

Changes for the Better

MITSUBISHI CNC

Connection and Maintenance Manual

M730BM/M750BM








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Introduction

This manual is called MITSUBISHI CNC M730BM/M750BM CONNECTION AND MAINTENANCE MANUAL and covers the items related to installation, connection and maintenance of this NC Control unit. Read this manual thoroughly before using. For safe use, fully understand "Precautions for Safety" on the next page first.

Details described in this manual:

CAUTION

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

Precautions for Safety

Always read this manual and enclosed documents before installation, operation, maintenance and inspection to ensure correct usage. Thoroughly understand the basics, safety information and precautions of the devices before using.

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




When the user could be subject to imminent 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 minor or moderate injuries or the property could be damaged if handling is mistaken.










Note that the items under " **CAUTION**", could lead to serious consequences as well depending on the situation. Please follow all items listed in "Precautions for Safety" as they are equally important.

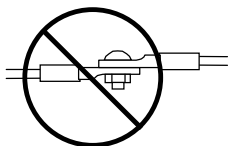
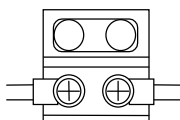
For Safe Use

This product is not designed or manufactured on the assumption that the product will be used for the equipment or systems that are to be subject to any fatal consequences. Please inquire our customer service department about any particular usage other than the normal usage as a machine tool.

1. Items related to prevention of electric shocks






WARNING

-  Do not open or remove the front cover while the power is ON or during operation. The high voltage terminals and charged sections will be exposed, and this could result in electric shocks.
-  Do not remove the front cover even when the power is OFF, except for the wiring works or periodic inspections. The inside of the controller and drive unit are charged, and this could result in electric shocks.
-  Always wait at least 15 minutes after turning the power OFF. Then, check the voltage with a tester, etc., before wiring works, inspections or connecting with peripheral devices. Failure to observe this could result in electric shocks.
-  Earth ground the controller, drive unit and motor according to the local laws. (In Japan, ground the 200V Series input products with Class C or higher protective grounding and the 400V Series input with Class D or higher protective grounding.)
-  All wiring works, maintenance and inspections must be carried out by a qualified technician. Failure to observe this could result in electric shocks. Contact your nearby Service Center or Service Station for replacing parts and servicing.
-  Wire the controller, drive unit and motor after installation. Failure to observe this could result in electric shocks.
-  Do not operate the switches with wet hands. Failure to observe this could result in electric shocks.
-  Do not damage, apply excessive stress, place heavy things on or sandwich the cables. Failure to observe this could result in electric shocks.
-  Insulate the power lead using a fixed terminal block. Failure to observe this could result in electric shocks.




2. Items related to prevention of fire

CAUTION







-  Install the controller, drive unit, motor and regenerative resistor on non-combustible material. Installation directly on or near combustible materials could result in fires.
-  If any malfunction in the unit is observed, shut off the power at the unit's power supply side. Continuous flow of large current could result in fires.
-  Install an appropriate no fuse breaker (NFB) and contactor (MC) on the power input section of the drive unit and configure the sequence that shuts the power off upon drive unit's emergency stop or alarm.
-  When a breaker is shared for multiple power supply units, the breaker may not function upon short-circuit failure in a small capacity unit. Do not share a breaker for multiple units as this is dangerous.
-  Incorrect wiring and connections could cause the devices to damage or burn.

3. Items related to prevention of bodily injury or property damage

DANGER

-  Never look into the optical communication connector. Strong light of short wavelength is coming out from the connector while the power is ON. Failure to observe this could injure your eyes.

CAUTION


















-  Do not apply voltages to the connectors or terminals other than voltages indicated in the connection manual for the controller or specifications manual for the drive unit. Failure to observe this could cause the devices to rupture or damage, etc.
-  Incorrect connections could cause the devices to rupture or damage, etc. Always connect the cables to the indicated connectors or terminals.
-  Incorrect polarity (+ -) could cause the devices to rupture or damage, etc.
-  Persons wearing medical devices, such as pacemakers, must stay away from this unit. The electromagnetic waves could adversely affect the medical devices.
-  Fins on the rear of the unit, regenerative resistor and motor, etc., will be hot during operation and for a while after the power has been turned OFF. Do not touch or place the parts and cables, etc. close to these sections. Failure to observe this could result in burns.
-  Do not enter the machine's movable range during automatic operation. Keep your hands, feet or face away from the spindle during rotation.

4. General Precautions













Always follow the precautions below. Incorrect handling could result in faults, injuries or electric shocks, etc.

(1) Transportation and installation

CAUTION





-  Correctly transport the products according to the mass.
-  Use motor's suspension bolts to transport the motor itself. Do not use it to transport the motor after installation onto the machine.
-  Do not stack the products exceeding the indicated limit.
-  Do not hold the cables, shaft or detector when transporting the motor.
-  Do not transport the controller or drive unit by suspending or holding the connected wires or cables.
-  Do not hold the front cover when transporting the drive unit, or the front cover could come off, causing the unit to drop.
-  Install on a non-combustible place where the unit's or motor's mass can be withstood according to the instruction manual.
-  The motor does not have a complete water-proof (oil-proof) structure. Do not allow oil or water to contact or enter the motor. Prevent the cutting chips from being accumulated on the motor as they easily soak up oil.
-  When installing the motor facing upwards, take measures on the machine side so that gear oil, etc., will not enter the motor shaft.
-  Do not remove the detector from the motor. (The detector installation screw is treated with sealing.)
-  Do not allow foreign matters, especially, conductive foreign matters such as screws or metal chips, or combustible foreign matters such as oil, to enter the controller, drive unit or motor. Failure to observe this could result in rupture or damage.
-  Do not get on the product or place heavy objects on it.
-  Provide prescribed distance between the controller/drive unit and inner surface of the control panel/other devices.
-  Do not install or operate the controller, drive unit or motor that is damaged or has missing parts.
-  Take care not to cut hands, etc. with the heat radiating fins or metal edges.
-  Do not block the intake/outtake ports of the servomotor with the cooling fan.
-  Install the controller's display unit and operation board unit on the spot where cutting oil will not reach.

CAUTION

-  The controller, drive unit and motor are precision devices, so do not drop or apply thumping vibration and strong impacts on them.
-  Hard disk unit is a precision device, so do not drop or apply strong impacts on it.
-  Store and use the units according to the environment conditions indicated in each specifications manual.
-  Securely fix the motor to the machine. The motor could come off during operation if insecurely fixed.
-  Always install the motor with reduction gear in the designated direction. Failure to observe this could result in oil leaks.
-  Always install a cover, etc., over the shaft so that the rotary section of the motor cannot be touched during motor rotation.
-  When installing a coupling to the servomotor shaft end, do not apply impacts by hammering, etc. The detector could be damaged.
-  Use a flexible coupling when connecting with a ball screw, etc., and keep the shaft core deviation smaller than the tolerable radial load of the shaft.
-  Do not use a rigid coupling as an excessive bending load will be applied on the shaft and could cause the shaft to break.
-  Do not apply a load exceeding the tolerable level onto the motor shaft. The shaft or bearing could be damaged.
-  Before using this product after a long period of storage, please contact the Mitsubishi Service Station or Service Center.
-  Following the UN recommendations, battery units and batteries should be transported based on the international regulations such as those determined by International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), International Maritime Organization (IMO) and U.S. Department of Transportation (DOT).

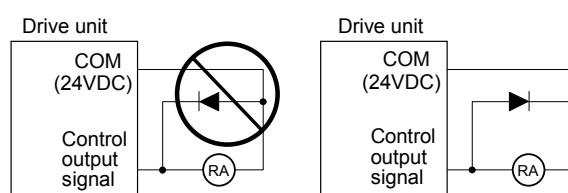
(2) Items related to wiring

CAUTION

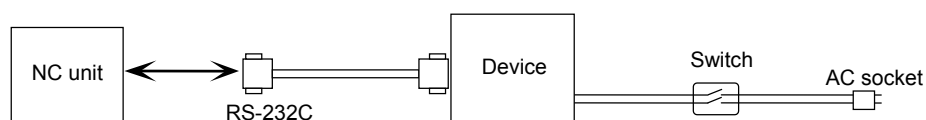
-  Correctly wire this product. Failure to observe this could result in motor runaway, etc.
-  Do not install a phase advancing capacitor, surge absorber or radio noise filter on the output side of the drive unit.
-  Correctly connect the output side (terminal U, V, W). The motor will not run properly if incorrectly connected.
-  Always install an AC reactor per each power supply unit.

⚠ CAUTION

- ⚠ Always install an appropriate breaker per each power supply unit. A breaker cannot be shared for multiple power supply units.
- ⚠ Do not directly connect a commercial power supply to the motor. Failure to observe this could result in faults.
- ❗ When using an inductive load such as relays, always connect a diode in parallel to the load as a noise countermeasure.
- ❗ When using a capacitive load such as a lamp, always connect a protective resistor in series to the load to suppress rush currents.
- ⚠ Do not mistake the direction of the surge absorption diode to be installed on the DC relay for the control output signal. If mistaken, the signal will not be output due to fault in the drive unit, and consequently the protective circuit, such as emergency stop, could be disabled.





- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⚠ Do not connect or disconnect the PCBs while the power is ON.
- ⚠ Do not pull the cables when connecting/disconnecting it.
- ⚠ Securely tighten the cable connector fixing screw or fixing mechanism. Insufficient fixing could result in deviation during operation.
- ⚡ Always treat the shield cables indicated in the Connection Manual with grounding measures such as cable clamps.
- ⚠ Separate the signal wire from the drive line or power line when wiring.
- ⚠ Use wires and cables whose wire diameter, heat resistance level and bending capacity are compatible with the system.
- ⚡ Ground the device according to the requirements of the country where the device is to be used.
- ⚠ Wire the heat radiating fins and wires so that they do not contact.
- ⚠ When using the RS-232C device as a peripheral device, caution must be paid for connector connection/disconnection.
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.
















(3) Adjustments

CAUTION




-  Check and adjust programs and each parameter before starting operation. Failure to observe this could result in unpredictable operations depending on the machine.
-  Do not make drastic adjustments or changes as the operation could become unstable.

(4) Usage

CAUTION






-  Install an external emergency stop circuit so that the operation can be stopped and the power turns OFF immediately when unforeseen situation occurs. A contactor, etc., is required in addition to the shutoff function mounted in the controller.
-  Turn OFF the power immediately if any smoke, abnormal noise or odor is generated from the controller, drive unit or motor.
-  Only a qualified technician may disassemble or repair this product.
-  Do not alter.
-  Use a noise filter, etc. to reduce the effect of electromagnetic disturbances in the case where electromagnetic disturbances could adversely affect the electronic devices used near the drive unit.
-  Use the drive unit, motor and each regenerative resistor with the designated combination. Failure to observe this could result in fires or faults.
-  The combination of the motor and drive unit that can be used is determined. Be sure to check the models of motor and drive unit before test operation.
-  The brakes (electromagnetic brakes) mounted in the motor are used for the purpose of holding, and must not be used for normal braking. Also, do not run the motor with the motor brake applied. Motor brake is used for the purpose of holding.
-  For the system running via a timing belt, install a brake on the machine side so that safety can be ensured.
-  Be sure to confirm SERVO OFF (or READY OFF) when applying the electromagnetic brake. Also, be sure to confirm SERVO ON prior to releasing the brake.
-  When using the DC OFF type electromagnetic brake, be sure to install a surge absorber on the brake terminal.
-  Do not connect or disconnect the cannon plug while the electromagnetic brake's power is ON. The cannon plug pins could be damaged by sparks.
-  After changing programs/parameters, or after maintenance/inspection, always carry out a test operation before starting actual operation.

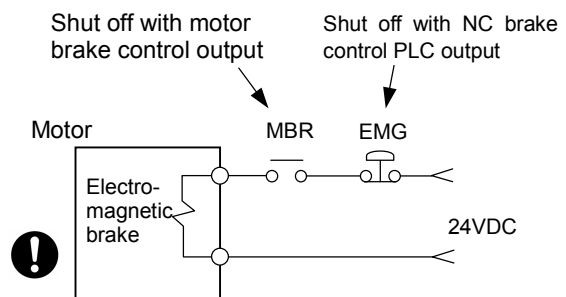
CAUTION

-  Use the power that are complied with the power specification conditions (input voltage, input frequency, tolerable instantaneous power failure time) indicated in each specifications manual.
-  When making detector cables, do not mistake connection. Failure to observe this could result in malfunction, runaway or fire.
-  When using NC Card, first power ON the NC Card, and then the base I/O unit. If the base I/O unit is powered ON first, current flows from the connection cable to the NC Card, resulting in malfunction in the PC or the cards installed in the PC.

(5) Troubleshooting










CAUTION

-  Use a motor with electromagnetic brakes or establish an external brake mechanism for the purpose of holding; this serves as countermeasures for possible hazardous situation caused by power failure or product fault.
-  Use a double circuit structure for the electromagnetic brake's operation circuit so that the brakes will activate even when the external emergency stop signal is issued.
-  The machine could suddenly restart when the power is restored after an instantaneous power failure, so stay away from the machine. (Design the machine so that the operator safety can be ensured even if the machine restarts.)
-  To secure the absolute position, do not shut off the servo drive unit's control power supply when its battery voltage drops (warning 9F) in the servo drive unit side.
-  If the battery voltage drop warning alarm occurs in the controller side, make sure to back up the machining programs, tool data and parameters, etc. with the input/output device before replacing the battery.
Depending on the level of voltage drop, memory loss could have happened. In that case, reload all the data backed up before the alarm occurrence.






(6) Maintenance, inspection and part replacement

CAUTION

-  Periodically back up the programs, tool data and parameters to avoid potential data loss. Also, back up those data before maintenance and inspections.
-  When replacing the battery on the controller side, the machining programs, tool data and parameters, should be backed up with the input/output device beforehand.
In case the memory is damaged in replacing the batteries, reload all the data backed up before replacing the battery.
-  The electrolytic capacitor's capacity will drop due to deterioration. To prevent secondary damage due to capacitor's faults, Mitsubishi recommends the electrolytic capacitor to be replaced approx. every five years even when used in a normal environment. Contact the Service Center or Service Station for replacements.
-  Do not perform a megger test (insulation resistance measurement) during inspection.
-  Do not replace parts or devices while the power is ON.
-  Do not short-circuit, charge, overheat, incinerate or disassemble the battery.
-  The hard disk unit has a service life, and must be replaced before its expiration.
-  As a precautionary measure, always back up the customer's data stored in the hard disk unit. The safety of the customer's data stored in the hard disk unit cannot be guaranteed.
-  There may be a unit filled with substitute Freon in the heat radiating fins of the 37kW or smaller unit. Be careful not to break the heat radiating fins during maintenance or replacement.

(7) Disposal

CAUTION

-  Take the batteries and backlights for LCD, etc., off from the controller, drive unit and motor, and dispose of them as general industrial wastes.
-  Do not alter or disassemble controller, drive unit, or motor.
-  Collect and dispose of the spent batteries and the backlights for LCD according to the local laws.

(8) General precautions

To explain the details, drawings given in the instruction manual, etc., may show the unit with the cover or safety partition removed. When operating the product, always place the cover or partitions back to their original position, and operate as indicated in the instruction manual, etc.

Disposal



(Note) This symbol mark is for EU countries only.
This symbol mark is according to the directive 2006/66/EC Article 20 Information for end-users and Annex II.

Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.

This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.

If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:

Hg: mercury (0,0005%), Cd: cadmium (0,002%), Pb: lead (0,004%)

In the European Union there are separate collection systems for used batteries and accumulators.

Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.

Please, help us to conserve the environment we live in!

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II. MAINTENANCE MANUAL

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I. CONNECTION MANUAL

1. Outline

This manual explains the items required for installing and connecting the MITSUBISHI CNC M730BM /M750BM.

Read this manual thoroughly and understand the product's functions and performance before starting to use. This manual is written on the assumption that all option functions are added, but the actually delivered device may not have all functions.

Features of the Mitsubishi CNC M730BM/M750BM

(1) High-speed bus connection between panel computer and NC

The panel computer and NC are connected with a high-speed bus (PCI bus: maximum 133MB/s).

(2) Compatible with high-speed optical servo communication

Connection to a high-speed servo drive unit is possible.

(3) New RISC-CPU incorporated

New RISC-CPU enhances high performance.

ASIC, which has a new architecture supporting the new RISC-CPU, also enhances processing efficiency.

(4) Book-type I/O unit employed

Book-type I/O unit enables less-wiring in the cabinet.

2.1 System Configuration(Without Loader)

2.1 System Diagram (Without Loader)



2.2 System Configuration(With Loader)

The diagram illustrates the connection of the FCU7-HN376-02 Operation Panel I/O Unit to the Main Electric Cabinet and the Loder Electric Cabinet. The diagram includes a power supply section, a machine operation panel, and various I/O units (RIO, CG, OPT) connected by cables (G240, F070, G080, G017, G380, G122, G213). It also shows a pendant box system diagram and a main electric cabinet system diagram.

Power Supply Section: L1, L2, L3, PE, Circuit breaker, ON, OFF, MC, MC, 24Vdc, DCOUT, ACIN, FG, Circuit Protector.

Pendant Box System Diagram: Machine operation panel, User Cable, Manual Pulse generator F020/F021/F022 Cable, EMG, SIO, OT release SW, RS-232C Device.

Main Electric Cabinet System Diagram: SH41 Cable, RIO2, RIO1, RIO2, RIO1, G122 Cable, DCIN, 24Vdc, Machine I/O DI(192)/DO(192), Machine I/O DI(64)/DO(64), FCU7-DX079, FCU7-DX078, DO32, DI32, 5Vin, RIO1, 5Vout, RIO1, CG17, DC24VIN, SKIP, MPG, F101 Cable (for reference), Sensor signals, 4pins, 24Vdc.

Loder Electric Cabinet System Diagram: SH41 Cable, RIO2, RIO1, RIO2, RIO1, G122 Cable, DCIN, 24Vdc, Machine I/O DI(160)/DO(160), Machine I/O DI(64)/DO(64), FCU7-DX079, FCU7-DX078, DO32, DI32, 5Vin, RIO1, 5Vout, RIO1, CG17, DC24VIN, SKIP, MPG, R-TM2 with no further relay, MPG max3 F020/F021/F022 Cable.

Operation Panel I/O Unit FCU7-HN376-02: CE56, CE57, BAT1, G240 Cable, 24Vdc, F070 Cable, DCIN, CG62, AVR, RIO, SIO, MPG, EMG, Handle Maximum 3 pieces (5V or 12V), SIO x2 G033/G034 Cable, To next unit or terminator, RS-232C Device.

CNC Unit FCU7-HN633-04 /FCU7-HN653-05: AVR, CG62, CG17, OPT1, EXT, G017 Cable, G380 Cable(PCF Type).

Machine operation panel: RIO3 DI(208)/DO(192)+Handle Maximum 3 pieces.

MDS-D/DH-V1/V2 Servo/Spindle Drive Units: G017 Cable, G380 Cable(PCF Type).

2.3 Unit List

(1) Control unit and Extension unit

Type	Function	Configuration element	Details
FCU7-HN633-04	NC Control unit set (For M730BM)	Main control card: HN633 I/O interface + memory card: HN684 PCI bus fixing metal plate Pendant box fixing metal	Set of NC control section Book-type I/O unit interface Optical servo (1st part system)
FCU7-HN653-05	NC Control unit set (For M750BM)	Main control card: HN653 I/O interface + memory card: HN685 PCI bus fixing metal plate Pendant box fixing metal	Set of NC control section Book-type I/O unit interface Optical servo (1st part system)
FCU7-HN693	Extension unit set	Extension card: HN693 PCI bus fixing metal plate Pendant box fixing metal	Large capacity memory: 5120m (max.) Ethernet communication CF card interface Extension of optical servo (2nd part system) I/O link interface
FCU7-HN376-02 (Note1)	Operation panel I/O unit set	Power supply/operation panel I/O: HN376	Types of batteries used FCU6-BTBOX-36

(Note 1) Operation panel I/O unit and FCU7-HN376-01 cannot be used together.

(2) Book-type I/O unit

Type	Function	Configuration element	Details
FCU6-DX078	Base unit Source output +200mA Common separated	I/O card: HN378 Card fixing component	DI32/DO32 Skip inputs 4 points Manual pulse generator 3ch Remote I/O unit interface 2ch MTB's relay panel I/O
FCU7-DX079	Extension unit Source output +200mA Common separated	I/O card: HN379 Card fixing component	DI32/DO32 MTB's relay panel I/O
FCU7-EX007	Fixing unit	Unit fixing case	—

(3) Remote I/O unit

Type	Function	Configuration element	Details
FCUA-DX100	DI32 (Sink/source) +DO32 (sink)	RX311 card Case	DI32/DO32
FCUA-DX101	DI32 (Sink/source) +DO32 (source)	HR312 card Case	DI32/DO32
FUCA-DX110	DI64 (Sink/source) +DO48 (Sink)	RX311 card RX321-1 card Case	DI32/DO32 DI32/DO16
FCUA-DX111	DI64 (Sink/source) DO48 (Source)	RX311 card RX322-1 card Case	DI32/DO32 DI32/DO16
FUCA-DX120	DI64 (Sink/source) +DO48 (Sink) +AO×1	RX311 card RX323 card Case	DI32/DO32 DI32/DO16+AO×1
FUCA-DX121	DI64 (Sink/source) +DO48 (Source) +AO×1	HR312 card RX324 card Case	DI32/DO32 DI32/DO16+AO×1
FCUA-DX140	DI32 (Sink/source) +DO32 (Sink) +AI×4+AO×1	RX311 card RX341 card Case	DI32/DO32 AI×2+AO×1
FCUA-DX141	DI32 (Sink/source) +DO32 (Source) +AI×4+AO×1	HR312 card RX341 card Case	DI32/DO32 AI×2+AO×1
FCUA-DX201	DI32 (Sink/source) +DO32 (Source) DIN rail vertical mounting	RX312 card Case DIN rail mounting section	DI32/DO32
QY231	DI64 (Source) +DO48 (Source)	QY231 card Sheet metal	DI64/DO48

The Book-type IO unit's connector type for relay is different from that of the conventional type remote IO unit. When connecting the Book-type IO unit and conventional type remote IO unit, refer to the explanation of G212 cable in Chapter 10.

3. Installation

3.1 Control System Specifications

The specifications of the NC control unit, extension unit and operation panel I/O unit are shown below.

3.1.1 Environmental Conditions

Item		Specifications			Supplement
		Min.	Typ.	Max.	
Ambient temperature (C°)	During operation	0	-	55	
	During storage	-20	-	60	
Ambient humidity (% RH)	During operation (long term)	10	-	75	With no dew condensation
	During operation (short term)	10	-	95	With no dew condensation Short term: within one month generally
	During storage	10	-	75	With no dew condensation
Vibration resistance (m/s ²)	During operation	-	-	4.9	4.9 m/s ² =0.5G
	During transport	-	-	34.3	34.3 m/s ² =3.5G
Shock resistance (m/s ²)	During operation	-	-	29.4	29.4 m/s ² =3G
Working atmosphere		as on the right			No corrosive gasses, dust or oil mist

3.1.2 Dimensional/Weight Specifications

Item		Specification			Supplement
		Min.	Typ.	Max.	
Weight (kg)	Control unit	-	0.22	-	
	Extension unit	-	0.18	-	
	Operation panel I/O unit	-	0.25	-	
Outside dimensions (mm)	Control unit	174.63 (W) × 116.68 (D) × 20 (H)			
	Extension unit	174.63 (W) × 106.68 (D) × 20 (H)			
	Operation panel I/O unit	180 (W) × 130 (D) × 20 (H)			
How to install	Control unit	PCI-BUS connection			Need to use the dedicated fittings for Mitsubishi CNC.
	Extension unit	PCI-BUS connection			Need to use the dedicated fittings for Mitsubishi CNC.
	Operation panel I/O unit	Flat installation, Fixed to the stud pins using M3 screws.			

3.1.3 24VDC Input Specifications

Connect the 24VDC input to the operation panel I/O unit FCU7-HN376-02.

Item	Specification			Supplement
	Min.	Typ.	Max.	
Input power supply unit type	Commercially-available power supply unit			
Input voltage (V)	22.8	24.0	25.2	24V±5%
Input ripple (P – PV)	-	-	2.4	
Inrush current (A)	-	-	(Unfixed)	Depends on the AC/DC power supply used.
Protection against excess input voltage (V)	By 30V zener diode			
Protection against excess input current	4.0A fuse inserted			
Power interruption detection voltage (V)	No function			
Instantaneous power failure tolerance (ms)	8.0	-	-	Control circuit part only
Power consumption (W)	-	-	25	
Current consumption (A)	-	-	1.0	Total current consumed by NC control unit, extension unit and operation panel I/O unit.

3.2 Book-Type I/O Unit Specifications

The book-type I/O unit consists of the base unit FCU7-DX078 and the extension unit FCU7-DX079. Each of these specifications is described below.

3.2.1 Environmental Conditions

Item		Specification			Supplement
		Min.	Typ.	Max.	
Ambient temperature (C°)	During operation	0	-	55	
	During storage	-20	-	60	
Ambient humidity (% RH)	During operation (long term)	10	-	75	With no dew condensation
	During operation (short term)	10	-	95	With no dew condensation Short term: within one month generally
	During storage	10	-	75	With no dew condensation
Vibration resistance (m/s ²)	During operation	-	-	4.9	4.9m/s ² =0.5G
	During transport	-	-	34.3	34.3m/s ² =3.5G
Shock resistance (m/s ²)	During operation	-	-	29.4	29.4m/s ² =3G
Working atmosphere		as on the right			No corrosive gasses, dust or oil mist

3.2.2 Dimensional/Weight Specifications

Item		Specification			Supplement
		Min.	Typ.	Max.	
Weight (g)	DX078	-	-	220	
	DX079	-	-	180	
	EX007	-	-	280	
Dimensions (mm)		184.5 (D) × 70 (W) × 145 (H)			The installation dimensions of FCU7-EX007
How to install		Relayed with 96-pin DIN connector, Fixed with screws			

3.2.3 24VDC Input Specifications

Item	Specification			Supplement
	Min.	Typ.	Max.	
Input power supply unit type	Commercially-available power supply unit			
Input voltage (V)	22.8	24.0	25.2	24V±5%
Input ripple (P – PV)	-	-	2.4	
Inrush current (A)	-	-	35	Depends on the performance of the AC/DC power supply used.
Protection against excess input voltage (V)	By 30V zener diode			
Protection against excess input current	1.6A fuse inserted			
Power interruption detection voltage (V)	No function			
Instantaneous power failure tolerance (ms)	2.0	-	-	Control circuit part only
Power consumption (W)	-	-	4.8	When one FCU7-DX078 and one -DX079 are connected
Current consumption (A)	-	-	0.2	When one FCU7-DX078 and one -DX079 are connected
Connectors used	CG30	96-pin DIN, male		00-8272-396-000-123 (RoHS-compatible)
	I/O panel	96-pin DIN, female		00-8345-396-960-023 (RoHS-compatible connector is recommended)

3.2.4 5VDC Power Supply Output Specifications

Item		Specification			Supplement
		Min.	Typ.	Max.	
Output voltage (V)		4.75	5.00	5.25	5V±5%
Output current (A)		-	-	1.8	Up to one base unit + seven extension units+ three 5V manual pulse generators can be supported.
Ripple (mV P - P)		-	-	50	
Spike (mV P – P)		-	-	200	
Connectors used	CG30	96-pin DIN, male			00-8272-396-000-123 (RoHS-compatible)
	I/O panel	96-pin DIN, female			00-8345-396-960-023 (RoHS-compatible connector is recommended)
This power is applied to:		Base unit, extension unit, and manual pulse generator			Current consumed by one manual pulse generator is 80mA. Up to three generators

Note: Connect the 5VDC output of the CG30 connector only to the extension unit's power supply or 5V-specification manual pulse generator.

3.3 Installation

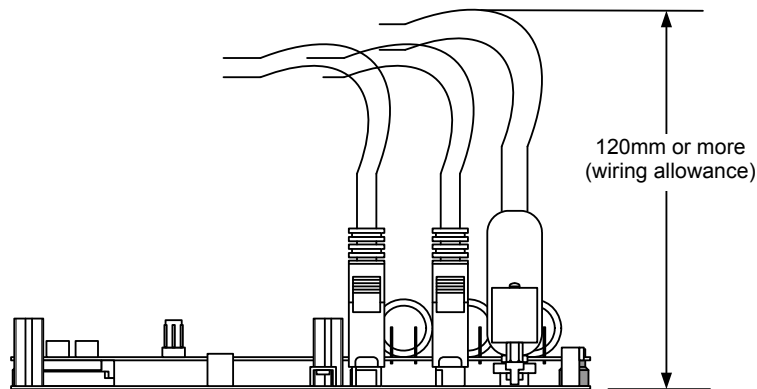
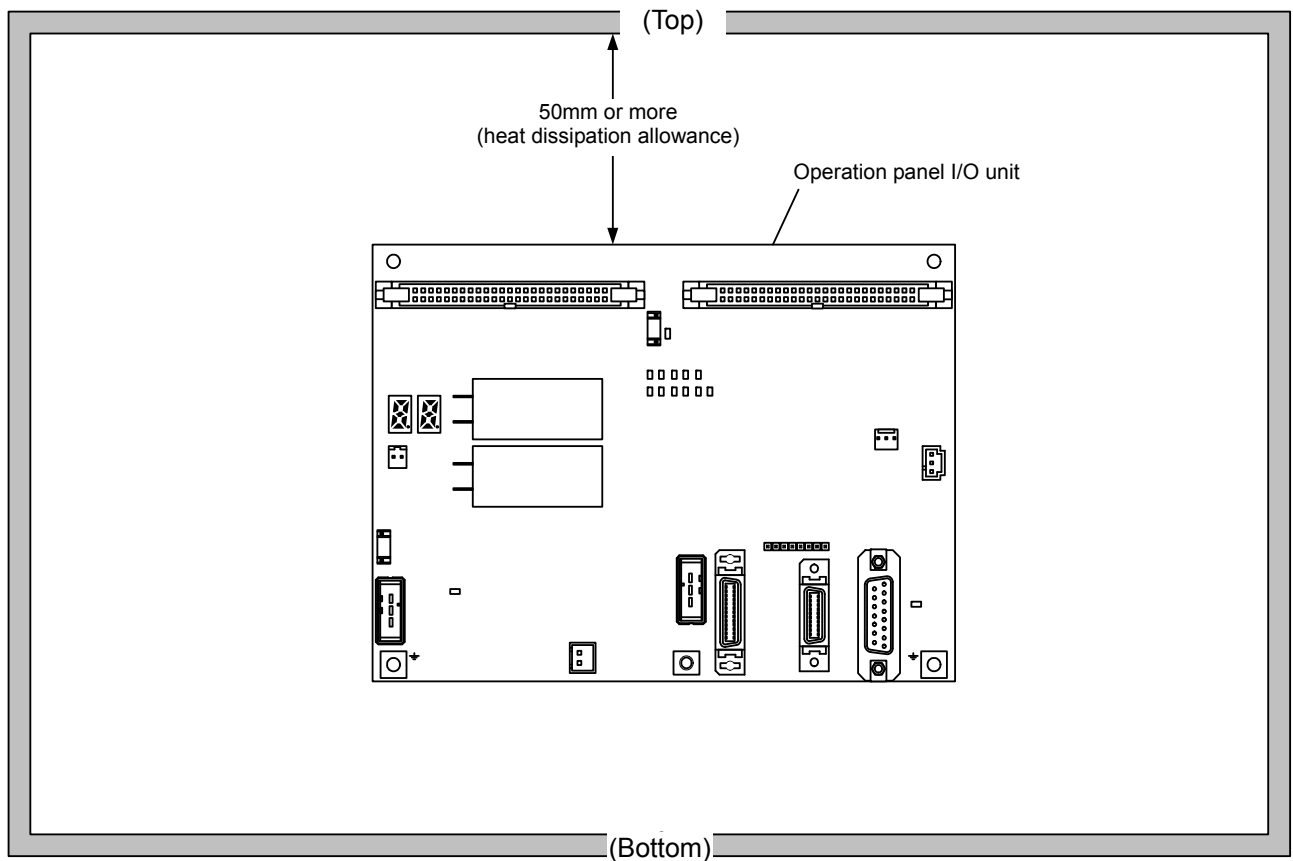
Basically, install each unit in a sealed structured cabinet. Always mind the following points in installing the units inside the cabinet.

- (1) Mount each unit vertically so that the front is visible.
- (2) Refer to the following drawing, and provide sufficient space for ventilation allowing for each unit's heat dissipation and cable wiring.

3.3.1 Installation Direction and Spacing of Operation Panel I/O Unit

Mind the following items in installing the unit inside the cabinet.

- (1) Mount the unit vertically so that the front is visible.
- (2) Refer to the following drawing, and provide sufficient space for ventilation allowing for each unit's heat dissipation and cable wiring.

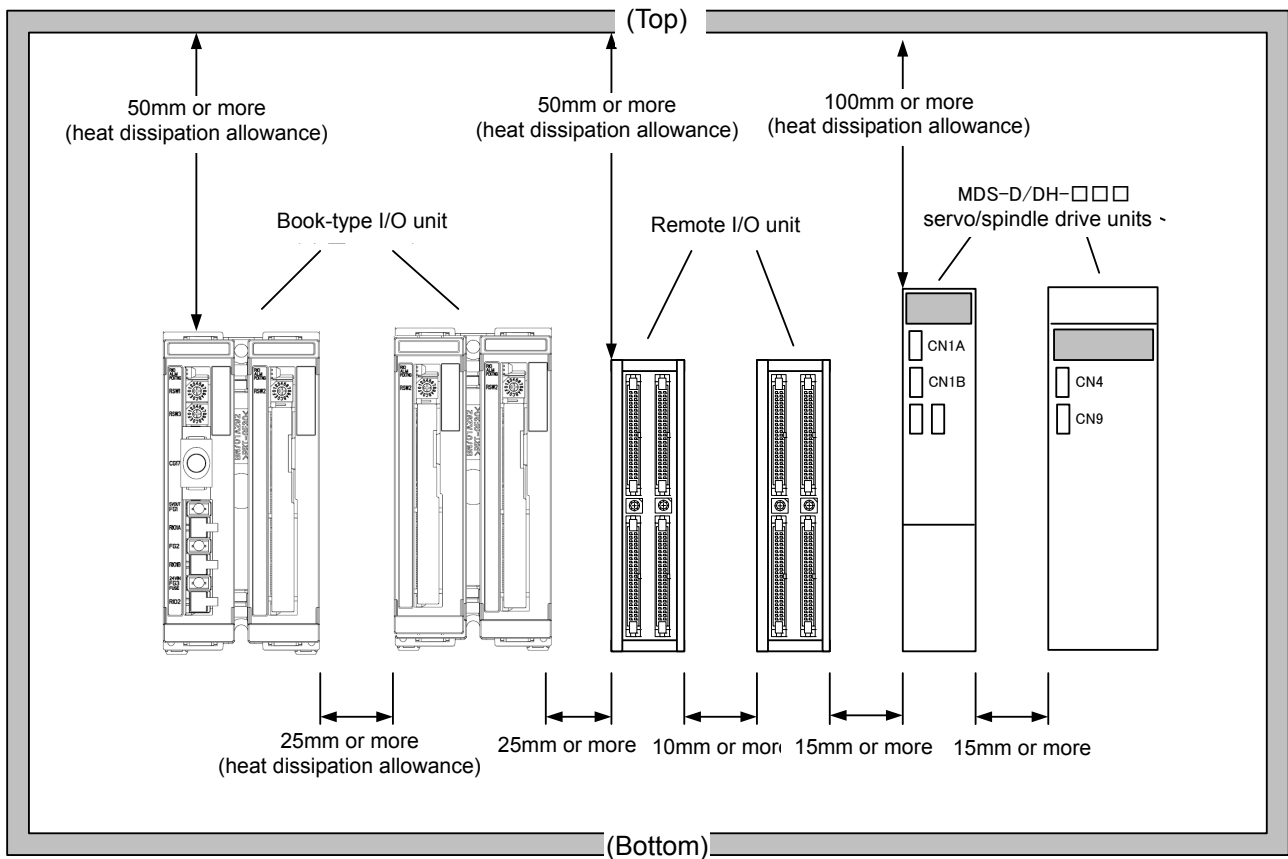


Installation direction and spacing of the operation panel I/O unit

3.3.2 Installation Direction and Spacing of I/O Unit

Mind the following items in installing the unit inside the cabinet.

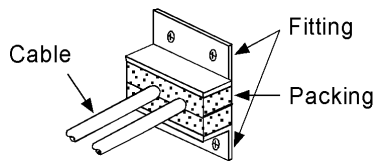
- (1) Mount the unit vertically so that the front is visible.
- (2) Refer to the following drawing, and provide sufficient space for ventilation allowing for each unit's heat dissipation and cable wiring.



Installation direction and spacing of the I/O unit

3.4 Preventing Entry of Foreign Matter


- (1) The inside of each unit uses a high density mounting which is susceptible to dust. Always use a sealed structure for the electric cabinet, and use the following measures.
- Provide dust-proof and oil-proof measures at the cable inlets by plugging them with packing.
 - Make sure that outdoor air does not enter inside from the heat dissipation holes, etc.
 - Cover all clearances.
 - Securely install the door packing.
 - Always attach packing when there is a rear cover.
 - Oil will easily accumulate on the top, and may enter the electric cabinet from the screw holes. Always provide special measures such as oil-proof packing.



Cable inlet (example)

- (2) Avoid machining in the periphery after installing each unit. If cutting chips, etc., adhere onto the electronic parts, trouble may occur.
- (3) The temperature rise in the electric cabinet must be 10°C or less in respect to the ambient temperature (target 5°C or less). The electric cabinet must be designed to satisfy the temperature conditions for the panel computer and NC Control unit, etc. (Refer to section "3.5 Heat radiation countermeasures" for details.) Use a panel cooler when necessary.
- (4) The panel computer's display operation may be affected by external magnetic fields. All sources of magnetic fields (transformers, fans, electromagnetic switches, solenoid relays, magnetic stands, magnetized works, drive cables with large current, etc.) must be separated by at least 200mm from the CRT display. The magnetic field generated by each of these sources will differ. The level may also differ according to the mounting direction, so normal operation may not be possible even if separated by 200mm or more. When deciding the layout of magnetic sources, consider the direction that the magnetic field is generated, and confirm the final layout with the actual machine.

CAUTION

-  **Do not allow conductive foreign matter such as screws or metal chips or combustible foreign matter such as oil enter each unit.**

3.5 Heat Radiation Countermeasures

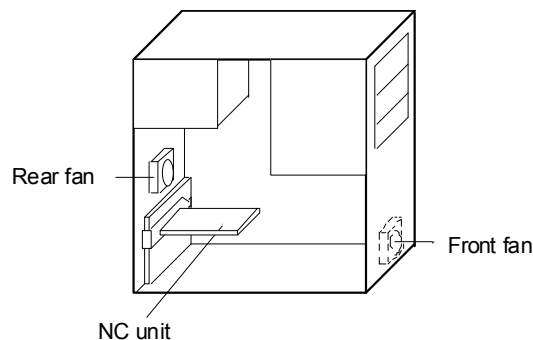
With the normal NC Control unit, the electric cabinet's ambient temperature is set within working conditions of 0 to 45°C, and the heat design is set based on a 10°C temperature rise in the electric cabinet. However, these conditions do not necessarily apply with the Mitsubishi CNC M730BM/M750BM.

That is because the operation of all units supplied from Mitsubishi is guaranteed at 55°C, but the operation of the panel computer at 55°C is not necessarily guaranteed.

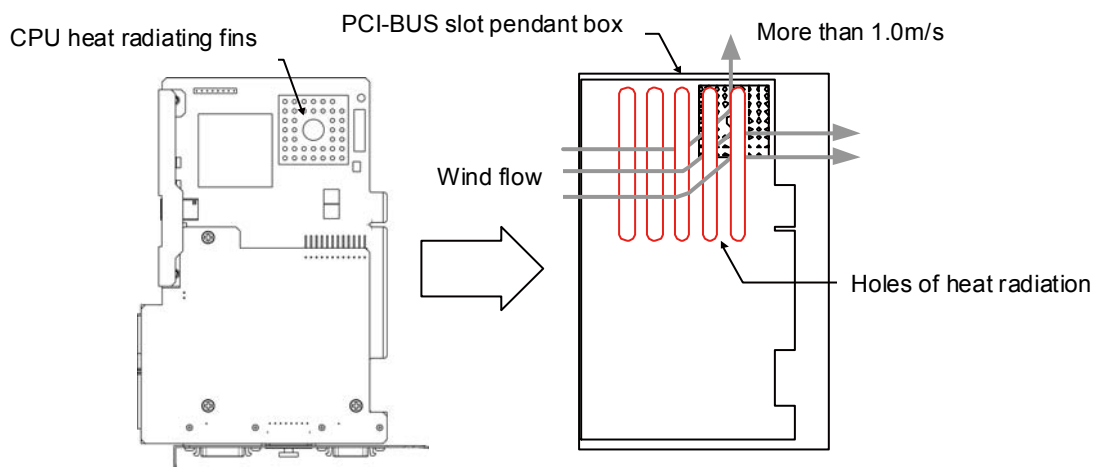
Thus, the electric cabinet's ambient temperature must be determined first as indicated below.

- (1) Determine the panel ambient temperature T_a .
ex. 0 to 35°C
- (2) Determine the internal temperature rise value ΔT .
ex. 5°C
- (3) Select the panel computer.
When T_{max} is 35°C and ΔT is 5°C, select a panel computer with a guaranteed temperature of 40°C or more (45°C or more with an allowance).
- (4) In this example, the average temperature in the panel is 40°C or less based on (1) and (2).

- (Notes)**
1. If heat builds up in the unit, such as at the top, mix the air in the cabinet with a fan.
 2. Use a panel cooler if necessary.
Use a panel cooler that does not lead outside air into the cabinet.
 3. If the panel computer's heat builds up in the panel computer, mix the air in the panel computer with a fan.



Ventilation more than 1.0m/s is needed for heat radiation around the CPU heat radiating fins of the NC control unit.



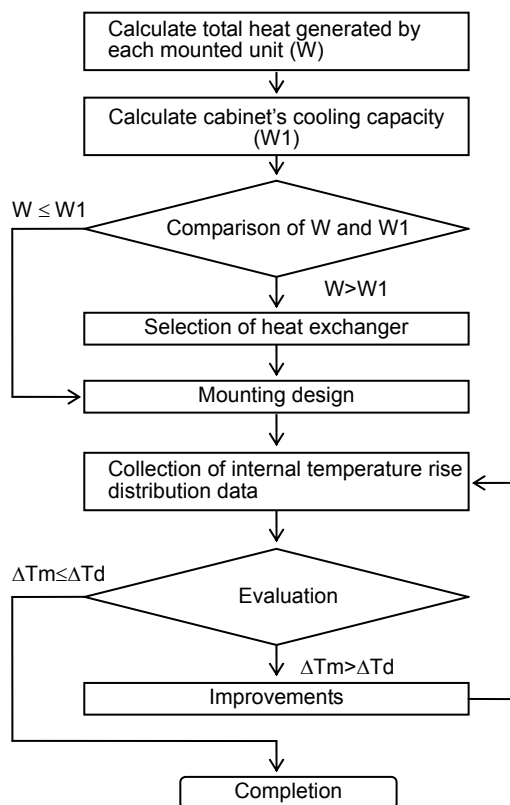
Please refer to following method for heat radiation countermeasures.

Example of heat radiation countermeasures

<Hypothetical conditions>

- (1) Cabinet ambient temperature : T_a
- (2) Internal temperature rise setting value : ΔT_d
(This is 10°C with the conventional NC, but set this to 10°C or less
(target value 5°C) for the Mitsubishi CNC M720BM.
- (3) Average temperature in cabinet: $T_a + \Delta T_d$

Procedures for heat design and verification



<Supplement>

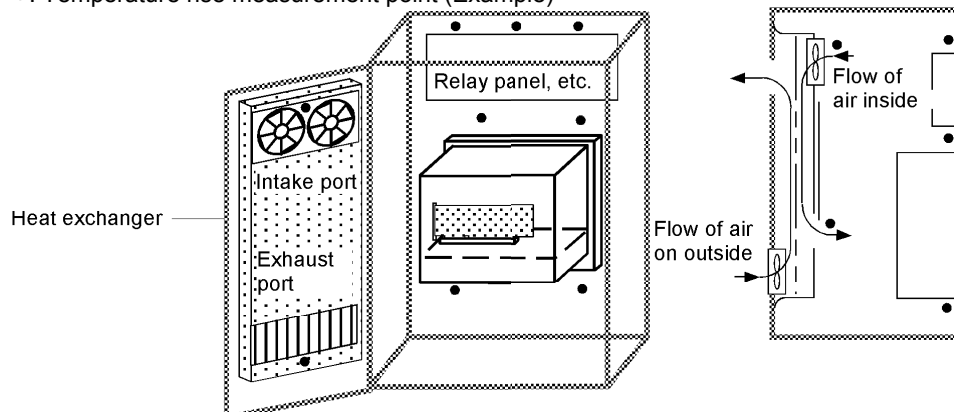
- (1) Refer to "3.1 Control System Specifications" and "3.2 Book-Type I/O Unit Specifications" for the heat generated by each unit.
- (2) Sealed cabinet (thin steel plate) cooling capacity calculation equation
 $W1 = U \times A \times \Delta T_d$
 $U: 6\text{W/m}^2 \times ^\circ\text{C}$
 ... with internal agitating fan
 $4\text{W/m}^2 \times ^\circ\text{C}$
 ... without internal agitating fan
 $A: \text{Effective heat radiation area (m}^2\text{)}$
 (Area where heat can be radiated from cabinet)

<Caution>

- When calculating the effective heat radiation area, do not include the parts that contact other objects.**
- (3) Points of caution for heat radiation countermeasures when designing mounting state
 - * Consider convection in cabinet (eliminate heat spots)
 - * Collect hot air at suction port in heat exchanger cabinet.
 - (4) Criteria for internal temperature rise distribution data
 - $\Delta T_m \text{ (average value)} \leq \Delta T_d$
 - $\Delta T_m \text{ max (maximum value)} \leq (\Delta T_d + 5)^\circ\text{C}$
 - $R \text{ (inconsistency } \Delta T_{m\text{max}} - \Delta T_{m\text{min}}) \leq 6^\circ\text{C}$
(Evaluate existence of heat spots)
 - ΔT_m : Internal temperature rise setting value

Instruction of mounting examples and temperature (ΔT) measurement positions (reference)

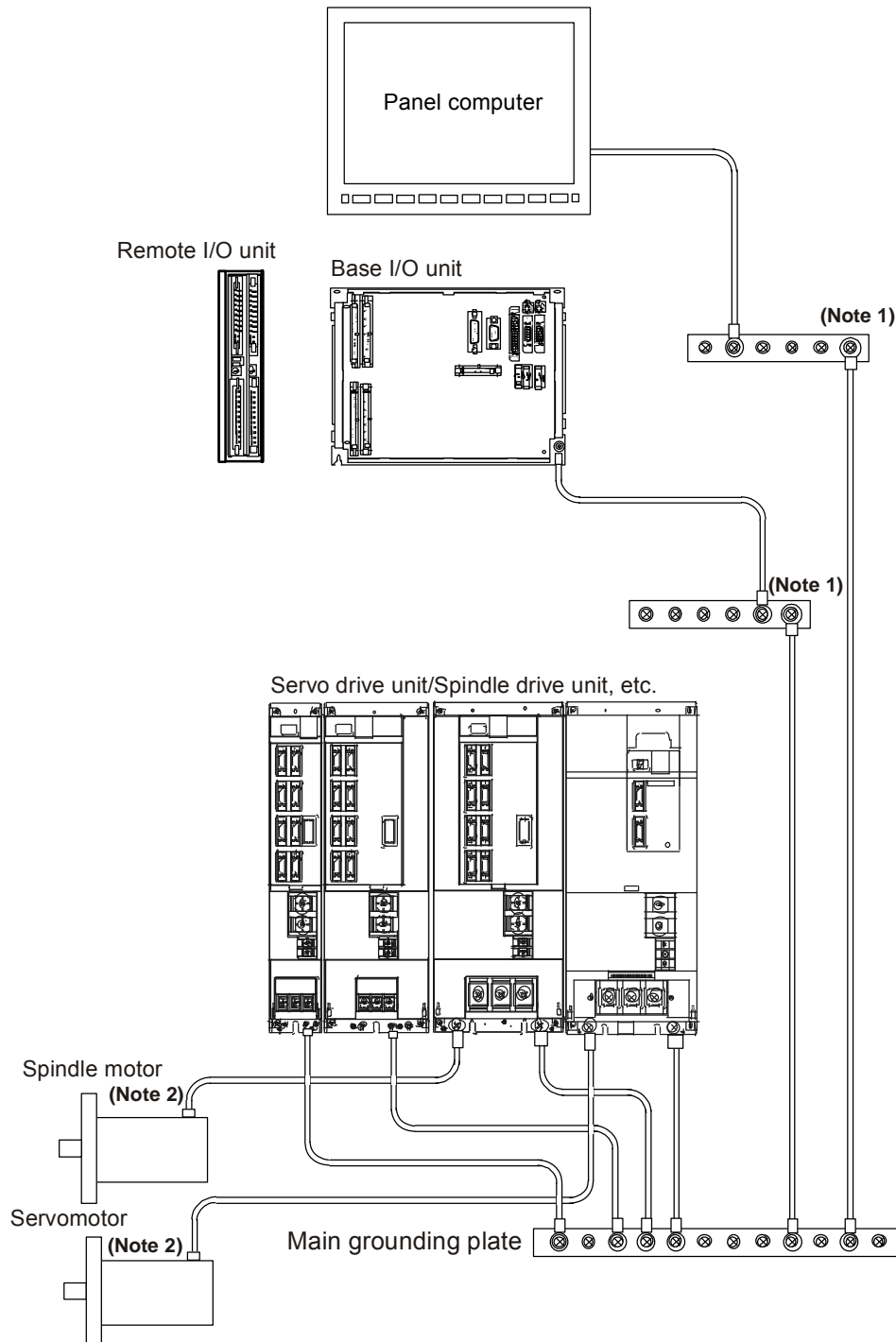
- : Temperature rise measurement point (Example)



3.6 Noise Countermeasures

(1) Connection of FG (Frame Ground)

The frame should basically be grounded at one ground point. When relaying through a grounding plate midway, separate the panel computer and remote I/O unit from the base I/O unit servo drive unit and spindle drive unit, and others. The NC Control unit's FG is connected with the panel computer's cabinet with a card mounting fitting.



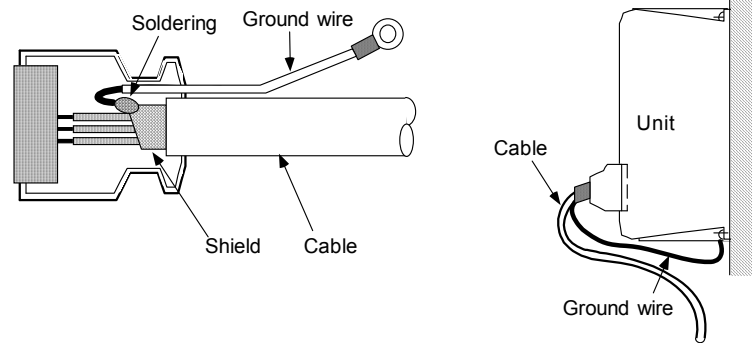
(Note 1) This is not required when a direct connection to the main grounding is possible.

(Note 2) Connect the motor's ground wire to the servo drive unit and spindle drive unit.

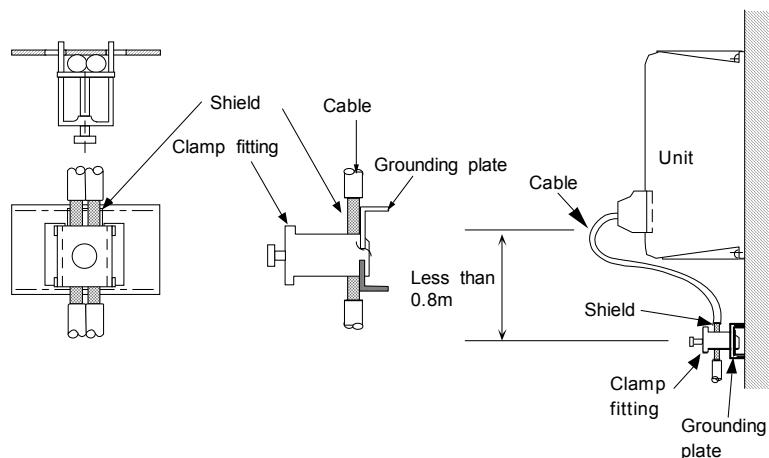
(2) Shield clamping of cables

The shield cable connected to the base I/O unit, servo drive unit and spindle drive unit must be connected to the ground to stabilize operation while preventing malfunctioning due to noise.

The shield can be connected to the ground with the lead wire or with a clamp fitting. Refer to the following drawings to treat the shield cable.

Example of connection with lead wire

(Note) When soldering the ground wire onto the shield, if the solder section is close to the shield, the signal wire's sheath could melt by the soldering heat and result in a short-circuit. Solder at a place 10 to 20mm away from the mesh section.

Example of connection with clamp fitting

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

Refer to "Section 9.7 Outline and installation outline drawing for grounding plate and clamp fitting" when manufacturing the clamp fitting and grounding plate. These parts can be ordered from Mitsubishi.



⚠ The shield cable indicated in this manual must be grounded with a cable clamp, etc.

The cables requiring a shield clamp using a connector case are shown below.

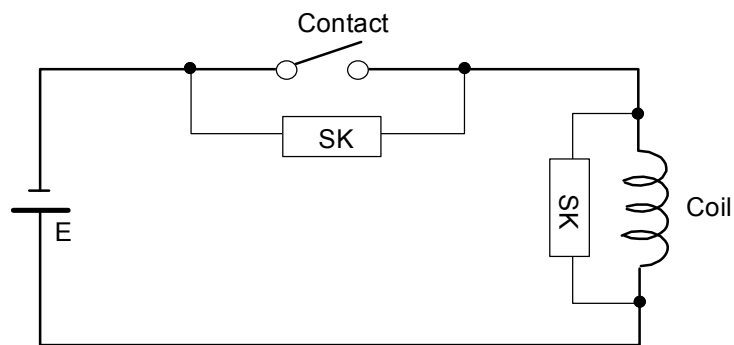
<Shield clamping method>

Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the copper foil tape wrapped around the sheath to the grounding plate in the connector.

Unit name	Connector name	Connection destination	Treatment at both ends of cable	
			Connection source	Connection destination
NC control unit (FCU7-HN633-04 /FCU7-HN653-05)	CG17 CG62	Book-type I/O unit Operation panel I/O unit	Connect the cable's shield to the grounding plate on the connector case.	Connect the cable's shield to the grounding plate on the connector case.
Book-type I/O unit	CG17	NC control unit	Connect the cable's shield to the grounding plate on the connector case.	Connect the cable's shield to the grounding plate on the connector case.
	RIO1A RIO1B RIO2	Remote I/O unit Remote I/O unit Remote I/O unit	Connect the cable's FG wire to the unit's FG terminal.	Connect the cable's FG wire to the FG terminal. (Do not connect it to the servo drive unit's FG terminal.)
Operation panel I/O unit	CG62 MPG SIO	NC control unit Manual pulse generator RS-232C device	Connect the cable's shield to the grounding plate on the connector case.	Connect the cable's shield to the grounding plate on the connector case.
	RIO	Remote I/O unit	Connect the cable's FG wire to the unit's FG terminal.	Connect the cable's FG wire to the FG terminal.

(3) Connecting spark killers

Connect a spark killer on the coil or contact in parallel for noise countermeasures.
Use spark killers which are 0.033 to 0.1 μ F, 10 to 120 Ω .

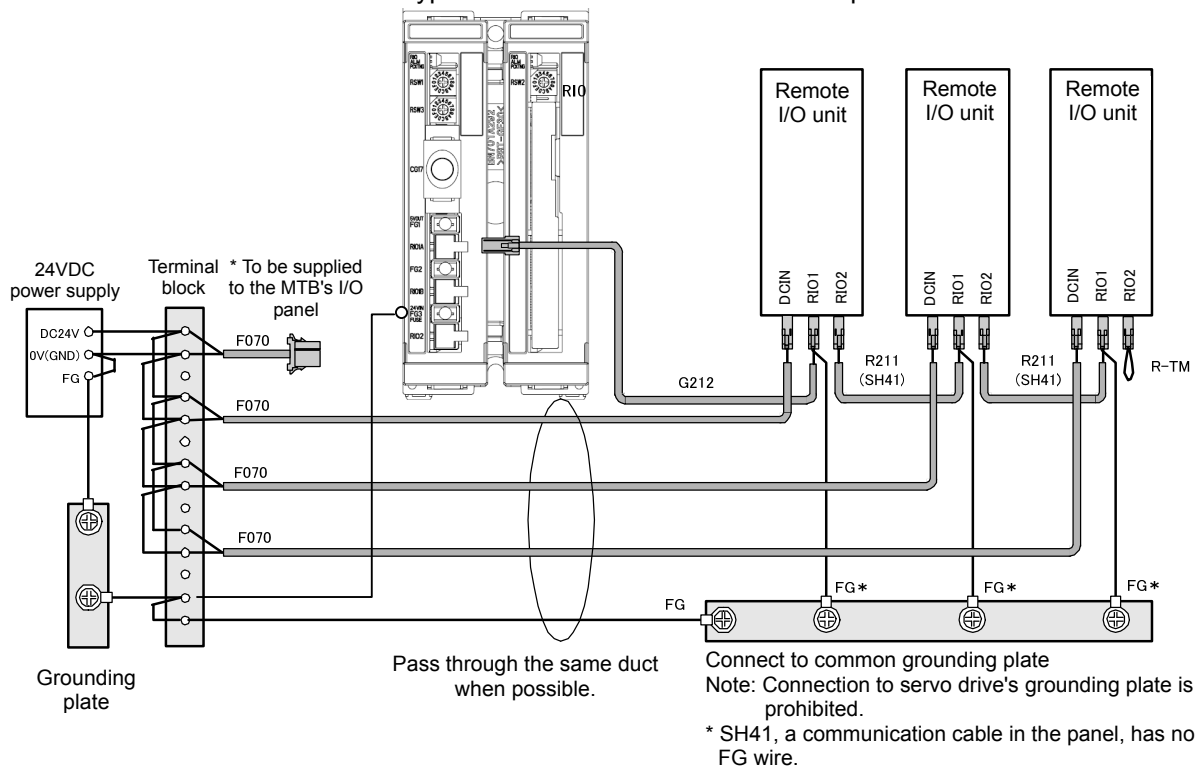


3. Installation

3.7 Connection of the Remote I/O Unit Communication Cable

3.7 Connection of the Remote I/O Unit Communication Cable

The connection between the Book-type I/O unit and remote I/O unit is explained below.



Connection of book-type I/O unit and conventional remote I/O unit

(1) Cable between 24VDC power supply and each unit.

Connect an F070 cable. Refer to Chapter 10 for the F070 cable manufacturing drawings.

(2) Cable between book-type I/O unit and conventional remote I/O unit

Connect the book-type I/O unit to the conventional remote I/O unit using a G212 cable. See Section 10 for the G212 cable manufacturing drawings.

If the book-type I/O unit and conventional remote I/O unit are in the same panel and the cable length is 2m or less, use a G212 cable. If the relayed I/O unit is installed outside the panel, or if the cable length exceeds 2m, use a cable reinforced for noise measures. Connect the FG wire with the shortest distance to a grounding plate other than the servo drive unit's grounding plate.

(3) Cable between remote I/O units

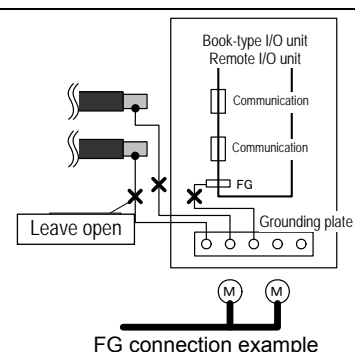
Connect adjacent remote I/O units using an SH41 cable. See Chapter 10 for the cable manufacturing drawings. If the remote I/O units are separated, use the FCUA-R211 cable, with which FG connection is available.

(Note) If the book-type I/O unit and remote I/O unit are installed

near a noise generating source, such as a servo drive unit and motor, noise may enter from the cable shield and may increase the remote I/O's communication errors.

This is also true if the I/O unit installed in a box attached outside the electric cabinet.

In these cases, do not connect the cable shield to FG (cabinet), but leave it open.



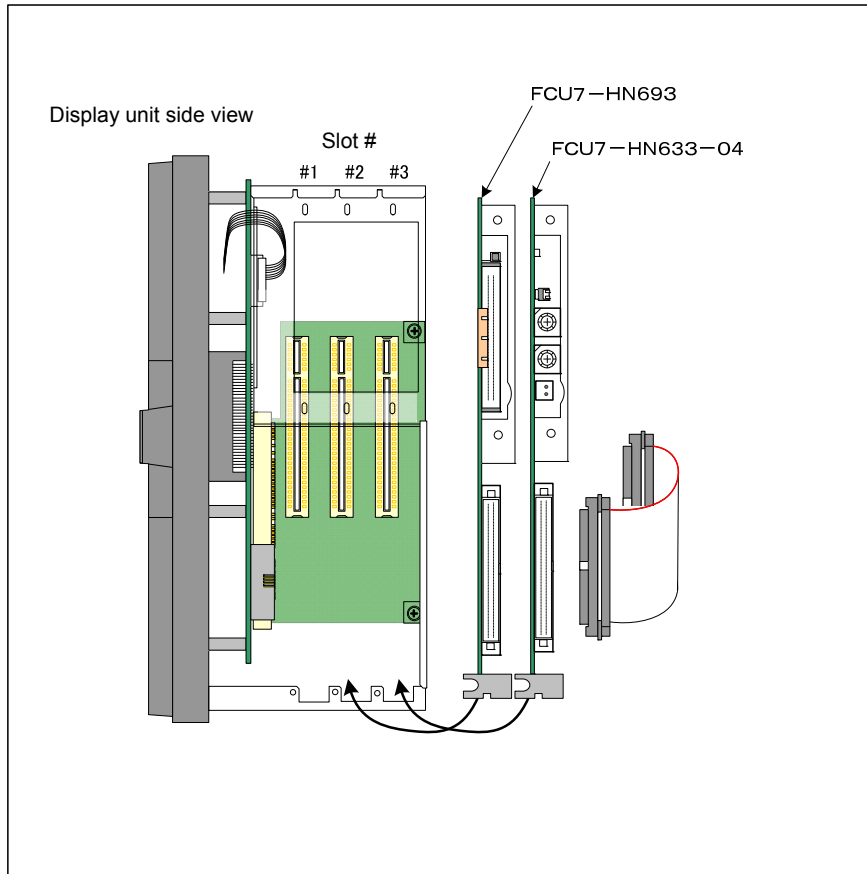
4. Connection of NC Control Unit

When mounting an NC control unit FCU7-HN633-04/FCU7-HN653-05 onto a display unit, connect the unit to the farthest PCI bus slot from the display part (slot #3). When adding an extension unit FCU7-HN693, connect it to the PCI extension slot on the NC control unit's left (slot #2).

4.1 Where to Mount on Display Unit

Mount the NC control unit into the PCI slot #3 or other PCI extension unit which is farthest from the heated part such as display section.

The extension unit must be mounted into the PCI slot #2 or other PCI extension slot which is on the immediate left of the NC control unit.



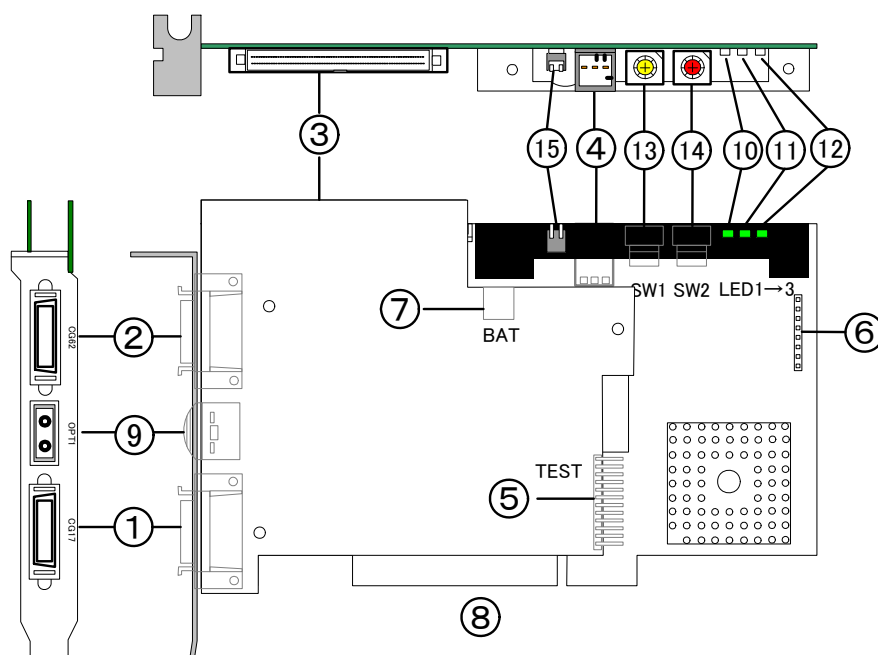
Where to mount the cards (for M730BM)

4. Connection of NC Control Unit

4.2 Names of NC Control Unit FCU7-HN633-04/FCU7-HN653-05 Section

4.2 Names of NC Control Unit FCU7-HN633-04/FCU7-HN653-05 Section

See below for name and its function of NC control unit's each section.



Part locations of NC control unit

No.	Connector name	Explanation of function
1	CG17	Use to connect with the book-type I/O unit.
2	CG62	Use to connect with the operation panel I/O card.
3	EXT	Use to connect with the extension unit.
4	AVR	Use to supply power from the operation panel I/O unit.
5	TEST	Not used.
6	ISP	Not used.
7	MNTBATIN	Use for maintenance.
8	PCI	Connected to the panel computer's extension slot.
9	OPT1	Use to connect the servo drive unit of 1st part system.

No.	LED name	Explanation of function
10	12V	This LED is used to confirm the 12V power supply from G180 or G181 cable.
11	PWGD	This LED is used to confirm the input power.
12	PRGOK	When lit in (Green): Normal When not lit: Power not supplied

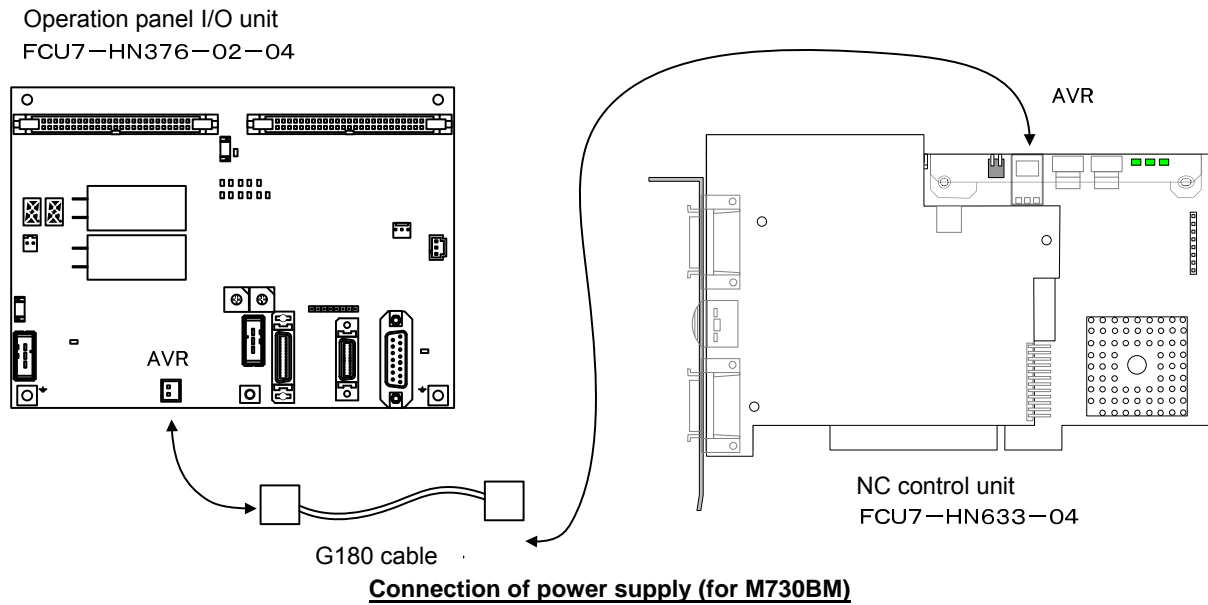
No.	Switch name	Explanation of function
13	SW1	Use for maintenance. Mass production machine (yellow)
14	SW2	Use for maintenance. Mass production machine (red)
15	SW3	Use for maintenance. Set both of two (bits) to "OFF" (upright) during use.

4.3 Connection of Power Supply

The NC Control unit needs a 12V power supply from the operation panel I/O unit FCU7-HN376-02 via the G180 cable.

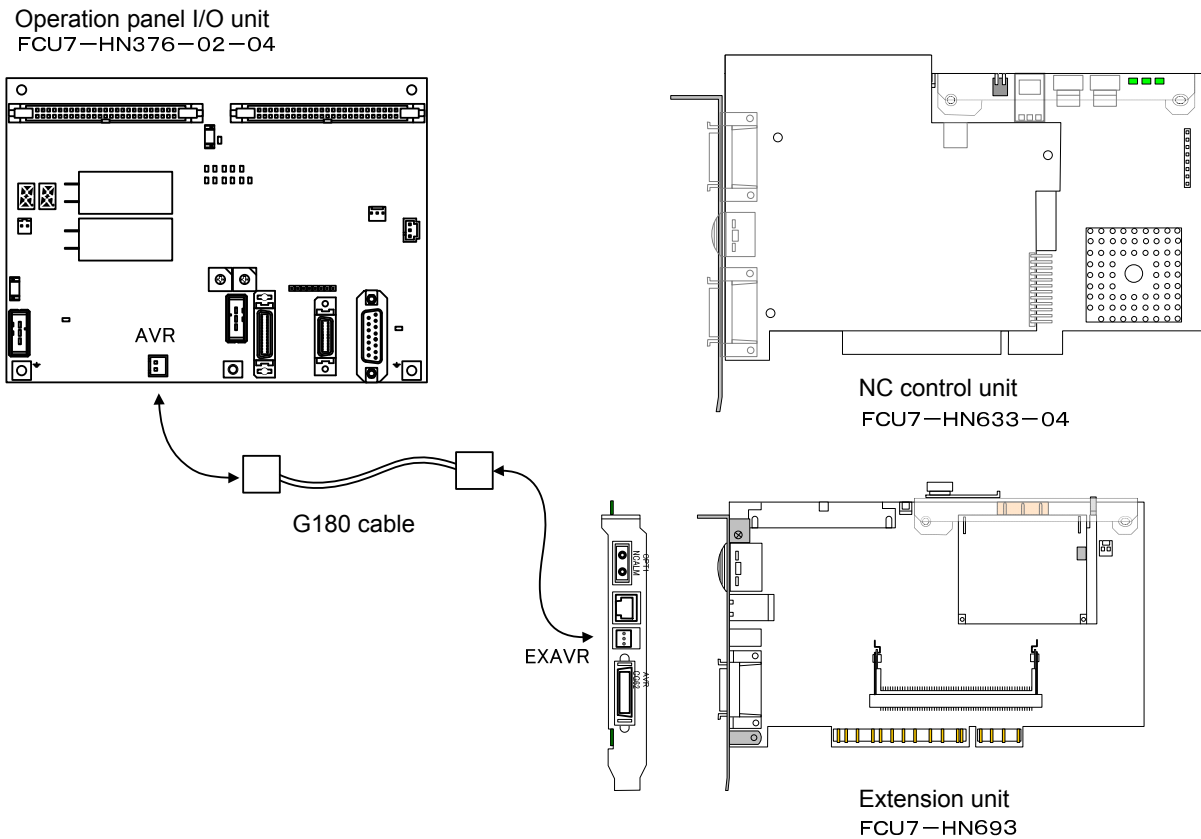
4.3.1 Connection of Power Supply (When there is no extension unit)

Supply 12V from the "AVR" connector on the operation panel I/O unit directly to the "AVR" connector of the control unit via the G180 cable.



4.3.2 Connection of Power Supply (When there is an extension unit)

When connecting the extension unit, the 12V is supplied from the "AVR" connector on the operation panel I/O unit to the "EXAVR" connector on the FCU7-HN693 via the G180 cable.



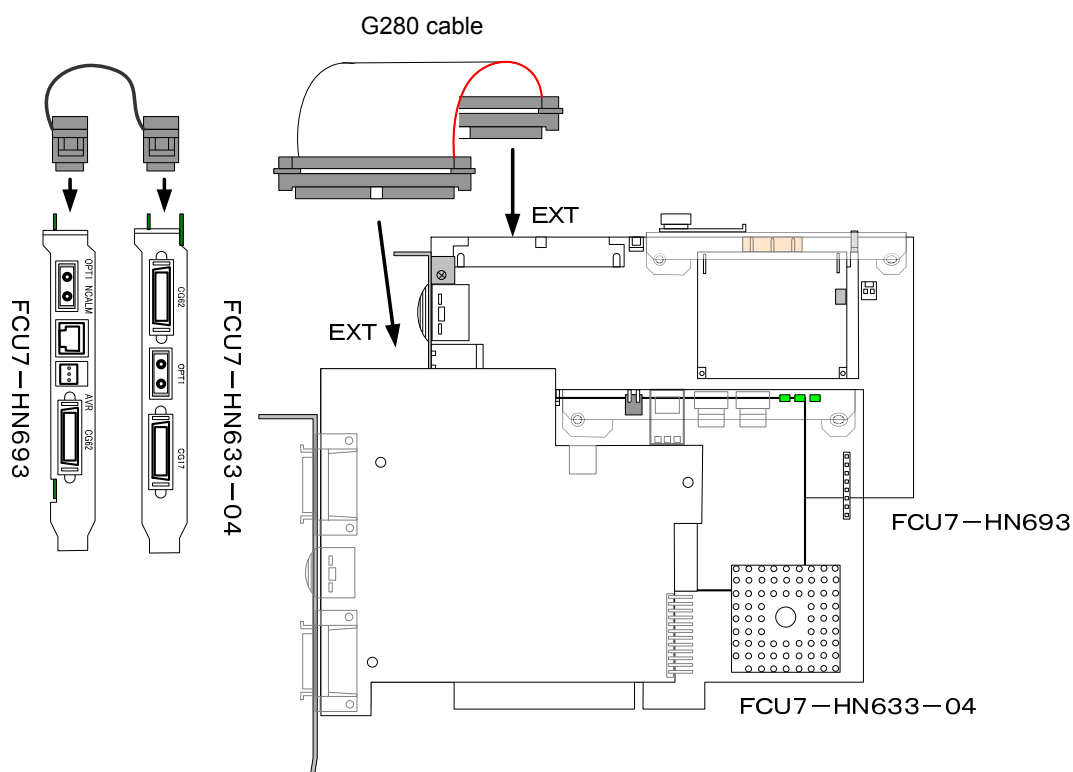
Connection of power supply (when there is an extension unit) (for M730BM)

4.4 Connection of Extension Unit

Connect the "EXT" connector on the NC control unit with "EXT" of the extension unit with the G280 cable. How to connect an extension unit is the same between M720BM and M730BM/M750BM.

An extension unit for M720BM, FCU7-HN692 cannot be used for M730BM/M750BM as the unit's signal allocation is different from that of M730BM/M750BM.

Control unit name	Extension unit name	Availability of combination
FCU7-HN623-02 (M720BM)	FCU7-HN692	Available
	FCU7-HN693	Unavailable
FCU7-HN633-04/FCU7-HN653-05 (M730BM/M750BM)	FCU7-HN692	Unavailable
	FCU7-HN693	Available

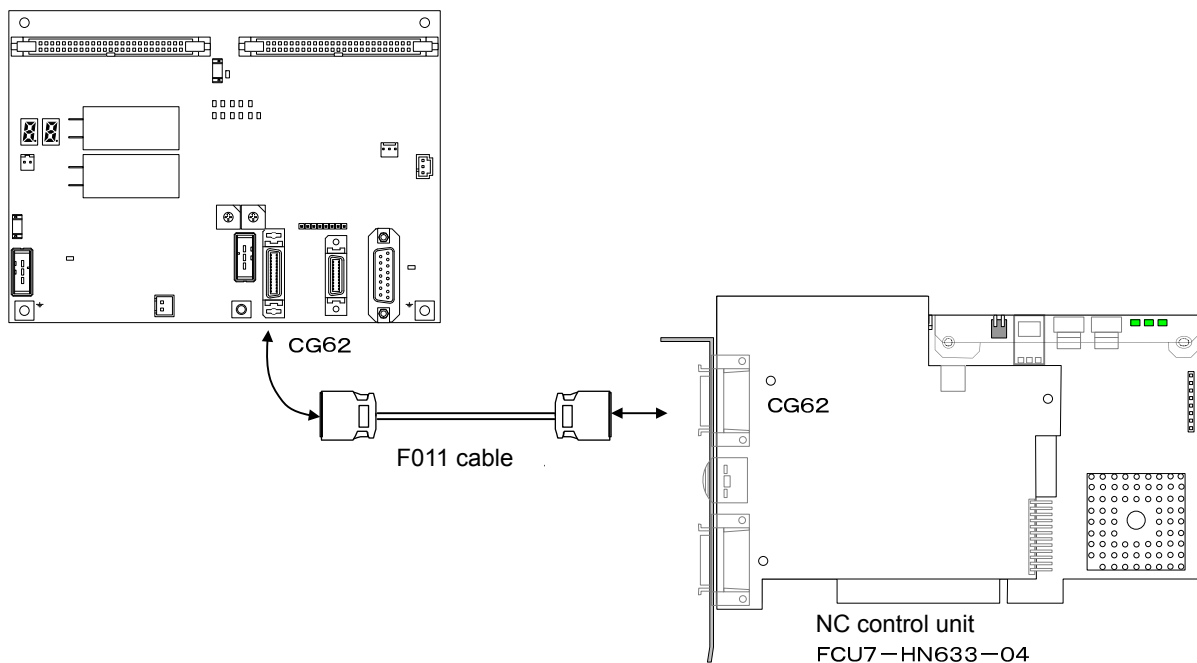


Connection of extension unit (for M730BM)

4.5 Connection of Operation Panel I/O Unit

Connect the “CG62” connector on the NC control unit with “CG62” of the extension unit with the F011 cable. How to connect an operation panel I/O unit is the same between M720BM and M730BM/M750BM.

Operation panel I/O unit
FCU7—HN376—02

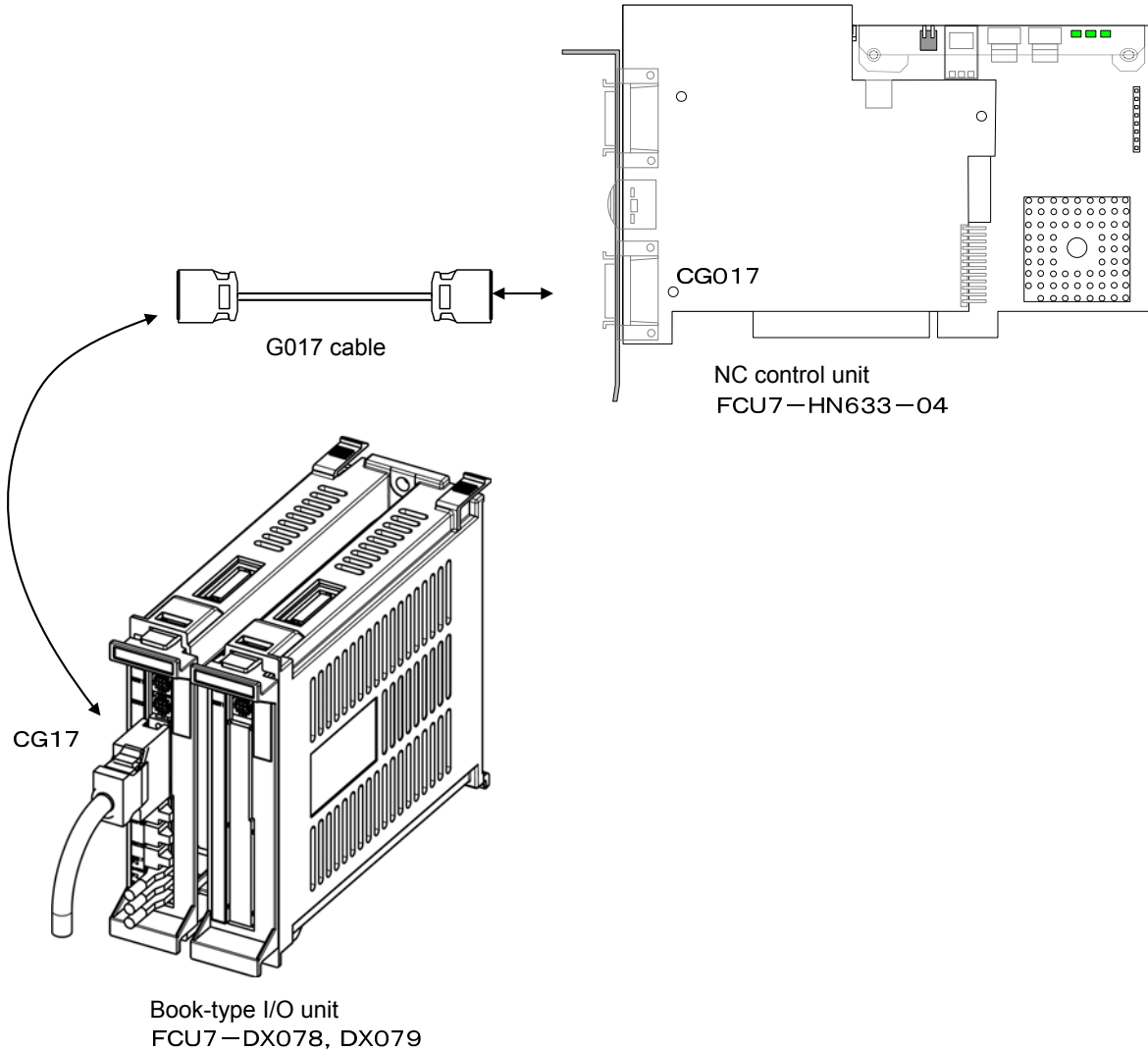


Connection of operation panel I/O unit (for M730BM)

4.6 Connection of Book-Type I/O Unit

Connect the “CG17” connector on the NC control unit with “CG17” of the book-type I/O unit with the G017 cable (20 pin – 20 pin).

F010 cable (50 pin – 50 pin) for M720BM is not available.



Connection of book-type I/O unit (for M730BM)

4. Connection of NC Control Unit

4.7 Connection of Optical Communication Servo Drive Unit

4.7 Connection of Optical Communication Servo Drive Unit

Connect the “OPT1” connector on the NC control unit with “CNA1” of the optical servo drive unit MDS-D/DH Series or MDS-D-SVJ3/SP3 Series with the G380 cable (or equivalent product). Between each drive unit, connect “CN1B” on one drive unit to “CN1A” of the next servo/spindle drive unit.

As the G396 cable is an optical fiber cable dedicated to connection within cabinet such as between one servo drive unit and another servo drive unit, do not use it for long distance connection such as between an NC control unit in the operation panel and a unit in the cabinet.

The maximum number of axes per part system is 16 axes. In the case of specification exceeding 16 axes, use the 2nd part system of the “OPT2” connector on an extension unit FCU7-HN693.

Note) Axis specifications of 1st and 2nd part systems are of the system specification. For available axis configuration, contact with Hardware System Section.

As for servo drive unit, refer to the following manuals.

“MDS-D Series Specifications Manual IB-1500010”

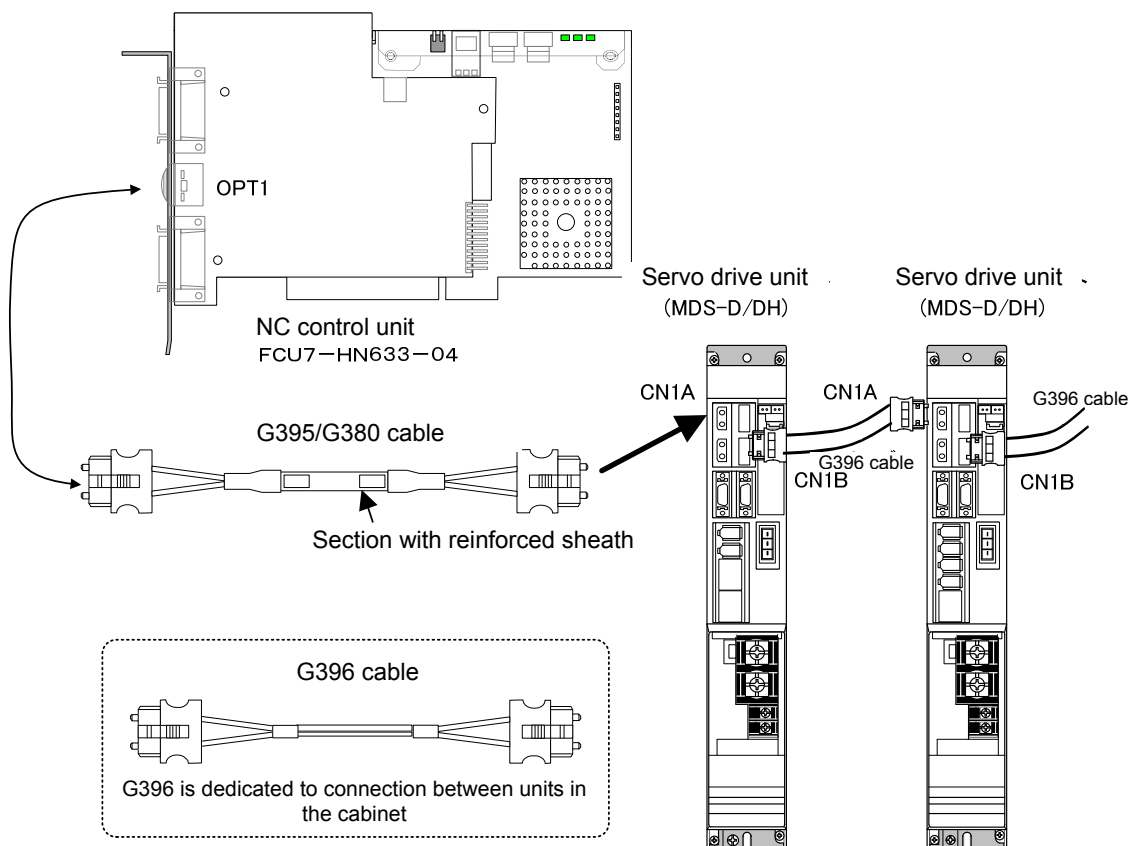
“MDS-DH Series Specifications Manual IB-1500002”

“MDS-DH Series Instruction Manual IB-1500024”

“MDS-D-SVJ3/SP3 Series Specifications Manual IB-1500157”

“MDS-D-SVJ3/SP3 Series Instruction Manual IB-1500192”

4.7.1 Connection of Optical Communication Servo Drive Unit (within 16 axes)



Connection of optical communication servo drive unit (within 16 axes) (for M730BM)

4. Connection of NC Control Unit

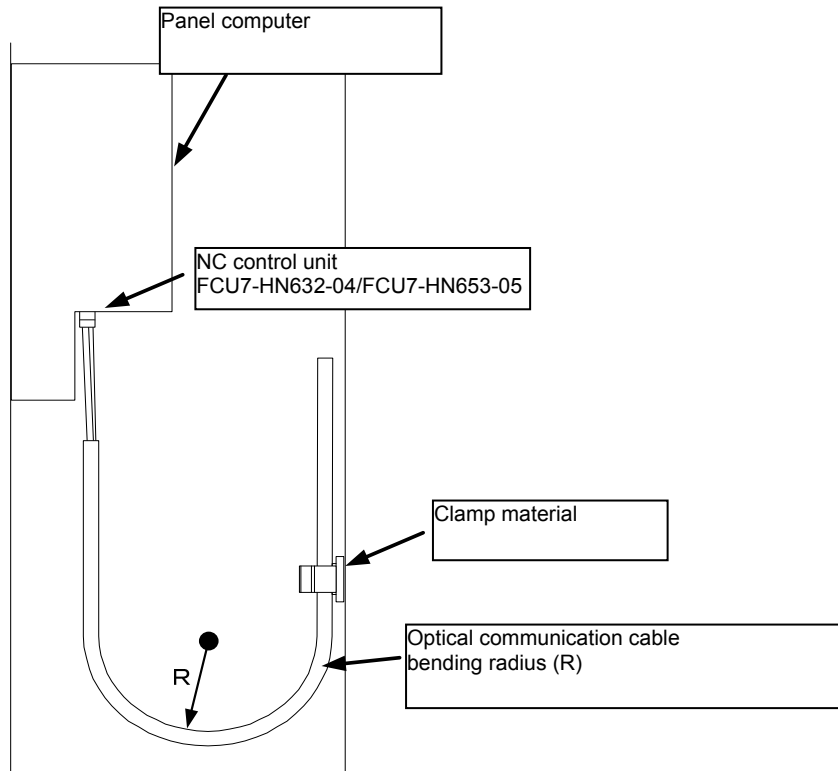
4.7 Connection of Optical Communication Servo Drive Unit

(Note1) Never bind the cables too tight with cable ties as it could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move.

Recommended clamp material: CKN-13SP KITAGAWA INDUSTRIES

(Note2) Never bundle the cables with vinyl tape. The plasticizer in the vinyl tape could cause the PCF cable reinforced sheath to damage.

(Note3) Loop the excessive cable with twice or more than the minimum bending radius.



Fixing of optical communication cable, and bending radius

(* 1) "Cable ties" refers to "Ty-Rap", which is a trademark of Thomas & Betts International, Inc., and "INSULOK", which is a trademark of HellermannTyton Co.,Ltd.



Never look into the optical communication connector. Strong light of short wavelength is coming out from the connector while the power is ON. Failure to observe this could injure your eyes.

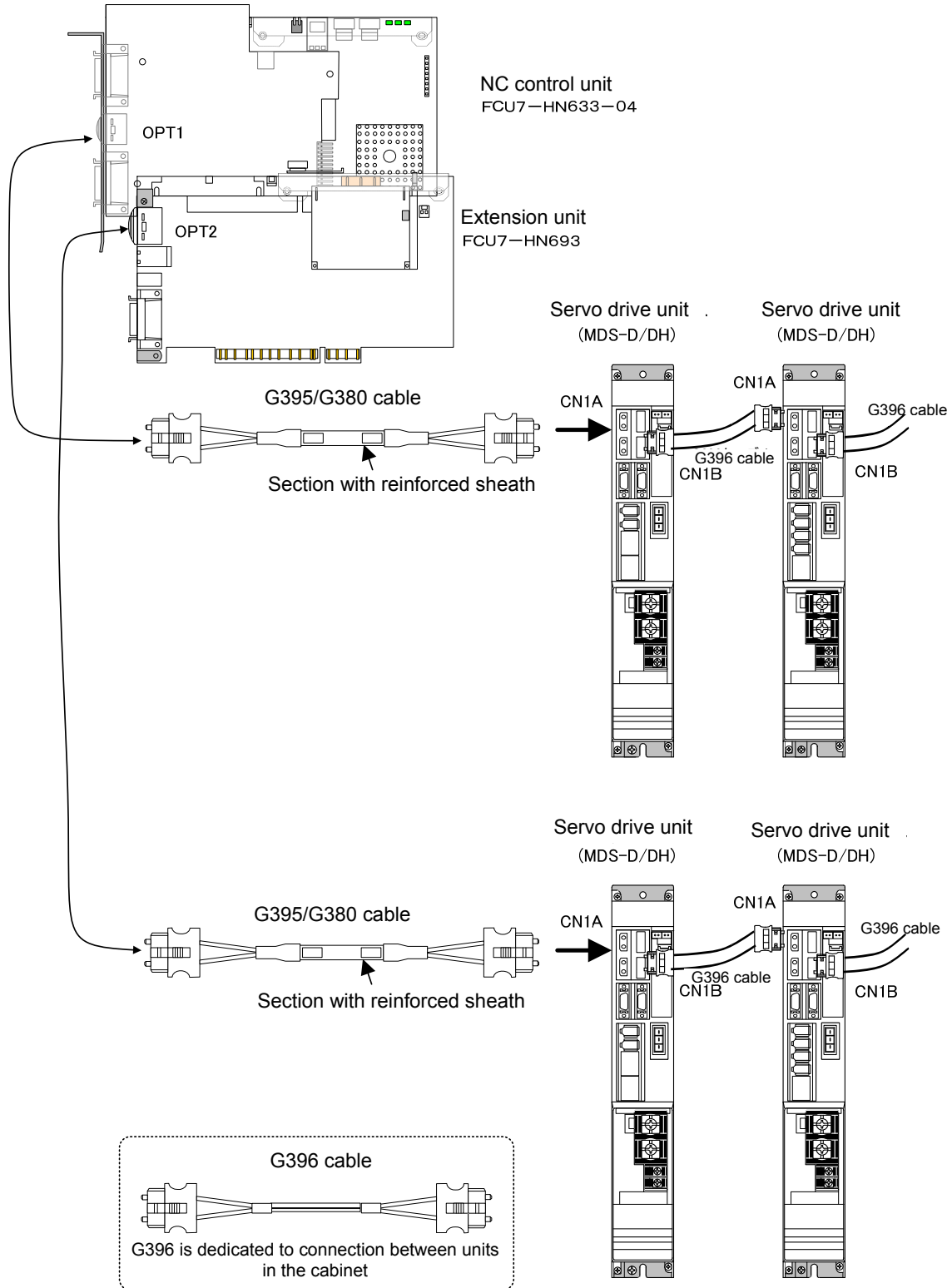
4. Connection of NC Control Unit

4.7 Connection of Optical Communication Servo Drive Unit

4.7.2 Connection of Optical Communication Servo Drive Unit (exceeding 16 axes)

In the case of specification exceeding 16 axes, use the 2nd part system of the “OPT2” connector on an extension unit FCU7-HN693.

Note) Axis specifications of 1st and 2nd part systems are of the system specification. For available axis configuration, contact with Hardware System Section.



Connection of optical communication servo drive unit (exceeding 16 axes) (for M730BM)



Never look into the optical communication connector. Strong light of short wavelength is coming out from the connector while the power is ON. Failure to observe this could injure your eyes.

4. Connection of NC Control Unit

4.7 Connection of Optical Communication Servo Drive Unit

4.7.3 Optical Cable Selection Criteria

<G380 cable>

Wire material: Optical communication cable PCF type (Core: Glass)

Application: Used when the cable length is 10m or more to 20m or less.

Cable	Min. bending radius	Wiring margin: 2R
2-core cable (section with reinforced sheath)	50mm	100mm
2-core cable (section without reinforced sheath)	25mm	50mm

<G396 cable>

Wire material: Optical communication cable POF type (Core: Plastic)

Application: When a cable length is 10m or less and it is wired inside the cabinet.

This cable is dedicated for connecting between the servo drive units inside the electric cabinet.

Cable	Min. bending radius	Wiring margin: 2R
2-core parallel code	30mm	60mm

<G395 cable>

Wire material: Optical communication cable POF type (Core: Plastic)

Application: For a cable length of 10m or less, and for wiring outside the cabinet.

Cable	Min. bending radius	Wiring margin: 2R
2-core cable (section with reinforced sheath)	50mm	100mm
2-core cable (section without reinforced sheath)	30mm	60mm

<Cable application list>

Cables applied	Cable length for wiring inside cabinet		Cable length for wiring outside cabinet	
	less than 10m	10 to 20m	less than 10m	10 to 20m
G380	○	○	○	○
G395	○	×	○	×
G396	○	×	×	×

4. Connection of NC Control Unit

4.8 FCU7-HN633-04/FCU7-HN653-05 Unit Connector Pin Assignment

4.8 FCU7-HN633-04/FCU7-HN653-05 Unit Connector Pin Assignment

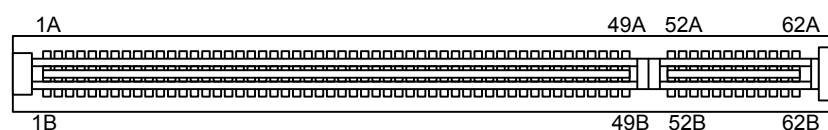
4.8.1 PCI Bus Connection Terminal PCI

Function	PCI bus connector
Number of pins	124pin
Connector type	No type since it is a pad on the PCB

Connector on PCB side



Connector on mother board side (reference)



No.	I/O	Signal name	No.	I/O	Signal name
1A	I	TRST	1B		N.C.
2A		12V	2B	I	TCK
3A	I	TMS	3B		GND
4A	I	TDI	4B	O	TDO
5A		5V	5B		5V
6A	O	INTA*	6B		5V
7A		N.C.	7B		N.C.
8A		5V	8B		N.C.
9A		N.C.	9B	O	PRSNT1*
10A		N.C.	10B		N.C.
11A		N.C.	11B	O	PRSNT2*
12A		GND	12B		GND
13A		GND	13B		GND
14A		N.C.	14B		N.C.
15A	I	RST*	15B		GND
16A		N.C.	16B	I	CLK
17A		GNT*	17B		GND
18A		GND	18B		REQ*
19A		N.C.	19B		N.C.
20A	I/O	AD30	20B	I/O	AD31
21A		N.C.	21B	I/O	AD29
22A	I/O	AD28	22B		GND
23A	I/O	AD26	23B	I/O	AD27
24A		GND	24B	I/O	AD25
25A	I/O	AD24	25B		N.C.
26A	I	IDSEL	26B	O	C/BE3*
27A		N.C.	27B	I/O	AD23
28A	I/O	AD22	28B	I	GND
29A	I/O	AD20	29B	I/O	AD21
30A		GND	30B	I/O	AD19
31A	I/O	AD18	31B		N.C.
32A	I/O	AD16	32B	I/O	AD17

No.	I/O	Signal name	No.	I/O	Signal name
33A		N.C.	33B	O	C/BE2*
34A	O	FRAME*	34B		GND
35A		GND	35B	O	IRDY*
36A	I	TRDY*	36B		N.C.
37A		GND	37B	I	DEVSEL*
38A	I	STOP*	38B		GND
39A		N.C.	39B		N.C.
40A		N.C.	40B	I/O	PERR*
41A		N.C.	41B		N.C.
42A		GND	42B	O	SERR*
43A	I/O	PAR	43B		3.3V
44A	I/O	AD15	44B	O	C/BE1*
45A		N.C.	45B	I/O	AD14
46A	I/O	AD13	46B		GND
47A	I/O	AD11	47B	I/O	AD12
48A		GND	48B	I/O	AD10
49A	I/O	AD9	49B		GND

No.	I/O	Signal name	No.	I/O	Signal name
50A			50B		
51A			51B		
52A	O	C/BE0*	52B	I/O	AD8
53A		N.C.	53B	I/O	AD7
54A	I/O	AD6	54B		N.C.
55A	I/O	AD4	55B	I/O	AD5
56A		GND	56B	I/O	AD3
57A	I/O	AD2	57B		GND
58A	I/O	AD0	58B	I/O	AD1
59A		N.C.	59B		N.C.
60A		N.C.	60B		N.C.
61A		5V	61B		5V
62A		5V	62B		5V

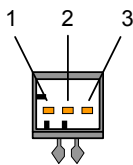
4. Connection of NC Control Unit

4.8 FCU7-HN633-04/FCU7-HN653-05 Unit Connector Pin Assignment

4.8.2 12VDC Input Connection Terminal AVR

Supply 12V power directly to the NC control unit by connecting a G180 cable to the NC control unit's AVR connector and to the operation panel I/O unit's AVR connector. M730BM/M750BM doesn't use a power supply bracket.

12VDC input connection terminal
Terminal name: AVR



<Board side connector's model name>
Connector: 1376135-2
Manufacturer: Tyco Electronics AMP

<Cable side connector's model name>
Connector: 2-1318120-3
Contact: For AWG18-22, Reel-type: 1318105-1, Bulk-type: 1318107-1
Recommended manufacturer: Tyco Electronics AMP

1	I	12VDC
2	-	OV (GND)
3	-	NC

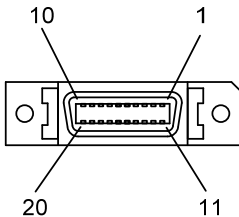
Connection terminal for 12VDC power supply

4.8.3 I/O Unit Connection Terminal CG17

Connect the NC control unit's CG17 connector to the book-type I/O unit's CG17 connector using a G017 cable (20 pin - 20 pin).

The F010 cable (50 pin - 50 pin) for M720BM is not available.

Base I/O unit connection terminal
Terminal name: CG17



<Board side connector's model name>
Connector: 1022052A
Manufacturer: Sumitomo 3M

1	I/O	TXRX1	11	I/O	TXRX1*
2	I/O	TXRX2	12	I/O	TXRX2*
3	-	0V(GND)	13	-	0V(GND)
4	O	SKIP1	14	O	SKIP1*
5	O	SKIP2	15	O	SKIP2*
6	O	SKIP3	16	O	SKIP3*
7	O	SKIP4	17	O	SKIP4*
8	-	0V(GND)	18	-	0V(GND)
9	-	0V(GND)	19	-	0V(GND)
10	-	0V(GND)	20	-	0V(GND)

<Cable side connector's model name>
Connector: 10120-3000VE (soldered type)
10120-6000EL (compressed type)
Case : 10320-52F0-008
Recommended manufacturer: Sumitomo 3M

Terminal for connecting between NC control unit and book-type I/O unit

4. Connection of NC Control Unit

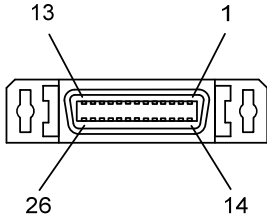
4.8 FCU7-HN633-04/FCU7-HN653-05 Unit Connector Pin Assignment

4.8.4 Operation Panel I/O Unit Connection Terminal CG62

A CG62 connector, which is for connecting NC control unit with operation panel I/O unit, can be used in the same way as M720BM. Use an F011 cable, which is the same as of M720BM (or an equivalent cable).

Operation panel I/O unit connection terminal

Terminal name: CG62



1	O	BAT	14	O	DCFAIL*
2	I	7SEG	15	I	7SEG*
3	O	EMGIN	16	O	EMGIN*
4	O	DCFAIL(Reserved)	17	O	BAT(Reserved)
5	-	0V(GND)	18	-	0V(GND)
6	I/O	TXRX3	19	I/O	TXRX3*
7	O	RTS1	20	I	CTS1
8	O	TXD1	21	I	RXD1
9	O	DTR1	22	I	DSR1
10	-	0V(GND)	23	-	0V(GND)
11	O	RTS2	24	I	CTS2
12	O	TXD2	25	I	RXD2
13	O	DTR2	26	I	DSR2

<Board side connector's model name>
Connector: 178238-4
Manufacturer: Tyco Electronics AMP

<Cable side connector's model name>
Connector :10126-6000L
Case :10326-3210-000
Recommended manufacturer: Sumitomo 3M

Terminal for connecting NC control unit with operation panel I/O unit

4.8.5 Extension Unit Connection Terminal EXT

Connect the G280 cable from the EXT connector on the NC control unit to the EXT connector on the extension unit. How to connect the extension unit is the same as that for M720BM.

An extension unit for M720BM, FCU7-HN692 cannot be used for M730BM/M750BM as the unit's signal allocation is different from that of M730BM/M750BM.

Control unit name	Extension unit name	Availability of combination
FCU7-HN623-02 (M720BM)	FCU7-HN692	Available
	FCU7-HN693	Unavailable
FCU7-HN633-04/FCU7-HN653-05 (M730BM/M750BM)	FCU7-HN692	Unavailable
	FCU7-HN693	Available

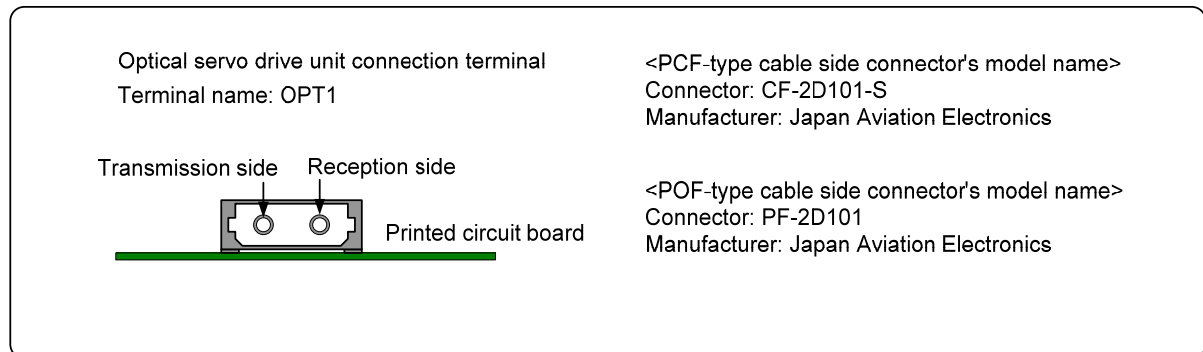
4. Connection of NC Control Unit

4.8 FCU7-HN633-04/FCU7-HN653-05 Unit Connector Pin Assignment

4.8.6 Optical Communication Servo Drive Unit Connection Terminal OPT1

This terminal is used for connecting the servo drive unit belonging to the first part system.

Note:



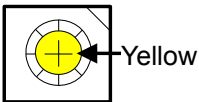
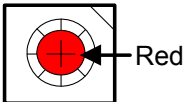
Optical communication servo drive unit connection terminal



Never look into the optical communication connector. Strong light of short wavelength is coming out from the connector while the power is ON. Failure to observe this could injure your eyes.

4.9 Rotary Switch

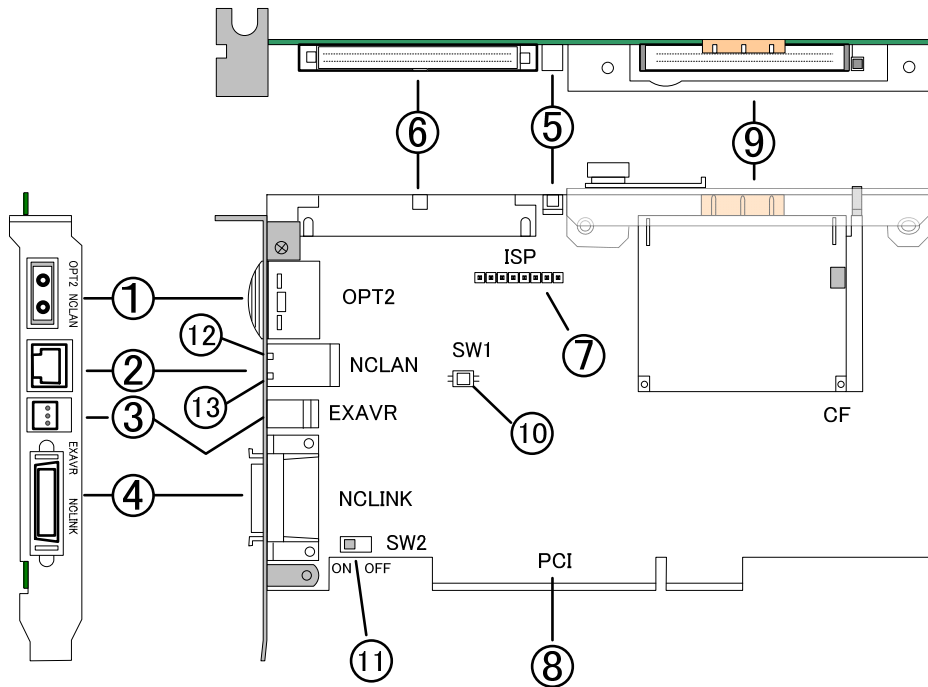
An NC control unit is equipped with two rotary switches, SW1 and SW2. Their names and functions are the same as those of M720BM.

Name	Color	Function
SW1	Yellow	<p>Use for maintenance. 0: For normal use. The system boots from the onboard ROM. 1 or bigger: Boot device is selected for maintenance. In normal use, if 1 or bigger is set, the system won't boot.</p> <p>Setting at shipping: 0</p> 
SW2	Red	<p>Use for maintenance. 0: For normal use. 1: The system boots with PLC stopped. C: For clearing SRAM. Do not use this setting for other than maintenance.</p> <p>Setting at shipping: 0</p> 

5. Connection of the Extension Unit

Connect the extension unit FCU7-HN693 to the PCI extension slot (slot #2).

5.1 Names of FCU7-HN693 Unit Sections



Layout of extension unit's parts

No.	Connector name	Explanation of function
1	OPT2	Use for communication of optical servo drive unit in the 2nd part system.
2	NCLAN	Use for Ethernet communication.
3	EXAVR	Use to supply 12V power from operation panel I/O unit.
4	NCLINK	Use for communication between NC control units.
5	BAT	Use for maintenance.
6	EXT	Use for connection with the NC Control unit.
7	ISP	Not used.
8	PCI	Connected to the panel computer's PCI-BUS slot.
9	CF	Use to connect to CF when CF operation option is enabled.

No.	Switch name	Explanation of function
10	SW1	Switch for maintenance (Not mounted)
11	SW2	Use to switch the ON/OFF of the terminating resistor for communication between NC control units. Either setting ON or OFF won't affect the ordinary performance.

No.	LED name	Explanation of function
12	LED1	Use for indicating Ethernet communication state.
13	LED2	Use for indicating Ethernet communication reception state.

5.2 Connection with the NC Control Unit

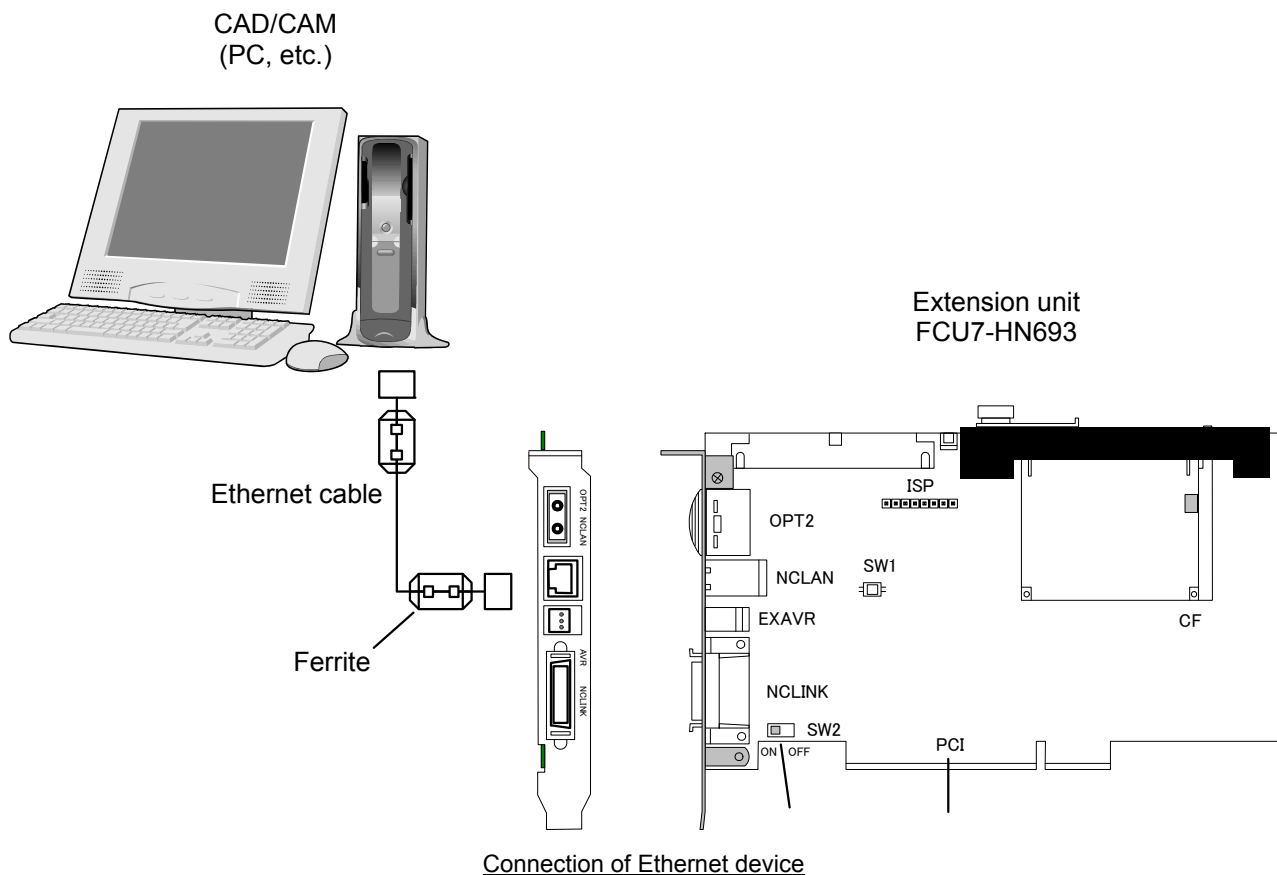
Refer to "4.4 Connection with the extension unit".

5.3 Connection with the Optical Communication Servo Drive Unit

Refer to "4.7.2 Connection of Optical Communication Servo Drive unit (exceeding 16 axes)".

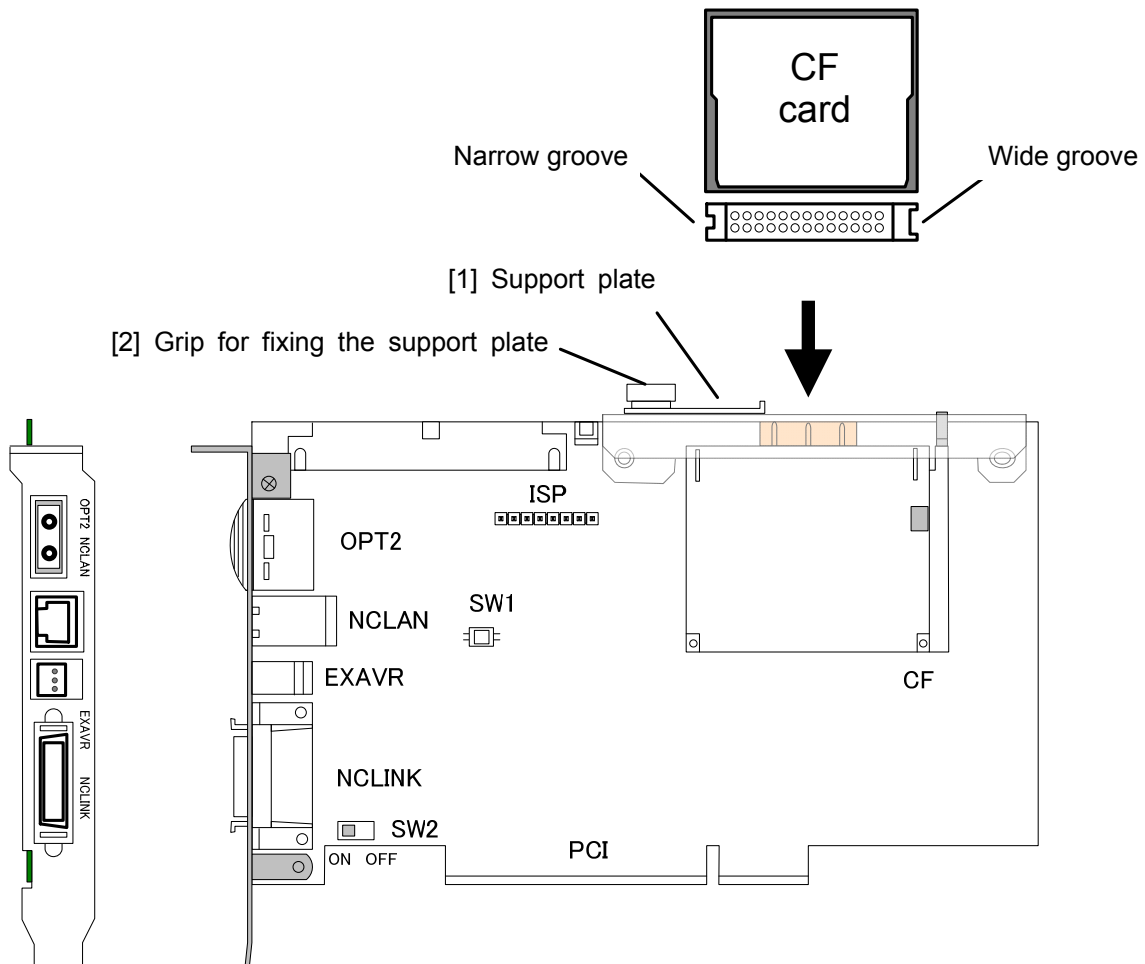
5.4 Connection with the Ethernet Device

To the "NCLAN" connector on the FCU7-HN693 unit, connect an Ethernet I/F of a commercially-available personal computer, etc. Use a cable that conforms to Category 5 (Category 5e is recommended). To ensure the operational stability, we recommend you to select a cable to which "shield" and "ferrite" are attached. The usage is the same as of M720BM Series. Therefore, refer to "720BM Series High-speed Program Server Operation Specifications" (BNP-C3051-118A).



5.5 Connection with CF card

Insert a CF card into the below illustrated location. To prevent the medium from getting out due to vibration, press the medium with the support plate [1] and fix with the fixing grip [2] after insertion. Commercially-available CF card can be used, but some of them may undergo "unstable operation", or "operation failure" due to the internal controller's characteristics. Therefore, users should check the performance before use. Also make sure to back up the data.



Note: The CF in the drawing is only an image for explanation. Thus, this doesn't have the actual scale.

Connection with CF card

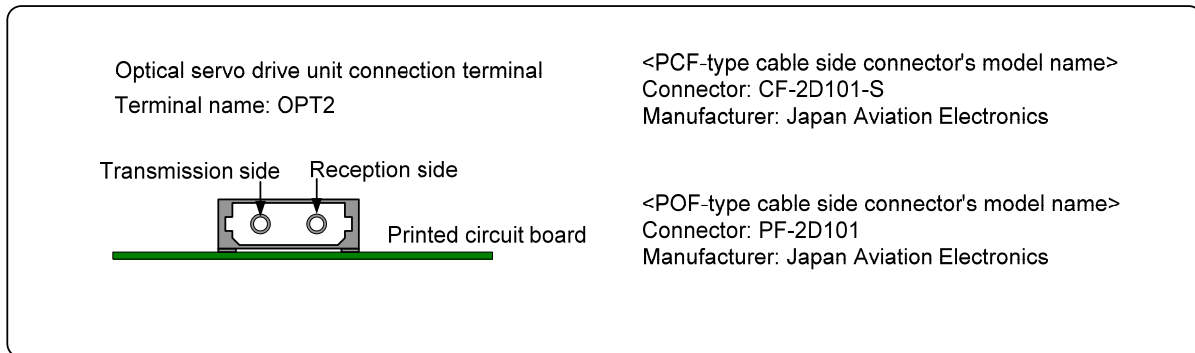
5. Connection of the Extension Unit

5.6 Connector Pin Assignment of Extension Unit FCU7-HN693

5.6 Connector Pin Assignment of Extension Unit FCU7-HN693

5.6.1 Optical Communication Servo Drive Unit Connection Terminal OPT2

This terminal is used for connecting the optical communication servo drive unit belonging to the second part system.



Optical communication servo drive unit connection terminal

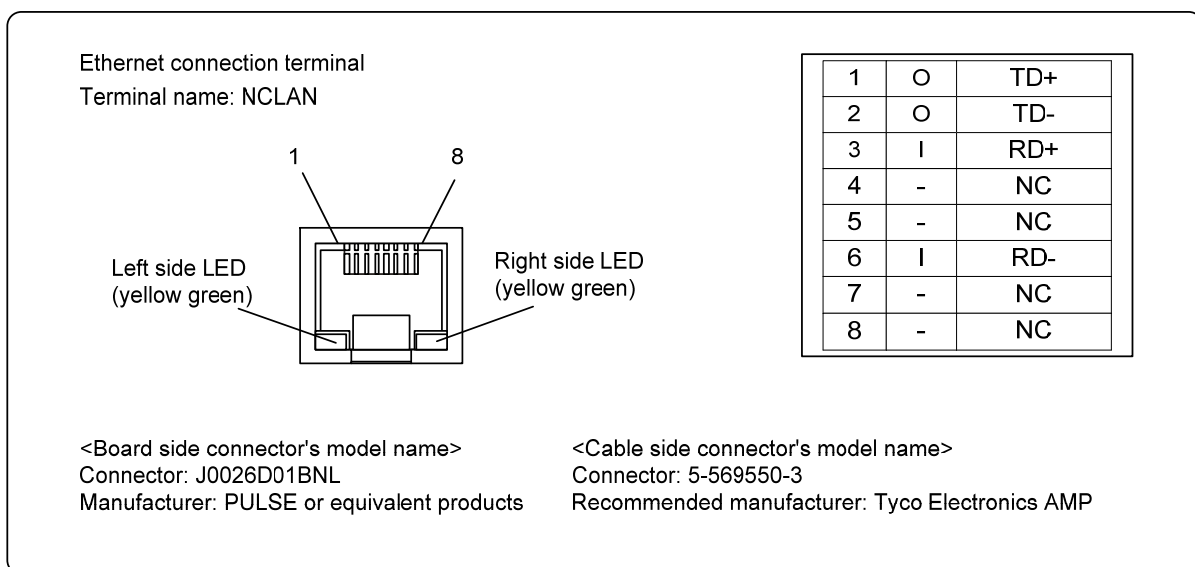


Never look into the optical communication connector. Strong light of short wavelength is coming out from the connector while the power is ON. Failure to observe this could injure your eyes.

5.6.2 Ethernet Communication Connection NCLAN

This terminal is used for connecting NCLAN, a connector for Ethernet communication. This supports 100BASE-TX/10BASE communication.

Use a cable that conforms to Category 5 (Category 5e is recommended). To ensure the operational stability, we recommend you to select a cable to which "shield" and "ferrite" are attached.



Ethernet communication connection terminal

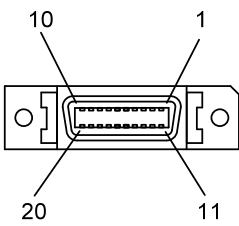
5. Connection of the Extension Unit

5.6 Connector Pin Assignment of Extension Unit FCU7-HN693

5.6.3 I/O Link Communication Connection NCLAN

This terminal is used for the I/O link between NC Control units.

I/O link connection terminal
Terminal name: NCLINK



<Board side connector's model name>
Connector: 10220-52A
Manufacturer: Sumitomo 3M

1	-	0V(GND)	11	-	0V(GND)
2	I	RXD	12	I	RXD*
3	-	NC	13	-	NC
4	O	TXD	14	O	TXD*
5	-	NC	15	-	NC
6	-	NC	16	-	NC
7	-	NC	17	-	NC
8	-	NC	18	-	NC
9	-	NC	19	-	NC
10	-	NC	20	-	NC

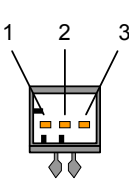
<Cable side connector's model name>
Connector: 10120-3000VE (soldered type)
10120-6000EL (compressed type)
Case : 10320-52F0-008
Recommended manufacturer: Sumitomo 3M

I/O link communication connection terminal

5.6.4 12VDC Input Connection Terminal EXAVR Power Supply Terminal EXAVR

The power supply terminal of FCU7-HN693 is a connector made by Tyco Electronics AMP. For M720BM's extension unit, FCU7-HN692, a connector made by Japan Molex is used instead. Connect this terminal to the operation panel I/O unit, FCU7-HN376-02 with a G180 cable in order to supply 12V power.

12VDC input connection terminal
Terminal name: EXAVR



<Board side connector's model name>
Connector: 1376135-2
Manufacturer: Tyco Electronics AMP

<Cable side connector's model name>
Connector: 2-1318120-3
Contact: For AWG18-22, Reel-type: 1318105-1, Bulk-type: 1318107-1
Recommended manufacturer: Tyco Electronics AMP

1	I	DC12V
2	-	0V(GND)
3	-	FG

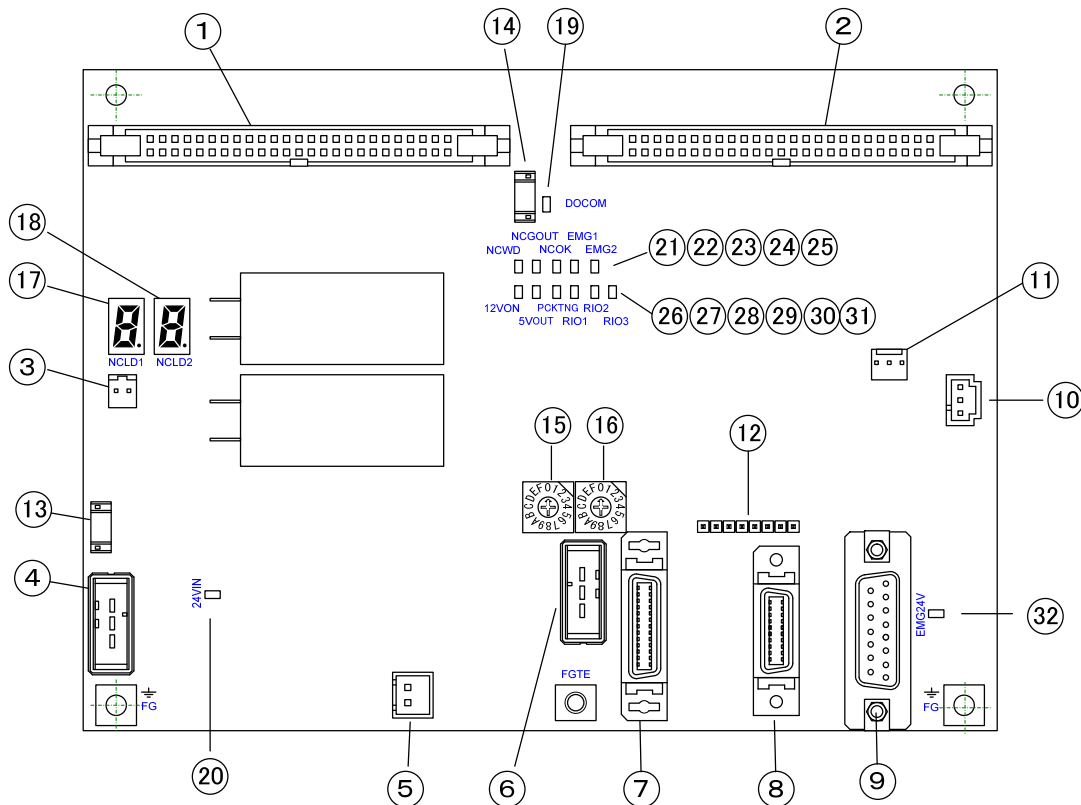
12VDC input connection terminal

6. Connection of the Operation Panel I/O Unit

6.1 Names of FCU7-HN376-02 Unit Sections

6. Connection of the Operation Panel I/O Unit

6.1 Names of FCU7-HN376-02 Unit Sections



Part locations of operation panel I/O unit

No.	Connector name	Explanation of function
1	CE56	Use to connect the machine input/output.
2	CE57	Use to connect the machine input/output.
3	BAT1	Used to connect the battery unit BTBOX (BTBOX-36). BTBOX-36 can be used with M730BM/M750BM only: when used with M720BM, an alarm for low battery voltage will occur.
4	DCIN	Use to supply the 24VDC power.
5	AVR	Use to supply power to the extension unit or NC control unit.
6	RIO	Use to connect with the remote I/O unit.
7	CG62	Use to connect with the NC control unit.
8	SIO	Use to connect with the RS-232C device.
9	MPG	Use to connect with the optical servo drive unit.
10	EMGIN	Use to connect the manual pulse generator.
11	TEST	Not used.
12	ISP	Not available: Used by Mitsubishi for shipping test.

No.	Switch name	Explanation of function
13	F1	Protects the control circuit from overcurrent. (Fuse type: LM40, rating: 4A, manufacturer: Daito Communication)
14	F2	Protects the machine output circuit from overcurrent. The current passes in a batch through the CE56 and 57 DOCOM pins. (Fuse type: LM40, rating: 4A, manufacturer: Daito Communication)

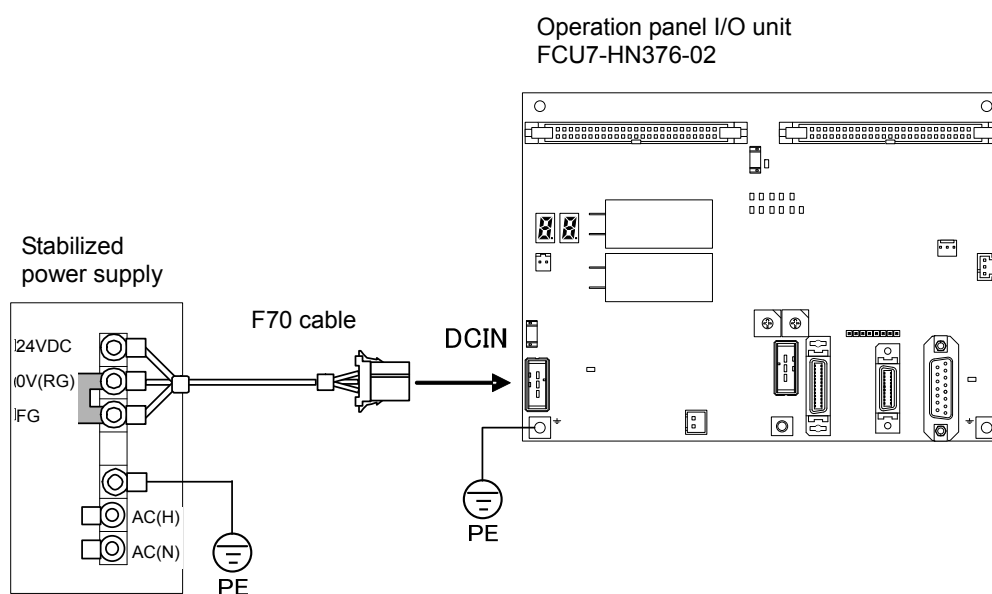
6. Connection of the Operation Panel I/O Unit

6.1 Names of FCU7-HN376-02 Unit Sections

No.	Switch name	Explanation of function
15	CS1	Use to set the machine input/output station numbers. Set the station numbers with the 32 points DI: X0 -X1F and DO: Y0-Y1F. Normally "0" is set when using as the operation board I/O. Set an even number (0, 2, 4, 6). If an odd number is set, the previous even station number will be set. The station number with the 16 points DI: X20-X2F and one manual pulse generator is automatically assigned as the station number (odd station number) after the station number set with CS1.
16	CS3	Use to set the manual pulse generator station number. Set the station number of the manual pulse generator (2nd, 3rd) I/F circuit. When more than 8 is set, the remote I/O station for the manual pulse generator (2nd, 3rd) will be invalidated.
17	NCLD1	7-segment LED for confirming the system operation status.
18	NCLD2	
19	DOCOM	LED for confirming state of communication to machine output common pin.
20	24VIN	LED to confirming 24VDC continuity status.
21	NCWD	LED for confirming NC control unit's watch dog error status.
22	NCGOUT	LED for maintenance.
23	NCOK	LED for confirming NC control unit operation status.
24	EMG1	LED for confirming emergency stop button status.
25	EMG2	LED for confirming emergency stop status.
26	12VON	LED for confirming 12V continuity status.
27	5VON	LED for confirming 5V continuity status.
28	PCKTNG	LED for confirming remote I/O communication status.
29	RIO1	LED for confirming communication status of remote I/O unit (system 1).
30	RIO2	LED for confirming communication status of remote I/O unit (system 2).
31	RIO3	LED for confirming communication status of remote I/O unit (system 3).
32	EMG24V	LED for confirming EMG output circuit continuity status.

6.2 Connection of 24VDC Power Supply

24VDC is supplied to the "DCIN" connector on the operation panel I/O unit.



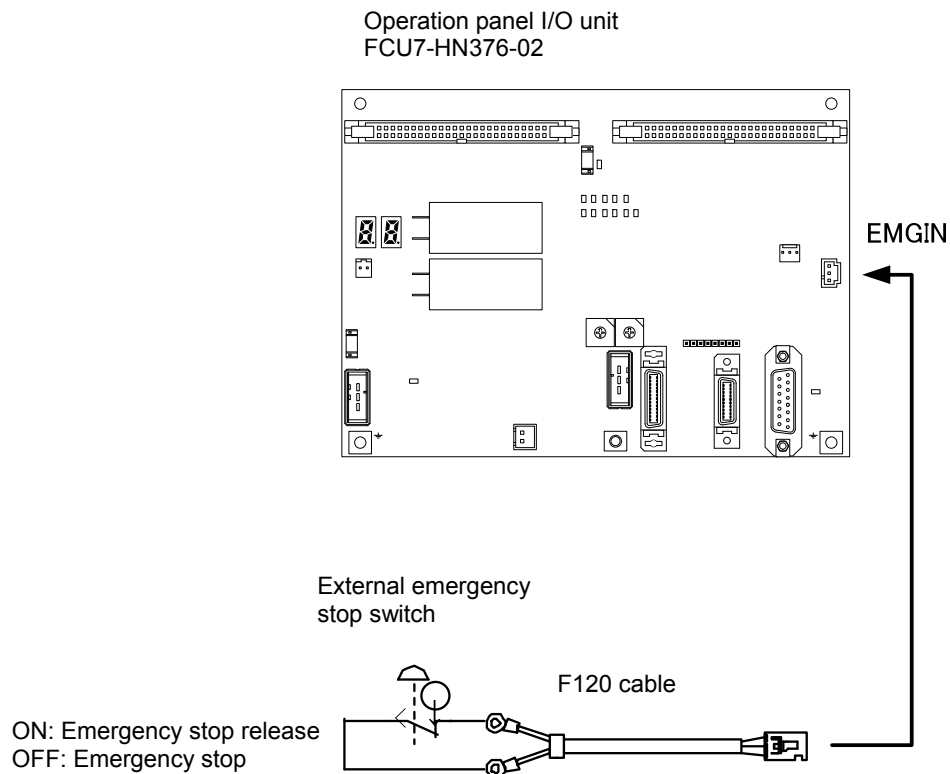
24VDC connection diagram to the operation panel I/O unit

6. Connection of the Operation Panel I/O Unit

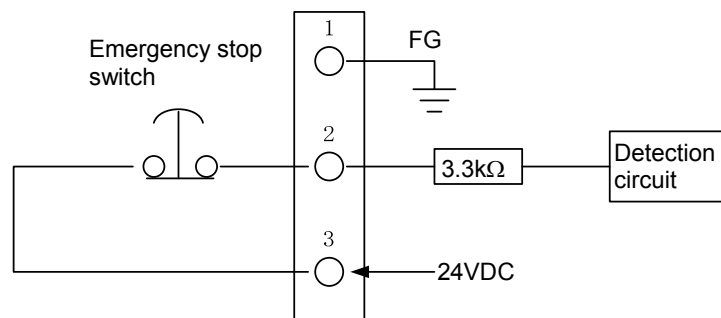
6.3 Connection of the External Emergency Stop

6.3 Connection of the External Emergency Stop

External emergency stop can be input by using the "EMGIN" connector on the operation panel I/O unit.



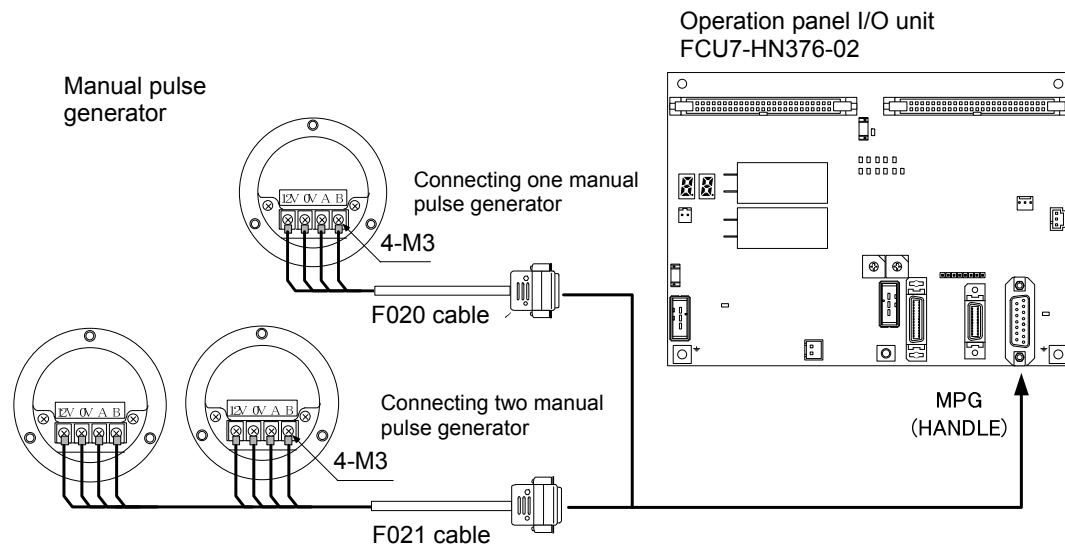
Emergency stop (EMG) signal connection diagram



Emergency stop (EMG) signal interface circuit

Emergency stop function is compliant to the stop category 1 of the European Safety Standards "EN60204-1".

6.4 Connection of Manual Pulse Generator



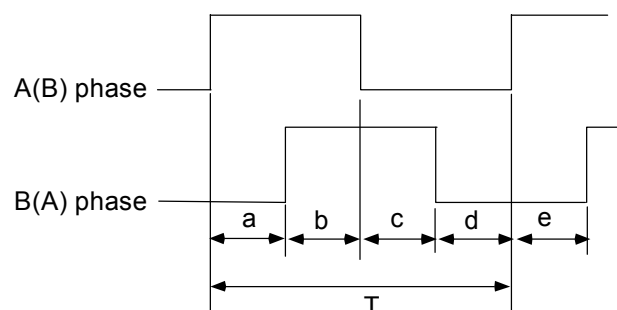
Manual pulse generator connection diagram

When devices (pulse generators) other than manual pulse generators (HD60) are connected to the FCU7-HN376-02, use within the ranges shown in the following specifications. The 25 pulse/rev type and 100 pulse/rev type are available for the commercially-available manual pulse generators.

Input/output conditions

Input pulse signal type	90° phase difference between A phase and B phase. (Refer to waveform (e) below.)
Input signal voltage	H-level 3.5V to 5.25V, L-level 0V to 0.5V
Max. input pulse frequency	100kHz
Power voltage for pulse generator	12VDC \pm 10% or 5VDC \pm 5%
Max. output current	300mA
No. of pulses per rotation	25 pulse/rev or 100 pulse/rev (Note) Mitsubishi supplies 25-pulse/rev type manual pulse generator.

Input waveform The input waveform phase difference must be $\pm T/10$ (T: cycle) or less.

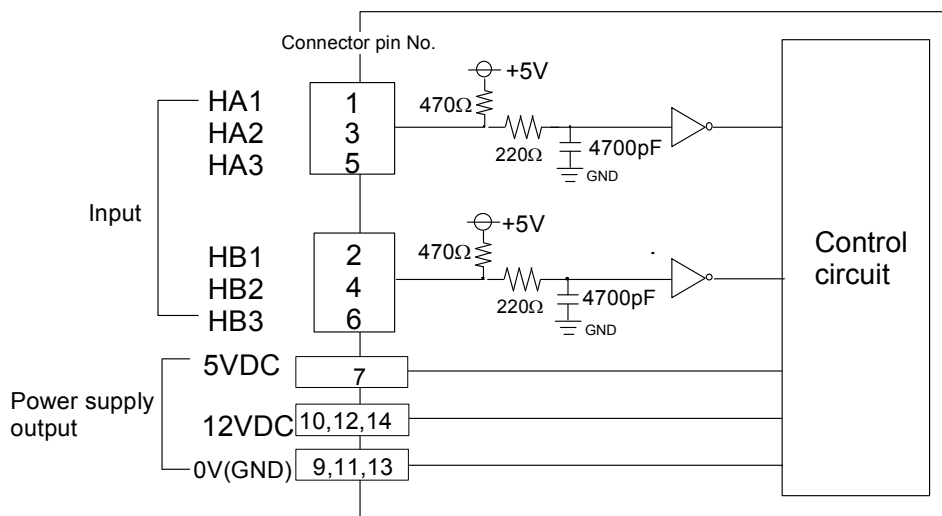


a. b. c. d. e: A or B phase rising edge (falling edge) phase difference = $T/4 \pm T/10$
T: A or B phase cycle (Min. 10 μ s)

6. Connection of the Operation Panel I/O Unit

6.5 Connection of RS-232C Communication Device

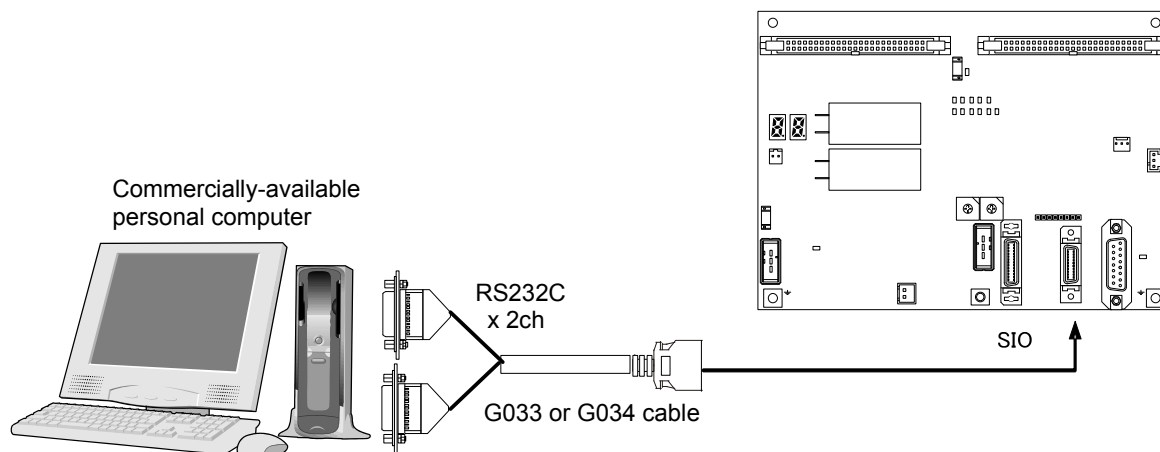
Input/output circuit



The power voltage supplied to the manual pulse generator can be changed between 5VDC and 12VDC by changing the cable wiring. Supply the power from pin 7 for the 5VDC power supply manual pulse generator, and from pins 10, 12 and 14 for the 12VDC power supply manual pulse generator. Use several power and 0V (GND) wire materials in the cable.

6.5 Connection of RS-232C Communication Device

The "SIO" connector on the operation panel I/O unit is connected with the RS232C I/F on a commercially-available personal computer, etc.

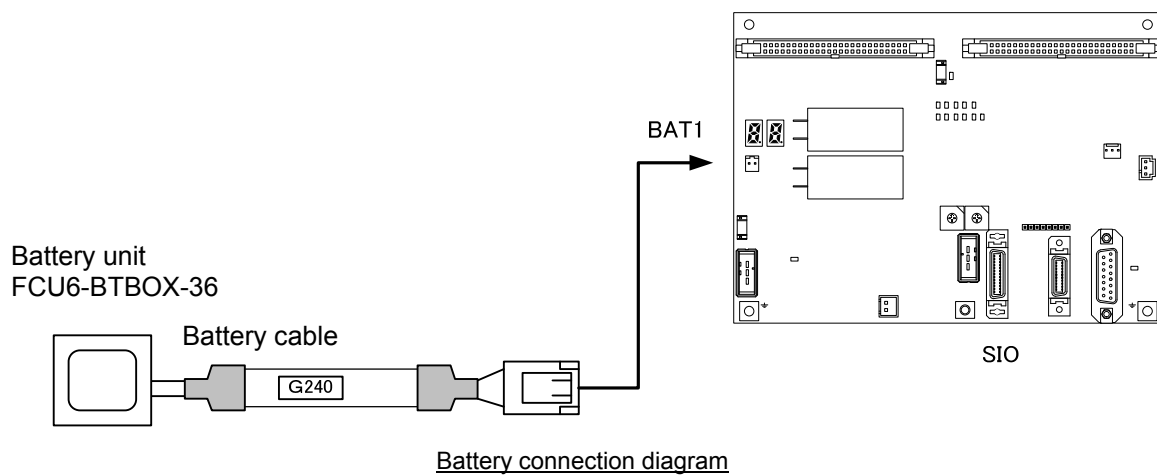


RS-232C communication device connection diagram

Note) "RS232C" refers to the official standard "ANSI/TIA/EIA-232-F-1997". This manual uses the term "RS-232C", which is commonly used.

6.6 Connection of Battery

The "BAT1" connector on the operation panel I/O unit is connected with the battery FUC6-BTBOX-36.



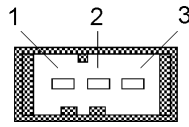
Applicable battery: FUC6-BTBOX

6.7 Connection with NC Control Unit

Refer to "4.5 Connection with operation panel I/O unit" for connection with NC control unit.

6.8 Connector Pin Assignment

6.8.1 Power Input Terminal (24VDC) DCIN

24VDC input
DCIN

<Cable side connector type>

Connector : 2-178288-3

Contact : 1-175218-5

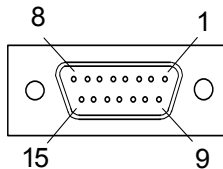
Recommended manufacturer:

Tyco Electronics AMP

1	I	+24V
2		GND
3		FG

(Note) I/O in the table indicates the assignment looking from the I/O unit.

6.8.2 Manual Pulse Generator Connection Terminal MPG (HANDLE)

Manual pulse generator
MPG
(HANDLE)

<Cable side connector type>

Connector : CDA-15P

Contact : CD-PC-111

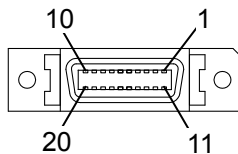
Case : HDA-CTH

Recommended manufacturer: Hirose Electric

1	I	HA1A	9		GND
2	I	HA1B	10		+12V
3	I	HA2A	11		GND
4	I	HA2B	12		+12V
5	I	HA3A	13		GND
6	I	HA3B	14		+12V
7		+5V	15		
8					

(Note) I/O in the table indicates the assignment looking from the I/O unit.

6.8.3 EIA/TIA-232C Device Connection Terminal RS232C

RS232C
SIO

<Cable side connector type>

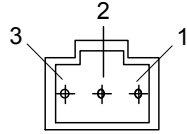
Connector: DHA-RB20-S122N

Recommended manufacturer: DDK

1		GND	11		GND
2	I	RXD1	12	O	TXD1
3	I	CTS1	13	O	RTS1
4	I	DSR1	14	O	DTR1
5		GND	15		GND
6		reserve	16		reserve
7	I	RXD2	17	O	TXD2
8	I	CTS2	18	O	RTS2
9	I	DSC2	19	O	DTR2
10		24VDC	20		0V (RG)

6.8.4 External Emergency Stop Connection Terminal EMG

EMG



<Cable side connector type>

Connector : 51030-0330

Contact : 50084-8160

Recommended manufacturer: MOLEX

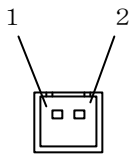
1		FG
2	I	EMG IN
3	O	COM

(COM pin outputs 24VDC)

6.8.5 NC Control Unit Power Output Terminal (12VDC) AVR

12VDC input connection terminal

Terminal name: AVR



<Board side connector type>

Connector: 53258-3002

Manufacturer: MOLEX

1	O	12VDC
2	—	0V (GND)

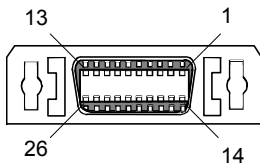
<Cable side connector type>

Connector: 51067-0200

Contact: 50217-8100

Recommended manufacturer: MOLEX

6.8.6 NC Control Unit Connection Terminal CG62



<Cable side connector type>

Plug : 10126-6000EL

Shell: 10326-3210-000

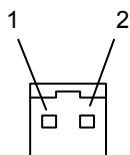
Recommended manufacturer:
Sumitomo 3M

No.	I/O	Signal name	No.	I/O	Signal name
1	I	BAT	14	I	DCFAIL*
2	O	7SEGCON	15	O	7SEGCON*
3	I	CPU_EMGIN	16	I	CPU_EMGIN*
4	O	CPU_EMGOUT	17	O	CPU_EMGOUT*
5		GND	18		GND
6	I/O	TXRXD1	19	I/O	TXRXD1*
7	O	RTS1	20	I	CTS1
8	O	TD1	21	I	RD1
9	O	DR1	22	I	DC1
10		GND	23		GND
11	O	RTS2	24	I	CTS2
12	O	TD2	25	I	RD2
13	O	DR2	26	I	DC2

6.8.7 Battery Connection Terminal BAT

Backup power input connection terminal

Terminal name: BAT1



<Board side connector type>

Connector: IL-2P-S3FP2-1

Manufacturer: Japan Aviation Electronics

1	O	0V (GND)
2	—	(+) side input

<Cable side connector type>

Connector: IL-2S-S3L-(N)

Contact: IL-C2-1-1000

Recommended manufacturer:
Japan Aviation Electronics

6.8.8 Machine Input/Output Terminal CE56/C57

Machine input/output connection terminal

CE56

		A			B
1	O	0V(RG)	1	O	24VDC
2	I	X00	2	I	X01
3	I	X02	3	I	X03
4	I	X04	4	I	X05
5	I	X06	5	I	X07
6	I	X08	6	I	X09
7	I	X0A	7	I	X0B
8	I	X0C	8	I	X0D
9	I	X0E	9	I	X0F
10	I	X10	10	I	X11
11	I	X12	11	I	X13
12	I	X14	12	I	X15
13	I	X16	13	I	X17
14		DICOM0	14		
15			15		
16	O	Y00	16	O	Y01
17	O	Y02	17	O	Y03
18	O	Y04	18	O	Y05
19	O	Y06	19	O	Y07
20	O	Y08	20	O	Y09
21	O	Y0A	21	O	Y0B
22	O	Y0C	22	O	Y0D
23	O	Y0E	23	O	Y0F
24		DOCOM	24		DOCOM
25		DOCOM	25		DOCOM

C57

		A			B
1	O	0V(RG)	1	O	24VDC
2	I	X18	2	I	X19
3	I	X1A	3	I	X1B
4	I	X1C	4	I	X1D
5	I	X1E	5	I	X1F
6	I	X20	6	I	X21
7	I	X22	7	I	X23
8	I	X24	8	I	X25
9	I	X26	9	I	X27
10	I	X28	10	I	X29
11	I	X2A	11	I	X2B
12	I	X2C	12	I	X2D
13	I	X2E	13	I	X2F
14			14		DICOM5
15			15		
16	O	Y10	16	O	Y11
17	O	Y12	17	O	Y13
18	O	Y14	18	O	Y15
19	O	Y16	19	O	Y17
20	O	Y18	20	O	Y19
21	O	Y1A	21	O	Y1B
22	O	Y1C	22	O	Y1D
23	O	Y1E	23	O	Y1F
24		DOCOM	24		DOCOM
25		DOCOM	25		DOCOM

[Cable side connector type]

PCB connector: HIF3BB-50PA-2.54DSA
(straight local guide center type)

Recommended cable side connector type: HIF3BB-50D-2.54R (or equivalent product)

6.9 Protection Fuse

The 24VDC input circuit of the operation panel I/O unit FCU7-HN376-02 has a fuse (F1) for protecting the DO output circuit from burnout, and another fuse (F2) for protecting against burnout due to short-circuit. Replace with a new fuse with the same rating if it is blown.

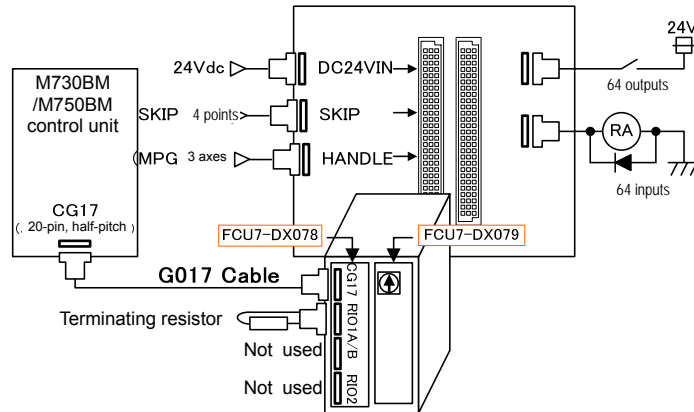
Name	Function	Rating	Manufacturer	Name
F1	Protect the DO output circuit	4A	Daito Communication	LM40
F2	Protect the control circuit from burnout	4A	Daito Communication	LM40

7. Connection of Book-Type I/O Unit

7.1 Combination

7.1.1 Standard Configuration Example

The standard configuration consists of one NC control unit and one base unit, FCU7-DX078 (DI: 32 points, DO: 32 points) and one extension unit, FCU7-DX079 (DI: 32 points, DO: 32 points).



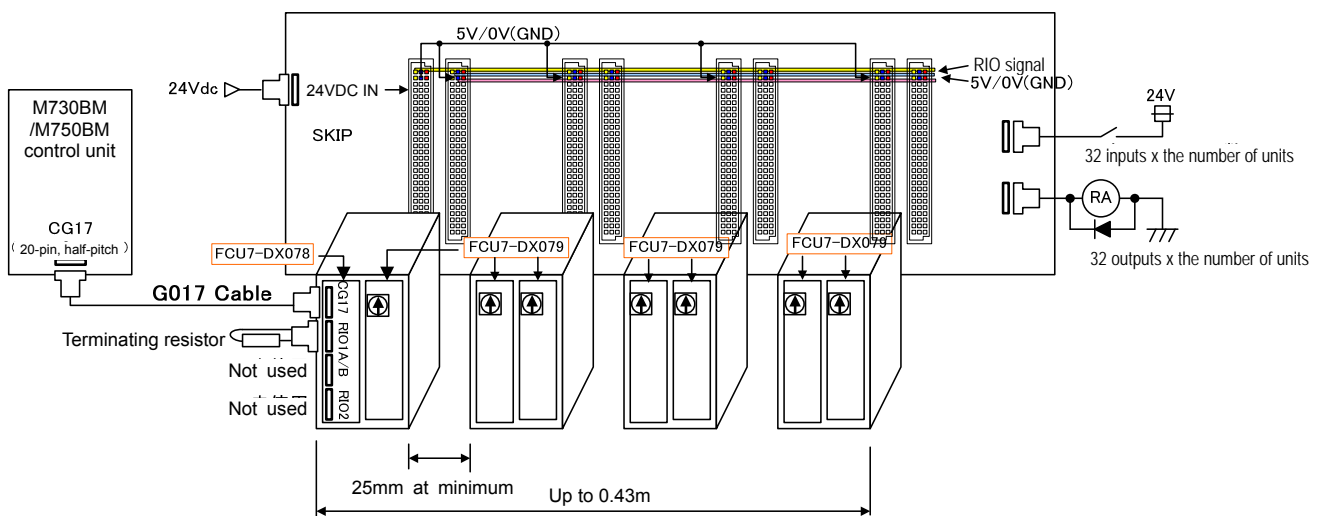
Standard configuration example

Standard configuration example of book-type I/O unit

7.1.2 Extended Configuration Example

If the numbers of I/O points in the standard configuration are insufficient, you can extend by mounting expansion connectors on the machine tool builder's I/O panel side. For one NC control unit, one base unit, FCU7-DX078 (DI: 32 points, DO: 32 points) and up to seven extension units FCU7-DX079 (DI: 32 points, DO: 32 points) can be connected. This means that up to eight units can be combined. However, please keep in mind that the three remote I/O channels on the base unit are occupied when you enable the manual pulse generator's I/F.

In this case, you can eliminate the communication signal cable and power cable by relaying the remote I/O signal and 5V/0V(GND) to the CG30 connector using the machine tool builder's I/O panel. Separate the units from each other by 25mm or more in order to secure the I/O panel's strength between the square holes (12mm x 7mm) opened on the panel for heat radiation and for fixing.



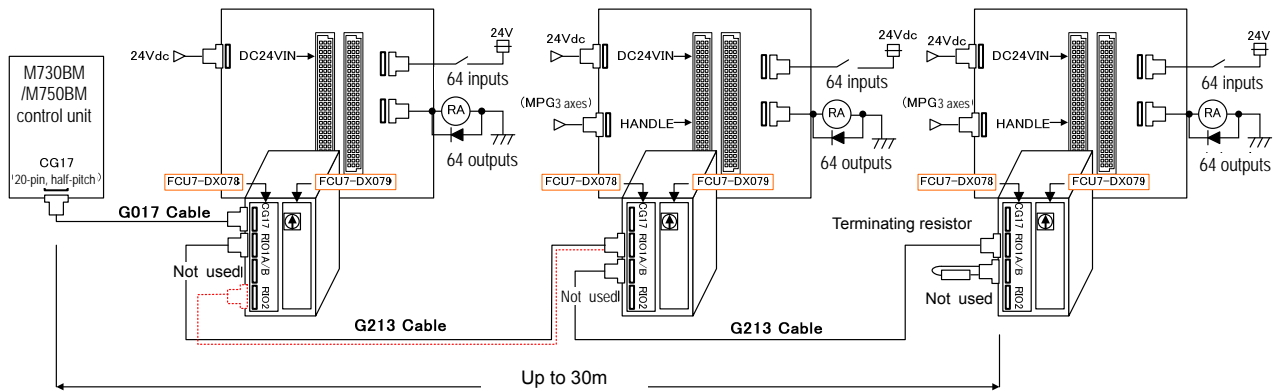
Extended configuration example

Extended configuration example of book-type I/O unit

7.1.3 Distributed Configuration Example

If you want to place the units apart from each other, connect the connectors RIO1A (or RIO1B) of the base units FCU7-DX078 using G213 cables.

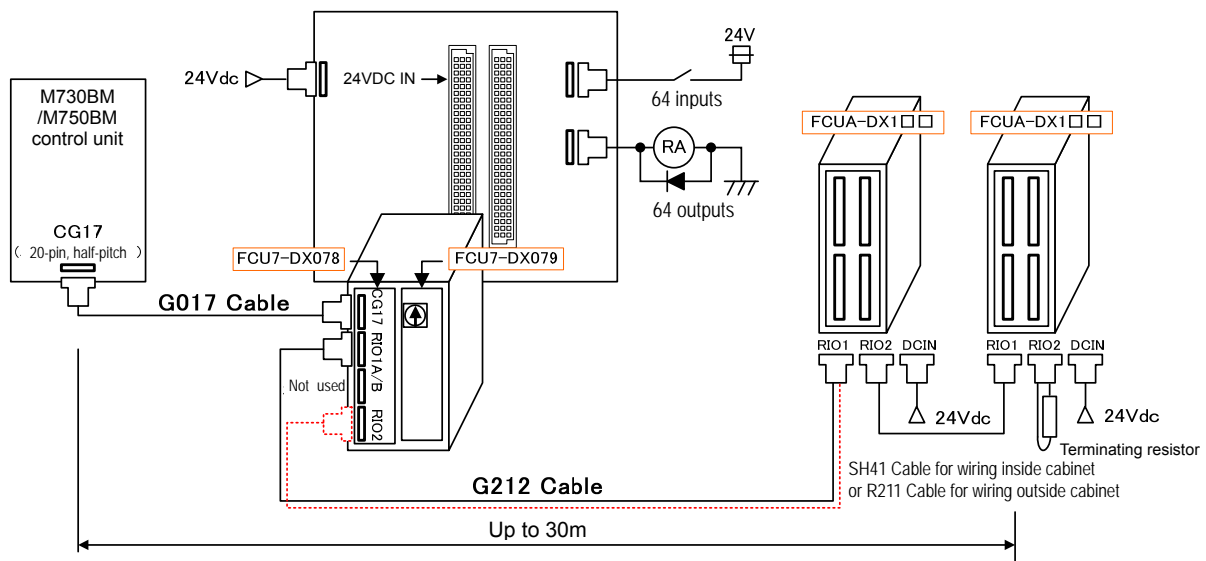
Among the units, only the base unit FCU7-DX078, which is connected to the NC control unit, can occupy the remote I/O's second part system channel (RIO2). Up to eight remote I/O channels are available, as long as the line length between the NC control unit and the terminal unit is 30m or less. Please keep in mind that the three remote I/O channels of the base unit are occupied when you enable the manual pulse generator's I/F function.



Distributed configuration example of book-type I/O unit

7.1.4 Connection with Conventional Remote I/O Unit

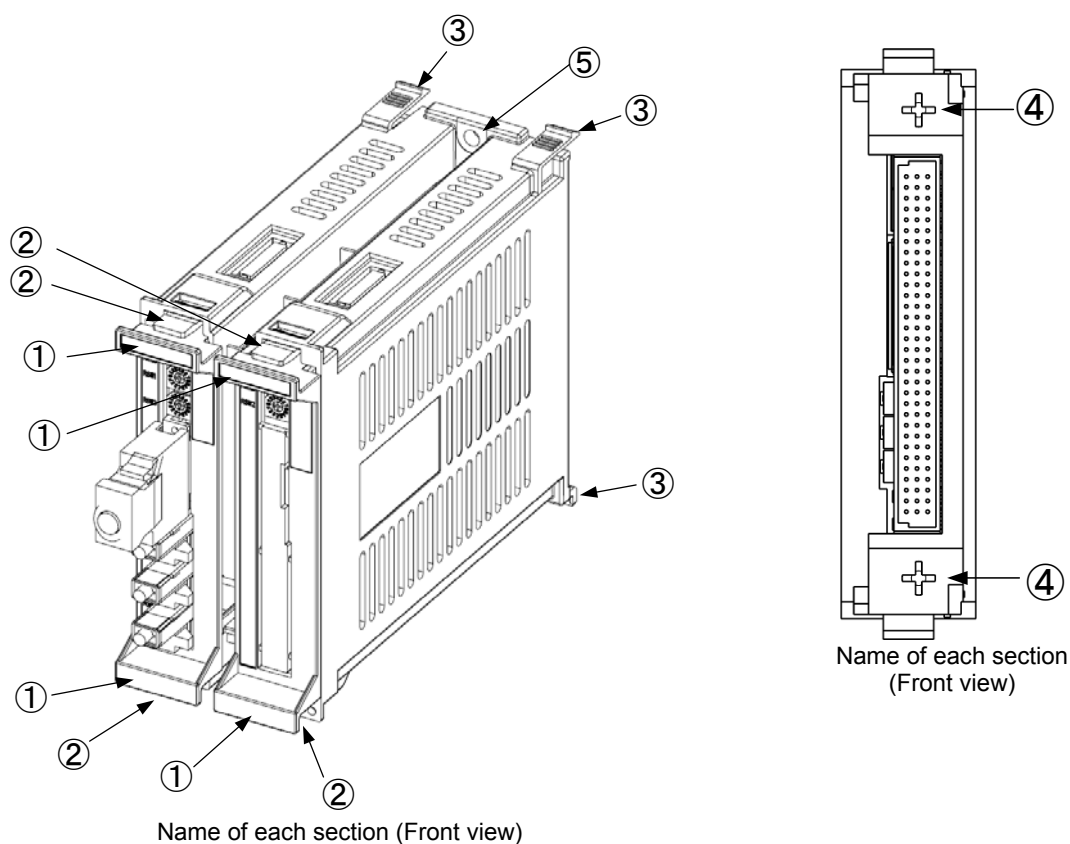
When you connect the book-type I/O unit with the conventional remote I/O units, such as FCUA-DX1□□ and FCU6-DX○○○, you can connect them to the RIO1A (or RIO1B) of the base unit FCU7-DX078 using a G212 cable. Among the units, only the base unit FCU7-DX078 can occupy the remote I/O's second part system channel (RIO2). Up to eight remote I/O channels are available, as long as the line length between the NC control unit and the terminal unit is 30m or less. Please keep in mind that the three remote I/O channels of the base unit are occupied when you enable the manual pulse generator's I/F function.



Book-type I/O unit connected to conventional remote I/O units

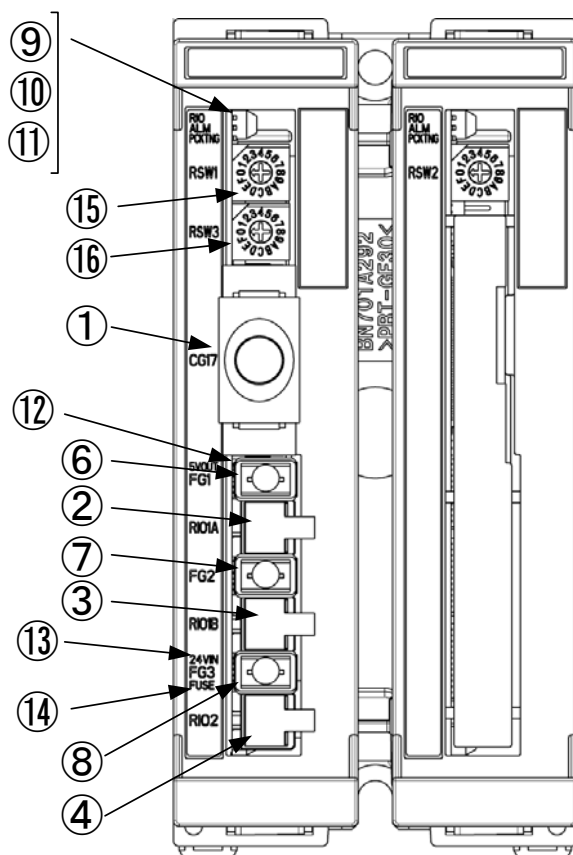
7.2 Name of Book-Type I/O Unit Section

7.2.1 Names of Sections Common Between Base Unit And Extension Unit

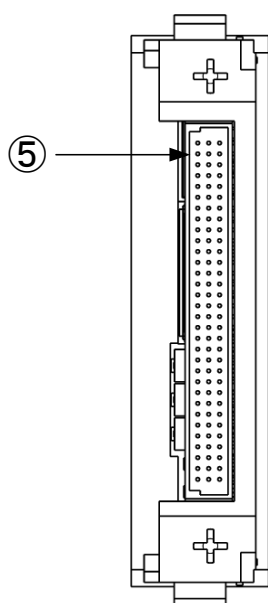


No.	Name	Explanation of function
1	Unit pulling knob	Knobs to pull out the unit.
2	Unit lock lever	Knobs to fix FCU7-DX078/DX079 to the frame case.
3	Hooks for temporary fixing the case	Hooks to temporarily fix the case to the MTB's signal splitter.
4	Positioning guide	Guides when inserting FCU7-DX078/DX079 in the MTB's signal splitter.
5	Fixing screw hole	M5 screw holes to fix the unit. Two holes at top and bottom.

7.2.2 Names of FCU7-DX078 (Base unit) Section



Name of each section (Front view)



Name of each section (Rear view)

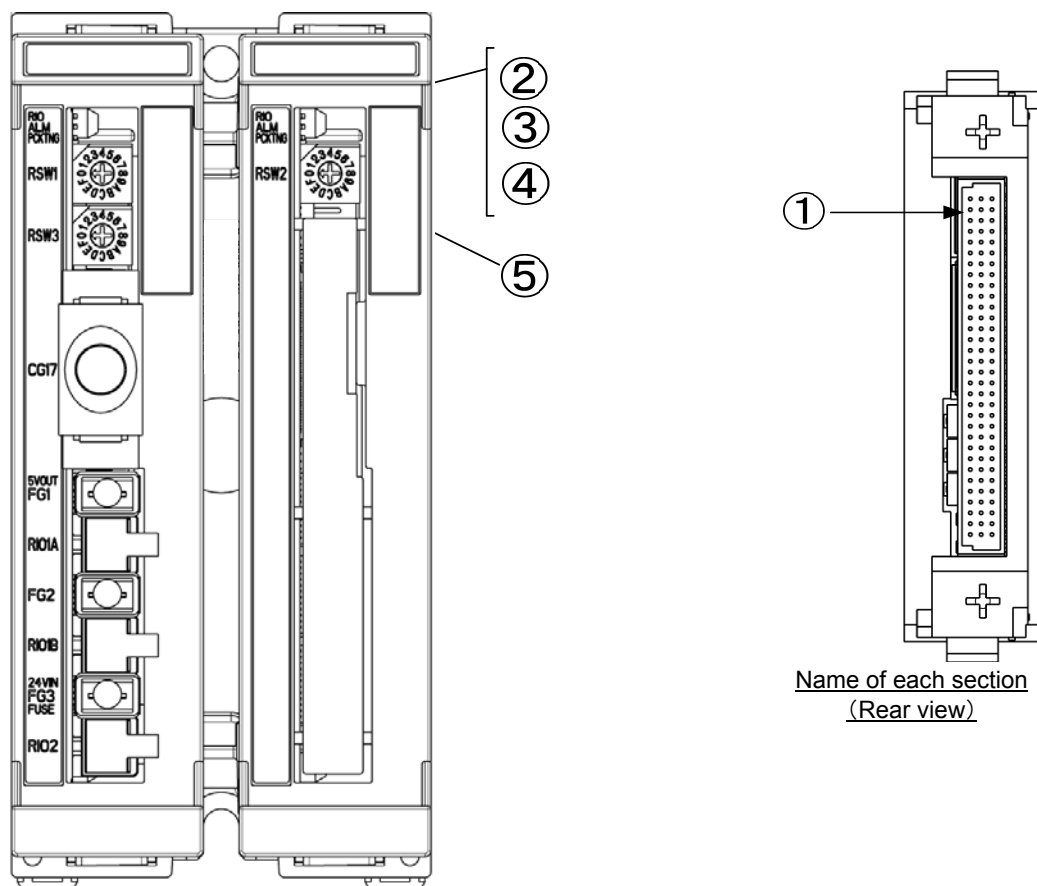
No.	Connector name	Explanation of function
1	CG17	Use to connect with the control unit.
2	RIO1A	Use to connect with the 1st part system of remote I/O communication.
3	RIO1B	Use to connect with the 1st part system of remote I/O communication.
4	RIO2	Use to relay to the 2nd part system of remote I/O communication.
5	CG30	Use to connect to the signal splitter.
6	FG1	FG terminal
7	FG2	FG terminal
8	FG3	FG terminal

For details of LEDs, refer to Chapter 7.11.

No	LED name	Explanation of function
9	RIO	This LED is used to show the remote I/O communication is being carried out.
10	ALM	This LED is used to show the remote I/O communication is stopping.
11	PCKTNG	This LED is turned ON when remote I/O communication is cut off, and OFF when it restarts.
12	5VOUT	This LED is used to confirm the 5V power supply is normally working.
13	24VIN	These LEDs are used to inform the fuse is welding.
14	FUSE	
		Refer to "7.12 Protection Fuse".

No	Switch name	Explanation of function
15	RSW1	Set the station numbers with the 32 points DI: X□□-X□□, DO: Y△△-Y△△. Depending on the station number, X□□-X□□ and Y△△-Y△△ change. E.g.) Rotary switch "0": X00-X1F, Y00-Y1F Rotary switch "1": X20-X3F, Y20-Y3F
16	RSW3	Use to set the manual pulse generator station number. Use the rotary switch RSW3 of the base unit FCU7-DX078 to set the remote I/O station numbers of manual pulse generators (1st, 2nd, and 3rd). If an even station number "0", "2", "4", or "6" is set, the consecutive next odd station number will be automatically assigned. Make sure the station number doesn't duplicate with RSW1 or RSW2 of an extension unit FCU7-DX079. E.g.) When RSW3= "2" 1st manual pulse generator: Assigned to the latter half of the set station number "2", X50-X5F 2nd manual pulse generator: Assigned to the first half of the set station number "3", X60-X6F 3rd manual pulse generator: Assigned to the latter half of the set station number "3", X70-X7F If an odd number is set, the previous even station number will be set. When "F" is set, the remote I/O station for the manual pulse generator (1st, 2nd, and 3rd) will be disabled. Setting from "8" to "E" is the same as setting "F".

7.2.3 Names of FCU7-DX079 (Extension unit) Section



Name of each section
(Rear view)

No.	Connector name	Explanation of function
1	CG30	Use to connect to the signal splitter.
2	RIO	This LED is used to show the remote I/O communication is being carried out.
3	ALM	This LED is used to show the remote I/O communication is stopping.
4	PCKTNG	This LED is turned ON when remote I/O communication is cut off, and OFF when it restarts.
5	RSW2	Set the station numbers with the 32 points DI: X□□-X□□, DO: Y△△-Y△△. Depending on the station number, X□□-X□□ and Y△△-Y△△ change. E.g.) Rotary switch "0": X00-X1F, Y00-Y1F Rotary switch "1": X20-X3F, Y20-Y3F

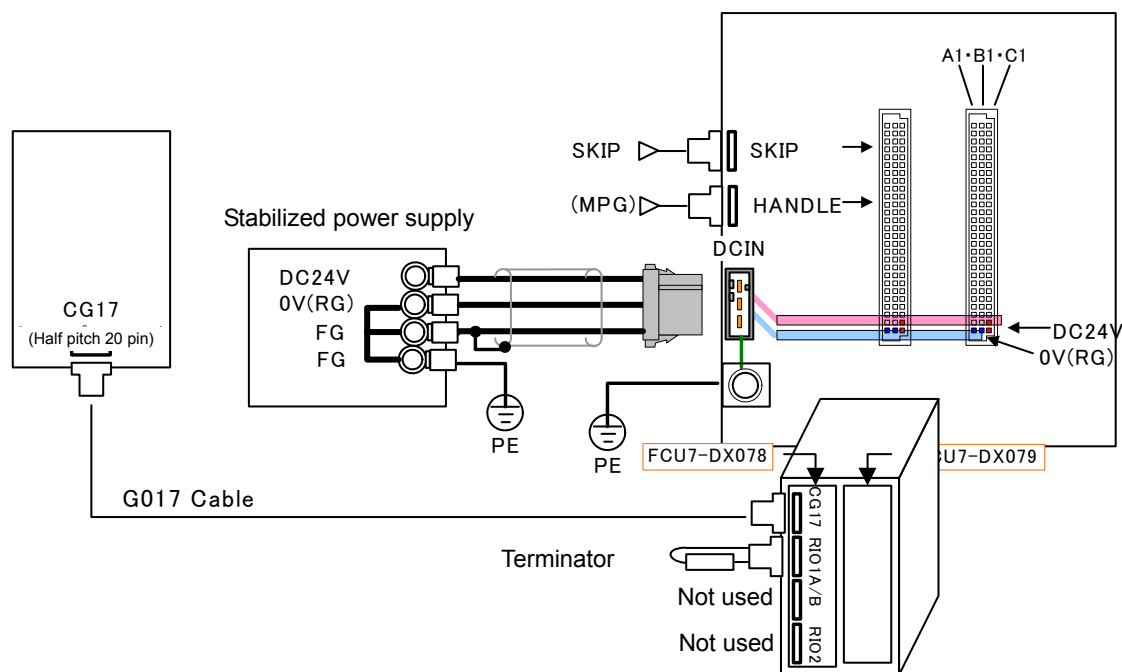
7.3 Connection of Power Supply

7.3.1 Connection of 24VDC Power Supply

Supply 24VDC to the base unit FCU7-DX078 from MTB's IO panel via the CG30 connector.

In order to avoid mistakes in DI/DO allocation, make sure to mount the base unit FCU7-DX078 on the left, the extension unit FCU7-DX079 on the right.

A UL certification of the book type I/O unit applies with the UL Standards on the condition that the stabilized power supply unit supplying 24VDC to each unit is a UL Class2-approved part.



Connection of MTB's I/O panel and 24VDC power supply

7.3.2 Connection of 5VDC Power Supply

Supply 5V power to the extension unit FCU7-DX079 and manual pulse generator from the base unit FCU7-DX078. The pattern width of 5V and 0V(GND) should be 2mm or more. Mount the ceramic capacitors of 22 μ F/16V and 0.1 μ F/16V on each connector's ends.

Do not connect for a purpose other than the 5V supply to the extension unit FCU7-DX079 and manual pulse generator.

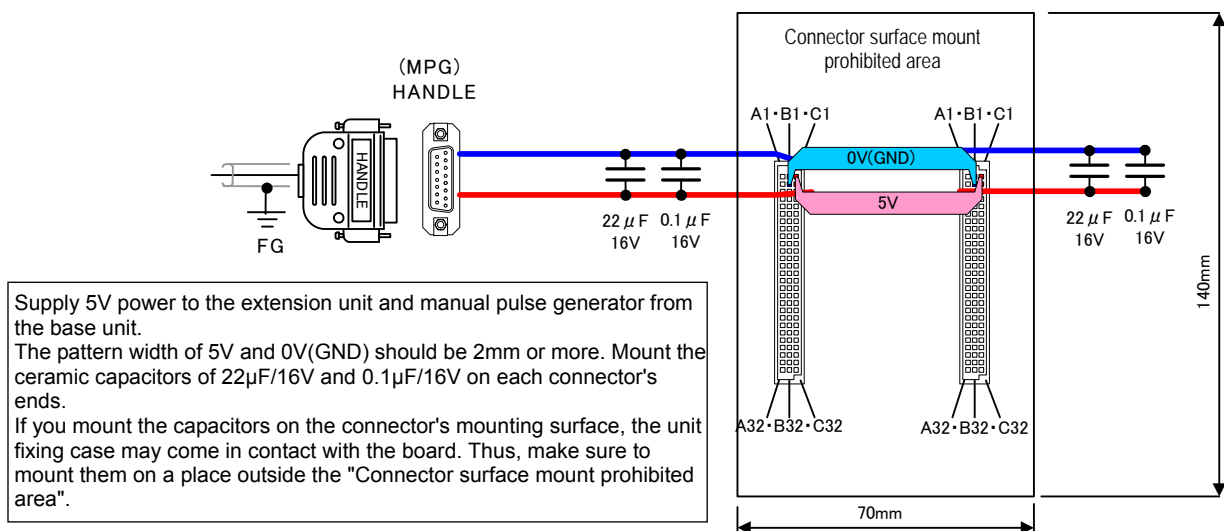
If you mount the capacitors on the connector's mounting surface, the unit fixing case may come in contact with the board. Thus, make sure to mount them on a place outside the "Connector surface mount prohibited area".

For the details of "Connector surface mount prohibited area", refer to the panel cutout dimension diagram in Section 9.5.

Capacitor names for reference

22 μ F: GRM31CB31C226EK15 (Murata Manufacturing) or equivalent products

0.1 μ F: GRM188B11C104KA01 (Murata Manufacturing) or equivalent products



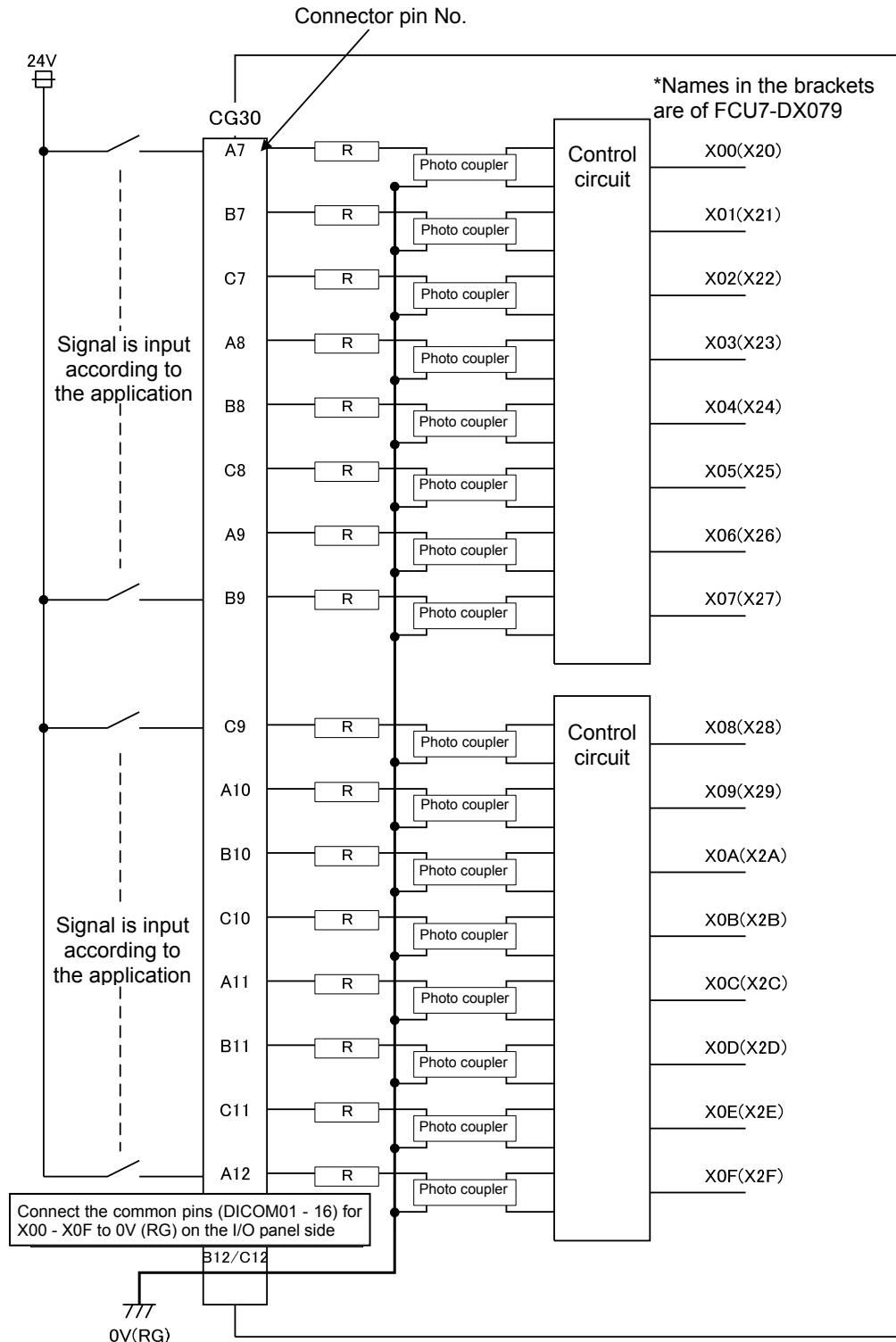
Connection diagram between MTB's I/O panel and 5VDC power supply

7.4 Assignment of Machine Input (DI) Signals

The machine input signals are connected via the I/O panel and CG30 connector. Between the base unit FCU7-DX078 and extension unit FCU7-DX079, the pin Nos. and input No. assignments are the same for the CG30 connector. Input device Nos. are determined by the rotary switch setting.

7.4.1 Assignment of DI01 (X00) to DI16 (X0F)

As the 16 points from DI01 (X00) to DI16 (X0F) use the common pins DICOM01 to 16 (B12, C12), connect them to 0V (RG) on the MTB's I/O panel.

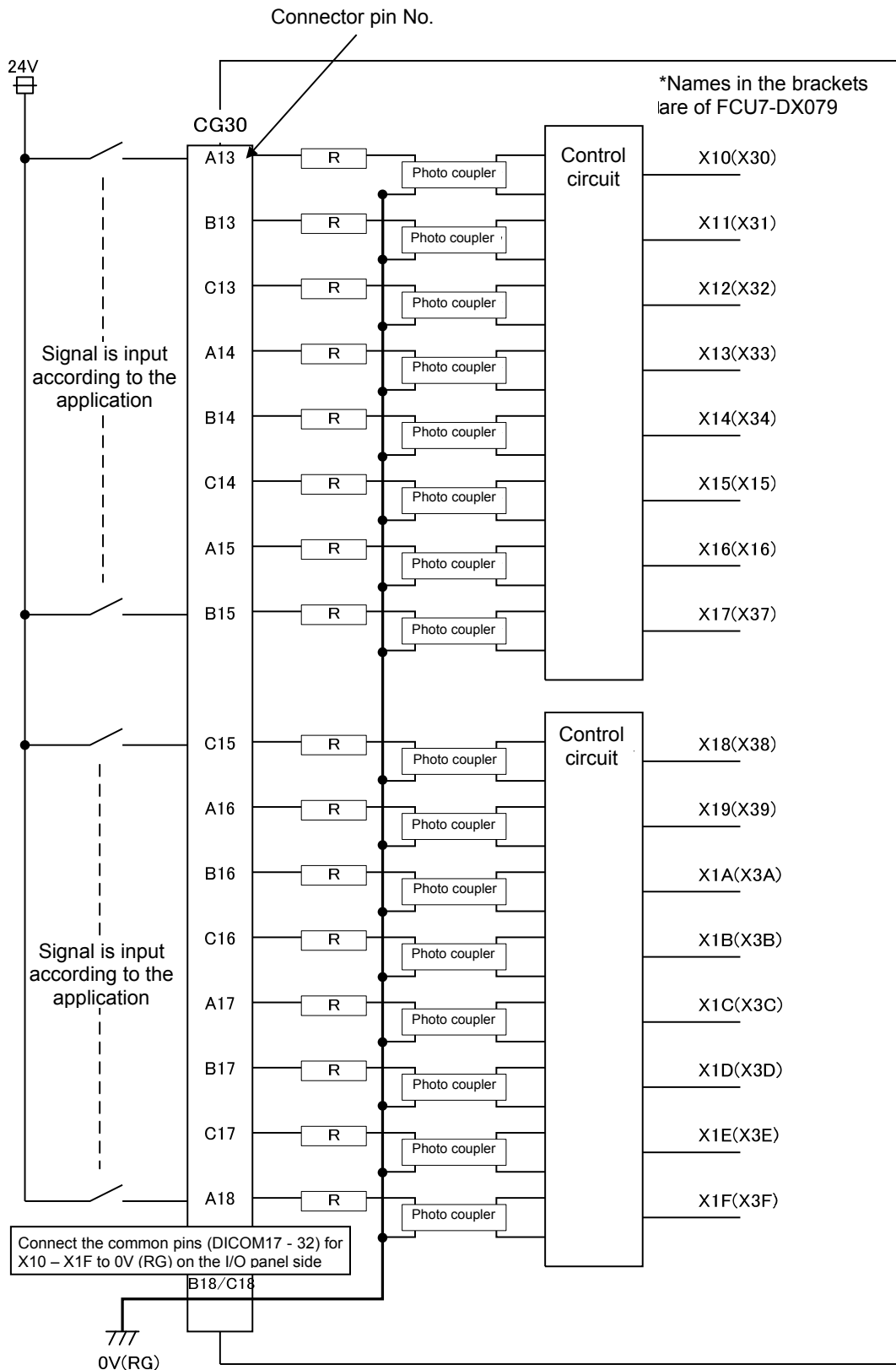


Assignment of machine input DI01 (X00) to DI16 (X0F)

(In this example, RSW1 of base unit FCU7-DX078 is set to "0", RSW2 of extension unit FCU7-DX079 is set to "1")

7.4.2 Assignment of DI17 (X10) to DI32 (X1F)

As the 16 points from DI17 (X10) to DI32 (X1F) use the common pins DICOM17 to 32 (B18, C18), connect them to 0V (RG) on the MTB's I/O panel.

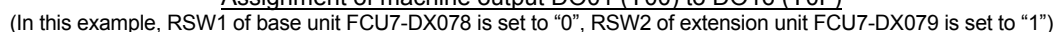


Assignment of machine input DI17 (X10) to DI32 (X1F)

(In this example, RSW1 of base unit FCU7-DX078 is set to "0", RSW2 of extension unit FCU7-DX079 is set to "1")

The machine output signals are connected via the I/O panel and CG30 connector. Between the base unit FCU7-DX078 and extension unit FCU7-DX079, the pin Nos. and input No. assignments are the same for the CG30 connector. Input device Nos. are determined by the rotary switch setting. Connect the servo drive unit to SV1 (servo axis, PLC axis, spindle) and SV2 (auxiliary axis: MR-J2-CT) of the base I/O unit.

The 16 points from DO01 (Y00) to DO16 (Y0F) are 60mA output. Among DO01 (Y00) - DO16 (Y0F), 200mA output is possible only for one arbitrary point.



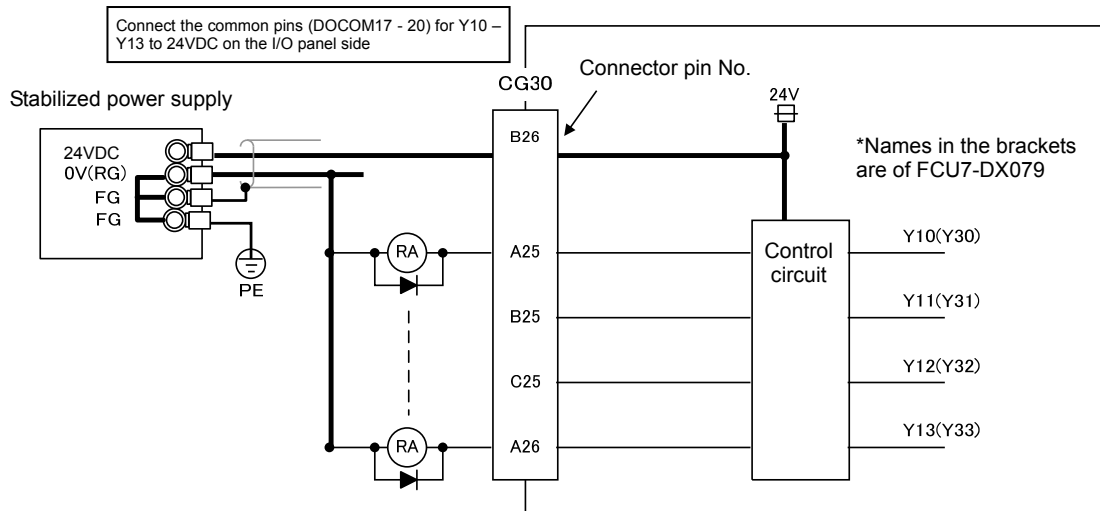
7. Connection of Book-Type I/O Unit

7.5 Assignment of Machine Output (DO) Signals

7.5.2 Assignment of DO17 (Y10) to DO20 (Y13)

As the 4 points from DO17 (Y10) to DO20 (Y13) use the common pins Docom17 to 20 (B26), connect them to 24VDC on the MTB's I/O panel.

The 4 points from DO17 (Y10) to DO20 (Y13) are 200mA output. As long as the total output current is within 800mA, 300mA output is possible only for one arbitrary point.



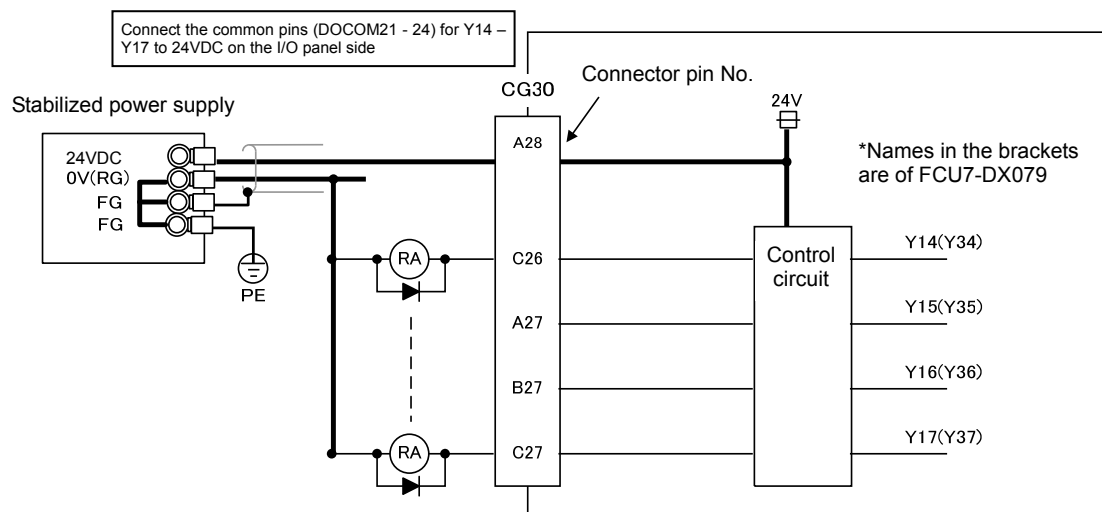
Assignment of machine output DO17 (Y10) to DO20 (Y13)

(In this example, RSW1 of base unit FCU7-DX078 is set to "0", RSW2 of extension unit FCU7-DX079 is set to "1")

7.5.3 Assignment of DO21 (Y14) to DO24 (Y17)

As the 4 points from DO21 (Y14) to DO24 (Y17) use the common pins Docom21 to 24 (A28), connect them to 24VDC on the MTB's I/O panel.

The 4 points from DO21 (Y14) to DO24 (Y17) are 200mA output. As long as the total output current is within 800mA, 300mA output is possible only for one arbitrary point.



Assignment of machine output DO21 (Y14) to DO24 (Y17)

(In this example, RSW1 of base unit FCU7-DX078 is set to "0", RSW2 of extension unit FCU7-DX079 is set to "1")

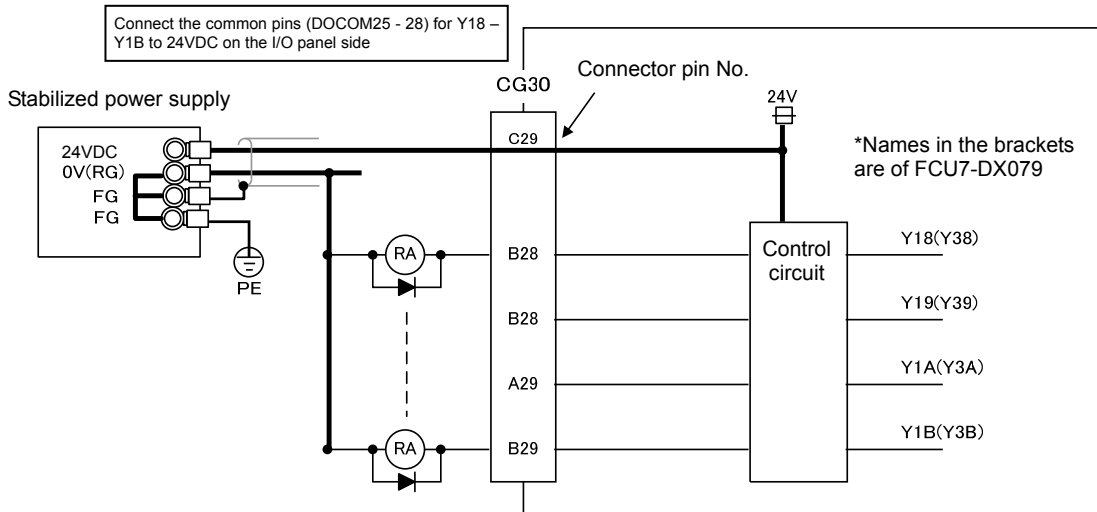
7. Connection of Book-Type I/O Unit

7.5 Assignment of Machine Output (DO) Signals

7.5.4 Assignment of DO25 (Y18) to DO28 (Y1B)

As the 4 points from DO25 (Y18) to DO28 (Y1B) use the common pins DOCOM25 to 28 (C29), connect them to 24VDC on the MTB's I/O panel.

The 4 points from DO25 (Y18) to DO28 (Y1B) are 200mA output. As long as the total output current is within 800mA, 300mA output is possible only for one arbitrary point.



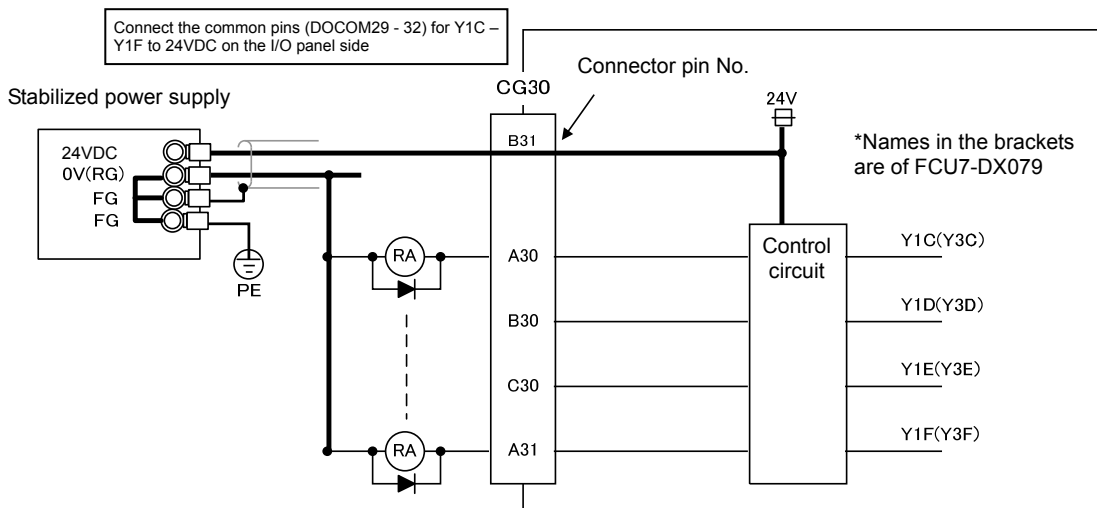
Assignment of machine output DO25 (Y18) to DO28 (Y1B)

(In this example, RSW1 of base unit FCU7-DX078 is set to "0", RSW2 of extension unit FCU7-DX079 is set to "1")

7.5.5 Assignment of DO29 (Y1C) to DO32 (Y1F)

As the 4 points from DO29 (Y1C) to DO32 (Y1F) use the common pins DOCOM29 to 32 (B31), connect them to 24VDC on the MTB's I/O panel.

The 4 points from DO29 (Y1C) to DO32 (Y1F) are 200mA output. As long as the total output current is within 800mA, 300mA output is possible only for one arbitrary point.



Assignment of machine output DO29 (Y1C) to DO32 (Y1F)

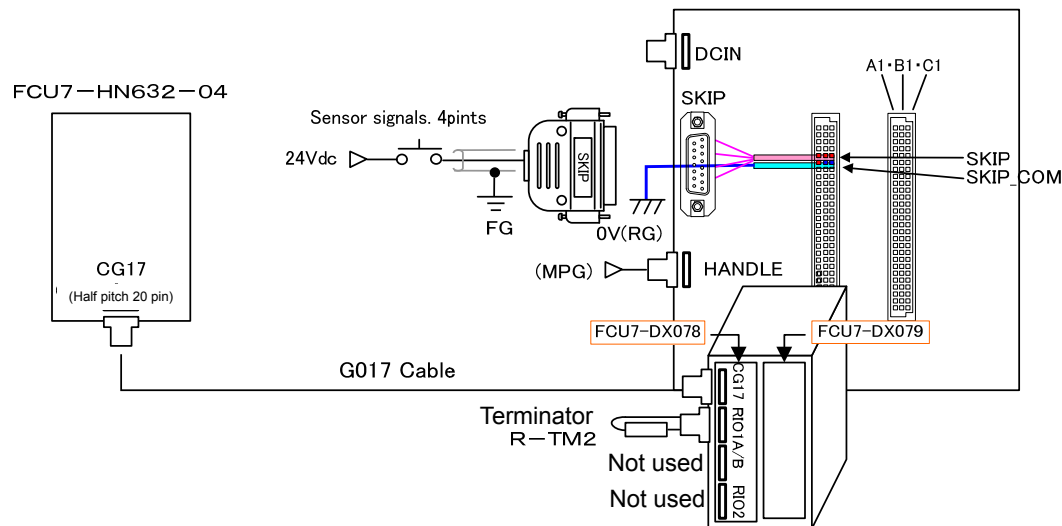
(In this example, RSW1 of base unit FCU7-DX078 is set to "0", RSW2 of extension unit FCU7-DX079 is set to "1")

7.6 Connection of Skip Signal

Input the SKIP signals to the base unit FCU7-DX078 from MTB's I/O panel via the CG30 connector. Input them from the connector directly to pins A5 (SKIP1), B5 (SKIP2), C5 (SKIP3), and A6 (SKIP4) of the CG30 connector. Connect the common pins B6 and C6 of SKIP to 0G (RG) on the MTB's I/O panel side.

In order to avoid mistakes in DI/DO allocation, make sure to mount the base unit FCU7-DX078 on the left, the extension unit FCU7-DX079 on the right.

(SKIP signals do not have to be input to the extension unit FCU7-DX079.)



Connection of MTB's I/O panel and SKIP signals (for M730BM)

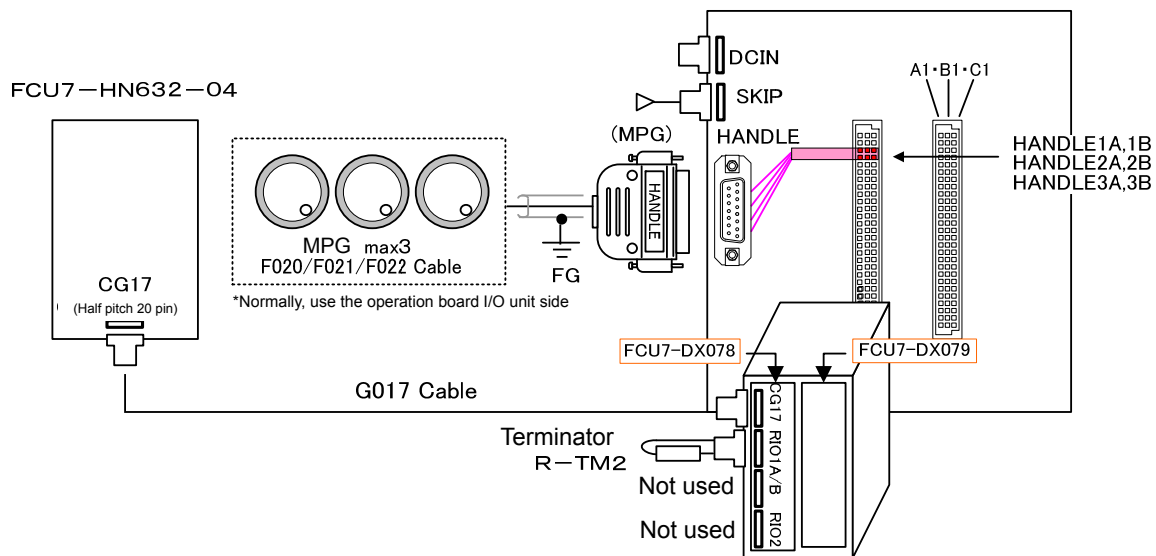
7.7 Connection of Manual Pulse Generator Signals

Input the manual pulse generator signals to the base unit FCU7-DX078 from MTB's I/O panel via the CG30 connector. Input them from the connector's A and B phase signals directly to pins A3, A4 (HANDLE1), B3, B4 (HANDLE2), and C3, C4 (HANDLE3) of the CG30 connector.

Use the rotary switch RSW3 of the base unit FCU7-DX078 to set the remote I/O station numbers. If an even station number "0", "2", "4", or "6" is set, the consecutive next odd station number will be automatically assigned. Make sure the station number doesn't duplicate with RSW1 or RSW2 of an extension unit FCU7-DX079.

In order to avoid mistakes in DI/DO allocation, make sure to mount the base unit FCU7-DX078 on the left, the extension unit FCU7-DX079 on the right.

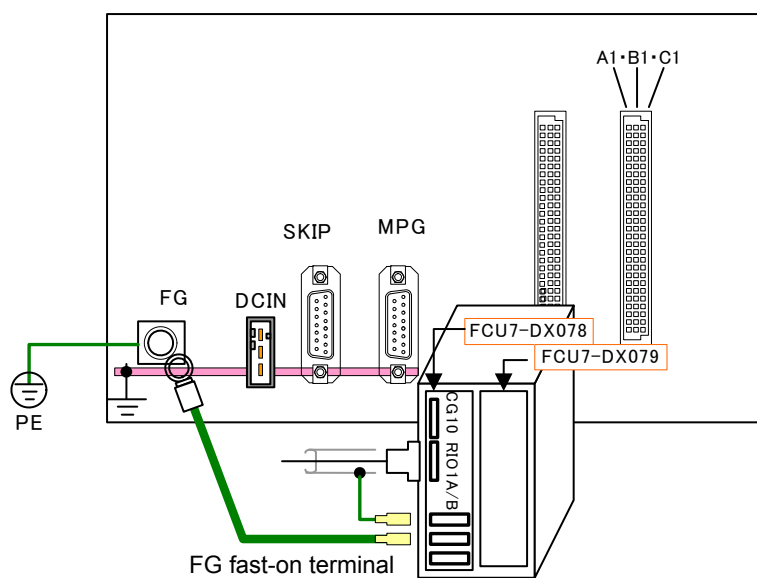
(Manual pulse generator signals do not have to be input the extension unit FCU7-DX079.)



Connection of MTB's I/O panel and manual pulse generator signals (for M730BM)

7.8 Connection of FG

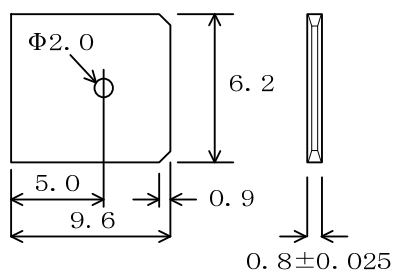
Connect the FG fast-on terminal of the base unit FCU7-DX078 to the FG terminal of MTB's I/O panel.



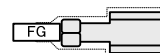
Connection of FG

FG connection terminal

Terminal name: FG1, FG2, FG3



<Unit side tab terminal shape>



<Cable side fast-on terminal type>

Type: 175022-1

(For AWG20-14, 250 Series)

Recommended manufacturer: Tyco Electronics AMP

Terminal protection tube: 174817-2 (Yellow)

Unit: mm

FG fast-on terminal (FG connection)

7.9 Connector Pin Assignment

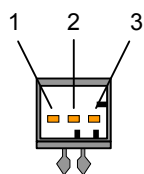
7.9.1 RIO1A, RIO1B

RIO1B is a relay connector for using FCU7-DX078 as an extension DI/DO of a loader unit, etc. at a distant location.

As RIO1A and RIO1B are connected one for one, either of them can be used, however, connect RIO1A closer to NC control unit, and RIO1B to the terminal unit side.

Remote I/O communication
connection terminal

Terminal name: RIO1A, 1B



<PCB side connector type>

Connector: 1376135-1

Manufacturer: Tyco Electronics AMP

<Cable side connector type>

Connector: 1-1318120-3

Contact: For AWG 24, chained: 1318106-1, detached: 1318108-1

Contact: For AWG 22, chained: 1318105-1, detached: 1318107-1

Recommended manufacturer: Tyco Electronics AMP

1	I/O	TXRX1
2	I/O	TXRX1*
3	–	0V(GND)

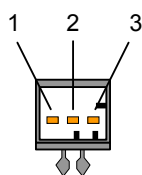
RIO1A, 1B connector

7.9.2 RIO2 Connector

Connect the second part system of the remote I/O communication to RIO2. It is equipped only with FCU7-DX078, and it is enabled by connecting it with the NC control unit via the G017 cable. The functions in the unit cannot be used only with the relay of the G017 cable.

Remote I/O communication connection terminal

Terminal name: RIO2



<PCB side connector type>

Connector: 1376135-1

Manufacturer: Tyco Electronics AMP

<Cable side connector type>

Connector: 1-1318120-3

Contact: For AWG 24, chained: 1318106-1, detached: 1318108-1

Contact: For AWG 22, chained: 1318105-1, detached: 1318107-1

Recommended manufacturer: Tyco Electronics AMP

1	I/O	TXRX2
2	I/O	TXRX2*
3	–	0V(GND)

RIO2 connector

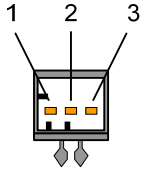
7.9.3 DC24IN (For Reference)

The DC24IN is equipped on the MTB's I/O panel. This section shows you the conventional connector and its pin assignment as reference. The MTB selects the connector type to use.

[Reference description: Conventional connector]

24VDC connection terminal

Terminal name: DC24IN



<PCB side connector type>

Connector: 2-178313-5

Manufacturer: Tyco Electronics AMP

<Cable side connector type>

Connector: 2-178288-3

Contact: 2-175218-5

Recommended manufacturer: Tyco Electronics AMP

1	I	DC24V
2	-	0V(RG)
3	-	FG

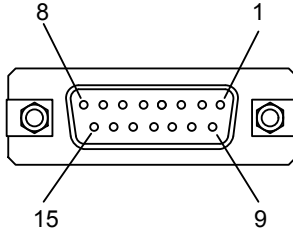
DC24IN connector (Conventional connector pin assignment)

7.9.4 Manual Pulse Generator (For Reference)

The manual pulse generator connector is equipped on the MTB's I/O panel. This section shows you the conventional connector and its pin assignment as reference. The MTB selects the connector type to use. Select a cable with the FG, and connector with which the FG treatment is possible.

Manual pulse generator
connection terminal

Terminal name: MPG (HANDLE)



<PCB side connector type>

Connector: 17JE-13150-37 (D23A)

Manufacturer: DDK

<Cable side connector type>

Connector: CDA-15P

Contact: CD-PC-111

Case: HDA-CTH

Recommended manufacturer: Hirose Electric

1	I	1HA	9	-	0V(GND)
2	I	1HB	10	-	Not used
3	I	2HA	11	-	0V(GND)
4	I	2HB	A	-	Not used
5	I	3HA	13	-	0V(GND)
6	I	3HB	14	-	Not used
7	O	5VDC	15	-	Not used
8	-	Not used			

Manual pulse generator connector (Conventional connector pin assignment)

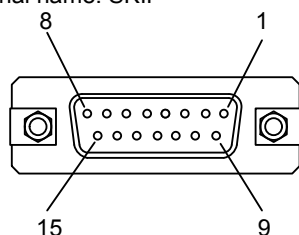
7.9.5 SKIP/Sensor Signal (For Reference)

The number of the skip input points is 4.

The SKIP signal connector is equipped on the MTB's I/O panel. This section shows you the conventional connector and its pin assignment as reference. The MTB selects the connector type to use. Select a cable with the FG, and connector with which the FG treatment is possible.

SKIP signal input connection terminal

Terminal name: SKIP



<PCB side connector type>

Connector: 17JE-13150-37 (D23A)

Manufacturer: DDK

1	-	0V(RG)	9	-	0V(RG)
2	I	SKIP IN1	10	I	SKIP IN3
3	I	SKIP IN2	11	I	SKIP IN4
4	-	Not used	12	-	Not used
5	-	Not used	13	-	Not used
6	-	Not used	14	-	Not used
7	-	Not used	15	-	0V(RG)
8	-	0V(RG)			

<Cable side connector type>

Connector: CDA-15P

Contact: CD-PC-111

Case: HDA-CTH

Recommended manufacturer: Hirose Electric

SKIP input connector (Conventional connector pin assignment)

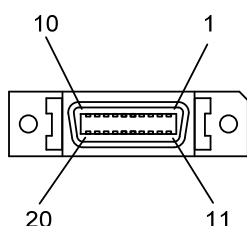
7.9.6 CG17 (NC Control Unit Connection)

Connect the NC control unit FCU7-HN633-04/FCU7-HN653-05 and base unit FCU7-DX078 with the G017 cable. As the F010 cable of the M720BM system is a 50 pin connector, it can not be used here.

Function	Connecting the NC control unit
Number of pins	20 pins
Connector type	1022052A (Right angle)/DHA-RB20-S122N-FA (Straight)
Connector rated current	0.5A/Pin
Counterpart connector type	10120-600EL/10320-3210-00

NC control unit connection terminal

Terminal name: CG17



<PCB side connector type>

Connector: 1022052A

Manufacturer: Hirose Electric

1	I/O	TXRX1	11	I/O	TXRX1*
2	I/O	TXRX2	12	I/O	TXRX2*
3	-	Not used	13	-	Not used
4	O	SKIP1	14	O	SKIP1*
5	O	SKIP2	15	O	SKIP2*
6	O	SKIP3	16	O	SKIP3*
7	O	SKIP4	17	O	SKIP4*
8	-	0V(GND)	18	-	0V(GND)
9	-	0V(GND)	19	-	0V(GND)
10	-	Not used	20	*	Not used

<Cable side connector type>

Connector: 10120-3000VE (Soldered part)

10120-6000EL (Solderless part)

10320-52F0-008

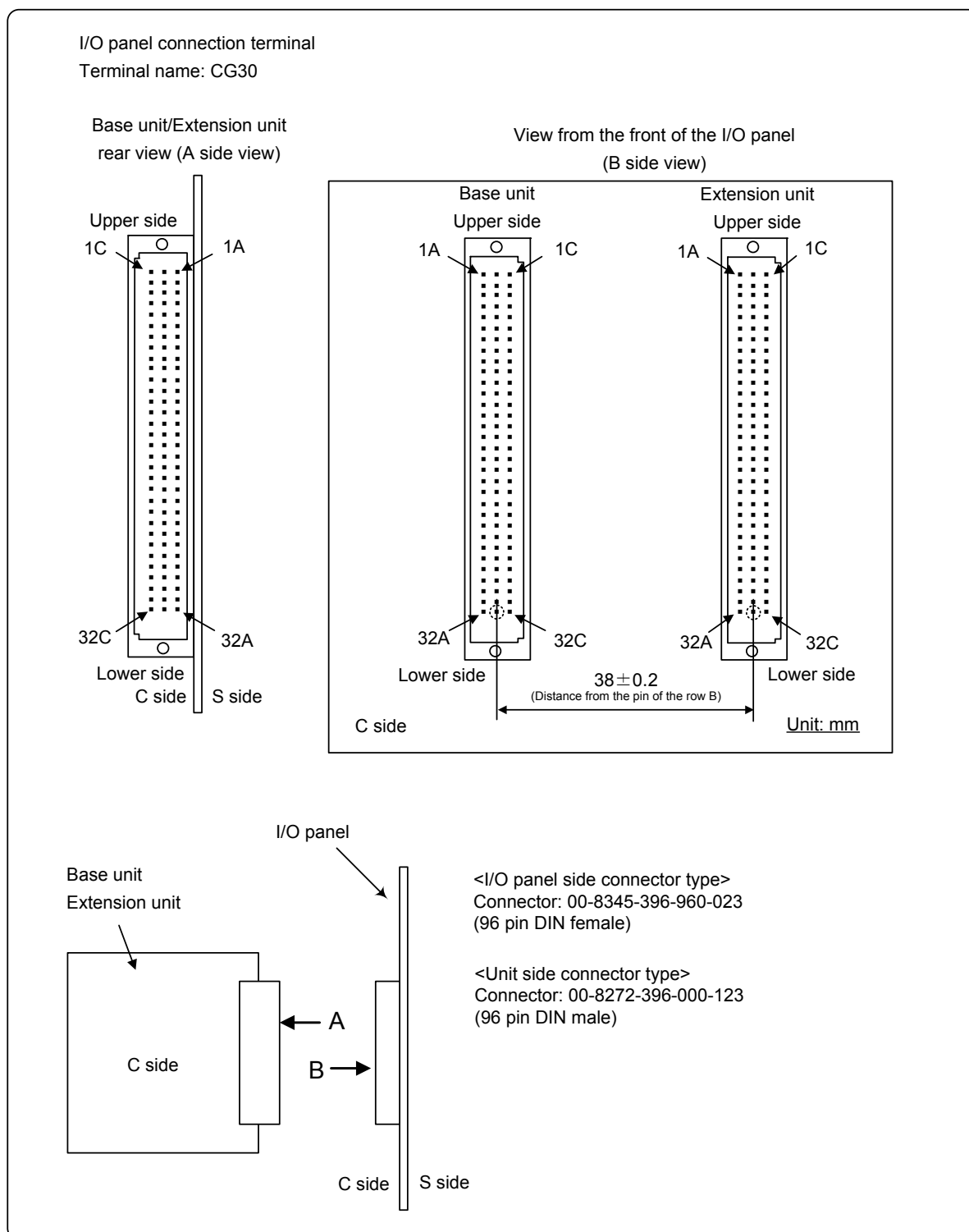
Recommended manufacturer: Sumitomo 3M

CG17 connector (NC control unit connection)

7.9.7 CG30 (I/O Panel Connection)

Connect the MTB's I/O panel and the base unit/extension unit via a DIN type 96 pin connector.

Function	DI/DO divider remote I/O relay, 24V input, 5V relay, manual pulse generator input, SKIP input
Number of pins	96 pins
Connector type	00-8272-396-000-123 (ELCO 96 pin male, compliant to RoHS)
Connector rated current	2.0A/Pin
Counterpart connector type	00-8345-396-960-023 (ELCO 96 pin female, product compliant to RoHS is recommended)



CG30 connector (I/O panel connection)

7. Connection of Book-Type I/O Unit

7.9 Connector Pin Assignment

Base unit				Extension unit			
	A	B	C		A	B	C
1	TXRX	0V(GND)	5Vout	1	TXRX1	0V(GND)	5Vin
2	TXRX1*	0V(GND)	5Vout	2	TXRX1*	0V(GND)	5Vin
3	HANDL1A	HANDL2A	HANDL3A	3	HANDL1A (Not used)	HANDL2A (Not used)	HANDL3A (Not used)
4	HANDL1B	HANDL2B	HANDL3B	4	AHNDL1B (Not used)	HANDL2B (Not used)	HANDL3B (Not used)
5	SKIP1	SKIP2	SKIP3	5	SKIP1 (Not used)	SKIP2 (Not used)	SKIP3 (Not used)
6	SKIP4	SKIP_COM	SKIP_COM	6	SKIP4 (Not used)	SKIP_COM (Not used)	SKIP_COM (Not used)
7	DI1(X00)	DI2(X01)	DI3(X02)	7	DI33(X20)	DI34(X21)	DI35(X22)
8	DI4(X03)	DI5(X04)	DI6(X05)	8	DI36(X23)	DI37(X24)	DI38(X25)
9	DI7(X06)	DI8(X07)	DI9(X08)	9	DI39(X26)	DI40(X27)	DI41(X28)
10	DI10(X09)	DI11(X0A)	DI12(X0B)	10	DI42(X29)	DI43(X2A)	DI44(X2B)
11	DI13(X0C)	DI14(X0D)	DI15(X0E)	11	DI45(X2C)	DI46(X2D)	DI47(X2E)
12	DI16(X0F)	DICOM_1-16	DICOM_1-16	12	DI48(X2F)	DICOM_33-48	DICOM_33-48
13	DI17(X10)	DI18(X11)	DI19(X12)	13	DI49(X30)	DI50(X31)	DI51(X32)
14	DI20(X13)	DI21(X14)	DI22(X15)	14	DI52(X33)	DI53(X34)	DI54(X35)
15	DI23(X16)	DI24(X17)	DI25(X18)	15	DI55(X36)	DI56(X37)	DI57(X38)
16	DI26(X19)	DI27(X1A)	DI28(X1B)	16	DI58(X39)	DI59(X3A)	DI60(X3B)
17	DI29(X1C)	DI30(X1D)	DI31(X1E)	17	DI61(X3C)	DI62(X3D)	DI63(X3E)
18	DI32(X1F)	DICOM_17-32	DICOM_17-32	18	DI64(X3F)	DICOM_49-64	DICOM_49-64
19	DO1(Y00)	DO2(Y01)	DO3(Y02)	19	DO33(Y20)	DO34(Y21)	DO35(Y22)
20	DO4(Y03)	DO5(Y04)	DO6(Y05)	20	DO36(Y23)	DO37(Y24)	DO38(Y25)
21	DO7(Y06)	DO8(Y07)	DO9(Y08)	21	DO39(Y26)	DO40(Y27)	DO41(Y28)
22	DO10(Y09)	DO11(Y0A)	DO12(Y0B)	22	DO42(Y29)	DO43(Y2A)	DO44(Y2B)
23	DO13(Y0C)	DO14(Y0D)	DO15(Y0E)	23	DO45(Y2C)	DO46(Y2D)	DO47(Y2E)
24	DO16(Y0F)	DOCOM_1-16	DOCOM_1-16	24	DO48(Y2F)	DOCOM_31-48	DOCOM_31-48
25	DO17-200(Y10)	DO18-200(Y11)	DO19-200(Y12)	25	DO49-200(Y30)	DO50-200(Y31)	DO51-200(Y32)
26	DO20-200(Y13)	DOCOM_17-20	DO21-200(Y14)	26	DO52-200(Y33)	DOCOM_49-52	DO53-200(Y34)
27	DO22-200(Y15)	DO23-200(Y16)	DO24-200(Y17)	27	DO54-200(Y35)	DO55-200(Y36)	DO56-200(Y37)
28	DOCOM_21-24	DO25-200(Y18)	DO26-200(Y19)	28	DOCOM_53-56	DO57-200(Y38)	DO58-200(Y39)
29	DO27-200(Y1A)	DO28-200(Y1B)	DOCOM_25-28	29	DO59-200(Y3A)	DO60-200(Y3B)	DOCOM_57-60
30	DO29-200(Y1C)	DO30-200(Y1D)	DO31-200(Y1E)	30	DO61-200(Y3C)	DO62-200(Y3D)	DO63-200(Y3E)
31	DO32-200(Y1F)	DOCOM_29-32	24Vin	31	DO64-200(Y3F)	DOCOM_61-64	24Vin (Not used)
32	GND(RG)	GND(RG)	24Vin	32	GND(RG) (Not used)	GND(RG) (Not used)	24Vin (Not used)

Supplement 1: DO output of hatching is 200mA.

Supplement 2: 0V (RG) is the ground of the 24V power supply. 0V (GND) is the ground of the 5V logic system.
The noise countermeasure is applied to 0V (GND) against the 24V input power, so do not share the pattern with 0V (RG).

7.9.8 FG Fast-on Terminal

For the FG of the remote I/O communication cable and base unit FCU7-DX078, fast-on terminals FG1, FG1, and FG3 are used.

FG1 to FG3 are connected to the pattern in the PCB, so any of them is equally available. Main applications are as below.

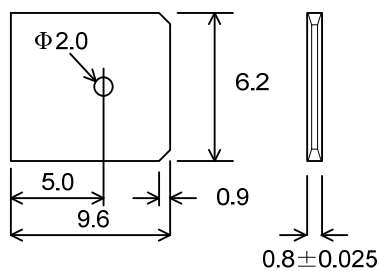
FG1: Connect the FGs and I/O communication cables of the whole unit to the electric cabinet's FG plate

FG2: FG connection of the remote I/O communication cable

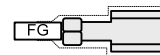
FG3: Spare

FG connection terminal

Terminal names: FG1, FG2, FG3



<Unit side tab terminal shape>



<Cable side fast-on terminal type>

Type: 175022-1

(250 series for AWG20-14)

Recommended manufacturer: Tyco Electronics AMP

Terminal protective tube: 174817-2 (Yellow)

Unit: mm

FG fast-on terminal (FG connection)

7.10 Rotary Switch

7.10.1 Name and Function

RSW1 is equipped on a base unit for setting station numbers of DI/DO. RSW2 is equipped on an extension unit for setting station numbers of DI/DO. RSW3 is equipped on a base unit for setting station numbers of interface circuits of manual pulse generators (1st, 2nd, and 3rd). When set to 8 or bigger, the remote I/O stations of manual pulse generators (1st, 2nd, and 3rd) will be disabled.

Name	Function
RSW1/RSW2	Set the station numbers with the 32 points DI: X△△-X△△, DO: Y△△-Y△△. Depending on the station number, X△△-X△△ and Y△△-Y△△ change. E.g.) Rotary switch "0": X00-X1F, Y00-Y1F Rotary switch "1": X20-X3F, Y20-Y3F
RSW3 (Note 1)	Use to set the manual pulse generator station number. Use the rotary switch RSW3 of the base unit FCU7-DX078 to set the remote I/O station numbers of manual pulse generators (1st, 2nd, and 3rd). If an even station number "0", "2", "4", or "6" is set, the consecutive next odd station number will be automatically assigned. Make sure the station number doesn't duplicate with RSW1 or RSW2 of an extension unit FCU7-DX079. E.g.) When RSW3= "2" 1st manual pulse generator: Assigned to the latter half of the set station number "2", X50-X5F 2nd manual pulse generator: Assigned to the first half of the set station number "3", X60-X6F 3rd manual pulse generator: Assigned to the latter half of the set station number "3", X70-X7F If an odd number is set, the previous even station number will be set. When "F" is set, the remote I/O station for the manual pulse generator (1st, 2nd, and 3rd) will be disabled.

Note1: Not equipped on an extension unit FCU7-DX079.

7.10.2 Setting at Shipping

Setting at shipping is as follows.

Unit type	Name	Setting at shipping	Function
FCU7-DX078	RSW1	0	Remote I/O 1st station selected
	RSW3	F	Manual pulse generator interface disabled, remote I/O station number not assigned
FCU7-DX079	RSW2	1	Remote I/O 2nd station selected

7.10.3 Meaning of Setting

Base unit: RSW1/ Extension unit: RSW2

Setting	Meaning
0	Remote I/O station No. "1st station" is selected (Note 2)
1	Remote I/O station No. "2nd station" is selected (Note 2)
2	Remote I/O station No. "3rd station" is selected (Note 2)
3	Remote I/O station No. "4th station" is selected (Note 2)
4	Remote I/O station No. "5th station" is selected (Note 2)
5	Remote I/O station No. "6th station" is selected (Note 2)
6	Remote I/O station No. "7th station" is selected (Note 2)
7	Remote I/O station No. "8th station" is selected (Note 2)
8	Setting not allowed (For manufacturers test. Using not allowed.)
9	Setting not allowed (For manufacturers test. Using not allowed.)
A	Setting not allowed (For manufacturers test. Using not allowed.)
B	Setting not allowed (For manufacturers test. Using not allowed.)
C	Setting not allowed (For manufacturers test. Using not allowed.)
D	Setting not allowed (For manufacturers test. Using not allowed.)
E	Setting not allowed (For manufacturers test. Using not allowed.)
F	Setting not allowed (For manufacturers test. Using not allowed.)

(Note 2) When enabling manual pulse generator with RSW3, the RSW3's setting No. and the next No. must be different from the station numbers of the base unit FCU7-DX078 and extension unit FCU7-DX079.

RSW3 (This is not equipped on an extension unit FCU7-DX079.)

Setting	Meaning
0	For the 1st manual pulse generator, remote I/O station No. "1st station" is selected. For the 2nd and 3rd manual pulse generators, remote I/O station No. "2nd station" is selected.
1	Setting not allowed. (If selected, it is the same as setting "0".)
2	For the 1st manual pulse generator, remote I/O station No. "3rd station" is selected. For the 2nd and 3rd manual pulse generators, remote I/O station No. "4th station" is selected.
3	Setting not allowed. (If selected, it is the same as setting "2".)
4	For the 1st manual pulse generator, remote I/O station No. "5th station" is selected. For the 2nd and 3rd manual pulse generators, remote I/O station No. "6th station" is selected.
5	Setting not allowed. (If selected, it is the same as setting "4".)
6	For the 1st manual pulse generator, remote I/O station No. "7th station" is selected. For the 2nd and 3rd manual pulse generators, remote I/O station No. "8th station" is selected.
7	Setting not allowed. (If selected, it is the same as setting "6".)
8	When from "8" to "F" is set, the remote I/O station for the manual pulse generator (1st, 2nd, 3rd) will be disabled. (Not recognized by the NC control unit.) When no manual pulse generator is used, in order to avoid mistakes during maintenance, set "F".
9	
A	
B	
C	
D	
E	
F	

7.11 LED

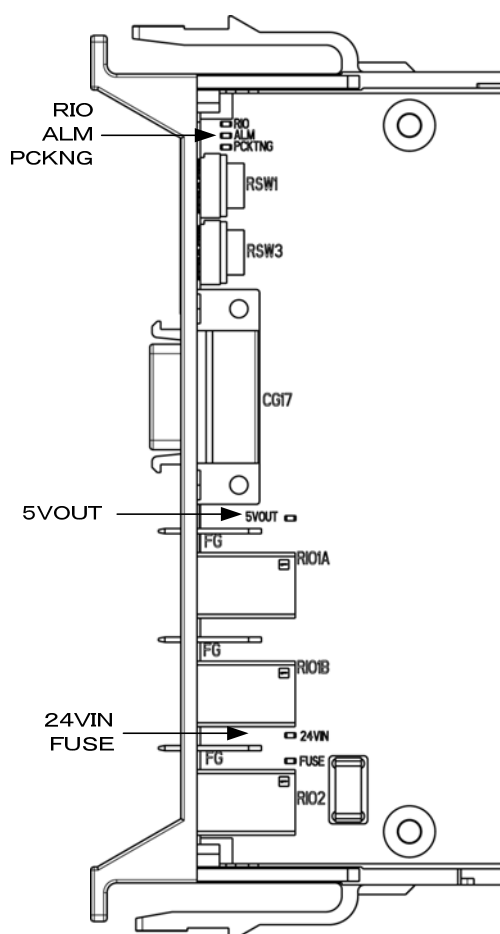
Meaning of LED's lit/flickering/not lit is as follows.

A set of two LEDs, 24VIN and FUSE shows 24VDC input and fuse welding.

Name	Function	Color	Status			
24VIN	These LEDs are used to inform fuse welding	Green	Lit	Lit	Not lit	Not lit
FUSE		Green	Lit	Not lit	Lit	Not lit
		24VDC input OK Fuse not welding	24VDC input OK Fuse welding		24VDC not input Fuse status unknown	

Supplement: The LED is lit when input of several volts is detected. This is not for checking the voltage level of 24VDC.

Name	Function	Color	Status		Supplement
			When normal	During error	
5VOUT	This LED is used to confirm the 5V power supply.	Green	Lit	Not lit	The LED is lit when 5V is output. This is not for checking the voltage level.
RIO	This LED is used to show the remote I/O communication is being carried out.	Green	Lit	Not lit	The LED is lit during communication. (As it flickers very fast, it looks like it is lit.)
ALM	This LED is used to show the remote I/O communication is stopping.	Red	Not lit	Lit	The LED is lit when the communication stops.
PCKTNG	This LED is turned ON when remote I/O communication is cut off, and OFF when it restarts.	Red	Not lit	Flickering	



LED positions

Note) The positions may be different from those of the final products

7.12 Fuse for Protection

The 24VDC input circuit of base unit FCU7-DX078 has a fuse for protection from burning at short-circuit. If the fuse blows out, remove the base unit FCU7-DX078 from the box, and replace the fuse with a rated fuse. As an extension unit doesn't have a conversion circuit from 24V to 5V, it doesn't have a fuse.

Name	Function	Rating	Manufacturer	Type	Supplement
FUSE	Protection of control circuit from burning	1.6A	Daito Communication apparatus	LM16	Equipped only on a base unit

8. Connection of Remote I/O Unit

M730BM/M750BM, which employs a book-type I/O unit, requires G213 cable for additional use of remote I/O unit (DX unit). Usual cables FCUA-R211 and SH41 cannot be used for the book-type I/O unit.

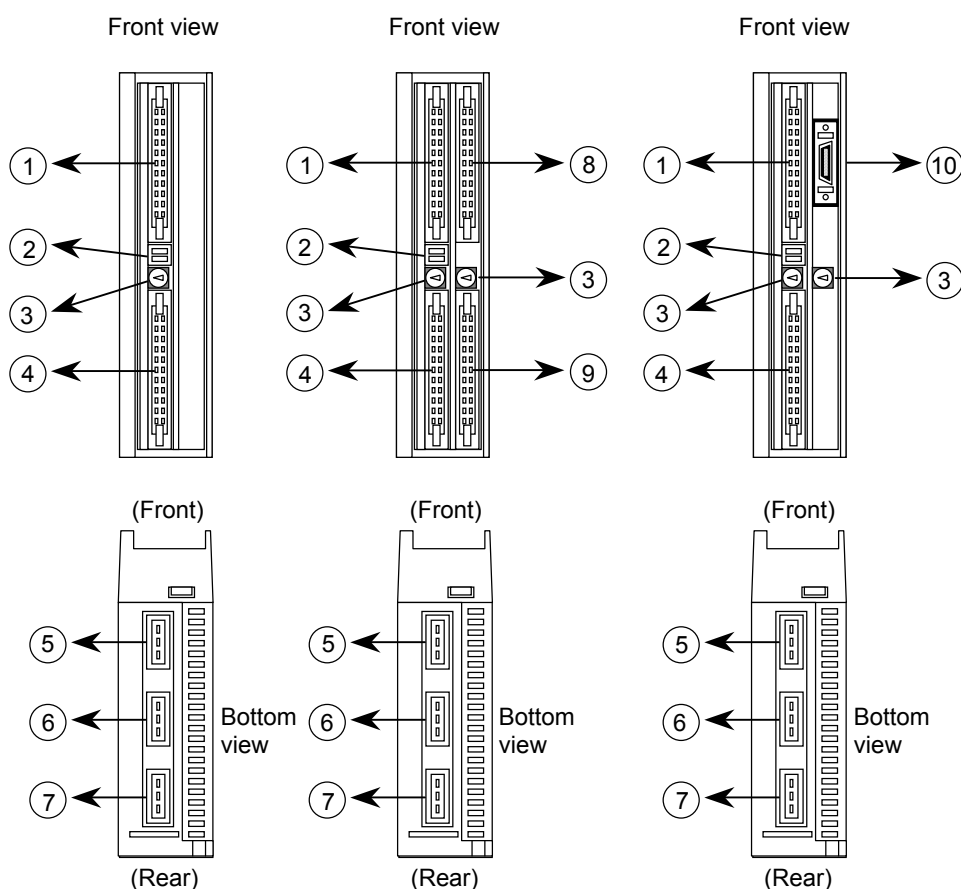
8.1 Outline of Remote I/O Unit

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 operation panel I/O unit.

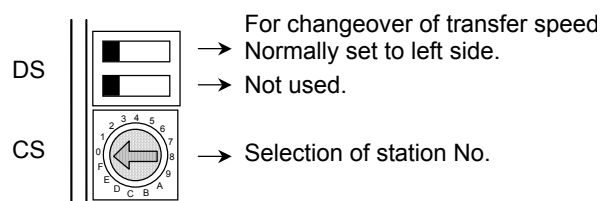
When the remote I/O unit is connected with serial links, multiple units can be used as long as the total No. of occupied stations (channels) is within 8 channels.

Unit type	Machine control signals that can be handled	No. of occupied serial link stations
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) : 64 points (photo coupler insulation) sink/source type Digital output signal (DO) : 48 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-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

8.2 Names of Each Remote I/O Unit Section



- ① DI-L (machine input signal connector)
- ② DS (transfer speed changeover switch)
- ③ CS (station No. changeover switch)
- ④ DO-L (machine output signal connector)
- ⑤ RIO1 (serial connection connector #1)
- ⑥ RIO2 (serial connection connector #2)
- ⑦ DCIN (24VDC (+) power input connector)
- ⑧ DI-R (machine input signal connector)
- ⑨ DO-R (machine output signal connector)
- ⑩ AIO (analog signal input/output connector)



Enlarged view of DS and CS

8. Connection of Remote I/O Unit

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

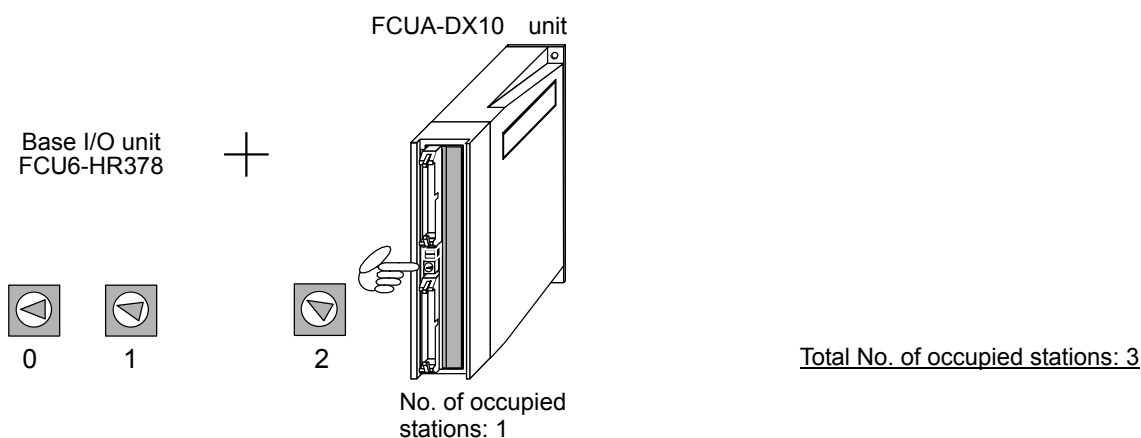
8.3 Setting of Station No. When Using Multiple Remote I/O Units

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

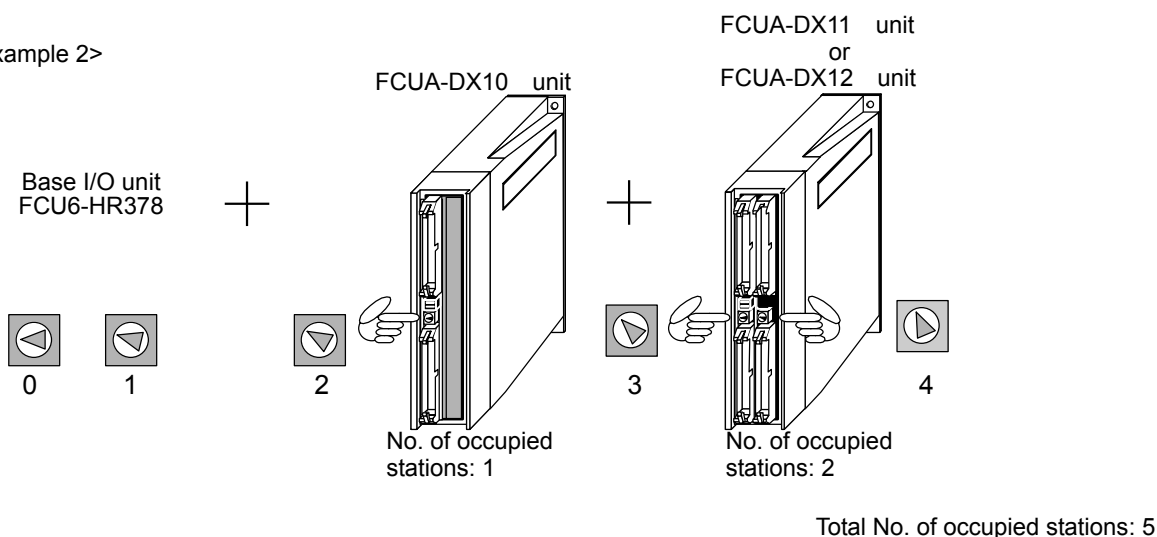
Unit name	No. of occupied serial link stations
FCUA-DX10 □	1
FCUA-DX11 □	2
FCUA-DX12 □	2
FCUA-DX14 □	2

When using multiple remote I/O units, a characteristic station No. must be set for each unit. The FCUA-DX10 □ unit has one station No. setting switch, and FCUA-DX11 □, DX12 □ and DX14 □ unit have two switches. Each of these switches must be set to a characteristic station No. within a range of 0 to 7.

<Setting example 1>



<Setting example 2>



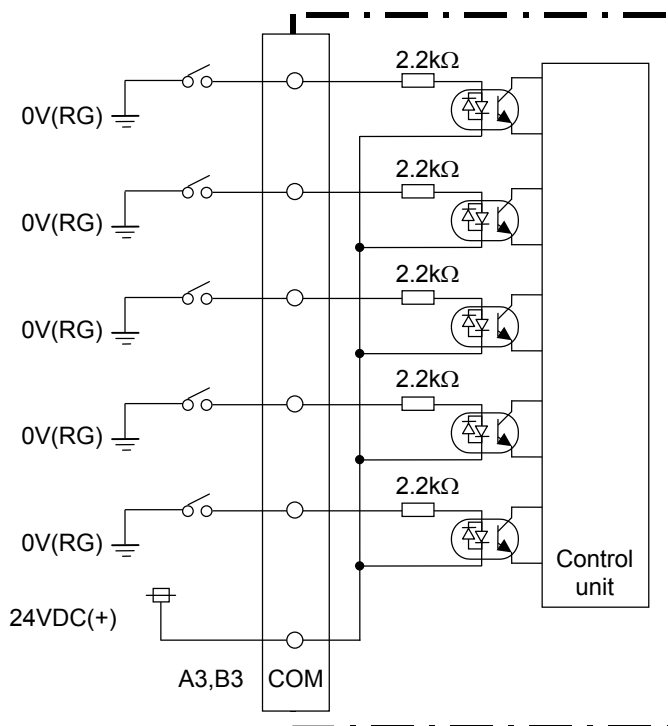
(Note) The assignment of each unit's input/output signal address will change with the setting of the channel No. Refer to "PLC Interface Manual" for details.

8.4 Outline of Digital Signal Input Circuit

Sink type and source type share the digital signal input circuit.
Connect according to each respective diagram below.

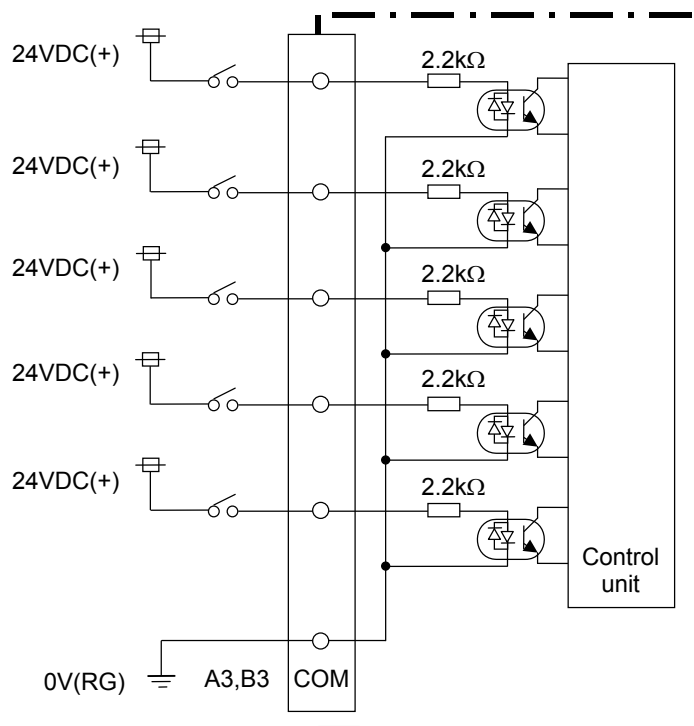
Input circuit

(Machine side) DI-L/DI-R



Sink type

(Machine side) DI-L/DI-R



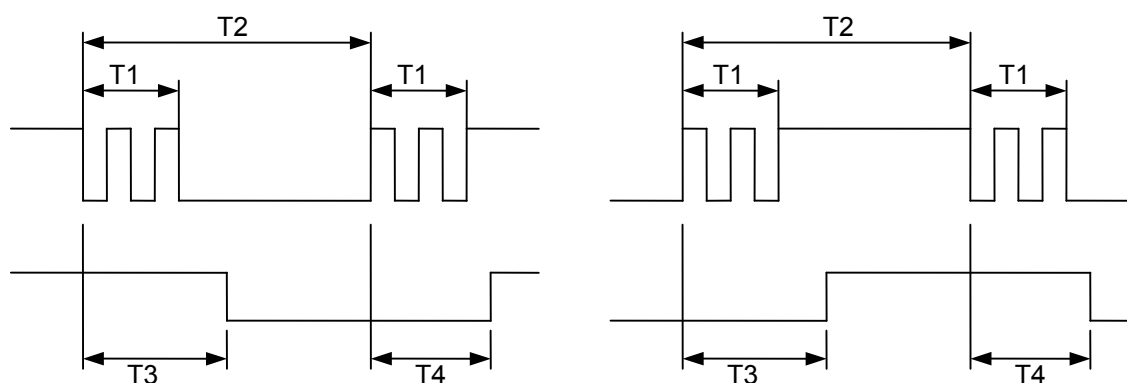
Source type

Input conditions

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

		Sink type	Source type
1	Input voltage at external contact ON	6V or less	18V or more, 25.2V or less
2	Input current at external contact ON	9mA or more	
3	Input voltage at external contact OFF	20V or more, 25.2V or less	4V or less
4	Input current at external contact OFF	2mA or less	
5	Tolerable chattering time	3ms or less (Refer to T1 below)	
6	Input signal holding time	40ms or more (Refer to T2 below)	
7	Input circuit operation delay time	$3\text{ms} \leq T3 \leq T4 \leq 16\text{ms}$	
8	Machine side contact capacity	30V or more, 16mA or more	

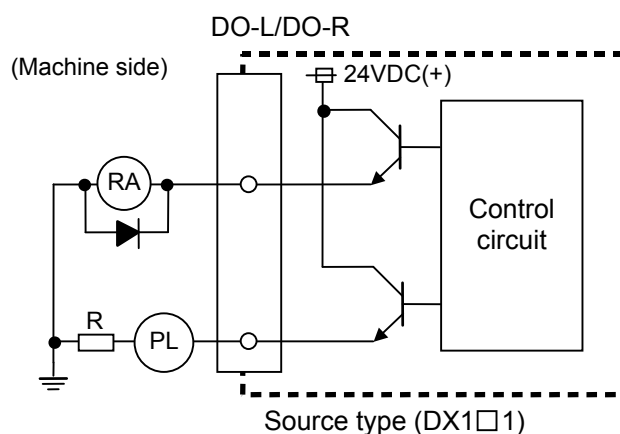
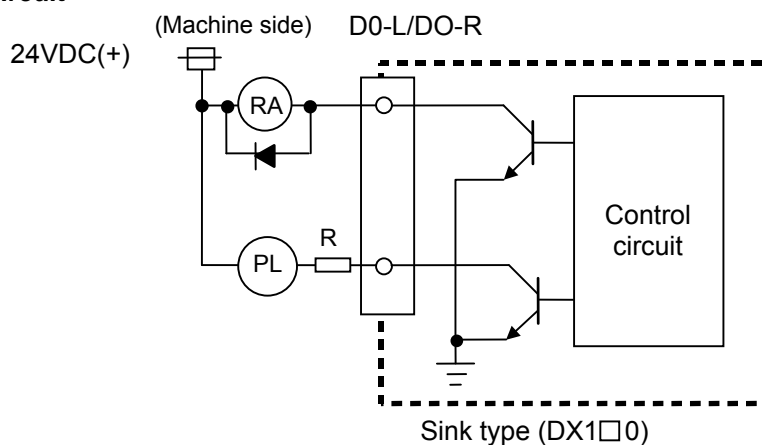
(Note) Input signal holding time: 40ms or more as a guideline. The input signal can only be confirmed if held longer than the ladder process cycle time.



8.5 Outline of Digital Signal Output Circuit

The digital signal output circuit uses a sink type (DX1□0) or source type (DX1□1). Use within the specification ranges shown below.

Output circuit



Output conditions

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

(Note 1) When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, 100mA or more) in parallel to the load.

(Note 2) When using a capacitive load such as a lamp, always connect a protective resistor ($R=150\Omega$) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)

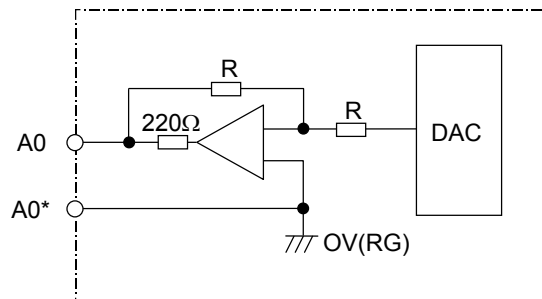
⚠ CAUTION

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

8.6 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

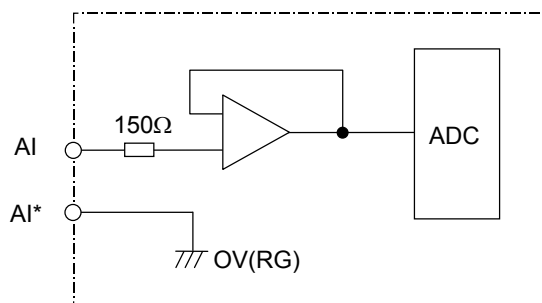
Output voltage	0V to $\pm 10\text{V}$ ($\pm 5\%$)
Resolution	12bit ($\pm 10\text{V} \times n/4096$) (Note)
Load conditions	10k Ω load resistance
Output impedance	220 Ω

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

8.7 Outline of Analog Signal Input Circuit

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

Input circuit



Input conditions

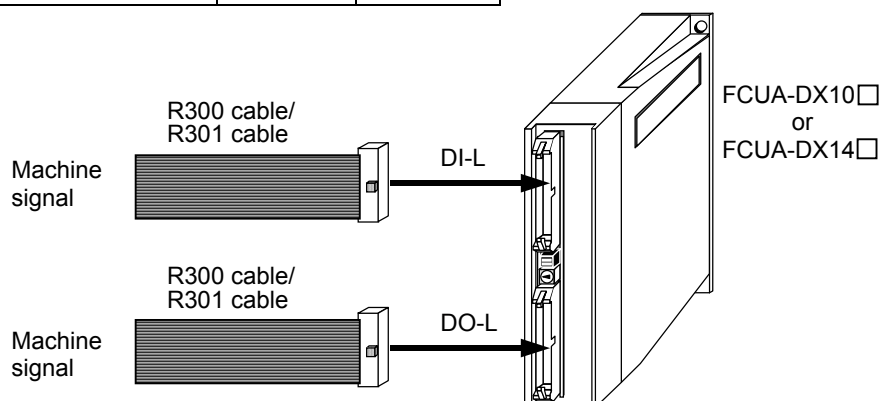
Max. input rating	±15V
Resolution	10V/2000 (5mV)
Precision	Within ±25mV
AD input sampling time	14.2ms (AI0)/42.6ms (AI1 to 3)

8. Connection of Remote I/O Unit

8.8 Connection of FCUA-DX10□/14□ Unit and Machine Control Signal

8.8 Connection of FCUA-DX10□/14□ Unit and Machine Control Signal

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

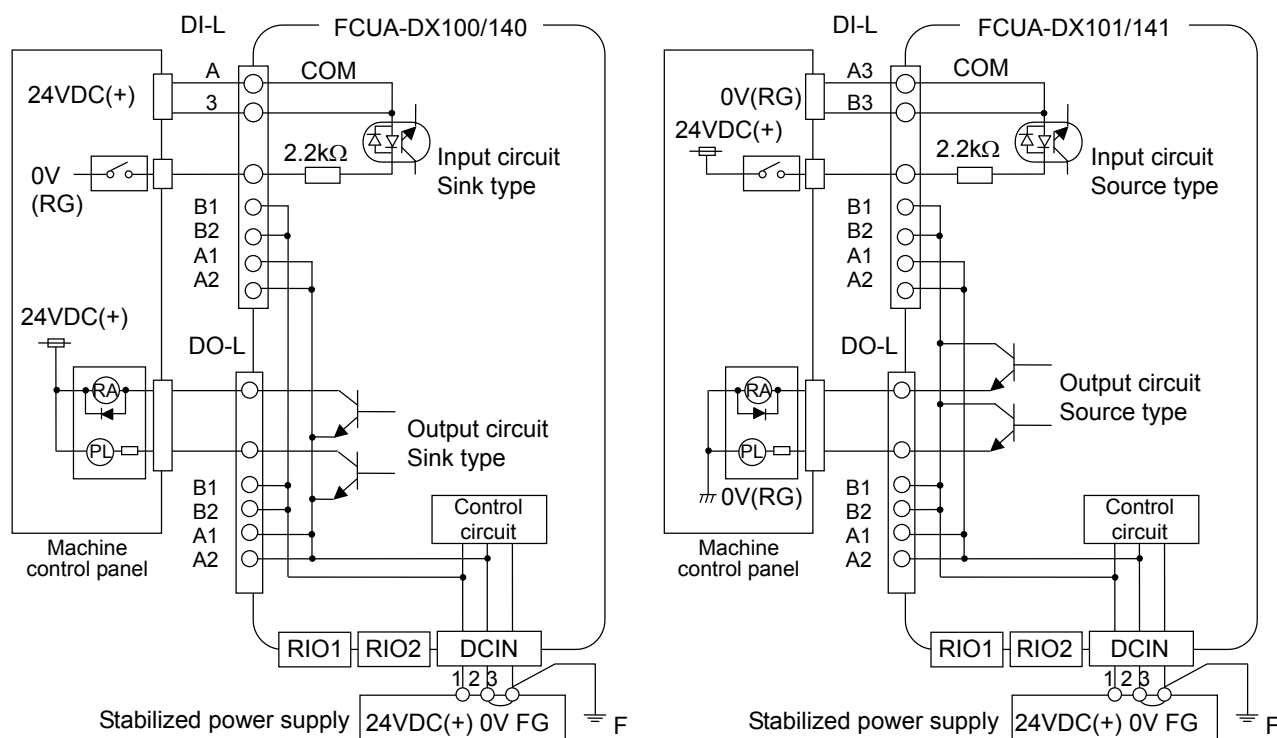


The remote I/O unit cable types include the R300 and R301 types. The R300 cable has one end cut off, and the R301 cable is used for connection to the IDEC Izumi terminal block BX1F-T40A (**Note 1**). The R300-3M and R301-3M cables are available. If a cable longer than 3m is required, use the CN300 and CS301 connector set.

The one-end CN300 connector (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The CS301 connector set (optional with both ends) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block (IDEC Izumi).

(Note 1) IDEC Izumi I/O terminal BX1F-T40

<Outline of connection>



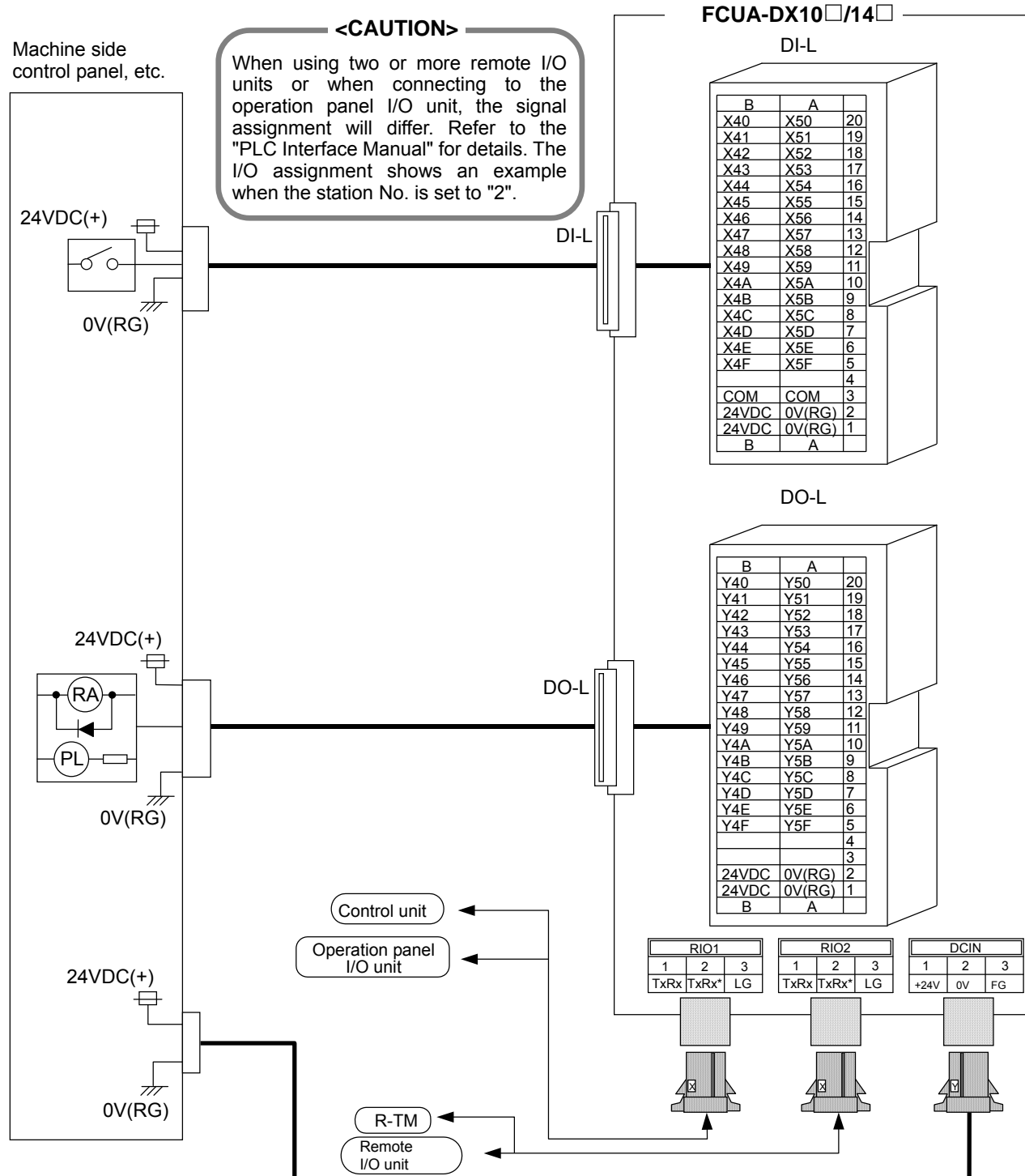
CAUTION

- ⚠ 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.

8. Connection of Remote I/O Unit

8.8 Connection of FCUA-DX10□/14□ Unit and Machine Control Signal

<Signal assignment table>



<Adaptive connector>

DCIN (CN220)

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

RIO1/RIO2 (CN211)

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

DI-L/DO-L (CN300)

Solderless type connector:
7940-6500SC
Manufacturer: 3M

Terminator (R-TM)

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

(Note 1) () is the MITSUBISHI original type name.

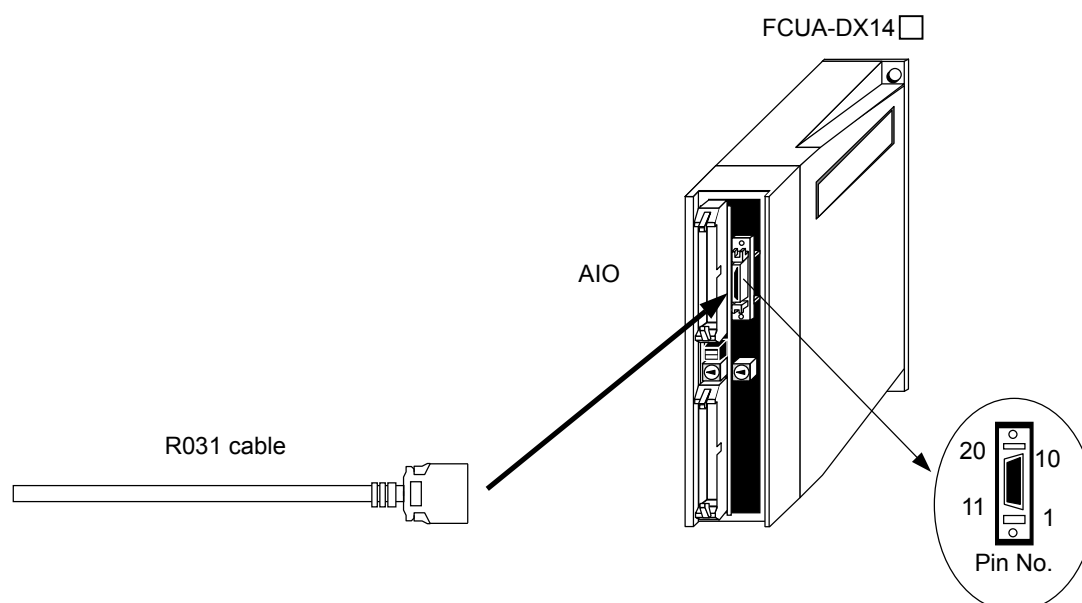
(Note 2) Refer to Section 10 for the details on R-TM.

8. Connection of Remote I/O Unit

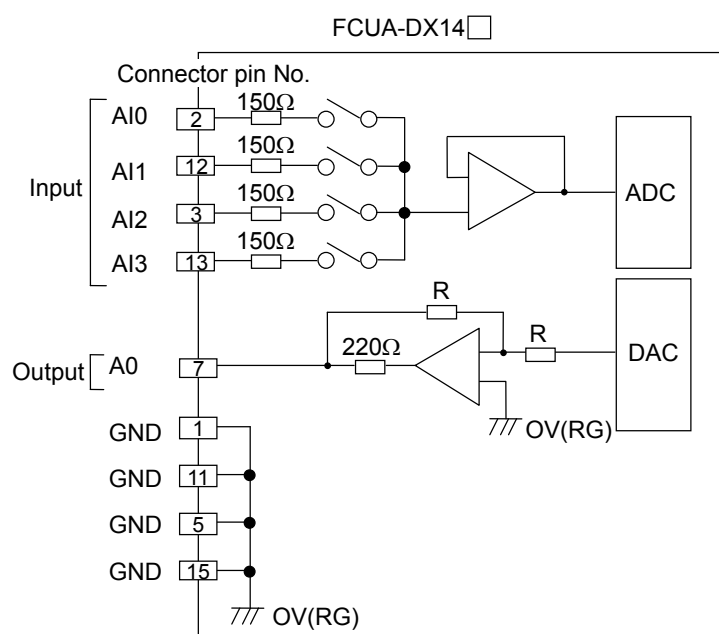
8.9 Connection of FCUA-DX14 □ Unit and Analog Input/Output Signal

8.9 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 cable, use the CS000 connector set (optional, with both ends).



Input/output circuit



CAUTION

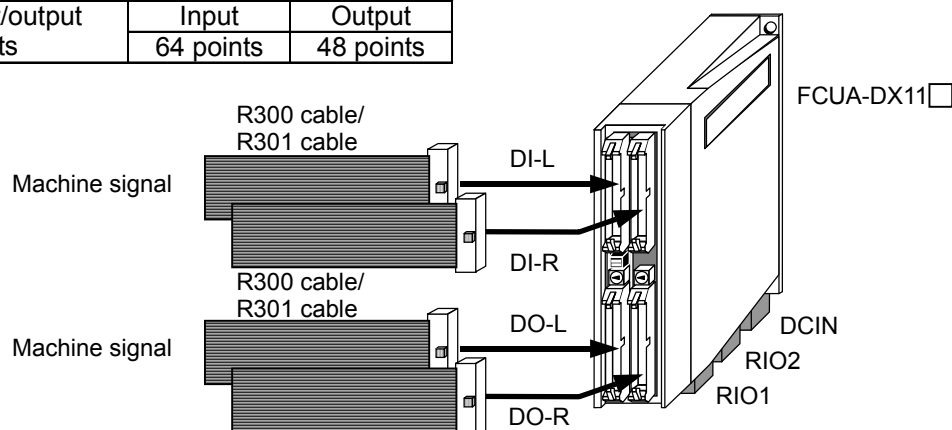
- ⚠ Incorrect connections could damage the device, so always connect the cable to the designated connector.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

8. Connection of Remote I/O Unit

8.10 Connection of FCUA-DX11□ Unit and Machine Control Signal

8.10 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

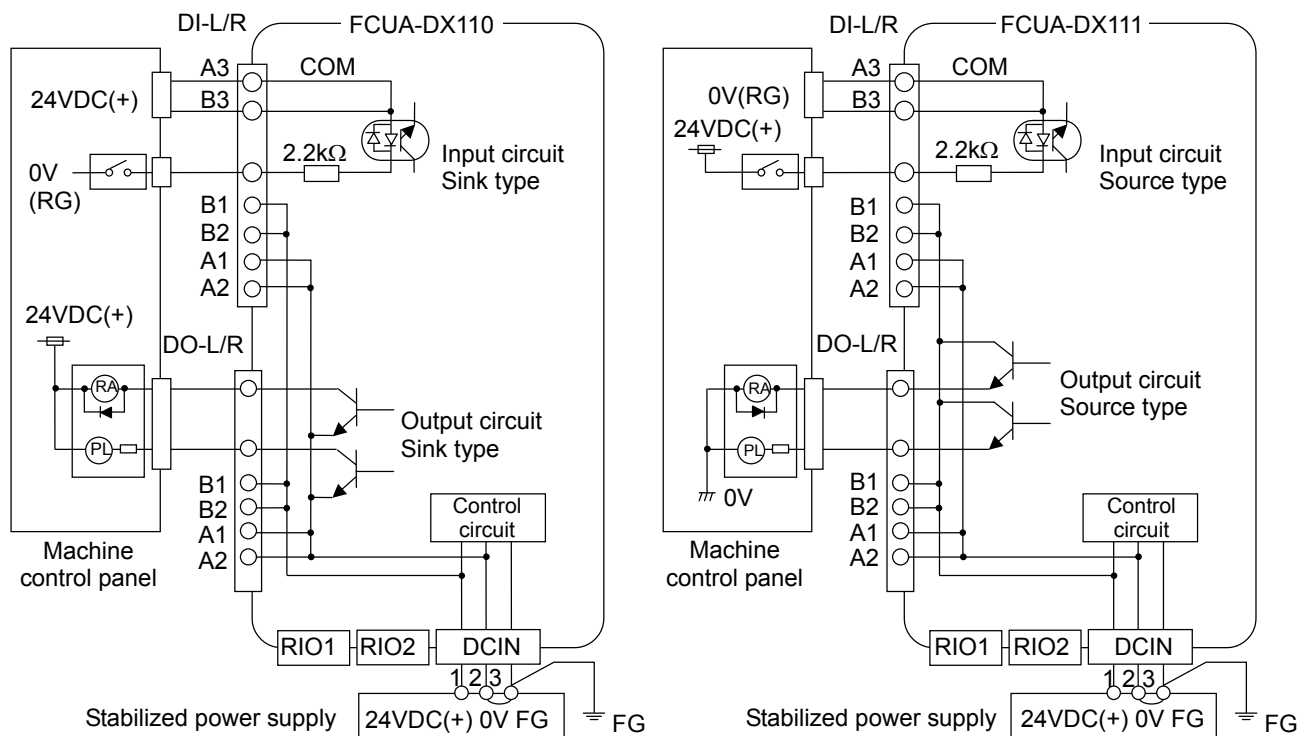


The remote I/O unit cable types include the R300 and R301 types. The R300 cable has one end cut off, and the R301 cable is used for connection to the IDEC Izumi terminal block BX1F-T40A (**Note 1**). The R300-3M and R301-3M cables are available. If a cable longer than 3m is required, use the CN300 and CS301 connector set.

The one-end CN300 connector (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The CS301 connector set (optional with both ends) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block (IDEC Izumi).

(Note 1) IDEC Izumi I/O terminal BX1F-T40

<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.

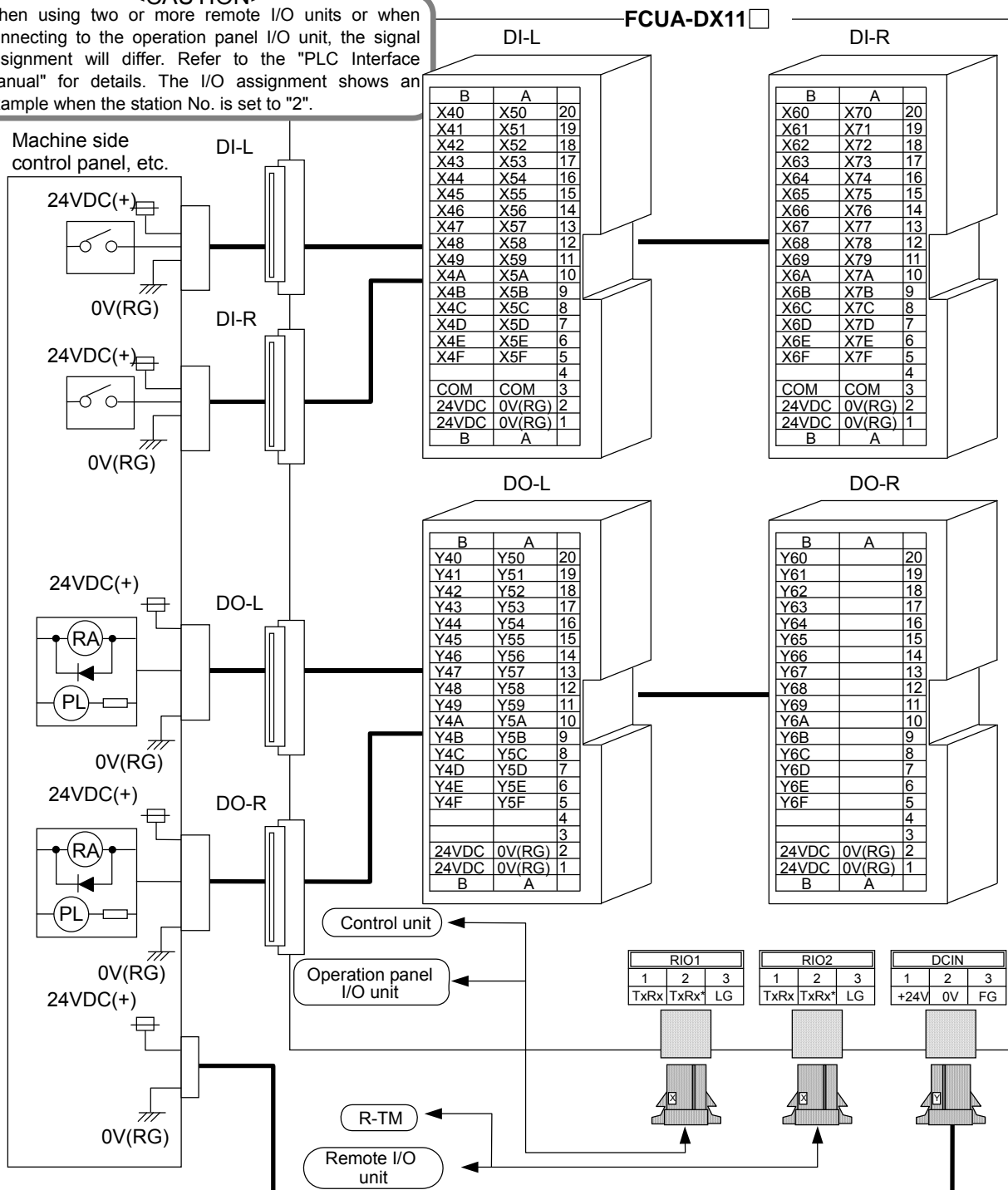
8. Connection of Remote I/O Unit

8.10 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 operation panel I/O unit, the signal assignment will differ. Refer to the "PLC Interface Manual" for details. The I/O assignment shows an example when the station No. is set to "2".



<Adaptive connector>

DCIN (CN220)

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

RIO1/RIO2 (CN211)

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

DI-L/DO-L (CN300)
DI-R/DO-R

Solderless type
connector: 7940-6500SC
Manufacturer: 3M

Terminator (R-TM)

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

(Note 1) () is the MITSUBISHI original type name.

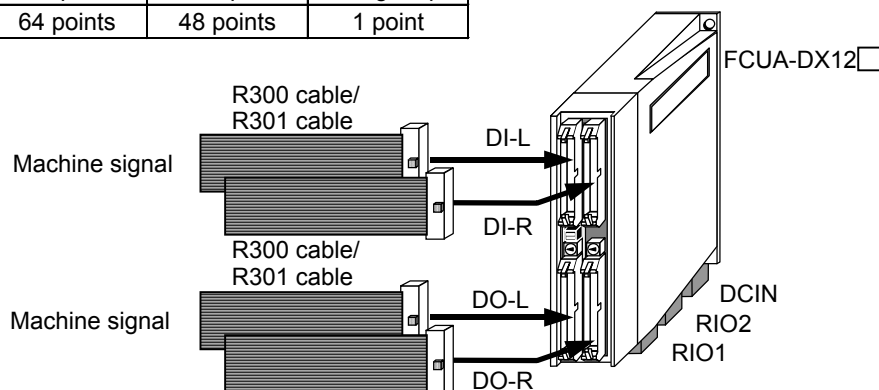
(Note 2) Refer to Section 10 for the details on R-TM.

8. Connection of Remote I/O Unit

8.11 Connection of FCUA-DX12□ Unit and Machine Control Signal

8.11 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	1 point

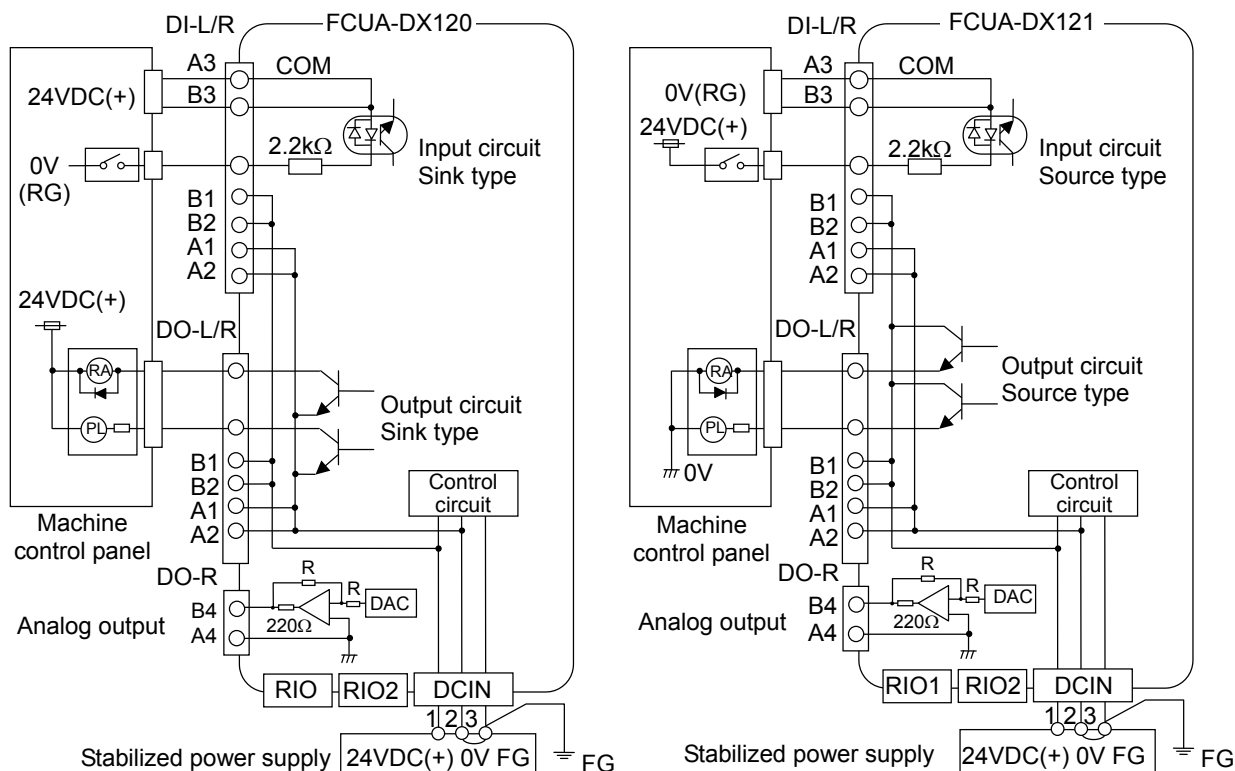


The remote I/O unit cable types include the R300 and R301 types. The R300 cable has one end cut off, and the R301 cable is used for connection to the IDEC Izumi Denki terminal block BX1F-T40A (**Note 1**). The R300-3M and R301-3M cables are available. If a cable longer than 3m is required, use the CN300 and CS301 connector set.

The one-end connector CN300 (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The CS301 connector set (optional, with both ends) includes the DI-L and DO-L connectors, and two connectors for connection with the terminal block (IDEC Izumi).

(Note 1) IDEC Izumi I/O terminal BX1F-T40

<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.

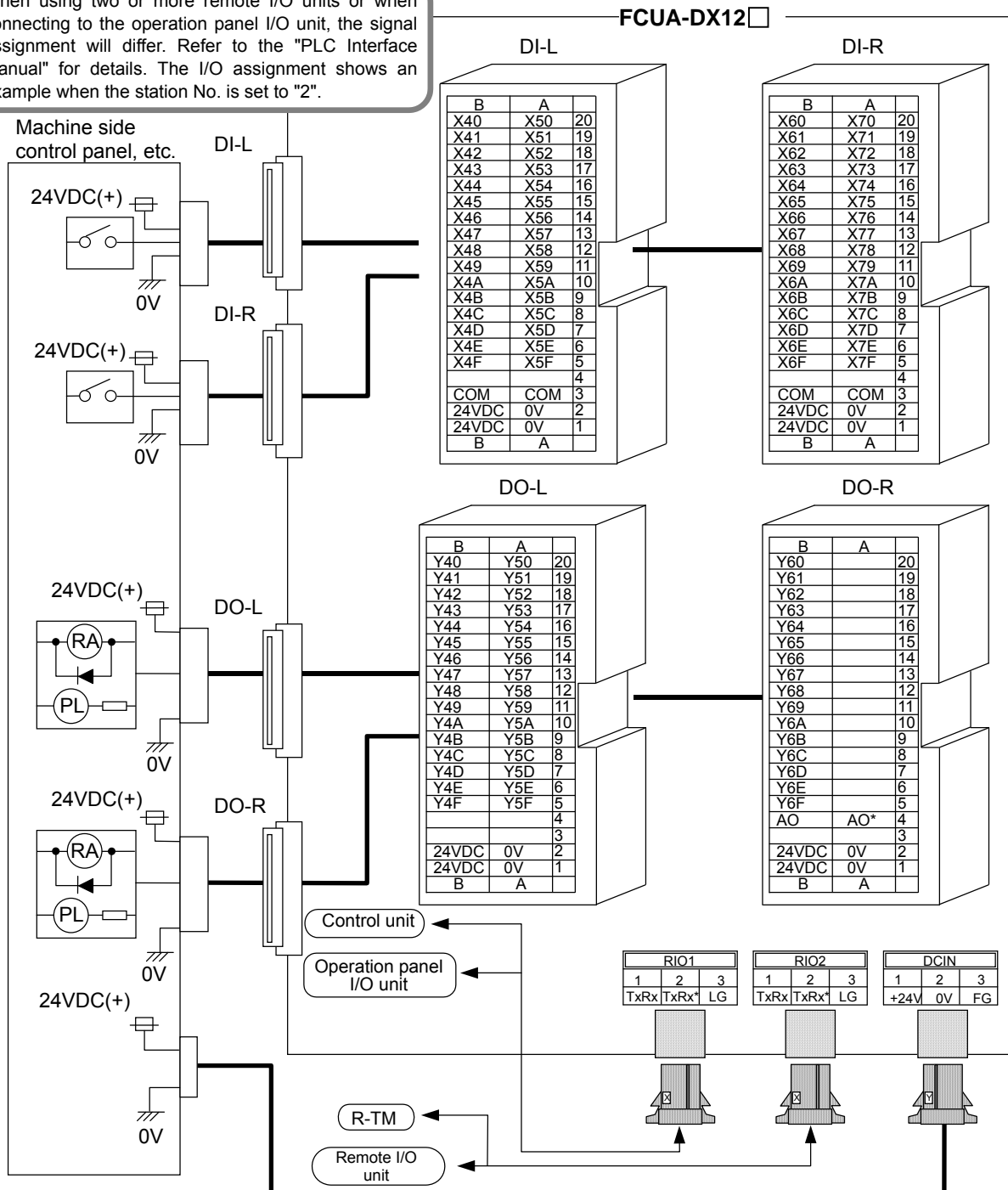
8. Connection of Remote I/O Unit

8.11 Connection of FCUA-DX12 Unit and Machine Control Signal

<Signal assignment table>

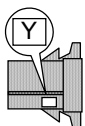
<CAUTION>

When using two or more remote I/O units or when connecting to the operation panel I/O unit, the signal assignment will differ. Refer to the "PLC Interface Manual" for details. The I/O assignment shows an example when the station No. is set to "2".



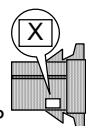
<Adaptive connector>

DCIN (CN220)



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

RIO1/RIO2 (CN211)



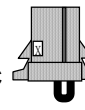
Connector: 1-178288-3
Contact: 1-175218-2
Manufacturer: Tyco Electronics AMP

DI-L/DO-L (CN300)
DI-R/DO-R



Solderless type
connector: 7940-6500SC
Manufacturer: 3M

Terminator (R-TM)



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

(Note 1) () is the MITSUBISHI original type name.

(Note 2) Refer to Section 10 for the details on R-TM.

8.12 Cables

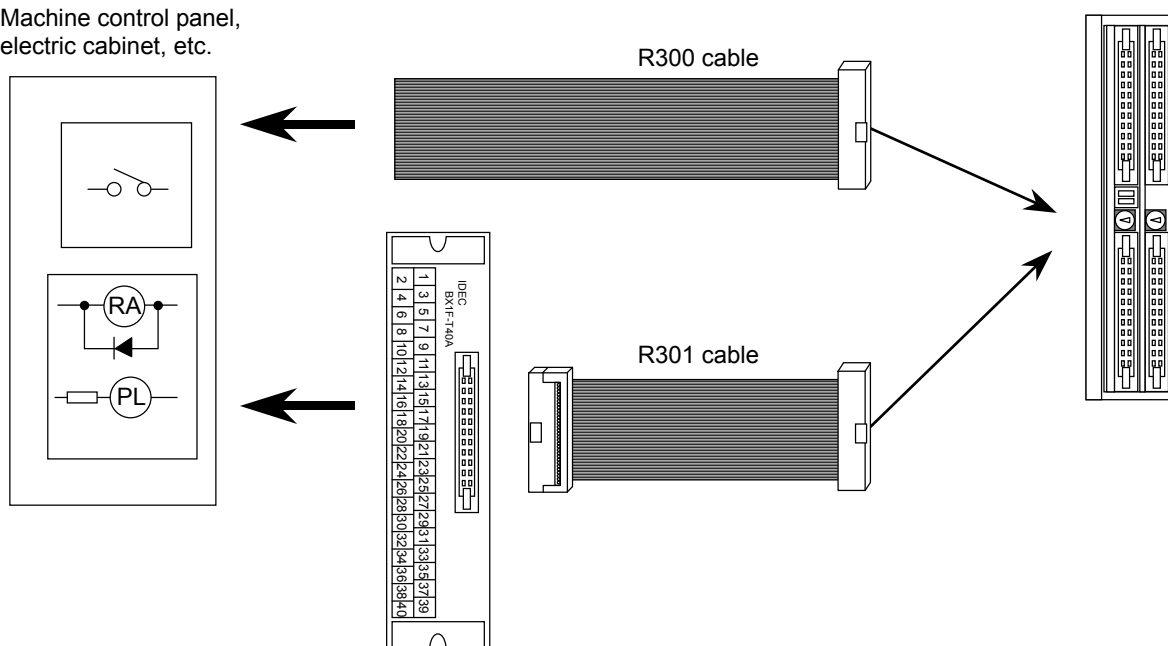
The remote I/O unit cable types include the R300 and R301 types. The R300 cable has one end cut off, and the R301 cable is used for connection to the IDEC Izumi terminal block BX1F-T40A (**Note 1**). Both the R300-3M and R301-3M are available.

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

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

(Note 1) IDEC Izumi I/O terminal BX1F-T40A

Machine control panel,
electric cabinet, etc.



Connector pin correspondence table

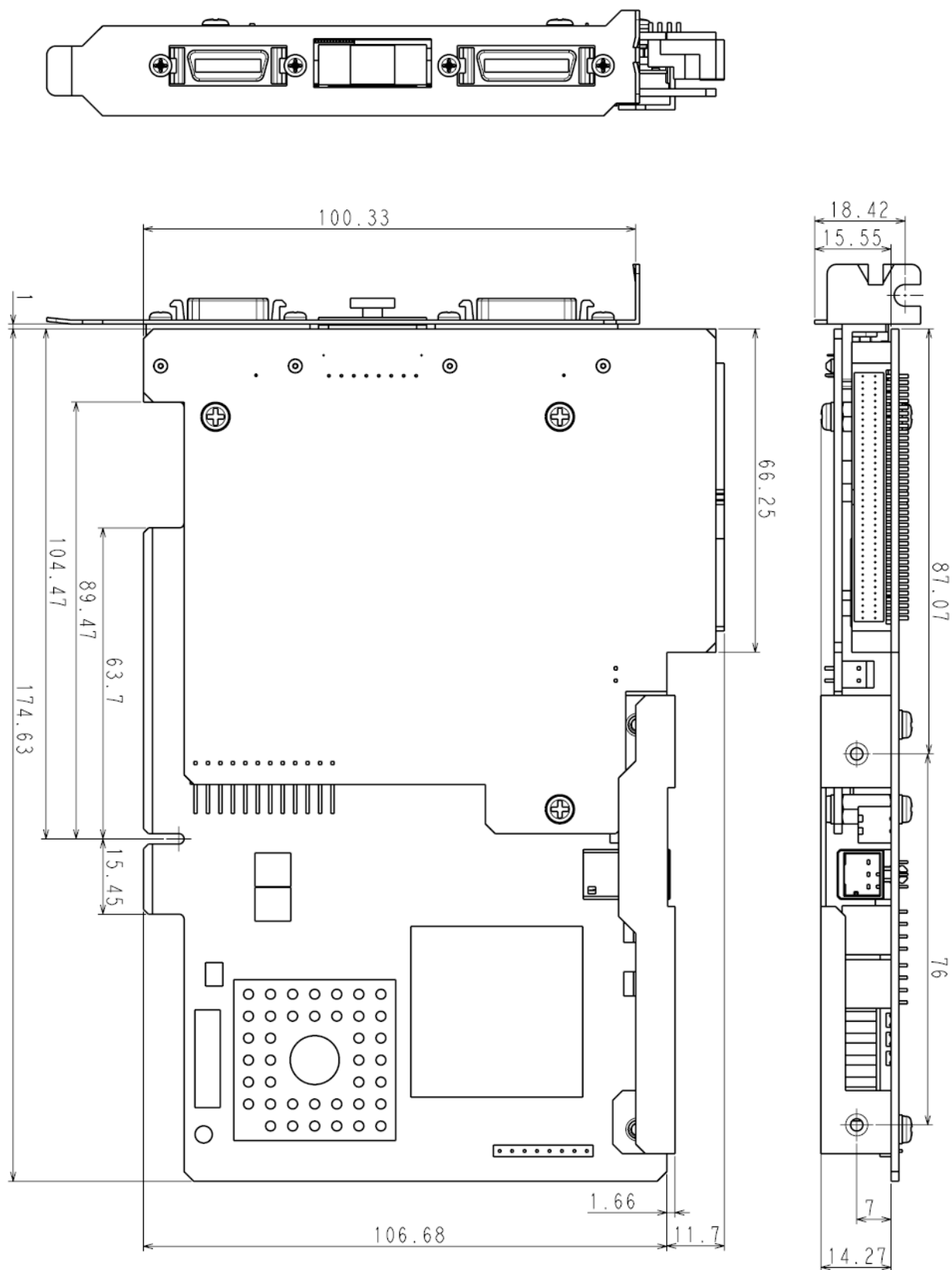
Terminal block BX1F	FCUA- DX1□□	Terminal block BX1F	FCUA- DX1□□
1	A1	2	B1
3	A2	4	B2
5	A3	6	B3
7	A4	8	B4
9	A5	10	B5
11	A6	12	B6
13	A7	14	B7
15	A8	16	B8
17	A9	18	B9
19	A10	20	B10
21	A11	22	B11
23	A12	24	B12
25	A13	26	B13
27	A14	28	B14
29	A15	30	B15
31	A16	32	B16
33	A17	34	B17
35	A18	36	B18
37	A19	38	B19
39	A20	40	B20

9. Outline Structure/Drawing

9.1 Outline Drawing of NC Control Unit FCU7-HN633-04/FCU7-HN653-05

9. Outline Structure/Drawing

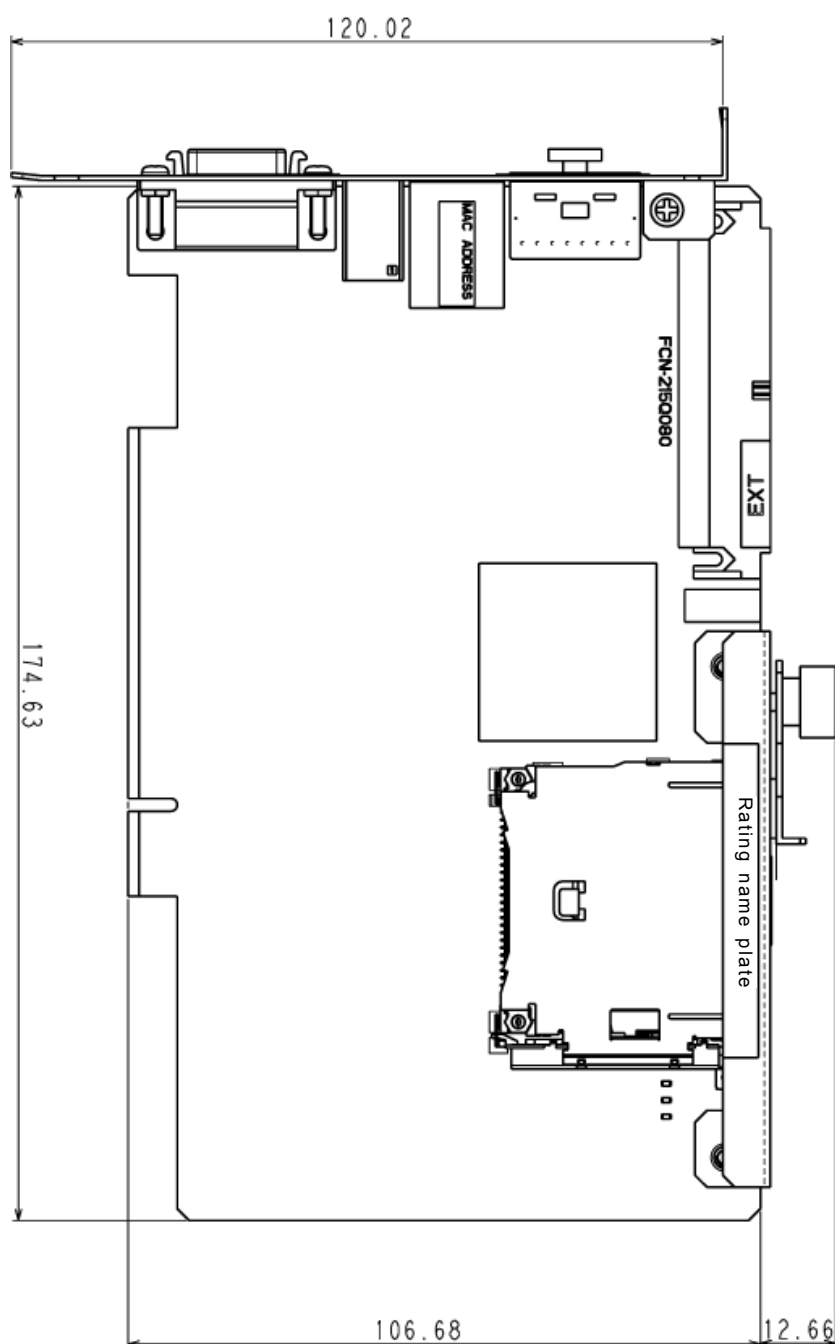
9.1 Outline Drawing of NC Control Unit FCU7-HN633-04/FCU7-HN653-05



Outline drawing of NC Control Unit FCU7-HN633-04/FCU7-HN653-05

9.2 Outline Drawing of Extension Unit FCU7-HN693

The unit's thickness is the same as that of NC control unit FCU7-HN633-04/FCU7-HN653-05.

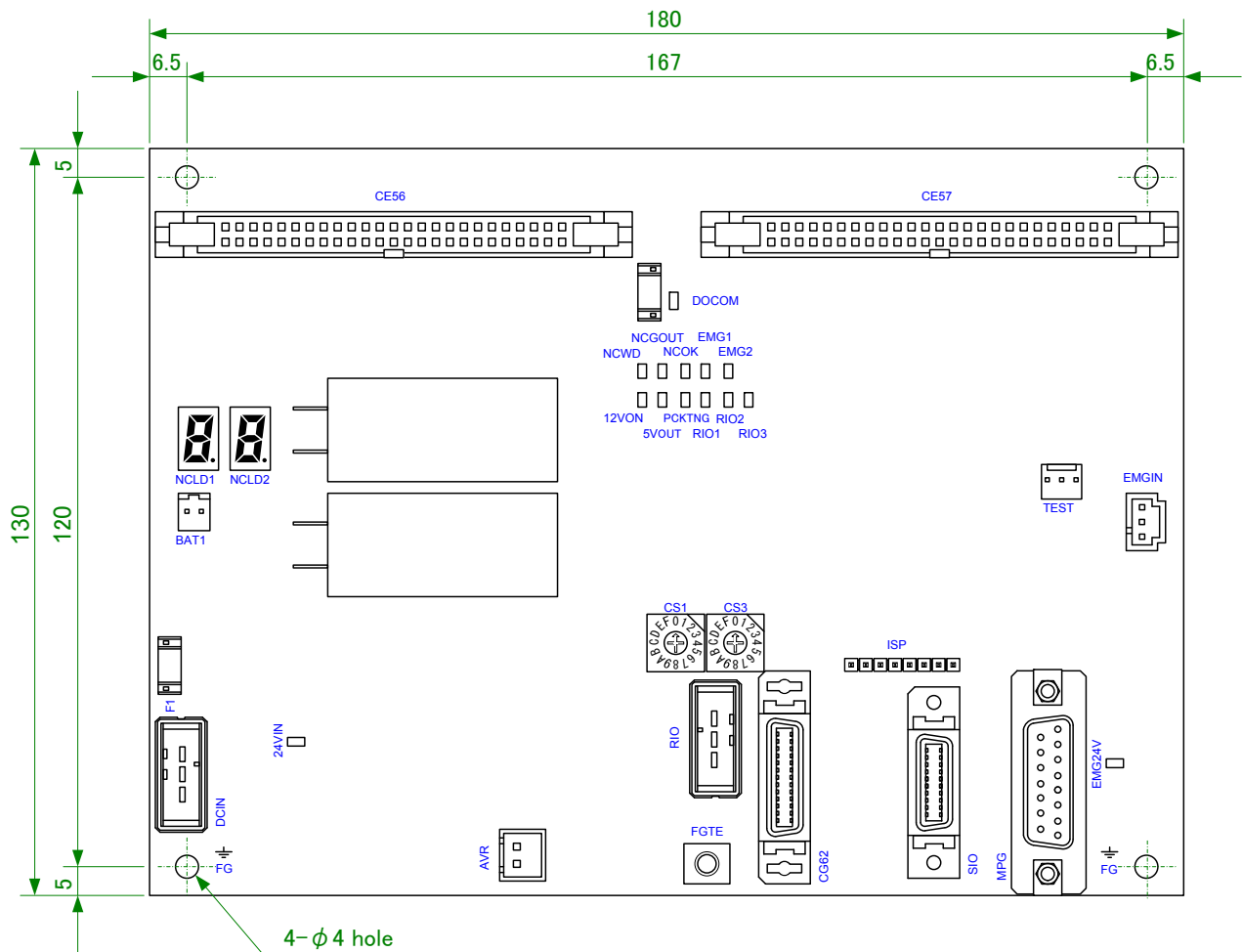


Outline drawing of extension unit FCU7-HN693

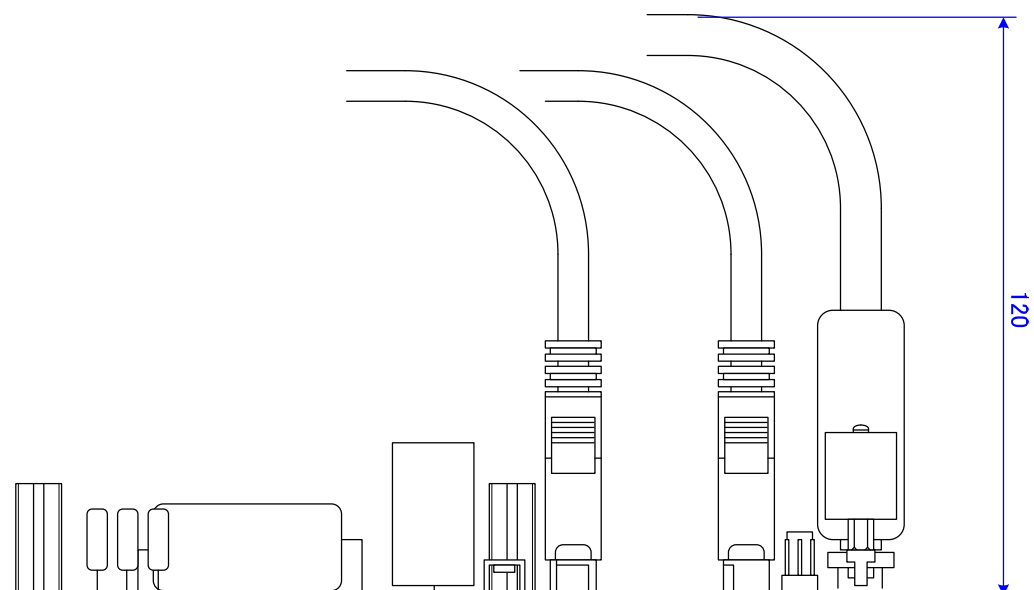
9. Outline Structure/Drawing

9.3 Outline Drawing of Operation Panel I/O Unit FCU7-HN376-02

9.3 Outline Drawing of Operation Panel I/O Unit FCU7-HN376-02



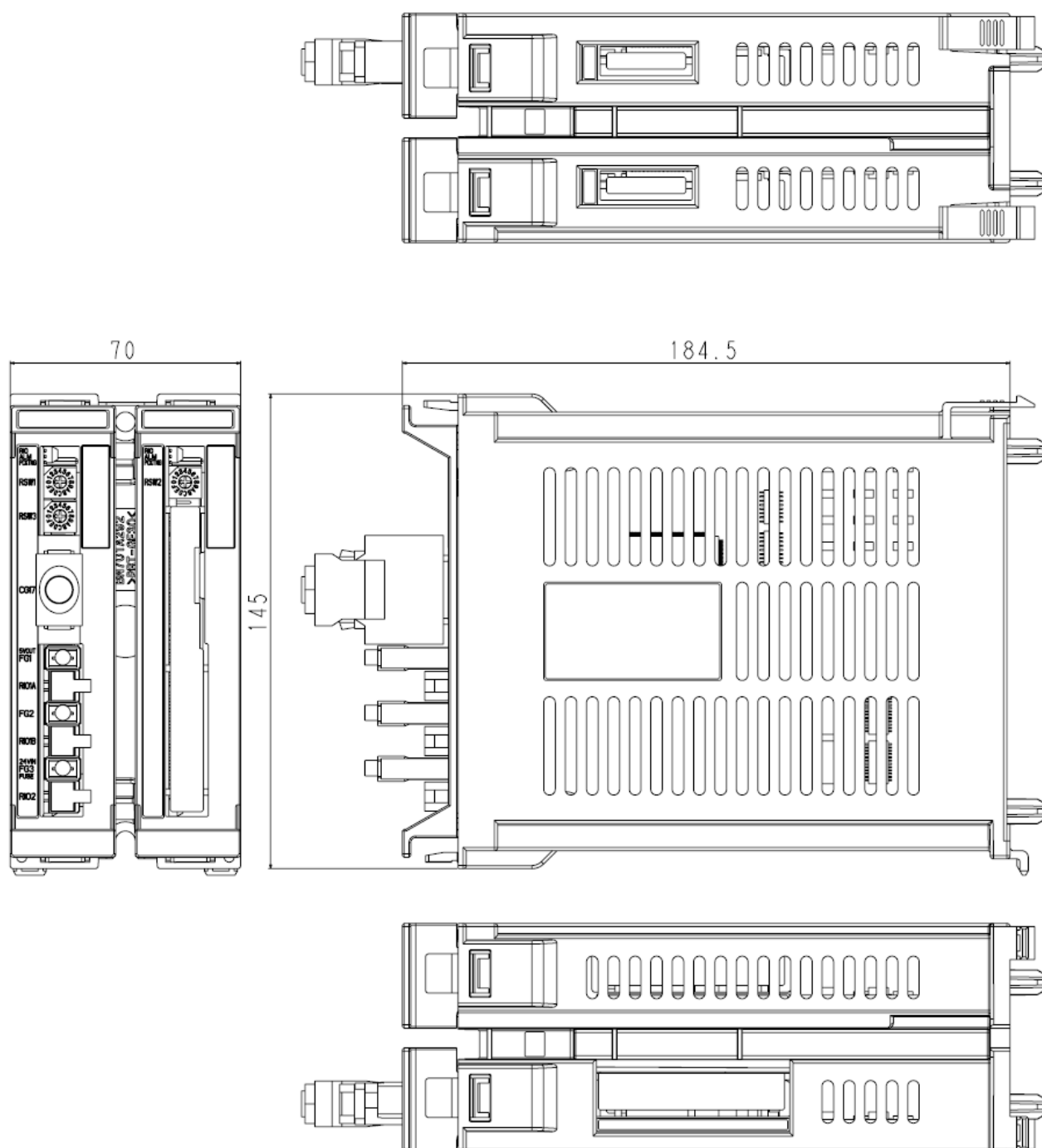
Outline drawing of operation panel I/O unit (FCU7-HN376-02)



Dimension of space for cable removal from the operation I/O unit (FCU7-HN376-02)

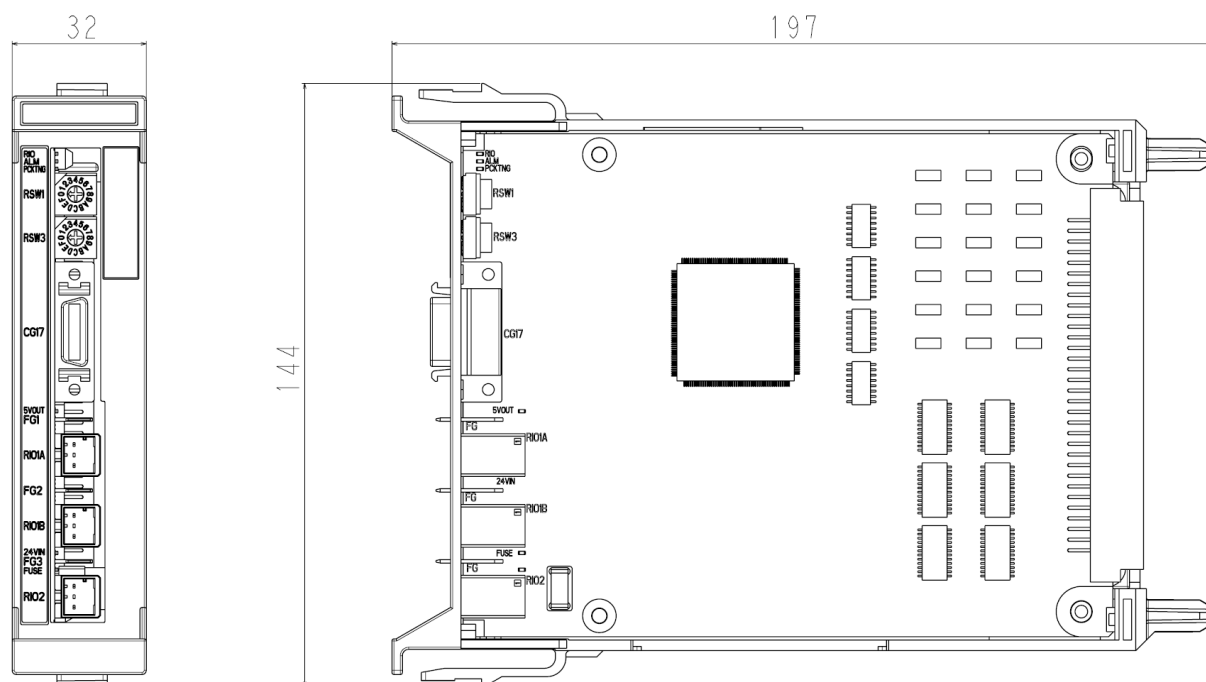
9.4 Outline Drawing of Book-type I/O Unit

9.4.1 Dimensions of Entire Book-type I/O Unit



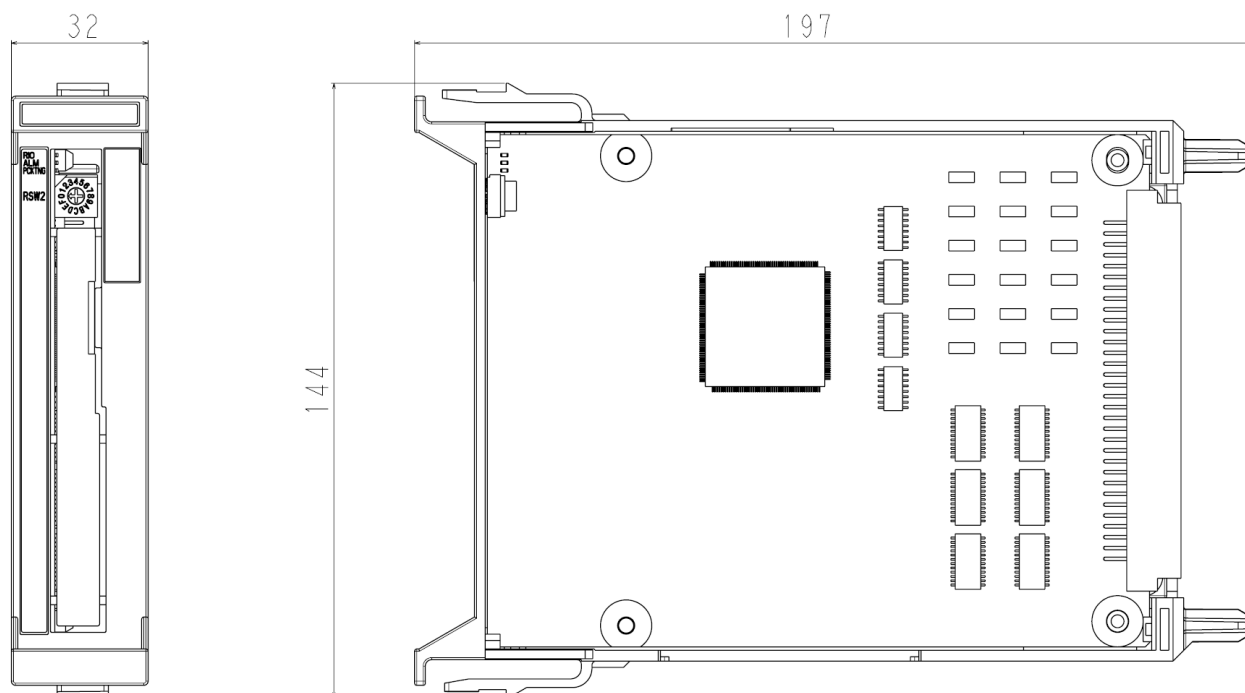
Dimension diagram of entire book-type I/O unit

9.4.2 Outline Drawing of Base Unit (FCU7-DX078)



Outline drawing of base unit (FCU7-DX078)

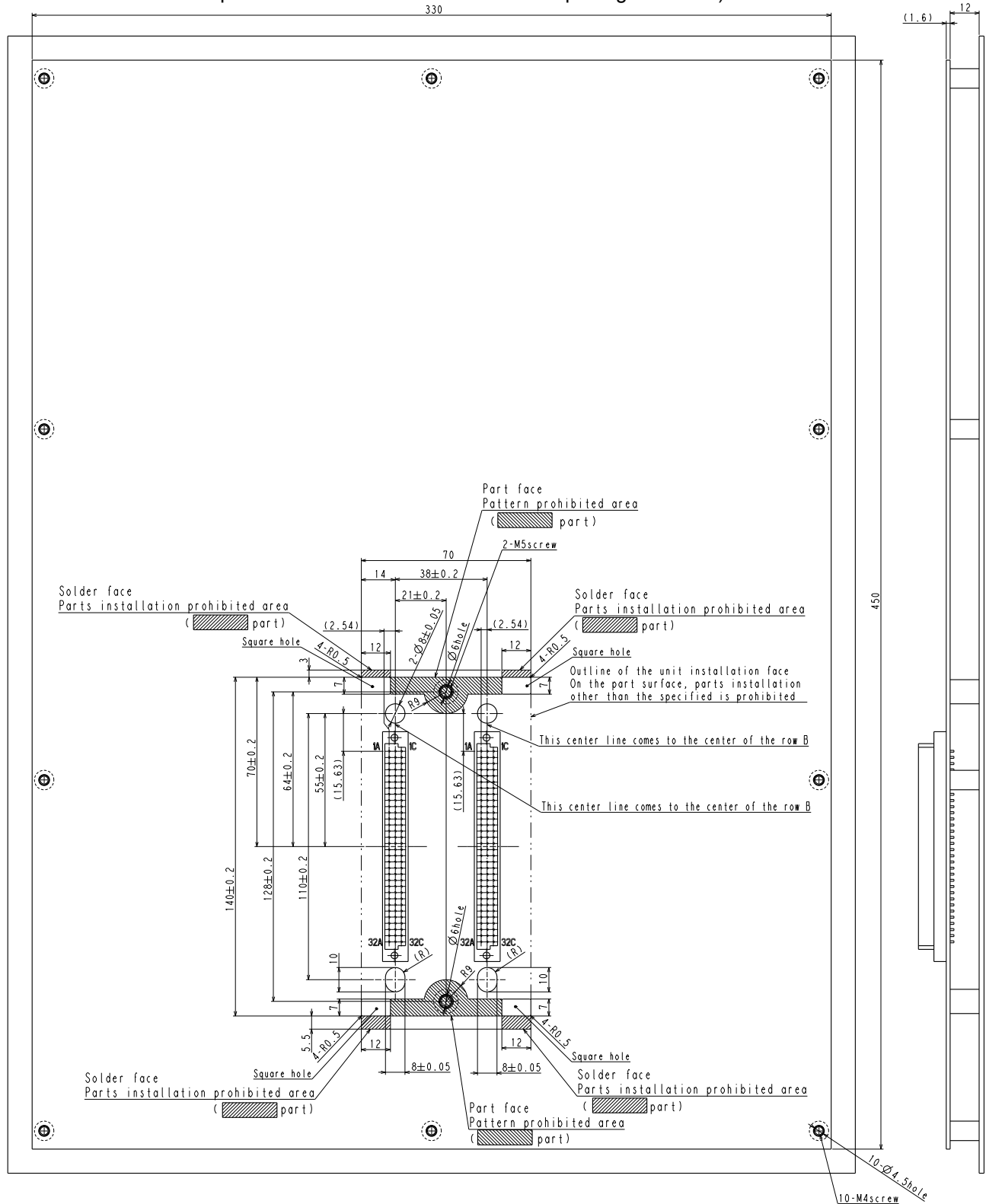
9.4.3 Outline Drawing of Extension Unit (FCU7-DX079)



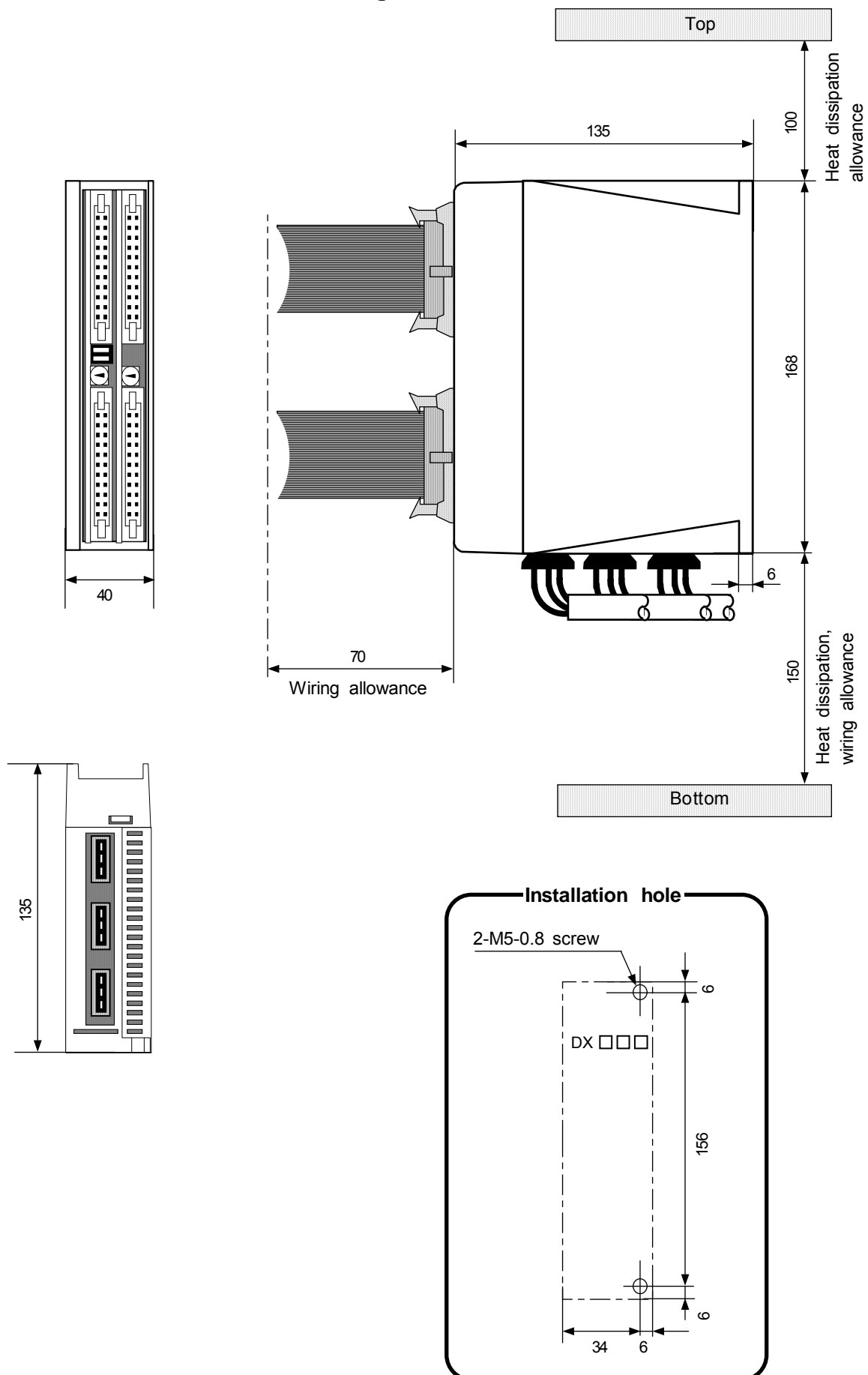
Outline drawing of extension unit (FCU7-DX079)

9.5 Panel Cut Dimensions to Install Book-Type I/O Unit

Layout of the CG30 connectors (female) and the guide holes and fixing screw holes are as below. Attach the studs at the positions of the $\Phi 6\text{mm}$ holes, and fix the unit with the M5 screws. As the unit fixing latches will be on the back side of the $12 \times 7\text{mm}$ square holes (S side), installation of parts is prohibited in these areas. Pattern is prohibited in the parts that contact with the case of the part faces. (In the below drawing, the prohibited parts are shadowed with oblique lines that are drawn from the left top to right bottom.)



9.6 Remote I/O Unit Outline Drawing

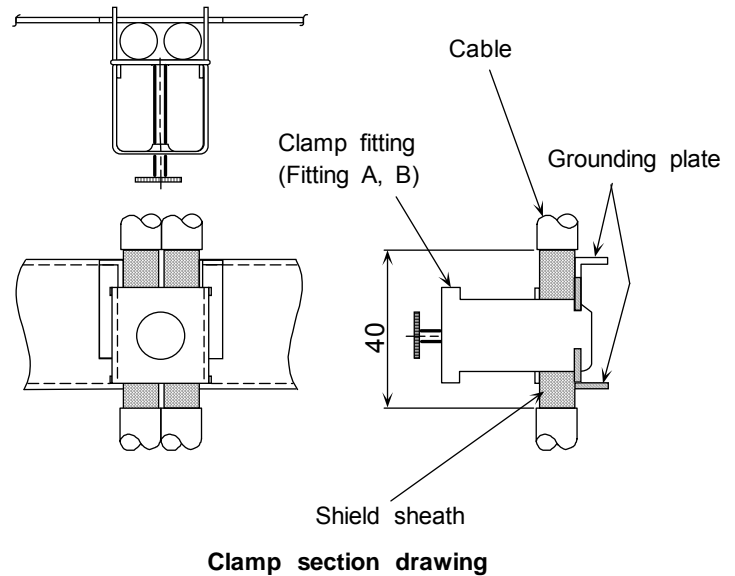


9. Outline Structure/Drawing

9.7 Outline and Installation Outline Drawing for Grounding Plate and Clamp Fitting

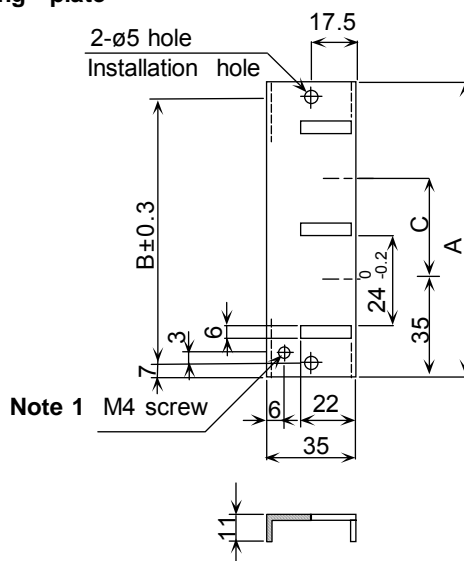
9.7 Outline and Installation Outline Drawing for Grounding Plate and Clamp Fitting

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.

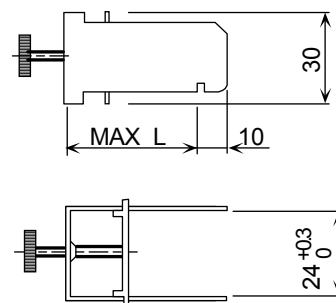


Outline drawing

Grounding plate



Clamp fitting



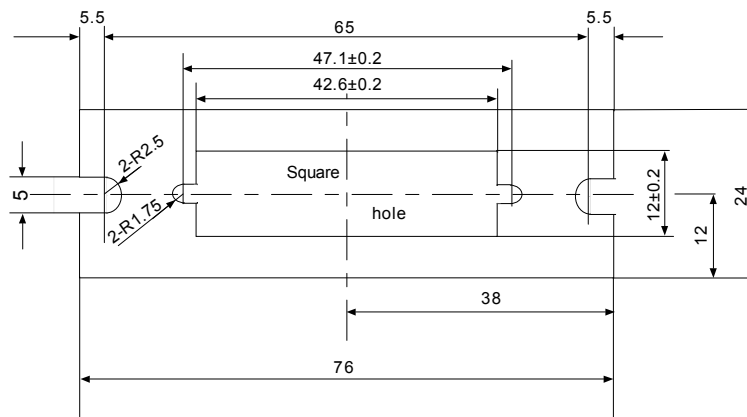
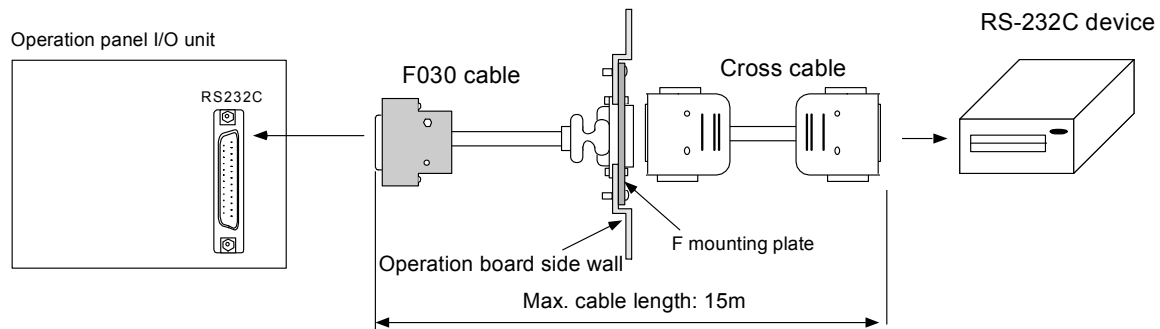
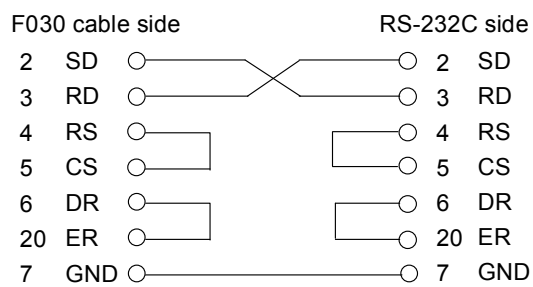
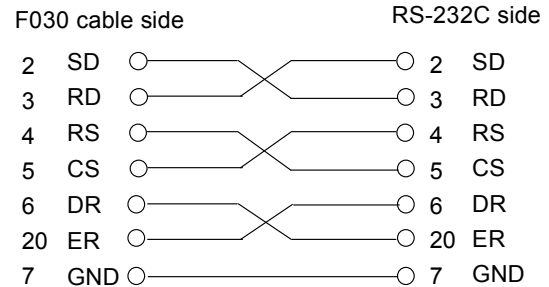
Note 1) Screw hole for wiring to cabinet's grounding plate

Note 2) The grounding plate thickness is 1.6mm

	A	B	C	Enclosed fittings
AERSBAN-DSET	100	86	30	Clamp fitting A × 2
AERSBAN-ESET	70	56	—	Clamp fitting B × 1

	L
Clamp fitting A	70
Clamp fitting B	45

9.8 F Installation Plate Outline Drawing

Example of use with RS-232C devicesCross cable connectionFor DC code controlFor DR/ER control

<Caution>

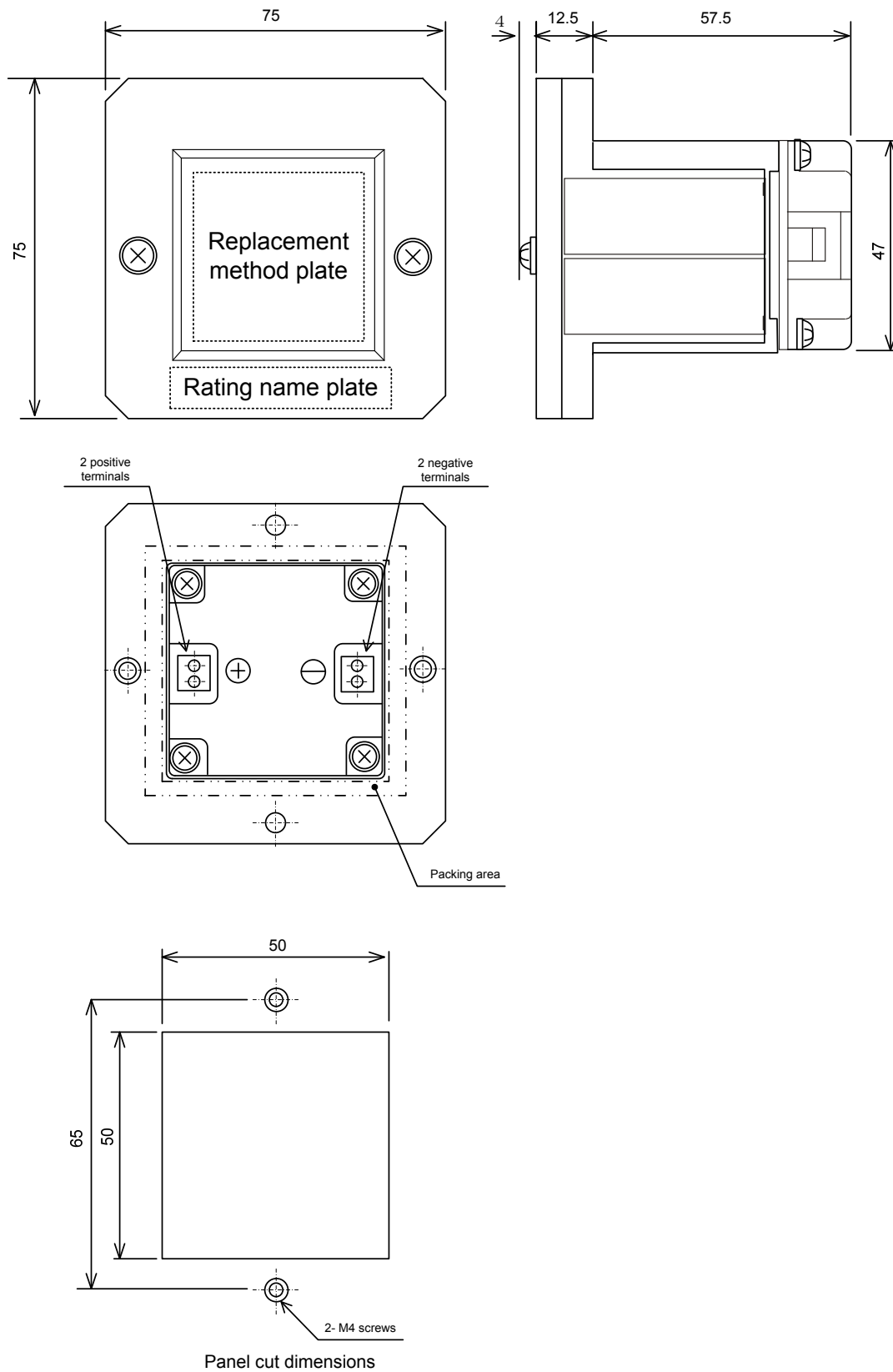
- Do not connect anything to the open pins.
- Keep the overall cable length to less than 15m.

Recommended applicable connector

Connector: HDBB-25PF(05) (Hirose Electric)
Case: HDB-CTH (Hirose Electric)

9.9 Outline Drawing of Battery Unit (FCU6-BTBOX-36)

The dimensions are equivalent to those of the battery unit FCU6-BTBOX-36 (3.6V) specification.



Outline drawing of battery unit

10. Cable

As for cables whose chapter No. is not mentioned, refer to “720BM Connection and Maintenance Manual IB-1500103” for their manufacturing drawings.

10.1 Cable List

Chapter No.	Cable type	Application	Supplement	Maximum length
10.2	F011	Connects NC Control unit to operation panel I/O unit		2m
10.3	G017	Connects NC Control unit to book-type I/O unit		20m
10.4	F020	Connects operation panel I/O unit to manual pulse generator	One manual pulse generator usable	10m
	F021	Connects operation panel I/O unit to manual pulse generator	Two manual pulse generators usable	10m
	F022	Connects operation panel I/O unit to manual pulse generator	Three manual pulse generators usable	10m
10.5	G033	Connects operation panel I/O unit to RS232C device	For 1ch	15m (Note 2)
	G034	Connects operation panel I/O unit to RS232C device	For 2ch	15m (Note 2)
10.6	F070	24VDC power supply		3m
10.7	F120	Emergency stop input		30m
10.8	G180	Connects 12V power to NC Control unit or extension unit	Equivalent to G080 except for connector	2m
10.9	FCUA-R211	Connects conventional I/O unit to another conventional I/O unit	For short-distance connection (up to 10m)	10m (Note 1, 3)
10.10	G211	Connects conventional I/O unit to another conventional I/O unit	For long-distance connection (more than 10m)	30m (Note 1, 3)
10.11	G212	Connects book-type I/O unit to another book-type I/O unit		30m (Note 1, 3)
10.12	G213	Connects book-type I/O unit to conventional I/O unit		30m (Note 1, 3)
10.13	G240	Connects operation panel I/O unit to battery box		5m
10.14	G280	Connects NC Control unit to extension unit		4cm
10.25	FCU7-R300	For machine input/output for conventional I/O unit	40 pin flat cable	—
10.16	FCU7-R301	For machine input/output for conventional I/O unit	40 pin flat cable	—
10.17	G380	Optical servo communication PCF cable	With outer sheath, for panel external wiring	20m
10.18	G395	Optical servo communication POF cable	With outer sheath, for panel internal wiring	10m
10.19	G396	Optical servo communication POF cable	With outer sheath, for panel internal wiring	10m
10.20	SH41	MC link B communication (remote I/O communication)	For connecting devices in the cabinet	1m
10.21	R-TM	MC link B communication (remote I/O communication) terminator	Connect to last station for remote I/O unit	—
10.22	R-TM2	Book-type I/O unit terminator	Connect to last station for remote I/O unit	—




(Note 1) Wire length from NC Control unit to last unit.

(Note 2) The sum (L3 + L4) of the cable length (L3) from the NC Control unit to the operation panel I/O unit and the cable length (L4) from the operation panel I/O unit to each unit must be the maximum wire length or shorter.

(Note 3) If the sum of the cable length from the NC Control unit to the last unit exceeds 30m, consult with NC Hardware System Section.

Notes for the cable drawings

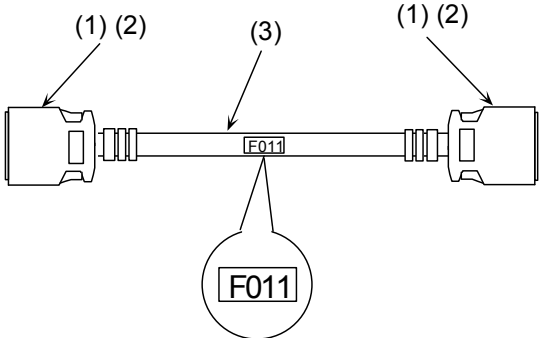
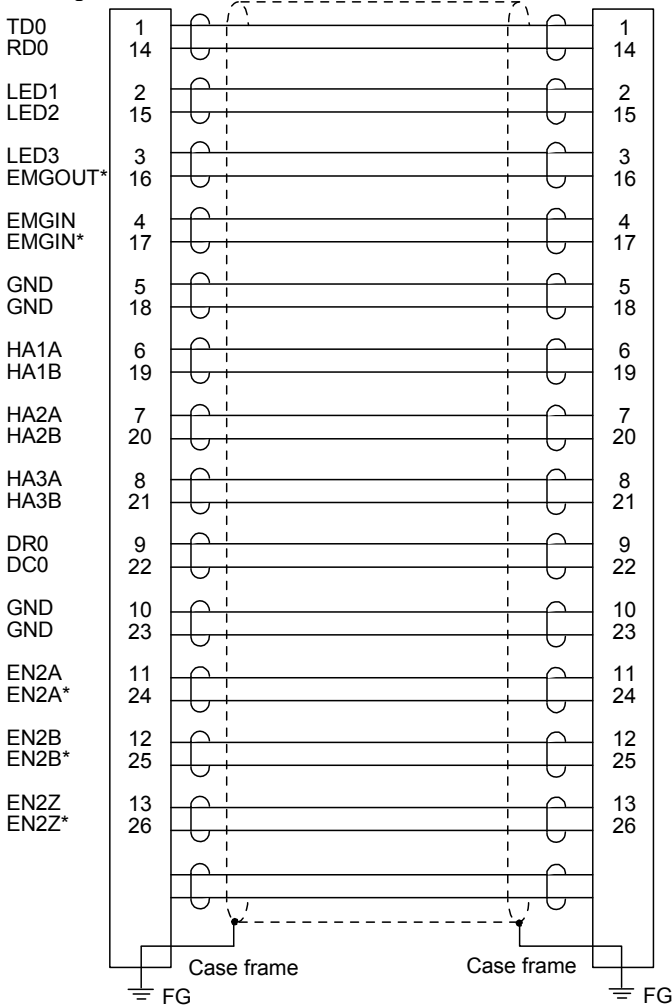
Common symbols in the cable drawings are as below.

1.  indicates twisted pair.
2.  indicates the shield sheath.
3.  indicates soldering.

4. In the cable drawings, the partner of the twisted pair cable is given a priority, so the pin No. of the connectors at both ends are not necessary in number of order.

5. Equivalent parts can be used for the connector, contact and wire material.

10.2 F011 Cable Manufacturing Drawing

Cable type: F011 cable		Application: Connection between NC Control unit and operation panel I/O unit																	
Application: Connection between NC card and relay card		List of parts used																	
Assembly drawing																			
		<table border="1"> <thead> <tr> <th>No.</th><th>Part name</th><th>Recommended part type</th><th>Quantity</th></tr> </thead> <tbody> <tr> <td>1</td><td>Plug</td><td>Sumitomo 3M 10126-6000EL</td><td>2</td></tr> <tr> <td>2</td><td>Shell</td><td>Sumitomo 3M 10326-3210-000</td><td>2</td></tr> <tr> <td>3</td><td>Wire material</td><td>Toyokuni Electric Cable UL20276 AWG28×15P</td><td>(1)</td></tr> </tbody> </table>		No.	Part name	Recommended part type	Quantity	1	Plug	Sumitomo 3M 10126-6000EL	2	2	Shell	Sumitomo 3M 10326-3210-000	2	3	Wire material	Toyokuni Electric Cable UL20276 AWG28×15P	(1)
No.	Part name	Recommended part type	Quantity																
1	Plug	Sumitomo 3M 10126-6000EL	2																
2	Shell	Sumitomo 3M 10326-3210-000	2																
3	Wire material	Toyokuni Electric Cable UL20276 AWG28×15P	(1)																
		Maximum cable length: 2m																	
Connection diagram																			
																			
Manufacturing precautions																			
(1) The wire material shall be a shielded, 15-pair cable equivalent to UL20276 Standard AWG28 (0.08mm ²).																			
(2) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.																			
(3) Attach the nameplate (with protective cover stamped with the cable name) in the position designated in the assembly drawing.																			
(4) Fold the wire material shield over the sheath, and wrap copper foil tape over it. Clamp with the connector's GND plate.																			
(5) The part 1 plug and part 2 shell are solderless types. If soldering types are required, use parts 10126-3000VE for the plug and 10326-52F0-008 for the shell (both parts manufactured by Sumitomo 3M).																			

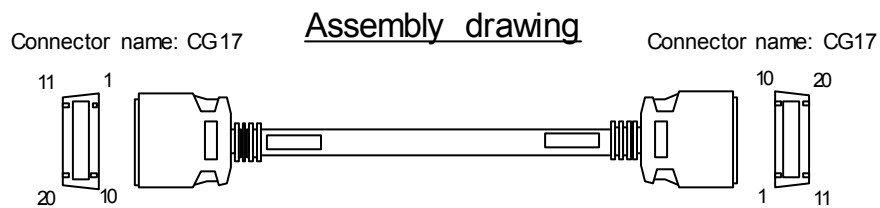
10. Cable

10.3 G017 Cable Manufacturing Drawing (NC Control Unit Connection)

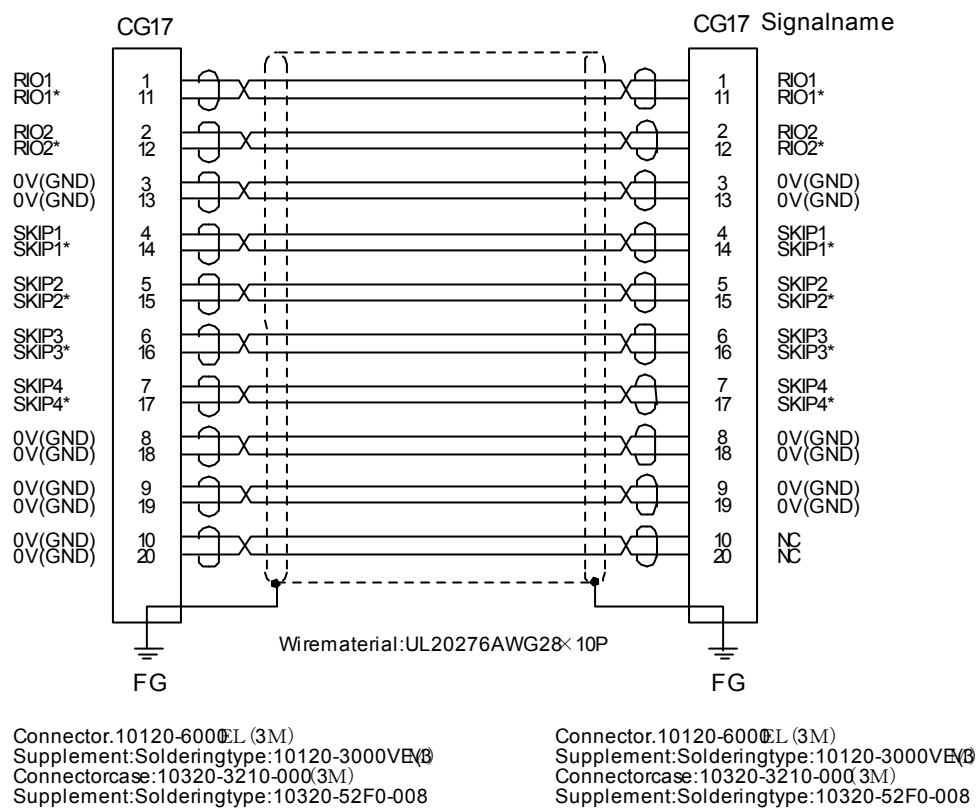
10.3 G017 Cable Manufacturing Drawing (NC Control Unit Connection)

Cable type: G017 cable

Application: Connection between NC control unit and book-type I/O unit



Connection diagram



(Note 1) Fold the wire material shield over the sheath, and wrap copper foil tape over it. Clamp with the connector's GND plate.

10.4 F020/F021/F022 Cable Manufacturing Drawing

Cable type: F020/021/022 cable	Application: Manual pulse generator (12V power supply type)
--------------------------------	-------------------------------------------------------------

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

Precautions
The circles indicate the used channel.

MPG
Connector : CDA-15P
Contact : CD-PC-111x12
Case : HDA-CTH
Recommended manufacturer:
Hirose Electric

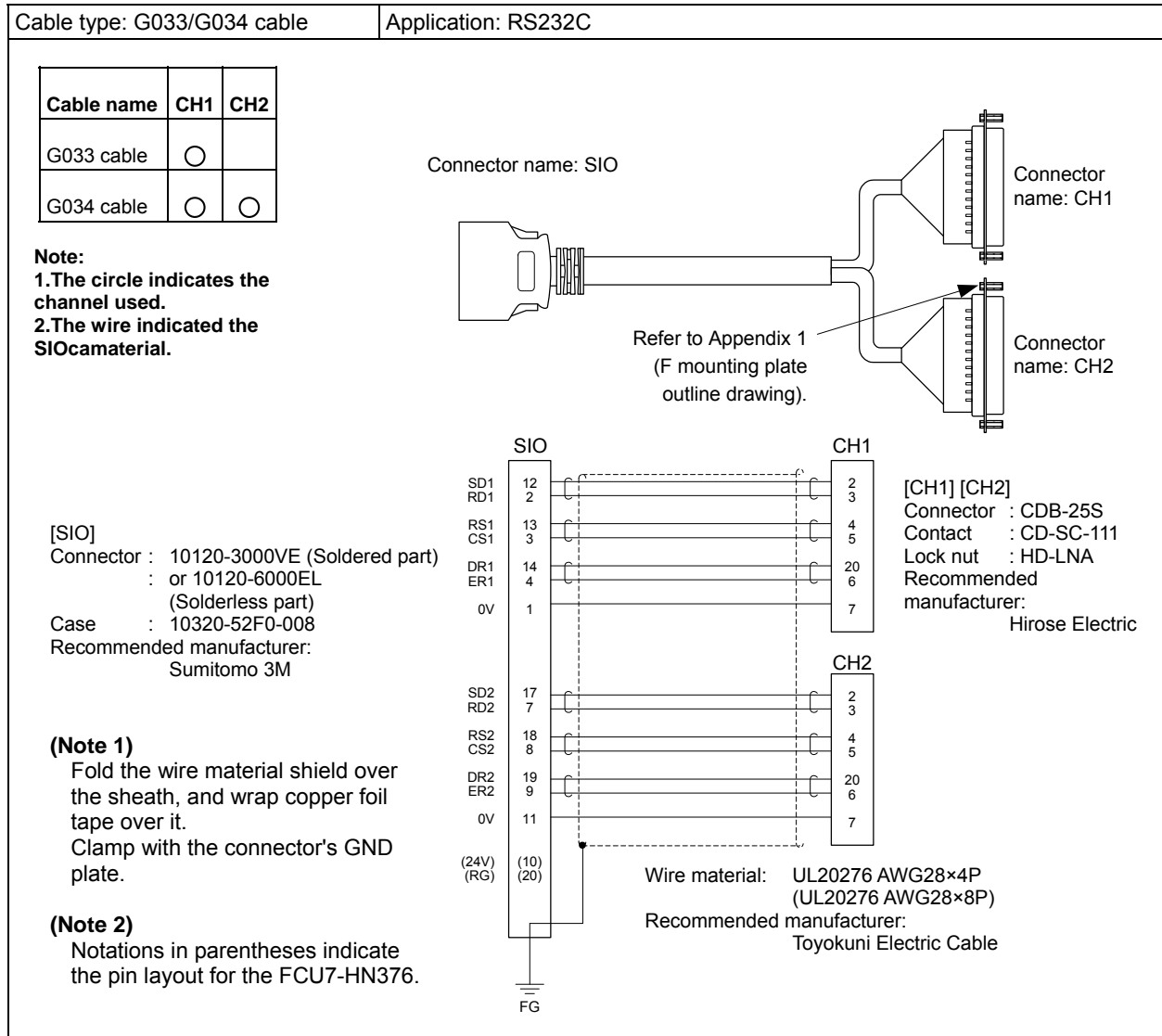
Wire material : B-22(19)U x 2SJ-1 x 9
Recommended manufacturer : Sumitomo Electric Industries

Crimp terminal : V1.25-3x12
Recommended manufacturer : JST

(Note 1) Fold the cable shield over the sheath, and wrap copper foil tape over it.
Connect the wound copper foil tape to the connector's GND plate.

(Note 2) The connector case is connected to the FG. Use a nickel-base chrome-plated part.

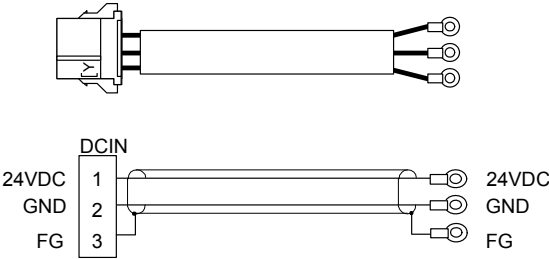
10.5 G033/G034 Cable Manufacturing Drawing



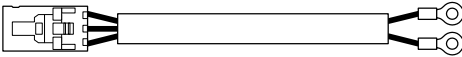
10. Cable

10.6 F070 Cable Manufacturing Drawing (24VDC Power Supply)

10.6 F070 Cable Manufacturing Drawing (24VDC Power Supply)

Cable type: F070 cable	Application: 24VDC input
<p>Connector name : DC24IN</p>  <p>DCIN</p> <p>24VDC 1 GND 2 FG 3</p> <p>24VDC GND FG</p> <p>Wire material: B-18(19)U x 2SJ-1 x 9 Recommended manufacturer: Sumitomo Electric Industries</p> <p>DCIN Connector : 2-178288-3 Contact : 1-175218-5 x 3 Recommended manufacturer: Tyco Electronics AMP</p> <p>Crimp terminal: V1.25-3 or V1.25-4 x 3 Recommended manufacturer: JST</p> <p>Caution: If the cable is 15m or longer, use 16AWG (1.25mm²).</p>	

10.7 F120 Cable Manufacturing Drawing (Emergency Stop Signal Input)

Cable type: F120 cable	Application: Emergency stop
<p>Connector name : EMG</p>  <p>EMG</p> <p>FG 1 EMG IN 2 COM 3</p> <p>B22-9</p> <p>EMG IN COM</p> <p>Connector : 51030-0330 Contact : 50084-8160 x 3 Recommended manufacturer : MOLEX</p> <p>Wire material : B-22(19)U x 2SJ-1 x 9 Recommended manufacturer : Sumitomo Electric Industries</p> <p>Crimp terminal : V1.25-3 x 2 Recommended manufacturer : JST</p>	

10. Cable

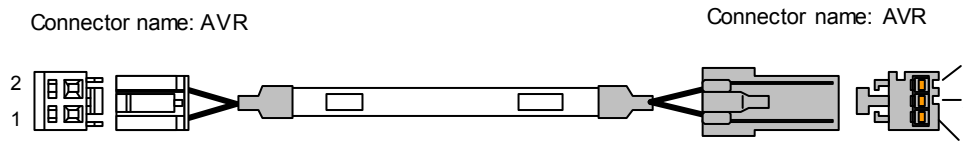
10.8 G180 Cable (NC Control Unit Power Supply Connection)

10.8 G180 Cable (NC Control Unit Power Supply Connection)

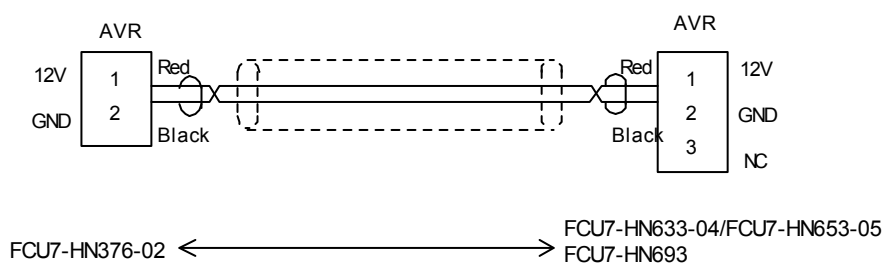
Cable type: G180 cable

Application: 12V power supply from operation panel I/O unit to NC control unit

Assembly drawing



Connection diagram



(Note 1) Protect the cable ends with heat-shrinkable tubing, etc.

10. Cable

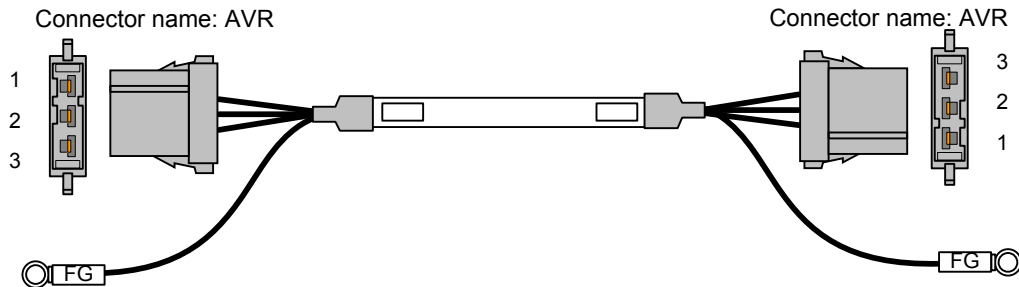
10.9 FCUA-R211 Cable Manufacturing Drawing (Connection Between Conventional Remote I/O Units, For 10m or Less)

10.9 FCUA-R211 Cable Manufacturing Drawing (Connection Between Conventional Remote I/O Units, For 10m or Less)

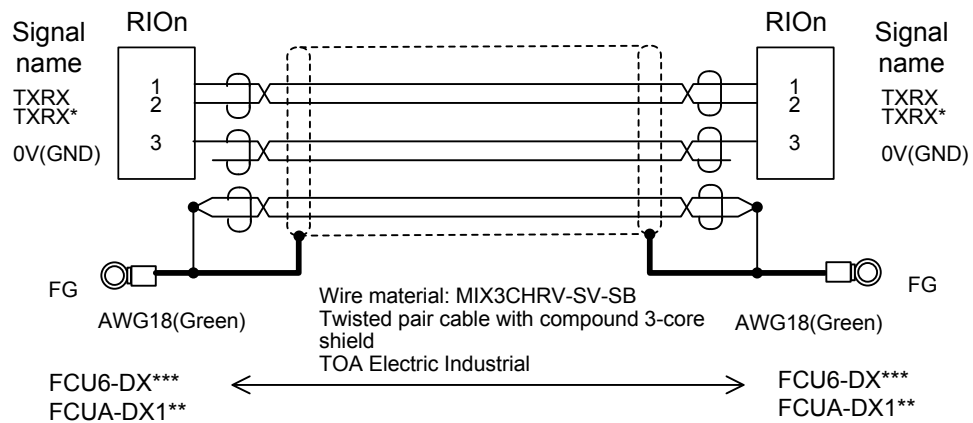
Cable type: R211 cable

Application: Communication between conventional remote I/O units
(For short distance connection, 10m or less)

Assembly drawing



Connection diagram



Use the same types of connectors and contacts for both ends
Connector: 1-178288-3 (Tyco Electronics AMP)
Contact: 1-175218-2 (Tyco Electronics AMP)

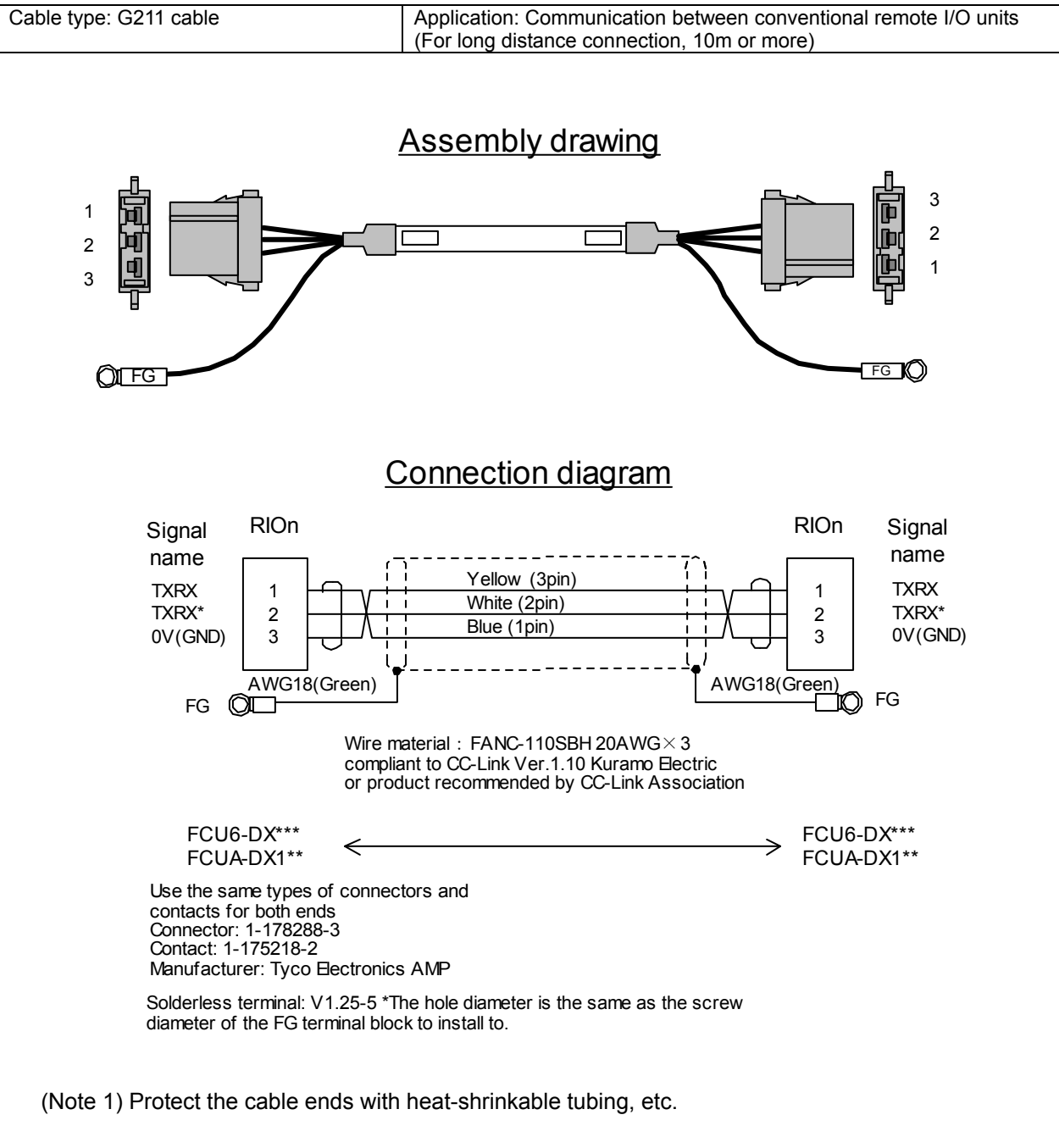
Solderless terminal: V1.25-5 *The hole diameter is the same as the screw diameter of the FG terminal block to install to.

(Note 1) Protect the cable ends with heat-shrinkable tubing, etc.

10. Cable

10.10 G211 Cable Manufacturing Drawing (Connection Between Conventional Remote I/O Units, For 10m or More)

10.10 G211 Cable Manufacturing Drawing (Connection Between Conventional Remote I/O Units, For 10m or More)



10. Cable

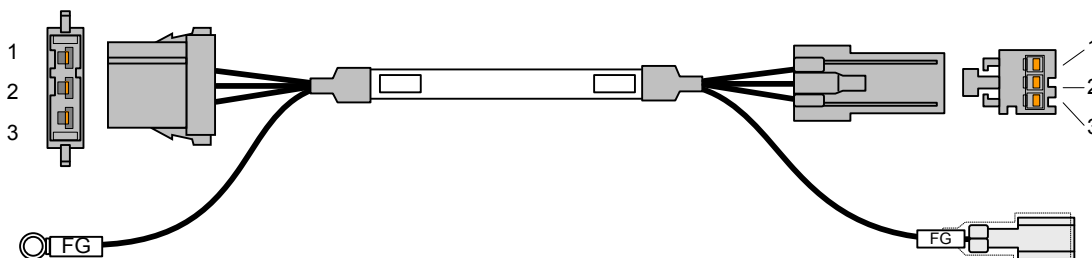
10.11 G212 Cable (RIO Communication, Conventional Unit Connection)

10.11 G212 Cable (RIO Communication, Conventional Unit Connection)

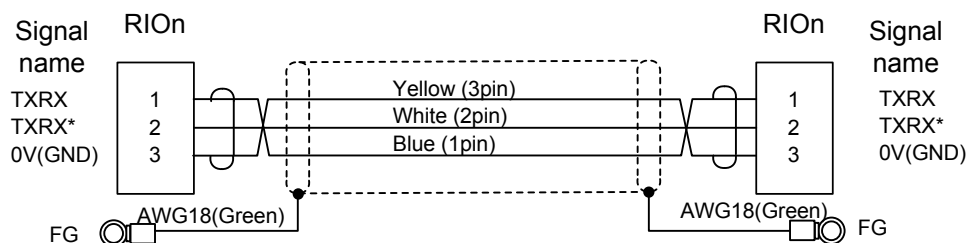
Cable type: G212 cable

Application: Communication between conventional type remote I/O unit and book-type type I/O unit

Assembly drawing



Connection diagram



Wire material : FANC-110SBH 20AWG×3
compliant to CC-Link Ver.1.10 Kuramo Electric
or product recommended by CC-Link Association

FCU6-DX***
FCUA-DX1**

Book-type I/O unit

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

Connector: 1-1318120-3
Contact: For AWG24
Chained : 1318106-1 Detached: 1318108-1
For AWG22
Chained : 1318105-1 Detached: 1318107-1
Manufacturer: Tyco Electronics AMP

Solderless terminal: V1.25-5 *The hole diameter is the same as the screw diameter of the
FG terminal block to install to.
Fast-on terminal: 175022-1 (250 Series for AWG20-14, Tyco Electronics AMP)

(Note 1) Protect the cable ends with heat-shrinkable tubing, etc.

10. Cable

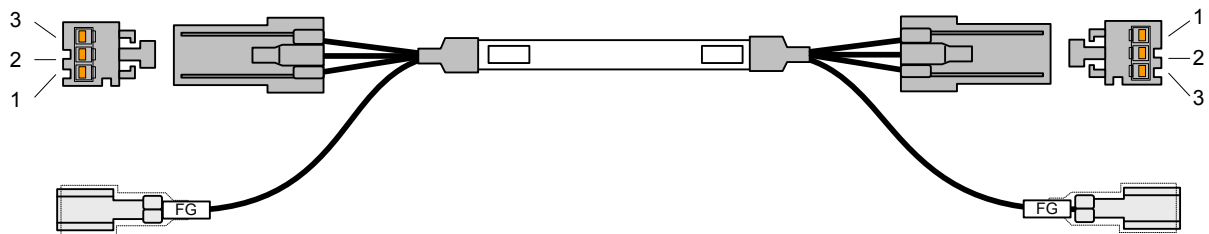
10.12 G213 Cable (RIO Communication, Connection Between FCU7-DX078s)

10.12 G213 Cable (RIO Communication, Connection Between FCU7-DX078s)

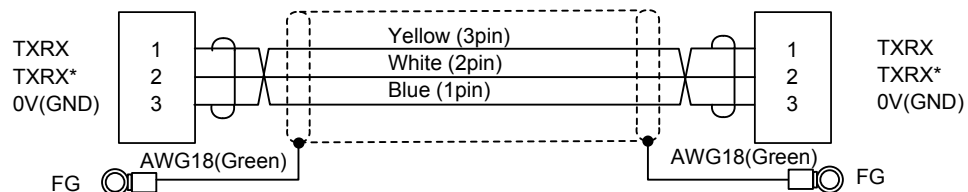
Cable type: G213 cable

Application: Communication between book-type I/O units

Assembly drawing



Connection diagram



Wire material : FANC-110SBH 20AWG×3
compliant to CC-Link Ver.1.10 Kuramo Electric
or product recommended by CC-Link Association

Book-type I/O unit ← → Book-type I/O unit

Use the same types of connectors and contacts for both ends

Connector: 1-1318120-3

Contact: For AWG24

Chained: 1318106-1 Detached: 1318108-1

For AWG22

Chained: 1318105-1 Detached: 1318107-1

Manufacturer: Tyco Electronics AM

Fast-on terminal: 175022-1 (250 Series for AWG20-14, Tyco Electronics AMP)

(Note 1) Protect the cable ends with heat-shrinkable tubing, etc.

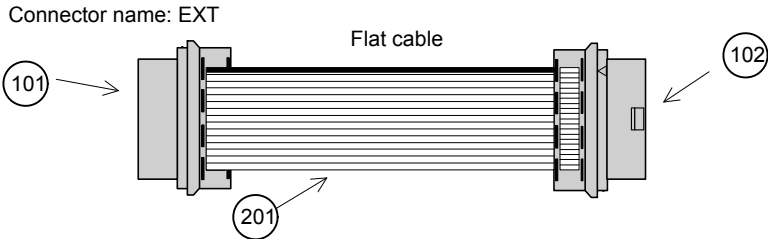
10. Cable

10.13 G240 Cable Manufacturing Drawing


10.13 G240 Cable Manufacturing Drawing

Cable type	G240			
Application	Battery			
Part No.	Part name	Type	Qty.	Recommended manufacturer
101	Connector	IL-2S-S3L-(N)	1	Japan Aviation Electronics
102	Contact	IL-C2-1-10000	2	Japan Aviation Electronics
201	Wire material	AWG#24 Red × 1, Black × 1		

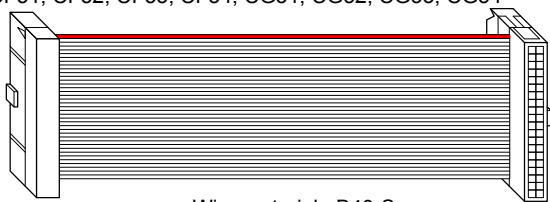
10.14 G280 Cable Manufacturing Drawing

Cable type	G280	Max. wire length	4cm	* The maximum cable length is 4cm.
Application	Extension bus			
<div><p>Connector name: EXT</p></div>				
Part No.	Part name	Type	Qty.	Recommended manufacturer
101	Connector	FCN-217J080-G/0	1	FUJITSU
102	Connector	FCN-217J080-G/0	1	FUJITSU
201	Wire material			

10.15 FCUA-R300 Cable Manufacturing Drawing

Cable type: R300 cable	Application: DI/DO cable Single-side connector not available
<p>Connector name : DI-L/DO-L, DI-R/DO-R CF31, CF32, CF33, CF34, CG31, CG32, CG33, CG34</p> <p>Connector : 7940-6500SC Strain relief : 3448-7940 Recommended manufacturer : 3M</p>  <p>Wire material : B40-S Recommended manufacturer : Oki Electric Cable</p>	

10.16 FCUA-R301 Cable Manufacturing Drawing

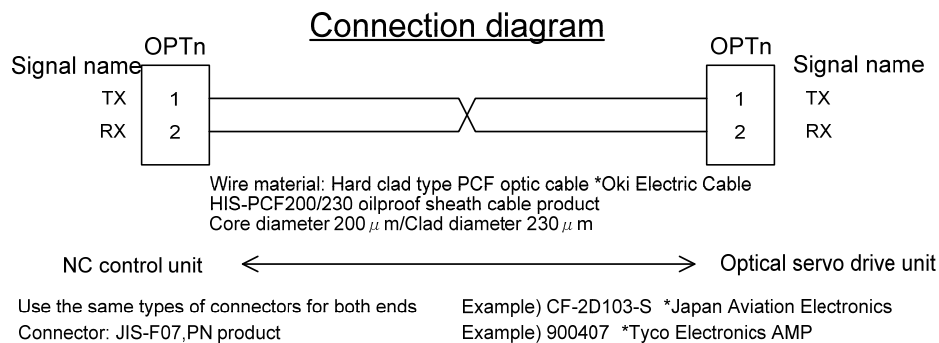
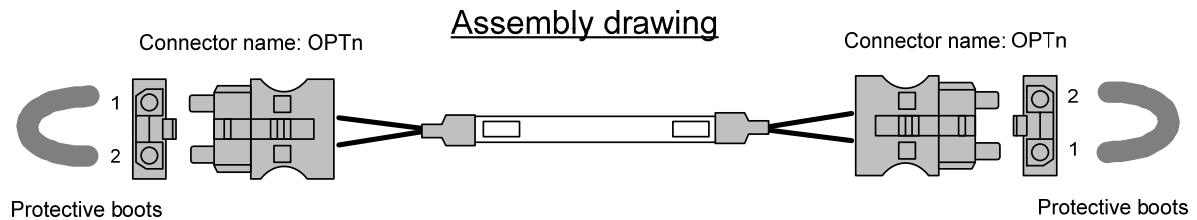
Cable type: R301 cable	Application: DI/DO cable Double-side connector available
<p>Connector name : DI-L/DO-L, DI-R/DO-R CF31, CF32, CF33, CF34, CG31, CG32, CG33, CG34</p> <p>Connector : 7940-6500SC Recommended manufacturer: 3M</p>  <p>Wire material : B40-S Recommended manufacturer : Oki Electric Cable</p> <p>Connector : 7940-6500SC Strain relief : 3448-7940 Recommended manufacturer : 3M</p>	

10. Cable

10.17 G380 Cable (Optical Servo Communication PCF Cable)

10.17 G380 Cable (Optical Servo Communication PCF Cable)

Cable type: G380 cable	Application: Communication between NC control unit and optical servo drive unit (For panel external wiring) Use when the cable length is 10m or more to 20m or less
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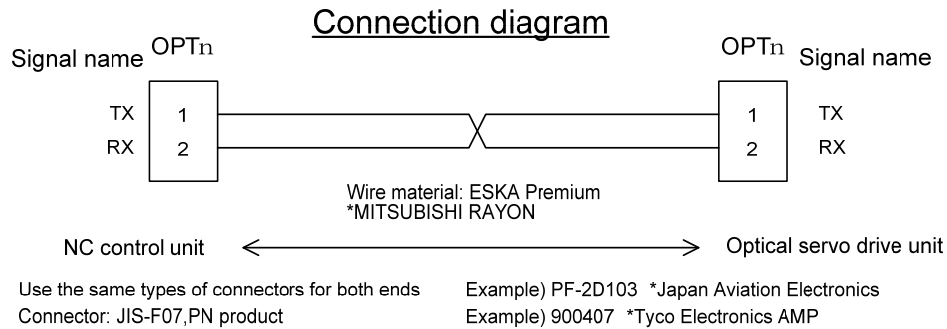
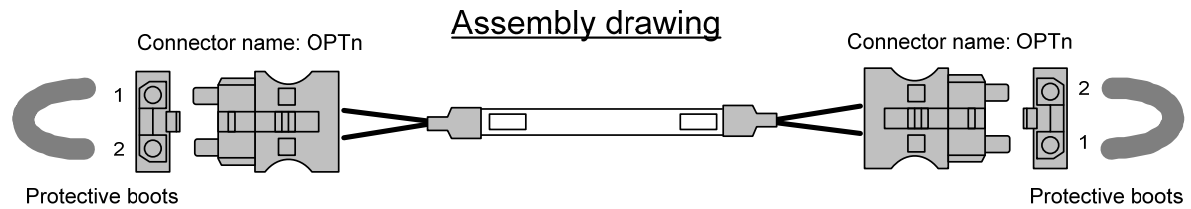
- (Note 1) Protect the cable ends with heat-shrinkable tubing, etc.
- (Note 2) When wiring the cable, protect the optical fiber ends with protective boots.
- (Note 3) Binding the cables too tight with binding bands could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move. Recommended clamp material: CKN-13P KITAGAWA INDUSTRIES
- (Note 4) Never bundle the cables with vinyl tape. The elasticizer in the vinyl tape could cause the PCF cable reinforced sheath to damage.
- (Note 5) Loop the excessive cable with twice or more than the minimum bending radius (R=50mm).

10. Cable

10.18 G395 Cable (Optical Servo Communication POF Cable)

10.18 G395 Cable (Optical Servo Communication POF Cable)

Cable type: G395 cable	Application: Communication between NC control unit and optical servo drive unit (For panel external wiring) Use when wiring in the panel with a cable of 10m or less
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(Note 1) Protect the cable ends with heat-shrinkable tubing, etc.

(Note 2) When wiring the cable, protect the optical fiber ends with protective boots.

(Note 3) Binding the cables too tight with binding bands could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move. Recommended clamp material: CKN-13P KITAGAWA INDUSTRIES

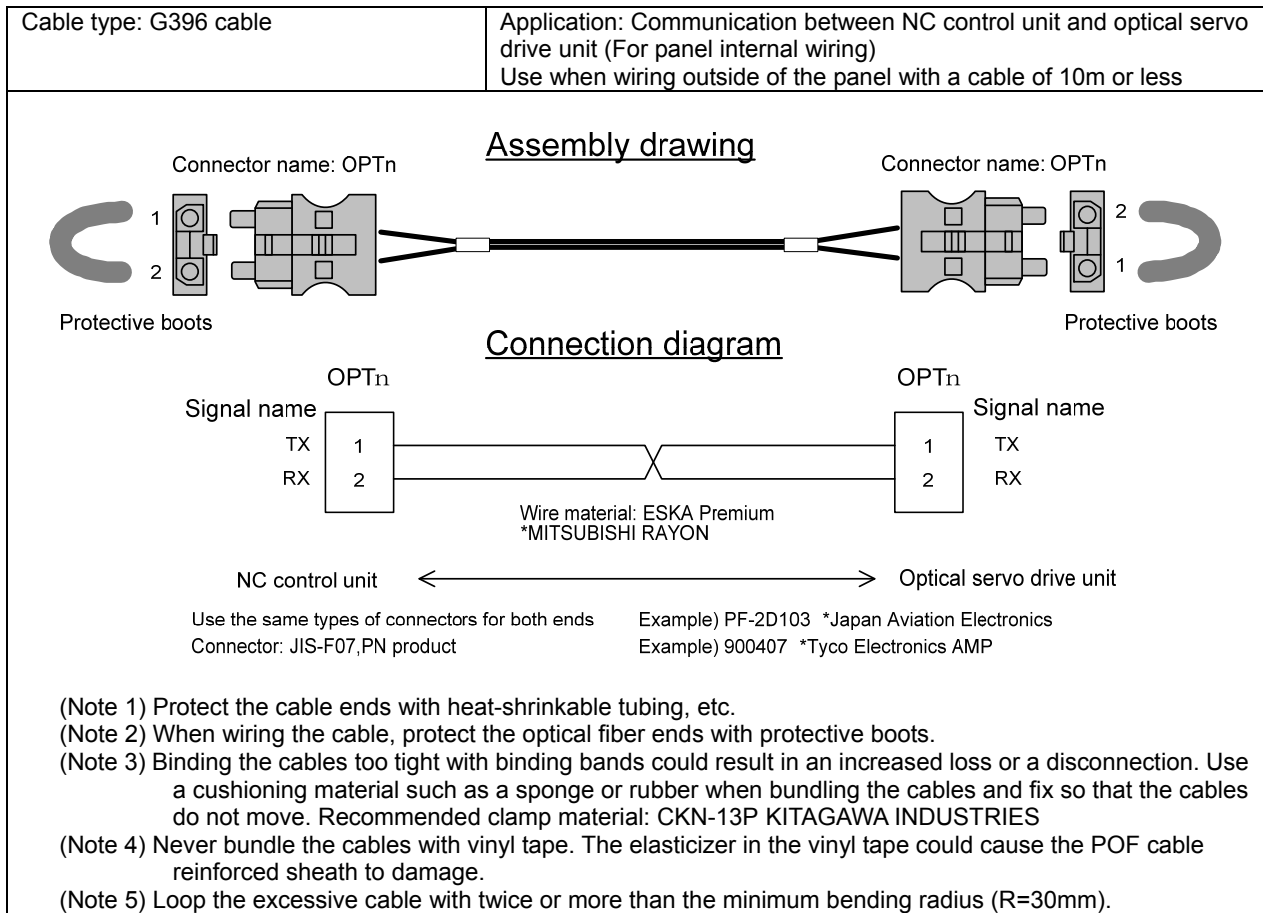
(Note 4) Never bundle the cables with vinyl tape. The elasticizer in the vinyl tape could cause the POF cable reinforced sheath to damage.

(Note 5) Loop the excessive cable with twice or more than the minimum bending radius (R=50mm).

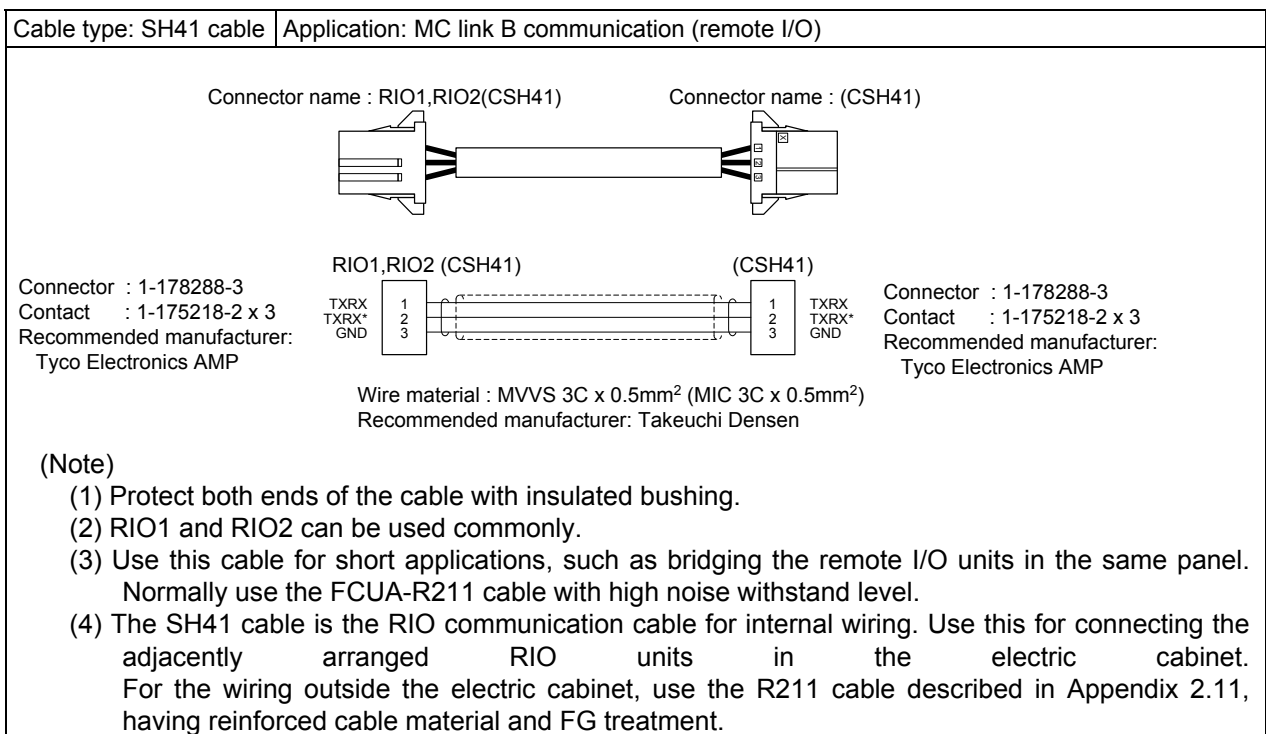
10. Cable

10.19 G396 Cable (Optical Servo Communication POF Cable)

10.19 G396 Cable (Optical Servo Communication POF Cable)



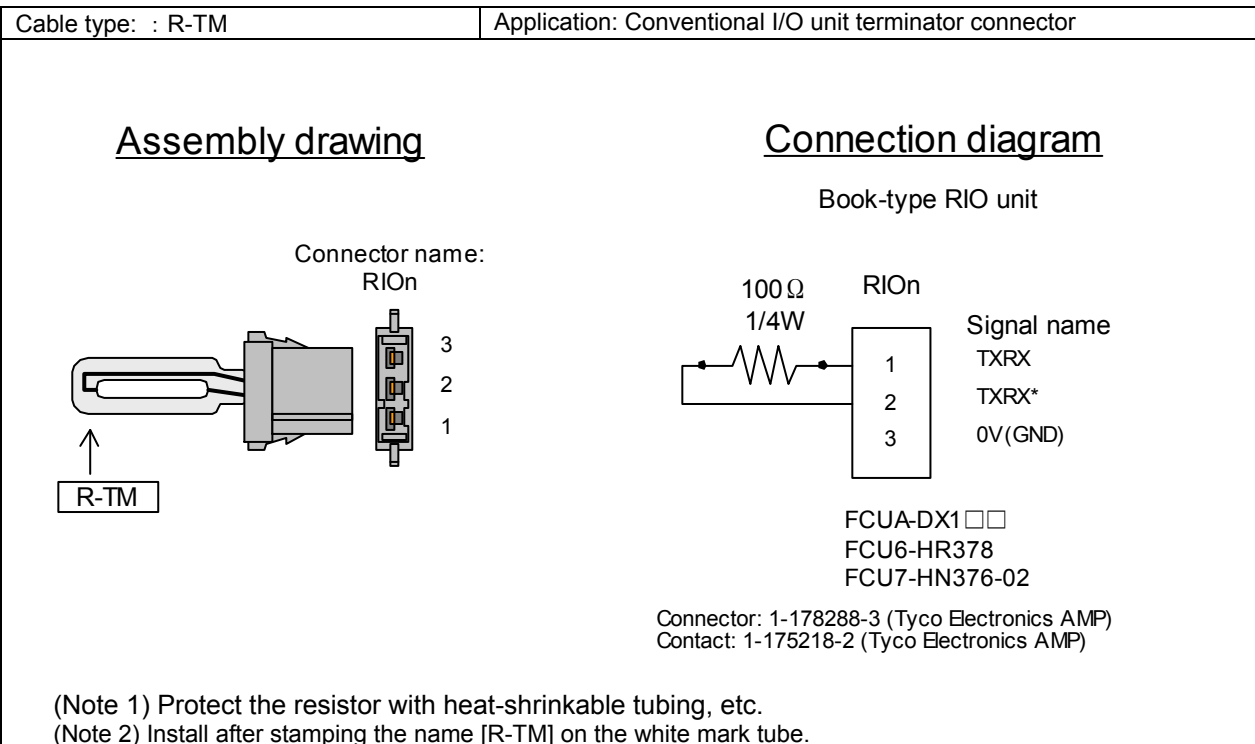
10.20 SH41 Cable Manufacturing Drawing



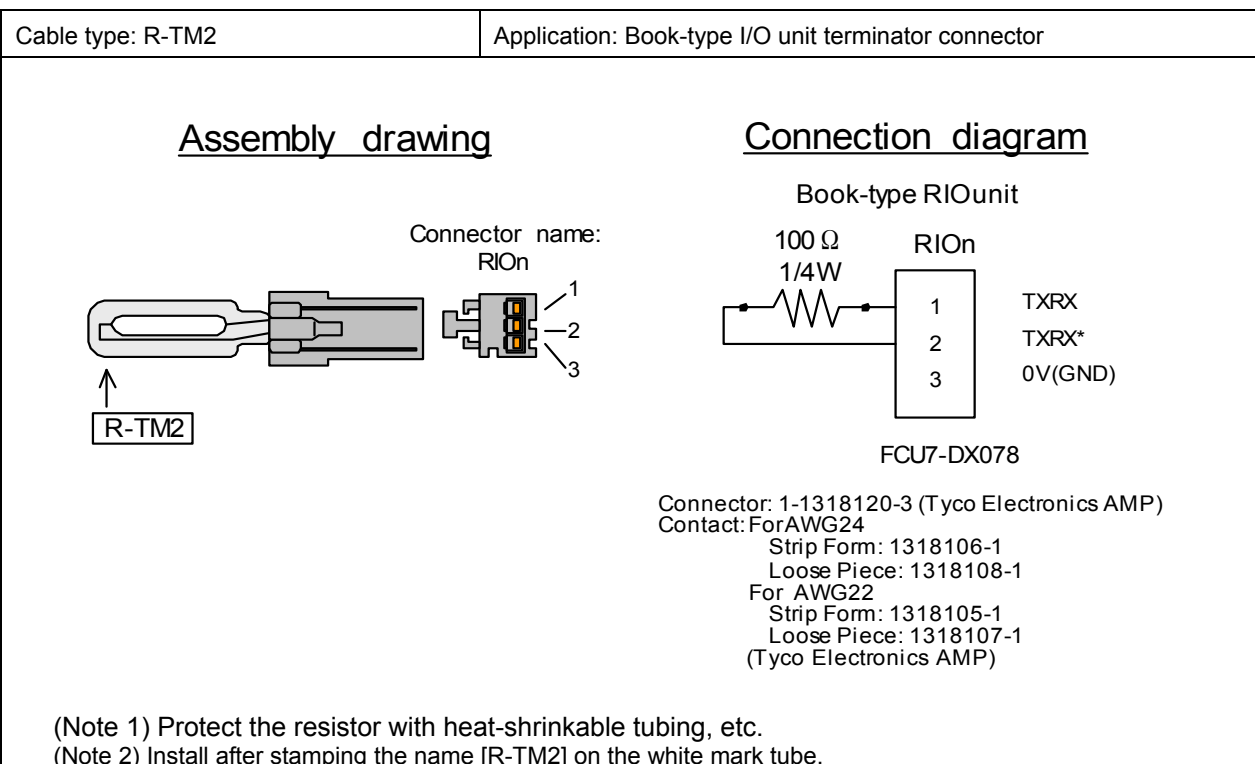
10. Cable

10.21 R-TM (Conventional I/O Unit Terminator Connector)

10.21 R-TM (Conventional I/O Unit Terminator Connector)



10.22 R-TM2 (Book-Type I/O Unit Terminator Connector)



Appendix 1 EMC Installation Guidelines

1.1 Introduction

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

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

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

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

1.2 EMC Directives

The EMC Directives largely regulate the following two items.

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

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

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

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

1.3 EMC Measures

The main items relating to EMC measures include the following.

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

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

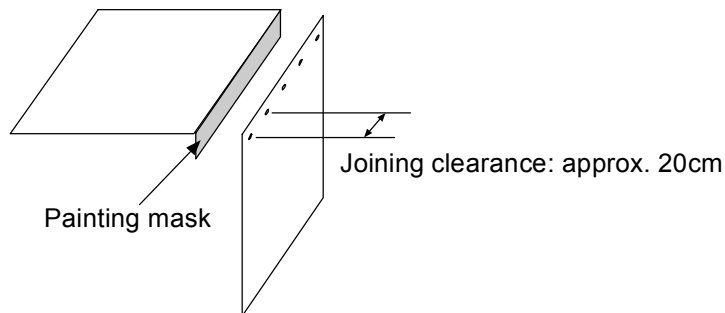
- (1) Accurately ground the devices.
- (2) Use shielded cables.
- (3) Increase the electrical seal of the panel. Reduce the gaps and holes.

1.4 Panel Structure

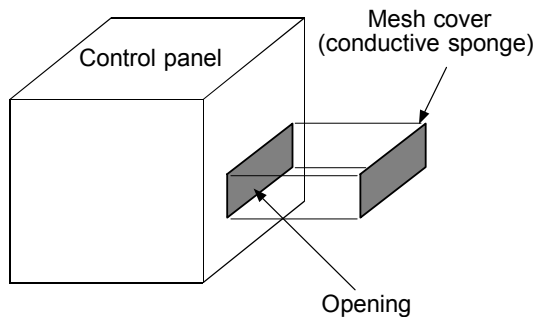
The design of the panel is a very important factor for the EMC measures, so take the following measures into consideration.

1.4.1 Measures for Control Panel Body

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



- (3) Be careful not to warp the plate due to the screw fixing, etc. By creating a clearance, noise could leak from that place.
- (4) Plate (nickel tin) 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.

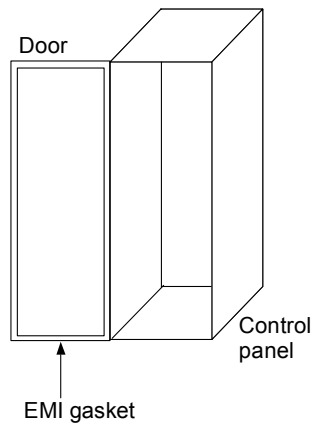


(Note) Using screws to fix the plates that have been painted is the same as an insulated state. Peel the paint and fix the screws.

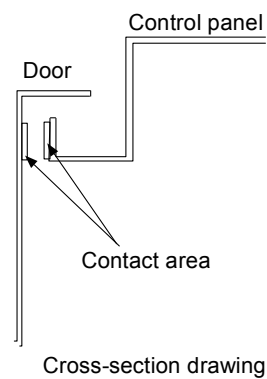
1.4.2 Measures for Door

- (1) Use metal for all materials configuring the panel.
- (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

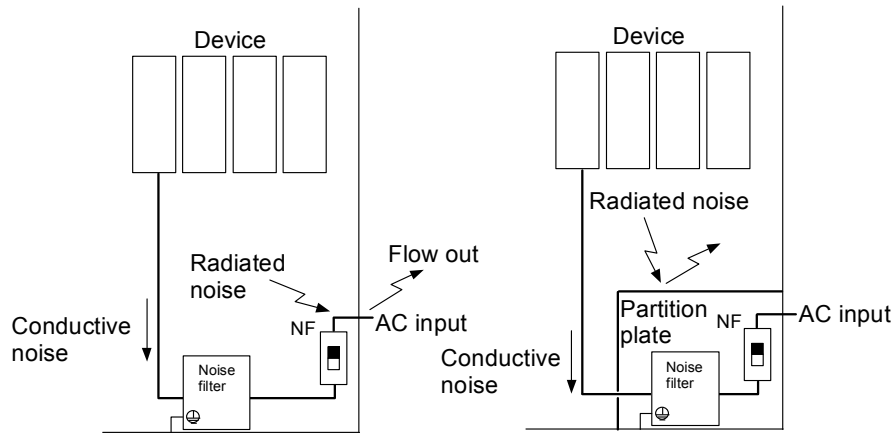


- The EMI gasket or conductive packing must contact the metal surface uniformly and at the correct position.
- When not using a gasket, ground the control panel grounding with a grounding wire to lower the door's impedance.

(Note) 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.

1.4.3 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 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.

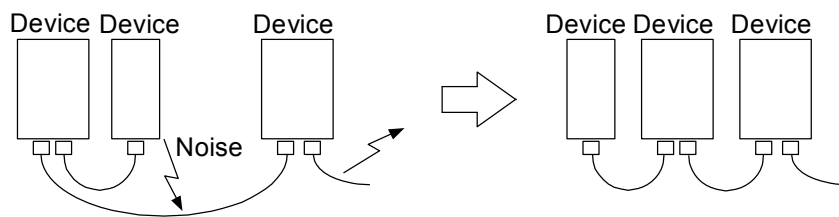
(Note) Selection of the noise filter capacity will differ according to the drive unit and devices being used. Refer to the "EMC Installation Guidelines" NC Servo Drive Unit Section [BNP-B8582-45].

1.5 Measures for Wiring in Panel

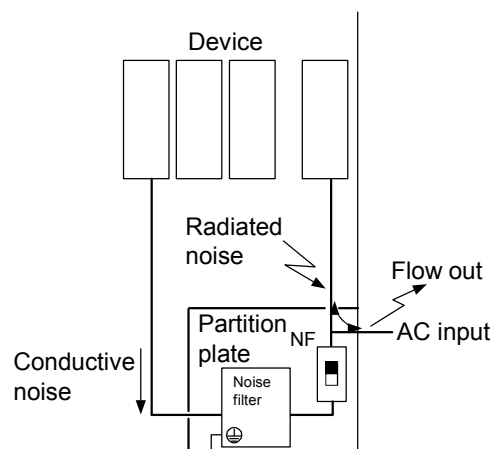
Cables serve as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated. The following measures must be sufficiently considered for the cables (SH21/F010/FCUA-R211) that carry out high-speed communication.

1.5.1 Precautions for Wiring in Panel

- (1) If the cables are led unnecessary in the panel, they will pick up noise. Pay attention to the device layout and wire length so that the wiring length is as short as possible.

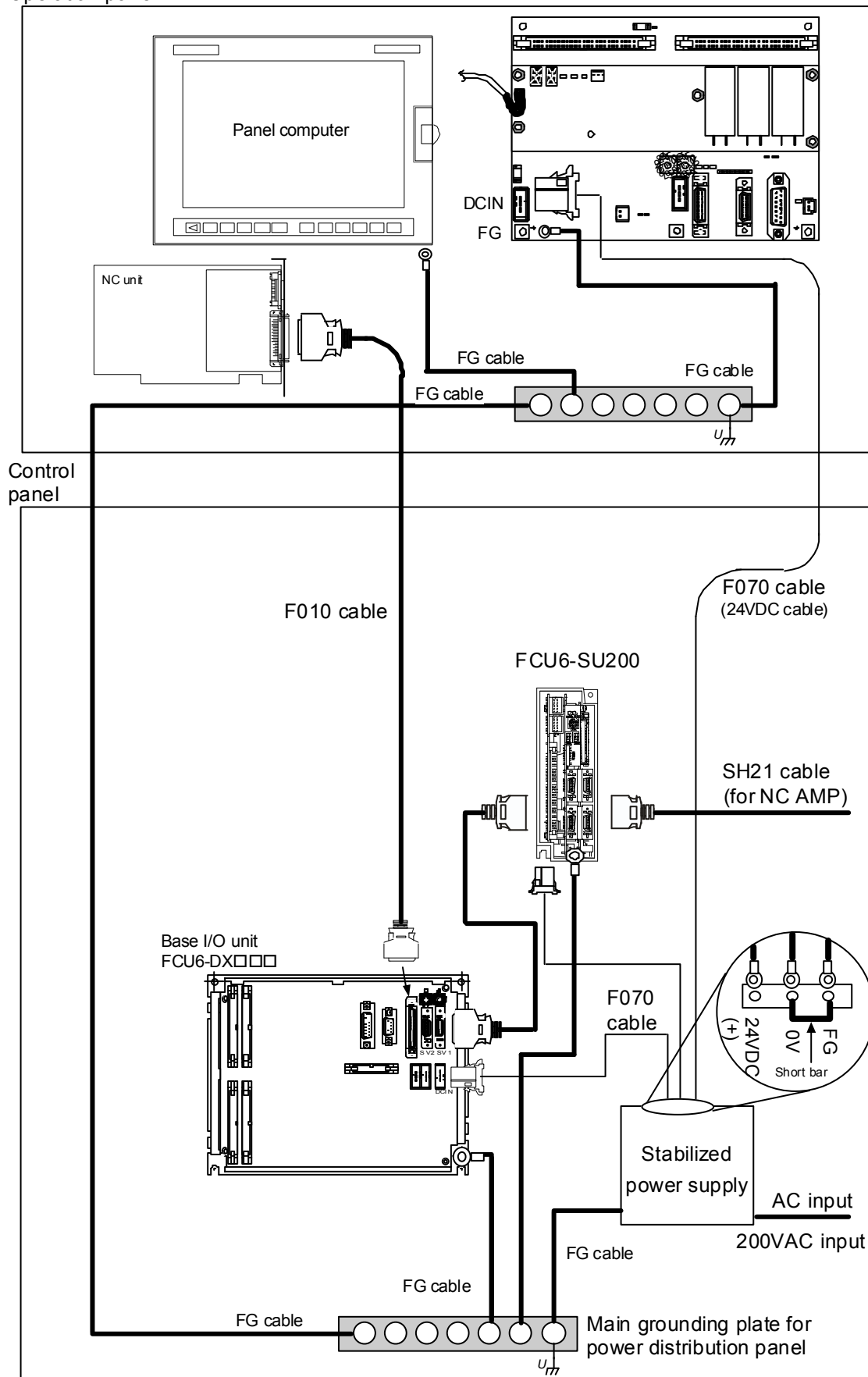


- (2) Always connect the grounding wire to the FG terminal indicated on the device.
- (3) Keep the drive line and detector cable to the drive section motor as far apart from the other wirings as possible when wiring.
- (4) Do not lead the power supply wire around the panel without using a filter.



1.5.2 NC Control Unit Grounding Wire

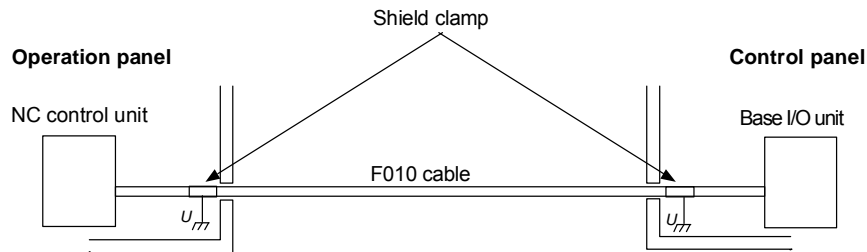
Operation panel



1.5.3 Shield Treatment of Cables

Use shielded cables for the cables wired outside the panel in the MITSUBISHI CNC M720BM.
Use a shield clamp within 10cm from the lead-out port of the panel.

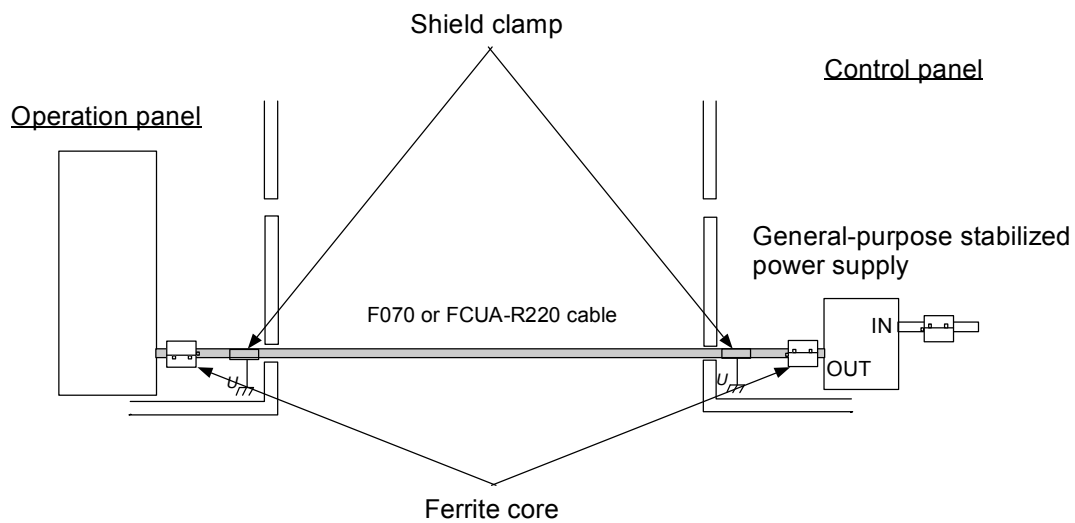
(1) I/O interface cable [F010 cable]



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

(Note) The shield clamp is not required if the control unit and base I/O unit are wired in the same panel.

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

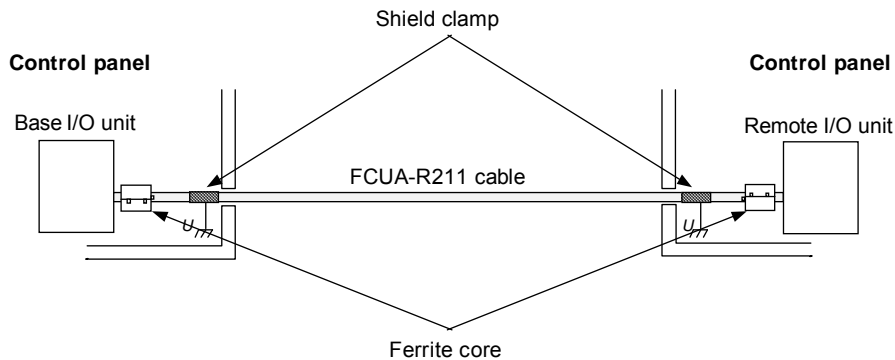


- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.

(Note 1) Always install a ferrite core on the general-purpose stabilized power supply.
(The ferrite core may not be required depending on the selected power supply.)

(Note 2) Install a ferrite core on the input side of the NC power supply.

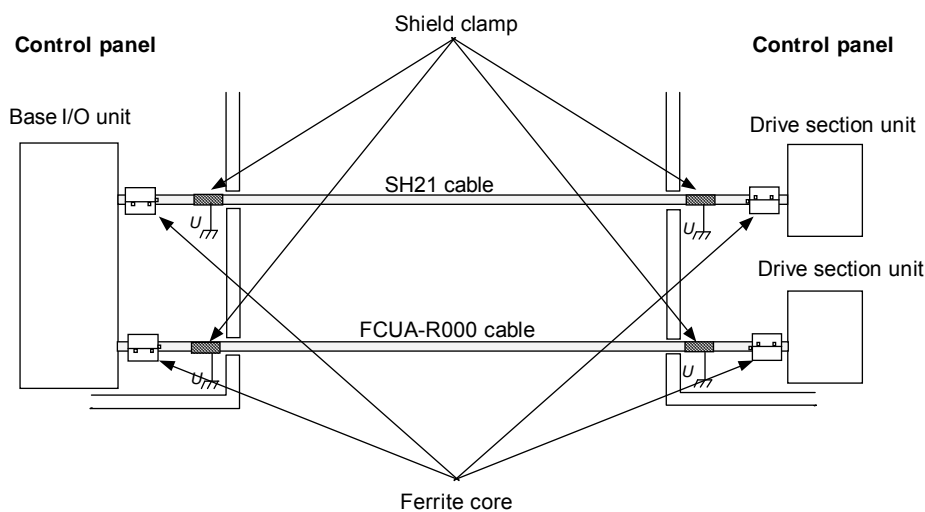
(3) Remote I/O cable [FCUA-R211 cable]



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

(Note) The shield clamp and ferrite core are not required if the control unit and base I/O unit are wired in the same panel.

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



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

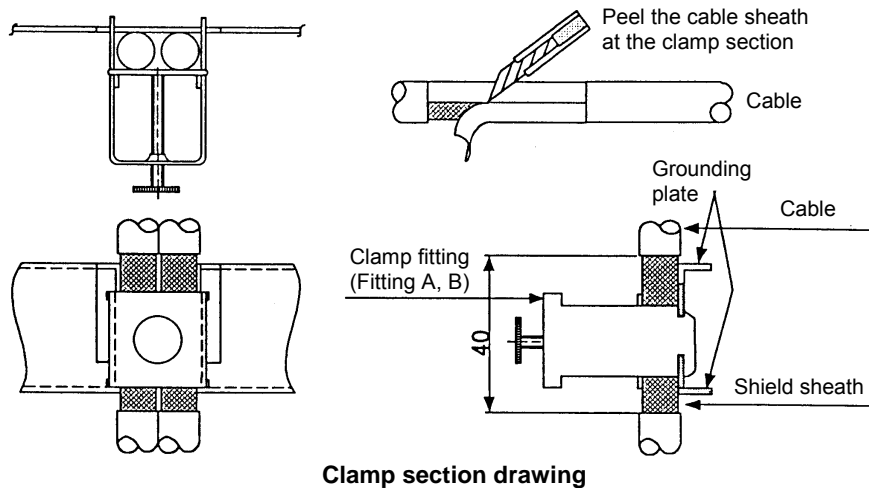
(Note) The shield clamp and ferrite core are not required if the drive section unit and base I/O unit are wired in the same panel.

1.6 Parts for EMC Measures

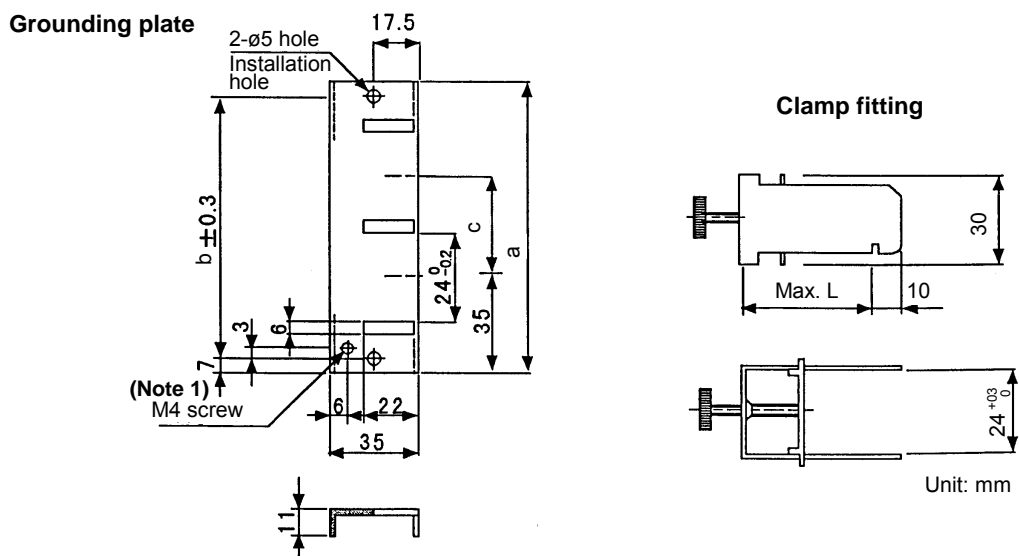
1.6.1 Shield Clamp Fitting

The ground can be directly connected to the grounding plate as shown below to increase the effect. Install the grounding plate near the outlet (within 10cm) of each panel, and press against the grounding plate with the clamp fitting. If the cables are thin, several can be bundled and clamped together. To provide sufficient frame ground, install the grounding plate directly on the cabinet or connect with a grounding wire.

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



• Outline drawing



(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
AERSBAN-DSET	100	86	30	Clamp fitting A × 2
AERSBAN-ESET	70	56	—	Clamp fitting B × 1

	L
Clamp fitting A	70
Clamp fitting B	45

1.6.2 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

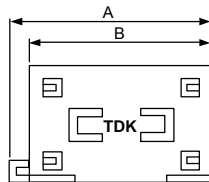


Fig. 1

ZCAT-A type

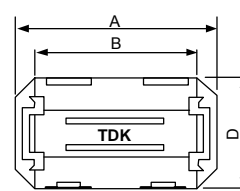


Fig. 2

ZCAT-B type

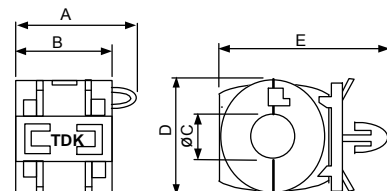


Fig. 3

ZCAT-C type

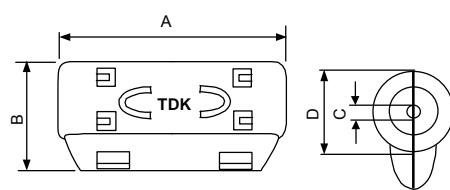


Fig. 4

Recommended ferrite core

Unit: mm

Part Name	Fig.	A	B	øC	D	E	Applicable cable outer diameter	Mass (g)
ZCAT1518-0730-M(-BK) *1	1	22±1	18±1	7±1	15±1	—	7max.	6
ZCAT1518-0730(BK) *2	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) *1	1	36±1	32±1	9±1	19.5±1	—	9max.	22
ZCAT2032-0930(-BK) *2	1	36±1	32±1	9±1	19.5±1	—	9max.	22
ZCAT2132-1130-M (-BK) *1	1	36±1	32±1	11±1	20.5±1	—	11max.	22
ZCAT2132-1130 (-BK) *2	1	36±1	32±1	11±1	20.5±1	—	11max.	22
ZCAT3035-1330-M (-BK) *1	1	39±1	34±1	13±1	30±1	—	13max.	63
ZCAT3035-1330 (-BK) *2	1	39±1	34±1	13±1	30±1	—	13max.	63
ZCAT1325-0530A-M (-BK) *1	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) *1	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
ZCAT2749-0430-M (-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 ø4.8 to 4.9mm, plate thickness 0.5 to 2mm
- ZCAT-C type: Structure that prevents easy opening after case is closed.

1.6.3 Surge Protector

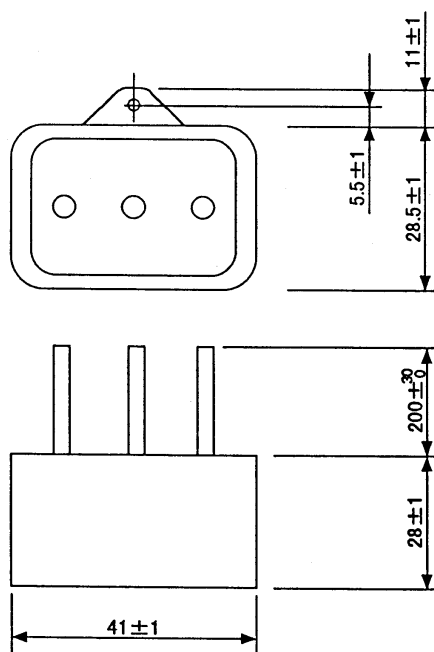
(1) Surge absorber

Make sure that surge does not directly enter the AC line supplying the general-purpose stabilized power supply (prepared by user) to the control unit, base I/O unit, remote I/O unit and communication terminal. The following product or equivalent is recommended for the surge killer.

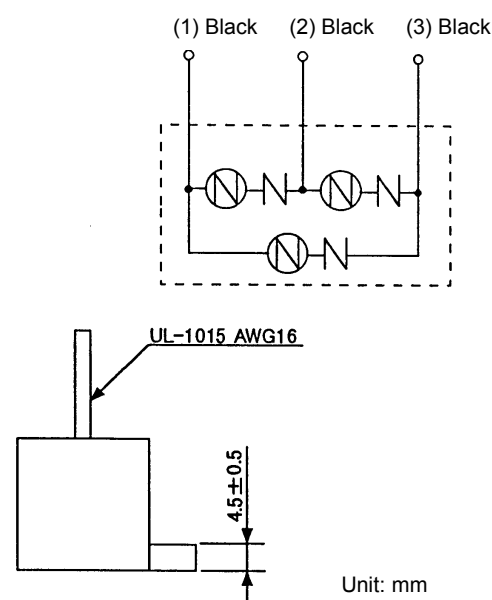
- 1) Part name : RAV-781BYZ-2
Manufacturer : Okaya electric industries

Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage $V \pm 10\%$	Surge resistance level 8/20 μ s	Surge withstand voltage 1.2/50 μ s	Electro- static capacity	Working temperature range
250V 3 ϕ	300V	783V	2500A	20kV	75pF	-20°C to +70°C

Outline drawing



Circuit drawing

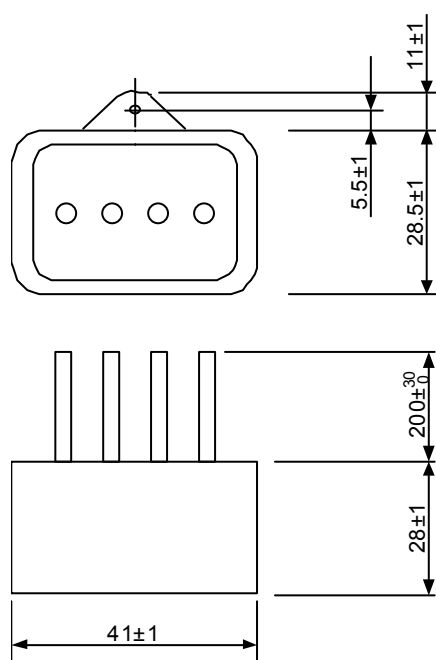


* Refer to the manufacturer's catalog for detailed characteristics, outline and connection methods of the surge absorber.

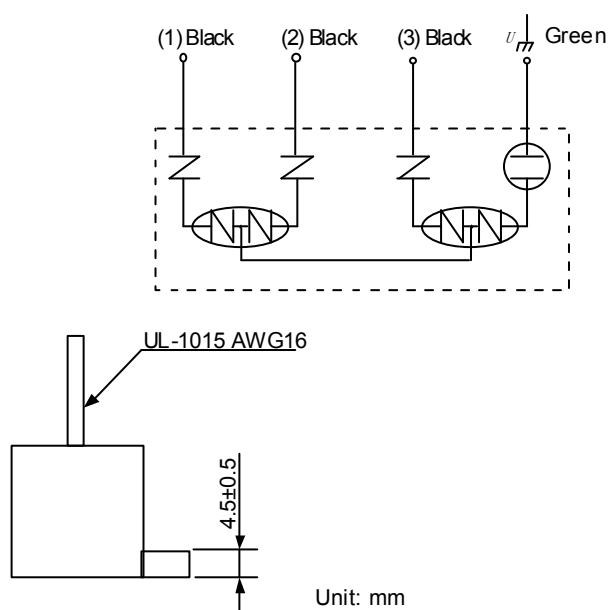
- 2) Part name : RAV-781BXZ-4
 Manufacturer : Okaya electric industries

Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage V \pm 10%	Surge resistance level 8/20 μ s	Surge withstand voltage 1.2/50 μ s	Electro- static capacity	Working temperature range
250V 3 ϕ	300V	700V	2500A	2kV	75pF	-20°C to +70°C

Outline drawing



Circuit drawing

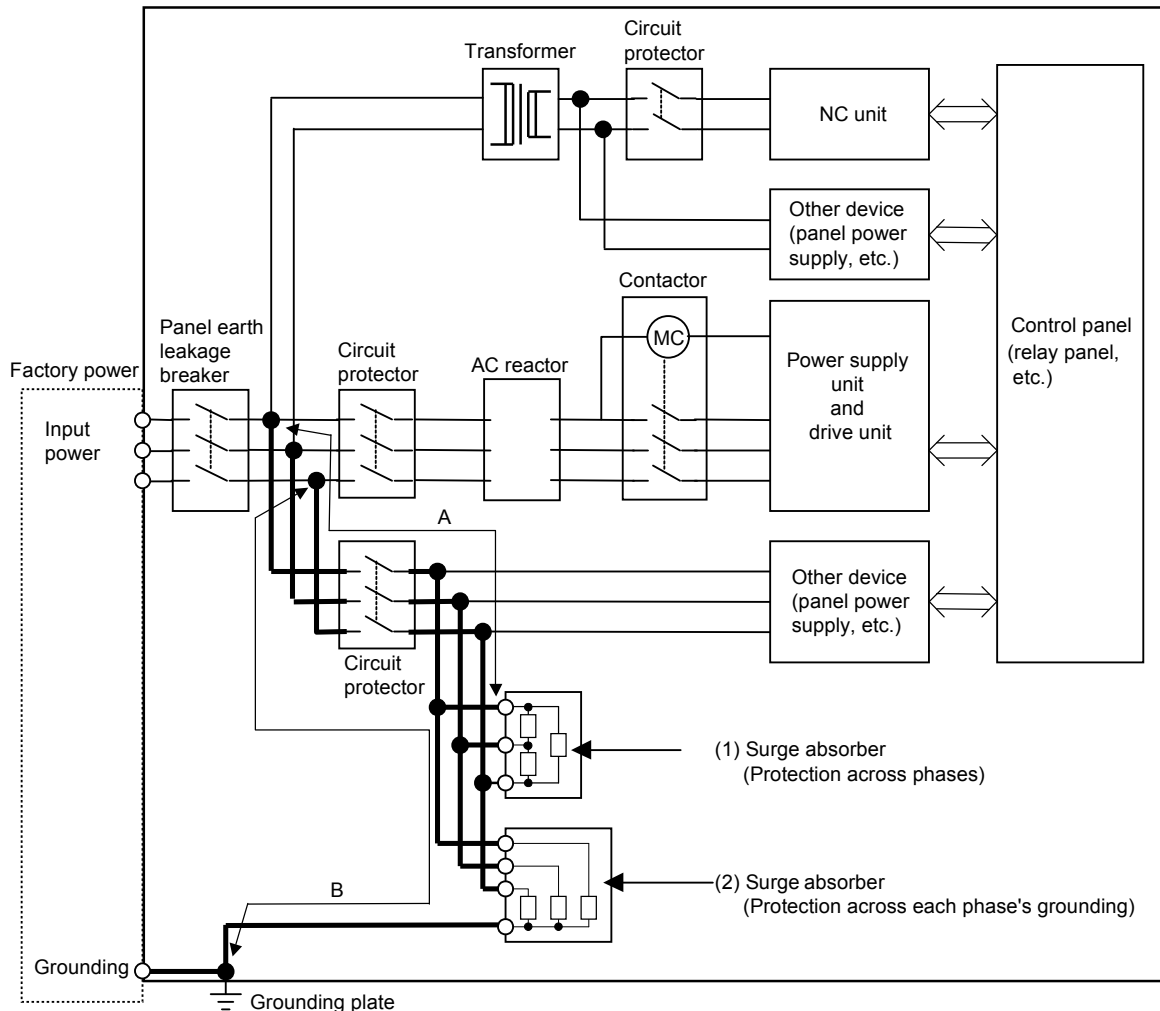


- * Refer to the manufacturer's catalog for detailed characteristics, outline and connection methods of the surge absorber.

(2) Example of surge absorber installation

An example of installing the surge absorber in the machine control panel is shown below.

A short-circuit fault will occur in the surge absorber if a surge exceeding the tolerance is applied. Thus, install a circuit protection breaker in the stage before the surge absorber. Note that almost no current flows to the surge absorber during normal use, so a breaker installed as the circuit protection for another device can be used for the surge absorber.



Surge absorber installation

⚠ CAUTION

1. The wires from the surge absorber should be connected without extensions.
2. If the surge absorber cannot be installed just with the enclosed wires, keep the wiring length of A and B to 2m or less. If the wires are long, the surge absorber's performance may drop and inhibit protection of the devices in the panel.
3. Surge absorber to be selected varies depending on input power voltage.

1.6.4 Selection of Stabilized Power Supply

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

Stabilized power supply selection items

Item		Unit	Conditions
Output	Voltage fluctuation	±5%	±5% or less of 24VDC output
	Ripple noise	max.120 mV	±5% or less of 24VDC output
	Spike noise	max.500 mV	
Output current		—	Refer to the corresponding Connection Manual and calculate this.
Output holding time		min.20 ms	Instantaneous OFF time

Standards

Safety Standards : UL1950, CSA C22.2 No. 234 approved, IEC950 compliant
 Noise Terminal Voltage : FCC Class A, VCCI-Class A
 Higher Harmonics Current Restrictions : IEC61000-3-2

Appendix 2 Transportation Restrictions for Lithium Batteries

2.1 Restriction for Packing

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

To ensure safety during transportation, lithium batteries (battery unit) directly exported from Mitsubishi are packaged in a dedicated container (UN package) for which safety has been confirmed. When the customer is transporting these products with means subject to the UN Regulations, such as air transport, the shipper must follow the details explained in the section "2.1.2 Handling by User".

Appendix 2 Transportation Restrictions for Lithium Batteries

2.1 Restriction for Packing

2.1.1 Target Products

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

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

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

Mitsubishi type	Battery type	Lithium metal content	Battery class
MDS-A-BT-4	ER6-B4-11	2.6g	Battery
MDS-A-BT-6	ER6-B6-11	3.9g	
MDS-A-BT-8	ER6-B8-11	5.2g	
FCU6-BT4-D1	Combination of ER6-B4D-11 and ER6	2.6g+0.65g	Battery cell
(built-in battery)	CR23500SE-CJ5	1.52g	

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

Mitsubishi type	Battery type	Lithium metal content	Battery class
MDS-A-BT-2	ER6-B2-12	1.3g	Battery
FCU6-BTBOX	2CR5	1.96g	
FCU6-BTBOX-36	2CR5	1.96g	
(built-in battery)	CR2032	0.067g	Battery cell
(built-in battery)	CR2450	0.173g	
(built-in battery)	ER6, ER6V	0.7g	
MR-BAT	MR-BAT	0.48g	
Q6BAT	Q6BAT	0.49g	

(Note 1) Dedicated packaging is required if the shipment exceeds 12 batteries/24 battery cells. Package the batteries so that this limit is not exceeded.

(Note 2) The battery units labeled as "FCUA-" instead of "MDS-A-" also use the same battery.

(Note 3) Always use the cell battery (MR-BAT) in combination with the dedicated case (MDS-BTCASE). Maximum 8 (either 2, 4, 6 or 8) cell batteries can be installed to the dedicated case (MDS-BTCASE).

(Example) Rating nameplate for battery units

MITSUBISHI BATTERY UNIT TYPE MDS-A-BT-6 OUTPUT DC 3.6 V LITHIUM BATTERIES: ER6 x6 Class 9 (Battery Type: ER6-B6-11) Mercury Content: Less than 1 ppm Lithium Metal Content: 3.9 g MITSUBISHI ELECTRIC CORPORATION JAPAN		
	←	Mitsubishi type
	←	Safety class
	←	Battery manufacturer type
	←	Lithium metal content

2.1.2 Handling by User

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

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

When shipping isolated lithium battery products (Packing Instruction 903)

(1) Reshipping in Mitsubishi UN packaging

The isolated battery's safety test and packaging specifications comply with the UN Regulations (Packing Instruction 903). Thus, the user only needs to add the following details before shipping. (Consult with the shipping company for details.)

- (a) Indication of container usage mark on exterior box (Label with following details recorded.)
- Proper shipping name (Lithium batteries)
 - UN NO. (UN3090 for isolated battery, UN3091 for battery incorporated in a device or included)
 - Shipper and consignee's address and name

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

- (b) Preparation of shipping documents (Declaration of dangerous goods)
 (Refer to the section "2.3 Example of Hazardous Goods Declaration List")

(2) When packaged by user

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

(a) Packing a lithium battery falling under Class 9

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

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

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

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

When shipping lithium batteries upon incorporating in a machinery/device (Packing Instruction 900)

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

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

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

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

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

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

The outline of the Packing Instruction 912 is as follows:

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

2.1.3 Reference

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

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

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

Federal Aviation Administration (FAA) and Research and Special Programs Administration (RSPA) announced an additional regulation (interim final rule) for the primary lithium batteries transportation restrictions item in "Federal Register" on Dec.15, 2004. This regulation became effective from Dec.29, 2004. This law is a domestic law of the United States, however it also applies to the domestic flight and international flight departing from or arriving in the United States. Therefore, when transporting lithium batteries to the United State, or within the United State, the shipper must take measures required to transport the lithium battery. Refer to the Federal Register and the Code of Federal Regulation ("2.2.4 Reference") for details.

2.2.1 Outline of Regulation

- (1) Transporting primary lithium battery by passenger aircraft is forbidden.
 - Excluding primary lithium battery for personal use in a carry-on or checked luggage
(Lithium metal content should be not more than 5g for cell and 25g for battery. For details on the lithium metal content, refer to the table in the section "2.1.1 Target Products".)
- (2) When transporting primary lithium battery by cargo aircraft, indicate that transportation by passenger aircraft is forbidden on the exterior box.

2.2.2 Target Products

All NC products for which the lithium batteries are used are subject to the regulation.
(Refer to the table in the section "2.1.1 Target Products".)

2.2.3 Handling by User

What is described in the section "2.2.1 Outline of Regulation" is solely Mitsubishi's opinion. The shipper must confirm orders indicated in the section "2.2.4 Reference" for transportation method corresponding the regulation. Actually, these should be checked by the company commissioned for the actual lithium battery transportation.

(1) Indication of exterior box

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

Display example

<p style="text-align: center;">PRIMARY LITHIUM BATTERIES</p> <p style="text-align: center;">FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT.</p>

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

2.2.4 Reference

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

Appendix 2 Transportation Restrictions for Lithium Batteries

2.3 Example of Hazardous Goods Declaration List

2.3 Example of Hazardous Goods Declaration List

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

This will be applied only to the batteries described in the section “2.1 Restriction for Packing”.

(1) Outline of hazard

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

(2) First-aid measure

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

(3) Fire-fighting measure

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

(4) Measure for leakage

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

Appendix 2 Transportation Restrictions for Lithium Batteries

2.3 Example of Hazardous Goods Declaration List

(5) Handling and storage

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

(6) Physical/chemical properties

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

(7) Stability and reactivity

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

(8) Toxicological information

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

(Lithium metal)

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

(9) Ecological information

Mobility, Persistence/Decomposability, Bio-accumulation potential, Ecological toxicity	Not found.
-----------------------------------------------------------------------------------------------	------------

(10) Ecological information

Dispose of the battery following local laws or regulations.

Pack the battery properly to prevent a short-circuit and avoid contact with water.

Appendix 3 Precautions for Compliance to UL/c-UL Standards

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

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

- (1) Selection of external 24VDC power supply unit (The unit shall be prepared by the machine tool builder.)
MITSUBISHI CNC M700 Series numerical control unit complies with the UL Standards on the condition that the stabilized power supply unit supplying 24VDC to each unit is a UL-approved part.
Use a UL-approved part for the stabilized power supply unit supplying 24VDC to each unit.
- (2) Unit ambient temperature
MITSUBISHI CNC M700 Series numerical control unit complies with the UL Standards on the condition that the unit is used at a temperature less than the maximum ambient temperature determined by specifications.
Make sure that the maximum ambient temperature of each unit does not exceed the temperature determined by specifications.
- (3) Book-type I/O unit
A UL certification of the book type I/O unit applies with the UL Standards on the condition that the stabilized power supply unit supplying 24VDC to each unit is a UL Class2-approved part.

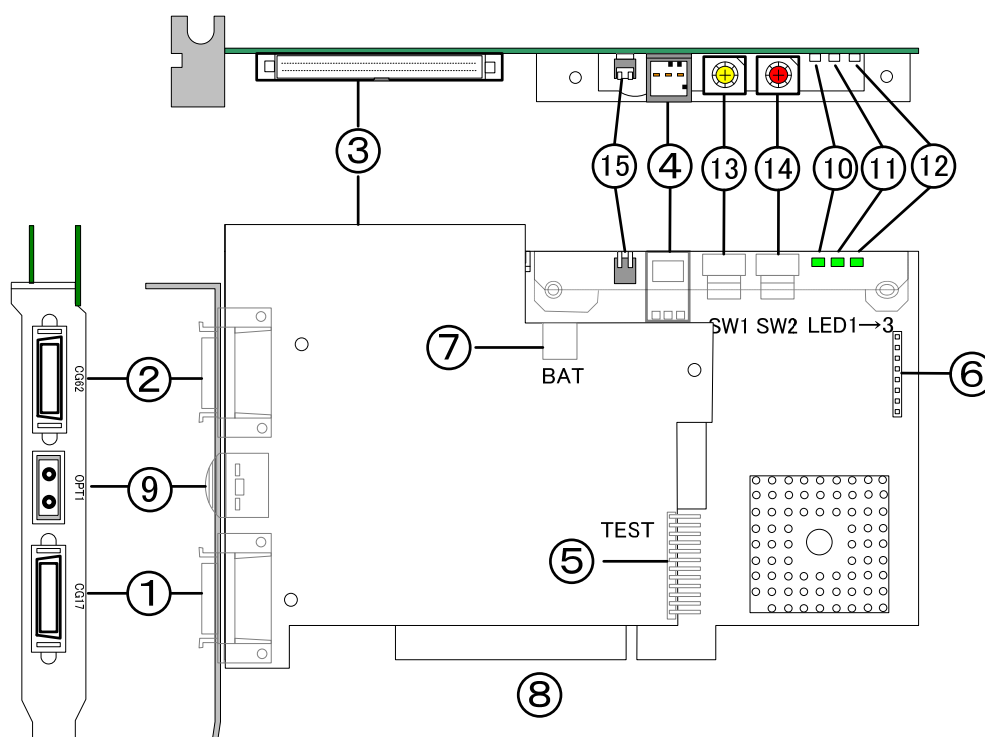
II. MAINTENANCE MANUAL

1. Explanation of Module Functions

1.1 NC Contril Unit (FCU7-HN633-04/FCU7-HN653-05)

1. Explanation of Module Functions

1.1 NC Control Unit (FCU7-HN633-04/FCU7-HN653-05)



Layout of NC control unit's sections

No.	Connector Name	Explanation of function
1	CG17	Use to connect with the book-type I/O unit.
2	CG62	Use to connect with the operation panel I/O card.
3	EXT	Use to connect with the extension unit.
4	AVR	Use to supply power from the operation panel I/O unit.
5	TEST	Not used.
6	ISP	Not used.
7	MNTBATIN	Use for maintenance
8	PCI	Connected to the panel computer's PCI-BUS slot.
9	OPT1	Use for communication with the optical servo drive unit in the first part system.

No.	Name	Explanation of function
13	SW1	Use for maintenance (yellow).
14	SW2	Use for maintenance (red).
15	SW3	Use for maintenance. Set the both bits to OFF (to the uninclined side).





Switch's side view

1. Explanation of Module Functions

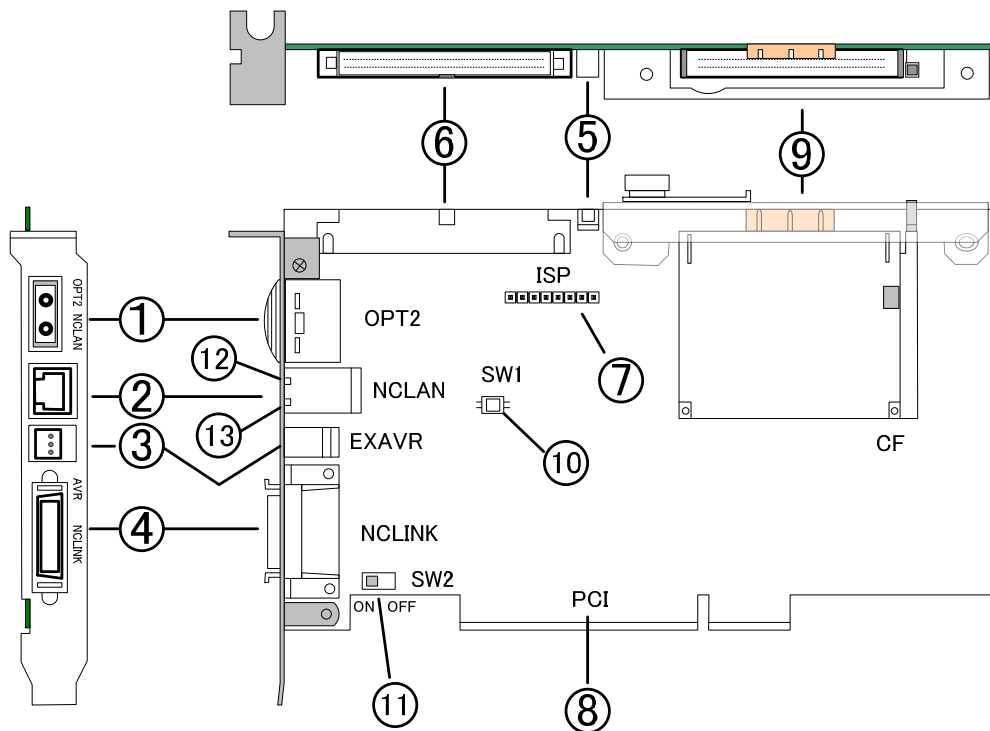
1.1 NC Contril Unit (FCU7-HN633-04/FCU7-HN653-05)

No.	LED Name	Function	Color	Status		Supplement
				Normal	Error	
10	12VIN	LED for confirming that 12V power is supplied through the G180 cable.	Green	ON	OFF	If this LED is OFF, check if the NC control unit is connected to the operation panel I/O unit via the G180 cable.
11	PWGD	LED for confirming the internal power status.	Green	ON	OFF	If 12VIN is ON and PWGD is OFF, there may be an internal circuit fault. In this case, the unit replacement is needed.
12	PRGOK	LED for confirming the initial setting of the internal circuit.	Green	ON	OFF	If this LED is OFF, there may be an internal circuit fault. In this case, the unit replacement is needed.

CAUTION

-  Do not apply a voltage on the connectors other than that indicated in this manual. Failure to observe this could lead to rupture or damage, etc.
-  An incorrect connection could damage the devices. Connect the cable to the specified connector.
-  Do not connect or disconnect the cables connected between each unit while the power is ON.
-  Do not mount or remove each PCB while the power is ON.

1.2 Extension Unit (FCU7-HN693)






Layout of extension unit's sections

No.	Connector name	Explanation of function
1	OPT2	Use for communication of optical servo drive unit in the 2nd part system.
2	NCLAN	Use for Ethernet communication.
3	EXAVR	Use to supply 12V power from operation panel I/O unit.
4	NCLINK	Use for communication between NC control units.
5	BAT	Use for maintenance.
6	EXT	Use for connection with the NC Control unit.
7	ISP	Not used.
8	PCI	Connected to the panel computer's PCI-BUS slot.
9	CF	Use to connect to CF when CF operation option is enabled.

No.	Switch name	Explanation of function
10	SW1	Switch for maintenance (Not mounted)
11	SW2	Use to switch the ON/OFF of the terminating resistor for communication between NC control units. Either setting ON or OFF won't affect the ordinary performance.

No.	Name	Function	Color	State		Supplement
				Normal	Error	
12	LED1	LED for indicating the Ethernet communication status.	Green	Blink	OFF	When this LED doesn't blink, check if the cable is disconnected or broken. If the cable has no problem, the unit replacement is needed.
13	LED2	LED for indicating the Ethernet communication reception status.	Green	ON / OFF	-	ON: Communicating at 100Mbps OFF: Communicating at 10Mbps Check this LED together with LED1.

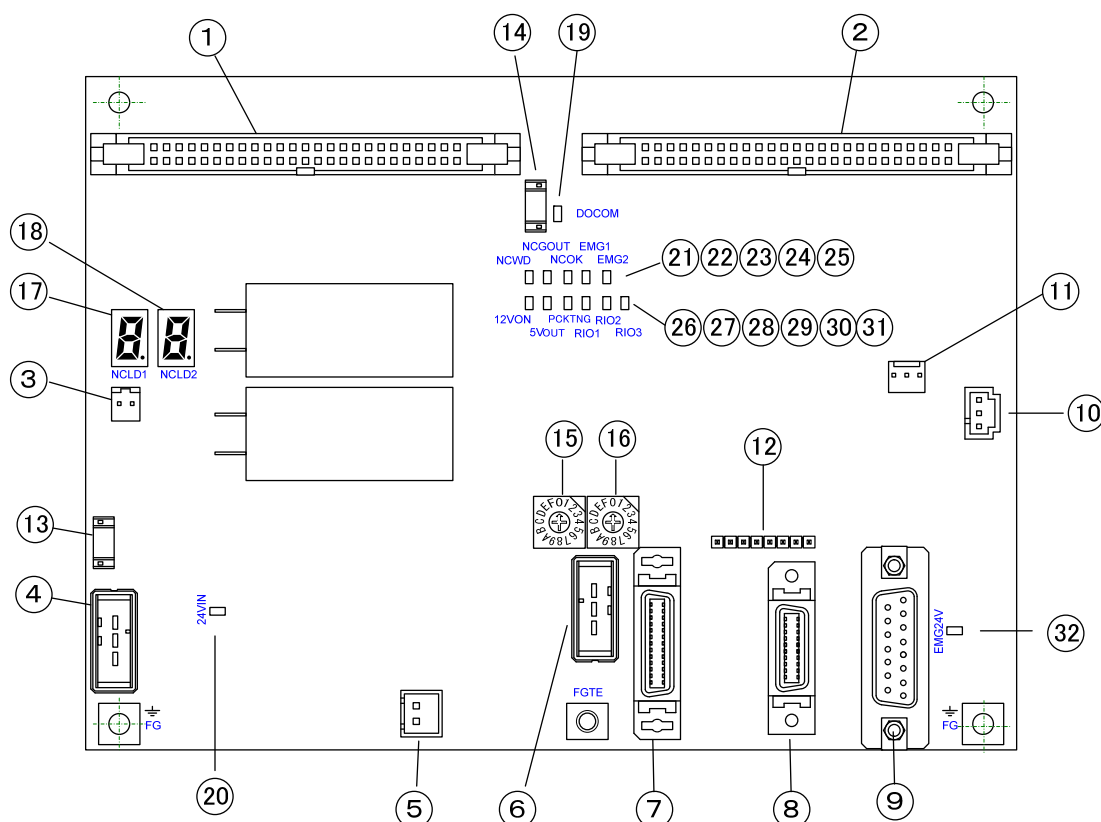
**CAUTION**

-  Do not apply a voltage on the connectors other than that indicated in this manual. Failure to observe this could lead to rupture or damage, etc.
-  An incorrect connection could damage the devices. Connect the cable to the specified connector.
-  Do not connect or disconnect the cables connected between each unit while the power is ON.
-  Do not mount or remove each PCB while the power is ON.
-  Never look into the optical communication connector. Strong light of short wavelength is coming out from the connector while the power is ON. Failure to observe this could injure your eyes.

1. Explanation of Module Functions

1.3 Names of Operation Panel I/O Unit (FCU7-HN376-02) Sections

1.3 Names of Operation Panel I/O Unit (FCU7-HN376-02) Sections



Layout of operation panel I/O unit's sections

No.	Connector name	Explanation of function
1	CE56	Use to connect the machine input/output.
2	CE57	Use to connect the machine input/output.
3	BAT1	Used to connect the battery unit BTBOX (BTBOX-36). BTBOX-36 can be used with M730BM/M750BM only: when used with M720BM, an alarm for low battery voltage will occur.
4	DCIN	Use to supply the 24VDC power.
5	AVR	Use to supply power to the extension unit or NC control unit.
6	RIO	Use to connect with the remote I/O unit.
7	CG62	Use to connect with the NC Control unit.
8	SIO	Use to connect with the RS-232C device.
9	MPG	Use to connect the manual pulse generator.
10	EMGIN	Use to connect the emergency stop signal.
11	TEST	Not used.
12	ISP	Not available: Used by Mitsubishi for shipping test.

No.	Switch name	Explanation of function
13	F1	Protects the control circuit from overcurrent. (Fuse type: LM40, rating: 4A, manufacturer: Daito Communication)
14	F2	Protects the machine output circuit from overcurrent. The current passes in a batch through the CE56 and 57 Docom pins. (Fuse type: LM40, rating: 4A, manufacturer: Daito Communication)






1. Explanation of Module Functions

1.3 Names of Operation Panel I/O Unit (FCU7-HN376-02) Sections

No.	Switch name	Explanation of function
15	CS1	Use to set the machine input/output station numbers. Set the station numbers with the 32 points DI: X0 -X1F and DO: Y0-Y1F. Normally "0" is set when using as the operation board I/O. Set an even number (0, 2, 4, 6). If an odd number is set, the previous even station number will be set. The station number with the 16 points DI: X20-X2F and one manual pulse generator is automatically assigned as the station number (odd station number) after the station number set with CS1.
16	CS3	Use to set the manual pulse generator station number. Set the station number of the manual pulse generator (2nd, 3rd) I/F circuit. When more than 8 is set, the remote I/O station for the manual pulse generator (2nd, 3rd) will be invalidated.

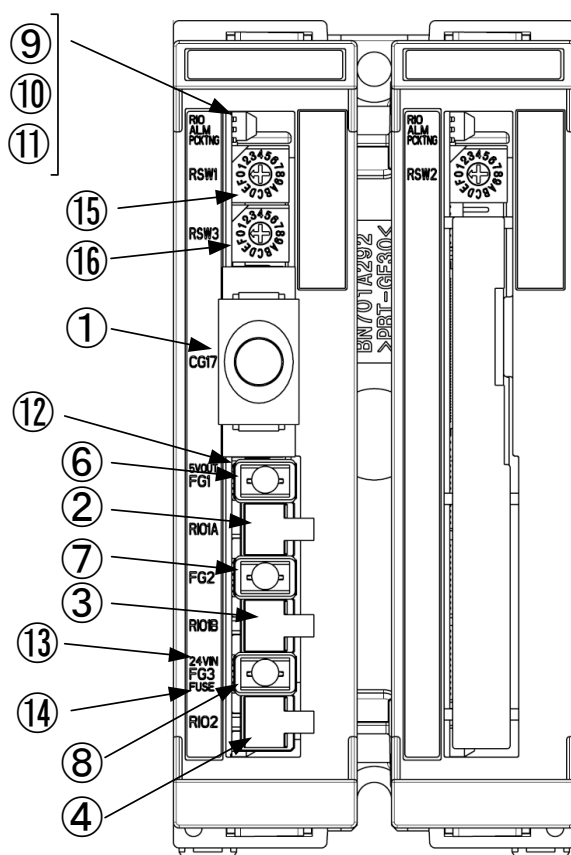
No.	LED name	Explanation of function
17	NCLD1	7-segment LED for confirming the system operation status.
18	NCLD2	
19	DOCOM	LED for confirming state of communication to machine output common pin.
20	24VIN	LED to confirming 24VDC continuity status.
21	NCWD	LED for confirming NC Control unit's watch dog error status.
22	NCGOUT	LED for maintenance.
23	NCOK	LED for confirming NC Control unit operation status.
24	EMG1	LED for confirming emergency stop button status.
25	EMG2	LED for confirming emergency stop status.
26	12VON	LED for confirming 12V continuity status.
27	5VON	LED for confirming 5V continuity status.
28	PCKTNG	LED for confirming remote I/O communication status.
29	RIO1	LED for confirming communication status of remote I/O unit (system 1).
30	RIO2	LED for confirming communication status of remote I/O unit (system 2).
31	RIO3	LED for confirming communication status of remote I/O unit (system 3).
32	EMG24V	LED for confirming EMG output circuit continuity status.

CAUTION

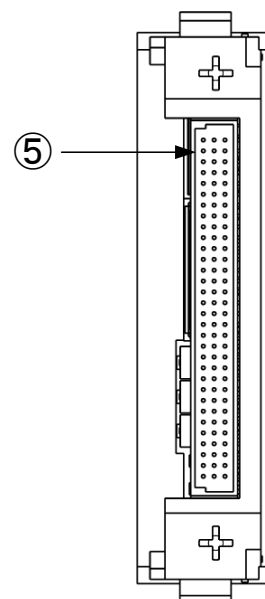
-  **NCGOUT, LED1, LED2, LED3 and EMG2 are used for maintenance by the machine tool builder. Neither the ON nor OFF state is a fault.**
-  **Do not apply a voltage on the connectors other than that indicated in this manual. Failure to observe this could lead to rupture or damage, etc.**
-  **An incorrect connection could damage the devices. Connect the cable to the specified connector.**
-  **Do not connect or disconnect the cables connected between each unit while the power is ON.**
-  **Do not mount or remove each PCB while the power is ON.**

1.4 Book-type I/O Unit

1.4.1 Names of FCU7-DX078 (base unit) section



Name of each section (Front view)



Name of each section (Rear view)

No.	Connector name	Explanation of function
1	CG17	Use to connect with the control unit.
2	RIO1A	Use to connect with the 1st part system of remote I/O communication.
3	RIO1B	Use to connect with the 1st part system of remote I/O communication.
4	RIO2	Use to relay to the 2nd part system of remote I/O communication.
5	CG30	Use to connect to the signal splitter.
6	FG1	FG terminal
7	FG2	FG terminal
8	FG3	FG terminal

No.	Name	Function	Color	Status		Supplement
				Normal	Error	
9	RIO	LED for indicating that remote I/O communication is in progress.	Green	ON	OFF	ON when data is being transmitted. (As this LED blinks at short intervals, it looks like as if it's kept ON.)
10	ALM	LED for indicating that remote I/O communication is suspended.	Red	OFF	ON	ON when the communication is stopped.
11	PCKTNG	LED for confirming the remote I/O communication status.	Red	OFF	Blink	Sometimes ON or blink: Communication condition is not good.
12	5VOUT	LED for confirming that 5V power supply functions properly.	Green	ON	OFF	

Name	Function	Color	Status			
24VIN	LEDs (used together)	Green	ON	ON	OFF	OFF
FUSE	for checking the fuse welding	Green	ON	OFF	ON	OFF
			24VDC input OK No fuse breakage	24VDC input OK Fuse breakage		No 24VDC input Fuse's state unknown

Supplement: These LEDs turn ON when a couple of voltage is applied. Therefore, you can't verify the 24VDC voltage level with these LEDs.

For details of switches, refer to Chapter 7.9





No.	Switch name	Explanation of function
15	RSW1	Set the station numbers with the 32 points DI: X□□-X□□, DO: Y△△-Y△△. Depending on the station number, X□□-X□□ and Y△△-Y△△ change. E.g.) Rotary switch "0": X00-X1F, Y00-Y1F Rotary switch "1": X20-X3F, Y20-Y3F
16	RSW3	Use to set the manual pulse generator station number. Use the rotary switch RSW3 of the base unit FCU7-DX078 to set the remote I/O station numbers of manual pulse generators (1st, 2nd, and 3rd). If an even station number "0", "2", "4", or "6" is set, the consecutive next odd station number will be automatically assigned. Make sure the station number doesn't duplicate with RSW1 or RSW2 of an extension unit FCU7-DX079. E.g.) When RSW3= "2" 1st manual pulse generator: Assigned to the latter half of the set station number "2", X50-X5F 2nd manual pulse generator: Assigned to the first half of the set station number "3", X60-X6F 3rd manual pulse generator: Assigned to the latter half of the set station number "3", X70-X7F If an odd number is set, the previous even station number will be set. When "F" is set, the remote I/O station for the manual pulse generator (1st, 2nd, and 3rd) will be disabled. Setting from "8" to "E" is the same as setting "F".

The 24VDC input circuit in the base unit FCU7-DX078 has a fuse for protecting itself against burnout due to short circuit. When this fuse is blown, take the base unit FCU7-DX078 out from the external box and replace the fuse with new one with the same rating.

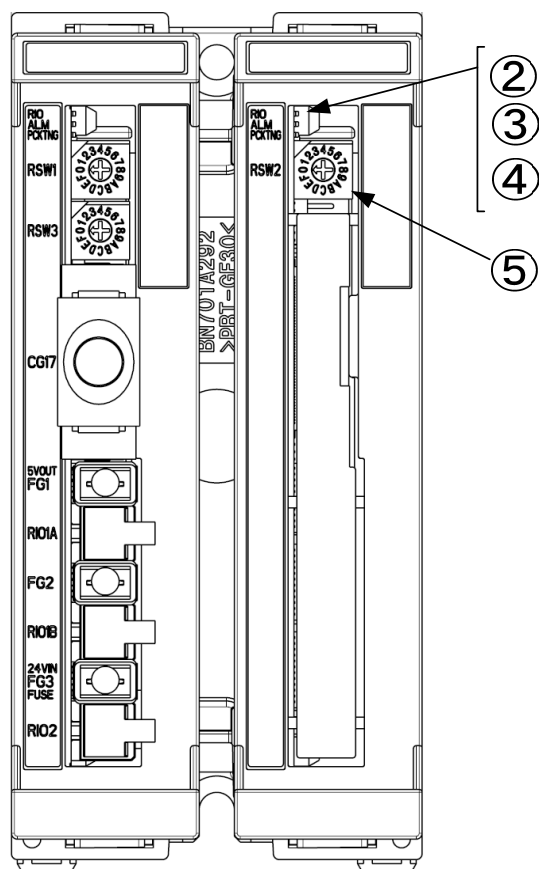
The extension unit has no voltage converting circuit (from 24V into 5V), thus the unit doesn't have this fuse.

Name	Function	Rating	Manufacturer	Model name	Supplement
FUSE	Protect the control circuit from burnout	1.6A	Daito Communication	LM16	Mounted on the base unit only

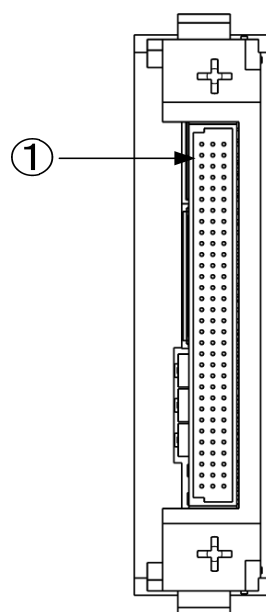
CAUTION

-  Do not apply a voltage on the connectors other than that indicated in this manual. Failure to observe this could lead to rupture or damage, etc.
-  An incorrect connection could damage the devices. Connect the cable to the specified connector.
-  Do not connect or disconnect the cables connected between each unit while the power is ON.
-  Do not mount or remove each PCB while the power is ON.

1.4.2 Names of FCU7-DX079 (Extension Unit) Each Section



Names of each section (front view)







Names of each section (back view)

No.	Connector name	Explanation of function
1	CG30	Use to connect with the MTB's I/O panel.

No.	Name	Function	Color	Status		Supplement
				Normal	Error	
2	RIO	LED for indicating that remote I/O communication is in progress.	Green	ON	OFF	ON when data is being transmitted. (As this LED blinks at short intervals, it looks like as if it's kept ON.)
3	ALM	LED for indicating that remote I/O communication is suspended.	Red	OFF	ON	ON when communication is stopped.
4	PCKTNG	LED for confirming the remote I/O communication status.	Red	OFF	Blink	Sometimes ON or blink: Communication condition is not good.

No.	Switch name	Explanation of function
5	RSW2	<p>Set the station numbers of each of the 32 points: DI: X□□-X□□, DO: Y□□-Y□□.</p> <p>The addresses of X□□-X□□ and Y△△-Y□□ change in accordance with the rotary switch setting.</p> <p>Example) Rotary switch "0": X00-X1F, Y00-Y1F Rotary switch "1": X20-X3F, Y20-Y3F</p>

**CAUTION**

-  Do not apply a voltage on the connectors other than that indicated in this manual. Failure to observe this could lead to rupture or damage, etc.
-  An incorrect connection could damage the devices. Connect the cable to the specified connector.
-  Do not connect or disconnect the cables connected between each unit while the power is ON.
-  Do not mount or remove each PCB while the power is ON.

1.5 Battery Unit

1.5.1 Specifications

There are two types of battery units available: FCU6-BTBOX for M720BM, whose output voltage is 4.0V and FCU6-BTBOX-36, whose output voltage is 3.6V. The standard battery for M730BM/M750BM is the 3.6V specified FCU6-BTBOX-36.

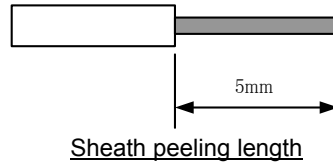
Item	Specification
Unit name	Control panel installed battery box
Unit model name	FCU6-BTBOX-36
Battery model name	2C-R5, a lithium battery for camera
Battery voltage	6V
Nominal capacity	1300mAh
Number of batteries used	2
Battery box's output voltage	3.6V
Number of part systems possible to back up	One part system for NC control unit
Back up period	1 year * When this battery is used for NC control unit, backup is possible for a couple of years. But we recommend you to replace the battery unit when replacing the servo drive unit's battery unit.

Item	Specification
Ambient temperature during operation	0 to 55°C
Ambient temperature during storage	-20 to 60°C
Ambient humidity during operation	45 to 75%RH (No dew condensation)
Ambient humidity during storage	45 to 80%RH (No dew condensation)
Vibration resistance	4.9m/s ² or less *4.9m/s ² = 0.5G
Shock resistance	29.4 m/s ² G or less, 29.4m/s ² =3G
Working atmosphere	No corrosive gasses, dust or oil mist
Water/Oil resistance	In conformity with IP54 (when installed inside the control panel)

1.5.2 Cable connection

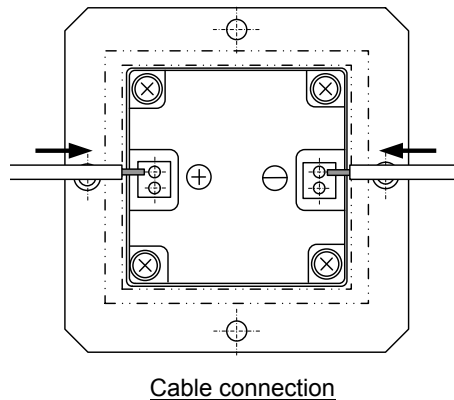
- How to treat the cable ends

Before use, peel a part of the cable sheath and twist the core wires. Take care to prevent short-circuiting with the neighboring poles caused by fine wire strands. Do not solder onto the core wires, as a contact fault could occur.

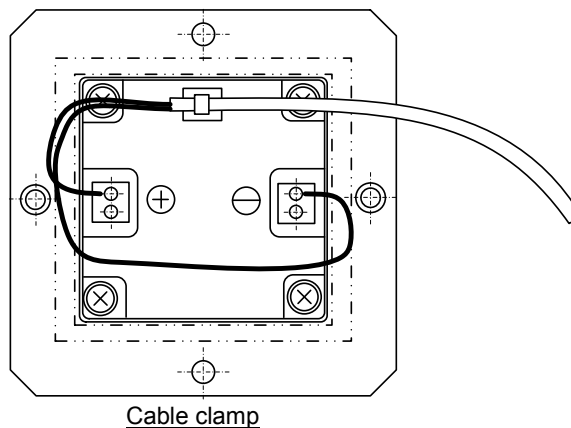


- How to connect

As shown above, peel a part of the battery cable's sheath, insert it into the battery box's terminal block in the horizontal direction, and then tight it with screws. The tightening torque should be between 0.22 and 0.25 N·m. Check the polarity shown on the cover, so as not to wire with the wrong polarity.



Clamp the cable using the clamps on the terminal block's cover as illustrated below, so that excess stress won't be applied to the cable.



CAUTION

- An incorrect connection may damage the devices, so connect the cables to the specified connectors.
- Do not connect with the wrong polarity. Failure to observe this could damage the control unit or detector, or cause the zero point missing.
- Do not connect or disconnect the PCBs while the power is ON.

2. Troubleshooting

If trouble occurs during operation, the accurate cause must be found so that adequate measures can be taken. Perform the following checks for this.

2.1 Troubleshooting

Confirm "when", "when doing what", "what kind of trouble" and "how frequently" the trouble occurred. Also check how many years the machine has been operated, and how many hours a day it is used.

(1) General confirmation items

- Machine tool builder and type of machine
- Panel computer type

(2) When?

- What time did the trouble occur?
- How long had passed after the power was turned ON?

(3) When doing what?

- What was the NC operation mode?
 During automatic operationProgram No., sequence No. and program details when the trouble occurred.
 During manual operationWhat was the manual operation mode?
- What was the operation procedure?
- What were the previous and next steps?
- What screen is displayed on the panel computer's display?
- What is the state of the peripheral devices?
- What was the setting display unit screen?
- Did the trouble occur during input/output operations?
- What was the machine side state?
- Did the trouble occur while replacing the tools?
- Did hunting occur in the control axis?

(4) What kind of trouble?

- What was displayed on the setting display unit's Alarm Diagnosis screen?
 Display the Alarm Diagnosis screen, and check the alarm details.
- What was displayed for the machine sequence alarm?

(5) How frequently?

If the trouble occurs infrequently or if it occurs during the operation of another machine, the cause may be an error in the power voltage or the noise, etc. Check whether the power voltage is normal (does it drop momentarily when other machines are operating?), and whether noise measures have been taken.

- How often does the trouble occur in a day? (Times/day)
- Were the peripheral devices operating?
- Check whether the same trouble is repeated during the same operation. (Repeatability)
- Check whether the same trouble occurs when the conditions are changed.
- Does the trouble occur during a specific mode?
- Does the trouble occur when the overhead crane is operating?
- What is the frequency in the same workpiece?
- What is the ambient temperature?
(Was there a sudden change in the temperature? Was the fan at the top of the control unit rotating?)
- Is there any contact defect or insulation defect in the cables?
(Is there any oil or cutting oil splattered onto the cables?)

(6) Details displayed at trouble

- Details of LED display on NC control unit
Is 12V lit?
Is PWGD lit?
Is PRGOK lit?
- Details of LED display on extension unit
Is LED1 on the Ethernet connector lit or blinking?
Is LED2 on the Ethernet connector lit or blinking? How about LED2?
- Details of LED display on book-type I/O unit
Is 24VIN lit?
Is FUSE lit?
Is 5VOUT lit?
Is RIO faintly lit?
Is ALM OFF?
- Details of LED display on operation panel I/O unit
What does the 7-segment LED, NCLED1 indicate?
What does the 7-segment LED, NCLED2 indicate?
Is 24VIN lit?
Is 5VOUT lit?
Is 12VON lit?
Is EMG1 lit?
Is NCWD lit?
Is NCOK lit?
Are the LEDs RIO1 through RIO3 lit? What is the status of 24VIN?
- What does the LED on the servo drive unit indicate?

2.1.1 Possible Causes of Trouble

The most common cause is a cable contact defect and wire breakage defect

- Is the connection correct?
- Are the cables bent or stepped on?
- Are the joints of the cables and connectors deteriorated?
- Was a continuity test done on the cables?
- Are any of the terminal block or connector screws loosen?
- Is any oil or cutting fluid splattering on the cables?
- Was a cable disconnected while the power was ON?
- Is any cable overheated?

Often trouble occurs due to fluctuation in the power voltage or noise from the communication cable.

- Is the power voltage always correct?
- Is the power frequency always correct?
- Does the voltage fluctuate depending on the time?
- Does the voltage drop momentarily when a peripheral device starts operation?
- Was there an instantaneous power failure before the trouble?
- Have measures against noise been taken for each unit?
- Are the communication and power system cables separated and laid?
- Is the communication cable shield sufficient?

The trouble may also occur due to sudden temperature changes or vibration and impact, although this is rare.

- Are the ambient temperature and humidity adequate?
- Is the fan in the panel where the unit is stored rotating?
- Is the panel fixed on a flat and stable floor with little vibration?

2.1.2 Confirmation Items for Each Configuration Unit**NC Control unit confirmation items**

- Is the rotary switch SW1 set to "0"?
- Is the rotary switch SW2 set to "0"?
- Has the unit been inserted to PCI-BUS deep enough? Was it mounted obliquely?
- Have you omitted inserting the power cable G180?
- Have the operation panel I/O unit and communication cable F011 connected obliquely?

Items to confirm for operation panel I/O unit

- Were the station No. settings done correctly by the rotary switch CS1?
- Were the station No. settings done correctly by the rotary switch CS3?
- Is 24VDC power correctly supplied to the connector DCIN?
- Have you omitted inserting the power cable G180?
- Aren't the operation panel I/O unit and communication cable F011 connected obliquely?
- Is the battery connected to the battery connector, BAT1?
- Has the shield clamping been done correctly against noise?
(Refer to "(2) Shield clamping of cables" (Example of connection with clamp fitting) of "3.6 Noise Countermeasures" in Chapter I "Connection Manual".)

Items to confirm for book-type I/O unit

- Were the station No. settings done correctly by the rotary switch RSW1?
- When the manual pulse generator is not used, has the rotary switch RSW2 been set to "F"?
- Has the unit inserted enough so that the both hooks are locked on the unit outer frame?
- Is the unit's FG terminal connected to the FG terminal block of the control system?
- Is the unit's FG terminal connected to the terminal block, to which the servo drive unit's terminal has been connected?
- If the book-type I/O unit is used as the terminal station, is the terminating resistor R-TM2 attached?

Items to confirm for remote I/O unit

- If the communication with NC control unit is not normally performed, the red lamp inside the unit turns ON. This red lamp also turns ON when the cable is broken or disconnected. When in normal, the green lamp is ON.
- Check if the rotary switches on the front of the unit are set correctly. If more than one unit has the same setting number, the communication may become unstable even when the green lamp is ON.
(Refer to "8.3 Setting of Station No. When Using Multiple Remote I/O Units" of Chapter I "Connection Manual" for details.)
- Is the 24VDC (external power) correctly supplied to each unit?
- Are the connectors connected properly to each unit? Are any connectors inclined?

2.1.3 Causes and Remedies for Each Phenomenon

This section shows the procedures of how to check at a trouble due to hardware factors. Refer to "M730BM Alarm/Parameter Manual" (IB1500907) for the details of alarm displays, including the troubles caused by the software factors.

If each unit is likely to have a failure, please contact your nearby service center.

NC control unit fails to start up	
"Main Frame Could not initialize NC. Application will close" is shown on the screen, and the NC control unit fails to start up.	<ul style="list-style-type: none"> Open the operation panel's cover and see what are shown on the 7-segment LEDs [NCLED1] and [NCLED2] of the operation panel I/O unit (FCU7-HN376-02). [Action] Check the following in accordance with the LED indication. If NC control unit fails to start even after unit replacement and RAM clear, confirm that the rotary switches "SW1" and "SW2" on the NC control unit are set to "0". [Action] Set the rotary switches to "0" after RAM clear.
The 7-segment LEDs [NCLED1] and [NCLED2] are OFF.	<ul style="list-style-type: none"> Confirm that the 24VDC power is supplied from the operation panel I/O unit (FCU7-HN376-02). [Action] Check the 24VDC power supply by monitoring the LED "24VIN". If the LED "24VIN" is ON and the 7-segment LED is OFF, then check if the fuse specified in "1.3 Names of Operation Panel I/O Unit (FCU7-HN376-01) Sections" is broken. If there is no fuse breakage, the operation panel I/O unit (FCU7-HN376-02) may have a failure.
The 7-segment LEDs [NCLED1] and [NCLED2] show [88].	<ul style="list-style-type: none"> NC fails to start the initial startup. [Action] Confirm that the communication cable F011 is fully inserted. [Action] Check if the power cable G180 is disconnected. [Action] Check if the LED "12VIN" on the NC control unit is lit. If this LED fails to be ON, the operation panel I/O unit (FCU7-HN376-02) may have a failure. [Action] Check if the LED "PWGD" on the NC control unit is lit. If the LED "12VIN" is ON, and "PWGD" and "PRGOK" are OFF, the NC control unit may have a failure.
The 7-segment LEDs [NCLED1] and [NCLED2] show a value other than [88] and this indication won't be refreshed.	<ul style="list-style-type: none"> Check if the LED "WD" on the operation panel I/O unit (FCU7-HN376-02) is OFF. [Action] If the LED "WD" is lit, there may be SRAM data loss due to battery voltage drop, or the NC control unit may have a failure.
NC starts up, but the READY signal fails to be ON	
An alarm occurs.	<ul style="list-style-type: none"> Take an appropriate measure for each alarm.
PLC fails to start up.	<ul style="list-style-type: none"> Confirm that the rotary switches "SW1" and "SW2" on the NC control unit are set to "0". [Action] If the settings are other than "0", set to "0" and restart. [Action] If the NC fails to start with the "0" setting, check the "PLC stop" parameter setting. [Action] If PLC fails to start while the "PLC stop" parameter setting is being "enabled", there may be the NC control unit failure.
Book-type I/O unit fails to be recognized.	<ul style="list-style-type: none"> Refer to the section where the failures relating to book-type I/O unit are described.

Failures relating to communication error (Y02 System error) with servo drive unit	
The error number [0050] is shown.	<ul style="list-style-type: none"> System error has occurred. It has exceeded the processing time. [Action] Software or hardware failure may be the cause.
The error number [0051] is shown.	<ul style="list-style-type: none"> Communication failure between NC control unit and servo drive unit. Check the alarm number [□□△△]. * There are both the error number and alarm number. [Action] Check if the optical communication cable is about to disconnect. [Action] If an alarm occurs after unit replacement, both or either of the NC control unit's or servo drive unit's software version may be old. So, open the diagnosis screen and check the software version shown on the unit configuration. [Action] If PLC fails to start up while the "PLC stop" parameter is set to "enabled", the NC control unit may have a failure.
Book-type I/O unit can't be recognized.	<ul style="list-style-type: none"> Refer to the section where the failures relating to book-type I/O unit are described.





Failures relating to battery	
"Z52 Battery drop 0001 (Battery warning)" is shown.	<ul style="list-style-type: none"> The voltage of the battery for the NC control unit has dropped to 3.2V. [Action] Refer to "3.2.2 Replacing the Batteries" to replace the batteries. If this battery alarm occurs 1 or 2 years after the replacement of the NC control unit's battery, the NC control unit may have a failure. Please back up the data. [Action] If this alarm occurs on the servo drive unit's battery, the handling will vary for each part system and servo drive unit type. So, please refer to the servo drive unit manual.
"Z52 Battery drop 0003 (Battery alarm)" is shown.	<ul style="list-style-type: none"> The voltage of the battery for the NC control unit has dropped to 2.8V or below. [Action] If this alarm occurs on the NC control unit's battery, refer to "3.2.2 Replacing the Batteries" to replace them. When [0003: Battery alarm] is shown, the machining programs and parameters in SRAM may be destroyed. So, load the backup data again. [Action] If this alarm occurs on the servo drive unit's battery, the handling will vary for each part system and servo drive unit type. So, please refer to the servo drive unit manual.

Failure relating to temperature rise	
"Z53 CNC overheat" alarm is shown.	<ul style="list-style-type: none"> • This alarm occurs when the NC control unit's ambient temperature has risen above around 55°C. <p>[Action] If no problems have occurred after the installation of the machine, and this alarm has occurred during the machine's continuous operation, the cooling fan in the display unit may have stopped. So, check if the display unit's cooling fan is working.</p> <p>[Action] If there is no problem with the display unit's cooling fan, the thermal detection circuit in the NC control unit may have a failure.</p>

Failure relating to remote I/O communication (Common to book-type I/O unit and DX unit)	
Right after the startup, "Z55 RIO communication stop" is shown.	<ul style="list-style-type: none"> • Check if the remote I/O unit's station number settings are duplicated. <p>[Action] If the numbers are duplicated, change the numbers in accordance with the PLC ladder. If they are not duplicated, see below.</p>
After startup, "Z55 RIO communication stop" is sometimes displayed.	<ul style="list-style-type: none"> • Refer to 2.1.4 and open the diagnosis screen to check the communication error counter. <p>[Action] If the CRC error counter and connection error counter are counted up while observing, take noise measure.</p> <p>[Action] If the CRC error counter is not counted up, but connection error counter is counted up, there may be insufficient 24VDC input power or 24VDC's instantaneous failure due to contact failure.</p> <p>[Action] If there is no problem with the 24VDC voltage and current capacity, and also no problem with the 24V system's contactor contacts, there may be the unit's failure.</p>
After unit replacement, "Z55 RIO communication stop" is sometimes displayed.	<ul style="list-style-type: none"> • Check if a terminating resistor is attached to the terminal unit. <p>[Action] Attach the terminating resistor which you've detached at the unit replacement. <ul style="list-style-type: none"> • Check if the cable's FG line is connected to a location different from that before unit replacement. <p>[Action] If you connect the FG line to the same FG grounding terminal block as of the servo drive unit, the noise resistance will be weaker. Thus, connect the FG cable in the same condition as before unit replacement.</p> </p>

Failures relating to book-type I/O unit	
Book-type I/O unit fails to be recognized.	<ul style="list-style-type: none"> • Confirm that the book-type I/O unit is fully inserted to the MTB's I/O panel. • Confirm that the LED "24VIN" for confirming the 24VDC input is lit on the base unit FCU7-DX078. [Action] The 24VDC input is supplied from the MTB's I/O panel. If the LED "24VIN" is OFF, check the power line system of the MTB's I/O panel. • Confirm that the LED "FUSE" for confirming the fuse breakage is lit on the base unit FCU7-DX078. [Action] If the LED "FUSE" is OFF, the fuse is broken. Take the unit FCU7-DX078 out from the case and replace the fuses. • Confirm that the LED "RIO" for confirming the communication is lit on the base unit and extension unit. [Action] If the LED "RIO" is OFF, the cable may be broken or disconnected, or the unit may have a failure.
The LED "5VOUT" for confirming the internal control power supply is not turned ON.	<ul style="list-style-type: none"> • The unit may have a failure. [Action] Replace the units.
The LED "ALM" for indicating the communication alarm is ON.	<ul style="list-style-type: none"> • Check if the remote I/O unit's station number settings are duplicated. [Action] If the numbers are duplicated, change the setting in accordance with the PLC ladder. If the numbers are not duplicated, refer to the following items.
The LED "FUSE" on the base unit is not lit.	<ul style="list-style-type: none"> • Check if the LED "24VIN" for confirming the 24VDC input is lit. [Action] If the LED "24VIN" is ON, the fuse is broken. Take the unit FCU7-DX078 out from the case and replace the fuses.
The manual pulse unit doesn't function.	<ul style="list-style-type: none"> • Check the setting of the rotary switch "SW3" on the base unit FCU7-DX078. [Action] "8" to "F" are the settings to "disable" the manual pulse unit. So, change the setting of "SW3" to be the one specified in the PLC ladder.
All the input signals fail to be input.	<ul style="list-style-type: none"> • If there is a fuse at the DI common input on the MTB's I/O panel side, check if the fuse is broken. [Action] If there is no fuse breakage, the unit may have a failure.
Some of the input signals fail to be input.	<ul style="list-style-type: none"> • When common control is carried out on the MTB's I/O panel side, check the connection destination of the related DI common inputs. [Action] If there is no problem with the related DI common inputs, the unit may have a failure.
Output devices sometimes malfunction.	<ul style="list-style-type: none"> • Check the DO allocation numbers of the output device and check the load current. [Action] For the 200mA and 300mA outputs, refer to "7.5 Assignment of Machine Output (DO) Signals" in Connection Manual.

CAUTION

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

2.1.4 Diagnosis of Remote I/O Communication Error

Check the remote I/O unit's communication status on the diagnosis screen.

Items possible to diagnose are:

- ① Connected units and their station numbers
- ② Existence of communication error for each connected unit
- ③ Number of communication errors that occurred for each connected unit

(1) Connection status output

Output the connection status of the remote I/O unit (station)

R register \ Bit	7	6	5	4	3	2	1	0	System to which remote I/O unit is connected
R10064 high-order	*	*	*	*	*	*	*	*	RIO1
low-order	*	*	*	*	*	*	*	*	RIO2
R10065 high-order	*	*	*	*	*	*	*	*	RIO3
low-order	-	-	-	-	-	-	-	-	Not used
Station	8th	7th	6th	5th	4th	3rd	2nd	1st	* ... 0: Connection OFF 1: Being connected

(2) Error occurrence time output

Count and output the number of errors occurred in the communication between the control unit and remote I/O unit (station).

After power ON, the counter shows a count of continuous errors. When you change the bit 0 of R10072 from "1" to "0", this counter can be used as an accumulated error counter.

1st station	2nd station	3rd station	4th station	5th station	6th station	7th station	8th station	System to which remote I/O unit is connected
R10000	R10001	R10002	R10003	R10004	R10005	R10006	R10007	RIO1
R10008	R10009	R10010	R10011	R10012	R10013	R10014	R10015	RIO2
R10016	R10017	R10018	R10019	R10020	R10021	R10022	R10023	RIO3

R register high-order 8 bits 0x00 to 0xFF (0 to 255 times) · · · Number of CRC error occurrences (accumulated)
low-order 8 bits 0x00 to 0xFF (0 to 255 times) · · · Number of connection error occurrences (accumulated)

Cautions/Restrictions

- (1) The control unit is unable to recognize a remote I/O unit to which power or communication cable is not connected, nor a remote I/O unit to which power is not supplied. Therefore, if any of these remote I/O units has a failure, the remote I/O error won't occur. And at this time, the remote I/O unit's connection status output (R register) will be "0".
- (2) Check if physically existing remote I/O units are correctly working by use of the connection status output (R register) and error occurrence time output (R register).
- (3) If the number of the error occurrences has exceeded 255, the error occurrence time output (R register) is counted from 0 (0x00) again.
- (4) Even when the power is turned ON again, the error occurrence time outputs (R register) are all kept.

3. Daily Maintenance and Periodic Inspection and Maintenance

Unlike the conventional NC Control unit, the maintenance and inspection for this unit must be performed on the panel computer as well. Refer to the panel computer instruction manual and complete the maintenance and inspection.

3.1 Maintenance Tools

(1) Measuring instruments

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

Table 3.1 Maintenance tools

Tool	Condition	Application
Tester		To check that the wiring to the NC Control unit is correct before turning the power ON.
AC voltmeter	Measure the AC power voltage. The tolerable error is $\pm 2\%$ or less.	To measures the AC power voltage being supplied to the external 24VDC power supply unit or panel computer.
DC voltmeter	Max. scale 30V. The tolerable error is $\pm 2\%$ or less.	To measure the DC power voltage. <ul style="list-style-type: none"> • External power supply 24V (machine input/output interface) • Battery voltage • Panel computer extension bus DC output
Phase rotation meter		To check the connection order of the AC 3-phase input power supply.
Oscilloscope		General measurement and simple troubleshooting

(Note 1) Currently, a high-accuracy digital multi-meter is commonly used as a tester. This digital multi-meter can be used as both an AC voltmeter and a DC voltmeter. When measuring a minute current, a correct measurement may not be possible because of the digital multi-meter's input impedance.

(2) Tools

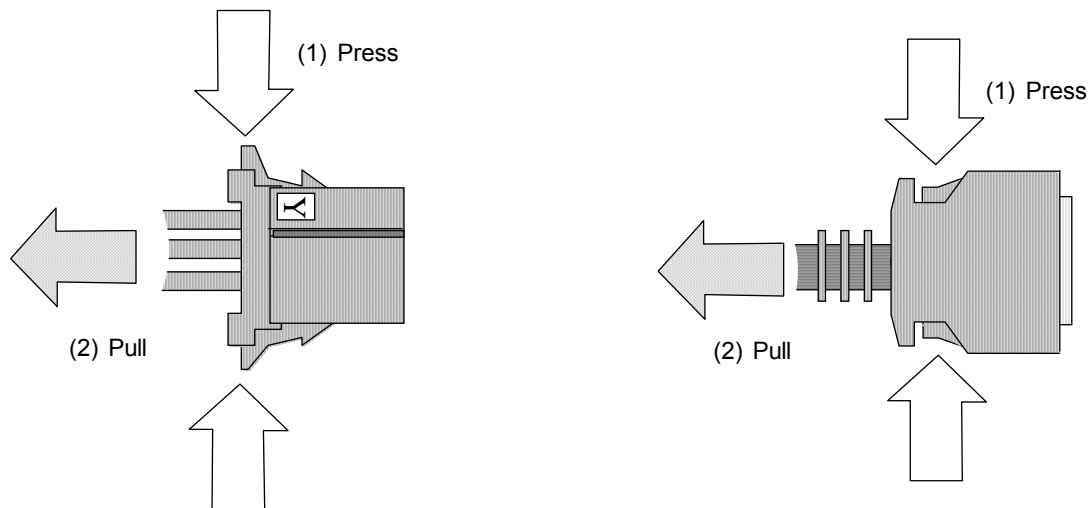
Phillips screwdriver (large, medium, small)
 Flat-tip screwdriver (large, medium, small)
 Radio pliers

3.2 Replacement Methods

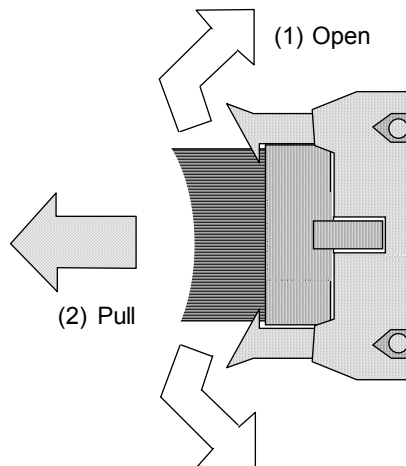
3.2.1 Cable

Replacing cables imposes many risks. Be sure to turn the power OFF beforehand.
Disconnect each cable with the following procedures.

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



- (b) For a flat cable type connector with latches, open the latches in the directions of the arrows, and pull the connector off.



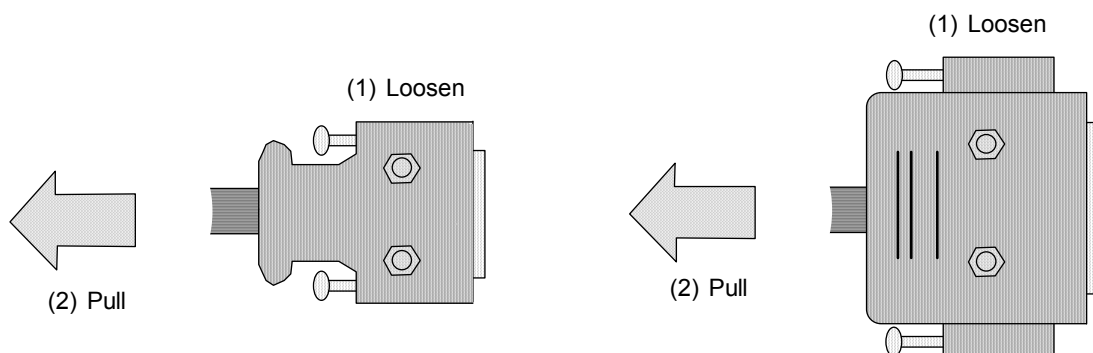
CAUTION

- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⊘ Do not connect the cable by pulling on the cable wire.

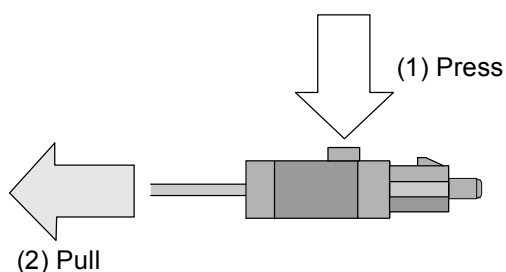
3. Daily Maintenance and Periodic Inspection and Maintenance

3.2 Replacement Methods

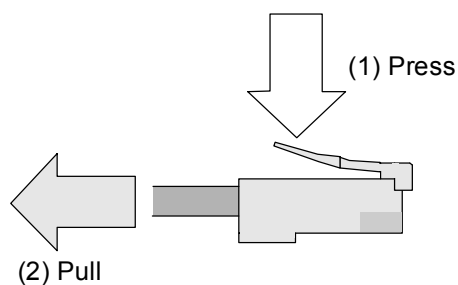
(c) For the screw fixed type connector, loosen the two fixing screws, and pull the connector off.



(d) For the optical cable connector, pull off while holding down the lock button.



(e) For the Ethernet connector, pull off while holding down the locked latch.



- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.
- ⊘ Do not connect the cable by pulling on the cable wire.

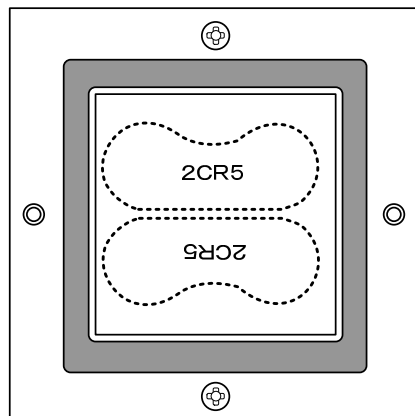
3.2.2 Replacing the batteries

Data such as the parameters and machining programs which must be backed up when the power is turned OFF are held with the battery box (FCU6-BTBOX-36) connected to the battery connector in the operation panel I/O unit.

When the message "Z52 Battery fault" appears, replace the batteries in the following procedure.

***Replace the batteries with the NC's power and servo control's power ON.**


- (1) Turn the machine's power ON, and charge the large-capacity capacitor for maintenance mounted in the NC control unit. Charge for over one minute.
- (2) Backup the data such as the parameters and machining programs which must be backed up.
- (3) Keep the machine's power "ON" when replacing the batteries.
- (4) Open the battery box's cover equipped on the electric cabinet door at the back of the machine to replace the batteries. Insert the batteries in the directions shown in the below figure with the batteries' terminals facing the back. If the directions are wrong, the cover cannot be closed.
- (5) The battery box contains two batteries. Replace both of them together.
- (6) After replacing, make sure that the machine starts normally.
- (7) Duration of the large-capacity capacitor for maintenance is 30 minutes. Replace the batteries within 30 minutes.

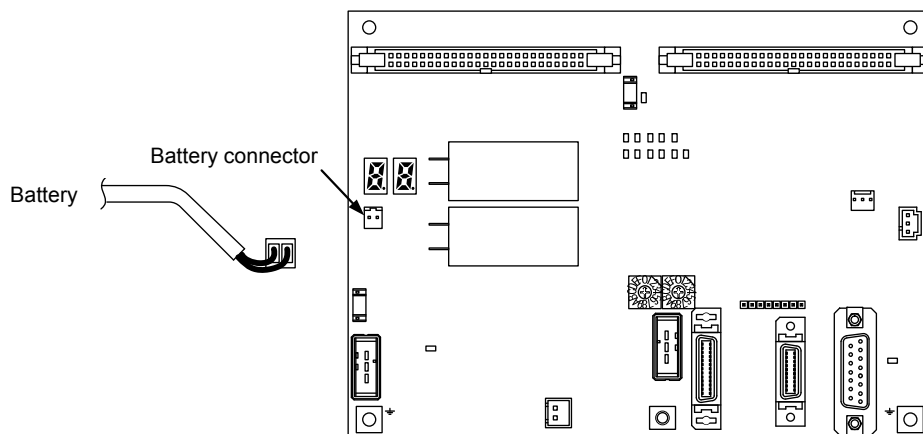


Directions of the batteries

Working battery type : 2C-R5 (commercially available)
Quantity : 2

CAUTION

-  Always turn the NC control unit power ON and charge the large-capacity capacitor for maintenance in the unit before replacing the batteries or operation board I/O unit, or disconnecting the F001 cable. If the F011 cable is disconnected without charging the large-capacity capacitor, the data could be lost.



Connection of the battery cable

Precautions for handling battery

- Always replace the battery with the same type.
- Do not disassemble the battery.
- Do not place the battery in flames or water.
- Do not pressurize and deform the battery.
- This is a primary battery so do not charge it.
- Dispose of the spent battery as industrial waste.



CAUTION

- ❗ When the battery voltage drop warning occurs, save the machining programs, tool data and parameters in an input/output device. Then, replace the battery. If the battery alarm is issued, the machining programs, tool data and parameters may be destroyed. Reload each data after replacing the battery.
- ⚠ Do not replace the battery while the power is ON.
- ⚠ Do not short circuit, charge, overheat, incinerate or disassemble the battery.
- ⚠ Dispose the spent battery according to local laws.




3.2.3 Replacing the NC Control Unit

Replace the NC control unit within 30 minutes after turning the machine and panel computer power OFF. If the work takes longer than 30 minutes, the NC data could be lost. Back up the NC data for safety purposes before replacing the unit.

The replacement procedures are as follow.

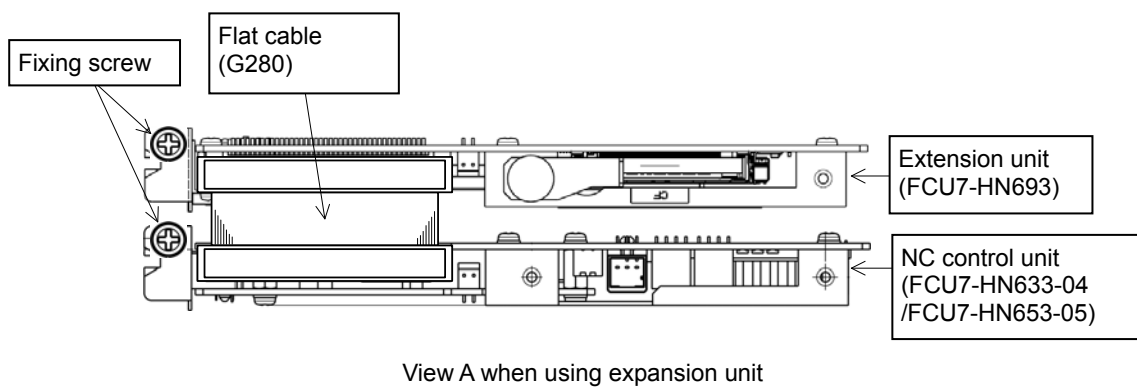
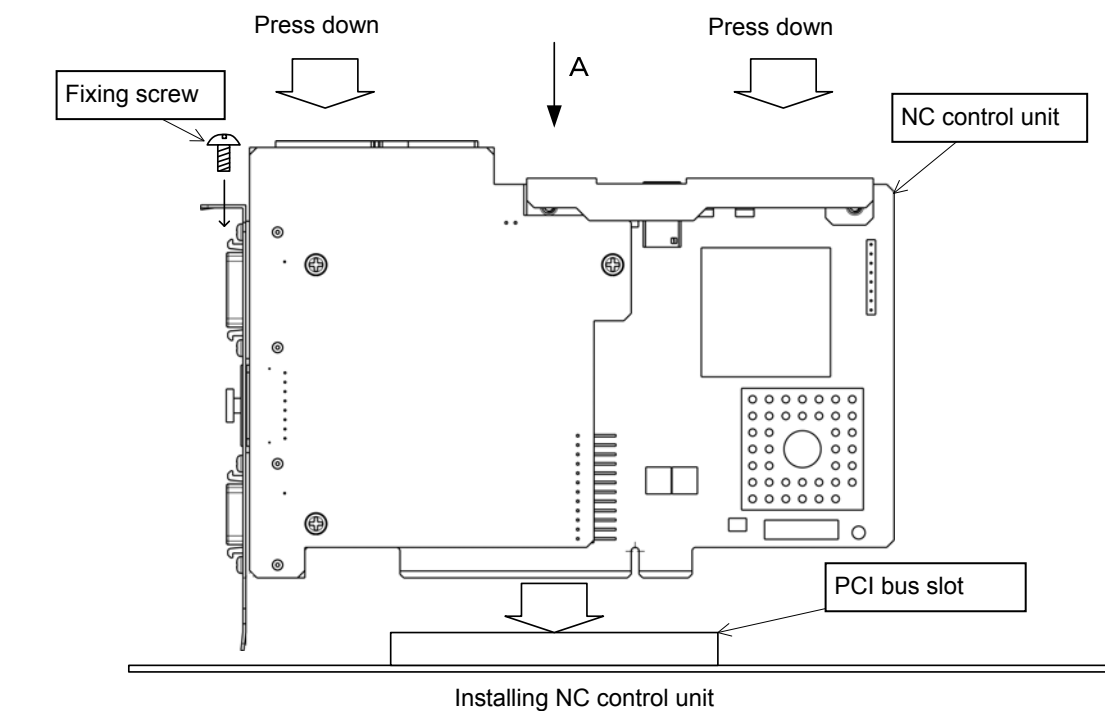
- (1) Confirm that the machine and panel computer power are OFF. (If not OFF, turn the power OFF.)
- (2) Disconnect all cables connected to the NC Control unit and the panel computer's power cable.
- (3) Following the panel computer manual instructions, remove the panel computer cover.
(Note) Follow the precautions provided by the panel computer manufacturer. Turn the panel computer power OFF, and confirm that the power cable is disconnected.
- (4) Disconnect the power cable (G180) from the power bracket connected to the NC Control unit, and when using the optional extension unit, disconnect the flat cable (G280) connecting the NC Control unit and extension unit.
- (5) Remove the one fixing screw fixing the NC control unit to the panel computer. (Refer to Fig. 1)
- (6) Hold the edges of the card mounting fitting and NC control unit, and pull out the NC in the horizontal direction. (Refer to Fig. 1.)
(Note) Always touch an exposed metal section of the panel computer to release any static electricity before touching the NC control unit.
Avoid touching the NC control unit or panel computer chips or circuits with hands.
- (7) Check the settings of the rotary switch and DIP switches on the removed NC control unit, and note down the setting values.
- (8) Connect a backup battery to the battery connector (BAT) to protect the setting values in the removed NC control unit.
- (9) Set the rotary switch on the new NC Control unit to be replaced to the same settings as those checked in step (7).
- (10) Hold the edges of the card mounting fitting and NC control unit, and insert, as if pressing in the top edge of the NC Control unit, into the back of the panel computer PCI bus slot. Take care to the notch on the slot at this time.
(Note) Avoid touching the NC Control unit or panel computer chips or circuits with hands.
- (11) Fix the NC Control unit and panel computer with the fixing screw removed in step (5).
(Note) Securely tighten the screw.
- (12) Connect the cable disconnected in step (4).
- (13) Following the panel computer manual instructions, mount the panel computer cover.
- (14) Connect all cables connected to the NC Control unit and the panel computer's power cable.
(Note) Connect the cables to the specified connectors.

CAUTION

-  **Incorrect connections may damage the devices, so connect the cables to the specified connectors.**
-  **Do not replace the NC Control unit while the power is ON.**
-  **Do not connect or disconnect the connection cables between each unit while the power is ON.**

3. Daily Maintenance and Periodic Inspection and Maintenance

3.2 Replacement Methods



3.2.4 Replacing the Extension Unit

Turn the machine and panel computer power OFF before replacing the extension unit.
The replacement procedures are as follow.

- (1) Confirm that the machine and panel computer power are OFF. (If not OFF, turn the power OFF.)
- (2) Disconnect all cables connected to the extension unit and the panel computer's power cable.
- (3) Following the panel computer manual instructions, remove the panel computer cover.

(Note) Follow the precautions provided by the panel computer manufacturer. Turn the panel computer power OFF, and confirm that the power cable is disconnected.

- (4) Disconnect the flat cable connecting the extension unit and NC Control unit.
- (5) Remove the one fixing screw fixing the extension unit to the panel computer. (Refer to Fig. 2)
- (6) Hold the edges of the card mounting fitting and extension unit, and pull out the extension unit in the horizontal direction. (Refer to Fig. 2.)

(Note) Always touch an exposed metal section of the panel computer to release any static electricity before touching the extension unit.

Avoid touching the extension unit or panel computer chips or circuits with hands.

- (7) Connect a backup battery to the battery connector (BAT) to protect the setting values in the removed extension unit.
- (8) Hold the edges of the card mounting fitting and extension unit, and insert, as if pressing in the top edge of the extension unit, into the back of the panel computer PCI bus slot. Take care to the notch on the slot at this time.

(Note) Avoid touching the extension unit or panel computer chips or circuits with hands.

- (9) Fix the NC control unit and panel computer with the fixing screw removed in step (5).

(Note) Securely tighten the screw.


- (10) Connect the cable disconnected in step (4).
- (11) Following the panel computer manual instructions, mount the panel computer cover.
- (12) Connect all cables connected to the extension unit and the panel computer's power cable.

(Note) Connect the cables to the specified connectors.

CAUTION

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

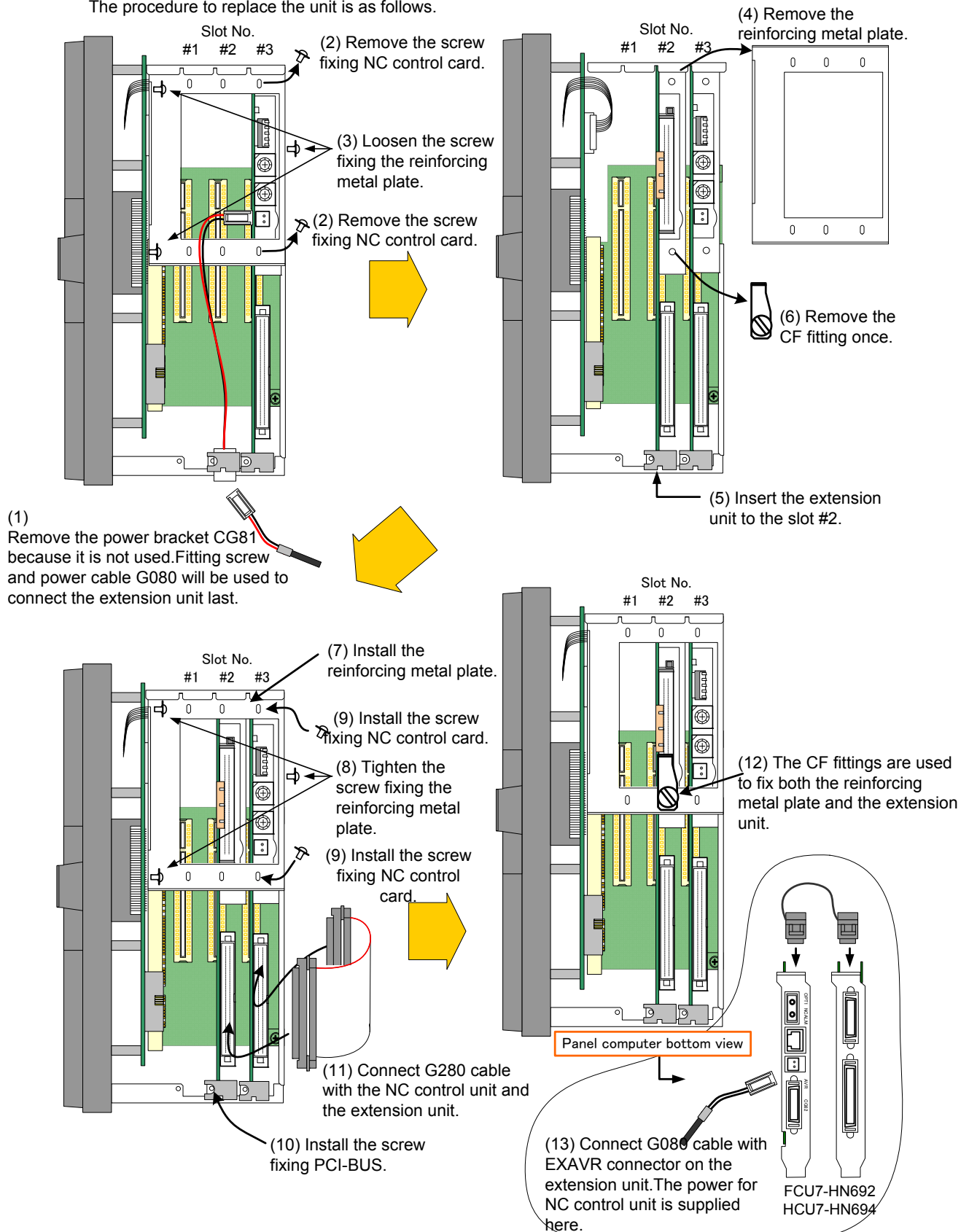
 **Do not replace the extension unit while the power is ON.**

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

3. Daily Maintenance and Periodic Inspection and Maintenance

3.2 Replacement Methods

Turn the machine power and the panel computer power OFF before adding the extension unit.
The procedure to replace the unit is as follows.



3.2.5 Attaching the book-type I/O unit

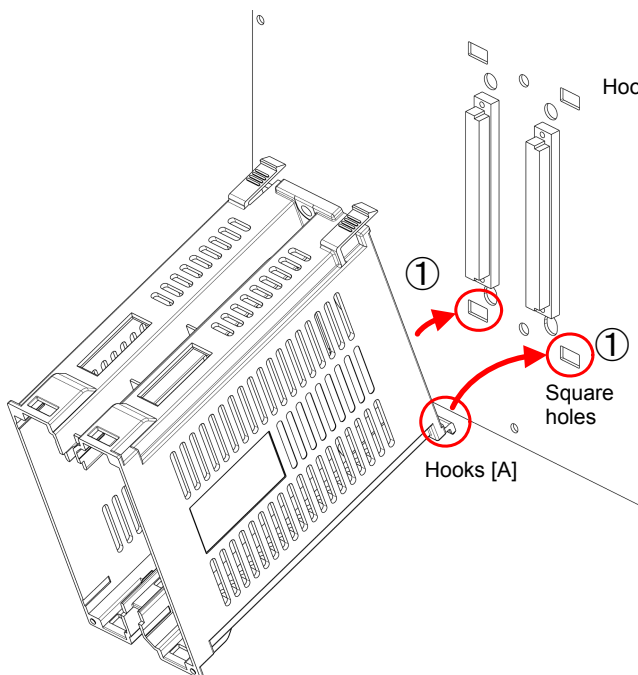
Attach the book-type I/O unit to the I/O panel following the below procedures.

- ① Hook the hooks [A] of the bottom of the I/O unit outer frame over the square holes of the I/O panel.
- ② Insert the hooks for temporary fixing [B] of the top of the I/O unit outer frame into the square holes of the I/O panel to temporarily fix the outer frame.
- ③ Use the M5x16 screws [C-1] [C-2] (with plain washer, spring washer) to fix the outer frame.
- ④ Insert the base unit FCU7-DX078 in the specified position.
- ⑤ Insert the extension unit FCU7-DX079 in the specified position.

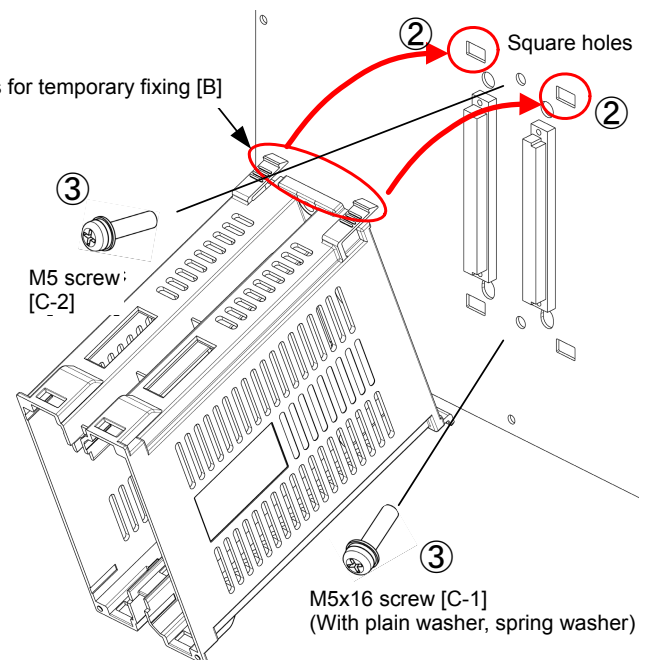
*The specified positions are different depending on the MTB's I/O panel, so refer to the MTB's electric drawing.

[Prohibited action]

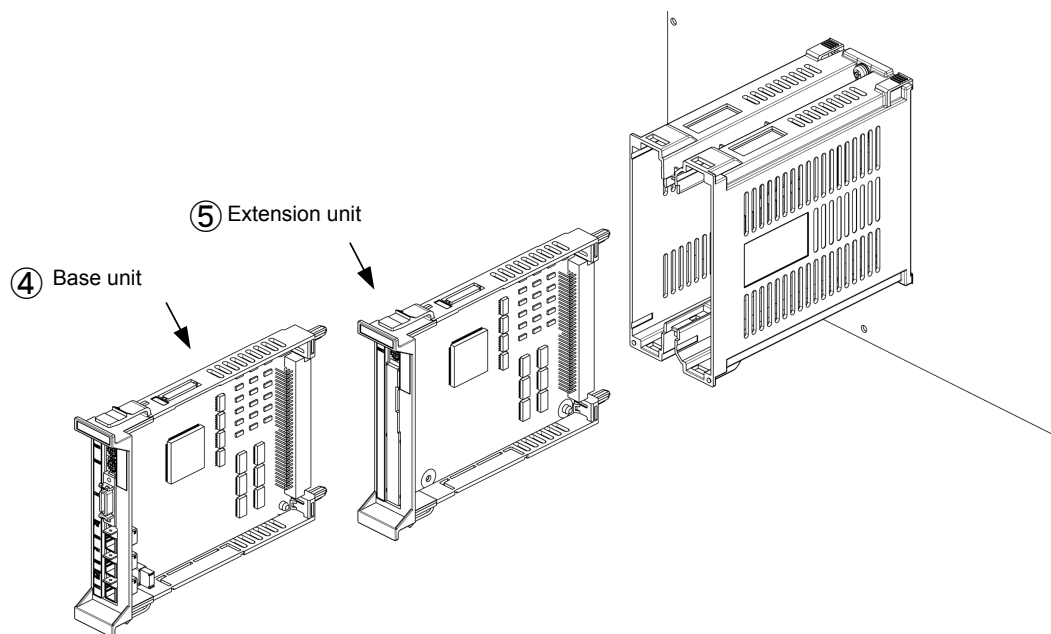
When attaching the I/O unit outer frame to the I/O panel, if it is attached with the base unit/extension unit inserted in it, the CG30 connector pins will be bent. Therefore, first attach only the outer frame to the I/O panel.



Procedure 1 to attach the I/O unit outer frame



Procedure 2 to attach the I/O unit outer frame



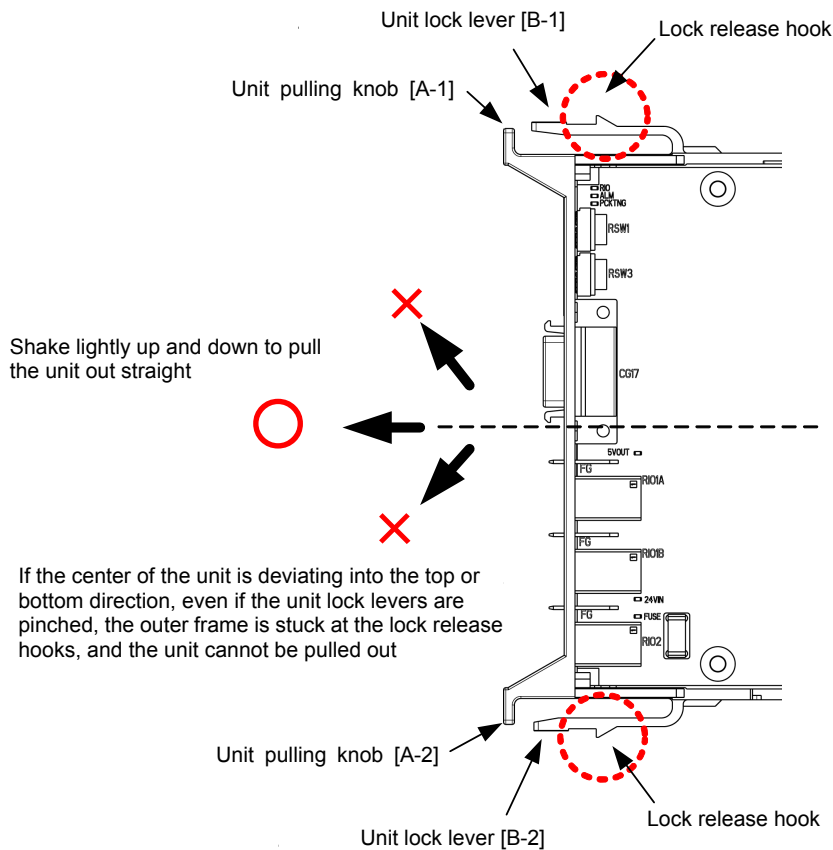
Installing the base unit/extension unit

CAUTION

- ⚠ Incorrect connections may damage the devices, so connect the cables to the specified connectors.
- ⊘ Do not replace the base I/O unit while the power is ON.
- ⊘ Do not connect or disconnect the connection cables between each unit while the power is ON.

3.2.6 Replacing the book-type I/O unit

When replacing the base unit FCU7-DX078 or extension unit FCU7-DX079, pinch the unit pulling knobs [A-1] [A-2] and the unit lock levers [B-1] [B-2] together, and shake lightly up and down to pull the unit out straight. If the center of the base unit/extension unit is deviating into the top or bottom direction, even if the unit lock levers are properly pinched, the outer frame is stuck at the lock release hooks, and the unit cannot be pulled out. In such a case, do not force to pull the unit out.



Lock release hooks of the base unit/extension unit, and how to pull the unit out

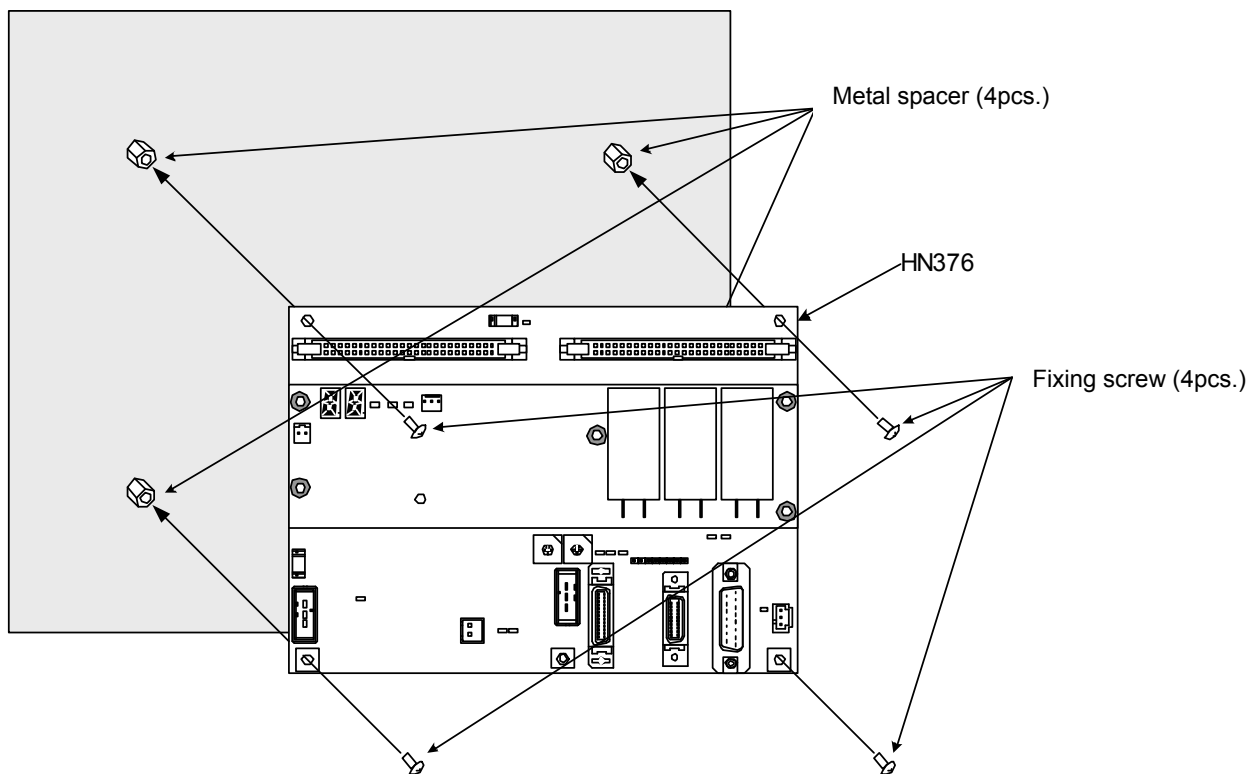
3.2.7 Replacing Operation Panel I/O Unit

The operation panel I/O unit is mounted in the operation board.

Always replace the operation panel I/O unit with the machine power turned OFF.

The replacement procedures are as follow.

- (1) Check that the machine power is turned OFF. (If the power is not OFF, turn it OFF.)
- (2) Open the operation board door.
- (3) Disconnect all cables connected to the operation panel I/O unit.
- (4) Remove the operation panel I/O unit fixing screws attached to the operation board, and remove the operation panel I/O unit from the operation board.
- (5) Replace with a new operation panel I/O unit, and fix with the fixing screws.
- (6) Connect all cables connected to the operation panel I/O unit. (Connect the cables to the designated connectors.)
- (7) Close the operation board.



Replacing the operation panel I/O unit

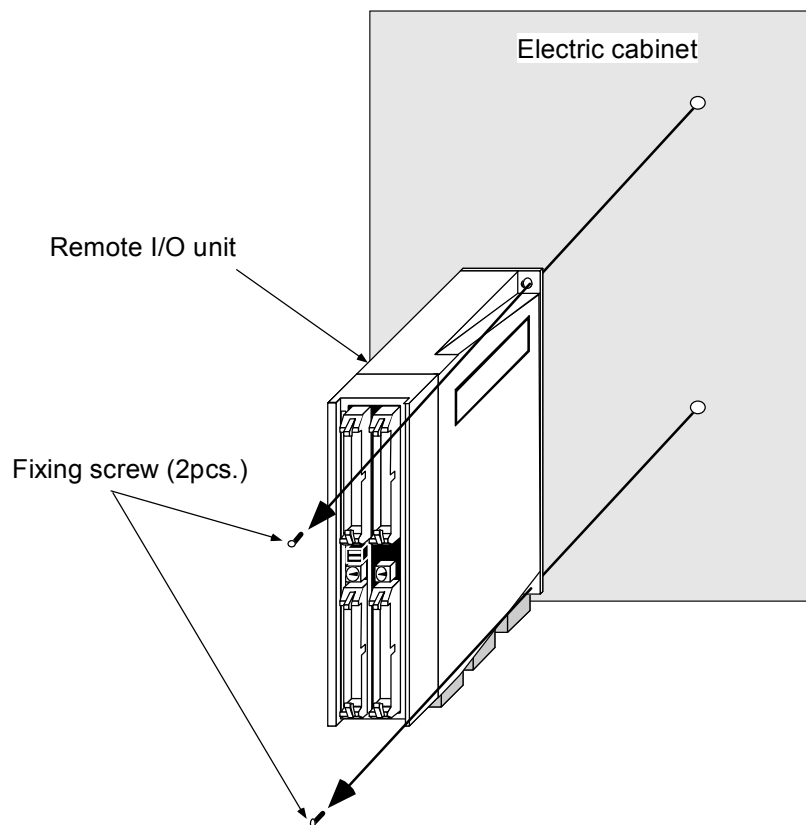
CAUTION

- Incorrect connections may damage the devices, so connect the cables to the specified connectors.**
- Do not replace the operation panel I/O unit while the power is ON.**
- Do not connect or disconnect the connection cables between each unit while the power is ON.**




3.2.8 Replacing Remote I/O Unit

The remote I/O unit is generally installed on the electric cabinet side.
Always replace the remote I/O unit with the machine power turned OFF.

- (1) Check that the machine power is turned OFF. (If the power is not OFF, turn it OFF.)
- (2) Open the electric cabinet door.
- (3) Disconnect all cables connected to the remote I/O unit.
- (4) Remove the screws fixing the remote I/O unit to the electric cabinet, and remove the remote I/O unit from the electric cabinet.
(Loosen the one lower fixing screw first, and then remove the one upper fixing screw while supporting the unit with a hand. Then lift the unit upward and off. The one lower fixing screw do not need to be removed.)
- (5) Replace with a new remote I/O unit, and fix the unit onto the electric cabinet with the fixing screws.
- (6) Connect all cables connected to the remote I/O unit. (Connect the cables to the designated connectors.)
- (7) Close the electric cabinet door.



CAUTION

-  Incorrect connections may damage the devices, so connect the cables to the specified connectors.
-  Do not replace the remote I/O unit while the power is ON.
-  Do not connect or disconnect the connection cables between each unit while the power is ON.

Revision History

Date of revision	Manual No.	Revision details
Mar. 2009	IB(NA)1500939-A	First edition created.
July 2010	IB(NA)1500939-B	<ul style="list-style-type: none">- Details for M750BM were added to the following chapter. “2.3 Unit List” (1) Control unit and Extension unit- Mistakes were corrected.

Global Service Network

AMERICA

MITSUBISHI ELECTRIC AUTOMATION INC. (AMERICA FA CENTER)

Central Region Service Center

500 CORPORATE WOODS PARKWAY, VERNON HILLS, IL., 60061, U.S.A.

TEL: +1-847-478-2500 / FAX: +1-847-478-2650

Western Michigan Service Satellite

ALLEGAN, MICHIGAN., 49010, U.S.A.

TEL: +1-847-478-2500 / FAX: +1-269-673-4092

Eastern Michigan Service Satellite

TEL: +1-847-478-2500 / FAX: +1-847-478-2650

Ohio Service Satellite

LIMA, OHIO, 45801, U.S.A.

TEL: +1-847-478-2500 / FAX: +1-847-478-2650

Minnesota Service Satellite

RICHFIELD, MINNESOTA, 55423, U.S.A.

TEL: +1-847-478-2500 / FAX: +1-847-478-2650

Western Region Service Center

5665 PLAZA DRIVE, CYPRESS, CALIFORNIA, 90630, U.S.A.

TEL: +1-714-220-4796 / FAX: +1-714-229-3818

North CA Service Satellite

PORTLAND, OREGON, 97086, U.S.A.

TEL: +1-714-220-4796 / FAX: +1-714-229-3818

Eastern Region Service Center

200 COTTONTAIL LANE

SOMERSET, NEW JERSEY, 08873, U.S.A.

TEL: +1-732-560-4500 / FAX: +1-732-560-4531

Western Pennsylvania Service Satellite

ERIE, PENNSYLVANIA, 16510, U.S.A.

TEL: +1-814-897-7820 / FAX: +1-814-987-7820

Southern Region Service Center

2810 PREMIERE PARKWAY SUITE 400, DULUTH, GEORGIA, 30097, U.S.A.

TEL: +1-678-258-4500 / FAX: +1-678-258-4519

Northern Texas Service Satellite

1000, NOLEN DRIVE SUITE 200, GRAPEVINE, TEXAS, 76051, U.S.A.

TEL: +1-817-251-7468 / FAX: +1-817-416-5000

Southern Texas Service Satellite

FRIENDSWOOD, TEXAS, 77546, U.S.A.

TEL: +1-832-573-0787 / FAX: +1-678-573-8290

Central Florida Service Satellite

SATELITE BEACH, FLORIDA, 32937, U.S.A.

TEL: +1-321-610-4436 / FAX: +1-321-610-4437

Canadian Region Service Center

4299 14TH AVENUE MARKHAM, ONTARIO, L3R 0J2, CANADA

TEL: +1-905-475-7728 / FAX: +1-905-475-7935

Mexico City Service Center

MARIANO ESCOBEDO 69 TLALNEPANTLA, 54030

EDO. DE MEXICO

TEL: +52-55-9171-7662 / FAX: +52-55-9171-7649

Monterrey Service Satellite

ARGENTINA 3900, FRACC. LAS TORRES, MONTERREY, N.L., 64720, MEXICO

TEL: +52-81-8365-4171 / FAX: +52-81-8365-4171

Brazil Service Center

ACESSO JOSE SARTORELLI, KM 2.1 CEP 18550-000, BOITUVA-SP, BRAZIL

TEL: +55-15-3363-9900 / FAX: +55-15-3363-9911

Brazilian's Sites Service Center

CITIES OF PORTO ALEGRE AND CAXIAS DO SUL BRAZIL

CITIES OF SANTA CATARINA AND PARANA STATES

TEL: +55-15-3363-9927

EUROPE

MITSUBISHI ELECTRIC EUROPE B.V. (EUROPE FA CENTER)

GOTHAER STRASSE 10, 40880 RATINGEN, GERMANY

TEL: +49-2102-486-0 / FAX: +49-2102-486-5910

Germany Service Center

KURZE STRASSE. 40, 70794 FILDERSSTADT-BONLANDEN, GERMANY

TEL: + 49-711-3270-010 / FAX: +49-711-3270-0141

France Service Center

25, BOULEVARD DES BOUVETS, 92741 NANTERRE CEDEX FRANCE

TEL: +33-1-41-02-83-13 / FAX: +33-1-49-01-07-25

France (Lyon) Service Satellite

120, ALLEE JACQUES MONOD 69800 SAINT PRIEST

TEL: +33-1-41-02-83-13 / FAX: +33-1-49-01-07-25

Italy Service Center

VIALE COLLEONI 7-PALAZZO SIRIO CENTRO DIREZIONALE COLLEONI,

20041 AGRATE BRIANZA MILANO ITALY

TEL: +39-039-60531-342 / FAX: +39-039-6053-206

Italy (Padova) Service Sattelite

VIA SAVELLI 24-35129 PADOVA ITALY

TEL: +39-039-60531-342 / FAX: +39-039-6053-206

U.K. Service Center

TRAVELLERS LANE, HATFIELD, HERTFORDSHIRE, AL10 8XB, U.K.

TEL: +44-1707-27-6100 / FAX: +44-1707-27-8992

Spain Service Center

CTRA. DE RUBI, 76-80-APDO. 420

08190 SAINT CUGAT DEL VALLES, BARCELONA SPAIN

TEL: +34-935-65-2236 / FAX: +34-935-89-1579

Poland Service Center

UL.KRAKOWSKA 50, 32-083 BALICE, POLAND

TEL: +48-12-630-4700 / FAX: +48-12-630-4727

Poland (Wroclaw) Service Center

UL.KOBIERZYCKA 23, 52-315 WROCLAW, POLAND

TEL: +48-71-333-77-53 / FAX: +48-71-333-77-53

Turkey Service Center

DARULACEZE CAD. FAMAS IS MERKEZI A BLOK No.43 KAT 2 80270 OKMEYDANI

ISTANBUL, TURKEY

TEL: +90-212-320-1640 / FAX: +90-212-320-1649

Czech Republic Service Center

TECHNOLOGICKA 374/6, 708 00 OSTRAVA-PUSTKOVEC, CZECH REPUBLIC

TEL: +420-59-5691-185 / FAX: +420-59-5691-199

Russia Service Center

213, B.NOVODIMITROVSKAYA STR., 14/2, 127015 MOSCOW, RUSSIA

TEL: +7-495-748-0191 / FAX: +7-495-748-0192

Sweden Service Center

STRANDKULLEN, 718 91 FROVI, SWEDEN

TEL: +46-581-700-20 / FAX: +46-581-700-75

Bulgaria Service Center

4 A. LYAPCHEV BOUL., 1756 - SOFIA, BULGARIA

TEL: +359-2-8176000 / FAX: +359-2-9744061

Ukraine (Kharkov) Service Center

APTEKARSKIY PEREUOK 9-A, OFFICE 3, 61001 KHARKOV, UKRAINE

TEL: +38-57-732-7744 / FAX: +38-57-731-8721

Ukraine (Kiev) Service Center

4-B, M. RASKOVOYI STR., 02660 KIEV, UKRAINE

TEL: +38-044-494-3355 / FAX: +38-044-494-3366

Belarus Service Center

703, OKTYABRSKAYA STR., 16/5, 220030 MINSK, BELARUS

TEL: +375-17-210-4626 / FAX: +375-17-227-5830

ASEAN

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

Singapore Service Center

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

Indonesia Service Center

WISMA NUSANTARA 14TH FLOOR JL. M.H. THAMRIN 59, JAKARTA 10350 INDONESIA
TEL: +62-21-3917-144 / FAX: +62-21-3917-164

Malaysia (KL) Service Center

60, JALAN USJ 10 /1B 47620 UEP SUBANG JAYA SELANGOR DARUL EHSAN, MALAYSIA
TEL: +60-3-5631-7605 / FAX: +60-3-5631-7636

Malaysia (Johor Baru) Service Center

No.16, JALAN SHAH BANDAR 1, TAMAN UNGKU TUN AMINAH, 81300 SKUDAI, JOHOR MALAYSIA
TEL: +60-7-557-8218 / FAX: +60-7-557-3404

Vietnam Service Center-1

47-49 HOANG SA ST. DAKAO WARD, DIST. 1, HO CHI MINH CITY, VIETNAM
TEL: +84-8-910-4763 / FAX: +84-8-910-2593

Vietnam Service Center-2

THUAN KIEN PLAZA 190 HONG BANG ROAD. TOWER C. SUITE 3002. DIST. 5,
HO CHI MINH CITY, VIETNAM
TEL: +84-8-240-3587 / FAX: +84-8-726-7968

Vietnam (Hanoi) Service Center

5TH FL., 93B KIM LIEN ST., PHUONG LIEN WARD, DONG DA DIST.
TEL: +84-8-573-7646 / FAX: +84-4-573-7650

Philippines Service Center

UNIT No.411, ALABAMG CORPORATE CENTER KM 25. WEST SERVICE ROAD
SOUTH SUPERHIGHWAY, ALABAMG MUNTINLUPA METRO MANILA, PHILIPPINES 1771
TEL: +63-2-807-2416 / FAX: +63-2-807-2417

MITSUBISHI ELECTRIC AUTOMATION (THAILAND) CO., LTD. (THAILAND FA CENTER)
BANG-CHAN INDUSTRIAL ESTATE No.111 SOI SERITHAI 54

T.KANNAYAO, A.KANNAYAO, BANGKOK 10230, THAILAND
TEL: +66-2906-8255 / FAX: +66-2906-3239

Thailand Service Center

898/19, 20, 21, 22 S.V. CITY BUILDING OFFICE TOWER 1 FLOOR 7
RAMA RD BANGPONGPANG, YANNAWA, BANGKOK 10120. THAILAND
TEL: +66-2-682-6522 / FAX: +66-2-682-9750

INDIA

MITSUBISHI ELECTRIC ASIA PVT LTD.

FIRST & SECOND FLOOR, AVR BASE, MUNICIPAL No.BC-308,
HENNURE BANASWADI ROAD, HRBR RING ROAD, BANGALORE-560 043, INDIA
TEL: +91-80-4020-1600 / FAX: +91-80-4020-1699

India (Pune) Service Center

EL-3, J BLOCK, M.I.D.C., BHOSARI PUNE 411026, INDIA
TEL: +91-20-2710-2000 / FAX: +91-20-2710-2185

India (Bangalore) Service Center

S 615, 6TH FLOOR, MANIPAL CENTER, BANGALORE 560001, INDIA
TEL: +91-80-509-2119 / FAX: +91-80-532-0480

India (Delhi) Service Center

1197, SECTOR 15 PART-2, OFF DELHI-JAIPUR HIGHWAY BEHIND 32nd MILESTONE
GURGAON 122001, INDIA
TEL: +91-98-1024-8895

OCEANIA

MITSUBISHI ELECTRIC AUSTRALIA LTD.

Oceania Service Center

348 VICTORIA ROAD, RYDALMERE, N.S.W. 2116, AUSTRALIA
TEL: +61-2-9684-7269 / FAX: +61-2-9684-7245

CHINA

MITSUBISHI ELECTRIC AUTOMATION (SHANGHAI) LTD. (CHINA FA CENTER)

China (Shanghai) Service Center

4/F ZHI FU PLAZA, NO. 80 XIN CHANG ROAD,
SHANGHAI 200003, CHINA
TEL: +86-21-2322-3030 / FAX: +86-21-2322-3000

China (Beijing) Service Center

9/F, OFFICE TOWER1, HENDERSON CENTRE, 18 JIANGUOMENNEI AVENUE
DONGCHENG DISTRICT, BEIJING, CHINA 100005
TEL: +86-10-6518-8830 / FAX: +86-10-6518-8030

China (Tianjin) Service Center

B-2-801-802, YOUYI BUILDING. 50 YOUYI ROAD, HEXI DISTRICT,
TIANJIN, CHINA 300061
TEL: +86-22-2813-1015 / FAX: +86-22-2813-1017

China (Chengdu) Service Center

BLOCK B-1, 23F, CHUAN XIN MANSION, 18 SECTION 2,
RENMIN ROAD SOUTH, CHENGDU, SICHUAN, CHINA 610016
TEL: +86-28-8619-9730 / FAX: +86-28-8619-9805

China (Shenzhen) Service Center

ROOM 2512-2516, GREAT CHINA INTERNATIOANL EXCHANGE SQUARE, JINTIAN RD.S.,
FUTIAN DISTRICT, SHENZHEN, CHINA 518034
TEL: +86-755-2399-8272 / FAX: +86-755-8218-4776

KOREA

MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. (KOREA FA CENTER)

Korea Service Center

1480-6, GAYANG-DONG, GANGSEO-GU SEOUL 157-200, KOREA
TEL: +82-2-3660-9607 / FAX: +82-2-3663-0475

Korea Busan Service Satellite

#405 BUSAN INDUSTRIAL SUPPLIES MARKET BLDG, 578 KWAEBOP-DONG, SASANG-GU,
BUSAN 617-726, KOREA
TEL: +82-51-319-3747 / FAX: +82-51-319-3768

TAIWAN

MITSUBISHI ELECTRIC TAIWAN CO., LTD. (TAIWAN FA CENTER)

TAIWAN (Taichung) Service Center

No.8-1, GONG YEH 16TH RD., TAICHUNG INDUSTRIAL PARK TAICHUNG CITY, TAIWAN R.O.C
TEL: +886-4-2359-0688 / FAX: +886-4-2359-0689

TAIWAN (Taipei) Service Center

3TH. FLOOR, No.122 WUKUNG 2ND RD., WU-KU HSIANG, TAIPEI HSIEN, TAIWAN R.O.C
TEL: +886-2-2299-2205 / FAX: +886-2-2298-1909

TAIWAN (Tainan) Service Center

2F (C), 1-1, CHUNGHWA-RD., YONGKANG CITY, TAINAN HSIEN, TAIWAN R.O.C
TEL: +886-6-313-9600 / FAX: +886-6-313-7713

Notice

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

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

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