MITSUBISHI ELECTRIC

Changes for the Better

MITSUBISHI CNC

70 Series

Connection Manual

IB-1500254(ENG)-D

Introduction

This manual covers the items required for installing and connecting the MITSUBISHI CNC 70 Series. 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.
The unit names, cable names and various specifications are subject to change without notice. Please confirm these before placing an order.

⚠ 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.

The numerical control unit is configured of the control unit, display unit, operation board, servo drive unit, spindle drive unit, power supply unit + driver, servomotor, and spindle motor, etc.

In this manual, the following items are generically called the "controller".
- Control unit
- Display unit
- Operation board
- Numerical control unit peripheral devices (input/output unit, safety unit)

In this manual, the following items are generically called the "drive unit".
- Servo drive unit
- Spindle drive unit
- Power supply unit + driver

In this manual, the following items are generically called the "motor".
- Servo motor
- Spindle motor

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".

⚠**DANGER**	When the user could be subject to imminent fatalities or serious injuries if handling is mistaken.
⚠**WARNING**	When the user could be subject to fatalities or serious injuries if handling is mistaken.
⚠**CAUTION**	When the user could be subject to 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.

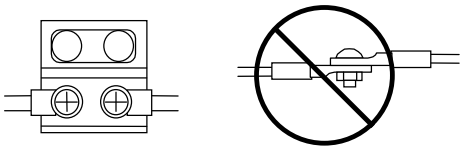
For Safe Use

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
⚠ When transporting or installing a built-in IPM spindle or linear servomotor, be careful so that your hand or property will not be trapped in the motors or other metal objects. Also keep the devices with low magnetic tolerance away from the product.

⚠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 bursting, 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 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.)

⚠ CAUTION
⚠ 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 motor with the cooling fan.
⚠ Install the controller's display section and operation board section on the spot where cutting oil will not reach.
⚠ 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.
⚠ Always install an appropriate breaker per each power supply unit. A breaker cannot be shared for multiple power supply units.

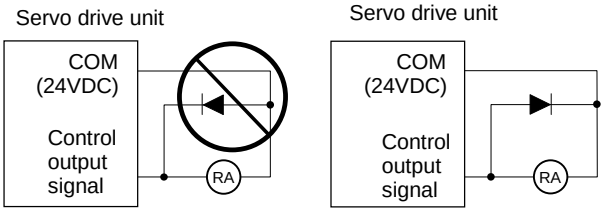
⚠ CAUTION

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 serially 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. The motor could come off during operation if insecurely fixed.

Always treat the shield cables indicated in the Connection Manual with grounding measures such as cable clamps.

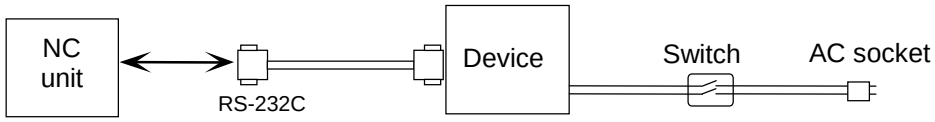
Separate the signal wire from the drive line or power line when wiring.

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

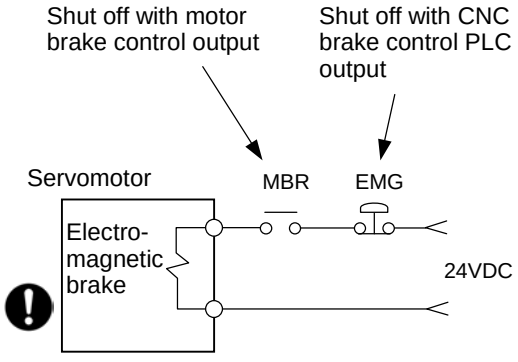
⚠ CAUTION

- **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 servomotor 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.**
- **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.**

(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.**



⚠ CAUTION
⚠ 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.
⚠ 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.

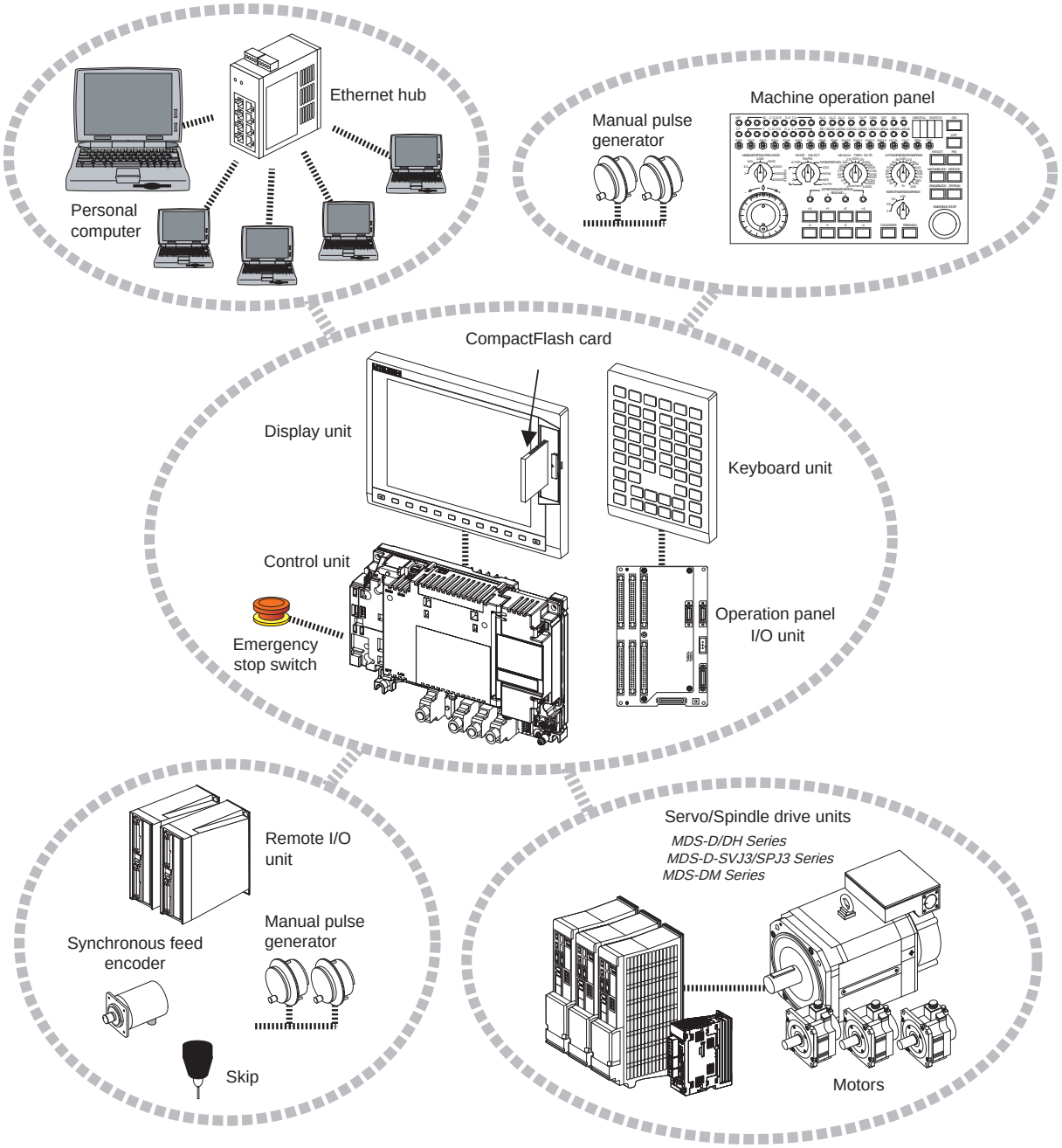
Please, help us to conserve the environment we live in!

Contents

1

System Configuration

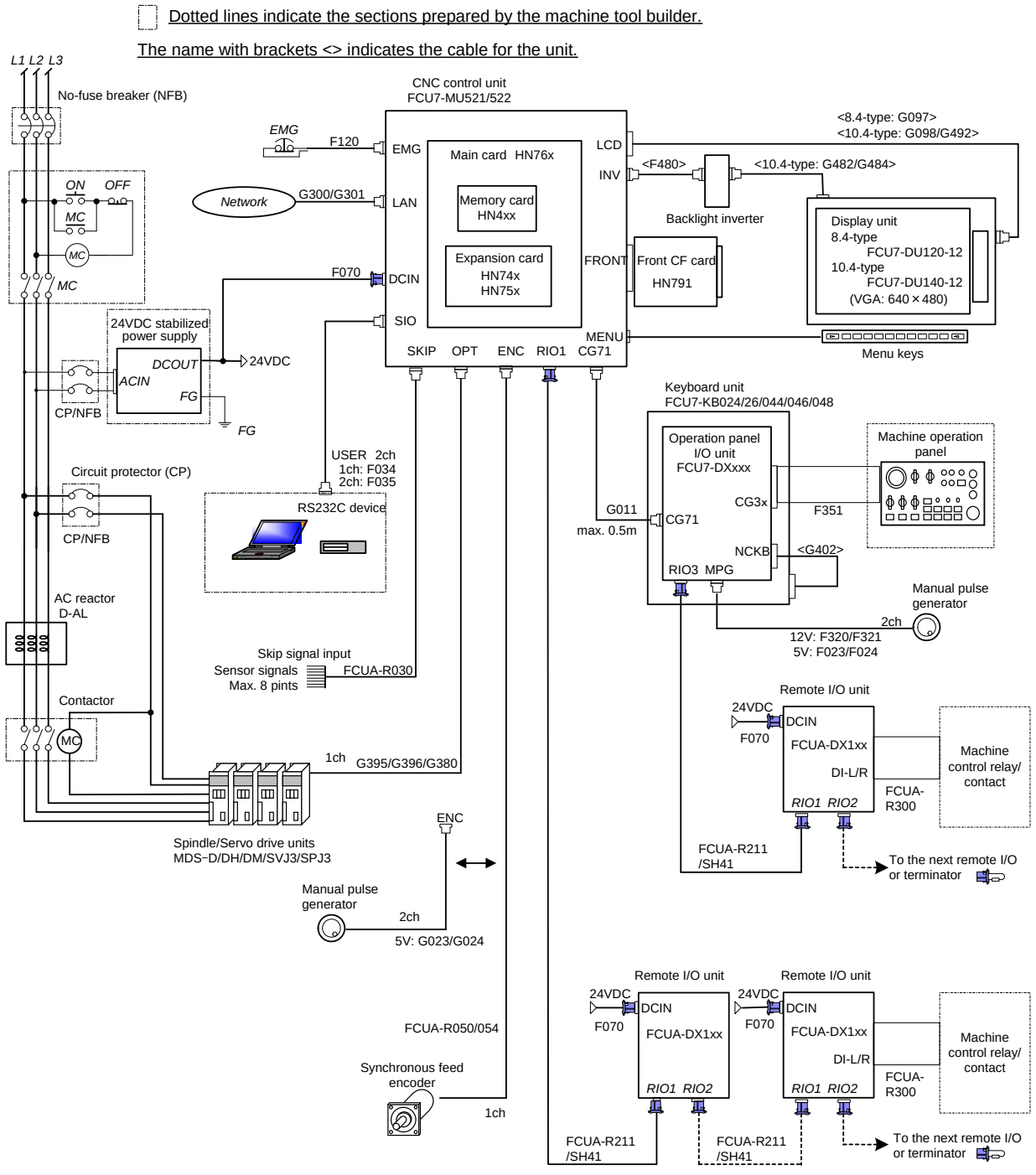
1.1 System Basic Configuration Drawing



(Note 1) Control unit is mounted on the back side of the display unit.
(Note 2) Operation panel I/O unit is mounted on the back side of the keyboard unit.

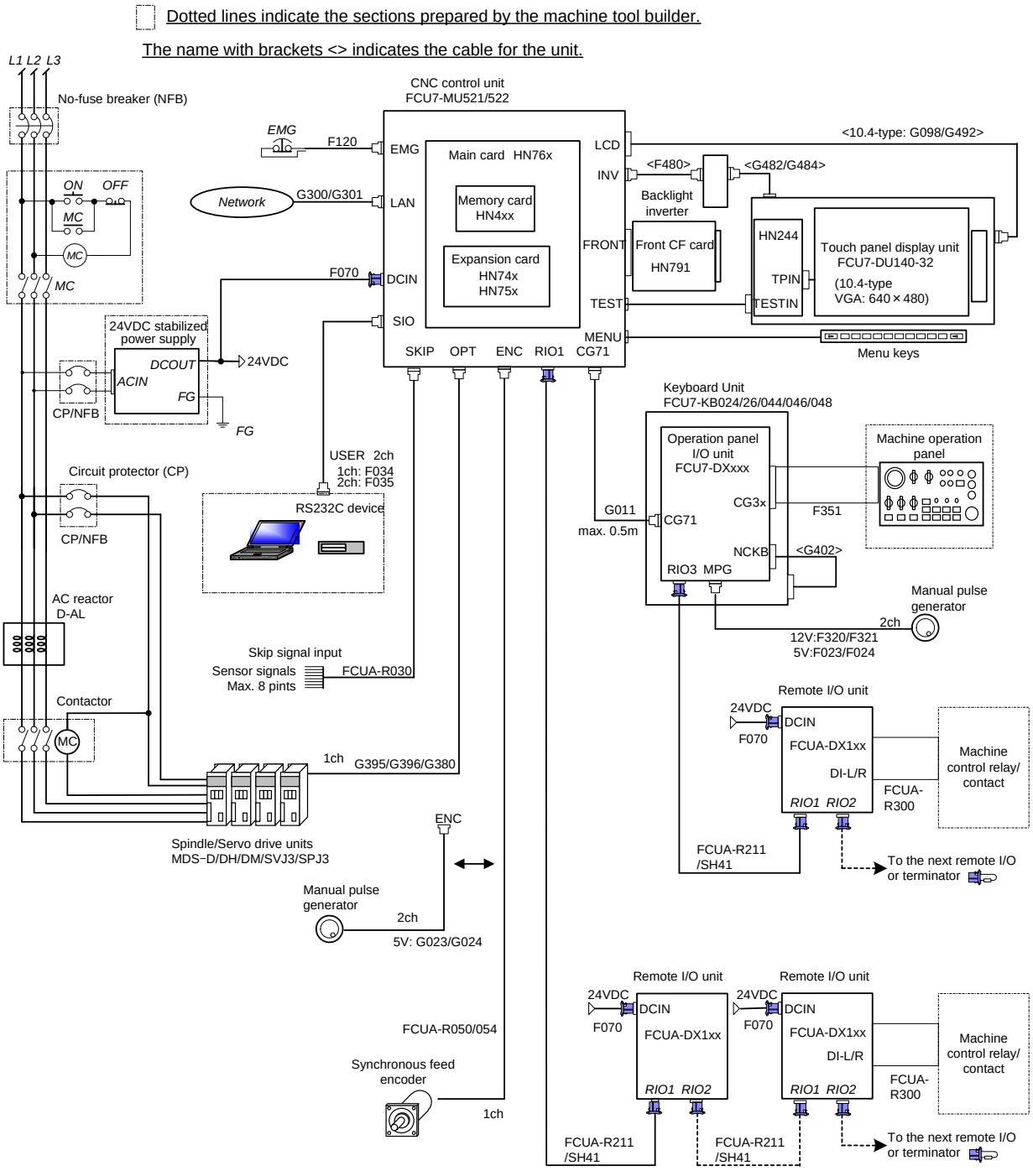
1.2 General Connection Diagram

1.2.1 Without Touch Panel



(Note) As for drive section, only the brief diagram is given here. Refer to the drive unit's manual for details.

1.2.2 With Touch Panel



(Note) As for drive section, only the brief diagram is given here. Refer to the drive unit's manual for details.

1.3 List of Units and Cables

1.3.1 List of Units

Classification	Components	Type	Remarks
[Control unit] NC functions and display controller For M70 TypeB system	Main control card (HN761) Memory card (HN451) CF I/F card (HN791)	FCU7-MU521	Export Trade Control Ordinance and Foreign Trade Ordinance noncompliant unit
[Control unit] NC functions and display controller For M70 TypeA system	Main control card (HN761) Memory card (HN451) Expansion card (HN751) CF I/F card (HN791)	FCU7-MU522	Export Trade Control Ordinance and Foreign Trade Ordinance noncompliant unit
[Display unit] 8.4-type color TFT (VGA:640*480)	LCD panel Backlight inverter (84PW031) Menu keys Inverter cable (G480) LCD cable (G097)	FCU7-DU120-12	CF card I/F is normally equipped w ith the control unit
[Display unit] 10.4-type color TFT (VGA:640*480)	LCD panel Backlight inverter (104PW161) Menu keys Inverter cable (G480) LCD cable (G098/G492) Backlight cable (G482/G484)	FCU7-DU140-12	CF card I/F is normally equipped w ith the control unit
[Display unit] 10.4-type color TFT touch panel (VGA:640*480)	LCD panel Backlight inverter (104PW161) Menu keys Touch panel Touch panel control card (HN244) Touch panel cable (G422) Inverter cable (G480) LCD cable (G098/G492) Backlight cable (G482/G484)	FCU7-DU140-32	CF card I/F is normally equipped w ith the control unit
[Operation panel I/O unit] DI 24V/0V common input DO Sink output	Base card (HN341) Terminator (R-TM)	FCU7-DX710	DI: 64-points 24V/0V common type DO: 64-points sink type MPG:2ch Occupied stations (fixed): 1, 2, 7, 8 RIO3 extensible stations: 3, 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Source output	Base card (HN351) Terminator (R-TM)	FCU7-DX711	DI: 64-points 24V/0V common type DO: 64-points source type MPG:2ch Occupied stations (fixed): 1, 2, 7, 8 RIO3 extensible stations: 3, 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Sink output	Base card (HN341) Terminator (R-TM) Add-on card (HN361)	FCU7-DX720	DI: 96-points 24V/0V common type DO: 80-points sink type MPG:2ch AO: 1 point Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Source output	Base card (HN351) Terminator (R-TM) Add-on card (HN371)	FCU7-DX721	DI: 96-points 24V/0V common type DO: 80-points source type MPG:2ch AO: 1 point Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Sink output	Base card (HN341) Terminator (R-TM) Add-on card (HN362)	FCU7-DX730	DI: 96-points 24V/0V common type DO: 96-points sink type MPG: 2ch Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Source output	Base card (HN351) Terminator (R-TM) Add-on card (HN372)	FCU7-DX731	DI: 96-points 24V/0V common type DO: 96-points source type MPG:2ch Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6

Classification	Components	Type	Remarks
[Keyboard unit] 8.4-type display keyboard Sheet keys	Escutcheon, key switch G402 cable	FCU7-KB024	Connect with G011 cable from control unit Mounting method: Mount on front panel
[Keyboard unit] 8.4-type display keyboard Clear keys	Escutcheon, key switch G402 cable	FCU7-KB026	Connect with G011 cable from control unit Mounting method: Mount on front panel
[Keyboard unit] 10.4-type display keyboard Sheet keys	Escutcheon, key switch G402 cable	FCU7-KB044	Connect with G011 cable from control unit Mounting method: Mount on front panel
[Keyboard unit] 10.4-type display keyboard	Escutcheon, key switch G402 cable	FCU7-KB046	Connect with G011 cable from control unit Mounting method: Mount on front panel
[Keyboard unit] 10.4-type display keyboard Clear keys	Escutcheon, key switch G402 cable	FCU7-KB048	Connect with G011 cable from control unit Mounting method: Mount on front panel
[Remote I/O unit] 24V/0V common input + Sink output	RX311	FCUA-DX100	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points sink type (non-insulation) Number of occupied stations: 1
[Remote I/O unit] 24V/0V common input + Sink output	RX311+RX321-1	FCUA-DX110	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points sink type (non-insulation) Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Sink output + Analog output	RX311+RX321	FCUA-DX120	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points sink type (non-insulation) AO: 1 point Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Sink output + Analog input/output	RX311+RX341	FCUA-DX140	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points sink type (non-insulation) AI: 4 points AO: 1 point Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Source output	RX312	FCUA-DX101	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points source type (non-insulation) Number of occupied stations: 1
[Remote I/O unit] 24V/0V common input + Source output	RX312+RX322-1	FCUA-DX111	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points source type (non-insulation) Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Source output + Analog output	RX312+RX322	FCUA-DX121	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points source type (non-insulation) AO: 1 point Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Source output + Analog input/output	RX312+RX341	FCUA-DX141	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points source type (non-insulation) AI: 4 points AO: 1 point Number of occupied stations: 2

Classification	Components	Type	Remarks
[Scan I/O card] (Source type)	HR357	HR357	Scan DI/DO = 64 points/64 points DI/DO = 32 points/32 points
[Scan I/O card] (Sink type)	HR347	HR347	Scan DI/DO = 64 points/64 points DI/DO = 32 points/32 points
[CC-Link unit] CC-Link × 1ch	HN746	FCU7-HN746	To be mounted on the NC control unit
[External power supply unit] External power supply with power supply ON/OFF function	Power supply card Case set	PD25	Input 200VAC Output 24VDC (3A)
[Manual pulse generator]	UFO-01-2Z9 (Produced by NIDEC NEMICON)	UFO-01-2Z9 (Recommended)	Input 5VDC 100pulse/rev
[Manual pulse generator]	HD60	HD60	Input 12VDC 25pulse/rev
[Encoder] Synchronous feed encoder	OSE1024-3-15-68	OSE1024-3-15-68	Input 5VDC 1024pulse/rev

(Note 1) Operation panel I/O unit is mounted on the back side of the keyboard unit FCU7-KB024/ KB026/ KB044/ KB046/ KB048.

(Note 2) Operation panel I/O units for 700 Series (FCU7-DX67x/ FCU7-DX77x) are not available.

(Note 3) DI: Digital input signals, DO: Digital output signals, AI: Analog input signals, AO: Analog output signals

1.3.2 Durable Parts

Durable parts	Part type
Control unit battery	Q6BAT
Backlight for FCU7-DU120-12	84LHS06
Backlight for FCU7-DU140-12/32	104LHS39 (for unit version "*")
	104LHS52 (for unit version "A" and later)
Touch panel protective sheet for FCU7-DU140-32	BN939B036G51
Key sheet for FCU7-KB024/44	BN330B532G51

1.3.3 Replacements

Replacements	Part type
Protection fuse	LM40
Front memory interface card CF-70	HN791

1.3.4 List of Cables

Type	Application	Length (m) of cables provided by Mitsubishi	Max. cable length
CNP2E-1-*M	Motor side PLG cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-6P-*M	Motor side detector cable (for A74/ A51)/ Ball screw side detector cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-7P-*M	Motor side detector cable (for A74/ A51)/ Ball screw side detector cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-8P-*M	Motor side detector cable (for A48)/ Ball screw side detector cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-9P-*M	Motor side detector cable (for A48)/ Ball screw side detector cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-D-*M	MDS-B-SD unit cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-HP-*M	MDS-B-HR unit cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
DG21-*M	Battery cable (For drive unit - battery unit)	0.3, 0.5, 1, 5	5m
DG22-*M	Battery cable (For servo drive unit - servo drive unit) * This cable is required to supply the power from the battery unit to multiple drive units.	0.3, 0.5, 1, 5	5m
F023 L*M	Manual pulse generator cable (5V): 1ch (for connection to operation board I/O unit)	1, 2, 3, 5, 8, 10, 15, 20	20m
F024 L*M	Manual pulse generator cable (5V): 2ch (for connection to operation board I/O unit)	1, 2, 3, 5, 8, 10, 15, 20	20m
F034 L*M	RS-232C I/F cable: 1ch	0.5, 1, 2, 3, 5, 8, 10	15m (*)
F035 L*M	RS-232C I/F cable: 2ch	0.5, 1, 2, 3, 5, 8, 10	15m (*)
F070 L*M	24VDC power cable	0.5, 1.5, 3, 5, 8, 10, 15, 20	30m
F110 L*M	24VDC power cable for PD25	0.5, 1.5, 3, 5, 8, 10, 15	15m
F120 L*M	Emergency stop cable	0.5, 1.5, 3, 5, 8, 10, 15, 20	30m
F170 L*M	ON/OFF switch cable for PD25	0.5, 1.5, 3, 5, 8, 10, 15	15m
F221 L*M	Analog output cable	1, 2, 3, 5, 8, 10, 15, 20	30m
F320 L*M	Manual pulse generator cable (12V): 1ch (for connection to operation board I/O unit)	1, 2, 3, 5, 8, 10, 15, 20	50m
F321 L*M	Manual pulse generator cable (12V): 2ch (for connection to operation board I/O unit)	1, 2, 3, 5, 8, 10, 15, 20	50m
F351	DI/DO cable (one side connector) (for operation board I/O unit)	3	50m
FCUA-R030-*M	SKIP input	3, 7	20m
FCUA-R031-*M	Analog input/output	2, 3, 7	30m
FCUA-R050-*M	Encoder input (straight, with connector)	5	30m
FCUA-R054-*M	Encoder input (right angle, with connector)	3, 5, 10, 15, 20	30m
FCUA-R211-*M	Remote I/O (with terminal block)	0.3, 1, 2, 5, 8, 10, 15, 20	30m (*)
FCUA-R300	DI/DO cable (one side connector) (for remote I/O unit)	3	50m
FCUA-R301-*M	DI/DO cable (both side connectors) (for remote I/O unit)	1, 2, 3, 5	50m
G011 L*M	Operation board I/O interface cable	0.5	0.5m
G023 L*M	Manual pulse generator cable (5V): 1ch (for connection to control unit)	1, 2, 3, 5, 8, 10, 15, 20	20m (*)
G024 L*M	Manual pulse generator cable (5V): 2ch (for connection to control unit)	1, 2, 3, 5, 8, 10, 15, 20	20m (*)
G300 L*M	LAN cross cable (Shielded cable is recommended when the length will be 1m or more)	1, 3, 5, 10	10m
G301 L*M	LAN straight cable (Shielded cable is recommended when the length will be 1m or more)	1	1m

Type	Application	Length (m) of cables provided by Mitsubishi	Max. cable length
G380 L*M	Optical communication cable (PCF type with reinforced sheath) (for wiring outside of the panel)	5, 10, 12, 15, 20	20m
G395 L*M	Optical communication cable (POF type with reinforced sheath) (for wiring outside of the panel)	1, 2, 3, 5, 10	10m
G396 L*M	Optical communication cable (POF type without reinforced sheath) (for wiring inside of the panel)	0.3, 0.5, 1, 2, 3, 5	10m
R-TM	Remote I/O Interface terminator	-	-
SH21	Power supply communication cable	0.35, 0.5, 0.7, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, 10, 15, 20, 30	30m
SH41	Remote I/O (between units in a panel)	0.3, 0.5, 0.7	1m (*)

(Note 1) Asterisks "*" in type columns indicate cable length (unit: m).

(Note 2) Lengths indicated with an asterisk (*) in the max. cable length column indicate the maximum cable length when connecting to the control unit via other unit.

1 System Configuration

2

General Specifications

2.1 Environment Conditions

Item	Unit name		Control unit	Display unit	Keyboard unit	Operation panel I/O unit
	Type		FCU7-MU521/522	FCU7-DU120-12/ 140-*2	FCU7-KB024/26/ 44/46/48	FCU7-DX71*/72*/73*
General Specifications	Ambient temperature	During operation	0 to 55C°			
		During storage	-20 to 60C°			
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)			
		Short term	10 to 95% RH (with no dew condensation) (Note 1)			
	Vibration resistance		4.9m/s^2 or less (during operation)			
	Shock resistance		29.4m/s^2 or less (during operation)			
	Working atmosphere		No corrosive gases, dust or oil mist			
Required power specifications	Power voltage		24VDC ±5% Ripple noise 200mV (P-P)	3.3/12VDC	5VDC	3.3/5VDC
				(Provided by the control unit)		
	Power capacity		24V 2.5A	-	-	- (Note 2)
	Instantaneous stop tolerance time		20ms			-
Others	Heating value	(max.)	12.0W	FCU7-DU120-12: 10W FCU7-DU140-*2: 12W	1.0W	Control section: 5W (Note 3)
	Mass	(kg)	1.0	FCU7-DU120-12: 1.5 FCU7-DU140-*2: 2.0	0.8	0.4
	Outline dimension	(mm)	235(width) x 173(height) x 73(depth) (Depth from the plate mounting surface: 60)	FCU7-DU120-12: 260(width) x 200(height) FCU7-DU140-*2: 290(width) x 220(height)	FCU7-KB024/26: 140(width) x 200(height) FCU7-KB044/46: 140(width) x 220(height) FCU7-KB048: 230(width) x 220(height)	120(width) x 180(height)

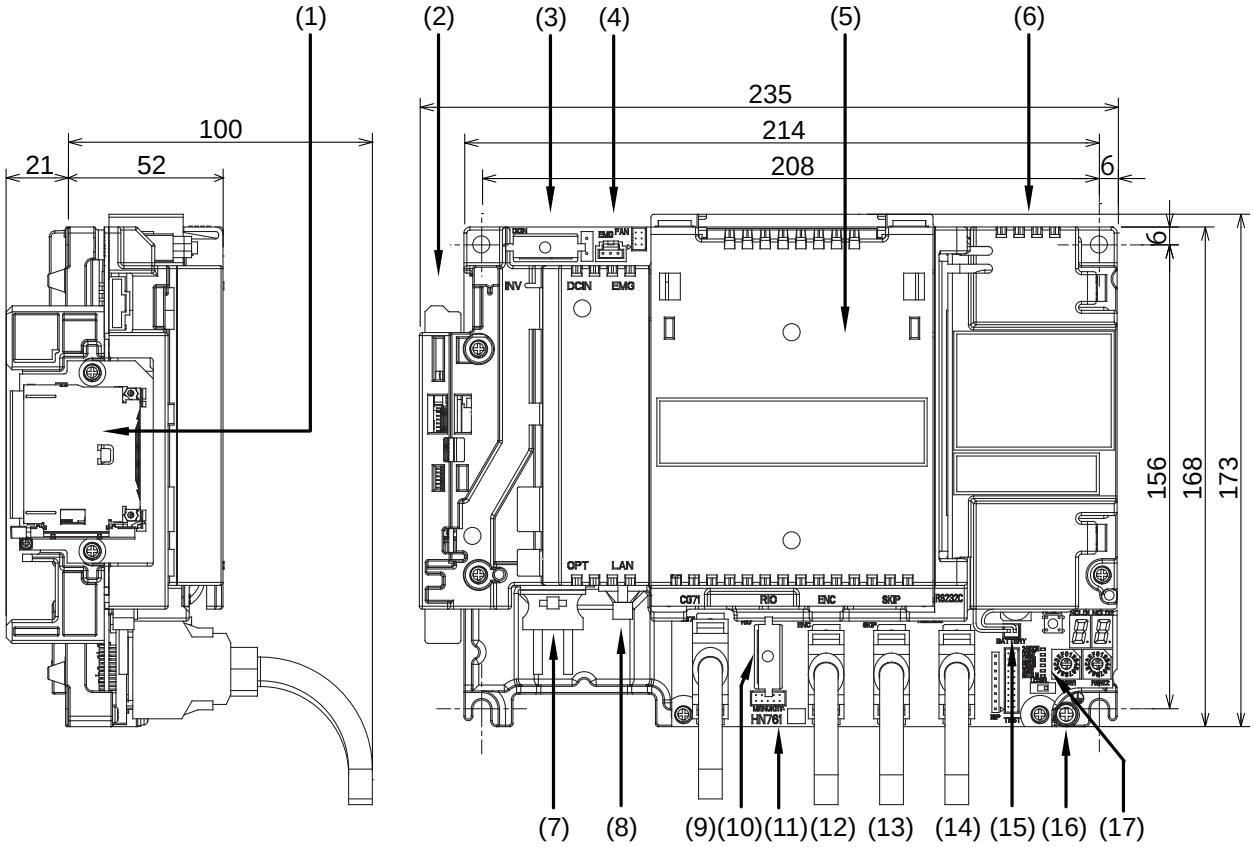
Item	Unit name		Remote I/O unit			
	Type		FCUA-DX10*	FCUA-DX11*	FCUA-DX12*	FCUA-DX14*
General Specifications	Ambient temperature	During operation	0 to 55C°			
		During storage	-20 to 60C°			
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)			
		Short term	10 to 95% RH (with no dew condensation) (Note 1)			
	Vibration resistance		4.9m/s^2 or less (during operation)			
	Shock resistance		29.4m/s^2 or less (during operation)			
	Working atmosphere		No corrosive gases or dust			
Required power specifications	Input power voltage		24VDC±5% Ripple noise 200mV (P-P)			
	Power capacity		24V 0.7A (Note 4)	24V 1.5A (Note 4)		24V 0.7A (Note 4)
	Instantaneous stop tolerance time		-			
Others	Heating value	(max.)	25W (Note 5)	30W (Note 5)		30W (Note 5)
	Mass		0.5kg	0.6kg	0.6kg	0.6kg

(Note 1) "Short term" means within one month.
(Note 2) For the current value of the I/O circuit, calculate with the number of points used and load.
(Note 3) For the heating value of the I/O circuit, calculate with the number of points used.
(Note 4) Allows only the amount to be consumed by control circuit.
(Note 5) Differs according to the number of machine input operation points and the load and number of points connected to the machine output. The maximum value applies when all points are ON.
(Note 6) MITSUBISHI CNC 70 Series, which is an open equipment, must be installed within a sealed metal control panel.

2.2 Control Unit

Dimension and names of parts

[FCU7-MU521/ FCU7-MU522]



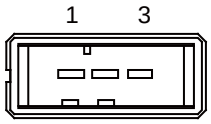
No.	Connector name	Function		No.	Connector name	Function
(1)	CF	Front CF card I/F		(10)	RIO1	Remote I/O unit I/F
(2)	INV	Display unit backlight inverter I/F		(11)	MENUKEY	Menu key I/F
(3)	DCIN	24VDC input		(12)	ENC	Encoder input 1ch (5V manual pulse generator input 2ch)
(4)	EMG	External emergency stop input				
(5)	ADONCCB	Expansion card slot		(13)	SKIP	Skip input 8ch
(6)	LCD	Display unit signal I/F		(14)	SIO	Serial communication (RS-232C) I/F 2ch
(7)	OPT	Optical communication I/F		(15)	BAT	Battery (Q6BAT) I/F
(8)	LAN	Ethernet I/F		(16)	FG	FG terminal
(9)	CG71	Operation panel I/O unit I/F		(17)		LED

(1) Front CF card I/F (CF)

Operation-guaranteed CF cards and SD memory cards (SD-CF adapter is required) are recommended. (Refer to "2.11 Precautions for Use of Commercially Available CF cards".)

(2) Display unit backlight inverter I/F (INV)

(3) 24VDC input (DCIN)



1	I	+24V
2		0V
3		FG

<Cable side connector type>

Connector: 2-178288-3
Contact: 1-175218-5 x3
Recommended manufacturer: Tyco Electronics AMP

(a) Specifications of power supply

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

[Stabilized power supply selection items]

Item		Standard setting
Output	**Voltage fluctuation**	±5% or less of 24VDC
	Ripple noise	200mV (P-P)
Power capacity		2.5A or more
Output holding time		20ms
Overcurrent protection		Required

[Standards]

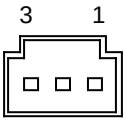
Safety Standards: UL1950, CSA C22.2 No.234 approved, IEC950 compliant
Noise Terminal Voltage: FCC Class A, VCCI-Class A
High Harmonics Current Restrictions: IEC61000-3-2

(Note) 24VDC voltage may drop instantaneously due to rush current at the beginning of 24V power supply to the control unit. The level of voltage drop depends on the capacity of the power supply. Do not share the power supply with the devices that have alarms to warn the voltage drop.

⚠CAUTION

1. Using a stabilized power supply without overcurrent protection may cause the unit's failure due to miswiring of 24V.

(4) External emergency stop input (EMG)



1		FG
2	I	EMG IN
3	O	+24V

* Be sure to connect EMG terminal cable (G123) to the connector when not used.

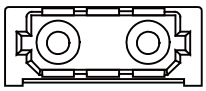
<Cable side connector type>

Connector: 51030-0330
Contact: 50084-8160 x3
Recommended manufacturer: MOLEX

(5) Expansion card slot (ADONCCB)

(6) Display unit signal I/F (LCD)

(7) Optical communication I/F (OPT)



<Cable side connector type>

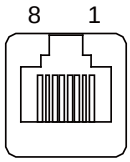
(PCF type)

Connector: CF-2D101-S
Recommended manufacturer: Japan Aviation Electronics

(POF type)

Connector: PF-2D101
Recommended manufacturer: Japan Aviation Electronics

(8) Ethernet I/F (LAN)



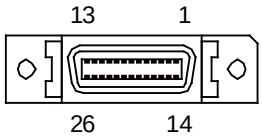
1	O	TD+
2	O	TD-
3	I	RD+
4		
5		
6	I	RD-
7		
8		

* Connect connector case with FG pattern.
* Use cross cable (G300) when directly connecting a device such as a personal computer to the unit.

<Cable side connector type>

Connector: 5-569550-3
Recommended manufacturer: Tyco Electronics AMP

(9) Operation panel I/O unit I/F (CG71)



1		GND	**14**		GND
2		5V	**15**		5V
3		5V	**16**		3.3V
4		GND	**17**		GND
5	O	KBCS0*	**18**	O	KBCS1*
6	O	KBCS2*	**19**	O	KBAD0
7	O	KBAD1	**20**	O	KBAD2
8	I	KBD0	**21**	I	KBD1
9	I	KBD2	**22**	I	KBD3
10	O	KBRES*	**23**	O	RDYOUT*
11	O	BUZOUT*	**24**		3.3V
12	I/O	TXRX3	**25**	I/O	TXRX3*
13	O	SCAN36	**26**	O	SCAN37

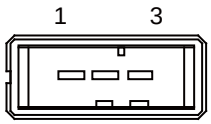
* Connect connector case with FG pattern.

<Cable side connector type>

Plug: 10126-3000VE
Shell: 10326-52F0-008
Recommended manufacturer: Sumitomo 3M

(10) Remote I/O unit I/F (RIO1)

Up to eight remote I/O stations can be connected.



1	I/O	TXRX1
2	I/O	TXRX1*
3		0V

<Cable side connector type>

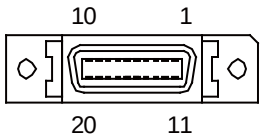
Connector: 1-178288-3

Contact: 1-175218-2 x3

Recommended manufacturer: Tyco Electronics AMP

(11) Menu key I/F (MENUKEY)

(12) Encoder input 1ch/ 5V manual pulse generator input 2ch (ENC)



1		0V	**11**		0V
2	I	ENC1C	**12**	I	ENC1C*
3	I	ENC1B	**13**	I	ENC1B*
4	I	ENC1A	**14**	I	ENC1A*
5		0V	**15**		0V
6	O	5V	**16**	O	5V
7	I	HA2A	**17**	I	HA2B
8	I	HA1A	**18**	I	HA1B
9		NC	**19**		NC
10	O	5V	**20**	O	5V

* Connect connector case with FG pattern.

<Cable side connector type>

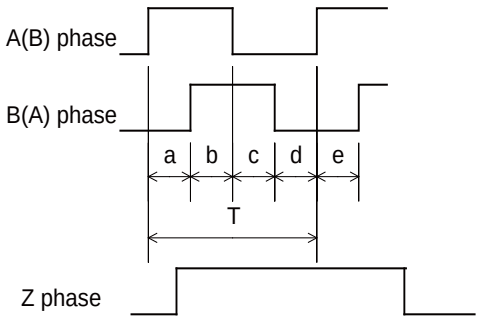
Plug: 10120-3000VE

Shell: 10320-52F0-008

Recommended manufacturer: Sumitomo 3M

(a) Synchronous feed encoder input conditions

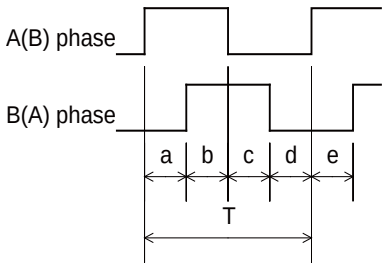
Input pulse signal type	A and B phases (with phase difference 90°), Z phase (Refer to the waveform below.)
Input signal voltage	H level 3.5V to 5.25V L level 0V to 0.5V
Voltage of encoder power supply	5VDC±10%
Current consumption	200mA or less
Number of pulses per rotation	1024 pulse/rev
Cable length	50m or less



a.b.c.d.e: A phase or B phase rising edge (falling edge) phase difference = T/4 ± T/10

(b) 5V manual pulse generator input conditions

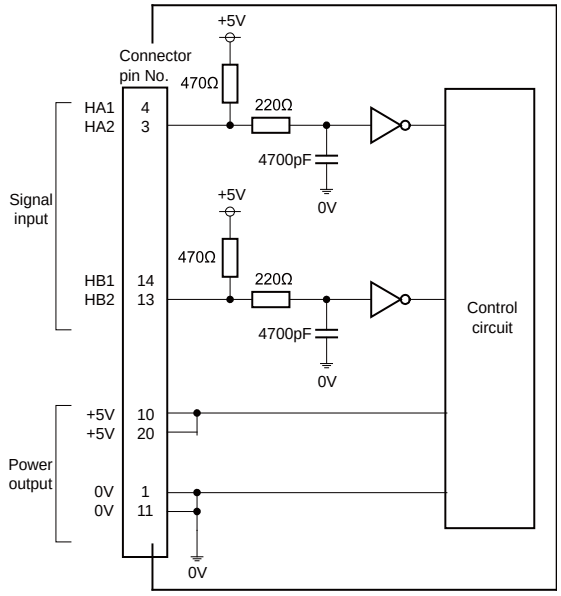
Input pulse signal type	A and B phases (with phase difference 90°) (Refer to the waveform below.)
Input signal voltage	H level 3.5V to 5.25V L level 0V to 0.5V
Max. input pulse frequency	100kHz
Pulse generators power supply voltage	5VDC±10%
Current consumption	100mA or less
Number of pulses per rotation	25 pulse/rev or 100 pulse/rev
Cable length	20m or less



a.b.c.d.e: A phase or B phase rising edge (falling edge) phase difference = T/4 ± T/10

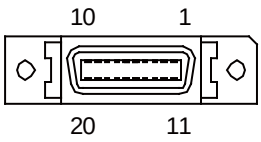
T: A or B phase cycle (Min. 10 μ s)

(c) 5V manual pulse generator input/output circuit



When using the synchronous feed encoder and the manual pulse generator at the same time, connect the manual pulse generator to the operation panel I/O unit or use a distribution cable made by the machine tool builder.

(13) Skip input 8ch (SKIP)



1		0V	**11**		0V
2	I	SKIP0	**12**	I	SKIP1
3	I	SKIP2	**13**	I	SKIP3
4		NC	**14**		NC
5		0V	**15**		0V
6		NC	**16**		NC
7	I	SKIP4	**17**	I	SKIP5
8	I	SKIP6	**18**	I	SKIP7
9		NC	**19**		NC
10		NC	**20**		NC

* Connect connector case with FG pattern.

<Cable side connector type>

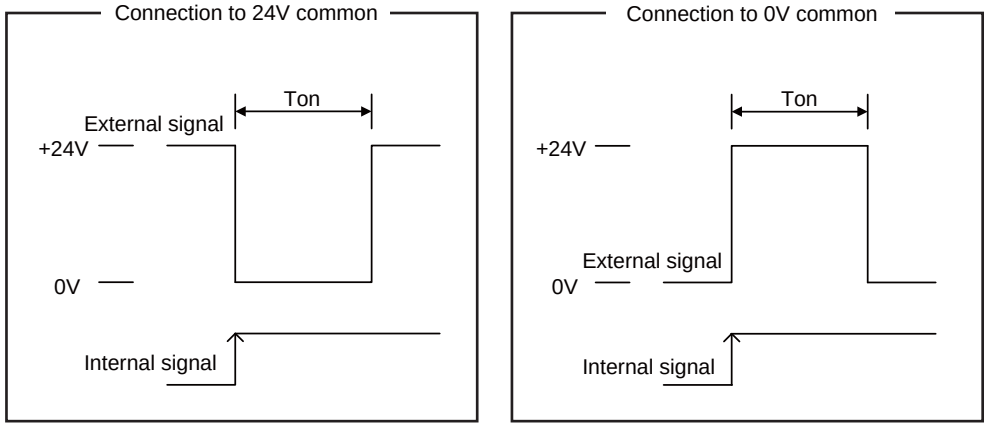
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: Sumitomo 3M

(a) Skip signal input conditions

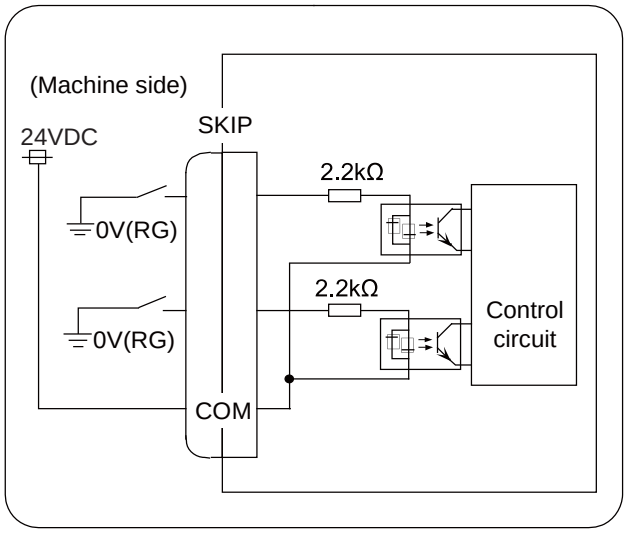
Use the input signal within the following condition ranges.

Input voltage at external contact ON	18V or more, 25.2V or less
Input current at external contact ON	6mA or more
Input voltage at external contact OFF	4V or less
Input current at external contact OFF	2mA or less
Input signal holding time (Ton)	2ms or more
Internal response time	0.08ms or less
Machine side contact capacity	+30V or more, 16mA or more

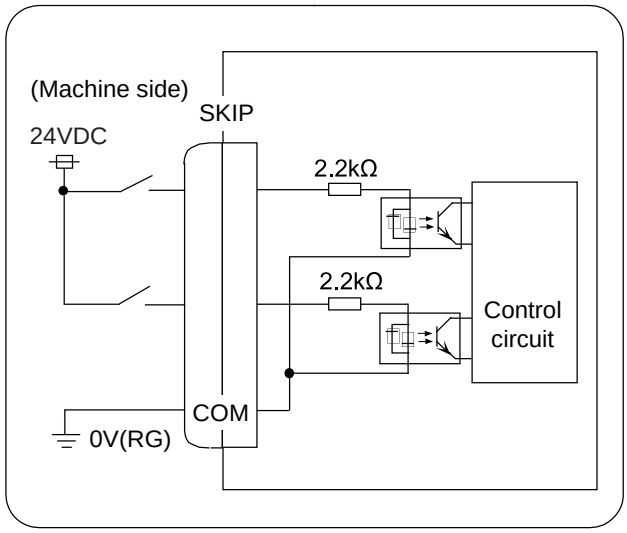
(Note) "Input voltage at external contact ON" means the voltage between the external input signal and the COM terminal.



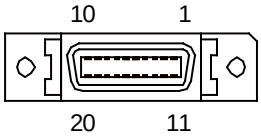
Connection to 24V common



Connection to 0V common



(14) Serial communication (RS-232C) I/F 2ch (SIO)



1		0V	**11**		0V
2	I	RD1(RXD1)	**12**	O	SD1(TXD1)
3	I	CS1(CTS1)	**13**	O	RS1(RTS1)
4	O	DR1(DSR1)	**14**	I	ER1(DTR1)
5		0V	**15**		0V
6		NC	**16**		NC
7	I	RD2(RXD2)	**17**	O	SD2(TXD2)
8	I	CS2(CTS2)	**18**	O	RS2(RTS2)
9	O	DR2(DSR2)	**19**	I	ER2(DTR2)
10		NC	**20**		NC

* Connect connector case with FG pattern.

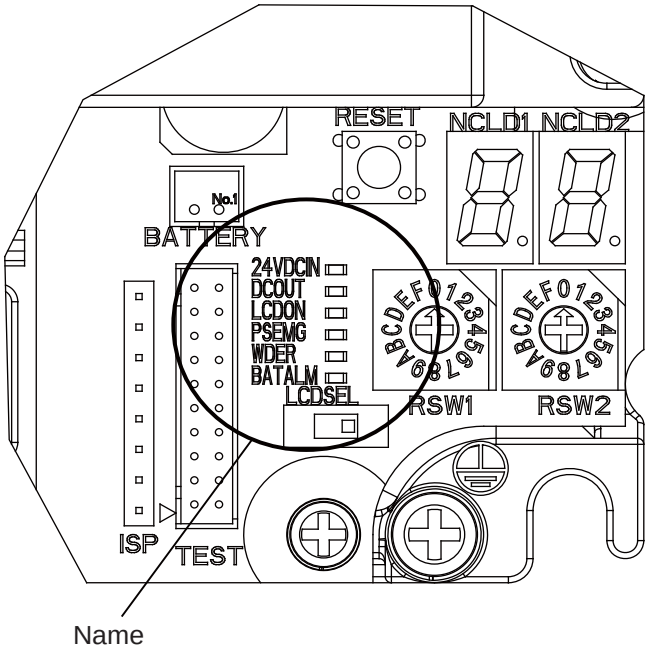
<Cable side connector type>

Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: Sumitomo 3M

(15) Battery (Q6BAT) I/F (BAT)

(16) FG terminal (FG)

(17) LED

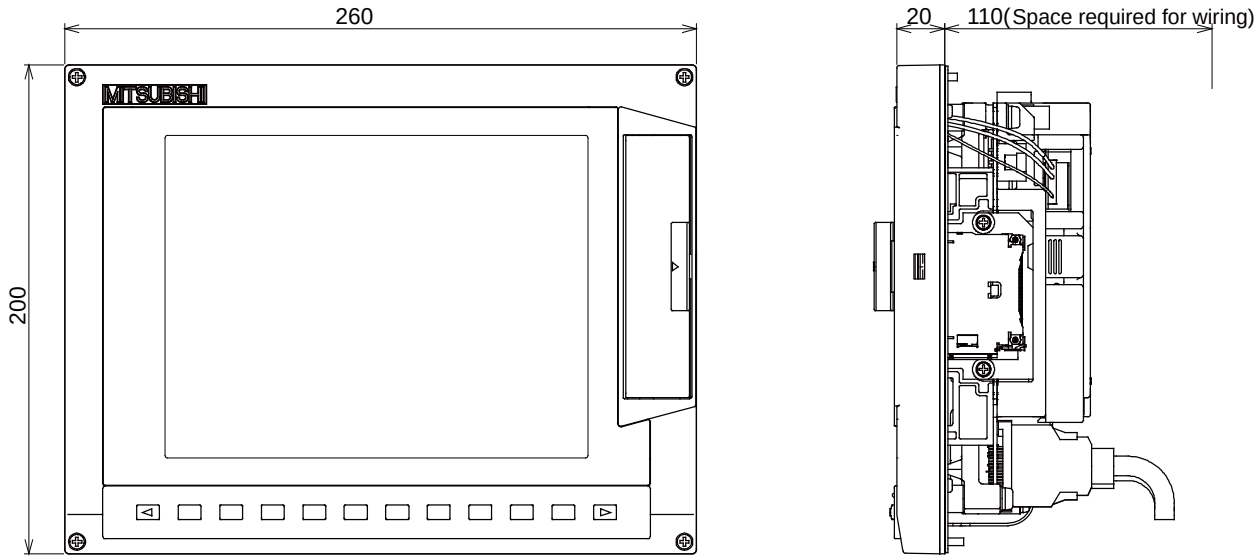


Name	Function	At fault	Conditions
24VDCIN	+24VDC input check	Not lit	(1) Failure of +24VDC input (2) Disconnection of fuse
DCOUT	Internal output voltage check	Not lit	(1) Failure of internal voltage output in control unit (2) Short circuit of +5VDC output on CG71 or ENC or FAN connector
LCDON	+12VDC output voltage check for backlight inverter	Not lit	(1) Failure of 12VDC output in control unit (2) 24VDC input voltage is not +20V or less
PSEMG	External emergency stop status display	Lit (Red)	External emergency stop signal has inputted
WDER	System error display	Lit (Red)	(1) Failure of control unit (2) SRAM data is broken
BATALM	Battery voltage drop	Lit (Red)	Battery voltage has dropped to 2.7V or less

2.3 Display Unit

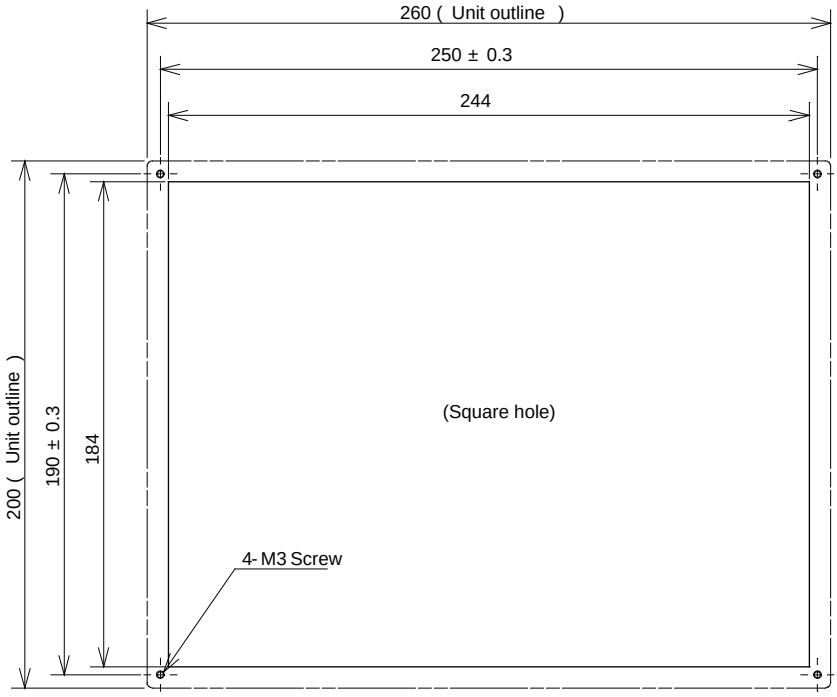
Outline dimension

[FCU7-DU120-12 (8.4-type)]

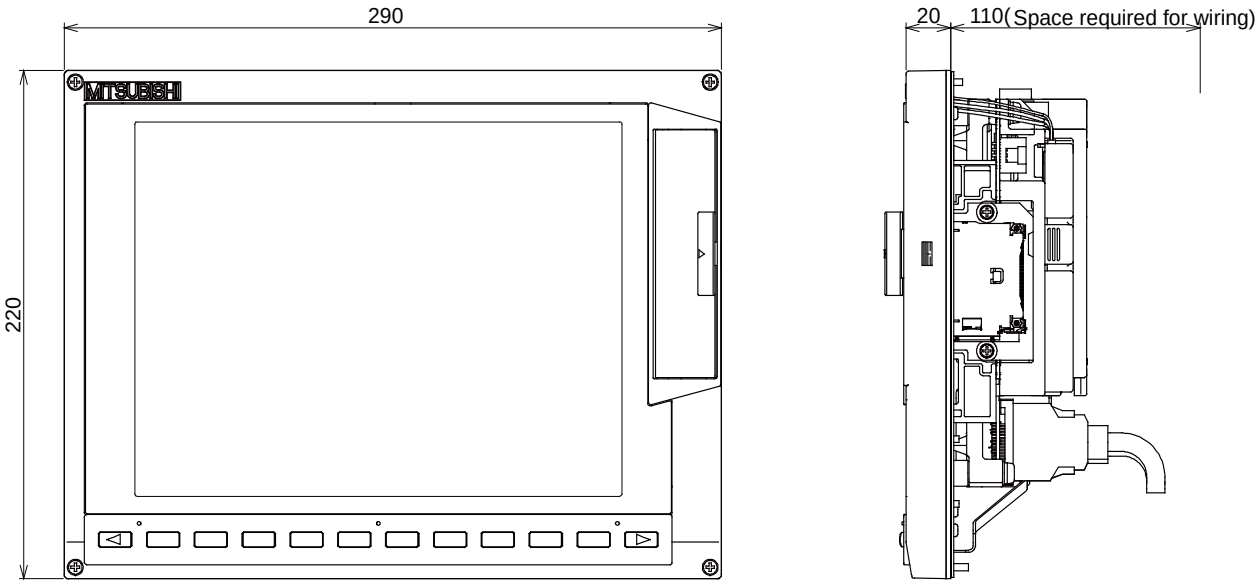


(Note 1) The above side view shows the state with the control unit mounted.
(Note 2) Consider the minimum radius value of optical communication cable for the bottom space.
(Refer to "4.1.2 Precautions for Using Optical Communication Cable".)

<Panel cut dimension drawing>

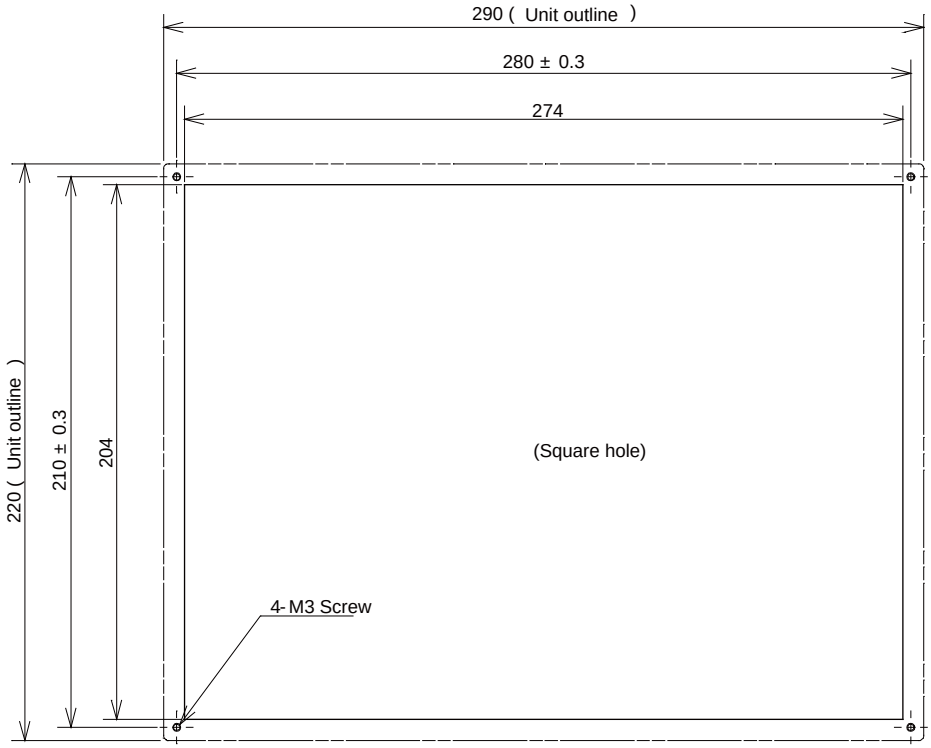


[FCU7-DU140-12 (10.4-type)]

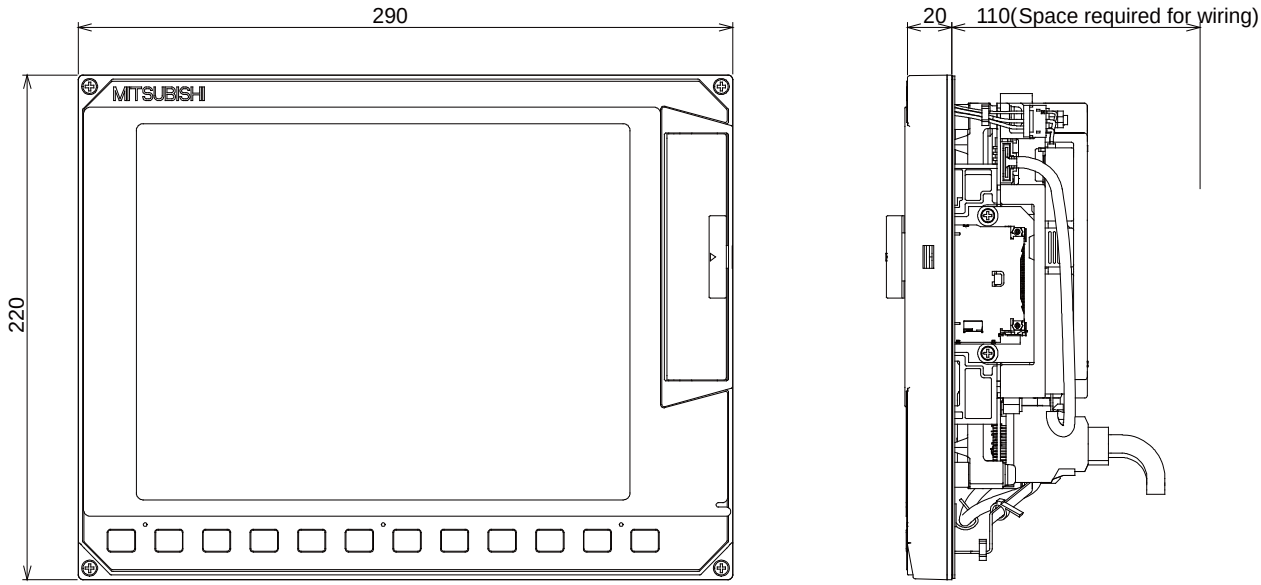


(Note 1) The above side view shows the state with the control unit mounted.
(Note 2) Consider the minimum radius value of optical communication cable for the bottom space.
(Refer to "4.1.2 Precautions for Using Optical Communication Cable".)

<Panel cut dimension drawing>

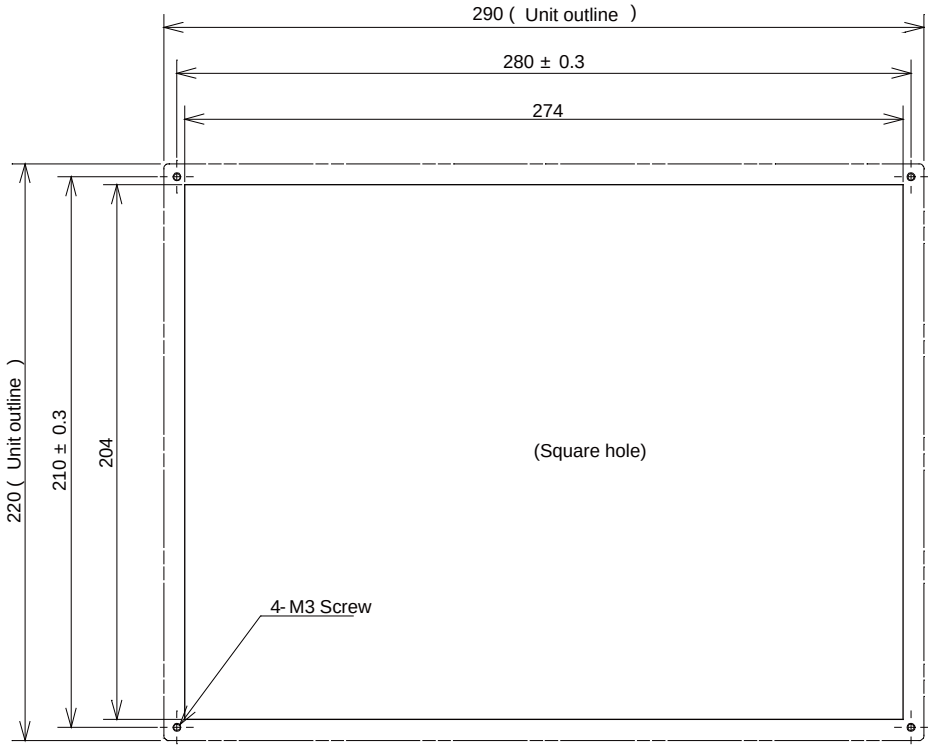


[FCU7-DU140-32 (10.4-type with touch panel)]



(Note 1) The above side view shows the state with the control unit mounted.
(Note 2) Consider the minimum radius value of optical communication cable for the bottom space.
(Refer to "4.1.2 Precautions for Using Optical Communication Cable".)

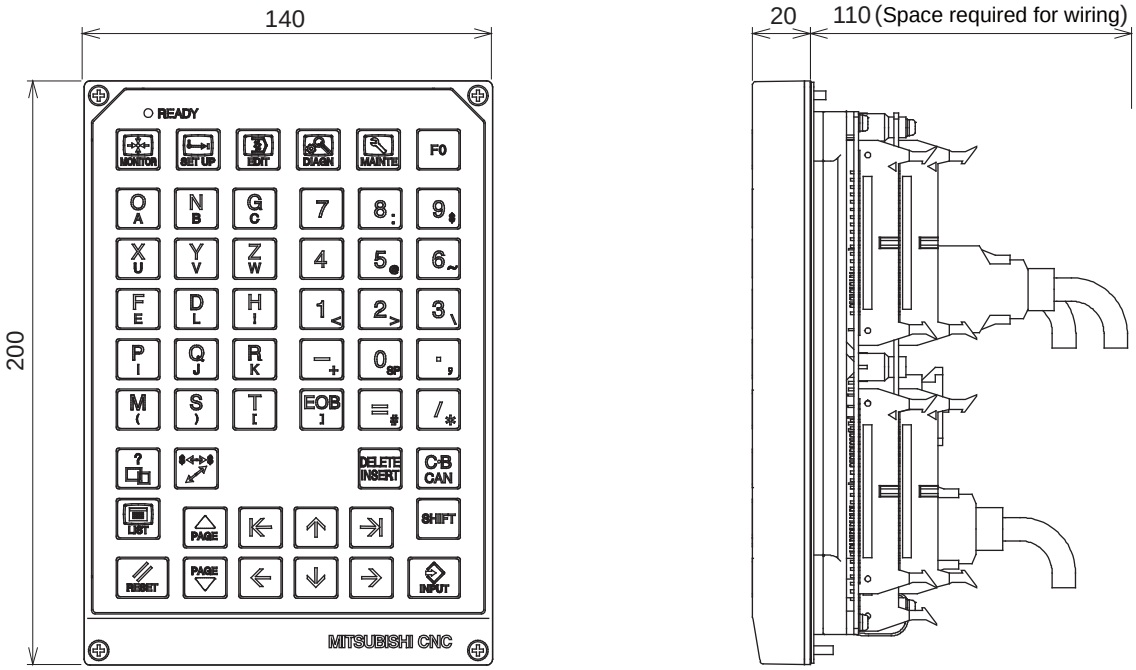
<Panel cut dimension drawing>



2.4 Keyboard Unit

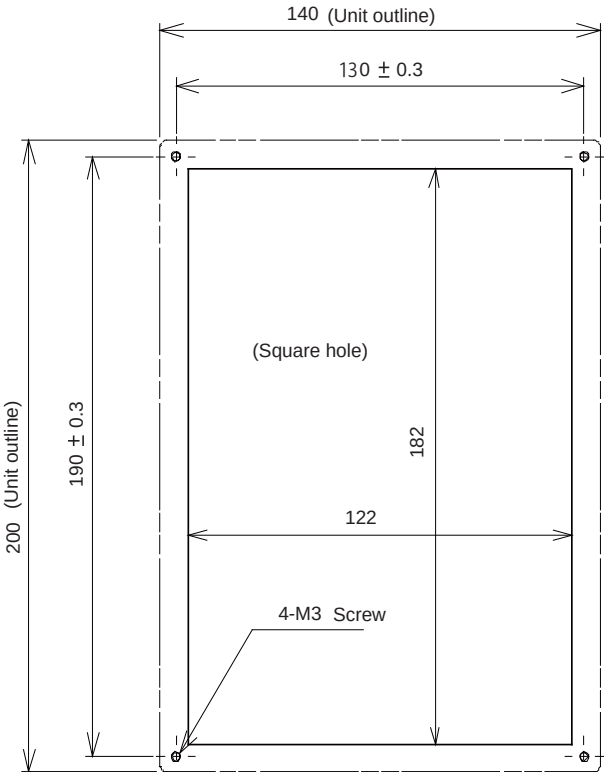
Outline dimension

[FCU7-KB024 (8.4-type)]

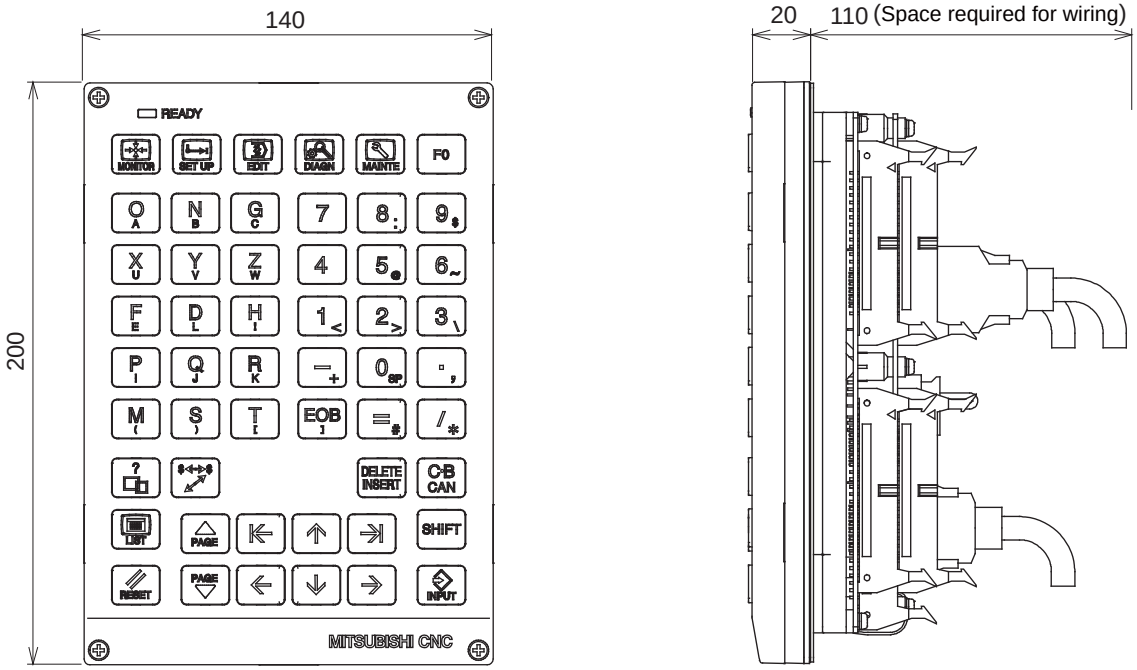


(Note) The above side view shows the state with the operation panel I/O unit FCU7-DX720/DX721 mounted.

<Panel cut dimension drawing>

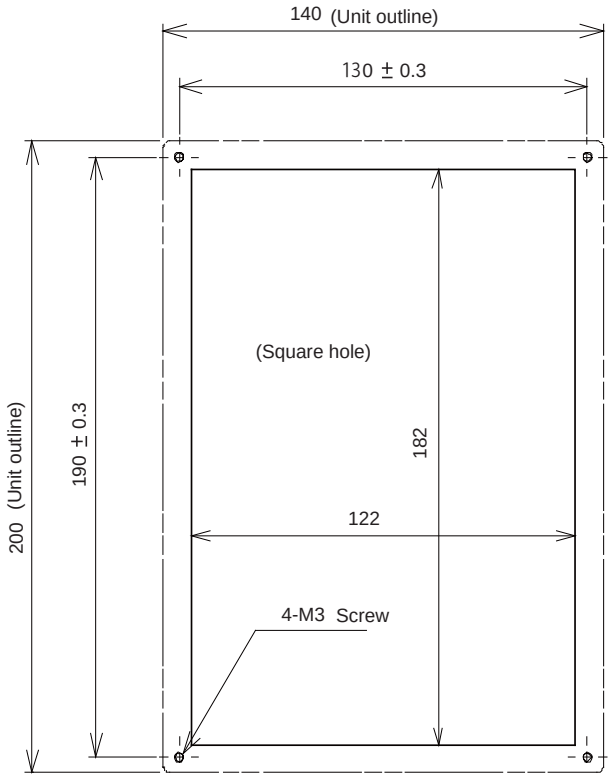


[FCU7-KB026 (Clear keys for 8.4-type)]

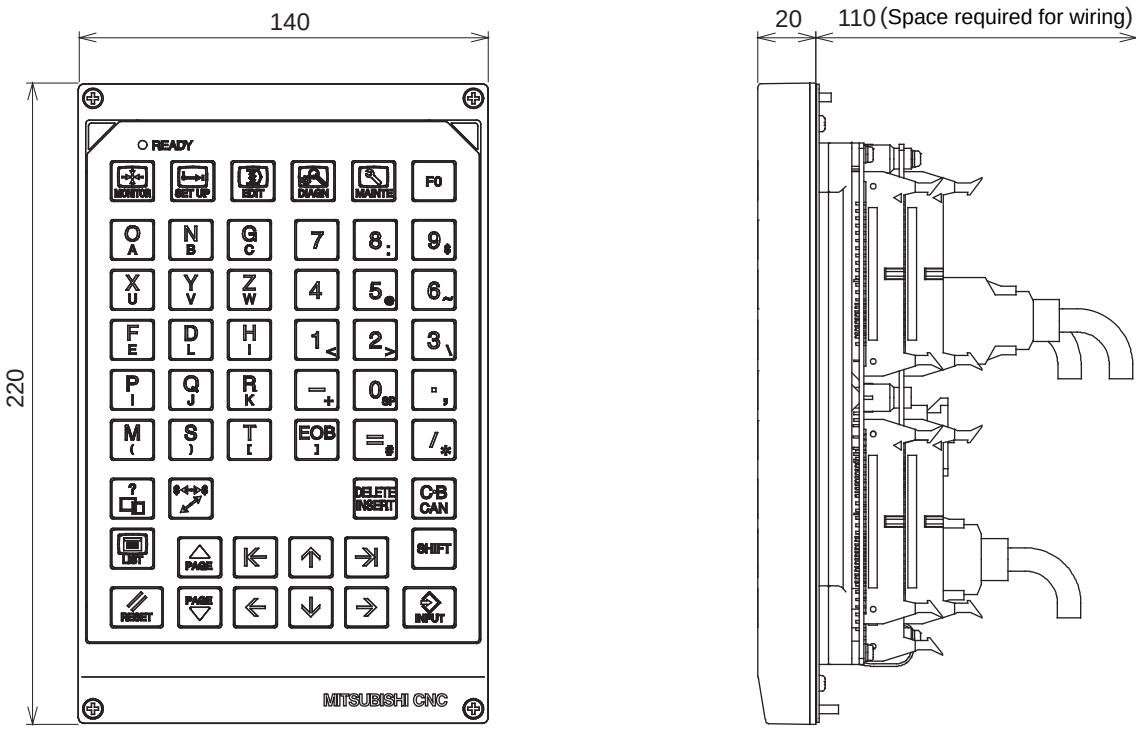


(Note) The above side view shows the state with the operation panel I/O unit FCU7-DX720/DX721 mounted.

<Panel cut dimension drawing>

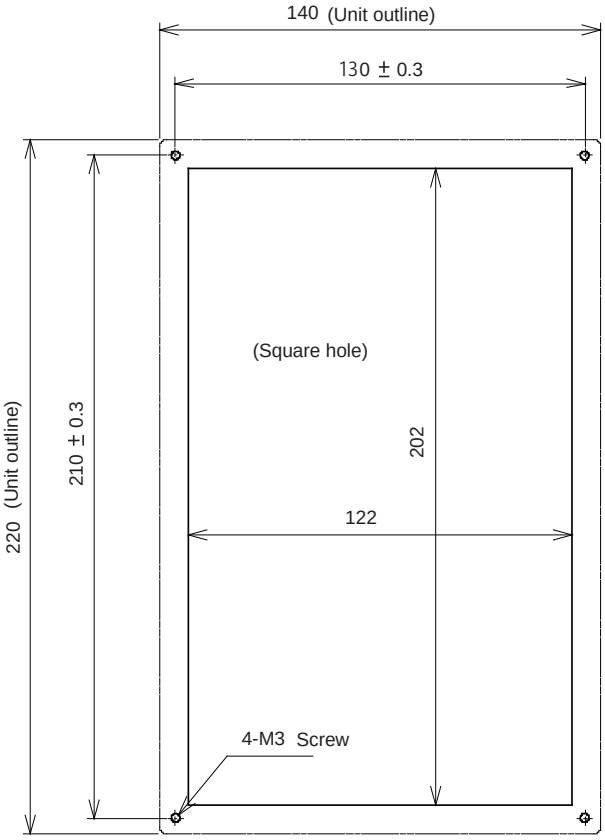


[FCU7-KB044 (10.4-type)]

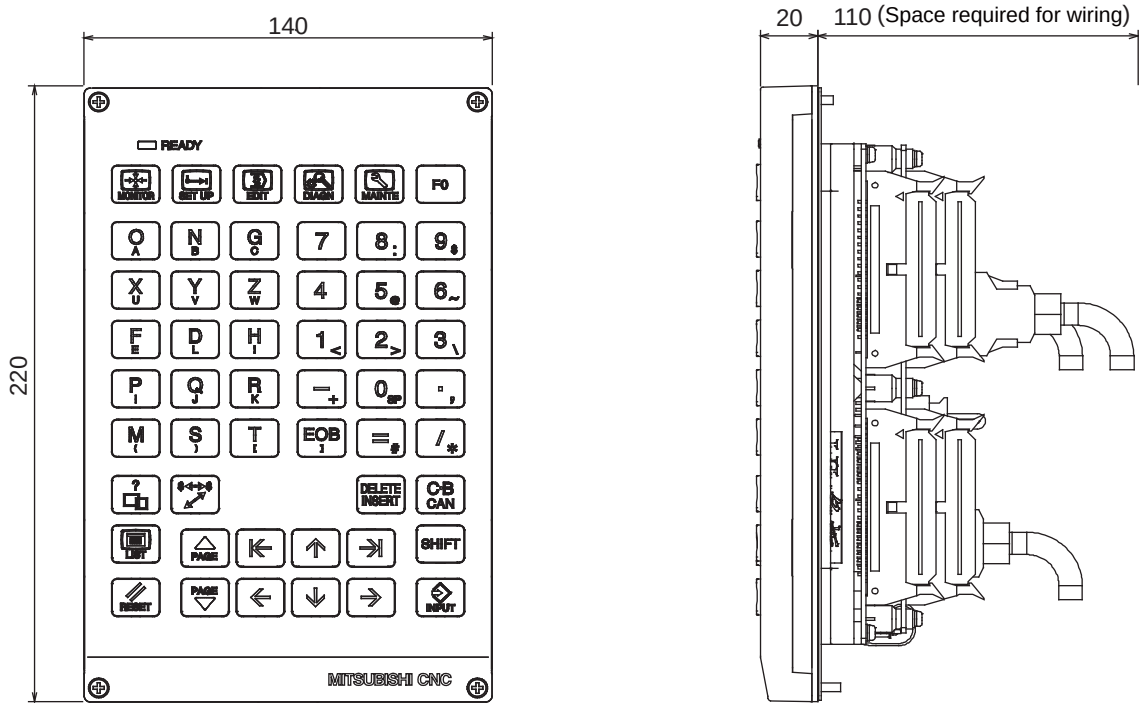


(Note) The above side view shows the state with the operation panel I/O unit FCU7-DX720/DX721 mounted.

<Panel cut dimension drawing>

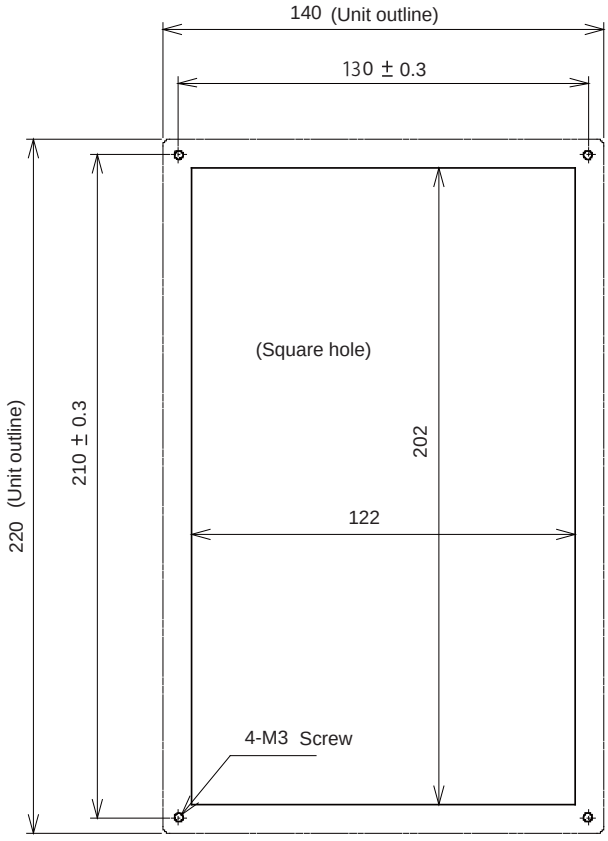


[FCU7-KB046 (Clear keys for 10.4-type)]

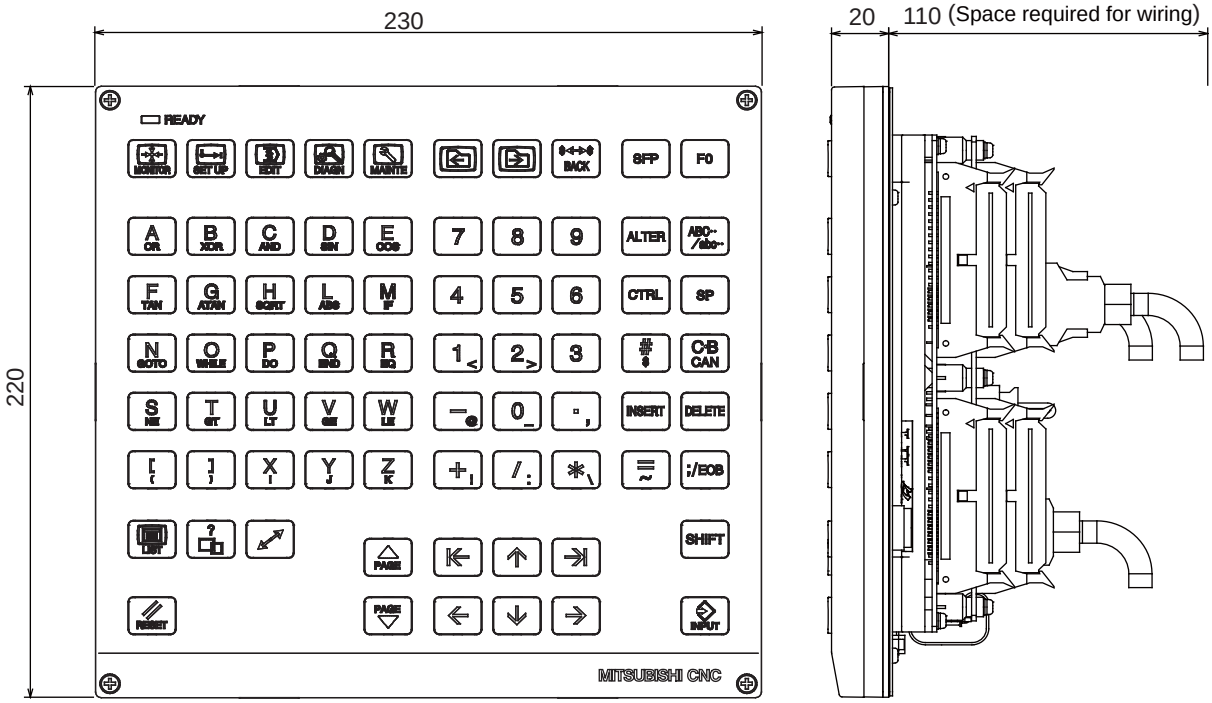


(Note) The above side view shows the state with the operation panel I/O unit FCU7-DX720/DX721 mounted.

<Panel cut dimension drawing>

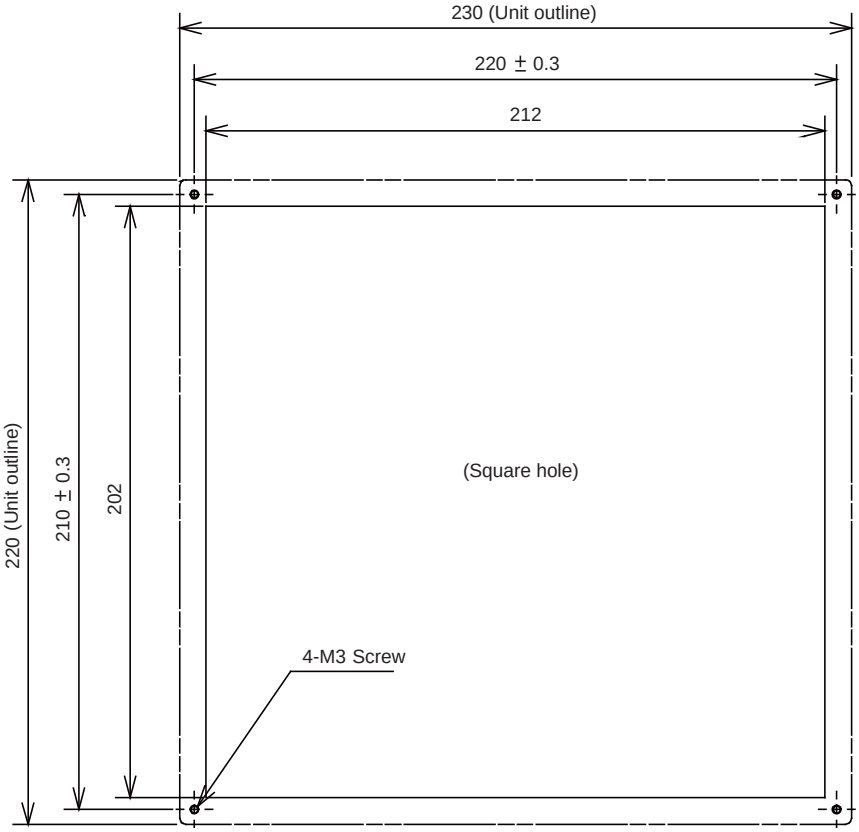


[FCU7-KB048 (Clear keys for 10.4-type)]



(Note) The above side view shows the state with the operation panel I/O unit FCU7-DX720/DX721 mounted.

<Panel cut dimension drawing>



2.5 Operation Panel I/O Unit

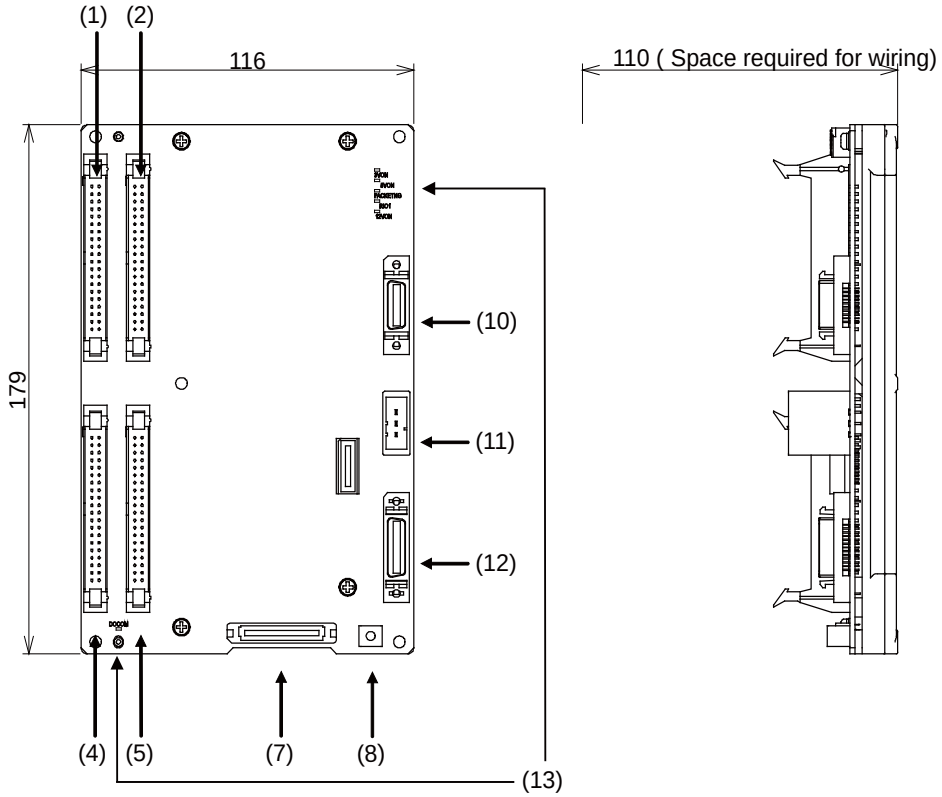
Characteristics of operation panel I/O unit are as follows.

(1) Number of DI/DO points that can be mounted on the machine operation panel is 64/64 as standard and 96/96 at the maximum. Both sink and source types are available.
Operation panel I/O unit DI/DO uses equivalent serial link connections as those used for remote I/O.
(2) Remote I/O interface --- 1ch
Remote I/O unit, scan I/O card, etc. can be extended up to 4 stations. Note that the following (a) and (b) will be applied if DI/DO mounted on the operation panel I/O unit is used.
(a) When 64 points/64 points are used: Up to 4 stations, 128 points/128 points in total, are available.
(b) When 96 points/96 points are used: Up to 3 stations, 96 points/96 points in total, are available.
(3) Manual pulse generator --- 2ch
5V and 12V manual pulse generators can be connected.
(4) Installation on the back side of the keyboard unit is possible. Allows space saving inside the operation panel.

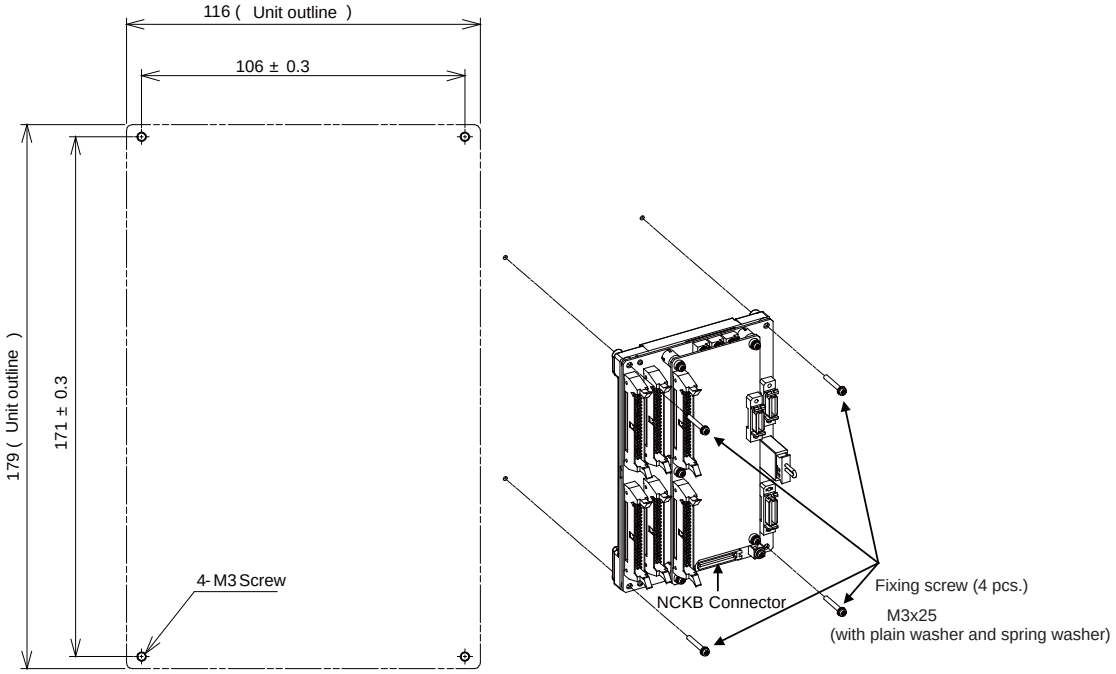
Classification	Components	Type	Remarks
[Operation panel I/O unit] DI 24V/0V common input DO Sink output	Base card (HN341) Terminator (R-TM)	FCU7-DX710	DI: 64-points 24V/0V common type DO: 64-points sink type MPG:2ch Occupied stations (fixed): 1, 2, 7, 8 RIO3 extensible stations: 3, 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Source output	Base card (HN351) Terminator (R-TM)	FCU7-DX711	DI: 64-points 24V/0V common type DO: 64-points source type MPG:2ch Occupied stations (fixed): 1, 2, 7, 8 RIO3 extensible stations: 3, 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Sink output	Base card (HN341) Terminator (R-TM) Add-on card (HN361)	FCU7-DX720	DI: 96-points 24V/0V common type DO: 80-points sink type MPG:2ch AO: 1 point Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Source output	Base card (HN351) Terminator (R-TM) Add-on card (HN371)	FCU7-DX721	DI: 96-points 24V/0V common type DO: 80-points source type MPG:2ch AO: 1 point Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Sink output	Base card (HN341) Terminator (R-TM) Add-on card (HN362)	FCU7-DX730	DI: 96-points 24V/0V common type DO: 96-points sink type MPG: 2ch Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6
[Operation panel I/O unit] DI 24V/0V common input DO Source output	Base card (HN351) Terminator (R-TM) Add-on card (HN372)	FCU7-DX731	DI: 96-points 24V/0V common type DO: 96-points source type MPG:2ch Occupied stations (fixed): 1, 2, 3, 7, 8 RIO3 extensible stations: 4, 5, 6

(Note 1) The station Nos. occupied by the operation panel I/O unit cannot be changed. If the unit has rotary switches, do not change the switch settings when shipped.
(Settings when shipped: CS1 -> 0/ CS2 -> 1/ CS3 -> 6)
(Note 2) Set the number of DI points that are simultaneously turned ON to be less than half of the total points. If many points are set to be simultaneously turned ON in high temperature, operation panel I/O unit may be deteriorated due to the heat.

Dimension and names of parts
[FCU7-DX710/ FCU7-DX711]



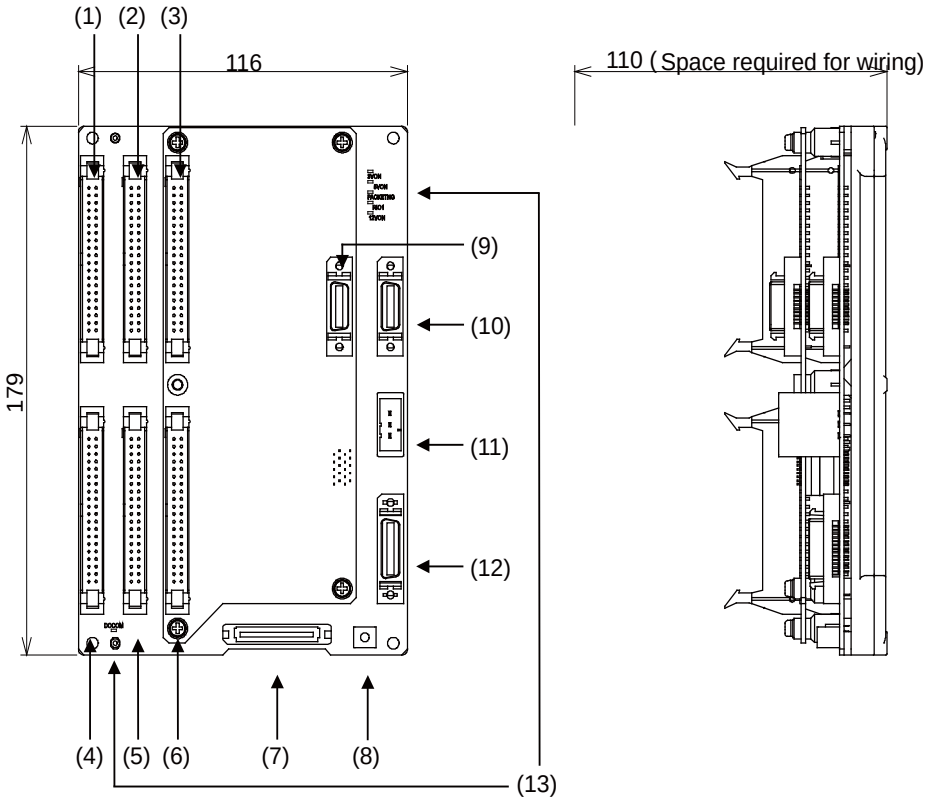
<Installation dimension drawing>



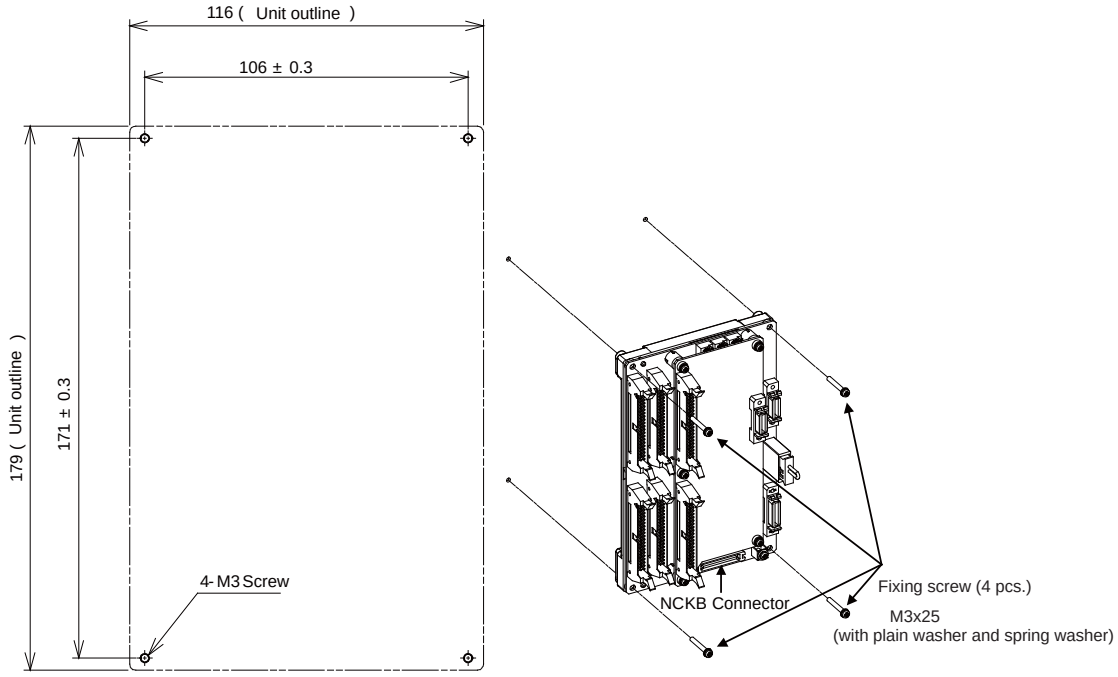
(Remarks)When using FCU7-KB024/FCU7-KB026/FCU7-KB044, the operation panel I/O unit can be mounted on the back of the keyboard.

(Note) Use M3x25 screws (with spring washer and plain washer) when mounting the operation panel I/O unit.

[FCU7-DX720/ FCU7-DX721/ FCU7-DX730/ FCU7-DX731]



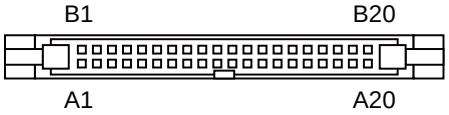
<Installation dimension drawing>



(Remarks)When using FCU7-KB024/FCU7-KB026/FCU7-KB044, the operation panel I/O unit can be mounted on the back of the keyboard.

(Note) Use M3x25 screws (with spring washer and plain washer) when mounting the operation panel I/O unit.

(1) Machine input (CG31)
Digital input 32 points (1st station)
(2) Machine input (CG33)
Digital input 32 points (2nd station)
(3) Machine input (CG35)
Digital input 32 points (3rd station)



<Cable side connector type>
Connector: 7940-6500LC
Recommended manufacturer: Sumitomo 3M

CG31

B			A		
20	I	X200	**20**	I	X210
19	I	X201	**19**	I	X211
18	I	X202	**18**	I	X212
17	I	X203	**17**	I	X213
16	I	X204	**16**	I	X214
15	I	X205	**15**	I	X215
14	I	X206	**14**	I	X216
13	I	X207	**13**	I	X217
12	I	X208	**12**	I	X218
11	I	X209	**11**	I	X219
10	I	X20A	**10**	I	X21A
9	I	X20B	**9**	I	X21B
8	I	X20C	**8**	I	X21C
7	I	X20D	**7**	I	X21D
6	I	X20E	**6**	I	X21E
5	I	X20F	**5**	I	X21F
4		NC	**4**		NC
3		COM	**3**		COM
2	I	+24V	**2**		0V
1	I	+24V	**1**		0V

CG33

B			A		
20	I	X220	**20**	I	X230
19	I	X221	**19**	I	X231
18	I	X222	**18**	I	X232
17	I	X223	**17**	I	X233
16	I	X224	**16**	I	X234
15	I	X225	**15**	I	X235
14	I	X226	**14**	I	X236
13	I	X227	**13**	I	X237
12	I	X228	**12**	I	X238
11	I	X229	**11**	I	X239
10	I	X22A	**10**	I	X23A
9	I	X22B	**9**	I	X23B
8	I	X22C	**8**	I	X23C
7	I	X22D	**7**	I	X23D
6	I	X22E	**6**	I	X23E
5	I	X22F	**5**	I	X23F
4		NC	**4**		NC
3		COM	**3**		COM
2	I	+24V	**2**		0V
1	I	+24V	**1**		0V

CG35

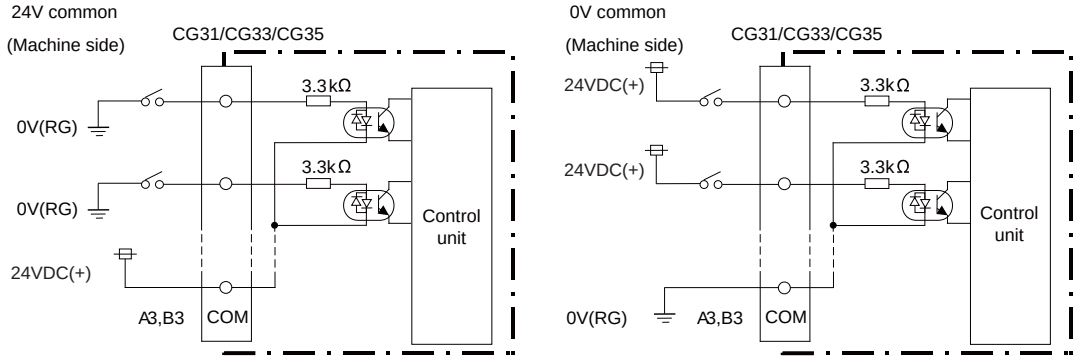
B			A		
20	I	X240	**20**	I	X250
19	I	X241	**19**	I	X251
18	I	X242	**18**	I	X252
17	I	X243	**17**	I	X253
16	I	X244	**16**	I	X254
15	I	X245	**15**	I	X255
14	I	X246	**14**	I	X256
13	I	X247	**13**	I	X257
12	I	X248	**12**	I	X258
11	I	X249	**11**	I	X259
10	I	X24A	**10**	I	X25A
9	I	X24B	**9**	I	X25B
8	I	X24C	**8**	I	X25C
7	I	X24D	**7**	I	X25D
6	I	X24E	**6**	I	X25E
5	I	X24F	**5**	I	X25F
4		NC	**4**		NC
3		COM	**3**		COM
2	I	+24V	**2**		0V
1	I	+24V	**1**		0V

Each station has fixed input/output assignments. Refer to "PLC Interface Manual" for details.

(a) Outline of digital signal input circuit

Both 24V common and 0V common connections are allowed in the digital signal input circuit. Follow the wiring diagram below for each type.

Input circuit



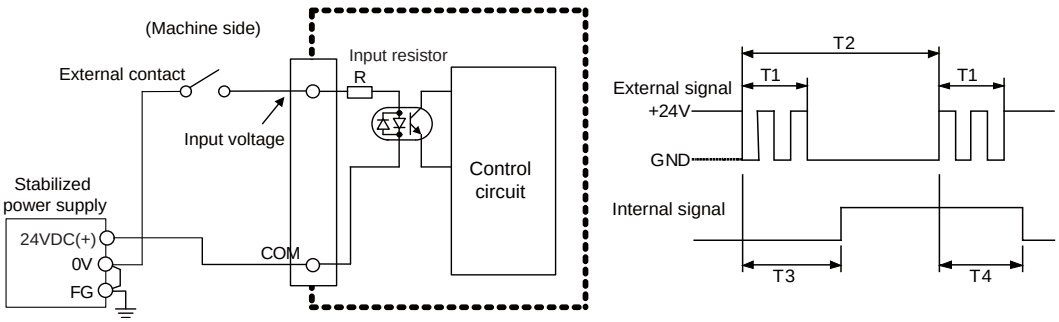
Input conditions

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

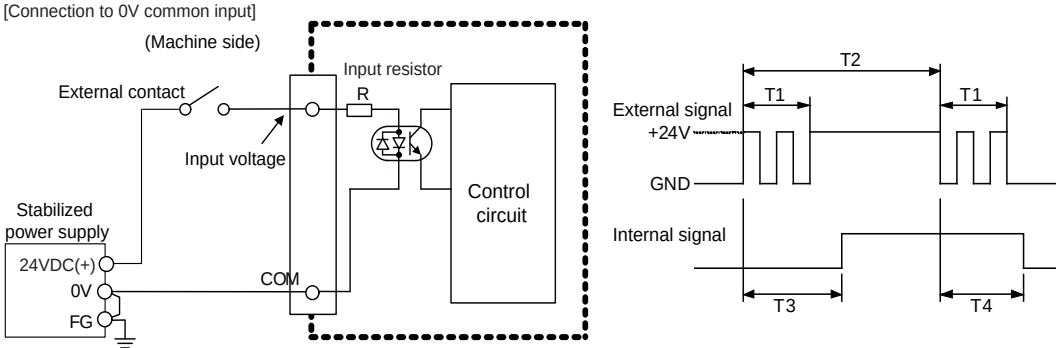
		24V common	0V common
1	**Input voltage at external contact ON**	6V or less	18V or more, 25.2V or less
2	**Input current at external contact ON**	9mA or more	
3	**Input voltage at external contact OFF**	20V or more, 25.2V or less	4V or less
4	**Input current at external contact OFF**	2mA or less	
5	**Input resistance**	Approx. 3.3kΩ	
6	**Tolerable chattering time (T1)**	3ms	
7	**Input signal holding time (T2)**	40ms or more (Note)	
8	**input circuit operation delay time (T3 and T4)**	3ms ≤ T3 ≒ T4 ≤ 16ms	
9	**Machine side contact capacity**	30V or more, 16mA or more	

(Note) Input signal holding time: The guide is 40ms or more. The input signal will not be recognized unless it is held for the ladder processing cycle time or longer.

[Connection to 24V common input]



[Connection to 0V common input]



(4) Machine output (CG32)

Digital output 32 points (1st station)

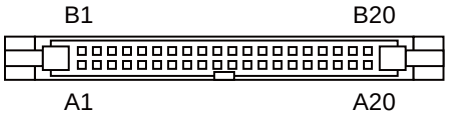
(5) Machine output (CG32)

Digital output 32 points (2nd station)

(6) Machine output (CG36)

FCU7-DX730/DX731: Digital output 32 points (3rd station)

FCU7-DX720/DX721: Digital output 16 points (3rd station) (with analog output)



<Cable side connector type>

Connector: 7940-6500LC

Recommended manufacturer: Sumitomo 3M

CG32

B			A		
20	O	Y200	**20**	O	Y210
19	O	Y201	**19**	O	Y211
18	O	Y202	**18**	O	Y212
17	O	Y203	**17**	O	Y213
16	O	Y204	**16**	O	Y214
15	O	Y205	**15**	O	Y215
14	O	Y206	**14**	O	Y216
13	O	Y207	**13**	O	Y217
12	O	Y208	**12**	O	Y218
11	O	Y209	**11**	O	Y219
10	O	Y20A	**10**	O	Y21A
9	O	Y20B	**9**	O	Y21B
8	O	Y20C	**8**	O	Y21C
7	O	Y20D	**7**	O	Y21D
6	O	Y20E	**6**	O	Y21E
5	O	Y20F	**5**	O	Y21F
4		COM	**4**		COM
3		COM	**3**		COM
2	I	+24V	**2**		0V
1	I	+24V	**1**		0V

CG34

B			A		
20	O	Y220	**20**	O	Y230
19	O	Y221	**19**	O	Y231
18	O	Y222	**18**	O	Y232
17	O	Y223	**17**	O	Y233
16	O	Y224	**16**	O	Y234
15	O	Y225	**15**	O	Y235
14	O	Y226	**14**	O	Y236
13	O	Y227	**13**	O	Y237
12	O	Y228	**12**	O	Y238
11	O	Y229	**11**	O	Y239
10	O	Y22A	**10**	O	Y23A
9	O	Y22B	**9**	O	Y23B
8	O	Y22C	**8**	O	Y23C
7	O	Y22D	**7**	O	Y23D
6	O	Y22E	**6**	O	Y23E
5	O	Y22F	**5**	O	Y23F
4		COM	**4**		COM
3		COM	**3**		COM
2	I	+24V	**2**		0V
1	I	+24V	**1**		0V

CG36 (Note)

B			A		
20	O	Y240	**20**	O	Y250
19	O	Y241	**19**	O	Y251
18	O	Y242	**18**	O	Y252
17	O	Y243	**17**	O	Y253
16	O	Y244	**16**	O	Y254
15	O	Y245	**15**	O	Y255
14	O	Y246	**14**	O	Y256
13	O	Y247	**13**	O	Y257
12	O	Y248	**12**	O	Y258
11	O	Y249	**11**	O	Y259
10	O	Y24A	**10**	O	Y25A
9	O	Y24B	**9**	O	Y25B
8	O	Y24C	**8**	O	Y25C
7	O	Y24D	**7**	O	Y25D
6	O	Y24E	**6**	O	Y25E
5	O	Y24F	**5**	O	Y25F
4		COM	**4**		COM
3		COM	**3**		COM
2	I	+24V	**2**		0V
1	I	+24V	**1**		0V

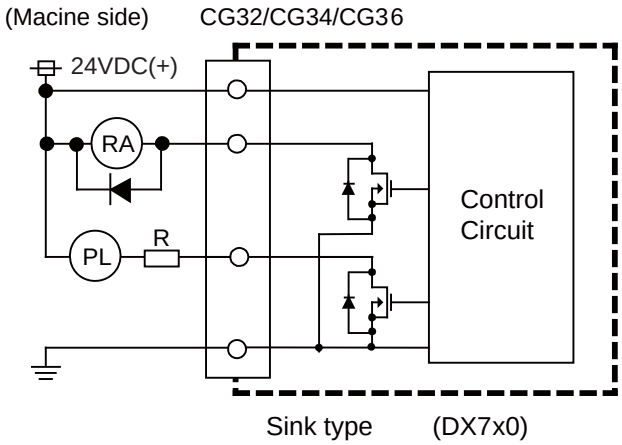
(Note) FCU7-DX720/DX721 uses 16 points of digital outputs, Y240 to Y24F.

Each station has fixed input/output assignments. Refer to "PLC Interface Manual" for details.

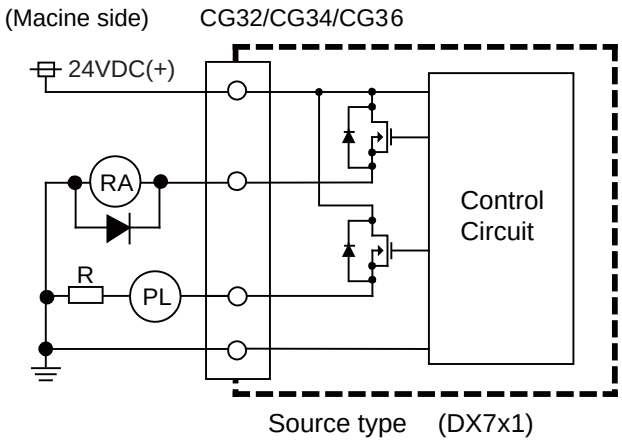
(a) Outline of digital signal output circuit

The digital signal output circuit uses a sink type (DX7x0) or source type (DX7x1).
Use within the specification ranges shown below.

Output circuit



Sink type (DX7x0)



Source type (DX7x1)

RA : Relay
PL : Pilot lamp

Output conditions

Insulation method	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=150Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)

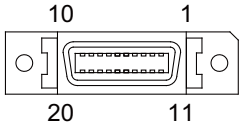
⚠CAUTION

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

(7) Keyboard I/F (NCKB)

(8) FG terminal (FG)

(9) Analog output 1ch (AO)



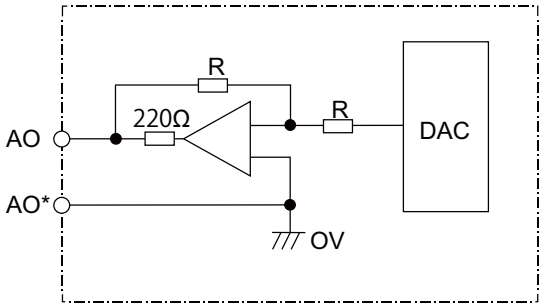
1		GND	**11**		NC
2		NC	**12**		NC
3		NC	**13**		NC
4		NC	**14**		NC
5		NC	**15**		NC
6		NC	**16**		NC
7		AO	**17**		NC
8		NC	**18**		NC
9		NC	**19**		NC
10		NC	**20**		NC

* Connect connector case with FG pattern.

<Cable side connector type>

Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: Sumitomo 3M

Output circuit



Output conditions

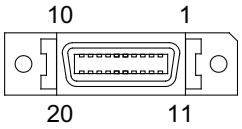
Output voltage	0V to ±10V (±5%)
Resolution	12bit (±10V×n/4096) (Note)
Load conditions	10kΩ load resistance
Output impedance	220Ω

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

Connector pin assignment

1	AO*	GND
7	AO	Analog voltage output

(10) Manual pulse generator input 2ch (5V and 12V) (MPG)



1		GND	**11**		GND
2		reserve	**12**		reserve
3	I	2HA	**13**	I	2HB
4	I	1HA	**14**	I	1HB
5		GND	**15**		GND
6	O	24VDC	**16**	O	24VDC
7		reserve	**17**		reserve
8		reserve	**18**		reserve
9		reserve	**19**		reserve
10	O	5VDC	**20**	O	5VDC

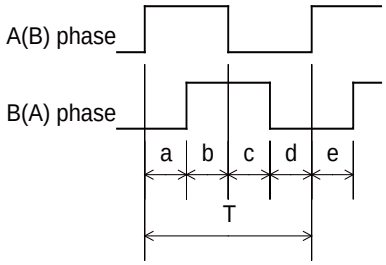
* Connect connector case with FG pattern.

<Cable side connector type>

Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: Sumitomo 3M

<Input conditions>

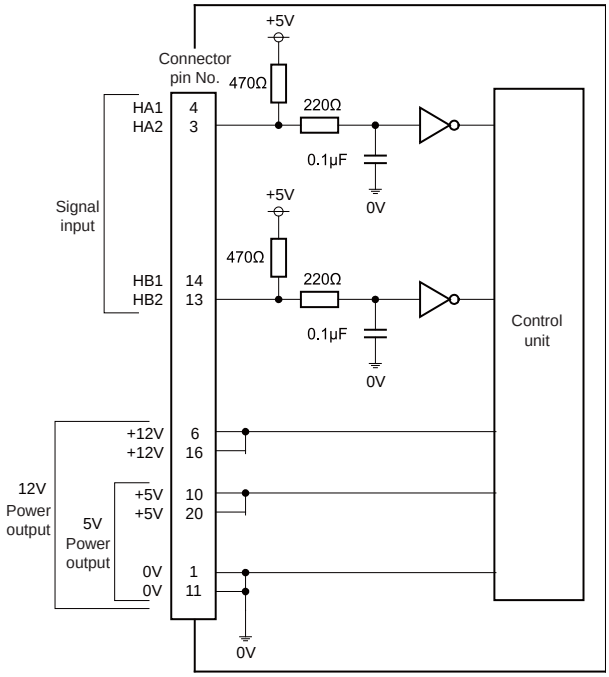
	5V manual pulse generator input conditions	**12V manual pulse generator input conditions**
Input pulse signal type	A and B phases (with phase difference 90°) (Refer to the waveform below.)	
Input signal voltage	H level 3.5V to 5.25V L level 0V to 0.5V	
Max. input pulse frequency	100kHz	
Pulse generators power supply voltage	5VDC±10%	12VDC±10%
Current consumption	100mA or less	
Number of pulses per rotation	25 pulse/rev or 100 pulse/rev	
Cable length	20m or less	50m or less



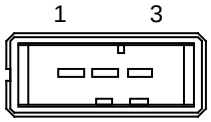
a.b.c.d.e: A phase or B phase rising edge (falling edge) phase difference = T/4 ± T/10

T: A or B phase cycle (Min. 10 μ s)

<Input/output circuit>



(11) Remote I/O unit I/F (RIO3)



1	I/O	TXRX3
2	I/O	TXRX3*
3		0V(GND)

<Cable side connector type>

Connector: 1-178288-3
Contact: 1-175218-2 x3
Recommended manufacturer: Tyco Electronics AMP

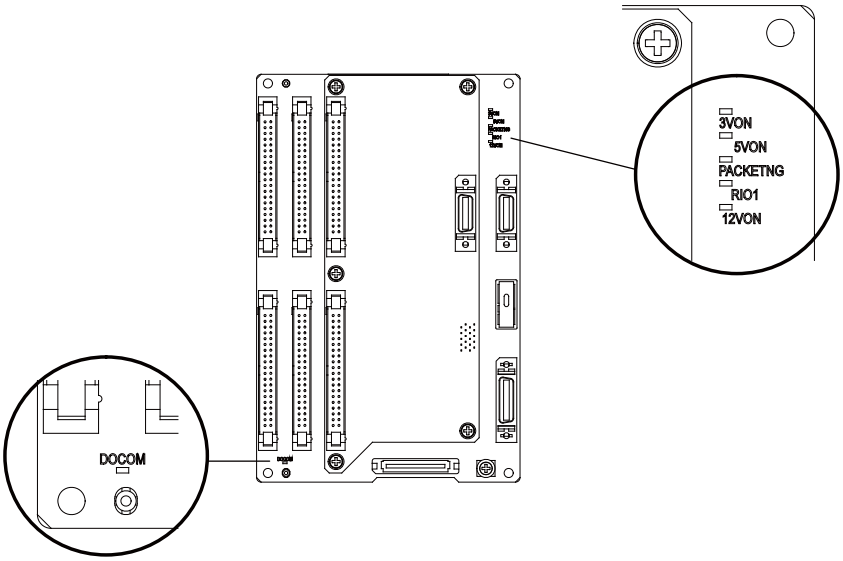
Refer to the following chart for the maximum number of connecting stations and I/O points.

Operation panel I/O unit type	Max. number of stations (RIO3 connection)	Max. number of I/O points (RIO3 connection)
FCU7-DX710/DX711	4 stations (stations 3rd to 6th can be used)	128 points/128 points
FCU7-DX720/DX721	3 stations (stations 4th to 6th can be used)	96 points/96 points
FCU7-DX730/DX731	3 stations (stations 4th to 6th can be used)	96 points/96 points

(Note) Refer to the section "2.6 Remote I/O Unit" for the number of occupying stations and I/O points of remote I/O units.

(12) Control unit I/F (CG71)

(13) LED



Name	Function	At fault	Conditions
3VON	+3VDC input check	Not lit	(1) Disconnection between control unit and operation panel I/O unit
5VON	+5VDC input check	Not lit	(1) Disconnection between control unit and operation panel I/O unit (2) Short circuit of manual pulse generator cable
PACKETNG	RIO communication status check	Lit (Red)	(1) Partial disconnection between control unit and operation panel I/O unit (2) Miswiring of extended I/O unit to RIO3
RIO1	RIO communication status check	Not lit	
12VON	For manual pulse generator		Short circuit of manual pulse generator cable
DOCOM	+24VDC input check (for source output)	Not lit	(1) Disconnection of 24V input (2) Disconnection of protection fuse on the operation panel I/O unit (Note) Sink output type does not have the LED for DOCOM.

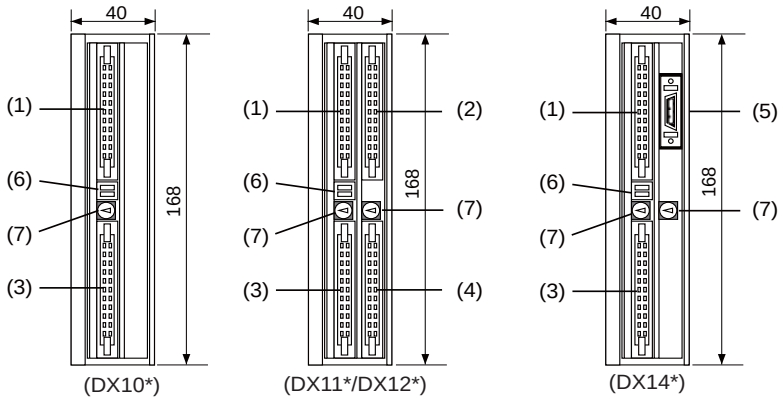
2.6 Remote I/O Unit

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 to connect the unit with the control unit or the operation panel I/O unit.
Multiple remote I/O units can be used as long as the total number of occupied stations is eight or less.

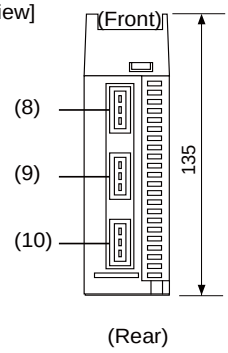
Classification	Components	Type	Remarks
[Remote I/O unit] 24V/0V common input + Sink output	RX311	FCUA-DX100	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points sink type (non-insulation) Number of occupied stations: 1
[Remote I/O unit] 24V/0V common input + Sink output	RX311+RX321-1	FCUA-DX110	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points sink type (non-insulation) Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Sink output + Analog output	RX311+RX321	FCUA-DX120	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points sink type (non-insulation) AO: 1 point Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Sink output + Analog input/output	RX311+RX341	FCUA-DX140	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points sink type (non-insulation) AI: 4 points AO: 1 point Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Source output	RX312	FCUA-DX101	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points source type (non-insulation) Number of occupied stations: 1
[Remote I/O unit] 24V/0V common input + Source output	RX312+RX322-1	FCUA-DX111	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points source type (non-insulation) Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Source output + Analog output	RX312+RX322	FCUA-DX121	DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points source type (non-insulation) AO: 1 point Number of occupied stations: 2
[Remote I/O unit] 24V/0V common input + Source output + Analog input/output	RX312+RX341	FCUA-DX141	DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points source type (non-insulation) AI: 4 points AO: 1 point Number of occupied stations: 2

Dimension and names of parts

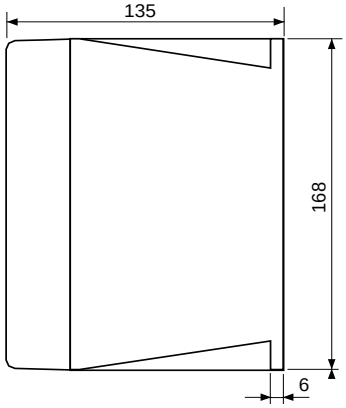
[Front view]



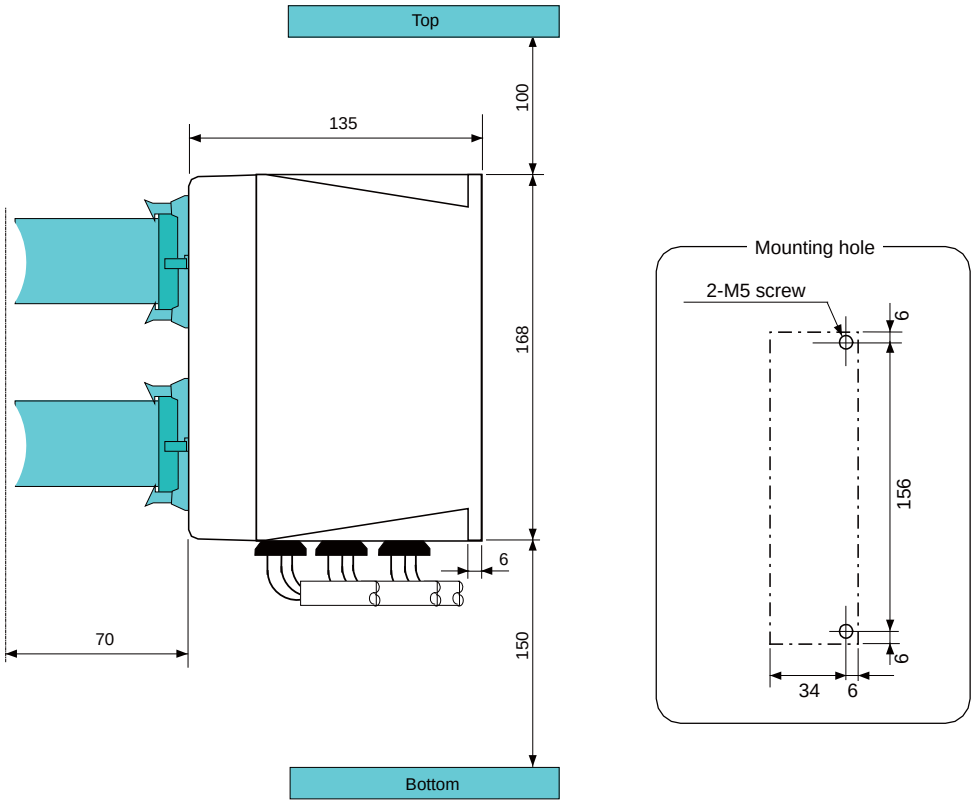
[Bottom view]



[Side view]



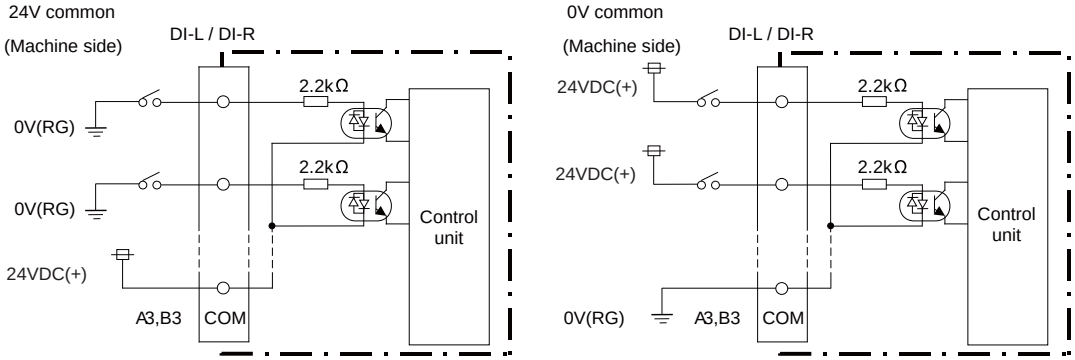
<Installation dimension drawing>



(1) Machine input (DI-L)
(2) Machine input (DI-R)

Both 24V common and 0V common connections are allowed in the digital signal input circuit. Follow the wiring diagram below for each type.

Input circuit



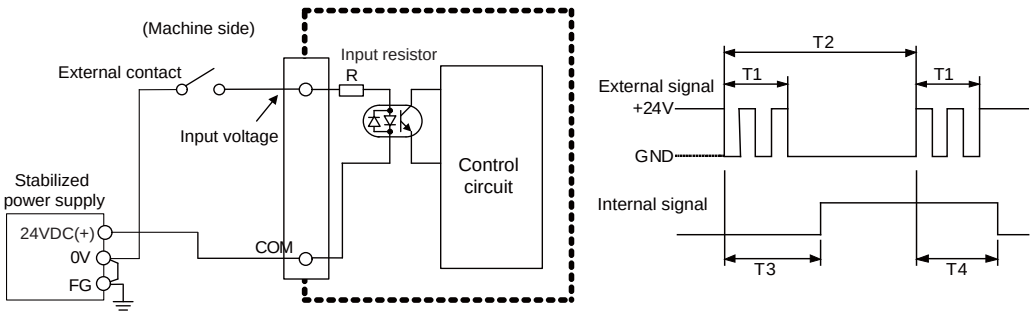
Input conditions

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

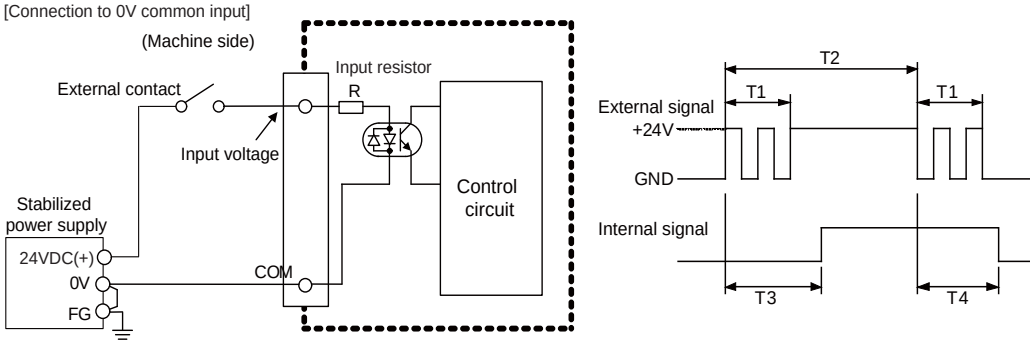
		24V common	0V common
1	**Input voltage at external contact ON**	6V or less	18V or more, 25.2V or less
2	**Input current at external contact ON**	9mA or more	
3	**Input voltage at external contact OFF**	20V or more, 25.2V or less	4V or less
4	**Input current at external contact OFF**	2mA or less	
5	**Input resistance**	Approx. 2.2kΩ	
6	**Tolerable chattering time (T1)**	3ms	
7	**Input signal holding time (T2)**	40ms or more (Note)	
8	**input circuit operation delay time (T3 and T4)**	3ms ≤ T3 ≒ T4 ≤ 16ms	
9	**Machine side contact capacity**	30V or more, 16mA or more	

(Note) Input signal holding time: The guide is 40ms or more. The input signal will not be recognized unless it is held for the ladder processing cycle time or longer.

[Connection to 24V common input]



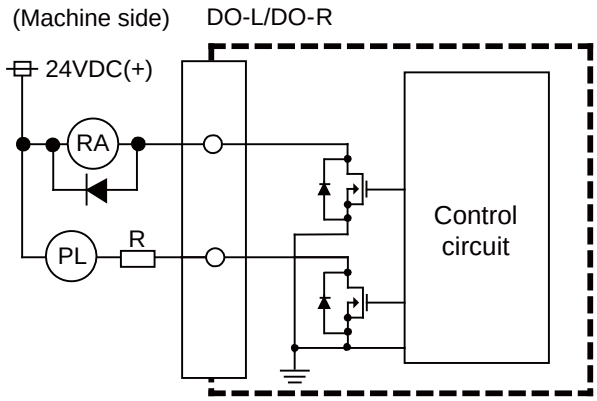
[Connection to 0V common input]



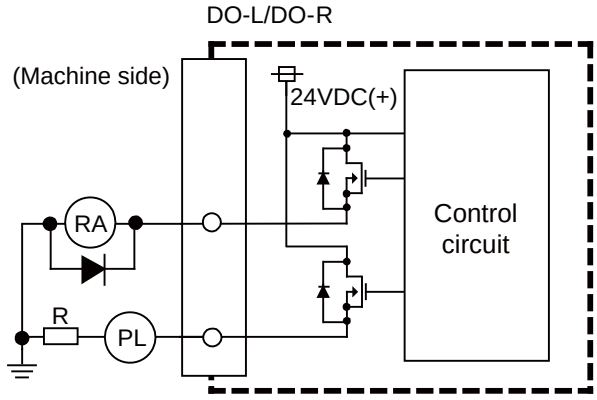
(3) Machine output (DO-L)
(4) Machine output (DO-R)

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



Sink type (DX1*0)



Source type (DX1*1)

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=150Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)

⚠ CAUTION

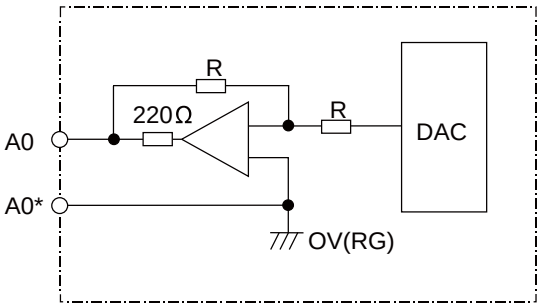
1. When using an inductive load such as a relay, always connect a diode in parallel to the load.
2. When using a capacitive load such as a lamp, always connect a protective resistor serially to the load to suppress rush currents.

(5) Analog signal input/output (AIO)

(a) Outline of analog signal output circuit

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

Output circuit



Output conditions

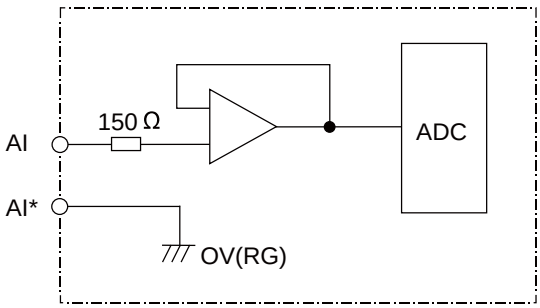
Output voltage	0V to ±10V (±5%)
Resolution	12bit (±10V×n/4096) (Note)
Load conditions	10kΩload resistance
Output impedance	220Ω

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

(b) Outline of analog signal input circuit

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

Input circuit



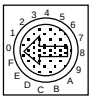
Input conditions

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

(6) Transfer speed changeover switch (DS)

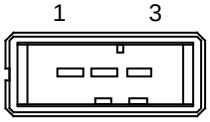
→ Not used
→ Not used

(7) Station No. changeover switch (CS)



→ Selection of station No.

(8) Remote I/O unit I/F #1 (RIO1)
(9) Remote I/O unit I/F #2 (RIO2)

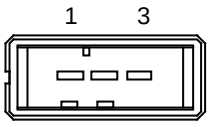


1	I/O	TXRX
2	I/O	TXRX*
3		0V

<Cable side connector type>

Connector: 1-178288-3
Contact: 1-175218-2 x3
Recommended manufacturer: Tyco Electronics AMP

(10) 24VDC input (DCIN)



1	I	+24V
2		0V
3		FG

<Cable side connector type>

Connector: 2-178288-3
Contact: 1-175218-5 x3
Recommended manufacturer: Tyco Electronics AMP

2.7 Scan I/O Unit

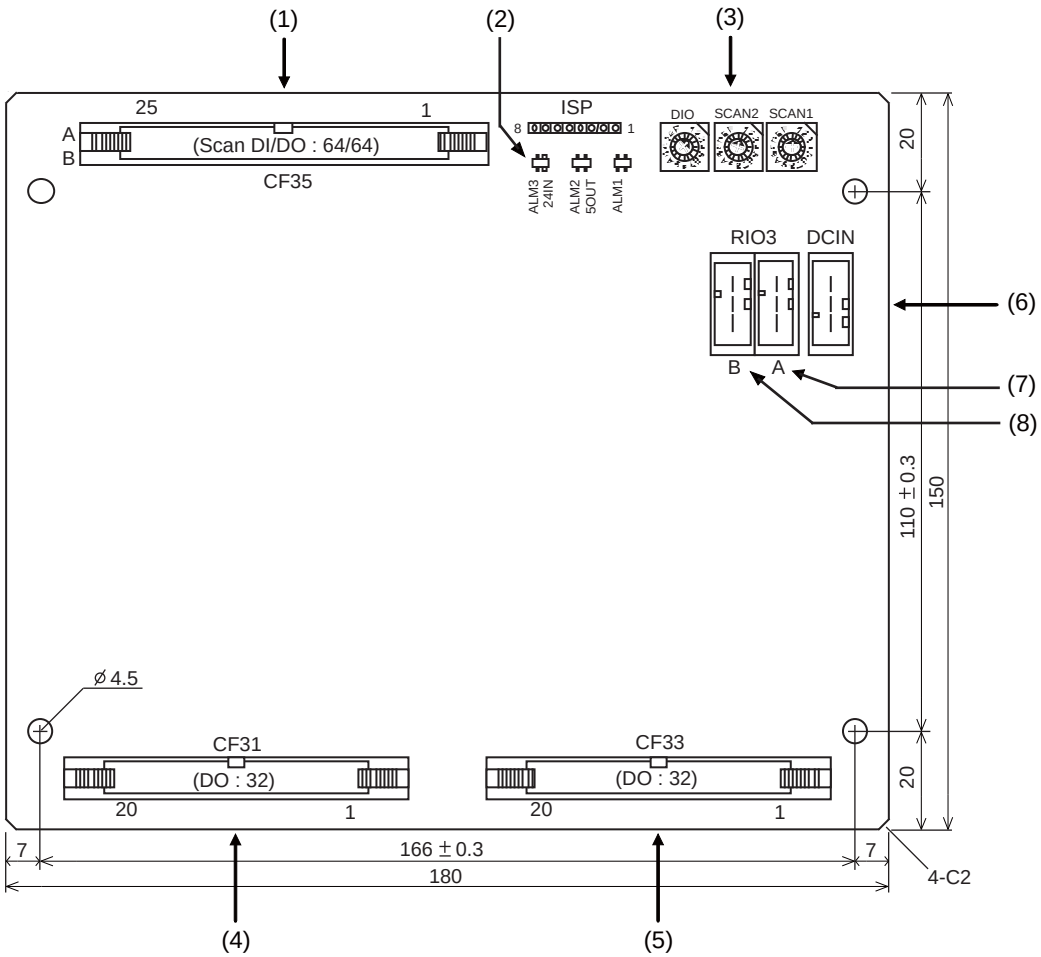
The HR347/357 card is the machine operation panel input/output card. It has a digital input/output and scan input/output, and is connected to the machine operation panel and other devices.

		Item	HR347	HR357
Scan	Input	Number of points	64 points	
		Configuration	8 common × 8 data matrix	
		Rated voltage	5VDC	
		Max. current	80mA/point	
		Input cycle	1.46ms cycle, 11.68ms cycle	
		Input signal holding time	11.68ms or more (*1)	
	Output	Number of points	64 points	
		Configuration	4 common × 8 data + 4 common × 8 data matrix	
		Rated load voltage	5VDC	
		Max. output current	200mA/point	
		Output cycle	1.46ms cycle, 5.84ms cycle	
Digital	Input	Number of points	32 points	
		Type	24V common/ 0V common	
		Input voltage at external contact ON	6V or less	18V or more, 25.2V or less
		Input current at external contact ON	2mA or less	9mA or more
		Input voltage at external contact OFF	20V or more, 25.2V or less	4V or less
		Input current at external contact OFF	9mA or more	2mA or less
		Tolerable chattering time	2.2ms or less	
		Input signal holding time	40ms or more	
		Input circuit operation delay time	2.2ms ≤ T3 ≒ T4 ≤ 11ms	
		Machine side contact capacity	30V or more, 16mA or more	
	Output	Number of points	32 points	
		Rated load voltage	24VDC	
		Max. output current	60mA/point	
		Type	Sink	Source

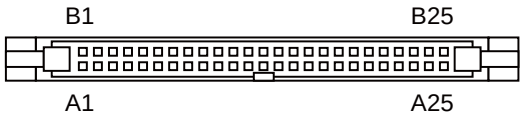
(*1) Input signal holding time: The guide is 11.68ms or more. The input signal will not be recognized unless it is held for the ladder processing cycle time or longer.

Dimension and names of parts

[HR347/ HR357]



(1) Scan type input/output (CF35)



CF35					
		B			A
25		GND	25		GND
24	O	LC3B	24	O	LC3A
23	O	LC2B	23	O	LC2A
22	O	LC1B	22	O	LC1A
21	O	LC0B	21	O	LC0A
20	I	LD7B*	20	I	LD7A*
19	I	LD6B*	19	I	LD6A*
18	I	LD5B*	18	I	LD5A*
17	I	LD4B*	17	I	LD4A*
16	I	LD3B*	16	I	LD3A*
15	I	LD2B*	15	I	LD2A*
14	I	LD1B*	14	I	LD1A*
13	I	LD0B*	13	I	LD0A*
12		GND	12		
11			11		
10			10		
9	O	KYC7*	9	O	KYC6*
8	O	KYC5*	8	O	KYC4*
7	O	KYC3*	7	O	KYC2*
6	O	KYC1*	6	O	KYC0*
5	I	KYD7*	5	I	KYD6*
4	I	KYD5*	4	I	KYD4*
3	I	KYD3*	3	I	KYD2*
2	I	KYD1*	2	I	KYD0*
1			1		GND

(Note) The GND pin is normally unused.
Do not connect the GND pin to the frame ground.

<Cable side connector type>

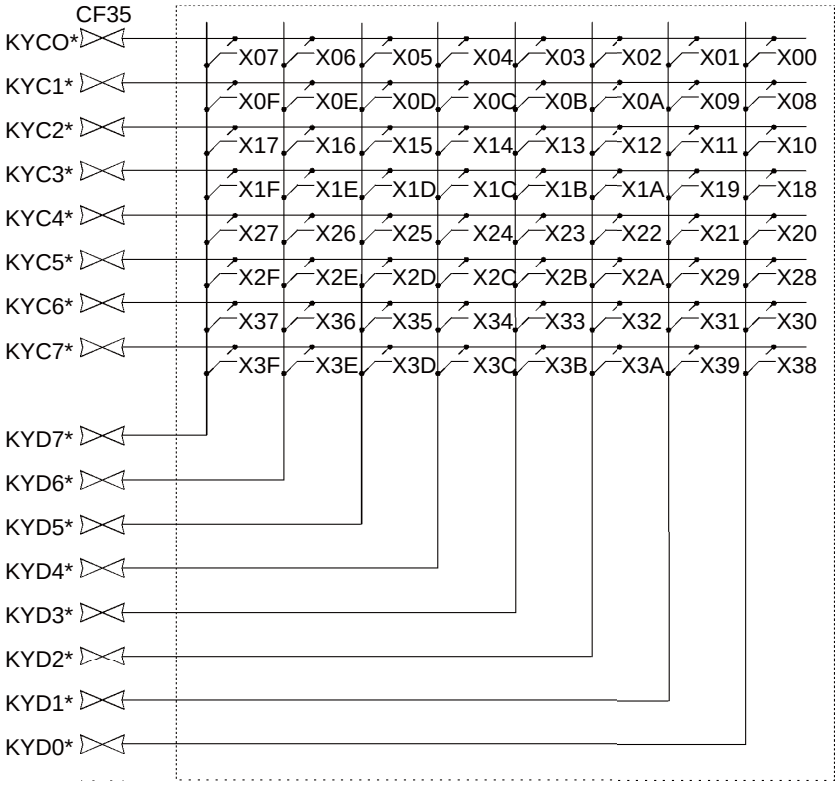
Connector: 7950-6500SC
Relief: 3448-7950
Recommended manufacturer: Sumitomo 3M

LCxA/B	Common signals for scan DO
LDxA/B*	Data signals for scan DO
KYCx*	Common signals for scan DI
KYDx*	Data signals for scan DI

* This is an example when SCAN1 is set to "0", SCAN2 to "1", and DIO to "2".
Refer to "PLC Interface Manual" for details.

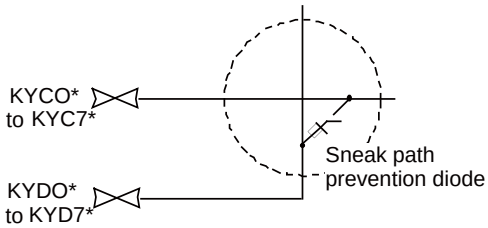
(a) Scan input

An example is shown of a scan input circuit manufactured by the machine manufacturer.

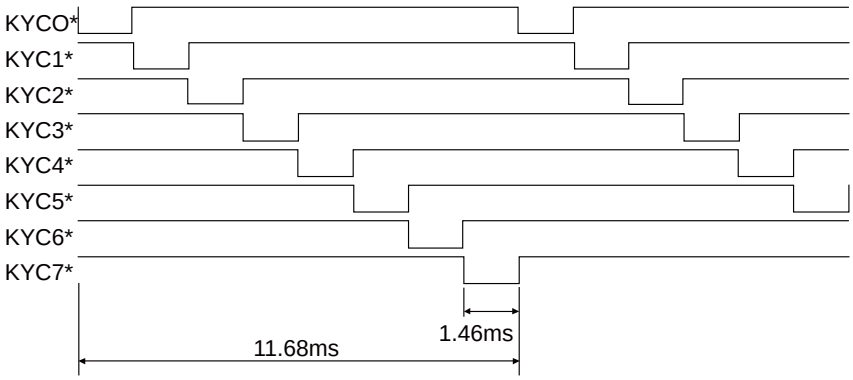


<Example of a circuit manufactured by the machine tool builder>

(Note) To scan input, connect a sneak path prevention diode as shown in the following drawing. The unit may not be able to read the correct input signals without a sneak path prevention diode installed.

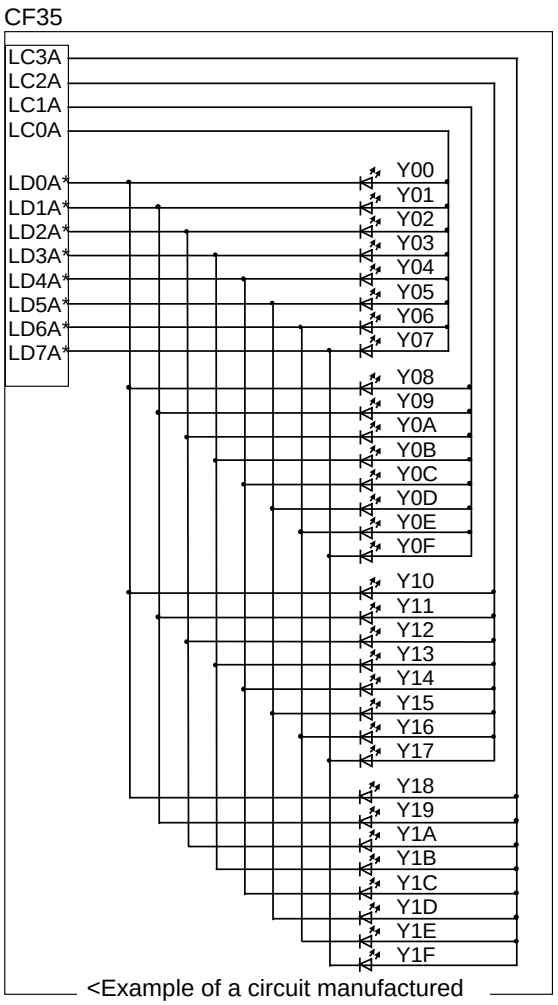


The common signals are changed over with scan input as shown in the following drawing. Key input data can be received when the common signal is LOW. The common signal changeover cycle is 11.68ms, but the input signal will not be recognized unless it is held for the ladder processing cycle time or longer. The scan input is a 5V system.

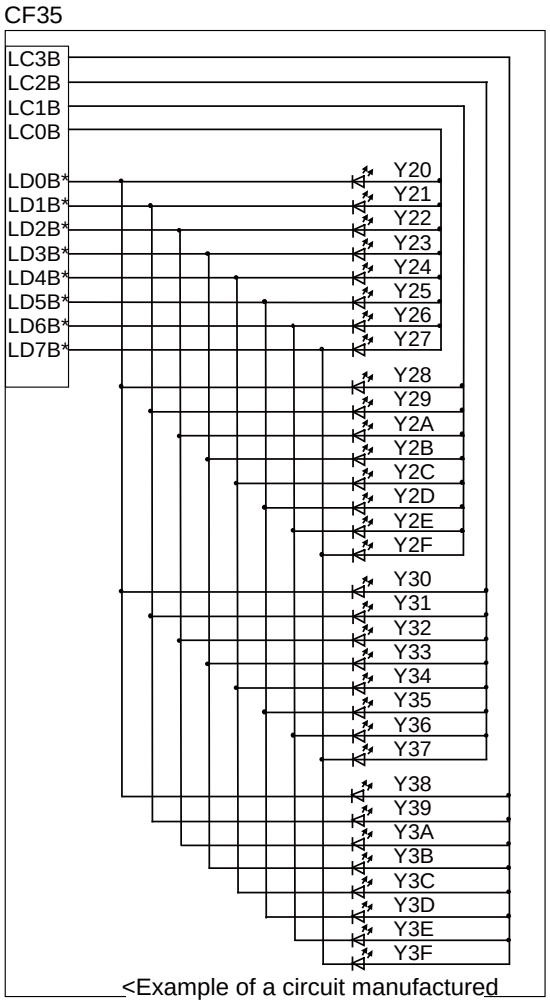


(b) Scan output

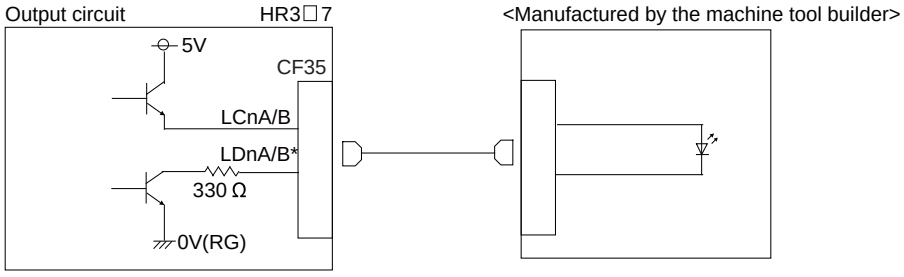
An example is shown of a scan output circuit manufactured by the machine manufacturer.



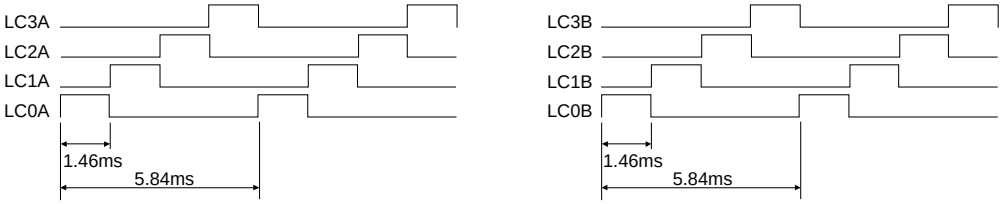
<Example of a circuit manufactured by the machine tool builder>



<Example of a circuit manufactured by the machine tool builder>



The common signals are changed over with scan output as shown in the following drawing. The LED outputs data, and lights only when the common signal is HIGH. The common signal changes to 4 signals in succession, and light s once every 5.84ms for 1.46ms only. The scan output is a 5V system.

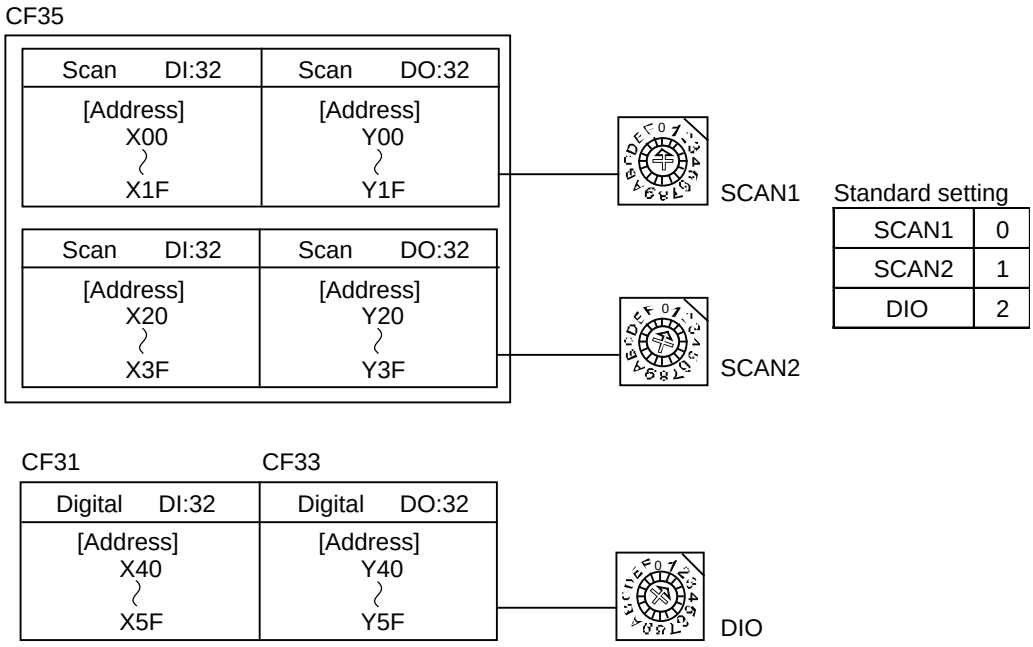


(2) LED

LED	Function	Color	Status		Remedy
			Normal	At fault	
24IN	24VDC input check	Green	Lit	Not lit	24VDC voltage check
5OUT	Internal output voltage check	Green	Lit	Not lit	Contact the MITSUBISHI service dept.
ALM1	Communication error of the station designated by rotary switch "SCAN1"	Red	Not lit	Lit	Check the station No. designation by the rotary switch of the remote I/O unit.
ALM2	Communication error of the station designated by rotary switch "SCAN2"	Red	Not lit	Lit	Check the station No. designation by the rotary switch of the remote I/O unit.
ALM3	Communication error of the station designated by rotary switch "DIO"	Red	Not lit	Lit	Check the station No. designation by the rotary switch of the remote I/O unit.

(3) Rotary switch

Set the address (station No.) assignment in DI/DO: 32/32 point units. Set using SCAN1, SCAN 2 and DIO rotary switches. The assignment address is changed with the rotary switch setting.

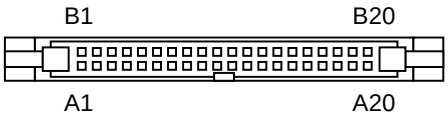


Rotary switch	Description
SCAN1	For scan input/output station No. setting 32points/32points (Normally set to "0")
SCAN2	For scan input/output station No. setting 32points/32points (Normally set to "1")
DIO	For digital input/output station No. setting 32points/32points (Normally set to "2")

(Note) Set each different station Nos. for SCAN1, SCAN2 and DIO. Up to 8 stations can be used in a part system. Set the Nos. from 0 to 7.

(4) Machine input (CF31)

Digital input



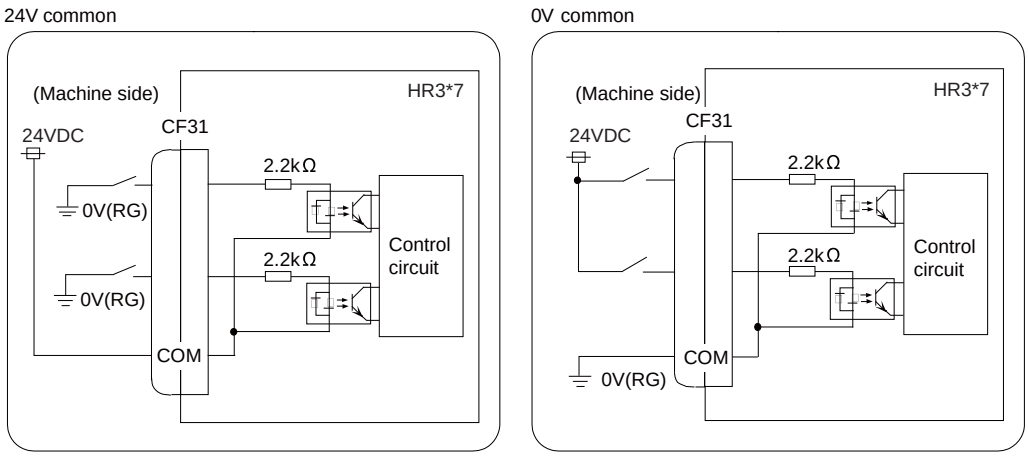
CF31					
		B			A
20	I	X40	20	I	X50
19	I	X41	19	I	X51
18	I	X42	18	I	X52
17	I	X43	17	I	X53
16	I	X44	16	I	X54
15	I	X45	15	I	X55
14	I	X46	14	I	X56
13	I	X47	13	I	X57
12	I	X48	12	I	X58
11	I	X49	11	I	X59
10	I	X4A	10	I	X5A
9	I	X4B	9	I	X5B
8	I	X4C	8	I	X5C
7	I	X4D	7	I	X5D
6	I	X4E	6	I	X5E
5	I	X4F	5	I	X5F
4			4		
3	I	COM	3	I	COM
2	I	24VDC	2		0V(RG)
1	I	24VDC	1		0V(RG)

<Cable side connector type>

Connector: 7940-6500SC
Relief: 3448-7940
Recommended manufacturer: Sumitomo 3M

* This is an example when SCAN1 is set to "0", SCAN2 to "1", and DIO to "2".
Refer to "PLC Interface Manual" for details.

Both 24V common and 0V common connections are allowed in the digital signal input circuit.



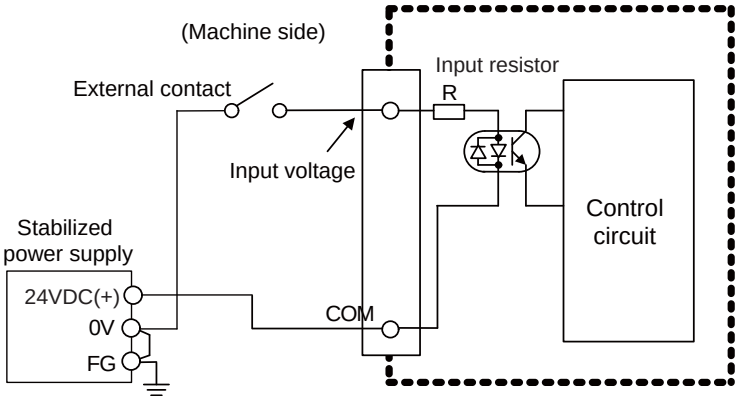
Input conditions

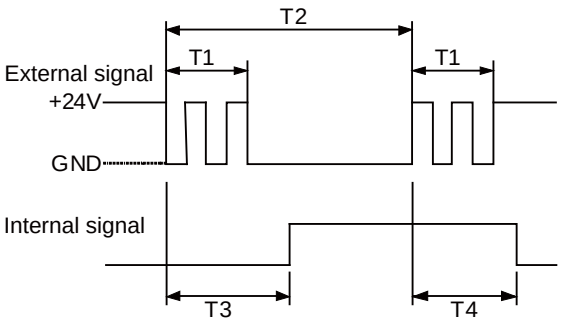
The input signals must be used within the following condition ranges.

		24V common	0V common
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	**Input resistance**	Approx. 2.2kΩ	
6	**Tolerable chattering time (T1)**	3ms	
7	**Input signal holding time (T2)**	40ms or more (Note)	
8	**Input circuit operation delay time (T3 and T4)**	3ms ≤ T3 ≒ T4 ≤ 16ms	
9	**Machine side contact capacity**	30V or more, 16mA or more	

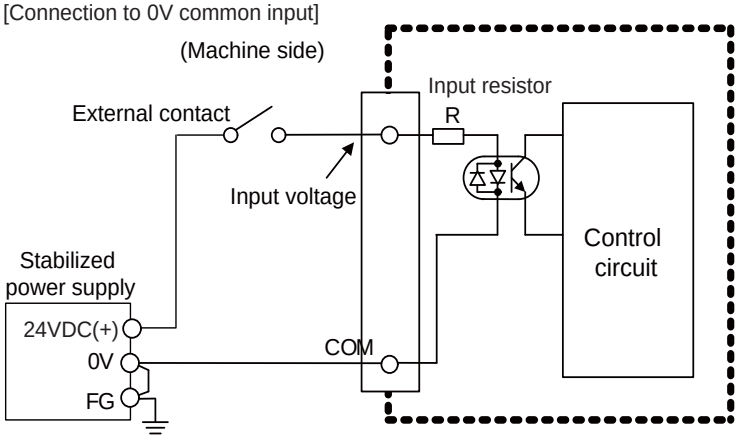
(Note) Input signal holding time: The guide is 40ms or more. The input signal will not be recognized unless it is held for the ladder processing cycle time or longer.

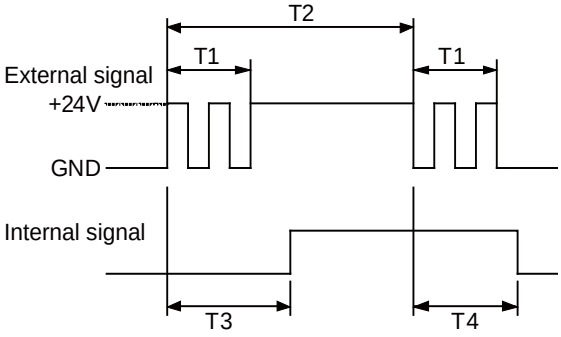
[Connection to 24V common input]





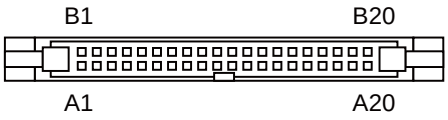
[Connection to 0V common input]





(5) Machine output (CF33)

Digital output



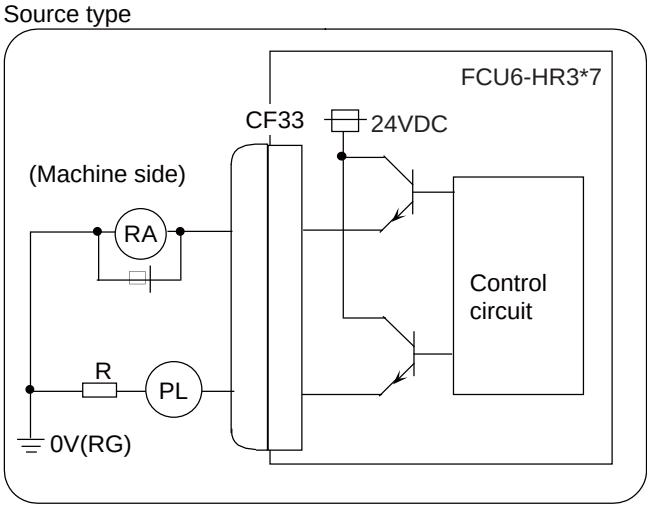
CF33					
		B			A
20	O	Y40	20	O	Y50
19	O	Y41	19	O	Y51
18	O	Y42	18	O	Y52
17	O	Y43	17	O	Y53
16	O	Y44	16	O	Y54
15	O	Y45	15	O	Y55
14	O	Y46	14	O	Y56
13	O	Y47	13	O	Y57
12	O	Y48	12	O	Y58
11	O	Y49	11	O	Y59
10	O	Y4A	10	O	Y5A
9	O	Y4B	9	O	Y5B
8	O	Y4C	8	O	Y5C
7	O	Y4D	7	O	Y5D
6	O	Y4E	6	O	Y5E
5	O	Y4F	5	O	Y5F
4			4		
3			3		
2	I	24VDC	2		0V(RG)
1	I	24VDC	1		0V(RG)

<Cable side connector type>

Connector: 7940-6500SC
Relief: 3448-7940
Recommended manufacturer: Sumitomo 3M

* This is an example when SCAN1 is set to "0", SCAN2 to "1", and DIO to "2".
Refer to "PLC Interface Manual" for details.

The HR357 output circuit is a source type (source output).



⚠CAUTION

1. Do not apply any voltage to the connector other than that specified in this manual. Failure to observe this could cause bursting, damage, etc.

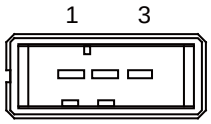
Output conditions

Insulation method	Non-insulation
Rated load voltage	24VDC
Max. output current	60mA/point
Saturation voltage	1.6V (standard)
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=150Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)

(6) 24VDC input (DCIN)

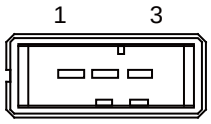


1	I	+24V
2		0V
3		FG

<Cable side connector type>

Connector: 2-178288-3
Contact: 1-175218-5 x3
Recommended manufacturer: Tyco Electronics AMP

(7) Remote I/O unit I/F (RIO3A)
(8) Remote I/O unit I/F (RIO3B)



1	I/O	TXRX1
2	I/O	TXRX1*
3		0V

<Cable side connector type>

Connector: 1-178288-3
Contact: 1-175218-2 x3
Recommended manufacturer: Tyco Electronics AMP

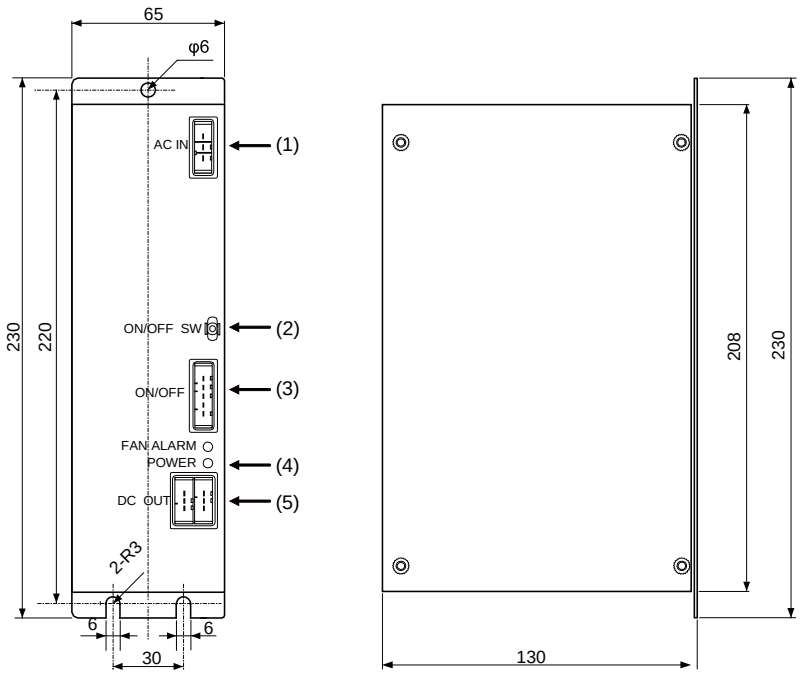
2.8 External Power Supply Unit

Item	PD25
Input power voltage	200 to 230VAC +10%-15% 50/60Hz±1Hz
Output current	3A
Dimension	130mm×65mm×230mm
Mass	1.5kg
Output holding time	300ms

(Note) PD25 will not be turned ON by the ON/OFF switch immediately after the power OFF. Wait at least 2 seconds, and then turn the power ON.

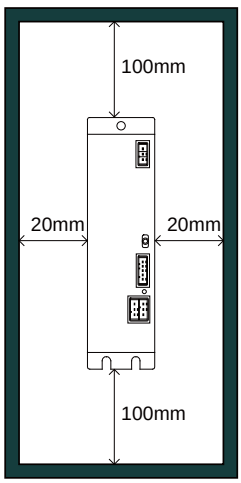
Dimension and names of parts

[PD25]

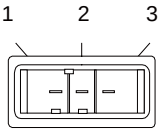


<Mounting direction and clearance>

Mount the external power supply unit vertically and so that it is visible from the front. Provide space for heat dissipation and ventilation.



(1) AC power input (ACIN)



1	I	ACIN N
2	I	ACIN H
3		FG

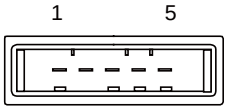
<Cable side connector type>

Connector: 2-178128-3
Contact: 1-175218-5 ×3
Recommended manufacturer: Tyco Electronics AMP

(2) ON/OFF switch (ON/OFF SW)

Switch ON (upward): 24VDC output
Switch OFF (downward): 24VDC output OFF

(3) ON/OFF input (ON/OFF)



1		NC
2	I	P-OFF
3		0V
4		0V
5	I	P-ON

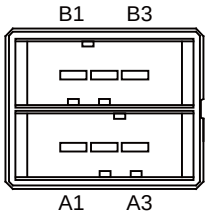
<Cable side connector type>

Connector: 1-178288-5
Contact: 1-175218-5 ×4
Recommended manufacturer: Tyco Electronics AMP

(4) LED (POWER)

Green light at +24V output

(5) 24VDC output (DCOUT)



1A	O	ACFAIL	**1B**	O	+24V
2A		0V	**2B**		0V
3A		NC	**3B**		FG

<Cable side connector type>

Connector: 3-178127-6

Contact: 1-175218-5 (for AWG16) ×3, 1-175217-5 (for AWG22) ×2

Recommended manufacturer: Tyco Electronics AMP

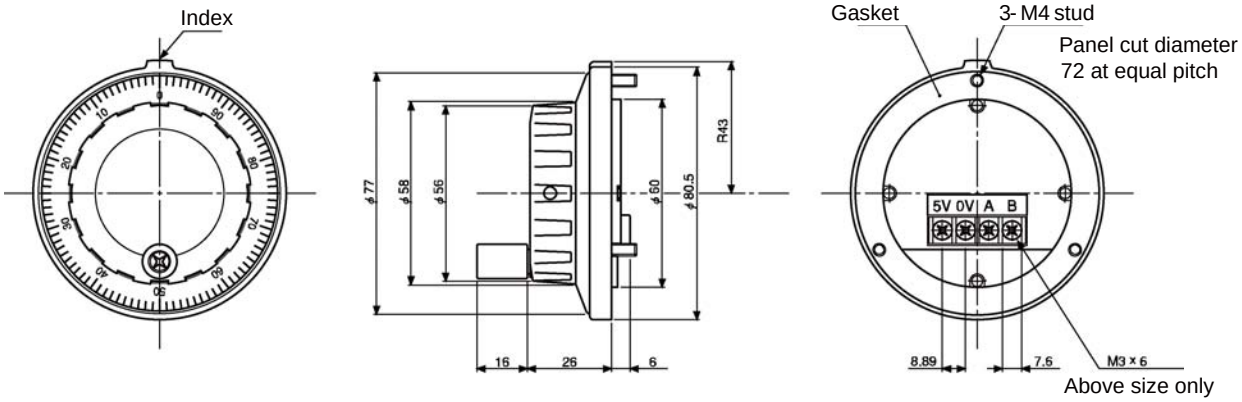
2.9 Manual Pulse Generator

Outline dimension

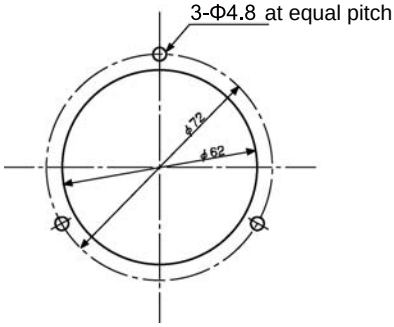
[UFO-01-2Z9]

5V

100 pulse



<Panel cut drawing>



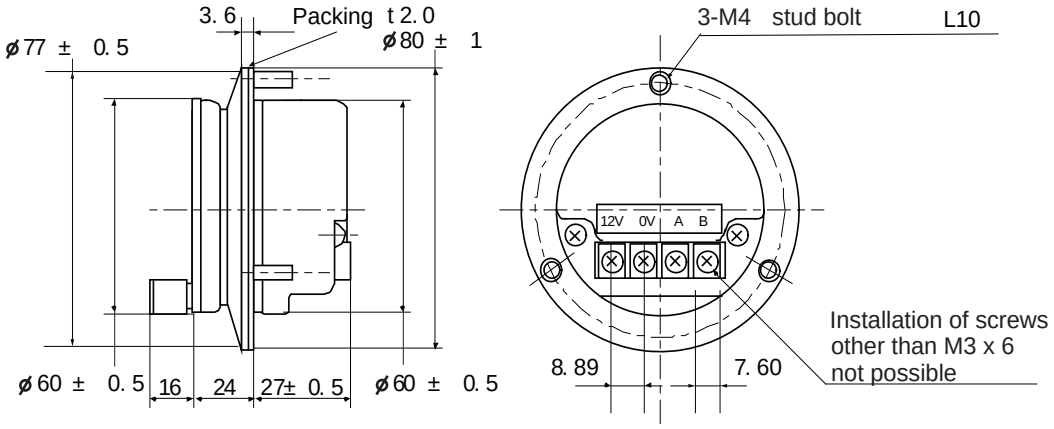
Produced by NIDEC NEMICON CORPORATION

(Note) This product does not comply with the MELDAS specifications.

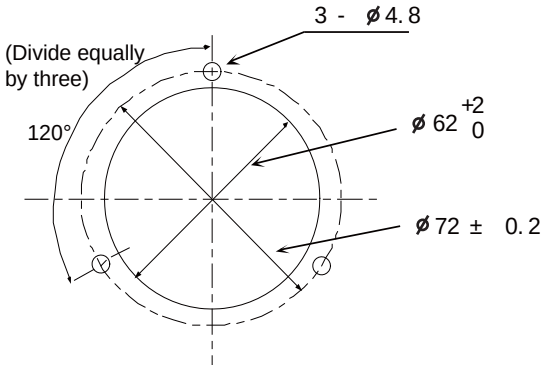
[HD60]

12V

25 pulse



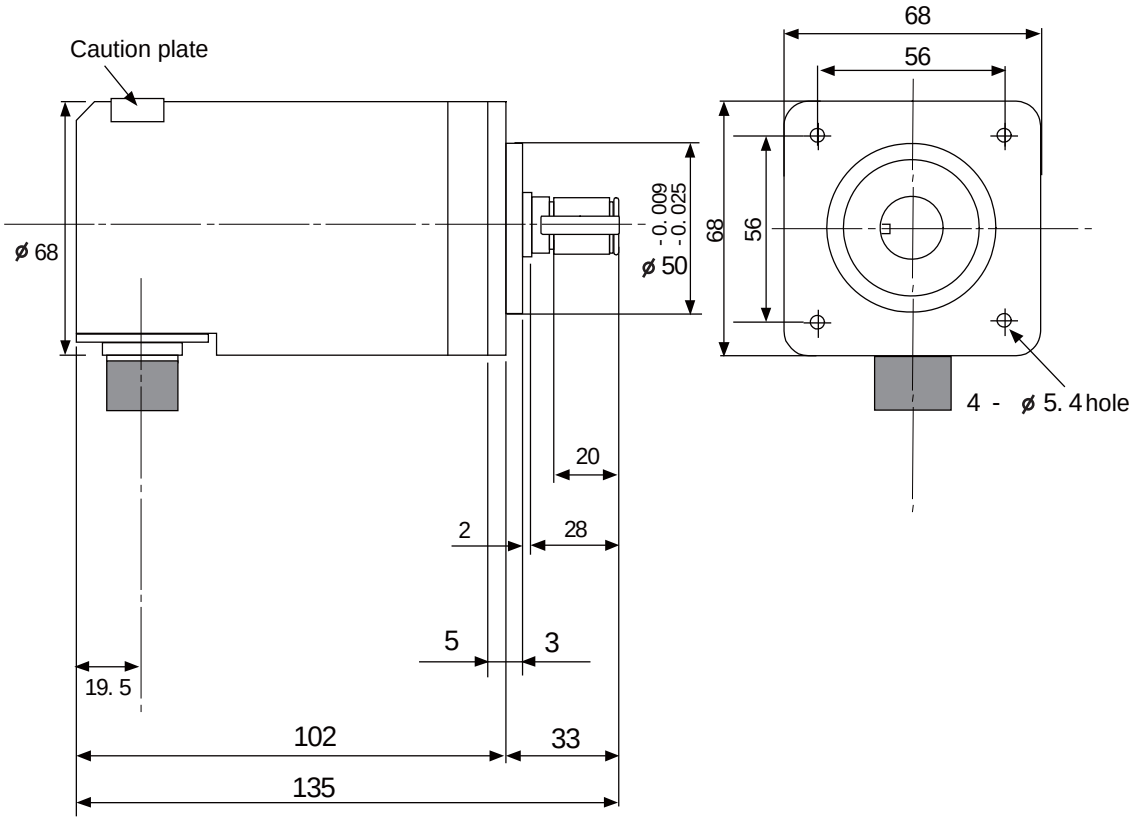
<Panel cut dimension drawing>

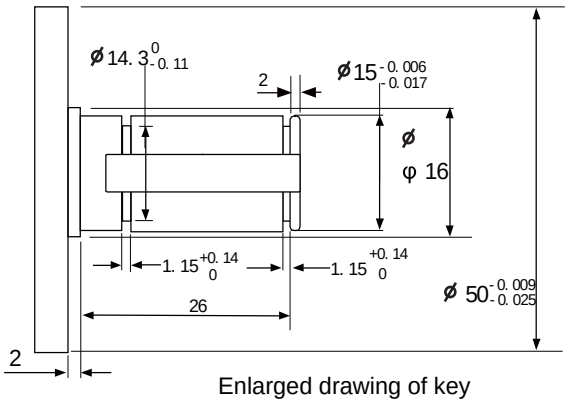


2.10 Synchronous Feed Encoder

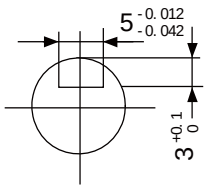
Dimension and names of parts

[OSE-1024-3-15-68]

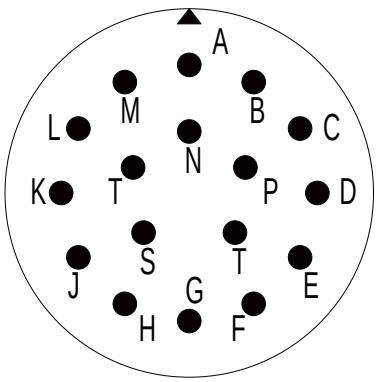




Enlarged drawing of key



Cross section BB
Valid depth of key groove is 21mm



Connector pin assignment

Pin	Function	Pin	Function
A	A phase	**K**	0V
B	Z phase	**L**	-
C	B phase	**M**	-
D	-	**N**	A phase
E	Case grounding	**P**	Z phase
F	-	**R**	B phase
G	-	**S**	-
H	+5V	**T**	-
J	-		

2.11 Precautions for Use of Commercially Available CF Cards

(1) Commercially available CF cards may not be compatible with MITSUBISHI units or suitable FA environment for temperature- or noise-wise. In case of using it, careful performance check must be required by the machine tool builder.

(2) When inserting/removing a commercially available CF card, turn the MITSUBISHI device's power OFF to avoid any troubles. If a card must be inserted and removed while the power is ON, make sure to take sufficient time (approx. ten seconds or more) between the insertion and removal.

(3) Do not pull out the card or turn OFF the power during access to the CF card. Failure to observe this could cause the memory contents to be erased. In case of emergency, always perform backups by having your important data duplicated, etc. as MITSUBISHI will not guarantee the broken or lost data.

(4) The following products' operations have been guaranteed by MITSUBISHI.

<SanDisk CompactFlash cards>

64MB SDCFB-64-J60 (JAN: 4523052000294)
128MB SDCFB-128-J60 (JAN: 4523052000300)
256MB SDCFB-256-J60 (JAN: 4523052000317)
512MB SDCFB-512-J60 (JAN: 4523052000324)
1.0GB SDCFB-1024-J60 (JAN: 4523052000331)

<Panasonic SD memory cards>

1.0GB SD-CF adapter BN-CSDABP3/P + SD memory card (1GB) RP-SDM01GJ1A
2.0GB SD-CF adapter BN-CSDABP3/P + SD memory card (2GB) RP-SDM02GJ1A

(Note) The adapter BN-CSDABP3/P does not support SDHC memory card.
SD-CF adapter which supports SDHC is required when SDHC memory card is used.

The successful operations of these cards are confirmed under certain conditions. Some cards might not work under the end-users' system environment. And some cards might have the same type name but different parts inside: Complete guarantees cannot be given.
Contact the manufacturer or distributor before purchase: There might be some cards which are not currently produced.

3

Installation

3.1 Heat Radiation Countermeasures

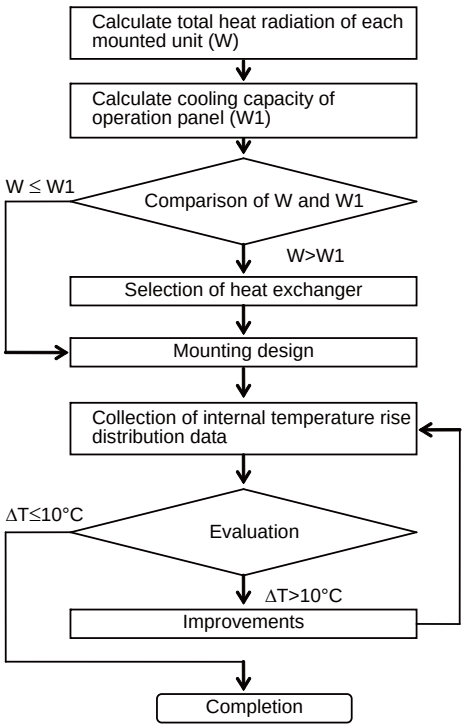
Please refer to the following method for heat radiation countermeasures.

Example of heat radiation countermeasures

<Hypothetical conditions>

(1) Average internal temperature of operation panel: T ≤ 55°C
(2) Peripheral temperature of operation panel : Ta ≤ 0°C to 45°C
(3) Internal temperature rise value : ΔT = T–Ta (*max*) = 10°C

Procedures for heat design and verification



<Supplement>

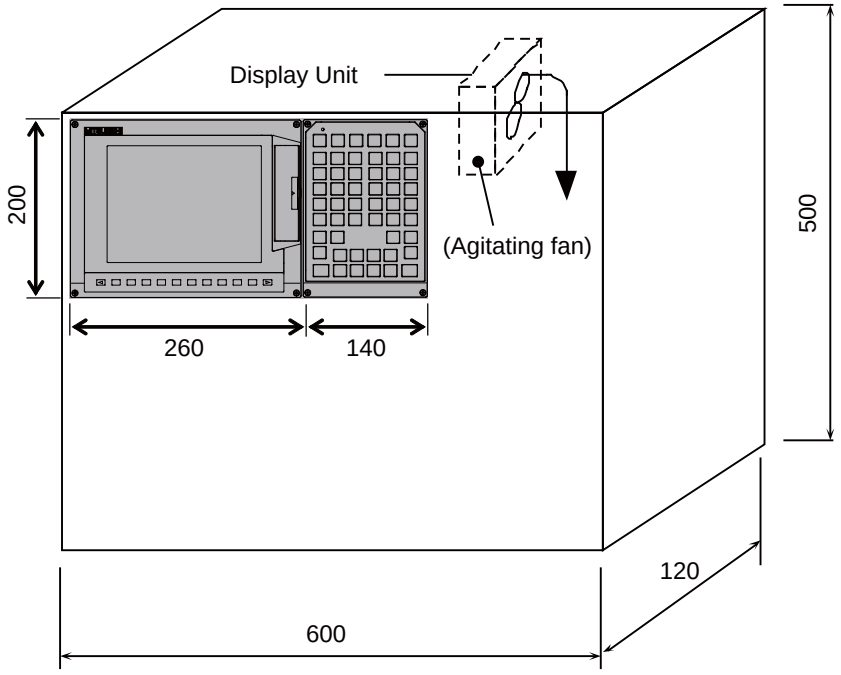
(1) Refer to "3. General Specification" for the heat generated by each unit.

(2) Enclosed cabinet (thin steel plate) cooling capacity calculation equation
W1 = U × A × ΔT
U: 6 W/m^2°C
A: Effective heat radiation area (m^2)
ΔT: Internal temperature rise value (10°C)
(Area where heat can be radiated from operation panel)
<Caution>
8 W/m^2°C can be applied only when the operation panel is so small that the internal temperature stays uniform.

(3) Points of caution for heat radiation countermeasures when designing mounting state
* Consider convection in operation panel (eliminate heat spots)
* Collect hot air at suction port of heat exchanger in operation panel.

(4) Criterion for internal temperature rise distribution data
ΔT (average value) ≤ 10°C
ΔT*max* (maximum value) ≤ 15°C
R (inconsistency ΔT*max* – ΔT*min*) ≤ 6°C
(Evaluate existence of heat spots)

The following shows an example of calculation applied to heat radiation countermeasures for the operation panel when 8.4-type display unit is used. Because heat will accumulate in the upper portions of the unit, install an agitating fan as required.



Calculation example of panel internal heating value

(1) Calculation of unit heating value

Heating value (W)

Total heating value of units (W): 28W

(control unit + display unit + keyboard unit + operation panel I/O unit)

Total heating value (W) by machine input (D1): 5.6W

(24V (total heating value when the 32 points are simultaneously turned ON) × 7.3mA × 32)

... 24V (current consumption per point of the operation panel I/O unit DI) divided by 3.3kΩ

≒ 7.3mA

Total heating value W = 33.6W (28 + 5.6)

(2) Calculation of operation panel cooling capacity

Tolerance value for temperature rise (⊿t)

Panel internal temperature (according to each unit's specification) T ≤ 55C°

Panel peripheral temperature (according to machine's specification) Ta ≤ 45C°

Tolerance value for internal temperature rise ⊿T = 10C° (T – Ta)

Heat radiation area (A)

The surface of the molded unit, which has lower radiation capacity than the base plate surface, should be excluded for the heat radiation area in principle. The bottom of the operation panel, which has difficulty in radiating due to the temperature distribution, should also be excluded for the heat radiation area in principle.

Heat radiation area A = 0.71mm^2

(≒ 0.6 × 0.12 + 0.6 × 0.5 × 2 – (0.26 + 0.14) × 0.2 + 0.12 × 0.5 × 2)

(Top panel) (Front/rear panels) (Unit surface) (Both sides)

Operation panel cooling capacity (W1)

Calculate the cooling capacity to keep the temperature rise in the operation panel less than 10°C.

Cooling capacity W1 = 42.6W (6 × A × ⊿T)

(3) Comparison of heating value and operation panel cooling capacity

The operation panel cooling capacity is over the heating value, which presumed no need to install the heat exchanger.

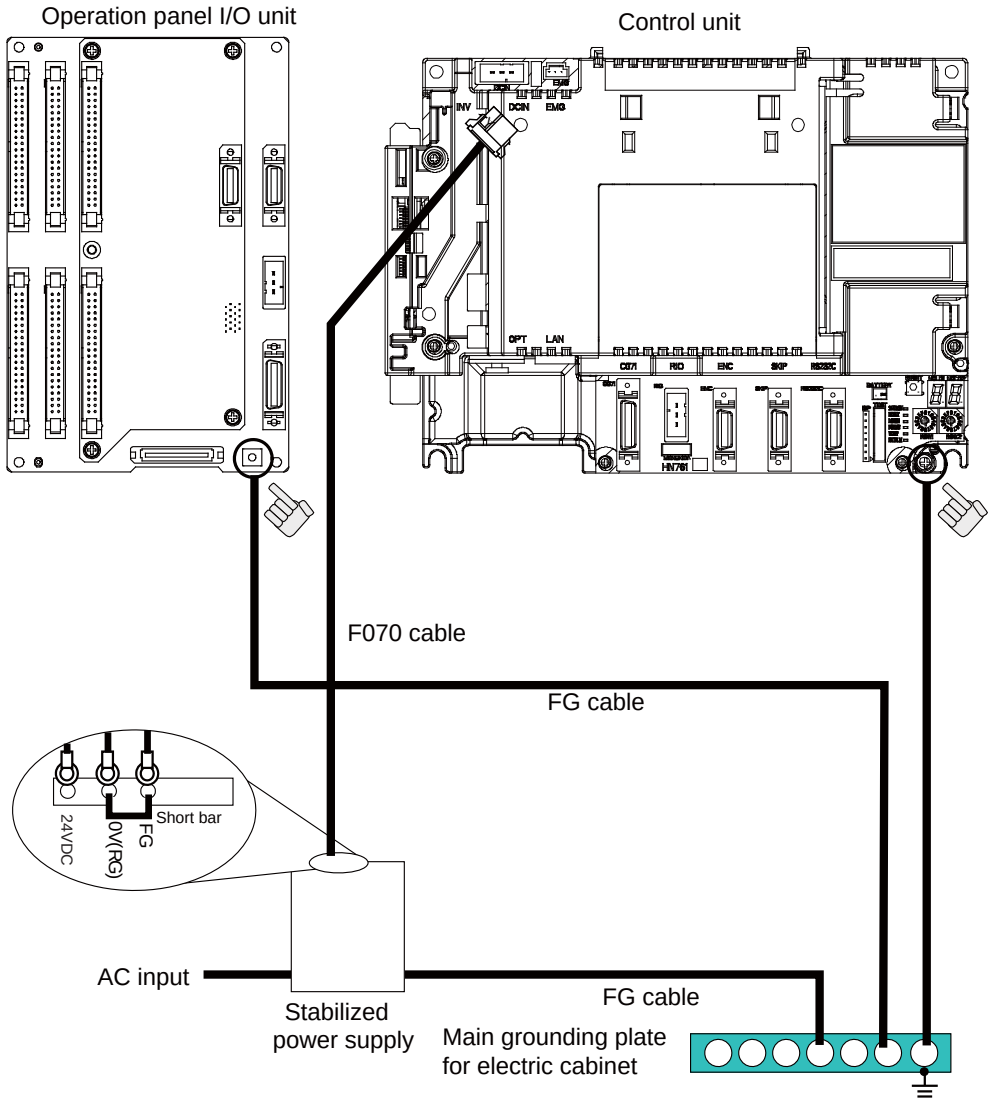
(4) Confirmation with the actual machine

The result of the calculation above is only a rough indication. The actual temperature rise may differ according to the structure of the operation panel. Be sure to confirm the temperature rise value in the operation panel when the machine is running.

3.2 Noise Countermeasures

3.2.1 Connection of FG (Frame Ground)

The frame should basically be grounded at one ground point.
Connect the control unit and operation panel I/O unit's 0V (RG) to the FG on the +24V stabilized power supply.



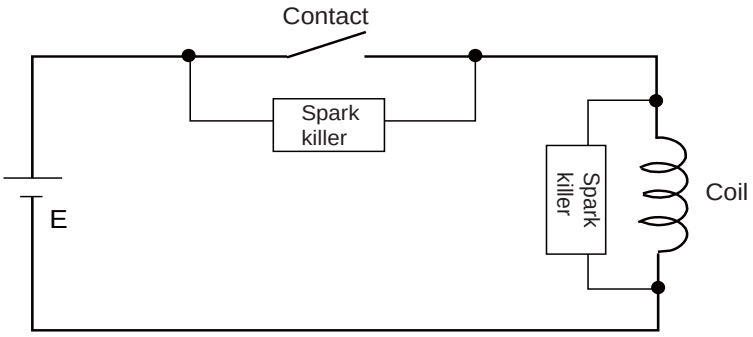
(Note) "24VDC" represents (+) side (24VDC) of 24V stabilized power supply, while "0V(RG)" represents (-) side. "FG" (Frame Ground) corresponds to the general expression "PE" (Protective Earth).

3.2.2 Shield Clamping of Cables

The shield cables connected to the units must be properly connected to the ground with clamp fittings and the like in order to stabilize the system's operation while preventing malfunctioning due to exogenous noise. (Refer to 5.6.1.)

3.2.3 Connecting Spark Killers

Connect a spark killer on the coil or the contact in parallel for noise countermeasures.
Use spark killers which are 0.33 to 0.1 μ F, 10 to 120Ω.

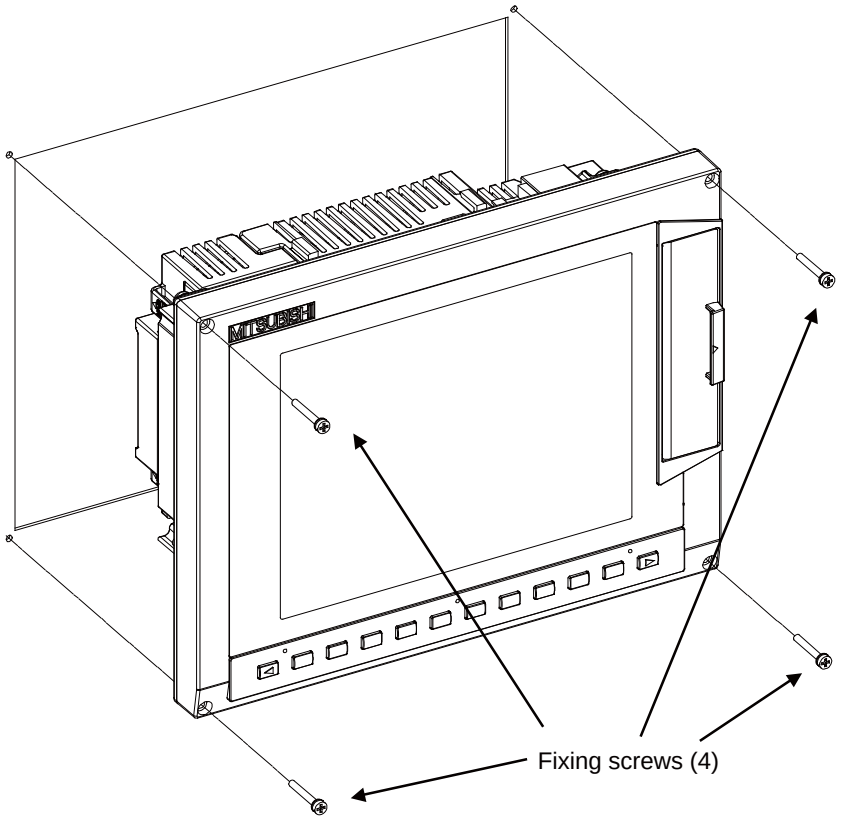


3.3 Unit Installation

3.3.1 Display unit

Mount the display unit with four fixing screws.

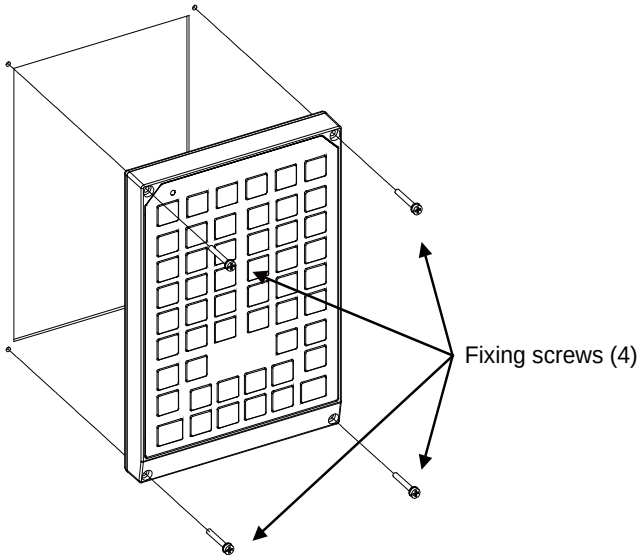
(Note) Refer to "2.3 Display Unit" for the panel cut dimension drawing and the screw hole position.



3.3.2 Keyboard Unit

Mount the keyboard unit with four fixing screws.

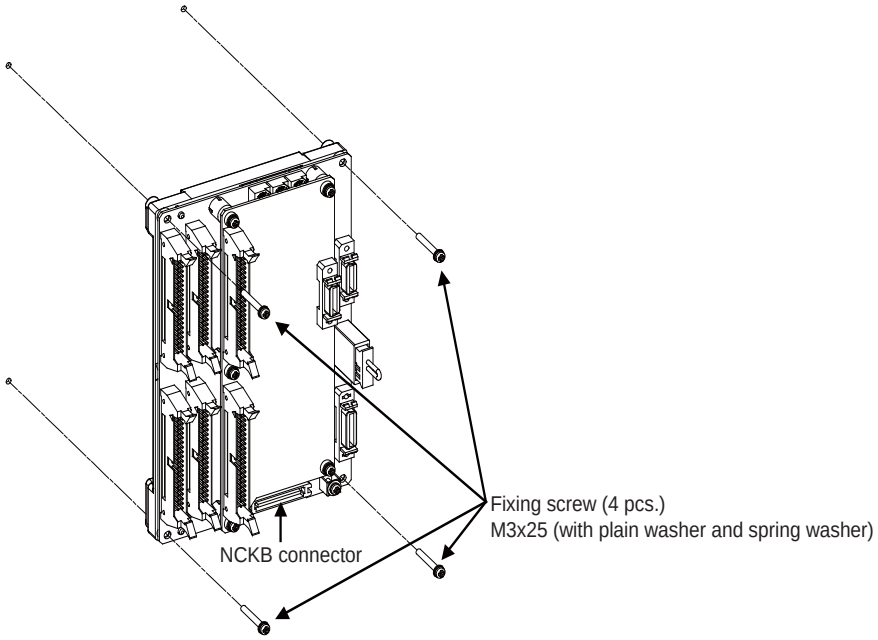
(Note) Refer to "2.5 Keyboard Unit" for the panel cut dimension drawing and the screw hole position.



3.3.3 Operation Panel I/O Unit

Mount the operation panel I/O unit on the back of the keyboard unit with four fixing screws.

(Note) The operation panel I/O unit is usually mounted on the keyboard unit when shipped.



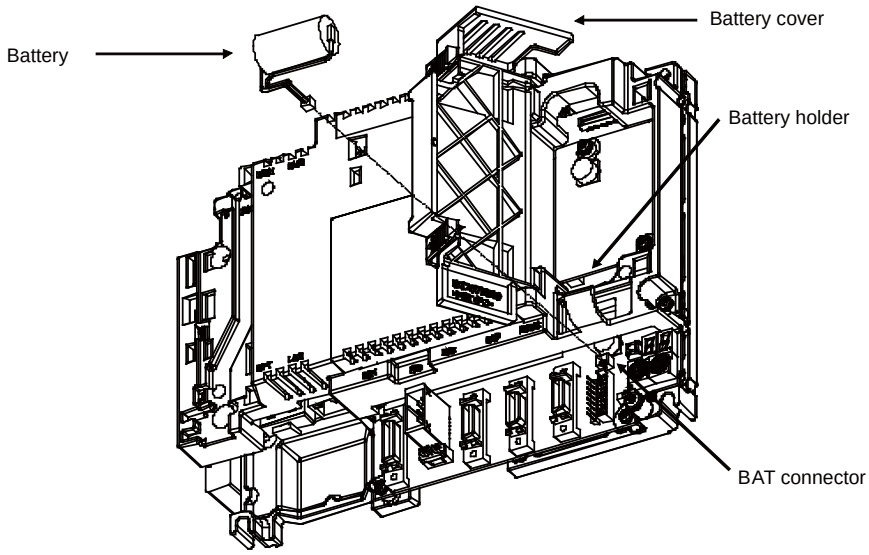
3.3.4 Control Unit Battery

A lithium battery in the control unit battery holder retains parameter settings, machining programs and the like, which requires to be backed up at the power OFF.

Battery	Q6BAT
Battery cumulative data holding time	45,000 hours (At 0 to 45C°. The life will be shorter if the temperature is high.)
Battery life	Approx. 5 years (from date of battery manufacture)

[Installation method]

(1) Check that the machine power is turned OFF. (If the power is not OFF, turn it OFF.)
(2) Confirm that the control unit LED, 7-segment display, etc., are all OFF.
(3) Open the battery cover of the control unit. Pull the right side of the battery cover toward front.
(4) Fit the new battery into the battery holder.
(7) Insert the connector connected to the new battery into the BAT connector. Pay attention to the connector orientation, being careful not to insert backwards.
(8) Close the front cover of the control unit. At this time, confirm that the cover is closed by listening for the "click" sound when the latch catches.



[Precautions for handling battery]

(1) Do not disassemble the battery.
(2) Do not place the battery in flames or water.
(3) Do not pressurize and deform the battery.
(4) This is a primary battery so do not charge it.

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

4

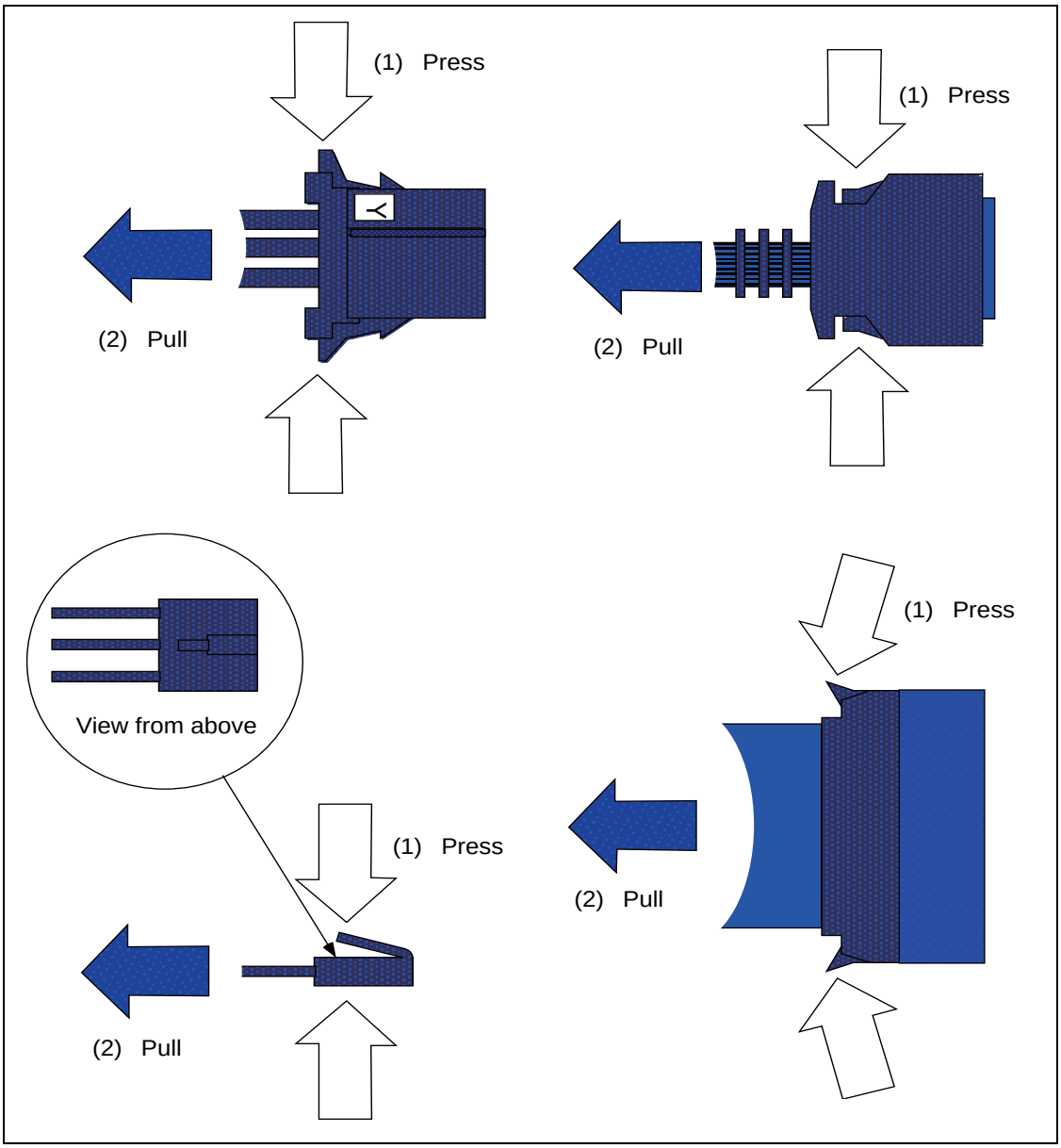
Connection

4.1 Precautions for Wiring

4.1.1 Precautions when Connecting/Disconnecting Cables

If the cable is connected/disconnected without turning the power OFF, the normal unit or peripheral devices could be damaged, and risks could be imposed.
Disconnect each cable with the following procedures.

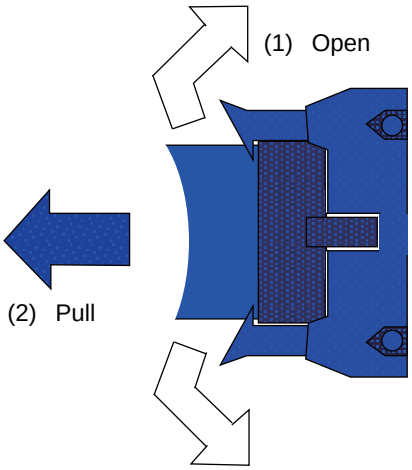
(a) For the following type of connector, press the tabs with a thumb and forefinger in the direction of the arrow, and pull the connector off.



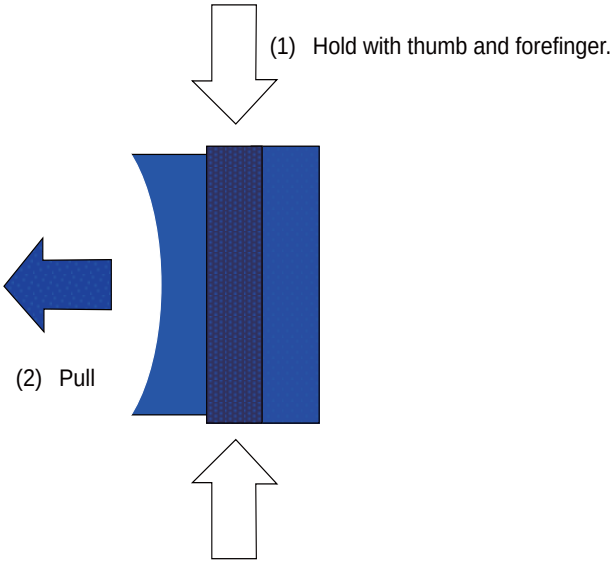
⚠CAUTION

1. Do not connect or disconnect the connection cables between each unit while the power is ON. Do not pull the cables when connecting/disconnecting it.

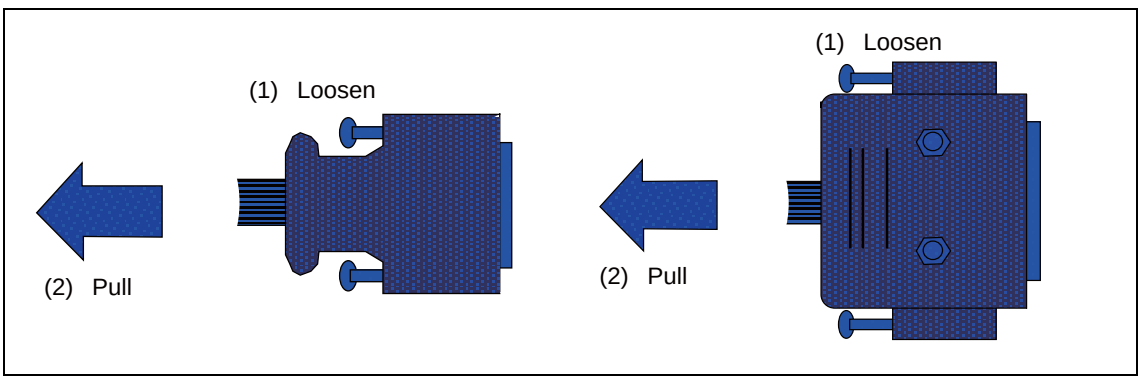
(b) For a flat cable type connector with latches, open the latches in the directions of the arrows, and pull the connector off.



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



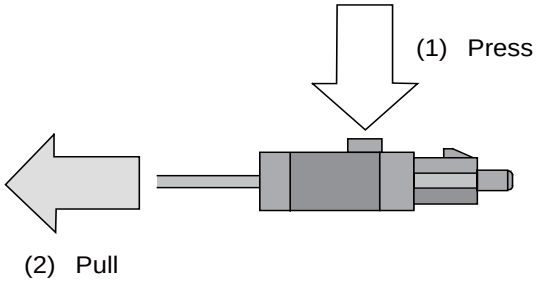
(d) For the screw fixed type connector, loosen the two fixing screws, and pull the connector off.



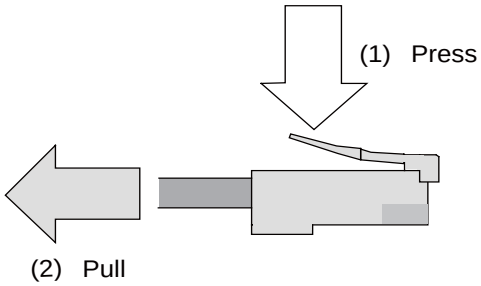
⚠ CAUTION

1. Do not connect or disconnect the connection cables between each unit while the power is ON.
2. Do not pull the cables when connecting/disconnecting it.

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



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



⚠CAUTION

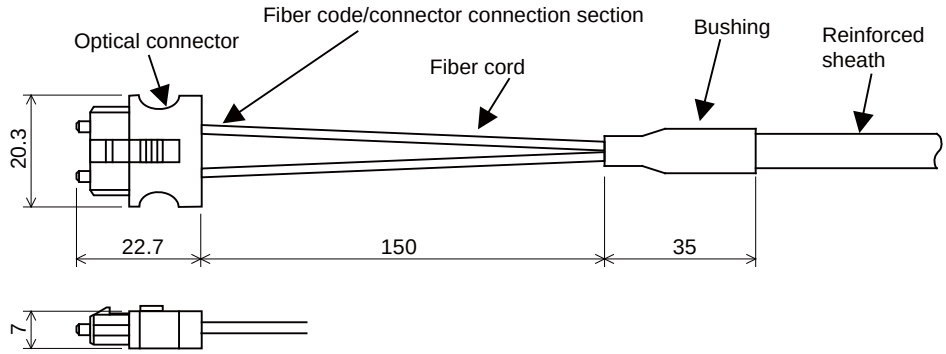
1. Do not connect or disconnect the connection cables between each unit while the power is ON.
2. Do not pull the cables when connecting/disconnecting it.

4.1.2 Precautions for Using Optical Communication Cable

An optical communication cable is used for communication between the control unit and the drive unit. Special precautions, differing from the conventional cable, are required when laying and handling the optical communication cable.

(Note) If the cable you use is not Mitsubishi's, malfunctions resulted from connection problems or aged deterioration are not covered under the warranty.

4.1.2.1 Optical Communication Cable Outline and Parts



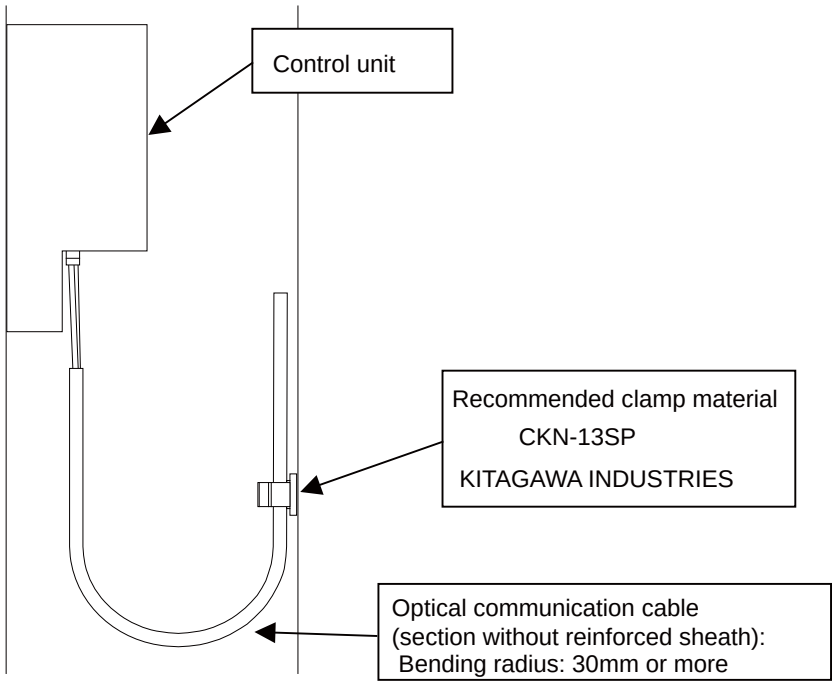
To ensure the system performance and reliability, purchase the optical communication cable from Mitsubishi. A machining drawing is given in "8. Cable" as reference, but the purchased optical communication cable cannot be cut or connected by the machine tool builder.

4.1.2.2 Precautions for Handling Optical Communication Cable

(1) A protective cap is attached to the optical module and optical communication cable mounted on the PCB when the system is delivered. Leaving this protective cap unattached could result in connection faults from the adherence of dirt and dust. Do not remove the protective cap when not connecting the cable. If dirty, wipe off lightly with a piece of dry gauze, etc. (Do not use solvents such as alcohol as the optical fiber material could melt.)
(2) Hold the connector section when connecting or disconnecting the optical connector. Holding the fiber cord will result in force exceeding the tolerable tension on the fiber cord and connector connection section, and could cause the fiber cord to dislocate from the optical connector thereby inhibiting use.
(3) The optical connector cannot be connected in reversed. Check the connector orientation when connecting the optical communication cable to the optical module. Align the connector lock lever with the lock holes on the PCB's optical module, and press the connector straight in. Confirm that the lock lever connects with the optical module and that a "click" is heard.
(4) When disconnecting the optical communication cable from the PCB, press the lock release buttons on the lock lever, and pull out the cable while holding the connector section. The connector could be damaged if the cable is pulled without pressing down on the lock release buttons.
(5) Do not apply excessive force onto the optical communication cable by stepping on it or dropping tools, etc., on it.

4.1.2.3 Precautions for Laying Optical Communication Cable

(1) Do not apply a force exceeding the cable's tolerable tension. Binding the cables too tight with tie-wraps 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.
(2) Do not connect the cables with a radius less than the tolerable bending radius. Excessive stress could be applied near the connector connection section and cause the optical characteristics to drop. The cable bending radius should be 10 times or more than the outer diameter at the reinforced sheath, and 20 times or more than the outer diameter at the fiber cord section.
(3) Do not apply torsion to the optical communication cable. Laying a twisted cable could cause the optical characteristics to drop.
(4) When laying the cables in a conduit, avoid applying stress on the fiber cord and connector connection section. Use the tensile end such as a pulling eye or cable grip, etc.
(5) Fix the reinforced sheath with a cable clamp so that the mass of the optical communication cable is not directly applied on the fiber cord and connector connection section.
(6) Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the POF cable to break.
(7) Loop the excessive cable with twice or more than the minimum bending radius.



Recommended clamp material: CKN-13SP KITAGAWA INDUSTRIES.

4.1.3 Precautions for Connecting 24V Power Supply

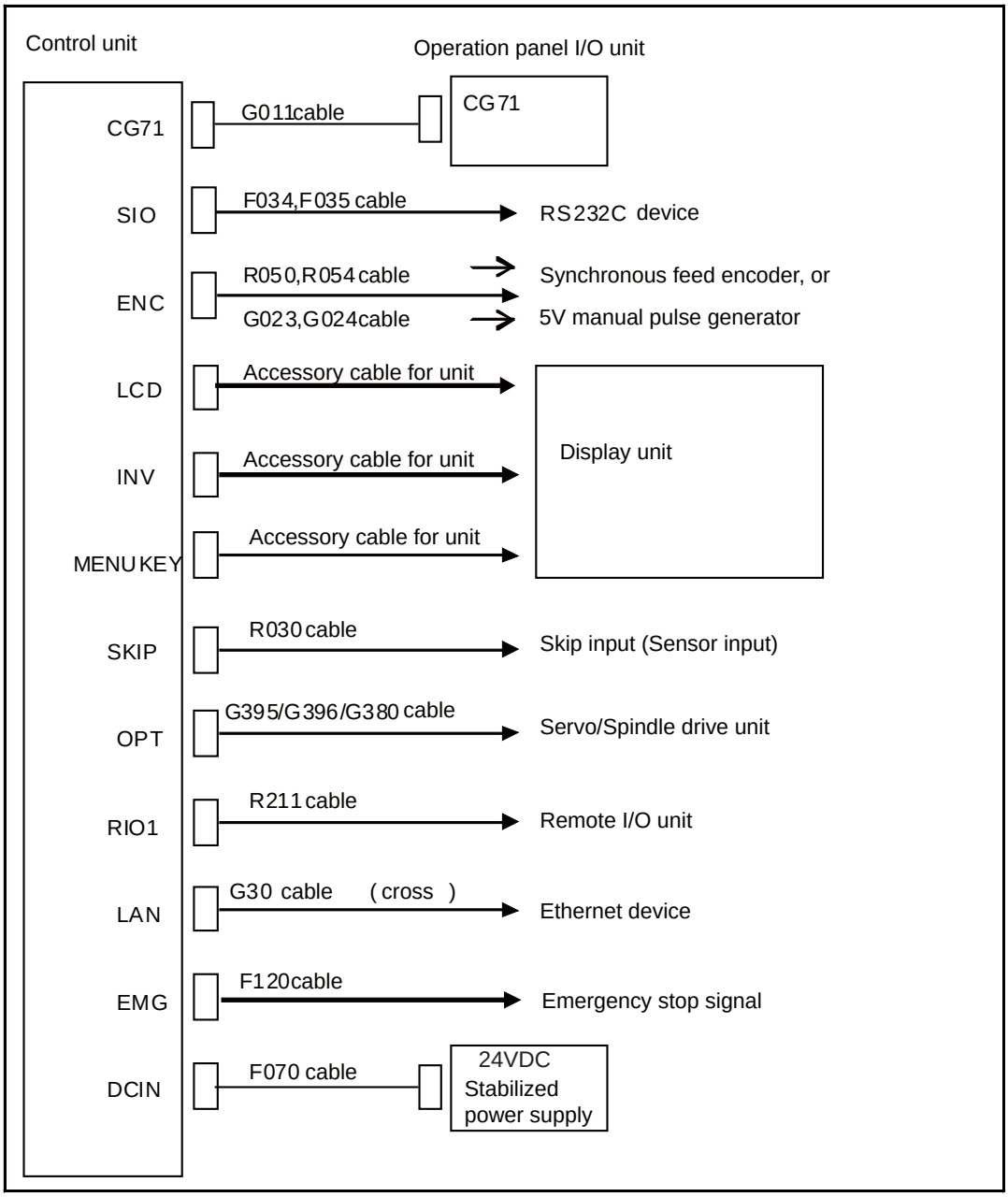
(1) When 24V power is supplied to the unit (control unit, display unit) under the following conditions, welding may occur on the contacts due to rush current; so be careful.

When 24VDC's ON/OFF are directly controlled by a magnetic switch such as relay AND
When heat capacity of the contacts for relay, etc. used to control 24VDC's ON/OFF is small.

4.2 Connection of Control Unit

The method for connecting to each unit and device from the control unit are explained in this section.

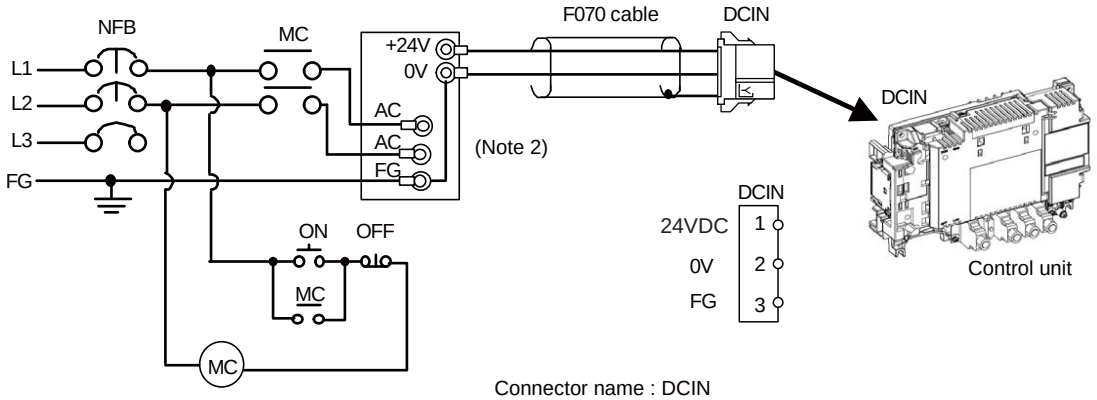
4.2.1 Control Unit Connection System Drawing



4.2.2 Connecting with Power Supply

Connect a general-purpose 24VDC stabilized power supply or PD25 power supply unit to the control unit.

(1) When using general-purpose 24VDC stabilized power supply



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

(Note 1) Rush current may occur to lead welding on the contacts, when a magnetic switch such as relay directly controls 24VDC's ON/OFF during 24V power supply to the control unit. Use relay with large heat capacity of contacts to control 24VDC's ON/OFF.

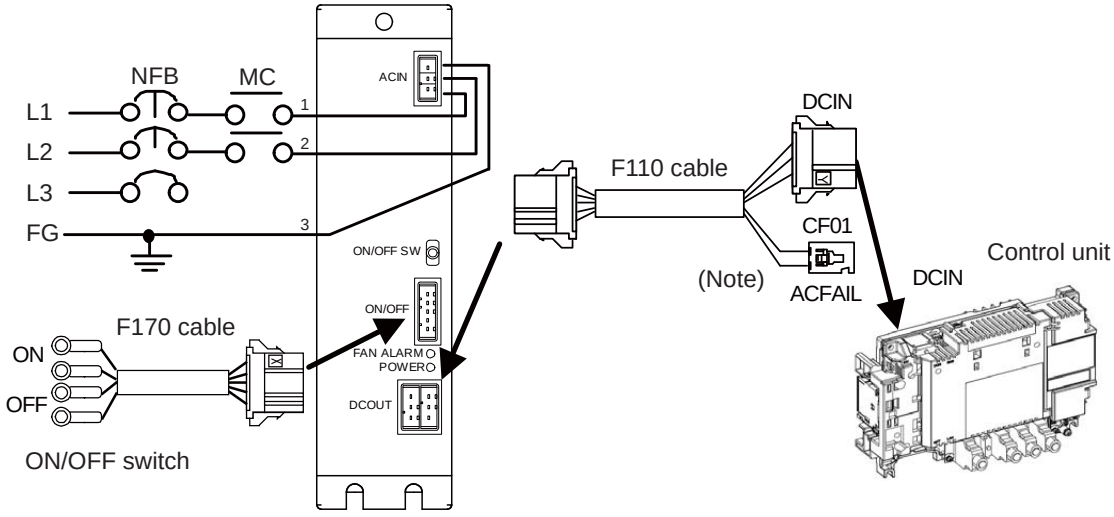
(Note 2) Make a short-circuit between OV and FV on the terminal to cut noise.

<Related items>

Cable drawing: "8.11 F070 Cable"

Connector pin assignment: "2.2 Control Unit" (DCIN connector)

(2) When using PD25 power supply unit



(Note) MITSUBISHI CNC 70 series does not employ ACFAIL function. (CF01 is not connected.)

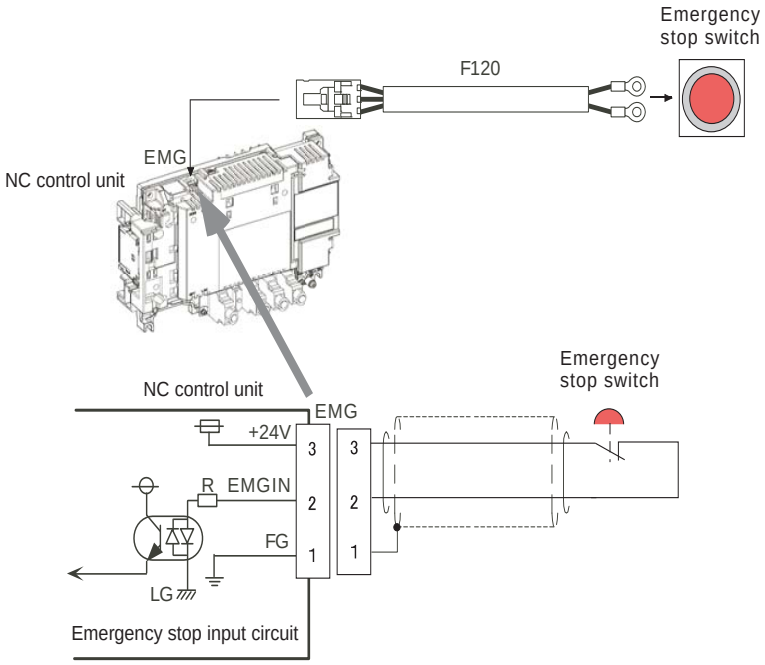
<Related items>

Cable drawing: "8.12 F110 Cable" "8.14 F170 Cable"

Connector pin assignment: "2.2 Control Unit" (DCIN connector)

4.2.3 Connecting with Emergency Stop Signal

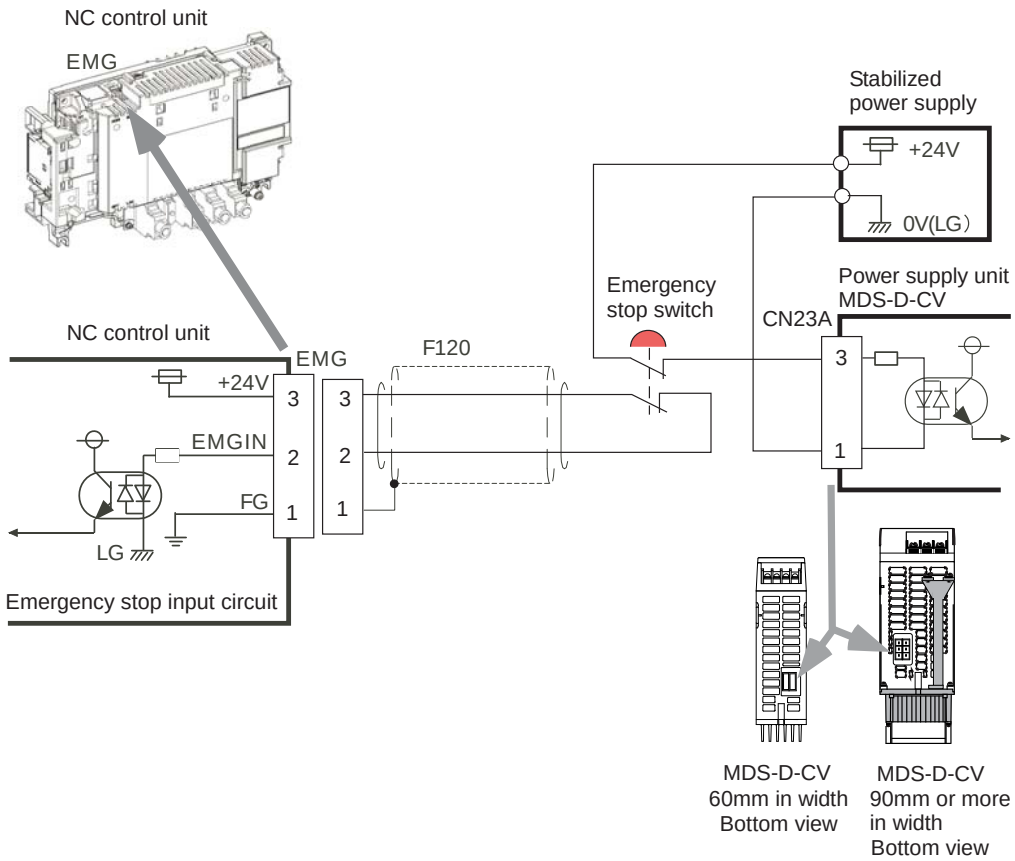
Emergency stop switch is connected to EMG connector by F120 cable.



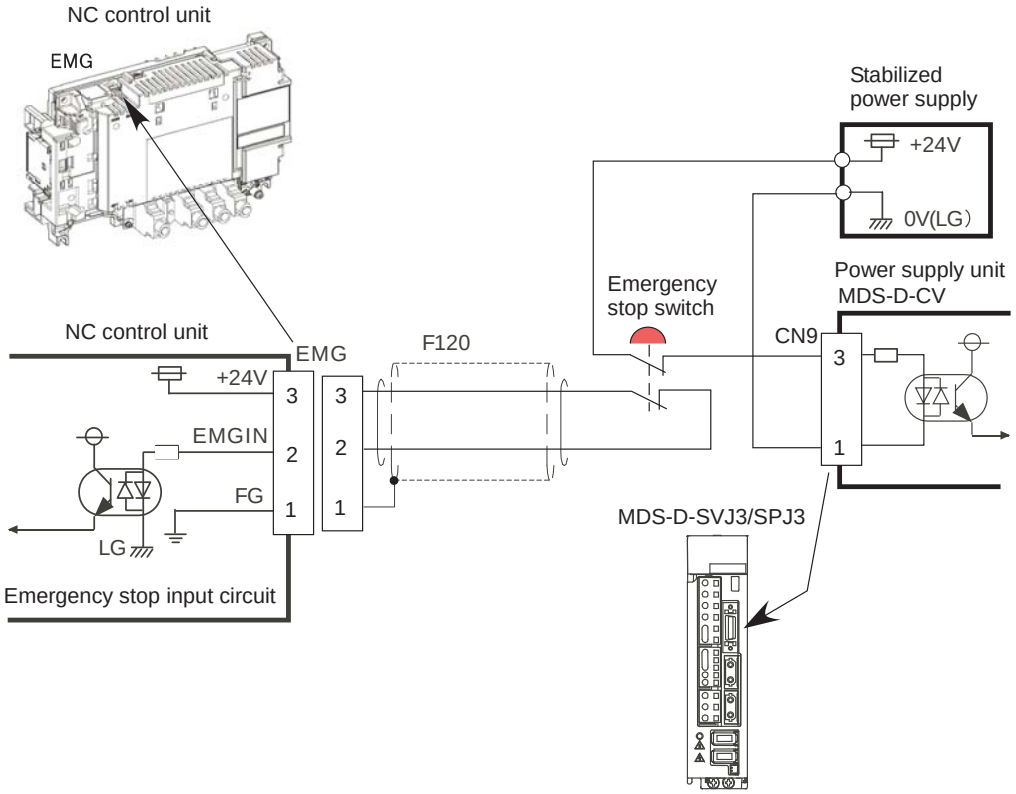
<Related items>

Cable drawing: "8.13 F120 Cable"

<Power suppply unit external emergency stop: Example 1>



<Power supply unit external emergency stop: Example 2>

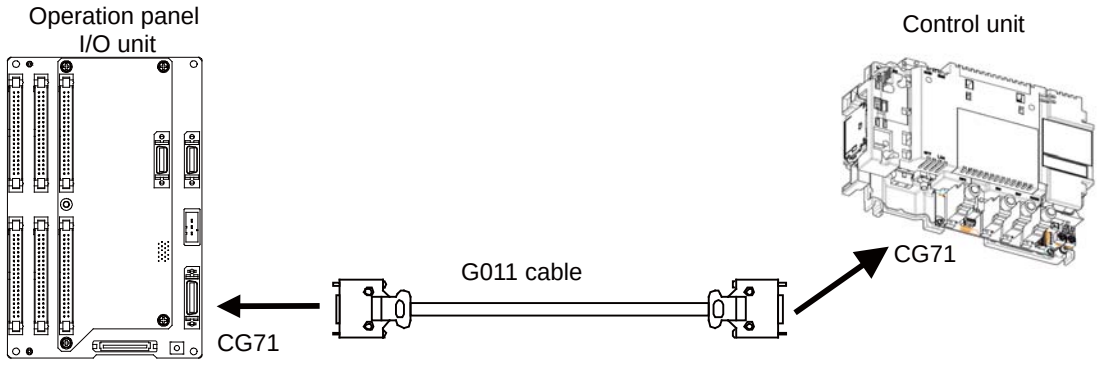


<Caution>

(1) External emergency stop cannot substitute the emergency stop signal which is input to NC.
(2) When duplicating emergency stop input, wire the NC emergency stop input and the power supply unit external emergency stop input from the same emergency stop switch.
(3) Refer to "MDS-D/DH Series Instruction Manual" when applying motor brake control.

4.2.4 Connecting with Operation Panel I/O Unit

Connect the operation panel I/O unit to the connector CG71.



<Related items>

Cable drawing: "8.23 G011 Cable"

Connector pin assignment: "2.2 Control Unit" (CG71 connector)

4.2.5 Connecting with Servo Drive Unit

Connect the optical communication cables from the NC to the each drive unit so that they run in a straight line from the NC to the drive unit that is a final axis. Up to 11 axes can be connected per system. Note that the number of connected axes is limited by the NC.

(Note) Refer to "4.1.2 Precautions for Using Optical Communication Cable" when handling and wiring optical communication cable.

Cable application table

Cable	Panel internal wiring		Panel external wiring	
	Under 10m	10 to 20m	10m or less	10 to 20m
G396	○	×	×	×
G395	○	×	○	×
G380	○	○	○	○

4.2.5.1 Connecting with MDS-D/DH Series

⚠ CAUTION Connect the NC and the drive units by the optical communication cables. The distance between the NC and the final drive unit must be within 30m and the bending radius within 80mm.

POINT Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the MDS-D/DH Series Instruction Manual.) The axis No. has no relation to the order for connecting to the NC.

(1) When using one power supply unit

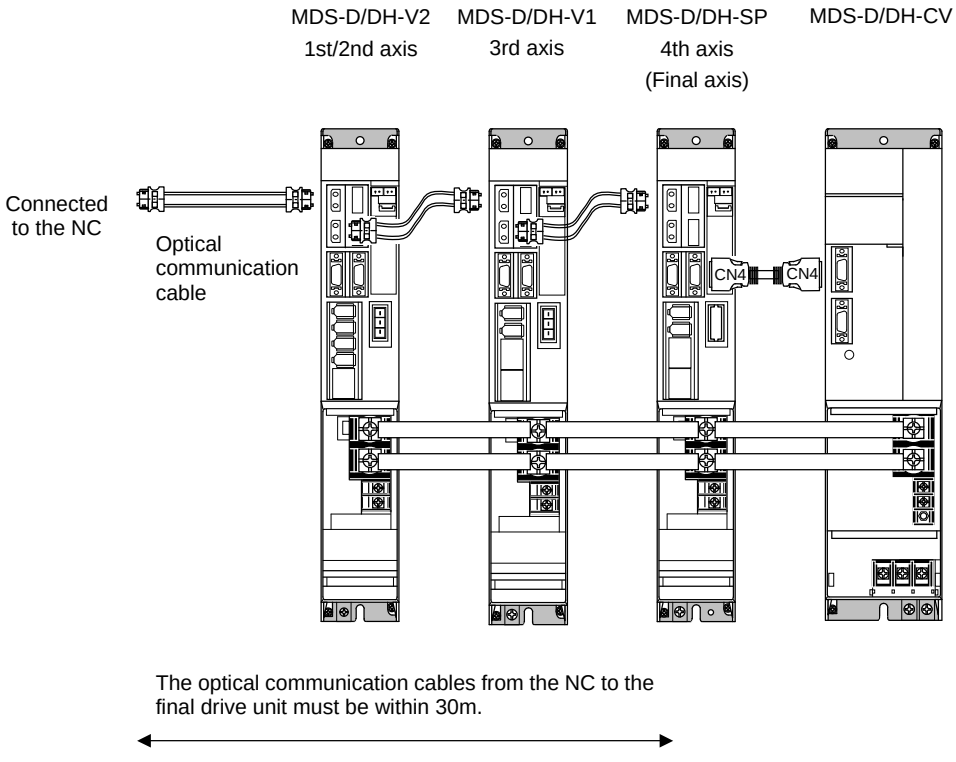
Connect the largest-capacity spindle drive unit to the final axis of the NC communication bus in order to control the power supply unit. The spindle drive unit must be installed adjacent to the power supply unit. In the system with servo only, a servo drive unit for controlling unbalance axis must be installed in the same manner in the same way.

<Connection>

CN1A: CN1B connector on NC or previous stage's drive unit

CN1B: CN1A connector on next stage's drive unit

CN4: Connector for communication between power supply unit (master side) and drive unit

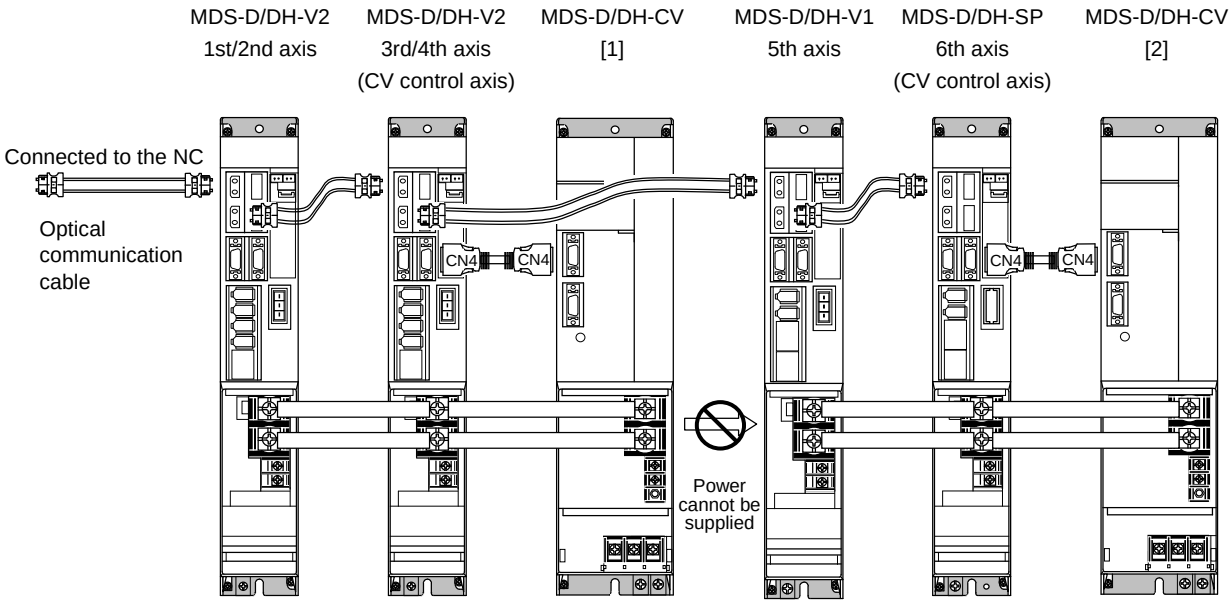


Connection when using one power supply unit

(2) When using two or more power supply units within a single NC communication bus system

Two or more power supply units may be required within a single NC communication bus system if the spindle drive unit capacity is large. The drive unit receiving power (L+, L-) from each power supply unit must always have NC communication cable connection at the NC side of each power supply unit. In the NC communication bus connection example below, power supply [1] cannot supply power (L+, L-) to the 5th axis servo drive unit.

For basic connection information, refer to the MDS-D/DH Series Instruction Manual.



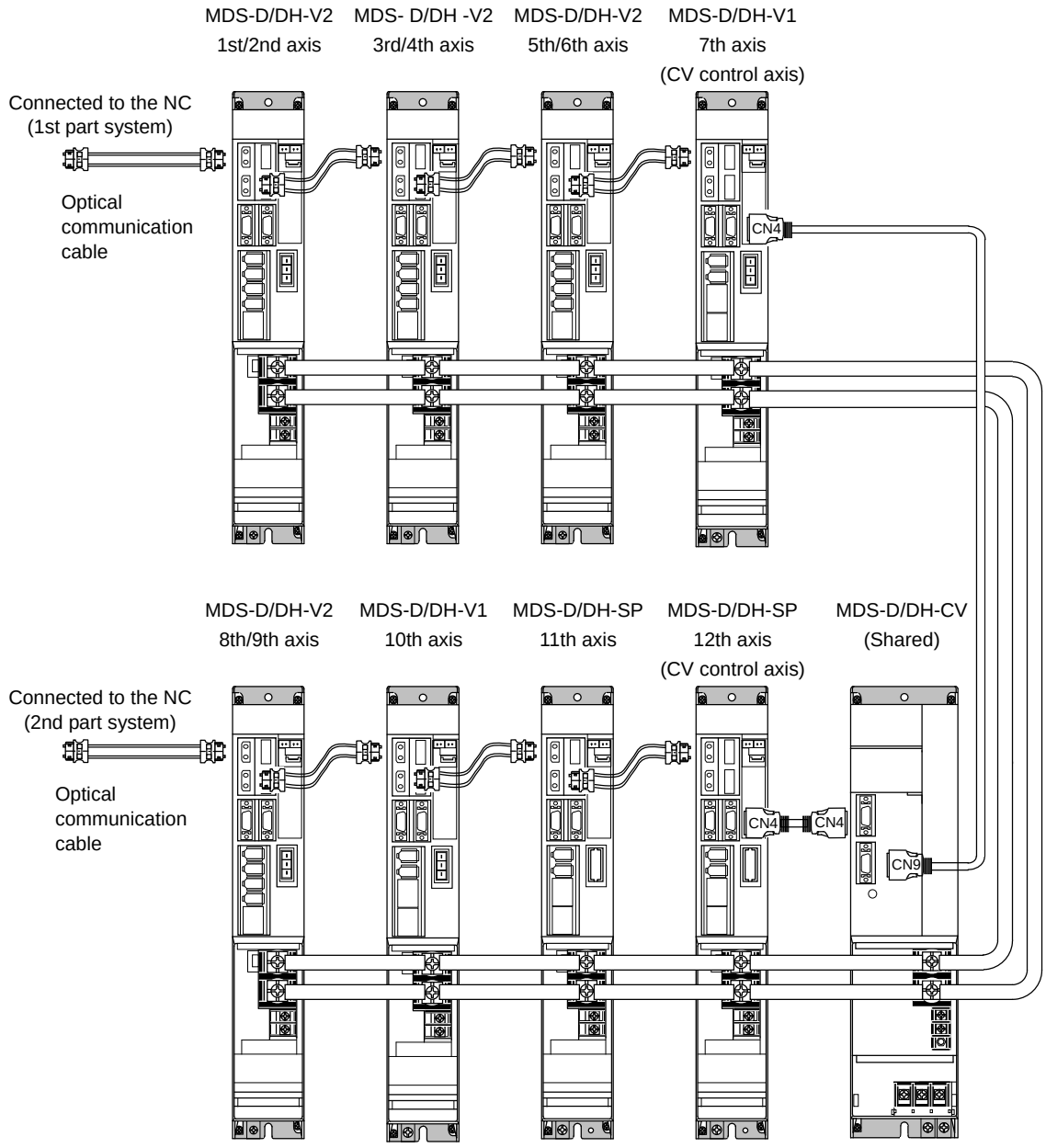
Connections when using two or more power supply units within a single NC communication bus system

⚠CAUTION The drive unit receiving power (L+, L-) from each power supply unit must always have NC communication bus connection at the NC side of each power supply unit.

(3) When using one power supply shared unit by two NC communication bus systems

In systems employing a number of small-capacity drive units, a single power supply unit can be shared by two NC communication bus systems. In this case, a power supply control axis must be set for each axis of each NC communication bus.

For basic connection information, refer to the MDS-D/DH Series Instruction Manual.



Connections when using one power supply shared by two NC communication bus systems

⚠ CAUTION

If the two NC communication bus systems include a spindle drive unit, connect the power supply unit's CN4 connector to the CN4 connector of the largestcapacity spindle drive unit. If there is no spindle drive unit, connect to the unbalance-axis servo drive unit.

4.2.5.2 Connecting with MDS-DM Series

⚠CAUTION Connect the NC and the drive units by the optical communication cables. The distance between the NC and the final drive unit must be within 30m and the bending radius within 80mm.

POINT Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the MDS-DM Series Instruction Manual.) The axis No. has no relation to the order for connecting to the NC.

(1) Connecting the MDS-DM-V3

(a) When using one power supply unit

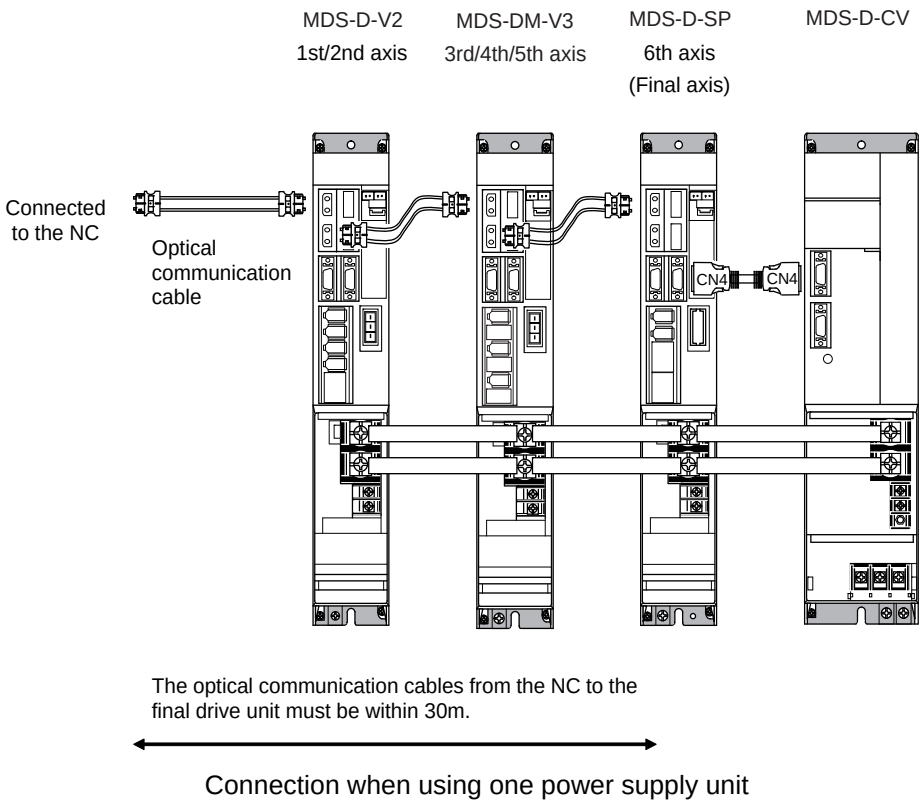
Connect the largest-capacity spindle drive unit to the final axis of the NC communication bus in order to control the power supply unit. The spindle drive unit must be installed adjacent to the power supply unit. In the system with servo only, a servo drive unit for controlling unbalance axis must be installed in the same manner in the same way.

<Connection>

CN1A: CN1B connector on NC or previous stage's drive unit

CN1B: CN1A connector on next stage's drive unit

CN4: Connector for communication between power supply unit (master side) and drive unit

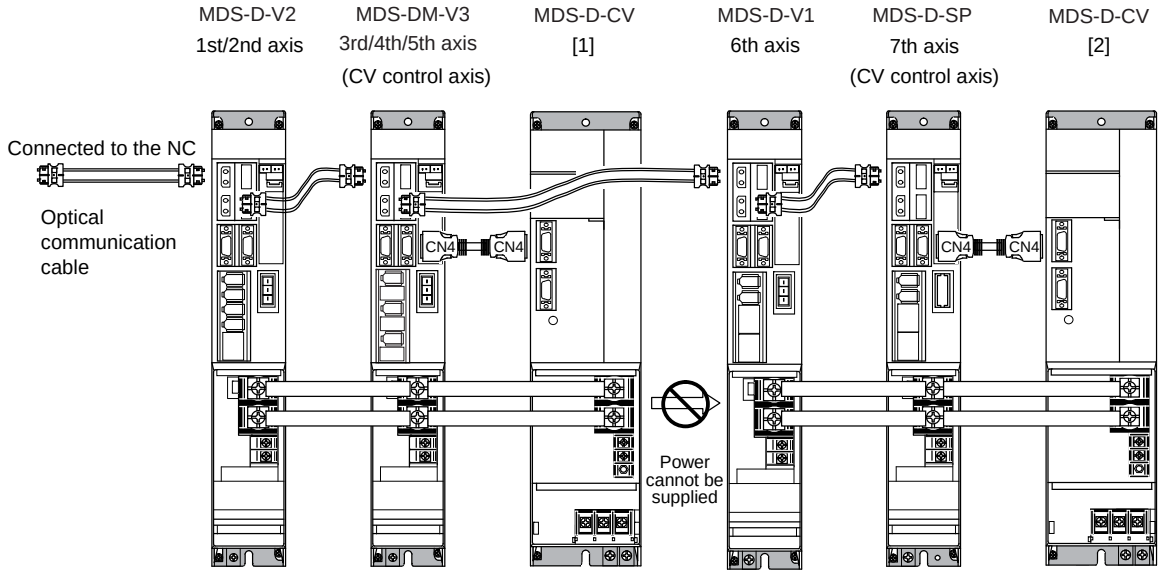


Connection when using one power supply unit

(b) When using two or more power supply units within a single NC communication bus system

Two or more power supply units may be required within a single NC communication bus system if the spindle drive unit capacity is large. The drive unit receiving power (L+, L-) from each power supply unit must always have NC communication cable connection at the NC side of each power supply unit. In the NC communication bus connection example below, power supply [1] cannot supply power (L+, L-) to the 6th axis servo drive unit.

For basic connection information, refer to the MDS-DM Series Instruction Manual.



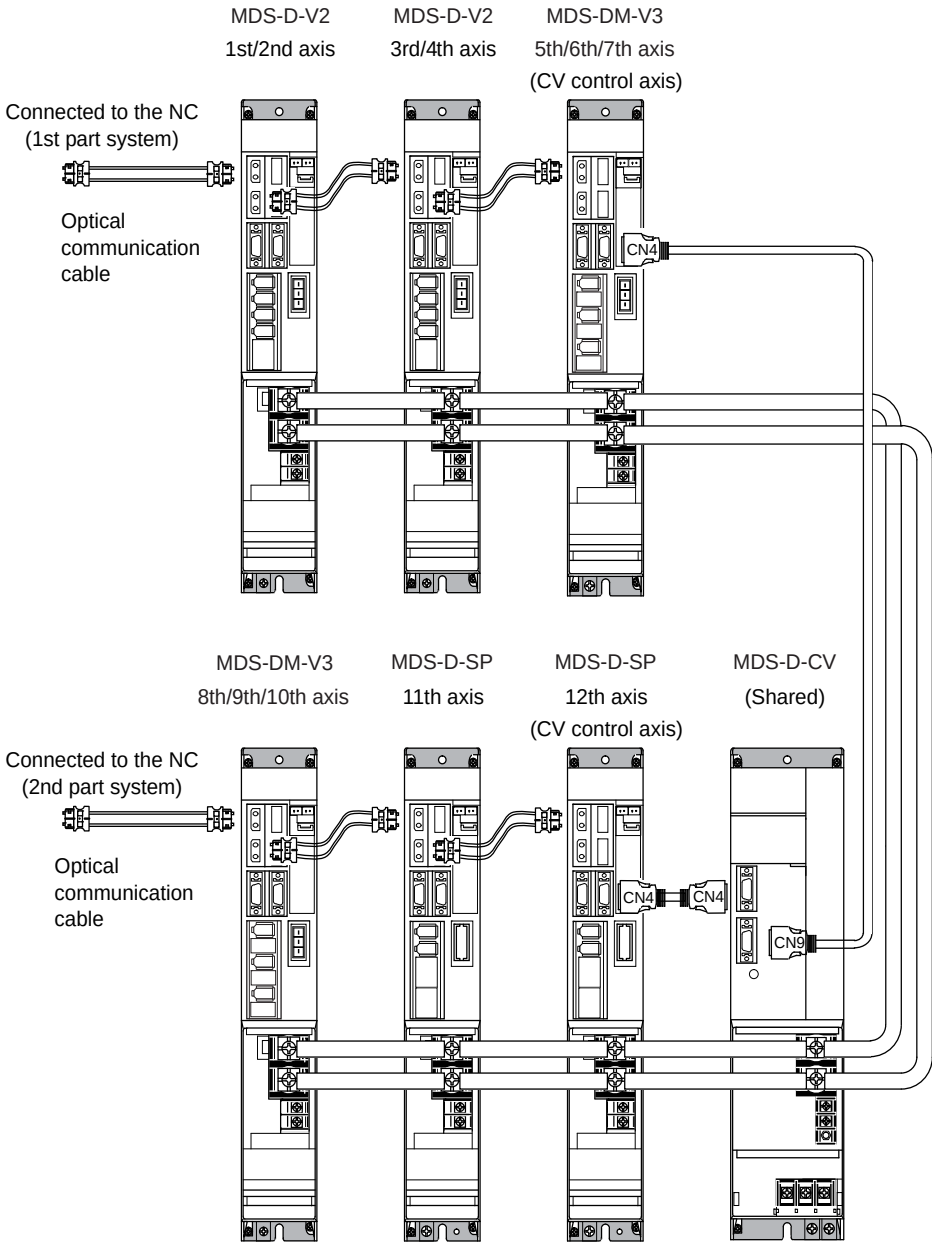
Connections when using two or more power supply units within a single NC communication bus system

⚠CAUTION The drive unit receiving power (L+, L-) from each power supply unit must always have NC communication bus connection at the NC side of each power supply unit.

(c) When using one power supply shared unit by two NC communication bus systems

In systems employing a number of small-capacity drive units, a single power supply unit can be shared by two NC communication bus systems. In this case, a power supply control axis must be set for each axis of each NC communication bus.

For basic connection information, refer to the MDS-DM Series Instruction Manual.

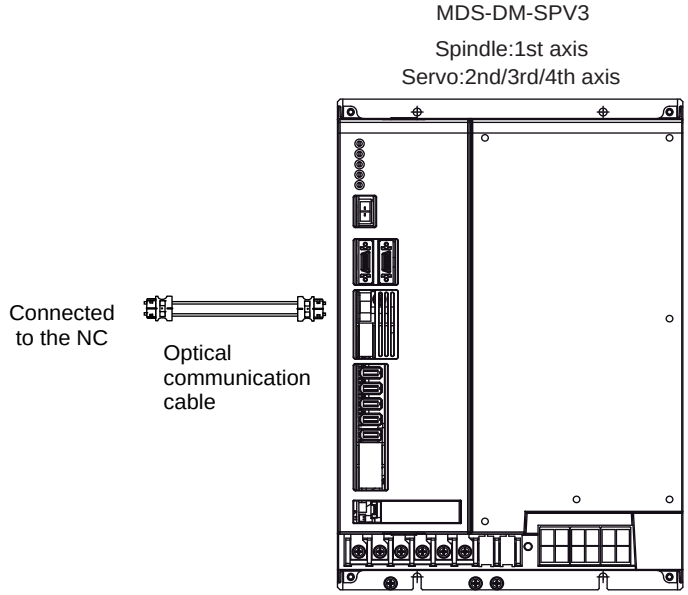


Connections when using one power supply shared by two NC communication bus systems

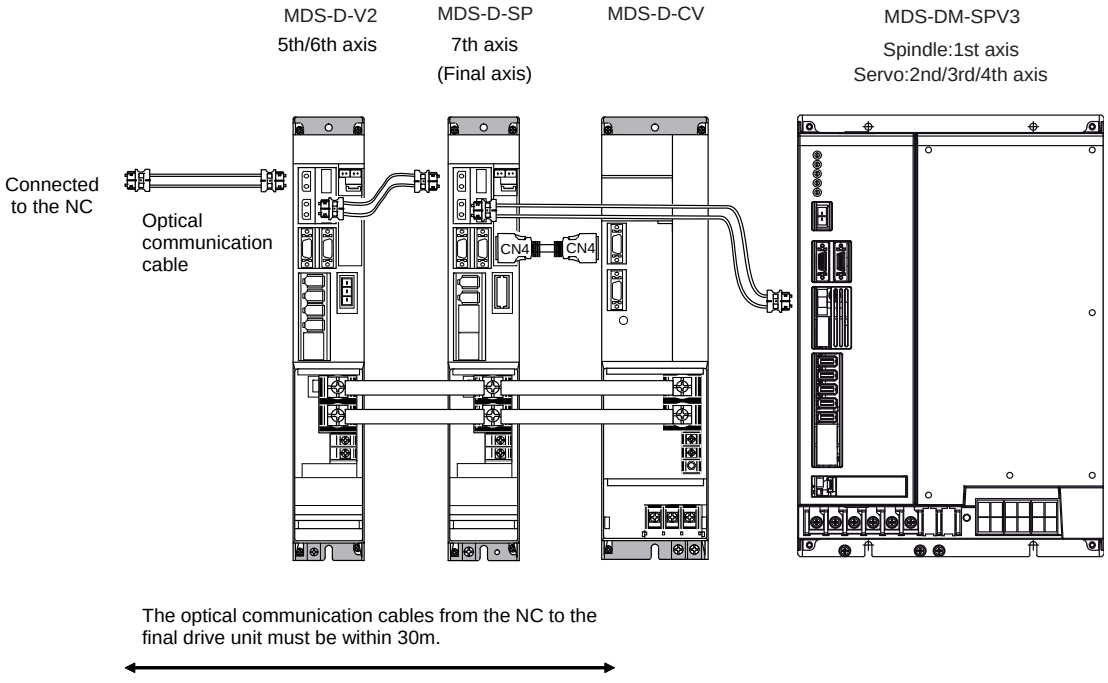
⚠CAUTION If the two NC communication bus systems include a spindle drive unit, connect the power supply unit's CN4 connector to the CN4 connector of the largestcapacity spindle drive unit. If there is no spindle drive unit, connect to the unbalance-axis servo drive unit.

(2) Connecting the MDS-DM-SPV2/SPV3

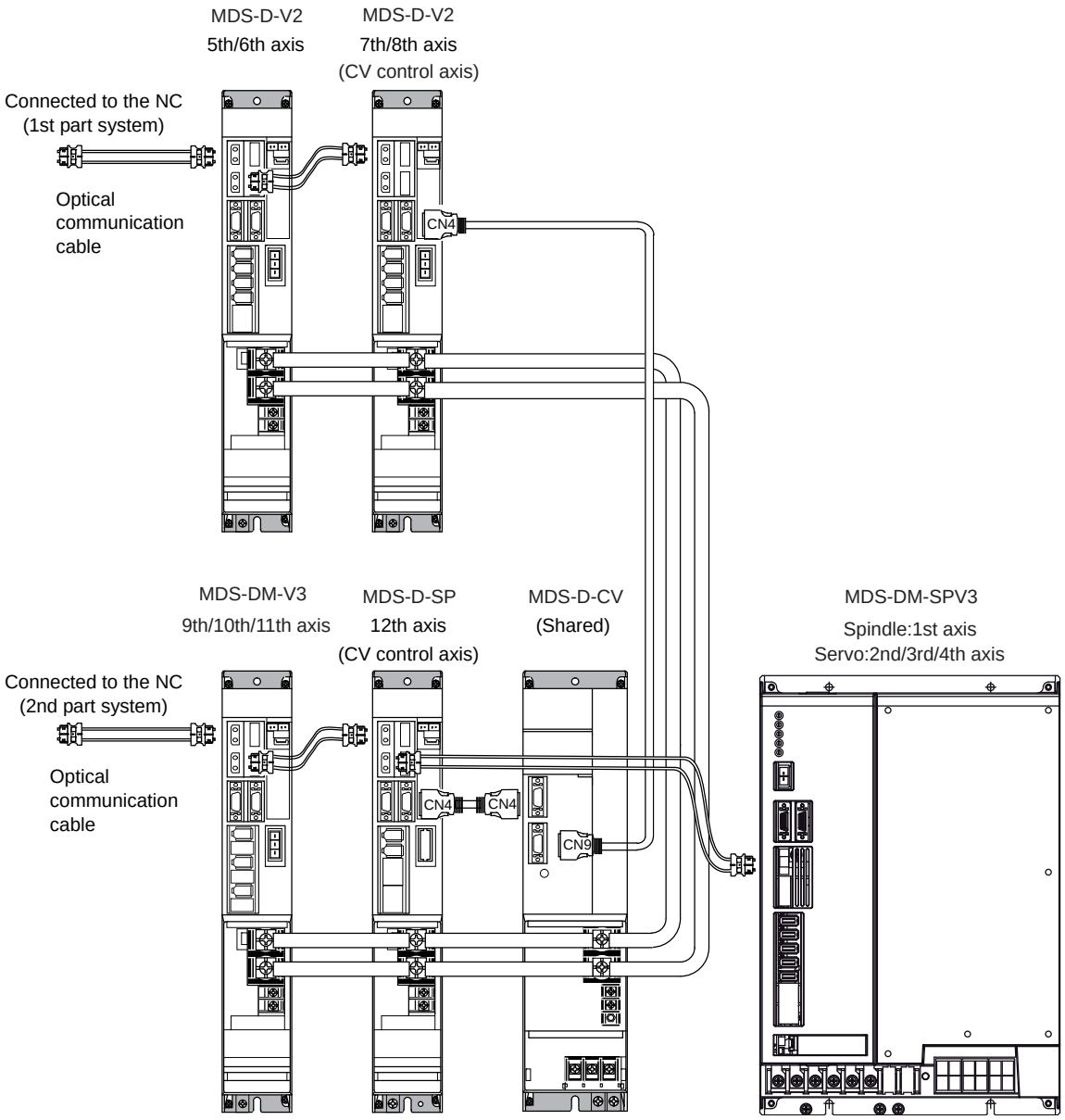
(a) When using only MDS-DM-SPV3



(b) When using the MDS-D unit together



(c) When using one power supply shared unit by two NC communication bus systems



4.2.5.3 Connecting with MDS-SVJ3/SPJ3 Series

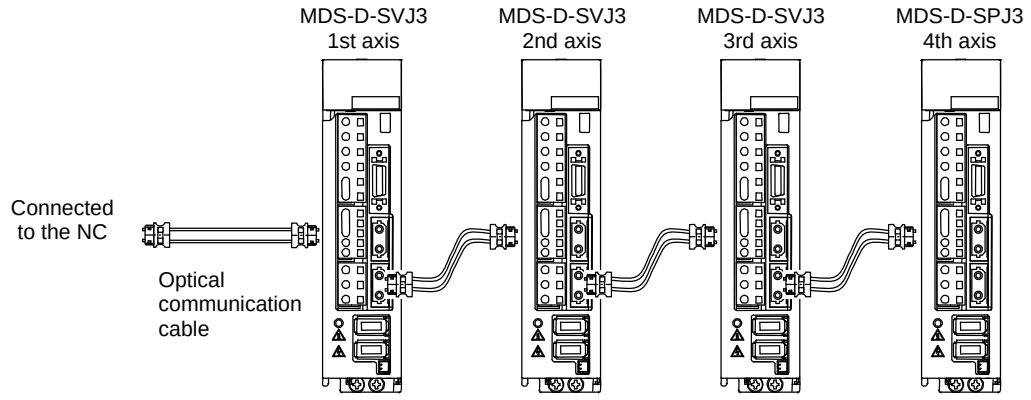
⚠CAUTION Connect the NC and the drive units by the optical communication cables. The bending radius must be within 50mm.

POINT Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the MDS-SVJ3/SPJ3 Series Instruction Manual.) The axis No. has no relation to the order for connecting to the NC.

<Connection>

CN1A: CN1B connector on NC or previous stage's drive unit

CN1B: CN1A connector on next stage's drive unit

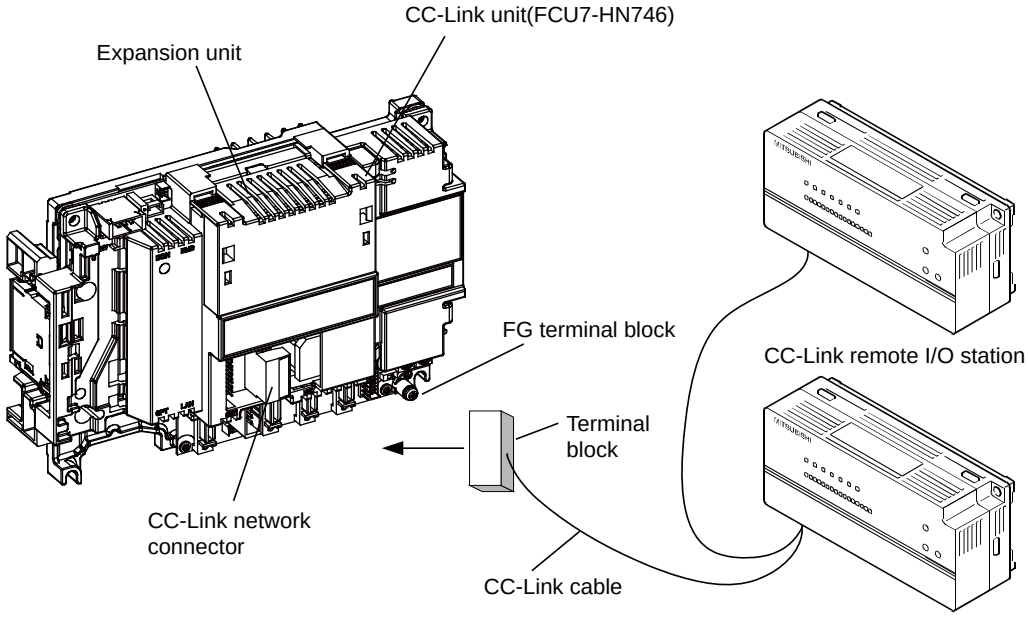


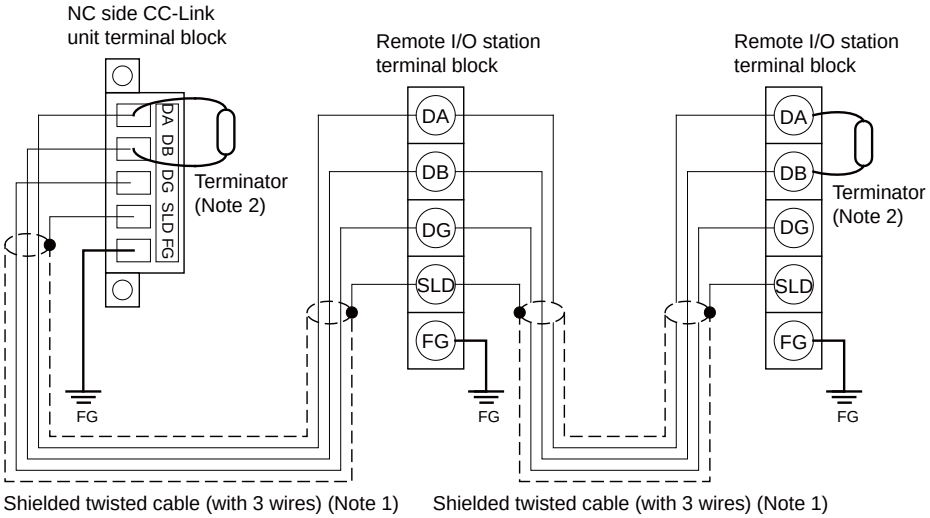
The optical communication cable up to 5m can be used in G396 series, and up to 20m in G380 series.

4.2.6 Connecting I/O Devices via CC-Link

CC-Link unit (FCU7-HN746) works as master station or local station of CC-Link (Ver.2 mode).
Mount the CC-Link unit on the control unit's expansion card slot.
CC-Link uses the dedicated cable. Connect the cable to the terminal block provided with the CC-Link unit.
Make sure to attach the terminator, provided with the CC-Link unit, to the final station unit.

(Note) CC-Link is an option unit.





(Note 1) Unless the CC-Link dedicated cable is used, CC-Link system does not guarantee its operation. For the specifications of the CC-Link dedicated cable and the inquiries, see the homepage of the CC-Link Partner Association (http://www.cc-link.org/). (Click “Product Information”.)

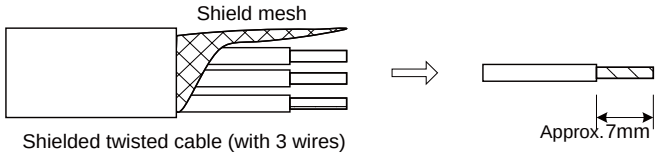
(Note 2) Use the terminator provided with the CC-Link unit. The value of the terminator depends on the cable used: 110Ω when the CC-Link dedicated cable is used, 130Ω when the CC-Link dedicated high performance cable is used.

(Note 3) Use the FG terminal on the NC side CC-Link terminal block for the connection to the ground of the electric cabinet.

Wiring the cables to the CC-Link terminal block

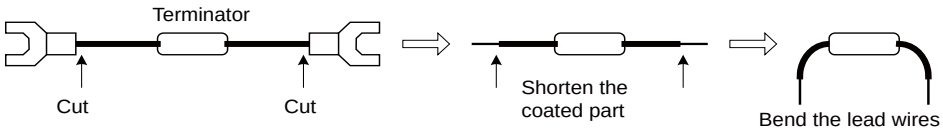
(1) Remove the sheath of the cable and isolate each internal wire from the shield mesh.

(2) Remove the shield mesh and the coat of each internal wire. Twist the core wires.

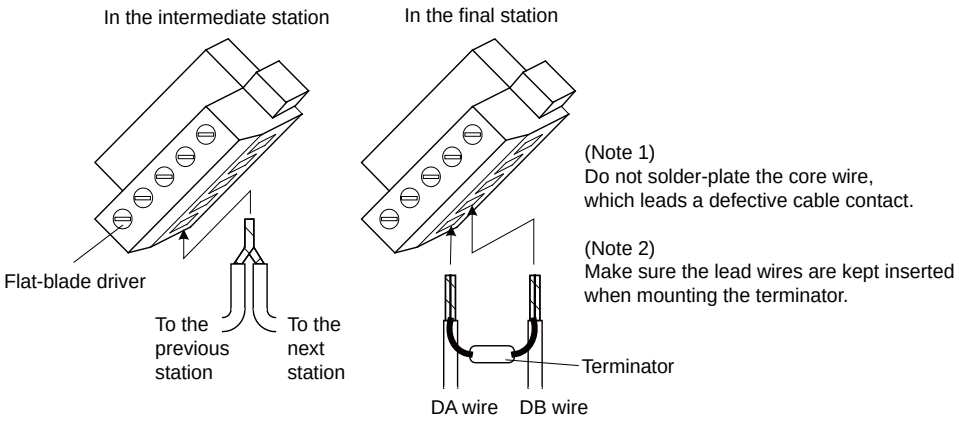


(3) In the intermediate station, twist together the same wires or the shield meshes of the cables from/to the previous/next station.

(4) In the final station, process the provided terminator as follows to attach to the station.



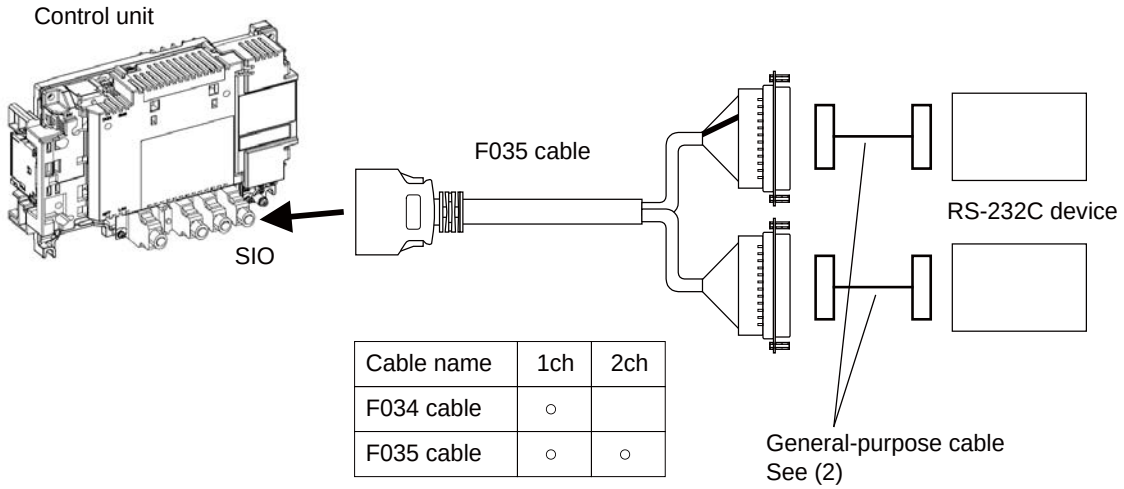
(5) Insert the core wire into the opening of the terminal block. Hold the wire tight with a flat-blade screwdriver. Check the screws on the terminal are loose enough before inserting the wires into the openings.



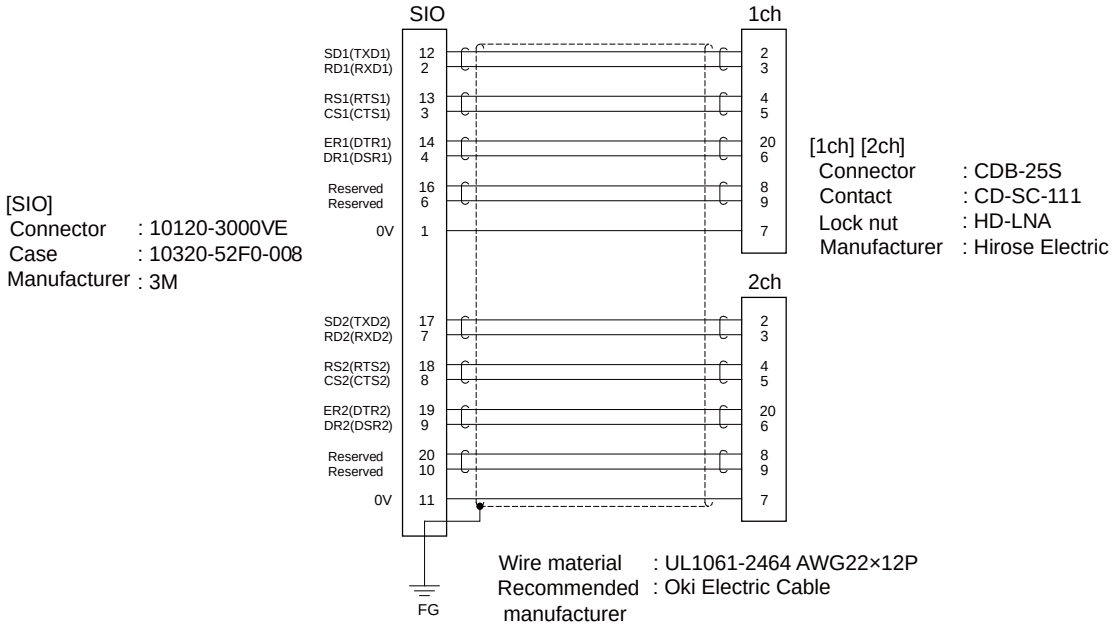
(6) After wiring cables to the terminal block, Mount the terminal block into the CC-Link connector and fix it with a flat-blade screwdriver.

4.2.7 Connecting with RS-232C Device

(1) Connect the RS-232C device to the connector SIO.



Cable name	1ch	2ch
F034 cable	○	
F035 cable	○	○



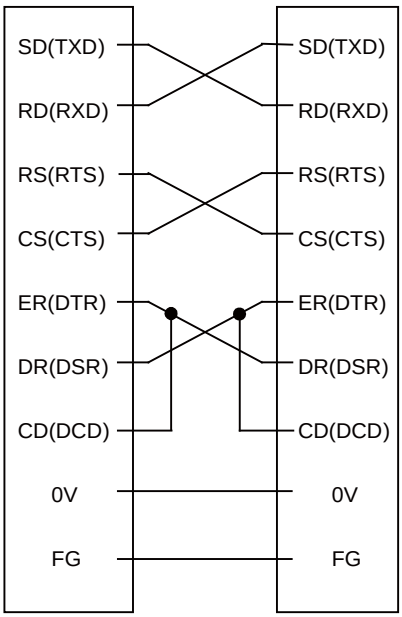
<Related items>

Cable drawing: "8.10 F034/F035 Cable"

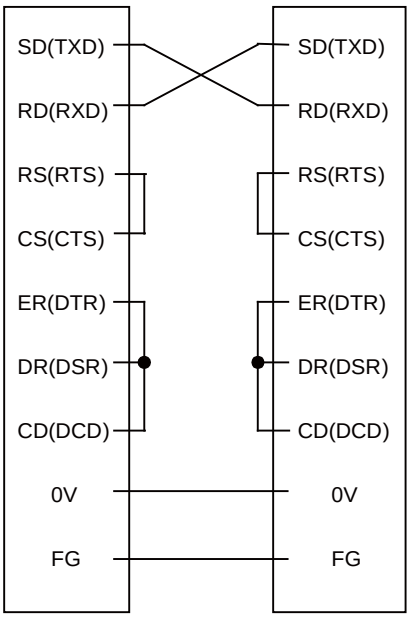
Connector pin assignment: "2.2 Control Unit" (SIO connector)

(2) Example of wiring connections to the RS-232C device
When connecting to the RS-232C device, refer to the following diagrams and cross the wiring for the transmission signals.

Hand shaking
upon RS/CS, ER/DR signals

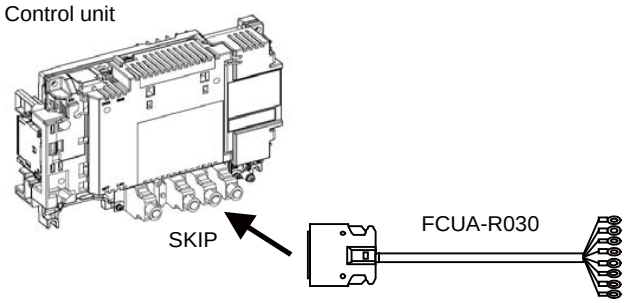


No hand shaking
upon RS/CS, ER/DR signals



4.2.8 Connecting with Skip Signal (Sensor)

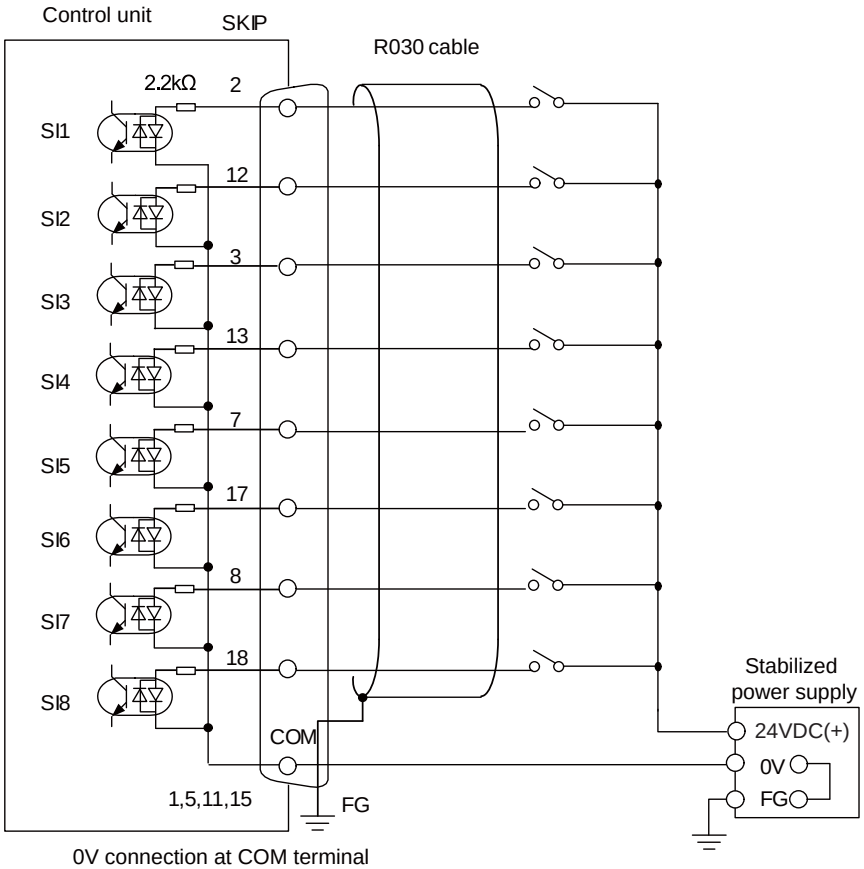
Connect skip signals to the connector SKIP.
Skip signals are used for processing high-speed signals. Always shield the cable.



(Note) Connecting the skip signal cable to a wrong connector causes a damage on the control unit when turning ON the skip signal power supply. Confirm the wiring before turning the power ON.

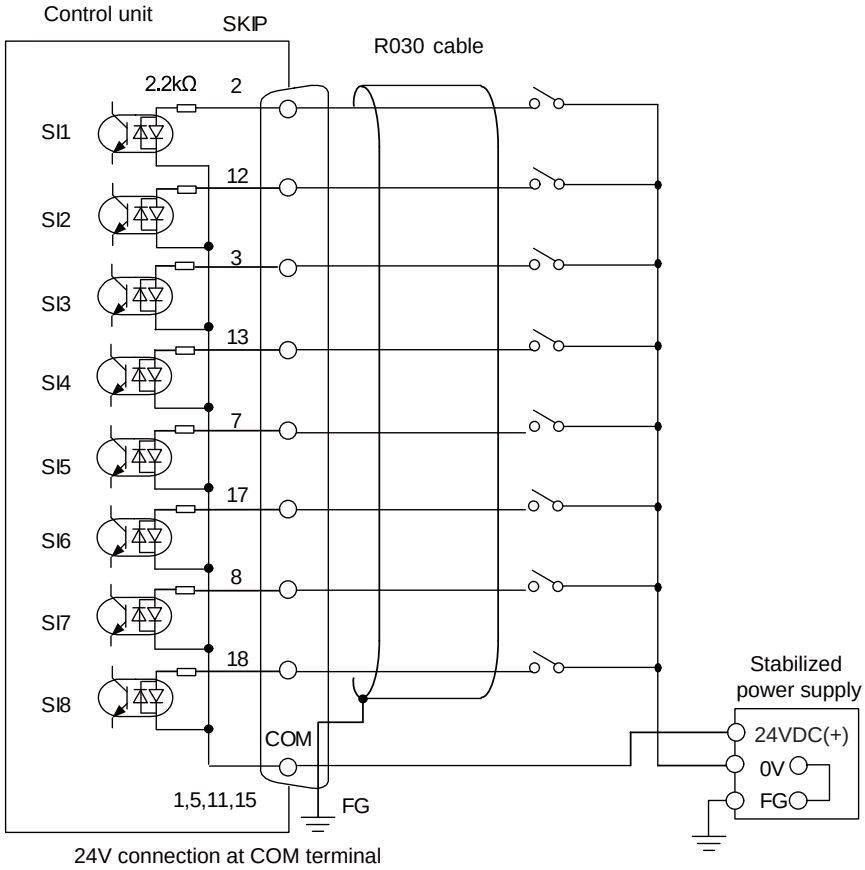
(1) Connection of skip signal cable

<0V connection at COM terminal>



0V connection at COM terminal

<24V connection at COM terminal>



24V connection at COM terminal

(Note 1) NC recognizes input signals of 2ms or more as the valid skip signals. If machine contacts (relay, etc.) are used, malfunctions will occur due to chattering. Use semiconductor contacts (transistor, etc.).

(Note 2) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.

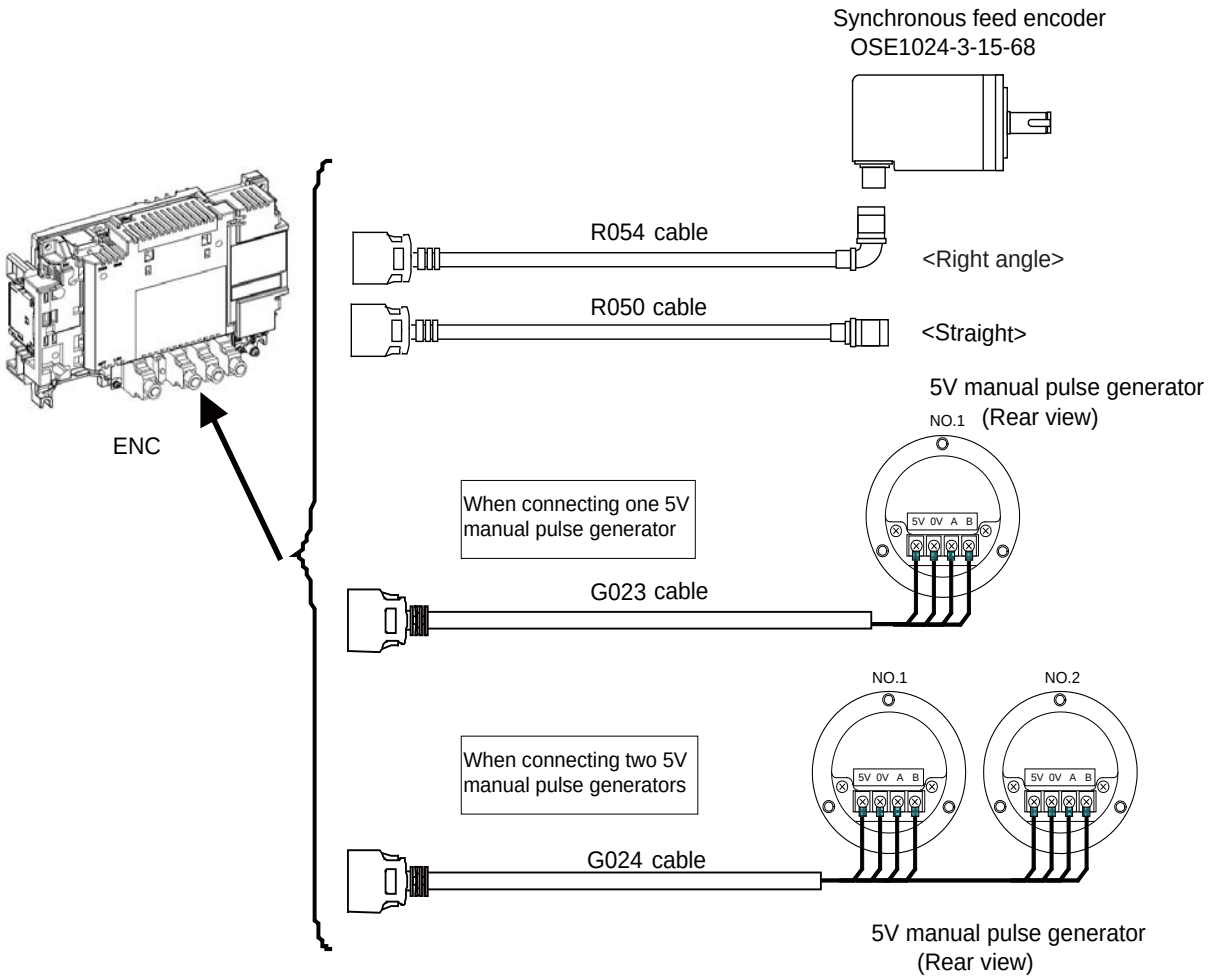
<Related items>

Cable drawing: "8.18 FCUA-R030 Cable"

Connector pin assignment: "2.2 Control Unit" (SKIP connector)

4.2.9 Connecting with Synchronous Feed Encoder/ Manual Pulse Generator

Synchronous feed encoder (1ch) or 5V power supply type manual pulse generator (2ch) can be connected.



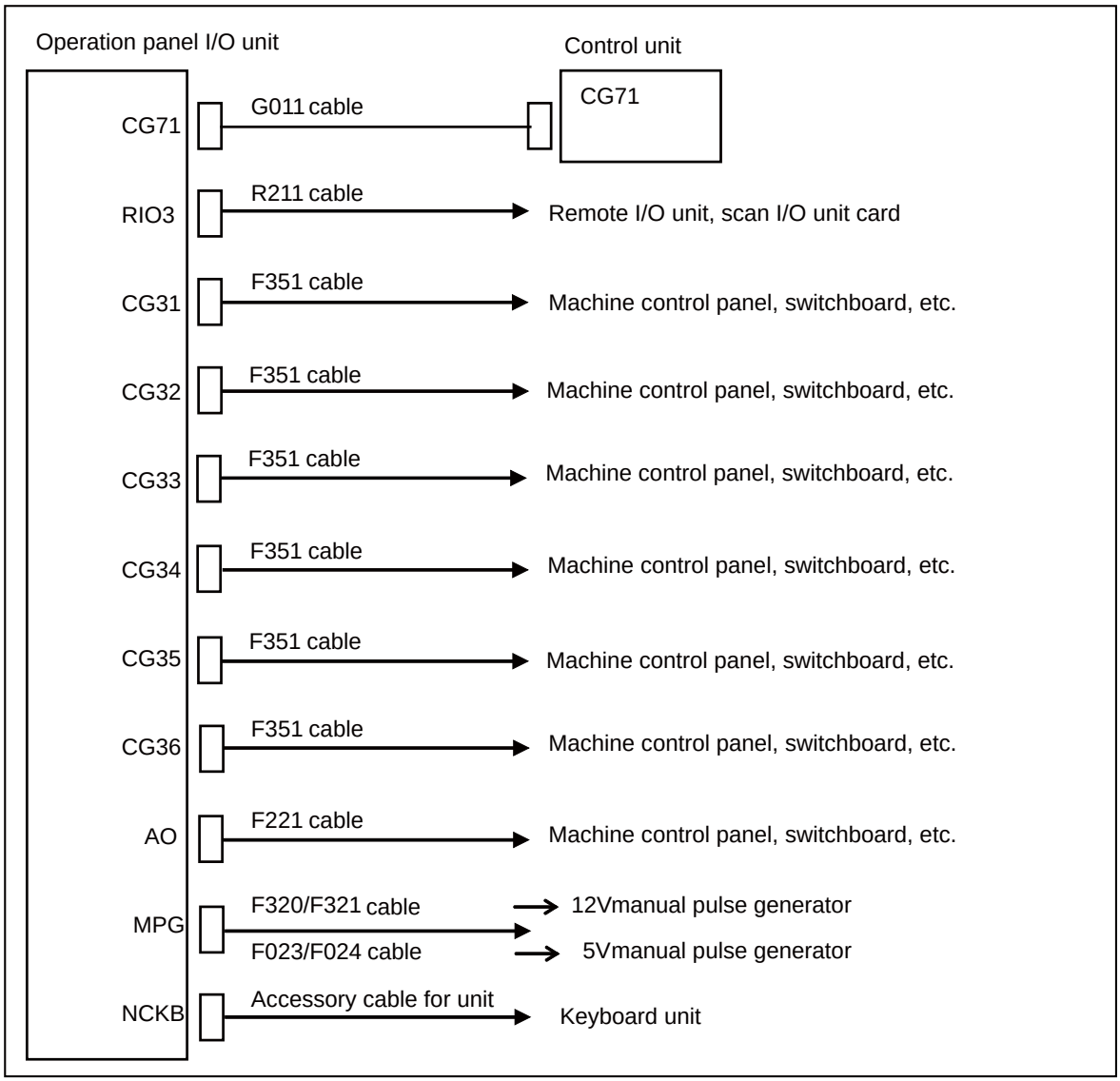
<Related items>

Cable drawing: "8.20 FCUA-R050/R054 Cable" and "8.24 G023/G024 Cable"
Connector pin assignment: "2.2 Control Unit" (ENC connector)

When using the synchronous feed encoder and the manual pulse generator at the same time, the cables must be prepared by the machine tool builder.

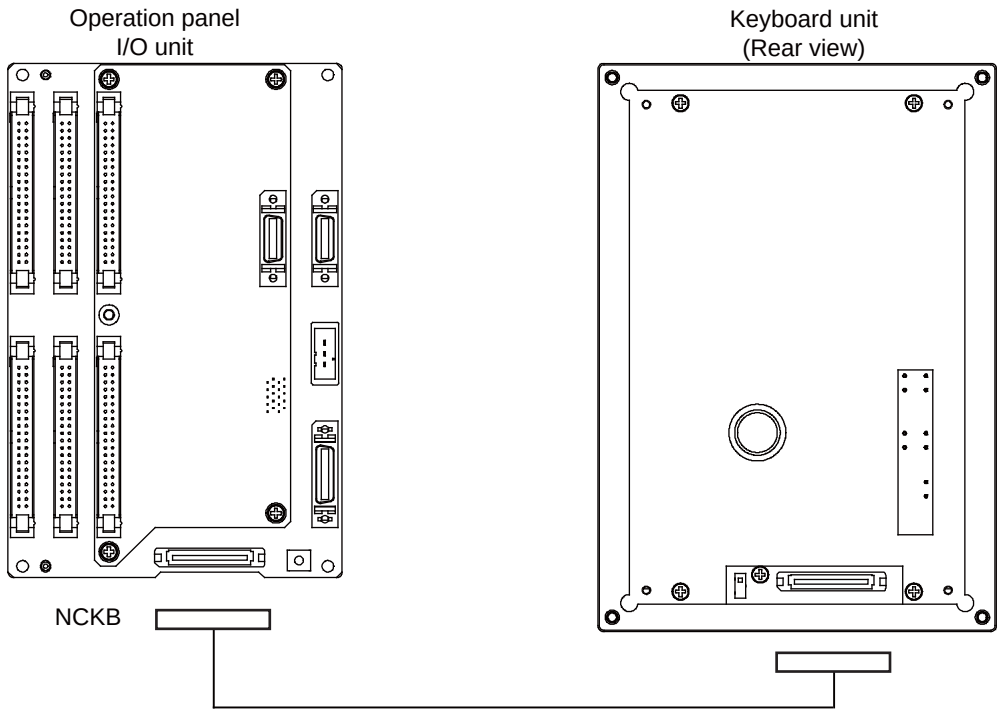
4.3 Connection of Operation Panel I/O Unit

4.3.1 Operation Panel I/O Unit Connection System Drawing



4.3.2 Connecting with Keyboard Unit

Connect the keyboard unit to the connector NCKB.
The cable comes with the keyboard unit.



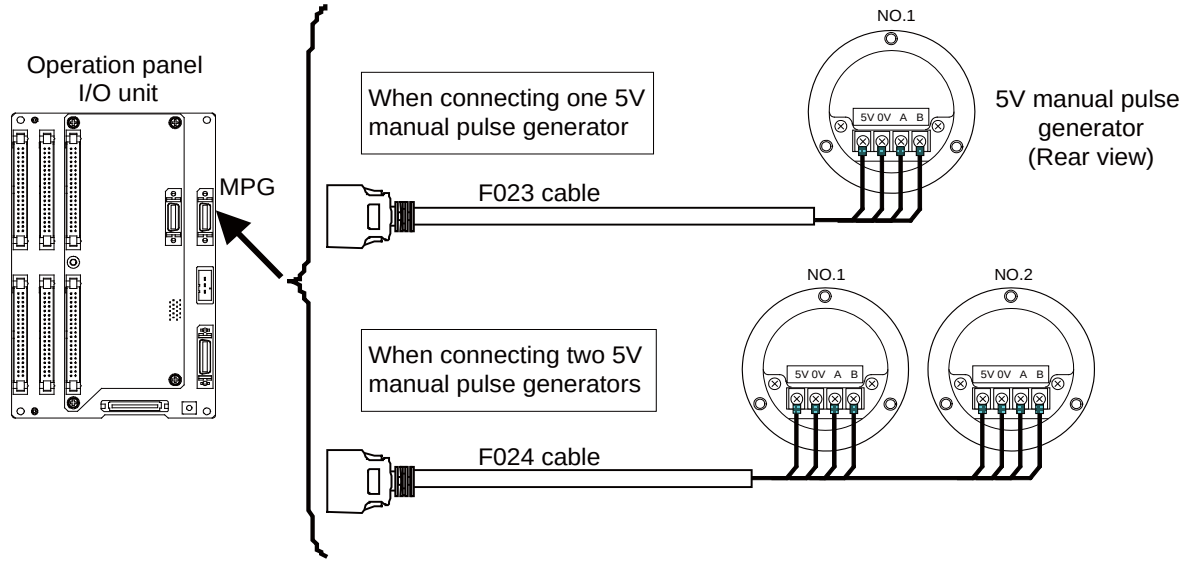
(Note) Firmly insert the connection cable until it is locked.

4.3.3 Connecting with Manual Pulse Generator (MPG)

Both 5V power supply type (UFO-01-2Z9, etc.) and 12V power supply type (HD60, etc.) manual pulse generator can be used. Take the maximum cable length, etc. into consideration when selecting.

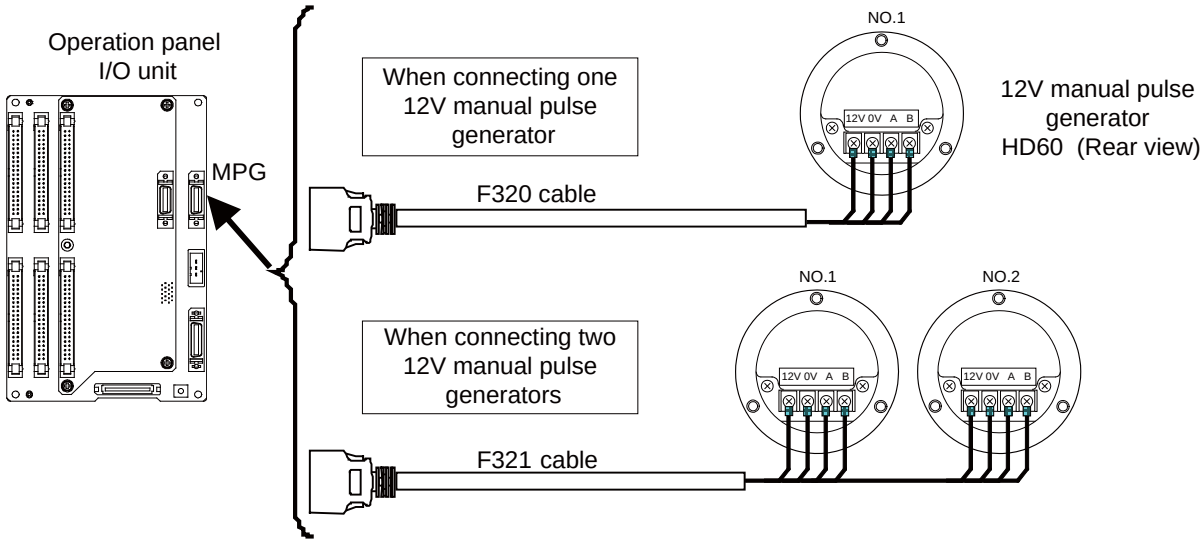
(1) Connecting with 5V manual pulse generator (maximum cable length: 20m)

Connect the 5V manual pulse generator to the connector MPG.



(2) Connecting with 12V manual pulse generator (maximum cable length: 50m)

Connect the 12V manual pulse generator to the connector MPG.



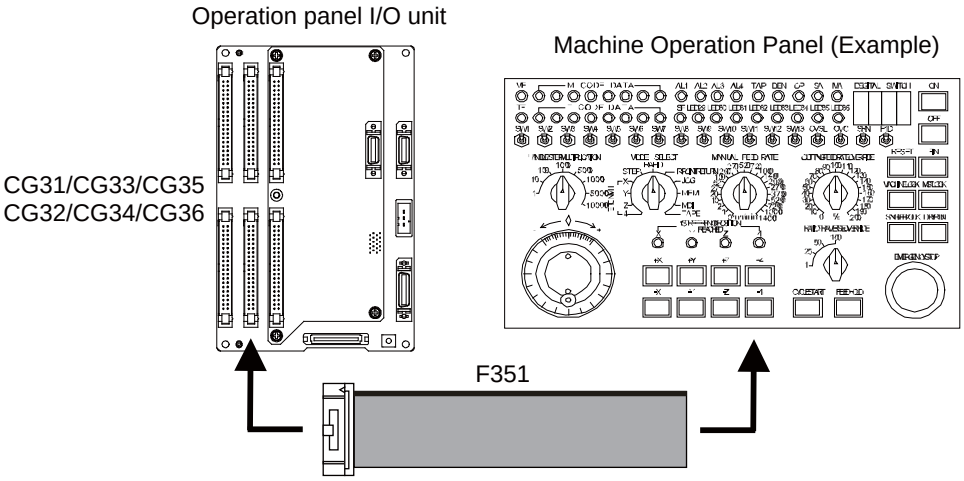
(Note 1) When selecting a manual pulse generator, make sure that its case and 0V terminal are insulated.
(Note 2) Select 25pulse/rev or 100pulse/rev on the parameter screen.

<Related items>

Cable drawing: "8.9 F023/F024 Cable"
Connector pin assignment: "2.5 Operation Panel I/O Unit" (MPG connector)

4.3.4 Connecting with Machine Operation Panel

Connect the machine operation panel to the connector CG31, CG32, CG33, CG34, CG35 or CG36.

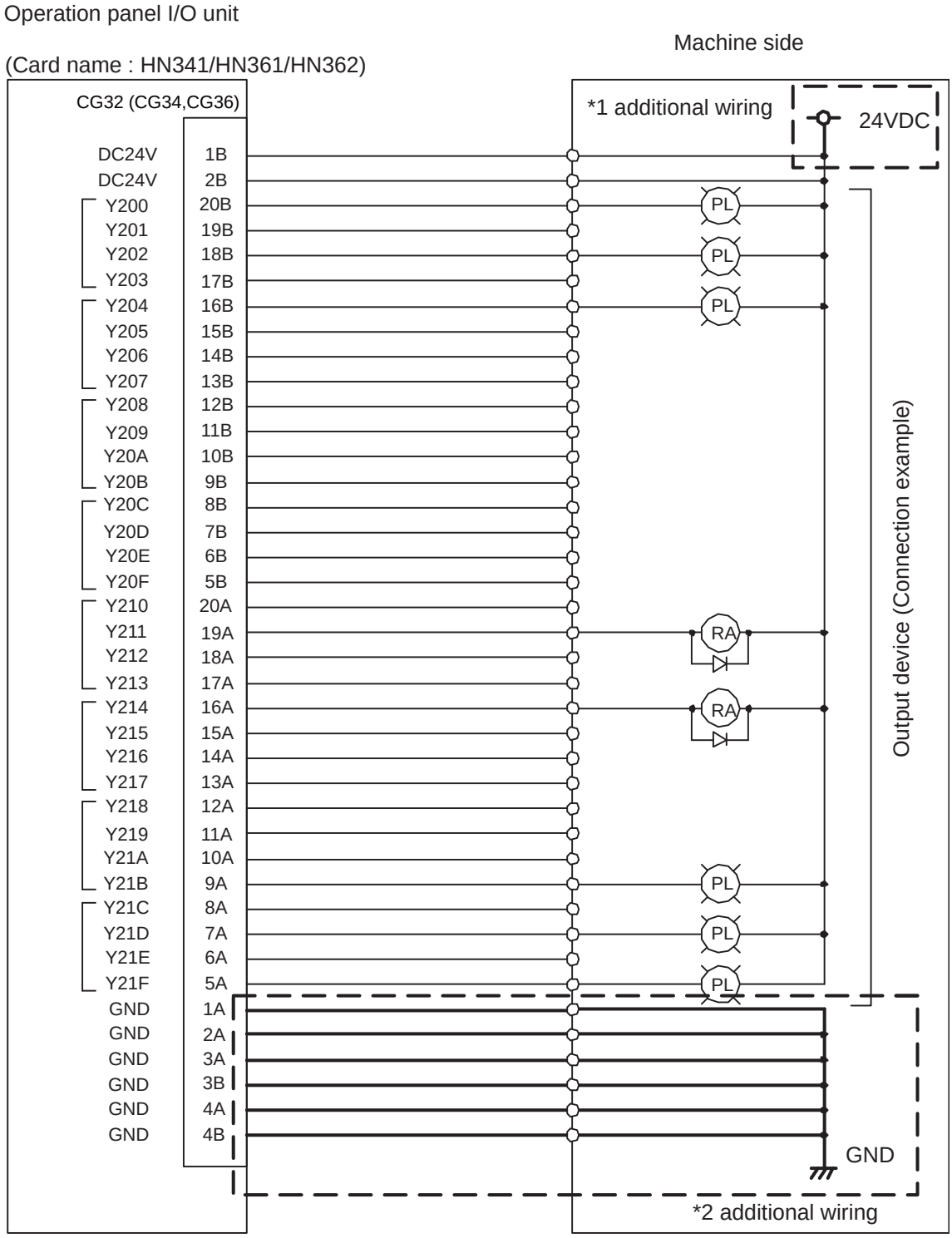


<Related items>

Cable drawing: "8.17 F351 Cable"

Connector pin assignment: "2.5 Operation Panel I/O Unit" (CG31/CG32/CG33/CG34/CG35/CG36 connector)

4.3.4.1 Wiring for Sink Type Output (FCU7-DX710/DX720/DX730)



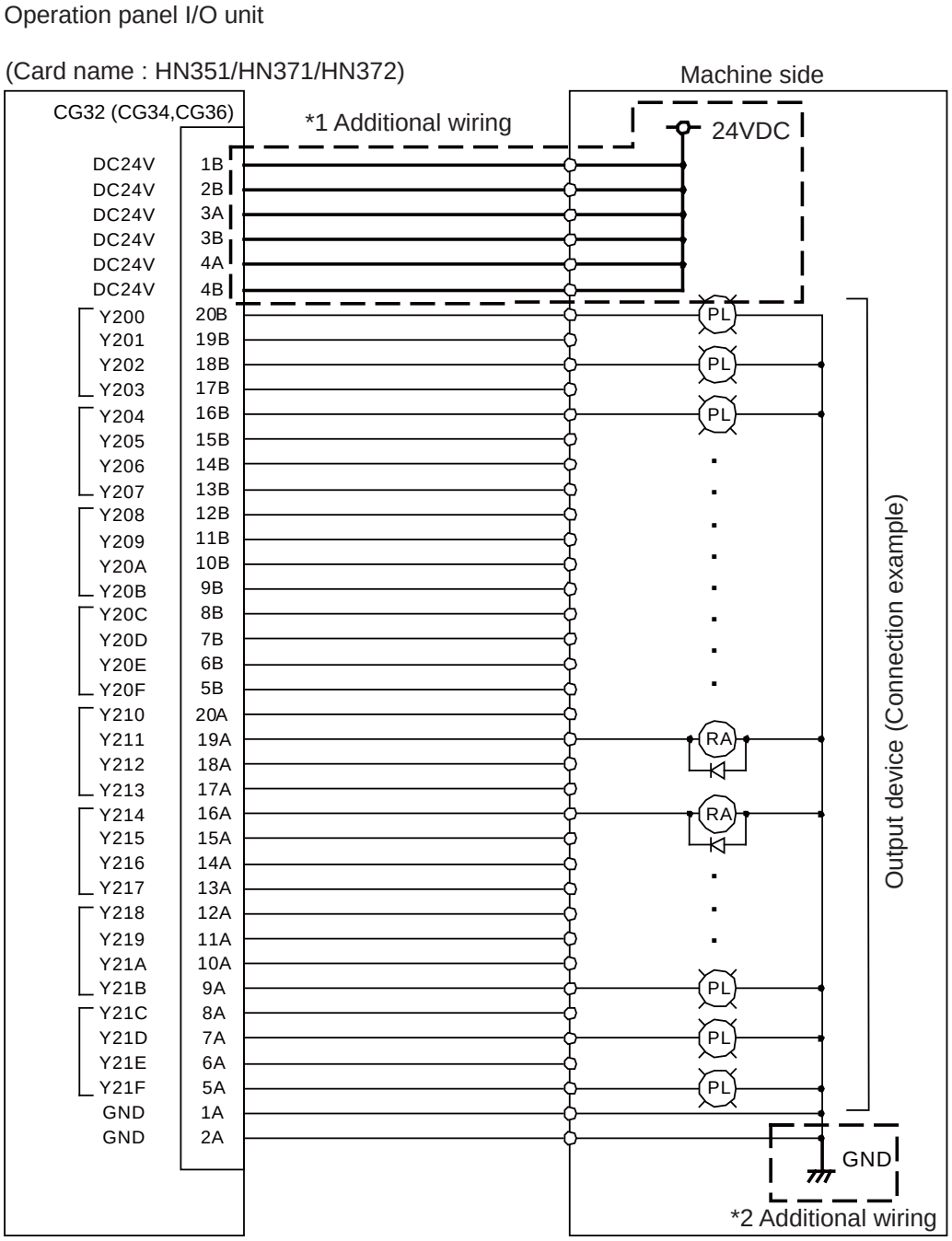
(Note 1) Connect +24V to either or both of the flat connector 1B, 2B (24VDC). (*1)

(Note 2) Connect 0V (GND) to the flat connector 3A, 3B, 4A, 4B (GND). (*2)
Decide the number of GNDs to wire with regard to the total amount of each connector's maximum output current and the voltage drop by the cables. The rated current is 1A per connector pin.

(Note 3) Connect 0V (GND) to the flat connector 1A, 2A (GND). (*2)

(Note 4) When large current flows due to small amount of connected load, fuse may be blown out or 24V power supply voltage may drop. In order to secure the appropriate current value, watch the connected load.

4.3.4.2 Wiring for Source Type Output (FCU7-DX711/DX721/DX731)



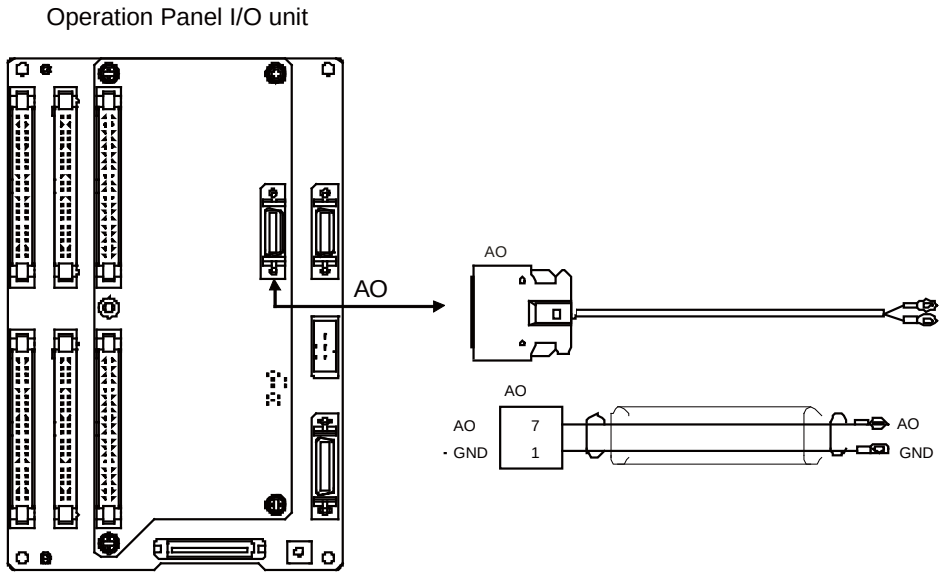
(Note 1) Connect +24V to either or both of the flat connector 1B, 2B (24VDC). (*1)

(Note 2) Connect +24V (GND) to the flat connector 3A, 3B, 4A, 4B (24VDC). (*1)
Decide the number of 24VDCs to wire with regard to the total amount of each connector's maximum output current and the voltage drop by the cables. The rated current is 1A per connector pin.

(Note 3) Connect 0V (GND) to the flat connector 1A, 2A (GND). (*2)

(Note 4) When large current flows due to small amount of connected load, fuse may be blown out or 24V power supply voltage may drop. In order to secure the appropriate current value, watch the connected load.

4.3.4.3 Outline of Analog Signal Output Circuit



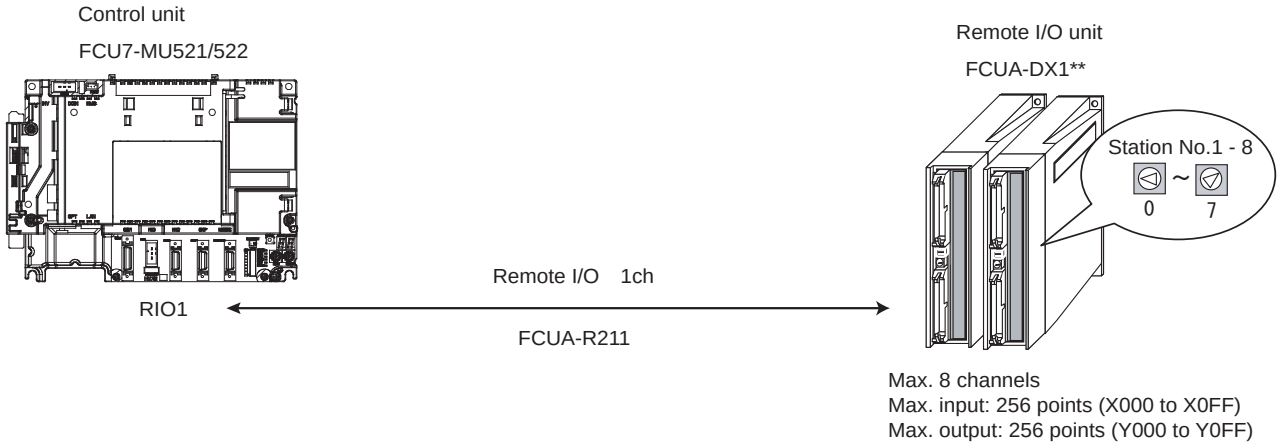
The analog signal output circuit can be used only for the FCU7-DX720/DX721.

4.4 Connection of Remote I/O Unit

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

4.4.1 Connection and Station No. Setting on Remote I/O Unit

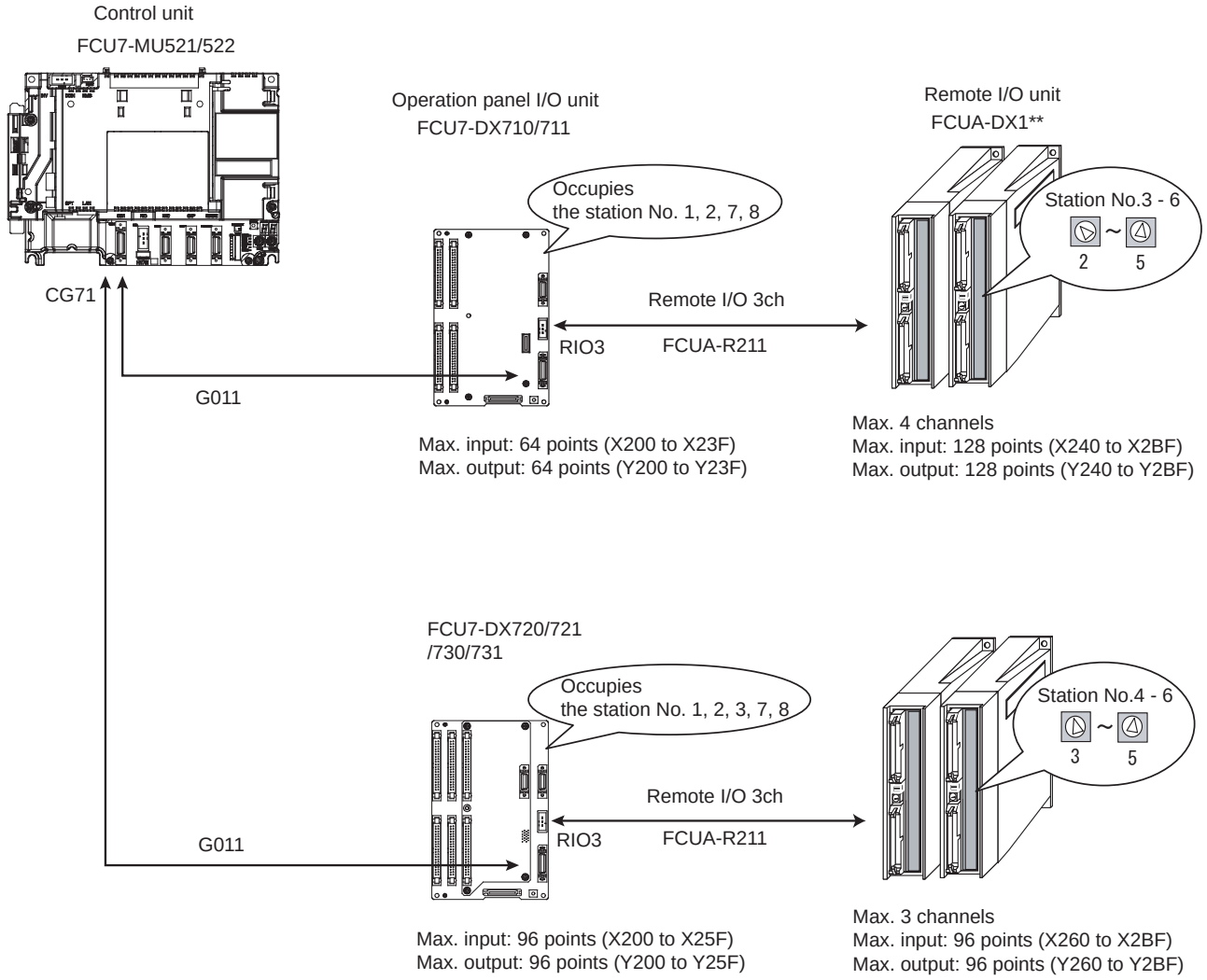
When connecting directly to the control unit



(Note) A remote I/O unit has one or two rotary switch(es) for unit No. setting, which links the device Nos. (with X/Y). The rotary switch setting is as follows, from "0" to "7".

Station No.	Rotary switch
1	0
2	1
3	2
4	3
5	4
6	5
7	6
8	7

When connecting to the operation panel I/O unit



(Note) Operation panel I/O unit occupies the specified Nos. of stations. (Station No. 7 and 8 are reserved for manual pulse generator.)
RIO3 can use either four stations (3rd to 6th) or three stations (4th to 6th) which depends on the operation panel I/O unit type.

4.4.2 Station No. Setting when Using Multiple Remote I/O Units

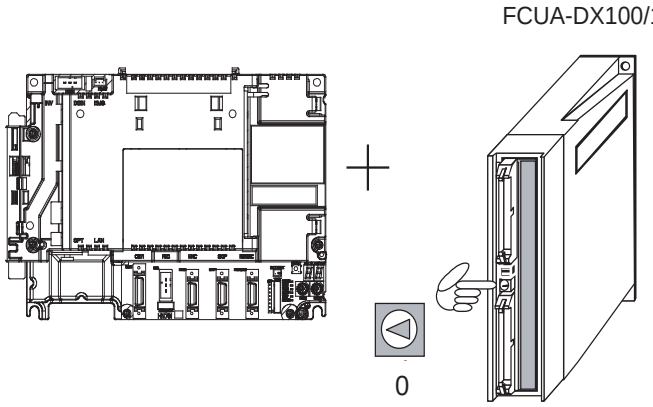
Multiple remote I/O units can be used, as long as the total No. of occupied stations connected with serial links is eight or less. (three/four or less when connected to the operation panel I/O unit).

Unit type	Number of occupied 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 rotary switch, FCUA-DX11*, DX12* and DX14* unit have two. Each of these switches must be set to a characteristic station No. within a range of 0 to 7 (3 to 6 when connected to the operation panel I/O unit).

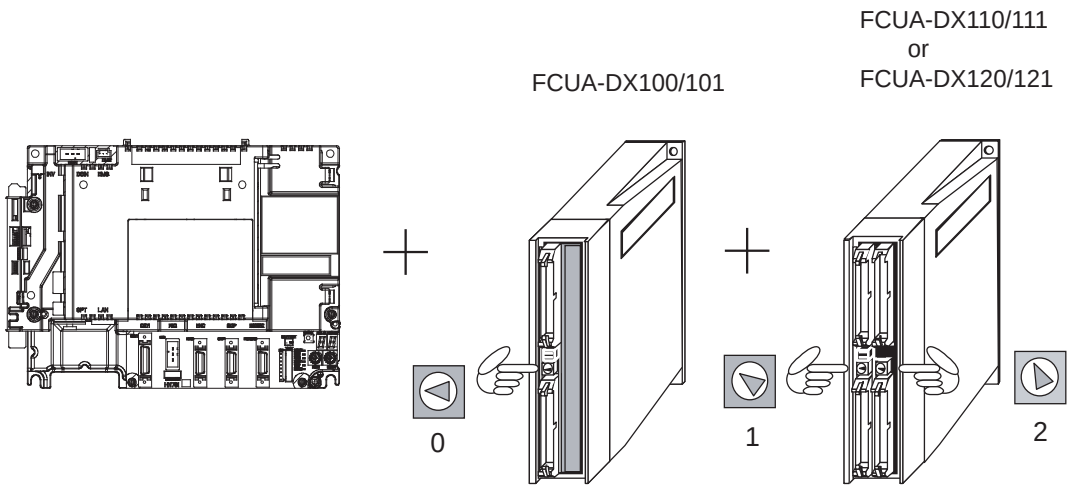
When connecting directly to the control unit

Setting example 1



Total number of occupied stations: 1

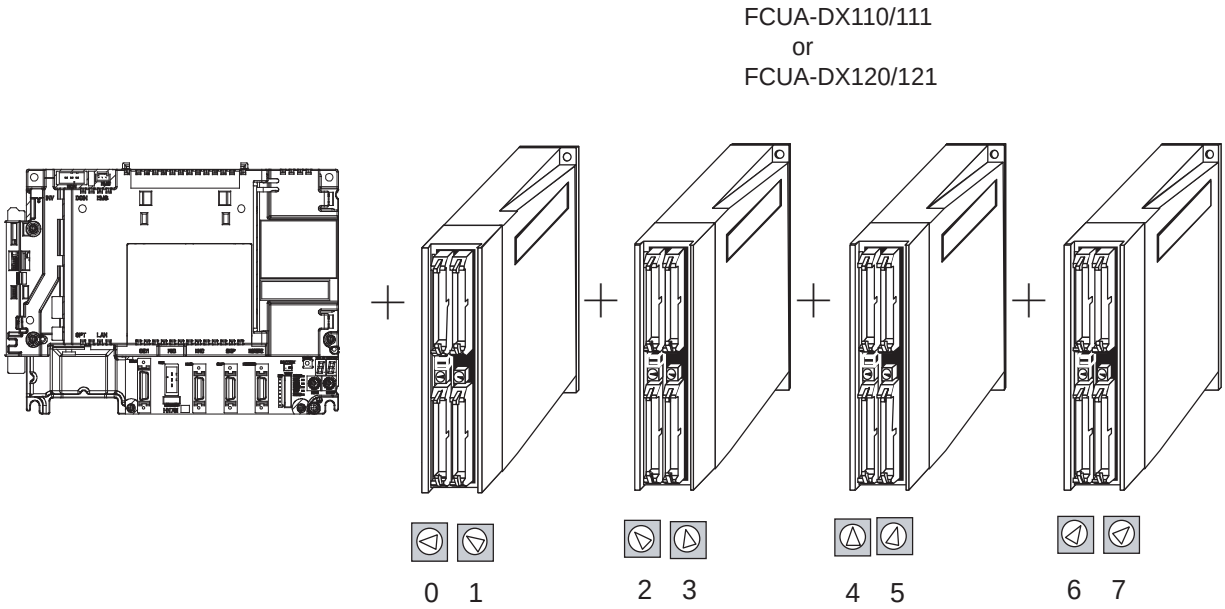
Setting example 2



Number of occupied stations: 1 **2**

Total number of occupied stations: 3

Setting example 3



Number of occupied stations: 2 2 2 2

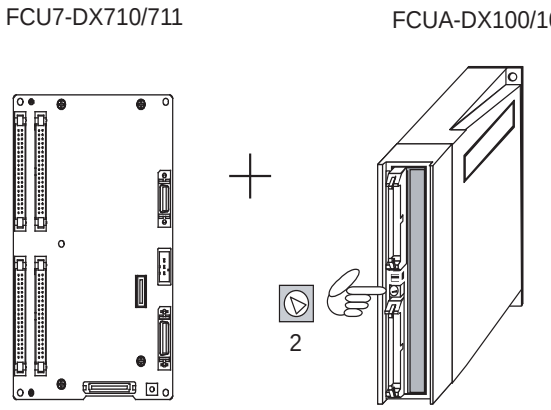
Total number of occupied stations: 8 (Maximum configuration)

When connecting to the operation panel I/O unit

Station No. 1, 2, 7, 8 (or 1, 2, 3, 7, 8) are occupied by the operation panel I/O unit. (Station No. 7 and 8 are reserved for manual pulse generator.) The maximum numbers of stations and I/O points assigned to remote I/O unit(s) via RIO3 are as follows.

Operation panel I/O unit type	Max. number of stations (RIO3 connection)	Max. number of I/O points (RIO3 connection)	Remote I/O rotary switch setting range
FCU7-DX710	4 stations (No. 3 to 6)	128 points/128 points	2 to 5
FCU7-DX711	4 stations (No. 3 to 6)	128 points/128 points	2 to 5
FCU7-DX720/730	3 stations (No. 4 to 6)	96 points/96 points	3 to 5
FCU7-DX721/731	3 stations (No. 4 to 6)	96 points/96 points	3 to 5

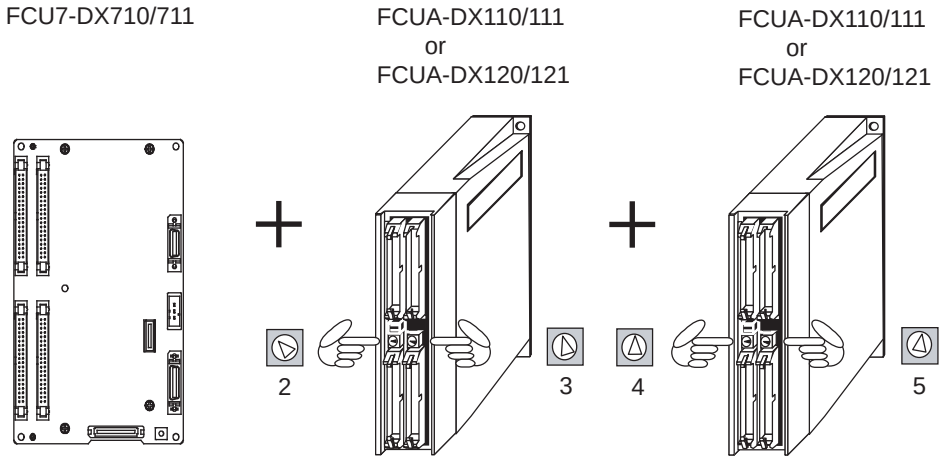
Setting example 1



Number of occupied stations: 1

Total number of occupied stations: 1

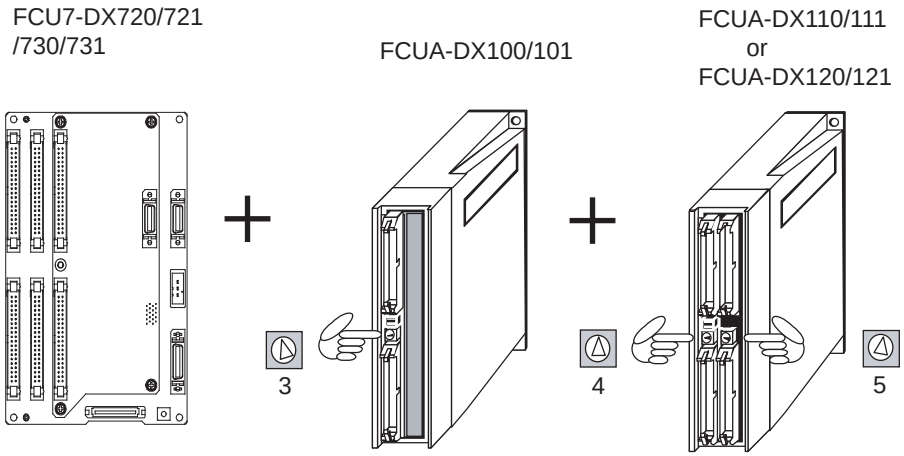
Setting example 2



Number of occupied stations: 2 **2**

Total number of occupied stations: 4 (Maximum configuration)

Setting example 3

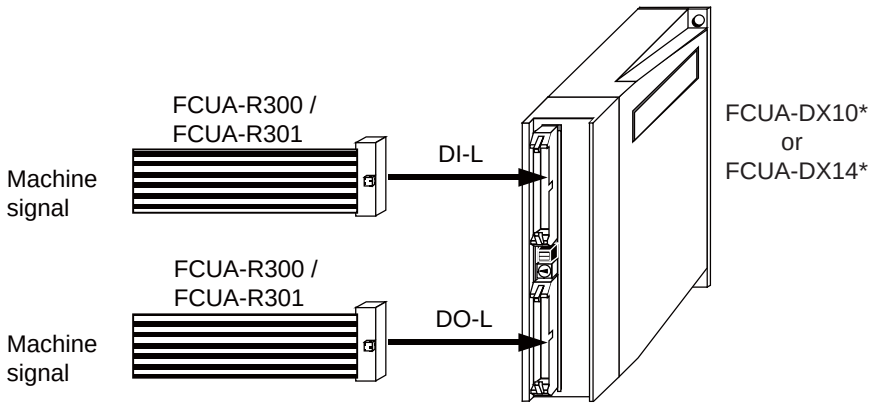


Number of occupied stations: 1 2

Total number of occupied stations: 3 (Maximum configuration)

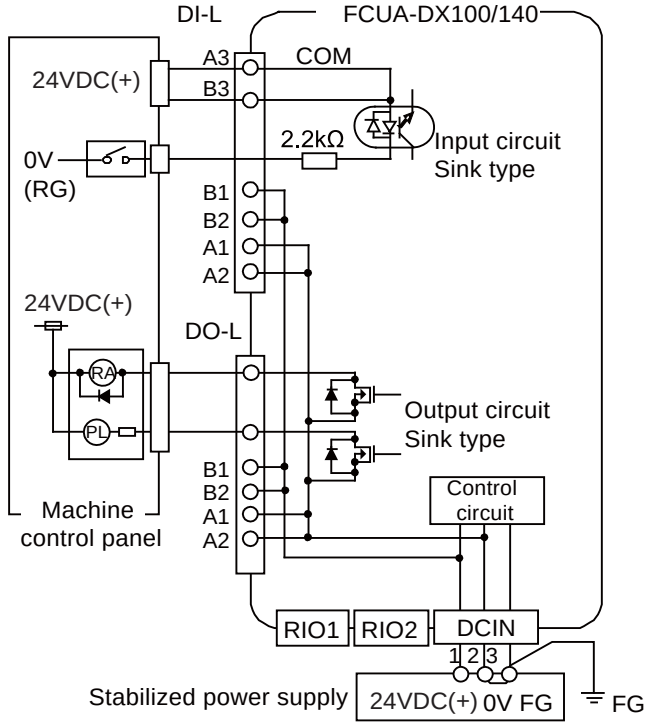
4.4.3 Connecting FCUA-DX10*/14* Unit with Machine Control Signal

Type of machine input/output signal and number of points	Input	Output
	32 points	32 points

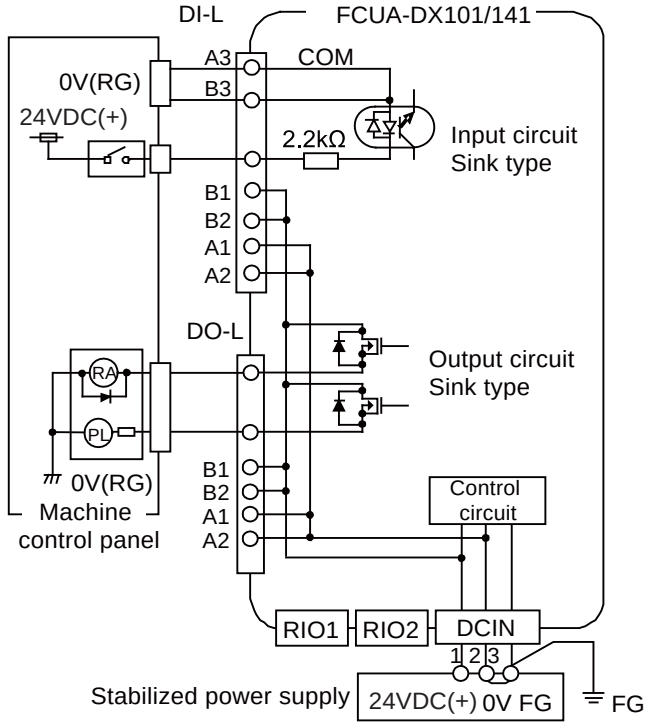


<Outline of connection>

Connection to 24V common (example)



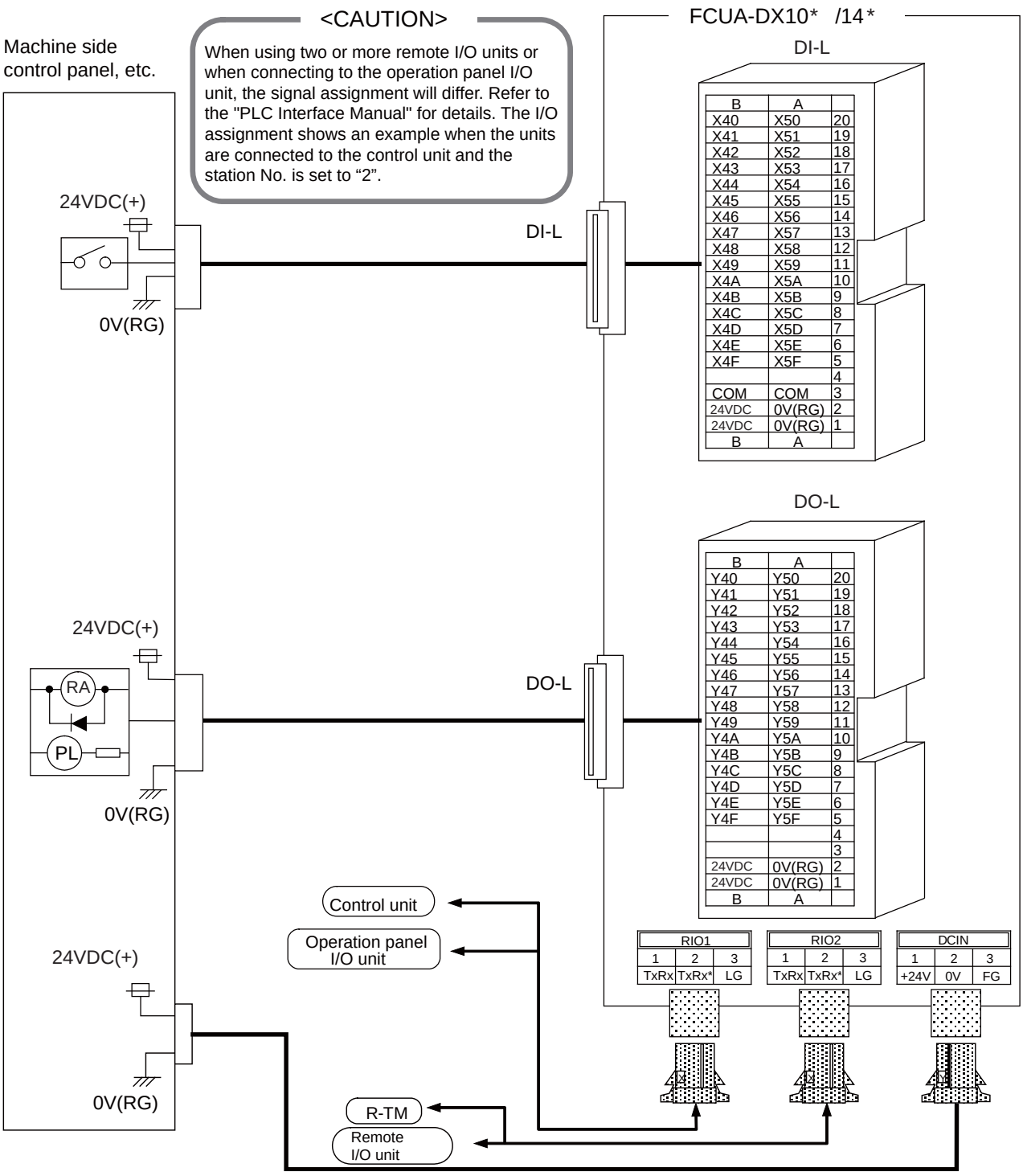
Connection to 0V common (example)



⚠ CAUTION

1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.

<Signal assignment>



<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

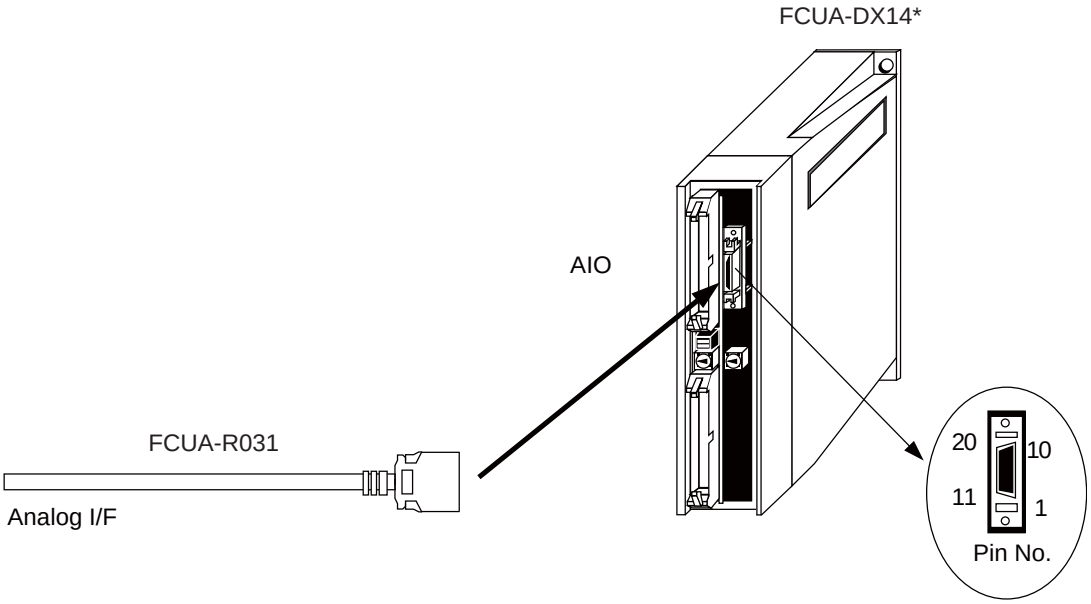
Terminator (R-TM)

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

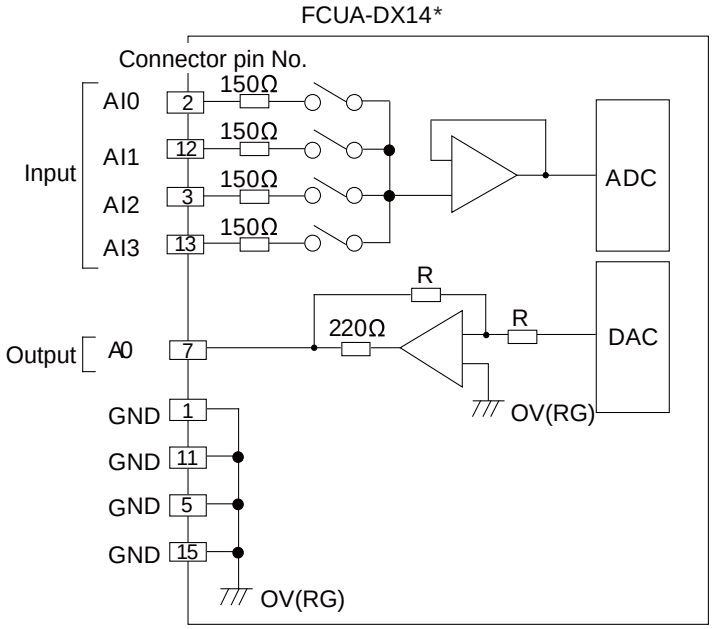
(Note 1) ( ) is the MITSUBISHI original type name.
(Note 2) Refer to "8.30 R-TM Terminator Connector" for the details of R-TM.

4.4.4 Connecting FCUA-DX14* Unit with Analog Input/Output Signal

For the analog input/output signal, connect the FCUA-R031 cable to "AIO". Up to four input points and one output point can be connected for the analog input/output signal. When manufacturing the FCUA-R031 cable, use the FCUA-CS000 connector set (optional, with both ends).



Input/output circuit

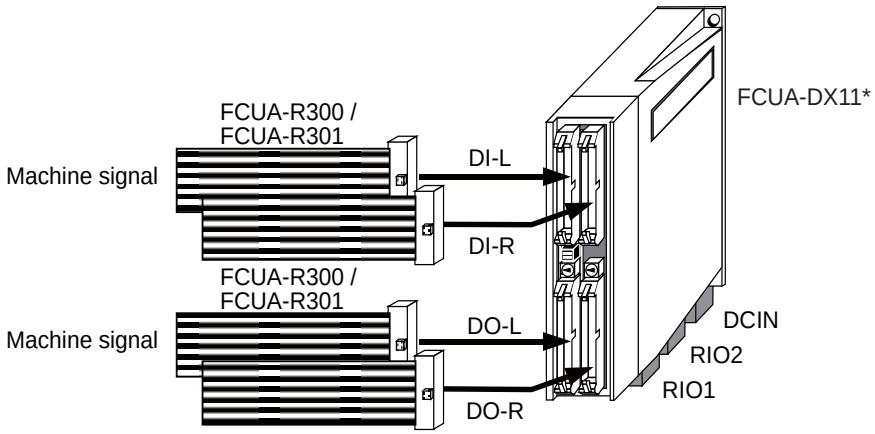


⚠ CAUTION

1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.

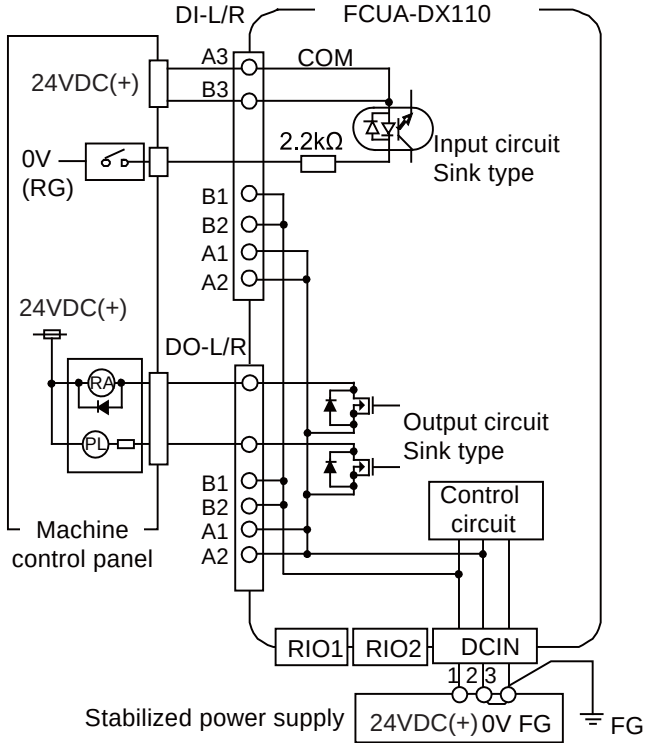
4.4.5 Connecting FCUA-DX11* Unit with Machine Control Signal

Type of machine input/output signal and number of points	Input	Output
	64 points	48 points

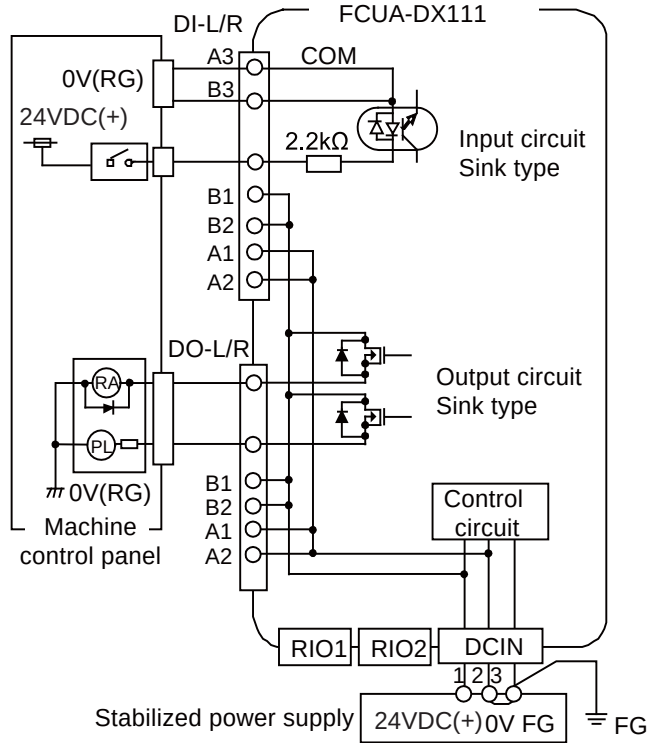


<Outline of connection>

Connection to 24V common (example)



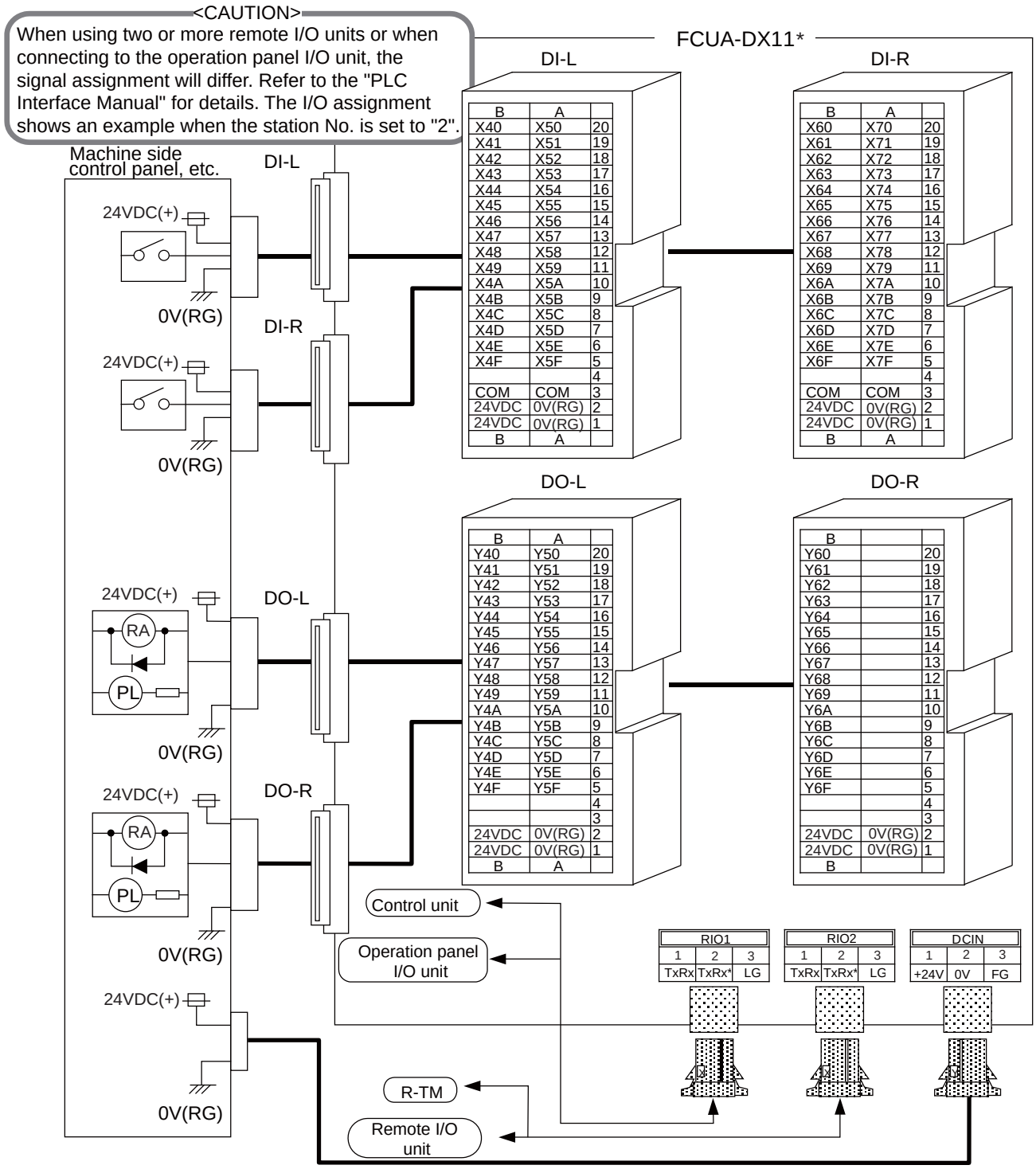
Connection to 0V common (example)



⚠CAUTION

1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.

<Signal assignment>



<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

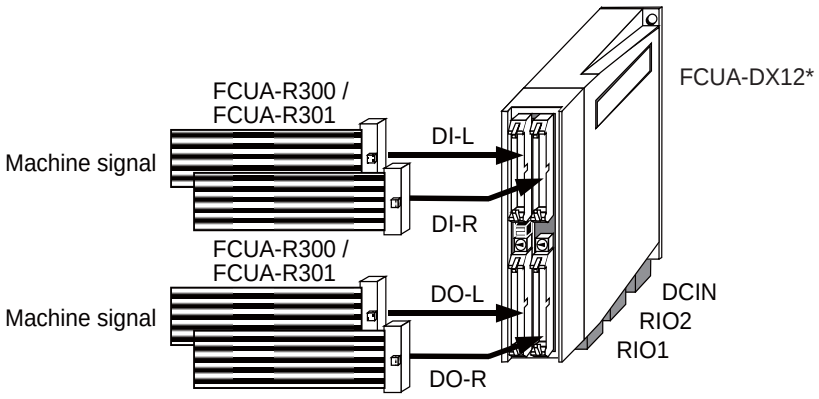
Terminator (R-TM)

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

(Note 1) ( ) is the MITSUBISHI original type name.
(Note 2) Refer to "8.30 R-TM Terminator Connector" for the details of R-TM.

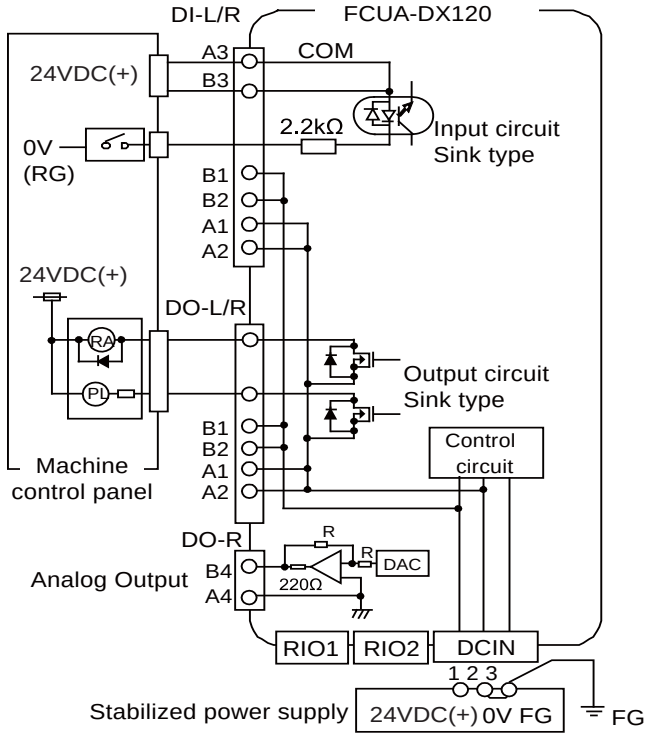
4.4.6 Connecting FCUA-DX12* Unit with Machine Control Signal

Type of machine input/output signal and number of points	Input	Output	Analog output
	64 points	48 points	1 points

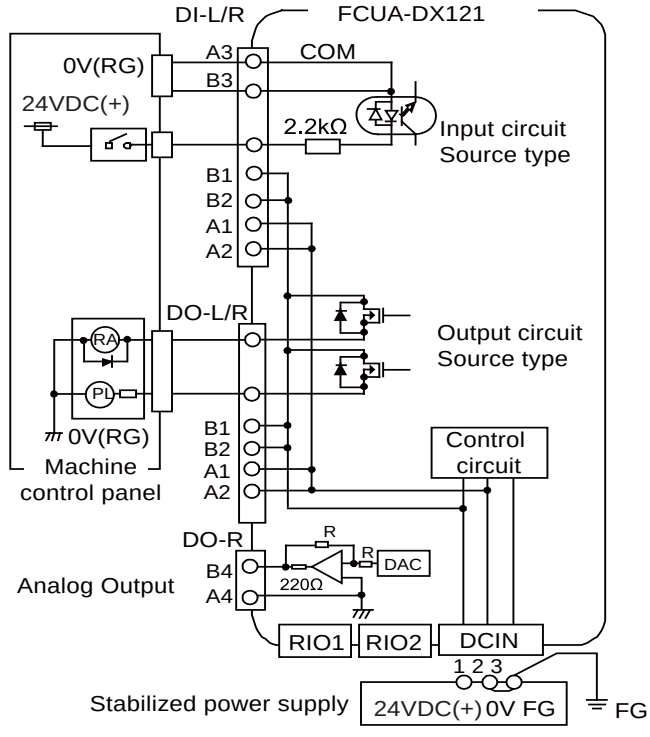


<Outline of connection>

Connection to 24V common (example)



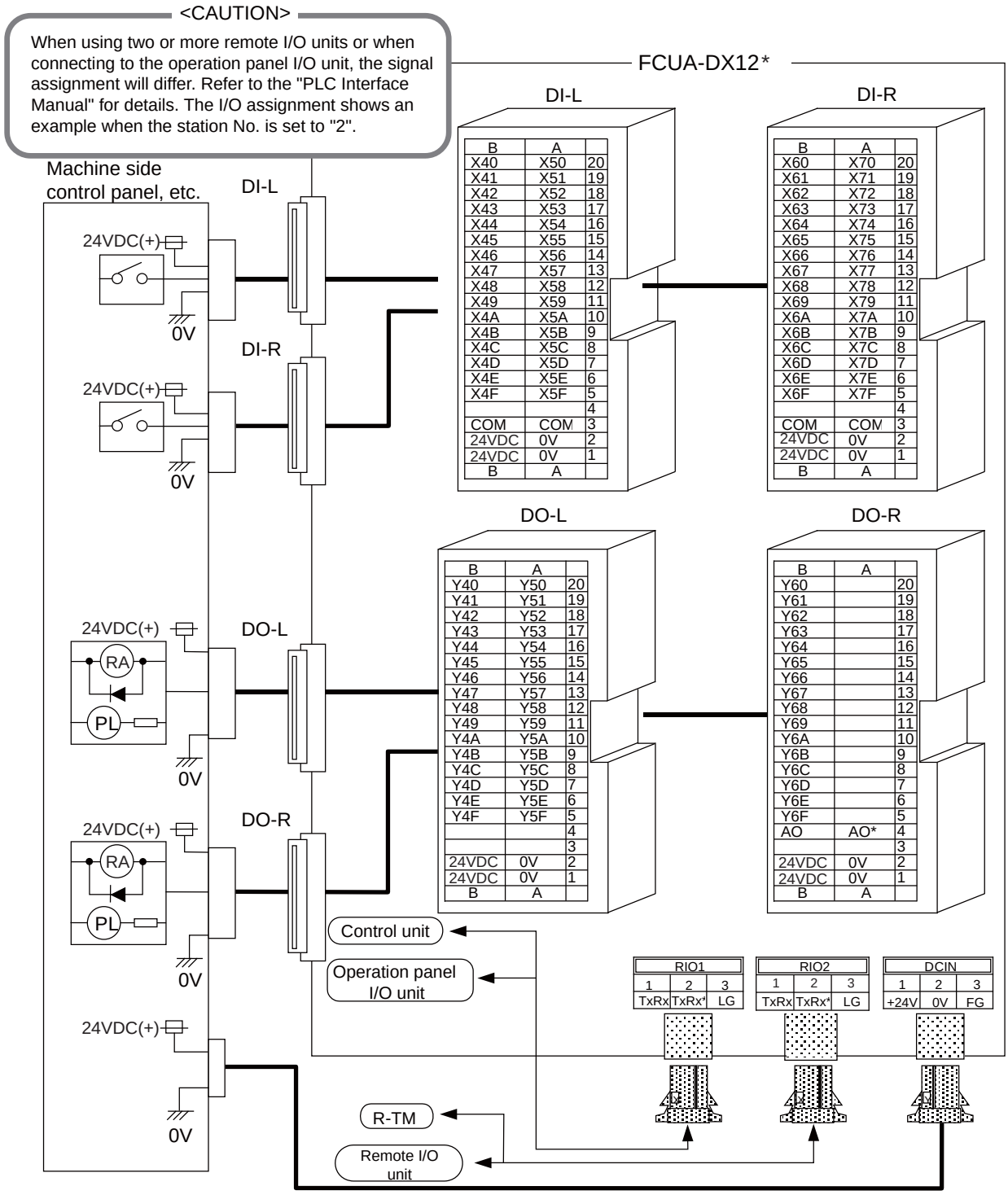
Connection to 0V common (example)



⚠ CAUTION

1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.

<Signal assignment>



B	A	
X40	X50	20
X41	X51	19
X42	X52	18
X43	X53	17
X44	X54	16
X45	X55	15
X46	X56	14
X47	X57	13
X48	X58	12
X49	X59	11
X4A	X5A	10
X4B	X5B	9
X4C	X5C	8
X4D	X5D	7
X4E	X5E	6
X4F	X5F	5
		4
COM	COM	3
24VDC	0V	2
24VDC	0V	1
B	A	

B	A	
X60	X70	20
X61	X71	19
X62	X72	18
X63	X73	17
X64	X74	16
X65	X75	15
X66	X76	14
X67	X77	13
X68	X78	12
X69	X79	11
X6A	X7A	10
X6B	X7B	9
X6C	X7C	8
X6D	X7D	7
X6E	X7E	6
X6F	X7F	5
		4
COM	COM	3
24VDC	0V	2
24VDC	0V	1
B	A	

B	A	
Y40	Y50	20
Y41	Y51	19
Y42	Y52	18
Y43	Y53	17
Y44	Y54	16
Y45	Y55	15
Y46	Y56	14
Y47	Y57	13
Y48	Y58	12
Y49	Y59	11
Y4A	Y5A	10
Y4B	Y5B	9
Y4C	Y5C	8
Y4D	Y5D	7
Y4E	Y5E	6
Y4F	Y5F	5
		4
		3
24VDC	0V	2
24VDC	0V	1
B	A	

B	A	
Y60		20
Y61		19
Y62		18
Y63		17
Y64		16
Y65		15
Y66		14
Y67		13
Y68		12
Y69		11
Y6A		10
Y6B		9
Y6C		8
Y6D		7
Y6E		6
Y6F		5
AO	AO*	4
		3
24VDC	0V	2
24VDC	0V	1
B	A	

<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 "8.30 R-TM Terminator Connector" for the details of R-TM.

4.5 Connection of Scan I/O card

(1) External power supply (DCIN)

24VDC is required for the HR347/HR357 card operation. Prepare a stabilized power supply that satisfies the following specifications.

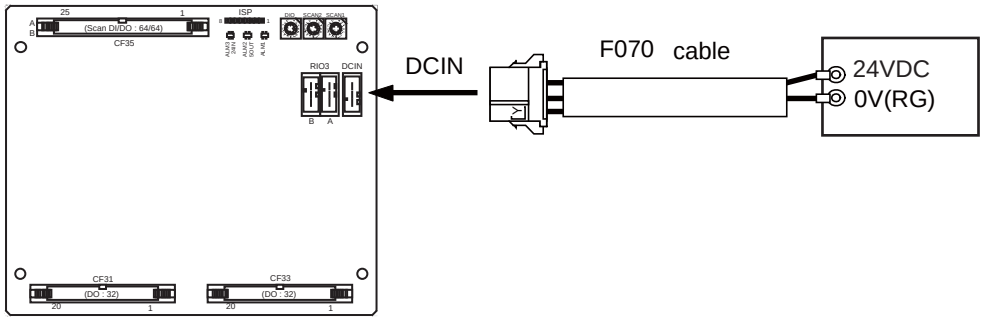
Output: 24VDC±5%

Ripple: ±5%(P-P)

Rated output current: 2.5A

* The rated output current is the value when using 60mA × 32 points for the machine output.

Prepare a power supply that satisfies the 24VDC output's total output current and control current (0.5A).

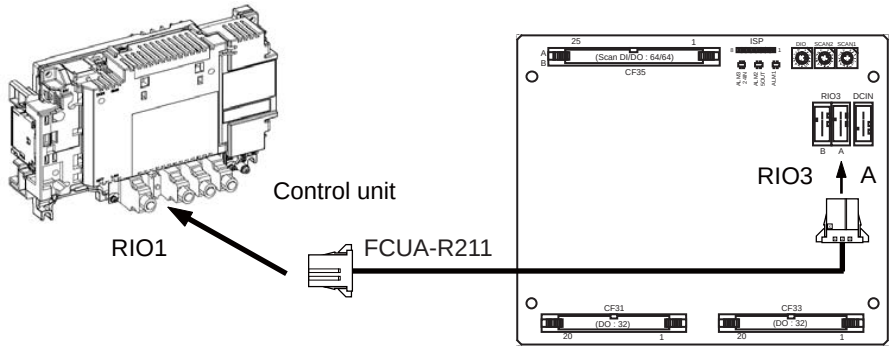


HR357

(2) Connecting the remote I/O communication cable (RIO3A/B)

(a) Connection of the RIO3A connector

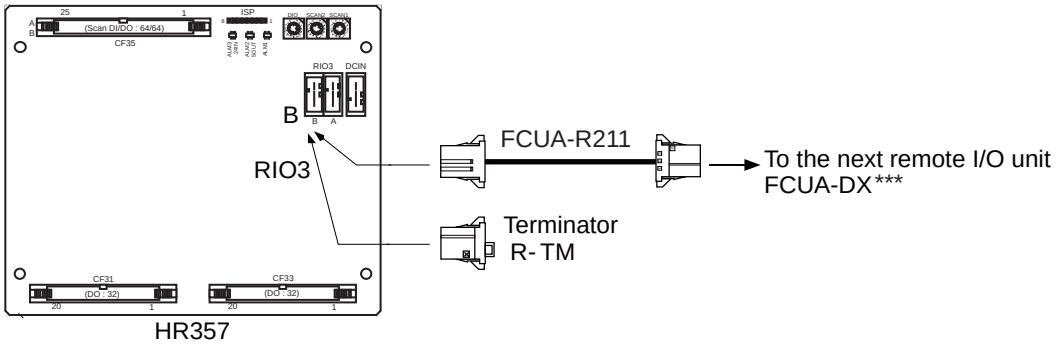
Connect the RIO3A to the RIO1 connector of the control unit or the RIO3 of the operation panel I/O unit.



HR357

(b) Connection of the RIO3B connector

Multiple remote I/O units can be used, as long as the total No. of occupied stations connected with serial links is less than eight. (Refer to "4.4 Connection of Remote I/O Unit" for details.) HR357 occupies three stations, so the remote I/O units can be connected to the RIO3B in combinations of 5 stations or less. Connect a terminator to the RIO3B when it is not connected to any device.



HR357

5

EMC Installation Guidelines

Refer to the "EMC Installation Guidelines BNP-B8582-45" for details related to the drive section (servo/spindle drive unit).

5.1 Introduction

EMC Directives became mandatory as of January 1, 1996. The subject products must have a CE mark attached indicating that the product complies with the Directives.
As the NC unit is a component designed to control machine tools, it is believed that it is not a direct EMC Directives subject. However, we would like to introduce the following measure plans to back up EMC Directives compliance of the machine tool as the NC unit is a major component of the machine tools.

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

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

5.2 EMC Directives

The EMC Directives largely regulate the following two items.
- Emission Capacity to prevent output of obstructive noise that adversely affects external devices.
- Immunity Capacity to not malfunction due to obstructive noise from external source.

The details of each level are classified in the table below.
It is assumed that the Standards and test details required for a machine tool are the same as these.

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

5.3 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.

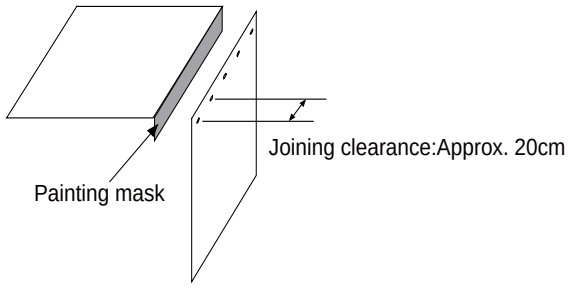
(1) Accurately ground the devices.
(2) Use shielded cables.
(3) Increase the electrical seal of the panel. Reduce the gaps and holes.

5.4 Panel Structure

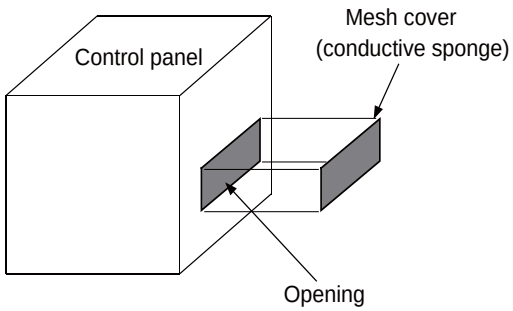
The design of the panel is a very important factor for the EMC measures, so take the following measures into consideration.

5.4.1 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.



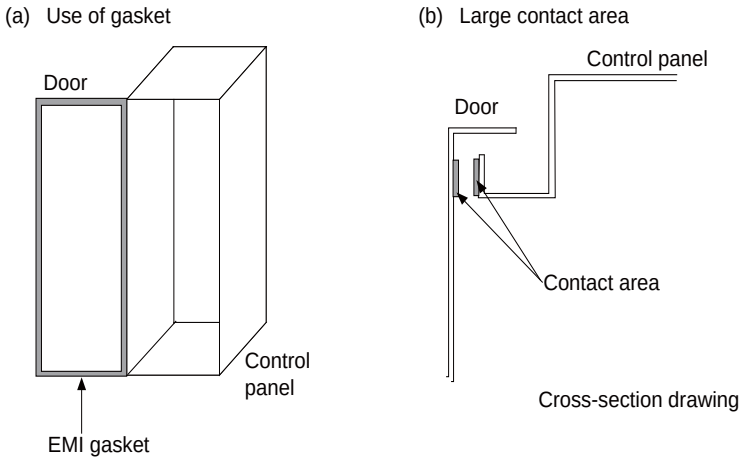
(3) Note that if the plate warps due to the screw fixing, etc. By creating a clearance, noise could leak from that place.
(4) Plate (nickel tin) the metal plate surface at the grounding plate, and connect the connections with a low impedance.
(5) If there is a large opening, such as ventilation holes,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



(Note 1) Using screws to fix the plates that have been painted is the same as an insulated state. Peel the paint and fix the screws.

5.4.2 Measures for Door

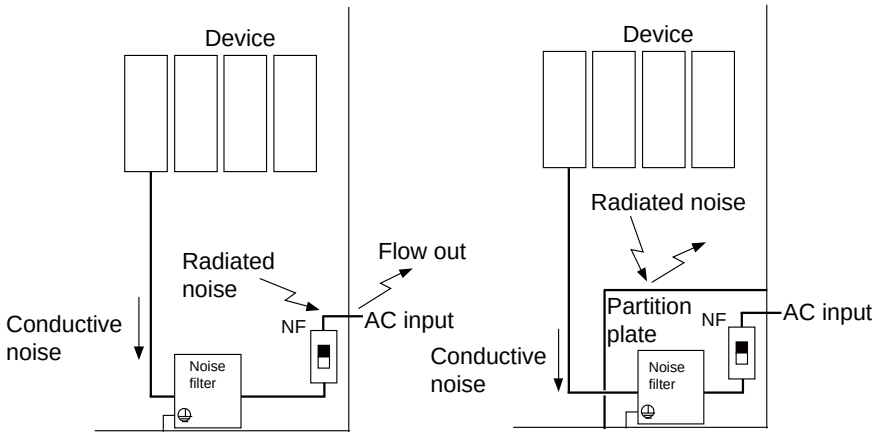
(1) Use metal for all members configuring the panel.
(2) When joining the door, use a gasket to lower the impedance of the contacting sections, or use a structure with a large contact area as shown below.
(3) The EMI gasket or conductive packing must contact the metal surface uniformly and at the correct position.



(Note 1) When not using a gasket, ground the control panel grounding with a grounding wire to lower the door's impedance.
(Note 2) 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.

5.4.3 Measures for Power Supply

(1) Shield the power supply section and insert a filter to prevent the noise from flowing in or out. Selection of the noise filter capacity will differ according to the drive unit and devices being used. Refer to the "EMC Installation Guidelines" (BNP-B8582-45).



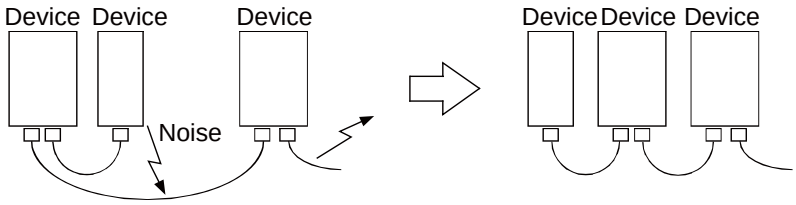
(Note 1) The conductive noise can be suppressed by inserting a noise filter, but the radiated noise will flow out.
(Note 2) The conductive and radiated noise can both be suppressed by adding a partition plate to the noise filter.

5.5 Measures for Wiring in Panel

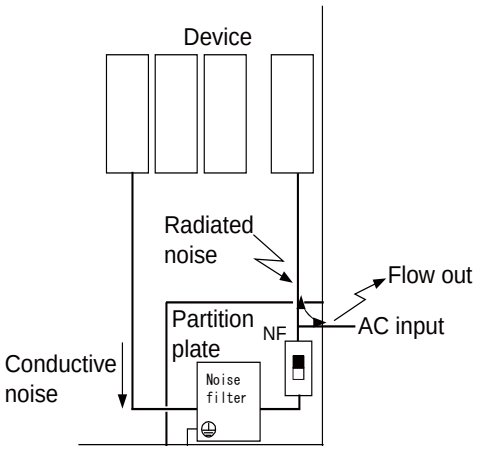
Cables act as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated.
The following measures must be sufficiently considered for the cables (SH21/G013/F012/FCUA-R211) that carry out high-speed communication.

5.5.1 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.



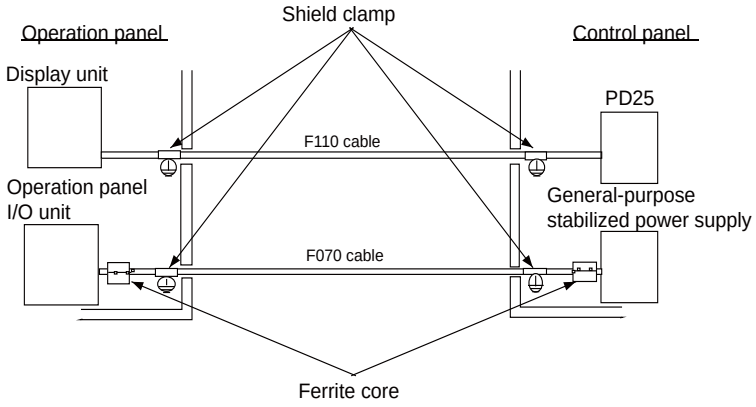
(2) Always connect the grounding wire to the FG terminal indicated on the device.
(3) Keep the distance between the drive line and detector cable to the drive section motor as far apart as possible when wiring.
(4) Do not lead the power supply wire around the panel without using a filter.



5.5.2 Shield Treatment of Cables

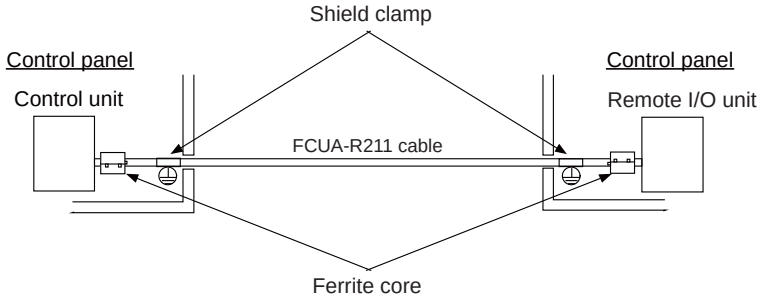
Use shielded cables for the cables wired outside the panel.
Use a shield clamp within 10cm of the lead-out port from the panel. (Refer to "5.6.1 Shield Clamp Fitting".)

(1) DC power supply cable [F110/F070 cable]



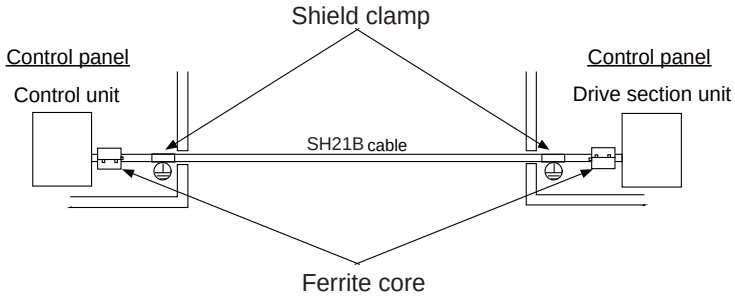
- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.
- Always install a ferrite core on the general-purpose stabilized power supply. (Refer to "5.6.2 Ferrite Core".) The ferrite core may not be required depending on the selected power supply.

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



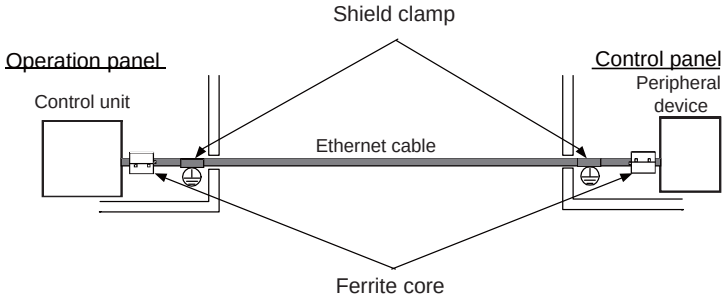
- Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.

(3) Servo communication cable [SH21 cable]



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

(4) Ethernet cable



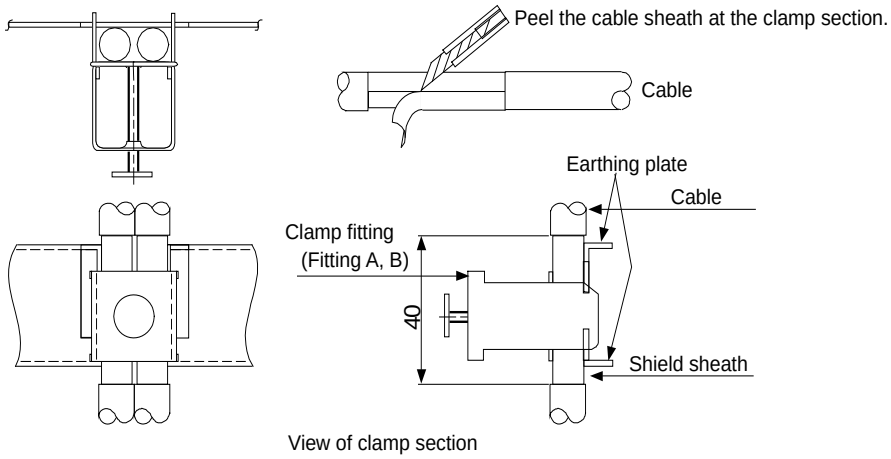
- Use a shielded cable. Use a shield clamp within 10cm from the panel's inlet/outlet.
- Install a ferrite core on both ends of the connected units.

5.6 EMC Countermeasure Parts

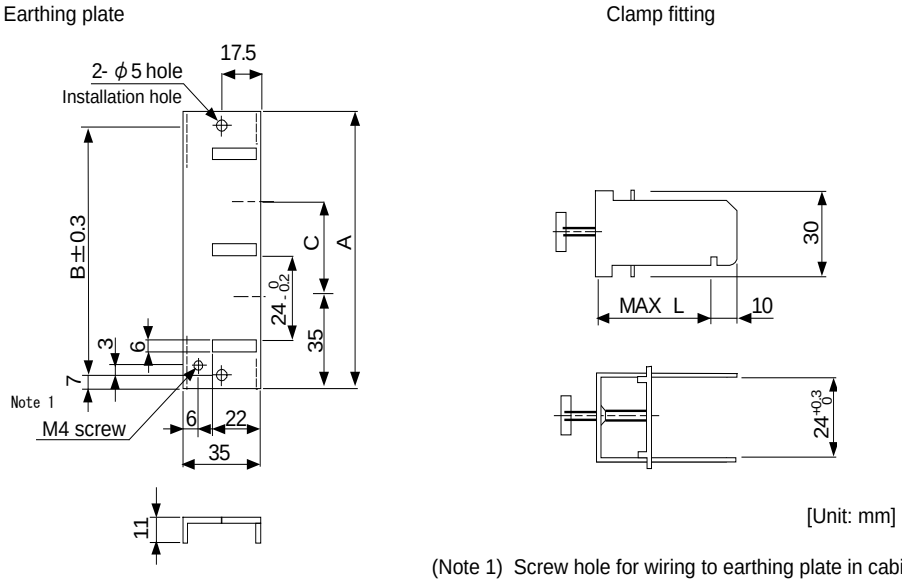
5.6.1 Shield Clamp Fitting

The effect can be improved by directly connecting the cable's shield sheath to the grounding plate as shown below.
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.

	A	B	C	Enclosed fittings			L
AERSBAN-DSET	100	86	30	Clamp fitting A × 2		Clamp fitting A	70
AERSBAN-ESET	70	56	-	Clamp fitting B × 1		Clamp fitting B	45



・Outline drawing

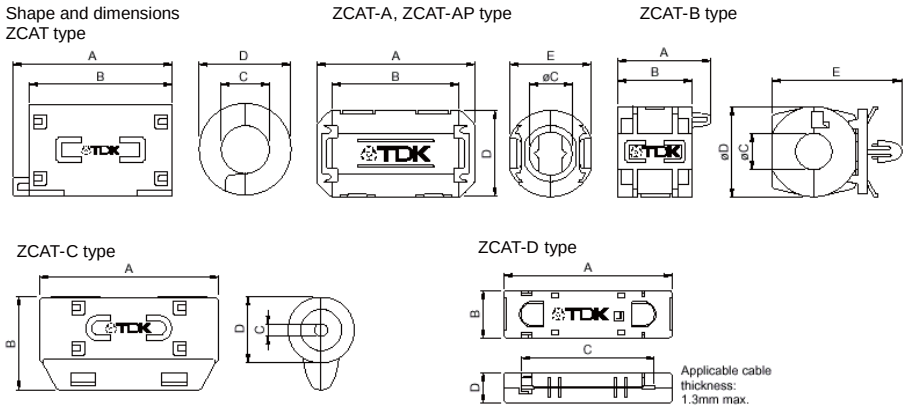


[Unit: mm]

(Note 1) Screw hole for wiring to earthing plate in cabinet.
(Note 2) The earthing plate thickness is 1.6mm.

5.6.2 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

Unit: mm

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

*1 The M stamp is attached.
*2 A fixing band is attached at shipment.
*3 The core is fixed with double-sided tape. (The tape is enclosed with the part.)

- ZCAT-B type: Cabinet fixing type installation hole ø4.8 to 4.9mm, plate thickness 0.5 to 2mm
- ZCAT-AP, ZCAT-C type: Structure that prevents easy opening after case is closed.

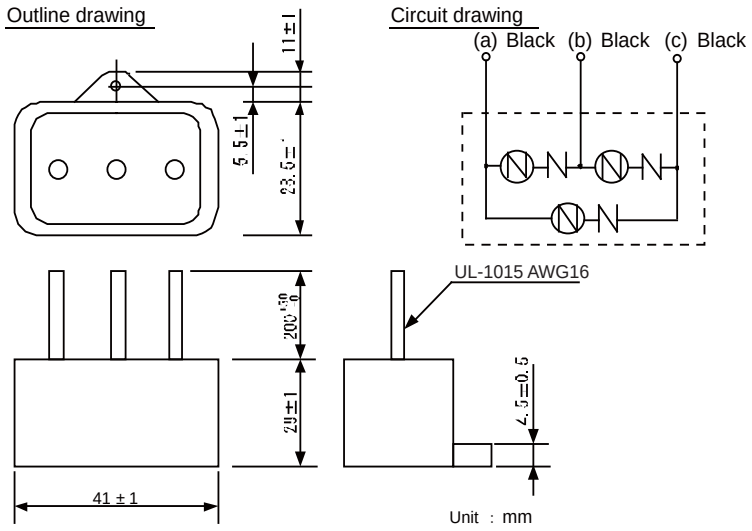
5.6.3 Surge Absorber

Make sure that the surge does not directly enter the AC line of the general-purpose stabilized power supply (user-prepared) supplying power to the control unit and DIO. Select the following product or equivalent for the surge absorber. Refer to the manufacturer catalog for detailed characteristics, outline and connection methods of the surge absorber.

(1) Part name: RAV-781BYZ-2

Manufacturer: OKAYA ELECTRIC INDUSTRIES

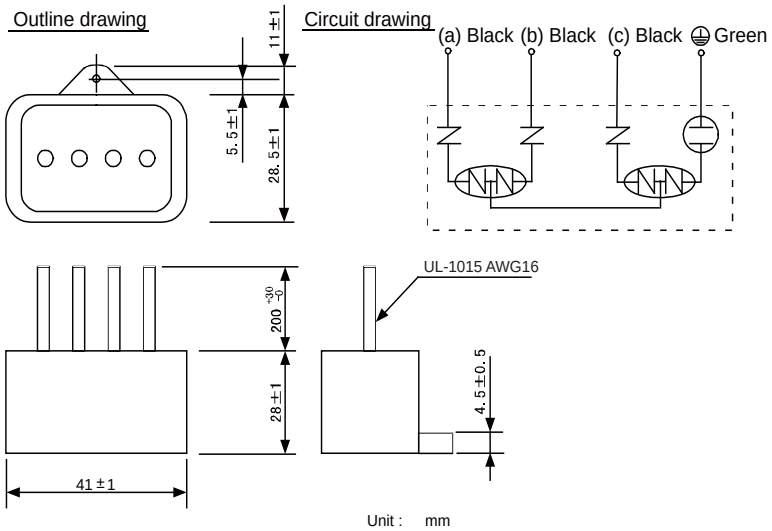
Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage V±10%	Surge withstand level 8/20μs	Surge electrical discharge start voltage 1.2/50μs	Static capacity	Working temperature range
250V 3φ	300V	783V	2,500A	20kV	75pF	-20 to +70C°



(2) Part name: RAV-781BXZ-4

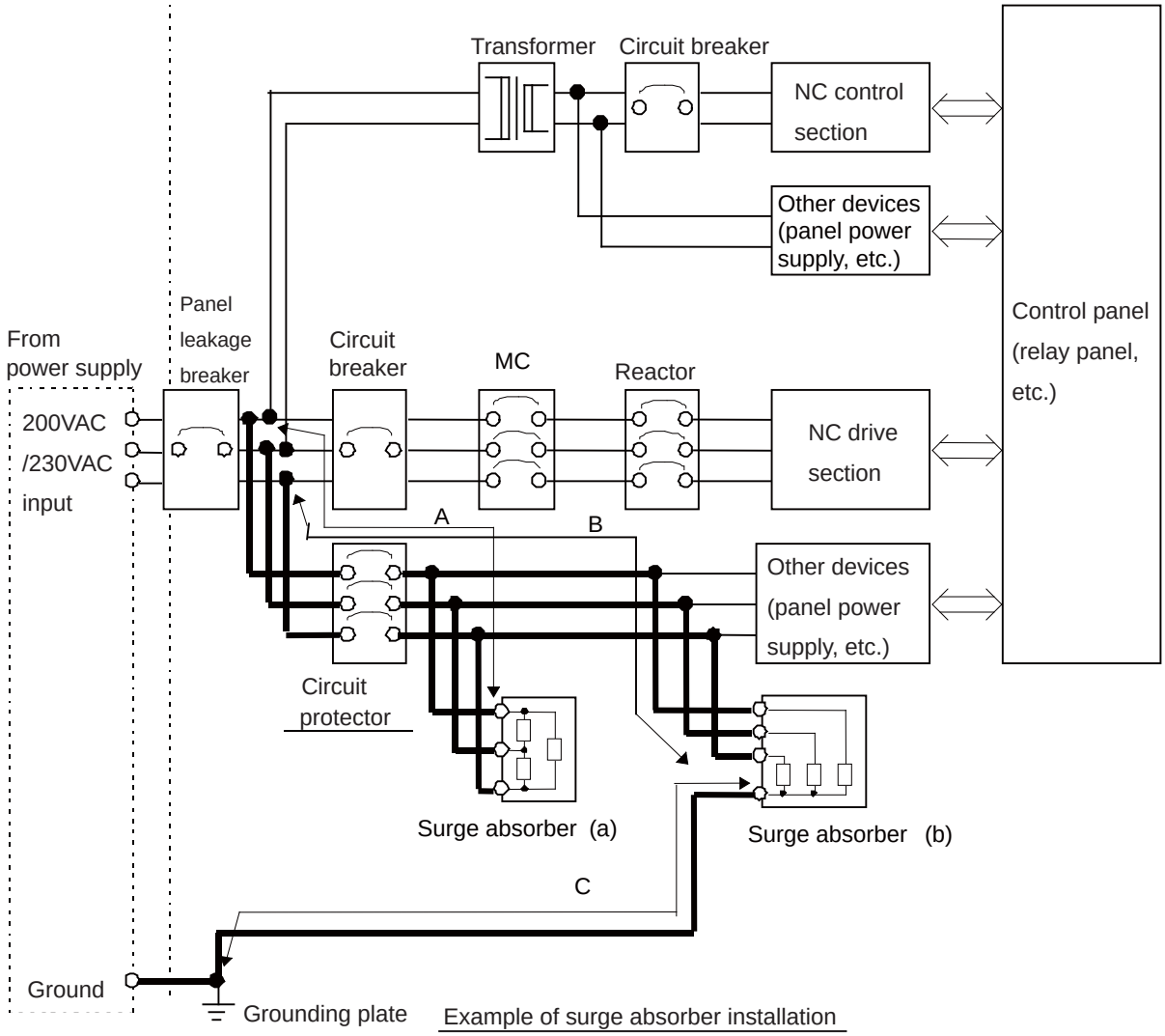
Manufacturer: OKAYA ELECTRIC INDUSTRIES

Circuit voltage 50/60Hz Vrms	Max. tolerable circuit voltage	Clamp voltage V±10%	Surge withstand level 8/20μs	Surge electrical discharge start voltage 1.2/50μs	Static capacity	Working temperature range
250V 3φ	300V	700V	2,500A	2kV	75pF	-20 to +70C°



(3) 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.

5.6.4 Selection of Stabilized Power Supply

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

Stabilized power supply selection items

Item		Standard setting	Remarks
Out-put	Voltage fluctuation	±5%	±5% or less of 24VDC output
	Ripple noise	120mV (max.)	
	Spike noise	500mV (max.)	
Output current		——	Refer to the maximum current consumption of the unit in use and calculate.
Output holding time		20ms (min)	Instantaneous power failure time (AC side)

Standards

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

6

Transportation Restrictions for Lithium Batteries

6.1 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 "6.1.2 Handling by User".

6.1.1 Target Products

The following Mitsubishi NC products use lithium batteries. The UN Regulations classify the batteries as dangerous goods (Class 9) or not dangerous goods according to the lithium content. If the batteries subjected to hazardous materials are incorporated in a device and shipped, a dedicated packaging (UN packaging) is not required. However, the item must be packed and shipped following the Packing Instruction 912 specified in the IATA DGR (Dangerous Goods Regulation) book.
Also, all lithium battery products incorporated in a machinery or device must be fixed securely in accordance with the Packing Instruction 900 and shipped with protection in a way as to prevent damage or short-circuits.

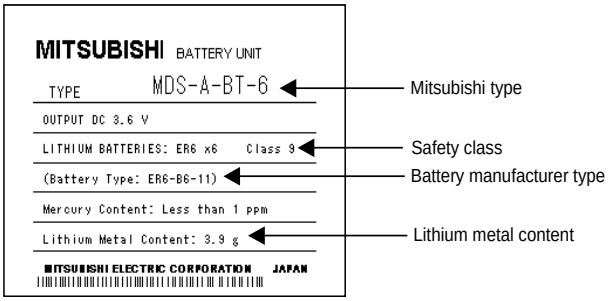
(1) Products requiring dedicated packaging (Materials falling under Class 9)

Mitsubishi type (Type for arrangement)	Battery type	Lithium metal content	Application	Battery class
MDS-A-BT-4	ER6-B4-11	2.6g	For servo	Battery
MDS-A-BT-6	ER6-B6-11	3.9g	For servo	
MDS-A-BT-8	ER6-B8-11	5.2g	For servo	
FCU6-BT4-D1	Combination of ER6-B4D-11 and ER6	2.6g+0.65g	For NC/ servo	
CR23500SE-CJ5 (Note 1)	CR23500SE-CJ5	1.52g	For NC (M500)	Battery cell

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

Mitsubishi type (Type for arrangement)	Battery type	Lithium metal content	Application	Battery class
MDS-A-BT-2	ER6-B2-12	1.3g	For servo	Battery
FCU6-BTBOX series	2CR5	1.96g	For NC/ servo	
CR2032 (for built-in battery)	CR2032	0.067g	For NC	Battery cell
CR2450 (for built-in battery)	CR2450	0.173g	For NC	
ER6, ER6V series (for built-in battery)	ER6, ER6V	0.7g	For NC/ servo	
A6BAT(MR-BAT)	ER17330V	0.48g	For servo	
Q6BAT	Q6BAT	0.49g	For NC	
MR-J3BAT	ER6V	0.65g	For servo	

(Note 1) When CR23500SE-CJ5 is incorporated in the unit, this battery is not subject to the regulation.
(Note 2) Dedicated packaging is required if the shipment exceeds 12 batteries/24 battery cells. Package the batteries so that this limit is not exceeded.
(Note 3) The battery units labeled as "FCUA-" instead of "MDS-A-" also use the same battery.
(Note 4) Always use the cell battery (A6BAT) in combination with the dedicated case (MDS-BTCASE). Maximum 8 (either 2, 4, 6 or 8) cell batteries (A6BAT) can be installed to the dedicated case (MDS-BTCASE).
(Example) Rating nameplate for battery units



6.1.2 Handling by User

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

IATA: International Air Transport Association

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

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

(1) Reshipping in Mitsubishi UN packaging

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

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

[1] Proper shipping name (Lithium batteries)

[2] UN NO. (UN3090 for isolated battery, UN3091 for battery incorporated in a device or included)

[3] 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 "6.3 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

[1] Consult with The Ship Equipment Inspection Society of Japan for details on packaging.

[2] 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

[1] 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.)

[2] Prepare for the certificates or test results showing compliance to battery safety test.

(The safety test results have been obtained from the battery manufacturer. Consult with Mitsubishi when the safety test results are required.)

[3] Prepare for shipping as explained in "(1) Reshipping in Mitsubishi UN packaging".

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

Pack and prepare for shipping the item in accordance with the Packing Instruction 900 specified in the IATA DGR (Dangerous Goods Regulation) book. (Securely fix the batteries that comply with the UN Manual of Tests and Criteria to a machinery or device, and protect in a way as to prevent damage or short-circuit.)
Note that all the lithium batteries provided by Mitsubishi have cleared the UN recommended safety test; fixing the battery units or cable wirings securely to the machinery or device will be the user's responsibility.
Check with your shipping company for details on packing and transportation.

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

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

The outline of the Packing Instruction 912 is as follows:

(1) 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.
(2) A device incorporating lithium batteries has to be stored in a strong water-proofed outer packaging.
(3) To prevent an accidental movement during shipment, securely store the item in an outer packaging.
(4) Lithium content per device should be not more than 12g for cell and 500g for battery.
(5) Lithium battery mass per device should be not more than 5kg.

6.1.3 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

6.2 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 if also applies to the domestic flight and international flight departing from or arriving in the United States. Therefore, when transporting lithium batteries to the United State, or within the United State, the shipper must take measures required to transport lithium batteries. Refer to the Federal Register and the code of Federal Regulation ("6.2.4 Reference") for details.

6.2.1 Outline of Regulation

(1) Transporting primary lithium battery by passenger aircraft is forbidden.
  (a) 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 "6.1.1 Target Products".)
(2) When transporting primary lithium battery by cargo aircraft, indicate that transportation by passenger aircraft is forbidden on the exterior box.

6.2.2 Target Products

All NC products for which the lithium batteries are used are subject to the regulation.
(Refer to the table "6.1.1 Target Products".)

6.2.3 Handling by User

The "6.1.1 Outline of Regulation" described above is solely Mitsubishi's opinion. The shipper must confirm orders of "6.1.4 Reference" described below for transportation method corresponding the regulation.
These should be checked by the company commissioned for the actual lithium battery transportation.

(1) Indication of exterior box

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

Display example

PRIMARY LITHIUM BATTERIES **FORBIDDEN FOR TRANSPORT ABOARD PASSENGER AIRCRAFT.**

  (a) The character color must be displayed with contrast. (black characters against white background, black characters against yellow background, etc.)
  (b) 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)

6.2.4 Reference

(1) 49CFR (Code of Federal Regulation, Title49) (173.185 Lithium batteries and cells.)
http://www.access.gpo.gov/nara/cfr/waisidx_00/49cfr173_00.html
(2) DOT regulation body (Department of Transportation)
http://hazmat.dot.gov/regs/rules/final/69fr/docs/69fr-75207.pdf

6.3 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 "6.1 Restriction for Packing".

(1) Outline of hazard

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

(2) First-aid measure

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

(3) Fire-fighting measure

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

(4) Measure for leakage

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

(5) Handling and storage

Handling	**Cautions for safety handling**	Do not peel the external tube or damage it. Do not dispose of the battery in fire or expose it to heat. Do not immerse the battery in water or get it wet. Do not throw the battery. Do not disassemble, modify or transform the battery. Do not short-circuit the battery.
Storage	**Appropriate storage condition**	Avoid direct sunlight, high temperature and high humidity. (Recommended temp. range: +5 to +35C°, 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) Caution for disposal

Dispose of the battery following local laws or regulations.

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

7

Precautions for Compliance to UL/c-UL Standards

7 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.

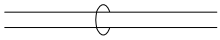
(1) Selection of external 24VDC power supply unit (The unit shall be prepared by the machine tool builder.)
MITSUBISHI CNC70 Series numerical control unit complies with the UL Standards on the condition that the stabilized power supply unit supplying 24VDC to each unit is a UL-approved part.
Use a UL-approved part for the stabilized power supply unit supplying 24VDC to each unit.

(2) Unit ambient temperature
MITSUBISHI CNC70 Series numerical control unit complies with the UL Standards on the condition that the unit is used at a temperature less than the maximum ambient temperature given in chapter 2. Make sure that the maximum ambient temperature of each unit does not exceed the temperature given in chapter 2.

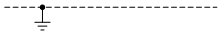
8

Cable

(Note) Symbols for writing cable drawings

(1)  indicates twisted pair.

(2)  indicates the shield sheath.

(3)  indicates shield clamping to the grounding plate.

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

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

8.1 Cable Wire and Assembly

(1) Cable wire

The specifications of the wire used for each cable, and the machining methods are shown in this section. When manufacturing the detector cable and battery connection cable, use the recommended wires shown below or equivalent products.

(a) Heat resistant specifications cable

Wire type (special order part)	Finish outer diameter	Sheath material	No. of pairs	Wire characteristics					
				Configuration	Conductive resistor	Withstand voltage	Insulation resistance	Heat resistance temperature	Flexibility
BD20288 Compound 6-pair shielded cable Specification No. Bangishi-17145 (Note 1)	8.7mm	Heat resistant PVC	2 (0.5mm^2)	100 strands/ 0.08mm	40.7Ω/km or less	500VAC / 1min	1000MΩ/ km or more	105C°	70×10^4 times or more at R200
			4 (0.2mm^2)	40 strands/ 0.08mm	103Ω/km or less				

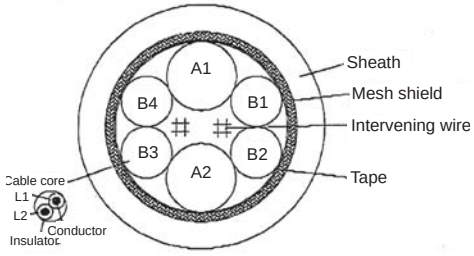
(b) General-purpose heat resistant specifications cable

Wire type (special order part)	Finish outer diameter	Sheath material	No. of pairs	Wire characteristics					
				Configuration	Conductive resistor	Withstand voltage	Insulation resistance	Heat resistance temperature	Flexibility
BD20032 Compound 6-pair shielded cable Specification No. Bangishi-16903 Revision No. 3 (Note 1)	8.7mm	PVC	2 (0.5mm^2)	100 strands/ 0.08mm	40.7Ω/km or less	500VAC/ 1min	1000MΩ/ km or more	60C°	100×10^4 times or more at R200
			4 (0.2mm^2)	40 strands/ 0.08mm	103Ω/km or less				

(Note 1) Bando Electric Wire (Contact: 81+48-461-0561 http://www.bew.co.jp)

(Note 2) The Mitsubishi standard cable is the (a) Heat resistant specifications cable. For MDS-C1/CH series, (b) or equivalent is used as the standard cable.

Compound 6-pair cable structure drawing

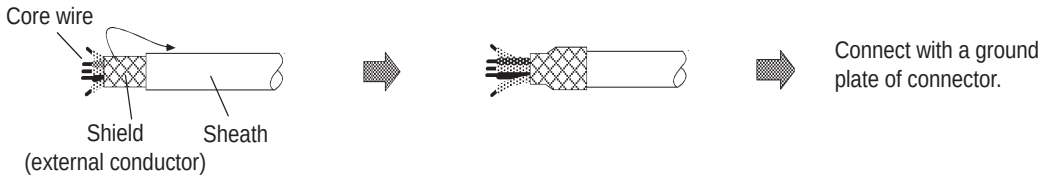


Core identification

Pair No.	Insulator color	
	L1	L2
A1 (0.5mm^2)	Red	White
A2 (0.5mm^2)	Black	White
B1 (0.2mm^2)	Brown	Orange
B2 (0.2mm^2)	Blue	Green
B3 (0.2mm^2)	Purple	White
B4 (0.2mm^2)	Yellow	White

(2) Cable assembly

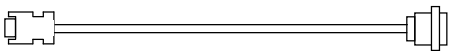
Assemble the cable with the cable shield wire securely connected to the ground plate of the connector.

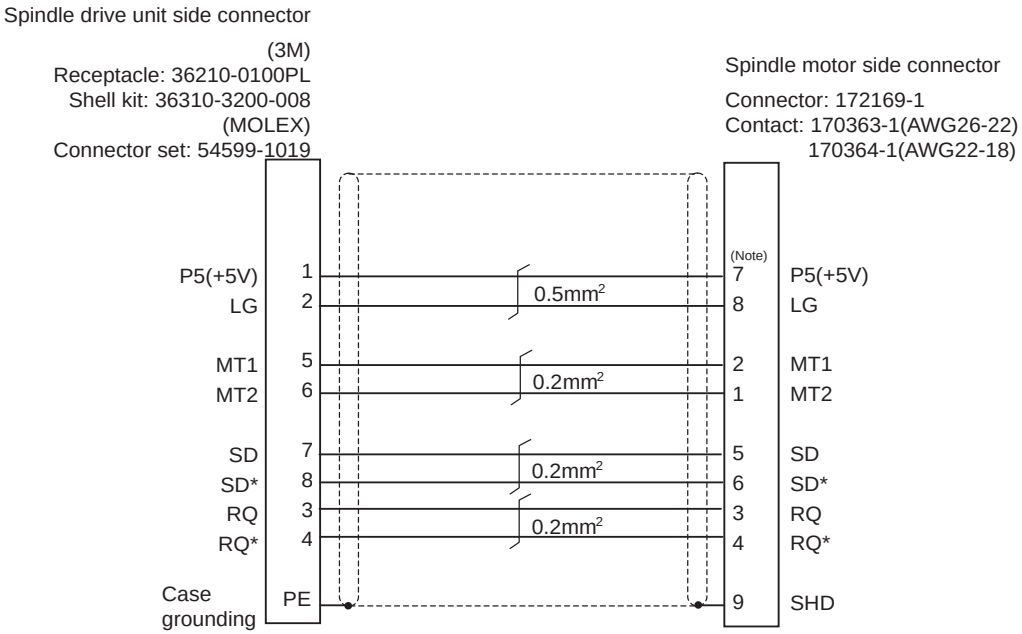


8.2 CNP2E-1 Cable

Max. cable length: 30m

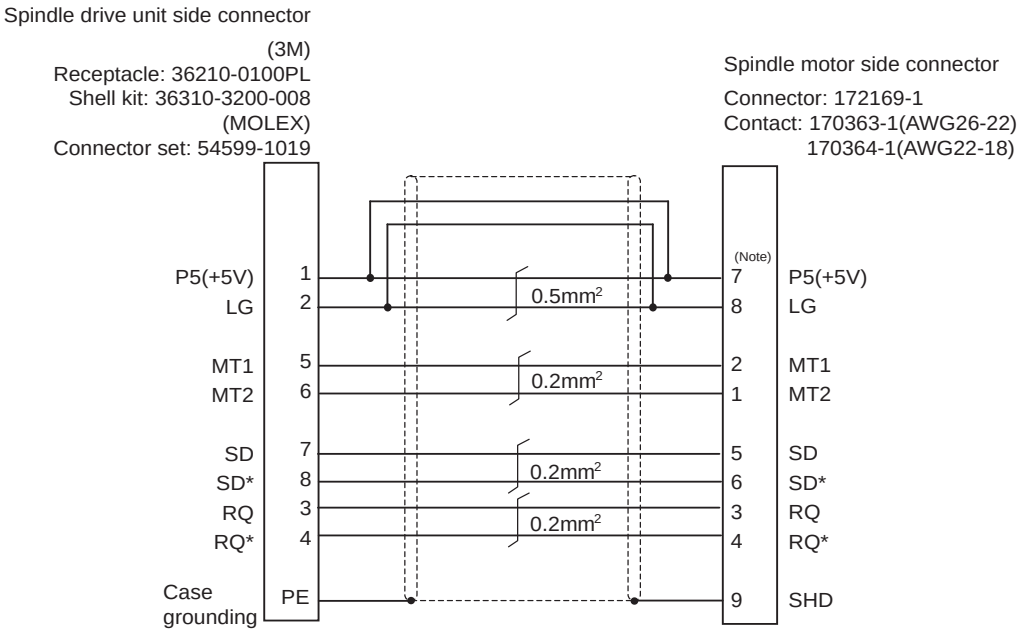
Application: Motor side PLG cable





(Note) For the pin “7” or “8”, use the contact “170364-1”.
For the other pins, use the contact “170363-1”.

<Cable connection diagram (for 15m or less)>



(Note) For the pin “7” or “8”, use the contact “170364-1”.
For the other pins, use the contact “170363-1”.

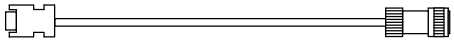
<Cable connection diagram (for 15m to 30m)>

8.3 CNV2E-6P/CNV2E-7P Cable

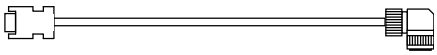
Max. cable length: 30m

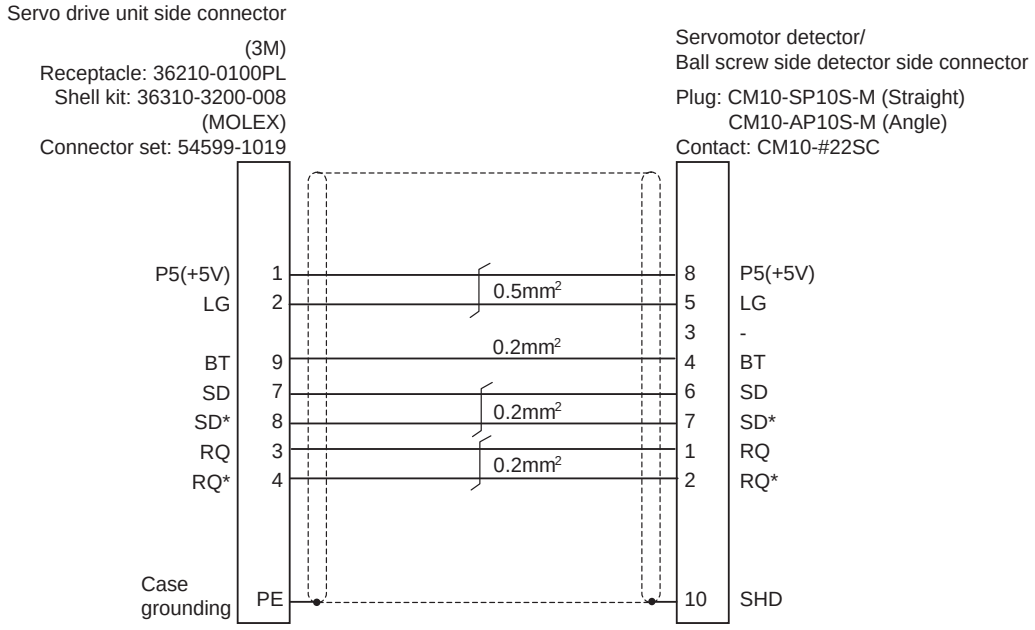
Application: Motor side detector cable (for A74/ A51)/ Ball screw side detector cable

CNV2E-6P-*M (Straight)

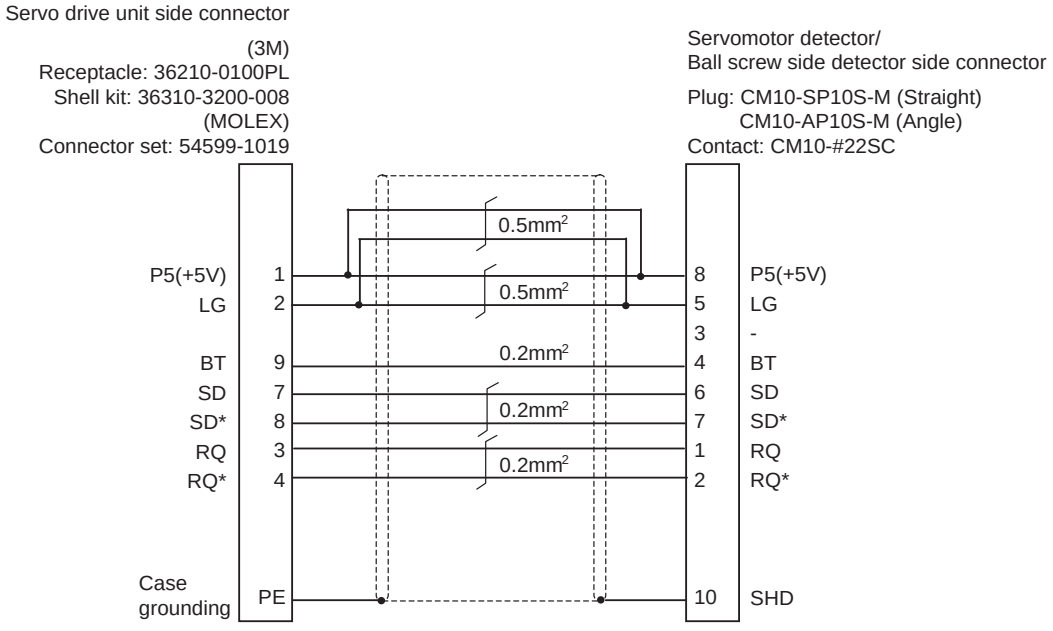


CNV2E-6P-*M (Angle)





<Cable connection diagram (for 15m or less)>



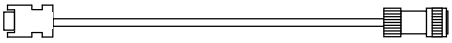
<Cable connection diagram (for 15m to 30m)>

8.4 CNV2E-8P/CNV2E-9P Cable

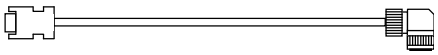
Max. cable length: 30m

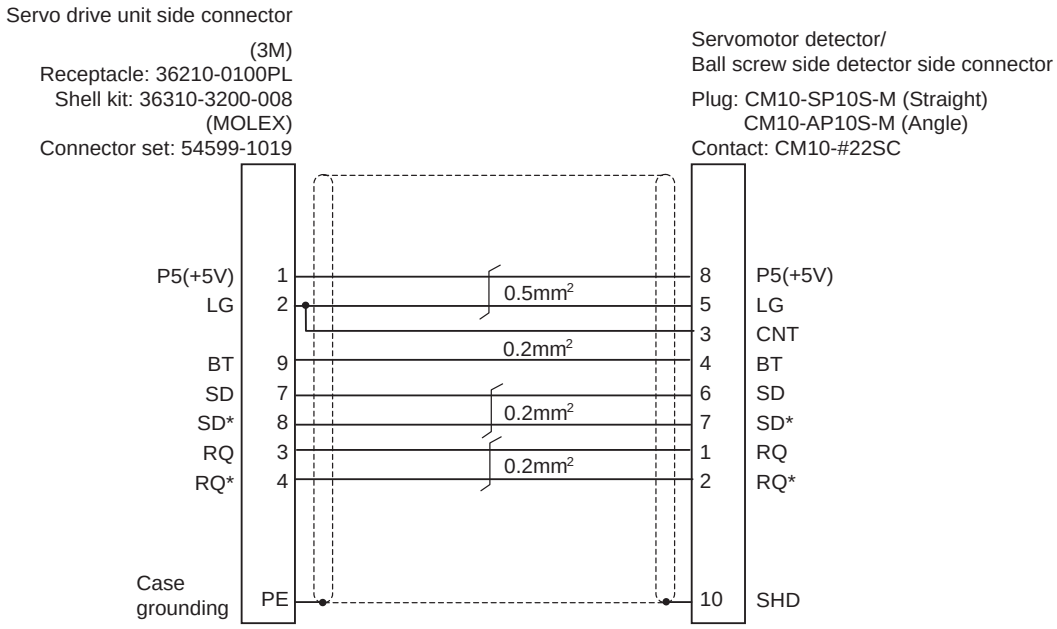
Application: Motor side detector cable (for A48/ Ball screw side detector cable

CNV2E-8P-*M (Straight)

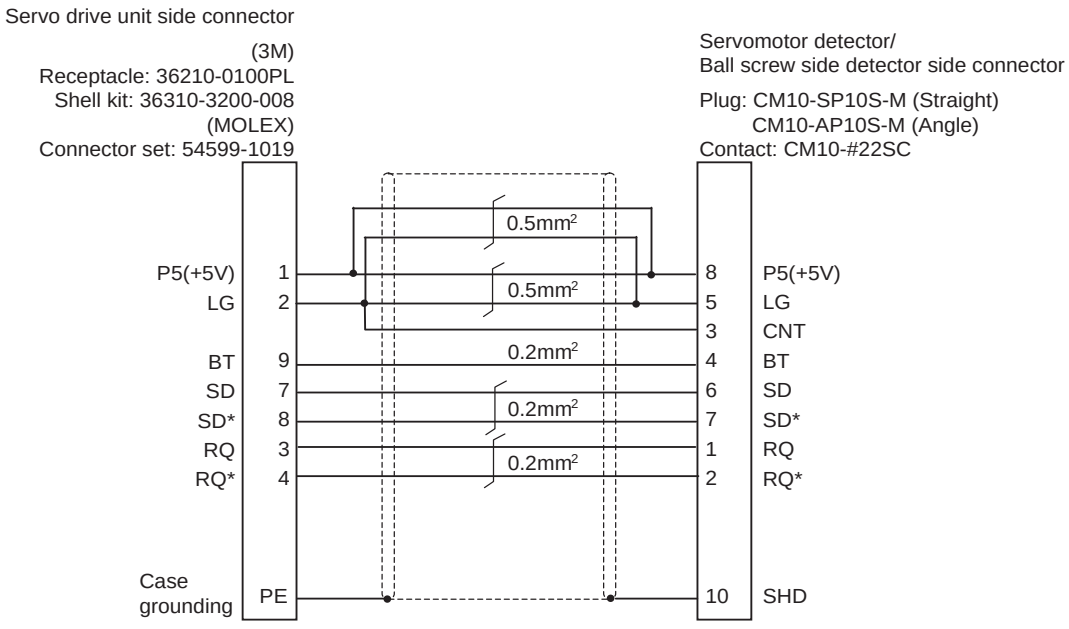


CNV2E-9P-*M (Angle)





<Cable connection diagram (for 15m or less)>

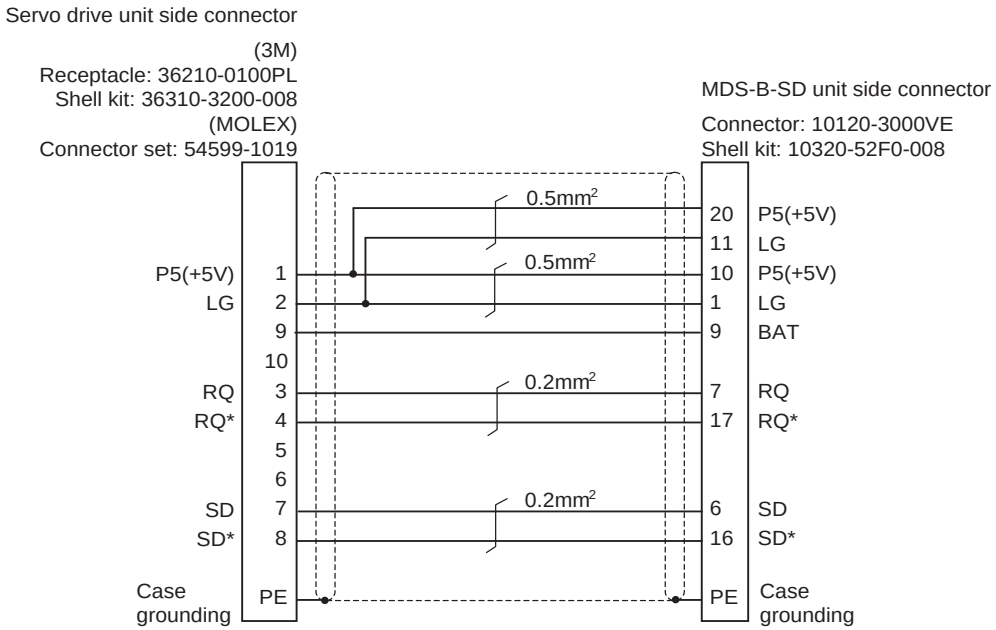


<Cable connection diagram (for 15m to 30m)>

8.5 CNV2E-D Cable

Max. cable length: 30m

Application: MDS-B-SD unit cable

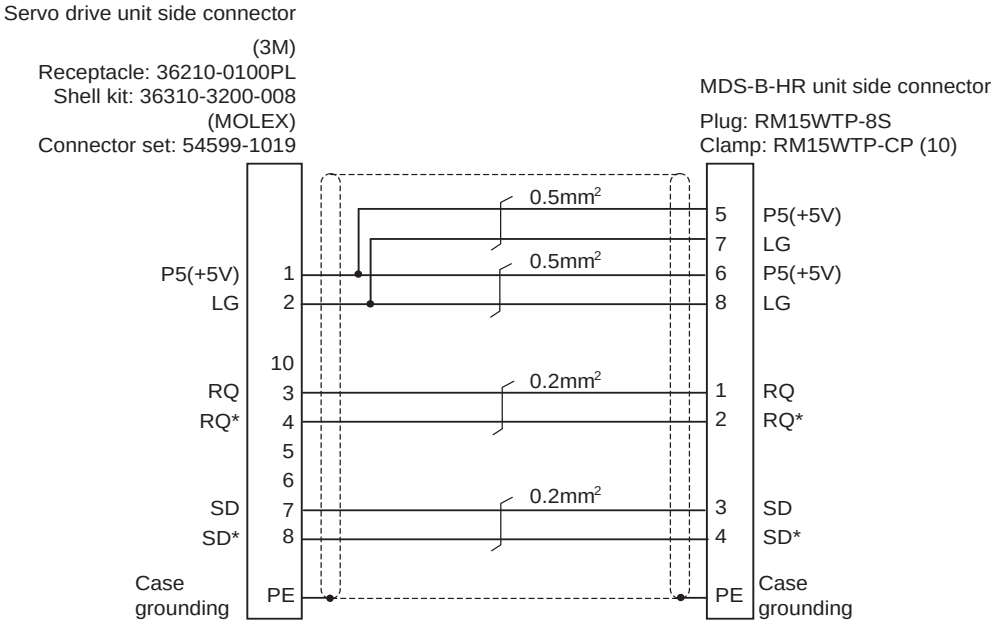


<Cable connection diagram>

8.6 CNV2E-HP Cable

Max. cable length: 30m

Application: MDS-B-HR unit cable

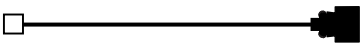


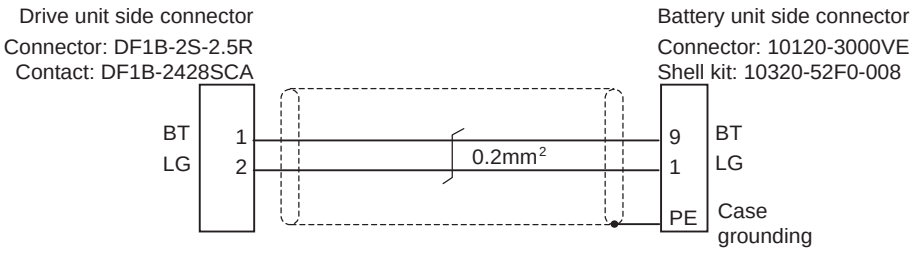
<Cable connection diagram>

8.7 DG21 Cable

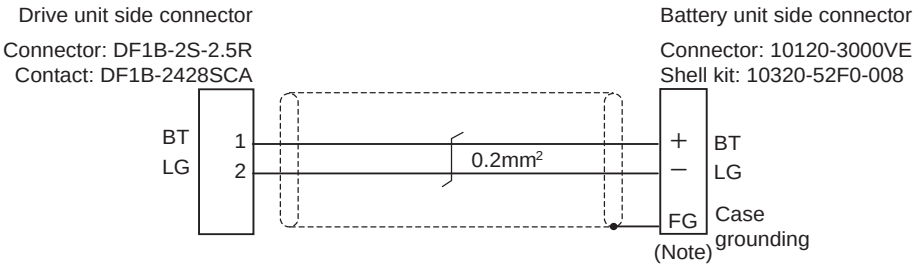
Max. cable length: 5m

Application: Battery cable (For drive unit - battery unit)





<Cable connection diagram between drive unit and MDS-A-BT/ A6BAT(MR-BAT)(MDS-BTCASE)>



(Note) Connect the cable shield with installation screw of unit.

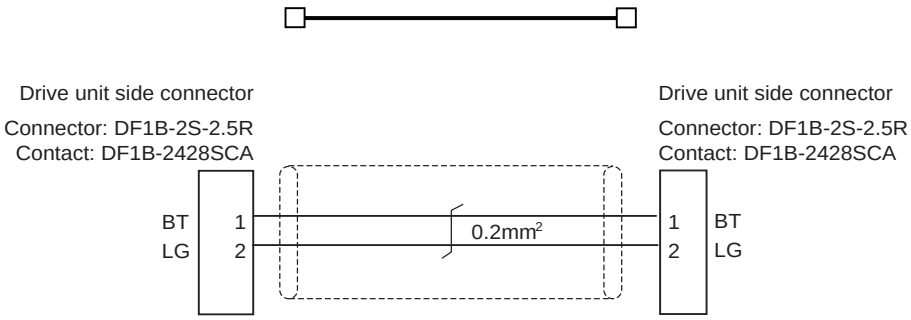
<Cable connection diagram between drive unit and FCU6-BTBOX-36>

8.8 DG22 Cable

Max. cable length: 5m

Application: Battery cable (For servo drive unit - servo drive unit)

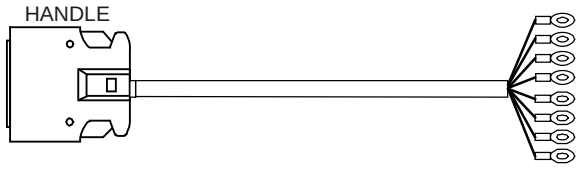
* This cable is required to supply the power from the battery unit to multiple drive units.

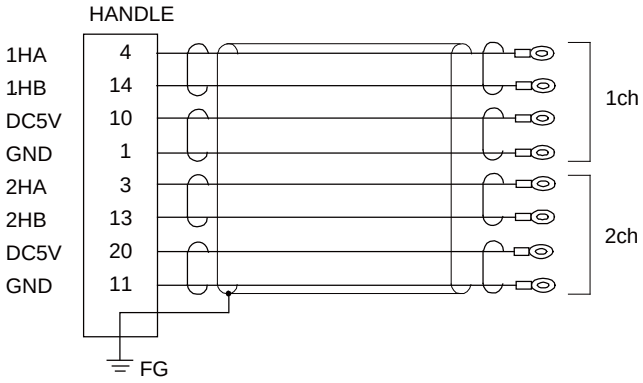


<Cable connection diagram between drive unit and drive unit>

8.9 F023/F024 Cable

Max. cable length: 20m
Application: Manual Pulse Generator (5VDC spec)





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

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

[1ch][2ch]
Crimp terminal: V1.25-3
Recommended manufacturer: JST

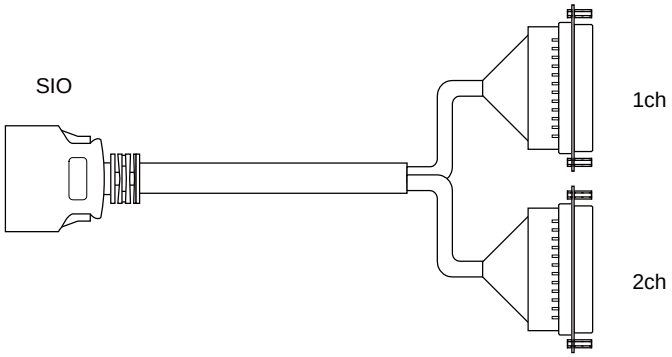
Cable name	1ch	2ch
F023 cable	○	
F024 cable	○	○
○: Usable channel		

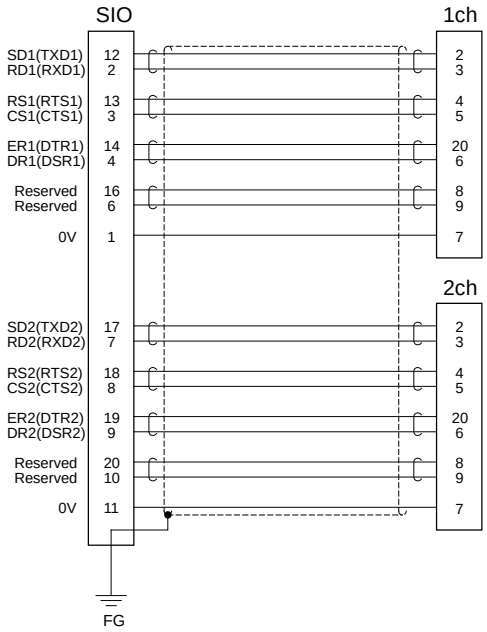
(Note) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.

8.10 F034/F035 Cable

Max. cable length: 15m (the maximum length of the cable when connected to the control unit via other units)

Application: RS-232C for control unit





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

Wire material: UL1061-2464
AWG24×12P
Recommended manufacturer: Oki Electric Cable

[1ch][2ch]
Connector: CDB-25S
Contact: CD-SC-111×9
Lock nut: HD-LNA×2
Recommended manufacturer: Hirose Electric

Cable name	1ch	2ch
F034 cable	○	
F035 cable	○	○
○: Usable channel		

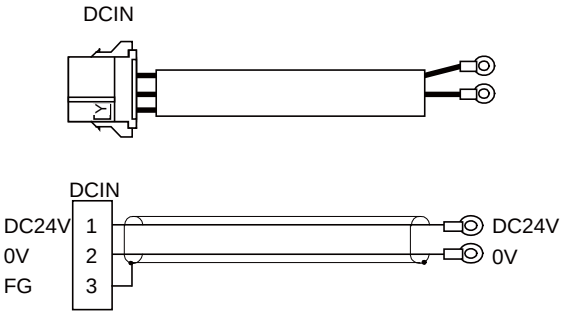
(Note 1) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.

(Note 2) Signal names in parentheses "( )" are generally used.

(Note 3) Connect to the serial communication connector of the control unit. Use G031/G032 cable when connecting to the serial communication connector of the display unit.

8.11 F070 Cable

Max. cable length: 30m
Application: 24VDC input



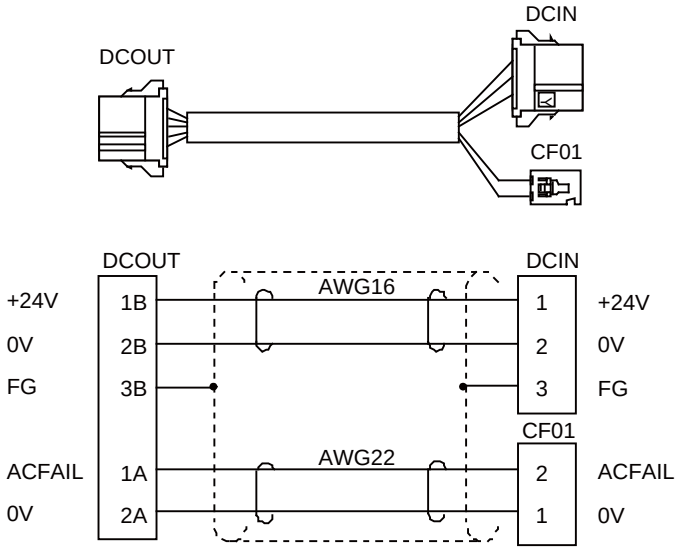
[DCIN]
Connector: 2-178288-3
Contact: 1-175218-5 ×3
Recommended manufacturer: Tyco Electronics AMP

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

Crimp terminal: V1.25-3 or V1.25-4×2
Recommended manufacturer: JST

8.12 F110 Cable

Max. cable length: 15m
Application: 24VDC input, power OFF detection



[DCOUT]
Connector: 3-178127-6
Contact:
1-175218-5 (for AWG16) ×3,
1-175217-5 (for AWG22) ×2
Recommended manufacturer:
Tyco Electronics AMP

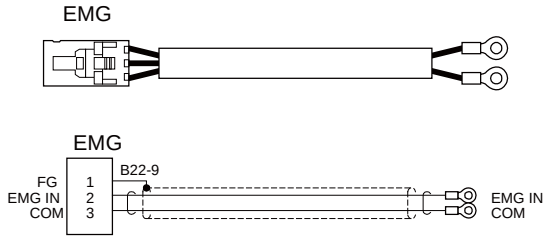
Wire material:
UL2464 2×22AWG+2×16AWG SS-95138
Recommended manufacturer: DDK

[DCIN]
Connector: 2-178288-3
Contact: 1-175218-5 ×3
Recommended manufacturer:
Tyco Electronics AMP
[CF01]
Connector: 51030-0230
Contact: 50084-8160 ×2
Recommended manufacturer:
MOLEX

8.13 F120 Cable

Max. cable length: 30m

Application: Emergency stop



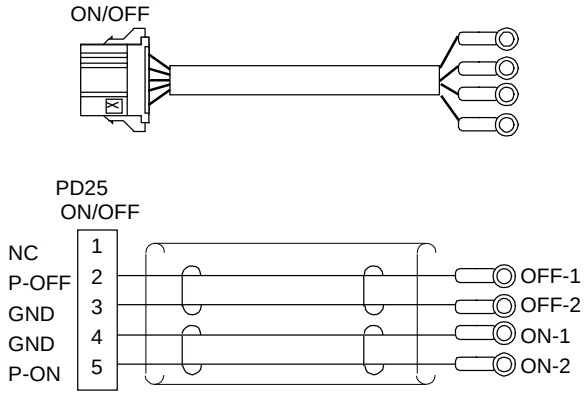
[EMG]
Connector: 51030-0330
Contact: 50084-8160 ×3
Recommended manufacturer: MOLEX

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

Crimp terminal: V1.25-3 ×2
Recommended manufacturer: JST

8.14 F170 Cable

Max. cable length: 15m
Application: ON/OFF switch for PD25



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

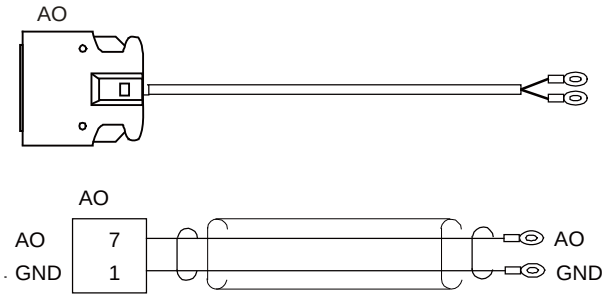
Wire material: DPVVSB 3P×0.3mm^2
Recommended manufacturer:
Bando Electric Wire

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

(Note) Select the crimp terminal suitable for the terminal block and switch you use.

8.15 F221 Cable

Max. cable length: 30m
Application: Analog output



[AO]
Connector: 10120-3000VE
Contact: 10320-52F0-008
Recommended manufacturer: 3M

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

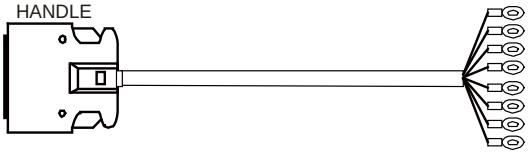
Crimp terminal: V1.25-3
Recommended manufacturer: JST

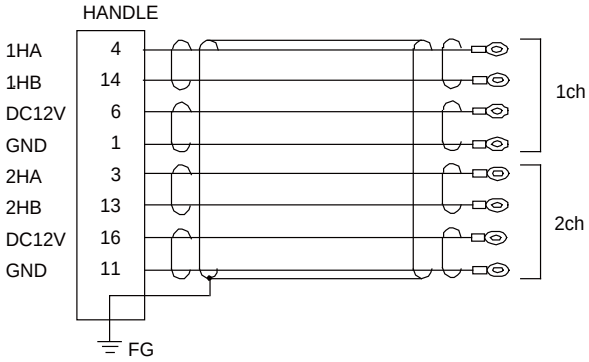
(Note 1) Follow the instruction of the machine side in connecting the shield. Do not connect on the base I/O unit side.
(Note 2) Select the crimp terminal suitable for the terminal block you use.

8.16 F320/F321 Cable

Max. cable length: 50m

Application: Manual Pulse Generator (12VDC spec)





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

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

[1ch][2ch]
Crimp terminal: V1.25-3
Recommended manufacturer: JST

Cable name	1ch	2ch
F320 Cable	○	
F321 Cable	○	○
○: Usable channel		

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

8.17 F351 Cable

Max. cable length: 50m
Application: DI/DO

CG31,CG32,CG33,CG34,CG35,CG36

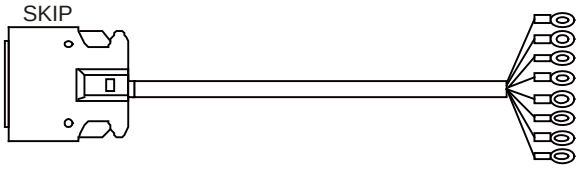
[CG31, CG32, CG33, CG34, CG35, CG36]
Connector: 7940-6500SC
Strain relief: 3448-7940
Recommended manufacturer: 3M

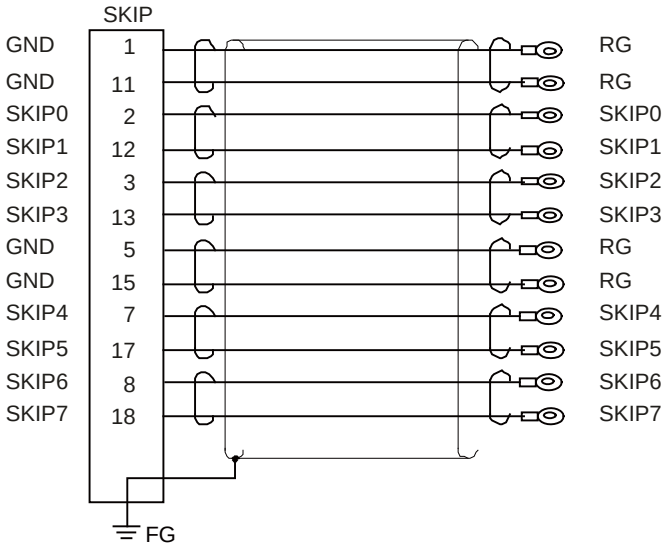
Wire material: B40-S
Recommended manufacturer:
Oki Electric Cable

(Note) This cable is used to connect the operation panel I/O unit. Select FCUA-R300, which doesn't have strain relief, when connecting to remote I/O unit.

8.18 FCUA-R030 Cable

Max. cable length: 20m
Application: SKIP input





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

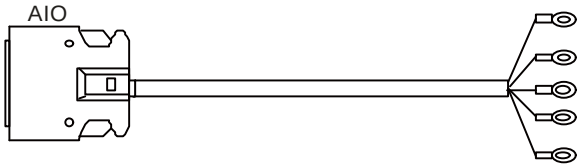
Wire material: UL1061-2464
AWG22×6P
Recommended manufacturer:
Oki Electric Cable

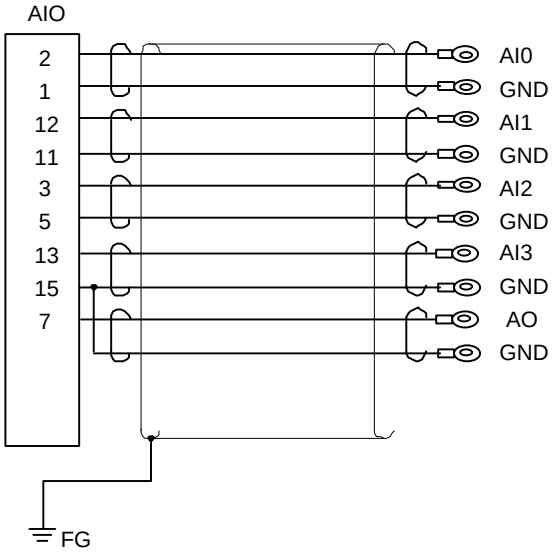
Crimp terminal: V1.25-4 ×12
Recommended manufacturer: JST

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

8.19 FCUA-R031 Cable

Max. cable length: 30m
Application: Analog signal input/output





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

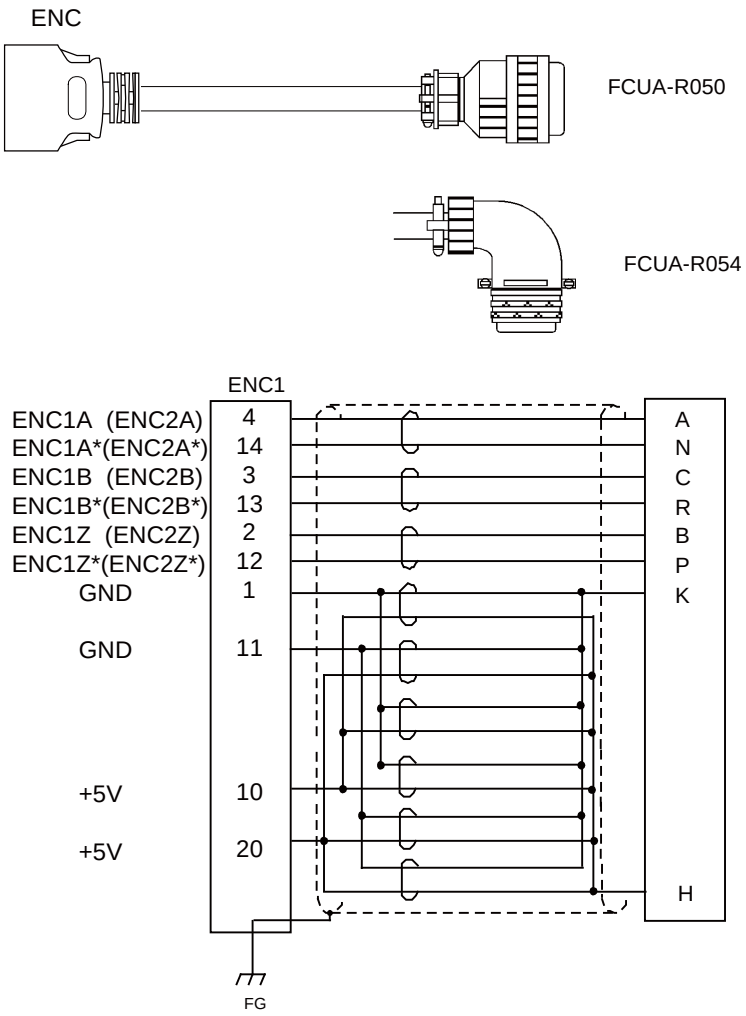
Wire material: UL1061-2464
AWG22×6P
Recommended manufacturer:
Oki Electric Cable

Crimp terminal: V1.25-4 ×12
Recommended manufacturer: JST

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

8.20 FCUA-R050/R054 Cable

Max. cable length: 30m
Application: Encoder input



[ENC1]
Plug: 10120-3000VL
Shell: 10320-52F0-008
Recommended manufacturer: 3M

Wire material: UL1061-2464
AWG24×12P
Recommended manufacturer:
Oki Electric Cable

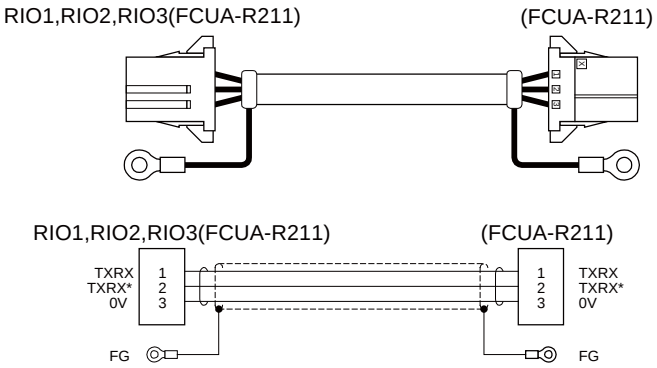
[FCUA-R050 cable]
Connector: MS3106B20-29S
Cable clamp: MS3057-12A
Recommended manufacturer:
ITT Cannon
[FCUA-R054 cable]
Connector: MS3108B20-29S
Cable clamp: MS3057-12A
Recommended manufacturer:
ITT Cannon

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

8.21 FCUA-R211 Cable

Max. cable length: 30m (the maximum length of the cable when connected to the control unit via other units)

Application: Remote I/O



[RIO1, RIO2, RIO3]
Connector: 1-178288-3
Contact: 1-175218-2 ×3
Recommended manufacturer:
Tyco Electronics AMP

Wire material:
MVVS 3C×0.5mm^2 (MIC 3C×0.5mm^2)
Recommended manufacturer: Takeuchi Densen

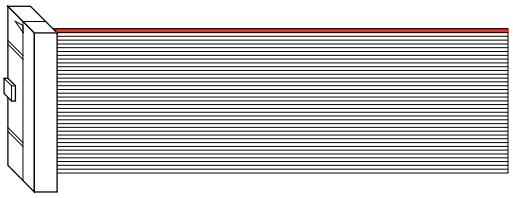
Connector: 1-178288-3
Contact: 1-175218-2 ×3
Recommended manufacturer:
Tyco Electronics AMP

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

8.22 FCUA-R300/FCUA-R301 Cable

Type: FCUA-R300
Max. cable length: 50m
Application: DI/DO cable (one side connector)

DI-L/DO-L, DI-R/DO-R

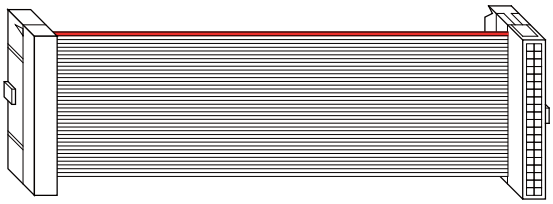


[DI-L/DO-L,DI-R/DO-R]
Connector: 7940-6500SC
Recommended manufacturer: 3M

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

Type: FCUA-R301
Max. cable length: 50m
Application: DI/DO cable (both side connectors)

DI-L/DO-L, DI-R/DO-R

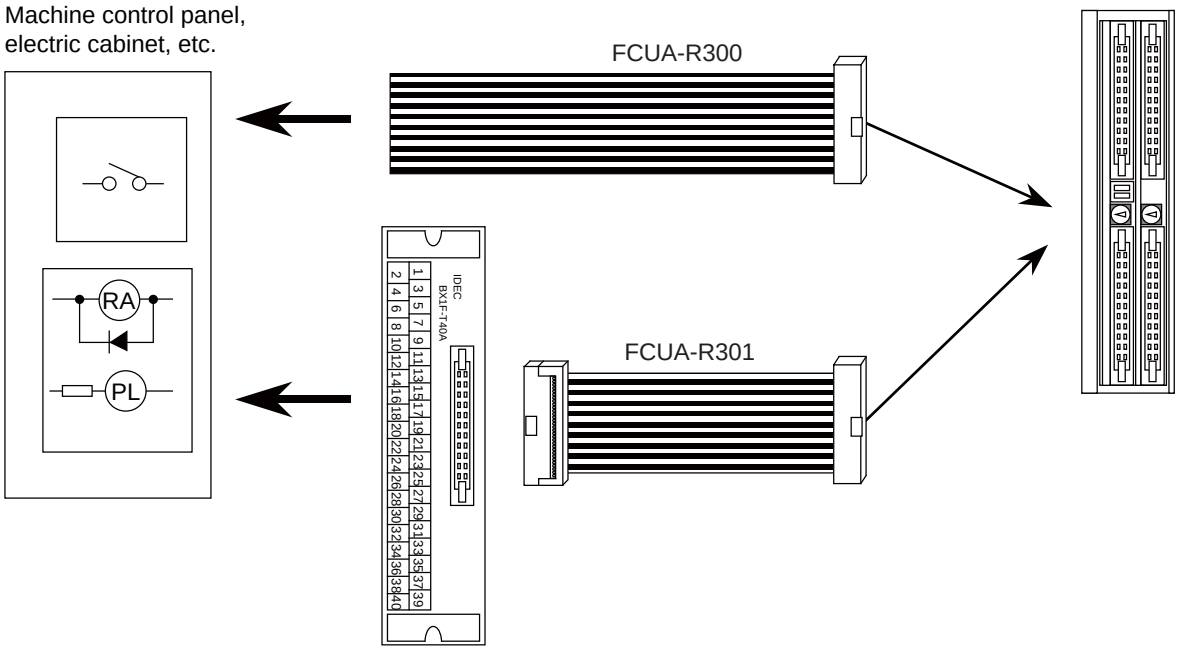


[DI-L/DO-L,DI-R/DO-R]
Connector: 7940-6500SC
Recommended manufacturer: 3M

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

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

There are two types of cable for the remote I/O unit: FCUA-R300 and FCUA-R301.
The FCUA-R300 cable has one end cut off, and the FCUA-R301 cable is used for connection to the IDEC terminal block BX1F-T40A (Note 1). If a cable longer than 3m is required, use the connector set FCUA-CN300 or FCUA-CS301.
The one-end FCUA-CN300 connector (optional, with one end) includes the DI-L (DI-R) and DO-L (DO-R) connectors. The FCUA-CS301 connector (optional, with both ends) includes the DI-L (DI-R) and DO-L (DO-R) connectors, and two connectors for connection with the terminal block (IDEC).
(Note 1) IDEC I/O terminal BX1F-T40A

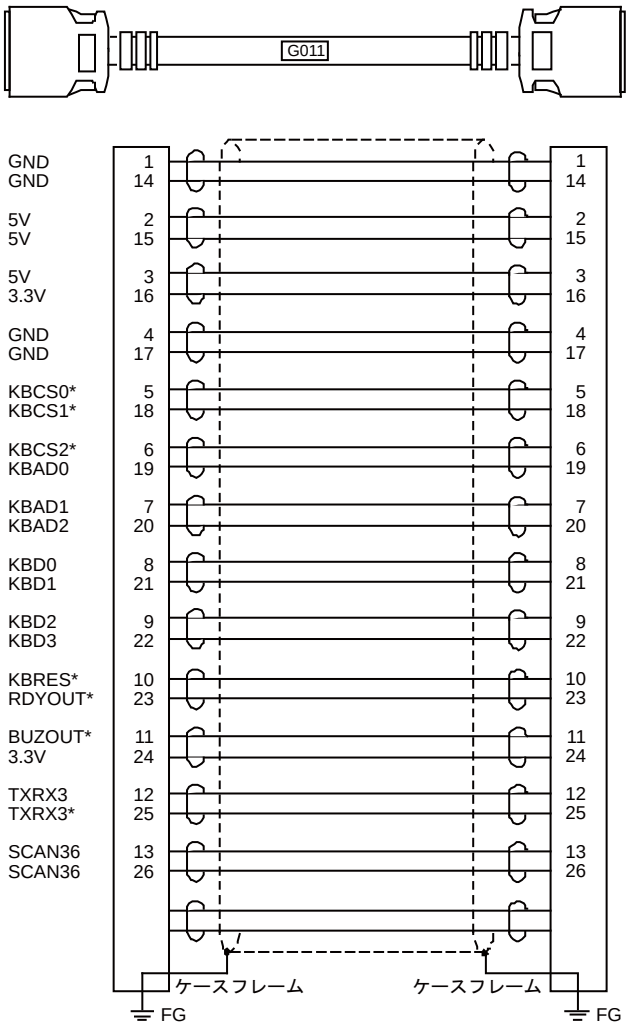


Connector pin correspondence			
Terminal block BX1F	**FCUA-DX1****	**Terminal block BX1F**	**FCUA-DX1****
1	A1	2	B1
3	A2	4	B2
5	A3	6	B3
7	A4	8	B4
9	A5	10	B5
11	A6	12	B6
13	A7	14	B7
15	A8	16	B8
17	A9	18	B9
19	A10	20	B10
21	A11	22	B11
23	A12	24	B12
25	A13	26	B13
27	A14	28	B14
29	A15	30	B15
31	A16	32	B16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

8.23 G011 Cable

Max. cable length: 0.5m

Application: Connection between NC unit and operation panel I/O unit



[CG71]
Connector: 10126-3000VE
Case: 10326-52F0-008
Recommended manufacturer: 3M

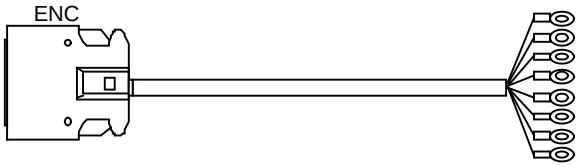
Wire material: UL20276 AWG28×13P
Recommended manufacturer:
Toyokuni Electric Cable

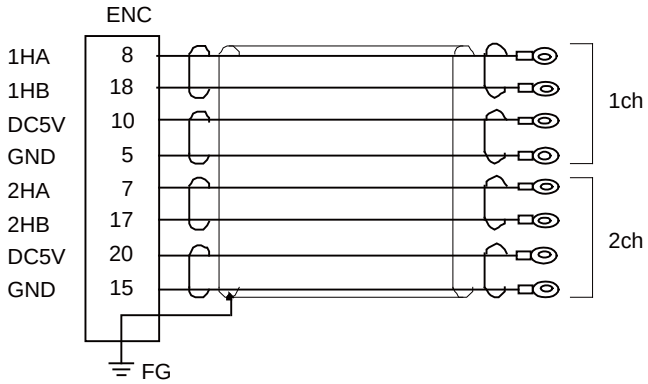
(Note) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.

8.24 G023/G024 Cable

Max. cable length: 20m (the maximum length of the cable when connected to the control unit via other units)

Application: Manual Pulse Generator (5VDC spec)





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

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

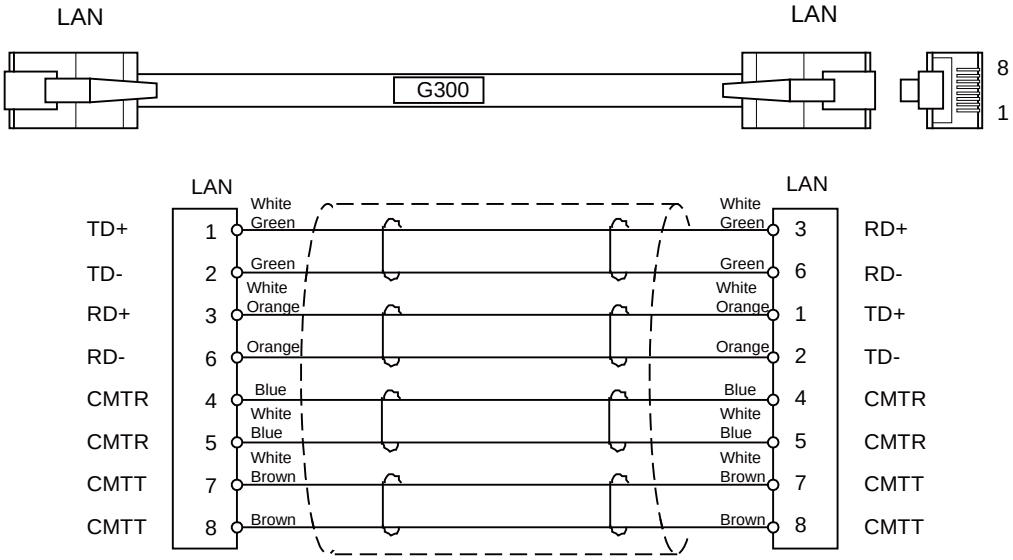
[1ch][2ch]
Crimp terminal: V1.25-3 ×8
Recommended manufacturer: JST

Cable name	1ch	2ch
G023 cable	○	
G024 cable	○	○
○: Usable channel		

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

8.25 G300 Cable

Max. cable length: 10m
Application: LAN cross cable

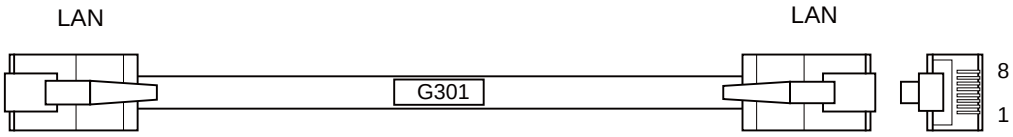


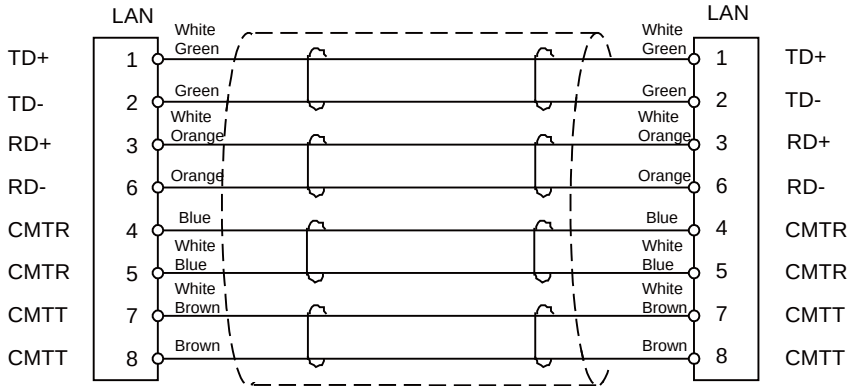
[LAN]
Connector: 5-558530
Recommended manufacturer:
Tyco Electronics AMP

Wire material: LAN category 5 twisted pair x 4P

8.26 G301 Cable

Max. cable length: 1m
Application: LAN straight cable





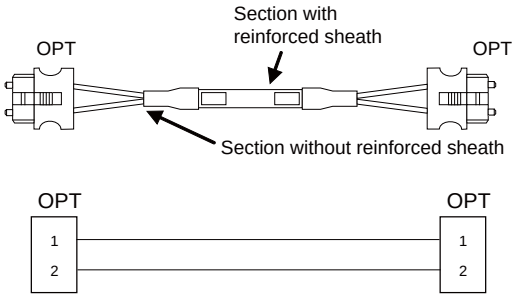
[LAN]
Connector: 5-558530
Recommended manufacturer:
Tyco Electronics AMP

Wire material: LAN category 5 twisted pair x 4P

8.27 G380 Cable

Max. cable length: 20m

Application: Optical communication cable PCF type (Core: Glass) Use when the cable length is 10m or more to 20m or less.



[OPT]
Connector: CF-2D101-S
Recommended manufacturer:
Japan Aviation Electronics

Wire material:
Hard clad type PCF optic cable
Recommended manufacturer:
Oki Electric Cable

Cable	Minimum bending radius: R
2-core cable (section with reinforced sheath)	50mm
2-core cable (section without reinforced sheath)	25mm

(Note 1) Binding the cables too tight with tie-wraps 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.

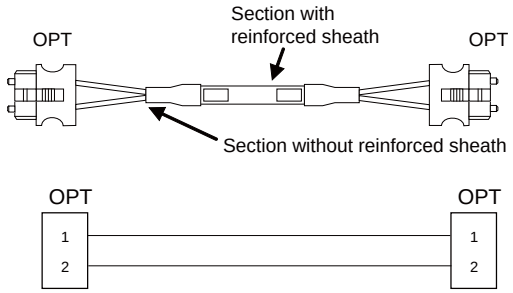
(Note 2) Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the PCF cable reinforced sheath to damage.

(Note 3) Loop the excessive cable with twice or more than the minimum bending radius.

8.28 G395 Cable

Max. cable length: 10m

Application: Optical communication cable PCF type (Core: Plastic) Use when wiring outside of the panel with a cable of 10m or less.



[OPT]
Connector: PF-2D103
Recommended manufacturer:
Japan Aviation Electronics

Wire material: ESCA Premium
Recommended manufacturer:
MITSUBISHI RAYON

Cable	Minimum bending radius: R
2-core cable (section with reinforced sheath)	50mm
2-core cable (section without reinforced sheath)	30mm

(Note 1) Binding the cables too tight with tie-wraps 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.

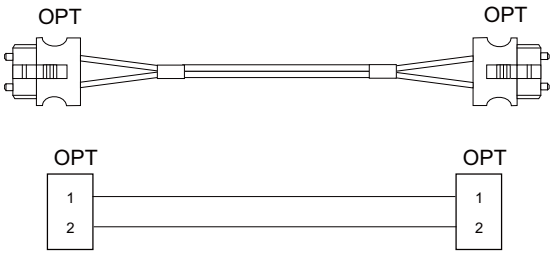
(Note 2) Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the POF cable to break.

(Note 3) Loop the excessive cable with twice or more than the minimum bending radius.

8.29 G396 Cable

Max. cable length: 10m

Application: Optical communication cable PCF type (Core: Plastic) Use when wiring in the panel with a cable of 10m or less.



[OPT]
Connector: PF-2D103
Recommended manufacturer:
Japan Aviation Electronics

Wire material: ESCA Premium
Recommended manufacturer:
MITSUBISHI RAYON

Cable	Minimum bending radius: R
2-core parallel cord	30mm

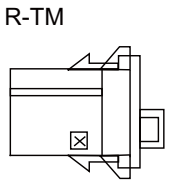
(Note 1) Binding the cables too tight with tie-wraps could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move. Recommended clamp material: CKN-13SP KITAGAWA INDUSTRIES.

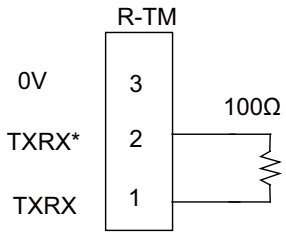
(Note 2) Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the POF cable to break.

(Note 3) Loop the excessive cable with twice or more than the minimum bending radius.

8.30 R-TM Terminator Connector

Application: Remote I/O interface terminal





[R-TM]
Connector: 1-178288-3 (Xtype)
Contact: 1-175216-2 ×2
Recommended manufacturer: Tyco Electronics AMP
Resistor: 100Ω 1/4W

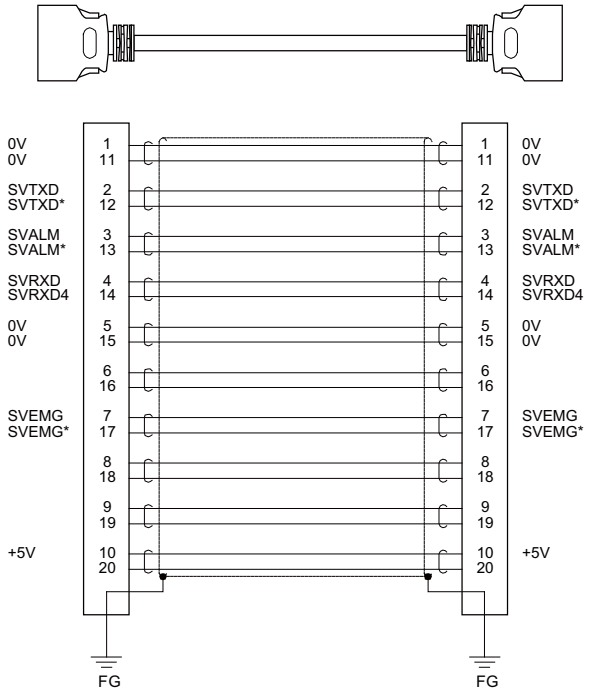
(Note 1) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
(Note 2) Cover the 100Ω terminator with a black insulation tube.
(Note 3) Stamp the connector name "R-TM" in white on the rear of the connector.

8.31 SH21 Cable

Max. cable length: 30m

Application: Power supply communication cable

SV1, SV2



[SV1, SV2]
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M

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

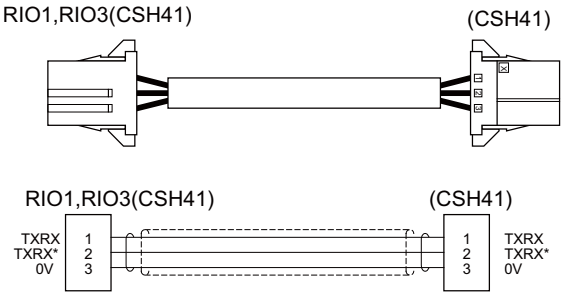
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M

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

8.32 SH41 Cable

Max. cable length: 1m (the maximum length of the cable when connected to the control unit via other units)

Application: Remote I/O



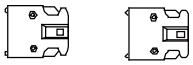
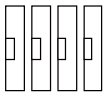
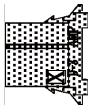
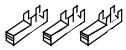
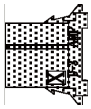
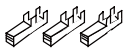
[RIO1, RIO2, RIO3]
Connector: 1-178288-3
Contact: 1-175218-2 ×3
Recommended manufacturer:
Tyco Electronics AMP

Wire material:
MVVS 3C×0.5mm^2 (MIC 3C×0.5mm^2)
Recommended manufacturer: Takeuchi Densen

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

(Note 1) Protect both ends of the cable with insulated bushing.
(Note 2) RIO1 and RIO3 can be used commonly.
(Note 3) Use this cable for short applications, such as bridging the remote I/O units in the same panel. Normally use the FCUA-R211 cable with high noise withstand level.

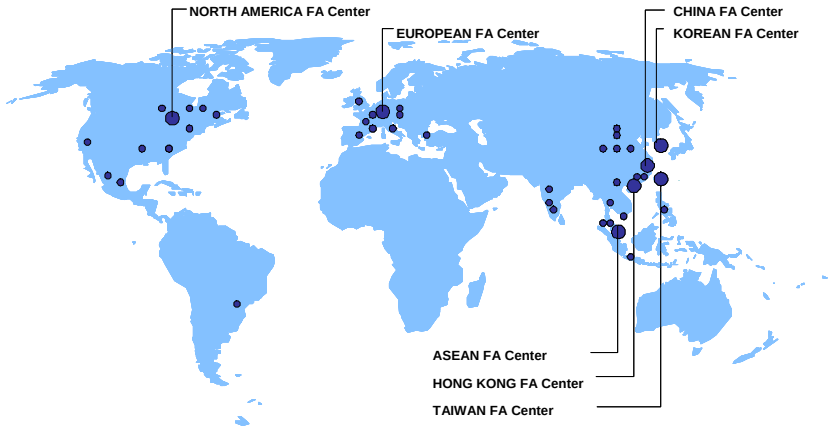
8.33 List of Cable Connector Sets

Type	Application	Package contents	
FCUA-CS000	Control unit - General I/O units Control unit - SVJ	Connector (3M) 10120-3000VE x 2pcs 	Connector case (3M) 10320-52F0-008 x 2pcs. 
FCUA-CS301	Remote I/O unit - terminal block	Connector (3M) 7940-6500SC x 4pcs. 	Strain relief (3M) 3448-7940 x 2pcs. 
FCUA-CN211	Remote I/O communication connector	Connector (Tyco Electronics AMP) 1-178288-3 x 1pc. 	Gold contact (Tyco Electronics AMP) 1-175218-2 x 3pcs. 
FCUA-CN220	24VDC power supply connector	Connector (Tyco Electronics AMP) 2-178288-3 x 1pc. 	Tin contact (Tyco Electronics AMP) 1-175218-5 x 3pcs. 
FCUA-CN300	DIO connector	Connector (3M) 7940-6500SC x 2pcs. 	

Revision History

Date of revision	Manual No.	Revision details
Sep. 2006	IB(NA)1500254-A	First edition created.
Mar. 2007	IB(NA)1500254-C	- Explanations of FCU7-DU140-32 and FCU7-KB026 were added. - Explanations of scan I/O were added. - Mistakes were corrected.
Sep. 2008	IB(NA)1500254-D	- Explanations of keyboard units FCU7-KB046 and FCU7-KB048 were added. - Explanations of CC-Link unit FCU7-HN746 were added. - The construction of chapters and sections was revised. - Mistakes were corrected.

Global service network



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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.

Duplication Prohibited

MITSUBISHI CNC

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE : TOKYO BUILDING,2-7-3 MARUNOUCHI,CHIYODA-KU,TOKYO 100-8310,JAPAN

MODEL	70 Series
MODEL CODE	008—490
Manual No.	IB-1500254 (ENG)

IB(NA)1500254(ENG)-D(0809)MEE