MITSUBISHI ELECTRIC

Changes for the Better

Numerical Control (CNC)

Connection and Setup Manual

M800VS/M80V Series

IB-1501613(ENG)-L

Introduction

This manual describes the items required for installing, connecting and setting up the Mitsubishi Electric CNC.
Read this manual thoroughly and understand the product's functions and performance before use.

Supported models of this manual are as follows:

Supported models	Abbreviations in this manual
M800VS Series	M850VS, M830VS
M80V Series	M80V TypeA, M80V TypeB

Abbreviations for model names used in this manual are as follows:

Abbreviations	Supported models
M800V, M800V Series	M800VS Series
M80V, M80V Series	M80V Series
M800V/M80V, M800V/M80V Series	M800VS Series/M80V Series
M8V, M8V Series	M800VS Series/M80V Series

To safely use this CNC unit, thoroughly study the "Precautions for Safety" before use.
Be sure to keep this manual always at hand.
Also refer to the manuals on "Manual List" as necessary.

■ Notes on reading this manual

(1) This manual is written on the assumption that all optional 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.

(2) This manual explains general parameters which are operated on the CNC side.
For information about each machine tool, refer to manuals issued from the machine tool builder.
If the descriptions relating to "restrictions" and "allowable conditions" conflict between this manual and the machine tool builder's instruction manual, the later has priority over the former.

(3) This manual is intended to contain as much descriptions as possible even about special operations.
The operations to which no reference is made in this manual should be considered "impossible".

(4) This manual is for the machine tool builders who set up the CNC system.

(5) Do not connect to the pin described as "NC" on the pin assignment table of the connector.

(6) The characteristic values and numerical values without tolerances mentioned in this manual are representative values.

■ Details described in this manual

- This book is configured as follows. Refer to the following chapters as necessary.
  - Installation and connection: Chapter 1 to 16
  - Setup: Chapter 17 to 37

- In this manual, the following abbreviations might be used.
  L system: Lathe system
  M system: Machining center system

- The numerical control unit is configured of the control unit, display unit, operation board (operation panel I/O unit), servo drive unit, spindle drive unit, power supply unit with driver, servomotor, spindle motor, etc.

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

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

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

Manual List

Manuals related to M800V/M80V Series are listed as follows.
These manuals are written on the assumption that all optional functions are added to the targeted model.
Some functions or screens may not be available depending on the machine or specifications set by MTB. (Confirm the specifications before use.)
The manuals issued by MTB take precedence over these manuals.

Manual	IB No.	Purpose and Contents
M800V/M80V Series Instruction Manual (1/2)	IB-1501806	♦ Explanation for display unit and screen operation ♦ Settings before machining, setup, etc.
M800V/M80V Series Instruction Manual (2/2)	IB-1501807	♦ Explanation for settings at machining, operation status, etc. ♦ Explanation for other functions
M800V/M80V Series Programming Manual (Lathe System) (1/2)	IB-1501619	♦ G code programming for lathe system ♦ Basic functions, etc.
M800V/M80V Series Programming Manual (Lathe System) (2/2)	IB-1501620	♦ G code programming for lathe system ♦ Functions for multi-part system, high-accuracy function, etc.
M800V/M80V Series Programming Manual (Machining Center System) (1/2)	IB-1501621	♦ G code programming for machining center system ♦ Basic functions, etc.
M800V/M80V Series Programming Manual (Machining Center System) (2/2)	IB-1501622	♦ G code programming for machining center system ♦ Functions for multi-part system, high-accuracy function, etc.
M800V/M80V Series Alarm Manual	IB-1501808	♦ Alarms
M800V/M80V Series Parameter Manual	IB-1501809	♦ Parameters

Manuals for MTBs (NC)

Manual	IB No.	Purpose and Contents
M800V/M80V Series Specifications Manual (Function)	IB-1501610	• Model selection • Outline of various functions
M800V/M80V Series Specifications Manual (Hardware)	IB-1501611	• Model selection • Specifications of hardware unit
M800VW/M80VW Series Connection and Setup Manual	IB-1501612	• Detailed specifications of hardware unit • Installation, connection, wiring, setup (startup/adjustment)
M800VS/M80V Series Connection and Setup Manual	IB-1501613	• Detailed specifications of hardware unit • Installation, connection, wiring, setup (startup/adjustment)
M800V/M80V Series PLC Development Manual	IB-1501614	• Electrical design • I/O relation (assignment, setting, connection), field network • Development environment (PLC on-board, peripheral development environment), etc.
M800V/M80V Series PLC Programming Manual (1/2)	IB-1501667	• Electrical design • Sequence programming • Explanation for instructions, functions, and parameters
M800V/M80V Series PLC Programming Manual (2/2)	IB-1501668	• Electrical design • Sequence programming • Usage examples of instructions
M800V/M80V Series PLC Interface Manual (1/2)	IB-1501804	• Electrical design • List of interface signals between NC and PLC
M800V/M80V Series PLC Interface Manual (2/2)	IB-1501805	• Electrical design • Details of interface signals between NC and PLC
M800V/M80V Series Maintenance Manual	IB-1501617	• Cleaning and replacement for each unit • Other items related to maintenance
NC Designer2 Instruction Manual	IB-1501250	• Explanation for handling NC NC Designer2
High Speed Processing Unit User's Manual	IB-1501714	• Specifications for high speed processing unit (HPU)
NC Machining AI Diagnosis NC MachiningAID Instruction Manual	IB-1501762	• Explanation for handling NC MachiningAID

Manuals for MTBs (drive section)

Manual	IB No.	Contents
MDS-E/EH Series Specifications Manual	IB-1501226	• Specifications for power supply regeneration type
MDS-E/EH Series Instruction Manual	IB-1501229	• Instruction for power supply regeneration type
MDS-EJ/EJH Series Specifications Manual	IB-1501232	• Specifications for regenerative resistor type
MDS-EJ/EJH Series Instruction Manual	IB-1501235	• Instruction for regenerative resistor type
MDS-EM/EMH Series Specifications Manual	IB-1501238	• Specifications for multi-hybrid, power supply regeneration type
MDS-EM/EMH Series Instruction Manual	IB-1501241	• Instruction for multi-hybrid, power supply regeneration type
DATA BOOK	IB-1501252	• Specifications of servo drive unit, spindle drive unit, motor, etc.
MDS-EX-CVP Series Specifications and Instruction Manual	IB-1501587	• Specifications and instruction for the power supply unit with large capacity

Manuals for MTBs (Others)

Manual	No.	Purpose and Contents
GOT2000 Series User's Manual (Hardware)	SH-081194ENG	• Outline of hardware such as part names, external dimensions, installation, wiring, maintenance, etc. of GOTs
GOT2000 Series User's Manual (Utility)	SH-081195ENG	• Outline of utilities such as screen display setting, operation method, etc. of GOTs
GOT2000 Series User's Manual (Monitor)	SH-081196ENG	• Outline of each monitor function of GOTs
GOT2000 Series Connection Manual (Mitsubishi Electric Products)	SH-081197ENG	• Outline of connection types and connection method between GOT and Mitsubishi Electric connection devices
GOT2000 Series Connection Manual (Non-Mitsubishi Electric Products 1)	SH-081198ENG	• Explanation for connection types and connection method between GOT and other company's devices
GOT2000 Series Connection Manual (Non-Mitsubishi Electric Products 2)	SH-081199ENG	
GOT2000 Series Connection Manual (Microcomputers, MODBUS/Fieldbus Products, Peripherals)	SH-081200ENG	• Explanation for connection types and connection method between GOT and microcomputers, MODBUS/fieldbus products, peripherals
GT SoftGOT2000 Version1 Operating Manual	SH-081201ENG	• Explanation for system configuration, screen configuration and operation method of monitoring software GT SoftGOT2000
GT Designer3 (GOT2000) Screen Design Manual	SH-081220ENG	• Outline of screen design method using screen creation software GT Designer3
GOT2000/GOT1000 Series CC-Link Communication Unit User's Manual	IB-0800351	• Explanation for handling CC-Link communication unit (for GOT2000 series/GOT1000 series)
GX Developer Version 8 Operating Manual (Startup)	SH-080372E	• Explanation for system configuration, installation, etc. of PLC development tool GX Developer
GX Developer Version 8 Operating Manual	SH-080373E	• Explanation for operations using PLC development tool GX Developer
GX Converter Version 1 Operating Manual	IB-0800004	• Explanation for operations using data conversion tool GX Converter
GX Works2 Installation Instructions	BCN-P5999-0944	• Explanation for the operating environment and installation method of GX Works2
GX Works2 Version 1 Operating Manual (Common)	SH-080779ENG	• Explanation for the system configuration of GX Works2 and the functions common to Simple project and Structured project such as parameter setting, operation method for the online function
GX Works2 Version 1 Operating Manual (Simple Project)	SH-080780ENG	• Explanation for methods for such as creating and monitoring programs in Simple project of GX Works2
GX Works2 Version 1 Operating Manual (Simple Project, Function Block)	SH-080984ENG	• Explanation for methods for such as creating function blocks, pasting function blocks to sequence programs, and operating FB library in Simple project of GX Works2
GX Works2 Version 1 Operating Manual (Structured Project)	SH-080781ENG	• Explanation for methods for such as creating and monitoring programs in Structured project of GX Works2
GX Works3 Installation Instructions	BCN-P5999-0391	• Explanation for the operating environment and installation method of GX Works3
MELSEC-Q/L/F Structured Programming Manual (Fundamentals)	SH-080782ENG	• Explanation for programming methods, types of programming languages, etc. required to create structured programs
MELSEC-Q/L Structured Programming Manual (Application Functions)	SH-080784ENG	• Explanation for specifications and functions related to application functions which can be used in structured programs
MELSEC-Q CC-Link System Master/ Local Module User's Manual	SH-080394E	• Explanation for system configuration, installation, wiring, etc. of master/local modules for CC-Link system
MELSEC iQ-R Programming Manual (CPU Module Instructions, Standard Functions/Function Blocks)	SH-081266ENG	• Explanation for instructions, general-purpose functions, and general-purpose function blocks required for programming the sequencer MELSEC iQ-R series

Reference Manual for MTBs

Manual	No.	Purpose and Contents
M800/M80/M800V/M80V Series Smart safety observation Specification manual	BNP-C3072-022	• Explanation for smart safety observation function
M800V/M80V Series Interactive cycle insertion (Customization) Specification manual	BNP-C3095-121-0003	• Explanation for interactive cycle insertion (English translation pending)
M800V/M80V Series Synchronous Control Specifications manual	BNP-C3095-074	• Explanation for synchronous control (English translation pending)
M800V/M80V Series Multiple-Axis Synchronization Control Specifications manual	BNP-C3095-339	• Explanation for multiple-axis synchronization control
M800/M80 Series MELSEC development tool (GX Developer) Specifications manual	BNP-C3072-097	• Explanation for specifications related to CNC-specific usage method in the user PLC development environment using GX Developerl (English translation pending)
M800V/M80V Series EtherNet/IP Specifications manual	BNP-C3095-263	• Explanation for EtherNet/IP
M800/M80 Series FL-net Specifications manual	BNP-C3072-368	• Explanation for FL-net
M800/M80 Series CC-Link IE Field (Master/local) Specifications manual	BNP-C3072-283	• Explanation for CC-Link IE Field
M800V/M80V Series CC-Link IE TSN (Remote Station) Specifications manual	BNP-C3095-399	• Explanation for CC-Link IE TSN (Remote Station)
M800V/M80V Series Wireless LAN Specifications manual	BNP-C3095-425-01	• Explanation for wireless LAN

Precautions for Safety

Always read the specifications issued by the machine tool builder, this manual, related manuals and attached documents before installation, operation, programming, maintenance or inspection to ensure correct use. Understand this numerical controller, safety items and cautions before using the unit.
This manual ranks the safety precautions into "DANGER", "WARNING" and "CAUTION".

⚠ DANGER **When the user may be subject to fatalities or major 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 may be subject to medium or minor injuries or when only property damage may occur, if handling is mistaken.**

Note that even items ranked as " ⚠ CAUTION" may lead to serious consequences depending on the situation. All the items are important and must always be observed.

The following signs indicate prohibition and compulsory.

⃠	**This sign indicates prohibited behavior (must not do).** **For example,  indicates "Keep fire away".**
●	**This sign indicated a thing that is pompously (must do).** **For example,  indicates "it must be grounded".**

The meaning of each pictorial sign is as follows.

 **CAUTION**	 **CAUTION rotated object**	 **CAUTION HOT**	 **Danger Electric shock risk**	 **Danger explosive**
 **Prohibited**	 **Disassembly is prohibited**	 **KEEP FIRE AWAY**	 **General instruction**	 **Earth ground**

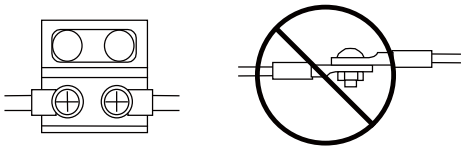
For Safe Use

Mitsubishi Electric CNC is designed and manufactured solely for applications to machine tools to be used for industrial purposes.
Do not use this product in any applications other than those specified above, especially those which are substantially influential on the public interest or which are expected to have significant influence on human lives or properties.

■ 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 caution could result in electric shocks.**
- **Earth ground the controller, drive unit and motor according to the local laws. (In Japan, ground the 200 V Series input products with class D grounding work and the 400 V Series input with class C grounding work.)**
- **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 for replacing parts and servicing.**
- **Wire the controller, drive unit and motor after installation. Failure to observe this caution 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.**



- **Completely turn off the all lines of the power supply externally before wiring. Not completely turning off all power could result in electric shock or damage to the product.**
- **When turning on the power supply or operating the module after wiring, be sure that the module's terminal covers are correctly attached. Not attaching the terminal cover could result in electric shock.**

■ 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.**

■ 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 and setup 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.

Do not reverse polarity (+ -). Failure to observe this could cause bursting, 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.

■ General precautions

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

[Items related to product and manual]

⚠ CAUTION

For items described as "Restrictions" or "Usable State" in this manual, the instruction manual issued by the machine tool builder takes precedence over this manual.

Items that are not described in this manual must be interpreted as "not possible".

This manual is written on the assumption that all the applicable functions are included. Some of them, however, may not be available for your NC system. Refer to the specifications issued by the machine tool builder before use.

For information about each machine tool, refer to manuals issued from the machine tool builder.

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 starting to use.

For details on the connection with safety observing I/O device, refer to "Smart safety observation Specification manual" (BNP-C3072-022).

For details on wireless LAN, refer to "Wireless LAN Specifications Manual" (BNP-C3095-425).

To protect the availability, integrity and confidentiality of the NC system against cyber-attacks including unauthorized access, denial-of-service (DoS) (*1) attack, and computer virus from external sources via a network, take security measures such as firewall, VPN, and anti-virus software.
(*1) Denial-of-service (DoS) refers to a type of cyber-attack that disrupts services by overloading the system or by exploiting a vulnerability of the system.

Mitsubishi Electric assumes no responsibility for any problems caused to the NC system by any type of cyber-attacks including DoS attack, unauthorized access and computer virus.

[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 encoder 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. 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 encoder from the motor. (The encoder installation screw is treated with sealing.)**

⚠ **Do not allow foreign matter to enter the controller, drive unit or motor. Take particular care to avoid allowing any conductive foreign matters such as screws or metal chips, or combustible foreign matters such as oil to enter. 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.**

⚠ CAUTION

⚠ **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.**

⚠ **The controller and drive unit are precision devices, so do not drop or apply strong impacts on them.**

⚠ **Store and use the units according to the environment conditions indicated in each specifications manual.**

⚠ **When disinfectants or insecticides must be used to treat wood packaging materials, always use methods other than fumigation (for example, apply heat treatment at the minimum wood core temperature of 56 °C for a minimum duration of 30 minutes (ISPM No. 15 (2009))).**

If products such as units are directly fumigated or packed with fumigated wooden materials, halogen substances (including fluorine, chlorine, bromine and iodine) contained in fumes may contribute to the erosion of the capacitors. When exporting the products, make sure to comply with the laws and regulations of each country.

⚠ **Do not use the products in conjunction with any components that contain halogenated flame retardants (bromine, etc). Failure to observe this may cause the erosion of the capacitors.**

⚠ **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 encoder 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 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).**

[Items related to wiring]

⚠ CAUTION

⚠ **Correctly wire this product. Failure to observe this could result in motor runaway, etc.**

⚠ **Connect the cables to the designated connectors. Incorrect connections could damage the device.**

⚠ **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.**

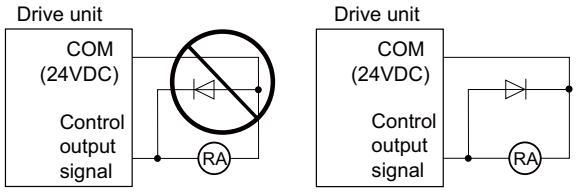
⚠ **Always install an appropriate breaker per each power supply unit. A breaker cannot be shared for multiple power supply units.**

⚠ **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 cables between units 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 them.**

⚠ **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.**

⚠ CAUTION

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

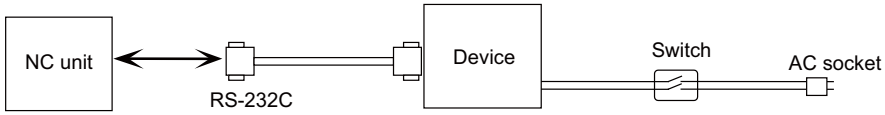
⚠ **Carry out wiring so that there is no possibility of short circuit between wires, nor of dangerous state.**

⚠ **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.**



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

⚠ **Output from 12 V/5 V/3.3 V connectors is for powering peripheral devices only. If used for powering other equipment, NC operation will not be guaranteed due to voltage drops or wraparound noise.**

When using an inductive load such as a relay, always connect a diode in parallel to the load to prevent a counter-electromotive force.

When the rush current exceeds the maximum output current, always connect a protective resistor serially to the load to suppress rush currents.

⚠ **The wires from the surge absorber should be connected without extensions.**

[Setup]

⚠ WARNING

Do not cancel the emergency stop before confirming the basic operation.

Always set the stroke end and stored stroke limit. Failure to set this could result in collision with the machine end.

⚠ 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.

The operations to which no reference is made in this manual should be considered "impossible".

This manual is written on the assumption that all the applicable functions are included. Some of them, however, may not be available for your NC system. Refer to the specifications issued by the machine tool builder before use.

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 starting to use.

If the battery low warning is issued, save the machining programs, tool data and parameters in an input/output device, and then replace the battery. When the battery alarm is issued, the machining programs, tool data and parameters may have been destroyed. Replace the battery and then reload the data.

Do not adjust the spindle when possible risks associated with adjustment procedures are not thoroughly taken into consideration.

Be careful when touching spindle's rotating section, or your hand may be caught in or cut.

[Operation and Adjustments]

⚠ CAUTION

If the operation start position is set in a block which is in the middle of the program and the program is started, the program before the set block is not executed. Please confirm that G and F modal and coordinate values are appropriate. If there are coordinate system shift commands or M, S, T and B commands before the block set as the start position, carry out the required commands using the MDI, etc. If the program is run from the set block without carrying out these operations, there is a danger of interference with the machine or of machine operation at an unexpected speed, which may result in breakage of tools or machine tool or may cause damage to the operators.

Under the constant surface speed control (during G96 modal), if the axis targeted for the constant surface speed control moves toward the spindle center, the spindle rotation speed will increase and may exceed the allowable speed of the workpiece or chuck, etc. In this case, the workpiece, etc. may jump out during machining, which may result in breakage of tools or machine tool or may cause damage to the operators.

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 in the parameters as the operation could become unstable.

In the explanation on bits, set all bits not used, including blank bits, to "0".

[Usage]

⚠ CAUTION

⚠ **Use this product within the range of environmental condition described in this manual. Using this product in an environment outside the range could result in electric shock, fire, operation failure, or damage to or deterioration of the product.**

❗ **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.**

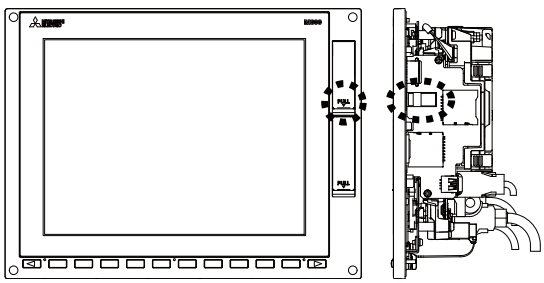
⚠ **Use the power that are complied with the power specification conditions (input voltage, input frequency, tolerable time for instantaneous power interruption) indicated in each specifications manual.**

⚠ **When making encoder cables, do not mistake connection. Failure to observe this could result in malfunction, runaway or fire.**

⚠ **Surge absorber to be selected varies depending on input power voltage.**

⚠ **Data transfer over wireless LAN may not be as stable as wired connection and packets might be lost depending on the surroundings and the location. Be sure to verify operation before using wireless LAN.**

⚠ **When the Wireless LAN function is used, keep the wireless module at least 20 cm away from your body (head/torso). The wireless module is mounted on the part surrounded by the dotted line in the figure below.**



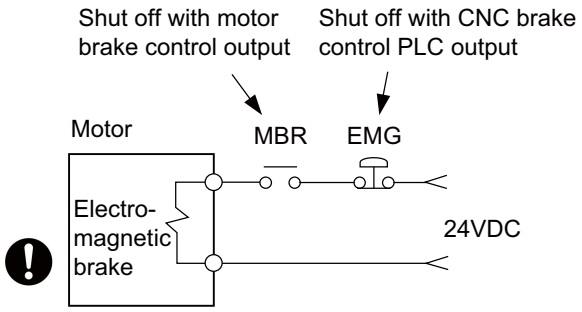
⚠ **Before touching the unit, make sure to touch a conductive material such as a grounded metal object to discharge static electricity accumulated in human body, etc. Otherwise, faults or malfunction may occur in the unit.**

[Troubleshooting]

⚠ CAUTION

⚠ **Use a motor with electromagnetic brakes or establish an external brake mechanism for the purpose of holding; this serves as countermeasures for possible hazardous situation caused by power failure or product fault.**

⚠ **Use a double circuit structure for the electromagnetic brake's operation circuit so that the brakes will activate even when the external emergency stop signal is issued.**



⚠ **The machine could suddenly restart when the power is restored after an instantaneous power failure, so stay away from the machine. (Design the machine so that the operator safety can be ensured even if the machine restarts.)**

⚠ **To secure the absolute position, do not shut off the servo drive unit's control power supply when its battery voltage drops (warning 9F) in the servo drive unit side.**

If the battery voltage drop warning alarm occurs in the controller side, make sure to back up the machining programs, tool data and parameters, etc. with the input/output device before replacing the battery. Depending on the level of voltage drop, memory loss could have happened. In that case, reload all the data backed up before the alarm occurrence.

[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.
Memory loss could have happened in replacing the battery. In this case, reload all the data which 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 Electric recommends the electrolytic capacitor to be replaced approx. every five years even when used in a normal environment. Contact the Service Center 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.**

[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.**

[Notes on radio frequency interference]

⚠ CAUTION

⚠ **The wireless module in this product uses the radio channels in the same frequency band (channels 1 - 13 in the 2.4 GHz band) as the following equipment and radio stations:**

- **Industrial, scientific and medical equipment**
- **Radio stations for RFID used for factory production lines**
  - **(1) Premises radio stations (radio stations requiring licenses)**
  - **(2) Specified low-power radio stations (radio stations not requiring licenses)**

Because using the wireless functionality could cause harmful interference to these equipment and radio stations, note the following:

- **Before using this product, ensure that no premises radio stations or specified low-power radio stations for RFID operate nearby.**
- **If this product causes harmful interference to premises radio stations for RFID, promptly change the frequency to avoid interference.**

Channels W53 and W56 in 5 GHz band are also used by weather radar and aerospace radar, and if there is radar activity on the channel, communication may be interrupted. You can avoid this problem by using channel W52 only, or enabling a function that immediately selects a different channel if radar is detected. For information on how to configure these settings, refer to the manual for the wireless access point. The channels W52 and W53 in 5 GHz band are prohibited for outdoor use.

Other notes on using the wireless functionality are described on " Appendix 4: Country/Region Code Setting (for Wireless LAN Function)". Read them in addition to the notes in this section.

[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.

Treatment of waste

The following two laws will apply when disposing of this product. Considerations must be made to each law. The following laws are in effect in Japan. Thus, when using this product overseas, the local laws will have a priority. If necessary, indicate or notify these laws to the final user of the product.

(1) Requirements for "Law for Promotion of Effective Utilization of Resources"
   (a) Recycle as much of this product as possible when finished with use.
   (b) When recycling, often parts are sorted into steel scraps and electric parts, etc., and sold to scrap contractors. Mitsubishi Electric recommends sorting the product and selling the members to appropriate contractors.

(2) Requirements for "Law for Treatment of Waste and Cleaning"
   (a) Mitsubishi Electric recommends recycling and selling the product when no longer needed according to item (1) above. The user should make an effort to reduce waste in this manner.
   (b) When disposing a product that cannot be resold, it shall be treated as a waste product.
   (c) The treatment of industrial waste must be commissioned to a licensed industrial waste treatment contractor, and appropriate measures, including a manifest control, must be taken.
   (d) Batteries correspond to "primary batteries", and must be disposed of according to local disposal laws.

Disposal



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

Your MITSUBISHI ELECTRIC product is designed and manufactured with high quality materials and components which can be recycled and/or reused.
This symbol means that batteries and accumulators, at their end-of-life, should be disposed of separately from your household waste.
If a chemical symbol is printed beneath the symbol shown above, this chemical symbol means that the battery or accumulator contains a heavy metal at a certain concentration. This will be indicated as follows:
Hg: mercury (0.0005%), Cd: cadmium (0.002%), Pb: lead (0.004%)
In the European Union there are separate collection systems for used batteries and accumulators.
Please, dispose of batteries and accumulators correctly at your local community waste collection/recycling centre.

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

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Handling of our product

(English)
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

본 제품의 취급에 대해서

(한국어 /Korean)
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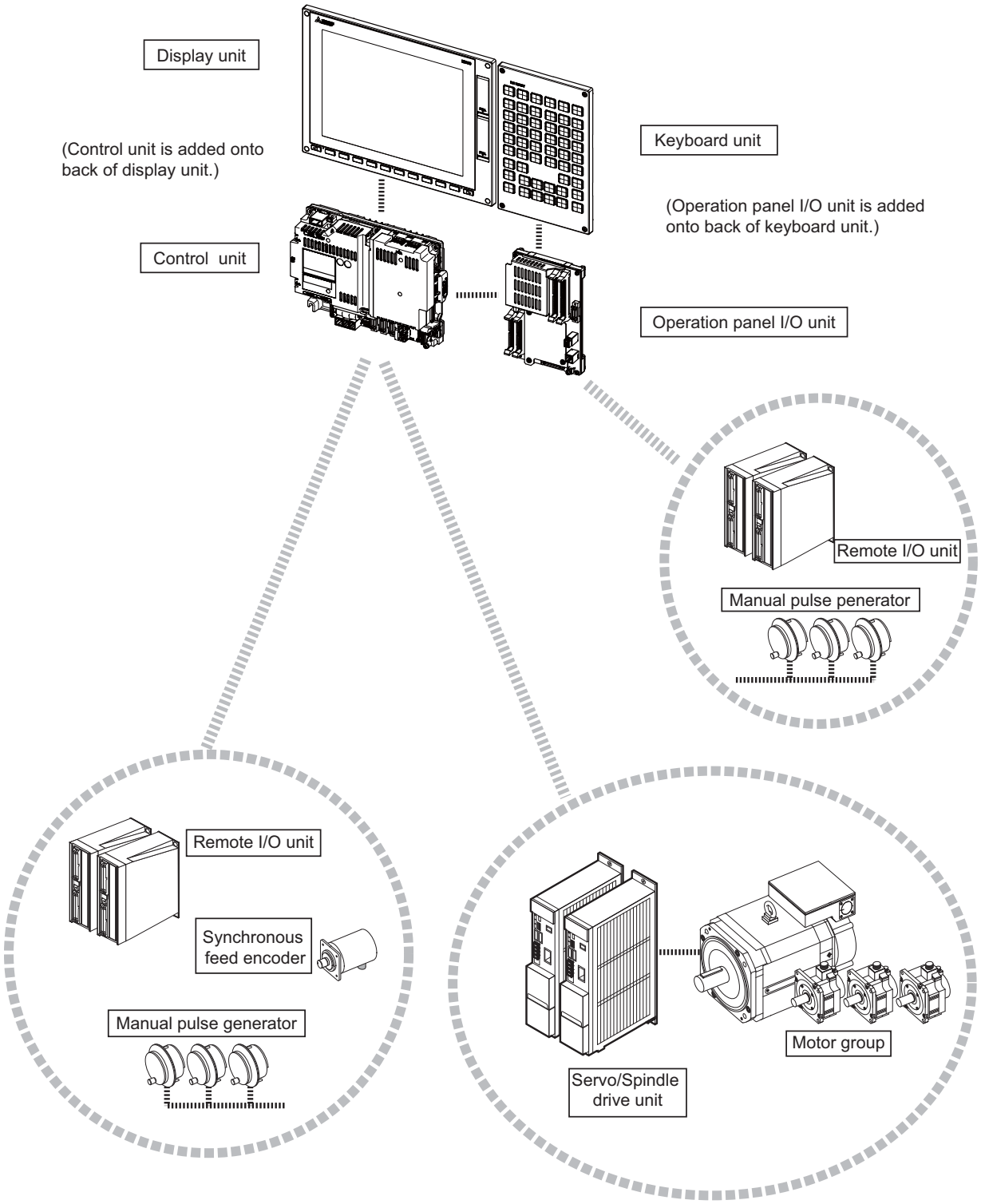
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44 Appendix 7: Precautions for Compliance to UL/c-UL Standards 703

1

System Basic Configuration

1.1 System Basic Configuration Drawing



Note

(1) For the drive unit configuration, refer to the instruction manual of the drive unit you use.

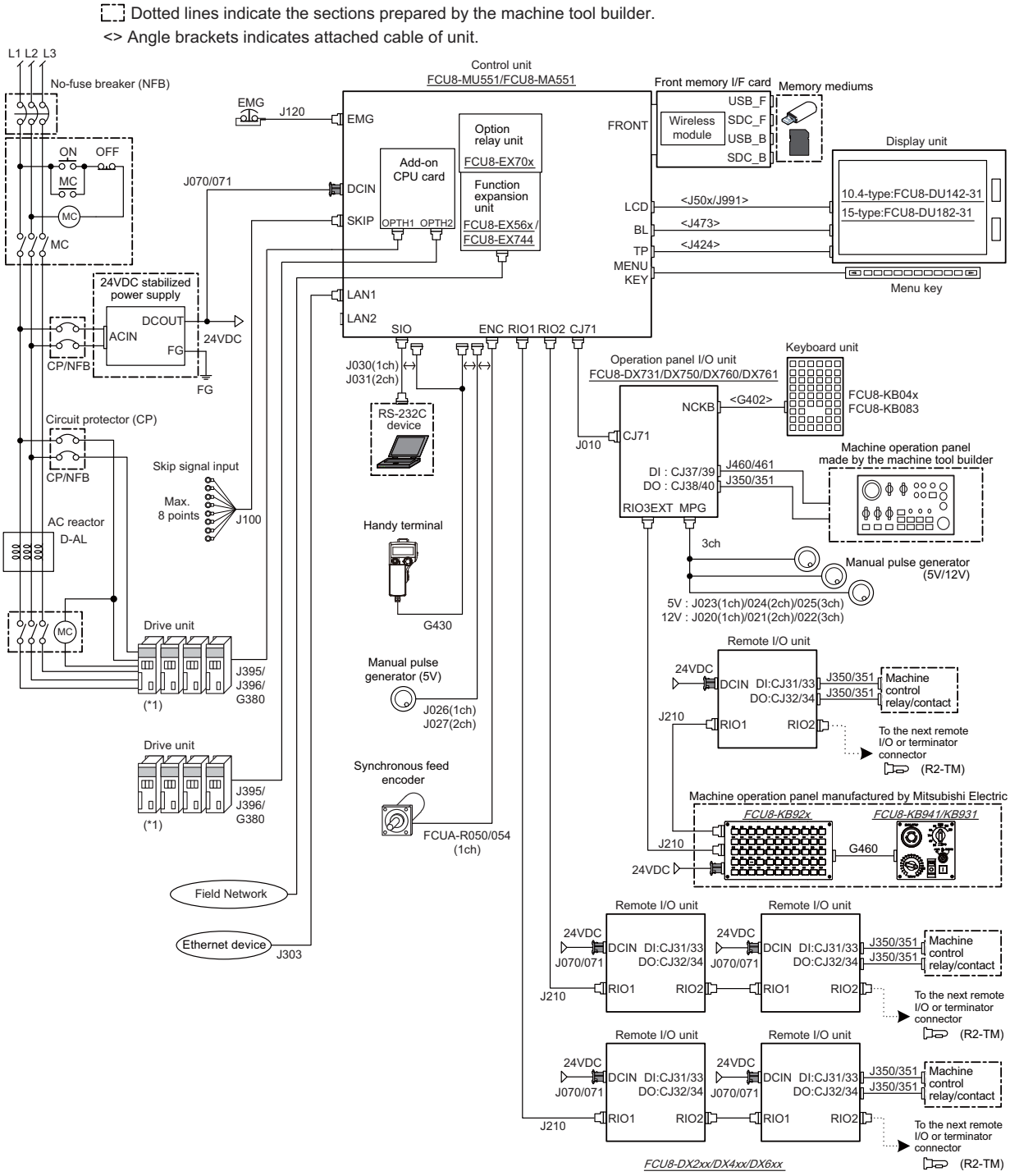
2

General Connection Diagram

Typical general connection diagrams for respective models are described.
Refer to the following chapters for parts where the connection differs depending on the unit configuration.

2.3 19-type Display Unit
2.4 Connecting an Operation Panel I/O Unit (FCU8-DX834)
2.5 Connecting a Pulse-controlled Inverter (M80V Series)
2.6 Connecting a BiSS Encoder
2.7 Connecting an Image Input Expansion Unit
2.8 Connecting a Laser I/F Unit
2.9 Connecting an EcoMonitorLight

2.1 M800VS Series



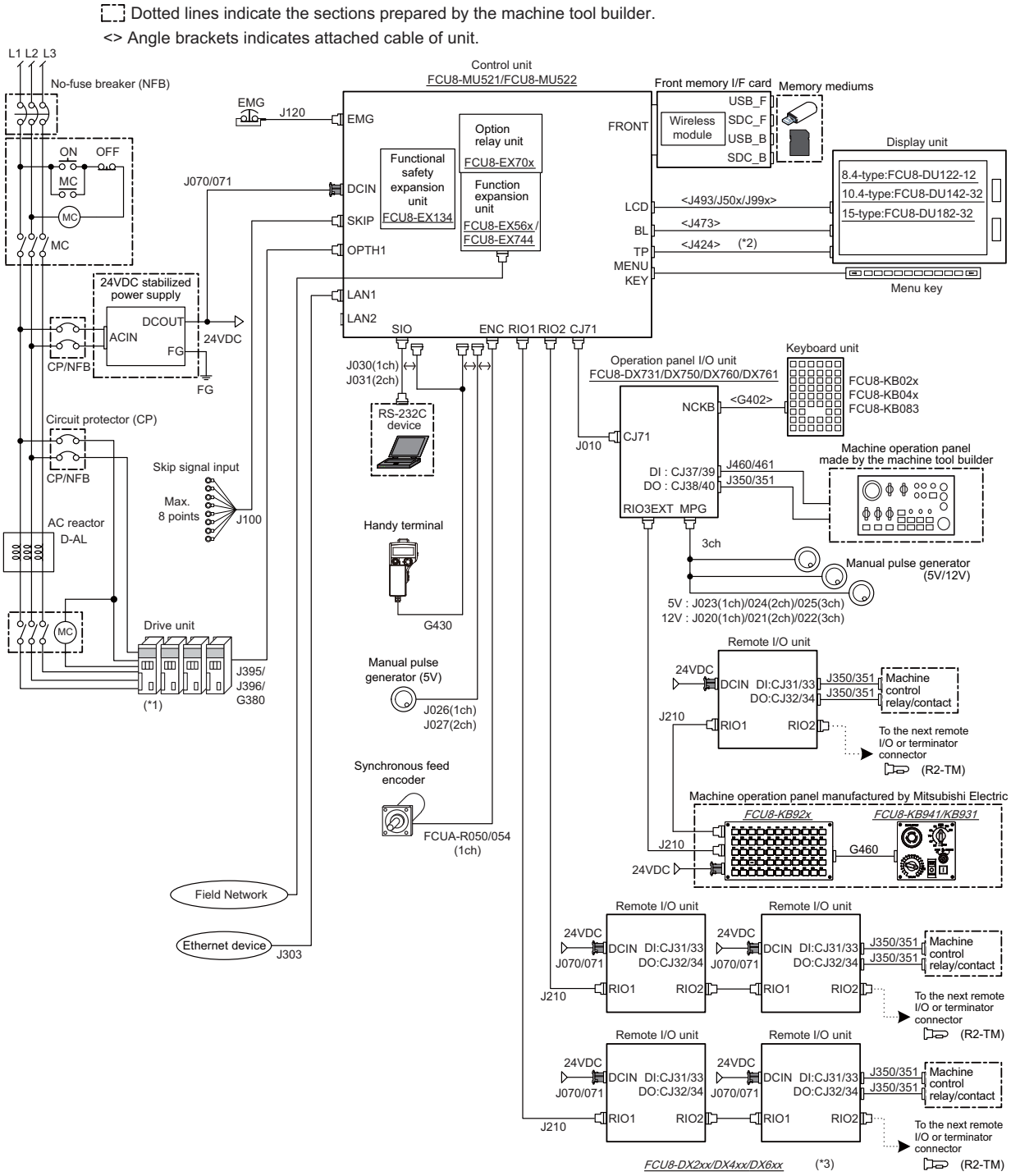
(*1) For information on how to connect the drive unit, refer to the drive unit's manual.

Note

(1) For details on connecting to the machine operation panel manufactured by Mitsubishi Electric, refer to the chapter "14 Connection of Machine Operation Panel".

2.2 M80V Series

The general connection diagram with smart safety observation function is as below.
Without smart safety observation function, functional safety expansion unit is not installed in the control unit.



(*1) For information on how to connect the drive unit, refer to the drive unit's manual.
(*2) For the 8.4-type display unit, TP connector is not used.
(*3) The safety remote I/O unit is available only when the functional safety expansion unit is mounted.

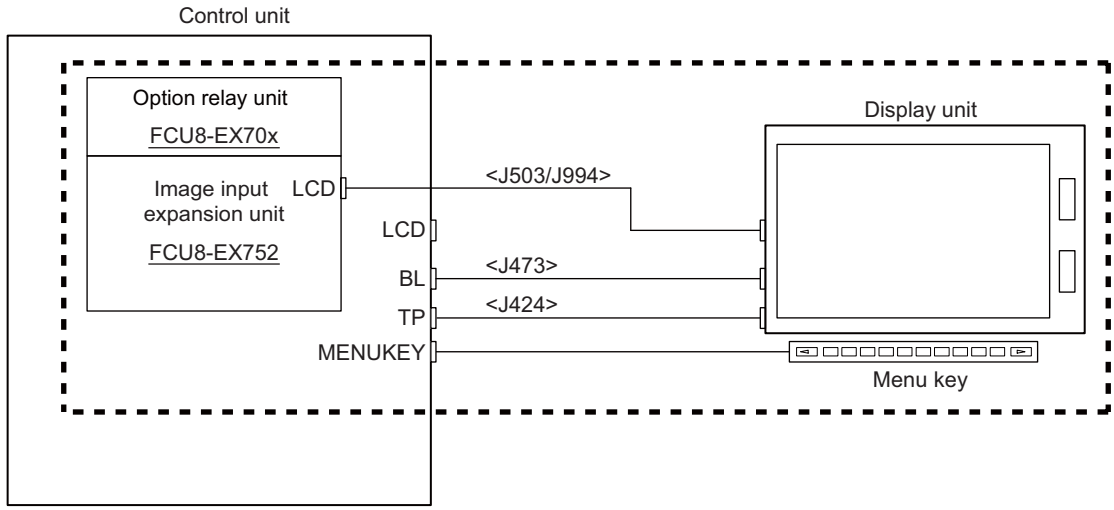
Note

(1) For details on connecting to the machine operation panel manufactured by Mitsubishi Electric, refer to the chapter "14 Connection of Machine Operation Panel".

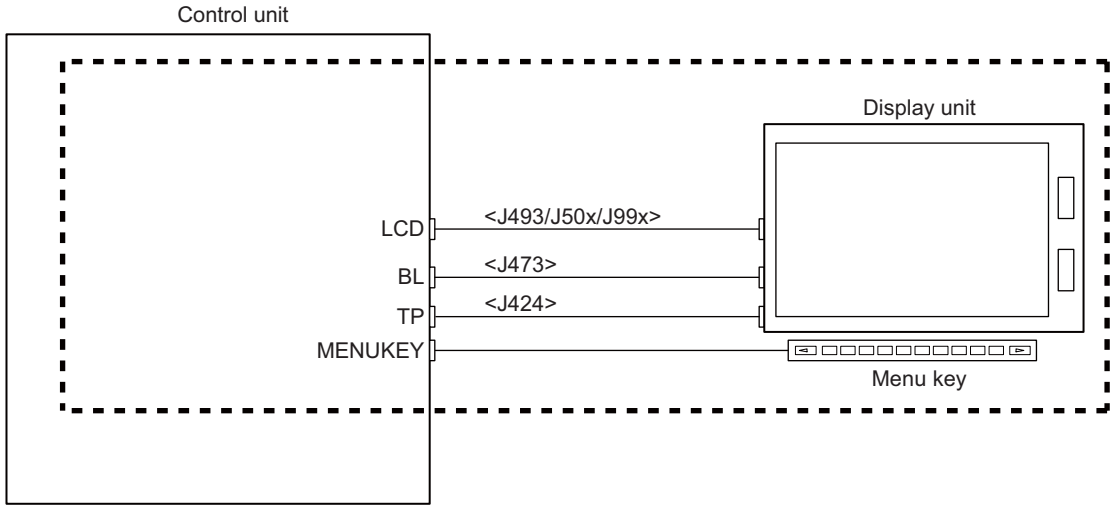
2.3 19-type Display Unit

Dotted lines indicate the sections which is different from the other display units (8.4-type, 10.4-type, and 15-type) in the display unit (19-type).
To connect the 19-type display unit to the CNC, an image input expansion unit is required.

19-type display unit



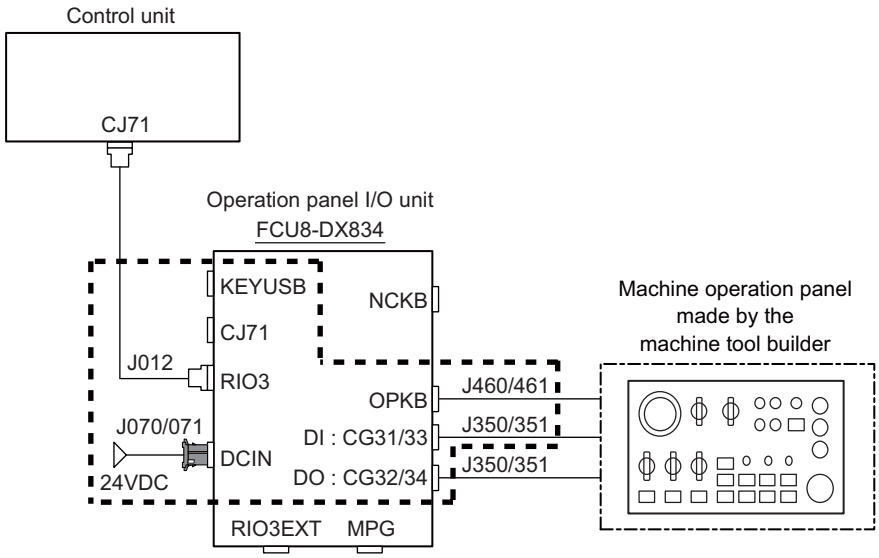
Other display units (8.4-type, 10.4-type, and 15-type)



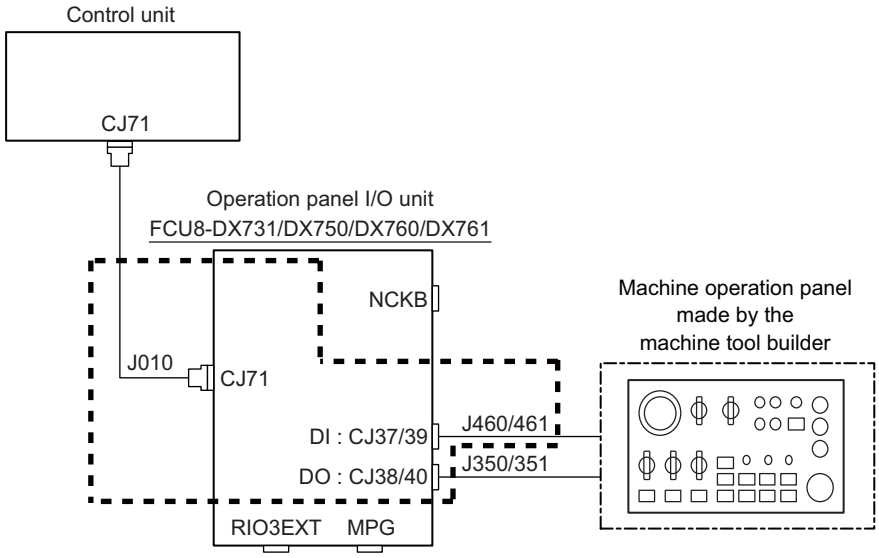
2.4 Connecting an Operation Panel I/O Unit (FCU8-DX834)

Dotted lines indicate the sections which is different from the FCU8-DX731/DX750/DX760/DX761 in FCU8-DX834.

FCU8-DX834



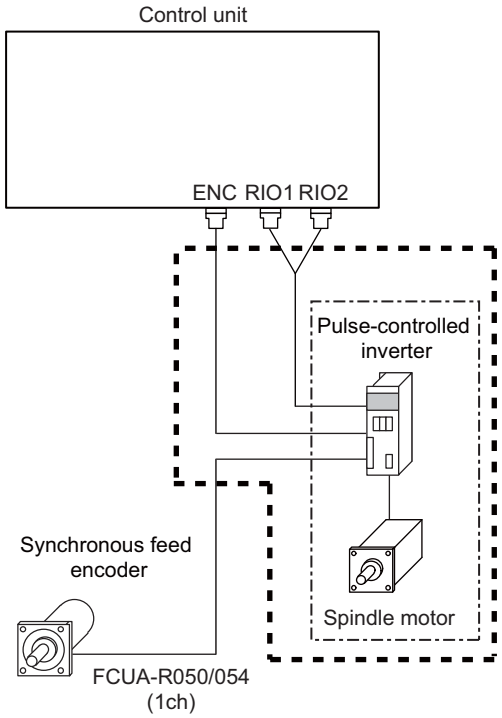
FCU8-DX731/DX750/DX760/DX761



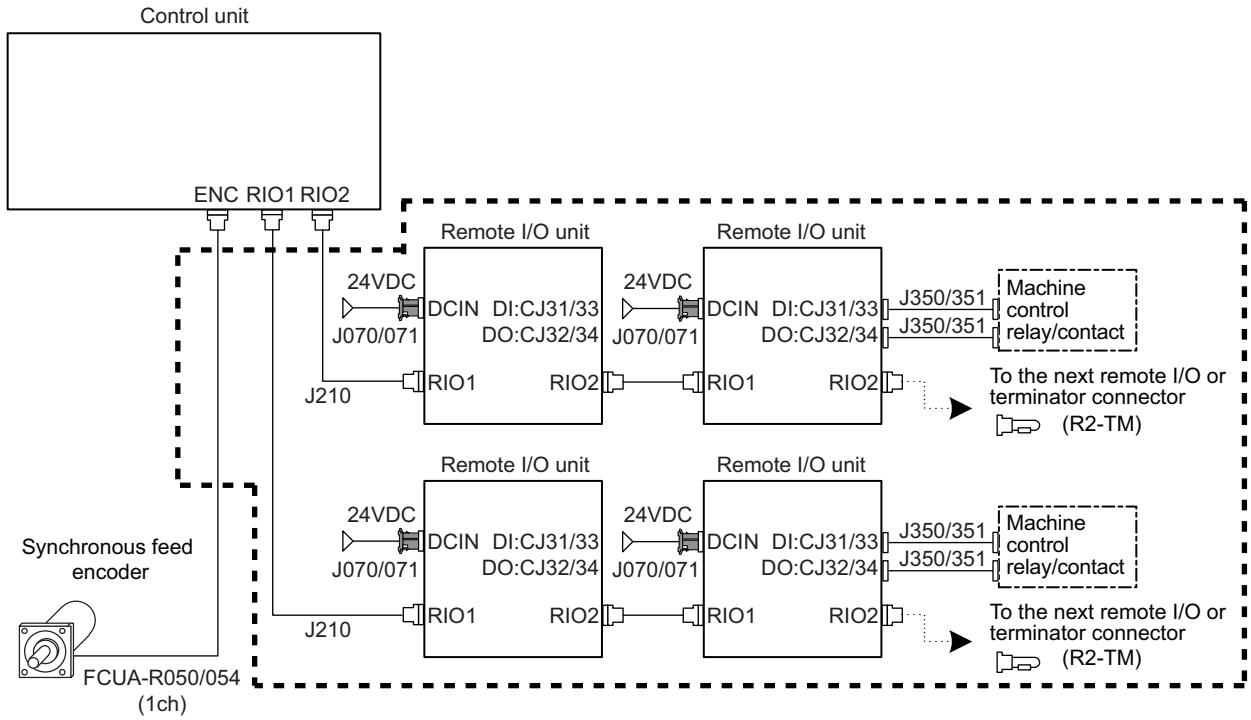
2.5 Connecting a Pulse-controlled Inverter (M80V Series)

Pulse-controlled inverter refers to an inverter capable of controlling spindle operation through pulse train input.
Connect a pulse-controlled inverter to RIO1 and RIO2 of the control unit.
The parts surrounded by the dotted lines in the figures below are different.

Connecting a pulse-controlled inverter



ENC/RIO1/RIO2 when the spindle drive unit is connected

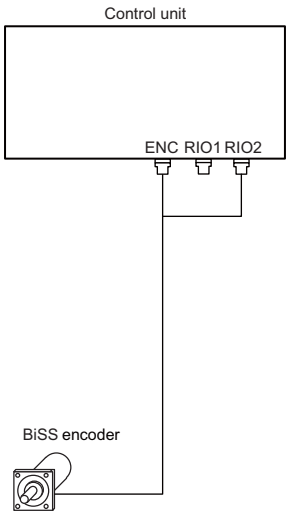


Note

(1) When the pulse-controlled inverter is connected, the remote I/O unit cannot be connected to the either of the RIO1 connector or the RIO2 connector.

2.6 Connecting a BiSS Encoder

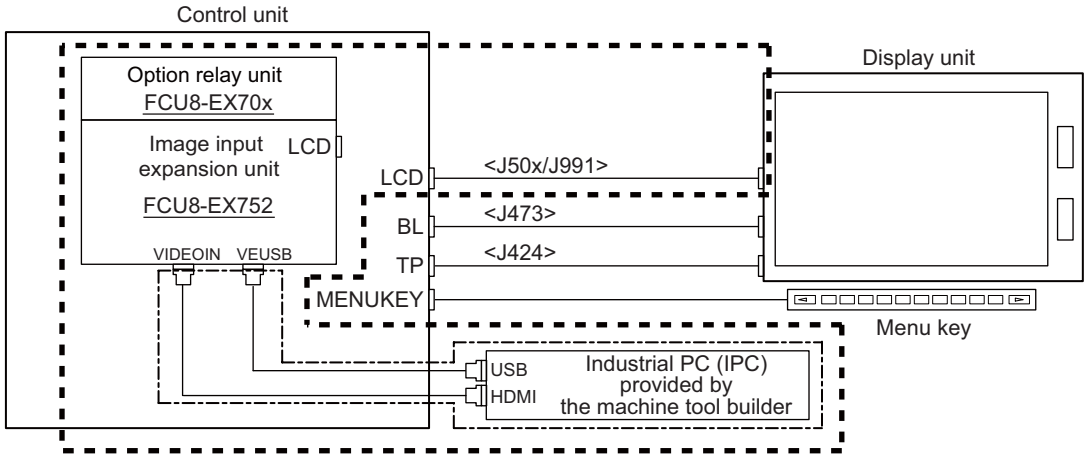
BiSS encoder refers to an encoder compatible with BiSS-C.
Connect the BiSS encoder to the ENC connector and the RIO2 connector of the control unit.



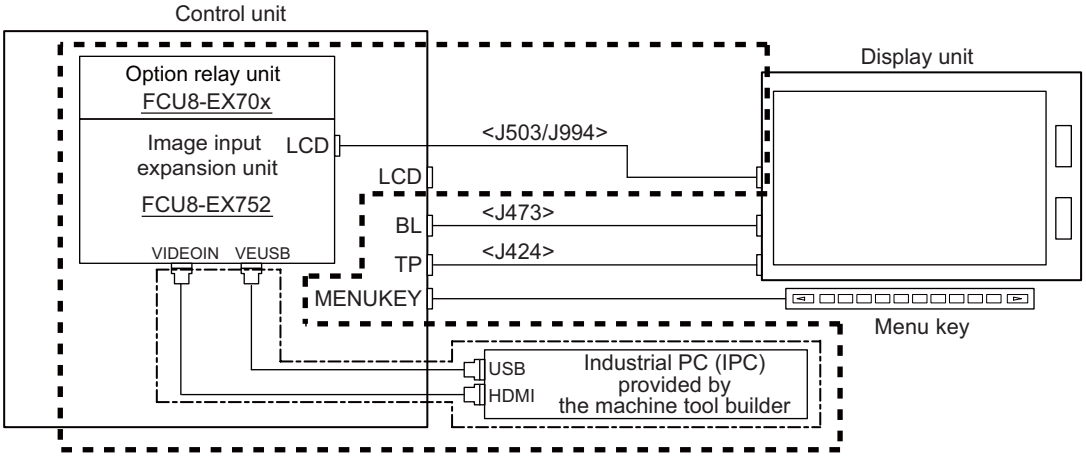
2.7 Connecting an Image Input Expansion Unit

Some connections differ depending on the display unit type.

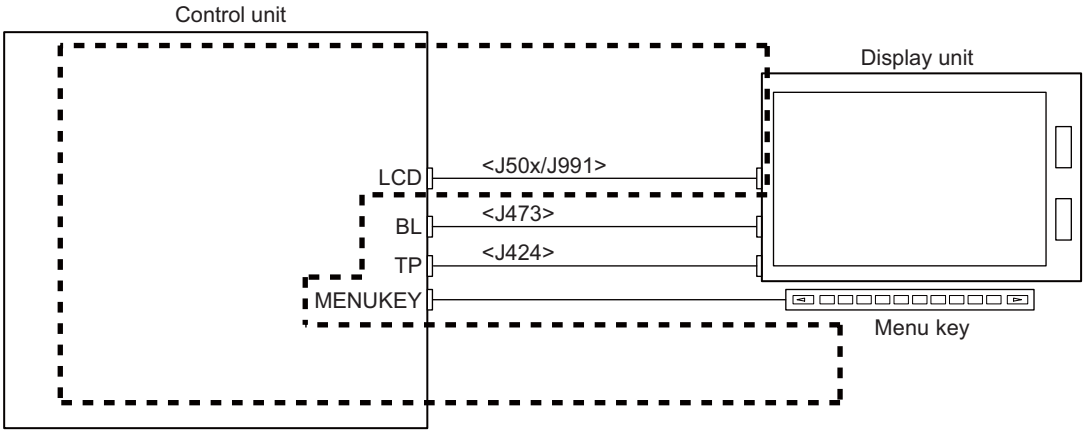
10.4-type display unit and 15-type display unit



19-type display unit



Connection without the image input expansion unit

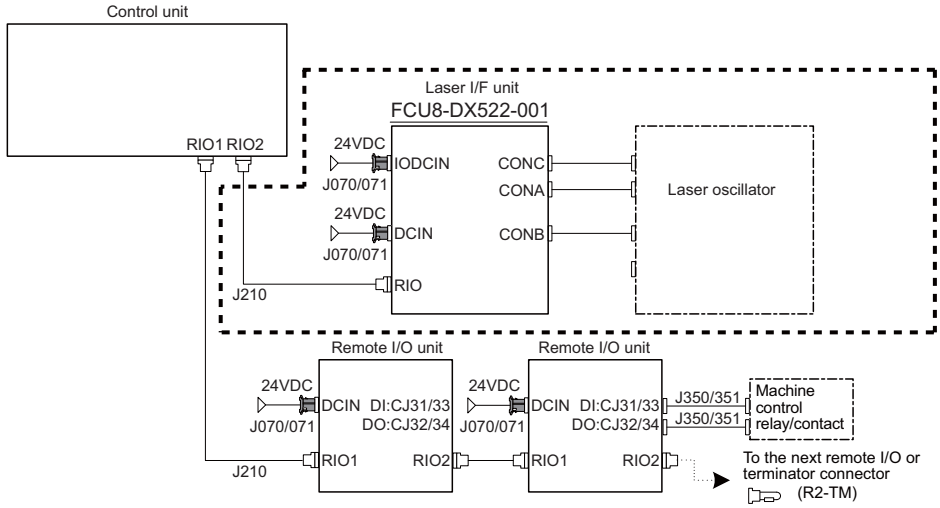


Note

(1) 8.4-type display unit does not support the image input expansion unit.

2.8 Connecting a Laser I/F Unit

Connect the laser I/F unit to RIO1 or RIO2 of the control unit.
The following figure shows an example of connecting the laser I/F unit to RIO2.

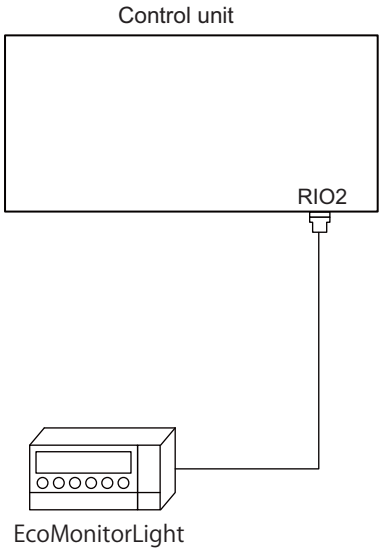


Note

(1) The laser I/F unit occupies all one channel; therefore, a remote I/O unit cannot be connected before or after the laser I/F unit.

2.9 Connecting an EcoMonitorLight

Connect the EcoMonitorLight to RIO2 of the control unit.



3

List of Configuration

3.1 Control Unit [M800VS]

Classification	Type	Components	Remarks
NC functions and display controller For M830VS	FCU8-MU551	Base control card Add-on CPU card Front-side memory I/F card	This unit is not compliant with both Export Trade Control Order and Foreign Exchange Order.
NC functions and display controller For M850VS	FCU8-MA551	Base control card Add-on CPU card Front-side memory I/F card	This unit is not compliant with Export Trade Control Order, and it is compliant with Foreign Exchange Order.

3.2 Control Unit [M80V]

Classification	Type	Components	Remarks
NC functions and display controller For M80V Type B	FCU8-MU521	Base control card Front-side memory I/F card	This unit is not compliant with both Export Trade Control Order and Foreign Exchange Order.
NC functions and display controller For M80V Type A	FCU8-MU522	Base control card Front-side memory I/F card	This unit is not compliant with both Export Trade Control Order and Foreign Exchange Order.

3.3 Display Unit [M800VS]

Classification	Type	Components	Remarks
10.4-type color LCD touchscreen (VGA: 640 x 480)	FCU8-DU142-31	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front-side memory I/F is normally equipped with the control unit
15-type color LCD touchscreen (XGA: 1024 x 768)	FCU8-DU182-31	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front-side memory I/F is normally equipped with the control unit
19-type color LCD touchscreen (SXGA:1280 x 1024)	FCU8-DU194-31	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front-side memory I/F is normally equipped with the control unit.

3.4 Display Unit [M80V]

Classification	Type	Components	Remarks
8.4-type color LCD (VGA: 640 x 480)	FCU8-DU122-12	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front-side memory I/F is normally equipped with the control unit
10.4-type color LCD touchscreen (VGA: 640 x 480)	FCU8-DU142-32	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front-side memory I/F is normally equipped with the control unit
15-type color LCD touchscreen (XGA: 1024 x 768)	FCU8-DU182-32	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front-side memory I/F is normally equipped with the control unit
19-type color LCD touchscreen (SXGA:1280 x 1024)	FCU8-DU194-32	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front-side memory I/F is normally equipped with the control unit.

3.5 Keyboard Unit [M800VS]

Classification	Type	Components	Remarks
Keyboard for 10.4-type display unit Clear key	FCU8-KB041	Escutcheon, key switch G402 cable Screw cap set	ONG layout (for L system, XZF)
Keyboard for 10.4-type display unit Clear key	FCU8-KB046	Escutcheon, key switch G402 cable Screw cap set	ONG layout (for M system/L system, XYZ)
Keyboard for 10.4-type display unit Clear key	FCU8-KB047	Escutcheon, key switch G402 cable Screw cap set	Full keyboard (for M system/L system) (in tandem)
Keyboard for 10.4-type display unit Clear key	FCU8-KB048	Escutcheon, key switch G402 cable Screw cap set	ABC layout (for M system/L system)
Keyboard for 15-type display unit Clear key	FCU8-KB083	Escutcheon, key switch G402 cable Screw cap set	Full keyboard (for M system/L system) (in tandem)
Keyboard for 19-type display unit	FCU8-KB091	Escutcheon, key switch G402 cable Screw cap set	Full keyboard (QWERTY layout) (in tandem)

3.6 Keyboard Unit [M80V]

Classification	Type	Components	Remarks
Keyboard for 8.4-type display unit Clear key	FCU8-KB026	Escutcheon, key switch G402 cable Screw cap set	ONG layout (for M system/L system, XYZ)
Keyboard for 8.4-type display unit Clear key	FCU8-KB028	Escutcheon, key switch G402 cable Screw cap set	ONG layout (for L system, XZF)
Keyboard for 8.4-type display unit Clear key	FCU8-KB029	Escutcheon, key switch G402 cable Screw cap set	ONG layout (for M system/L system) (in tandem)
Keyboard for 10.4-type display unit Clear key	FCU8-KB041	Escutcheon, key switch G402 cable Screw cap set	ONG layout (for L system, XZF)
Keyboard for 10.4-type display unit Clear key	FCU8-KB046	Escutcheon, key switch G402 cable Screw cap set	ONG layout (for M system/L system, XYZ)
Keyboard for 10.4-type display unit Clear key	FCU8-KB047	Escutcheon, key switch G402 cable Screw cap set	Full keyboard (for M system/L system) (in tandem)
Keyboard for 10.4-type display unit Clear key	FCU8-KB048	Escutcheon, key switch G402 cable Screw cap set	ABC layout (for M system/L system)
Keyboard for 15-type display unit Clear key	FCU8-KB083	Escutcheon, key switch G402 cable Screw cap set	Full keyboard (for M system/L system) (in tandem)
Keyboard for 19-type display unit	FCU8-KB091	Escutcheon, key switch G402 cable Screw cap set	Full keyboard (QWERTY layout) (in tandem)

3.7 Operation Panel I/O Unit

Classification	Type	Components	Remarks
DI 24 V/0 V common input [64 points] DO Source output [48 points] AO analog output [1 point]	FCU8-DX731	Base card RIO 2.0 terminator connector (R2-TM)	DI: 64-point 24 V/0 V common type DO: 48-point source type (200 mA/point) AO: 1 point Manual pulse generator input: 2 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1, 3, 7 to 12, 20 to 22 RIO extensible stations: 2, 4 to 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [96 points] DO Source output [64 points]	FCU8-DX750	Base card RIO 2.0 terminator connector (R2-TM)	DI: 96-point 24 V/0 V common type DO: 64-point source type (200 mA/point) Manual pulse generator input: 3 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 3, 7 to 12, 20 to 22 RIO extensible stations: 4 to 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [96 points] DO Source output [96 points]	FCU8-DX760	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 96-point 24 V/0 V common type DO: 96-point source type (200 mA/point) Manual pulse generator input: 3 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 4, 7 to 12, 20 to 22 RIO extensible stations: 5, 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [96 points] DO Source output [64 points] AI Analog input [1 point] AO Analog output [1 point]	FCU8-DX761	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 96-point 24 V/0 V common type DO: 64-point source type (200 mA/point) AI: 1 point AO: 1 point Manual pulse generator input: 3 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 5, 7 to 12, 20 to 22 RIO extensible stations: 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [64 points] DO Source output [64 points] Scan input [64 points] Scan output [64 points]	FCU8-DX834	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 64-point 24 V/0 V common type DO: 64-point source type (200 mA/point) Scan input: 64 points Scan output: 64 points Manual pulse generator input: 3ch Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 4, 7 to 14, 20 to 22 RIO extensible stations: 5, 6, 15 to 19, 23 to 64

- DI: Digital input signals, DO: Digital output signals

3.8 Remote I/O Unit

Classification	Type	Components	Remarks
DI 24 V/0 V common input [32 points] DO Source output [32 points]	FCU8-DX220	Base card RIO 2.0 connector set	DI: 32-point 24 V/0 V common type DO: 32-point source type (200 mA/point) Number of occupied stations: 1
DI 24 V/0 V common input [64 points] DO Source output [48 points]	FCU8-DX230	Base card RIO 2.0 connector set	DI: 64-point 24 V/0 V common type DO: 48-point source type (200 mA/point) Number of occupied stations: 2
DI 24 V/0 V common input [64 points] DO Source output [48 points] AO analog output [1 point]	FCU8-DX231	Base card RIO 2.0 connector set	DI: 64-point 24 V/0 V common type DO: 48-point source type (200 mA/point) AO: 1 point Number of occupied stations: 2
AI analog input [4 points] AO analog output [1 point]	FCU8-DX202	Base card RIO 2.0 connector set	AI: 4 points AO: 1 point Number of occupied stations: 1
DI 0 V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213	Base card RIO 2.0 connector set	DI: 16-point 0 V common type (3 mA/point) DO: 8-point source type (2 A/point) Number of occupied stations: 1
DI 0 V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213-1	Base card RIO 2.0 connector set	DI: 16-point 0 V common type (9 mA/point) DO: 8-point source type (2 A/point) Number of occupied stations: 1
DI 24 V/0 V common input [32 points] DO Source output [32 points] (*1)	FCU8-DX520	Base card RIO 2.0 connector set	DI: 32-point 24 V/0 V common type (9 mA/point) DO: 32-point source type (200 mA/point) Number of occupied stations: 1
Safety DI 0 V common input [8 points] Safety DO Source output (large capacity) [4 points]	FCU8-DX654	Base card RIO 2.0 connector set	Safety DI: 8-point 0 V common type (3 mA/point) Safety DO: 4-point source type (2 A/point) Number of occupied stations: 2
Safety DI 0 V common input [8 points] Safety DO Source output (large capacity) [4 points]	FCU8-DX654-1	Base card RIO 2.0 connector set	Safety DI: 8-point 0 V common type (9 mA/point) Safety DO: 4-point source type (2 A/point) Number of occupied stations: 2
DI 24 V/0 V common input [32 points] DO Source output [32 points] Safety DI 0 V common input [8 points] (*2) Safety relay output [4 points] (*3)	FCU8-DX651	Base card Add-on card RIO 2.0 connector set	DI: 32-point 24 V/0 V common type DO: 32-point source type (200 mA/point) Safety DI: 8-point 0 V common type Safety relay: 4 points (non-voltage contact) Relay contact welding detection Number of occupied stations: 3
Thermistor input [12 points]	FCU8-DX408	Base card RIO 2.0 connector set	Thermistor input: 12 points Number of occupied stations: 3
Multi-analog input [4 points] (*4)	FCU8-DX409	Base card RIO 2.0 connector set	Multi-analog input: 4 points Number of occupied stations: 4

(*1) The machine signal output of FCU8-DX520 is configured with 8 commons. The number of output points per common is 4.
When total output current of a common is 0.8 A or less, 0.3 A can be output at only any one point.

(*2) Safety DI uses 16 points of terminal because of the duplication wiring.

(*3) Safety relay output uses 8 points of terminal because of the duplication wiring.

(*4) Voltage input, current input, thermocouple input and resistance temperature detector input are selected for each channel.

- DI: Digital input signals, DO: Digital output signals, AI: Analog input signals, AO: Analog output signals

3.9 Laser I/F Unit

Classification	Type	Components	Remarks
Laser I/F unit	FCU8-DX522-001	Base card Connector set	DI: 26-point 0 V common type DO: 22-point source type (200 mA/point) PWM: 1 point Relay: 3 points (1 A/point) AI: 1 point AO: 1 point Remote I/O occupies 1 ch.

3.10 Functional Safety Expansion Unit [M80V]

Classification	Type	Components	Remarks
Functional safety expansion unit	FCU8-EX134	Add-on card	Smart safety observation

3.11 Function Expansion Unit

Classification	Type	Components	Remarks
CC-Link expansion unit	FCU8-EX561	CC-Link I/F PCB	CC-Link 1ch
PROFIBUS-DP master unit	FCU8-EX563	PROFIBUS-DP I/F PCB	PROFIBUS-DP 1ch
CC-Link IE Field Master/local unit	FCU8-EX564	Base card Add-on card	CC-Link IE Field 2 ch
EtherNet/IP scanner/adapter unit	FCU8-EX565	Base card Add-on card	EtherNet/IP 1 ch (LAN1 only; LAN2 unavailable)
FL-net expansion unit	FCU8-EX568	Base card Add-on card	FL-net 1 ch (LAN1 only; LAN2 unavailable)
CC-Link IE TSN expansion unit	FCU8-EX569	Base card Add-on card	CC-Link IE TSN network 1 ch (LAN1 only; LAN2 unavailable)
Vibration cutting expansion unit	FCU8-EX744	Base card	Vibration cutting function
Image input expansion unit	FCU8-EX752	Base card Add-on card Cable holder	19-type display function, Image input function with IPC (Image input I/F: HD-MI)

Classification	Type	Components	Remarks
Option relay unit	FCU8-EX704	Relay PCB	Function expansion unit for 1 slot
Option relay unit	FCU8-EX705	Relay PCB	Function expansion unit for 2 slots

- To use the function expansion unit, the option relay unit (FCU8-EX70x) is required.

3.12 Manual Pulse Generator

Classification	Type	Components	Remarks
5 V manual pulse generator	UFO-01-2Z9	UFO-01-2Z9 (Produced by NIDEC NEMICON)	Input: 5 VDC 100 pulse/rev
12 V manual pulse generator	HD60C	HD60C	Input: 12 VDC 25 pulse/rev

3.13 Synchronous feed encoder

Classification	Type	Components	Remarks
Synchronous feed encoder	OSE1024-3-15-68	OSE1024-3-15-68	Input: 5 VDC 1024 pulse/rev 6000 rpm, 68-square flange
Synchronous feed encoder	OSE1024-3-15-68-8	OSE1024-3-15-68-8	Input: 5 VDC 1024 pulse/rev 8000 rpm, 68-square flange
Synchronous feed encoder	OSE1024-3-15-160	OSE1024-3-15-160	Input: 5 VDC 1024 pulse/rev 6000 rpm, 160-square flange

3.14 Machine Operation Panel

Classification	Type	Components	Remarks
Main panel A (For 8.4-type/15-type display unit)	FCU8-KB921	Escutcheon, key switch Control card G054 cable, screw cap set	Mitsubishi Electric standard key layout (55 keys) (Standard specification A)
Main panel A (For 10.4-type display unit)	FCU8-KB923	Escutcheon, key switch Control card G054 cable, screw cap set	Mitsubishi Electric standard key layout (55 keys) (Standard specification A)
Main panel B (For 8.4-type/15-type display unit)	FCU8-KB925	Escutcheon, key switch Control card G054 cable, screw cap set	Mitsubishi Electric standard key layout (55 keys) (Standard specification B)
Main panel B (For 10.4-type display unit)	FCU8-KB926	Escutcheon, key switch Control card G054 cable, screw cap set	Mitsubishi Electric standard key layout (55 keys) (Standard specification B)
Main panel (For 8.4-type/15-type display unit)	FCU8-KB922	Escutcheon, key switch Control card G054 cable, screw cap set	Custom specification, 55-key layout (Clear key top cover sold separately)
Main panel (For 10.4-type display unit)	FCU8-KB924	Escutcheon, key switch Control card G054 cable, screw cap set	Custom specification, 55-key layout (Clear key top cover sold separately)
Clear key top set	N030C975G51/ N030C975G55	Clear key top cover (20 pieces/60 pieces)	
Set of labels for M7 standard key layout	N939A169G51	Labels for M7 standard key layout (1 sheet)	
Sub panel A (Common for all display units)	FCU8-KB931	Escutcheon Emergency stop switch, override switch ON/OFF switch, screw cap set	Mitsubishi Electric standard switch specification (Standard specification A)
Sub panel A (Common for all display units)	FCU8-KB941	Escutcheon Emergency stop switch, override switch ON/OFF switch, screw cap set	Mitsubishi Electric standard switch specification (Standard specification B)

3.15 Handy Terminal

Classification	Type	Components	Remarks
Handy terminal	HG1T-SB12UH- MK1346-L5		

3.16 Cable Connector Sets

Classification	Type	Components	Remarks
General I/O (For SKIP, SIO, MPG, AIO)	FCUA-CS000	Connector (10120-3000PE, 2 pcs.) Shell kit (10320-52F0-008, 2 pcs.)	
Emergency stop connector (For EMG)	005057-9403 0016020103 x 3 pcs.	Connector (50-57-9403), Contact (0016020103, 3 pcs.)	
Connector kit for RIO 2.0 unit	RIO2 CON	Connector (1-1318119-3, 2 pcs.), Contact (1318107-1, 8 pcs.), Connector (2-178288-3), Contact (1-175218-5, 3 pcs.)	
Connector kit for laser I/F	RIOL-CON	Connector (1-1318119-3, 2 pcs.), Contact (1318107-1, 8 pcs.), Connector (2-178288-3, 2 pcs.), Contact (1-175218-5, 6 pcs.)	
24 VDC power supply connector (For DCIN)	FCUA-CN220	Connector (2-178288-3), Contact (1-175218-5, 3 pcs.)	
DI/DO connector (For operation panel I/O unit) (For remote I/O unit)	7940-6500SC x 4 pcs. 3448-7940 x 4 pcs.	Connector (7940-6500SC, 4 pcs.), Strain relief (3448-7940, 4 pcs.)	FCU8-DX731
DI connector (For operation panel I/O unit)	7950-6500SC x 2 pcs. 3448-7950 x 2 pcs.	Connector (7950-6500SC, 2 pcs.), Strain relief (3448-7950, 2 pcs.)	FCU8-DX750/760/761
Connector for CJ71	2-1318119-4 1318107-1 x 8 pcs.	Connector (2-1318119-4), Contact (1318107-1, 8 pcs.)	
THERMISTOR connector	37104-2165-000FL 10P	Connector (37104-2165-000FL, 10 pcs.)	

3.17 Thermistor Set

Classification	Type	Components	Remarks
Thermistor	PT3C-51F-M2 10P	Thermistor (PT3C-51F-M2, 10 pieces)	

3.18 Genuine Memory Card

Classification	Type	Components	Remarks
Exclusive SD cards for 1 GB	FCU8-SD001G	FCU8-SD001G	1 GB capacity
Exclusive SD cards for 4 GB	FCU8-SD004G	FCU8-SD004G	4 GB capacity

3.19 Durable Parts

Durable parts	Part type
Battery for control unit	Q6BAT

- Contact the Service Center, Sales Office or dealer for repairs or part replacement.

3.20 Replacements

Replacements	Part type	Manufacturer
Protection fuse for operation panel I/O unit	LM50	Daito Communication Apparatus Co., Ltd.
Protection fuse for FCU8-DX220/230/231/651	LM50	Daito Communication Apparatus Co., Ltd.
Protection fuse for FCU8-DX213/654/213-1/654-1	MP63	Daito Communication Apparatus Co., Ltd.
Protection fuse for FCU8-DX522-001	LM50	Daito Communication Apparatus Co., Ltd.
Pair of SD/USB covers for display unit	N031C089G51	-

3.21 List of Cables

[Cable relating to NC]

Type	Application	Available cable length (m)	Max. cable length
FCUA-R050-xM	Wiring between synchronous encoder and control unit (straight, with connector)	5	30 m
FCUA-R054-xM	Wiring between synchronous encoder and control unit (right angle, with connector)	3, 5, 10, 15, 20	30 m
G071 LxM	24 VDC relay cable for machine operation panel	0.12, 0.5, 1	1 m
G123	Cable for emergency stop release	-	-
G430 LxM	Cable for connection to handy terminal	3, 5, 10	10 m
G460 LxM	Cable for machine operation panel (Cable between main panel and sub panel)	0.5	0.5 m
J010 LxM	Operation panel I/O interface cable	0.5, 1	1 m
J012 LxM	Operation panel I/O interface cable (for FCU8-DX834)	0.5, 1	1 m
J020 LxM	Manual pulse generator cable (12 V): 1 ch	1, 2, 3, 5, 7, 10, 15, 20, 30	50 m
J021 LxM	Manual pulse generator cable (12 V): 2 ch	1, 2, 3, 5, 7, 10, 15, 20, 30	50 m
J022 LxM	Manual pulse generator cable (12 V): 3 ch	1, 2, 3, 5, 7, 10, 15, 20, 30	50 m
J023 LxM	Manual pulse generator cable (5 V): 1 ch	1, 2, 3, 5, 7, 10, 15, 20	20 m
J024 LxM	Manual pulse generator cable (5 V): 2 ch	1, 2, 3, 5, 7, 10, 15, 20	20 m
J025 LxM	Manual pulse generator cable (5 V): 3 ch	1, 2, 3, 5, 7, 10, 15, 20	20 m
J026 LxM	Manual pulse generator cable (5 V): 1 ch (For connection to control unit)	1, 2, 3, 5, 7, 10, 15, 20	20 m (*)
J027 LxM	Manual pulse generator cable (5 V): 2 ch (For connection to control unit)	1, 2, 3, 5, 7, 10, 15, 20	20 m (*)
J030 LxM	RS-232C I/F cable: 1 ch	1, 2, 3, 5, 7, 10	15 m (*)
J031 LxM	RS-232C I/F cable: 2 ch	1, 2, 3, 5, 7, 10	15 m (*)
J070 LxM	24 VDC power cable	1, 2, 3, 5, 7, 10, 15	15 m
J071 LxM	24 VDC power cable (for long distance)	20	20 m
J100 LxM	SKIP input cable	1, 2, 3, 5, 7, 10, 15, 20	20 m
J120 LxM	Emergency stop cable	1, 2, 3, 5, 7, 10, 15, 20, 30	30 m
J121 LxM	Emergency stop cable for machine operation panel	1, 2, 3, 5, 7, 10, 15, 20, 30	30 m
J210 LxM	Remote I/O 2.0 communication cable	0.3, 1, 2, 3, 5, 7, 10, 15, 20, 30	50 m
J221 LxM	Analog input/output cable (for remote I/O unit)	2, 3, 7	30 m
J224 LxM	Analog input/output cable (for operation panel I/O unit)	1, 2, 3, 5, 7, 10, 15, 20	30 m
J225 LxM	Analog output cable (for operation panel I/O unit)	1, 2, 3, 5, 7, 10, 15, 20	30 m
J303 LxM	LAN straight cable	1, 2, 3, 5, 7, 10, 15, 20, 30	50 m
J350 LxM	DI/DO cable (connectors at both ends)	1, 2, 3, 5	50 m
J351 LxM	DI/DO cable (connector at one end)	3	50 m
J460 LxM	DI/DO cable (connectors at both ends)	1, 2, 3, 5	50 m
J461 LxM	DI/DO cable (connector at one end)	3	50 m
R2-TM	Terminator for remote I/O interface	-	-

Note

(1) "x" in type columns indicate cable length (unit: m).

(2) Lengths indicated with an asterisk (*) in the "Max. cable length" column indicate the maximum cable length when connecting via other unit.

[Cable Relating to Drive Unit]

Type	Application	Available cable length (m)	Max. cable length
CNP2E-1-xM	Motor side PLG cable Spindle side accuracy encoder TS5690 cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30 m
CNP3EZ-2P-xM	Spindle side detector cable OSE-1024 cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30 m
CNP3EZ-3P-xM	Spindle side detector cable OSE-1024 cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30 m
CNV2E-8P-xM	For HG/HG-H, HQ-H, HK/HK-H, HG-JR Motor side encoder cable (for D47/D48/D51/D74/G48) Ball screw side encoder cable (OSA405ET2AS, OSA676ET2AS)	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30 m
CNV2E-9P-xM	For HG/HG-H, HQ-H, HK/HK-H, HG-JR Motor side encoder cable (for D47/D48/D51/D74/G48) Ball screw side encoder cable (OSA405ET2AS, OSA676ET2AS)	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30 m
CNV2E-D-xM	MDS-B-SD unit cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30 m
CNV2E-HP-xM	MDS-EX-HR unit cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30 m
DG30-xM	Battery cable (for wiring between drive unit and battery box, between drive units)	0.3, 0.5, 1, 2, 3, 5, 7, 10	10 m
G380 LxM	Optical communication cable Wiring between drive units (outside panel)	5, 10, 12, 15, 20, 25, 30	30 m
J395 LxM	Optical communication cable Wiring between drive units (outside panel) Wiring between NC and-drive unit	3, 5, 7, 10	10 m
J396 LxM	Optical communication cable Wiring between drive units (inside panel)	0.2, 0.3, 0.5, 1, 2, 3, 5	10 m
MR-BKS1CBLx-MA1-H	<200V Series> Brake cable for HG96 load side angle	2, 3, 5, 7, 10	10 m
MR-BKS1CBLx-MA2-H	<200V Series> Brake cable for HG96 reverse load side angle	2, 3, 5, 7, 10	10 m
MR-BT6V2CBL LxM	Battery cable (MDS-EJ/EJH) (for wiring between drive units)	0.3, 1	1 m
MR-D05UDL3M-B	STO cable	3	3 m
MR-ENE4CBLxM-H-MTH	For HG-H1502 Motor side encoder cable (for D48/D51/D74)	5, 10, 20, 30	30 m
MR-PWS1CBLx-MA1-H	<200V Series> Power cable for HG96 load side angle	2, 3, 5, 7, 10	10 m
MR-PWS1CBLx-MA2-H	<200V Series> Power cable for HG96 reverse load side angle	2, 3, 5, 7, 10	10 m
SH21 LxM	Power supply communication cable Backup unit communication cable	0.35, 0.5, 1, 2, 3	30 m

Note

(1) "x" in type columns indicate cable length (unit: m).

(2) Lengths indicated with an asterisk (*) in the "Max. cable length" column indicate the maximum cable length when connecting via other unit.

3.22 System Type

Series	Model name	System type	Control unit	Display unit
M800VS Series	M850VS	FCA850H-9SV	FCU8-MA551-001	FCU8-DU194-31 (19-type color LCD touchscreen)
		FCA850H-8SV		FCU8-DU182-31 (15-type color LCD touchscreen)
		FCA850H-4SV		FCU8-DU142-31 (10.4-type color LCD touchscreen)
	M830VS	FCA830H-9SV	FCU8-MU551-001	FCU8-DU194-31 (19-type color LCD touchscreen)
		FCA830H-8SV		FCU8-DU182-31 (15-type color LCD touchscreen)
		FCA830H-4SV		FCU8-DU142-31 (10.4-type color LCD touchscreen)
M80V Series	M80V TypeA	FCA80H-9AV	FCU8-MU522-001	FCU8-DU194-32 (19-type color LCD touchscreen)
		FCA80H-8AV		FCU8-DU182-32 (15-type color LCD touchscreen)
		FCA80H-4AV		FCU8-DU142-32 (10.4-type color LCD touchscreen)
		FCA80P-2AV		FCU8-DU122-12 (8.4-type color LCD)
	M80V TypeB	FCA80H-9BV	FCU8-MU521-001	FCU8-DU194-32 (19-type color LCD touchscreen)
		FCA80H-8BV		FCU8-DU182-32 (15-type color LCD touchscreen)
		FCA80H-4BV		FCU8-DU142-32 (10.4-type color LCD touchscreen)
		FCA80P-2BV		FCU8-DU122-12 (8.4-type color LCD)

4

General Specifications

4.1 Environment Conditions [M800VS]

4.1.1 Installation Environment Conditions

Item	Unit name		Control unit	Display unit
	Type		FCU8-MU551/MA551	FCU8-DU142-31: (10.4-type) FCU8-DU182-31: (15-type) FCU8-DU194-31: (19-type)
General specifications	Ambient temperature	During operation	0 °C to 58 °C	
		During storage	-20 °C to 60 °C	
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)	
		Short term	10% to 95% RH (with no dew condensation) (*1)	
	Vibration resistance		4.9 m/s^2 or less	
	Shock resistance		29.4 m/s^2 or less	
	Working atmosphere		No corrosive gases, dust or oil mist	
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level	
	Power supply voltage		24 VDC	FCU8-DU142-31: 12 VDC/5 VDC/3.3 VDC FCU8-DU182-31: 12 VDC/5 VDC/3.3 VDC FCU8-DU194-31: 12 VDC/5 VDC/3.3 VDC
				(Supply from control unit)
	Current consumption		2.5 A	- (*2)
	Maximum heating value	(W)	16	FCU8-DU142-31: 10 FCU8-DU182-31: 14 FCU8-DU194-31: 33
	Mass	(kg)	1.1	FCU8-DU142-31: 1.7 FCU8-DU182-31: 4.1 FCU8-DU194-31: 5.5
	Outline dimensions W × H or W × H × D	(mm)	239.1 × 173.4 × 75	FCU8-DU142-31: 290 × 220 FCU8-DU182-31: 400 × 320 FCU8-DU194-31: 475 × 400

(*1) "Short term" means roughly within one month.

(*2) The current consumption of the display unit is included in that of the control unit.

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

(2) When the display unit is mounted on an incline, the inclination angle to place the unit should be 30 degrees or less from the vertical direction.

Item	Unit name		Keyboard unit	Operation panel I/O unit		Machine operation panel
	Type		**FCU8-KB041/KB046: (10.4-type) FCU8-KB047: (10.4-type/vertical arrangement) FCU8-KB048: (10.4-type) FCU8-KB083: (15-type/vertical arrangement) FCU8-KB091: (19-type/vertical arrangement)**	**FCU8-DX731 FCU8-DX750 FCU8-DX760 FCU8-DX761**	**FCU8-DX834**	**FCU8-KB921/KB922/KB925 FCU8-KB923/KB924/KB926 FCU8-KB931/KB941**
General specifications	Ambient temperature	During operation	0 °C to 58 °C			
		During storage	-20 °C to 60 °C			
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)			
		Short term	10% to 95% RH (with no dew condensation) (*1)			
	Vibration resistance		4.9 m/s^2 or less			
	Shock resistance		29.4 m/s^2 or less			
	Working atmosphere		No corrosive gases, dust or oil mist			
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level			
	Power supply voltage		5 VDC (Supply from control unit)	5 VDC/3.3 VDC	24 VDC	24 VDC (*4)
	Current consumption		- (*2)		0.3 A (*5)	0.3 A (*4)
	Maximum heating value	(W)	1	4 (*3)	8 (*3)	7.2
	Mass	(kg)	FCU8-KB041/KB046: 0.8 FCU8-KB047: 1.3 FCU8-KB048: 1.4 FCU8-KB083: 1.5 FCU8-KB091: 1.6	FCU8-DX731: 0.3 FCU8-DX750: 0.4 FCU8-DX760: 0.5 FCU8-DX761: 0.5	0.4	FCU8-KB921/KB922/KB925: 1.1 FCU8-KB923/KB924/KB926: 1.2 FCU8-KB931/KB941: 0.5
	Outline dimensions W × H	(mm)	FCU8-KB041/KB046: 140 × 220 FCU8-KB047: 290 × 160 FCU8-KB048: 230 × 220 FCU8-KB083: 400 × 140 FCU8-KB091: 475 × 120	116 × 179		FCU8-KB921/KB922/KB925: 260 × 140 FCU8-KB923/KB924/KB926: 290 × 140 FCU8-KB931/KB941: 140 × 140

(*1) "Short term" means roughly within one month.

(*2) The current consumption of the keyboard unit and the operation panel I/O unit (control section) are included in that of the control unit. Current consumption for the I/O circuit needs to be separately calculated based on the number of points used and its load.

(*3) For the heating value of the I/O circuit, calculate with the number of points used.

(*4) 24 V power input is not required for FCU8-KB931/KB941.

(*5) Current consumption for the I/O circuit needs to be separately calculated based on the number of points used and its load.

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

Item	Unit name		Remote I/O unit						
	Type		FCU8-DX220/ DX230/ DX231	FCU8-DX202	FCU8-DX213/ DX213-1/ DX654/ DX654-1	FCU8-DX520	FCU8-DX408	FCU8-DX409	FCU8-DX651
General specifications	Ambient temperature	During operation	0 °C to 58 °C						
		During storage	-20 °C to 60 °C						
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)						
		Short term	10% to 95% RH (with no dew condensation) (*1)						10% to 85% RH (with no dew condensation) (*1)
	Vibration resistance		4.9 m/s^2 or less						
	Shock resistance		29.4 m/s^2 or less						
	Working atmosphere		No corrosive gases, dust or oil mist						
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level						
	Power supply voltage		24 VDC						
	Current consumption		3.5 A (*2)	0.3 A	0.3 A (*3)	6.7 A (*6)	0.1 A	0.2 A	3.7 A (*2)
	Maximum heating value	(W)	8 (*4)				3	6 (*5)	8 (*4)
	Mass	(kg)	0.4				0.2	0.3	0.8
	Outline dimensions W × H × D	(mm)	40 × 175 × 133	40 × 175 × 119	40 × 175 × 130	40 × 175 × 134	40 × 175 × 109	40 × 175 × 130	104 × 175 × 115

(*1) "Short term" means roughly within one month.
(*2) This value includes the maximum value of DO external load current (3.2 A).
(*3) This value does not include DO external load current.
(*4) For the heating value of the I/O circuit, calculate with the number of points used.
(*5) The maximum value including the heating value of analog input circuit.
(*6) This value includes the maximum value of DO external load current (6.4 A).

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

Item	Unit name		Laser I/F unit
	Type		FCU8-DX522-001
General specifications	Ambient temperature	During operation	0 °C to 58 °C
		During storage	-20 °C to 60 °C
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)
		Short term	10% to 95% RH (with no dew condensation) (*1)
	Vibration resistance		4.9 m/s^2 or less
	Shock resistance		29.4 m/s^2 or less
	Working atmosphere		No corrosive gases, dust or oil mist
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level
	Power supply voltage		24 VDC
	Current consumption		0.3 A (*2)
	Maximum heating value	(W)	8 (*3)(*4)
	Mass	(kg)	0.4
	Outline dimensions W × H × D	(mm)	40 × 175 × 133

(*1) "Short term" means roughly within one month.
(*2) This value does not include DO external load current.
(*3) For the heating value of the I/O circuit, calculate with the number of points used.
(*4) The maximum value including the heating value of analog input circuit.

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

4.1.2 24 VDC Stabilized Power Supply Selecting Conditions

Consider the following characteristics for the stabilized power supply, and select the power supply that complies with laws, regulations, or safety standards of the country where the machine will be installed.

Item		Specifications	Remarks
Output	Voltage	24 VDC	When the stabilized power supply and 24 VDC input unit are distant, select the stabilized power supply which is possible to set output voltage 24 VDC or more allowing for the influence of voltage down by the cable.
	Voltage fluctuation	±5%	
	Current	-	Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
	Ripple noise	0.2 V (P-P)	
	Output holding time	min 20ms	Output holding time is decided by loading ratio; however, the stabilized power supply which complies with the specification on the left must be selected during maximum loading.
	Overcurrent output shutoff function	-	Use a power supply having the overcurrent output shutoff function.

⚠ CAUTION

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

4.2 Environment Conditions [M80V]

4.2.1 Installation Environment Conditions

Item	Unit name		Control unit	Display unit
	Type		FCU8-MU521/MU522	FCU8-DU122-12: (8.4-type) FCU8-DU142-32: (10.4-type) FCU8-DU182-32: (15-type) FCU8-DU194-32: (19-type)
General specifications	Ambient temperature	During operation	0 °C to 58 °C	
		During storage	-20 °C to 60 °C	
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)	
		Short term	10% to 95% RH (with no dew condensation) (*1)	
	Vibration resistance		4.9 m/s^2 or less	
	Shock resistance		29.4 m/s^2 or less	
	Working atmosphere		No corrosive gases, dust or oil mist	
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level	
	Power supply voltage		24 VDC	FCU8-DU122-12: 12 VDC/3.3 VDC FCU8-DU142-32: 12 VDC/5 VDC/3.3 VDC FCU8-DU182-32: 12 VDC/5 VDC/3.3 VDC FCU8-DU194-32: 12 VDC/5 VDC/3.3 VDC
				(Supplied from control unit)
	Current consumption		2.5 A	- (*2)
	Maximum heating value	(W)	12	FCU8-DU122-12: 8 FCU8-DU142-32: 10 FCU8-DU182-32: 14 FCU8-DU194-32: 33
	Mass	(kg)	1.1	FCU8-DU122-12: 1.2 FCU8-DU142-32: 1.7 FCU8-DU182-32: 4.1 FCU8-DU194-32: 5.5
	Outline dimensions W × H or W × H × D	(mm)	239.1 × 173.4 × 75	FCU8-DU122-12: 260 × 200 FCU8-DU142-32: 290 × 220 FCU8-DU182-32: 400 × 320 FCU8-DU194-32: 475 × 400

(*1) "Short term" means roughly within one month.

(*2) The current consumption of the display unit is included in that of the control unit.

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

(2) When the display unit is mounted on an incline, the inclination angle to place the unit should be 30 degrees or less from the vertical direction.

Item	Unit name		Keyboard unit	Operation panel I/O unit		Machine operation panel
	Type		**FCU8-KB026/KB028: (8.4-type) FCU8-KB029: (8.4-type/vertical arrangement) FCU8-KB041/KB046: (10.4-type) FCU8-KB047: (10.4-type/vertical arrangement) FCU8-KB048: (10.4-type) FCU8-KB083: (15-type/vertical arrangement) FCU8-KB091: (19-type/vertical arrangement)**	**FCU8-DX731 FCU8-DX750 FCU8-DX760 FCU8-DX761**	**FCU8-DX834**	**FCU8-KB921/KB922/KB925 FCU8-KB923/KB924/KB926 FCU8-KB931/KB941**
General specifications	Ambient temperature	During operation	0 °C to 58 °C			
		During storage	-20 °C to 60 °C			
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)			
		Short term	10% to 95% RH (with no dew condensation) (*1)			
	Vibration resistance		4.9 m/s^2 or less			
	Shock resistance		29.4 m/s^2 or less			
	Working atmosphere		No corrosive gases, dust or oil mist			
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level			
	Power supply voltage		5 VDC (Supply from control unit)	5 VDC/3.3 VDC	24 VDC	24 VDC (*4)
	Current consumption		- (*2)		0.3 A (*5)	0.3 A (*4)
	Maximum heating value	(W)	1	4 (*3)	8 (*3)	7.2
	Mass	(kg)	FCU8-KB026/KB028: 0.75 FCU8-KB029: 1.0 FCU8-KB041/KB046: 0.8 FCU8-KB047: 1.3 FCU8-KB048: 1.4 FCU8-KB083: 1.5 FCU8-KB091: 1.6	FCU8-DX731: 0.3 FCU8-DX750: 0.4 FCU8-DX760: 0.5 FCU8-DX761: 0.5	0.4	FCU8-KB921/KB922/KB925: 1.1 FCU8-KB923/KB924/KB926: 1.2 FCU8-KB931/KB941: 0.5
	Outline dimensions W × H	(mm)	FCU8-KB026/KB028: 140 × 200 FCU8-KB029: 260 × 140 FCU8-KB041/KB046: 140 × 220 FCU8-KB047: 290 × 160 FCU8-KB048: 230 × 220 FCU8-KB083: 400 × 140 FCU8-KB091: 475 × 120	116 × 179		FCU8-KB921/KB922/KB925: 260 × 140 FCU8-KB923/KB924/KB926: 290 × 140 FCU8-KB931/KB941: 140 × 140

(*1) "Short term" means roughly within one month.

(*2) The current consumption of the keyboard unit and the operation panel I/O unit (control section) are included in that of the control unit. Current consumption for the I/O circuit needs to be separately calculated based on the number of points used and its load.

(*3) For the heating value of the I/O circuit, calculate with the number of points used.

(*4) 24 V power input is not required for FCU8-KB931/KB941.

(*5) Current consumption for the I/O circuit needs to be separately calculated based on the number of points used and its load.

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

Item	Unit name		Remote I/O unit						
	Type		FCU8-DX220/ DX230/ DX231	FCU8-DX202	FCU8-DX213/ DX213-1/ DX654/ DX654-1	FCU8-DX520	FCU8-DX408	FCU8-DX409	FCU8-DX651
General specifications	Ambient temperature	During operation	0 °C to 58 °C						
		During storage	-20 °C to 60 °C						
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)						
		Short term	10% to 95% RH (with no dew condensation) (*1)						10% to 85% RH (with no dew condensation) (*1)
	Vibration resistance		4.9 m/s^2 or less						
	Shock resistance		29.4 m/s^2 or less						
	Working atmosphere		No corrosive gases, dust or oil mist						
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level						
	Power supply voltage		24 VDC						
	Current consumption		3.5 A (*2)	0.3 A	0.3 A (*3)	6.7 A (*6)	0.1 A	0.2 A	3.7 A (*2)
	Maximum heating value	(W)	8 (*4)				3	6 (*5)	8 (*4)
	Mass	(kg)	0.4				0.2	0.3	0.8
	Outline dimensions W × H × D	(mm)	40 × 175 × 133	40 × 175 × 119	40 × 175 × 130	40 × 175 × 134	40 × 175 × 109	40 × 175 × 130	104 × 175 × 115

(*1) "Short term" means roughly within one month.
(*2) This value includes the maximum value of DO external load current (3.2 A).
(*3) This value does not include DO external load current.
(*4) For the heating value of the I/O circuit, calculate with the number of points used.
(*5) The maximum value including the heating value of analog input circuit.
(*6) This value includes the maximum value of DO external load current (6.4 A).

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

Item	Unit name		Laser I/F unit
	Type		FCU8-DX522-001
General specifications	Ambient temperature	During operation	0 °C to 58 °C
		During storage	-20 °C to 60 °C
	Ambient humidity	Long term	10% to 75% RH (with no dew condensation)
		Short term	10% to 95% RH (with no dew condensation) (*1)
	Vibration resistance		4.9 m/s^2 or less
	Shock resistance		29.4 m/s^2 or less
	Working atmosphere		No corrosive gases, dust or oil mist
	Altitude		Operation/Storage: 1000 meters or less above sea level, Transportation: 13000 meters or less above sea level
	Power supply voltage		24 VDC
	Current consumption		0.3 A (*2)
	Maximum heating value	(W)	8 (*3)(*4)
	Mass	(kg)	0.4
	Outline dimensions W × H × D	(mm)	40 × 175 × 133

(*1) "Short term" means roughly within one month.
(*2) This value does not include DO external load current.
(*3) For the heating value of the I/O circuit, calculate with the number of points used.
(*4) The maximum value including the heating value of analog input circuit.

Note

(1) For the whole NC system, consider the characteristics of the drive units when the altitude is more than 1000 meters above sea level.
Refer to the manual of drive unit for details.

4.2.2 24 VDC Stabilized Power Supply Selecting Conditions

Consider the following characteristics for the stabilized power supply, and select the power supply that complies with laws, regulations, or safety standards of the country where the machine will be installed.

Item		Specifications	Remarks
Output	Voltage	24 VDC	When the stabilized power supply and 24 VDC input unit are distant, select the stabilized power supply which is possible to set output voltage 24 VDC or more allowing for the influence of voltage down by the cable.
	Voltage fluctuation	±5%	
	Current	-	Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
	Ripple noise	0.2 V (P-P)	
	Output holding time	min 20ms	Output holding time is decided by loading ratio; however, the stabilized power supply which complies with the specification on the left must be selected during maximum loading.
	Overcurrent output shutoff function	-	Use a power supply having the overcurrent output shutoff function.

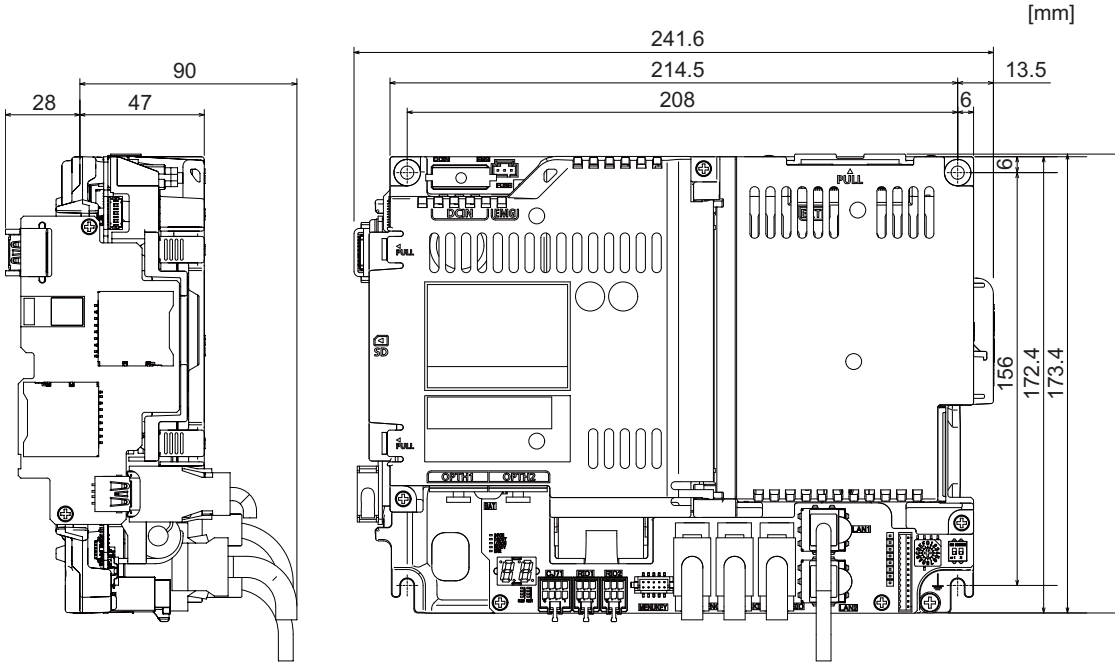
⚠ CAUTION

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

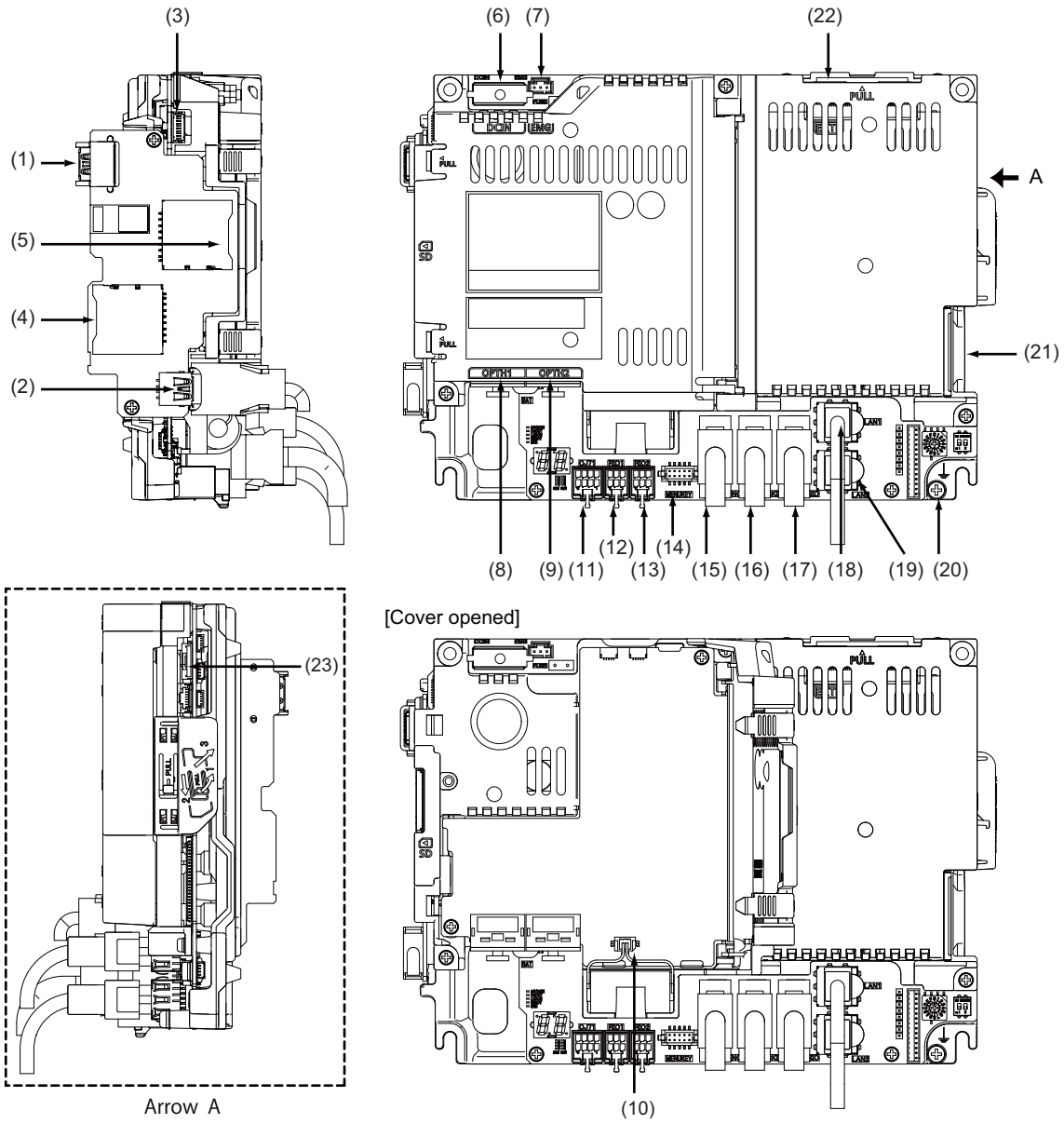
4.3 Control Unit [M800VS]

4.3.1 FCU8-MU551 / FCU8-MA551

Outline dimensions



Connector



No.	Connector name	Function		No.	Connector name	Function
(1)	USB_F	Front-side USB memory I/F		(13)	RIO2	Remote I/O 2.0 communication
(2)	USB_B			(14)	MENUKEY	Menu key I/F
(3)	BL	Display unit backlight I/F		(15)	ENC	Encoder input 1 ch (5 V manual pulse generator input 2 ch)
(4)	SDC_F	Front-side SD card I/F		(16)	SKIP	SKIP input 8 points
(5)	SDC_B	Back-side SD card I/F		(17)	SIO	RS-232C communication 2 ch
(6)	DCIN	24 VDC input		(18)	LAN1	Ethernet communication
(7)	EMG	External emergency stop input		(19)	LAN2	System reserved
(8)	OPTH1	High-speed optical servo communication		(20)	FG	FG terminal
(9)	OPTH2	High-speed optical servo communication		(21)	LCD	Display unit signal I/F
(10)	BAT	Battery I/F		(22)	EXT_P	Function expansion unit I/F
(11)	CJ71	Operation panel I/O unit I/F		(23)	TP	Touch panel I/F
(12)	RIO1	Remote I/O 2.0 communication				

⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

⚠ The 12 V/5 V/3.3 V output from the connector is used only to supply power to dedicated peripheral devices. If it is used to power other devices, NC operation may be guaranteed due to voltage drops or wraparound noise. Do not use it to supply power to other devices.

(1) USB_F (Front-side USB memory I/F)

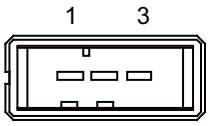
(2) USB_B

(3) BL (Display unit backlight I/F)

(4) SDC_F (Front-side SD card I/F)

(5) SDC_B (Back-side SD card I/F)

(6) DCIN (24 VDC input)



1	I	+24 V
2		0 V
3		FG

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

[Power supply specifications]
Consider the following selection items when selecting the stabilized power supply (supplied by the machine tool 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
Output	**Voltage fluctuation**	±5% or less of 24 VDC
	Ripple noise	200 mV (P-P)
Power capacity		Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
Output holding time		20 ms
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

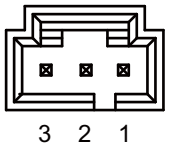
Note

- 24 VDC voltage may drop instantaneously due to rush current at the beginning of 24 V 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

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

(7) EMG (External emergency stop input)



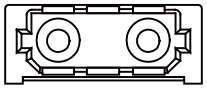
1		FG
2	I	EMG IN
3	O	+24 V

<Cable side connector type>
Connector: 50-57-9403
Contact: 0016020103
Manufacturer: MOLEX

Note

- Use this when installing an emergency stop switch in the electric cabinet. When this connector is not used, connect a terminator connector (G123 cable).

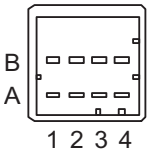
(8) OPTH1 (High-speed optical servo communication 1st ch)
(9) OPTH2 (High-speed optical servo communication 2nd ch)



<Cable side connector type>
Connector: LGP-Z0007K
Manufacturer: HONDA TSUSHIN KOGYO

(10) BAT (Battery I/F)

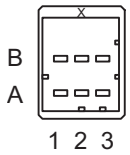
(11) CJ71 (Operation panel I/O unit I/F)



A1	I/O	TXRXD	B1	I/O	TXRXD*
A2	-	+5 V	B2	-	+3.3 V
A3	-	-	B3	-	0 V
A4	-	FG	B4	-	0 V

<Cable side connector type>
Connector: 2-1318119-4
Contact: 1318107-1
Manufacturer: TE Connectivity

(12) RIO1 (Remote I/O 2.0 communication 1st ch)
(13) RIO2 (Remote I/O 2.0 communication 2nd ch)
Up to 64 remote I/O stations can be connected.



A			B		
1	I/O	TXRXD	**1**	I/O	TXRXD*
2		NC	**2**		0 V
3		FG	**3**		NC

<Cable side connector type>
Connector: 1-1318119-3
Contact: 1318107-1
Manufacturer: TE Connectivity

[Connecting a pulse-controlled inverter [M80V]]

For M80V, RIO1 and RIO2 connectors can be used as interfaces to output pulses. With this function, you can connect a pulse-controlled inverter with RS422 interface to M80V.

Note

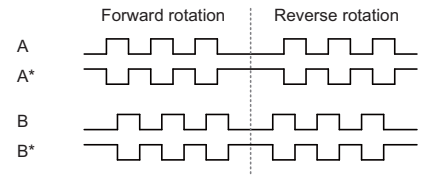
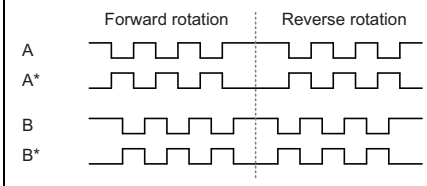
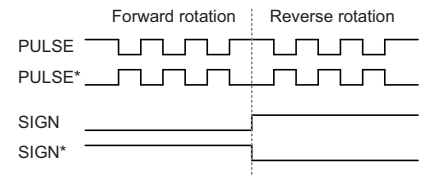
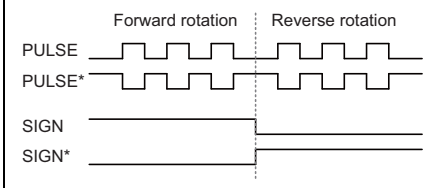
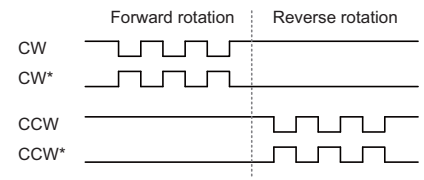
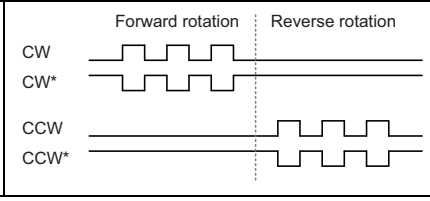
- When you use a function with pulse output, remote I/O unit cannot be connected to the RIO1 and RIO2 connectors.
- When you use a function with pulse output, BiSS encoder and EcoMonitorLight cannot be connected to the RIO2 connector.

RIO1						RIO2					
A			B			A			B		
1	O	A/PULSE/CW	**1**	O	A*/PULSE*/CW*	**1**	O	B/SIGN/CCW	**1**	O	B*/SIGN*/CCW*
2		NC	**2**		0 V	**2**		NC	**2**		0 V
3		FG	**3**		NC	**3**		FG	**3**		NC

<Pulse output specifications>

Number of control axes		One axis
Pulse output mode (*1)		A phase/B phase, PULSE/SIGN, CW/CCW
Pulse output frequency		1 to 4,000,000 pulses per second
Pulse output signal		RS422 differential driver output
Signal voltage	**Differential output voltage**	2.0 V or greater
	Common mode output voltage	3.0 V or less
Output current		250 mA in maximum
Cable length		30 meters or less

(*1) The output signal logic type can be selected with the logic selecting function.

Pulse output mode	Positive logic	Negative logic
A phase/B phase		
PULSE/SIGN		
CW/CCW		

[Connecting a BiSS encoder]

RIO2 connector and ENC connector can be used as BiSS interface. This enables you to connect a BiSS encoder with RS422 interface.

Note

- When the BiSS encoder is connected, the remote I/O unit, the pulse-controlled inverter, and the EcoMonitorLight cannot be connected to the RIO2 connector.

RIO2					
A			B		
1	O	MA+	**1**	O	MA-
2		NC	**2**		0V
3		FG	**3**		NC

<Cable side connector type>
Connector: 1-1318119-3
Contact: 1318108-1
Manufacturer: TE Connectivity

<BiSS interface specifications>

Connectable number		One piece
Protocol		BiSS C (*1)
Transmission		625 kbps to 5 Mbps
Output signal		RS422 differential driver output
Output signal voltage	**Differential output voltage**	2.0 V or greater
	Common mode output voltage	3.0 V or less
Output current		250 mA in maximum
Input signal		RS422 differential driver input
Input signal voltage	**Differential input voltage**	0.2 V or greater
	Input voltage range	0 V to 5.25 V
Cable length		30 m or less

(*1) Access to the slave register is not supported.

[Connecting an EcoMonitorLight]

EcoMonitorLight can be connected to the RIO2 connector.

Note

- When the EcoMonitorLight is connected, the remote I/O unit, the pulse-controlled inverter, and the BiSS encoder cannot be connected to the RIO2 connector.

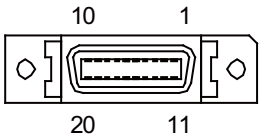
RIO2					
A			B		
1	I/O	485+	**1**	I/O	485-
2		NC	**2**		NC
3		SLD	**3**		NC

<Cable side connector type>
Connector: 1-1318119-3
Contact: 1318107-1
Manufacturer: TE Connectivity

(14) MENUKEY (Menu key I/F)

(15) ENC Encoder input 1 ch, 5 V manual pulse generator input 2 ch)

Synchronous feed encoder or 5 V manual pulse generator can be connected to this connector.



1		0 V	**11**		0 V
2	I	ENC1Z	**12**	I	ENC1Z*
3	I	ENC1B	**13**	I	ENC1B*
4	I	ENC1A	**14**	I	ENC1A*
5		0 V	**15**		0 V
6	O	+5 V	**16**	O	+5 V
7	I	HA2A	**17**	I	HA2B
8	I	HA1A	**18**	I	HA1B
9		NC	**19**		NC
10	O	+5 V	**20**	O	+5 V

- Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

Note

- When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
  (Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)
- Both the synchronous feed encoder and the manual pulse generator can be connected at the same time.
  (In this case, the cables must be prepared by the machine tool builder.)

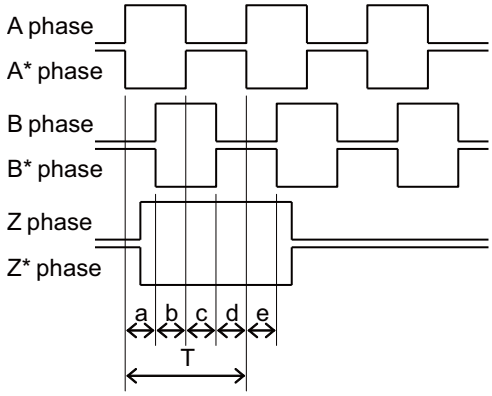
[Input for synchronous feed encoder]

Note

- When a synchronous feed encoder is connected, a BiSS encoder cannot be connected.

<Specification of input part>

Number of pulse phases		Three phases (A phase, B phase, a phase difference 90 degrees, Z phase) (Refer to the waveform below.)
Signal output of the encoder		RS422 differential driver output
Signal voltage	**Differential input voltage**	0.2 V or greater
	Input voltage range	0 V to 5.25 V
Power supply voltage		5 VDC ±10%
Current consumption		200 mA or less
Number of pulses per rotation		1024 pulse/rev (However, any pulse can be set when the external encoder position output I/F function is used.)
Input frequency (rotation speed)		136 kHz or less (8000 r/min or less)
Cable length		50 m or less

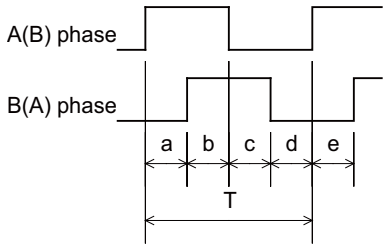


a, b, c, d and e: A phase or B phase rising edge (falling edge) phase difference = T/4 ± T/10

[Input for 5 V manual pulse generator]

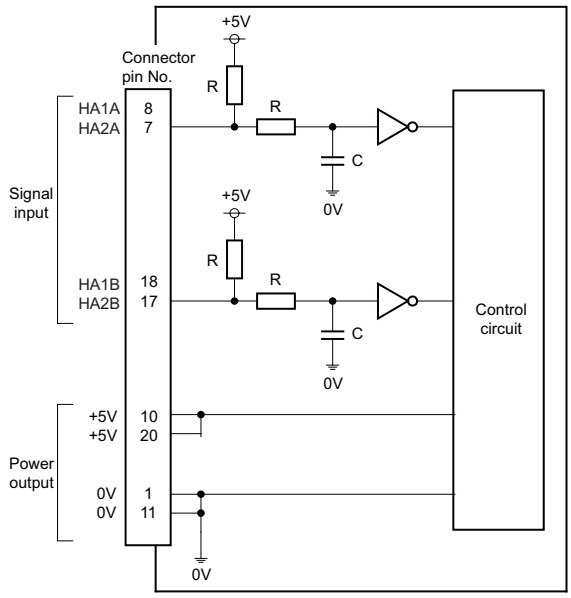
<Specification of input part>

Number of pulse phases	Two phases (A phase, B phase, a phase difference 90 degrees) (Refer to the waveform below.)
Signal output of manual pulse generator	Voltage output, open collector output
Signal voltage	H level 3.5 V to 5.25 V L level 0 V to 0.5 V
Power supply voltage	5 VDC ±10%
Current consumption	100 mA or less
Number of pulses per rotation	25 pulse/rev, 100 pulse/rev
Input frequency (rotation speed)	1 kHz or less (2400 rpm or less for 25 pulses/rev, 600 rpm or less for 100 pulses/rev)
Cable length	20 m or less



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

<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.

[Connecting a BiSS encoder]

Refer to [Connecting a BiSS encoder] in (13) for the BiSS encoder specifications.

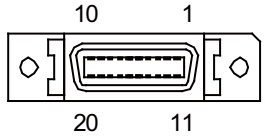
Note

- When the BiSS encoder is connected, the synchronous feed encoder cannot be connected.

1		0V	**11**		0V
2		NC	**12**		NC
3		NC	**13**		NC
4	I	SL+	**14**	I	SL-
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

HA1A, HA1B, HA2A, and HA2B are signals for the manual pulse generator.
They are used when the BiSS encoder and the manual pulse generator are connected at the same time.

(16) SKIP (SKIP input 8 points)



1		COM GND	**11**		COM GND
2	I	SKIP IN1	**12**	I	SKIP IN2
3	I	SKIP IN3	**13**	I	SKIP IN4
4		NC	**14**		NC
5		COM GND	**15**		COM GND
6		NC	**16**		NC
7	I	SKIP IN5	**17**	I	SKIP IN6
8	I	SKIP IN7	**18**	I	SKIP IN8
9		NC	**19**		NC
10		NC	**20**		NC

- Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

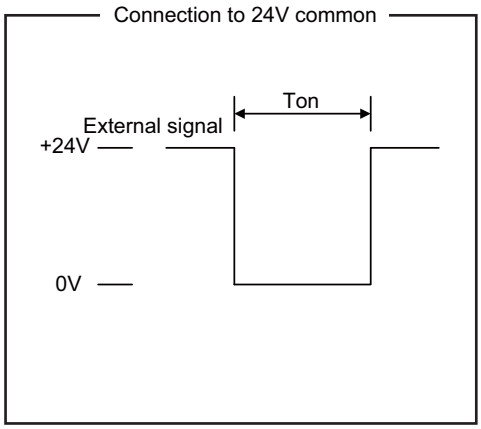
Note

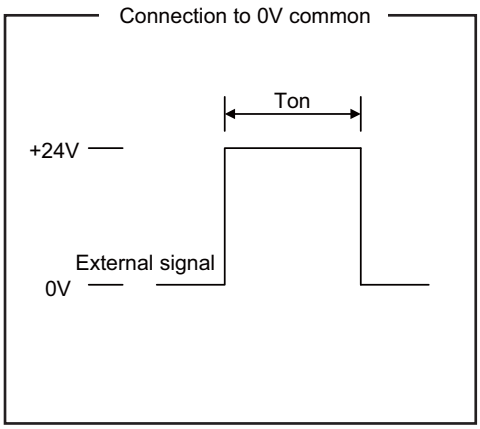
- When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
  (Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

[Skip signal input conditions]

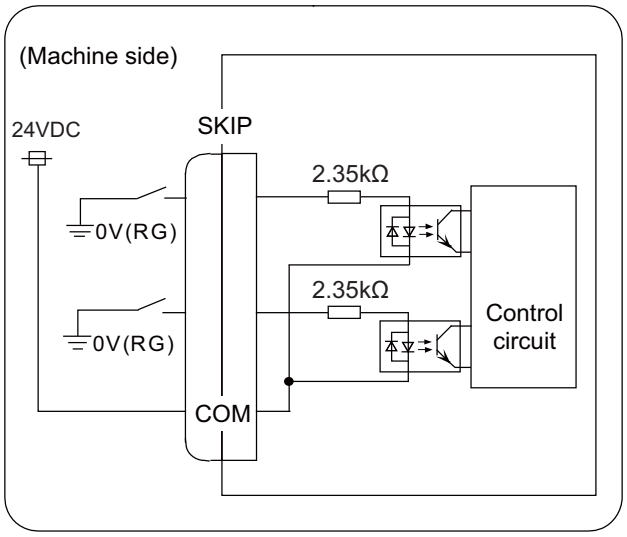
Use the input signal within the following condition ranges.

		24 V common	0 V common
1	**Input voltage at external contact ON**	6 V or less	18 V or more, 25.2 V or less
2	**Input current at external contact ON**	6 mA or more	
3	**Input voltage at external contact OFF**	20 V or more, 25.2 V or less	4 V or less
4	**Input current at external contact OFF**	2 mA or less	
5	**Input resistance**	2.35 kΩ	
6	**Input signal holding time (Ton)**	2 ms or more	
7	**Internal response time**	0.08 ms or less	
8	**Machine side contact capacity**	+30 V or more, 16 mA or more	

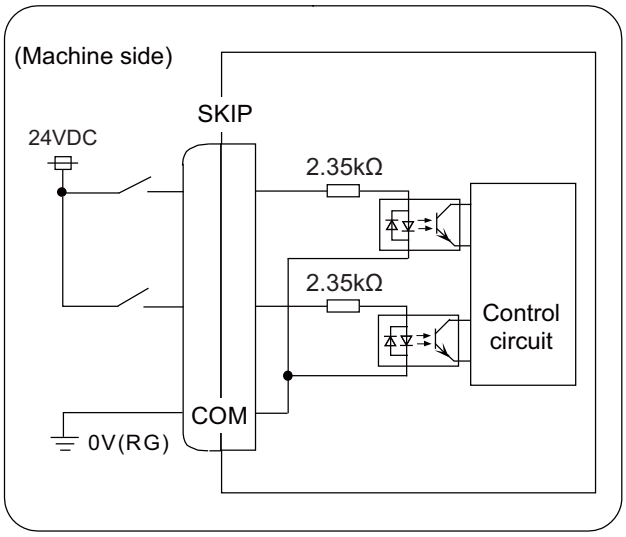




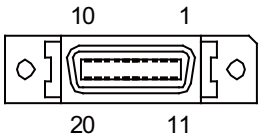
Connection to 24V common



Connection to 0V common



(17) SIO (RS-232C communication 2 ch)



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

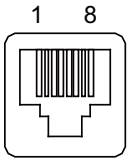
- Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

Note

- When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
  (Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

(18) LAN1 (Ethernet communication)



1	I/O	TXRXD0+
2	I/O	TXRXD0-
3	I/O	TXRXD1+
4	I/O	TXRXD2+
5	I/O	TXRXD2-
6	I/O	TXRXD1-
7	I/O	TXRXD3+
8	I/O	TXRXD3-

- Connect connector case with FG pattern.
- Use J303 cable when directly connecting a device such as a personal computer to the unit.

<Cable side connector type>
Connector: J00026A0165
Manufacturer: Japan Telegärtner

(19) LAN2 (System reserved)

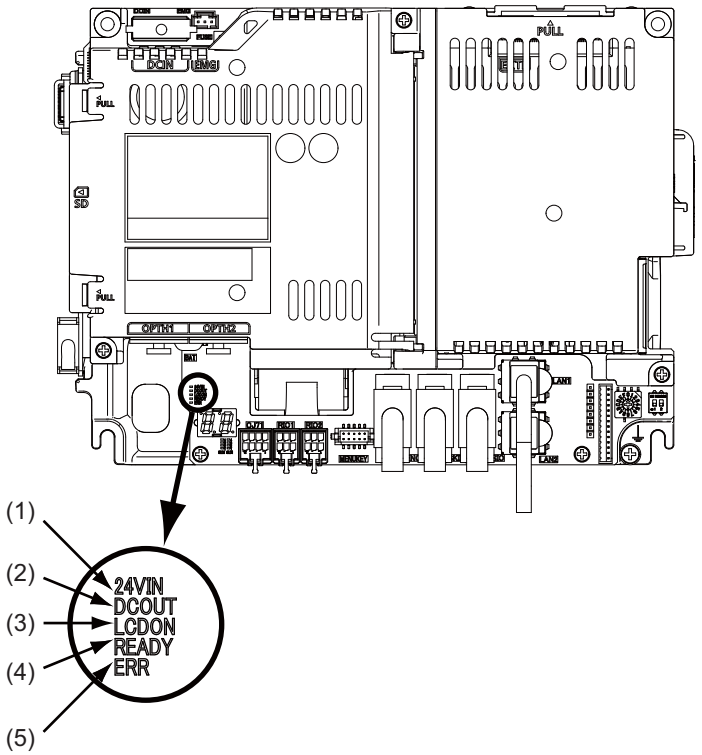
(20) FG (FG terminal)

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

(22) EXT_P (Function expansion unit I/F)

(23) TP (Touch panel I/F)

LED

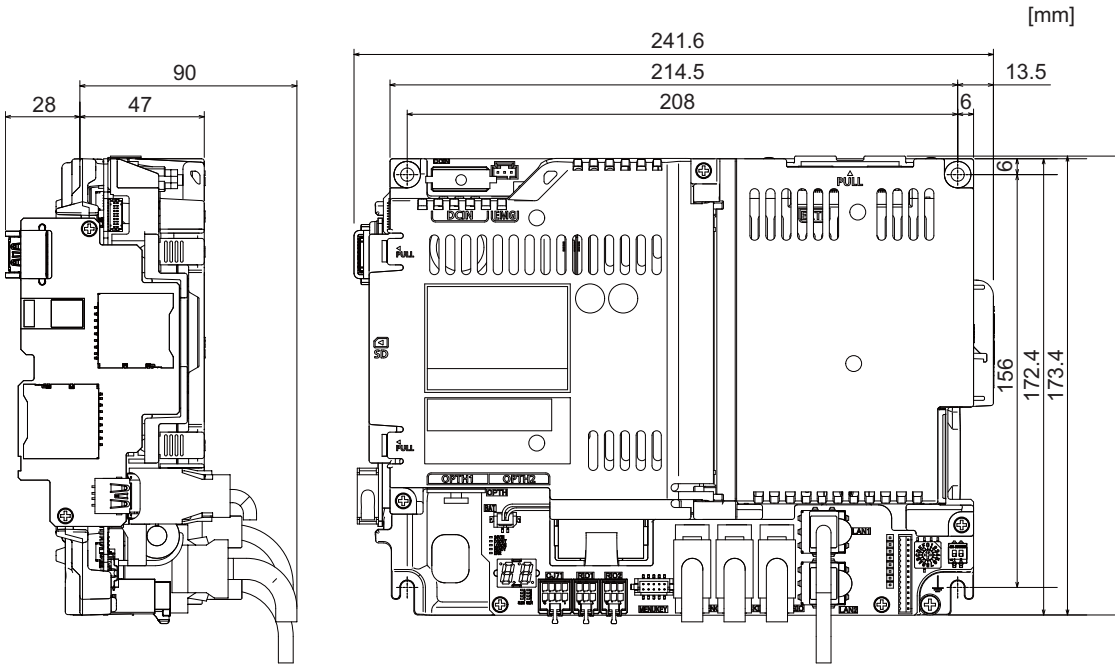


No.	Name	Lamp state	Details
(1)	24VIN	Lit (Green)	24 VDC power is being supplied from the external power supply.
		Not lit	The followings may have caused an error: • No 24 VDC-power supply from the external power supply. • Disconnection of fuse near DCIN connector. • Failure of LED.
(2)	DCOUT	Lit (Green)	Internal voltage is normally output.
		Not lit	The followings may have caused an error: • 24 V-power is not being supplied from the external power supply. • Failure in any of the power output circuits. • Failure of LED or IC which helps turn the LED ON.
(3)	LCDON	Lit (Green)	12 VDC for the backlight of display unit is normally output.
		Not lit	The followings may have caused an error: • Failure of 12 VDC output in control unit. • 24 VDC input voltage is +20 V or less.
(4)	READY	Lit (Green)	Ready ON state.
		Not lit	Ready OFF state.
(5)	ERR	Lit (Red)	H/W is not operating properly. The followings may have caused an error: • NC watchdog error. • Failure of main CPU card.
		Not lit	H/W is operating properly.

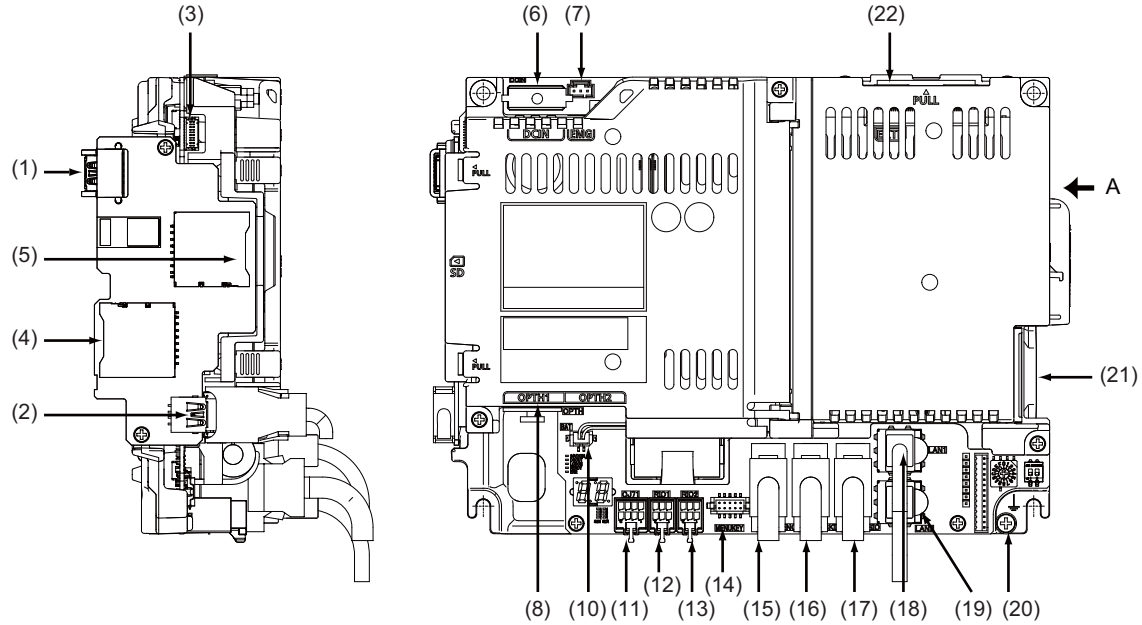
4.4 Control Unit [M80V]

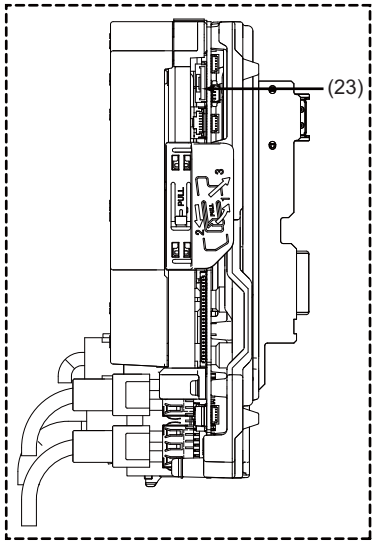
4.4.1 FCU8-MU521 / FCU8-MU522

Outline dimensions



Connector





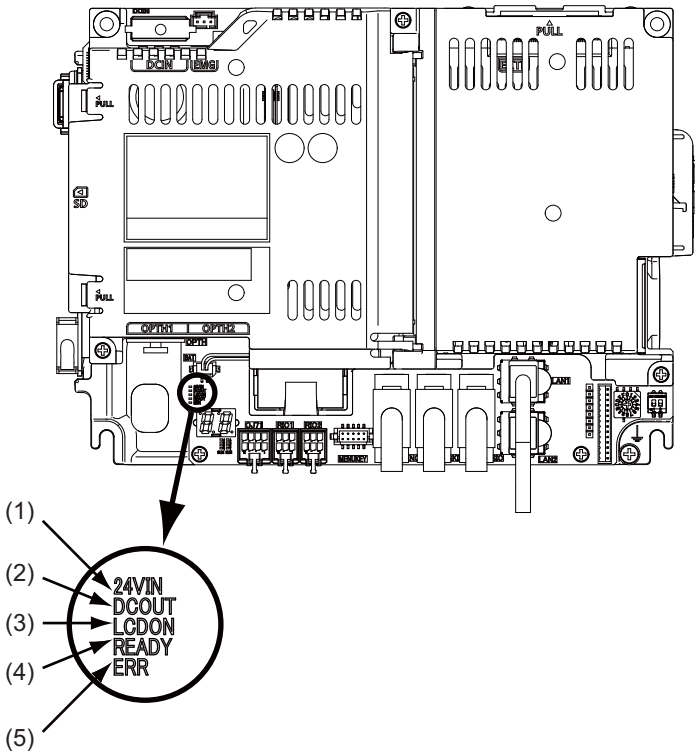
Arrow A

No.	Connector name	Function		No.	Connector name	Function
(1)	USB_F	Front-side USB memory I/F		(13)	RIO2	Remote I/O 2.0 communication
(2)	USB_B			(14)	MENUKEY	Menu key I/F
(3)	BL	Display unit backlight I/F		(15)	ENC	Encoder input 1 ch (5 V manual pulse generator input 2 ch)
(4)	SDC_F	Front-side SD card I/F		(16)	SKIP	SKIP input 8 points
(5)	SDC_B	Back-side SD card I/F		(17)	SIO	RS-232C communication 2 ch
(6)	DCIN	24 VDC input		(18)	LAN1	Ethernet communication
(7)	EMG	External emergency stop input		(19)	LAN2	System reserved
(8)	OPTH1	High-speed optical servo communication		(20)	FG	FG terminal
(10)	BAT	Battery I/F		(21)	LCD	Display unit signal I/F
(11)	CJ71	Operation panel I/O unit I/F		(22)	EXT_P	Function expansion unit I/F
(12)	RIO1	Remote I/O 2.0 communication		(23)	TP	Touch panel I/F

Note

- Refer to "4.3 Control Unit [M800VS]" for details on the connectors.

LED

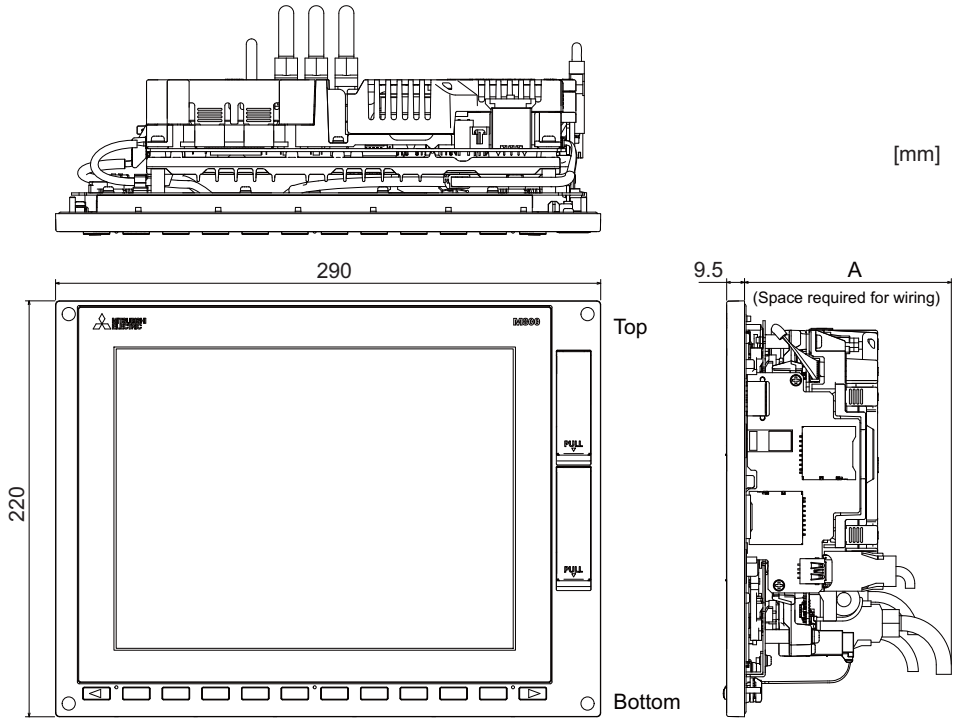


No.	Name	Lamp state	Details
(1)	24VIN	Lit (Green)	24 VDC power is being supplied from the external power supply.
		Not lit	The followings may have caused an error: • No 24 VDC-power supply from the external power supply. • Disconnection of fuse near DCIN connector. • Failure of LED.
(2)	DCOUT	Lit (Green)	Internal voltage is normally output.
		Not lit	The followings may have caused an error: • 24 V-power is not being supplied from the external power supply. • Failure in any of the power output circuits. • Failure of LED or IC which helps turn the LED ON.
(3)	LCDON	Lit (Green)	12 VDC for the backlight of display unit is normally output.
		Not lit	The followings may have caused an error: • Failure of 12 VDC output in control unit. • 24 VDC input voltage is +20 V or less.
(4)	READY	Lit (Green)	Ready ON state.
		Not lit	Ready OFF state.
(5)	ERR	Lit (Red)	H/W is not operating properly. The followings may have caused an error: • NC watchdog error. • Failure of main CPU card.
		Not lit	H/W is operating properly.

4.5 Display Unit [M800VS]

4.5.1 10.4-type (FCU8-DU142-31)

Outline dimensions

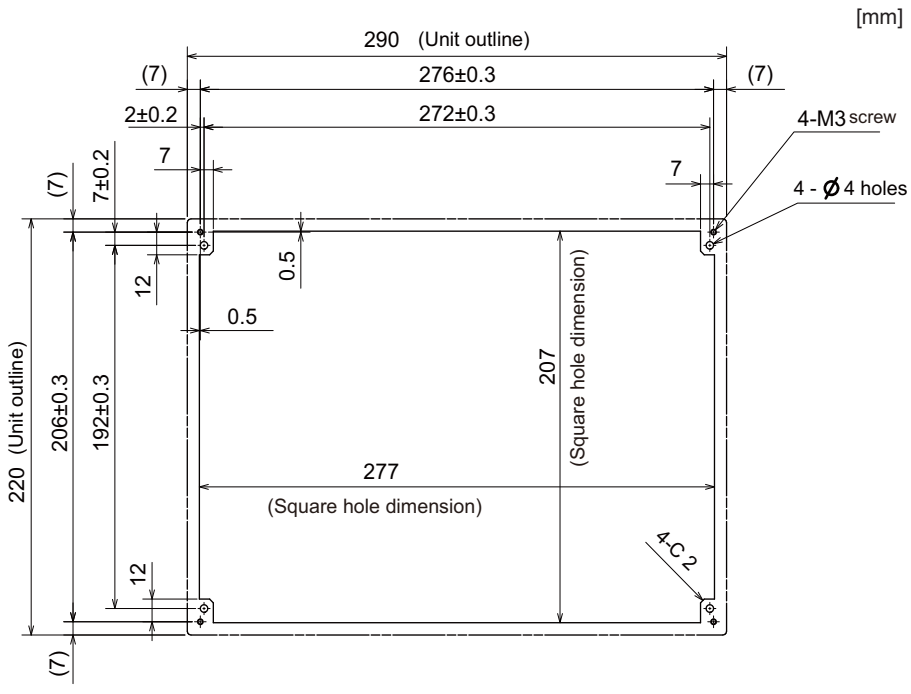


	Option relay unit not mounted	Option relay unit FCU8-EX704 mounted	Option relay unit FCU8-EX705 mounted
A (Space required for wiring)	110		114

Note

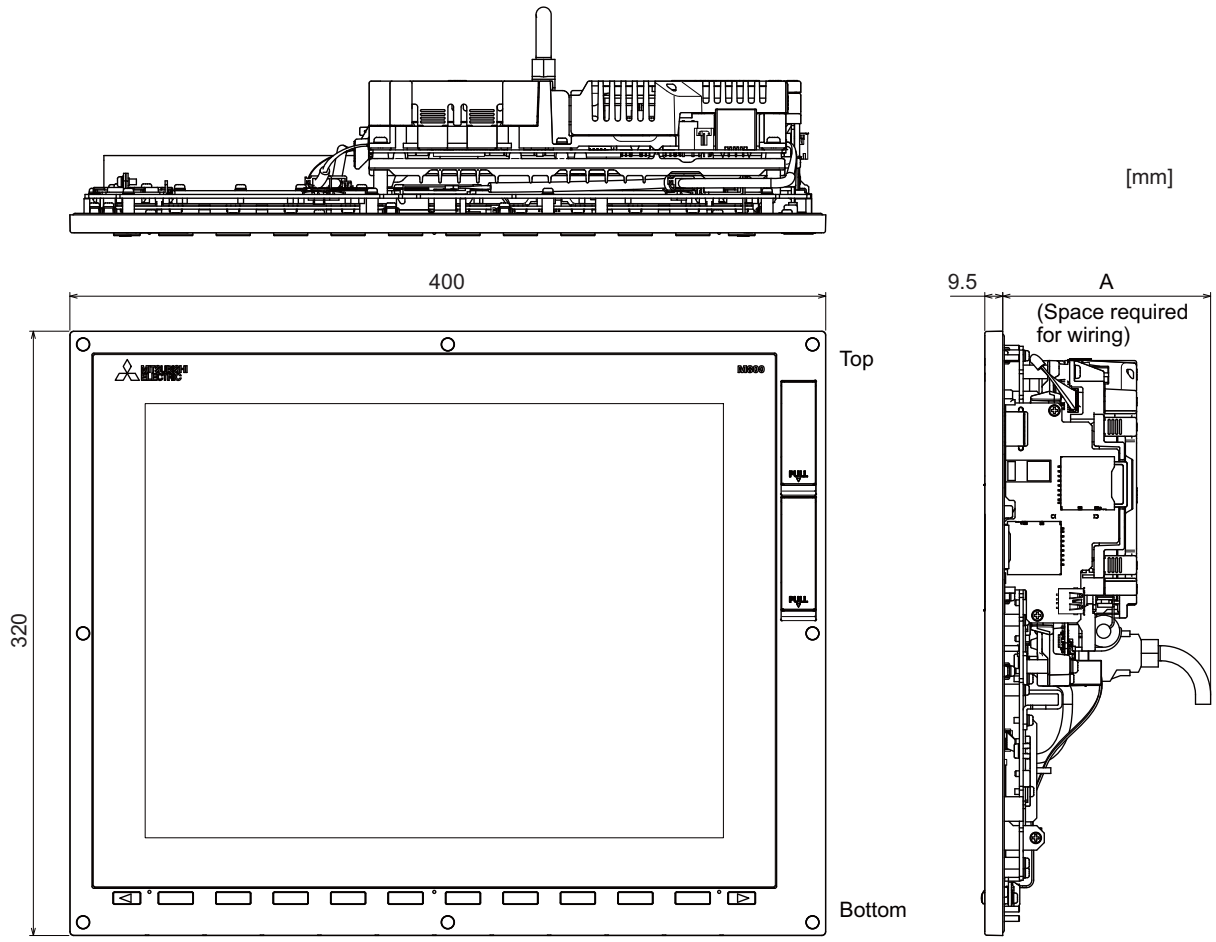
(1) The figure above shows the state with the control unit mounted.

Panel cut dimensions



4.5.2 15-type (FCU8-DU182-31)

Outline dimensions

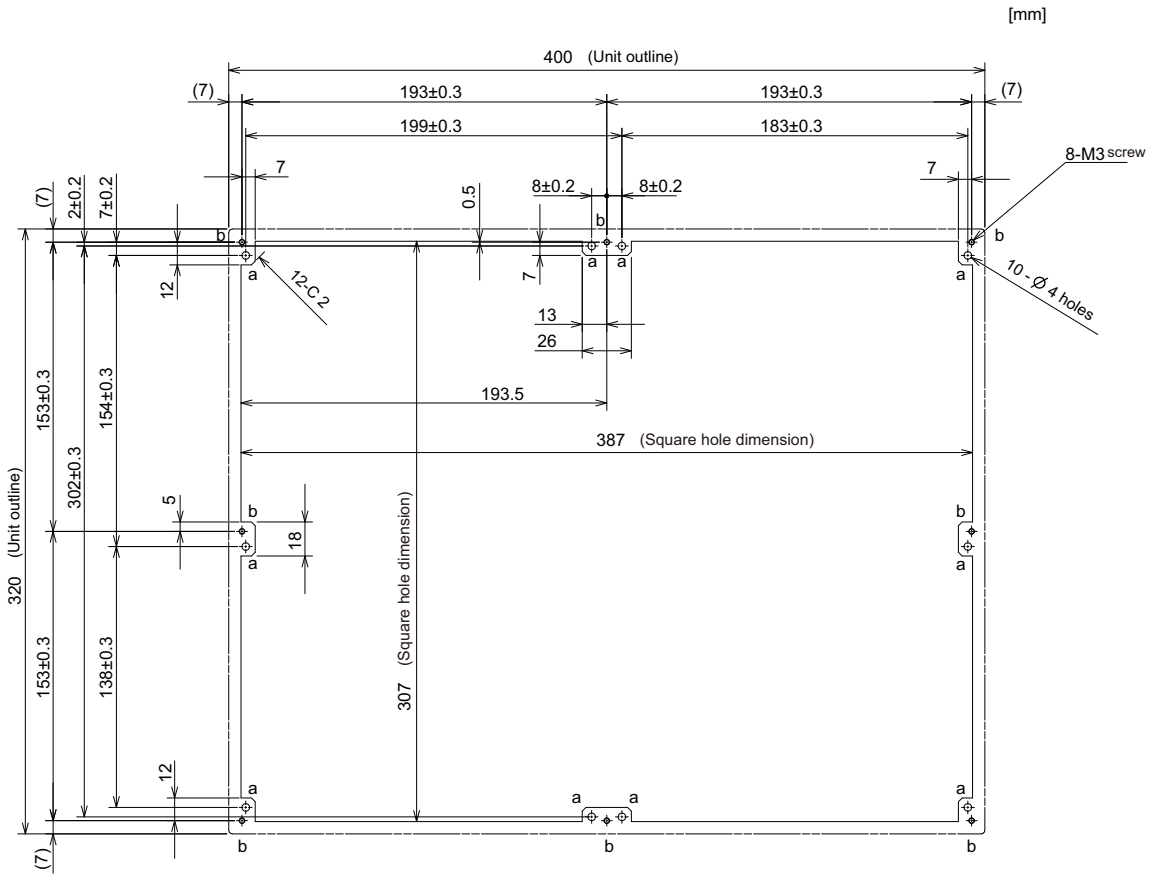


	Option relay unit not mounted	Option relay unit FCU8-EX704 mounted	Option relay unit FCU8-EX705 mounted
A (Space required for wiring)	110		114

Note

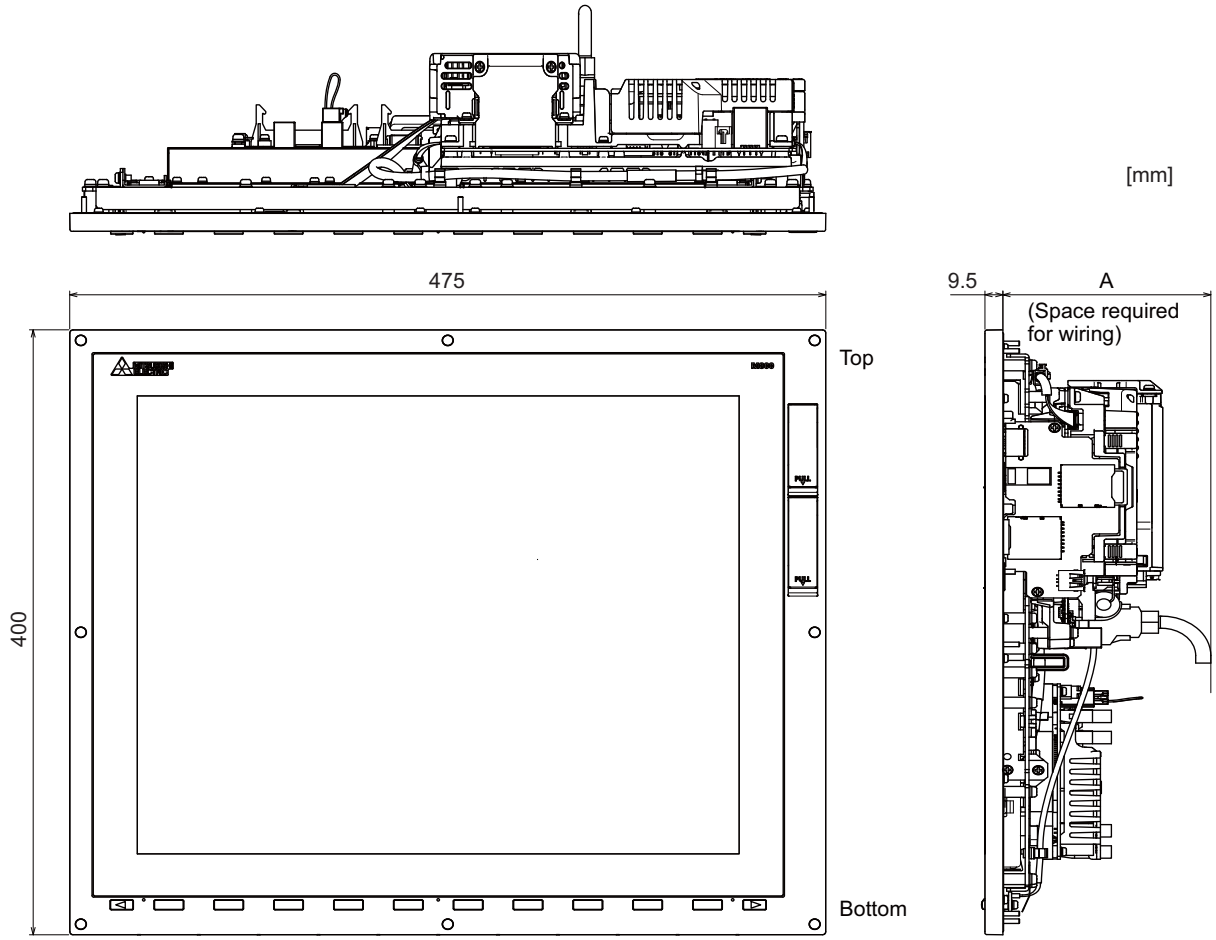
(1) The figure above shows the state with the control unit mounted.

Panel cut dimensions



4.5.3 19-type (FCU8-DU194-31)

Outline dimensions



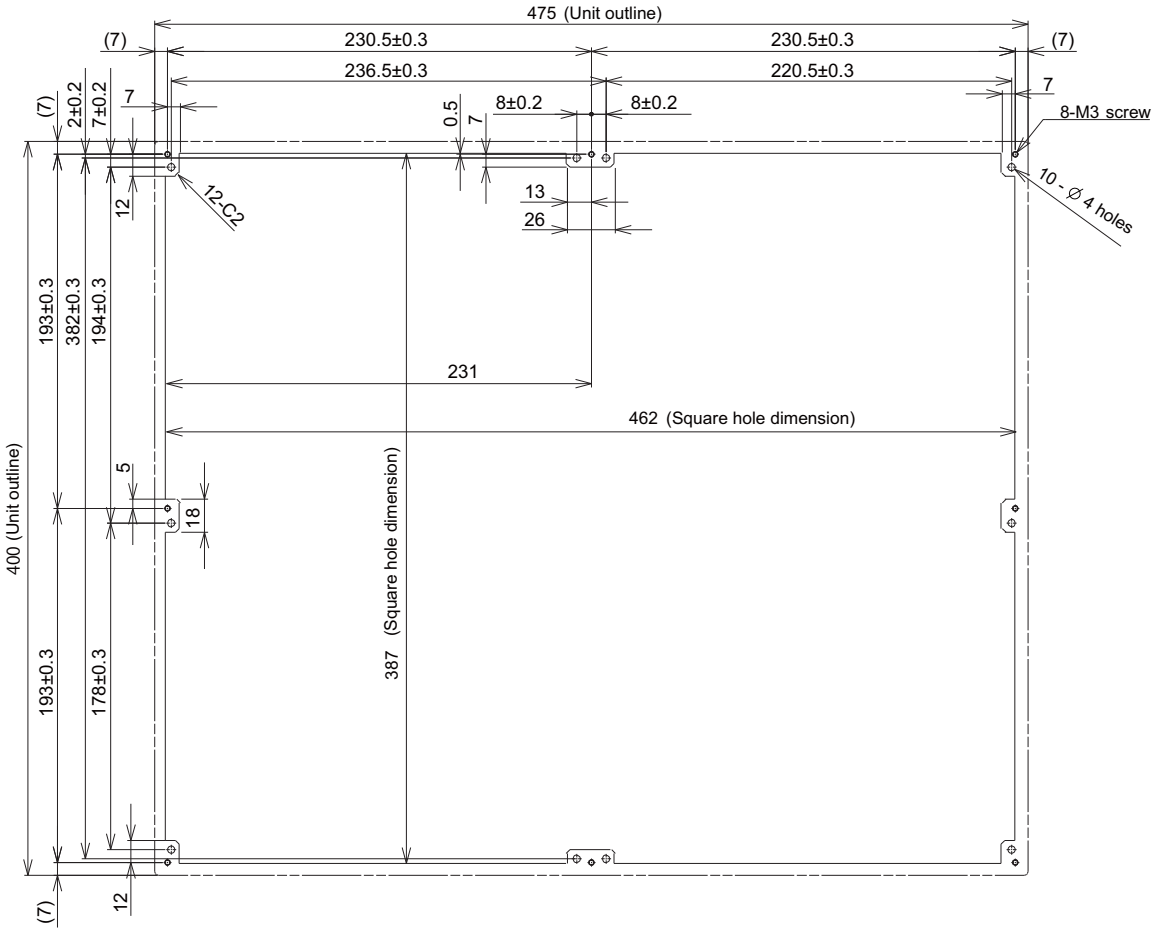
	Option relay unit not mounted	Option relay unit FCU8-EX704 mounted	Option relay unit FCU8-EX705 mounted
A (Space required for wiring)	110		114

Note

(1) The figure above shows the state with the control unit mounted.

Panel cut dimensions

[mm]



4.5.4 Precautions

[Precautions for handling touchscreen]

(1) Operate the touchscreen with fingers. The touchscreen does not react with nails.
(2) The use of gloves, work gloves, etc. will have effects such as the deterioration of the operation feeling depending on the material and thickness of the gloves.
(3) The initialization process is performed for 3 seconds after the power is turned ON. Do not touch the touchscreen with a finger, hold a palm over, put the conductive objects such as metals on, etc., during the initialization.
(4) If the surface of the touchscreen gets dirt, wipe it off with soft cloth.
(5) Make sure to ground FG terminal of the control unit at one ground point. Refer to “5.2.1 Connection of Frame Ground (FG)".
Otherwise, touchscreen reaction time and usability will remarkably deteriorate.
(6) Do not place a device which removes static electricity such as an ionizer. The static electricity-removing device may worsen the response and usability of the touchscreen.

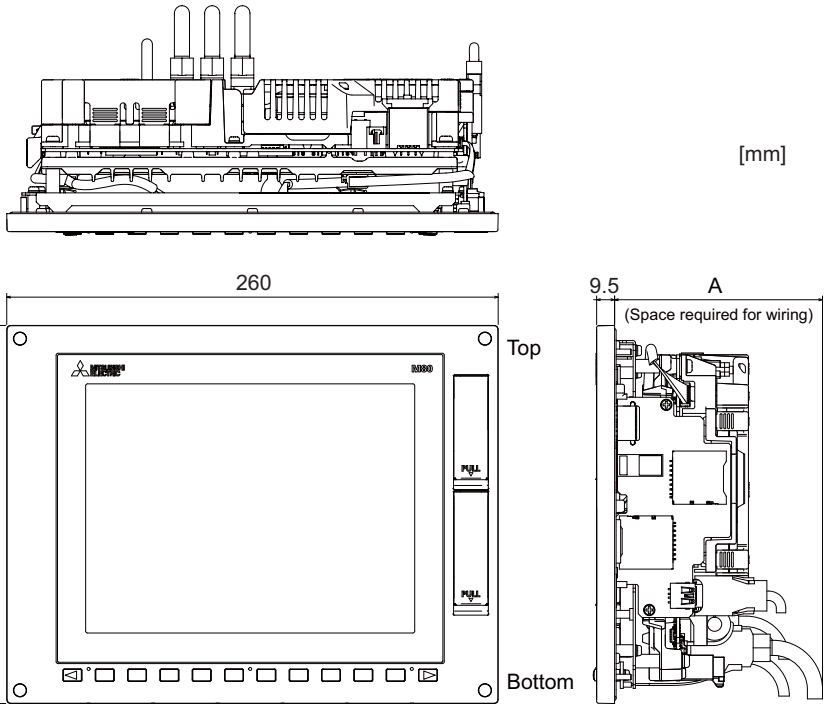
[Characteristic of liquid crystal display panels]

As a characteristic of liquid crystal display panels, bright dots (always lit) and dark dots (never lit) may appear on the panel. Since liquid crystal display panels comprise a great number of display elements, the appearance of bright and dark dots cannot be reduced to zero.
Variation of liquid crystal display panels may cause differences in color, uneven brightness and flickering.
Note that these phenomena are characteristics of liquid crystal display panels and it does not mean the products are defective or damaged.

4.6 Display Unit [M80V]

4.6.1 8.4-type (FCU8-DU122-12)

Outline dimensions

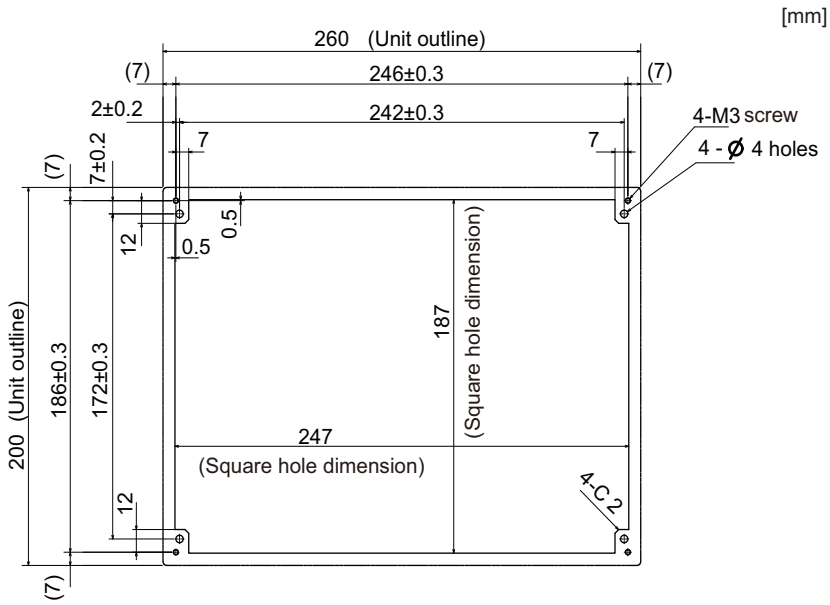


	Option relay unit not mounted	Option relay unit FCU8-EX704 mounted	Option relay unit FCU8-EX705 mounted
A (Space required for wiring)	110		114

Note

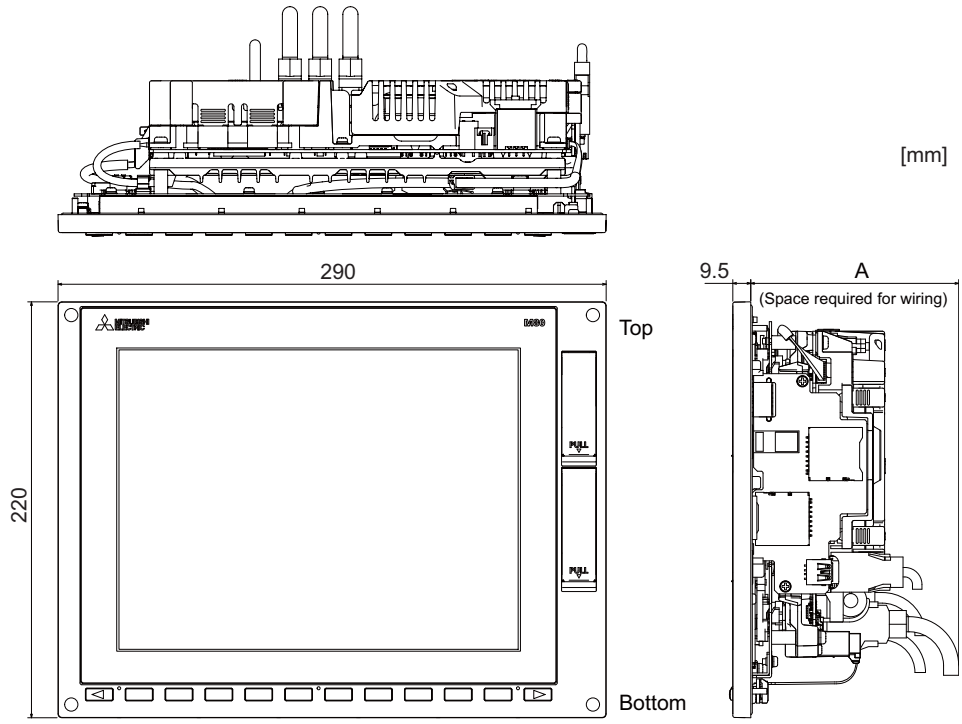
(1) The 8.4-type display unit is incompatible with the touchscreen.
(2) The figure above shows the state with the control unit mounted.

Panel cut dimensions



4.6.2 10.4-type (FCU8-DU142-32)

Outline dimensions

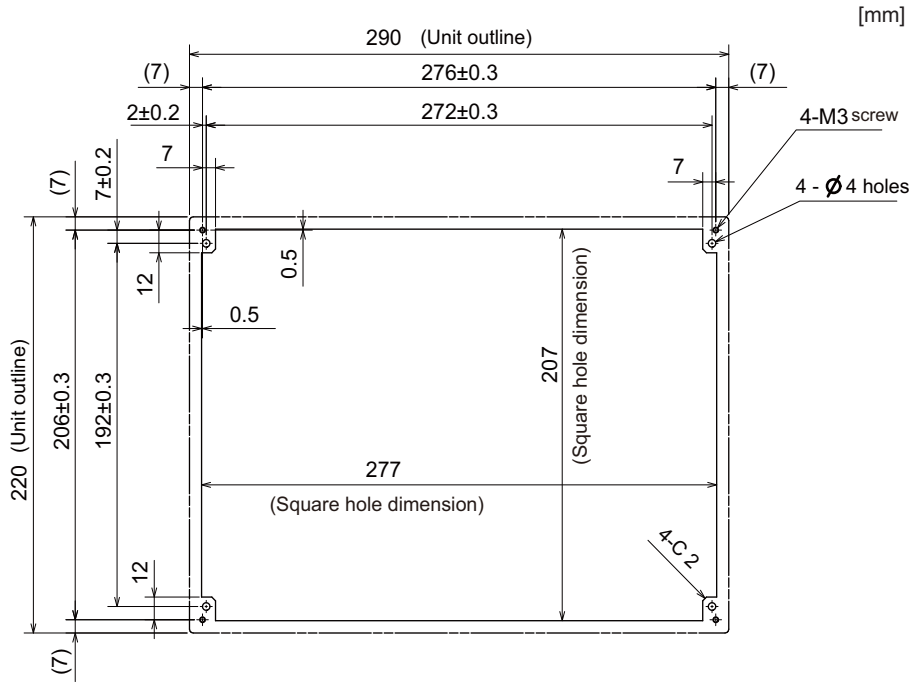


	Option relay unit not mounted	Option relay unit FCU8-EX704 mounted	Option relay unit FCU8-EX705 mounted
A (Space required for wiring)	110		114

Note

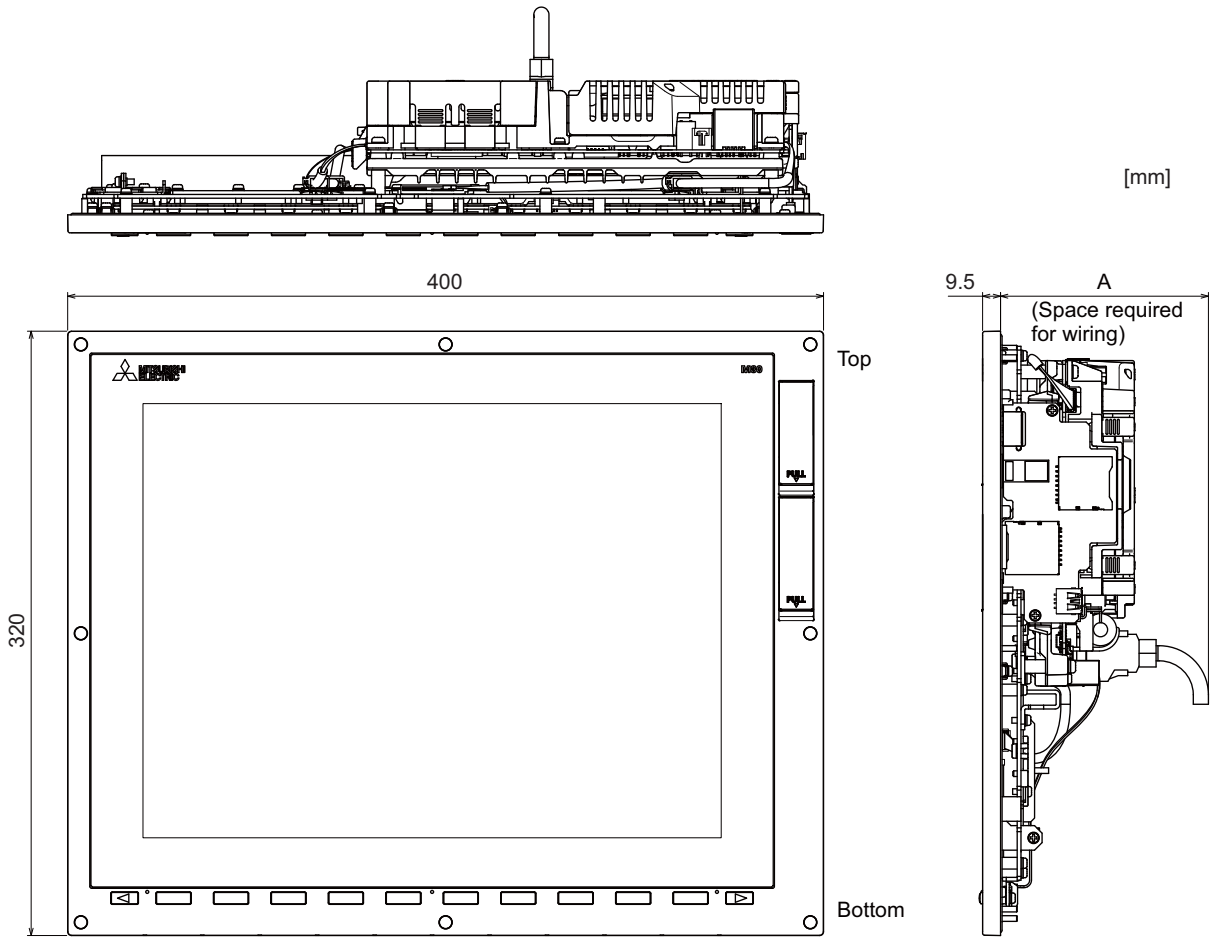
(1) The figure above shows the state with the control unit mounted.

Panel cut dimensions



4.6.3 15-type (FCU8-DU182-32)

Outline dimensions

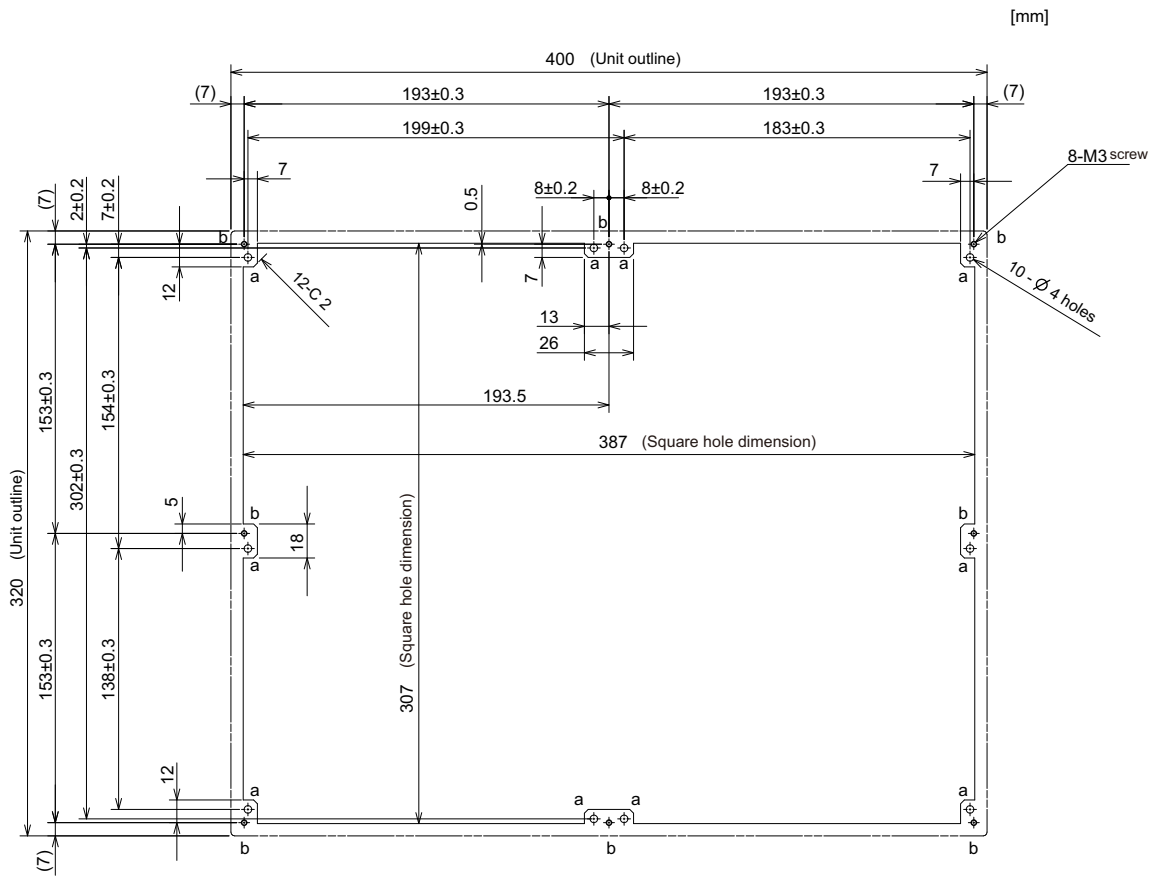


	Option relay unit not mounted	Option relay unit FCU8-EX704 mounted	Option relay unit FCU8-EX705 mounted
A (Space required for wiring)	110		114

Note

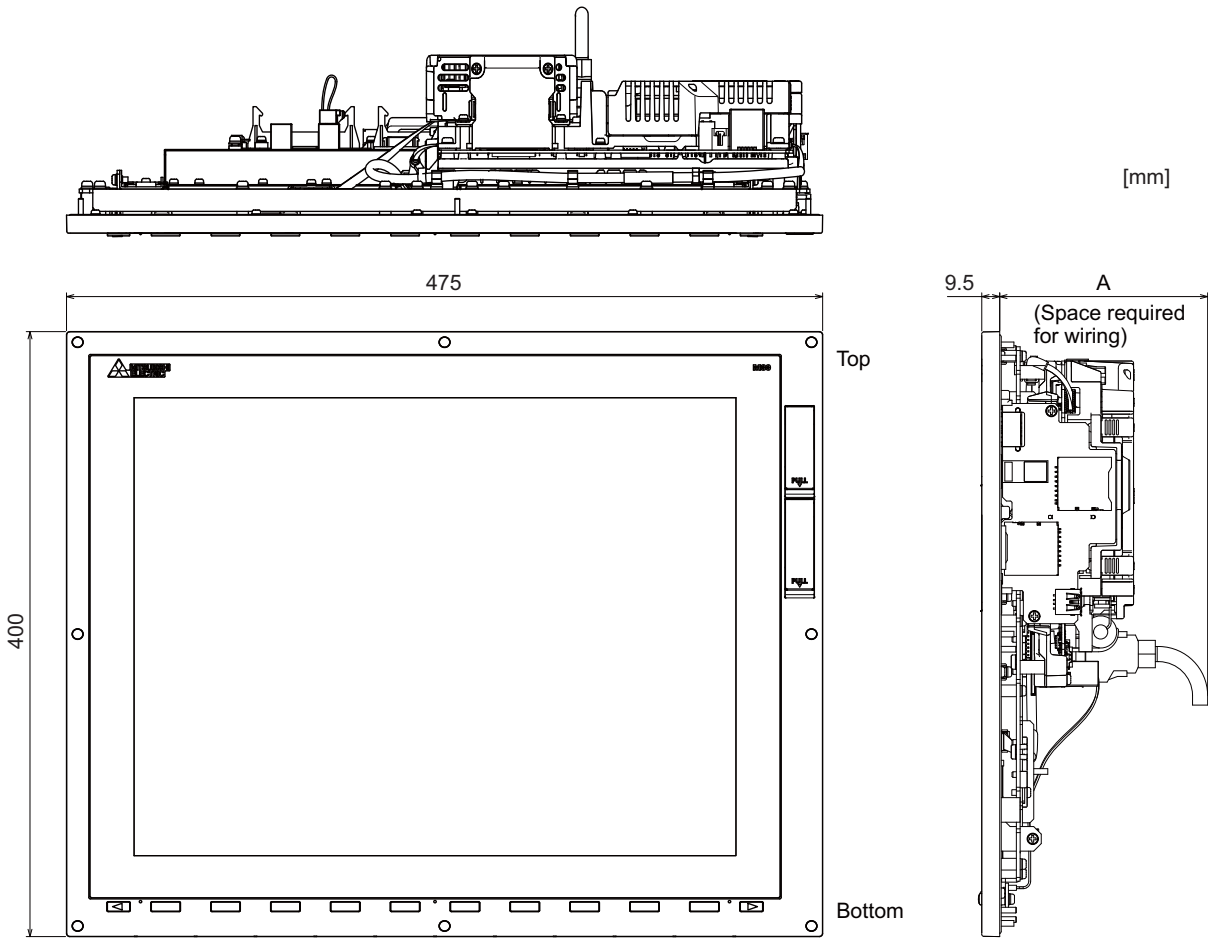
(1) The figure above shows the state with the control unit mounted.

Panel cut dimensions



4.6.4 19-type (FCU8-DU194-32)

Outline dimensions



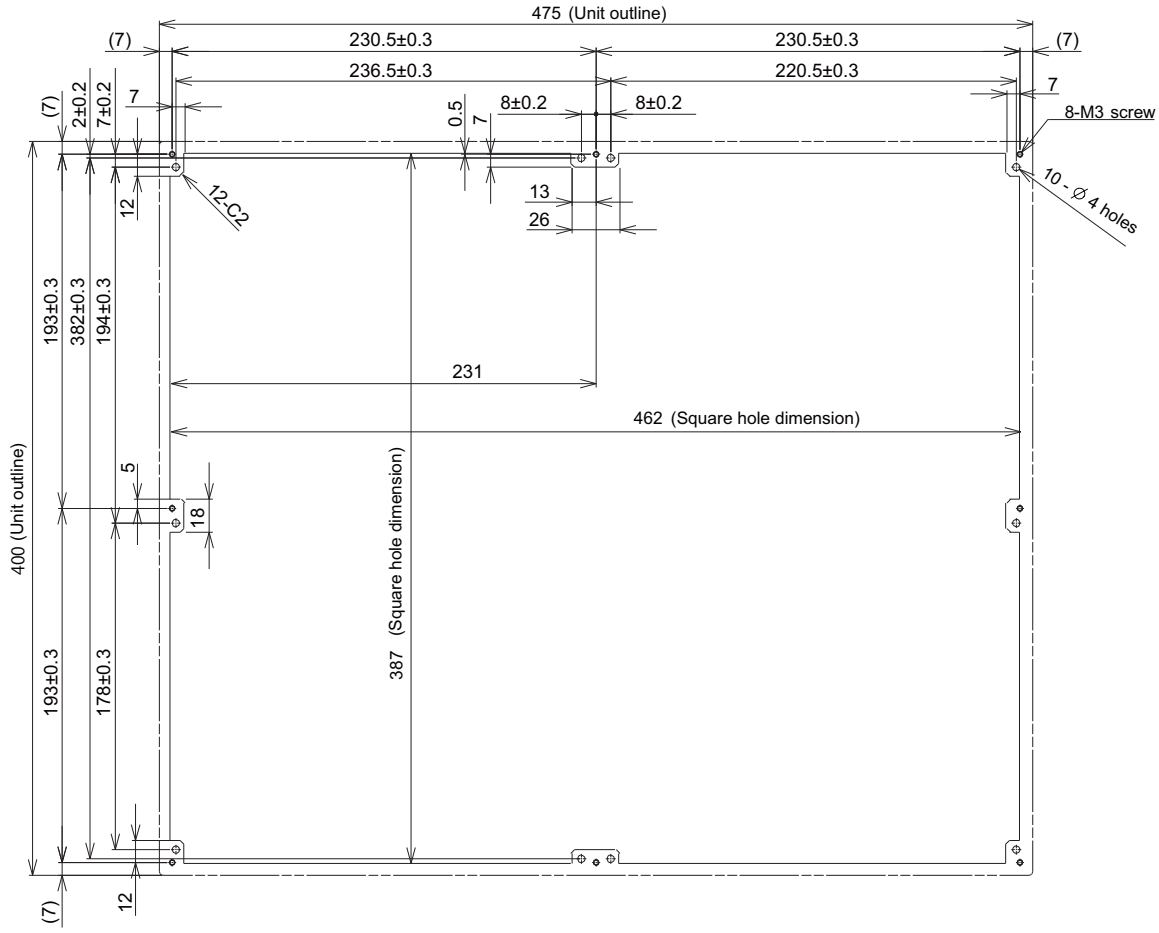
	Option relay unit not mounted	Option relay unit FCU8-EX704 mounted	Option relay unit FCU8-EX705 mounted
A (Space required for wiring)	110		114

Note

(1) The figure above shows the state with the control unit mounted.

Panel cut dimensions

[mm]



4.6.5 Precautions

[Precautions for handling touchscreen]

(1) Operate the touchscreen with fingers. The touchscreen does not react with nails.
(2) The use of gloves, work gloves, etc. will have effects such as the deterioration of the operation feeling depending on the material and thickness of the gloves.
(3) The initialization process is performed for 3 seconds after the power is turned ON. Do not touch the touchscreen with a finger, hold a palm over, put the conductive objects such as metals on, etc., during the initialization.
(4) If the surface of the touchscreen gets dirt, wipe it off with soft cloth.
(5) Make sure to ground FG terminal of the control unit at one ground point. Refer to “5.2.1 Connection of Frame Ground (FG)".
Otherwise, touchscreen reaction time and usability will remarkably deteriorate.
(6) Do not place a device which removes static electricity such as an ionizer. The static electricity-removing device may worsen the response and usability of the touchscreen.

[Characteristic of liquid crystal display panels]

As a characteristic of liquid crystal display panels, bright dots (always lit) and dark dots (never lit) may appear on the panel. Since liquid crystal display panels comprise a great number of display elements, the appearance of bright and dark dots cannot be reduced to zero.
Variation of liquid crystal display panels may cause differences in color, uneven brightness and flickering.
Note that these phenomena are characteristics of liquid crystal display panels and it does not mean the products are defective or damaged.

4.7 Keyboard Unit

Note

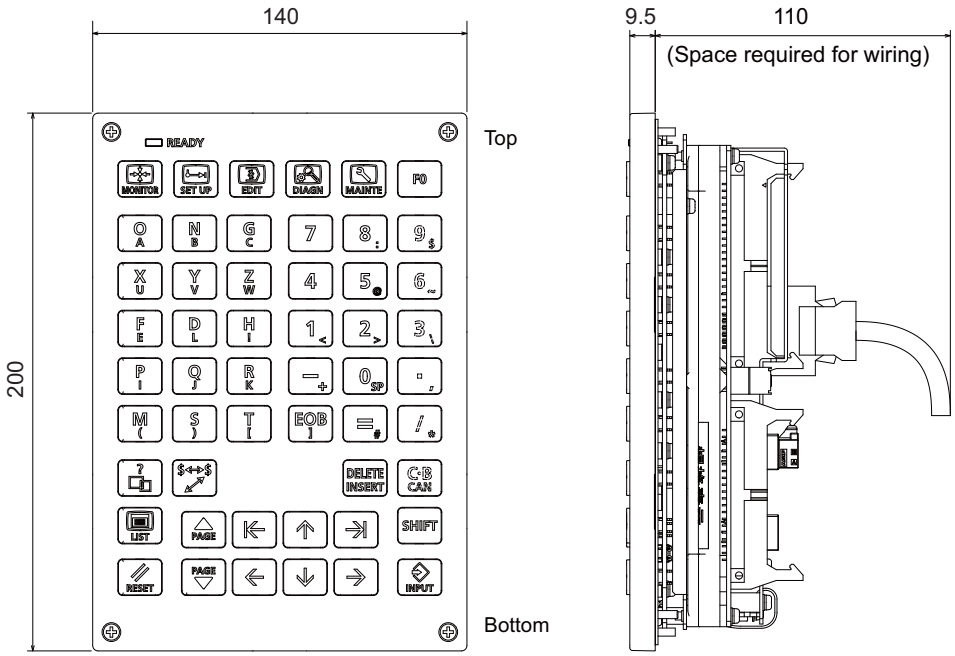
(1) Do not change the setting for the rotary switch mounted on the keyboard unit.
If the setting is changed, the keyboard will not work.

Type name	The initial value of the rotary switch
FCU8-KB026	1
FCU8-KB028	3
FCU8-KB029	0
FCU8-KB041	2
FCU8-KB046	0
FCU8-KB047	0
FCU8-KB048	0
FCU8-KB083	A
FCU8-KB091	0

4.7.1 Keyboard for 8.4-type Display Unit (FCU8-KB026)

Outline dimensions

[mm]

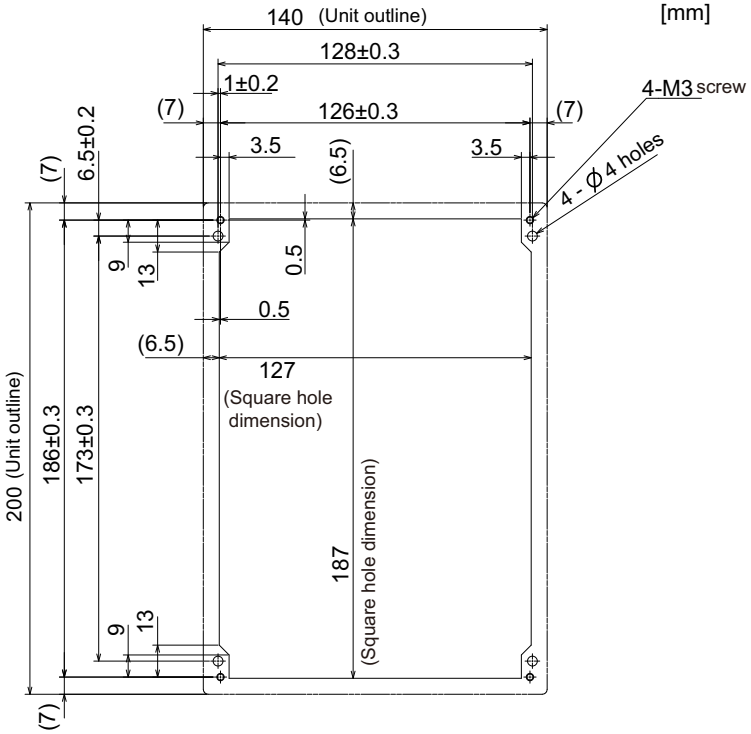


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

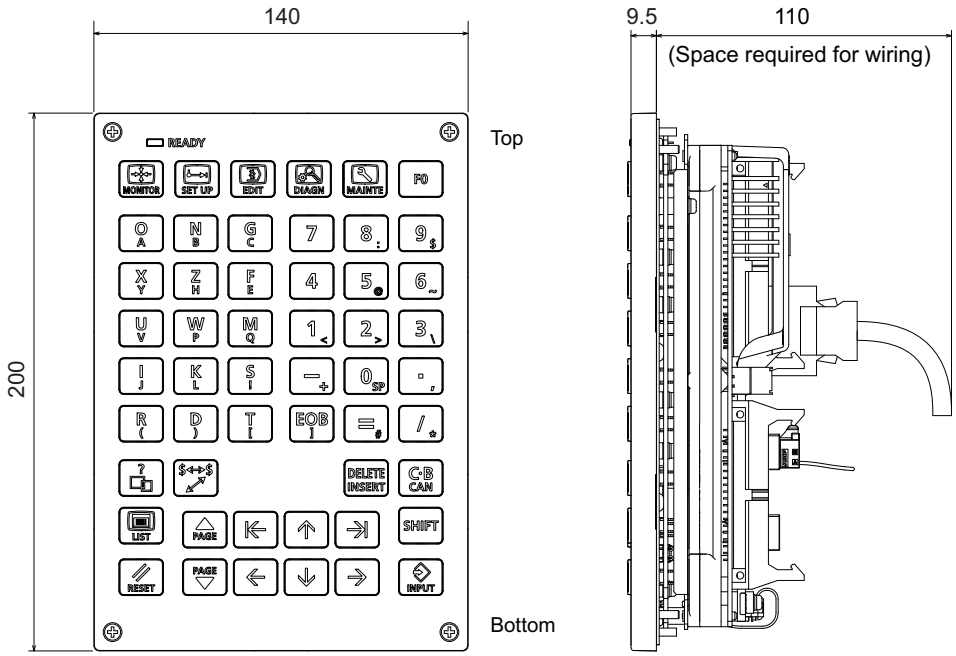
[mm]



4.7.2 Keyboard for 8.4-type Display Unit (FCU8-KB028)

Outline dimensions

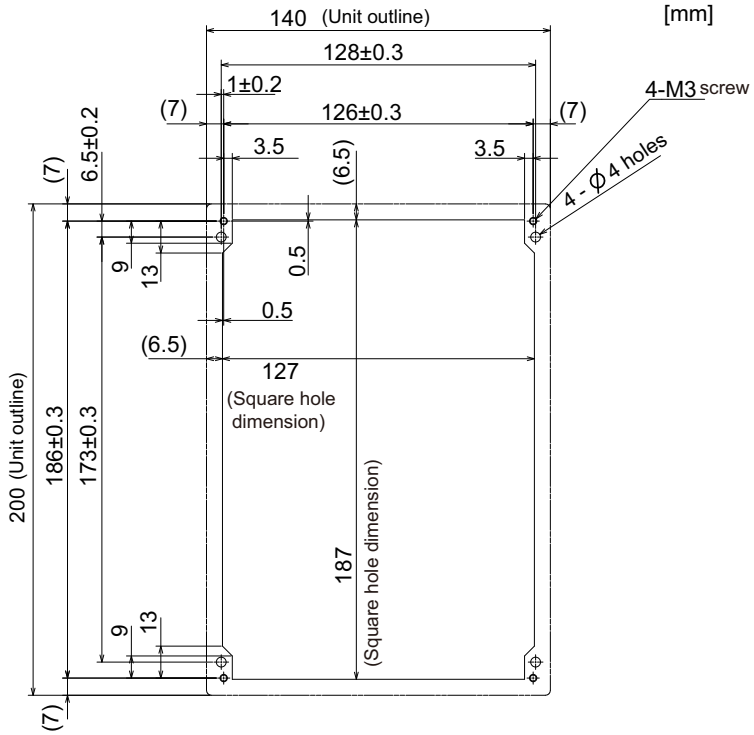
[mm]



Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

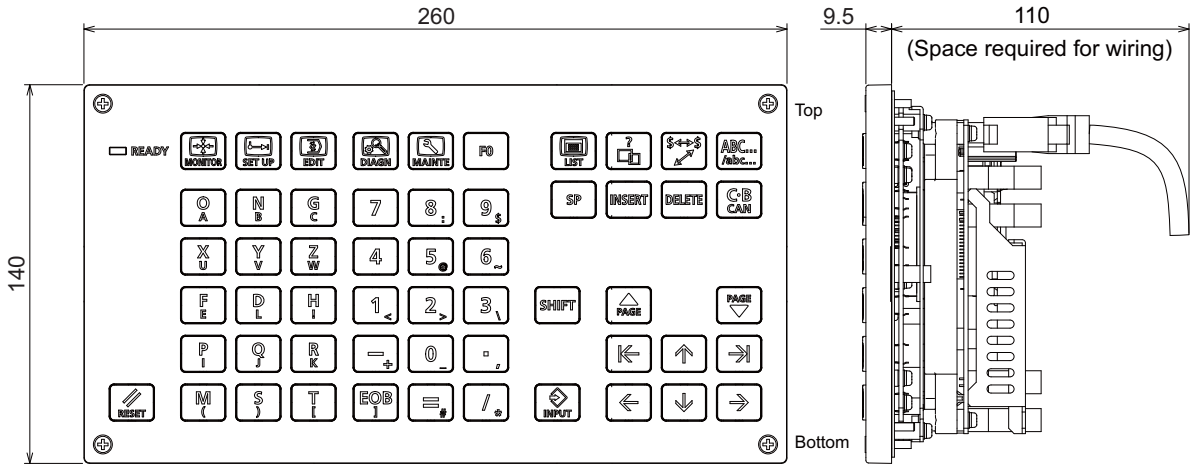
Panel cut dimensions



4.7.3 Keyboard for 8.4-type Display Unit (FCU8-KB029)

Outline dimensions

[mm]

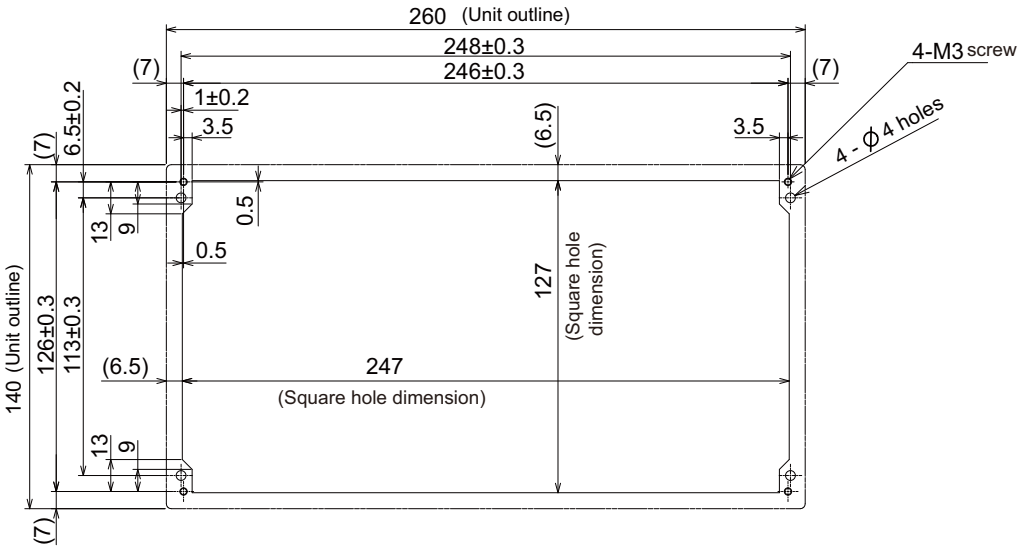


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

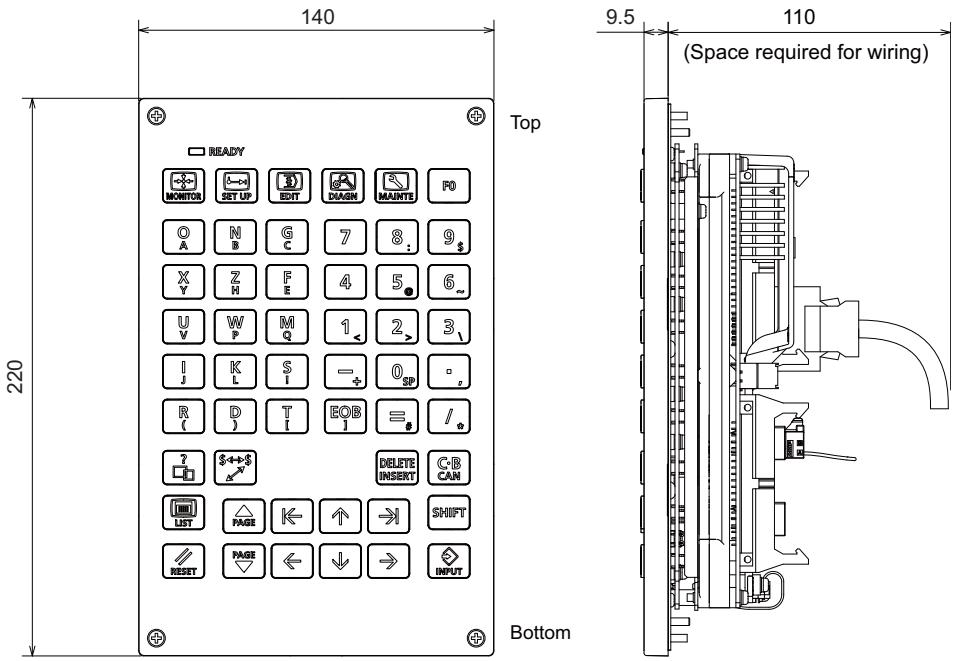
[mm]



4.7.4 Keyboard for 10.4-type Display Unit (FCU8-KB041)

Outline dimensions

[mm]

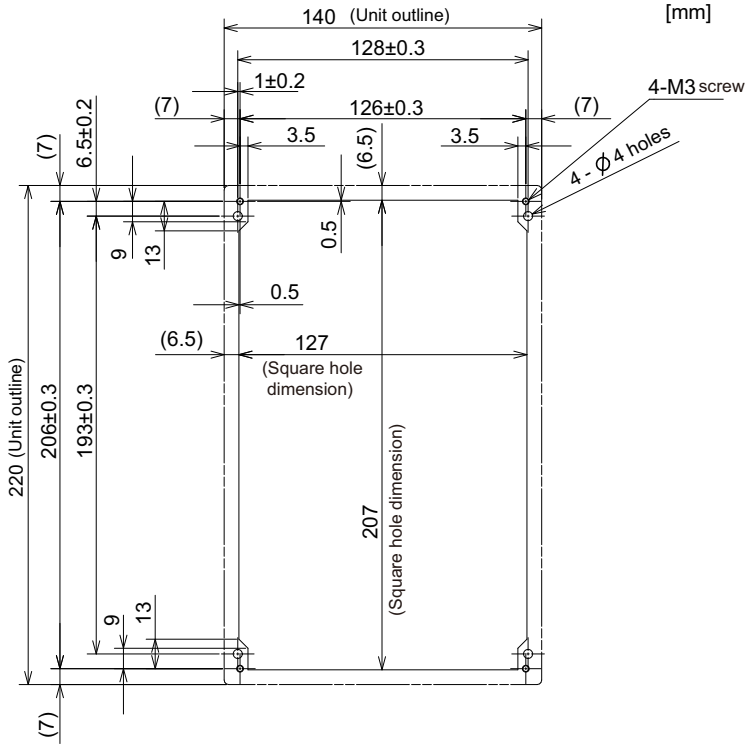


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

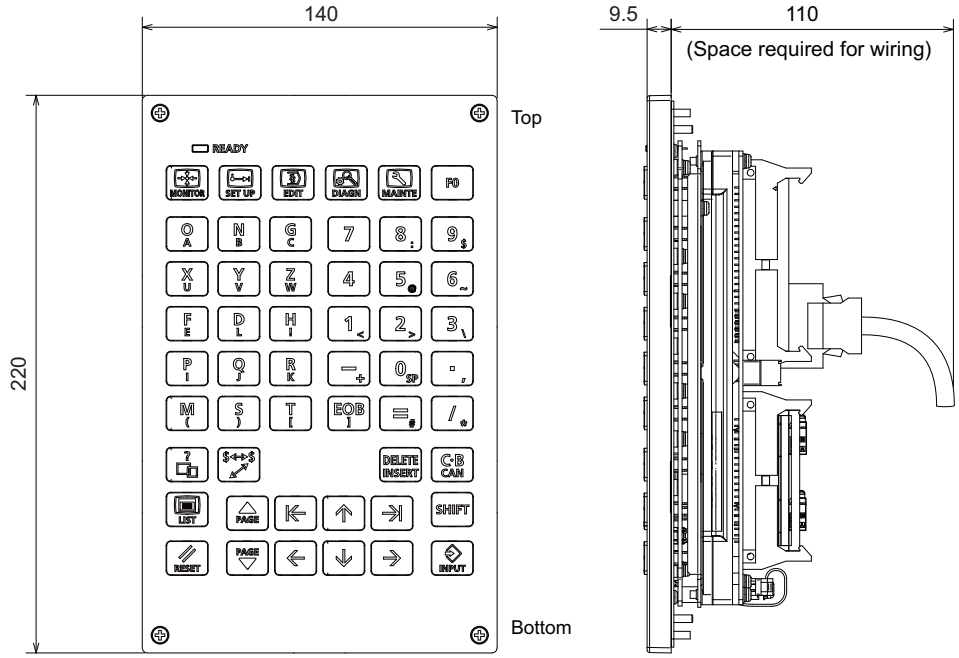
[mm]



4.7.5 Keyboard for 10.4-type Display Unit (FCU8-KB046)

Outline dimensions

[mm]

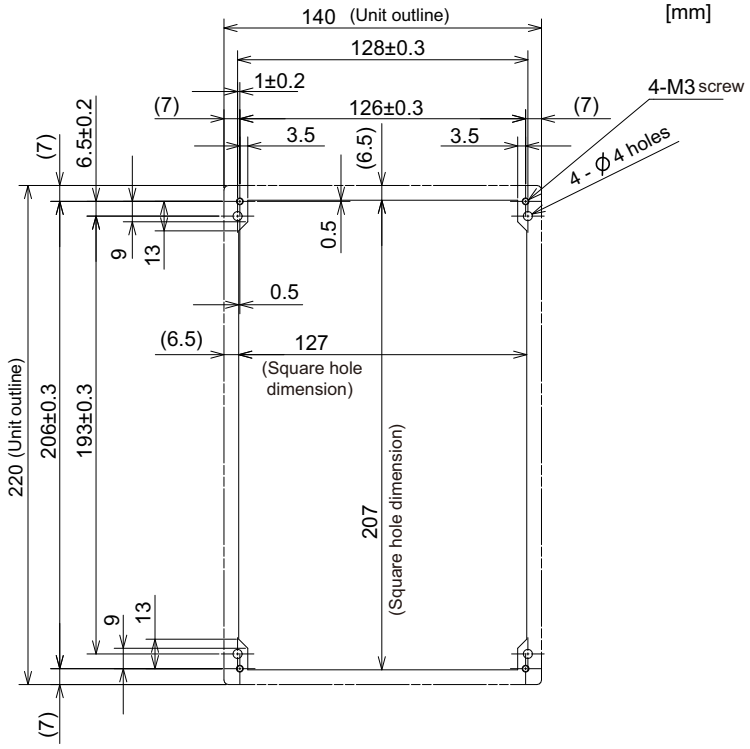


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

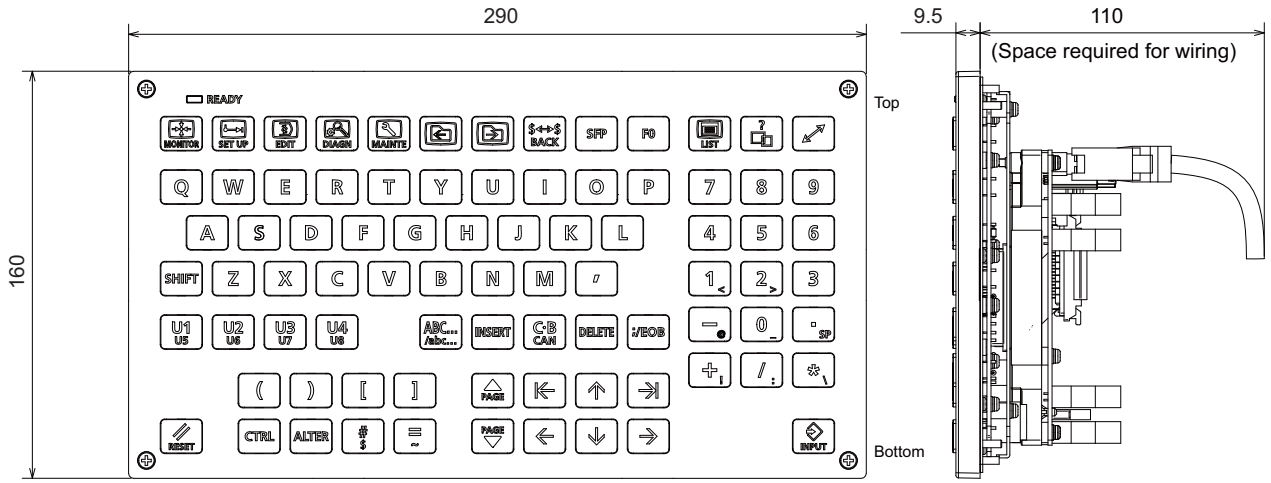
[mm]



4.7.6 Keyboard for 10.4-type Display Unit (FCU8-KB047)

Outline dimensions

[mm]

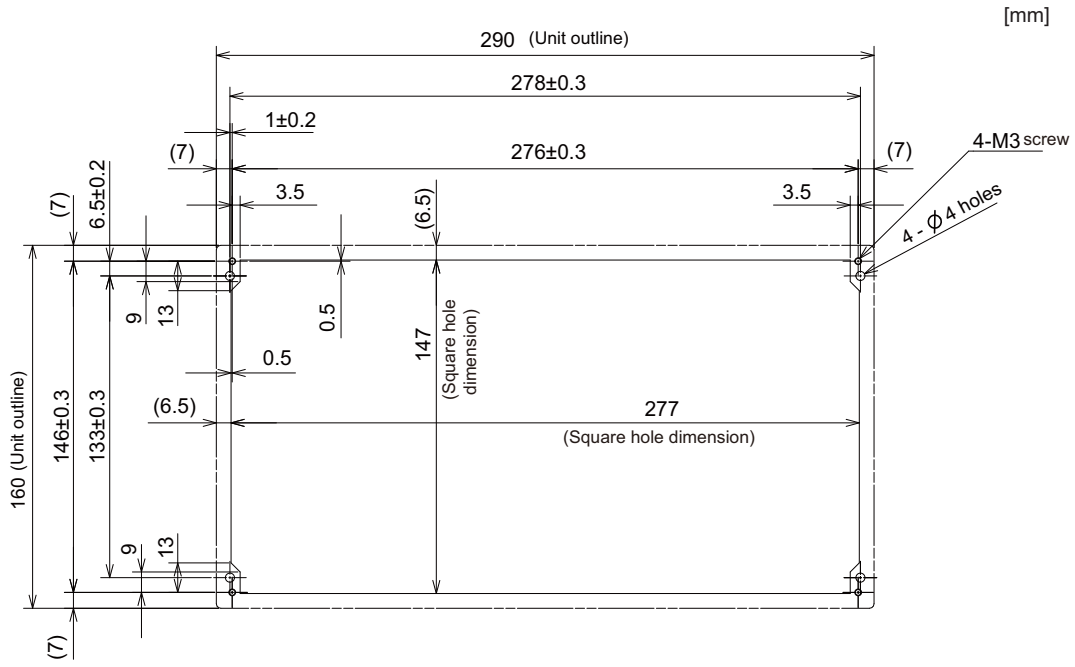


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

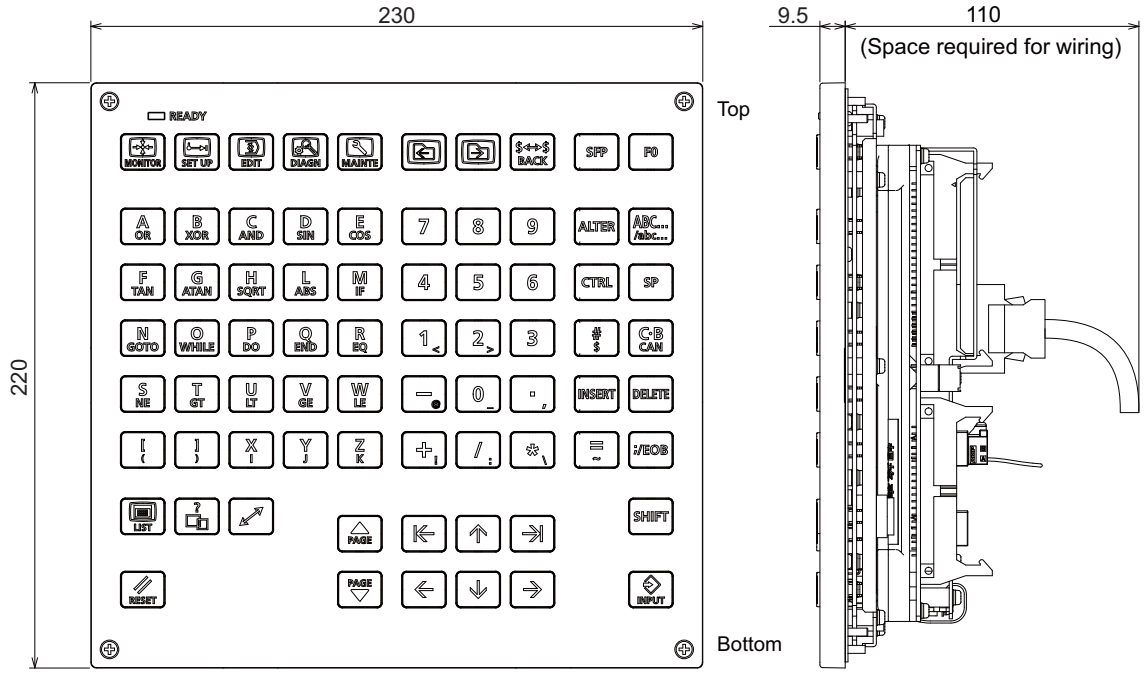
[mm]



4.7.7 Keyboard for 10.4-type Display Unit (FCU8-KB048)

Outline dimensions

[mm]

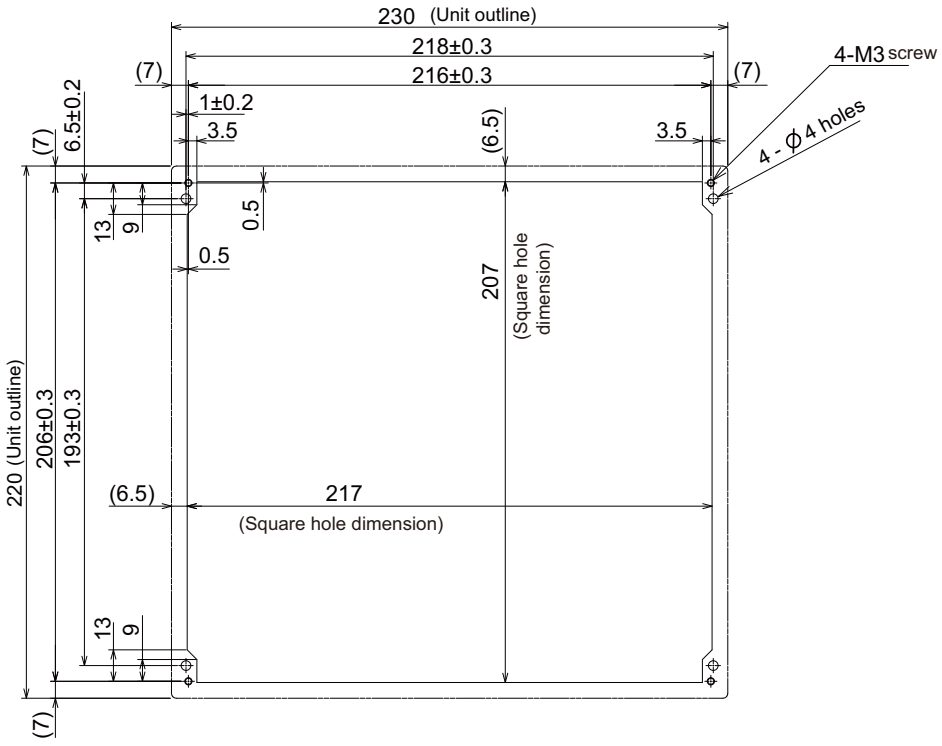


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

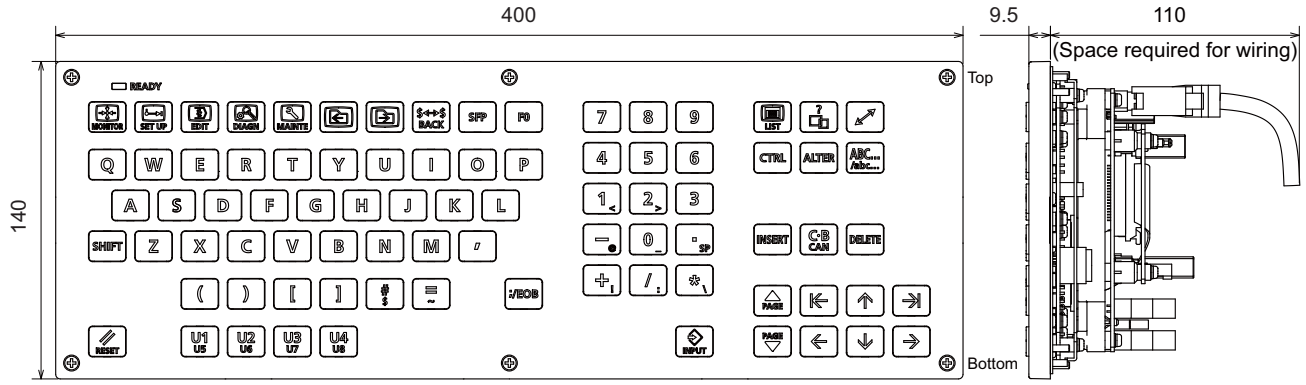
[mm]



4.7.8 Keyboard for 15-type Display Unit (FCU8-KB083)

Outline dimensions

[mm]

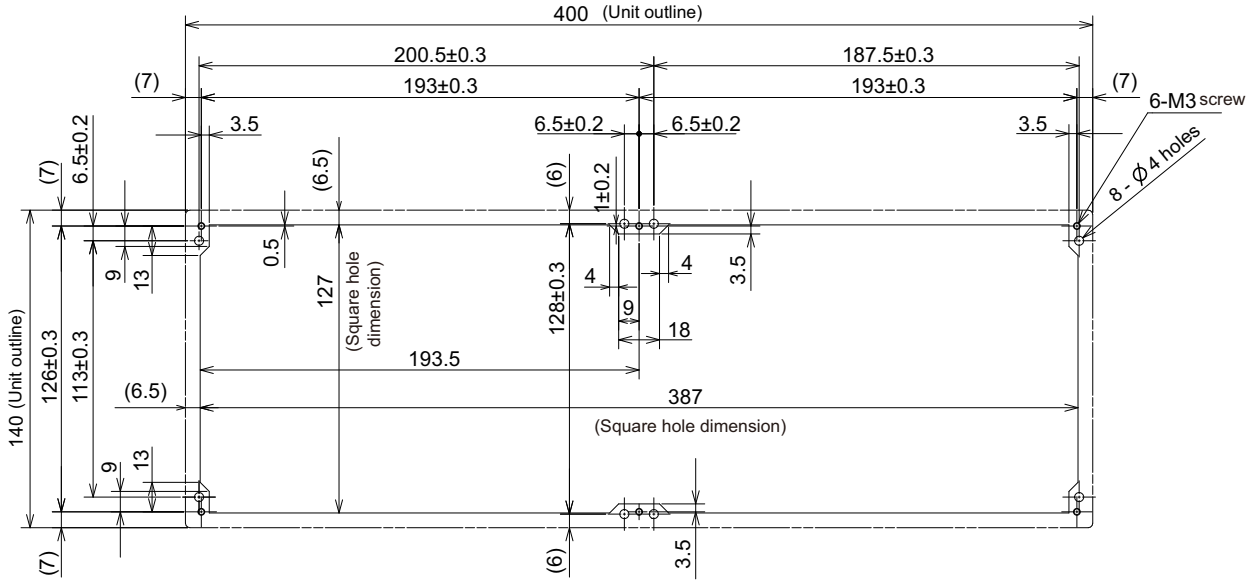


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

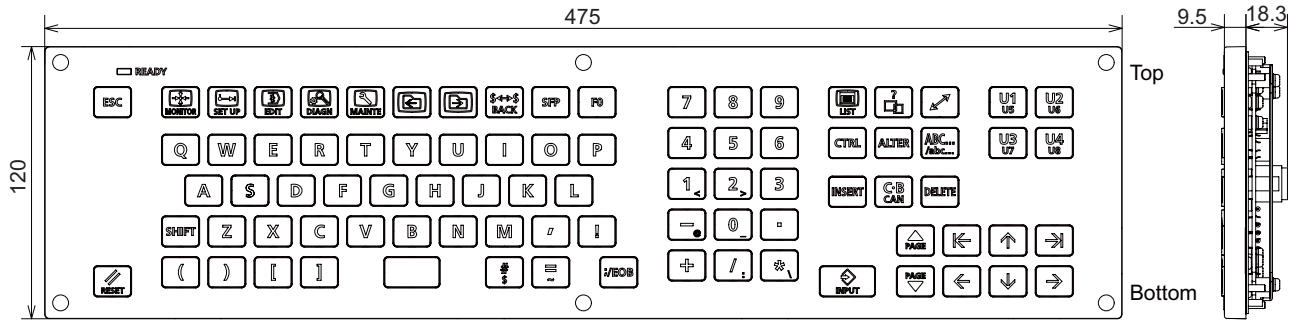
[mm]



4.7.9 Keyboard for 19-type Display Unit (FCU8-KB091)

Outline dimensions

[mm]

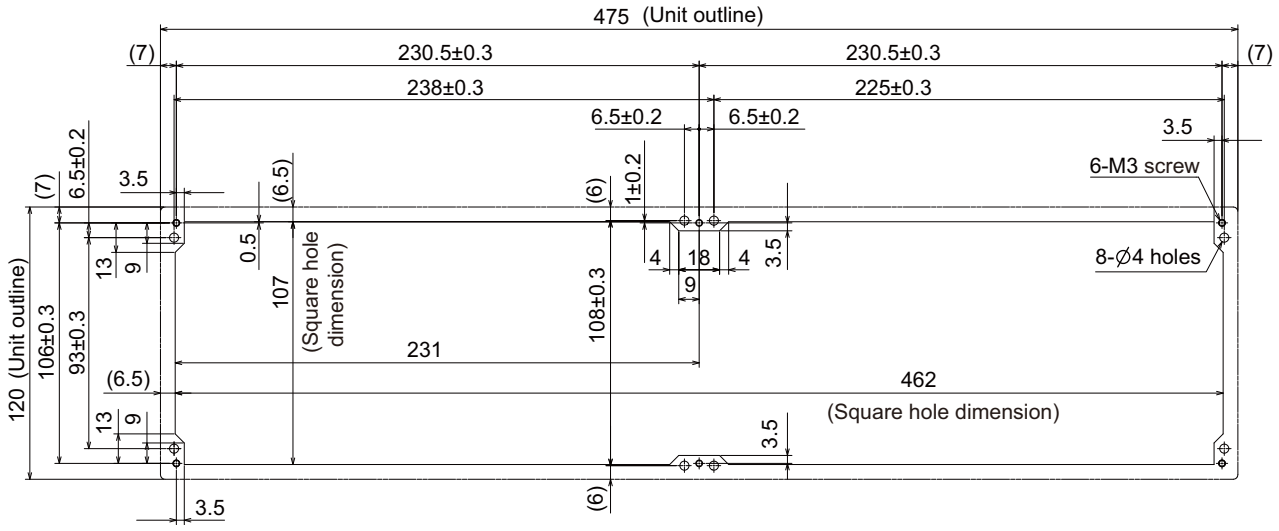


Note

(1) The above side view shows the state with the operation panel I/O unit mounted.

Panel cut dimensions

[mm]



4.8 Operation Panel I/O Unit

4.8.1 List of Units

Classification	Type	Components	Remarks
DI 24 V/0 V common input [64 points] DO Source output [48 points] AO analog output [1 point]	FCU8-DX731 (*1)	Base card RIO 2.0 terminator connector (R2-TM)	DI: 64-point 24 V/0 V common type DO: 48-point source type (200 mA/point) AO: 1 point Manual pulse generator input: 2 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1, 3, 7 to 12, 20 to 22 RIO extensible stations: 2, 4 to 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [96 points] DO Source output [64 points]	FCU8-DX750	Base card RIO 2.0 terminator connector (R2-TM)	DI: 96-point 24 V/0 V common type DO: 64-point source type (200 mA/point) Manual pulse generator input: 3 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 3, 7 to 12, 20 to 22 RIO extensible stations: 4 to 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [96 points] DO Source output [96 points]	FCU8-DX760	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 96-point 24 V/0 V common type DO: 96-point source type (200 mA/point) Manual pulse generator input: 3 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 4, 7 to 12, 20 to 22 RIO extensible stations: 5, 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [96 points] DO Source output [64 points] AI Analog input [1 point] AO Analog output [1 point]	FCU8-DX761	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 96-point 24 V/0 V common type DO: 64-point source type (200 mA/point) AI: 1 point AO: 1 point Manual pulse generator input: 3 ch Control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 5, 7 to 12, 20 to 22 RIO extensible stations: 6, 13 to 19, 23 to 64
DI 24 V/0 V common input [64 points] DO Source output [64 points] Scan input [64 points] Scan output [64 points]	FCU8-DX834 (*2)	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 64-point 24 V/0 V common type DO: 64-point source type (200 mA/point) Scan input: 64 points Scan output: 64 points Manual pulse generator input: 3 ch Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1 to 4, 7 to 14, 20 to 22 RIO extensible stations: 5, 6, 15 to 19, 23 to 64

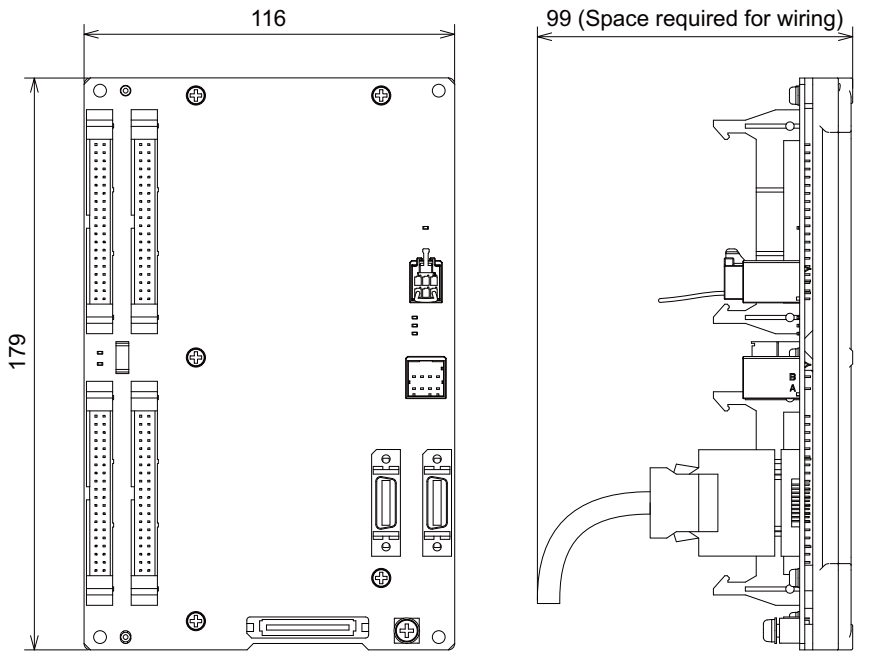
(*1) The form of the CG31/CG32/CG35/CG36 connectors on FCU8-DX731 are the same as that of CJ38/CJ40/CJ42 connectors on other units. Be careful not to connect to a wrong connector. See the descriptions mentioned in the later section for more specific explanation on connections.

(*2) The connection method of DO (CG32/CG34) of FCU8-DX834 is different from other operation panel I/O units. Be careful not to connect to a wrong connector. See the descriptions mentioned in the later section for more specific explanation on connections.

4.8.2 FCU8-DX731/FCU8-DX750/FCU8-DX760/FCU8-DX761/FCU8-DX834

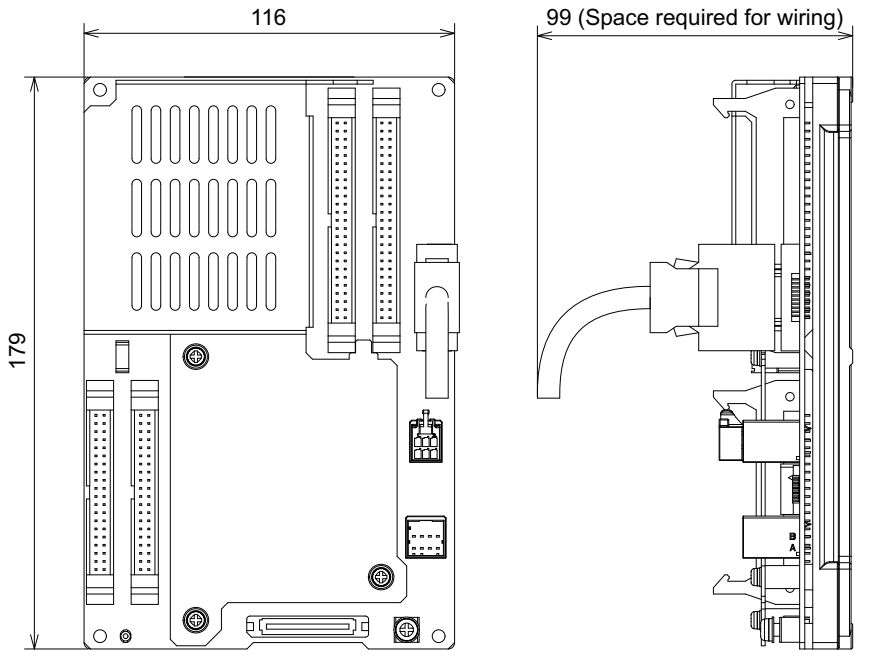
Outline dimensions: FCU8-DX731

[mm]



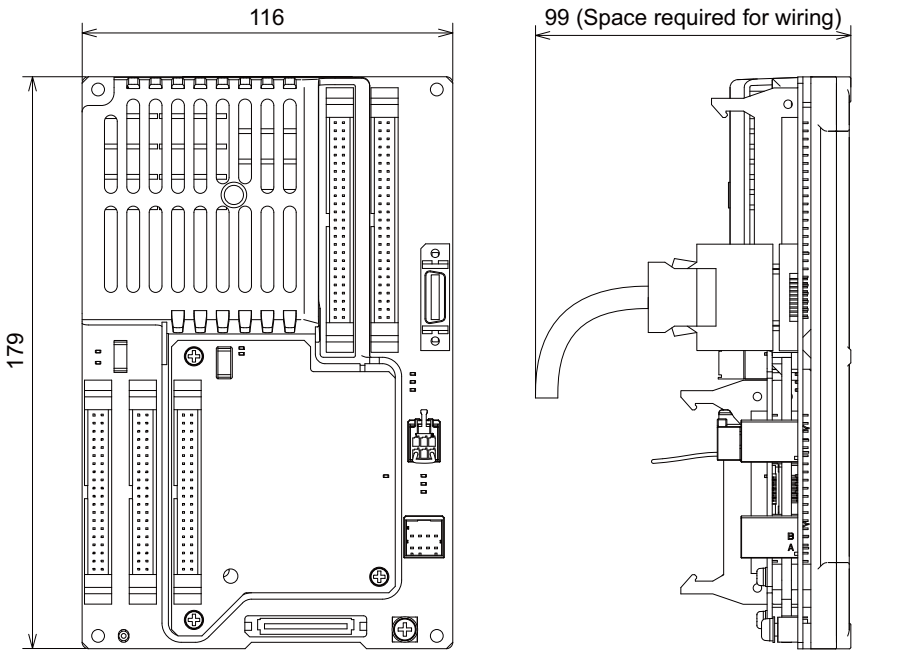
Outline dimensions: FCU8-DX750

[mm]



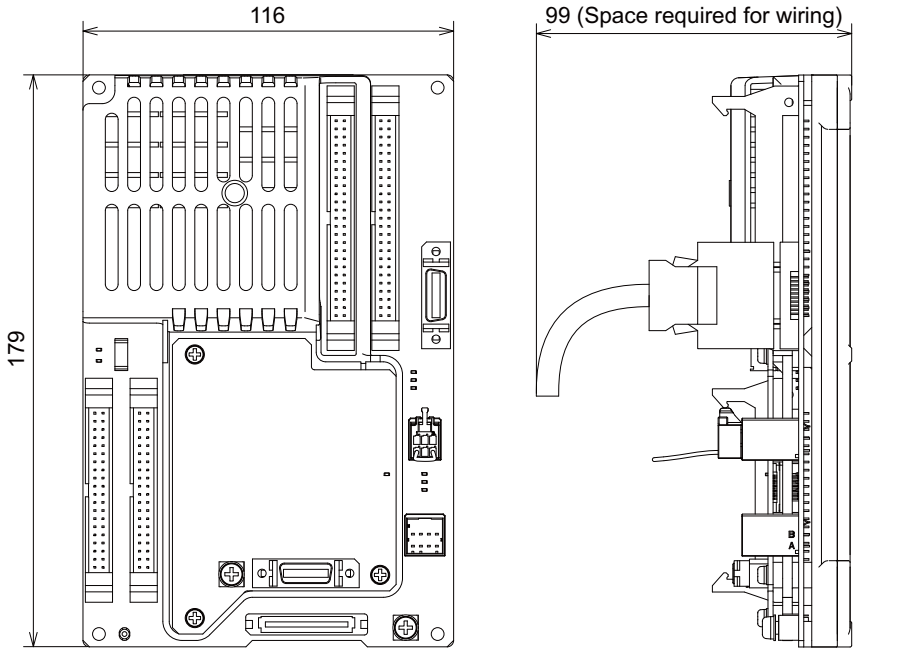
Outline dimensions: FCU8-DX760

[mm]



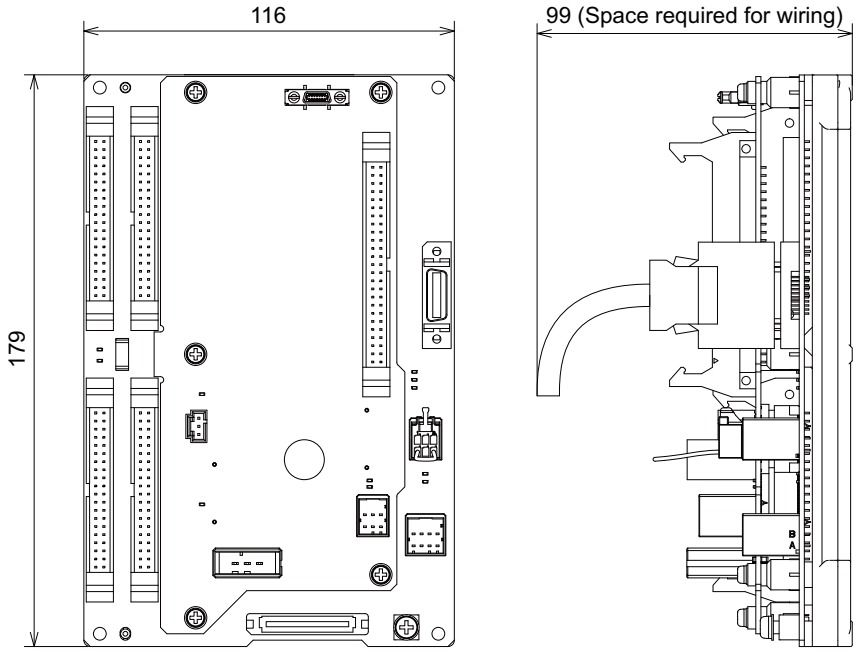
Outline dimensions: FCU8-DX761

[mm]

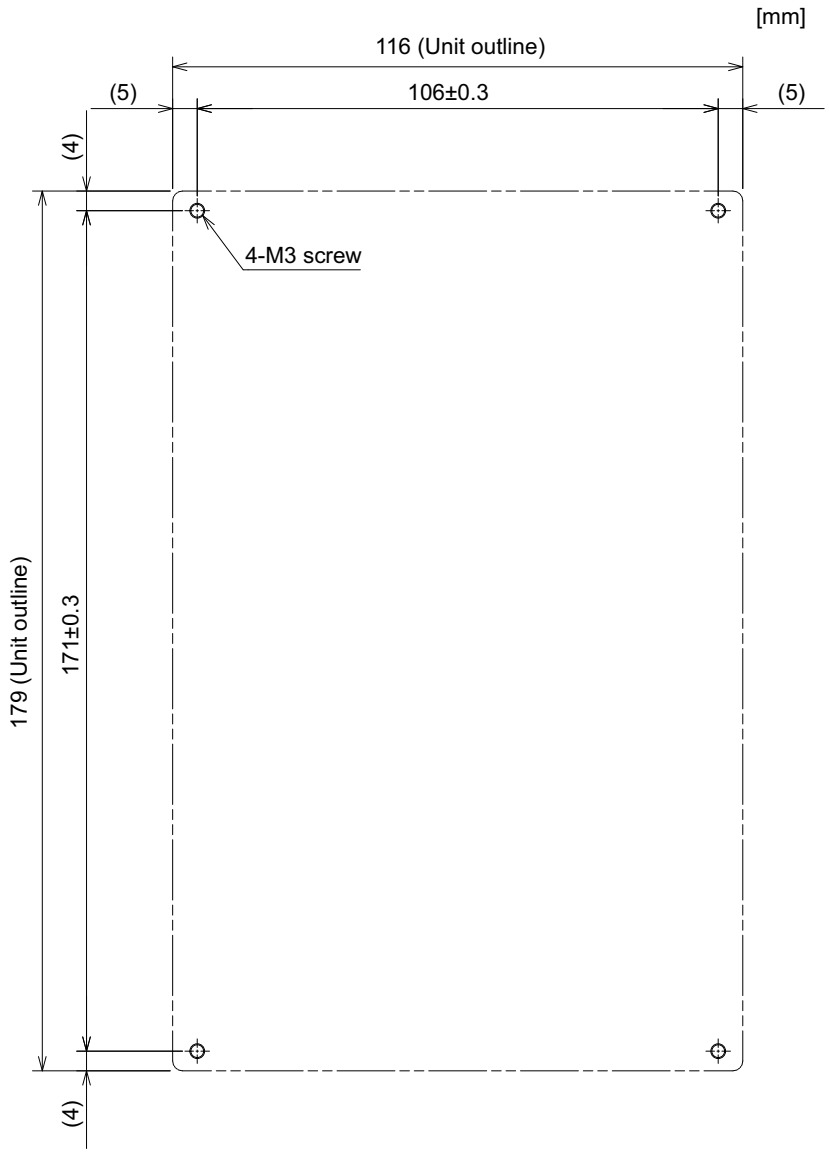


Outline dimensions: FCU8-DX834

[mm]



Installation dimension: FCU8-DX731/FCU8-DX750/FCU8-DX760/FCU8-DX761/FCU8-DX834

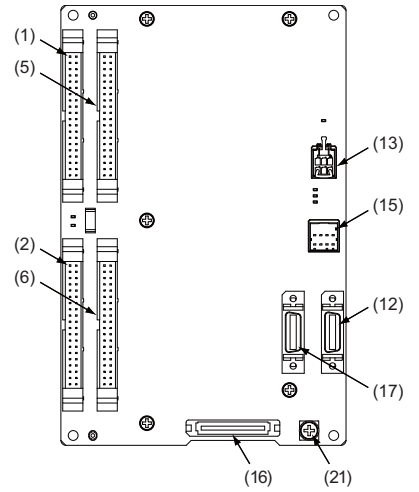


Note

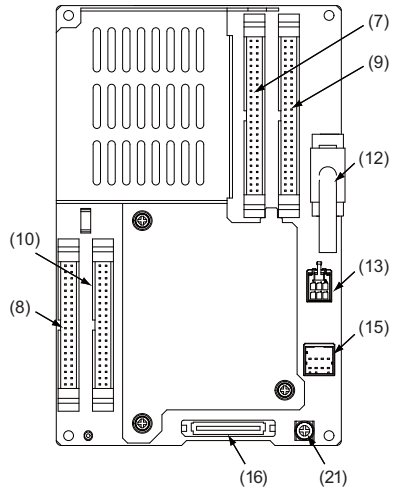
- The unit thickness of the fixed part with screws is 16.6 mm.
  Select the fixing screws having the length suitable for the thickness.

Connector

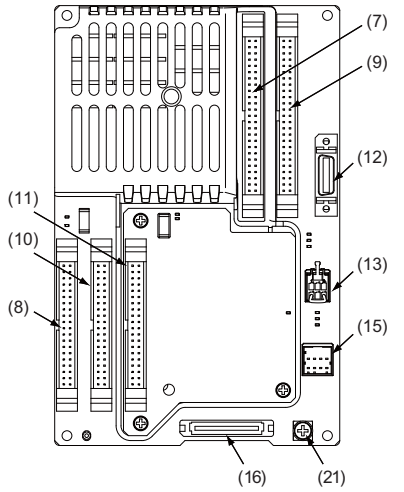
FCU8-DX731



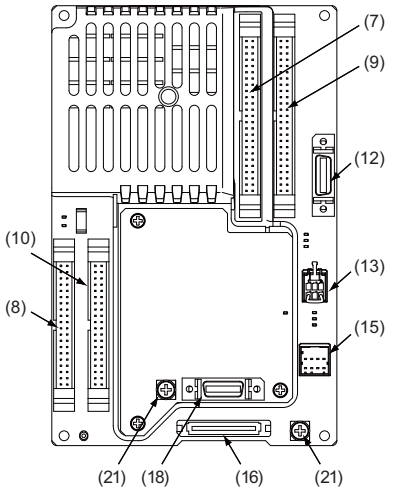
FCU8-DX750



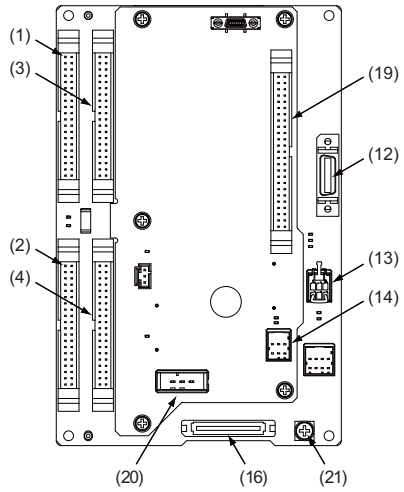
FCU8-DX760



FCU8-DX761



FCU8-DX834



No.	Connector name	Function		No.	Connector name	Function
(1)	CG31	Machine signal input		(12)	MPG	Manual pulse generator input
(2)	CG32	Machine signal output		(13)	RIO3EXT	Remote I/O 2.0 communication
(3)	CG33	Machine signal input		(14)	RIO3	Remote I/O 2.0 communication
(4)	CG34	Machine signal output		(15)	CJ71 (*1)	Control unit I/F
(5)	CG35	Machine signal input		(16)	NCKB	Keyboard I/F
(6)	CG36	Machine signal output		(17)	AO	Analog output
(7)	CJ37	Machine signal input		(18)	AIO	Analog input Analog output
(8)	CJ38	Machine signal output		(19)	OPKB	Scan input Scan output
(9)	CJ39	Machine signal input		(20)	DCIN	24 VDC input
(10)	CJ40	Machine signal output		(21)	FG	FG terminal
(11)	CJ42	Machine signal output				

(*1) The CJ71 connector of FCU8-DX834 is not used.

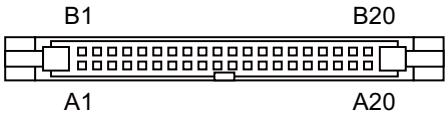
⚠ CAUTION

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

⚠ Connect the cables to the designated connectors. Incorrect connections could damage the device.

⚠ The 12 V/5 V/3.3 V output from the connector is used only to supply power to dedicated peripheral devices. If it is used to power other devices, NC operation may be guaranteed due to voltage drops or wraparound noise. Do not use it to supply power to other devices.

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



CG31						CG33						CG35					
B			A			B			A			B			A		
20	I	X200	**20**	I	X210	**20**	I	X220	**20**	I	X230	**20**	I	X240	**20**	I	X250
19	I	X201	**19**	I	X211	**19**	I	X221	**19**	I	X231	**19**	I	X241	**19**	I	X251
18	I	X202	**18**	I	X212	**18**	I	X222	**18**	I	X232	**18**	I	X242	**18**	I	X252
17	I	X203	**17**	I	X213	**17**	I	X223	**17**	I	X233	**17**	I	X243	**17**	I	X253
16	I	X204	**16**	I	X214	**16**	I	X224	**16**	I	X234	**16**	I	X244	**16**	I	X254
15	I	X205	**15**	I	X215	**15**	I	X225	**15**	I	X235	**15**	I	X245	**15**	I	X255
14	I	X206	**14**	I	X216	**14**	I	X226	**14**	I	X236	**14**	I	X246	**14**	I	X256
13	I	X207	**13**	I	X217	**13**	I	X227	**13**	I	X237	**13**	I	X247	**13**	I	X257
12	I	X208	**12**	I	X218	**12**	I	X228	**12**	I	X238	**12**	I	X248	**12**	I	X258
11	I	X209	**11**	I	X219	**11**	I	X229	**11**	I	X239	**11**	I	X249	**11**	I	X259
10	I	X20A	**10**	I	X21A	**10**	I	X22A	**10**	I	X23A	**10**	I	X24A	**10**	I	X25A
9	I	X20B	**9**	I	X21B	**9**	I	X22B	**9**	I	X23B	**9**	I	X24B	**9**	I	X25B
8	I	X20C	**8**	I	X21C	**8**	I	X22C	**8**	I	X23C	**8**	I	X24C	**8**	I	X25C
7	I	X20D	**7**	I	X21D	**7**	I	X22D	**7**	I	X23D	**7**	I	X24D	**7**	I	X25D
6	I	X20E	**6**	I	X21E	**6**	I	X22E	**6**	I	X23E	**6**	I	X24E	**6**	I	X25E
5	I	X20F	**5**	I	X21F	**5**	I	X22F	**5**	I	X23F	**5**	I	X24F	**5**	I	X25F
4		NC	**4**		NC	**4**		NC	**4**		NC	**4**		NC	**4**		NC
3		DICOM	**3**		DICOM	**3**		DICOM	**3**		DICOM	**3**		DICOM	**3**		DICOM
2		+24 V	**2**		0 V	**2**		+24 V	**2**		0 V	**2**		+24 V	**2**		0 V
1		+24 V	**1**		0 V	**1**		+24 V	**1**		0 V	**1**		+24 V	**1**		0 V

The input/output assignment is modifiable using a parameter. Refer to "18.6.4.2 Arbitrary Device Assignment" for more details.

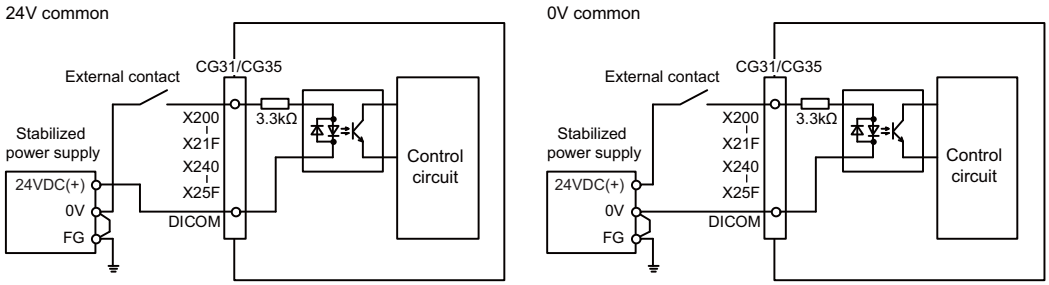
<Cable side connector type>
Connector: XG4M-4030/7940-6500SC
Strain relief: XG4T-4004/3448-7940
Manufacturer: OMRON/3M

[Outline of digital signal input circuit]

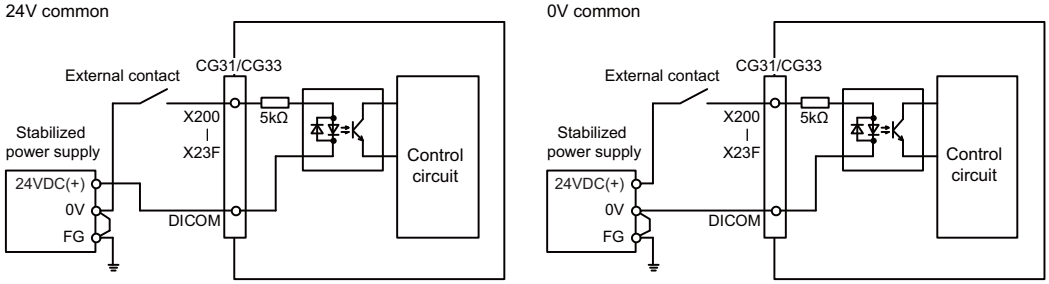
Both 24 V common and 0 V common connections are allowed in the digital signal input circuit.
Follow the wiring diagram below for each type.

<Input circuit>

[FCU8-DX731]



[FCU8-DX834]



<Input conditions>
Set the input signal within the range as shown in the conditions below.

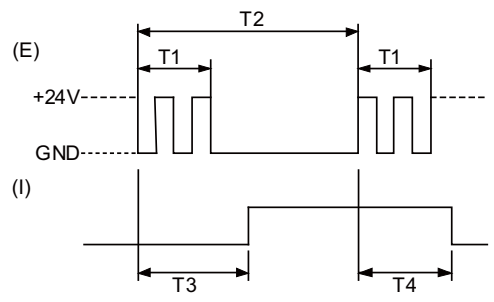
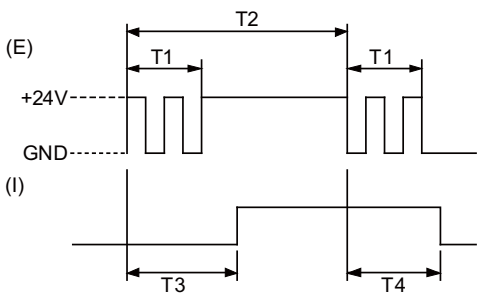
[FCU8-DX731]

		24 V common	0 V common
1	**Input voltage at external contact ON**	6 V or less	18 V or more, 25.2 V or less
2	**Input current at external contact ON**	5 mA or more	
3	**Input voltage at external contact OFF**	20 V or more, 25.2 V or less	4 V or less
4	**Input current at external contact OFF**	1.2 mA or less	
5	**Input resistance**	3.3 kΩ	
6	**Tolerable chattering time (T1)**	3 ms	
7	**Input signal holding time (T2)**	40 ms or more (*1)	
8	**Input circuit operation delay time (T3 and T4)**	3 ms to 16 ms	
9	**Machine side contact capacity**	30 V or more, 16 mA or more	

[FCU8-DX834]

		24 V common	0 V common
1	**Input voltage at external contact ON**	6 V or less	18 V or more, 25.2 V or less
2	**Input current at external contact ON**	3 mA or more	
3	**Input voltage at external contact OFF**	20.2 V or more, 25.2 V or less	3.8 V or less
4	**Input current at external contact OFF**	0.7 mA or less	
5	**Input resistance**	5 kΩ	
6	**Tolerable chattering time (T1)**	3 ms	
7	**Input signal holding time (T2)**	40 ms or more (*1)	
8	**Input circuit operation delay time (T3 and T4)**	3 ms to 16 ms	
9	**Machine side contact capacity**	30 V or more, 16 mA or more	

(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

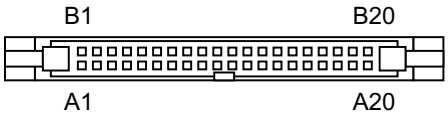
Connection to 24 V common input	Connection to 0 V common input
	

(E): External signal, (I): Internal signal

Note

- 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, operation panel I/O unit may be deteriorated due to the heat.

(2) CG32 (Machine signal output)
Digital output 32 points (1st station)
(4) CG34 (Machine signal output)
Digital output 32 points (2nd station)
(6) CG36 (Machine signal output)
Digital output 16 points (3rd station)
(8) CJ38 (Machine signal output)
Digital output 32 points (1st station)
(10) CJ40 (Machine signal output)
Digital output 32 points (2nd station)
(11) CJ42 (Machine signal output)
Digital output 32 points (4th station)



[FCU8-DX731/FCU8-DX750/FCU8-DX760/FCU8-DX761]

CG32							CG36					
B			A				B			A		
20	O	Y200	**20**	O	Y210		**20**	O	Y240	**20**		NC
19	O	Y201	**19**	O	Y211		**19**	O	Y241	**19**		NC
18	O	Y202	**18**	O	Y212		**18**	O	Y242	**18**		NC
17	O	Y203	**17**	O	Y213		**17**	O	Y243	**17**		NC
16	O	Y204	**16**	O	Y214		**16**	O	Y244	**16**		NC
15	O	Y205	**15**	O	Y215		**15**	O	Y245	**15**		NC
14	O	Y206	**14**	O	Y216		**14**	O	Y246	**14**		NC
13	O	Y207	**13**	O	Y217		**13**	O	Y247	**13**		NC
12	O	Y208	**12**	O	Y218		**12**	O	Y248	**12**		NC
11	O	Y209	**11**	O	Y219		**11**	O	Y249	**11**		NC
10	O	Y20A	**10**	O	Y21A		**10**	O	Y24A	**10**		NC
9	O	Y20B	**9**	O	Y21B		**9**	O	Y24B	**9**		NC
8	O	Y20C	**8**	O	Y21C		**8**	O	Y24C	**8**		NC
7	O	Y20D	**7**	O	Y21D		**7**	O	Y24D	**7**		NC
6	O	Y20E	**6**	O	Y21E		**6**	O	Y24E	**6**		NC
5	O	Y20F	**5**	O	Y21F		**5**	O	Y24F	**5**		NC
4		DOCOM	**4**		DOCOM		**4**		DOCOM	**4**		DOCOM
3		DOCOM	**3**		DOCOM		**3**		DOCOM	**3**		DOCOM
2		DOCOM	**2**		0 V		**2**		DOCOM	**2**		0 V
1		DOCOM	**1**		0 V		**1**		DOCOM	**1**		0 V

CJ38							CJ40							CJ42						
B			A				B			A				B			A			
20	O	Y200	**20**	O	Y210		**20**	O	Y220	**20**	O	Y230		**20**	O	Y260	**20**	O	Y270	
19	O	Y201	**19**	O	Y211		**19**	O	Y221	**19**	O	Y231		**19**	O	Y261	**19**	O	Y271	
18	O	Y202	**18**	O	Y212		**18**	O	Y222	**18**	O	Y232		**18**	O	Y262	**18**	O	Y272	
17	O	Y203	**17**	O	Y213		**17**	O	Y223	**17**	O	Y233		**17**	O	Y263	**17**	O	Y273	
16	O	Y204	**16**	O	Y214		**16**	O	Y224	**16**	O	Y234		**16**	O	Y264	**16**	O	Y274	
15	O	Y205	**15**	O	Y215		**15**	O	Y225	**15**	O	Y235		**15**	O	Y265	**15**	O	Y275	
14	O	Y206	**14**	O	Y216		**14**	O	Y226	**14**	O	Y236		**14**	O	Y266	**14**	O	Y276	
13	O	Y207	**13**	O	Y217		**13**	O	Y227	**13**	O	Y237		**13**	O	Y267	**13**	O	Y277	
12	O	Y208	**12**	O	Y218		**12**	O	Y228	**12**	O	Y238		**12**	O	Y268	**12**	O	Y278	
11	O	Y209	**11**	O	Y219		**11**	O	Y229	**11**	O	Y239		**11**	O	Y269	**11**	O	Y279	
10	O	Y20A	**10**	O	Y21A		**10**	O	Y22A	**10**	O	Y23A		**10**	O	Y26A	**10**	O	Y27A	
9	O	Y20B	**9**	O	Y21B		**9**	O	Y22B	**9**	O	Y23B		**9**	O	Y26B	**9**	O	Y27B	
8	O	Y20C	**8**	O	Y21C		**8**	O	Y22C	**8**	O	Y23C		**8**	O	Y26C	**8**	O	Y27C	
7	O	Y20D	**7**	O	Y21D		**7**	O	Y22D	**7**	O	Y23D		**7**	O	Y26D	**7**	O	Y27D	
6	O	Y20E	**6**	O	Y21E		**6**	O	Y22E	**6**	O	Y23E		**6**	O	Y26E	**6**	O	Y27E	
5	O	Y20F	**5**	O	Y21F		**5**	O	Y22F	**5**	O	Y23F		**5**	O	Y26F	**5**	O	Y27F	
4		DOCOM	**4**		DOCOM		**4**		DOCOM	**4**		DOCOM		**4**		DOCOM	**4**		DOCOM	
3		DOCOM	**3**		DOCOM		**3**		DOCOM	**3**		DOCOM		**3**		DOCOM	**3**		DOCOM	
2		DOCOM	**2**		0 V		**2**		DOCOM	**2**		0 V		**2**		DOCOM	**2**		0 V	
1		DOCOM	**1**		0 V		**1**		DOCOM	**1**		0 V		**1**		DOCOM	**1**		0 V	

[FCU8-DX834]

CG32							CG34					
B			A				B			A		
20	O	Y200	**20**	O	Y210		**20**	O	Y220	**20**	O	Y230
19	O	Y201	**19**	O	Y211		**19**	O	Y221	**19**	O	Y231
18	O	Y202	**18**	O	Y212		**18**	O	Y222	**18**	O	Y232
17	O	Y203	**17**	O	Y213		**17**	O	Y223	**17**	O	Y233
16	O	Y204	**16**	O	Y214		**16**	O	Y224	**16**	O	Y234
15	O	Y205	**15**	O	Y215		**15**	O	Y225	**15**	O	Y235
14	O	Y206	**14**	O	Y216		**14**	O	Y226	**14**	O	Y236
13	O	Y207	**13**	O	Y217		**13**	O	Y227	**13**	O	Y237
12	O	Y208	**12**	O	Y218		**12**	O	Y228	**12**	O	Y238
11	O	Y209	**11**	O	Y219		**11**	O	Y229	**11**	O	Y239
10	O	Y20A	**10**	O	Y21A		**10**	O	Y22A	**10**	O	Y23A
9	O	Y20B	**9**	O	Y21B		**9**	O	Y22B	**9**	O	Y23B
8	O	Y20C	**8**	O	Y21C		**8**	O	Y22C	**8**	O	Y23C
7	O	Y20D	**7**	O	Y21D		**7**	O	Y22D	**7**	O	Y23D
6	O	Y20E	**6**	O	Y21E		**6**	O	Y22E	**6**	O	Y23E
5	O	Y20F	**5**	O	Y21F		**5**	O	Y22F	**5**	O	Y23F
4		+24 V	**4**		+24 V		**4**		+24 V	**4**		+24 V
3		+24 V	**3**		+24 V		**3**		+24 V	**3**		+24 V
2		+24 V	**2**		0 V		**2**		+24 V	**2**		0 V
1		+24 V	**1**		0 V		**1**		+24 V	**1**		0 V

The input/output assignment is modifiable using a parameter. Refer to "18.6.4.2 Arbitrary Device Assignment" for more details.

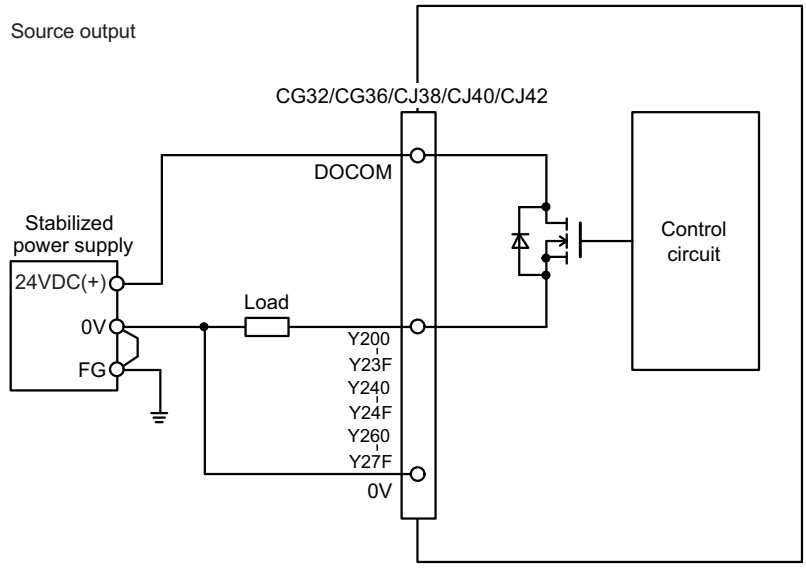
<Cable side connector type>
Connector: XG4M-4030/7940-6500SC
Strain relief: XG4T-4004/3448-7940
Manufacturer: OMRON/3M

[Outline of digital signal output circuit]

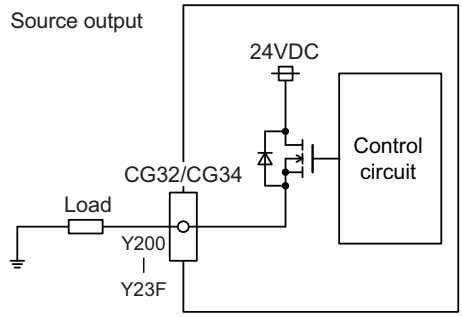
Use within the specification ranges shown below.

<Output circuit>

[FCU8-DX731/FCU8-DX750/FCU8-DX760/FCU8-DX761]



[FCU8-DX834]

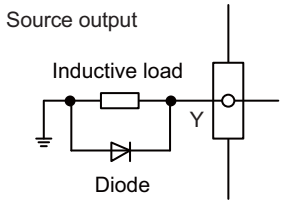


<Output conditions>

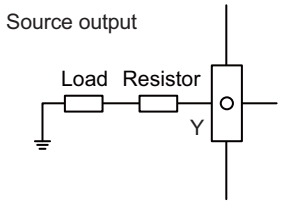
Insulation method	Non-insulation
Rated load voltage	24 VDC
Maximum output current	0.2 A per point [Total output current of whole unit] - For FCU8-DX731/DX750/DX761/DX834: 3.8 A or less - For FCU8-DX760: 5.7 A or less
Output delay time	40 µs

Note

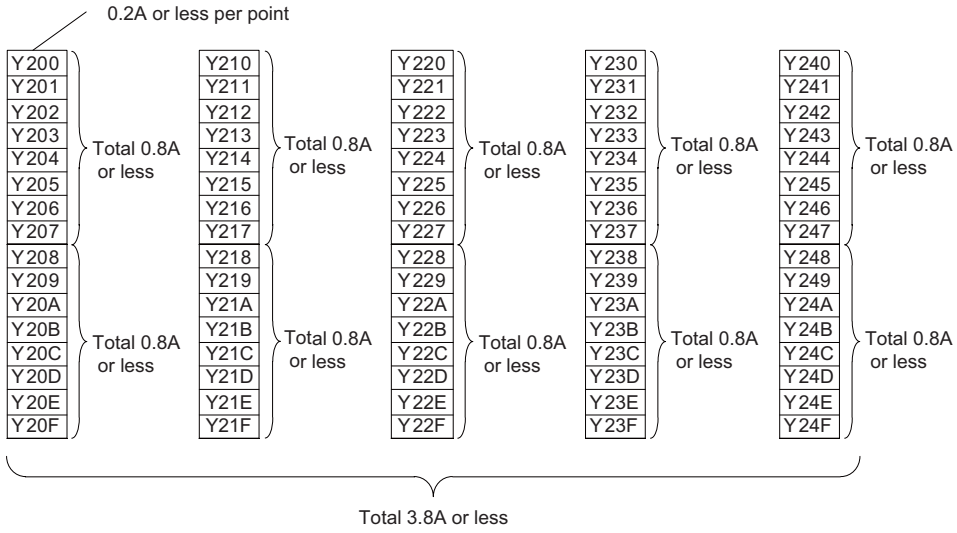
- When using an inductive load such as a relay, always connect a diode (voltage resistance 100 V or more, twice or more the load current) in parallel to the load.

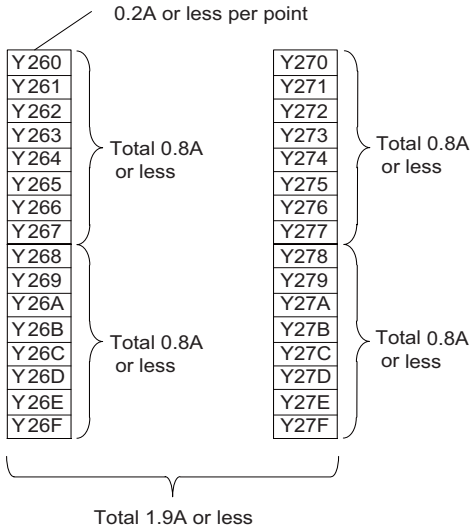


- When the rush current exceeds the maximum output current indicated previously, always connect a protective resistor serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



- Always keep the total sum of output current of each Y200 to Y207, Y208 to Y20F, Y210 to Y217, Y218 to Y21F, Y220 to Y227, Y228 to Y22F, Y230 to Y237, Y238 to Y23F, Y240 to Y247, Y248 to Y24F, Y260 to Y267, Y268 to Y26F, Y270 to Y277, and Y278 to Y27F less than 0.8 A.





⚠ CAUTION

(1) When using an inductive load such as a relay, always connect a diode in parallel to the load to prevent a counter-electromotive force.

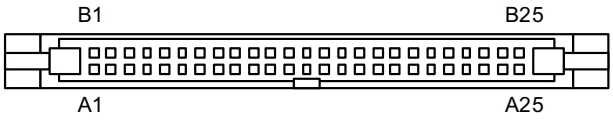
(2) When the rush current exceeds the maximum output current, always connect a protective resistor serially to the load to suppress rush currents.

(7) CJ37 (Machine signal input)

Digital input 48 points (1st and 2nd stations)

(9) CJ39 (Machine signal input)

Digital input 48 points (2nd and 3rd stations)



CJ37							CJ39					
B			A				B			A		
25	I	X200	**25**	I	X218		**25**	I	X230	**25**	I	X248
24	I	X201	**24**	I	X219		**24**	I	X231	**24**	I	X249
23	I	X202	**23**	I	X21A		**23**	I	X232	**23**	I	X24A
22	I	X203	**22**	I	X21B		**22**	I	X233	**22**	I	X24B
21	I	X204	**21**	I	X21C		**21**	I	X234	**21**	I	X24C
20	I	X205	**20**	I	X21D		**20**	I	X235	**20**	I	X24D
19	I	X206	**19**	I	X21E		**19**	I	X236	**19**	I	X24E
18	I	X207	**18**	I	X21F		**18**	I	X237	**18**	I	X24F
17	I	X208	**17**	I	X220		**17**	I	X238	**17**	I	X250
16	I	X209	**16**	I	X221		**16**	I	X239	**16**	I	X251
15	I	X20A	**15**	I	X222		**15**	I	X23A	**15**	I	X252
14	I	X20B	**14**	I	X223		**14**	I	X23B	**14**	I	X253
13	I	X20C	**13**	I	X224		**13**	I	X23C	**13**	I	X254
12	I	X20D	**12**	I	X225		**12**	I	X23D	**12**	I	X255
11	I	X20E	**11**	I	X226		**11**	I	X23E	**11**	I	X256
10	I	X20F	**10**	I	X227		**10**	I	X23F	**10**	I	X257
9	I	X210	**9**	I	X228		**9**	I	X240	**9**	I	X258
8	I	X211	**8**	I	X229		**8**	I	X241	**8**	I	X259
7	I	X212	**7**	I	X22A		**7**	I	X242	**7**	I	X25A
6	I	X213	**6**	I	X22B		**6**	I	X243	**6**	I	X25B
5	I	X214	**5**	I	X22C		**5**	I	X244	**5**	I	X25C
4	I	X215	**4**	I	X22D		**4**	I	X245	**4**	I	X25D
3	I	X216	**3**	I	X22E		**3**	I	X246	**3**	I	X25E
2	I	X217	**2**	I	X22F		**2**	I	X247	**2**	I	X25F
1		DICOM	**1**		DICOM		**1**		DICOM	**1**		DICOM

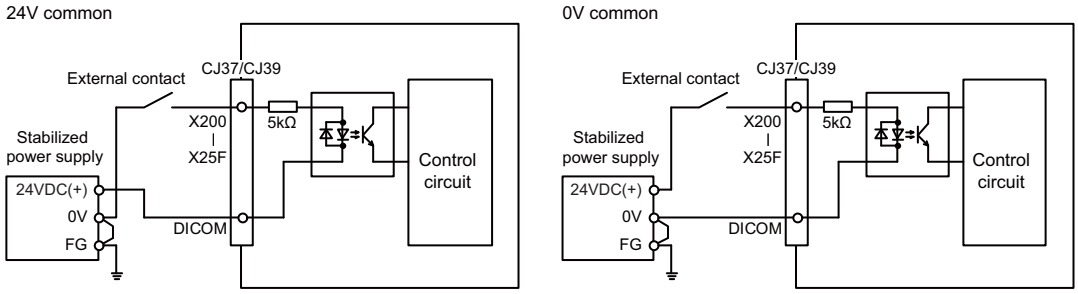
The input/output assignment is modifiable using a parameter. Refer to "18.6.4.2 Arbitrary Device Assignment" for more details.

<Cable side connector type>
Connector: XG4M-5030/7950-6500SC
Strain relief: XG4T-5004/3448-7950
Manufacturer: OMRON/3M

[Outline of digital signal input circuit]

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

<Input circuit>

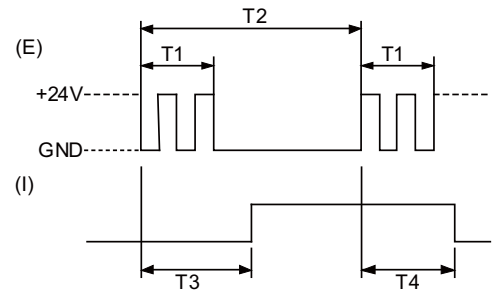
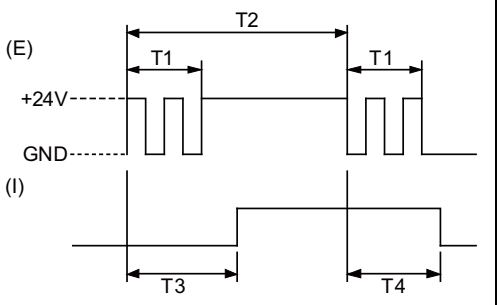


<Input conditions>

Set the input signal within the range as shown in the conditions below.

		24 V common	0 V common
1	**Input voltage at external contact ON**	6 V or less	18 V or more, 25.2 V or less
2	**Input current at external contact ON**	3 mA or more	
3	**Input voltage at external contact OFF**	20.2 V or more, 25.2 V or less	3.8 V or less
4	**Input current at external contact OFF**	0.7 mA or less	
5	**Input resistance**	5 kΩ	
6	**Tolerable chattering time (T1)**	3 ms	
7	**Input signal holding time (T2)**	40 ms or more (*1)	
8	**Input circuit operation delay time (T3 and T4)**	3 ms to 16 ms	
9	**Machine side contact capacity**	30 V or more, 16 mA or more	

(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

Connection to 24 V common input	Connection to 0 V common input
	

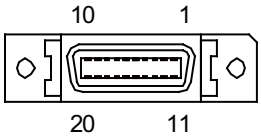
(E): External signal, (I): Internal signal

Note

- Set the number of DI points that are simultaneously turned ON to less than half of the total points.
  If there are many points that are turned ON at the same time, operation panel I/O unit may deteriorate due to heat.

(12) MPG (Manual pulse generator input)

5 V manual pulse generator and 12 V manual pulse generator can be connected to this connector.



[FCU8-DX731]

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

[FCU8-DX750/FCU8-DX760/FCU8-DX761]

1		0 V	**11**		0 V
2	I	HA3A	**12**	I	HA3B
3	I	HA2A	**13**	I	HA2B
4	I	HA1A	**14**	I	HA1B
5		0 V	**15**		0 V
6	O	+12 V	**16**	O	+12 V
7		NC	**17**		NC
8		NC	**18**		NC
9	O	+12 V	**19**	O	+5 V
10	O	+5 V	**20**	O	+5 V

- Connect connector case with FG pattern.

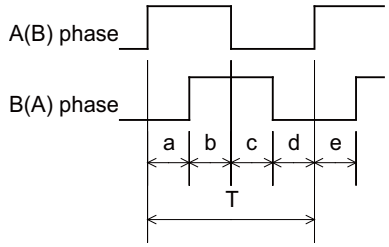
<Cable side connector type>
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

Note

- When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
  (Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

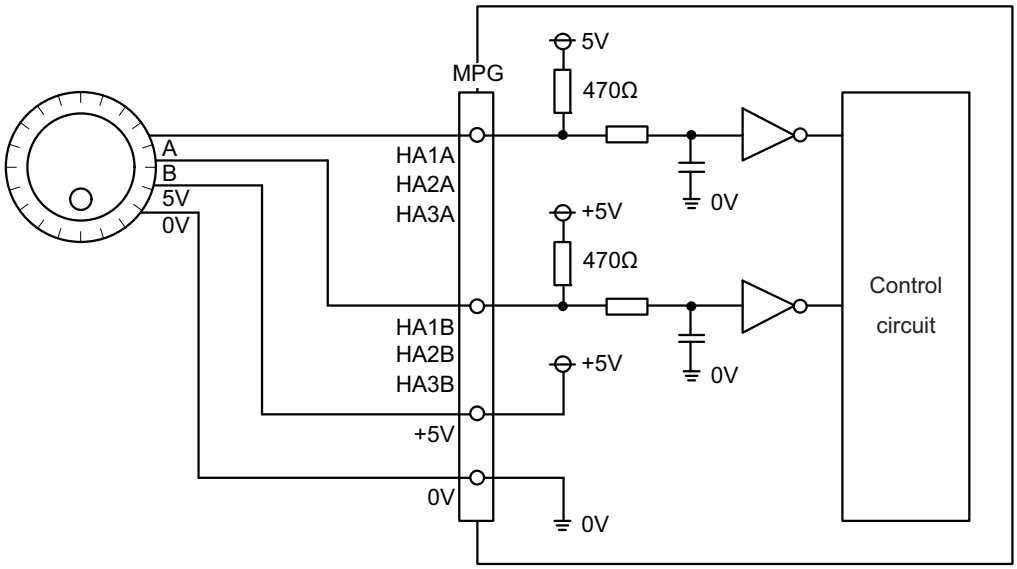
<Specification of input part>

	5 V manual pulse generator	12 V manual pulse generator
Number of pulse phases	Two phases (A phase, B phase, a phase difference 90 degrees) (Refer to the waveform below.)	
Signal output of manual pulse generator	Open collector output	
Signal voltage	H level 3.5 V to 5.25 V L level 0 V to 0.5 V	
Power supply voltage	5 VDC ±10%	12 VDC ±10%
Current consumption	100 mA or less	
Number of pulses per rotation	25 pulse/rev, 100 pulse/rev	
Input frequency (rotation speed)	1 kHz or less (2400 rpm or less for 25 pulses/rev, 600 rpm or less for 100 pulses/rev)	
Cable length	20 m or less	50 m or less



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

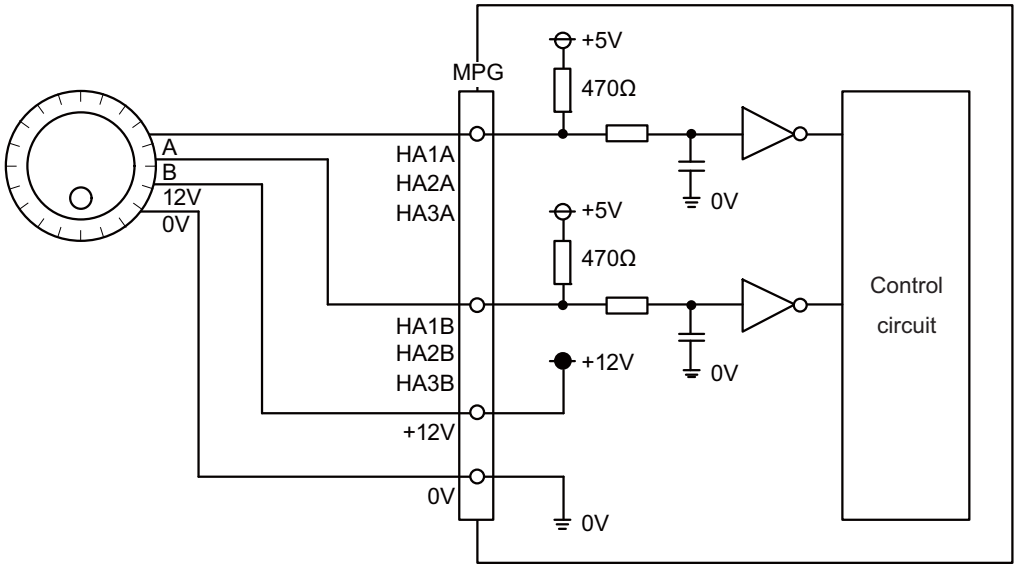
<Input/output circuit>
[5 V manual pulse generator]



Note

- No HA3A and HA3B in FCU8-DX731.

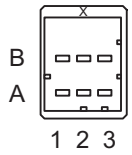
[12 V manual pulse generator]



Note

- No HA3A and HA3B in FCU8-DX731.

(13) RIO3EXT (Remote I/O 2.0 communication)
(14) RIO3 (Remote I/O 2.0 communication)



A			B		
1	I/O	TXRXD	**1**	I/O	TXRXD*
2		NC	**2**		0 V
3		FG	**3**		NC

<Cable side connector type>
Connector: 1-1318119-3
Contact: 1318107-1
Manufacturer: TE Connectivity

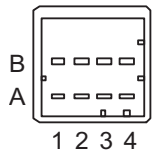
Refer to the following chart for the maximum number of connecting stations and I/O points to the connector RIO3EXT.

Operation panel I/O unit type	Max. number of stations (RIO3EXT connection)	Max. number of I/O points (RIO3EXTconnection)
FCU8-DX731	53 stations (2nd, 4th to 6th, 13th to 19th, and 23rd to 64th stations can be used)	1696 points/ 1696 points
FCU8-DX750	52 stations (4th to 6th, 13th to 19th, and 23rd to 64th stations can be used)	1664 points/1664 points
FCU8-DX760	51 stations (5th, 6th, 13th to 19th, and 23rd to 64th stations can be used)	1632 points/1632 points
FCU8-DX761	50 stations (6th, 13th to 19th, and 23rd to 64th stations can be used)	1600 points/1600 points
FCU8-DX834	49 stations (5th, 6th, 15th to 19th, and 23rd to 64th stations can be used)	1568 points/1568 points

Note

- Refer to the section "4.9 Remote I/O Unit" for the number of occupying stations and I/O points of remote I/O units.

(15) CJ71 (Control unit I/F)



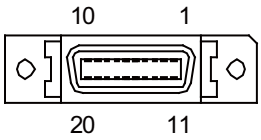
A1	I/O	TXRXD	**B1**	I/O	TXRXD*
A2	-	+5 V	**B2**	-	+3.3 V
A3	-	-	**B3**	-	0 V
A4	-	FG	**B4**	-	0 V

<Cable side connector type>
Connector: 2-1318119-4
Contact: 1318107-1
Manufacturer: TE Connectivity

(16) NCKB (Keyboard I/F)

(17) AO (Analog output)

Analog output can be connected to this connector.



1		0 V	**11**		0 V
2		NC	**12**		NC
3		NC	**13**		NC
4		NC	**14**		NC
5		0 V	**15**		0 V
6		NC	**16**		NC
7	O	AO	**17**		NC
8		NC	**18**		NC
9		NC	**19**		NC
10		NC	**20**		NC

- Connect connector case with FG pattern.

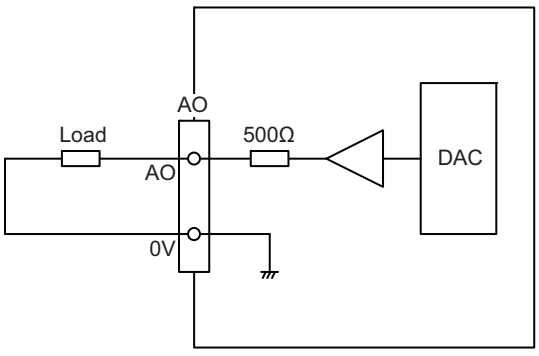
<Cable side connector type>
Plug: 10120-3000PE
Shell: 10320-56F0-008
Manufacturer: 3M

Note

- When using the jackscrew M2.6-type 10320-56S0-008-F for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
  (Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

[Outline of analog signal output circuit]

<Output circuit>

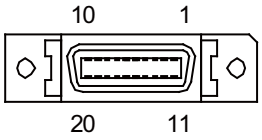


<Output conditions>

Analog output voltage	-10 V to 10 V (±5%)
Resolution	10 V/4095 = 2.44 mV
Load conditions	External load resistance value 10 kΩ or more
Output resistance value	500 Ω

(18) AIO (Analog input, Analog output)

Analog input and analog output can be connected to this connector.



1		0 V	**11**		0 V
2	I	AI0	**12**		NC
3		NC	**13**		NC
4		NC	**14**		NC
5		0 V	**15**		0 V
6		NC	**16**		NC
7	O	AO	**17**		NC
8		NC	**18**		NC
9		0 V	**19**		NC
10		NC	**20**		NC

- Connect connector case with FG pattern.

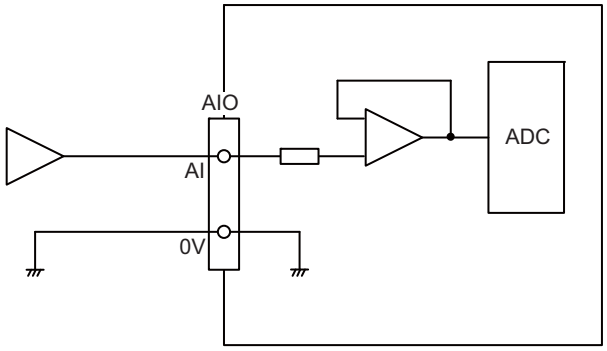
<Cable side connector type>
Plug: 10120-3000PE
Shell: 10320-56F0-008
Manufacturer: 3M

Note

- When using the jackscrew M2.6-type 10320-56S0-008-F for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
  (Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

[Outline of analog signal input circuit]

<Input circuit>



<Input conditions>

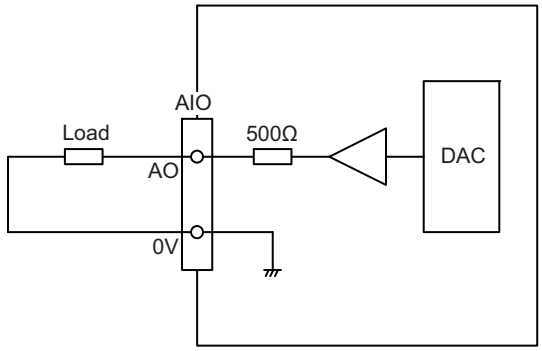
Analog input voltage	-10 V to 10 V
Max. input rating (*1)	±15 V
Resolution	|-10 V to +10 V|/4095 = 4.88 mV
Repeatability	Within ±25 mV (*2)
Tolerance	±0.35 V

(*1) This indicates the input voltage which must not be exceeded even in an instant.

(*2) Except when the accuracy is affected by the noise.

[Outline of analog signal output circuit]

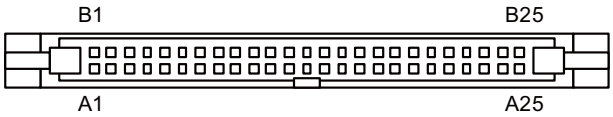
<Output circuit>



<Output conditions>

Analog output voltage	-10 V to 10 V (±5%)
Resolution	10 V/4095 = 2.44 mV
Load conditions	External load resistance value 10 kΩ or more
Output resistance value	500 Ω

(19) OPKB (Scan input, scan output)

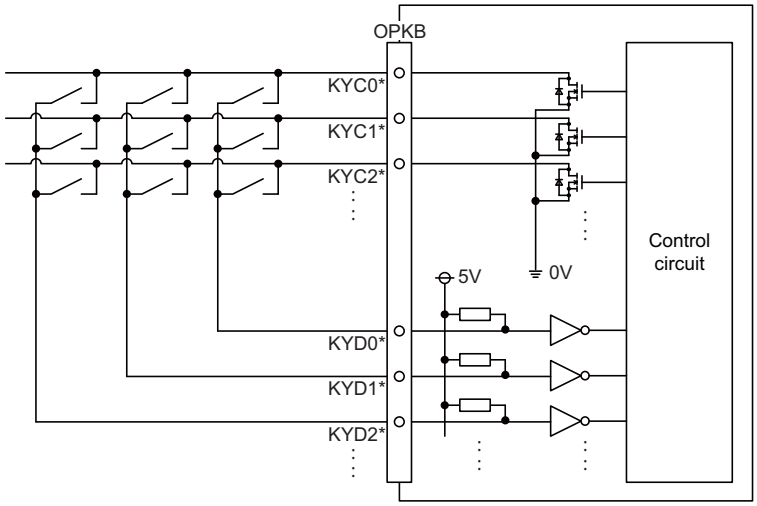


OPKB					
B			A		
25		0 V	**25**		0 V
24	O	LC3B	**24**	O	LC3A
23	O	LC2B	**23**	O	LC2A
22	O	LC1B	**22**	O	LC1A
21	O	LC0B	**21**	O	LC0A
20	I	LD7B*	**20**	I	LD7A*
19	I	LD6B*	**19**	I	LD6A*
18	I	LD5B*	**18**	I	LD5A*
17	I	LD4B*	**17**	I	LD4A*
16	I	LD3B*	**16**	I	LD3A*
15	I	LD2B*	**15**	I	LD2A*
14	I	LD1B*	**14**	I	LD1A*
13	I	LD0B*	**13**	I	LD0A*
12		0 V	**12**		NC
11		NC	**11**		NC
10		NC	**10**	O	NC
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		NC	**1**		0 V

<Cable side connector type>
Connector: XG4M-5030/7950-6500SC
Strain relief: XG4T-5004/3448-7950
Manufacturer: OMRON/3M

[Outline of scan input circuit]

<Input circuit>

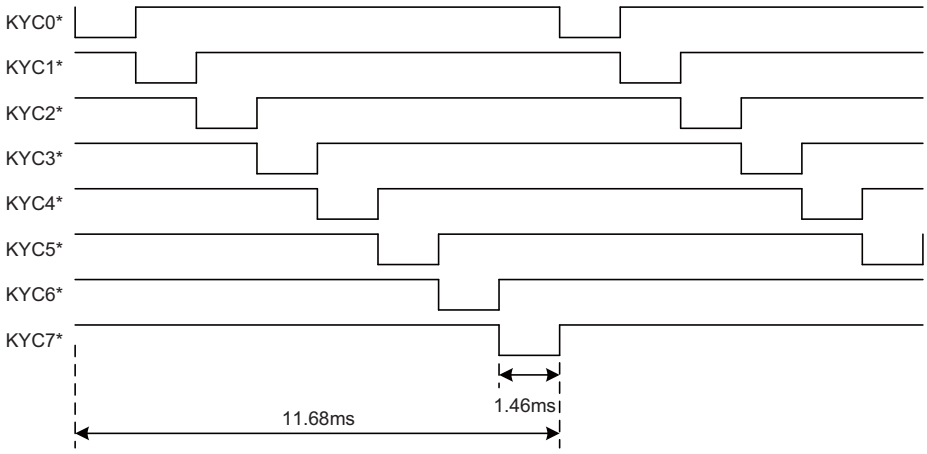


<Input conditions>

1	**Number of points**	64 points
2	**Configuration**	Matrix of 8 common signals × 8 data signals
3	**Rated voltage**	5 VDC
4	**Minimum applicable load**	1.4 mA per point
5	**Input signal holding time**	11.68 ms or more (*1)

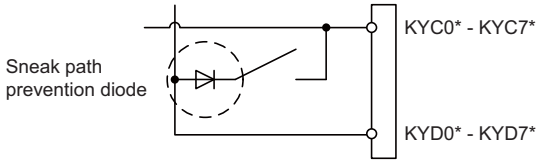
(*1) Input signal holding time: The guide is 11.68 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

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 11.68 ms, but the input signal is recognized only when state of the signal is held longer than the ladder processing cycle time.



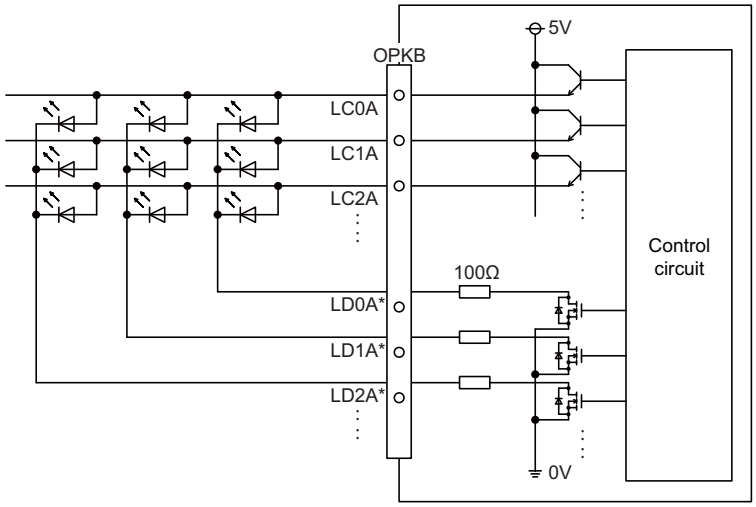
Note

- To perform a scan input, connect a sneak path prevention diode as illustrated below. Input signals may not be read correctly without the sneak path prevention diode.



[Outline of scan output circuit]

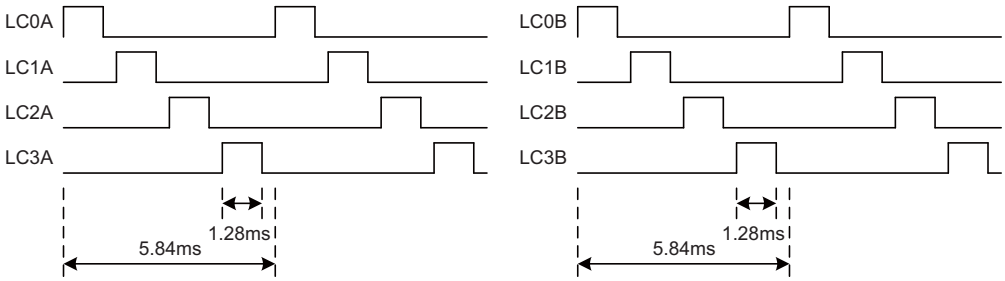
<Output circuit>



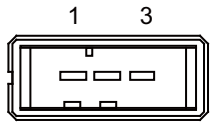
<Output conditions>

1	**Number of points**	64 points
2	**Configuration**	Matrix of 4 common signals × 4 data signals + 4 common signals × 4 data signals
3	**Rated voltage**	5 VDC
4	**Maximum output current**	23 mA per point

The common signals are switched over with scan output as shown in the following drawing. The LED lights only when the common signal is High. As the common signal, four signals are switched in order, and LED lights once every 5.84 ms for 1.28 ms.



(20) DCIN (24 VDC input)



1	I	+24 V
2		0 V
3		FG

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

[Power supply specifications]
Consider the following selection items when selecting the stabilized power supply (supplied by the machine tool 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
Output	**Voltage fluctuation**	±5% or less of 24 VDC
	Ripple noise	200 mV (P-P)
Power capacity		Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
Output holding time		20 ms
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

- 24 VDC voltage may drop instantaneously due to rush current at the beginning of 24 V power supply to the operation panel I/O 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.

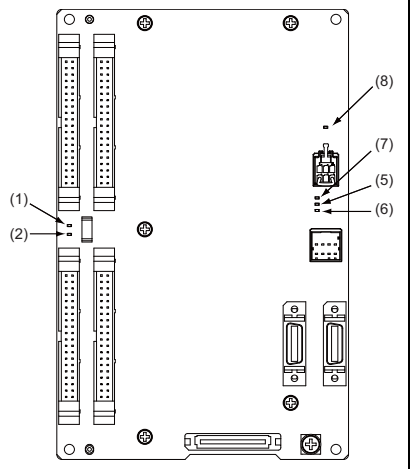
⚠ CAUTION

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

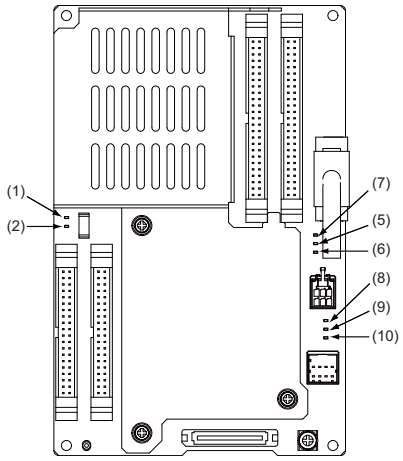
(21) FG (FG terminal)

LED

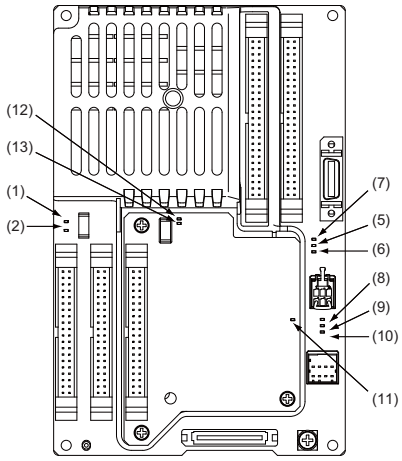
FCU8-DX731



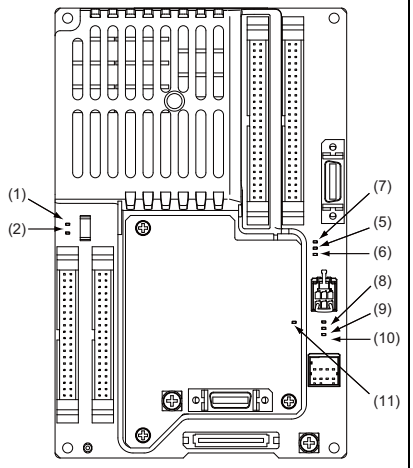
FCU8-DX750



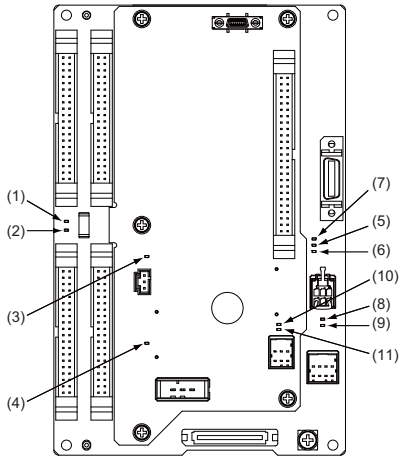
FCU8-DX760



FCU8-DX761



FCU8-DX834



No.	Name	Function	Color	Status		Details
				Normal	At fault	
(1)	FUSE	Fuse status	Green	Lit	Not lit	Not lit when a fuse has been blown out.
(2)	DOCOM	Energization status of 24 VDC input (DOCOM) of CG32/CG36/CJ38/CJ40 connector	Green	Lit	Not lit	Lit when a current is applied.
(3)	EMG	Emergency stop input status	Red	Not lit	Lit	Lit when an emergency stop has occurred.
(4)	24 VDCIN	Energization status of 24 VDC input of DCIN connector	Green	Lit	Not lit	Lit when a current is applied.
(5)	5VIN	5 V power supply circuit status	Green	Lit	Not lit	Lit when the circuit is normally operated.
(6)	3VIN	3.3 V power supply circuit status	Green	Lit	Not lit	Lit when the circuit is normally operated.
(7)	12VON	12 V power supply circuit status	Green	Lit	Not lit	Lit when the circuit is normally operated.
(8)	ALM1	RIO communication error	Red	Not lit	Lit	Lit when RIO communication error has occurred.
(9)	ALM2	RIO communication error	Red	Not lit	Lit	Lit when RIO communication error has occurred.
(10)	ALM3	RIO communication error	Red	Not lit	Lit	Lit when RIO communication error has occurred.
(11)	ALM4	RIO communication error	Red	Not lit	Lit	Lit when RIO communication error has occurred.
(12)	FUSE2	Fuse status	Green	Lit	Not lit	Not lit when a fuse has been blown out.
(13)	DOCOM2	Energization status of 24 VDC input (DOCOM) of CJ42 connector	Green	Lit	Not lit	Lit when a current is applied.

4.9 Remote I/O Unit

Types of signals described on the list of units can be input/output from the remote I/O unit (FCU8-DXxxx) according to the type and No. of contacts. Remote I/O units are used by being connected to 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 64 or less.

Note

(1) The maximum connectable number of remote I/O units is 32.

4.9.1 List of Units

Classification	Type	Components	Remarks
DI 24 V/0 V common input [32 points] DO Source output [32 points]	FCU8-DX220	Base card RIO 2.0 connector set	DI: 32-point 24 V/0 V common type DO: 32-point source type (200 mA/point) Number of occupied stations: 1
DI 24 V/0 V common input [64 points] DO Source output [48 points]	FCU8-DX230	Base card RIO 2.0 connector set	DI: 64-point 24 V/0 V common type DO: 48-point source type (200 mA/point) Number of occupied stations: 2
DI 24 V/0 V common input [64 points] DO Source output [48 points] AO analog output [1 point]	FCU8-DX231	Base card RIO 2.0 connector set	DI: 64-point 24 V/0 V common type DO Source type [48 points] (200 mA/point) AO: 1 point Number of occupied stations: 2
AI analog input [4 points] AO analog output [1 point]	FCU8-DX202	Base card RIO 2.0 connector set	AI: 4 points AO: 1 point Number of occupied stations: 1
DI 0 V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213	Base card RIO 2.0 connector set	DI: 16-point 0 V common type (3 mA/point) DO: 8-point source type (2 A/point) Number of occupied stations: 1
DI 0 V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213-1	Base card RIO 2.0 connector set	DI: 16-point 0 V common type (9 mA/point) DO: 8-point source type (2 A/point) Number of occupied stations: 1
DI 24 V/0 V common input [32 points] DO Source output [32 points] (*1)	FCU8-DX520	Base card RIO 2.0 connector set	DI: 32-point 24 V/0 V common type (9 mA/point) DO: 32-point source type (200 mA/point) Number of occupied stations: 1
Safety DI 0 V common input [8 points] Safety DO Source output (large capacity) [4 points]	FCU8-DX654	Base card RIO 2.0 connector set	Safety DI: 8-point 0 V common type (3 mA/point) Safety DO: 4-point source type (2 A/point) Number of occupied stations: 2
Safety DI 0 V common input [8 points] Safety DO Source output (large capacity) [4 points]	FCU8-DX654-1	Base card RIO 2.0 connector set	Safety DI: 8-point 0 V common type (9 mA/point) Safety DO: 4-point source type (2 A/point) Number of occupied stations: 2
DI 24 V/0 V common input [32 points] DO Source output [32 points] Safety DI 0V common input [8 points] (*2) Safety relay output [4 points] (*3)	FCU8-DX651	Base card Add-on card RIO 2.0 connector set	DI: 24 V/0 V common type [32 points] DO: 32-point source type (200 mA/point) Safety DI: 8-point 0 V common type Safety relay: 4 points (non-voltage contact) Relay contact welding detection Number of occupied stations: 3
Thermistor input (12 points)	FCU8-DX408	Base card RIO 2.0 connector set	Thermistor input: 12 points Number of occupied stations: 3
Multi-analog input [4 points] (*4)	FCU8-DX409	Base card RIO 2.0 connector set	Multi-analog input: 4 points Number of occupied stations: 4

(*1) The machine signal output of FCU8-DX520 is configured with 8 commons. The number of output points per common is 4.
When total output current of a common is 0.8 A or less, 0.3 A can be output at only any one point.

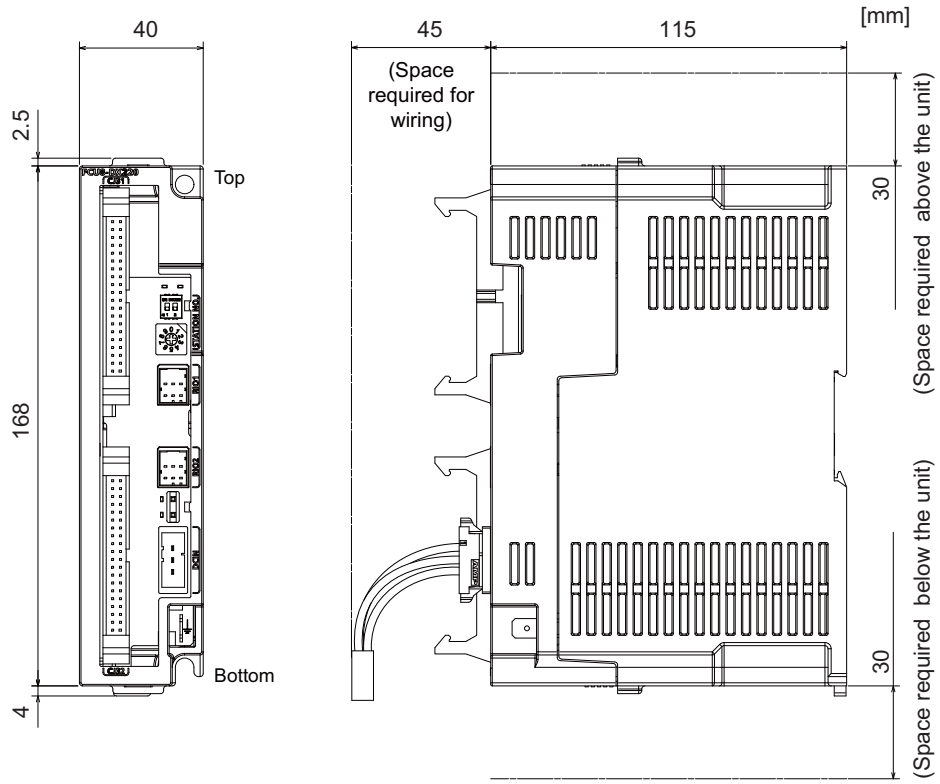
(*2) Safety DI uses 16 points of terminal because of the duplication wiring.

(*3) Safety relay output uses 8 points of terminal because of the duplication wiring.

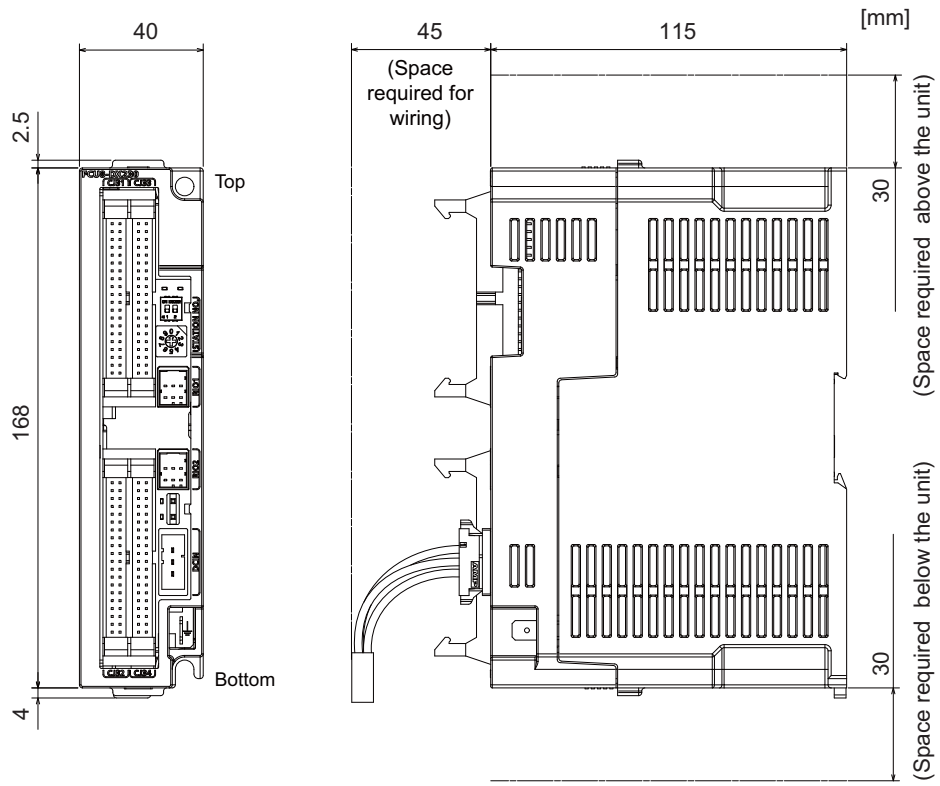
(*4) Voltage input, current input, thermocouple input and resistance temperature detector input are selected for each CH.

4.9.2 FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX202/FCU8-DX213/ FCU8-DX213-1/FCU8-DX520/FCU8-DX654/FCU8-DX654-1/FCU8-DX651/ FCU8-DX408/FCU8-DX409

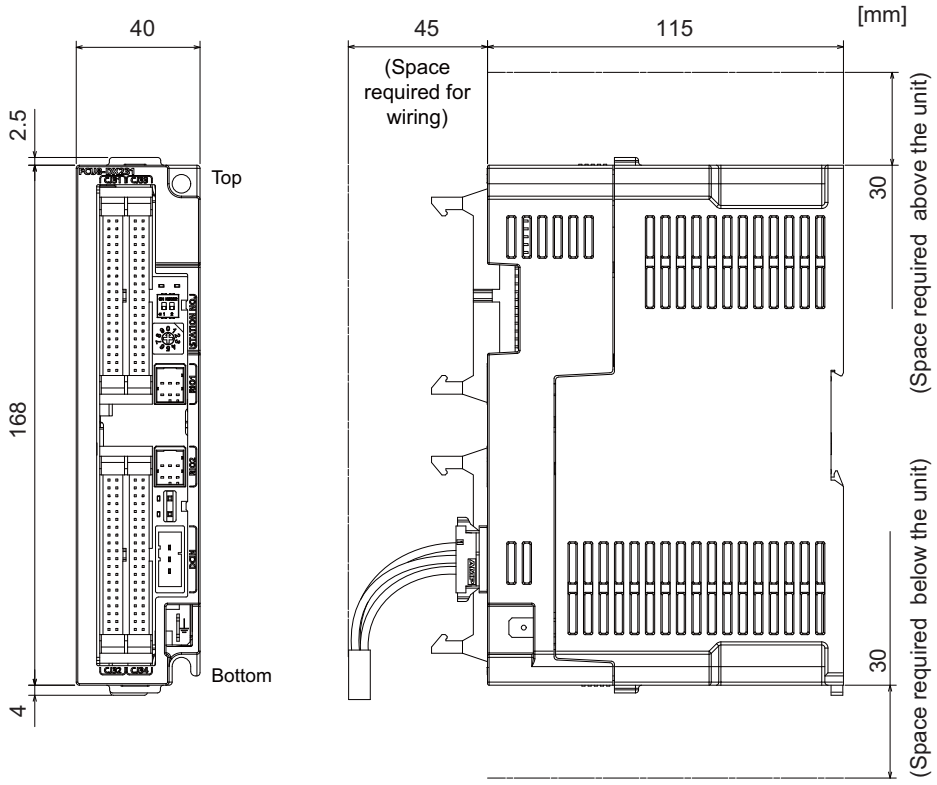
Outline dimensions: FCU8-DX220



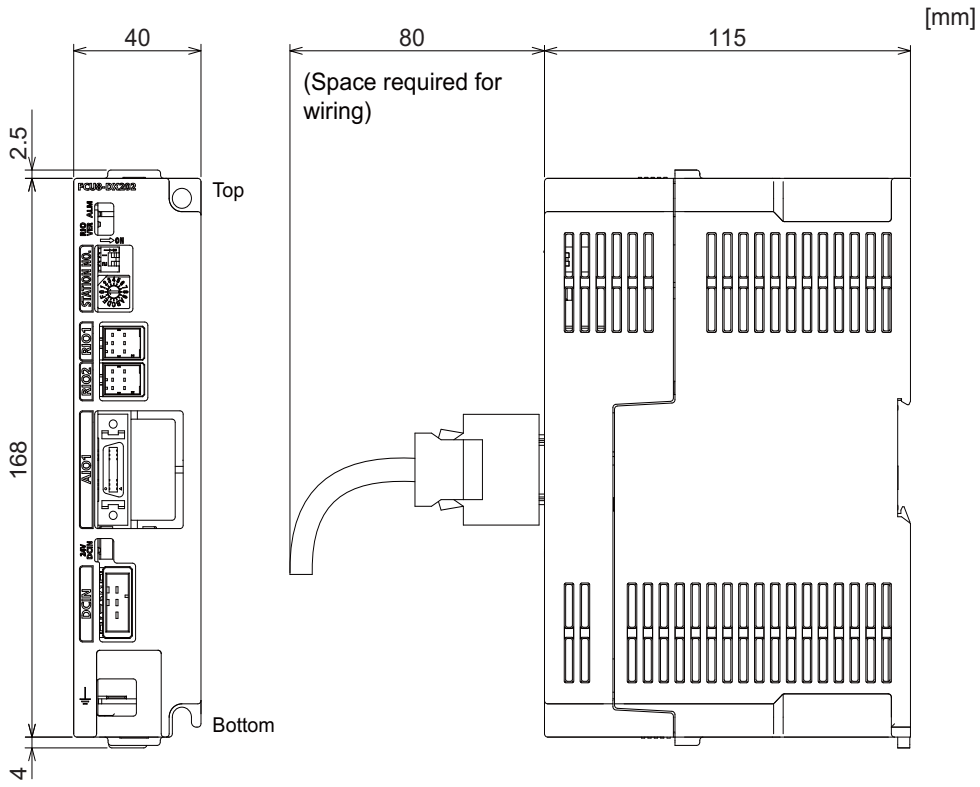
Outline dimensions: FCU8-DX230



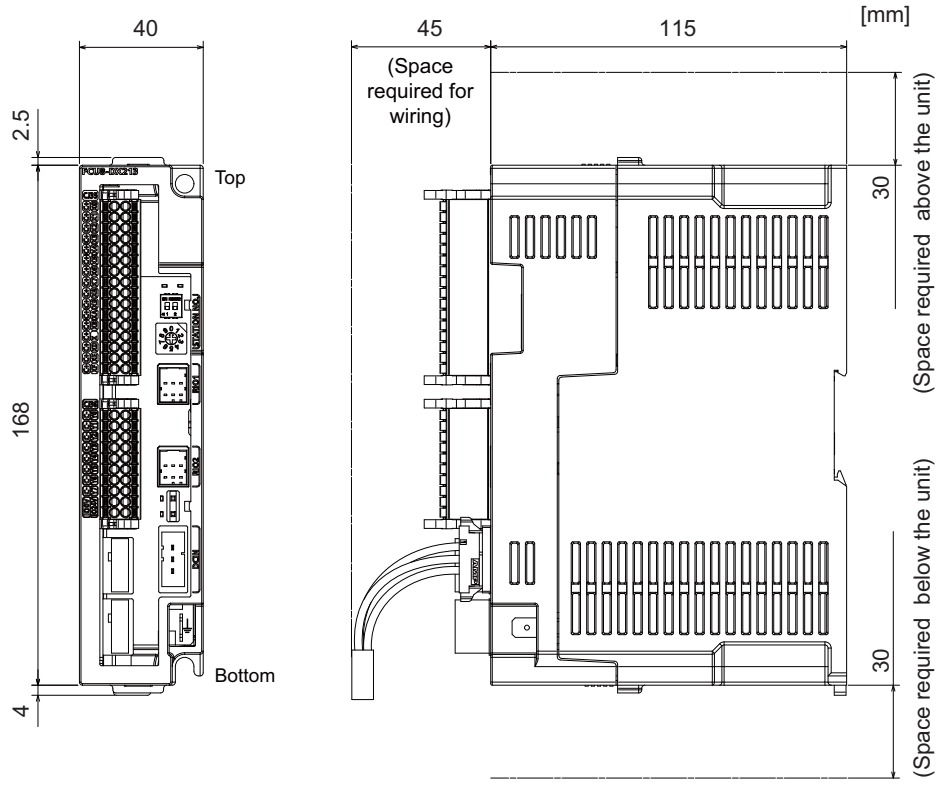
Outline dimensions: FCU8-DX231



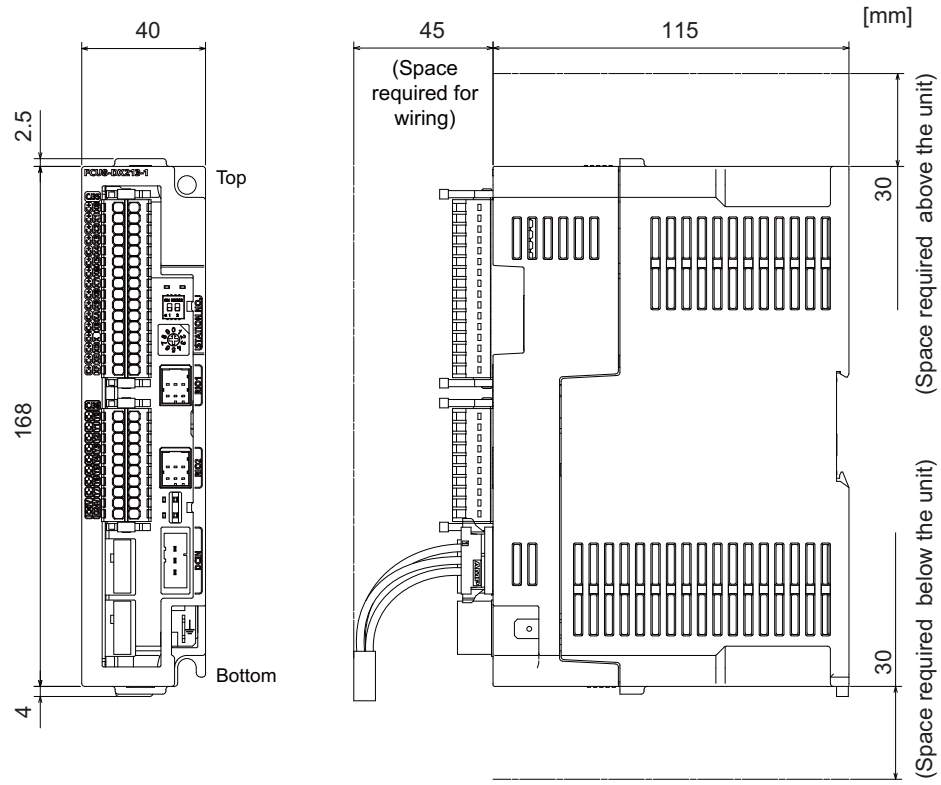
Outline dimensions: FCU8-DX202



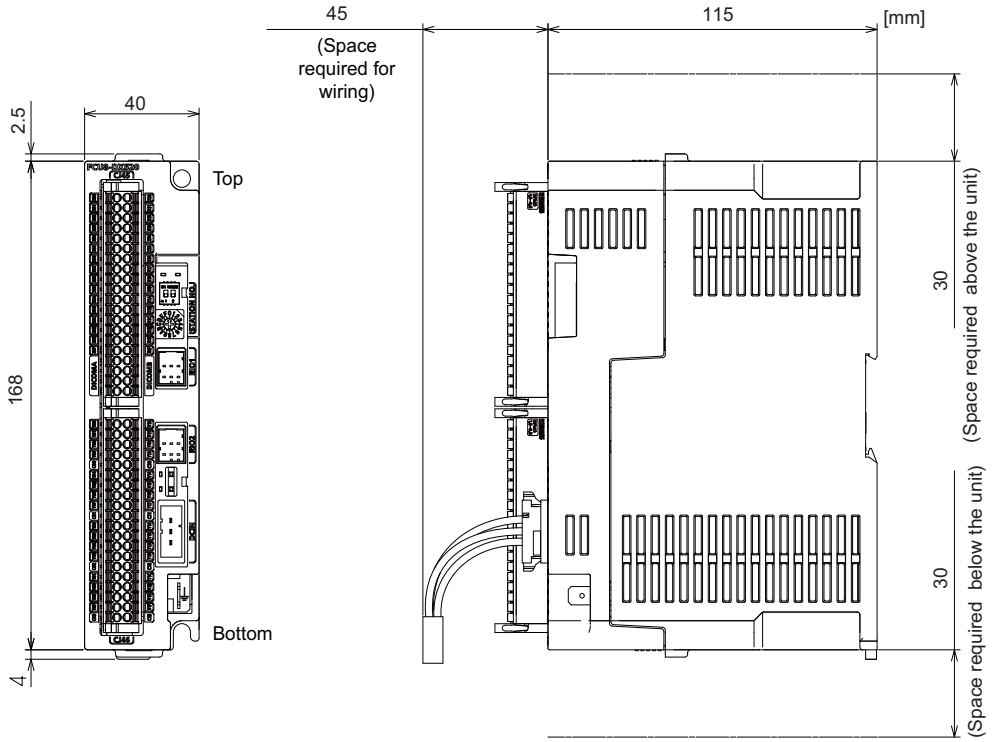
Outline dimensions: FCU8-DX213



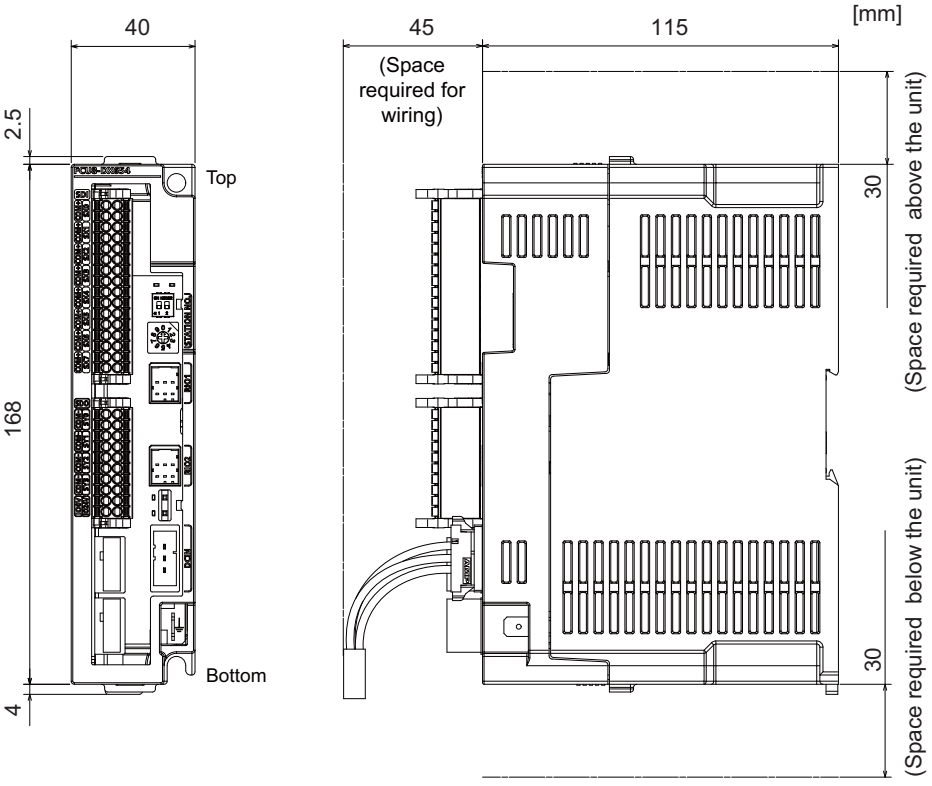
Outline dimensions: FCU8-DX213-1



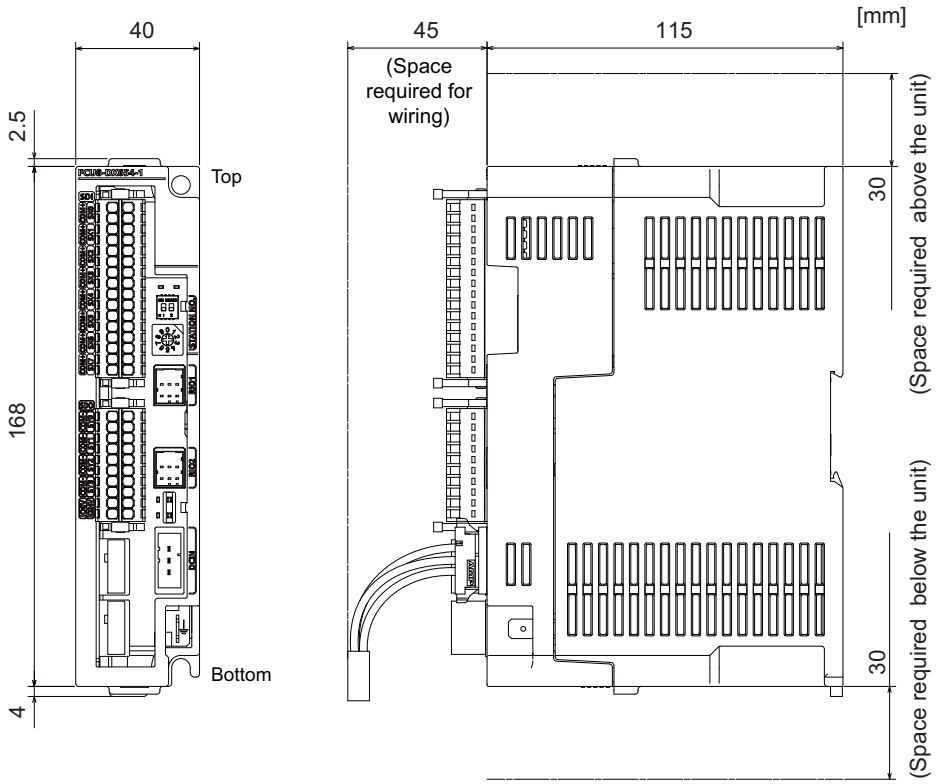
Outline dimensions: FCU8-DX520



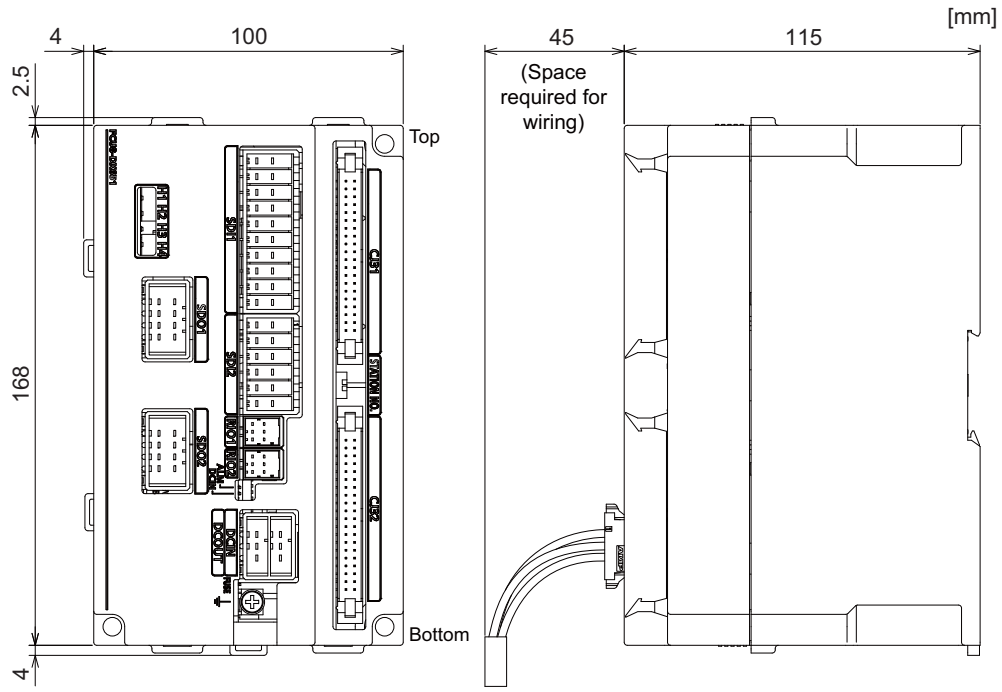
Outline dimensions: FCU8-DX654



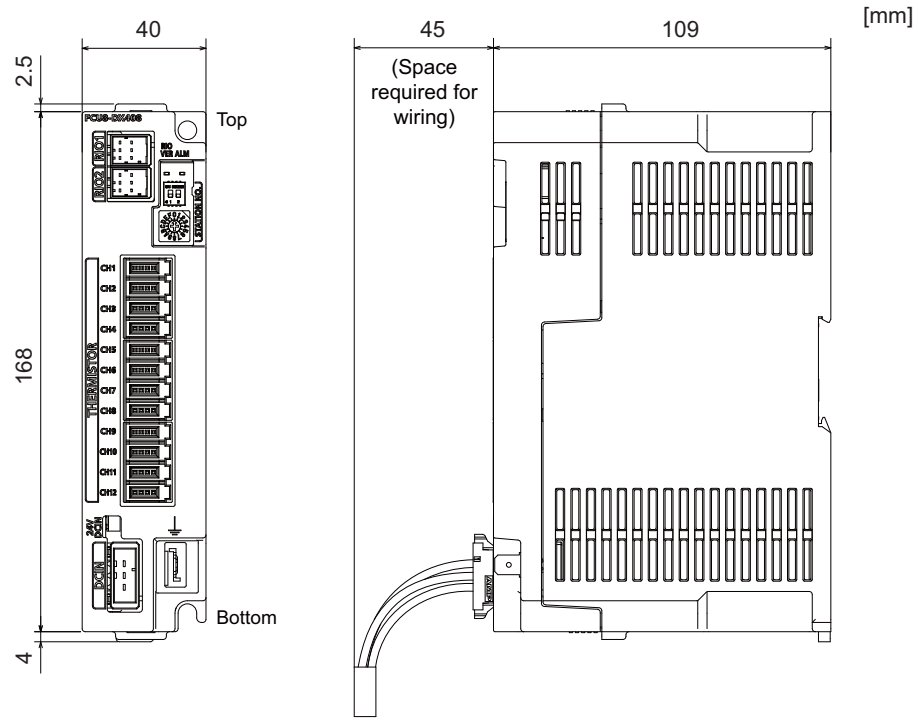
Outline dimensions: FCU8-DX654-1



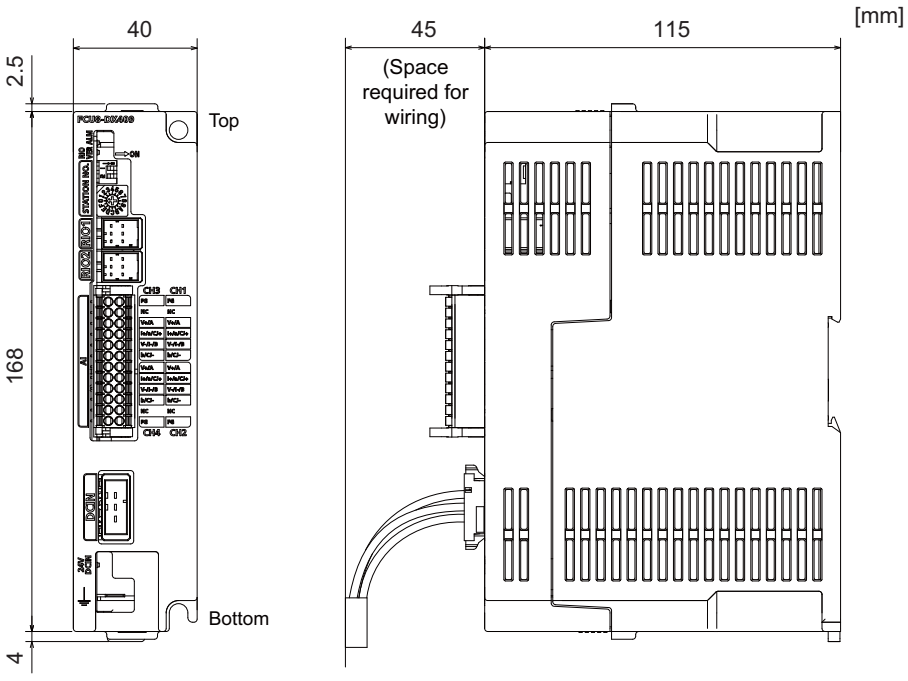
Outline dimensions: FCU8-DX651



Outline dimensions: FCU8-DX408

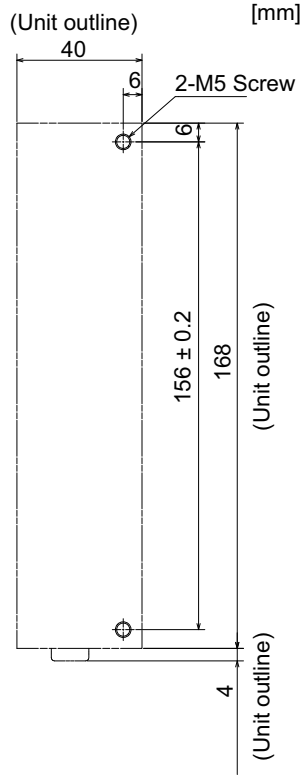


Outline dimensions: FCU8-DX409



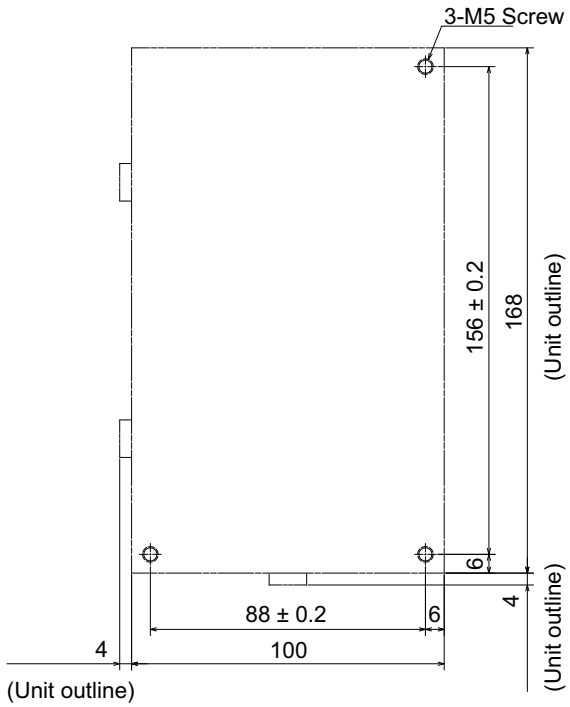
Installation dimensions: FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX202/FCU8-DX213/ FCU8-DX213-1/FCU8-DX520/FCU8-DX654/FCU8-DX654-1/FCU8-DX408/FCU8-DX409

[mm]



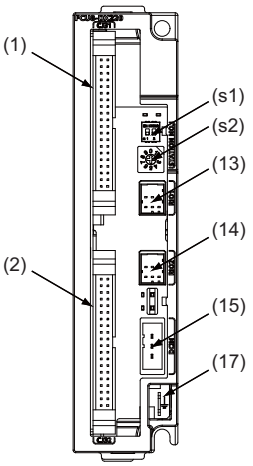
Installation dimensions: FCU8-DX651

[mm]

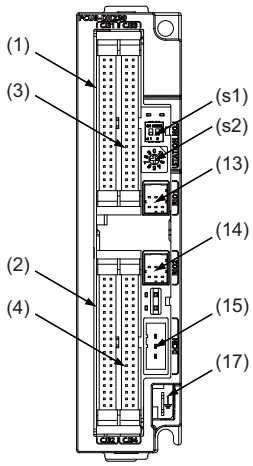


Connector

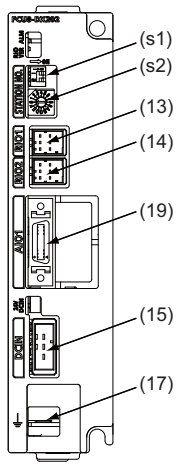
FCU8-DX220



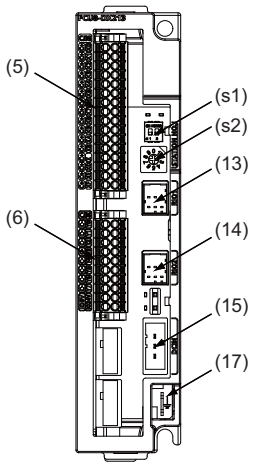
FCU8-DX230/DX231



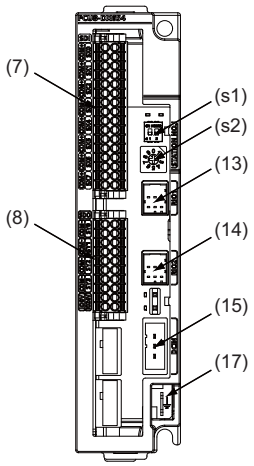
FCU8-DX202



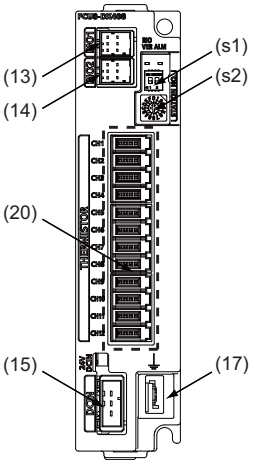
FCU8-DX213/DX213-1



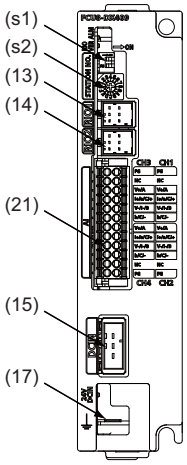
FCU8-DX654/DX654-1



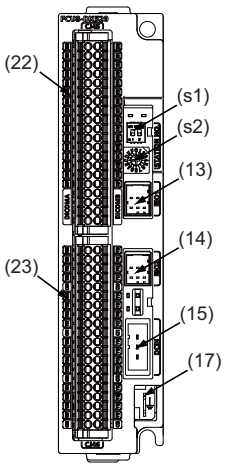
FCU8-DX408



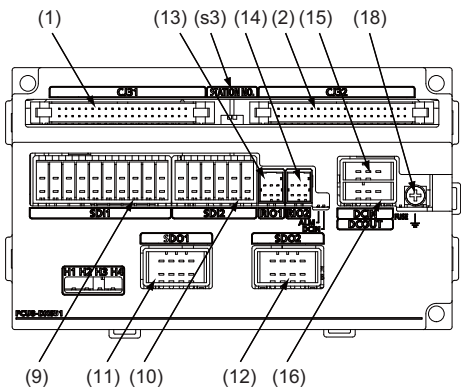
FCU8-DX409



FCU8-DX520



FCU8-DX651



No.	Connector name	Function
(1)	CJ31	Machine signal input
(2)	CJ32	Machine signal output
(3)	CJ33	Machine signal input
(4)	CJ34	Machine signal output
(5)	CJ35	Machine signal input
(6)	CJ36	Machine signal output
(7)	SDI	Safety machine signal input
(8)	SDO	Safety machine signal output
(9)	SDI1	Safety DI input
(10)	SDI2	Safety DI input
(11)	SDO1	Safety relay output
(12)	SDO2	Safety relay output

No.	Connector name	Function
(13)	RIO1	Remote I/O 2.0 communication
(14)	RIO2	Remote I/O 2.0 communication
(15)	DCIN	24 VDC input
(16)	DCOUT	24 VDC output
(17)	FG	FG terminal
(18)	FG	FG terminal (M4 screw)
(19)	AIO1	Analog input Analog output
(20)	THERMISTOR	Thermistor input
(21)	AI	Multi-analog input
(22)	CJ45	Machine signal input
(23)	CJ46	Machine signal output

No.	Switch name	Function
(s1)	STATION No.	Station No. group setting switch
(s2)		Station No. setting switch
(s3)		Station No. setting switch

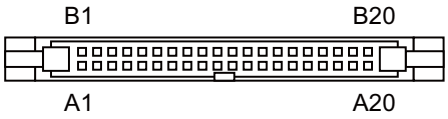
⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

⚠ Output from 12 V/5 V/3.3 V connectors is for powering peripheral devices only. If used for powering other equipment, NC operation will not be guaranteed due to voltage drops or wraparound noise.

(1) CJ31 (Machine signal input)
(3) CJ33 (Machine signal input)



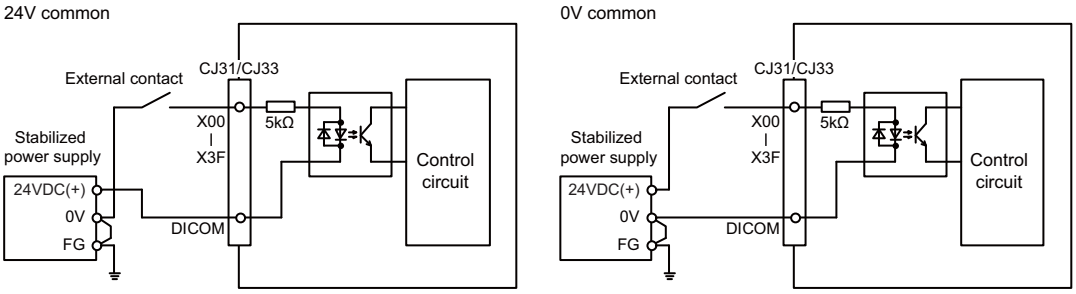
CJ31							CJ33					
B			A				B			A		
20	I	X00	**20**	I	X10		**20**	I	X20	**20**	I	X30
19	I	X01	**19**	I	X11		**19**	I	X21	**19**	I	X31
18	I	X02	**18**	I	X12		**18**	I	X22	**18**	I	X32
17	I	X03	**17**	I	X13		**17**	I	X23	**17**	I	X33
16	I	X04	**16**	I	X14		**16**	I	X24	**16**	I	X34
15	I	X05	**15**	I	X15		**15**	I	X25	**15**	I	X35
14	I	X06	**14**	I	X16		**14**	I	X26	**14**	I	X36
13	I	X07	**13**	I	X17		**13**	I	X27	**13**	I	X37
12	I	X08	**12**	I	X18		**12**	I	X28	**12**	I	X38
11	I	X09	**11**	I	X19		**11**	I	X29	**11**	I	X39
10	I	X0A	**10**	I	X1A		**10**	I	X2A	**10**	I	X3A
9	I	X0B	**9**	I	X1B		**9**	I	X2B	**9**	I	X3B
8	I	X0C	**8**	I	X1C		**8**	I	X2C	**8**	I	X3C
7	I	X0D	**7**	I	X1D		**7**	I	X2D	**7**	I	X3D
6	I	X0E	**6**	I	X1E		**6**	I	X2E	**6**	I	X3E
5	I	X0F	**5**	I	X1F		**5**	I	X2F	**5**	I	X3F
4		NC	**4**		NC		**4**		NC	**4**		NC
3		DICOM	**3**		DICOM		**3**		DICOM	**3**		DICOM
2		+24 V	**2**		0 V		**2**		+24 V	**2**		0 V
1		+24 V	**1**		0 V		**1**		+24 V	**1**		0 V

<Cable side connector type>
Connector: XG4M-4030/7940-6500SC
Strain relief: XG4T-4004/3448-7940
Manufacturer: OMRON/3M

[Outline of digital signal input circuit]

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

<Input circuit>

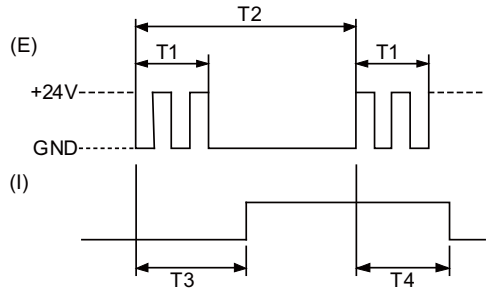
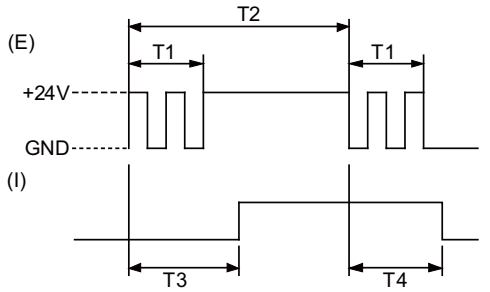


<Input conditions>

Set the input signal within the range as shown in the conditions below.

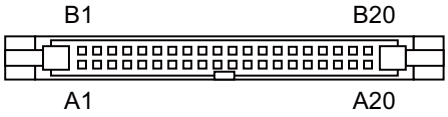
		24 V common	0V common
1	**Input voltage at external contact ON**	6 V or less	18 V or more, 25.2 V or less
2	**Input current at external contact ON**	3 mA or more	
3	**Input voltage at external contact OFF**	20.2 V or more, 25.2 V or less	3.8 V or less
4	**Input current at external contact OFF**	0.7 mA or less	
5	**Input resistance**	5 kΩ	
6	**Tolerable chattering time (T1)**	3 ms	
7	**Input signal holding time (T2)**	40 ms or more (*1)	
8	**Input circuit operation delay time (T3 and T4)**	3 to 16 ms	
9	**Machine side contact capacity**	30V or more, 16 mA or more	

(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

Connection to 24 V common input	Connection to 0 V common input
	

(E): External signal, (I): Internal signal

(2) CJ32 (Machine signal output)
(4) CJ34 (Machine signal output)



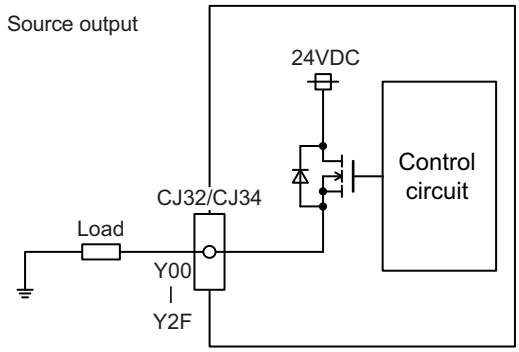
CJ32							CJ34(FCU8-DX230)							CJ34(FCU8-DX231)					
B			A				B			A				B			A		
20	O	Y00	**20**	O	Y10		**20**	O	Y20	**20**		NC		**20**	O	Y20	**20**		NC
19	O	Y01	**19**	O	Y11		**19**	O	Y21	**19**		NC		**19**	O	Y21	**19**		NC
18	O	Y02	**18**	O	Y12		**18**	O	Y22	**18**		NC		**18**	O	Y22	**18**		NC
17	O	Y03	**17**	O	Y13		**17**	O	Y23	**17**		NC		**17**	O	Y23	**17**		NC
16	O	Y04	**16**	O	Y14		**16**	O	Y24	**16**		NC		**16**	O	Y24	**16**		NC
15	O	Y05	**15**	O	Y15		**15**	O	Y25	**15**		NC		**15**	O	Y25	**15**		NC
14	O	Y06	**14**	O	Y16		**14**	O	Y26	**14**		NC		**14**	O	Y26	**14**		NC
13	O	Y07	**13**	O	Y17		**13**	O	Y27	**13**		NC		**13**	O	Y27	**13**		NC
12	O	Y08	**12**	O	Y18		**12**	O	Y28	**12**		NC		**12**	O	Y28	**12**		NC
11	O	Y09	**11**	O	Y19		**11**	O	Y29	**11**		NC		**11**	O	Y29	**11**		NC
10	O	Y0A	**10**	O	Y1A		**10**	O	Y2A	**10**		NC		**10**	O	Y2A	**10**		NC
9	O	Y0B	**9**	O	Y1B		**9**	O	Y2B	**9**		NC		**9**	O	Y2B	**9**		NC
8	O	Y0C	**8**	O	Y1C		**8**	O	Y2C	**8**		NC		**8**	O	Y2C	**8**		NC
7	O	Y0D	**7**	O	Y1D		**7**	O	Y2D	**7**		NC		**7**	O	Y2D	**7**		NC
6	O	Y0E	**6**	O	Y1E		**6**	O	Y2E	**6**		NC		**6**	O	Y2E	**6**		NC
5	O	Y0F	**5**	O	Y1F		**5**	O	Y2F	**5**		NC		**5**	O	Y2F	**5**		NC
4		NC	**4**		NC		**4**		NC	**4**		NC		**4**	O	AO	**4**		AO*
3		NC	**3**		NC		**3**		NC	**3**		NC		**3**		NC	**3**		NC
2		+24 V	**2**		0 V		**2**		+24 V	**2**		0 V		**2**		+24 V	**2**		0 V
1		+24 V	**1**		0 V		**1**		+24 V	**1**		0 V		**1**		+24 V	**1**		0 V

<Cable side connector type>
Connector: XG4M-4030/7940-6500SC
Strain relief: XG4T-4004/3448-7940
Manufacturer: OMRON/3M

[Outline of digital signal output circuit]

Use within the specification ranges shown below.

<Output circuit>

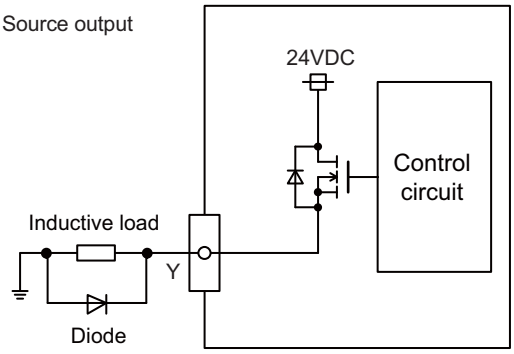


<Output conditions>

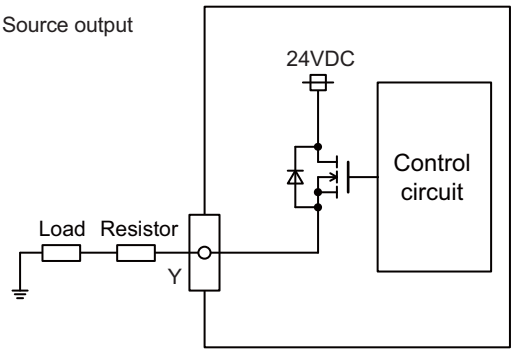
Insulation method	Non-insulation
Rated load voltage	24 VDC
Maximum output current	0.2 A per point 3.2 A or less for whole unit
Output delay time	40 μs

Note

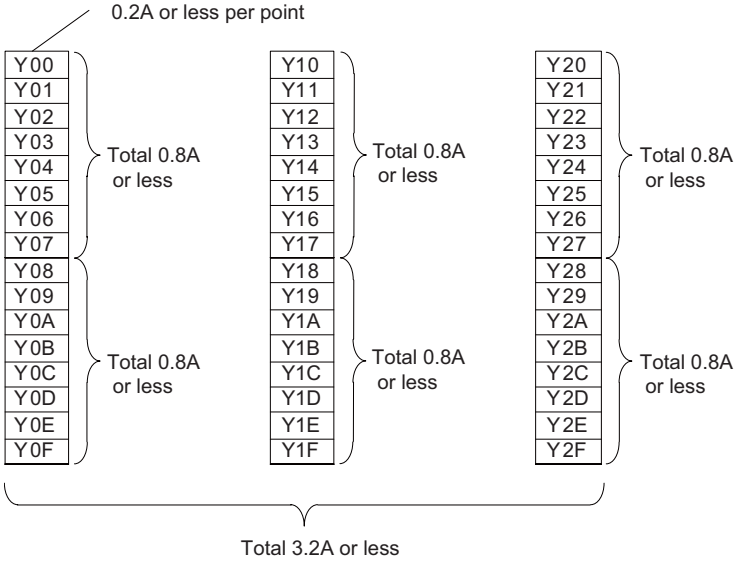
- When using an inductive load such as a relay, always connect a diode (voltage resistance 100 V or more, twice or more the load current) in parallel to the load.



- When the rush current exceeds the maximum output current indicated previously, always connect a protective resistor serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



- Always keep the total sum of output current of each Y00 to Y07, Y08 to Y0F, Y10 to Y17, Y18 to Y1F, Y20 to Y27, and Y28 to Y2F less than 0.8A.



⚠ CAUTION

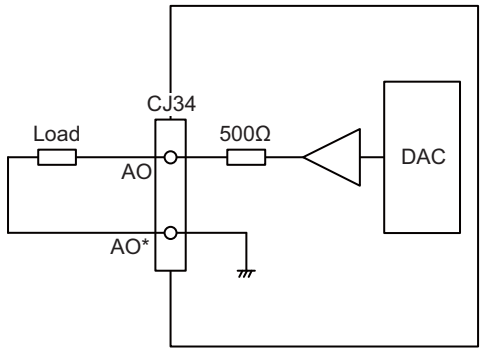
(1) When using an inductive load such as a relay, always connect a diode in parallel to the load to prevent a counter-electromotive force.

(2) When the rush current exceeds the maximum output current, always connect a protective resistor serially to the load to suppress rush currents.

[Outline of analog signal output circuit]

The analog signal output circuit can be used only for FCU8-DX231.

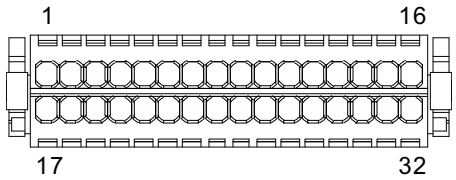
<Output circuit>



<Output conditions>

Analog output voltage	-10 to 10 V (±5%)
Resolution	10 V/4095 = 2.44 mV
Load conditions	External load resistance value 10 kΩ or more
Output resistance value	500 Ω

(5) CJ35 (Machine signal input)



16	I	X0F	**32**		COMB+
15	I	X0E	**31**		COMA+
14	I	X0D	**30**		COMB+
13	I	X0C	**29**		COMA+
12	I	X0B	**28**		COMB+
11	I	X0A	**27**		COMA+
10	I	X09	**26**		COMB+
9	I	X08	**25**		COMA+
8	I	X07	**24**		COMB+
7	I	X06	**23**		COMA+
6	I	X05	**22**		COMB+
5	I	X04	**21**		COMA+
4	I	X03	**20**		COMB+
3	I	X02	**19**		COMA+
2	I	X01	**18**		COMB+
1	I	X00	**17**		COMA+

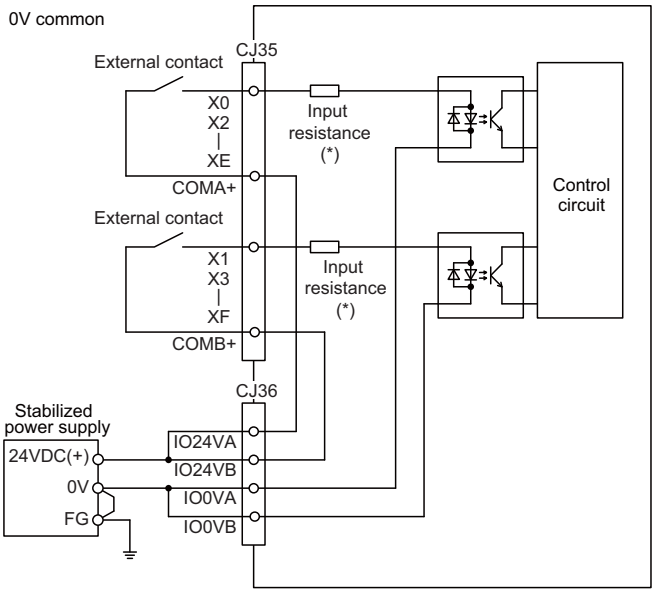
<Cable side connector type>
Connector: 713-1116/037-000
Manufacturer: WAGO

(The cable side connector is attached to the unit.)

[Outline of digital signal input circuit]

Follow the wiring diagram below.

<Input circuit>



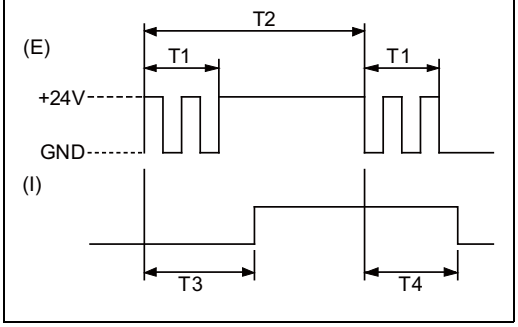
<Input conditions>

Set the input signal within the range as shown in the conditions below.

		For DX213	For DX213-1
1	**Input voltage at external contact ON**	18 V or more, 25.2 V or less	
2	**Input current at external contact ON**	3 mA or more	9 mA or more
3	**Input voltage at external contact OFF**	3.8 V or less	4.0 V or less
4	**Input current at external contact OFF**	0.7 mA or less	1.5 mA or less
5	**Input resistance (*)**	5 kΩ	2.2 kΩ
6	**Tolerable chattering time (T1)**	3 ms	
7	**Input signal holding time (T2)**	40 ms or more (*1)	
8	**Input circuit operation delay time (T3 and T4)**	3 to 16 ms	
9	**Machine side contact capacity**	30 V or more, 16 mA or more	

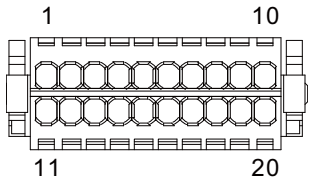
(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

Connection to 0V common input



(E): External signal, (I): Internal signal

(6) CJ36 (Machine signal output)



10	I	IO24VB	**20**		IO0VB
9	I	IO24VA	**19**		IO0VA
8	O	Y07	**18**		COMB-
7	O	Y06	**17**		COMA-
6	O	Y05	**16**		COMB-
5	O	Y04	**15**		COMA-
4	O	Y03	**14**		COMB-
3	O	Y02	**13**		COMA-
2	O	Y01	**12**		COMB-
1	O	Y00	**11**		COMA-

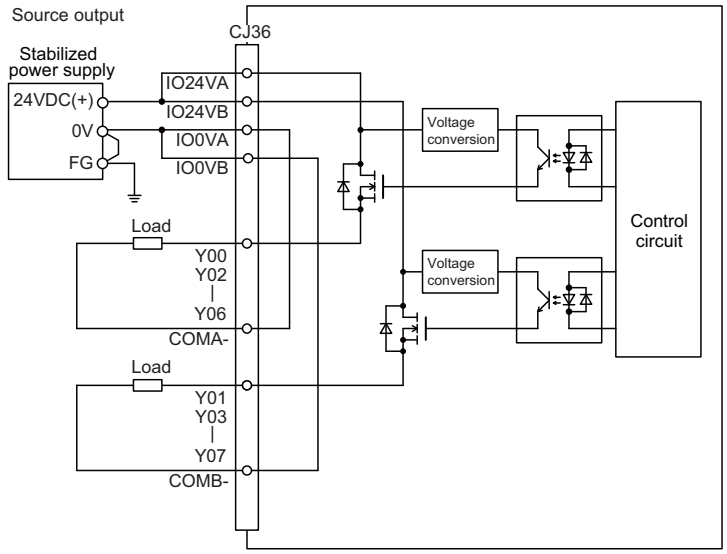
<Cable side connector type>
Connector: 713-1110/037-000
Manufacturer: WAGO

(The cable side connector is attached to the unit.)

[Outline of digital signal output circuit]

Use within the specification ranges shown below.

<Output circuit>

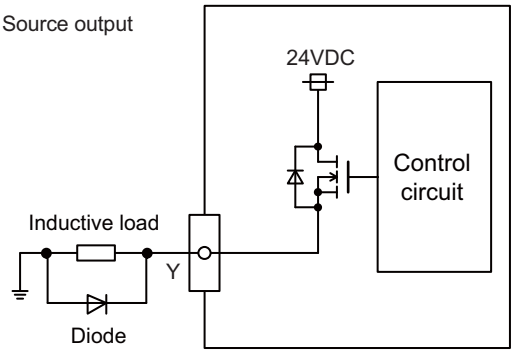


<Output conditions>

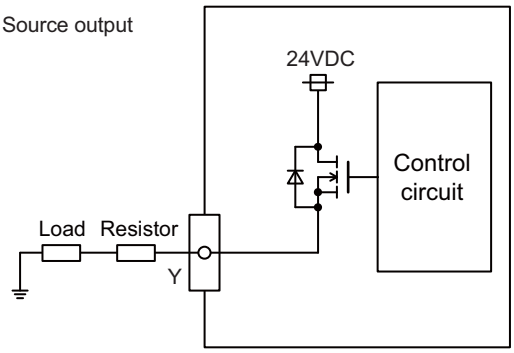
Insulation method	Optocoupler insulation
Rated load voltage	24 VDC
Maximum output current	2 A per point 8 A or less for whole unit
Output delay time	400 μs

Note

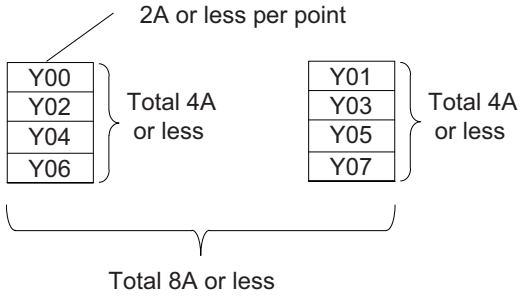
- When using an inductive load such as a relay, always connect a diode (voltage resistance 100 V or more, twice or more the load current) in parallel to the load.



- When the rush current exceeds the maximum output current indicated previously, always connect a protective resistor serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



- Always keep the total sum of output current of each Y00/Y02/Y04/Y06 and Y01/Y03/Y05/Y07 less than 4A.

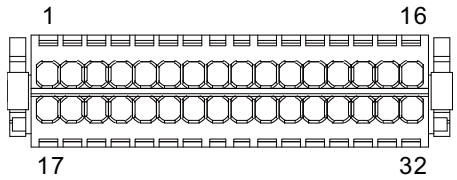


⚠ CAUTION

(1) When using an inductive load such as a relay, always connect a diode in parallel to the load to prevent a counter-electromotive force.

(2) When the rush current exceeds the maximum output current, always connect a protective resistor serially to the load to suppress rush currents.

(7) SDI (Safety machine signal input)



16	I	SX07B	**32**		COMB+
15	I	SX07A	**31**		COMA+
14	I	SX06B	**30**		COMB+
13	I	SX06A	**29**		COMA+
12	I	SX05B	**28**		COMB+
11	I	SX05A	**27**		COMA+
10	I	SX04B	**26**		COMB+
9	I	SX04A	**25**		COMA+
8	I	SX03B	**24**		COMB+
7	I	SX03A	**23**		COMA+
6	I	SX02B	**22**		COMB+
5	I	SX02A	**21**		COMA+
4	I	SX01B	**20**		COMB+
3	I	SX01A	**19**		COMA+
2	I	SX00B	**18**		COMB+
1	I	SX00A	**17**		COMA+

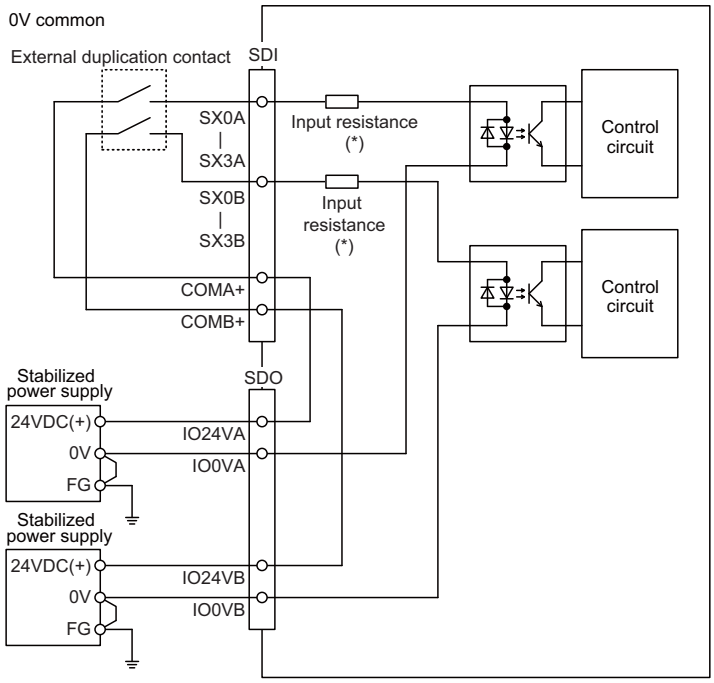
<Cable side connector type>
Connector: 713-1116/037-000
Manufacturer: WAGO

(The cable side connector is attached to the unit.)

[Outline of digital signal input circuit]

Follow the wiring diagram below.

<Input circuit>



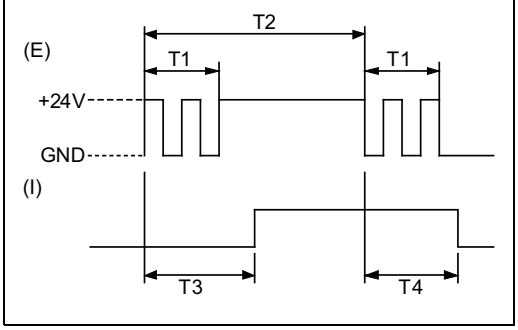
<Input conditions>

Set the input signal within the range as shown in the conditions below.

		For DX654	For DX654-1
1	**Input voltage at external contact ON**	18 V or more, 25.2 V or less	
2	**Input current at external contact ON**	3 mA or more	9 mA or more
3	**Input voltage at external contact OFF**	3.8 V or less	4.0 V or less
4	**Input current at external contact OFF**	0.7 mA or less	1.5 mA or less
5	**Input resistance (*)**	5 kΩ	2.2 kΩ
6	**Tolerable chattering time (T1)**	3 ms	
7	**Input signal holding time (T2)**	40 ms or more (*1)	
8	**Input circuit operation delay time (T3 and T4)**	3 to 16 ms	
9	**Machine side contact capacity**	30 V or more, 16 mA or more	

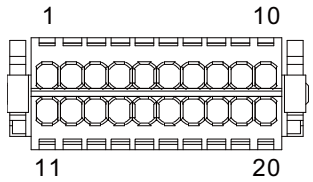
(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

Connection to 0 V common input



(E): External signal, (I): Internal signal

(8) SDO (Safety machine signal output)



10	I	IO24VB	**20**		IO0VB
9	I	IO24VA	**19**		IO0VA
8	O	SY03B	**18**		COMB-
7	O	SY03A	**17**		COMA-
6	O	SY02B	**16**		COMB-
5	O	SY02A	**15**		COMA-
4	O	SY01B	**14**		COMB-
3	O	SY01A	**13**		COMA-
2	O	SY00B	**12**		COMB-
1	O	SY00A	**11**		COMA-

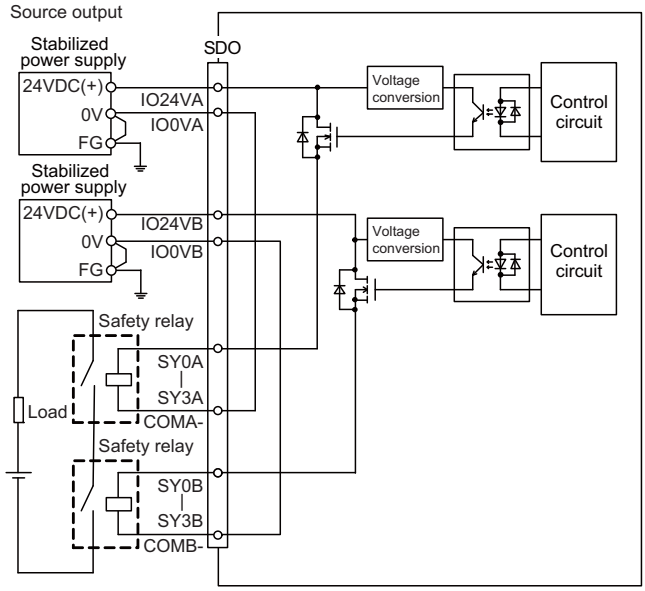
<Cable side connector type>
Connector: 713-1110/037-000
Manufacturer: WAGO

(The cable side connector is attached to the unit.)

[Outline of digital signal output circuit]

Use within the specification ranges shown below.

<Output circuit>

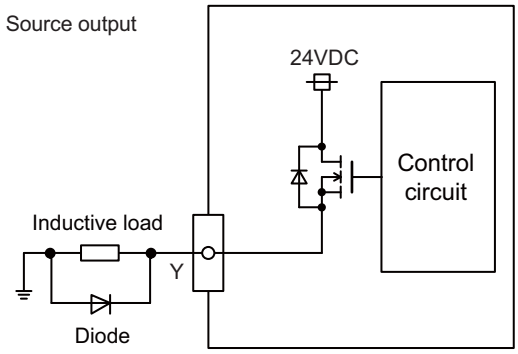


<Output conditions>

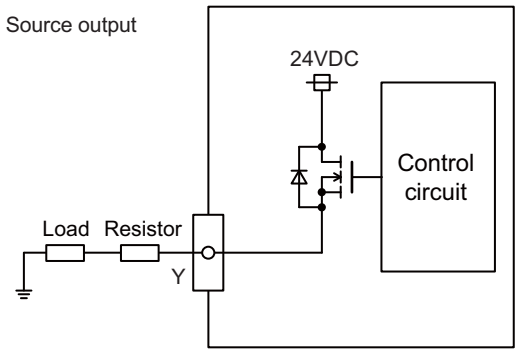
Insulation method	Optocoupler insulation
Rated load voltage	24 VDC
Maximum output current	2 A per point 8 A or less for whole unit
Output delay time	400 µs

Note

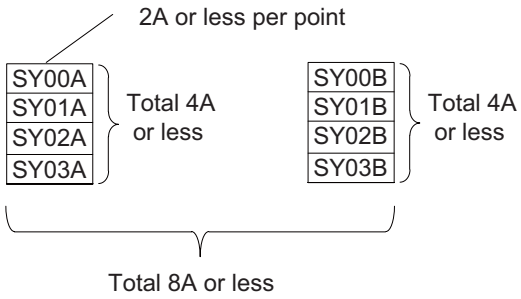
- When using an inductive load such as a relay, always connect a diode (voltage resistance 100 V or more, twice or more the load current) in parallel to the load.



- When the rush current exceeds the maximum output current indicated previously, always connect a protective resistor serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



- Always keep the total sum of output current of each SY00A to SY03A, and SY00B to SY03B less than 4A.

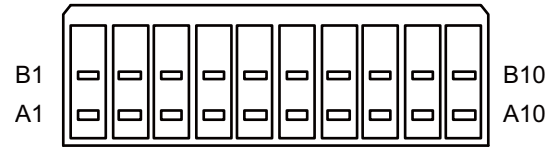


⚠ CAUTION

(1) When using an inductive load such as a relay, always connect a diode in parallel to the load to prevent a counter-electromotive force.

(2) When the rush current exceeds the maximum output current, always connect a protective resistor serially to the load to suppress rush currents.

(9) SDI1 (Safety DI input)



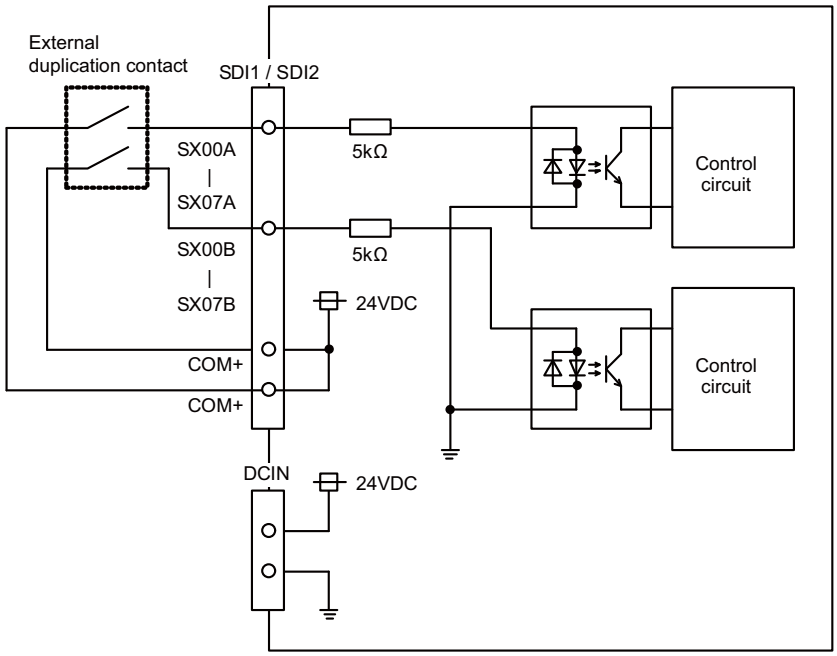
B			A		
10		COM+	**10**	I	SX04B
9		COM+	**9**	I	SX04A
8		COM+	**8**	I	SX03B
7		COM+	**7**	I	SX03A
6		COM+	**6**	I	SX02B
5		COM+	**5**	I	SX02A
4		COM+	**4**	I	SX01B
3		COM+	**3**	I	SX01A
2		COM+	**2**	I	SX00B
1		COM+	**1**	I	SX00A

<Cable side connector type>
Connector: 175362-1 (2-pole type)
Connector: 175363-1 (4-pole type)
Connector: 1318095-1 (6-pole type)
Contact: 175218-2
Manufacturer: TE Connectivity

[Outline of digital signal input circuit]

Follow the wiring diagram below.

<Input circuit>



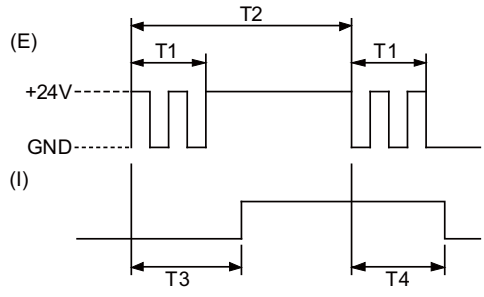
<Input conditions>

Set the input signal within the range as shown in the conditions below.

		0 V common
1	**Input voltage at external contact ON**	18 V or more, 25.2 V or less
2	**Input current at external contact ON**	3 mA or more
3	**Input voltage at external contact OFF**	3.8 V or less
4	**Input current at external contact OFF**	0.7 mA or less
5	**Input resistance**	5 kΩ
6	**Tolerable chattering time (T1)**	3 ms
7	**Input signal holding time (T2)**	40 ms or more (*1)
8	**Input circuit operation delay time (T3 and T4)**	3 to 16 ms
9	**Machine side contact capacity**	30 V or more, 16 mA or more

(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

Connection to 0V common input



(E): External signal, (I): Internal signal

(10) SDI2 (Safety DI input)

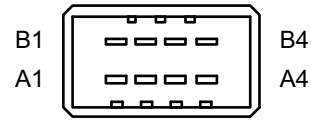


B			A		
6		COM+	**6**	I	SX07B
5		COM+	**5**	I	SX07A
4		COM+	**4**	I	SX06B
3		COM+	**3**	I	SX06A
2		COM+	**2**	I	SX05B
1		COM+	**1**	I	SX05A

<Cable side connector type>
Connector: 175362-1 (2-pole type)
Connector: 175363-1 (4-pole type)
Connector: 1318095-1 (6-pole type)
Contact: 175218-2
Manufacturer: TE Connectivity

[Outline of digital signal input circuit]
Refer to (9) SDI1 (Safety DI input).

(11) SDO1 (Safety relay output)
(12) SDO2 (Safety relay output)



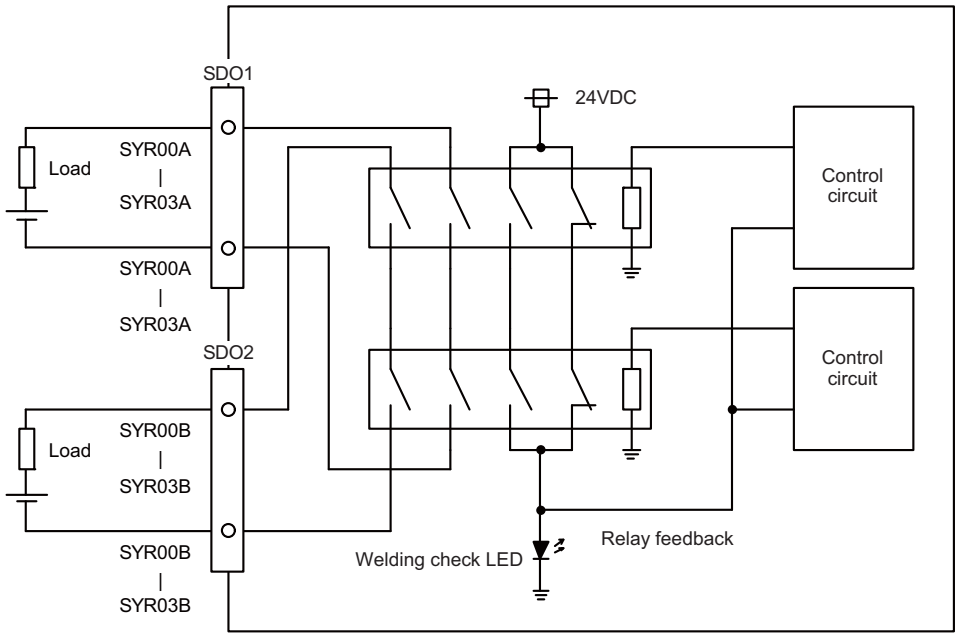
SDO1						SDO2					
B			A			B			A		
4		SYR03A	**4**		SYR03A	**4**		SYR03B	**4**		SYR03B
3		SYR02A	**3**		SYR02A	**3**		SYR02B	**3**		SYR02B
2		SYR01A	**2**		SYR01A	**2**		SYR01B	**2**		SYR01B
1		SYR00A	**1**		SYR00A	**1**		SYR00B	**1**		SYR00B

<Cable side connector type>
Connector: 178289-4
Contact: 175218-2
Manufacturer: TE Connectivity

[Outline of digital signal output circuit]

Use within the specification ranges shown below.

<Output circuit>



<Output conditions>

Insulation method	Insulated by relay
Output method	Non-voltage A contact
Contact structure	Forced guide style relay
Rated voltage	250 VAC, 125 VDC
Rated current	6 A
Minimum applicable load	1 mA, 5 VDC
Operation time	20 ms or less (contact bounce not included)
Response time	8 ms or less (contact bounce not included)
Return time	20 ms or less (contact bounce not included)
Life	100,000 times or more with 250 VAC, 6 A resistant load (opening/closing frequency: 20 times/min)
	100,000 times or more with 30 VDC, 6 A resistant load (opening/closing frequency: 20 times/min)
	500,000 times or more with 250 VAC, 1 A resistant load (opening/closing frequency: 30 times/min)
	500,000 times or more with 30 VDC, 1 A resistant load (opening/closing frequency: 30 times/min)
	100,000 times or more with 15 AC: 240 VAC, 2 A induction load (opening/closing frequency: 20 times/min, cosφ = 0.3)
	100,000 times or more with 13 DC: 24 VDC, 1 A induction load (opening/closing frequency: 20 times/min, L/R = 48 ms)
Max. operation frequency	20 times/min

<Precautions>

- Influence on the relay life by a connected load

  An actual relay life can be substantially shortened depending on the type of a connected load and the characteristics of its inrush current.

  The inrush current generated by a connected load can lead to contact welding of the module.

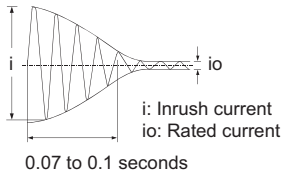
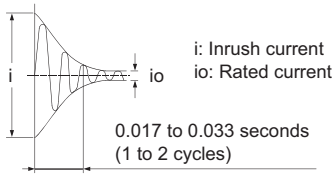
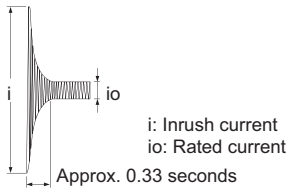
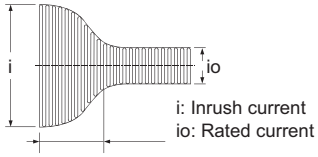
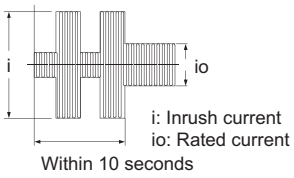
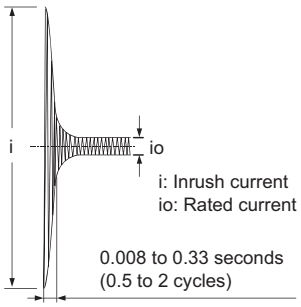
  To prevent shortening of the relay life and contact welding, take the following measures:

  - Considering the possibility of a high inrush current, select a load so that the inrush current generated by the connected load falls within the range of the rated current of the module.
  - Connect a relay capable of withstanding the inrush current, outside the module.

  The following table lists the relations between typical loads and each inrush current.

  Select a load so that the inrush current, i, and rated current, io, fall within the range of the rated switching current described in the module specifications.

  Depending on the load amount, the inrush current may flow for a long time.

Load type	Waveform	Inrush current "i"/ Rated current "io"	Waveform	Inrush current "i"/ Rated current "io"
Inductive load	Load of a solenoid 	Approx. 10 to 20 times	Load of an electromagnetic contactor 	Approx. 3 to 10 times
Lamp load	Load of an incandescent bulb 	Approx. 3 to 10 times	Load of a mercury lamp 	Approx. 3 times (*1)
	Load of a fluorescent 	Approx. 5 to 10 times	-	-
Capacitive load	Capacitive load (*2) 	Approx. 20 to 40 times	-	-

(*1) A typical discharge lamp circuit is configured with a combination of discharge tubes, transformers, choke coils, capacitors and others. Because of this, be especially careful of the case of a high power factor and a low power supply impedance, where the inrush current flowing into the output module can be 20 to 40 times as high as the rated current.

(*2) When the wiring is long, be careful with the cable capacity as well.

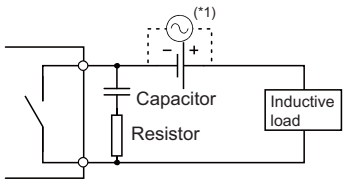
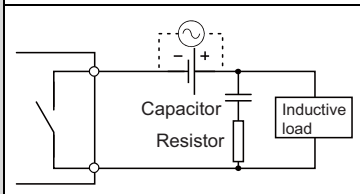
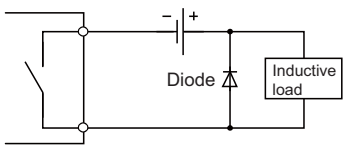
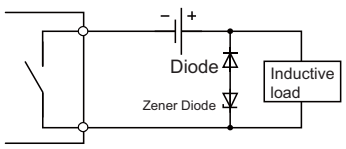
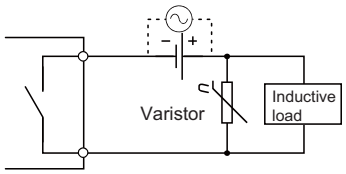
- Measures against back EMF

  Provide a contact protection circuit for an extended contact life, noise prevention at contact close, and reduction of the carbides and nitric acids formed by an arc discharge.

  An incorrect circuit involves a high risk of contact welding.

  With the contact protection circuit, the recovery time may be delayed.

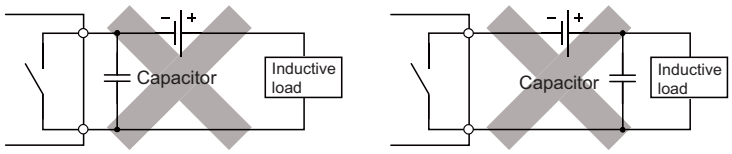
  The following table shows typical examples of the contact protection circuit.

Circuit example		Element selection criteria	Remarks
Capacitor + resistance method (CR method)		Estimate the constants of a capacitor and resistance with the following as a guide. Some differences, however, may arise from a variation in the nature and characteristics of the load. • Capacitor: 0.5 to 1 (μF) for a load current of 1 A • Resistance: 0.5 to 1 (Ω) for a power supply voltage of 1 V Use a capacitor with voltage resistance of the rated voltage or higher. In an AC circuit, use a capacitor with no polarity.	When a relay or solenoid is used as the load, the recovery time is delayed. A capacitor has the effect of reducing a discharge at contact OFF, while a resistance has the effect of limiting a current at contact ON.
			
Diode method		Use a diode that satisfies the following conditions: • A reverse breakdown voltage is more than ten times as high as the circuit voltage. • A forward current is more than twice as high as the load current.	The recovery time is delayed than the CR method.
Diode + zener diode method		Use a zener diode whose zener voltage is higher than the power supply voltage.	This method is suitable for the case where the diode method results in a substantial delay in the recovery time.
Varistor method		Select a varistor whose cut-off voltage (Vc) satisfies the following conditions: • Vc > power supply voltage × 1.5 (V) • Vc > power supply voltage × 1.5 (V) × √2 (on AC power supply) Note that selecting an element of a too high Vc leads to a weaker effect.	The recovery time is a little delayed.

(*1) On AC power supply, the impedance of the CR needs to be sufficiently higher than that of the load. (for preventing errors due to the leakage current of the CR)

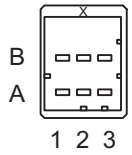
POINT

- Avoid using contact protection circuits like the following. Although highly effective in reducing the arc at current cutoff, a charge current flows into the capacitor when the contact turns on or off, which leads to the risk of contact welding. A DC inductive load, generally considered to be more difficult to open and close than a resistive load, can achieve the same performance of a resistive load in an appropriate configuration of the protection circuit.



- Install the protection circuit near the load or contact (module). A long distance between them may inhibit the effect of the protection circuit. As a guide, install it at a distance of no more than 50cm.

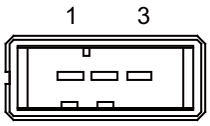
(13) RIO1 (Remote I/O 2.0 communication)
(14) RIO2 (Remote I/O 2.0 communication)



A			B		
1	I/O	TXRXD	**1**	I/O	TXRXD*
2		NC	**2**		0 V
3		FG	**3**		NC

<Cable side connector type>
Connector: 1-1318119-3
Contact: 1318107-1
Manufacturer: TE Connectivity

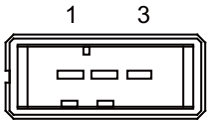
(15) DCIN (24 VDC input)



1	I	+24 V
2		0 V
3		FG

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

(16) DCOUT (24 VDC output)



1	O	+24 V
2		0 V
3		FG

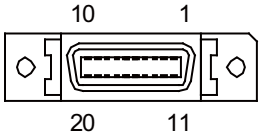
<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

(17) FG (FG terminal)

(18) FG (FG terminal (M4 screw))

(19) AIO1 (Analog input, analog output)

Analog input and analog output can be connected to this connector.



1		0 V	**11**		0 V
2	I	AI 0	**12**	I	AI 1
3	I	AI 2	**13**	I	AI 3
4		NC	**14**		NC
5		0 V	**15**		0 V
6		NC	**16**		NC
7	O	AO	**17**		NC
8		NC	**18**		NC
9		0 V	**19**		NC
10		NC	**20**		NC

- Connect connector case with FG pattern.

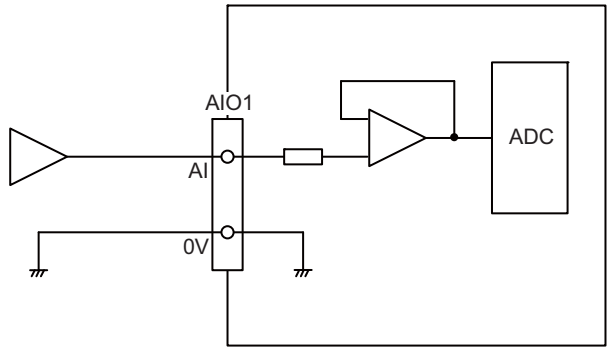
<Cable side connector type>
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

Note

- When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
  (Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

[Outline of analog signal input circuit]

<Input circuit>



<Input conditions>

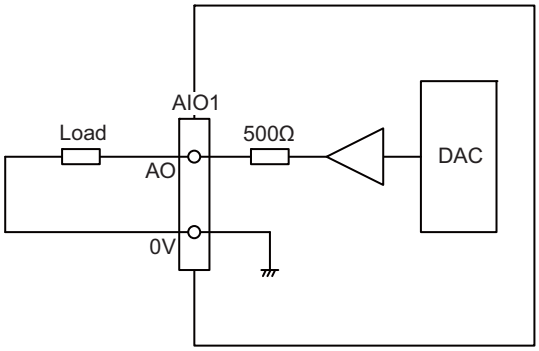
Analog input voltage	-10 to 10 V
Max. input rating (*1)	±15 V
Resolution	|-10 to +10 V|/4095 = 4.88 mV
Repeatability	Within ±25 mV (*2)
Tolerance	±0.35V

(*1) This indicates the input voltage which must not be exceeded even in an instant.

(*2) Except when the accuracy is affected by the noise.

[Outline of analog signal output circuit]

<Output circuit>

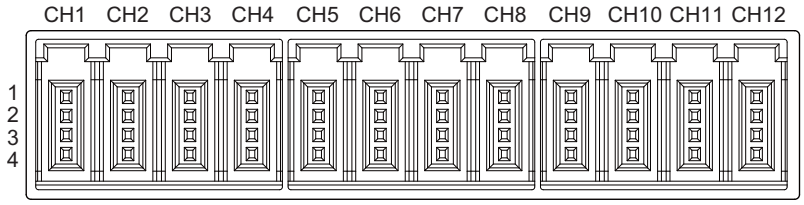


<Output conditions>

Analog output voltage	-10 to 10 V (±5%)
Resolution	10 V/4095 = 2.44 mV
Load conditions	External load resistance value 10 kΩ or more
Output resistance value	500 Ω

(20) THERMISTOR (Thermistor input)

Thermistor can be connected to this connector.

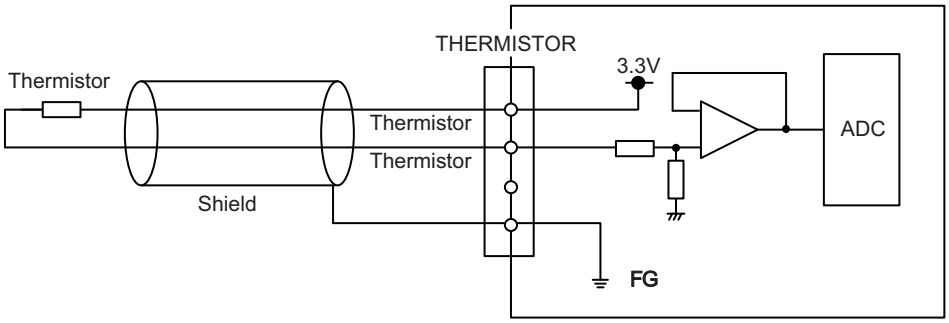


	CH1	CH2	CH3	CH4	CH5	CH6
1	FG	FG	FG	FG	FG	FG
2	NC	NC	NC	NC	NC	NC
3	Thermistor CH1	Thermistor CH2	Thermistor CH3	Thermistor CH4	Thermistor CH5	Thermistor CH6
4	Thermistor CH1	Thermistor CH2	Thermistor CH3	Thermistor CH4	Thermistor CH5	Thermistor CH6

	CH7	CH8	CH9	CH10	CH11	CH12
1	FG	FG	FG	FG	FG	FG
2	NC	NC	NC	NC	NC	NC
3	Thermistor CH7	Thermistor CH8	Thermistor CH9	Thermistor CH10	Thermistor CH11	Thermistor CH12
4	Thermistor CH7	Thermistor CH8	Thermistor CH9	Thermistor CH10	Thermistor CH11	Thermistor CH12

<Cable side connector type>
Connector: 37104-2165-000FL
Manufacturer: 3M

[Outline of the thermistor input circuit]



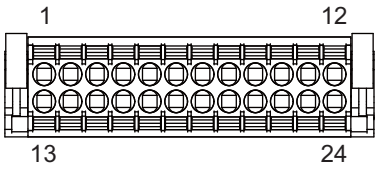
Measurement temperature	-10 °C to +150.0 °C
Resolution	0.1 °C
Precision	±1.5 °C (Measurement temperature -10 to +10 °C) ±1.0 °C (Measurement temperature +10 to +70 °C) ±1.5°C (Measurement temperature +70 to +110 °C) ±2.0 °C (Measurement temperature +110 to +130 °C) ±2.5 °C (Measurement temperature +130 to +150 °C)
Thermal responsiveness (*1)	This varies depending on the setting of the parameter (#1334). ±10 °C/s (When the setting of #1334 is "-1") ±20 °C/s (When the setting of #1334 is "0") ±45 °C/s (When the setting of #1334 is "1") ±90°C/s (When the setting of #1334 is "2")
Disconnection detection function	Provided

(*1) This indicates the maximum measurable temperature change amount per unit time.
When the temperature change exceeds the described value, it cannot be measured correctly.

Note

- Do not connect any thermistor other than PT3C-51F-M2 made by SHIBAURA ELECTRONICS Co., Ltd.

(21) AI (Multi-analog input)



13	CH3	FG	**1**	CH1	FG
14		NC	**2**		NC
15		V+/A	**3**		V+/A
16		I+/a/CJ+	**4**		I+/a/CJ+
17		V-/I-/B	**5**		V-/I-/B
18		b/CJ-	**6**		b/CJ-
19	CH4	V+/A	**7**	CH2	V+/A
20		I+/a/CJ+	**8**		I+/a/CJ+
21		V-/I-/B	**9**		V-/I-/B
22		b/CJ-	**10**		b/CJ-
23		NC	**11**		NC
24		FG	**12**		FG

<Cable side connector type>
Connector: DFMC1,5/12-ST-3,5-LR
Manufacturer: Phoenix Contact

(The cable side connector is attached to the unit.)

[Outline of multi-analog input circuit]
There are four types of multi-analog input as below:
- Voltage input
- Current input
- Thermocouple input
- Resistance temperature detector input

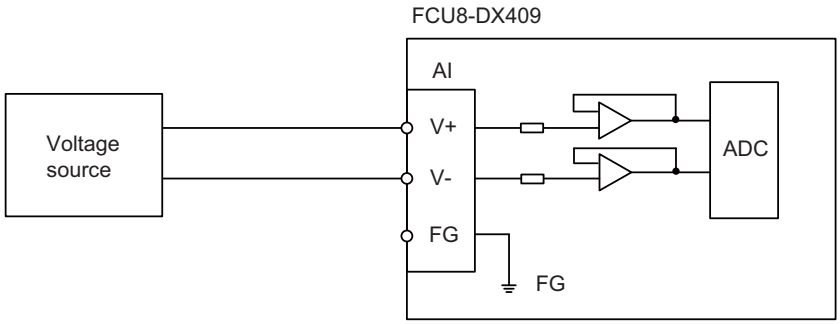
The measurement mode (voltage measurement, current measurement, temperature (thermocouple) measurement and temperature (resistance temperature detector) measurement) can be set for each CH and input corresponding to the mode can be performed.
All CHs (CH1 to CH4) are set to the voltage measurement mode when the machine is delivered.

Note

- Input the signal within the appropriate input range for the set measurement mode.
  - Do not input the voltage when the current or temperature (thermocouple or resistance temperature detector) measurement mode is set. This could result in faults of the unit. Pay close attention to the combination of the measurement mode setting and input.
- Running-in is required for about 10 to 15 minutes after the power is ON until the measurement value is stable.
- Do not apply voltage or current from external devices before turning ON the power of multi-analog input unit. This may damage the multi-analog input unit.
  Turn ON the power of the multi-analog input unit and external device at the same time, or wire circuit so that the power supply of the multi-analog input unit is turned ON first.

(a) Outline of voltage input circuit

<Input circuit>



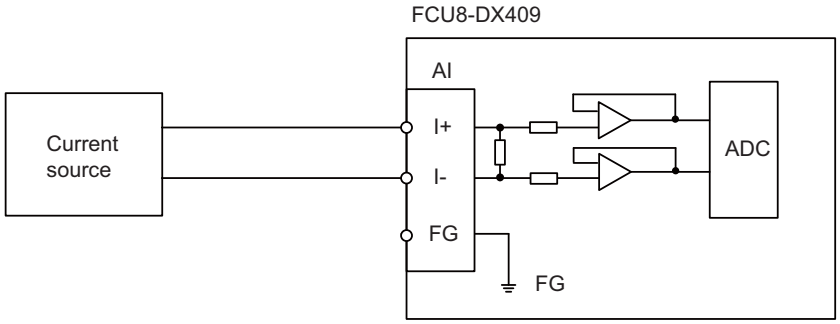
<Input conditions>

Set the input signal within the range as shown in the conditions below.

Input voltage range	-10 V to +10 V
Max. input rating	±13 V
Resolution	-10 V to +10 V|/64000 = 312.5 µV
Max. input delay (AI input to R register output)	40 ms
Disconnection detection function	None
Precision	±0.5%FS (FS: Full Scale)

(b) Outline of current input circuit

<Input circuit>



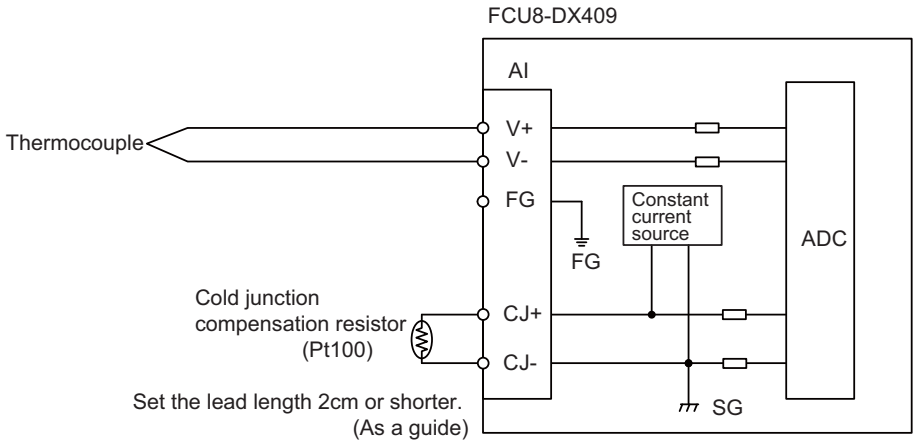
<Input conditions>

Set the input signal within the range as shown in the conditions below.

Input current range	-20 mA to +20 mA
Max. input rating	±30 mA
Resolution	|-20 mA to +20 mA|/32000 = 1.25 µA
Input resistance	250 Ω
Max. input delay (AI input to R register output)	40 ms
Disconnection detection function	None
Precision	± 0.5%FS (FS: Full Scale)

(c) Outline of thermocouple input circuit

<Input circuit>



<Input conditions>

Set the input signal within the range as shown in the conditions below.

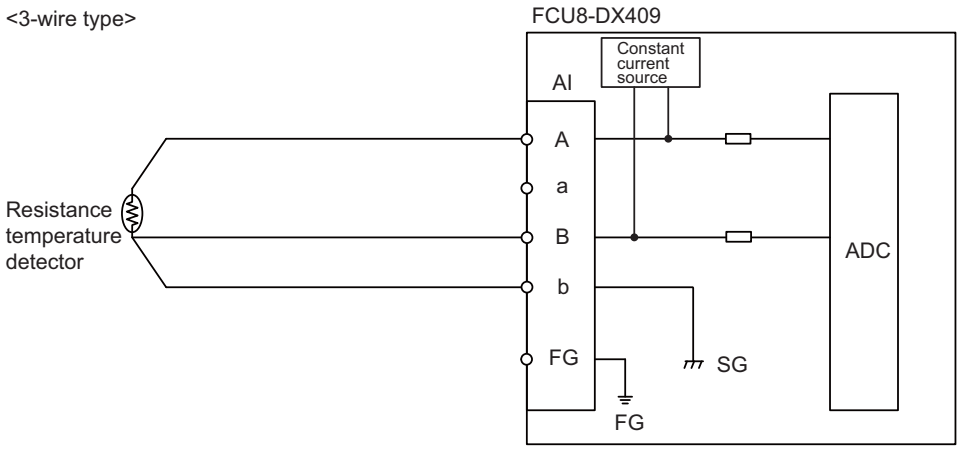
Input temperature range		-40 °C to +600 °C
Resolution		0.1 °C
Cold junction compensation		Use Pt100.
Cold junction compensation precision		±1 °C
Max. input delay (AI input to R register output)		40 ms
Disconnection detection function		Provided
Precision (*1)	**K type**	±3 °C (Measurement temperature -40 to +150 °C)
		±4 °C (Measurement temperature +150 to +300 °C)
		±5 °C (Measurement temperature +300 to +450 °C)
		±6 °C (Measurement temperature +450 to +600 °C)
	J type	±2.8 °C (Measurement temperature -40 to +150 °C)
		±3.8 °C (Measurement temperature +150 to +300 °C)
		±4.8 °C (Measurement temperature +300 to +450 °C)
		±5.8 °C (Measurement temperature +450 to +600 °C)

(*1) Refer to "(e) Supplement: Overall precision of temperature measurement".

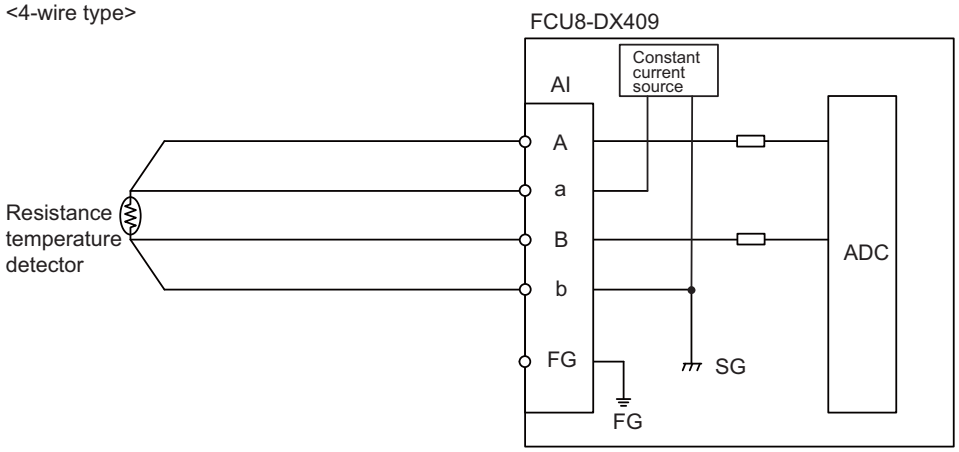
(d) Outline of resistance temperature detector input circuit

<Input circuit>

<3-wire type>



<4-wire type>



<Input conditions>

Set the input signal within the range as shown in the conditions below.

Input temperature range		-50°C to +300°C
Resolution		0.1 °C (Normal mode) or 0.03 °C (High resolution mode)
Max. input delay (AI input to R register output)		40 ms
Disconnection detection function		Provided
Precision (*1)	**Pt100**	±1.5 °C (Measurement temperature -50 to +150 °C)
		±1.8 °C (Measurement temperature +150 to +300 °C)
	Pt1000	±1.8 °C (Measurement temperature -50 to +150 °C)
		±2.2 °C (Measurement temperature +150 to +300 °C)

(*1) Refer to "(e) Supplement: Overall precision of temperature measurement".

(e) Supplement: Overall precision of temperature measurement

The precision shown in (c) and (d) is the one attributed to the unit. The thermocouple or resistance temperature detector input to the unit also has precision and the overall precision of temperature measurement is the addition of the precision of unit and the precision of thermocouple or resistance temperature detector.
The precision of unit includes the cold junction compensation precision (±1 °C).

<Calculation example of thermocouple overall precision>

Thermocouple overall precision = Unit precision + thermocouple precision

When K-type or Class2 thermocouple is used, if the measurement point temperature is 100 °C, the overall precision is as below.

- According to the thermocouple standard (IEC60584-1), K-type or Class 2 thermocouple precision is "± 2.5 °C or 0.75% of the measurement temperature, whichever has the greater value"

(Overall precision) = ±3 [°C] ± 2.5 [°C]
= ±5.5 [°C]

<Calculation example of resistance temperature detector overall precision>

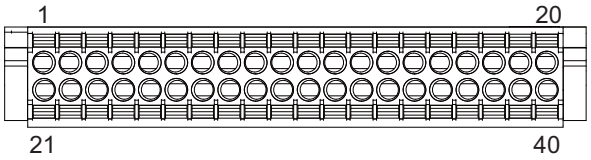
Resistance temperature detector overall precision = Unit precision + Resistance temperature detector

When Pt100 or ClassA resistance temperature detector is used, if measurement point temperature is 100 °C, the overall precision is as below.

- According to the Platinum RTD standard (IEC60751), Pt100 or Class A precision is "± (0.15 + 0.002 |t|) [°C] t: Measurement temperature"

(Overall precision) = ±1.5 [°C] ± (0.15 + 0.002 × 100) [°C]
= ± 1.85 [°C]

(22) CJ45 (Machine signal input)



21	I	X00	1	I	X10
22	I	X01	2	I	X11
23	I	X02	3	I	X12
24	I	X03	4	I	X13
25	I	X04	5	I	X14
26	I	X05	6	I	X15
27	I	X06	7	I	X16
28	I	X07	8	I	X17
29	I	X08	9	I	X18
30	I	X09	10	I	X19
31	I	X0A	11	I	X1A
32	I	X0B	12	I	X1B
33	I	X0C	13	I	X1C
34	I	X0D	14	I	X1D
35	I	X0E	15	I	X1E
36	I	X0F	16	I	X1F
37		DICOMA	17		DICOMB
38		DICOMA	18		DICOMB
39		DICOMA	19		DICOMB
40		DICOMA	20		DICOMB

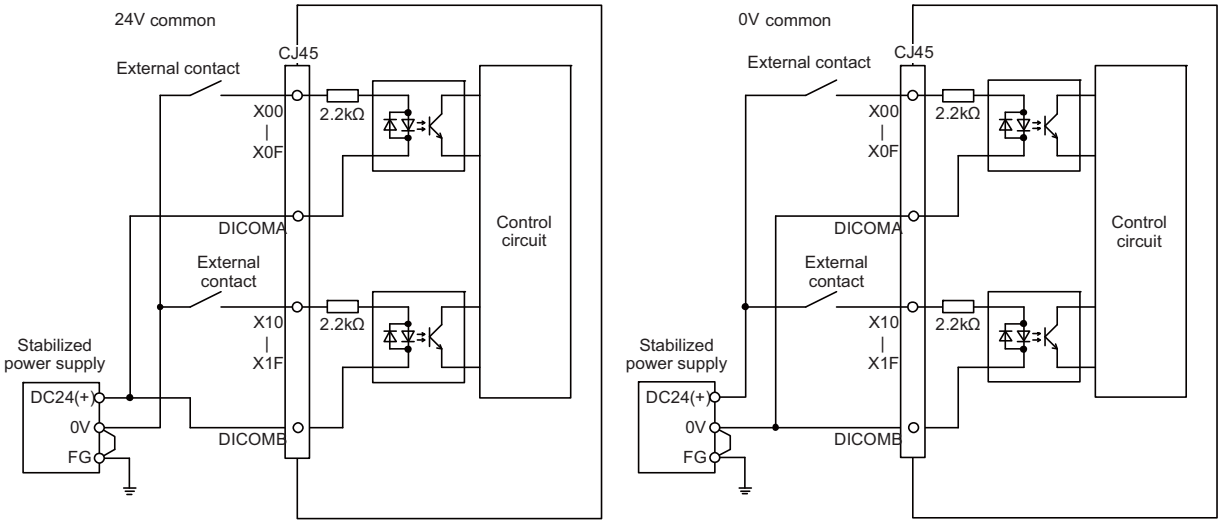
<Cable side connector type>
Connector: DFMC1.5/20-ST-3.5-LR
Manufacturer: Phoenix Contact

(The cable side connector is attached to the unit.)

[Outline of digital signal input circuit]

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

<Input circuit>



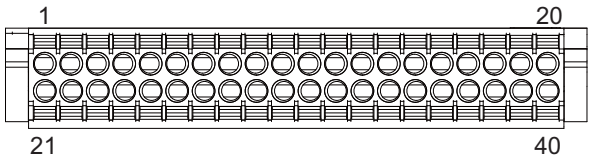
<Input conditions>

Set the input signal within the range as shown in the conditions below.

		24 V common	**0 V common**
1	Input voltage at external contact ON	6 V or less	18 V or more, 25.2 V or less
2	Input current at external contact ON	9 mA or more	
3	Input voltage at external contact OFF	20.2 V or more, 25.2 V or less	4.0 V or less
4	Input current at external contact OFF	1.5 mA or less	
5	Input resistance	2.2 kΩ	
6	Tolerable chattering time (T1)	3 ms	
7	Input signal holding time (T2)	40 ms or more (*1)	
8	Input circuit operation delay time (T3 and T4)	3 ms to 16 ms	
9	Machine side contact capacity	30 V or more, 16 mA or more	

(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

(23) CJ46 (Machine signal output)



21	O	Y00	1	O	Y10
22	O	Y01	2	O	Y11
23	O	Y02	3	O	Y12
24	O	Y03	4	O	Y13
25		C00	5		C10
26	O	Y04	6	O	Y14
27	O	Y05	7	O	Y15
28	O	Y06	8	O	Y16
29	O	Y07	9	O	Y17
30		C01	10		C11
31	O	Y08	11	O	Y18
32	O	Y09	12	O	Y19
33	O	Y0A	13	O	Y1A
34	O	Y0B	14	O	Y1B
35		C02	15		C12
36	O	Y0C	16	O	Y1C
37	O	Y0D	17	O	Y1D
38	O	Y0E	18	O	Y1E
39	O	Y0F	19	O	Y1F
40		C03	20		C13

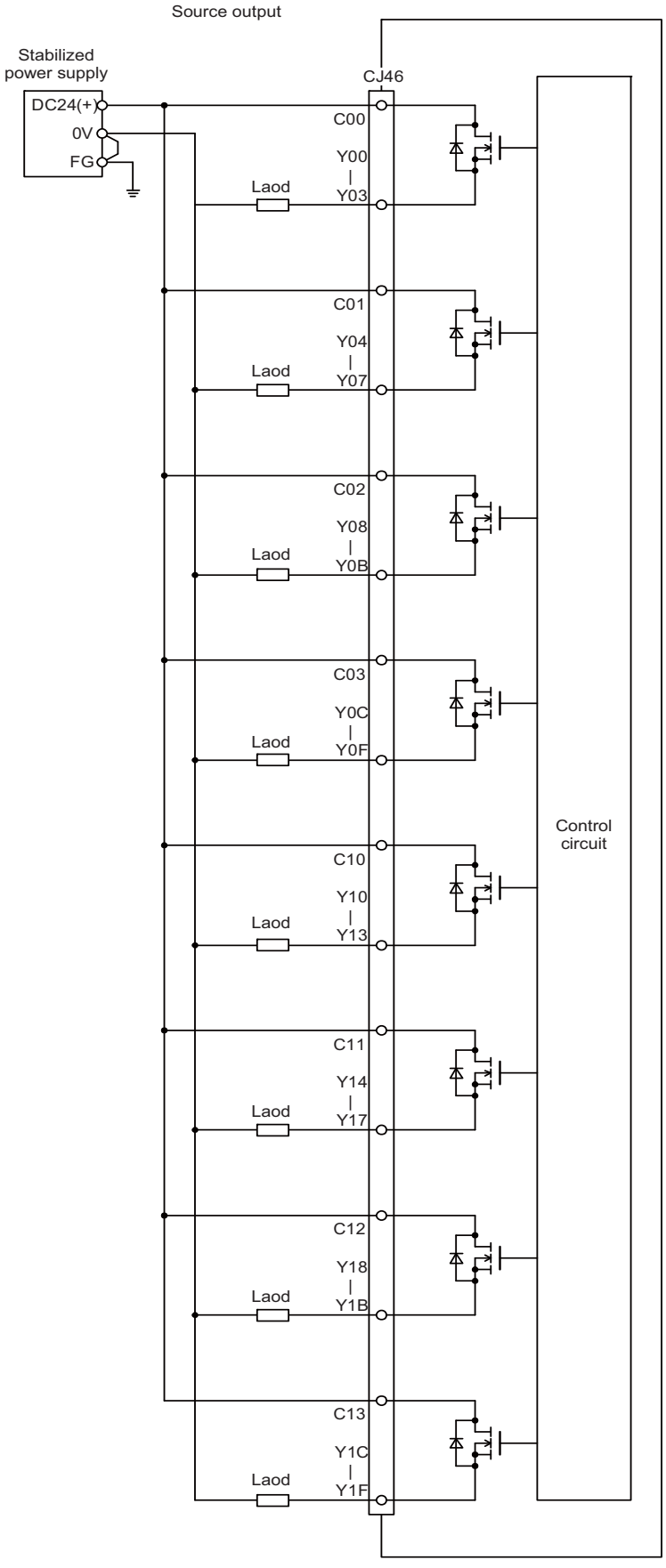
<Cable side connector type>
Connector: DFMC1.5/20-ST-3.5-LR
Manufacturer: Phoenix Contact

(The cable side connector is attached to the unit.)

[Outline of digital signal output circuit]

Use within the specification ranges shown below.

<Output circuit>

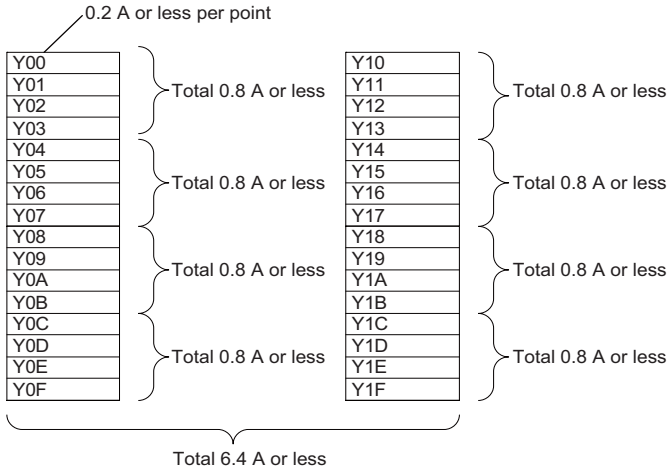


<Output conditions>

Insulation method	Non-insulation
Rated load voltage	24 VDC
Maximum output current	0.2 A per point 6.4 A or less for whole unit
Output delay time	40 μs

Note

- Always keep the total sum of output current of each Y00 to Y03, Y04 to Y07, Y08 to Y0B, Y0C to Y0F, Y10 to Y13, Y14 to Y17, Y18 to Y1B and Y1C to Y1F to be equal to or less than 0.8A.
  When total output current is 0.8 A or less, 0.3 A can be output at only any one point.



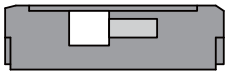
(s1) STATION No. (Station No. group setting switch)



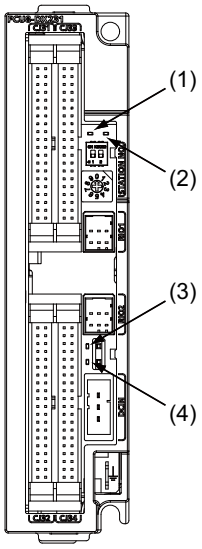
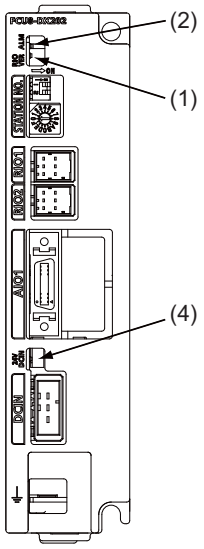
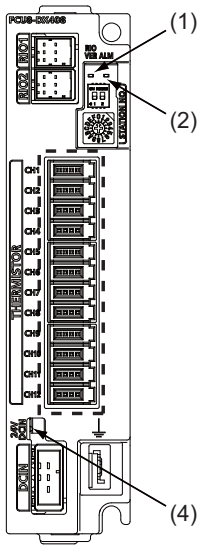
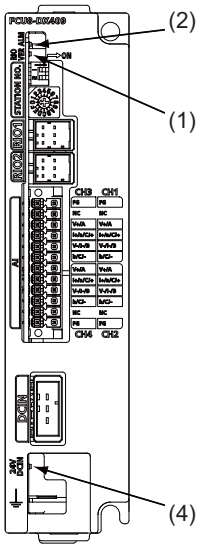
(s2) STATION No. (Station No. setting switch)



(s3) STATION No. (Station No. setting switch)

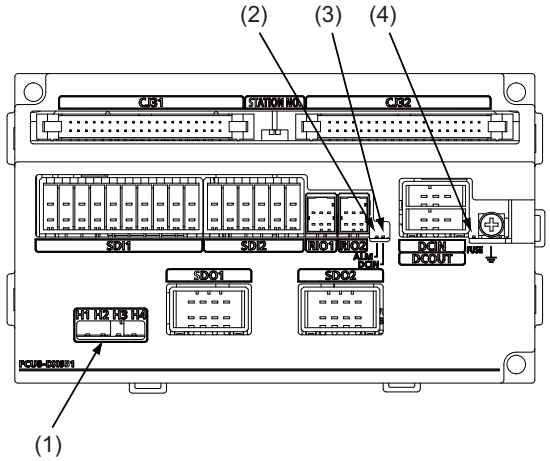


LED: FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX202/FCU8-DX213/FCU8-DX213-1/ FCU8-DX520/FCU8-DX654/FCU8-DX654-1/FCU8-DX408/FCU8-DX409

FCU8-DX220/FCU8-DX230/FCU8-DX231/ FCU8-DX213/FCU8-DX213-1/ FCU8-DX520/FCU8-DX654/FCU8-DX654-1	FCU8-DX202	FCU8-DX408	FCU8-DX409
			

No.	Name	Function	Color	Status		Details
				Normal	At fault	
(1)	RIOVER	RIO communication status	Green	Lit when RIO2.0 communication is occurring Not lit when RIO1.0 communication is occurring		
(2)	ALM	RIO communication error	Red	Not lit	Lit	Lit when RIO communication error has occurred.
(3)	FUSE	Fuse status	Green	Lit	Not lit	Not lit when a fuse has been blown out.
(4)	24 VDCIN	Energization status of 24 VDC input of DCIN connector	Green	Lit	Not lit	Lit when a current is applied.

LED: FCU8-DX651

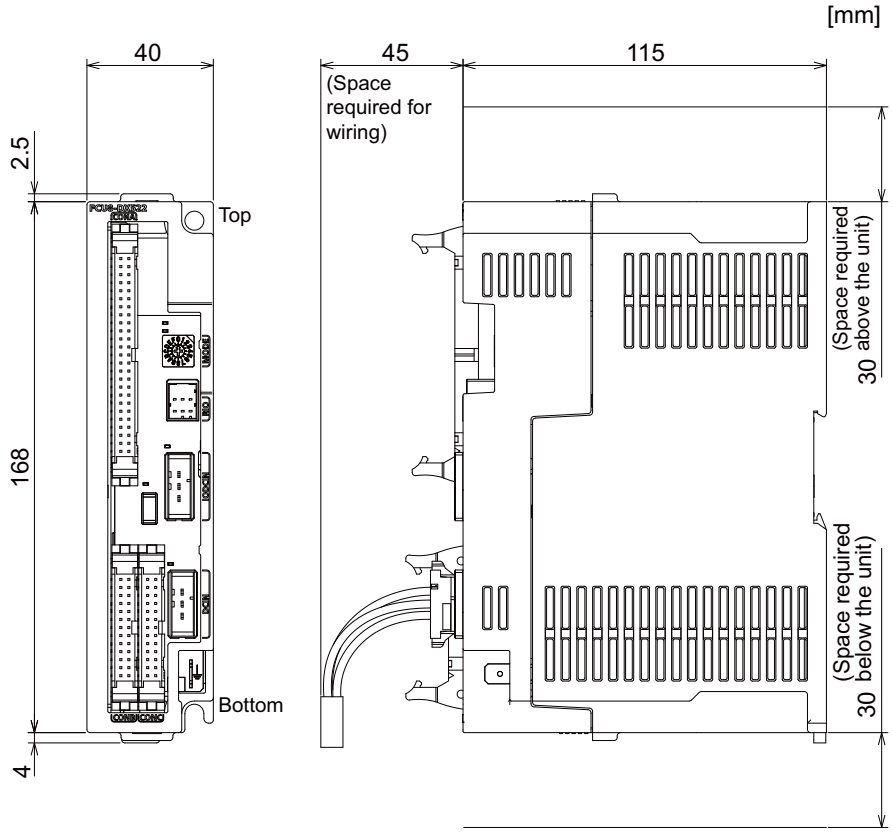


No.	Name	Function	Color	Status		Details
				Normal	At fault	
(1)	H1	Safety relay output SYR00 status	Green	Lit	Not lit	Not lit when the relay is welded.
	H2	Safety relay output SYR01 status	Green	Lit	Not lit	Not lit when the relay is welded.
	H3	Safety relay output SYR02 status	Green	Lit	Not lit	Not lit when the relay is welded.
	H4	Safety relay output SYR03 status	Green	Lit	Not lit	Not lit when the relay is welded.
(2)	ALM	RIO communication error	Red	Not lit	Lit	Lit when RIO communication error has occurred.
(3)	DCIN	Energization status of 24 VDC input of DCIN connector	Green	Lit	Not lit	Lit when a current is applied.
(4)	FUSE	Fuse status	Green	Lit	Not lit	Not lit when a fuse has been blown out.

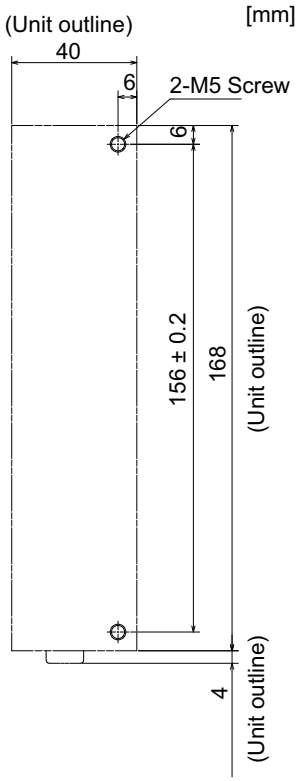
4.10 Laser I/F Unit

4.10.1 FCU8-DX522-001

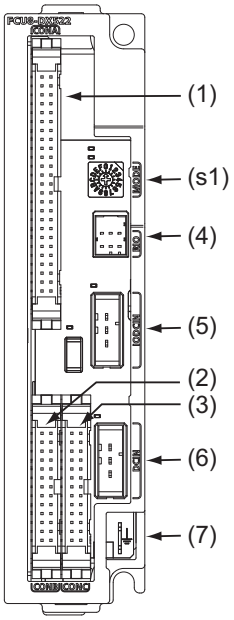
Outline dimensions



Installation dimensions



Connector



No.	Connector name	Function
(1)	CONA	Laser oscillator signal input Laser oscillator signal output
(2)	CONB	Laser oscillator signal input Laser oscillator signal output (PWM output, relay output)
(3)	CONC	Analog input Analog output
(4)	RIO	Remote I/O laser connection (*1)
(5)	IODCIN	24 VDC input (for IO)
(6)	DCIN	24 VDC input (for control)
(7)	FG	FG terminal

No.	Connector name	Function
(s1)	-	Mode setting switch (*2)

(*1) When the laser I/F unit is connected, the remote I/O unit cannot be connected between the control unit and the laser I/F unit.

(*2) The mode setting switch must be set to "0".

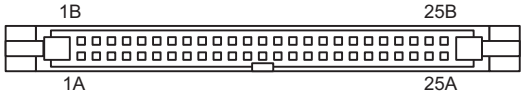
⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

⚠ Output from 12 V/5 V/3.3 V connectors is for powering peripheral devices only. If used for powering other equipment, NC operation will not be guaranteed due to voltage drops or wraparound noise.

(1) CONA (laser oscillator signal input, laser oscillator signal output)



B			A		
25	I	DI15	25	I	DI14
24	I	DI13	24	I	DI12
23	I	DI11	23	I	DI10
22	I	DI0F	22	I	DI0E
21	I	DI0D	21	I	DI0C
20	I	DI0B	20	I	DI0A
19	I	DI09	19	I	DI08
18	I	DI07	18	I	DI06
17	I	DI05	17	I	DI04
16	I	DI03	16	I	DI02
15	I	DI01	15	I	DI00
14	O	DO15	14	O	DO14
13	O	DO13	13	O	DO12
12	O	DO11	12	O	DO10
11	O	DO0F	11	O	DO0E
10	O	DO0D	10	O	DO0C
9	O	DO0B	9	O	DO0A
8	O	DO09	8	O	DO08
7	O	DO07	7	O	DO06
6	O	DO05	6	O	DO04
5	O	DO03	5	O	DO02
4	O	DO01	4	O	DO00
3		0 V	3		+24 V
2		NC	2		0 V
1		FG	1		NC

<Cable side connector type>
Discrete wire pressure welding socket: XG5M-5032-N
Semi-cover for pressure welding: XG5S-2501

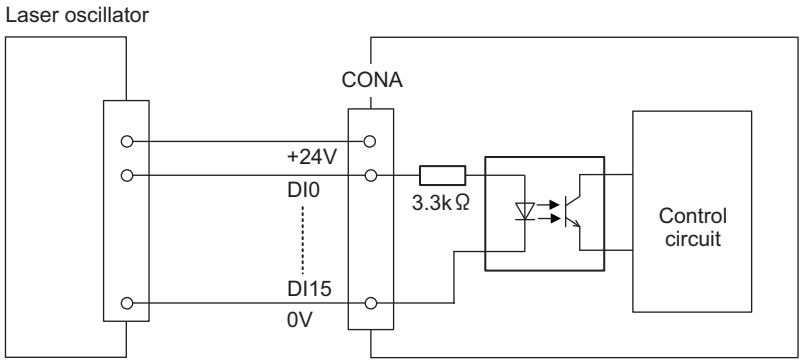
Discrete wire crimp socket: XG5N-501
Contact for crimp: XG5W-0231

Manufacturer: OMRON

[Outline of digital signal input circuit]

Connection to 0 V common only is also allowed in the digital signal input circuit.
Follow the wiring diagram below.

<Input circuit>



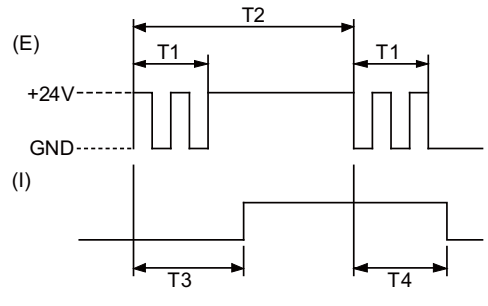
<Input conditions>

Set the input signal within the range as shown in the conditions below.

		0 V common
1	Input voltage at external contact ON	18 V or more, 25.2 V or less
2	Input current at external contact ON	5 mA or more
3	Input voltage at external contact OFF	4 V or less
4	Input current at external contact OFF	1.2 mA or less
5	Input resistance	3.3 kΩ
6	Tolerable chattering time (T1)	3 ms
7	Input signal holding time (T2)	40 ms or more (*1)
8	Input circuit operation delay time (T3 and T4)	3 ms to 16 ms
9	Machine side contact capacity	30 V or more, 16 mA or more

(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

Connection to 0 V common input

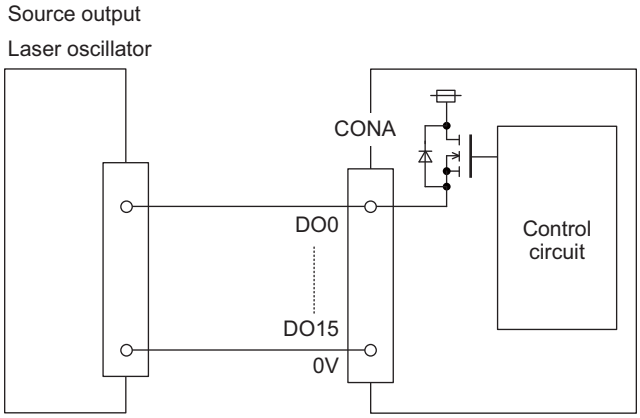


(E): External signal, (I): Internal signal

[Outline of digital signal output circuit]

Use within the specification ranges shown below.

<Output circuit>

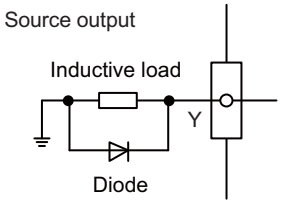


<Output conditions>

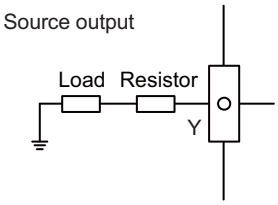
Insulation method	Insulation
Rated load voltage	24 V
Maximum output current	0.2 A per point [Total output current of whole CONA] 2.4 A or less
Output delay time	150 µs

Note

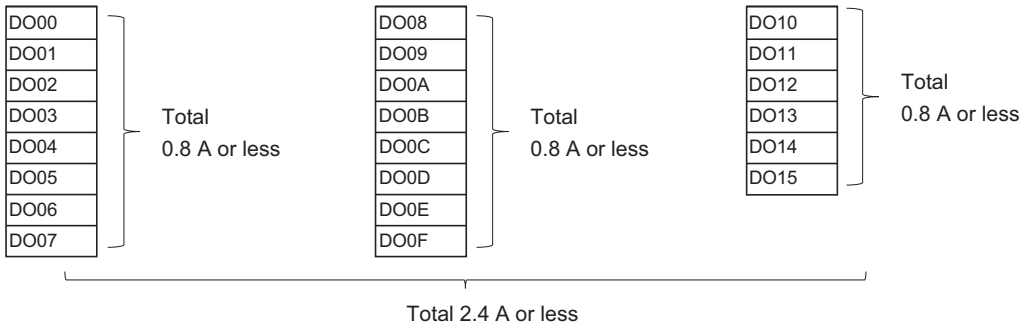
- When using an inductive load such as a relay, always connect a diode (voltage resistance 100 V or more, twice or more the load current) in parallel to the load.



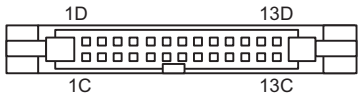
- When the rush current exceeds the maximum output current indicated previously, always connect a protective resistor serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



- Always keep the total sum of output current of each DO00 to DO07, DO08 to DO0F and DO10 to DO15 less than 0.8A.



(2) CONB (laser oscillator signal input, laser oscillator signal output)



D			C		
13		NC	13	-	NC
12		NC	12	I	DI19
11		0 V	11	I	DI18
10		0 V	10	I	DI17
9		+24 V	9	I	DI16
8		+24 V	8		NC
7		NC	7		NC
6		0 V	6	O	DO16
5		DO17_IN	5		DO17_OUT
4		DO18_IN	4		DO18_OUT
3		DO19_IN	3		DO19_OUT
2		NC	2		NC
1		FG	1		FG

<Cable side connector type>
Discrete wire pressure welding socket: XG5M-2632-N
Semi-cover for pressure welding: XG5S-1301

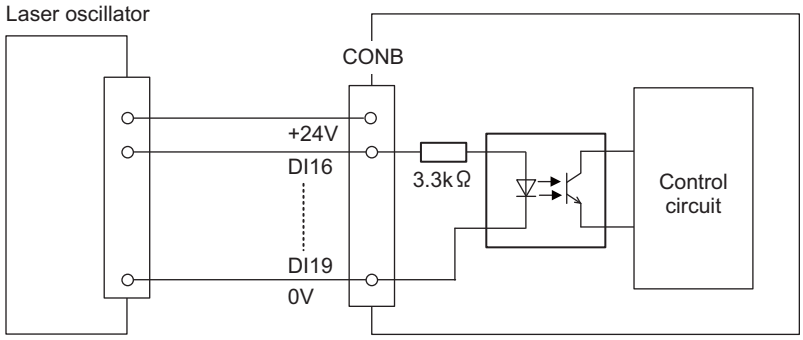
Discrete wire crimp socket: XG5N-261
Contact for crimp: XG5W-0231

Manufacturer: OMRON

[Outline of digital signal input circuit]

Connection to 0 V common only is also allowed in the digital signal input circuit.
Follow the wiring diagram below.

<Input circuit>



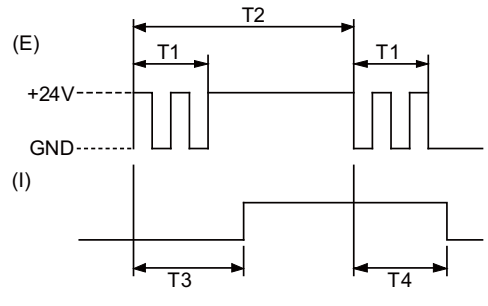
<Input conditions>

Set the input signal within the range as shown in the conditions below.

		0 V common
1	Input voltage at external contact ON	18 V or more, 25.2 V or less
2	Input current at external contact ON	5 mA or more
3	Input voltage at external contact OFF	4 V or less
4	Input current at external contact OFF	1.2 mA or less
5	Input resistance	3.3 kΩ
6	Tolerable chattering time (T1)	3 ms
7	Input signal holding time (T2)	40 ms or more (*1)
8	Input circuit operation delay time (T3 and T4)	3 ms to 16 ms
9	Machine side contact capacity	30 V or more, 16 mA or more

(*1) Input signal holding time: The guide is 40 ms or more. The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

Connection to 0 V common input



(E): External signal, (I): Internal signal

[Outline of PWM signal output circuit]

Use within the specification ranges shown below.

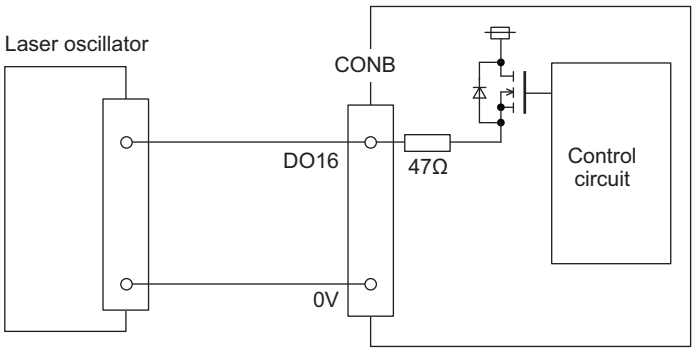
A use as digital signal output is available.

Note

PWM signal cannot be output from DO16 at the same time as analog output.

To output PWM from analog output, use DO16 as digital signal output.

<Output circuit>

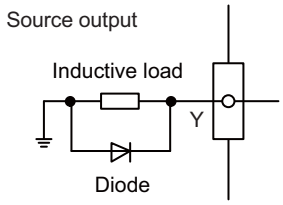


<Output conditions>

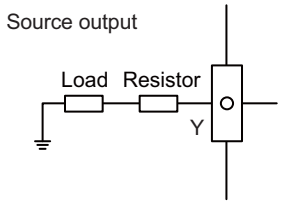
Insulation method	Optocoupler insulation
Rated load voltage	24 V
Maximum output current	60 mA
Maximum frequency	1 Hz to 9999 Hz (Setting unit: 1 Hz)
Duty ratio	0.0% to 100.0% (Setting unit: 0.1%)
Output delay time	4 µs
Minimum pulse width	5 µs

Note

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



- When the rush current exceeds the maximum output current indicated previously, always connect a protective resistor serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.

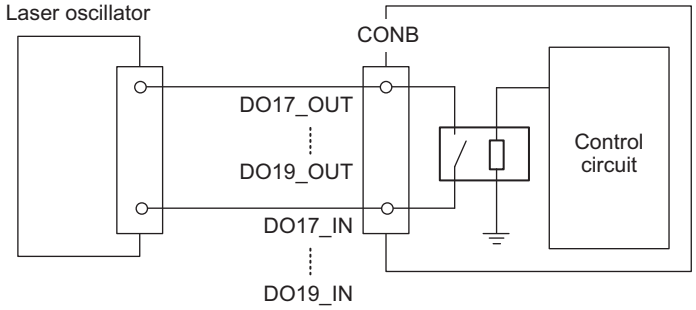


[Outline of relay signal output circuit]

Use within the specification ranges shown below.

Use a RIO unit with built-in relay for functional safety.

<Output circuit>



<Output conditions>

Insulation method	Insulation by relay
Output method	Non-voltage A contact
Contact structure	General relay
Rated voltage	24 VDC
Rated current	1 A
Operation time	10 ms
Response time	10 ms
Return time	10 ms
Life	50,000 times with 24 VDC, 1 A resistant load
Max. operation frequency	30 times/min

<Precautions>

- Influence on the relay life by a connected load

  An actual relay life can be substantially shortened depending on the type of a connected load and the characteristics of its inrush current.

  The inrush current generated by a connected load can lead to contact welding of the module.

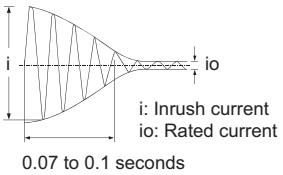
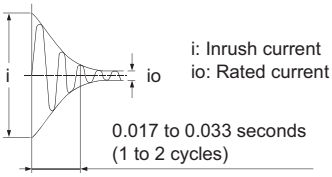
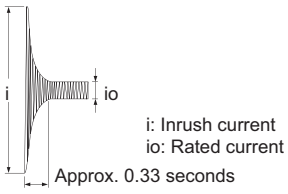
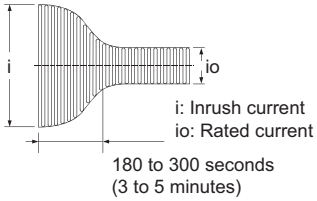
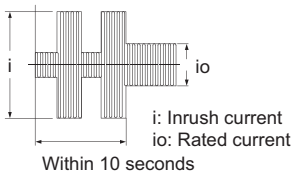
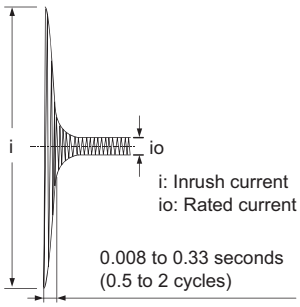
  To prevent shortening of the relay life and contact welding, take the following measures:

  - Considering the possibility of a high inrush current, select a load so that the inrush current generated by the connected load falls within the range of the rated current of the module.
  - Connect a relay capable of withstanding the inrush current, outside the module.

  The following table lists the relations between typical loads and each inrush current.

  Select a load so that the inrush current, i, and rated current, io, fall within the range of the rated switching current described in the module specifications.

  Depending on the load amount, the inrush current may flow for a long time.

Load type	Waveform	Inrush current "i"/ Rated current "io"	Waveform	Inrush current "i"/ Rated current "io"
Inductive load	Load of a solenoid 	Approx. 10 to 20 times	Load of an electromagnetic contactor 	Approx. 3 to 10 times
Lamp load	Load of an incandescent bulb 	Approx. 3 to 10 times	Load of a mercury lamp 	Approx. 3 times (*1)
	Load of a fluorescent 	Approx. 5 to 10 times	-	-
Capacitive load	Capacitive load (*2) 	Approx. 20 to 40 times	-	-

(*1) A typical discharge lamp circuit is configured with a combination of discharge tubes, transformers, choke coils, capacitors and others. Because of this, be especially careful of the case of a high power factor and a low power supply impedance, where the inrush current flowing into the output module can be 20 to 40 times as high as the rated current.

(*2) When the wiring is long, be careful with the cable capacity as well.

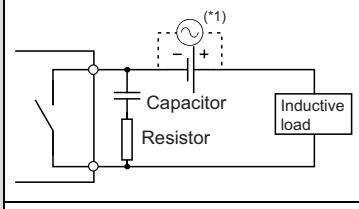
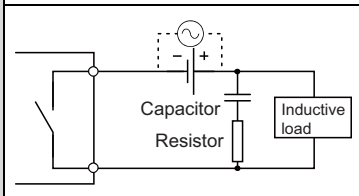
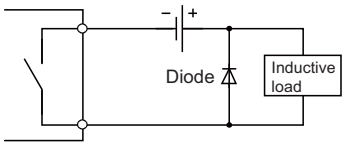
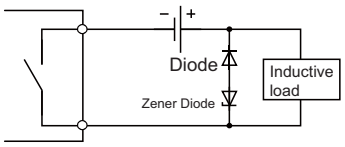
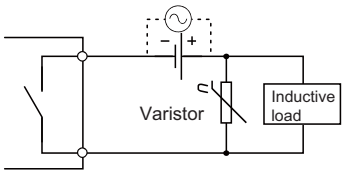
- Measures against back EMF

  Provide a contact protection circuit for an extended contact life, noise prevention at contact close, and reduction of the carbides and nitric acids formed by an arc discharge.

  An incorrect circuit involves a high risk of contact welding.

  With the contact protection circuit, the recovery time may be delayed.

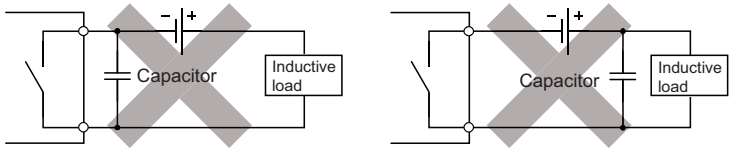
  The following table shows typical examples of the contact protection circuit.

Circuit example		Element selection criteria	Remarks
Capacitor + resistance method (CR method)		Estimate the constants of a capacitor and resistance with the following as a guide. Some differences, however, may arise from a variation in the nature and characteristics of the load. • Capacitor: 0.5 to 1 (μF) for a load current of 1 A • Resistance: 0.5 to 1 (Ω) for a power supply voltage of 1 V Use a capacitor with voltage resistance of the rated voltage or higher. In an AC circuit, use a capacitor with no polarity.	When a relay or solenoid is used as the load, the recovery time is delayed. A capacitor has the effect of reducing a discharge at contact OFF, while a resistance has the effect of limiting a current at contact ON.
			
Diode method		Use a diode that satisfies the following conditions: • A reverse breakdown voltage is more than ten times as high as the circuit voltage. • A forward current is more than twice as high as the load current.	The recovery time is delayed than the CR method.
Diode + zener diode method		Use a zener diode whose zener voltage is higher than the power supply voltage.	This method is suitable for the case where the diode method results in a substantial delay in the recovery time.
Varistor method		Select a varistor whose cut-off voltage (Vc) satisfies the following conditions: • Vc > power supply voltage × 1.5 (V) • Vc > power supply voltage × 1.5 (V) × √2 (on AC power supply) Note that selecting an element of a too high Vc leads to a weaker effect.	The recovery time is a little delayed.

(*1) On AC power supply, the impedance of the CR needs to be sufficiently higher than that of the load. (for preventing errors due to the leakage current of the CR)

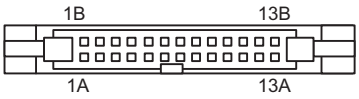
POINT

- Avoid using contact protection circuits like the following. Although highly effective in reducing the arc at current cutoff, a charge current flows into the capacitor when the contact turns on or off, which leads to the risk of contact welding. A DC inductive load, generally considered to be more difficult to open and close than a resistive load, can achieve the same performance of a resistive load in an appropriate configuration of the protection circuit.



- Install the protection circuit near the load or contact (module). A long distance between them may inhibit the effect of the protection circuit. As a guide, install it at a distance of no more than 50 cm.

(3) CONC (Analog input, Analog output)



B			A		
13		0 V	13	I	AI0
12		0 V	12		Reserved
11		0 V	11		Reserved
10		0 V	10		Reserved
9		NC	9		NC
8		NC	8		Reserved
7		0 V	7	O	AO0
6		0 V	6		NC
5		NC	5		NC
4		NC	4		NC
3		NC	3		NC
2		NC	2		NC
1		FG	1		FG

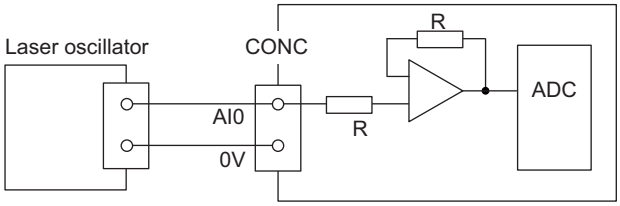
<Cable side connector type>
Discrete wire pressure welding socket: XG5M-2632-N
Semi-cover for pressure welding: XG5S-1301

Discrete wire crimp socket: XG5N-261
Contact for crimp: XG5W-0231

Manufacturer: OMRON

[Outline of analog signal input circuit]

<Input circuit>



<Input conditions>

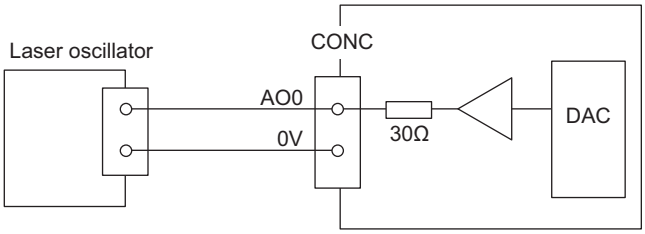
Analog input voltage	0 V to 10 V
Max. input rating (*1)	12.5 V
Resolution	+10 V/16383 = 0.6104 mV
Repeatability	±25 mV (*2)
Tolerance	±0.35 V

(*1) This indicates the input voltage which must not be exceeded even in an instant.

(*2) Except when the accuracy is affected by the noise.

[Outline of analog signal output circuit]

<Output circuit>

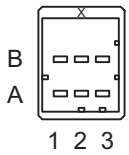


<Output conditions>

Analog output voltage	0 V to 10 V (±5%)
Resolution	+10 V/16383 = 0.6104 mV
Load conditions	External load resistance value 2.2 kΩ or more
Output resistance value	30 Ω
Maximum frequency (*1)	1 Hz to 4000 Hz (Setting unit: 1 Hz)
Duty ratio (*1)	0.0% to 100.0% (Setting unit: 0.1%)
Minimum pulse width (*1)	50 μs

(*1) This indicates the conditions when PWM signal is output from analog signal output.
When the PWM signal is output from DO16, the PWM signal cannot be output from the analog signal output.

(4) RIO (remote I/O laser connection)



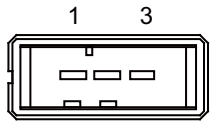
A			B		
1	I/O	TXRXD	1	I/O	TXRXD*
2		NC	2		0 V
3		FG	3		NC

<Cable side connector type>
Connector: 1-1318119-3
Contact: 1318107-1
Manufacturer: TE Connectivity

Note

When the laser I/F unit is connected, the remote I/O unit cannot be connected between the control unit and the laser I/F unit.

(5) IODCIN (24 VDC input)
(6) DCIN (24 VDC input)



1	I	+24 V
2		0 V
3		FG

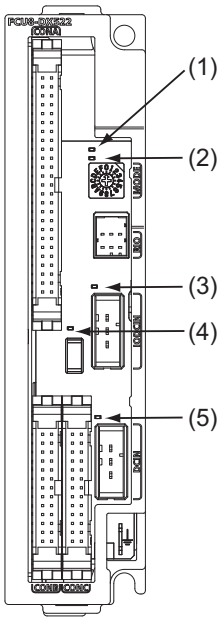
<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

(7) FG (FG terminal)

(s1) Mode setting switch
The mode setting switch must be set to "0".



LED



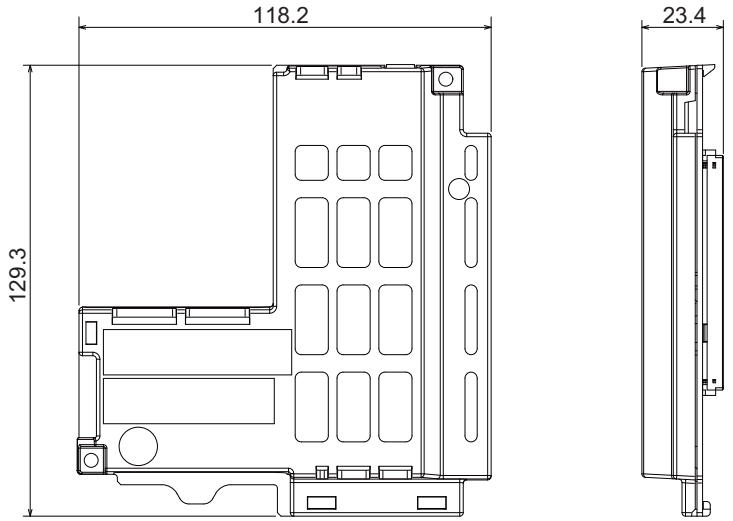
No.	Name	Function	Color	Status		Details
				Normal	At fault	
(1)	READY	Communication status with control unit	Green	Lit	Not lit	Not lit when a communication error has occurred.
(2)	ERROR	Error status	Red	Not lit	Lit	Lit when an error has occurred.
(3)	IO24VIN	Energization status of 24 VDC input of IODCIN connector	Green	Lit	Not lit	Lit when a current is applied.
(4)	FUSE	Fuse status	Green	Lit	Not lit	Not lit when a fuse has been blown out.
(5)	24VIN	Energization status of 24 VDC input of DCIN connector	Green	Lit	Not lit	Lit when a current is applied.

4.11 Functional Safety Expansion Unit

4.11.1 Functional Safety Expansion Unit (FCU8-EX134)

Outline dimensions

[mm]

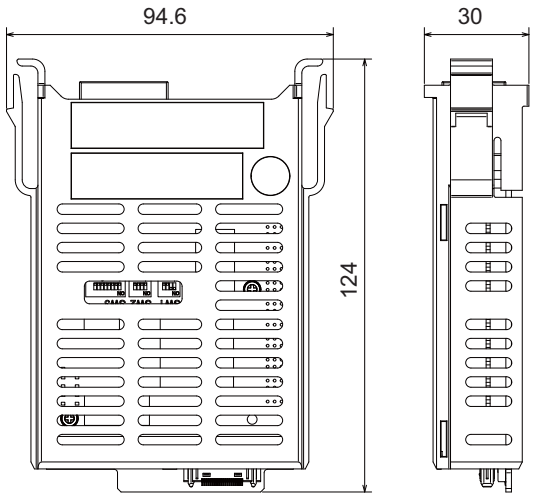


4.12 Function Expansion Unit

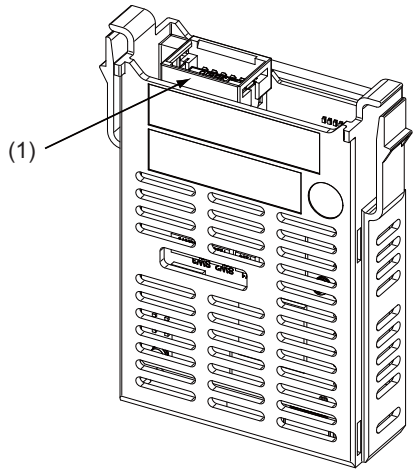
4.12.1 CC-Link (FCU8-EX561)

Outline dimensions

[mm]



Connector



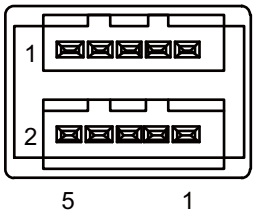
No.	Connector name	Function
(1)	CCL	CC-Link communication

⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

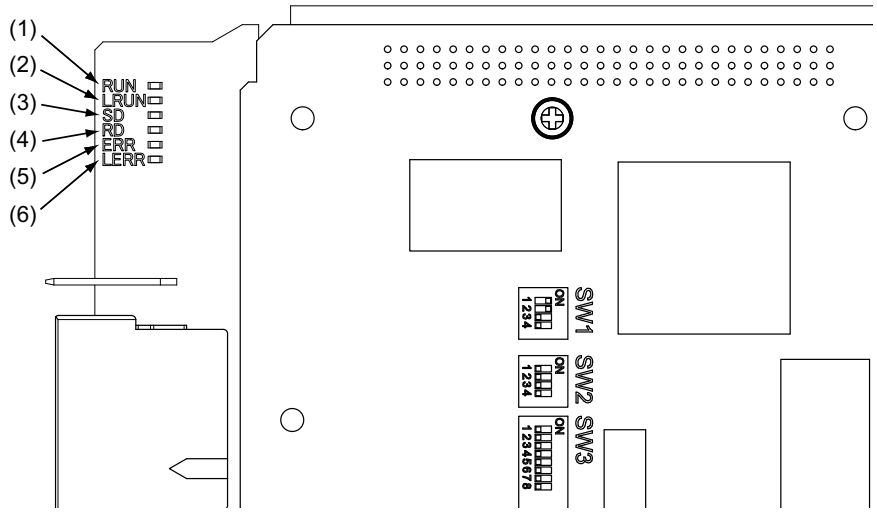
(1) CCL (CC-Link communication)



1	I/O	DA
2	I/O	DB
3		DG
4		NC
5		SLD

<Cable side connector type>
Connector: 35505-6000-BOM GF
Manufacturer: 3M

LED



No.	Name	Color	Status	Details
(1)	RUN	Green	Lit	CC-Link module normal
			Not lit	Watchdog timer error
(2)	LRUN	Green	Lit	Data link in progress
(3)	SD	Green	Lit	Data being sent
(4)	RD	Green	Lit	Data being received
(5)	ERR	Red	Lit	Switch configuration fault (LERR also lit), master duplicate, faulty parameter, or communication error
			Flashing	Other data link error (at master station)
(6)	LERR	Red	Lit	Data link communication error
			Flashing	Active station no., mode change

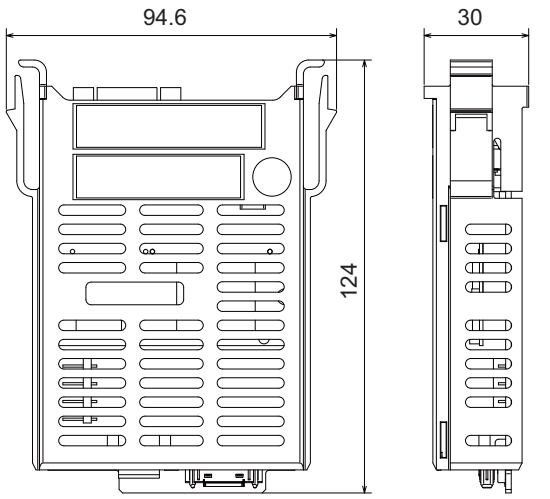
Note

- All LEDs (RUN, LRUN, SD, RD, ERR, and LERR) will be lit while the CC-Link module is resetting.

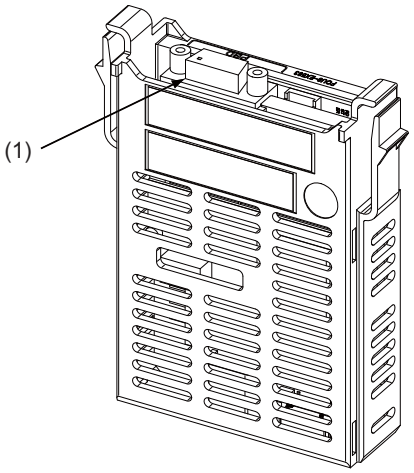
4.12.2 PROFIBUS-DP (FCU8-EX563)

Outline dimensions

[mm]



Connector



No.	Connector name	Function
(1)	PBD	PROFIBUS-DP

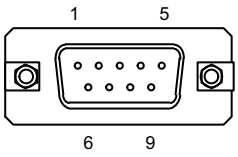
⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

⚠ Output from 5 V connectors is for powering peripheral devices only. If used for powering other equipment, NC operation will not be guaranteed due to voltage drops or wraparound noise. Do not use it to supply power to other devices.

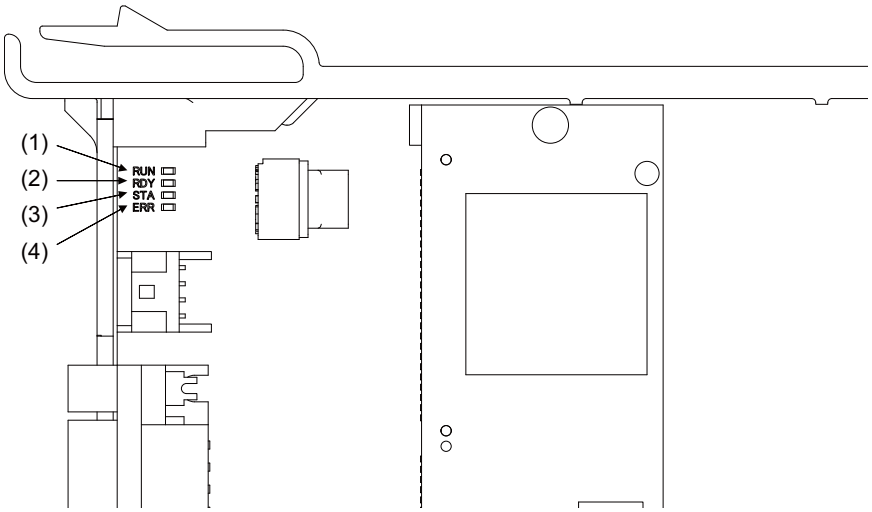
(1) PBD (PROFIBUS-DP communication)



1		NC	**6**		+5 V
2		NC	**7**		NC
3	I/O	RXD/TXD-P	**8**	I/O	RXD/TXD-N
4	I/O	CNTR-P	**9**		NC
5		0 V			

<Cable side connector type>
Connector: 6GK1 500-0FC10
Manufacturer: Siemens

LED



No. and Name	Color	Status	Details
(1) RUN (Green) (2) RDY (Yellow) (Module status)	Green	Lit	PROFIBUS-DP module operating normally
	Green/yellow	Flashing	Waiting to boot
	Yellow	Lit	Boot error
	-	Lit	No power supply, broken module
(3) STA (Green) (4) ERR (Red) (Communication status)	Green	Blinks periodically	Configuration successful, communication not established
	Green	Blinks at irregular intervals	Configuration failed, stack error
	Green	Lit	Communicating with slave
	Red	Flashing	Lost communication with at least one slave
	Red	Lit	Lost communication with all slaves

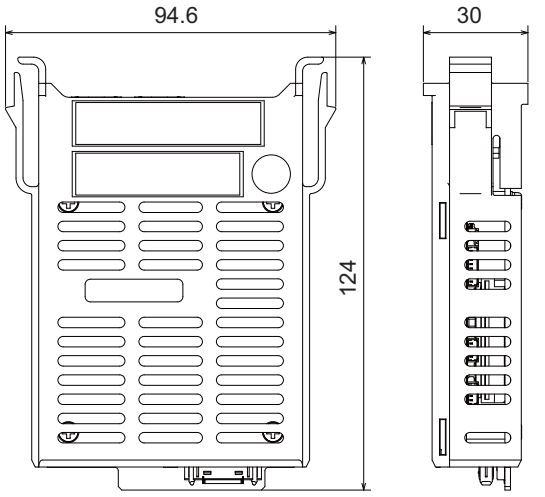
Note

- All LEDs (RUN, RDY, STA, and ERR) will be lit while the PROFIBUS-DP module is resetting.
- The combination of RUN/RDY lights indicate PROFIBUS-DP module status.
- The combination of STA/ERR lights indicate PROFIBUS-DP communication status.

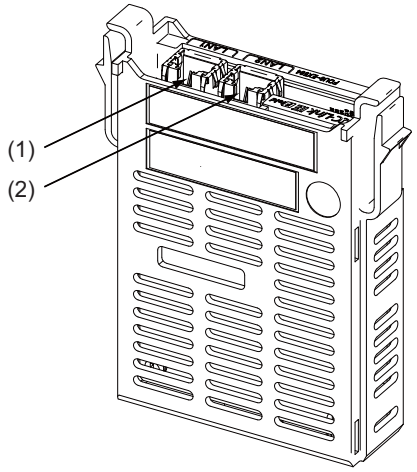
4.12.3 CC-Link IE Field (FCU8-EX564)

Outline dimensions

[mm]



Connector



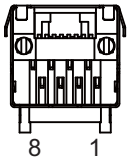
No.	Connector name	Function
(1)	LAN1	CC-Link IE Field communication
(2)	LAN2	

⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

(1) LAN1 (CC-Link IE Field communication 1st channel)
(2) LAN2 (CC-Link IE Field communication 2nd channel)

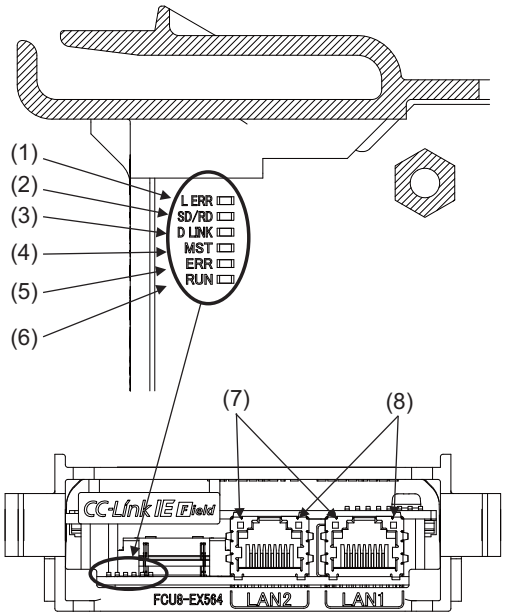


1	I/O	TXRXD0+
2	I/O	TXRXD0-
3	I/O	TXRXD1+
4	I/O	TXRXD2+
5	I/O	TXRXD2-
6	I/O	TXRXD1-
7	I/O	TXRXD3+
8	I/O	TXRXD3-

- Connect connector case with FG pattern.

<Cable side connector type>
Connector: J00026A0165
Manufacturer: Japan Telegärtner

LED

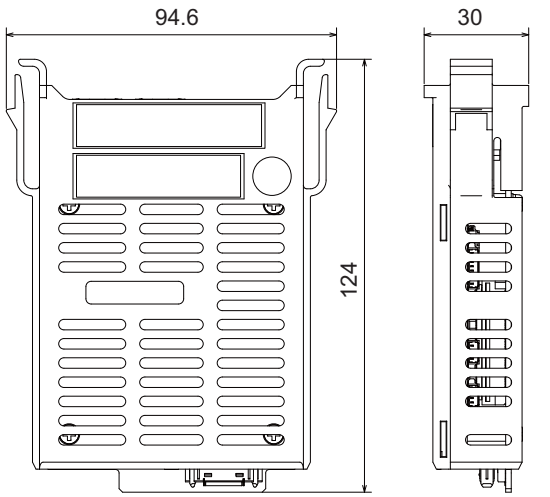


No.	Name	Color	Status	Details
(1)	L ERR	Red	Not lit	Normal data received and loopback not performed
			Lit	Abnormal data received or loopback being performed
(2)	SD/RD	Green	Lit	Data being sent or received
			Not lit	Data not sent nor received
(3)	D LINK	Green	Lit	Data link (cyclic transmission being performed)
			Flashing	Data link (cyclic transmission stopped)
			Not lit	Data link not performed (disconnected)
(4)	MST	Green	Lit	Operating as master station
			Not lit	Operating as local station
(5)	ERR	Red	Not lit	Normal operation
			Flashing (500 ms interval)	A data link faulty station detected
			Flashing (200 ms interval)	Failure occurring
			Lit	Error in all stations detected or occurring
(6)	RUN	Green	Lit	Hardware running normally
			Not lit	Hardware error occurring
(7)	LINK	Green	Lit	Link-up
			Not lit	Link-down
(8)	L ER	Red	Lit	Normal data received and loopback not performed
			Not lit	Abnormal data received or loopback being performed

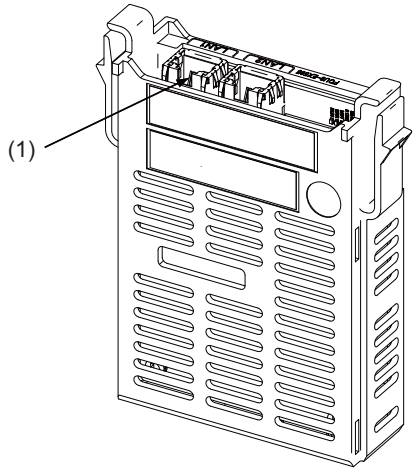
4.12.4 EtherNet/IP (FCU8-EX565)

Outline dimensions

[mm]



Connector



No.	Connector name	Function
(1)	LAN1	EtherNet/IP communication

Note

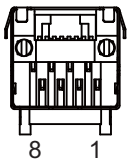
- On this unit, EtherNet/IP function is supported by the "LAN1" port only. Do not use LAN2 because it does not support EtherNet/IP function.

⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

(1) LAN1 (EtherNet/IP communication)

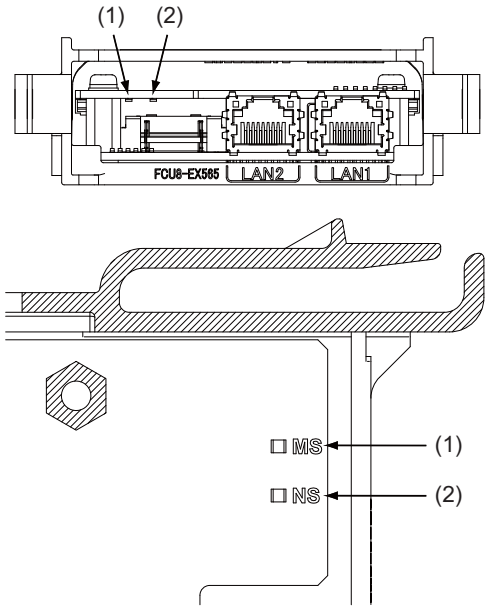


1	O	TXD+	**5**		NC
2	O	TXD-	**6**	I	RXD-
3	I	RXD+	**7**		NC
4		NC	**8**		NC

- Connect connector case with FG pattern.

<Cable side connector type>
Connector: J00026A0165
Manufacturer: Japan Telegärtner

LED



No.	Name	Green LED	Red LED	Details
(1)	MS (Green/red) (Module status)	Flashing	Flashing	Device self-testing
		Flashing	Not lit	Waiting for initialization
		Lit	Not lit	Normal operation
		Not lit	Flashing	Recoverable error
		Not lit	Lit	Unrecoverable error (hardware replacement required)
(2)	NS (Green/red) (Communication status)	Flashing green/red (alternating)		Self-diagnosis
		Not lit	Not lit	No IP address
		Flashing	Not lit	Not connected
		Lit	Not lit	Normal operation
		Not lit	Flashing	Connection timeout
		Not lit	Lit	Duplicate IP address

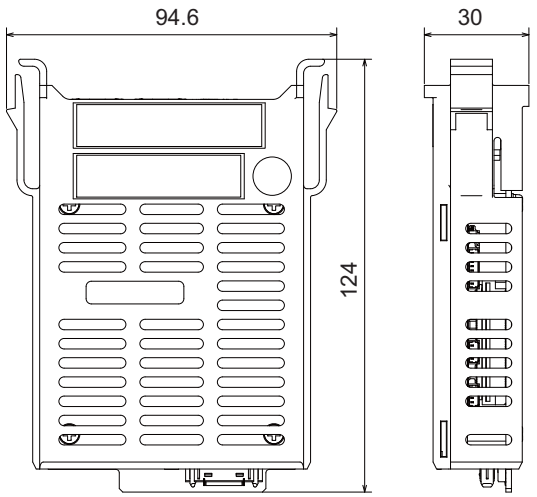
Note

- Ignore all LED combinations not listed in the table above.

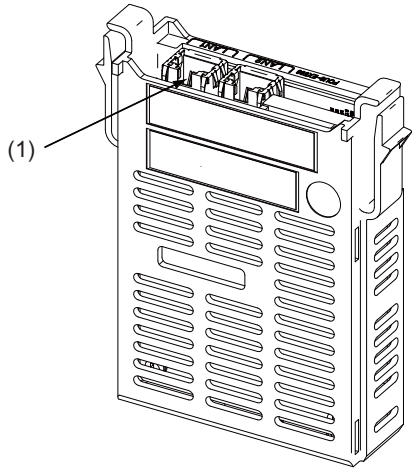
4.12.5 FL-net (FCU8-EX568)

Outline dimensions

[mm]



Connector



No.	Connector name	Function
(1)	LAN1	FL-net communication

Note

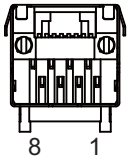
- On this unit, FL-net function is supported by the "LAN1" port only. LAN2 does not support FL-net function.

⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

(1) LAN1 (FL-net communication)

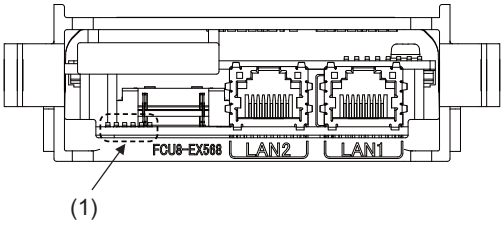


1	O	TXD+	**5**		NC
2	O	TXD-	**6**	I	RXD-
3	I	RXD+	**7**		NC
4		NC	**8**		NC

- Connect connector case with FG pattern.

<Cable side connector type>
Connector: J00026A0165
Manufacturer: Japan Telegärtner

LED

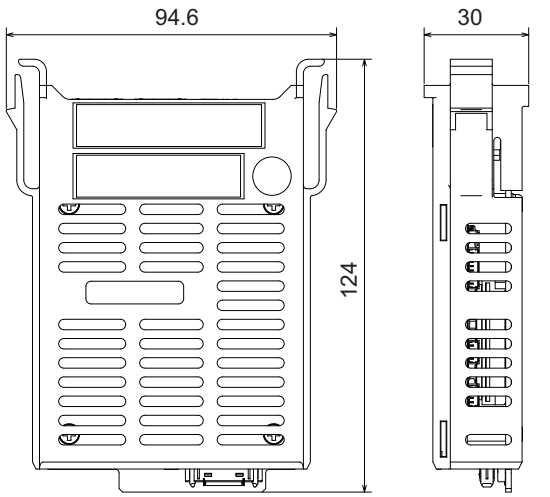


(1) Ignore LED on FCU8-EX568. (This is used by Mitsubishi Electric.)

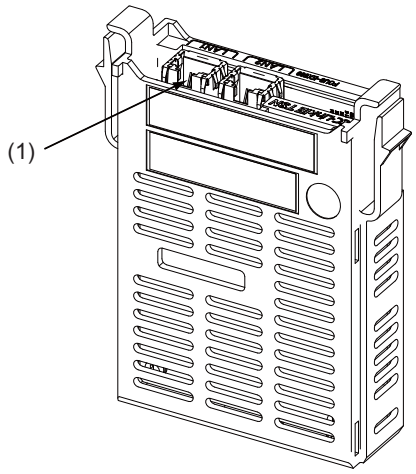
4.12.6 CC-Link IE TSN Expansion Unit (FCU8-EX569)

Outline dimensions

[mm]



Connector



No.	Connector name	Function
(1)	LAN1	CC-Link IE TSN communication

Note

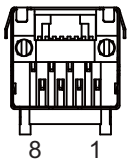
- On this unit, CC-Link IE TSN function is supported by the "LAN1" port only. LAN2 does not support CC-Link IE TSN function.

⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

(1) LAN1 (CC-Link IE TSN communication)

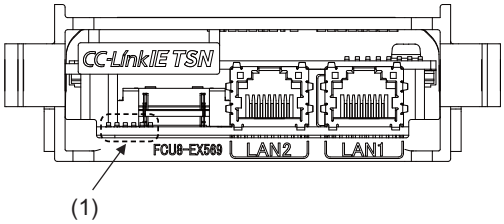


1	O	TXD+	**5**		NC
2	O	TXD-	**6**	I	RXD-
3	I	RXD+	**7**		NC
4		NC	**8**		NC

- Connect connector case with FG pattern.

<Cable side connector type>
Connector: J00026A0165
Manufacturer: Japan Telegärtner

LED

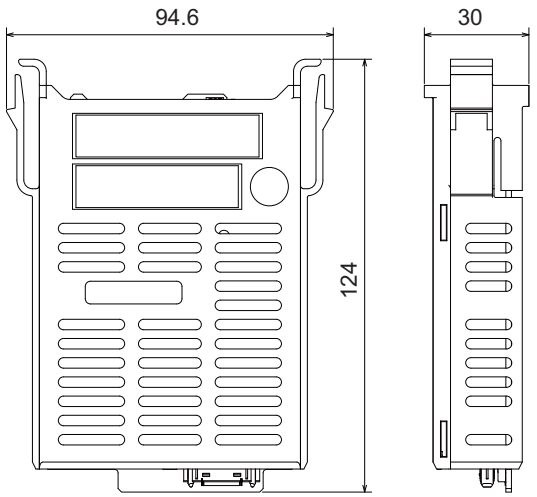


(1) Ignore LED on FCU8-EX569. (This is used by Mitsubishi Electric.)

4.12.7 Vibration Cutting Expansion Unit (FCU8-EX744)

Outline dimensions

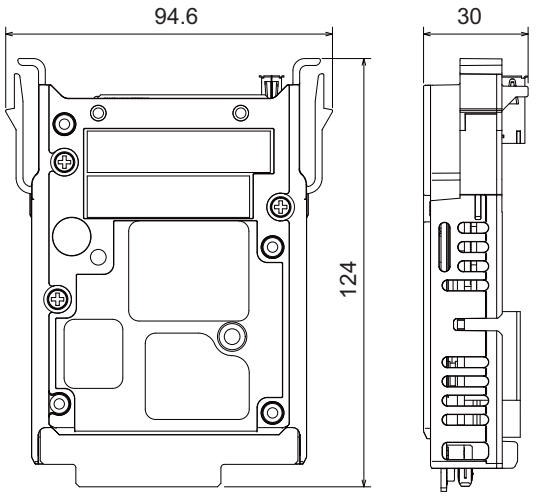
[mm]



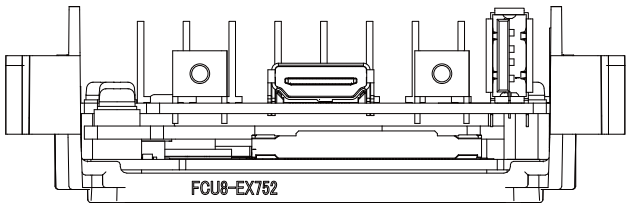
4.12.8 Image Input Expansion Unit (FCU8-EX752)

Outline dimensions

[mm]



Connector



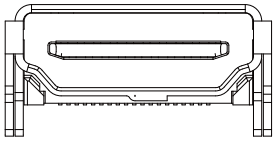
No.	Connector name	Function
(1)	VIDEOIN	IPC image signal input I/F
(2)	VEUSB	IPC touch signal transmission I/F

⚠ CAUTION

⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. 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.

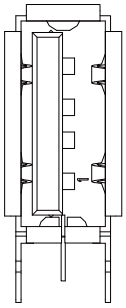
(1) VIDEOIN (IPC image signal input I/F)



1	TMDS_2+	11	TMDS_CLKGND
2	TMDS_2GND	12	TMDS_CLK-
3	TMDS_2-	13	CEC
4	TMDS_1+	14	NO_CHRGE
5	TMDS_1GND	15	DDC_CLK
6	TMDS_1-	16	DDC_DAT
7	TMDS_0+	17	DDCCEC/GND
8	TMDS_0GND	18	+5 V
9	TMDS_0-	19	PULS_DETECT
10	TMDS_CLK+		

- Connect connector case with FG pattern.

(2) VEUSB (IPC touch signal transmission I/F)



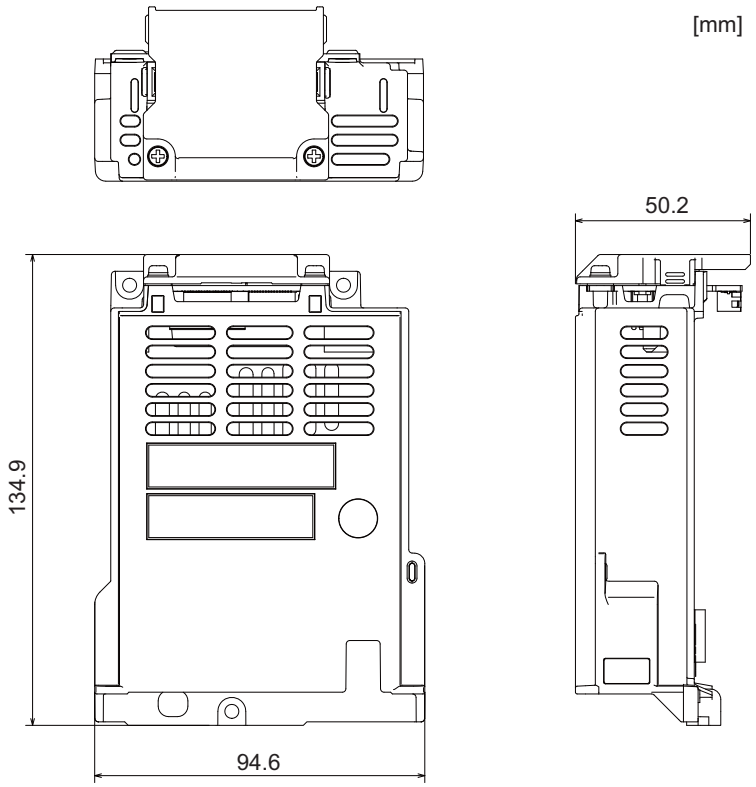
1	VBUS
2	D-
3	D+
4	GND+

- Connect connector case with FG pattern.

4.12.9 Option Relay Unit (FCU8-EX704)

Outline dimensions

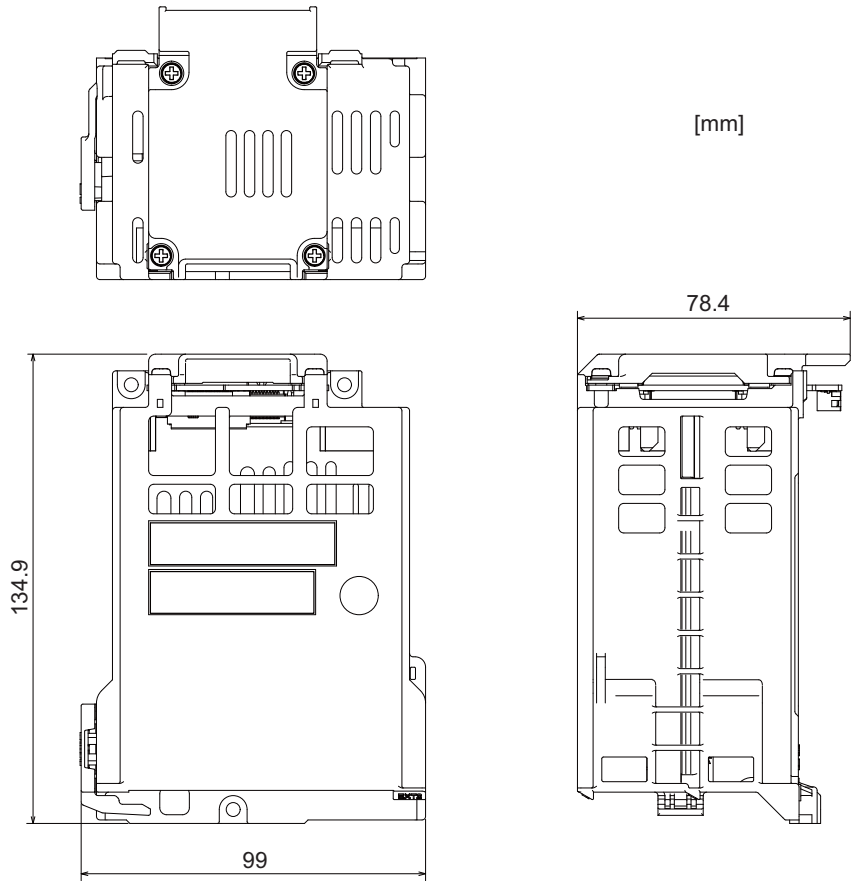
[mm]



4.12.10 Option Relay Unit (FCU8-EX705)

Outline dimensions

[mm]



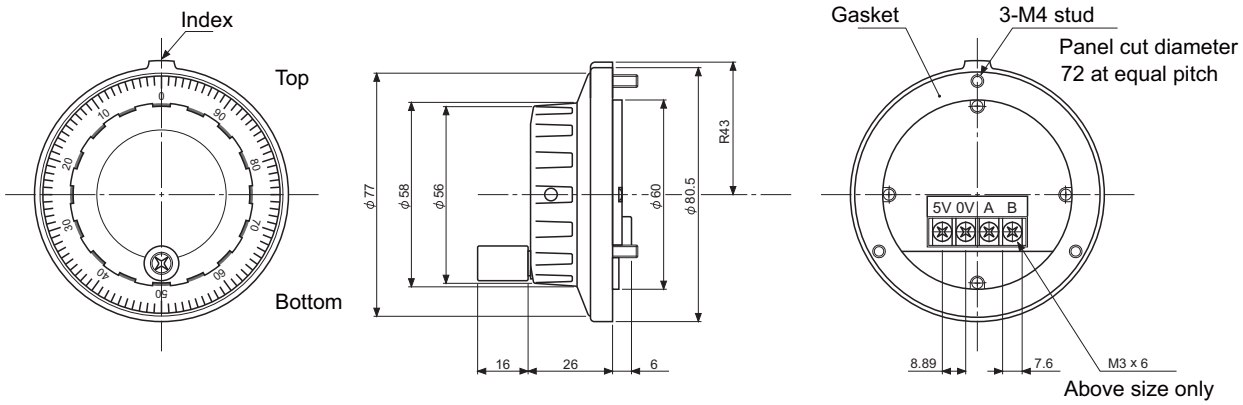
4.13 Manual Pulse Generator

4.13.1 5 V Manual Pulse Generator (UFO-01-2Z9)

■ 100 pulse/rev

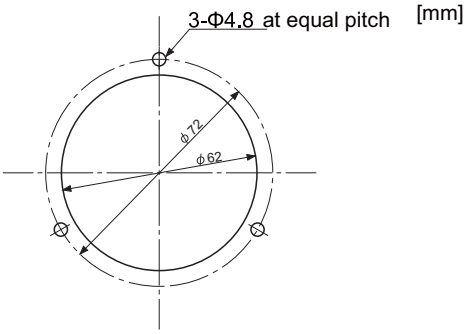
Outline dimensions

[mm]



Panel cut dimensions

[mm]



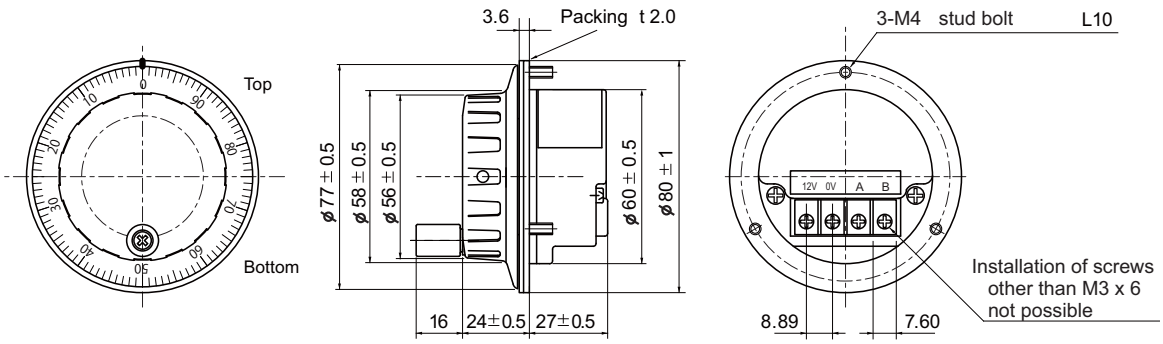
Produced by NIDEC NEMICON CORPORATION

4.13.2 12 V Manual Pulse Generator (HD60C)

■ 25 pulse/rev

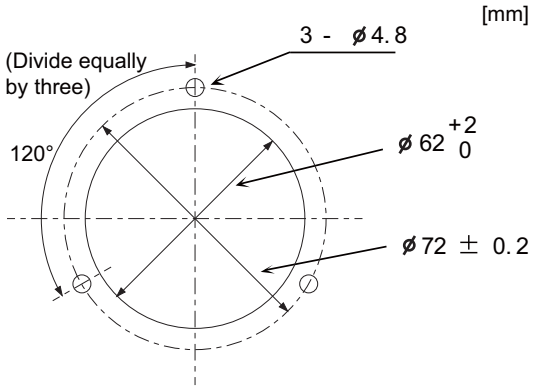
Outline dimensions

[mm]



Panel cut dimensions

[mm]

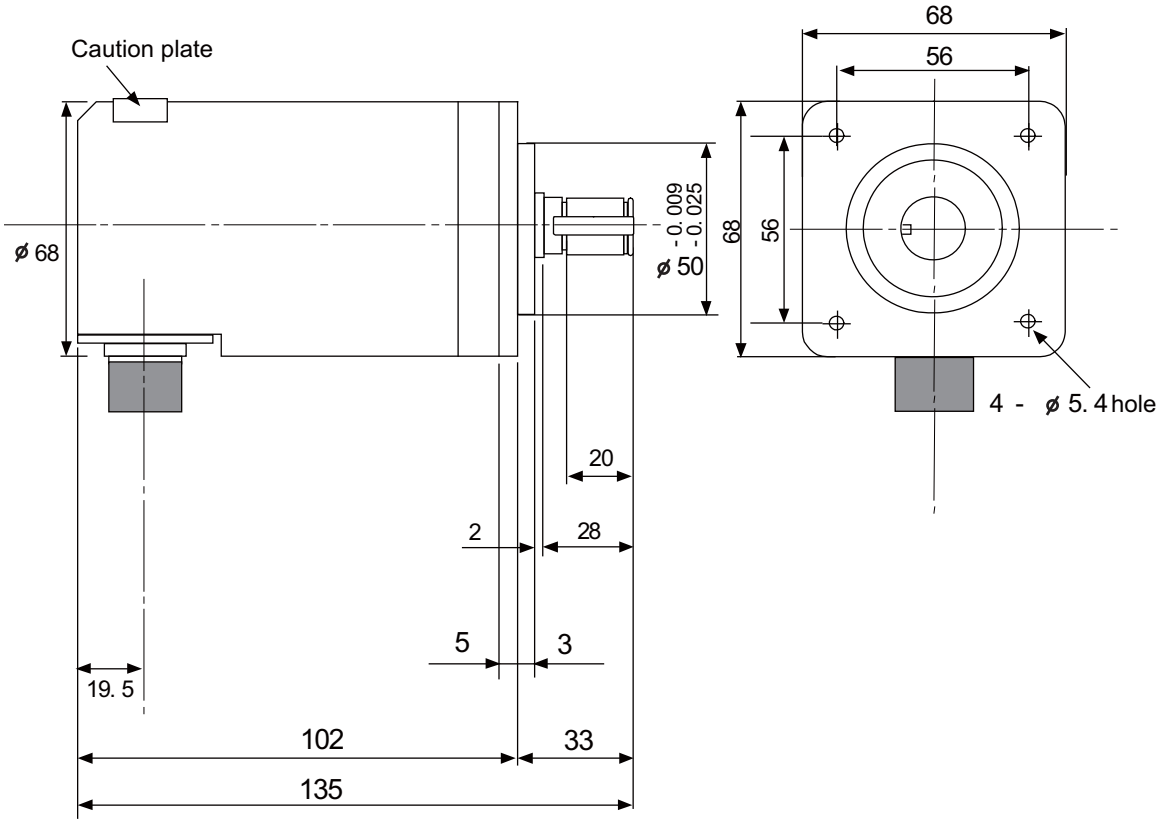


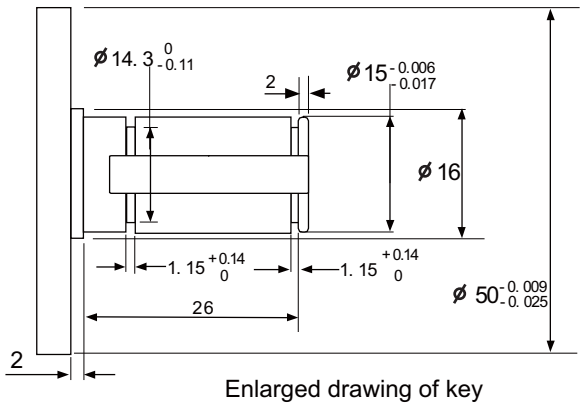
4.14 Synchronous Feed Encoder

4.14.1 Synchronous Feed Encoder (OSE-1024-3-15-68)

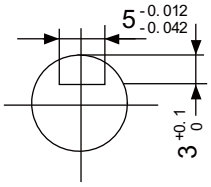
Outline dimensions

[mm]



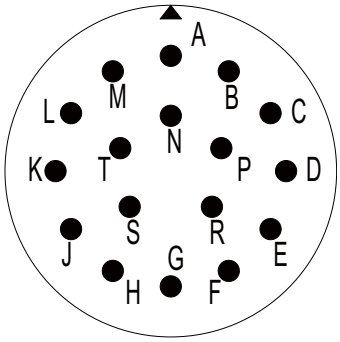


Enlarged drawing of key



Cross section BB
Valid depth of key groove is 21mm

Connector



<Connector pin assignment>

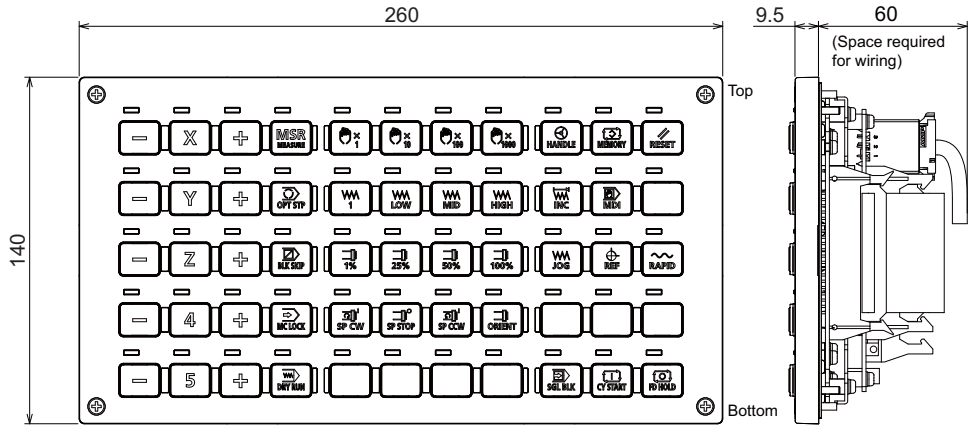
Pin	Function	Pin	Function
A	A phase	**K**	0 V
B	Z phase	**L**	-
C	B phase	**M**	-
D	-	**N**	A phase reverse
E	Case grounding	**P**	Z phase reverse
F	-	**R**	B phase reverse
G	-	**S**	-
H	+5 V	**T**	-
J	-		

4.15 Machine Operation Panel

4.15.1 Main Panels (FCU8-KB921/FCU8-KB922/FCU8-KB925, FCU8-KB923/FCU8-KB924/FCU8-KB926)

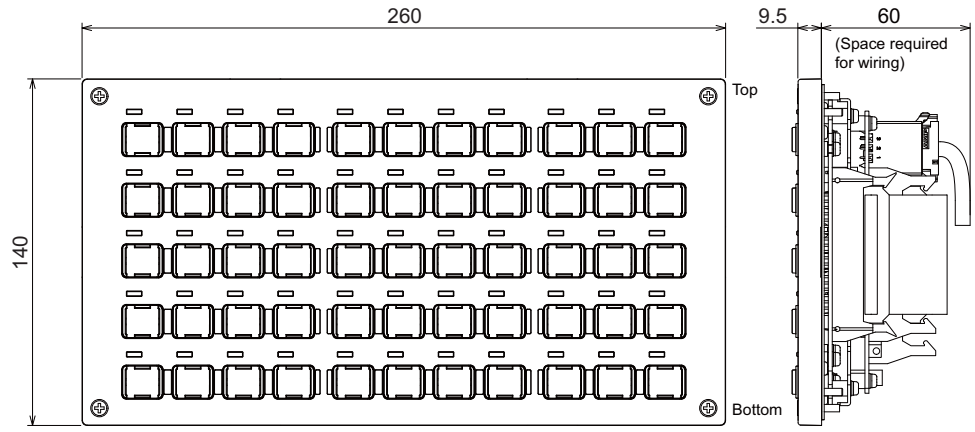
Outline dimensions: FCU8-KB921

[mm]



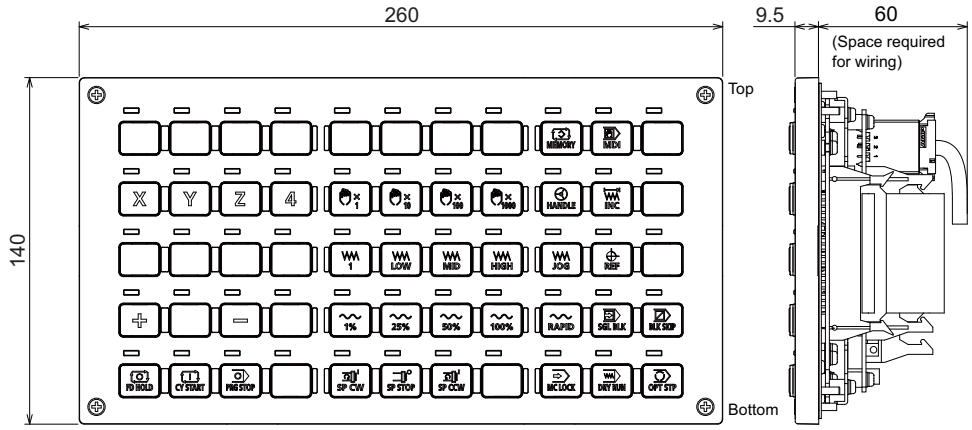
Outline dimensions: FCU8-KB922

[mm]



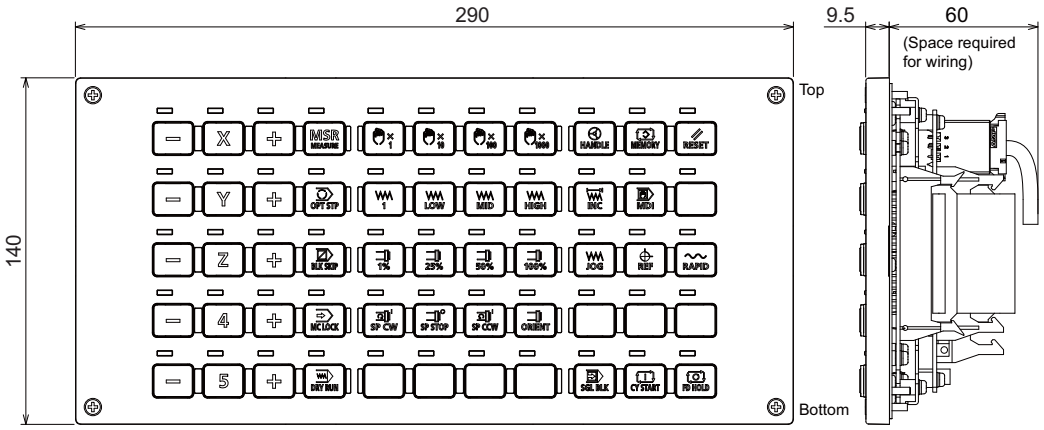
Outline dimensions: FCU8-KB925

[mm]



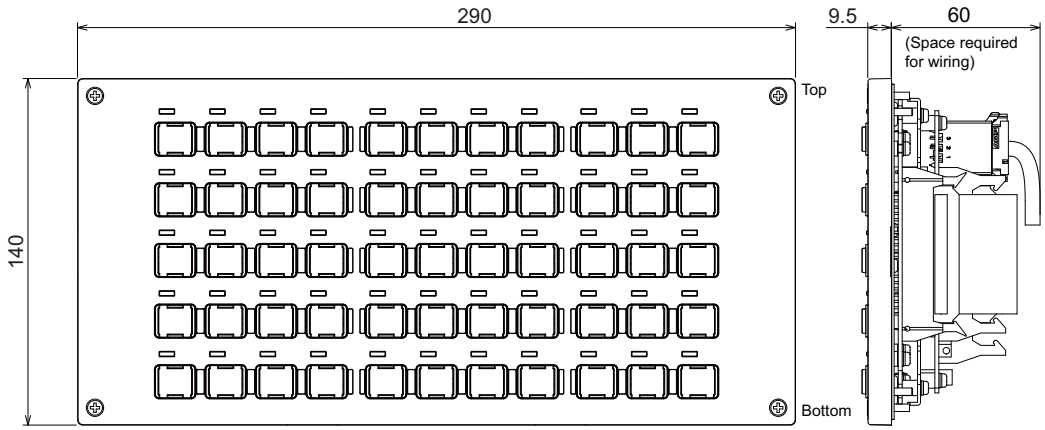
Outline dimensions: FCU8-KB923

[mm]



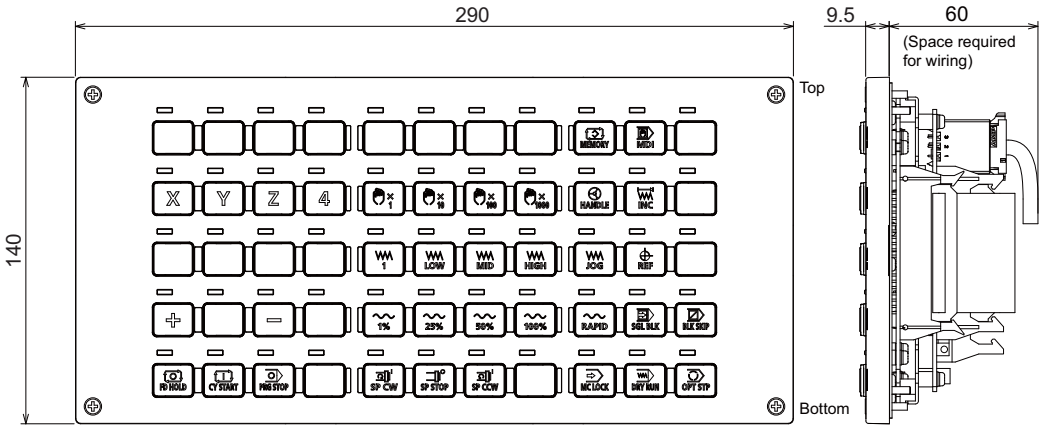
Outline dimensions: FCU8-KB924

[mm]



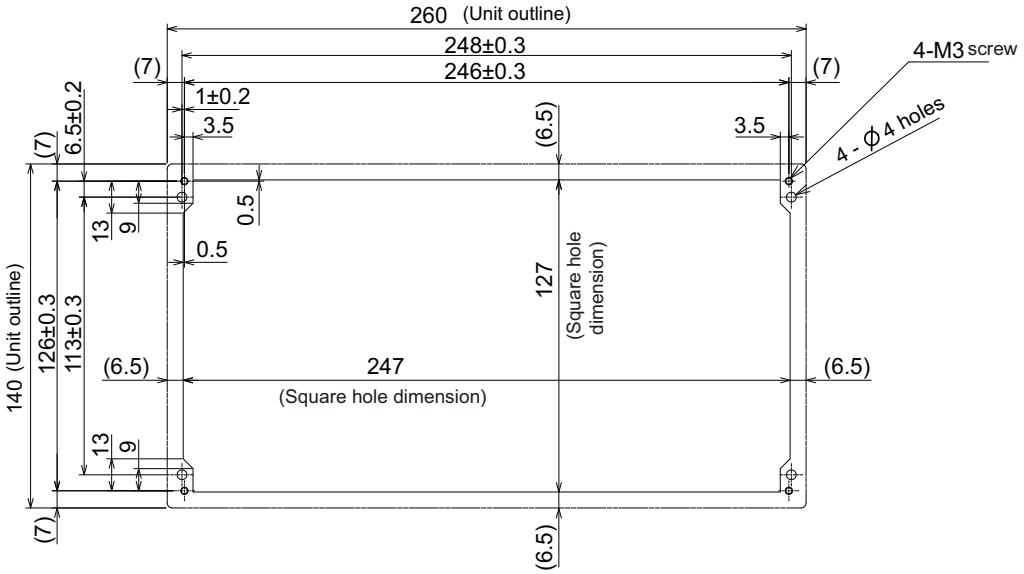
Outline dimensions: FCU8-KB926

[mm]



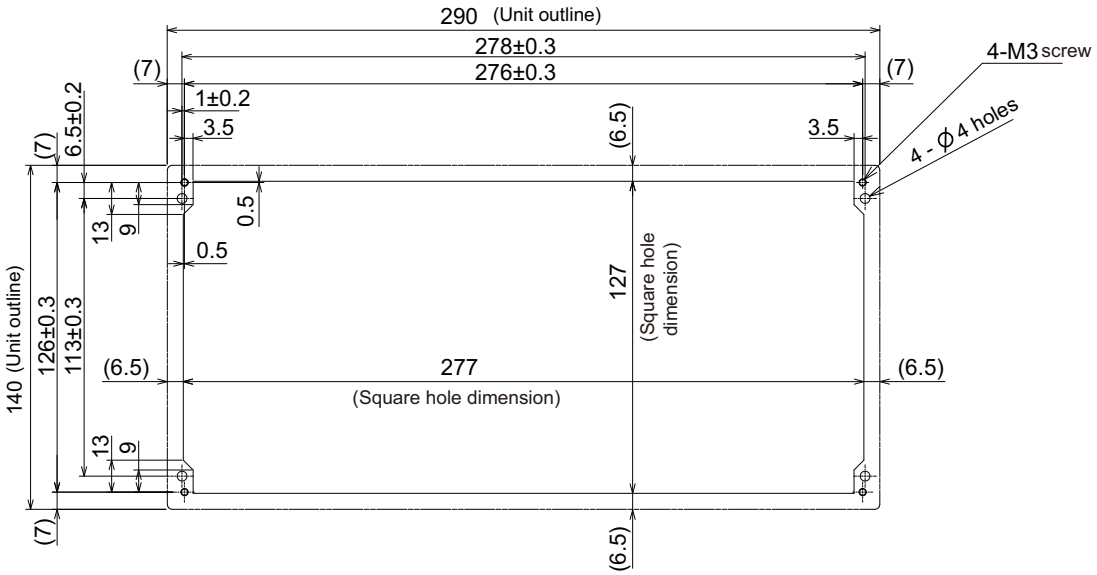
Panel cut dimensions: FCU8-KB921/FCU8-KB922/FCU8-KB925

[mm]

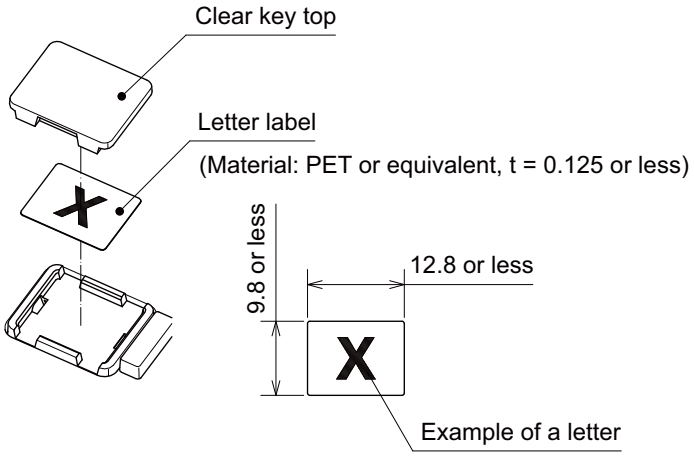


Panel cut dimensions: FCU8-KB923/FCU8-KB924/FCU8-KB926

[mm]

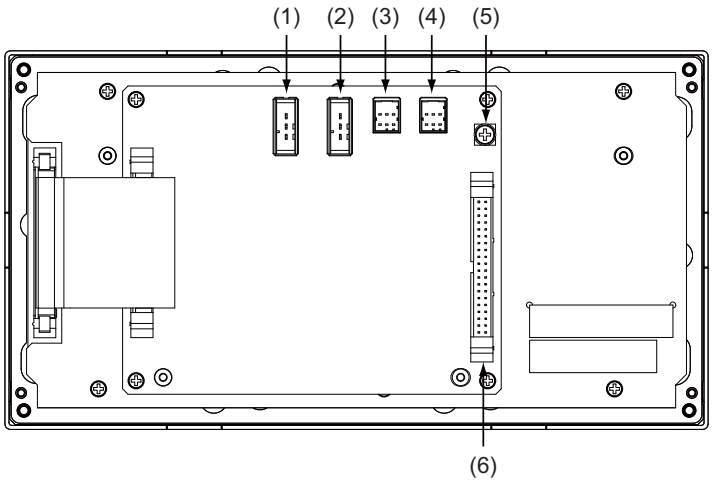


Letter label dimension: FCU8-KB922/FCU8-KB924

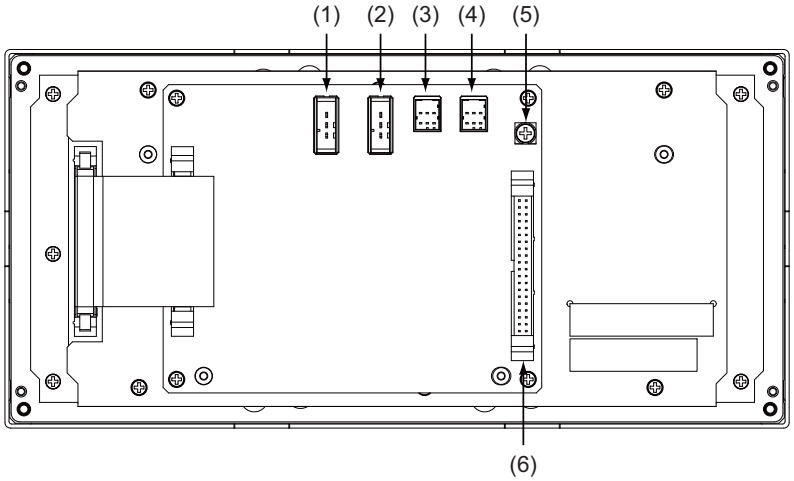


Connector

FCU8-KB921/
FCU8-KB922/
FCU8-KB925

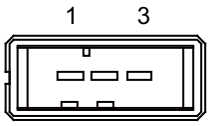


FCU8-KB923/
FCU8-KB924/
FCU8-KB926



No.	Connector name	Function		No.	Connector name	Function
(1)	DCIN	24 VDC input		(4)	RIOOUT	Remote I/O 2.0 communication (relay)
(2)	DCOUT	24 VDC output		(5)	FG	FG terminal
(3)	RIOIN	Remote I/O 2.0 communication (input)		(6)	SUBP	Sub panel connection

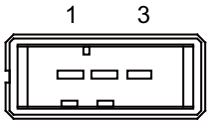
(1) DCIN (24 VDC input)



1	I	+24V
2		0 V
3		FG

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

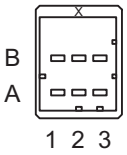
(2) DCOUT (24 VDC output)



1	O	+24V
2		0 V
3		FG

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

(3) RIOIN (Remote I/O 2.0 communication (input))
(4) RIOOUT (Remote I/O 2.0 communication (relay))
Up to 64 remote I/O stations can be connected.

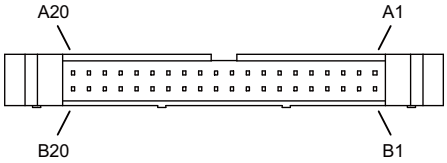


A			**B**		
1	I/O	TXRXD	**1**	I/O	TXRXD*
2		NC	**2**		0 V
3		FG	**3**		NC

<Cable side connector type>
Connector: 1-1318119-3
Contact: 1318107-1
Manufacturer: TE Connectivity

(5) FG (FG terminal)

(6) SUBP (Sub panel connection)



B20		NC	A20		NC
B19		NC	A19		NC
B18		NC	A18		NC
B17		NC	A17		NC
B16		0 V	A16	I	Spare SW(ZR5$23[5])
B15		0 V	A15	I	Spare SW(ZR5$23[4])
B14		0 V	A14	I	Spare SW(ZR5$23[3])
B13		0 V	A13	I	Memory protection (ZR5$23[2])
B12		NC	A12	I	RSW3_G(ZR5$23[1])
B11	I	RSW3_F(ZR5$22[D])	A11	I	RSW3_E(ZR5$22[F])
B10	I	RSW3_D(0 V)	A10	I	RSW3_C(ZR5$23[0])
B9	I	RSW3_B(ZR5$22[E])	A9	I	RSW3_A(ZR5$22[C])
B8		NC	A8	I	RSW2_G(ZR5$22[B])
B7	I	RSW2_F(ZR5$22[7])	A7	I	RSW2_E(ZR5$22[9])
B6	I	RSW2_D(0 V)	A6	I	RSW2_C(ZR5$22[A])
B5	I	RSW2_B(ZR5$22[8])	A5	I	RSW2_A(ZR5$22[6])
B4		NC	A4	I	RSW1_G(ZR5$22[5])
B3	I	RSW1_F(ZR5$22[1])	A3	I	RSW1_E(ZR5$22[3])
B2	I	RSW1_D(0 V)	A2	I	RSW1_C(ZR5$22[4])
B1	I	RSW1_B(ZR5$22[2])	A1	I	RSW1_A(ZR5$22[0])

RSW1: Cutting override switch
RSW2: Rapid traverse override switch
RSW3: Spare switch

Note

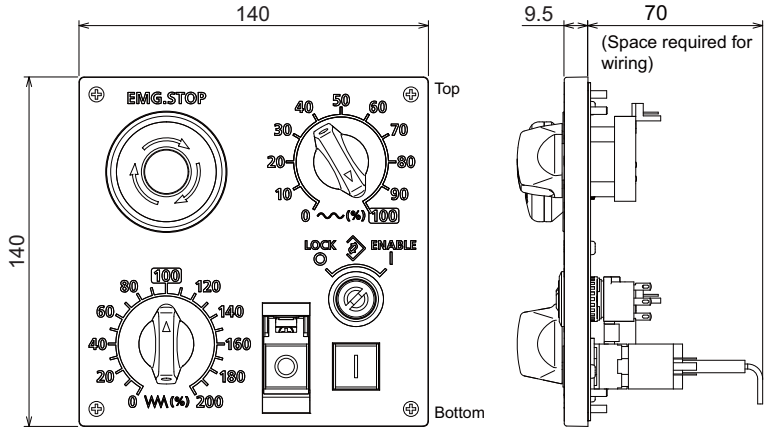
(1) "$" in the device No. varies depending on the channel No. of RIO.
(RIO1 = "0", RIO2 = "2", RIO3 = "4")

<Cable side connector type>
Connector: HIF3BA-40D-2.54C
Contact: HIF3-2428SC
Manufacturer: Hirose Electric

4.15.2 Sub Panel A (FCU8-KB931/FCU8-KB941)

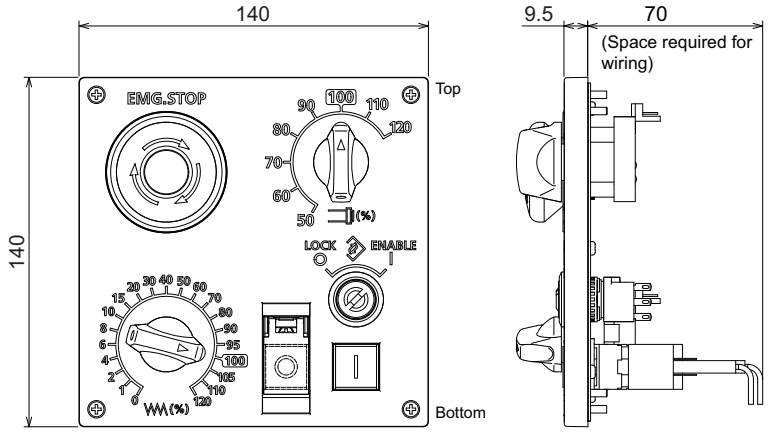
Outline dimensions: FCU8-KB931

[mm]



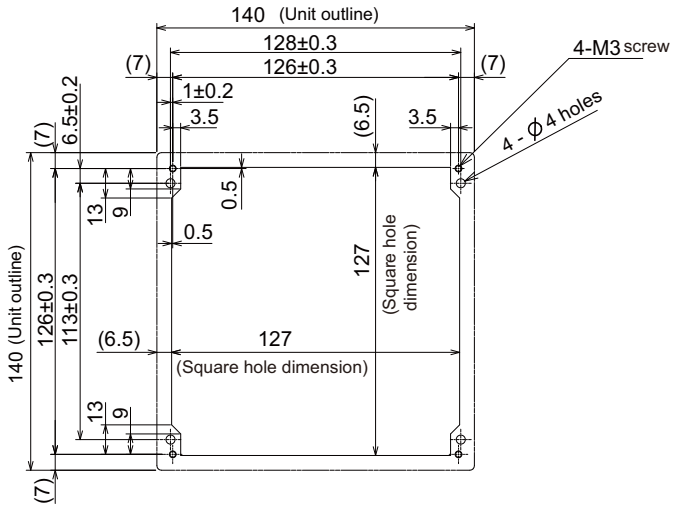
Outline dimensions: FCU8-KB941

[mm]

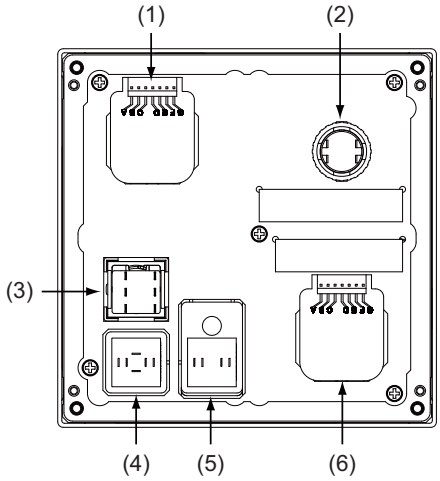


Panel cut dimensions: FCU8-KB931/FCU8-KB941

[mm]

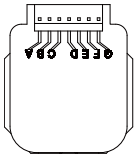


Connector



No.	Switch name		No.	Switch name
(1)	Rapid traverse override		(4)	ON switch
(2)	Emergency stop switch		(5)	OFF switch
(3)	Memory protection switch		(6)	Cutting override

(1) Rapid traverse override



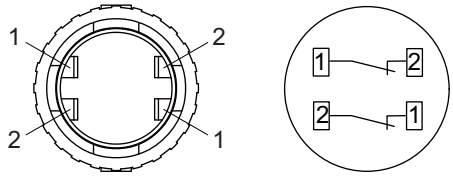
A	O	Output signal a
B	O	Output signal c
C	O	Output signal e
D	-	Common terminal
E	O	Output signal d
F	O	Output signal b
G	O	Parity check signal

<Switch type>
Switch: AC09-GY0/10L3B02
Manufacturer: Fuji Electric
Connection: Connector

<Switch side connector type>
Connector: IL-7P-S3EN2
Manufacturer: Japan Aviation Electronics

<Cable side connector type>
Connector: IL-7S-S3L-(N)
Contact: IL-C2-10000
Manufacturer: Japan Aviation Electronics

(2) Emergency stop switch

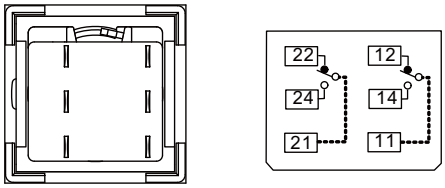


A	O	Contact 1 (B contact)
B	O	Contact 2 (B contact)

<Switch type>
Switch: XA1E-BV4U02TR
Manufacturer: IDEC
Connection: Terminal

<Cable side connector type>
Connector: Faston terminal #110
Manufacturer: -

(3) Memory protection switch



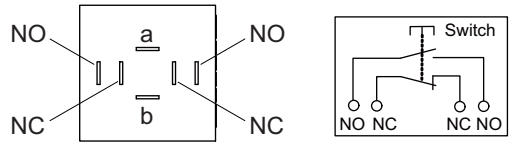
Contact 2 Contact 1

22	O	Contact 2 (B contact)	**12**	O	Contact 1 (B contact)
24	O	Contact 2 (A contact)	**14**	O	Contact 1 (A contact)
21	-	Contact 2 (Common)	**11**	-	Contact 1 (Common)

<Switch type>
Switch :LB6K-2ST2B
Manufacturer: IDEC
Connection: Terminal

<Cable side connector type>
Connector: Faston terminal #110
Manufacturer: -

(4) ON switch



a	I	Lamp terminal (+)
b	O	Lamp terminal (-)
NO	O	Contact 1 (A contact)
NC	O	Contact 2 (B contact)

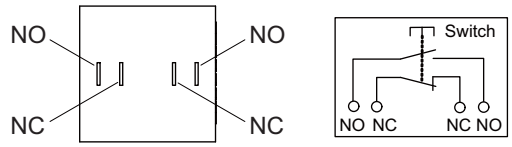
Note

- Connect LGCON terminal and ON terminal of G170 cable to NO terminal of ON switch.

<Switch type>
Switch: AH165-SLW11X3/0063
Manufacturer: IDEC
Connection: Terminal

<Cable side connector type>
Connector: Faston terminal #110
Manufacturer: -

(5) OFF switch



NO	O	Contact 1 (A contact)
NC	O	Contact 2 (B contact)

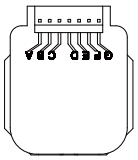
Note

- Contact LGCOFF terminal and OFF terminal of G170 cable to NO terminal of OFF switch.

<Switch type>
Switch: AH165-SLB11X3/0063
Manufacturer: IDEC
Connection: Terminal

<Cable side connector type>
Connector: Faston terminal #110
Manufacturer: -

(6) Cutting override



A	O	Output signal a
B	O	Output signal c
C	O	Output signal e
D	-	Common terminal
E	O	Output signal d
F	O	Output signal b
G	O	Parity check signal

<Switch type>
Switch: AC09-GY0/20L3B02
Manufacturer: Fuji Electric
Connection: Connector

<Switch side connector type>
Connector: IL-7P-S3EN2
Manufacturer: Japan Aviation Electronics

<Cable side connector type>
Connector: IL-7S-S3L-(N)
Contact: IL-C2-10000
Manufacturer: Japan Aviation Electronics

4.16 Handy Terminal

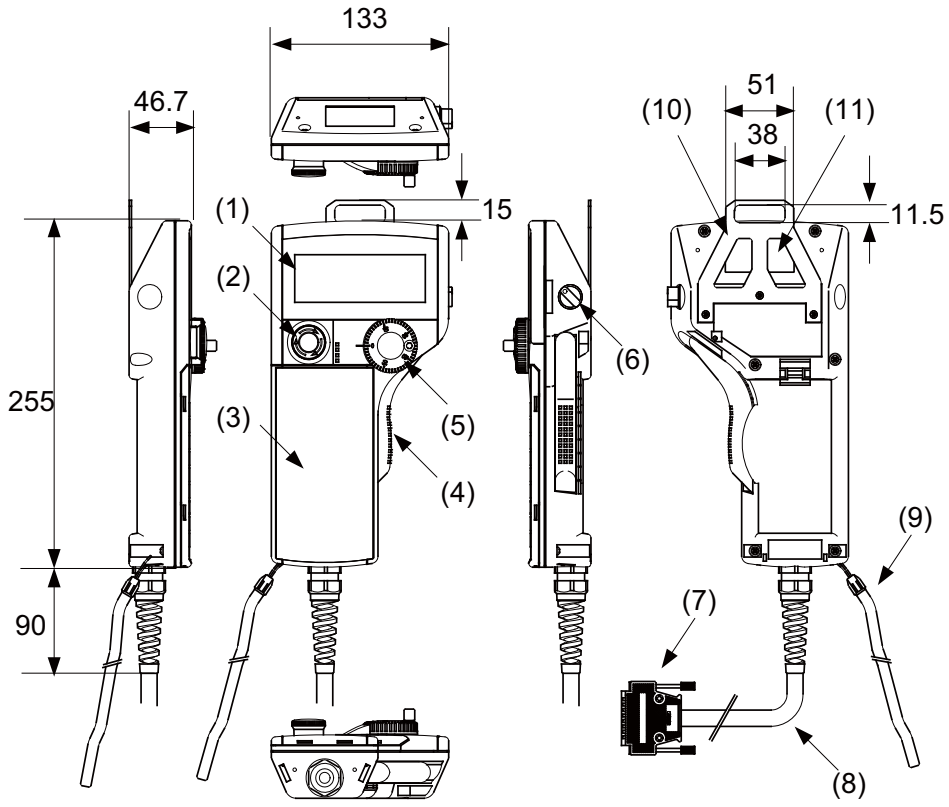
Item	Unit name		Handy terminal
	Type		HG1T-SB12UH-MK1346-L5
General specifications	Ambient temperature	During operation	0 to 40 °C
		During storage	-20 °C to 60 °C
	Ambient humidity		Long term: 10 to 75% RH (with no dew condensation)
			Short term: 10 to 95% RH (with no dew condensation) (*1)
	Vibration resistance	During operation	9.8 m/s^2 [1.0 G] or less, 10 to 55 Hz
	Shock resistance	During storage	98 m/s^2 [10.0 G] or less
	Working atmosphere		No corrosive gases, dust or oil mist
Power specifications	Power supply voltage		24 VDC ±5% Ripple noise 240 mV (P-P)
	Current consumption	(max.)	0.2A
	Instantaneous stop tolerance time		24 VDC : 4 ms or less
Others	Heating value		4 W (max.)
	Mass		0.6 kg

(*1) "Short term" means within one month.

Note

(1) The unit is an IP65F equivalent.

Dimension and names of parts



No.	Name	Function/Specification		No.	Name	Function/Specification
(1)	LCD	Monochrome display with backlight 192 (W) × 64 (H) dots		(7)	HOST	Host interface connector (DDK: 17JE-23250-02(D8A6))
(2)	SW1	Emergency stop switch Contact rating/Contact: 24 VDC, 1A Contact configuration: 2b contacts (IDEC Corporation: HA1E-V2S2VR)		(8)	-	Host interface cable (5 m)
(3)	-	Membrane switch (*1)		(9)	-	Simplified hand strap (IDEC Corporation: HG9Z-PS1)
(4)	SW2	Enable switch Contact rating/Contact: 24 VDC , 50 mA Contact configuration: 3-position contact × 2 (OFF-ON-OFF) (IDEC Corporation: HE3B-M2)		(10)	-	Panel mounting bracket (IDEC Corporation: HG9Z-TK1)
(5)	SW4	Manual Pulse Generator Output: Open collector 4.7 kΩ pull-up resistor is connected. (TOKYO SOKUTEIKIZAI CO., LTD: RE19PH50C16RR)		(11)	-	Serial number plate
(6)	SW6	Selector switch				

(*1) Do not press multiple switches simultaneously: When three or more switches are pressed simultaneously, unpressed switches are also detected as pressed ones.

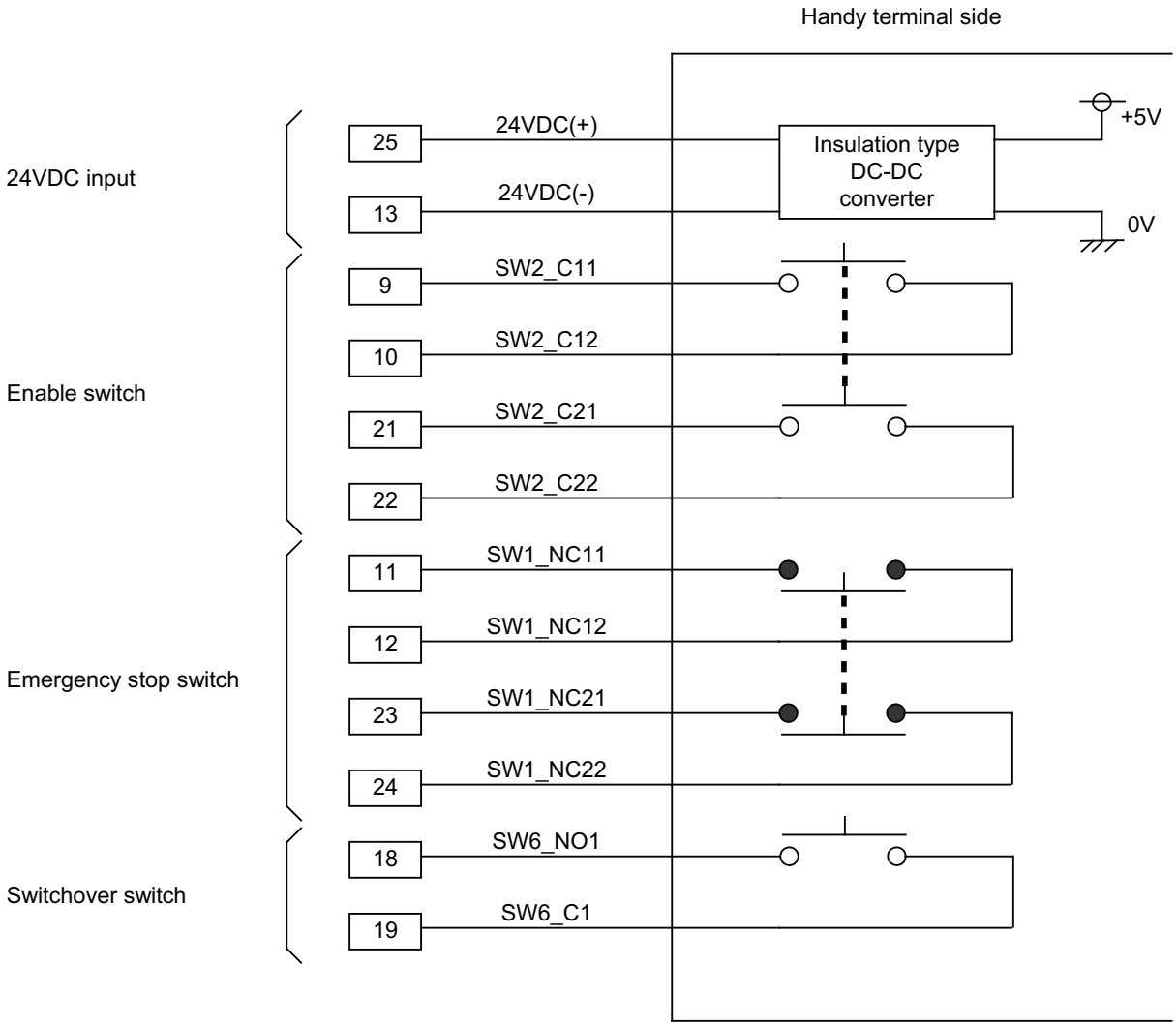
[Signal explanation]

HOST terminal No.	HOST connector signal name	Input/Output	Function/Name
1	FG	-	Frame ground
2	Reserved	-	Reserved
3	Reserved	-	Reserved
4	Reserved	-	Reserved
5	Reserved	-	Reserved
6	0 V	-	Ground
7	RS(RTS)	O	RS-232C communication signal (Request To Send)
8	CS(CTS)	I	RS-232C communication signal (Clear To Send)
9	SW2_C11	-	Enable switch contact 1 terminal 1
10	SW2_C12	-	Enable switch contact 1 terminal 2
11	SW1_NC11	-	Emergency stop switch contact 1 terminal 1
12	SW1_NC12	-	Emergency stop switch contact 1 terminal 2
13	24 VDC (-)	I	24 VDC ground
14	SD(TXD)	O	RS-232C communication signal (Send Data)
15	RD(RXD)	I	RS-232C communication signal (Receive Data)
16	HA	O	Manual pulse generator A phase signal
17	HB	O	Manual pulse generator B phase signal
18	SW6_NO1	-	Switchover switch terminal 1
19	SW6_C1	-	Switchover switch terminal 2
20	0 V	-	Ground
21	SW2_C21	-	Enable switch contact 2 terminal 1
22	SW2_C22	-	Enable switch contact 2 terminal 2
23	SW1_NC21	-	Emergency stop switch contact 2 terminal 1
24	SW1_NC22	-	Emergency stop switch contact 2 terminal 2
25	24 VDC (+)	I	24 VDC input

Note

(1) The input/output goes to/from the handy terminal.

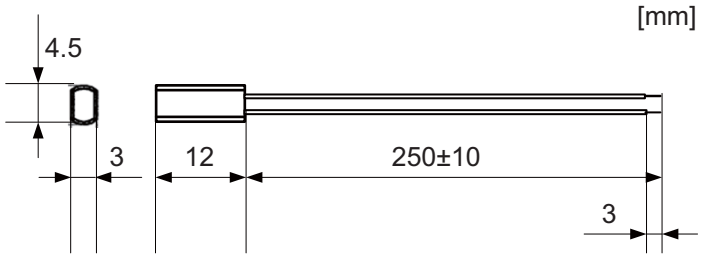
[Terminal connections]



4.17 Thermistor

4.17.1 Thermistor(PT3C-51F-M2)

Outline dimensions



Made by SHIBAURA ELECTRONICS Co., Ltd.

Ambient temperature	-10 to + 190 °C
Insulation resistance	100 MΩ or more at 500 VDC [between case and lead wire]

4.18 Exclusive SD Cards

Item		FCU8-SD001G	FCU8-SD004G
Capacity		1 GB	4 GB
NAND Flash		SLC (*1)	
Ambient temperature	During operation	-25 °C to +85 °C	
	During storage	-40 °C to +85 °C	
Ambient humidity	During operation	5% to 95%RH (with no dew condensation)	
	During storage	5% to 95%RH (with no dew condensation)	

(*1) SLC stands for Single Level Cell, and it stores one bit data in each memory cell.
This provides longer life span and high product reliability in comparison with MLC (Multi Level Cell) and TLC (Triple Level Cell), which are commonly applied to SD cards.

Note

(1) Do not touch the terminal part with fingers, etc. when handling the SD cards.
The contamination of the terminal part of SD card causes a contact failure or a trouble.

4.19 Specifications and Precautions of USB/SD/LAN/Wireless LAN/HDMI Interface

4.19.1 USB Interface (Memory I/F card)

Standards	USB2.0
Data transfer speed (*1)	High Speed (480 Mbps) Full Speed (12 Mbps) Low Speed (1.5 Mbps)
Power supply to USB device	Supply voltage: 5 V ±5% Supply current: Max. 500 mA/port
Number of free ports	Front × 1
Maximum cable length	5 m

(*1) Data transfer speed is the theoretical value on the standard, and the actual speed will be inferior to the value listed above. The transfer speed may be restrained depending on the specification of the connected device.

Note

(1) Do not connect the devices other than the USB memory.

■ Precautions for insertion/removal of USB memory

When inserting/removing a USB memory, turn the Mitsubishi Electric device's power OFF. Do not pull out the USB memory or turn OFF the power during access to the USB memory. Failure to observe this could cause the memory contents to be erased.
When inserting/removing a USB memory, be sure to have enough interval to perform that (about 10 seconds or more).
In case of emergency, always perform backups by having your important data duplicate, etc. as Mitsubishi Electric will not guarantee the broken or lost data.

■ Precaution for operation with front-side USB memory

A USB memory to be used has to be supported USB2.0 Hi-Speed (480 Mbps).
When connecting the USB memory, connect it directly without using the extension cable or USB hub.
Machine vibration may cause the USB memory to fall out depending on environment. Therefore, the operation with the front-side USB memory is required to be performed on your own responsibility.

■ Static electricity

Static electricity may cause malfunction of USB memory. Before using the USB memory, make sure to touch a conductive material such as a grounded metal object to discharge static electricity accumulated in human body, etc.

4.19.2 USB Interface (Image Input Expansion Unit)

Standards	USB2.0
Data transfer speed (*1)	High Speed (480 Mbps) Full Speed (12 Mbps) Low Speed (1.5 Mbps)
Number of free ports	Image input expansion unit x 1

(*1) Data transfer speed is the theoretical value on the standard, and the actual speed will be inferior to the value listed above. The transfer speed may be restrained depending on the specification of the connected device.

Note

(1) Do not connect any cables or devices other than USB Type A cable.

■ Precautions for insertion/removal of USB cable

When inserting/removing a USB cable, turn the Mitsubishi Electric device's power OFF. If the cable is inserted/removed while the power is ON, an overvoltage is applied to the IC mounted inside the Mitsubishi Electric device, which may cause a failure.

4.19.3 SD Interface (Memory I/F card)

Standards	SD/SDHC (*1)
Transfer speed	According to the connecting SD card
Maximum capacity	32 GB
Number of free ports	Front × 1, Rear × 1

(*1) SDXC is not supported.

■ Precautions for use of commercially available SD card

Mitsubishi Electric will not provide performance guarantee and maintenance for commercially available SD card, mini SD card or micro SD card (requires converting adapter). When any of them is to be used, careful performance check must be required by the machine tool builder.
Commercially available devices may not be compatible with Mitsubishi Electric units or suitable FA environment for temperature- or noise-wise.

■ Precautions for insertion/removal of SD card

When inserting/removing an SD card, turn the Mitsubishi Electric device's power OFF. Do not pull out the card or turn OFF the power during access to the SD 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 duplicate, etc. as Mitsubishi Electric will not guarantee the broken or lost data.

■ Static electricity

Static electricity may cause malfunction of SD card. Before using the SD card, make sure to touch a conductive material such as a grounded metal object to discharge static electricity accumulated in human body, etc.

4.19.4 LAN Interface (Control Unit)

Standards	100BASE-TX/10BASE-T
Data transfer speed(*1)	100 Mbps/10 Mbps
Number of free ports	Control unit × 2

(*1) Data transfer speed is the theoretical value on the standard, and the actual speed will be inferior to the value listed above. The transfer speed may be restrained depending on the specification of the connected device.

Note

(1) When half-duplex communication is made, the response time may become long depending on the connected device. Use full-duplex communication to connect with the opposite device via a switching HUB.

■ Precautions for selection of LAN cable

Make sure to select the LAN cables which are "category 5e or above" and "shielded". Cable wire material with double shielded, which is appropriate for FA environment, is recommended.

4.19.5 Wireless LAN Interface (Control Unit)

Compatible standards		IEEE802.11b/IEEE802.11g/IEEE802.11a/IEEE802.11n
Data transfer speed (*1)		11 Mbps/54 Mbps/54 Mbps/150 Mbps
Communication frequency band		2.4/5 GHz band
Operation mode		Infrastructure mode (AP/STA) (*2)
Supported channel (*3)	**AP mode**	1-13 ch, 36-48 ch (W52), 149-165 ch (W58)
	STA mode	Automatically track the connected AP.
Maximum connectable number in AP mode		5 pieces
Security		WPA-PSK WPA2-PSK
Number of antennas		1 (built-in chip antenna)

(*1) Data transfer speed is the theoretical value on the standard, and the actual speed will be inferior to the value listed above. The transfer speed may be restrained depending on the specification of the connected device.

(*2) "AP" is the access point or the parent device, and "STA" is the station or the child device.

(*3) The supported channel depends on the setting of the country/region code. Refer to "41 Appendix 4: Country/Region Code Setting (for Wireless LAN Function)" for the setting of the country/region code.

■ Name of this function

This product has not received Wi-Fi certification. Use terms such as "wireless LAN", "WLAN", etc.

4.19.6 HDMI Interface (Image Input Expansion Unit)

Standards	HDMI Type A High Speed
Input resolution	Full HD (*1) HD SXGA XGA VGA
Number of free ports	Image input expansion unit x 1

(*1) The maximum available input resolution of the image signals is Full HD, but the resolution of the display units for Mitsubishi Electric is 19-type (SXGA), 15-type (VGA) and 10.4-type (VGA).

Note

(1) Do not connect any cables or devices other than HDMI Type A cable.

■ Precautions for insertion/removal of HDMI cable

When inserting/removing an HDMI cable, turn the Mitsubishi Electric device's power OFF. If the cable is inserted/removed while the power is ON, an overvoltage is applied to the IC mounted inside the Mitsubishi Electric device, which may cause a failure.

5

Installation

5.1 Heat Radiation Countermeasures

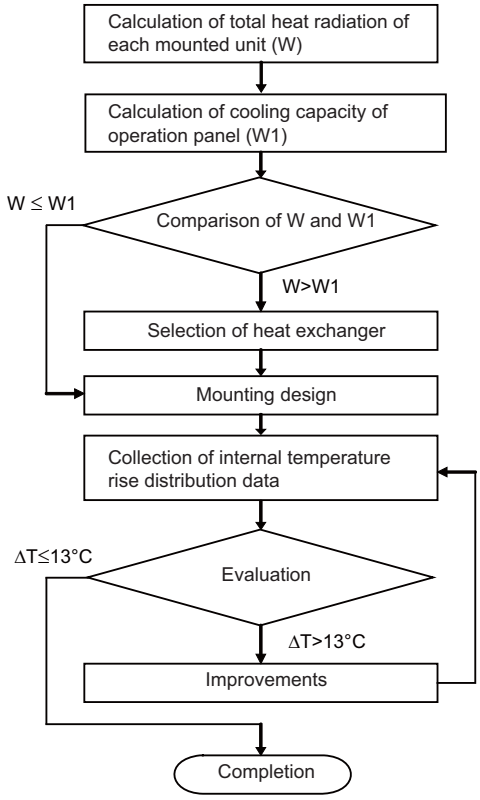
Please refer to the following method for heat radiation countermeasures.

Example of heat radiation countermeasures

■ Hypothetical conditions

- Average internal temperature of operation panel: T ≤ 58 °C
- Peripheral temperature of operation panel: Ta ≤ 0 °C to 45 °C
- Internal temperature rise value: ΔT = T - Ta (max) = 13 °C

[Procedures for heat design and verification]



[Supporting description]

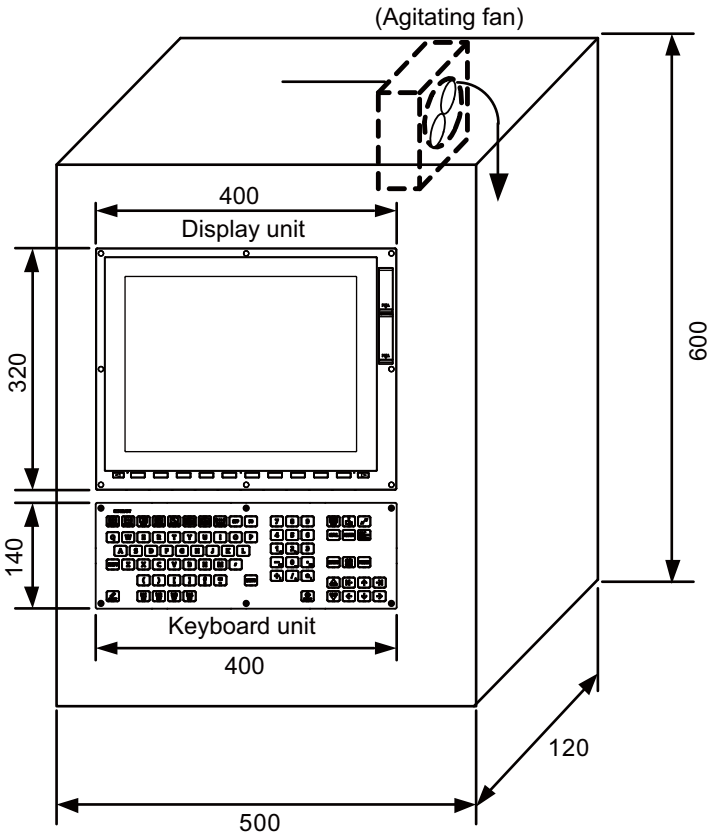
- Refer to "4 General Specifications" for the heat generated by each unit.
- Enclosed cabinet (thin steel plate) cooling capacity calculation equation
  W1 = U × A × ΔT
  U : 6 W/m^2 °C
  A: Effective heat radiation area (m^2) (Area where heat can be radiated from operation panel
  ΔT: Internal temperature rise value (13 °C)

Note

(1) 8 W/m^2 °C can be applied only when the operation panel is so small that the internal temperature stays uniform.

- 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
- Criterion for internal temperature rise distribution data
  ΔT (average) ≤ 13 °C
  ΔTmax (maximum value) ≤ 15 °C
  R (inconsistent ΔTmax - ΔTmin) ≤ 6 °C
  (Checking for hot spots)

The following shows an example of calculation applied to heat radiation countermeasures for the operation panel when 15-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

[Calculation of unit heating value (In the case of FCU8-DU182-32 + FCU8-MU521 + FCU8-KB083 + FCU8-DX750)]

<Heating value (W)>

Total heating value of units (W):

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

Total heating value (W) by machine input (DI) :

5.5 W (= 24 V (total heating value when the 48 points are simultaneously turned ON) × 4.8 mA × 48)

24 V (current consumption per point of the operation panel I/O unit DI) divided by 5 kΩ ≈ 4.8 mA

Total heating value W = 36.5W (31 + 5.5)

[Calculation of operation panel cooling capacity]

<Tolerance value for temperature rise (Δt)>

- Panel internal temperature (according to each unit's specification) T ≤ 58 °C
- Panel peripheral temperature (according to machine's specification) Ta ≤ 45 °C

Tolerance value for internal temperature rise ΔT = 13 °C (T - Ta)

<Heat radiation area (A)>

The surface of the molded unit, which has lower radiation capacity than the metal 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

$$= 0.62\ mm^2\ (\fallingdotseq \underset{(1)}{(0.5 \times 0.12)} + \underset{(2)}{(0.6 \times 0.5 \times 2)} + \underset{(3)}{(0.12 \times 0.6 \times 2)} - \underset{(4)}{((0.32 \times 0.4) + (0.14 \times 0.4))})$$

(1) Top surface
(2) Front/rear surfaces
(3) Side surfaces
(4) Unit surfaces

<Operation panel cooling capacity (W1)>

Calculate the cooling capacity to keep the temperature rise in the operation panel less than 13 °C.

Cooling capacity W1 = 48.4 W (6 × A × ΔT)

[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.

[Confirmation with actual machine]

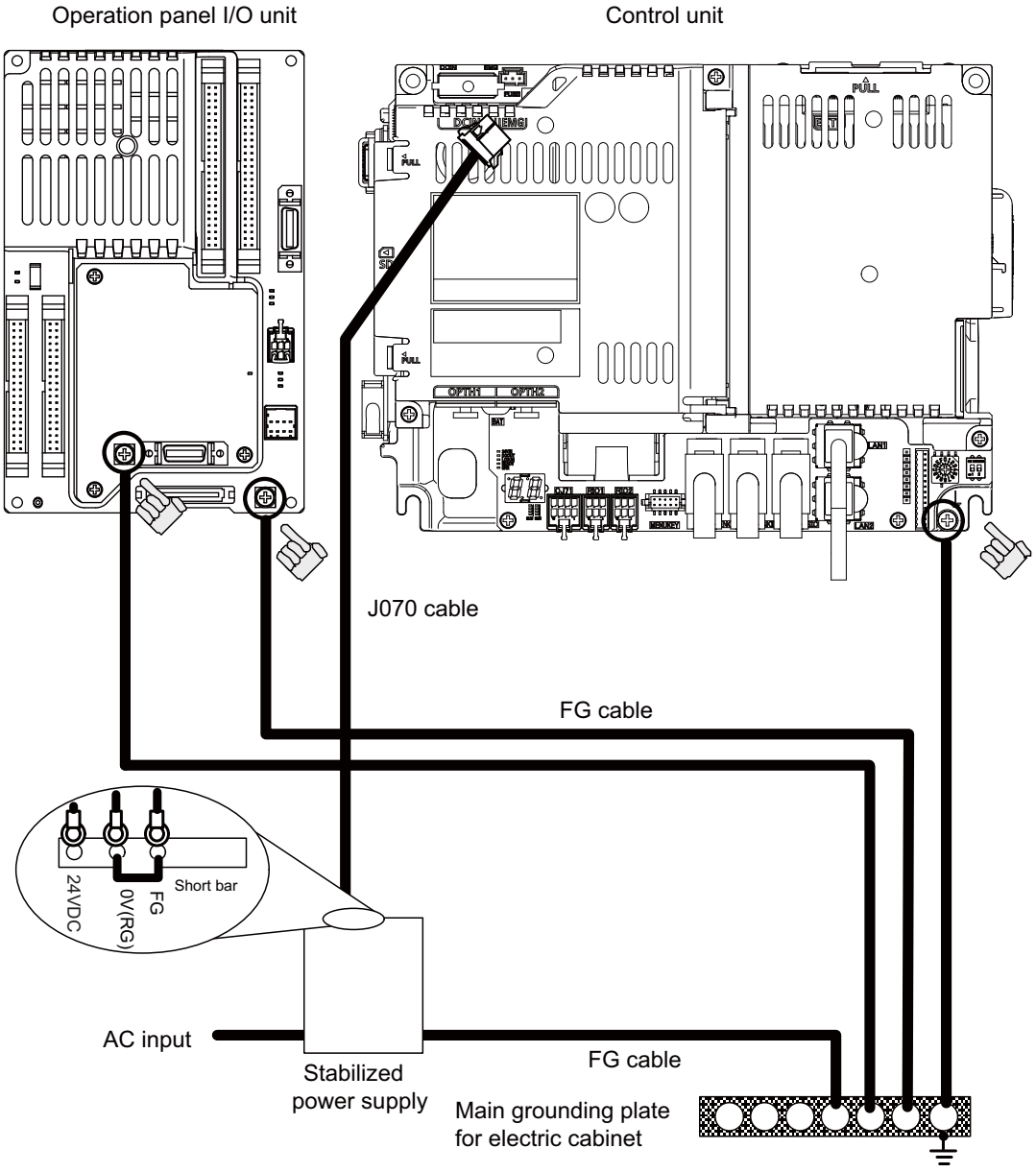
The result of the calculation above is only a rough indication. The actual temperature rise may differ according to the structure of the operation panel.

The actual unit heating value may differ depending on the user's machine specifications or operating environment. Be sure to confirm the temperature rise value in the operation panel when the actual machine is running.

5.2 Noise Countermeasures

5.2.1 Connection of Frame Ground (FG)

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.
(Be sure to ground the ground terminal of the control unit otherwise the influence is exerted on the usability of the touchscreen.)



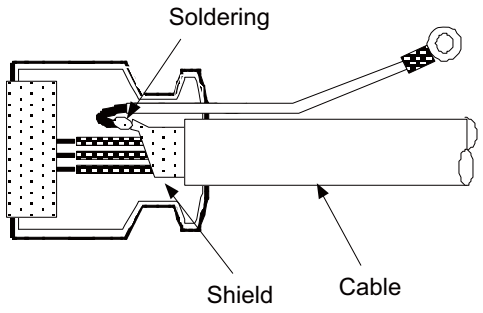
Note

(1) "24VDC" represents (+) side of 24V stabilized power supply, while "0V(RG)" represents (-) side.
"FG" (Frame Ground) corresponds to the functional earth.

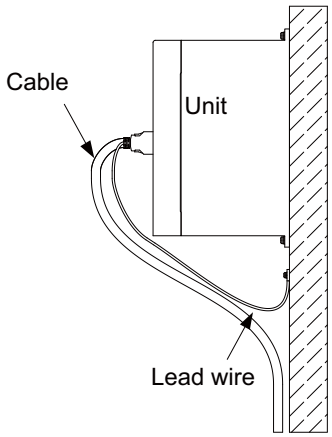
5.2.2 Shield Clamping of Cables

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

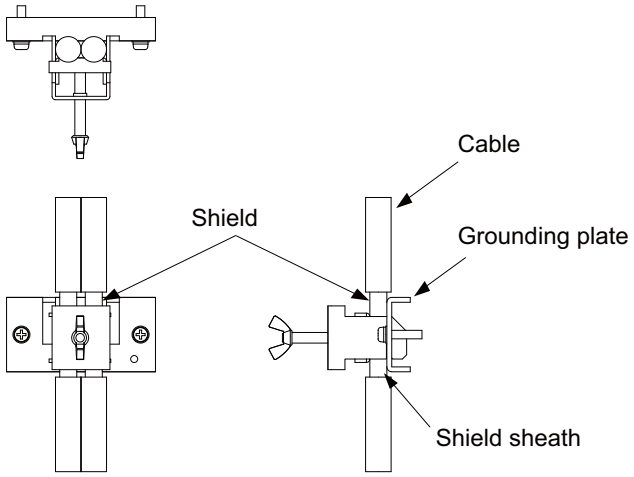
■ Example of connection with lead wire

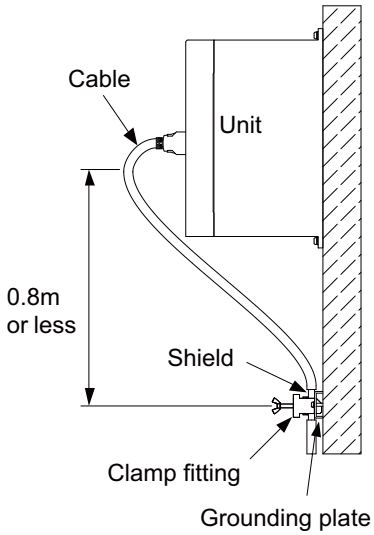


Example of lead wire treatment



■ Example of connection with clamp fitting

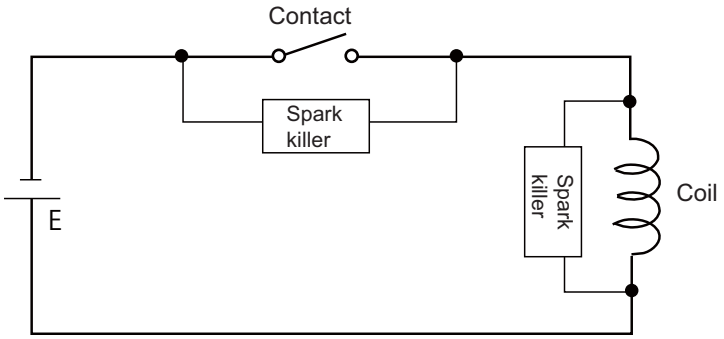




- Peel part of the cable sheath and expose the shield as shown in the drawing. Press the exposed part against the grounding plate with the cable clamp fittings.
- If the cables are thin, several can be bundled and clamped together.
- Use adequate force when tightening the cable so that the wire material is not damaged.
- Connect each grounding plate together and ground them at one point.

5.2.3 Connecting Spark Killers

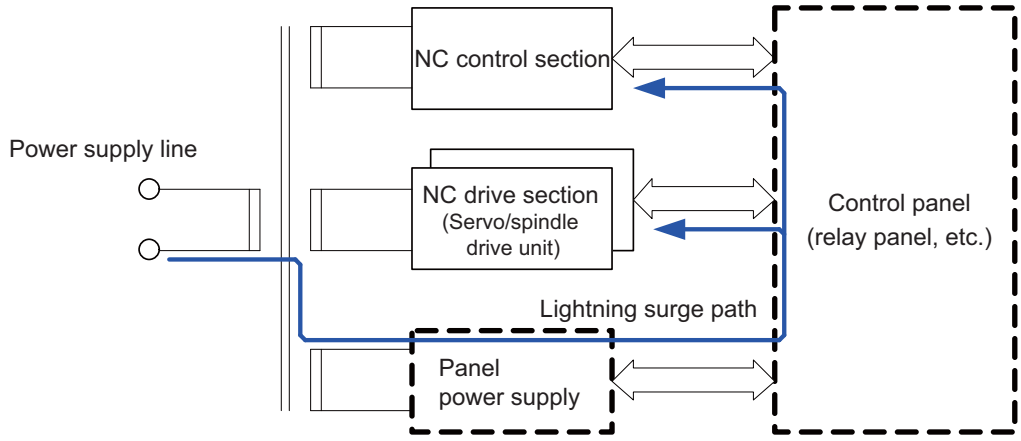
The noise which is generated during the operation of the coil or contact needs to be eliminated.
Connect the spark killers (CR composite element) in the parallel with the coil and the contact for the countermeasure.
The spark killer is effective in eliminating the noise generated by electromagnetic induction.



Spark killer	C : 0.033 to 0.1μF R : 10 to 120Ω

5.2.4 Lightning Surge Protection Countermeasure

Generally, the lightning surge intrudes into the control power supply of device from the power supply line, and the surge may damage the control power supply and the internal circuit.
For protection from the lightning surge, Mitsubishi Electric CNC unit has the surge absorber for the control power supply of the CNC control section and the CNC drive section.
However, when there is a device which is not applied with the countermeasure as illustrated below, the lightning surge may intrude through the signal line of the device which is not applied with the countermeasure and may damage the NC device.

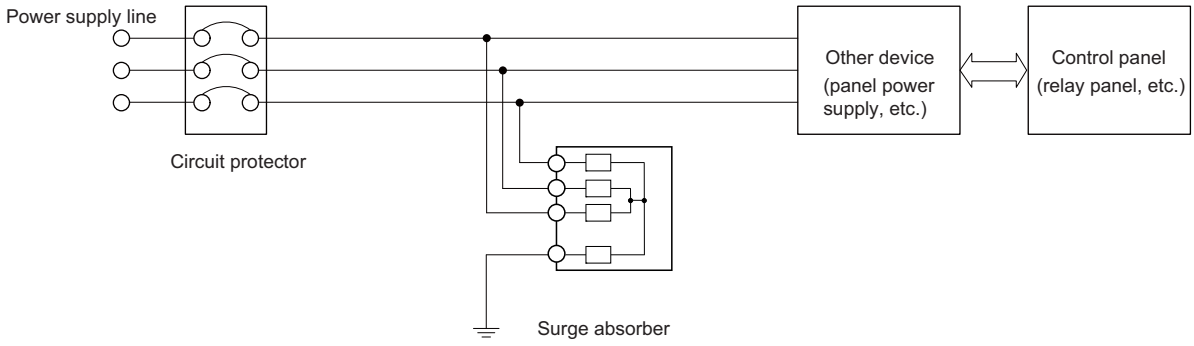


Path of damage caused by lightning surge

■ Protection method

Add the surge absorber to the power supply lines as illustrated below for the power supply device, etc., which are separately prepared.
The following two items are needed to protect the whole from surge.

- Surge absorber installation
- Circuit protector installation



Lightning surge countermeasure for three-phase power supply line

■ Product example of surge absorber

Surge absorber for OKAYA ELECTRIC INDUSTRIES

Type	Rated voltage (50/60 Hz)	DC breakdown voltage	Voltage protection level	Normal discharge current	Max. discharge current	Surge current life
RSPD-250-U4	250 VAC (Three phase)	700 V ±25%	1.3 kV	8/20 μs 2.5 kA	8/20 μs 5 kA	Approx. 300 times 8/20 μs -1 kA

Note

(1) Refer to "42.6.3 Surge Absorber" for outline dimensions, etc.
Refer to the manufacturer catalog for detailed characteristics, outline and connection methods of the surge absorber.

5.3 Unit Installation

5.3.1 Display Unit

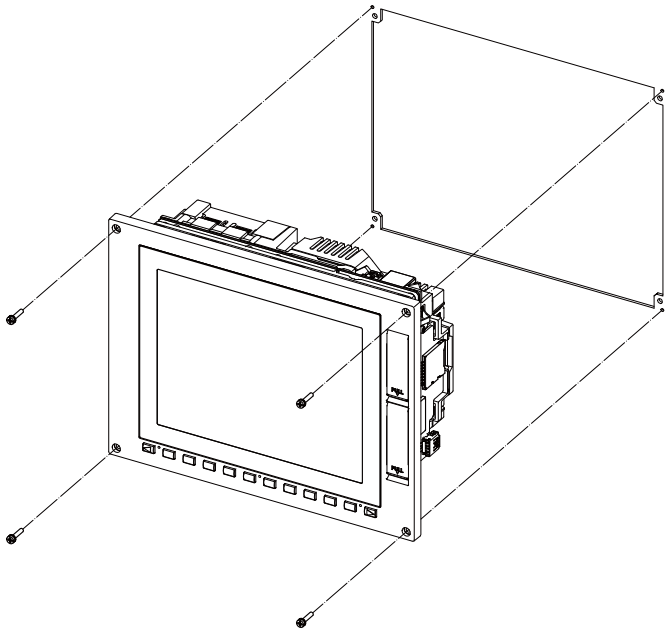
Mount the display unit with the prescribed number of fixing screws.

Note

(1) Refer to "General Specifications: Display Unit" for the panel cut dimension drawing and the screw hole position.

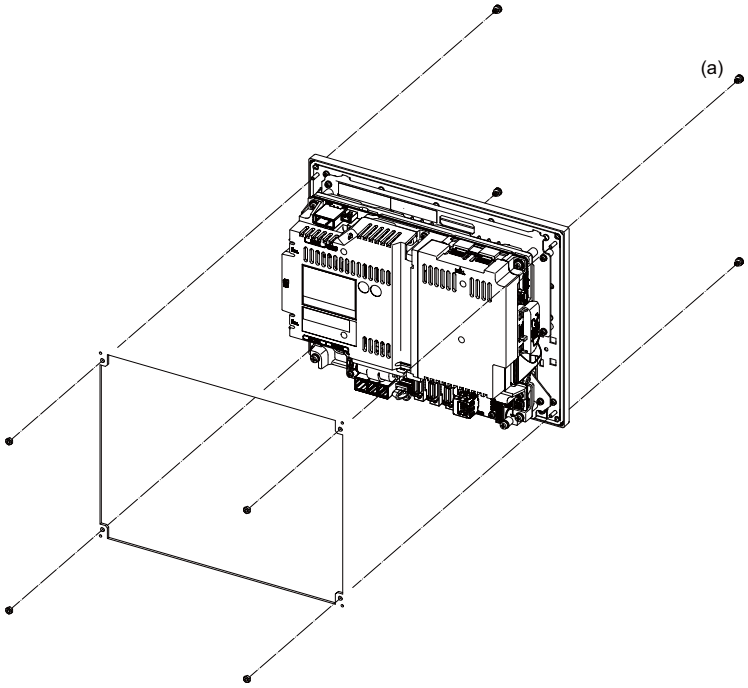
FCU8-DU122 (8.4-type display unit)

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

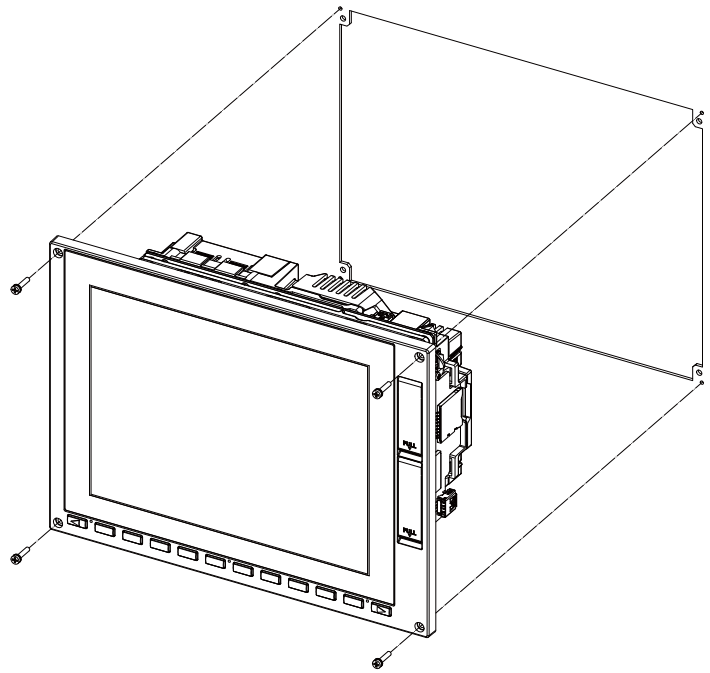
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 pieces of screw caps (a) are provided with the unit.)

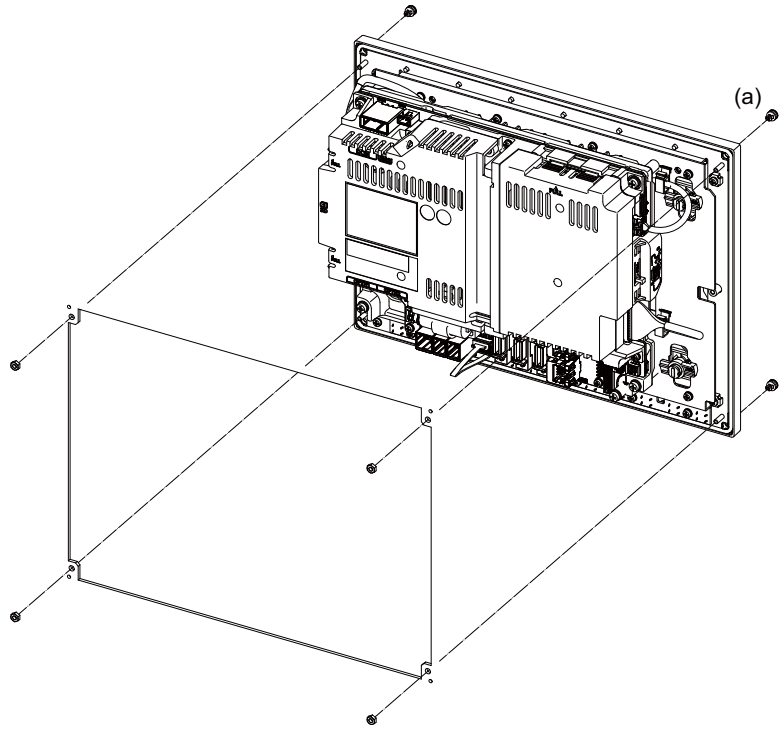
FCU8-DU142 (10.4-type display unit)

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

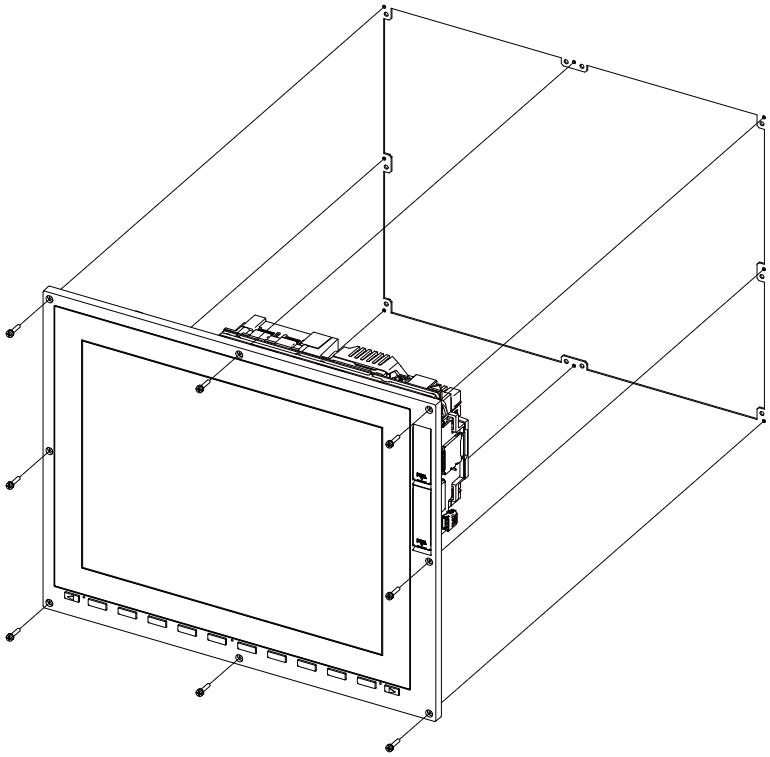
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 pieces of screw caps (a) are provided with the unit.)

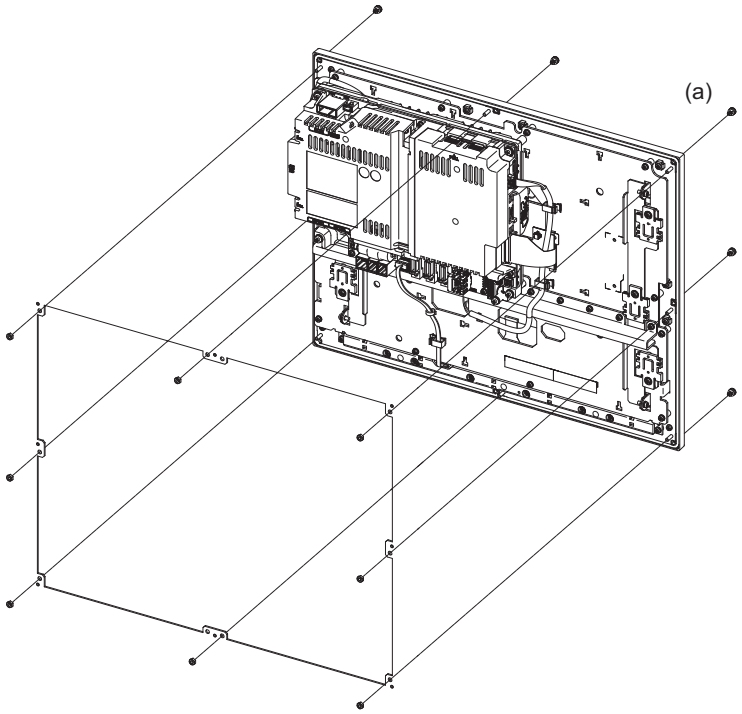
FCU8-DU182 (15-type display unit)

[Front mounting]



Fixing screw: Cheese head screw M3 (8 pieces)
(Fixing screws are provided with the unit.)

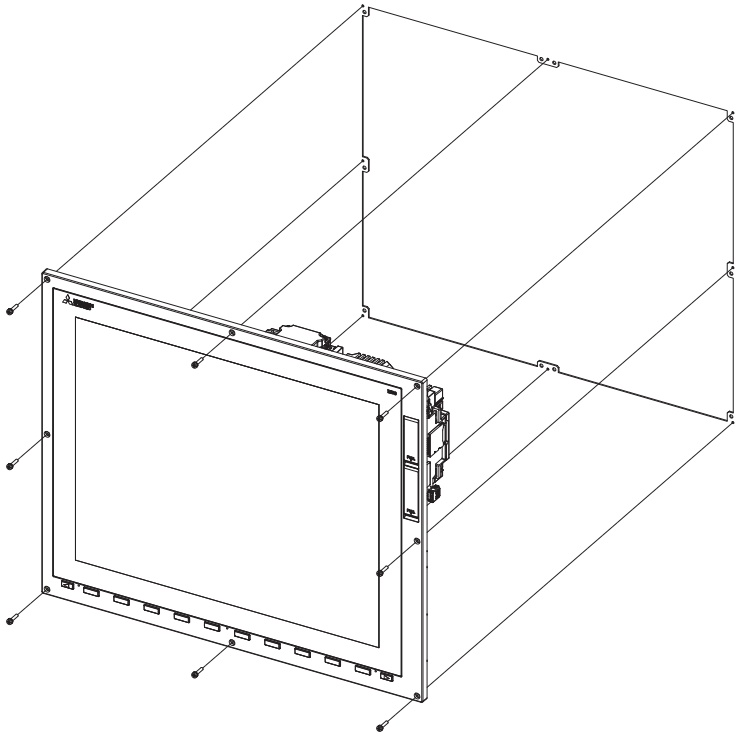
[Rear mounting]



Fixture: M3 nut (8 pieces)
(8 screw caps (a) provided with the unit.)

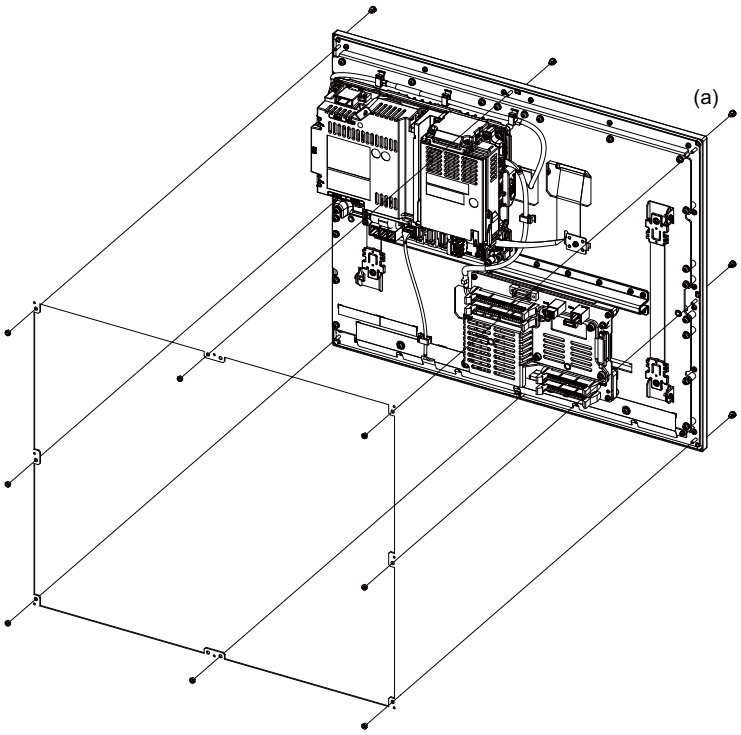
FCU8-DU194 (19-type display unit)

[Front mounting]



Fixing screw: Cheese head screw M3 (8 pieces)
(Fixing screws are provided with the unit.)

[Rear mounting]



Fixture: M3 nut (8 pieces)
(8 screw caps (a) provided with the unit.)

Image input expansion unit (FCU8-EX752) and option relay unit (for 2 slots (FCU8-EX705))

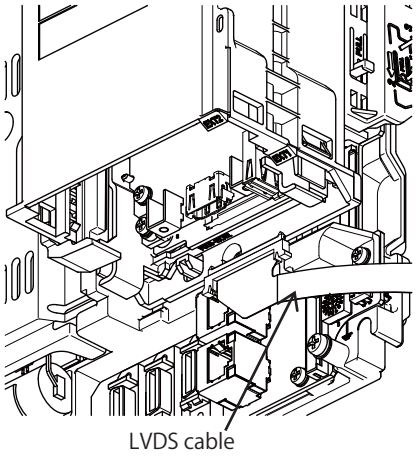
The 19-type display unit is delivered with an image input expansion unit mounted on the control unit.
For the units other than 19-type display unit, the image input expansion unit must be mounted by the machine tool builder.

Note

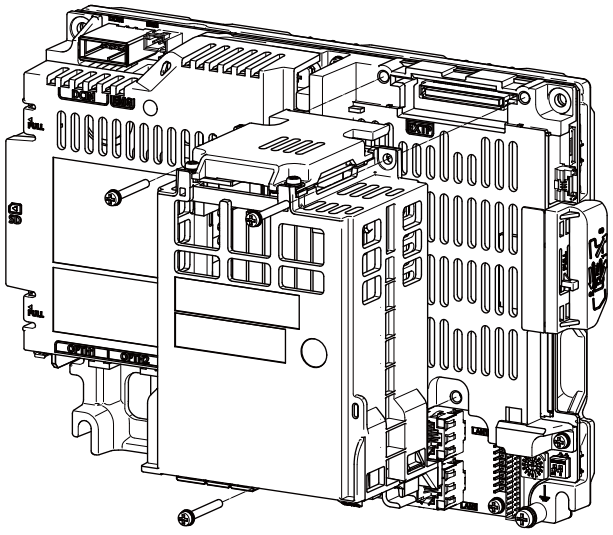
(1) For option relay unit for 2 slots (FCU8-EX705), mount the image input expansion unit on EXT1.
(2) When the image input expansion unit (FCU8-EX752) and the LVDS cable is connected/disconnected, make sure to turn the power OFF.

Method for inserting the function expansion unit into EXT2 of FCU8-EX705 (for 2 slots)

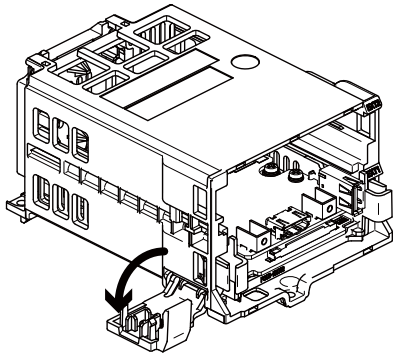
(1) Disconnect the LVDS cable connected to the FCU8-EX752.



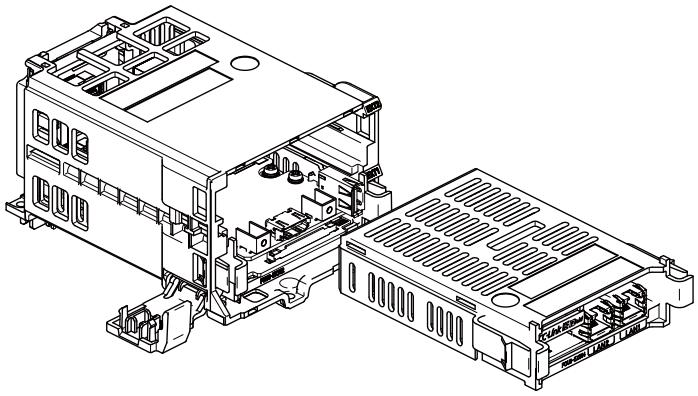
(2) Remove the three M3 × 25 screws.



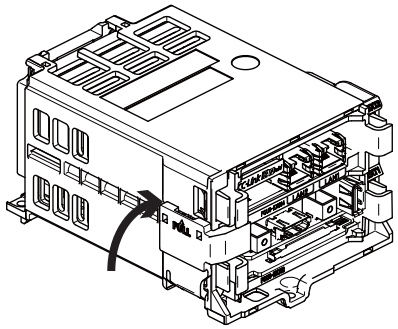
(3) Remove the cover of FCU8-EX705.



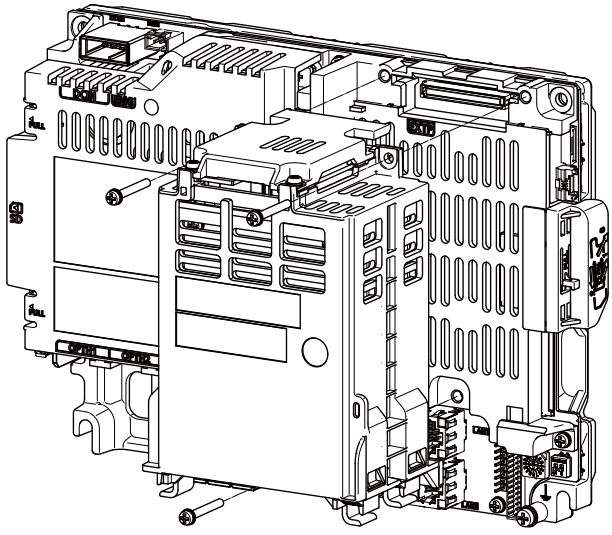
(4) Insert the function expansion unit into EXT2.



(5) Close the cover of FCU8-EX705.



(6) Fix FCU8-EX705 to the control unit with three M3 x 25 screws.



(7) Connect the LVDS cable to FCU8-EX752.

5.3.2 Keyboard Unit

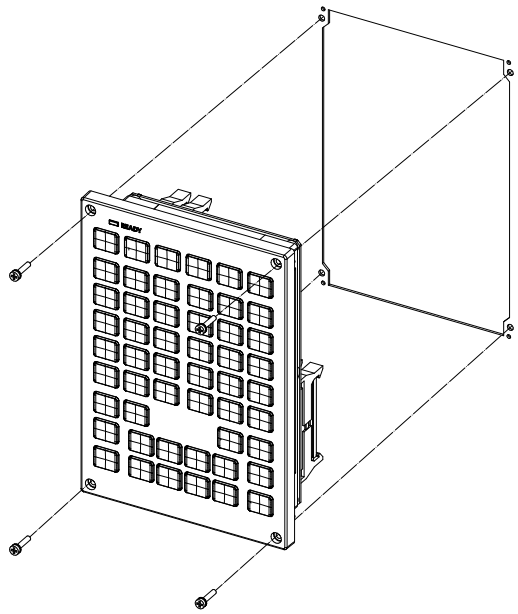
Mount the keyboard unit with the prescribed number of fixing screws.

Note

(1) Refer to "4.7 Keyboard Unit" for the panel cut dimension drawing and screw hole positions.

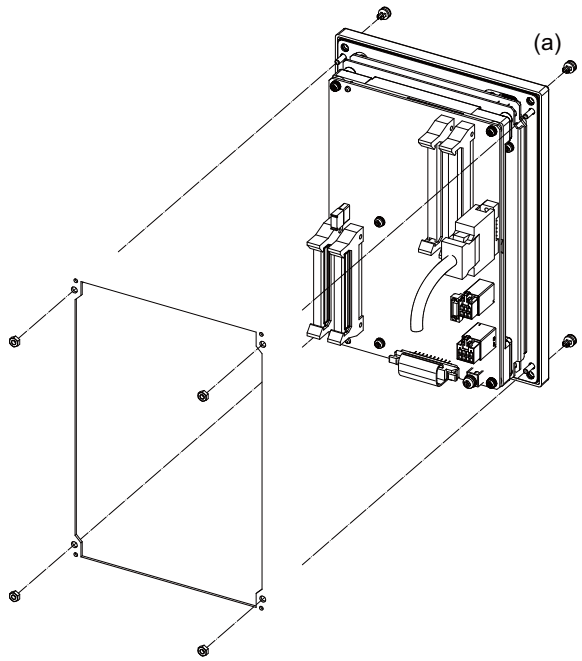
FCU8-KB026/KB028

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

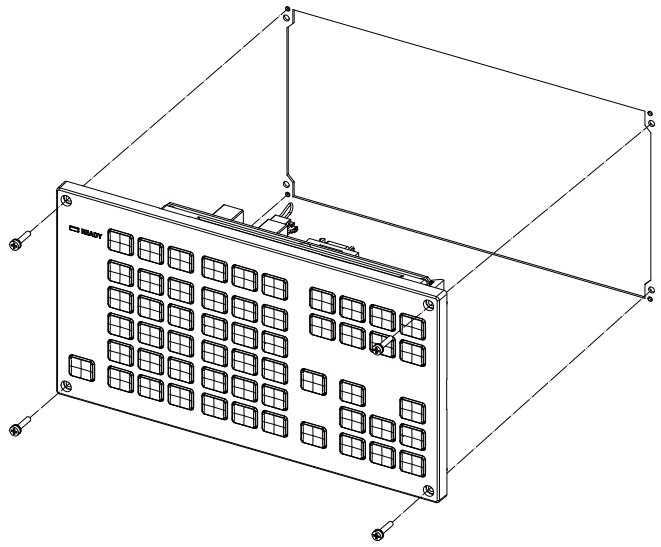
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 screw caps (a) provided with the unit.)

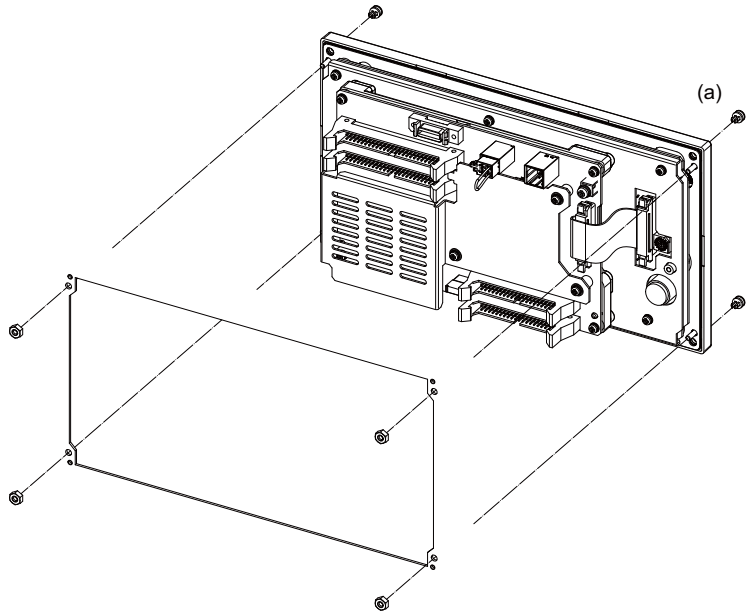
FCU8-KB029

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

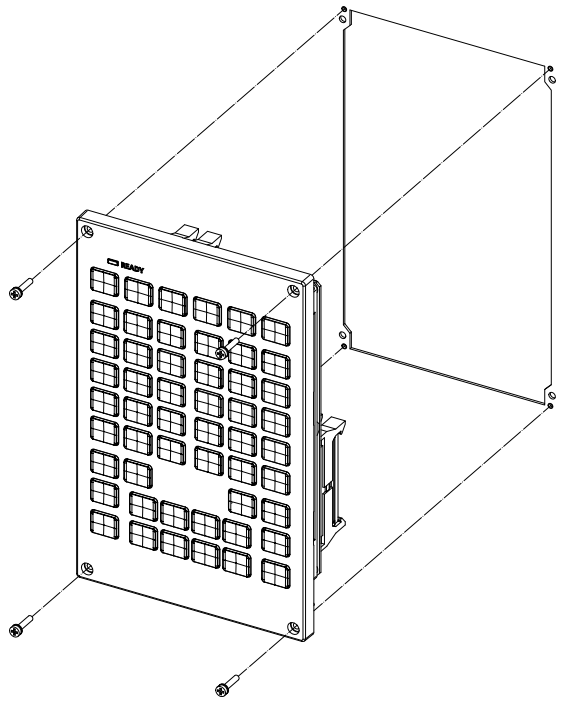
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 screw caps (a) provided with the unit.)

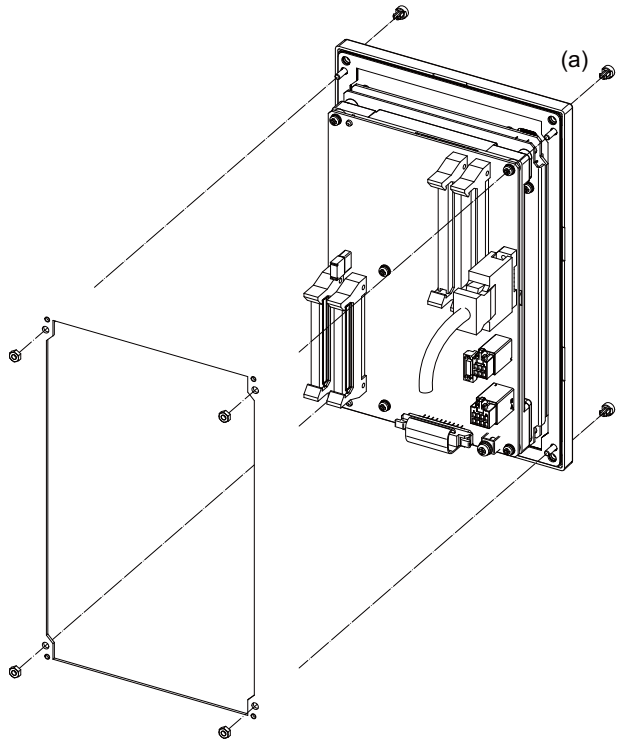
FCU8-KB041/KB046

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

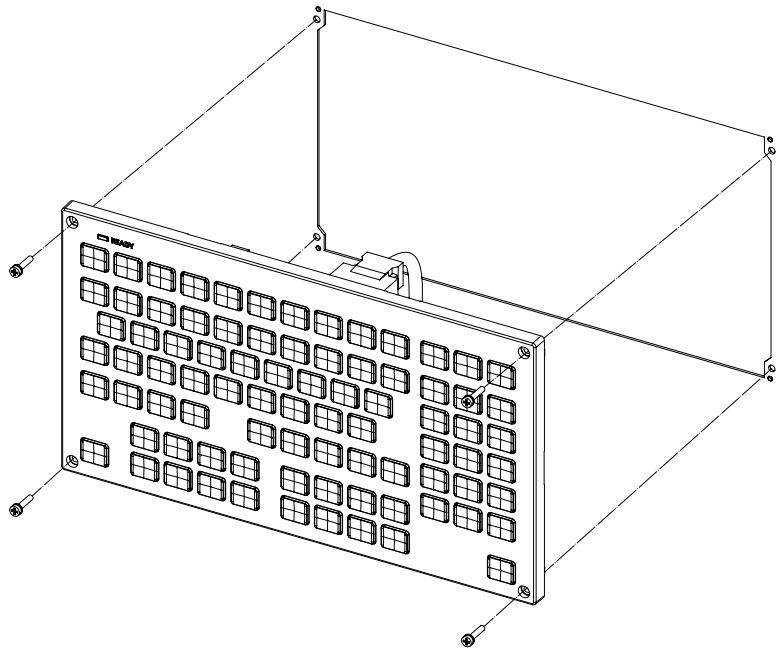
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 screw caps (a) provided with the unit.)

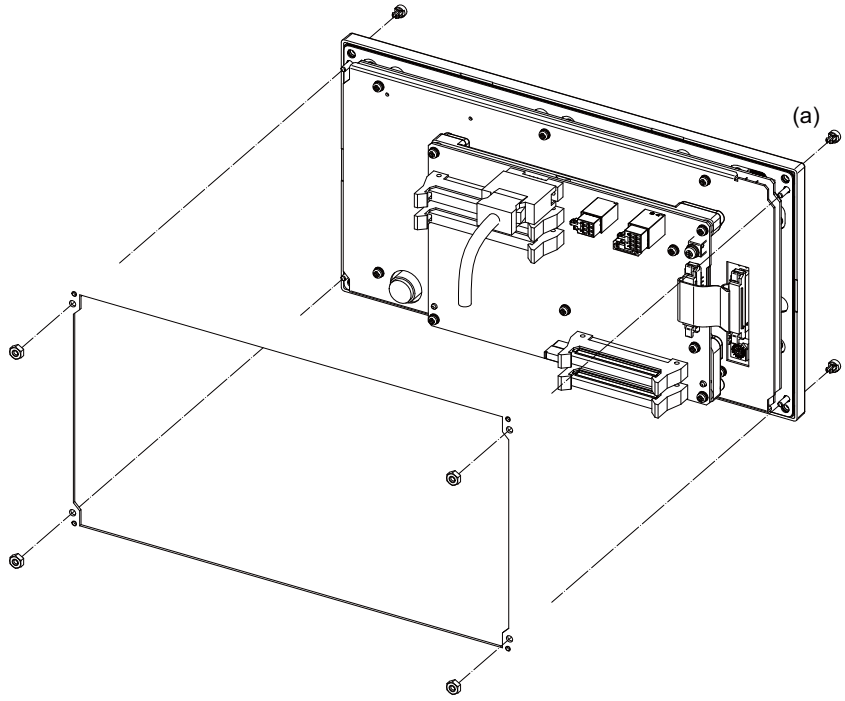
FCU8-KB047

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

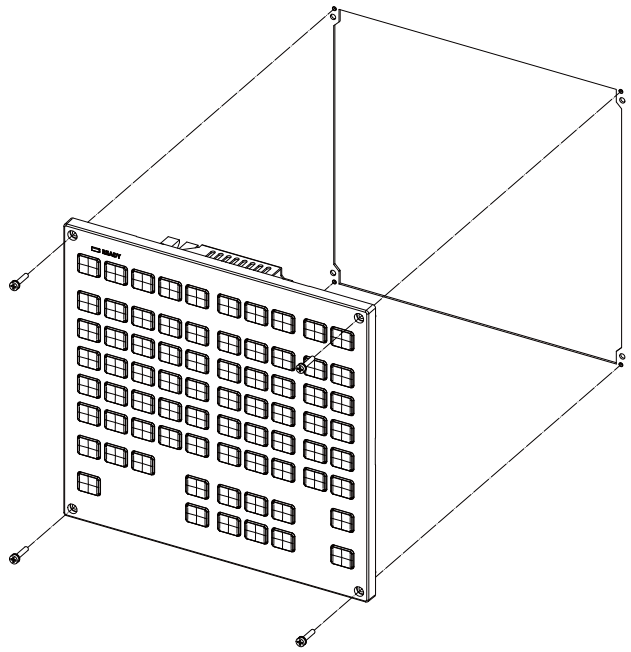
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 screw caps (a) provided with the unit.)

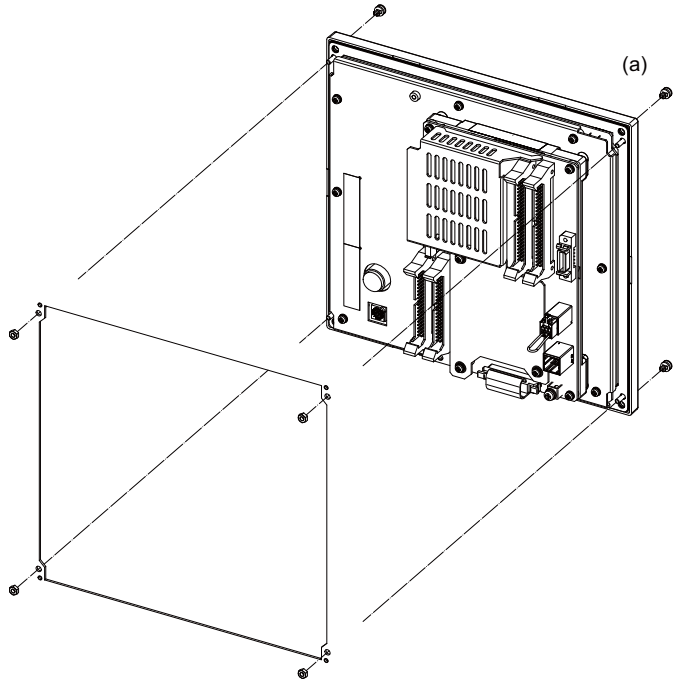
FCU8-KB048

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

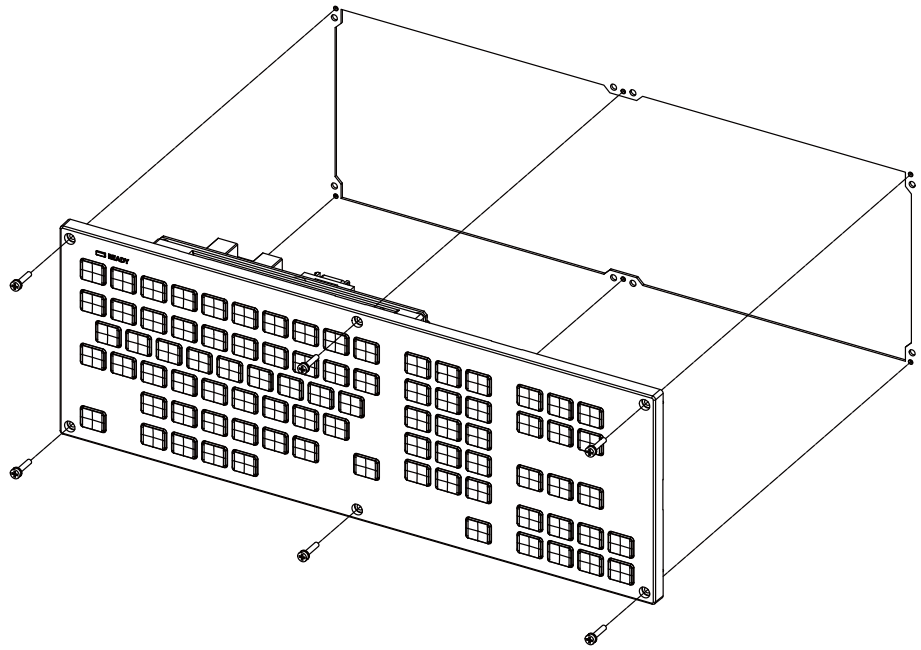
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 screw caps (a) provided with the unit.)

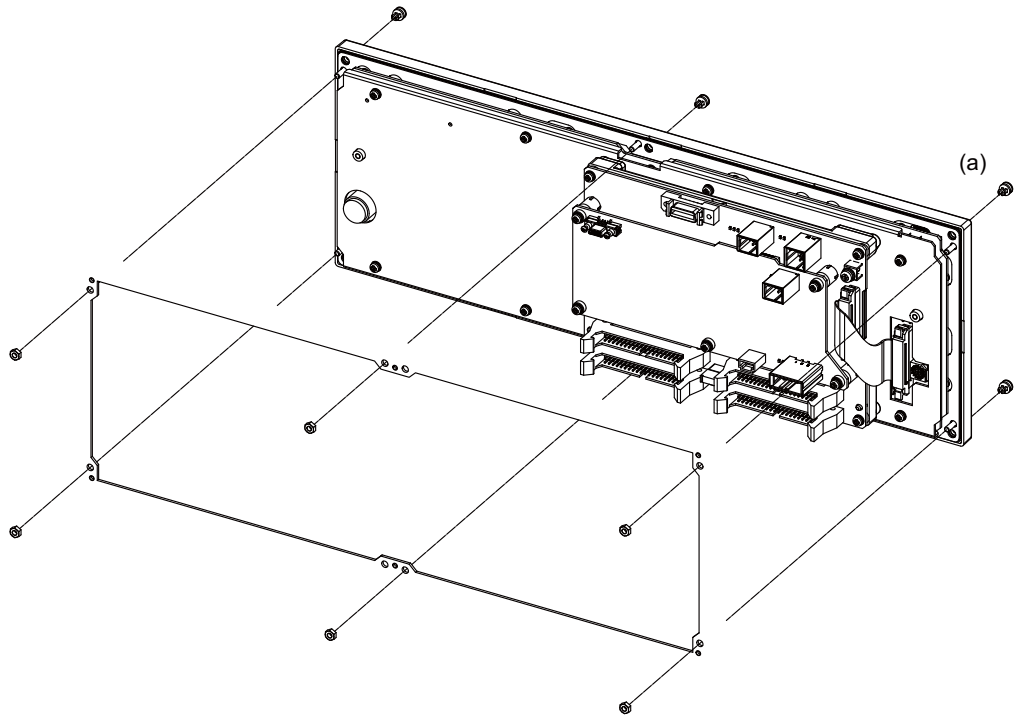
FCU8-KB083

[Front mounting]



Fixing screw: Cheese head screw M3 (6 pieces)
(Fixing screws are provided with the unit.)

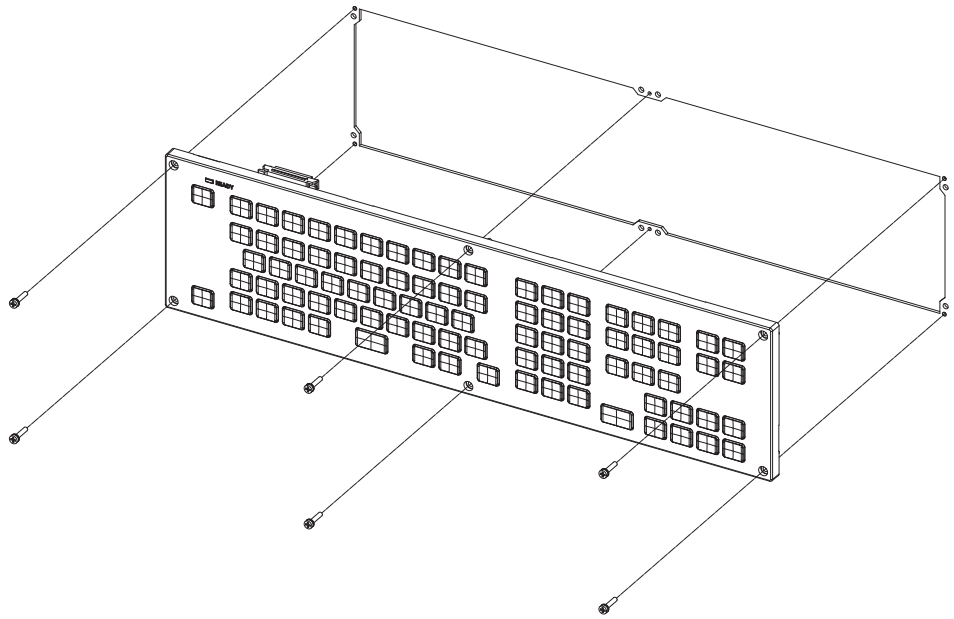
[Rear mounting]



Fixture: M3 nut (6 pieces)
(6 screw caps (a) provided with the unit.)

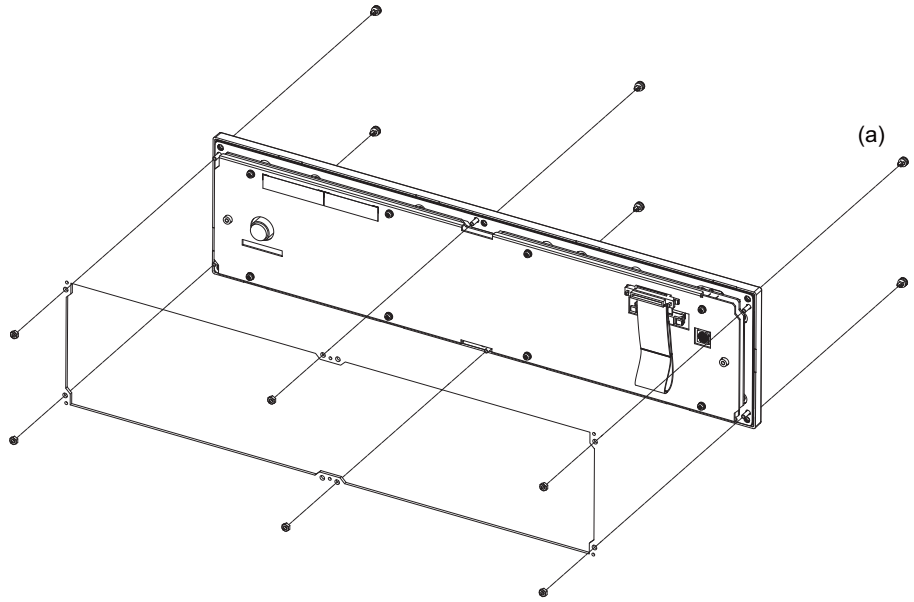
FCU8-KB091

[Front mounting]



Fixing screw: Cheese head screw M3 (6 pieces)
(Fixing screws are provided with the unit.)

[Rear mounting]



Fixture: M3 nut (6 pieces)
(6 screw caps (a) provided with the unit.)

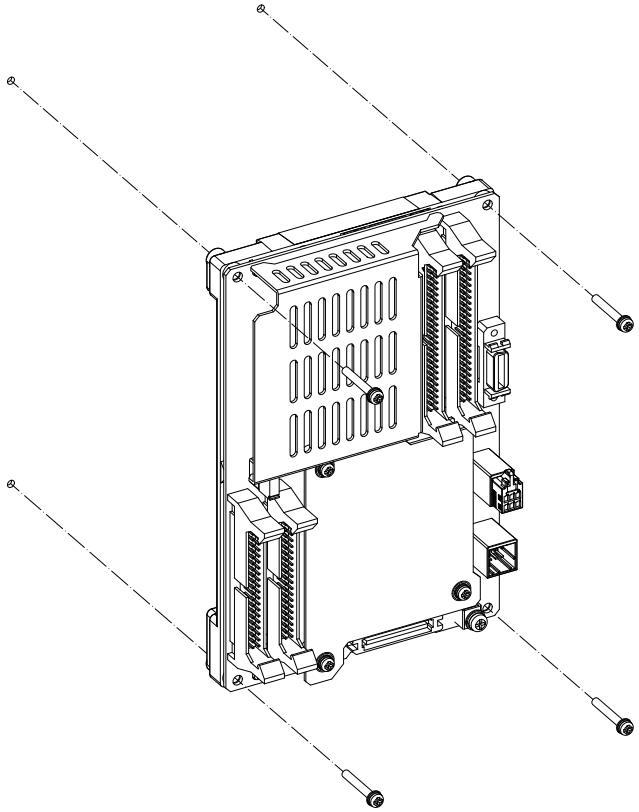
5.3.3 Operation Panel I/O Unit

Mount the operation panel I/O unit with the prescribed number of fixing screws.

Note

(1) Refer to "4.8 Operation Panel I/O Unit" for the installation dimensions and screw hole positions.

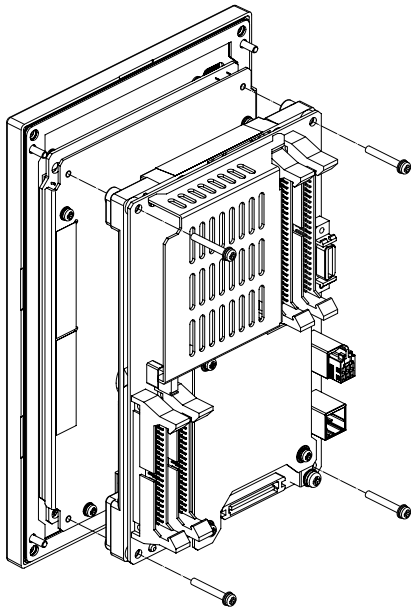
FCU8-DX731/FCU8-DX750/FCU8-DX760/FCU8-DX761/FCU8-DX834



Fixing screw: M3 (4 pieces)

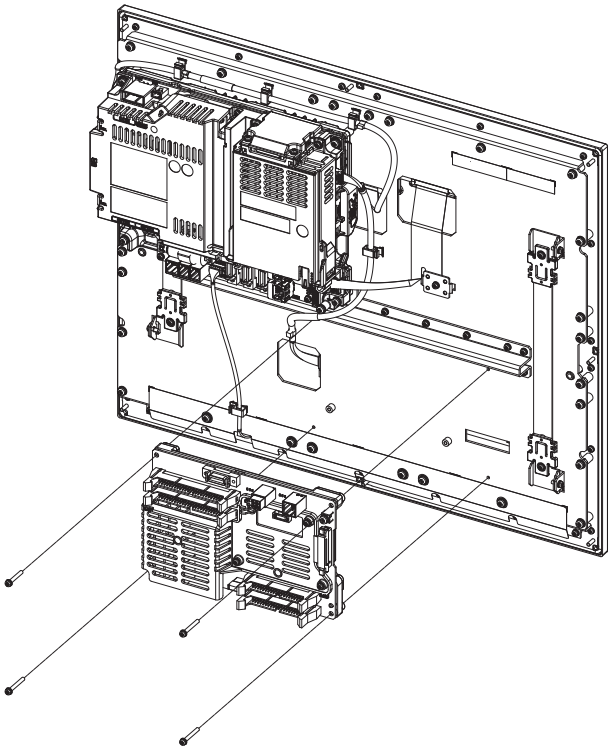
[Installation on the back side of the keyboard]

Operation panel I/O unit can be installed on the back side of the keyboard.



Fixing screw: M3 x 25 (4 pieces)

[Installation on backside of 19-type display unit]



Fixing screw: M3 x 25 (4 pieces)

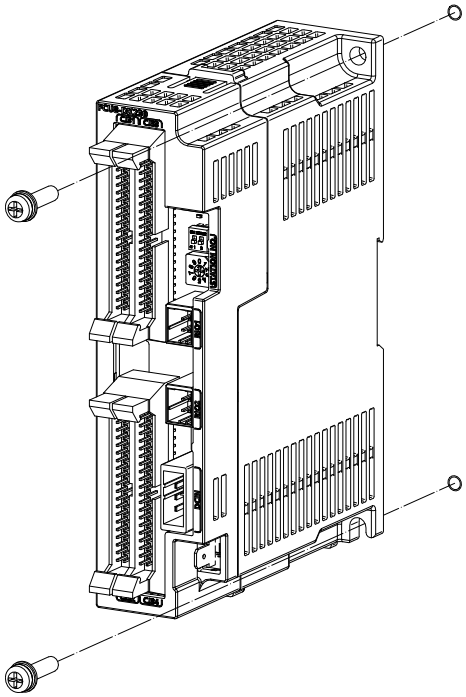
5.3.4 Remote I/O Unit

Mount the remote I/O unit with the prescribed number of fixing screws.

Note

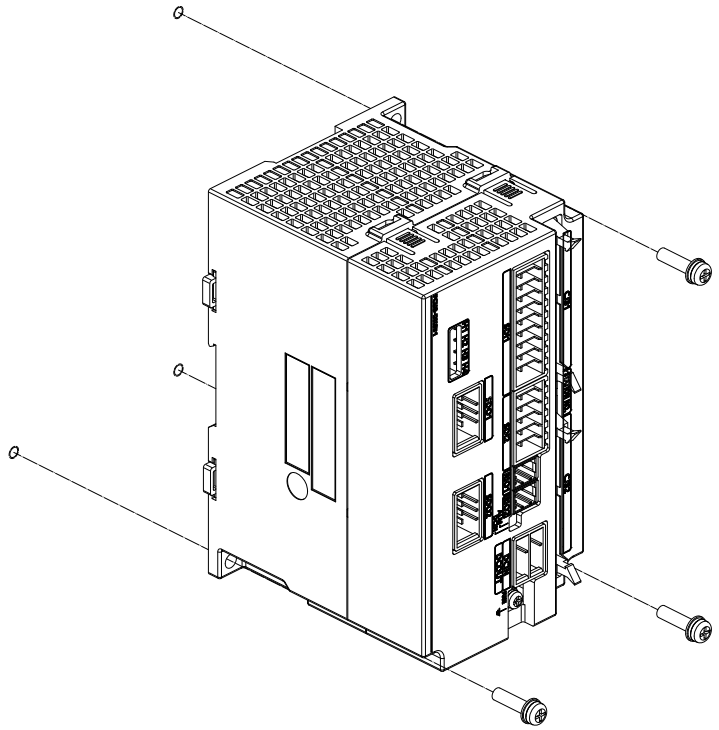
(1) Refer to "4.9 Remote I/O Unit" for the installation dimensions and screw hole positions.

FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX202/FCU8-DX213/FCU8-DX213-1/ FCU8-DX520/FCU8-DX654/FCU8-DX654-1/FCU8-DX408/FCU8-DX409



Fixing screw: M5 (2 pieces)

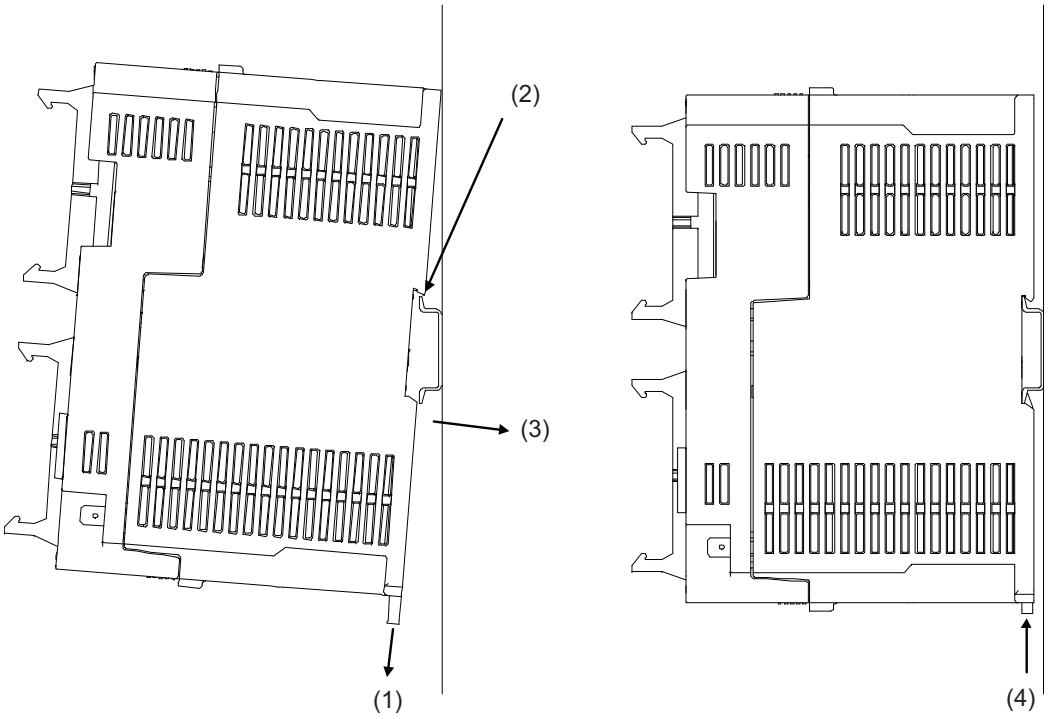
FCU8-DX651



Fixing screw: M5 (3 pieces)

■ Installation to DIN rail

(1) Set down the rail hook.
(2) Hook the upper latch of the unit on the DIN rail.
(3) Push the unit into the rail.
(4) Lock it.



Designate the type below as DIN rail standard

- TH35-7.5Fe: 7.5
- TH35-7.5AL: 7.5
- TH35-15Fe: 15

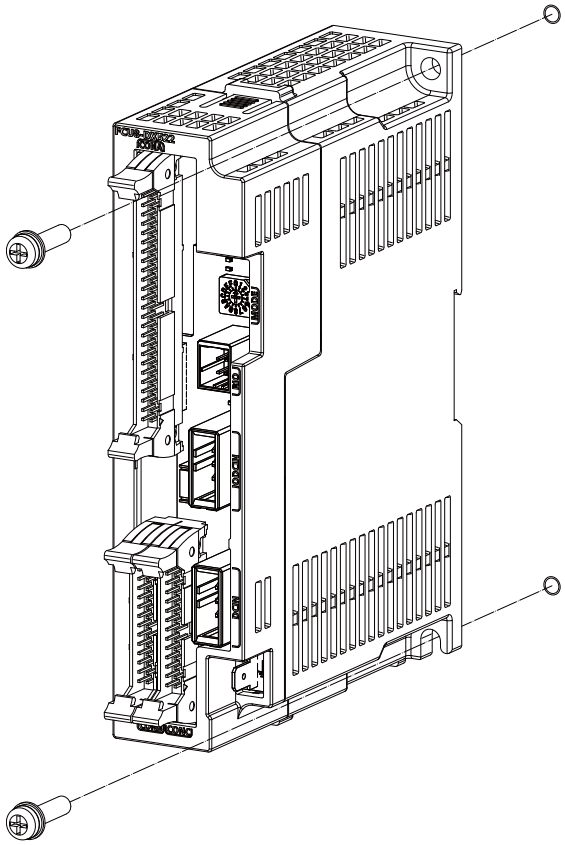
5.3.5 Laser I/F Unit

Mount the laser I/F with the prescribed number of fixing screws.

Note

(1) Refer to "4.10 Laser I/F Unit" for the installation dimensions and screw hole positions.

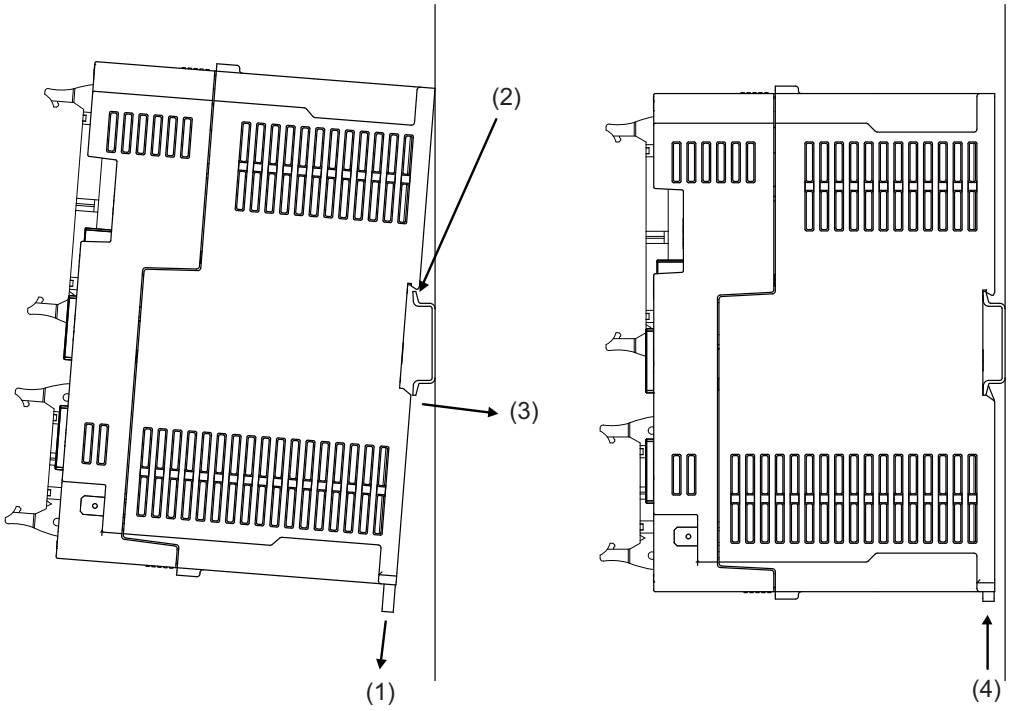
FCU8-DX522-001



Fixing screw: M5 (2 pieces)

■ Installation to DIN rail

(1) Set down the rail hook.
(2) Hook the upper latch of the unit on the DIN rail.
(3) Push the unit into the rail.
(4) Lock it.



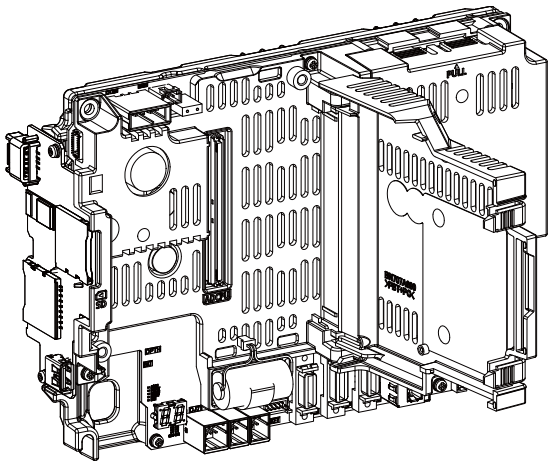
Designate the type below as DIN rail standard

- TH35-7.5Fe: 7.5
- TH35-7.5AL: 7.5
- TH35-15Fe: 15

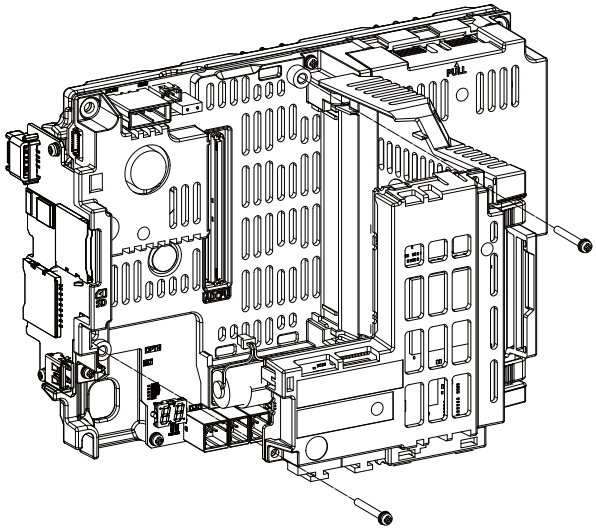
5.3.6 Functional Safety Expansion Unit

Install the functional safety expansion unit as follows:

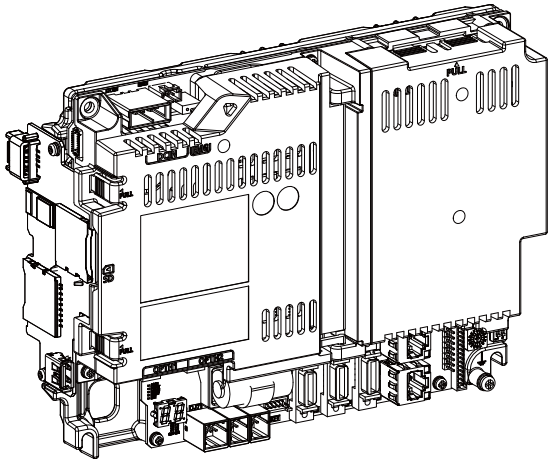
(1) Open the cover of control unit.



(2) Fix the functional safety expansion unit with two screws.



(3) Close the cover of control unit.

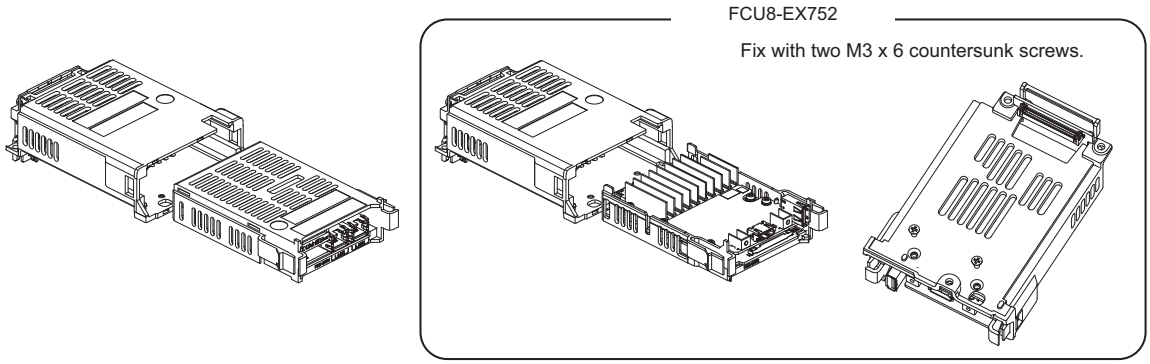


5.3.7 Function Expansion Unit

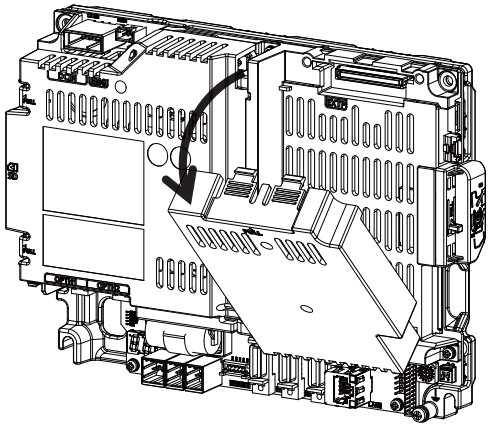
Install the expansion unit as follows:

Installing the option relay unit: FCU8-EX704 (for 1 slot)

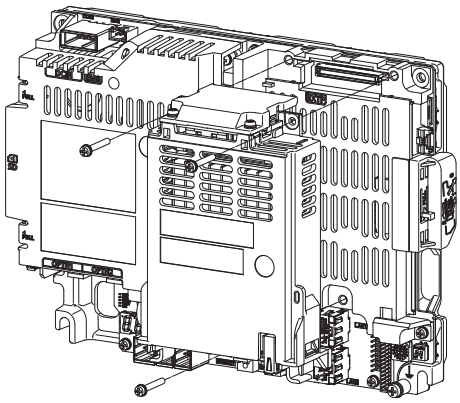
(1) Insert the function expansion unit into FCU8-EX704.



(2) Remove the cover on the back side of control unit.

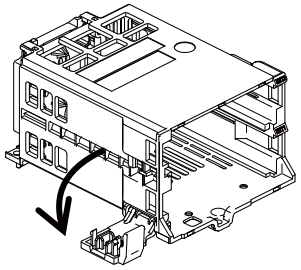


(3) Fix FCU8-EX704 to the control unit with three M3 x 25 screws.

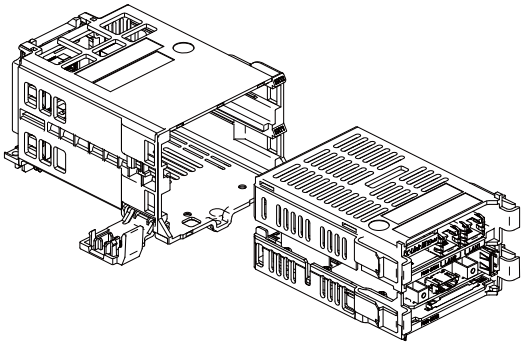


Installing the option relay unit: FCU8-EX705 (for 2 slots)

(1) Remove the cover of FCU8-EX705.

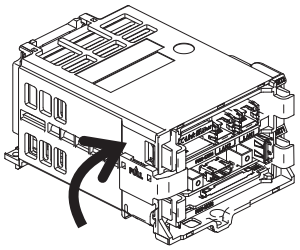


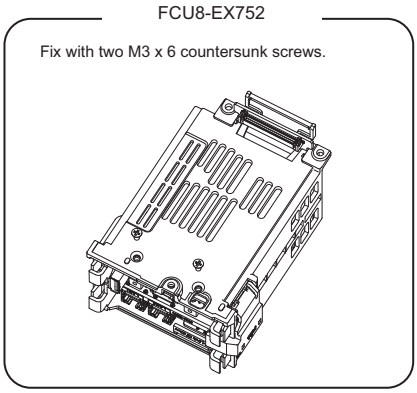
(2) Insert the function expansion unit into FCU8-EX705.



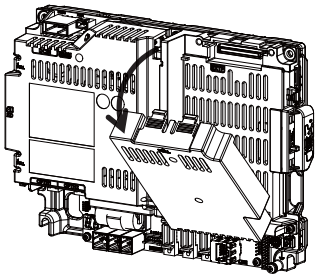
Make sure to insert FCU8-EX752 into EXT1.

(3) Close the cover of FCU8-EX705.

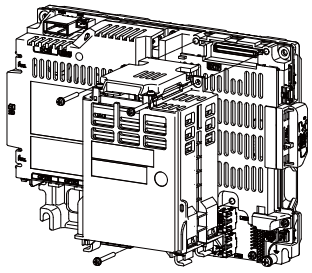




(4) Remove the cover on the back side of control unit.



(5) Fix FCU8-EX705 to the control unit with three M3 x 25 screws.

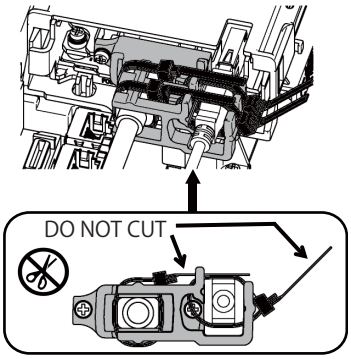


Replacing the option relay unit: FCU8-EX704 (for 1 slot) -> FCU8-EX705 (for 2 slots)

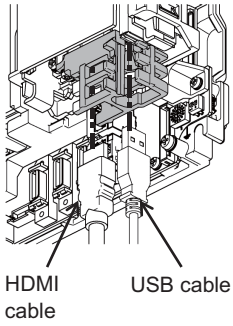
(1) Disconnect the cables connected to the function expansion unit.

FCU8-EX752

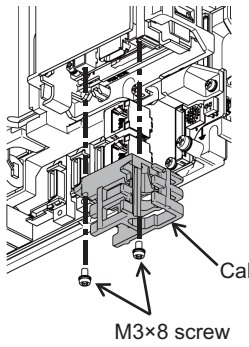
(a) Loosen cable ties and remove them.
(The cable ties are reusable. Do not cut cable ties because they can be used for re-bundling.)



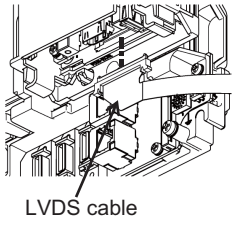
(b) Remove cables.



(c) Remove cable holder.



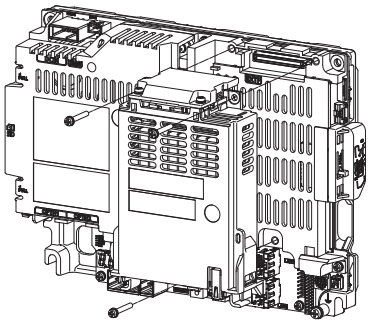
(d) Remove LVDS cable.
(Only when it is connected.)



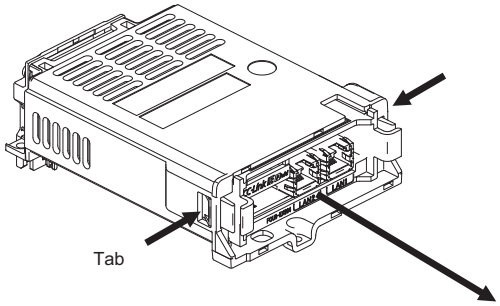
Note

- When the cable is connected/disconnected, make sure to turn the power OFF.

(2) Remove the three M3 × 25 screws.

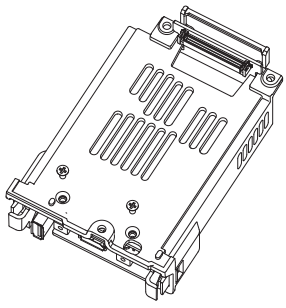


(3) Take the function expansion unit out while pressing the right and left tabs.



FCU8-EX752

Remove two M3 x 6 countersunk screws.



(4) Refer to "Installing the option relay unit: FCU8-EX705 (for 2 slots)" to install FCU8-EX705.
Refer to "Connection method of HDMI cable and USB cable with image input expansion unit" for method for connecting HDMI cable and USB cable to FCU8-EX752.

5.3.8 Machine Operation Panel

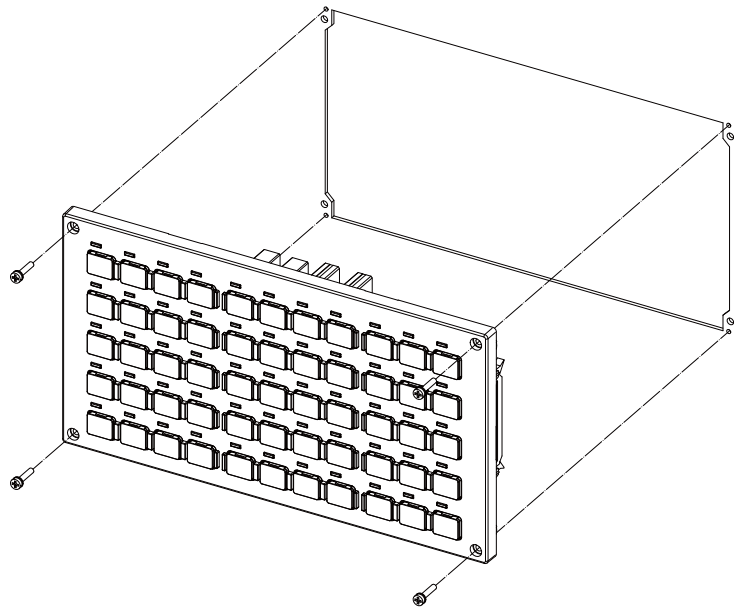
Mount the machine operation panel (main panel and sub panel) with the prescribed number of fixing screws.

Note

(1) Refer to "4.15 Machine Operation Panel" for the panel cut dimension drawing and screw hole positions.

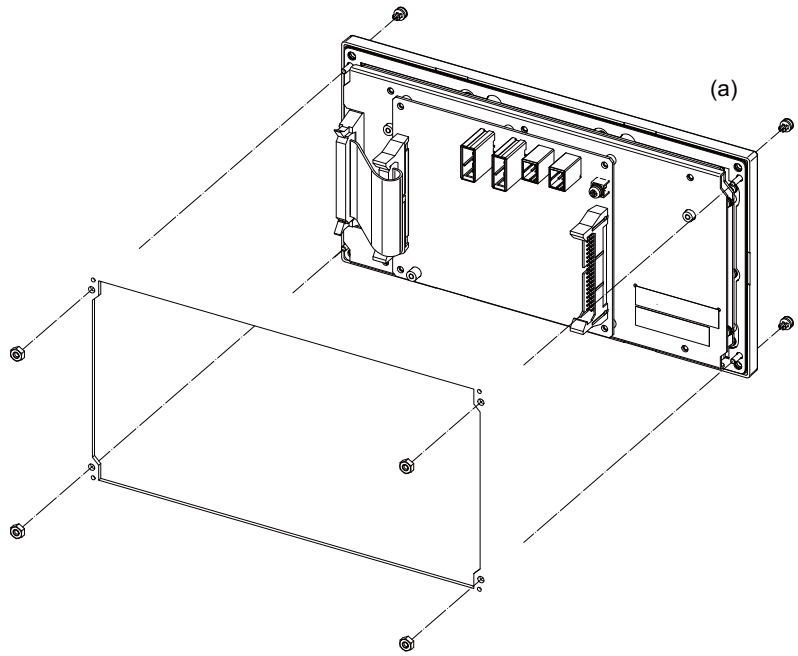
FCU8-KB921/KB922/KB923/KB924/KB925/KB926

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

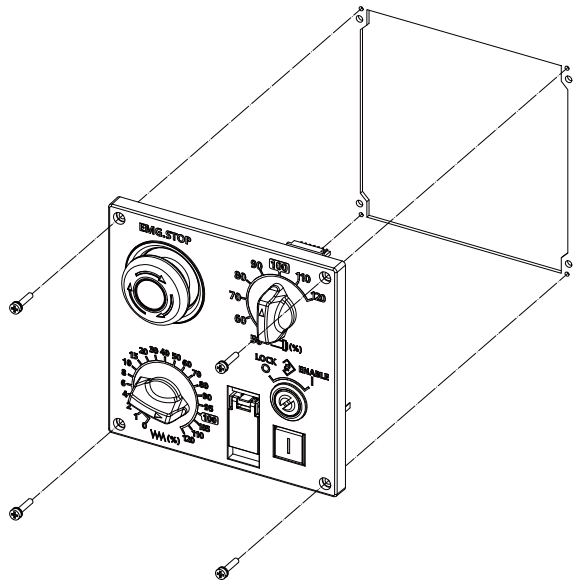
[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 screw caps (a) provided with the unit.)

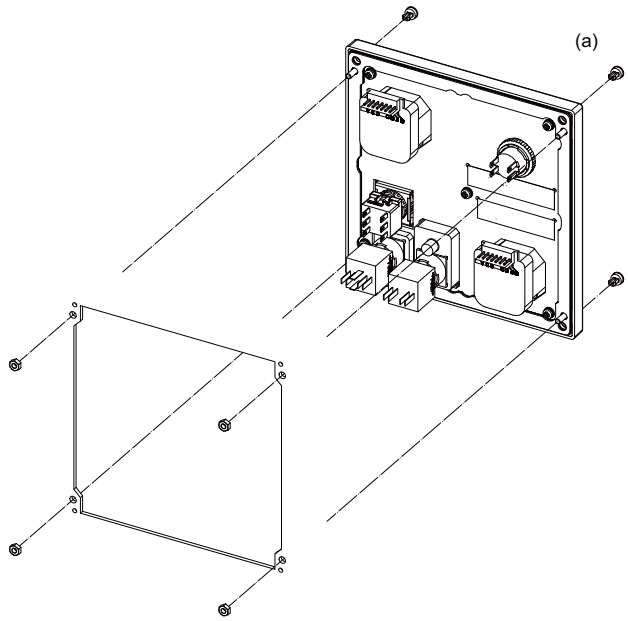
FCU8-KB931/FCU8-KB941

[Front mounting]



Fixing screw: Cheese head screw M3 (4 pieces)
(Fixing screws are provided with the unit.)

[Rear mounting]



Fixture: M3 nut (4 pieces)
(4 screw caps (a) provided with the unit.)

6

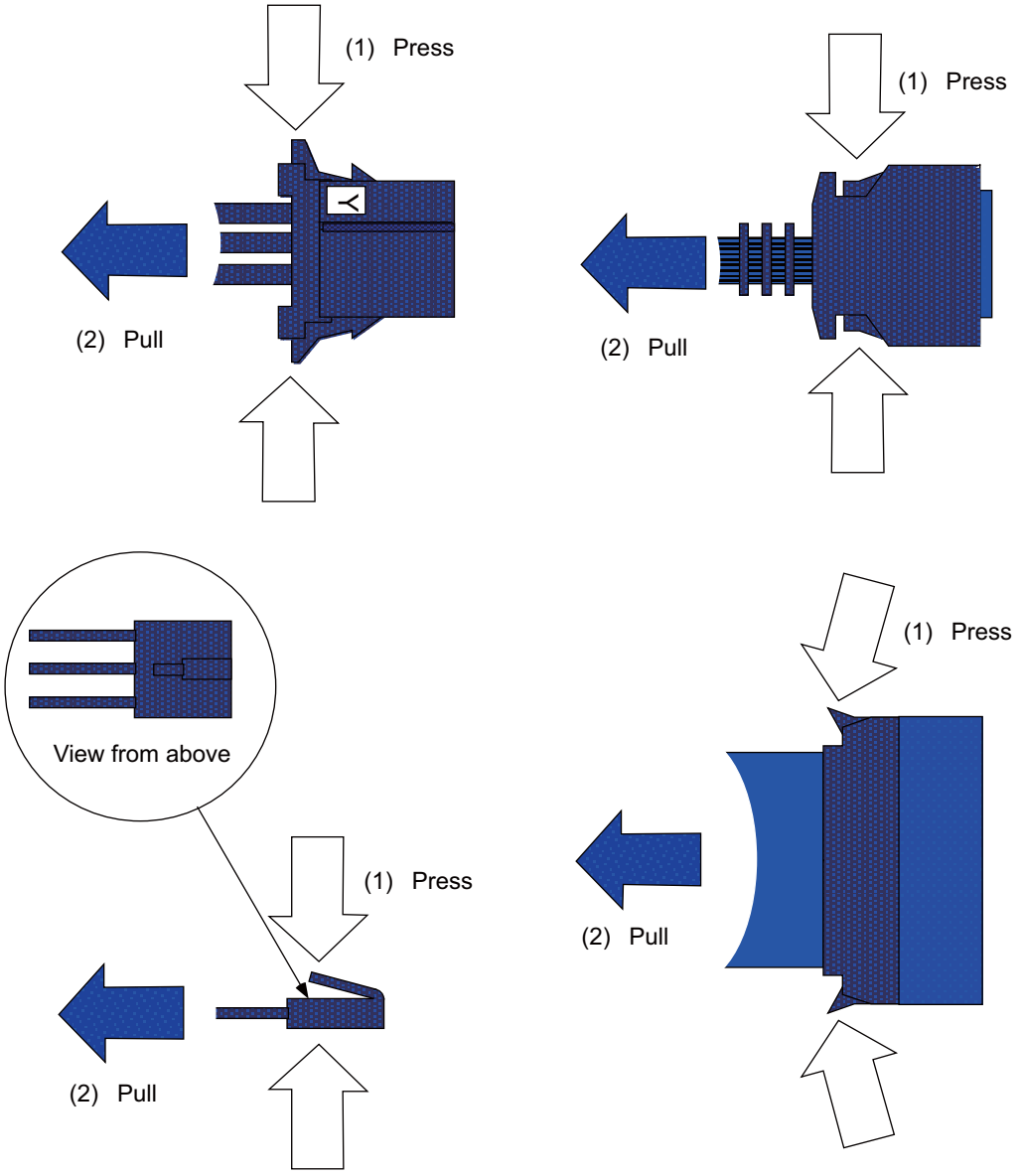
Precautions for Connecting

6.1 Precautions for Wiring

6.1.1 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.

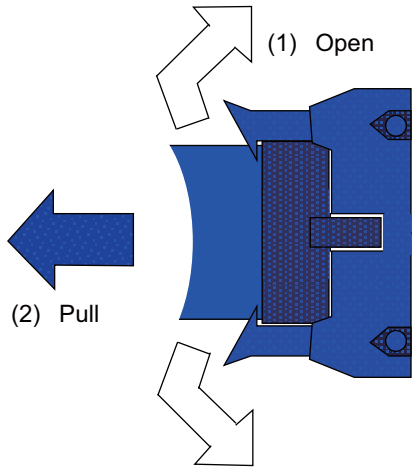


⚠ CAUTION

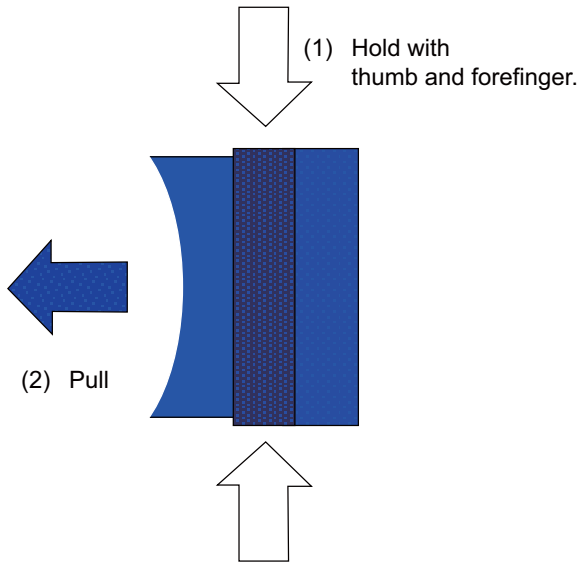
(1) Do not connect or disconnect the cables between units while the power is ON.

(2) Do not pull on the cables when connecting/disconnecting them.

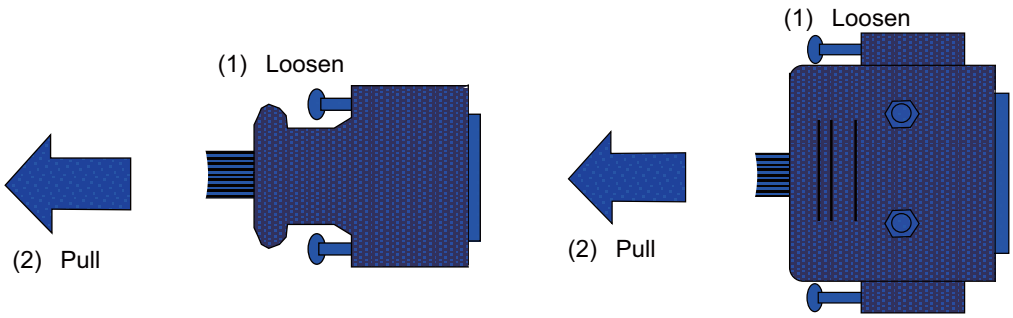
(b) For flat cable type connectors with latches, open the latches in the directions of the arrows and pull the connector off.



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



(d) For screw locking connectors, loosen the two locking screws and pull out the connector.

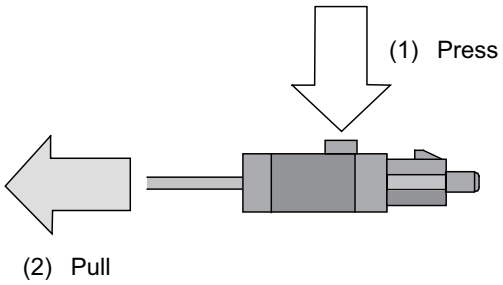


⚠ CAUTION

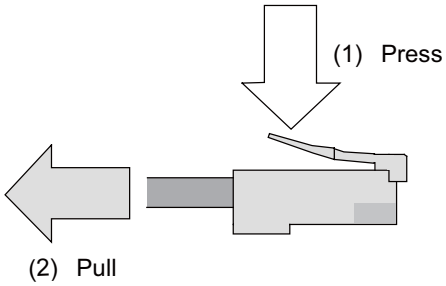
(1) Do not connect or disconnect the cables between units while the power is ON.

(2) Do not pull on the cables when connecting/disconnecting them.

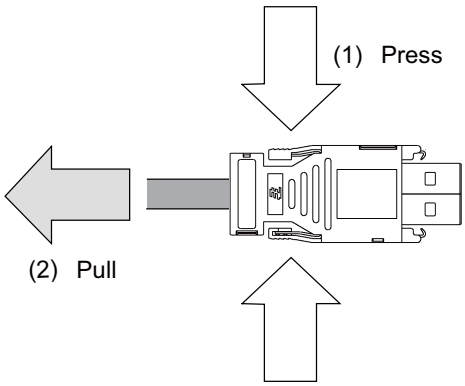
(e) For optical cable connectors, hold down the lock button and pull off the connector.



(f) For Ethernet connectors, hold down the locking tab and pull out the connector.



(g) For the USB connector, pull off while holding down the locked latch.



⚠ CAUTION

(1) Do not connect or disconnect the cables between units while the power is ON.

(2) Do not pull on the cables when connecting/disconnecting them.

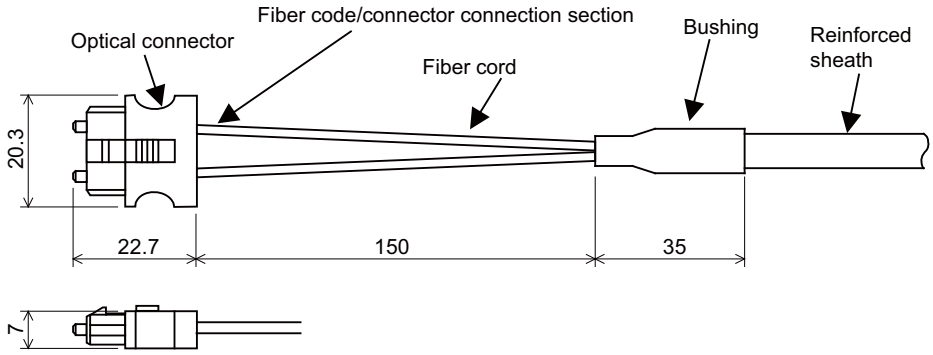
6.1.2 Precautions for Using Optical Communication Cable

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

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

Optical communication cable outline and parts



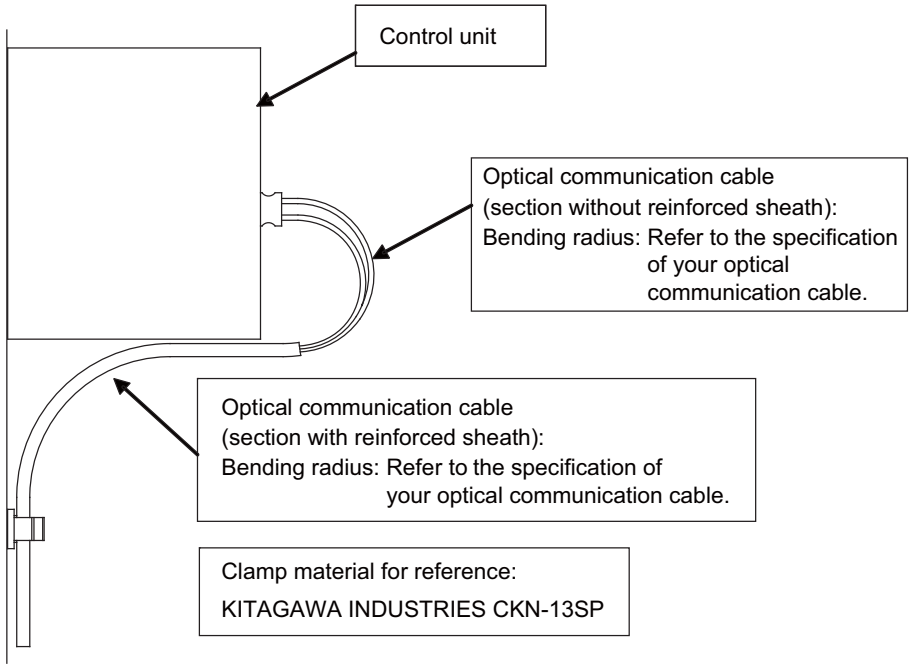
To ensure the system performance and reliability, purchase the optical communication cable from Mitsubishi Electric. A machining drawing is given in "Cable" as reference, but the purchased optical communication cable cannot be cut or connected by the machine tool builder.

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.

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.



6.1.3 Precautions for Connecting 24 V Power Supply

(1) When 24 V power is supplied to the unit, inrush current may weld the contacts in place under the following conditions. Be careful of it.
- When 24 VDC power is directly controlled ON/OFF by a relay or other magnetic switch AND When heat capacity is low for the contacts of the magnetic switches used to control 24 VDC power

6.2 Turning the Power ON/OFF

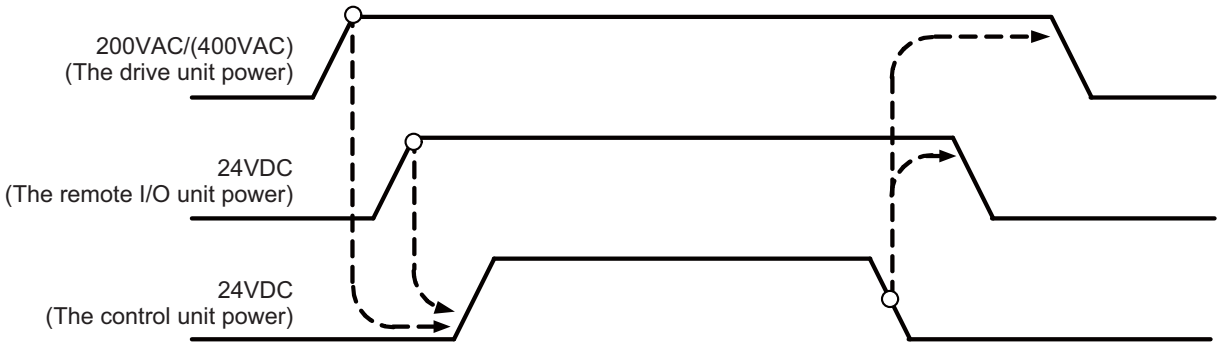
The diagram below shows the ON/OFF timing of the drive unit power supply (200 VAC/400 VAC), remote I/O unit power supply (24 VDC) and control unit power supply (24 VDC).

[Power ON]
Turn the power ON in the following order; drive unit, remote I/O unit -> control unit.

If the control unit is powered ON before the drive unit or remote I/O unit, the initial communication with the drive unit or remote I/O unit may fail and the alarm "Servo communication error" or "Remote I/O unequipped error" may occur.

[Power OFF]
Turn the power OFF in the following order; control unit -> remote I/O unit, drive unit.

If the remote I/O unit or drive unit is powered OFF before the control unit, the alarm "Remote I/O communication error" may occur with the detection of remote I/O unit communication stop, or the alarms "Absolute value data illegal", "Servo communication error", etc., may occur by the failure of data acquisition.

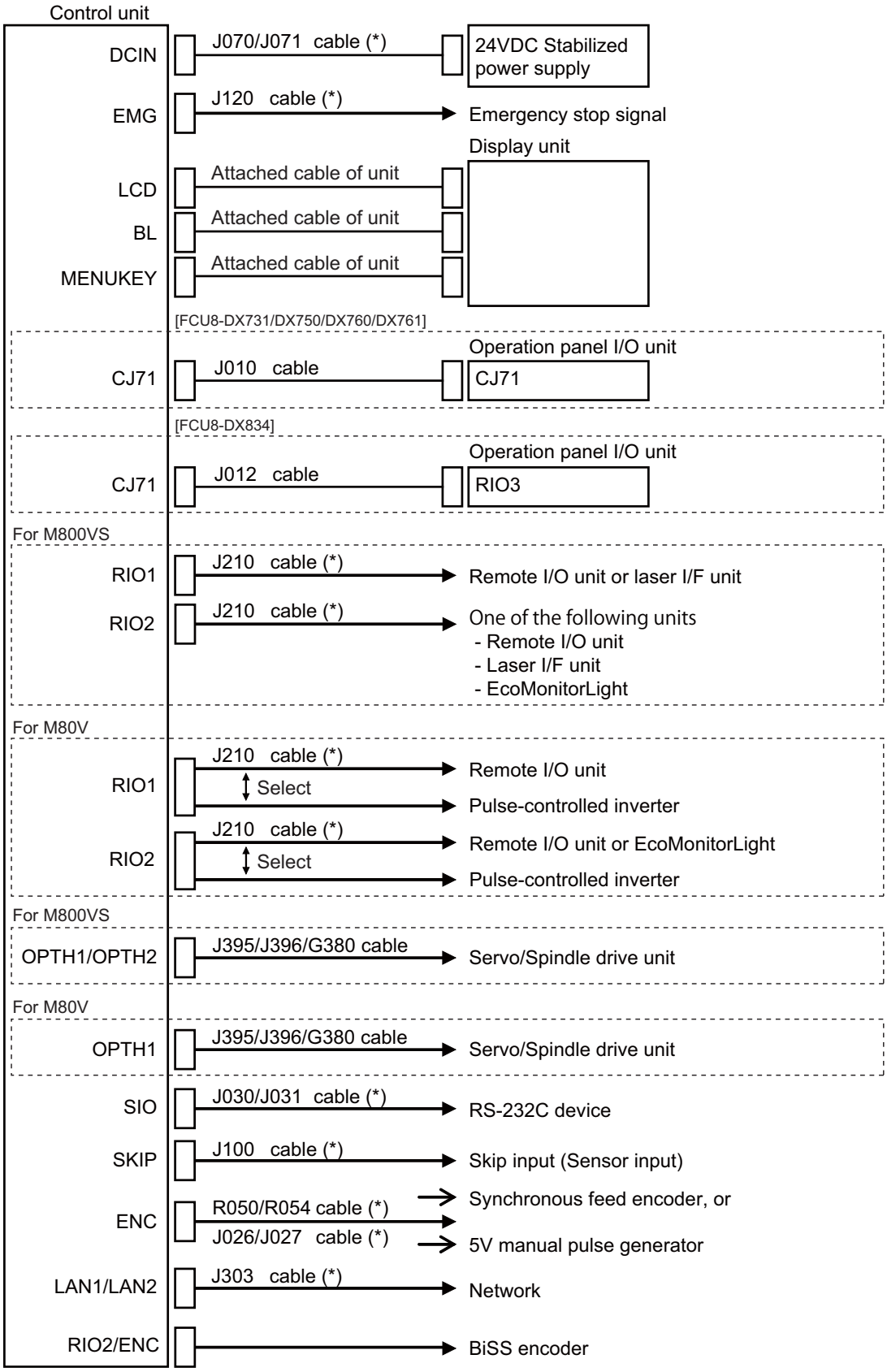


7

Connection of Control Unit

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

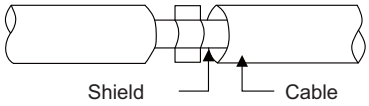
7.1 Control Unit Connection System Drawing



Note

(1) The mounted connector differs depending on the unit. Refer to the following chapter for which of the connector is mounted.
"4.3 Control Unit [M800VS]" "4.4 Control Unit [M80V]"
(2) For connection to the machine operation panel, refer to the chapter "14 Connection of Machine Operation Panel".
(3) The section indicated with asterisk (*) indicates cable to be wired outside the operation panel.
Since the cable could be affected by the exogenous noise depending on the environment, the following noise counter-measure is recommended.
<Note> For the 19-type display unit and image input expansion unit, use the shield clamp because the cables are easily affected by the exogenous noise.

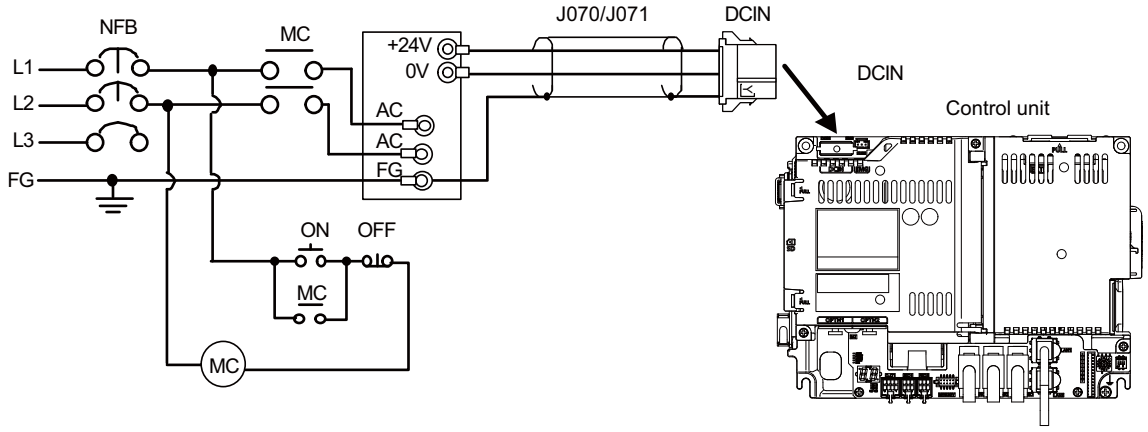
Expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



When you cannot use the shield clamp, install a ferrite core as a substitute.
<Related item>
Shield clamp fitting: "42.6.1 Shield Clamp Fitting"
Ferrite core: "42.6.2 Ferrite Core"

7.2 Connecting with Power Supply

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



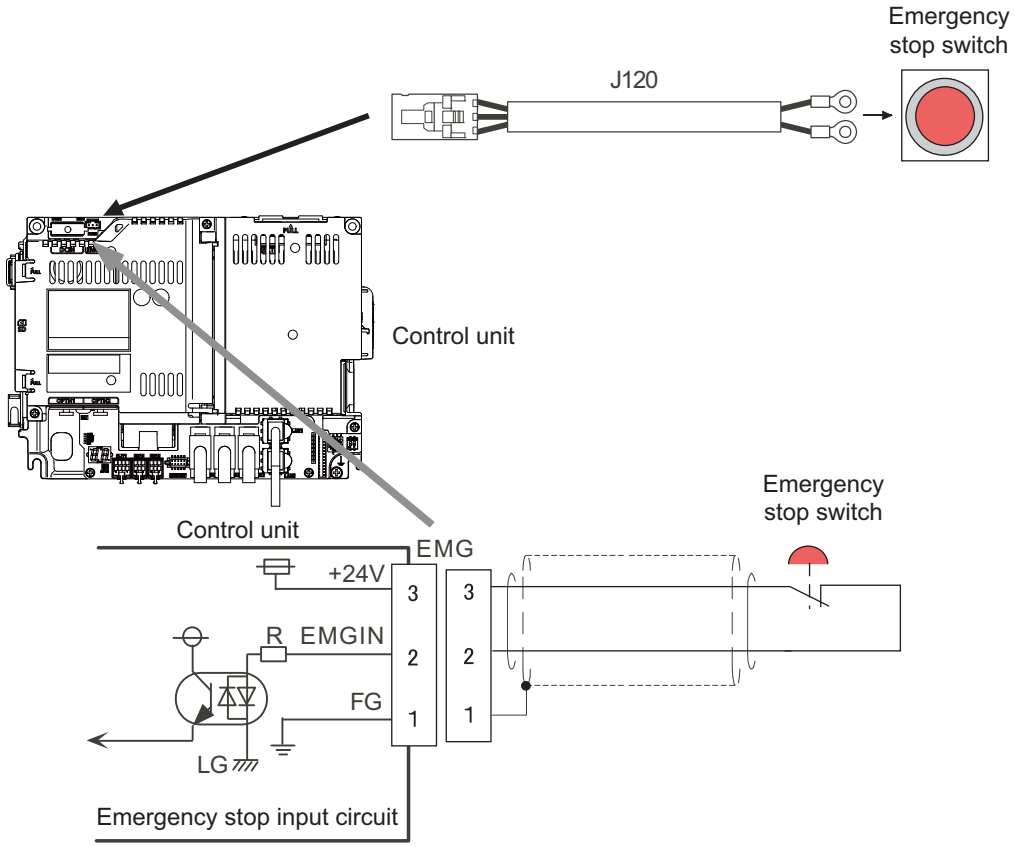
Note

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

[Related items]
Cable connection drawing: "16.2.12 J070/J071 Cable"
Connector pin assignment: "4.3 Control Unit [M800VS]" (DCIN connector)

7.3 Connecting with Emergency Stop Signal

Connect the emergency stop switch to EMG connector of the control unit.



Note

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

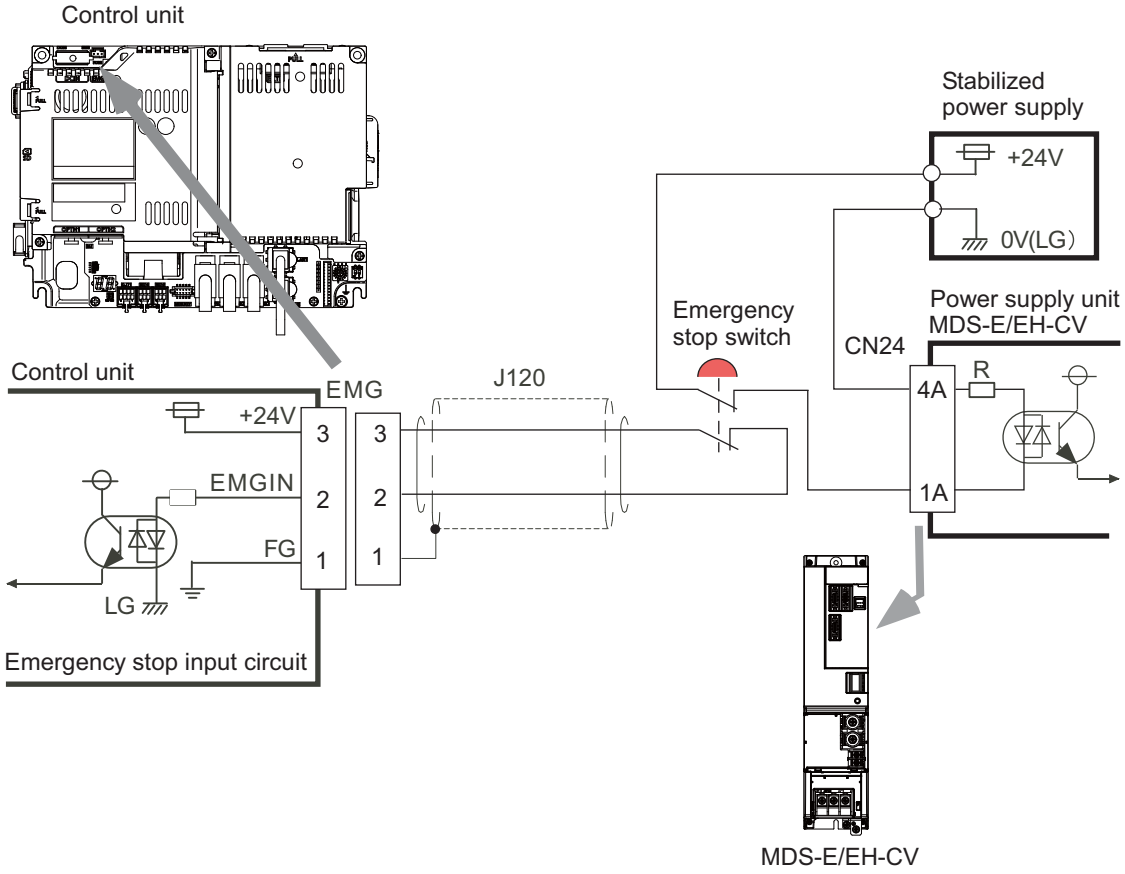
[Related items]

Cable connection drawing: "16.2.14 J120 Cable"

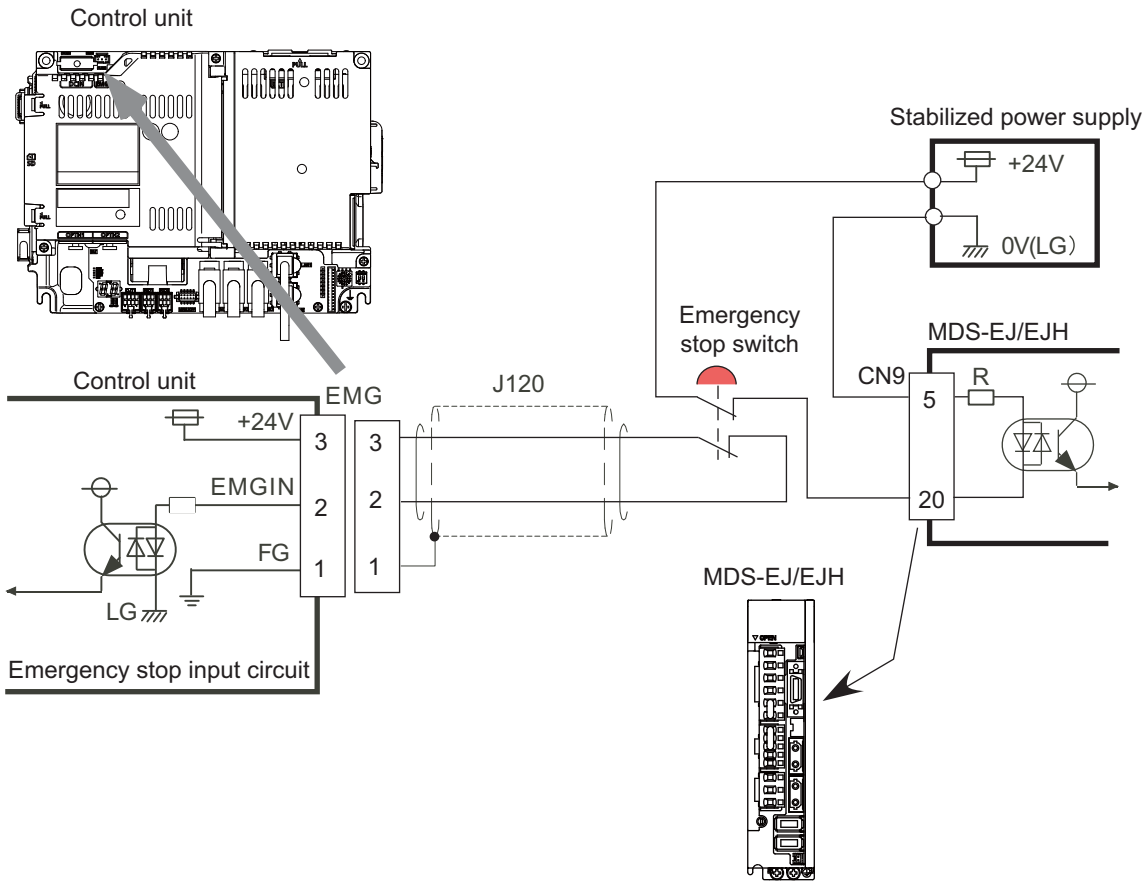
Connector pin assignment: "4.3 Control Unit [M800VS]" (EMG connector)

ISO13849-1 (PLd, Cat.3) and IEC62061 (SIL CL2) can be realized by using the safety remote I/O unit (directly wiring the external emergency stop redundantly). Refer to "Smart safety observation" (BNP-C3072-022) for details.

Power supply unit (MDS-E/EH-CV) external emergency stop: Example



Drive unit (MDS-EJ/EJH) external emergency stop: Example



Note

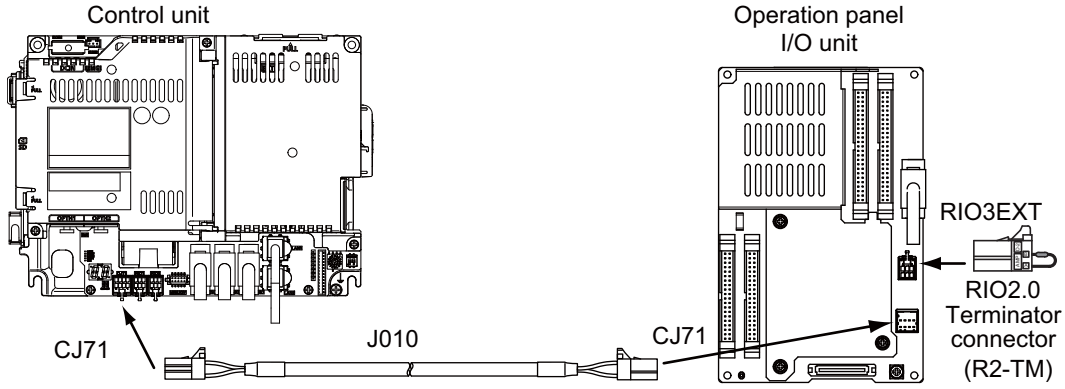
(1) External emergency stop cannot substitute the emergency stop signal which is input to NC.
It is a function which helps the NC emergency stop.

(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.

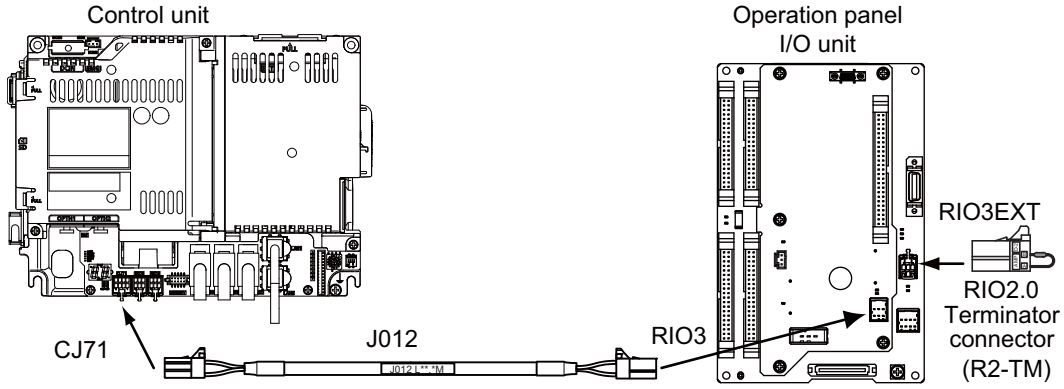
7.4 Connecting with Operation Panel I/O Unit

Connect the operation panel I/O unit to CJ71 connector of the control unit.

FCU8-DX731/FCU8-DX750/FCU8-DX760/FCU8-DX761



FCU8-DX834



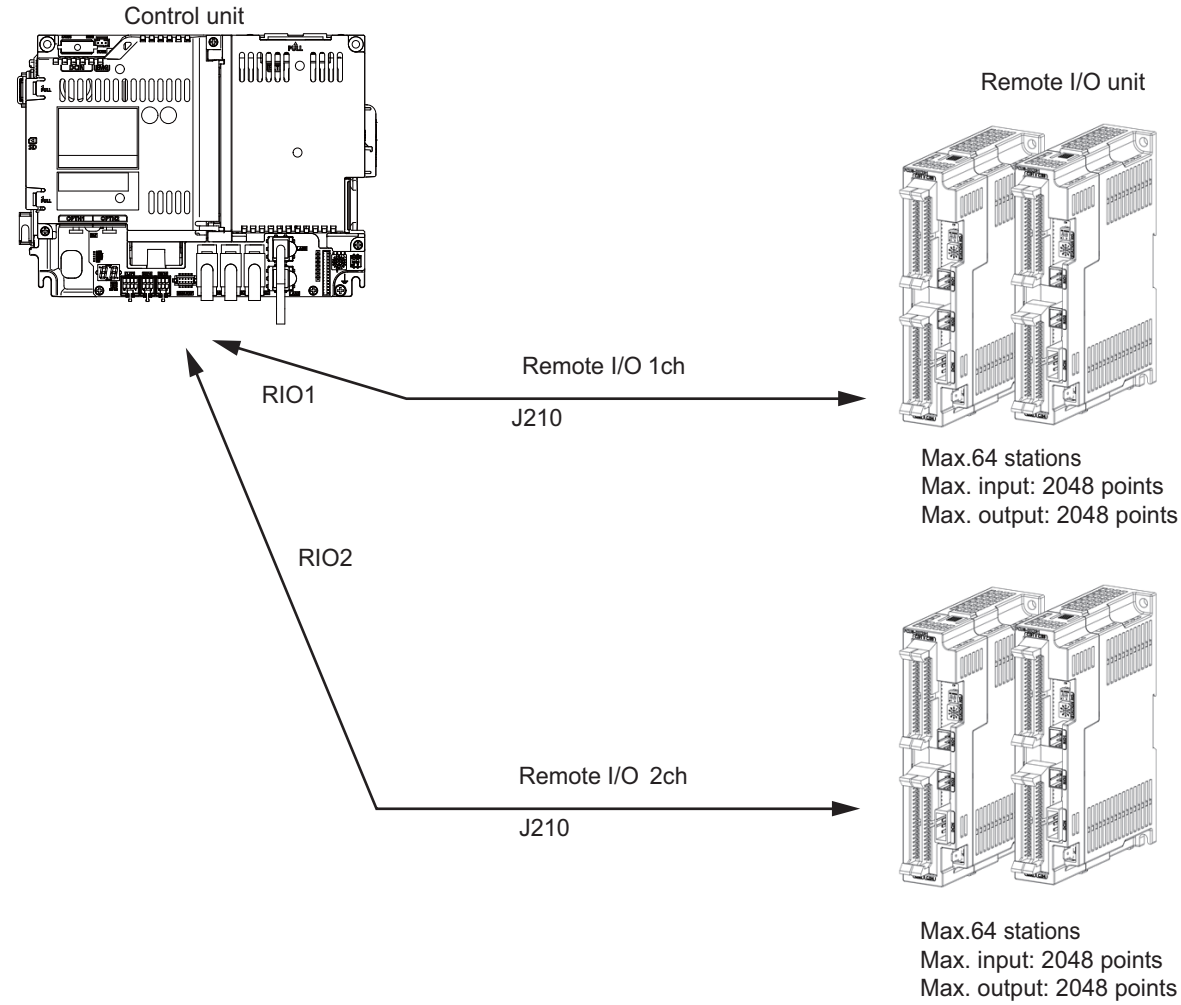
[Related items]

Cable connection drawings: "16.2.6 J010 Cable", "16.2.7 J012 Cable"

Connector pin assignment: "4.3 Control Unit [M800VS]" (CJ71 connector)

7.5 Connecting with Remote I/O Unit

Connect the remote I/O unit to RIO1 or RIO2 connector of the control unit.



Note

(1) Connect the J210 cable to the RIO1 or RIO2 connector of the control unit.
Check the connector position with the actual machine.

(2) When you use a function with pulse output, the remote I/O unit cannot be connected to RIO1 and RIO2 connectors.

[Related items]

Cable connection drawing: "16.2.16 J210 Cable"

Connector pin assignment: "4.3 Control Unit [M800VS]" (RIO1 connector, RIO2 connector)

7.6 Connecting with 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. Note that the number of connected axes is limited by the NC.

Note

(1) Refer to "6.1.2 Precautions for Using Optical Communication Cable" when handling and wiring optical communication cable.

[Cable application table]

Cable	Panel internal wiring		Panel external wiring	
	Under 10 m	10 m to 30 m	10 m or less	10 m to 30 m
J396	○	×	×	×
J395	○	×	○	×
G380	○	○	○	○

7.6.1 Connecting with Drive Unit MDS-E/EH Series

7.6.1.1 Connection of Optical Communication Cables

⚠ CAUTION

(1) Connect the NC and drive units with the optical communication cable. The distance between the NC and final drive unit must be within 30 m and the specified bending radius (for wiring inside panel: 25 mm, and for wiring outside panel: 50 mm) or more.

(2) For the main circuit wiring of the drive unit and power supply unit, wire 200 V series drive units with MDS-E-CV and 400 V series drive units with MDS-EH-CV.

POINT

Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the drive unit manual.)
Axis No. is unrelated to the order for connecting to the NC.

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.

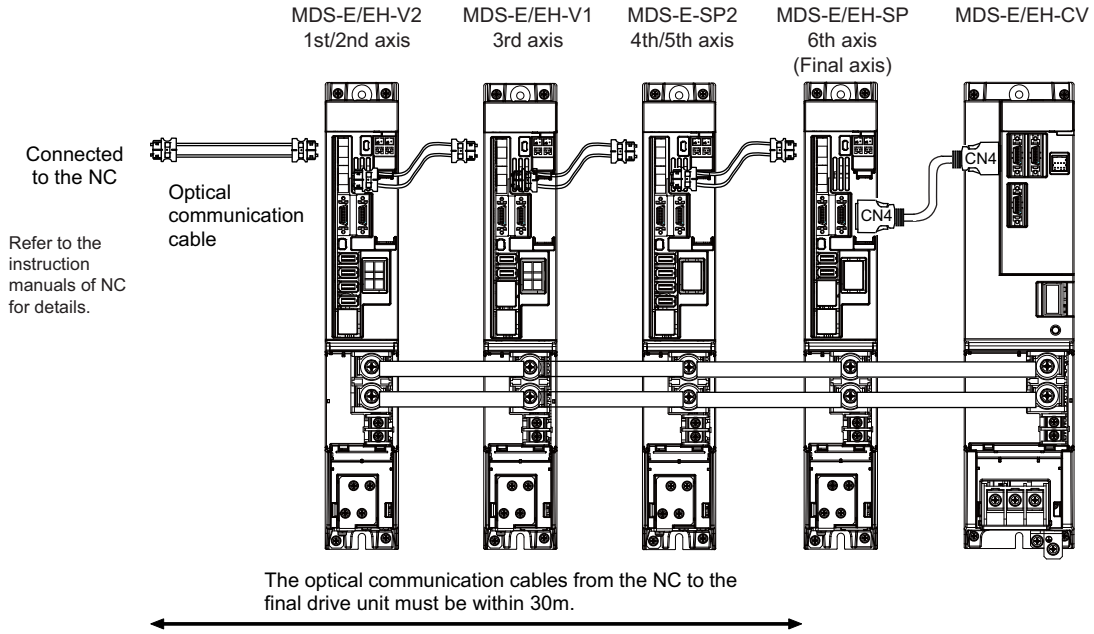
[Connection]

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

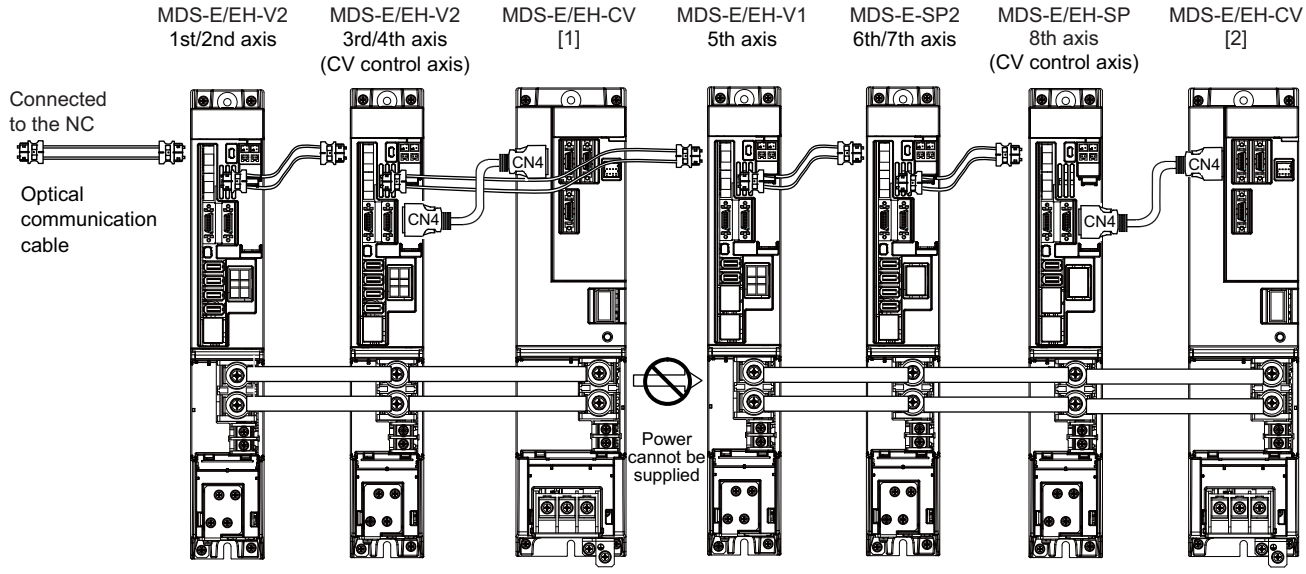
Connection when using one power supply unit



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 "When Using One Power Supply Unit" above.

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



⚠ CAUTION

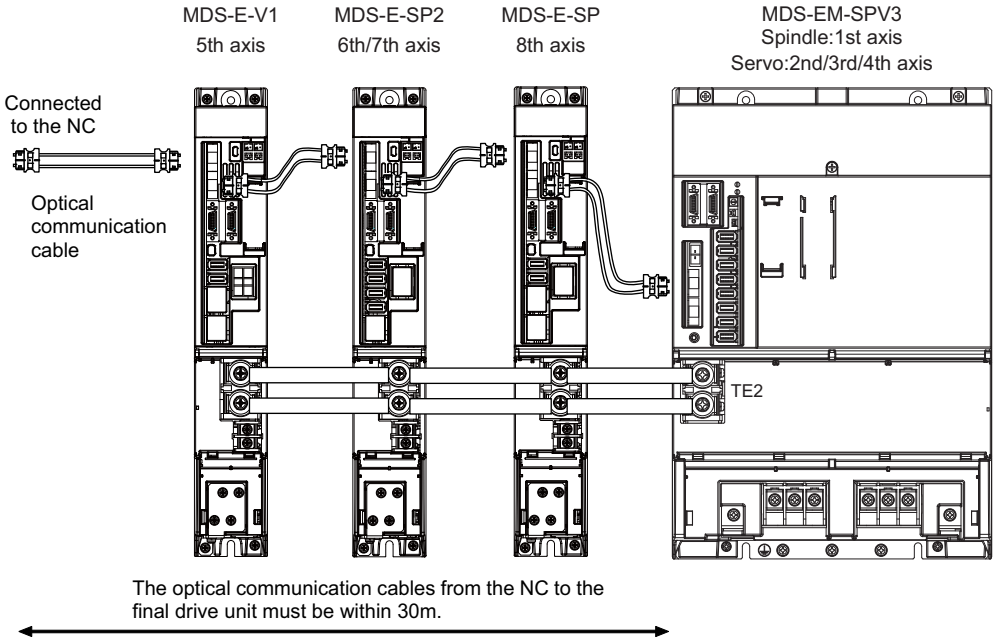
(1) The NC communication bus connection for the drive unit receiving power (L+, L-) from each power supply unit must be connected to the NC side of the power supply unit.

(2) If two or more power supply units are connected in the drive system, confirm that the units are not connected with each other through the L+ and L- lines before turning ON the power.
Also make sure that the total capacity of the drive units connected to the same power supply unit meets the unit's selected capacity.

When using the additional axis drive unit by supplying power (L+, L-) from MDS-EM/EMH unit

The power (L+, L-) can be supplied to the additional axis drive unit by using the power supply part which is built into MDS-EM/EMH.

When using MDS-EM and MDS-E drive units in combination



When using MDS-EM drive unit together with MDS-E

⚠ CAUTION

(1) There is a limit to the combination of the drive unit.
Refer to "7.3 Selection of the Additional Axis Drive Unit" in "MDS-EM/EMH Series Specifications Manual".

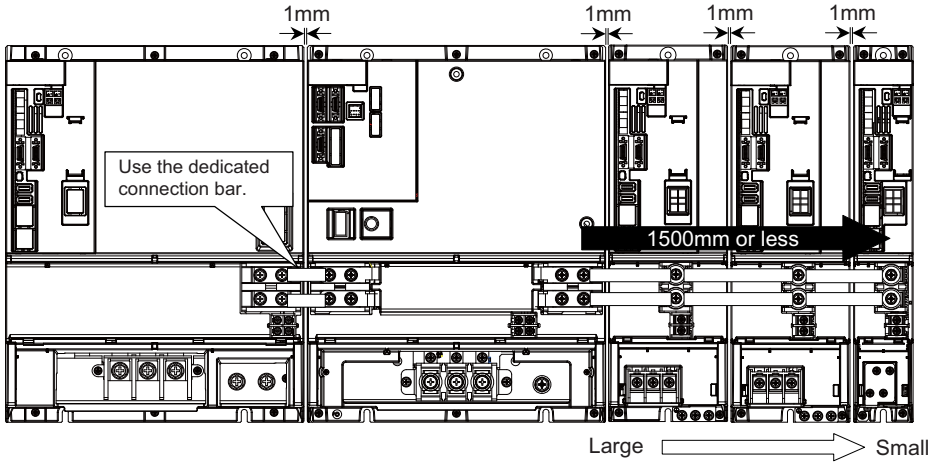
(2) When using the additional axis drive unit by supplying power (L+, L-) from the MDS-EM/EMH unit, wire the optical communication cables such that the MDS-EM/EMH unit is the final axis. Failure to observe this could lead to damage unit.

(3) When installing the additional axis unit, install the spindle drive unit with maximum capacity adjacent to the MDS-EM/EMH-SPV3. Connections for other drive units should be such that the total TE2 wiring length is 800 mm or less.

7.6.1.2 Drive Unit Arrangement

Arrange the drive units in the following procedure.

(1) Install a power supply unit.
(2) Arrange drive units in order of the nominal current from largest from the right.
(3) In the arrangement, the clearance between the units is 1 mm.
(4) Arrange the drive units with the DC connection length from the power supply unit being 1500 mm or less.
For the arrangement of 1500 mm or more, multiple power supply units are required.
(5) Arrange large capacity drive units at the left of the power supply unit with the clearance between the drive units being 1 mm.



Arrange drive units in order of nominal current from largest.

POINT

(1) Arrange large capacity drive units at the left of the power supply unit with the clearance between the drive units being 1 mm.

(2) Power supply units equivalent to the number of large capacity drive units are required.

(3) MDS-E-SP-400/640, MDS-EH-SP-200/320/480/600, and MDS-EH-V1-200 are the large capacity drive units.

7.6.2 Connecting with Drive Unit MDS-EM/EMH Series

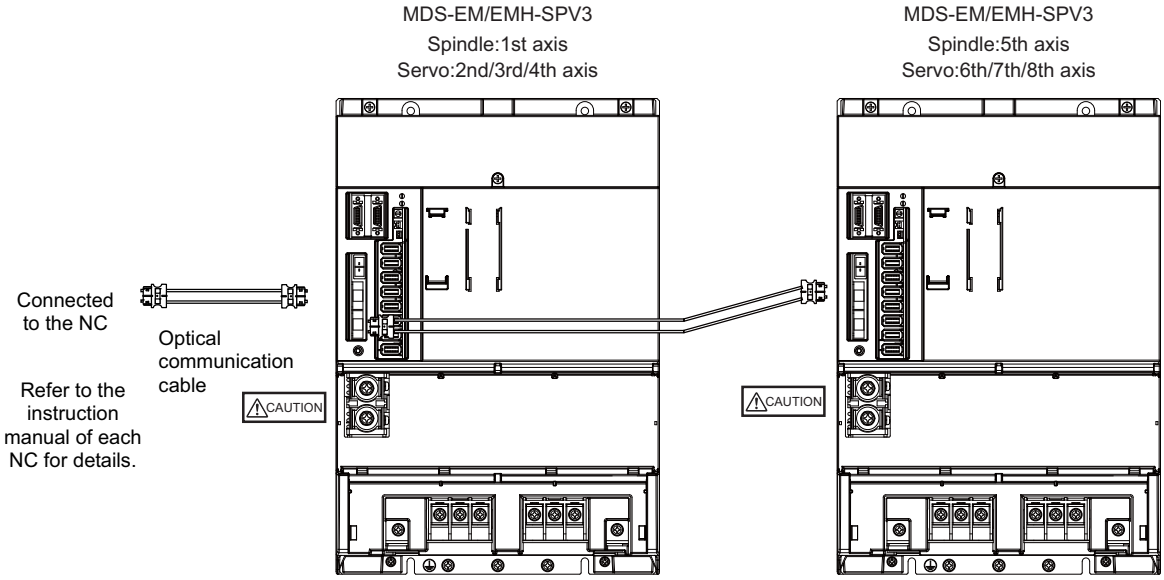
⚠ CAUTION

Connect the NC and drive units with the optical communication cable. The distance between the NC and final drive unit must be within 30 m and the specified bending radius (for wiring inside panel: 25 mm, and for wiring outside panel: 50 mm) or more.

POINT

Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the drive unit manual.)
Axis No. is unrelated to the order for connecting to the NC.

When using only MDS-EM/EMH-SPV Series



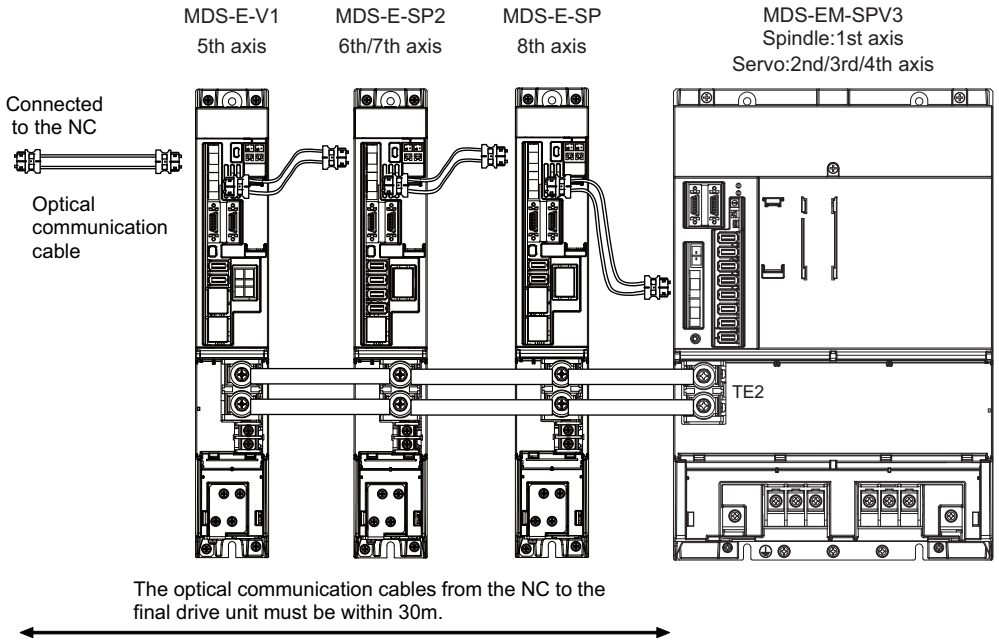
⚠ CAUTION

Confirm that the TE2 (L+, L-) wiring is not connected to other power supply before turning the power ON.

When using together with the MDS-E/EH unit

The power (L+, L-) can be supplied to the additional axis drive unit by using the power supply part which is built into MDS-EM/EMH. For the additional axis unit receiving power (L+,L-) from the MDS-EM/EMH unit, the optical cable must be connected at the NC side of the MDS-EM/EMH unit.

When using MDS-EM and MDS-E drive units in combination



When using MDS-EM drive unit together with MDS-E

> ⚠ **CAUTION**
>
> **There is a limit to the combination of the drive unit.**
> **Refer to "7.3 Selection of the Additional Axis Drive Unit" in "MDS-EM/EMH Series Specifications Manual".**

7.6.3 Connecting with Drive Unit MDS-EJ/EJH Series

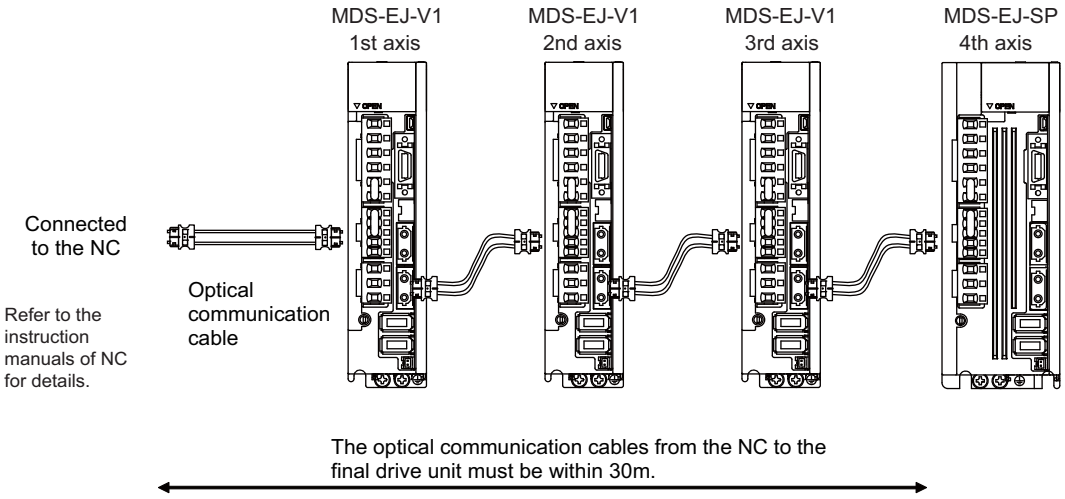
⚠ CAUTION

Connect the NC and drive units with the optical communication cable. The distance between the NC and final drive unit must be within 30 m and the specified bending radius (for wiring inside panel: 25 mm, and for wiring outside panel: 50 mm) or more.

POINT

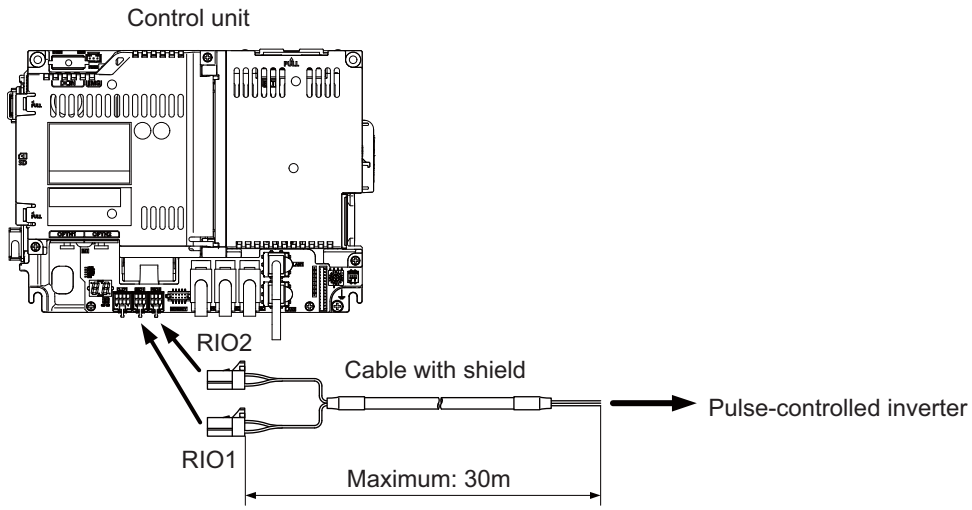
Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the drive unit manual.)
Axis No. is unrelated to the order for connecting to the NC.

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



7.7 Connecting with Pulse-Controlled Inverter [M80V]

Connect the pulse-controlled inverter to RIO1 and RIO2 connectors of the control unit.

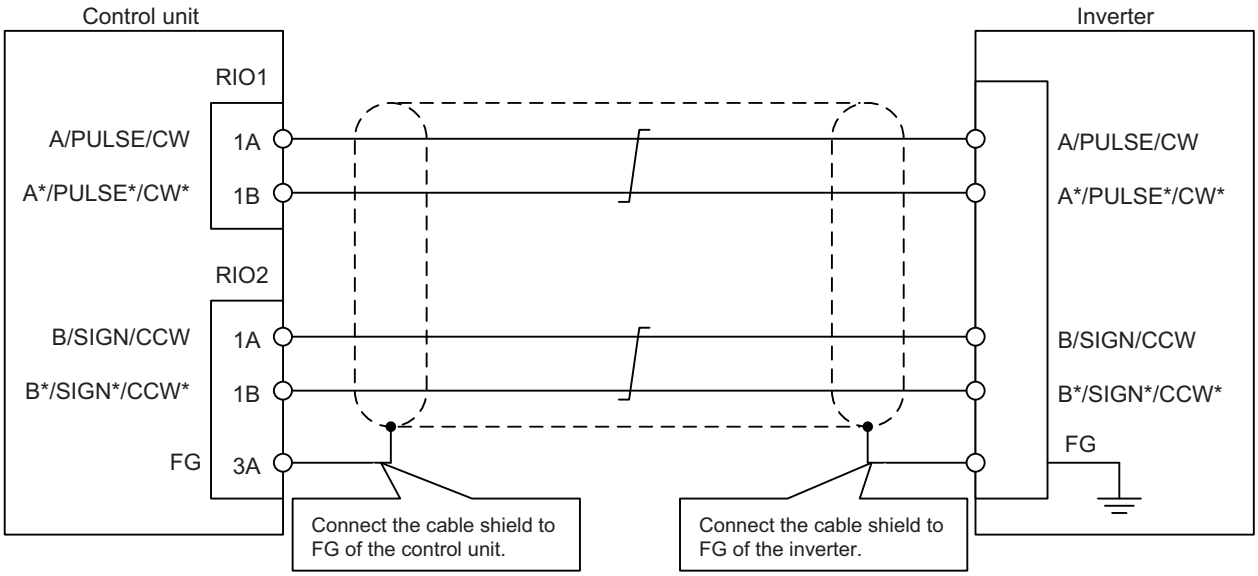


[Recommended wire material]
Wire material: HK-SB/20276XL Black LF 2P × 22AWG
Manufacturer: Taiyo Cabletec

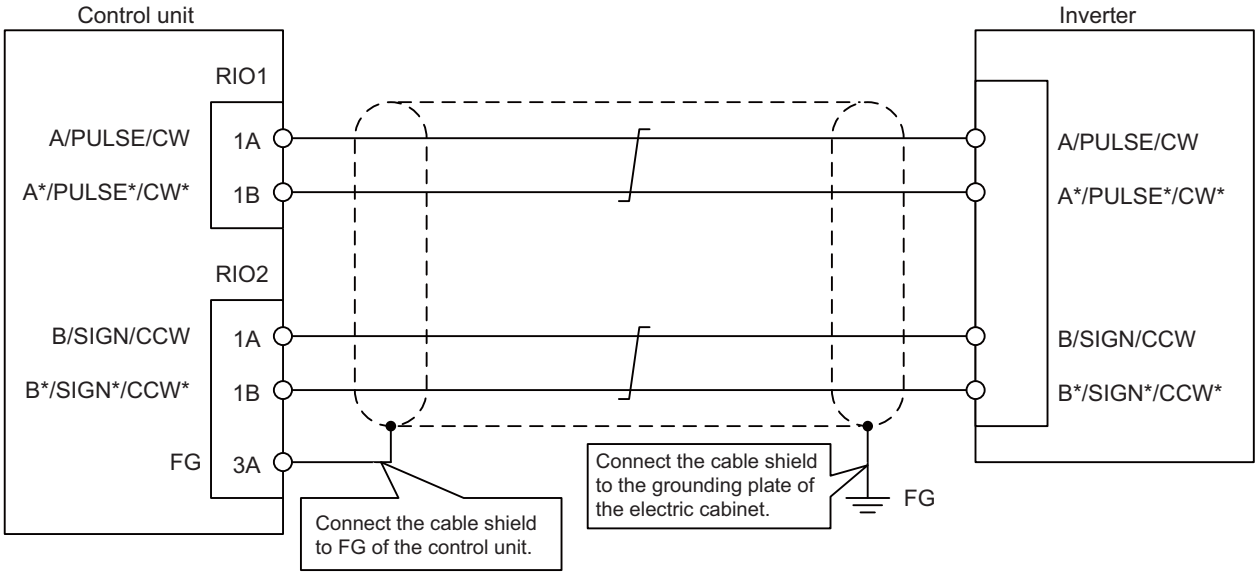
[Related items]
Connector pin assignment: "4.4 Control Unit [M80V]" (RIO1/RIO2 connector)

> **⚠ CAUTION**
>
> **(1) Connect the cable to the designated connector. Incorrect connections could damage the device.**
>
> **(2) Do not connect or disconnect the cables between units while the power is ON.**
>
> **(3) Use shielded cable and ground it in order to reduce noise interference.**

Connecting the inverter with an FG terminal



Connecting the inverter without an FG terminal

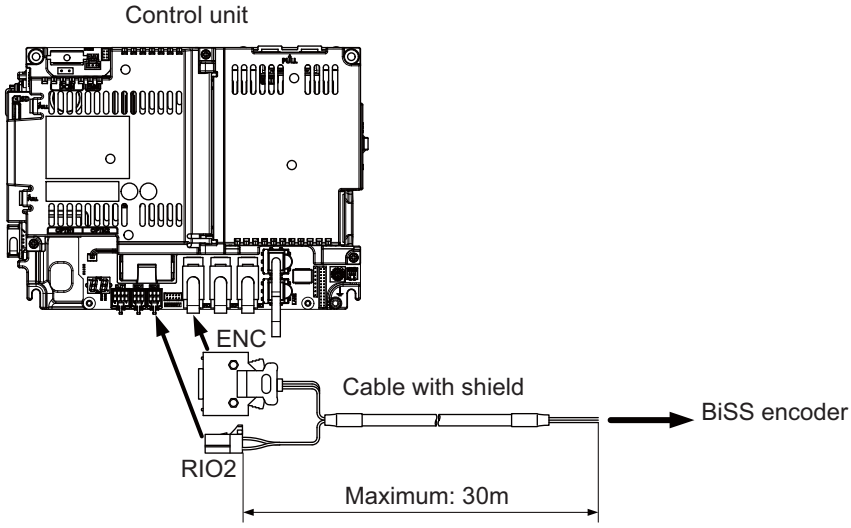


Note

(1) Connect cable shields to both FG on the control unit and the inverter. When there is no FG terminal on the inverter, use a clamp fitting or other tools to connect to the grounding plate of the electric cabinet.

7.8 Connecting with a BiSS Encoder

Connect the BiSS encoder to RIO2 connector and ENC connector of the control unit.



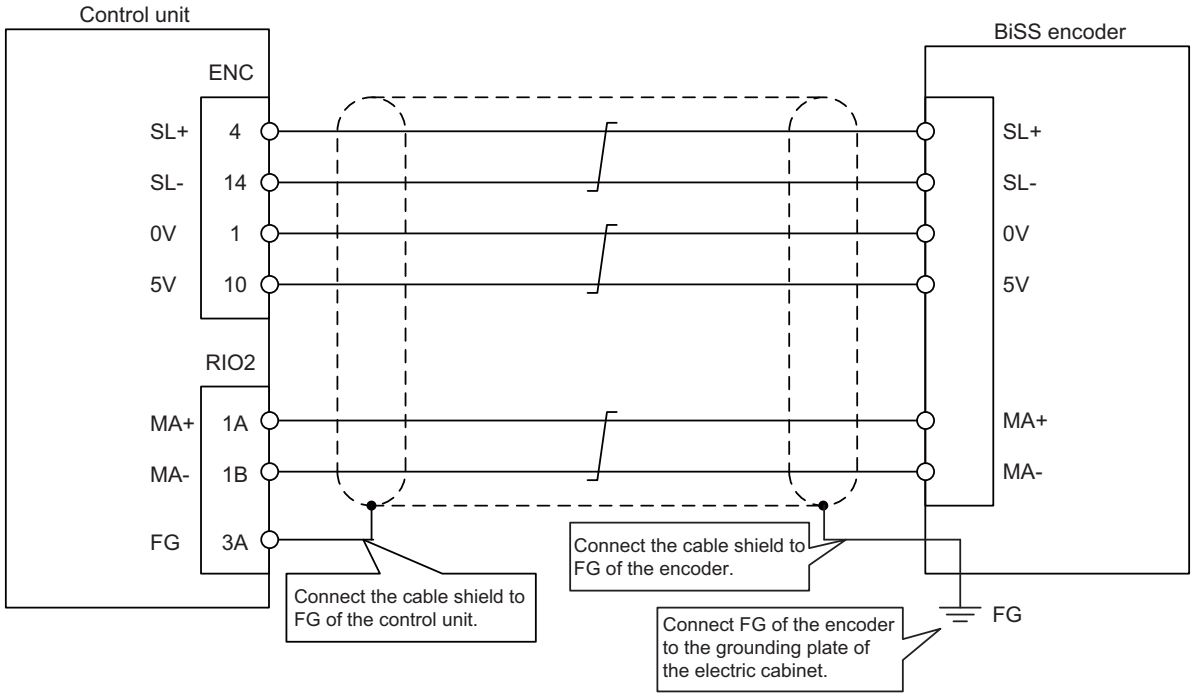
[Recommended wire material]

Wire material: HK-SB/20276XL Black LF 3P × 24AWG

Manufacturer: Taiyo Cabletec

[Related items]

Connector pin assignment: "General Specifications: Control Unit" (RIO1/RIO2 connector)



⚠ CAUTION

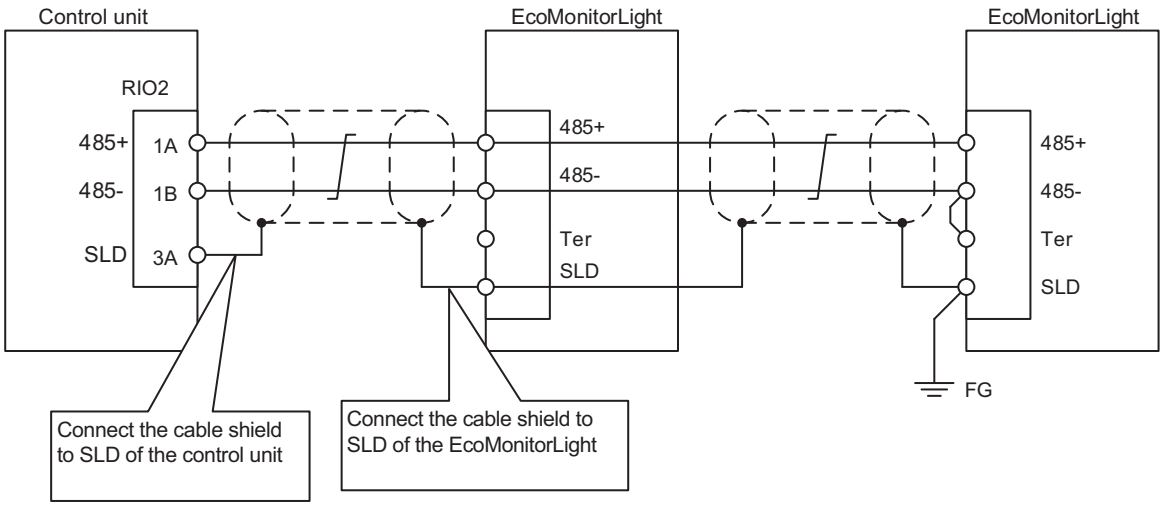
(1) Connect the cable to the designated connector. Incorrect connections could damage the device.

(2) Do not connect or disconnect the cables between units while the power is ON.

(3) Use shielded cable and ground it in order to reduce noise interference.

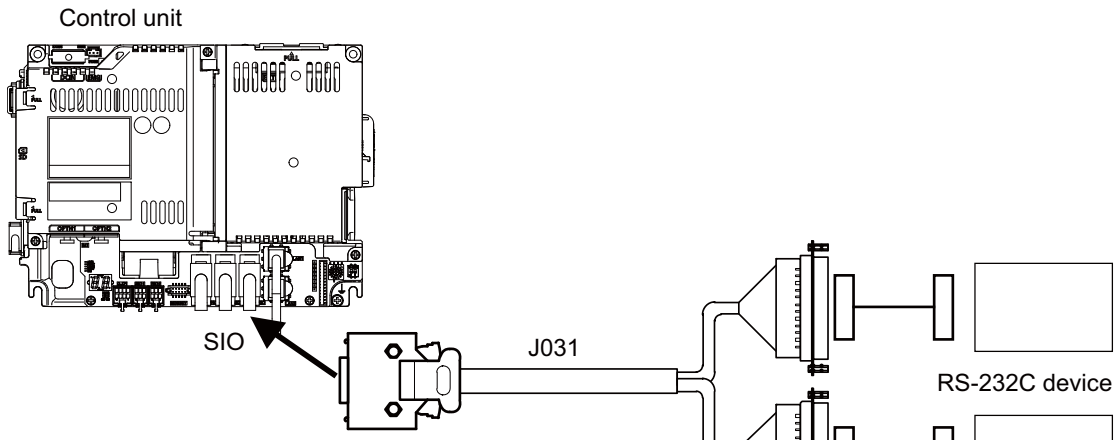
7.9 Connecting with EcoMonitorLight

Connect the EcoMonitorLight to the RIO2 connector of the control unit.



7.10 Connecting with RS-232C Device

Connect the RS-232C device to SIO connector of the control unit.



Cable name	1ch	2ch
J030 cable	○	
J031 cable	○	○

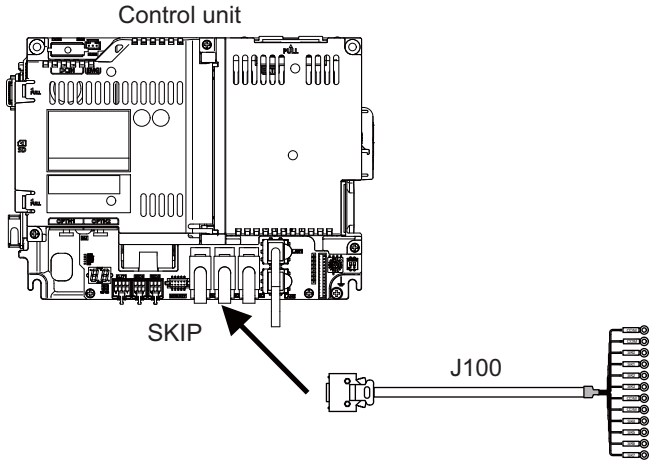
[Related items]

Cable connection drawing: "16.2.11 J030/J031 Cable"

Connector pin assignment: "4.3 Control Unit [M800VS]" (SIO connector)

7.11 Connecting with Skip Signal (Sensor)

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

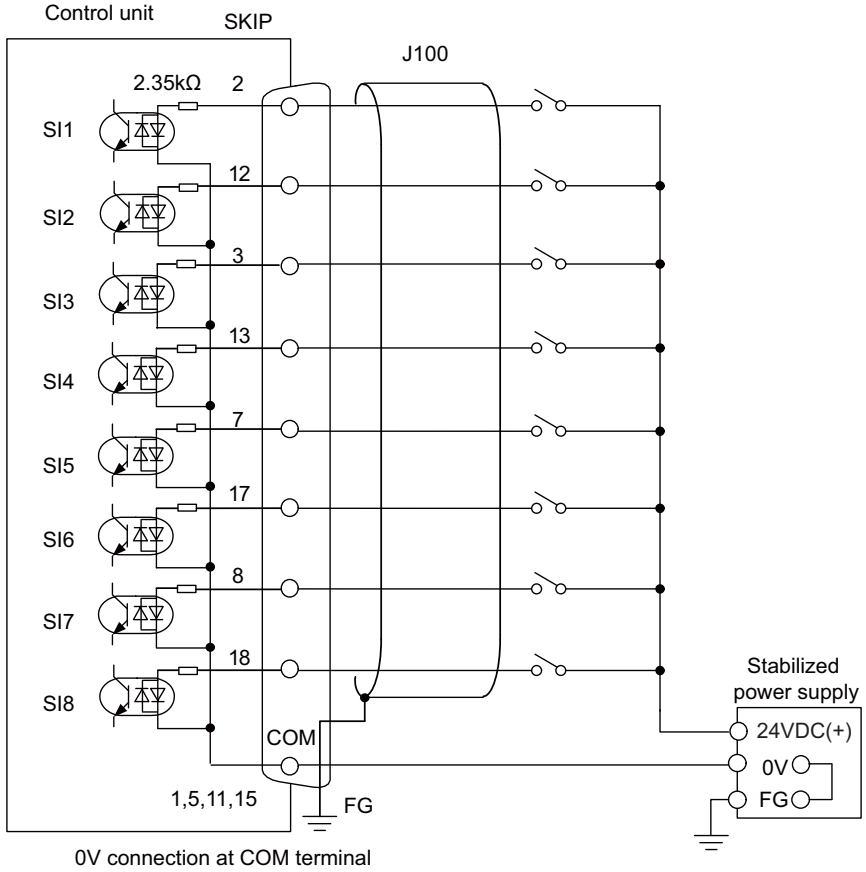


Note

(1) 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.

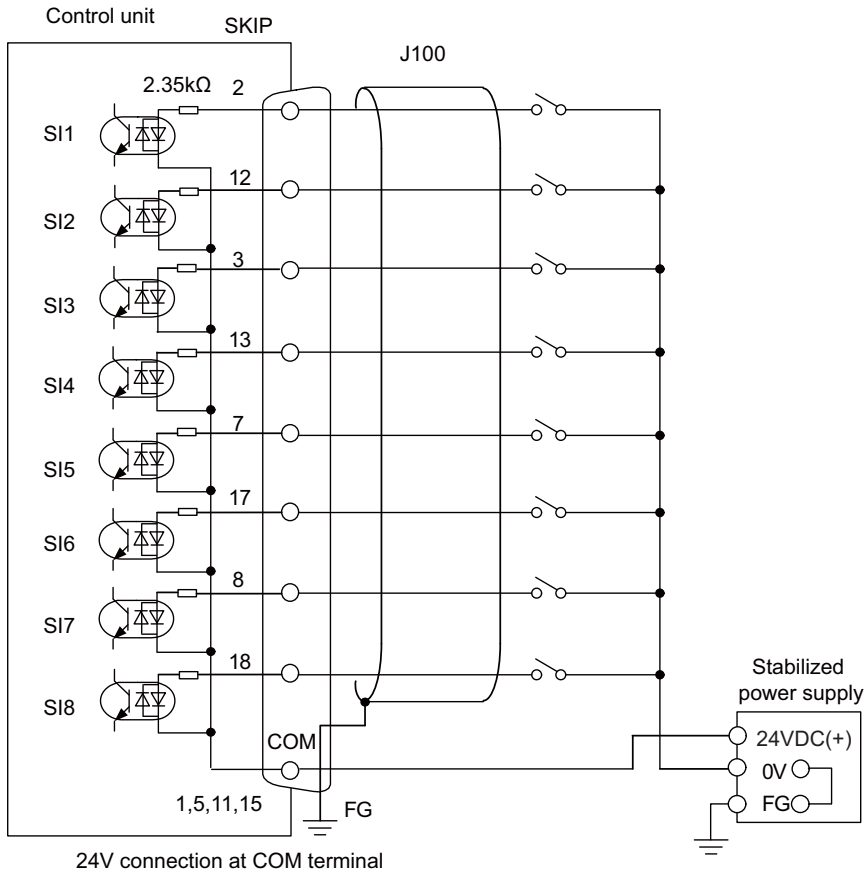
Connection of skip signal cable

■ 0 V connections at COM terminal



0V connection at COM terminal

■ 24 V connections at COM terminal



24V connection at COM terminal

Note

(1) NC recognizes input signals of 2 ms 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.).

(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.

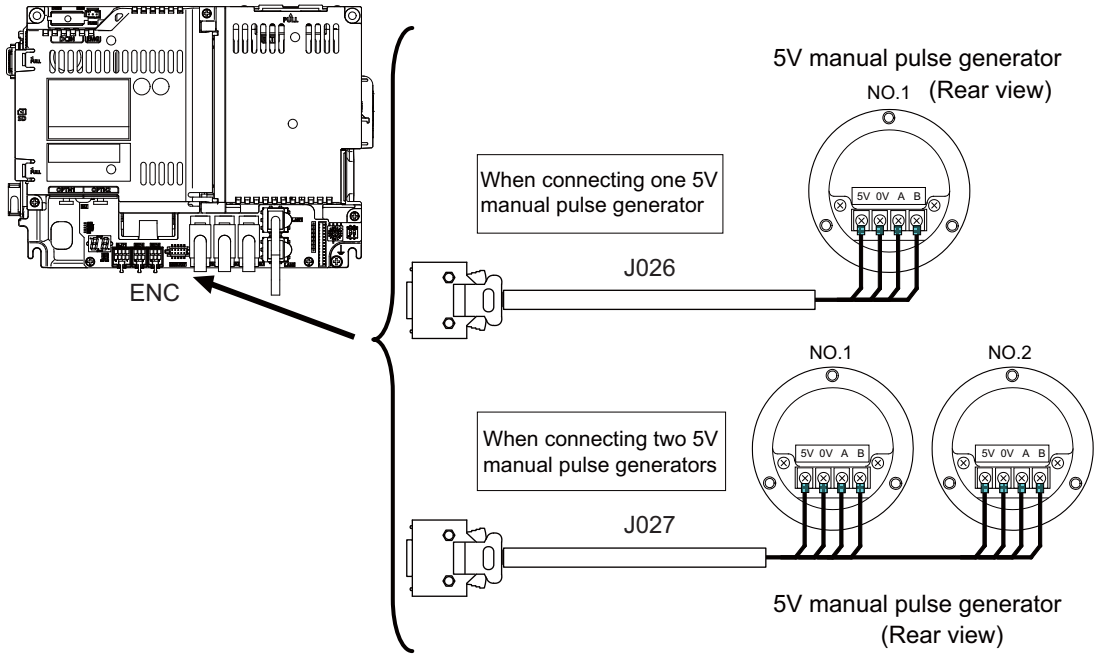
[Related items]

Cable connection drawing: "16.2.13 J100 Cable"

Connector pin assignment: "4.3 Control Unit [M800VS]" (SKIP connector)

7.12 Connecting with Manual Pulse Generator

Connect the 5 V power supply type manual pulse generator (2 ch) to ENC connector of the control unit.



[Related items]

Cable connection drawing: "16.2.10 J026/J027 Cable"

Connector pin assignment: "4.3 Control Unit [M800VS]" (ENC connector)

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

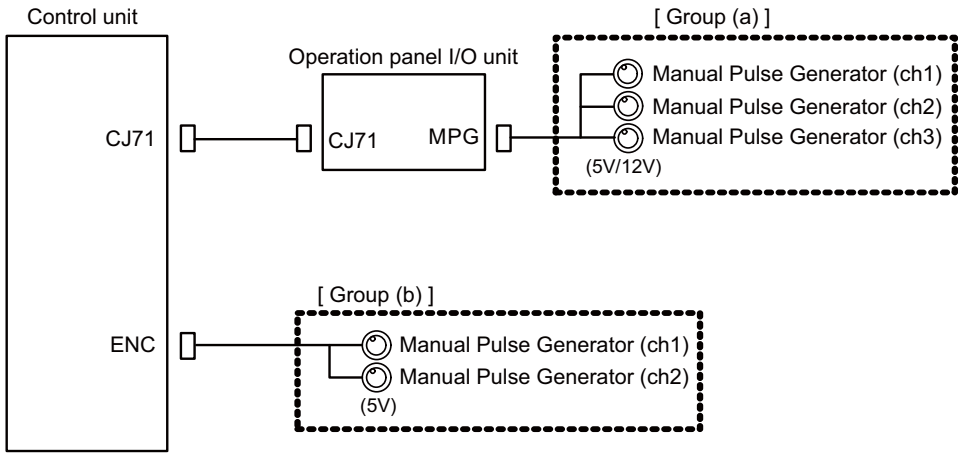
7.12.1 Handle Numbers

There are two types of the handle numbers assignment: automatic assignment and arbitrary assignment.

Automatic assignment

Set all the parameters from "#1395 H1_pno" (1st handle selection) to "#1397 H3_pno" (3rd handle selection) to "0000".
An example is shown below.
"ENC": Connector on control unit (two channels), "MPG": Connector on operation panel I/O unit (Up to three channels)

Operation panel I/O unit	Handle assignment		
	1st handle	2nd handle	3rd handle
Used	Group (a) ch1	Group (a) ch2	Group (a) ch3
Not used	Group (b) ch1	Group (b) ch2	

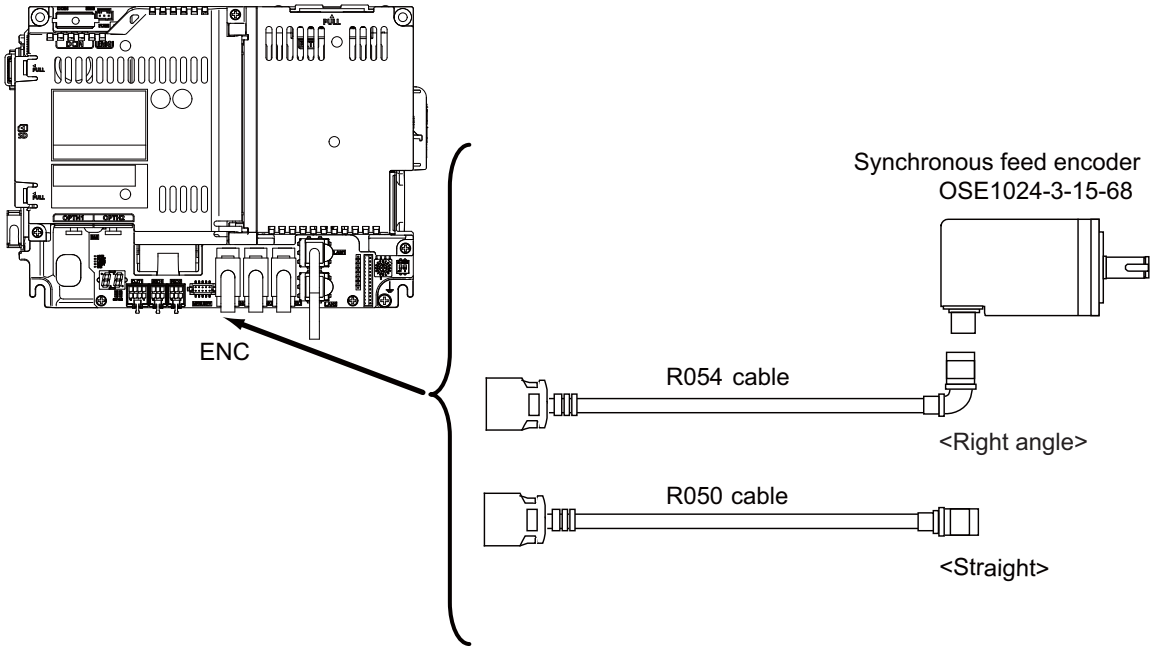


Arbitrary assignment

Assign the handle I/F arbitrary according to the setting values of the parameters "#1395 H1_pno" (1st handle selection) to "#1397 H3_pno" (3rd handle selection).

7.13 Connecting with Synchronous Feed Encoder

Connect the synchronous feed encode (1 ch) to ENC connector of the control unit.



[Related items]

Cable connection drawing: "16.2.1 FCUA-R050/R054 Cable"

Connector pin assignment: "4.3 Control Unit [M800VS]" (ENC connector)

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

7.14 Connecting I/O Device via Function Expansion Unit

Mount the function expansion unit onto the dedicated slot of the control unit.

Note

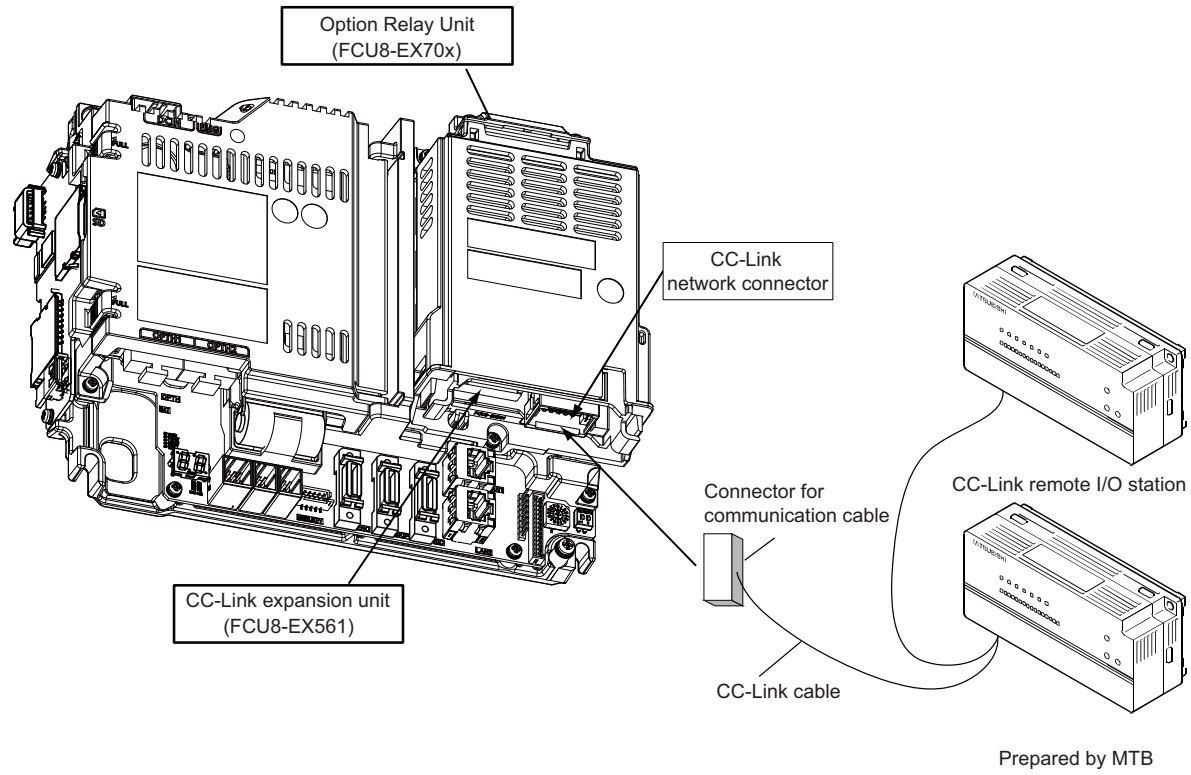
(1) To use the function expansion unit, the function expansion relay unit (FCU8-EX70x) is required.

(2) When the option relay unit FCU8-EX705 (for two slots) is connected, the available combinations of the communication function expansion units for which two slots can be used are as follows. Any combination not stated below cannot be used.
Either slot can be used.

Case 1	FCU8-EX561: CC-Link	FCU8-EX561: CC-Link
Case 2		FCU8-EX563: PROFIBUS-DP
Case 3		FCU8-EX564: CC-Link IE Field
Case 4		FCU8-EX565: EtherNet/IP
Case 5		FCU8-EX568: FL-net
Case 6		FCU8-EX569: CC-Link IE TSN
Case 7	FCU8-EX563: PROFIBUS-DP	FCU8-EX564: CC-Link IE Field
Case 8		FCU8-EX565: EtherNet/IP
Case 9		FCU8-EX568: FL-net
Case 10		FCU8-EX569: CC-Link IE TSN
Case 11	FCU8-EX564: CC-Link IE Field	FCU8-EX564: CC-Link IE Field
Case 12		FCU8-EX565: EtherNet/IP
Case 13		FCU8-EX568: FL-net
Case 14		FCU8-EX569: CC-Link IE TSN
Case 15	FCU8-EX565: EtherNet/IP	FCU8-EX568: FL-net
Case 16		FCU8-EX569: CC-Link IE TSN
Case 17	FCU8-EX568: FL-net	FCU8-EX569: CC-Link IE TSN

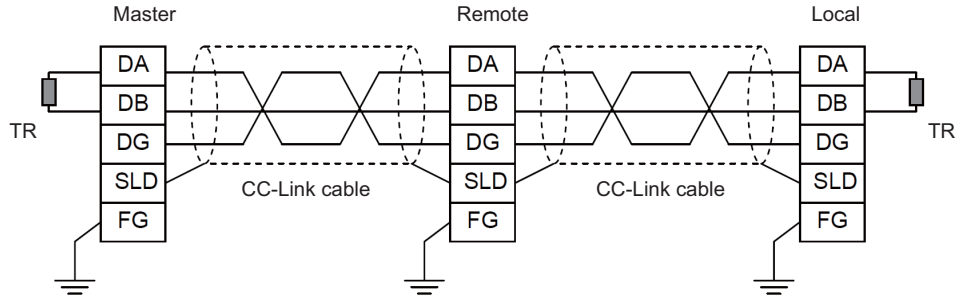
7.14.1 Connecting I/O Device via CC-Link

Use the dedicated communication cable for CC-Link network connection. Connect the communication cable to the communication connector of the CC-Link expansion unit.
The connector for the communication cable on the CC-Link expansion unit side is provided with the CC-Link expansion unit.
Use the Ver.1.10-compatible CC-Link dedicated cable as the communication cable. CC-Link system cannot provide its performance with the Ver.1.10-incompatible cable, because it may cause the restrictions such as the reduction of maximum cable length, increment of cable length between stations, and unusability of mixed wire materials from the different manufacturers.
Make sure to attach the terminator to the final station unit.



Terminator connection

Excerpt from "CC-Link cable wiring manual" (published by CC-Link partner association).

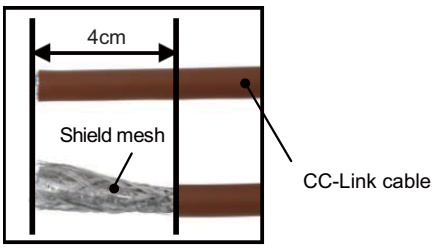


Note

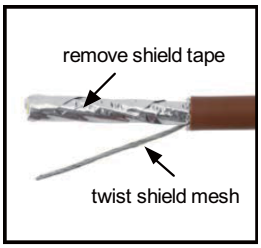
(1) Unless the CC-Link dedicated cable is used, CC-Link system does not guarantee its operation. For the specifications of the CC-Link dedicated cable and the inquiries, see the homepage of the CC-Link Partner Association (http://www.cc-link.org/). (Click "Product Information".)
(2) The value of the terminator that can be used for Ver.1.10-compatible CC-Link dedicated cable is 110 Ω.
(3) The terminator attaching to the communication connector on the CC-Link expansion unit side is the connector type which has built-in resistance. The communication connector has a two-level structure, however there is no difference in the specification attaching the cable to either one.

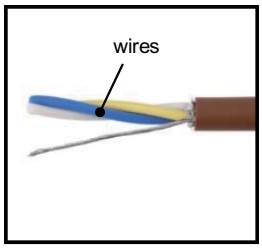
CC-Link cable connecting procedure

(1) Remove the sheath of the CC-Link cable about 4 cm.

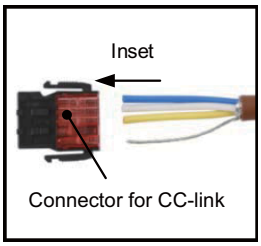


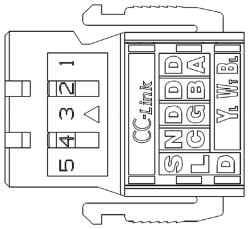
(2) Isolate the shield mesh and the wires covered with shield tape.
Remove the shield tape from wires.





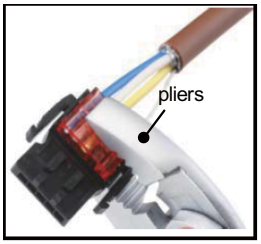
(3) Insert the wires to the connector for CC-Link as below.



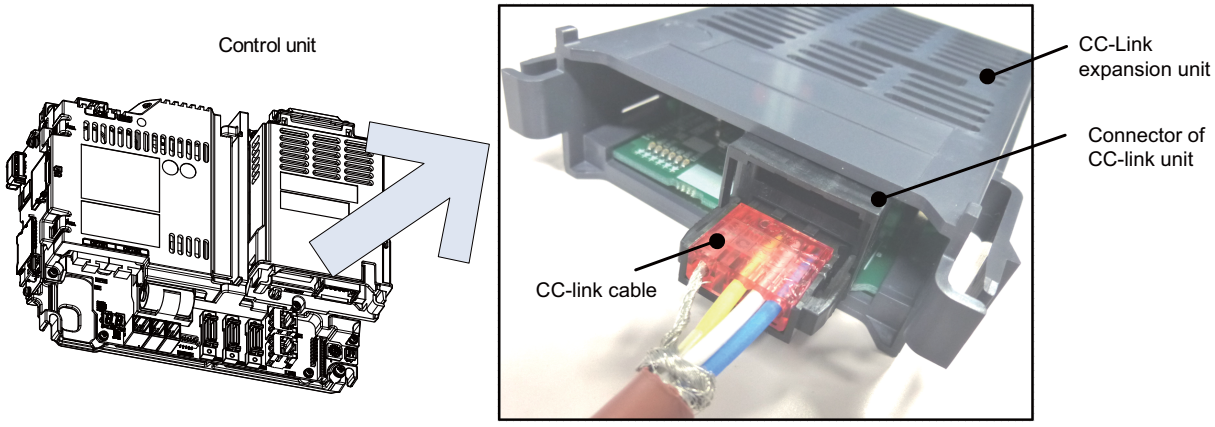


1 pin: Blue wire (cover notation: DA B)
2 pin: White wire (cover notation: DB W)
3 pin: Yellow wire (cover notation: DG Y)
4 pin: Not connected
5 pin: Shield wire (cover notation: SLD)

(4) Press the connector with the use of a pliers.
Check that the clamp point is flat to the connector.



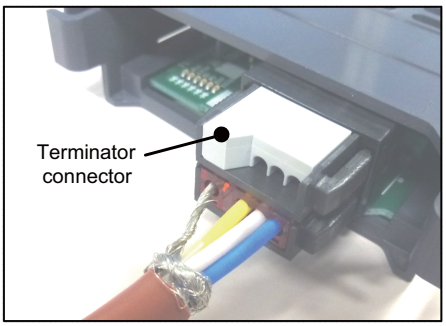
(5) Insert the CC-Link cable into the connector of CC-Link unit.



Note

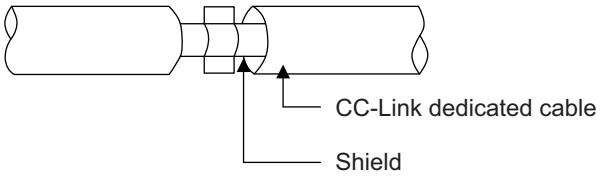
- Connector of CC-Link unit is two-step structure. It is not different even if attach the cable to whichever.

(6) Insert the terminator to the connector of CC-Link unit as in the figure.
In the final station, the terminator connector is required.



Countermeasures for CC-Link dedicated cable noise

When the CC-Link expansion unit is being used, expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



Refer to "4.4 Shield connection to ground" of "CC-Link cable wiring manual" (published by CC-Link partner association) for shield wire grounding for CC-Link dedicated cable.

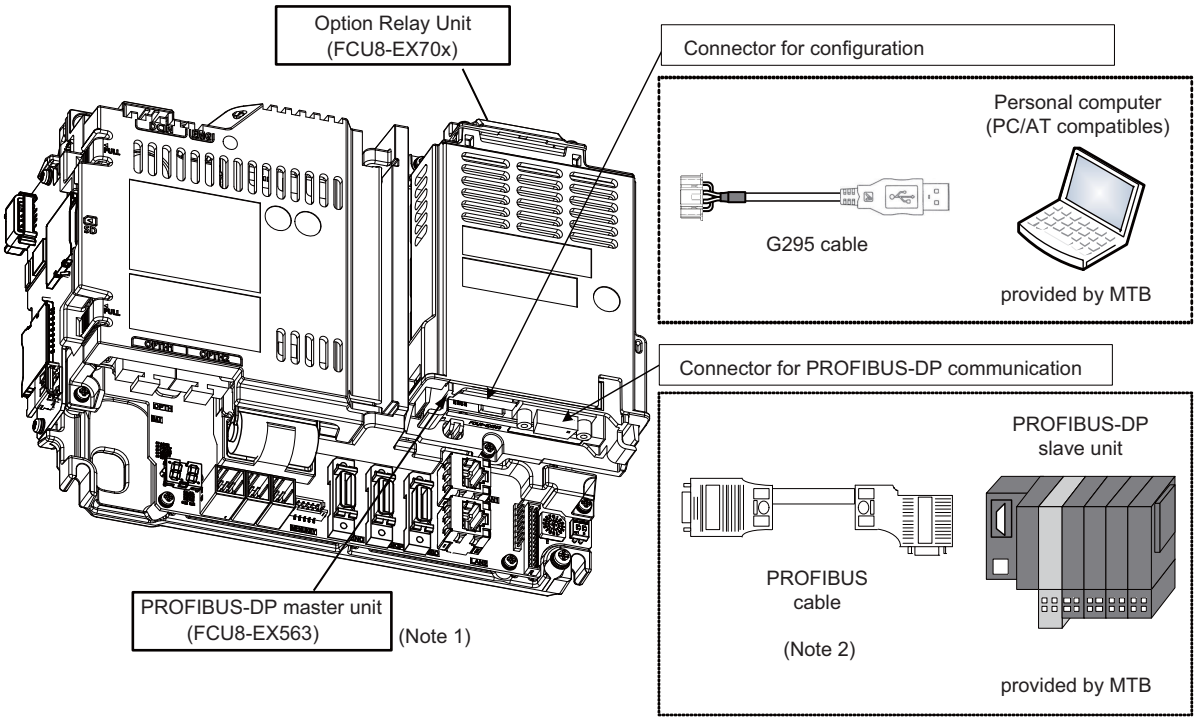
[Related items]
Shield clamp fitting: "42.6.1 Shield Clamp Fitting"

7.14.2 Connecting I/O Device via PROFIBUS-DP

The expansion unit FCU8-EX563 functions as a master station of PROFIBUS-DP. Use the PROFIBUS dedicated communication cable for connection to PROFIBUS-DP.
Make sure to attach the terminator to the final station unit of the network. There is a slide switch on the PROFIBUS communication cable for setting the terminator. Turning "ON" the slide switch means attaching the terminator. Make sure to turn "ON" the slide switch for the last station, and to turn "OFF" for other stations.
To use the expansion unit as a master station of PROFIBUS-DP, set the parameter with the configuration software (a tool for parameter setting). When setting the parameter, you need to use the cable G295 to connect the PROFIBUS-DP master unit to the configuration software- installed personal computer (PC/AT compatible machine).

Note

(1) The communication parameters, etc. at the time of setup are required to be backed up for maintenance.



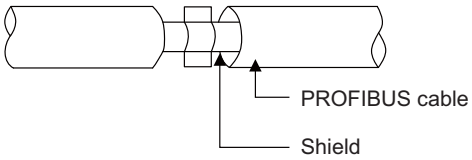
(*1) Use the rotary switch of PROFIBUS-DP master unit with the initial value "0".
(*2) The performance is not guaranteed unless the PROFIBUS dedicated cable is used. For the specifications of the PROFIBUS dedicated cable or for contact information for any inquiries, see the homepage of PROFIBUS & PROFINET International (PI) (http://www.profibus.com/).

Contact information for inquiries related to the configuration software is as follows.

Hilscher Gesellschaft fur Systemautomation mbH Rheinstrasse 78 D-65795 Hattersheim Germany TEL: +49-6190-9907-0 FAX: +49-6190-9907-50	Japanese distributor: Euro-Far East Co., Ltd Lilas Nogisaka Bldg. #901 Minami Aoyama 1-15-18 Minato-ku, Tokyo 107-0062 JAPAN TEL: 03-3470-8769 FAX: 03-3478-8648

Countermeasures for PROFIBUS cable noise

When the PROFIBUS-DP master unit is being used, expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



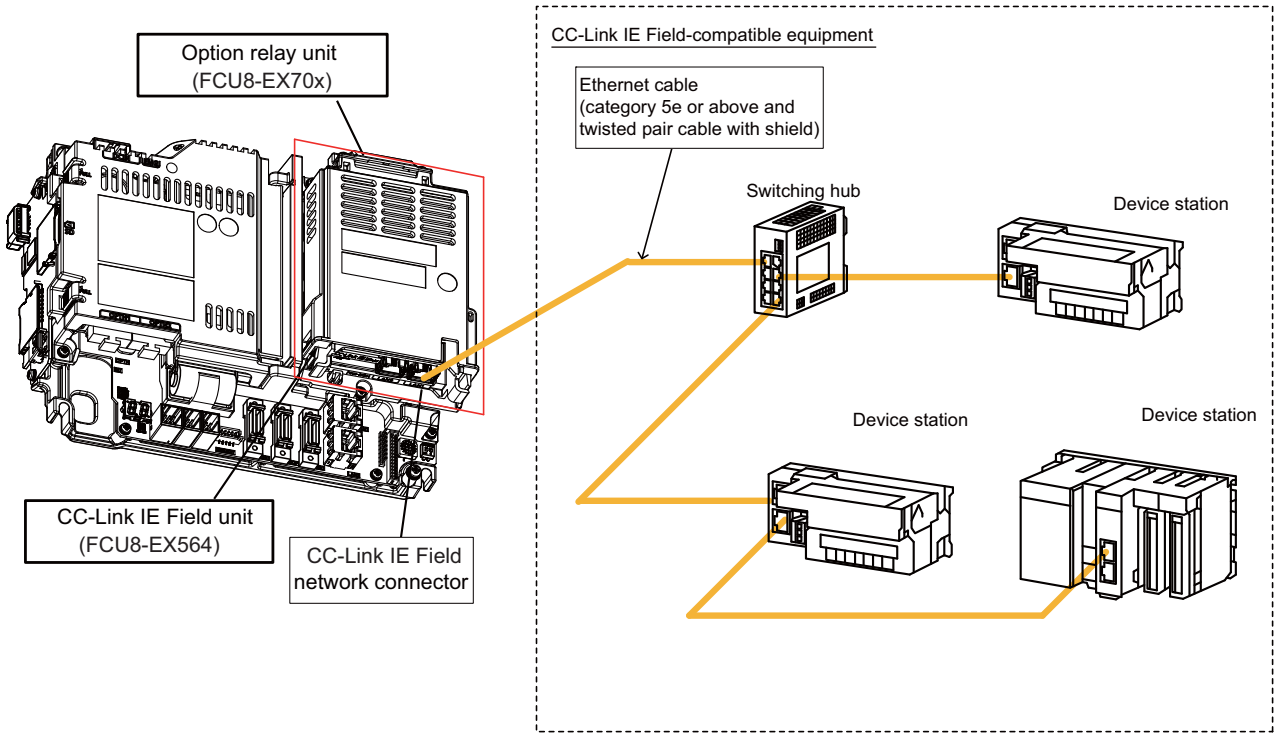
When you cannot use the shield clamp, install a ferrite core as a substitute to PROFIBUS cable (near the expansion unit). (Recommended model name: ZCAT2032-0930(-BK))

[Related items]

Shield Clamp Fittings: "42.6.1 Shield Clamp Fitting"
Ferrite Core: "42.6.2 Ferrite Core"

7.14.3 Connecting I/O Device via CC-Link IE Field

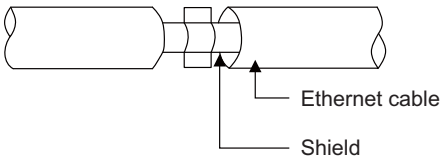
The expansion unit FCU8-EX564 functions as a master station or device station (local station) of CC-Link IE Field. Connect the CC-Link IE Field-compatible equipment with an Ethernet cable (category 5e or above and twisted pair shield cable). For details, refer to "CC-Link IE Field (Master/local) Specifications manual" (BNP-C3072-283).



(* Prepared by MTB)

Countermeasures for Ethernet cable noise

When the CC-Link IE Field unit is being used, expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



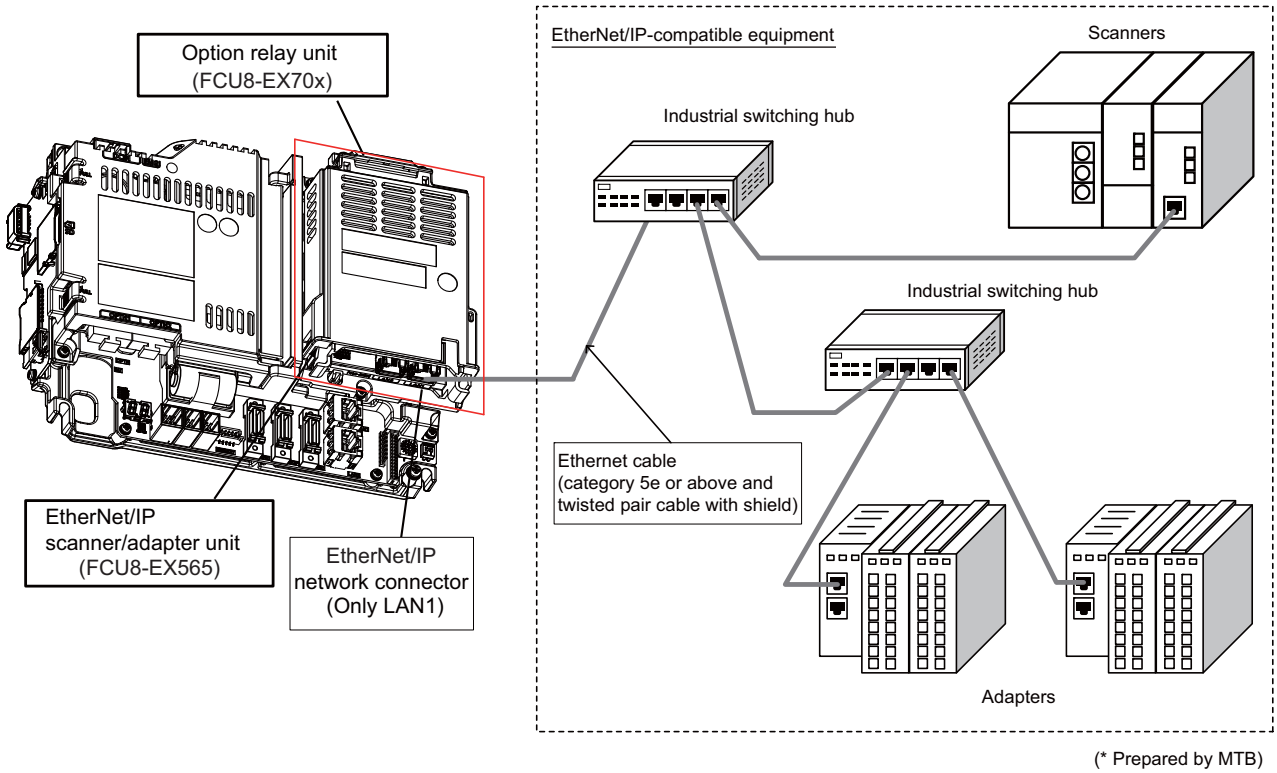
When you cannot use the shield clamp, install a ferrite core as a substitute to ethernet cable (near the expansion unit). (Recommended model name: ZCAT2032-0930(-BK))

[Related items]

Shield Clamp Fittings: "42.6.1 Shield Clamp Fitting"
Ferrite Core: "42.6.2 Ferrite Core"

7.14.4 Connecting I/O Device via EtherNet/IP

The expansion unit FCU8-EX565 functions as a scanner or an adapter of EtherNet/IP. Connect the EtherNet/IP-compatible equipment with an Ethernet cable (category 5e or above and twisted pair shield cable).
For details, refer to "EtherNet/IP Specifications manual" (BNP-C3095-263).

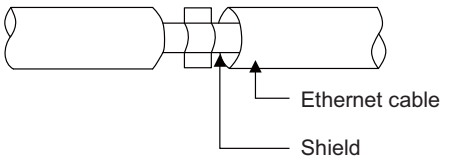


Note

(1) EtherNet/IP scanner/adapter unit is equipped with two RJ-45 connectors (LAN1 and LAN2); however, the function of EtherNet/IP is available only on LAN1. Do not connect any cable to LAN2 port.

Countermeasures for Ethernet cable noise

When the EtherNet/IP scanner/adapter unit is being used, expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.

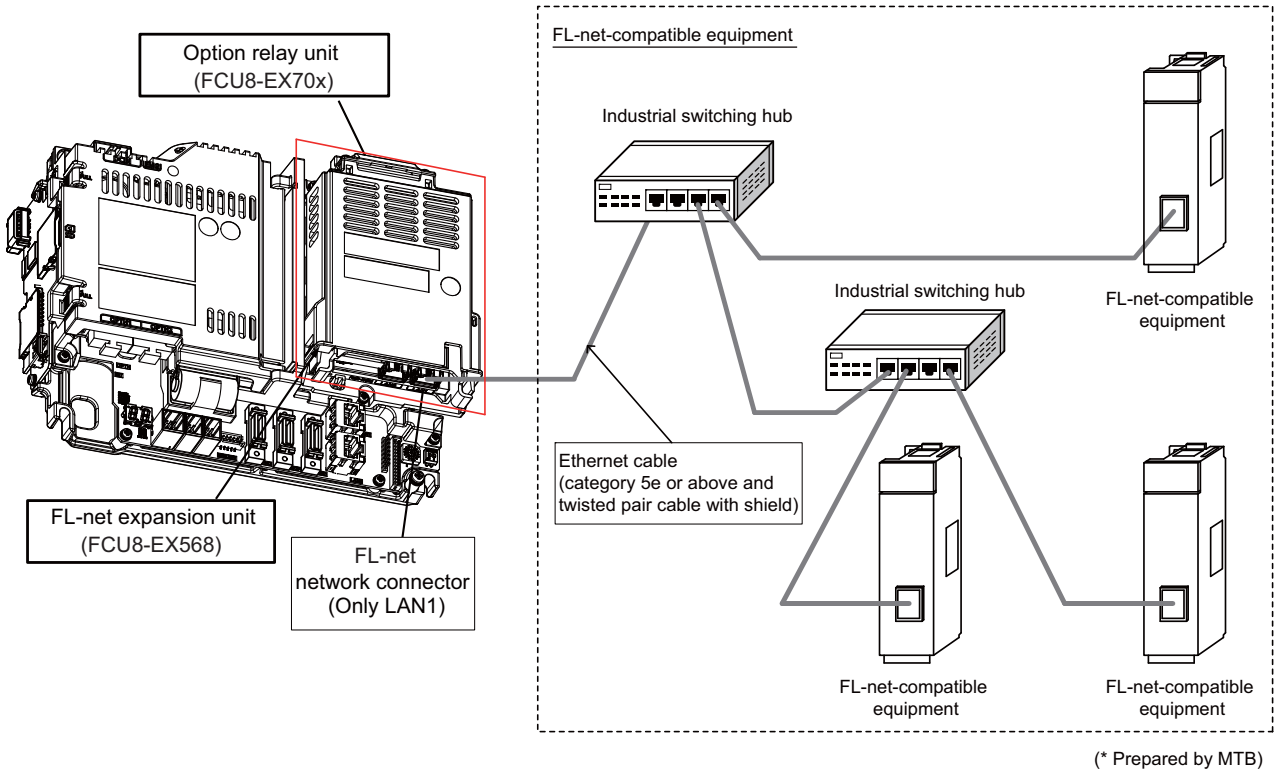


When you cannot use the shield clamp, install a ferrite core as a substitute to ethernet cable (near the expansion unit).
(Recommended model name: ZCAT2032-0930(-BK))

[Related items]
Shield Clamp Fittings: "42.6.1 Shield Clamp Fitting"
Ferrite Core: "42.6.2 Ferrite Core"

7.14.5 Connecting I/O Device via FL-net

The expansion unit FCU8-EX568 functions as a node of FL-net. Connect the FL-net-compatible equipment with an ethernet cable (category 5e or above and twisted pair shield cable).
For details, refer to the "M800/M80 Series FL-net Specifications Manual".

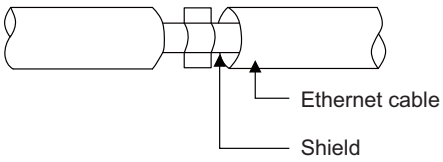


Note

(1) FL-net expansion unit is equipped with two RJ-45 connectors (LAN1 and LAN2); however, the function of FL-net is available only on LAN1. Do not connect any cable to LAN2 port.

Countermeasures for Ethernet cable noise

When the FL-net expansion unit is being used, expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.

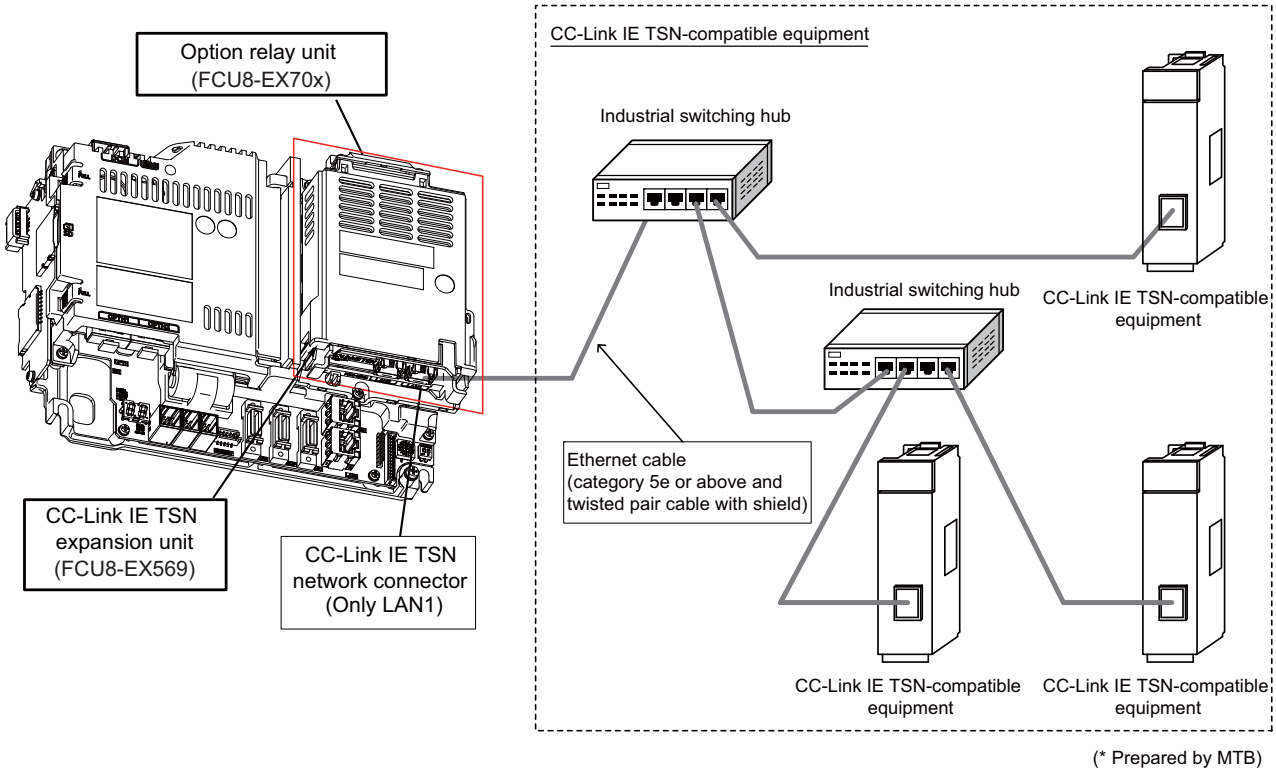


When you cannot use the shield clamp, install a ferrite core as a substitute to ethernet cable (near the expansion unit).
(Recommended model name: ZCAT2032-0930(-BK))

[Related items]
Shield Clamp Fittings: "42.6.1 Shield Clamp Fitting"
Ferrite Core: "42.6.2 Ferrite Core"

7.14.6 Connecting I/O Device via CC-Link IE TSN

The expansion unit FCU8-EX569 functions as a CC-Link IE TSN device station (local station). Connect the CC-Link IE TSN-compatible equipment with an Ethernet cable (category 5e or above and twisted pair shield cable).
For details, refer to "CC-Link IE TSN (Remote Station) Specifications manual" (BNP-C3095-399).

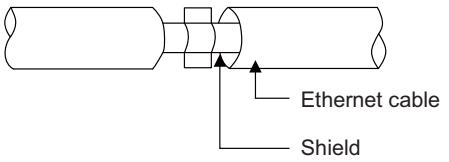


Note

(1) CC-Link IE TSN expansion unit is equipped with two RJ-45 connectors (LAN1 and LAN2); however, the function of CC-Link IE TSN is available only on LAN1. Do not connect any cable to LAN2 port.

Countermeasures for Ethernet cable noise

When the CC-Link IE TSN expansion unit is being used, expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



When you cannot use the shield clamp, install a ferrite core as a substitute to ethernet cable (near the expansion unit).
(Recommended model name: ZCAT2032-0930(-BK))

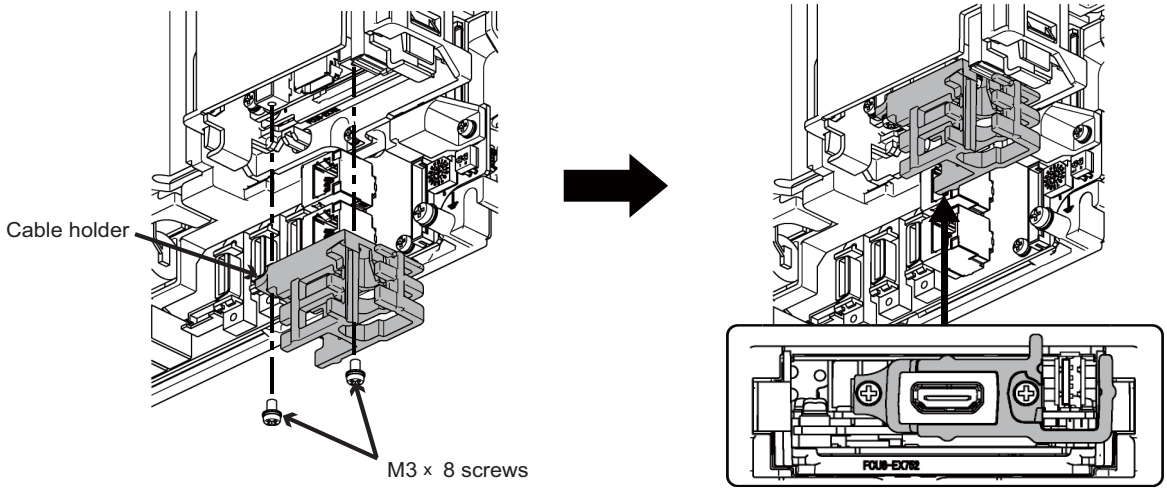
[Related items]
Shield Clamp Fittings: "42.6.1 Shield Clamp Fitting"
Ferrite Core: "42.6.2 Ferrite Core"

7.14.7 Connecting with IPC via Image Input Expansion

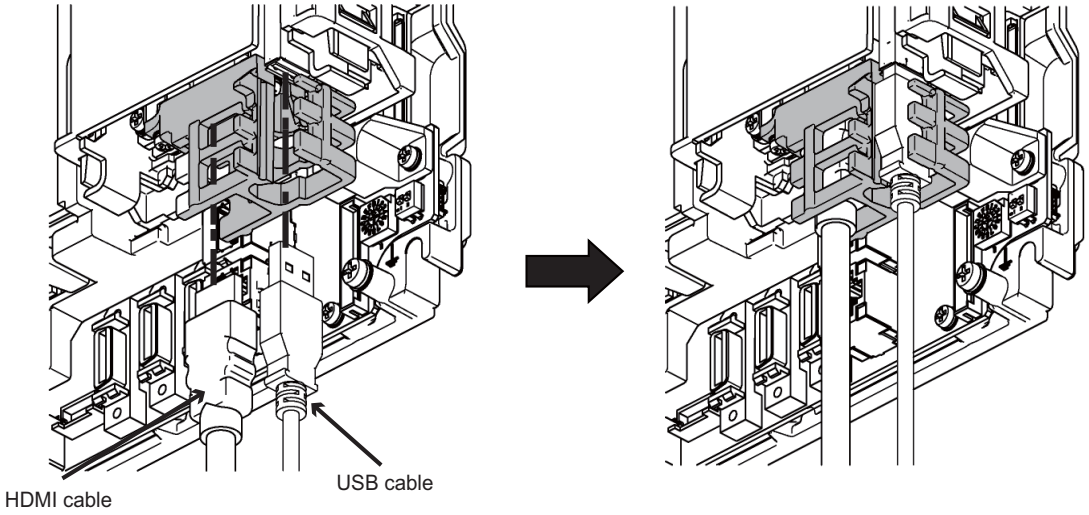
Commercially available HDMI cable and USB cable are used to connect the image input expansion unit and IPC (industrial PC). Unless the image input expansion unit is connected with IPC, the HDMI cable and USB cable do not need to be connected.
When the HDMI cable and USB cable are connected, use jigs to fix them to the unit. The jigs are provided with the image input expansion unit.

Connection method of HDMI cable and USB cable with image input expansion unit

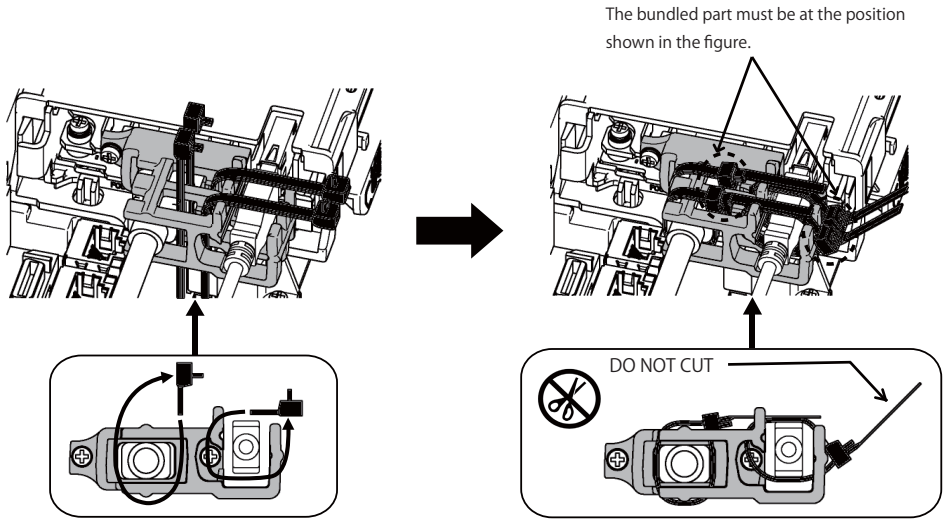
(1) Fix the cable holder with M3 x 8 pan head screws.



(2) Connect the HDMI cable and USB cable.



(3) Tighten the cable ties at four points.
(The cable ties are reusable. Do not cut the cable ties because they can be used for re-bundling.)

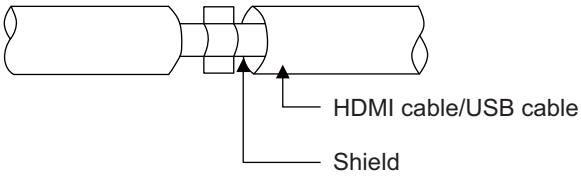


Note

(1) If the cables are not bundled with the cable ties, it may cause them to disconnect.
(2) If the bundled part is not at the position shown in the figure, there may be an interference with cables of other units, which may result in breakage of the units or the cables.

Countermeasures for HDMI cable/USB cable noise

When the image input expansion unit is being used, expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.
A malfunction of IPC may occur due to wraparound noise. Use the clamp respectively on the image input expansion unit side and on the IPC side.



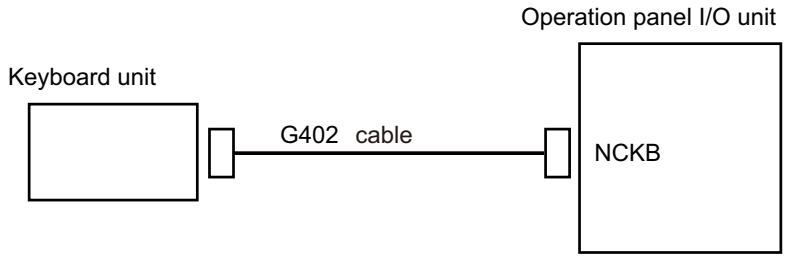
[Related items]
Shield Clamp Fittings: "42.6.1 Shield Clamp Fitting"

8

Connection of Keyboard Unit

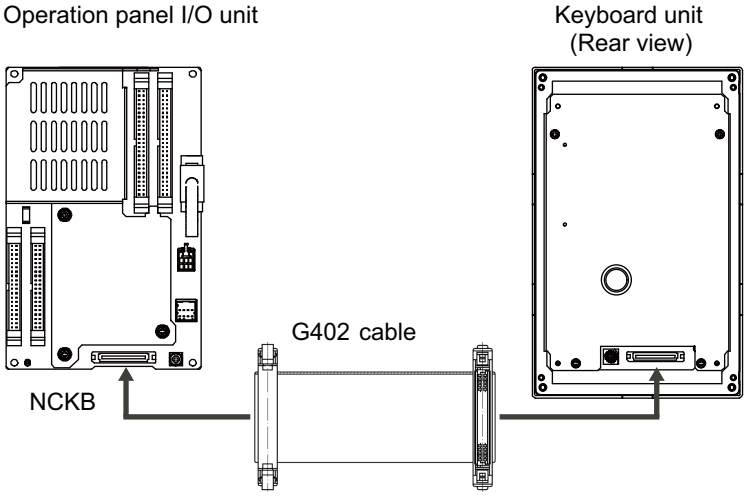
The method for connecting to each unit and device from the keyboard unit is briefly explained in this chapter.

8.1 Keyboard Unit Connection System Drawing



8.2 Connecting with Operation Panel I/O Unit

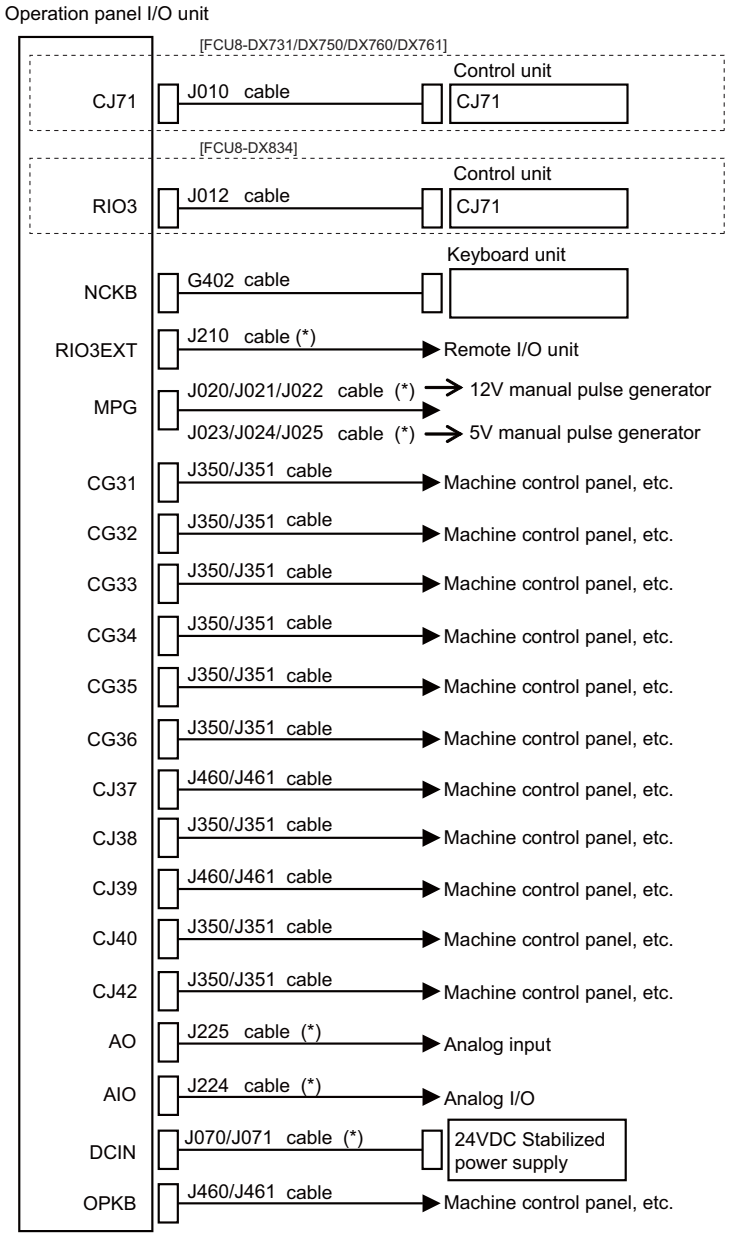
Connect the operation panel I/O unit to connector of the keyboard unit.



9

Connection of Operation Panel I/O Unit

9.1 Operation Panel I/O Unit Connection System Drawing

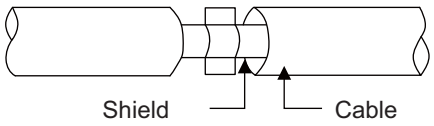


Note

(1) For connection to the machine operation panel, refer to the chapter "14 Connection of Machine Operation Panel".

(2) The section indicated with asterisk (*) indicates cable to be wired outside the operation panel.
Since the cable could be affected by the exogenous noise depending on the environment, the following noise countermeasure is recommended.

Expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



When you cannot use the shield clamp, install a ferrite core as a substitute.

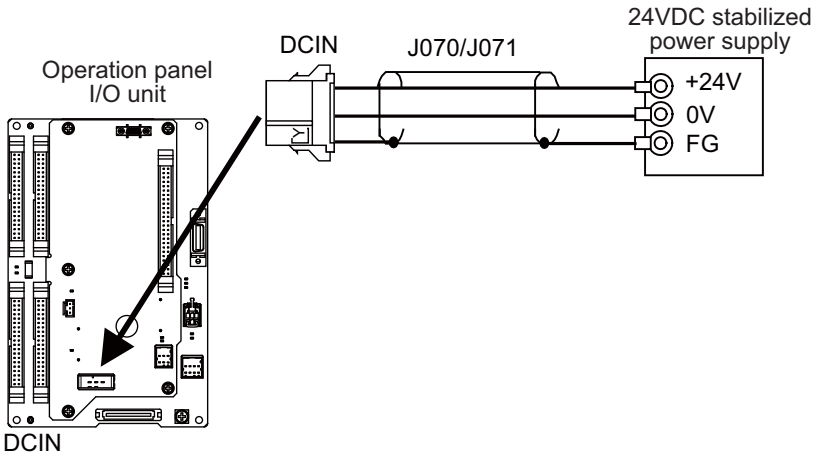
<Related item>

Shield clamp fitting: "42.6.1 Shield Clamp Fitting"

Ferrite core: "42.6.2 Ferrite Core"

9.2 Connecting with Power Supply

Connect 24 VDC power supply (general-purpose stabilized power supply) to the operation panel I/O unit.



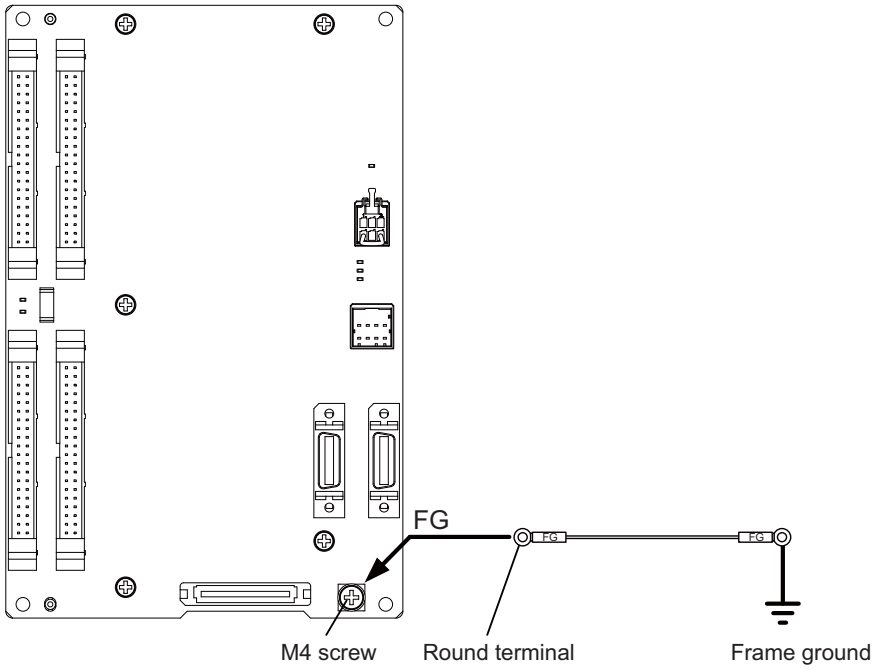
[Related items]

Cable connection drawing: "16.2.12 J070/J071 Cable"

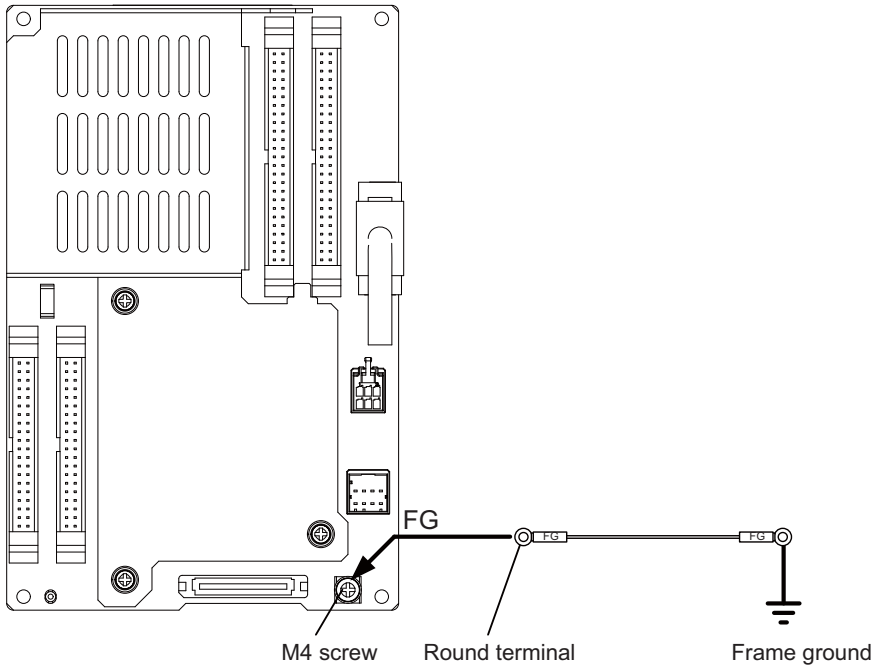
Connector pin assignment: "4.8 Operation Panel I/O Unit" (DCIN connector)

9.3 Connecting with Frame Ground

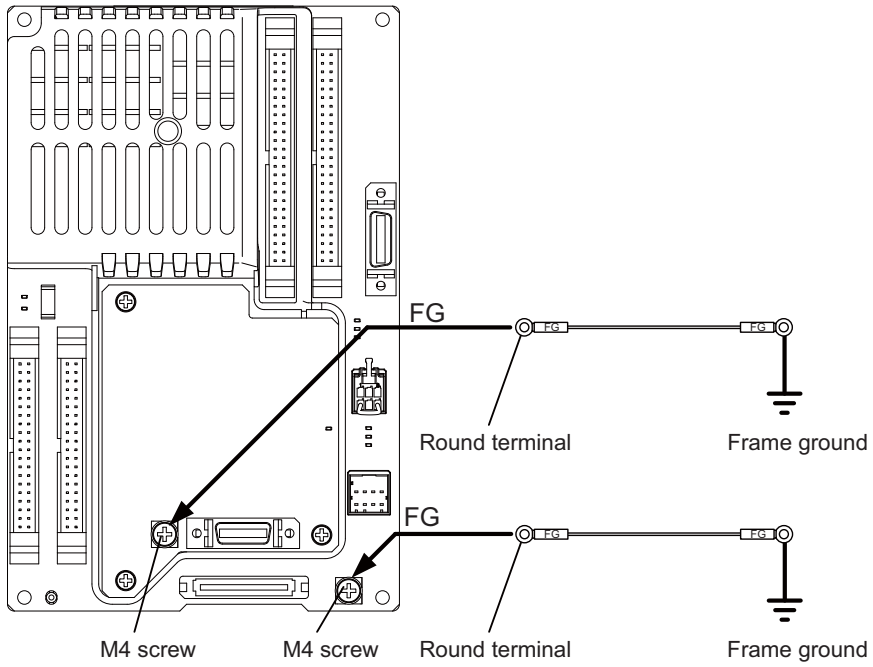
FCU8-DX731



FCU8-DX750/FCU8-DX760

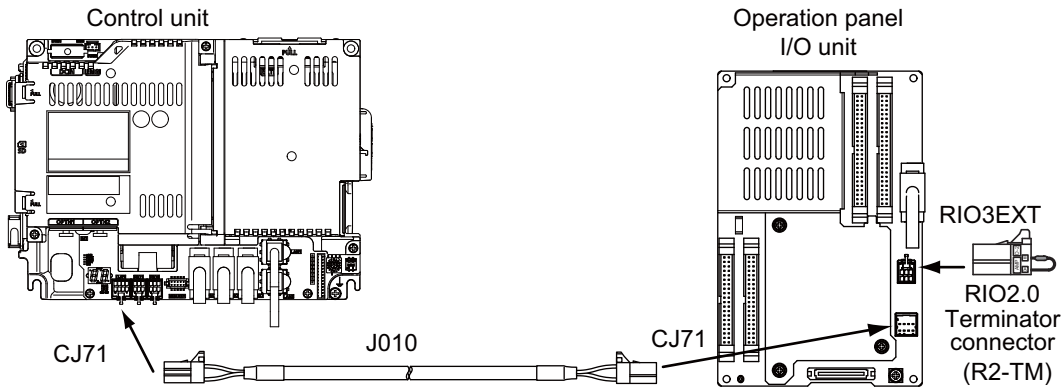


FCU8-DX761


FG
FG
FG
Round terminal
Frame ground
FG
FG
FG
M4 screw
M4 screw
Round terminal
Frame ground

9.4 Connecting with Control Unit

Connect the control unit to CJ71 connector of the operation panel I/O unit.



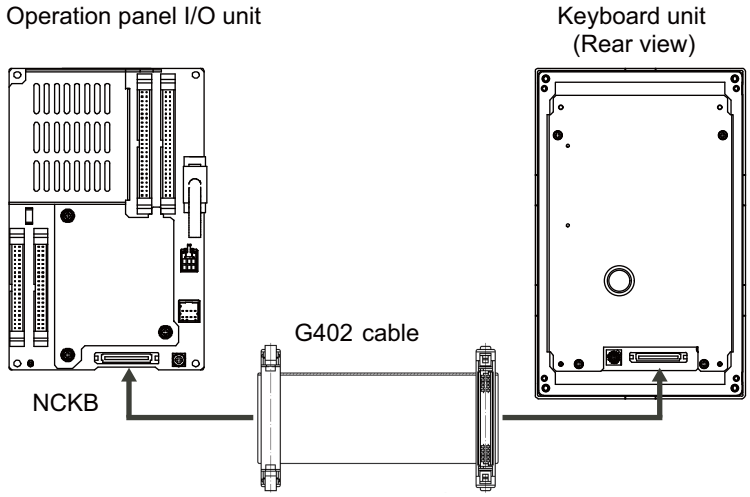
[Related items]

Cable connection drawing: "16.2.6 J010 Cable"

Connector pin assignment: "4.8 Operation Panel I/O Unit" (CJ71 connector)

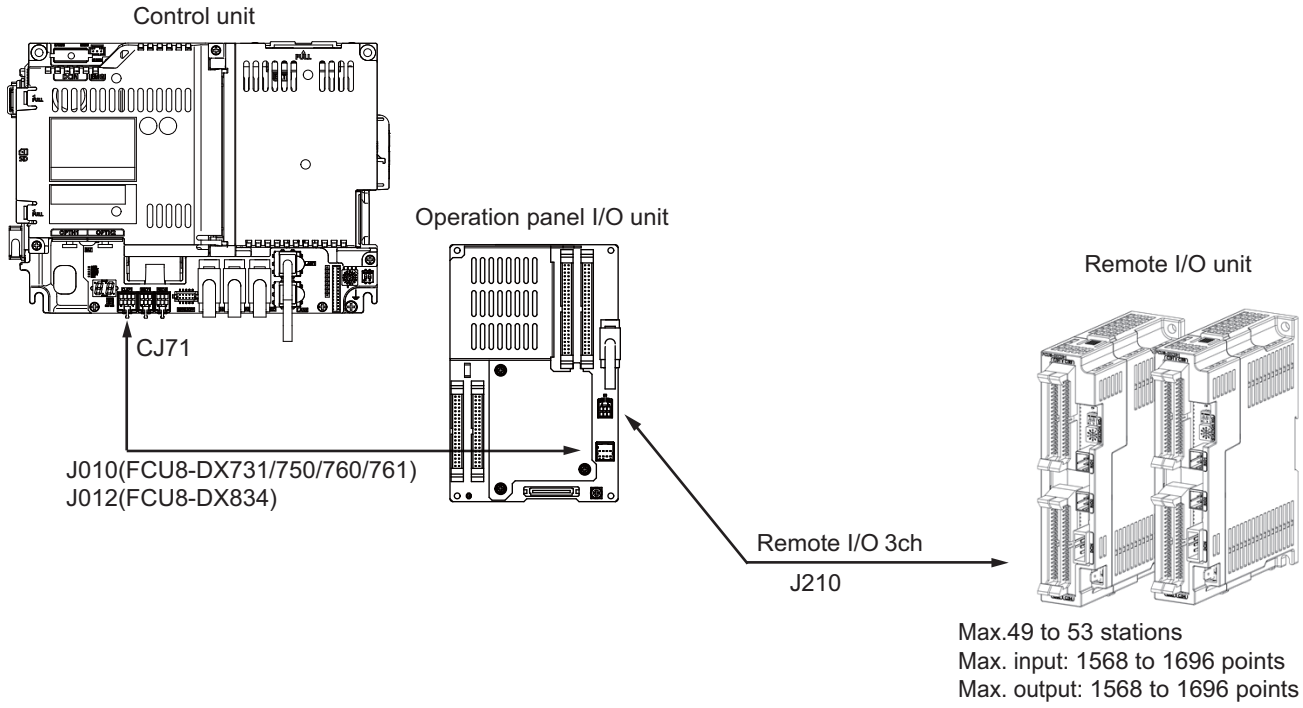
9.5 Connecting with Keyboard Unit

Connect the keyboard unit to NCKB connector of the operation panel I/O unit.



9.6 Connecting with Remote I/O Unit

Connect the remote I/O unit to RIO3EXT connector of the operation panel I/O unit.



Operation panel I/O unit	RIO occupied stations
FCU8-DX731	1, 3, 7 to 12, 20 to 22
FCU8-DX750	1 to 3, 7 to 12, 20 to 22
FCU8-DX760	1 to 4, 7 to 12, 20 to 22
FCU8-DX761	1 to 5, 7 to 12, 20 to 22
FCU8-DX834	1 to 4, 7 to 14, 20 to 22

[Related items]

Cable connection drawing: "16.2.16 J210 Cable"

Connector pin assignment: "4.8 Operation Panel I/O Unit" (RIO3EXT connector)

Note

(1) The maximum connectable number of remote I/O units is 32.

9.7 Connecting with Manual Pulse Generator (MPG)

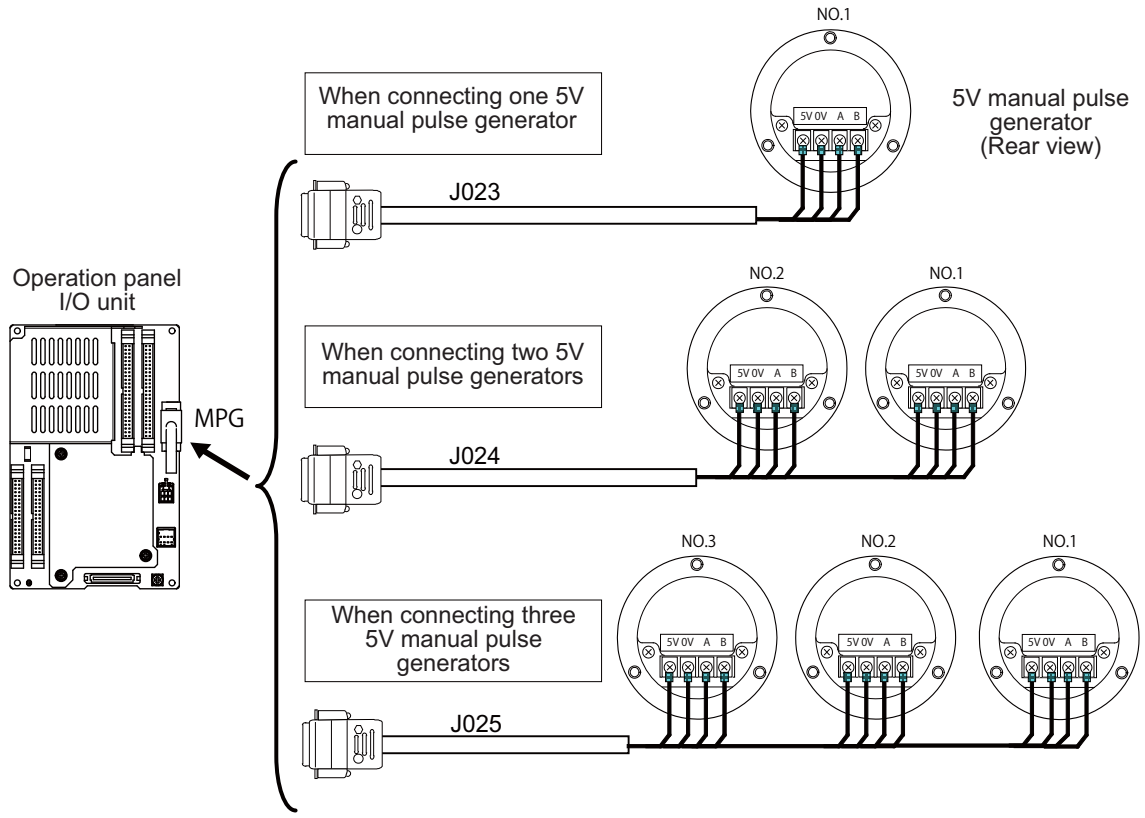
Connect the manual pulse generator to MPG connector of the operation panel I/O unit.
Both 5 V power supply type (UFO-01-2Z9) and 12 V power supply type (HD60C) manual pulse generator can be used. Take the maximum cable length, etc. into consideration when selecting.

Note

(1) Set one of the following parameters which is suitable for your manual pulse generator.
- 5 V manual pulse generator (UFO-01-2Z9): #1240 set12/bit0 = 1 (100 pulse/rev)
- 12 V manual pulse generator (HD60C): #1240 set12/bit0 = 0 (25 pulses/rev)

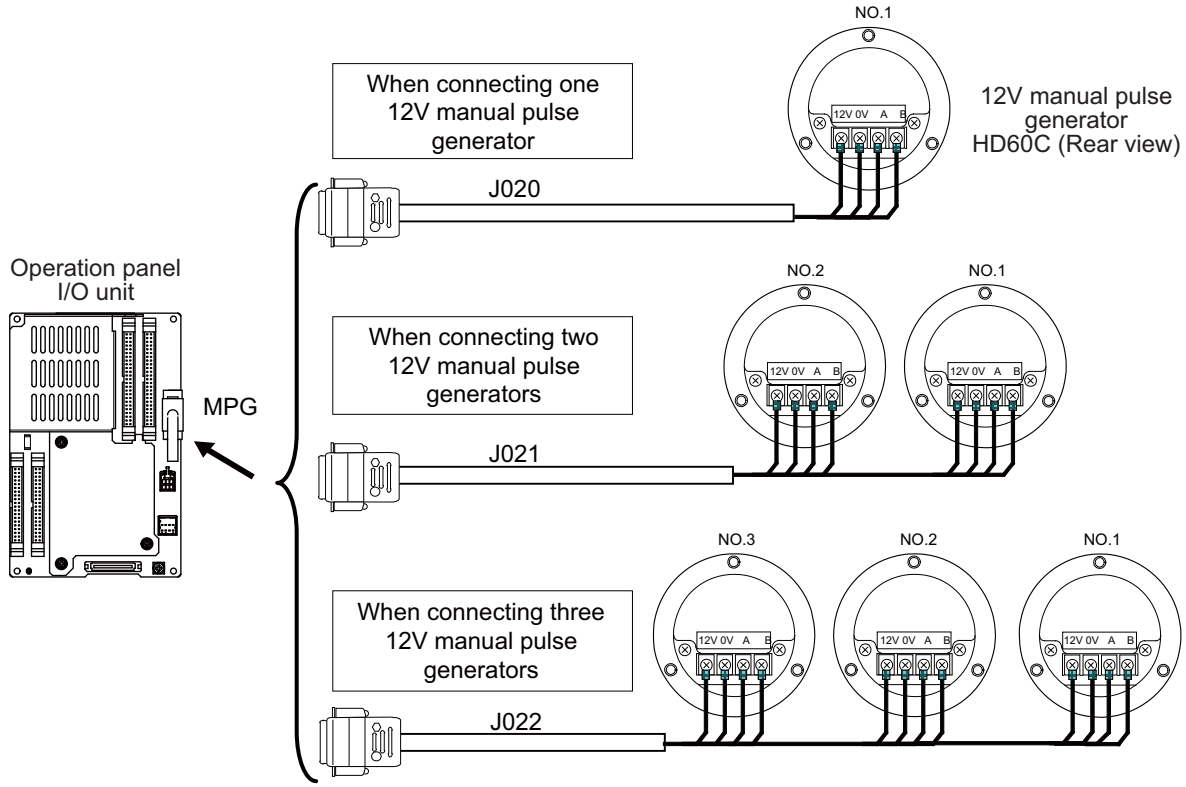
Connecting with 5 V manual pulse generator (maximum cable length: 20 m)

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



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

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



Note

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

[Related items]

Cable connection drawings: "16.2.8 J020/J021/J022 Cable", "16.2.9 J023/J024/J025 Cable"
Connector pin assignment: "4.8 Operation Panel I/O Unit" (MPG connector)

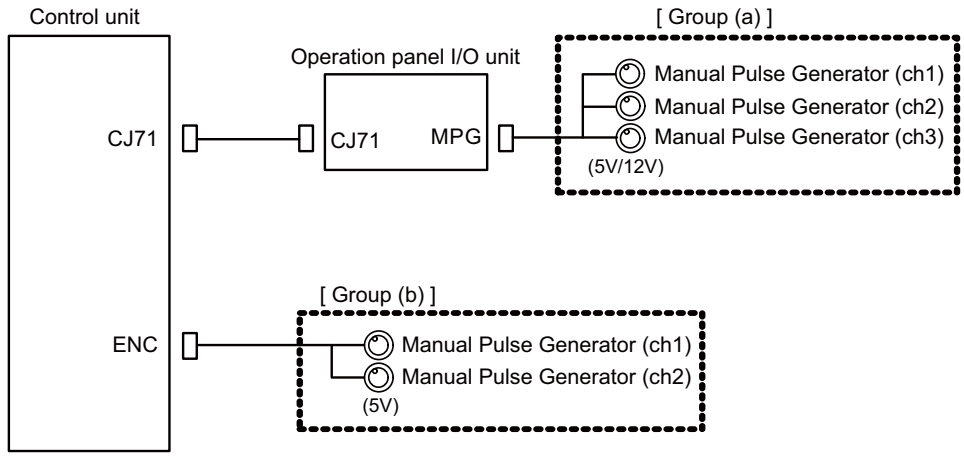
9.7.1 Handle Numbers

There are two types of the handle numbers assignment: automatic assignment and arbitrary assignment.

Automatic assignment

Set all the parameters from "#1395 H1_pno" (1st handle selection) to "#1397 H3_pno" (3rd handle selection) to "0000".
An example is shown below.
"ENC": Connector on control unit (two channels), "MPG": Connector on operation panel I/O unit (Up to three channels)

Operation panel I/O unit	Handle assignment		
	1st handle	2nd handle	3rd handle
Used	Group (a) ch1	Group (a) ch2	Group (a) ch3
Not used	Group (b) ch1	Group (b) ch2	



Arbitrary assignment

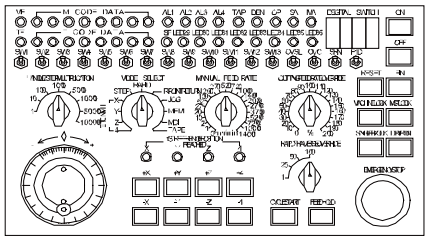
Assign the handle I/F arbitrary according to the setting values of the parameters "#1395 H1_pno" (1st handle selection) to "#1397 H3_pno" (3rd handle selection).

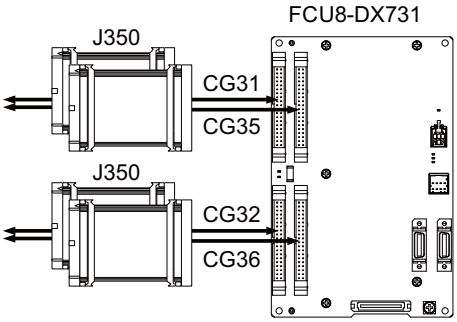
9.8 Connecting with Machine Operation Panel

Connect the machine operation panel to CG31/CG32/CG35/CG36/CJ37/CJ38/CJ39/CJ40/CJ42/OPKB connector of the operation panel I/O unit.

FCU8-DX731

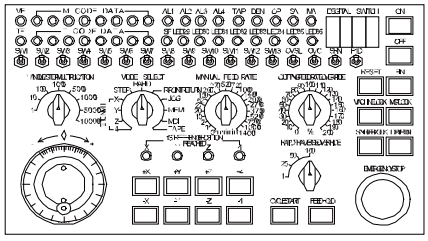
Machine operation panel (example)

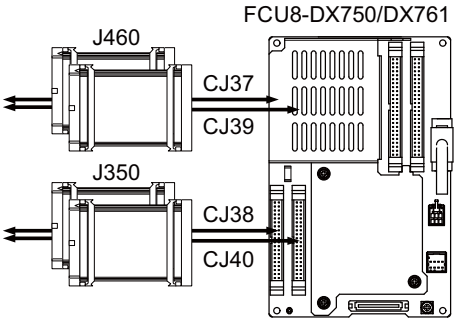




FCU8-DX750/DX761

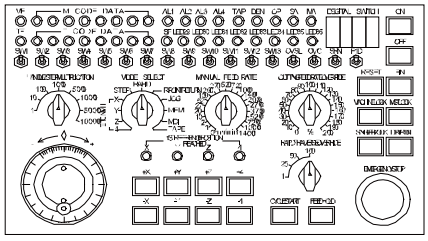
Machine operation panel (example)

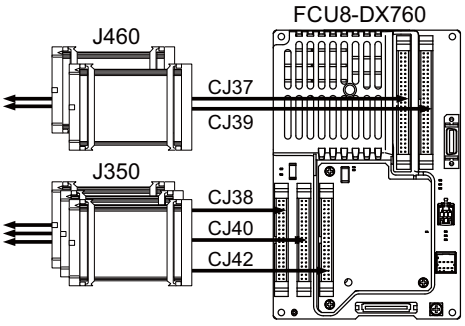




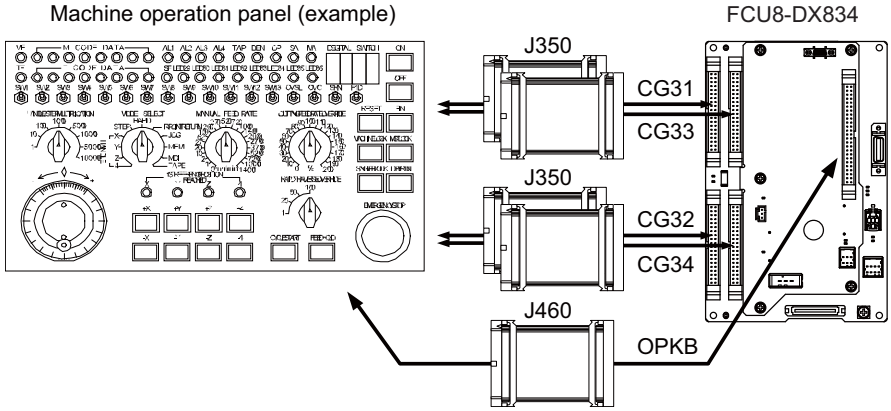
FCU8-DX760

Machine operation panel (example)





FCU8-DX834



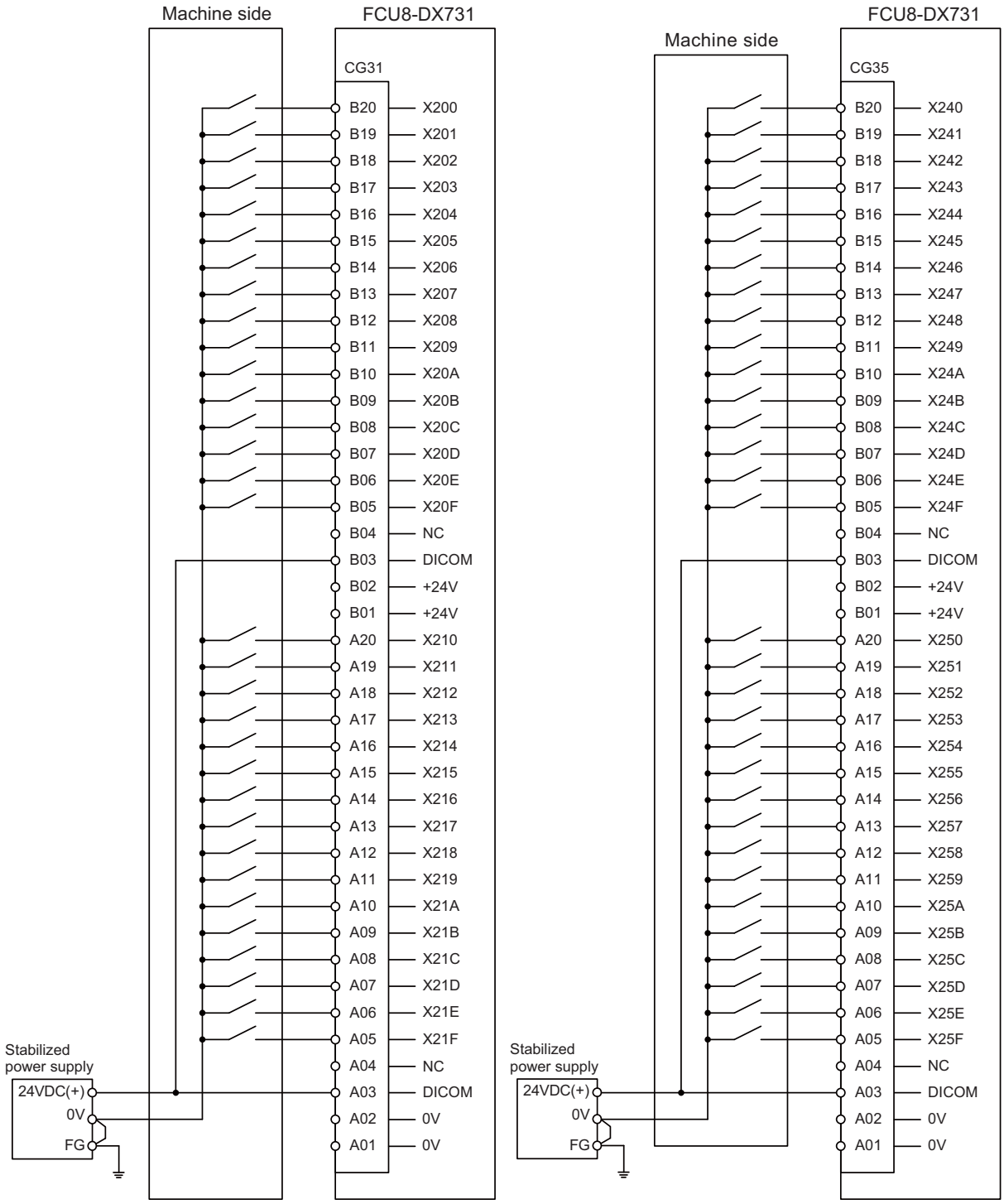
[Related items]

Cable connection drawing: "Cable: J350 Cable", "16.2.23 J460 Cable"

Connector pin assignment: "4.8 Operation Panel I/O Unit" (CG31/CG32/CG35/CG36/CJ37/CJ38/CJ39/CJ40/CJ42/OPKB connector)

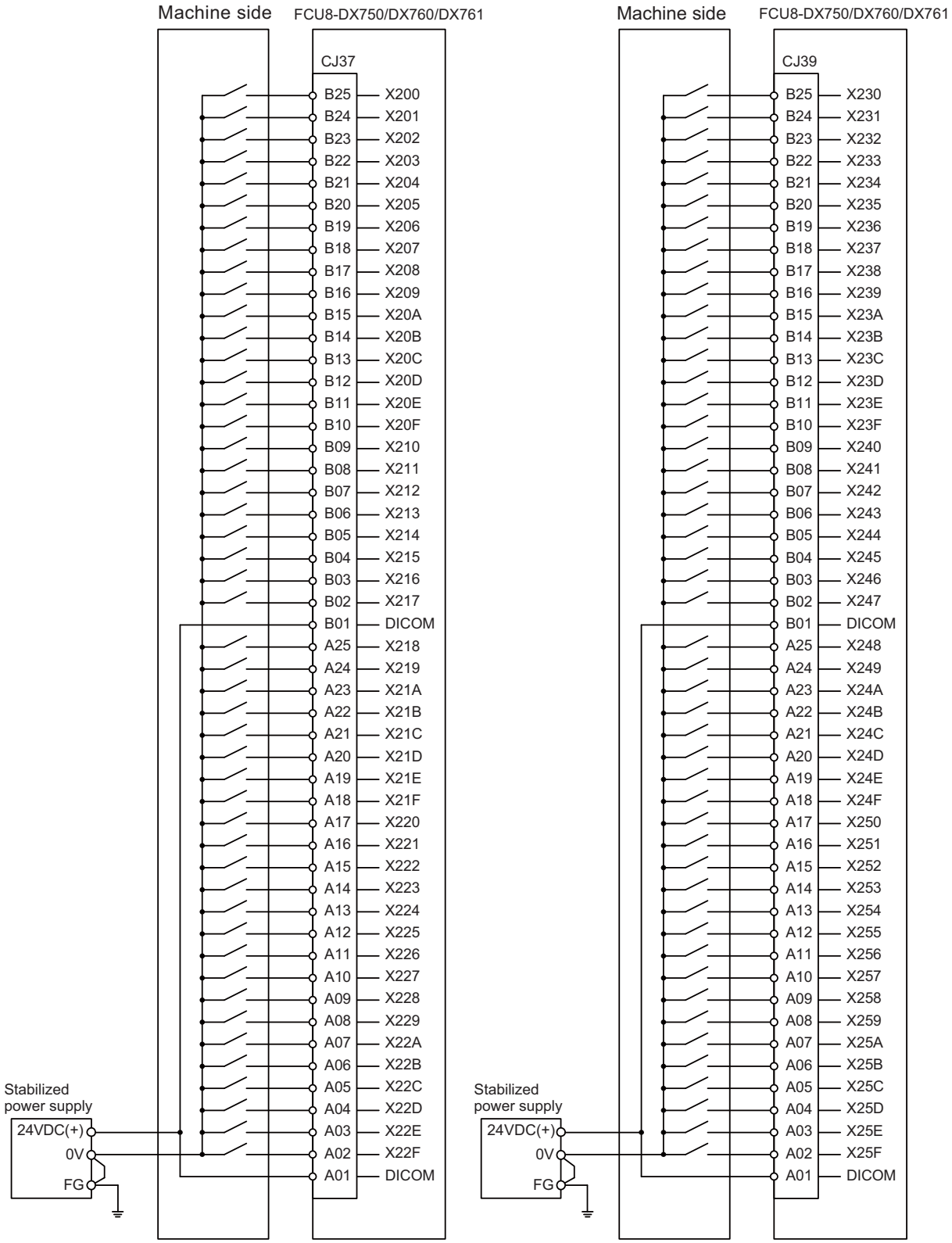
9.8.1 Wiring for 24 V Common Input

FCU8-DX731



For connection details, refer to the descriptions on machine input connector pin assignment in " (1) CG31 (Machine signal input)" or " (5) CG35 (Machine signal input)" of "4.8 Operation Panel I/O Unit".

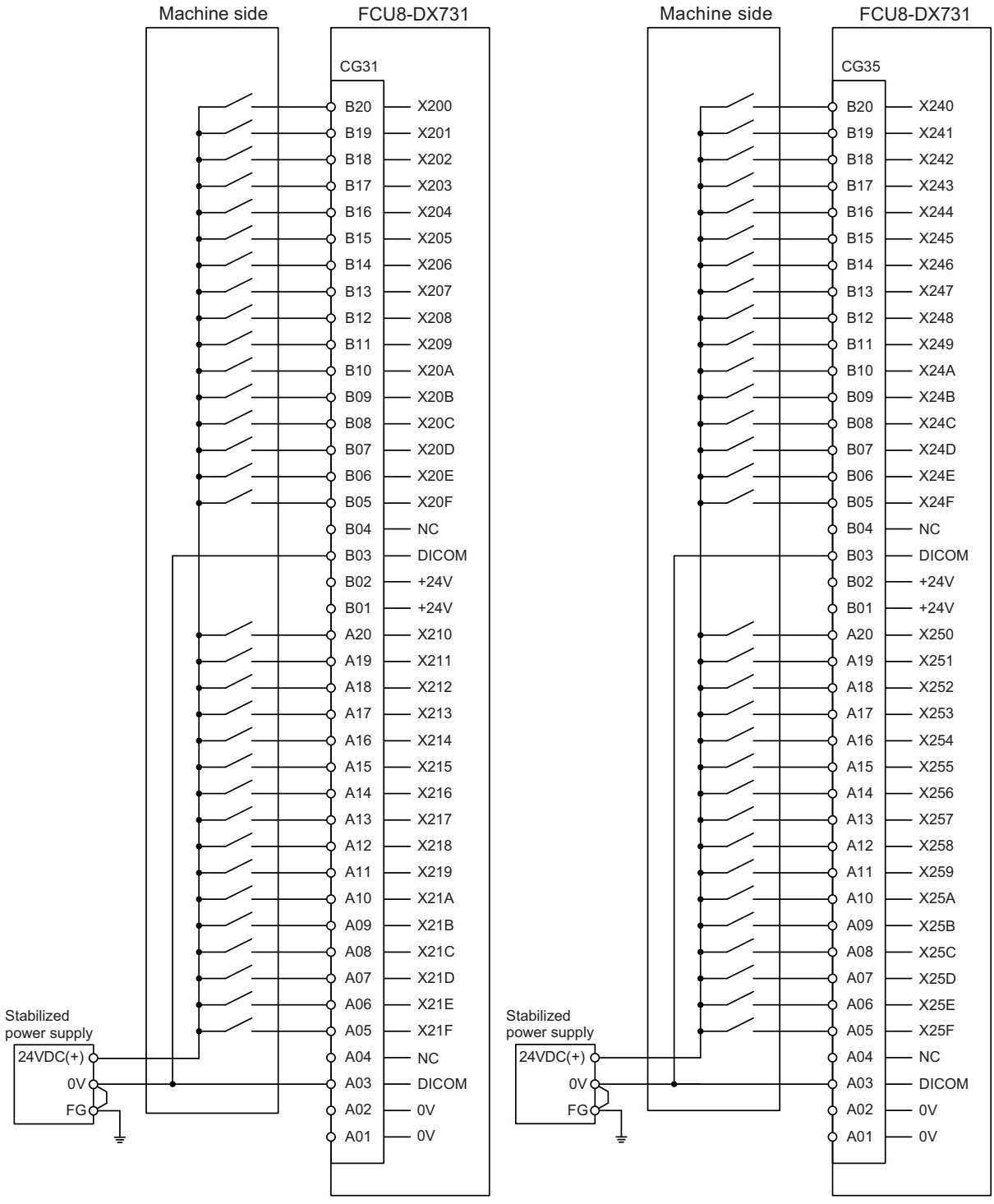
FCU8-DX750/FCU8-DX760/FCU8-DX761



For connection details, refer to the descriptions on machine input connector pin assignment in " (7) CJ37 (Machine signal input)" or " (9) CJ39 (Machine signal input)" of "4.8 Operation Panel I/O Unit".

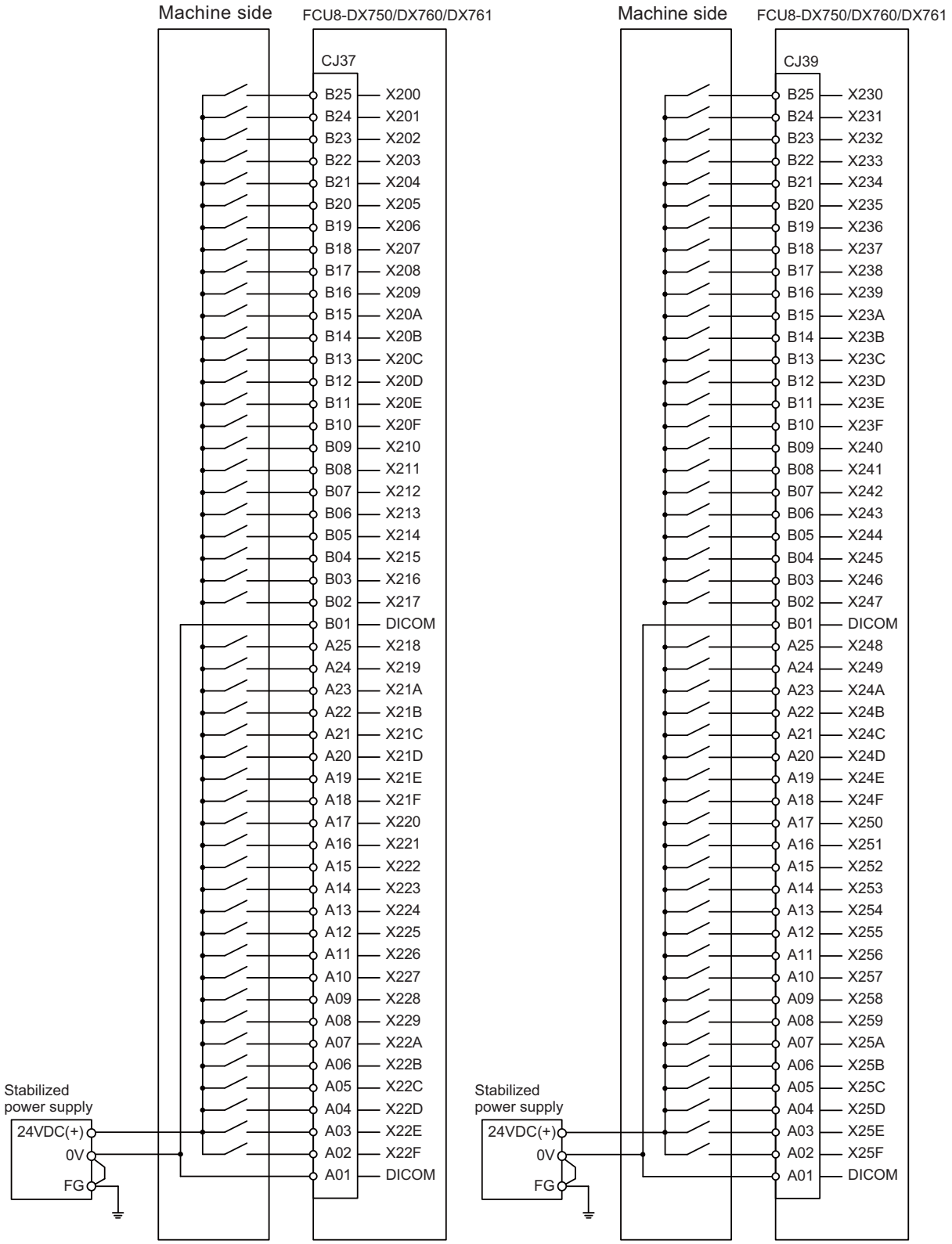
9.8.2 Wiring for 0 V Common Input

FCU8-DX731



For connection details, refer to the descriptions on machine input connector pin assignment in " (1) CG31 (Machine signal input)" or " (5) CG35 (Machine signal input)" of "4.8 Operation Panel I/O Unit".

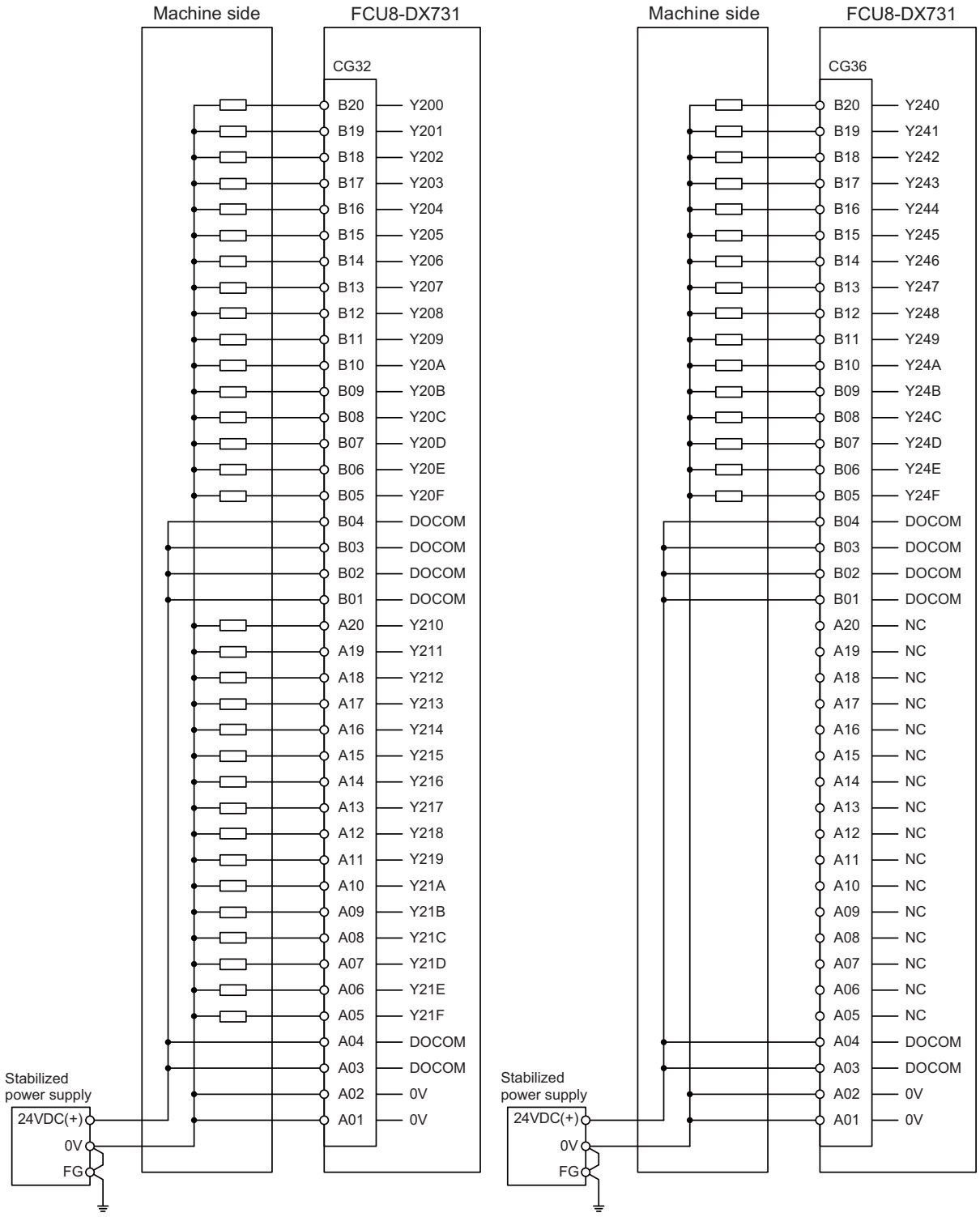
FCU8-DX750/FCU8-DX760/FCU8-DX761



For connection details, refer to the descriptions on machine input connector pin assignment in " (7) CJ37 (Machine signal input)" or " (9) CJ39 (Machine signal input)" of "4.8 Operation Panel I/O Unit".

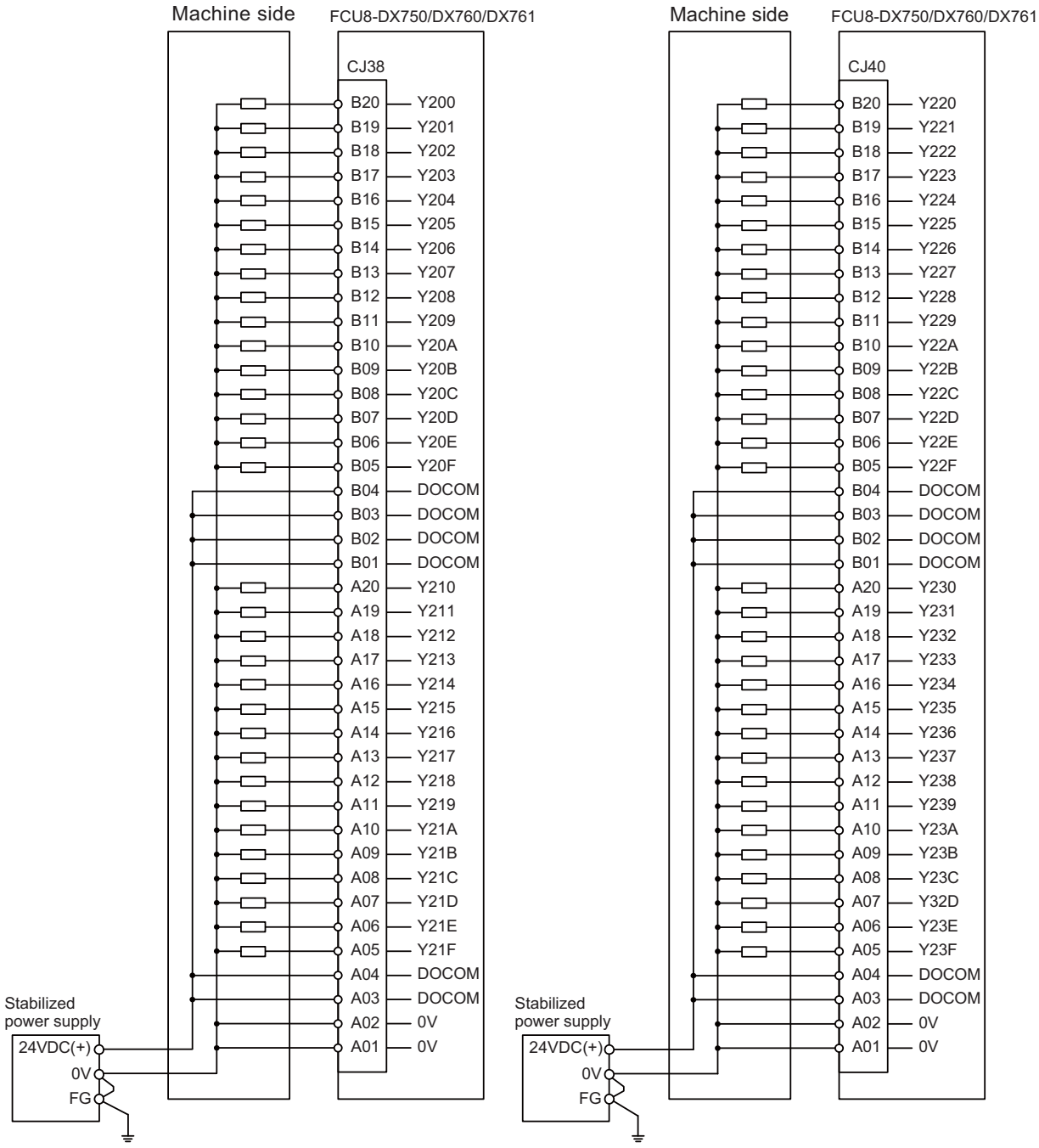
9.8.3 Wiring for Source Type Output

FCU8-DX731



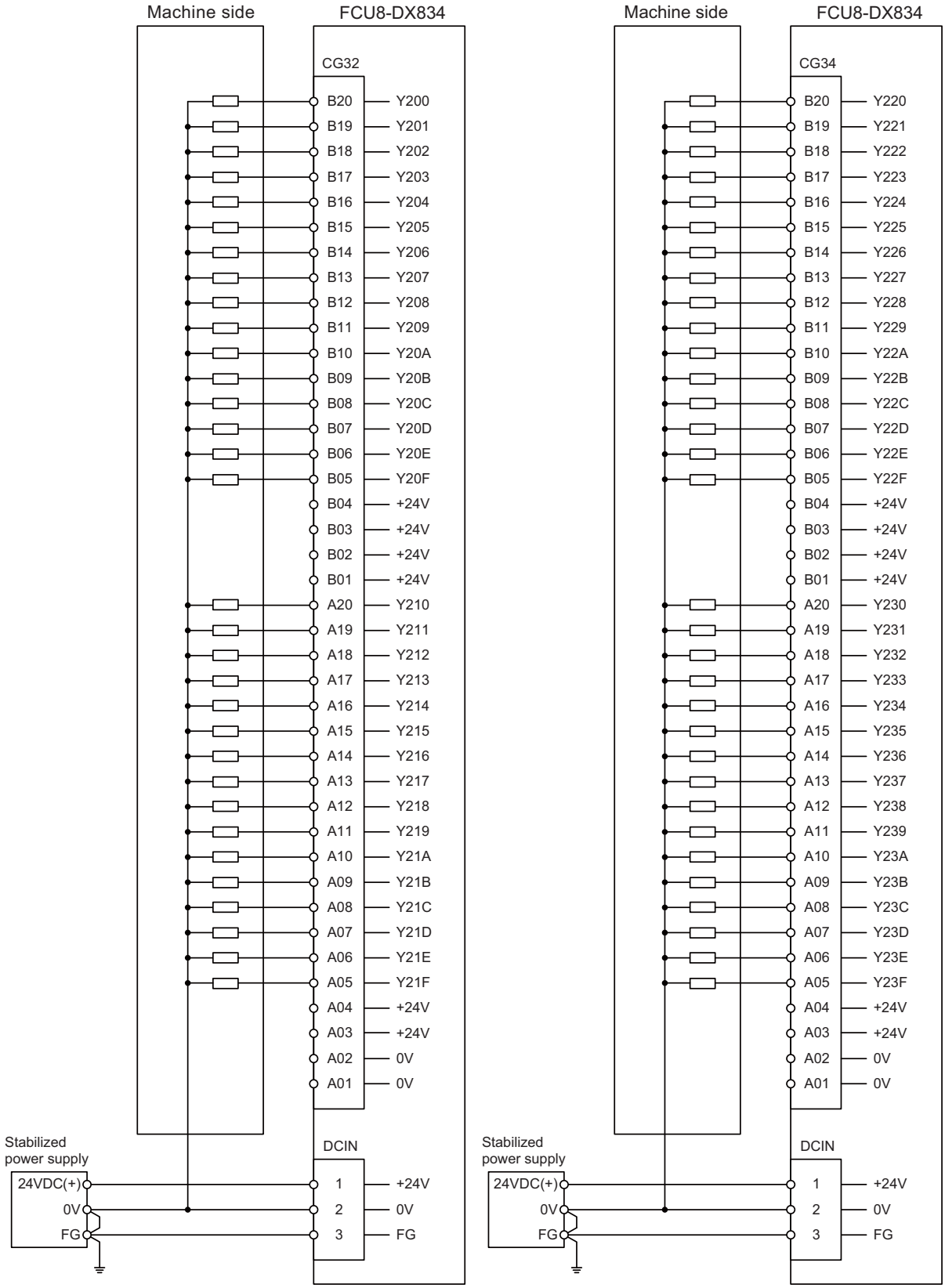
For connection details, refer to the descriptions on machine Input connector pin assignment in " (2) CG32 (Machine signal output)" or " (6) CG36 (Machine signal output)" of "4.8 Operation Panel I/O Unit".

FCU8-DX750/FCU8-DX760/FCU8-DX761



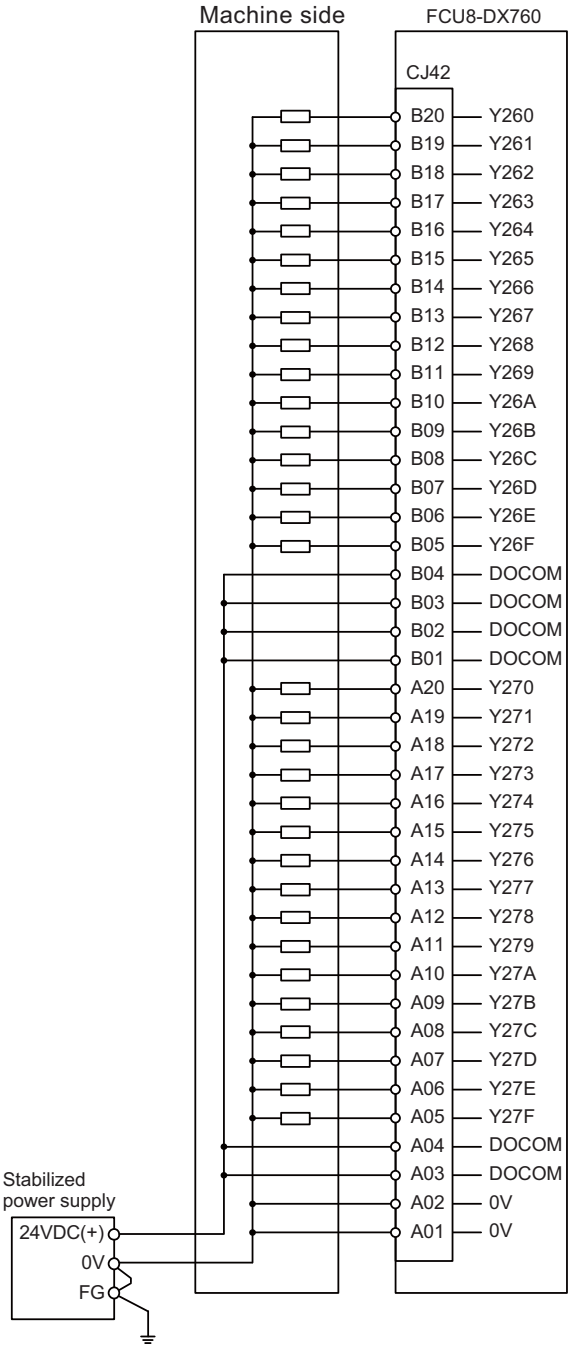
For connection details, refer to the descriptions on machine output connector pin assignment in " (8) CJ38 (Machine signal output)" or " (10) CJ40 (Machine signal output)" of "4.8 Operation Panel I/O Unit".

FCU8-DX834



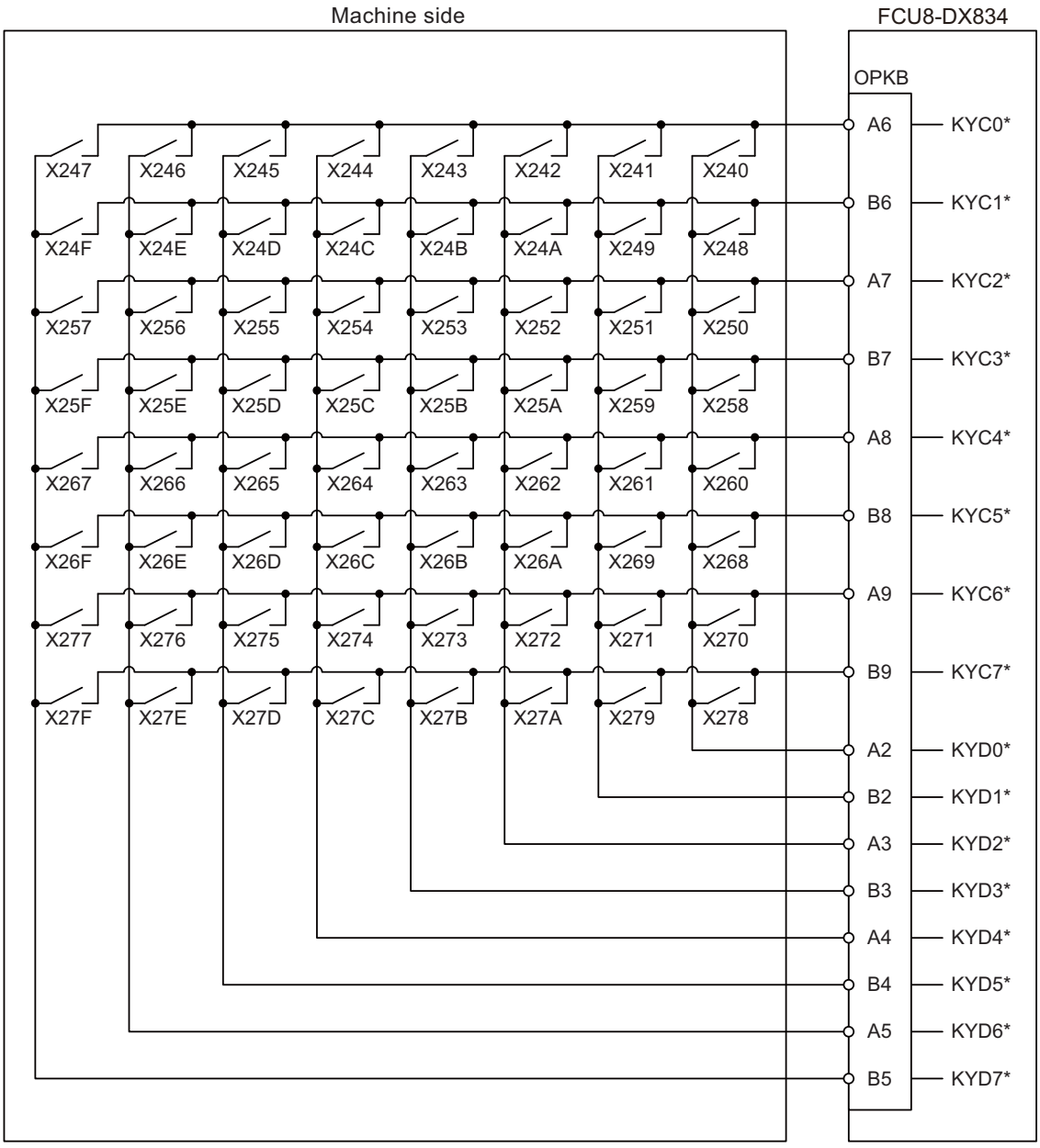
For connection details, refer to the descriptions on machine output connector pin assignment in " (2) CG32 (Machine signal output)" or " (4) CG34 (Machine signal output)" of "4.8 Operation Panel I/O Unit".

9.8.4 Example of Wiring CJ42 (FCU8-DX760)



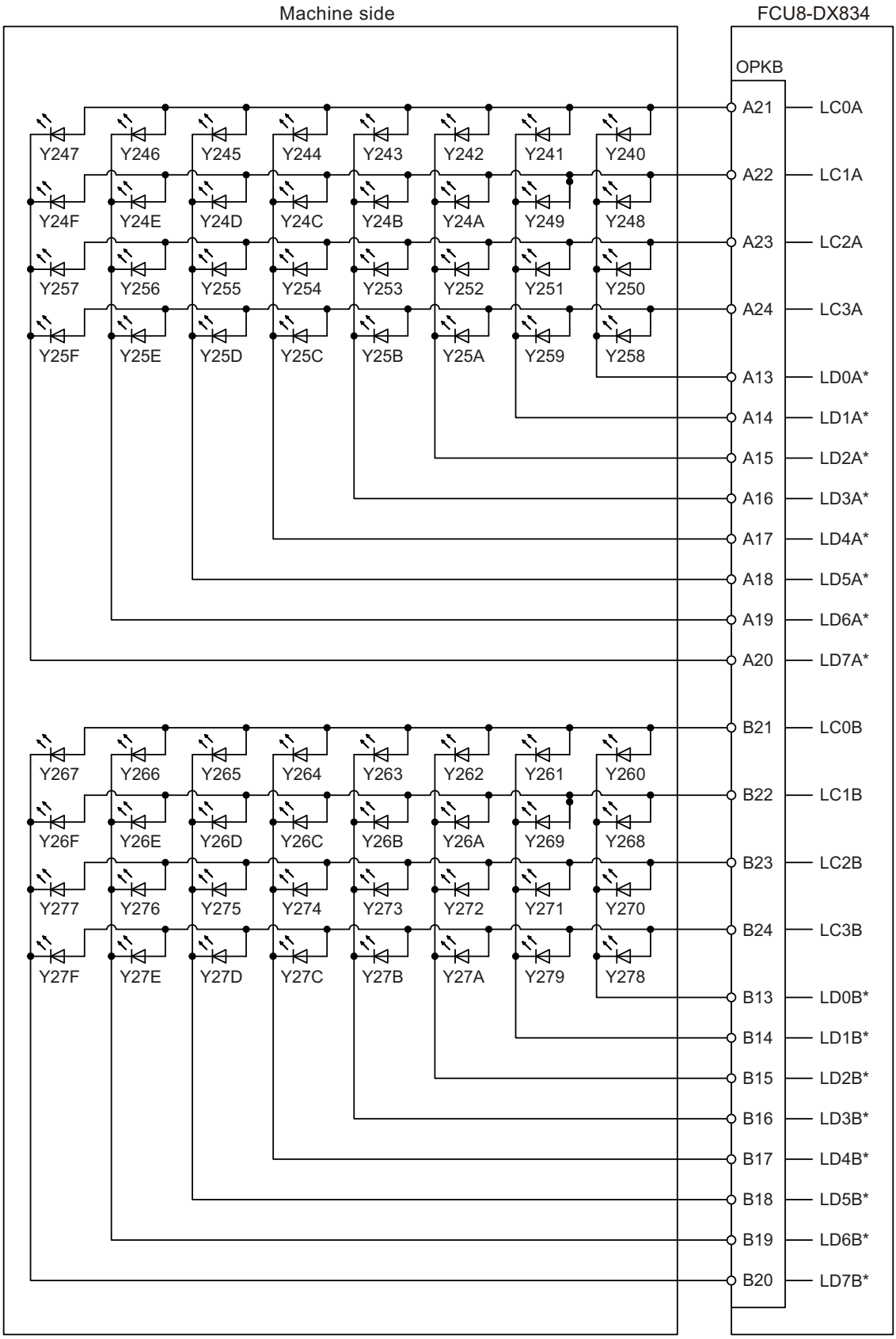
For connection details, refer to the descriptions on machine output connector pin assignment in " (11) CJ42 (Machine signal output)" of "4.8 Operation Panel I/O Unit".

9.8.5 Connection with the Scan Input Signal (FCU8-DX834)



For connection details, refer to the descriptions on machine output connector pin assignment in " (19) OPKB (Scan input, scan output)" of "4.8 Operation Panel I/O Unit".

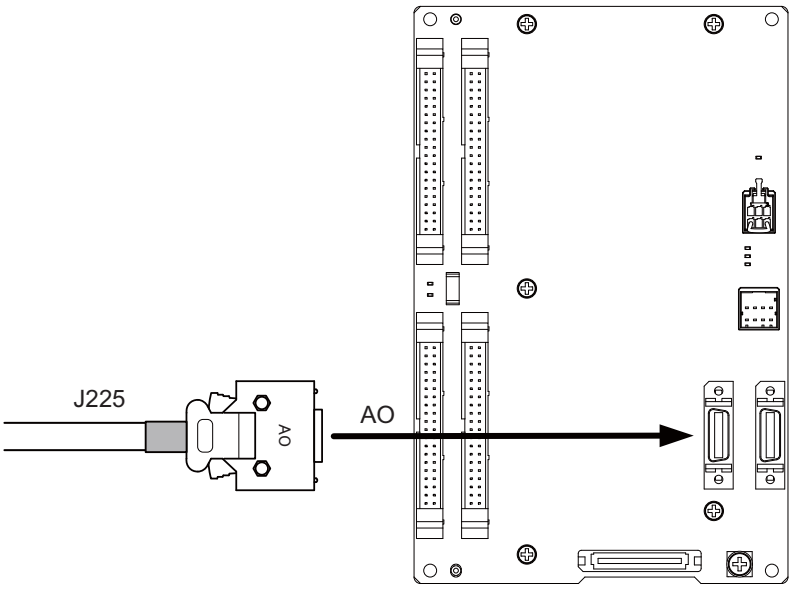
9.8.6 Connection with the Scan Output Signal (FCU8-DX834)



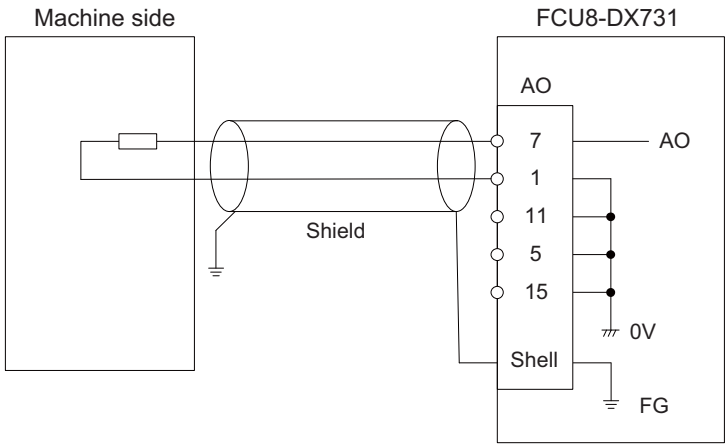
For connection details, refer to the descriptions on machine output connector pin assignment in " (19) OPKB (Scan input, scan output)" of "4.8 Operation Panel I/O Unit".

9.9 Connecting with Analog Output Signal (FCU8-DX731)

For the analog output signals, connect J225 cable to the AO connector of FCU8-DX731.
The analog output signals are available to connect up to one point for the input, and up to one point for the output.

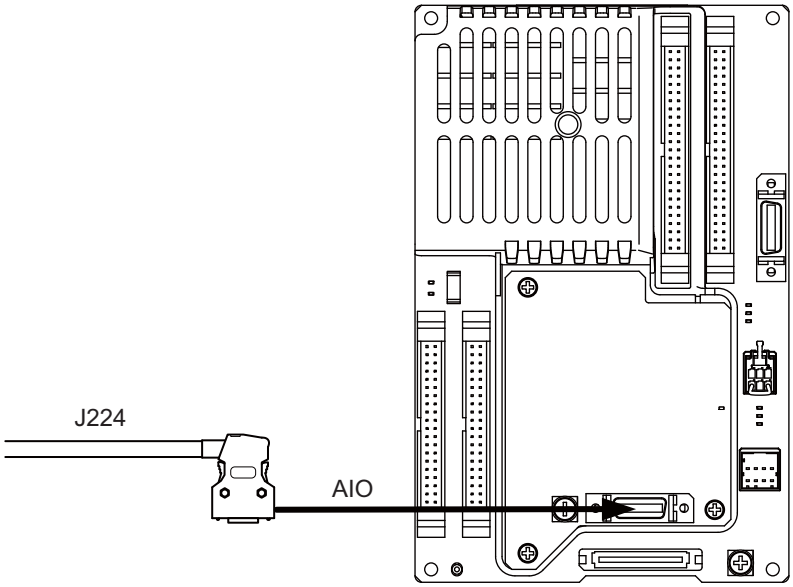


[Related items]
Cable connection drawing: "16.2.19 J225 Cable"
Connector pin assignment: "4.8 Operation Panel I/O Unit" (AO connector)

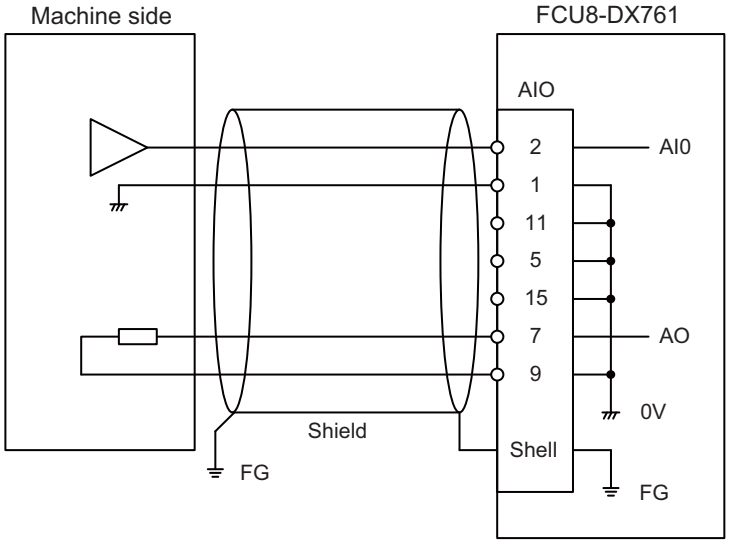


9.10 Connecting with Analog I/O Signal (FCU8-DX761)

For the analog input/output signals, connect J224 cable to the AIO connector of FCU8-DX761.
The analog input/output signals are available to connect up to one point for the input, and up to one point for the output.



[Related items]
Cable connection drawing: "16.2.18 J224 Cable"
Connector pin assignment: "4.8 Operation Panel I/O Unit" (AIO connector)

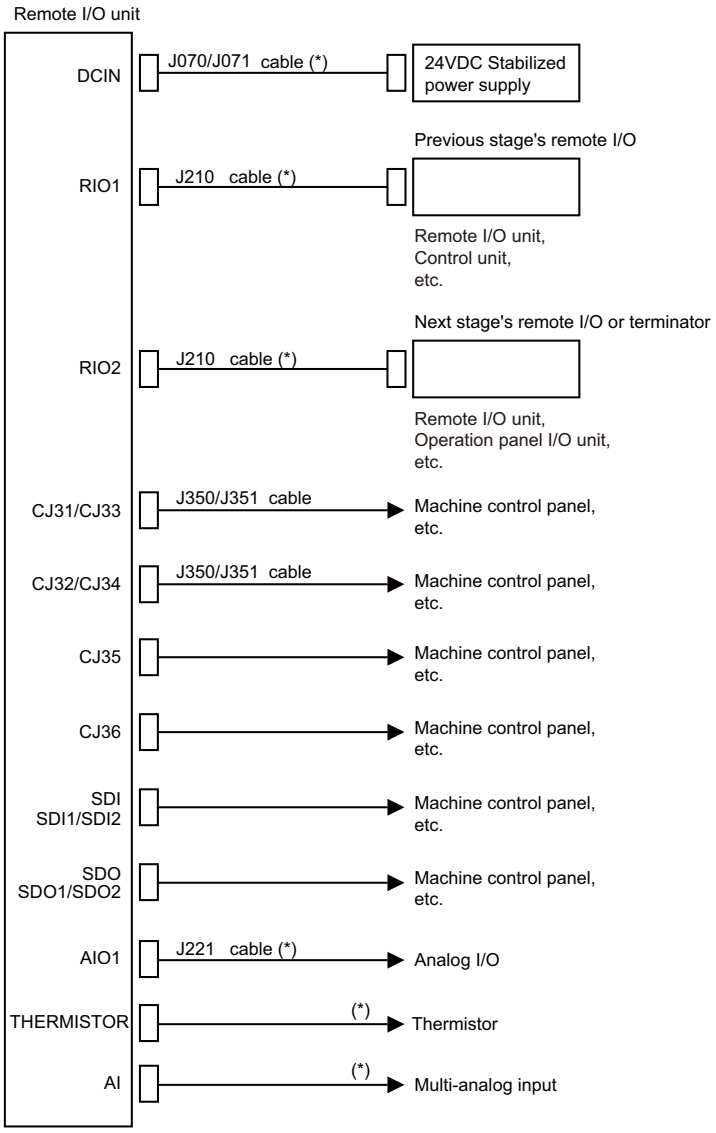


10

Connection of Remote I/O Unit

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

10.1 Remote I/O Unit Connection System Drawing



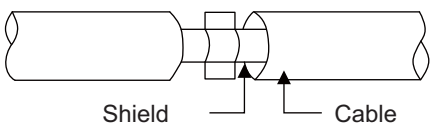
Note

(1) The mounted connector differs depending on the unit. Refer to the following chapter for which of the connector is mounted.
"4.9 Remote I/O Unit"

(2) For connection to the machine operation panel, refer to the chapter "14 Connection of Machine Operation Panel".

(3) The section indicated with asterisk (*) indicates cable to be wired outside the electric cabinet.
Since the cable could be affected by the exogenous noise depending on the environment, the following noise countermeasure is recommended.

Expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



When you cannot use the shield clamp, install a ferrite core as a substitute.

<Related item>

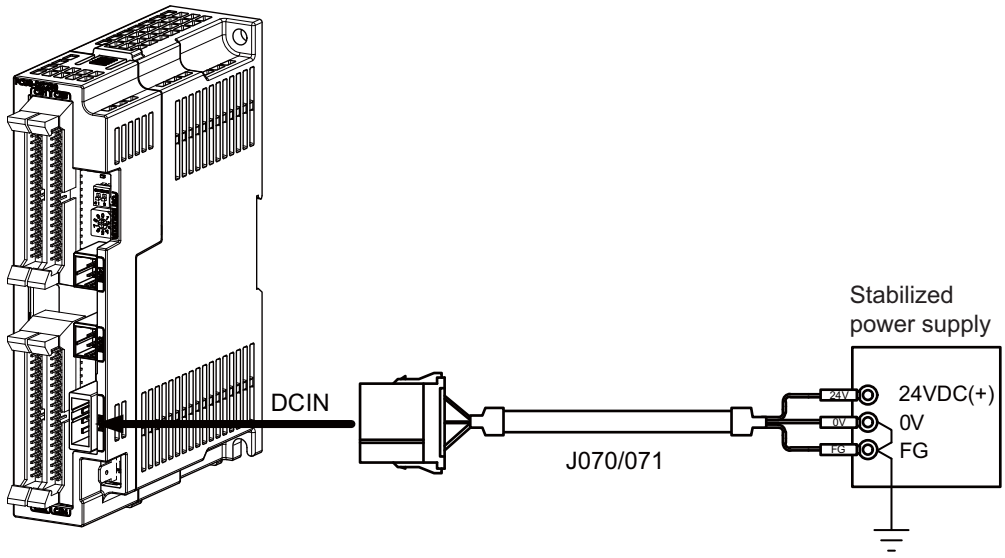
Shield clamp fitting: "42.6.1 Shield Clamp Fitting"

Ferrite core: "42.6.2 Ferrite Core"

10.2 Connecting with Power Supply

Connect 24 VDC power supply (general-purpose stabilized power supply) to the remote I/O unit.

FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX202/FCU8-DX213/FCU8-DX213-1/ FCU8-DX520/FCU8-DX654/FCU8-DX654-1/FCU8-DX408/FCU8-DX409

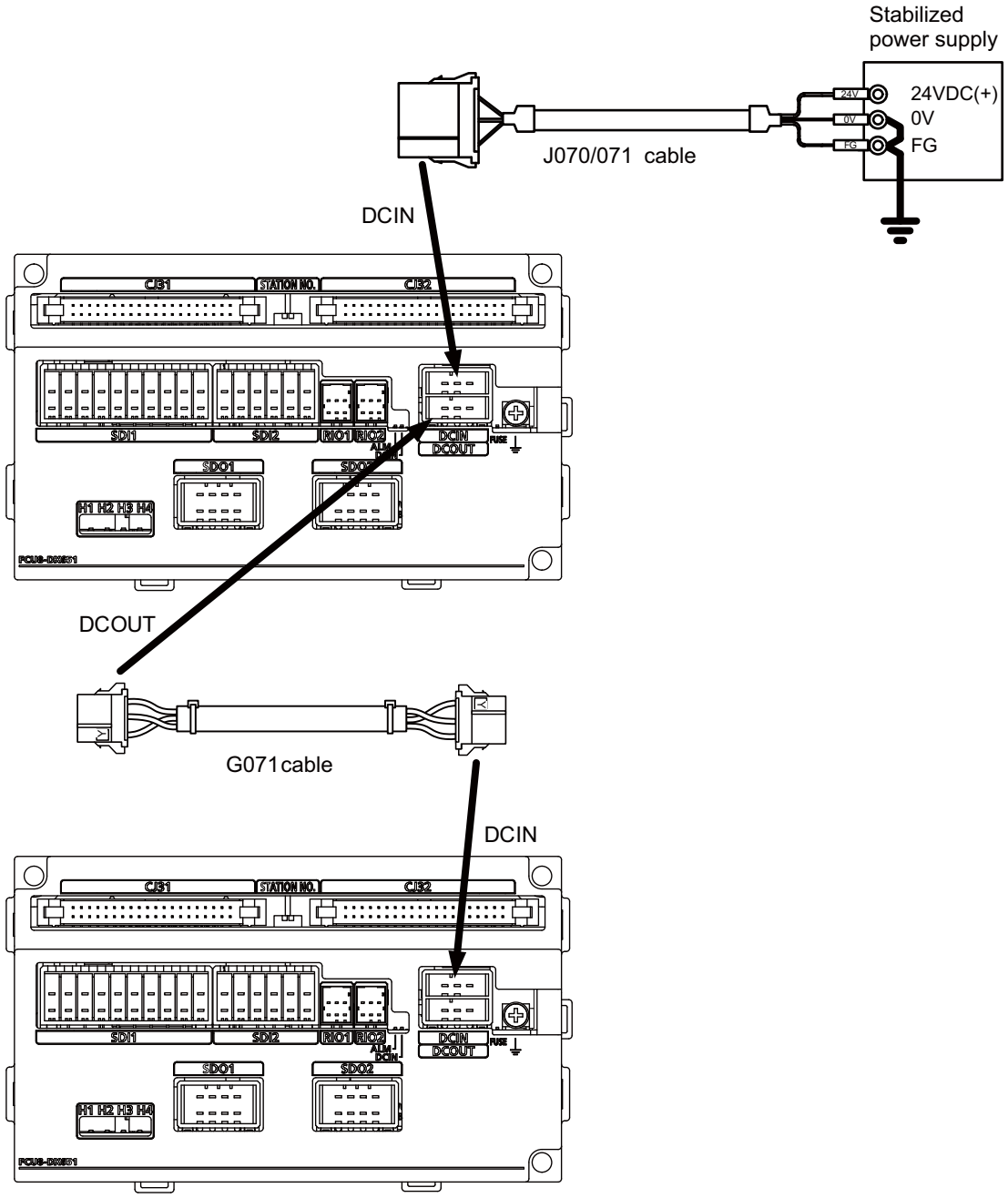


[Related items]

Cable connection drawing: "16.2.12 J070/J071 Cable"

Connector pin assignment: "4.9 Remote I/O Unit" (DCIN connector)

FCU8-DX651



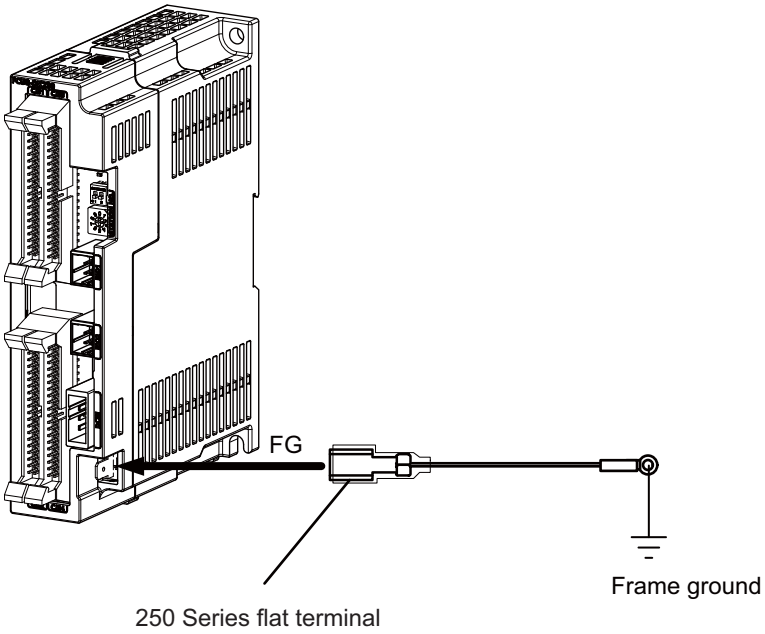
[Related items]

Cable connection drawings: "16.2.12 J070/J071 Cable", "16.2.2 G071 Cable"

Connector pin assignment: "4.9 Remote I/O Unit" (DCIN connector)

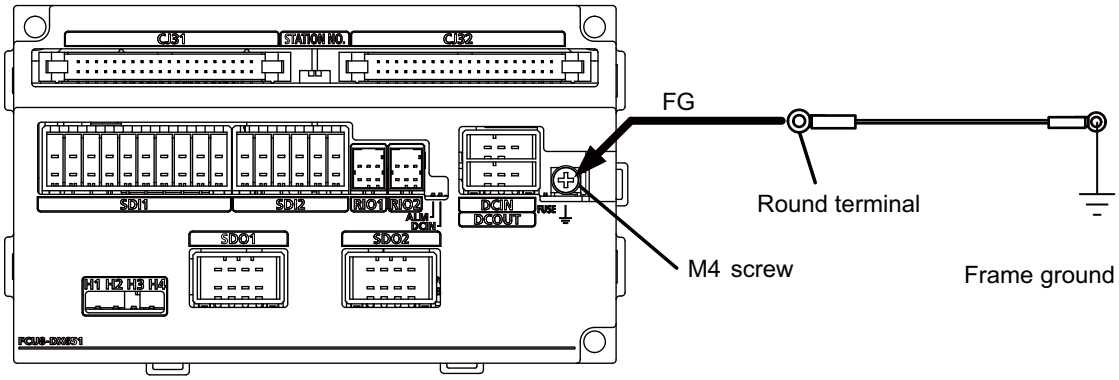
10.3 Connecting with Frame Ground

FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX202/FCU8-DX213/FCU8-DX213-1/ FCU8-DX520/FCU8-DX654/FCU8-DX654-1/FCU8-DX408/FCU8-DX409

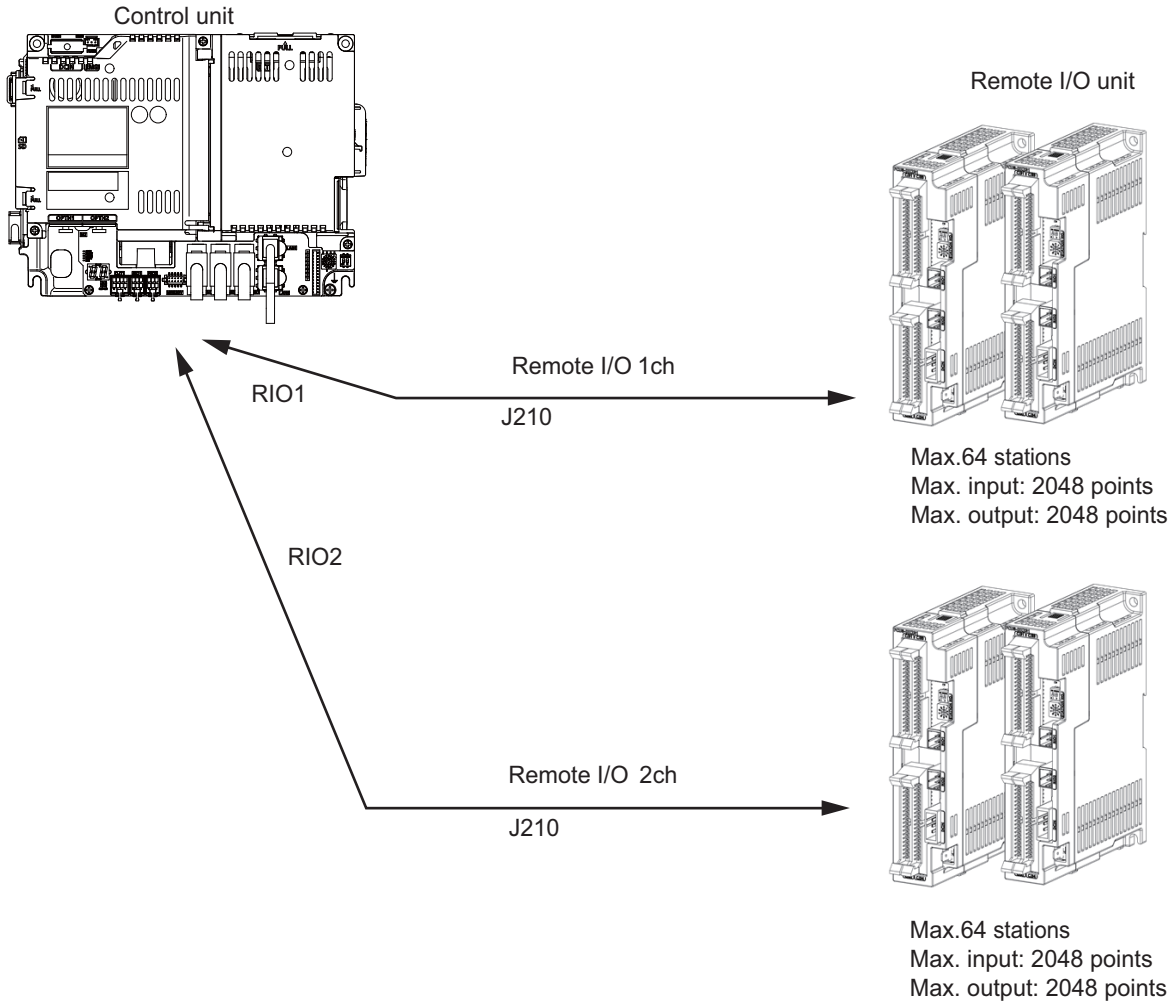


[Flat terminal type]
Flat terminal: 175021-1/175023-1
Protection cover: 174817-2
Manufacturer: TE Connectivity

FCU8-DX651



10.4 Connecting with Control Unit

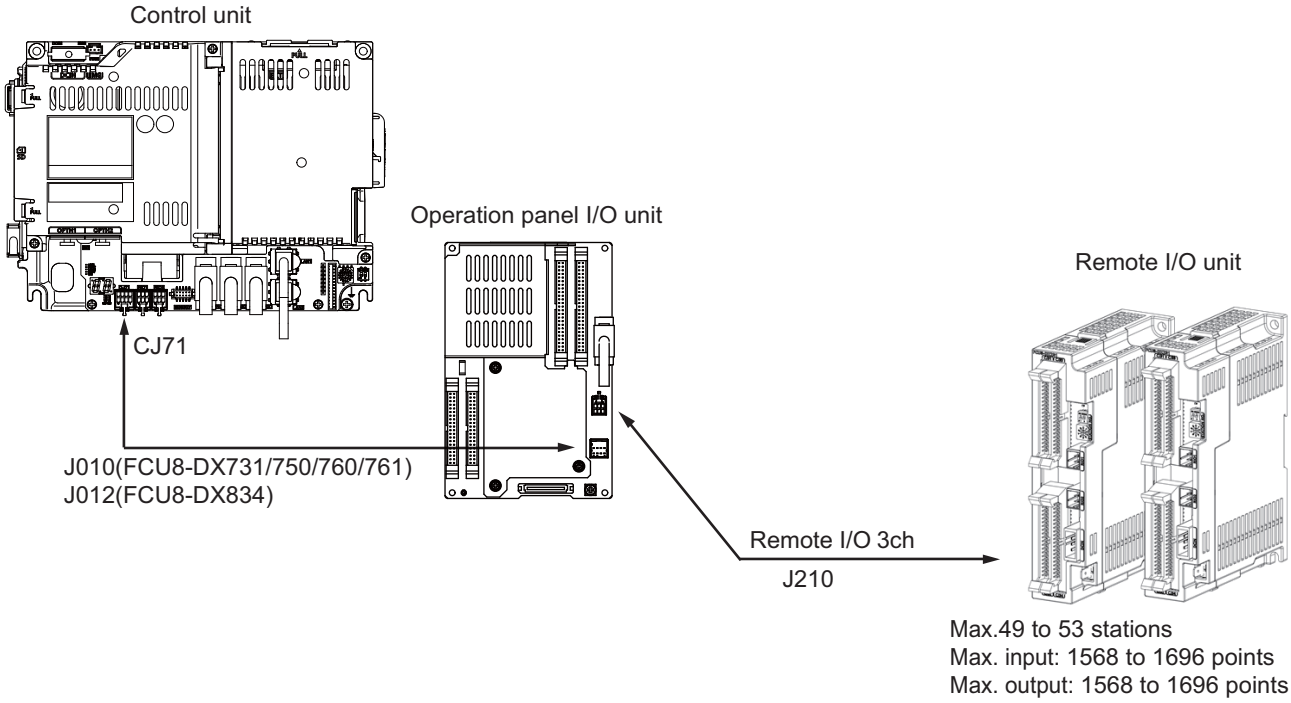


Note

(1) Connect the J210 cable to the RIO1 or RIO2 connector of the control unit.
Check the connector position with the actual machine.

Refer to "18.6.2 Connection and Station No. Setting on Remote I/O Unit" for station No. settings.

10.5 Connecting with Operation Panel I/O Unit



Operation Panel I/O Unit	RIO occupied stations
FCU8-DX731	1, 3, 7 to 12, 20 to 22
FCU8-DX750	1 to 3, 7 to 12, 20 to 22
FCU8-DX760	1 to 4, 7 to 12, 20 to 22
FCU8-DX761	1 to 5, 7 to 12, 20 to 22
FCU8-DX834	1 to 4, 7 to 14, 20 to 22

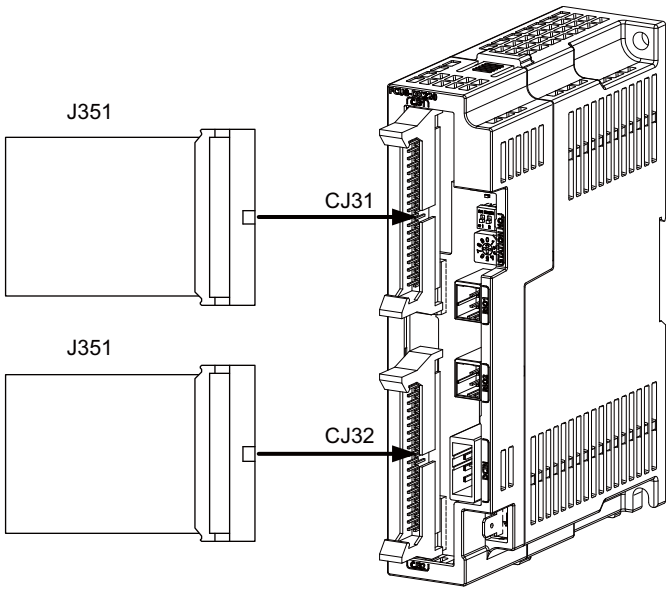
Note

(1) The maximum connectable number of remote I/O units is 32.

Refer to "18.6.2 Connection and Station No. Setting on Remote I/O Unit" for station No. settings.

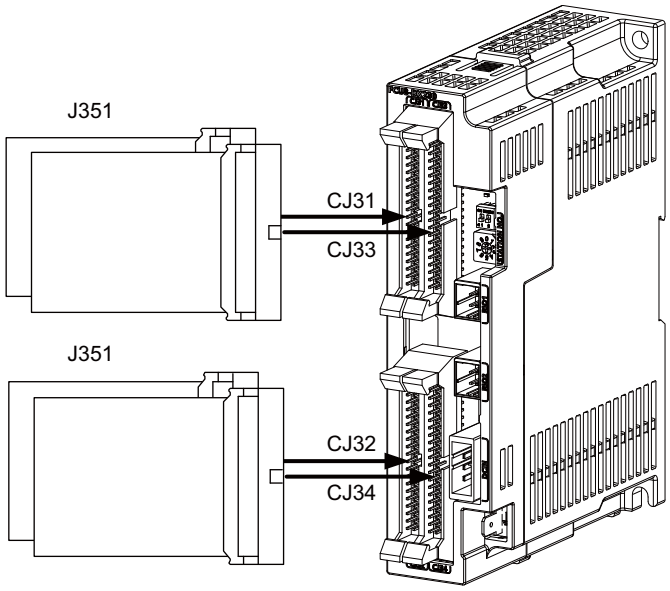
10.6 Connecting with Machine Control Signal (FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX651)

FCU8-DX220



[Related items]
Cable connection drawing: "Cable: J351 Cable"
Connector pin assignment: "4.9 Remote I/O Unit" (CJ31/CJ32 connector)

FCU8-DX230/FCU8-DX231



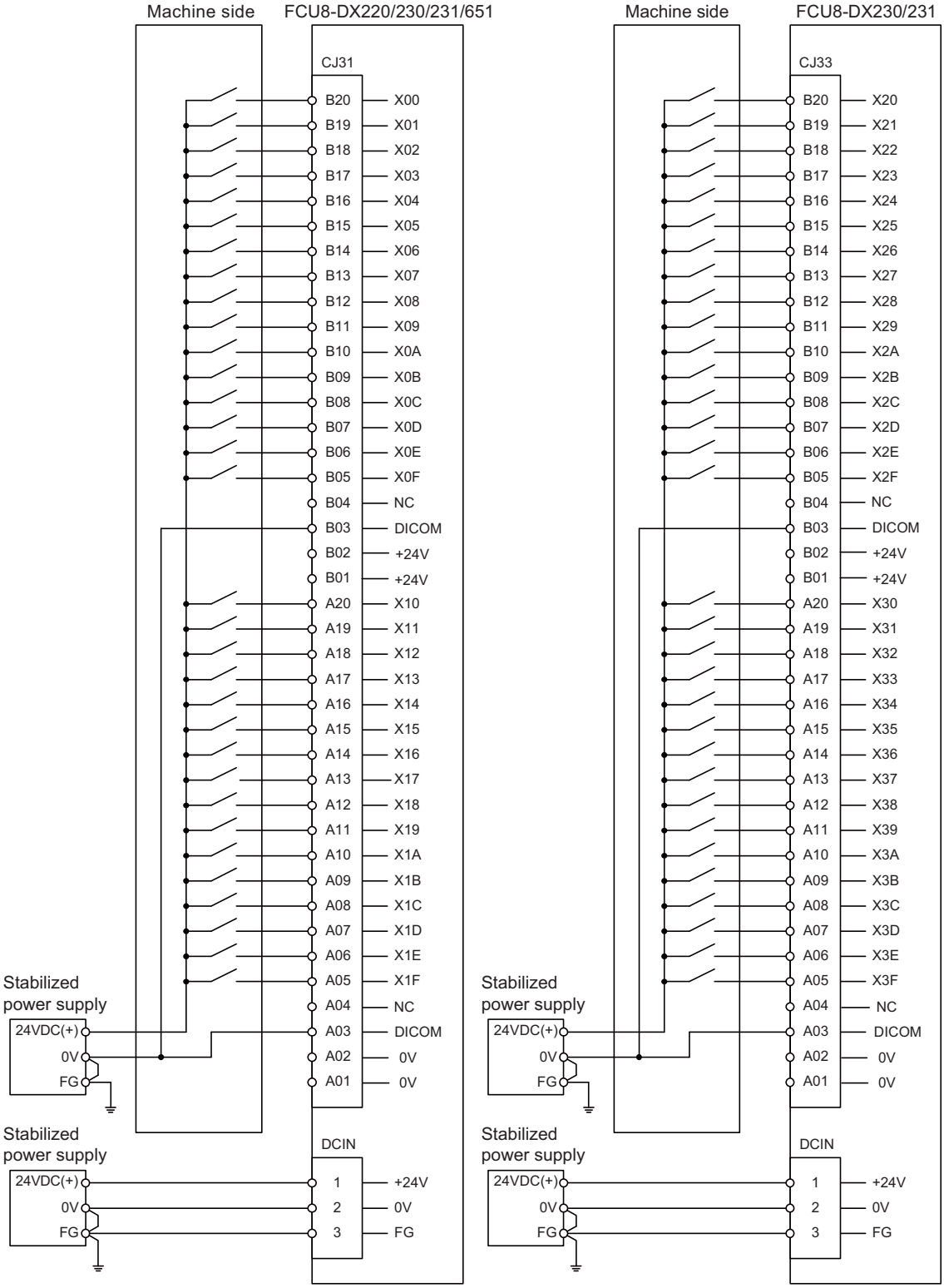
[Related items]
Cable connection drawing: "Cable: J351 Cable"
Connector pin assignment: "4.9 Remote I/O Unit" (CJ31/CJ32/CJ33/CJ34 connector)

⚠ CAUTION

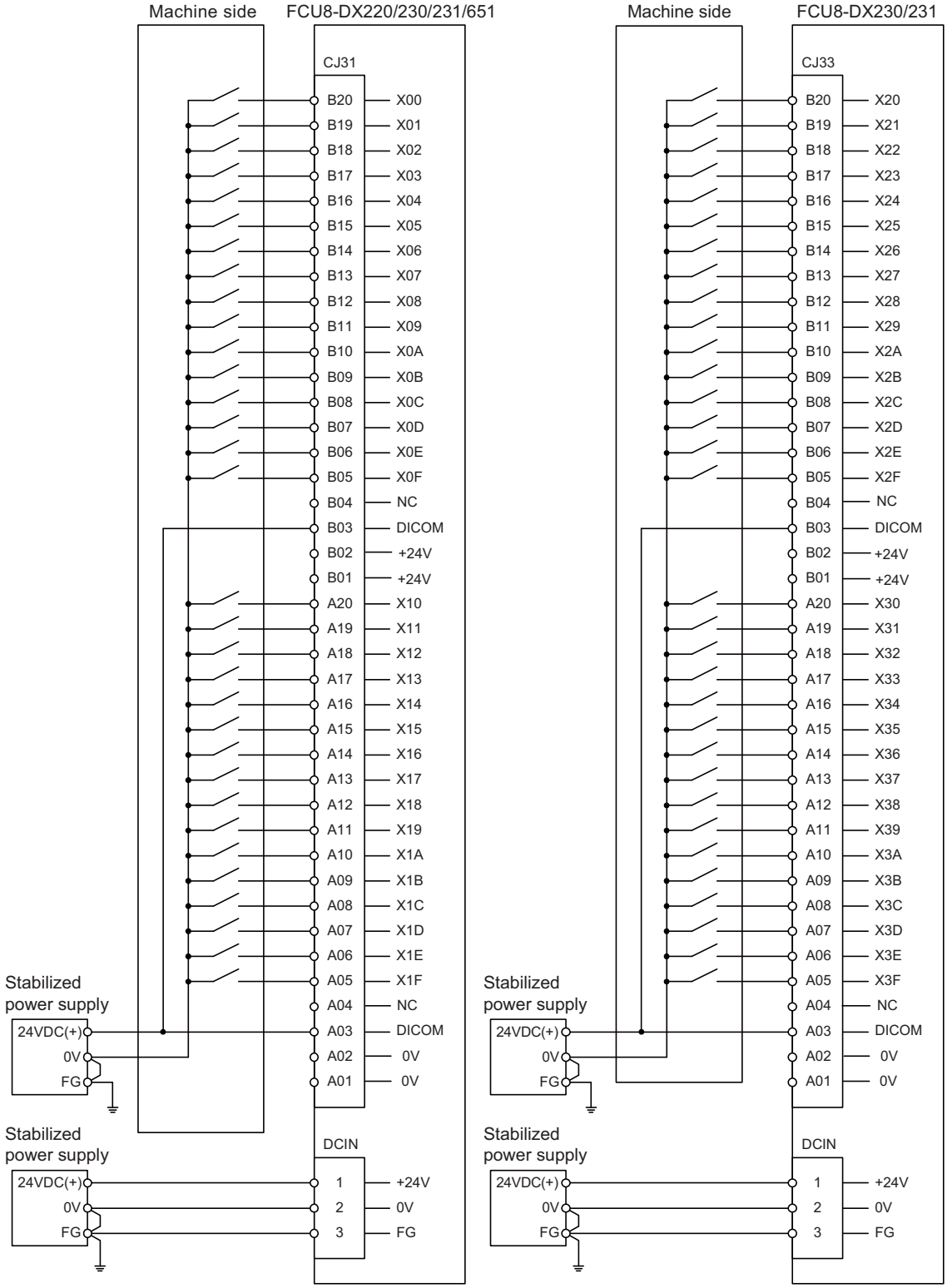
(1) Connect the cable to the designated connector. Incorrect connections could damage the device.

(2) Do not connect or disconnect the cables between units while the power is ON.

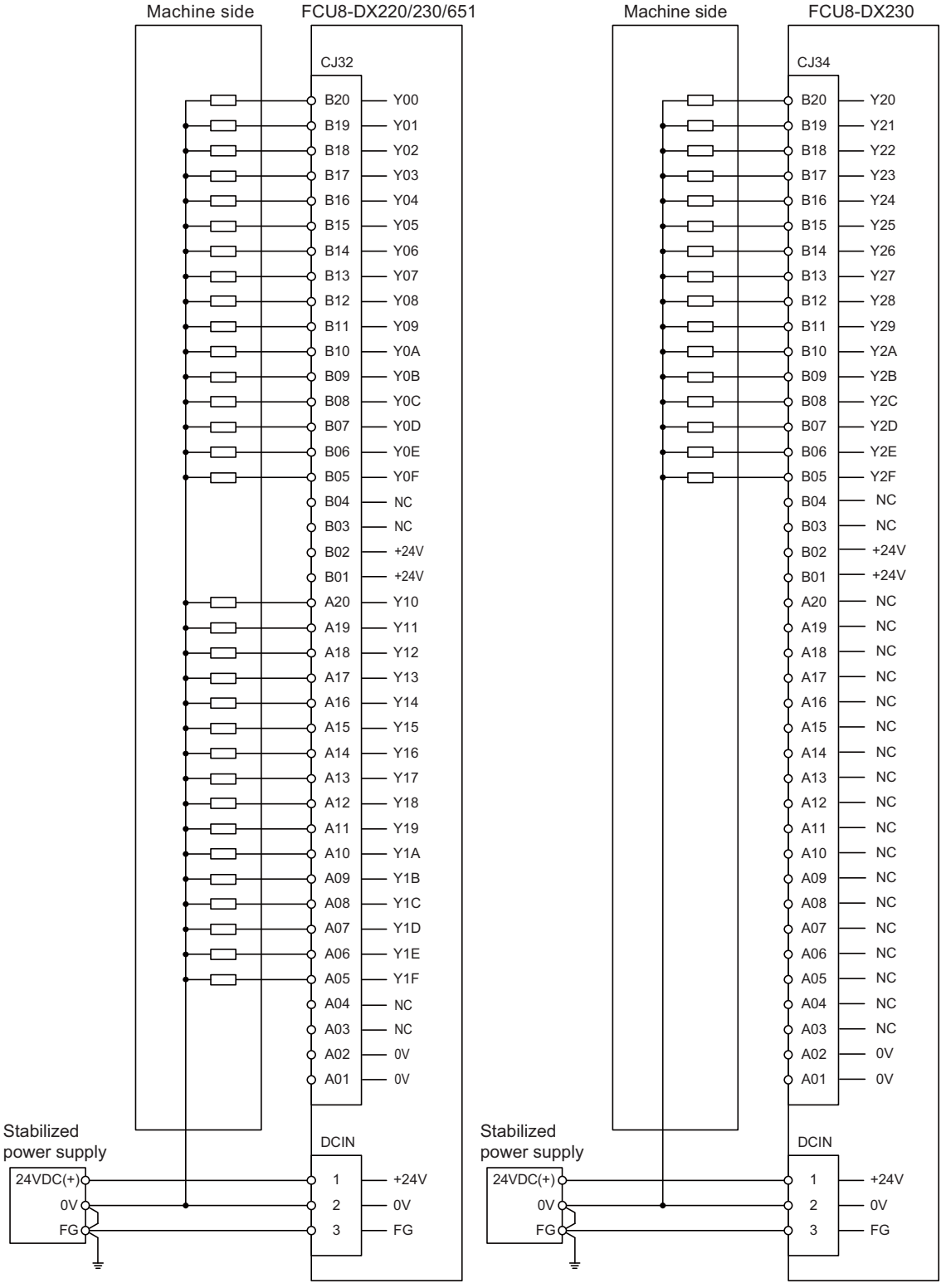
Machine input 0 V common



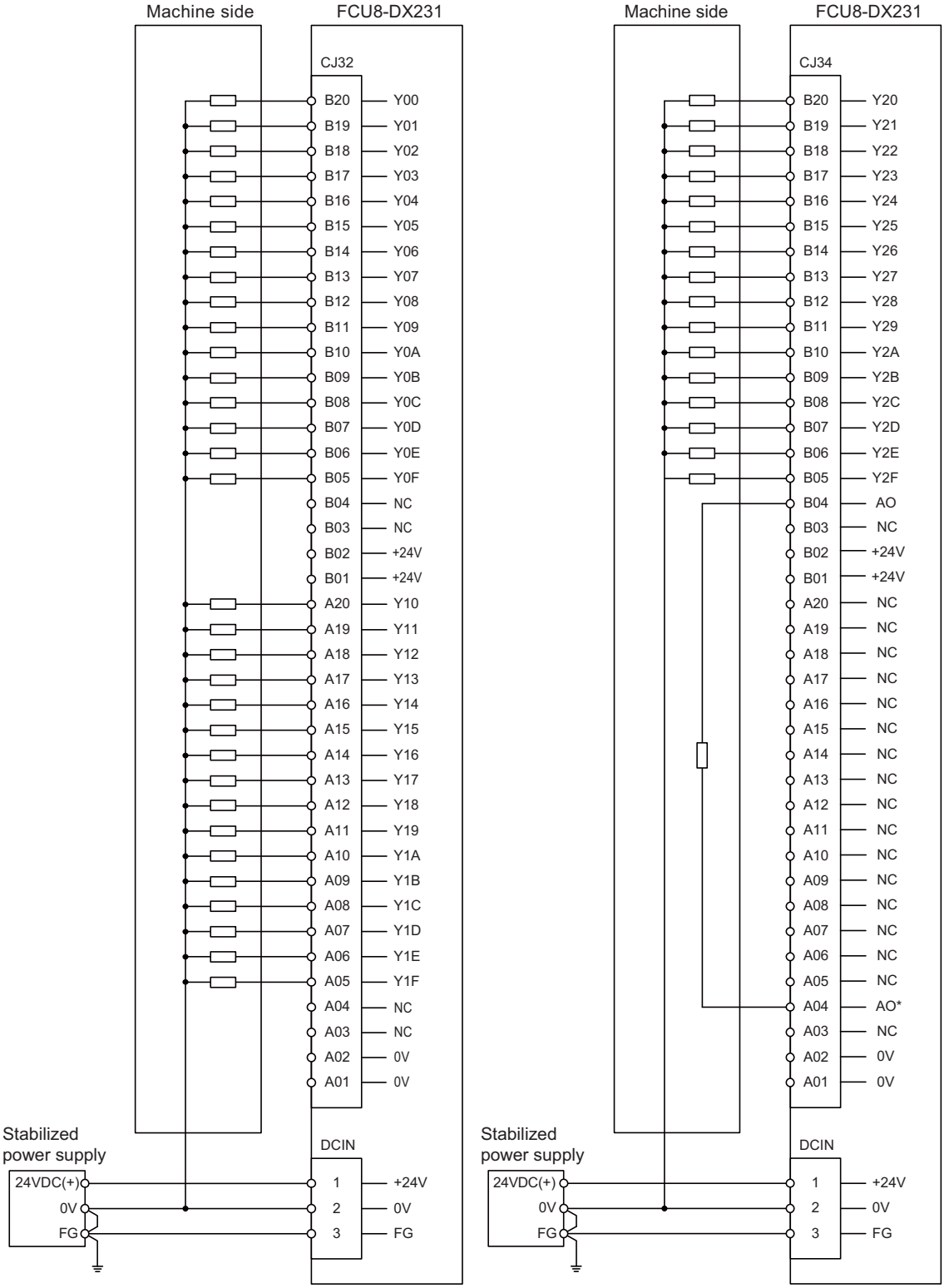
Machine input 24 V common



Machine output: FCU8-DX220/FCU8-DX230/FCU8-DX651



Machine output: FCU8-DX231



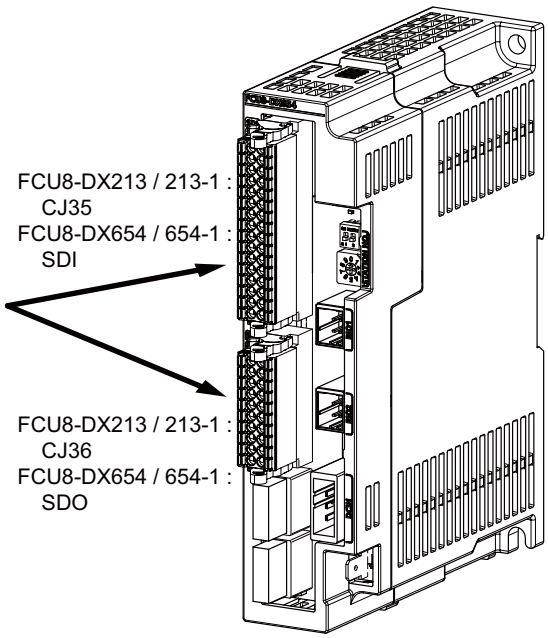
10.7 Connecting with Machine Control Signal (FCU8-DX213/FCU8-DX213-1/FCU8-DX654/FCU8-DX654-1)

FCU8-DX213/FCU8-DX213-1/FCU8-DX654/FCU8-DX654-1

<Applicable cable>
Solid wire : 0.08 - 1.5 mm^2
Twisted wire : 0.08 - 1.5 mm^2
Bar terminal with insulation collar : 0.25 - 0.75 mm^2
Bar terminal without insulation collar : 0.25 - 1.0 mm^2

<Wire mounting tool type>
Screwdriver : 210-719
Manufacturer : WAGO

<Bar terminal type>
Bar terminal : 216 series
Manufacturer : WAGO



[Related items]
Connector pin assignment: "4.9 Remote I/O Unit" (CJ35/CJ36/SDI/SDO connector)

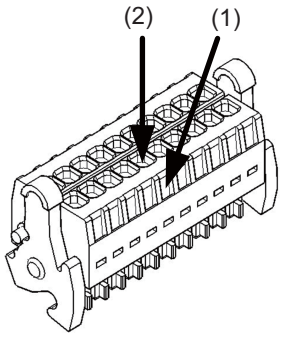
⚠ CAUTION

(1) Connect the cable to the designated connector. Incorrect connections could damage the device.

(2) Do not connect or disconnect the cables between units while the power is ON.

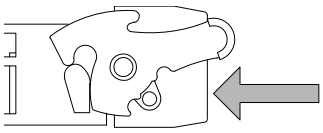
Mounting the wire

(1) Insert a slotted screwdriver (blade width: 2.5 mm).
(2) Insert the wire and then pull the screwdriver out.

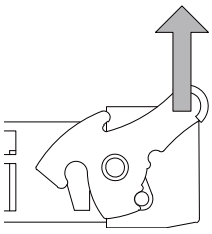


Mounting the connector

(1) Push the connector to the lock lever position.

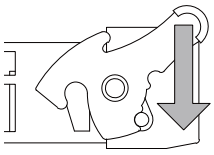


(2) Push the right and left lock levers up simultaneously.

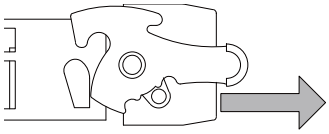


Removing the connector

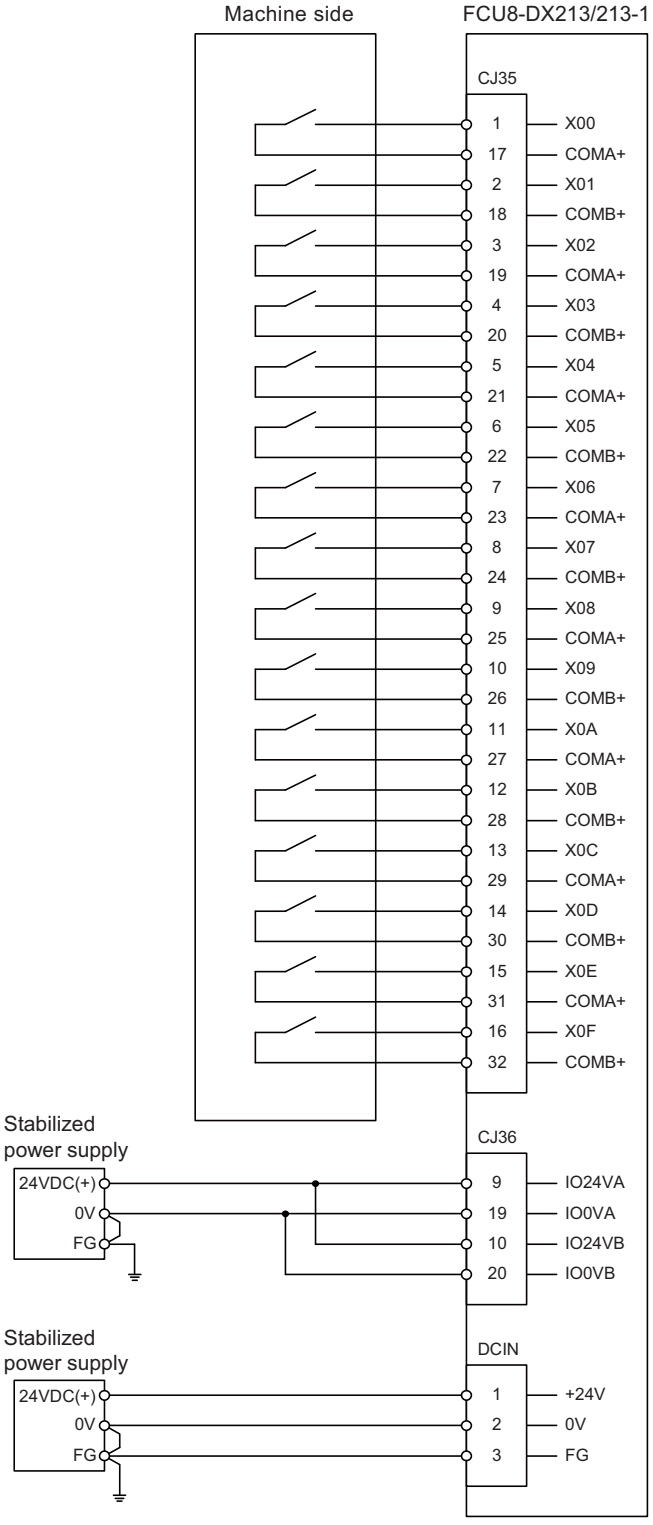
(1) Push the right and left lock levers down simultaneously.



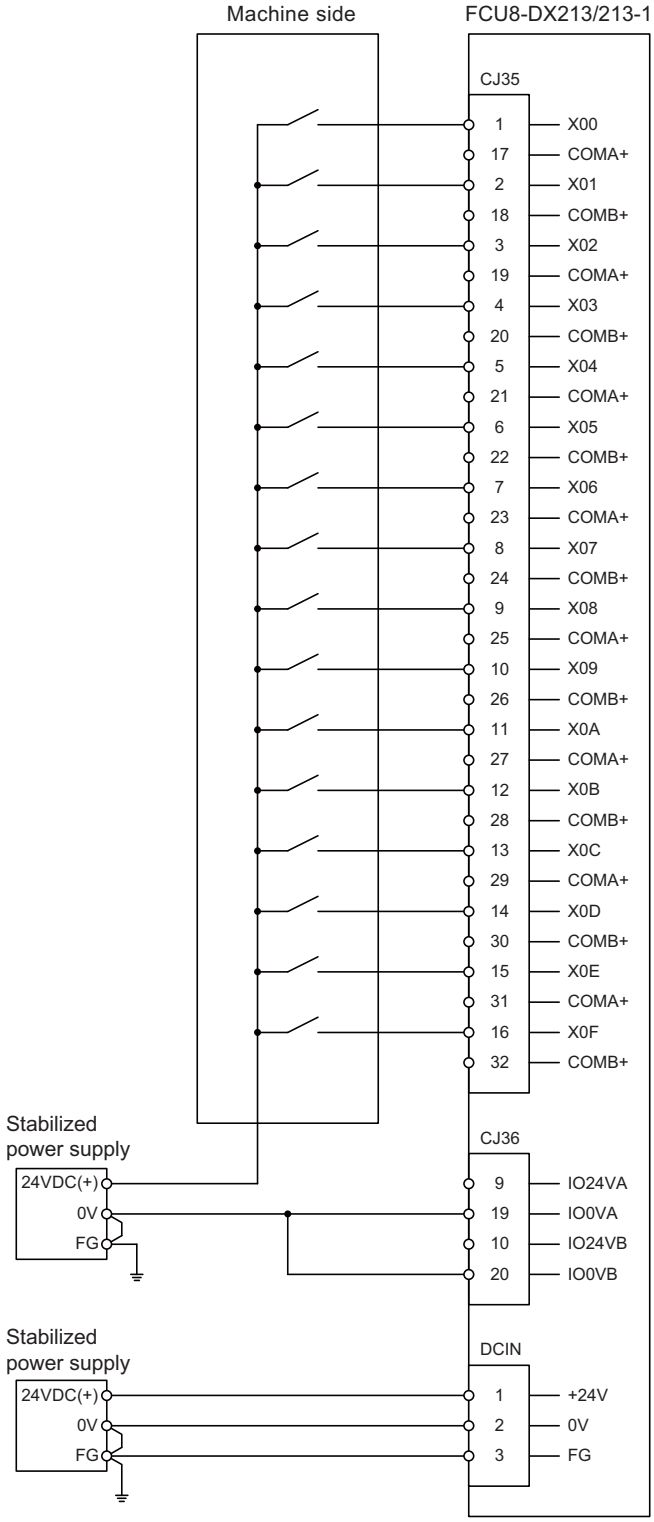
(2) Release the lock and pull the connector out.



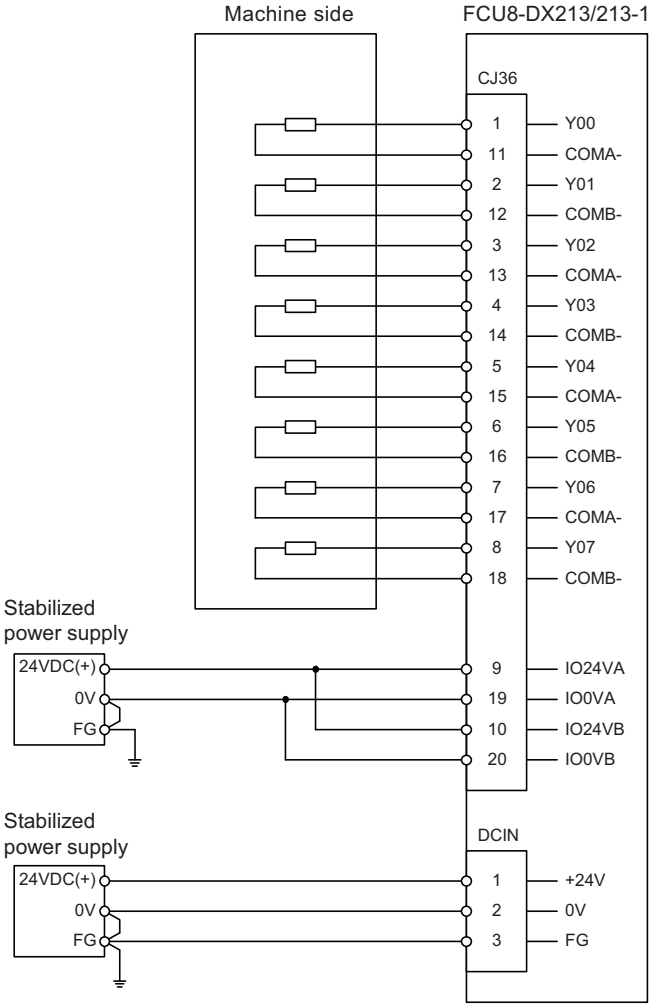
Machine input (wiring example 1): FCU8-DX213/FCU8-DX213-1



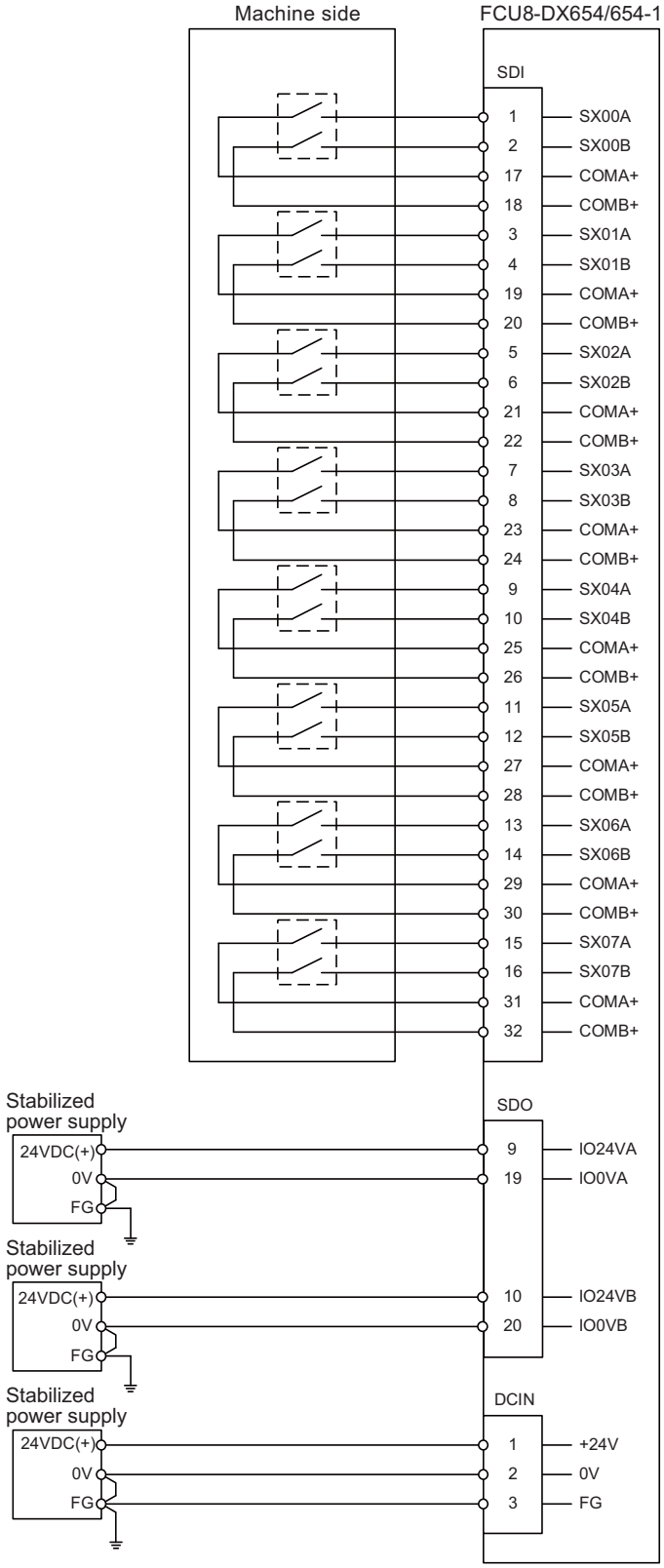
Machine input (wiring example 2): FCU8-DX213/FCU8-DX213-1



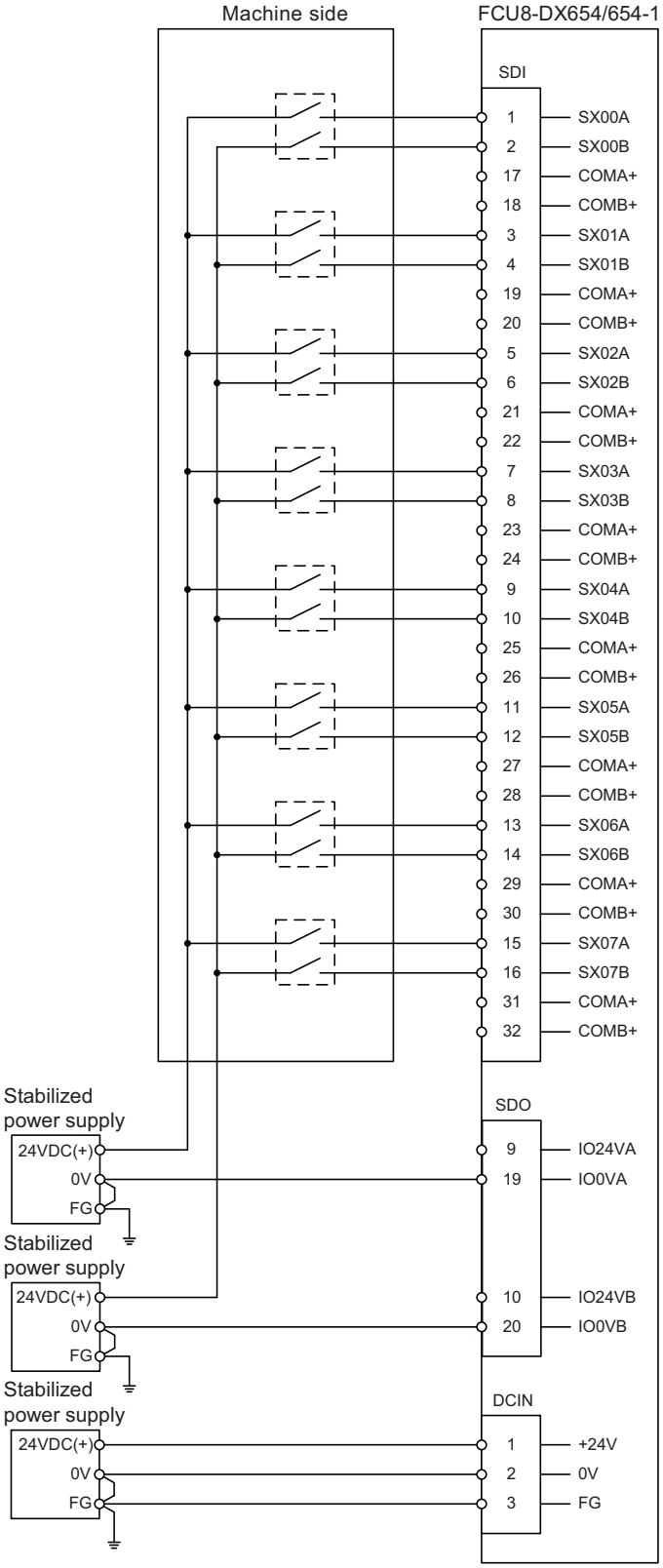
Machine output: FCU8-DX213/FCU8-DX213-1



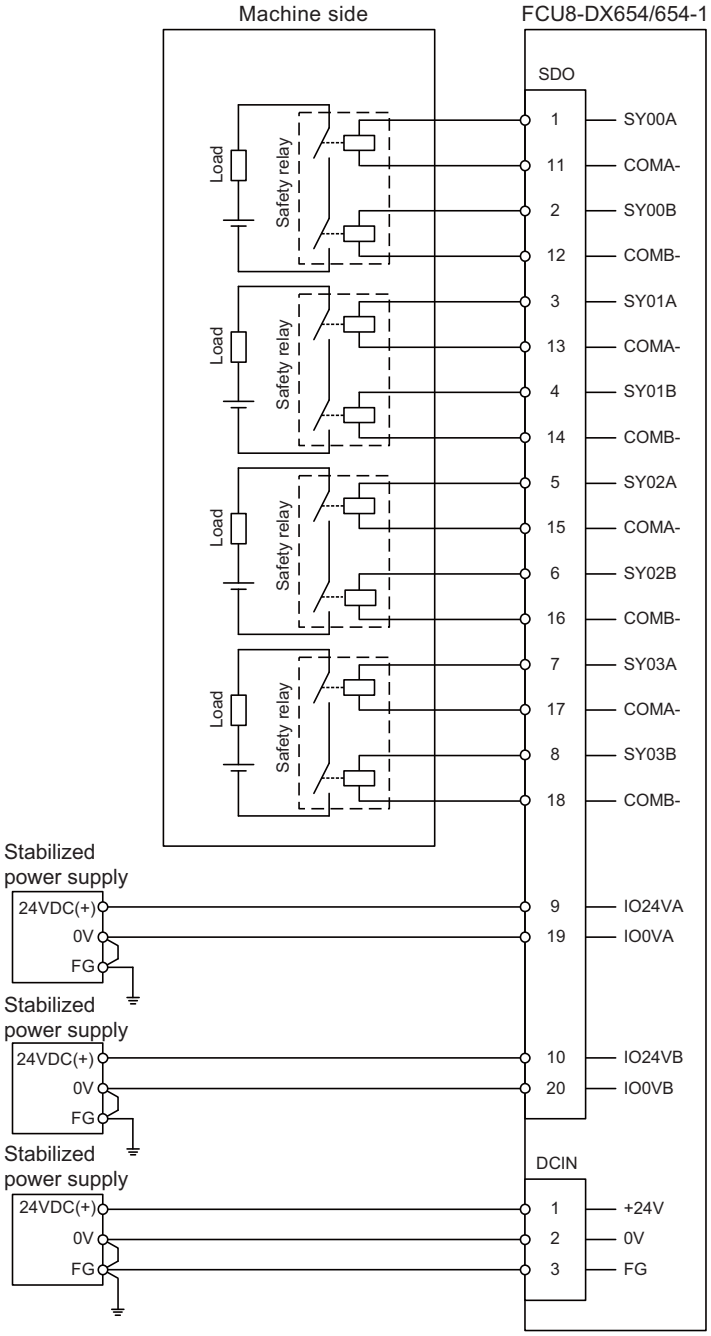
Safety machine input (wiring example 1): FCU8-DX654/FCU8-DX654-1



Safety machine input (wiring example 2): FCU8-DX654/FCU8-DX654-1

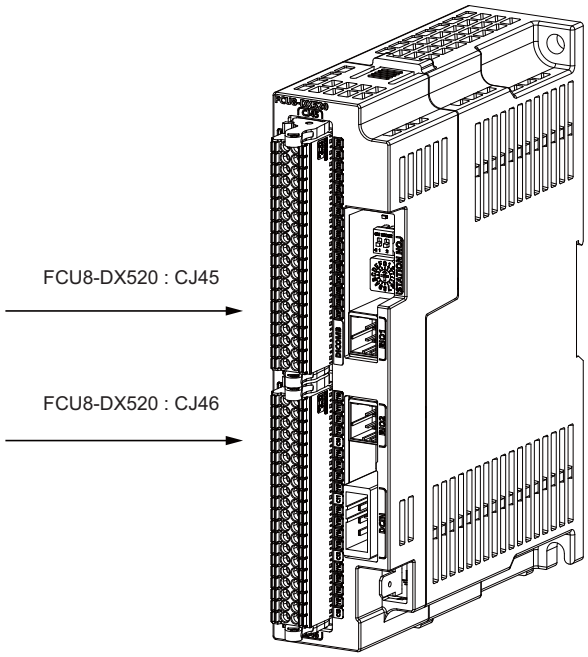


Safety machine output: FCU8-DX654/FCU8-DX654-1



10.8 Connecting with Machine Control Signal (FCU8-DX520)

FCU8-DX520



<Applicable cable>

Solid wire	: 0.2 to 1.5 mm^2
Twisted wire	: 0.2 to 1.5 mm^2
Bar terminal with insulation collar	: 0.25 to 0.75 mm^2
Bar terminal without insulation collar	: 0.25 to 1.5 mm^2
Stripping line length	: 10 mm

<Wire mounting tool (driver) type>

Type	: SZS 0.4× 2.5 VDE
Manufacturer	: Phoenix Contact

<Bar terminal type>

Type	: AI series
Manufacturer	: Phoenix Contact

<Crimp tool type>

Type	: CRIMPFOX 6
Manufacturer	: Phoenix Contact

<Recommended cable with shield material>

Type	: HK-SB/20276XL LF
Manufacturer	: Taiyo Cabletec

(Select the wire diameter from CJ45, CJ46 connector specifications.)

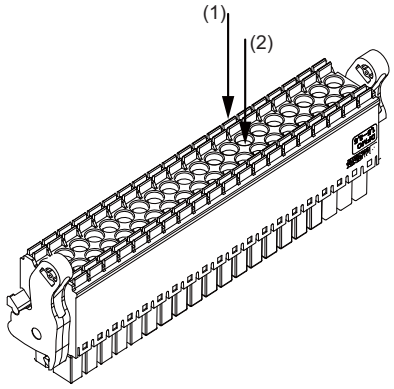
Maximum cable length is 50 m.

[Related items]

Connector pin assignment: "4.9 Remote I/O Unit" (CJ45/CJ46 connector)

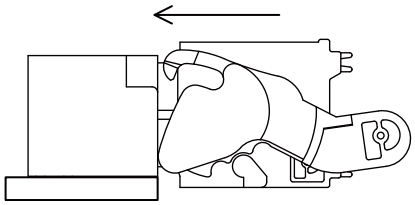
Mounting the wire

(1) Push in the wire opening lever (orange) using a slotted screwdriver (blade width: 2.5 mm).
(2) Insert the wire and then pull the screwdriver out of the wire opening lever.

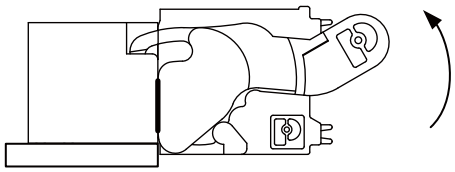


Mounting the connector

(1) Push the connector to the lock and release (LR) lever position.

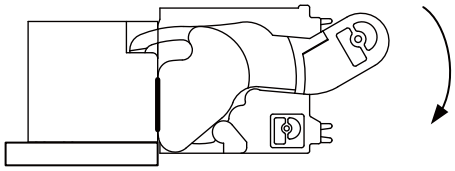


(2) When the connector is pushed in to the end, the LR lever is applied. If the lever is loose, lift up the latch and tighten the lever.

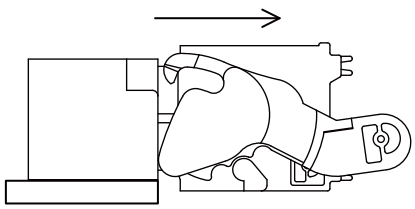


Removing the connector

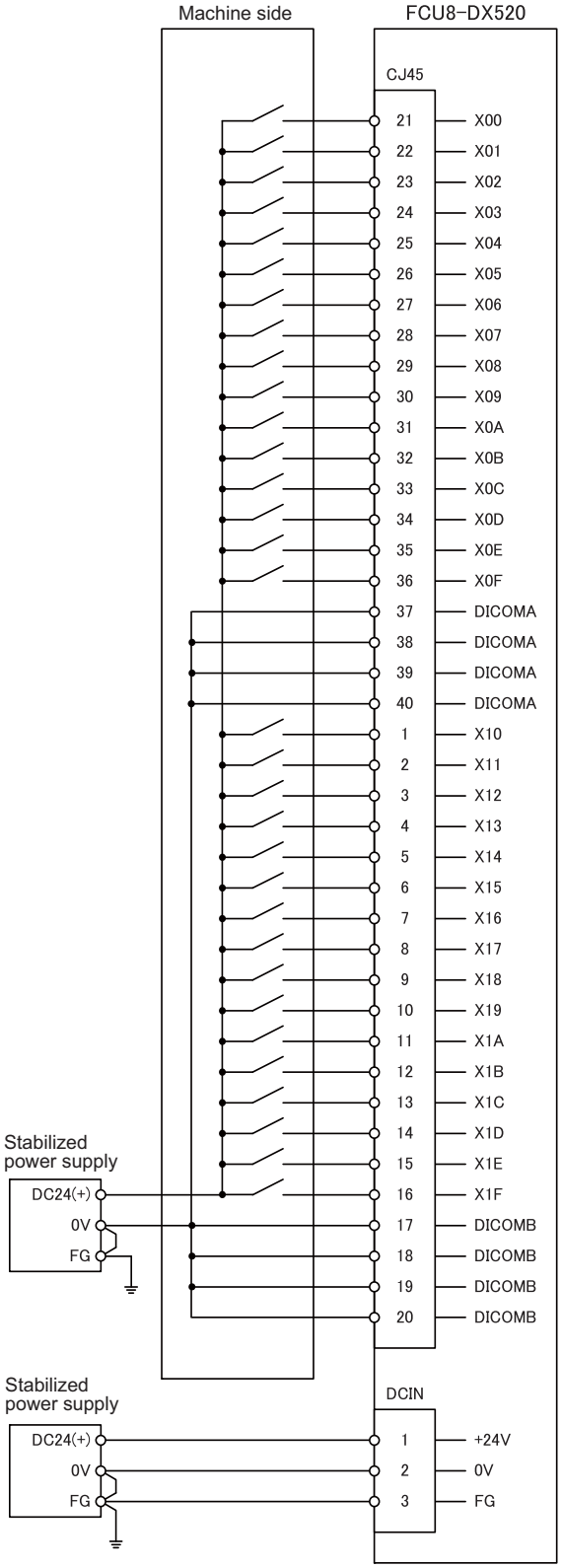
(1) Push the lock and release (LR) levers down simultaneously.



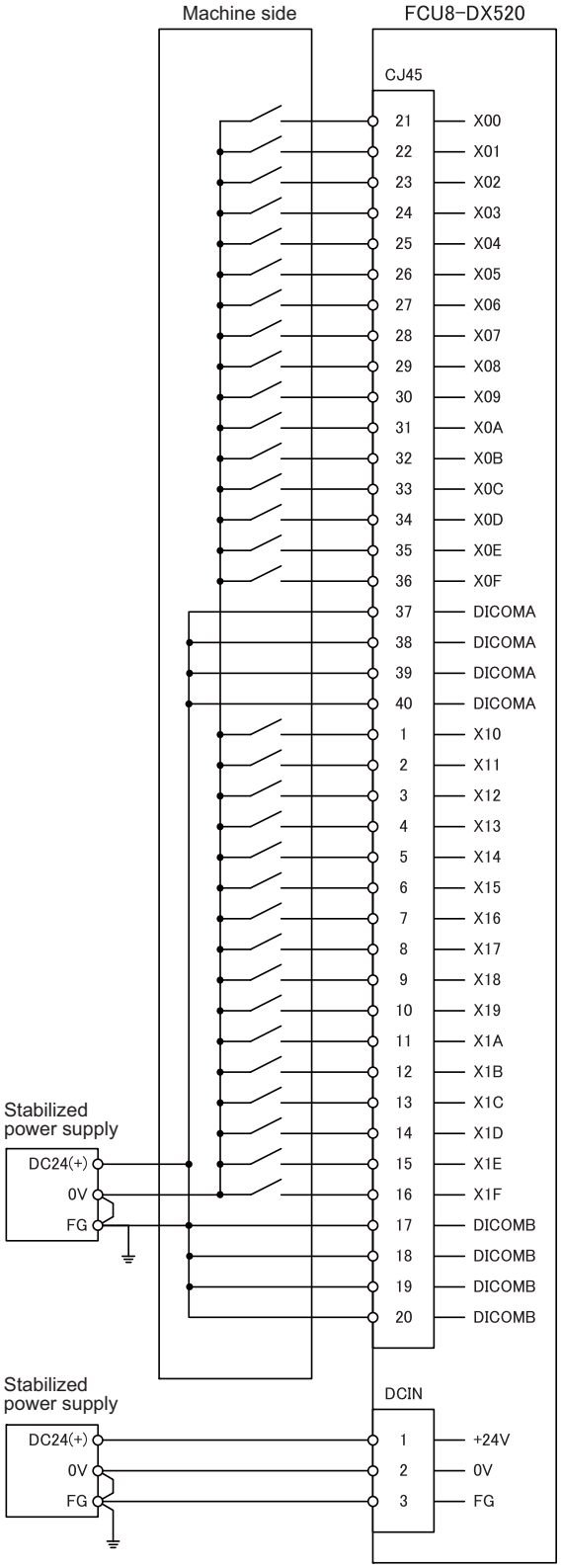
(2) After unlocking (the connector is pushed out by the LR lever and left half-inserted), pull out the connector.



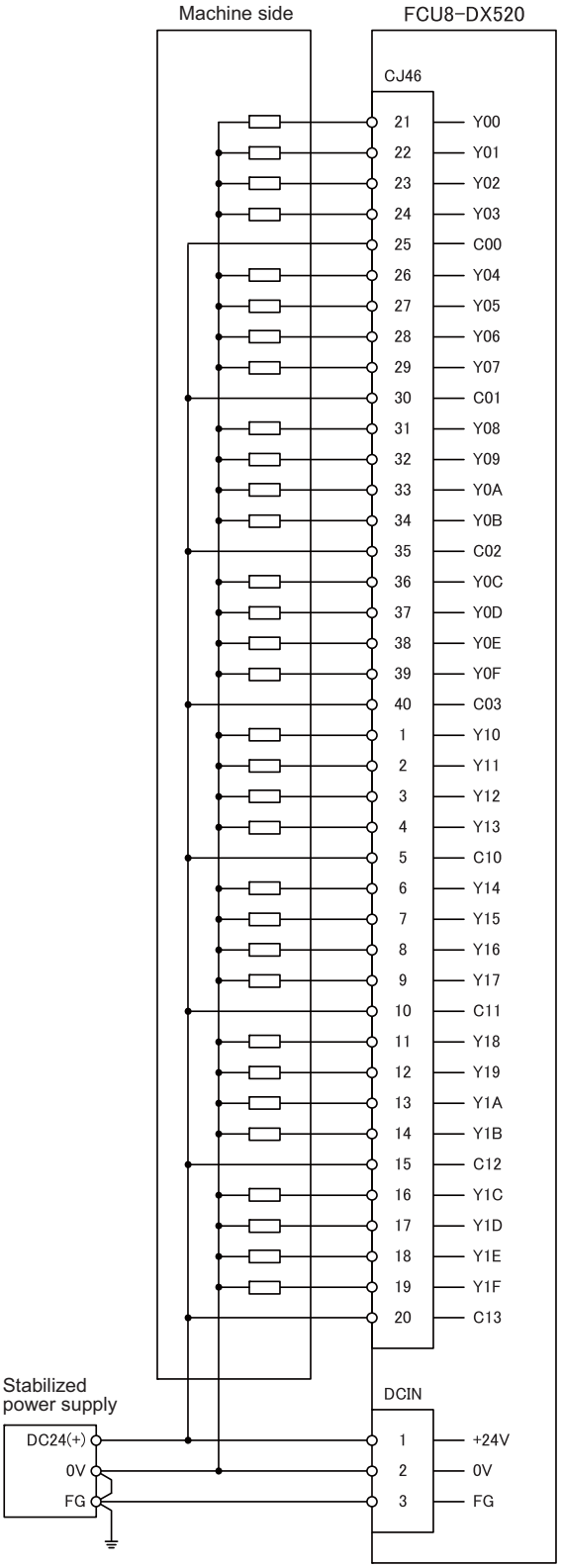
Machine input 0 V common



Machine input 24 V common



Machine output



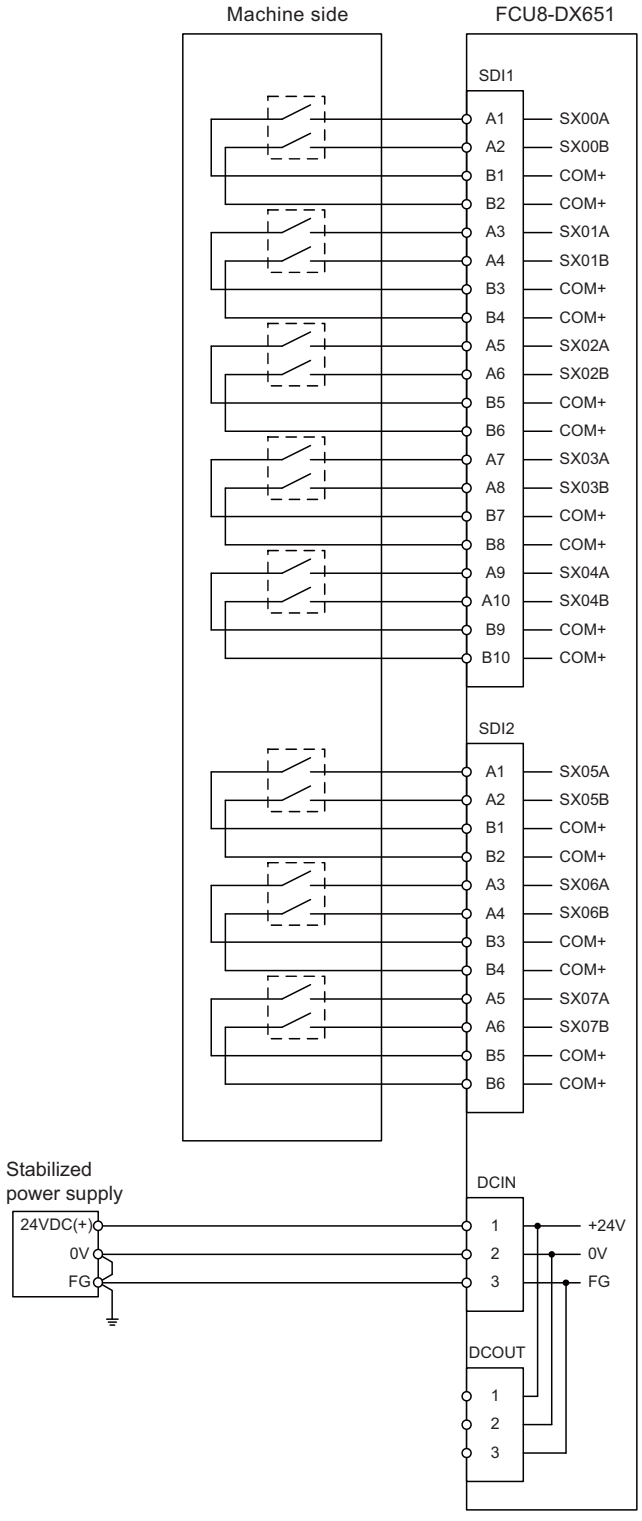
10.9 Connecting with Safety Machine Control Signal (FCU8-DX651)

⚠ CAUTION

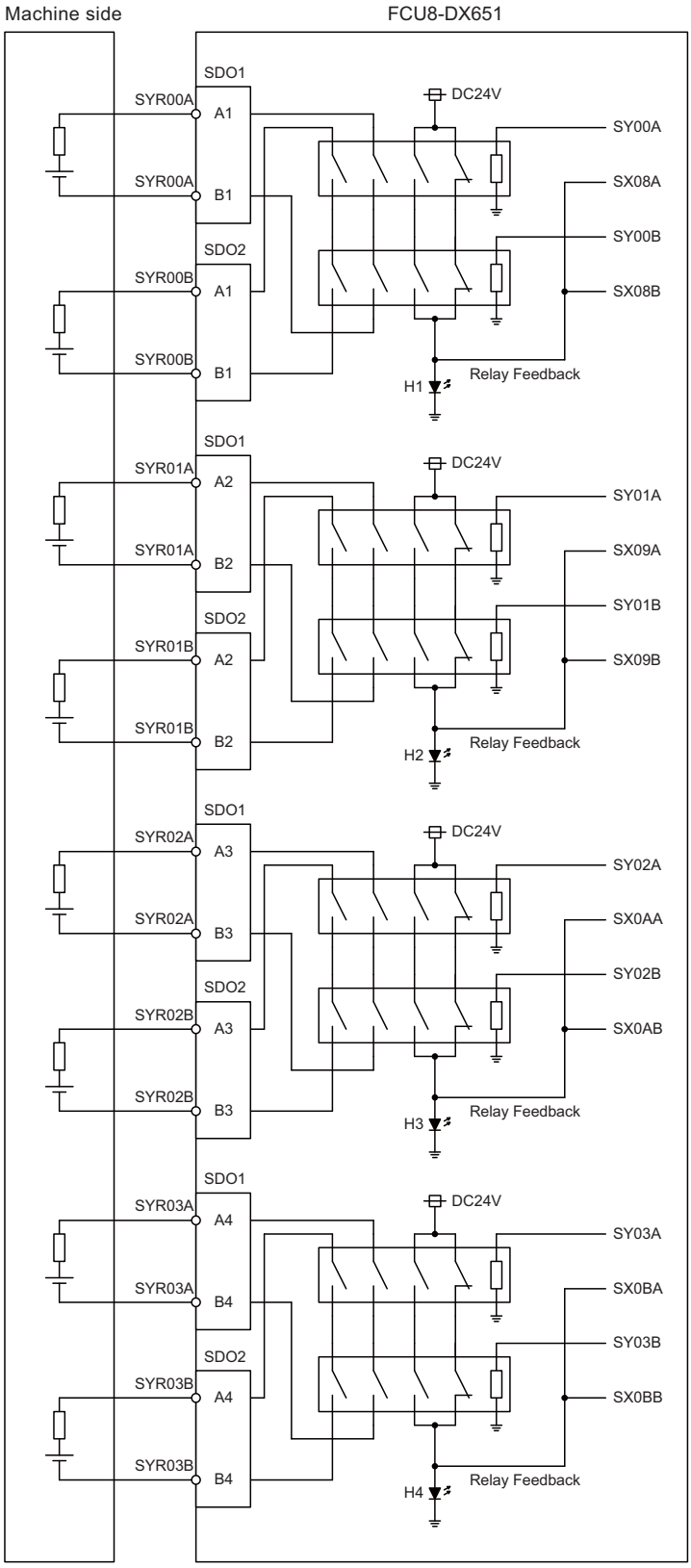
(1) Connect the cable to the designated connector. Incorrect connections could damage the device.

(2) Do not connect or disconnect the cables between units while the power is ON.

Safety DI input

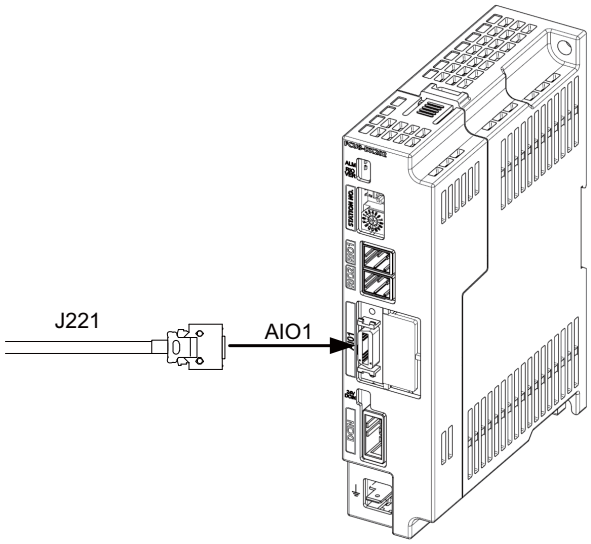


Safety relay output



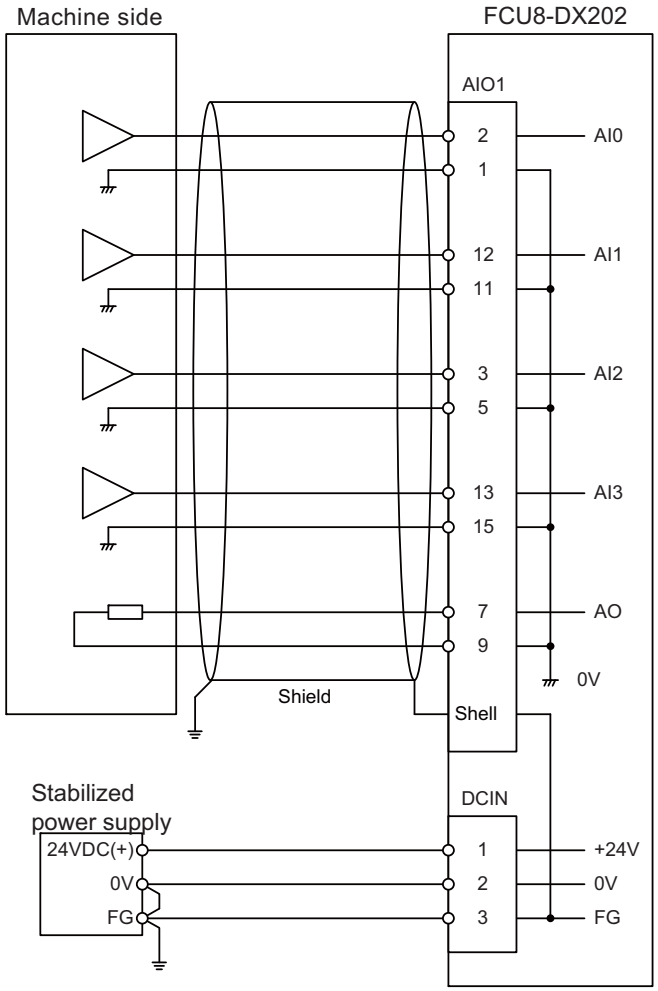
10.10 Connecting with Analog I/O Signal (FCU8-DX202)

For the analog input/output signals, connect J221 cable to the AIO1 connector of FCU8-DX202. The analog input/output signals are available to connect up to four points for the input, and up to one point for the output.



[Related items]
Cable connection drawing: "16.2.17 J221 Cable"
Connector pin assignment: "4.9 Remote I/O Unit" (AIO1 connector)

Input/output circuit



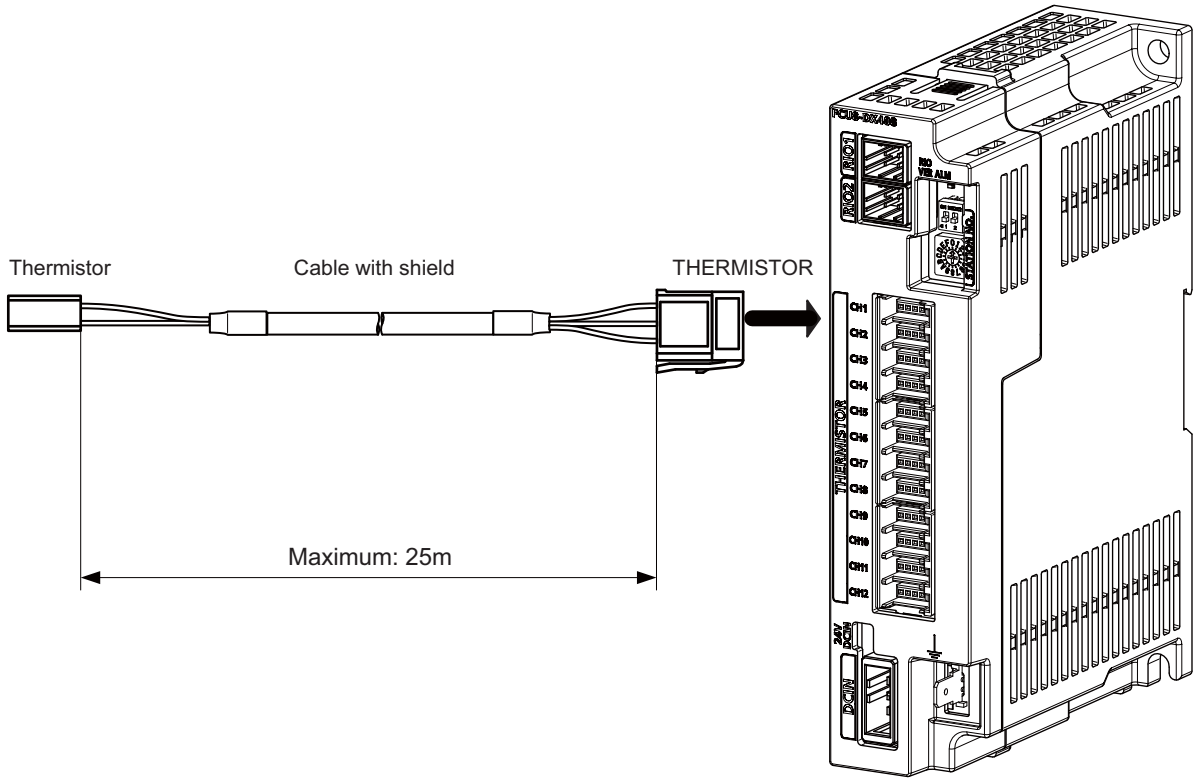
⚠ CAUTION

(1) Connect the cable to the designated connector. Incorrect connections could damage the device.

(2) Do not connect or disconnect the cables between units while the power is ON.

10.11 Connecting with Thermistor (FCU8-DX408)

Connect the thermistor with THERMISTOR connector.
The maximum cable length is 25 m.
The recommended shield cable is "HK-SB/20276XL, black, LF 1P X 22AWG" made by Taiyo Cabletec.



[Related items]
Connector pin assignment: "4.9 Remote I/O Unit" (THERMISTOR connector)

⚠ CAUTION

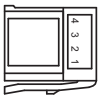
(1) Connect the cable to the designated connector. Incorrect connections could damage the device.

(2) Do not connect or disconnect the cables between units while the power is ON.

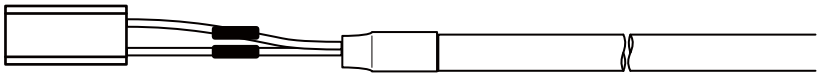
(3) Use shielded cable and ground it in order to reduce noise interference.

Thermistor cable connecting procedure

The thermistor cable has the following configuration:

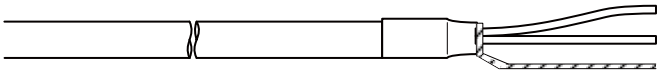
Thermistor	Cable with shield	THERMISTOR connector
		

(1) Solder the thermistor to the shield cable and cover the joint surface with the protection tube.



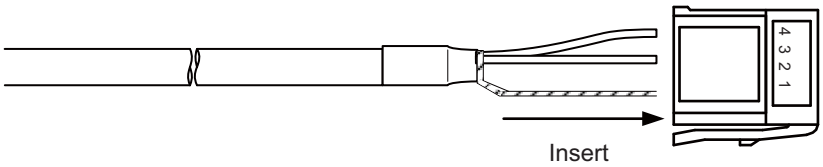
Tube for protection

(2) Twist the shield of the cable or pull out the drain wire.



Twister shield wire
or drain wire

(3) Insert the wire into the THERMISTOR connector as follows:

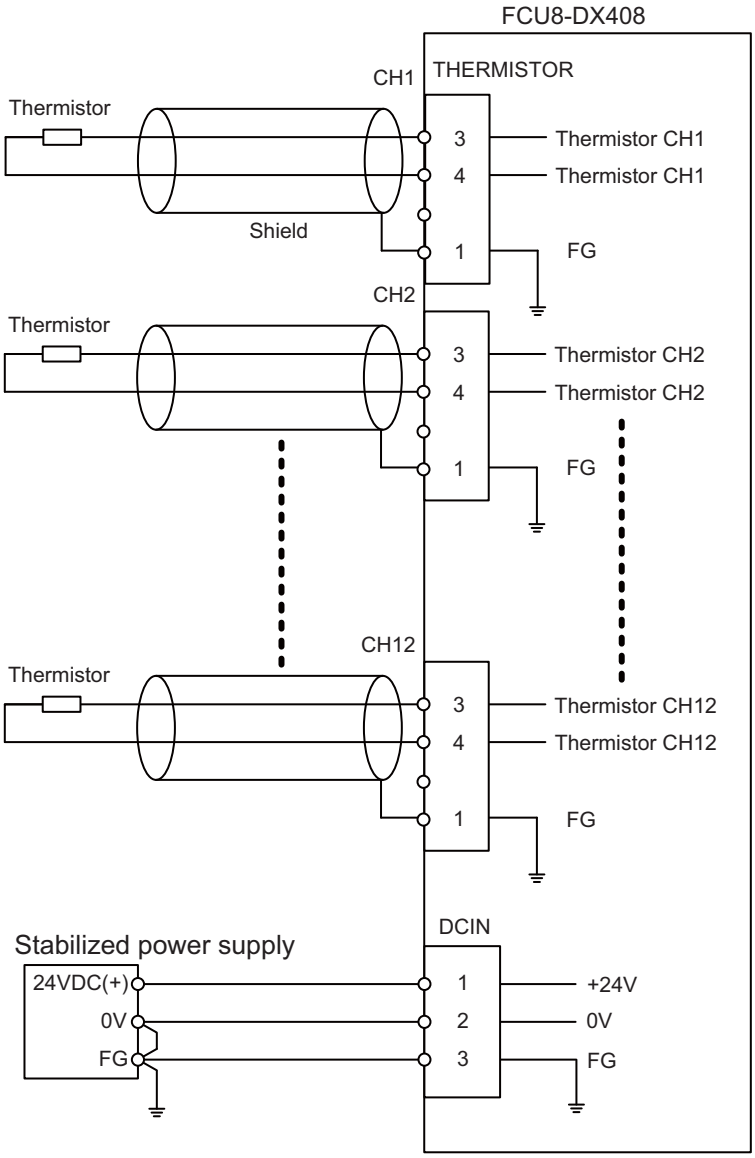


Insert

1 pin: Twisted shield wire or drain wire
2 pin: Not connected.
3 pin: Thermistor
4 pin: Thermistor

(4) Crimp the THERMISTOR connector with pliers.
Make sure the crimp is horizontal.

Connecting with thermistor: FCU8-DX408



10.12 Connecting with Multi-analog Input Signal (FCU8-DX409)

There are four types of multi-analog input signals as below:

- Voltage input signal
- Current input signal
- Thermocouple input signal
- Resistance temperature detector input signal

Connect these signals to AI connector.

Up to 4 points of multi-analog input signals (CH1 to CH4) can be connected.

The measurement mode (voltage measurement, current measurement, temperature (thermocouple) measurement and temperature (resistance temperature detector) measurement) can be set for each CH.

All CHs (CH1 to CH4) are set to the voltage measurement mode when the machine is delivered.

Prepare the thermocouple, resistance temperature detector and cable with shield.

[Note]

- Input the appropriate signal for the set measurement mode.

  Note

  - Do not input the voltage when the current or temperature (thermocouple or resistance temperature detector) measurement mode is set. This could result in faults of the unit. Pay close attention to the combination of the measurement mode setting and input.

- Running-in is required for about 10 to 15 minutes after the power is ON until the measurement value is stable.
- Do not apply voltage or current from external devices before turning ON the power of multi-analog input unit. This may damage the multi-analog input unit.
  Turn ON the power of the multi-analog input unit and external device at the same time, or wire circuit so that the power supply of the multi-analog input unit is turned ON first.

⚠ CAUTION

(1) Connect the cable to the designated connector. Incorrect connections could damage the device.

(2) Do not connect or disconnect the cables between units while the power is ON.

AI: DFMC1, 5/12-ST-3, 5-LR (Phoenix Contact)

<Applicable cable>

Solid wire	: 0.2-1.5 mm^2
Twisted wire	: 0.2-1.5 mm^2
Bar terminal with insulation collar	: 0.25-0.75mm^2
Bar terminal without insulation collar	: 0.25-1.5mm^2
Stripping line length	: 10 mm

<Wire mounting tool (driver) type>

Type : SZS 0, 4X2, 5 VDE
Manufacturer : Phoenix Contact

<Bar terminal type>

Type : AI series
Manufacturer : Phoenix Contact

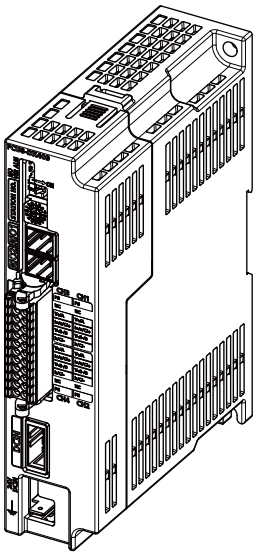
<Crimp tool type>

Type : CRIMPFOX 6
Manufacturer : Phoenix Contact

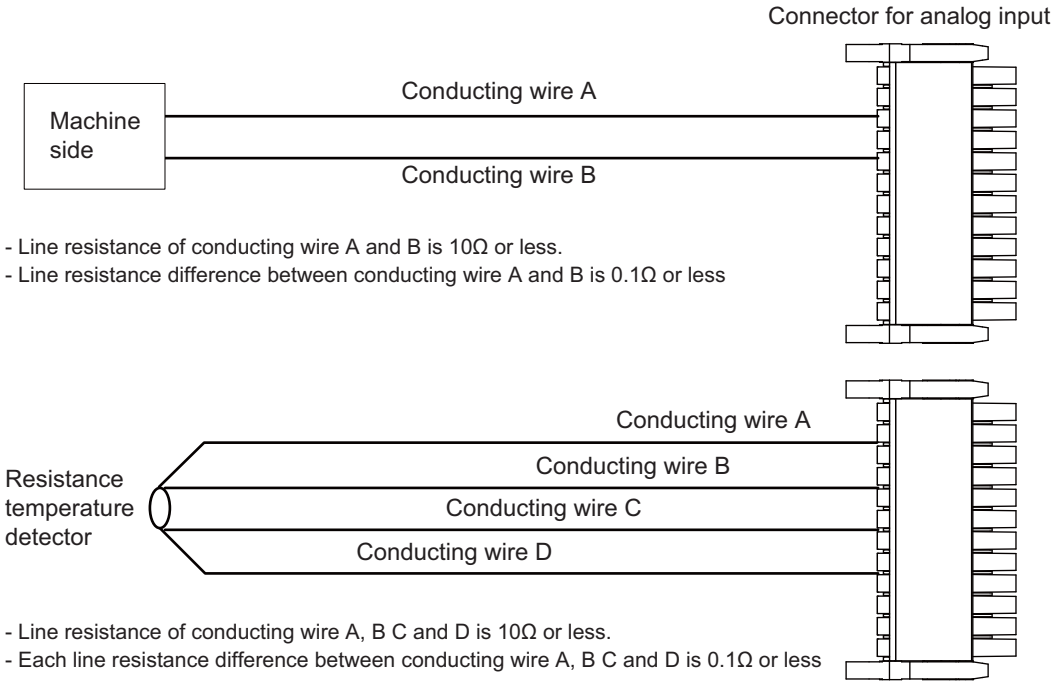
<Recommended cable with shield material>

Type : HK-SB/20276XL LF
Manufacturer : Taiyo Cabletec
(Select the wire diameter from AI connector specification.)

FCU8-DX409 : AI



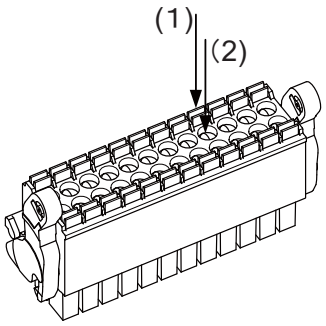
Maximum cable length is 50 m. Line resistance is 10 Ω or less, and line resistance difference is 0.1 Ω or less (see below).



[Mounting the wire]

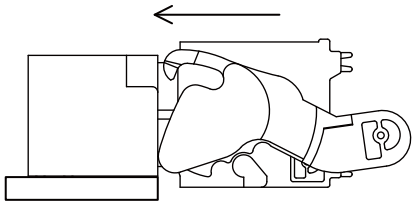
(1) Push in the wire opening lever (orange) using a slotted screwdriver (blade width: 2.5 mm).

(2) Insert the wire and then pull the screwdriver out of the wire opening lever.

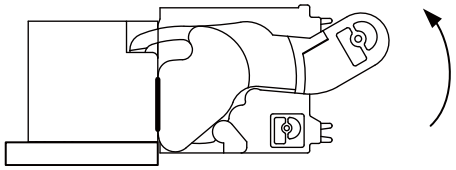


[Mounting the connector]

(1) Push the connector to the lock and release (LR) lever position.

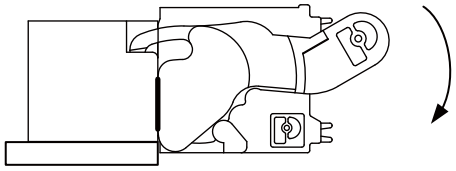


(2) When the connector is pushed in to the end, the LR lever is applied. If the lever is loose, lift up the latch and tighten the lever.

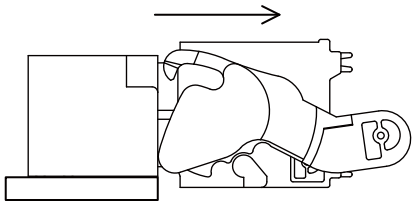


[Removing the connector]

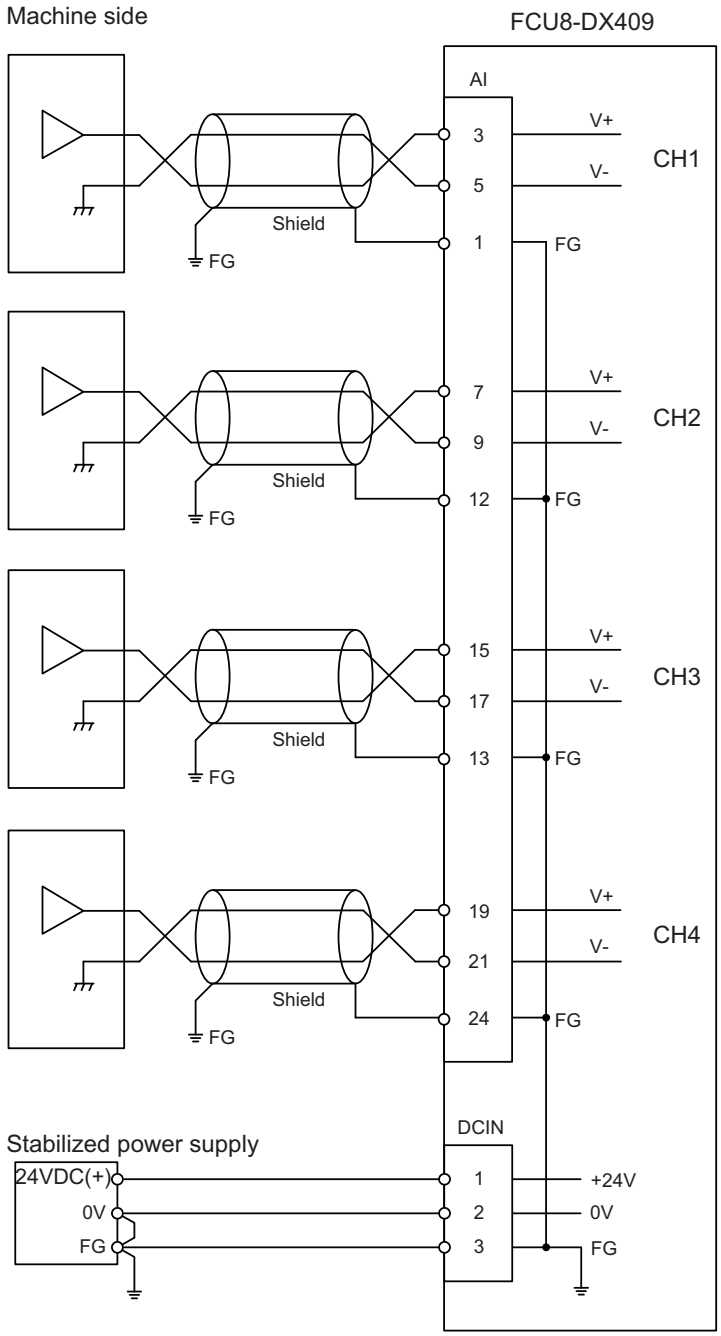
(1) Push the lock and release (LR) levers down simultaneously.



(2) After unlocking (the connector is pushed out by the LR lever and left half-inserted), pull out the connector.

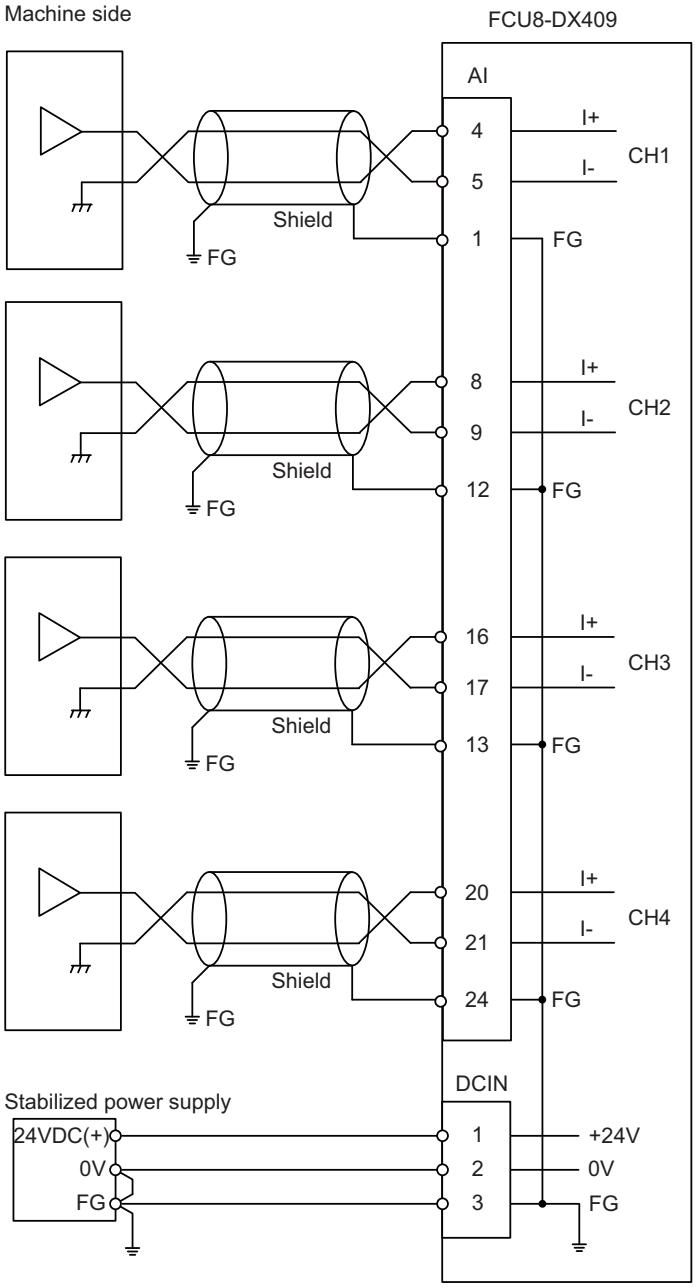


Connecting with the voltage input signal



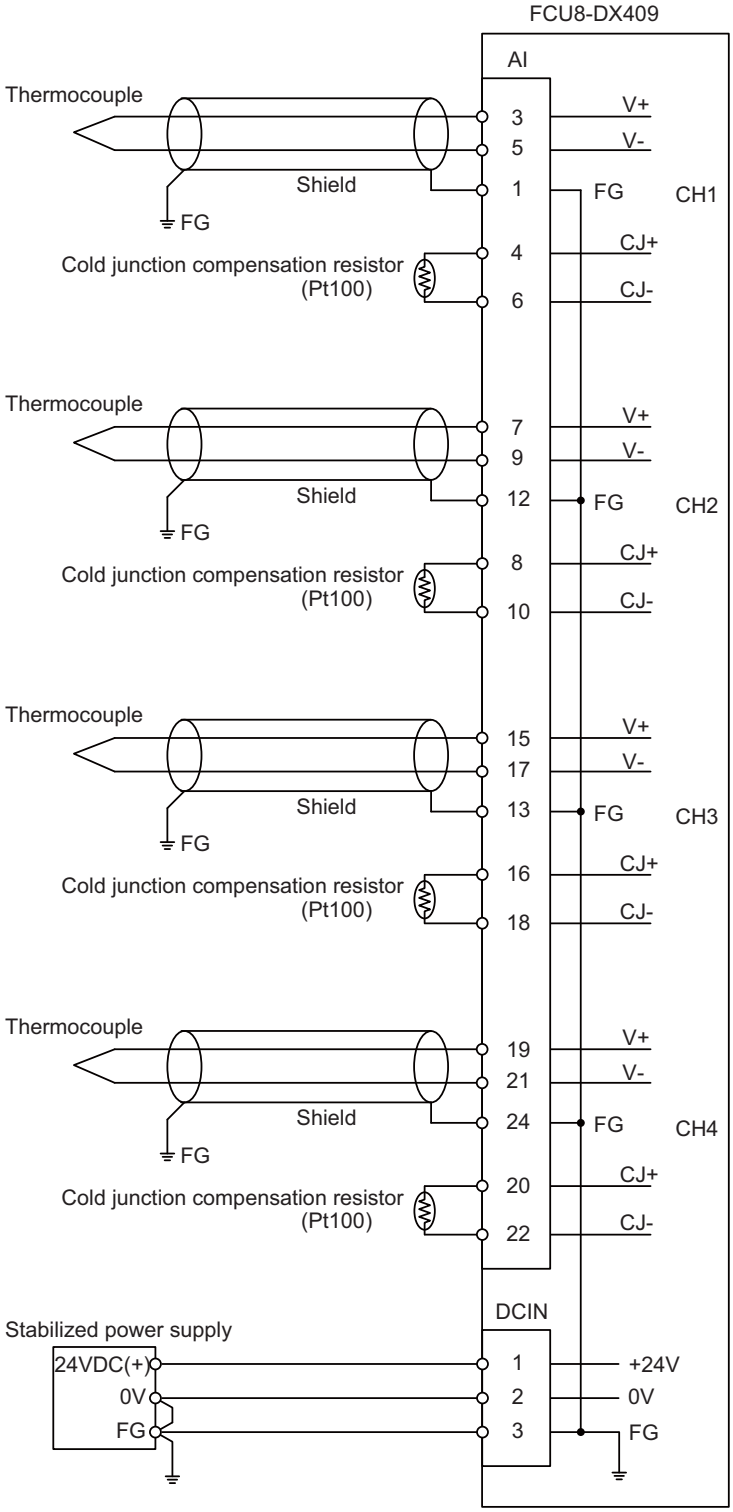
- Use the twisted cable with shield to reduce the influence of noise.
- Connect the shield to FG pin of AI connector. Ground the machine side, too.
- Do not connect or disconnect the cables between units while the power is ON.

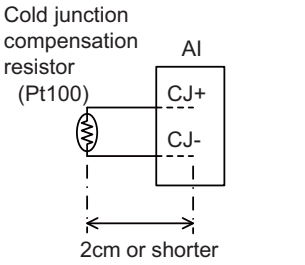
Connecting with the current input signal



- Use the twisted cable with shield to reduce the influence of noise.
- Connect the shield to FG pin of AI connector. Ground the machine side, too.
- Do not connect or disconnect the cables between units while the power is ON.

Connecting with the thermocouple input signal





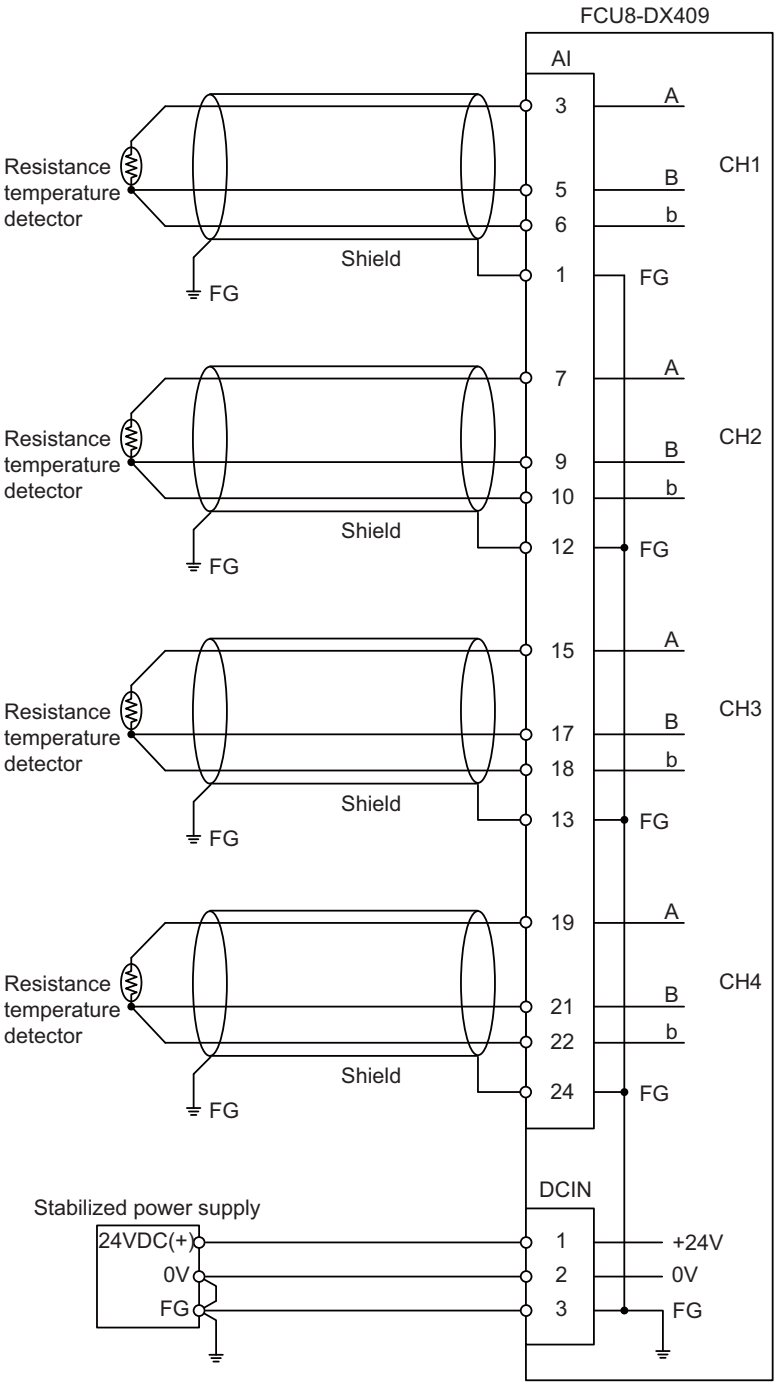
Set the lead length 2cm or shorter including the length to insert to AI connector. (As a guide)

- Connect the shield to FG pin of AI connector. Ground the thermocouple tip side, too.
- Do not connect or disconnect the cables between units while the power is ON.
- Keep the lead length of cold junction compensation resistors as short as possible. (2 cm or shorter as a guide)

Connecting with the resistance temperature detector input signal

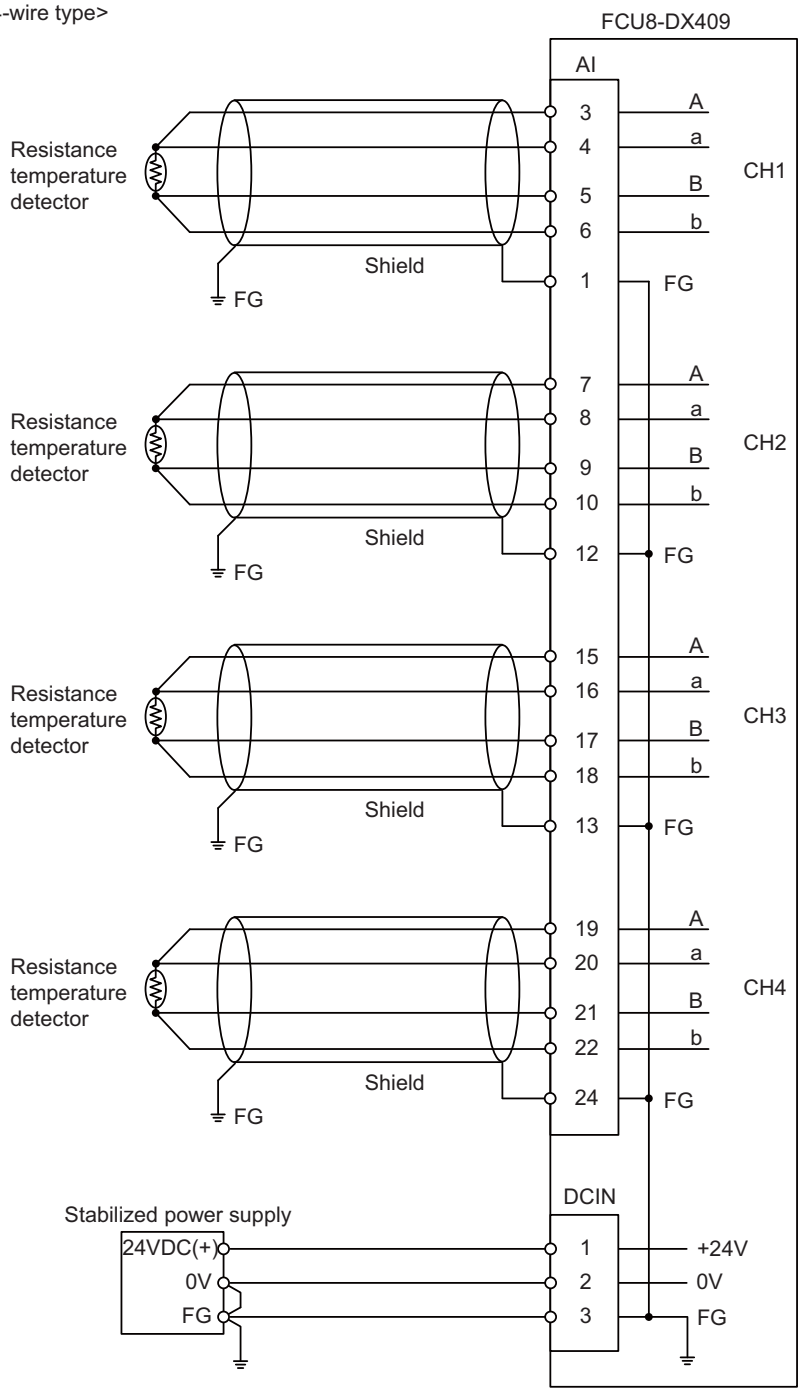
There are 3-wire type and 4-wire type for the connecting method of resistance temperature detector.

<3-wire type>



- Use the shield cable with shield to reduce the influence of noise.
- Connect the shield to FG pin of AI connector. Ground the cold junction compensation resistor side, too.
- Do not connect or disconnect the cables between units while the power is ON.

<4-wire type>



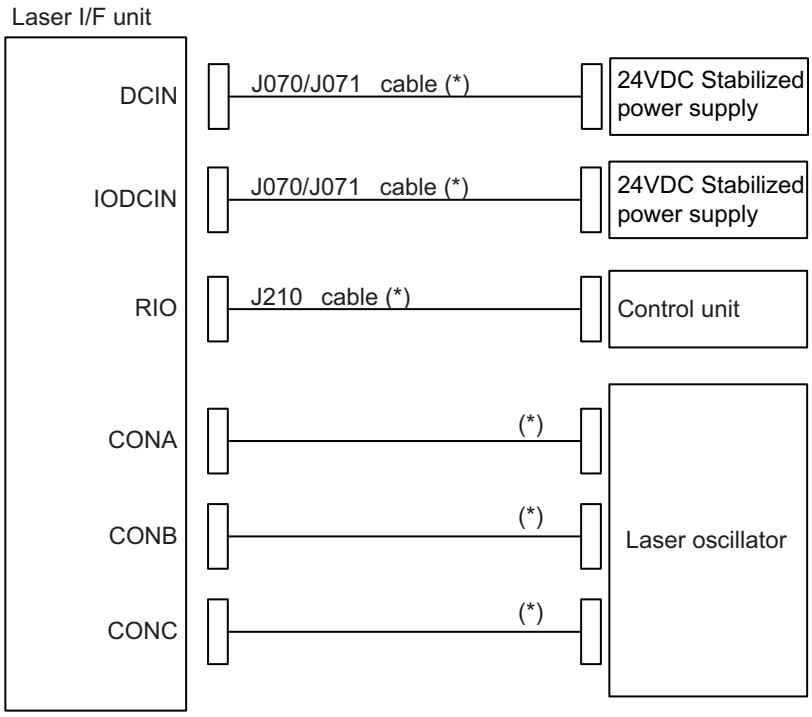
- Use the shield cable with shield to reduce the influence of noise.
- Connect the shield to FG pin of AI connector. Ground the cold junction compensation resistor side, too.
- Do not connect or disconnect the cables between units while the power is ON.

11

Connection of Laser I/F Unit

This chapter describes the connection of the laser I/F unit and machine control signals.

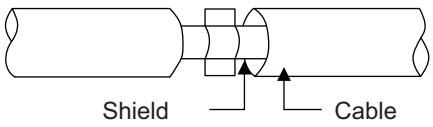
11.1 Laser I/F Unit Connection System Drawing



Note

(1) The section indicated with asterisk (*) indicates cable to be wired outside the electric cabinet.
Since the cable could be affected by the exogenous noise depending on the environment, the following noise countermeasure is recommended.

Expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



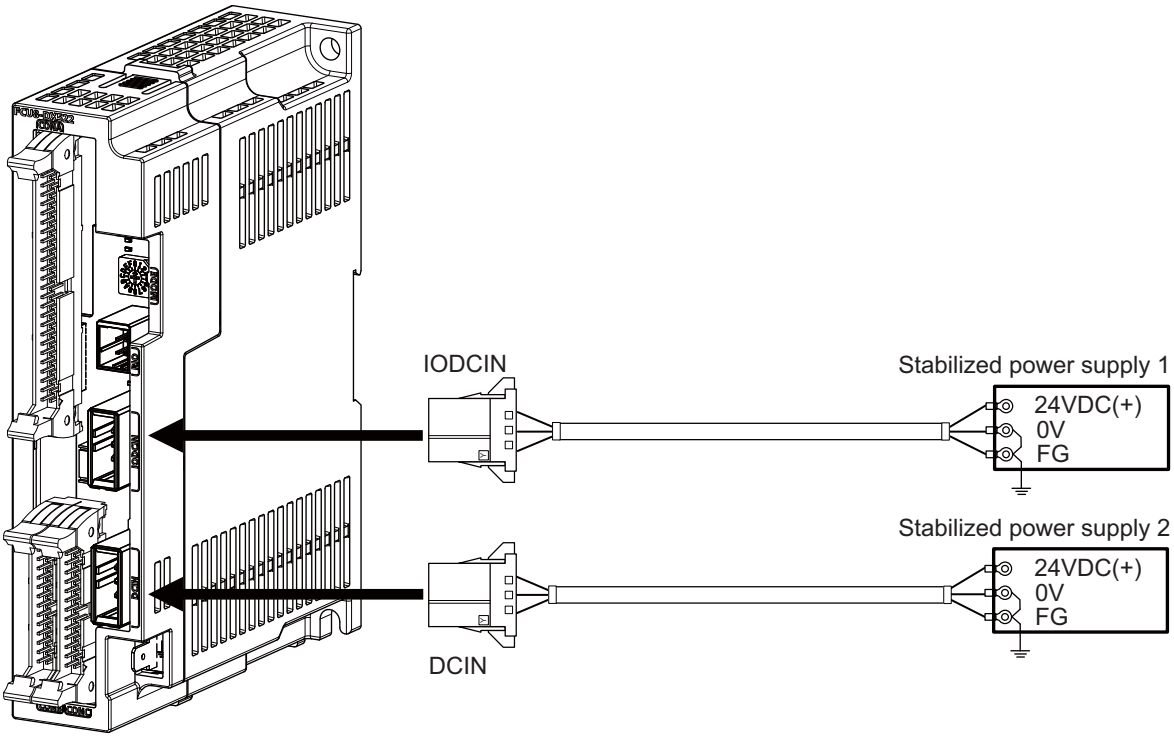
When you cannot use the shield clamp, install a ferrite core as a substitute.

<Related item>

Shield clamp fitting: "42.6.1 Shield Clamp Fitting"

Ferrite core: "42.6.2 Ferrite Core"

11.2 Connecting with Power Supply

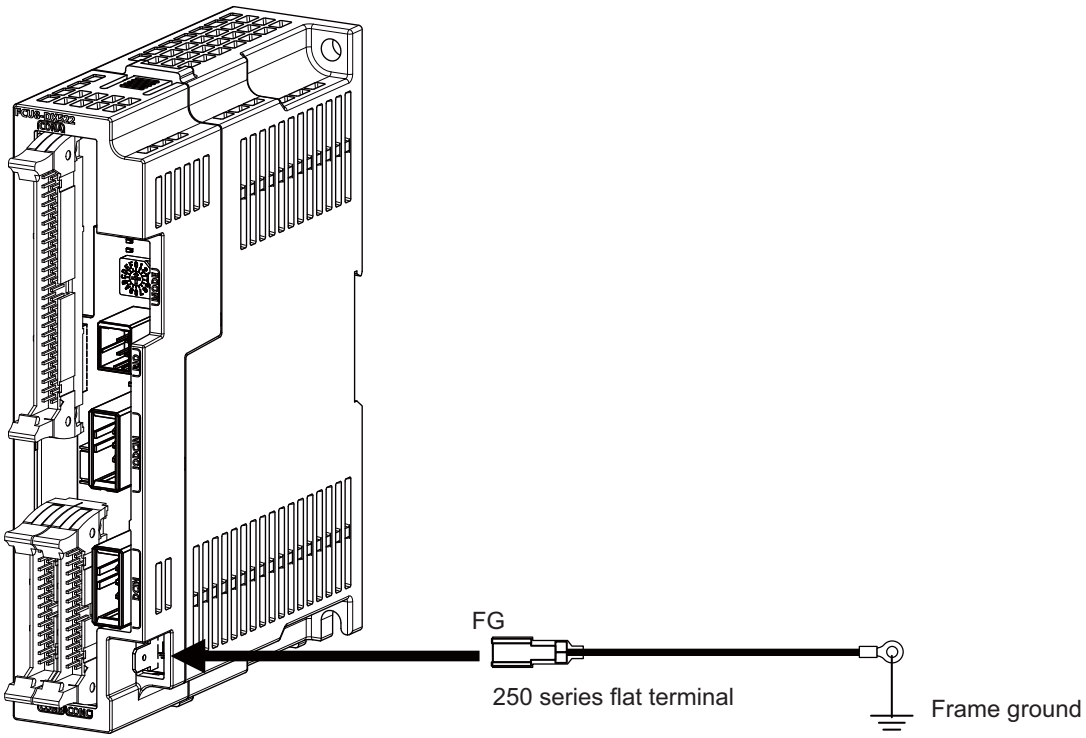


[Related items]

Cable connection drawing: "16.2.12 J070/J071 Cable"

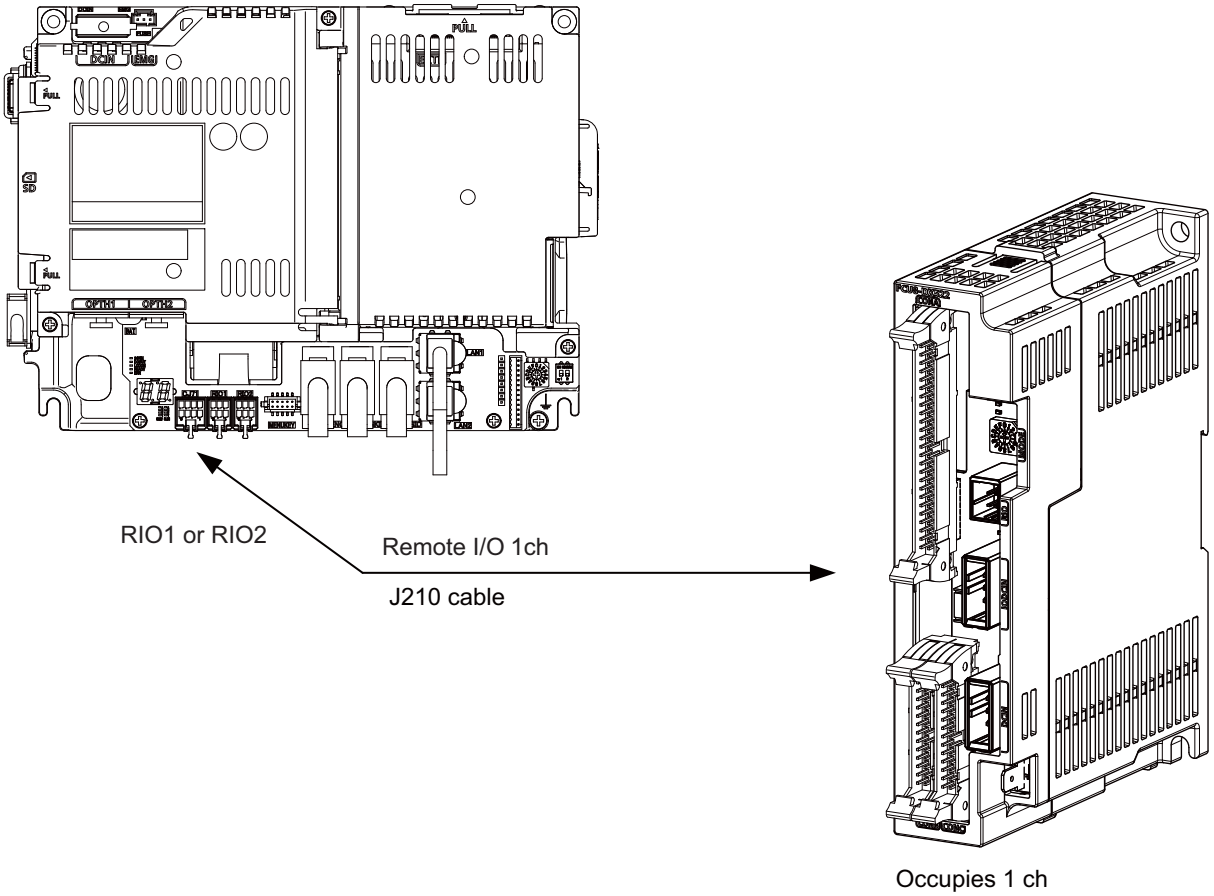
Connector pin assignment: "4.10 Laser I/F Unit" (DCIN, IODCIN connector)

11.3 Connecting with Frame Ground



[Flat terminal type]
Flat terminal: 175021-1/175023-1
Protection cover: 174817-2
Manufacturer: TE Connectivity

11.4 Connecting with Control Unit



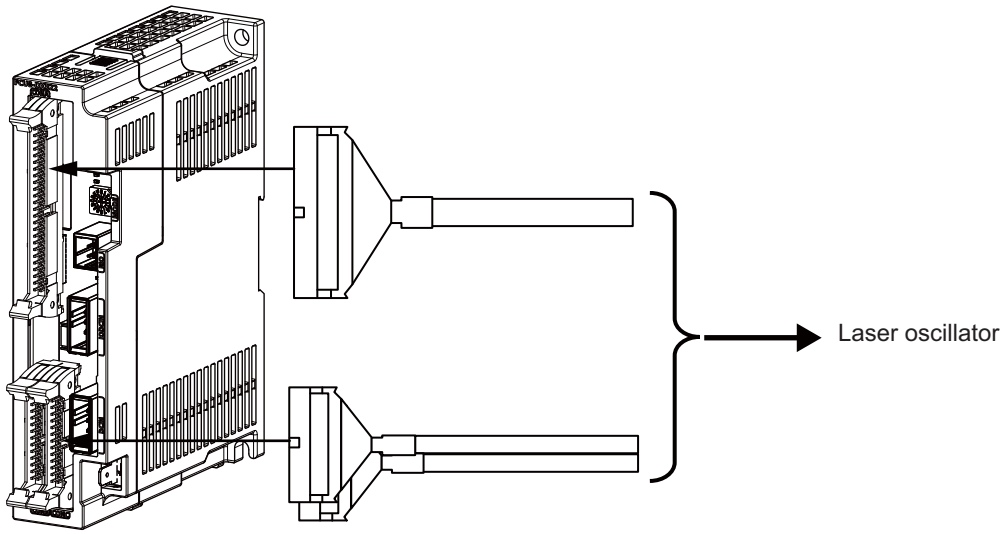
Note

(1) Connect the J210 cable to the RIO1 or RIO2 connector of the control unit.
Check the connector position with the actual machine.

(2) Laser I/F unit occupies 1 ch of the remote I/O. The remote I/O unit cannot be connected between the control unit and the laser I/F unit.

11.5 Connecting with Laser Oscillator

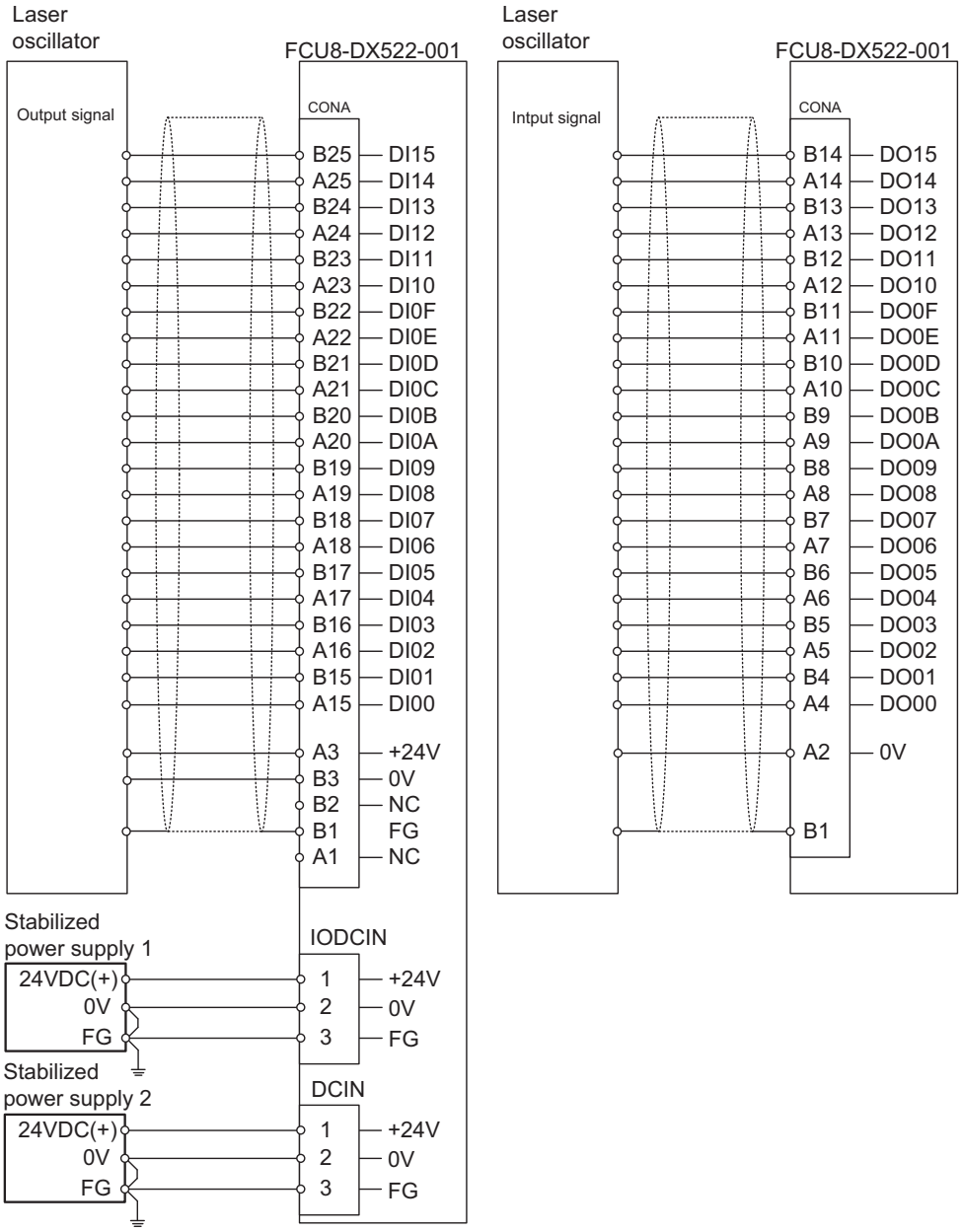
FCU8-DX522-001



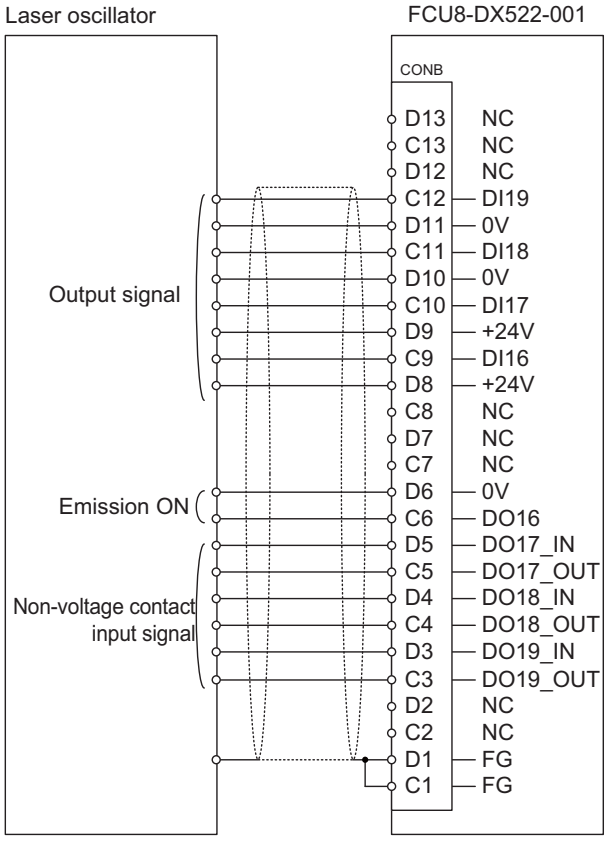
[Related items]
Connector pin assignment: "4.10 Laser I/F Unit" (CONA, CONB, CONC connector)

> **⚠ CAUTION**
>
> **(1) Connect the cable to the designated connector. Incorrect connections could damage the device.**
>
> **(2) Do not connect or disconnect the cables between units while the power is ON.**

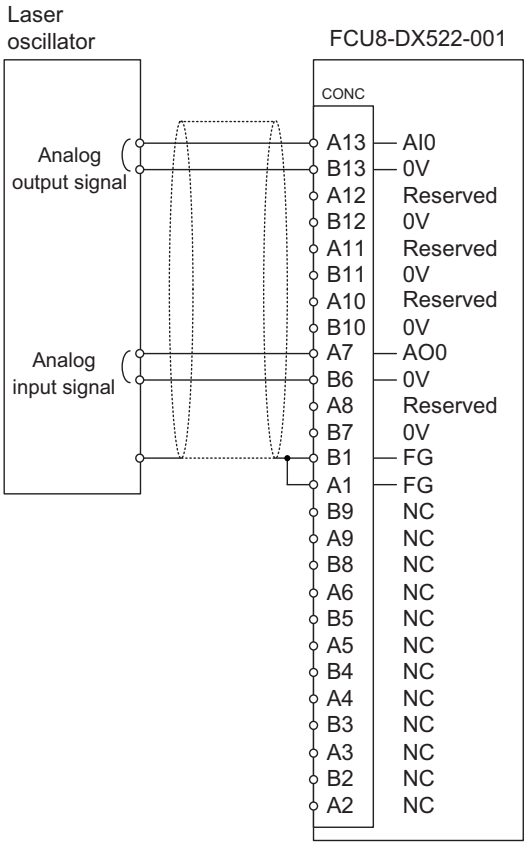
[Example connection of CONA]



[Example connection of CONB]



[Example connection of CONC]



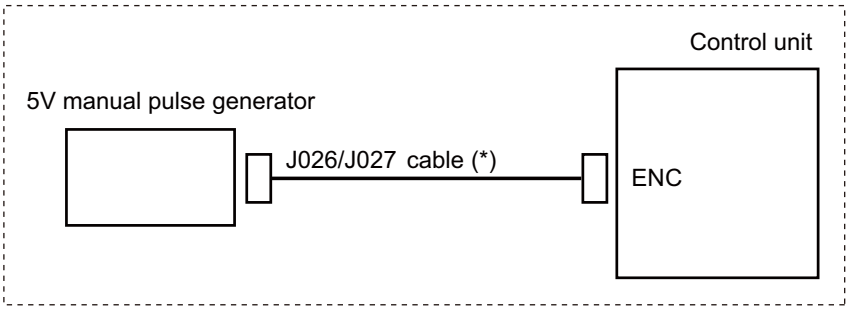
12

Connection of Manual Pulse Generator

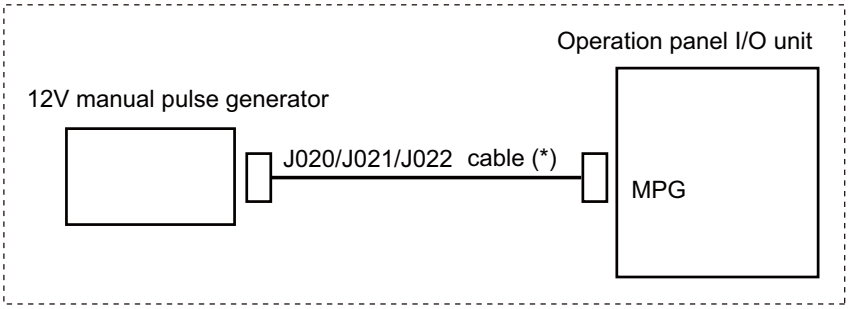
The method for connecting to each unit and device from the manual pulse generator is briefly explained in this chapter.

12.1 Manual Pulse Generator Connection System Drawing

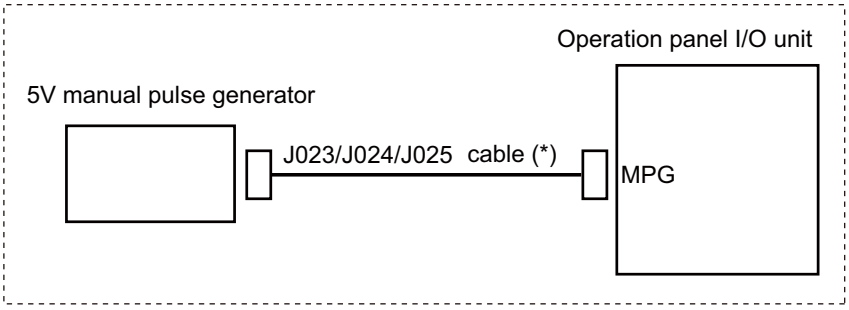
Connecting to control unit (5V)



Connecting to operation panel I/O unit (12V)



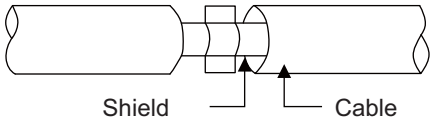
Connecting to operation panel I/O unit (5V)



Note

(1) The section indicated with asterisk (*) indicates cable to be wired outside the operation panel.
Since the cable could be affected by the exogenous noise depending on the environment, the following noise countermeasure is recommended.

Expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



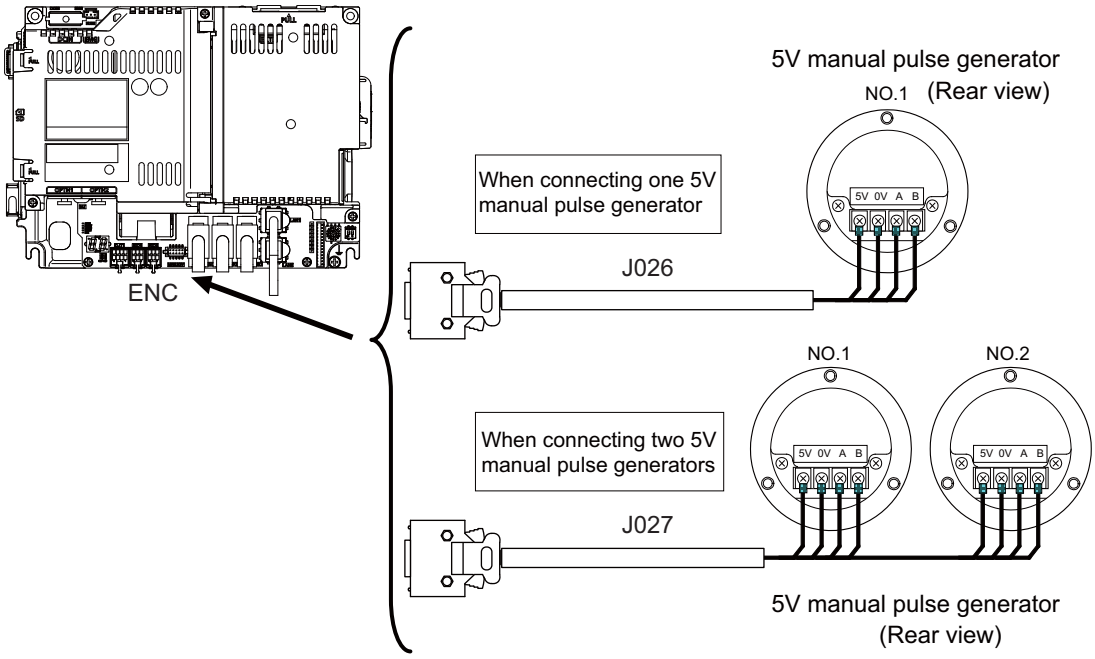
When you cannot use the shield clamp, install a ferrite core as a substitute.

<Related item>

Shield clamp fitting: "42.6.1 Shield Clamp Fitting"

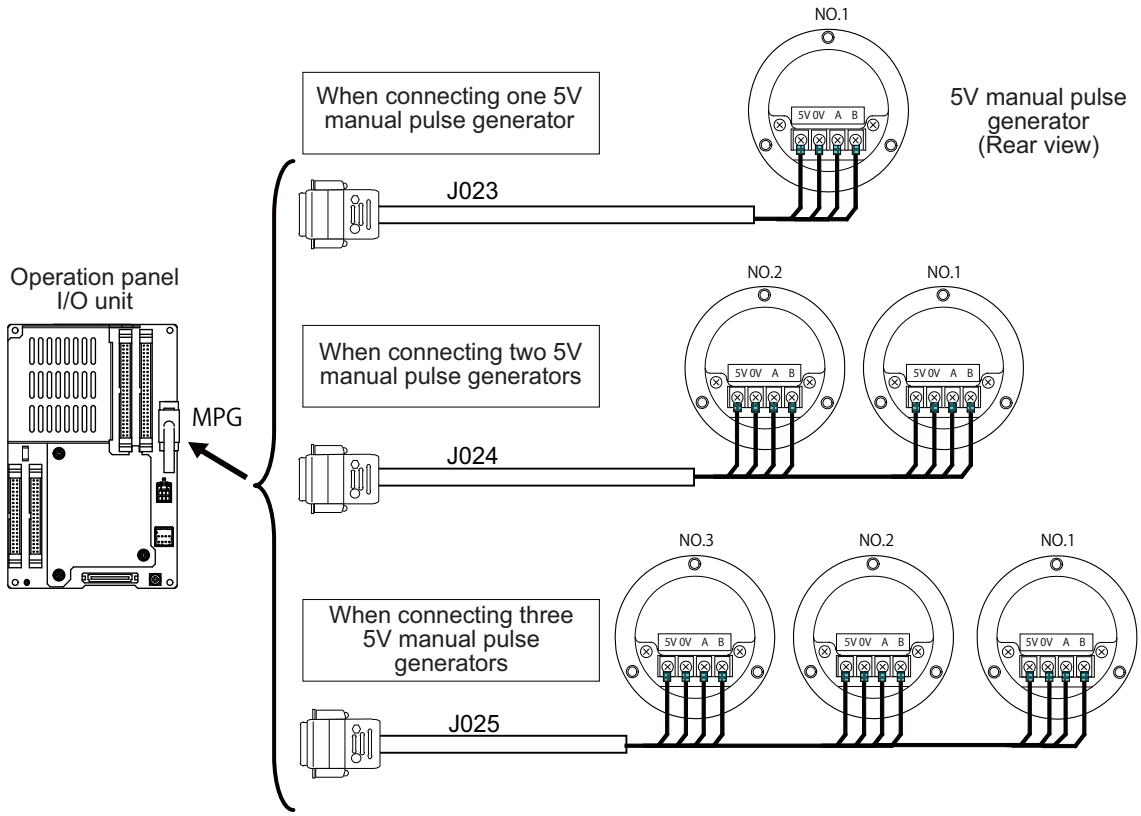
Ferrite core: "42.6.2 Ferrite Core"

12.2 Connecting with Control Unit

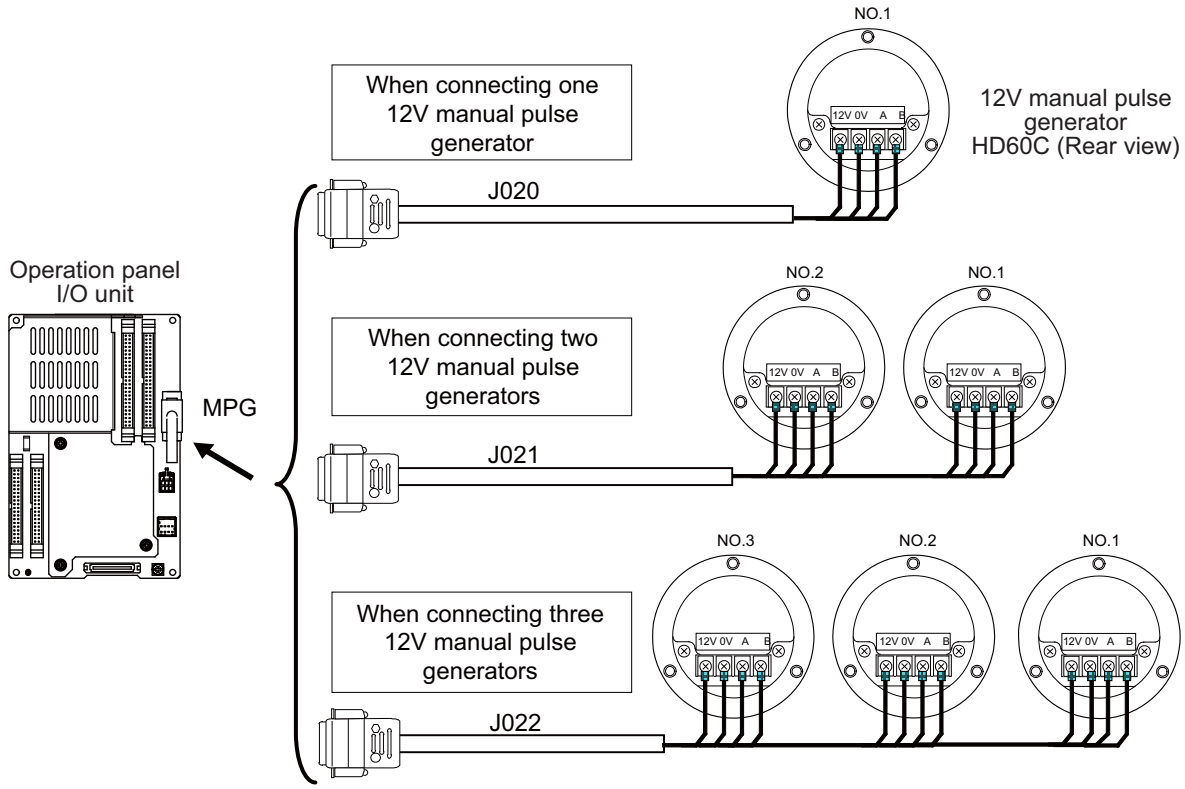


12.3 Connecting with Operation Panel I/O Unit

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



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



Note

(1) When selecting a manual pulse generator, make sure that its case and 0 V terminal are insulated.

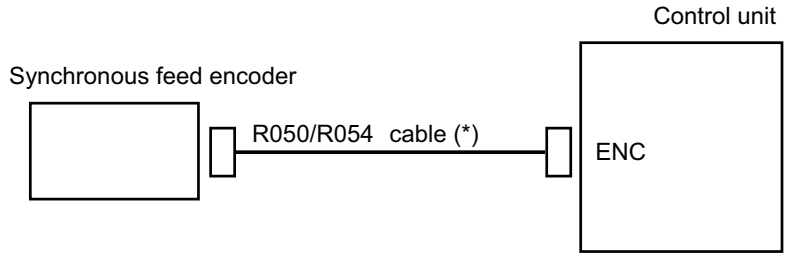
(2) Select 25 pulse/rev or 100 pulse/rev on the parameter screen.

13

Connection of Synchronous Feed Encoder

The method for connecting to each unit and device from the synchronous feed encoder is explained in this chapter.

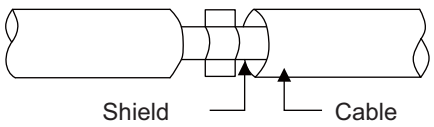
13.1 Synchronous Feed Encoder Connection System Drawing



Note

(1) The section indicated with asterisk (*) indicates cable to be wired outside the operation panel.
Since the cable could be affected by the exogenous noise depending on the environment, the following noise countermeasure is recommended.

Expose the cable by removing a part of the cable sheath and use the shield clamp for the exogenous noise countermeasure.



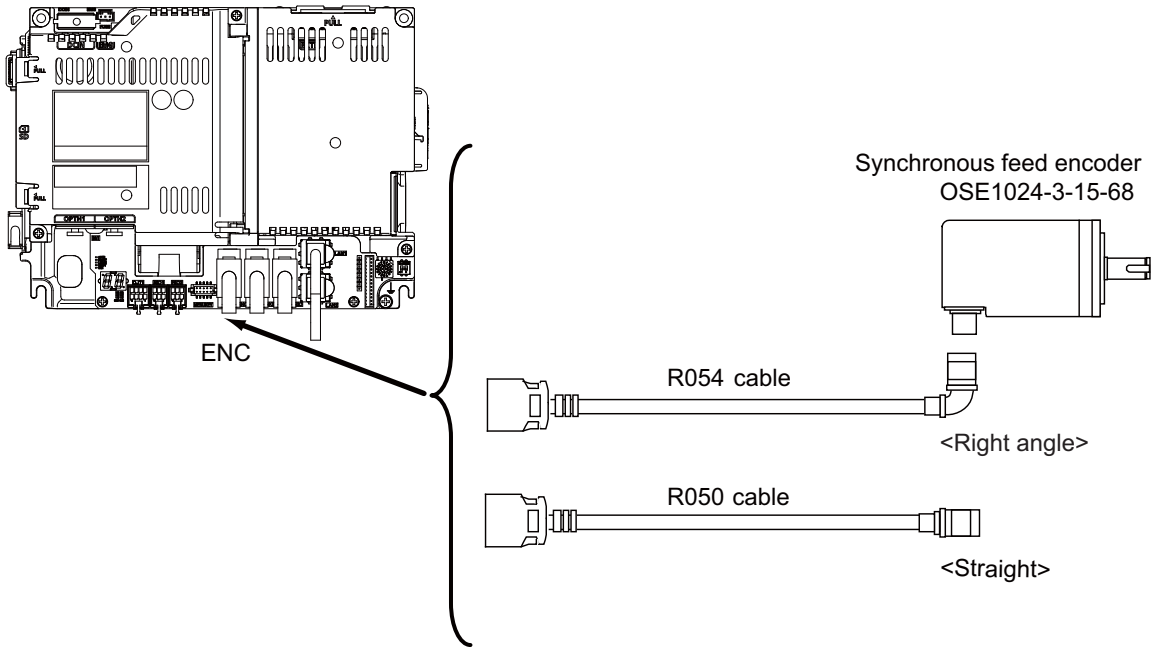
When you cannot use the shield clamp, install a ferrite core as a substitute.

<Related item>

Shield clamp fitting: "42.6.1 Shield Clamp Fitting"

Ferrite core: "42.6.2 Ferrite Core"

13.2 Connecting with Control Unit

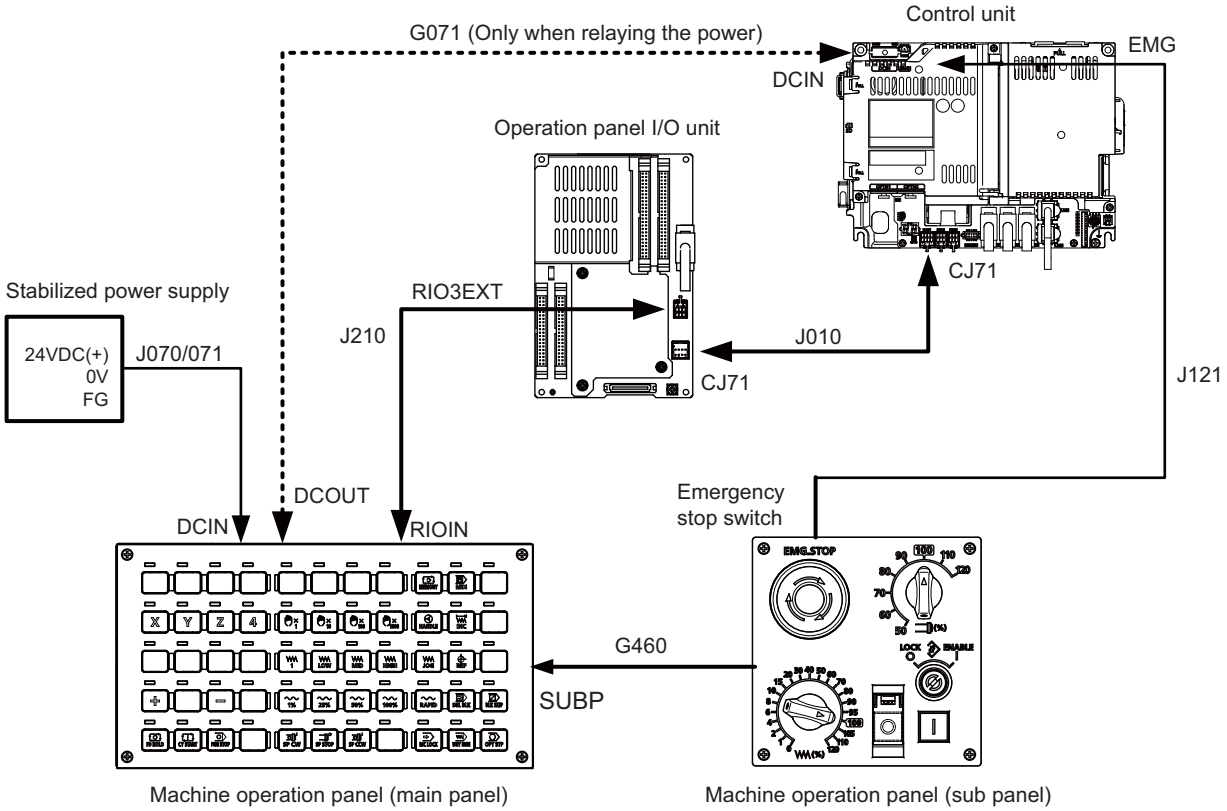


14

Connection of Machine Operation Panel

This chapter briefly explains how to connect the machine operation panel manufactured by Mitsubishi Electric to each unit and device.

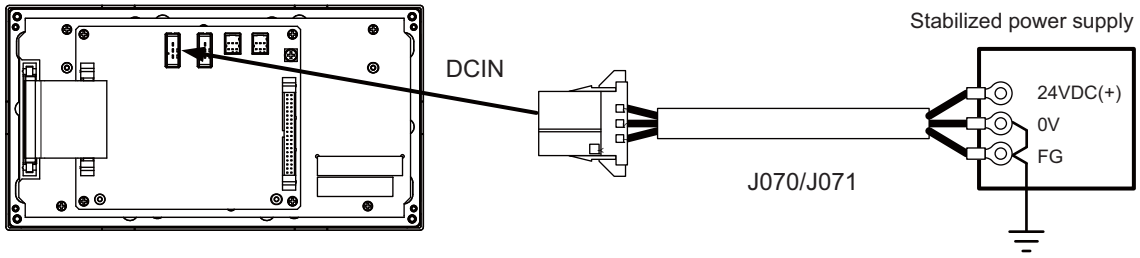
14.1 Machine Operation Panel Connection System Drawing



14.2 Connecting with Power Supply

Connect 24 VDC power supply (general-purpose stabilized power supply) to the main panel of the machine operation panel.

FCU8-KB921/KB922/KB923/KB924/KB925/KB926



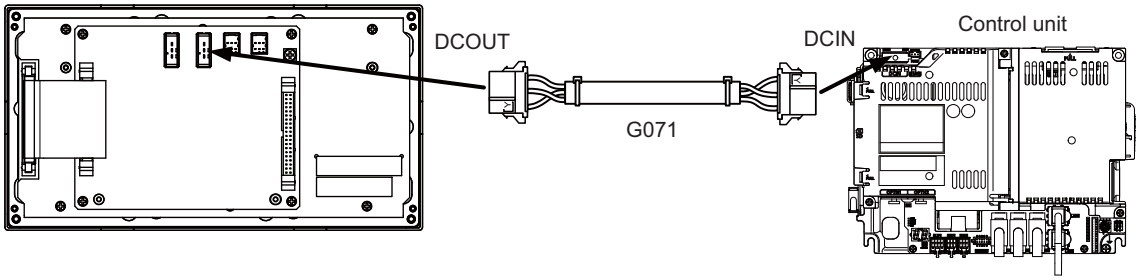
[Related items]

Cable connection drawing: "16.2.12 J070/J071 Cable"

Connector pin assignment: "4.15.1 Main Panels (FCU8-KB921/FCU8-KB922/FCU8-KB925, FCU8-KB923/FCU8-KB924/FCU8-KB926)" (DCIN connector)

When sharing the 24 VDC power supply with the control unit, connect a 24 VDC relay cable.

FCU8-KB921/KB922/KB923/KB924/KB925/KB926



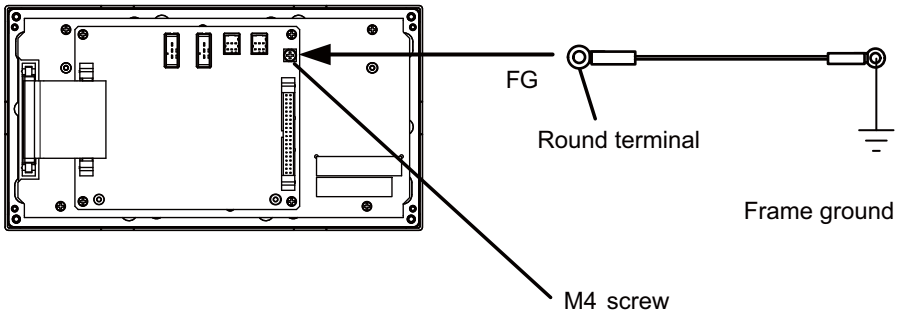
[Related items]

Cable connection drawing: "16.2.2 G071 Cable"

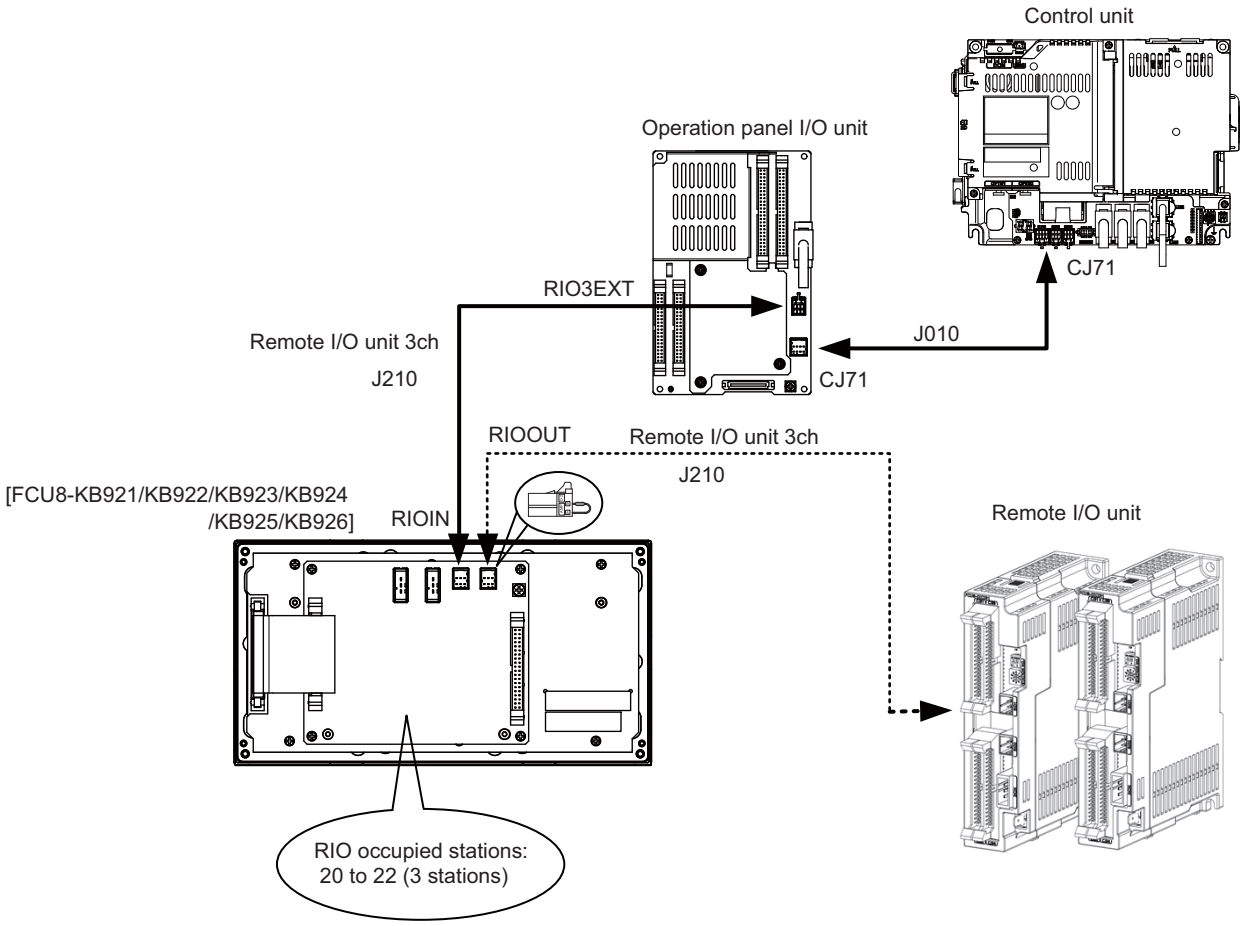
Connector pin assignment: "4.15.1 Main Panels (FCU8-KB921/FCU8-KB922/FCU8-KB925, FCU8-KB923/FCU8-KB924/FCU8-KB926)" (DCOUT connector)

14.3 Connecting with Frame Ground

FCU8-KB921/KB922/KB923/KB924/KB925/KB926



14.4 Connecting with Operation Panel I/O Unit



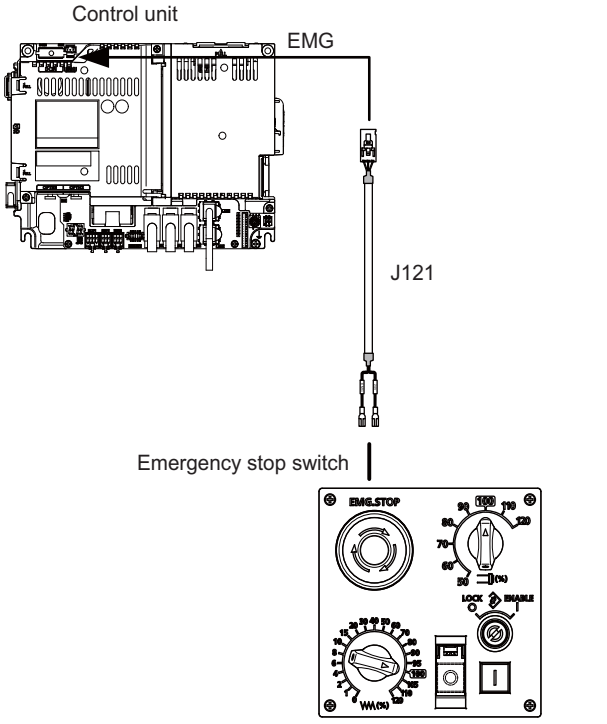
When the remote I/O unit on the next stage is not relayed, connect the R2-TM terminal.

[Related items]

Cable connection drawing: "16.2.6 J010 Cable" "16.2.16 J210 Cable"

Connector pin assignment: "4.15.1 Main Panels (FCU8-KB921/FCU8-KB922/FCU8-KB925, FCU8-KB923/FCU8-KB924/FCU8-KB926)" (RIOIN/RIOOUT connector)

14.5 Connecting Emergency Stop Switch



Machine operation panel (sub panel)

Note

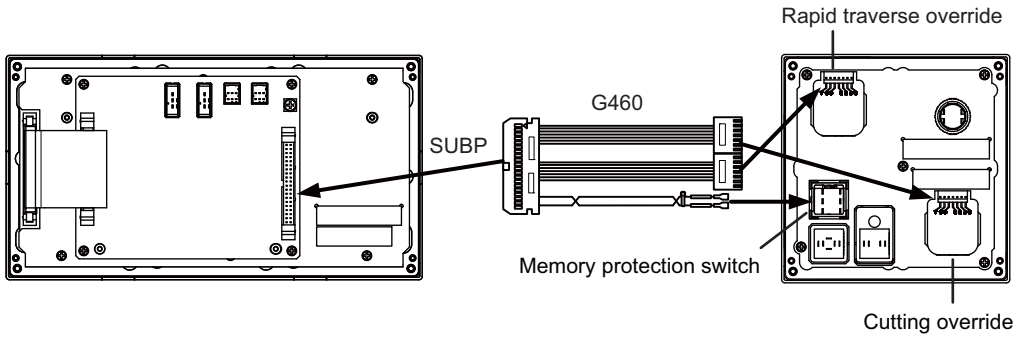
(1) Emergency stop is compliant to the stop category 1 of the European Safety Standards "EN60204-1".

[Related items]

Cable connection drawing: "16.2.15 J121 Cable"

Connector pin assignment: "4.15.2 Sub Panel A (FCU8-KB931/FCU8-KB941)" (emergency stop switch)

14.6 Connecting with Sub Panel



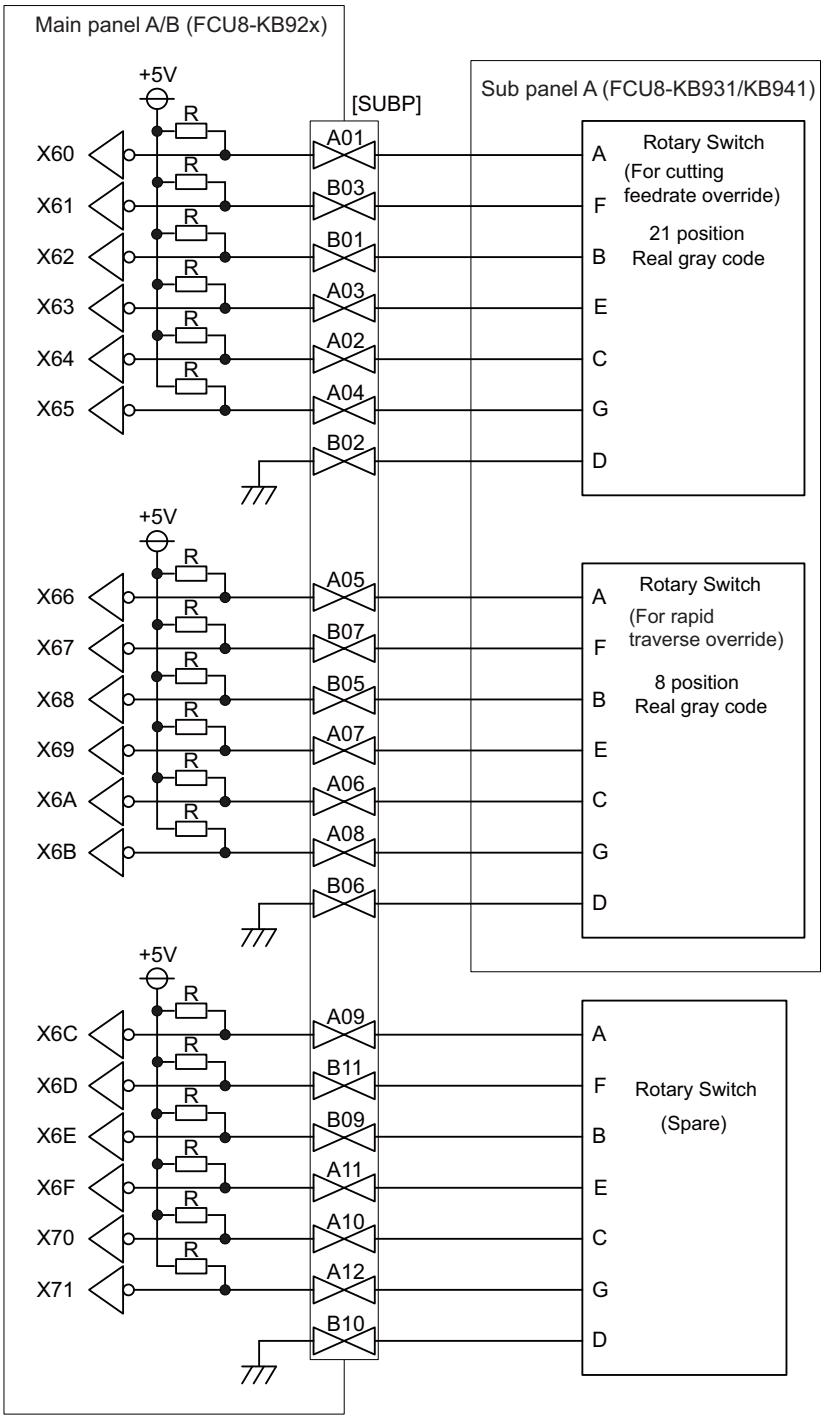
[Related items]

Cable connection drawing: "16.2.5 G460 Cable"

Connector pin assignment: "4.15.1 Main Panels (FCU8-KB921/FCU8-KB922/FCU8-KB925, FCU8-KB923/FCU8-KB924/FCU8-KB926)" (SUBP connector)

Connector pin assignment: "4.15.2 Sub Panel A (FCU8-KB931/FCU8-KB941)" (rapid traverse override, cutting override, memory protection switch)

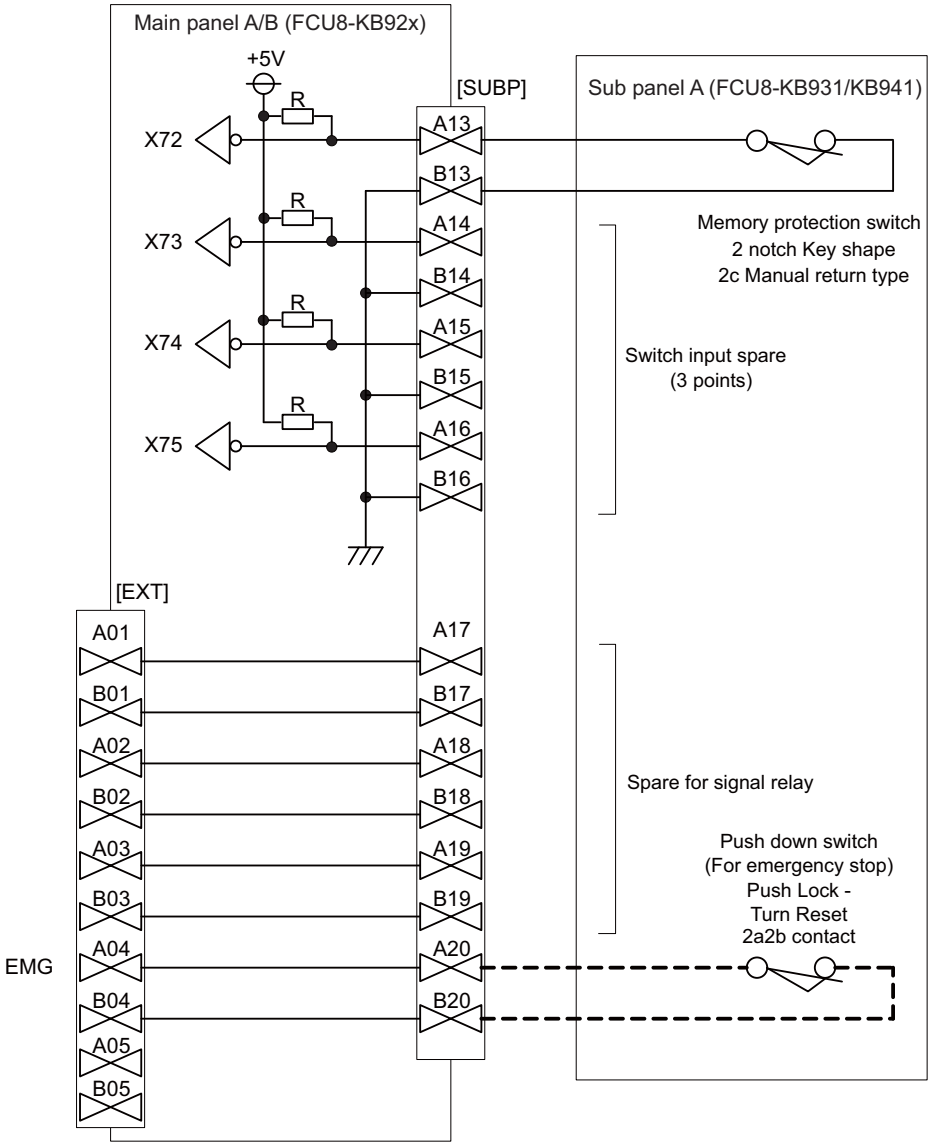
Wiring of rotary switch (SUBP)



Note

(1) Use the special lead wire with a connector for wiring of rotary switch.
Lead wire with a connector: ACX011-705 (7 terminals, 0.5 m) Fuji Electric
(2) A09 to 12 and B09 to 11 of SUBP are spares, so they do not need wiring.
(3) Select a rotary switch which guarantees 5 V/1 mA.
(4) Length of cables must be 0.5 m or shorter.
(5) The numbers in the above diagram do not indicate the actual device numbers.

Wiring of other switches (SUBP)



Note

(1) Wirings for memory protection switches must be directly soldered to terminals or use tab terminals (110 series).
(2) When wiring the emergency stop switch, the crimp terminal must be fastened with thread.
(3) For NCs whose control unit and display unit are integrated, wire the emergency stop switch directly to the EMG connector of the control unit. (Use J121 cable.)
For a separated-type NC, wire it directly to the EMG connector of the operation panel I/O unit.
(4) Select a rotary switch which guarantees 5 V/1 mA.
(5) Length of cables must be 0.5 m or shorter.
(6) The numbers in the above diagram do not indicate the actual device numbers.

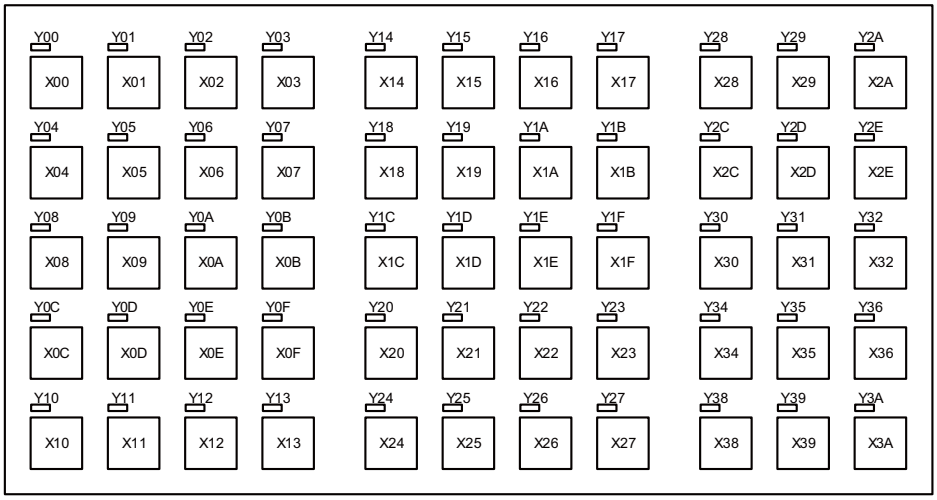
14.7 Software Interface

Station Nos. of the machine operation panel RIOs are fixed. Device Nos. such as switch and LED on the machine operation panel are fixed as follows:

Channel No.	No	Device		Function
RIO1	#1	20th station	Input: ZR5022/ZR5023	[Input] Reading switch data of the sub panel
	#2	21st station	Input: ZR5024/ZR5025	[Input] Reading key data of the main panel (55 points) [Output] LED lighting control (55 points)
			Output: ZR6024/ZR6025	
	#3	22nd station	Input: ZR5026/ZR5027	
			Output: ZR6026/ZR6027	
RIO2	#1	20th station	Input: ZR5222/ZR5223	[Input] Reading switch data of the sub panel
	#2	21st station	Input: ZR5224/ZR5225	[Input] Reading key data of the main panel (55 points) [Output] LED lighting control (55 points)
			Output: ZR6224/ZR6225	
	#3	22nd station	Input: ZR5226/ZR5227	
			Output: ZR6226/ZR6227	
RIO3	#1	20th station	Input: ZR5422/ZR5423	[Input] Reading switch data of the sub panel
	#2	21st station	Input: ZR5424/ZR5425	[Input] Reading key data of the main panel (55 points) [Output] LED lighting control (55 points)
			Output: ZR6424/ZR6425	
	#3	22nd station	Input: ZR5426/ZR5427	
			Output: ZR6426/ZR6427	

Main panel (key switch/LED)

Main panel is equipped with 55 switches and 55 LEDs.
I/O devices are assigned to the switches and LEDs as illustrated below.
(The numbers given in the drawing represent the positions, not the device Nos.)



Note

(1) If the stations of machine operation panel and other remote I/O unit overlap, all the connections of the overlapping stations are invalidated and cannot be used. Stations which do not overlap can be used.

[Device No. of key switches]

Key switch	Device	Key switch	Device
X00	ZR5$24[0]	X20	ZR5$26[0]
X01	ZR5$24[1]	X21	ZR5$26[1]
X02	ZR5$24[2]	X22	ZR5$26[2]
X03	ZR5$24[3]	X23	ZR5$26[3]
X04	ZR5$24[4]	X24	ZR5$26[4]
X05	ZR5$24[5]	X25	ZR5$26[5]
X06	ZR5$24[6]	X26	ZR5$26[6]
X07	ZR5$24[7]	X27	ZR5$26[7]
X08	ZR5$24[8]	X28	ZR5$26[8]
X09	ZR5$24[9]	X29	ZR5$26[9]
X0A	ZR5$24[A]	X2A	ZR5$26[A]
X0B	ZR5$24[B]	Not used	ZR5$26[B]
X0C	ZR5$24[C]	X2C	ZR5$26[C]
X0D	ZR5$24[D]	X2D	ZR5$26[D]
X0E	ZR5$24[E]	X2E	ZR5$26[E]
X0F	ZR5$24[F]	Not used	ZR5$26[F]
X10	ZR5$25[0]	X30	ZR5$27[0]
X11	ZR5$25[1]	X31	ZR5$27[1]
X12	ZR5$25[2]	X32	ZR5$27[2]
X13	ZR5$25[3]	Not used	ZR5$27[3]
X14	ZR5$25[4]	X34	ZR5$27[4]
X15	ZR5$25[5]	X35	ZR5$27[5]
X16	ZR5$25[6]	X36	ZR5$27[6]
X17	ZR5$25[7]	Not used	ZR5$27[7]
X18	ZR5$25[8]	X38	ZR5$27[8]
X19	ZR5$25[9]	X39	ZR5$27[9]
X1A	ZR5$25[A]	X3A	ZR5$27[A]
X1B	ZR5$25[B]	Not used	ZR5$27[B]
X1C	ZR5$25[C]	Not used	ZR5$27[C]
X1D	ZR5$25[D]	Not used	ZR5$27[D]
X1E	ZR5$25[E]	Not used	ZR5$27[E]
X1F	ZR5$25[F]	Not used	ZR5$27[F]

Note

(1) "$" in the device No. varies depending on the channel No. of RIO.
(RIO1 = "0", RIO2 = "2", RIO3 = "4")

(2) While the key switch is pressed, "1" is input in the ZR device.

[Device No. of LEDs]

LED	Device		LED	Device
Y00	ZR6$24[0]		Y20	ZR6$26[0]
Y01	ZR6$24[1]		Y21	ZR6$26[1]
Y02	ZR6$24[2]		Y22	ZR6$26[2]
Y03	ZR6$24[3]		Y23	ZR6$26[3]
Y04	ZR6$24[4]		Y24	ZR6$26[4]
Y05	ZR6$24[5]		Y25	ZR6$26[5]
Y06	ZR6$24[6]		Y26	ZR6$26[6]
Y07	ZR6$24[7]		Y27	ZR6$26[7]
Y08	ZR6$24[8]		Y28	ZR6$26[8]
Y09	ZR6$24[9]		Y29	ZR6$26[9]
Y0A	ZR6$24[A]		Y2A	ZR6$26[A]
Y0B	ZR6$24[B]		Not used	ZR6$26[B]
Y0C	ZR6$24[C]		Y2C	ZR6$26[C]
Y0D	ZR6$24[D]		Y2D	ZR6$26[D]
Y0E	ZR6$24[E]		Y2E	ZR6$26[E]
Y0F	ZR6$24[F]		Not used	ZR6$26[F]
Y10	ZR6$25[0]		Y30	ZR6$27[0]
Y11	ZR6$25[1]		Y31	ZR6$27[1]
Y12	ZR6$25[2]		Y32	ZR6$27[2]
Y13	ZR6$25[3]		Not used	ZR6$27[3]
Y14	ZR6$25[4]		Y34	ZR6$27[4]
Y15	ZR6$25[5]		Y35	ZR6$27[5]
Y16	ZR6$25[6]		Y36	ZR6$27[6]
Y17	ZR6$25[7]		Not used	ZR6$27[7]
Y18	ZR6$25[8]		Y38	ZR6$27[8]
Y19	ZR6$25[9]		Y39	ZR6$27[9]
Y1A	ZR6$25[A]		Y3A	ZR6$27[A]
Y1B	ZR6$25[B]		Not used	ZR6$27[B]
Y1C	ZR6$25[C]		Not used	ZR6$27[C]
Y1D	ZR6$25[D]		Not used	ZR6$27[D]
Y1E	ZR6$25[E]		Not used	ZR6$27[E]
Y1F	ZR6$25[F]		Not used	ZR6$27[F]

Note

(1) "$" in the device No. varies depending on the channel No. of RIO.
(RIO1 = "0", RIO2 = "2", RIO3 = "4")

Sub panel

Sub panel is equipped with cutting override, rapid traverse override, memory protection switch and emergency stop switch. Direct wiring is available for the emergency stop switch, and device numbers for the other switches are assigned as listed below:

[Cutting override (6-bit)]

Setting value	Device					
	ZR5$22[0]	ZR5$22[1]	ZR5$22[2]	ZR5$22[3]	ZR5$22[4]	ZR5$22[5]
0	0	0	0	0	0	0
10	1	0	0	0	0	1
20	1	1	0	0	0	0
30	0	1	0	0	0	1
40	0	1	1	0	0	0
50	1	1	1	0	0	1
60	1	0	1	0	0	0
70	0	0	1	0	0	1
80	0	0	1	1	0	0
90	1	0	1	1	0	1
100	1	1	1	1	0	0
110	0	1	1	1	0	1
120	0	1	0	1	0	0
130	1	1	0	1	0	1
140	1	0	0	1	0	0
150	0	0	0	1	0	1
160	0	0	0	1	1	0
170	1	0	0	1	1	1
180	1	1	0	1	1	0
190	0	1	0	1	1	1
200	0	1	1	1	1	0

[Rapid traverse override (6-bit)]

Setting value	Device					
	ZR5$22[6]	ZR5$22[7]	ZR5$22[8]	ZR5$22[9]	ZR5$22[A]	ZR5$22[B]
0	0	0	0	0	0	0
10	1	0	0	0	1	0
20	1	1	0	0	0	0
30	0	1	0	0	1	0
40	0	1	1	0	0	0
50	1	1	1	0	1	0
60	1	0	1	0	0	0
70	0	0	1	0	1	0
80	0	0	1	1	0	0
90	1	0	1	1	1	0
100	1	1	1	1	0	0

[Memory protection switch (1-bit)]

Setting value	Device
	ZR5$23[2]
LOCK	0
ENABLE	1

Note

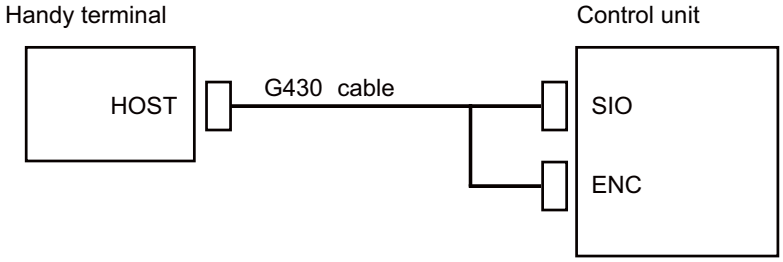
(1) "$" in the device No. varies depending on the channel No. of RIO.
(RIO1 = "0", RIO2 = "2", RIO3 = "4")

15

Connection of Handy Terminal

This chapter briefly explains how to connect the handy terminal to each unit and device.

15.1 Handy Terminal Connection System Drawing

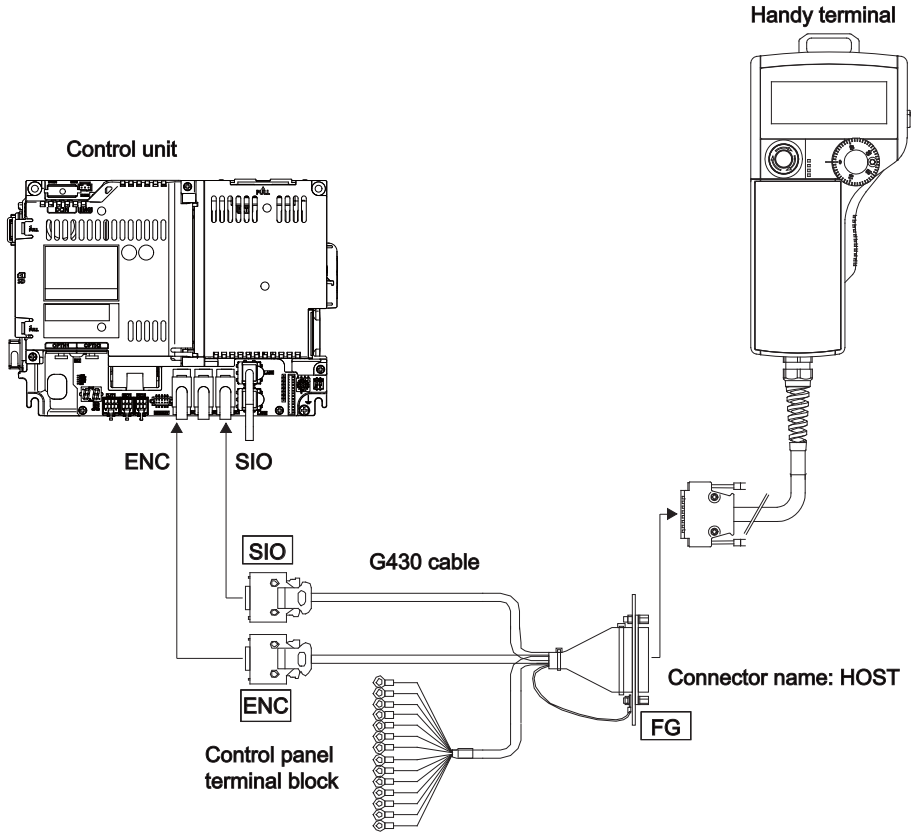


Note

(1) Connect the HOST connector of the G430 cable to the grounding plate.

15.2 Connecting with Control Unit

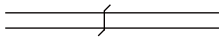
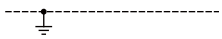
Connect the handy terminal to SIO connector and ENC connector of the control unit.
Also, connect the emergency stop switch (SW1), enable switch (SW2), selector switch (SW) and 24 VDC input to the control panel terminal block.



16

Cables

16.1 Symbols for Writing Cable Drawings

-  : indicates twisted pair.
-  : indicates the shield outer sheath.
-  : indicates shield clamping to the grounding plate.
- In the cable drawings, the partner of the twisted pair cable is given priority. Please be aware that the pin No. of the connectors at both ends are not necessarily in sequential order.
- Equivalent parts can be used for the connector, contact and wire material.
- The tolerances of the cables provided by Mitsubishi Electric are as follows:

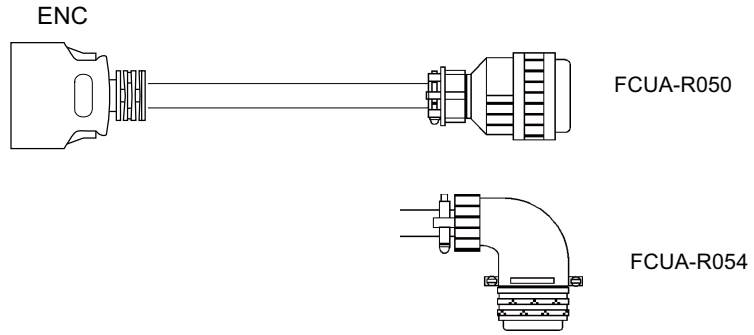
Cable length (mm)	Tolerances (mm)
600 or shorter	±30
601 to 1000	±50
1001 to 5000	±100
5001 to 10000	±150
10001 to 15000	±200
15001 to 20000	±300

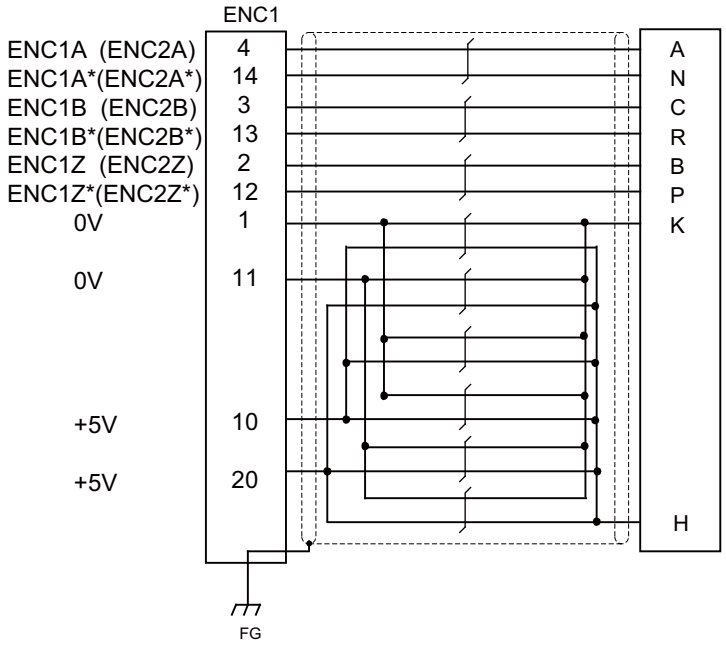
16.2 Cable Relating to NC

16.2.1 FCUA-R050/R054 Cable

Max. cable length: 30 m

Application: Synchronous encoder - control unit





[ENC1]
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

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

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

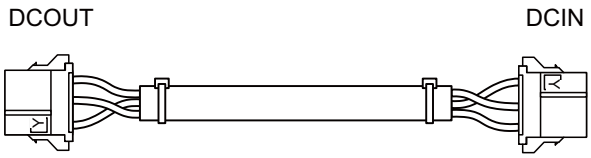
Note

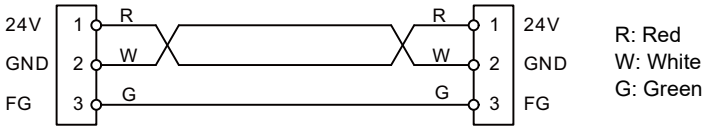
(1) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.

16.2.2 G071 Cable

Max. cable length: 1 m

Application: 24 VDC relay cable for machine operation panel





[DCOUT]
Connector: 2-178288-3
Contact: 1-175218-5 x 3
Manufacturer: TE Connectivity

Wire material: UL1264 AWG16
(Red, White, Green)

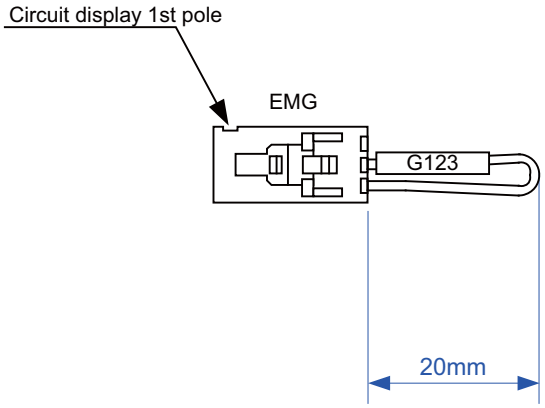
[DCIN]
Connector: 2-178288-3
Contact: 1-175218-5 x 3
Manufacturer: TE Connectivity

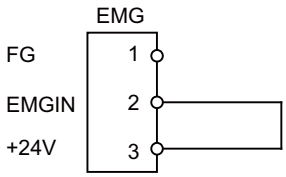
Note

(1) These cables are available only when wired to a same control panel.

16.2.3 G123 Cable

Application: Cable for emergency stop release





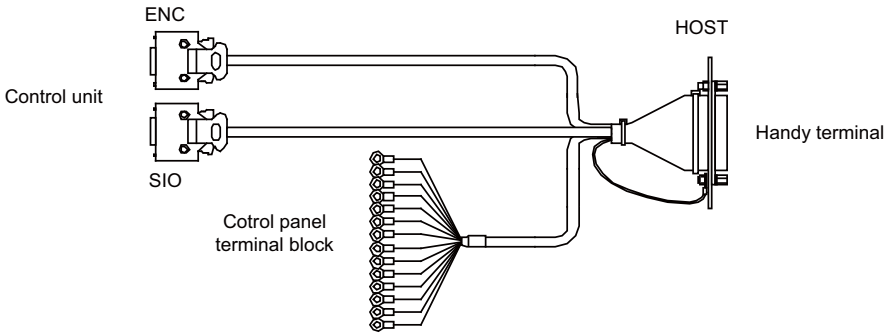
Wire material: UL1007 AWG22

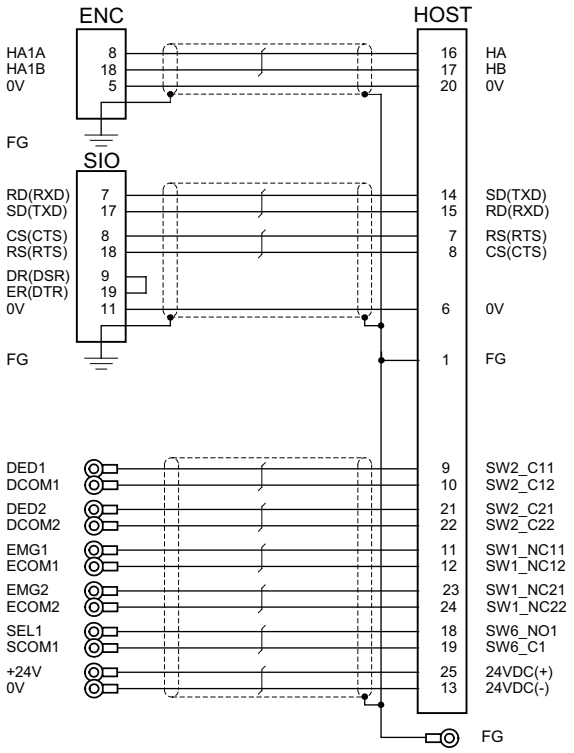
[EMG]
Connector: 50-57-9403
Contact: 0016020103
Manufacturer: MOLEX

16.2.4 G430 Cable

Max. cable length: 10 m

Application: For connection to handy terminal





[ENC][SIO]
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M
Wire material: UL1061-2464 AWG28 × 3P
Manufacturer: Oki Electric Cable

FG terminal
Crimp terminal: V1.25-4
Manufacturer: JST
Wire material: UL1061-2464 AWG18 (Green)
Manufacturer: Oki Electric Cable

[HOST]
Plug: CDB-25S
Contact: CD-SC-221 × 21
Manufacturer: Hirose Electric

[Control panel terminal block]
Crimp terminal: R1.25-3.5
Manufacturer: JST
Wire material: UL1061-2464 AWG24 × 8P
Manufacturer: Oki Electric Cable

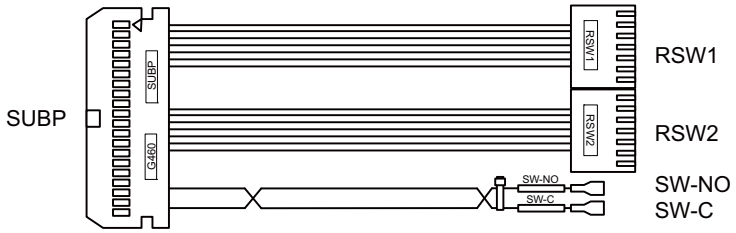
Note

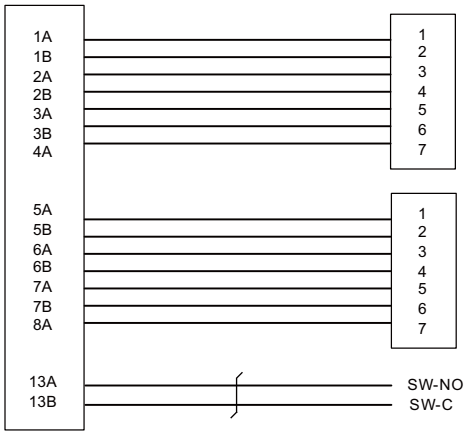
(1) Fold the cable shield over the sheath, and wrap copper foil tape over it.
Connect the wound copper foil tape to GND plate of the connector.

16.2.5 G460 Cable

Max. cable length: 0.5 m

Application: Cable for machine operation panel (cable between main panel and sub panel)





[RSW1][RSW2]
1: Purple
2: Blue
3: Green
4: Yellow
5: Orange
6: Red
7: Brown

[SUBP]
Connector: HIF3BA-40D-2.54C
Contact: HIF3-2428SC × 16
Manufacturer: Hirose Electric

Wire material: UL1007 AWG24
(Red, Black)

[RSW1][RSW2]
Connector with cable: ACX011-705 x 2
Contact: 1-175218-5 x 3
Manufacturer: Fuji Electric

[SW-NO][SW-C]
Connector: STO-01T-110N
Manufacturer: JST

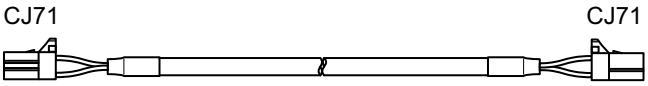
Note

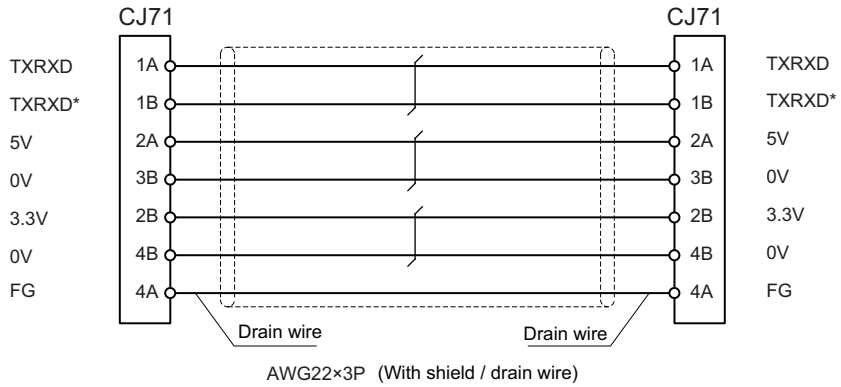
(1) Coat the connector [SW-NO][SW-C] with an insulation.

16.2.6 J010 Cable

Max. cable length: 1m

Application: Operation panel I/O interface cable





[CJ71]
Connector: 2-1318119-4
Contact: 1318107-1
Manufacturer: TE Connectivity

Wire material: HRZEV-SB-A(20276) AWG22×3P
Manufacturer: DYDEN

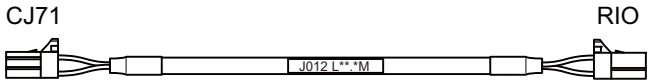
Note

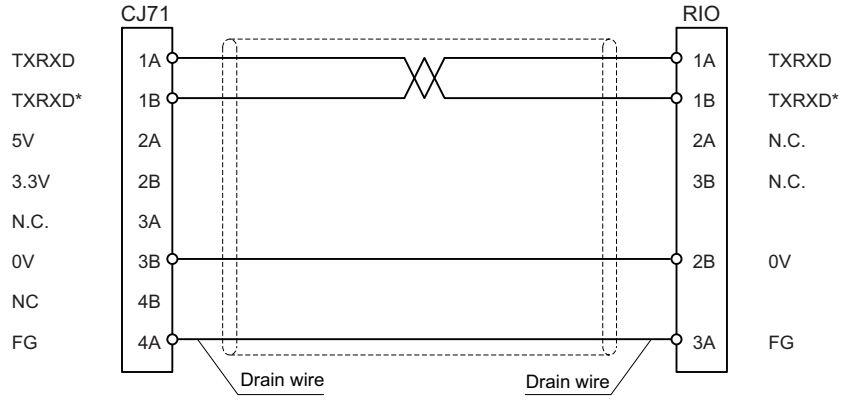
(1) Use the wire material with the characteristic impedance of 110 Ω.

16.2.7 J012 Cable

Max. cable length: 1m

Application: Operation panel I/O interface cable (for FCU8-DX834)





[CJ71]
Connector: 2-1318119-4
Contact: 1318107-1 (1318105-1)
Manufacturer: TE Connectivity

Wire material: HK-SB/20276XL Black LF 2P×22AWG
Manufacturer: Taiyo Cabletec

[RIO]
Connector: 1-1318119-3
Contact: : 1318107-1
Manufacturer: TE Connectivity

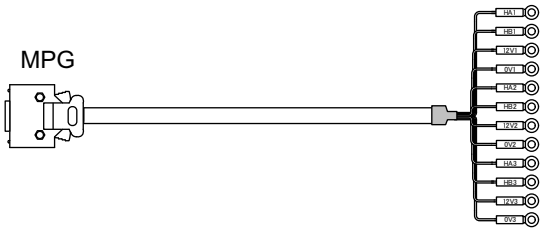
Note

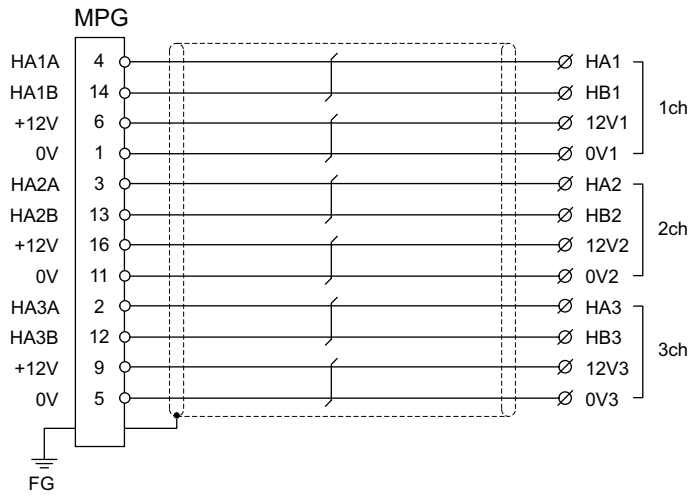
(1) Use the wire material with the characteristic impedance of 110 Ω.

16.2.8 J020/J021/J022 Cable

Max. cable length: 50 m

Application: Manual pulse generator cable (12 V)





[MPG]
Connector: 10120-3000PE
Case: 10320-52F0-008
Manufacturer: 3M

Wire material: UL2464 U-TKVVBS AWG24 × 6P
Manufacturer: Tatsuta Tachii Electric Cable

[1ch][2ch][3ch]
Crimp terminal: R1.25-3 × 12
Manufacturer: JST

Cable name	1ch	2ch	3ch
J020 cable	○		
J021 cable	○	○	
J022 cable	○	○	○
○ : Usable channel Unconnectable to control unit side			

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.

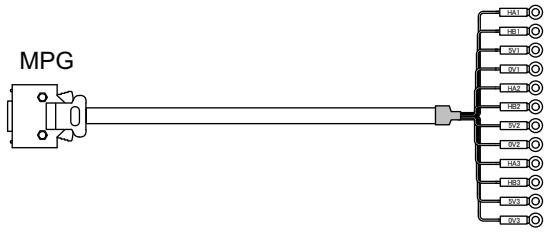
(2) The cables for 1ch and 2ch are compatible with F320 or F321 cable of the conventional model.

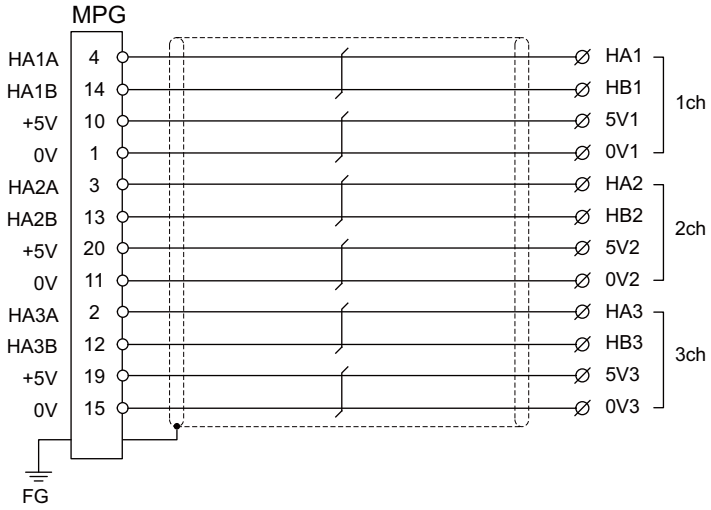
(3) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.2.9 J023/J024/J025 Cable

Max. cable length: 20 m

Application: Manual pulse generator cable (5V)





[MPG]
Connector: 10120-3000PE
Case: 10320-52F0-008
Manufacturer: 3M

Wire material: UL2464 U-TKVVBS AWG22 × 6P
Manufacturer: Tatsuta Tachii Electric Cable

[1ch][2ch][3ch]
Crimp terminal: R1.25-3 × 12
Manufacturer: JST

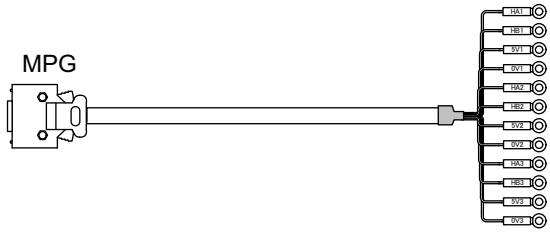
Cable name	1ch	2ch	3ch
J023 cable	○		
J024 cable	○	○	
J025 cable	○	○	○
○ : Usable channel Unconnectable to control unit side			

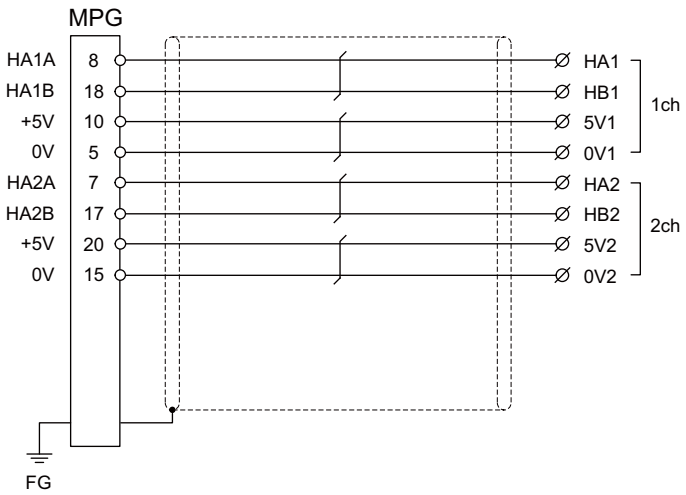
Note

(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.
(2) The cables for 1ch and 2ch are compatible with F023 or F024 cable of the conventional model.
(3) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.2.10 J026/J027 Cable

Max. cable length: 20 m (the maximum length of the cable when connected to the control unit via other units)
Application: Manual pulse generator cable (5 V)





[MPG]
Connector: 10120-3000PE
Case: 10320-52F0-008
Manufacturer: 3M

Wire material: UL2464 U-TKVVBS AWG22 × 6P
Manufacturer: Tatsuta Tachii Electric Cable

[1ch][2ch]
Crimp terminal: R1.25-3 × 8
Manufacturer: JST

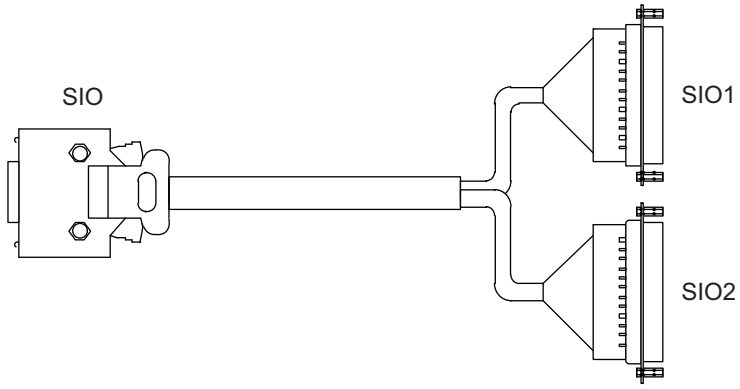
Cable name	1ch	2ch
J026 cable	○	
J027 cable	○	○
○ : Usable channel Unconnectable to operation board side		

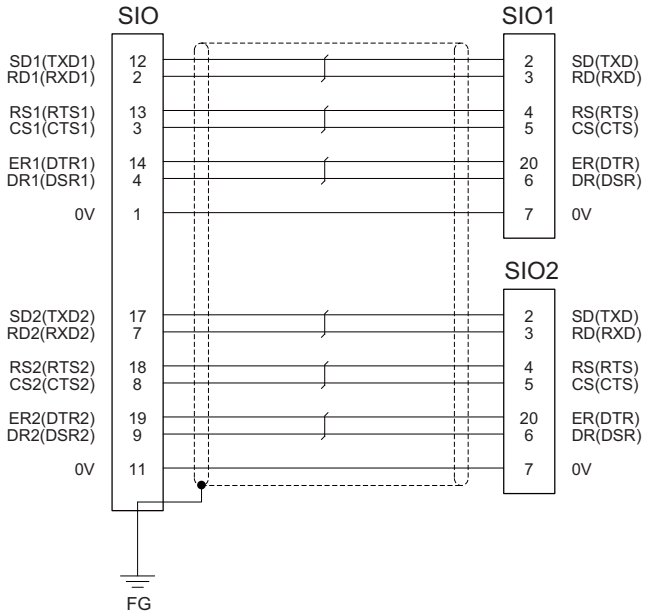
Note

(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.
(2) The cables are compatible with G023 or G024 cable of the conventional model.
(3) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.2.11 J030/J031 Cable

Max. cable length: 15 m (the maximum length of the cable when connected to the control unit via other units)
Application: RS-232C I/F cable





[SIO]
Connector: 10120-3000PE
Case: 10320-52F0-008
Manufacturer: 3M

Wire material: 2464C BIOS-CL3-26 07P
Manufacturer: Bando Electric Wire

[SIO1][SIO2]
Connector: CDB-25S
Contact: CD-SC-111
Lock nut: HD-LNA
Manufacturer: Hirose Electric

Cable name	SIO1	SIO2
J030 cable	○	
J031 cable	○	○
○ : Usable channel		

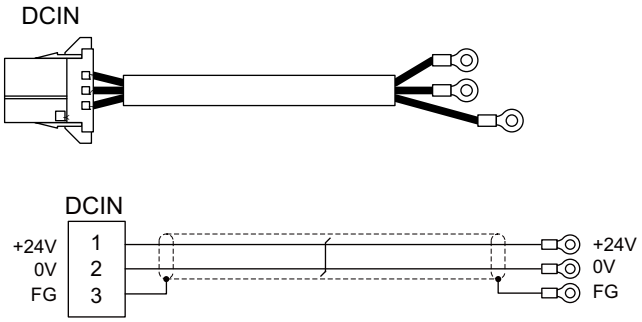
Note

(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.
(2) Signal names in parentheses "( )" are generally used.
(3) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.2.12 J070/J071 Cable

Max. cable length: 15 m (J070)/20 m (J071)

Application: 24 VDC power cable



[DCIN]
Connector: 2-178288-3
Contact: 1-175218-5
Manufacturer: TE Connectivity

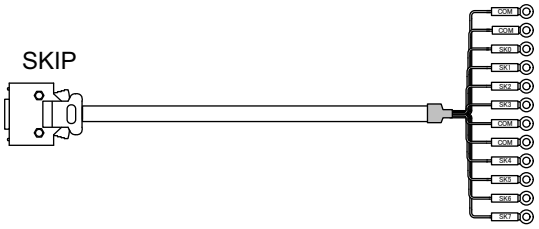
[J070 cable]
Wire material: 2464C BIOS-CL3-16 02C × 16AWG(26/0.26)
Manufacturer: Bando Electric Wire

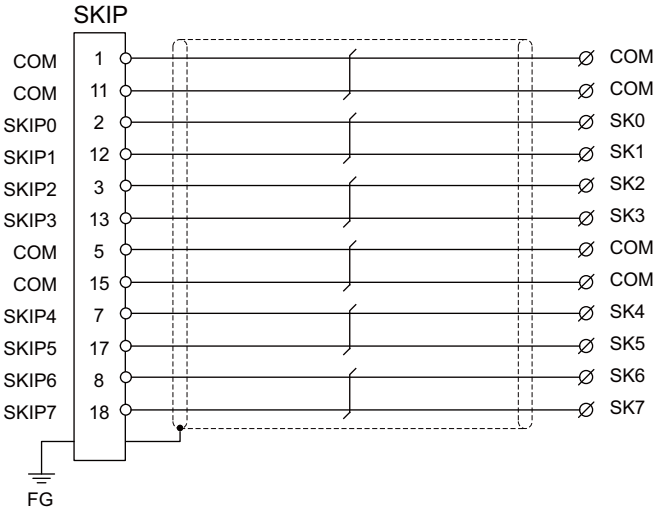
[J071 cable]
Wire material: D-LIST3Z-SB 2.5*2C
Manufacturer: DYDEN CORPORATION

Crimp terminal: R1.25-4 × 3
Manufacturer: JST

16.2.13 J100 Cable

Max. cable length: 20 m
Application: Skip





[SKIP]
Connector: 10120-3000PE
Case: 10320-52F0-008
Manufacturer: 3M

Wire material: UL2464 U-TKVVBS AWG24 × 6P
Manufacturer: Tatsuta Tachii Electric Cable

Crimp terminal: R1.25-3.5 × 12
Manufacturer: JST

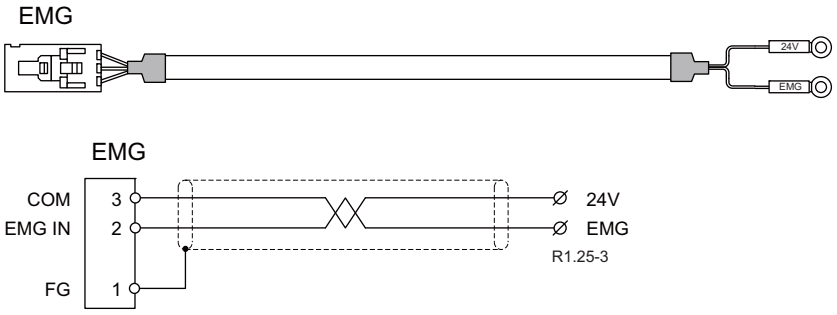
Note

(1) Fold the cable shield over the sheath, and wrap copper foil tape over it.
Connect the wound copper foil tape to GND plate of the connector.
(2) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.2.14 J120 Cable

Max. cable length: 30 m

Application: Emergency stop cable



[EMG]
Connector: 50-57-9403
(former model number: 51030-0330)
Contact: 0016020103
(former model number: 50084-8129)
Manufacturer: MOLEX

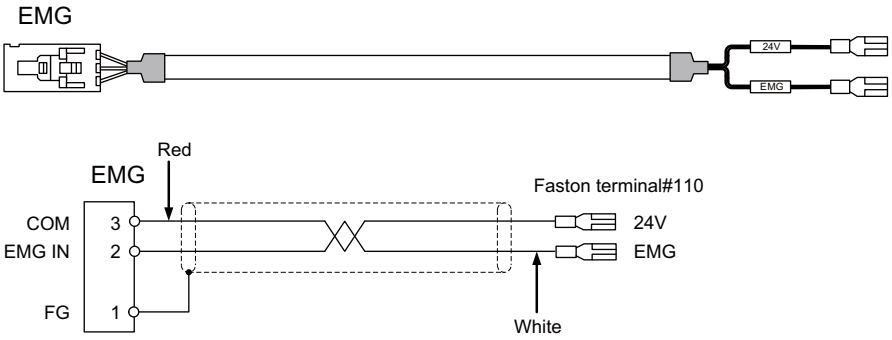
Wire material: 2464C BIOS-CL3-22 01P
Manufacturer: Bando Electric Wire

Crimp terminal: R1.25-3 × 2
Manufacturer: JST

16.2.15 J121 Cable

Max. cable length: 30 m

Application: Emergency stop cable for machine operation panel



[EMG]
Connector: 50-57-9403
Contact: 0016020103
Manufacturer: MOLEX

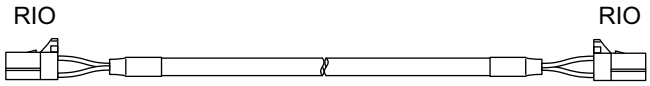
Wire material: 2464C BIOS-CL3-22 01P
Manufacturer: Bando Electric Wire

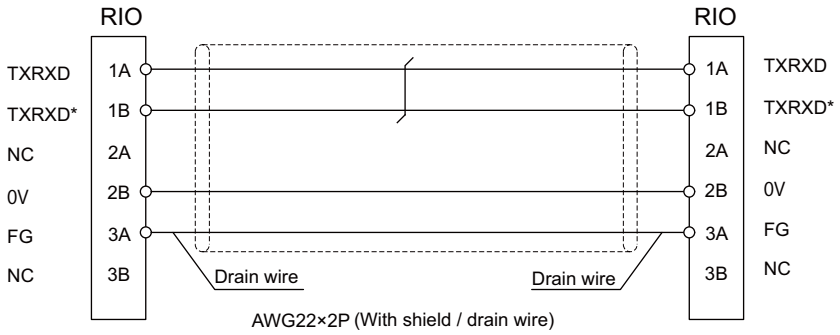
Crimp terminal: Faston terminal #110 with insulating coating

16.2.16 J210 Cable

Max. cable length: 50 m

Application: Remote I/O 2.0 communication cable





[RIO]
Connector: 1-1318119-3
Contact: 1318107-1
Manufacturer: TE Connectivity

Wire material: HK-SB/20276XL Black LF 2P × 22AWG
Manufacturer: Taiyo Cabletec

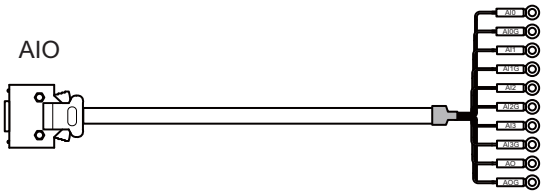
Note

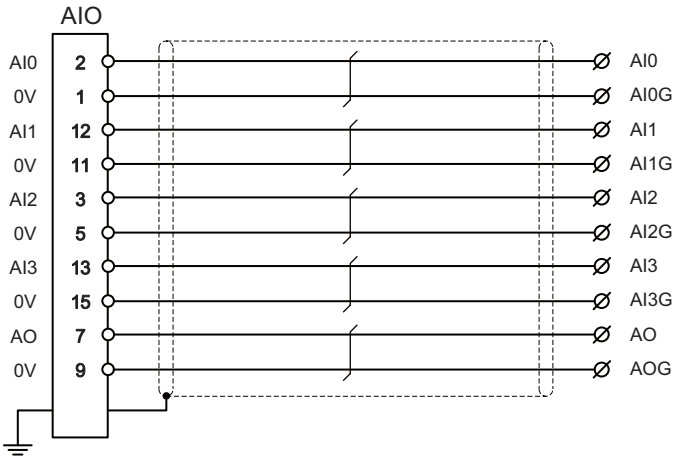
(1) Use the wire material with the characteristic impedance of 110 Ω.

16.2.17 J221 Cable

Max. cable length: 30 m

Application: Analog input/output cable (for remote I/O unit)





[AIO]
Connector: 10120-3000PE
Case: 10320-52F0-008
Manufacturer: 3M

Wire material: UL2464 U-TKVVBS AWG24 × 6P
Manufacturer: Tatsuta Tachii Electric Cable

Crimp terminal: R1.25-3.5 x 10
Manufacturer: JST

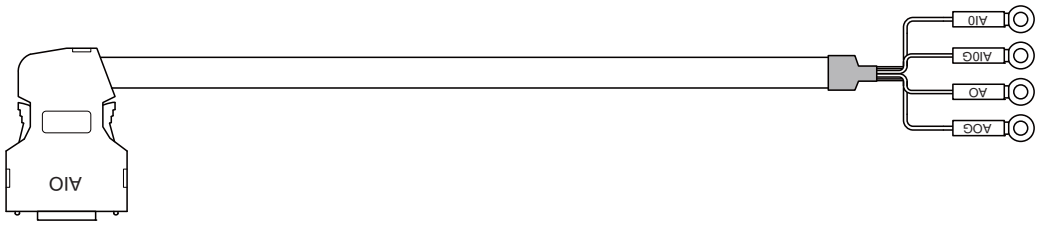
Note

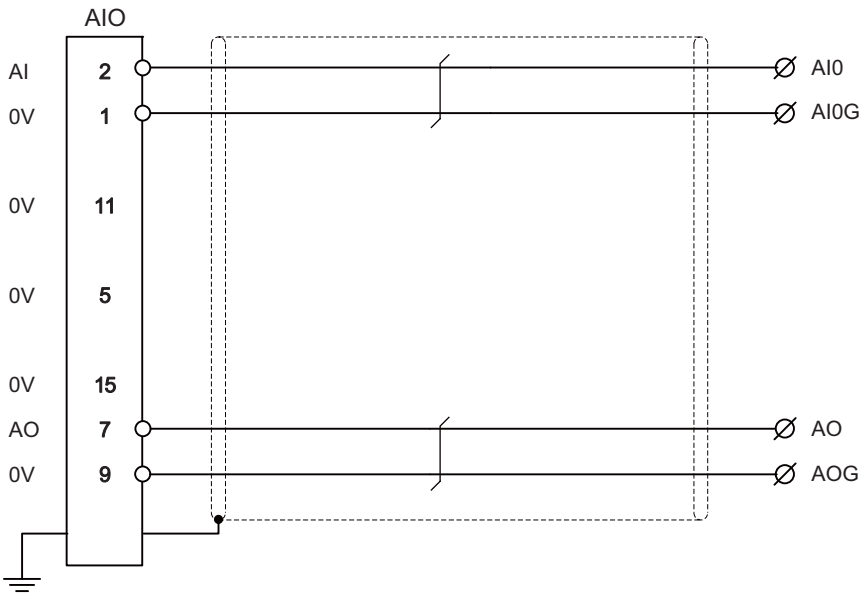
(1) Fold the cable shield over the sheath, and wrap copper foil tape over it.
Connect the wound copper foil tape to GND plate of the connector.
(2) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)
(3) FCUA-R031 cable of the conventional models is also available to use.
(4) For FCUA-R031, AOG and AI3G share the pin #15. For J221, however, AOG uses the pin #9.

16.2.18 J224 Cable

Max. cable length: 30m

Application: Analog input/output cable (for operation panel I/O unit)





[AIO]
Connector: 10120-3000PE
Case: 10320-56F0-008
Manufacturer: 3M

Wire material: UL2464 U-TKVVBS AWG24 × 2P
Manufacturer: Tatsuta Tachii Electric Cable

Crimp terminal: R1.25-3.5 x 10
Manufacturer: JST

Note

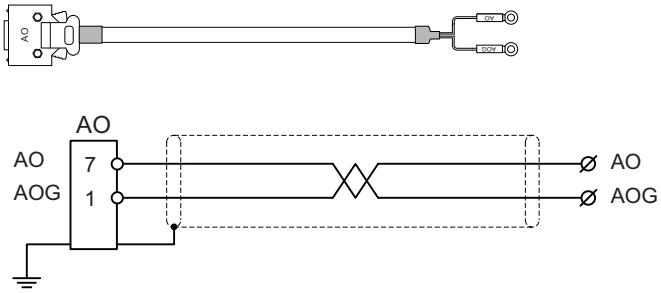
(1) Fold the cable shield over the sheath, and wrap copper foil tape over it.
Connect the wound copper foil tape to GND plate of the connector.

(2) When using the jackscrew M2.6-type 10320-56S0-008-F for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.2.19 J225 Cable

Max. cable length: 30m

Application: Analog output cable (for operation panel I/O unit)



[AO]
Connector: 10120-3000PE
Case: 10320-52F0-008
Manufacturer: 3M

Wire material: UL2464 U-TKVVBS AWG24 × 1P
Manufacturer: Tatsuta Tachii Electric Cable

Crimp terminal: R1.25-3.5 x 2P
Manufacturer: JST

Note

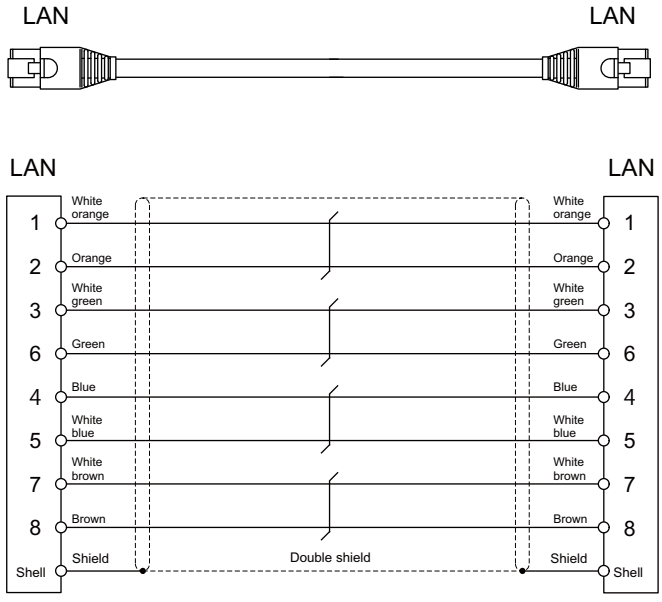
(1) Fold the cable shield over the sheath, and wrap copper foil tape over it.
Connect the wound copper foil tape to GND plate of the connector.

(2) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.2.20 J303 Cable

Max. cable length: 50 m

Application: LAN straight cable



[LAN]
Connector: J00026A0165
Boot: B00080F0090
Manufacturer: Japan Telegärtner

Wire material: FANC-IEF-SB 24AWG × 4P
Manufacturer: Kuramo Electric

16.2.21 J350 Cable

Max. cable length: 50 m

Application: DI/DO

CG31,CG32,CG35,CG36,
CJ31,CJ32,CJ33,CJ34,
CJ38,CJ40,CJ42



[CG31,CG32,CG35,CG36,CJ31,CJ32,CJ33,CJ34,CJ38,CJ40,CJ42]

Connector: XG4M-4030/7940-6500SC
Strain relief: XG4T-4004/3448-7940
Manufacturer: OMRON/3M

Wire material: UL2651 AWG28x40 (FLEX-S(40)-7/0.127 7030 2651P)
Manufacturer: Oki Electric Cable

16.2.22 J351 Cable

Max. cable length: 50 m

Application: DI/DO

CG31,CG32,CG35,CG36,
CJ31,CJ32,CJ33,CJ34,
CJ38,CJ40,CJ42



[CG31,CG32,CG35,CG36,CJ31,CJ32,CJ33,CJ34,CJ38,CJ40,CJ42]

Connector: XG4M-4030/7940-6500SC
Strain relief: XG4T-4004/3448-7940
Manufacturer: OMRON/3M

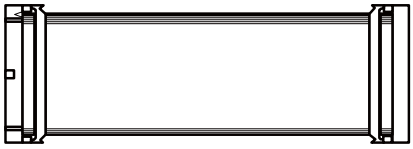
Wire material: UL2651 AWG28x40 (FLEX-S(40)-7/0.127 7030 2651P)
Manufacturer: Oki Electric Cable

16.2.23 J460 Cable

Max. cable length: 50 m

Application: DI/DO

CJ37,CJ39



[CJ37, CJ39]
Connector: XG4M-5030/7950-6500SC
Strain relief: XG4T-5004/3448-7950
Manufacturer: OMRON/3M

Wire material: UL2651 AWG28x50 (FLEX-S(50)-7/0.127 7030 2651P)
Manufacturer: Oki Electric Cable

Note

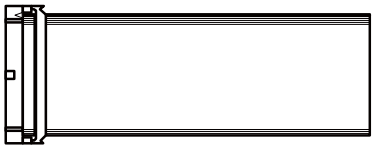
(1) This cable is used to connect the operation panel I/O unit.

16.2.24 J461 Cable

Max. cable length: 50 m

Application: DI/DO

CJ37,CJ39



[CJ37, CJ39]
Connector: XG4M-5030/7950-6500SC
Strain relief: XG4T-5004/3448-7950
Manufacturer: OMRON/3M

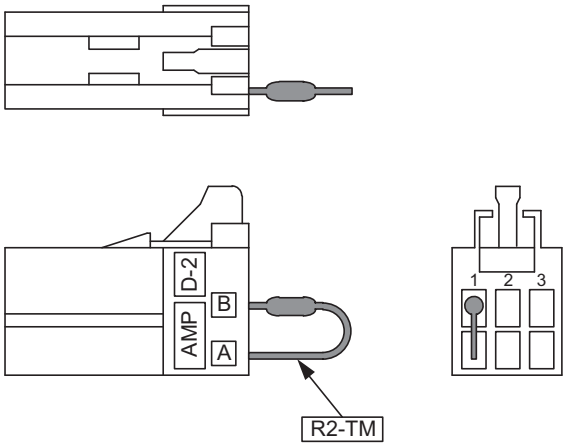
Wire material: UL2651 AWG28x50 (FLEX-S(50)-7/0.127 7030 2651P)
Manufacturer: Oki Electric Cable

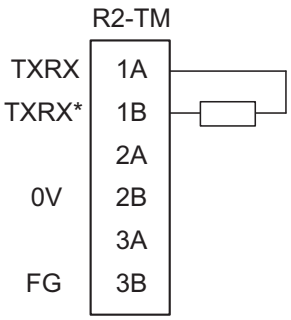
Note

(1) This cable is used to connect the operation panel I/O unit.

16.2.25 R2-TM Terminator Connector

Application: Terminator for remote I/O interface





[R2-TM]
Connector: 1-1318119-3
Contact: 1318108-1
Manufacturer: TE Connectivity
Resistor: 110 Ω 1/4 W

Note

(1) The parts used shall be Mitsubishi Electric recommended parts, and any equivalent products that are compatible with the specifications are acceptable.
(2) Cover the 110 Ω terminator with a black insulation tube.
(3) Stamp the connector name "R2-TM" in white on the rear of the connector.

16.3 Cable Relating to Image Input Expansion Unit

16.3.1 HDMI Cable

Image input expansion unit side connector shape: HDMI Type A
Recommended HDMI cable (*1): High-speed certified HDMI cable
Max. cable length (*2): The maximum cable length differs depending on the cable specifications.
Application: IPC image signal input

(*1) A cable with the following structure is recommended to reduce effects of external noise on the image signals.

Cable type	Cable structure		
	Plug plating specifications	Pin plating specifications	Cable shield structure
High speed or above	Gold plated	Gold plated	Triple shielded

(*2) The maximum cable length of HDMI cable is not specified in the HDMI standards, but correct signals might not be received due to weak signals when the cable is longer than 5 m.
The cable length must be 30 m or shorter due to the product specifications.
If long distance wiring is required, consider use of a cable applicable to long distance wiring or contact Mitsubishi Electric.

16.3.2 USB cable

Image input expansion unit side connector shape: USB Type A
Recommended USB cable: USB 2.0 certified cable (with the "Certified Hi-Speed USB" logo)
Max. cable length (*1): 5 m
Application: IPC signal transmission

(*1) The maximum cable length of USB 2.0 certified cable is 5 m.
If 5 m or longer wiring is required, contact Mitsubishi Electric.

16.4 Cable Relating to Drive Unit

16.4.1 Cable Wire and Assembly

Cable wire

The specifications of the wire used for each cable, and the machining methods are shown in this section. Mitsubishi Electric uses the cables shown in the tables below. When manufacturing the encoder cable and battery connection cable, use the wires shown below or equivalent products.

■ Heat resistant specifications cable

Wire type (Third-party products)	Finished 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 (*1)	8.7 mm	Heat-resistant PVC	2 (0.5 mm^2)	100 strands/ 0.08 mm	40.7 Ω/km or less	500 VAC/ 1 min	1000 MΩ/km or more	105 °C	70×10^4 times or more at R200
			4 (0.2 mm^2)	40 strands/ 0.08 mm	103 Ω/km or less				

■ General-purpose heat resistant specifications cable

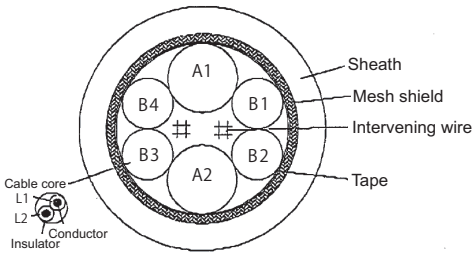
Wire type (Third-party products)	Finished outer diameter	Sheath material	No. of pairs	Wire characteristics					
				Configuration	Conductive resistor	Withstand voltage	Insulation resistance	Heat resistance temperature	Flexibility
BD20032 Compound 6-pair shielded cable Specification No. Bangishi-16903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

(*1) Bando Electric Wire (http://www.bew.co.jp/)

Note

(1) The Mitsubishi Electric standard cable is the heat-resistant cable. When the operating environment temperature is low and bending resistance is required, use a cable with high bending specifications.

Compound 6-pair cable structure drawing

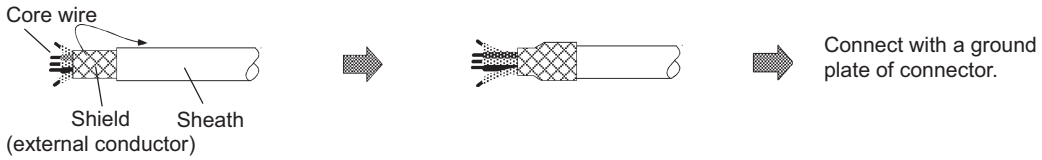


Core identification

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

Cable assembly

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



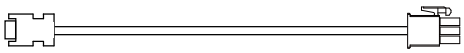
16.4.2 CNP2E-1 Cable

Max. cable length: 30 m

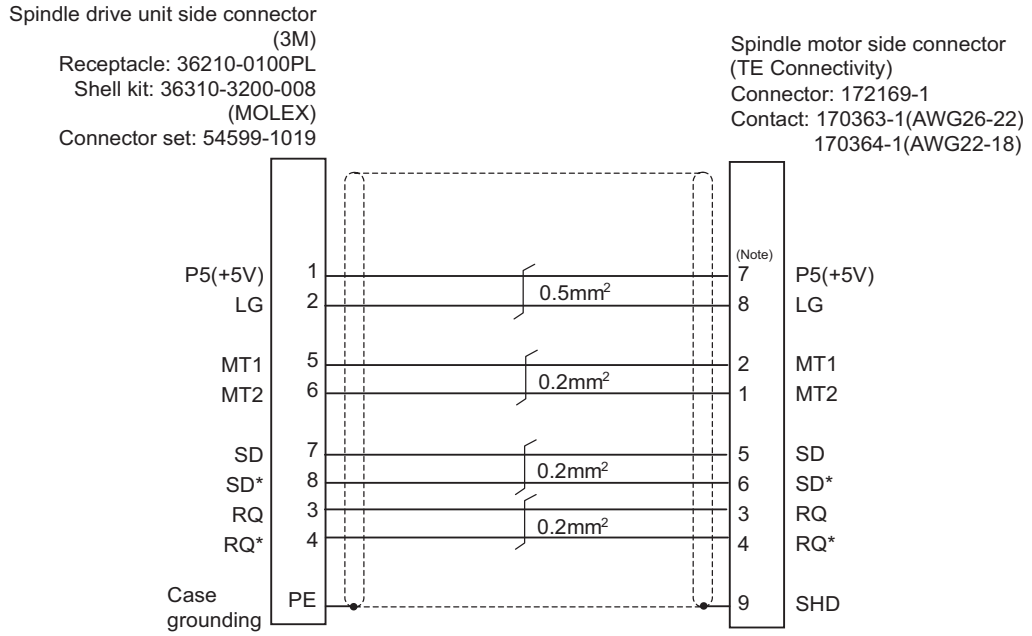
Application: Motor side PLG cable

Spindle side accuracy encoder

TS5690 cable

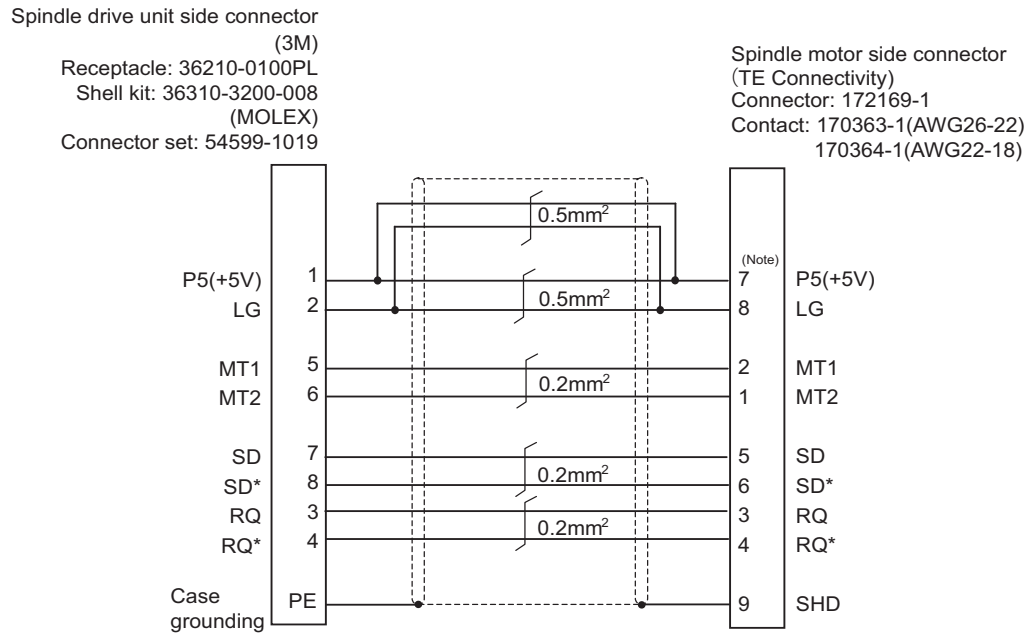


[Cable connection diagram (for 15 m or less)]



(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 15 m to 30 m)]



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

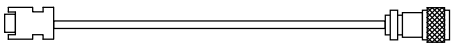
16.4.3 CNP3EZ-2P/CNP3EZ-3P Cable

Max. cable length: 30 m

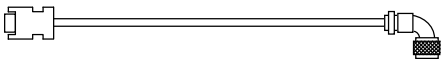
Application: Spindle side encoder cable

OSE-1024 cable

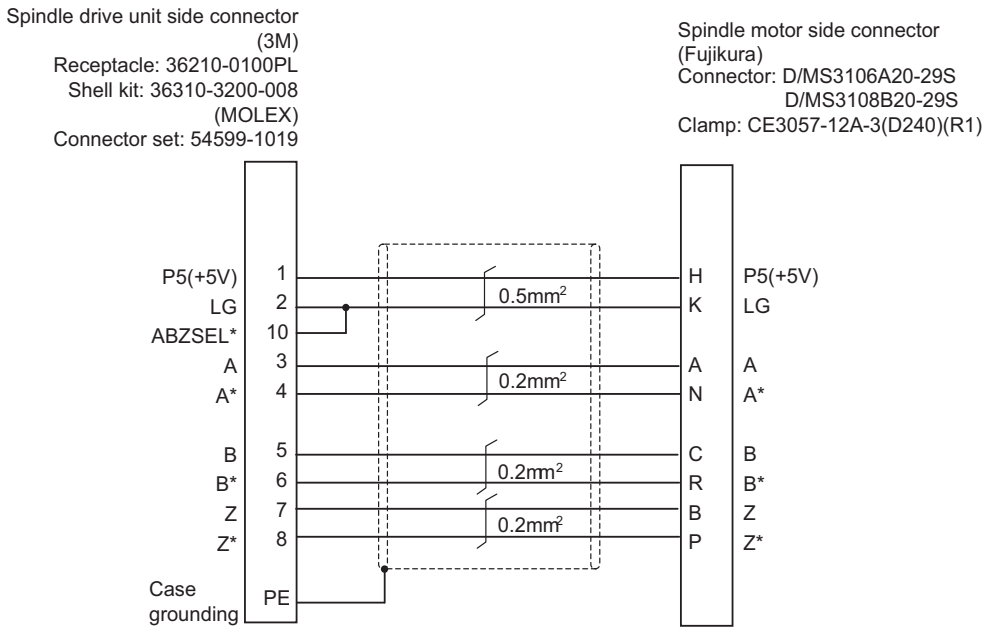
CNP3EZ-2P (Straight)



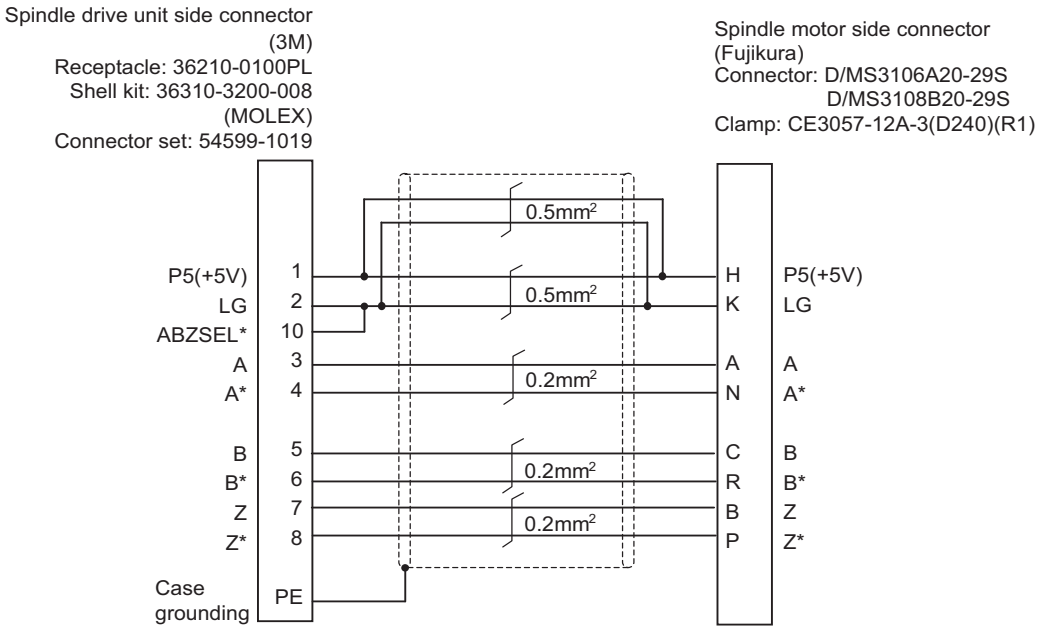
CNP3EZ-3P (Angle)



[Cable connection diagram (for 15 m or less)]



[Cable connection diagram (for 15 m to 30 m)]

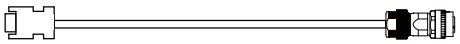


16.4.4 CNV2E-8P/CNV2E-9P Cable

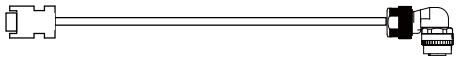
Max. cable length: 30 m

Application: For HG/HG-H, HQ-H, HK/HK-H, HG-JR Motor side encoder cable (for D47/D48/D51/D74/G48)
Ball screw side encoder cable (OSA405ET2AS, OSA676ET2AS)

CNV2E-8P (Straight)

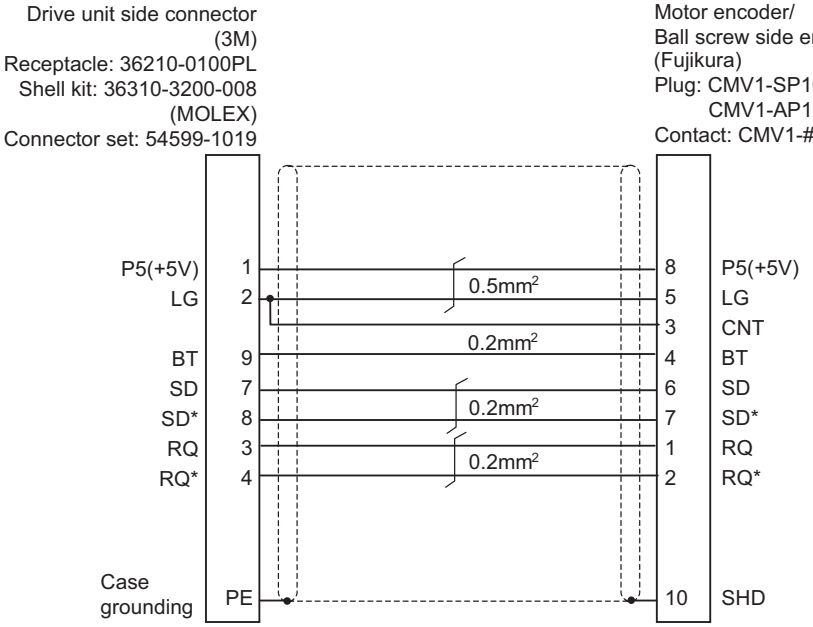


CNV2E-9P (Angle)

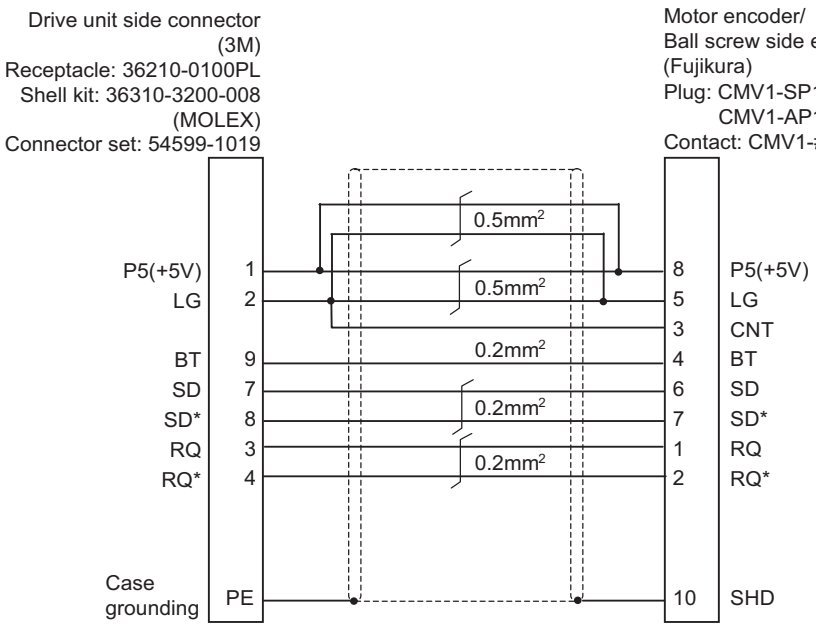


■ HG(-H), HQ-H Series

[Cable connection diagram (for 15 m or less)]

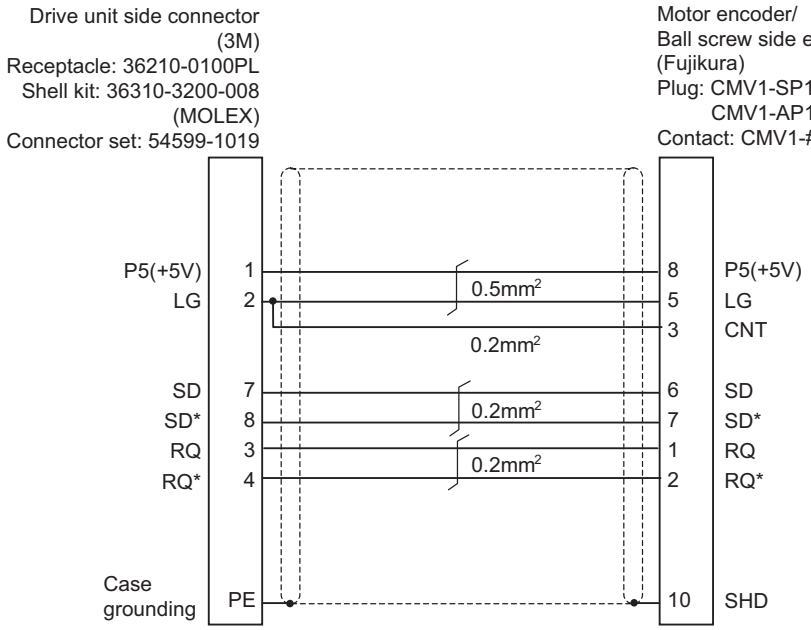


[Cable connection diagram (for 15 m to 30 m)]

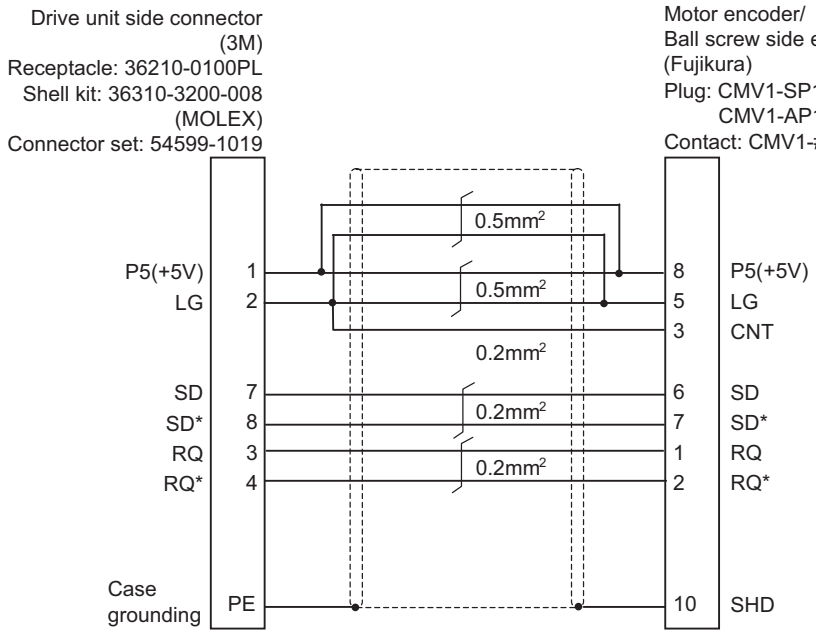


■ HK(-H) Series

[Cable connection diagram (for 15 m or less)]



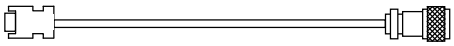
[Cable connection diagram (for 15 m to 30 m)]



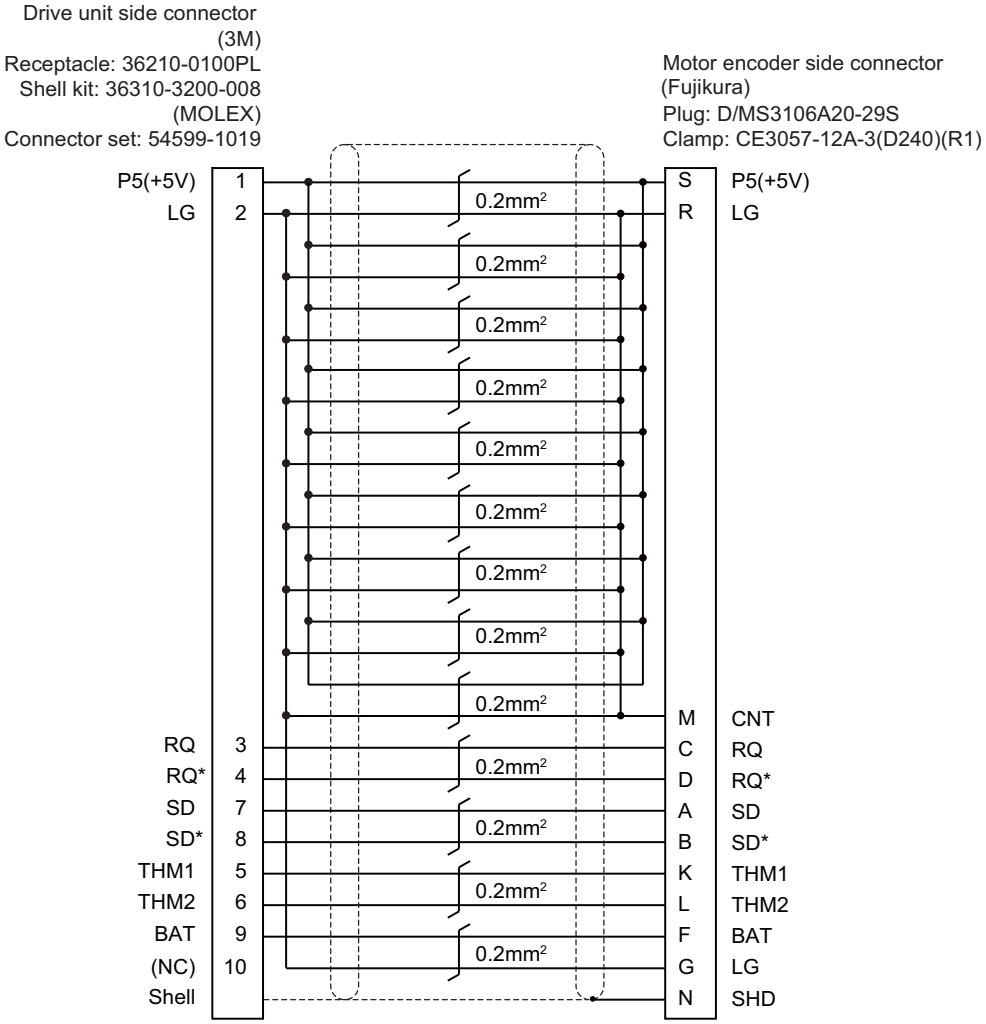
16.4.5 MR-ENE4CBL-H-MTH Cable

Max. cable length: 30 m

Application: For HG-H1502 Motor side encoder cable (for D48/D51/D74)



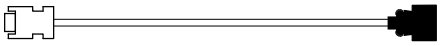
[Cable connection diagram]



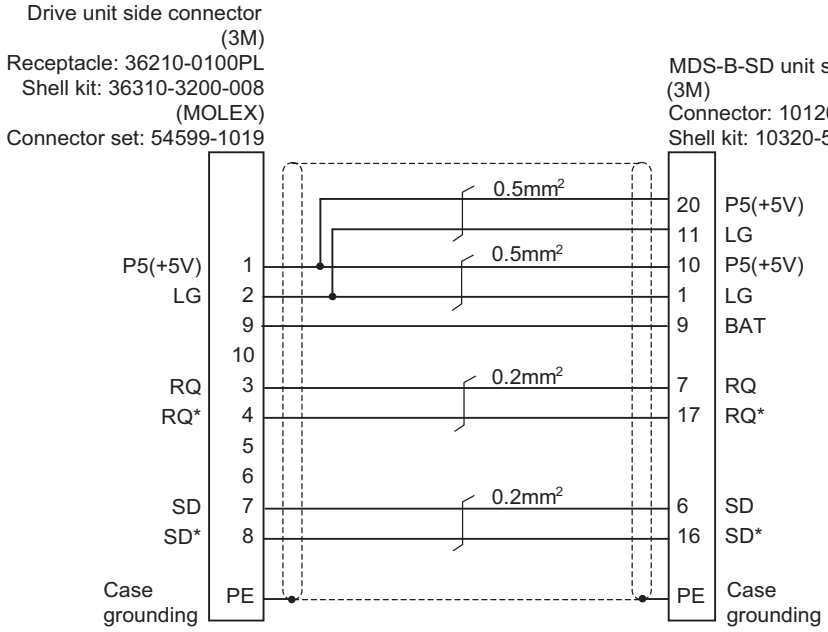
16.4.6 CNV2E-D Cable

Max. cable length: 30 m

Application: MDS-B-SD unit cable



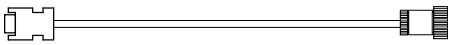
[Cable connection diagram]



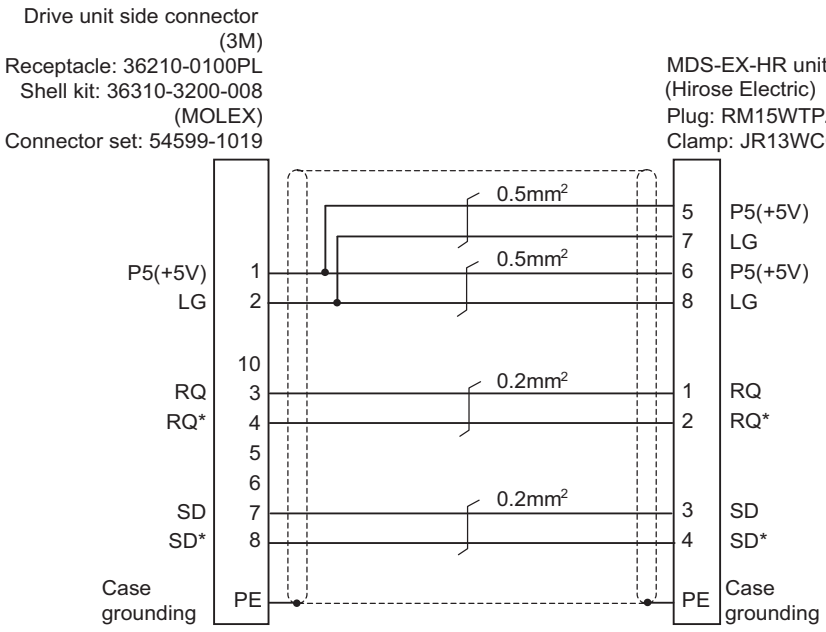
16.4.7 CNV2E-HP Cable

Max. cable length: 30 m

Application: MDS-EX-HR unit cable



[Cable connection diagram]



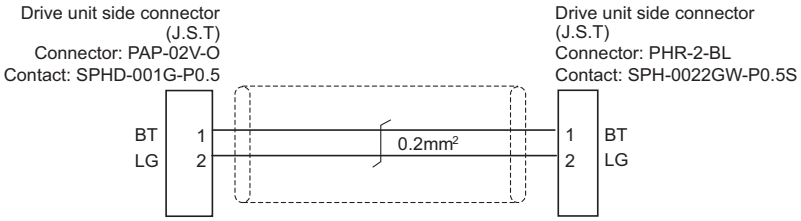
16.4.8 DG30 Cable

Max. cable length: 10 m

Application: Battery cable

(For drive unit - battery box, For drive unit - drive unit)





16.4.9 G380 Cable

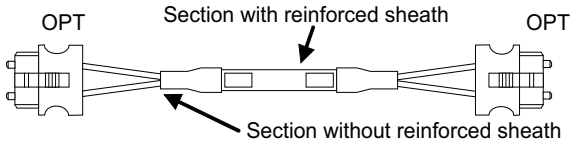
Max. cable length: 30 m

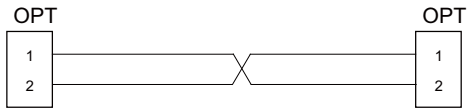
Application: Optical communication cable

For wiring between drive units (outside panel)

For optical communication repeater unit

Use when the cable length is 10 m or more to 30 m or less.





[OPT]
Connector: 1123445-1
Manufacturer: TE Connectivity

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

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

Note

(1) Binding the cables too tightly 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. (Clamp material for reference: KITAGAWA INDUSTRIES CKN-13SP)

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

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

16.4.10 J395 Cable

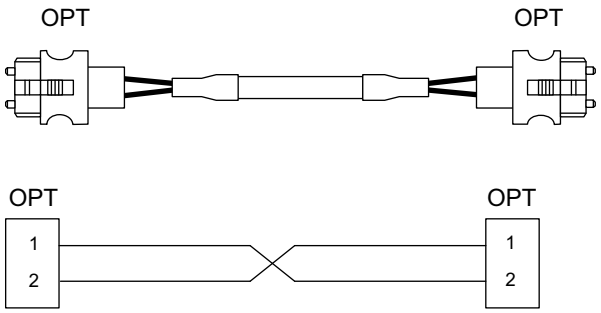
Max. cable length: 10 m

Application: Optical communication cable

For wiring between drive units (outside panel)

For wiring between NC and drive unit

Use when wiring outside of the panel with a cable of 10 m or less.



[OPT]
Connector: LGP-Z0007PK
Manufacturer: HONDA TSUSHIN KOGYO

Wire material: PFDU-CL1002-22E60VT
Manufacturer: TORAY

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

Note

(1) Binding the cables too tightly 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. (Clamp material for reference: KITAGAWA INDUSTRIES CKN-13SP)

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

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

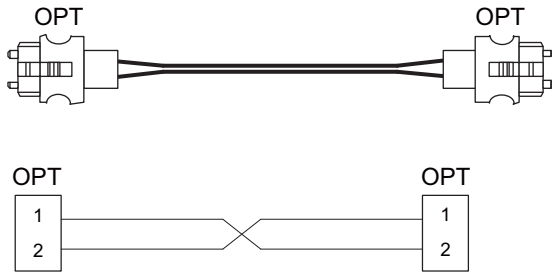
16.4.11 J396 Cable

Max. cable length: 10 m

Application: Optical communication cable

For wiring between drive units (inside panel)

Use when wiring inside of the panel with a cable of 10 m or less.



[OPT]
Connector: LGP-Z0007PK
Manufacturer: HONDA TSUSHIN KOGYO

Wire material: PFDU-CD1002-18E22T
Manufacturer: TORAY

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

Note

(1) Binding the cables too tightly 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. (Clamp material for reference: KITAGAWA INDUSTRIES CKN-13SP)

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

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

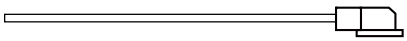
16.4.12 MR-BKS1CBL-A1-H/MR-BKS1CBL-A2-H Cable

Max. cable length: 10 m

Application: <200 V Series> Brake cable for HG96

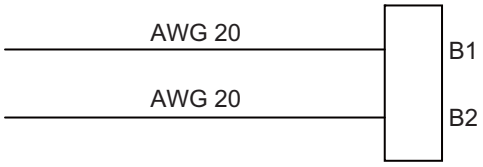
MR-BKS1CBL-A1-H (load side angle)

MR-BKS1CBL-A2-H (reverse load side angle)



[Cable connection diagram]

Servo motor brake connector
(Japan Aviation Electronics)
Connector: JN4FT02SJ1-R
Hood, Socket insulator,
Bushing and Ground nut
Contact: ST-TMH-S-C1B-100(A534G)
Crimp tool: CT160-3TMH5B

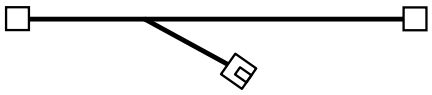


16.4.13 MR-BT6V2CBL Cable

Max. cable length: 1 m

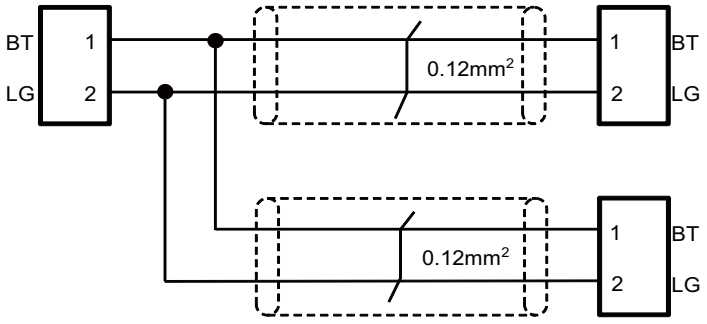
Application: Battery cable (MDS-EJ/EJH)

(drive unit - drive unit)



Drive unit side connector
(J.S.T)
Connector: PAP-02V-O
Contact: SPHD-001G-P0.5

Drive unit side connector
(J.S.T)
Connector: PAP-02V-O
Contact: SPHD-001G-P0.5



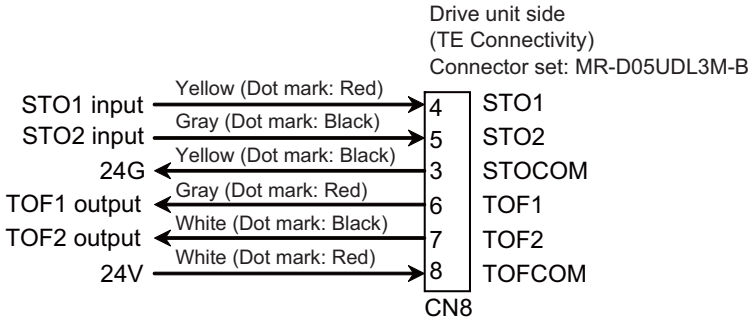
Battery unit side connector
(J.S.T)
Connector: PALR-02VF
Contact: SPAL-001T-P0.5

16.4.14 MR-D05UDL3M-B Cable

Max. cable length: 3 m

Application: STO cable





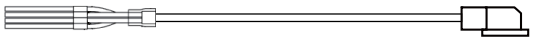
16.4.15 MR-PWS1CBL-A1-H/MR-PWS1CBL-A2-H Cable

Max. cable length: 10 m

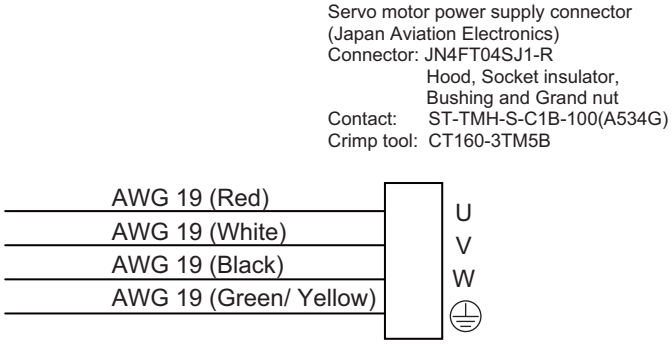
Application: <200 V Series> Power cable for HG96

MR-PWS1CBL-A1-H (load side angle)

MR-PWS1CBL-A2-H (reverse load side angle)



[Cable connection diagram]

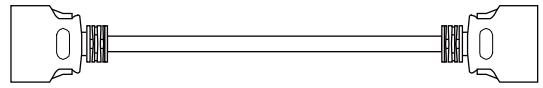


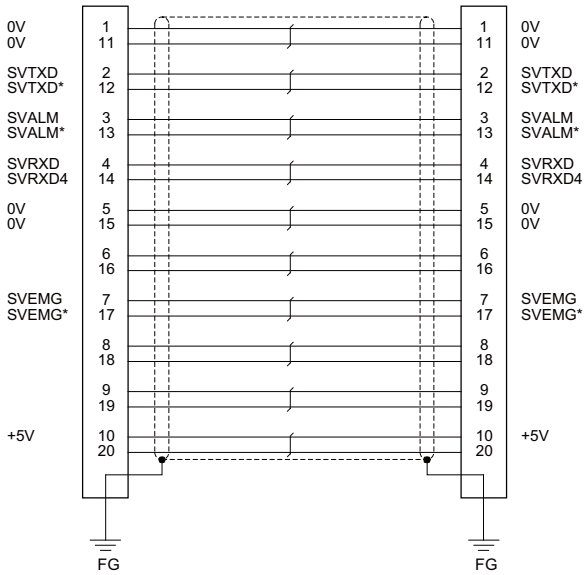
16.4.16 SH21 Cable

Max. cable length: 30 m

Application: Power supply communication cable
Backup unit communication cable

CN4, CN9





[CN4, CN9]
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

Wire material: UL20276 AWG28 × 10P
Manufacturer: Toyokuni Electric

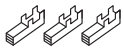
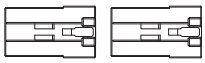
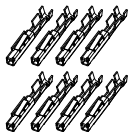
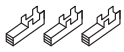
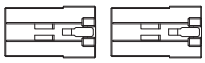
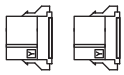
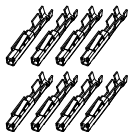
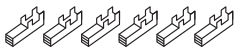
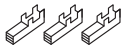
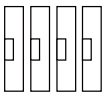
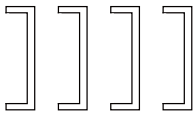
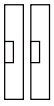
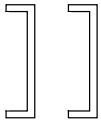
Plug: 10120-3000PE
Shell: 10320-52F0-008
Manufacturer: 3M

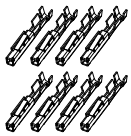
Note

(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.

(2) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.
(Manufacturer recommended tightening torque: 0.20 ±0.05 N·m)

16.5 List of Cable Connector Sets

Type	Application	Package contents	
FCUA-CS000	General I/O units (For SKIP, SIO, MPG, AIO)	Connector (3M) 10120-3000PE x 2 	Shell kit (3M) 10320-52F0-008 x 2 
005057-9403 0016020103 x 3	Emergency stop connector (For EMG)	Connector (MOLEX) 50-57-9403 x 1 	Gold contact (MOLEX) 0016020103 x 3 
RIO2 CON	Connector kit for RIO 2.0 unit	Connector (TE Connectivity) 1-1318119-3 x 2  Connector (TE Connectivity) 2-178288-3 x 1 	Contact (TE Connectivity) 1318107-1 x 8  Contact (TE Connectivity) 1-175218-5 x 3 
RIOL-CON	Connector kit for laser I/F	Connector (TE Connectivity) 1-1318119-3 x 2  Connector (TE Connectivity) 2-178288-3 x 2 	Contact (TE Connectivity) 1318107-1 x 8  Contact (TE Connectivity) 1-175218-5 x 6 
FCUA-CN220	24 VDC power supply connector (For DCIN)	Connector (TE Connectivity) 2-178288-3 x 1 	Contact (TE Connectivity) 1-175218-5 x 3 
7940-6500SC x 4 3448-7940 x 4	DO connector (for operation panel I/O unit) DI/DO connector (for remote I/O unit)	Connector (3M) 7940-6500SC x 4 	Strain relief (3M) 3448-7940 x 4 
7950-6500SC x 2 3448-7950 x 2	DI connector (For operation panel I/O unit)	Connector (3M) 7950-6500SC x 2 	Strain relief (3M) 3448-7950 x 2 

Type	Application	Package contents	
2-1318119-4 1318107-1 x 8	Connector for CJ71	Connector (TE Connectivity) 2-1318119-4 x 1 	Contact (TE Connectivity) 1318107-1 x 8 
37104-2165-000FL 10P	THERMISTOR connector (For thermistor input unit)	Connector (3M) 37104-2165-000FL x 10 	

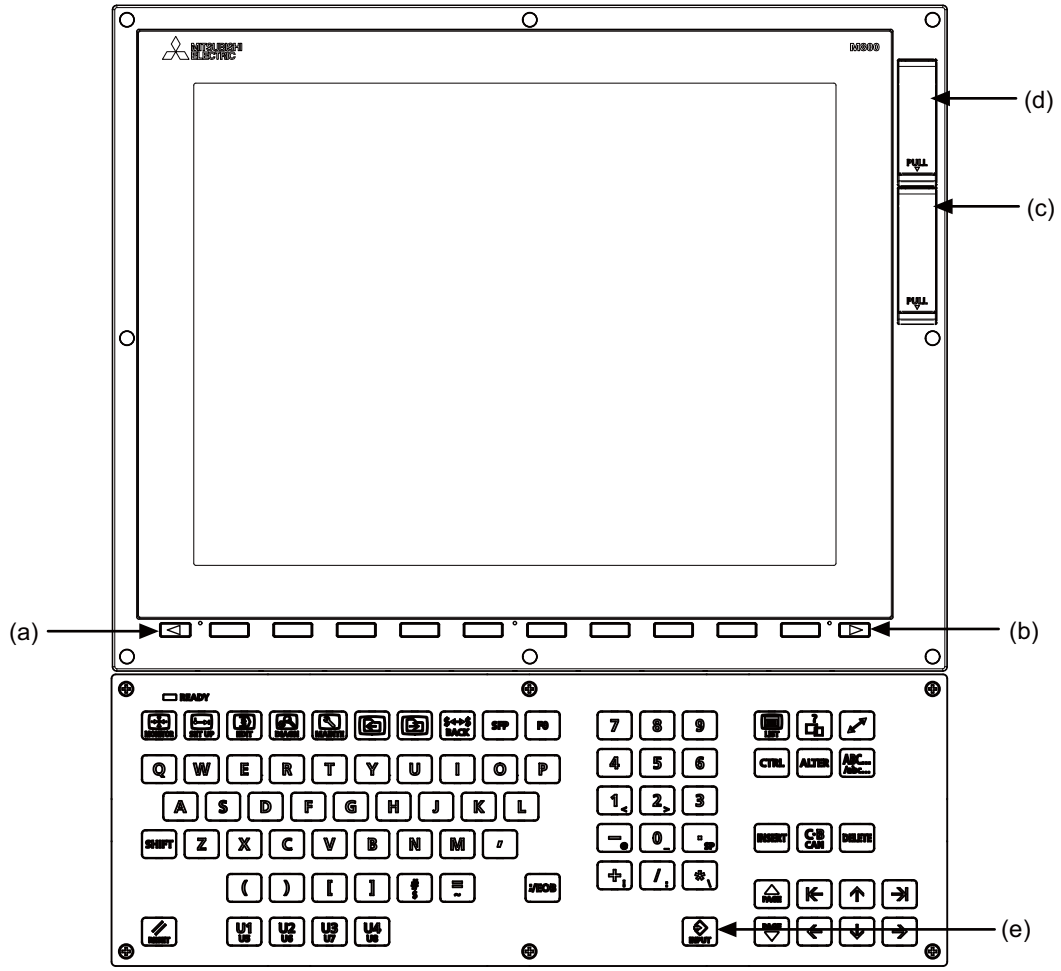
17

Setup Outline

17.1 Hardware Configuration

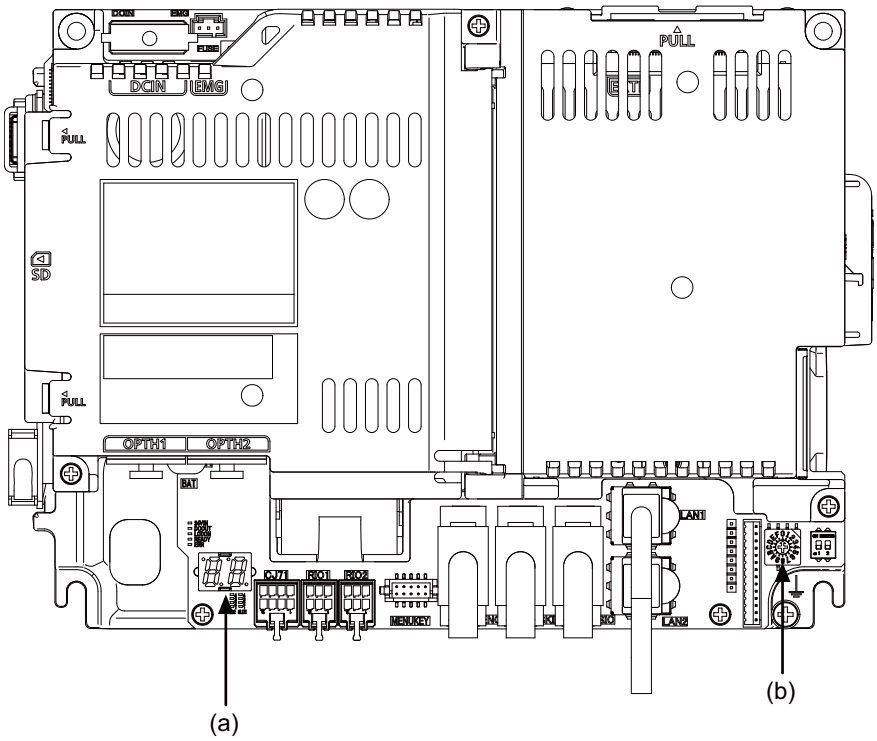
The following shows the hardware names used in this manual.

[Example of 15-type]

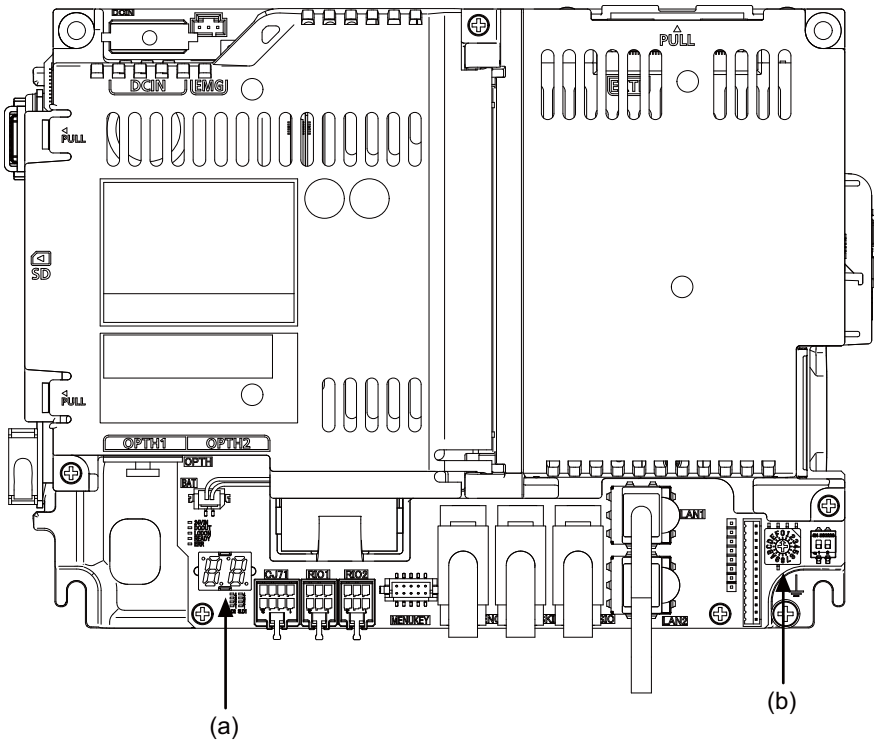


(a) Cancel key
(b) Menu changeover key
(c) Front-side SD card I/F
(d) USB I/F
(e) [INPUT] key

[M800VS]



[M80V]



(a) 7-segment LED
(b) Rotary switch

17.2 Flow of Initial Setup

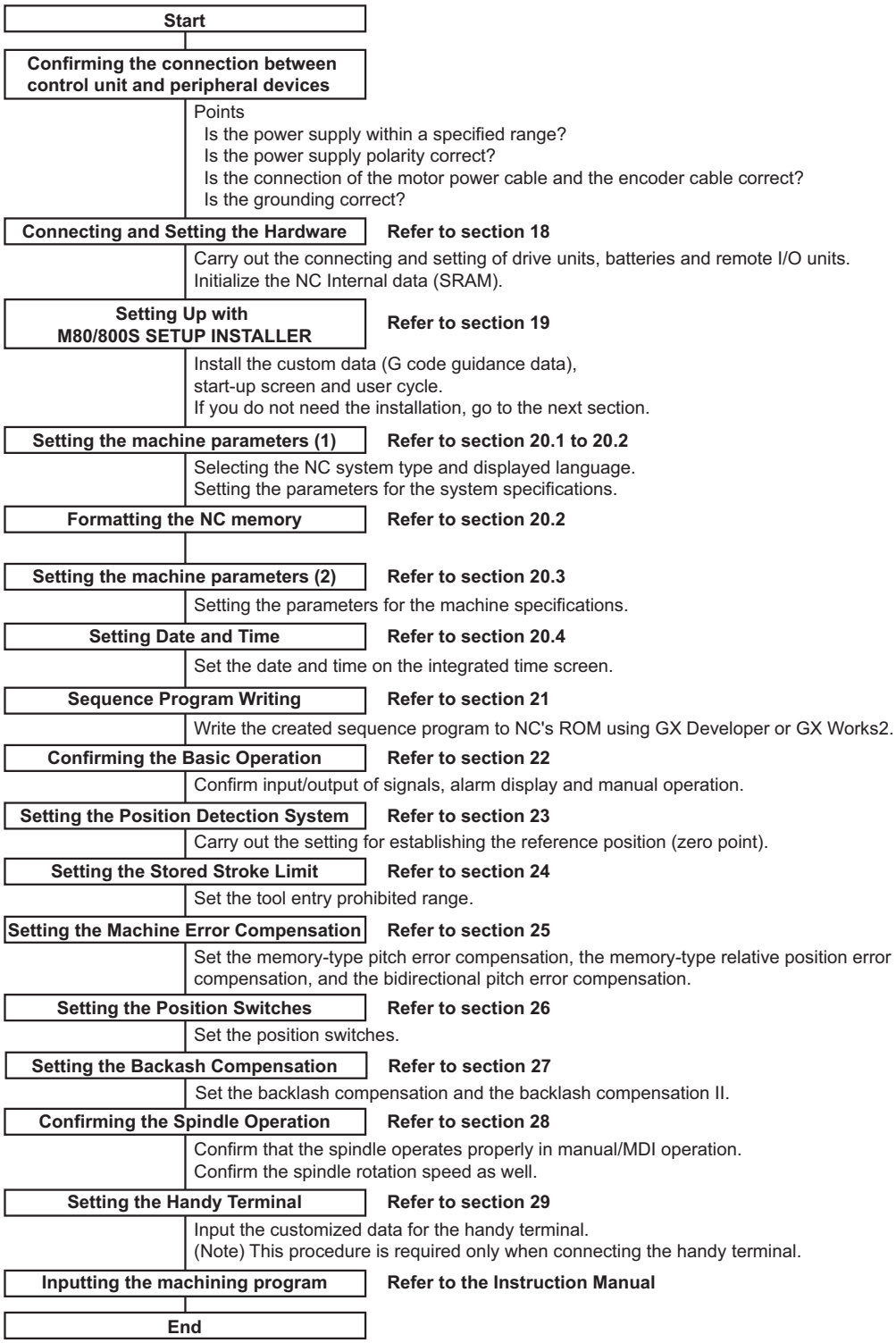
The following flow chart shows the procedures of the initial setup.

Note

(1) When setting up with backup files, refer to "37 Data Backup and Restoration".

⚠ WARNING

Do not cancel the emergency stop before confirming the basic operation.



For other settings, refer to the following chapters:

- 30 Deceleration Check
- 31 Synchronous Control and Multiple-axis Synchronization Control
- 32 OMR Control
- 33 Variable Torsion Compensation
- 34 Adjust S-analog Screen
- 35 Device Open Parameter Screen
- 36 SRAM Open Parameter Screen
- 37 Data Backup and Restoration

When using the system lock, refer to "38 Appendix 1: Setting the System Lock".
When using the protection setting, refer to "39 Appendix 2: Protection Setting".

18

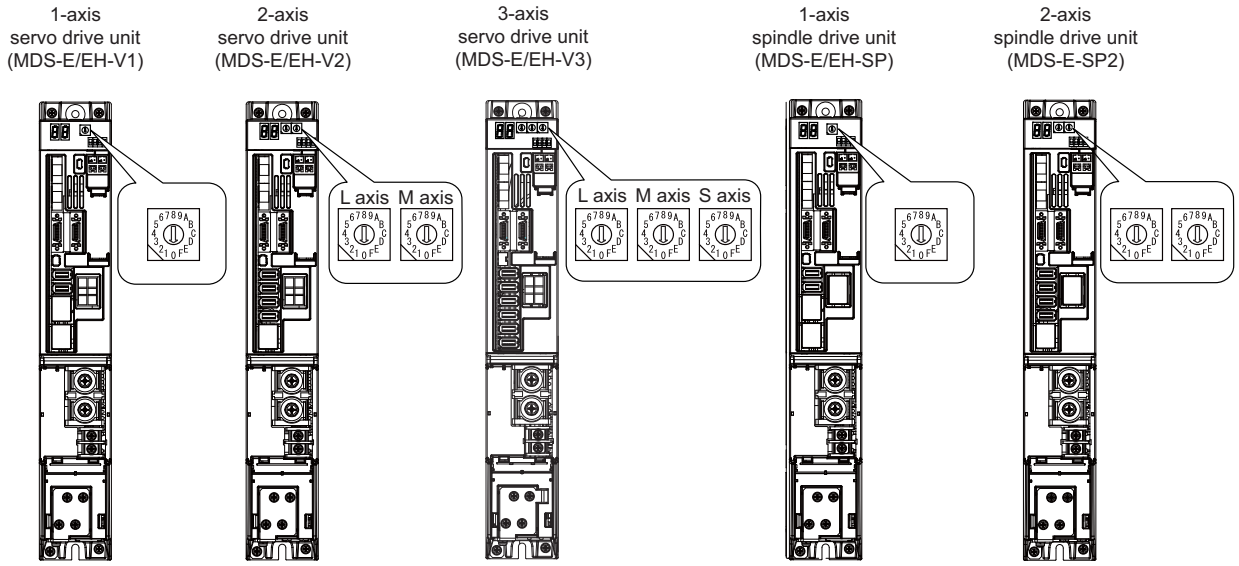
Setting the Hardware

18.1 Setting Drive Unit MDS-E/EH Series

18.1.1 Setting the Rotary Switch

Set the axis number with the rotary switch.

■ Drive unit

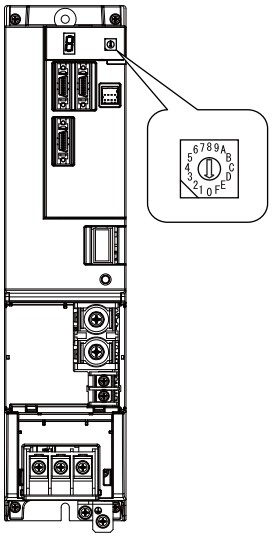


[MDS-E/EH-V1/V2/SP, MDS-E/EH-V3/SP2 setting]

Rotary switch setting	AXIS NO.
0	1st axis
1	2nd axis
2	3rd axis
3	4th axis
4	5th axis
5	6th axis
6	7th axis
7	8th axis
8	9th axis
9	10th axis
A	11th axis
B	12th axis
C	13th axis
D	14th axis
E	15th axis
F	16th axis

■ Power supply unit

Power supply unit
(MDS-E/EH-CV)

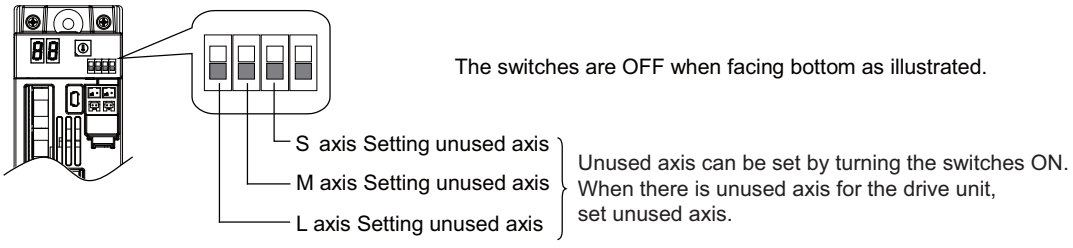


[MDS-E/EH-CV setting]

Rotary switch setting	Setting item
0	Normal setting
1 to 3	Setting prohibited
4	External emergency stop setting
5 to F	Setting prohibited

18.1.2 Setting the DIP Switch

As a standard setting, turn the all DIP switches OFF.



> **⚠ CAUTION**
>
> **An axis set unused is not included in the functional safety.**

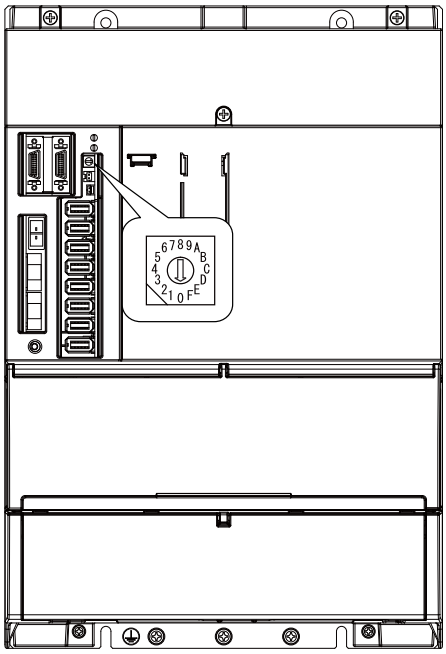
18.2 Setting Drive Unit MDS-EM/EMH Series

18.2.1 Setting the Rotary Switch

Set the axis number with the rotary switch.

■ Drive unit

Multi axis unit
(MDS-EM/EMH-SPV3)



[MDS-EM/EMH-SPV3 setting]

Rotary switch setting	Axis configuration	Spindle	Servo		
			L-axis	M-axis	S-axis
0	Spindle and 3 servo axes	1st axis	2nd axis	3rd axis	4th axis
1		5th axis	6th axis	7th axis	8th axis
2		9th axis	10th axis	11th axis	12th axis
3		13th axis	14th axis	15th axis	16th axis
4	Spindle and 2 servo axes	1st axis	2nd axis	3rd axis	-
5		5th axis	6th axis	7th axis	-
6		9th axis	10th axis	11th axis	-
7		13th axis	14th axis	15th axis	-
8	Setting impossible	-	-	-	-
9	Setting impossible	-	-	-	-
A	Setting impossible	-	-	-	-
B	Setting impossible	-	-	-	-
C	Setting impossible	-	-	-	-
D	Setting impossible	-	-	-	-
E	Setting impossible	-	-	-	-
F	Setting impossible	-	-	-	-

⚠ CAUTION

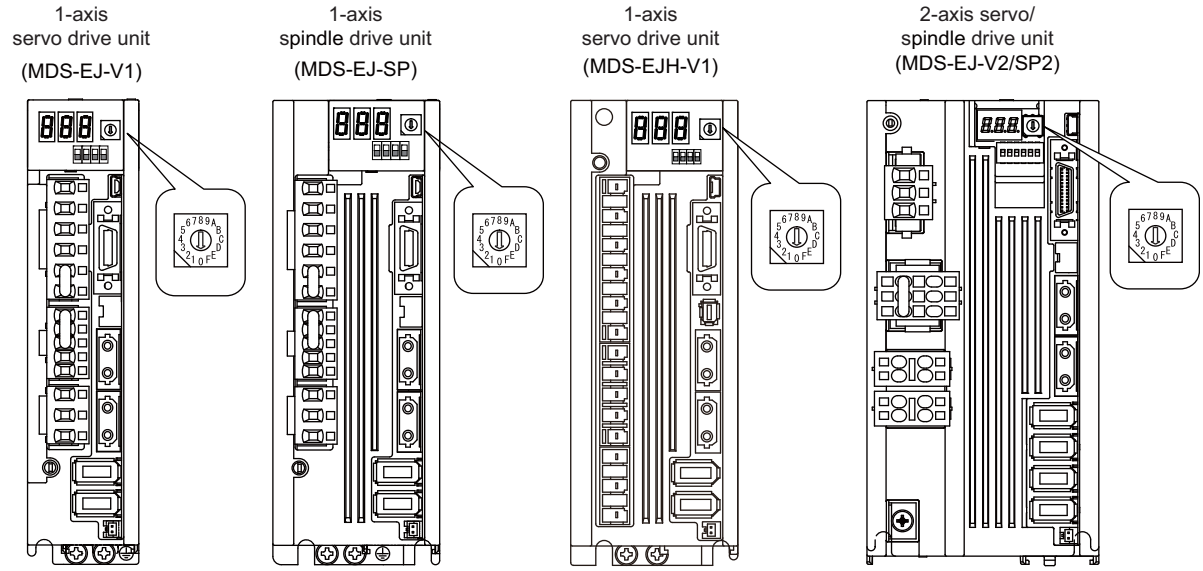
The axis configuration "Spindle + Servo 2 axes" is the state where the servo axis S is disabled.
Set the NC parameter (#1021) according to the axis numbers.

18.3 Setting Drive Unit MDS-EJ/EJH Series

18.3.1 Setting the Rotary Switch

Set the axis number with the rotary switch.

■ Drive unit



[MDS-EJ/EJH-V1, MDS-EJ-SP setting]

Rotary switch setting	AXIS NO.
0	1st axis
1	2nd axis
2	3rd axis
3	4th axis
4	5th axis
5	6th axis
6	7th axis
7	8th axis
8	9th axis
9	10th axis
A	11th axis
B	12th axis
C	13th axis
D	14th axis
E	15th axis
F	16th axis

[MDS-EJ-V2/SP2 setting]

Rotary switch setting	AXIS NO.	
	L-axis	M-axis
0	1st axis	2nd axis
1	2nd axis	3rd axis
2	3rd axis	4th axis
3	4th axis	5th axis
4	5th axis	6th axis
5	6th axis	7th axis
6	7th axis	8th axis
7	8th axis	9th axis
8	9th axis	10th axis
9	10th axis	11th axis
A	11th axis	12th axis
B	12th axis	13th axis
C	13th axis	14th axis
D	14th axis	15th axis
E	15th axis	16th axis
F	Setting prohibited	

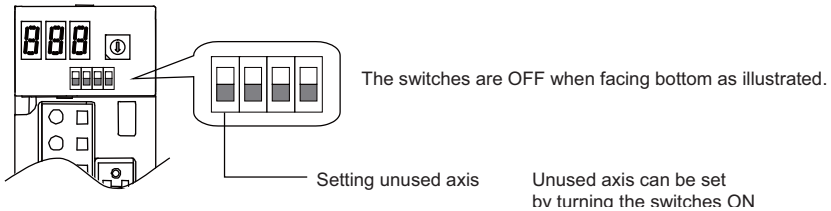
Note

(1) As for 2-axis drive unit, one rotary switch sets the L and M axes to the consecutive axis Nos.
(2) As for 2-axis drive unit, the rotary switch setting "F" is prohibited.

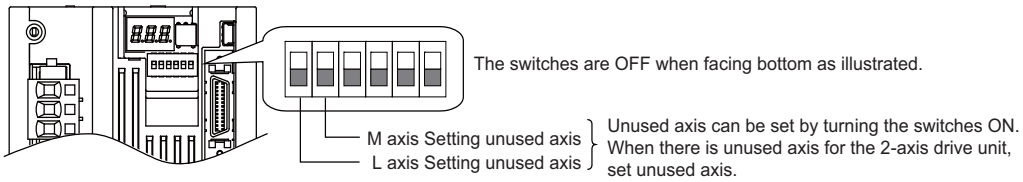
18.3.2 Setting the DIP Switch

As a standard setting, turn the all DIP switches OFF.

[MDS-EJ/EJH-V1, MDS-EJ-SP setting]



[MDS-EJ-V2/SP2 setting]



⚠ CAUTION

An axis set unused is not included in the functional safety.

18.4 Setting Up without Connecting to the Motor/Drive Units at the Setup of Drive Unit

When connecting the motor or drive unit after setting up the system, set the axis data beforehand to enable the operation without the motor or drive unit. The following shows the procedures.

Setting Up without Connecting to the Motor

The axis detachment can be used for servo axis. The detachment function cannot be used for spindle.

(1) Set the drive unit rotary switch and "#1021 mcp_no" for the axis that is not connected to the motor.
(2) Set the parameter "#1070 axoff" to "1" for the axis that is not connected to the motor.
(3) Perform either (a) or (b).
  (a) Set parameter "#8201 AX. RELEASE" to "1" for the axis that is not connected to the motor.
  (b) Turn ON the control axis detach signal (Y780) for the axis that is not connected to the motor.

Setting Up without Connecting to the Drive Unit

Set the following parameters.

(1) Set "#1021 mcp_no" (for the servo axis) or "#3031 smcp_no" (for the spindle) to the axis or the spindle that is not connected to the drive unit.
(2) Set the following parameters to the axis that is not connected to the drive unit.
  For the servo axis: Set "#2018 no_srv" to "1".
  For the spindle: Set "#3024 sout" to "0".

Note

(1) After connecting to the drive unit, make sure to set "#2018 no_srv" to "0" and "#3024 sout" to "1".

18.5 Connecting the Batteries

18.5.1 Control Unit Battery

> **⚠ CAUTION**
>
> **The battery is not connected when the machine is delivered. Be sure to connect the battery before starting up.**

Lithium batteries in the control unit battery holder retain parameters, machining programs and other data which require backing up at power OFF.

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

[Precautions for handling battery]

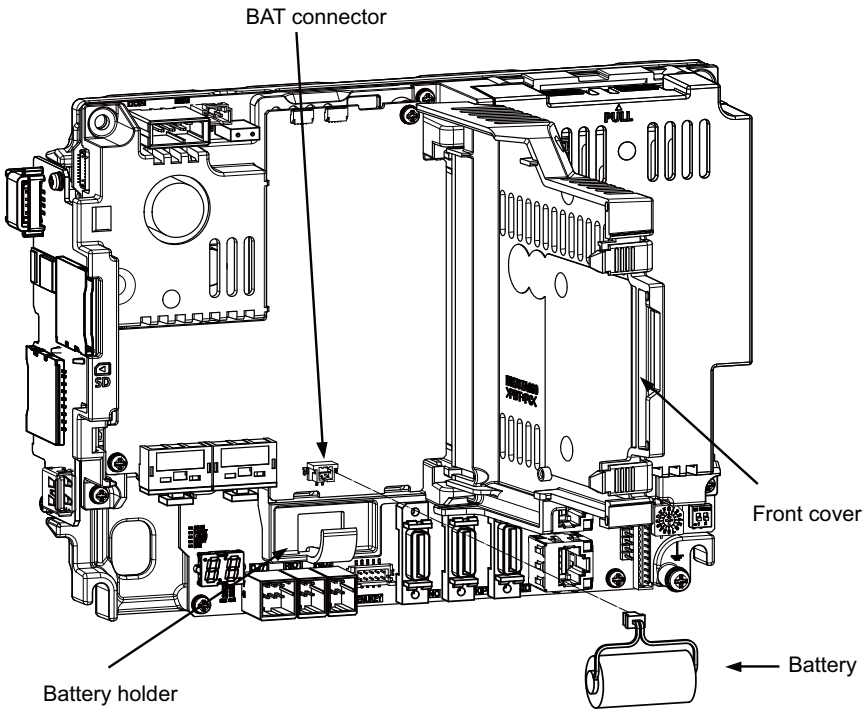
- Do not disassemble the battery.
- Do not place the battery in flames or water.
- Do not pressurize and deform the battery.
- This is a primary battery so do not charge it.

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

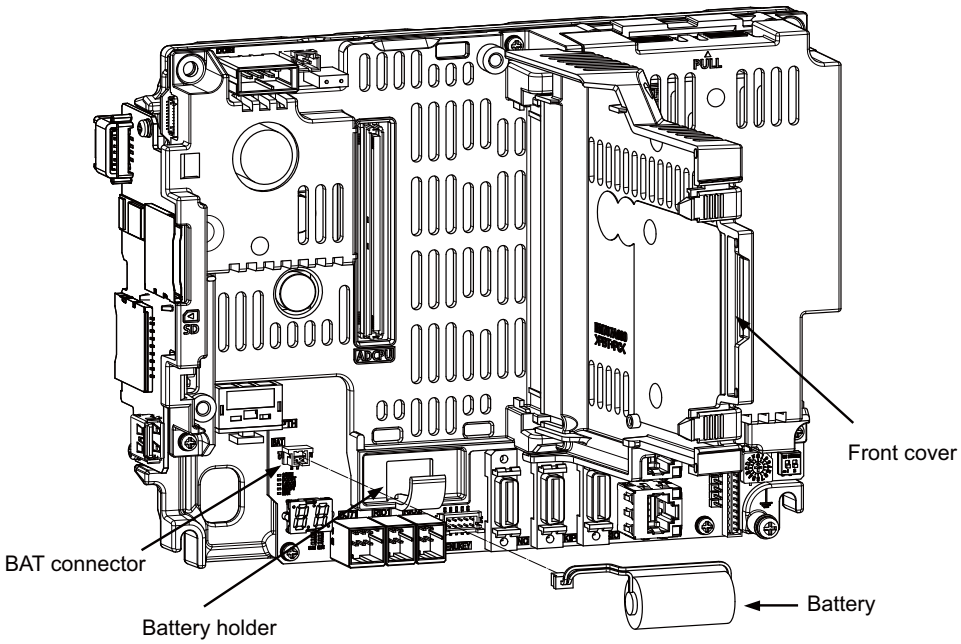
■ Installation procedure

(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 front cover of the control unit.
(4) Fit the new battery into the battery holder.
(5) Insert the connector connected to the new battery into the BAT connector. Pay attention to the connector orientation: do not insert backwards.
(6) 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.

[M800VS]



[M80V]

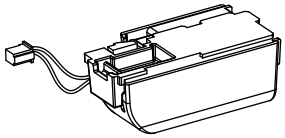
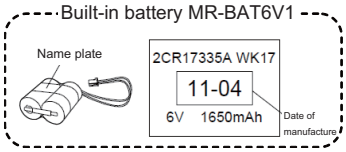


18.5.2 Servo Drive Unit Battery

Note

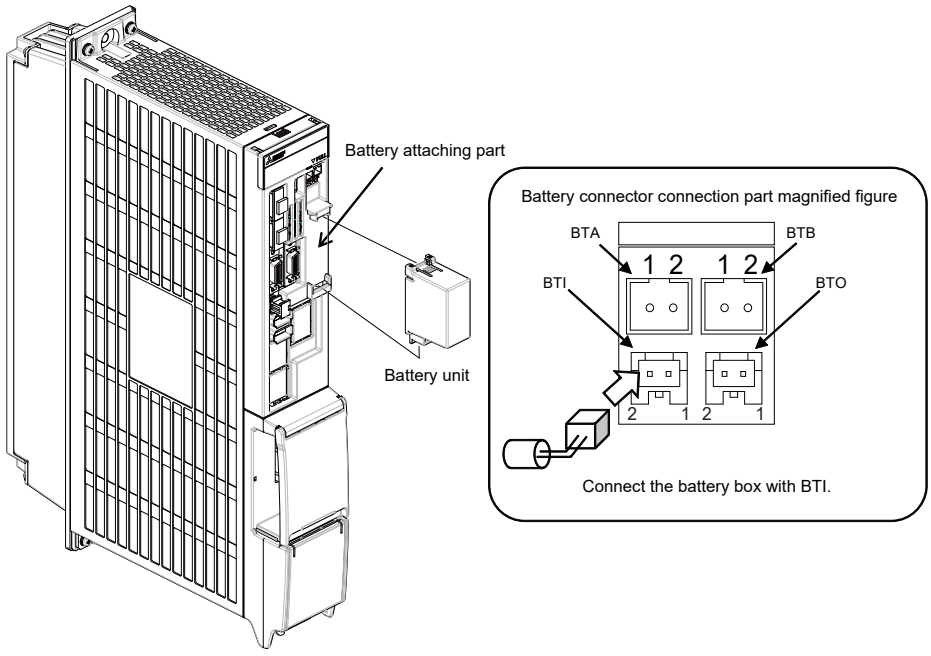
(1) The battery connection is not necessary unless the drive unit employs absolute position detection. (Spindle drive unit does not require the battery, because the unit does not employ absolute position detection.)

There are batteries as shown below. Refer to the drive unit's specification manual for details.

Type		MDS-BAT6V1SET	MDSBTBOX-LR2060	MR-BAT6V1SET
Installation type		Drive unit installation	Control panel installation	Drive unit installation
Hazard class		Not applicable	Not applicable	Not applicable
Number of connectable axes		Up to 3 axes	Up to 8 axes	Up to 3 axes
Change method		Battery option change	Battery change	Battery option change
Appearance				 
Compatible model	E/EH	○	○	-
	EM	-	○	○
	EJ/EJH	-	○	○

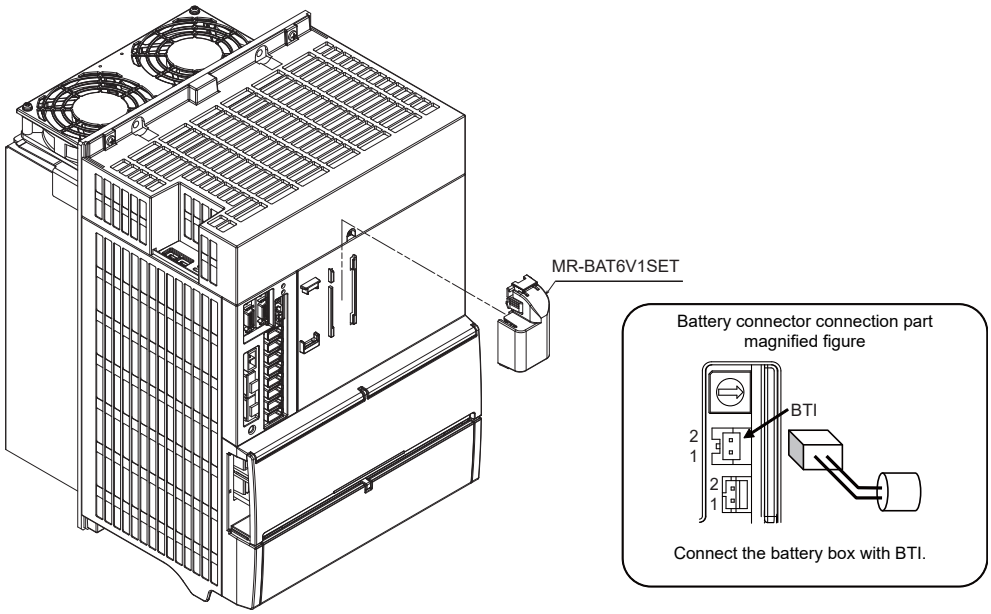
[MDS-E/EH-Vx]

Connect the battery connector to the connector BTI of the drive unit.



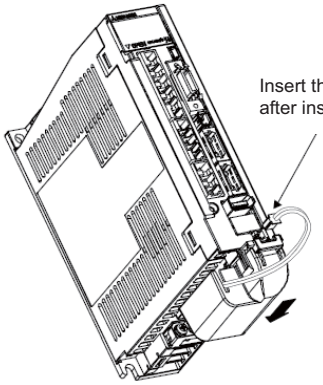
[MDS-EM]

Connect the battery connector to the connector BTI of the drive unit.

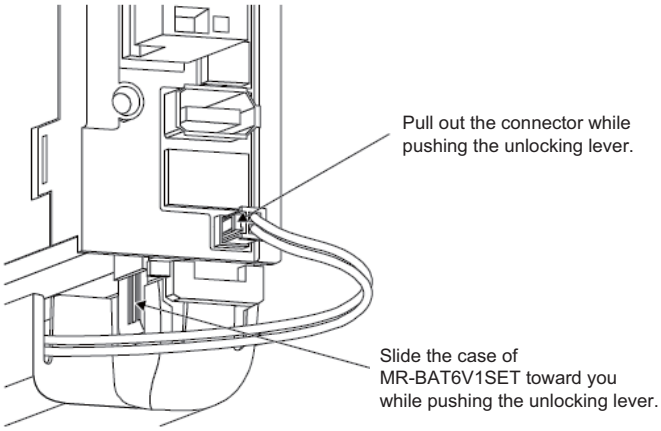


[MDS-EJ/EJH-Vx]

Connect the battery connector to the connector BAT of the drive unit.



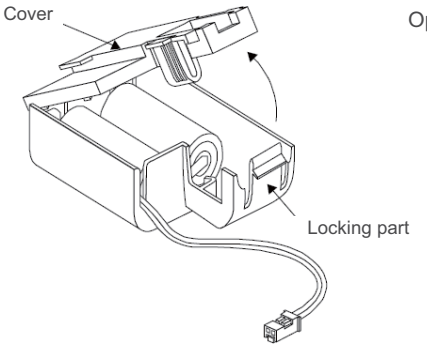
Installation



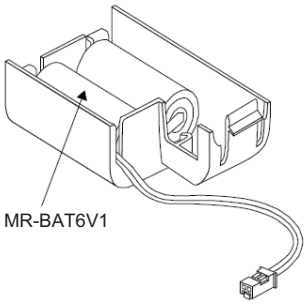
Removal

■ Replacing the built-in battery

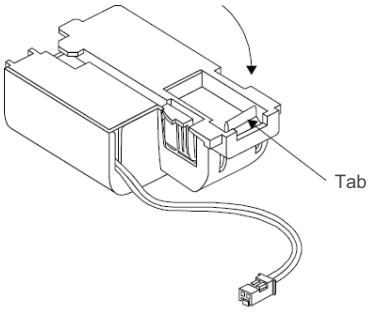
MR-BAT6V1SET that reached the end of the life can be reused by replacing the MR-BAT6V1 battery.



Open the cover while pushing the locking part.



Replace the built-in battery with a new battery for MR-BAT6V1.



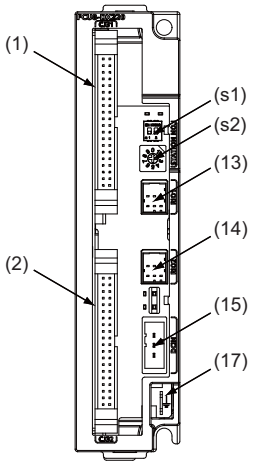
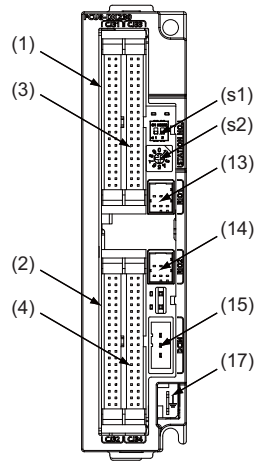
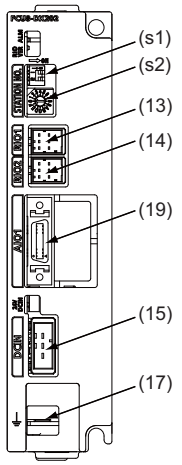
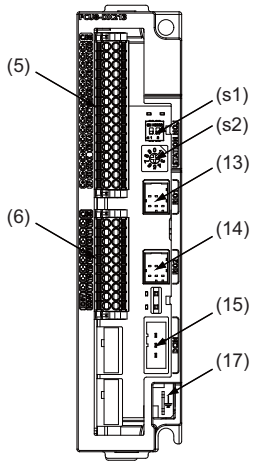
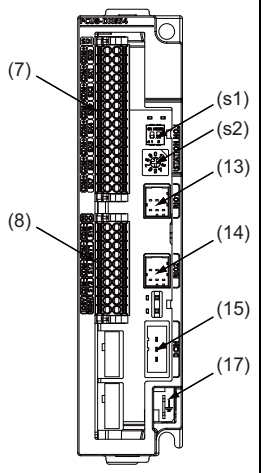
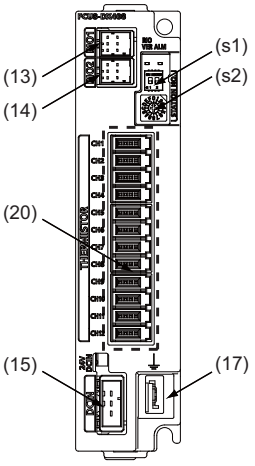
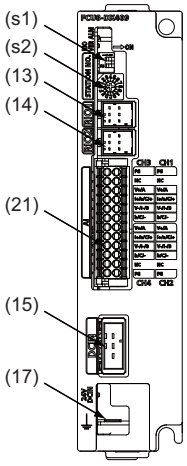
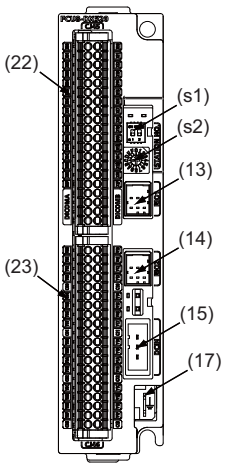
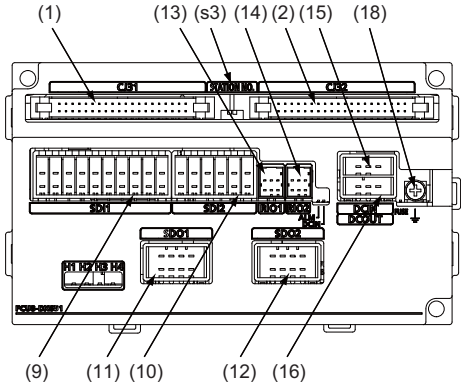
Close the cover by pushing until it is fixed with the tab of the locking part.

18.6 Connecting and Setting the Remote I/O Unit

18.6.1 Outline of the Remote I/O Unit

The specification varies for each remote I/O unit.

Each unit has one or two rotary switch(es) that determines the unit No. and associates the unit with its device No. (with X/Y).

FCU8-DX220	FCU8-DX230/DX231	FCU8-DX202	FCU8-DX213/DX213-1	FCU8-DX654/DX654-1
				
FCU8-DX408	**FCU8-DX409**	**FCU8-DX520**	**FCU8-DX651**	
				

No.	Connector name	Function
(1)	CJ31	Machine signal input
(2)	CJ32	Machine signal output
(3)	CJ33	Machine signal input
(4)	CJ34	Machine signal output
(5)	CJ35	Machine signal input
(6)	CJ36	Machine signal output
(7)	SDI	Safety machine signal input
(8)	SDO	Safety machine signal output
(9)	SDI1	Safety DI input
(10)	SDI2	Safety DI input
(11)	SDO1	Safety relay output
(12)	SDO2	Safety relay output

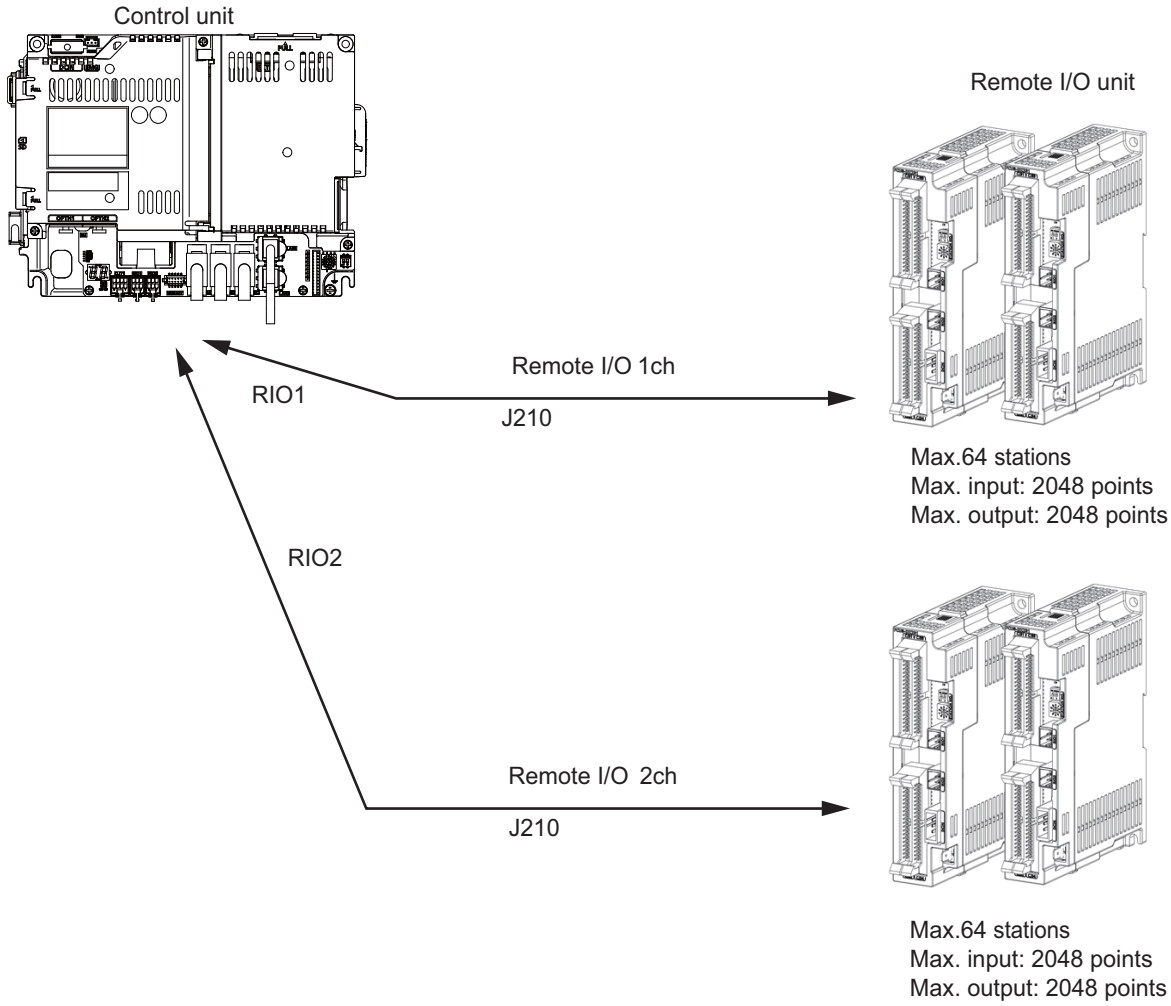
No.	Connector name	Function
(13)	RIO1	Remote I/O 2.0 communication
(14)	RIO2	Remote I/O 2.0 communication
(15)	DCIN	24 VDC input
(16)	DCOUT	24 VDC output
(17)	FG	FG terminal
(18)	FG	FG terminal (M4 screw)
(19)	AIO1	Analog input Analog output
(20)	THERMISTOR	Thermistor input
(21)	AI	Multi-analog input
(22)	CJ45	Machine signal input
(23)	CJ46	Machine signal output

No.	Switch name	Function
(s1)	STATION No.	Station No. group setting switch
(s2)		Station No. setting switch
(s3)		Station No. setting switch

Unit type	Machine control signals that can be handled	Total	Number of occupied stations
FCU8-DX220	Digital input signal (DI)	32 points	1
	Digital output signal (DO)	32 points	
FCU8-DX230	Digital input signal (DI)	64 points	2
	Digital output signal (DO)	48 points	
FCU8-DX231	Digital input signal (DI)	64 points	2
	Digital output signal (DO)	48 points	
	Analog output (AO)	1 point	
FCU8-DX202	Analog input signal (AI)	4 points	1
	Analog output signal (AO)	1 point	
FCU8-DX213/DX213-1	Digital input signal (DI)	16 points	1
	Digital output signal (DO)	8 points	
FCU8-DX520	Digital input signal (DI)	32 points	1
	Digital output signal (DO)	32 points	
FCU8-DX654/DX654-1	Safety digital input signal (DI)	8 points	2
	Safety digital output signal (DO)	4 points	
FCU8-DX651	Digital input signal (DI)	32 points	3
	Digital output signal (DO)	32 points	
	Safety digital input signal (DI)	8 points	
	Safety digital output signal (DO)	4 points	
FCU8-DX408	Thermistor input (THERMISTOR)	12 points	3
FCU8-DX409	Multi-analog input (Multi AI)	4 points	4

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

When connecting directly to the control unit



Note

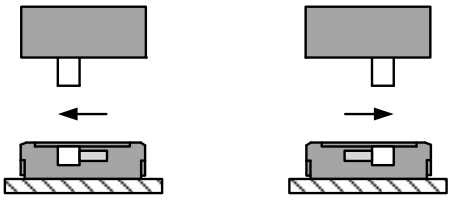
(1) Connect the J210 cable to the RIO1 or RIO2 connector of the control unit.
Check the connector position with the actual machine.

(2) A remote I/O unit has two slide switches (station No. group setting switches) and one rotary switch (station No. setting switch) for station No. setting, which link the device Nos. (with X/Y). Set the slide switches and the rotary switch as follows.

Slide switch		Rotary switch	Station No.			
1	2		FCU8-DX213/DX213-1/ DX220/DX202/DX520	FCU8-DX230/DX231/ DX654/DX654-1	FCU8-DX408	FCU8-DX409
OFF	OFF	0	1	1, 2	1, 2, 3	1, 2, 3, 4
		1	2	2, 3	2, 3, 4	2, 3, 4, 5
		2	3	3, 4	3, 4, 5	3, 4, 5, 6
		:	:	:	:	:
		F	16	16, 17	16, 17, 18	16, 17, 18, 19
OFF	ON	0	17	17, 18	17, 18, 19	17, 18, 19, 20
		1	18	18, 19	18, 19, 20	18, 19, 20, 21
		2	19	19, 20	19, 20, 21	19, 20, 21, 22
		:	:	:	:	:
		F	32	32, 33	32, 33, 34	32, 33, 34, 35
ON	OFF	0	33	33, 34	33, 34, 35	33, 34, 35, 36
		1	34	34, 35	34, 35, 36	34, 35, 36, 37
		2	35	35, 36	35, 36, 37	35, 36, 37, 38
		:	:	:	:	:
		F	48	48, 49	48, 49, 50	48, 49, 50, 51
ON	ON	0	49	49, 50	49, 50, 51	49, 50, 51, 52
		1	50	50, 51	50, 51, 52	50, 51, 52, 53
		2	51	51, 52	51, 52, 53	51, 52, 53, 54
		:	:	:	:	:
		F	64	64, 1	64, 1, 2	64, 1, 2, 3

The station Nos. of FCU8-DX651 can be set in two ways according to the slide switch (station No. setting switch). Set the knob to the left for the station No. setting 1 and to the right for the station No. setting 2.

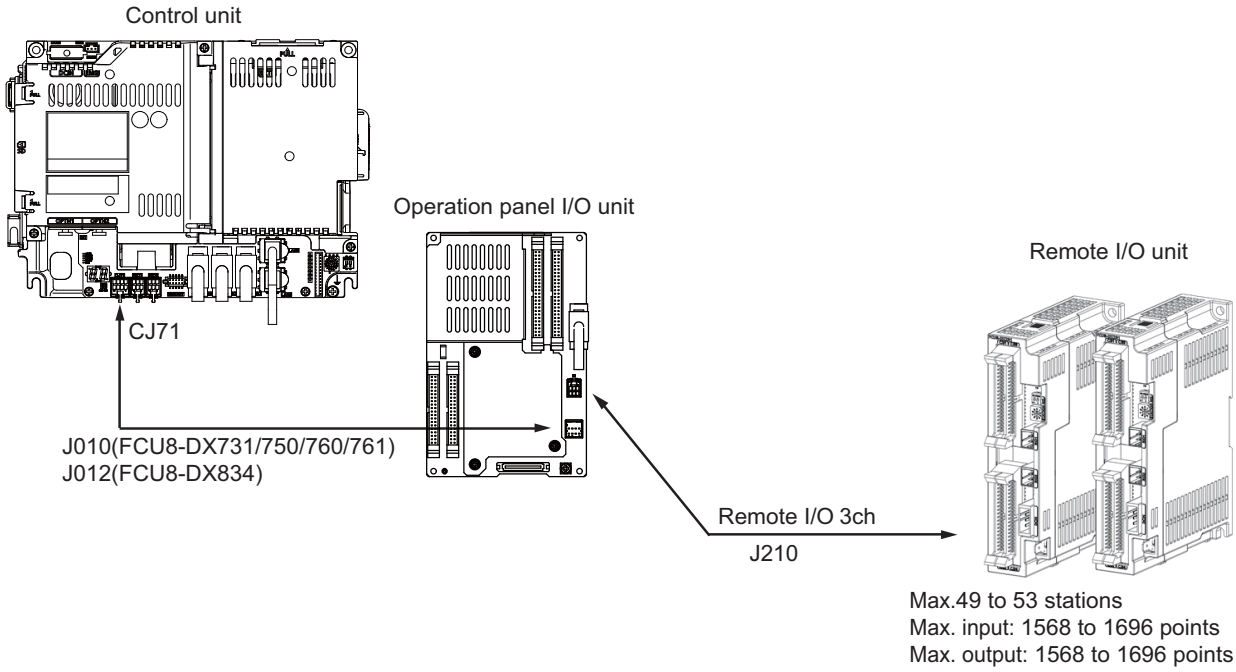
Station No. setting 1 Station No. setting 2



Device	Station No. setting 1	Station No. setting 2
DI/DO	Station No. 1	Station No. 4
Safety DI (SX00A to SX07A)/ Safety relay output (SY00A to SY03A)/ Relay feedback (SX08A to SX0BA)	Station No. 2	Station No. 5
Safety DI (SX00B to SX07B)/ Safety relay output (SY00B to SY03B)/ Relay feedback (SX08B to SX0BB)	Station No. 3	Station No. 6

(3) Refer to "18.6.4 PLC Device Assignment of Digital Signal (DI/DO)" for assigned device Nos.

When connecting to the operation panel I/O unit



Operation panel I/O unit	RIO occupied stations	Extensible stations
FCU8-DX731	1, 3, 7 to 12, 20 to 22	2, 4 to 6, 13 to 19, 23 to 64
FCU8-DX750	1 to 3, 7 to 12, 20 to 22	4 to 6, 13 to 19, 23 to 64
FCU8-DX760	1 to 4, 7 to 12, 20 to 22	5, 6, 13 to 19, 23 to 64
FCU8-DX761	1 to 5, 7 to 12, 20 to 22	6, 13 to 19, 23 to 64
FCU8-DX834	1 to 4, 7 to 14, 20 to 22	5, 6, 15 to 19, 23 to 64

Note

(1) Refer to "18.6.4 PLC Device Assignment of Digital Signal (DI/DO)" for assigned device Nos.

(2) The maximum connectable number of remote I/O units is 32.

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

Multiple remote I/O units can be used, as long as the total number of occupied stations is 64 or less.
(When the operation panel I/O unit is connected to the remote I/O unit, the total number must be the sum of occupied stations for both units.)

Unit type	Number of occupied stations
FCU8-DX220	1
FCU8-DX230	2
FCU8-DX231	2
FCU8-DX202	1
FCU8-DX213/ DX213-1	1
FCU8-DX654/DX654-1	2
FCU8-DX651	3
FCU8-DX408 (*1)	3
FCU8-DX409 (*2)	4
FCU8-DX520	1

(*1) Only one FCU8-DX408 unit can be connected in the entire system.
(*2) The maximum connectable number of FCU8-DX409 is four.

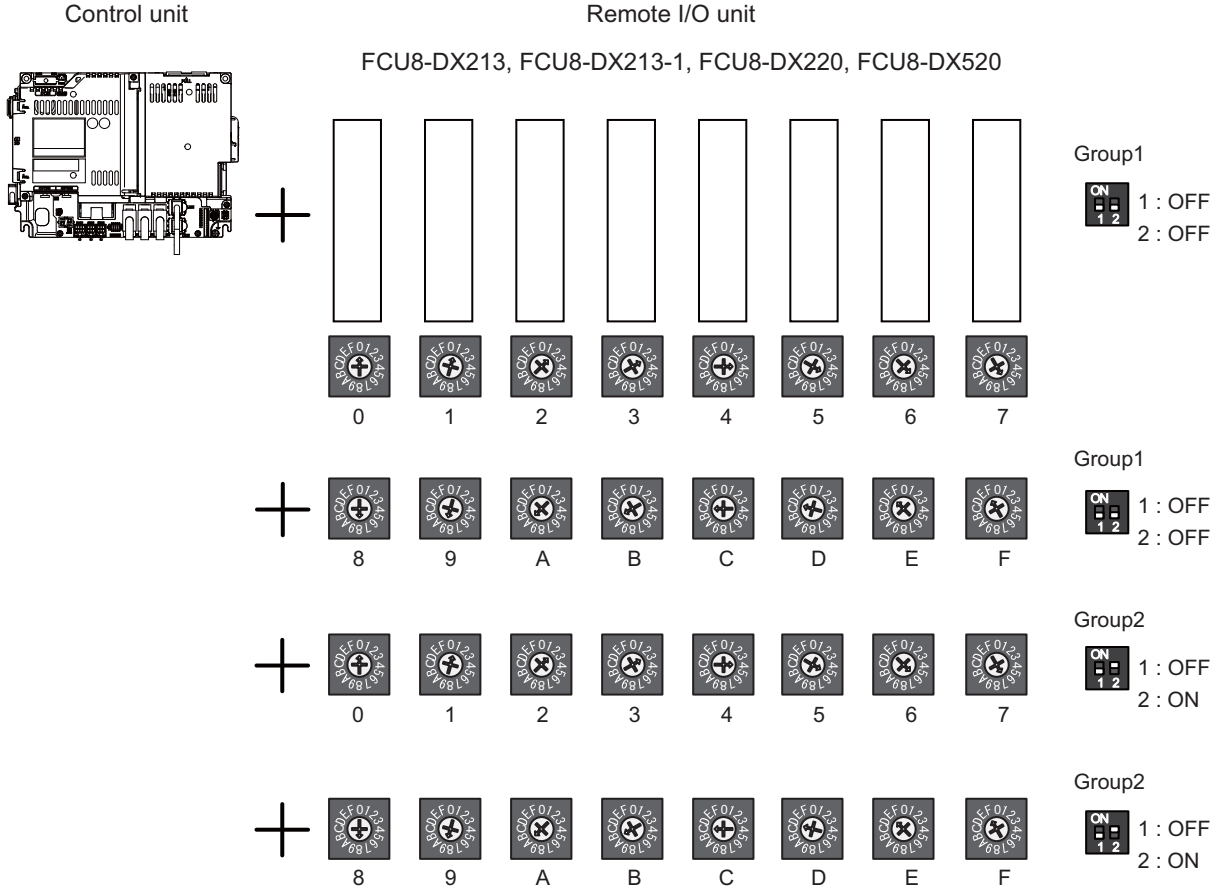
To use multiple remote I/O units, a characteristic station No. must be set for each unit. A unit has the station No. group setting switches and the station No. setting switch. These switches must be set to the characteristic station No. which is not duplicate with the occupied stations of the operation panel I/O unit.

Note

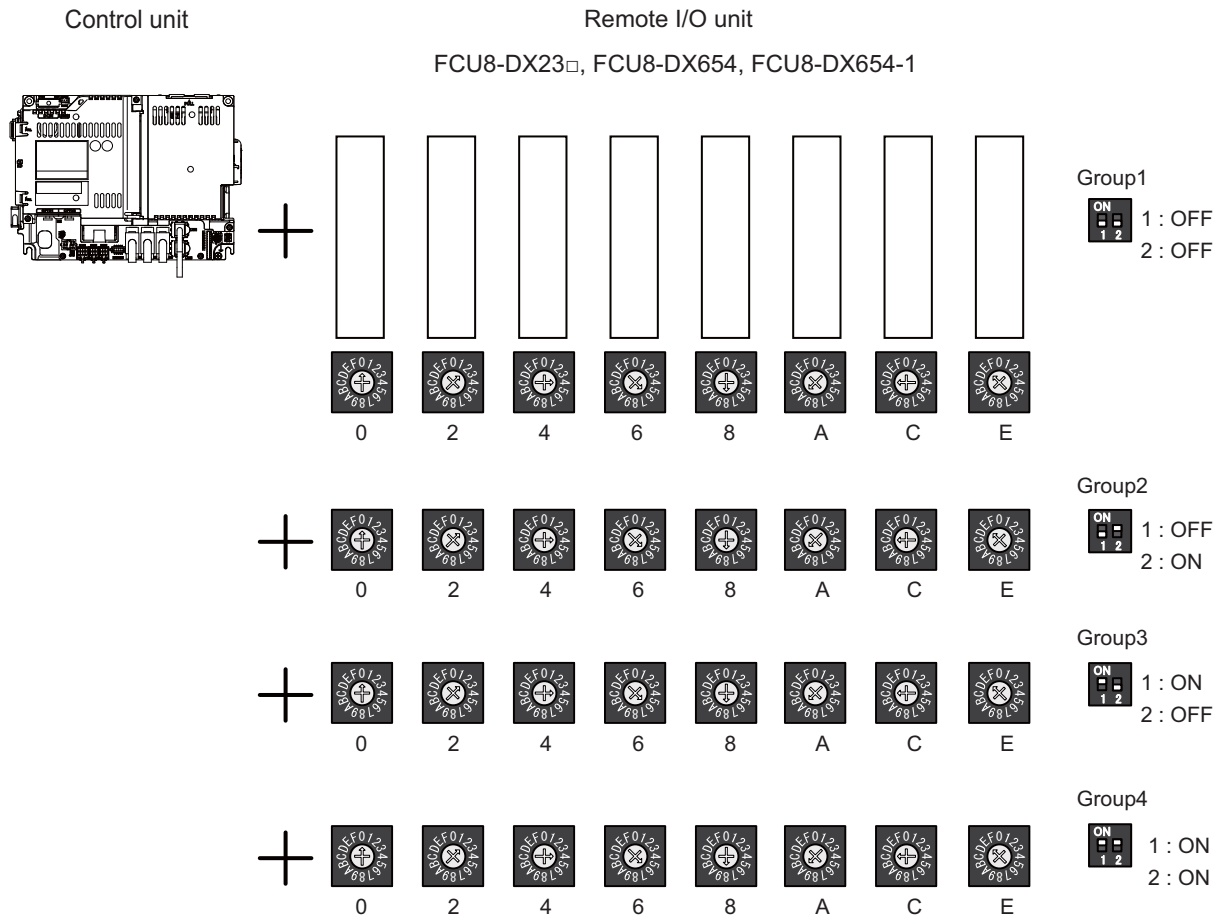
(1) The maximum connectable number of remote I/O units is 32 per channel.

When connecting directly to the control unit

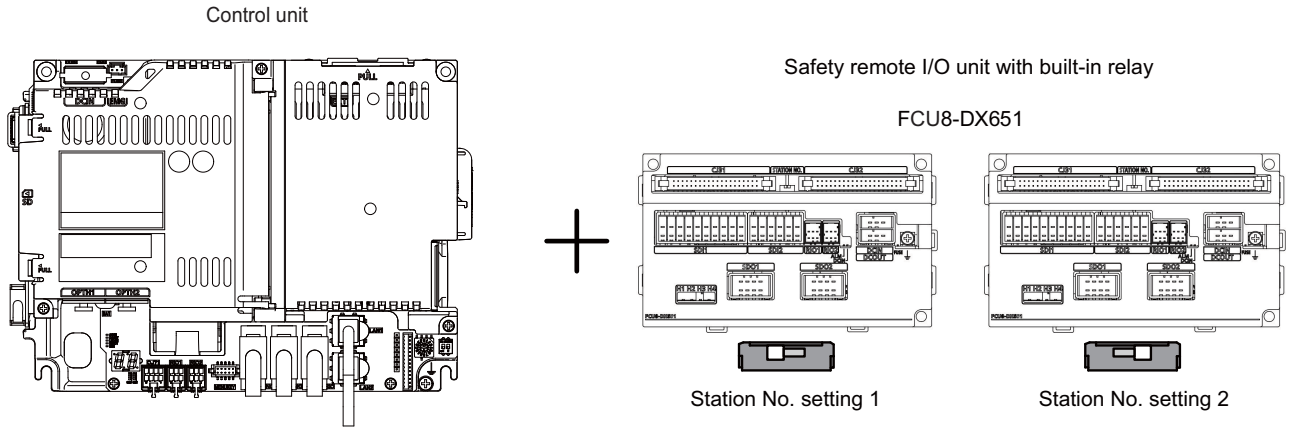
■ **Setting example 1**



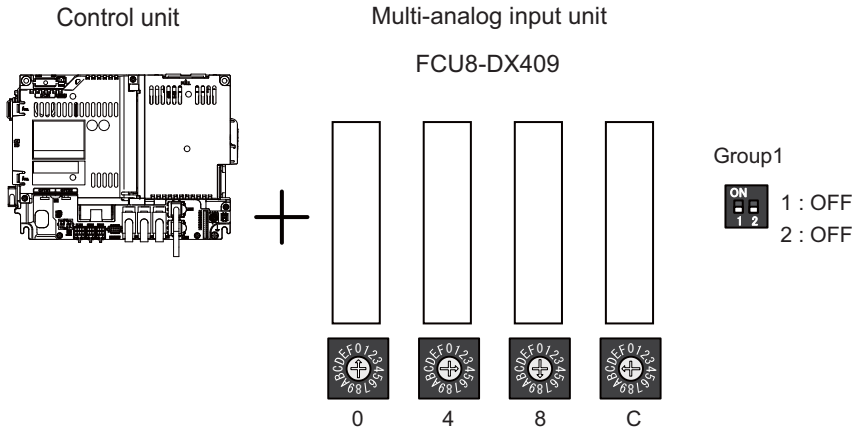
■ Setting example 2



■ Setting example 3



■ Setting example 4



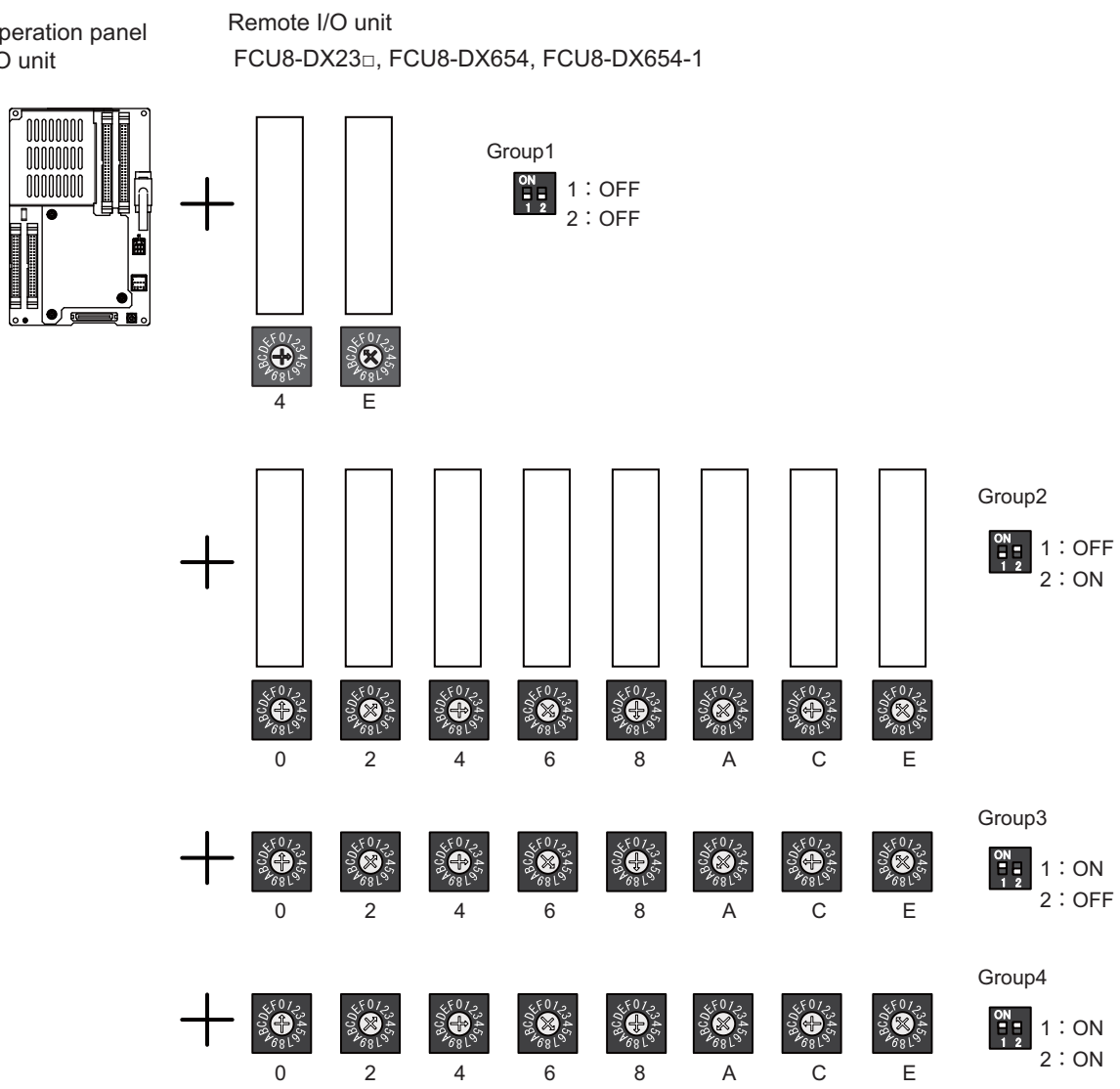
When connecting to the operation panel I/O unit

Operation panel I/O unit occupies 9 to 11 stations among station No. 1 to 64.

RIO3 can occupy up to 49 to 53 stations as shown in the table below.

Operation panel I/O unit type	Maximum number of stations (RIO3 connection)	Maximum number of I/O points (RIO3 connection)
FCU8-DX731	53 stations	Input: 1696 points, Output: 1696 points
FCU8-DX750	52 stations	Input: 1664 points, Output: 1664 points
FCU8-DX760	51 stations	Input: 1632 points, Output: 1632 points
FCU8-DX761	50 stations	Input: 1600 points, Output: 1600 points
FCU8-DX834	49 stations	Input: 1568 points, Output: 1568 points

■ Setting example 1



Note

(1) The maximum connectable number of remote I/O units is 32.

18.6.4 PLC Device Assignment of Digital Signal (DI/DO)

The input/output signals (analog signal, DI/DO, etc.) are assigned to the PLC devices, and the digital signals (DI/DO) can be assigned to the arbitrary PLC devices by the parameters.
Either "Fixed device assignment" which automatically assigns the signals to fixed PLC devices defined by the system or "Arbitrary device assignment" which user can assign the signals the arbitrary PLC devices by the parameters can be selected by setting the RIO assignment parameter "#53001 RIO dev assign" (selection of RIO device assignment method).

[Fixed device assignment] (Parameter "#53001 RIO dev assign" is set to "0".)
Settings are not required because the assignment to the fixed PLC devices are automatically performed.
Refer to "18.6.4.1 Fixed Device Assignment" for more details.

[Arbitrary device assignment] (Parameter "#53001 RIO dev assign" is set to "1".)
Set the PLC devices which are assigned to the DI/DO of each remote I/O unit station by the parameters.
Refer to "18.6.4.2 Arbitrary Device Assignment" for more details.

18.6.4.1 Fixed Device Assignment

- By setting the parameter "#53001 RIO dev assign" to "0", the PLC device assignment method, which is to be used for input/output of each remote I/O unit station, will be the fixed device assignment.
- PLC devices assigned for each remote I/O unit station at the time of the fixed device assignment are as follows:

		Station No.							
Channel No.		1	2	…	8	9	…	63	64
RIO1	Input device	X0000 to X001F	X0020 to X003F	…	X00E0 to X00FF	ZR5000 /ZR5001	…	ZR5108 /ZR5109	ZR5110 /ZR5111
	Output device	Y0000 to Y001F	Y0020 to Y003F	…	Y00E0 to Y00FF	ZR6000 /ZR6001	…	ZR6108 /ZR6109	ZR6110 /ZR6111
RIO2	Input device	X0100 to X011F	X0120 to X013F	…	X01E0 to X01FF	ZR5200 /ZR5201	…	ZR5308 /ZR5309	ZR5310 /ZR5311
	Output device	Y0100 to Y011F	Y0120 to Y013F	…	Y01E0 to Y01FF	ZR6200 /ZR6201	…	ZR6308 /ZR6309	ZR6310 /ZR6311
RIO3	Input device	X0200 to X021F	X0220 to X023F	…	X02E0 to X02FF	ZR5400 /ZR5401	…	ZR5508 /ZR5509	ZR5510 /ZR5511
	Output device	Y0200 to Y021F	Y0220 to Y023F	…	Y02E0 to Y02FF	ZR6400 /ZR6401	…	ZR6508 /ZR6509	ZR6510 /ZR6511

Note

(1) Do not use the input/output signals of the system-occupied stations of RIO3 and operation panel I/O unit-connected channels.

- A part of PLC devices assigned for each station of remote I/O units can input/output signals with PLC high speed by setting the high-speed input/output specification parameters or R registers.
  - The devices for inputting/outputting signals with PLC high speed can be set individually for the high-order and the low-order per 16 points for DI and DO of each remote I/O unit station.
  - Only devices of the first to eighth stations for each remote I/O channel can input/output signals with PLC high speed. The devices of the ninth to 64th stations input/output with PLC medium speed.
  - The parameter and R register numbers for the high-speed input/output designation are as follows:

		Station No.			
Channel No.		1 to 4		5 to 8	
		Parameter No.	R register No.	Parameter No.	R register No.
RIO1	High-speed input specification	#6457	R7828 low-order	#6458	R7828 high-order
	High-speed output specification	#6461	R7830 low-order	#6462	R7830 high-order
RIO2	High-speed input specification	#6459	R7829 low-order	#6460	R7829 high-order
	High-speed output specification	#6463	R7831 low-order	#6464	R7831 high-order
RIO3	High-speed input specification	#6465	R7832 low-order	#6466	R7832 high-order
	High-speed output specification	#6473	R7836 low-order	#6474	R7836 high-order

Note

(1) The above parameters are invalid when the devices have been assigned arbitrarily.
(2) Refer to "PLC Programming Manual" for details of the setting method.

18.6.4.2 Arbitrary Device Assignment

Parameter setting for device arbitrary assignment

- By setting the parameter "#53001 RIO dev assign" to "1", the assignment method for PLC devices to be used for input/output of each remote I/O unit station becomes arbitrary device assignment.
- For arbitrary device assignment, set the PLC devices for input and output to DI/DO (32 points) of each remote I/O unit station by the parameters. Also, set the assignment of the operation panel I/O unit.
- Turn the power OFF and ON to enable arbitrary device assignment after the parameter settings.
- Set the input/output device assignment and high-speed input/output specification by the parameters for each station of all remote I/O units which have DI/DO function (except safety DI/DO). If all stations have not been set, the MCP alarm (Y05) is issued when the power is turned ON.

	Parameter set No.(*1)								
Name	**#1**	**…**	**#64**	**#65**	**…**	**#128**	**#129**	**…**	**#182**
Target channel No. #n	#53011	…	#53641	#53651	…	#54281	#54291	…	#54821
Target station No. #n(*2)	#53012	…	#53642	#53652	…	#54282	#54292	…	#54822
DI device name #n	#53013	…	#53643	#53653	…	#54283	#54293	…	#54823
DI device No. #n	#53014	…	#53644	#53654	…	#54284	#54294	…	#54824
DO device name #n	#53015	…	#53645	#53655	…	#54285	#54295	…	#54825
DO device No. #n	#53016	…	#53646	#53656	…	#54286	#54296	…	#54826
High-speed input specification #n	#53017	…	#53647	#53657	…	#54287	#54297	…	#54827
High-speed output specification #n	#53018	…	#53648	#53658	…	#54288	#54298	…	#54828

(*1) A set of RIO assignment parameters consists of eight parameters (from target channel number to high-speed output specification) for one station.

(*2) Arbitrary device assignment cannot be performed for the system-occupied stations of RIO3 and operation panel I/O unit-connected channels.

- The PLC devices that are valid for arbitrary device assignment are as follows:

PLC device	Word/Bit	Input	Output	Assignable range	PLC device No. format
X	Bit	○	-	X0000 to X05FF When PROFIBUS specification is added. X400 to X5FF are unavailable.	Hexadecimal
Y	Bit	-	○	Y0000 to Y05FF When PROFIBUS specification is added. Y400 to Y5FF are unavailable.	Hexadecimal
ZR	Word	○	○	ZR5000 to ZR5999 (for input) ZR6000 to ZR6999 (for output)	Decimal

Note

(1) Duplication check is not performed between the PLC devices which are set with machine input/output signal other than the remote I/O such as CC-Link or PROFIBUS and PLC devices which are set with arbitrary device assignment. If the PLC devices have duplicated, NC or PLC ladder cannot be carried out correctly. When using machine input/output signal other than the remote I/O, make sure to confirm that the PLC devices do not duplicate the PLC devices set with arbitrary device assignment.

(2) Assignment cannot be performed for the devices corresponding to the system-occupied stations of RIO3. If you connect the operation panel to any channel other than RIO3, assignment is also disabled for the devices corresponding to the system-occupied stations of the said channel.

- Even when the RIO assignment parameters are set in the remote I/O unit stations which have the analog input/output and safety DI/DO functions, the input/output is not carried out to the set PLC devices.
- Up to 24 stations can be specified for high-speed input/output specification each for input and output. If 25 or more stations are specified, the MCP alarm (Y05) is issued.

- High-speed input/output specification can be set by R registers below as well as the RIO assignment parameters.

		Station No.							
Channel No.		**1 to 8**	**9 to 16**	**17 to 24**	**25 to 32**	**33 to 40**	**41 to 48**	**49 to 56**	**57 to 64**
RIO1	**High-speed input specification**	R30544 low-order	R30544 high-order	R30545 low-order	R30545 high-order	R30546 low-order	R30546 high-order	R30547 low-order	R30547 high-order
	High-speed output specification	R30560 low-order	R30560 high-order	R30561 low-order	R30561 high-order	R30562 low-order	R30562 high-order	R30563 low-order	R30563 high-order
RIO2	**High-speed input specification**	R30548 low-order	R30548 high-order	R30549 low-order	R30549 high-order	R30550 low-order	R30550 high-order	R30551 low-order	R30551 high-order
	High-speed output specification	R30564 low-order	R30564 high-order	R30565 low-order	R30565 high-order	R30566 low-order	R30566 high-order	R30567 low-order	R30567 high-order
RIO3	**High-speed input specification**	R30552 low-order	R30552 high-order	R30553 low-order	R30553 high-order	R30554 low-order	R30554 high-order	R30555 low-order	R30555 high-order
	High-speed output specification	R30568 low-order	R30568 high-order	R30569 low-order	R30569 high-order	R30570 low-order	R30570 high-order	R30571 low-order	R30571 high-order

Note

(1) Turn the power OFF and ON after the R register settings to enable the settings.

(2) One bit of each R register is equivalent to one station. The high-speed input/output specification can be performed by turning ON the R register bits of the stations to be input or output with PC high speed. To output the 10th station of RIO1 at high speed, for instance, turn bit9 of R30544 ON.

(3) High-speed input/output designation is disabled for the system-occupied stations of RIO3 and operation panel I/O unit-connected channels.
Even when the bit6 to bitD of R30552 and R30568 are turned ON, they will be invalid.

(4) The above settings are invalid with fixed device assignment.

- In the following cases, the MCP alarm (Y05) is issued when the power is turned ON. The number of the RIO assignment parameter with illegal setting state is displayed.
  (a) The value outside the range of setting has been set to the RIO assignment parameter (except "#53001 RIO dev assign").

  (b) Two or more stations of the target channel No. and the target station No. are set redundantly to the RIO assignment parameters.

  (Example) The power is turned ON in a state where the 1st and 2nd stations of RIO1 are set redundantly to the RIO assignment parameters #1 to #5 as shown in the table below.
  (Both the 1st and 2nd stations are connected to the NC control unit.)

Parameter set No.#n	Target channel No. #n (Parameter No.)	Target station No. #n (Parameter No.)	Setting state
1	1 (#53011)	0 (#53012)	RIO1 1st station is set
2	1 (#53021)	1 (#53022)	RIO1 2nd station is set
3	1 (#53031)	1 (#53032)	RIO1 2nd station is set
4	1 (#53041)	0 (#53042)	RIO1 1st station is set
5	1 (#53051)	0 (#53052)	RIO1 1st station is set

<Result>
The parameter number (53031) of "Target channel #3" is displayed on the MCP alarm (Y05). Duplication error of RIO1 2nd station is detected first because the RIO assignment parameter is checked from the top. Between the parameter set #2 and #3 to which 2nd station of RIO1 are set, parameter set #3 which is the latter is displayed as the alarm.

  (c) A PLC device outside the assignable range has been set to the RIO assignment parameter.
  (d) 25 or more stations have been specified with the high-speed input or output with the RIO assignment parameters.
  (e) The RIO assignment parameters have not been specified to the remote I/O unit stations with DI/DO functions (except safety DI/DO) that are connected to NC.
  (f) Two or more stations of the PLC devices are set redundantly to the RIO assignment parameters.

Note

(1) However, in the following cases, the MCP alarm (Y05) is not issued even in any case of (a) to (f).
- "0" has been set to the target channel.
- Remote I/O unit with DI/DO function is not connected to the station specified with the target channel and station number.
- The parameter "#1238 set10/bit3" is ON (the input from RIO is ignored).

(Example) The power is turned ON in a state where the X100 and X200 of the PLC device are set redundantly to the RIO assignment parameters #1 to #5 as shown in the table below.
(All stations which has been set to the RIO assignment parameters #1 to #5 are connected to the NC control unit.)

Parameter set No.#n	DI device name #n (Parameter No.)	DI device No. #n (Parameter No.)	Setting state
1	X (#53013)	100 (#53014)	X100 is set
2	X (#53023)	200 (#53024)	X200 is set
3	X (#53033)	200 (#53034)	X200 is set
4	X (#53043)	100 (#53044)	X100 is set
5	X (#53053)	100 (#53054)	X100 is set

<Result>
The parameter number (53034) of "DI device No. #3" is displayed on the MCP alarm (Y05). Duplication error of X200 is detected first because the RIO assignment parameter is checked from the top. Between the parameter set #2 and #3 to which the X200 is set, parameter set #3 which is the latter is displayed as the alarm.

Operating parameter setting screen

[Rules for setting RIO assignment parameters]

- For arbitrary device assignment, assign PLC devices to all stations which are connected to the remote units with DI/DO function. Devices can be assigned in random order for arbitrary device assignment. It is unnecessary to assign in order of the target channels, target station numbers, PLC devices, etc.
- Set the PLC device numbers after setting the PLC device names.
  A setting error occurs if PLC number is input when the PLC device name is in the unset (blank) state. When a PLC device name is changed, PLC device number of the same parameter set number is cleared to zero.
- When setting the bit devices, set the DI and DO device numbers in increments of 32 points. A setting error occurs if device number is not a multiple of 32 (20 for hexadecimal).
- When setting the word devices, set the DI and DO device numbers in increments of two words (32 bits).
  A setting error occurs if the device number is odd.
- Set the target channels to "0" for the parameter sets which are not set for device assignment. The setting state of the parameter sets to which "0" has been set for the target channel is not checked.
- The RIO assignment parameter setting values are retained even when the fixed device assignment and arbitrary device assignment are switched.

[RIO assignment parameter setting state check ("Device Setting Check")]

- The RIO assignment parameter setting state can be checked without rebooting the power by setting the RIO assignment parameter "Device Setting Check" to "1" when performing the arbitrary device assignment.
  The RIO assignment parameter setting state is not checked at the fixed device assignment.
- The RIO assignment parameter settings cannot be valid only by inputting "1" to "Device Setting Check". To enable the arbitrary device assignment, turn the power OFF and ON after the RIO assignment parameter settings.
- The value of "Device Setting Check" goes back to "0" after the check for the RIO parameter setting state is completed.
- The RIO assignment parameter setting state of each remote I/O unit station with the analog input/output and safety DI/DO functions is not checked.
- The setting state of the parameter set which has been set as the station unconnected to the NC control unit is not checked.
- The setting state of the parameter sets of which the target channel number has been set to "0" is not checked.

18.6.5 Thermistor Input Interface

- By connecting the remote I/O unit with thermistor, up to 12 points of thermistor input are available.
  For details on units with the thermistor input function, refer to "4.9 Remote I/O Unit".

- Up to 12 points of the thermistor are detected in the ascending order of the channel No. and station No. of the remote I/O unit. The file registers outputting temperature information are assigned inputs (thermistor input n (TIn)) but are not assigned to the 13th or later thermistor input. The relationship between thermistor inputs and file registers is as follows:

[PLC input signals]

Through the interface you can read the temperature sensed by a thermistor connected to the designated connector of thermistor input-equipped remote I/O unit.

Channel	File register	Data update cycle
TI0	ZR13028	The thermistor voltage acquired with the thermistor input-equipped remote I/O unit is input after converted to a temperature value per PLC medium-speed cycle. One station of remote I/O has 4 thermistor inputs, thus 4 PLC medium-speed cycles are required for the inputs of one station.
TI1	ZR13029	
TI2	ZR13030	
TI3	ZR13031	
TI4	ZR13032	
TI5	ZR13033	
TI6	ZR13034	
TI7	ZR13035	
TI8	ZR13036	
TI9	ZR13037	
TI10	ZR13038	
TI11	ZR13039	

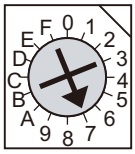
18.7 Initializing the NC Internal Data (SRAM)

The initialization does not affect the settings of the option parameters.

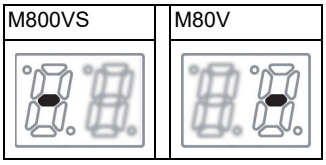
Note

- The DIP switches next to the rotary switch are for our adjustment. Do not change them after the shipment. Normally, switches No. 1 and 2 are in the OFF state (downward).

(1) With the NC power OFF, turn the rotary switch to "7", then turn the power ON.



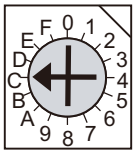
(2) Turn the power OFF after one of the two 7-segment LEDs (see below) displays "-" (hyphen).



Note

- Ignore the display on the side not marked with "-" in the above 7-segment LED displays.

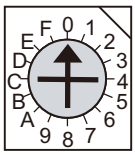
(3) Change the rotary switch to "C" and then turn the power ON.



(4) The 7-segment LED display will change in the sequence "08" > "00" > "01" ... "08". When it shows "0y", SRAM clear is completed.
(it takes 8 seconds)

(5) Turn the NC power OFF.

(6) Turn the rotary switch to "0" again.



(7) Turn the power OFF and ON.

Note

(1) After initializing and turning the NC power ON, the IP address is initialized as follows.
<Base specification parameter>
#1934 Local IP address: 192.168.100.1
Failure to communicate with the screen may be caused by inconsistency between the parameter value and the "C:\WINDOWS\melcfg.ini" setting value. Confirm that "C:\WINDOWS\melcfg.ini" is set as shown below.
Last line of C:\WINDOWS\melcfg.ini

```
...
[HOSTS]
TCP1 = 192.168.100.1,683
```

(2) The initial screen after the initialization is displayed in English. Refer to "20.1 Selecting the NC System Type and Displayed Language" for additional language settings.

19

Setting Up with M80/800S SETUP INSTALLER

Note

(1) M80/800S SETUP INSTALLER is used to install custom screens and startup screen.
If you do not need the installation, go to the next section.

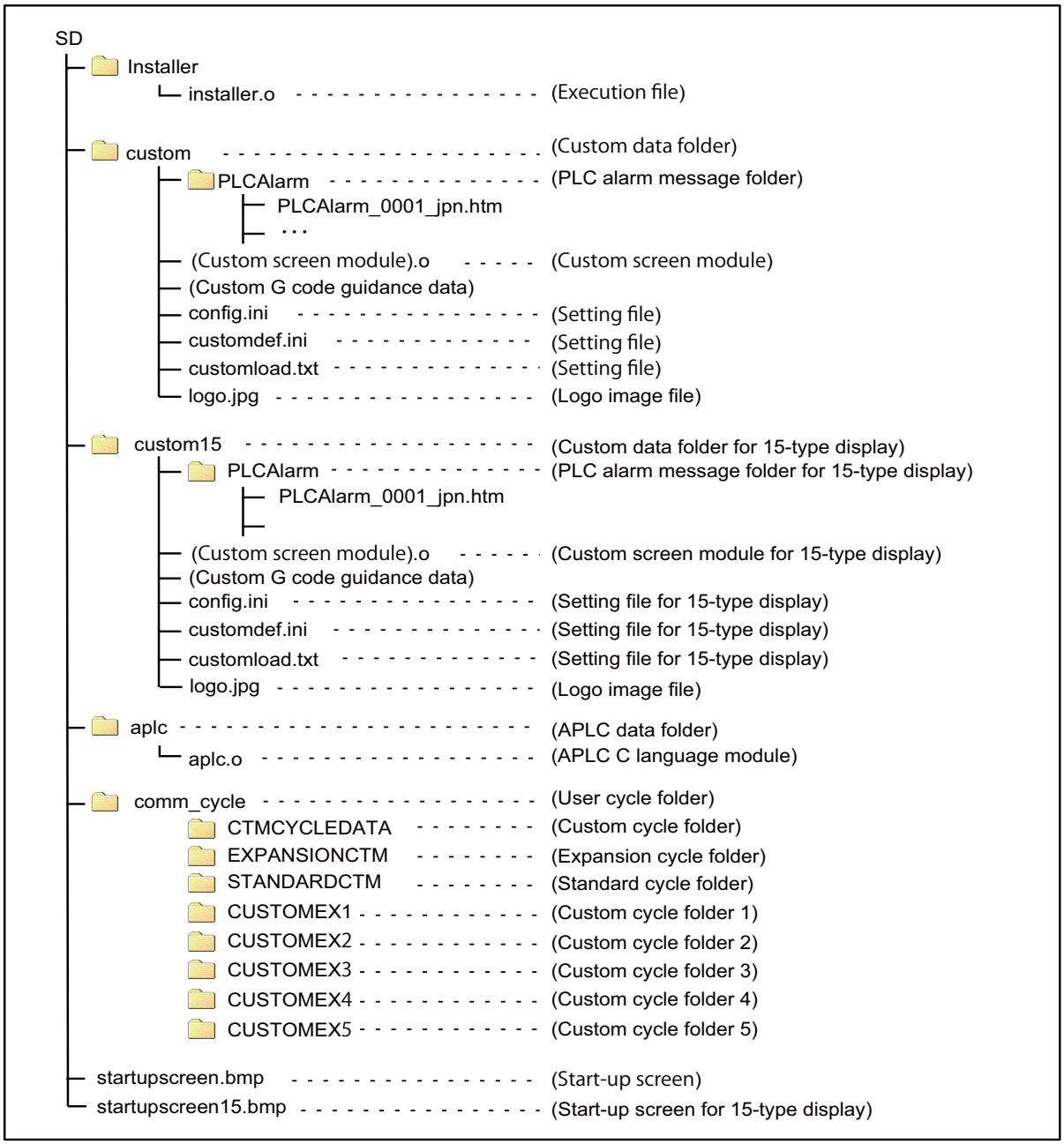
You can install the following data with M80/800S SETUP INSTALLER.

- Custom data
  - Custom screen
  - PLC alarm guidance
- Custom startup screen
- APLC data

An SD card is used for the installation.
Mitsubishi Electric will not provide performance guarantee and maintenance for commercially available SD card. When any of them is to be used, careful performance check must be required by the machine tool builder.
Commercially available devices may not be compatible with Mitsubishi Electric units or suitable FA environment for temperature- or noise-wise.

19.1 Activate M80/800S SETUP INSTALLER

(1) Write the data for M80/800S SETUP INSTALLER into an SD card.
The data configuration is as illustrated below.



[Custom data setting files]

config.ini	: Setting file for registering custom screen and G code guidance folder
customdef.ini	: Setting file for registering custom screens to menu and function buttons on standard screen
custom-load.txt	: Setting file for registering the object data name and load sequence

[Custom G code guidance data]

Store the custom G code guidance data in the G code guidance folder set with config.ini.

[Start-up screen]

- Install the bitmap file of the initial screen to be displayed at power ON.
- Select "24-bit color" for colors. (Displayed by reducing to 16-bit color (RGB565).)
  For an 8.4-type display unit or a 10.4-type display unit, select "640 * 440". For a 15-type display unit, select "1024 * 728".
- Name the startup screen file "startupscreen.bmp" for an 8.4-type display unit or a 10.4-type display unit, or "startup-screen15.bmp" for a 15-type display unit.

[APLC C language module]

The size of APLC C language module must be 512 KB or less.

[User cycle]

For details of user cycle, refer to "M800V/M80V Series Interactive Cycle Insertion (Customization) Specification manual".

[Data storage capacity]

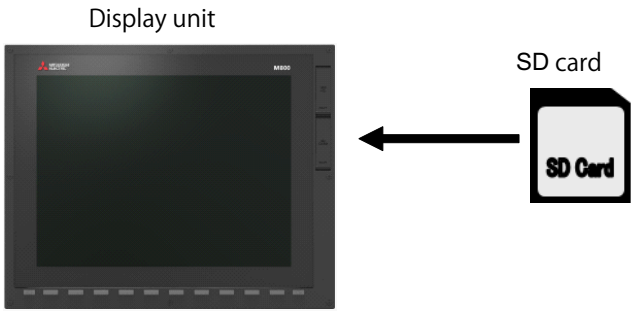
Storage capacity of the installation data is as follows:

Install data	Data storage size	General description
Custom data (*1)	Less than 30 MB	Size on disk
User cycle (*2)	Less than 20 MB	
APLC C language module (aplc.o)	512 KB or less	Module size

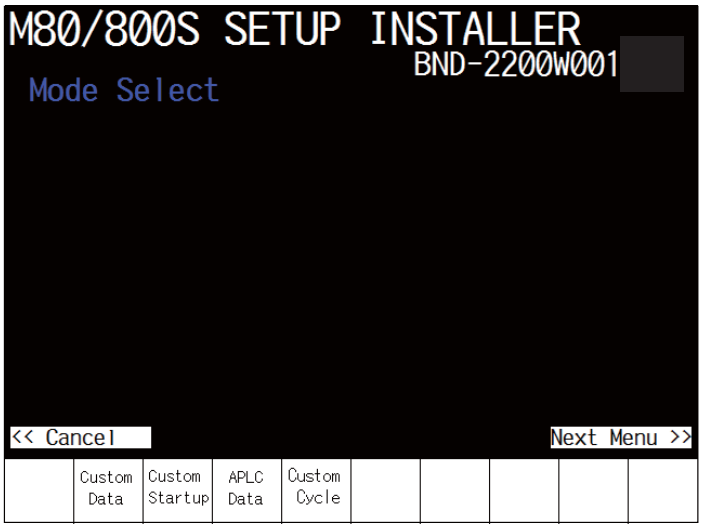
(*1) For custom screen module, the capacity limit is up to 6 MB.

(*2) Storage capacity is calculated on built-in memory; thus, it may be different from the data size on installation medium.

(2) Insert an SD card of the M80/800S SETUP INSTALLER into the front-side SD interface.



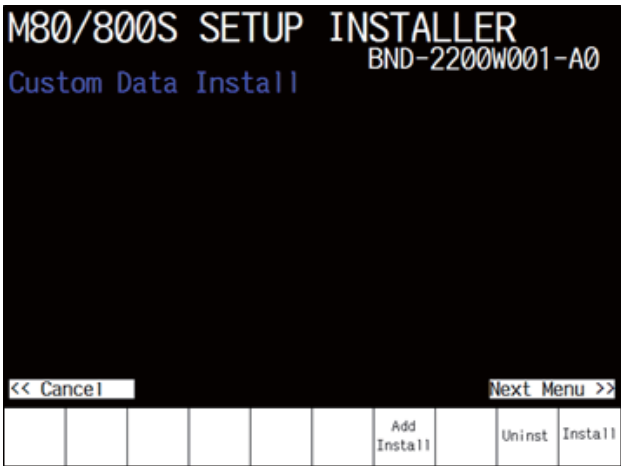
(3) Turn ON the power while pressing Return key.
-> Some time after the start-up screen is opened, "M80/800S SETUP INSTALLER" is activated with a beep sound.



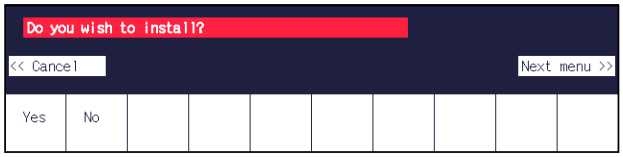
19.2 Install Custom Screen

Carry out the procedures of this section to register custom screens.
When you use standard screens only, there is no need to carry out the procedure.

(1) Press the [Custom Data] menu.
-> The screen is changed to the custom data installation screen.



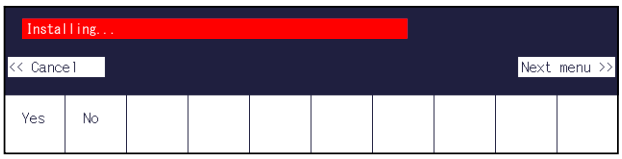
(2) Press the [Install] menu.
(For additional installation, press [Add Install].)



(3) When a confirmation message appears, press the [Yes] menu.

Note

- Do not power OFF during installation.



(4) When installation is finished, "Installation completed" appears.



Note

(1) When an additional custom screen is installed, files (directories) other than the custom data setting files (Config.ini, customdef.ini, customload.txt) are overwritten. For the custom data setting files, the description is added if there is no duplicated data in every section. However, if the registration information (items in the section, such as screen No. offset value, menu position on the custom screen, function buttons, etc.) is duplicated, the "Installation error." message appears and the installation is not performed. For details of each section, refer to "NC Desginer2 Instruction Manual".

(2) To uninstall the custom screen data, press the [Uninst] menu instead of [Install] in the step (2).
Note, however, that both "Custom screen", "PLC alarm message" and "Logo image file" are uninstalled by the uninstallation operation..

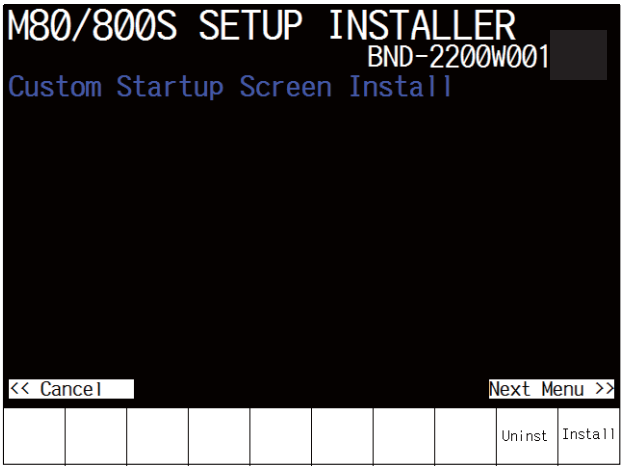
(3) The size of custom data must be 30 MB or less. If it exceeds 30 MB, the following message appears and the installation fails.
"Installation Error. Please check the file size."

(4) Installation or uninstallation is not executed when the [Yes] menu is pressed continuously after the previous installation or uninstallation operation. Press ◁ Return key to return to the initial screen and start the procedure again.

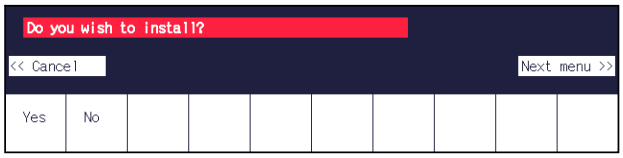
19.3 Install Start-up Screen

Carry out the procedures of this section to register custom start-up screen.
When you use standard start-up screen, there is no need to carry out the procedures.

(1) Press the [Custom Startup] menu.
-> The screen is changed to the start-up screen installation screen.



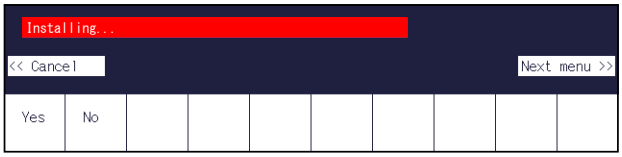
(2) Press the [Install] menu.



(3) When a confirmation message appears, press the [Yes] menu.

Note

- Do not power OFF during installation.



(4) When installation is finished, "Installation completed" appears.



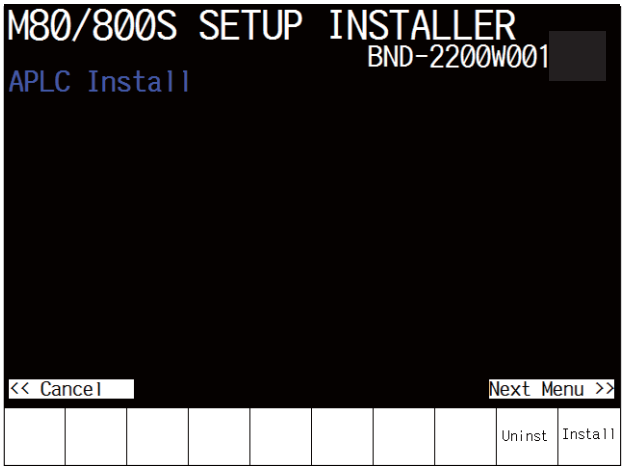
Note

(1) To uninstall the startup screen data, press the [Uninst] menu instead of [Install] in the step (2).
(2) Installation or uninstallation is not executed when the [Yes] menu is pressed continuously after the previous installation or uninstallation operation. Press Return key to return to the initial screen and start the procedure again.

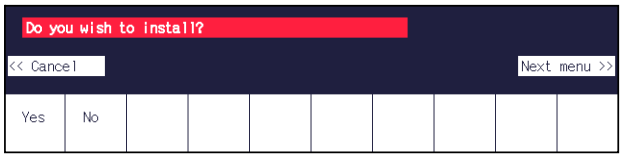
19.4 Install APLC C Language Module

Carry out the procedures of this section to register APLC C language module.
When you do not use APLC C language module, there is no need to carry out the procedure.

(1) Press the [APLC Data] menu.
-> The screen is changed to APLC C language module installation screen.



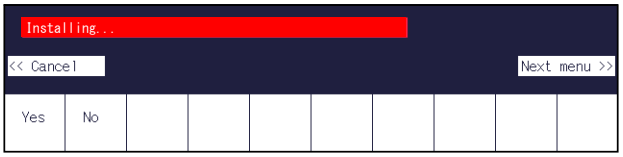
(2) Press the [Install] menu.



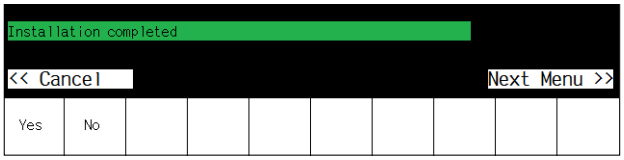
(3) When a confirmation message appears, press the [Yes] menu.

Note

- Do not power OFF during installation.



(4) When installation is finished, "Installation completed" appears.



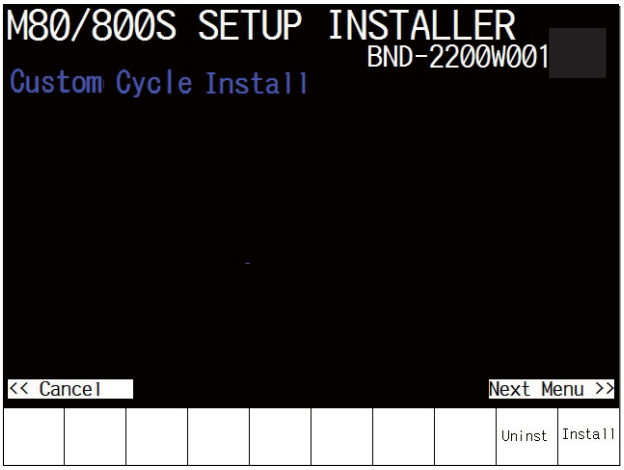
Note

(1) To uninstall the APLC data data, press the [Uninst] menu instead of [Install] in the step (2).
(2) Installation or uninstallation is not executed when the [Yes] menu is pressed continuously after the previous installation or uninstallation operation. Press ◁ Return key to return to the initial screen and start the procedure again.

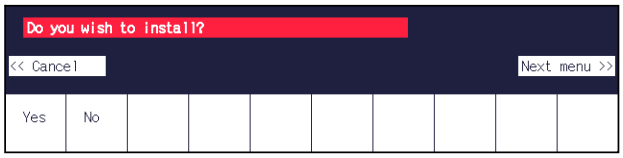
19.5 Install User Cycle

Carry out the procedures of this section to register user cycle.
When you do not use user cycle, there is no need to carry out the procedure.

(1) Press the [Custom Cycle] menu.
-> The screen is changed to user cycle installation screen.



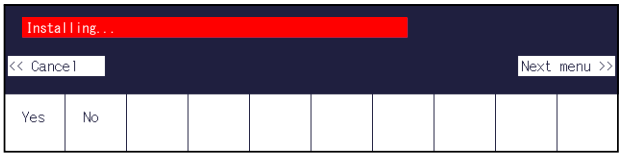
(2) Press the [Install] menu.



(3) When a confirmation message appears, press the [Yes] menu.

Note

- Do not power OFF during installation.



(4) When installation is finished, "Installation completed" appears.



Note

(1) To uninstall the user cycle data, press the [Uninst] menu instead of [Install] in the step (2).
(2) The size of user cycle must be 30 MB or less. If it exceeds 30 MB, the following message appears and the installation fails.
"Installation Error. Please check the file size."
(3) Installation or uninstallation is not executed when the [Yes] menu is pressed continuously after the previous installation or uninstallation operation. Press ◁ Return key to return to the initial screen and start the procedure again.

20

Setting the Parameters and Date/Time

> **⚠ WARNING**
>
> **Confirm the emergency stop state before carrying out the steps in this chapter.**

Refer to the section of "Alarm/Parameter Manual" for the details of the parameters.
You can also refer to the parameter guidance display.

Note

(1) Normally, the initial setting of NC is performed with NC Configurator2.
NC Configurator2 is a tool for supporting the parameter setting of NC.
For details, refer to "NC Configurator2 Instruction Manual" (IB-1501045).

20.1 Selecting the NC System Type and Displayed Language

When employing the lathe system, set the parameter as follows.

(1) On the Mainte screen, select [Mainte] and then [Psswd input].
Enter the machine tool builder password in the setting area and press the [INPUT] key.

Note

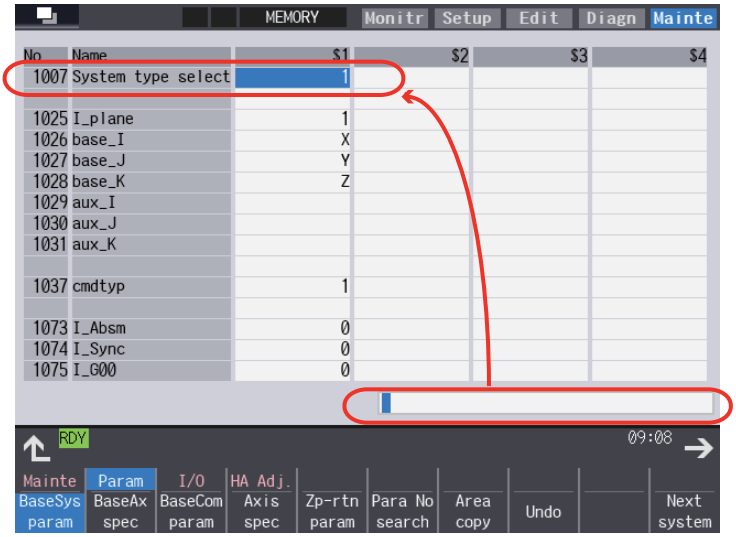
- To enter the character "A", press the shift key and then "A" key. Do not press both keys at the same time.
- The entered password is displayed as "******".

(2) Go back to the Mainte screen and select [Param].

(3) Select [Para Nosearch]. Enter "1043" in the setting area and press the [INPUT] key.
Select the language to be displayed.

(4) Select [Para Nosearch]. Enter "1007" in the setting area and press the [INPUT] key.
The screen changes to the base system parameters screen. The cursor moves to the "#1007 System type select" field.

(5) Enter "1" in the setting area and press the [INPUT] key. (0: Machining center system 1: Lathe system)



(6) Turn the power OFF and ON.

20.2 Setting the Parameters for the System Specifications

(1) On the Mainte screen, select [Mainte] and then [Psswd input]. Enter the machine tool builder password in the setting area and press the [INPUT] key.

(2) Go back to the Mainte screen. Then select [Param].
Set the parameters according to the system specifications.
"#1001 SYS_ON(System validation setup)"
"#1002 axisno(Number of axes)"
"#1003 iunit(Input setup unit)"
"#1004 ctrl_unit(Control unit)"
"#1005 plcunit(PLC unit)"
"#1006 mcmpunit(Machine error compensation unit)"
"#1037 cmdtyp(Command type)"
"#1039 spinno(Number of spindles)"
"#1155 DOOR_m"...Set to "100".
"#1156 DOOR_s"... Set to "100".
"#1511 DOORPm(Signal input device 1 for door interlock II: for each system)"
"#1512 DOORPs(Signal input device 2 for door interlock II: for each system)"

(3) After turning the power OFF and ON, select [Mainte] on the maintenance screen, switch the menu by the Menu change button and then select [Format].

(4) When "Input the password" is displayed, enter the machine tool builder password in the setting area and then press [INPUT] key.

(5) When "Format NC memory? (Y/N)" is displayed, press "Y". "Format complete" will be displayed.

(6) Turn the power ON again and select [Mainte] --> [Psswd input] on the maintenance screen. Enter the machine tool builder password in the setting area and press the [INPUT] key.
Select [Param] again on the Mainte screen. Set the following parameters.
"#1010 srvunit" (Output unit(servo))
"#1013 axname" (Axis name)
- When the arbitrary axis exchange control is valid, set the axis names in "#12071 adr_abs[1]" to "#12078 adr_abs[8]".

"#1021 mcp_no" (Drive unit I/F channel No. (servo))

Set the following parameters as needed.
"#1014 incax" (Incremental command axis name)
- When the arbitrary axis exchange control is valid, set the incremental command axis name in "#12079 adr_inc[1]" to "#12086 adr_inc[8]".

"#1015 cunit" (Command unit)
"#1017 rot" (Rotational axis)
"#1018 ccw" (Motor CCW)
"#1019 dia" (Diameter specification axis)
"#1020 sp_ax" (Spindle interpolation)
"#1022 axname2" (2nd axis name)

(7) Turn the power OFF and ON.

20.3 Setting the Parameters for the Machine Specifications

(1) On the Mainte screen, select [Mainte] and then [Psswd input]. Enter the machine tool builder password in the setting area and press the [INPUT] key.

Note

- To enter the character "A", press the shift key and then "A" key. Do not press both keys at the same time.

(2) Go back to the Mainte screen. Then select [Param].
Set the parameters according to the machine specifications. Setting of the following parameters is necessary.

[Base system parameters]
"#1025 I_plane" (Initial plane selection)
"#1026 base_I x" (Initial plane selection)
"#1027 base_J" (Base axis J)
"#1028 base_K" (Base axis K)
"#1029 aux_I" (Flat axis I)
"#1030 aux_J" (Flat axisJ)
"#1031 aux_K" (Flat axis K)

[Base axis specification parameters]
"#1603 PLCdev_no (Axis device assignment No.)"

Note

- Set this in one of the following cases:
  - When the system has five or more part systems
  - When the part system has nine or more axes
  - When you want to change the assignment of axis device

[Device]

Part system 1	Part system 2	Part system 3	Part system 4	
(1)	(9)	(17)	(25)	Axis 1
(2)	(10)	(18)	(26)	Axis 2
(3)	(11)	(19)	(27)	Axis 3
(4)	(12)	(20)	(28)	Axis 4
(5)	(13)	(21)	(29)	Axis 5
(6)	(14)	(22)	(30)	Axis 6
(7)	(15)	(23)	(31)	Axis 7
(8)	(16)	(24)	(32)	Axis 8

Note

- The device Nos corresponding to (1) to (32) differ depending on device type.

[Configuration example for seven part systems (Number of axes per part system: 8, 1, 1, 1, 1, 1, 3)]

(Assumed to use the device of each part system in the ladder as follows:)

$1 Axis 1 [Axis 1] -> (1)	$1 Axis 2 [Axis 2] -> (2)
$1 Axis 3 [Axis 3] -> (3)	$1 Axis 4 [Axis 4] -> (4)
$1 Axis 5 [Axis 5] -> (5)	$1 Axis 6 [Axis 6] -> (6)
$1 Axis 7 [Axis 7] -> (7)	$1 Axis 8 [Axis 8] -> (8)
$2 Axis 1 [Axis 9] -> (9)	$3 Axis 1 [Axis 10] -> (10)
$4 Axis 1 [Axis 11] -> (11)	$5 Axis 1 [Axis 12] -> (12)
$6 Axis 1 [Axis 13] -> (13)	$7 Axis 1 [Axis 14] -> (14)
$7 Axis 2 [Axis 15] -> (15)	$7 Axis 3 [Axis 16] -> (16)

Note

- (17) to (32) are unused areas.

[Parameter setting value (For the above configuration example)]

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
#1603	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

[Base common parameters]

- #1041 I_inch (Initial state (inch))
- #1042 pcinch (PLC axis command (inch))
- #1239 set11/bit1 (Handle I/F selection)
- #1240 set12/bit0 (Handle input pulse)

[Axis specification parameter]

- #2001 rapid (Rapid traverse rate)
- #2002 clamp (Cutting feedrate for clamp function)
- #2003 smgst (Acceleration and deceleration modes)
- #2004 G0tL (G0 time constant)
- #2005 G0t1 (G0 time constant (primary delay)/Second-step time constant for soft acceleration/deceleration)
- #2007 G1tL (G1 time constant)
- #2008 G1t1 (G1 time constant (primary delay)/Second-step time constant for soft acceleration/deceleration)

[Spindle specification parameter]

- #3001 slimt1 (Limit rotation speed (Gear: 00))
- #3002 slimt2 (Limit rotation speed (Gear: 01))
- #3003 slimt3 (Limit rotation speed (Gear: 10))
- #3004 slimt4 (Limit rotation speed (Gear: 11))
- #3005 smax1 (Maximum rotation speed (Gear: 00))
- #3006 smax2 (Maximum rotation speed (Gear: 01))
- #3007 smax3 (Maximum rotation speed (Gear: 10))
- #3008 smax4 (Maximum rotation speed (Gear: 11))
- #3023 smini (Minimum rotation speed)
- #3024 sout (Spindle connection)
- #3031 smcp_no (Drive unit I/F channel No.(spindle))
- #3109 zdetspd (Z phase detection speed)

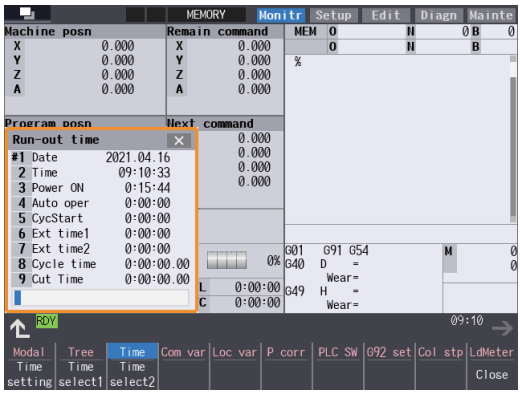
Set the servo parameters according to the instruction manual for your drive.
Set the spindle parameters according to "Parameter setting list".

(3) Turn the power OFF and ON.

20.4 Setting Date and Time

(1) Select [Time] on the Monitr screen.

(2) Select [Time setting] on the integrated time screen.
The time setting mode is entered. The cursor appears at the "#1 Date" position in the Run-out time display.



(3) Set the date and time to "#1 Date" and "#2 Time" respectively.

(4) Select [Selfdia] on the [Diagn] screen.

(5) Select [Battery clear] on the [Selfdia] screen, and set the battery used years to "0".

Note

(1) If battery used years is not cleared, passed years from default date (2014/4/1) will be displayed on battery used years.

21

Sequence Program Writing

Sequence program writing is executed by connecting a personal computer, in which GX Developer or GX Works2 has been installed, to the control unit.
For details of GX Works2,.refer to the "PLC Development Manual”
For details of GX Developer, refer to instruction manuals and specifications manuals related to GX Developer which are listed in "Manual List".

21.1 Writing Sequence Program using the SD Card

Save the sequence program in an SD card and write the data to NC using the external file operations on PLC onboard.

21.2 Setting the Ethernet Communication

21.2.1 Confirming the IP Address for CNC

Confirm the IP address set for the CNC. IP address is set to the following parameter.

Basic common parameter	Item	Description	Setting example
#1926	Global IP address	IP address for CNC seen from an external source	192.168.200.1
#1927	Global Subnet mask	Subnet mask of #1926	255.255.255.0

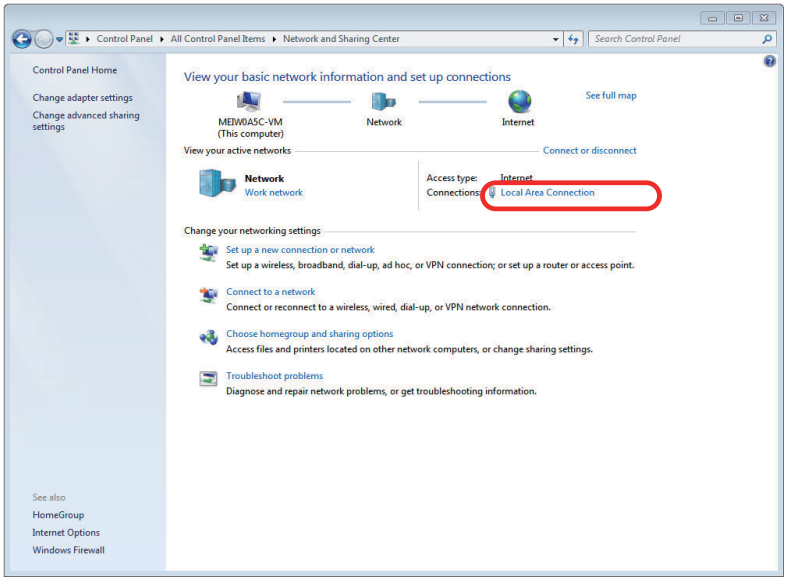
The case of when the initial value "192.168.200.1" after SRAM clear has been set is explained as an example in this chapter.

21.2.2 Setting the IP Address for PC Side

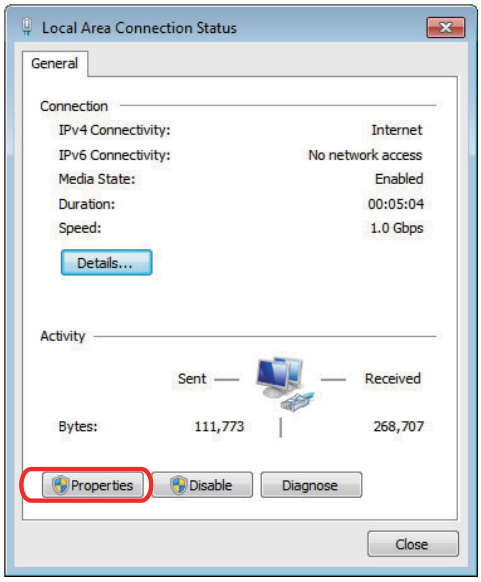
For the personal computer for which GX Developer or GX Works2 is available, IP address has to be set within the same subnet mask as CNC unit.

(1) Select [Start] - [Control Panel] - [Network and Internet] - [Network and Sharing Center] from task bar.

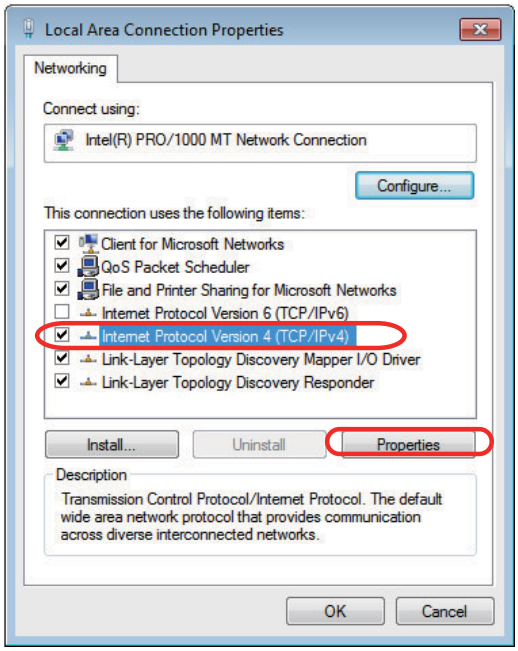
(2) "Network and Sharing Center" is displayed. Click [Local Area Connection].



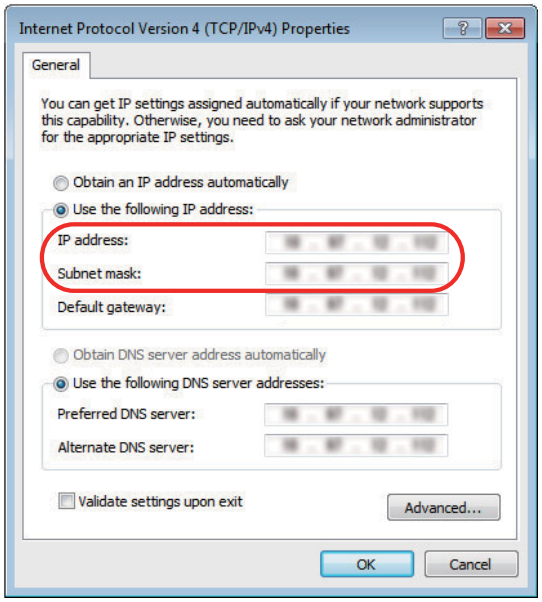
(3) "Local Area Connection Status" is displayed. Click [Properties].



(4) Click "Internet Protocol Version 4 (TCP/IPv4)" on the [Networking] tab, and then click [Properties].



(5) Take a note of the displayed IP address and subnet mask.



(6) Set the following addresses.
(Example) IP address: 192.168.200.2
Subnet mask: 255.255.255.0

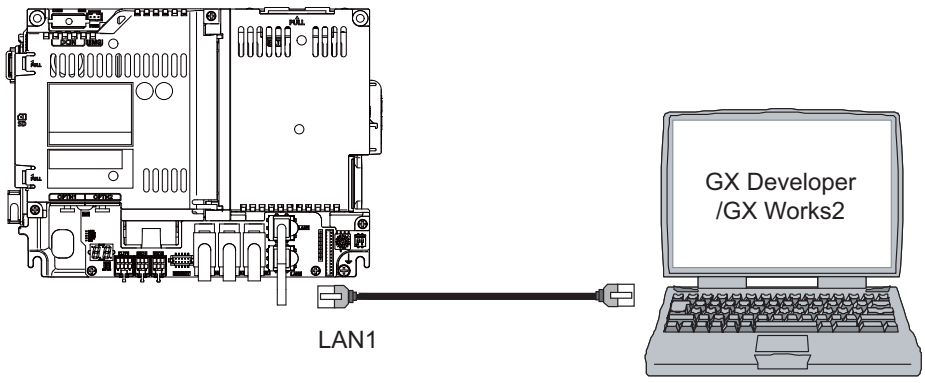
Note

- In the section "21.2.1 Confirming the IP Address for CNC", set an IP address in the range of "192.168.200.1" to "192.168.200.254", but do not use "192.168.200.1". Note that when other CNC and devices are connected on the same network, be careful not to duplicate the address with other CNC and devices.

(7) Click [OK] and close all the windows.

21.3 Connecting the Control Unit and a Personal Computer

Connect a personal computer, which has GX Developer or GX Works2 installed, to the control unit.



Note

(1) It is recommended to use GX Developer Version 8.114U (SW8D5C-GPPW) and later.
(2) It is recommended to use GX Works2 Version 1.570U and later.
(3) Carry out the Ethernet communication setting (IP address and so on) on the personal computer before connecting it to NC.

21.4 Setting the Communication with GX Works2

To create the machine sequence and user safety sequence of the CNC, use the Mitsubishi Electric FA engineering software GX Works2, which is the PLC development tool for the Mitsubishi Electric PLC MELSEC Series.

Machine sequence: Control circuit created to control the machine tools (ladder circuit)

User safety sequence: Control circuit of the safety-related I/O observation created with the smart safety observation function (ladder circuit)

(1) Start the setting screen by the following operation in the navigation window on GX Works2.
Select [Connection Destination], then double-click [Current Connection].

(2) Set the following items in the order of the list.

[For the machine sequence]

Setting item		Setting content	Remark
PC side I/F		Ethernet board	
	Network No.	1	(*1)
	Station No.	1	(*1)
	Protocol	TCP	(*1)
Sequencer side I/F		Ethernet unit	
	Type name	QJ71E71	(*2)
	Station No.	1	(*2)
	IP address	IP address of CNC	(*2)
	IP Input Format	DEC.	(*2)
	Station No. <-> IP information	Automatic Response System	(*2)
Other Station Setting		Other station (Single network)	
	Time out check (sec.)	Arbitrary time (Approx. 10 sec. or more)	(*3)
	Number of retries	0	(*3)
Network Communication Route Detailed setting of Ethernet			
	Access to Ethernet module set on PCL side I/F		(*4)

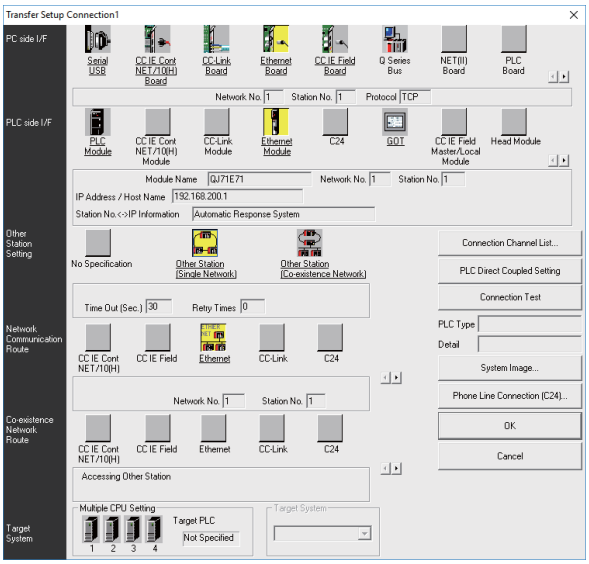
(*1) Double-click [Ethernet Board] to display the setting item.

(*2) Double-click [Ethernet Module] to display the setting item.

(*3) Double-click [Other Station (Single network)] to display the setting item.

(*4) Double-click [Ethernet] to display the setting item.

[Transfer Setup Connection screen]

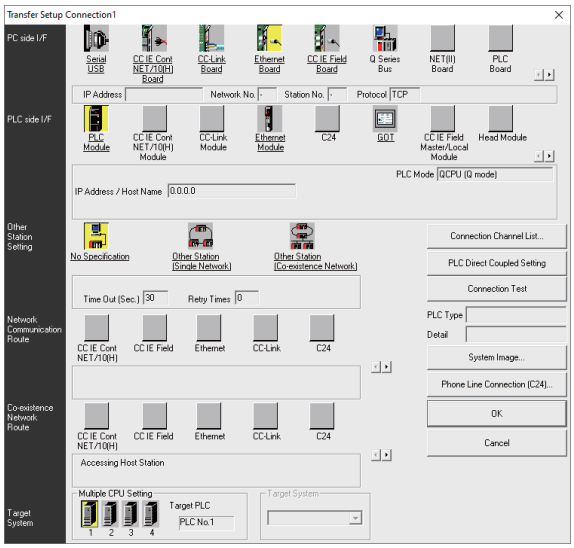


[For the user safety sequence]

Setting item		Setting content	Remark
PC side I/F		Ethernet board	
	Network No.	1	(*1)
	Station No.	1	(*1)
	Protocol	TCP	(*1)
Sequencer side I/F		CPU unit	
	CPU mode	QCPU (Q mode)	(*2)
	Ethernet: direct port connection and connection via hub selection	Connection via hub	(*2)
	IP address	IP address of CNC	(*2)
	IP Input Format	DEC.	(*2)
Other station		No other station designated	
	Time out check (secs.)	Arbitrary time (Approx. 10 sec. or more)	(*3)
	Number of retries	0	(*3)
Multi CPU			
	For the user safety sequence 1, select No. 1.		
	For the user safety sequence 2, select No. 2.		

(*1) Double-click [Ethernet Board] to display the setting item.
(*2) Double-click [Ethernet Module] to display the setting item.
(*3) Double-click [Other Station (Single network)] to display the setting item.

[Transfer Setup Connection screen]



(3) Press the [Connection test] button after completing the setting.
If communication is successful, the message "Connected with Q26UDHCPU" is displayed with the multi-CPU connection status below the message. This indicates the connection status of each project.

21.5 Setting the Parameters on GX Works2

Note

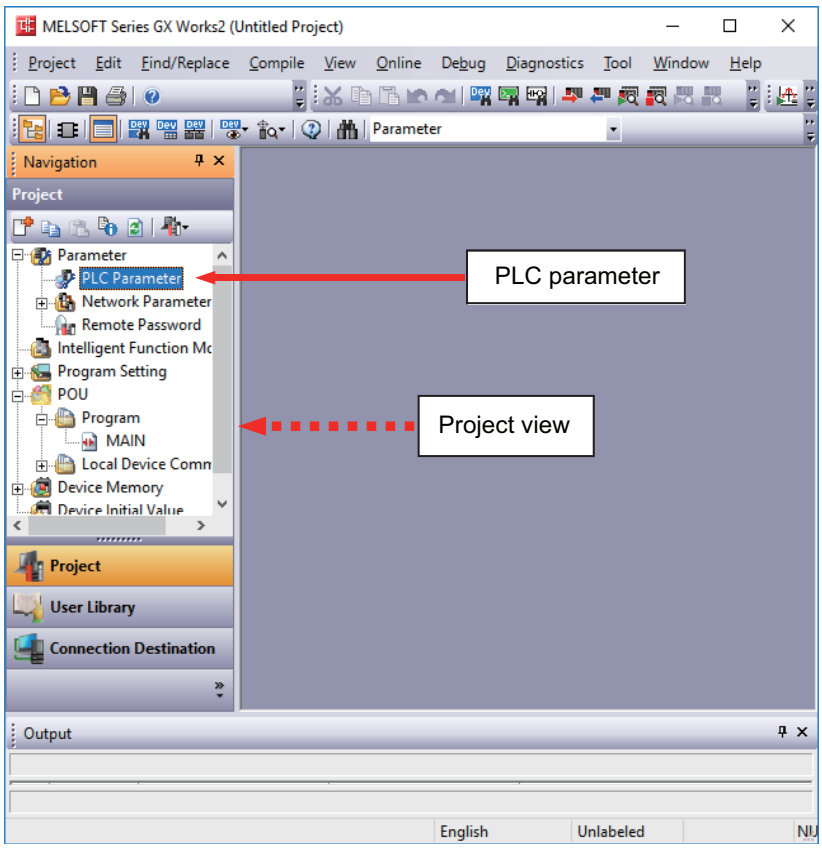
(1) There are two methods of ladder programming; independent program method and multi-program method, which makes differences in parameter settings. An incorrect parameter setting in the ladder programming may cause a write error. For details of the parameter settings, refer to the "PLC Development Manual".

21.5.1 Parameter Setting Screen

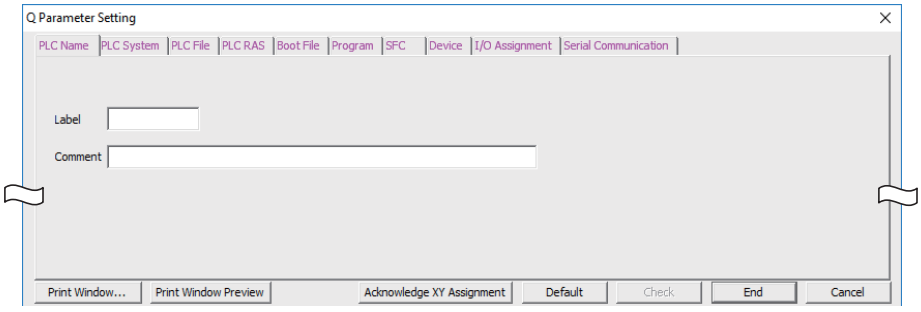
(1) Displaying the parameter setting screen

To open the parameter setting screen, display the project view on the navigation window by the following operation. Expand the tree by double-clicking [Parameter], and double-click [PLC Parameter].

[Project] -> Double-click [Parameter] -> Double-click [PLC Parameter]



The above operation opens the following parameter setting screen. Tab names in red indicate that the initial values are set.



21.5.2 Setting Device Points

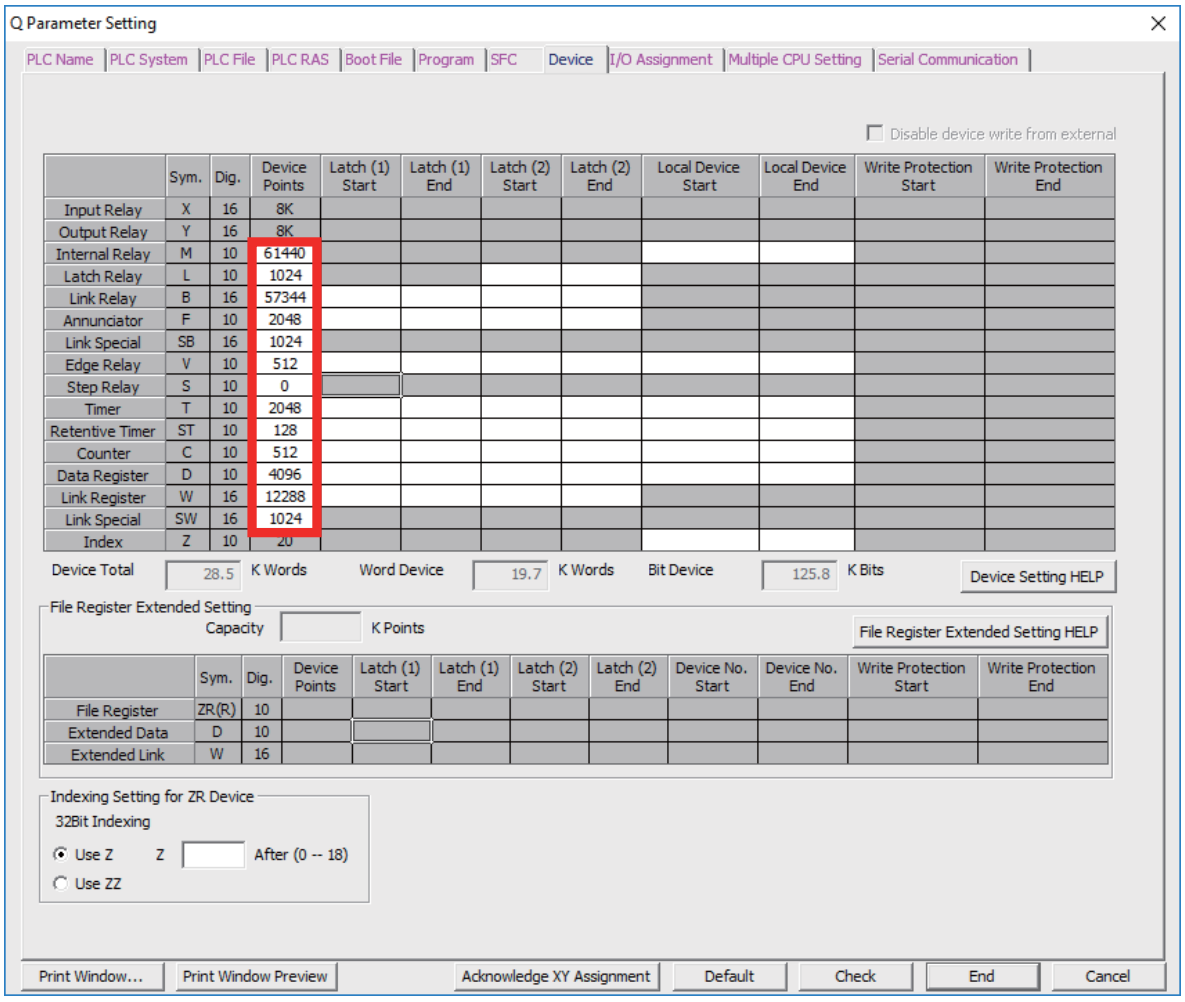
After creating a sequence program management area (project), the number of device points to be used in the project must be set first. This operation is required every time a new project is created.
For details on each setting item, refer to the "PLC Programming Manual".

Note

- If this operation is not performed, an error occurs when a sequence program is downloaded to a CNC controller.

(1) Select the [Device] tab.
Populate the device points in the parameter with the numbers of device points + common points that are set on the device setting screen in built-in PLC (built-in edit function). An error occurs when the number of device points is wrong. The device range usable for each project changes in the multi-project environment.

(2) Enter the device points, and click [End] on the following screen.
Set the number of device points ("number of device points + number of common points" which has been set at the device setting screen of built-in PLC built-in editing function) in the section in red square below. The number should match the currently connected project. When all device points are set, press [End] to end editing.



Note

- If the wrong number is set, downloading to the CNC controller fails with an error.

21.5.3 Setting the Number of Common Pointer Points

In the following cases, set the pointer No. common to sequence programs.

- When creating the sequence programs with the multi-program method
- When creating sequence programs of main process with ST language

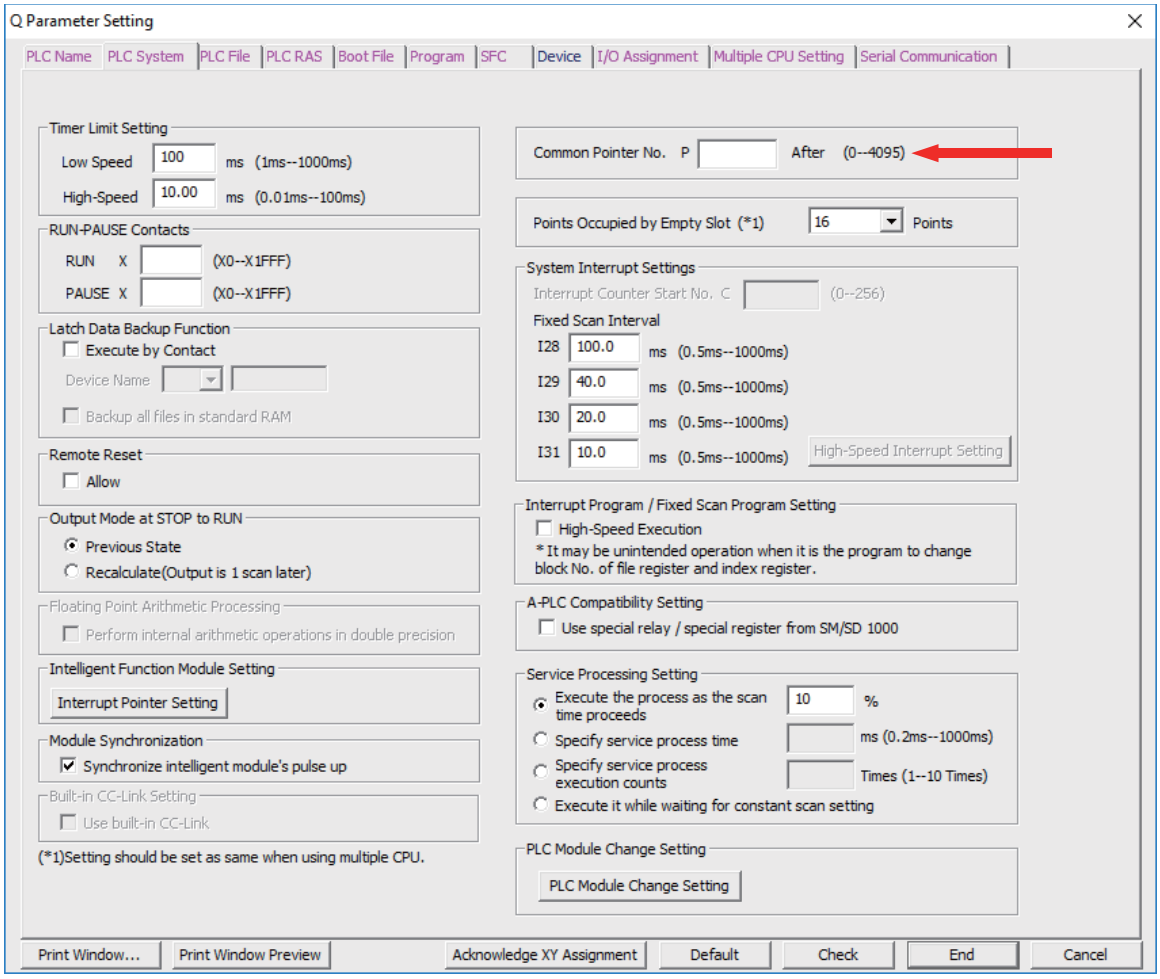
This operation is required every time a new project is created, and parameter files must be written to the CNC controller.

Note

- When common pointer No. is not set, "P1800" is set.
  When a simple project (with labels) or a structured project is newly created, or when "Project Type" is changed to any of the said project, "2048" is automatically set to "Common Pointer No." as the default value if its setting has been blank.

(1) Select the [PLC System] tab.

(2) Set a numeric value in [Common Pointer No.], and click [End] on the following screen.



21.5.4 Setting the Program Execution Order

In the following cases, set the execution method and execution order to sequence programs.

- When creating the sequence programs with the multi-program method
- When creating sequence programs of main process with ST language

This operation is required before a sequence program is executed on the CNC controller, and parameter files must be written to the CNC controller.

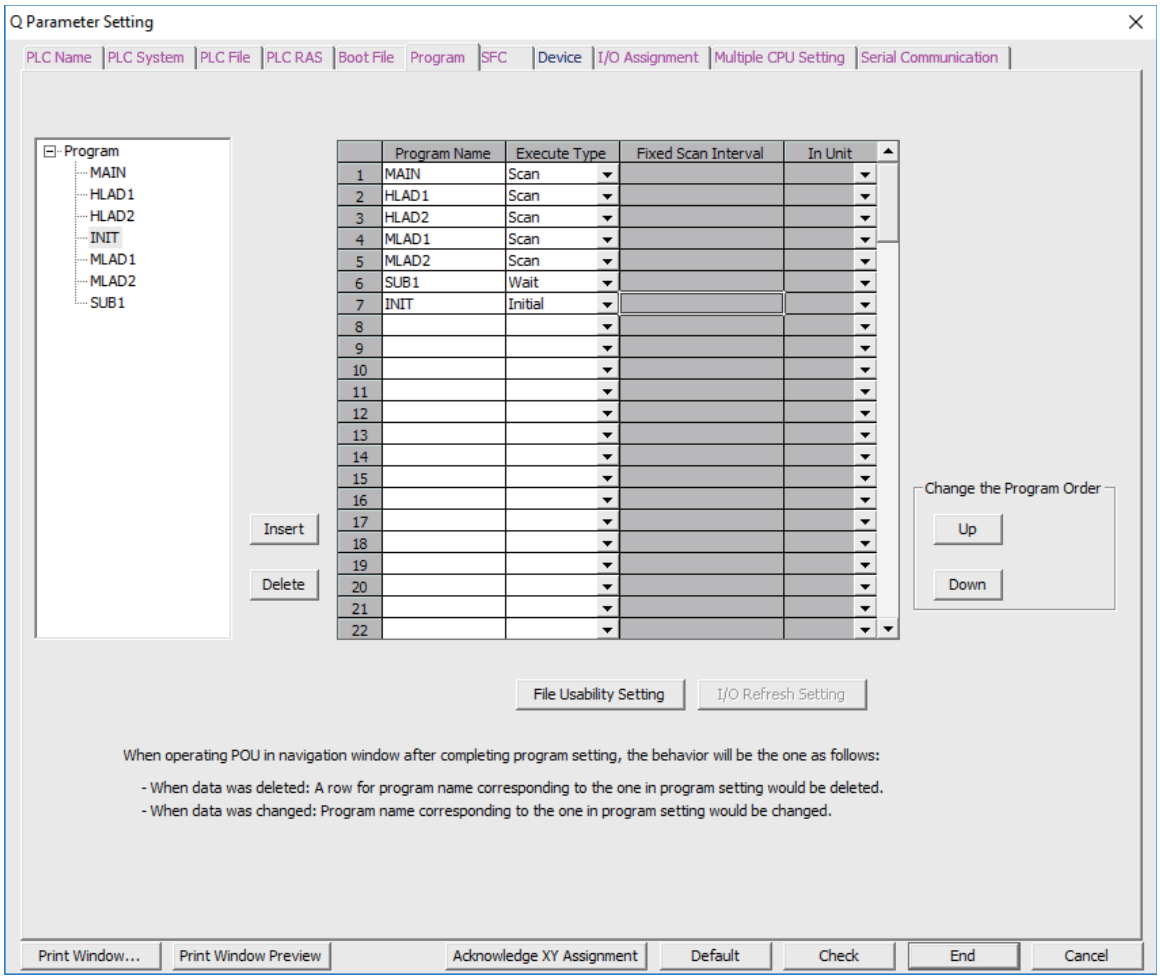
Note

- If this operation is not completed when the multi-program method is in use or when creating sequence programs of main process with ST language, an error will occur on the RUN of sequence programs.

(1) Select the [Program] tab.

(2) Select the name of the sequence program to be registered for execution from the program list on the left side of the following screen, and press [Insert]. Select the execution mode from the registered program list on the right side.

(3) After registering all sequence programs to execute, click [End].



21.6 Writing a Sequence Program with GX Works2

Note

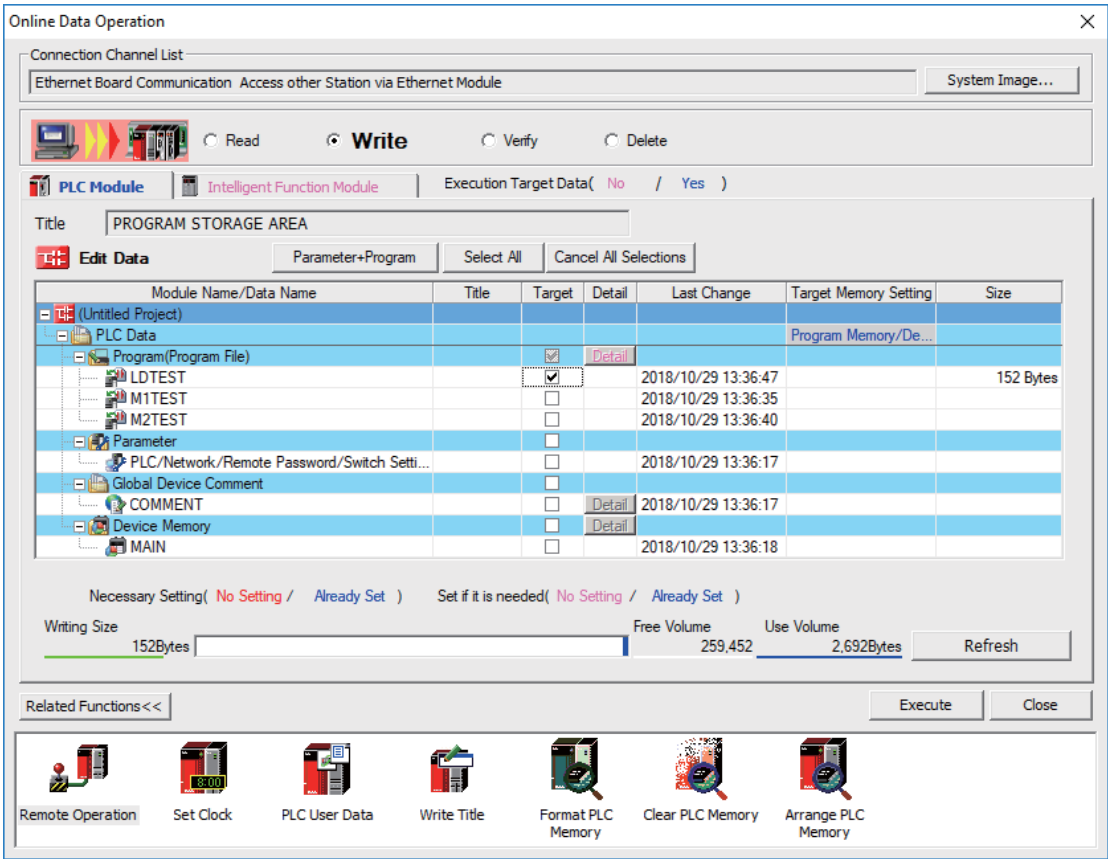
(1) This operation writes data to the temporary storage in the CNC (RAM in CNC). The temporary storage area (RAM inside CNC) does not hold data after the power is turned OFF. To retain data after power OFF, write sequence programs to the ROM in the CNC according to "21.7 Writing a Sequence Program to ROM with GX Works2".

■ Operating procedure for simple projects (without labels)

The following is the operation procedure for a project in which labels are not used.

(1) Start the operation screen by the following operation on GX Works2.
[Online] -> [Write to PLC...]

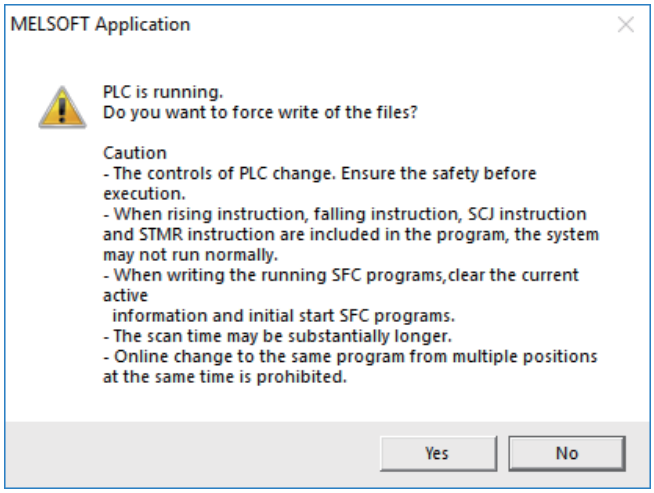
(2) Select [Program Memory/Device Memory] in [Target Memory Setting] of PLC data on the following screen.
Select write sequence program files, and click [Execute].
RUN/STOP of PLC can be instructed by selecting [Related Functions] - [Remote Operation].



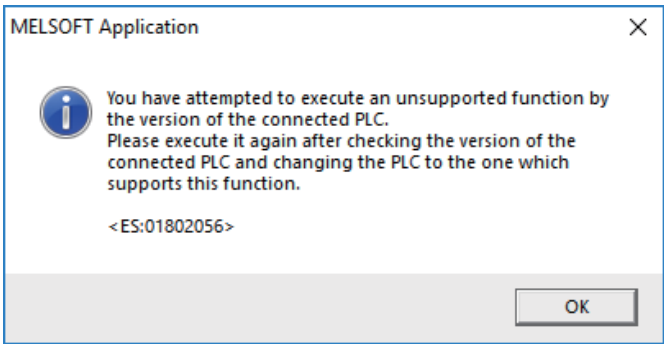
Note

- [Program Memory/Device Memory] is the only valid option for [Target Memory Setting].

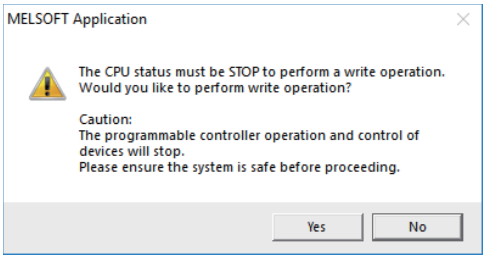
- If an attempt is made to remove the check from parameter and write sequence programs while a PLC is running, the message shown below is displayed.
  "Your PC is running. Force the file to be written?"



The CNC only supports writing during RUN from the [Compile] menu; if [Yes] is clicked, an error dialog is displayed and sequence programs are not written.



Click [No] and then click [Yes] when the following message is displayed:
"Perform a remote stop and write to PC?"

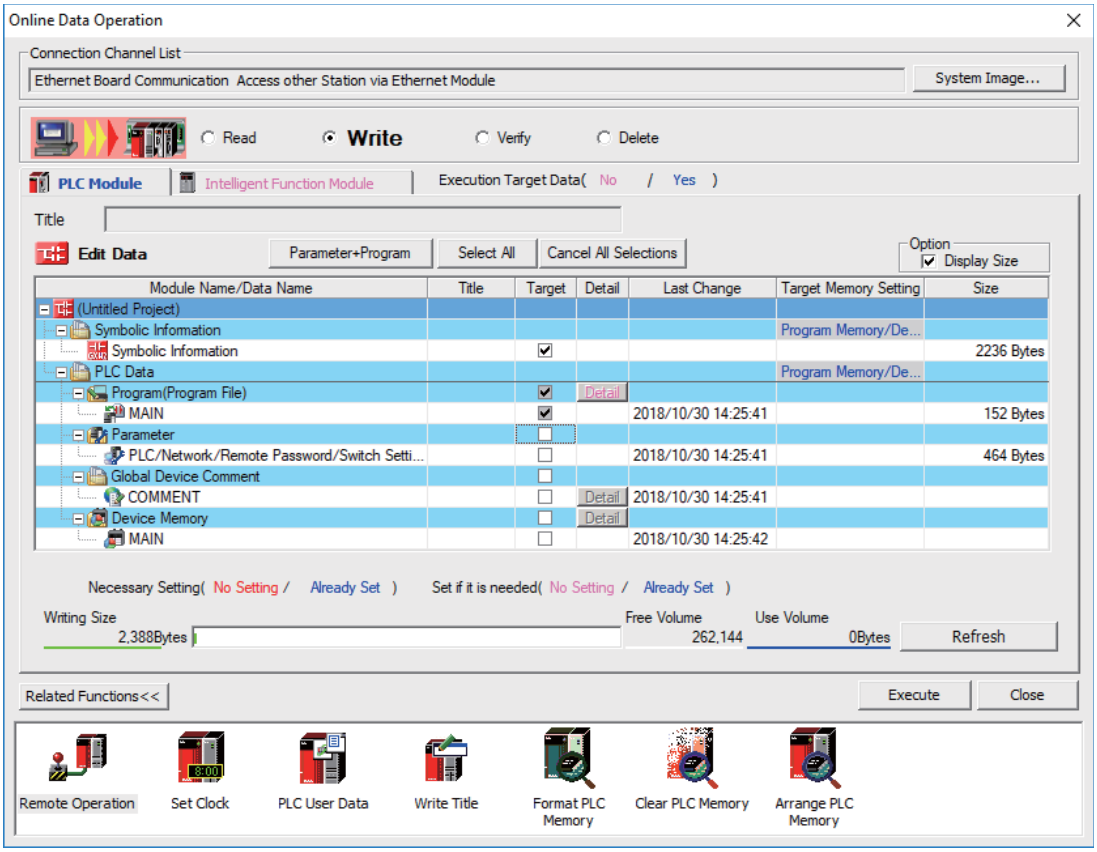


■ Operating procedure for simple projects (with labels)

The operating procedure when "use label" is set is described below.

(1) Start the operation screen by the following operation on GX Works2.
[Online] -> [Write to PLC...]

(2) Select [Program Memory/Device Memory] in [Target Memory Setting] for [Symbolic Information] on the following screen.
Select [Program Memory/Device Memory] in [Target Memory Setting] for PLC data.
Click [Parameter+Program], and then click [Execute].
RUN/STOP of PLC can be instructed by selecting [Related Functions] - [Remote Operation].



Note

- [Program Memory/Device Memory] is the only valid option for [Target Memory Setting].
- Since device memory cannot be written to the CNC controller, unselect the checkbox for device memory.
- Make sure to write parameters at the same time when the symbolic information is to be written. If parameters are not written, the project has not been compiled when the symbolic information is read.
- If an attempt is made to remove the check from parameter and write sequence programs while a PLC is running, the message shown below is displayed.
  "Your PC is running. Force the file to be written?"
  The CNC only supports writing during RUN from the [Compile] menu; if [Yes] is clicked, an error dialog is displayed and sequence programs are not written.
  Click [No], and click [Yes] to the prompt: "The CPU status must be STOP to perform a write operation. Would you like to perform write operation?"

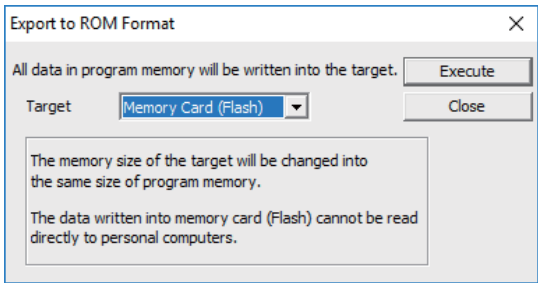
21.7 Writing a Sequence Program to ROM with GX Works2

Note

(1) Write operation to the ROM is not necessary for the user safety sequence.

[Operation procedure]

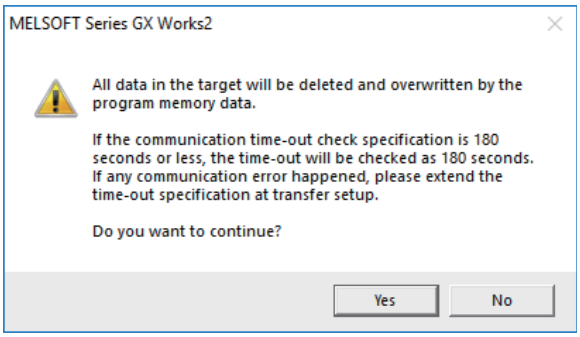
(1) Start the operation screen by the following operation on GX Works2.
[Online] -> [Export to ROM Format]



Note

- Only [memory card (Flash)] is valid as [Target].

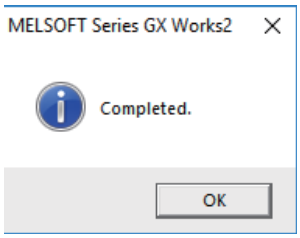
(2) Click [Execute] to display the following dialog, and click [Yes].



Note

- When [Yes] is clicked in the above dialog, sequence program files on the ROM in the CNC the CNC controller are over-write and deleted. This should be done with extreme caution.

(3) When the execution is completed, the dialog below is displayed. Click [OK].



21.8 Setting the PLC Parameters

Select [Param] - [Bit select] on the Mainte screen and set the bit selection parameters from #6449 to #6452.
See the following table for details of the parameters.

	Symbol name	7	6	5	4	3	2	1	0
0	#6449 R7824 L	Control unit thermal alarm on	Setting and display unit thermal mgmt valid ■	-	Battery alarm / warning detection disabled	Counter C retention	Integrated timer ST retention	PLC counter program valid	PLC timer program valid
1	#6450 R7824 H	-	External alarm message display ■	Alarm/ operator change ■	Full screen display of message ■	-	Operator message valid	0 F method 1 R method	Alarm message valid
2	#6451 R7825 L	-	-	-	-	-	Built-in edit function edit invalid ■	-	Built-in edit function edit valid ■
3	#6452 R7825 H	-	Branch destination label check valid	-	Serial handy terminal communica-tion valid	-	-	-	-

Note

(1) Be sure to set the bits indicated "-" and blanks to "0".

(2) Functions marked with "■" may not be available for some machine types.

22

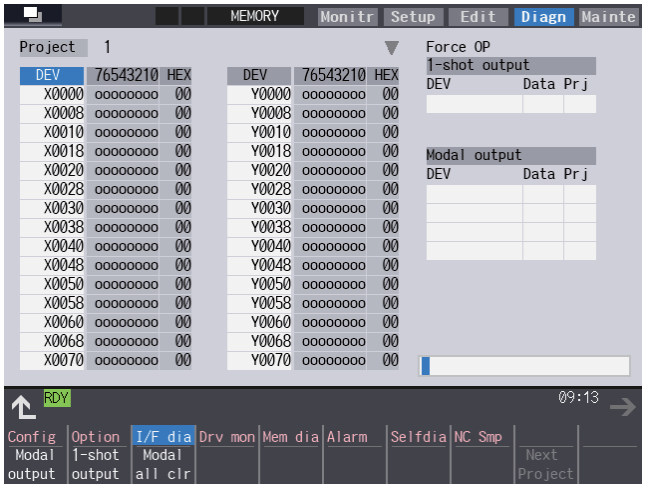
Confirming the Basic Operation

22.1 Checking Inputs/Outputs and Alarms

■ Checking the input signals

(1) Select [I/F dia] on the [Diagn] screen.

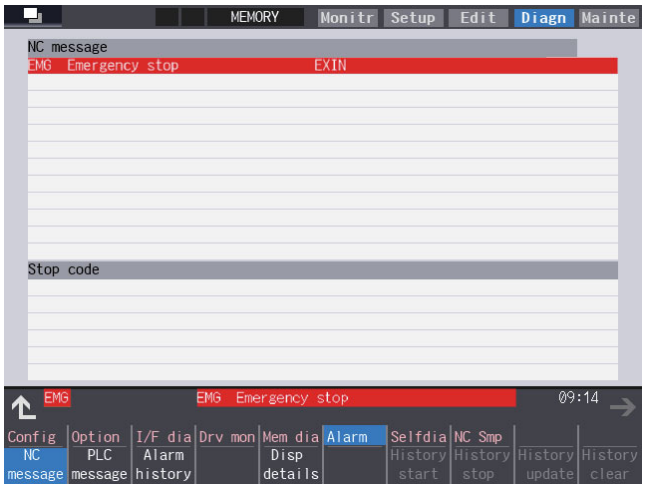
(2) Confirm that signals turn ON/OFF properly on the IF Diagnosis screen.



■ Checking the alarm display

(1) Select [Alarm] on the [Diagn] screen.

(2) Check any other alarm than "Emergency stop EXIN" displayed on the Alarm screen.



22.2 Confirming Manual Operation

22.2.1 Using the Manual Pulse Generator

(1) Select the handle mode.

(2) Set the handle feed magnification to a minimum value.

(3) Cancel the emergency stop. Confirm the operation status displays "RDY".

Note

- If any abnormal noise or vibration occurs, execute an emergency stop and take a measure against vibration. (Refer to "22.3.1 First Measure Against Vibration".)
- If there is a keyboard, it can also be confirmed with the READY lamp ON.

(4) Select an axis and turn the manual pulse generator by one scale. Confirm the direction and the amount of the movement on the current position display.
If the display is not correct, check parameters, PLC programs and devices' connections.

(5) Turn the manual pulse generator and confirm the direction and the amount of the machine's movement.
If the display is not correct, check parameters.
(Related parameters: "#1018 ccw (Motor CCW)", "#2201 SV001(PC1) (Motor side gear ratio)", "#2202 SV002(PC2) (Machine side gear ratio)", "#2218 SV018(PIT) (Ball screw pitch)" and so on)

Note

- Take care of the machine's movement range during the operation.

(6) Check the rest of the axes for each with the same operation as above.

22.2.2 Using JOG Feed

(1) Select JOG mode.

(2) Set the manual feed rate to 100 mm/min.

(3) Cancel the emergency stop. Confirm the operation status displays "RDY".

Note

- If any abnormal noise or vibration occurs, execute an emergency stop and take a measure against vibration. (Refer to "22.3.1 First Measure Against Vibration".)
- If there is a keyboard, it can also be confirmed with the READY lamp ON.

(4) Select an axis, press the JOG feed button and move the axis to safe area. Confirm the direction and the amount of the movement on the current position display.
If the display is not correct, check parameters, PLC programs and devices' connections.

(5) Confirm the direction and the amount of machine's movement.
If the display is not correct, check parameters.
(Related parameters: "#1018 ccw (Motor CCW)", "#2201 SV001(PC1) (Motor side gear ratio)", "#2202 SV002(PC2) (Machine side gear ratio)", "#2218 SV018(PIT) (Ball screw pitch)" and so on)

Note

- Take care of the machine's movement range during the operation.

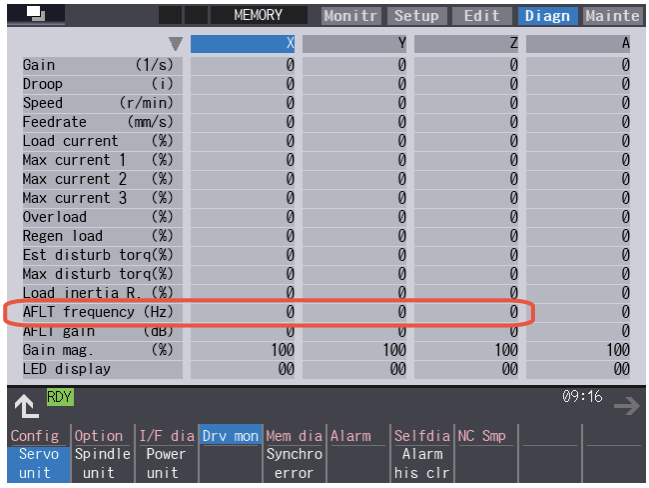
(6) Check the rest of the axes for each with the same operation as above.

22.3 Servo Simplified Adjustment

22.3.1 First Measure Against Vibration

Setting the filter can reduce the vibration.

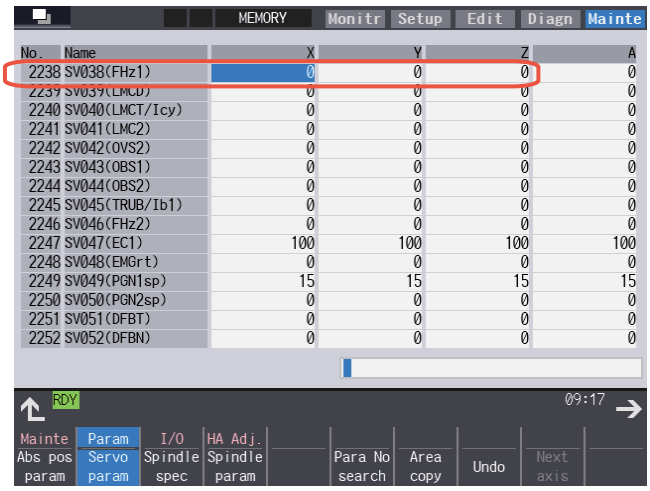
(1) Select [Drv mon] and then [Servo unit] on the [Diagn] screen. See the displayed value in "AFLT frequency".



Note

- The screen above is when NC parameters have default values.

(2) Select [Param] and then [Servo param] on the Mainte screen. Set the AFLT frequency value you saw at (1) to "#2238 SV038 FHz1 (Notch filter frequency 1)".



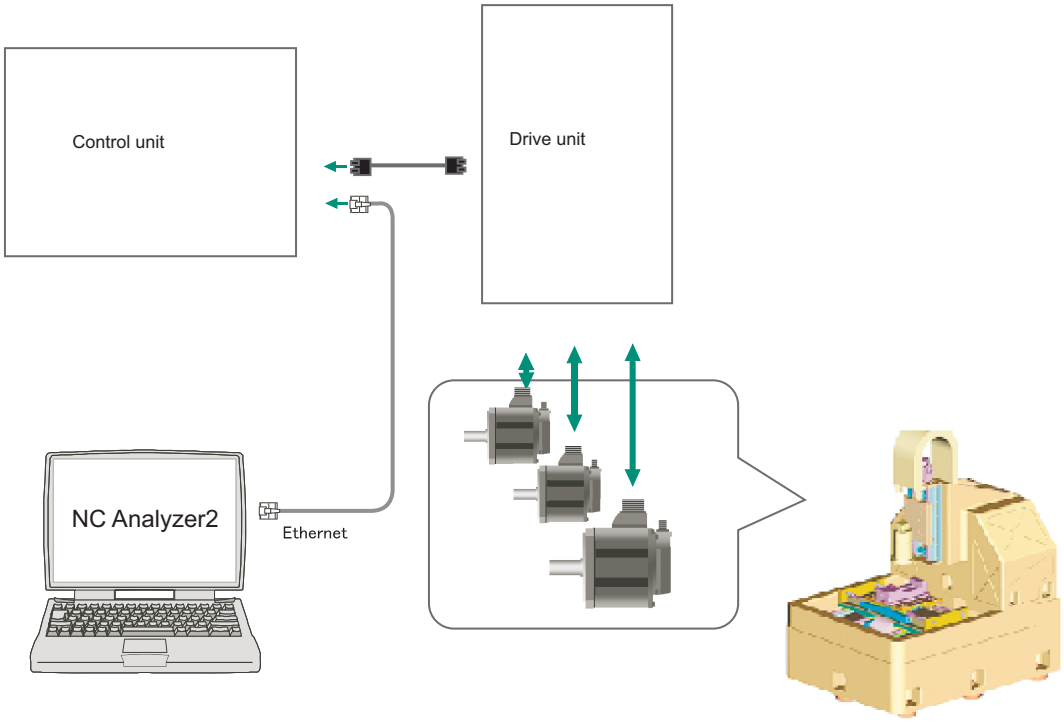
Note

- The screen above is when NC parameters have default values.

If the vibration is not reduced by the measure, refer to the manuals of the drive unit you are using.

22.3.2 NC Analyzer2

Servo parameters can be automatically adjusted by measuring and analyzing the machine characteristics. Measurement and analysis are conducted by driving the motor using machining programs for adjustment or vibration signals. Various data can also be sampled.



[Functions]

Adjustment wizard	Description
Velocity loop gain adjustment	Automatically adjusts velocity loop gain and resonance filters.
Lost motion adjustment	Adjusts the lost motion automatically for the delay in response caused when the direction of the machine rotates is reversed.

Measurement and adjustment	Description
Frequency response measurement	Measures the frequency response of speed loop for the designated axis. The result will be output as frequency response waveform.
Reciprocation acceleration/deceleration measurement	Measures the reciprocation acceleration/deceleration for the designated axis. The result will be output as time-series waveform. (*1)
Roundness measurement	Measures the roundness for the designated axis. The result will be output as roundness waveform. (*1)
Synch tap error measurement	Measures the synchronous tap error for the designated axis. The result will be output as time-series waveform. (*1)
Spindle acceleration/deceleration measurement	Measures the spindle acceleration/deceleration for the designated axis. The result will be output as time-series waveform. (*1)
Spindle orientation measurement	Measures the spindle orientation for the designated axis. The result will be output as time-series waveform. (*1)
Spindle C-axis measurement	Executes the reciprocation acceleration/deceleration measurement of spindle C axis with specified axis. The result will be output as time-series waveform. (*1)
Spindle synchronization measurement	Executes an arbitrary machining program with specified axis, and measures spindle synchronization by using that data. The result will be output as time-series waveform.
PLC axis acceleration/deceleration measurement	Executes an arbitrary machining program with specified axis, and measures PLC axis acceleration/deceleration by using that data. The result will be output as time-series waveform.
Arbitrary path measurement (*2)	Executes an arbitrary machining program with specified two axes. The result will be output as arbitrary path measurement waveform. (*1)

(*1) For the measurement, use a machining program created by the program creation function of NC Analyzer2 or any machining program.

(*2) Two or more NC axes in the same system are needed.

For details, refer to "NC Analyzer2 Instruction Manual".

23

Setting the Position Detection System

There are two kinds of position detection system: one is "relative position detection", which establishes the reference position (zero point) at every CNC power-ON; the other is "absolute position detection", which allows to start the operation without establishing the reference position (zero point) again after the CNC power-ON.

23.1 Adjusting the Absolute Position Detection System

There are four types of the absolute position zero point initial setting: "marked point alignment method I", "marked point alignment method II", "machine end stopper method", and "dog-type".
Set the parameter "#2049 type (Absolute position detection method)" for the type and method of absolute position zero point initial setting.
The required components differ depending on the detection method.

Method	Required component	Basic position	#2049 type	#2059 zerbas	Reference
Marked point alignment method I	None	The first grid point which is returned from where the mark is aligned.	2	1	23.1.1
Marked point alignment method II	None	The position where the marks are aligned.	4	0	23.1.2
Machine end stopper method	Machine end stopper	The position where the table is pushed against the machine end stopper.	1	0	23.1.3 23.1.4
		The first grid point which is returned from where the table is pushed against the machine end stopper.	1	1	
Dog type	Dog, dog-sensor	The first grid point after the dog OFF.	3	0	23.1.5

■ Characteristics of each method

[Marked point alignment method I]
Align the table side's mark and the machine side's mark.
The first grid point (electrical basic position) which is returned from the position where the marks are aligned is determined as the basic position.
Because the first grid point which is returned from the marks are aligned is determined as the basic position, the reproducibility is kept even the position information is lost due to running out of battery etc.

[Marked point alignment method II]
Align the table side's mark and the machine side's mark.
The position (machine basic position) where the marks are aligned is determined as the basic position.
Because the position where the marks are aligned is determined as the basic position, the reproductivity is low if the position information is lost due to running out of battery etc.

[Machine end stopper method]
Pushes the table against the machine end stopper.

- When "#2059 zerbas" is set to "0"
  The position (machine basic position) where the table is pushed against the machine end stopper is taken as the basic position.
- When "#2059 zerbas" is set to "1"
  The first grid point (electrical basic position) which is returned from the position where the table is pushed against the machine end stopper is taken as the basic position.

There are two types of the machine end stopper method: automatic initialization and manual initialization.
When the automatic initialization is applied, the axis travels automatically after the JOG is started.
When the manual initialization is applied, the axis travels by handle mode or JOG mode while confirming each operation.

[Dog-type]
This method requires a dog sensor.
Move the table until the dog is kicked, and the first grid point after the dog OFF is determined as the basic position.

23.1.1 Marked Point Alignment Method I

(1) Preparations
Set the parameters on the absolute position parameter screen.

➡ #2049 type (absolute position detection method): 2 (marked point alignment method I)
#2050 absdir (basic point of Z direction): 0 or 1
#2059 zerbas (select zero point parameter and basic point): 1
The parameters other than "#2049 type" can also be set on the absolute position setting screen.

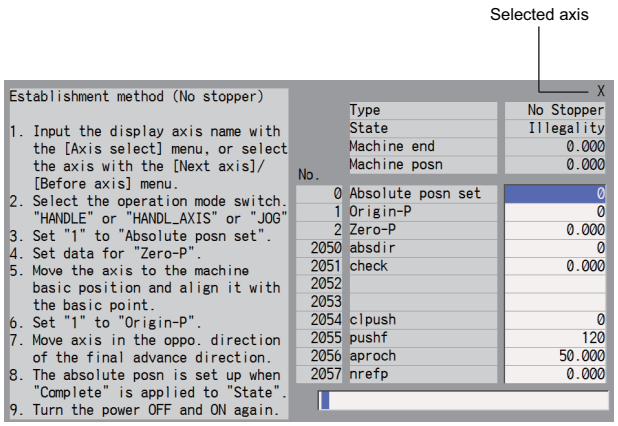
(2) Turn the power OFF and ON.
(Only when "#2049 type" is specified again.)

The following are the operations on the absolute position setting screen. ([Mainte] - [To Abs pos])

(3) Select an axis to set the absolute position.

There are two methods to select an axis.
- Select the menu [Axis select], enter the axis name in the input area then press [INPUT]. (For the axis name, input the name set to the parameter "#1022 axname2" (2nd axis name).)
- Press the menu [Prev axis] and [Next axis] to switch the axis.

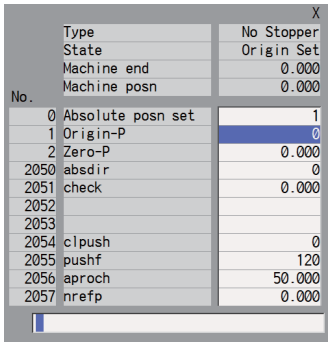
➡



(4) Select "Handle mode" or "Jog mode" for the machine operation switch.

(5) Confirm that the cursor is on "Absolute posn set", input "1" in the input area, and press the [INPUT] key.

➡ The input value will be registered in the "Absolute posn set" area.
State: [Origin set]



(6) Move the axis to the position where the table side's mark and machine side's mark are aligned.

(7) Move the cursor to "Origin-P" with the [↑] and [↓] keys.
Input "1" in the input area and press the [INPUT] key.

➡ The input value will be registered in the "Origin-P" area.
State: [Ret. Ref. P.]
Machine end: Distance between the position where the table side's mark and machine side's mark are aligned and the first grid point

(8) Move the axis in the direction designated with the absolute position parameter "#2050 absdir".

(9) The axis stops when it reached the first grid point. ➡ State: [Complete]
Machine position: Current machine position

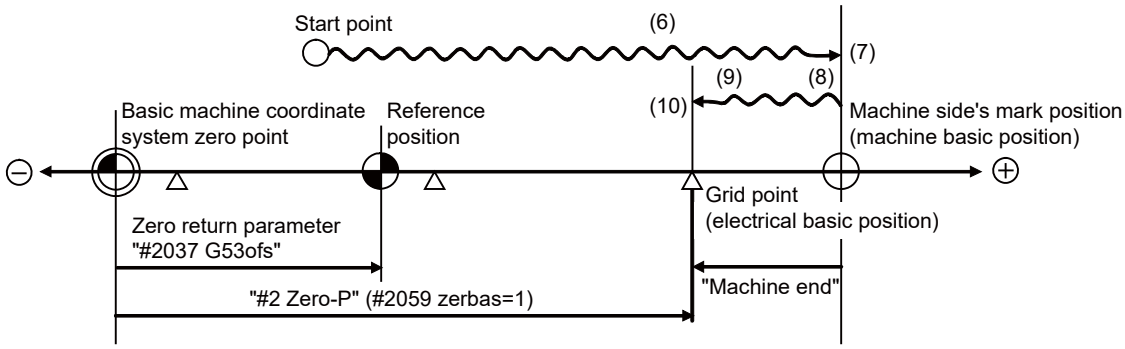
(10) Set the "Zero-P".

Move the cursor to "Zero-P" with the [↑] and [↓] keys. Input the distance from the basic machine coordinate zero point to the grid point immediately preceding the basic position in the input area then press [INPUT].

Setting "Zero-P"

When the machine is set up for the first time or when the grid point has changed because of replacement of motor and encoder, set the distance from the basic machine coordinate system zero point from the grid point (electrical basic position) to "Zero-P".
(When you set machine basic position as basic machine coordinate system zero point, set the display value of "Machine end" to "Zero-P".)
When you perform zero point initial setting due to the disappearance of the absolute position, the grid point (electrical basic position) does not change; therefore, there is no need to set "Zero-P" again.

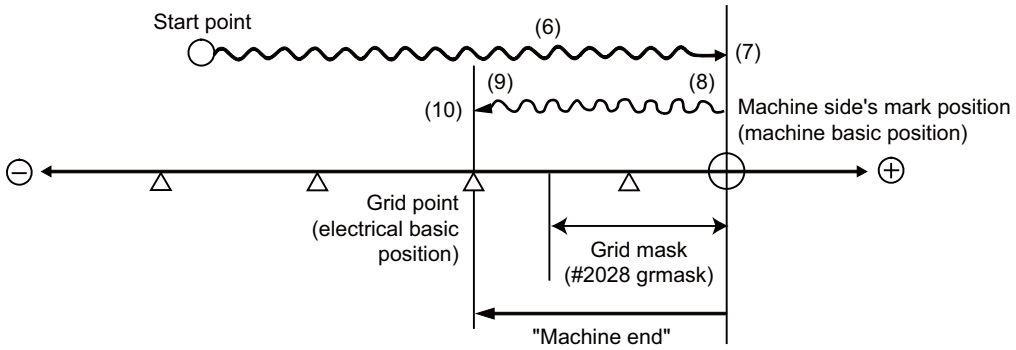
The zero point initial setting is now complete. After initializing all axes, turn the power OFF and ON.



- (6) to (10) in this diagram indicate steps of the operation procedure.

Note

- To change just the basic machine coordinate zero point, set "#0 Absolute posn set" and "#2 Zero-P", and then turn the power OFF and ON.
- If aligning the axis to the marked point is attempted without passing the grid point even once after turning the power ON, the operation message "Not Passed on grid" will display. Return to a point before the last grid, and then repeat from the step of aligning the axis on the marked point.
- If the first grid point is covered by the grid mask (#2028 grmask) as a result of return to the electrical basic position in the step (8), the axis stops at the next grid point. Note that reference position shift amount (#2027 G28sft) is invalid.



- Confirm the "absdir" setting if the machine does not move in the direction of "#2050 absdir" in step (8). The machine will move only in the positive direction when set to "0" or the negative direction when set to "1".

23.1.2 Marked Point Alignment Method II

(1) Preparations
Set the parameters on the absolute position parameter screen.

→ #2049 type (absolute position detection method): 4 (marked point alignment method II)
#2059 zerbas (select zero point parameter and basic point): 0
The parameters other than "#2049 type" can also be set on the absolute position setting screen.

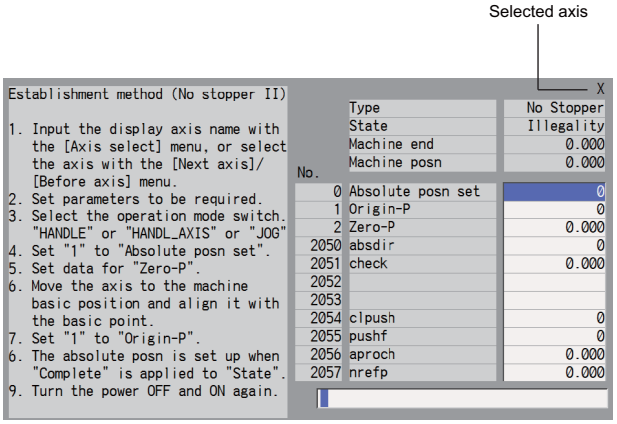
(2) Turn the power OFF and ON.
(Only when "#2049 type" is specified again.)

The following are the operations on the absolute position setting screen. ([Mainte] - [To Abs pos])

(3) Select an axis to set the absolute position.

There are two methods to select an axis.
- Select the menu [Axis select], enter the axis name in the input area then press [INPUT]. (For the axis name, input the name set to the parameter "#1022 axname2" (2nd axis name).)
- Press the menu [Prev axis] and [Next axis] to switch the axis.

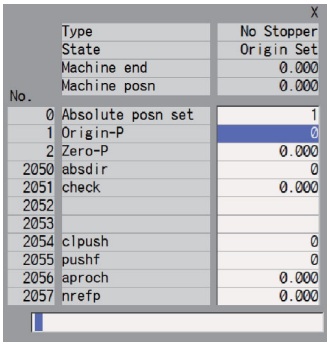
→



(4) Select "Handle mode" or "Jog mode" for the machine operation switch.

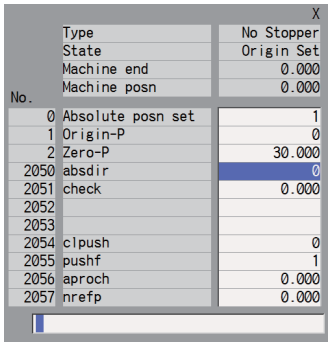
(5) Confirm that the cursor is on "Absolute posn set", input "1" in the input area, and press the [INPUT] key.

→ The input value will be registered in the "Absolute posn set" area.
State: [Origin set]



(6) Move the cursor to "Zero P" with the [↑] and [↓] keys.
Enter the value for "Zero-P" in the input area and press the [INPUT] key.

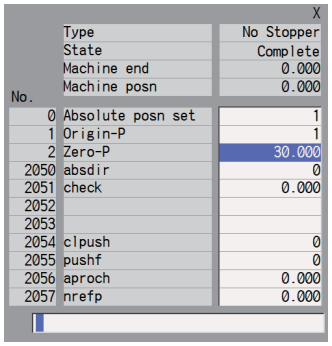
➡ The input value will be registered in the "Zero-P" area.



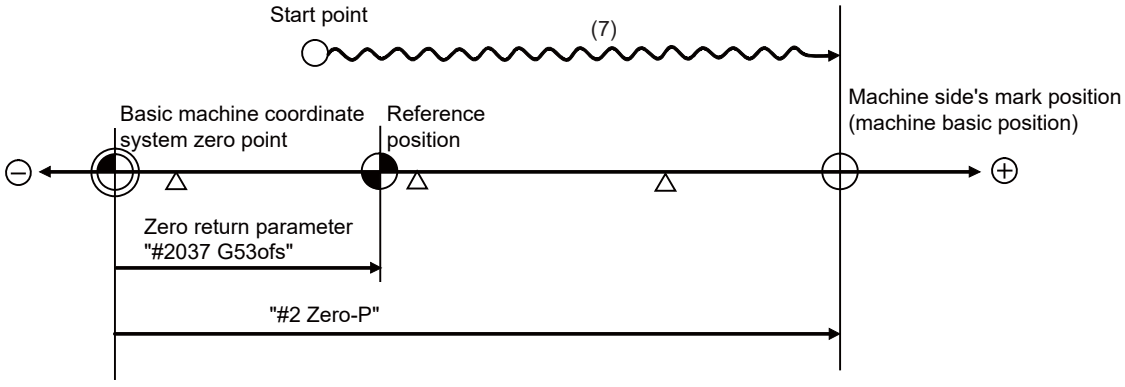
(7) Move the axis to the position where the table side's mark and machine side's mark are aligned.

(8) Move the cursor to "Origin-P" with the [↑] and [↓] keys.
Input "1" in the input area and press the [INPUT] key.

➡ The input value will be registered in the "Origin-P" area.
State: [Complete]
Machine end: 0.000
Machine position: Value set for "Zero-P"



The zero point initial setting is now complete. After initializing all axes, turn the power OFF and ON.



Note

- To change just the basic machine coordinate zero point, set "#0 Absolute posn set" and "#2 Zero-P", and then turn the power OFF and ON.

23.1.3 Machine End Stopper Method: Automatic Initialization

(1) Preparations
Set the parameters on the absolute position parameter screen.

➡ #2049 type (absolute position detection method): 1 (stopper method)
#2054 clpush (current limit): 0 to 100 (*1)
#2055 pushf (push speed): 1 to 999
#2056 aproch (approach point): 0 to 999.999
#2059 zerbas (select zero point parameter and basic point): 0 or 1 (*2)
The parameters other than "#2049 type" can also be set on the absolute position setting screen.

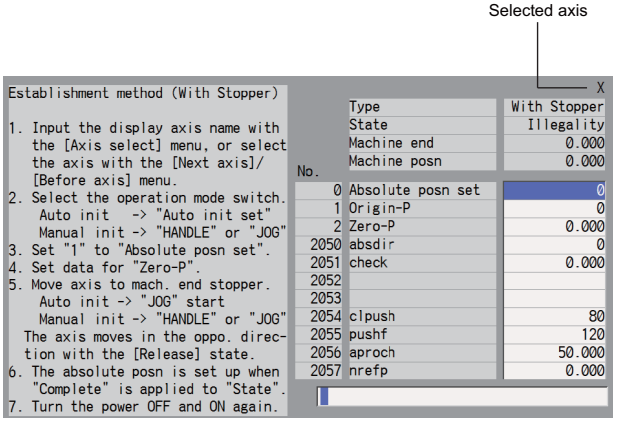
(2) Turn the power OFF and ON.
(Only when "#2049 type" is specified again.)

The following are the operations on the absolute position setting screen. ([Mainte] - [To Abs pos])

(3) Select an axis to set the absolute position.

There are two methods to select an axis.
- Select the menu [Axis select], enter the axis name in the input area then press [INPUT]. (For the axis name, input the name set to the parameter "#1022 axname2" (2nd axis name).)
- Press the menu [Prev axis] and [Next axis] to switch the axis.

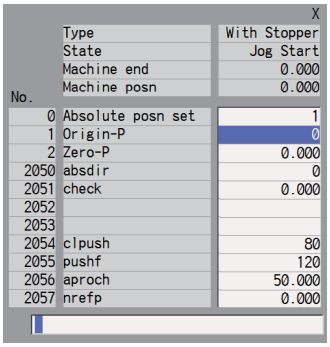
➡



(4) Select "Auto init set" for the machine operation switch.

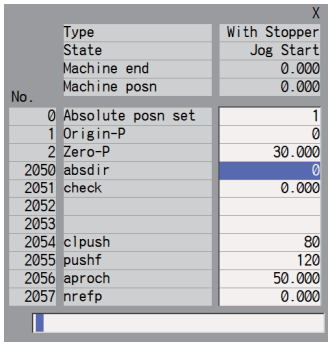
(5) Confirm that the cursor is on "Absolute posn set", input "1" in the input area, and press the [INPUT] key.

➡ The input value will be registered in the "Absolute posn set" area.



(6) [When "#2059 zerbas" is set to "0"]
Set the "Zero-P". (*2)
Move the cursor to "Zero P" with the [↑] and [↓] keys.
Input the distance from the basic machine coordinate zero point to the basic position in the input area then press [INPUT].

➡ The input value will be registered in the "Zero-P" area.



(7) Start JOG operation.

The axis moves toward the machine end stopper at the pushing speed (#2055 pushf).

➡ State: [Stopper1]

(8) After the axis pushes against the machine end stopper and the current reaches its limit continually during given time period, the axis returns toward the approach point at the pushing speed.

➡ State: [Zero-P. Rel.]

(9) After the axis arrives at the approach point, the axis moves toward the machine end stopper at the pushing speed.

➡ State: [Stopper2]

(10) [When "#2059 zerbas" is set to "0"]
The axis pushes against the machine end stopper and stops when the current reaches its limit.

➡ State: [Complete]
Machine end: 0.000
Machine position: Current machine position

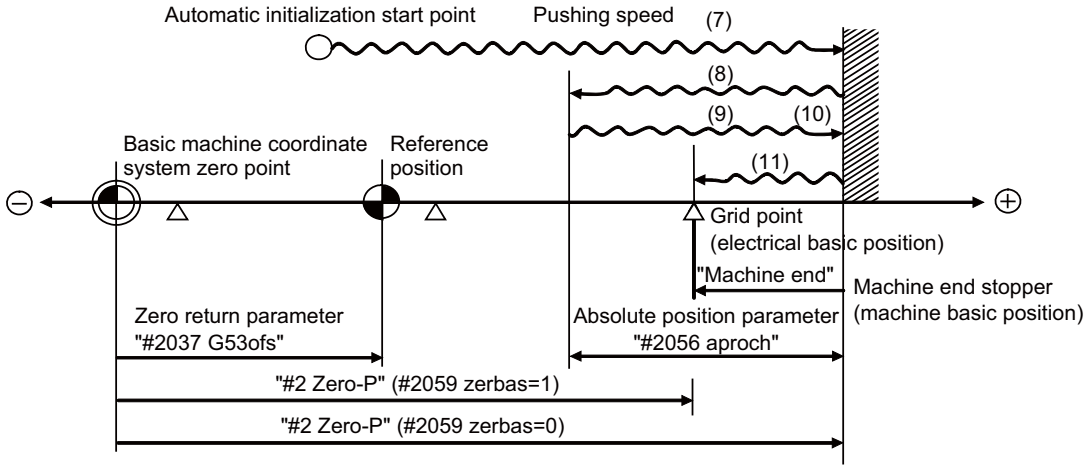
(11) [When "#2059 zerbas" is set to "1"]
The axis pushes against the machine end stopper, and the current reaches its limit, the axis reverses and moves at the pushing speed. Then the axis stops at the first grid point.
Move the cursor to "Zero-P" with the [↑] and [↓] keys.
Input the distance from the basic machine coordinate zero point to the grid point immediately preceding the basic position in the input area then press [INPUT].

➡ State: [Complete]
Machine end: Distance between the machine end stopper and the grid point immediately before the stopper
Machine position: Current machine position

The zero point initial setting is now complete. After initializing all axes, turn the power OFF and ON.

(*1) Low current limit value may prevent the basic movement of the axis. Do not set such a low value.
Set an appropriate value taking into account the acceleration torque and the friction torque.
When the current limit value is set too low, the servo error 3E (magnetic pole position detection error) may occur.

(*2) Depending on the setting value of the parameter "#2059 zerbas", the value set for "Zero-P" differ as shown in the following figure.



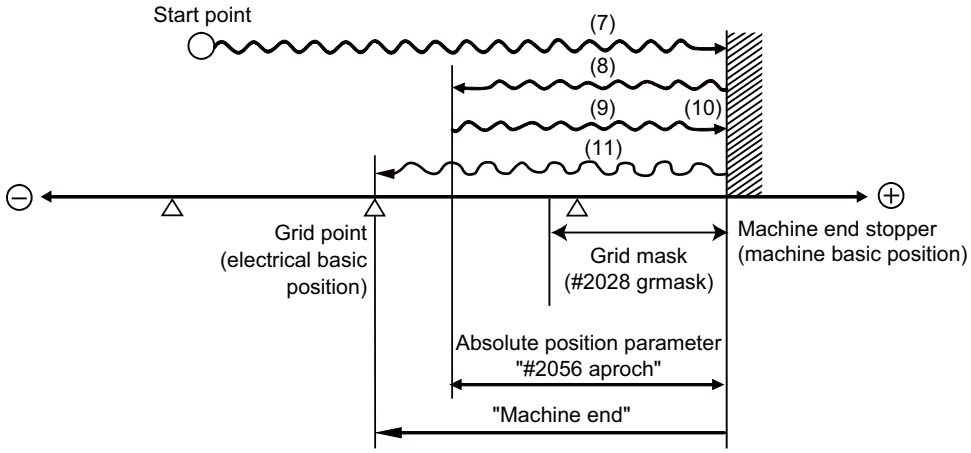
- (7) to (11) in this diagram indicate steps of the operation procedure.

Note

(1) To change just the basic machine coordinate zero point, set "#0 Absolute posn set" and "#2 Zero-P", and then turn the power OFF and ON.

(2) If attempting to push toward the machine end stopper without passing the grid point even once after turning the power ON, the operation message "Not Passed on grid" will display. Return to a point before the last grid, and then repeat from the step of pushing toward the machine end stopper.

(3) If the first grid point is covered by the grid mask (#2028 grmask) as a result of return to the electrical basic position in the step (11), the axis stops at the next grid point. Note that reference position shift amount (#2027 G28sft) is invalid.



(4) Acceleration/deceleration during movement at the specified push speed is performed in smoothing-off (stepfeed) mode.

(5) If "0" is specified for "#2056 aproch" of the absolute position parameters, the machine zero point is regarded as the approach point.

(6) Automatic initialization is interrupted if one of the following events occurs. If it is interrupted, [State] indicates "Jog Start" (after selecting the "Auto init set" mode if it is caused by mode change), so restart operation from the step of JOG-start.

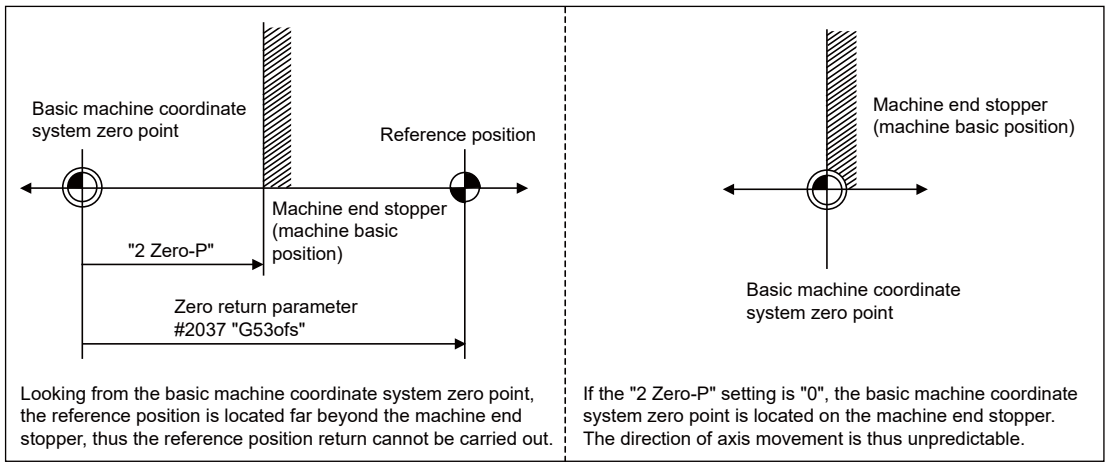
- An absolute position detection alarm occurs.
- Operation preparation signal turns OFF.
- The mode is changed.
- The system is reset.

If [State] is "Complete" before automatic initialization is started, "State" returns to "Complete" when power is turned OFF and ON again without restarting the operation.

(7) Automatic initialization cannot be started in the following cases. The operation message "Can't start" will appear if starting is attempted.

- When "#0 Absolute posn set" is not set.
- When the "#2 Zero-P" setting is inappropriate.
- When the absolute position parameter "#2055 pushf" is not set.
- When "Z71 Abs encoder failure 0005" has occurred.

Supplementing one of the points above, "Zero-P" setting is inappropriate when "#2 Zero-P" is smaller than the "#2037 G53ofs" or when "#2 Zero-P" is set to "0" as shown below.



23.1.4 Machine End Stopper Method: Manual Initialization

(1) Preparations
Set the parameters on the absolute position parameter screen.

➡ #2049 type (absolute position detection method): 1 (stopper method)
#2054 clpush (current limit): 0 to 100 (*1)
#2059 zerbas (select zero point parameter and basic point): 0 or 1 (*2)
The parameters other than "#2049 type" can also be set on the absolute position setting screen.

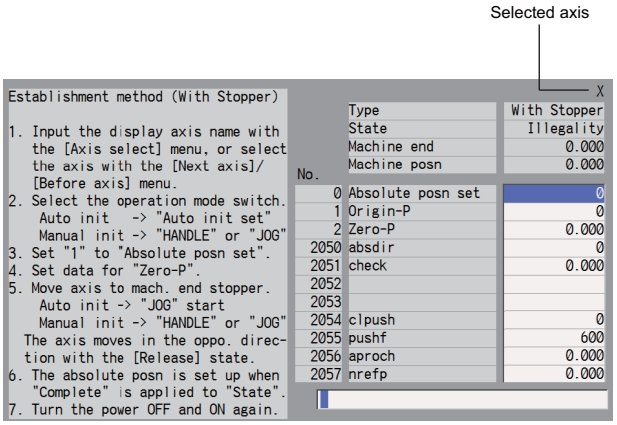
(2) Turn the power OFF and ON.
(Only when "#2049 type" is specified again.)

The following are the operations on the absolute position setting screen. ([Mainte] - [To Abs pos])

(3) Select an axis to set the absolute position.

There are two methods to select an axis.
- Select the menu [Axis select], enter the axis name in the input area then press [INPUT]. (For the axis name, input the name set to the parameter "#1022 axname2" (2nd axis name).)
- Press the menu [Prev axis] and [Next axis] to switch the axis.

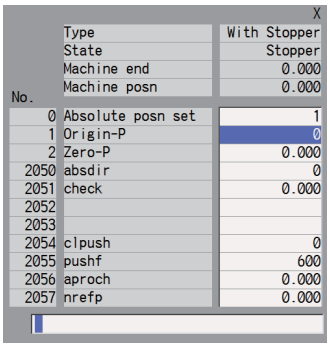
➡



(4) Select "Handle mode" or "Jog mode" for the machine operation switch.

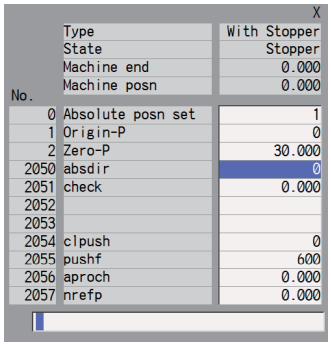
(5) Confirm that the cursor is on "Absolute posn set", input "1" in the input area, and press the [INPUT] key.

➡ The input value will be registered in the "Absolute posn set" area.



(6) [When "#2059 zerbas" is set to "0"]
Set the "Zero-P". (*2)
Move the cursor to "Zero P" with the [↑] and [↓] keys.
Input the distance from the basic machine coordinate zero point to the machine end stopper in the input area then press [INPUT].

➡ The input value will be registered in the "Zero-P" area.



(7) Press the axis against the machine end stopper.

➡ State: [Stopper]
Machine end: Distance between the machine end stopper and the grid point immediately before the stopper

(8) [When "#2059 zerbas" is set to "0"]
The axis pushes against the machine end stopper and stops when the current reaches its limit.

➡ State: [Complete]
Machine end: 0.000
Machine position: Current machine position

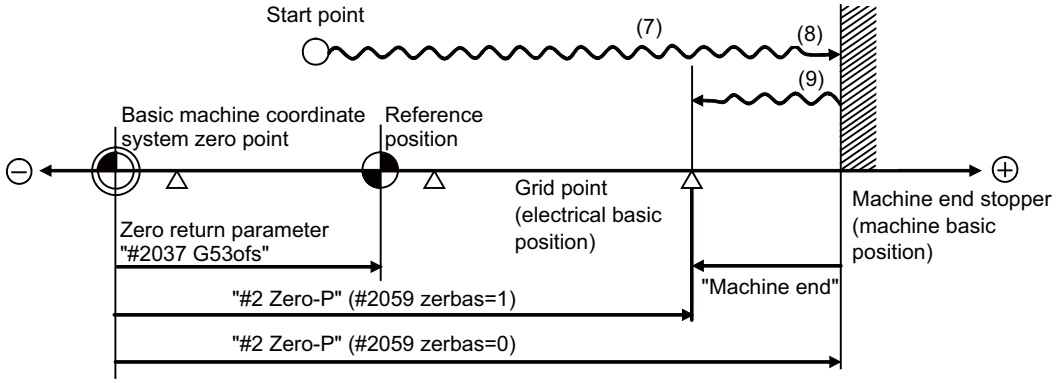
(9) [When "#2059 zerbas" is set to "1"]
The axis pushes against the machine end stopper, and the current reaches its limit, the axis reverses and moves at the pushing speed (set by "#2055 pushf"). Then the axis stops at the first grid point.
Move the cursor to "Zero-P" with the [↑] and [↓] keys.
Input the distance from basic machine coordinate system zero point to the grid point immediately preceding the machine end stopper then press [INPUT].

➡ State: [Complete]
Machine end: Distance between the machine end stopper and the grid point immediately before the stopper
Machine position: Current machine position

The zero point initial setting is now complete. After initializing all axes, turn the power OFF and ON.

(*1) Low current limit value may prevent the basic movement of the axis. Do not set such a low value.
Set an appropriate value taking into account the acceleration torque and the friction torque.
When the current limit value is set too low, the servo error 3E (magnetic pole position detection error) may occur.

(*2) Depending on the setting value of the parameter "#2059 zerbas", the value set for "Zero-P" differ as shown in the following figure.



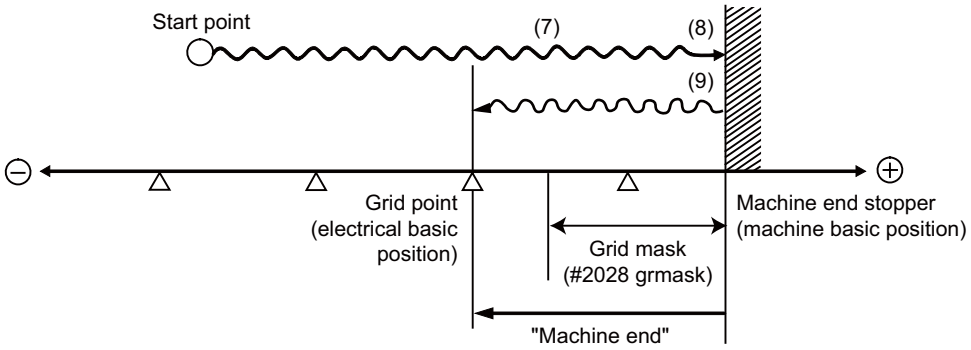
- (7) to (9) in this diagram indicate steps of the operation procedure.

Note

(1) To change just the basic machine coordinate zero point, set "#0 Absolute posn set" and "#2 Zero-P", and then turn the power OFF and ON.

(2) If attempting to push toward the machine end stopper without passing the grid point even once after turning the power ON, the operation message "Not Passed on grid" will display. Return to a point before the last grid, and then repeat from the step of pushing toward the machine end stopper.

(3) If the first grid point is covered by the grid mask (#2028 grmask) as a result of return to the electrical basic position in the step (9), the axis stops at the next grid point. Note that reference position shift amount (#2027 G28sft) is invalid.



23.1.5 Dog-type

(1) Preparations
Set the parameters on the absolute position parameter screen.

➡ #2049 type (absolute position detection method): 3 (dog-type)
The parameters such as approach speed and grid mask amount also need to be adjusted.

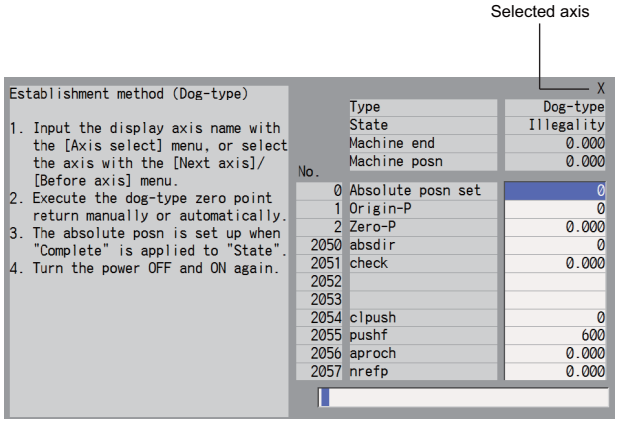
(2) Turn the power OFF and ON.
(Only when "#2049 type" is specified again.)

The following are the operations on the absolute position setting screen. ([Mainte] - [To Abs pos])

(3) Select an axis to set the absolute position.

There are two methods to select an axis.
- Select the menu [Axis select], enter the axis name in the input area then press [INPUT]. (For the axis name, input the name set to the parameter "#1022 axname2" (2nd axis name).)
- Press the menu [Prev axis] and [Next axis] to switch the axis.

➡



(4) Execute the manual or automatic dog-type zero point return.

➡ State: [Zero-P. Rel.]
Machine position: Current machine position

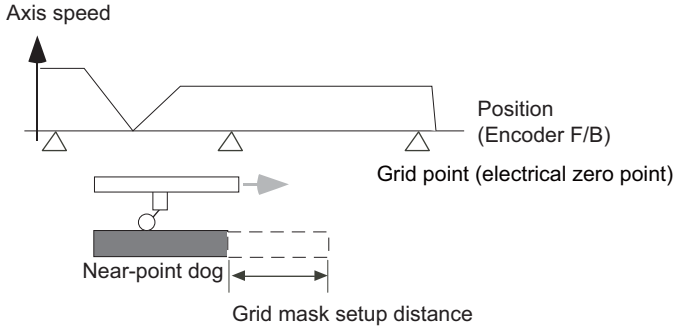
(5) The axis arrives at the zero point.

➡ State: [Complete]
Machine position: 0.000

The zero point initial setting is now complete. After initializing all axes, turn the power OFF and ON.

Note

(1) If the dog-type reference position return is interrupted by resetting, the previous state ("Complete" or "Illegality") will display in the [State] column.
(2) With dog-type reference position return, reference position return can be executed again even if the [State] is "Complete".
(3) If the first grid point is covered by the grid mask (#2028 grmask) as a result of return to the electrical zero point, the axis stops at the next grid point. Note that reference position shift amount (#2027 G28sft) is invalid.



23.1.6 Setting the Grid Interval and the Reference Encoder for Grid Interval

Set the parameters "#2041 grspcref" (reference encoder for grid interval) and "#2029 grspc" (grid interval) according to the machine configuration.

[For semi-closed loop control]

Set the reference encoder for grid interval to "0" (grid interval from motor side).
Set the grid interval same value as the ball screw pitch.
If the reference encoder for grid interval is set to "1" (grid interval by machine side), the grid interval must be set to the calculated amount of grid movement per 1 motor rotation ("#2201 SV001 PC1"/"#2202 SV002 PC2" x "#2218 SV018 PIT").

[For full-closed loop control]

Set the reference encoder for grid interval to "1" (grid interval by machine side).
Set the grid interval same value as the Z phase pitch.
If the reference encoder for grid interval is set to "0" (grid interval by motor side), the grid interval must be to set to the calculated amount of grid movement per Z phase pitch ("2202 SV002 PC2"/"#2201 SV001 PC1" x the Z phase pitch on the machine side encoder).

[Parameter settings for "Grid interval" and "Reference encoder for grid interval"]

Loop control	#2041 grspcref Reference encoder for grid interval	#2029 grspc Grid interval	Calculation for the grid interval
Semi-closed	0: grid interval by the motor side	Same value as the ball screw pitch	unnecessary
	1: grid interval by the machine side	Calculated value of "#2201 SV001 PC1"/ "#2202 SV002 PC2" x "#2218 SV018 PIT"	necessary
Full-closed	0: grid interval by the motor side	Calculated value of "2202 SV002 PC2"/ "#2201 SV001 PC1" x Z phase pitch on machine side encoder	necessary
	1: grid interval by the machine side	Same value as the Z phase pitch	unnecessary

(*) If the grid interval is set to "0", ball screw pitch "#2218 SV018 PIT" will be used instead of grid interval.

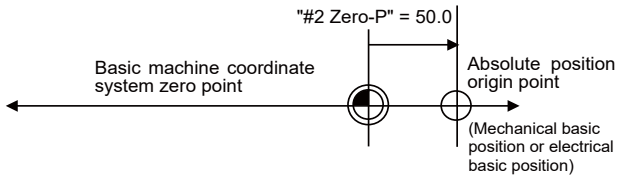
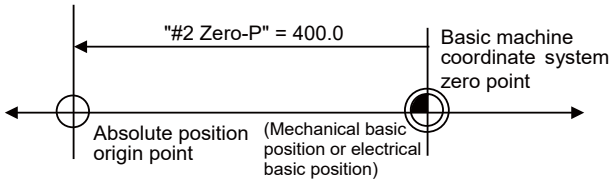
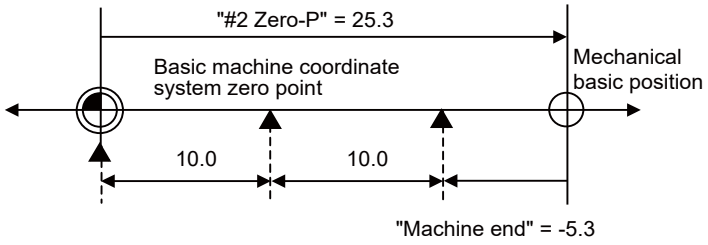
23.1.7 Precautions Common for the Initilization Operation

(1) The "#0 Absolute posn set" parameter (axis for which zero point is to be initialized) can be set simultaneously for all axes or individually for each axis.
(2) The "#0 Absolute posn set" parameter cannot be turned OFF with the keys. It is turned OFF when the power is turned ON again.
(3) "#2 ZERO-P" can be set at any time as long as "#0 Absolute posn set" is set to "1".
(4) The grid point must be passed at least once after turning the power ON before initializing the zero point. If the grid point has not been passed, the operation message "Not passed on grid" will appear at the "Machine posn".
(5) When the absolute position is established, the required data will be stored in the memory.

23.1.8 Precautions Common for the Dogless-type Absolute Position Encoder

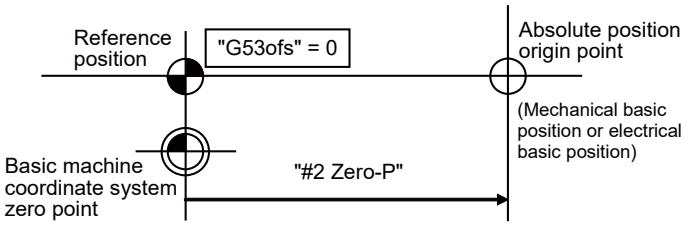
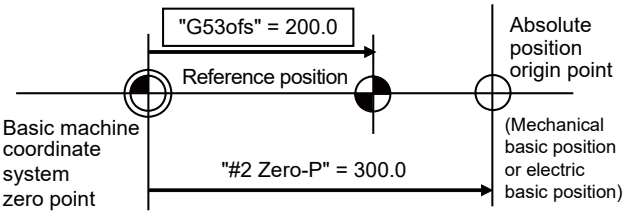
(1) Example of setting "#2 Zero-P" parameter

For the "#2 Zero-P" parameter, set the coordinate value of the absolute position origin point (machine reference position or electrical basic position) looking from the basic machine coordinate zero point.

(Example 1) To set the zero point at 50.0 mm before absolute position origin point on + end	
(Example 2) To set the zero point at 400.0 mm before the machine basic position or absolute position origin point on - end.	
(Example 3) To set the basic machine coordinate zero point on the grid point, calculate the "#2 Zero-P" parameter setting value as shown below using the value displayed at "Machine end". "Machine end" shows the distance from the machine reference position to the previous grid point. (Note that when setting the electrical reference position coordinate value in "#2 Zero-P", the "Machine end" value does not need to be considered.) To set the third grid point as the zero point when "Machine end" displays -5.3 at the + end reference position. (Example of 10.0 mm grid interval.)	
To set the third grid point as the zero point when "Machine end" displays -5.3 at the + end reference position. (Example of 10.0 mm grid interval.)	

(2) Setting the reference position

The reference position can be set as shown below by setting the zero point return parameter "#2037 G53ofs".

(Example 1) To set the reference position to the same position as the basic machine coordinate zero point.	
(Example 2) To set the reference position to the +200.0 mm position from the basic machine coordinate zero point. (To set the basic machine coordinate zero point 300.0 mm before the absolute position origin point.)	

(3) When an MPI scale made by Mitsubishi Heavy Industries Machine Tool Co., Ltd. is used, set the zero point return parameters so that Z phase of the MPI scale becomes the grid point (electric basic position), and then perform zero point initialization setting.

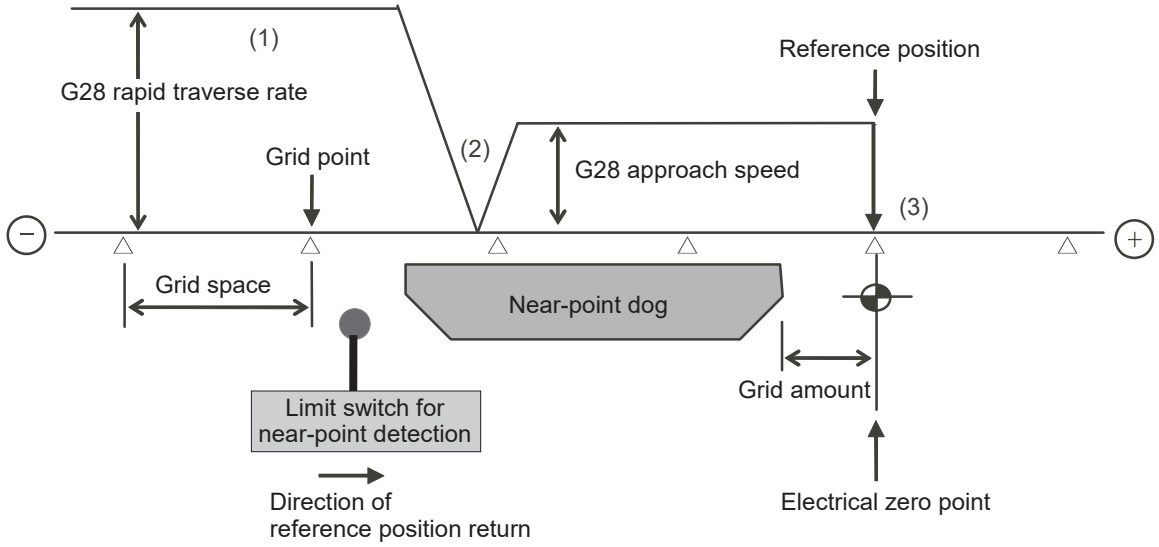
23.2 Adjustment of Reference Position Return in Relative Position Detection System

23.2.1 Dog-type Reference Position Return Operation

In the dog-type reference position return, the axis moves as follows:

(1) Starts moving at G28 rapid traverse rate.
(2) Decelerates to stop when the near-point dog is detected during the movement. Then, resumes moving at G28 approach speed.
(3) Stops at the first grid point after leaving the near-point dog.

This grid point, where the axis stopped at (3), is called the electrical zero point. Normally, this electrical zero point is regarded as the reference position.



The first reference position return after turning the power ON is carried out with the dog-type reference position return. The second and following returns are carried out with either the dog-type reference position return or the high-speed reference position return, depending on the parameter.
High-speed reference position return is a function that directly positions to the reference position saved in the memory without decelerating at the near-point dog.

Note

(1) If reference position return has never been executed after turning the power ON and a movement command other than G28 is executed, the program error (P430) will occur.

23.2.2 Dog-type Reference Position Return Adjustment Procedures

Adjust the dog-type reference position return with the following steps.

(1) Select [Param] from the maintenance screen, and then use the page up/down keys to select [Zp-rtn param].
The [zero point parameter] screen appears.

(2) Set the following parameters to "0" on the [zero point parameter] screen.
Reference position shift amount (#2027 G28sft)
Grid mask amount (#2028 grmask)

(3) Turn the power OFF and ON, and then execute the reference position return.

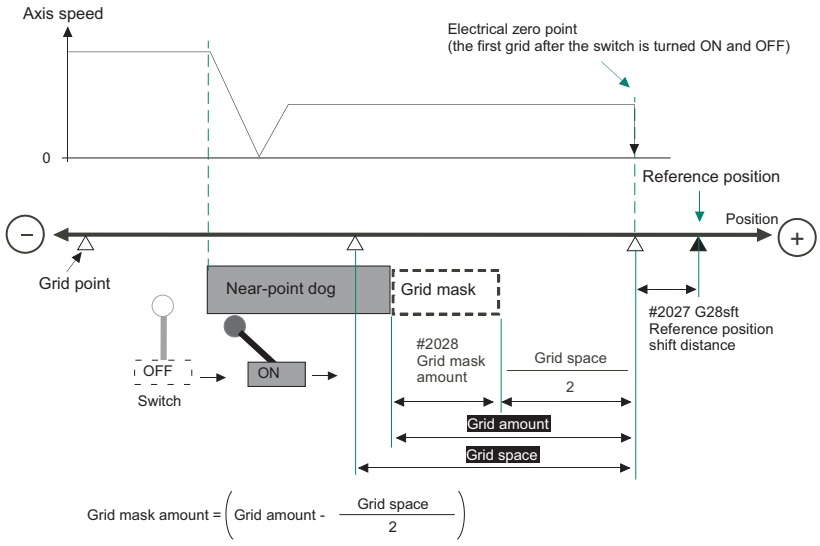
Note

- Select "reference position return mode" and use the switches on the machine operation panel to command and operate axis movement. The panel switches are made by the machine tool builder.

(4) Select [Drv mon] screen from the diagnosis screen, and display the drive monitor screen.
Feed the page and check "Grid space" and "Grid amount".

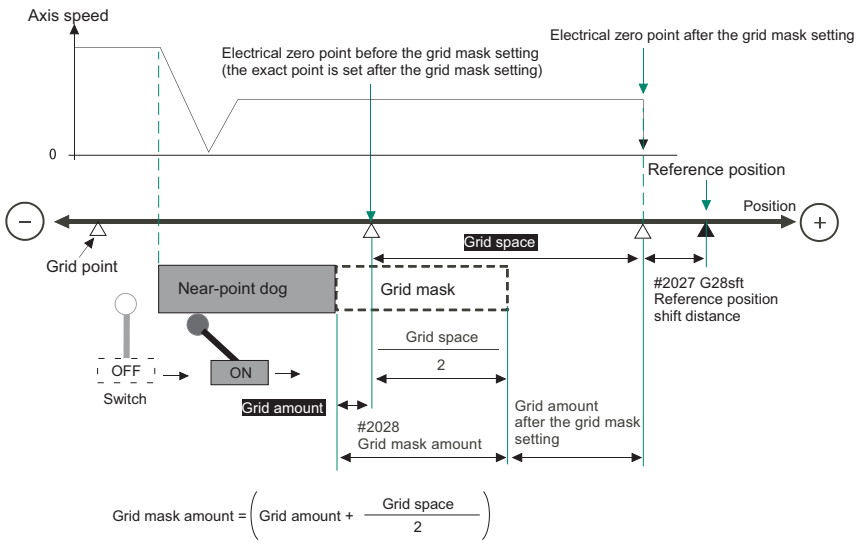
(5) Determine the grid mask amount according to the state as shown below.

■ When $\frac{\text{Grid space}}{2}$ is smaller than the grid amount



$$\text{Grid mask amount} = \left(\text{Grid amount} - \frac{\text{Grid space}}{2}\right)$$

■ When $\frac{\text{Grid space}}{2}$ is larger than the grid amount



$$\text{Grid mask amount} = \left(\text{Grid amount} + \frac{\text{Grid space}}{2}\right)$$

(6) Set the decided grid mask amount for "#2028 grmask" of the [zero point parameter] screen.

(7) Turn the power OFF and ON, and then execute the reference position return.

(8) Confirm the grid space and grid amount values on DRIVE MONITOR screen.
If the grid amount value is approximately half of the grid space, the grid mask amount has been set correctly. If the value is not approximately half, repeat the procedure from step (1).

(9) Set the reference position shift amount (#2027 G28sft).
To designate the electrical zero point as the reference position, set "#2027 G28sft" to "0".

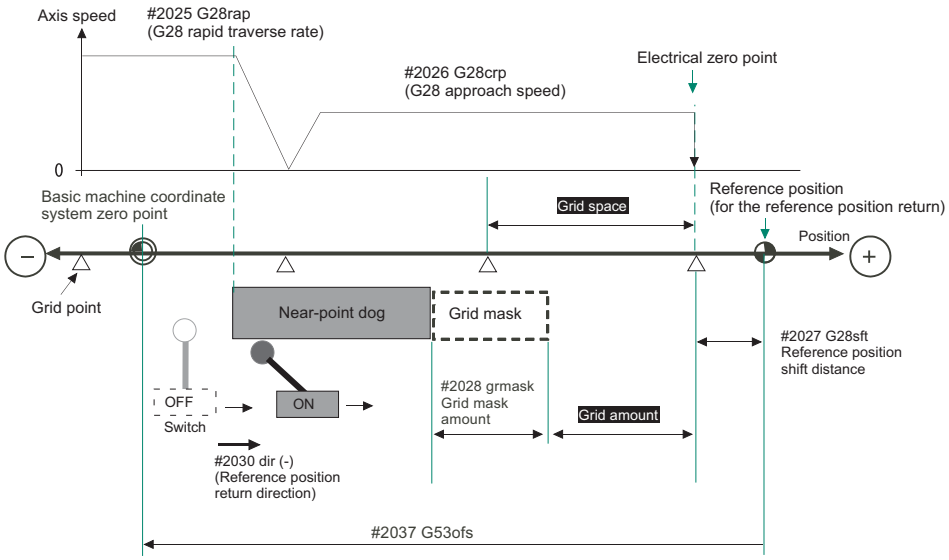
(10) Turn the power OFF and ON, and then execute the reference position return.

Note

- The axis moves at the speed set in "#2025 G28rap G28 rapid traverse rate".
  The parameter "#2025 G28rap G28 rapid traverse rate" is usually set to the maximum speed, which sets the reference position return to high-speed movement for the second pass and later. Take extra care for the safe axis movement.

(11) Set the machine coordinate system offset amount (#2037 G53ofs).

Terms and parameters related to the dog-type reference position return



[Electrical zero point]
The first grid point after the dog OFF.
If the grid point is at the position where the near-point dog is kicked OFF, the position of electrical zero point may be at the grid point where the dog is kicked OFF or at the next grid point because of the delay of the limit switch operation. This causes a deviation of reference position by the amount of the grid space.
Setting the grid mask amount ("#2028 grmask") prevents this deviation.

[Reference position]
The base for position and coordinate.
The axis is positioned to this position by the manual reference position return command or G28 command in the machining program.
The position is determined by shifting from the electrical zero point by the amount of "#2027 G28sft Reference position shift amount".

[Grid point]
The position encoder has a Z-phase that generates one pulse per rotation. The 0-point position of this Z-phase is the grid point.
Thus, there is a grid point per rotation of the position encoder, and the machine has many grid points at a regular pitch.
The grid point can be set at intervals of grid space by setting the grid space (#2029 grspc). Thus, multiple grid points can be set per encoder rotation.

[Grid amount]
The grid amount is the distance from where the near-point detection limit switch leaves the near-point dog to the grid point (electrical zero point) as the dog-type reference position return is executed.
The grid amount can be confirmed on the DRIVE MONITOR screen.
After setting the grid mask, the grid amount shows the distance from the grid mask OFF to the grid point.

[G28 rapid traverse rate (#2025 G28rap)]
Set the feedrate for dog-type reference position return in manual operation and the automatic operation.
The rapid traverse rate (#2001 rapid) is applied for the feedrate during the high-speed reference position return.

[G28 approach speed (#2026 G28crp)]
Set the approach speed to the reference position after decelerating to a stop by the near-dog detection. Since the G28 approach speed is accelerated and decelerated in steps (no-acceleration/deceleration), the mechanical shock, etc. could occur if the speed is too large. The G28 approach speed should be set between 100 and 300 mm/min., or within 500 mm/min. at the fastest.

[Reference position shift amount (#2027 G28sft)]
When shifting the reference position from the electrical zero point, set the shift amount.
The shifting direction can be set only in the reference position return direction.
If the reference position shift amount is "0", the grid point (electrical zero point) will be the reference position.

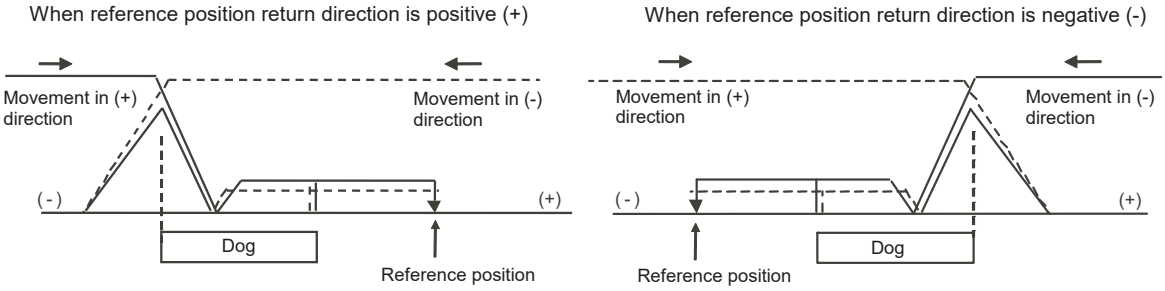
[Grid mask amount (#2028 grmask)]
The first grid point after the dog OFF is regarded as the electrical zero point.
If the grid point is at the position where the near-point dog is kicked OFF, the position of electrical zero point may be at the grid point where the dog is kicked OFF or at the next grid point because of the delay of the limit switch operation. This causes a deviation of reference position by the amount of the grid space. Thus, the position that the dog is kicked OFF needs to be at the approximate center of the grid space.
Adjustments are made by setting the grid mask amount or changing the near-point dog.
Setting the grid mask has the same effect as lengthening the near-point dog. Refer to the previous procedures for detailed setting.

[Grid space (#2029 grspc)]
Set the distance between grids.
Set either the ball screw pitch value (#2218 PIT) or the movement amount per motor rotation as the normal grid space. To make the grid space smaller, set a divisor of the grid space.

[Calculation method for movement amount per motor rotation]
- When linear feed mechanism is a ball screw:
  The movement amount per motor rotation = the motor side gear ration / the machine side gear ratio x the ball screw pitch
- When linear feed mechanism is a rack and pinion:
  The movement amount per motor rotation = the motor side gear ration / the machine side gear ratio x number of pinion gear teeth x the rack pitch
- For the rotary axis:
  The movement angle per motor rotation = the motor side gear ration / the machine side gear ratio x 360

[Reference position return direction (#2030 dir (-))]

This indicates the direction of the (axis) movement after the dog-type reference position return is executed and the limit switch kicks the dog and decelerates to a stop. Can be set to either positive "0" or negative "1".
Set to "0" if the reference position is in the positive direction from the near-point dog.
Set to "1" if the reference position is in the negative direction from the near-point dog.



[Axis with no reference position (#2031 noref)]

To perform a dog-type reference position return and absolute position detection for the axis, set to "0".
To perform a relative position detection without a reference position return for the axis, set to "1".

[Machine coordinate system offset (#2037 G53ofs)]

Set the amount to shift the basic machine coordinate system zero point position from the reference position.
When set to "0", the reference position will be the basic machine coordinate zero point.
In this parameter, set the position of the reference position looking from the basic machine coordinate system zero point with the coordinates of basic machine coordinate system. By the reference position return after the power is turned ON, the machine position will be set and the basic machine coordinate system will be established.

[Grid display type (#1229 set01/bit6)]

Select the grid display type on DRIVE MONITOR screen during dog-type reference position return.
0: Distance from dog OFF to electric zero point (including the grid mask amount)
1: Distance from dog OFF to electric zero point (excluding the grid mask amount)

24

Setting the Tool Entry Prohibited Area

Following functions are available for setting a tool entry prohibited area to detect over travels (OT).

(1) Stroke end

The axis movement is restricted by the signal that detects the stroke ends.

(2) Stored stroke limit

Prohibited areas are set with parameters.



When stroke end is set, the axis will move the distance required to decelerate and stop after the limit switch is activated.
When stored stroke limit is set, the axis will stop before the prohibited area of the stored stroke limit including the deceleration distance.
For safety, set the stroke end and also, the stored stroke limit.

> **⚠ WARNING**
>
> **Always set the stroke end and stored stroke limit. Failure to set this could result in collision with the machine end.**

24.1 Stroke End

The axis movement is restricted by the signal that detects the stroke ends.
Signal device No. is allocated by the following parameters.
Parameters "#2074" and "#2075" will be valid only when "#1226 aux10/bit5" is set to "1".

- #1226 aux10/bit5: Set to "1" (enables dog signal assignment).
- #2074 H/W OT+: Set the input device for assigning the OT (+) signal. (Setting range 0000 to 03FF (Hexadecimal))
- #2075 H/W OT-: Set the input device for assigning the OT (-) signal. (Setting range 0000 to 03FF (Hexadecimal))

Note

(1) When "OT IGNORED" (R248) signal is set to ON, the stroke end signal associated with a specific control axis can be ignored.

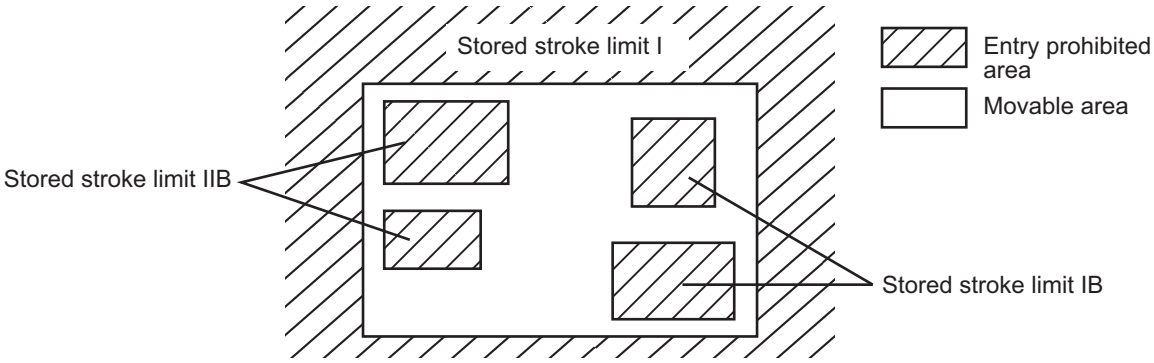
(2) When parameter "#1226 aux10/bit5" is set to "1", do not set the same device No. for parameters #2073 to #2075. Setting the same device No. may cause the emergency stop. However, the device number will not be checked for the axis which is set the signal to ignore (R248, R272).

24.2 Stored Stroke Limit

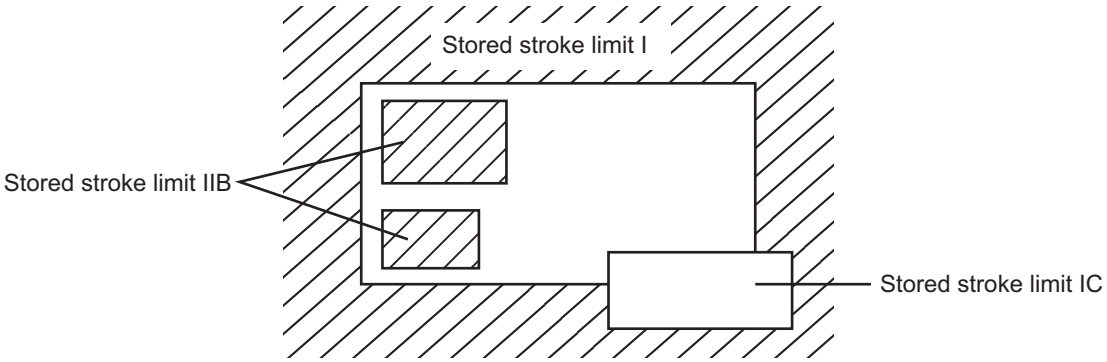
24.2.1 Outline

The axis can be stopped before entering the prohibited area by setting the axis entry prohibited area.
The inside or outside of the specified area can be set as the entry prohibited area.
There are "stored stroke limit I/II" where the outside of the specified area is the prohibited area, "stored stroke limit IB/IIB" where the inside of the specified area is the prohibited area, and "stored stroke limit IC" where the movable area is specified in the prohibited area.
Up to five entry prohibited areas can be set by combining them.

[Usage example 1]



[Usage example 2]



The axis decelerates to a stop before entering the prohibited area, and an alarm occurs.
The axis that caused the alarm can move only in the opposite direction in which it has just moved.

[Enabling conditions of stored stroke limit]

When the relative position detection system is used, the stored stroke limit is disabled until the reference position return is completed after the power is turned ON.

If "#2049 type" (Absolute position detection method) is set to "9", the stored stroke limit can be enabled even when the reference position return has not been completed.

Note

(1) If the absolute position detection is enabled when using the absolute position detection system, the stored stroke limit will be enabled immediately after the power is turned ON.

(2) The stored stroke limit is disabled for a sub axis during simple synchronous control.

[Stored stroke limit coordinates]

The stored stroke limit check is carried out in the basic machine coordinate system established by the reference position return.

When the stored stroke limit is enabled with the reference position return not been completed, the stored stroke limit check is executed with the basic machine coordinate system at the time of last power-OFF as temporary one.

When the 1st dog-type reference position return is completed after the power is turned ON, the proper coordinate system is established.

⚠ CAUTION

Always set the stored stroke limit. Failure to set this could result in collision with the machine end.

The prohibited areas of the stored stroke limit are set with parameters or program commands.

The upper and lower limits of the area are set with the coordinate values on the basic machine coordinate system for each axis. The stroke check will not be executed when the upper and lower limits are set to the same value.

This function is enabled only for axis whose reference position is established.

Before the axis enters the prohibited area, an operation error occurs, and the axis will stop moving.

The alarm can be reset by moving the erroneous axis in the opposite direction.

During automatic operation, if an alarm occurs with even one axis, all axes will decelerate to a stop.

During manual operation, only the axis that caused the alarm will decelerate to a stop.

The axis will always stop at a position before the prohibited area. The distance between the prohibited area and the stop position depends on the feedrate.

The stored stroke limits I, II, IIB, IB and IC are handled as follows.

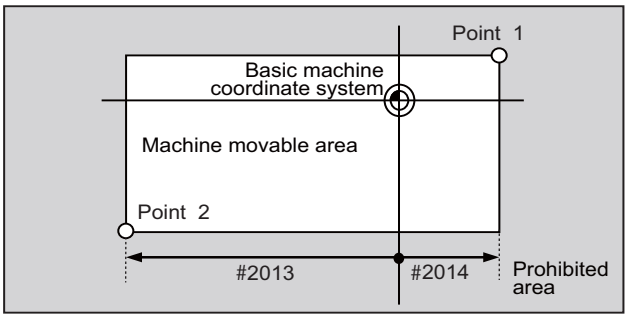
Type	Area	Set by	Area setting parameters	Related parameters
I	Outside prohibited	Machine tool builder	#2013 OT- (Soft limit I -) #2014 OT+ (Soft limit I +)	
II	Outside prohibited	User	#8204 OT-CHECK-N #8205 OT-CHECK-P	• #8202 OT-CHECK OFF: 0 • #8210 OT INSIDE: 0
IIB	Inside prohibited	User	#8204 OT-CHECK-N #8205 OT-CHECK-P	• #8202 OT-CHECK OFF: 0 • #8210 OTINSIDE: 1
			#8231 OT-CHECK[2]-N #8232 OT-CHECK[2]-P	• #8230 OT-CHECK[2] OFF: 0 • #8210 OT INSIDE: 1
IB	Inside prohibited	Machine tool builder	#2061 OT_1B- (Soft limit IB-) #2062 OT_1B+ (Soft limit IB+)	• #2063 OT_1Btype (Soft limit IB type) : 0 (IB enabled)
			#2706 OT_1B[2]- (Soft limit IB[2]-) #2707 OT_1B[2]+ (Soft limit IB[2]+)	• #2063 OT_1Btype (Soft limit IB type) : 0 (IB enabled)
IC	Inside allowed	Machine tool builder	#2061 OT_1B- (Soft limit IB-) #2062 OT_1B+ (Soft limit IB+)	• #2063 OT_1Btype (Soft limit IB type) : 2 (IC enabled)

Note

(1) The stored stroke limit is disabled for axis where the reference point is not established.
(2) The stored stroke limit is disabled for axis where the same values are set to the upper and lower limits of the area setting parameters.
(3) When the stored stroke limit I and II are used together, the overlap of the areas designated by them (I and II) is the movable area.
(4) The stored stroke limit IB and IC cannot be used together.

24.2.2 Stored Stroke Limit I

This is a stroke limit function used by the machine tool builder. Boundaries are set by the parameters "2013 OT-" and "#2014 OT+". The outside of the set boundary is the prohibited area.
When used with the stored stroke limit II function, the tolerable area by both functions is the movable area.



Set the coordinate value of the basic machine coordinate system in the following parameters.
Point 1: #2014 OT+
Point 2: #2013 OT-

Note

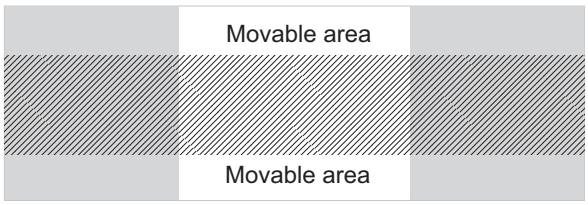
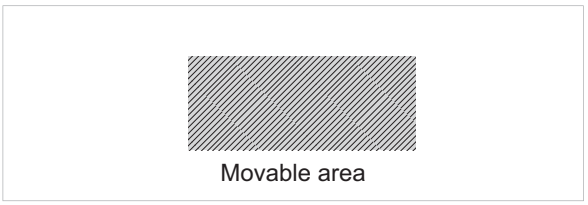
(1) This function will be disabled if the same value (other than "0") is set for both "#2013 OT-" and "#2014 OT+".

24.2.3 Stored Stroke Limit II

Boundaries are set by the axis parameters "#8204 OT-CHECK-N" and "#8205 OT-CHECK-P" or with program commands. Either the inside or the outside of the set boundary is the prohibited area. Whether to prohibit the inside or outside of the area is determined by "#8210 OT-INSIDE". When the inside is prohibited, this function is called stored stroke limit IIB.
When using program commands, entry of the tool into the prohibited area is prohibited with G22, and entry into the prohibited area is enabled with G23.
The stored stroke limit II function can be disabled for each axis by setting "#8202 OT-CHECK OFF" to "1".

When "#8210 OT INSIDE" is set to "1" (IIB enabled), a prohibited area can be set in addition to the area described above. Boundaries of the additional area are set by the parameters "#8231 OT-CHECK[2]-N" and "#8232 OT-CHECK[2]-P". The inside of the set boundary is the prohibited area.
The boundaries of the additional area cannot be set with the program commands (G22/G23).
The stored stroke limit IIB function of the additional area can be disabled for each axis by setting "#8230 OT-CHECK[2] OFF" to "1".
When "#8210 OT INSIDE" is set to "0" (II enabled), the stored stroke limit IIB function of the additional area is disabled. The setting values of "#8230 OT-CHECK[2] OFF", "#8231 OT-CHECK[2]-N" and "#8232 OT-CHECK[2]-P" are ignored.

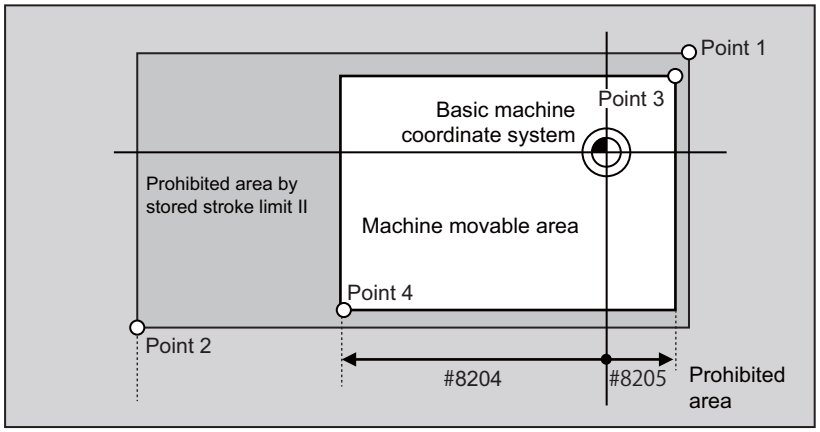
"#8210 OT INSIDE" can be set for each axis. The operation is as follows when the combined settings are used.

Horizontal axis: X Vertical axis: Z		Movement prohibited area	
X	Outside prohibited		(*1)
Z	Outside prohibited		
X	Outside prohibited		(*1)
Z	Inside prohibited		
X	Inside prohibited		(*2)
Z	Inside prohibited		

(*1) When the outside area is prohibited for even one of X and Z axes, the prohibited area is the entire area specified for the X and Z axes.
(*2) When the inside area is prohibited for both X and Z axes, the prohibited area is the overlap of the areas specified for the X and Z axes.

[Stored stroke limit II (When outside area is prohibited)]

When this function is used with the stored stroke limit I, the tolerable area by both functions is the movable area.



Set the coordinate value of the basic machine coordinate system in the following parameters.

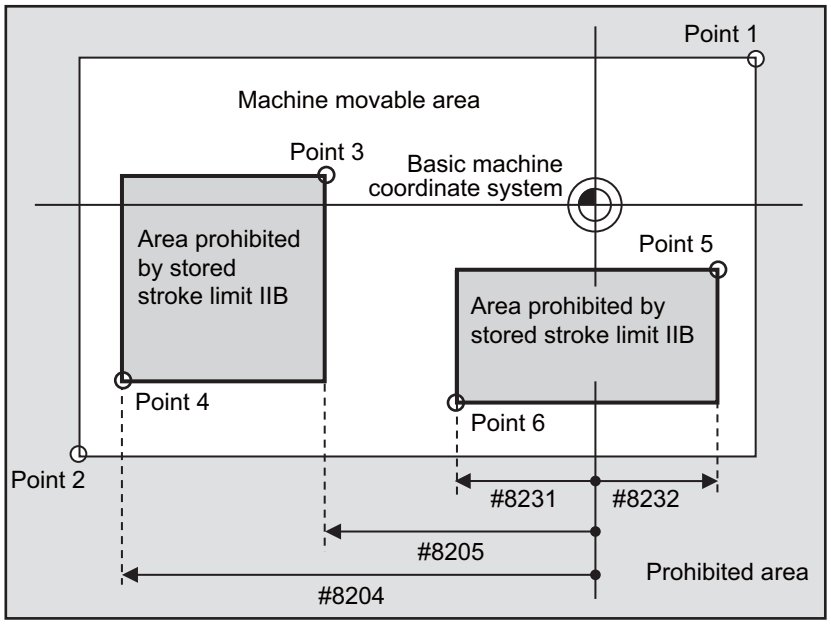
Point 3: #8205 OT-CHECK-P

Point 4: #8204 OT-CHECK-N

The area determined by points 1 and 2 is the prohibited area set by the stored stroke limit I.

[Stored stroke limit IIB (When inside area is prohibited)]

An area except for that of the stored stroke limit I becomes the movement prohibited area.



Set the coordinate value of the basic machine coordinate system in the following parameters.

Point 3: #8205 OT-CHECK-P

Point 4: #8204 OT-CHECK-N

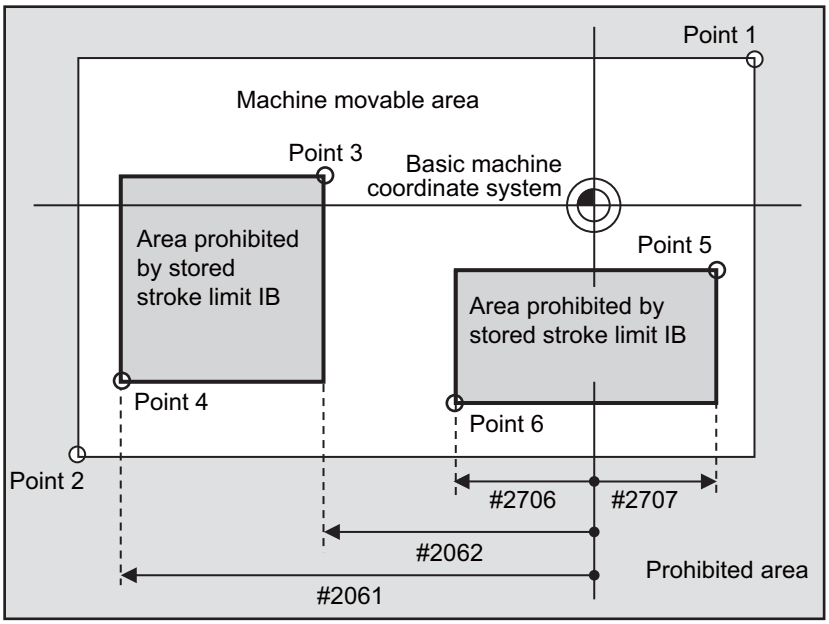
Point 5: #8232 OT-CHECK[2]-P

Point 6: #8231 OT-CHECK[2]-N

The area determined by points 1 and 2 is the prohibited area set by the stored stroke limit I.

24.2.4 Stored Stroke Limit IB

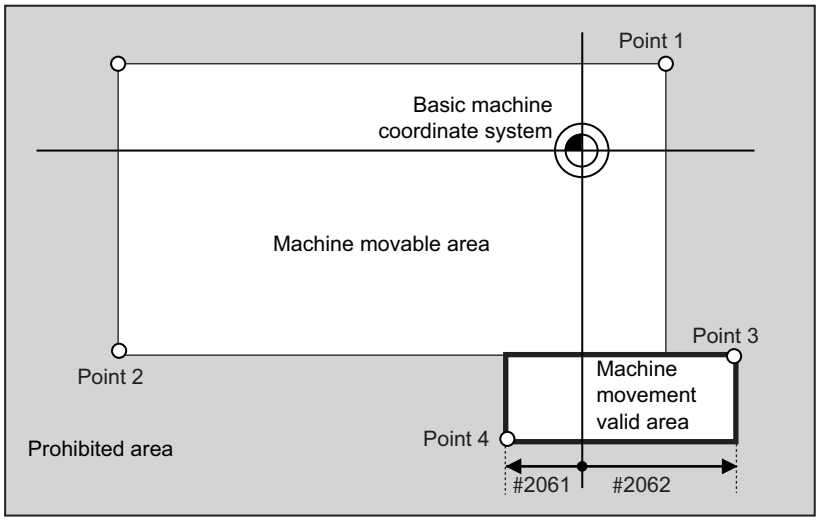
When the stored stroke limit IB is enabled, up to two prohibited areas can be set.
Boundaries are set for each axis with the parameters "# 2061 OT_1B-", "# 2062 OT_1B+", "2706 OT_1B[2]-" and "#2707 OT_1B[2]+". The inside of the set boundary is the prohibited area.
This function is enabled when the parameter "#2063 OT_1Btype" is set to "0".



Set the coordinate value of the basic machine coordinate system in the following parameters.
Point 3: #2062 OT_1B+
Point 4: #2061 OT_1B-
Point 5: #2707 OT_1B[2]+
Point 6: #2706 OT_1B[2]-
The area determined by points 1 and 2 is the prohibited area set by the stored stroke limit I.

24.2.5 Stored Stroke Limit IC

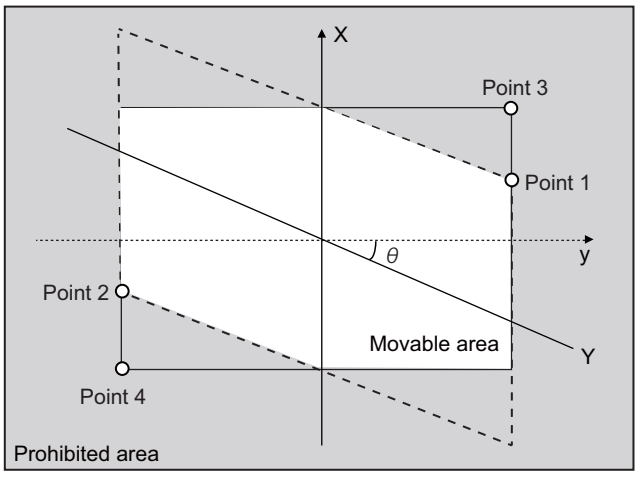
Boundaries are set for each axis with the parameters "#2061 OT_1B-" and "#2062 OT_1B+". The inside of the set boundary is the machine movement valid area.
This function is enabled when the parameter "#2063 OT_1Btype" is set to "2". It cannot be used with the soft limit IB.



Set the coordinate value of the basic machine coordinate system in the following parameters.
Point 3: #2062 OT_1B+
Point 4: #2061 OT_1B-
The area determined by points 1 and 2 is the prohibited area set by the stored stroke limit I.

24.2.6 Movable Area during Inclined Axis Control

By setting "#2063 OT_1Btype" to "3", the inclined axis can be checked with the program coordinates using the area set for stored stroke limit IB/IC ("#2061" and "#2062"). The stored stroke limit IB and IC cannot be used together at this time.
By using this function with stored stroke limit I, the check can be carried out simultaneously with the actual axis and program coordinate value. In this case, the area that does not fit into either of the following two prohibited areas will be the movable area.



X: Actual X axis
Y: Actual Y axis
y: Program Y axis
θ: Inclined angle

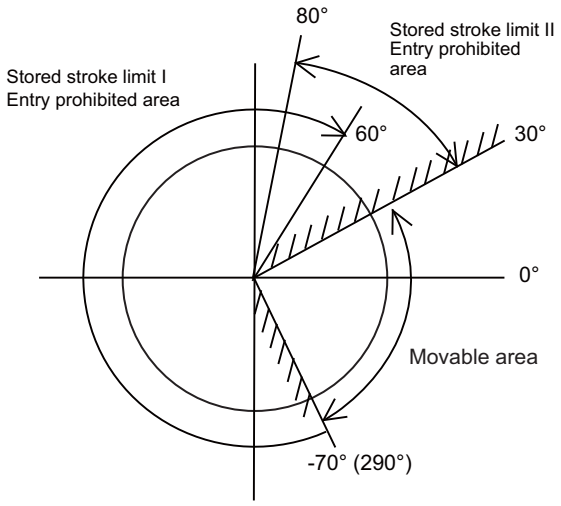
Set the coordinate value of the basic machine coordinate system in the following parameters.
Point 3: #2062 OT_1B+
Point 4: #2061 OT_1B-
The area determined by points 1 and 2 is the prohibited area set by the stored stroke limit I.

To use this function, the optional specification of stored stroke limit IC is required.

24.2.7 Stored Stroke Limit for Rotation Axis

Stored stroke limits I and II are used as the stored stroke limit for the rotation axis. The area between the maximum and minimum values of the prohibited area's parameters, which does not contain the 0 point of the basic machine coordinate system, is the entry prohibited area.
The prohibited area parameters for the rotary axis can be set to establish "maximum value" < "minimum value" ("#2014 OT+" < "#2013 OT-", "#8205 OT-CHECK-P" < "#8204 OT-CHECK-N"). This will be handled the same as if "maximum value" > "minimum value" ("#2014 OT+" > "#2013 OT-", "#8205 OT-CHECK-P" > "#8204 OT-CHECK-N").

(Example) Stored stroke limit I (maximum value and minimum value of prohibited area parameter)
#2013 OT -: -70.000°
#2014 OT +: 60.000°
Stored stroke limit II (maximum value and minimum value of prohibited area parameter)
#8204 OT-CHECK-N: 30.000°
#8205 OT-CHECK-P: 80.000°



Note

(1) Do not use stored stroke limits IB, IIB or IC.
Disable stored stroke limits IB, IIB and IC by setting the parameters as shown below.
#8210 OT INSIDE: 0 (stored stroke limit II enabled, IIB disabled)
#2061 and #2062 are set to same value (stored stroke limits IB and IC disabled)

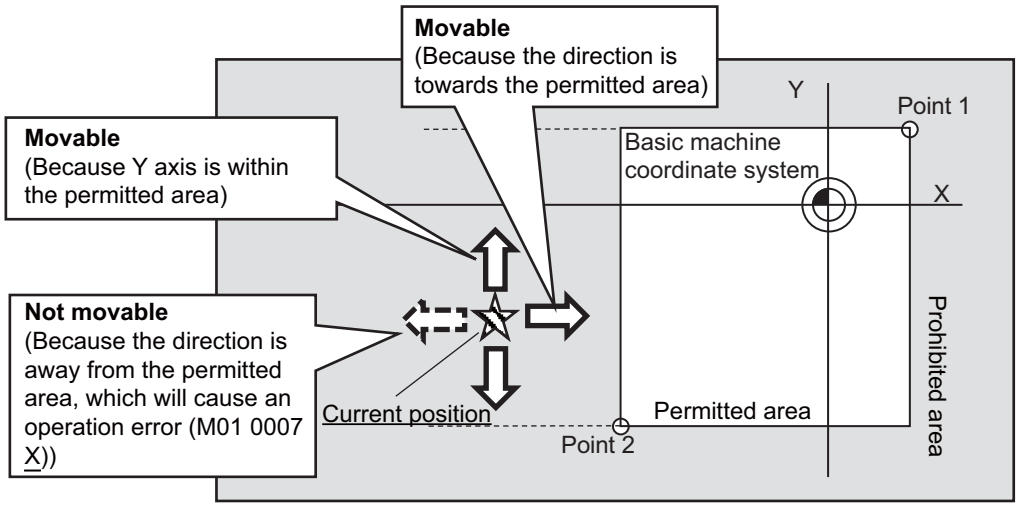
24.2.8 Changing the Area for the Stored Stroke Limit I

The area of the stored stroke limit I can be changed to the value set to R register for each axis.
When the "Stored stroke limit I change request" signal is ON, the area of stored stroke limit changes. Changing the area for the stored stroke limit I is also possible during automatic operation. Also, the current settings for the stored stroke limit I can be checked with the R register values.
Refer to "PLC Programming Manual" and "PLC Interface Manual" for details.

24.2.9 Behavior in Prohibited Area

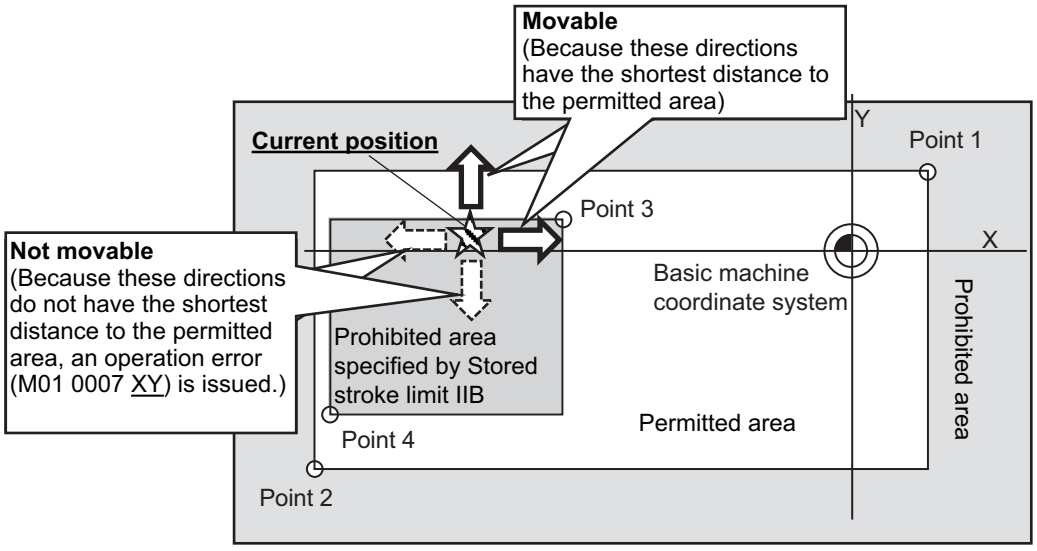
24.2.9.1 Stored Stroke Limits I, IC, and II

When the tool has entered the prohibited area of stored stroke limit I, IC, or II, the operation error (M01 0007) occurs.
When the operation error occurs, only the axis that is within the prohibited area is prevented from moving away from the permitted area.
In the example below, the X coordinate of the current position is within the prohibited area. So the movement in the X(-) direction is disabled because the direction is not towards the permitted area.
The Y coordinate of the current position is within the permitted area. So the movement in the Y direction is permitted within the permitted area even though the tool is inside of the prohibited area.



24.2.9.2 Stored Stroke Limits IB and IIB

With stored stroke limits IB and IIB, the tool can be restricted from moving within the prohibited area with the parameter "#1711 cfg11/bit1" (disable movement in stored stroke limit IB/IIB prohibited area).
When this parameter is ON, the tool is only allowed to move along each axis in the direction closer to the permitted area.
When an attempt is made to move an axis in the direction that has the longer distance to the permitted area, the operation error (M01 0007) is issued, which disables the movement.
The alarm can be canceled through NC reset or by moving the axis in the direction that has the shorter distance to the permitted area. The function of disabling movement in the prohibited area is supported by stored stroke limits IB and IIB. It will not work for the prohibited area of stored stroke limit I, IC or II.

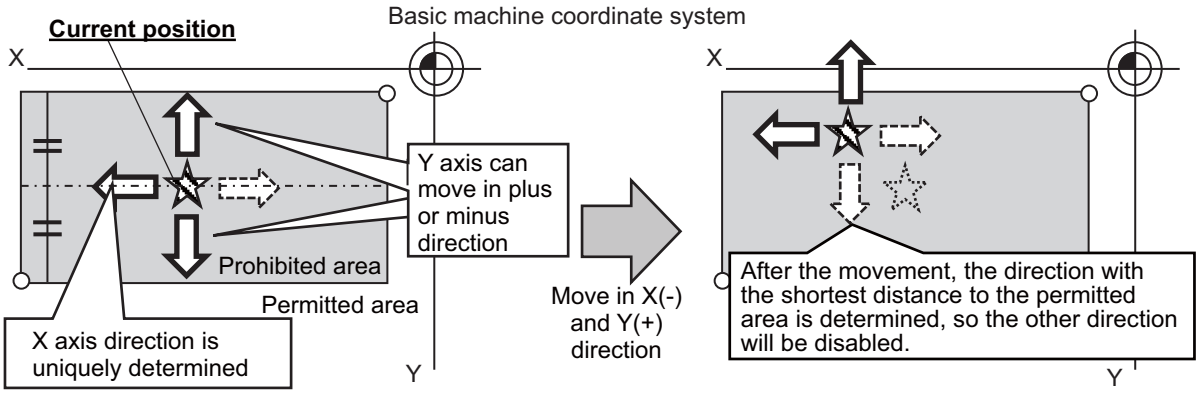


Note

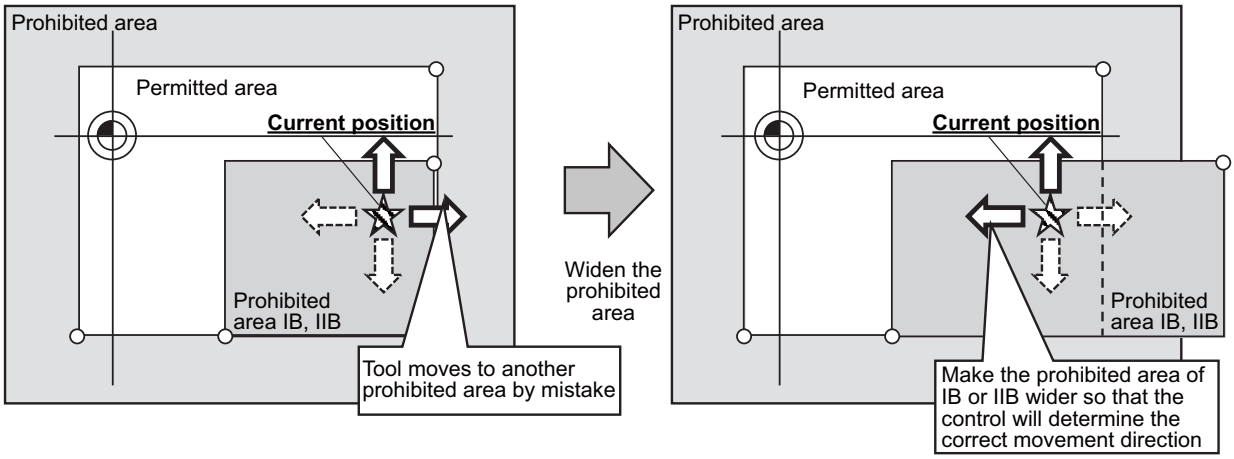
(1) The function of disabling movement in the prohibited area works while the tool is within the prohibited area of stored stroke limit IB or IIB. The function does not disable any movement within the permitted area (including the boundary).

(2) All the axes for which the function disables movement are indicated in the alarm guidance.

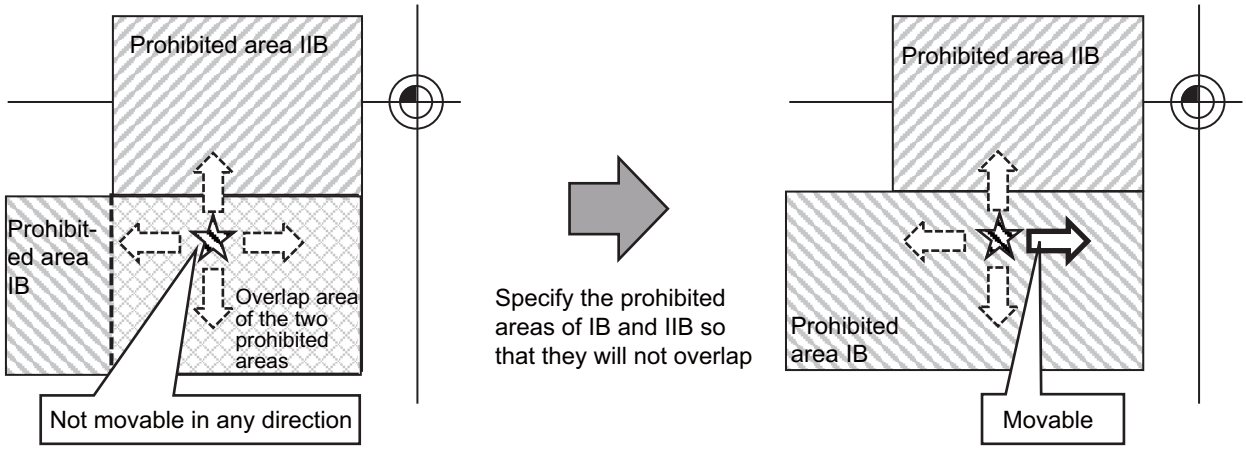
(3) If the tool is at the center of the prohibited area, as illustrated below, the distances to the permitted areas in both the positive and negative directions are equal. In this case, the tool can move in either direction. Note that when the direction that has the shorter distance to the permitted area is uniquely determined as a result of the tool movement, the function will disable movement in all the directions except for the said direction.



(4) If the stored stroke limit IB/IIB function is used together with the stored stroke limit function that does not support this function, the tool may be allowed to move towards the prohibited area of the combined stored stroke limit function, as illustrated below. To prevent this, it is recommended to set the areas of stored stroke limit IB and IIB to be large enough.



(5) As illustrated below, when stored stroke limit IB and IIB are used together, tool movement may be disabled entirely if the tool enters the overlap of the two prohibited areas. To prevent this, configure the prohibited areas of stored stroke limit IB and IIB so as not to overlap with each other. (If misconfiguration results in the tool entering the overlap of the two prohibited areas, disable stored stroke limit IIB to move the tool.)



24.2.10 Precautions

(1) When stored stroke limit is enabled, the control axis always decelerates to a stop at a position before the prohibited area, and normally the tool does not enter the prohibited area. However, in the following cases, the tool may enter the prohibited area.

- The control axis is in a servo-off state (the servo motor has no drive power) near the boundary between the permitted area and the prohibited area, and the tool enters the prohibited area due to an external factor (falls by gravity, etc.).
- The area setting parameters ("#2013 OT-", "#2014 OT+", etc.) and the enabling condition parameters ("#8202 OT-CHECK OFF", "#2063 OT_1Btype", etc.) of stored stroke limit are changed to a area including coordinates of the tool.
- "#1088 G30SL" (Disable G30 soft limit), "#1116 G30SLM" (Invalidate soft limit) and "#2022 G30SLX" (Validate soft limit (automatic and manual)) are set to "0" (enabled).
- "#1261 set33/bit5" (Operation switch at OT and soft limit in synchronous operation method) is set to "0".
- "#1444 otsys" (Stop all part systems at OT) is set to "0" (Stop each part system).

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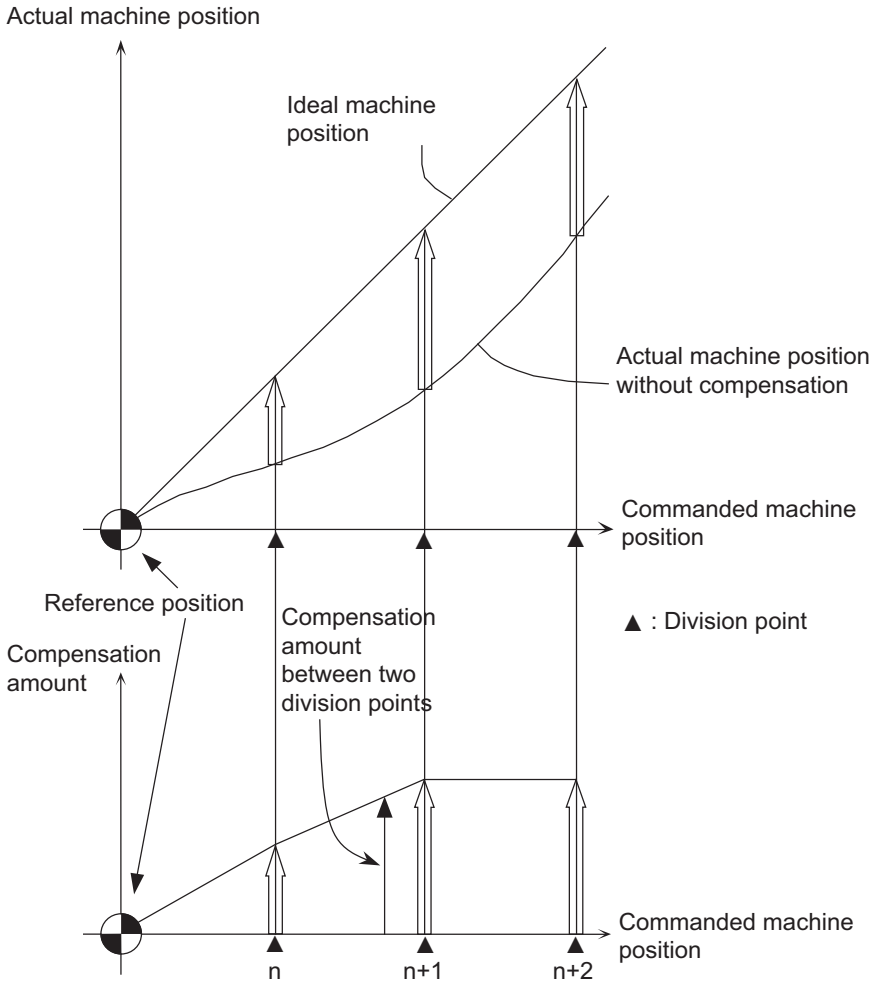
Setting the Machine Error Compensation

25.1 Memory-type Pitch Error Compensation/Memory-type Relative Position Error Compensation

25.1.1 Outline

Memory-type pitch error compensation

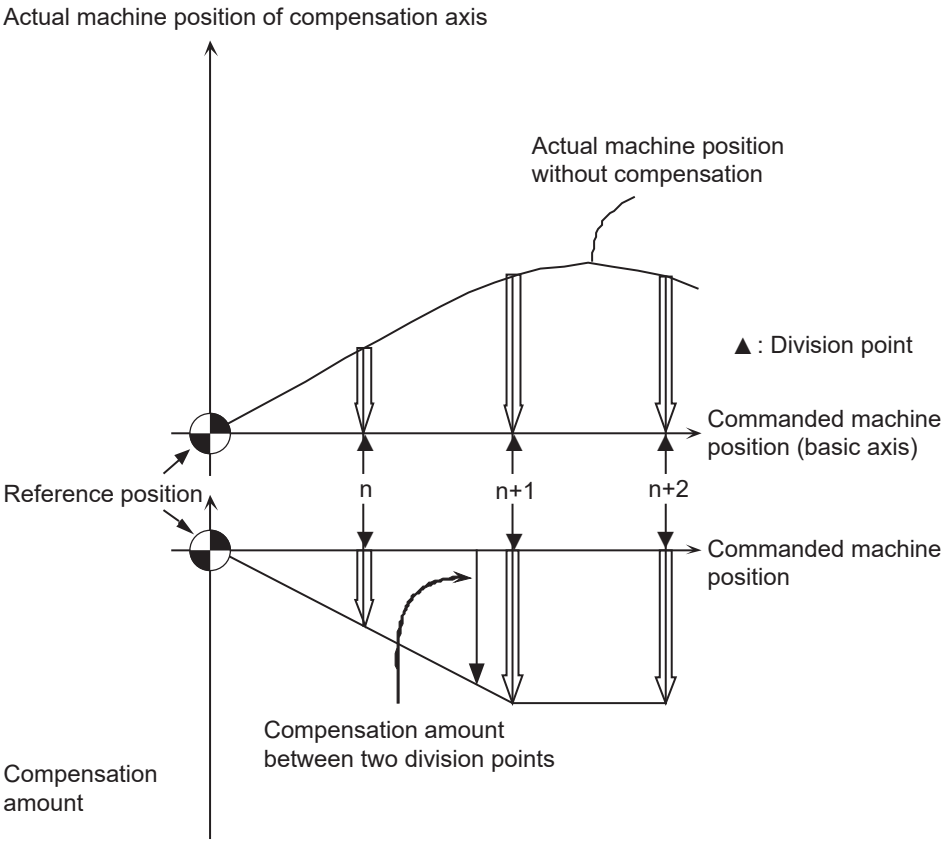
According to the specified parameters, this method compensates an axis feed error caused by a ball screw pitch error, etc. You can set the compensation amount for each division point obtained by equally dividing the machine coordinates based on the reference position. (See the figure below.)
The compensation amount can be set by either the absolute or incremental amount method. Select the method with "#4000 Pinc".
Machine position between division points "n" and "n+1" is smoothly compensated by the linear approximation of the compensation amount.



Relationship between the compensation amount and machine position

Memory-type relative position error compensation

This function compensates the relative position error between two orthogonal axes caused by deflection of the moving according to the specified parameters.
You can set compensation amount in the compensated axis direction for each division point obtained by equally dividing the machine coordinates of the basic axis. (See the figure below.)
"Basic axis" refers to the one axis of two orthogonal axes on which relative position compensation is made. This axis is used as the criterion for relative-error measurement. "Compensation axis" refers to the coordinate axis that is orthogonal to the basic axis. The compensation is actually made for this coordinate axis.
Machine position between division points "n" and "n+1" is smoothly compensated by the linear approximation of the compensation amount.



Relationship between the compensation amount and machine position

25.1.2 Setting Compensation Data

There are two methods for setting the compensation data: absolute amount method and incremental amount method.
"#4000 Pinc"

0: Absolute amount method

1: Incremental amount method

Absolute amount method

When you feed an axis from the reference position to each division point, calculate and set the compensation amount using the following formula.

Compensation amount = (Commanded position - Actual machine position) × 2

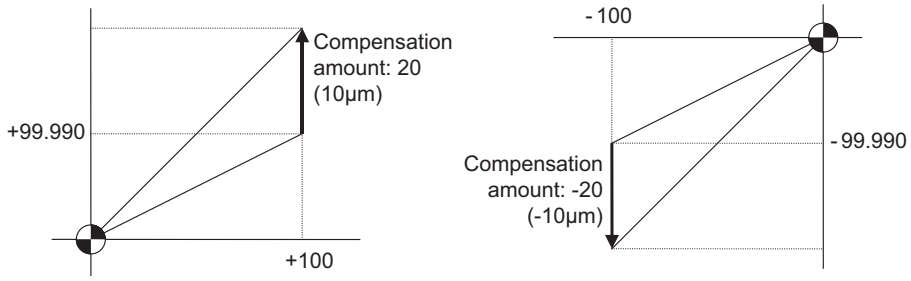
The unit of compensation amount depends on the setting of machine error compensation unit ("#1006 mcmpunit").
The following shows examples when #1006 is set to "B".

(Example 1) Feeding an axis from the reference position to a position of +100 mm (See left figure below)

When the actual machine position is 99.990 mm, the compensation amount at the +100 mm position is "20".
(100000 - 99990) × 2 = 20

(Example 2) Feeding an axis from the reference position to a position of -100 mm (See right figure below)

When the actual machine position is -99.990 mm, the compensation amount at the -100 mm position is "-20".
(-100000 - (-99990)) × 2 = -20

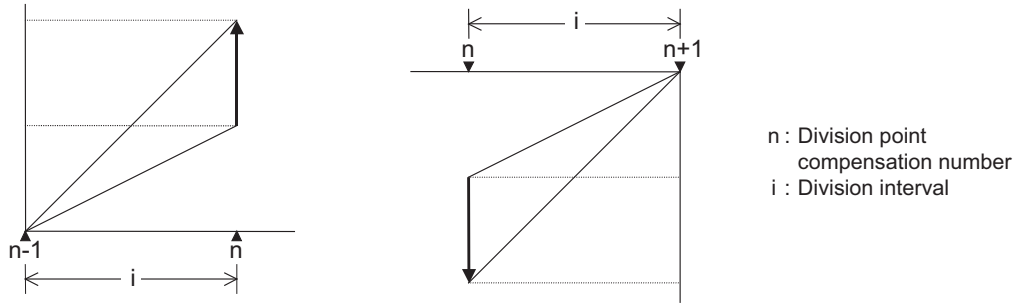


Incremental amount method

Here, the compensation amount at division point "n" is calculated for the axis moved by the "interval between division points" as specified by #4007. The formula used to calculate compensation amount will differ depending on whether division point "n" is on the positive side or the negative side from the reference position.

[On the positive side]
Actual travel amount = (Actual machine position of division point "n") - (Actual machine position of division point "n-1") (See left figure below)
Compensation amount = (Interval between division points - Actual travel amount) × 2
[On the negative side]
Actual travel amount = (Actual machine position of division point "n") - (Actual machine position of division point "n+1") (See right figure below)
Compensation amount = (Interval between division points + Actual travel amount) × 2

In both cases, the unit of compensation amount depends on the setting of the machine error compensation unit ("#1006 mcmpunit").

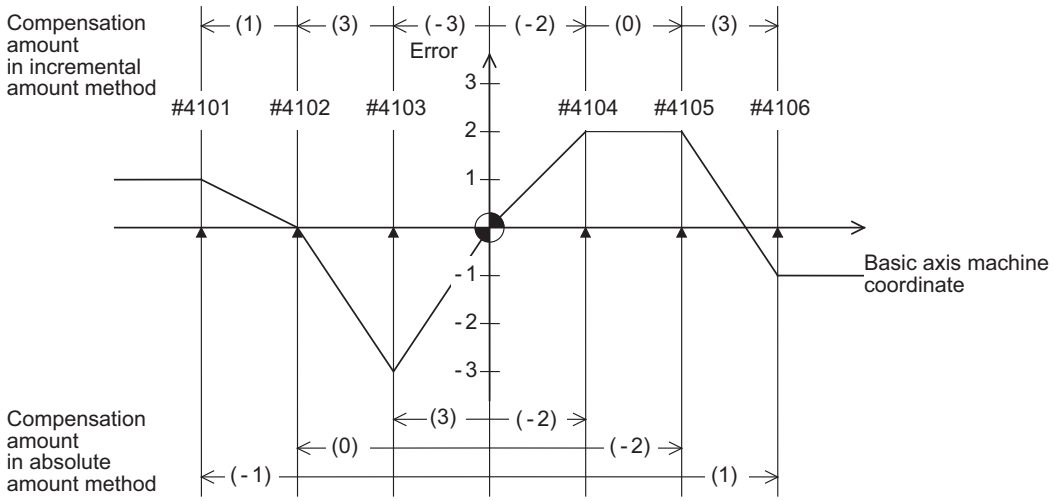


Unit of compensation amount : Machine error compensation unit (#1006)
Range of compensation amount : -32768 to 32767

25.1.3 Setting Method

25.1.3.1 Using a Linear Axis as Basic Axis

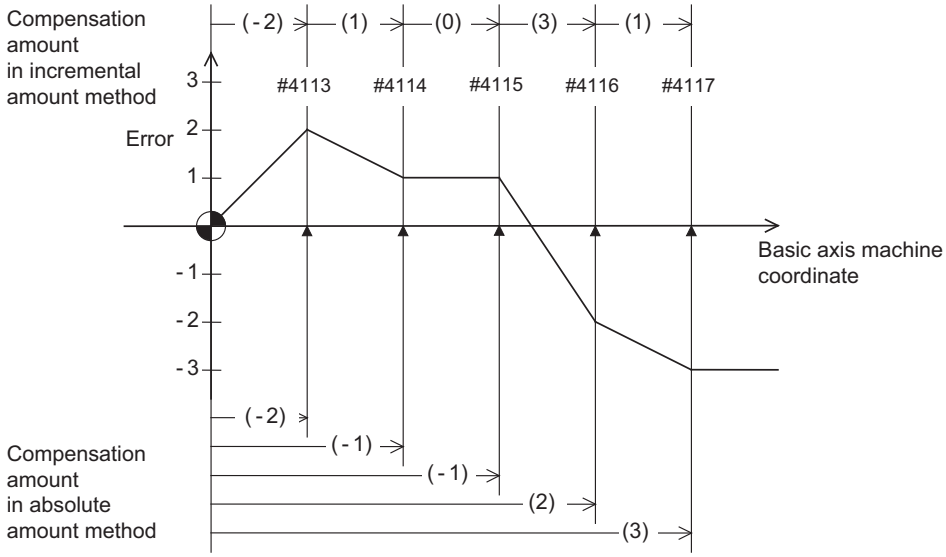
When "mdvno" or "pdvno" exists at both ends of "rdvno"



Division point number		#4101	#4102	#4103	#4104	#4105	#4106		rdvno	4103
Specified machine position		-300.000	-200.000	-100.000	100.000	200.000	300.000		mdvno	4101
Real machine position		-299.999	-200.000	-100.003	100.002	200.002	299.999		pdvno	4106
Compensation amount	Incremental amount method	2	6	-6	-4	0	6		spcdv	100.000
	Absolute amount method	-2	0	6	-4	-4	2			

Compensation beyond the setting range ("mdvno" to "pdvno") will be based on the compensation amount at "mdvno" or "pdvno".

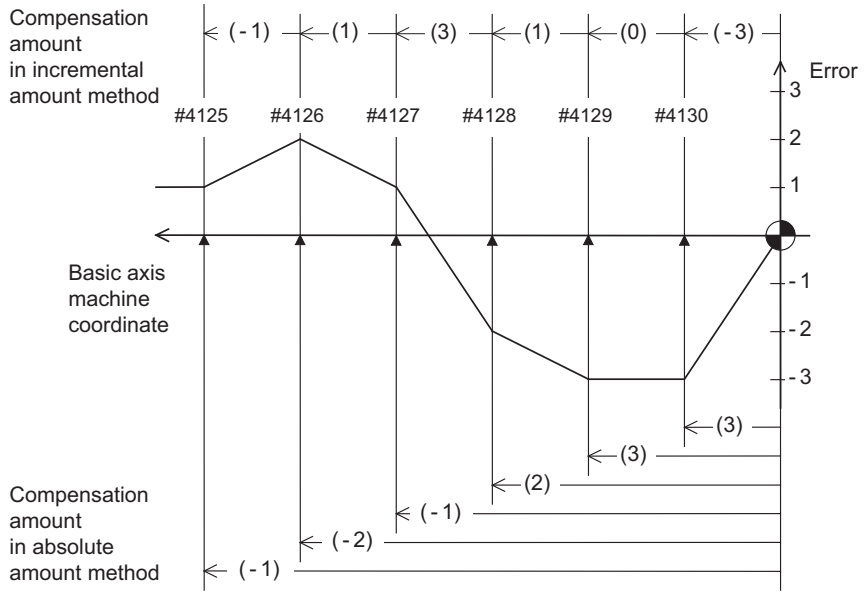
When the range compensated is only the positive range



Division point number		**#4113**	**#4114**	**#4115**	**#4116**	**#4117**		rdvno	4112
Compensation amount	**Incremental amount method**	-4	2	0	6	2		mdvno	4113
	Absolute amount method	-4	-2	-2	4	6		pdvno	4117

Compensation for machine positions beyond "pdvno" will be based on the compensation amount at "pdvno". If the machine position is on the negative side in this case, no compensation will be executed.

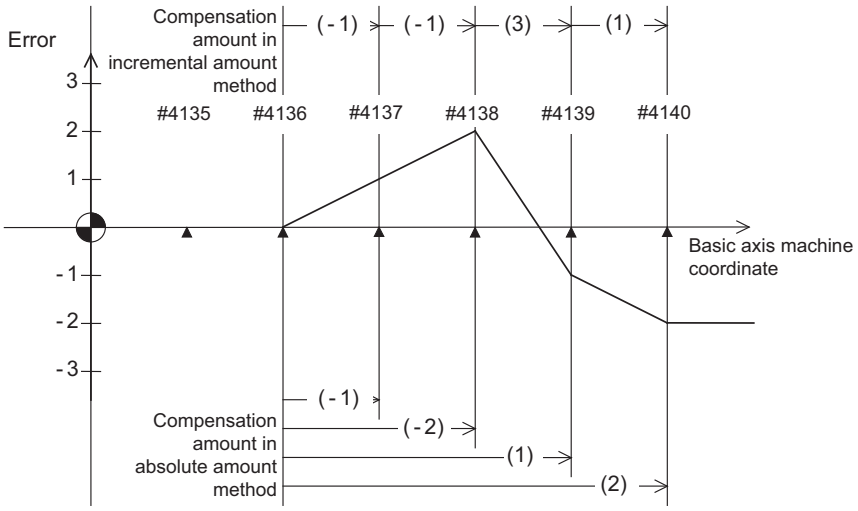
When the range compensated is only the negative range



Division point number		#4125	#4126	#4127	#4128	#4129	#4130		rdvno	4130
Compensation amount	Incremental amount method	-2	2	6	2	0	-6		mdvno	4125
	Absolute amount method	-2	-4	-2	4	6	6		pdvno	4130

Compensation for machine positions beyond "mdvno" will be based on the compensation amount at "mdvno".

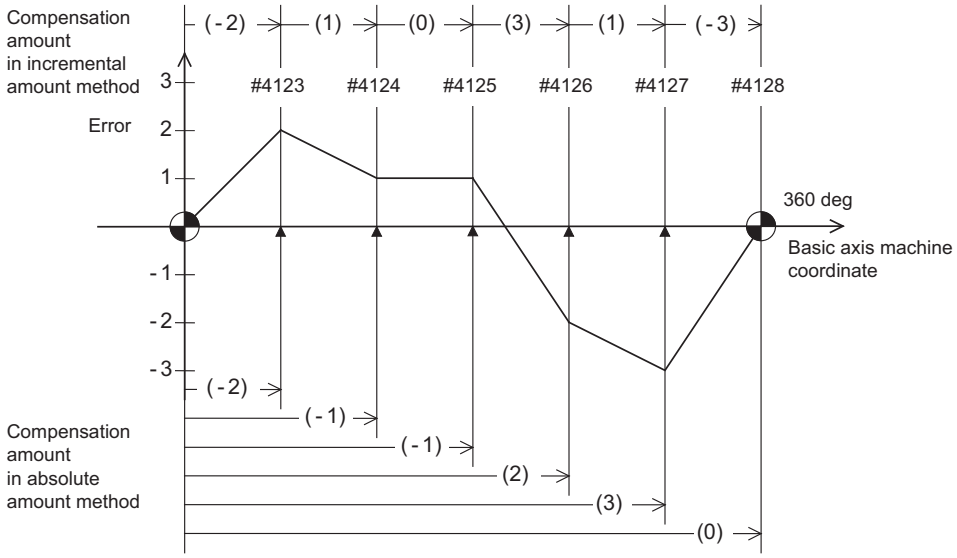
When compensation is executed in a range that contains no reference position



Division point number		**#4135**	**#4136**	**#4137**	**#4138**	**#4139**	**#4140**		rdvno	4134
Compensation amount	**Incremental amount method**			-2	-2	6	2		mdvno	4136
	Absolute amount method			-2	-4	2	4		pdvno	4140

In this case, compensation is executed in the range from "mdvno" to "pdvno".
This setting is also applied to the compensation executed in an range in which a machine position is negative and a reference position is not included.

25.1.3.2 Using a Rotary Axis as Basic Axis



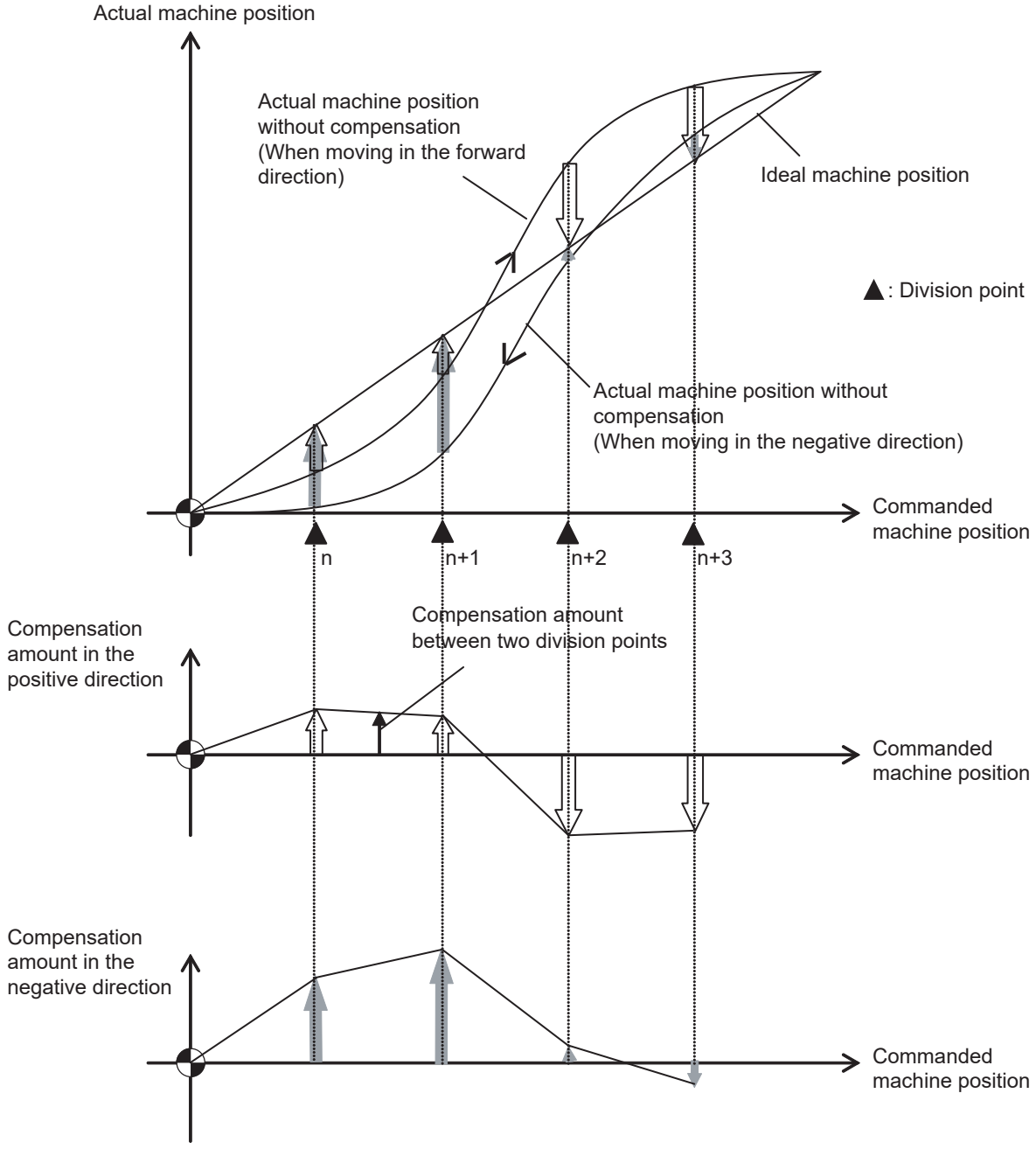
Division point number		#4123	#4124	#4125	#4126	#4127	#4128		rdvno	4122
Compensation amount	Incremental amount method	-4	2	0	6	2	-6		mdvno	4123
	Absolute amount method	-4	-2	-2	4	6	0		pdvno	4128

The sum of the compensation amounts set with the incremental amount method is always "0".
In the absolute amount method, the compensation amount at the terminal point (360 degrees) is always "0".

25.2 Bidirectional Pitch Error Compensation

25.2.1 Outline

Compensation amounts can be set respectively for the movement in positive and negative directions, and compensation can be made for each direction. This method will reduce the difference between the path in the positive direction and path in the negative direction.
You can set the compensation amount for each division point obtained by equally dividing the machine coordinates based on the reference position. (See the figure below.)
The compensation amount can be set by either the absolute or incremental amount method. Select the method with "#4000 Pinc".
Machine position between division points "n" and "n+1" is smoothly compensated by the linear approximation of the compensation amount.



Relationship between the compensation amount and machine position

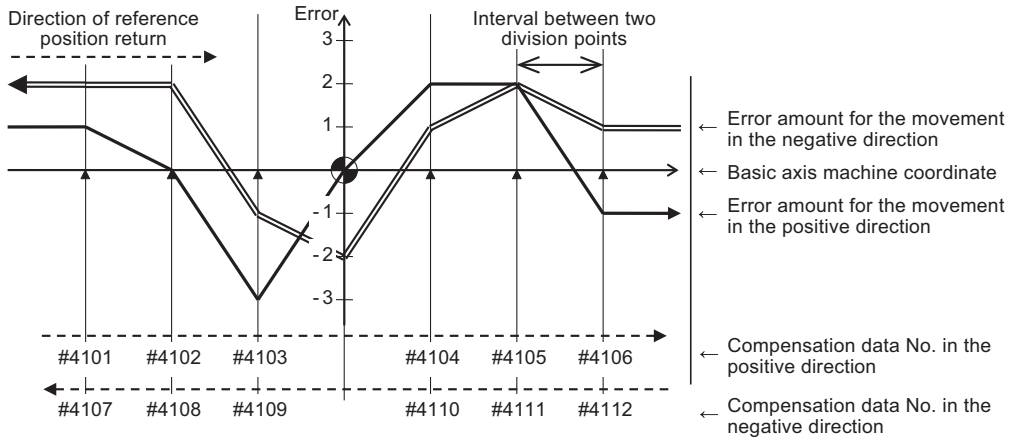
25.2.2 Setting Method

25.2.2.1 Using a Linear Axis as Basic Axis

This section describes how to set bidirectional pitch error data by taking the linear axis having a pitch error such as illustrated below as an example.

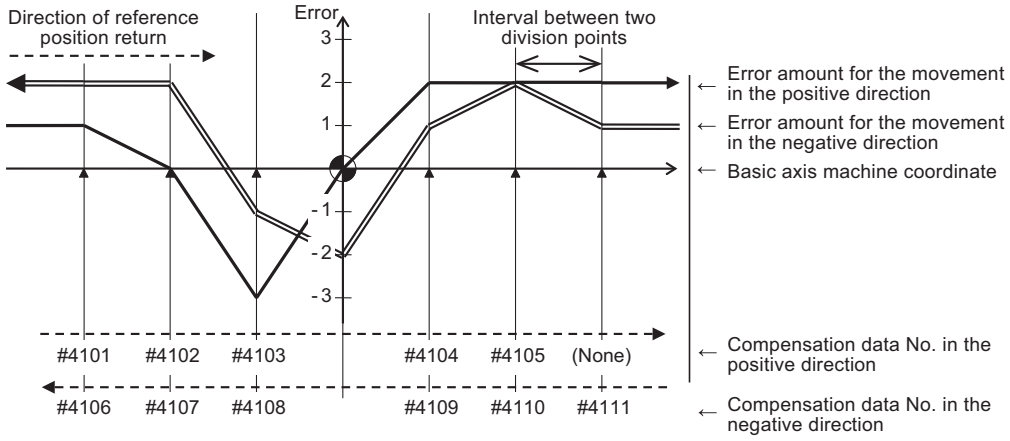
Allocating compensation No.

As shown in the figure below, compensation range is divided into equal intervals based on the reference position, and compensation data Nos. are allocated for each movement in positive and negative directions.
For both positive and negative directions, numbers are allocated from the division point on the most negative side toward the positive side. (The figure shows an example of allocating #4101 to # 4106 in the positive direction and #4107 to #4112 in the negative direction.)
No compensation data No. is allocated to the reference position.



Bidirectional pitch error (linear axis)

Make sure to allocate the same number of compensation data to division points for positive and negative directions.
When the odd number of compensation data are set, compensation points allocated to the positive direction become one point less than that of the negative direction. For example, in the following figure, the division point indicated with "(None)" has no allocated compensation No. Accordingly, the compensation data of the previous compensation No. (#4105) is also used for the division point indicated with "(None)".



Bidirectional pitch error having odd number of compensation points (linear axis)

Setting parameters

(1) Set the setting method for compensation amount to "#4000 Pinc".

#4000 setting value	Setting method
0 (Absolute amount method)	This method sets the difference between the commanded position and the actual machine position of each division point as the compensation amount.
1 (Incremental amount method)	This method sets the difference between the commanded travel amount and the actual travel amount when the axis moved from the adjacent division point as the compensation amount.

(2) Set the axis name to be compensated to "#4001 cmpax". Set the same axis name to "#4002 drcax" as well.

(3) From the division points in the positive direction, set the compensation No. of the division point which is one point in the negative direction from the reference position to "#4003 rdvno".

(4) Set the first and the last compensation Nos. allocated to division points to "#4004 mdvno" and "#4005 pdvno", respectively.

(5) Set the compensation factor to "#4006 sc".

(6) Set the interval between division points to "#4007 spcdv".

(7) Set "#4008 twopc" to "1". The function bidirectional pitch error compensation is enabled.

(8) For "#4009 refcmp", set to the following compensation amounts after measuring the actual machine position in "Setting pitch error compensation data".

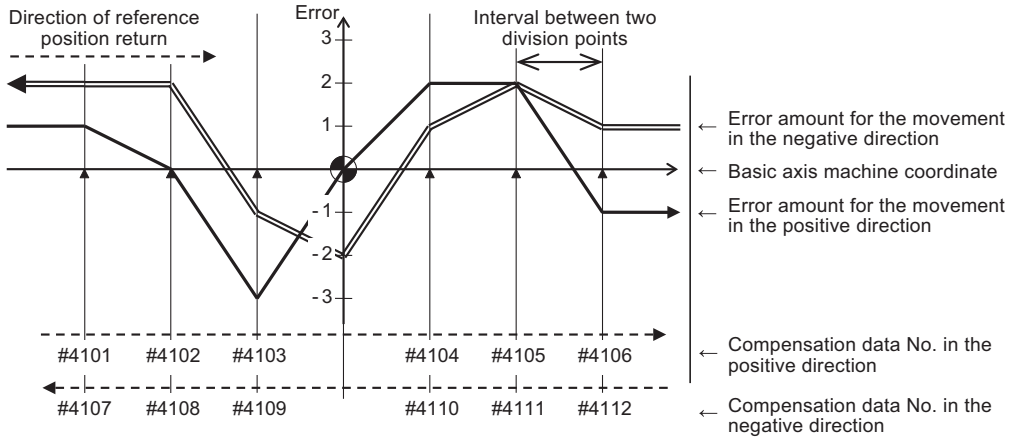
[When "#2030 dir (-)" is set to "0"]

Compensation amount = - (Actual machine position for the reference position when the direction of travel is negative) × 2

[When "#2030 dir (-)" is set to "1"]

Compensation amount = - (Actual machine position for the reference position when the direction of travel is positive) × 2

In both cases, the unit of compensation amount depends on the setting of the machine error compensation unit ("#1006 mcmpunit").



Bidirectional pitch error (linear axis)

[Parameter settings]

Parameter	#4001	#4002	#4003	#4004	#4005	#4006	#4007	#4008	#4009
	cmpax	drcax	rdvno	mdvno	pdvno	sc	spcdv	twopc	refcmp
Setting value	X	X	4103	4101	4112	1	10.000	1	4

Setting pitch error compensation data

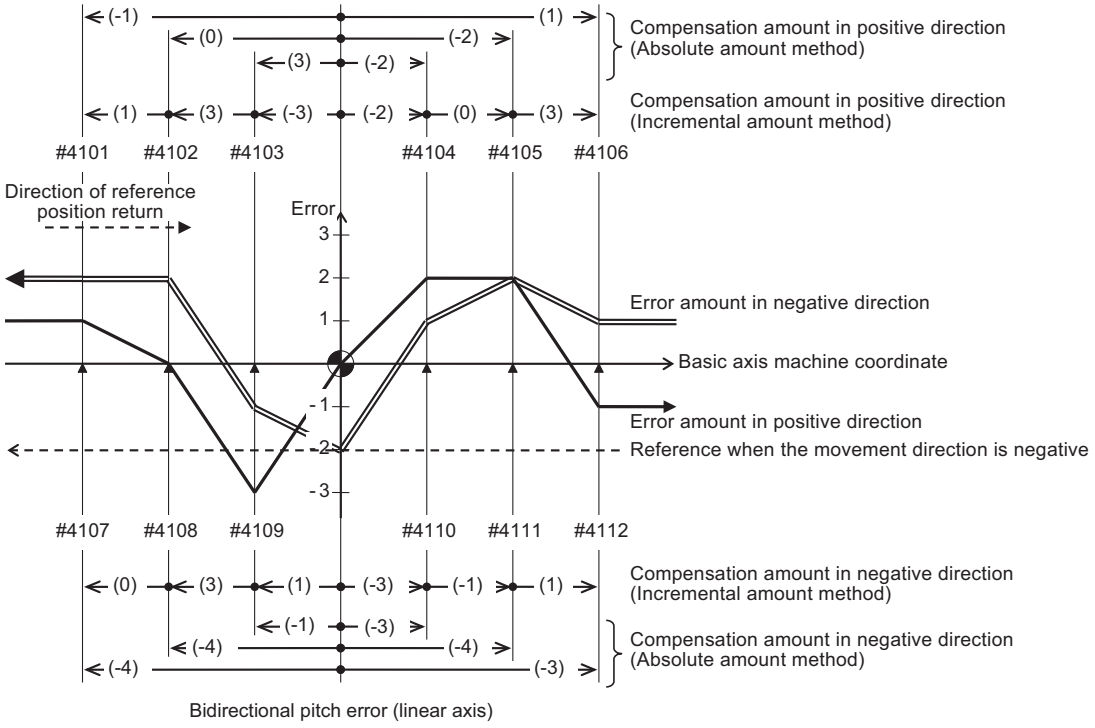
(1) Move the axis to positive or negative direction, then measure and record actual machine position of each division point. Calculate compensation amount for each division point based on the actual machine position.

#4000 setting value	Calculation method of compensation amount (*1)
0 (Absolute amount method)	Compensation amount = (Commanded machine position - Actual machine position) × 2
1 (Incremental amount method)	Here, the compensation amount at division point "n" is calculated for the axis moved by the "interval between division points" as specified by #4007. The formula used to calculate compensation amount will differ depending on whether division point "n" is on the positive side or the negative side from the reference position. [On the positive side] Actual travel amount = (Actual machine position of division point "n") - (Actual machine position of division point "n-1") Compensation amount = (Interval between division points - Actual travel amount) × 2 [On the negative side] Actual travel amount = (Actual machine position of division point "n") - (Actual machine position of division point "n+1") Compensation amount = (Interval between division points + Actual travel amount) × 2

Note

- The unit of compensation amount depends on the setting of machine error compensation unit ("#1006 mcmpunit").

(2) Set the calculated compensation amount to the parameter of compensation No. allocated to each division point.



Bidirectional pitch error (linear axis)

[Compensation amount settings]

Movement direction		Positive						Negative					
Compensation data No.		#4101	#4102	#4103	#4104	#4105	#4106	#4107	#4108	#4109	#4110	#4111	#4112
Compensation amount	Absolute amount method	-2	0	6	-4	-4	2	-8	-8	-2	-6	-8	-6
	Incremental amount method	2	6	-6	-4	0	6	0	6	2	-6	-2	2

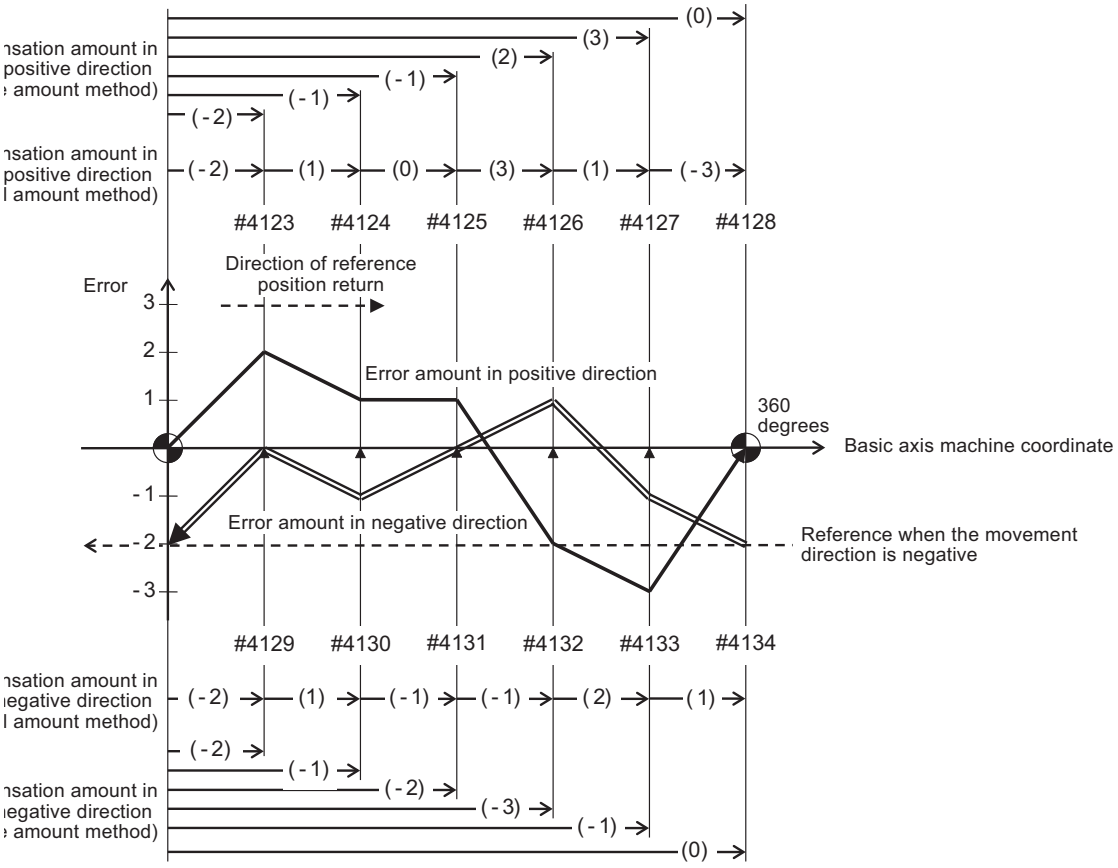
25.2.2.2 Using a Rotary Axis as Basic Axis

This section describes how to set bidirectional pitch error data by taking a rotary axis having a pitch error such as illustrated below as an example.

Set the pitch error compensation data for an rotary axis in the same way as a linear axis.

However, note the following points.

- Set the interval between two division points so that the last division point will be 360 degrees.
- The sum of the compensation amounts set with the incremental amount method will always be "0".
- The compensation amount of the terminal point in the absolute amount method (360 degrees) will always be "0".



Bidirectional pitch error (rotary axis)

[Parameter settings]

Parameter	#4001	#4002	#4003	#4004	#4005	#4006	#4007	#4008	#4009
	cmpax	drcax	rdvno	mdvno	pdvno	sc	spcdv	twopc	refcmp
Setting value	C	C	4122	4123	4134	1	60.000	1	4

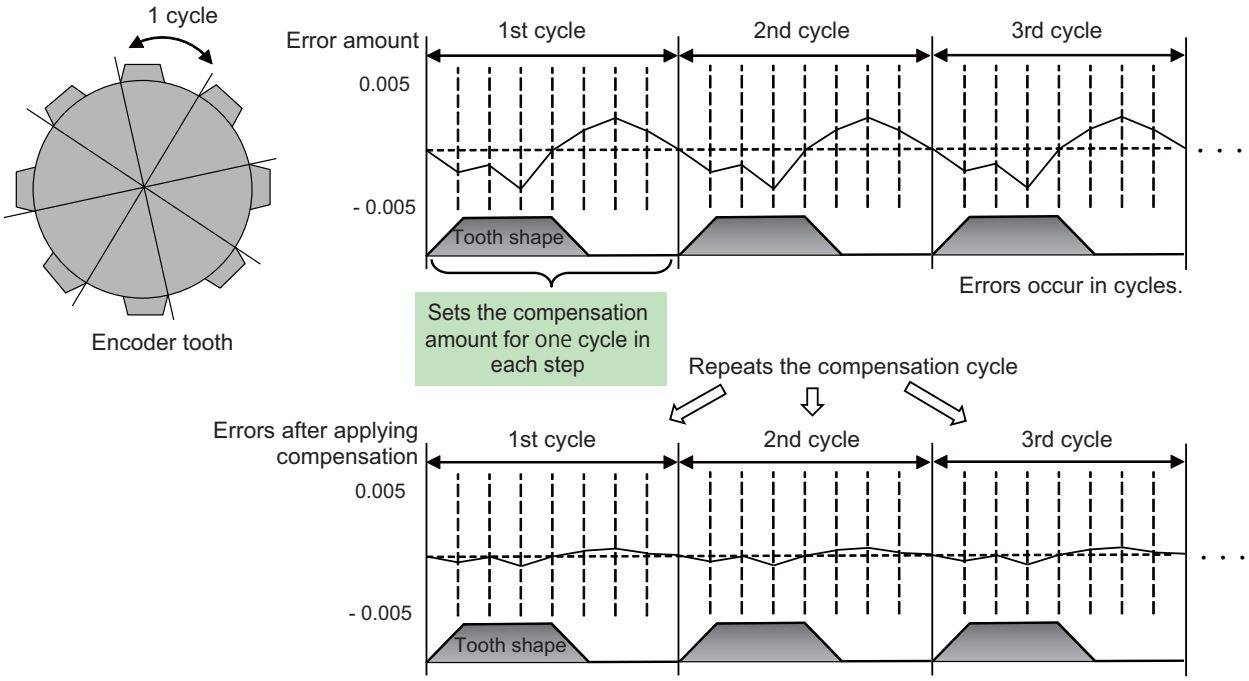
[Compensation amount settings]

Division point number		#4123	#4124	#4125	#4126	#4127	#4128	#4129	#4130	#4131	#4132	#4133	#4134
Compensation amount	Absolute amount method	-4	-2	-2	4	6	0	-4	-2	-4	-6	-2	0
	Incremental amount method	-4	2	0	6	2	-6	-4	2	-2	-2	4	2
Movement direction		Positive						Negative					

25.3 Cyclic Error Compensation

25.3.1 Outline

When the machine operation induces certain cyclic errors, this function compensates a series of cyclic errors by setting the compensation amount for a single cycle.
Short-pitched compensation is possible for the errors occurring due to the tooth shape of the encoder.
The period of the error cycle, number of steps in the cycle (up to 128 steps), and compensation amount at each step can be set with parameters.



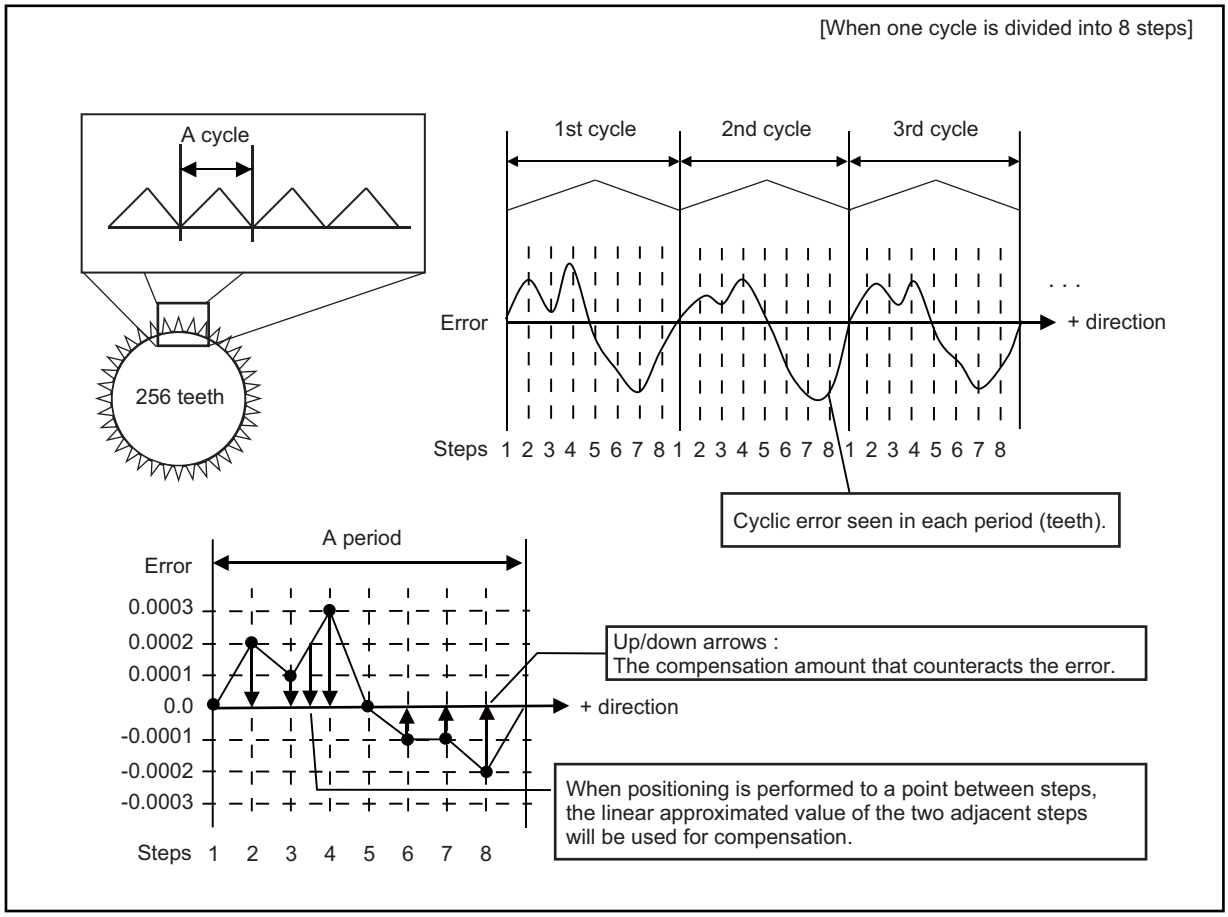
[Enabling Conditions]

- The cyclic error compensation specifications must be enabled, and the parameter "#2585 Cyccmp" (Enable cyclic error compensation) must be set to "1".
- This function is only available in CNC-controlled axes. It is not available in PLC-controlled axes. Switch to C axis mode for spindle position control when applying this function to the spindle.
- This function is only available in rotary axes. It is not available in linear axes. The parameters related to the rotary axis must be as follows;

Parameter	Setting value
#1017 rot (rotary axis)	1
#2218 PIT (ball screw pitch)	360
#2070 div_RT (rotational axis division count)	360 or 0

25.3.2 Setting Method

This function divides one error cycle into multiple steps and compensates at each step. Positions between steps are also compensated by the linear approximation of the values at each step.
For example, as shown in the figure below, when similar errors occur at each tooth of a gear with 256 teeth, one tooth is regarded as one cycle, and the compensation amount at each step within a cycle is specified. Specify a value that counteracts the effect of the errors to the compensation amounts. By using the same compensation amounts for each tooth, the errors of the whole gear can be compensated.



Before setting parameters, refer to the next section "25.3.3 Error Measurement" for measuring errors.

- The compensation amount is the value whose sign is reversed to counteract the effect of the errors.
- Set compensation amounts as absolute values. Do not set relative values.
- The compensation amounts stored in the locations specified from "Cyclic error compensation: initial number of compensation" (#2586 Cycstnum) to "Cyclic error compensation: number of divisions" (#2587 Cycdv) are used.

Note

(1) This parameter setting uses the parameters that are also used by memory-type pitch error compensation (#4101-5999, #44001-47712).
Ensure that no parameter overlapping occurs when choosing the number of the parameter.

- The unit of this compensation amount is 1/10000°.

Parameter Setting Example

This section takes the example shown in the figure on the previous page (When the gear has 256 teeth and one cycle is divided into 8 steps) to describe the parameter setting procedure.

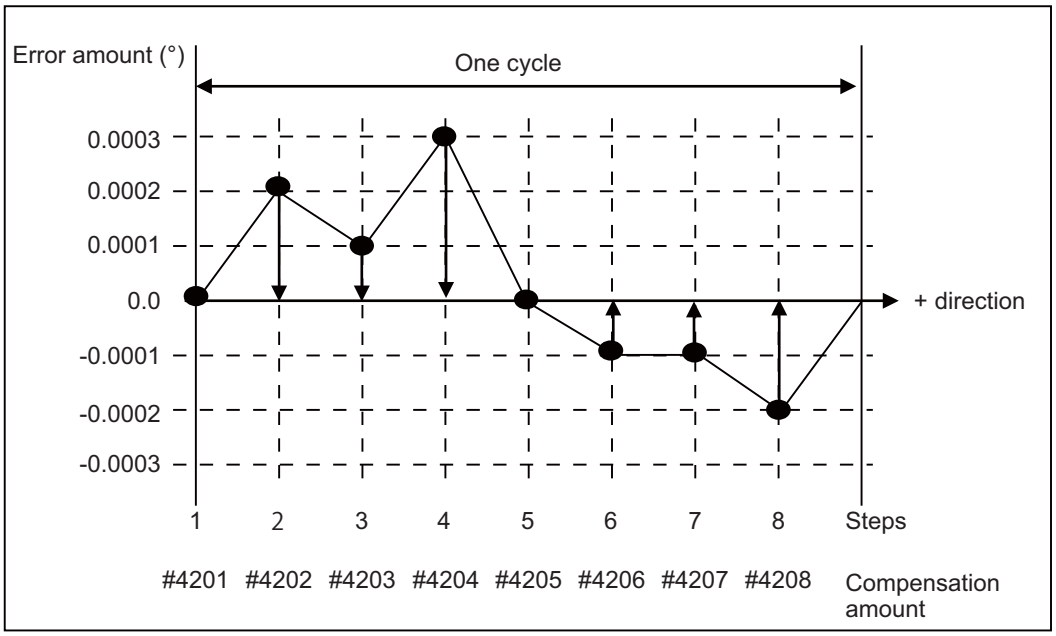
[Axis specification parameters]

Parameter		Setting value	Description
#2585	Enable cyclic error compensation	1	Compensation enabled.
#2586	Cyclic error compensation: initial number of compensation	4201	Starts from the parameter #4201.
#2587	Cyclic error compensation: number of divisions	8	Occupies eight parameters (one-error cycle is divided into 8 steps).
#2588	Cyclic error compensation: cycle constant	256	One gear has 256 cycles.

[Error data]

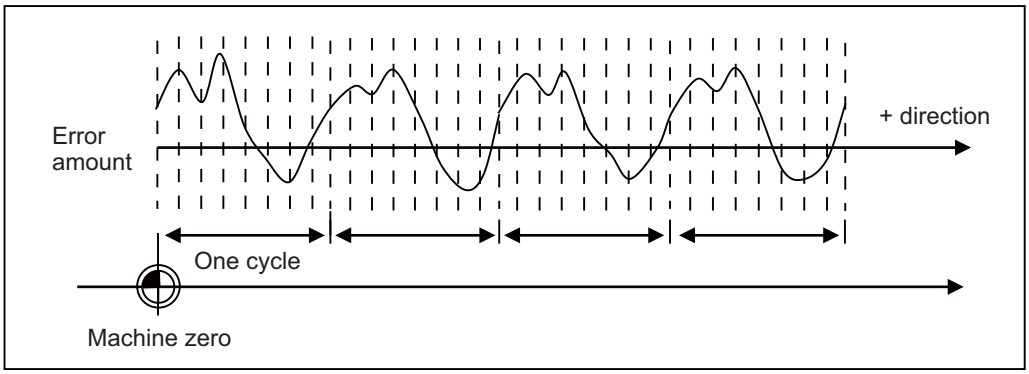
THeaderC								
Step number	#4201	#4202	#4203	#4204	#4205	#4206	#4207	#4208
Value configured (Compensation amount)	0	-2	-1	-3	0	1	1	2

[Compensation amount settings (When one cycle is divided into 8 steps)]



25.3.3 Error Measurement

This function performs compensation based on the position deviation related to the machine zero. When measuring errors, disable all types of compensation (such as pitch error compensation and backlash compensation), and also the functions accompanied by the offset of the coordinate system such as workpiece coordinate system offset. Then start the measurement with the start point of the error cycle matching the machine coordinate zero point.
For machines that configure the reference position shift distance "#2027 G28sft", first set #2027 prior to measuring the error.



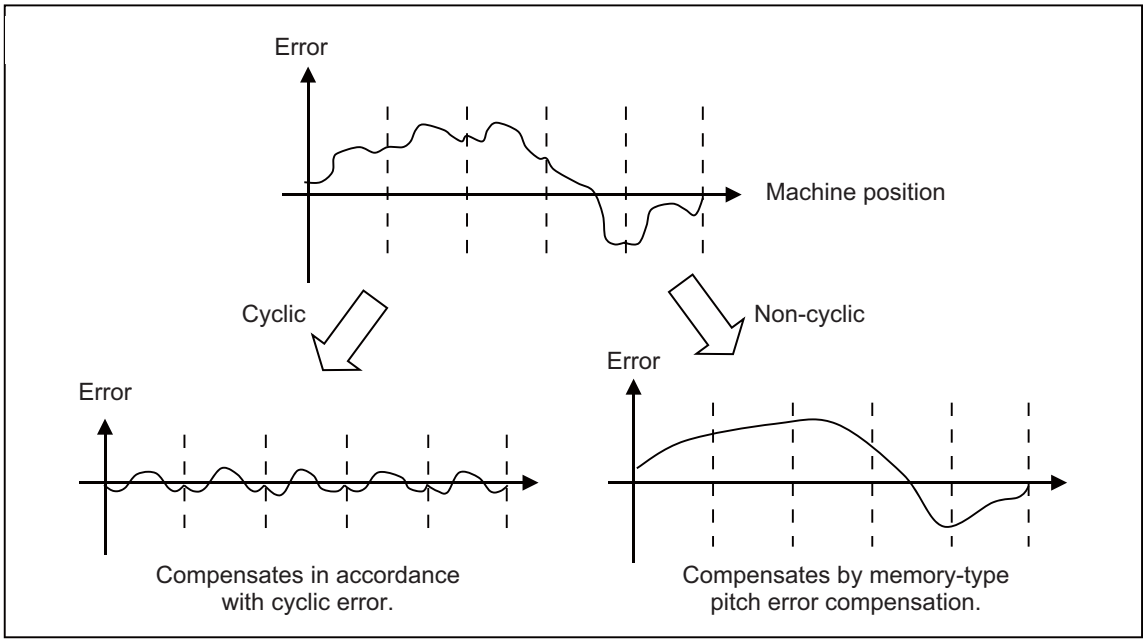
25.3.4 Precautions

(1) The updates regarding the compensation amount of this function are immediately reflected to the operation. Note that large compensation amounts might cause sudden machine vibration.
(2) This function starts compensating after the zero point is established.
When the zero point has not been established, this function is not available even if the parameter is set to Enabled.
(3) As changing the reference position shift distance "#2027 G28sft" changes the position of the machine coordinate zero point, compensation amounts will need to be reconfigured in this case.
When the coordinate system offset has been performed for functions such as workpiece coordinate system offset and reference position #1 "#2037 G53ofs", it is not necessary to reconfigure the compensation amounts if each has already been appropriately configured relative to the machine coordinate zero point.
(4) This function uses the same parameters as functions such as memory-type pitch error compensation when configuring compensation amounts (#4101-#5999). Ensure that no parameters are set incorrectly.
(5) When the settings used exceed the parameter setting range in "Cyclic error compensation: initial number of compensation" (#2586 Cycstnum) and "Cyclic error compensation: number of divisions" (#2587 Cycdv), the compensation configured for the axis is not enabled.
(Example) Compensation start No. is 5995, and step No. is 16. (exceeds the range of parameter number, #5999)

25.3.5 Relation with Other Functions

[Memory-type pitch error compensation]

This function can be used simultaneously with the memory-type pitch error compensation. As shown in the figure below, when the error profile consists of both cyclic errors and non-cyclic errors, a higher accuracy of compensation can be achieved by combining the memory-type pitch error compensation and this function.



26

Setting the Position Switches

26.1 Outline

Position switches (PSW) are used as alternatives for the dog switches provided on the machine axis. Virtual dog switches can be used by specifying axis names and conditions of virtual dog positions. This function outputs a signal to the PLC interface when the machine reaches the specified area. The virtual dog switches are called "position switches" (PSW). 24 points of the position switches can be set for each part system.

[Position switch Nos. of PSW1 to PSW24 and signal devices]

	Parameter				Device							
	<axis>	<dog1>	<dog2>	<check>	$1	$2	$3	$4	$5	$6	$7	$8
PSW1	#7501	#7502	#7503	#7504	X1D00	X1D20	X1D40	X1D60	X1D80	X1DA0	X1DC0	X1DE0
PSW2	#7511	#7512	#7513	#7514	X1D01	X1D21	X1D41	X1D61	X1D81	X1DA1	X1DC1	X1DE1
PSW3	#7521	#7522	#7523	#7524	X1D02	X1D22	X1D42	X1D62	X1D82	X1DA2	X1DC2	X1DE2
PSW4	#7531	#7532	#7533	#7534	X1D03	X1D23	X1D43	X1D63	X1D83	X1DA3	X1DC3	X1DE3
:	:	:	:	:	:	:	:	:	:	:	:	:
PSW24	#7731	#7732	#7733	#7734	X1D17	X1D37	X1D57	X1D77	X1D97	X1DB7	X1DD7	X1DF7

The corresponding device signal turns ON when the machine position of the control axis is within the range set by the parameters "dog1" and "dog2" in the above table, and turns OFF when it is out of the range. The machine position is based on the basic machine coordinate system.
Whether the machine has moved into the area specified with the position switches can be judged at high speed by setting the parameter "#7500 Pcheck" (High-speed switching of position switch).
To judge the entry of the machine to the area, set the parameter "check" in the above table to select which type of position to be used for each position switch from the following: commanded machine position or feed back position from encoder.
For description of the parameter, refer to "Alarm/Parameter Manual".

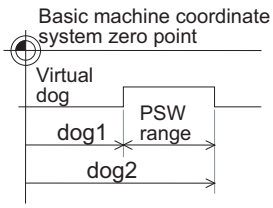
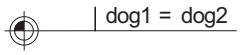
The position switch is enabled when the specified axis establishes the reference position.
The timing to establish the reference position differs between relative position detection and absolute position detection as follows.

[For absolute position detection system]
When the power is turned ON after the zero point initial setting is completed

[For relative position detection system]
When the first reference position return is completed after the power is turned ON
(The position switch is disabled on all the axes until the reference position return is completed.)

26.2 Setting and Operation Examples of dog1 and dog2

■ For linear axes

Settings of dog1 and dog2	Positions of dog1 and dog2	Description	
dog1 < dog2		A signal is output when the machine reaches between dog1 and dog2.	
dog1 > dog2		A signal is output when the machine reaches between dog2 and dog1.	
dog1 = dog2		A signal is output when the machine is at dog1 (dog2).	

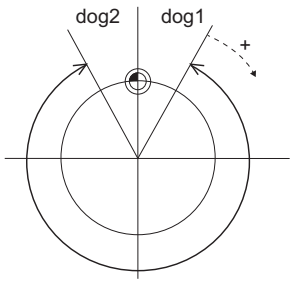
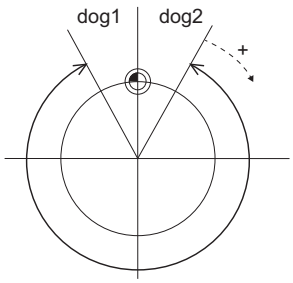
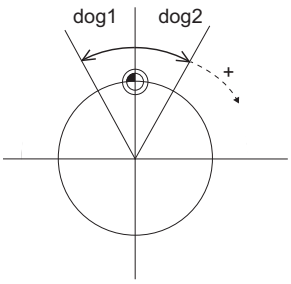
■ For rotary axes

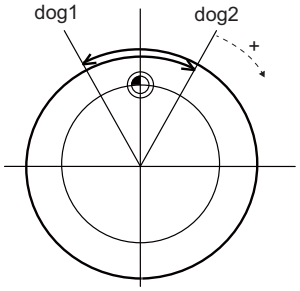
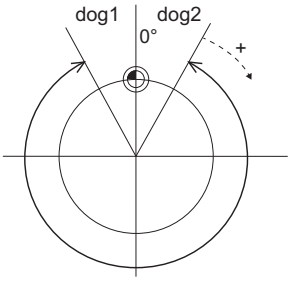
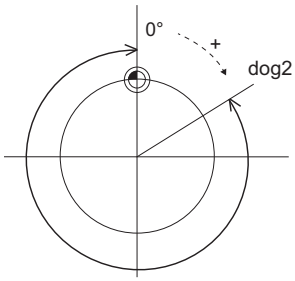
Regardless of the size of the setting values of dog1 and dog2, the signal is turned ON when the axis reaches between dog1 and dog2. When a positive value and a negative value are set, the signal is turned ON when the axis reaches the range before and after "0".

When a value equal to or larger than "360" is set to dog1 or dog2, the machine position does not reach the dog position; therefore, it is regarded as that "359.999" is set.

When a value equal to or less than "-360" is set to dog1 or dog2, the machine position does not reach the dog position; therefore, it is regarded as that "-360" is set.

When a value equal to or larger than "360" or a value less than "-360" is set to both of dog1 and dog2, the machine position does not reach the dog position; therefore, the signal is not output.

Settings of dog1 and dog2	Positions of dog1 and dog2		Description
dog1 < dog2		(Example) dog1 = 30.000 dog2 = 330.000	A signal is output when the machine reaches between dog1 and dog2.
dog1 > dog2		(Example) dog1 = 330.000 dog2 = 30.000	A signal is output when the machine reaches between dog2 and dog1.
When dog1 is in the negative area		(Example) dog1 = -30.000 dog2 = 30.000	A signal is output when the machine reaches between dog2 and dog1. A signal is output in the same manner even if dog2 is in the negative area.

Settings of dog1 and dog2	Positions of dog1 and dog2		Description
dog1 ≤ 0 and 360 ≤ dog2		(Example) dog1 = -30.000 dog2 = 390.000	A signal is always output when the angle of dog1 and dog2 is within a range of 0 to 360 degrees.
-360 < dog2 < dog1 ≤ 0		(Example) dog1 = -30.000 dog2 = -330.000	A signal is output when the machine reaches between dog1 and dog2. For -360 < dog1 < dog2 ≤ 0, a signal is output in the same manner.
360 ≤ dog1 and 0 < dog2 < 360		(Example) dog1 = 420.000 dog2 = 60.000	When a value equal to or larger than "360" is set to dog1, the machine position does not reach the dog position; therefore, a signal is output when the machine reaches between dog1 and dog2 in the same manner as if "359.999" is set.
360 ≤ dog1, dog2 or dog1, dog2 < -360	-	-	The machine position does not reach the dog position; therefore, a signal is not output.

26.3 Canceling the Position Switch

When "0" is set to the axis name parameter (#75*1), the axis name of the position switch is deleted, and the position switch is disabled. However, the data in <dog1> and <dog2> are still retained in a memory. To enable the position switch again, only an axis name is required for setting.

26.4 Position Switch Interlock (Interlock out of Setting Range)

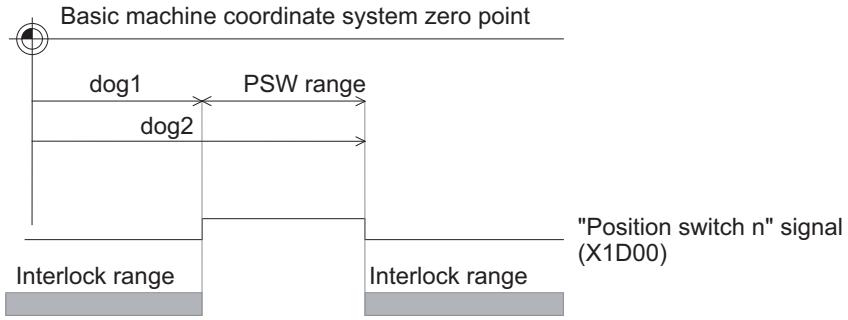
When the machine position is out of the position switch range, the position switch interlock (interlock out of setting range) function applies an interlock to the axis, and movement of the axis targeted by the position switch is prohibited.
When the machine position goes out of the range set with the parameter of the position switches (PSW1 to PSW24), the "Position switch n" signal (X1D00) is turned OFF. Then, when the "Position switch n interlock" signal (Y1D00) is turned ON, an interlock is applied to the axis, and movement is prohibited. When the "Position switch n interlock" signal (Y1D00) is turned ON for the axis which is out of the position switch range (the "Position switch n" signal (X1D00) is OFF), an interlock is applied to the axis, and movement is prohibited. While the axis targeted is being interpolated, all the axes stop moving.
The position switch interlock is disabled for the following axes.

- Axis where the reference position return has not been completed (for relative position detection)
- Axis where the absolute position initial setting has not been completed
- Axis where the absolute position initial setting is being carried out

The movement in the interlock range is as follows.

[For linear axes]

The axis can move only in the direction toward the position switch range.
If a command is issued in the direction away from the position switch range, the operation error (M01 0004) occurs.



[For rotary axes]

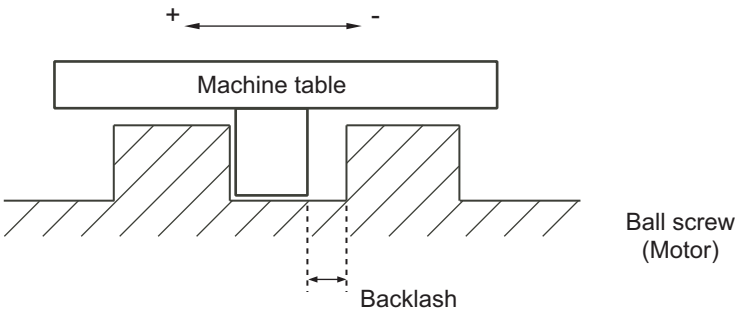
If axis movement is commanded in the interlock state, the operation error (M01 0004) occurs.
To move the axis, turn OFF the "Position switch n interlock" signal (Y1D00) to cancel the interlock state.
Even if the axis is moved away from the position switch range in this state, the interlock is not applied.

27

Setting the Backlash Compensation

27.1 Backlash Compensation

Travel amount of a machine table may become less than the commanded amount due to the error (backlash) caused by reversal of the direction of the axis.
The backlash compensation is a function which automatically adds compensation amount to the travel amount when the direction of the axis is reversed.



There are two types of backlash compensation as follows.

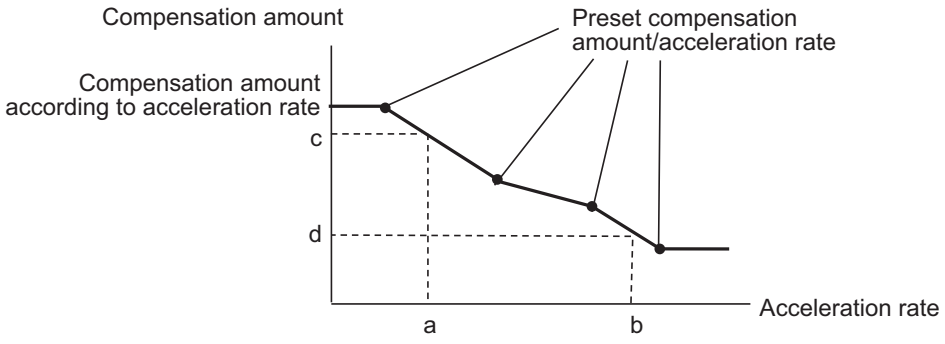
- G0 backlash (#2011 G0back)
  Compensation amount that is used when an axis moved at the rapid traverse speed (G0).
  Compensation amount is also measured at rapid traverse speed.
- G1 backlash (#2012 G1back)
  Compensation amount that is used when an axis moved at cutting feedrate (G1, G2, G3).
  Compensation amount to be set is measured using the most commonly used feedrate.

27.2 Backlash Compensation II

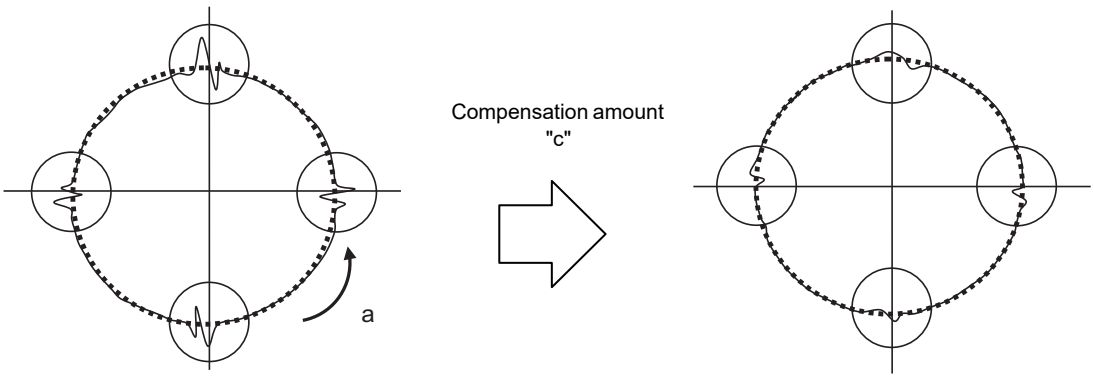
This function reduces quadrant error caused by the backlash when the traversing direction is reversed in machines where semi-closed loop control is implemented.

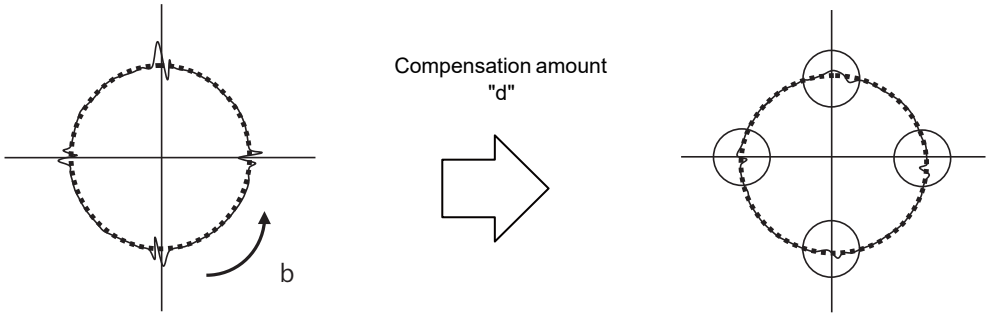
Acceleration rate at axis direction reversal varies depending on the change of circular radius and commanded speed at machining. The most appropriate compensation amount also changes at the point. Accordingly, in the function "backlash compensation II", up to four compensation amounts are set for each axis for each different acceleration rate, and compensation amounts are calculated corresponding to each acceleration rate. Through the above procedures, quadrant projections are suppressed.

Compensation based on the acceleration rate at a direction reversal improves machining accuracy. For the range between the acceleration rates defined in parameters, the error is compensated using the compensation amount obtained through linear interpolation.



[Before the compensation] **[After the compensation]**





27.2.1 Enabling Conditions for Backlash Compensation II

Backlash compensation II is enabled when all the following conditions are satisfied.

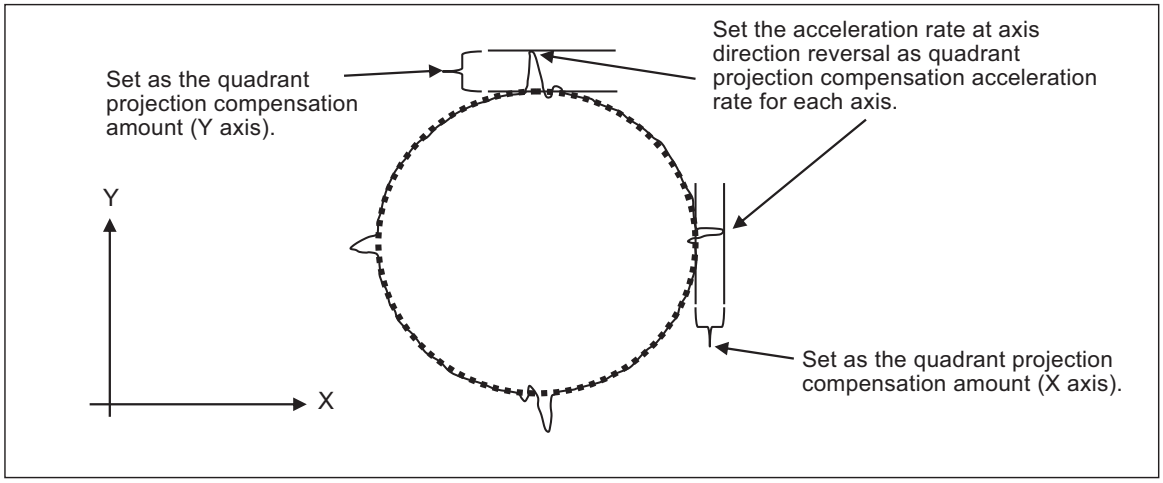
- Backlash compensation II option is ON.
- "14360 valBL2" (enable backlash compensation II) is ON.
- "#14361 BL2_a1" (backlash compensation II acceleration rate 1) is not "0".

Backlash compensation II can be specified valid/invalid status for each axis.

27.2.2 Procedure of Setting Backlash Compensation II

To set backlash compensation II parameters, measure up to four acceleration rates and quadrant projection sizes at axis direction reversal, changing settings such as circular radius and commanded speed.
Set the compensation patterns measured when a direction of the axis reversed to backlash compensation II acceleration rate 1 to 4 and backlash compensation amount II 1 to 4.

[Setting acceleration rate and compensation amount]



27.2.2.1 Setting the Backlash Compensation II Acceleration Rate

For the backlash compensation II acceleration rate, set the acceleration rate ($\mu m/s^2$) at reversal of direction of the axis on which compensation to be performed.
Up to four backlash compensation II acceleration rates can be set for each axis.

- Backlash compensation II acceleration rate 1: "#14361 BL2_a1"
- Backlash compensation II acceleration rate 2: "#14363 BL2_a2"
- Backlash compensation II acceleration rate 3: "#14365 BL2_a3"
- Backlash compensation II acceleration rate 4: "#14367 BL2_a4"

Set the backlash compensation II acceleration rate 1 to 4 in ascending order.
When the number of compensation patterns is less than four, set "0" for the parameters of the acceleration rates which are not used.
For example, when there are three compensation patterns, set the parameter "#14367 BL2_a4" to "0".

27.2.2.2 Setting Compensation Amount of Backlash Compensation II

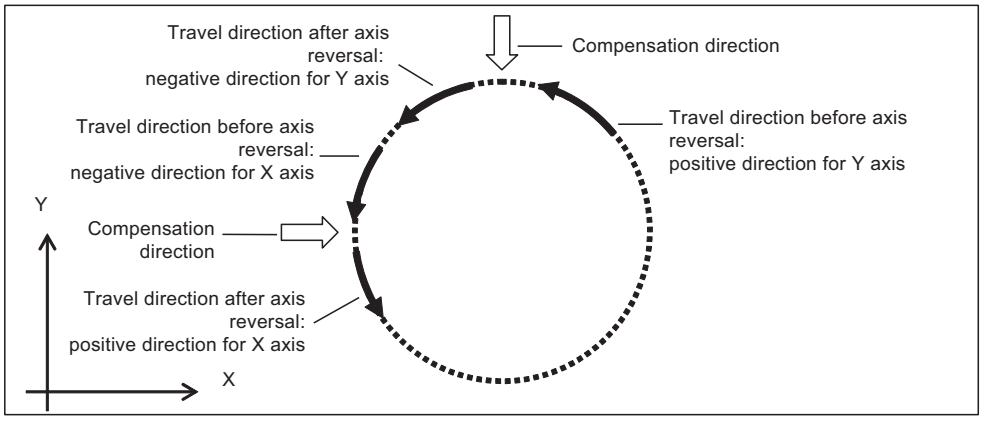
For the backlash compensation II compensation amount, set the size of projection which is generated at axis direction reversal.
For the unit of compensation amount, follow the setting of "#1006 mcmpunit" (Machine error compensation unit).

- Backlash compensation II compensation amount 1: "#14362 BL2_c1"
- Backlash compensation II compensation amount 2: "#14364 BL2_c2"
- Backlash compensation II compensation amount 3: "#14366 BL2_c3"
- Backlash compensation II compensation amount 4: "#14368 BL2_c4"

Set compensation amounts corresponding to acceleration rates which have been set in the previous chapter "27.2.2.1 Setting the Backlash Compensation II Acceleration Rate" for the parameters above.
For example, set a compensation amount which corresponds to backlash compensation II acceleration rate 2 for "#14364 BL2_c2".

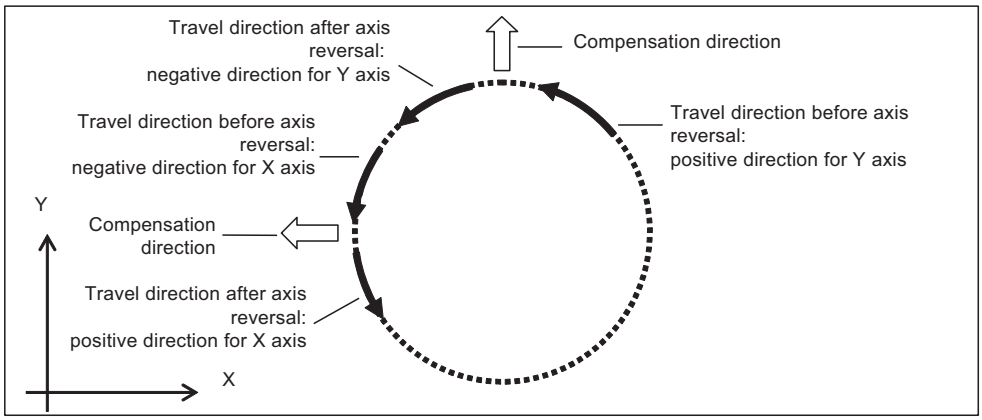
When a positive value is set as the compensation amount, compensation is performed in the travel direction of the axis after axis reversal.

[Compensation direction with a compensation amount set to a positive value]



When a negative value is set as a compensation amount, compensation is performed in the travel direction of the axis before axis reversal.

[Compensation direction with a compensation amount set to a negative value]



27.2.2.3 Precautions for Setting Parameters

For the backlash compensation II acceleration rates, set values greater than "0" in ascending order for acceleration rates 1 to 4.

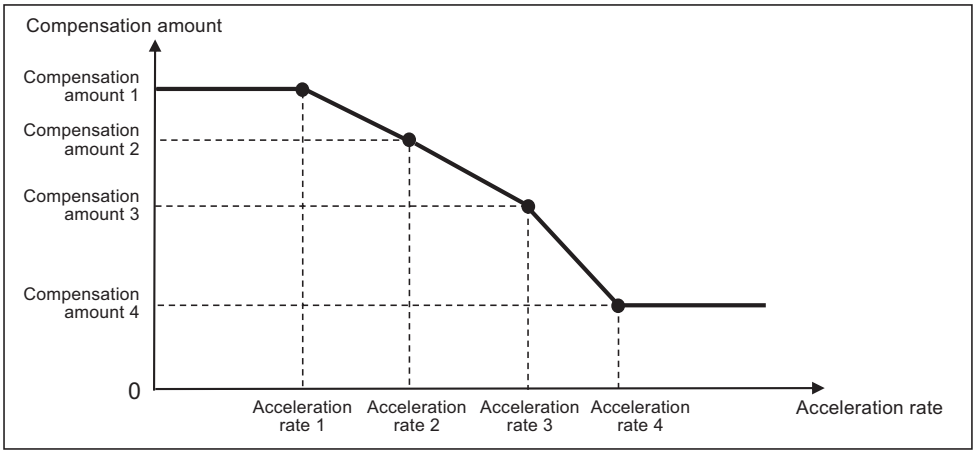
Parameters are enabled when the backlash compensation II acceleration rates are set in ascending order.

The following describes the relationship between setting patterns and parameters to be enabled.

When the value of acceleration rate 1 is greater than "0", and the values of acceleration rate 1 to 4 are in ascending order

The following shows the setting which has four measured compensation patterns.

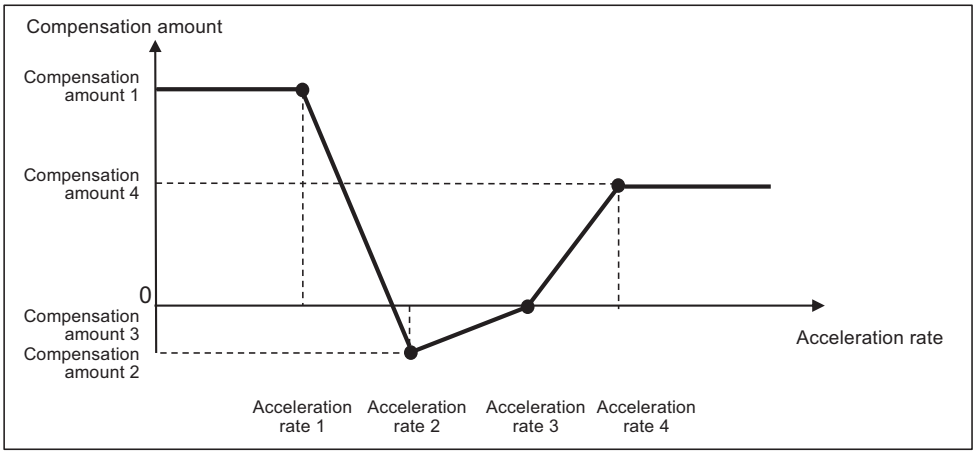
Acceleration rate 1 to 4 and compensation amount 1 to 4 are all valid, and these values are used for calculating the compensation amounts.



Note that compensation amount may not be in ascending order because the value increase or decrease depending on the acceleration rate.

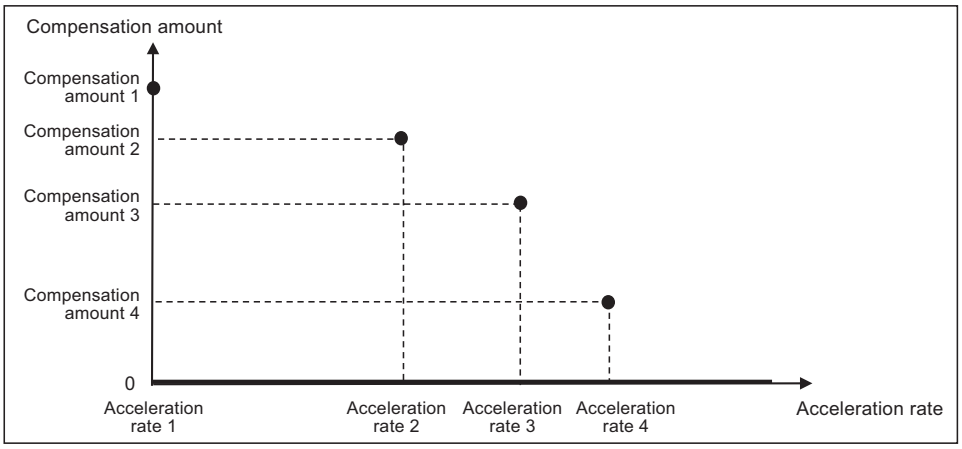
"0" and negative values can also be set as illustrated below.

[When compensation amounts are not in ascending order]



When the acceleration rate 1 is set to "0"

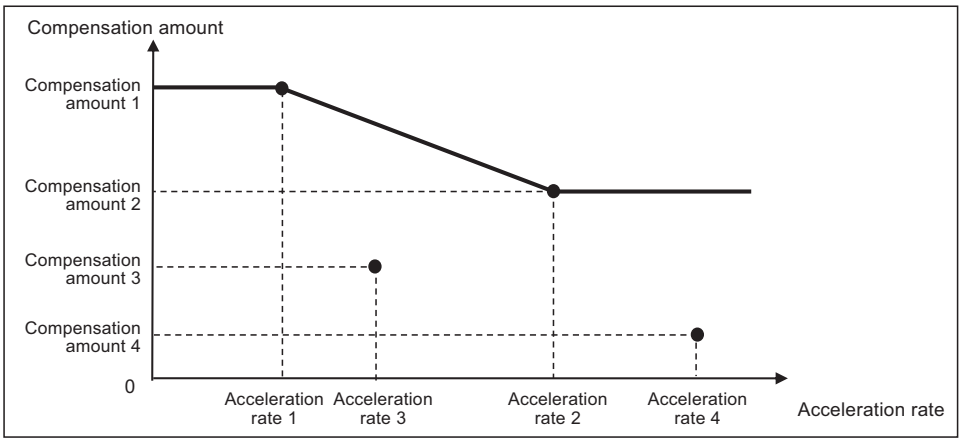
Backlash compensation II is disabled.
Quadrant projection compensation is not performed on the axis, and the compensation amount is handled as "0".



When part of setting values of acceleration rate 1 to 4 are set in ascending order

Parameters are enabled when the corresponding acceleration rates are set in ascending order. Parameters are disabled and not used for calculating compensation amount when the corresponding acceleration rates are not set in ascending order.
For example, when acceleration rate 1 and 2 are set in ascending order but the value of acceleration rate 3 is smaller than that of acceleration rate 2, the settings will be as follows.

- Acceleration rate 1 and 2, and compensation amount 1 and 2 are valid.
- Acceleration rate 3 and 4, and compensation amount 3 and 4 are invalid.



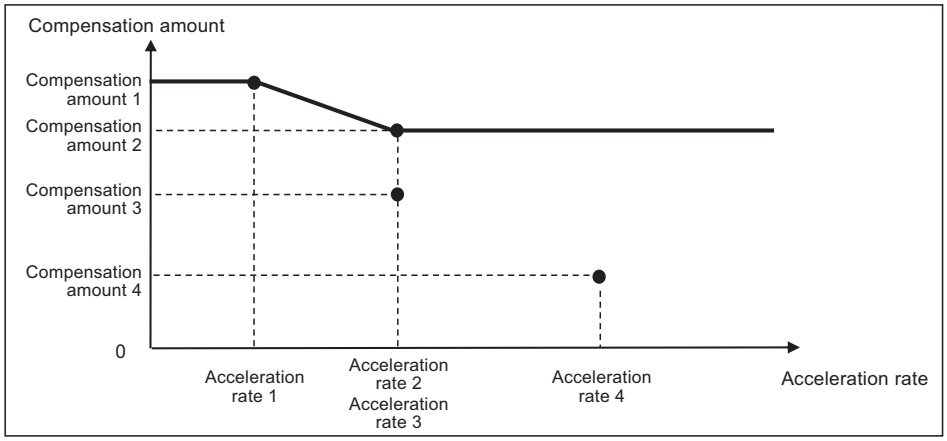
When the number of measured compensation patterns are less than four, compensation is carried out for the compensation patterns which are measured by setting "0" to acceleration rates corresponding to compensation patterns which have not been measured yet.
For example, when there are two compensation patterns, "0" is set to the acceleration rate 3.

When the same values are set to consecutive acceleration rates

Ascending order in acceleration rate setting refers to the case where subsequent values become greater than the previous ones. Therefore, the same as when the first of acceleration rates 1 to 4 are set in ascending order, parameters for the acceleration rates which are no longer arranged in ascending order are disabled; accordingly, the compensation amounts are not calculated.

For example, when acceleration rate 1 and 2 are in ascending order but acceleration rate 3 is equal to acceleration rate 2, the settings will be as follows.

- Acceleration rate 1 and 2, and compensation amount 1 and 2 are valid.
- Acceleration rate 3 and 4, and compensation amount 3 and 4 are invalid.



28

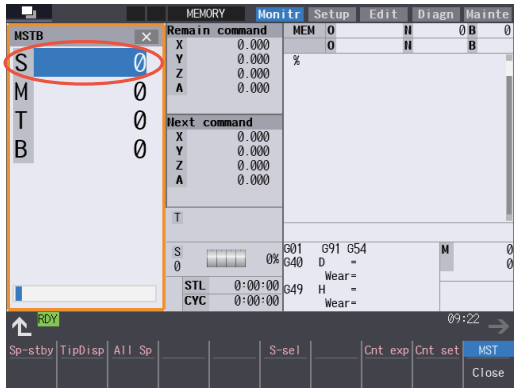
Confirming the Spindle Operation

Confirm that the spindle operates properly in manual/MDI operation. Confirm the spindle rotation speed as well.

> **⚠ CAUTION**
>
> **(1) Do not adjust the spindle when possible risks associated with adjustment procedures are not thoroughly taken into consideration.**
>
> **(2) Be careful when touching spindle's rotating section, or your hand may be caught in or cut.**

28.1 In Manual Operation (with Manual Numerical Command)

(1) Select [MST] on the monitor (Monitr) screen. Enter a spindle rotation speed (ex. 100 /min) in "S" field.



(2) Enter "3" in "M" field to rotate the spindle.

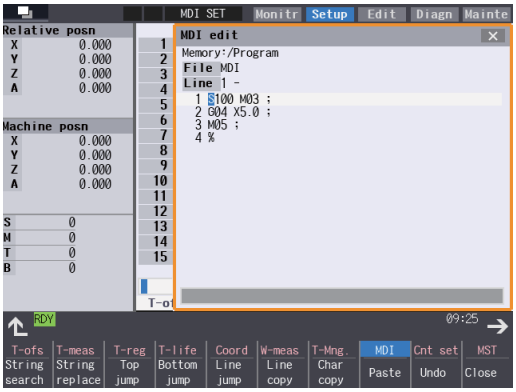
(3) Check the rotation speed of the spindle motor while the spindle is rotating. Refer to the section of "Confirming the Rotation Speed".

(4) After checking the rotation speed, set "M" to "5" or press the spindle stop button to stop the spindle rotation.

28.2 In MDI Operation

(1) Select MDI mode.

(2) Select [MDI] on the Setup screen. Enter a program to issue an S command.



Program example (to rotate the spindle at 100 r/min for 5 seconds)
S100M03;
G04X5.0;
M05;
Press the [INPUT] key after entering the program.

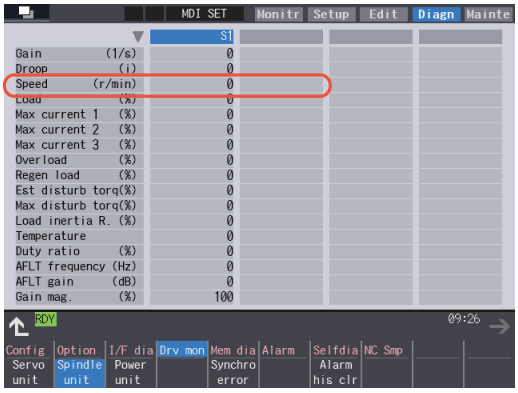
(3) Press the automatic start button.

(4) Check the rotation speed of the spindle motor while the spindle is rotating. Refer to the section of "Confirming the Rotation Speed".

28.3 Confirming the Rotation Speed

(1) Select [Drv mon] and then [Spindle unit] on the [Diagn] screen.

(2) Check the rotation speed of the spindle motor. (To obtain the spindle rotation speed, apply the gear ratio to the motor's rotation speed.)



Note

- If the vibration is not reduced by the measure, refer to the manuals of the servo drive unit.

29

Setting the Handy Terminal

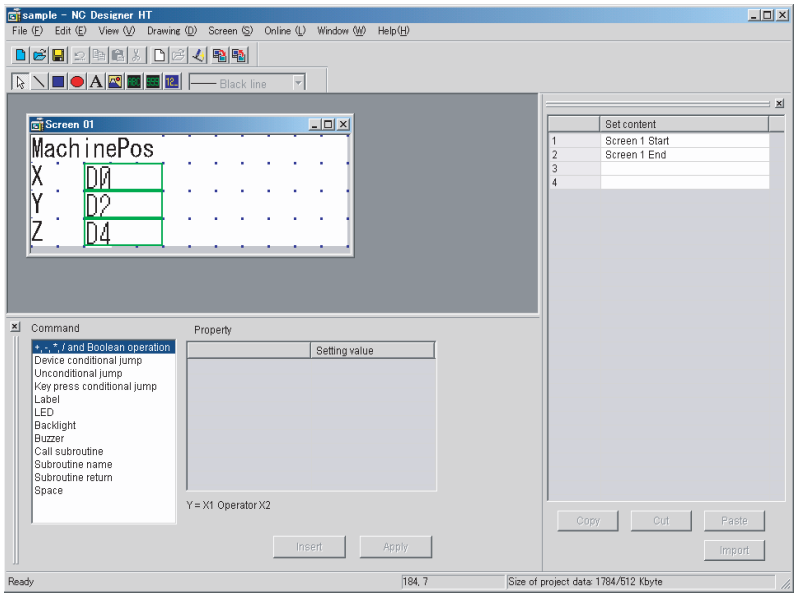
It is necessary to customize the display part composition, the key input, the communication condition with NC, etc. to connect the handy terminal (HG1T-SB12UH-MK1346-Lx).
Create the customized data with "NC Designer HT" and download it to the handy terminal.

There are two methods to input customized data for the handy terminal.
- Connecting a personal computer and the handy terminal and inputting the data from "NC Designer HT"
- Connecting NC and the handy terminal and inputting the data from an SD card

29.1 Inputting the Data from a Personal Computer

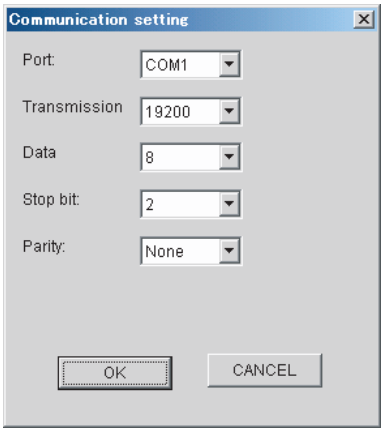
Create a project data (*.p1t), which is handled as customized data, with the customized data creation tool "NC Designer HT". Then download it to the handy terminal.

(1) Start the customized data creation tool "NC Designer HT" to create the project data (*.p1t).



(2) Connect a personal computer and the handy terminal via serial RS-232C.

(3) Select [Online] - [Communication setting] from the menu of "NC Designer HT" and confirm the communication condition is as follows.
Port: Personal computer port
Transmission: 19200 [bps]
Data length: 8 [bit]
Stop bit: 2
Parity: None



(4) Select [Online] - [Download] from the menu of "NC Designer HT".

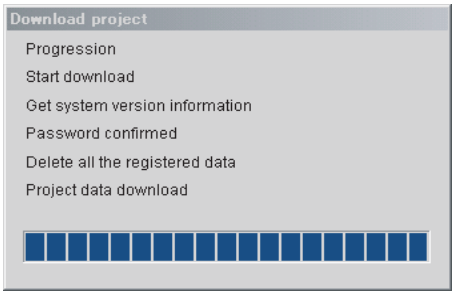
(5) The following dialog box is displayed. Select "Yes".



(6) If a password has been set to the downloaded customized data, the "Input password" dialog box will be displayed. Input the password and select "OK".



(7) The customized data will be downloaded to the handy terminal.



(8) When the download has been completed, the following dialog box will be displayed.



29.2 Inputting the Data from NC

Create a download data (handy.cod) from a project data (*.p1t) created with "NC Designer HT", then download it to the handy terminal.

(1) Start the customized data creation tool "NC Designer HT" to create a project data (*.p1t).

(2) Select [File] - [Writing download data] from the menu of "NC Designer HT" and save the data as download data named "handy.cod" in the root directory of the SD card.

(3) Insert the SD card used in (2) into the control unit.

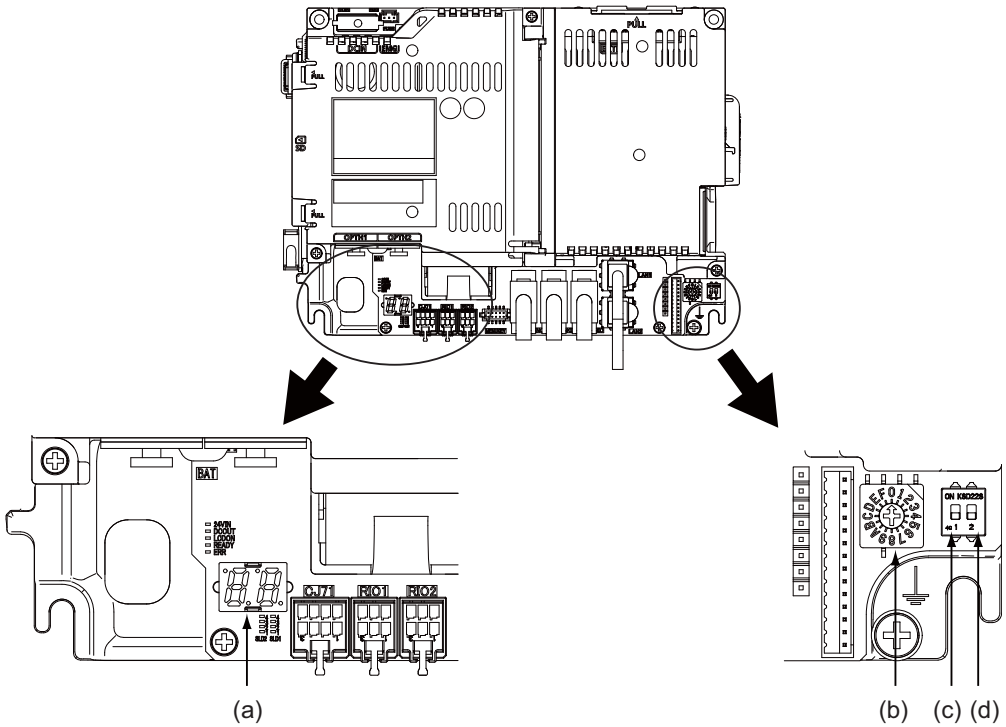
(4) Set the password currently set in the handy terminal to the parameter "#11011 Handy TERM. PW.".

Note

- When you download for the first time or the password for the present custom data of the handy terminal is invalid, leave the parameter blank.

(5) Turn OFF the NC and then connect the handy terminal to SIO connector on the control unit.

(6) Set the rotary switch on the control unit to "5".
Confirm that the DIP switches 1 and 2 are OFF. If they are ON, turn them OFF. (Normally, the DIP switches are OFF.)



(a)	LED	(c)	DIP switch 1
(b)	Rotary switch	(d)	DIP switch 2

(7) Turn ON the NC again. (*1)

(8) When the LED display on the control unit shows "En", turn OFF the NC.

(9) Remove the SD card and return the rotary switch.

(*1) Operating status is displayed by the LED on the control unit.
Lo ... Loading
En ... Complete without error
n1 - n7 ... Complete with error

When the download is completed with error, possible causes are as listed below.
Take measures and then perform the download procedure again.

LED	Cause	Measure
n1 ↑ Alternately ↓ 2-20	Process was stopped due to communication error. LED displays "n1" and "detailed cause" alternately.	When the detailed cause is 2, 4, 10 or 15, Confirm the wiring. Confirm the communication parameters. When the detailed cause is other than the above, Contact the service center. <Note> ♦ The detailed cause is the output value (absolute value) of PLC signal R299. For details on R299, refer to "PLC Interface Manual".
n2	There is no version consistency between the custom data creation tool and the handy terminal.	Confirm the version of custom data creation tool.
n3	The passwords set in the handy terminal and the NC are not consistent with each other.	Specify the password for custom data of the handy terminal correctly in "#11011 Handy TERM. PW.".
n4	There is no custom data named "handy.cod" in the SD card root.	Confirm the content of the SD card.
n5	The size of customize data exceeds 512KB.	The customize data cannot be downloaded unless the capacity is 512 KB or less.
n6	Process was stopped due to communication error (timeout error).	Set a longer timeout on the NC side.
n7	Process was stopped due to communication error (parameter error).	Confirm if Serial handy terminal communication valid (#6452 bit4) is ON. Confirm that "#6451/bit5" is OFF.

30

Deceleration Check

30.1 Function

The next block is executed after the axis is decelerated and stopped at the joint between the axis movement blocks. This is to reduce the machine shock and to prevent the corner roundness, at the time when the sudden change of the control axis feedrate occurs.

■ Deceleration check during rapid traverse

In rapid traverse mode, a deceleration check is always performed at the block end before executing the next block.

■ Deceleration check during cutting feed

In cutting feed mode, a deceleration check is performed at the block end before executing the next block when any one of the following conditions is valid.

- When the error detect switch is ON.
- When G09 (exact stop check) is commanded in the same block.
- When G61 (exact stop check mode) has been selected.

■ Selecting the deceleration check method

There are three methods for the deceleration check: command deceleration check method, smoothing check method and in-position check method.
The deceleration check method can be set independently for each execution block with the rapid traverse command (G00) or the cutting feed command (G01/G02/G03).

[Operation list]
This table shows the operation list for each movement command set.

	Current block		
Succeeding block	**G00**	**G01**	**G00/G01 without moving**
G00	○	(○) (*1)(*2)	×
G01	○	(○) (*1)(*3)	×
Other than the above	○	(○) (*1)	×

○: Deceleration check is valid
(○):
(*1) The deceleration check is valid when the error detect signal is ON, or when G09 or G61 is valid.
(*2) When the block commands G01 -> G00 are executed, #1502 G0Ipfg is turned ON, and the opposite direction movement is reversed, the command deceleration check is performed.
(*3) When the block commands G01 -> G01 are executed, #1503 G1Ipfg is turned ON, and the opposite direction movement is reversed, the command deceleration check is performed.
In the case other than the above conditions, the deceleration check is not performed.
Refer to "30.3 Deceleration Check for Opposite Direction Movement Reversal" for details on reverse rotation.
×: Deceleration check is invalid

[Selecting the deceleration check method]
There are three methods for the deceleration check, and the method is selected by the parameter.
- For execution blocks with a rapid traverse command (G00/G53)

Parameters	**Deceleration check method**	**Determination condition**
#1193 inpos		
0	Command deceleration check method	Deceleration check time passed
1	In-position check method	Deceleration check time passed, all axis smoothing zero and all axis in-position
2	Smoothing check method	Deceleration check time passed and all axis smoothing zero

- For execution blocks with a cutting feed command (G01/G02/G03)

Parameters			**Deceleration check method**	**Determination condition**
#1306 InpsTyp (G00/G01 common)	**#1389 G1SmthChk**	**#1223 aux07/BIT1**		
0 (cutting block)	**0**	**0**	Command deceleration check method	Deceleration check time passed
		1	In-position check method	Deceleration check time passed, all axis smoothing zero and all axis in-position
	1	**-**	Smoothing check method	Deceleration check time passed and all axis smoothing zero

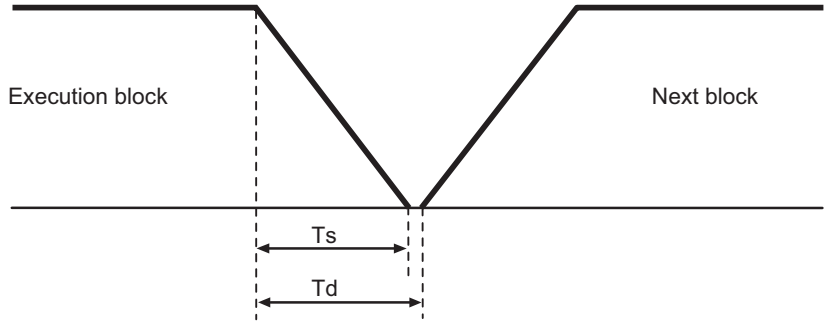
When "#1306 InpsTyp" is "1", the deceleration check method for the above execution block will be the same as that for rapid traverse regardless of the value for "#1389 G1SmthChk".

30.2 Deceleration Check Method

■ Command deceleration check method

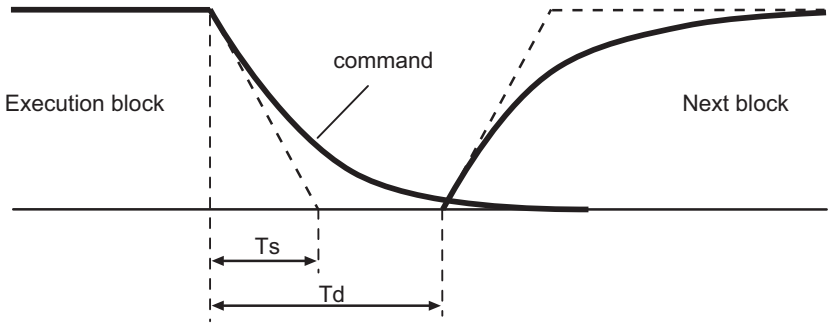
After interpolation for one block has been completed, the completion of the command system deceleration is confirmed before execution of the next block. The required time for the deceleration check is equal to the longest one of the deceleration check time for the simultaneously commanded axes, which are determined according to the acceleration/deceleration mode and time constant.

[For linear acceleration/deceleration]



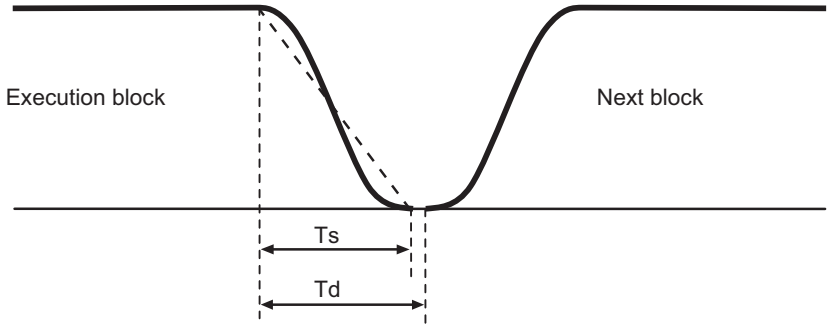
Ts: Liner acceleration/deceleration time constant
Td: Deceleration check time Td = Ts + α (0 to 10 ms)

[For exponential acceleration/deceleration]



Ts: Exponential acceleration/deceleration time constant
Td: Deceleration check time Td = Ts × 2 + α (0 to 10 ms)

[For soft acceleration/deceleration]



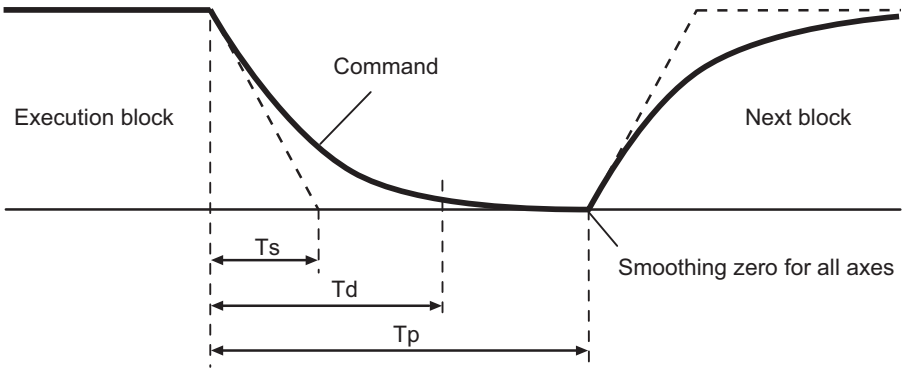
Ts: Soft acceleration/deceleration time constant
Td: Deceleration check time Td = Ts + α (0 to 10 ms)

The deceleration check time required during rapid traverse is the longest rapid traverse deceleration check time of all axes. This check time is determined by the rapid traverse acceleration/deceleration mode and rapid traverse acceleration/deceleration time constant of simultaneously commanded axes.
The deceleration check time required during cutting feed is determined in the same manner. It is the longest cutting feed deceleration check time of all axes. This check time is determined by the cutting feed acceleration/deceleration mode and cutting feed acceleration/deceleration time constant of simultaneously commanded axes.

■ Smoothing check method

After the command deceleration check has been completed, the completion of all axes smoothing zero in the part system is confirmed before execution of the next block.

[(Example) For exponential acceleration/deceleration]

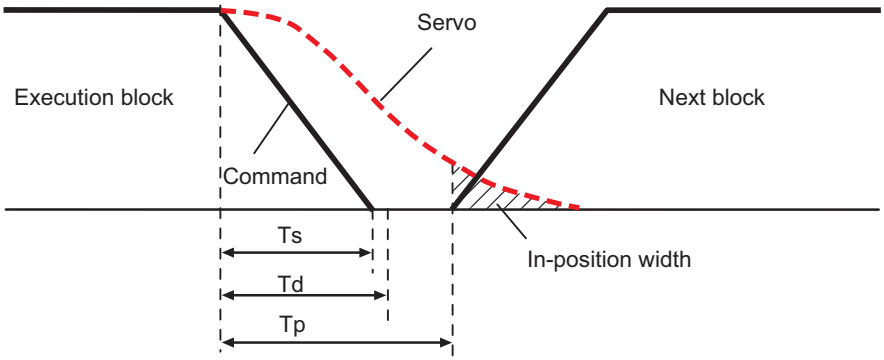


Ts: Exponential acceleration/deceleration time constant
Td: Deceleration check time
Tp: Waiting time for block completion

■ In-position check

When the in-position check is valid, the command deceleration check is carried out. After that, it is confirmed that the servo system positional error is less than the parameter setting value, and the next block is executed.
The in-position check width can be designated with the servo parameter in-position width (SV024). Note that G0 and G1 can be designated independently with the axis specification parameter G0 in-position check width (G0inps) and G1 in-position check width (G1inps). If both the servo parameter and axis specification parameter are set, the larger value will have the priority.

[(Example) For linear acceleration/deceleration]



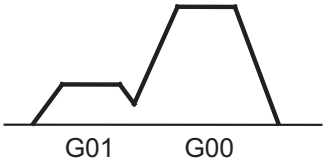
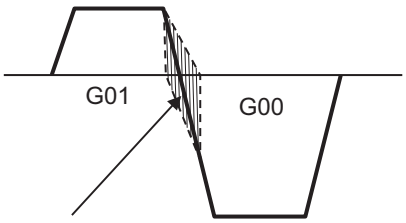
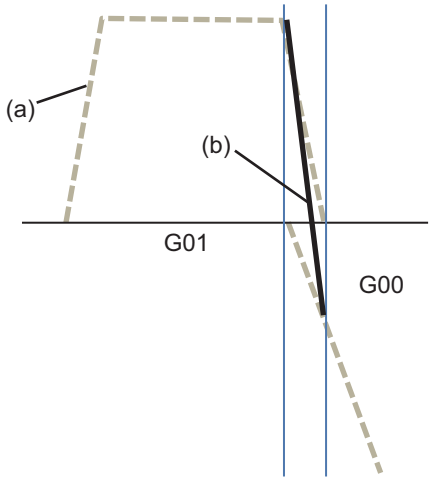
Ts: Liner acceleration/deceleration time constant
Td: Deceleration check time
Tp: Waiting time for block completion
If the SV024 setting value is larger, in-position check will end when the SV024 setting value is established.

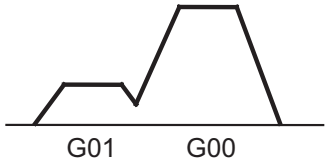
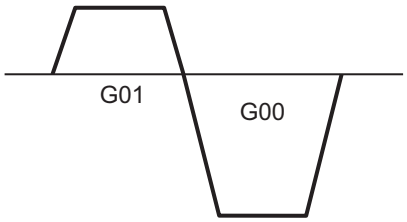
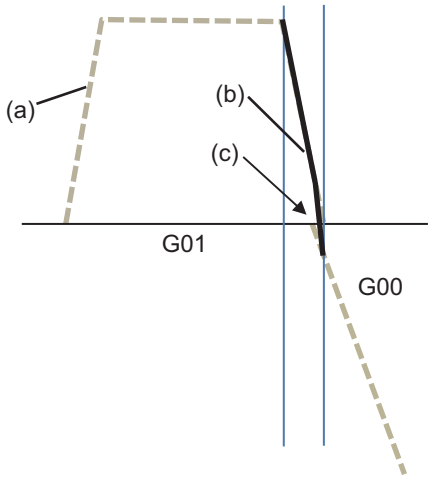
30.3 Deceleration Check for Opposite Direction Movement Reversal

Deceleration check cannot be designated for G01 -> G00 or G01 -> G01, but it can be designated in the following manner only when the movement reverses to the opposite direction in successive blocks. Deceleration check can also be executed if even one axis is moving in the opposite direction while several axes are interpolating.

■ Designating deceleration check for G01 -> G00 opposite direction movement reversal

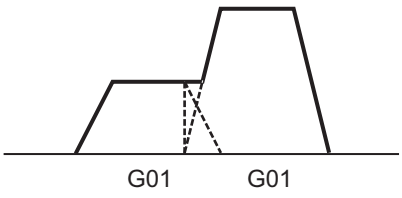
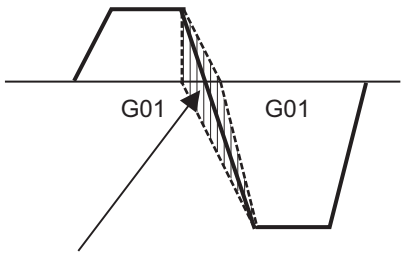
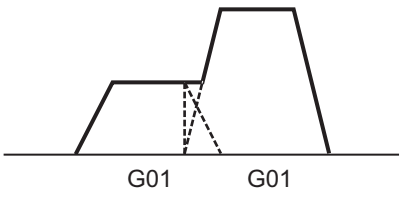
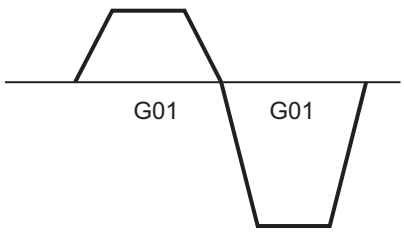
If the axis movement reverses to the opposite direction in a G01 to G00 successive block, the deceleration check for the movement in the opposite direction can be changed with the base specification parameter G01 -> G00 deceleration check (#1502 G0Ipfg).

	Same direction	Opposite direction
# 1502 = 0		 The acceleration rate is excessive due to the G01 and G00 composite speed. Enlarged figure  (a) Commanded speed (b) Resultant speed

	Same direction	Opposite direction
#1502 = 1		 Command deceleration Enlarged figure  (a) Commanded speed (b) Resultant speed (c) Command deceleration is completed.

■ Designating deceleration check for G01 -> G01 opposite direction movement reversal

If the axis movement reverses to the opposite direction in a G01 to G01 successive block, the deceleration check for the movement in the opposite direction can be changed with the base specification parameter G01 -> G01 deceleration check (#1503 G1lpfg).

	Same direction	Opposite direction
#1503 = 0		 The acceleration rate is excessive due to the G01 and G01 composite speed.
#1503 = 1		 Command deceleration

30.4 Parameters

■ Designating deceleration check

[Base specification parameters]

#	Item		Description	Setting range
1193	inpos	The definitions are changed based on the "#1306 InpsTyp Deceleration check specification type" setting.		
		When Deceleration check method 1 is selected	Select the deceleration check method for G0. 0: Command deceleration check 1: In-position check 2: Smoothing check	0 to 2
		When Deceleration check method 2 is selected	Select the deceleration confirmation method for the positioning or cutting command. 0: G0, G1+G9 Command deceleration check 1: G0, G1+G9 In-position check 2: G0,G1+G9 Smoothing check	
1223	aux07/bit1	Deceleration check method 2	Select the deceleration check method in G1+G9. 0: Command deceleration check in G1+G9 1: In-position check in G1+G9 Deceleration check is not performed for commands other than G1+G9. When "#1306 InpsTyp deceleration check specification type" is set to "1" (Deceleration check specification type 2), this parameter will be invalid.	0/1
1306	InpsTyp	Deceleration check specification type	Select the parameter specification type for the G0 or G1 deceleration check. 0: Deceleration check specification type 1 G0 is specified with "#1193 inpos". G1+G9 is specified with "#1223 aux07/bit1". 1: Deceleration check specification type 2 G0 or G1+G9 is specified with "#1193 inpos".	0/1
1389	G1SmthChk	Smoothing check method in cutting block	Select whether to apply smoothing check method to a cutting block for deceleration check, when deceleration check method is selected individually for G0 and G1 ("#1306 InpsTyp" = 0). 0: Follow the setting of "#1223 aux07/bit1" 1: Apply smoothing check method	0/1

■ Deceleration check during opposite direction travel

[Base specification parameters]

#	Item		Description	Setting range
1502	G0Ipfg	G1 -> G0 deceleration check	Select whether to perform a deceleration check when the travel direction is changed from G1 to G0. 0: NO 1: YES	0/1
1503	G1Ipfg	G1 -> G1 deceleration check	Select whether to perform a deceleration check when the travel direction is changed from G1 to G1. 0: NO 1: YES	0/1

■ Designating in-position check width

[Servo parameters]

#	Item		Description	Setting range
2224	**SV024 INP**	In-position detection width	Set the in-position detection width. Set the positioning accuracy required for the machine. The lower the setting is, the higher the positioning accuracy gets; however, the cycle time (setting time) becomes longer. The standard setting value is "50".	0 to 32767 (μm)
13024	**SP024 INP**	In-position detection width	Set the in-position detection width. Set the positioning accuracy required for the machine. The lower the setting is, the higher the positioning accuracy gets; however, the cycle time (setting time) becomes longer. The standard setting value is "875".	0 to 32767 (1°/1000)

[Axis specification parameters]

#	Item		Description	Setting range
2077	**G0inps**	G0 in-position width	Set the in-position width for G0. Between SV024 and this parameter, the parameter with a larger value will be applied. When set as "0", this parameter will be invalid: only SV024 will be available.	0.000 to 99.999 (mm)
2078	**G1inps**	G1 in-position width	Set the in-position width for G1. Between SV024 and this parameter, the parameter with a larger value will be applied. When set as "0", this parameter will be invalid: only SV024 will be available.	0.000 to 99.999 (mm)

30.5 Relation with Other Functions

- Tool compensation
  When the tool compensation is performed, the deceleration check will be operated on the block after compensation.
- Control axis synchronization (G125), control axis superimposition (G126), arbitrary axis exchange (G140), arbitrary axis superimposition (G156)
  When control axis synchronization (G125), control axis superimposition (G126), arbitrary axis exchange (G140) or arbitrary axis superimposition (G156) is performed in the other part system, the succeeding block start timing may be delayed in the cutting block to which the axis related to these functions belongs.
- Automatic error detect
  The deceleration check is invalid in the block with the automatic error detect ON, the block complete condition follows the automatic error detect.
- High-speed machining mode
  When in high-speed machining mode, if the axis movement reverses to the opposite direction in a G01 to G01 successive block, the commanded deceleration will not be performed even with G1Ipfg set to "1".
  When the axis movement reverses to the opposite direction in G01 to G00 successive block, it follows the setting of G0Ipfg.
- High-speed simple program check
  The deceleration check is performed during the high-speed operation in the high-speed simple program check also. The deceleration check time is reduced according to the time reduction coefficient during the high-speed simple program check operation.
- Deceleration check in polar coordinate interpolation/milling interpolation/cylindrical start/cancel command
  The deceleration check in polar coordinate interpolation/milling interpolation/cylindrical start/cancel command are as follows.

Parameter: #1223 aux07 BIT1	Deceleration check method
0	Command deceleration check
1	In-position check

30.6 Precautions

(1) When in-position check is valid, set the servo in-position width of the servo parameter.
(2) This function is invalid for the axes in the automatic machine lock.
(3) When the MSTB is commanded to the next block of the cutting commanded block, the MSTB code is output before the completion of the cutting command deceleration. The MSTB command must be executed after axis movement is complete. To execute the MSTB command, first confirm the DEN (motion command completion) signal with a PLC, and then execute.
(4) When the control axis in the synchronous/superimposition control exists in the part system for which in-position check method has been set, the deceleration completion will be determined when the smoothing for all axes reaches zero. (Same as the smoothing check method)
(5) When the thread cutting commands are issued consecutively, the deceleration check will not be performed at the block joint.
(6) When the parameter "#1205 G0bdcc"is set to "1", the value of in-position width set by "#2224 SV024" (In-position detection width) is applied.
In this case, in-position width setting of the parameter "#2077 G0inps" (G0 in-position width) and in-position check will be invalid.
(7) When pre-interpolation acceleration/deceleration is valid by the high accuracy control command etc. during the machine lock operation, the "Each axis in-position" signal is always turned ON.
(8) During synchronous operation, the "Each axis in-position" signal cannot be used.
(9) Deceleration Check for Opposite Direction Movement Reversal
- When deceleration check is valid ("#1502 G0Ipfg" = "1"), deceleration check will be executed when the axis reverses its movement to the opposite direction in a G1 to G0 successive block regardless of whether G0 non-interpolation is ON or OFF.
- When deceleration check is valid ("#1502 G0Ipfg" = "1"), deceleration check will also be executed when the axis reverses its movement to the opposite direction in a G1 to G0 successive block in fixed cycles.
- In the G1 -> G28, G1 -> G29 or G1 -> G30 successive blocks, deceleration check will always be executed when the G1 movement is completed, when movement to the intermediate point is completed and when movement to the return point is completed. Note that if the simple zero point return "#1222 aux06/bit7" is valid, G1 -> G0 deceleration check (#1502) will be followed when the G1 movement is completed and when movement to the intermediate point is completed. (Deceleration check will always be executed when movement to the return point is completed even in this case.)

(10) Deceleration check in movement including spindle/C-axis
The deceleration check for spindle/C-axis movement command is as described in the table below. That is because a vibration and so on occurs in the machine when the position loop gain (#13002 PGN) is changed during the axis movement.

Parameter	Rapid traverse command
Inpos(#1193)	**G0 → XX (G0+G9 → XX)**
0	Command deceleration check
1	In-position check
2	Smoothing check

Parameter	Parameter	Other than rapid traverse command (G1: other than G0 command)	
G1SmthChk(#1389)	**AUX07/BIT-1 (#1223/BIT-1)**	**G1 -> G0 (G1+G9 → XX)**	**G1 -> G1**
0	0	In-position check (Applicable only to SV024)	No deceleration check
	1		
1	0	Smoothing check	
	1		

Note

- When G1 command is issued, the in-position check is performed regardless of the deceleration check parameter.
- XX expresses all commands.

31

Synchronous Control and Multiple-axis Synchronization Control

31.1 Synchronous Control

This chapter describes position alignment that is required at the setup of the machine. Refer to "Synchronous Control Specifications Manual" (BNP-C3072-074) for details on parameter settings, operations, etc.

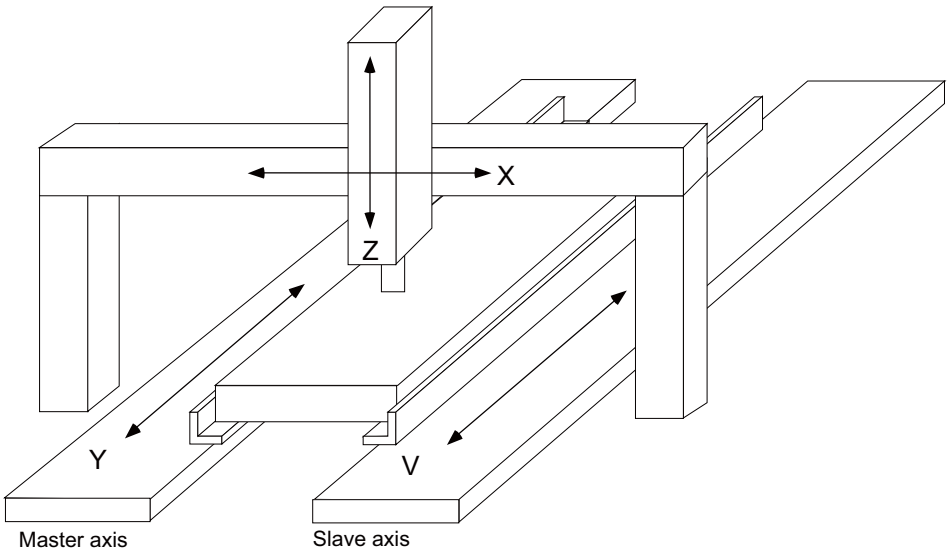
31.1.1 Outline

The synchronous control is a control method that both master and slave axes are controlled with the same movement command by designated the movement command for the master axis also to the slave axis. This function is assumed to be used in the large machine tool, etc. which drives one axis with two servo motors.
The axis that serves as the reference of synchronization is called "master axis", whereas the axis that follows the master axis is called "slave axis".

Note

(1) The axis detachment function cannot be added to the axes used in the synchronous control.
(2) Refer to the "Programming Manual" for combination with control axis synchronization between part systems.

- The synchronized axes are controlled with travel commands to the master axis.
- One slave axis can be set to one master axis.
- Up to the following sets of the master axes and slave axes can be set for all the part systems in total: 8 sets for M800 Series, 3 sets for M80 Series

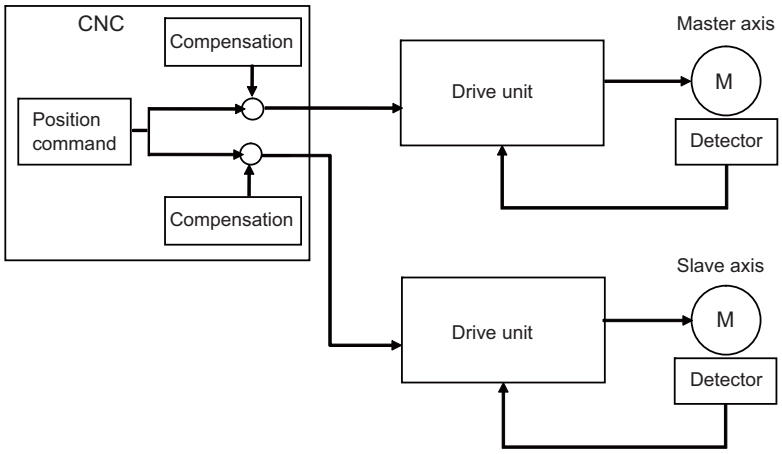


There are 3 types of synchronous control as follows:

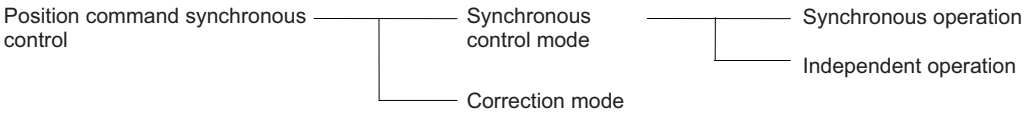
■ Position command synchronous control

This is used when the machine's rigidity is low.
The position commands from the NC are matched and the axes are driven in parallel.
This conforms the position command of the master axis to that of the slave axis using the synchronous control function of NC and drive those axes in parallel.
This can be used only by changing the NC setting, without changing the settings in the servo drive unit.

[Position command synchronous control diagram]



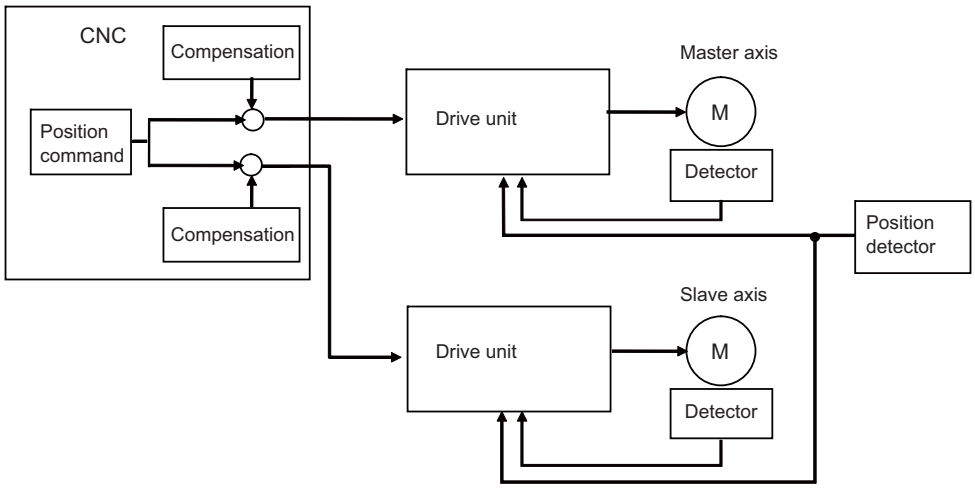
The position command synchronous control has the following configuration:



■ Speed command synchronous control

This is used when reducing the scale of the full-closed system or when the machine's rigidity, etc. cause the mutual interference to the axes positions.
This drives the master axis and the slave axis in parallel using the common position feedback. Since the feedrate of each axis is controlled by the speed feedback of each axis, the stable control is available.
This can be used when the settings of the NC and the servo drive unit are changed.

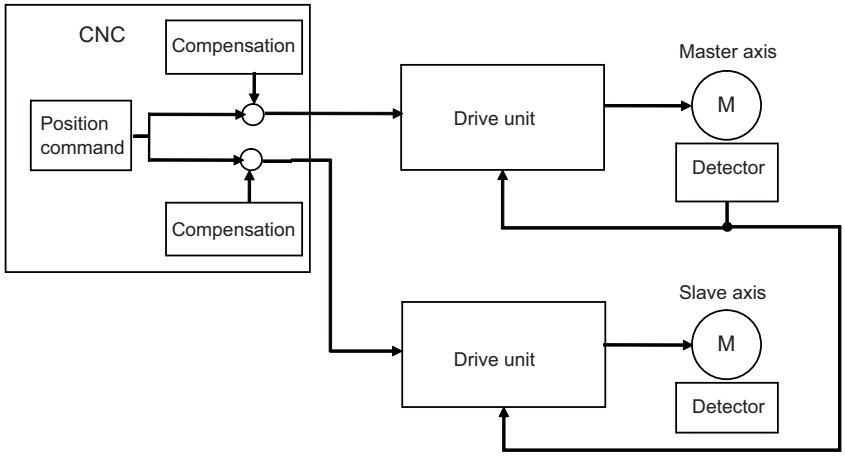
[Speed command synchronous control diagram]



■ Current command synchronous control

This is used when the machine's rigidity is high.
This drives the master and slave axes in parallel by reference to the speed feedback from the encoder onto the master axis side on the slave axis. Since that speed feedback is not the slave axis's itself, the slave axis easily vibrates. Also, as the slave axis is easily influenced by the disturbance, this is not appropriate for the machine tools which need the positioning accuracy or the interpolation accuracy.
This can be used when the setting of the NC and the servo drive unit are changed.

[Current command synchronous control diagram]



The "compensation" in the figures for position command synchronous control, speed command synchronous control, and current command synchronous control refers collectively to the pitch error compensation, thermal expansion compensation, backlash compensation, and external machine coordinate compensation.
The axes which can set the compensation during the synchronous control differ according to the synchronous control type.

31.1.1.1 Synchronous control mode

The following two operation methods are available in the synchronous control mode.

- Synchronous operation
  This is a method that both master and slave axes are moved simultaneously with the movement command for the master axis.
- Independent operation
  This is a method that either the master or slave axis is moved with the movement command for the master axis.

31.1.1.2 Correction mode

The synchronization is temporary canceled to adjust the balance of the master and slave axes during the synchronous control mode in the machine adjustment. Each axis can be moved separately with the manual handle feed or the arbitrary feed in manual mode. If the operation mode other than the manual handle feed and arbitrary feed in manual mode is applied during the correction mode, the operation error will occur.

31.1.2 Reference Position Establishment in Synchronous Operation

Carry out the position alignment of the master and slave axes during machine's setup. The positions between the synchronous axes tend to deviate at power ON, thus this deviation needs to be adjusted. After position alignment, the position error between the synchronous axes is always checked while the synchronous operation method is selected.
Perform the zero point establishment in the following steps for machines that perform synchronous operation at all times.

31.1.2.1 Zero Point Establishment in Relative Position Detection System/Dog-type Absolute Position Detection System

Position alignment at machine setup

In machine setup, carry out the position alignment between the two synchronous axes.
There are two types of position alignment methods as follows:

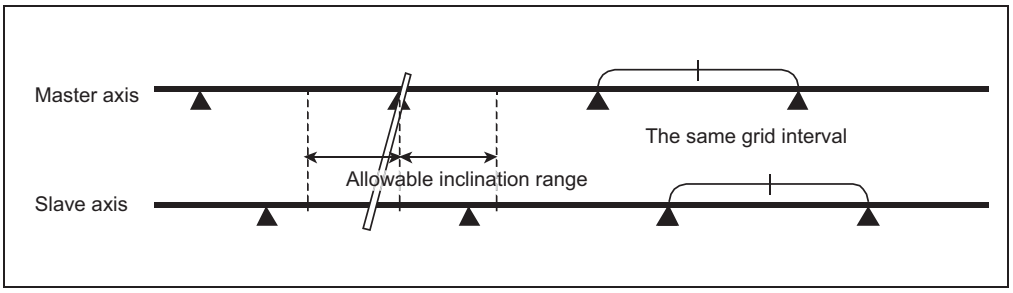
- Method using reference position adjustment value
- Method without using reference position adjustment value

■ Position alignment using reference position adjustment value

This method is enabled when in synchronous operation and "#1493 ref_syn" (synchronization at zero point establishment) is "1" (synchronous). This method is disabled when the parameter is set to "0" (asynchronous).

There are following limitations in using the reference position adjustment value.

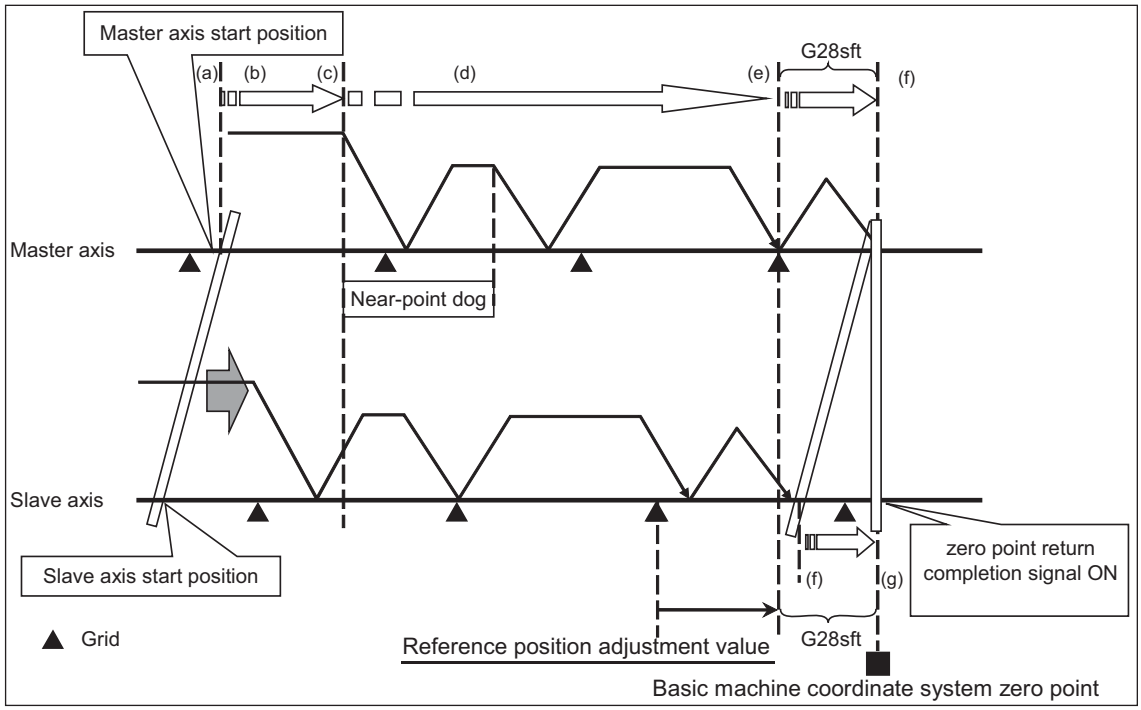
- The grid intervals (#2029 grspc) of the master and slave axes must be the same.
- Zero point return should start when the angle formed by the master and slave axes is smaller than [± Grid interval / 2]. The zero point of the master axis is deviated from that of the slave axis by one grid, when zero point return is performed while the inclination is exceeding the allowance.



When the procedure on the next page is performed and the reference position adjustment value is other than "0", the remaining distance of the slave axis is compensated by the reference position adjustment value in step (5). Therefore, when starting position alignment after balancing, set the reference position adjustment value to "0".
For speed command synchronization and current command synchronization, perform position alignment without using reference position adjustment value.

(1) From the PLC, turn ON the master and slave axis bits of the "synchronous control operation method" signal to select synchronous operation in "synchronous control mode".
(2) Carry out zero point return manually.
(3) When the master axis reaches a dog, both axes decelerate at the same time.
(4) After deceleration, both axes start traveling at a creep speed.
(5) The master axis travels until reaching the second grid after dog OFF, and stops on the grid. (If the deceleration after dog OFF goes over the 1st grid, the master axis will stop on the 3rd grid) If the reference position adjustment value is "0", the slave axis will move in synchronization with the master axis. If the value is not "0", the slave axis will be compensated by the reference position adjustment value to move asynchronously to the master axis.
(6) The master axis travels by the reference position shift distance (#2027 G28sft), and then stops. The slave axis travels in synchronization with the master axis.
(7) Switch to "Correction mode" and feed the slave axis by handle feed to the position of the desired zero point.
(8) At this point, the "reference position adjustment completion" signal is input from the PLC.
(9) When the "reference position adjustment completion" signal is input, the NC automatically sets the reference position adjustment value to "#2036 slv_adjust" (reference position adjustment value). Reference position adjustment value is a distance between the position calculated by subtracting the reference position shift distance from the current position and a near grid. Select a grid with which this vector becomes positive as the near grid. "#", which stands for the zero point return completion, is not displayed. The alarm (Z81 0001) is not cleared.
(10) Enter back into synchronous control mode synchronous operation.
(11) Carry out the normal manual zero point return. If necessary, adjust the position by the reference position shift distancet (#2027 G28sft). Set the reference position shift distance to the master axis' parameter. The slave axis value is ignored.

[Adjustment sequence]



■ Position alignment without using reference position adjustment value

[When synchronization at zero point establishment (#1493 ref_syn) is "0" (asynchronous)]

(1) Select the correction mode, and feed the master and slave axes using the manual handle to correct the error between the two axes. Use an instrument such as a level to detect horizontal level errors between the synchronous axes.
(2) Adjust the dog position. Adjust the dog position so that the return position is always the same at reference position return.
(3) Change back to synchronous mode, and carry out manual dog-type reference position return. Make sure to decelerate enough before carrying out reference position return. When the master and slave axes individually decelerate and reach zero point after the master axis' dog ON, adjust each axis' reference position shift distance (#2027 G28sft) so that there is no error between the two axes.

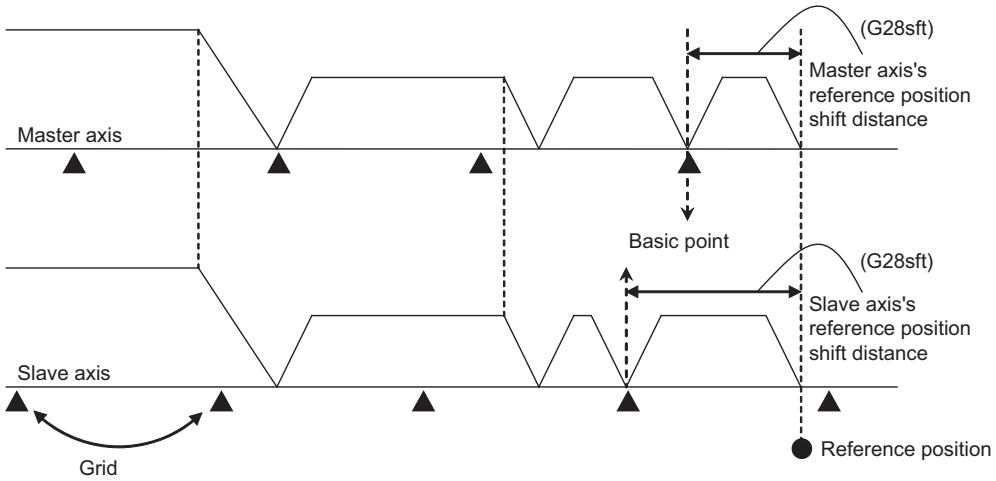
[When synchronization at zero point establishment (#1493 ref_syn) is "1" (synchronous)]

(1) Set "#2036 slv_adjust" (reference position adjustment value) to "0".
(2) From the PLC, turn ON the master and slave axis bits of the "synchronous control operation method" signal to select synchronous operation in "synchronous control mode".
(3) Carry out zero point return manually. The master axis travels until reaching the second grid after dog OFF, and stops on the grid. (If the deceleration after dog OFF goes over the 1st grid, the master axis will stop on the 3rd grid) The slave axis travels in synchronization with the master axis.
(4) When necessary, adjust the zero point using the reference position shift distance (#2027 G28sft). Set the reference position shift distance to the master axis' parameter. The slave axis value is ignored.

Position alignment after power ON

Normally, positions of the master and slave axes deviate at power ON, thus the position alignment for this deviation is required.
This position alignment is automatically done at the first dog-type reference position return after power ON. However, the settings of the zero point return parameters such as the reference position shift distance must be adjusted correctly.
Synchronous error check is not carried out until this position alignment is done.

Below is an example of reference position return.



31.1.2.2 Zero Point Establishment in Dogless-type Absolute Position Detection System

Zero point establishment in dogless-type absolute position detection system can be performed by combining "#1493 ref_syn" and "#1496 push_typ" in one of the three ways below.

[When synchronization is set to "0"]

Parameter	Setting value
Synchronization at zero point establishment (#1493 ref_syn)	0

Master axis and slave axis determine their zero points individually.

[When synchronization is set to "1" and stopper method is set to "0"]

Parameter	Setting value
Synchronization at zero point establishment (#1493 ref_syn)	1
Stopper method in zero point establishing operation (#1496 push_typ)	0

The zero points of both master and slave axes are determined by establishing the master axis' zero point. During stopper method in zero point initial setting, push until either master or slave axis reaches the current limit.

[When synchronization is set to "1" and stopper method is set to "1"]

Parameter	Setting value
Synchronization at zero point establishment (#1493 ref_syn)	1
Stopper method in zero point establishing operation (#1496 push_typ)	1

The zero points of both master and slave axes are determined by establishing the master axis' zero point. During stopper method in zero point initial setting, push toward the machine end stopper until both master and slave axes reach the current limit and the droop is canceled when the current limit is reached.

For position command synchronous control, the zero points of both master and slave axes need to be established. Therefore, select either [When synchronization is set to "1" and stopper method is set to "0"] or [When synchronization is set to "1" and stopper method is set to "1"].

Position alignment at machine setup

In machine setup, carry out the position alignment of the synchronous axes in the following procedure.

(1) Select the correction mode, and feed the master and slave axes using the manual handle to correct the error between the two axes. Use an instrument such as a level to detect horizontal level errors between the synchronous axes.
(2) Change back to synchronous mode, and carry out the zero point initial setting. There are two types of zero point initial setting: stopper method and marked point alignment method. Moreover, there are two types of stopper methods: manual initialization and automatic initialization, and there are two types of marked point alignment methods: Marked point alignment method I and marked point alignment method II. When automatic initialization is selected, some part of the following operations are automated.

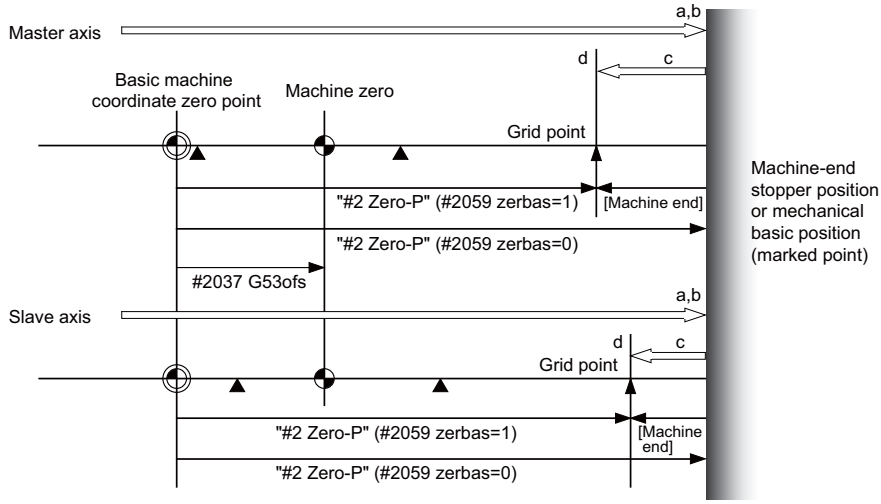
■ [When synchronization is set to "0"]

Parameter	Setting value
Synchronization at zero point establishment (#1493 ref_syn)	0

Master axis and slave axis determine their zero points individually.
(1) Individually set "#0 Absolute posn set" for both the master and slave axes to "1".
(2) For marked point alignment method, align both axes to the machine reference position (marked point) and set "#1 Origin-P" to "1". As for stopper method, push toward the machine end stopper until both axes reach the current limit.
(3) As for stopper method (#2059 = 0), push each axis against the machine end stopper, and when the current reaches its limit, the absolute position is established.
As for stopper method (#2059 = 1), push each axis against the machine end stopper, and when the current reaches its limit, each axis reverses and the absolute position is established.
As for marked point alignment method I, move each axis in the basic Z direction with "Ret. Ref. P." in "State", and when each axis reaches its grid point, the absolute position is established.
As for marked point alignment method II, the absolute position is established without moving to the grid point.
(4) Set "#2 Zero-P" for each axis.

- Synchronous error check is not performed during absolute position initial setting.
- When initial setting is carried out for one of the two synchronous axes, do this in asynchronous mode.
- During automatic initialization, the values set to push speed (#2055 pushf) for master and slave axes are valid respectively.
- PLC signal (AZSn) can also be used to set "#0 Absolute posn set" to "1".

The following is an operation example with synchronization at zero point establishment (#1493 ref_syn) set to "0" in zero point establishing operation:



Note

(1) In carrying out zero point initial setting, even when one axis has stopped on a grid, the other axis keeps traveling. Thus, decelerate enough before setting.

■ When synchronization is set to "1" and stopper method is set to "0"

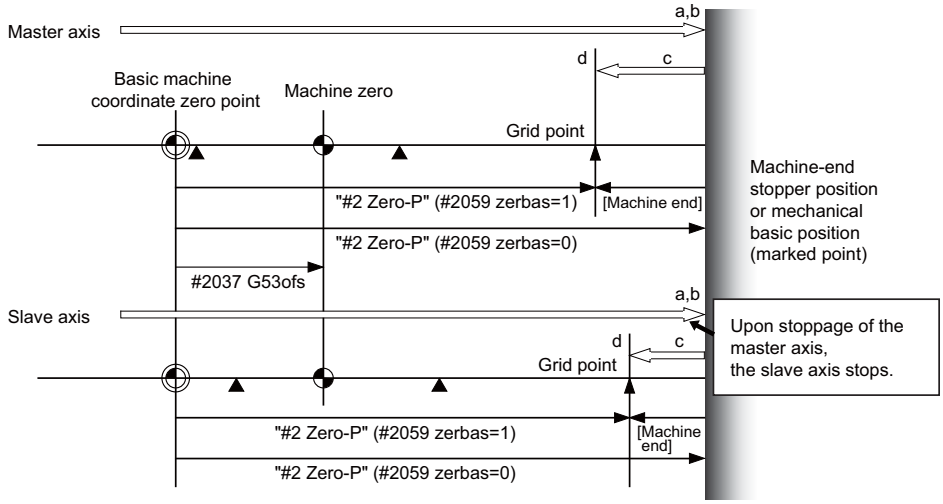
Parameter	Setting value
Synchronization at zero point establishment (#1493 ref_syn)	1
Stopper method in zero point establishing operation (#1496 push_typ)	0

The zero points of both master and slave axes are determined by establishing the master axis' zero point.
Slave axis moves synchronously with master axis.
At zero point establishment of stopper method, push until either master or slave axis reaches the current limit.
Due to this, when slave axis reaches the stopper first, the stopper position may not be the basic point.

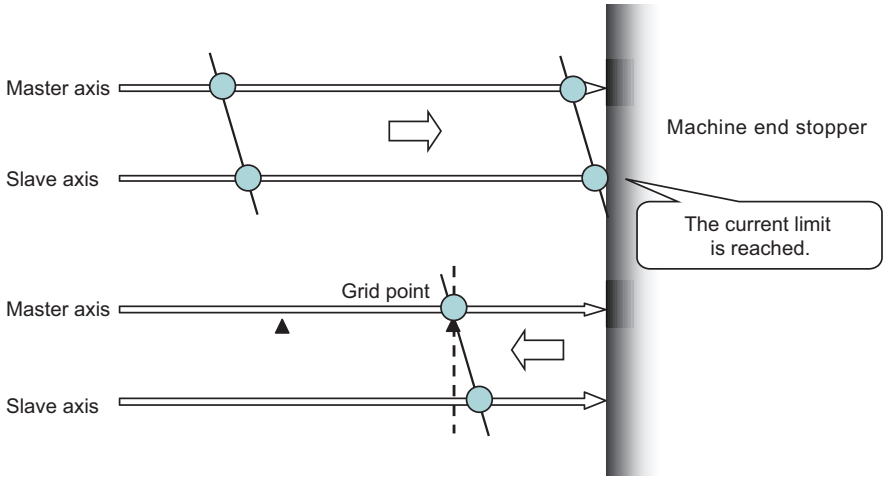
(1) Set "#0 Absolute posn set" on the master axis to "1". If "#0 Absolute posn set" on the slave axis is set to "1", a "Setting error" will occur.
(2) For marked point alignment method, align the master axis to the machine reference position (marked point) and set "#1 Origin-P" to "1". As for stopper method (#2059 zerbas = 1), push toward the machine end stopper until either master or slave axis reaches the current limit.
(3) As for stopper method (#2059 = 0), push master axis or slave axis against the machine end stopper, and when either of the axes reaches its current limit, the absolute position is established.
As for stopper method (#2059 = 1), push master axis or slave axis against the machine end stopper, and when either of the axes reaches its current limit, the axis reverses and the absolute position is established.
As for marked point alignment method I, move master axis in the basic Z direction with "Ret. Ref. P." in "State", and when the axis reaches its grid point, the absolute position is established.
As for marked point alignment method II, the absolute position is established without moving to the grid point.
(4) Set "#2 Zero-P" for the master axis. When the "#2 Zero-P" for the master axis is set, the same value is set to "#2 Zero-P" for the slave axis. The "#2 Zero-P" for the slave axis cannot be set.

- Synchronous error check is not performed during absolute position initial setting. If an operation error (M01 0051) occurs at the start of the initial setting, correct the error with correction mode before the initial setting is performed.
- During automatic initialization, the values set to push speed (#2055 pushf) and approach distance (#2056 aproch) for master axis are also valid for the slave axis.
- Set the same value to select zero point parameter and basic point(#2059 zerbas) for master and slave axes.
- When different values are set for "#2 Zero-P" on the master and slave axes, automatic initialization cannot be started.
- PLC signal (AZSn) can also be used to set "#0 Absolute posn set" to "1".
- When "#0 Absolute posn set" is set to "1" in the following states, a "Setting error" will occur.
  - Synchronous control method is not selected.
  - An attempt was made to set "#0 Absolute posn set" for the slave axis.
  - The initial setting method is marked point alignment method I and "#2050 absdir" is different for the master and slave axes.

The following is an operation example when synchronization at zero point establishment (#1493 ref_syn) is set to "1" in zero point establishing operation:



The following is the operation example of stopper method when the slave axis reaches the stopper first:



■ When synchronization is set to "1" and stopper method is set to "1"

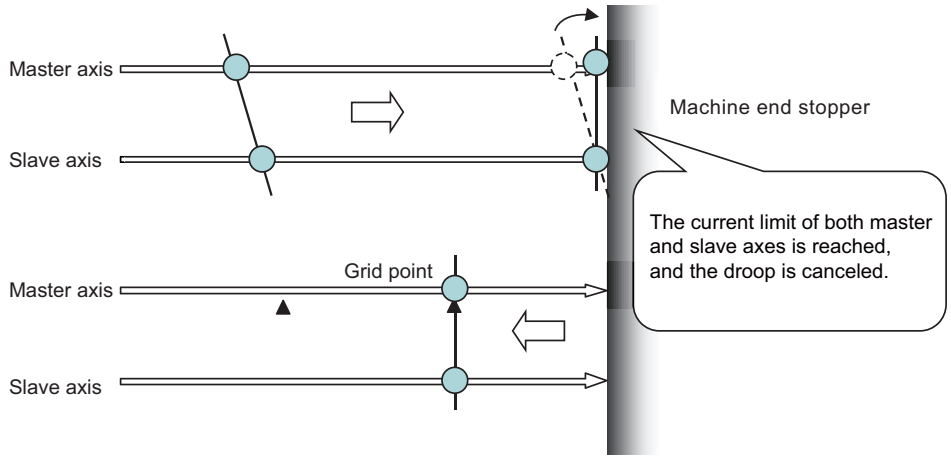
Parameter	Setting value
Synchronization at zero point establishment (#1493 ref_syn)	1
Stopper method in zero point establishing operation (#1496 push_typ)	1

The zero points of both master and slave axes are determined by establishing the master axis' zero point.
Slave axis moves synchronously with master axis.
At zero point establishment of stopper method, push toward the machine end stopper until both master and slave axes reach the current limit.
Also, the droop is canceled when the current limit is reached, which enables correction of the deviation to establish the zero point. During automatic initialization, the above operation is performed by two pushing operations.

(1) Set "#0 Absolute posn set" on the master axis to "1". If "#0 Absolute posn set" on the slave axis is set to "1", a "Setting error" will occur.
(2) For marked point alignment method, align the master axis to the machine reference position (marked point) and set "#1 Origin-P" to "1". The droop is canceled at this time. As for stopper method, push toward the machine end stopper until both axes reach the current limit. When the current limit is reached, the droop is canceled.
(3) As for stopper method (#2059 = 0), push master axis and slave axis against the machine end stopper, and when both of the axes reach their current limit, the absolute position is established.
As for stopper method (#2059 = 1), push master axis and slave axis against the machine end stopper, and when both of the axes reach their current limit, the axes reverse and the absolute position is established.
As for marked point alignment method I, move master axis in the basic Z direction with "Ret. Ref. P." in "State", and when the axis reaches its grid point, the absolute position is established.
As for marked point alignment method II, the absolute position is established without moving to the grid point.
(4) Set "#2 Zero-P" for the master axis. When the "#2 Zero-P" for the master axis is set, the same value is set to "#2 Zero-P" for the slave axis. The "#2 Zero-P" for the slave axis cannot be set.

- Synchronous error check is not performed during absolute position initial setting.
- During automatic initialization, the values set to push speed (#2055 pushf) and approach distance (#2056 aproch) for master axis are also valid for the slave axis.
- Set the same value for select zero point parameter and basic point(#2059 zerbas) for master and slave axes.
- When different values are set for "#2 Zero-P" on the master and slave axes, automatic initialization cannot be started.
- PLC signal (AZSn) can also be used to set "#0 Absolute posn set" to "1".
- When "#0 Absolute posn set" is set to "1" in the following states, a "Setting error" will occur.
  - Synchronous control method is not selected.
  - An attempt was made to set "#0 Absolute posn set" for the slave axis.
  - The initial setting method is marked point alignment method I and "#2050 absdir" is different for the master and slave axes.

The following is the operation example of stopper method when the slave axis reaches the stopper first:
Canceling the droop when the current limit is reached enables correcting the deviation of the master and slave axes with the stopper as positive.



Position alignment after power ON

Normally, positions of the master and slave axes deviate at power ON, thus the position alignment for this deviation is required.

Below are the position alignment methods.

- When synchronous error automatic correction at servo ON is enabled "#1281 ext17/bit3 = 1"
  The position of the slave axis is automatically corrected to the position of the master axis at servo ON.
- When synchronous error automatic correction at servo ON is disabled
  Position alignment is done automatically by carrying out manual zero point return. But the zero point related parameters need to be correctly adjusted and set.

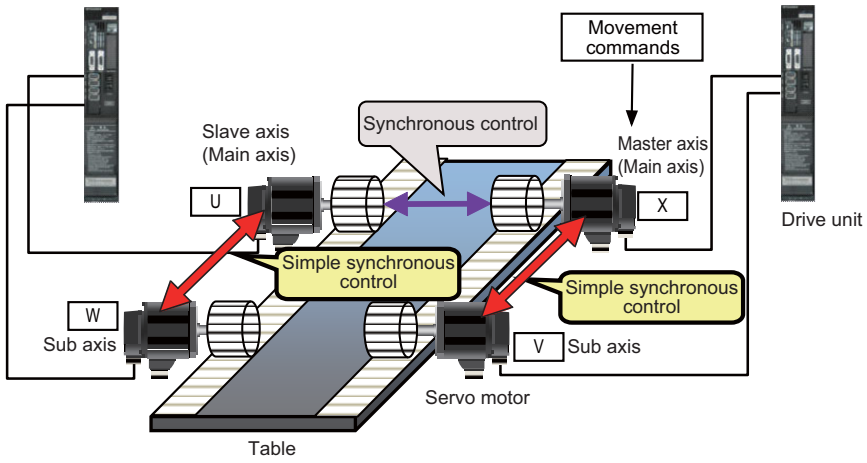
When zero point has been established, synchronous error check is carried out even before this position alignment.

31.1.3 Simple Synchronous Control

Simple synchronous control is an extension of the synchronous control function. This function enables an axis to be synchronized with the axis previously defined as master axis for the synchronous control, and another axis to be synchronized with the slave axis. Backlash can be restrained by distributing load torque imposed on one axis to two servo motors. When the synchronous control and the simple synchronous control are combined, one axis can be driven with four servo motors. An axis to be synchronized with is referred to as a "main axis" and an axis which follows the main axis is referred to as a "sub axis".
This is a control method in which the main axis and the sub axis are controlled in the same position by executing a position command for the main axis to the sub axis as well.

- The sub axes can be set only for the master axis and the slave axis for the synchronous control.
- The sub axis is controlled with the movement command for the main axis.
- Only one sub axis can be set for the main axis.
- The main axis and the sub axis are controlled at the same position. Therefore, the main axis and the sub axis can only be used together, while either of the axes can be used singly for single operation and correction mode for the synchronous control.
- For simple synchronous control, synchronization error between the main axis and the sub axis is not monitored.
- For the main axis and the sub axis, specify the speed command synchronous control or the current command synchronous control.

[Example of using simple synchronous control]



31.1.3.1 Zero Point Establishment During Simple Synchronous Control

There are following regulations and cautions regarding the zero point establishment during simple synchronous control.

- For the absolute position detection method (#2049 type), set to "2" (Marked point alignment method I) or "4" (Marked point alignment method II).
- Apply the same absolute position detection method (#2049 type) to the main axis and the sub axis.
- When the reference point establishment is performed for the master axis and the slave axis (main axis) in accordance with the zero point initial setting, the reference point for the sub axis is established at the same position.
- The absolute position setting is not available in the sub axis. If "#0 Abs pos set" of the sub axis is set to "1" in the "ABS.POSITION SET" screen, a "Setting error" will occur.
- If either the main axis or sub axis issued absolute position detection alarm (Z70 0003), the, same error will occur to the other axis.

31.1.4 Parameter Setting for Synchronous Control

To carry out synchronous control, it is necessary to set the synchronous axes names and the allowable synchronization error value.
There is a restriction in the settings of the slave axis's axis parameters.
For details, refer to "Synchronous Control Specifications Manual".

31.1.5 Relation with Other Functions

- Chopping

  Synchronous operation and chopping can be used together. When synchronous operation and chopping are used together, chopping operation can be performed on a large-scale machine tools such as gantry-type machining center, etc. For details, refer to "Synchronous Control Specifications Manual".

- Arbitrary axis exchange control

  Arbitrary axis exchange control can be performed for an axis which is set as a synchronous axis. When the arbitrary axis exchange (G140) is commanded for an axis during synchronization control, the program error (P503) occurs. When synchronous control is performed for an axis during axis exchange control, the operation error (M01 1036) occurs.

31.2 Multiple-axis Synchronization Control

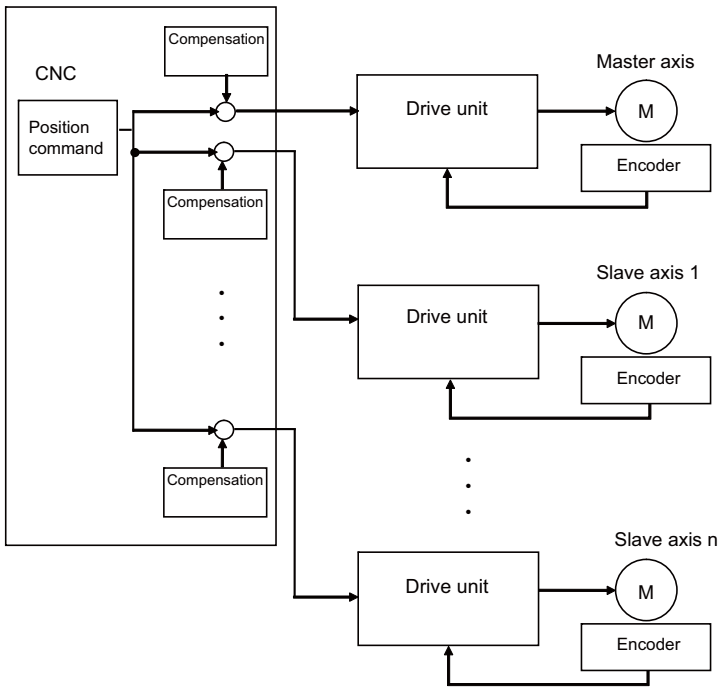
Refer to "Multiple-Axis Synchronization Control Specifications Manual" (BNP-C3072-339) for details on parameter settings, operations, etc.

31.2.1 Outline

Multiple-axis synchronization control is the function that enables multiple slave axes to be synchronized with commands to the master axis. This function can be used, for example, in multi-head machine configurations.
The axis that serves as the reference of synchronization is called "master axis", whereas the axis that follows the master axis is called "slave axis".

- The synchronized axes are controlled with travel commands to the master axis.
- For one master axis, two or more slave axes can be set.
- Up to three combinations of master axis and slave axis can be set for all the part systems.

[Configuration example of multiple-axis synchronization control]



The "compensation" in the figure refers collectively to the pitch error compensation, thermal expansion compensation, backlash compensation, and external machine coordinate compensation. Even under the multiple-axis synchronization control, the compensation is performed independently for each axis.

Perform position alignment for the master axis and each slave axis at the setup of the machine.
Also, position alignment between synchronous axes is required when power is turned ON. Perform automatic or manual reference position return, and start synchronous operation after and performing position alignment.
Refer to "23 Setting the Position Detection System" for more details on position alignment.

31.2.2 Synchronous Operation and Independent Operation

Independent operation is unavailable for multiple-axis synchronization control.
Make sure to include the master axis when configuring the setting of "synchronous control operation method" signal.

- Synchronous operation
  This method allows both master and slave axes to move synchronously by the movement commands to the master axis.
  This method is valid in both automatic and manual operations.
  The synchronous operation is selected and cancelled when all axis components are in commanded positions.
- Independent operation
  This is unavailable for multiple-axis synchronization control.

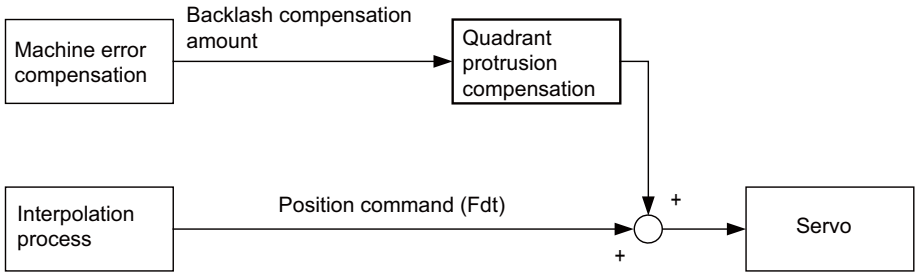
32

OMR Control

32.1 OMR II

OMR II is a function that estimates the machine or motor model (moment of inertia, clone friction, viscosity coefficient, etc.) that can cause a path error (error in actual tool path in respect to the path commanded with the program). High-accuracy machining is achieved by carrying out feed forward control based on that model. This allows error caused by quadrant protrusions during circular interpolation or quadrants on the inner side of the path to be greatly reduced.
OMR-II is a function that focuses on the quadrant protrusions, and improves the path error with this. Quadrant path compensation is included in OMR-II.

The quadrant protrusion compensation function improves quadrant protrusions by issuing compensation to the backlash compensation amount to compensate the error when the machine system direction is reversed.
By adding the compensated backlash compensation amount to the position command and sending it to the servo, the gradually increasing-type lost motion which occurs at quadrant changeover can be compensated.



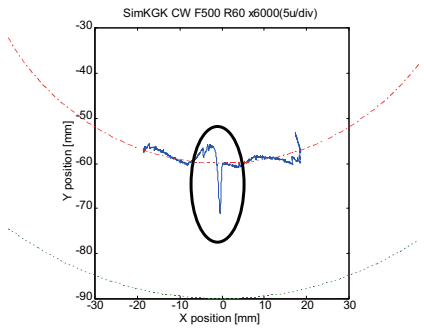
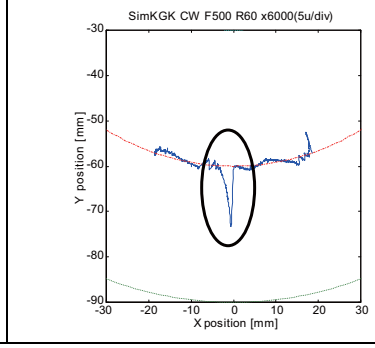
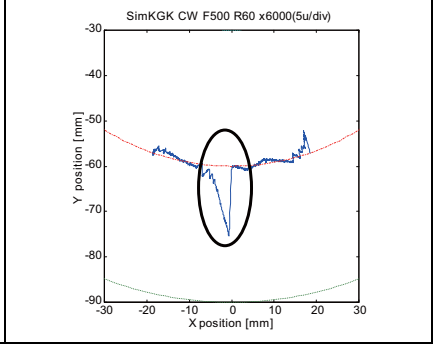
32.1.1 Adjustment Procedure

(1) Set "#2114 Blf fwdg" (Compensation FF gain) to "0".

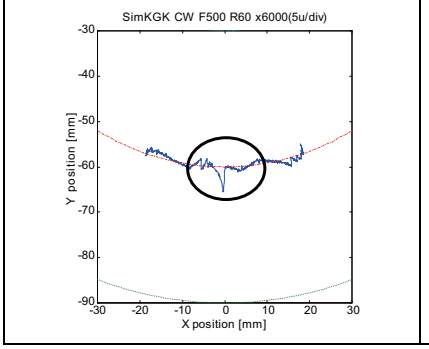
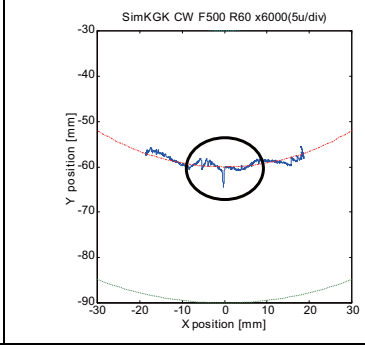
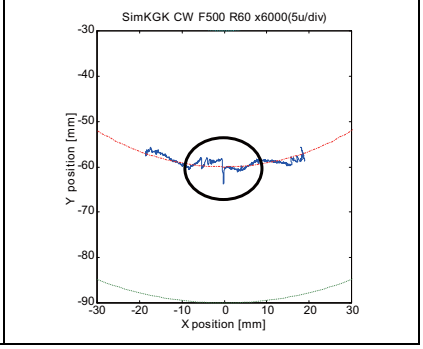
(2) Set values for "#2112 Blf motor inertia" (Motor inertia) and "#2115 Blf motor stl trq" (Motor stall torque) according to the motor specifications.
(For motor specifications, refer to the specifications manual of your drive unit.)

(3) Set "#2111 Blf valid" (Quadrant protrusion compensation valid) to "1".

(4) Adjust the setting value of "#2113 Blf visc friction" (Viscous friction) while checking the machine end.
The following figures are examples of adjusting the Y axis parameter.
Adjust the parameter while checking the part where the Y axis quadrant changeover occurs.
When the setting value of #2113 is small, a recessed part is generated inside the circle, while when the setting value of #2113 is large, a recessed part is generated outside the circle.
When a proper value is set, spike-shaped quadrant protrusions are generated with normal stepped backlash.
This quadrant protrusion is adjusted in the next section.

#2113 Blf visc friction		
0.8 × D	**D: Proper value**	**1.2 × D**
		

(5) Adjust the setting value of #2114 while checking the machine end.
The following figures are examples of adjusting the Y axis parameter.
Adjust the parameter while checking the part where the Y axis quadrant changeover occurs.
When the setting value of #2114 is small, a large quadrant protrusion is generated, while when the setting value of #2114 is large, a recessed part is generated inside the circle.

#2114 Blf fwdg		
60	**80: Proper value**	**100**
		

Note

(1) Even though #2111 is set to "1", if any of #2112, #2113, or #2115 is set to "0", the quadrant projection compensation is invalid.

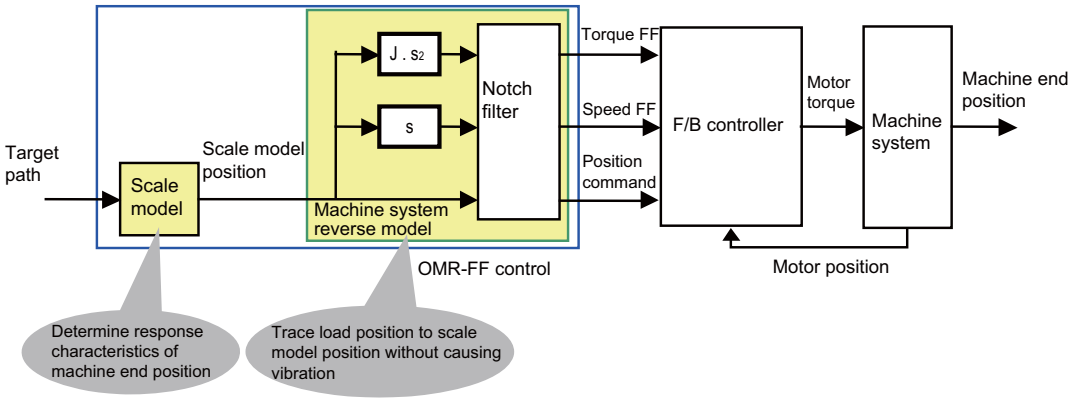
32.2 OMR-FF

OMR-FF is a function that estimates the causes (moment of inertia, clone friction, viscosity coefficient, etc.) of the path error (error in actual tool path in respect to the path commanded with the program) by making a model of the control target. Feed forward control is carried out based on that model.

With the OMR-FF control method, highly accurate machining can be achieved by using the command filter function to suppress vibration in addition to the reverse model feed forward function.
The reverse model feed forward function estimates the control target's vibration characteristics using a reverse model. The feed forward command for the appropriate position, speed and current can be obtained from this estimation. This allows the machine position to be tracked to the commanded position without causing vibration when using machine tools with low rigidity.
When the command filter function is also used, the high-range vibration elements in the command can also be suppressed.

New control method to bring out the full potential of a high-speed high-acceleration machine

- High tracking ability for the command (Smaller path error)
- Suppression of the machine vibration (Suppress low-range vibration without losing tracking ability)



[Setting parameters]

- Scale model time constant
- Machine system resonance frequency ωp, anti-resonance frequency ωz, attenuation rate ζ, inertia J

For details on OMR-FF, refer to the "Instruction Manual" for the drive unit.

32.2.1 OMR-FF Enabling Procedure (Servo)

(1) Disable the OMR-FF function.
- Set "#2139 omrff_off" to "1".
- Set "#2313 SV113/bit0" to "0".

(2) Use software such as NC Analyzer2 to adjust the feedback system (position loop gain, etc.) and inertia (# 2237 SV037 JL).
(For details, refer to the "Instruction Manual" of NC Analyzer2 and the "Instruction Manual" of your drive unit.)

(3) Enable the OMR-FF function.
- Set "#2139 omrff_off" to "0".
- Set "#2313 SV113/bit0" to "1".

(4) Set the parameters related to the OMR-FF function.
- Set the same value as "#2203 SV003 PGN" to "#2306 SV106 PGM".
- Set "#2312 SV112 IFF" to "10000".

To further adjust various gains, refer to the "Instruction Manual" for your drive unit.

32.2.2 OMR-FF Enabling Procedure (Spindle)

(1) Disable the OMR-FF function.
- Set "#13229 SP229/bit0" to "0".

(2) Use software such as NC Analyzer2 to adjust the feedback system (position loop gain, etc.) and inertia (# 13037 SP037 JL).
(For details, refer to the "Instruction Manual" of NC Analyzer2 and the "Instruction Manual" of your drive unit.)

(3) Enable the OMR-FF function.
- Set "#13229 SP229/bit0" to "1".

Set the following parameters for OMR-FF according to the desired mode.
- For spindle C-axis mode, set "#13035 SP035/bitD" to "1".
- For spindle synchronization control mode, set "#13036 SP036/bit5" to "1".

(4) Set the parameters related to the OMR-FF function.
- Set the same value as "#3203 SP003 PGN" to "#13106 SP106 PGM".
- Set "#13112 SP112 IFF" to "10000".

To further adjust various gains, refer to the "Instruction Manual" for your drive unit.

32.2.3 Precautions

(1) While OMR-FF control is being performed, the conventional feed forward control parameter (#2010 fwd_g) is disabled.
(2) To perform the synchronous control, set the axis parameters and servo parameters of the axes related to OMR-FF control of the master axis and slave axis to be the same.
(3) For the spindle, OMR-FF control is valid only in C-axis mode or spindle synchronization mode.
(4) To use the variable speed thread cutting function, set "#13036 SP036/bit5" to "0". However, in that case, OMR-FF control is invalid while spindle synchronization control is being performed.
(5) The OMR-FF control is disabled during the synchronous tapping, and the conventional feed forward control is performed.
(6) This function cannot be used in combination with a spindle type servo.

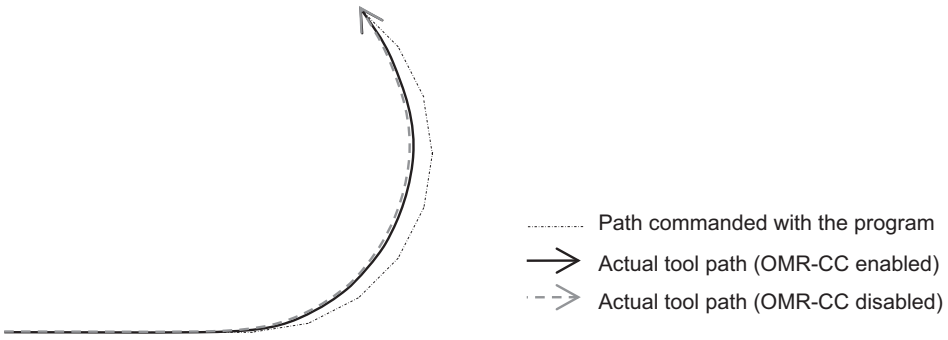
32.3 OMR-CC

OMR-CC is a function that improves the passing speed in curved parts such as arcs and free curved surfaces without increasing the path error (difference between the program path and the tool path) caused by the delay of the servo system. By enabling this function, the machining time can be shortened while maintaining the machining accuracy.

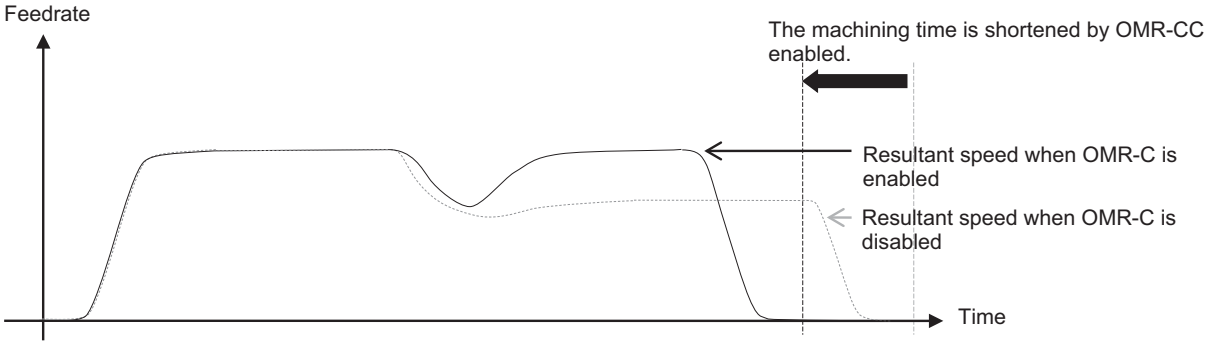
The path and feedrate when OMR-CC is enabled and when OMR-CC is disabled (OMR-FF is enabled) are outlined below.

[Operation example (Path and speed waveform of an arc-shaped machining)]

- Path to pass the curved parts when OMR-CC is enabled/disabled



- Resultant speed to pass the curved parts when OMR-CC is enabled/disabled



32.3.1 Enabling Conditions of OMR-CC

OMR-CC is enabled when all the following conditions are met.

- The additional specifications of OMR-CC are valid. (*1)
- "#2678 OMRCC_vaild" is set to "1".
- "#2306 SV106 PGM" is set to a value of "1" or more and "300" or less. (*2)
- "#2139 omrff_off" is set to "0". (*3)
- "#2313 SV113 SSF8/bit0" is set to "1". (*3)
- Spline interpolation 2 (G61.4) or tolerance control is being performed ("#12066 Tolerance ctrl ON" is set to "1").

(*1) When "#2678 OMRCC_vaild" is set to "1" while the additional specifications of OMR-CC are disabled, a setting error occurs.

(*2) When "#1753 cfgPR03/bit0" is set to "0", the enabling condition of the function is that "#2306 SV106 PGM" is in the range from "1" to "75".

(*3) When "#2139 omrff_off" is set to "1" or "#2313 SV113 SSF8/bit0" is set to "0" and "#2678 OMRCC_vaild" is set to "1", the operation error (M01 0159) occurs and the cycle start cannot be carried out.
The cycle start must be carried out after the parameters are reset to cancel the alarm.

32.3.2 Conditions for Temporarily Canceling Compensation by OMR-CC

The compensation by OMR-CC is temporarily canceled under any of the following conditions.

- One of the following commands to move the tool in rapid traverse is being performed.
  Positioning
  Reference position check
  Reference position return
  Start point return
  2nd to 4th reference position return
  Unidirectional positioning
- Synchronous tapping is being performed.

32.3.3 Description of Operation

32.3.3.1 OMR-CC Initial Setting

To use this function, set the parameters as follows.

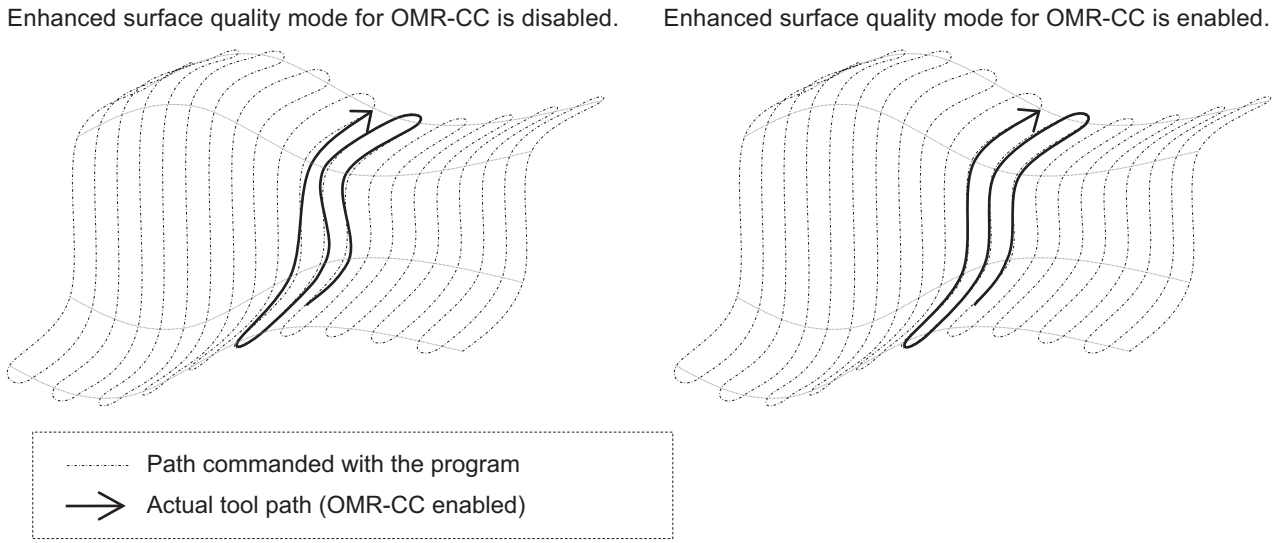
(1) Before enabling this function, set "#2306 SV106 PGM" by referring to "32.2.1 OMR-FF Enabling Procedure (Servo)".
(2) Set "#12066 Tolerance ctrl ON" to "1".
(3) Set "#2678 OMRCC_vaild" to "1" for each axis.

32.3.3.2 Adjustment by OMR-CC Compensation Factor

OMR-CC can adjust the feedrate in the curved part by changing "#2679 OMRCC_CompMag".
To shorten the cycle time, set a larger parameter setting value.
The degree of reduction in cycle time also depends on the machining program. In a machining program with few smooth curves, the cycle time may not be shortened even though a larger parameter setting value is set.
When mechanical vibration occurs, the vibration can be reduced by setting a smaller parameter setting value.
When the compensation magnification is the minimum ("#2679 OMRCC_CompMag" is set to "1"), the cycle time is approximately the same as when the OMR-FF control is being performed. When "#2679 OMRCC_CompMag" is set to "0", the operation is performed as if the standard value "50" is set.

32.3.3.3 Enhanced Surface Quality Mode for OMR-CC

Enhanced surface quality mode for OMR-CC is enabled by setting "#1753 cfgPR03/bit0" to "1". Enabling the enhanced surface quality mode for OMR-CC reduces variations of paths in the free curved surfaces and improves the surface quality. It is normally recommended to set "#1753 cfgPR03/bit0" to "1". When the setting of "#1753 cfgPR03/bit0" is changed, perform the process in "32.3.3.2 Adjustment by OMR-CC Compensation Factor" again.

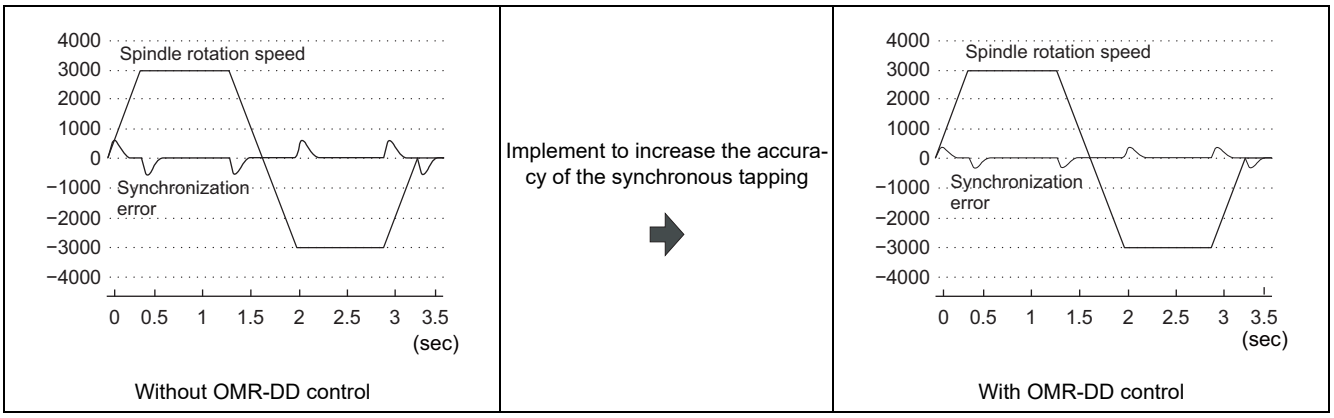


32.3.3.4 Difference Between OMR-CC and OMR-FF

Compared to OMR-FF, which has the same setting value as "#2306 SV106PGM", OMR-CC can shorten the machining time while maintaining machining accuracy.

32.4 High-speed Synchronous Tapping (OMR-DD)

The servo axis directly detects and compensates of the spindle's delay in tracking by using the communication between drive unit over the high-speed optical servo network. By minimizing the synchronization error, the accuracy of the synchronous tapping is increased.



For details on the high-speed synchronous tapping, refer to the "Instruction Manual" of the drive unit.

32.4.1 Enabling Conditions of the Function

The following conditions are required to enable this function.

- "#1281 ext17/bit5" (High-speed synchronous tapping valid) is set to "1".
- The synchronized servo and spindle are connected to the same channel.
  When they are not connected to the same channel, a normal synchronous tapping is performed.
- One spindle rotates with respect to one drilling axis of the synchronous tapping. (*1) (*2)

(*1) When multiple spindles rotate with respect to one drilling axis or one spindle rotates with respect to multiple drilling axes, a normal synchronous tapping is performed.
(*2) When the drilling axis is in synchronization control, the high-speed synchronous tapping can be performed for multiple sets (one set is one drilling axis and one spindle) by setting the slave axis parameter "#2713 stap_slave_sp_no" (Spindle No. for synchronous tapping slave axis).

32.4.2 Restrictions

This function has the following restrictions.

- High-speed synchronous tapping can be performed on up to four spindles on the same channel.
  The normal synchronous tapping is performed for the 5th and subsequent spindles.
- For "#1223 aux07/bit2" to "#1223 aux07/bit5" (Synchronous tap in-position check expansion function), you can select whether to enable the in-position check only for the hole bottom (bit4) and the R-point after the tapping retract (bit5).
  For I-point -> R-point (bit2), the in-position check cannot be omitted.
- When one of the following functions is commanded while the synchronization control is being performed, a normal synchronous tapping is performed.
  Program coordinate system rotation (for lathes)
  3-dimensional coordinate conversion
  Workpiece installation error compensation
  Inclined surface machining
- When the program coordinate system rotation is commanded while the inclined axis control is being performed, a normal synchronous tapping is performed.
- When the tapping axis is in the machine lock, a normal synchronous tapping is performed.
- When any of the vertical and horizontal axes of the selected plane is in the machine lock during program coordinate system rotation (for lathes), a normal synchronous tapping is performed.
- When any of the orthogonal axes of the part system being processed is in the machine lock during 3-dimensional coordinate conversion, workpiece installation error compensation, and inclined surface machining, a normal synchronous tapping is performed.
- High-speed synchronous tapping is not enabled while the tapping retract is being performed.
- When 3-dimensional coordinate conversion is performed, high-speed synchronous tapping can only be performed on the first part system.
  When it is commanded in the second part system or later, a normal synchronous tapping is performed.

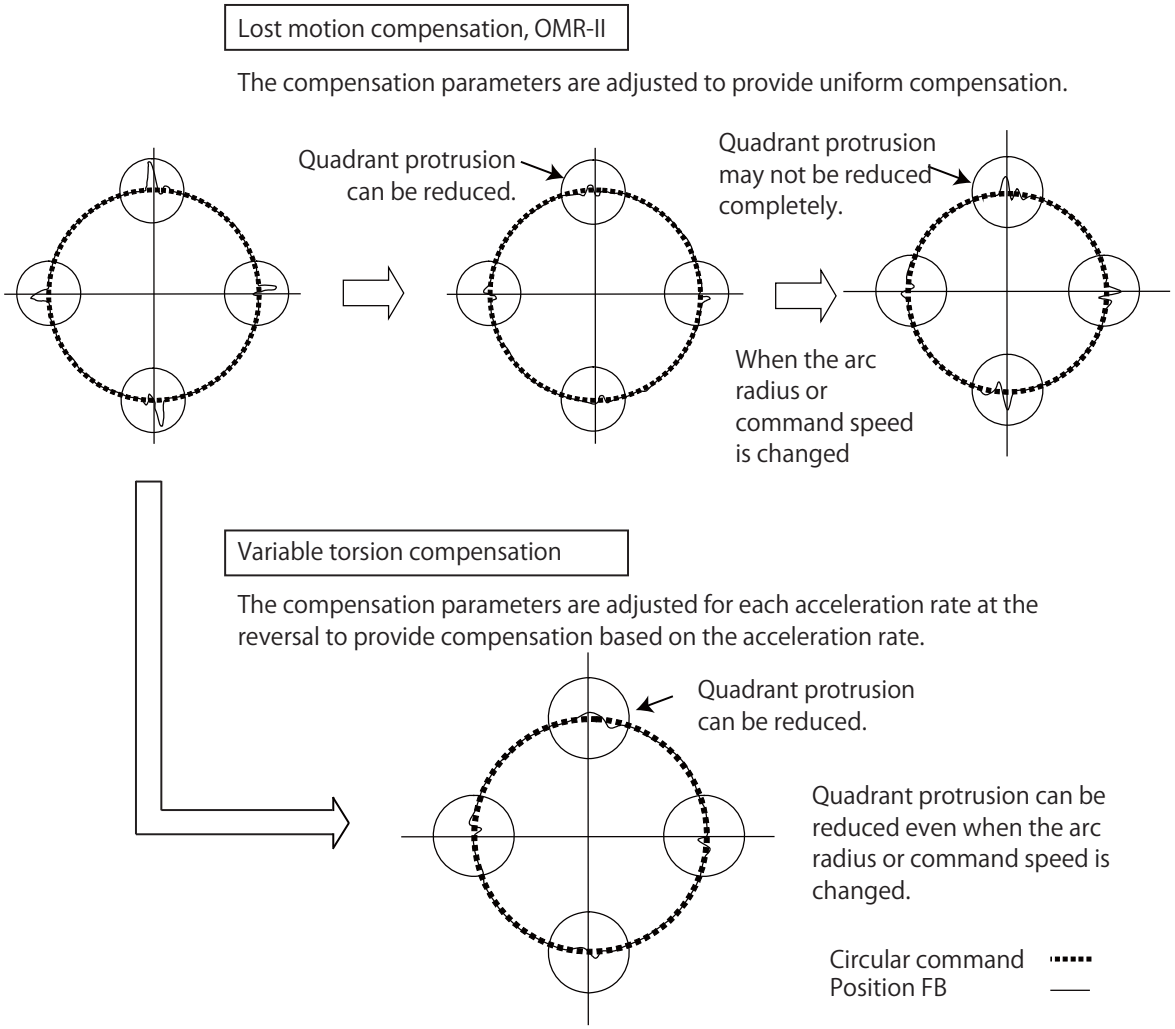
33

Variable Torsion Compensation

33.1 Outline

When the direction of the machine movement is reversed, a response delay (*1) causes protrusion on the path.
(*1) The response delay occurs due to dead band, such as friction, torsion, and backlash.

The lost motion compensation and OMR-II provide uniform compensation using the set compensation parameters regardless of the acceleration rate at the direction reversal to suppress the protrusion. However, the characteristics of the response delay at the reversal differs depending on the acceleration rate at the reversal; therefore, when the arc radius or command speed is changed, the compensation cannot be performed sufficiently.
The variable torsion compensation enables compensation based on the acceleration rate at the reversal and machining with high accuracy by setting the compensation parameters for each acceleration rate at the reversal.



This function is valid only on the first part system. Also, this function is valid on the basic axis and the additional axis. This function is invalid on the rotary axis and spindle.

33.2 Enabling Conditions

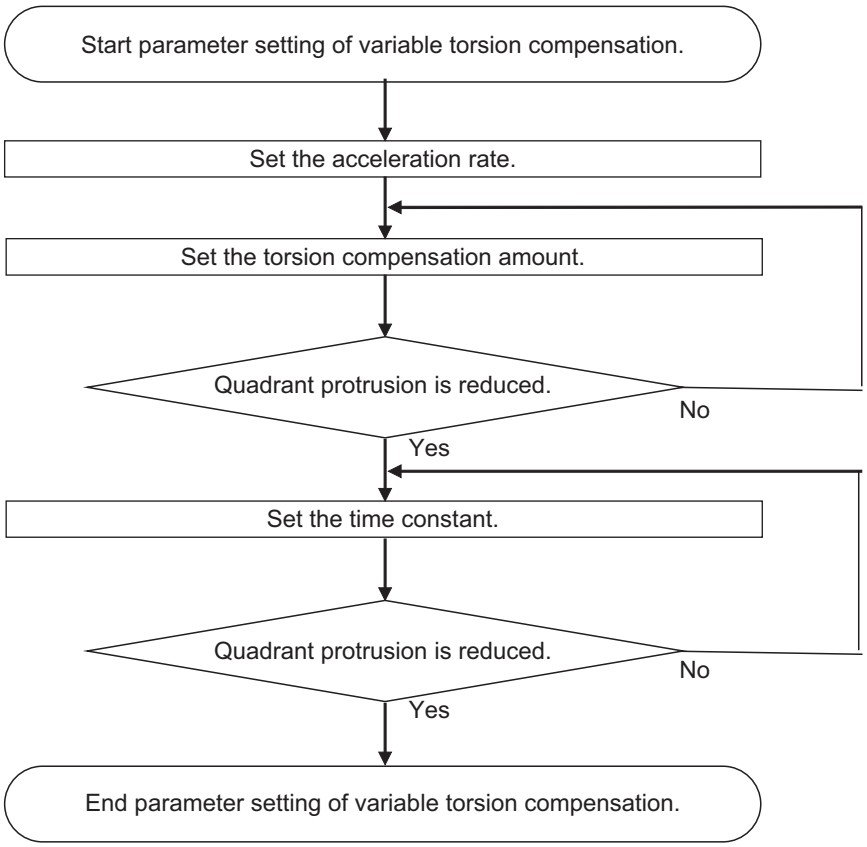
This function is enabled when all the following conditions are met.

- The optional specifications of variable torsion compensation are valid.
- "#14301 valVDC" (Variable full-closed torsion compensation ON) is "1".
- "#14311 VDCa1" (Variable full-closed torsion compensation acceleration 1) is not "0".
- The variable torsion compensation is available for the drive unit.

33.3 Parameter Setting Procedure

Set the parameters in the following order.

(1) Set the acceleration rate. (Refer to "33.3.1 Setting the Acceleration Rate".)
(2) Set the torsion compensation amount. (Refer to "33.3.2 Setting the Torsion Compensation Amount".)
(3) Set the time constant. (Refer to "33.3.3 Setting the Time Constant".)



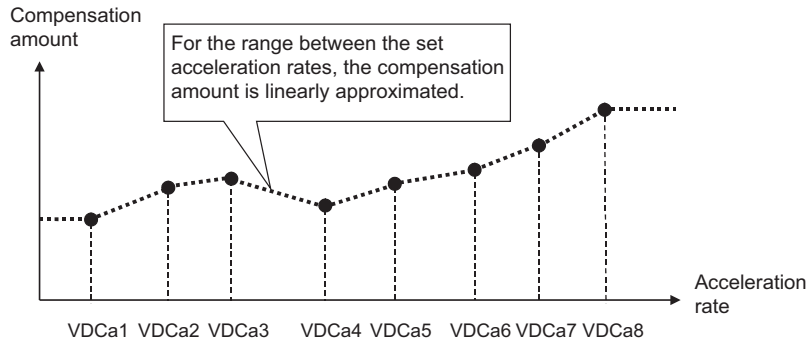
33.3.1 Setting the Acceleration Rate

Set the acceleration rate to which the variable torsion compensation is to be applied.
Set the acceleration rate at reversal of direction of the axis on which compensation is to be performed.
Set the acceleration rates by the 1st parameter to 8th parameter.
Set the acceleration rates to be greater from the 1st parameter to the 8th parameter.

1st parameter	2nd parameter	. .	8th parameter
Acceleration rate 1 (VDCa1)	Acceleration rate 2 (VDCa2)		Acceleration rate 8 (VDCa8)
Time constant 1 (VDCtex1)	Time constant 2 (VDCtex2)		Time constant 8 (VDCtex8)
:	:		:

0 < Acceleration rate 1 < Acceleration rate 2 < Acceleration rate 3 < Acceleration rate 4 < Acceleration rate 5 < Acceleration rate 6 < Acceleration rate 7 < Acceleration rate 8

For the range between the acceleration rates set in the 1st to 8th parameters, compensation is performed using the compensation amount that is linearly approximated.
For the acceleration rate smaller than that of the 1st parameter, compensation is performed using the 1st parameter. For the acceleration rate greater than that of the 8th parameter, compensation is performed using the 8th parameter.



The variable torsion compensation is invalid on the axis where "0" is set to the acceleration rate of the 1st parameter.
When the size correlation of the acceleration rates is incorrectly set from the 1st to 8th parameters, the incorrectly set parameter and the subsequent parameters are invalid.

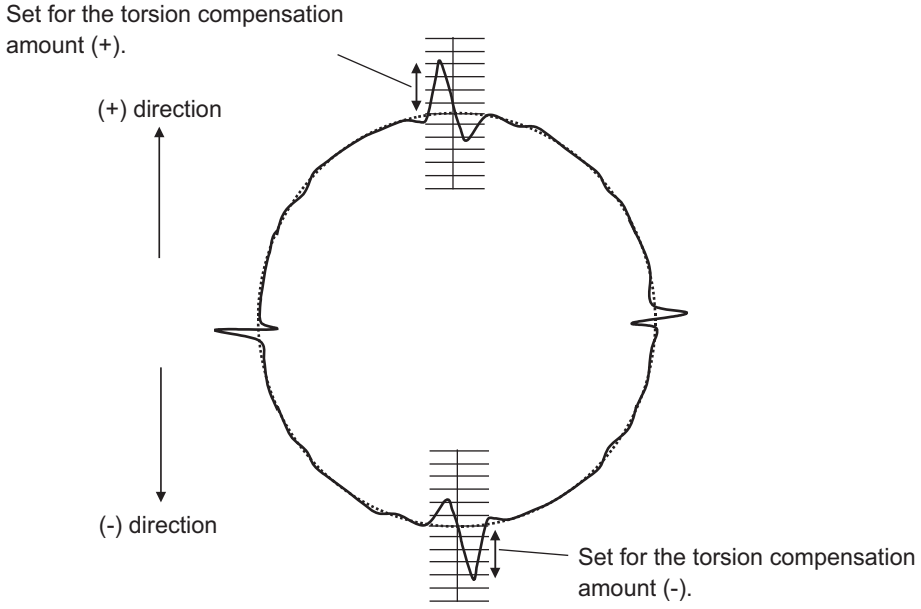
(Example) When the acceleration rate of the 4th parameter is smaller than that of the 3rd parameter
The parameters up to the 3rd parameter are valid, and the 4th and subsequent parameters are invalid. For the acceleration rate greater than that of the 3rd parameter, compensation is performed using the 3rd parameter.

The acceleration rate parameters are as follows.

	1st	2nd	3rd	4th	5th	6th	7th	8th
Acceleration rate (VDCa1 to 8)	#14311	#14316	#14321	#14326	#14331	#14336	#14341	#14346

33.3.2 Setting the Torsion Compensation Amount

Set the variable torsion compensation amounts in the (+) and (-) directions. Perform the setting for each acceleration rate. For the torsion compensation amount (+), set the protrusion size when the axis moves to the (+) direction and reverses to the (-) direction. For the torsion compensation amount (-), set the protrusion size when the axis moves to the (-) direction and reverses to the (+) direction.



The torsion compensation amount parameters are as follows.

	1st	2nd	3rd	4th	5th	6th	7th	8th
Torsion compensation amount (+) (VD-Cpex1 to 8)	#14313	#14318	#14323	#14328	#14333	#14338	#14343	#14348
Torsion compensation amount (-) (VDCnex1 to 8)	#14314	#14319	#14324	#14329	#14334	#14339	#14344	#14349

33.3.3 Setting the Time Constant

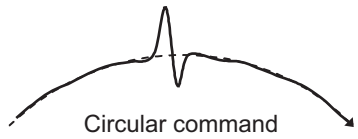
Set the time constant of the variable torsion compensation. Perform the setting for each acceleration rate.

When an appropriate value is set to the time constant, the quadrant protrusion is reduced.



When the quadrant protrusions are generated as follows, change the setting of the time constant.

■ When the outward protrusion from the arc is generated before the inward protrusion

	The compensation timing is late. Set a smaller value for the time constant.

■ When the outward protrusion from the arc is generated after the inward protrusion

	The compensation timing is early. Set a greater value for the time constant.

The time constant parameters are as follows.

	1st	2nd	3rd	4th	5th	6th	7th	8th
Time constant (VDCtex1 to 8)	#14312	#14317	#14322	#14327	#14332	#14337	#14342	#14347

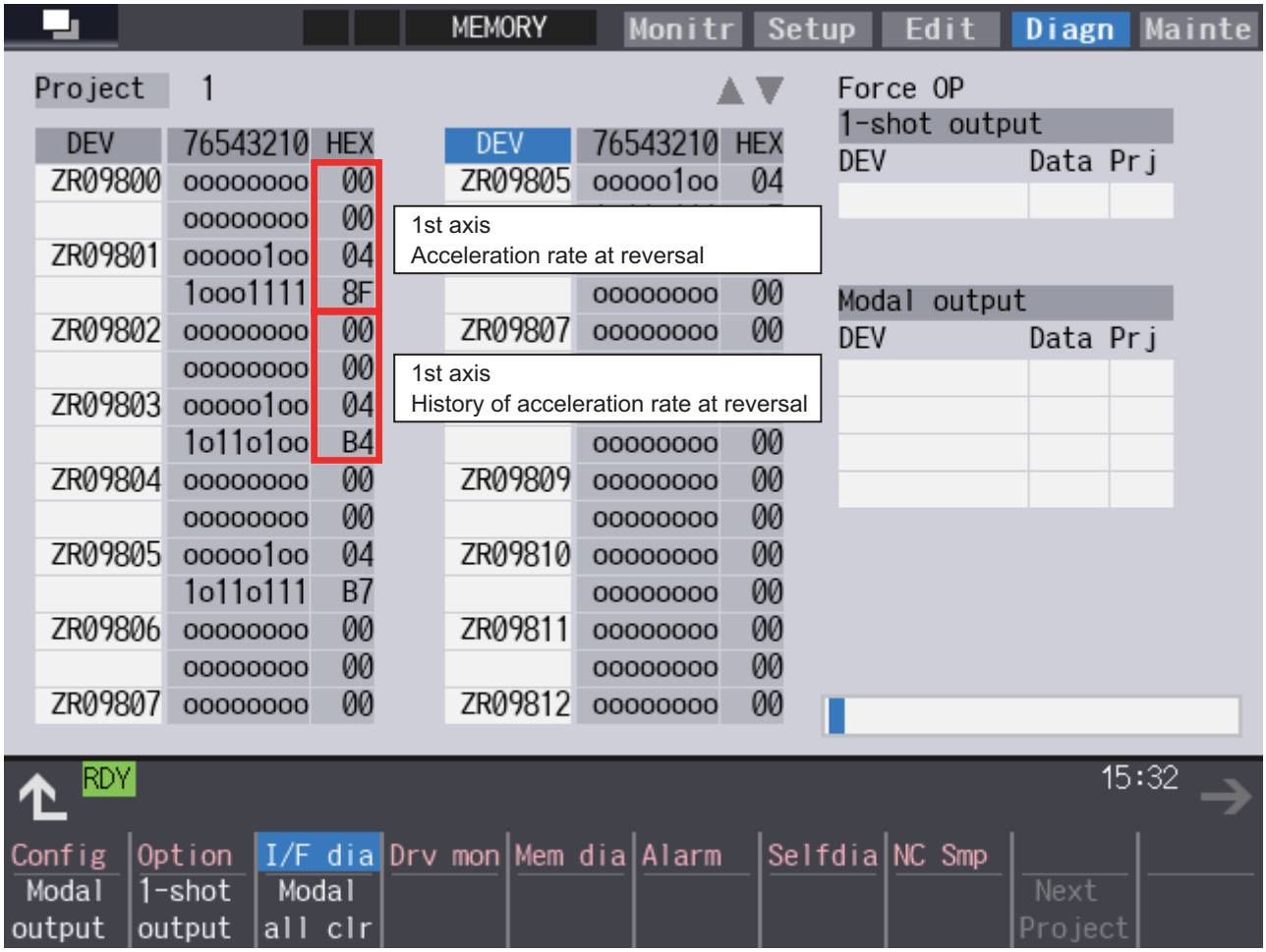
33.4 Acceleration Rate Display

Detect reversal of the direction in the variable torsion compensation function and display the acceleration rate at the reversal in hexadecimal.

Display the acceleration rate at reversal of each axis direction and the history in ZR9800 to ZR9927.

The situation of when the reversal of each axis direction occurred can be checked with the history of acceleration rate at the reversal.

For details of each register, refer to the "PLC Interface Manual".



33.5 Relation with Other Functions

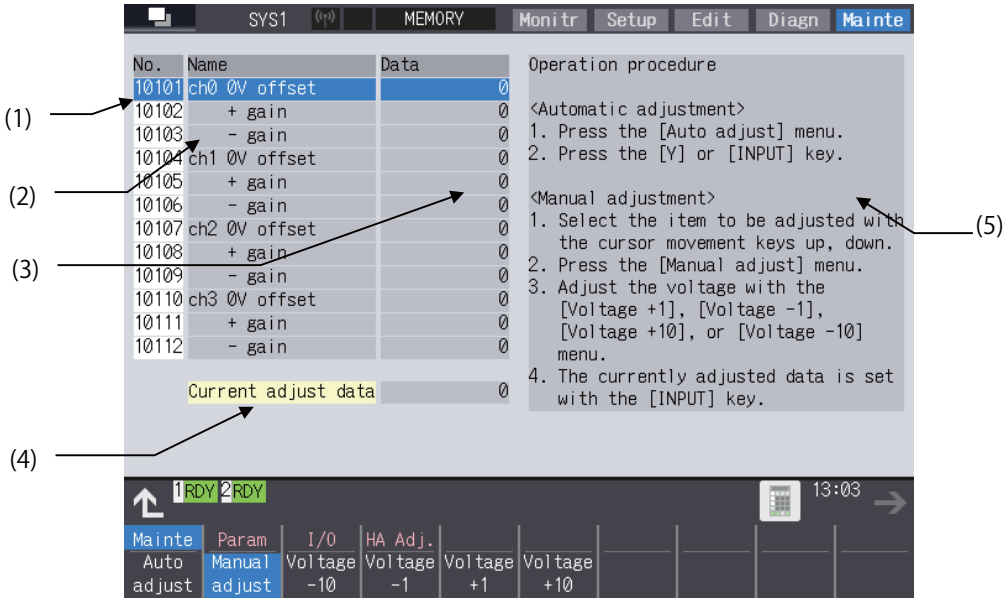
- Relation with lost motion
  When the variable torsion compensation is valid, the lost motion compensation is invalid.
- Relation with OMR-II
  It can be used with the variable torsion compensation.
- Relation with OMR-FF
  It can be used with the variable torsion compensation.
- Relation with drilling cycle high-speed retract
  It can be used with the variable torsion compensation. Even when the variable torsion compensation is valid, the lost motion compensation is valid during retract operation.
- Arbitrary axis exchange control
  When the arbitrary axis exchange control is performed while the variable torsion compensation is valid, the operation is as follows.
  - When the axis of the part system 1 is moved in the 2nd part system, compensation is performed by the variable torsion compensation parameter set to the axis.
  - When the axis of the part system 2 is moved in the 1st part system, the variable torsion compensation is not performed for the axis.

  The acceleration rate for axis before exchange is displayed as the acceleration rate at reversal of direction.
  - When the 2nd axis of the part system 1 is moved as the 2nd axis of the 2nd part system, the acceleration rate is displayed in the register of the 2nd axis of the part system 1.
  - When the 2nd axis of the part system 2 is moved as the 2nd axis of the part system 1, the variable torsion compensation is not performed for the axis, and the acceleration rate is not displayed in the register.
- Synchronous control
  It can be used with the variable torsion compensation.
  In the synchronous operation method, the same compensation is performed between the slave axis and the master axis. The compensation parameter set to the slave axis is ignored.
  In the independent operation method, the compensation is performed for the slave axis with the compensation parameter set to the slave axis.

34

Adjust S-analog Screen

The spindle analog output adjustment is carried out on this screen.



Display items

Display item	Details
(1) Parameter No.	This is a number to be used when inputting/outputting the parameters. For manual adjustments, this uses the [↑] [↓] keys to move the cursor to the setting item to be adjusted. The cursor does not display during automatic adjustments.
(2) Adjustment item name	This displays the names of the spindle analog adjustment items.
(3) Adjustment data	This displays the setting data for each adjustment item.
(4) Current adjust data	This displays data which is being adjusted manually. (Display only during a manual adjustment.)
(5) Operation procedure	This displays the operation procedures for automatic and manual adjustments.

Menus

Menu	Details	Reference
Auto adjust	This carries out automatic adjustment of the spindle analog output.	Performing Automatic Adjustments
Manual adjust	This carries out manual adjustment of the spindle analog output.	Performing Manual Adjustments
Voltage -10	This is used during manual adjustments to adjust downward in decrements of 10.	
Voltage -1	This is used during manual adjustments to adjust downward in decrements of 1.	
Voltage +1	This is used during manual adjustments to adjust upward in increments of 1.	
Voltage +10	This is used during manual adjustments to adjust upward in increments of 10.	

34.1 Adjustment Preparations

The PLC must be stopped when performing spindle analog output adjustments by one of the following methods below:

Operation methods (when stopping the PLC with the rotary switch)

(1) Set the rotary switch CS2 in the upper part of the unit to "1". ➡ The PLC is stopped.

Operation methods (when stopping the PLC on the maintenance screen)

(1) Press the function key [MAINTE] and then press the menu [MAINTE].

(2) Press [Psswd input].

(3) Enter the machine tool builder password.

(4) Press the menu [PLC STOP] and then press [Y] key. ➡ The PLC is stopped.

34.2 Performing Automatic Adjustments

Automatic adjustment will execute "0 V offset adjustment" and "+ gain adjustment" for the remote I/O analog outputs (max. 4ch) connected to the main unit. Negative (-) gain will be treated as the equal to positive (+) gain.

Operation methods

(1) Press the menu [Auto adjust]. ➡ An operation message "Execute? (Y/N)" will display.

(2) Press the[Y] or [INPUT] key. ➡ Automatic adjustment begins.
The operation message "Auto adjusting" appears.

The manual adjustment related menu is displayed in gray during the automatic adjustment, and manual adjustments will be disabled. Switching to other screens is also disabled at this time.
When automatic adjustment is complete, an operation message "Auto adjust complete" will display.
The highlighting of the menu [Auto adjust] is cleared and the cursor is returned to where it was before the auto adjustment.
The menu [Manual adjust] returns to the normal display and manual adjustment can be performed.

34.3 Performing Manual Adjustments

Adjusting the ch0 0 V offset

(1) Use the [↑] [↓] keys to move the cursor to "#10101", then press [Manual adjust].

➡ The current setting value is displayed under "Current adjust data".
A 0 V analog voltage is output to ch0 at this time.

(2) Monitor the analog voltage.

➡ Adjust the 0 V offset until the analog voltage is 0 V ±3.5 mV.
The setting range -999 to 999.

(3) <For plus-voltage>
Press [Voltage -1] or [Voltage -10].

➡ "Current adjust data" is adjusted downward in decrements of 1 each time [Voltage -1] is pressed.
"Current adjust data" is adjusted downward in decrements of 10 each time [Voltage -10] is pressed.

<For minus-voltage>
Press the menu [Voltage +1] or [Voltage +10].

➡ "Current adjust data" is adjusted upward in increments of 1 each time [Voltage +1] is pressed.
"Current adjust data" is adjusted upward in increments of +10 each time [Voltage 10] is pressed.

<Note>
- The range for "current adjust data" is -999 to 999. The adjustments cannot exceed this range.

(4) Press the [INPUT] key.

➡ "Current adjust data" will be set to "ch0 0 V offset", and the 0 V offset result in enabled.

Adjusting the ch0 + gain

(1) Use the [↑] [↓] keys to move the cursor to "#10102", then press [Manual adjust].

➡ The current setting value is displayed under "Current adjust data".
A +10 V analog voltage of ch0 is output at this time.

(2) Monitor the analog voltage.

➡ Adjust the + gain until the monitor voltage is 10 V ±3.5 mV.
The setting range -999 to 999.

(3) <For 10 V or higher>
Press the menu [Voltage -1] or [Voltage -10]

<For less than 10 V>
Press the menu [Voltage +1] or [Voltage +10].

(4) Press the [INPUT] key.

➡ "Current adjust data" will be set to "ch0 + gain", and the adjustment result is enabled.

Adjusting the ch0 - gain

(1) Use the [↑] [↓] keys to move the cursor to "#10103", then press [Manual adjust].

➡ The current setting value is displayed under "Current adjust data".
A -10 V analog voltage of ch 0 is output at this time.

(2) Monitor the analog voltage.

➡ Adjust the - gain until the monitor voltage is -10 V ±3.5 mV.
The setting range -999 to 999.

(3) <For -10V or higher>
Press the menu [Voltage -1] or [Voltage -10]

<For less than -10V>
Press the menu [Voltage +1] or [Voltage +10].

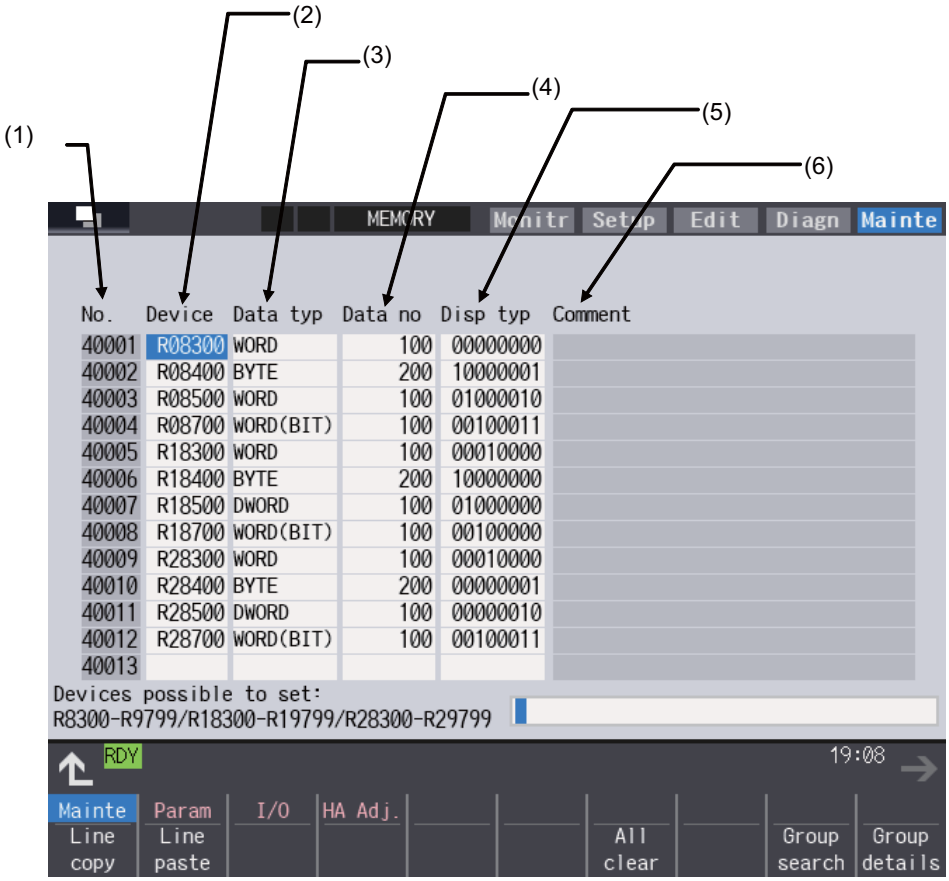
(4) Press the [INPUT] key.

➡ "Current adjust data" will be set to "ch0 - gain", and the adjustment result is enabled.

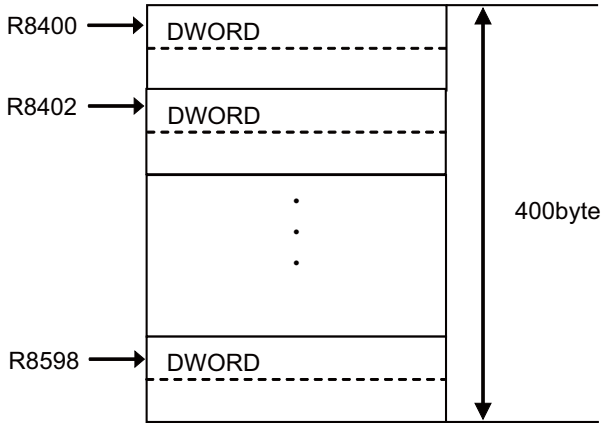
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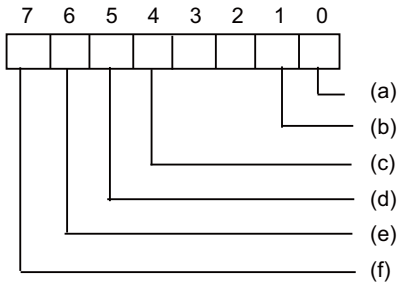
Device Open Parameter Screen

This function can set or change the user back up area of the PLC device from the NC screen.
Divide the device area in accordance with the specifications of the machine tool builder and switch the display format or data type for each divided area (hereinafter called a group information).



Display items

Display item	Details	Setting range
(1) Parameter No.	Displays the parameter Nos.(maximum of 100).	-
(2) Device allocation	Set the head device which designates the divided area. It is possible to designate the device allocation which overlaps with other groups. When "0" is set to the device allocation, it clears the settings (data type, display format etc.) of the target group. When an odd number address is set for the device allocation, DWORD cannot be designated for the data type.	R8300 to R9799 R18300 to R19799 R28300 to R29799 0
(3) Data type	Sets the data type (BYTE, WORD, DWORD, WORD(BIT)) for the allocated space. BYTE: Allocates space in 1-byte increments. WORD: Allocates space in 2-byte increments. DWORD: Allocates space in 4-byte increments. WORD(BIT): Allocates space in 2-byte increments. DWORD cannot be designated when the device allocation is an odd number address. BIT format is valid for the display format when WORD(BIT) is designated. The data type can also be designated by pressing the menu [BYTE], [WORD], [DWORD], or [WORD(BIT)].	0: WORD 1: DWORD 2: BYTE 3: WORD(BIT)
(4) Number of data	Set the number of data in the allocation area. Number of data available to designate varies depending on the designated data type. When the number of data is "0", the target group will be invalid. (Example) Device allocation: R8400 Data type: DWORD Number of data: 100  	0 to 3000 Depends on the device allocation and data type.

Display item	Details	Setting range
(5) Display format	Designate the display format of the data, the restriction of display, and the state of input protection.  (a) Cancel input protection 1: Not check Input protection check for the data protection key 2 will not be executed in the group detail screen. 0: Check Input protection check for the data protection key 2 will be executed in the group detail screen. The name of the data protection key varies depending on the machine tool builder. Refer to the instruction manual issued by the machine tool builder for details. (b) Cancel display restrictions 1: Display The group detail screen is displayed without entering the machine tool builder's password. 0: Not display The group detail screen is not displayed when the password is not entered. (c) BCD format 1: Enable Display the group detail screen data in BCD format. 0: Disable (d) BIT format 1: Enable Display the group detail screen data in BIT format. 0: Disable (e) HEX format (Hexadecimal format) 1: Enable Display the group detail screen data in HEX format. 0: Disable (f) Sign (Decimal format only) 1: Unsigned Displays the group detail screen data in unsigned decimal format. 0: Signed Display the group detail screen data in decimal format with sign. When "BCD format", "HEX format" and "BIT format" are all set to "0" (OFF) or more than one bit is set to "1" (ON), the data display format will be decimal format with sign.	-
(6) Group comment	Display a comment that is defined in the comment definition file for the device open or a comment of a head device of the group. • When defining a group Displays a comment for each group. It will be displayed regardless of device allocation and the setting of number of data. • When not defining a group Displays a comment for the device set under "(2) device allocation".	-

Menu for the device allocation/number of data input

Menu	Details
Line copy	Copy the data of a line where a cursor is placed.
Line paste	Writes the contents of the data copied (one line) into a line where the cursor is placed. If the data of the line is changed after [Line copy] is pressed, the data before change will be written when pasting it. Once the line is copied, it can be pasted many times until new area is copied.
All clear	Clears all allocation of the parameter in the device open parameter screen. Data of the devices will not be cleared.
Group search	When parameter No. is set and [INPUT] key is pressed, the group will be displayed with the set parameter No. at the top of the group. A cursor moves to the line of the target group.
Group details	The group detail screen corresponding to the group where a cursor is placed will be displayed. When the group where the cursor is placed is not set, it will be invalid.

Menu when inputting the display format

Menu	Details
W/ DEC sign	Change the display format to the decimal format with sign. When the data type is "WORD (BIT)", it will be changed to "WORD".
W/O DEC sign	Change the display format to the decimal format without sign. When the data type is "WORD (BIT)", it will be changed to "WORD".
HEX	Changes the display format to hexadecimal. When the data type is "WORD (BIT)", it will be changed to "WORD".
BIT	Change the display format to the BIT format. The data type is changed to "WORD (BIT)".
BCD	Change the display format to the BCD format. When the data type is "WORD (BIT)", it will be changed to "WORD".
Enable display	Select whether to display the target group information on the each group detail screen to users.
Cancel protect	Select whether the input protection of the data protection key 2 is valid/invalid for setting of the target group information on the each group detail screen to users.
Line copy	Copy the data of a line where a cursor is placed.
Line paste	Writes the contents of the data copied (one line) into a line where the cursor is placed. If the data of the line is changed after [Line copy] is pressed, the data before change will be written when pasting it. Once the line is copied, it can be pasted many times until new area is copied.
All clear	Clears all allocation of the parameter in the device open parameter screen. Data of the devices will not be cleared.
Group search	When parameter No. is set and [INPUT] key is pressed, the group will be displayed with the set parameter No. at the top of the group. A cursor moves to the line of the target group.
Group details	The group detail screen corresponding to the group where a cursor is placed will be displayed. When the group information, where a cursor is placed, is not set, it will be invalid.

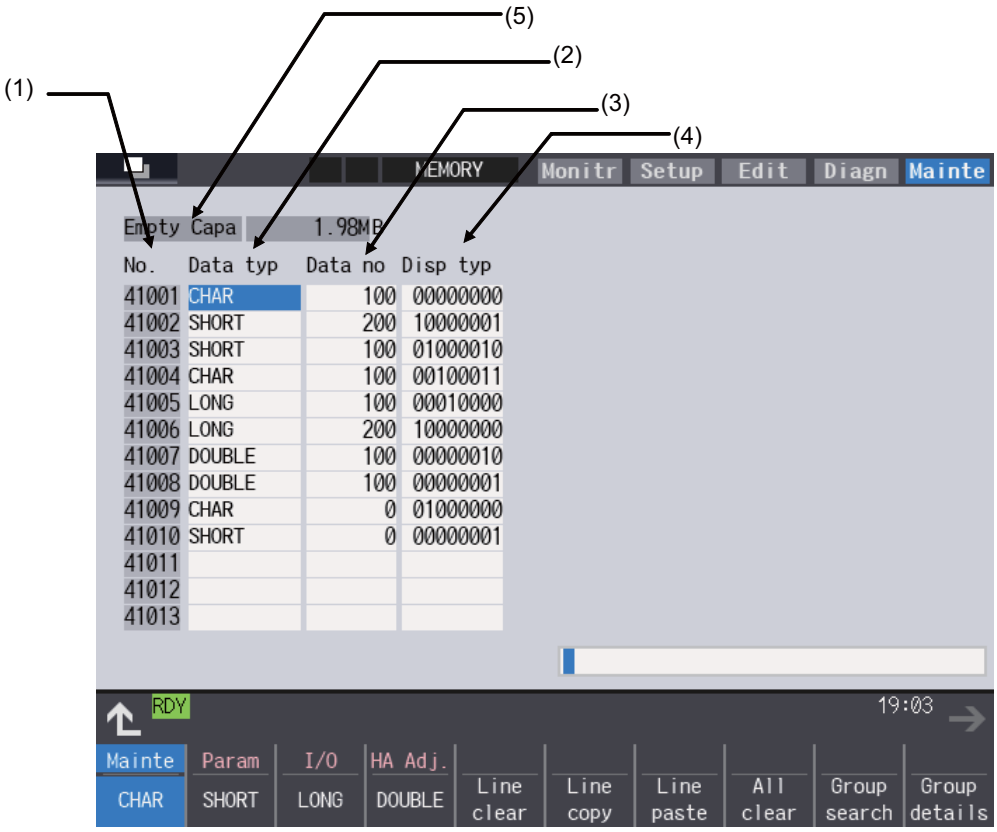
Menu when inputting the data type

Menu	Details
BYTE	Input "BYTE" to the data type. When the display format is BIT format, it will be changed to the desimal format with sign.
WORD	Inputs "WORD" to the data type. When the display format is BIT format, it will be changed to the desimal format with sign.
DWORD	Inputs "DWORD" to the data type. When the display format is BIT format, it will be changed to the desimal format with sign.
WORD (BIT)	Input "WORD(BIT)" to the data type. Display format will be changed to the BIT format.
Line copy	Copy the data of a line where a cursor is placed.
Line paste	Writes the contents of the data copied (one line) into a line where the cursor is placed. If the data of the line is changed after [Line copy] is pressed, the data before change will be written when pasting it. Once the line is copied, it can be pasted many times until new area is copied.
All clear	Clears all allocation of the parameter in the device open parameter screen. Data of the devices will not be cleared.
Group search	When parameter No. is set and [INPUT] key is pressed, the group will be displayed with the set parameter No. at the top of the group. A cursor moves to the line of the target group.
Group details	The group detail screen corresponding to the group where a cursor is placed will be displayed. When the group where the cursor is placed is not set, it will be invalid.

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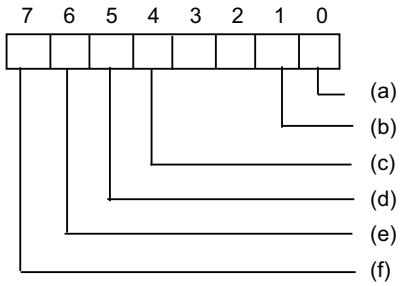
SRAM Open Parameter Screen

SRAM open area for a machine tool builder can be set or changed.
It can be divided according to the machine tool builder's usage, and the display format and the data format can be switched for each divided area (hereinafter called a group).



Display items

Display item	Details	Setting range
(1) Parameter No.	Displays the parameter Nos.(maximum of 100).	-
(2) Data type	Set the data type (CHAR, SHORT, LONG, DOUBLE) of the allocation area. CHAR: 1-byte integer type. Allocates space in 1-byte increments. SHORT: 2-byte integer type. Allocates space in 2-byte increments. LONG: 4-byte integer type. Allocates space in 4-byte increments. DOUBLE: 8-byte real type. Allocates space in 8-byte increments. Target group setting (No. of data, display format) will be cleared if "0" is designated. The data type can also be designated by pressing the menu [CHAR], [SHORT], [LONG] or [DOUBLE]. The data set will be valid after formatting and then turning the power ON again. If the power is turned ON without formatting after the setting, the warning "Z40 Format mismatch" will be displayed. The error will be kept displayed even the power is turned ON again until the reformatting is completed.	0 1: CHAR 2: SHORT 3: LONG 4: DOUBLE
(3) Number of data	Set the number of data in the allocation area. Number of data available to designate varies depending on the unit and the free space designated by the data type. When the number of data is "0", the target group will be invalid. The data set will be valid after formatting and then turning the power ON again. If the power is turned ON without formatting after the setting, the warning "Z40 Format mismatch" will be displayed. The error will be kept displayed even the power is turned ON again until the reformatting is completed.	0 to 9999999 Depends on the data type and the amount of free space.

Display item	Details	Setting range
(4) Display format	Designate the display format of the data, the restriction of display, and the state of input protection.  (a) Cancel input protection 1: Not check Input protection check for the data protection key 2 will not be executed in the group detail screen. 0: Check Input protection check for the data protection key 2 will be executed in the group detail screen. The name of the data protection key varies depending on the machine tool builder. Refer to the instruction manual issued by the machine tool builder for details. (b) Cancel display restrictions 1: Display The group detail screen is displayed without entering the machine tool builder's password. 0: Not display The group detail screen is not displayed when the password is not entered. (c) BCD format 1: Enable Display the group detail screen data in BCD format. 0: Disable (d) BIT format 1: Enable Display the group detail screen data in BIT format. 0: Disable (e) HEX format (Hexadecimal format) 1: Enable Display the group detail screen data in HEX format. 0: Disable (f) Sign (Decimal format only) 1: Unsigned Displays the group detail screen data in unsigned decimal format. 0: Signed Display the group detail screen data in decimal format with sign. This will be valid after the power is turned ON again. When "BCD format", "HEX format" and "BIT format" are all set to 0 or more than one bit is set to ON, the data display format will be decimal format with sign. If the data type is "DOUBLE", it will be decimal format with sign.	-
(5) Amount of free space	Display the amount of free space of the SRAM open area. It will be updated each time the data type or the number of data is set. If the data input exceeds the amount of free space, it will be displayed in negative value. The area will not be allocated even it is formatted. Adjust the data type and the number of data to make it positive value. The format is ####.##XB (X: prefix ... K, M). When it is less than 1024 byte, it is ####B.	-

Menu when inputting the data type

Menu	Details
CHAR	Input CHAR into the data type.
SHORT	Inputs SHORT into the data type.
LONG	Inputs LONG into the data type.
DOUBLE	Inputs DOUBLE into the data type.
Line clear	Delete a group in a line where a cursor is placed.
Line copy	Copy the data of a line where a cursor is placed.
Line paste	Writes the contents of the data copied (one line) into a line where the cursor is placed. If the data of the line is changed after [Line copy] is pressed, the data before change will be written when pasting it. Once the line is copied, it can be pasted many times until new area is copied.
All clear	Clears all allocation of the parameter in the SRAM open parameter screen. Data of the group detail will not be cleared.
Group search	When parameter No. is set and [INPUT] key is pressed, the group will be displayed with the set parameter No. at the top of the group. A cursor moves to the line of the target group.
Group details	The group detail screen corresponding to the group where a cursor is placed will be displayed. When the group where the cursor is placed is not set, it will be invalid.

Menu when inputting the number of data

Menu	Details
Line clear	Delete a group in a line where a cursor is placed.
Line copy	Copy the data of a line where a cursor is placed.
Line paste	Writes the contents of the data copied (one line) into a line where the cursor is placed. If the data of the line is changed after [Line copy] is pressed, the data before change will be written when pasting it. Once the line is copied, it can be pasted many times until new area is copied.
All clear	Clears all allocation of the parameter in the SRAM open parameter screen. Data of the group detail will not be cleared.
Group search	When parameter No. is set and [INPUT] key is pressed, the group will be displayed with the set parameter No. at the top of the group. A cursor moves to the line of the target group.
Group details	The group detail screen corresponding to the group where a cursor is placed will be displayed. When the group where the cursor is placed is not set, it will be invalid.

Menu when inputting the display format

Menu	Details
W/ DEC sign	Change the display format to the decimal format with sign.
W/O DEC sign	Change the display format to the decimal format without sign.
HEX	Changes the display format to hexadecimal.
BIT	Change the display format to the BIT format.
BCD	Change the display format to the BCD format.
Enable display	Change whether or not the group details screen is visible to users.
Cancel protect	Change whether the input protection check is valid or not.
Line clear	Delete a group in a line where a cursor is placed.
Line copy	Copy the data of a line where a cursor is placed.
Line paste	Writes the contents of the data copied (one line) into a line where the cursor is placed. If the data of the line is changed after [Line copy] is pressed, the data before change will be written when pasting it. Once the line is copied, it can be pasted many times until new area is copied.
All clear	Clears all allocation of the parameter in the SRAM open parameter screen. Data of the group detail will not be cleared.
Group search	When parameter No. is set and [INPUT] key is pressed, the group will be displayed with the set parameter No. at the top of the group. A cursor moves to the line of the target group.
Group details	The group detail screen corresponding to the group where a cursor is placed will be displayed. When the group where the cursor is placed is not set, it will be invalid.

37

Data Backup and Restoration

The following two functions are available for the data backup and restoration: all backup function for files in batch and input/output function for separate files.
The following devices can be designated to store the backed-up data.

- Memory card (Front-side SD card)
- DS (Back-side SD card of display unit)
- USB memory

Files to be backed up/restored are as follows:

Screen display	File name	Data type
System data	SRAM.BIN	SRAM data (binary files) Programs, parameters, R registers, etc.
	ALL.PRM (*1)	Parameters
	ASSEMBLY.INF (*1)	System configuration
	NCMEMORY2.IMG (*3)	Machining program data of NC memory 2
	COMVARn.DAT (*3) (*4)	Extended common variable data (extended common variable III)
	ALL.PRG/ALL2.PRG (*1) (*3) (*7)	Program batch file of NC memory/NC memory 2
	TOOL.OFS (*1) (*3) (*7)	Tool compensation amount data
	COMMON.VAR (*1) (*3) (*7)	Common variable data
	EXCOMMON.VAR (*1) (*3) (*7)	Extended common variable data (extended common variable I/II)
	WORK.OFS (*1) (*3) (*7)	Workpiece offset data
	TOOLALL.DAT (*1) (*3) (*7)	All tool data
	MMACRO.DAT (*3) (*8)	Machine tool builder macro file
	MMACVAREX.DAT (*3)	Machine tool builder macro variables extended file
Ladder	USERPLC.LAD	User PLC program
	EIPCONFDATA.BIN	EtherNet/IP configuration file
	PLCMSG_XXX.TXT (*2)	PLC message file for MTB
	PLCUMSG_XXX.TXT (*2)	PLC message file for users
	MCRMSG_XXX.TXT (*2)	Macro alarm message file
Safety parameter	SAFEPARA.BIN	Safety parameter (binary file)
Safety ladder1	SAFEPLC1.LAD	Safety PLC program1
Safety ladder2	SAFEPLC2.LAD	Safety PLC program2
APLC data	APLC.BIN (*9)	C language module created by user
Custom data	-	Custom screen data (Custom screen modules, setting files (Config.ini/customdef.ini/customload.txt) and guidance data) Motion control release file (*5) (*10) HPU custom module file (*5) (*6)

(*1) These data can be backed up only. It cannot be restored.
(*2) "XXX" indicates the abbreviation for each language.
(*3) This data is not included in the master data.
Master data is used to back up or restore the default data set by the MTB. The menus [Master Backup] and [Master Restore] are used for this operation.
Master data is always backed up in internal memory regardless of the selected device.
(*4) "n" indicates a value in the range from 1 to 1000.
(*5) The data is not backed up when the machine tool builder password is not input.
(*6) The data is backed up only when the parameter "#1762 cfgPR12/bit0" (NC-HPU optical communication: communication function valid) is set to "1".
(*7) The data is backed up only when the parameter "#1759 cfgPR09/bit3" (Individual NC data backup valid) is set to "1" and manual backup is performed.
(*8) The machine tool builder macro program is included in this file when a ROM area is selected as the storage area of the machine tool builder macro program (the parameter "#1049 mmac_R" is "1"). This file is backed up/restored only when the "machine tool builder macro memory capacity (512 KB/800 programs)" or "machine tool builder macro memory capacity (1024 KB/1000 programs)" specification is valid. When a SRAM area is selected (the parameter "#1049 mmac_R" is "0"), the machine tool builder macro program is included in SRAM.BIN, and this file is not used.
(*9) The data is backed up/restored only when the APLC release specification is valid.
(*10) The data is backed up/restored only when the motion control release specification is valid.

For the input/output function for separate files, refer to the "Instruction Manual".

37.1 All Backup

The following explains the procedure to backup the various NC data to the memory card in a batch.

Operation procedure

(1) Press the main menu [Mainte].

(2) Press the menu [All backup].

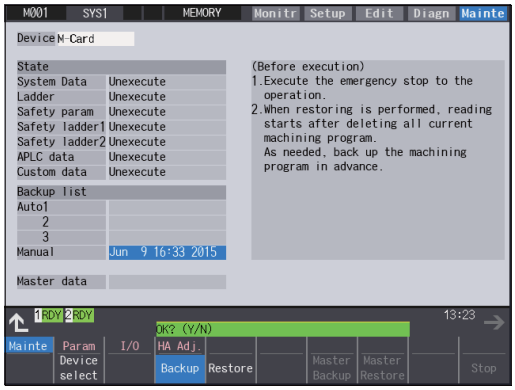
➡ If password input is required, input the machine tool builder password.

(3) Press the menu [Device select], and select the menu [Memory card] as a device to save the data.

➡ Make sure the device "Memory card" is displayed.

(4) Press the menu [Backup].

➡ The confirmation message appears.

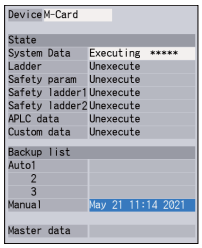


<Note>

- Press [N] or  to cancel this process.

(5) Press [Y], [y] or [INPUT].

➡ The backup starts.
"Executing" and "*" are displayed for the state of file under processing.



<Note>

- If any NC data files already exist in the backup folder, the confirmation message "Overwrite this file? (Y/N)" will display. Press [Y], [y] or [INPUT] to start the backup.
- When tool data is being sorted, the operation message "File access error" is displayed and the backup cannot be executed.
- For the custom data, the backup cannot be canceled during its execution.

(6) The backup is completed without error.

➡ The state for files that have been backed will update to "Complete", and the displayed dates in "Backup list" will be updated.

<Note>

- If the APLC release specification is invalid, APLC data cannot be backed up and "Not executed" will be displayed.

Note

(1) If an error occurs during the backup execution, the display will be as follows:
- Operation message: "File access error"
- Execution state: "Error" for the file on which an error has occurred
- Selected area: clear

(2) Even when the data protection key (for memory card or SD) is valid, the data can be backed up in the memory card or DS.

37.2 All Restoration

The following explains the procedure to restore the various NC data backed up to memory card in a batch.
The files which has been automatically backed up can be restored only when the device set by the parameter "#8919 Auto backup device" is selected.

Note

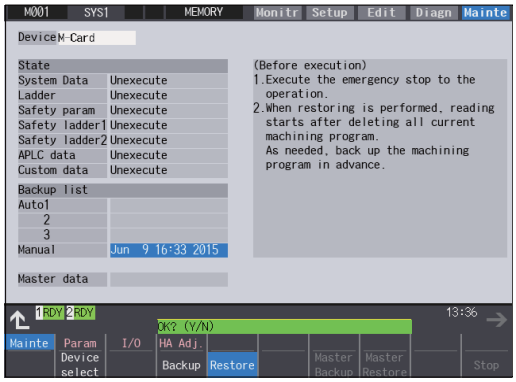
(1) For restorations, the destination system is not checked to see whether each file (system data, ladder and APLC data) is present.
(2) During a restoration, all system data, ladders, APLC data and custom data files are overwritten.
(3) In the following cases, an error message will display and the restoration will not be executed.
- During the automatic operation
- One of the data protection key 1, 2 and 3 is valid.
- The NC serial number does not match the manufacturing number of the backup data.
- The "System data" file does not exist in the transfer source.
- The ladder larger than 256 KB is stored and all backup is executed when the large-capacity PLC specification is valid, and then the specification is switched to invalid.

Operation procedure

(1) Press the main menu [Mainte].
(2) When the smart safety observation is valid, press the menu [Psswd input].
→ Input the safety password.

<Note>
- If the safety password is not entered, the safety parameters and the safety ladders cannot be restored.

(3) Press the menu [All backup].
→ If password input is required, input the machine tool builder password.
(4) Press the menu [Device select], and select the menu [Memory card] as a device where the data to be restored is stored.
→ Make sure the device "Memory card" is displayed.
(5) Press the menu [Restore].
→ The confirmation message appears.



<Note>
- Press [N] or to cancel this process.
- If the target device set for auto backup does not match the currently selected device, "Manual" is highlighted as the initial display position of the cursor.

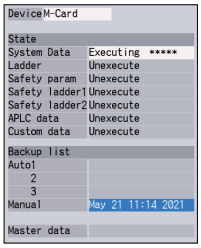
(6) Move the cursor to select the file.
Press the [INPUT] key.

The cursor moves as follows:
[↓] key:
Auto1 -> Auto2 -> Auto3 -> Manual -> Auto1 ...
[↑] key:
Auto1 -> Manual -> Auto3 -> Auto2 -> Auto1-> ...

➡ If there are no files at the current cursor position, the operation message "Select directory to restore" will display. Select the file again and then press the [INPUT] key.

(7) Press [Y], [y] or [INPUT].

➡ The restoration starts.
"Executing" and "*" are displayed for the state of file under processing.



<Note>
- If a PLC is in operation, the message "PLC running. Does it stop? (Y/N)" will display. Press [Y], [y] or [INPUT] to continue the restoration.
- When tool data is being sorted, the operation message "File access error" will display and prevent the restoration from executing.
- For the custom data, the restoration cannot be canceled during its execution.

(8) The restoration is completed without error.

➡ The state for files that have been restored will update to "Complete", and the operation message "Restoration complete" will display.
"Not executed" will be displayed for file which could not be restored, for instance, due to no file being present.

Note

(1) When the restoration fails, perform the restoration again otherwise it may cause an abnormal operation.
(2) Restored data writes over the previous absolute position data. Carry out the absolute position detection again after restoration.

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Appendix 1: Setting the System Lock

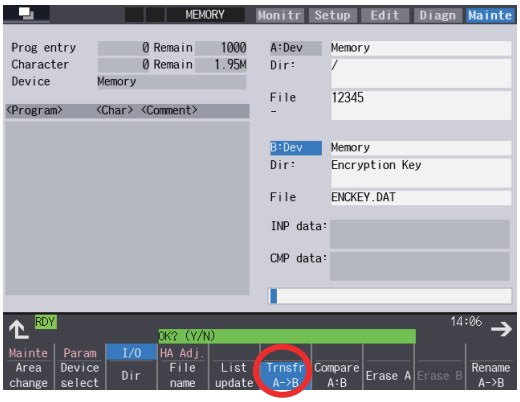
System lock is a function for a machine tool builder to set a valid term to use the machine that machine user is using.
If a decryption code is not input by a specified limit, the servo ready finish signal will be forcibly turned OFF and the use of the machine will be disabled.
Encryption key and decryption code need to be set in order to enable the system lock.

> **⚠ CAUTION**
>
> **The setting of encryption key and decryption code are required only when the system lock is used.**

38.1 Setting the Encryption Key

The system lock function is enabled by inputting an encryption key file while the system lock is disabled.
While the system lock is enabled, the date and time of the CNC cannot be set to a past date and time. Make sure to set the date and time correctly before inputting the encryption key.

(1) Set "#1249 set21/bit2" to "1".
(2) Save the encryption key file on an SD card (or USB memory).
(3) Insert the SD card (or USB memory) into the control unit.
(4) Select [Input/Output] on the Mainte screen.
(5) Enter an encryption key in the Input/output screen.
  (a) Set the device name, directory and file name in the "A:Dev" area.
  (b) Select "Memory" for the device field and "/CRE" for the directory field in the "B:Dev" area.
    Contents in the directory and file name sections will be written over.
    Directory field: "Encryption Key"
    File name field: "ENCKEY.DAT"
  (c) Press the menu key [Trnsfr A->B].



  (d) When a confirmation message appears, press either [Y] or [INPUT].
    If the encryption key has been set, the message "Setting completed normally" will display.
    If the encryption key has not been set, the message "Can't write file for dev B" will display. Check the encryption key file and set it correctly.
    [Possible causes of this failure]
    - Length of the encryption key is wrong; not eight letters
    - You have entered the encryption key on two or more lines
    - Unavailable letter is included (non-ASCII character or lower-case alphabetic characters)
    If an encryption key not intended to be input has been input, it can be reset by setting the correct encryption key with the same process. Note that, however, an encryption key cannot be reset after an expiration date is set by inputting the decryption code.
    If the specification is not provided, an error occurs when an encryption key is input.
(6) If the encryption key has been set correctly, a warning message "Z41 Decryption code is missing" will display.
    To enable the system lock, proceed to "Setting of Expiration Date" (next page).
    If you do not want to enable the system lock due to the miss entry of the encryption key, etc., the system lock will be invalid by turning the power OFF and ON again to clear the encryption key.

38.2 Setting of Expiration Date

Inputting a decryption code while the system lock is disabled, the system lock function becomes enabled and the expiration date is being set.

While the system lock is enabled, the date and time of the CNC cannot be set to a past date and time. Make sure to set the date and time correctly before inputting the decryption code.

(1) Save the decryption code file in an SD card (or USB memory).

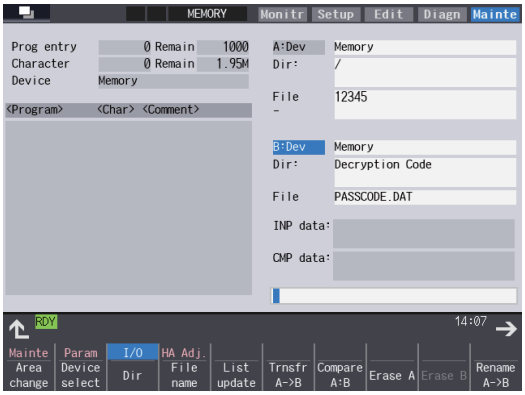
(2) Insert the SD card (or USB memory) into the control unit.

(3) Enter a decryption code in the Input/output screen.

(a) Set the device name, directory and file name in the "A:Dev" area.

(b) Select "Memory" for the "B:Dev" device field and press [Dir] to display [Decrypt code] on the screen menu key.
Contents in the directory section and file name section will be written over by pressing [Decryption code].
Directory field: "Decryption Code"
File name field: "PASSCODE.DAT"
Directory field: "Decryption Code"
File name field: "PASSCODE.DAT"
Selecting "Memory" for the device field and "/RLS" for the directory field under "B:Dev" will yield the same results.

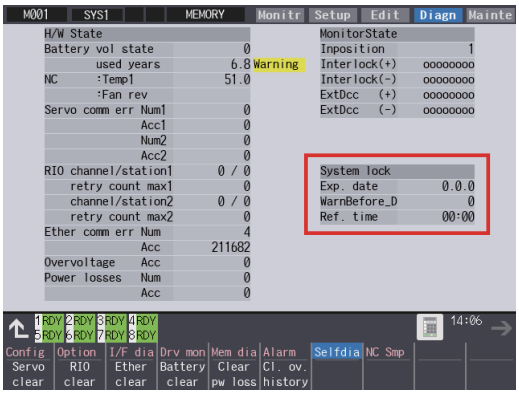
(c) Press the menu key [Trnsfr A->B].



(d) When a confirmation message appears, press either [Y] or [INPUT].
If the decryption code has been set correctly, "Setting completed normally" will display.
- If the warning message displays, this message will be cleared.
- If an alarm appears, the alarm message will be cleared but SA will not turn ON. Turn ON the NC power again.
- If the decryption code is incorrect, the message "Can't write file for dev B" will display.
- The "Executing automatic operation" error occurs during program operation, and the code cannot be set.

(4) Turn the power OFF and ON after the setting is completed.

(5) Select [Selfdia] on the [Diagn] screen and confirm that the system lock expiration date is indicated.



If the encryption key is already input and the time limit is not set, the time limit will not display.

38.3 Display of Time Limit Warning and Alarm Notification

- When the indication period of warning is reached, the warning "Z64 Valid term soon to be expired" appears at the bottom right of the screen.
  This warning appears at every cycle start after power ON until the expiry date comes. Cycle start operation will be available until the expiration date at the reference time indicated by the warning and alarm.
- Once the reference time indicated by the warning and alarm has passed on the expiration date, the alarm message "Z65 license expired" will display, and cycle start operation will be disabled. This alarm cannot be canceled with reset. Instead, enter the decryption code issued by a machine tool builder, and then turn OFF and ON the CNC power.
  If the expiry date is over during a cycle start operation, the operation continues until automatic operation pause, block stop or reset is input.
  If the expiry date is over during a cycle start operation and automatic operation or block stop occurred, cycle start operation cannot be performed.

38.4 Precautions

(1) The system lock function is enabled by setting an encryption key and an expiration date while the system lock is disabled. Be careful that the date and time of the CNC cannot be set both to a past and to a future from the expiration date while the system lock is enabled.
To advance the date and time to the expiration date, set "#1724 cfg24/bit2" (Allow system lock date and time) to "1". This parameter will be set to "0" when the power is turned ON or upon cycle start.

(2) MTBs need to manage the encryption dedicated tool and the encryption key not to be leaked to the users. The encryption key file must be created on a PC.

(3) If the power is cycled OFF and ON after the license has expired, "EMG Emergency stop LINE" may be displayed at the same time.

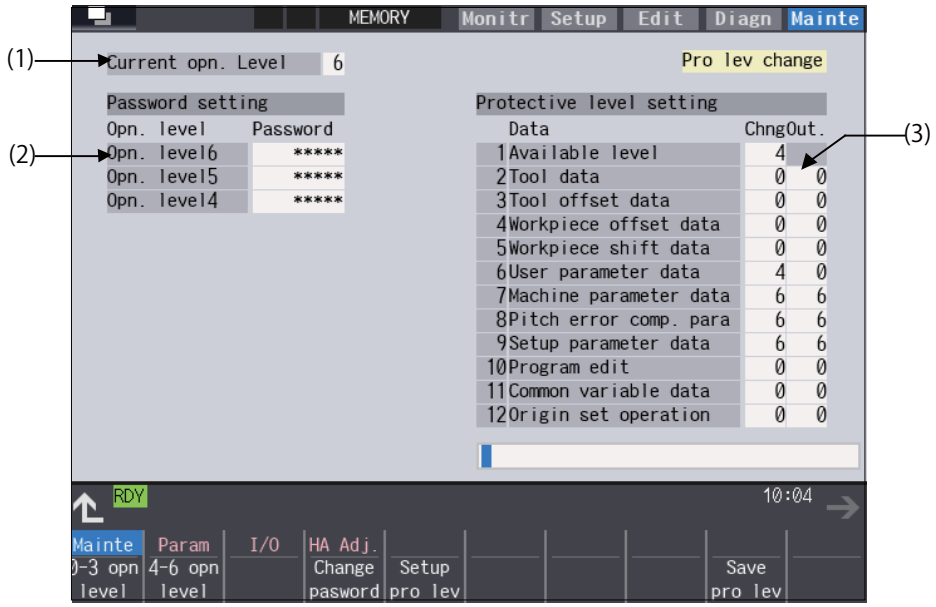
(4) When the clock data is incorrect without a battery backup, the automatic start cannot be performed. Exchange the battery and set the current date and time.

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Appendix 2: Protection Setting

Operating the maintenance screen reduces a phenomenon in which defective workpieces run out due to an operation mistake, by implementing a restriction with seven operation levels. The operation level varies depending on the MTB specifications. Refer to the instruction manual issued by the MTB for details.

39.1 Protect Setting Screen



Display items

Display items		Details
(1)	Current opn. level	Displays the current operation level.
(2)	Passwords at operation levels 4 to 6	Displays the passwords at operation levels 4 to 6 with "*****".
(3)	Protection level of each data item	Displays the protection level of each data item. The data set below the current operation level can be changed as needed. Changing the protection level displays the message "Pro lev change" at the upper right. Change: Specify the protection level when data is modified (including file input). Output: Specify the protection level for file output.

Menus

Menus	Details
0-3 opn level	Changes the present authenticated password to the non-authenticated state and switches the operation level to 0 to 3. The operation level (0 to 3) is determined according to the PLC signal status of the protection level.
4-6 opn level	Changes the operation levels.
Change pasword	Changes the password of the operation levels 4 to 6.
Setup pro lev	Changes the protection level of each data item.
Save pro lev	Saves the protection level setting of each data item.

Data to be protected

Display item	Objects to be protected			Initial value		Setting range	
		Change	Output	Change	Output	Change	Output
Available level	Table for protection level settings on this screen The table for protection level settings cannot be changed from an operation level lower than the set protection level.	○	-	4	-	4 to 6	-
Tool data	Tool management data Tool registration Tool life management data	○	-	0	0	0 to 6	0 to 6
	All tool data files (TOOLALL.DAT) Tool life management data file (TLIFE.TLF) Tool management data file (TOOLMNG.DAT)	○	○				
Tool offset data	Tool compensation amount data Tool measurement data	○	-	0	0	0 to 6	0 to 6
	Tool offset data files (TOOL.OFS)	○	○				
Workpiece offset data	Coordinate system offset data Workpiece installation error compensation data Workpiece position offset for rotary axis Work measurement data	○	-	0	0	0 to 6	0 to 6
	Workpiece offset data files (WORK.OFS)	○	○				
Workpiece shift data	Workpiece shift data	○	-	0	0	0 to 6	0 to 6
	All tool data files (TOOLALL.DAT)	○	○				
User parameter data	User parameter data Barrier data Range setting data	○	-	0	0	0 to 6	0 to 6
	Parameter files (ALL.PRM)	○	○				
Machine parameter data	Machine parameter data Device open parameter data SRAM open parameter data Spatial error compensation data file (POSTURE.DAT, POSTURE2.DAT to POSTURE4.DAT)	○	-	6	0	0 to 6	0 to 6
	Parameter files (ALL.PRM, AUXAXIS.PRM, SYSTEM.PRM, DEVOPEN.DAT, SRAMOPEN.DAT, DEVICENT.PRM) Interfering data (OBSTACL.DAT) R register data (RREG.REG) Spatial error compensation data file (POSTURE.BIN, POSTURE1.BIN to POSTURE4.BIN) HPU parameter file (HPU_PARAM.BIN)	○	○				
Pitch error compensation parameter	Error compensation parameter data Error data	○	-	6	0	0 to 6	0 to 6
	Parameter files (ALL.PRM)	○	○				

Display item	Objects to be protected			Initial value		Setting range	
		Change	Output	Change	Output	Change	Output
Setup parameter data	Automatic backup (Output) Batch backups (menu [Backup]) Batch backups (menu [Master Backup])	-	○	6	0	0 to 6	0 to 6
	Batch backups (menu [Restore]) Batch backups (menu [Master Restore]) HMI environment setting Memory format All erasure of machining programs (NC memory, NC memory 2) All erasure of machine macros All erasure of life data All erasure of tool data fixpro formatting HMI version-up System version-up Console execution Ladder monitoring (*1) Machine tool builder macro variables WE measurement macro writing Machine tool builder macro ROM write Security function	○	-				
	SRAM data files (SRAM.BIN) User PLC program files (USERPLC.LAD) User PLC program files per project (PROJECTxx.: 01 to available project No.) APLC data file (APLC.BIN) Custom folder (MSYS\CUSTOM) EtherNet/IP configuration file (EIPCONFDATA.BIN) Machine tool builder macro variables data file (MMACRO.VAR) Machine tool builder macro file (MMACRO.DAT)	○	○				
Program editing	Program editing (memory, memory 2 only) Buffer correction (memory, memory 2 only)	○	○ (*2)	0	0	0 to 6	0 to 6
	Machining program files (PRG/USER) Fixed cycle program (PRG/FIX)	○	○				
Common variable data	Common variable data(*3)	○	-	0	0	0 to 6	0 to 6
	Common variable data files (COMMON.VAR)	○	○				
Origin set operation	G92 set	○	-	0	0	0 to 6	0 to 6
Operator mail notification data	Operator mail notification setting Email communication address file Email communication setting file	○	-	0	0	0 to 6	0 to 6
	Email communication log file on input/output screen Email communication address file Email communication setting file	-	○				
Special function data	Laser processing condition file (LSRCOND.DAT)	○	○	0	0	0 to 6	0 to 6

(*1) When the protection level set for "Chng" of "Setup parameter data" is any of "0" to "3" and all of the following conditions are met, PLC on-board can be started but cannot be edited.
- Operation level is "3" or lower
- Operation level is at the protection level or higher

(*2) When the protection level set for "Out." of "Program edit" is higher than the current operation level, any program cannot be opened on the Edit screen. The message "Data protect" appears.

(*3) The common variables protected in #12111 to #12114 cannot be configured or changed regardless of the operation level or the protection level.

Note

(1) For specifications on inputting and outputting files which are objects to be protected, refer to "Instruction Manual".
(2) The following operations can be performed at the protection level 6 or higher.
- Modal output, one-shot output and modal clear
- PLC-STOP
- S analog adjustment
- Absolute position setting
- Servo diagnosis
- Collection setting
- HMI ending
- Screen size change
- PLC indexing test Operation

39.2 Returning the Password to the Non-input State (Operation level 0 to 3)

Operation Methods

(1) Press the menu [0-3 opn level].

➡ The menu [0-3 opn level] is highlighted.
The operation message "Change opn. level back to 0 to 3? (Y/N)" is displayed.
When the protection level setting is not saved, the operation message "Save the protective level setting? (Y/N)" is displayed, and the above message appears after Y/N is entered.

(2) Press the [Y] or [INPUT] key.

➡ The operation message "Operation level has returned to 0 to 3." is displayed, and the highlighted menu [0-3 opn level] returns to normal.
The operation level returns to one of operation levels 0 to 3 in accordance with the current signal status.
All menus are displayed in gray.

39.3 Changing the Operation Level to One of 4 to 6

Operation Methods

(Example) Change the operation level to "6"

(1) Press the menu [4-6 opn level].

➡ The menu [4-6 opn level] is highlighted.
The cursor appears on the current operation level.
The operation message "Select the opn. level to be changed to." is displayed.

(2) Enter the operation level to be changed to with a number.
(Example) 6 [INPUT]

➡ The operation message "Type in your password." is displayed.

(3) Enter the password of the level to be changed.

➡ <When the password is correct>
The operation message "Operation level has changed." is displayed, and the operation level after the change is displayed in the current operation level field.
<When the password is incorrect>
The operation message "Your password is incorrect." is displayed, and the operation level returns to the previous one.

In either case, the highlighted menu returns to normal, and the cursor disappears.

39.4 Changing the Password

Operation Methods

(Example) Change the password of operation level 4 from "OLDPASS" to "NEWPASS"

(1) Press the menu [Change pasword].
➡ The menu [Change pasword] is highlighted.
The operation message "Enter the current password." is displayed.
The cursor appears on the current operation level.

(2) Use [↑] or [↓] key to move the cursor to the operation level where you want to change the password. (Operation level 4 in this case)
➡ The operation message "Enter the current password." is displayed.

(3) Enter the current password for the operation level of the cursor position.
(Example) OLDPASS [INPUT]
➡ <When the password is correct>
The operation message "Enter a new password." is displayed.
<When the password is incorrect>
The operation message "Your password is incorrect." is displayed, and then the operation returns to the process (2).

(4) Enter a new password.
(Example) NEWPASS [INPUT]
➡ <When the acceptable password is entered>
The operation message "Type in the new password again." is displayed.
<When the unacceptable password is entered>
The operation message "Set a password that meets the condition." is displayed, and then the operation returns to the process (4).

(5) Enter the new password again.
(Example) NEWPASS [INPUT]
➡ <When the re-entered password is equal to the first one>
The operation message "Password changed" is displayed, and the highlighted menu option [Change password] returns to normal.
<When the re-entered password is not equal to the first one>
The operation message "Your password is incorrect." is displayed, and then the operation returns to the process (4).

Note

(1) Set a password with one-byte alphanumeric characters between 3 and 8 letters (only capital letters are acceptable for alphabet). In addition, "UPARA" is unavailable to set as the password.
(2) Changing the password is available only for the lower operation level than the current one.

39.5 Clearing the Password

Operation Methods

(Example) Clear the password of operation level 4

(1) Press the menu [Change pasword].
→ The menu [Change pasword] is highlighted.
The operation message "Enter the current password." is displayed.
The cursor appears on the current operation level.

(2) Use [↑] or [↓] key to move the cursor to the operation level where you want to change the password. (Operation level 4 in this case)
→ The operation message "Enter the current password." is displayed.

(3) Enter the current password for the operation level of the cursor position.
(Example) OLDPASS [INPUT]
→ <When the password is correct>
The operation message "Enter a new password." is displayed.
<When the password is incorrect>
The operation message "Your password is incorrect." is displayed, and then the operation returns to the process (2).

(4) Enter "0".
(Example) 0 [INPUT]
→ The operation message "Clear the password? (Y/N)" is displayed.

(5) Press the [Y] or [INPUT] key.
→ <When pressing [Y] or [INPUT] key>
The operation message "Password has been cleared" is displayed, and then the password returns to the initial one.
The highlighted menu [Change pasword] returns to normal.
<When pressing other than [Y] or [INPUT] key>
The operation message disappears and the password stays the same.
The highlighted menu [Change pasword] returns to normal.

Note

(1) Clearing the password is available only for the lower operation level than the current one.

39.6 Changing the Protection Level

Changing the protection level is available only for the data being set in the lower level than a current operation level.

Operation Methods

(Example) Change the "Available level" from "4" to "5"

(1) Press the menu [Setup pro lev]. → The menu [Setup pro lev] is highlighted.
The cursor appears on the "Chng" of "Available level".

(2) Move the cursor to the protection level to be changed, then enter the new protection level.
(Example) 5 [INPUT] → "5" is set in the "Chng" field of "Available level".
The cursor moves to the right when "Chng" is set.
(The cursor moves downward when "Available level" is changed.)
The cursor moves to the left below when [Out.] is set.
"Pro lev change" is displayed on the upper right of the screen.

(3) Press the menu [Setup pro lev]. → The highlighted menu [Setup pro lev] turns to normal.
The cursor disappears.

Note

(1) When the value of "Available level" in the setup protection level is higher than the current operation level, the protection level is unable to change. (The menu [Setup pro lev] is grayed out.)
(2) The higher protection level than the current operation level is unable to set.
(When the current operation level is "5", the protection level is unable to be set to "6".)
(3) When the protection level is changed during input-output, an error may occur in the middle of the input-output.

39.7 Saving the Protection Level Setting

Operation Methods

(1) Press the menu [Save pro lev]. → The operation message "Save the protective level setting? (Y/N)" is displayed.

(2) Press the [Y] or [INPUT] key. → The operation message "Protective level setting has been saved." is displayed.
The displayed message "Pro lev change" on the upper right of the screen is disappeared.

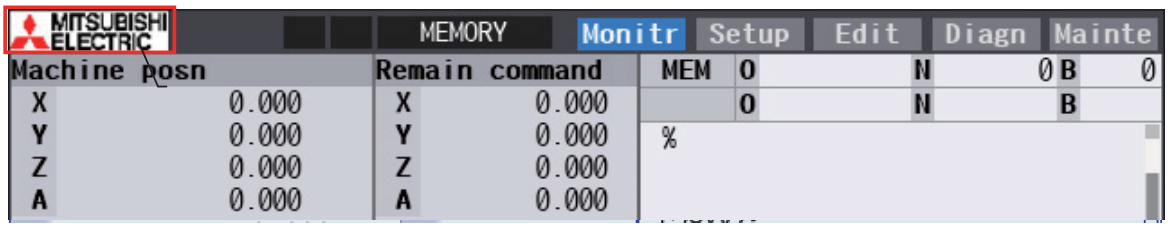
Note

(1) After the protection level is changed, if the screen is switched without saving the change, the operation message "Save the protective level setting? (Y/N)" is displayed. If you switch the screen without saving the change, the changed setting is canceled.
(2) After changing the protection level, if you turn the power OFF without saving the change, the changed protection level is canceled.

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Appendix 3: Displaying Original Logo on Standard Screen

A logo created by the machine tool builders can be displayed on the upper left of the standard screen. To display the logo, create a logo file (JPG) and install it. When a logo file is prepared by machine tool builders, the unit name (base common parameter "#1135 unt_nm") is not displayed.



[Logo file specification]

File name	logo.jpg	
Storage location (*1)	\Custom\	
Size (*2)	VGA	22 × 80 pixels
	XGA	32 × 135 pixels
Number of colors (*3)	16 bits	

(*1) Add the logo file to the installer as well as the customized screen module. (Refer to "19 Setting Up with M80/800S SETUP INSTALLER" for details.)

(*2) When the size of the logo file is different from the specified size, the display image may differ from the actual logo as a result of scaling to fit in the display range.

(*3) When the logo file is other than 16-bit color, the display image may differ from the actual color because it is converted to 16-bit color.

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Appendix 4: Country/Region Code Setting (for Wireless LAN Function)

41.1 Outline

To use the wireless LAN function, it is necessary to comply with the regulations regarding the use of radio waves in the country or region where the machine is installed.
By setting the country/region code corresponding to the country or region where the machine is installed, this numerical control device operates in compliance with the regulations of each country/region.
The country/region where the wireless LAN is approved differs depending on the NC system version.
The country/region code is set on the Mainte screen.

Country/region code list of approved countries/regions

The following shows the country/region codes of the countries or regions where the wireless LAN is approved.
Two-letter country/region codes defined in ISO 3166-1 alpha-2 are used as the country/region codes.
When your NC system version is equal to or newer than the "NC system supported version", the wireless LAN function is available in the country/region.
When your NC system version is older than the "NC system supported version", the wireless LAN function is unavailable in the country/region.

Country or region	Country/region code	NC system supported version
Austria	AT	A1
Belgium	BE	A1
Bulgaria	BG	A1
People's Republic of China	CN	A1
Cyprus	CY	A1
Czech	CZ	A1
Germany	DE	A1
Denmark	DK	A1
Estonia	EE	A1
Spain	ES	A1
Finland	FI	A1
France	FR	A1
England	GB	A1
Greece	GR	A1
Croatia	HR	A1
Hungary	HU	A1
Ireland	IE	A1
Italy	IT	A1
Japan	JP	A1
Lithuania	LT	A1
Luxembourg	LU	A1
Latvia	LV	A1
Malta	MT	A1
Netherlands	NL	A1
Poland	PL	A1
Portugal	PT	A1
Romania	RO	A1
Sweden	SE	A1
Slovenia	SI	A1
Slovakia	SK	A1
Turkey	TR	A1
Taiwan	TW	A1
United States of America	US	A1
Switzerland	CH	A2
Iceland	IS	A2
Liechtenstein	LI	A2
Norway	NO	A2
India	IN	A4
South Korea (*1)	KR	A7

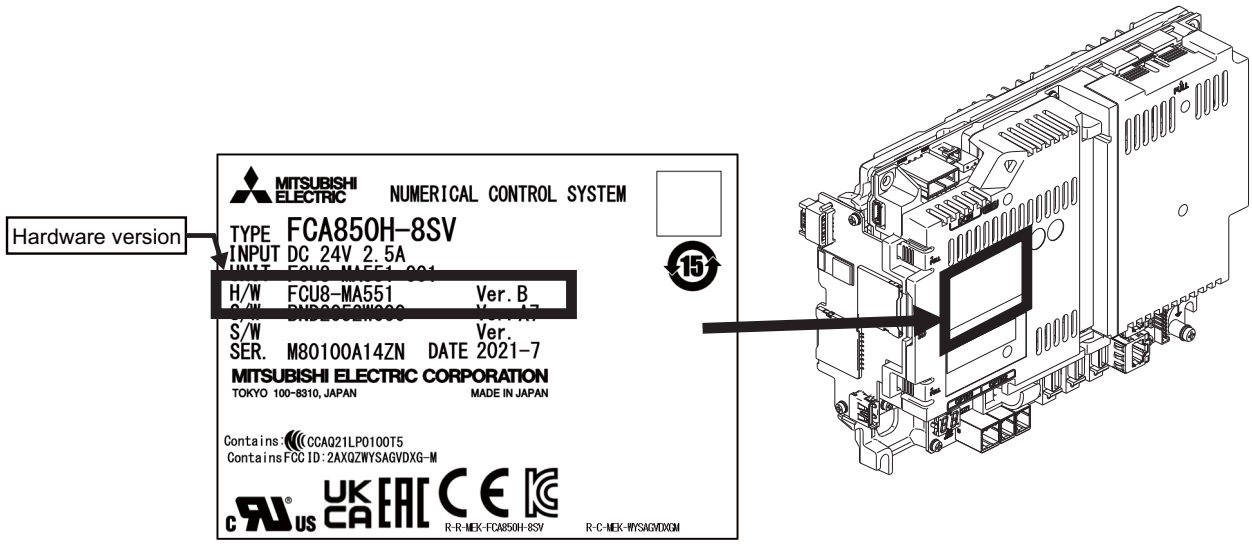
Country or region	Country/region code	NC system supported version
Thailand	TH	A7

(*1) When South Korea "KR" is set, the NC system version must be A7 or newer, and furthermore the hardware version of the control unit for M80V must be C or newer, and that for M800VS must be B or newer.
The Korean radio law has product labeling requirements, and only the control unit which is "Applicable" in the [List of hardware version applicable for South Korea "KR"] below complies with the requirements. If the control unit does not comply with the requirements, that is a violation of the law.

[List of hardware version applicable for South Korea "KR"]

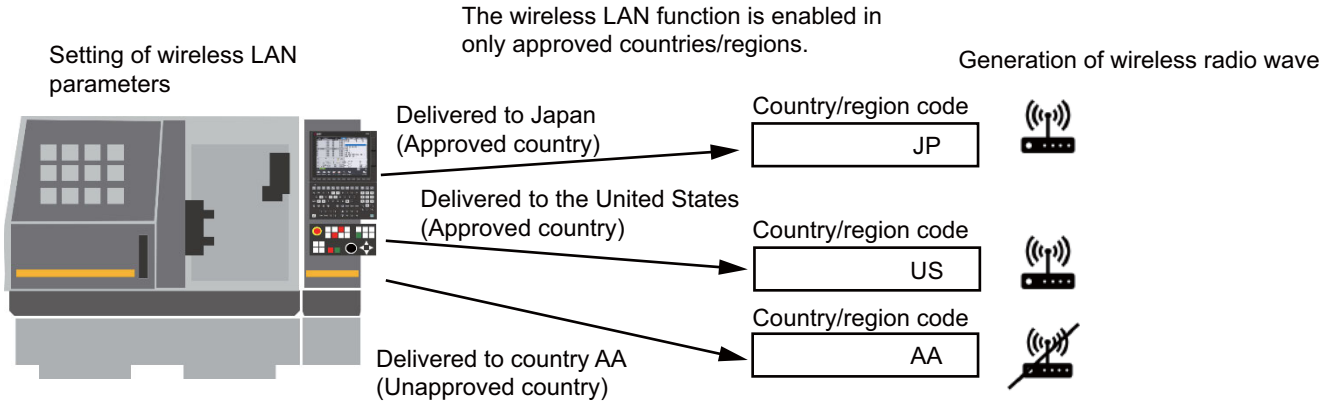
Series (Unit type)	Hardware version		
	A	B	C or newer
M80V(FCU8-MU521/FCU8-MU522)	Not applicable	Not applicable	Applicable
M800VS(FCU8-MU551/FCU8-MA551)	Not applicable	Applicable	Applicable

For example, if the NC system of version A7 or newer is installed in the control unit with hardware version A and the wireless LAN function is used with setting South Korea "KR", that is a violation of the law.
Even when the NC system of version A7 or newer is installed in the control unit which is "Not applicable" in the above list, if the country/region code is not set to South Korea "KR", there is no problem.
The hardware version can be checked on the control unit as shown below.



41.2 Wireless LAN Function

The wireless LAN function is disabled by default.
To enable the wireless LAN function, set the country/region code (refer to "41.3 Setting the Country/Region Code"), and set the required wireless LAN parameters (refer to the "Instruction Manual").
As shown below, the wireless LAN function is available only when the country/region code of the destination place(*1) is set correctly.
The wireless LAN function does not work when a country/region code of an unapproved country/region (not shown in " Country/region code list of approved countries/regions") is set.



Case where the destination place is the same as the shipping place(*2)

When the destination place is the same as the shipping place, the wireless LAN function is available by setting the country/region code of the destination place at the shipping place.
Set the country/region code for each machine.

Case where the destination place is different from the shipping place

When the destination place is different from the shipping place, the wireless LAN function is not available by setting the country/region code of the destination place at the shipping place. If the set country/region code does not match the country/region where the wireless LAN is used, that may be a violation of the radio law.

Example: When the shipping place is Japan and the destination place is the United State

Shipping place: Japan	Destination place: United States
• Set the country/region code to "JP". • Set "#75000 WLAN STA/AP mode" to "0" to disable the wireless LAN function. (This is to prevent the wireless LAN from being used in the destination place (United States) while the country/region code is set to the shipping place (Japan).)	• Overwrite the country/region code to "US". • Set the required wireless LAN parameters.

(*1) The destination place is a country/region to which the machine is sent, a country/region where the machine is used.
(*2) The shipping place is a country/region from which the machine is sent.

41.3 Setting the Country/Region Code

The country/region code password is required to set the country/region code.
When the country/region code password is not set, first it must be set.

41.3.1 Setting the Country/Region Code Password

When the country/region code password is set for the first time (When "#11895 LC_KEY" is set to "0")

(1) Select the menu [Mainte] on the Mainte screen.

(2) Select the menu [Psswd input], and enter the machine tool builder password. ➡ "#11895 LC_KEY" turns editable.

(3) Select the menu [Para No search] to search for the parameter "#11895 LC_KEY".

(4) Enter the the desired password in "#11895 LC_KEY".

When the country/region code password is changed (When "#11895 LC_KEY" is displayed as "**")**

(1) Select the menu [Mainte] on the Mainte screen.

(2) Select the menu [Psswd input], and enter the machine tool builder password.

(3) Select the menu [Psswd input] again, and enter the set country/region code password. ➡ "#11895 LC_KEY" turns editable.

(4) Select the menu [Para No search] to search for the parameter "#11895 LC_KEY".

(5) Enter a new password in "#11895 LC_KEY".

Note

- Do not tell the country/region code password to Mitsubishi Electric service representatives and end users. The machine tool builder who sets the country/region code password must manage it properly so that invalid country/region codes cannot be set.

41.3.2 Setting the Country/Region Code

Operation procedure

(1) Select the menu [Mainte] on the Mainte screen.

(2) Select the menu [Psswd input], and input the country/region code password.

(3) Press [INPUT]. ➡ The country/region code password is authenticated. The password authentication state continues until the power is turned OFF.

(4) Select the menu [C/R Code]. ➡ The cursor appears in the setting field of "WLAN C/R".

(5) Enter the country/region code and press [INPUT]. (Refer to " Country/region code list of approved countries/regions" for the country/region code.) ➡ The input value is displayed in the setting field of "WLAN C/R".

(6) Turn the power OFF and ON.

41.4 Precautions

- If SRAM data backed up on an NC of software version A1 or older is restored to an NC of version A2 or newer, the country/region code setting is cleared. In this case, the country/region code must be set again. For an NC of version A7 or newer, the country/region code password must be set as well.
- When the country/region code is not set, the wireless LAN function is disabled.
- The wireless LAN function cannot be used in countries/regions not listed in " Country/region code list of approved countries/regions".
- Ensure that the country/region code that matches the country or region where the machine is used has been configured correctly. If the configured country/region code does not match the country or region of operation, the operation may be in violation of the regulatory requirements by radio law. Mitsubishi Electric shall not be held liable for any issues arising from an incorrectly configured country/region code.
  Mitsubishi Electric assumes no responsibility for any problems caused by incorrect country/region code settings.
- The country/region code cannot be set during automatic operation.
- The set country/region code becomes valid when the power is turned ON again.
- Give the bundled manual (Wireless LAN Bundled Manual) to end users.
  The manual includes the legal requirements for use of wireless LAN devices.
- This product has not received Wi-Fi certification. Use terms such as "wireless LAN", "WLAN", etc.
- Machine tool builders and end users must use the wireless LAN function in approved countries or regions because it is not allowed to generate radio wave in unapproved countries/regions.
- "0" cannot be set in the country/region code password to prevent erroneous input. If "0" is input, "Setting error" appears, and the password is not changed.
- Key input remains in the key history when the parameter of the country/region code password is registered and authenticated. Delete all the key history after authentication. (The key history is included in the backup data (SRAM.BIN).)

41.5 Notes on Security

One benefit the wireless module offers is that it allows tablets and PCs to exchange data with a wireless access point over radio waves instead of LAN cables, enabling them to access the LAN freely within the area covered by radio waves. On the other hand, because radio waves reach throughout a limited area regardless of obstructions such as walls, if a malicious attacker exploits vulnerabilities, the content of communications could be stolen or malformed packets could be inserted, for example. The following are examples of such problems:

1. The content of communications is snooped on
   A malicious third party could deliberately intercept radio communications and snoop on IDs, passwords and other information.
2. The network gets broken into
   A malicious third party could gain unauthorized access to the network and the following actions could be done.
   - steal personal or confidential information (information leakage)
   - impersonate a valid user and transmit illegitimate information (impersonation)
   - intercept communications and transmit altered information (tampering)
   - destroy data and systems by spreading computer viruses or other harmful programs (vandalism)

You can reduce the likelihood of these problems by configuring the settings of security mechanisms provided by the wireless module and wireless access points.
Ensure that you fully understand the problems that could occur if the product is used without security settings being configured and configure the security settings at your own discretion and risk before using the product.

The following describes how to reduce and prevent these security problems:

(1) When using the NC in the AP mode, ensure the following:
   - For the parameter "#75007 Encryption key", set an alphanumeric string that is difficult for others to guess. Avoid consecutive numbers and strings that can be guessed from the MAC address, etc.
   - Restrict the IP addresses to allow access using the IP filter setting function.

(2) When using the NC in the STA mode, ensure the following when configuring the wireless LAN router settings:
   - For the passphrase used to configure wireless LAN settings, set an alphanumeric string that is difficult for others to guess. Avoid consecutive numbers and strings that can be guessed from the MAC address, etc.
   - For the security authentication mode in the wireless LAN settings, use WPA or WPA2.
   - To prevent unauthorized access from the Internet, take measures such as disabling PING response to avoid being identified on the Internet.
   - Change the password for the login to the management screen to one that is difficult for others to guess. For information about the wireless LAN settings, contact the manufacturer of the wireless LAN router.

(3) When using a device such as a PC or a tablet in the same network, ensure the following:
   - Keep the OS, software and anti-virus software updated to the latest version.
   - Do not open attached files and hyperlinks from a unreliable or unknown source.

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Appendix 5: EMC Installation Guidelines

For details of the drive section (servo/spindle drive unit), refer to the "EMC Installation Guidelines" of instruction manuals for each drive unit.

42.1 Introduction

EMC Directives became mandatory in EU (European Union) as of January 1, 1996. The subject products must have a CE mark attached indicating that the product complies with the Directives. In United Kingdom, the subject products require the EMC Directives and will need to have a UKCA marking as of January 1, 2023.
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.

- Methods of installation in control/operation panel
- Methods of wiring cables to outside of panel
- Introduction of members for measures

Mitsubishi Electric 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.

42.2 EMC Directives

The EMC Directives largely regulate the following two items.
- Emissions: Capacity to prevent output of interference noise that adversely affects external devices.
- Immunity: Capacity to not malfunction due to interference 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	CE marking/UKCA marking	
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
	Radiated noise 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 50/60 Hz 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

42.3 EMC Measures

The main items relating to EMC measures include the following.

- Store the device in a sealed metal panel.
- Ground all conductors that are floating electrically. Decrease the impedance.
- Increase the distance between the drive line and signal wire.
- Use shielded cables for wiring outside of the panel.
- Install a noise filter.

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

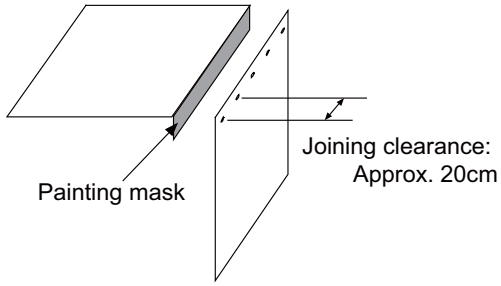
- Accurately ground the devices.
- Use shielded cables.
- Increase the electrical seal of the panel. Reduce the gaps and holes.

42.4 Panel Structure

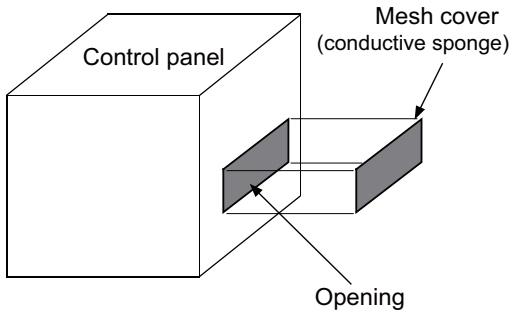
Panel design is a very important factor for the EMC measures. Take the following measures into consideration when creating panels.

42.4.1 Measures for Control Panel Body

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



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



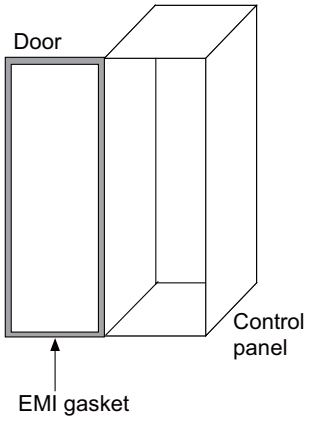
Note

(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.

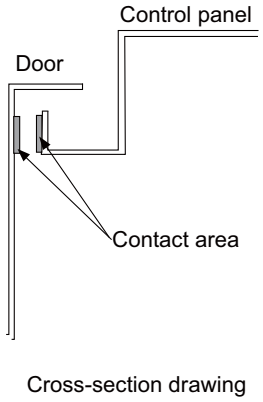
42.4.2 Measures for Door

- Use metal for all members configuring the panel.
- 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.
- The EMI gasket or conductive packing must contact the metal surface uniformly and at the correct position.

(a) Use of gasket



(b) Large contact area



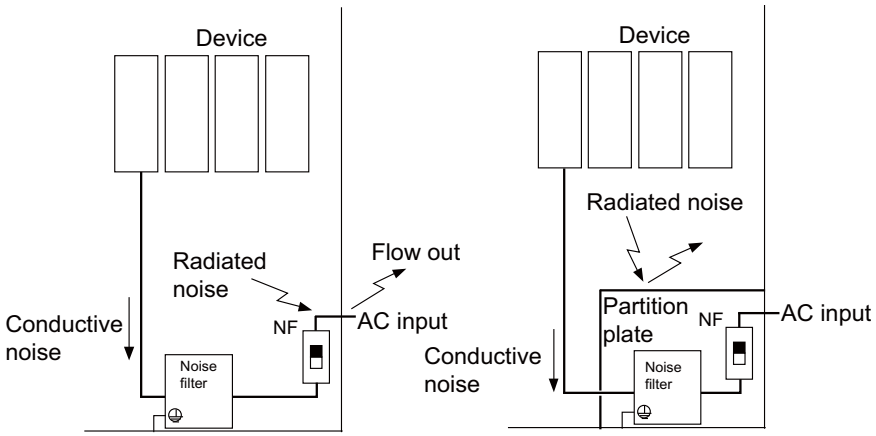
Cross-section drawing

Note

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

42.4.3 Measures for Power Supply

- 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.



Note

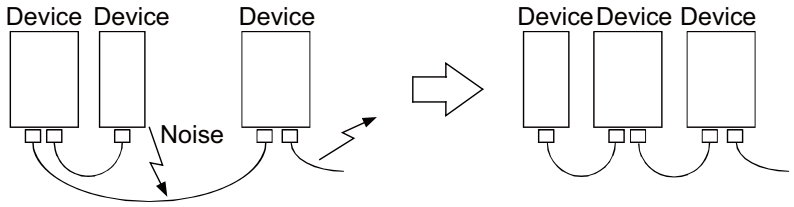
(1) The conductive noise can be suppressed by inserting a noise filter, but the radiated noise will flow out.
(2) The conductive and radiated noise can both be suppressed by adding a partition plate to the noise filter.

42.5 Measures for Wiring in Panel

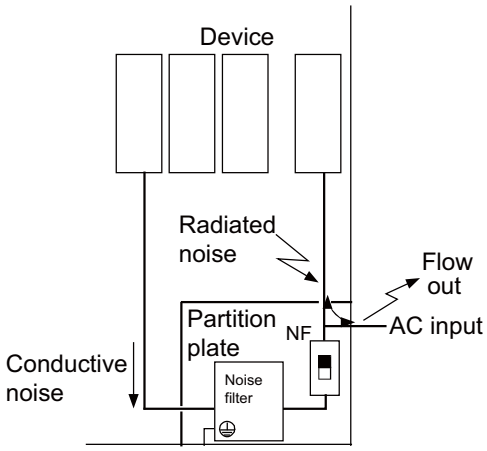
Cables act as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated.
The following measures must be sufficiently considered for the cables (J210/J303) that carry out high-speed communication.

42.5.1 Precautions for Wiring in Panel

- 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.



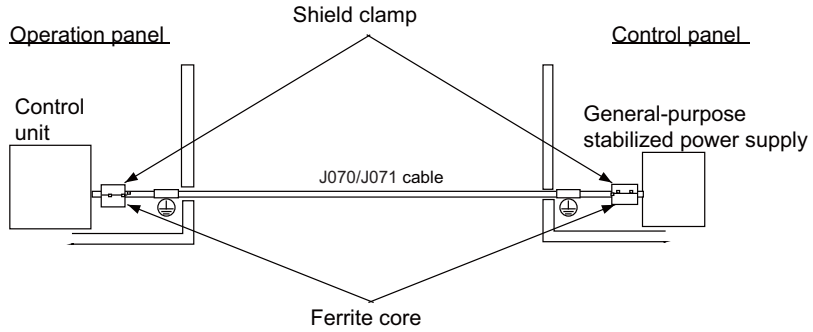
- Always connect the grounding wire to the FG terminal indicated on the device.
- Keep the distance between the drive line and encoder cable to the drive section motor as far apart as possible when wiring.
- Do not lead the power supply wire around the panel without using a filter.



42.5.2 Shield Treatment of Cables

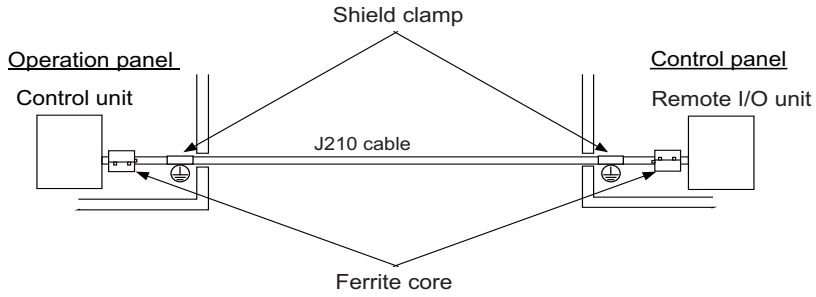
Use shielded cables for wiring outside the panel.
Use shield clamps within 10 cm of the lead-out port from the panel. (Refer to "42.6.1 Shield Clamp Fitting".)

■ DC power supply cable [J070/J071 cable]



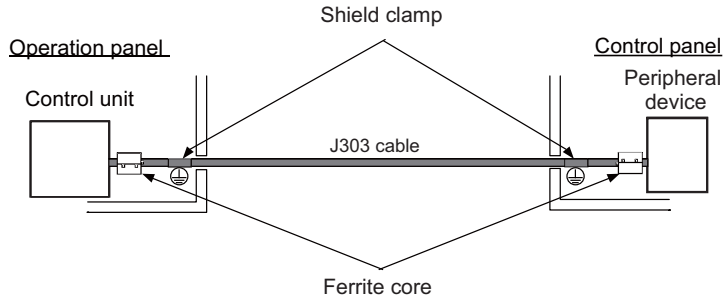
- Use a shield clamp within 10 cm from the panel's inlet/outlet.
- When using a ferrite core, install it on both ends of the connected units.
- Always install a ferrite core (Refer to "42.6.2 Ferrite Core") on the general-purpose stabilized power supply. The ferrite core may not be required depending on the selected power supply.

■ Remote I/O cable [J210 cable]



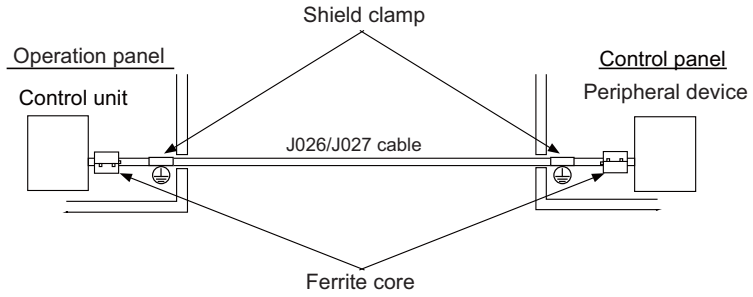
- Use a shield clamp within 10 cm from the panel's inlet/outlet.
- When using a ferrite core, install it on both ends of the connected units.

■ LAN cable [J303 cable]



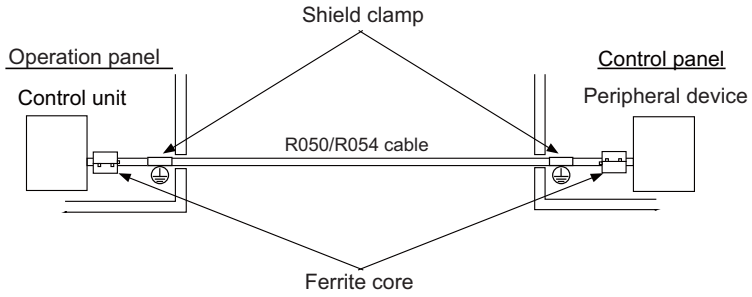
- Use a shielded cable. Use a shield clamp within 10 cm from the panel's inlet/outlet.
- When using a ferrite core, install it on both ends of the connected units.

■ Manual pulse generator cable (5V) [J026/J027 cable]



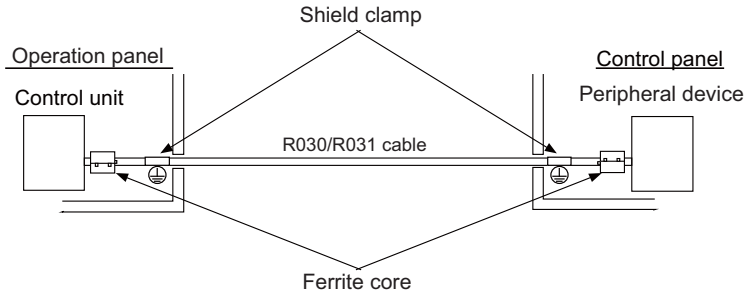
- Use a shield clamp within 10 cm from the panel's inlet/outlet.
- When using a ferrite core, install it on both ends of the connected units.

■ Cable between synchronous feed encoder and control unit [R050/R054 cable]



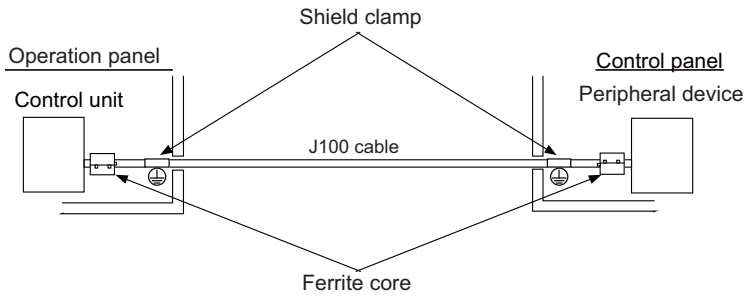
- Use a shield clamp within 10 cm from the panel's inlet/outlet.
- When using a ferrite core, install it on both ends of the connected units.

■ RS-232C I/F cable [J030/J031 cable]



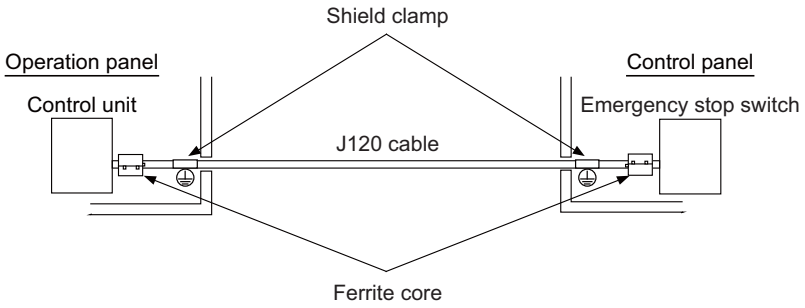
- Use a shield clamp within 10 cm from the panel's inlet/outlet.
- When using a ferrite core, install it on both ends of the connected units.

■ SKIP input cable [J100 cable]



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

■ Emergency stop cable [J120 cable]



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

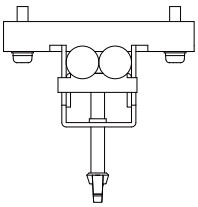
42.6 EMC Countermeasure Parts

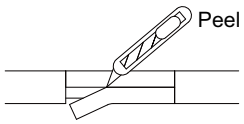
42.6.1 Shield Clamp Fitting

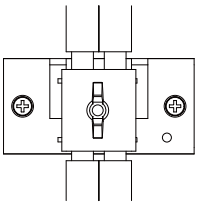
The effect can be improved by directly connecting the cable's shield sheath to the grounding plate as shown below.
Install the grounding plate near the outlet (within 10cm) of each panel, and press against the grounding plate with the clamp fitting.
If the cables are thin, several can be bundled and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

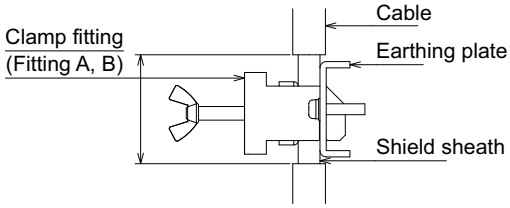
	A	B	C	Enclosed fittings
Ground Plate #D	100	86	30	Clamp fitting F × 2
Ground Plate #E	70	56	-	Clamp fitting G × 1

	L1 (maximum dimension when it is open)	L2 (reference dimension)
Clamp fitting F	25	(77)
Clamp fitting G	12	(54)





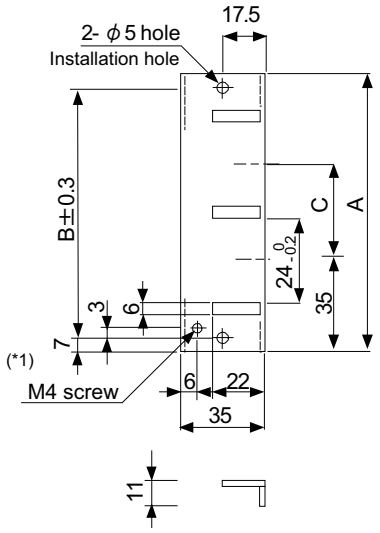




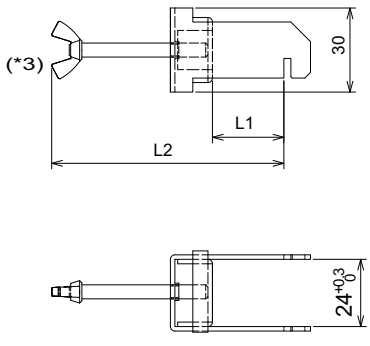
View of clamp section

・Outline drawing

Earthing plate



Clamp fitting

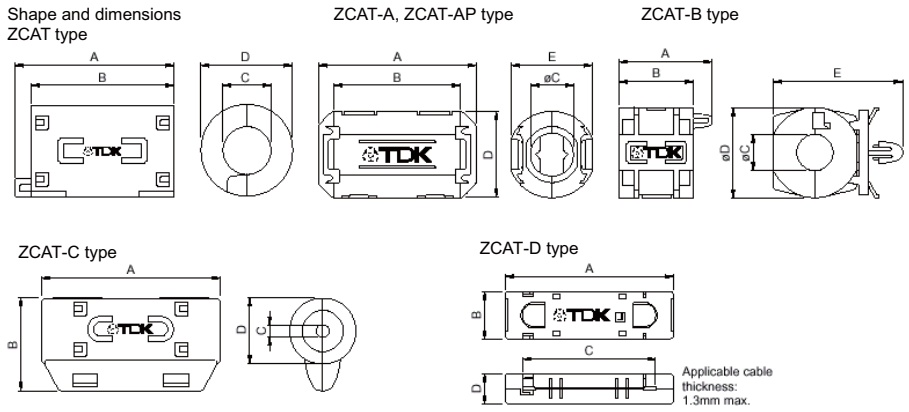


[Unit: mm]

(*1) Screw hole for wiring to earthing plate in cabinet.
(*2) The earthing plate thickness is 2.2mm.
(*3) The screw is a manual tightening part.
Tighten it with hands without using a tool.

42.6.2 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**	**φC**	**φD**	**E**	**Applicable cable outer diameter**	**Mass (g)**
ZCAT1518-0730-M(-BK)(*1)	22±1	18±1	7±1	15±1	-	Maximum 7	6
ZCAT1518-0730(BK)(*2)	22±1	18±1	7±1	15±1	-	Maximum 7	6
ZCAT2017-0930-M(-BK)	21±1	17±1	9±1	20±1	-	Maximum 9	11
ZCAT2032-0930-M(-BK)(*1)	36±1	32±1	9±1	19.5±1	-	Maximum 9	22
ZCAT2032-0930(-BK)(*2)	36±1	32±1	9±1	19.5±1	-	Maximum 9	22
ZCAT2132-1130-M(-BK)(*1)	36±1	32±1	11±1	20.5±1	-	Maximum 11	22
ZCAT2132-1130(-BK)(*2)	36±1	32±1	11±1	20.5±1	-	Maximum 11	22
ZCAT3035-1330-M(-BK)(*1)	39±1	34±1	13±1	30±1	-	Maximum 13	63
ZCAT3035-1330(-BK)(*2)	39±1	34±1	13±1	30±1	-	Maximum 13	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	Maximum 9	12
ZCAT2749-0430C-M(-BK)	49±1	27±1	4.5±1	19.5±1	-	Maximum 4.5	26
ZCAT4625-3430D(-BK)	45.5±1	24.5±1	34±1	12±1	-	For 26 core flat cable	32
ZCAT4625-3430DT(-BK)(*3)	45.5±1	24.5±1	34±1	13±1	-	For 26 core flat cable	32
ZCAT6819-5230D(-BK)	67.5±1	18.5±1	52±1	16±1	-	For 40 core flat cable	58
ZCAT6819-5230DT(-BK)(*3)	67.5±1	18.5±1	52±1	17±1	-	For 40 core flat cable	58

(*1) Stamped with an "M".
(*2) A fixing band is attached at shipment.
(*3) The core is taped with double-sided tape. (The part arrives taped)

- ZCAT-B type: Cabinet fixing type installation hole Φ4.8 to 4.9 mm, plate thickness 0.5 to 2 mm
- ZCAT-AP, ZCAT-C type: Structure that prevents easy opening after case is closed.

42.6.3 Surge Absorber

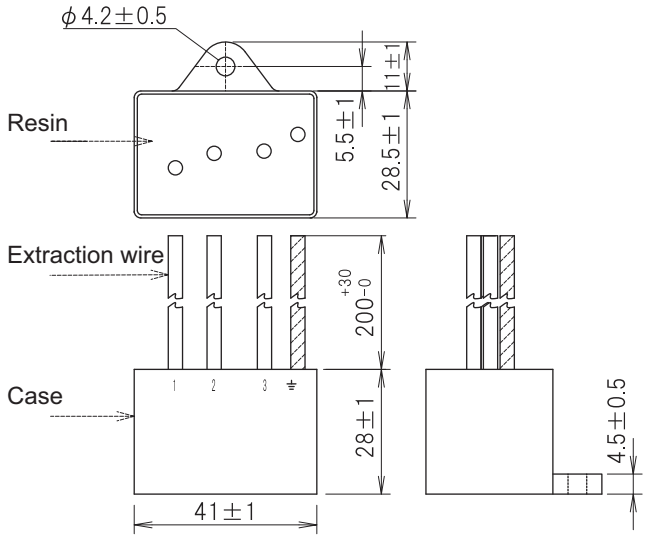
Make sure that the surge does not directly enter the AC line of the general-purpose stabilized power supply (user-prepared) supplying power to the control unit and DIO. Select the following product or equivalent for the surge absorber.
Refer to the manufacturer catalog for detailed characteristics, outline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

■ Part name: RSPD-250-U4

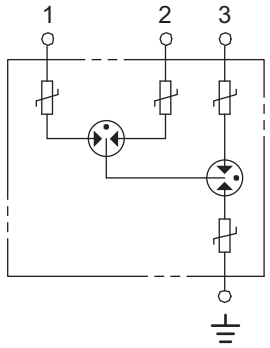
Manufacturer: OKAYA ELECTRIC INDUSTRIES

Rated voltage (50/60 Hz)	DC breakdown voltage	Voltage protection level	Normal discharge current	Max. discharge current	Surge current life
250 VAC (Three phase)	700 V ±25%	1.3 kV	8/20 µs 2.5 kA	8/20 µs 5 kA	Approx. 300 times 8/20 µs -1 kA

[Outline drawing]



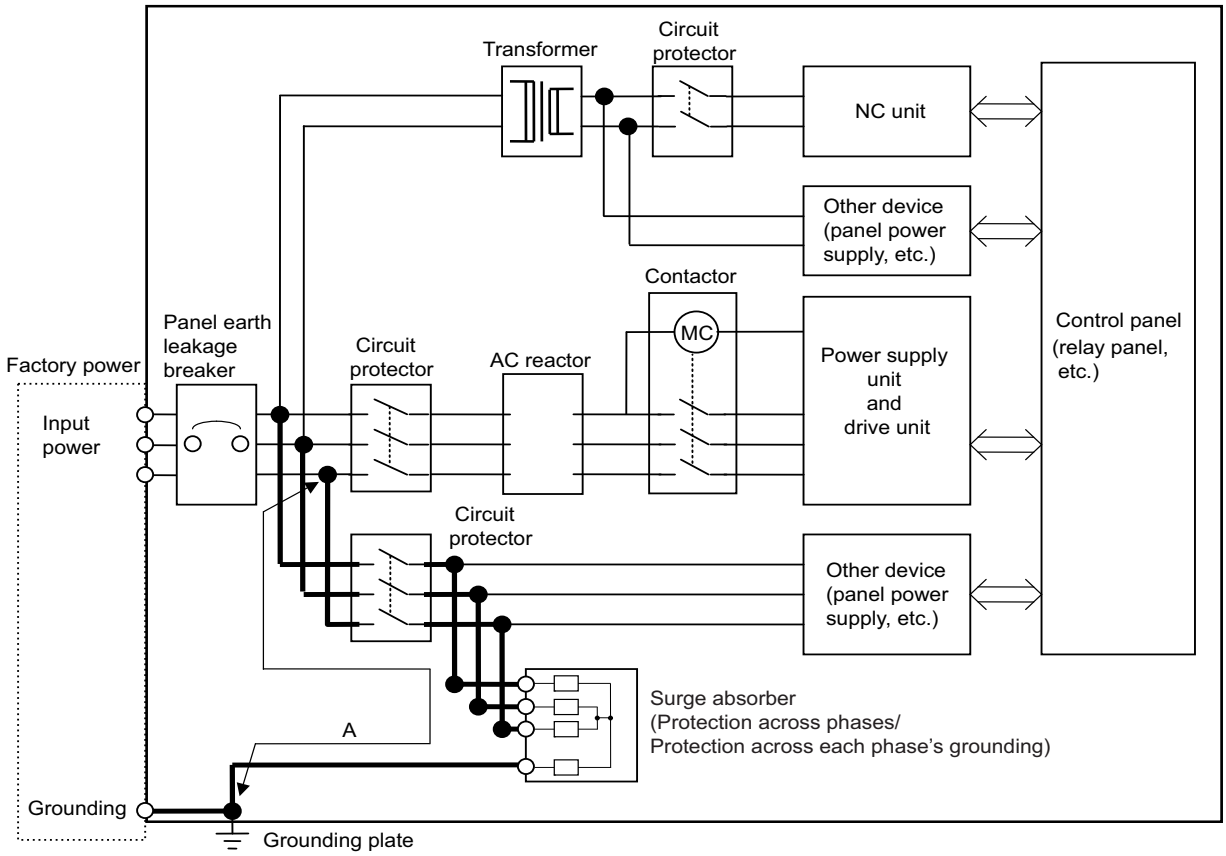
[Circuit drawing]



■ 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 to 2 m 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.

(4) Do not insert the surge absorber in the place with a lot of harmonic components.

42.6.4 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
Output	Voltage fluctuation	±5%	±5% or less of 24 VDC output
	Ripple noise	120 mV (max.)	
	Spike noise	500 mV (max.)	
Output current		——	Refer to the maximum current consumption of the unit in use and calculate.
Output holding time		20 ms (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

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Appendix 6: Restrictions for Lithium Batteries

43.1 Restriction for Packing

When transporting lithium batteries with means such as by air transport, measures corresponding to the United Nations Dangerous Goods Regulations (hereafter called "UN Regulations") must be taken.
The UN Regulations classify the batteries as dangerous goods (Class 9) or not dangerous goods according to the lithium metal content. To ensure safety during transportation, lithium batteries (battery unit) directly exported from Mitsubishi Electric 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 "Transportation Restrictions for Lithium Batteries: Handling by User".
The followings are restrictions for transportation. Each restriction is specified based on the recommendation of the United Nations.

Area	Transportation method	Restriction	Special clause
World	Air	ICAO, IATA	-
World	Marine	IMO	188
United States	All (air, marine, land)	DOT	49 CFR 173.185
Europe	land	RID, ADR	-

43.1.1 Target Products

The following Mitsubishi Electric CNC products use lithium batteries. If the lithium metal content exceeds 1 g for battery cell and 2 g for battery, the battery is classified as dangerous good (Class 9). In order to avoid an accidental actuation during the transportation, all lithium battery products incorporated in a machinery or device must be fixed securely and must be shipped with wrapped over the outer package as to prevent damage or short-circuits.

(1) Materials falling under Class 9

Mitsubishi Electric type (Type for arrangement)	Battery type	Lithium metal content	Number of incorporated batteries	Application (Data backup)	Battery class	Outline dimension drawing
CR23500SE-CJ5	CR23500SE-CJ5	1.52 kg	-	For NC SRAM (M500)	Battery cell	Refer to "Battery Option" in the specification manual for drive unit you are using for the outline dimension drawing for servo.

(2) Materials not falling under Class 9

Mitsubishi Electric type (Type for arrangement)	Battery type	Lithium metal content	Number of incorporated batteries	Application (Data backup)	Battery class	Outline dimension drawing
CR2032 (for built-in battery)	CR2032	0.067 kg	-	For NC SRAM	Battery cell	Refer to "Battery Option" in the specification manual for drive unit you are using for the outline dimension drawing for servo.
CR2450 (for built-in battery)	CR2450	0.173 kg	-	For NC SRAM		
ER6/ER6V series (for built-in battery)	ER6, ER6V	0.65 kg	-	For NC SRAM/servo encoder		
MR-BAT	ER17330V	0.48 kg	-	For servo encoder		
Q6BAT	Q6BAT	0.57 kg	-	For NC SRAM		
MDS-BAT6V1SET	2CR17335A	1.2 kg	2	For servo encoder	Battery	
MR-BAT6V1SET						

Note

(1) If the number of batteries exceeds 24 batteries for the battery cell or 12 batteries for the battery, the dedicated packing (for materials falling under Class 9) is required.

43.1.2 Handling by User

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
http://www.iata.org/
IMDG Code: A uniform international code for the transport of dangerous goods by seas determined by IMO (International Maritime Organization)
http://www.imo.org/

43.1.3 Reference

Refer to the following materials for details on the regulations and responses.
Guidelines regarding transportation of lithium batteries and lithium ion batteries
Battery Association of Japan
http://www.baj.or.jp/e

43.2 Products Information Data Sheet (ER Battery)

MSDS system does not cover the product used in enclosed state.
The ER battery described in this section applies to that product. This description is applied to the normal use, and is provided as reference but not as guarantee.
This description is based on the lithium battery's (ER battery) hazardous goods data sheet (Products Information Data Sheet) which Mitsubishi Electric has researched, and will be applied only to the ER batteries described in "Transportation Restrictions for Lithium Batteries: 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 a battery is 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: 20 ±15 °C, humidity: 70%RH or less)
	Material to avoid	Flammable or conductive material (Metal: may cause a short-circuit)

(6) Physical/chemical properties

Appearance	**Physical form**	Solid
	Shape	Cylinder type
	Smell	Odorless
	pH	Not applicable (insoluble)
	Boiling point/boiling range, melting point, decomposition temperature, flash point	No information

(7) Stability and reactivity

Stability	Stable under normal handling condition.
Condition to avoid	Do not store multiple batteries in the same location with their terminals uninsulated. Doing so 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

[Thionyl chloride]

Acute toxicity	Lc_{50}: 500 ppm (inhaled administration to rat)
Local effect	The lungs can be damaged by chronic cough, dyspnea and asthma.

[Aluminum chloride]

Acute toxicity	L_{D50}: 3700 ppm (oral administration to rat)
Local effect	Not found.

[Lithium chloride]

Acute toxicity	L_{D50}: 526 ppm (oral administration to rat)
Local effect	The central nerves and kidney can be influenced.

[Carbon black]

Acute toxicity	L_{D50}: 2,000 mg/kg > (rat)
Carcinogenicity	LARC group 2 (suspected of being carcinogenic)

(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.

43.3 Forbiddance of Transporting Lithium Battery by Passenger Aircraft Provided in the Code of Federal Regulation

This law is a domestic law of the United States, however it also applies to the domestic flight and international flight departing from or arriving in the United States. Therefore, when transporting lithium batteries to the United State, or within the United State, the shipper must take measures required to transport lithium batteries. Refer to the Federal Register and the code of Federal Regulation for details.
When transporting primary lithium battery by cargo aircraft, indicate that transportation by passenger aircraft is forbidden on the exterior box.
Lithium Metal batteries forbidden for transport aboard Passenger aircraft

43.4 California Code of Regulation "Best Management Practices for Perchlorate Materials"

When any products that contain primary lithium batteries with perchlorate are shipped to or transported through the State of California, they are subject to the above regulation.
The following information must be indicated on the package, etc. of the products that contain primary lithium batteries (with a perchlorate content of 6 ppb or higher).
Perchlorate Material - special handling may apply. See http://www.dtsc.ca.gov/hazardouswaste/perchlorate

43.5 Restriction Related to EU Battery Directive

EU Battery Directive (2006/66/EC) has been enforced since September 26th in 2008.
Hereby, battery and machinery incorporating battery marketed in European Union countries must be in compliance with the EU Battery Directive. Lithium battery provided by Mitsubishi Electric are subjected to this restriction.

43.5.1 Important Notes

Follow the instruction bellow as shipping products incorporating Mitsubishi Electric device.

(1) When shipping products incorporating Mitsubishi Electric device any time later than September 26th, 2008, the symbol mark shown as Figure 1 in section "Information for End-user" is required to be attached on the machinery or on the package. Also, the explanation of the symbol must be added.

(2) Machinery with battery and maintenance battery produced before the EU Battery Directive are also subjected to the restriction. When shipping those products to EU countries later than September 26th, 2008, follow the instruction explained in (1).

43.5.2 Information for End-user



Figure 1

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 center.

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

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Appendix 7: Precautions for Compliance to UL/c-UL Standards

(1) Selection of external 24 VDC power supply unit (The unit shall be prepared by the machine tool builder.)
This NC system complies with the UL Standards on the condition that the stabilized power supply unit supplying 24 VDC to each unit meets the requirements for SELV/limited power LPS or Class 2 power supplies and that supply voltage fluctuations do not exceed ±5% of nominal voltage.
The stabilized power supply unit supplying 24 VDC to each unit must comply with the requirements of international standards and national laws/standards required for stabilized power supplies.

(2) Unit's ambient environment
This NC system complies with the UL Standards on the condition that the unit is used under the environmental conditions described in "Environment Conditions", including the maximum relative humidity of 95% (non-condensing) and the maximum altitude of 1000 m.
To comply with UL Standards, each unit must be designed to be within the environmental conditions described in the "Environment Conditions" section.
The product must be used under environmental conditions of Overvoltage category II or lower and Pollution degree 2 or lower.

Revision History

Revision date	Manual No.	Changes
Jul. 2021	IB(NA)1501613-A	The first edition was created.
Mar. 2022	IB(NA)1501613-B	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version A3. The following units were added. • FCU8-DU194-31 (19-type color LCD touchscreen) • FCU8-DU194-32 (19-type color LCD touchscreen) • FCU8-KB091 (Keyboard for 19-type display unit) • FCU8-DX522-001 (Laser I/F Unit) • FCU8-EX752 (Image input expansion unit) The following chapters were added. • 2.3 19-type Display Unit • 2.6 Connecting a BiSS Encoder • 2.7 Connecting an Image Input Expansion Unit • 2.8 Connecting a Laser I/F Unit • 3.9 Laser I/F Unit • 4.5.3 19-type (FCU8-DU194-31) • 4.6.4 19-type (FCU8-DU194-32) • 4.7.10 Keyboard for 19-type Display Unit (FCU8-KB091) • 4.10 Laser I/F Unit • 4.12.7 Image Input Expansion Unit (FCU8-EX752) • 4.19.2 USB Interface (Image Input Expansion Unit) • 4.19.5 Wireless LAN Interface (Control Unit) • 4.19.6 HDMI Interface (Image Input Expansion Unit) • 5.3.5 Laser I/F Unit • 7.8 Connecting with a BiSS Encoder • 7.13.6 Connecting with IPC via Image Input Expansion • 11 Connection of Laser I/F Unit • 16.3 Cable Relating to Image Input Expansion Unit • 33 Variable Torsion Compensation The following chapters were changed. • 2.1 M800VS Series • 2.2 M80V Series • 2.4 Connecting an Operation Panel I/O Unit (FCU8-DX834) • 2.5 Connecting a Pulse-controlled Inverter (M80V Series) • 3.3 Display Unit [M800VS] • 3.4 Display Unit [M80V] • 3.5 Keyboard Unit [M800VS] • 3.6 Keyboard Unit [M80V] • 3.11 Function Expansion Unit • 3.16 Cable Connector Sets • 3.20 Replacements • 3.22 System Type • 4.1.1 Installation Environment Conditions • 4.2.1 Installation Environment Conditions • 4.3.1 FCU8-MU551 / FCU8-MA551 • 4.5.2 15-type (FCU8-DU182-31) • 4.5.4 Precautions • 4.6.3 15-type (FCU8-DU182-32) • 4.6.5 Precautions • 4.7 Keyboard Unit • 4.19.1 USB Interface (Memory I/F card) • 4.19.3 SD Interface (Memory I/F card) • 5.1 Heat Radiation Countermeasures • 5.3.1 Display Unit • 5.3.2 Keyboard Unit • 5.3.3 Operation Panel I/O Unit • 5.3.7 Function Expansion Unit • 7.1 Control Unit Connection System Drawing • 7.13 Connecting I/O Device via Function Expansion Unit • 9.1 Operation Panel I/O Unit Connection System Drawing • 10.1 Remote I/O Unit Connection System Drawing (Continue to the next page)

Revision date	Manual No.	Changes
		(Continued from the previous page) • 12.1 Manual Pulse Generator Connection System Drawing • 13.1 Synchronous Feed Encoder Connection System Drawing • 16.4.8 G380 Cable • 16.5 List of Cable Connector Sets • 19 Setting Up with M80/800S SETUP INSTALLER • 42.5.2 Shield Treatment of Cables Other mistakes were corrected.
Mar. 2023	IB(NA)1501613-C	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version A7. The following chapters were added. • 2.9 Connecting an EcoMonitorLight • 7.9 Connecting with EcoMonitorLight The following chapters were changed. • 2.1 M800VS Series • 2.2 M80V Series • 2.3 19-type Display Unit • 4.3.1 FCU8-MU551 / FCU8-MA551 • 4.5.4 Precautions • 4.6.5 Precautions • 4.9.2 FCU8-DX220/FCU8-DX230/FCU8-DX231/FCU8-DX202/FCU8-DX213/FCU8-DX213-1/FCU8-DX654/FCU8-DX654-1/FCU8-DX651/FCU8-DX408/FCU8-DX409 • 4.15.1 Main Panels A/B (FCU8-KB921/FCU8-KB922/FCU8-KB925, FCU8-KB923/FCU8-KB924/FCU8-KB926) • 5.2.1 Connection of Frame Ground (FG) • 7.1 Control Unit Connection System Drawing • 7.14.2 Connecting I/O Device via PROFIBUS-DP • 16.2.8 J020/J021/J022 Cable • 16.2.9 J023/J024/J025 Cable • 16.2.10 J026/J027 Cable • 16.2.13 J100 Cable • 16.2.17 J221 Cable • 16.2.18 J224 Cable • 16.2.19 J225 Cable • 25 Setting the Machine Error Compensation • 26 Setting the Position Switches • 37 Data Backup and Restoration • 39 Appendix 2: Protection Setting • 41 Appendix 4: Country Code Setting (for Wireless LAN Function) • 42 Appendix 5: EMC Installation Guidelines • 44 Appendix 7: Precautions for Compliance to UL/c-UL Standards Other mistakes were corrected.
Jul. 2023	IB(NA)1501613-D	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version A8. The following chapter was added • 16.4.5 MR-ENE4CBL-H-MTH Cable The following chapters were changed. • 2.3 19-type Display Unit • 2.7 Connecting an Image Input Expansion Unit • 3.6 Keyboard Unit [M80V] • 3.21 List of Cables • 4.2.1 Installation Environment Conditions • 4.7 Keyboard Unit • 5.3.2 Keyboard Unit • 15.1 Handy Terminal Connection System Drawing • 16.4.4 CNV2E-8P/CNV2E-9P Cable • 16.4.7 CNV2E-HP Cable • 24.2 Stored Stroke Limit The following chapter was deleted. • 4.7.1 Keyboard for 8.4-type Display Unit (FCU8-KB025) Other mistakes were corrected.

Revision date	Manual No.	Changes
Dec. 2023	IB(NA)1501613-E	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version A9. The following unit was added. • FCU8-EX569 (CC-Link IE TSN remote unit) The following chapters were added. • 4.12.6 CC-Link IE TSN Remote Unit (FCU8-EX569) • 7.14.6 Connecting I/O Device via CC-Link IE TSN • 32.3.3.1 OMR-CC Initial Setting • 32.3.3.3 Enhanced Surface Quality Mode for OMR-CC • 33.4 Acceleration Rate Display The following chapters were changed. • 3.11 Function Expansion Unit • 4.3.1 FCU8-MU551 / FCU8-MA551 • 5.2.2 Shield Clamping of Cables • 7.14 Connecting I/O Device via Function Expansion Unit • 7.14.2 Connecting I/O Device via PROFIBUS-DP • 7.14.4 Connecting I/O Device via EtherNet/IP • 16.2.1 FCUA-R050/R054 Cable • 16.2.4 G430 Cable • 32.3 OMR-CC • 32.3.1 Enabling Conditions of OMR-CC • 32.3.2 Conditions for Temporarily Canceling Compensation by OMR-CC • 32.3.3 Description of Operation • 32.3.3.2 Adjustment by OMR-CC Compensation Factor • 33.5 Relation with Other Functions • 42.6.1 Shield Clamp Fitting The following chapter was deleted. • 32.3.3.1 Adjustment by Setting Value of Scale Model Gain (PGM) Other mistakes were corrected.
Apr. 2024	IB(NA)1501613-F	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version AA. The following chapters were changed. • 3.21 List of Cables • 7.14.2 Connecting I/O Device via PROFIBUS-DP • 31.1 Synchronous Control • 37 Data Backup and Restoration Other mistakes were corrected.
Oct. 2024	IB(NA)1501613-G	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version B0. The following chapters were changed. • 19 Setting Up with M80/800S SETUP INSTALLER • 37 Data Backup and Restoration Other mistakes were corrected.

Revision date	Manual No.	Changes
Apr. 2025	IB(NA)1501613-H	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version B2. The following chapters were changed. • 2.1 M800VS Series • 2.2 M80V Series • 3.11 Function Expansion Unit • 4.3.1 FCU8-MU551/FCU8-MA551 • 4.4.1 FCU8-MU521/FCU8-MU522 • 4.12.6 CC-Link IE TSN Expansion Unit (FCU8-EX569) • 4.15.1 Main Panels A/B (FCU8-KB921/FCU8-KB922/FCU8-KB925, FCU8-KB923/FCU8-KB924/FCU8-KB926) • 7.14.6 Connecting I/O Device via CC-Link IE TSN • 14.7 Software Interface • 16.4.3 CNP3EZ-2P/CNP3EZ-3P Cable • 16.4.4 CNV2E-8P/CNV2E-9P Cable • 16.4.5 MR-ENE4CBL-H-MTH Cable • 32.4 High-speed Synchronous Tapping (OMR-DD) • 37 Data Backup and Restoration Other mistakes were corrected.
Aug. 2025	IB(NA)1501613-J	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version B4. The following chapters were changed. • 4.19.5 Wireless LAN Interface (Control Unit) • 24.1 Stroke End • 31.1 Synchronous Control • 32.4 High-speed Synchronous Tapping (OMR-DD) • 39 Appendix 2: Protection Setting • 41 Appendix 4: Country/Region Code Setting (for Wireless LAN Function) Other mistakes were corrected.
Jan. 2026	IB(NA)1501613-K	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version B8. Chapters 3, 4, 5, 7, 10, 14, 18 and 37 were modified. The main changes are as follows: The following chapter was added. • 10.8 Connecting with Machine Control Signal (FCU8-DX520) The contents were revised as follows. Main chapter numbers are indicated in parentheses. • Added the remote I/O unit (FCU8-DX520). (3.8, 4.1.1, 4.9.2, etc.) • Added the note of the European Safety Standards "EN60204-1". (7.3, 14.5) Other mistakes were corrected.
May 2026	IB(NA)1501613-L	Contents were revised to correspond to Mitsubishi Electric CNC M800V/M80V Series software version BB. Chapters 16 and 23 were modified. The main changes are as follows. Chapter numbers are indicated in parentheses. The contents were revised as follows. • Changed the wire material of J071 cable. (16.2.12) • Improved the explanation of absolute position detection system. (23.1, 23.1.1, 23.1.2, etc.) Other 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.

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MODEL	M800VS/M80V Series
MODEL CODE	100-744
Manual No.	IB-1501613

IB(NA)1501613(ENG)-L(2605)MEE
Made in JAPAN

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