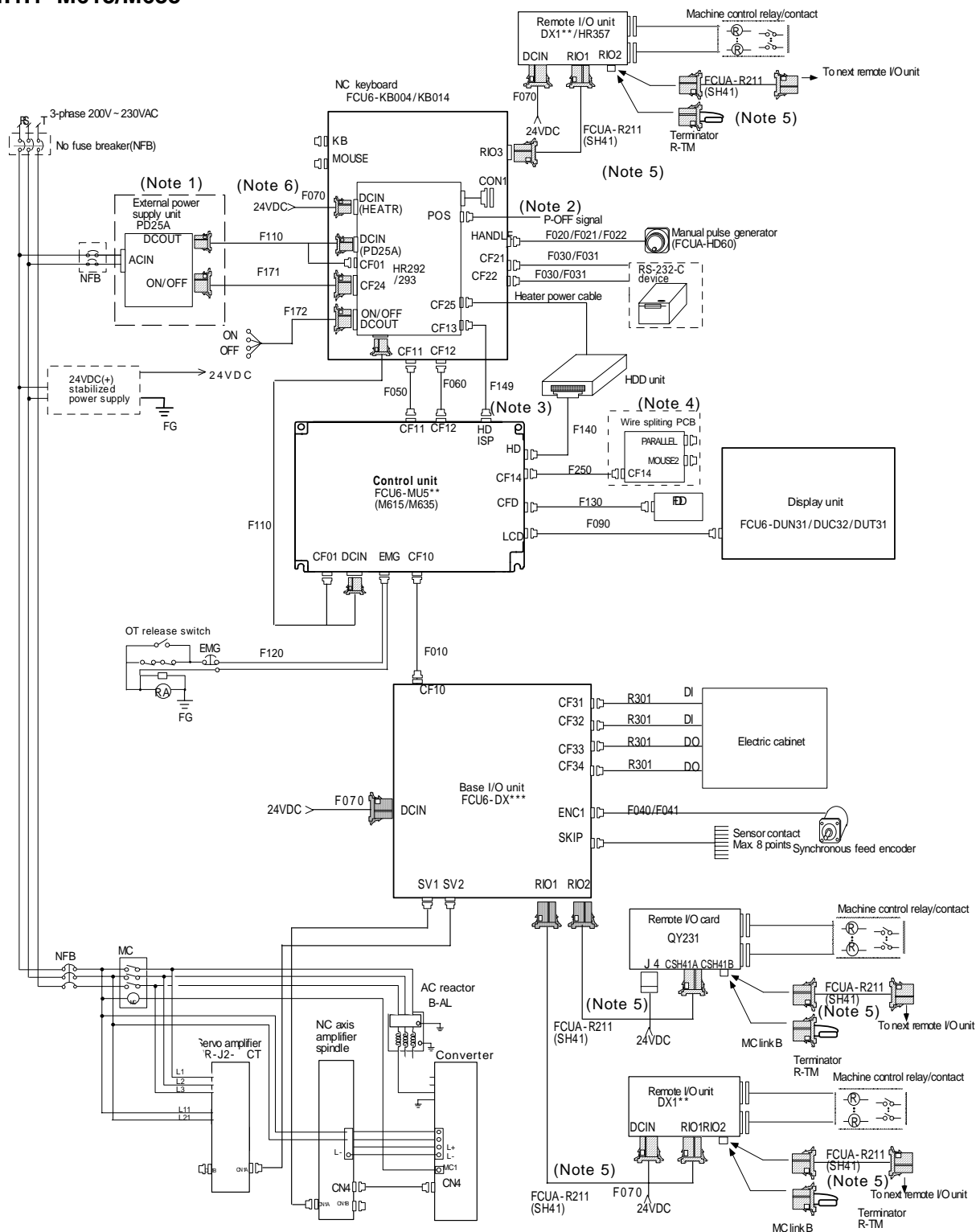
# CHAPTER 4 SYSTEM CONNECTION

## 4.1 General System Diagram

### CHAPTER 4 SYSTEM CONNECTION

#### 4.1 General System Diagram

##### 4.1.1 M615/M635

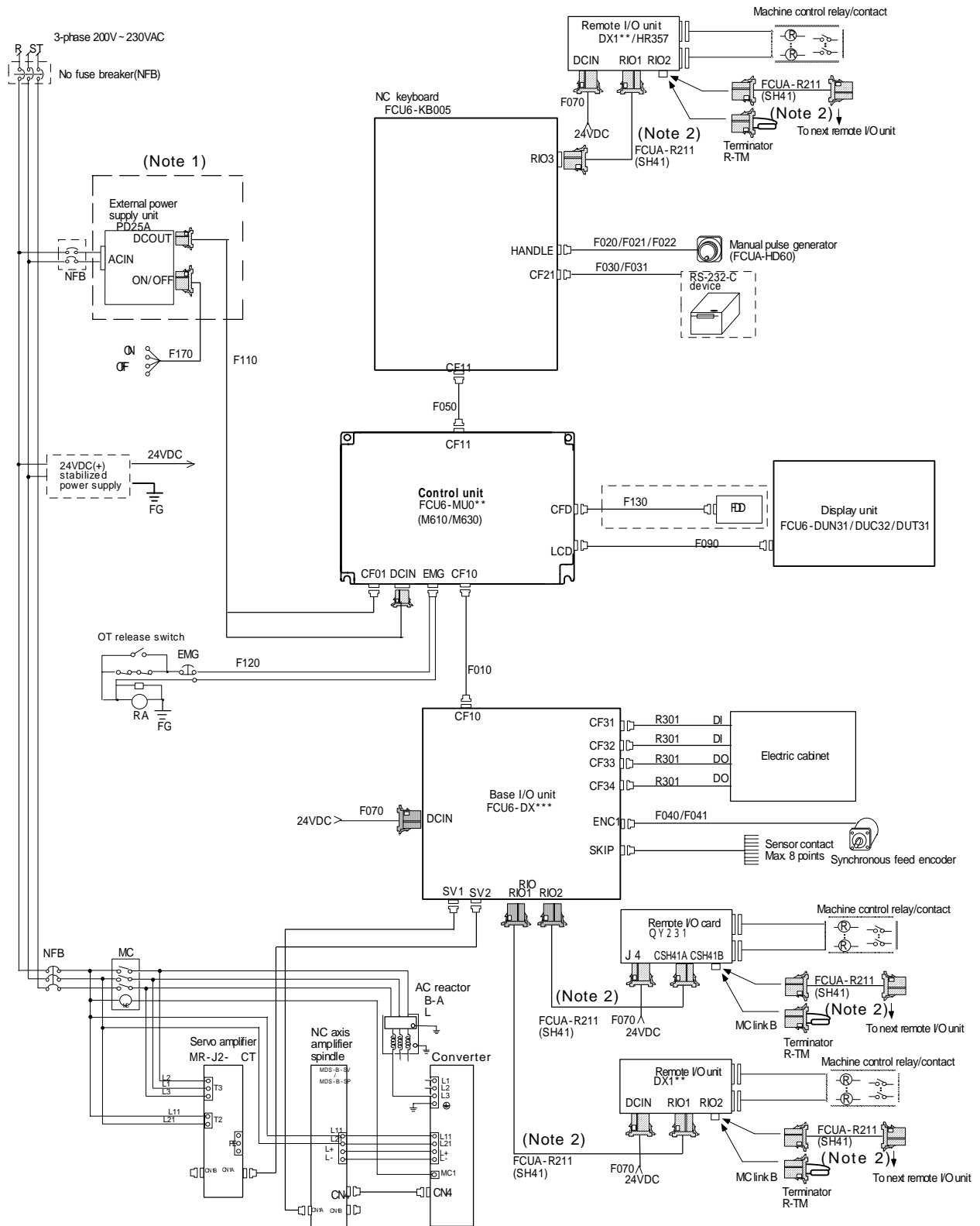


- (Note 1)** Refer to "Section 4.3.1 (2)" when not using the PD25A power supply.
- (Note 2)** After connecting the DO output selected by the user and the application software running on Windows has ended, turn the external power supply unit's power OFF with the DO output.
- (Note 3)** Connect the F149 cable pin 8 side [HD ISP] connection to the ISP terminal at the side of CF12. The target units are only FCU6-MU501 to FCU6-MU514. This is not used by the other units.
- (Note 4)** CF14 is used only for FCU6-MU515/516. This is not used by the other units.
- (Note 5)** Normally, use the FCUA-R211 cable for the RIO cable. If the cable length is short due to bridging between units in the same panel, the SH41 cable can be used.
- (Note 6)** The DCIN (HEATER) connector is not used with FCU6-KB014.

# CHAPTER 4 SYSTEM CONNECTION

## 4.1 General System Diagram

### 4.1.2 M610/M630



**(Note 1)** Refer to section 4.3.1 (2) when not using the PD25A power supply.

**(Note 2)** Normally, use the FCUA-R211 cable for the RIO cable.

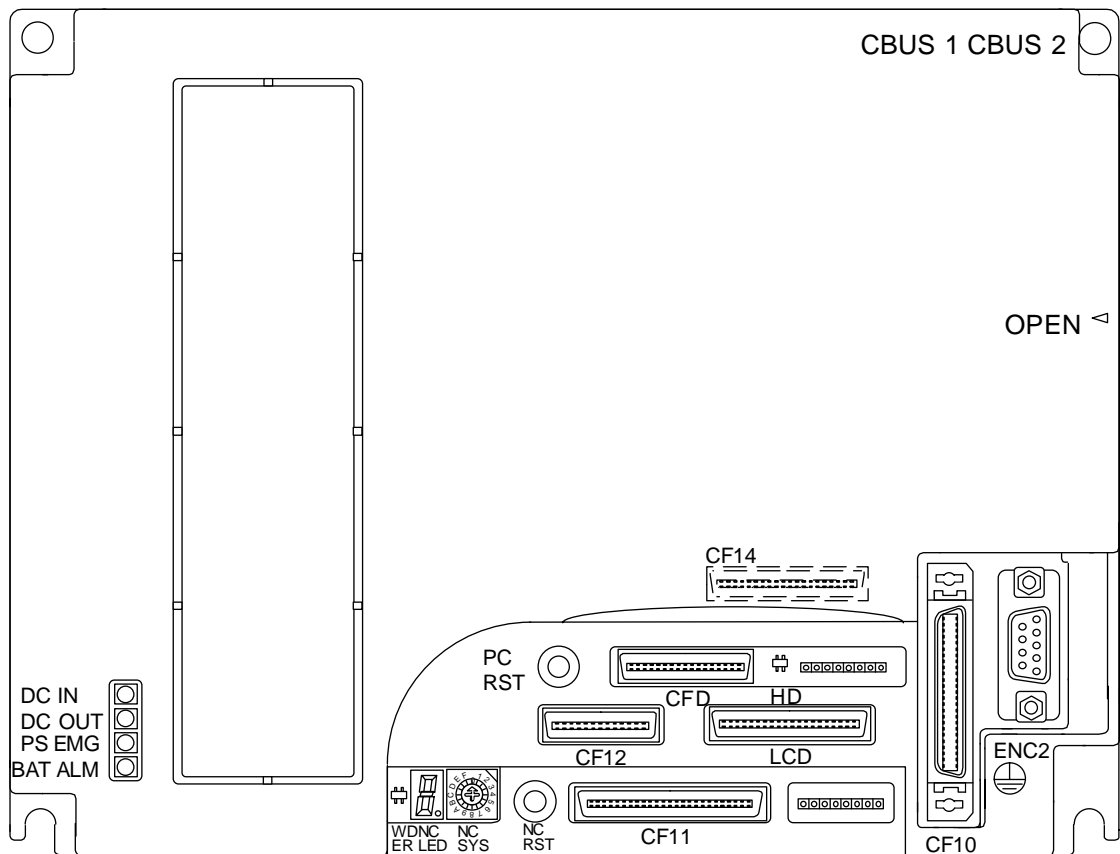
If the cable length is short due to bridging between units in the same panel, the SH41 cable can be used.



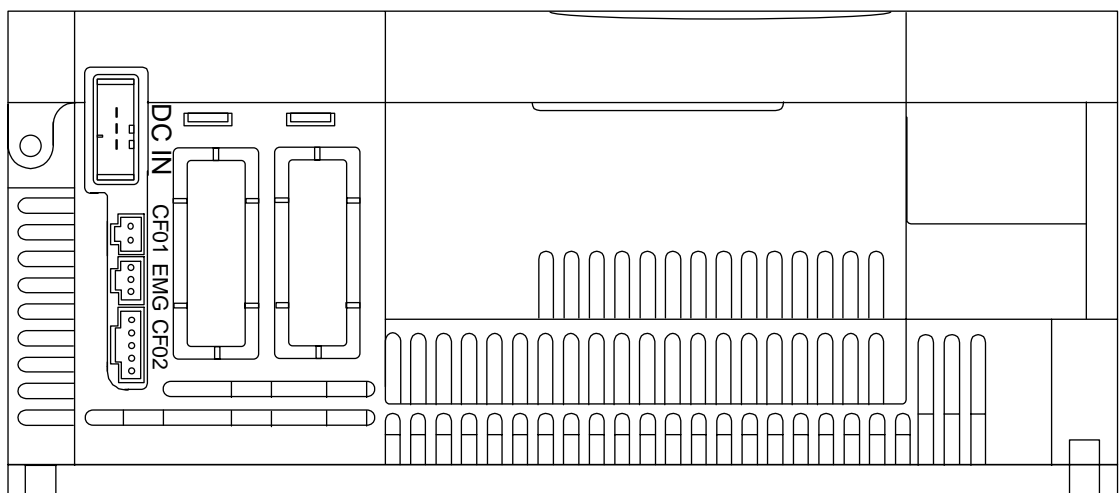
## 4.2 Connection of Control Unit

### 4.2.1 Control Unit Connector Layout Drawing

The connector layout drawing of the control unit is shown below.



Front



Bottom

**(Note 1)** Connector CF12 is not provided on the M610/630 control unit.

**(Note 2)** Connector CF14 is provided only on the FCU6-MU515/516.

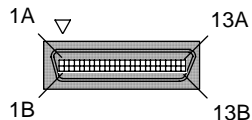


## CHAPTER 4 SYSTEM CONNECTION

### 4.2 Connection of Control Unit

PC interface

CF12



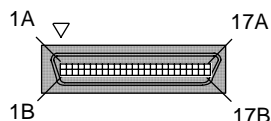
**<Cable side connector type>**

Connector: DHD-RB26-20AN  
Recommended maker: DDK

		A			B	
1	I/O	KBDATA	1	I/O	KBCLK	☐ KB
2		GND	2		GND	
3	I/O	MSDATA	3	I/O	MSCLK	☐ MOUSE
4		reserve	4	I	GND	
5	O	SD3	5	I	RD3	Serial 3
6	O	RS3	6	I	CS3	
7	O	ER3	7	I	DR3	
8	I	CD3	8	I	RI3	
9	O	SD4	9	I	RD4	Serial 4
10	O	RS4	10	I	CS4	
11	O	ER4	11	I	DR4	
12	I	CD4	12	I	RI4	
13	O	+5V	13	O	+5V	

Floppy disk drive

CFD



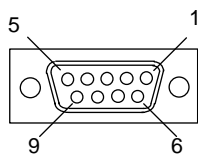
**<Cable side connector type>**

Connector: DHD-RB34-20AN  
Recommended maker: DDK

		A			B
1			1	O	DENSEL
2	O	+5V	2		GND
3			3	I	
4		GND	4	O	INDEX
5		GND	5	O	MT2
6		GND	6	O	DS1
7		GND	7	O	DS2
8		GND	8	O	MT1
9		GND	9	O	DIR
10		GND	10	O	STEP
11		GND	11	O	WD
12		GND	12	O	WE
13		GND	13	I	TRK0
14		GND	14	I	WP
15		GND	15	I	RD
16		GND	16	O	SIDE
17		GND	17	I	DCHG

Encoder

ENC2



**<Cable side connector type>**

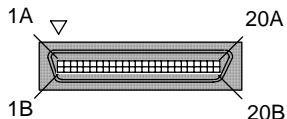
Connector : CDE-9PF  
Contact : CD-PC-111  
Case : HDE-CTH  
Recommended maker: Hirose

1	I	ENC2A	6	I	ENC2A*
2	I	ENC2B	7	I	ENC2B*
3	I	ENC2Z	8	I	ENC2Z*
4		GND	9	O	+5V
5		GND			

**CHAPTER 4 SYSTEM CONNECTION**  
**4.2 Connection of Control Unit**

PC interface 2

CF14



**<Cable side connector type>**  
 Connector : DHD-RB40-20AN  
 Recommended maker: DDK

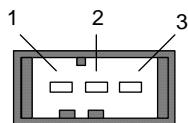
		A			B
1		GND	1		GND
2		GND	2		GND
3		GND	3		GND
4		GND	4		GND
5	O	PSLIN*	5	I/O	PD7
6	O	PINIT*	6	I/O	PD6
7	I	PERR*	7	I/O	PD5
8	O	AFD*	8	I/O	PD4
9	I	PSLCT*	9	I/O	PD3
10	I	PEND	10	I/O	PD2
11	I	PBUSY*	11	I/O	PD1
12	I	PACK*	12	I/O	PD0
13		+5V	13	O	PSTB*
14	I/O	MCLK2	14	I/O	MDATA2
15	I	OPMS	15		GND
16	O	HSYNC	16	O	VSYNC
17	O	REDRET	17	O	RED
18	O	GREENRET	18	O	GREEN
19	O	BLUEERT	19	O	BLUE
20		GND	20		GND

Parallel

Mouse 2

Display unit  
for maintenance

+24V input  
DCIN

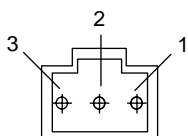


**<Cable side connector type>**

Connector : 2-178288-3  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

1	I	+24V
2		GND
3		FG

Emergency stop  
EMG

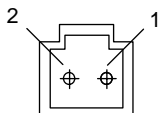


**<Cable side connector type>**

Connector : 51030-0330  
 Contact : 50084-8160  
 Recommended maker: Morex

1		FG
2	I	EMG IN
3	O	COM

Power off detection  
CF01



**<Cable side connector type>**

Connector : 51030-0230  
 Contact : 50084-8160  
 Recommended maker: Morex

1		GND
2	I	ACFAIL

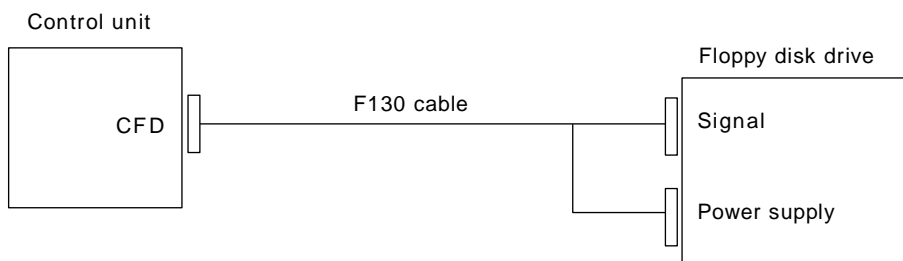
**⚠ CAUTION**

- ⚠ 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.

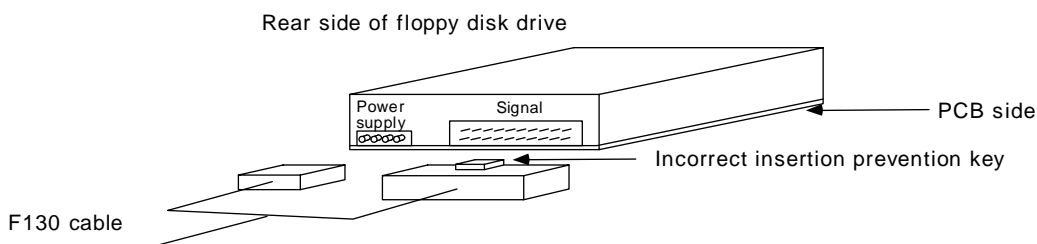
### 4.2.3 Connection of Floppy Disk Drive

#### (1) Connection of F130 cable

Connect the floppy disk drive to CFD on the control unit. Refer to Appendix 2 (F130 cable) for the floppy disk drive cable.

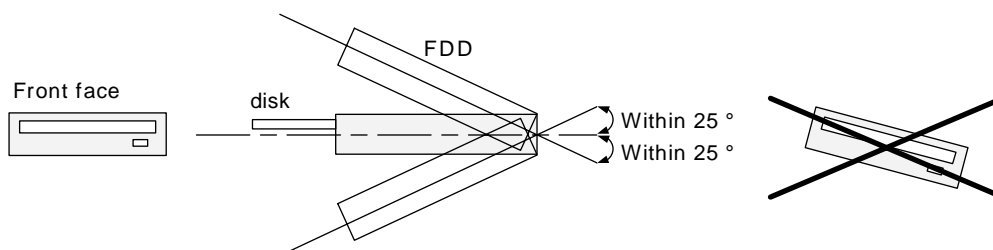


Connect the F130 cable and floppy disk drive as shown below. Place the PCB side downward and face the connector incorrect insertion prevention key upward when inserting.



#### (2) FDD installation conditions

The FDD body must be installed so that it is within  $\pm 25^\circ$  of the vertical or horizontal directions. The FDD cannot be used if the disk insertion port is inclined (other than vertical/horizontal).

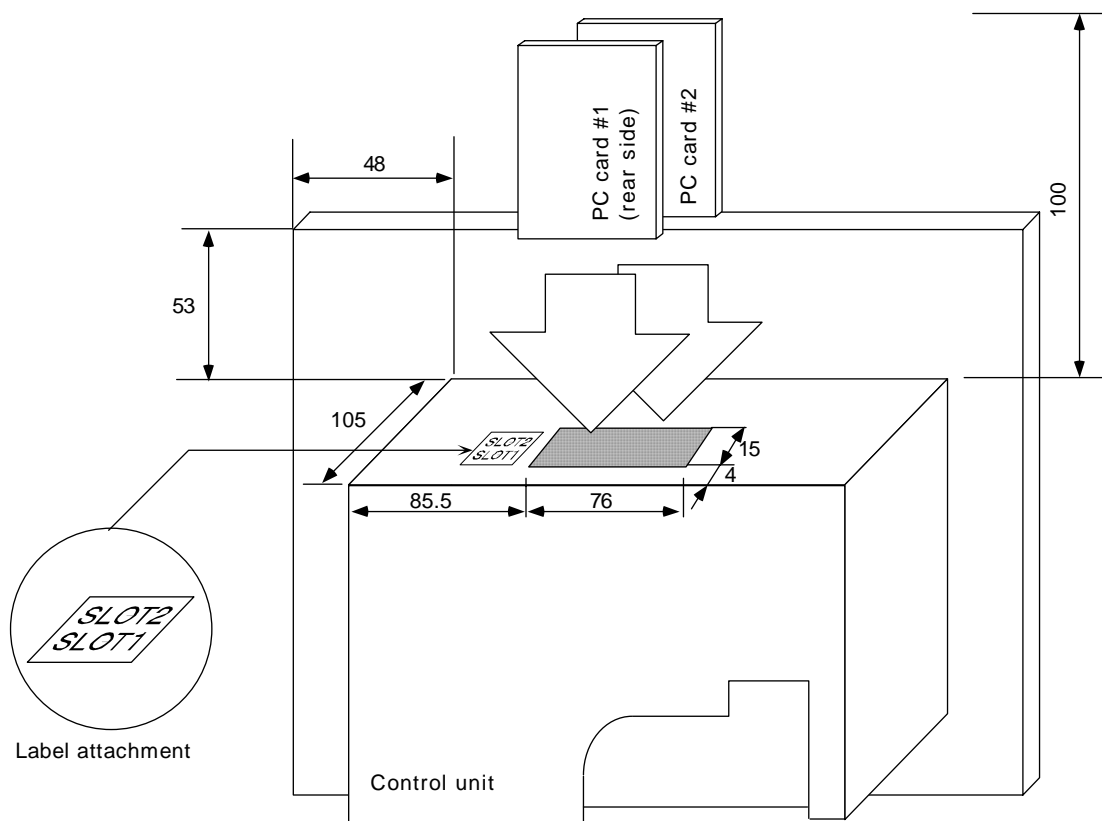


#### **CAUTION**

- ⚠ 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.

### 4.2.4 Connection of PC Card (PCMCIA)

The PC card (PCMCIA) is inserted in the control unit from the top of the control unit. When inserting the card, a space of 100 mm or more is required at the top of the control unit. To remove the card, press the eject button.



#### (PC card specifications)

The PCMCIA I/F mounted on the control unit satisfies the following specifications.

Standards	: PCMCIA_V2.1, JEIDA_4.2 compliance
No. of slots	: 2 slots
PC card power supply (Vcc)	: 5 V, 800 mA
Program power supply (Vpp)	: 12 V, 120 mA

#### (Note 1) PC card thickness

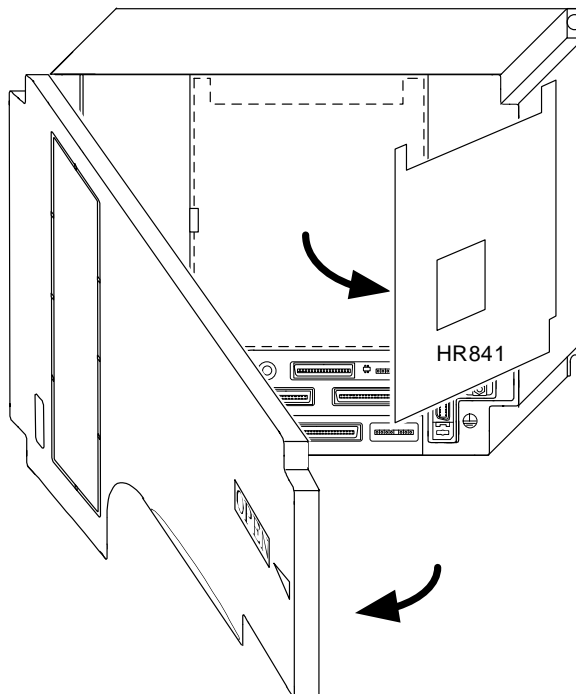
Type I (3.3mm)	} Up to two cards can be used
Type II (5.5mm)	
Type III (10.5mm)	

(Note 2) Limited to the 5V specification part (cannot be used with the 3.3V specifications)

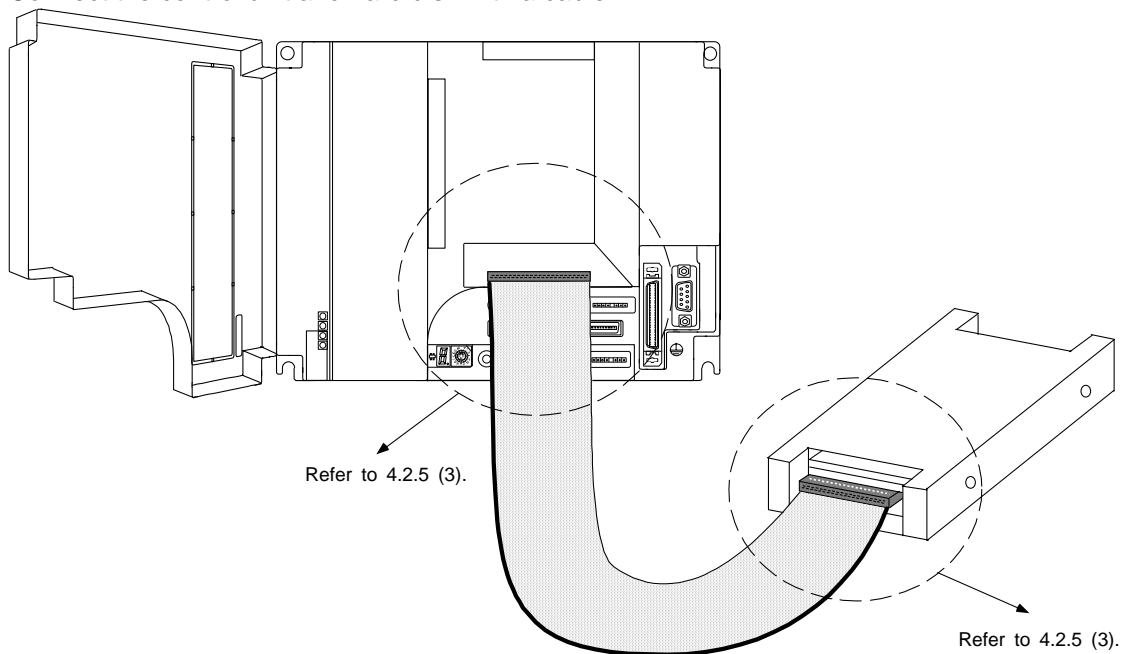
### 4.2.5 Connecting of Hard Disk Drive

The procedures for connecting the hard disk drive are shown below.

- (1) Open the control unit cover, and remove the HR841 card.



- (2) Connect the control unit and hard disk with a cable.



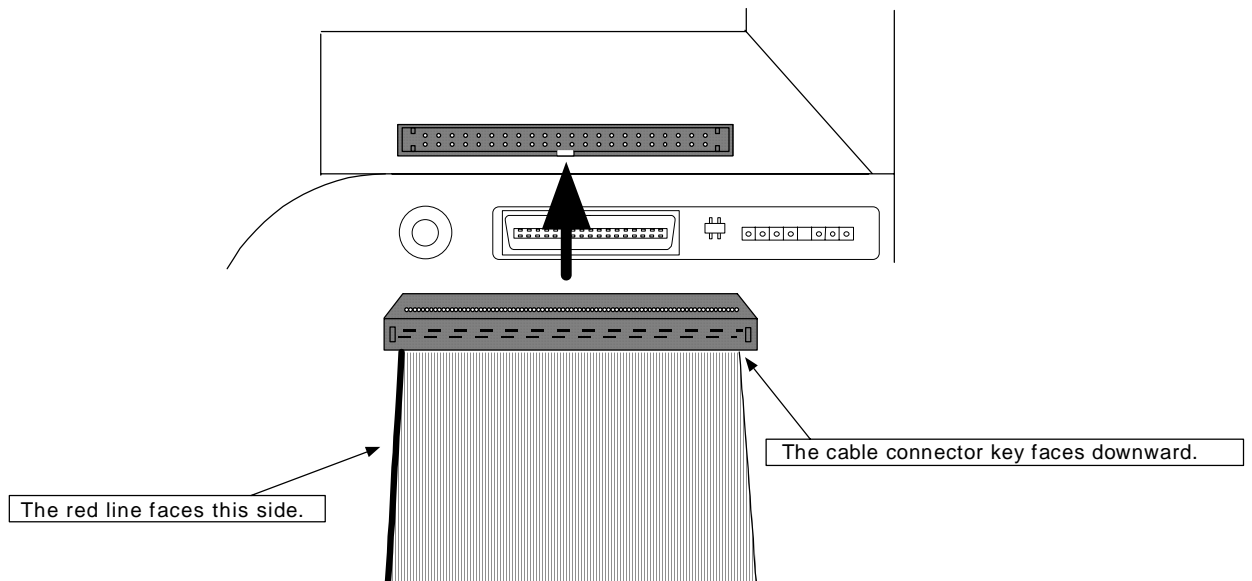
- (Note 1)** Use the cable enclosed with the hard disk. The max. cable length is 500mm.  
**(Note 2)** Take care when handling the hard disk drive. (Take care not to drop or shake the unit.)  
When installed vertically, keep the inclination within 15°, and lead the cable from above.



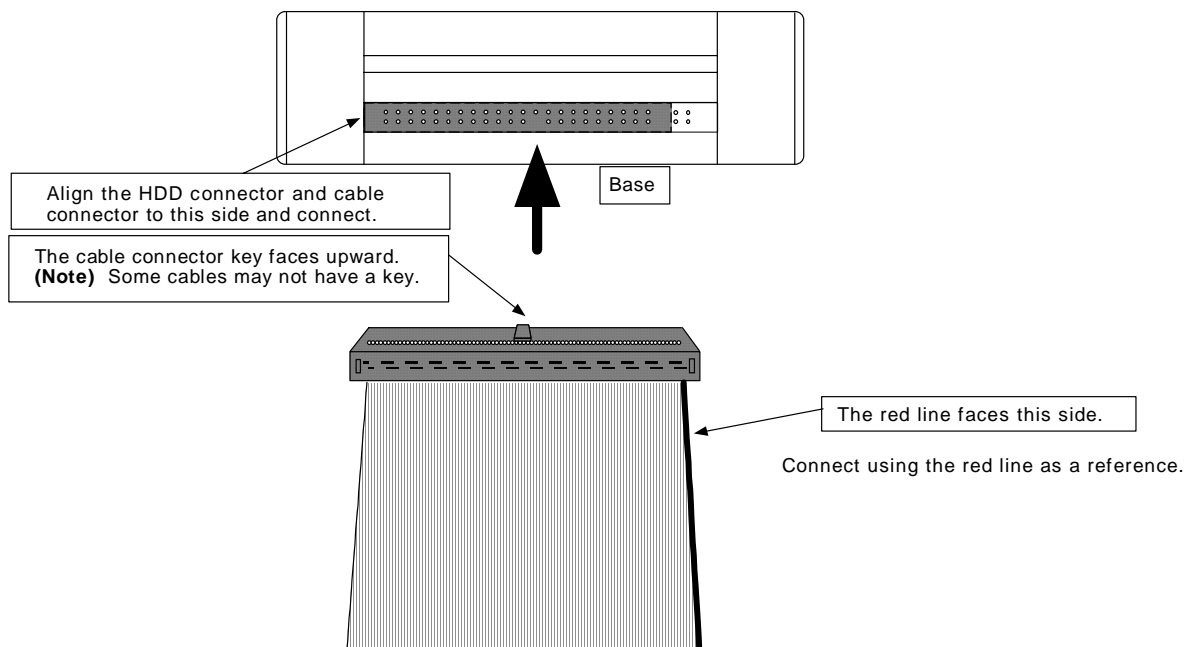
- ⊘ Do not connect or disconnect the cables between each unit while the power is ON.

(3) Connecting the cable

1) Connecting the control unit and cable



2) Connecting the hard disk drive and cable



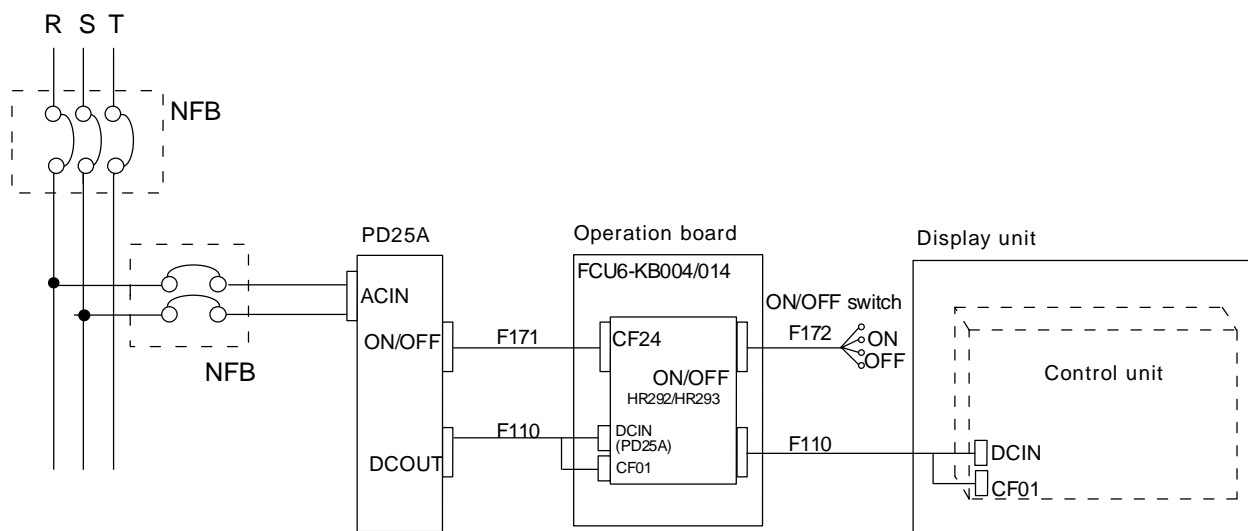


### 4.3 Connection of Power Supply

#### 4.3.1 Connection for Using PD25A Unit

The PD25A power supply is used to protect the hard disk in the M6 Series. After the power is turned OFF, 24VDC is output for 300mSec to prevent the power from being cut off while writing to the hard disk.

##### (1) PD25A connection



**Caution)** Refer to "Section 4.4 Connection of Operation Board" for details on connecting with the operation board.

##### (2) Power supply specifications

Input : 200/230VAC (-15%, +10%)

Output : 24VDC 3A max

	<b>External power supply unit</b>
Unit size	130 × 65 × 230
Back up time	300msec

**(Caution)** The power cannot be turned ON immediately after the PD25A power has been turned OFF. Wait approx. two seconds before turning the power ON.

**⚠ WARNING**

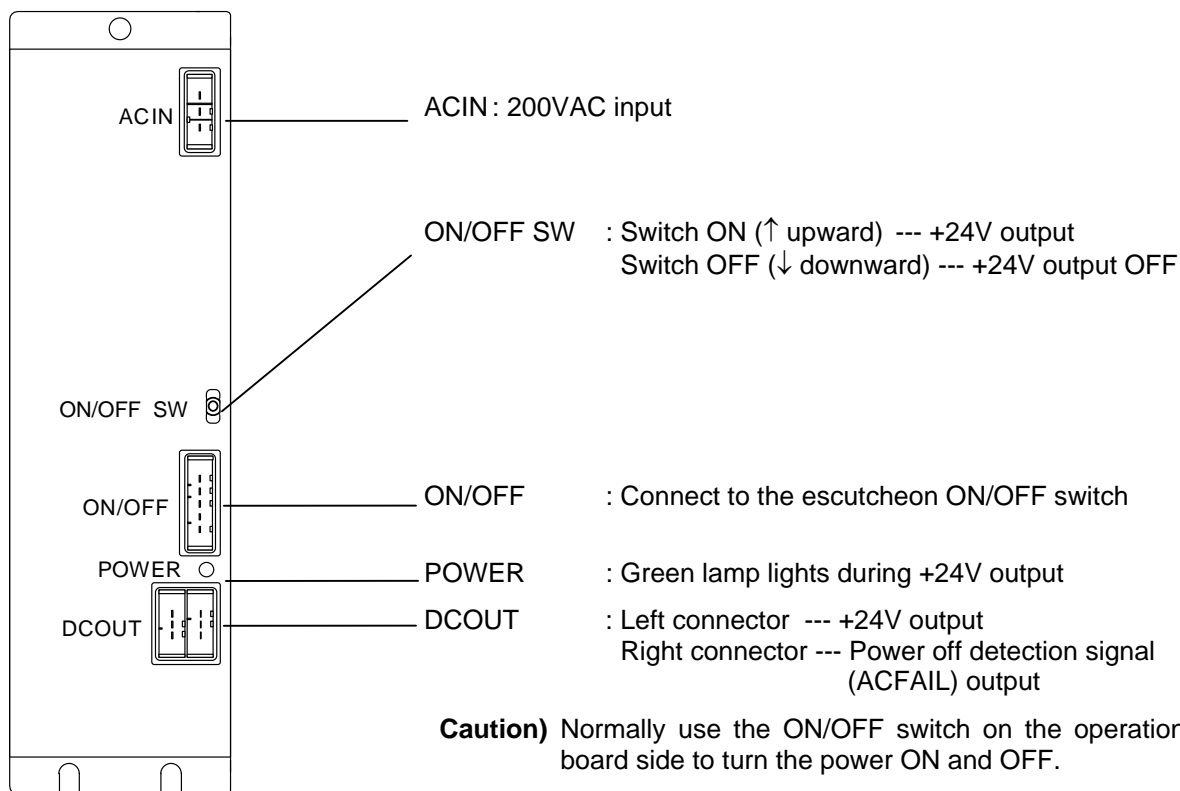
⚠ Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.

**⚠ CAUTION**

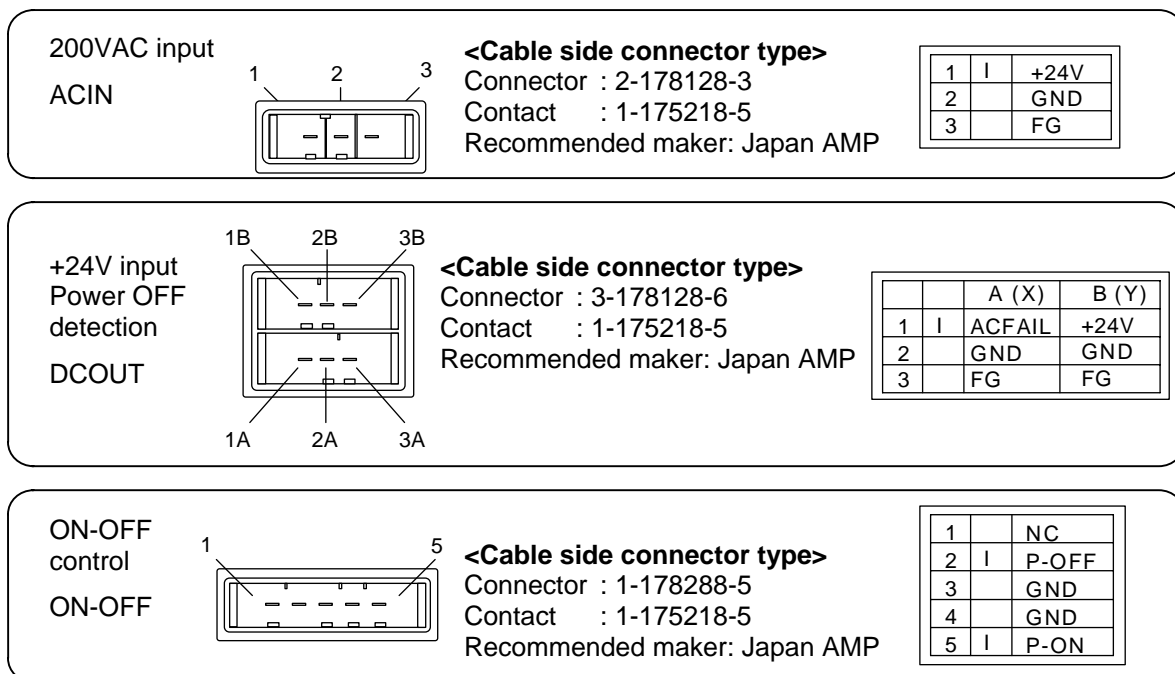
- ⚠ Separate the signal wire from the drive line/power line when wiring.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

CHAPTER 4 SYSTEM CONNECTION  
4.3 Connection of Power Supply

(3) Connector layout drawing



(4) PD25A connector pin assignment



**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.

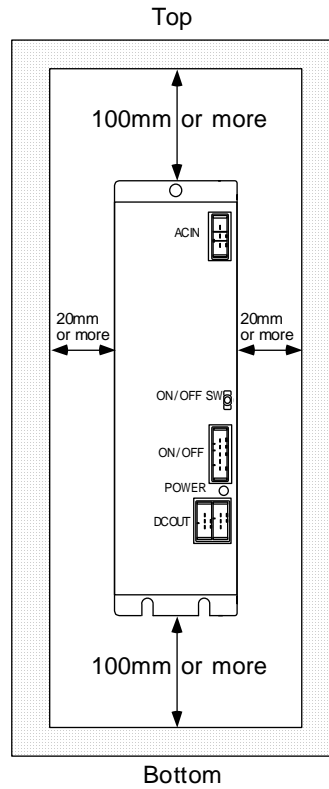
## CHAPTER 4 SYSTEM CONNECTION

### 4.3 Connection of Power Supply

---

#### (5) Installation direction and spacing

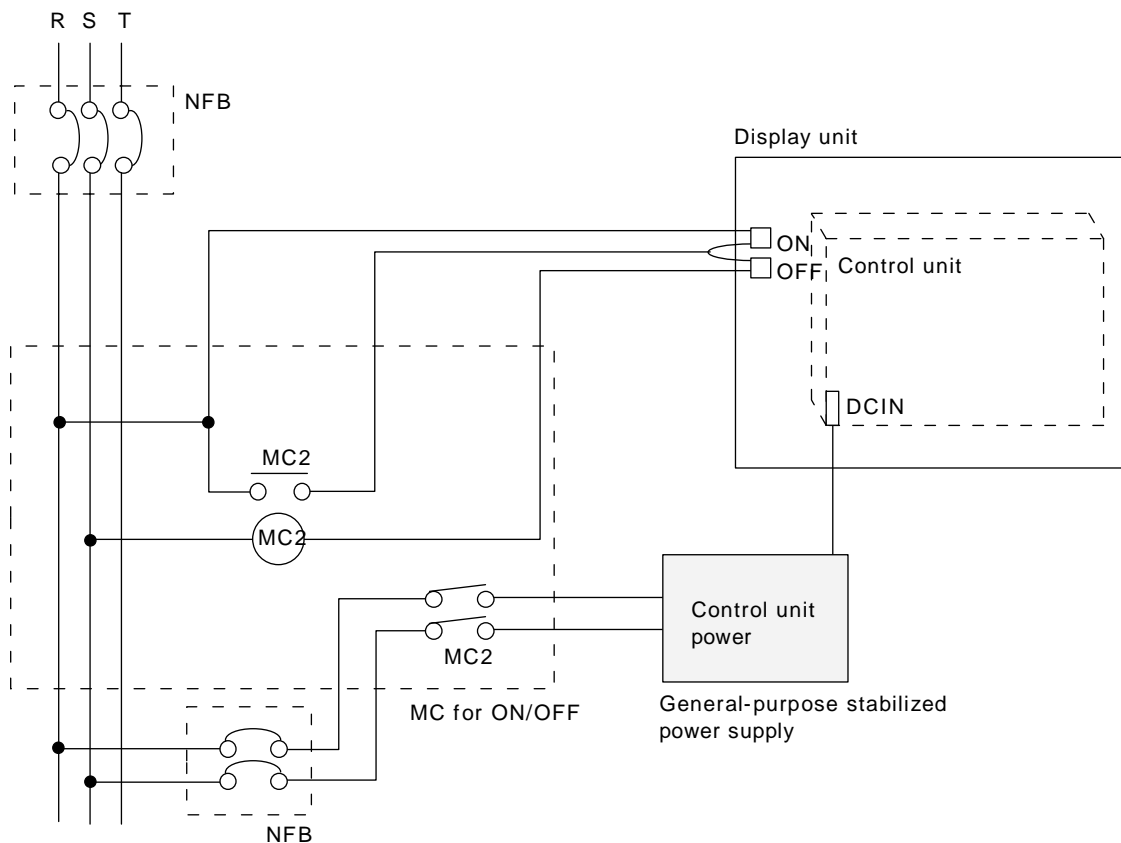
Install the PD25A unit vertically so that the front surface is visible.  
Provide the space shown below around the unit for heat radiation and ventilation.



### 4.3.2 Connection for Using General-purpose Stabilized Power Supply

A general-purpose stabilized power supply is used with the M6 Series (M610/630) not provided with a hard disk.

#### (1) General-purpose stabilized power supply connection



1. Refer to section "4.2.2 Control unit connector pin assignment" for details on the control unit's DCIN connection.
2. Leave CF01 on the control unit open.

**WARNING**

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

#### (2) Power supply specification

##### Control unit power specifications

Output voltage	+24V ± 5%
Ripple	± 5% (P-P)
Output current	3A

##### MC2 (ON/OFF MC) specifications

Contact rating	250VAC/1 A or more
Operation coil	250VAC/0.2 A or less
No. of contacts	3a or more
Standards	VDE Standards approved part

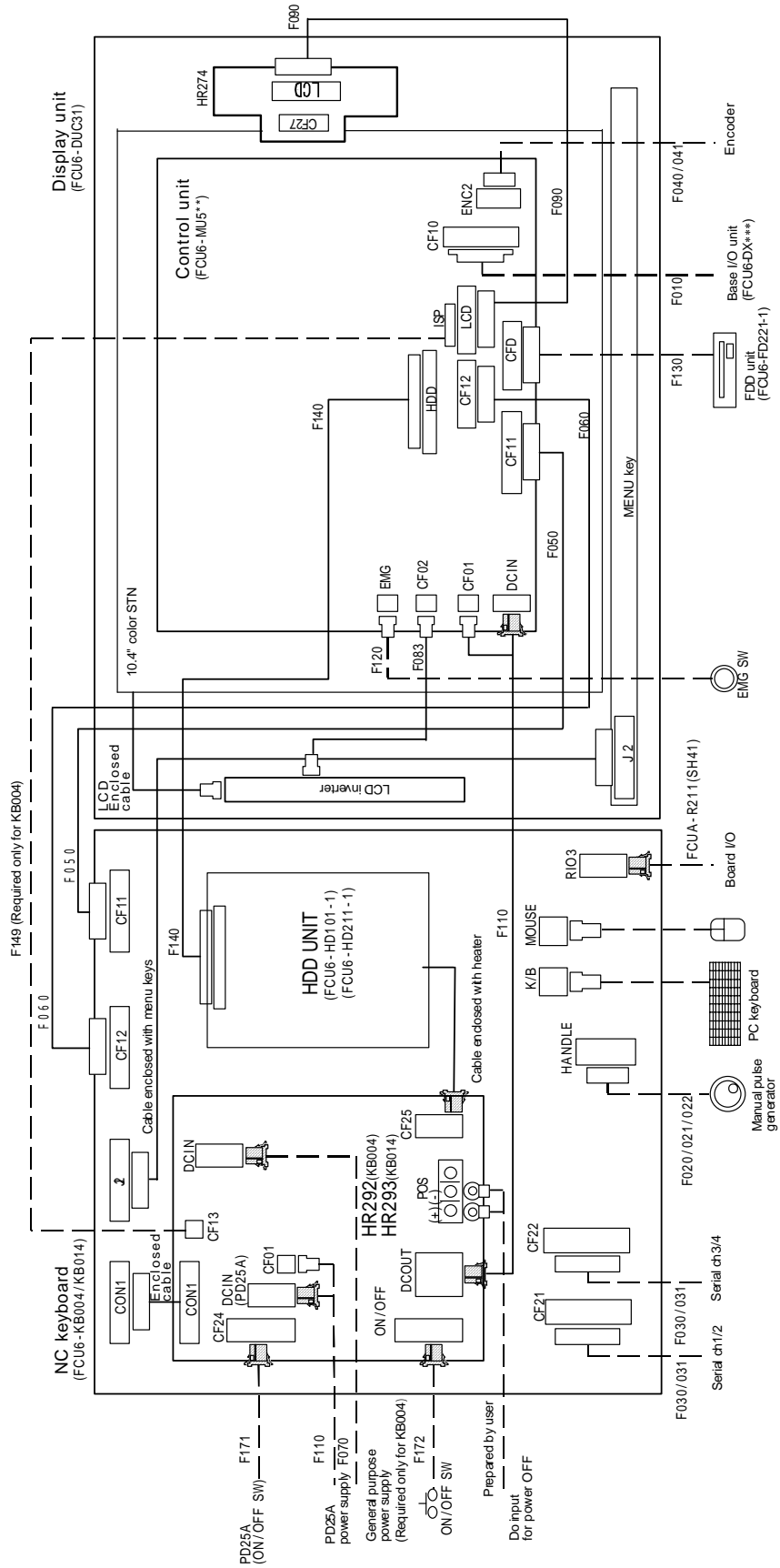
**Caution)** Prepare a control unit power supply (general-purpose stabilized power supply) separate from the base I/O and remote I/O unit power supply.



# CHAPTER 4 SYSTEM CONNECTION

## 4.4 Connection of Operation Board

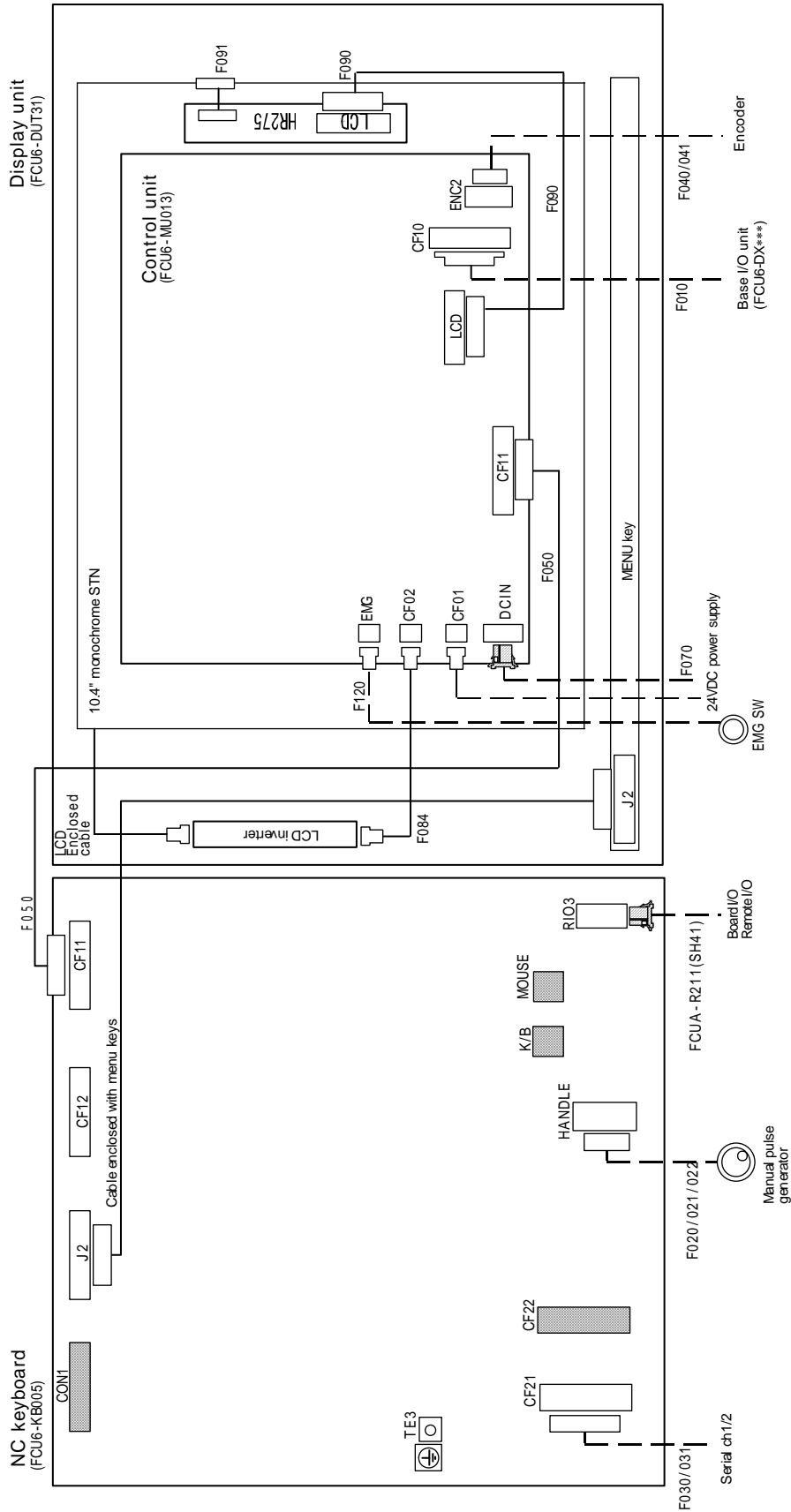
(2) With 10.4" color TFT



CHAPTER 4 SYSTEM CONNECTION  
4.4 Connection of Operation Board

4.4.2 Connection of M610/630

(1) With 10.4" monochrome STN



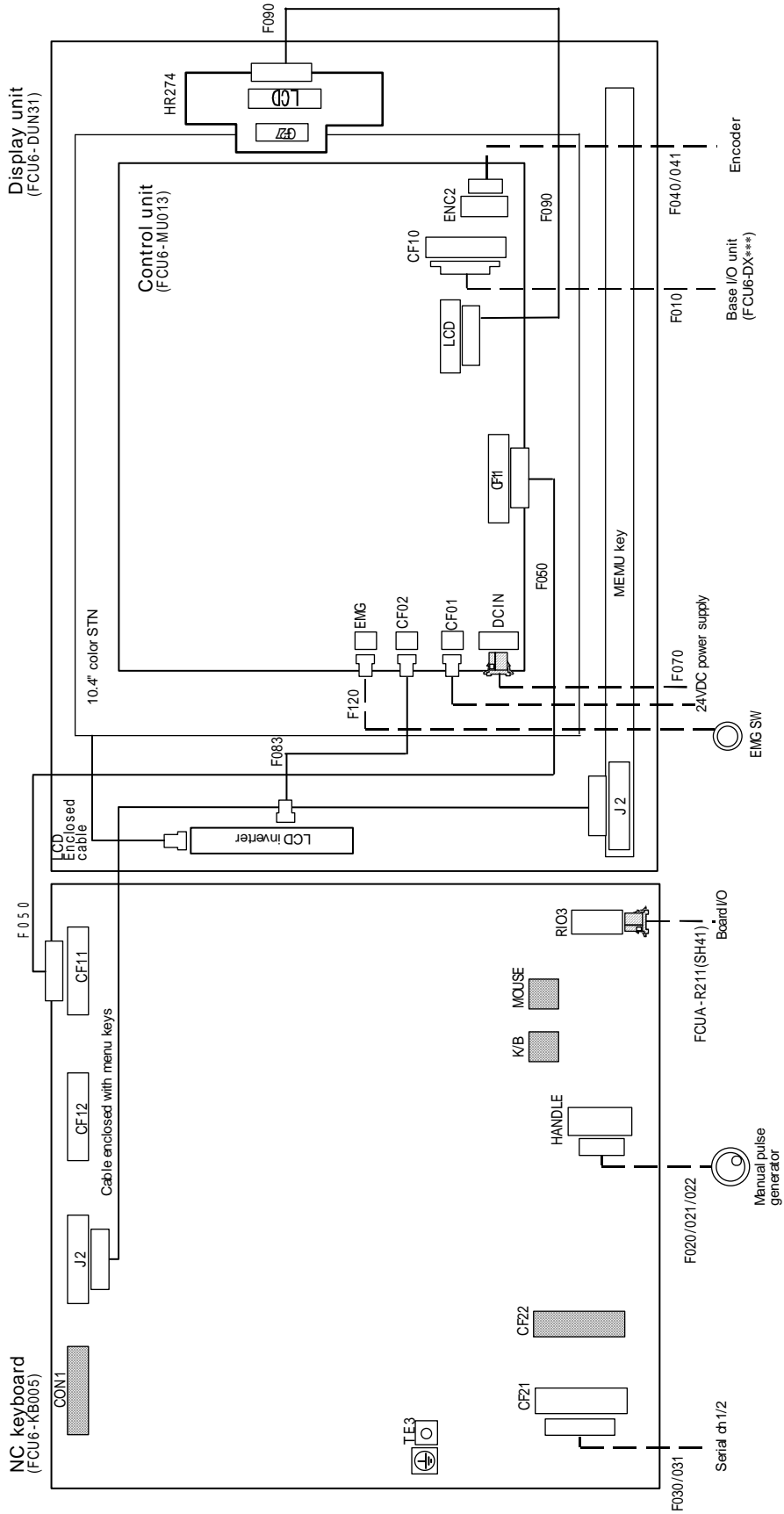
(Note) The connectors indicated with a shaded box cannot be used.





CHAPTER 4 SYSTEM CONNECTION  
4.4 Connection of Operation Board

(3) With 10.4" color TFT

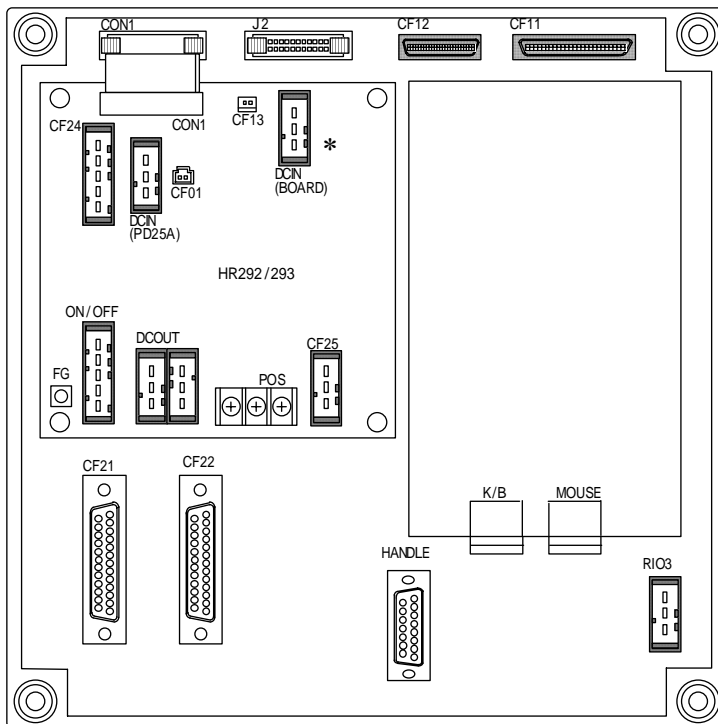


**(Note)** The connectors indicated with a shaded box cannot be used.

**CHAPTER 4 SYSTEM CONNECTION**  
**4.4 Connection of Operation Board**

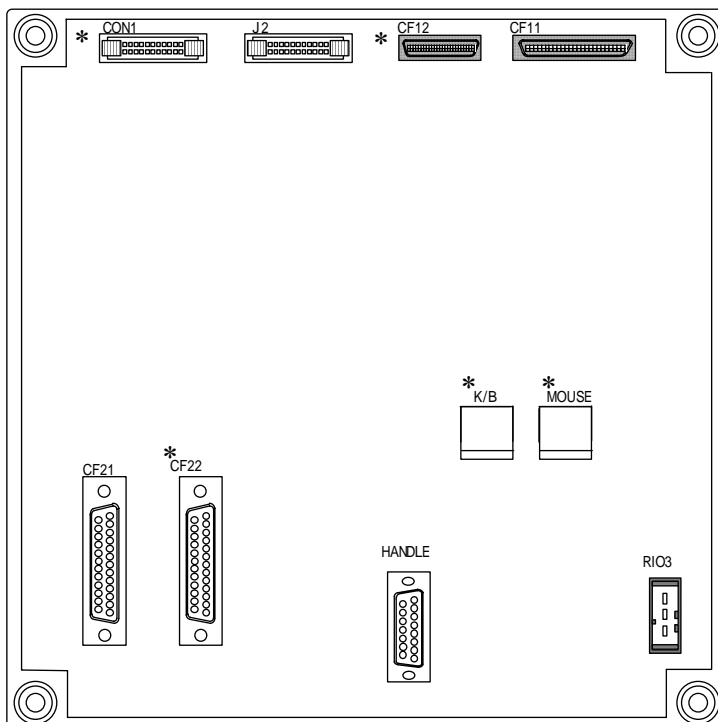
**4.4.3 Operation Board Connector Layout Drawing**

**(1) FCUA6-KB003/004/FCU6-KB013/014 connector layout drawing**



\* DCIN (BOARD) is not provided on the FCUA6-KB013/014.  
 (Card name: HR293)

**(2) FCUA6-KB005/006 connector layout drawing**

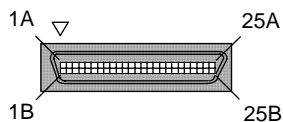


\* These are not used with the FCU6-KB005.

#### 4.4.4 Operation Board Connector Pin Assignment

NC keyboard

CF11



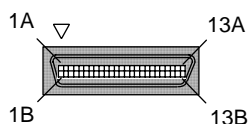
Refer to section 4.2.2 Control unit connector pin assignment (CF11) for details on the connector pin assignment.

**<Cable side connector type>**

Connector: DHD-RB50-20AN  
Recommended maker: DDK

PC interface

CF12



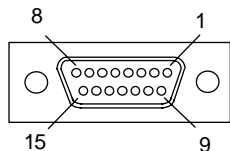
Refer to section 4.2.2 Control unit connector pin assignment (CF12) for details on the connector pin assignment.

**<Cable side connector type>**

Connector: DHD-RB26-20AN  
Recommended maker: DDK

Manual pulse generator

HANDLE



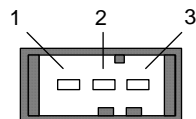
**<Cable side connector type>**

Connector : CDA-15P  
Contact : CD-PC-111  
Case : HDA-CTH  
Recommended maker: Hirose Denki

1	I	1HA	9		GND
2	I	1HB	10	O	+12V
3	I	2HA	11		GND
4	I	2HB	12	O	+12V
5	I	3HA	13		GND
6	I	3HB	14	O	+12V
7			15		
8					

Remote I/O

R103



**<Cable side connector type>**

Connector : 1-178288-3  
Contact : 1-175218-5  
Recommended maker: Japan AMP

1	I/O	TXRX3
2	I/O	TXRX3*
3		GND

**CAUTION**

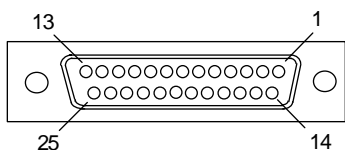
- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.

## CHAPTER 4 SYSTEM CONNECTION

### 4.4 Connection of Operation Board

#### RS-232-C (For NC)

CF21



**<Cable side connector type>**

Connector : CDB-25P  
 Contact : CD-PC-111  
 Case : HDB-CTH  
 Recommended maker: Hirose Denki

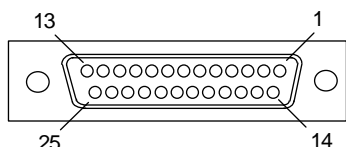
1			14	O	SD2
2	O	SD1	15	O	ER2
3	I	RD1	16	I	RD2
4	O	RS1	17	I	CS2
5	I	CS1	18		
6	I	DR1	19	O	RS2
7		GND	20	O	ER1
8			21	I	DR2
9			22		
10			23		
11		GND	24		GND
12		reserve	25		reserve
13					

**Explanation of signals**

SD : Send Data  
 RD : Receive Data  
 RS : Request to Send  
 CS : Clear to Send  
 DR : Data Set Ready  
 ER : Data Terminal Ready

#### RS-232-C (For PC)

CF22



**<Cable side connector type>**

Connector : CDB-25P  
 Contact : CD-PC-111  
 Case : HDB-CTH  
 Recommended maker: Hirose Denki

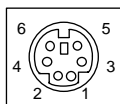
1			14	O	SD4
2	O	SD3	15	O	ER4
3	I	RD3	16	I	RD4
4	O	RS3	17	I	CS4
5	I	CS3	18	I	CD4
6	I	DR3	19	O	RS4
7		GND	20	O	ER3
8	I	CD3	21	I	DR4
9	I	RI3	22	I	RI4
10			23		
11		GND	24		GND
12		reserve	25		reserve
13					

**Explanation of signals**

SD : Send Data  
 RD : Receive Data  
 RS : Request to Send  
 CS : Clear to Send  
 DR : Data Set Ready  
 ER : Data Terminal Ready  
 CD : Carrier Detection  
 RI : Called Reply

#### Keyboard

KB



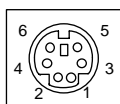
**<Cable side connector type>**

Connector: Mini DIN6P

1	I/O	KBDATA
2		
3		GND
4	O	+5V
5	I/O	KBCLK
6		

#### Mouse

MOUSE



**<Cable side connector type>**

Connector: Mini DIN6P

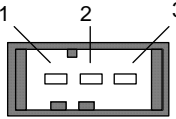
1	I/O	MSDATA
2		
3		GND
4	O	+5V
5	I/O	MSCLK
6		

**⚠ 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.

**CHAPTER 4 SYSTEM CONNECTION**  
**4.4 Connection of Operation Board**

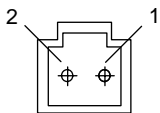
+24V input  
 DCIN (PD25A)  
 DCIN (BOARD)



**<Cable side connector type>**  
 Connector : 2-178288-3  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

1	I	+24V
2		GND
3		FG

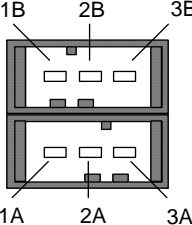
Power OFF detection  
 CF01



**<Cable side connector type>**  
 Connector : 51030-0230  
 Contact : 50084-8160  
 Recommended maker: Molex

1		GND
2	I	ACFAIL

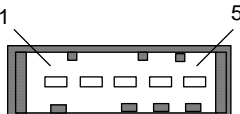
+24V input  
 Power OFF detection  
 DC OUT



**<Cable side connector type>**  
 Connector : 3-178128-6  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

		A	B
1	I	ACFAIL	+24V
2		GND	GND
3		FG	FG

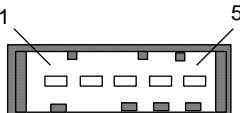
ON-OFF control  
 CF24



**<Cable side connector type>**  
 Connector : 1-178288-5  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

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

ON-OFF control  
 ON/OFF



**<Cable side connector type>**  
 Connector : 1-178288-5  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

1		NC
2	I	PowerON
3		LGON
4		PowerOFF
5	I	DC24V

**⚠ CAUTION**

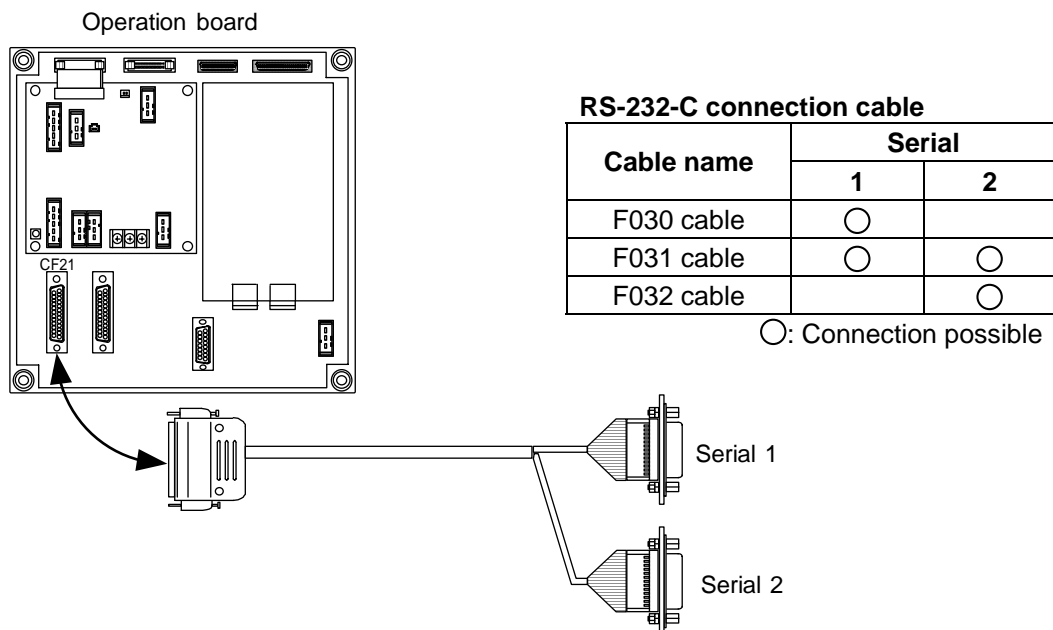
- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.

**CHAPTER 4 SYSTEM CONNECTION**  
**4.4 Connection of Operation Board**

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**4.4.5 Connection of RS-232-C (Serial 1, serial 2)**

Connect the NC side RS-232-C (serial 1, serial 2) to CF21 on the NC keyboard.

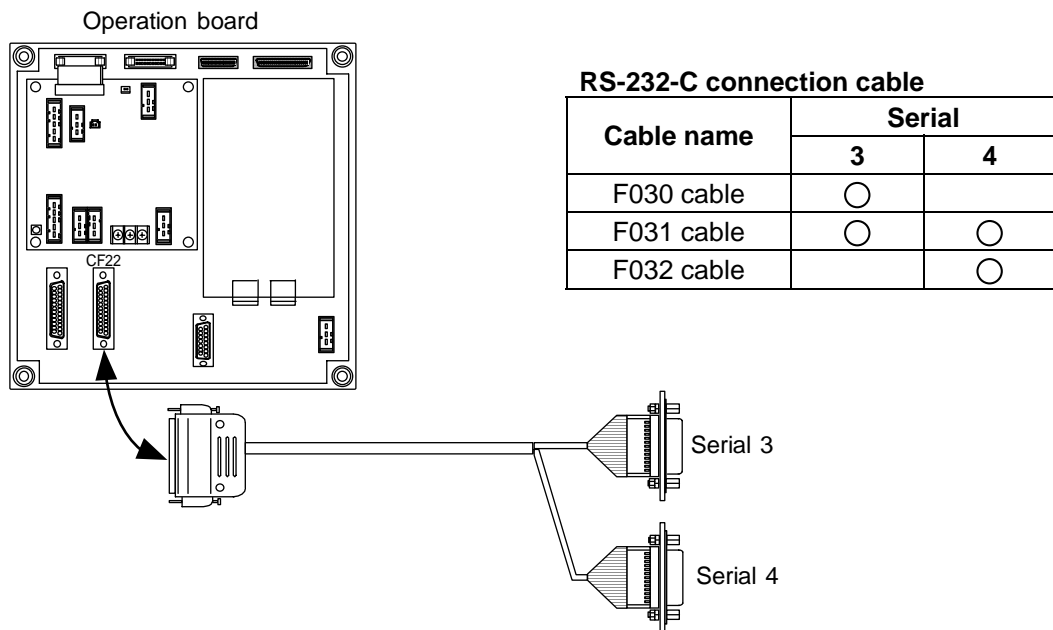


**<Related items>**

Cable manufacturing drawing: Appendix 2 (F030/031/033 cable)  
 Connector pin assignment : 4.4.3 Operation board connector pin assignment (CF21)

**4.4.6 Connection of RS-232-C (Serial 3, serial 4)**

Connect the personal computer side RS-232-C (serial 3, serial 4) to CF22 on the NC keyboard.

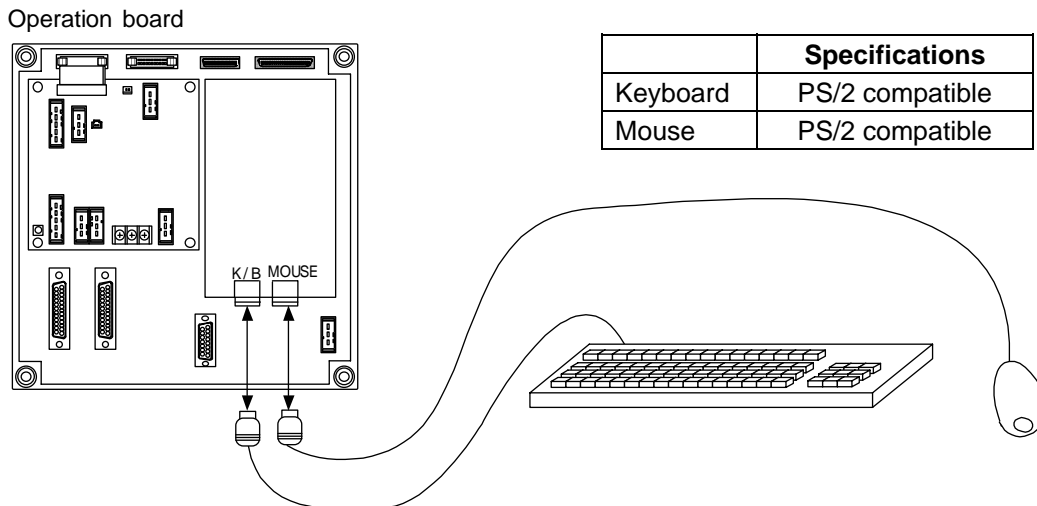


**<Related items>**

Cable manufacturing drawing: Appendix 2 (F030/031/033 cable)  
 Connector pin assignment : 4.4.3 Operation board connector pin assignment (CF22)

### 4.4.7 Keyboard and Mouse Connection

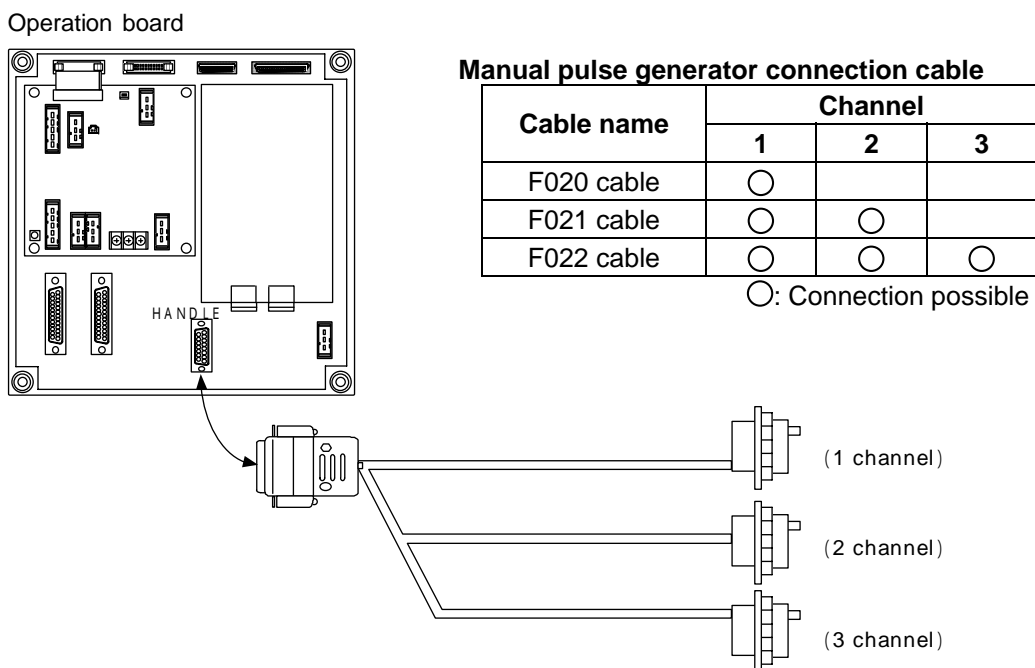
Connect the keyboard to KB on the NC keyboard.  
Connect the mouse to MOUSE on the NC keyboard.



**⚠ This connector is used for maintenance and service.**  
If a commercial keyboard or mouse is used, the system could malfunction or stop.

### 4.4.8 Connection of Manual Pulse Generator

Connect the manual pulse generator to HANDLE on the NC keyboard. Up to three channels can be connected for the manual pulse generator.



#### <Related items>

Outline drawing: Appendix 1

Cable manufacturing drawing: Appendix 2 (F020 cable)

Connector pin assignment : 4.4.3 Operation board connector pin assignment (HANDLE)

### 4.4.9 Connection of Operation Board I/O

The M6 Series operation board I/O is connected to RIO3 on the NC keyboard. Normally, connect the remote I/O unit to RIO3, and configure the No. of I/O points according to the user specifications. (Fig. 1) Refer to Chapter 6 Connection of remote I/O unit for details on the remote I/O unit.

When using the card-sized I/O for the operation board I/O, the user must manufacture a connector PCB for the card-sized I/O. (Fig. 2)

Refer to section 5.3 Connection of card-sized I/O for details.

(When using remote I/O unit)

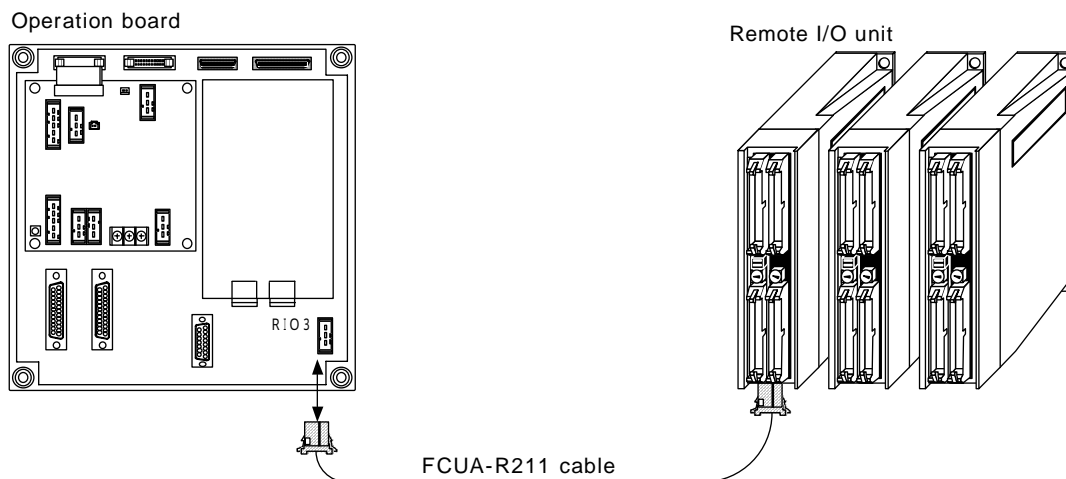


Fig. 1

(When using remote I/O unit)

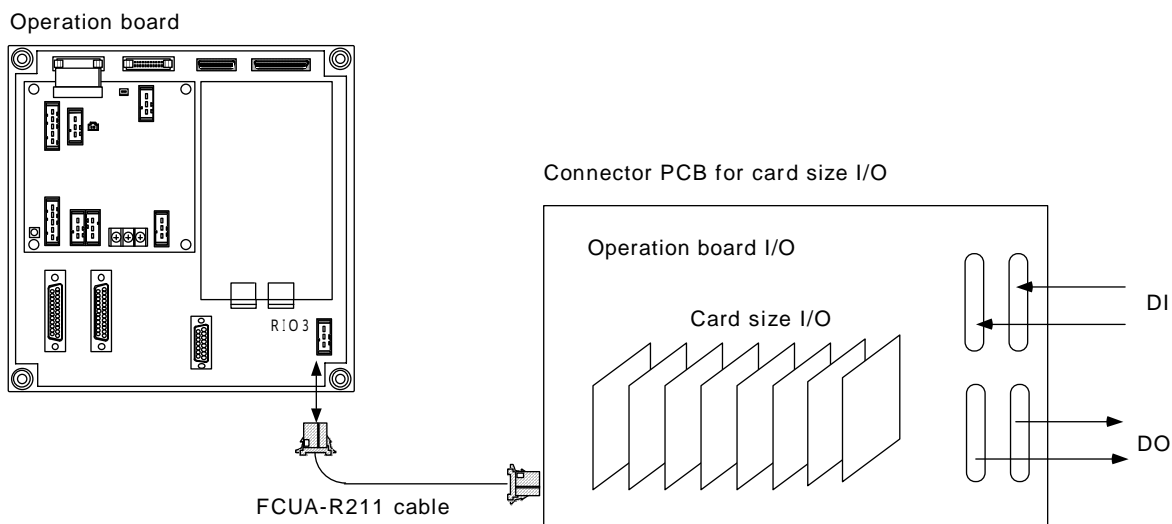


Fig. 2

<Related items>

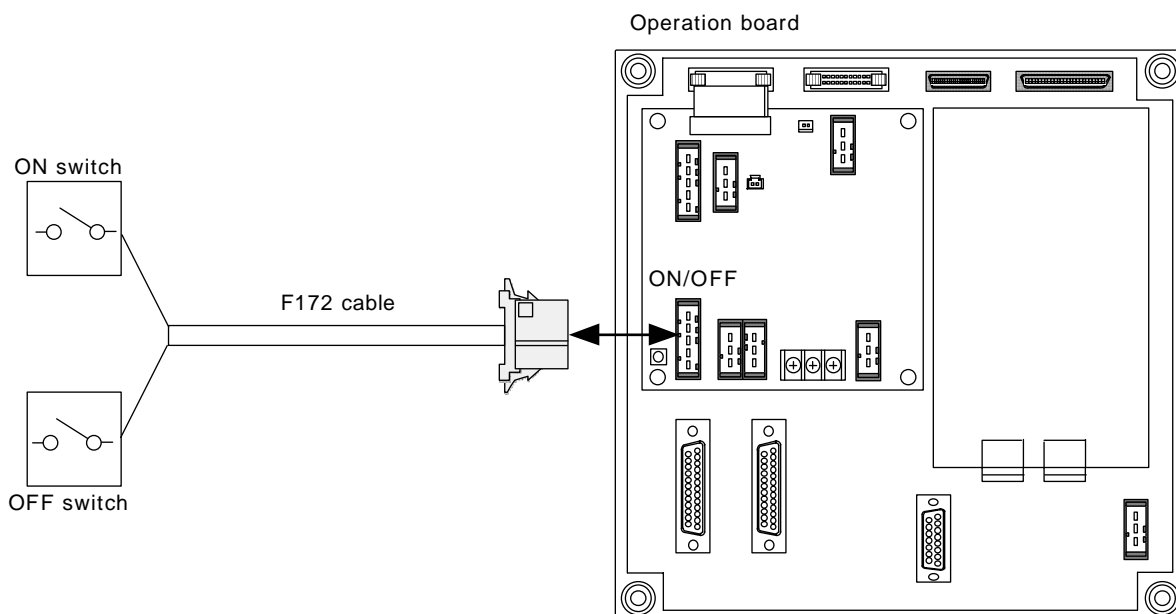
Cable manufacturing drawing: Appendix 2 (FCUA-R211 SH41 cable)

Connector pin assignment : 4.4.3 Operation board connector pin assignment



#### 4.4.10 Connection of ON/OFF Switch

The machine maker must prepare the ON/OFF switch. Connect the cable to the ON/OFF connector on the NC keyboard.



**(Note)** Use an A contact connection for both the ON switch and OFF switch.

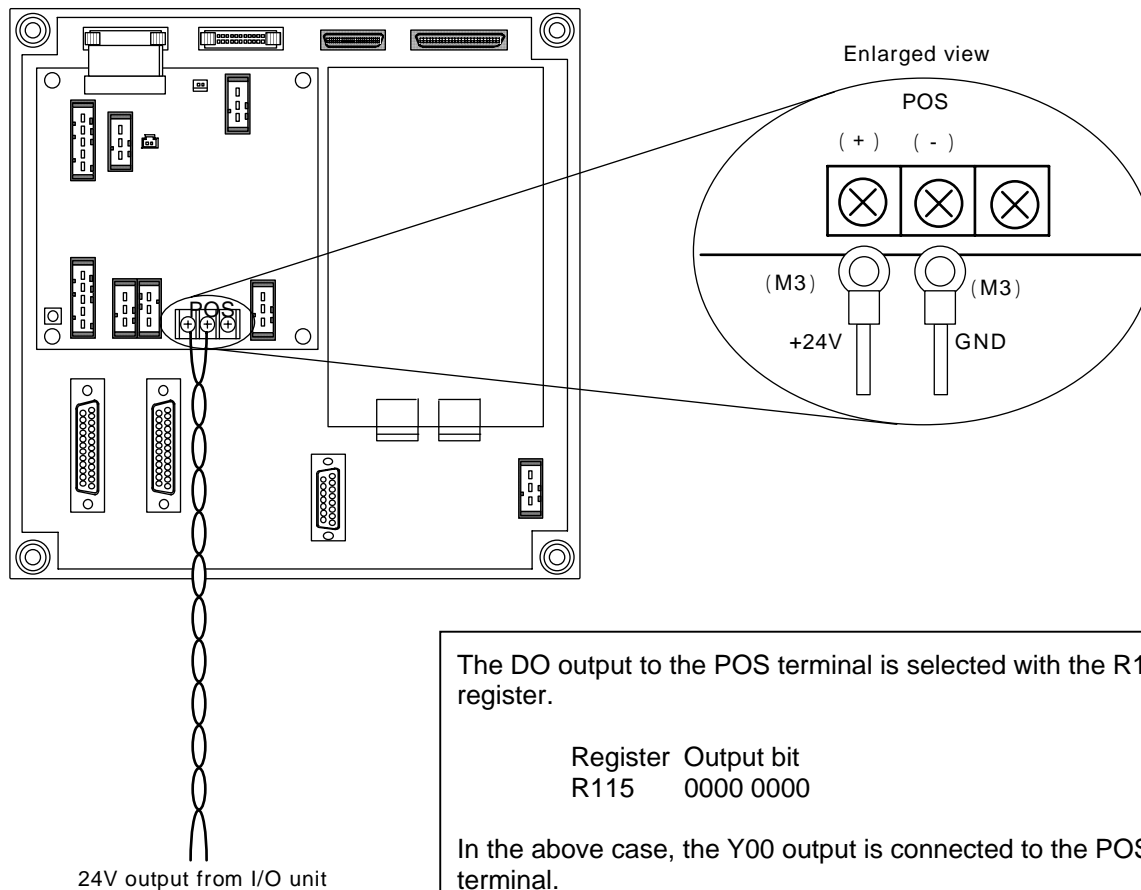
**CAUTION**

- ⚠ 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.
- ⚠ The pin Nos. of the ON/OFF connector connected to HR292/HR293 and the ON/OFF connector connected to PD25A differ. Take care when connecting.

### 4.4.11 POS (Power OFF Sequence) Connection

This turns OFF the power when Windows is ended.

Connect the random DO output, set by the machine manufacturer, to the POS terminal block.



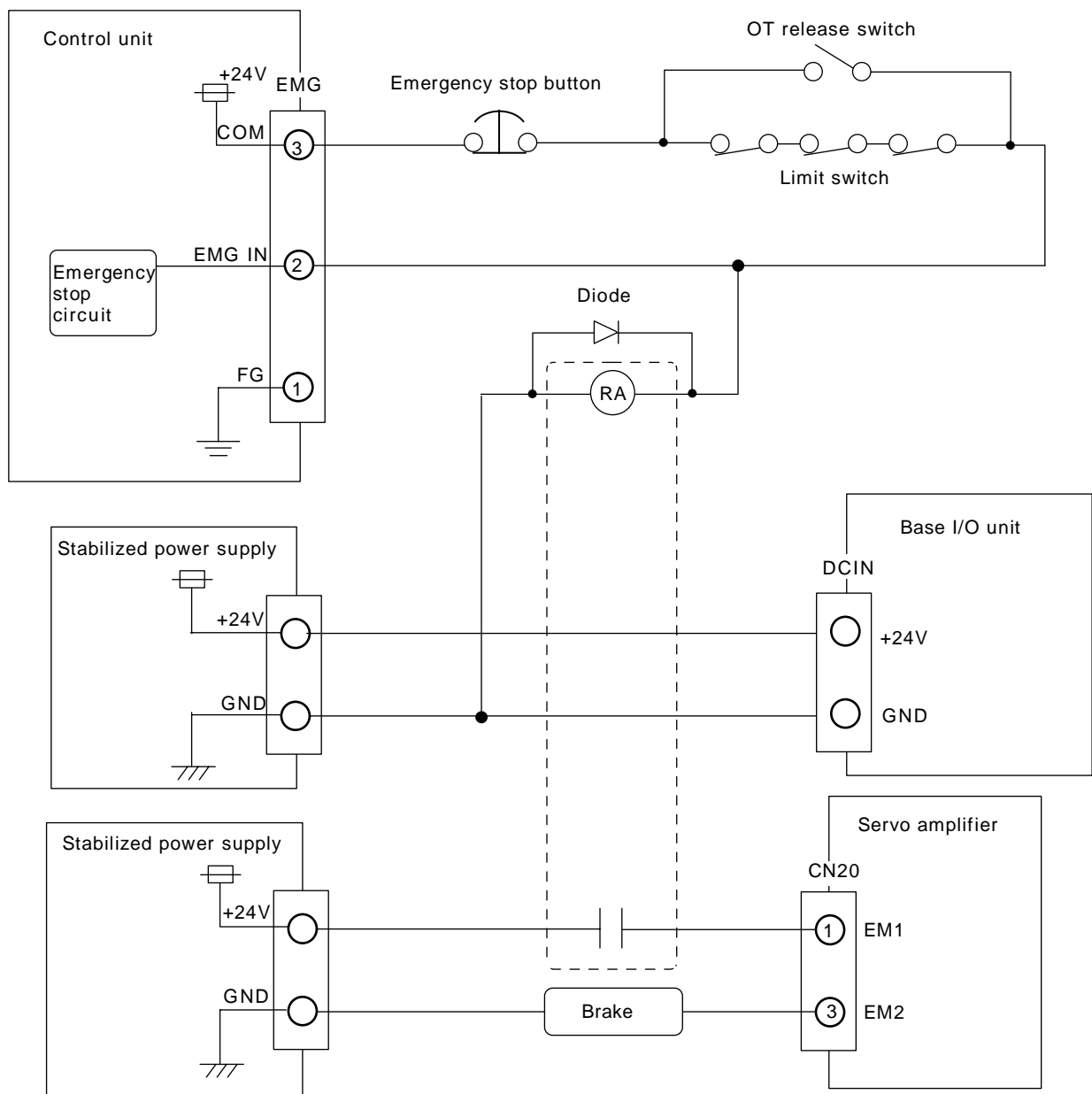
Refer to the "PLC Interface Manual" for details on changing the output designation.

#### CAUTION

- ⚠ The DO circuit can be either a sink output or source output. However, make sure that +24 V is connected to the (+) side of the POS terminal block, and the GND is connected to the (-) side.

### 4.5 Connection of Emergency Stop

Connect the emergency stop button to pin No. 3 of the EMG connector on the control unit.  
Do not use the EMG connector for applications other than emergency stop.  
Refer to Appendix 2 (F120 cable) for details on manufacturing the cable.



**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.1 Outline of I/O Interface**

---

## CHAPTER 5 CONNECTION OF I/O INTERFACE

### 5.1 Outline of I/O Interface

#### 5.1.1 Types of I/O Interfaces

The following four types of I/O interfaces are available.

1	Base I/O unit	The base I/O unit is used for connecting the servo amplifier, encoder, skip and remote I/O unit. One unit is always required per control unit.
2	Remote I/O unit	The remote I/O unit is connected to RIO1, RIO2 and RIO4-#1 to #4 on the base I/O unit.
3	Card-sized I/O	The card-sized I/O has a size of 55mm × 93mm. When using the card-sized I/O, the machine maker must manufacture a card-sized I/O connector PCB for connecting the card-sized I/O.
4	Scan I/O	The scan I/O is normally connected to RIO3 on the NC keyboard. The DI/DO input/output (32/32) can be used instead of the scan type.

1	Base I/O unit	FCU6-DX2 <input type="checkbox"/> <input type="checkbox"/>	Refer to section 5.2 Connection of Base I/O Unit.	SV1, SV2, ENC1, SKIP, RIO1, RIO2 and CR31(ADD ON PCB) have common Specifications
		FCU6-DX3 <input type="checkbox"/> <input type="checkbox"/>		
		FCU6-DX4 <input type="checkbox"/> <input type="checkbox"/>		
2	Remote I/O unit	FCUA-DX1 <input type="checkbox"/> <input type="checkbox"/>	Refer to section 6. Connection of remote I/O unit.	
3	Card-sized I/O	HR361	DI (sink)/DO (sink)=16/16	Refer to section 5.3 Connection of card-sized I/O.
		HR371	DI (source)/DO (source)=16/16	
		HR381	AO=1ch	
		HR383	AO/AI=1ch/4ch	
4	Scan I/O	HR347	DI (sink/source)/DO (sink)=32/32 DI (scan)/DO (scan)=64/64	Refer to section 5.4 Scan I/O Card Connection.
		HR357	DI (sink/source)/DO (source)=32/32 DI (scan)/DO (scan)=16/16	

**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.1 Outline of I/O Interface**

**5.1.2 Example of DI/DO Connection**

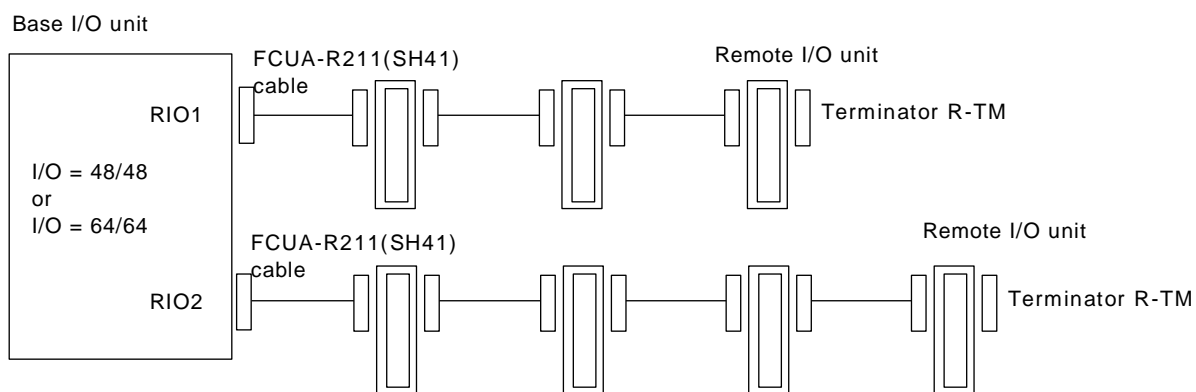
The DI/DO for the M600 Series has four types shown in section 5.1.1 I/O interface. Normally one base I/O unit is used, and the remote I/O unit is connected to RIO1 or RIO2. The No. of I/O points are configured according to the user specifications.

Refer to Chapter 6 Connection of remote I/O unit for details on the remote I/O unit.

When using the card-sized I/O for the operation board I/O, the user must manufacture a connector PCB for the card-sized I/O. (Fig. 2)

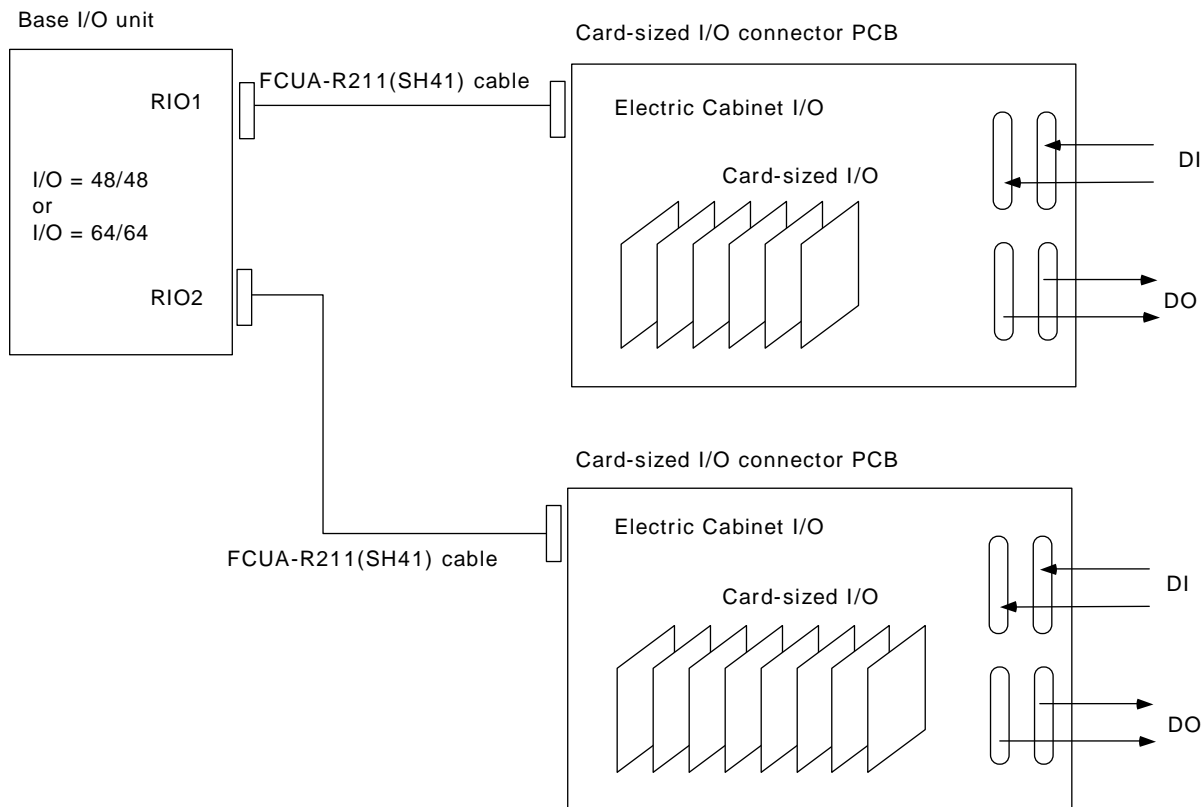
Refer to section 5.3 Connection of card-sized I/O for details.

**(When using remote I/O unit)**



**Fig. 1**

**(When using card-sized I/O)**

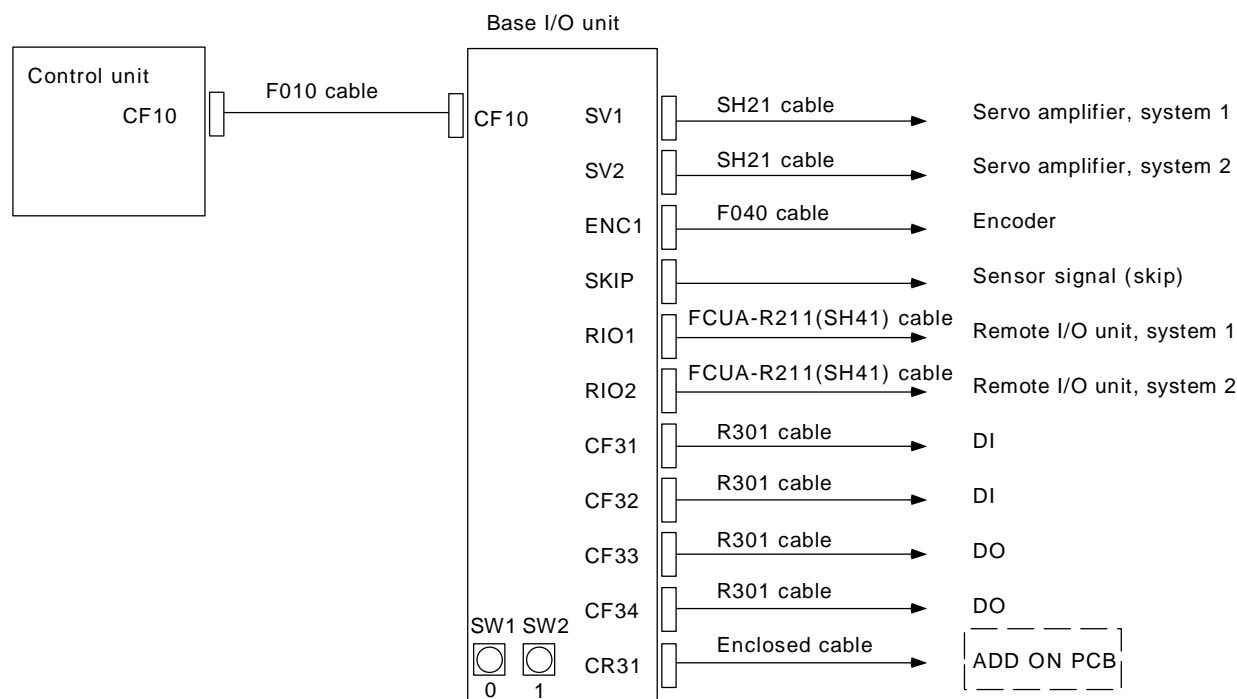


**Fig. 2**

**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.2 Connection of Base I/O Unit**

## 5.2 Connection of Base I/O Unit

### 5.2.1 Base I/O Connection System Drawing

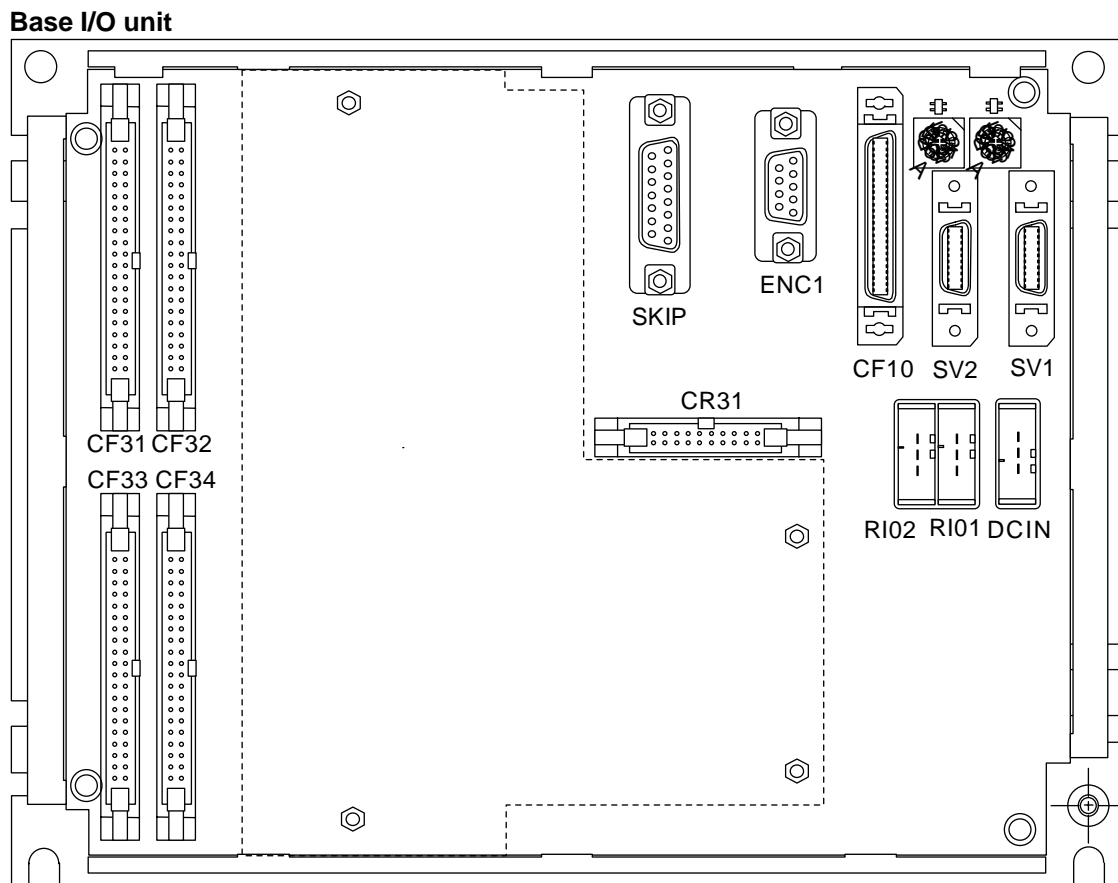



Unit name	FCU6-DX210/310 /320/330/340	FCU6-DX211/311 /321/331/341	FCU6-DX220/410 /420/430/440	FCU6-DX221/411 /421/431/441
Card name	HR325	HR335	HR327	HR337
SV1	Connect with servo amplifier system 1.			
SV2	Connect with servo amplifier system 2.			
ENC1	Connect with encoder. When using two channels for the encoder, connect the second channel to ENC2 of the control unit.			
SKIP	Connect with the sensor signal (skip) input. Up to eight points can be used.			
RIO1	Connect with the remote I/O unit. There are two channels occupied on the base I/O unit, so the remaining six channels can be used. However, when using the ADD ON PCB, the remaining five channels can be used. Refer to section 6.14 Setting of channel No. when using multiple remote I/O units for the occupied channels.			
RIO2	Connect with the remote I/O unit. Eight channels can be used. Refer to section 6.14 Setting of channel No. when using multiple remote I/O units for the occupied channels.			
CF31	DI:32 (sink/source)	DI:32 (sink/source)	DI:32 (sink/source)	DI:32 (sink/source)
CF32	DI:16 (sink/source)	DI:16 (sink/source)	DI:32 (sink/source)	DI:32 (sink/source)
CF33	DO:32 (sink type)	DO:32 (source type)	DO:32 (sink type)	DO:32 (source type)
CF34	DO:16 (sink type)	DO:16 (source type)	DO:32 (sink type)	DO:32 (source type)
CR31 (for ADD ON PCB)	DX320/420 (with RX323) : DI (sink/source)/DO (sink)=32/16, Ao 1 point DX310/410 (with RX323-1) : DI (sink/source)/DO (sink)=32/16 DX321/421 (with RX324) : DI (sink/source)/DO (source)=32/16, Ao 1 point DX311/411 (with RX324-1) : DI (sink/source)/DO (source)=32/16 DX330/331/430/431 (with RX331) : Manual pulse generator, 2CH DX340/341/440/441 (with RX341) : Ai 4 points, Ao 1 point			

CHAPTER 5 CONNECTION OF I/O INTERFACE  
5.2 Connection of Base I/O Unit

5.2.2 Base I/O Unit Connector Layout Drawing

The base I/O unit is used for connecting the servo amplifier, encoder, skip and remote I/O unit.  
One unit is always required per control unit.



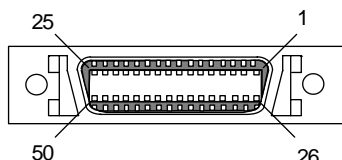
 : ADD ON PCB

**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.2 Connection of Base I/O Unit**

**5.2.3 Base I/O Unit Connector Pin Assignment**

I/O interface

CF10



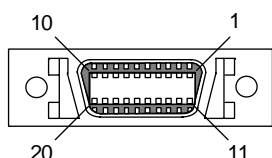
Refer to section 4.2.2 Control unit connector pin assignment (CF10) for details on the connector pin assignment.

**<Cable side connector type>**

Plug : 10150-6000EL  
 Shell : 10350-3210-000  
 Recommended maker: Sumitomo 3M

Servo amplifier

SV1



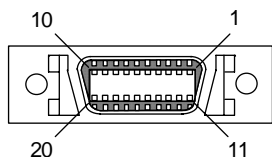
1		GND	11		GND
2	O	SVTXD1	12	O	SVTXD1*
3	I	SVALM1	13	I	SVALM1*
4	I	SVRXD1	14	I	SVRXD1*
5		GND	15		GND
6			16		
7	O	SVEMG1	17	O	SVEMG1*
8			18		
9			19		
10	O	+5V	20		

**<Cable side connector type>**

Plug : 10120-6000EL  
 Shell : 10320-3210-000  
 Recommended maker: Sumitomo 3M

Servo amplifier

SV2



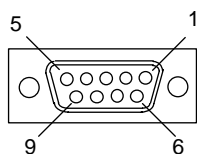
1		GND	11		GND
2	O	SVTXD2	12	O	SVTXD2*
3	I	SVALM2	13	I	SVALM2*
4	I	SVRXD2	14	I	SVRXD2*
5		GND	15		GND
6			16		
7	O	SVEMG2	17	O	SVEMG2*
8			18		
9			19		
10	O	+5V	20		

**<Cable side connector type>**

Plug : 10120-6000EL  
 Shell : 10320-3210-000  
 Recommended maker: Sumitomo 3M

Encoder

ENC1



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

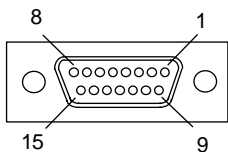
**<Cable side connector type>**

Connector : CDE-9PF  
 Contact : CD-PC-111  
 Case : HDE-CTH  
 Recommended maker: Hirose Denki



**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.2 Connection of Base I/O Unit**

Skip  
SKIP

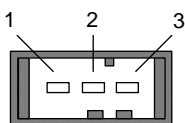


**<Cable side connector type>**

Connector : CDA-15P  
 Contact : CD-PC-111  
 Case : HDA-CTH  
 Recommended maker: Hirose Denki

1		GND	9		GND
2		SKIP IN1	10		SKIP IN2
3		SKIP IN3	11		SKIP IN4
4			12		
5		SKIP IN5	13		SKIP IN6
6		SKIP IN7	14		SKIP IN8
7			15		GND
8		GND			

Remote I/O  
RIO1

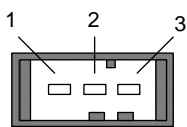


**<Cable side connector type>**

Connector : 1-178288-3  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

1	I/O	TXRX1
2	I/O	TXRX1*
3		GND

Remote I/O  
RIO2

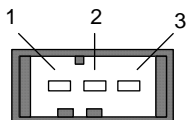


**<Cable side connector type>**

Connector : 1-178288-3  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

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

+24V input  
DCIN



**<Cable side connector type>**

Connector : 2-178288-3  
 Contact : 1-175218-5  
 Recommended maker: Japan AMP

1	I	+24V
2		GND
3		FG

**⚠ 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.

**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.2 Connection of Base I/O Unit**

DI/DO

CF31

		B			A
20	I	X00	20	I	X10
19	I	X01	19	I	X11
18	I	X02	18	I	X12
17	I	X03	17	I	X13
16	I	X04	16	I	X14
15	I	X05	15	I	X15
14	I	X06	14	I	X16
13	I	X07	13	I	X17
12	I	X08	12	I	X18
11	I	X09	11	I	X19
10	I	X0A	10	I	X1A
9	I	X0B	9	I	X1B
8	I	X0C	8	I	X1C
7	I	X0D	7	I	X1D
6	I	X0E	6	I	X1E
5	I	X0F	5	I	X1F
4			4		
3	I	COM>Note)	3	I	COM>Note)
2	I	+24V	2		GND
1	I	+24V	1		GND

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			4		
3	I	COM>Note)	3	I	COM>Note)
2	I	+24V	2		GND
1	I	+24V	1		GND

The values in parentheses are used only for FCU6-DX22 /DX4 .

CF33

		B			A
20	O	Y00	20	O	Y10
19	O	Y01	19	O	Y11
18	O	Y02	18	O	Y12
17	O	Y03	17	O	Y13
16	O	Y04	16	O	Y14
15	O	Y05	15	O	Y15
14	O	Y06	14	O	Y16
13	O	Y07	13	O	Y17
12	O	Y08	12	O	Y18
11	O	Y09	11	O	Y19
10	O	Y0A	10	O	Y1A
9	O	Y0B	9	O	Y1B
8	O	Y0C	8	O	Y1C
7	O	Y0D	7	O	Y1D
6	O	Y0E	6	O	Y1E
5	O	Y0F	5	O	Y1F
4			4		
3			3		
2	I	+24V	2	I	GND
1	I	+24V	1	I	GND

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			4		
3			3		
2	I	+24V	2	I	GND
1	I	+24V	1	I	GND

The values in parentheses are used only for FCU6-DX22 /DX4 .

**<Cable side connector type>**

Connector : 7940-6500SC

Relief : 3448-7940

Recommended maker: Sumitomo 3M

**Note)** This differs according to the sink/source type.  
 Supply the following voltage to COM.

Sink : 24VDC  
 Source: GND

The signal assignment (X, Y) differs according to the base I/O unit's station No. Refer to the "PLC Interface Manual" for details.

### 5.2.4 Base I/O Unit Input/Output Specifications

**(1) Rotary switch (SW1, SW2) settings**

Refer to Chapter 6 for the base I/O unit rotary switch (SW1, SW2) settings.

Reference item: 6.14 Setting of channel No. when using multiple remote I/O units

Normal setting	SW1	0	The base I/O unit occupies two channels.
	SW2	1	

**(2) RIO1, RIO2 terminator**

Connect a terminator to the final end of the remote I/O unit connected to RIO1 and RIO2.

Terminator type: R-TM

**(3) CF31, CF32 input circuit**

Refer to Chapter 6 for the base I/O unit CF31 and CF32 input circuits.

Reference item: 6.4 Outline of digital signal input circuit

1	Unit name	FCU6-DX210	FCU6-DX211	FCU6-DX220	FCU6-DX221
2	Card name	HR325	HR335	HR327	HR337
3	Input type	Sink/source	Sink/source	Sink/source	Sink/source
4	COM pin connection	+24V/GND	+24V/GND	+24V/GND	+24V/GND
5	No. of input points	48 points	48 points	64 points	64 points
6	Pin used for input	X0~X2F	X0~X2F	X0~X3F	X0~X3F

**(4) CF33, CF34 output circuit**

Refer to Chapter 6 for the base I/O unit CF33 and CF34 output circuits.

Reference item: 6.5 Outline of digital signal output circuit

1	Unit name	FCU6-DX210	FCU6-DX211	FCU6-DX220	FCU6-DX221
2	Card name	HR325	HR335	HR327	HR337
3	Output type	Sink type	Source type	Sink type	Source type
4	Output current	60mA/point	60mA/point	60mA/point	60mA/point
5	No. of output points	48 points	48 points	64 points	64 points
6	Pin used for output	Y0~Y2F	Y0~Y2F	Y0~Y3F	Y0~Y3F

**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.2 Connection of Base I/O Unit**

**(5) Specifications of ADD ON PCB connected to CR31**

Refer to Chapter 6 for the ADD ON PCB specifications. The ADD ON PCB occupies one channel.

Name	Reference item	Reference connector name
DX320/DX420 (RX323)	6.10 Connection of FCUA-DX12□ unit and machine control signal	FCUA-DX120: DI-R, DO-R
DX310/DX410 (RX323-1)	6.9 Connection of FCUA-DX11□ unit and machine control signal	FCUA-DX110: DI-R, DO-R
DX321/DX421 (RX324)	6.10 Connection of FCUA-DX12□ unit and machine control signal	FCUA-DX121: DI-R, DO-R
DX311/DX411 (RX324-1)	6.9 Connection of FCUA-DX11□ unit and machine control signal	FCUA-DX111: DI-R, DO-R
DX330/DX331/DX430/DX431 (RX331)	6.11 Connection of FCUA-DX13□ unit and handle	FCUA-DX13□: HANDLE
DX340/DX341/DX440/DX441 (RX341)	6.13 Connection of FCUA-DX14□ unit and analog input/output signal	FCUA-DX14□: AIO

Refer to Chapter 6 for the analog output specifications.

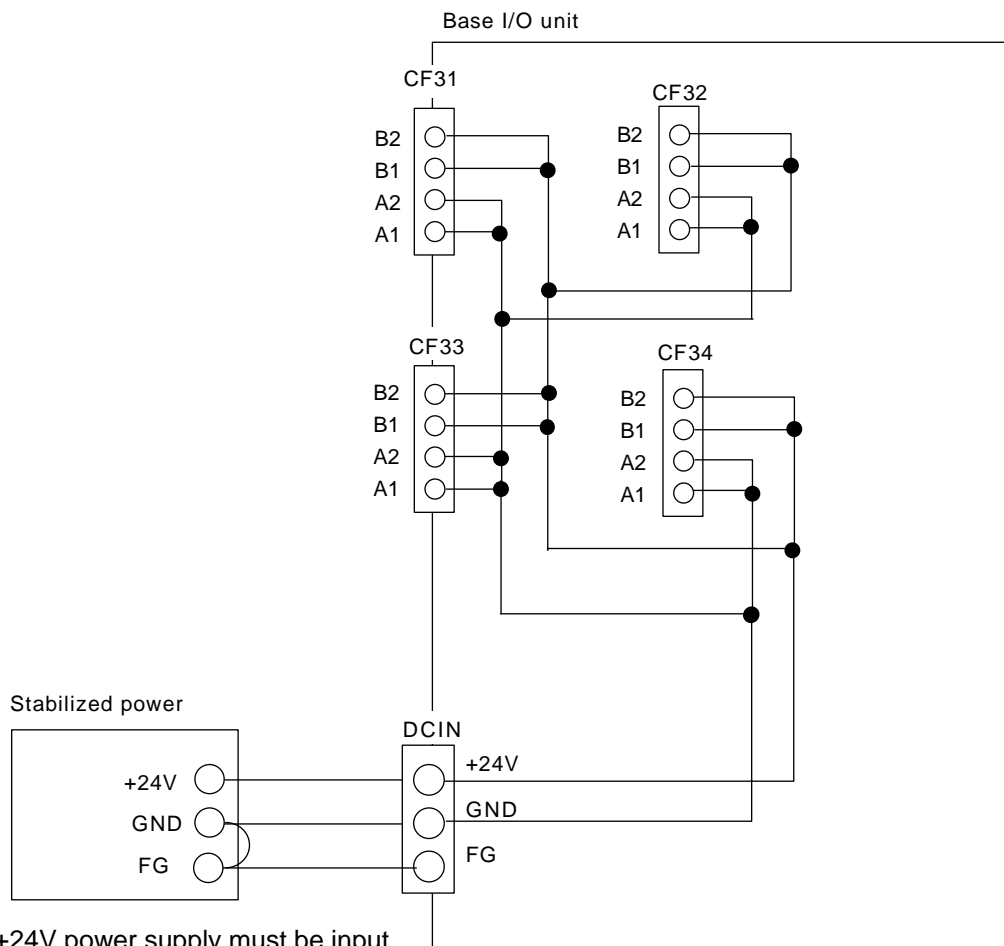
Reference item: 6.6 Outline of analog signal output circuit

Refer to Chapter 6 for the analog input specifications.

Reference item: 6.7 Outline of analog signal input circuit

**(6) Connection of base I/O unit power supply**

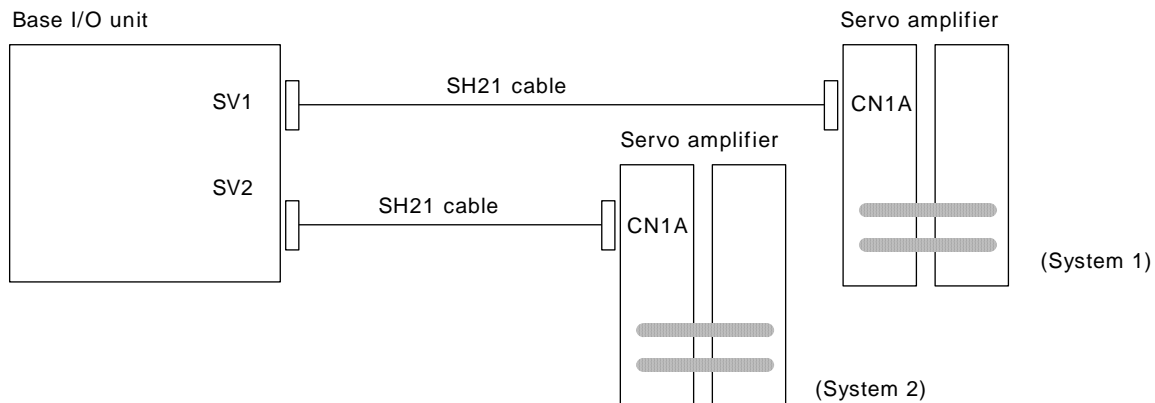
Supply the +24V power to the base I/O unit from the DCIN connector.



**(Note)** A +24V power supply must be input for both the sink type and source type.

### 5.2.5 Connection of Servo Amplifier

Connect the servo amplifier to SV1 (system 1) and SV2 (system 2) of the base I/O unit.



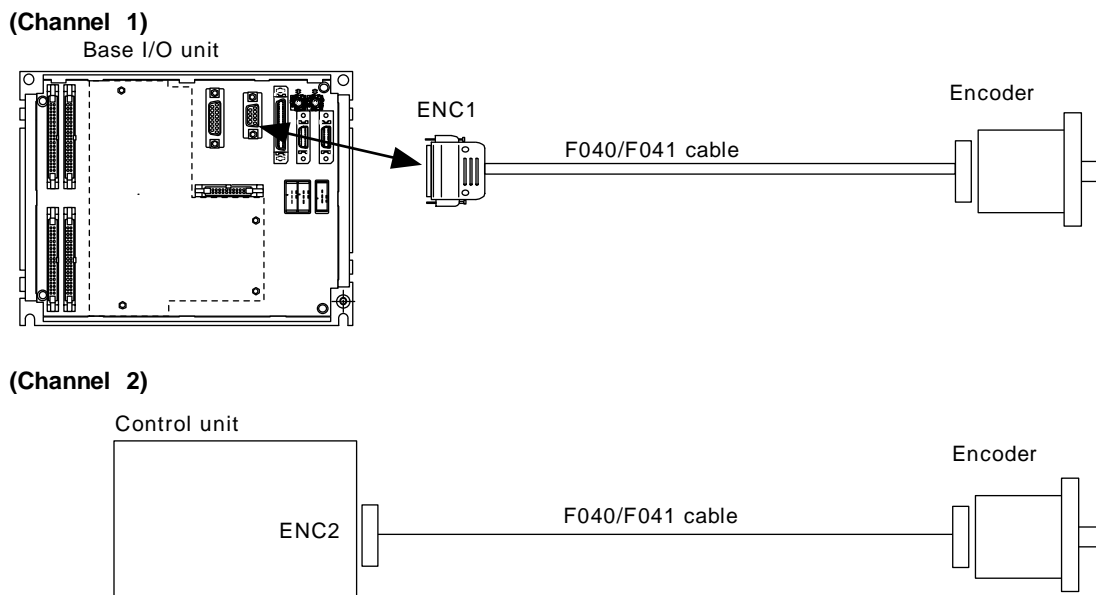
**<Related items>**

Cable manufacturing drawing: Appendix 2 (SH21 cable)

Connector pin assignment: 5.2.3 Base I/O unit connector pin assignment (SV1, SV2)

### 5.2.6 Connection of Encoder

Connect the encoder to ENC1 on the base I/O unit. When connecting two channels, connect the second channel to ENC2 on the control unit.



**<Related items>**

Outline drawing: Appendix 1

Cable manufacturing drawing: Appendix 2 (F040 cable)

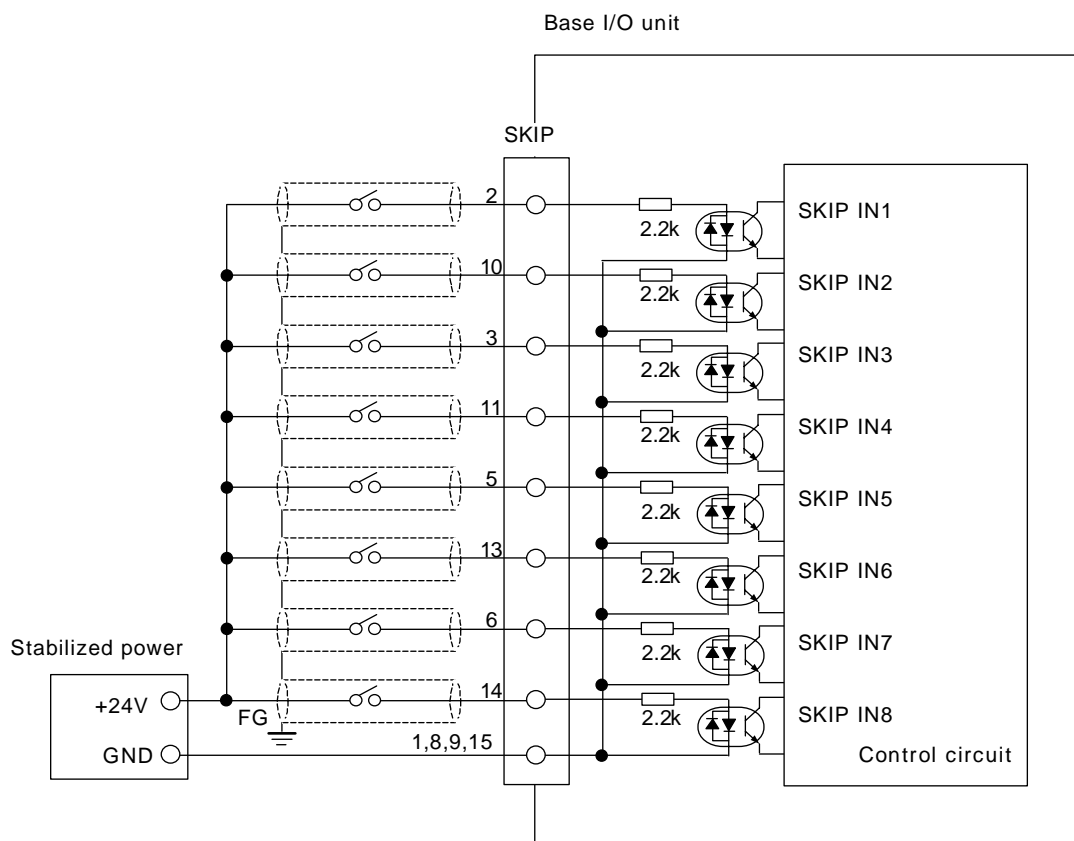
Connector pin assignment: 5.2.3 Base I/O unit connector pin assignment (ENC1)

4.2.2 Control unit connector pin assignment (ENC2)

### 5.2.7 Connection of Sensor Signal (skip)

Connect the sensor signal (skip) to SKIP on the base I/O unit. The sensor signal is used for processing the high-speed signals. Always shield the cable.

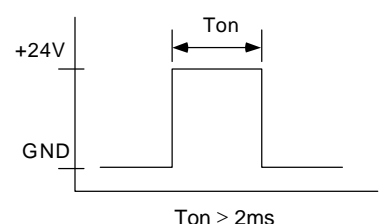
#### (1) Sensor signal (skip) cable



#### (2) Input conditions

Use the input signal within the following condition range.

1	Input voltage when external contact is ON	18V or more
2	Input current when external contact is ON	9mA or more
3	Input voltage when external contact is OFF	4V or less
4	Input current when external contact is OFF	2mA or less
5	Input signal hold time (Ton)	2ms or more
6	Internal response time	0.08ms or less
7	Machine side contact capacity	+30V or more, 16mA or more



#### <Related item>

Connector pin assignment: 5.2.3 Base I/O unit connector pin assignment (SKIP)

#### CAUTION

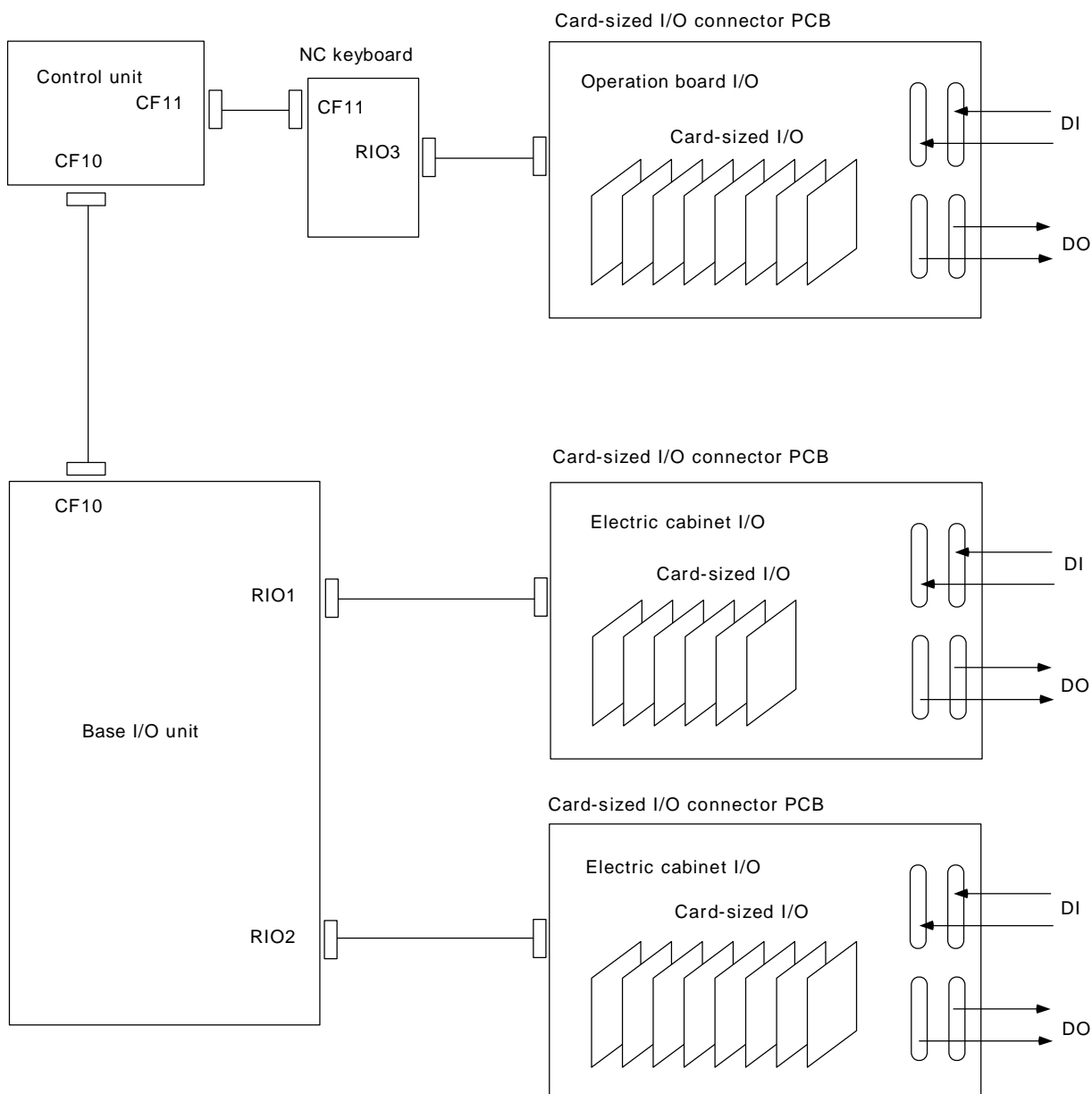
- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.

### 5.3 Connection of Card-sized I/O

#### 5.3.1 Examples of Card-sized I/O Usage

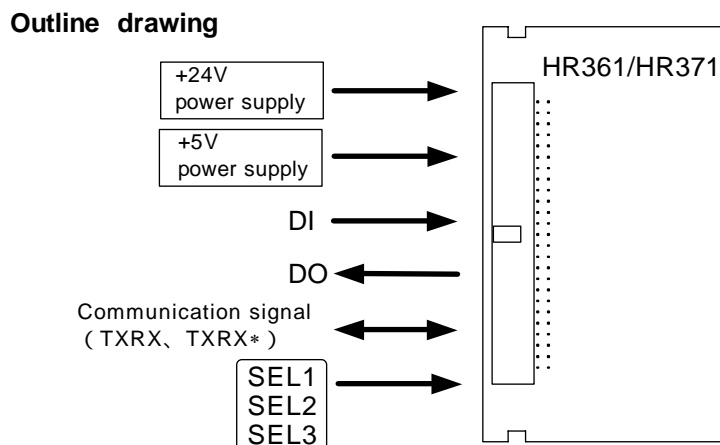
Examples of using the card-sized I/O are shown below. The card-sized I/O can be used as the operation board I/O or electric cabinet I/O.

When using the card-sized I/O the machine maker must manufacture a card-sized I/O connector PCB for connecting the card-sized I/O.



### 5.3.2 Card-sized I/O Specifications

The card-sized I/O (HR361/HR371) specifications are shown below. The card-sized I/O has 16 input points and 16 output points per card. When the card-sized I/O connector PCB is connected to RIO1, up to six cards can be used, and when connected to RIO2 and RIO3, up to eight cards can be used. The power supply (+24V, +5V) must be supplied from an external source.



#### (1) Basic specifications

Item	HR361	HR371	Remarks
No. of input points	16 points		
No. of output points	16 points		
Input/output type	Sink type	Source type	
HR361/HR371 PCB size	55mm × 93mm		
Connector PCB connector	9150-4500SC (50 pin)		Sumitomo 3M
HR361/HR371 usage connector	7650-5002SC (50 pin)		Sumitomo 3M

#### (2) Setting the channel No.

The card-sized I/O does not have a rotary switch, etc., for setting the channel No. Connect the connector CF30 SEL1 to 3 signal pin to +5V or GND on the base PCB as shown below. The card-sized I/O occupies one channel. Refer to section 6.14 Setting of channel No. when using multiple remote I/O units for the occupied channels.

Channel No. selection signal (pin No.)	Channel 1 CF30-1	Channel 2 CF30-2	Channel 3 CF30-3	Channel 4 CF30-4	Channel 5 CF30-5	Channel 6 CF30-6	Channel 7 CF30-7	Channel 8 CF30-8
SEL1 (CF30-A3)	GND	+5V	GND	+5V	GND	+5V	GND	+5V
SEL2 (CF30-B3)	GND	GND	+5V	+5V	GND	GND	+5V	+5V
SEL3 (CF30-A4)	GND	GND	GND	GND	+5V	+5V	+5V	+5V

#### (3) External power supply specifications

The power supply (+24V, +5V) for the card-sized I/O must be supplied from an external source. Prepare a power supply (stabilized power) that satisfies the following conditions per card.

**+24V power supply**

Output voltage	+24V ±5%
Ripple/noise	240mVp-p
Output current	1A

**+5V power supply**

Output voltage	+5V ±5%
Ripple/noise	50mVp-p
Output current	0.4A

The output current is the value when 60mA x 16 points are used. Prepare a power supply that satisfies the total output current of the +24V output.



### 5.3.3 Card-sized I/O Connector Pin Assignment

CF30

		A		B	
1		GND	1		GND
2	I/O	TXRX*	2	I/O	TXRX
3	I	SEL1	3	I	SEL2
4	I	SEL3	4	I	+24V
5	I	+24V	5	I	+24V
6		GND	6		GND
7	O	YF	7	O	Y7
8	O	YE	8	O	Y6
9	O	YD	9	O	Y5
10	O	YC	10	O	Y4
11	O	YB	11	O	Y3
12	O	YA	12	O	Y2
13	O	Y9	13	O	Y1
14	O	Y8	14	O	Y0
15		GND	15		GND
16	I	XF	16	I	X7
17	I	XE	17	I	X6
18	I	XD	18	I	X5
19	I	XC	19	I	X4
20	I	XB	20	I	X3
21	I	XA	21	I	X2
22	I	X9	22	I	X1
23	I	X8	23	I	X0
24		GND	24		GND
25	I	+5V	25	I	+5V

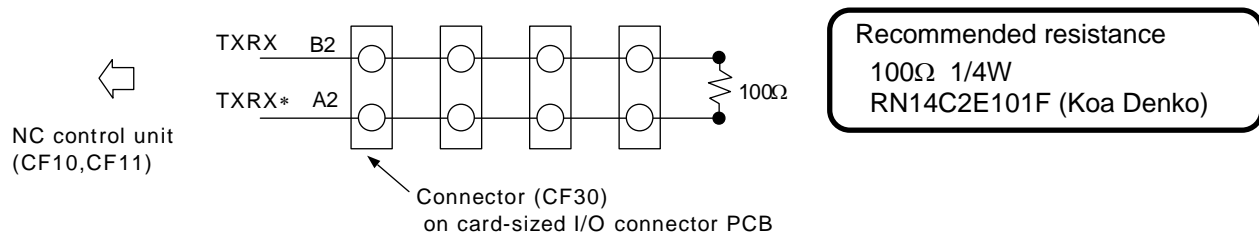
The signal assignment (X, Y) differs according to the base I/O unit's station No. Refer to the "PLC Interface Manual" for details.

### 5.3.4 Precautions for Wiring Card-sized I/O

#### (1) Connection of terminator

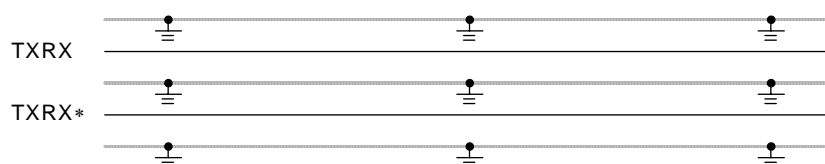
A terminator is required between the communication signal cables (TXRX, TXRX\*) of the card-sized I/O. Connect a terminator to the card-sized I/O connector PCB signal lines as shown below.

**(Example)** When four connectors are installed on card-sized I/O connector PCB.



#### (2) Shield treatment of communication signal cable

The card-sized I/O's communication signal cables (TXRX, TXRX\*) communicate at a high speed, so they must be wired separately from other signal cables. Shield each end of the signal with a GND pattern as shown below, and ground at several places.

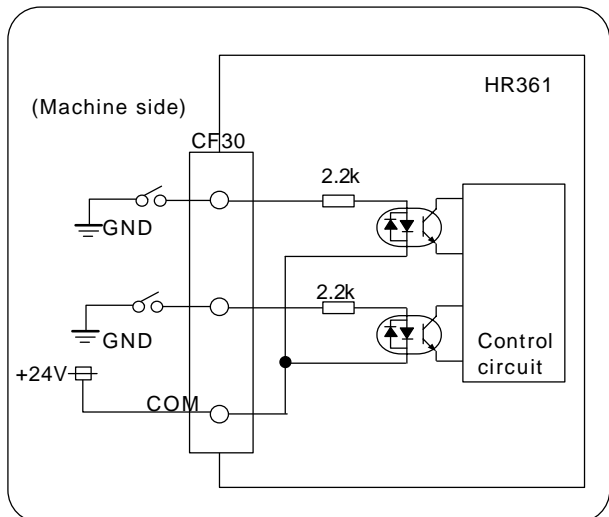


### 5.3.5 Card-sized I/O Input/Output Circuit

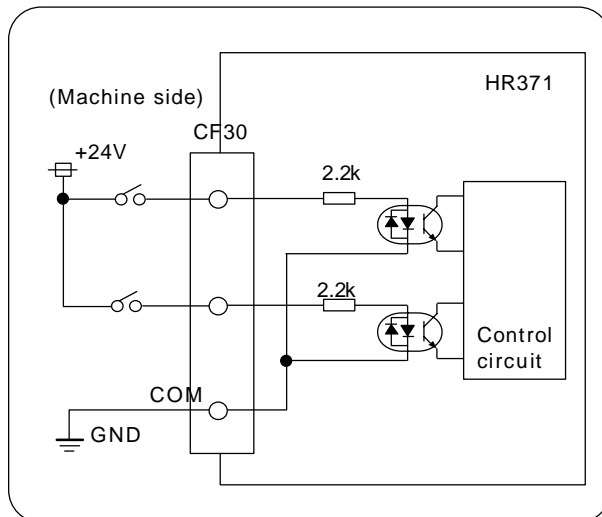
#### (1) Input circuit

The sink type (HR361) input circuit corresponding to the machine side sink output and the source type (HR371) input circuit corresponding to the machine side source output are shown below.

**Sink type**



**Source type**



**CAUTION**

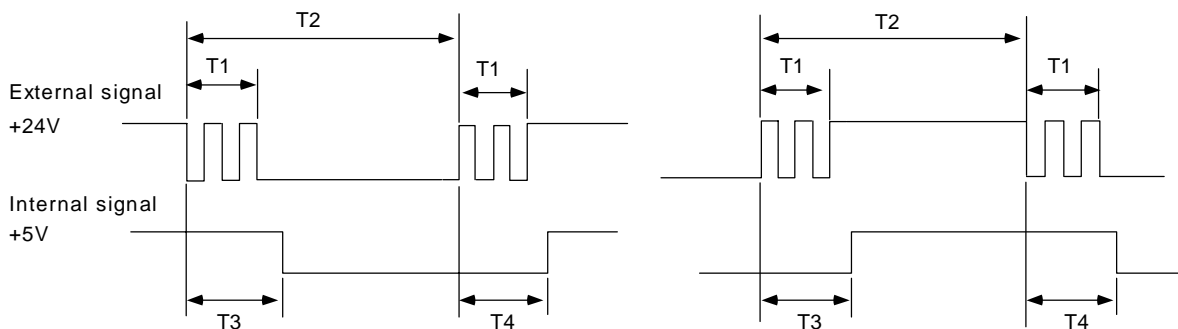
⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.

#### (2) Input conditions

Use the input signal within the following condition ranges.

		HR361	HR371
1	Input voltage when external contact is ON	6V or less	18V or more
2	Input current when external contact is ON	9mA or more	
3	Input voltage when external contact is OFF	20V or more	4V or less
4	Input current when external contact is OFF	2mA or less	
5	Tolerable chattering time	3ms or less (Refer to T1 below)	
6	Input signal hold time	40ms or more (Refer to T2 below)	
7	Input circuit operation delay time	$3\text{ms} \leq T3 \leq T4 \leq 20\text{ms}$	
8	Machine side contact capacity	+30V or more, 16mA or more	

Input signal hold time: 40 ms or more is the guideline, and if not held for longer than the ladder processing cycle time, the input signal will not be recognized.

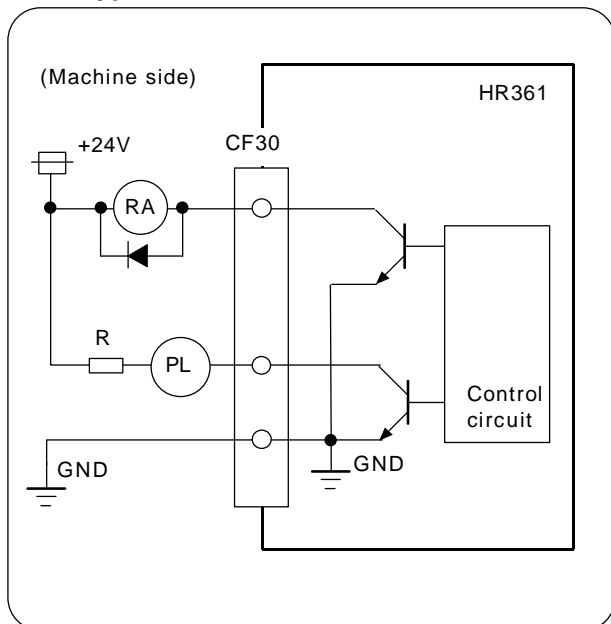


**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.3 Connection of Card-sized I/O**

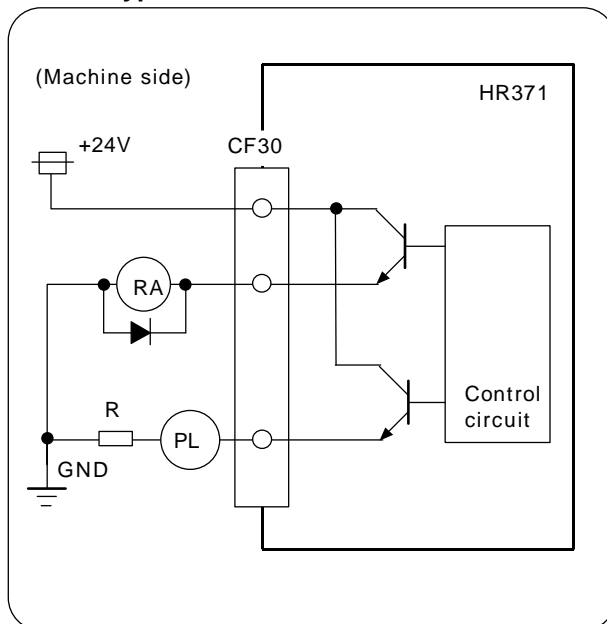
**(3) Output circuit**

The HR361 output circuit is a sink type (sink output), and the HR371 output circuit is a source type (source output).

**Sink type**



**Source type**



**⚠ CAUTION**

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

**(4) Output conditions**

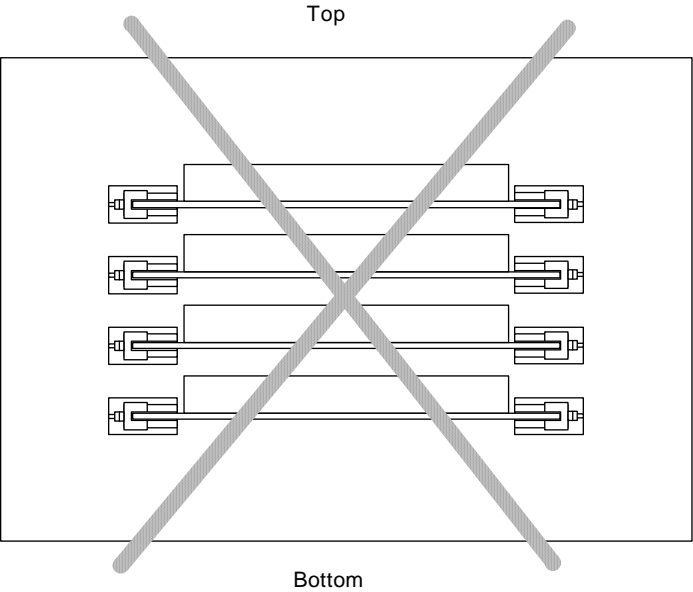
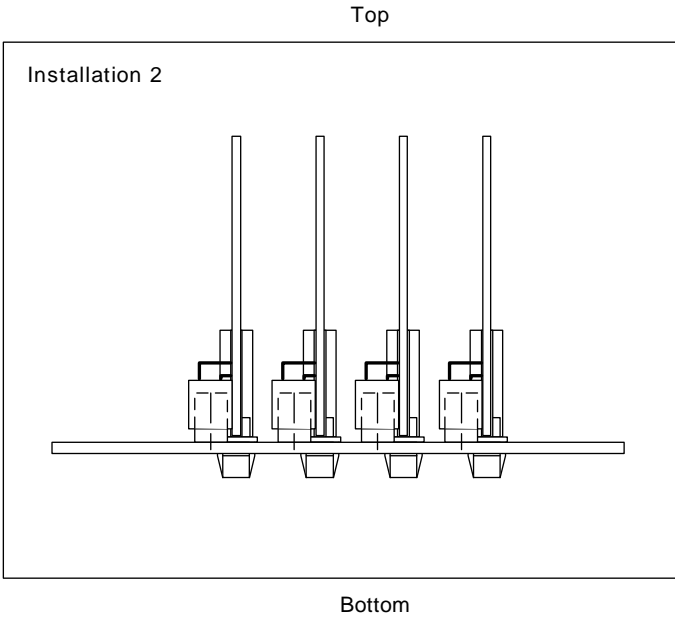
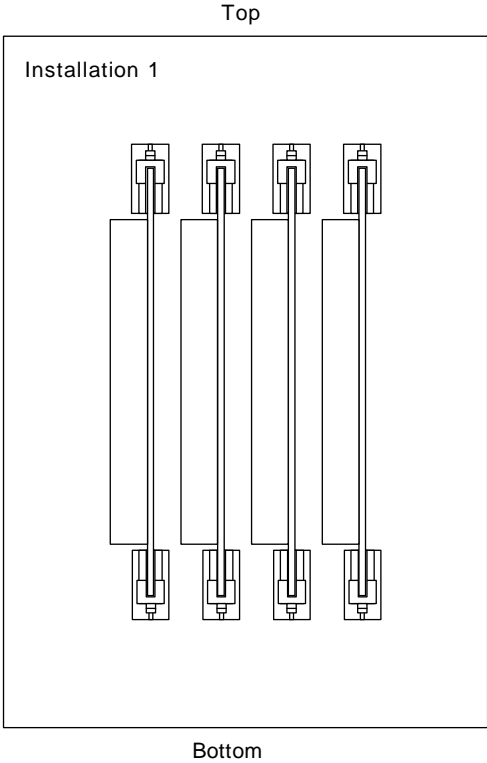
Output current	60mA/point
Saturated voltage (HR371 only)	1.6V (standard)
Output delay time	40μs

- \* When using an inductive load such as relays, always connect a diode (withstand voltage 100V or more, 100mA or more) in parallel to the load as a noise measure.
- \* 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, including the instantaneous current, is less than the above tolerable current.)

5.3.6 Installation of Card-sized I/O

(1) Installation direction

The card-sized I/O installation direction is shown below. Install the card-sized I/O with the installation 1 or installation 2 direction.



**(Note)** If the card-sized I/O is installed horizontally, the heat will build up, so do not install the card as shown on the left.

(2) Installation spacing

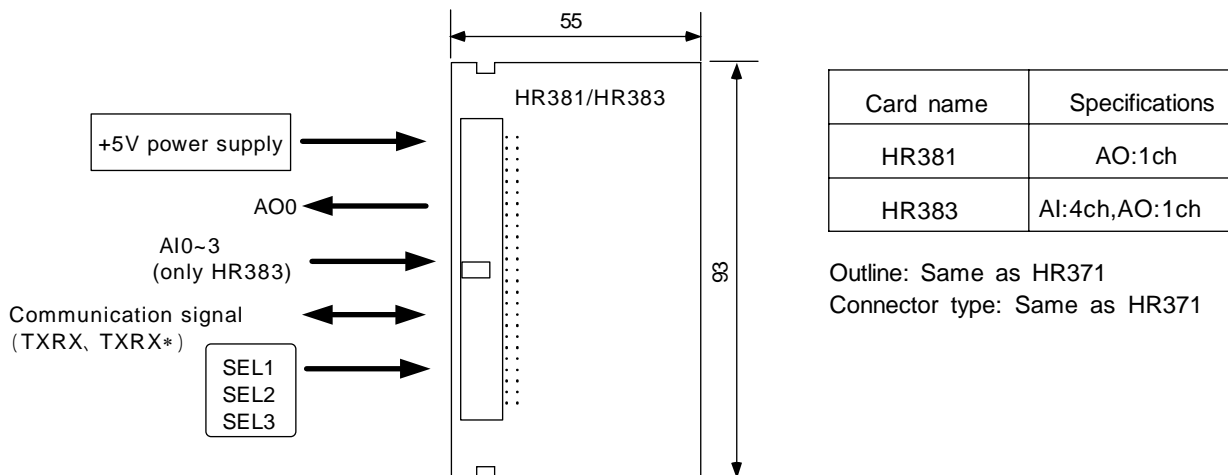
The card-sized I/O installation spacing must be 15mm or more. Refer to Appendix 1 (card-sized I/O outline drawing) for the installation example.

**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.3 Connection of Card-sized I/O**

**5.3.7 Card-size Analog I/O Connection**

The specifications of the card-size analog I/O (HR381/383) are shown in this section. The HR381 has one analog output channel, and the HR383 has four analog input channels and one analog output channel.

**(1) HR381/HR383 outline drawing**



**(2) Analog input/output specifications**

**Input conditions**

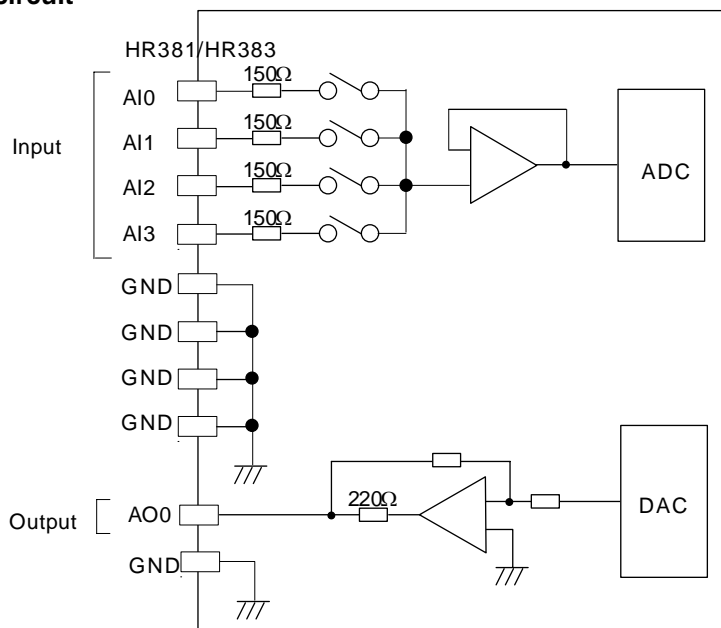
Max. output rating	±15V
Resolution	10V/2000 (5mV)
Precision	Within ±25V
AD input sampling time	14.2ms (AI0) ~ 42.6ms (AI1 ~ 3)

**Output conditions**

Output voltage	0V ~ ±10V (±5%)
Resolution	12bit (±10V × n/4096) <b>(Note 1)</b>
Load conditions	10kΩ load resistance
Output impedance	220Ω

**(Note 1)**  $n = (2^0 \sim 2^{11})$

**(3) Input/output circuit**



**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.3 Connection of Card-sized I/O**

**(4) Pin assignment**

HR381		CF36		HR383		CF36	
	A		B		A		B
1	GND	1	GND	1	GND	1	GND
2	I/O TXRX*	2	I/O TXRX	2	I/O TXRX*	2	I/O TXRX
3	I SEL1	3	I SEL2	3	I SEL1	3	I SEL2
4	I SEL3	4		4	I SEL3	4	
5		5		5		5	
6	GND	6	GND	6	GND	6	GND
7	-	7	-	7	-	7	-
8	-	8	-	8	-	8	-
9	-	9	-	9	-	9	-
10	-	10	-	10	-	10	-
11	-	11	-	11	-	11	-
12	-	12	-	12	-	12	-
13	-	13	-	13	-	13	-
14	-	14	O A00	14	-	14	O A00
15	GND	15	GND	15	GND	15	GND
16	-	16	-	16	-	16	-
17	-	17	-	17	-	17	-
18	-	18	-	18	-	18	-
19	-	19	-	19	-	19	-
20	GND	20	-	20	GND	20	I AI3
21	GND	21	-	21	GND	21	I AI2
22	GND	22	-	22	GND	22	I AI1
23	GND	23	-	23	GND	23	I AI0
24	GND	24	GND	24	GND	24	GND
25	I +5V	25	I +5V	25	I +5V	25	I +5V

AO0: Analog output 1ch

AI3: Analog input 4ch  
 AI2: Analog input 3ch  
 AI1: Analog input 2ch  
 AI0: Analog input 1ch

**(5) External power supply specifications**

The power supply (+5V) for the card-size analog I/O must be supplied from an external source. Prepare a power supply (stabilized power supply) that satisfies the following conditions for each card.

**+5V power supply**

Output voltage	+5V ±5%
Ripple and noise	50mVp-p
Output current	0.4A

**(6) Others**

When designing the connector PCB for the card-size analog I/O, refer to sections 5.3.1 to 5.3.6 for the other required items.

## 5.4 Scan I/O

### 5.4.1 Types of Scan I/O

The scan I/O is an input/output card for the machine operation board, and is provided with a digital input/output and scan input/output.

The following two types of scan I/O are available.

		HR347	HR357	Remarks
Scan	No. of input points	64	64	5V system
	No. of output points	64	64	
Digital	No. of input points	32	32	24V system
	No. of output points	32	32	
	Input/output type	Sink	Source	

#### (1) Scan input

64 DI points are configured with a matrix of eight common signals x eight data signals. (5V system)

#### (2) Scan output

64 DO points are configured with (four common signals x eight data signals) + (four common signals x eight data signals). (5V system)

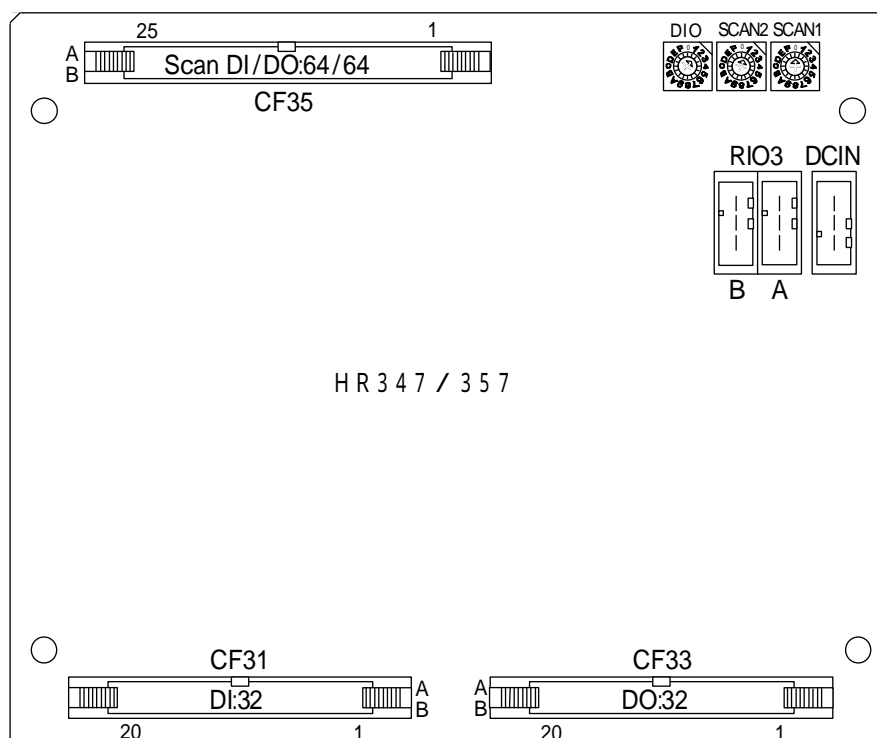
#### (3) Digital input

DI having an interface for each input point. (24V system)

#### (4) Digital output

DO having an interface for each output point. (24V system)

### 5.4.2 Scan I/O Connector Layout Drawing

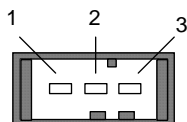


**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.4 Scan I/O**

**5.4.3 Scan I/O Connector**

Remote I/O

RIO3A/B



**<Cable side connector type>**

Connector : 1-178288-3

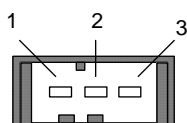
Contact : 1-175218-5

Recommended maker: Japan AMP

1	I/O	TXRX3
2	I/O	TXRX3*
3		GND

+24V input

DCIN



**<Cable side connector type>**

Connector : 2-178288-3

Contact : 1-175218-5

Recommended maker: Japan AMP

1	I	+24V
2		GND
3		FG

DI/DO

CF31

B			A		
20	I	X40	20	I	X50
19	I	X41	19	I	X51
18	I	X42	18	I	X52
17	I	X43	17	I	X53
16	I	X44	16	I	X54
15	I	X45	15	I	X55
14	I	X46	14	I	X56
13	I	X47	13	I	X57
12	I	X48	12	I	X58
11	I	X49	11	I	X59
10	I	X4A	10	I	X5A
9	I	X4B	9	I	X5B
8	I	X4C	8	I	X5C
7	I	X4D	7	I	X5D
6	I	X4E	6	I	X5E
5	I	X4F	5	I	X5F
4			4		
3	I	COM>Note)	3	I	COM>Note)
2	I	+24V	2		GND
1	I	+24V	1		GND

CF33

B			A		
20	O	Y40	20	O	Y50
19	O	Y41	19	O	Y51
18	O	Y42	18	O	Y52
17	O	Y43	17	O	Y53
16	O	Y44	16	O	Y54
15	O	Y45	15	O	Y55
14	O	Y46	14	O	Y56
13	O	Y47	13	O	Y57
12	O	Y48	12	O	Y58
11	O	Y49	11	O	Y59
10	O	Y4A	10	O	Y5A
9	O	Y4B	9	O	Y5B
8	O	Y4C	8	O	Y5C
7	O	Y4D	7	O	Y5D
6	O	Y4E	6	O	Y5E
5	O	Y4F	5	O	Y5F
4			4		
3			3		
2	I	+24V	2	I	GND
1	I	+24V	1	I	GND

**<Cable side connector type>**

Connector : 7940-6500SC

Relief : 3448-7940

Recommended maker: Sumitomo 3M

**Note)** This differs according to the sink/source type.  
Supply the following voltage to COM.

Sink : 24VDC  
Source: GND

The signal assignment (X, Y) differs according to the base I/O unit's station No.  
Refer to the "PLC Interface Manual" for details.



**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.4 Scan I/O**

Scan DI/DO

CF35

		B		A	
25		GND	25		GND
24	O	LC3B	24	O	LC3A
23	O	LC2B	23	O	LC2A
22	O	LC1B	22	O	LC1A
21	O	LC0B	21	O	LC0A
20	I	LD7B*	20	I	LD7A*
19	I	LD6B*	19	I	LD6A*
18	I	LD5B*	18	I	LD5A*
17	I	LD4B*	17	I	LD4A*
16	I	LD3B*	16	I	LD3A*
15	I	LD2B*	15	I	LD2A*
14	I	LD1B*	14	I	LD1A*
13	I	LD0B*	13	I	LD0A*
12		GND	12		
11			11		
10			10		
9	O	KYC7*	9	O	KYC6*
8	O	KYC5*	8	O	KYC4*
7	O	KYC3*	7	O	KYC2*
6	O	KYC1*	6	O	KYC0*
5	I	KYD7*	5	I	KYD6*
4	I	KYD5*	4	I	KYD4*
3	I	KYD3*	3	I	KYD2*
2	I	KYD1*	2	I	KYD0*
1			1		GND

**Note)** Normally the GND pin is not used.  
Do not connect the GND pin to the frame ground.

**<Cable side connector type>**

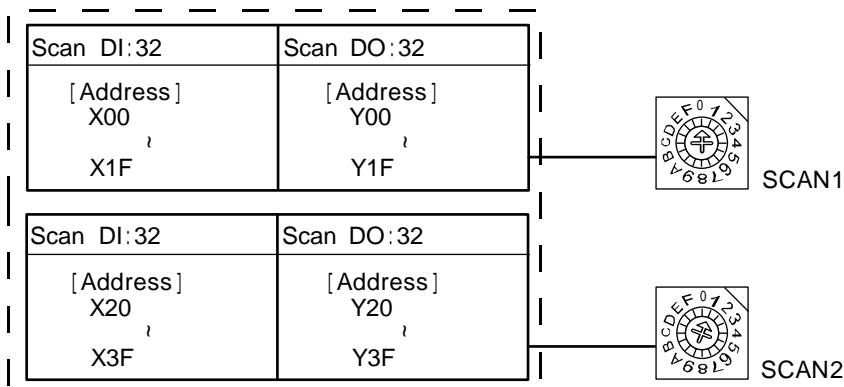
Connector : 7950-6500SC  
Relief : 3448-7950  
Recommended maker: Sumitomo 3M

LCx/A/B	Common signal for scan DO
LDx/A/B*	Data signal for DO
KYCx*	Common signal for scan DI
KYDx*	Data signal for DI

**5.4.4 Scan I/O Station No. Setting**

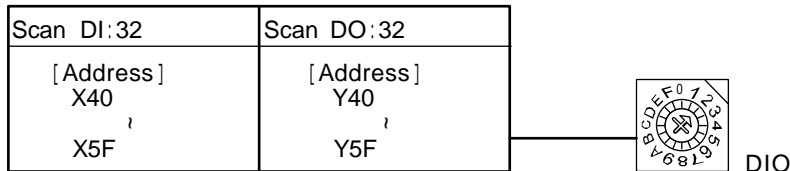
Set the address (station No.) assignment in a DI/DO: 32/32 point unit. The setting is made with the rotary switches SCAN1, SCAN2 and DIO. The assignment address will change according to the rotary switch settings.

CF35



CF31

CF33



Standard setting

SCAN1	0
SCAN2	1
DIO	2

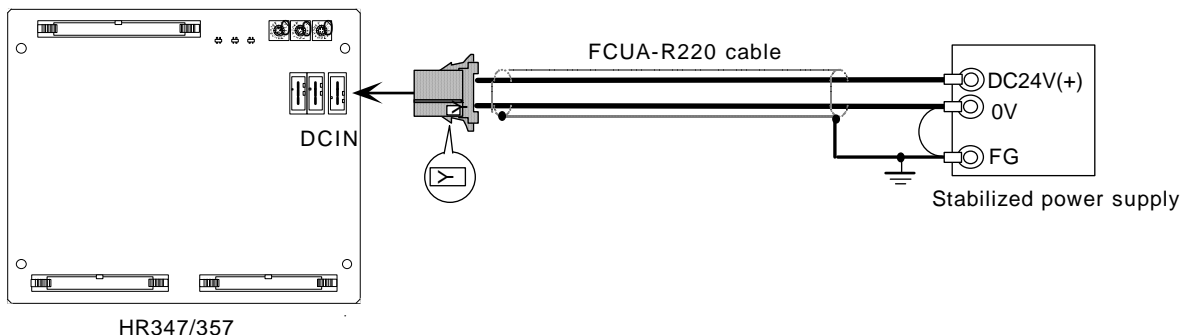
### 5.4.5 Scan I/O Connection

#### (1) External power supply (DCIN)

24VDC (+) is required for the card operation. Prepare a stabilized power supply that satisfies the following specifications.

Output : +24V ±5%  
 Ripple : ±5% (P-P)  
 Max. output current : 2.5A

\* The output current is the value for when 60mA × 32 points is used.  
 Prepare a power supply that satisfies the total output current of the +24V output.

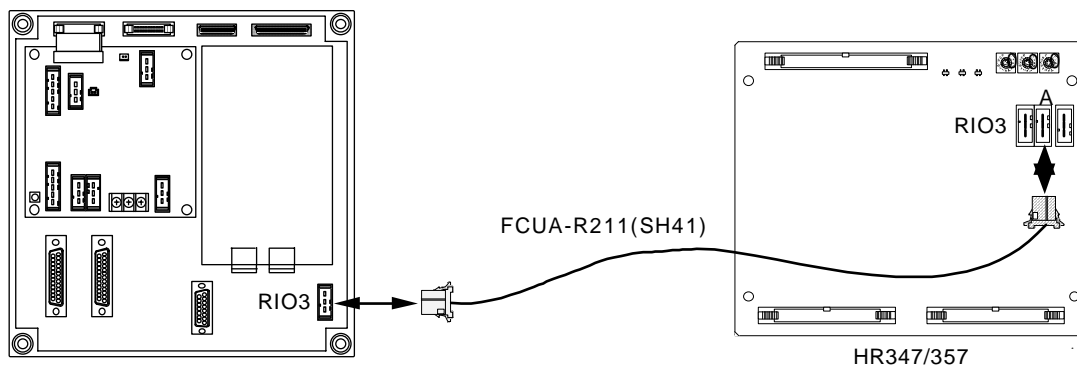


#### (2) Remote I/O connection (RIO3A/B)

##### 1) RIO3A connector connection

Connect RIO3A with the RIO connector.

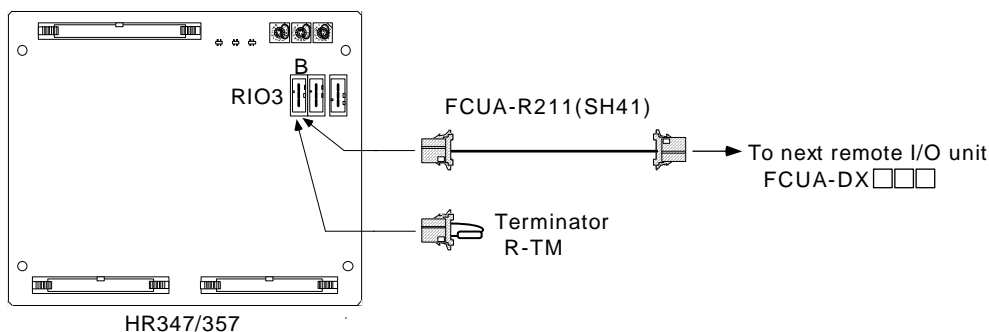
**Example)** Connection to operation board



##### 2) RIO3B connector connection

With the remote I/O unit, multiple units can be assembled and used within the range that the total No. of occupied stations is eight or less with a serial link connection. (Refer to Chapter 6 "Remote I/O unit connection" in the Connection Manual for details.)

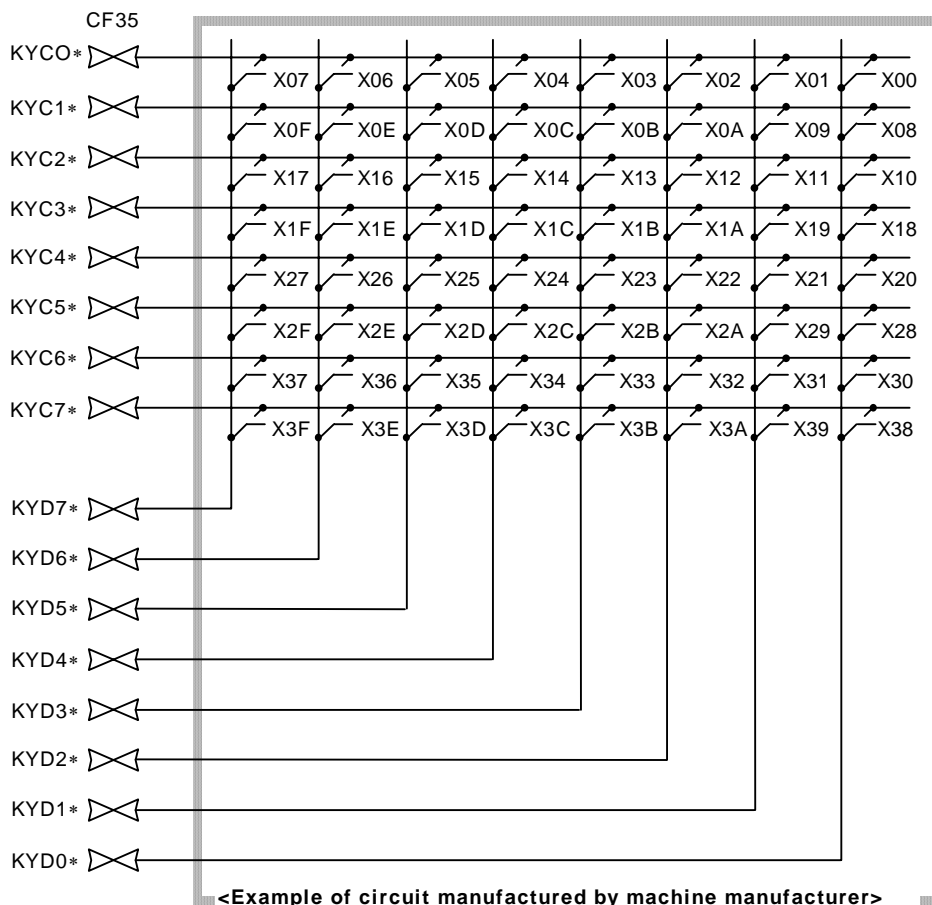
HR347/357 occupies three stations, and with a combination of five stations or less, the remote I/O unit can be connected to RIO3B. Connect a terminator to RIO3B when not connecting.



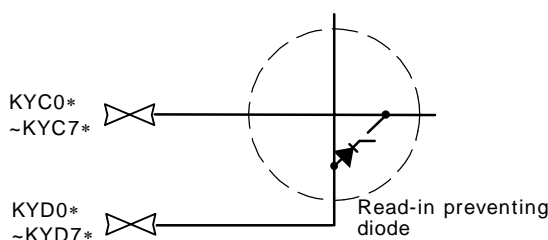
**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.4 Scan I/O**

**(3) Scan input (CF35)**

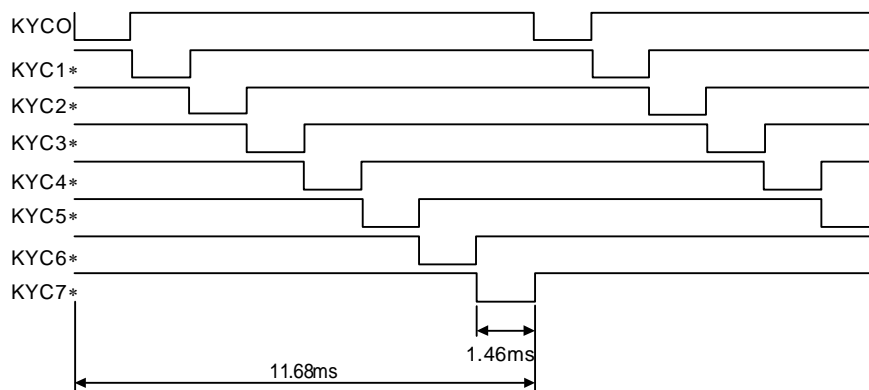
An example of the scan output circuit manufactured by the machine manufacturer is shown below. Refer to section 5.4.3 Scan IO connector for the connector pin assignments.



**Note)** Connect a lead-in preventing diode to the scan input as shown below. If a lead-in preventing diode is not inserted, the input signals may not be read in correctly.



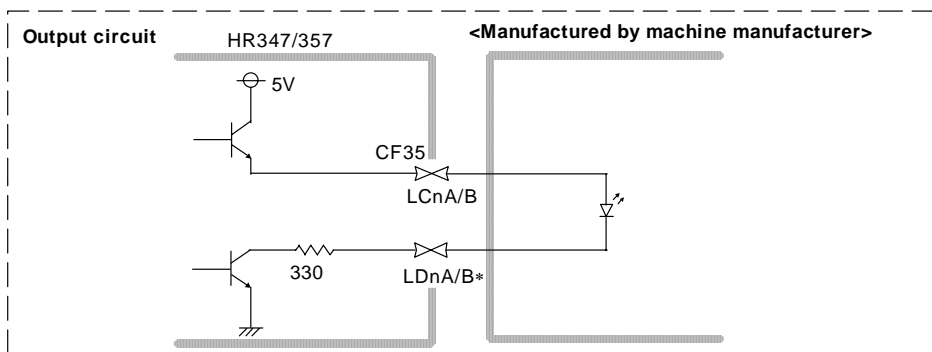
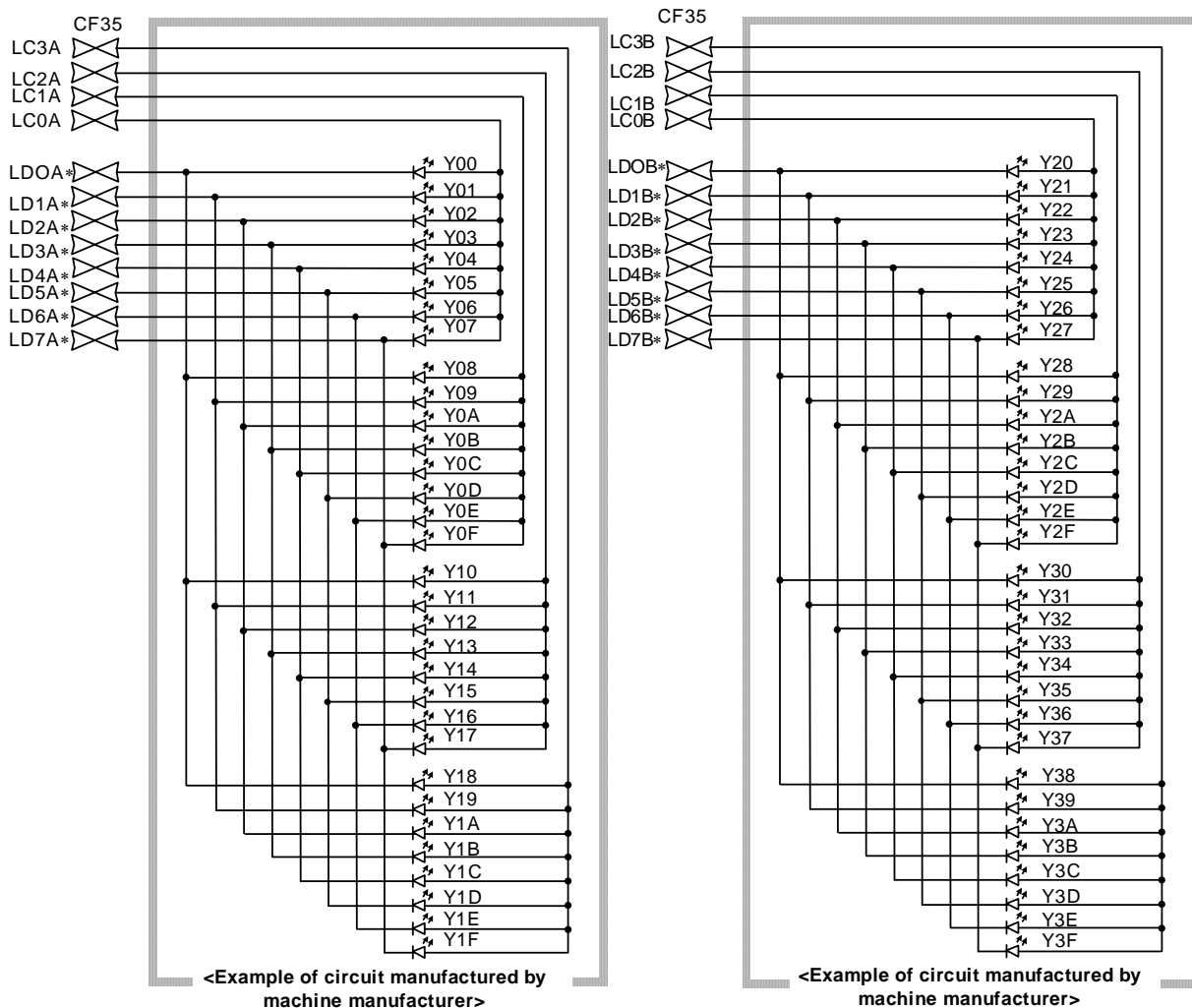
The scan input changes the common signals as shown below. The key input data is retrieved when the common signal is Low. The common signal changeover cycle is 11.68ms, and the data is retrieved when the key switch is ON for 11.68ms or more. The scan input is a 5V system.



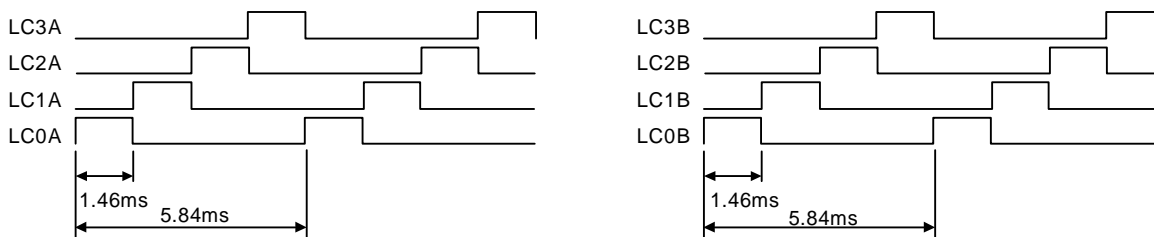
**CHAPTER 5 CONNECTION OF I/O INTERFACE**  
**5.4 Scan I/O**

**(4) Scan output (CF35)**

An example of the scan output circuit manufactured by the machine manufacturer is shown below. Refer to section 2. (2) Pin assignment for the connector pin assignments.



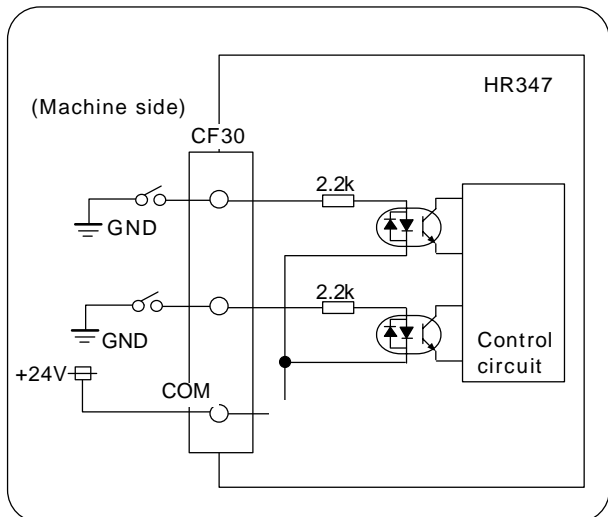
The scan output changes the common signals as shown below. The LED lights only when the data is output and the common signal is High. The common signal changes four signals in order. It lights only for 1.46ms once every 5.84ms. The scan output is a 5V system.



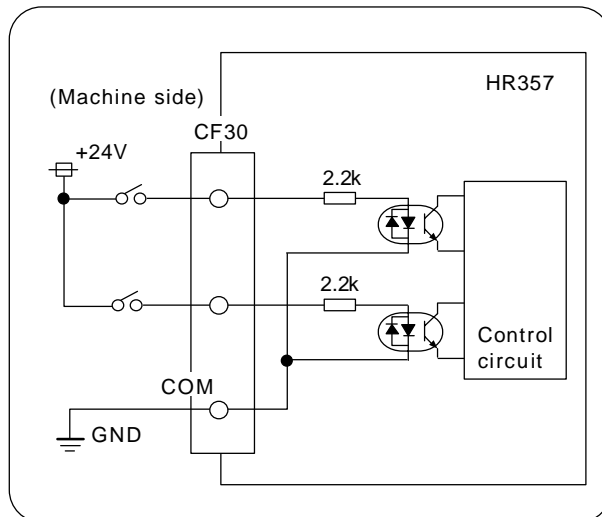
**(5) Digital input (CF31)**

A sink type input circuit corresponding to the machine side sink output, and a source type input circuit corresponding to the machine side source output are shown below.

**Sink type**



**Source type**



**Input conditions**

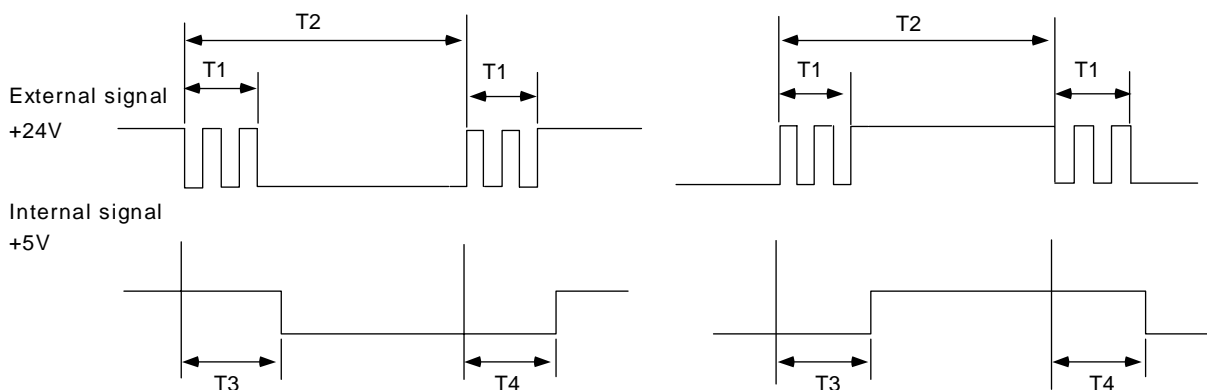
Use the input signal within the following condition ranges.

		<b>Sink type</b>	<b>Source type</b>
1	Input voltage when external contact is ON	6V or less	18V or more
2	Input current when external contact is ON	9mA or more	
3	Input voltage when external contact is OFF	20V or more	4V or less
4	Input current when external contact is OFF	2mA or less	
5	Tolerable chattering time	3ms or less (Refer to T1 below)	
6	Input signal hold time	40ms or more (Refer to T2 below)	
7	Input circuit operation delay time	$3\text{ms} \leq T3 \leq T4 \leq 20\text{ms}$	
8	Machine side contact capacity	+30V or more, 16mA or more	

**CAUTION**

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

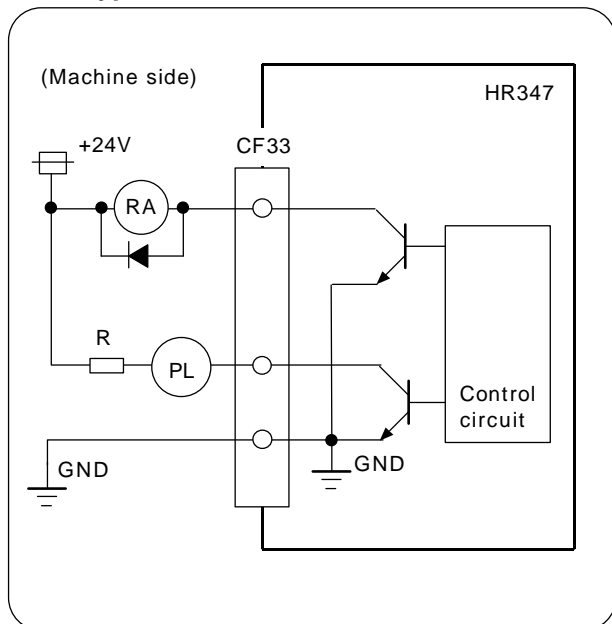
Input signal hold time: 40 ms or more is the guideline, and if not held for longer than the ladder processing cycle time, the input signal will not be recognized.



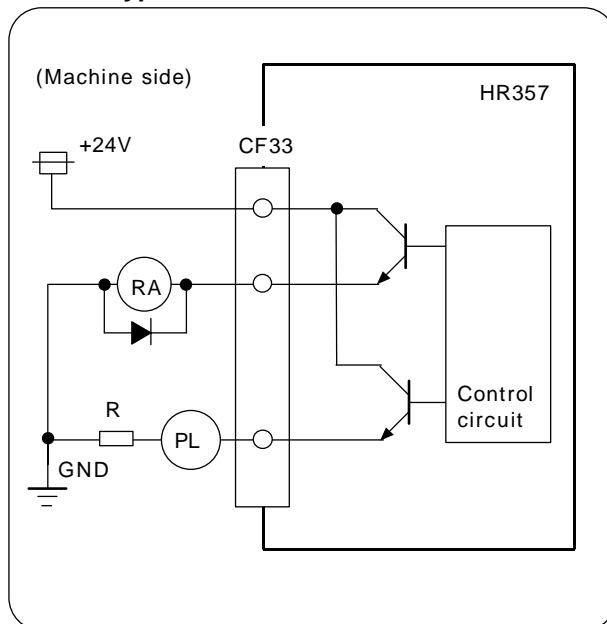
**(6) Digital output (CF33)**

The HR347 output circuit is a sink type (sink output), and the HR357 output circuit is a source type (source output).

**Sink type**



**Source type**



**Output conditions**

Insulation method	Non-insulation
Rated load voltage	DC+24V
Max. output current	60mA/point
Saturation voltage	1.6V (standard)
Output delay time	40μs

**⚠ CAUTION**

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

- \* When using an inductive load such as relays, always connect a diode (withstand voltage 100V or more, 100mA or more) in parallel to the load as a noise measure.
- \* 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, including the instantaneous current, is less than the above tolerable current.)

**CHAPTER 6 CONNECTION OF REMOTE I/O UNIT**  
**6.1 Outline of Remote I/O Unit**

## CHAPTER 6 CONNECTION OF REMOTE I/O UNIT

This chapter describes the connection of the remote I/O unit and machine control signals.

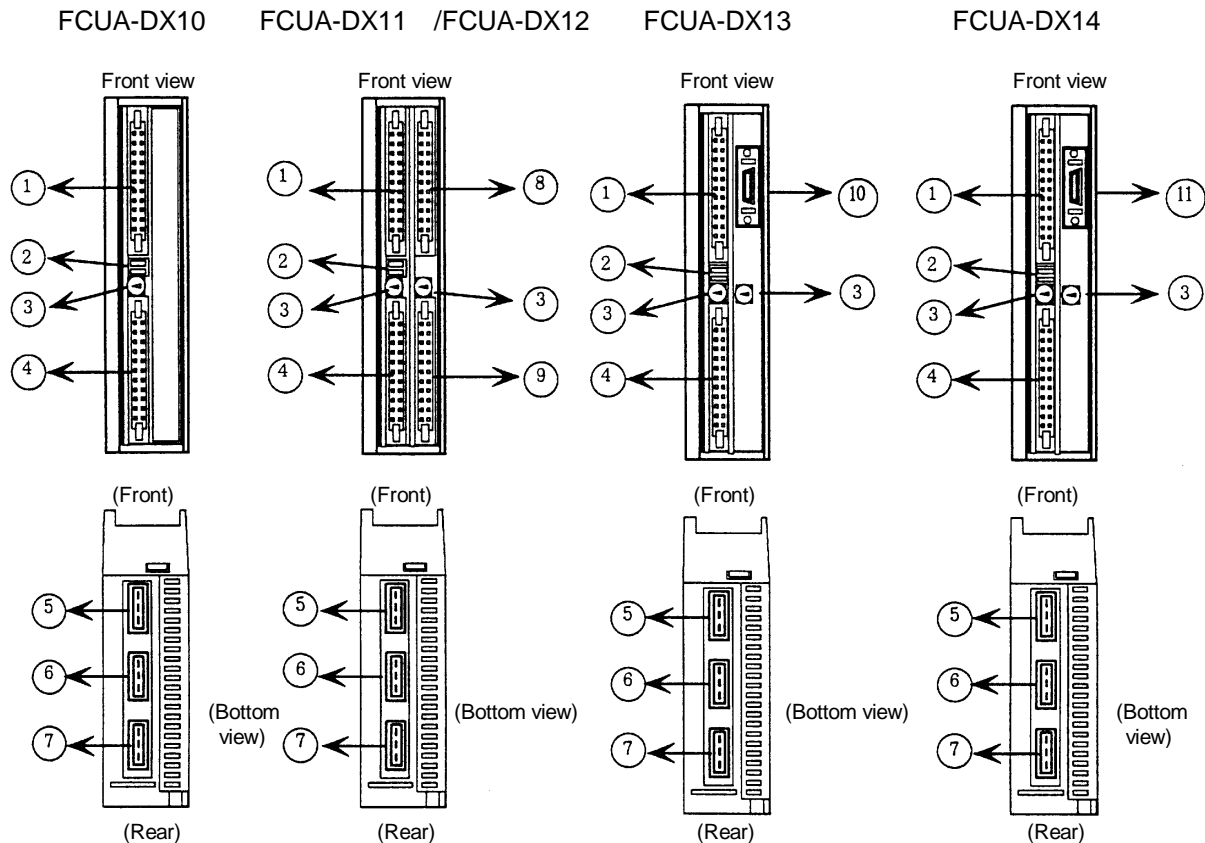
### 6.1 Outline of Remote I/O Unit

The following eight types of signals can be input/output from the remote I/O unit (FCUA-DX□□□) according to the type and No. of contacts. Use serial link connections (MC link B) to connect the unit with the control unit or the communication terminal.

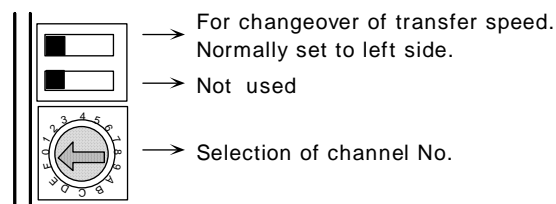
When the remote I/O unit is connected with serial links, multiple units can be used as long as the total No. of occupied channels is within 8 channels. (Refer to "Section 6.14 Setting the Channel No. for Connecting Multiple Remote I/O Units" for details.)

Unit name	Machine control signals that can be handled	No. of occupied serial link channels
FCUA-DX100	Digital input signal (DI) : 32 points (photo coupler insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) sink type	1
FCUA-DX101	Digital input signal (DI) : 32 points (photo coupler insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) source type	1
FCUA-DX110	Digital input signal (DI) : 64 points (photo coupler insulation) sink/source type Digital output signal (DO) : 48 points (non-insulation) sink type	2
FCUA-DX111	Digital input signal (DI) : F64 points (photo coupler insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) source type	2
FCUA-DX120	Digital input signal (DI) : 64 points (photo coupler insulation) sink/source type Digital output signal (DO) : 48 points (non-insulation) sink type Analog output (AO) : 1 point	2
FCUA-DX121	Digital input signal (DI) : 64 points (photo coupler insulation) sink/source type Digital output signal (DO) : 48 points (non-insulation) source type Analog output (AO) : 1 point	2
FCUA-DX130	Digital input signal (DI) : 32 points (photo coupler insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) sink type Handle input (AO) : 2 pieces	2
FCUA-DX131	Digital input signal (DI) : 32 points (photo coupler insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) source type Handle input (AO) : 2 pieces	2
FCUA-DX140	Digital input signal (DI) : 32 points (photo coupler insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) sink type Analog input (AI) : 4 points Analog output (AO) : 1 point	2
FCUA-DX141	Digital input signal (DI) : 32 points (photo coupler insulation) sink/source type Digital output signal (DO) : 32 points (non-insulation) source type Analog input (AI) : 4 points Analog output (AO) : 1 point	2

6.2 Names of Each Remote I/O Unit Section



- ① DI-L (machine input signal connector)
- ② DS (transfer speed changeover switch)
- ③ CS (channel 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 HANDLE (manual pulse generator signal input connector)
- ⑪ AIO (analog signal input/output connector)



Enlarged drawing of DS and CS

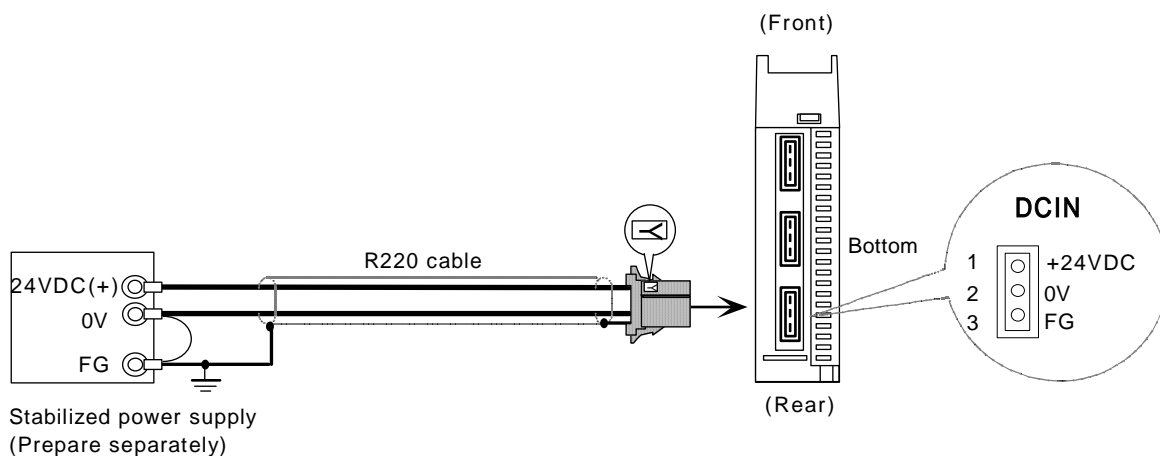


### 6.3 Connection of Remote I/O Power

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

Output voltage	+24V±5%	
Ripple	±5% (P-P)	
Max. output current	FCUA-DX10□	2.4A or more
	FCUA-DX11□	3.8A or more
	FCUA-DX12□	3.8A or more
	FCUA-DX13□	3.4A or more
	FCUA-DX14□	3.4A or more

The +24VDC power for the control circuit is supplied from the connector DCIN on the bottom of the unit. When manufacturing the R300 cable, use the single-end connector CN300 (optional, with one end), and when manufacturing the R301 cable, use the connector set CS301 (optional, with two ends).



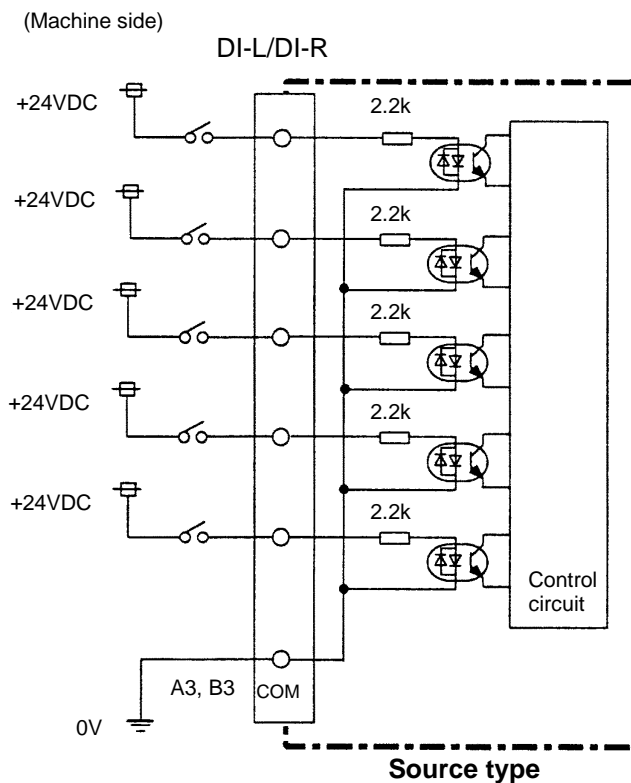
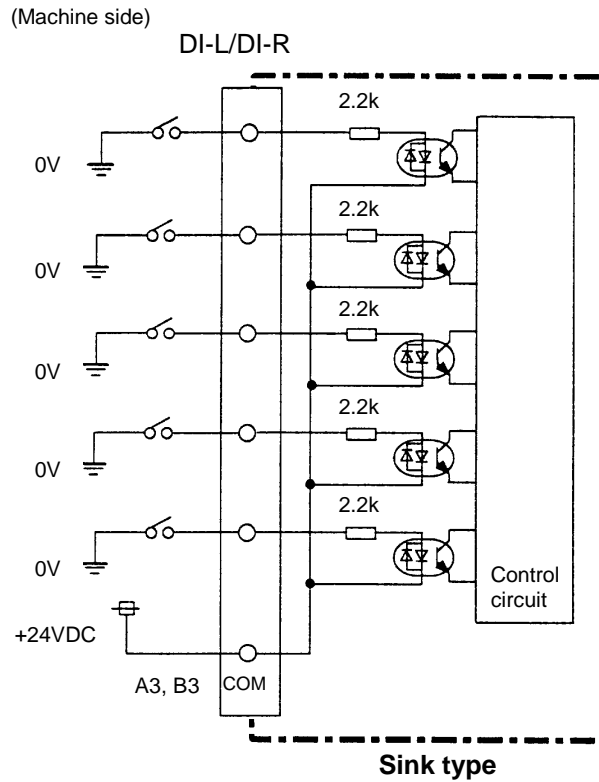
**CAUTION**

- ⚠ Do not apply voltages other than those indicated in this manual on the connector. Doing so may lead to destruction or damage.
- ⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.

### 6.4 Outline of Digital Signal Input Circuit

The input circuit can be selected from sink type or source type in card units.

#### Input circuit



**CHAPTER 6 CONNECTION OF REMOTE I/O UNIT**  
**6.4 Outline of Digital Signal Input Circuit**

---

**Input conditions**

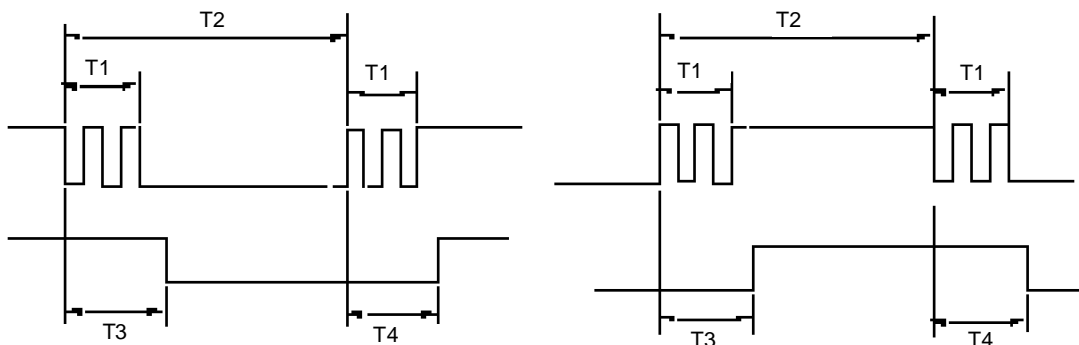
The input signals must be used within the following condition ranges.

**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
Input current at external contact OFF	2mA or less
Tolerable chattering time	3mSec or less (Refer to T1 below)
Input signal hold time	40mSec or more (Refer to T2 below)
Input circuit operation delay time	$3\text{mSec} \leq T3 \leq T4 \leq 20\text{mSec}$
Machine side contact capacity	30V or more, 16mA or more

**Sink type**

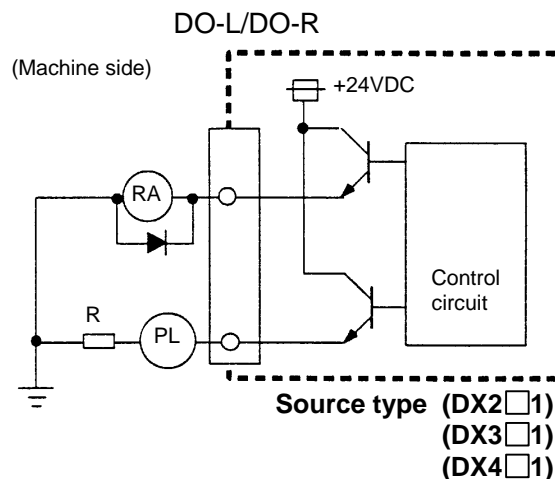
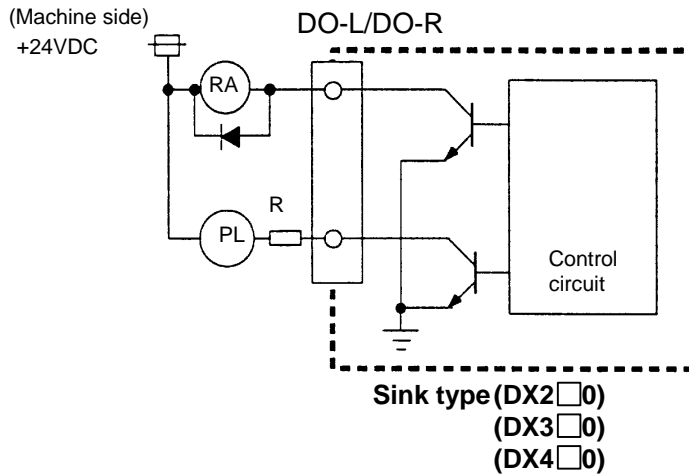
Input voltage at external contact ON	6V or more
Input current at external contact ON	9mA or more
Input voltage at external contact OFF	20V or more
Input current at external contact OFF	2mA or less
Tolerable chattering time	3mSec or less (Refer to T1 below)
Input signal hold time	40mSec or more (Refer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



## 6.5 Outline of Digital Signal Output Circuit

The digital signal output circuit uses a sink type (DX4□0, 3□0, 2□0) or source type (DX4□1, 3□1, 2□1). Use within the specification ranges shown below.

### Output circuit



### Output conditions

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

#### <CAUTION>

- \* When using an inductive load such as a relay, always connect a diode (voltage resistance 100 V or more, 100 mA or more) in parallel to the load.
- \* When using a capacity 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.)

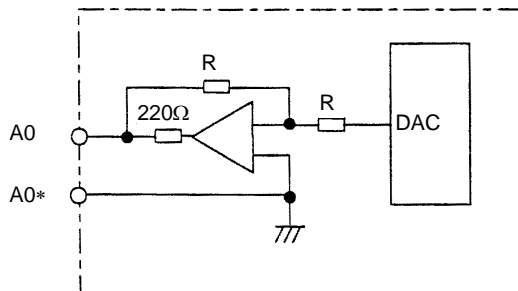


- ❗ When using an inductive load such as a relay, always connect a diode in parallel to the load.
- ❗ When using a capacity load such as a ramp, always connect a protective resistor serially to the load to suppress rush currents.

## 6.6 Outline of Analog Signal Output Circuit

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

### Output circuit



### Output conditions

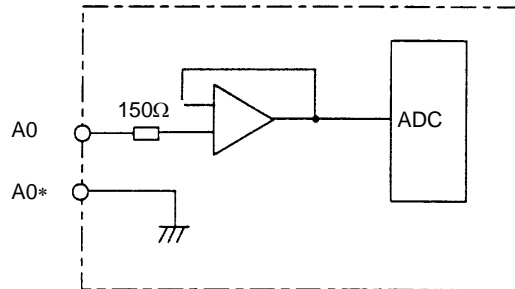
Output voltage	0V~±10V (±5%)
Resolution	12 bit ( $\pm 10V \times n/4096$ ) <b>(Note)</b>
Load conditions	10kΩ load resistance
Output impedance	220Ω

**(Note)**  $n = (2^0 \text{ to } 2^{11})$

## 6.7 Outline of Analog Signal Input Circuit

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

### Input circuit

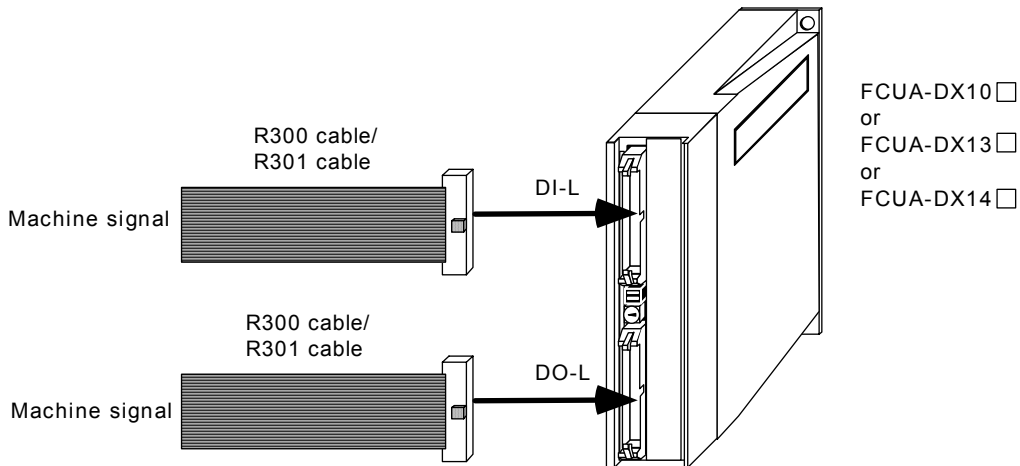


### Input conditions

Max. input rating	±15V
Resolution	10V/2000 (5mV)
Precision	Within ±25mV
AD input sampling time	14.2ms (A10)/42.6ms (A11~3)

**6.8 Connection of FCUA-DX10□/13□/14□ Unit and Machine Control Signal**

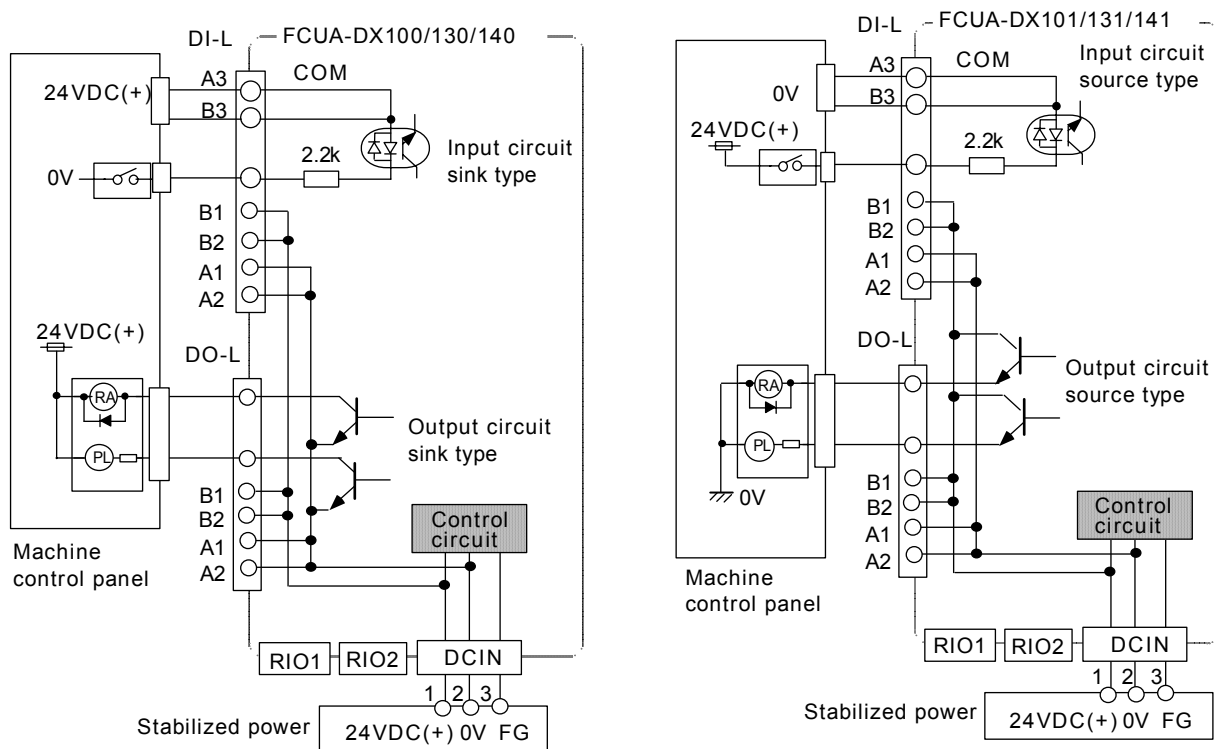
Type of machine input/output signal and No. of points	Input	Output
	32 points	32 points



The single-end connector CN300 (optional, with one end) includes the DI-L and DO-L connectors. The connector set CS301 (optional) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block \*).

\* ) Izumi Denki I/O terminal BX1F-T40      Tel.: 052-262-6946

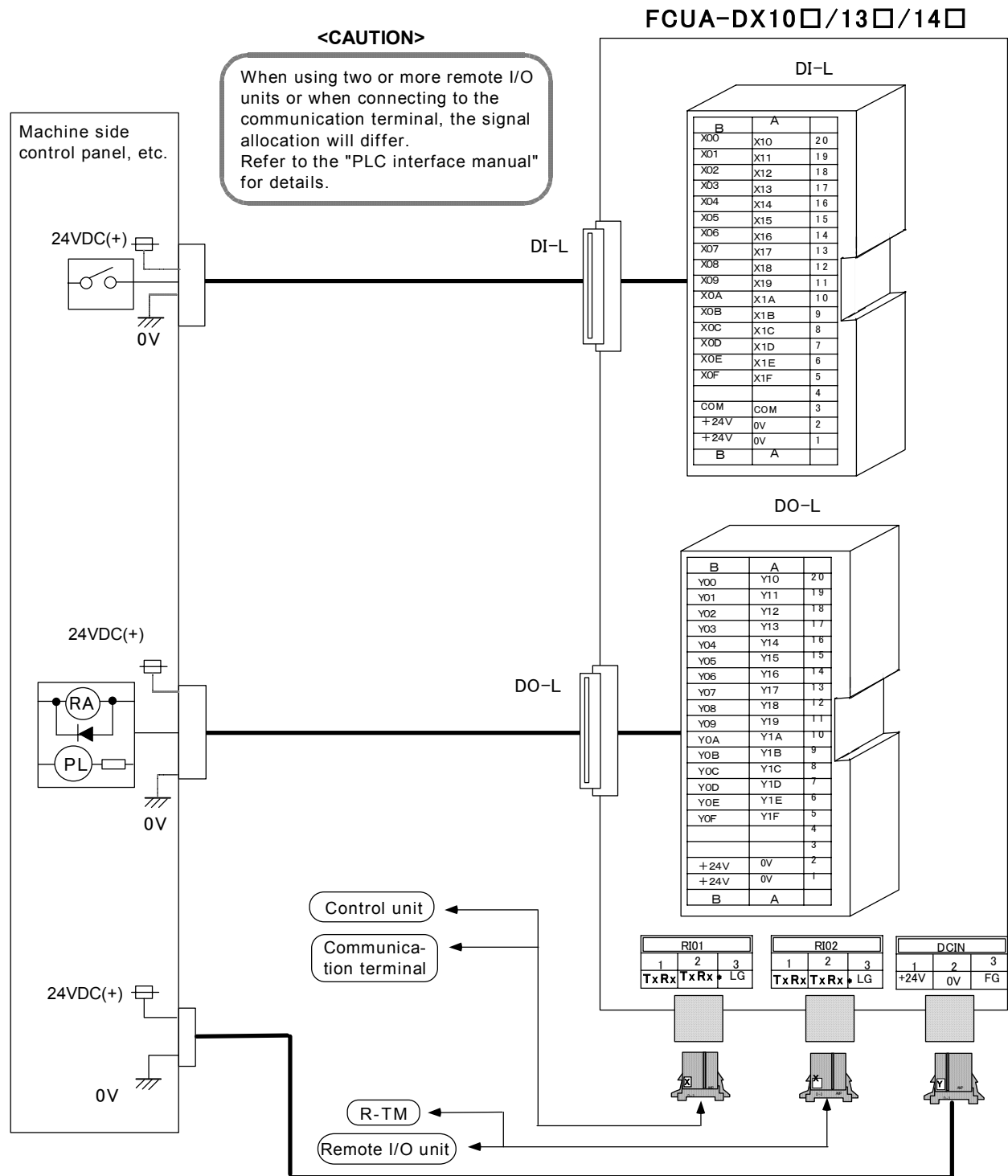
**<Outline of connection>**



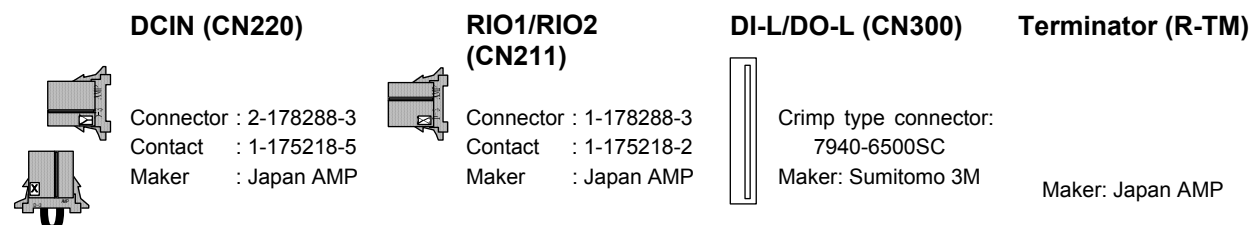
- ⚠ **Incorrect connections could damage the device, so always connect the cable to the designated connector.**
- ⊘ **Do not connect or disconnect the connection cables between each unit while the power is ON.**

**CHAPTER 6 CONNECTION OF REMOTE I/O UNIT**  
**6.8 Connection of FCUA-DX10□/13□/14□ Unit and Machine Control Signal**

**<Signal assignment table>**



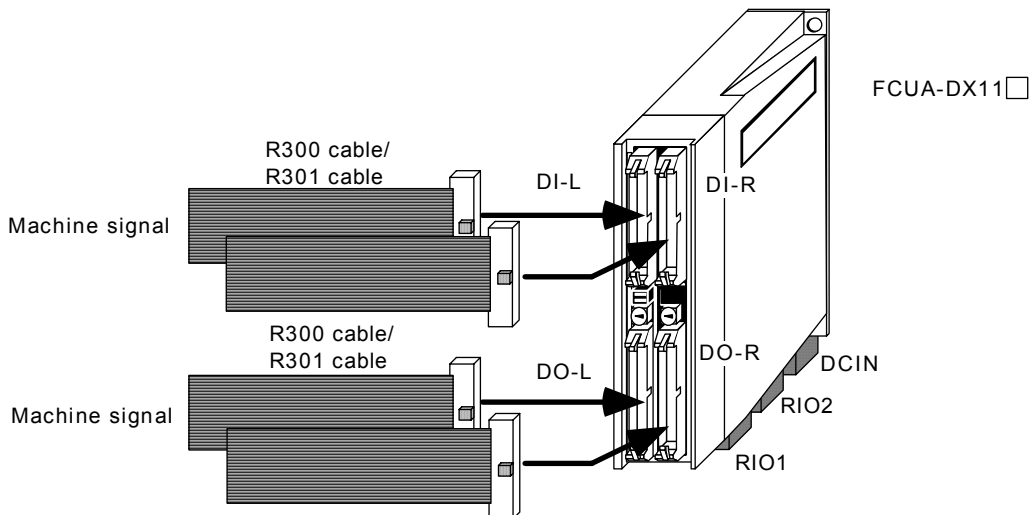
**<Adaptive connector>**





### 6.9 Connection of FCUA-DX11□ Unit and Machine Control Signal

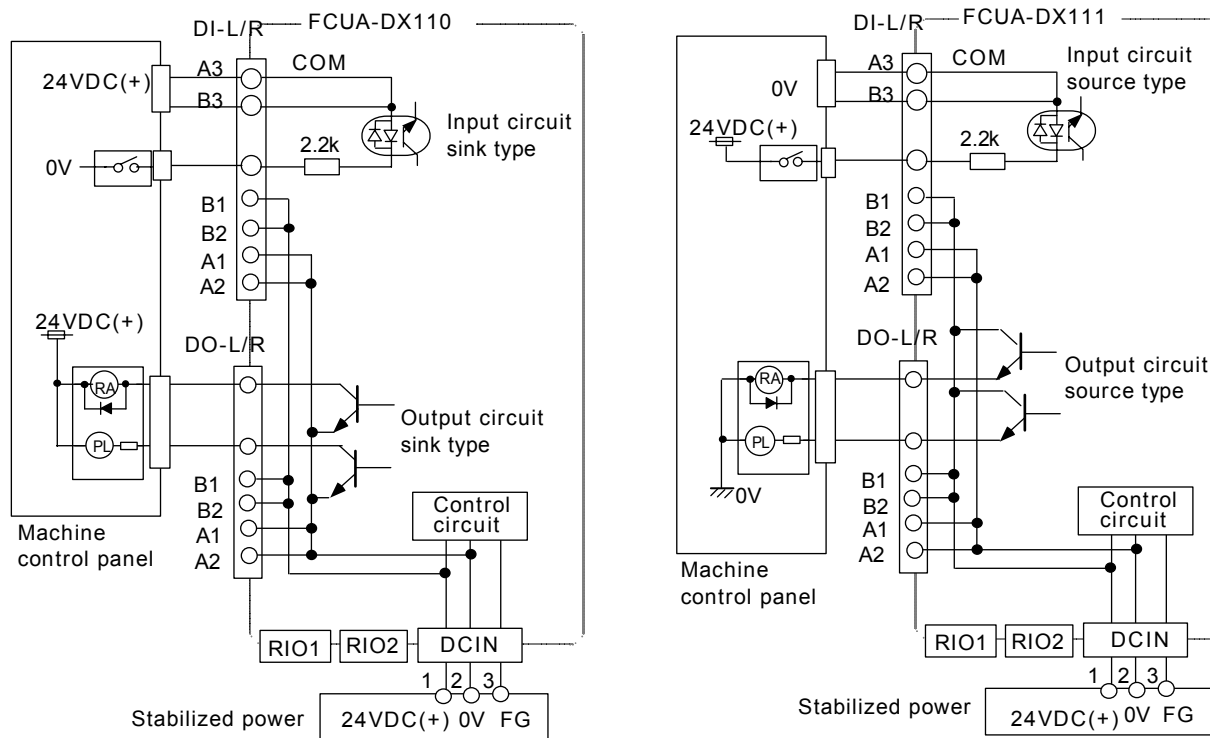
Type of machine input/output signal and No. of points	Input	Output
	64 points	48 points



The single-end connector CN300 (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The connector set CS301 (optional) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block \*).

\* ) Izumi Denki I/O terminal BX1F-T40      Tel.: 052-262-6946

#### <Outline of connection>



#### ⚠ CAUTION

- ⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

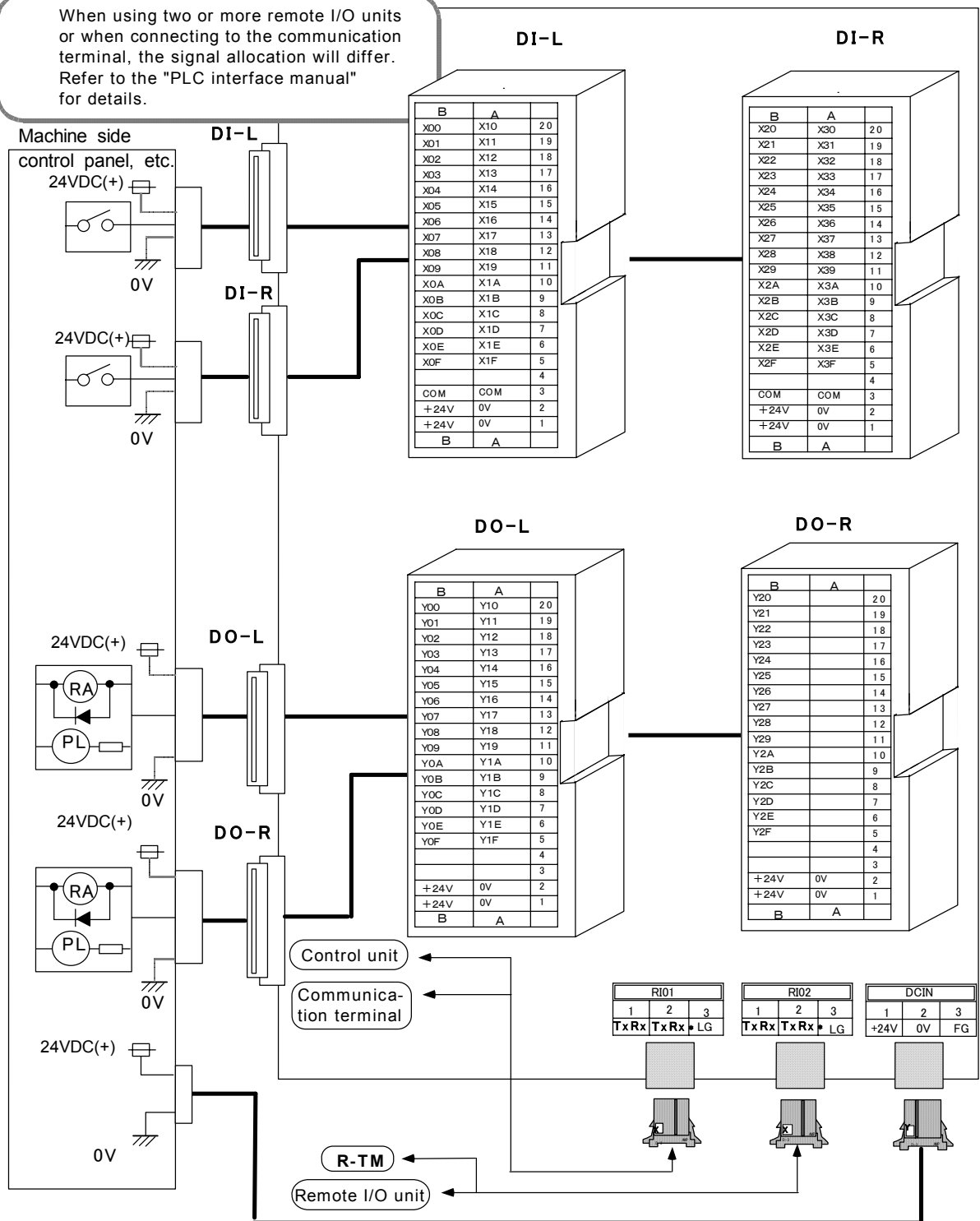
**CHAPTER 6 CONNECTION OF REMOTE I/O UNIT**  
**6.9 Connection of FCUA-DX11□ Unit and Machine Control Signal**

**<Signal assignment table>**

**<CAUTION>**

When using two or more remote I/O units or when connecting to the communication terminal, the signal allocation will differ. Refer to the "PLC interface manual" for details.

**FCUA-DX11□**



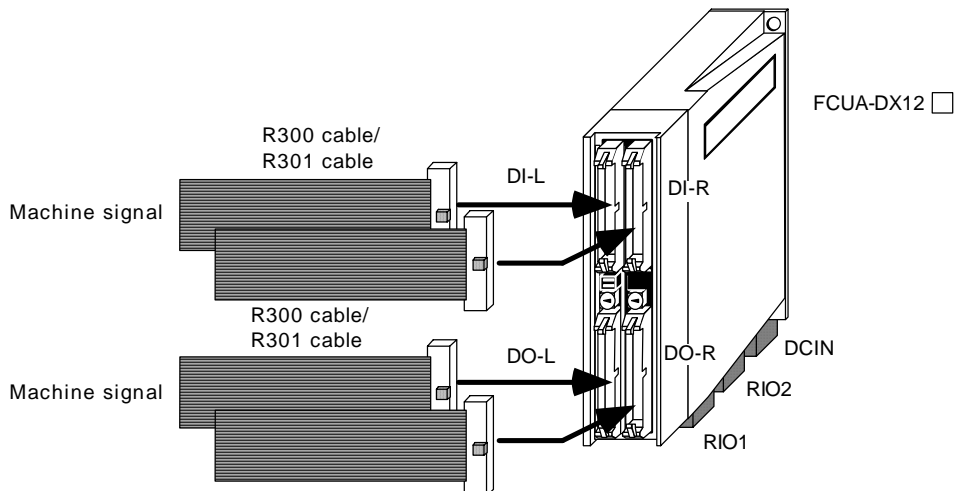
**<Adaptive connector>**

- |   |  |  |   |
|---|--|--|---|
| <p><b>DCIN (CN220)</b></p> <p>Connector : 2-178288-3<br/>         Contact : 1-175218-5<br/>         Maker : Japan AMP</p> | <p><b>RIO1/RIO2 (CN211)</b></p> <p>Connector : 1-178288-3<br/>         Contact : 1-175218-2<br/>         Maker : Japan AMP</p> | <p><b>DI-L/DO-L (CN300)</b><br/><b>DI-R/DO-R</b></p> <p>Crimp type connector:<br/>         7940-6500SC<br/>         Maker: Sumitomo 3M</p> | <p><b>Terminator (R-TM)</b></p> <p>Maker: Japan AMP</p> |
|---|--|--|---|

**CHAPTER 6 CONNECTION OF REMOTE I/O UNIT**  
**6.10 Connection of FCUA-DX12□ Unit and Machine Control Signal**

**6.10 Connection of FCUA-DX12□ Unit and Machine Control Signal**

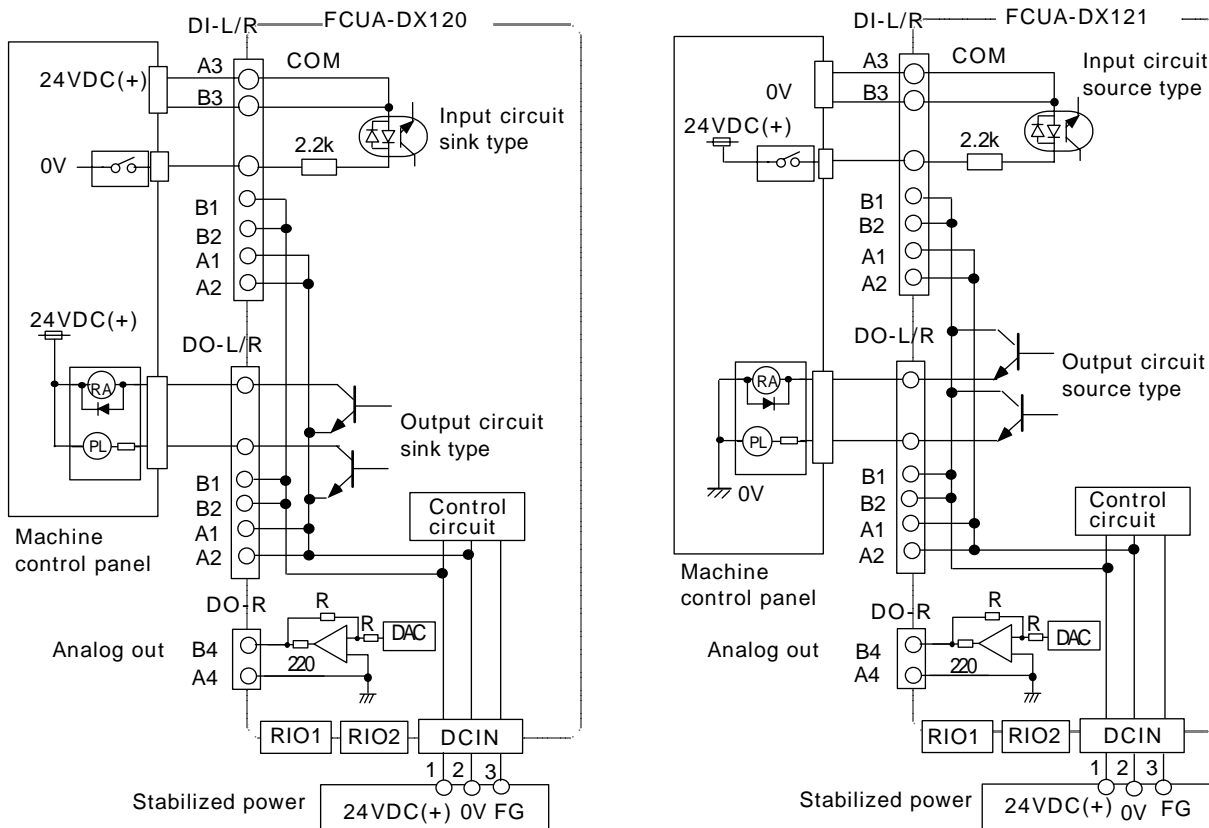
Type of machine input/output signal and No. of points	Input	Output	Analog output
		64 points	48 points



The single-end connector CN300 (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The connector set CS301 (optional) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block\*).

\*) Izumi Denki I/O terminal BX1F-T40 Tel.: 052-262-6946

**<Outline of connection>**



**CAUTION**

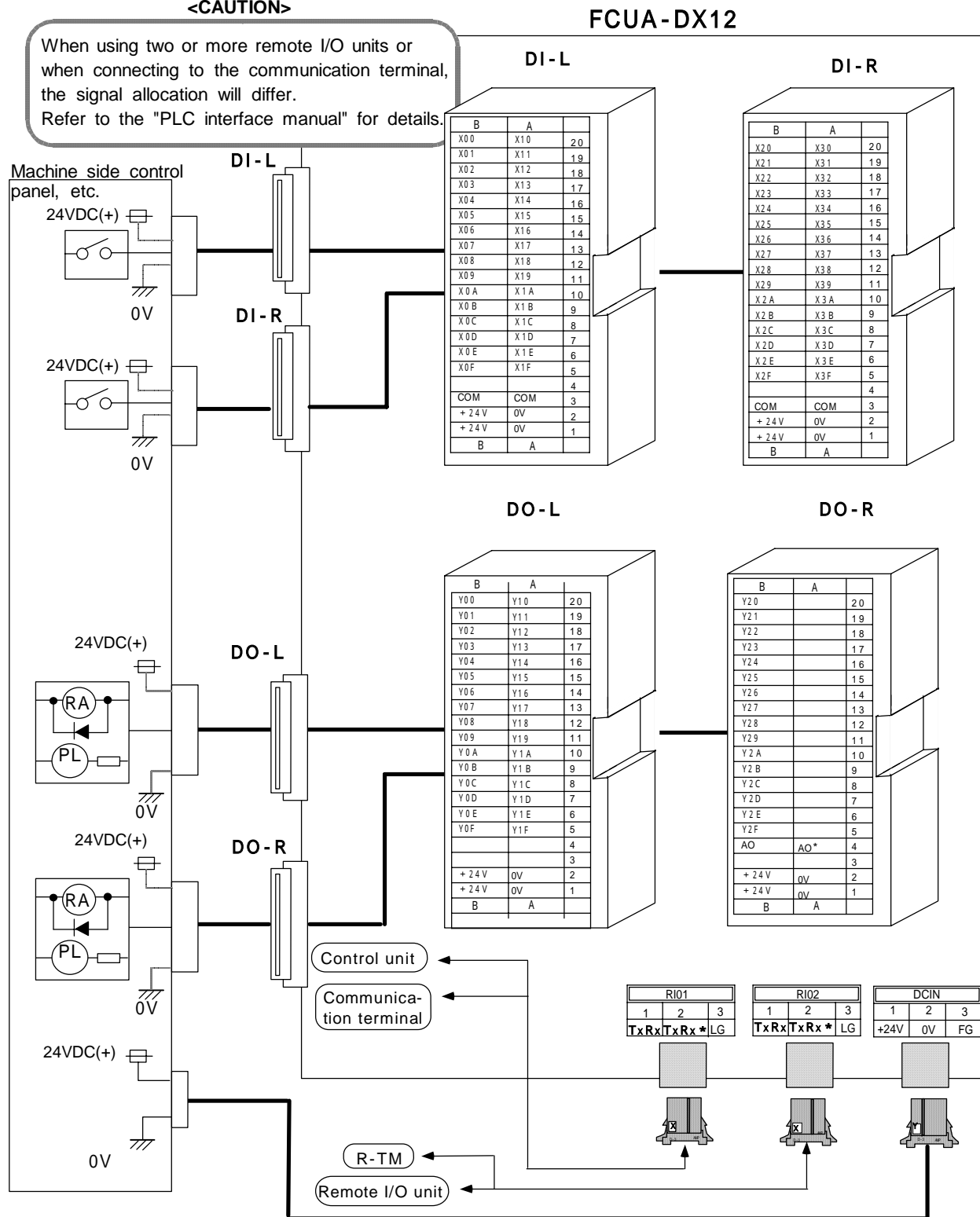
- ⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

**CHAPTER 6 CONNECTION OF REMOTE I/O UNIT**  
**6.10 Connection of FCUA-DX12 Unit and Machine Control Signal**





**<Signal assignment table>**

**<CAUTION>**

When using two or more remote I/O units or when connecting to the communication terminal, the signal allocation will differ. Refer to the "PLC interface manual" for details.



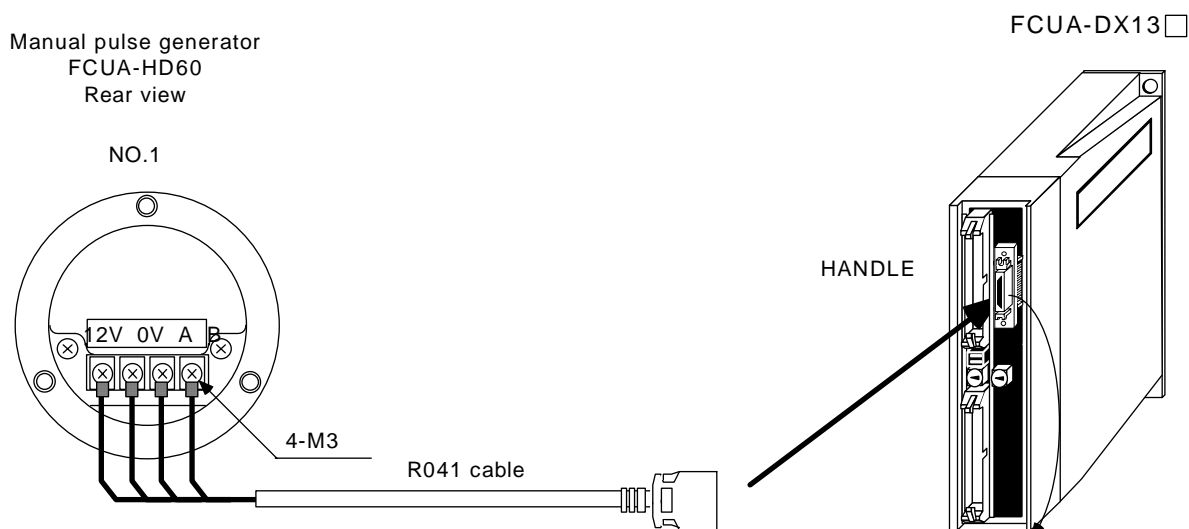
**<Adaptive connector>**

- |   |  |   |   |
|---|--|---|---|
| <p><b>DCIN (CN220)</b></p>  <p>Connector : 2-178288-3<br/>         Contact : 1-175218-5<br/>         Maker : Japan AMP</p> | <p><b>RIO1/RIO2 (CN211)</b></p>  <p>Connector : 1-178288-3<br/>         Contact : 1-175218-2<br/>         Maker : Japan AMP</p> | <p><b>DI-L/DO-L (CN300)</b></p>  <p>Crimp type connector:<br/>         7940-6500SC<br/>         Maker: Sumitomo 3M</p> | <p><b>Terminator (R-TM)</b></p>  <p>Maker: Japan AMP</p> |
|---|--|---|---|

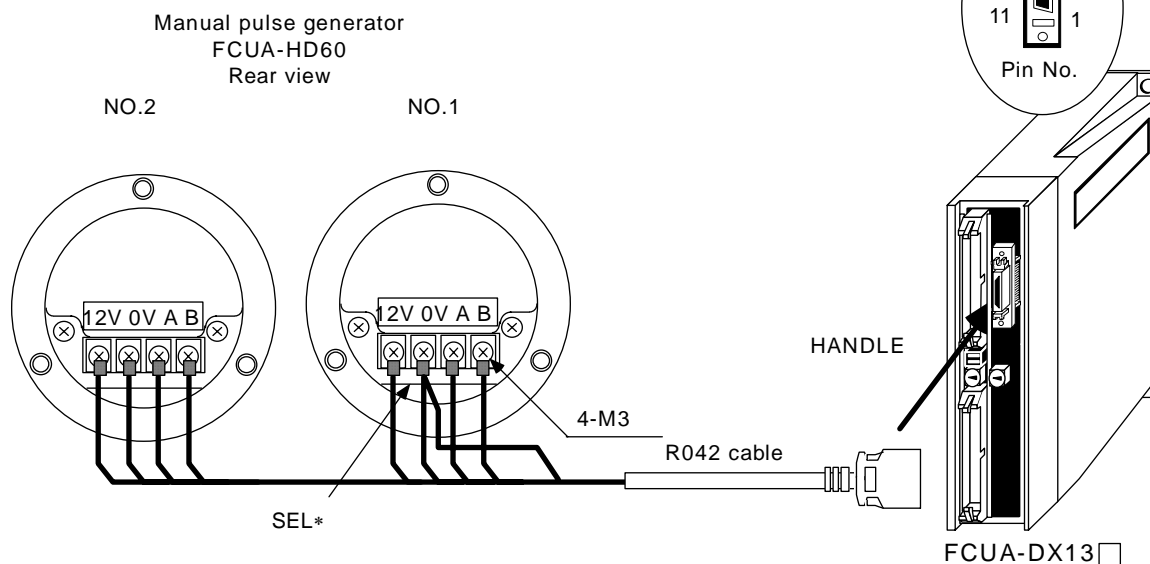
## 6.11 Connection of FCUA-DX13□ Unit and Handle

To connect the manual pulse generator, the R041 or R042 cable is connected to "HANDLE". Up to two manual pulse generators can be connected. When manufacturing the R041 or R042 cable, use the connector set CS000 (optional, with two ends). (Refer to the Appendix 11. Cable manufacturing drawing.)

### To connect one manual pulse generator



### To connect two manual pulse generators



When connecting the second manual pulse generator, connect the SEL\* signal to the No. 1's 0V.

### **CAUTION**

- ⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

### 6.12 Outline of FCUA-DX13□ Unit Pulse Input Circuit

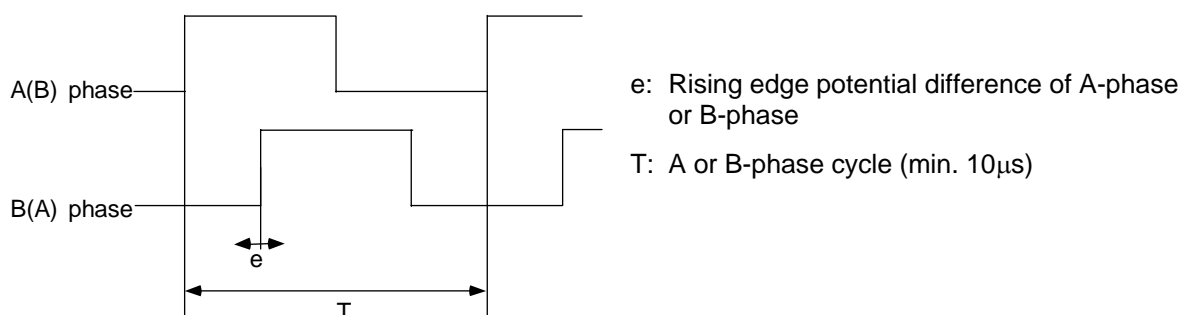
When connecting a device (pulse generator) other than the manual pulse generator to the FCUA-DX13□ unit, use within the following specifications.

#### Input/output conditions

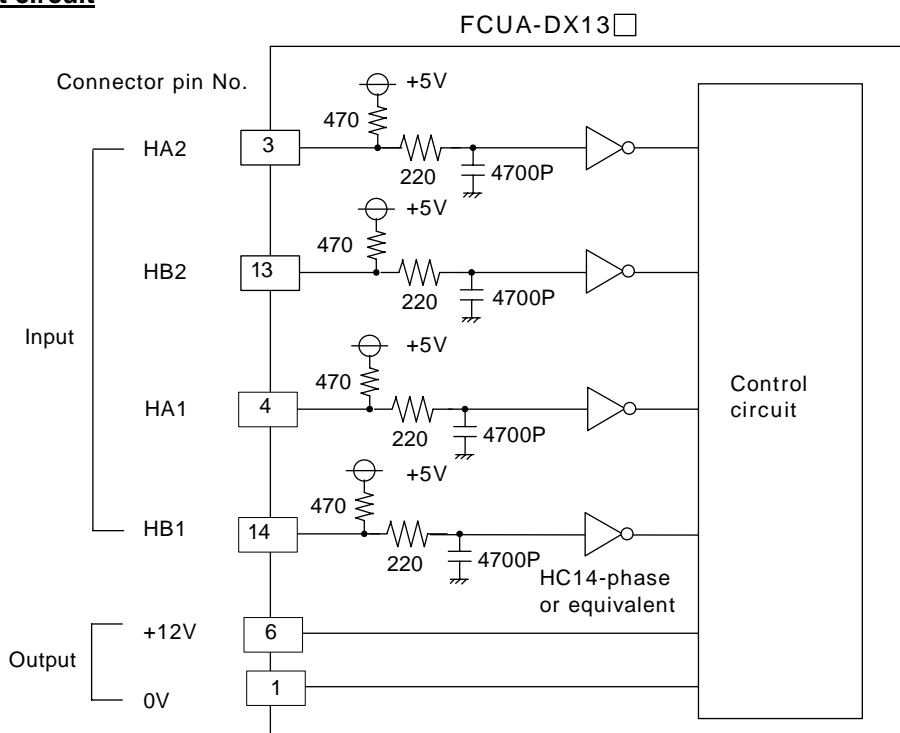
Input pulse signal format	2 signals of A-phase and B-phase potential difference 90 deg. (Refer to waveform below)
Input voltage	H level 3.5 V or more, L level 1.0 V or less
Max. frequency of input pulse	100kHz
Output voltage	12V ± 10%
Max. output current	300mA

#### Input waveform

The difference of the input waveform potential must be ± 45 deg. or less.



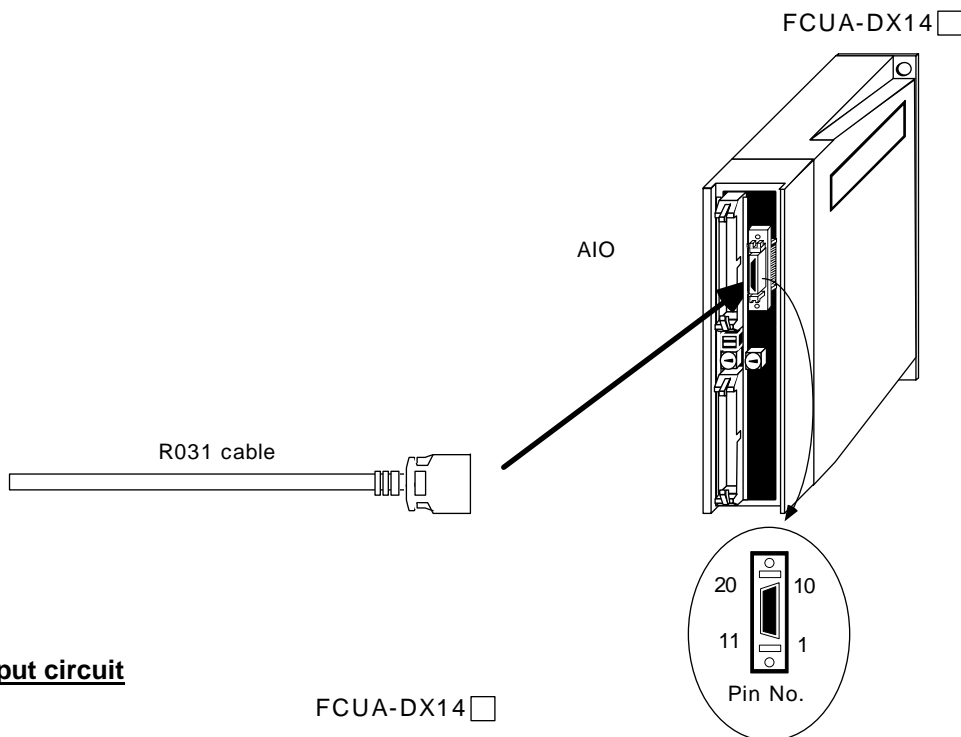
#### Input/output circuit



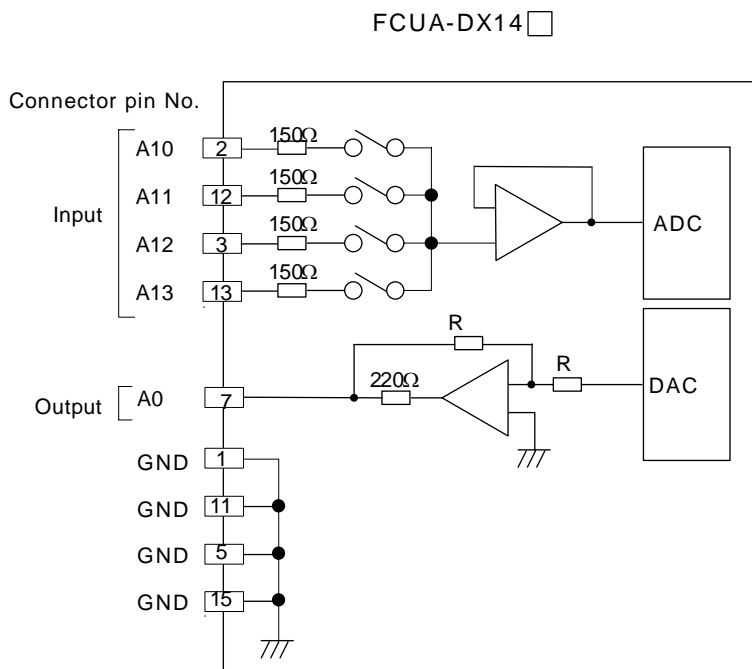
The R041-3M (for one unit) and R042-3M (for two units) are available for the handle cables.

### 6.13 Connection of FCUA-DX14□ Unit and Analog Input/Output Signal

For the analog input/output signal, the R031 cable is connected to "AIO". Up to four input points and one output point of the analog input/output signal can be connected. When manufacturing the R031, use the connector set CS000 (optional, with two ends). (Refer to the Appendix 2.11. Cable manufacturing drawing.)



#### Input/output circuit



**CAUTION**

- ⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

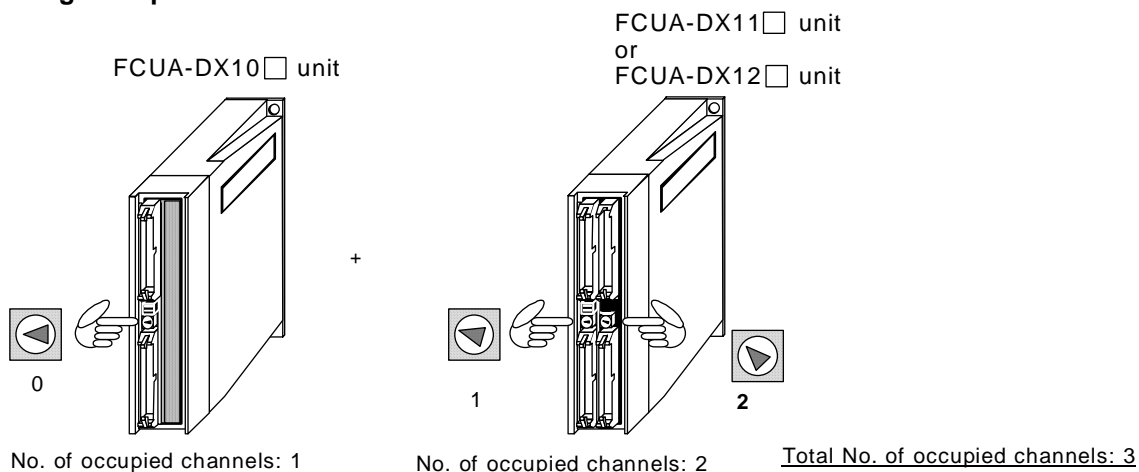
### 6.14 Setting of Channel No. when Using Multiple Remote I/O Units

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 channels is within 8 channels.

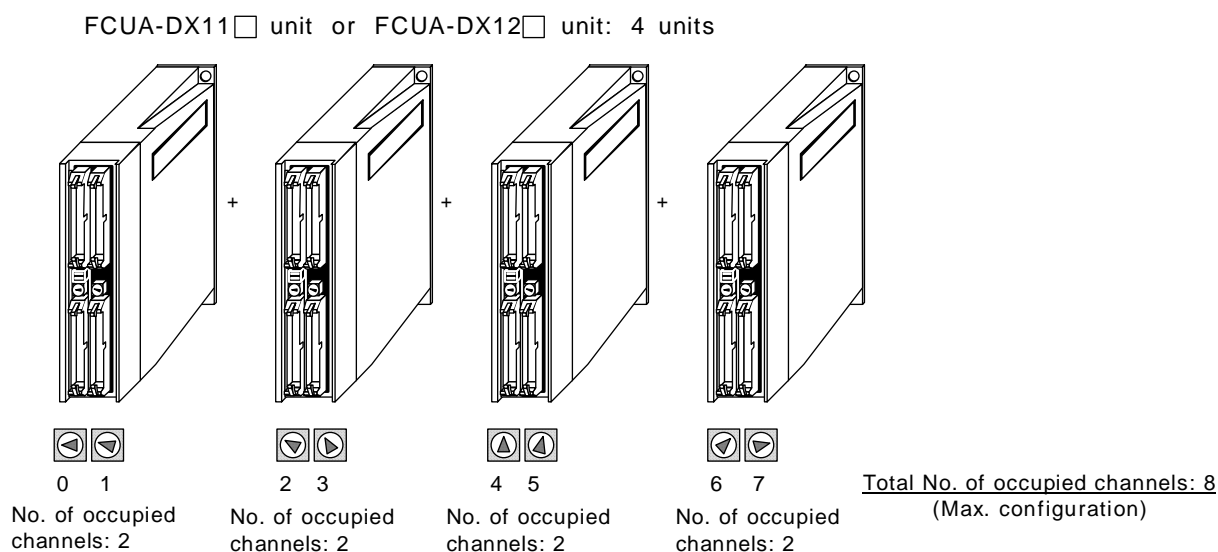
Unit name	No. of occupied serial link channels
FCUA-DX10 □	1
FCUA-DX11 □	2
FCUA-DX12 □	2
FCUA-DX13 □	2
FCUA-DX14 □	2

When using multiple remote I/O units, a characteristic channel No. must be set for each unit. The FCUA-DX10 □ unit has one channel No. setting switch, and FCUA-DX11 □, DX12 □, DX13 □ and DX14 □ unit have two switches. Each of these switches must be set to a characteristic channel No.

#### <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.



## 6.15 Cables

The remote I/O unit cable types include the R300 and R301 cables. One end of the R300 cable is cut, and the R301 cable is used for connections with the terminal block <sup>\*)</sup>. Both the R300-3M and R301-3M are available.

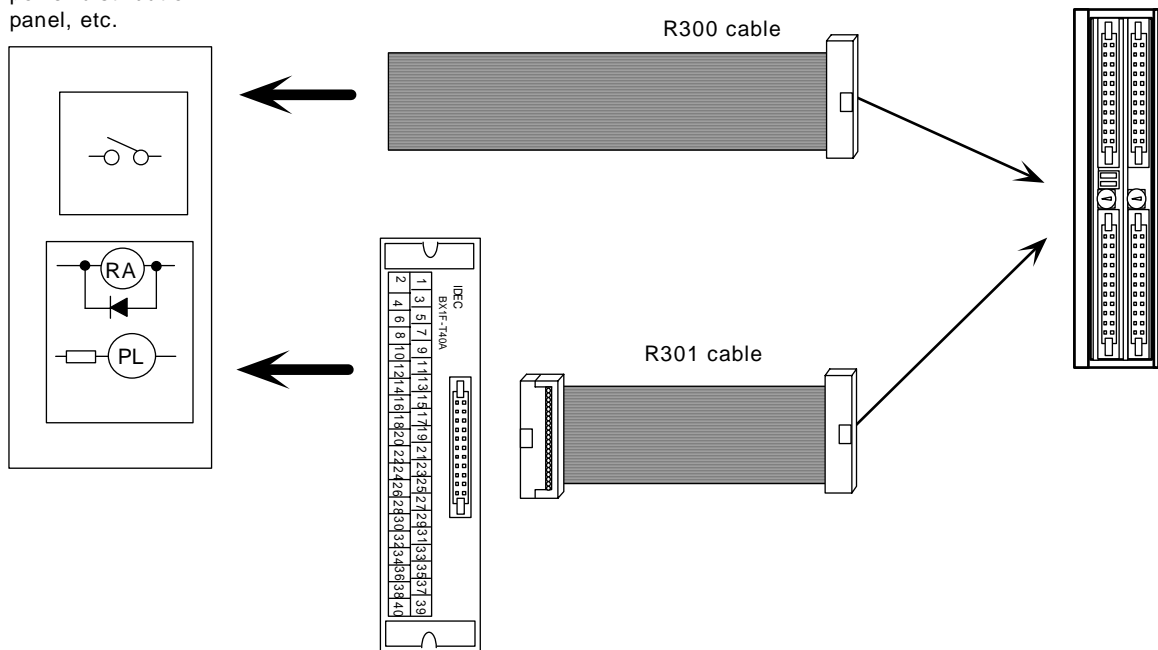
If a cable longer than 3 m is required, use the connector set CN300 or CS301.

The R041-3M (for one unit) and R042-3M (for two units) are available for the handle cables.

For the analog input/output cable, the R031 cable must be manufactured by the user.

<sup>\*)</sup> Izumi Denki I/O terminal BX1F-T40A Tel.: 052-262-6946

Machine control panel,  
power distribution  
panel, etc.



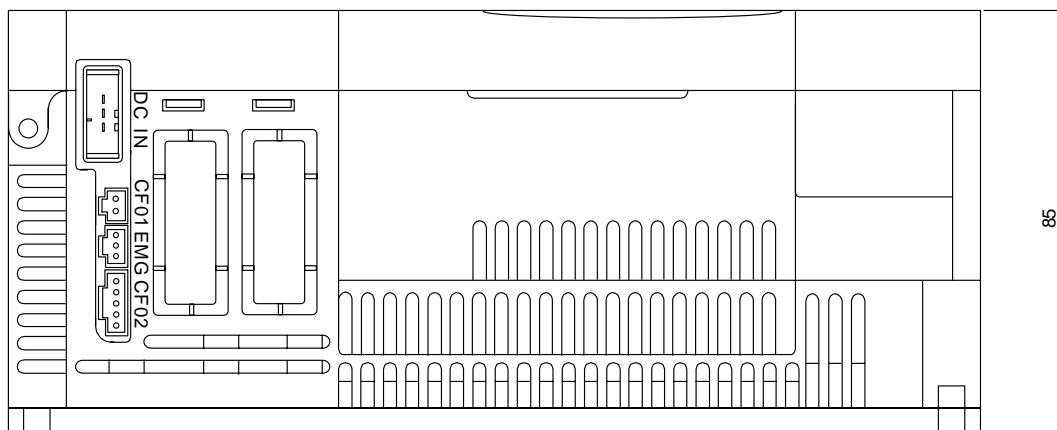
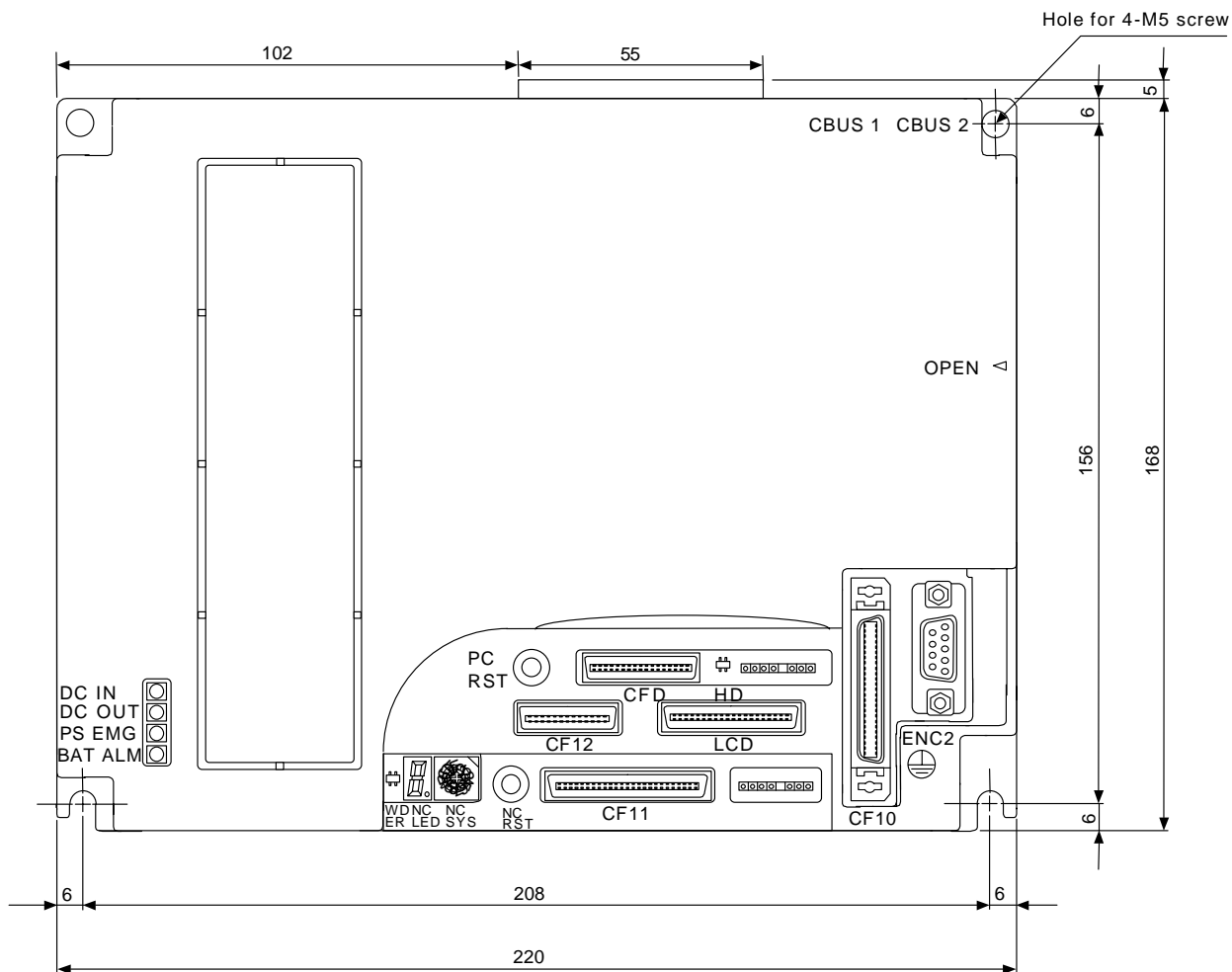
Connector pin correspondence table

Terminal block BX1F	DX1 □ □	Terminal block BX1F	DX1 □ □
1	A1	2	B1
3	A2	34	B2
5	A3	6	B3
7	A4	8	B4
9	A5	10	B5
11	A6	12	B6
13	A7	14	B7
15	A8	16	B8
17	A9	18	B9
19	A10	20	B10
21	A11	22	B11
23	A12	24	B12
25	A13	26	B13
27	A14	28	B14
29	A15	30	B15
31	A16	32	B16
33	A17	34	B17
35	A18	36	B18
37	A19	38	B19
39	A20	40	B20

APPENDIX 1 INSTALLATION DIMENSIONS  
 Appendix 1.1 Control Unit Outline Drawing

APPENDIX 1 INSTALLATION DIMENSIONS

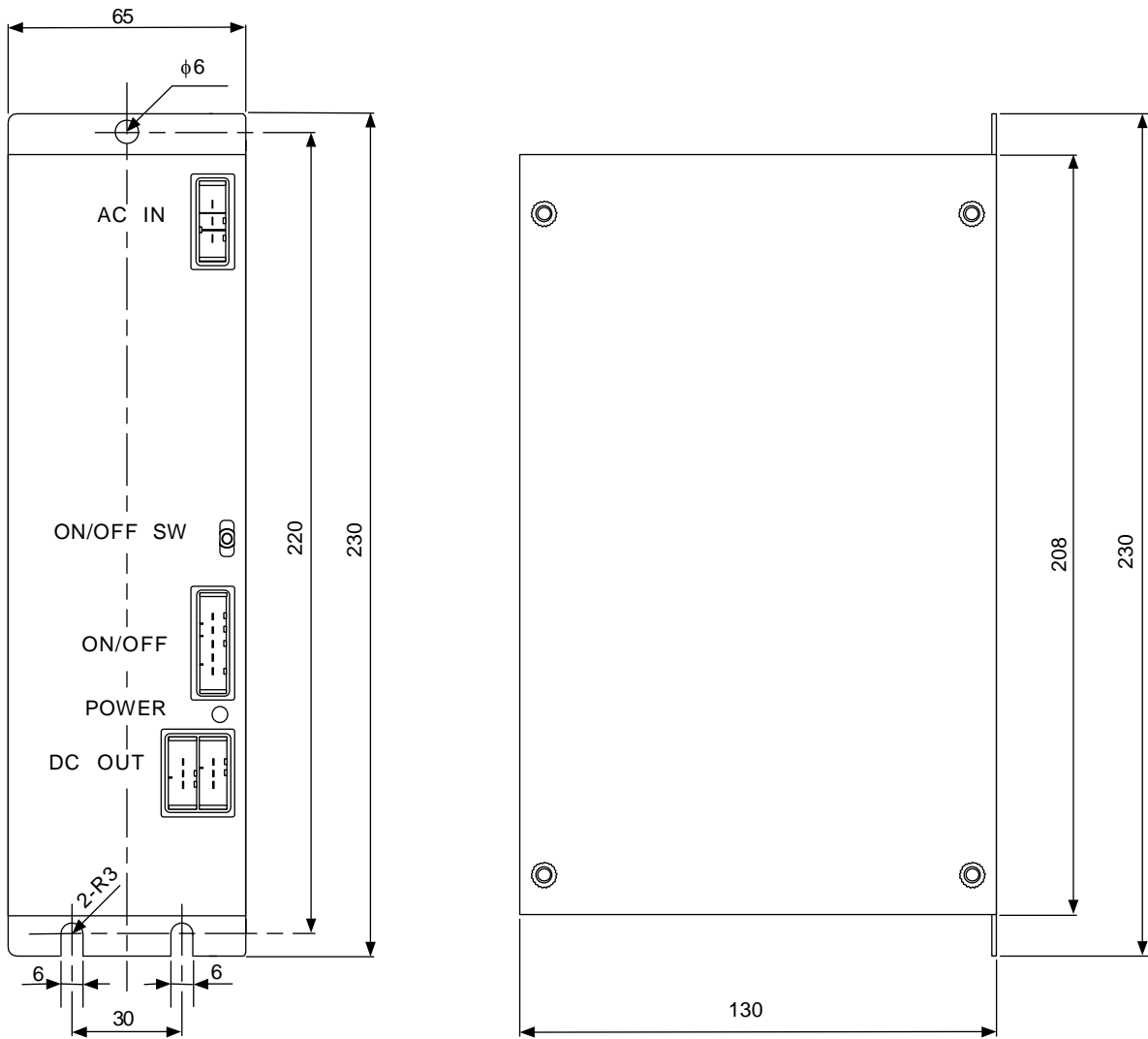
Appendix 1.1 Control Unit Outline Drawing





APPENDIX 1 INSTALLATION DIMENSIONS  
Appendix 1.3 External Power Supply Unit (PD25) Outline Drawing

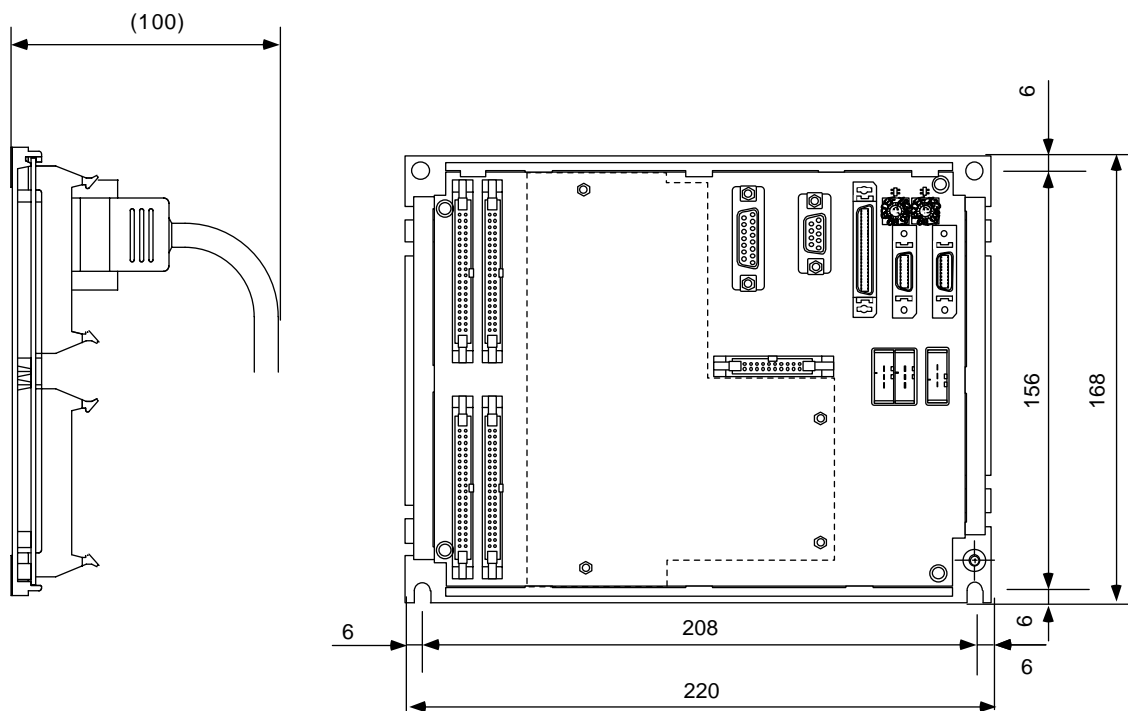
Appendix 1.3 External Power Supply Unit (PD25) Outline Drawing



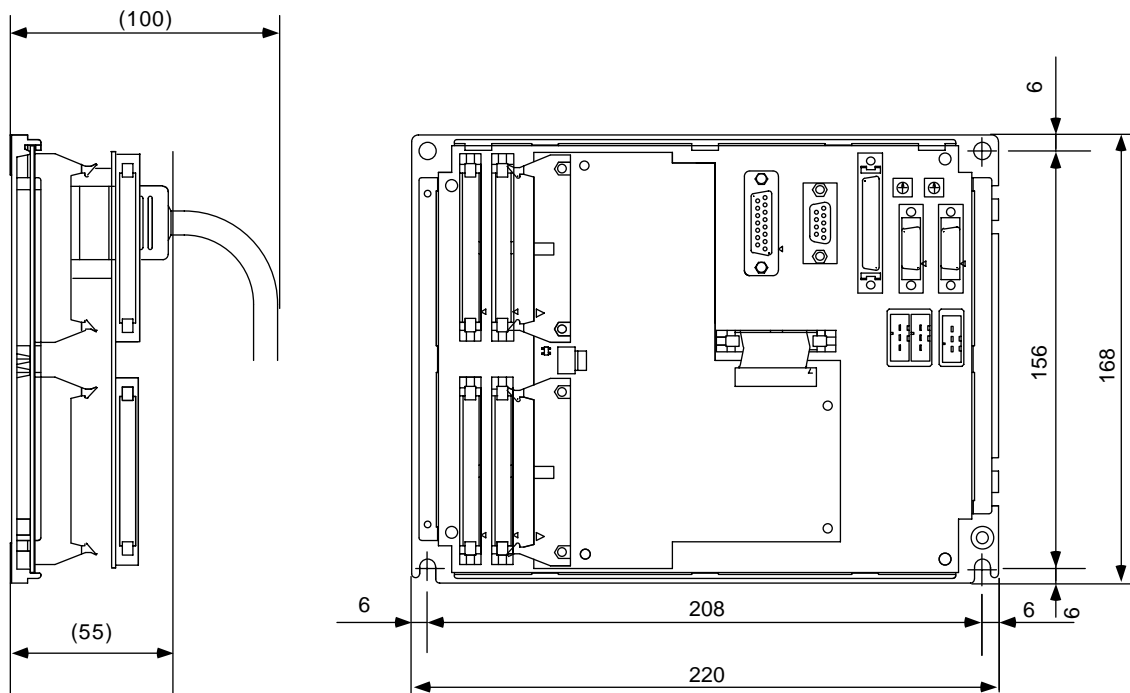
APPENDIX 1 INSTALLATION DIMENSIONS  
Appendix 1.4 Base I/O Unit Outline Drawing

Appendix 1.4 Base I/O Unit Outline Drawing

(1) Outline of FCU6-DX210/DX211/DX220/DX221

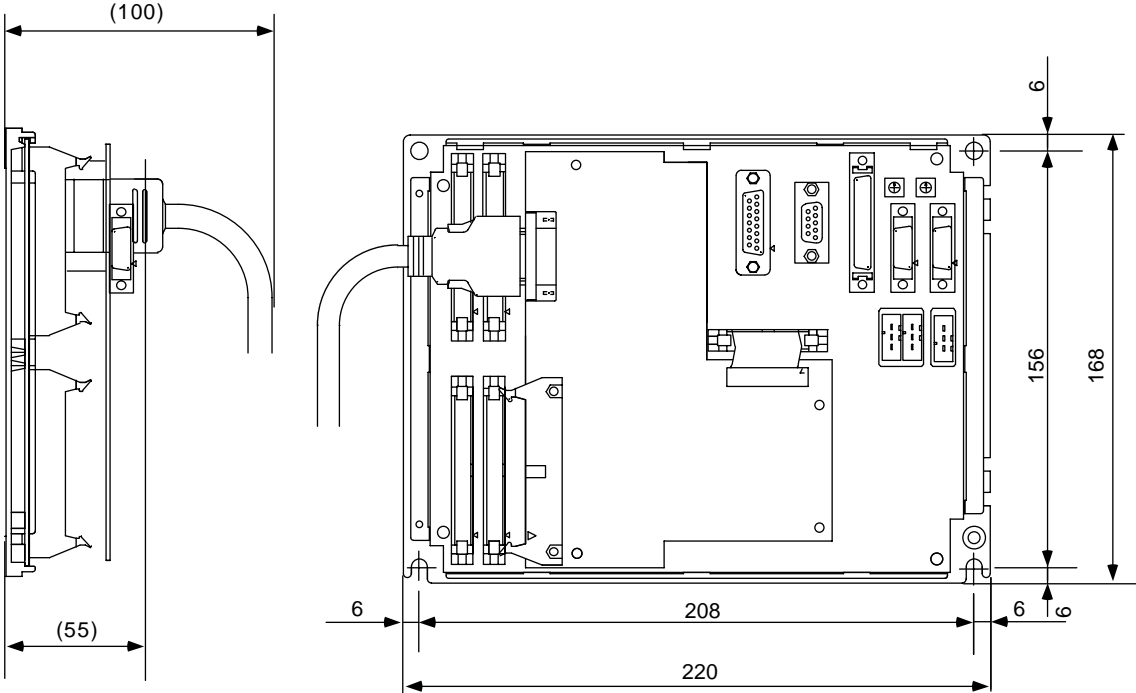


(2) Outline of FCU6-DX310/DX311/DX320/DX321/DX410/DX411/DX420/DX421



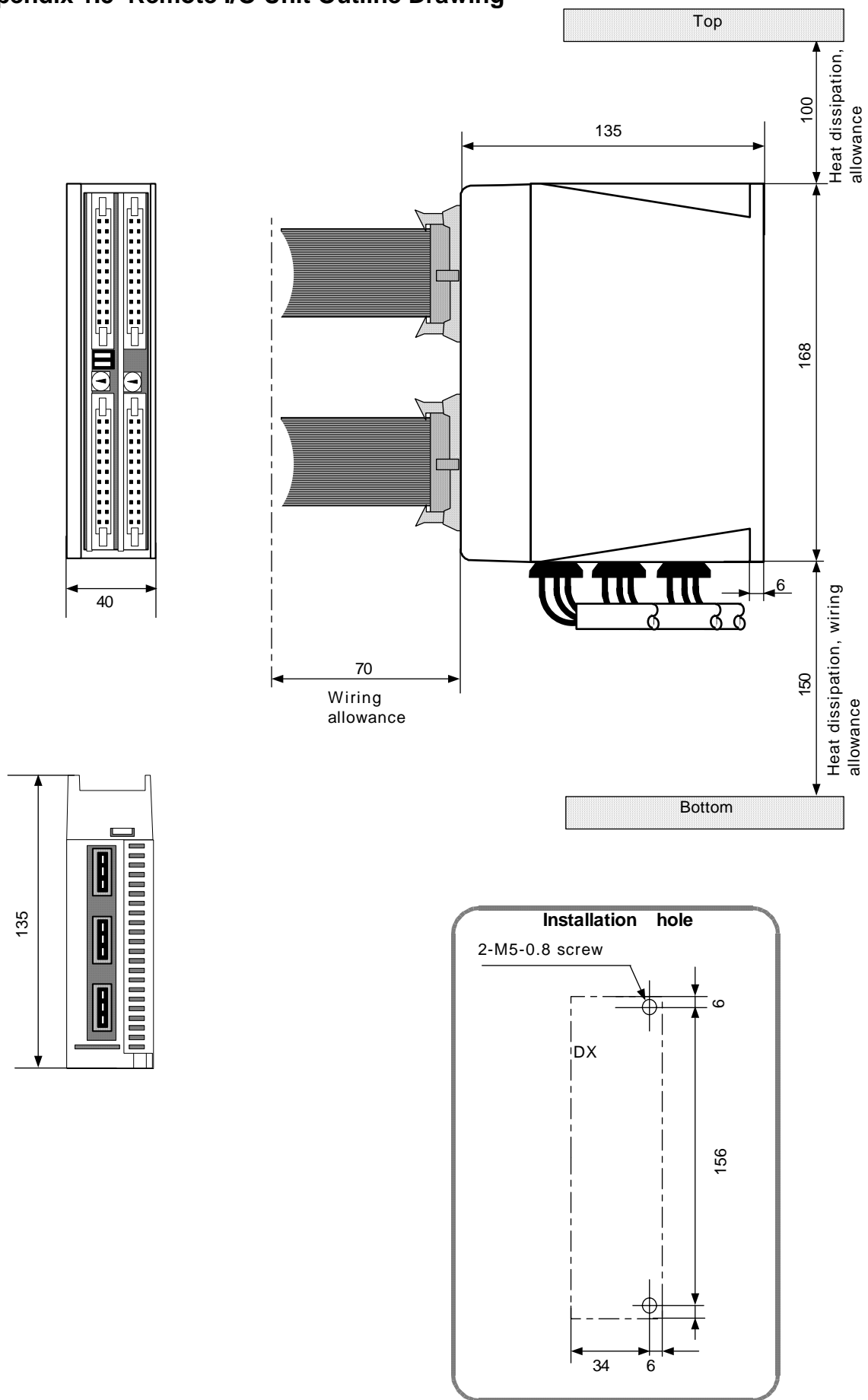
**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.4 Base I/O Unit Outline Drawing**

**(3) Outline of FCU6-DX330/DX331/DX340/DX341/DX430/DX431/DX440/DX441**



**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.5 Remote I/O Unit Outline Drawing**

**Appendix 1.5 Remote I/O Unit Outline Drawing**



**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.6 Card-sized I/O Outline Drawing**

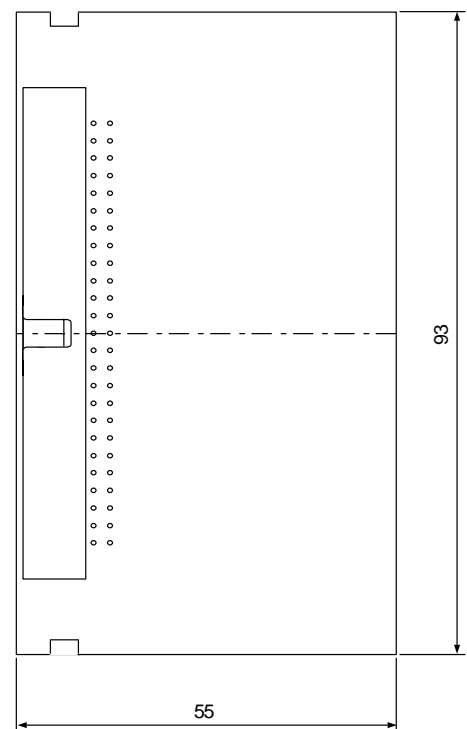
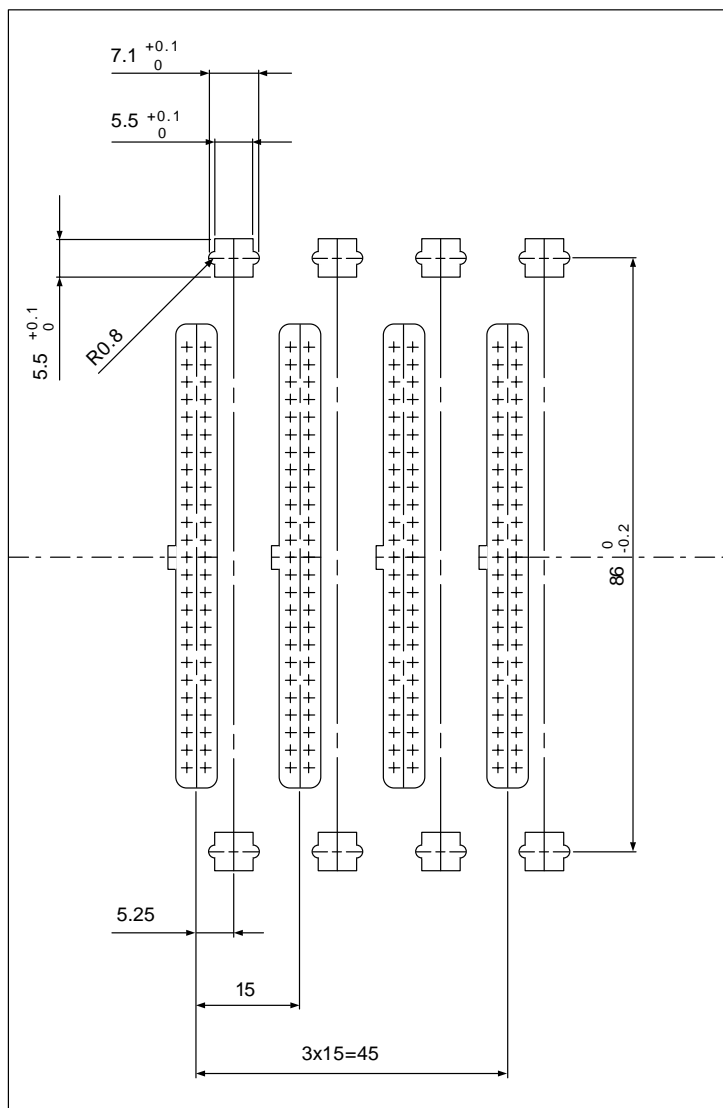
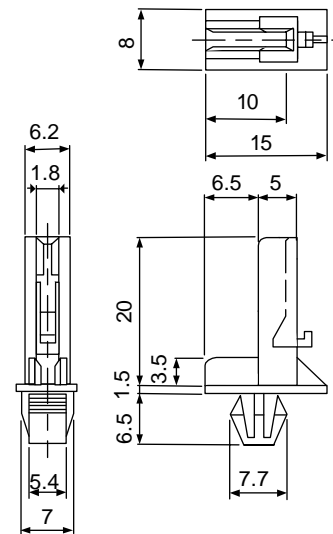
**Appendix 1.6 Card-sized I/O Outline Drawing**

Use the card corner holder for fixing the card-sized I/O.

**[Card corner holder]**

Type: KGCH-20-0

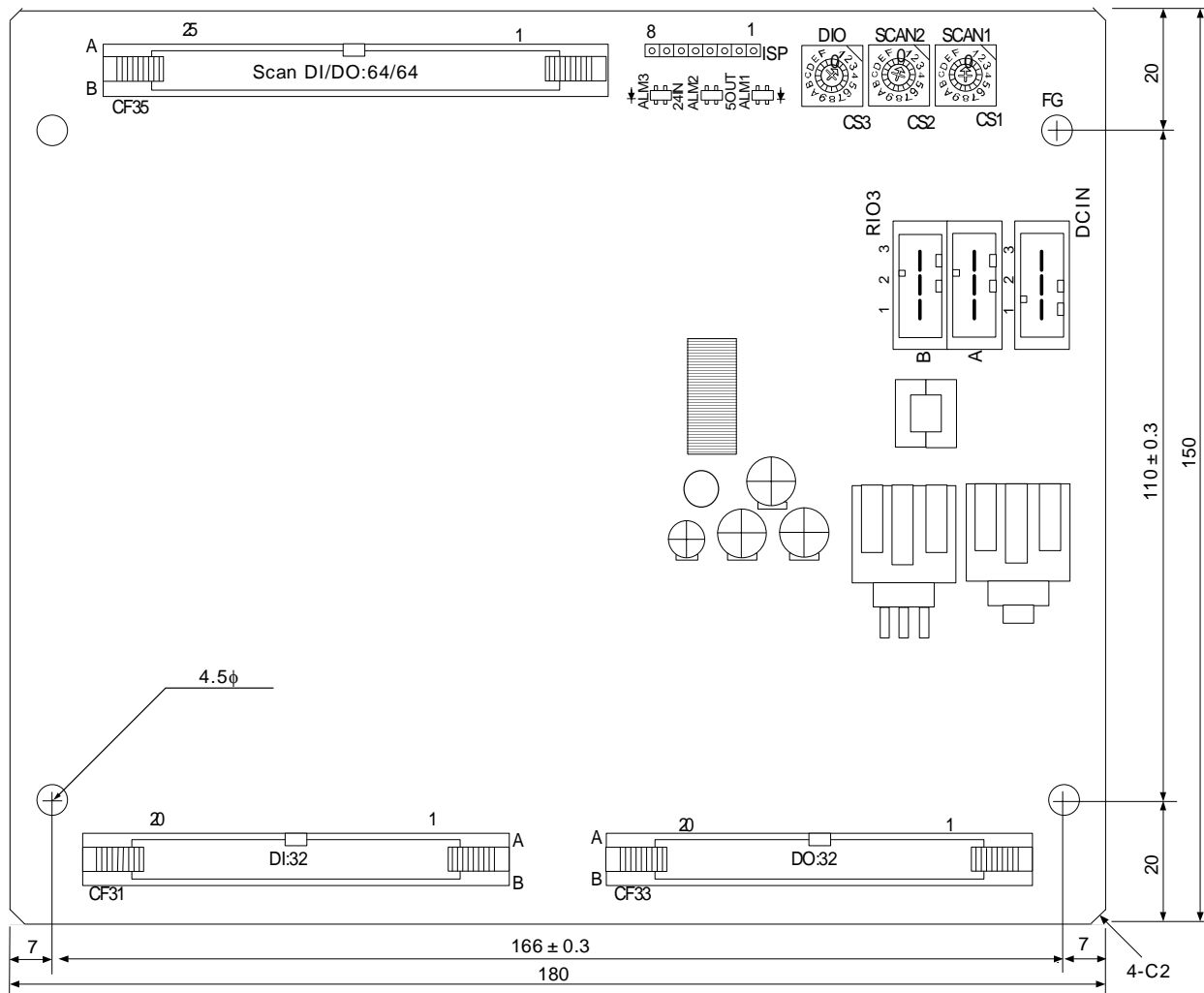
Recommended maker: Kitakawa Kogyo





**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.7 Scan I/O Card Outline Drawing**

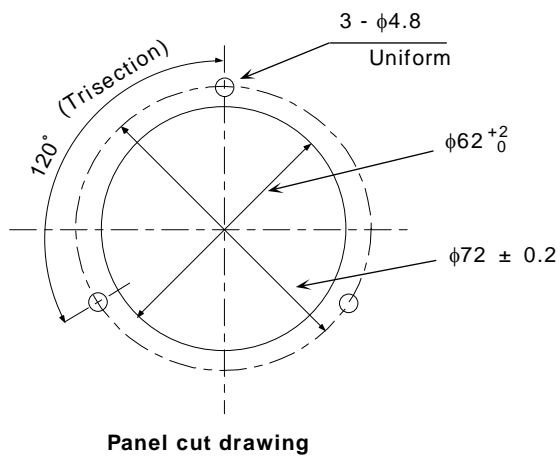
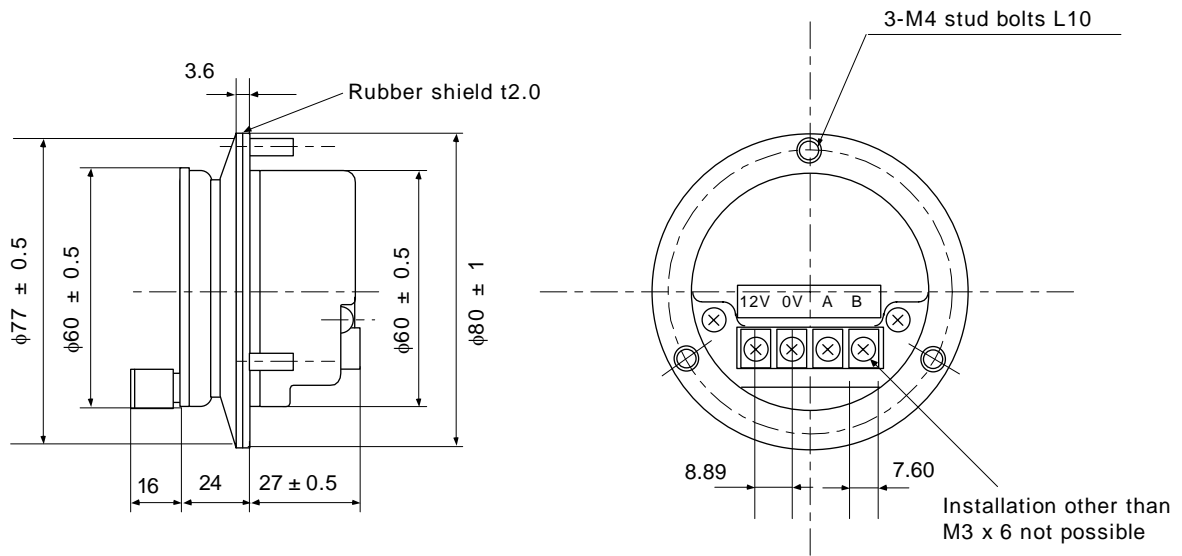
**Appendix 1.7 Scan I/O Card Outline Drawing**



\* The PCB height (depth) will be approx. 40mm when the connector is inserted, so secure a space more than that when installing.

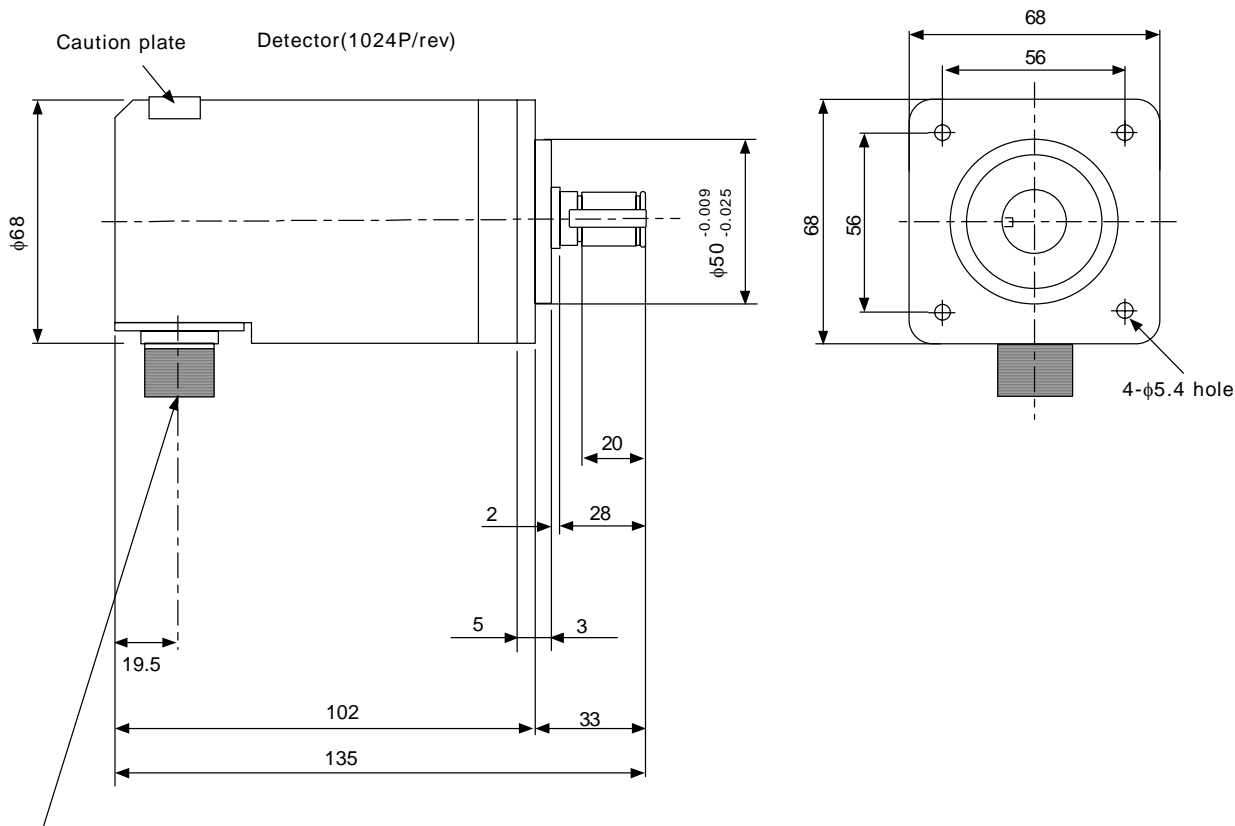
**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.8 Manual Pulse Generator (HD60) Outline Drawing**

**Appendix 1.8 Manual Pulse Generator (HD60) Outline Drawing**

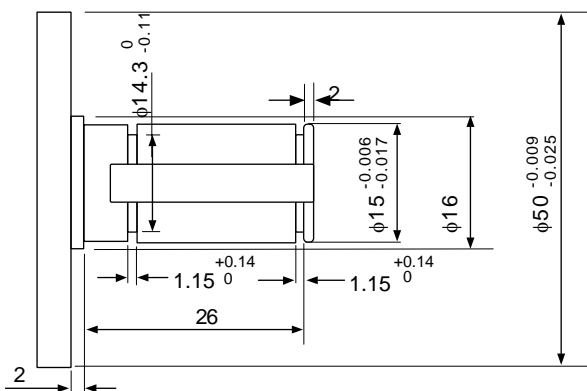


**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.9 Encoder (OSE-1024-3-15-68) Outline Drawing**

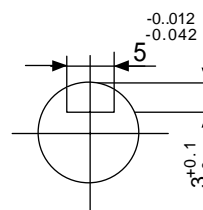
**Appendix 1.9 Encoder (OSE-1024-3-15-68) Outline Drawing**



Encoder side 97F3102E20-29P (or equivalent)  
 Applicable cable side MS3106A20-29S



**Enlarged view of key**



**Cross-section BB**

The effective depth of the key way is 21mm.

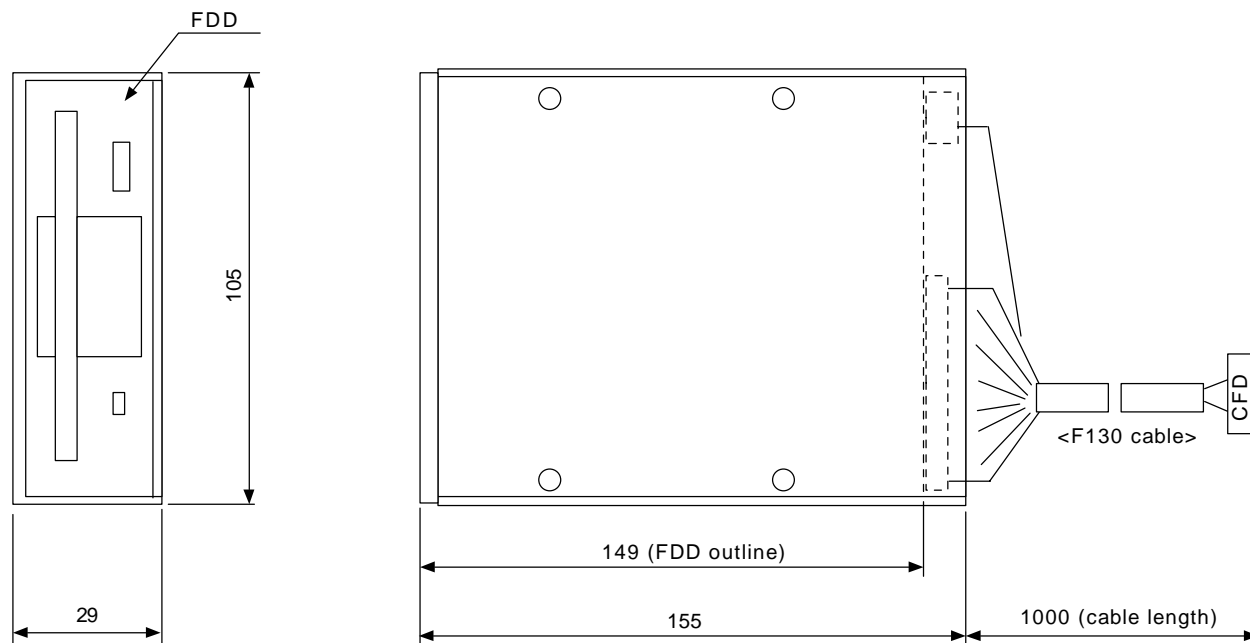
A	1chA	K	0V
B	2chZ	L	
C	3chB	M	
D		N	1ch $\bar{A}$
E	Case grounding	P	2ch $\bar{Z}$
F		R	3ch $\bar{B}$
G		S	
H	+5V	T	
J			

**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.10 Floppy Disk Drive Unit Outline Drawing**

**Appendix 1.10 Floppy Disk Drive Unit Outline Drawing**

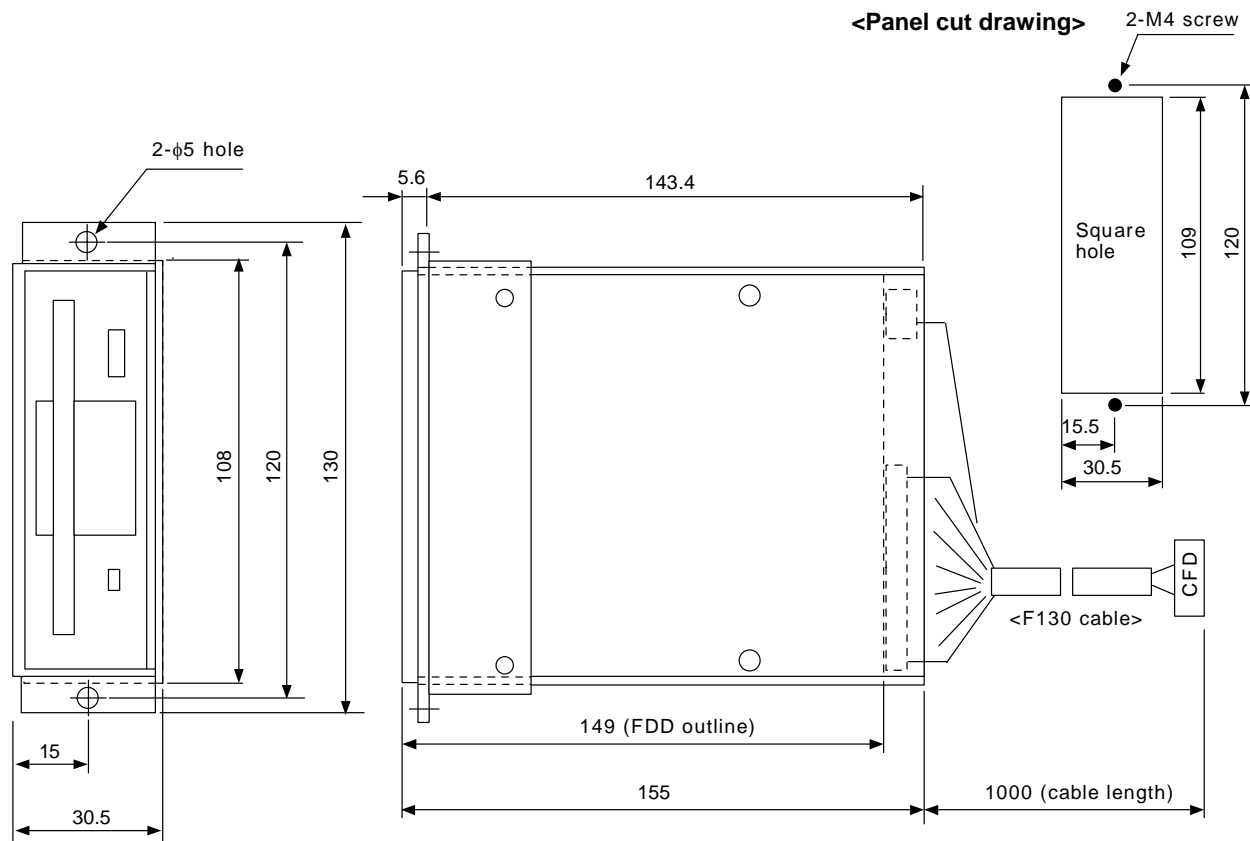
FDD unit outline (portable-type)

Type : FCU6-FD121-1



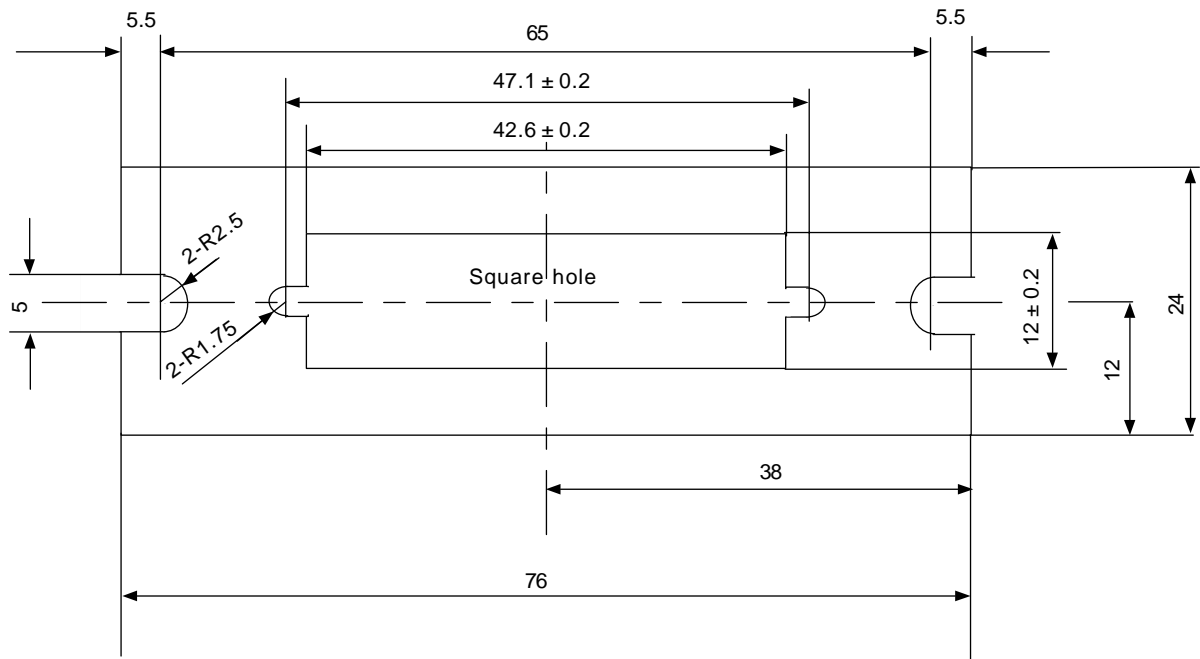
FDD unit outline (mounting specifications) Type: FCU6-FD221-1

<Panel cut drawing>



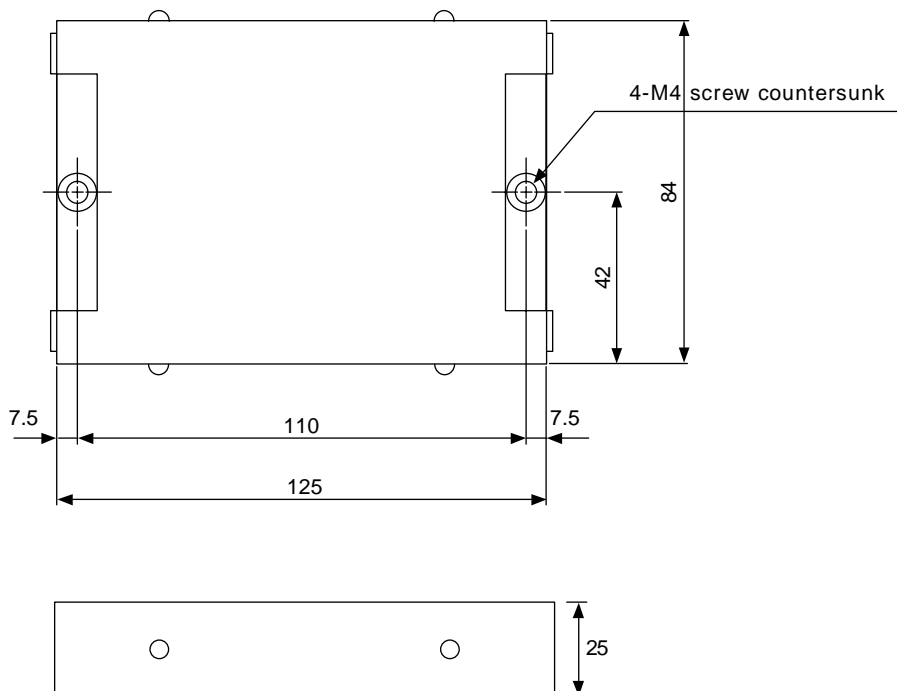
APPENDIX 1 INSTALLATION DIMENSIONS  
Appendix 1.11 F Installation Plate Outline Drawing

Appendix 1.11 F Installation Plate Outline Drawing



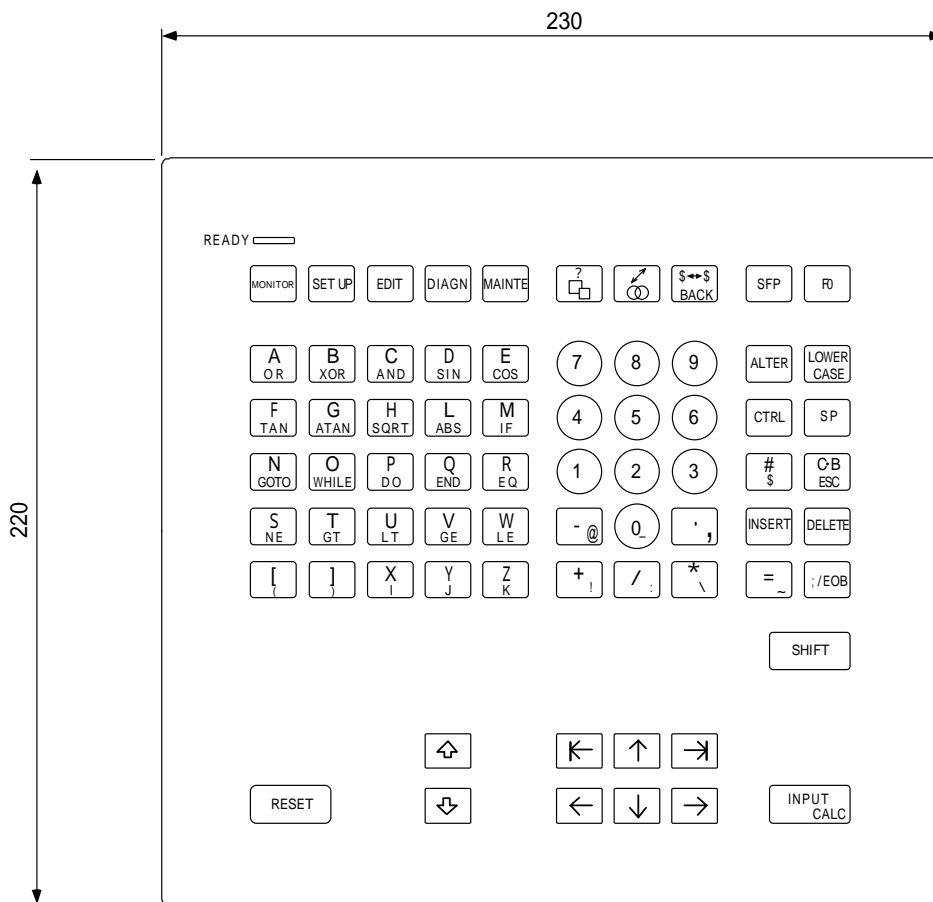
The plate thickness is 1.6 mm.

Appendix 1.12 External Hard Disk Drive Unit Outline Drawing

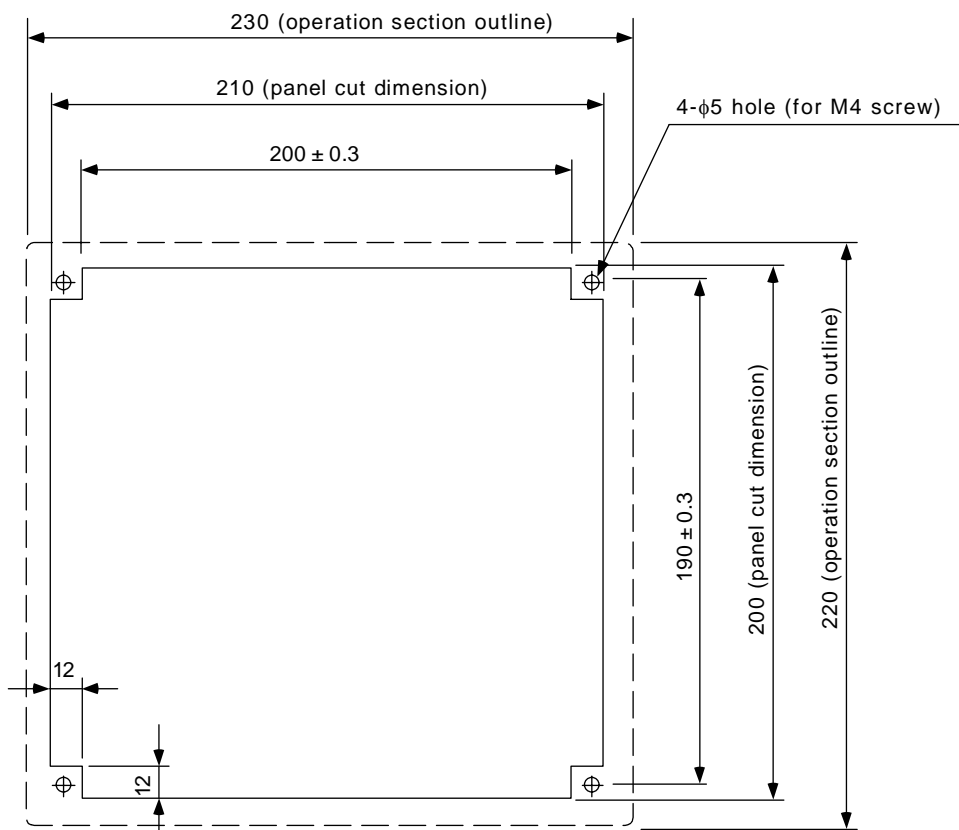


**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.13 NC Keyboard Outline Drawing**

**Appendix 1.13 NC Keyboard Outline Drawing**



**Panel cut drawing**

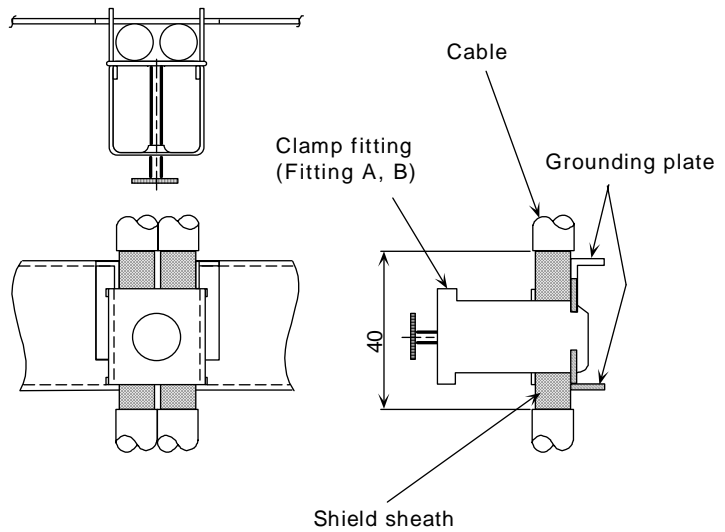


**APPENDIX 1 INSTALLATION DIMENSIONS**  
**Appendix 1.14 Grounding Plate and Clamp Fitting Outline Drawings**

**Appendix 1.14 Grounding Plate and Clamp Fitting Outline Drawings**

The shield wire generally only needs to be grounded to the connector's case frame. However, the effect can be improved by directly grounding to the grounding plate as shown on the right. Install the grounding 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 grounding plate with the clamp fitting. Note that if the cable is thin, several can be clamped together.

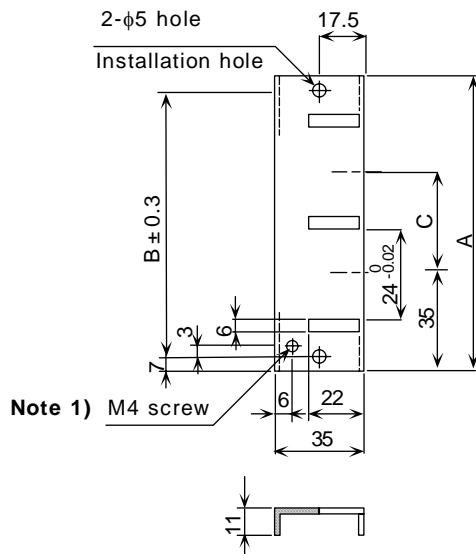
Install the grounding plate directly onto the cabinet or connect a grounding wire so that sufficient frame grounding is achieved. If the AERSBAN-SET, containing the grounding plate and clamp fitting, is required, please contact Mitsubishi.



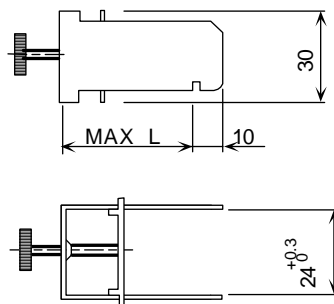
**Clamp section drawing**

**• Outline drawing**

**Grounding plate**



**Clamp fitting**



**Note 1)** Screw hole for wiring to cabinet's grounding plate

**Note 2)** The grounding plate thickness is 1.6mm

	<b>A</b>	<b>B</b>	<b>C</b>	<b>Enclosed fittings</b>
AERSBAN-DSET	100	86	30	Two clamp fittings A
AERSBAN-ESET	70	56	-	One clamp fitting B

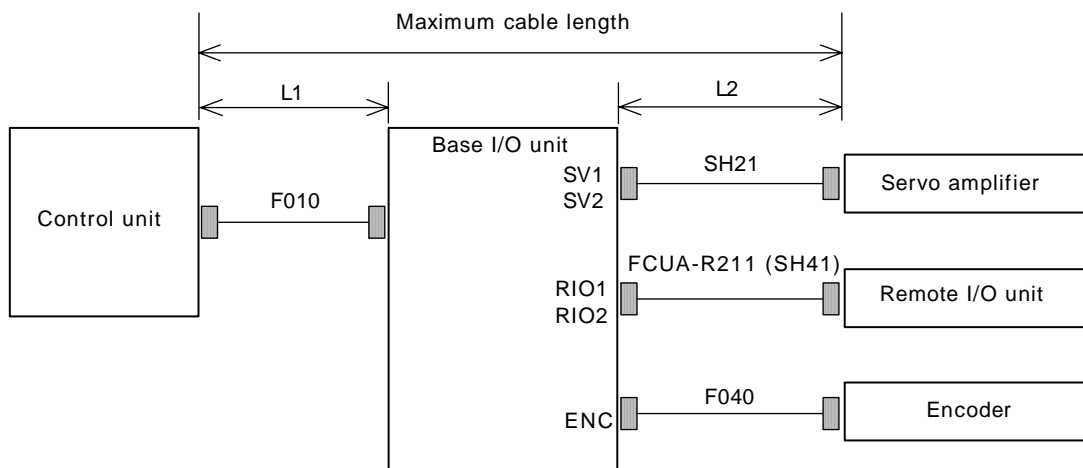
	<b>L</b>
Clamp fitting A	70
Clamp fitting B	45

APPENDIX 2 CABLE MANUFACTURING DRAWINGS

Cable type name table

No.	Appendix No.	Cable type	Application	Max. length	Remarks
1	Appendix 2.1	SH21 cable	Servo amplifier	*30m	
2	Appendix 2.2	SH41 cable	Remote I/O	*1m	Used between units in the same panel.
3	Appendix 2.3	FCUA-R211 cable	Remote I/O	*50m	
4	Appendix 2.4	R301 cable	DI/DO	50m	
5	Appendix 2.5	F010 cable	I/O INTERFACE	20m	
6	Appendix 2.6	F020 cable	Manual pulse generator: 1ch	50m	
7	Appendix 2.6	F021 cable	Manual pulse generator: 2ch	50m	
8	Appendix 2.6	F022 cable	Manual pulse generator: 3ch	50m	
9	Appendix 2.7	F030 cable	RS-232-C : 1ch	15m	
10	Appendix 2.7	F031 cable	RS-232-C : 2ch	15m	
11	Appendix 2.7	F032 cable	RS-232-C : 1ch	15m	
12	Appendix 2.8	F040 cable	Encoder: Straight	*50m	
13	Appendix 2.8	F041 cable	Encoder: Right angle	*50m	
14	Appendix 2.9	F050 cable	NC keyboard	1m	
15	Appendix 2.10	F060 cable	PC INTERFACE	1m	
16	Appendix 2.11	F070 cable	+24V input	30m	
17	Appendix 2.12	F110 cable	+24V input, power off detection	15m	
18	Appendix 2.13	F120 cable	Emergency stop	30m	
19	Appendix 2.14	F130 cable	Floppy disk drive	1m	
20	Appendix 2.15	F170 cable	ON/OFF switch	15m	Use of the PC built-in type is prohibited.
21	Appendix 2.16	F171 cable	ON/OFF switch	15m	
22	Appendix 2.17	F172 cable	ON/OFF switch	15m	
23	Appendix 2.18	ENC-SP1 cable	Spindle amplifier	50m	
24	Appendix 2.19	ENC-SP2 cable	FR-TK	50m	

(Note 1) For the cables marked with \* in the max. length cable column, the max. length is the sum (L1 + L2) of the cable length (L1) from the control unit to the base I/O unit and the cable length (L2) from the base I/O unit to each unit.



(Note 2) Symbols for writing cable manufacturing drawing  
The following symbols are used in the cable manufacturing drawing.

1. indicates twist.

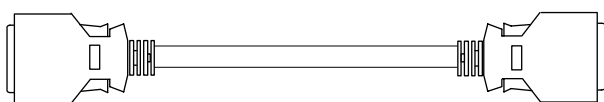
2. indicates the shield sheath.

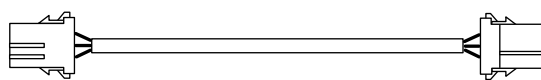
3. indicates shield clamping to the ground plate.

- In the cable manufacturing drawings, the partner of the twisted pair cable is given a priority, so the pin Nos. of the connectors at both end are not necessary in number of order.
- Equivalent parts can be used for the connector, contact and wire material.

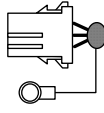
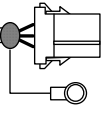
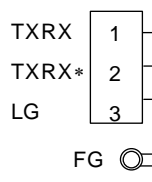
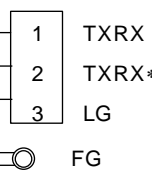


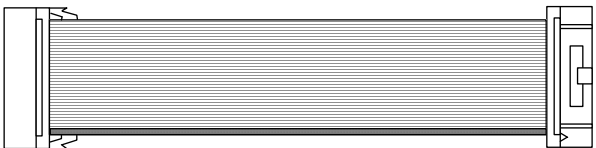
## APPENDIX 2 CABLE MANUFACTURING DRAWINGS

<b>Cable type name:</b> SH21 cable	<b>Usage:</b> Servo amplifier		<b>Appendix 2.1</b>
<p style="text-align: center;">Connector name : SV1, SV2 (CSH21) <span style="float: right;">Servo amplifier</span></p>  <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%;"> <p>SV1, SV2 (CSH21)                      Plug : 10120-6000EL                      Shell : 10320-3210-000                      Recommended maker: Sumitomo 3M</p> </div> <div style="width: 45%;"> <p>Plug : 10120-6000EL                      Shell : 10320-3210-000                      Recommended maker: Sumitomo 3M</p> </div> </div> <p style="text-align: center; margin-top: 10px;">Wire material: UL20276 AWG28 × 10P                      Recommended maker: Toyokuni Densen</p> <p style="text-align: center; margin-top: 10px;"><b>Note:</b> Fold the wire material shield over the sheath, and wrap copper foil tape over it.                      Clamp with the connector case GND plate.</p>			

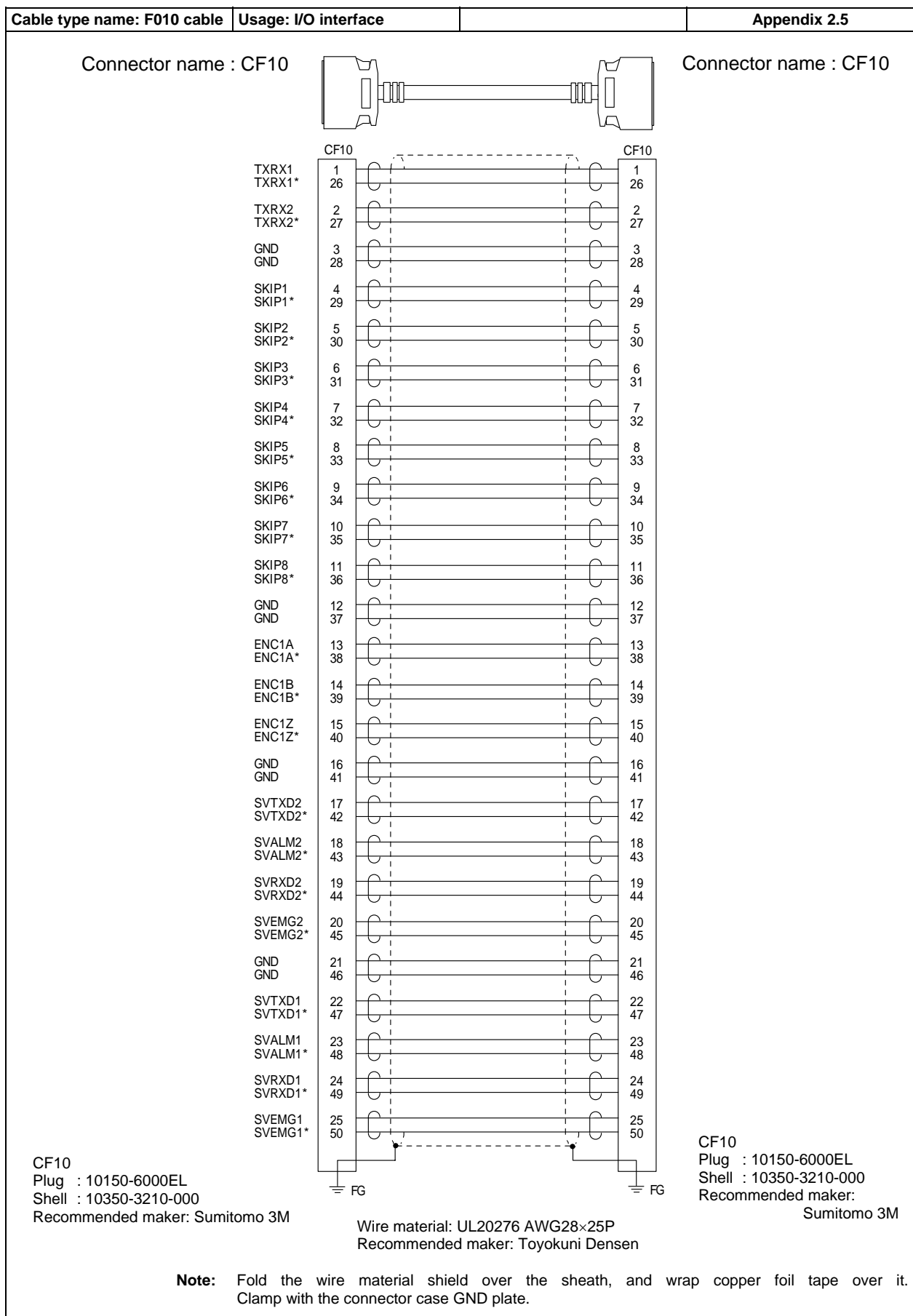
<b>Cable type name:</b> SH41 cable	<b>Usage:</b> Remote I/O		<b>Appendix 2.2</b>												
<p style="text-align: center;">Connector name : RIO1, RIO2, RIO3 (CSH41) <span style="float: right;">Connector name : (CSH41)</span></p>  <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;"> <p>RIO1,RIO2,RIO3(CSH41)</p> <table border="1" style="border-collapse: collapse;"> <tr><td>TXRX</td><td>1</td></tr> <tr><td>TXRX*</td><td>2</td></tr> <tr><td>GND</td><td>3</td></tr> </table> </div> <div style="text-align: center;"> <p>(CSH41)</p> <table border="1" style="border-collapse: collapse;"> <tr><td>1</td><td>TXRX</td></tr> <tr><td>2</td><td>TXRX*</td></tr> <tr><td>3</td><td>GND</td></tr> </table> </div> </div> <div style="margin-top: 20px;"> <p>RIO1, RIO2, RIO3 (CSH41) <span style="float: right;">(CSH41)</span></p> <p>Connector : 1-178288-3 <span style="float: right;">Connector : 1-178288-3</span></p> <p>Contact : 1-175218-2 <span style="float: right;">Contact : 1-175218-5</span></p> <p>Recommended maker: Japan AMP <span style="float: right;">Recommended maker: Japan AMP</span></p> <p style="text-align: center;">Wire material: MVVS 3C×0.3SQ (MIC 3C×0.3SQ)                      Recommended maker: Takeuchi Densen</p> <p style="margin-top: 10px;"><b>Note</b></p> <ol style="list-style-type: none"> <li>1. Protect both side of cable by isolated bush.</li> <li>2. RIO1, RIO2, RIO3 can be used as common.</li> <li>3. Use this cable if the cable length is short such as when bridging between remote I/O units in the same panel.                          Normally, use the FCUA-R11 cable having a high noise resistance level.</li> </ol> </div>				TXRX	1	TXRX*	2	GND	3	1	TXRX	2	TXRX*	3	GND
TXRX	1														
TXRX*	2														
GND	3														
1	TXRX														
2	TXRX*														
3	GND														

**APPENDIX 2 CABLE MANUFACTURING DRAWINGS**

<b>Cable type name: FCUA-R211 cable</b>	<b>Usage: Remote I/O</b>		<b>Appendix 2.3</b>
<p>Connector name : RIO1, RIO2, RIO3 (FCUA-R211)</p> 		<p>Connector name : (FCUA-R211)</p> 	
<p>RIO1,RIO2,RIO3(FCUA-R211)</p> 		<p>(FCUA-R211)</p> 	
<p>RIO1, RIO2, RIO3 (FCUA-R211)  Connector : 1-178288-3  Contact : 1-175218-2  Recommended maker: Japan AMP</p>		<p>(FCUA-R211)  Connector : 1-178288-3  Contact : 1-175218-2  Recommended maker: Japan AMP</p>	
<p>Wire material: MVVS 3C×0.3SQ (MIC 3C×0.3SQ)  Recommended maker: Takeuchi Densen</p>		<p><b>Precautions</b>  1. Protect both ends of the cable with insulated bushing.  2. RIO1, RIO2 and RIO3 can be used commonly.</p>	

<b>Cable type name: R301 cable</b>	<b>Usage: DI/DO</b>		<b>Appendix 2.4</b>
<p>Connector name : DI-L/DO-L, DI-R/DO-R  CF31,CF32, CF33, CF34</p> 			
<p>Connector : 7940-6500SC  Recommended maker: Sumitomo 3M</p>		<p>Connector : 7940-6500SC  Relief : 3448-7940  Recommended maker: Sumitomo 3M</p>	
<p>Wire material: B40-S  Recommended maker: Oki Densen</p>			

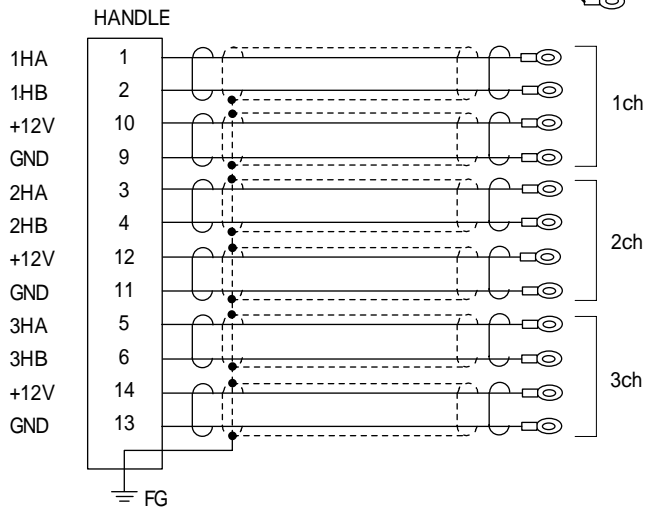
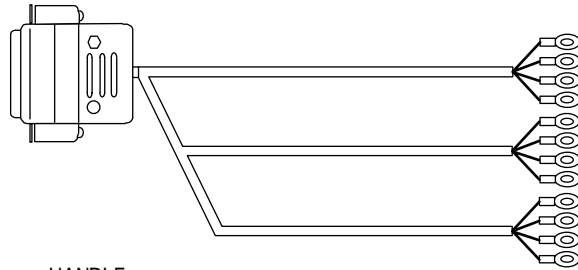
## APPENDIX 2 CABLE MANUFACTURING DRAWINGS



## APPENDIX 2 CABLE MANUFACTURING DRAWINGS

Cable type name: F020 cable	Usage: Manual pulse generator	Appendix 2.6
-----------------------------	-------------------------------	--------------

Connector name : HANDLE



Cable name	1ch	2ch	3ch
F020 cable	○		
F021 cable	○	○	
F022 cable	○	○	○

**Note:**  
○ means channels which are used.

Connector : CDA-15P  
 Contact : CD-PC-111  
 Case : HDA-CTH  
 Recommended maker: Hirose Denki

Crimp terminal: V1.25-3  
 Recommended maker: Japan Solderless

Wire material: B-22 (19) U×2SJ-1×9  
 Recommended maker: Sumitomo Denko

**Note:** Fold the wire material shield over the sheath, and wrap copper foil tape over it.  
 Clamp with the connector case GND plate.

## APPENDIX 2 CABLE MANUFACTURING DRAWINGS

<b>Cable type name:</b> F030 cable	<b>Usage:</b> RS-232-C	<b>Appendix 2.7</b>
------------------------------------	------------------------	---------------------

Connector name : CF21 or CF22 Connector name : CH1

CF21(CF22)

SD1(SD3)	2
RD1(RD3)	3
RS1(RS3)	4
CS1(CS3)	5
DR1(DR3)	6
ER1(ER3)	20
CD3	8
RI3	9
GND	7

FG

CH1

2
3
4
5
6
20
8
9
7

F installation plate:  
Refer to Appendix 1  
(F installation plate  
outline drawing).

**Note:**  
1. The signal names given in  
parentheses are equivalent to  
CF22.

<p>CF21 or CF22 Connector : CDB-25P Contact : CD-PC-111 Case : HDB-CTH Recommended maker: Hirose Denki</p>	<p>Connector : CDB-25S Contact : CD-SC-111 Cable clamp: HD-LNA Recommended maker: Hirose Denki</p>
--	--

Wire material: DPVVS<sub>B</sub> 6P×0.2SQ (DPVVS<sub>B</sub> 12P×0.2SQ)  
Recommended maker: Banto Electric Wire

**Note:** Fold the wire material shield over the sheath, and wrap copper foil tape over it.  
Clamp with the connector case GND plate.

<b>Cable type name:</b> F032 cable	<b>Usage:</b> RS-232-C	<b>Appendix 2.8</b>
------------------------------------	------------------------	---------------------

Connector name : CF21 or CF22 Connector name : CH2

CF21(CF22)

SD2(SD4)	14
RD2(RD4)	16
RS2(RS4)	19
CS2(CS4)	17
DR2(DR4)	21
ER2(ER4)	15
CD4	18
RI4	22
GND	24

FG

CH2

2
3
4
5
6
20
8
9
7

F installation plate:  
Refer to Appendix 1  
(F installation plate  
outline drawing).

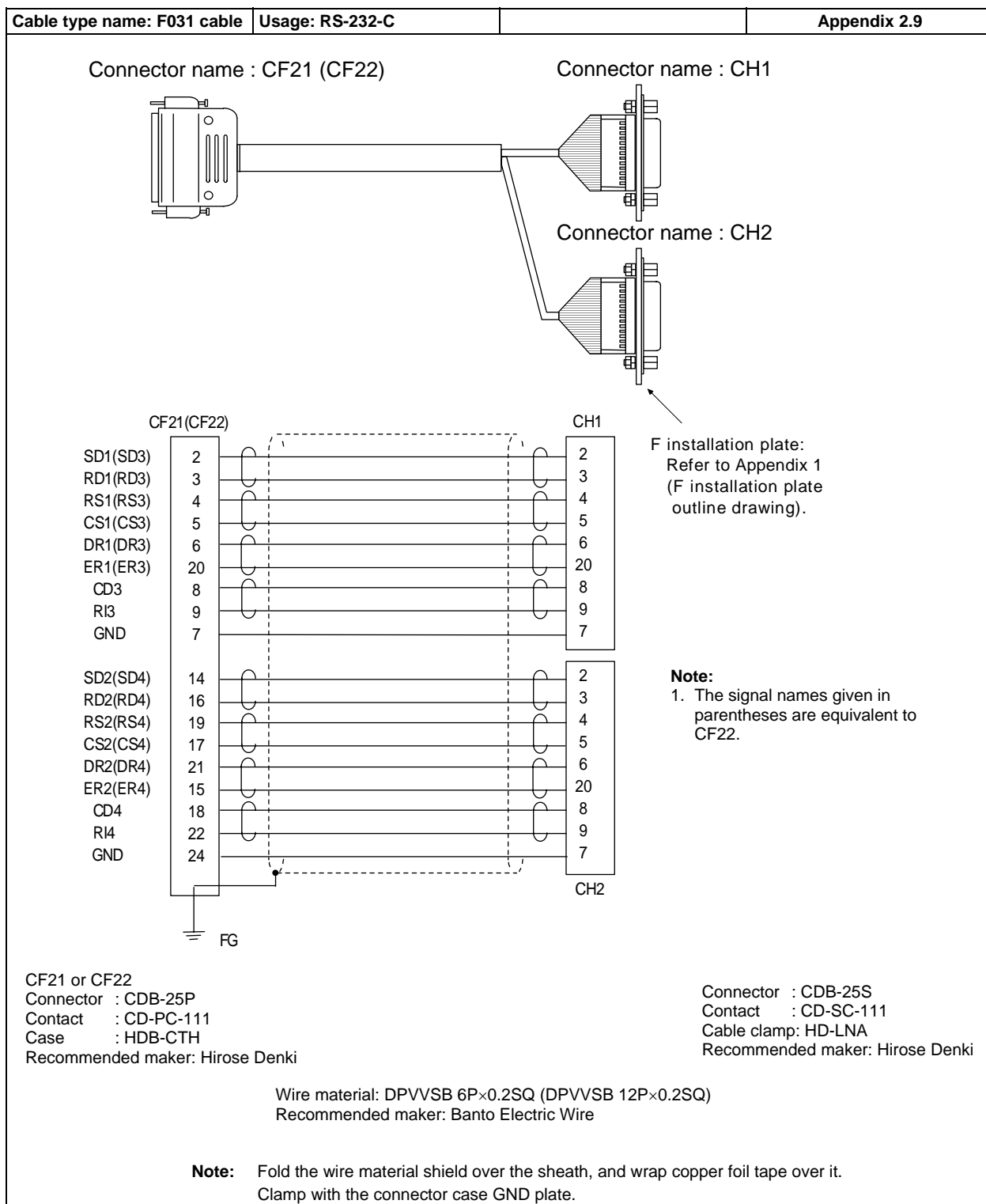
**Note:**  
1. The signal names given in  
parentheses are equivalent to  
CF22.

<p>CF21 or CF22 Connector : CDB-25P Contact : CD-PC-111 Case : HDB-CTH Recommended maker: Hirose Denki</p>	<p>Connector : CDB-25S Contact : CD-SC-111 Cable clamp: HD-LNA Recommended maker: Hirose Denki</p>
--	--

Wire material: DPVVS<sub>B</sub> 6P×0.2SQ (DPVVS<sub>B</sub> 12P×0.2SQ)  
Recommended maker: Banto Electric Wire


**Note:** Fold the wire material shield over the sheath, and wrap copper foil tape over it.  
Clamp with the connector case GND plate.

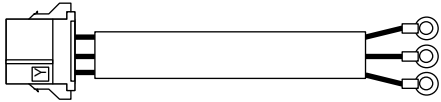
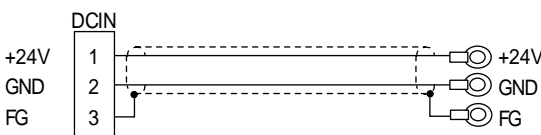
## APPENDIX 2 CABLE MANUFACTURING DRAWINGS

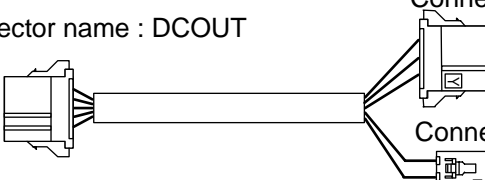
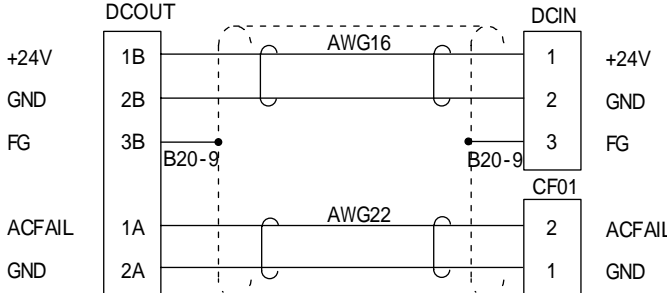




## APPENDIX 2 CABLE MANUFACTURING DRAWINGS

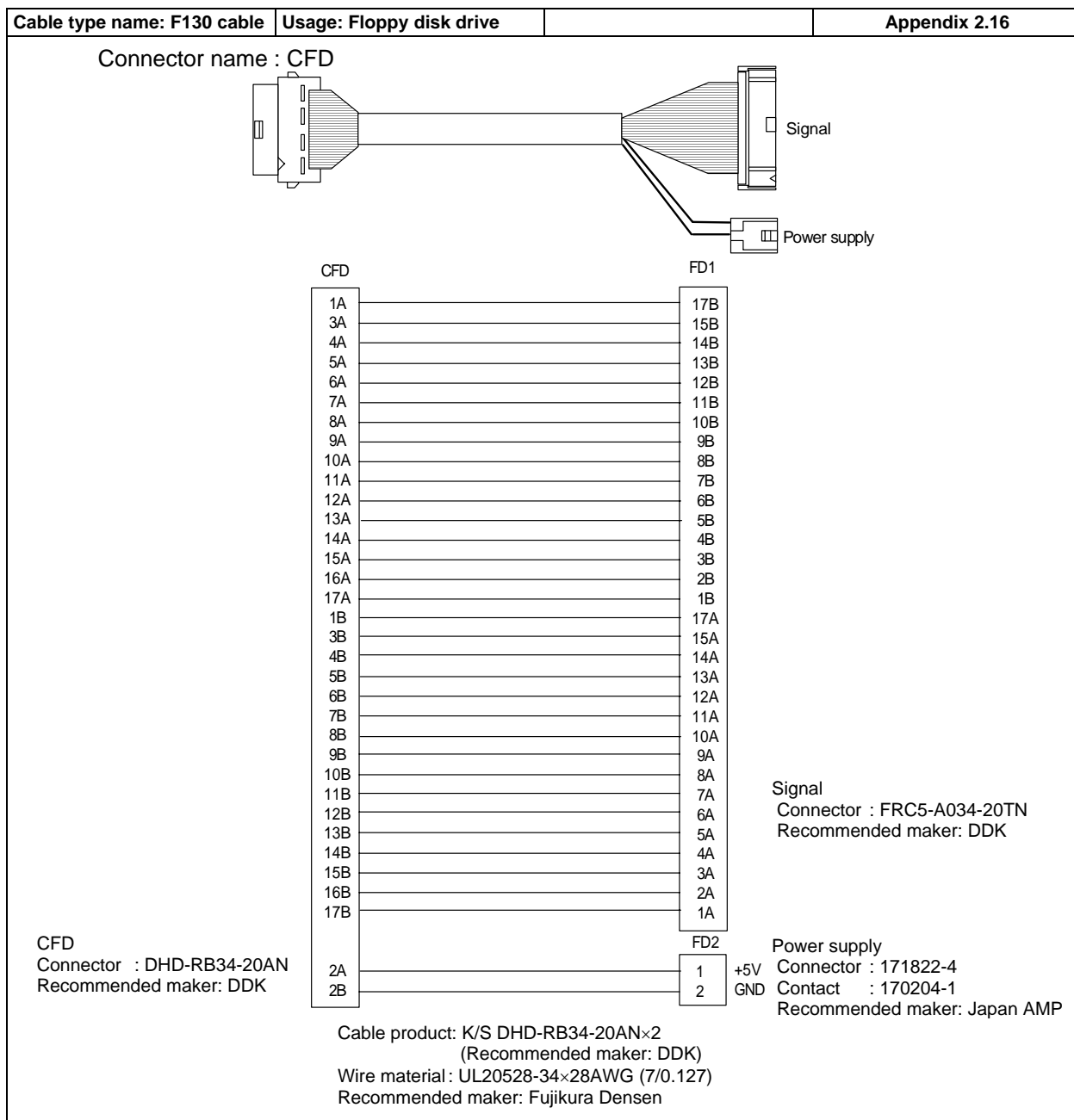
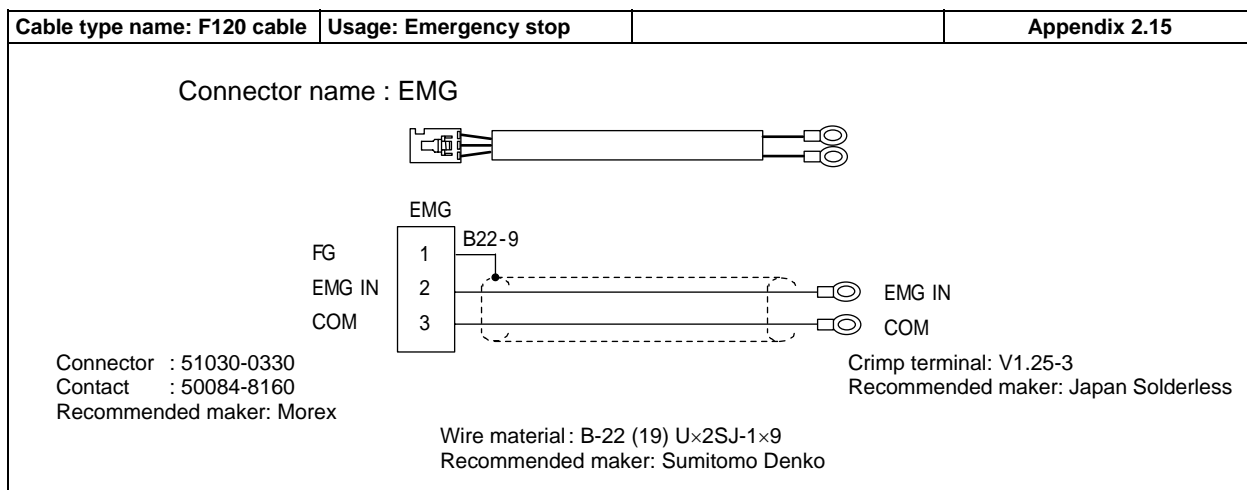
<b>Cable type name: F060 cable</b>	<b>Usage: PC INTERFACE</b>	<b>Appendix 2.12</b>
<p>Connector name : CF12 <span style="float: right;">Connector name : CF12</span></p>  <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> <p>CF12 Connector : DHD-RB26-20AN Recommended maker: DDK</p> </div> <div style="width: 30%; text-align: center;"> <p>Cable name : K/S DHD-RB26-20AN×2 (Recommended maker: DDK) Wire material: UL20528-26×28AWG (7/0.127) Recommended maker: Fujikura Densen</p> </div> <div style="width: 30%; text-align: right;"> <p>CF12 Connector : DHD-RB26-20AN Recommended maker: DDK</p> </div> </div>		

<b>Cable type name: F070 cable</b>	<b>Usage: +24V input</b>	<b>Appendix 2.13</b>
<p>Connector name : DCIN</p>  <div style="display: flex; justify-content: center; margin-top: 10px;">  </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> <p>Connector : 2-178288-3 Contact : 1-175218-5 Recommended maker: Japan AMP</p> </div> <div style="width: 30%; text-align: center;"> <p>Wire material: B-18 (19) U×2SJ-1×9 Recommended maker: Sumitomo Denko</p> </div> <div style="width: 30%; text-align: right;"> <p>Crimp terminal: V1.25-3 Recommended maker: Japan Solderless</p> </div> </div>		

<b>Cable type name: F110 cable</b>	<b>Usage: +24V input, power off detection</b>	<b>Appendix 2.14</b>
<p>Connector name : DCOUT <span style="float: right;">Connector name : DCIN</span></p>  <div style="display: flex; justify-content: center; margin-top: 10px;">  </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> <p>Connector : 3-178127-6 Contact : 1-175218-5 (for AWG16) : 1-175217-5 (for AWG22) Recommended maker: Japan AMP</p> </div> <div style="width: 30%; text-align: center;"> <p>Wire material: UL2464 2×22AWG+2×16AWG SS-95138 Recommended maker: Banto Electric Wire</p> </div> <div style="width: 30%; text-align: right;"> <p>Connector : 2-178288-3 Contact : 1-175218-5 Recommended maker: Japan AMP</p> <p>Connector : 51030-0230 Contact : 50084-8160 Recommended maker: Morex</p> </div> </div>		

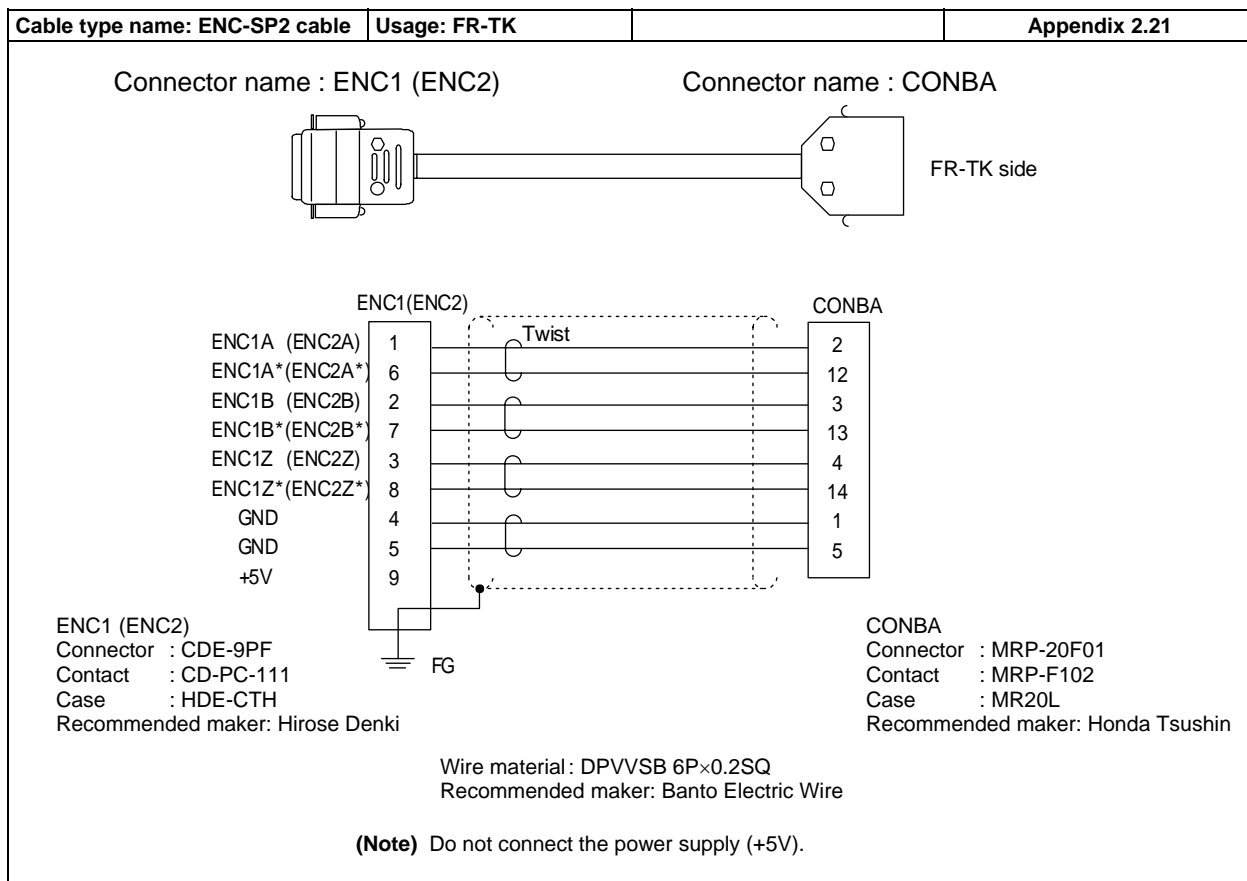
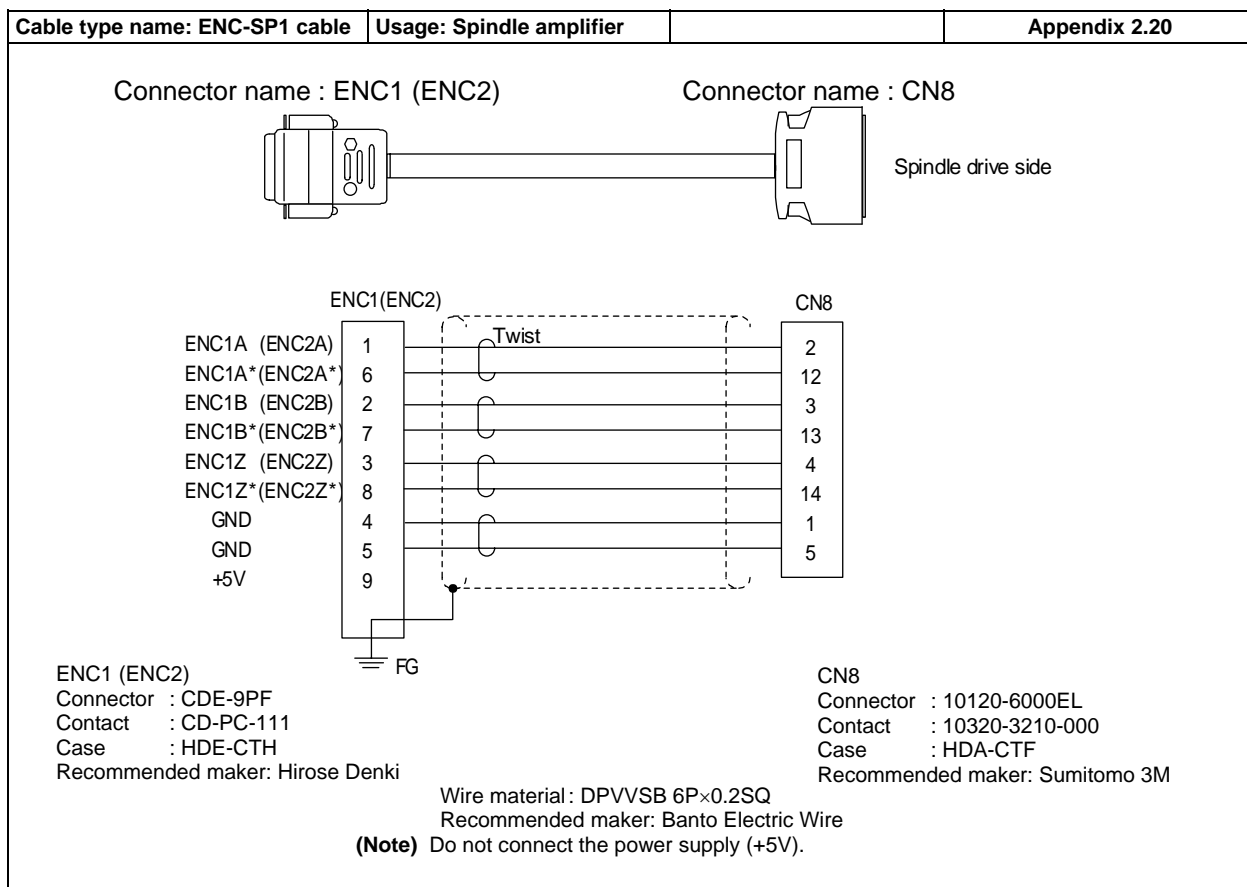


**APPENDIX 2 CABLE MANUFACTURING DRAWINGS**





## APPENDIX 2 CABLE MANUFACTURING DRAWINGS



## APPENDIX 3 EMC INSTALLATION GUIDELINES

This section is an excerpt of the "EMC Installation Guidelines BNP-B2230". Only the pages related to the M600 Series are given.  
Refer to the "EMC Installation Guidelines [BNP-B8582-45]" for details on the drive section (servo amplifier/spindle amplifier).

### 1. Introduction

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

As the NC unit is a component designed to control machine tools, it is believed that it is not a direct EMC Instruction subject. However, we would like to introduce the following measure plans to back up EMC Instruction 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 Instructions 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.

This section corresponds to the following Series.

MELDAS 600 Series

Matters related to the EMC measures in this manual have a priority over the details given in the Connection Manual.

**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**2. EMC Instructions**

---

**2. EMC Instructions**

The EMC Instructions 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 below in Table 1. It is assumed that the Standards and test details required for a machine tool are the same as these.

Class	Name	Details	EMC	Standard
Emission	Radiated noise	Restriction of electromagnetic noise radiated through the air	EN50081-2 EN61800-3 (Industrial environment)	EN55011 (CLASS: A)
	Conductive noise	Restriction of electromagnetic noise discharged from power supply line		
Immunity	Static electricity electrical discharge	<b>Example)</b> Regulation of withstand level of static electricity accumulated in human body	EN50082-2 EN61800-3 (Industrial environment)	IEC61000-4-2
	Radiation immunity	<b>Example)</b> Simulation of immunity from digital wireless telephones		IEC61000-4-3
	Burst immunity	<b>Example)</b> Regulation of withstand level of noise from relay or live wire being inserted or removed		IEC61000-4-4
	Conductive immunity	<b>Example)</b> Regulation of withstand level of noise flowed from power supply wires, etc.		IEC61000-4-6
	Power supply frequency field	<b>Example)</b> Regulation of electromagnetic noise of 50/60Hz power supply frequency		IEC61000-4-8
	Power supply dip (fluctuation)	<b>Example)</b> Regulation of power voltage drop withstand level		IEC61000-4-11
	Surge	<b>Example)</b> Regulation of withstand level of noise caused by lightning		IEC61000-4-5

### **3. EMC Measures**

The main items relating to EMC measures include the following.

- (1) Store the device in an electrically sealed metal panel.
- (2) Ground all conductors that are floating electrically. Decrease the impedance.
- (3) Increase the distance between the power cable 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.

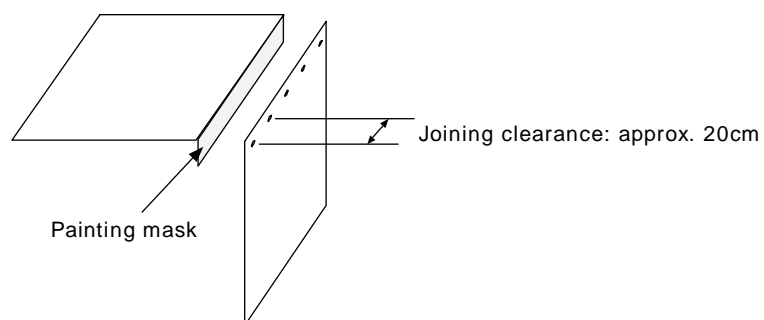
- (1) Accurately ground the devices.
- (2) Use shielded cables.
- (3) Increase the electrical seal of the panel. Reduce the gaps and holes.

## 4. Panel Structure

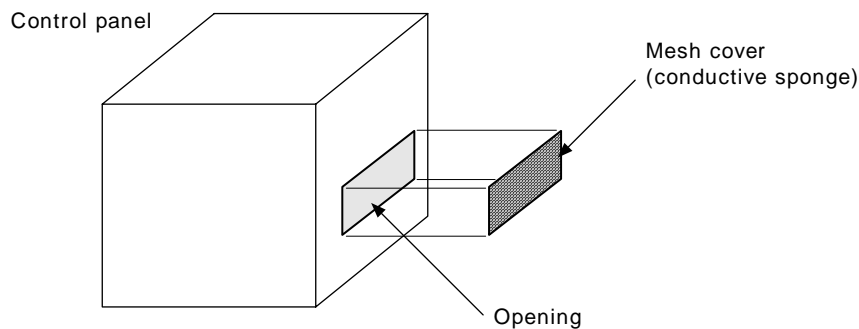
The design of the panel is a very important factor for the EMC measures, so take the following measures into consideration.

### 4.1 Measures for Control Panel Body

- (1) Use metal for all members configuring the panel.
- (2) When joining the top plate and side plates, etc., 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.

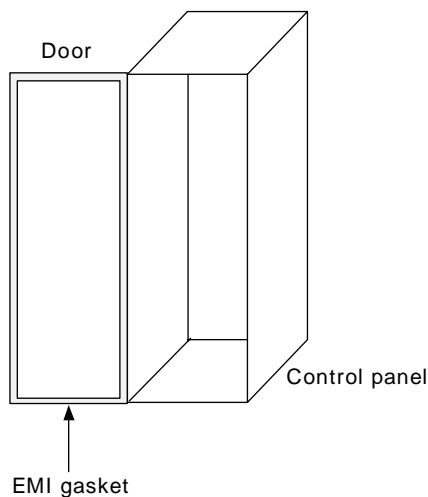


- Using screws to fix the plates that have been painted is the same as an insulated state. Peel the paint and fix the screws.

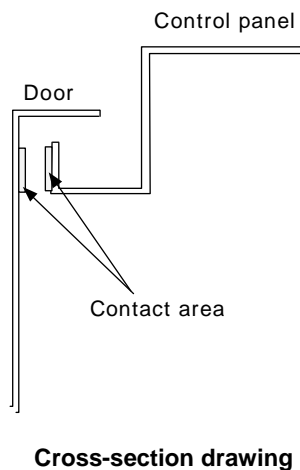
## 4.2 Measures for Door

- (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.

### a) Use of gasket



### b) Large contact area



- The EMI gasket or conductive packing must contact a uniform and correct position of the metal surface.
- 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.**

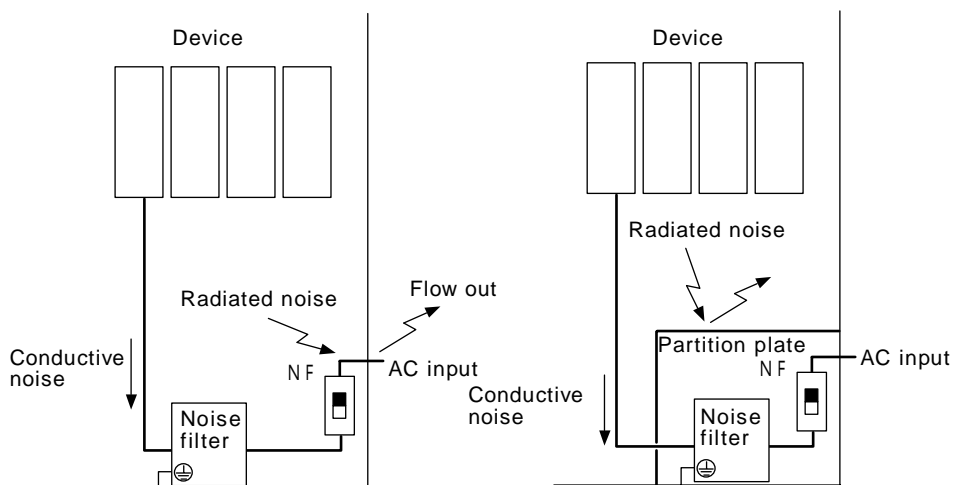


## APPENDIX 3 EMC INSTALLATION GUIDELINES

### 4. Panel Structure

#### 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

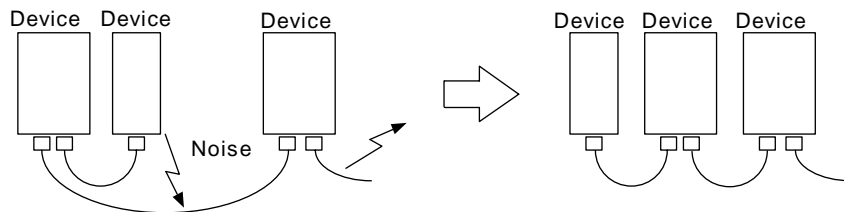
- Selection of the noise filter capacity will differ according to the drive amplifier and devices being used.  
Refer to the "EMC Installation Guidelines" NC Servo Amplifier Section [BNP-B8582-45].

## 5. Measures for Wiring in Panel

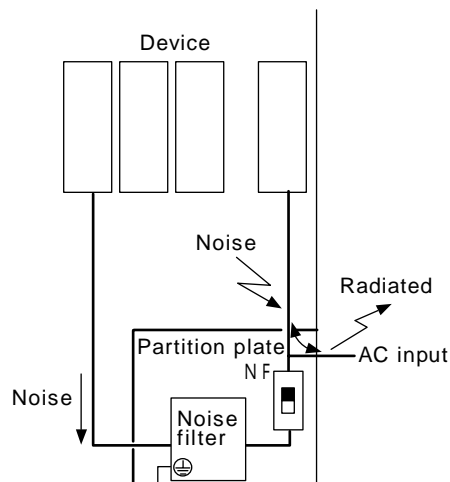
Cables act as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated. The following measures must be sufficiently considered for the cables (SH21/F010/FCUA-R211) that carry out high-speed communication.

### 5.1 Precautions for Wiring in Panel

- (1) If the cables are led unnecessary in the panel, they will be contaminated by noise. Thus, keep the device layout and wiring length as short as possible.



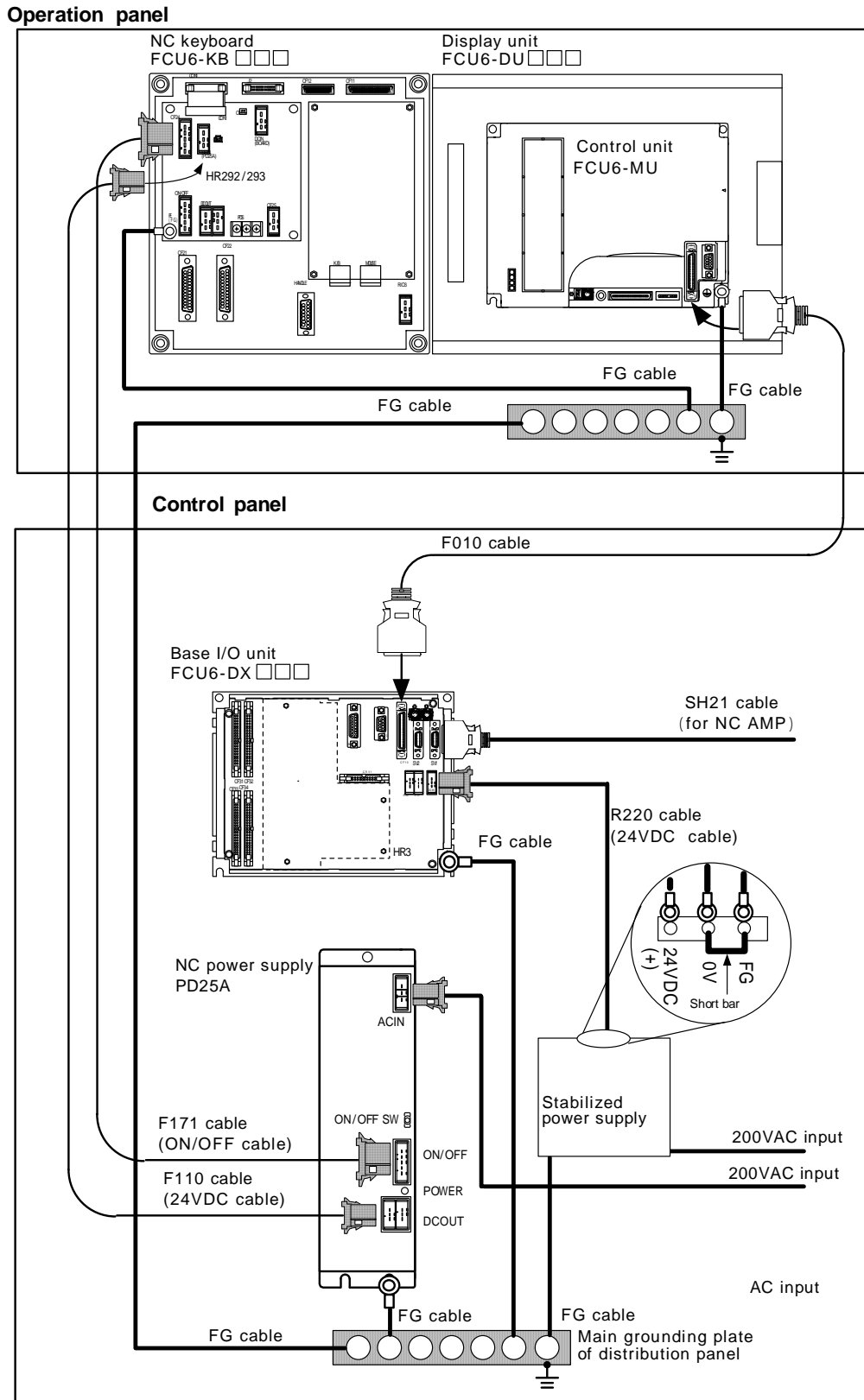
- (2) Always connect the grounding wire to the FG terminal indicated on the device.
- (3) Keep the distance between the power cable and detector cable to the drive section motor as far apart as possible when wiring.
- (4) Do not lead the power wire around the panel without using a filter.



**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**5. Measures for Wiring in Panel**

**5.2 NC Unit Grounding Wire**

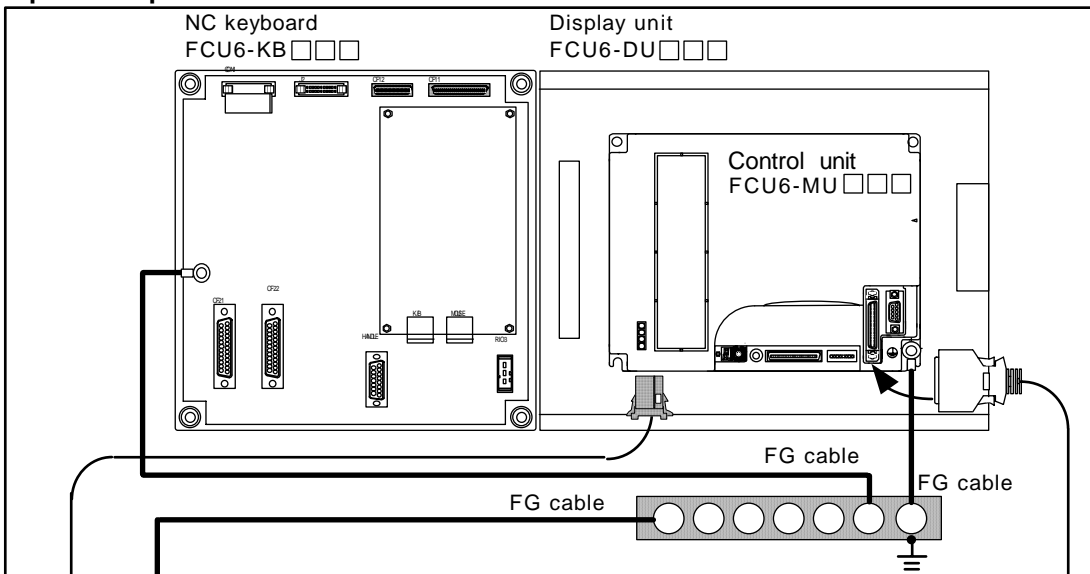
**(1) Example of grounding connection for M6□5 Series**



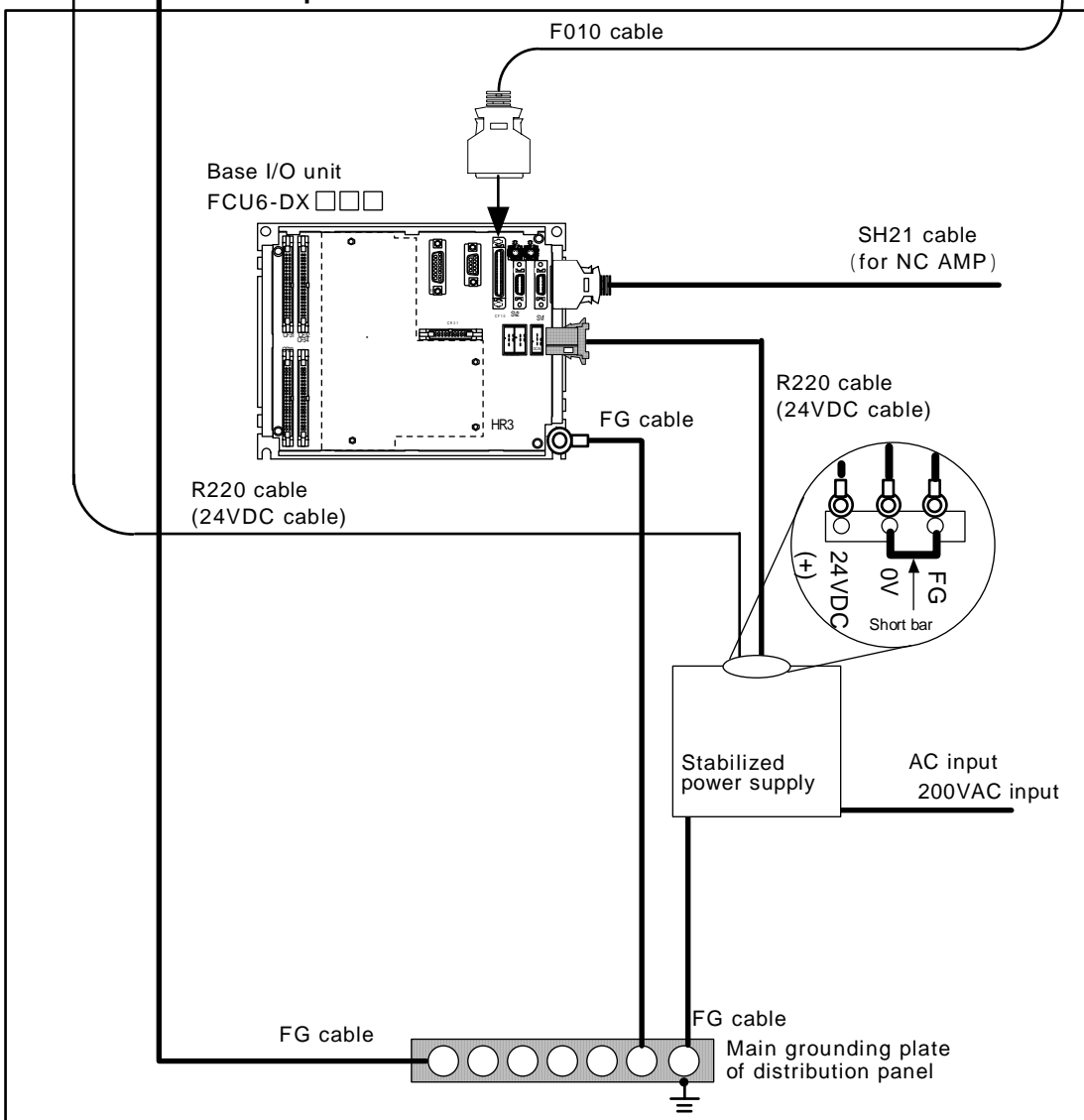
**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**5. Measures for Wiring in Panel**

**(2) Example of grounding connection for M6□0 Series**

**Operation panel**



**Control panel**



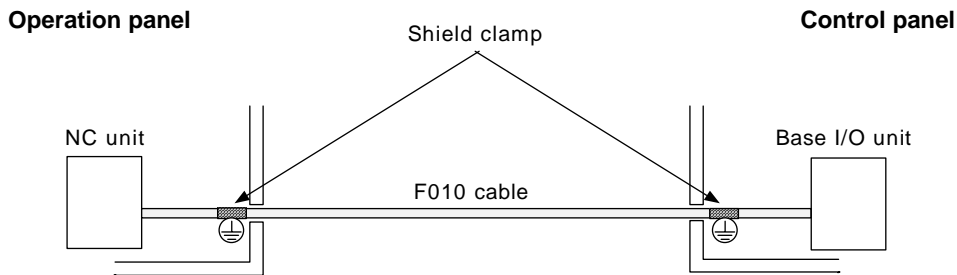
**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**5. Measures for Wiring in Panel**

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**5.3 Shield Treatment of Cables**

Use shielded cables for the cables wired outside the panel in the MELDAS600/64 Series. Use a shield clamp (refer to section 6.1) within 10cm of the lead-out port from the panel.

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

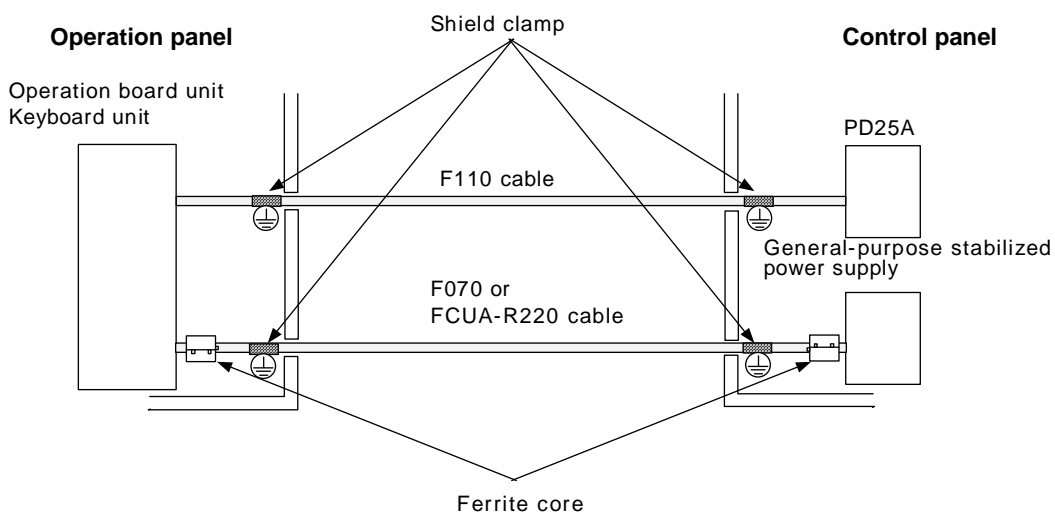


- Always use the shield clamp on both ends of the connected units.



- 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 [F110/070/FCUA-R220 cable]**



- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.

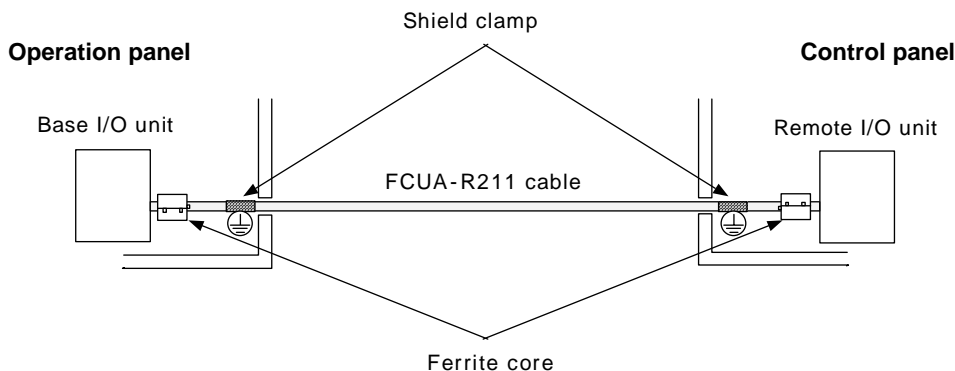


- Always install a ferrite core (refer to section 6.2) on the general-purpose stabilized power supply.  
 (The ferrite core may not be required depending on the selected power supply.)

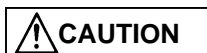
**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**5. Measures for Wiring in Panel**

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

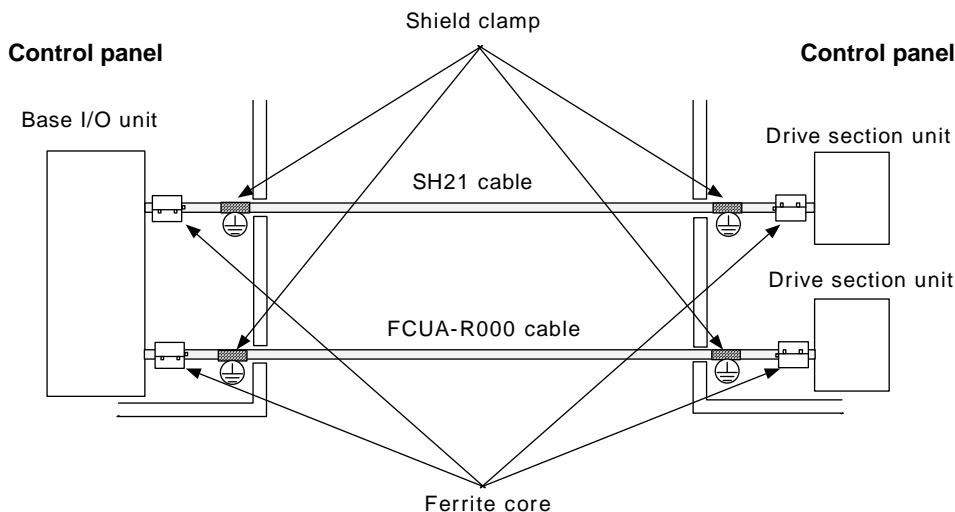


- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.



- The shield clamp is 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]**



- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.



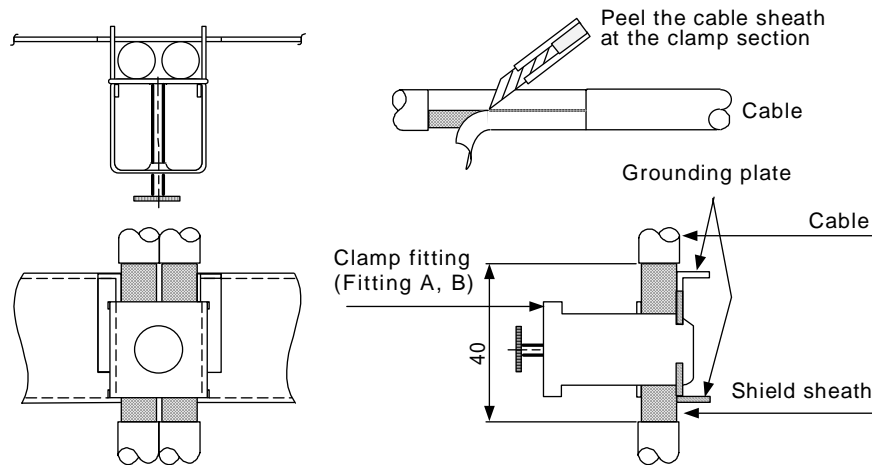
- The shield clamp is not required if the base I/O unit and drive section unit are wired in the same panel.

**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**6. Parts for EMC Measures**

**6. Parts for EMC Measures**

**6.1 Shield Clamp Fitting**

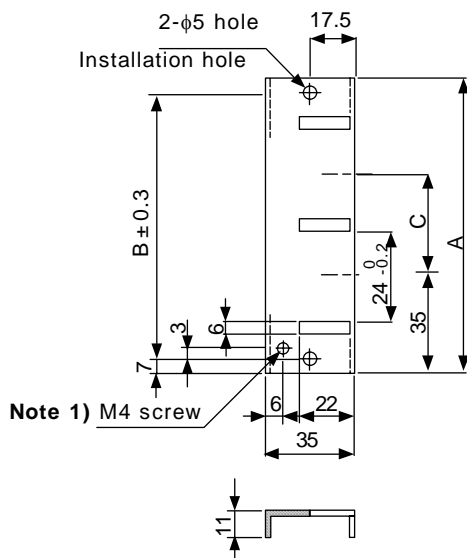
The ground can be directly connected to the grounding plate to increase the effect. Install the grounding plate near the outlet (within 10cm) of each panel, and press against the grounding plate with the clamp fitting. If the cables are thin, several can be bundled and clamped together. To provide sufficient frame grounding, install the grounding plate directly on the cabinet or connect with a grounding wire. If the grounding plate and clamp fitting set (AERSBA-□SET) is required, please contact Mitsubishi.



**Clamp section drawing**

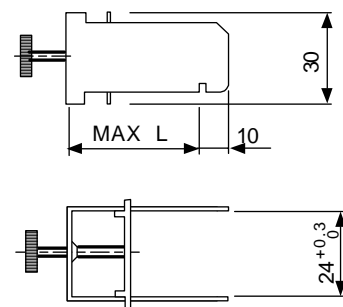
• **Outline drawing**

**Grounding plate**



**Note 1)** M4 screw

**Clamp fitting**



Unit: mm

**Note 1)** Screw hole for wiring to cabinet's grounding plate.  
**Note 2)** The grounding plate thickness is 1.6mm.

	A	B	C	Enclosed fitting		L
AERSBAN-DSET	100	86	30	Two A clamp fittings	A clamp fitting	70
AERSBAN-ESET	70	56	—	One B clamp fitting	B clamp fitting	45

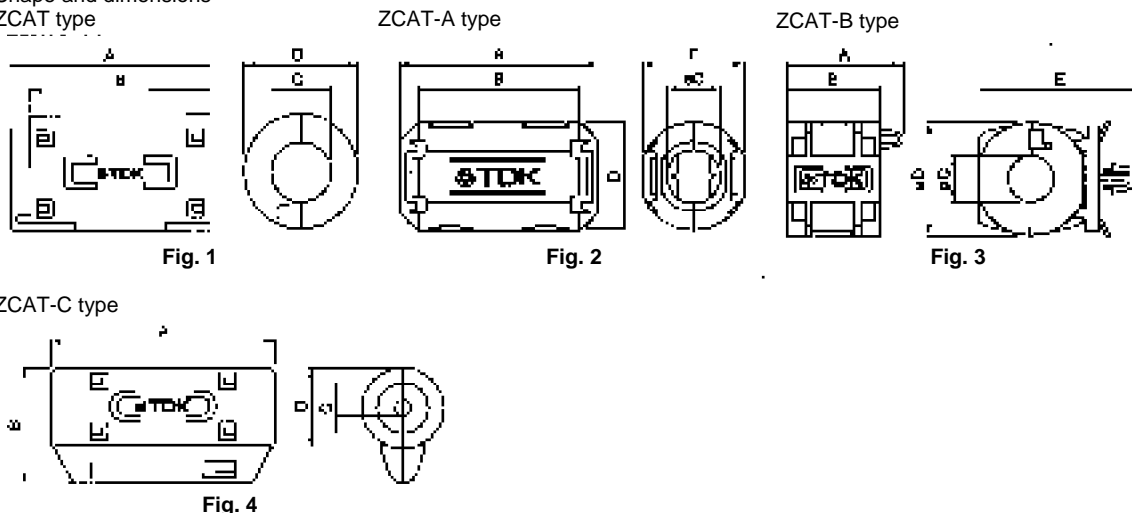
**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**6. Parts for EMC Measures**

**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

Shape and dimensions  
 ZCAT type



⊙ Recommended ferrite core

Unit: mm

Part name	Fig.	A	B	φC	φD	E	Applicable cable outer diameter	Weight (g)
ZCAT1518-0730-M (-BK) <sup>*1</sup>	1	22±1	18±1	7±1	15±1	—	7max.	6
ZCAT1518-0730-M (BK) <sup>*2</sup>	1	22±1	18±1	7±1	15±1	—	7max.	6
ZCAT2017-0930-M (-BK)	1	21±1	17±1	9±1	20±1	—	9max.	11
ZCAT2032-0930-M (-BK) <sup>*1</sup>	1	36±1	32±1	9±1	19.5±1	—	9max.	22
ZCAT2032-0930-M (-BK) <sup>*2</sup>	1	36±1	32±1	9±1	19.5±1	—	9max.	22
ZCAT2132-1130-M (-BK) <sup>*1</sup>	1	36±1	32±1	11±1	20.5±1	—	11max.	22
ZCAT2132-1130-M (-BK) <sup>*2</sup>	1	36±1	32±1	11±1	20.5±1	—	11max.	22
ZCAT3035-1330-M (-BK) <sup>*1</sup>	1	39±1	34±1	13±1	30±1	—	13max.	63
⊙ ZCAT3035-1330-M (-BK) <sup>*2</sup>	1	39±1	34±1	13±1	30±1	—	13max.	63
ZCAT1325-0530A-M (-BK) <sup>*1</sup>	2	25±1	20±1	5±1	12.8±1	11.2±1	3 ~ 5 (USB)	7
ZCAT1325-0530A (-BK)	2	25±1	20±1	5±1	12.8±1	11.2±1	3 ~ 5 (USB)	7
ZCAT1730-0730A-M (-BK)	2	30±1	23±1	7±1	16.5±1	15±1	4 ~ 7 (USB/IEE1394)	12
ZCAT2035-0930A-M (-BK) <sup>*1</sup>	2	35±1	28±1	9±1	19.5±1	17.4±1	6 ~ 9	22
ZCAT2035-0930A (-BK)	2	35±1	28±1	9±1	19.5±1	17.4±1	6 ~ 9	22
ZCAT2235-1030A-M (-BK)	2	35±1	28±1	10±1	21.5±1	20±1	8 ~ 10	27
ZCAT2436-1330A-M (-BK)	2	36±1	29±1	13±1	23.5±1	22±1	10 ~ 13	29
ZCAT2017-0930B-M (-BK)	3	21±1	17±1	9±1	20±1	28.5±1	9max.	12
ZCAT2749-0430M (-BK)	4	49±1	27±1	4.5±1	19.5±1	—	4.5max.	26

\*1. The M stamp is attached.

\*2. A fixing band is attached at shipment.

- ZCAT-B type: Cabinet fixing type installation hole φ4.8 to 4.9mm, plate thickness 0.5 to 2mm
- ZCAT-C type: Structure that prevents easy opening after case is closed.



**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**6. Parts for EMC Measures**

**6.3 Surge Protector**

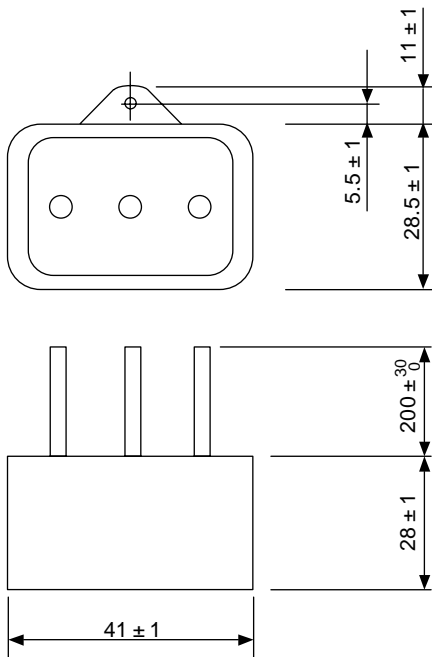
**(1) Surge absorber**

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.

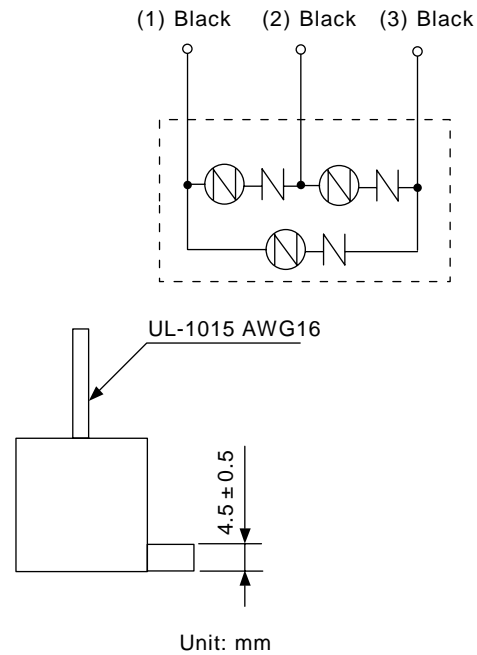
- 1) Part name : RAV-781BYZ-2  
 Manufacturer: Okaya Denki Sangyo

Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage V±10%	Surge resistance level 8/20µSec	Surge with-stand voltage 1.2/50µSec	Static capacity	Working temperature range
250V 3φ	300V	783V	2500A	20kV	75pF	-20 ~ +70°C

**Outline drawing**



**Circuit drawing**



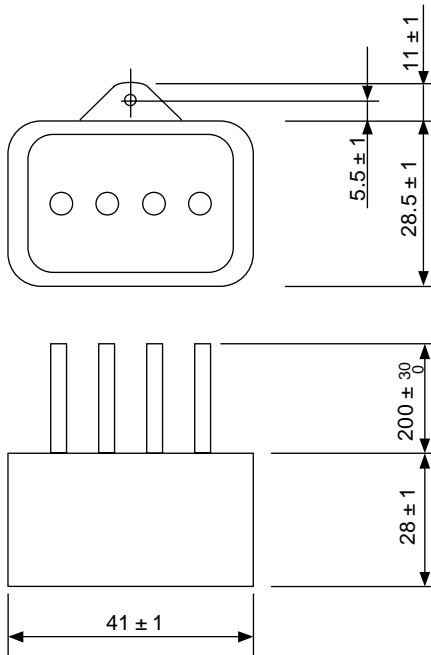
\* Refer to the manufacturer's catalog for details characteristics, outline and connection methods of the surge absorber.

**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**6. Parts for EMC Measures**

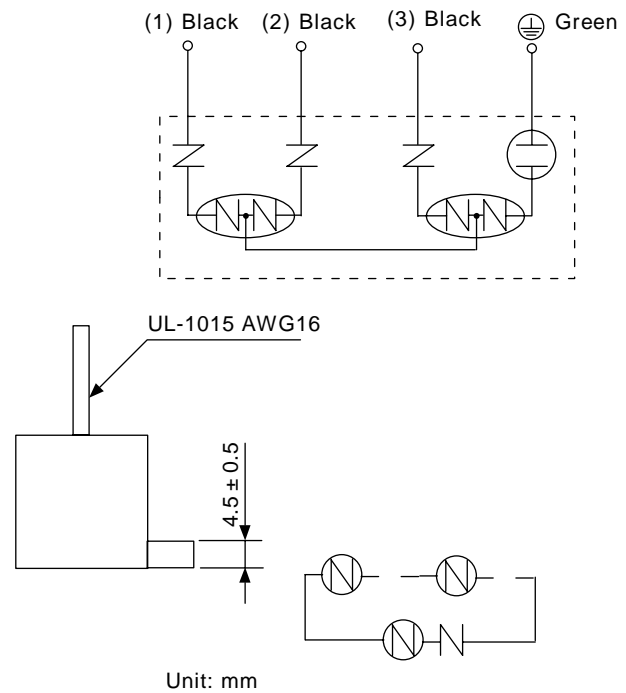
2) Part name : RAV-781BXZ-4  
 Manufacturer: Okaya Denki Sangyo

Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage V±10%	Surge resist-ance level 8/20µSec	Surge with-stand voltage 1.2/50µSec	Static capacity	Working temperature range
250V 3φ	300V	700V	2500A	2kV	75pF	-20 ~ +70°C

**Outline drawing**



**Circuit drawing**

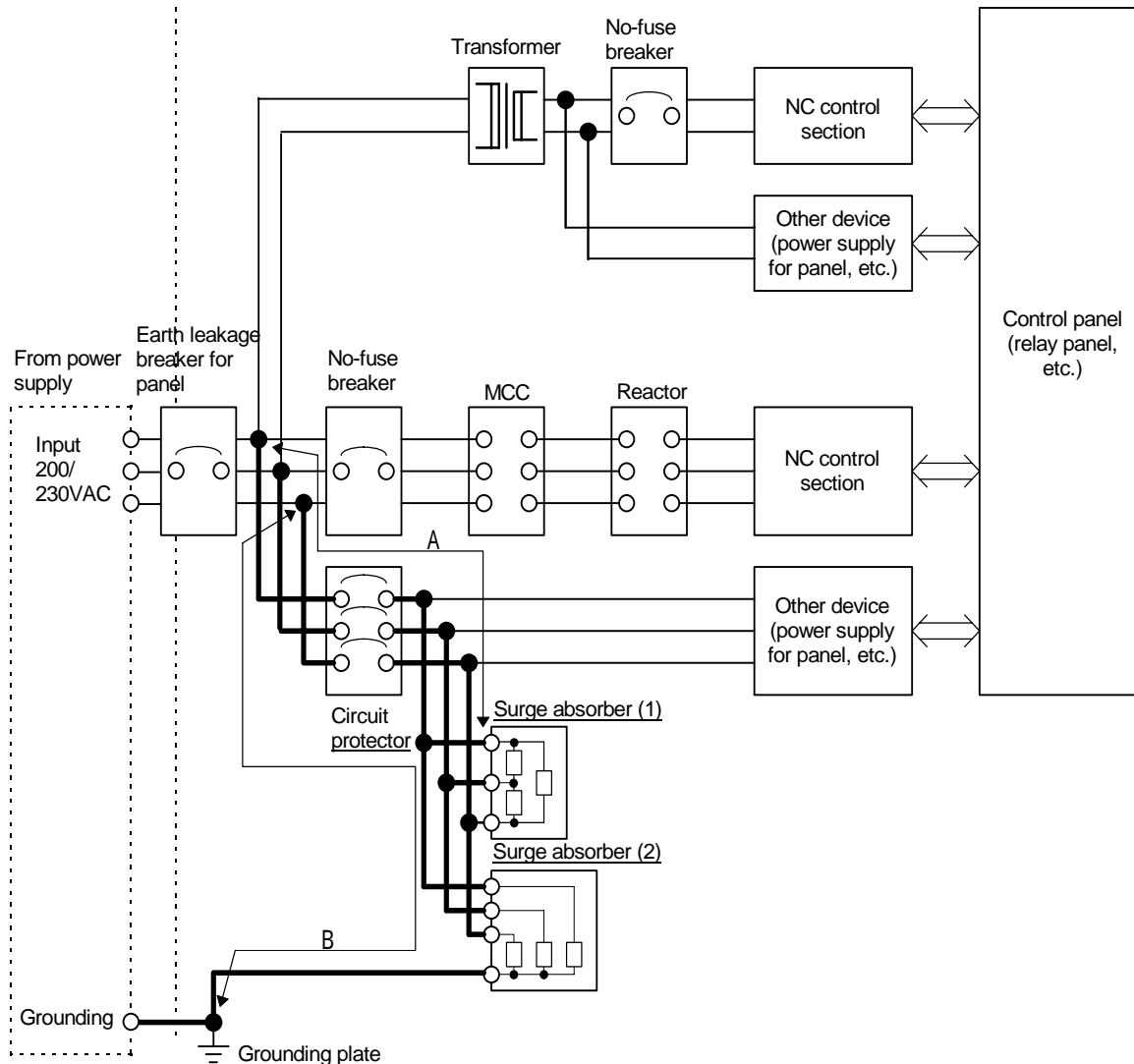


Unit: mm

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

**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**6. Parts for EMC Measures**

**(2) Surge absorber installation method**



**Surge absorber installation method**

**Precautions**

- 1) Thick wires will enhance the lightning surge absorption effect, so keep the wire as short as possible.  
 Wire material : Wire diameter 2mm<sup>2</sup> or more  
 Wire length Connection length (A) to surge absorber (1) is 2m or less.  
 Connection length (B) to surge absorber (2) is 2m or less.
  
- 2) When carrying out a withstand voltage test, while applying an overvoltage (100VAC, 1500VAC) on the power supply line, remove surge absorbers (2) as the surge absorber will function with the applied voltage.
  
- 3) A short-circuit accident 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. The current does not flow constantly to surge absorbers (1) and (2), so the circuit protector can also be used for the other devices.

**APPENDIX 3 EMC INSTALLATION GUIDELINES**  
**6. Parts for EMC Measures**

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#### 6.4 Selection of Stabilized Power Supply

Consider the following characteristics when selecting the stabilized power supply.  
Use a power supply that complies with CE Marking or that follows the safety standards given below.

Stabilized power supply selection items

Item		Symbol		Conditions
Output fluctuation	Voltage fluctuation	%	±5max.	±5% or less of 24VDC output
	Ripple noise	mV	120max.	±5% or less of 24VDC output
	Spike noise	mV	500max.	
Output current		A	—	Refer to the Connection Manual.
Output holding time		ms	20min.	Instantaneous off time

#### Standards

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

## Revision History

Revision	Date of revision	Revision details
*	97/03	First edition was issued.
A	97/04	Mistakes were corrected.
B	97/05	Mistakes were corrected.
C	99/01	Mistakes were corrected.
D	01/9/17	Design of the cover and the back cover were changed. MODEL, MODEL CODE, and Manual No. were added on the back cover.