

Changes for the Better

MITSUBISHI CNC

Connection and Setup Manual

M800W/M80W Series

A grayscale image of the Earth from space, showing continents and clouds. Overlaid on the center of the Earth is the text "MITSUBISHI CNC" in a large, white, stylized font with a slight shadow effect. The text is split into two lines: "MITSUBISHI" on top and "CNC" below it.

**MITSUBISHI
CNC**

Introduction

This manual covers the items required for installing, connecting and setting up the MITSUBISHI CNC.
Supported models are as follows:

Supported models	Abbreviations in this manual
M800W Series	M850W, M830W
M80W Series	M80W

Abbreviations in this manual are as follows:

Abbreviations	Supported models
M800, M800 Series	M800W Series
M80, M80 Series	M80W Series
M800/M80, M800/M80 Series	M800W Series/M80W Series
M8, M8 Series	M800W Series/M80W Series









Read this manual thoroughly and understand the product's functions and performance before starting to use.
This manual is written on the assumption that all 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.
Be sure to keep this manual always at hand.

This manual notes a reference chapter as "Chapter: Section: Paragraph".
(Example) For "4.1.1 Environment Conditions inside the Control Panel" :
"General Specifications: Environment Conditions: Environment Conditions inside the Operation"
("4.1.1 Environment Conditions inside the Operation" included in "4.1 Environment Conditions" of "4 General Specifications")

Notes on Reading This Manual

- (1) This book is configured as follows.
Refer to the following chapters as necessary.
Installation and connection: Chapter 1 to 18
Setup: Chapter 19 to 36
- (2) This manual explains general parameters as viewed from the NC.
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) The "special display unit" explained in this manual is the display unit incorporated by the machine tool builder, and is not the MITSUBISHI standard display unit.
- (5) This manual is for the machine tool builders who set up the NC system.
- (6) The control unit for M80W is mainly used as a control unit to explain the connection, etc. in the drawings on this manual.
- (7) Do not connect to the pin described as "NC" on the pin assignment table of the connector.

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.
-  Refer to the Instruction Manual issued by each machine tool builder for details on each machine tool.
-  Some screens and functions may differ depending on each NC system (or version), and some functions may not be possible. Please confirm the specifications before starting to use.
-  Refer to "Smart safety observation" (BNP-C3072-022) for details about the connection with safety observing I/O device.
-  Do not connect NC system to the Internet-connected network.
-  To maintain the safety of the NC system against unauthorized access from external devices via the network, take appropriate measures.

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

In this manual, the following items are generically called "controller".

- Control unit
- Display unit
- Personal computer 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 + driver

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

- Servo motor
- Spindle motor

Also refer to the manuals on "Manual List" as necessary.

Manual List

Manuals related to M800/M80/E80/C80 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
M800/M80/E80 Series Instruction Manual	IB-1501274	<ul style="list-style-type: none"> ◆ Operation guide for NC ◆ Explanation for screen operation, etc.
C80 Series Instruction Manual	IB-1501453	<ul style="list-style-type: none"> ◆ Operation guide for NC ◆ Explanation for screen operation, etc.
M800/M80/E80/C80 Series Programming Manual (Lathe System) (1/2)	IB-1501275	<ul style="list-style-type: none"> ◆ G code programming for lathe system ◆ Basic functions, etc.
M800/M80/E80/C80 Series Programming Manual (Lathe System) (2/2)	IB-1501276	<ul style="list-style-type: none"> ◆ G code programming for lathe system ◆ Functions for multi-part system, high-accuracy function, etc.
M800/M80/E80/C80 Series Programming Manual (Machining Center System) (1/2)	IB-1501277	<ul style="list-style-type: none"> ◆ G code programming for machining center system ◆ Basic functions, etc.
M800/M80/E80/C80 Series Programming Manual (Machining Center System) (2/2)	IB-1501278	<ul style="list-style-type: none"> ◆ G code programming for machining center system ◆ Functions for multi-part system, high-accuracy function, etc.
M800/M80/E80 Series Alarm/Parameter Manual	IB-1501279	<ul style="list-style-type: none"> ◆ Alarms ◆ Parameters
C80 Series Alarm/Parameter Manual	IB-1501560	<ul style="list-style-type: none"> ◆ Alarms ◆ Parameters

Manuals for MTBs (NC)

Manual	IB No.	Purpose and Contents
M800/M80/E80/C80 Series Specifications Manual (Function)	IB-1501505	<ul style="list-style-type: none"> ♦ Model selection ♦ Outline of various functions
M800/M80/E80/C80 Series Specifications Manual (Hardware)	IB-1501506	<ul style="list-style-type: none"> ♦ Model selection ♦ Specifications of hardware unit
M800W/M80W Series Connection and Setup Manual	IB-1501268	<ul style="list-style-type: none"> ♦ Detailed specifications of hardware unit ♦ Installation, connection, wiring, setup (startup/adjustment)
M800S/M80/E80 Series Connection and Setup Manual	IB-1501269	<ul style="list-style-type: none"> ♦ Detailed specifications of hardware unit ♦ Installation, connection, wiring, setup (startup/adjustment)
C80 Series Connection and Setup Manual	IB-1501452	<ul style="list-style-type: none"> ♦ Detailed specifications of hardware unit ♦ Installation, connection, wiring, setup (startup/adjustment)
M800/M80/E80 Series PLC Development Manual	IB-1501270	<ul style="list-style-type: none"> ♦ Electrical design ♦ I/O relation (assignment, setting, connection), field network ♦ Development environment (PLC on-board, peripheral development environment), etc.
M800/M80/E80 Series PLC Programming Manual	IB-1501271	<ul style="list-style-type: none"> ♦ Electrical design ♦ Sequence programming ♦ PLC support functions, etc.
M800/M80/E80/C80 Series PLC Interface Manual	IB-1501272	<ul style="list-style-type: none"> ♦ Electrical design ♦ Interface signals between NC and PLC
M800/M80/E80 Series Maintenance Manual	IB-1501273	<ul style="list-style-type: none"> ♦ Cleaning and replacement for each unit ♦ Other items related to maintenance
C80 Series Maintenance Manual	IB-1501454	<ul style="list-style-type: none"> ♦ Cleaning and replacement for each unit ♦ Other items related to maintenance

Manuals for MTBs (drive section)

Manual	IB No.	Contents
MDS-E/EH Series Specifications Manual	IB-1501226	<ul style="list-style-type: none"> ♦ Specifications for power supply regeneration type
MDS-E/EH Series Instruction Manual	IB-1501229	<ul style="list-style-type: none"> ♦ Instruction for power supply regeneration type
MDS-EJ/EJH Series Specifications Manual	IB-1501232	<ul style="list-style-type: none"> ♦ Specifications for regenerative resistor type
MDS-EJ/EJH Series Instruction Manual	IB-1501235	<ul style="list-style-type: none"> ♦ Instruction for regenerative resistor type
MDS-EM/EMH Series Specifications Manual	IB-1501238	<ul style="list-style-type: none"> ♦ Specifications for multi-hybrid, power supply regeneration type
MDS-EM/EMH Series Instruction Manual	IB-1501241	<ul style="list-style-type: none"> ♦ Instruction for multi-hybrid, power supply regeneration type
DATA BOOK	IB-1501252	<ul style="list-style-type: none"> ♦ Specifications of servo drive unit, spindle drive unit, motor, etc.

Manuals for MTBs (Others)

Manual	No.	Purpose and Contents
GOT2000 Series User's Manual (Hardware)	SH-081194	♦ Outline of hardware such as part names, external dimensions, installation, wiring, maintenance, etc. of GOTs
GOT2000 Series User's Manual (Utility)	SH-081195	♦ Outline of utilities such as screen display setting, operation method, etc. of GOTs
GOT2000 Series User's Manual (Monitor)	SH-081196	♦ Outline of each monitor function of GOTs
GOT2000 Series Connection Manual (Mitsubishi Electric Products)	SH-081197	♦ Outline of connection types and connection method between GOT and Mitsubishi Electric connection devices
GT Designer3 (GOT2000) Screen Design Manual	SH-081220	♦ Outline of screen design method using screen creation software GT Designer3

■ For M800/M80/E80 Series

Manual	No.	Purpose and Contents
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-0800004E	♦ 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 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
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

■ For C80 Series

Manual	No.	Purpose and Contents
MELSEC iQ-R Module Configuration Manual	SH-081262	♦ Outline of system configuration, specifications, installation, wiring, maintenance, etc.
MELSEC iQ-R CPU Module User's Manual (Startup)	SH-081263	♦ Outline of specifications, procedures before operation, troubleshooting, etc. for CPU module
MELSEC iQ-R CPU Module User's Manual (Application)	SH-081264	♦ Outline of memory, functions, devices, parameters, etc. for CPU module
QCPU User's Manual (Hardware Design, Maintenance and Inspection)	SH-080483	♦ Outline of specifications, necessary knowledge to configure the system and maintenance-related descriptions for Q series CPU module, etc.
GX Works3 Operating Manual	SH-081215	♦ Outline of functions, programming, etc.




Reference Manual for MTBs


Manual	No.	Purpose and Contents
M800/M80 Series Smart safety observation Specification manual	BNP-C3072-022	♦ Explanation for smart safety observation function
C80 Series Smart safety observation Specification manual	BNP-C3077-022	
M800/M80 Series CC-Link (Master/Local) Specification manual	BNP-C3072-089	♦ Explanation for CC-Link
M800/M80 Series PROFIBUS-DP Specification manual	BNP-C3072-118	♦ Explanation for PROFIBUS-DP communication function
M800/M80 Series Interactive cycle insertion (Customization) Specification manual	BNP-C3072-121-0003	♦ Explanation for interactive cycle insertion
M800/M80 Series EtherNet/IP Specifications manual	BNP-C3072-263	♦ Explanation for EtherNet/IP
M800/M80 Series CC-Link IE Field (Master/local) Specifications manual	BNP-C3072-283	♦ Explanation for CC-Link IE Field
M800/M80 Series GOT Connection Specifications manual	BNP-C3072-314	♦ Explanation for GOT connection
M800/M80 Series CC-Link IE Field Basic Specifications manual	BNP-C3072-337	♦ Explanation for CC-Link IE Field Basic

Precautions for Safety





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

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











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

Note that the items under "  CAUTION" could lead to serious consequences as well depending on the situation. All the items are important and must always be observed.

The following signs indicate prohibition and compulsory.

	<p>This sign indicates prohibited behavior (must not do).</p> <p>For example,  indicates "Keep fire away".</p>
	<p>This sign indicates a thing that is compulsory (must do).</p> <p>For example,  indicates "it must be grounded".</p>

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

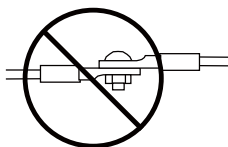
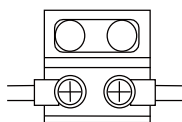
Mitsubishi CNC is designed and manufactured solely for applications to machine tools to be used for industrial purposes.



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.

1. Items related to prevention of electric shocks

WARNING






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



-  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.


2. Items related to prevention of fire

CAUTION







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

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

DANGER

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

CAUTION









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

4. General precautions

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
















(1) 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.
-  Refer to the Instruction Manual issued by each machine tool builder for details on each machine tool.
-  Some screens and functions may differ depending on each NC system (or version), and some functions may not be possible. Please confirm the specifications before starting to use.
-  Refer to "Smart safety observation" (BNP-C3072-022) for details about the connection with safety observing I/O device.
-  Do not connect NC system to the Internet-connected network.
-  To maintain the safety of the NC system against unauthorized access from external devices via the network, take appropriate measures.

(2) 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, or the front cover could come off, causing the unit to drop.
-  Install on a non-combustible place where the unit's or motor's mass can be withstood according to the instruction manual.
-  The motor does not have a complete water-proof (oil-proof) structure. Do not allow oil or water to contact or enter the motor. Prevent the cutting chips from being accumulated on the motor as they easily soak up oil.
-  When installing the motor facing upwards, take measures on the machine side so that gear oil, etc., will not enter the motor shaft.
-  Do not remove the encoder from the motor. (The encoder installation screw is treated with sealing.)
-  Do not allow foreign matters, especially, conductive foreign matters such as screws or metal chips, or combustible foreign matters such as oil, to enter the controller, drive unit or motor. Failure to observe this could result in rupture or damage.
-  Do not get on the product or place heavy objects on it.
-  Provide prescribed distance between the controller/drive unit and inner surface of the control panel/other devices.
-  Do not install or operate the controller, drive unit or motor that is damaged or has missing parts.
-  Take care not to cut hands, etc. with the heat radiating fins or metal edges.

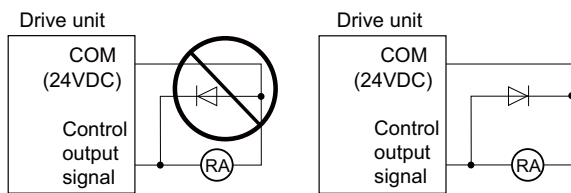
CAUTION

-  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).

(3) Items related to wiring

⚠ CAUTION

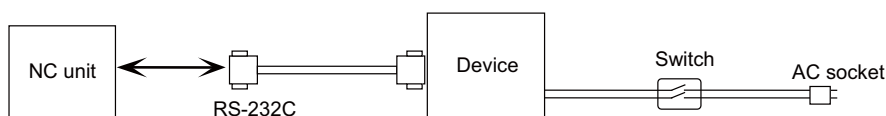
- ⚠ Correctly wire this product. Failure to observe this could result in motor runaway, etc.
- ⚠ Incorrect terminal connections could cause the devices to rupture or damage, etc.
- ⚠ Do not install a phase advancing capacitor, surge absorber or radio noise filter on the output side of the drive unit.
- ⚠ Correctly connect the output side (terminal U, V, W). The motor will not run properly if incorrectly connected.
- ⚠ Always install an AC reactor per each power supply unit.
- ⚠ Always install an appropriate breaker per each power supply unit. A breaker cannot be shared for multiple power supply units.
- ⚠ 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 24V.
- ⚠ 12V, 5V, and 3.3V output from connectors are to supply the power for dedicated peripheral devices. Do not use for other equipment to supply the power since we do not guarantee the NC operation by voltage down or noise sneaking.
- ⚠ 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.

(4) Set up

WARNING






-  Do not cancel the emergency stop before confirming the basic operation.
-  Always set the stroke end and stroke limit. Failure to set this could result in collision with the machine end.

CAUTION

-  If the descriptions relating to the "restrictions" and "allowable conditions" conflict between this manual and the machine tool builder's instruction manual, the latter has priority over the former.
-  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.


















(5) 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".

(6) 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 instantaneous power failure time) 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.

(7) Troubleshooting

⚠ CAUTION

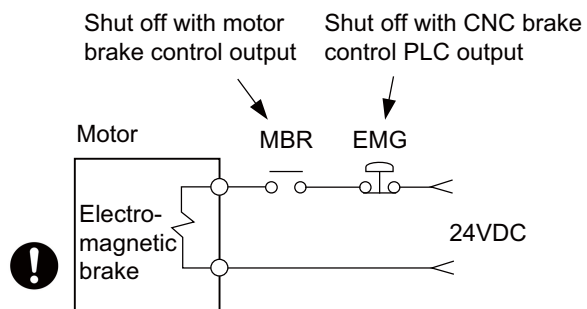
⚠ Use a motor with electromagnetic brakes or establish an external brake mechanism for the purpose of holding; this serves as countermeasures for possible hazardous situation caused by power failure or product fault.

⚠ 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.



(8) Maintenance, inspection and part replacement

⚠ CAUTION

⚠ Periodically back up the programs, tool data and parameters to avoid potential data loss. Also, back up those data before maintenance and inspections.

⚠ When replacing the battery on the controller side, the machining programs, tool data and parameters should be backed up with the input/output device beforehand. In case the memory is damaged in replacing the batteries, reload all the data backed up before replacing the battery.

⚠ The electrolytic capacitor's capacity will drop due to deterioration. To prevent secondary damage due to capacitor's faults, Mitsubishi recommends the electrolytic capacitor to be replaced approx. every five years even when used in a normal environment. Contact the Service Center 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.

(9) 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.

(10) 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 recommends sorting the product and selling the members to appropriate contractors.

- (2) Requirements for "Law for Treatment of Waste and Cleaning"
 - (a) Mitsubishi 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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本製品の取扱いについて

(日本語 /Japanese)

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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)

이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며 가정외의 지역에서 사용하는 것을 목적으로 합니다.

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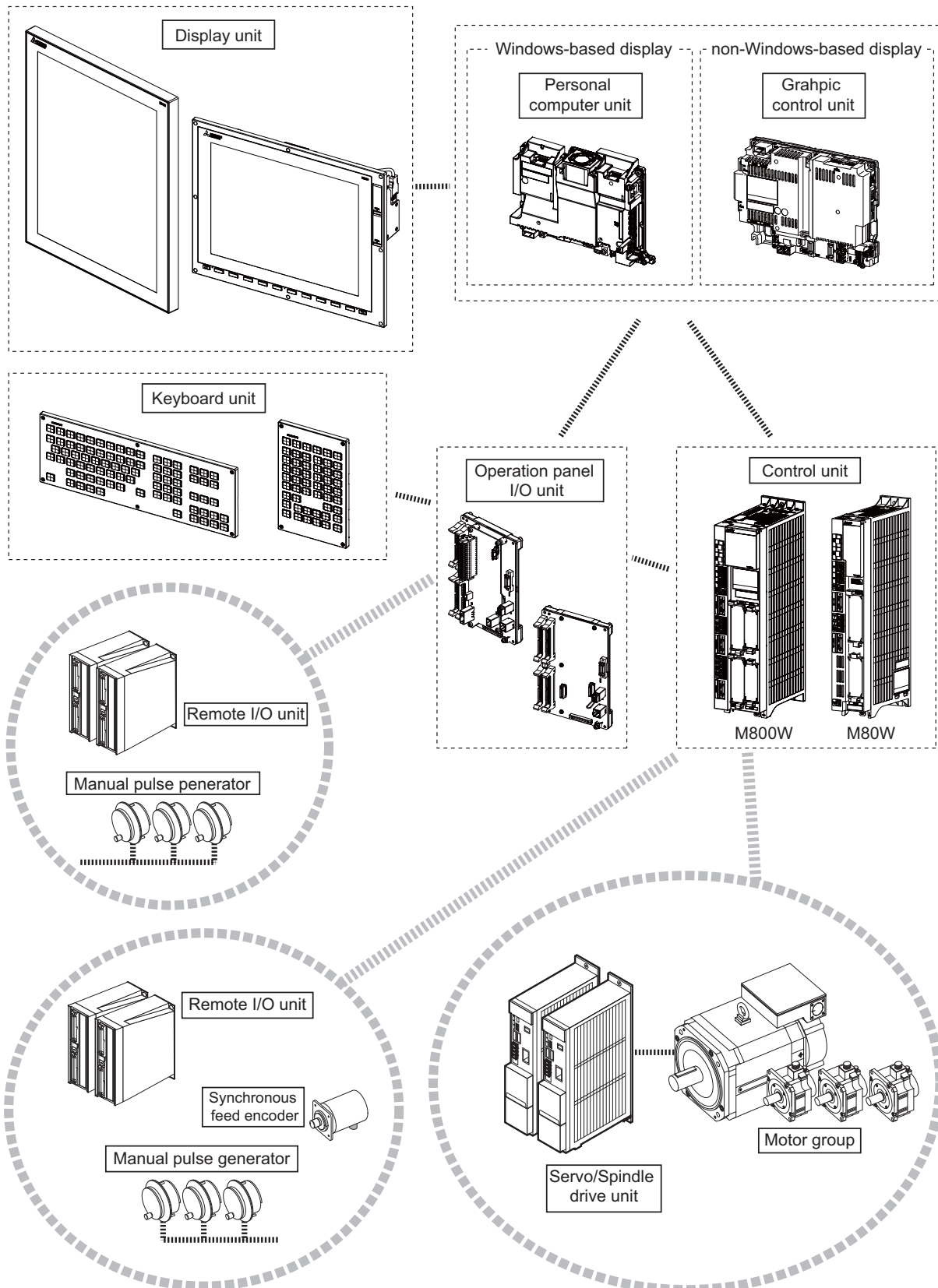
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System Basic Configuration

1.1 System Basic Configuration Drawing



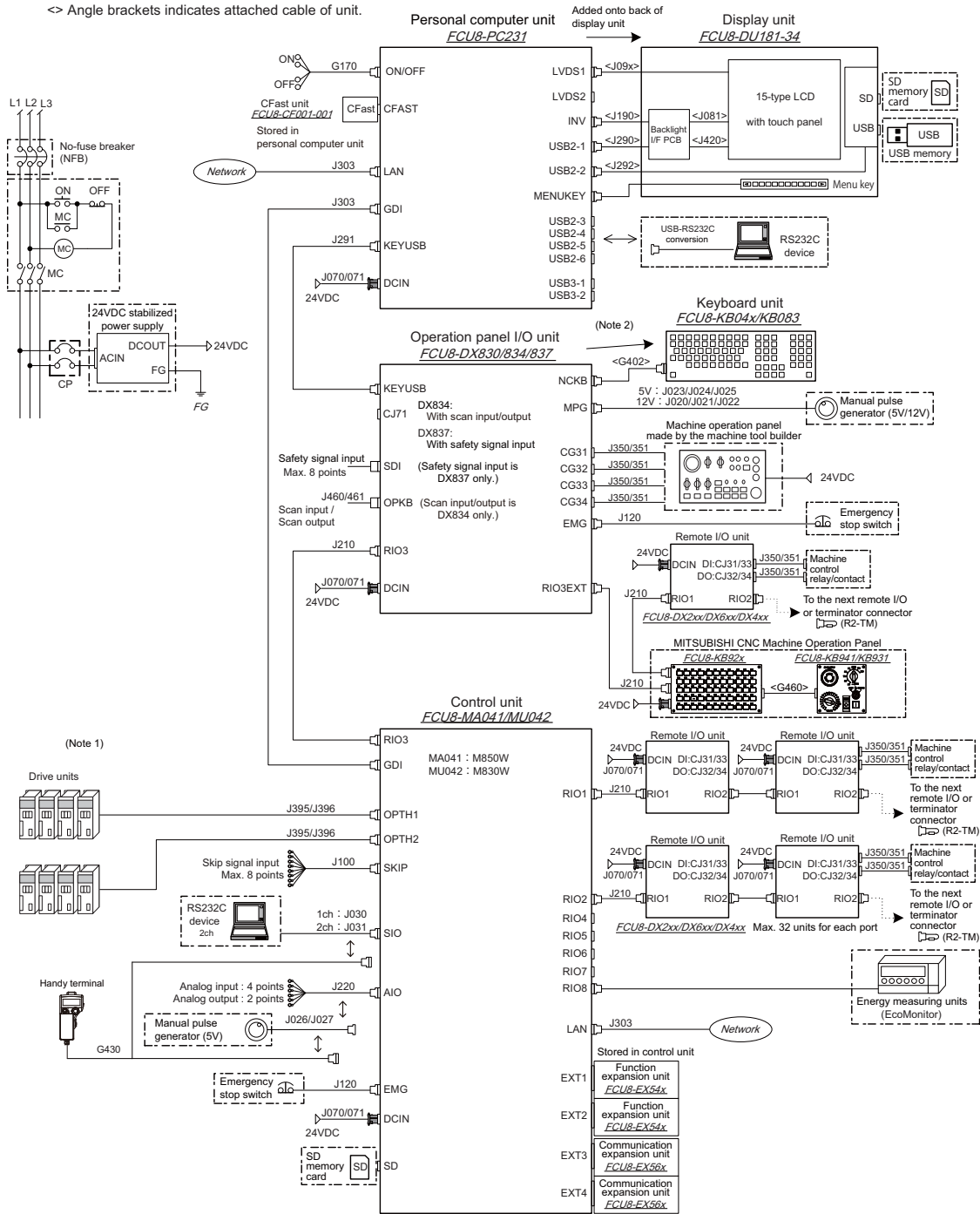
(Note) For the drive unit configuration, refer to the Instruction Manual of the drive unit you use.

General Connection Diagram

2.1 General Connection Diagram [M800W]

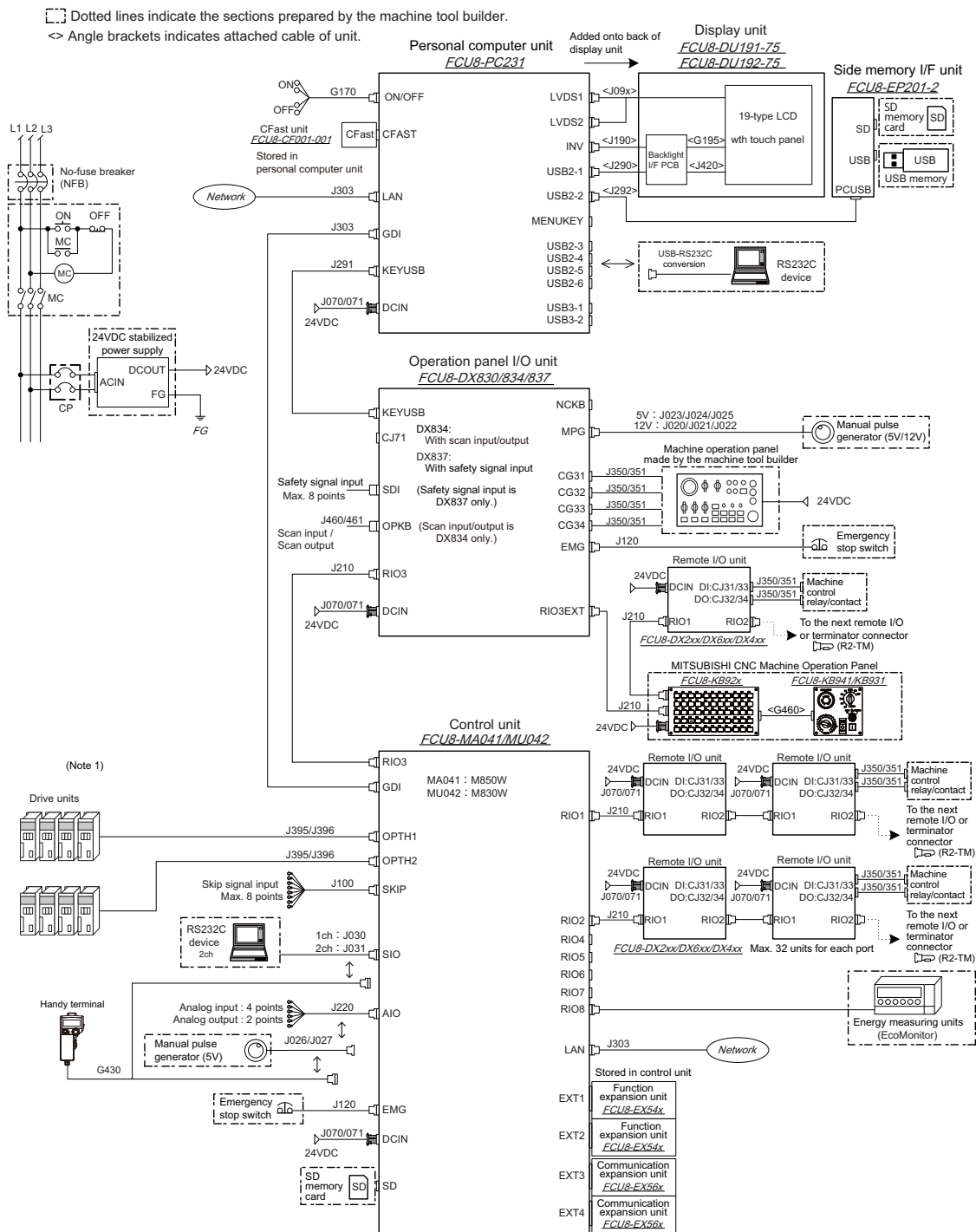
2.1.1 M800W, Windows-based Display (15-type)

⋯ Dotted lines indicate the sections prepared by the machine tool builder.
 <> Angle brackets indicates attached cable of unit.



- (Note 1) For information on how to connect the drive unit, refer to the drive unit's manual.
- (Note 2) When using a keyboard unit, install the operation panel I/O unit on the back of the keyboard unit.
- (Note 3) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

2.1.2 M800W, Windows-based Display (19-type)



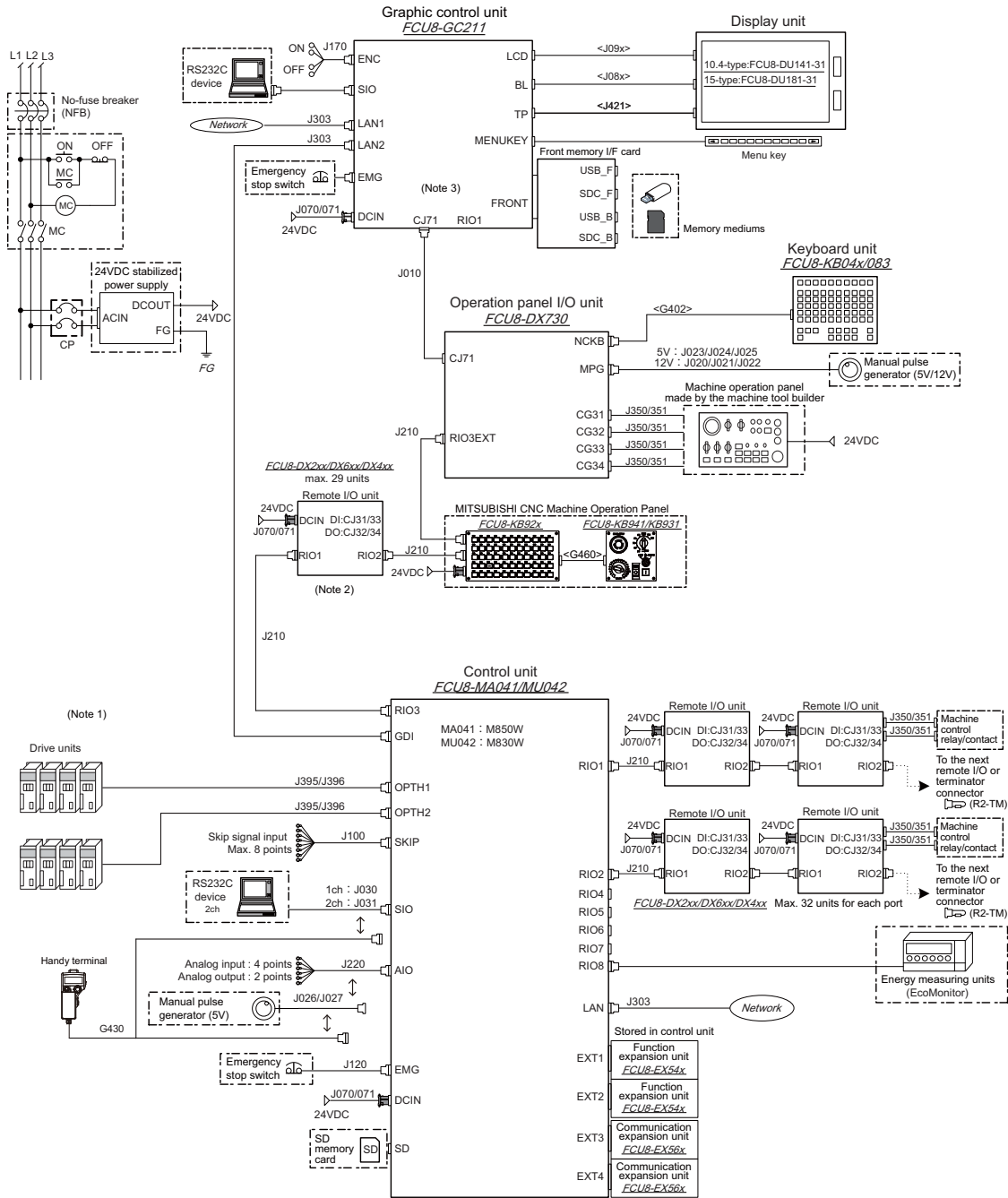
(Note 1) For information on how to connect the drive unit, refer to the drive unit's manual.

(Note 2) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

2 General Connection Diagram

2.1.3 M800W, Non-Windows-based Display (10.4-type / 15-type)

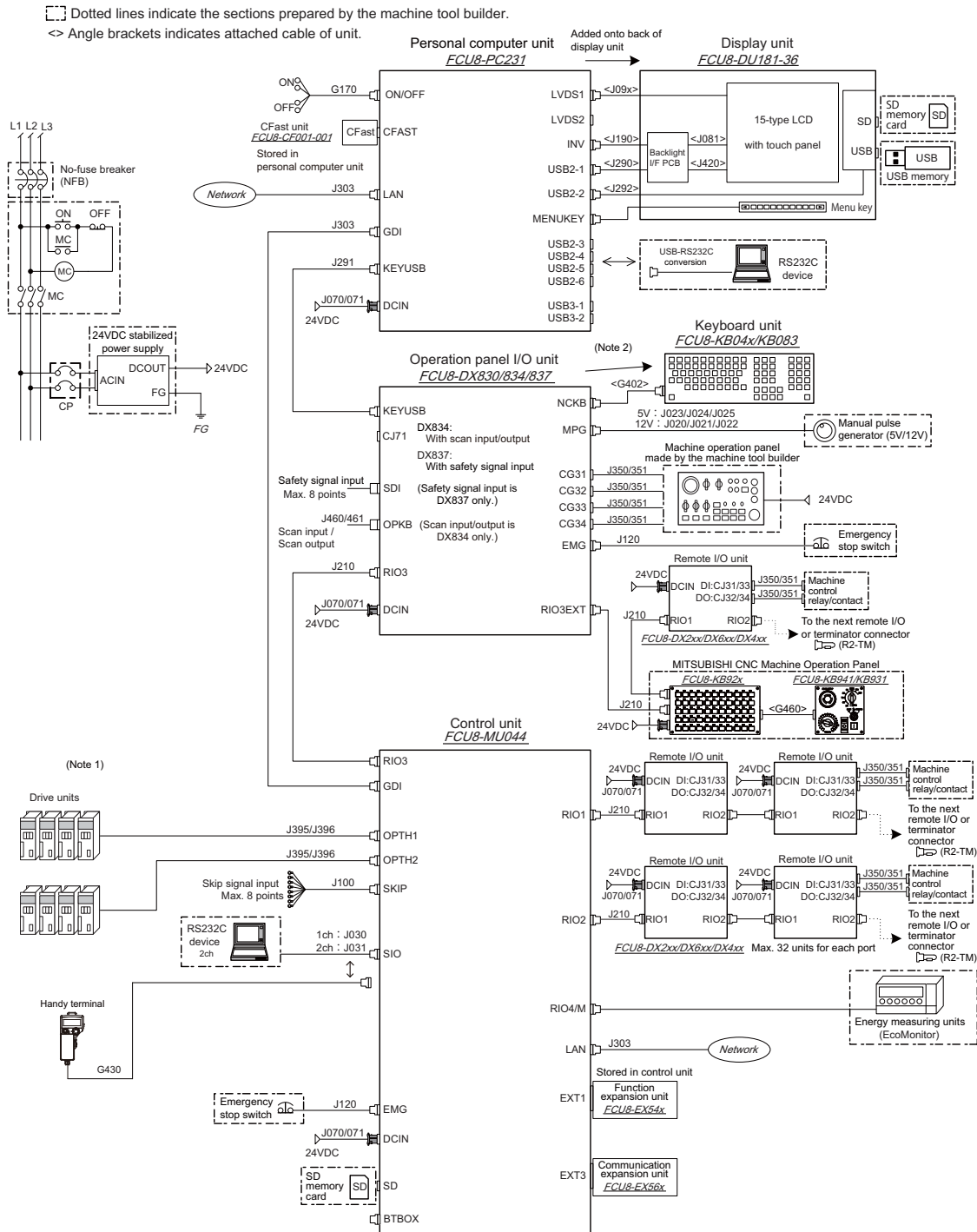
⋯ Dotted lines indicate the sections prepared by the machine tool builder.
 <> Angle brackets indicates attached cable of unit.



- (Note 1) For information on how to connect the drive unit, refer to the drive unit's manual.
- (Note 2) When connecting a remote I/O unit to the 3rd RIO channel, insert it between the control unit and operation panel I/O unit.
- (Note 3) There is no need to connect a terminator R2-TM to the graphic control unit.
- (Note 4) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

2.2 General Connection Diagram [M80W]

2.2.1 M80W, Windows-based Display (15-type)



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

(Note 2) When using a keyboard unit, install the operation panel I/O unit on the back of the keyboard unit.

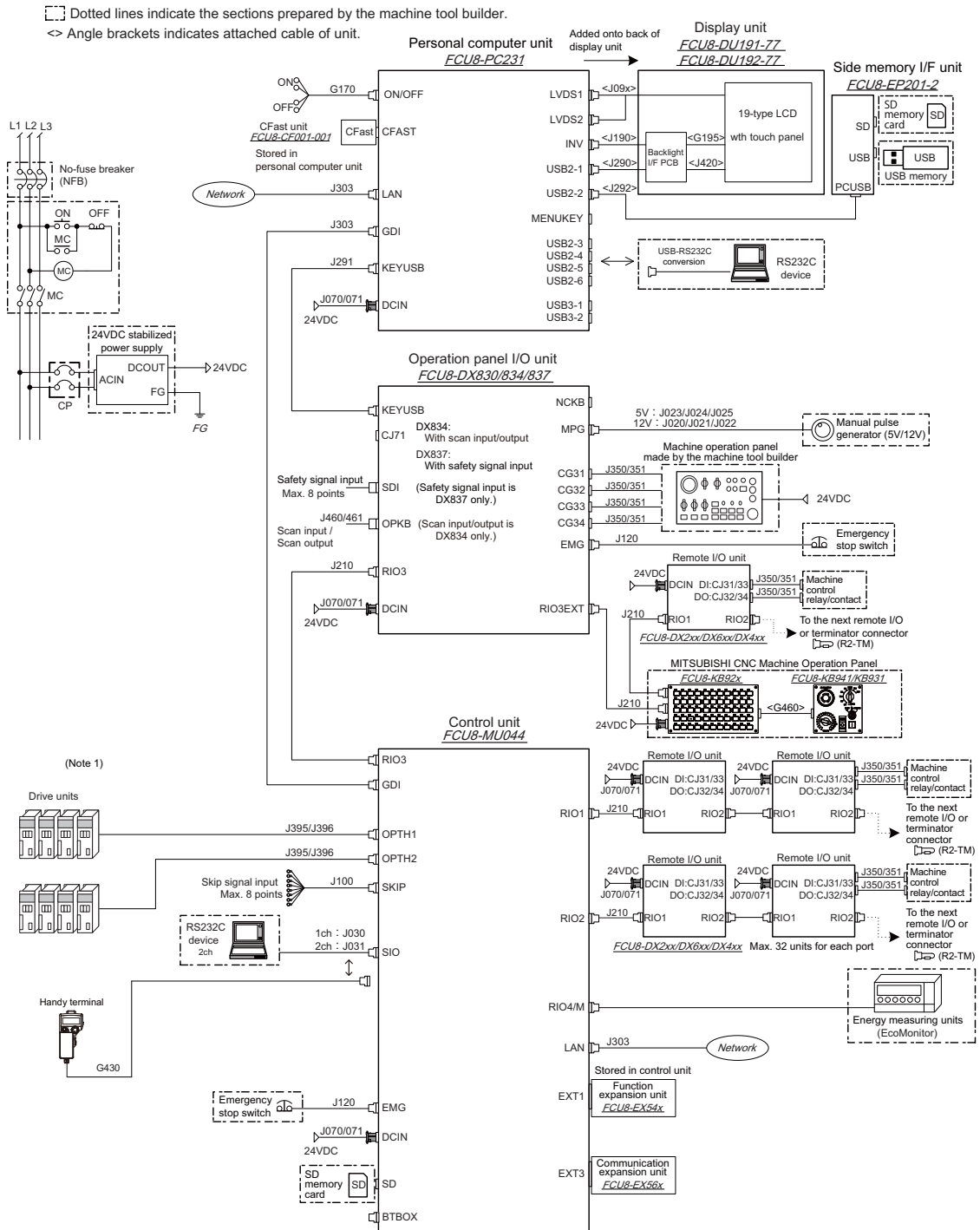
(Note 3) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

(Note 4) When the handle of handy terminal is used, connect ENC connector of G430 cable to MPG connector of the operation panel I/O unit.

Because the pin assignment of ENC connector of G430 is different from that of MPG connector of the operation panel I/O unit, conversion is required.

The conversion cable needs to be prepared by the MTB.

2.2.2 M80W, Windows-based Display (19-type)



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

(Note 2) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

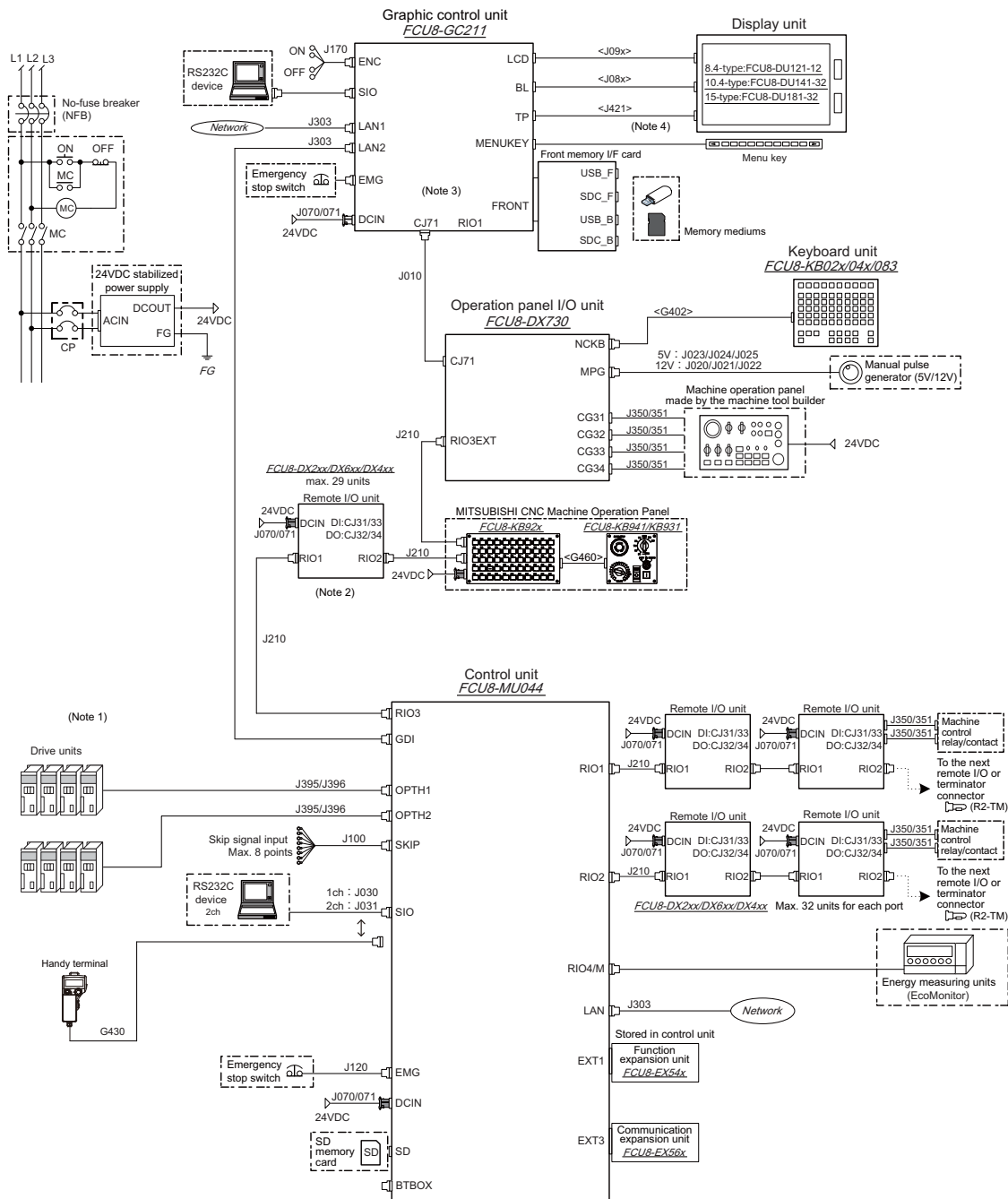
(Note 3) When the handle of handy terminal is used, connect ENC connector of G430 cable to MPG connector of the operation panel I/O unit.

Because the pin assignment of ENC connector of G430 is different from that of MPG connector of the operation panel I/O unit, conversion is required.

The conversion cable needs to be prepared by the MTB.

2.2.3 M80W, Non-Windows-based Display (8.4-type /10.4-type /15-type)

⋯ Dotted lines indicate the sections prepared by the machine tool builder.
 <> Angle brackets indicates attached cable of unit.



- (Note 1) For information on how to connect the drive unit, refer to the drive unit's manual.
- (Note 2) When connecting a remote I/O unit to the 3rd RIO channel, insert it between the control unit and operation panel I/O unit.
- (Note 3) There is no need to connect a terminator R2-TM to the graphic control unit.
- (Note 4) For the 8.4-type display unit, TP connector is not used.
- (Note 5) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".
- (Note 6) When the handle of handy terminal is used, connect ENC connector of G430 cable to MPG connector of the operation panel I/O unit.
 Because the pin assignment of ENC connector of G430 is different from that of MPG connector of the operation panel I/O unit, conversion is required.
 The conversion cable needs to be prepared by the MTB.

List of Configuration

3.1 Control Unit [M800W]

Classification	Type	Components	Remarks
NC functions For M830W	FCU8-MU042	Main CPU card (for non-applicable) 7SEG card SDHC: 1ch Back panel card Unit lid (Resin molded article) etc.	Export Trade Control Order noncompliant unit and Foreign Exchange Order noncompliant unit G123 cable for EMG is attached.
NC functions For M850W	FCU8-MA041	Main CPU card(for applicable) 7SEG card SDHC: 1ch Back panel card Unit lid (Resin molded article) etc.	Export Trade Control Order noncompliant unit and Foreign Exchange Order compliant unit G123 cable for EMG is attached.

3.2 Control Unit [M80W]

Classification	Type	Components	Remarks
NC functions For M80W	FCU8-MU044	Main CPU card (for non-applicable) 7SEG card SDHC: 1ch Back panel card Unit lid (Resin molded article) etc.	Export Trade Control Order noncompliant unit and Foreign Exchange Order noncompliant unit G123 cable for EMG is attached.

3.3 Display Unit [M800W]

Classification	Type	Components	Remarks
10.4-type color TFT touch panel (VGA:640*480)	FCU8-DU141-31	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front side memory I/F is normally equipped with the control unit (non-Windows-based display)
15-type color TFT touch panel (XGA:1024*768)	FCU8-DU181-31	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front side memory I/F is normally equipped with the control unit (non-Windows-based display)
15-type color TFT touch panel (XGA:1024*768)	FCU8-DU181-34	LCD panel Backlight I/F PCB Menu keys Escutcheon Base metal plate Cable Screw cap set	Personal computer unit is prepared at the same time. Built-in disk of the display unit is prepared at the same time. Front side memory I/F is normally equipped with the display unit (Windows-based display)
19-type color TFT touch panel (SXGA:1024*1280)	FCU8-DU191-75	LCD panel Backlight I/F PCB Escutcheon Base metal plate Cable	Personal computer unit is prepared at the same time. Built-in disk of the display unit is prepared at the same time. Side memory I/F unit is separately prepared. (Windows-based display)
19-type color TFT touch panel (SXGA:1280*1024)	FCU8-DU192-75	LCD panel Backlight I/F PCB Escutcheon Base metal plate Cable	Personal computer unit is prepared at the same time. Built-in disk of the display unit is prepared at the same time. Side memory I/F unit is separately prepared. (Windows-based display)

3.4 Display Unit [M80W]

Classification	Type	Components	Remarks
8.4-type color TFT (VGA:640*480)	FCU8-DU121-12	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front side memory I/F is normally equipped with the control unit (non-Windows-based display)
10.4-type color TFT touch panel (VGA:640*480)	FCU8-DU141-32	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front side memory I/F is normally equipped with the control unit (non-Windows-based display)
15-type color TFT touch panel (XGA:1024*768)	FCU8-DU181-32	LCD panel Menu keys Escutcheon Base metal plate Cable Screw cap set	Front side memory I/F is normally equipped with the control unit (non-Windows-based display)
15-type color TFT touch panel (XGA:1024*768)	FCU8-DU181-36	LCD panel Backlight I/F PCB Menu keys Escutcheon Base metal plate Cable Screw cap set	Personal computer unit is prepared at the same time. Built-in disk of the display unit is prepared at the same time. Front side memory I/F is normally equipped with the display unit (Windows-based display)
19-type color TFT touch panel (SXGA:1024*1280)	FCU8-DU191-77	LCD panel Backlight I/F PCB Escutcheon Base metal plate Cable	Personal computer unit is prepared at the same time. Built-in disk of the display unit is prepared at the same time. Side memory I/F unit is separately prepared. (Windows-based display)
19-type color TFT touch panel (SXGA:1280*1024)	FCU8-DU192-77	LCD panel Backlight I/F PCB Escutcheon Base metal plate Cable	Personal computer unit is prepared at the same time. Built-in disk of the display unit is prepared at the same time. Side memory I/F unit is separately prepared. (Windows-based display)

3.5 Personal Computer Unit

Classification	Type	Components	Remarks
Personal Computer Unit	FCU8-PC231	PC board PC cooling FAN Unit lid (Resin molded article) etc.	
Built-in Disk of the Display Unit	FCU8-CF001-001	Windows OS / data storage	Windows8

3.6 Graphic Control Unit [M800W]

Classification	Type	Components	Remarks
Graphic control unit	FCU8-GC211	Base control card Front-side memory I/F card	(Note) This unit occupies the 13th and 14th RIO stations.

3.7 Keyboard Unit [M800W]

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

3.8 Keyboard Unit [M80W]

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

3.9 Operation Panel I/O Unit

Classification	Type	Components	Remarks
DI 24V/0V common input [64 points] DO Source output [64 points]	FCU8-DX830	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 64-points 24V/0V common type DO: 64-points source type (200mA/point) Manual pulse generator input: 3ch Display unit I/F Keyboard unit I/F Emergency stop input 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 (Note) J291 cable is required for connection with the personal computer unit. (for windows-based display)
DI 24V/0V 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-points 24V/0V common type DO: 64-points source type (200mA/point) Scan input: 64 points Scan output: 64 points Manual pulse generator input: 3ch Display unit I/F Keyboard unit I/F Emergency stop input 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 (Note) J291 cable is required for connection with the personal computer unit. (for windows-based display)
DI 24V/0V common input [64 points] DO Source output [64 points] Safety DI 24V/0V common input [8 points]	FCU8-DX837	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 64-points 24V/0V common type DO: 64-points source type (200mA/point) Safety DI: 8-points 0V common type Manual pulse generator input: 3ch Display unit I/F Keyboard unit I/F Emergency stop input 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 (Note) J291 cable is required for connection with the personal computer unit. (for windows-based display)
DI 24V/0V common input [64 points] DO Source output [64 points]	FCU8-DX730	Base card RIO 2.0 terminator connector (R2-TM)	DI: 64-points 24V/0V common type DO: 64-points source type (200mA/point) Manual pulse generator input: 3ch Graphic control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1, 2, 7 to 12, 20 to 22 RIO extensible stations: 3 to 6, 15 to 19, 23 to 64 (13 and 14 are occupied by the graphic control unit.) (Note) J010 cable is required for connection with the graphic control unit. (for non-Windows-based display)

(Note) DI: Digital input signals, DO: Digital output signals

3.10 Remote I/O Unit

Classification	Type	Components	Remarks
DI 24V/0V common input [32 points] DO Source output [32 points]	FCU8-DX220	Base card RIO 2.0 connector set	DI: 32-points 24V/0V common type Do: 32-points source type (200mA/point) Number of occupied stations: 1
DI 24V/0V common input [64 points] DO Source output [48 points]	FCU8-DX230	Base card RIO 2.0 connector set	DI: 64-points 24V/0V common type DO: 48-points source type (200mA/point) Number of occupied stations: 2
DI 24V/0V common input DO Source output [48 points] AO Analog output [1 point]	FCU8-DX231	Base card RIO 2.0 connector set	DI: 64-points 24V/0V common type DO: 48-points source type (200mA/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 0V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213	Base card RIO 2.0 connector set	DI: 16-points 0V common type (3mA/point) DO: 8-points source type (2A/point) Number of occupied stations: 1
DI 0V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213-1	Base card RIO 2.0 connector set	DI: 16-points 0V common type (9mA/point) DO: 8-points source type (2A/point) Number of occupied stations: 1
Safety DI 0V common input [8 points] Safety DO Source output (large capacity) [4 points]	FCU8-DX654	Base card RIO 2.0 connector set	Safety DI: 8-points 0V common type (3mA/point) Safety DO: 4-points source type (2A/point) Number of occupied stations: 2
Safety DI 0V 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-points 0V common type (9mA/point) Safety DO: 4-points source type (2A/point) Number of occupied stations: 2
DI 24V/0V common input [32points] DO Source output [32 points] Safety DI 0V common input [8 points] (Note 1) Safety relay output [4 points] (Note 2)	FCU8-DX651	Base card Add-on card RIO 2.0 connector set	DI: 32-points 24V/0V common type Do: 32-points source type (200mA/point) Safety DI: 8-points 0V common type Safety relay: 4-points (non-voltage contact) Relay contact welding detection Number of occupied stations: 3 (Note 1) Safety DI uses 16 points of terminal because of the duplication wiring. (Note 2) Safety relay output uses 8 points of terminal because of the duplication wiring.
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] (Note 3)	FCU8-DX409	Base card RIO 2.0 connector set	Multi-analog input: 4 points (Note 3) Voltage input, current input, thermocouple input and resistance temperature detector input are selected for each CH. Number of occupied stations: 4

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

3.11 Function Expansion Unit

Classification	Type	Components	Remarks
Encoder (manual pulse generator) I/F expansion unit	FCU8-EX544	Encoder I/F PCB	Encoder input 1ch 5V manual pulse generator input 2ch

3.12 Communication 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 2ch
EtherNet/IP Scanner/adaptor unit	FCU8-EX565	Base card Add-on card	EtherNet/IP 1ch (Only LAN1, LAN2 cannot be used)
FL-net expansion unit	FCU8-EX568	Base card Add-on card	FL-net 1ch (Only LAN1, LAN2 cannot be used)

3 List of Configuration

3.13 Side Memory I/F Unit

Classification	Type	Components	Remarks
Side Memory I/F Unit	FCU8-EP201-2	Side memory I/F PCB J292 cable Structural member	SDHC 1ch USB2.0 1ch USB communication (between side memory I/F PCB and personal computer) Unit lid (resin molded article), metal plate, etc. Exclusive for 19-type display unit

3.14 Manual Pulse Generator

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

3.15 Synchronous Feed Encoder

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

3.16 MITSUBISHI CNC 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 standard key layout (55 keys) (Standard specification A)
Main panel A (For 8.4-type/15-type display unit)	FCU8-KB922	Escutcheon, key switch control card G054 cable, Screw cap set	Custom specification key layout (55 keys) (Clear key top cover sold separately)
Main panel B (For 10.4-type display unit)	FCU8-KB923	Escutcheon, key switch control card G054 cable, Screw cap set	MITSUBISHI standard key layout (55 keys) (Standard specification A)
Main panel B (For 10.4-type display unit)	FCU8-KB924	Escutcheon, key switch control card G054 cable, Screw cap set	Custom specification key layout (55 keys) (Clear key top cover sold separately)
Main panel A (For 8.4-type/15-type display unit)	FCU8-KB925	Escutcheon, key switch control card G054 cable, Screw cap set	MITSUBISHI 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 standard key layout (55 keys) (Standard specification B)
Sub panel A (Common for all display units)	FCU8-KB931	Escutcheon Emergency stop switch, Override switch ON/OFF switch, Screw cap set	MITSUBISHI 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 standard switch specification (Standard specification B)
Clear key top set	N030C975G51 / N030C975G55	Clear key top cover (20 pcs/60 pcs)	
Set of labels for M7 standard key layout	N939A169G51	Labels for M7 standard key layout (1 sheet)	

3.17 Handy Terminal

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

3.18 Cable Connector Sets

Classification	Type	Components	Remarks
General I/O units (For SKIP,SIO,MPG,AIO)	FCUA-CS000	Connector (10120-3000PE,2pcs), Shell kit (10320-52F0-008,2pcs)	
Emergency stop connector (For EMG)	005057-9403 0016020103 x 3 pcs.	Connector (50-57-9403), Contact (0016020103,3pcs.)	
Connector kit for RIO 2.0 unit	RIO2 CON	Connector (1-1318119-3,2pcs.), Contact (1318107-1,8pcs.), Connector (2-178288-3), Contact (1-175218-5,3pcs)	
24VDC power supply connector (For DCIN)	FCUA-CN220	Connector (2-178288-3), Contact (1-175218-5,3pcs)	
DI/DO connector (For operation panel I/O unit) (For remote I/O unit)	7940-6500SC x 4pcs. 3448-7940 x 4pcs.	Connector (7940-6500SC,4pcs.), Strain relief (3448-7940,4pcs.)	
ON/OFF switch connector	005057-9404 0016020103 x 4pcs.	Connector (50-57-9404), Contact (0016020103,4pcs.)	
THERMISTOR connector	37104-2165-000FL 10P	Connector (37104-2165-000FL,10pcs.)	

3.19 Thermistor Sets

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

3.20 Genuine Memory Card

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

3.21 Durable Parts

Durable parts	Part type
Battery for control unit	Q6BAT BKO-C10811H03
Cooling fan for personal computer unit	109P0424H3103

(Note) Contact the Service Center, Sales Office or dealer for repairs or part replacement.

3.22 Replacements

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

3.23 List of Cables

[Cable relating to NC]

Type	Application	Available cable length (m)	Max. cable length
FCUA-R050-xM	Synchronous encoder - control unit (straight, with connector) (for FCU8-EX544)	5	30m
FCUA-R054-xM	Synchronous encoder - control unit (right angle, with connector) (for FCU8-EX544)	3, 5, 10, 15, 20	30m
G071 LxM	24VDC relay cable for MITSUBISHI CNC machine operation panel	0.12, 0.5, 1	1m
G123	Cable for emergency stop release	-	-
G170 LxM	ON/OFF switch cable (ON/OFF switch - Personal computer unit) (for windows-based display)	1, 2, 3, 5, 10, 15	15m
G430 LxM	Cable for connection to handy terminal	3, 5, 10	10m
G460 LxM	Cable for MITSUBISHI CNC machine operation panel (Cable between main panel and sub panel)	0.5	0.5m
J010 LxM	Operation panel I/O interface cable (for non-Windows-based display)	0.5, 1	1m
J020 LxM	Manual pulse generator cable (12V): 1ch	1, 2, 3, 5, 7, 10, 15, 20, 30	50m
J021 LxM	Manual pulse generator cable (12V): 2ch	1, 2, 3, 5, 7, 10, 15, 20, 30	50m
J022 LxM	Manual pulse generator cable (12V): 3ch	1, 2, 3, 5, 7, 10, 15, 20, 30	50m
J023 LxM	Manual pulse generator cable (5V): 1ch	1, 2, 3, 5, 7, 10, 15, 20	20m
J024 LxM	Manual pulse generator cable (5V): 2ch	1, 2, 3, 5, 7, 10, 15, 20	20m
J025 LxM	Manual pulse generator cable (5V): 3ch	1, 2, 3, 5, 7, 10, 15, 20	20m
J026 LxM	Manual pulse generator cable (5V): 1ch (for connection to control unit)	1, 2, 3, 5, 7, 10, 15, 20	20m (*)
J027 LxM	Manual pulse generator cable (5V): 2ch (for connection to control unit)	1, 2, 3, 5, 7, 10, 15, 20	20m (*)
J030 LxM	RS-232C I/F cable: 1ch	1, 2, 3, 5, 7, 10	15m (*)
J031 LxM	RS-232C I/F cable: 2ch	1, 2, 3, 5, 7, 10	15m (*)
J070 LxM	24VDC power cable	1, 2, 3, 5, 7, 10, 15	15m
J071 LxM	24VDC power cable (for long distance)	20	20m
J100 LxM	SKIP input cable	1, 2, 3, 5, 7, 10, 15, 20	20m
J120 LxM	Emergency stop cable	1, 2, 3, 5, 7, 10, 15, 20, 30	30m
J121 LxM	Emergency stop cable for MITSUBISHI CNC machine operation panel	1, 2, 3, 5, 7, 10, 15, 20, 30	30m
J170 LxM	ON/OFF switch cable (ON/OFF switch - Graphic control unit) (for non-Windows-based display)	1, 2, 3, 5, 10, 15	15m
J210 LxM	Remote I/O 2.0 communication cable	0.3, 1, 2, 3, 5, 7, 10, 15, 20, 30	50m (*)
J220 LxM	Analog output cable (for M800W)	2, 3, 7	30m
J221 LxM	Analog input/output cable (for remote I/O unit)	2, 3, 7	30m
J291 LxM	Connection cable between personal computer unit and operation panel I/O unit	0.15, 0.5, 1	1m
J303 LxM	LAN straight cable	1, 2, 3, 5, 7, 10, 15, 20, 30	50m
J350 LxM	DI/DO cable (connectors at both ends)	1, 2, 3, 5	50m
J351 LxM	DI/DO cable (connector at one end)	3	50m
J460 LxM	DI/DO cable (connectors at both ends)	1, 2, 3, 5	50m
J461 LxM	DI/DO cable (connector at one end)	3	50m
R2-TM	Terminator for remote I/O interface	-	-

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

(Note 2) Lengths indicated with an asterisk (*) in the max. cable length column indicate the maximum cable length when connecting 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	30m
CNP3EZ-2P-xM	Spindle side encoder cable OSE-1024 cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNP3EZ-3P-xM	Spindle side encoder cable OSE-1024 cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-8P-xM	For HG/HG-H,HQ/HQ-H Motor side encoder cable (for D48/D51/D74)	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-9P-xM	For HG/HG-H,HQ/HQ-H Motor side encoder cable (for D48/D51/D74)	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-D-xM	MDS-B-SD unit cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
CNV2E-HP-xM	MDS-B-HR unit cable	2, 3, 4, 5, 7, 10, 15, 20, 25, 30	30m
DG30-xM	Battery cable (For drive unit - Battery box, For drive unit - drive unit)	0.3, 0.5, 1, 2, 3, 5, 7, 10	10m
G380 LxM	Optical communication cable For wiring between drive units (outside panel)	5, 10, 12, 15, 20, 25, 30	30m
J395 LxM	Optical communication cable For wiring between drive units (outside panel) For wiring between NC-drive units	3, 5, 7, 10	10m
J396 LxM	Optical communication cable For wiring between drive units (inside panel)	0.2, 0.3, 0.5, 1, 2, 3, 5	10m
MR- BKS1CBLxMA1-H	<200V Series> Brake cable for HG96 Lead out in direction of motor shaft	2, 3, 5, 7, 10	10m
MR- BKS1CBLxMA2-H	<200V Series> Brake cable for HG96 Lead out in opposite direction of motor shaft	2, 3, 5, 7, 10	10m
MR-BT6V2CBL LxM	Battery cable (MDS-EJ/EJH) (For drive unit - drive unit)	0.3, 1	1m
MR-D05UDL3M-B	STO cable	3	3m
MR- PWS1CBLxMA1-H	<200V Series> Power cable for HG96 Lead out in direction of motor shaft	2, 3, 5, 7, 10	10m
MR- PWS1CBLxMA2-H	<200V Series> Power cable for HG96 Lead out in opposite direction of motor shaft	2, 3, 5, 7, 10	10m
SH21 LxM	Power supply communication cable Power backup unit communication cable	0.35, 0.5, 1, 2, 3	30m

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

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

3.24 System Type

Series	Model name	System type	Control unit
M800W Series	M850W	FCA850U	FCU8-MA041-001
	M830W	FCA830U	FCU8-MU042-001
M80W Series	M80W	FCA80U	FCU8-MU044-001

4

General Specifications

4.1 Environment Conditions [M800W]

4.1.1 Environment Conditions inside the Operation Panel

Item	Unit name		Display unit	Personal computer unit	Graphic control unit	
	Type		FCU8-DU141-31 : (10.4-type) FCU8-DU181-31 : (15-type) FCU8-DU181-34 : (15-type) FCU8-DU191-75 : (19-type) FCU8-DU192-75 : (19-type)	FCU8-PC231	FCU8-GC211	
General Specifications	Ambient temperature	During operation	0 to 58°C			
		During storage	-20 to 60°C			
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)			
		Short term	10 to 95% RH (with no dew condensation) (Note 1)			
	Vibration resistance		4.9m/s ² [0.5G] or less			
	Shock resistance		29.4m/s ² [3G] 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		FCU8-DU141-31 : 12VDC/5VDC/3.3VDC FCU8-DU181-31 : 12VDC/5VDC/3.3VDC FCU8-DU181-34 : 12VDC/5VDC/3.3VDC FCU8-DU191-75 : 12VDC/5VDC FCU8-DU192-75 : 12VDC/5VDC (Supply from personal computer unit or graphic control unit)	24VDC	24VDC	
	Current consumption		24V 2.2A			24V 2.5A
	Maximum heating value	(W)	FCU8-DU141-31 : 10 FCU8-DU181-31 : 14 FCU8-DU181-34 : 18 FCU8-DU191-75 : 21 FCU8-DU192-75 : 21	32	12	
	Mass	(kg)	FCU8-DU141-31 : 1.7 FCU8-DU181-31 : 4 FCU8-DU181-34 : 4 FCU8-DU191-75 : 5.7 FCU8-DU192-75 : 5.7	1.2	1.1	
Outline dimension W×H or W×H×D	(mm)	FCU8-DU141-31 : 290×220 FCU8-DU181-31 : 400×320 FCU8-DU181-34 : 290×220 FCU8-DU191-75 : 365×440 FCU8-DU192-75 : 440×365	220×182×53.5	239.1×173.4×75		

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

(Note 2) 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.

(Note 3) When the display unit is mounted on an incline, the inclination angle to place the unit should follow below.
10.4 or 15-type display unit: the inclination should be 30 degrees or less from the vertical direction.
19-type display unit: the inclination should be 60 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-DX830/ DX834/DX837	FCU8-DX730	FCU8-KB921/KB922/ KB925 FCU8-KB923/KB924/ KB926 FCU8-KB931/KB941
General Specifications	Ambient temperature	During operation	0 to 58°C			
		During storage	-20 to 60°C			
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)			
		Short term	10 to 95% RH (with no dew condensation) (Note 1)			
	Vibration resistance		4.9m/s ² [0.5G] or less			
	Shock resistance		29.4m/s ² [3G] 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		5VDC	24VDC	5VDC, 3.3VDC	24VDC (Note 7)
			(Supply from Operation Panel I/O Unit)		(Supply from Graphic Control Unit)	
	Current consumption		- (Note 2)	24V 0.3A (Note 3)	- (Note 3,4)	0.3A (Note 7)
	Maximum heating value	(W)	1	8 (Note 5)	4 (Note 5)	7.2
Mass	(kg)	FCU8-KB041/KB046 : 0.8 FCU8-KB047 : 1.3 FCU8-KB048 : 1.4 FCU8-KB083 : 1.5	0.4	0.3	FCU8-KB921/KB922/ KB925 : 1.1 FCU8-KB923/KB924/ KB926 : 1.2 FCU8-KB931/KB941 : 0.5	
Outline dimension W×H	(mm)	FCU8-KB041/KB046 : 140×220 FCU8-KB047 : 290×160 FCU8-KB048 : 230×220 FCU8-KB083 : 400×140	116×179		FCU8-KB921/KB922/ KB925 : 260×140 FCU8-KB923/KB924/ KB926 : 290×140 FCU8-KB931/KB941 : 140×140	

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

(Note 2) The current consumption of the keyboard unit is included in that of the operation panel I/O unit or the graphic control unit.

(Note 3) Current consumption for the I/O circuit needs to be separately calculated based on the number of points used and its load.

(Note 4) The current consumption of FCU8-DX730 is included in that of the graphic control unit.

(Note 5) For the heating value of the I/O circuit, calculate with the number of points used.

(Note 6) 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.

(Note 7) 24V power input is not required for FCU8-KB931/KB941.

4.1.2 Environment Conditions inside the Control Panel

Item	Unit name		Control unit
	Type		FCU8-MU042 FCU8-MA041
General Specifications	Ambient temperature	During operation	0 to 55°C
		During storage	-20 to 60°C
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)
		Short term	10 to 95% RH (with no dew condensation) (Note 1)
	Vibration resistance		4.9m/s ² [0.5G] or less
	Shock resistance		29.4m/s ² [3G] 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		24VDC
	Current consumption		1.5A
	Maximum heating value	(W)	16
	Mass	(kg)	2.0
	Outline dimension W×H×D	(mm)	90×380×180

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

(Note 2) 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 General Specifications

Item	Unit name		Remote I/O unit					
	Type		FCU8-DX220/ DX230/ DX231	FCU8-DX202	FCU8-DX213/ DX213-1/ DX654/ DX654-1	FCU8-DX408	FCU8-DX409	FCU8-DX651
General Specifications	Ambient temperature	During operation	0 to 58°C					
		During storage	-20 to 60°C					
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)					
		Short term	10 to 95% RH (with no dew condensation) (Note 1)					10 to 85% RH (with no dew condensation) (Note 1)
	Vibration resistance		4.9m/s ² or less					
	Shock resistance		29.4m/s ² or less					
	Working atmosphere		No corrosive 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		24VDC					
	Current consumption		3.5A (Note 2)	0.3A	0.3A (Note 3)	0.1A	0.2A	3.7A (Note 2)
	Maximum heating value	(W)	8 (Note 4)			3	6 (Note 6)	8 (Note 4)
	Mass	(kg)	0.4			0.2	0.3	0.8
	Outline dimension W×H×D	(mm)	40×175×133	40×175×119	40×175×130	40×175×109	40×175×115	172×100×115

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

(Note 2) This value includes the maximum value of DO external load current (3.2A).

(Note 3) This value does not include DO external load current.

(Note 4) For the heating value of the I/O circuit, calculate with the number of points used.

(Note 5) 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.

(Note 6) The maximum value including the heating value of analog input circuit.

4.1.3 24VDC 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	24VDC	When the stabilized power supply and 24VDC input unit are distant, select the stabilized power supply which is possible to set output voltage 24VDC 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	0.2V (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 24V.

4.2 Environment Conditions [M80W]

4.2.1 Environment Conditions inside the Operation Panel

Item	Unit name		Display unit	Personal computer unit	Graphic control unit
	Type		FCU8-DU121-12 : (8.4-type) FCU8-DU141-32 : (10.4-type) FCU8-DU181-32 : (15-type) FCU8-DU181-36 : (15-type) FCU8-DU191-77 : (19-type) FCU8-DU192-77 : (19-type)	FCU8-PC231	FCU8-GC211
General Specifications	Ambient temperature	During operation	0 to 58°C		
		During storage	-20 to 60°C		
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)		
		Short term	10 to 95% RH (with no dew condensation) (Note 1)		
	Vibration resistance		4.9m/s ² [0.5G] or less		
	Shock resistance		29.4m/s ² [3G] 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		FCU8-DU121-12 : 12VDC/3.3VDC FCU8-DU141-32 : 12VDC/5VDC/3.3VDC FCU8-DU181-32 : 12VDC/5VDC/3.3VDC FCU8-DU181-36 : 12VDC/5VDC/3.3VDC FCU8-DU191-77 : 12VDC/5VDC FCU8-DU192-77 : 12VDC/5VDC (Supply from personal computer unit or graphic control unit)	24VDC	24VDC
	Current consumption		24V 2.2A		24V 2.5A
	Maximum heating value	(W)	FCU8-DU121-12 : 6 FCU8-DU141-32 : 10 FCU8-DU181-32 : 14 FCU8-DU181-36 : 18 FCU8-DU191-77 : 21 FCU8-DU192-77 : 21	32	12
Mass	(kg)	FCU8-DU121-12 : 1.2 FCU8-DU141-32 : 1.7 FCU8-DU181-32 : 4 FCU8-DU181-36 : 4 FCU8-DU191-77 : 5.7 FCU8-DU192-77 : 5.7	1.2	1.1	
Outline dimension W×H or W×H×D	(mm)	FCU8-DU121-12 : 260×200 FCU8-DU141-32 : 290×220 FCU8-DU181-32 : 400×320 FCU8-DU181-36 : 400×320 FCU8-DU191-77 : 365×440 FCU8-DU192-77 : 440×365	220×182×53.5	239.1×173.4×75	

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

(Note 2) 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.

(Note 3) When the display unit is mounted on an incline, the inclination angle to place the unit should follow below.
8.4, 10.4, or 15-type display unit: the inclination should be 30 degrees or less from the vertical direction.
19-type display unit: the inclination should be 60 degrees or less from the vertical direction.

4 General Specifications

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-DX830/ DX834/DX837	FCU8-DX730	FCU8-KB921/KB922/ KB925 FCU8-KB923/KB924/ KB926 FCU8-KB931/KB941
General Specifications	Ambient temperature	During operation	0 to 58°C				
		During storage	-20 to 60°C				
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)				
		Short term	10 to 95% RH (with no dew condensation) (Note 1)				
	Vibration resistance		4.9m/s ² [0.5G] or less				
	Shock resistance		29.4m/s ² [3G] 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		5VDC	24VDC	5VDC, 3.3VDC	24VDC (Note 7)	
			(Supply from Operation Panel I/O Unit)		(Supply from Graphic Control Unit)		
	Current consumption		- (Note 2)	24V 0.3A (Note 3)	- (Note 3,4)	0.3A (Note 7)	
	Maximum heating value		(W)	1	8 (Note 5)	4 (Note 5)	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	0.4	0.3	FCU8-KB921/KB922/ KB925 : 1.1 FCU8-KB923/KB924/ KB926 : 1.2 FCU8-KB931/KB941 : 0.5
Outline dimension 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	116×179		FCU8-KB921/KB922/ KB925 : 260×140 FCU8-KB923/KB924/ KB926 : 290×140 FCU8-KB931/KB941 : 140×140	

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

(Note 2) The current consumption of the keyboard unit is included in that of the operation panel I/O unit or the graphic control unit.

(Note 3) Current consumption for the I/O circuit needs to be separately calculated based on the number of points used and its load.

(Note 4) The current consumption of FCU8-DX730 is included in that of the graphic control unit.

(Note 5) For the heating value of the I/O circuit, calculate with the number of points used.

(Note 6) 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.

(Note 7) 24V power input is not required for FCU8-KB931/KB941.

4.2.2 Environment Conditions inside the Control Panel

Item	Unit name		Control unit
	Type		FCU8-MU044
General Specifications	Ambient temperature	During operation	0 to 55°C
		During storage	-20 to 60°C
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)
		Short term	10 to 95% RH (with no dew condensation) (Note 1)
	Vibration resistance		4.9m/s ² [0.5G] or less
	Shock resistance		29.4m/s ² [3G] 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		24VDC
	Current consumption		1.25A
	Maximum heating value	(W)	16
	Mass	(kg)	2.0
	Outline dimension W×H×D	(mm)	60×380×180

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

(Note 2) 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 General Specifications

Item	Unit name		Remote I/O unit					
	Type		FCU8-DX220/ DX230/ DX231	FCU8-DX202	FCU8-DX213/ DX213-1/ DX654/ DX654-1	FCU8-DX408	FCU8-DX409	FCU8-DX651
General Specifications	Ambient temperature	During operation	0 to 58°C					
		During storage	-20 to 60°C					
	Ambient humidity	Long term	10 to 75% RH (with no dew condensation)					
		Short term	10 to 95% RH (with no dew condensation) (Note 1)					10 to 85% RH (with no dew condensation) (Note 1)
	Vibration resistance		4.9m/s ² or less					
	Shock resistance		29.4m/s ² or less					
	Working atmosphere		No corrosive 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		24VDC					
	Current consumption		3.5A (Note 2)	0.3A	0.3A (Note 3)	0.1A	0.2A	3.7A (Note 2)
	Maximum heating value	(W)	8 (Note 4)			3	6 (Note 6)	8 (Note 4)
	Mass	(kg)	0.4			0.2	0.3	0.8
	Outline dimension W×H×D	(mm)	40×175×133	40×175×119	40×175×130	40×175×109	40×175×115	172×100×115

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

(Note 2) This value includes the maximum value of DO external load current (3.2A).

(Note 3) This value does not include DO external load current.

(Note 4) For the heating value of the I/O circuit, calculate with the number of points used.

(Note 5) 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.

(Note 6) The maximum value including the heating value of analog input circuit.

4.2.3 24VDC 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	24VDC	When the stabilized power supply and 24VDC input unit are distant, select the stabilized power supply which is possible to set output voltage 24VDC 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	0.2V (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

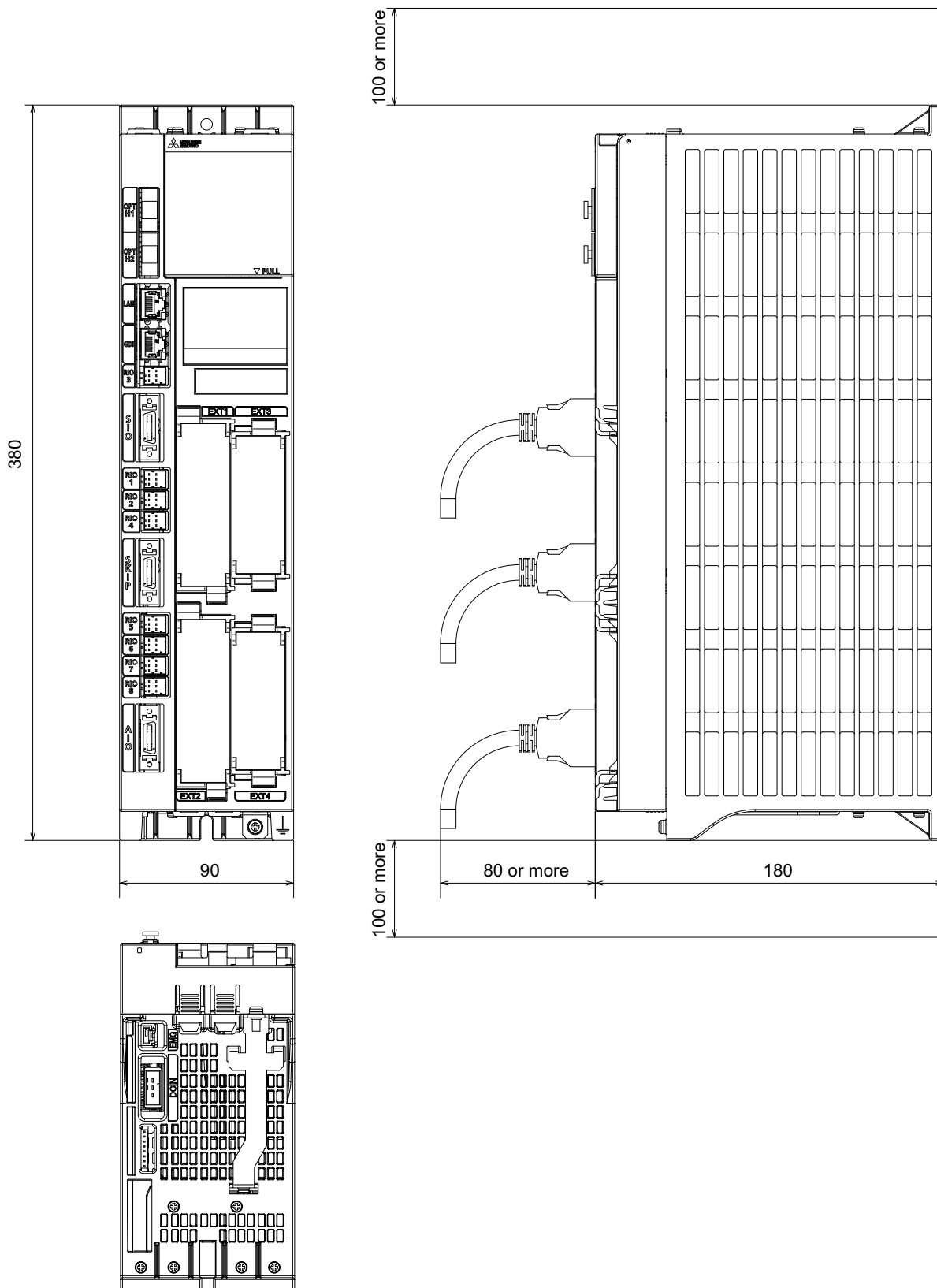
- Using a stabilized power supply without overcurrent protection may cause the unit's failure due to miswiring of 24V.

4.3 Control Unit [M800W]

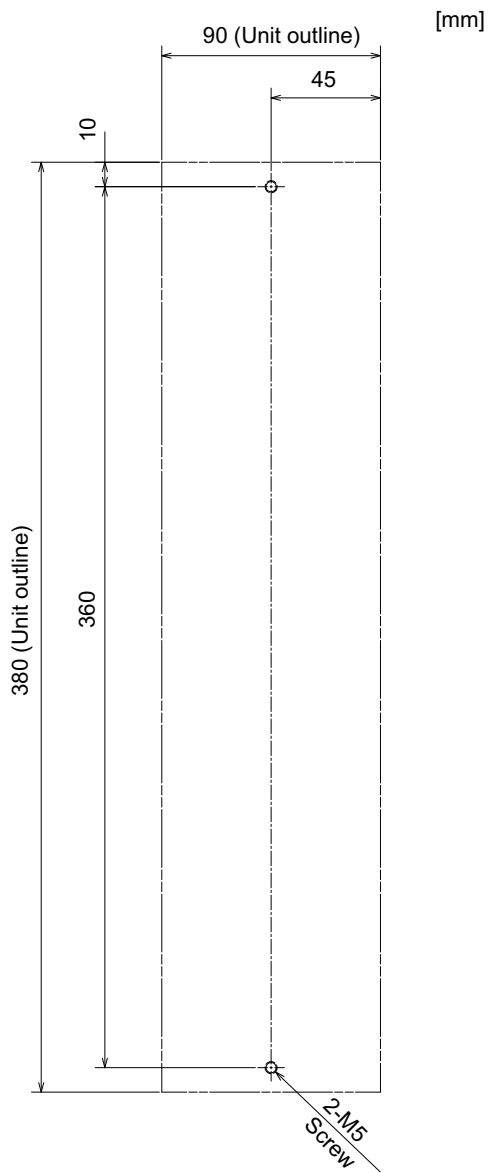
4.3.1 M830W(FCU8-MU042) / M850W(FCU8-MA041)

[Outline dimension]

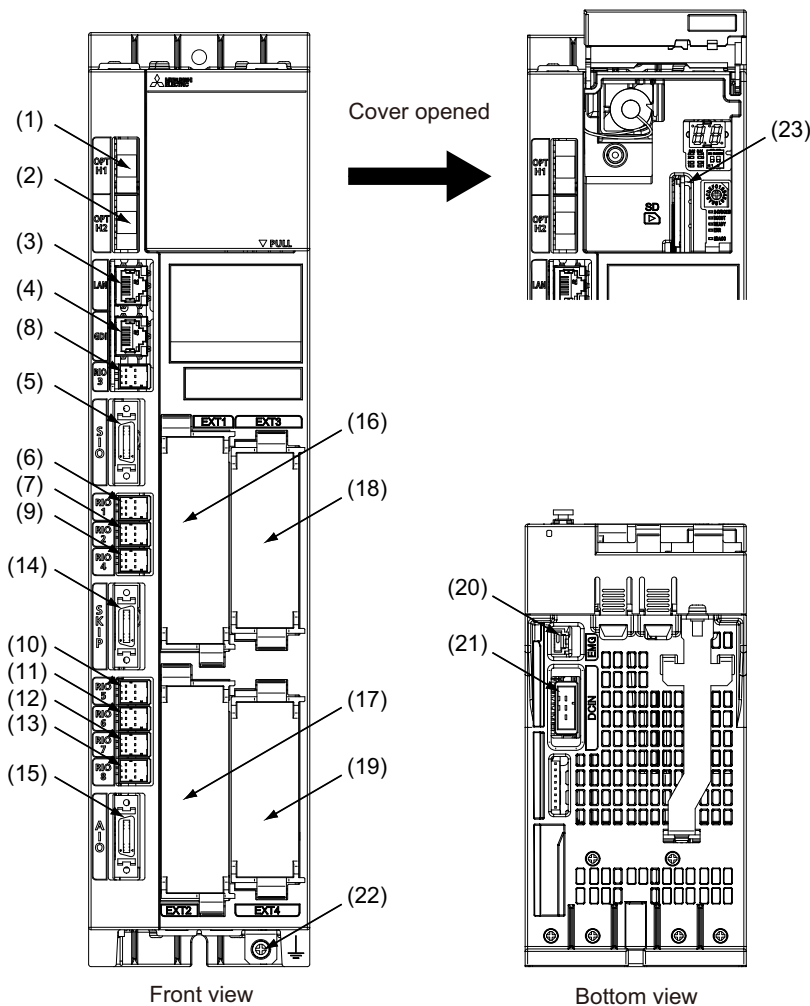
[mm]



[Installation dimension]



[Connector]

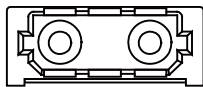


No.	Connector name	Function	No.	Connector name	Function
(1)	OPTH1	High-speed optical servo communication	(13)	RIO8	MODBUS/RTU communication (for connection to EcoMonitorLight)
(2)	OPTH2	High-speed optical servo communication	(14)	SKIP	SKIP input 8 points
(3)	LAN	Ethernet communication	(15)	AIO	Analog input 4ch Analog output 2ch 5V manual pulse generator input 2ch
(4)	GDI	Ethernet communication for personal computer unit connection	(16)	EXT1	Function expansion unit I/F slot
(5)	SIO	RS-232C communication 2ch	(17)	EXT2	Function expansion unit I/F slot
(6)	RIO1	Remote I/O 2.0 communication	(18)	EXT3	Communication expansion unit I/F slot
(7)	RIO2	Remote I/O 2.0 communication	(19)	EXT4	Communication expansion unit I/F slot
(8)	RIO3	Remote I/O 2.0 communication	(20)	EMG	External emergency stop input
(9)	RIO4	System reserved	(21)	DCIN	24VDC input
(10)	RIO5	System reserved	(22)	FG	FG terminal
(11)	RIO6	System reserved	(23)	SD	SD card I/F
(12)	RIO7	System reserved			

⚠ 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.
- ⚠ 12V, 5V, and 3.3V output from connectors are to supply the power for dedicated peripheral devices. Do not use for other equipment to supply the power since we do not guarantee the NC operation by voltage down or noise sneaking.

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

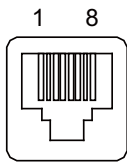


<Cable side connector type>

Connector : LGP-Z0007K

Recommended manufacturer : HONDA TSUSHIN KOGYO

(3) LAN (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-

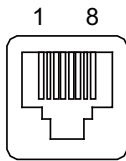
- Connect connector case with FG pattern.
- Use J303 cable when directly connecting a device such as a personal computer to the unit.

<Cable side connector type>

Connector : J00026A0165

Recommended manufacturer : Japan Telegärtner

(4) GDI (Ethernet communication for personal computer unit connection)



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

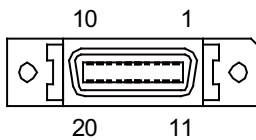
- Connect connector case with FG pattern.
- Use J303 cable when directly connecting a device such as a personal computer to the unit.

<Cable side connector type>

Connector : J00026A0165

Recommended manufacturer : Japan Telegärtner

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



1		0V	11		0V
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		0V	15		0V
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

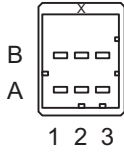
Recommended manufacturer : 3M

(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±0.05N·m)

- (6) RIO1 (Remote I/O 2.0 communication 1st channel)
- (7) RIO2 (Remote I/O 2.0 communication 2nd channel)
- (8) RIO3 (Remote I/O 2.0 communication 3rd channel)

Up to 64 remote I/O stations can be connected.



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

<Cable side connector type>

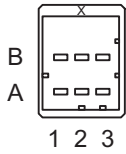
Connector : 1-1318119-3

Contact : 1318107-1

Recommended manufacturer : Tyco Electronics

- (9) RIO4 (System reserved)
- (10) RIO5 (System reserved)
- (11) RIO6 (System reserved)
- (12) RIO7 (System reserved)

(13) RIO8 (MODBUS/RTU communication (for connection to EcoMonitorLight))



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

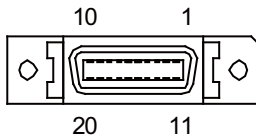
<Cable side connector type>

Connector : 1-1318119-3

Contact : 1318107-1

Recommended manufacturer : Tyco Electronics

(14) 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>

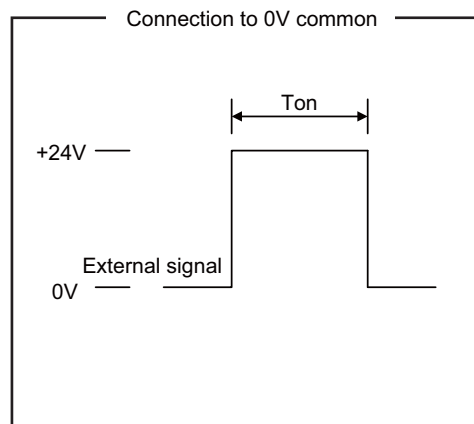
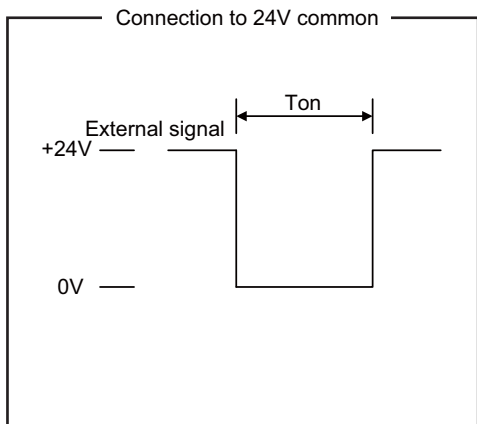
Plug : 10120-3000PE
 Shell : 10320-52F0-008
 Recommended manufacturer : 3M

(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±0.05N·m)

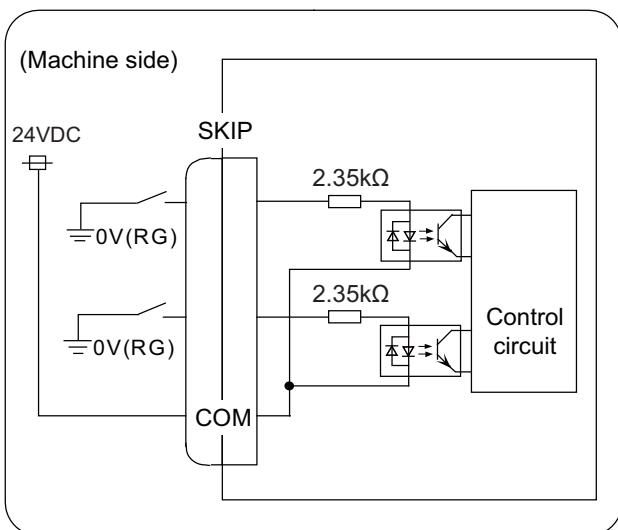
(a) Skip signal input conditions

Use the input signal within the following condition ranges.

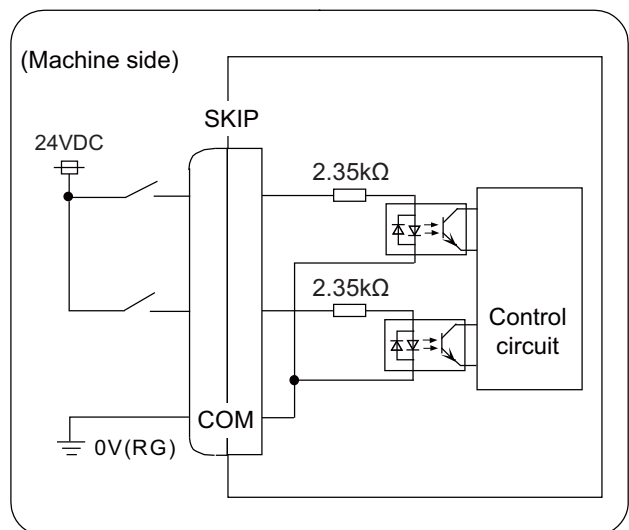
		24V common	0V common
1	Input voltage at external contact ON	6V or less	18V or more, 25.2V or less
2	Input current at external contact ON	6mA or more	
3	Input voltage at external contact OFF	20V or more, 25.2V or less	4V or less
4	Input current at external contact OFF	2mA or less	
5	Input resistance	2.35kΩ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



Connection to 24V common

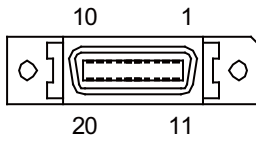


Connection to 0V common



(15) AIO (Analog input 4ch, Analog output 2ch, 5V Manual pulse generator input 2ch)

Analog input, analog output and 5V manual pulse generator can be connected to this connector.



1		0V	11		0V
2	I	AI 0	12	I	AI 1
3	I	AI 2	13	I	AI 3
4		0V	14		0V
5		0V	15		0V
6	O	AO 0	16	O	AO 1
7	I	HA2_A	17	I	HA2_B
8	I	HA1_A	18	I	HA1_B
9		0V	19		0V
10	O	+5V	20	O	+5V

- Connect connector case with FG pattern.

<Cable side connector type>

Plug : 10120-3000PE

Shell : 10320-52F0-008

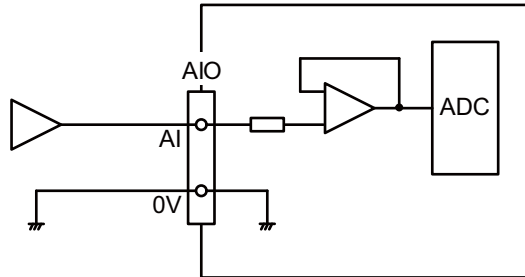
Recommended manufacturer : 3M

(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±0.05N·m)

(a) Outline of analog signal input circuit

Input circuit



Input conditions

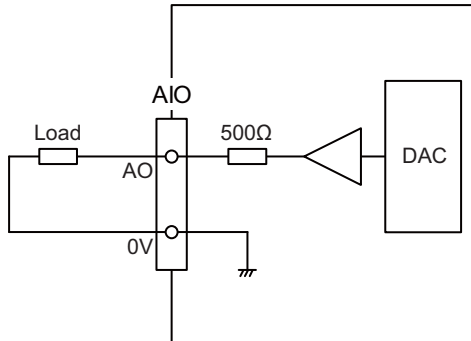
Analog input voltage	-10 to 10V
Max. input rating (Note 1)	±15V
Resolution	$ -10 \text{ to } +10\text{V} / 4095 = 4.88\text{mV}$
Precision	Within ±25mV (Note 2)
Tolerance	±0.35V

(Note 1) This indicates the input voltage which must not exceed even in an instant.

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

(b) Outline of analog signal output circuit

Output circuit



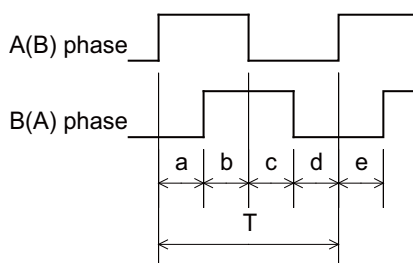
Output conditions

Analog output voltage	-10 to 10V (±5%)
Resolution	$10\text{V} / 4095 = 2.44\text{mV}$
Load conditions	10kΩ load resistance
Output resistance value	500Ω

(c) Input for 5V manual pulse generator

Specification of input part

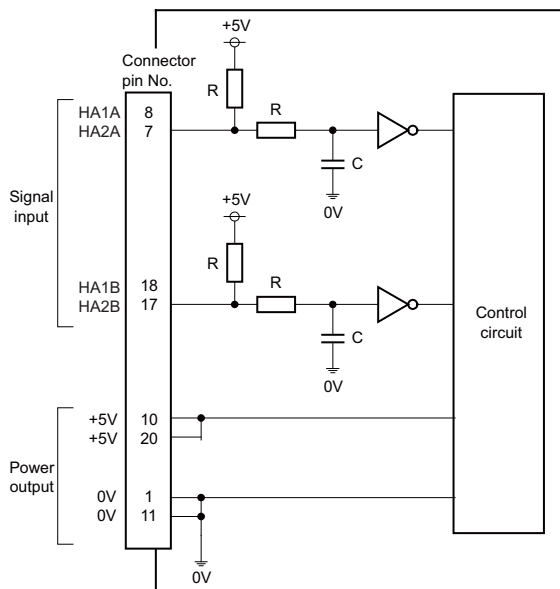
Number of pulse phases	Two phases (A phase, B phase, a phase difference 90 degrees) (Refer to the waveform below.)
Signal output of manual pulse generator	Voltage output, open collector output
Signal voltage	H level 3.5V to 5.25V L level 0V to 0.5V
Power supply voltage	5VDC±10%
Current consumption	100mA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



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

T: A or B phase cycle

Input/output circuit



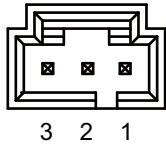
(16) EXT1 (Function expansion unit I/F slot)

(17) EXT2 (Function expansion unit I/F slot)

(18) EXT3 (Communication expansion unit I/F slot)

(19) EXT4 (Communication expansion unit I/F slot)

(20) EMG (External emergency stop input)



1		FG
2	I	EMG IN
3	O	+24V

<Cable side connector type>

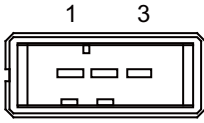
Connector : 50-57-9403

Contact : 0016020103

Recommended manufacturer : MOLEX

(Note) Use this when installing an emergency stop switch in the electric cabinet. Connect a terminator (G123 cable) when not using this connector.

(21) DCIN (24VDC input)



1		+24V
2		0V
3		FG

<Cable side connector type>

Connector : 2-178288-3

Contact : 1-175218-5

Recommended manufacturer : Tyco Electronics

(a) Specifications of power supply

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

[Stabilized power supply selection items]

Item	Standard setting
Output Voltage fluctuation	±5% or less of 24VDC
Ripple noise	200mV (P-P)
Power capacity	Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
Output holding time	20ms
Overcurrent protection	Required

[Standards]

Safety Standards: UL1950, CSA C22.2 No. 234 approved, IEC950 compliant

Noise Terminal Voltage: FCC Class A, VCCI-Class A

High Harmonics Current Restrictions: IEC61000-3-2

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

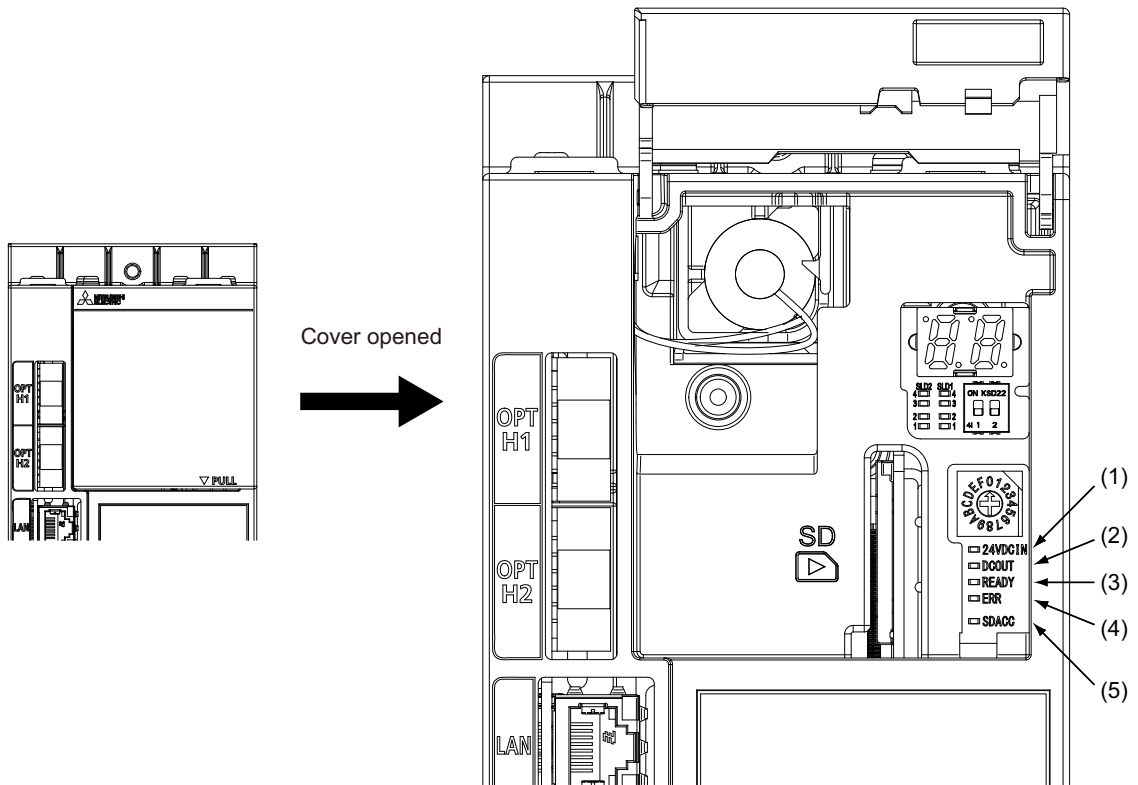
CAUTION

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

(22) FG (FG terminal)

(23) SD (SD card I/F)

[LED]

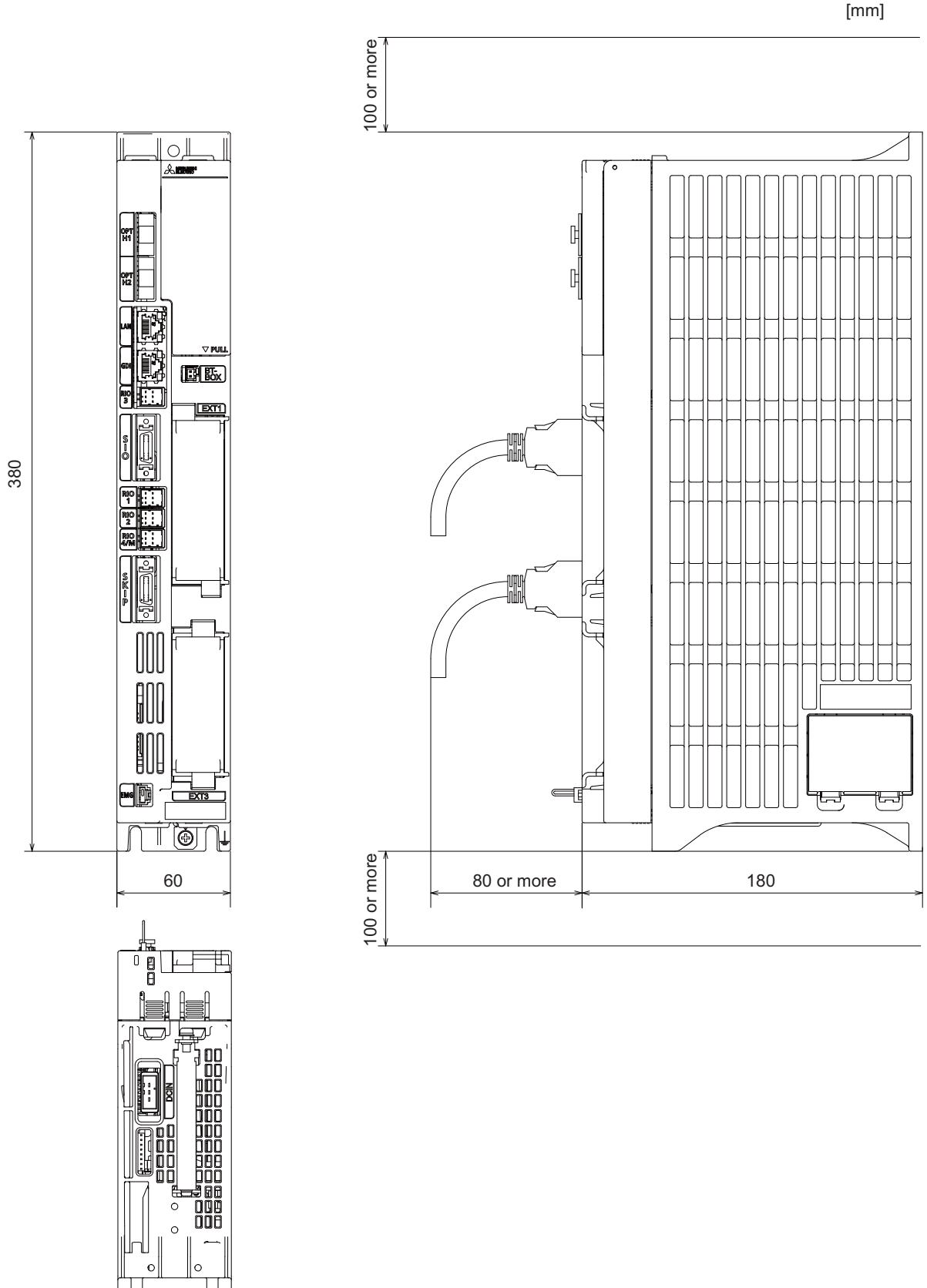


No.	Name	Lamp state	Details
(1)	24VDCIN	Lit (Green)	24V power is being supplied from the external power supply.
		Not lit	The following may have caused an error: - No 24V-power supply from the external power supply. - Disconnection of fuse near DCIN connector. - Failure of LED.
(2)	DCOUT	Lit (Green)	The followings are all successfully output; 5V and 3.3V generated from 24V; 2.5V, 1.8V, 1.5V, 1.15V, and 1.1V on the main card.
		Not lit	The followings may have caused an error: - No 24V-power supply 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)	READY	Lit (Green)	Servo ON (or ready ON) state.
		Not lit	Servo OFF (or ready OFF) state.
(4)	ERR	Lit (Red)	H/W is not operating properly. The followings may have caused an error: - Occurrence of NC watchdog error. - Failure of main CPU card.
		Not lit	H/W is operating properly.
(5)	SDACC	Flashing (Green)	Accessing to front side SD card.
		Not lit	Not accessing to front side SD card.

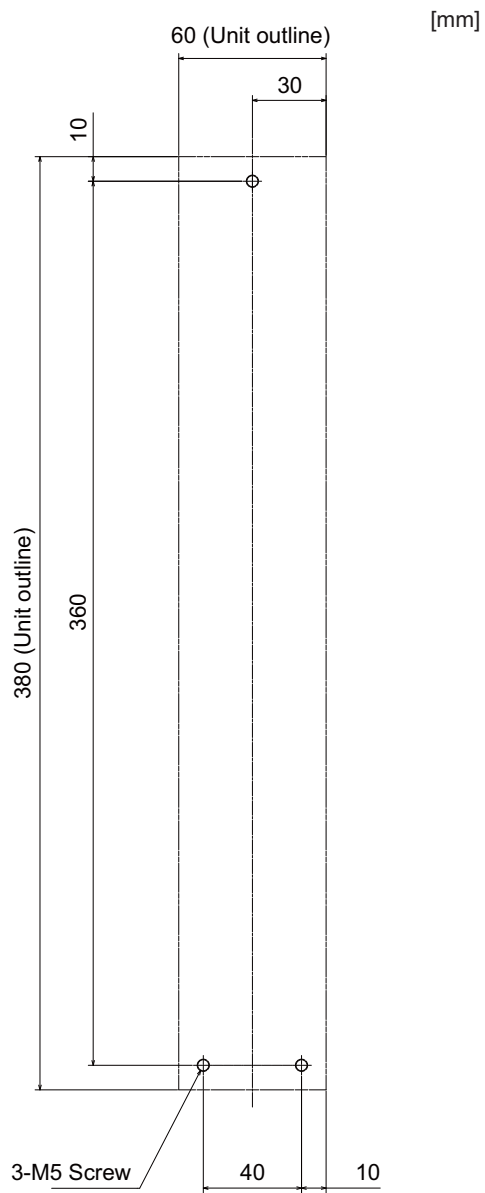
4.4 Control Unit [M80W]

4.4.1 FCU8-MU044

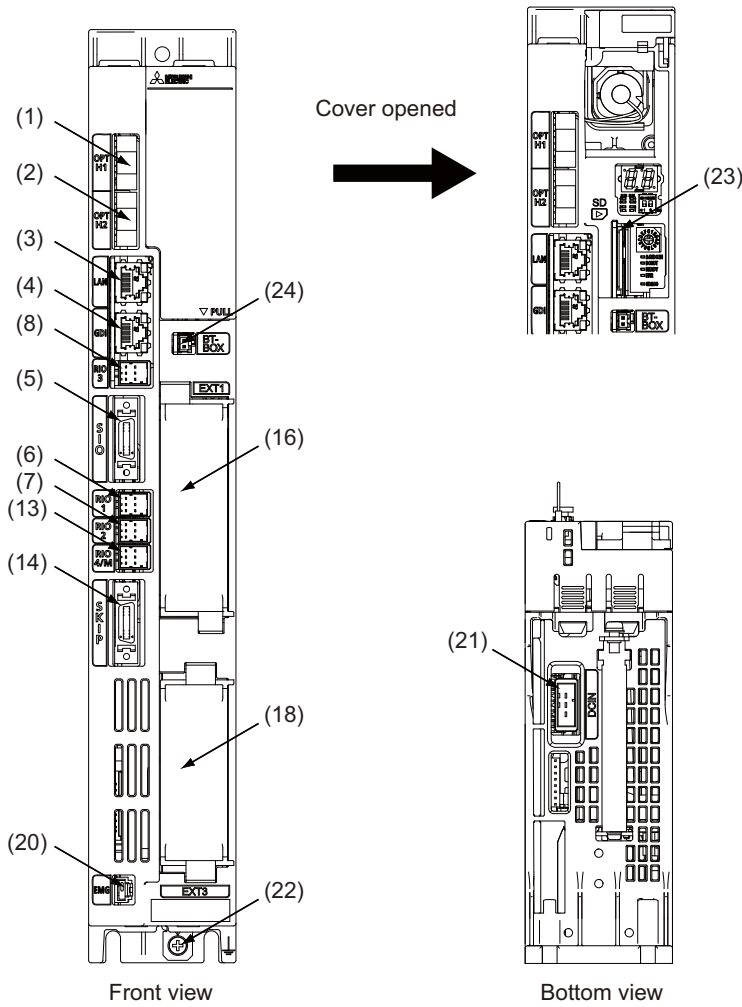
[Outline dimension]



[Installation dimension]



[Connector]



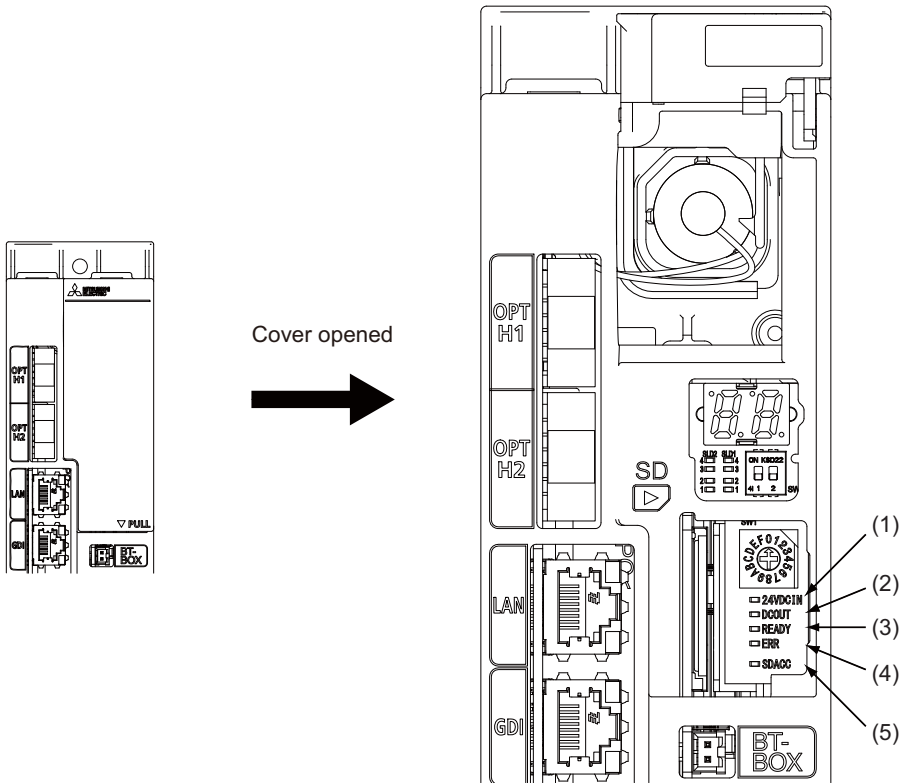
No.	Connector name	Function	No.	Connector name	Function
(1)	OPTH1	High-speed optical servo communication	(14)	SKIP	SKIP input 8 points
(2)	OPTH2	High-speed optical servo communication	(16)	EXT1	Function expansion unit I/F slot
(3)	LAN	Ethernet communication	(18)	EXT3	Communication expansion unit I/F slot
(4)	GDI	Ethernet communication for personal computer unit connection	(20)	EMG	External emergency stop input
(5)	SIO	RS-232C communication 2ch	(21)	DCIN	24VDC input
(6)	RIO1	Remote I/O 2.0 communication	(22)	FG	FG terminal
(7)	RIO2	Remote I/O 2.0 communication	(23)	SD	SD card I/F
(8)	RIO3	Remote I/O 2.0 communication	(24)	BT-BOX	System reserved
(13)	RIO4/M	MODBUS/RTU communication (for connection to EcoMonitorLight)			

Refer to "General Specifications: Control Unit [M800W]" for details on the connectors.

(Note 1) Refer to "(13) RIO8" of M800W for details on "(13) RIO4/M".

(Note 2) Details on "(24) BT-BOX" are not included in this manual.

[LED]

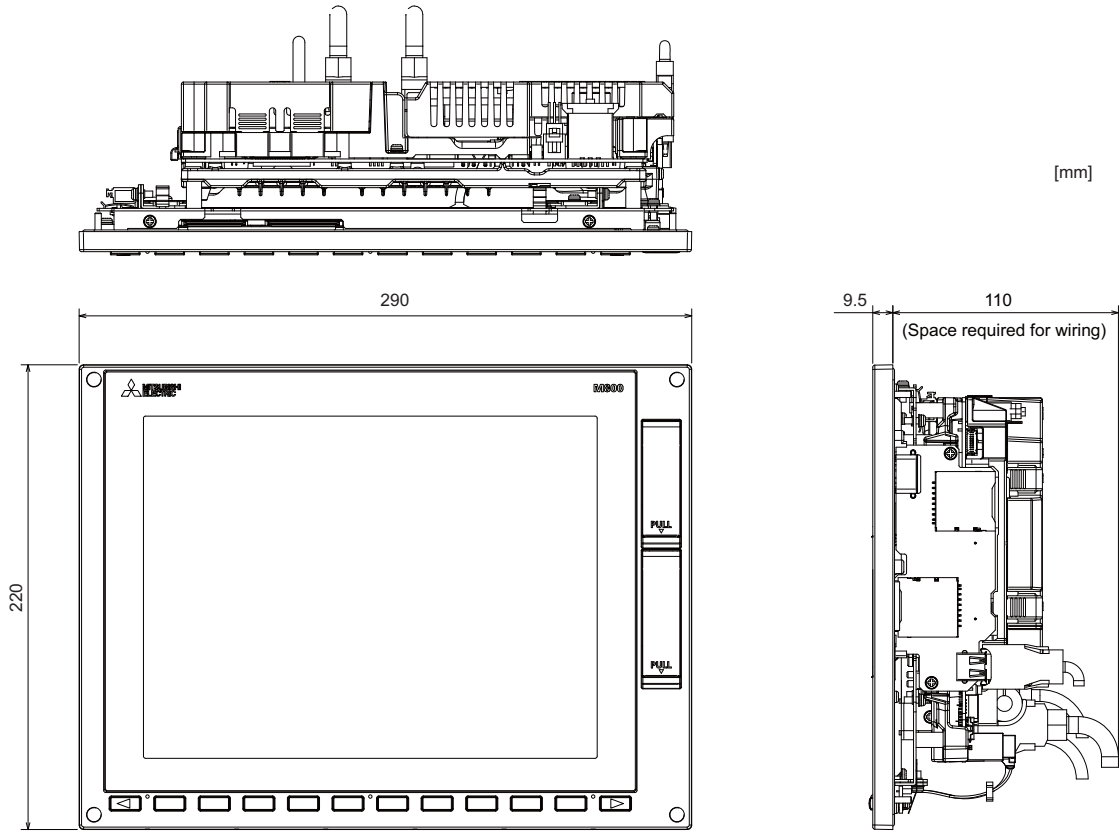


No.	Name	Lamp state	Details
(1)	24VDCIN	Lit (Green)	24V power is being supplied from the external power supply.
		Not lit	The following may have caused an error: - No 24V-power supply from the external power supply. - Disconnection of fuse near DCIN connector. - Failure of LED.
(2)	DCOUT	Lit (Green)	The followings are all successfully output; 5V and 3.3V generated from 24V; 2.5V, 1.8V, 1.5V, 1.15V, and 1.1V on the main card.
		Not lit	The followings may have caused an error: - No 24V-power supply 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)	READY	Lit (Green)	Servo ON (or ready ON) state.
		Not lit	Servo OFF (or ready OFF) state.
(4)	ERR	Lit (Red)	H/W is not operating properly. The followings may have caused an error: - Occurrence of NC watchdog error. - Failure of main CPU card.
		Not lit	H/W is operating properly.
(5)	SDACC	Flashing (Green)	Accessing to front side SD card.
		Not lit	Not accessing to front side SD card.

4.5 Display Unit [M800W]

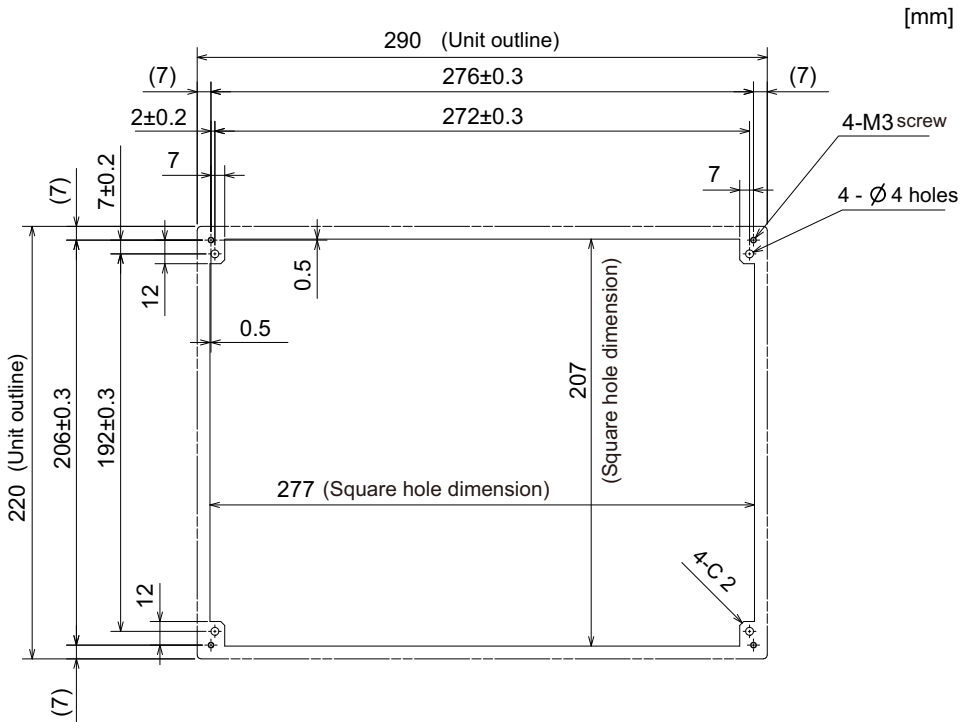
4.5.1 10.4-type (FCU8-DU141-31)

[Outline dimension]



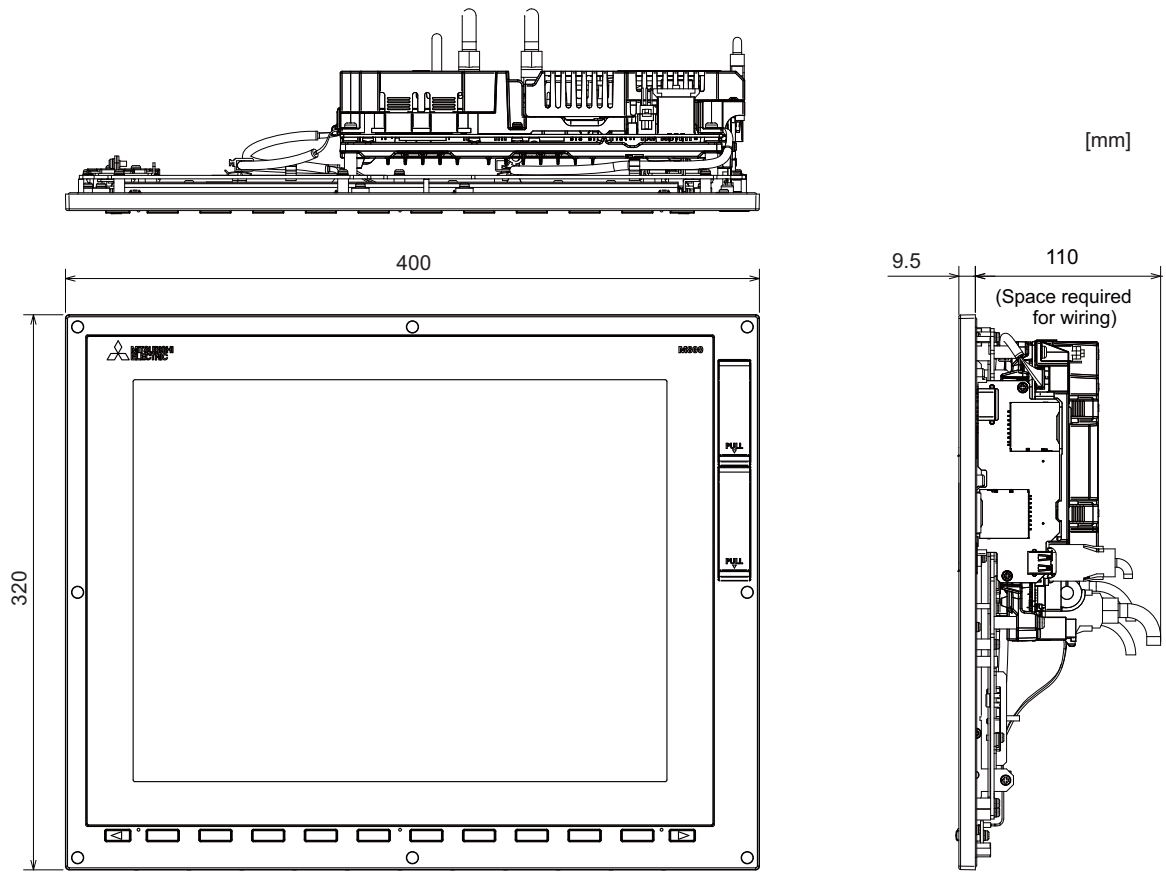
(Note) The figure above shows the state with the graphic control unit mounted.

[Panel cut dimension]



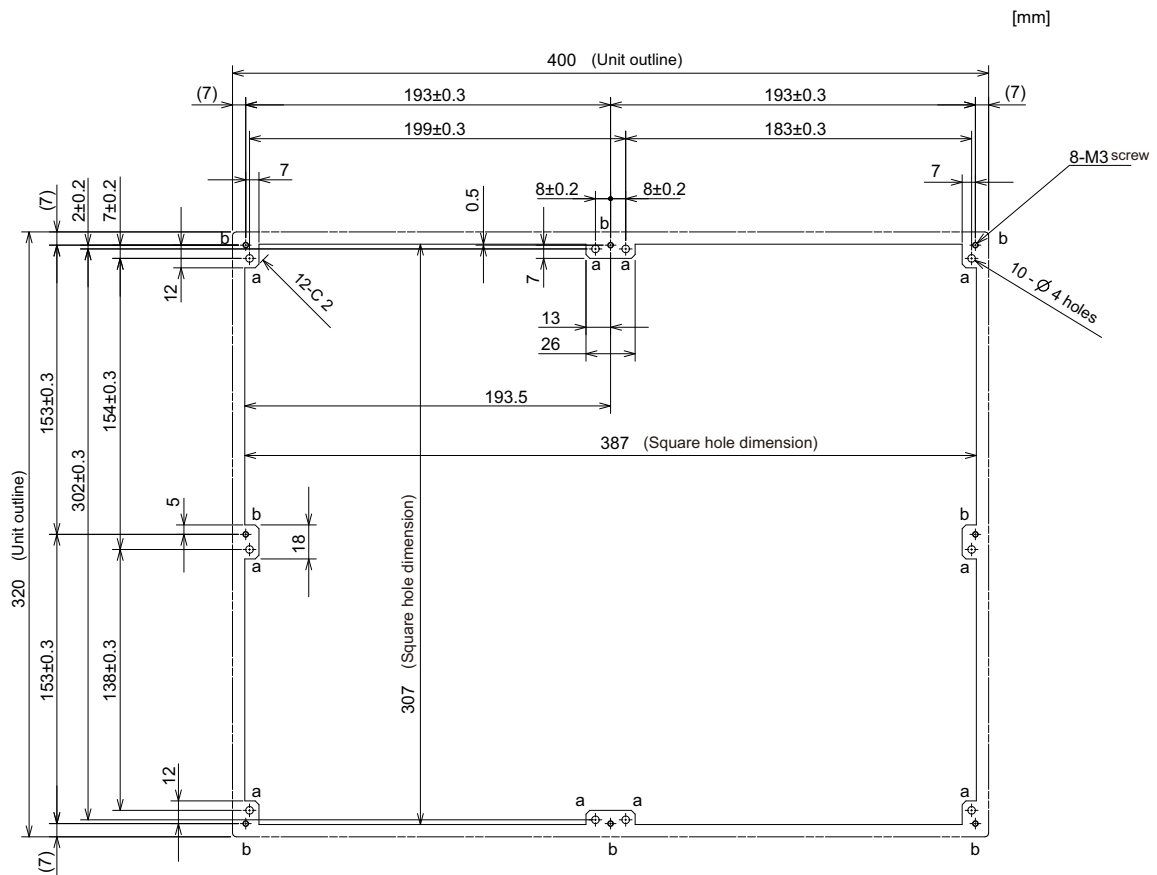
4.5.2 15-type (FCU8-DU181-31)

[Outline dimension]



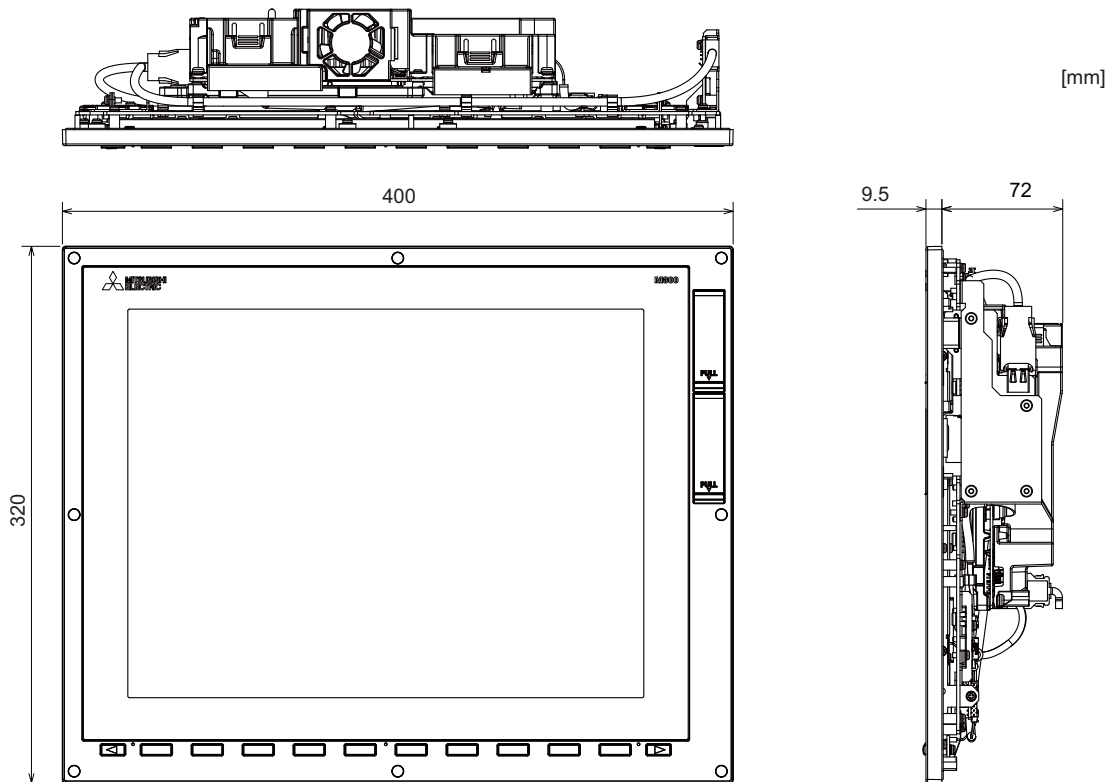
(Note) The figure above shows the state with the graphic control unit mounted.

[Panel cut dimension]



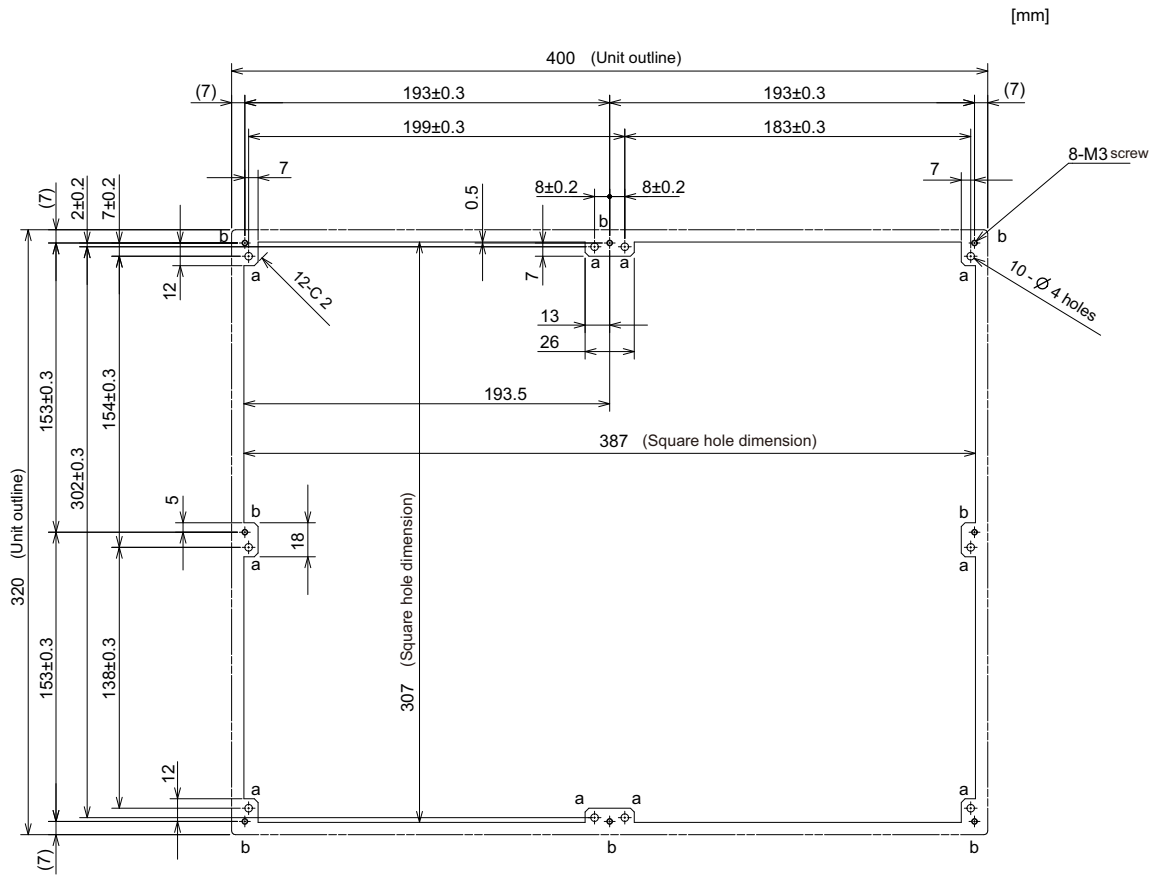
4.5.3 15-type (FCU8-DU181-34)

[Outline dimension]



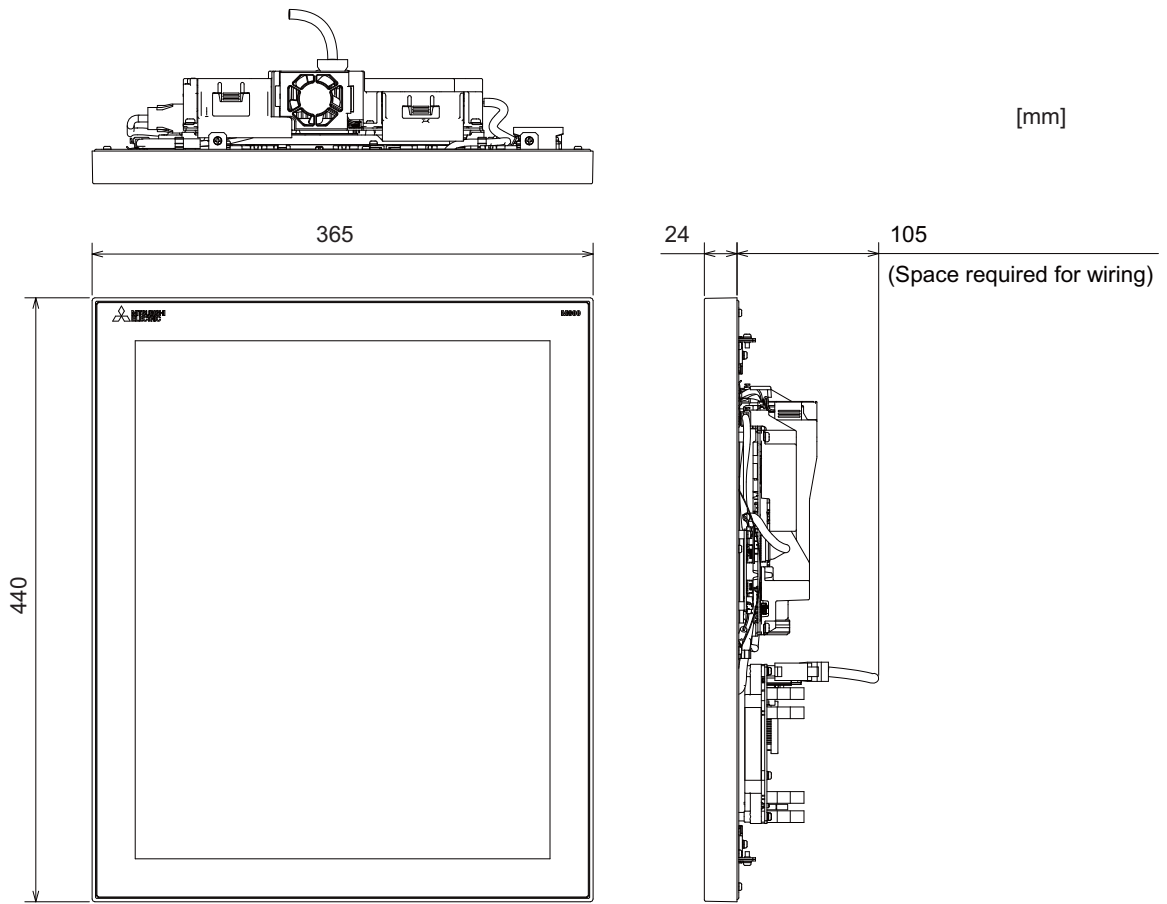
(Note) The figure above shows the state with the personal computer unit mounted.

[Panel cut dimension]



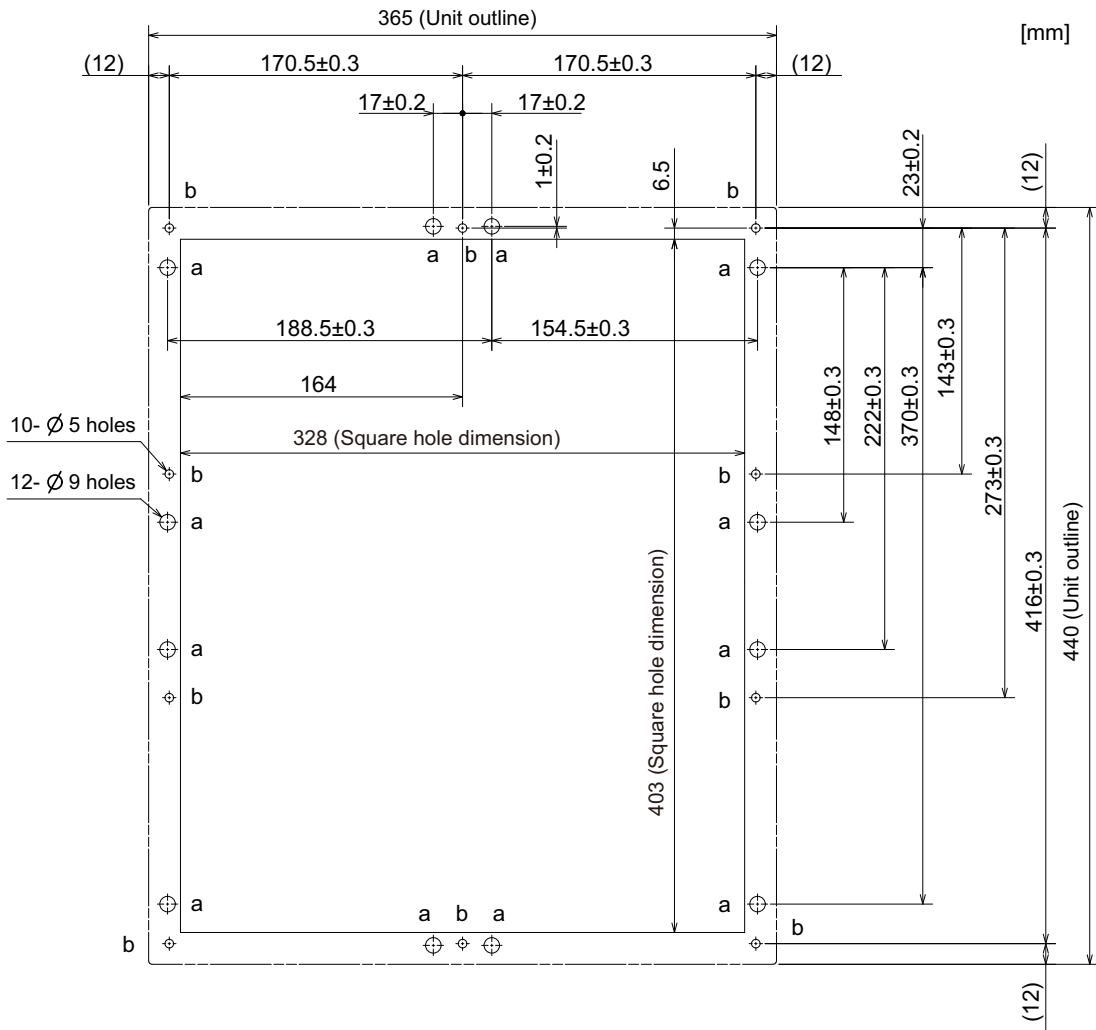
4.5.4 19-type (FCU8-DU191-75)

[Outline dimension]



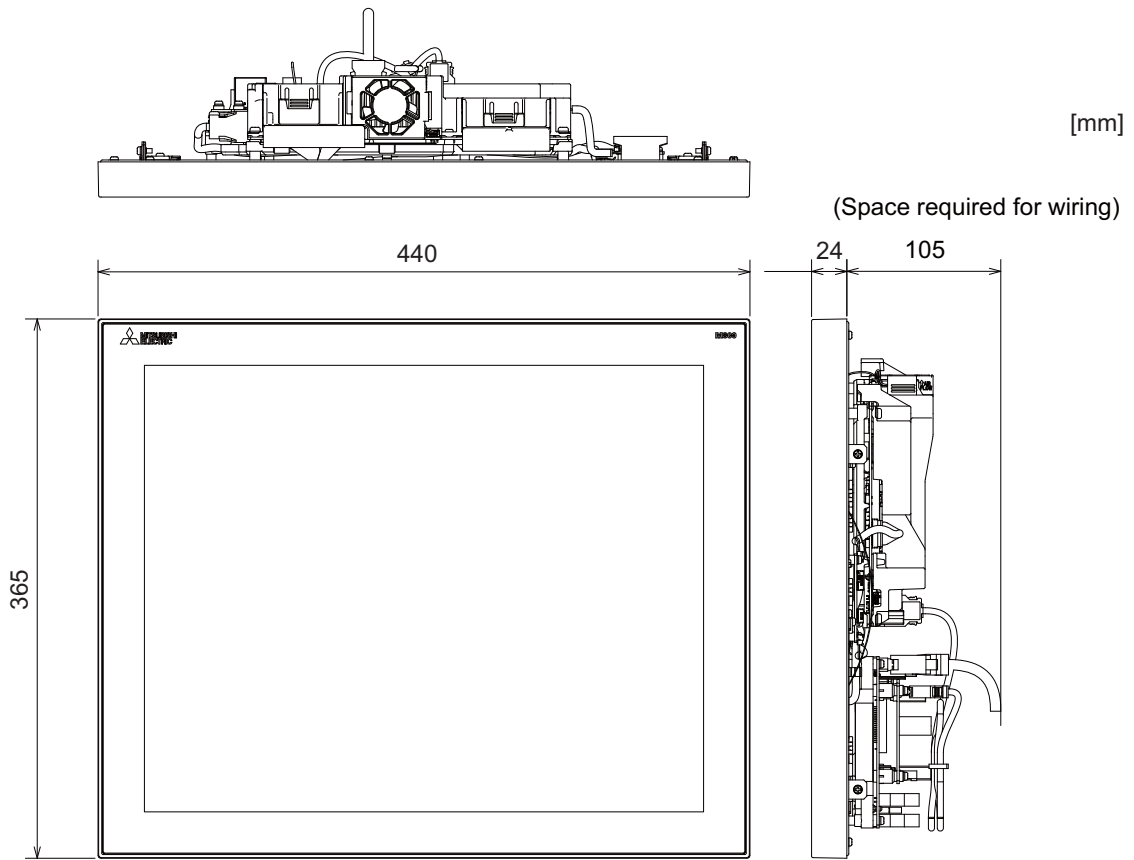
(Note) The figure above shows the state with the personal computer unit and the operation panel I/O unit mounted.

[Panel cut dimension]



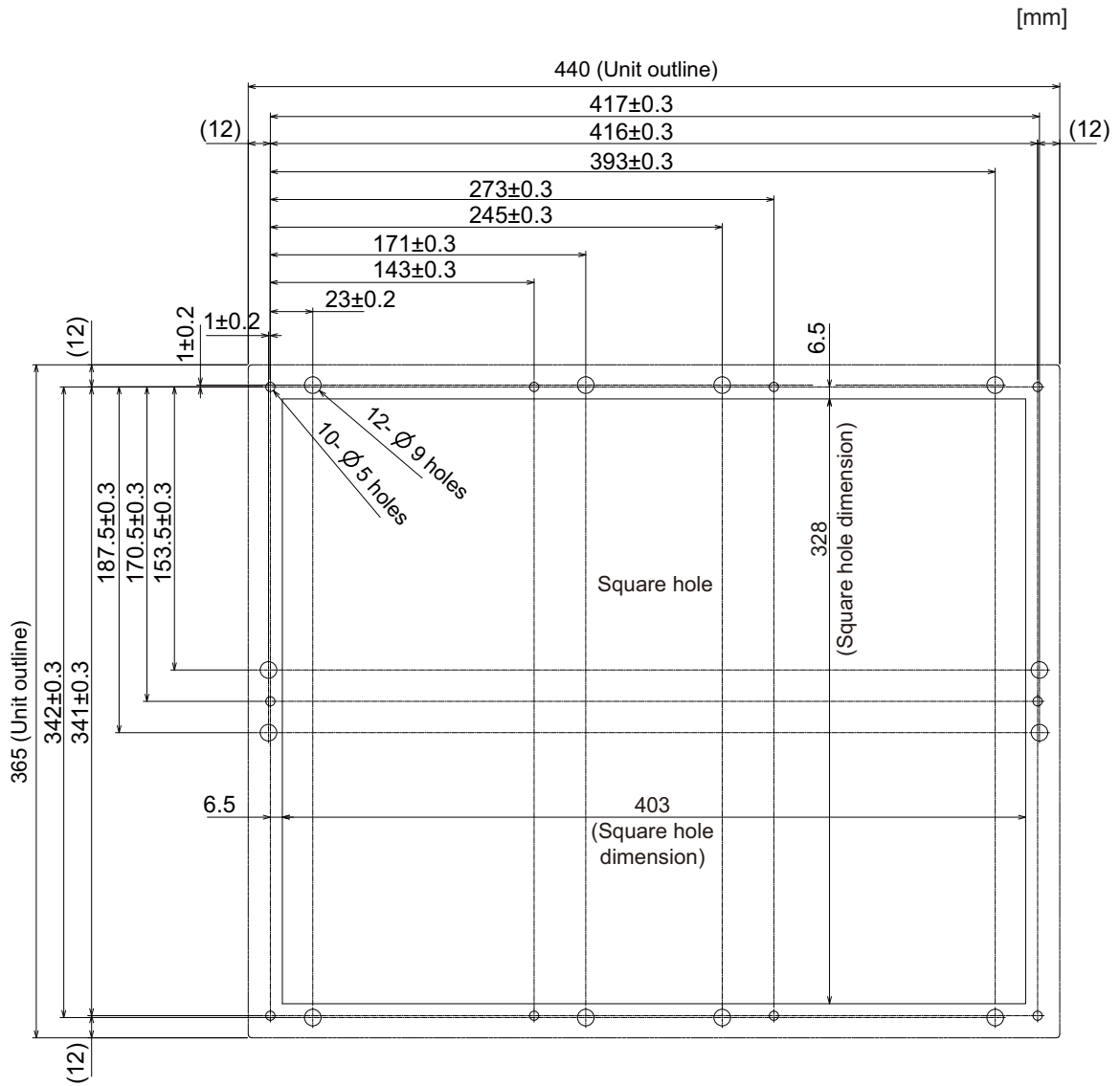
4.5.5 19-type (FCU8-DU192-75)

[Outline dimension]



(Note) The figure above shows the state with the personal computer unit and the operation panel I/O unit mounted.

[Panel cut dimension]



4.5.6 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 personal computer unit at one ground point. (Refer to "Installation: Connection of Frame Ground (FG)".) Otherwise, the reaction and usability of the touchscreen will remarkably deteriorate.

[Spot defect of LCD]

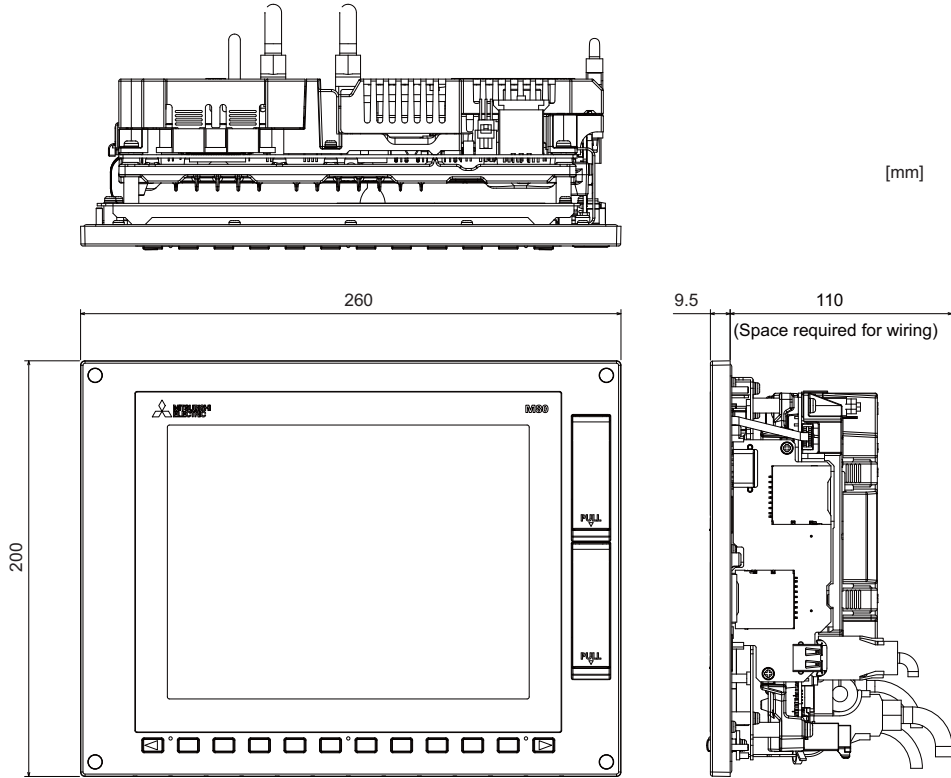
The display inspection standard at the time of shipment from MITSUBISHI is as follows.

	Item	Reference value
Spot defect	Bright spot defect	$N \leq 3$
	Black spot defect	$N \leq 3$
	Total number of defects	$N \leq 5$

4.6 Display Unit [M80W]

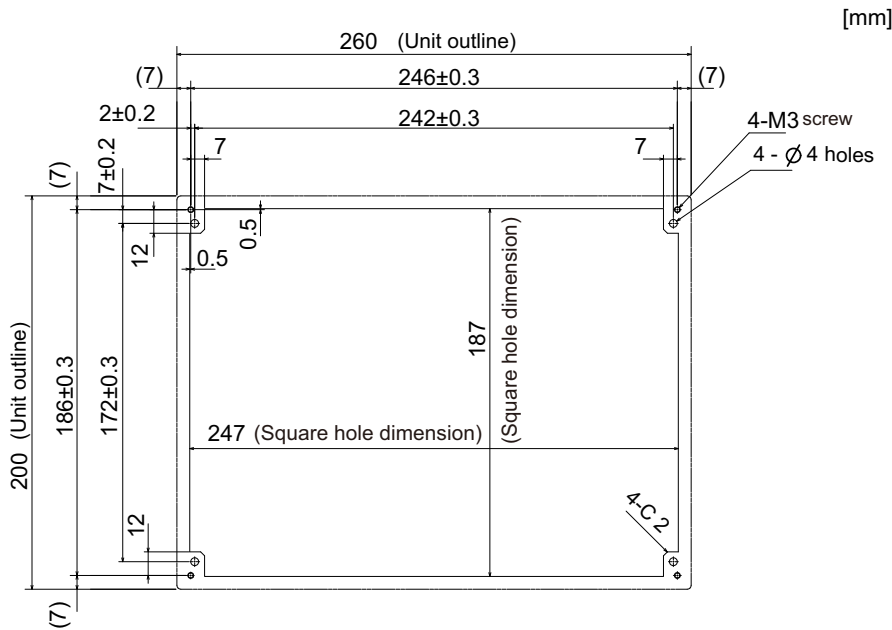
4.6.1 8.4-type (FCU8-DU121-12)

[Outline dimension]



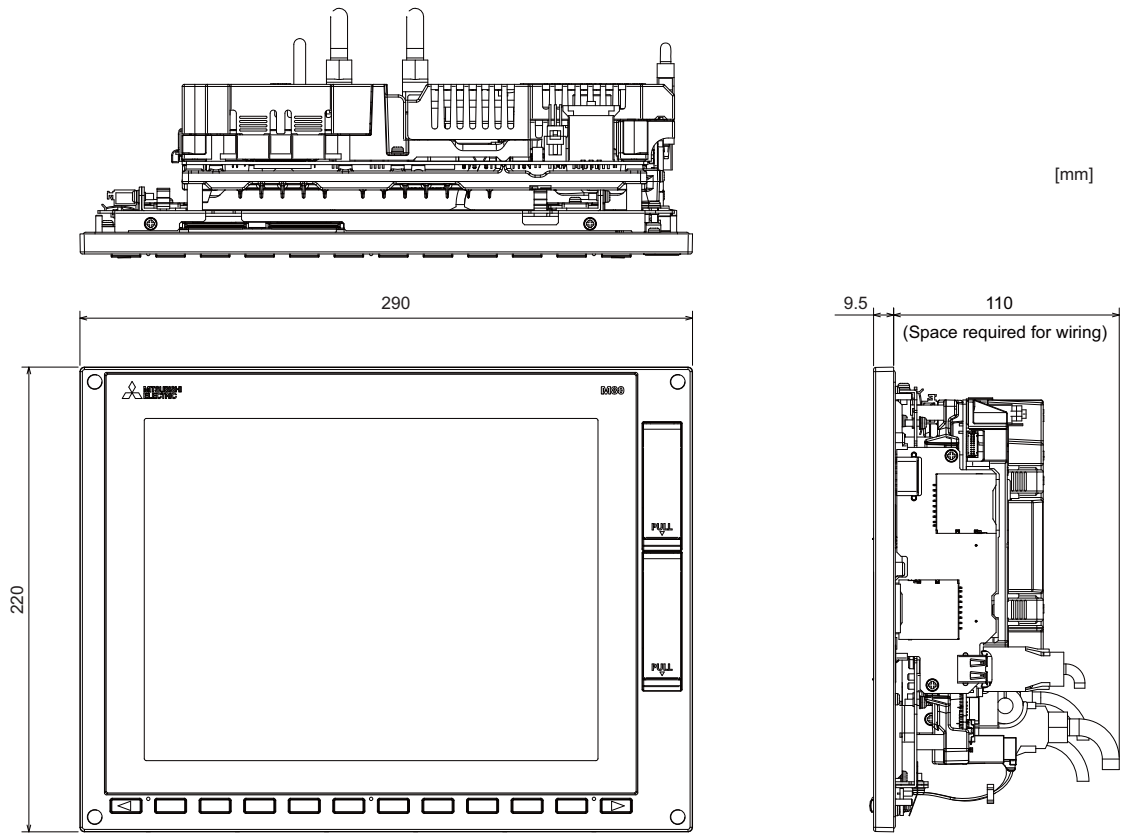
- (Note 1) The 8.4-type display unit is incompatible with the touchscreen.
- (Note 2) The figure above shows the state with the graphic control unit mounted.

[Panel cut dimension]



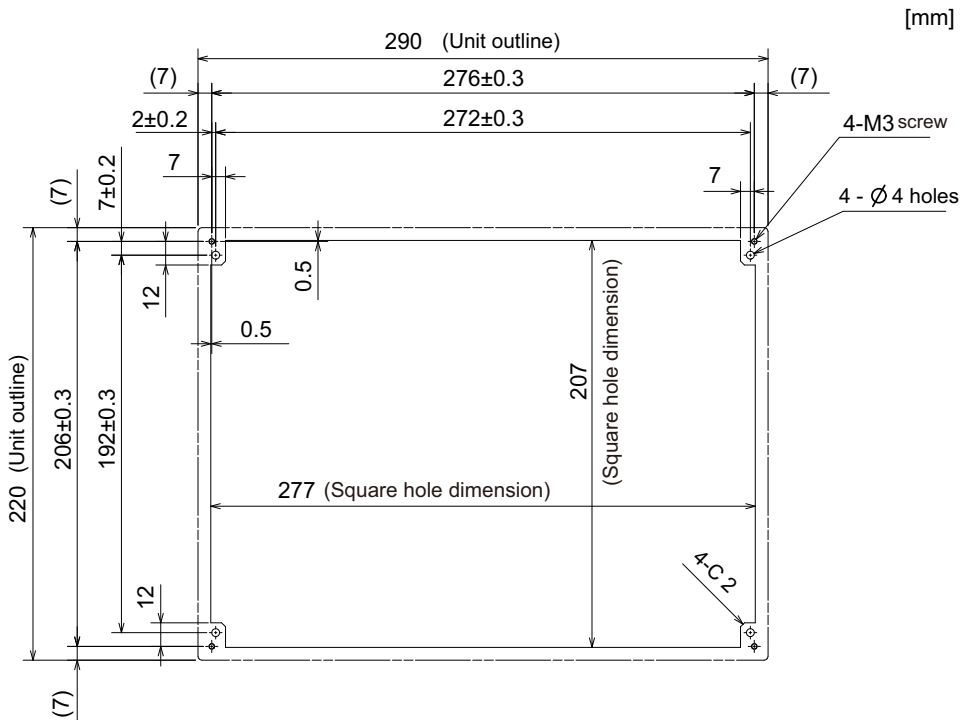
4.6.2 10.4-type (FCU8-DU141-32)

[Outline dimension]



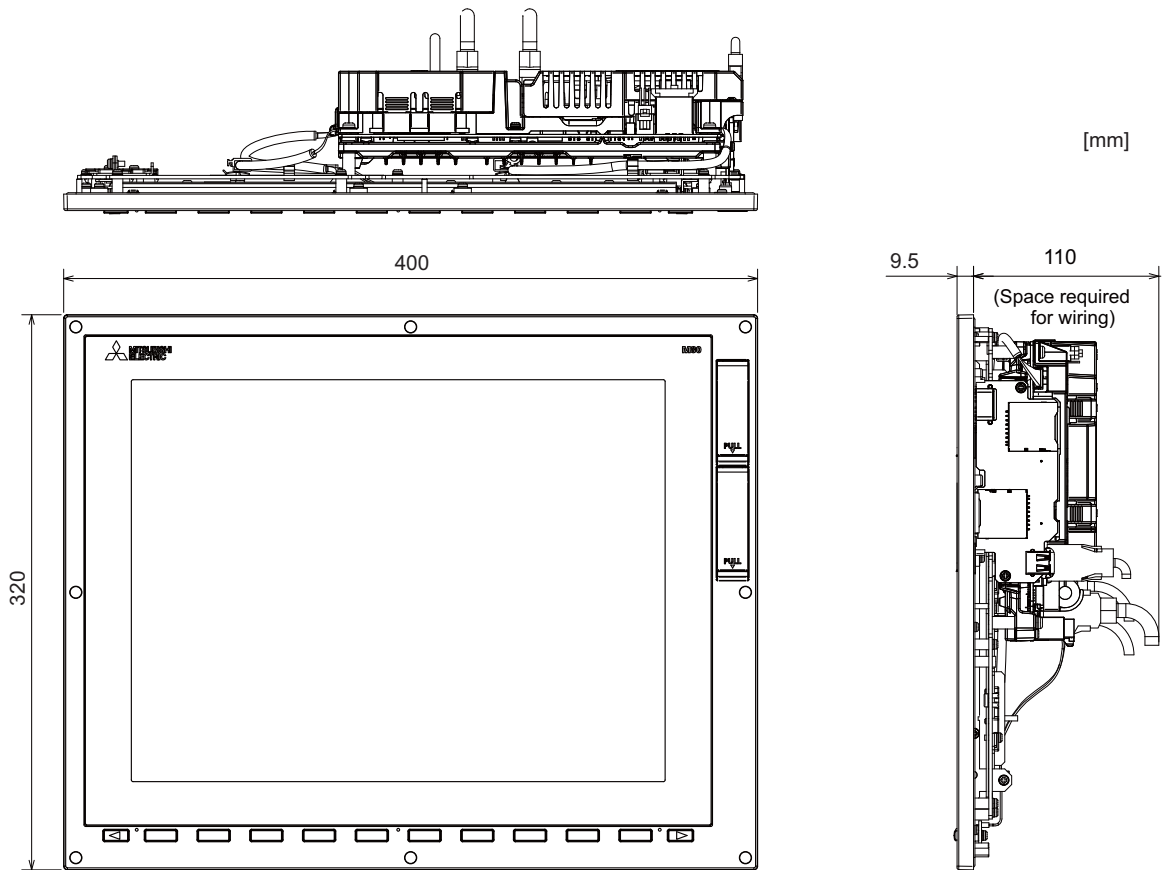
(Note) The figure above shows the state with the graphic control unit mounted.

[Panel cut dimension]



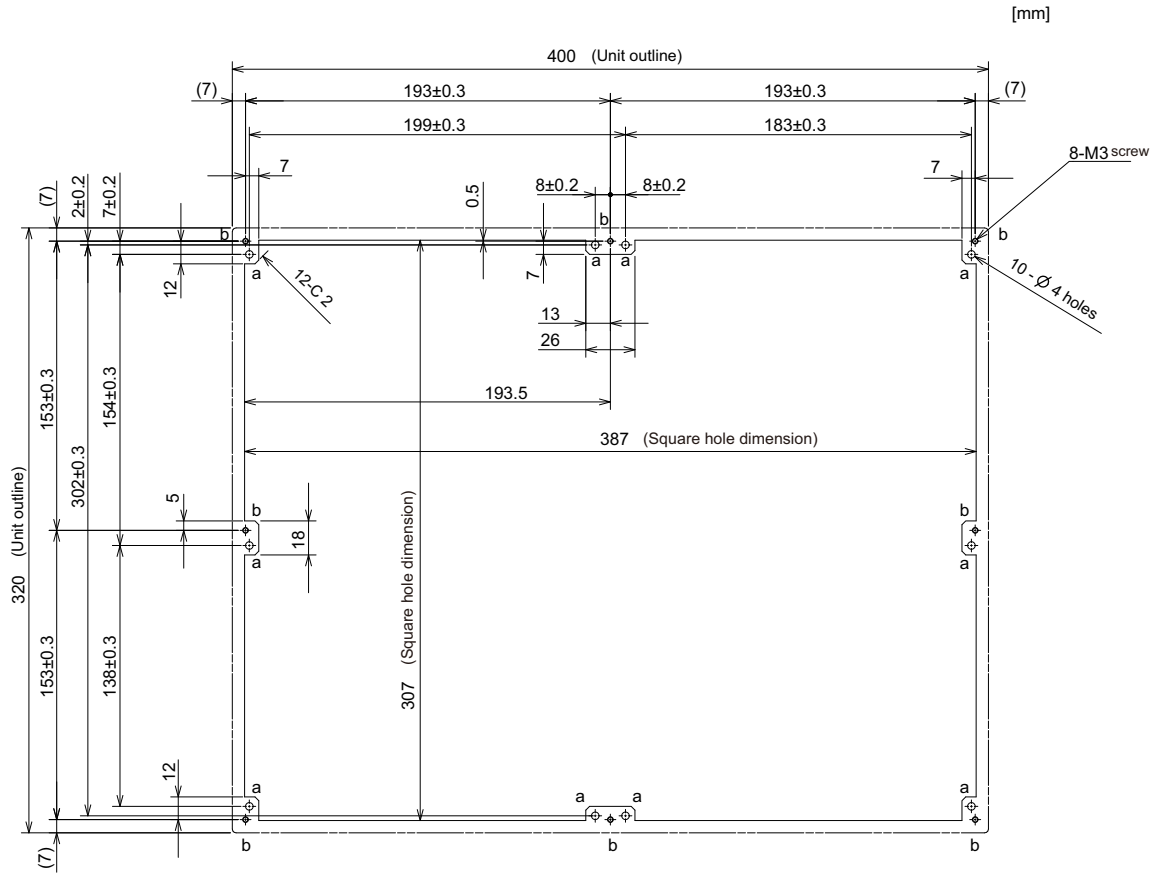
4.6.3 15-type (FCU8-DU181-32)

[Outline dimension]



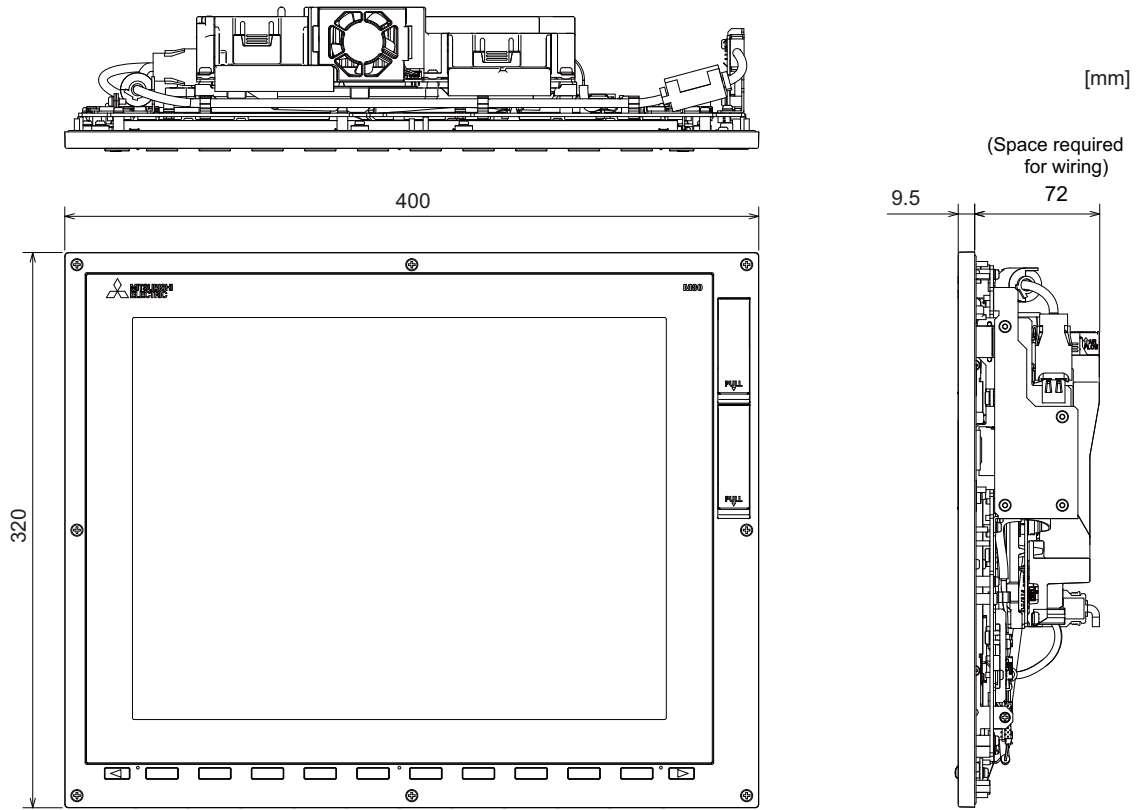
(Note) The figure above shows the state with the graphic control unit mounted.

[Panel cut dimension]



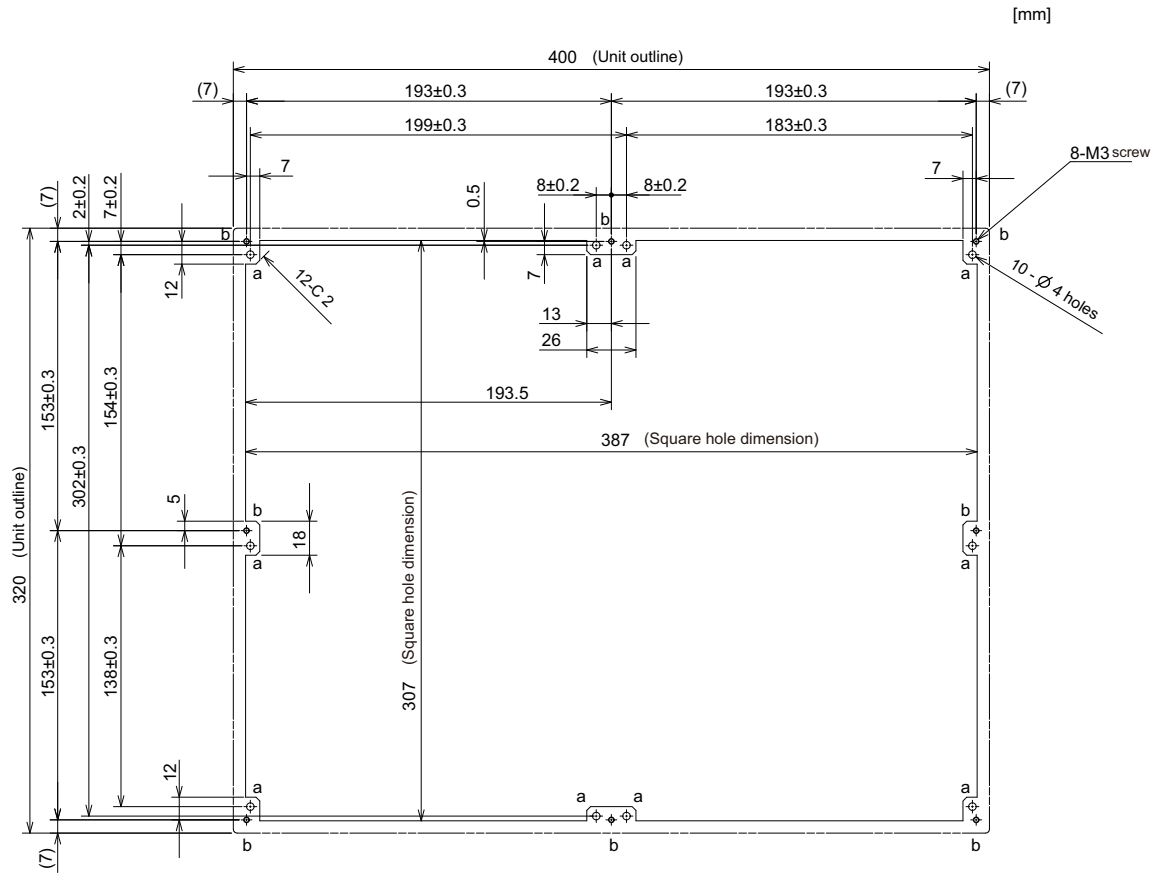
4.6.4 15-type (FCU8-DU181-36)

[Outline dimension]



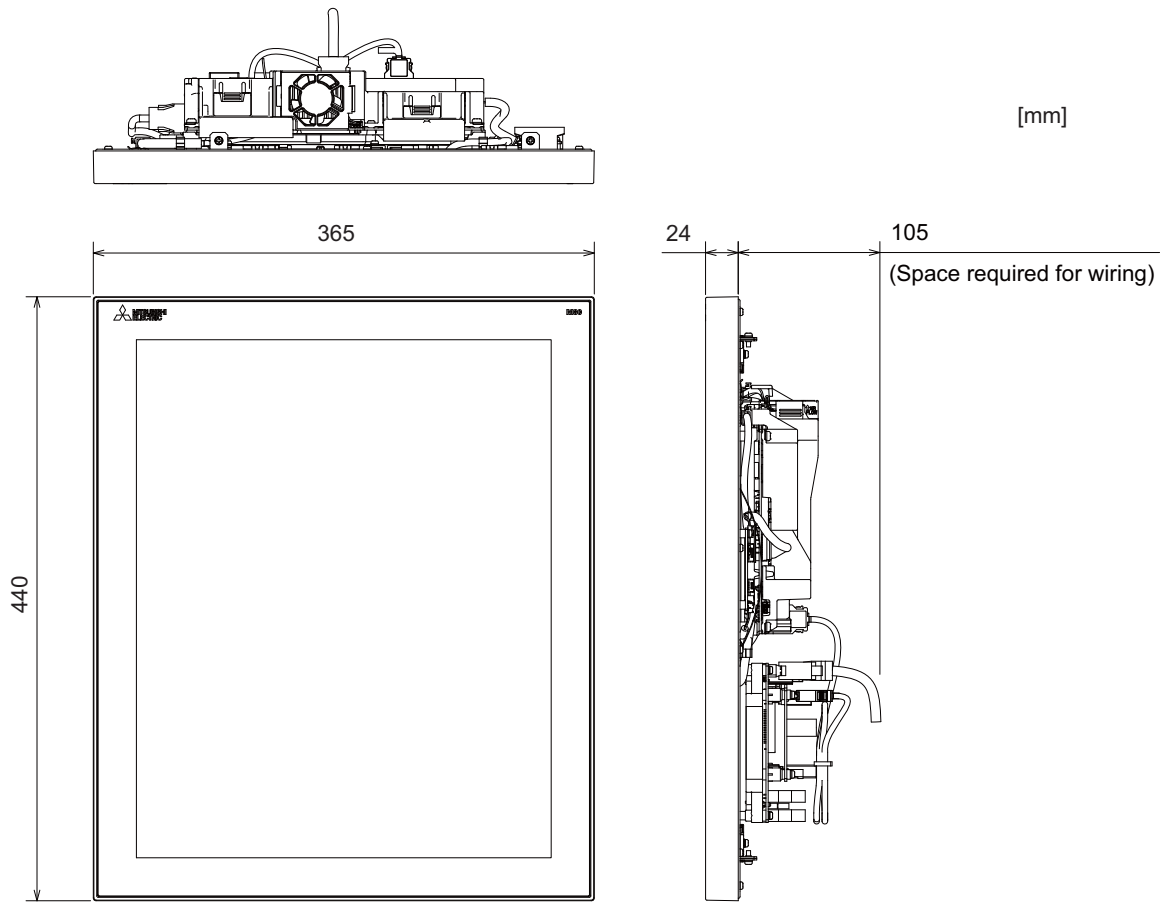
(Note) The figure above shows the state with the personal computer unit mounted.

[Panel cut dimension]



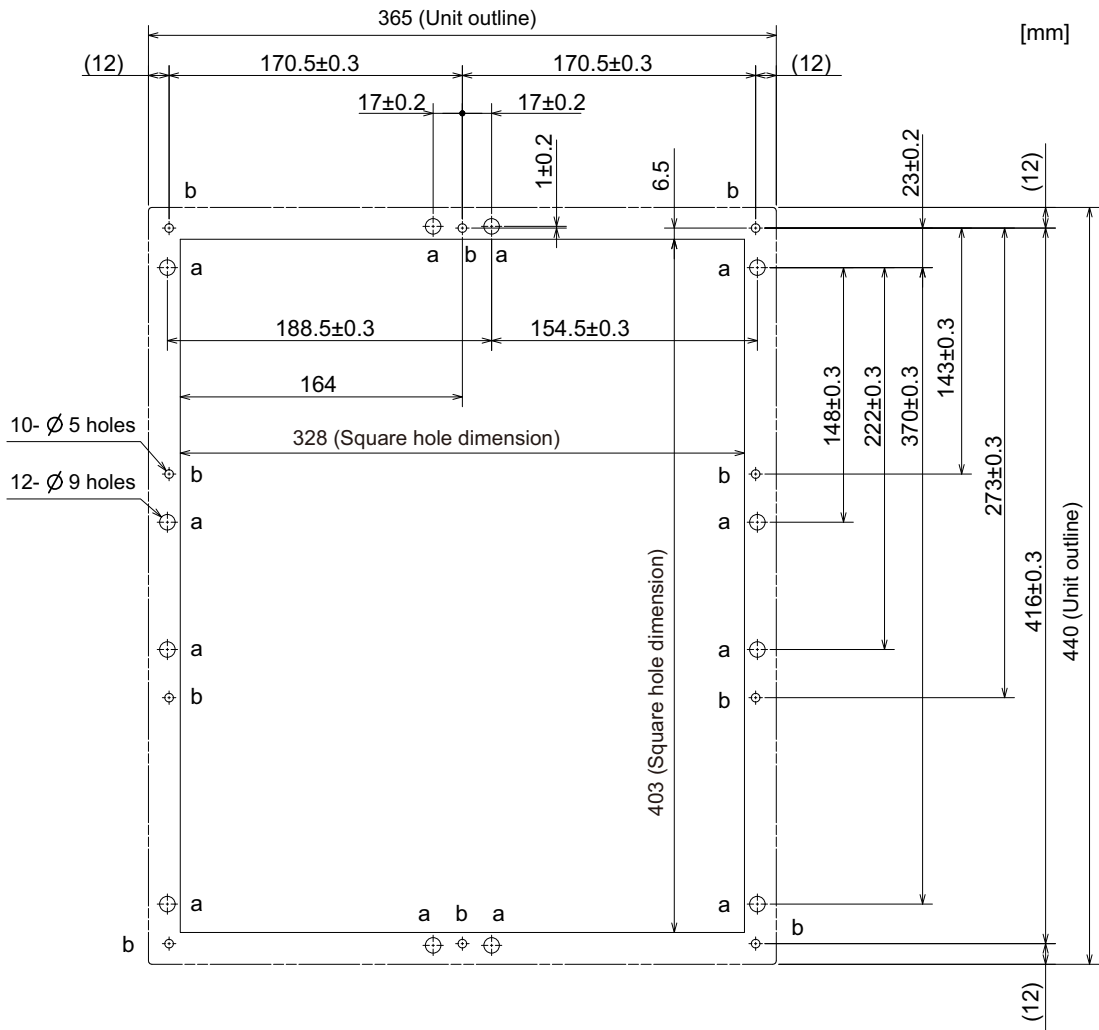
4.6.5 19-type (FCU8-DU191-77)

[Outline dimension]



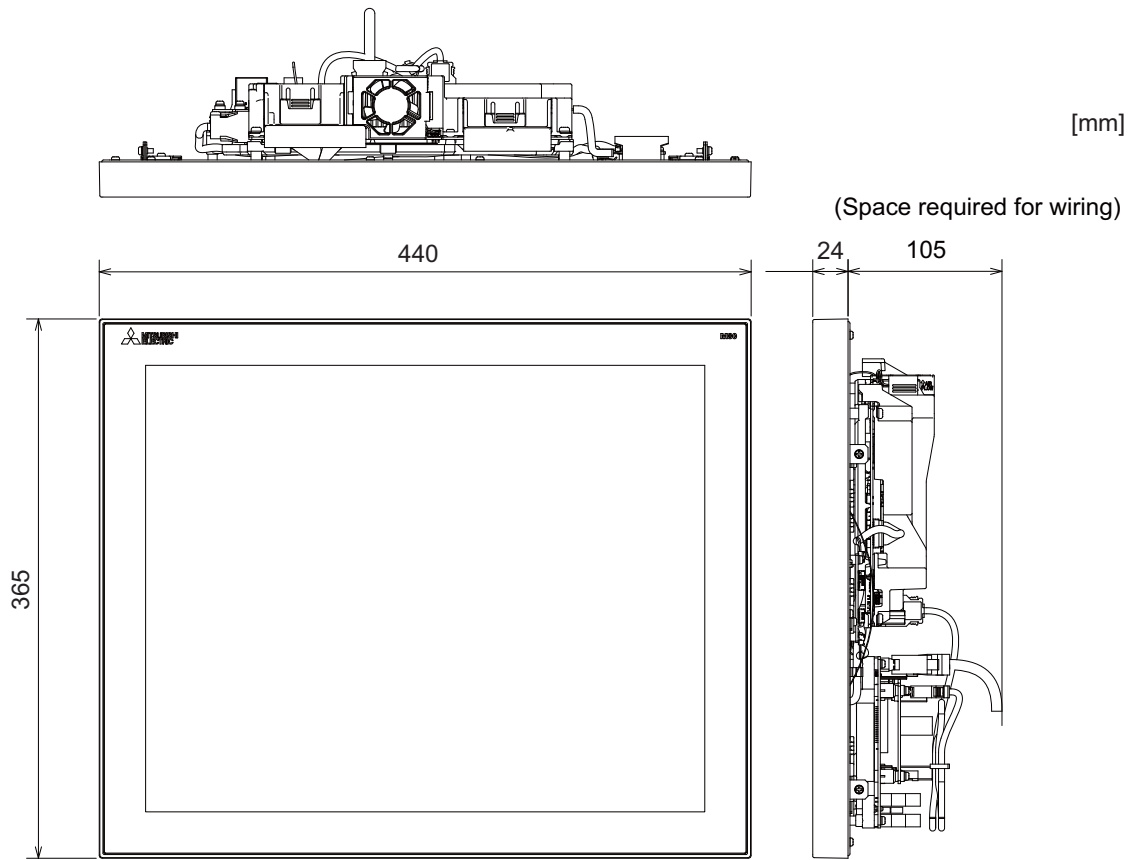
(Note) The figure above shows the state with the personal computer unit and the operation panel I/O unit mounted.

[Panel cut dimension]



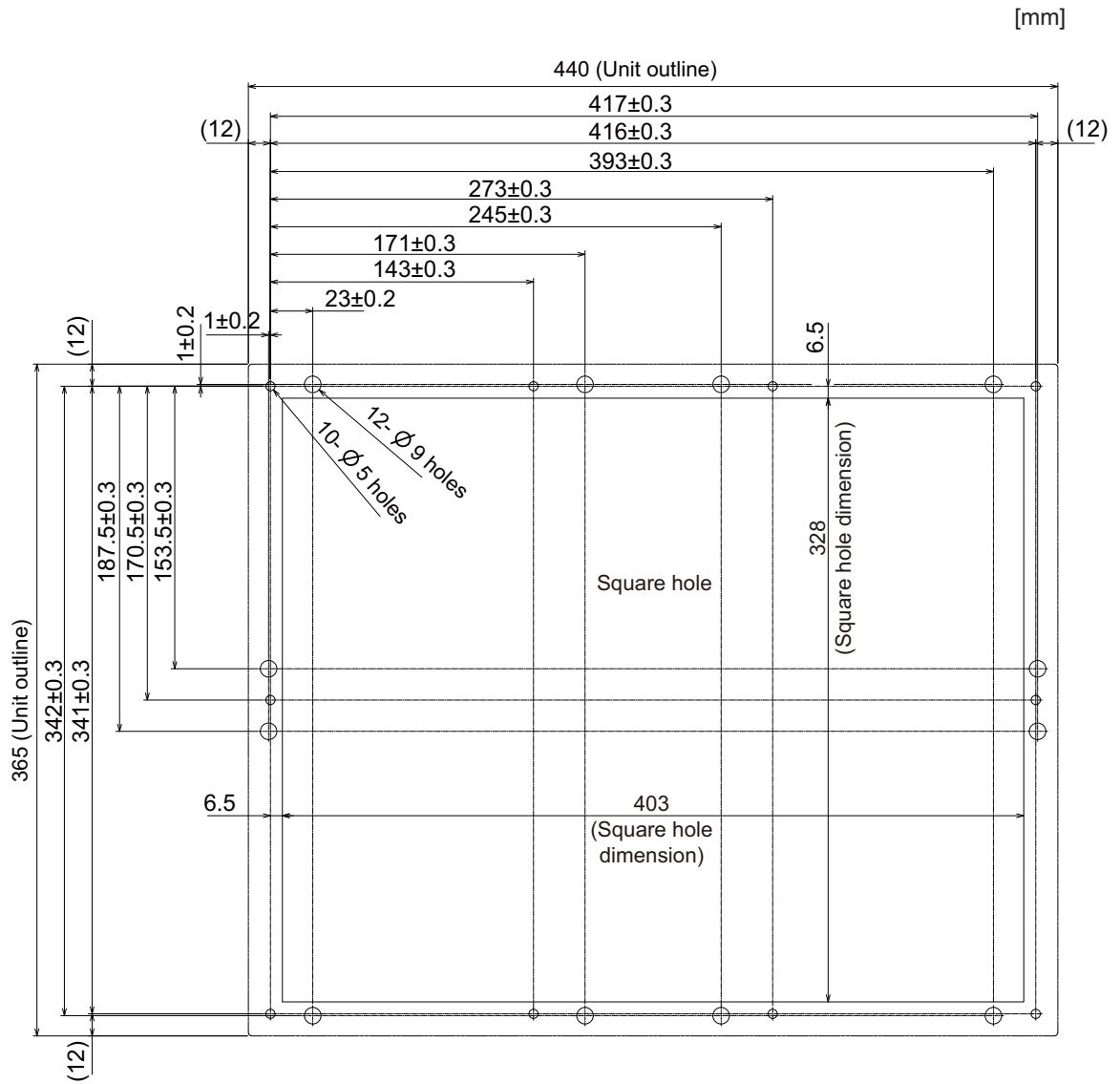
4.6.6 19-type (FCU8-DU192-77)

[Outline dimension]



(Note) The figure above shows the state with the personal computer unit and the operation panel I/O unit mounted.

[Panel cut dimension]



4.6.7 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 personal computer unit at one ground point. (Refer to "Installation: Connection of Frame Ground (FG)".) Otherwise, the reaction and usability of the touchscreen will remarkably deteriorate.

[Spot defect of LCD]

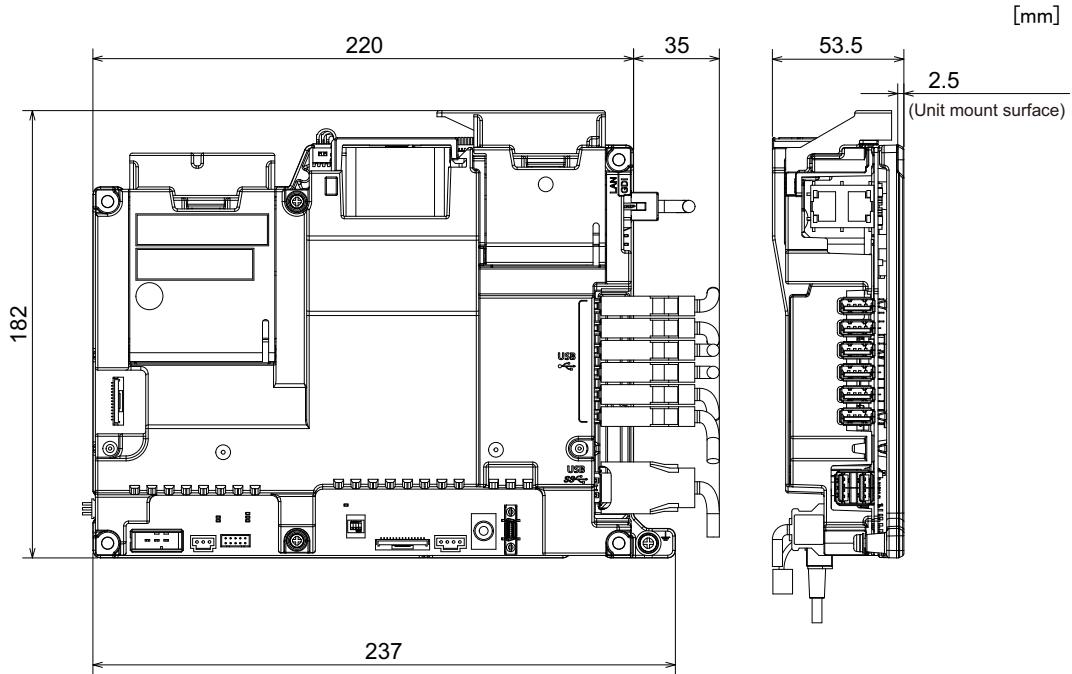
The display inspection standard at the time of shipment from MITSUBISHI is as follows.

	Item	Reference value
Spot defect	Bright spot defect	$N \leq 3$
	Black spot defect	$N \leq 3$
	Total number of defects	$N \leq 5$

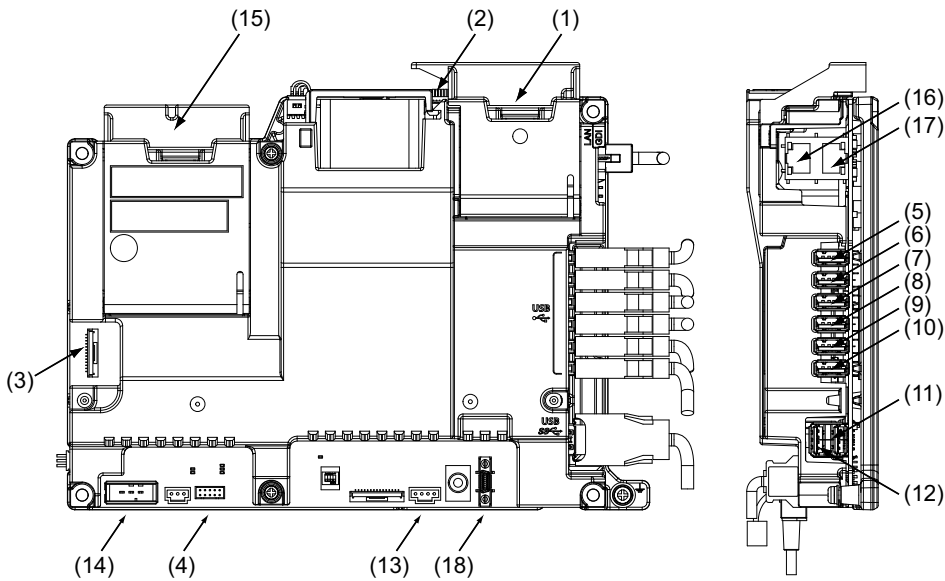
4.7 Personal Computer Unit

4.7.1 Personal Computer Unit (FCU8-PC231)

[Outline dimension]



[Connector]



No.	Connector name	Function	No.	Connector name	Function
(1)	LVDS1	Display unit signal I/F 1st ch	(10)	USB2-6	USB 2.0 I/F 6th ch
(2)	LVDS2	Display unit signal I/F 2nd ch	(11)	USB3-1	USB 3.0 I/F 1st ch
(3)	INV	LED backlight connection	(12)	USB3-2	USB 3.0 I/F 2nd ch
(4)	MENUKEY	Menu key I/F	(13)	ON/OFF	Power supply ON/OFF I/F
(5)	USB2-1	USB 2.0 I/F 1st ch	(14)	DCIN	24VDC input
(6)	USB2-2	USB 2.0 I/F 2nd ch	(15)	CFAST	Built-in disk connection of display unit
(7)	USB2-3	USB 2.0 I/F 3rd ch	(16)	LAN	Ethernet I/F
(8)	USB2-4	USB 2.0 I/F 4th ch	(17)	GDI	Ethernet I/F for control unit connection
(9)	USB2-5	USB 2.0 I/F 5th ch	(18)	KEYUSB	Operation panel I/O unit connection

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.
- ⚠ 12V, 5V, and 3.3V output from connectors are to supply the power for dedicated peripheral devices. Do not use for other equipment to supply the power since we do not guarantee the NC operation by voltage down or noise sneaking.

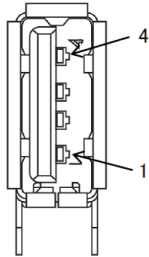
(1) LVDS1 (Display unit signal I/F 1st ch)

(2) LVDS2 (Display unit signal I/F 2nd ch)

(3) INV (LED backlight connection)

(4) MENUKEY (Menu key I/F)

- (5) USB2-1 (USB 2.0 I/F 1st ch)
- (6) USB2-2 (USB 2.0 I/F 2nd ch)
- (7) USB2-3 (USB 2.0 I/F 3rd ch)
- (8) USB2-4 (USB 2.0 I/F 4th ch)
- (9) USB2-5 (USB 2.0 I/F 5th ch)
- (10) USB2-6 (USB 2.0 I/F 6th ch)



1		Vcc
2	I/O	-Data0
3	I/O	+Data1
4		0V

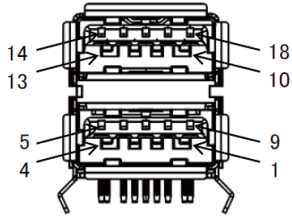
<Cable side connector type>

Connector : 2040305-1

Recommended manufacturer : Tyco Electronics

(11) USB3-1 (USB 3.0 I/F 1st ch)

(12) USB3-2 (USB 3.0 I/F 2nd ch)



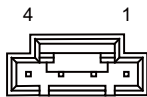
USB3-1			USB3-2		
1		0V	10		0V
2	I/O	-Data1	11	I/O	-Data0
3	I/O	+Data1	12	I/O	+Data0
4		Vcc	13		Vcc
5	O	SSTX1_D-	14	O	SSTX0_D-
6	O	SSTX1_D+	15	O	SSTX0_D+
7		0V	16		0V
8	O	SSRX1_D-	17	O	SSRX0_D-
9	O	SSRX1_D+	18	O	SSRX0_D+

<Cable side connector type>

Connector : 1932266-1

Recommended manufacturer : Tyco Electronics

(13) ON/OFF (Power supply ON/OFF I/F)



1		0V
2	I	PON
3	I	POFF
4		0V

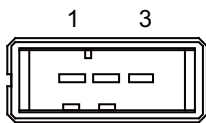
<Cable side connector type>

Connector : 51030-0430

Contact : 0016020103

Recommended manufacturer : MOLEX

(14) DCIN (24VDC input)



1		+24V
2		0V
3		FG

<Cable side connector type>

Connector : 2-178288-3

Contact : 1-175218-5

Recommended manufacturer : Tyco Electronics

(a) Specifications of power supply

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

[Stabilized power supply selection items]

Item	Standard setting
Output Voltage fluctuation	±5% or less of 24VDC
Ripple noise	200mV (P-P)
Power capacity	Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
Output holding time	20ms
Overcurrent protection	Required

[Standards]

Safety Standards: UL1950, CSA C22.2 No. 234 approved, IEC950 compliant

Noise Terminal Voltage: FCC Class A, VCCI-Class A

High Harmonics Current Restrictions: IEC61000-3-2

(Note) 24VDC voltage may drop instantaneously due to rush current at the beginning of 24V power supply to the control unit.

The level of voltage drop depends on the capacity of the power supply. Do not share the power supply with the devices that have alarms to warn the voltage drop.

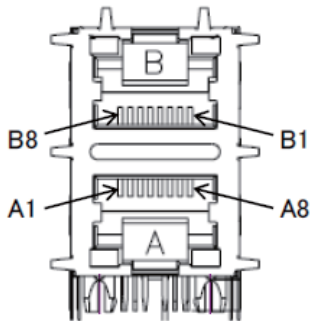
 **CAUTION**

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

(15) CFAST (Built-in disk connection of display unit)

(16) LAN (Ethernet I/F)

(17) GDI (Ethernet I/F for control unit connection)



LAN			GDI		
B1	I/O	BI_DA+	A1	I/O	BI_DA+
B2	I/O	BI_DA-	A2	I/O	BI_DA-
B3	I/O	BI_DB+	A3	I/O	BI_DB+
B4	I/O	BI_DC+	A4	I/O	BI_DC+
B5	I/O	BI_DC-	A5	I/O	BI_DC-
B6	I/O	BI_DB-	A6	I/O	BI_DB-
B7	I/O	BI_DD+	A7	I/O	BI_DD+
B8	I/O	BI_DD-	A8	I/O	BI_DD-

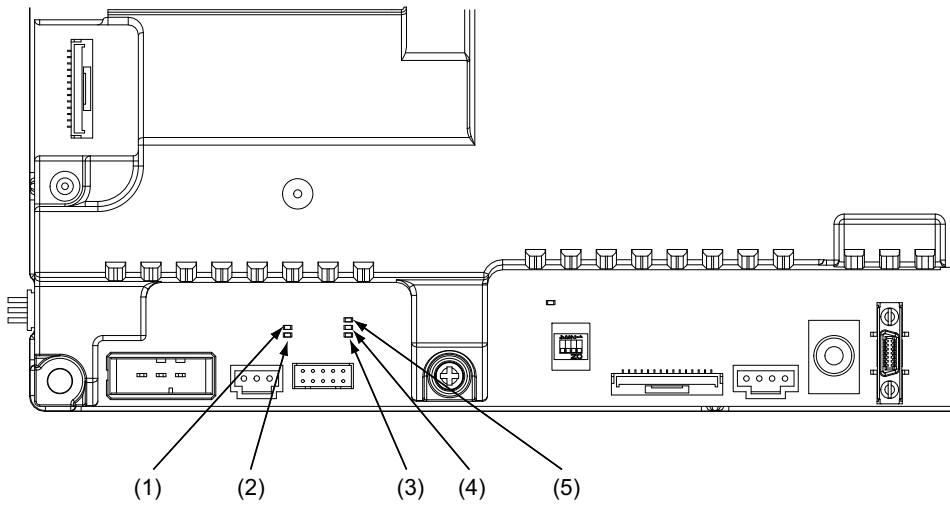
<Cable side connector type>

Connector : J00026A0165

Recommended manufacturer : Japan Telegärtner

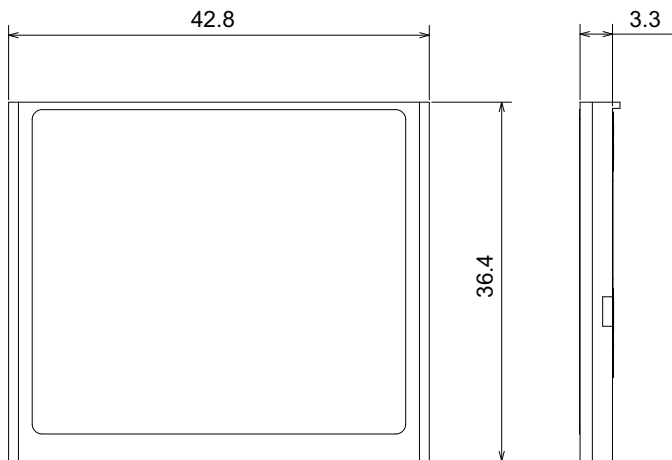
(18) KEYUSB (Operation panel I/O unit connection)

[LED]



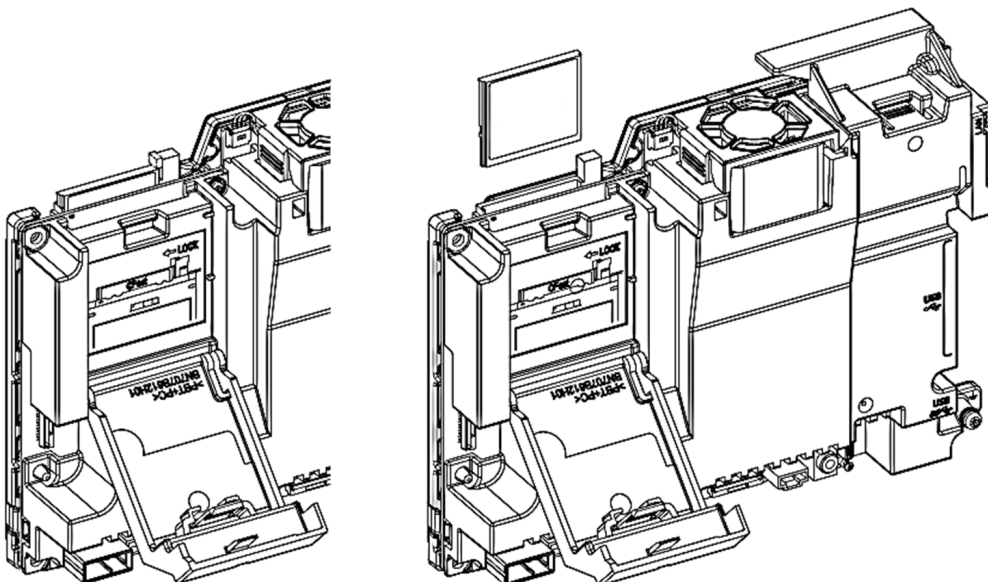
No.	Name	Function	Color	Status	
				Normal	At fault
(1)	DCIN	24VDC input observation	Green	Lit	Not lit
(2)	DCOUT	DC internal power supply output observation	Green	Lit	Not lit
(3)	12V	12VDC output observation	Green	Lit	Not lit
(4)	5V	5VDC output observation	Green	Lit	Not lit
(5)	3.3V	3.3VDC output observation	Green	Lit	Not lit

4.7.2 Built-in Disk of the Display Unit (FCU8-CF001-001)

[Outline dimension]**[Precautions for handling]**

(1) Precautions for use

- (a) Turn the MITSUBISHI device's power OFF before inserting or removing a built-in disk of the display unit.
- (b) To avoid troubles such as a data loss, do not pull out the built-in disk of the display unit or turn the power OFF during access to the built-in disk of the display unit.
- (c) The built-in disk slot of the display unit for the personal computer unit is provided with the mechanism which locks the built-in disk of the display unit. Make sure to lock to prevent fall of the built-in disk of the display unit.
- (d) Do not touch the connector section. Because the built-in disk of the display unit is the semiconductor product, take a countermeasure against static electricity at the time of handling.
- (e) Turn the power OFF according to "(2) To turn the power OFF" under the section "Connection: Turning the Power ON/OFF". If the power is turned OFF forcibly, the files may be corrupted.



(2) Data backup in built-in disk of the display unit

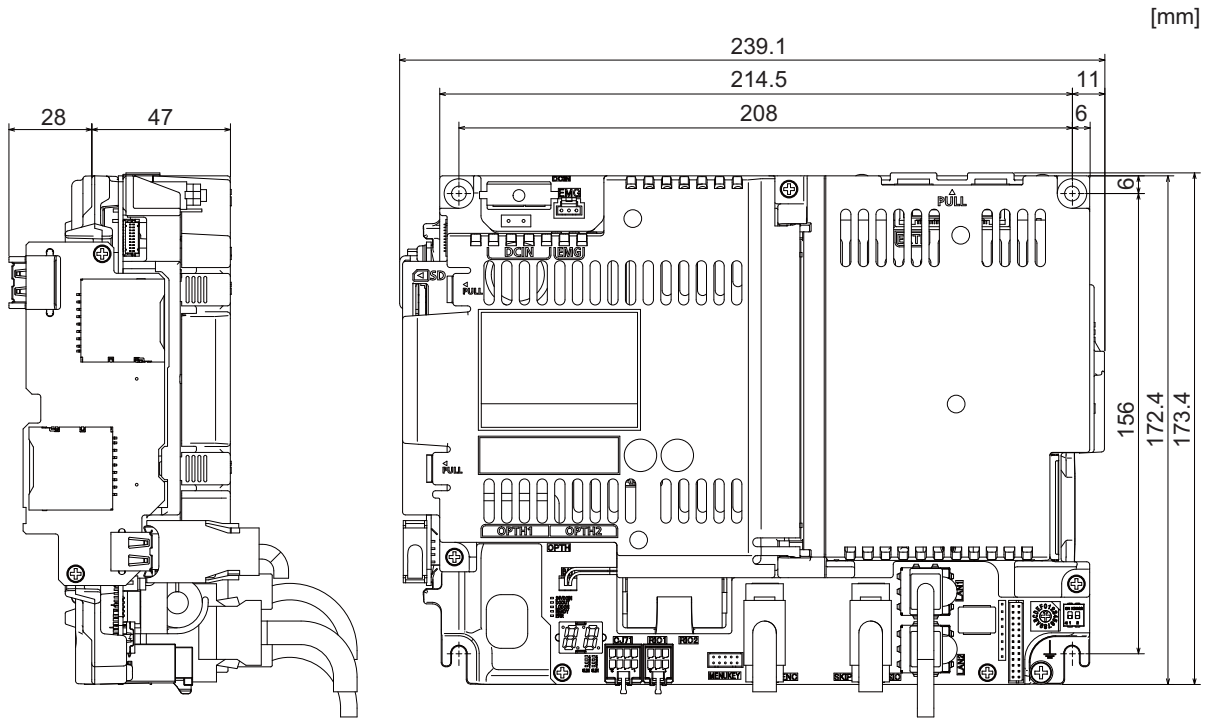
Backup must be regularly performed by the user.

MITSUBISHI will replace a built-in disk of the display unit, however MITSUBISHI will not take any responsibility for the damage caused by a data loss.

4.8 Graphic Control Unit

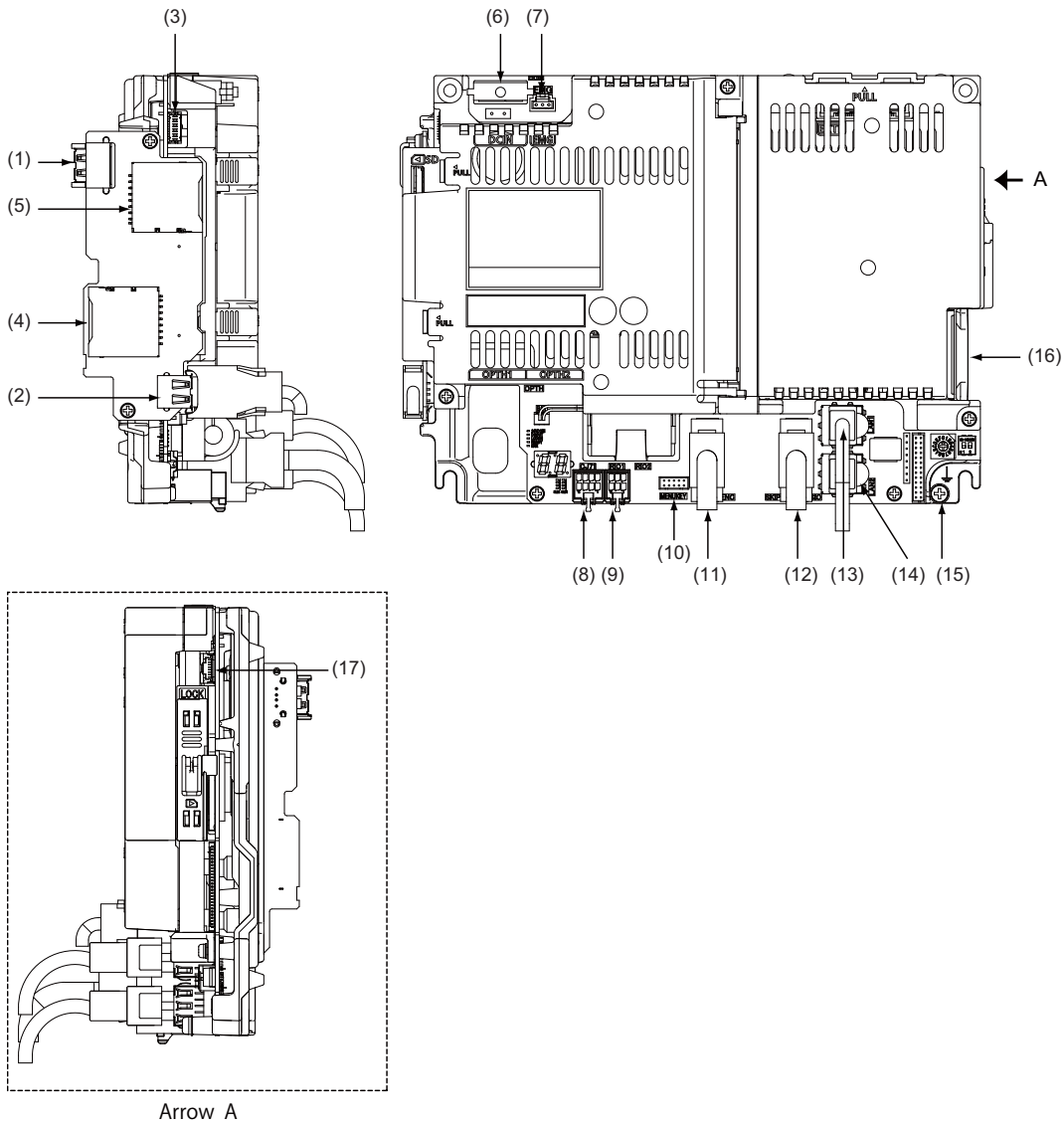
4.8.1 FCU8-GC211

[Outline dimension]




(Note) Refer to the following chapter for the space required for wiring.
 "4.5 Display Unit [M800W]"
 "4.6 Display Unit [M80W]"

[Connector]




No.	Connector name	Function	No.	Connector name	Function
(1)	USB_F	Front-side USB memory I/F	(10)	MENUKEY	Menu key I/F
(2)	USB_B		(11)	ENC	Power supply ON/OFF I/F
(3)	BL	Display unit backlight I/F	(12)	SIO	RS-232C communication 2ch
(4)	SDC_F	Front-side SD card I/F	(13)	LAN1	Ethernet communication
(5)	SDC_B	Back-side SD card I/F	(14)	LAN2	Ethernet communication
(6)	DCIN	24VDC input	(15)	FG	FG terminal
(7)	EMG	External emergency stop input	(16)	LCD	Display unit signal I/F
(8)	CJ71	Operation panel I/O unit I/F	(17)	TP	Touch panel I/F
(9)	RIO1	System reserved			

 **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.

 12V, 5V, and 3.3V output from connectors are to supply the power for dedicated peripheral devices. Do not use for other equipment to supply the power since we do not guarantee the NC operation by voltage down or noise sneaking.

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

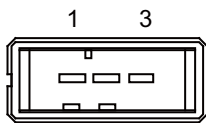
(2) USB_B

(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 (24VDC input)



1	I	+24V
2		0V
3		FG

<Cable side connector type>

Connector : 2-178288-3

Contact : 1-175218-5

Recommended manufacturer : Tyco Electronics

(a) Specifications of power supply

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

[Stabilized power supply selection items]

Item	Standard setting
Output Voltage fluctuation	±5% or less of 24VDC
Ripple noise	200mV (P-P)
Power capacity	Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
Output holding time	20ms
Overcurrent protection	Required

[Standards]

Safety Standards: UL1950, CSA C22.2 No. 234 approved, IEC950 compliant

Noise Terminal Voltage: FCC Class A, VCCI-Class A

High Harmonics Current Restrictions: IEC61000-3-2

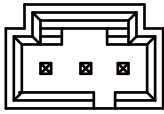
(Note) 24VDC voltage may drop instantaneously due to rush current at the beginning of 24V power supply to the control unit.

The level of voltage drop depends on the capacity of the power supply. Do not share the power supply with the devices that have alarms to warn the voltage drop.

CAUTION

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

(7) EMG (External emergency stop input)



3 2 1

1		FG
2	I	EMG IN
3	O	+24V

<Cable side connector type>

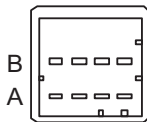
Connector : 50-57-9403

Contact : 0016020103

Recommended manufacturer : MOLEX

(Note) Use this when installing an emergency stop switch in the electric cabinet. Connect a terminator (G123 cable) when not using this connector.

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



1 2 3 4

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

<Cable side connector type>

Connector : 2-1318119-4

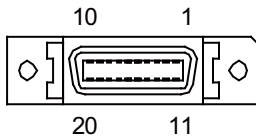
Contact : 1318107-1

Recommended manufacturer : Tyco Electronics

(9) RIO1 (System reserved)

(10) MENUKY (Menu key I/F)

(11) ENC (Power supply ON/OFF I/F)



1		0V	11		0V
2		NC	12		NC
3		NC	13		NC
4		NC	14		NC
5	I	LGON	15	I	LGOFF
6	O	+5V	16	O	+5V
7		NC	17		NC
8	I	ON	18	I	OFF
9		NC	19		NC
10	O	+5V	20	O	+5V

- Connect connector case with FG pattern.

<Cable side connector type>

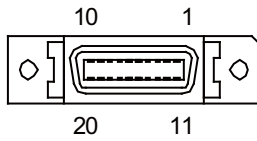
Plug : 10120-3000PE

Shell : 10320-52F0-008

Recommended 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±0.05N·m)

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



1		0V	11		0V
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		0V	15		0V
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>

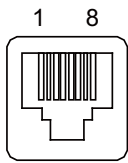
Plug : 10120-3000PE

Shell : 10320-52F0-008

Recommended 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±0.05N·m)

(13) 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-

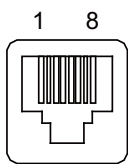
- Connect connector case with FG pattern.
- Use J303 cable when directly connecting a device such as a personal computer to the unit.

<Cable side connector type>

Connector : J00026A0165

Recommended manufacturer : Japan Telegärtner

(14) LAN2 (Ethernet communication)



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

- 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

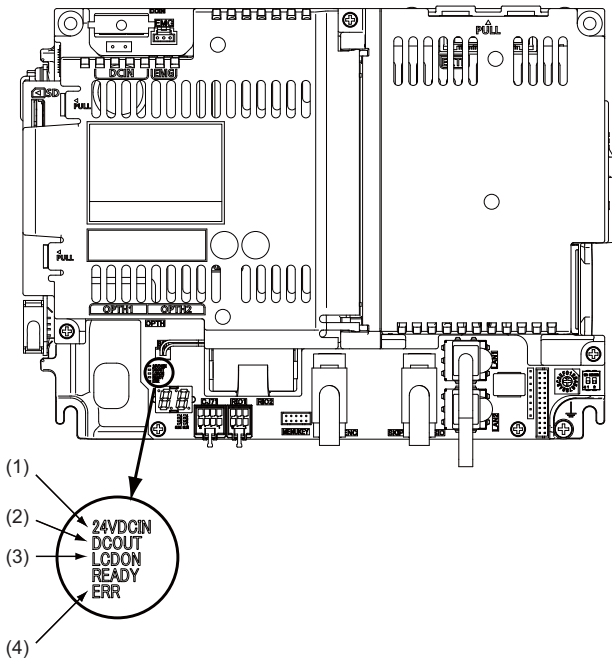
Recommended manufacturer : Japan Telegärtner

(15) FG (FG terminal)

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

(17) TP (Touch panel I/F)

[LED]



No.	Name	Lamp state	Details
(1)	24VDCIN	Lit (Green)	24VDC power is being supplied from the external power supply.
		Not lit	The following may have caused an error: - No 24VDC-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: - No 24V-power supply 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)	12VDC for the backlight of display unit is normally output.
		Not lit	The followings may have caused an error: - Failure of 12VDC output in control unit. - 24VDC input voltage is +20V or less.
(4)	ERR	Lit (Red)	H/W is not operating properly. The followings may have caused an error: - Occurrence of NC watchdog error. - Failure of main CPU card.
		Not lit	H/W is operating properly.

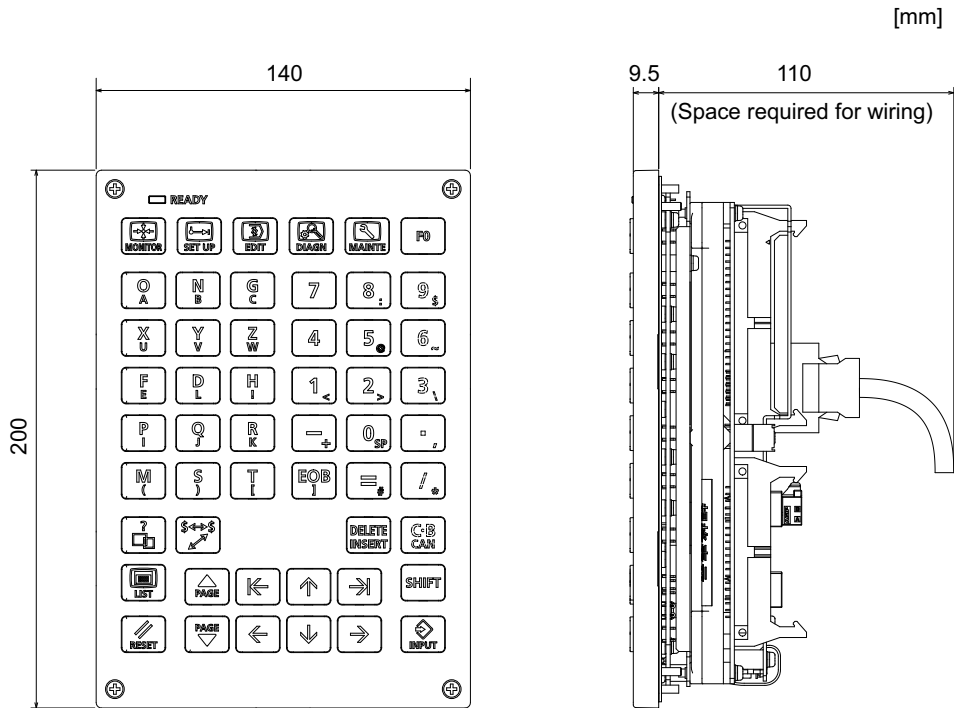
4.9 Keyboard Unit

- (Note) 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	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

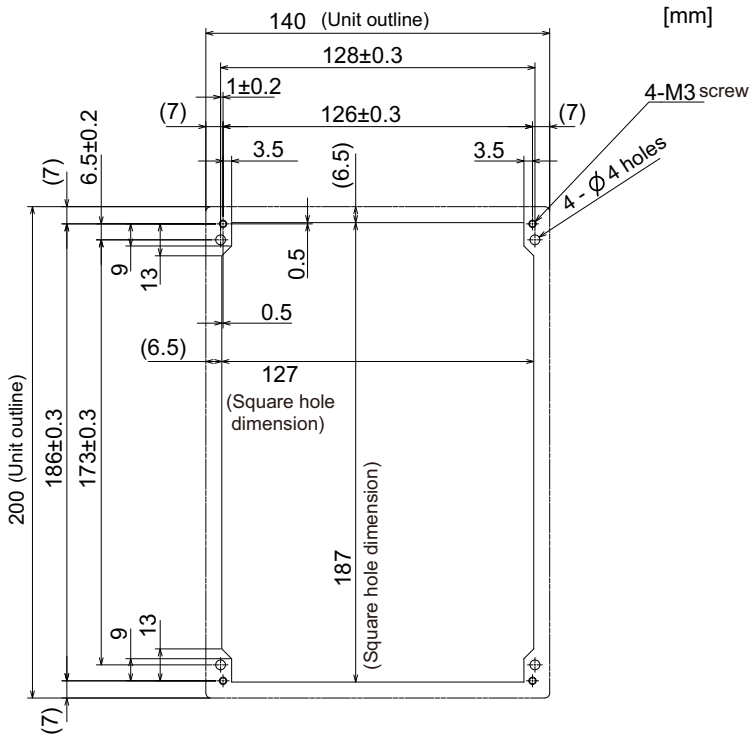
4.9.1 Keyboard for 8.4-type Display Unit (FCU8-KB026)

[Outline dimension]



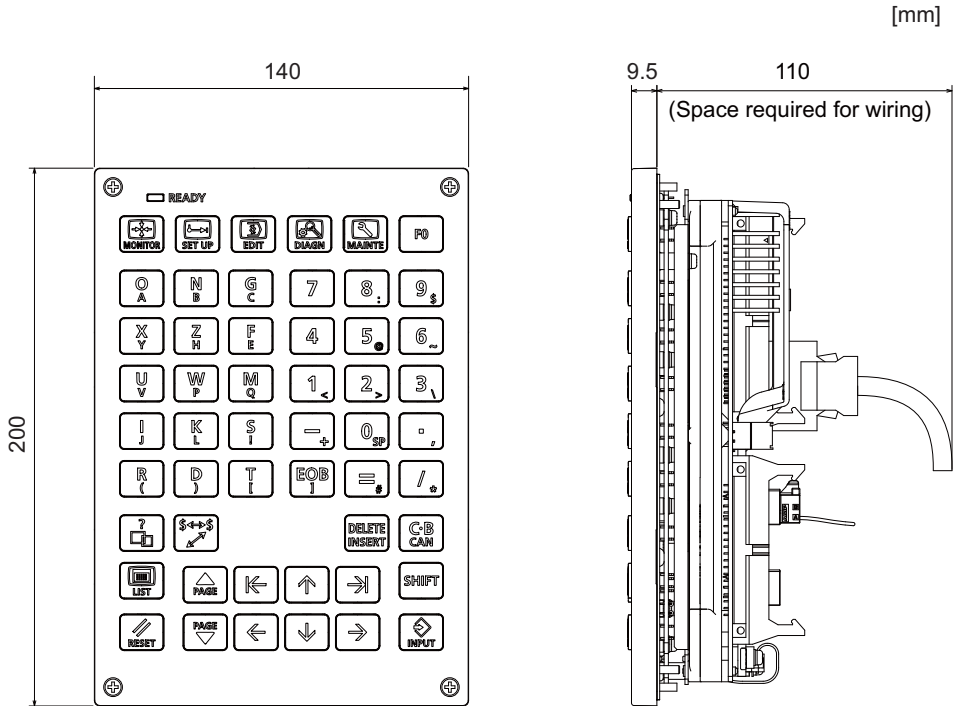
(Note) The above side view shows the state with the operation panel I/O unit mounted.

[Panel cut dimension]



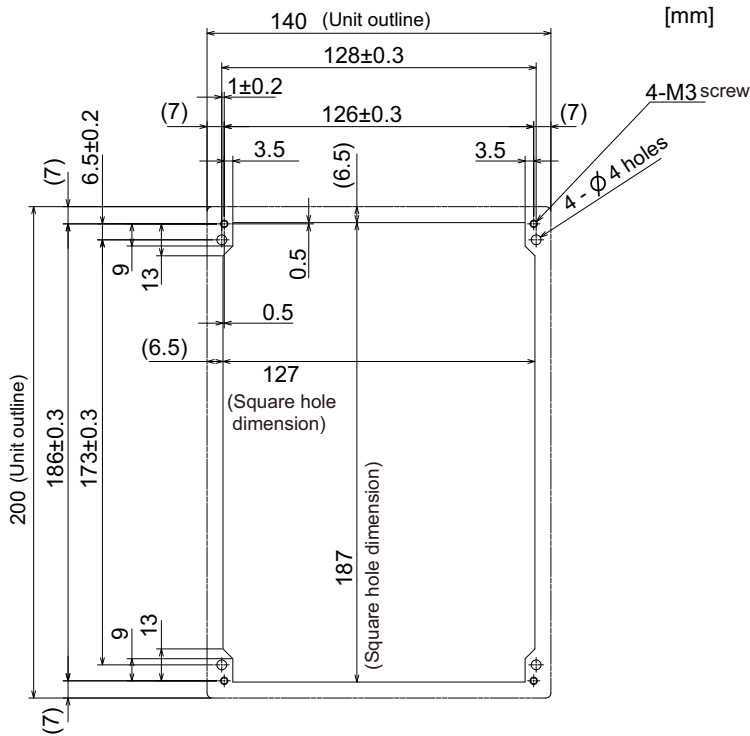
4.9.2 Keyboard for 8.4-type Display Unit (FCU8-KB028)

[Outline dimension]



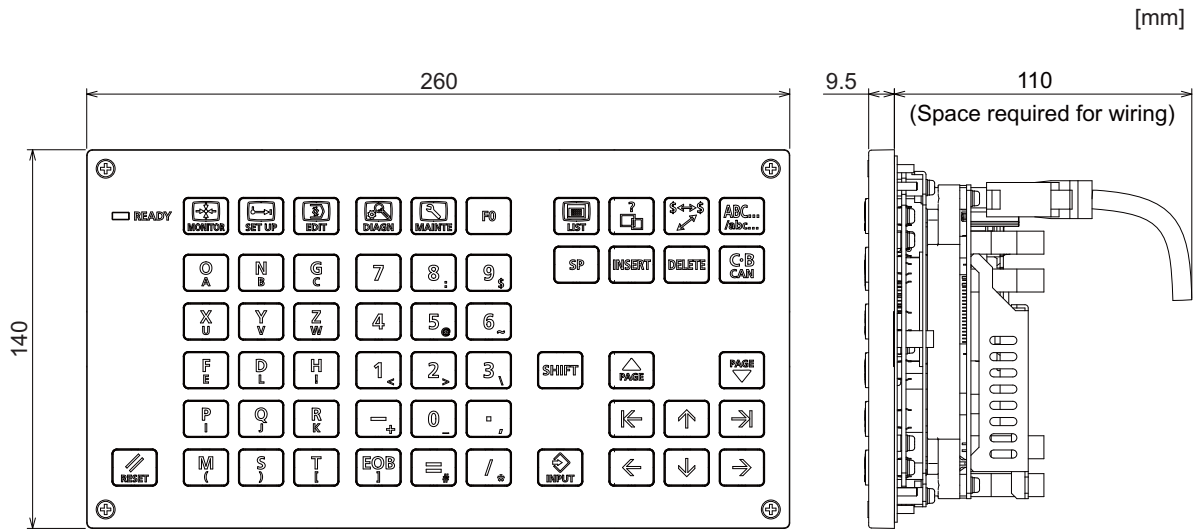
(Note) The above side view shows the state with the operation panel I/O unit mounted.

[Panel cut dimension]



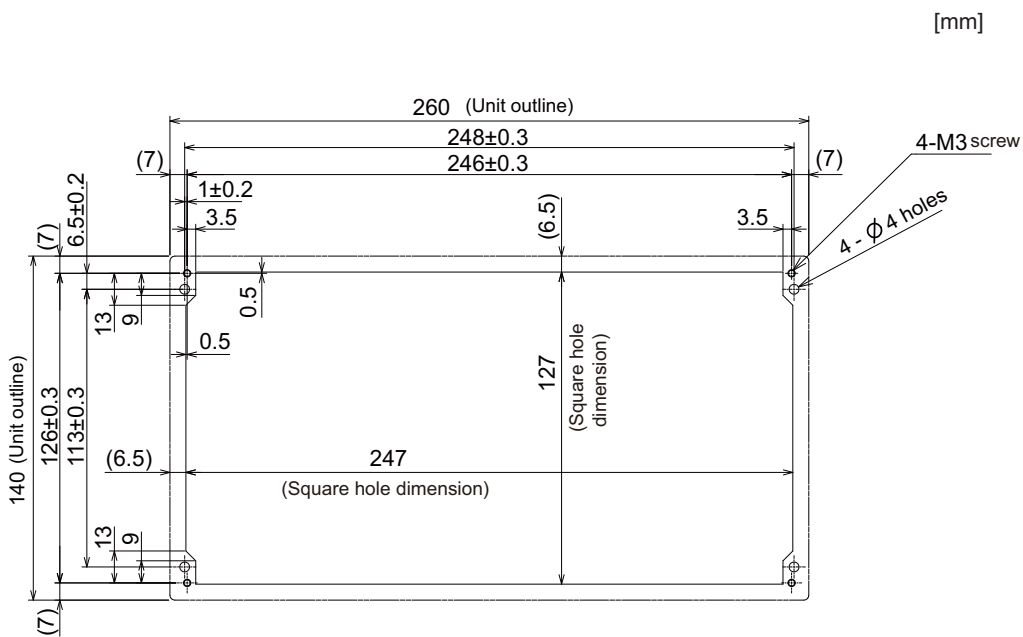
4.9.3 Keyboard for 8.4-type Display Unit (FCU8-KB029)

[Outline dimension]



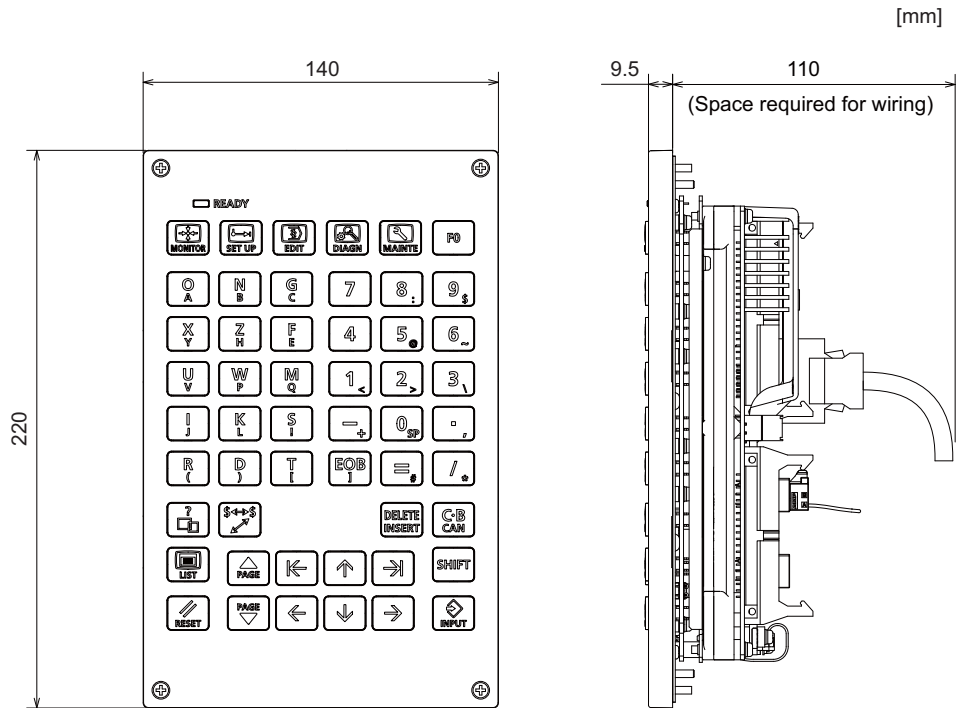
(Note) The above side view shows the state with the operation panel I/O unit mounted.

[Panel cut dimension]



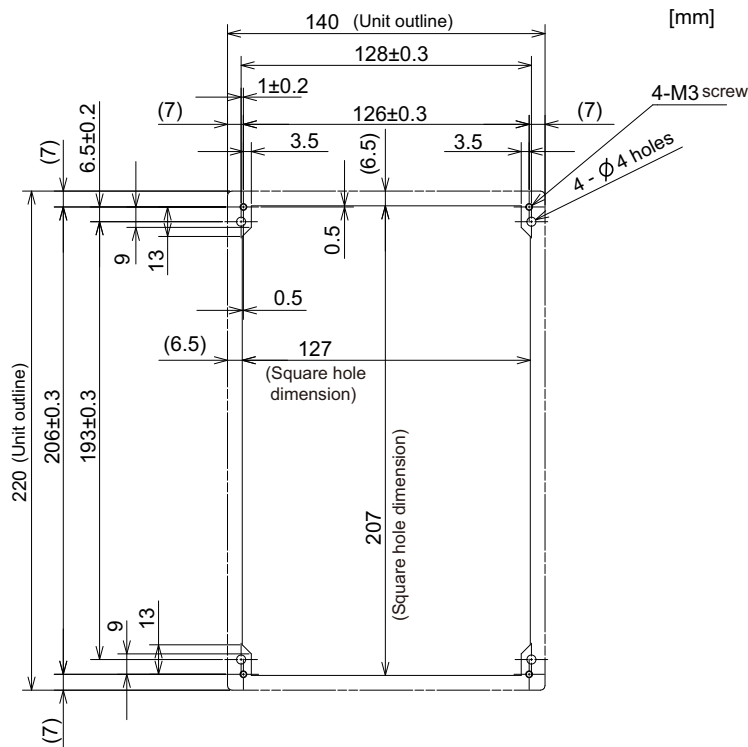
4.9.4 Keyboard for 10.4-type Display Unit (FCU8-KB041)

[Outline dimension]



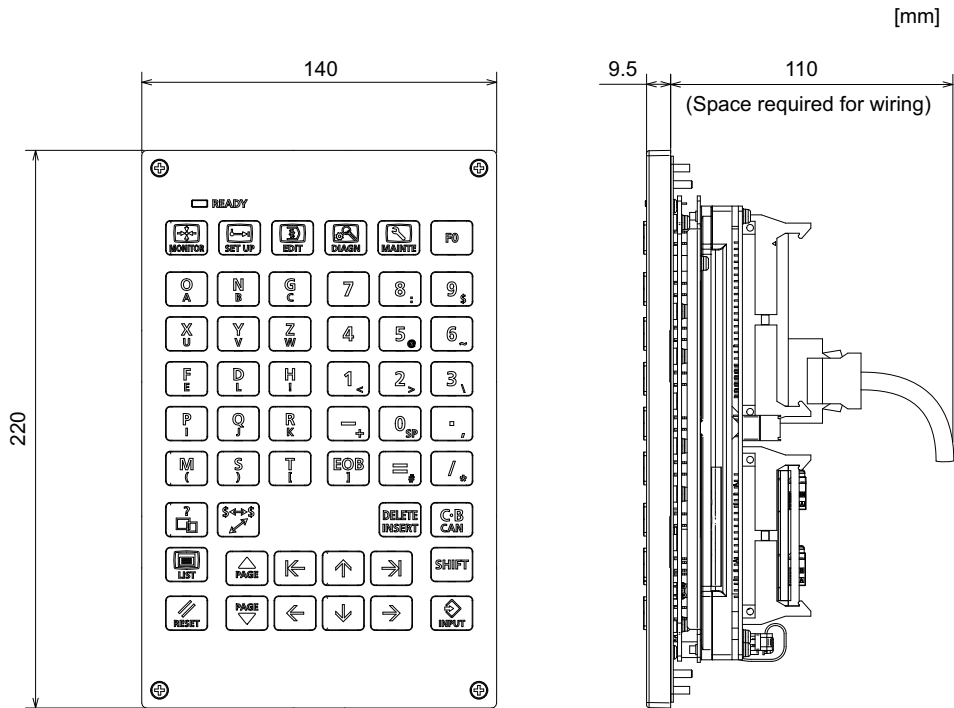
(Note) The above side view shows the state with the operation panel I/O unit mounted.

[Panel cut dimension]



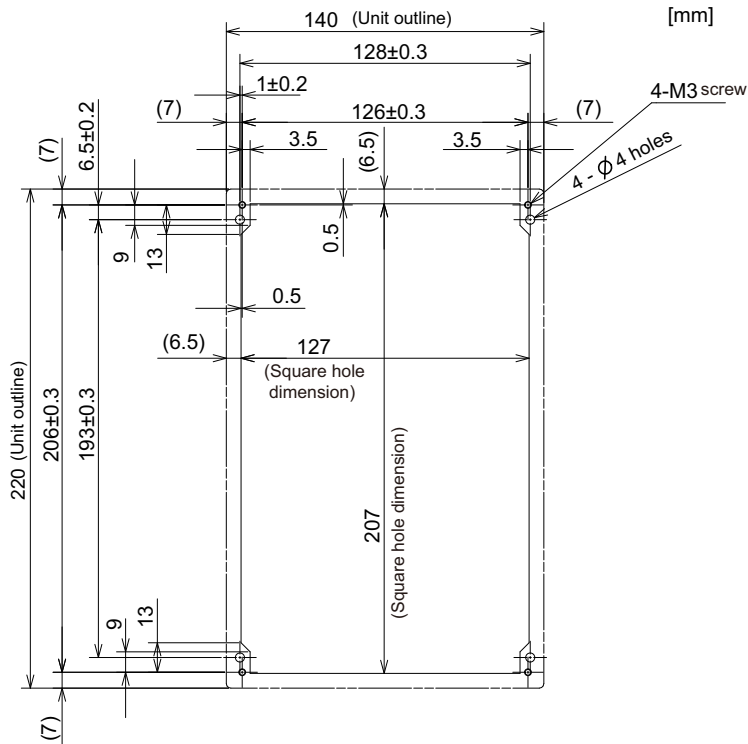
4.9.5 Keyboard for 10.4-type Display Unit (FCU8-KB046)

[Outline dimension]



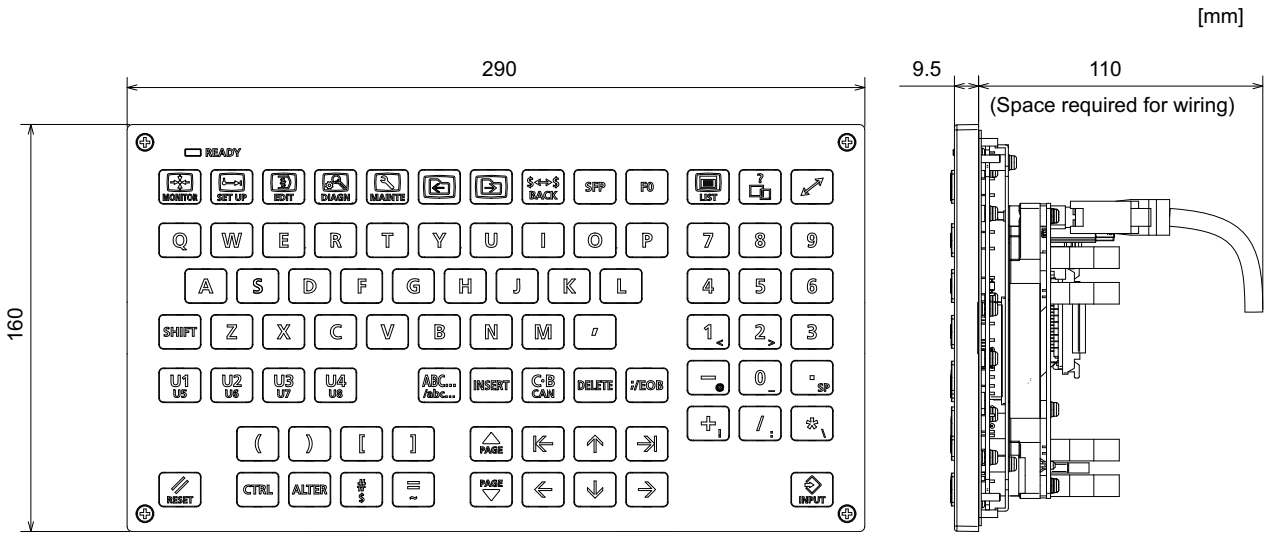
(Note) The above side view shows the state with the operation panel I/O unit mounted.

[Panel cut dimension]



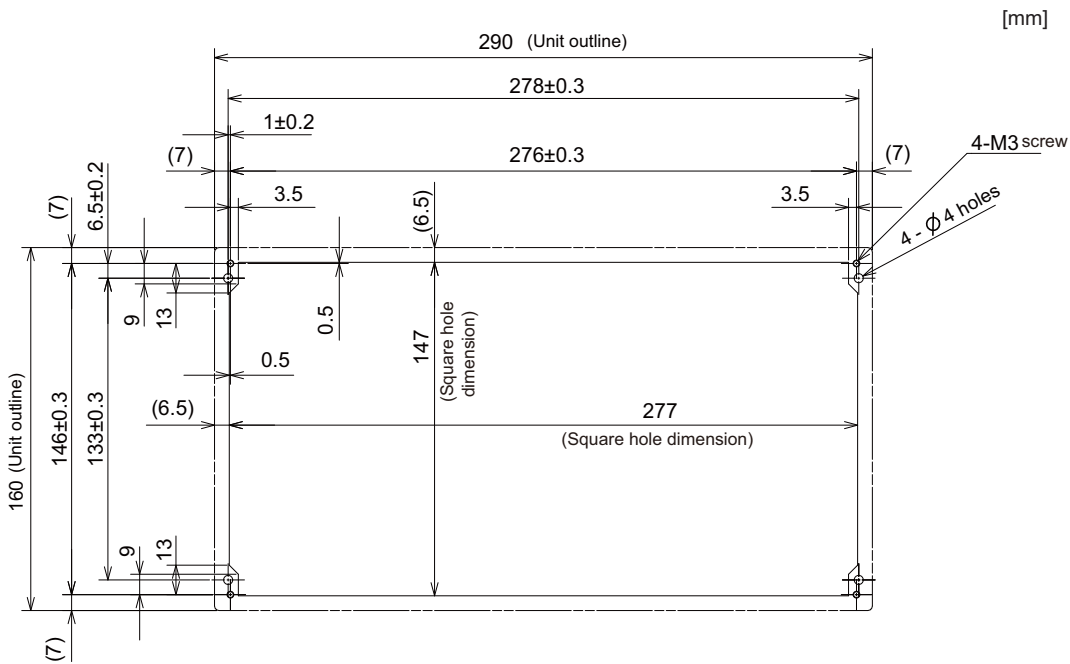
4.9.6 Keyboard for 10.4-type Display Unit (FCU8-KB047)

[Outline dimension]



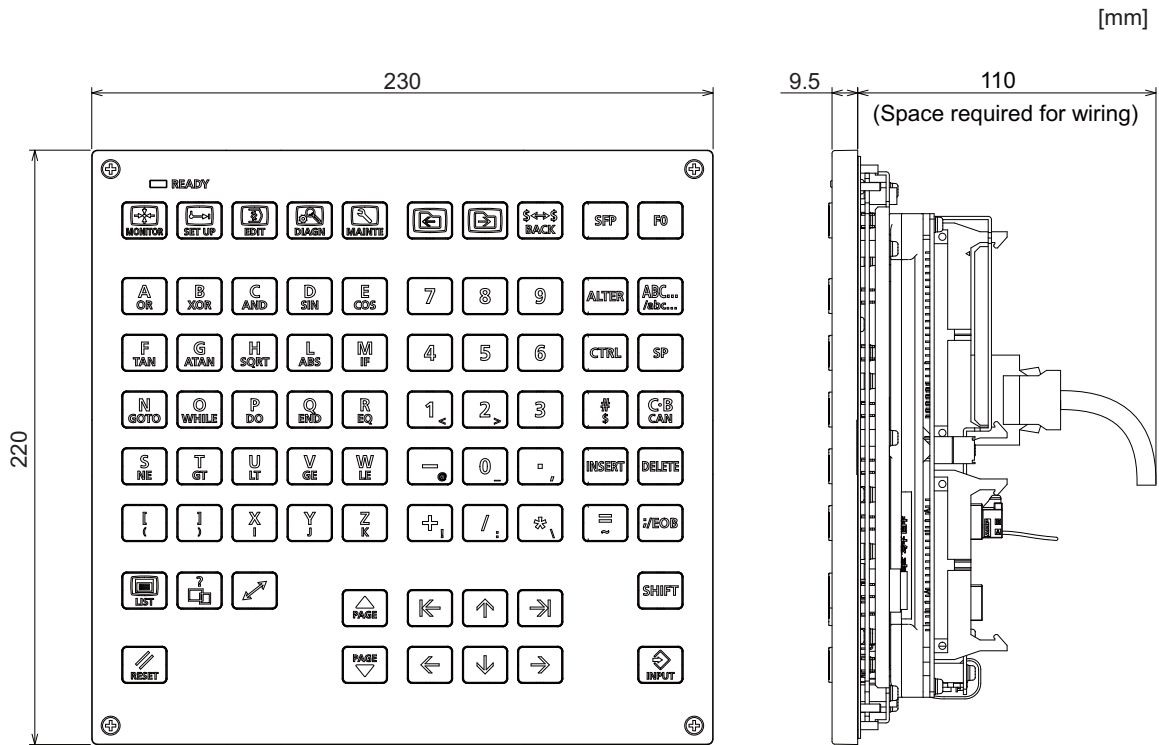
(Note) The above side view shows the state with the operation panel I/O unit mounted.

[Panel cut dimension]



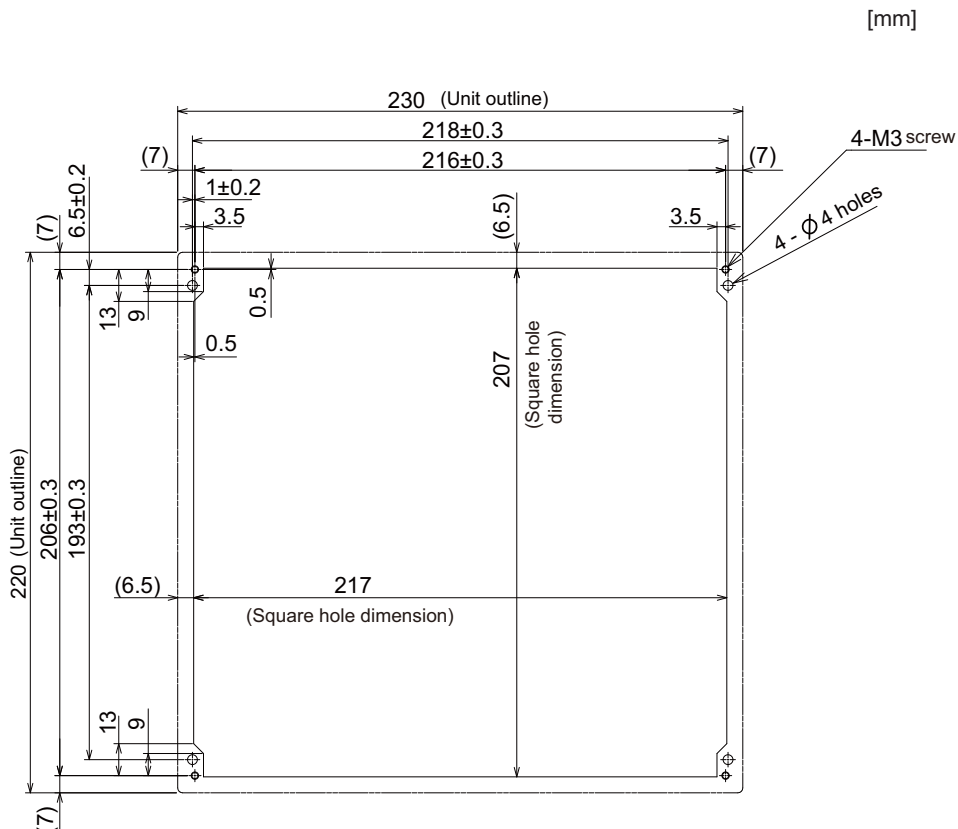
4.9.7 Keyboard for 10.4-type Display Unit (FCU8-KB048)

[Outline dimension]



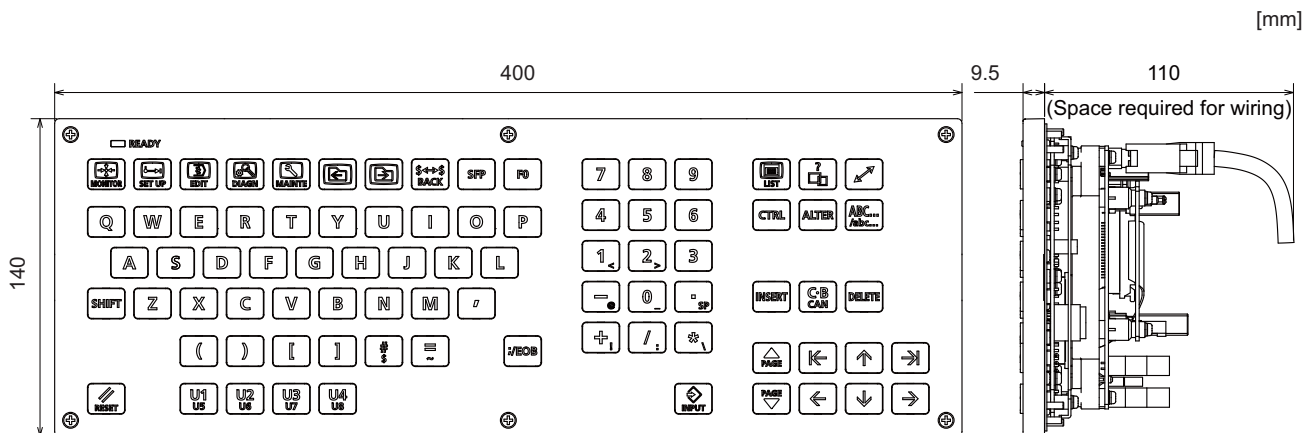
(Note) The above side view shows the state with the operation panel I/O unit mounted.

[Panel cut dimension]



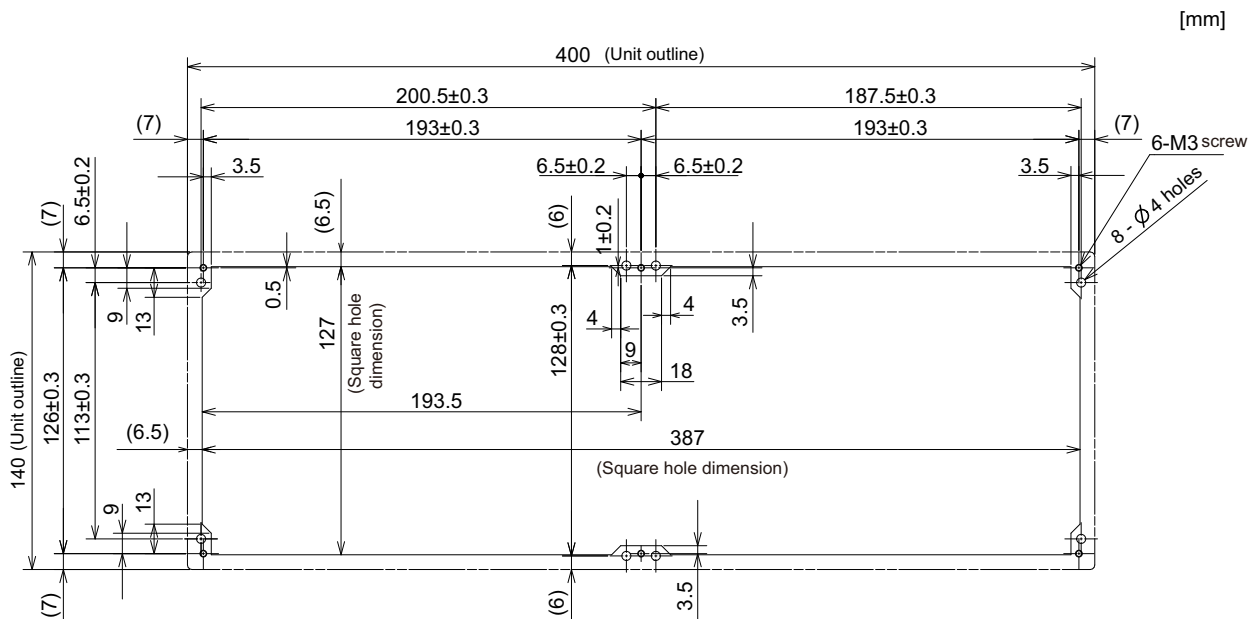
4.9.8 Keyboard for 15-type Display Unit (FCU8-KB083)

[Outline dimension]



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

[Panel cut dimension]



4.10 Operation Panel I/O Unit

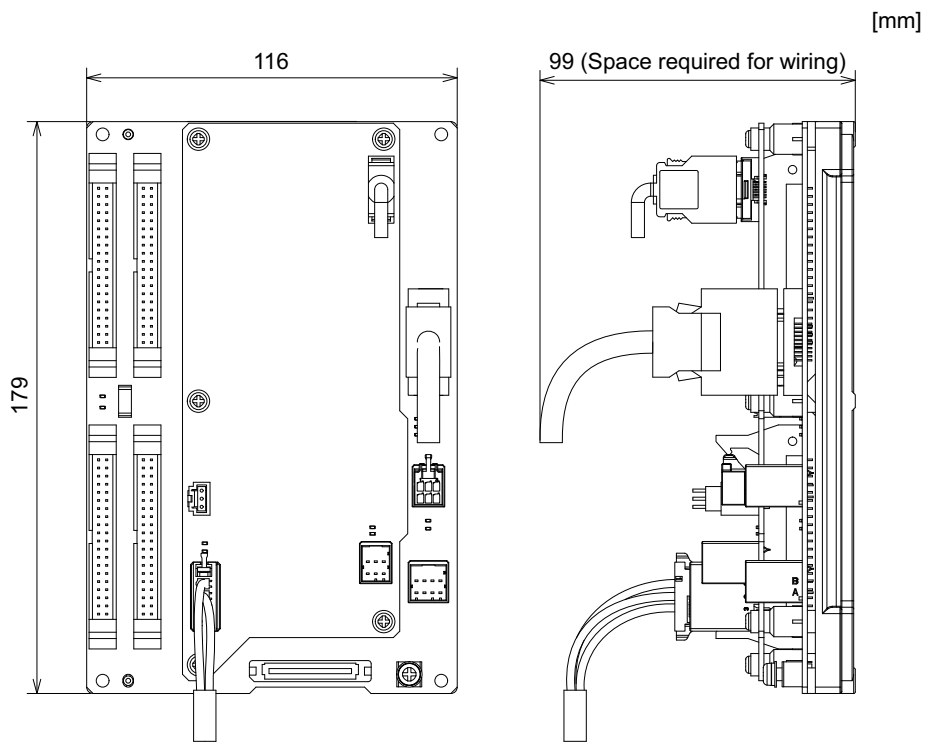
4.10.1 List of Units

Classification	Type	Components	Remarks
DI 24V/0V common input [64 points] DO Source output [64 points]	FCU8-DX830	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 64-points 24V/0V common type DO: 64-points source type (200mA/point) Manual pulse generator input: 3ch Display unit I/F Keyboard unit I/F Emergency stop input 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 (Note) J291 cable is required for connection with the personal computer unit. (for windows-based display)
DI 24V/0V common input [64 points] DO Source output [64 points] Scan input [64 points] Scan output [64 points]	FCU8-DX834 (Note)	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 64-points 24V/0V common type DO: 64-points source type (200mA/point) Scan input: 64 points Scan output: 64 points Manual pulse generator input: 3ch Display unit I/F Keyboard unit I/F Emergency stop input 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 (Note) J291 cable is required for connection with the personal computer unit. (for windows-based display)
DI 24V/0V common input [64 points] DO Source output [64 points] Safety DI 24V/0V common input [8 points]	FCU8-DX837	Base card Add-on card RIO 2.0 terminator connector (R2-TM)	DI: 64-points 24V/0V common type DO: 64-points source type (200mA/point) Safety DI: 8-points 0V common type Manual pulse generator input: 3ch Display unit I/F Keyboard unit I/F Emergency stop input 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 (Note) J291 cable is required for connection with the personal computer unit. (for windows-based display)
DI 24V/0V common input [64 points] DO Source output [64 points]	FCU8-DX730	Base card RIO 2.0 terminator connector (R2-TM)	DI: 64-points 24V/0V common type DO: 64-points source type (200mA/point) Manual pulse generator input: 3ch Graphic control unit I/F Keyboard unit I/F Remote I/O 2.0 I/F RIO occupied stations (fixed): 1, 2, 7 to 12, 20 to 22 RIO extensible stations: 3 to 6, 15 to 19, 23 to 64 (13 and 14 are occupied by the graphic control unit.) (Note) J010 cable is required for connection with the graphic control unit. (for non-Windows-based display)

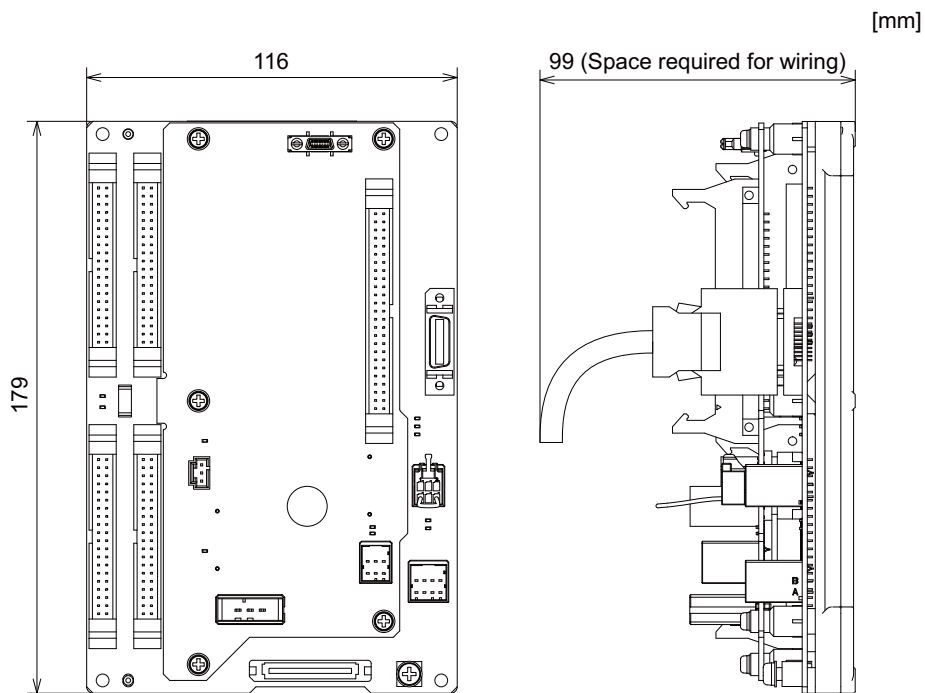
(Note) The connection method of DO (CG32/CG34) of FCU8-DX834 is different from other operation panel I/O units. Be careful not to connect to a wrong connector. See the descriptions mentioned in the later section for more specific explanation on connections.

4.10.2 FCU8-DX830 / FCU8-DX834 / FCU8-DX837 / FCU8-DX730

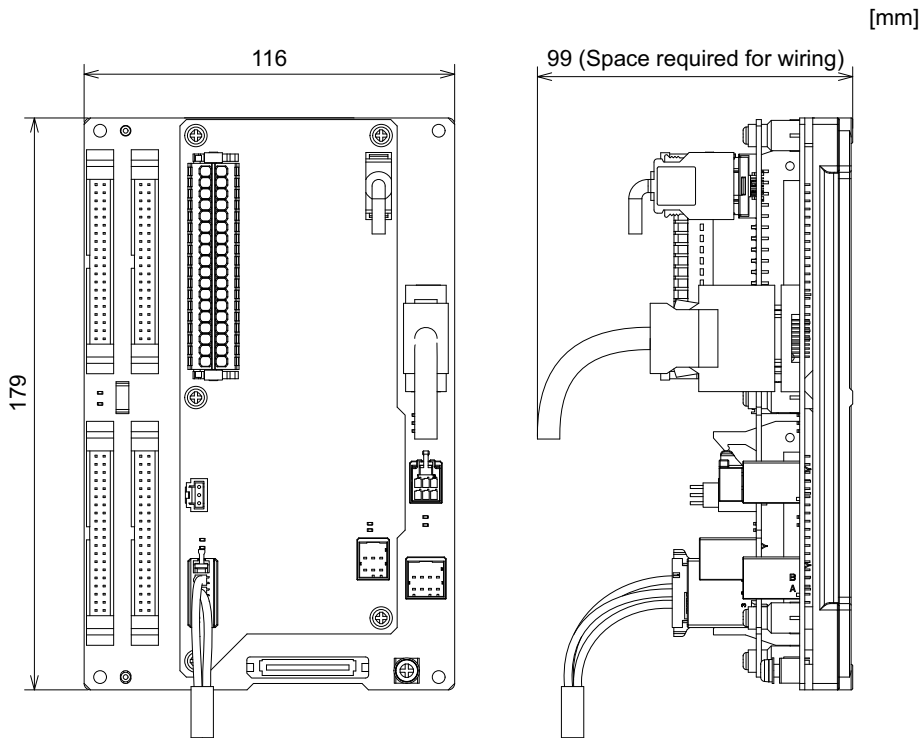
[Outline dimension : FCU8-DX830]



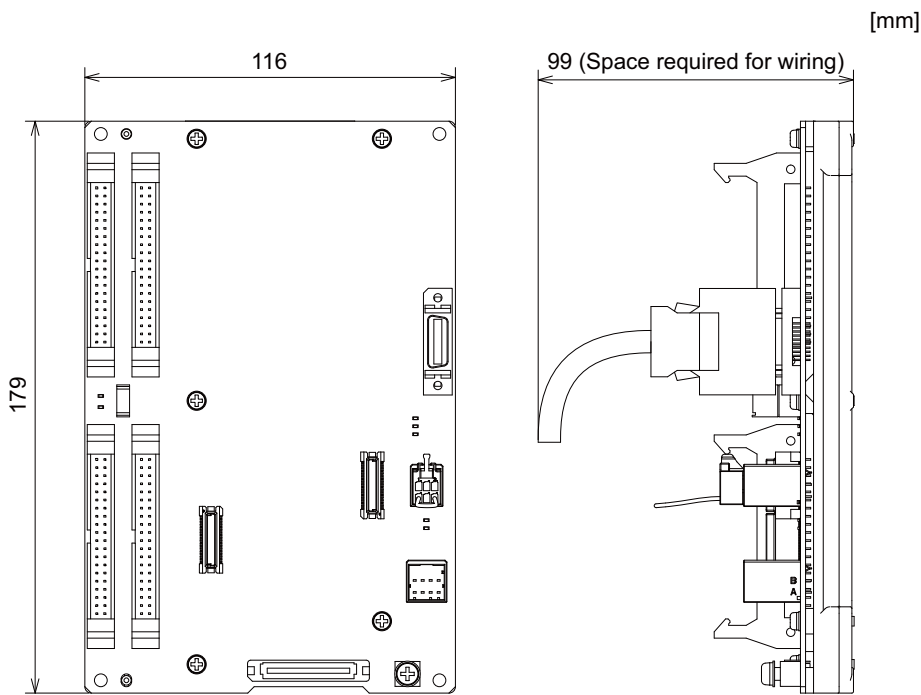
[Outline dimension : FCU8-DX834]



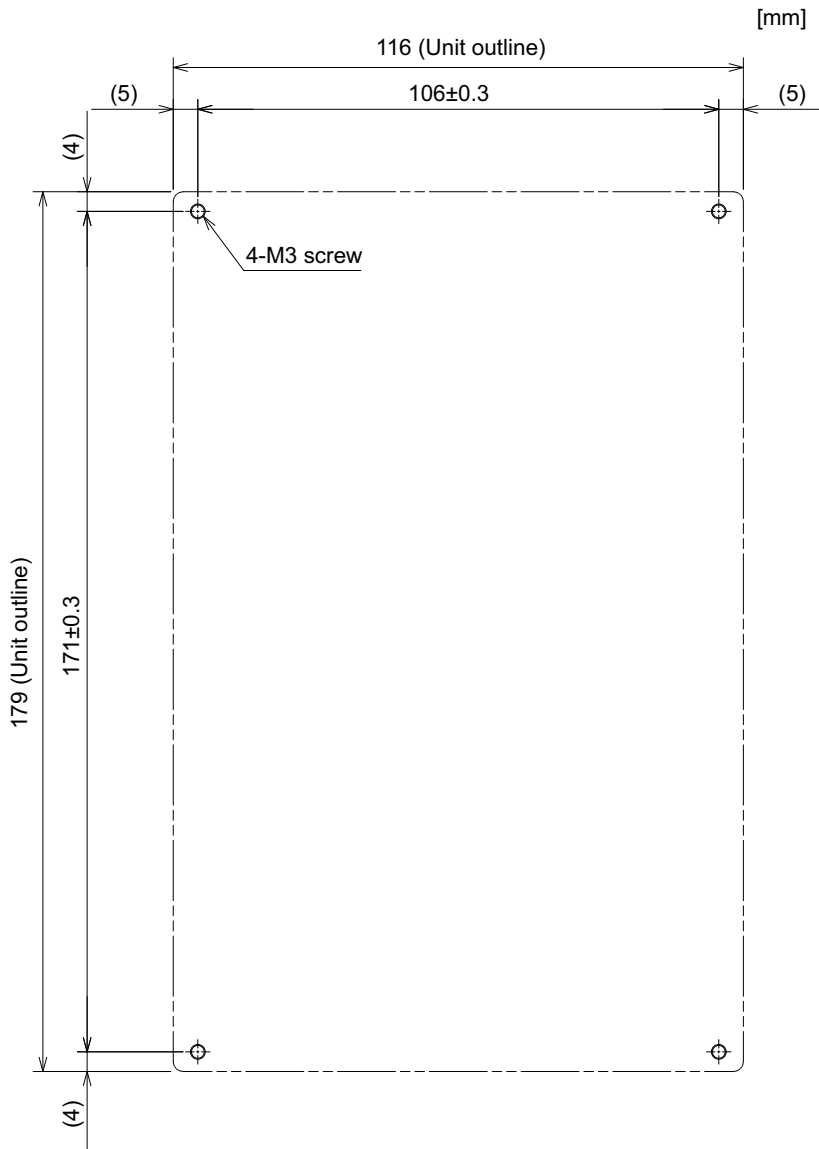
[Outline dimension : FCU8-DX837]



[Outline dimension : FCU8-DX730]

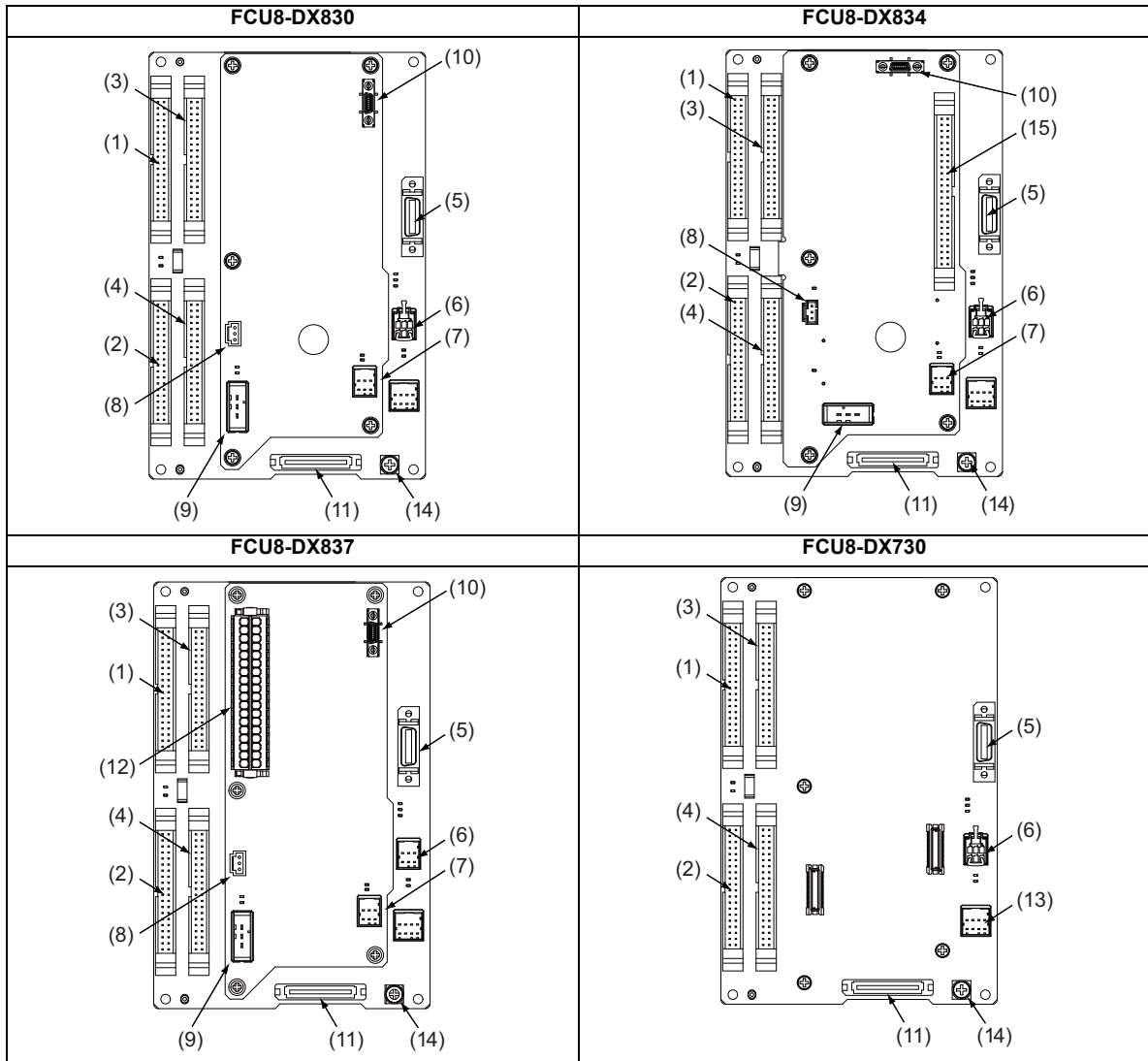


[Installation dimension : FCU8-DX830 / FCU8-DX834 / FCU8-DX837 / FCU8-DX730]



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

[Connector]



No.	Connector name	Function	No.	Connector name	Function
(1)	CG31	Machine signal input	(9)	DCIN	24VDC input
(2)	CG32	Machine signal output	(10)	KEYUSB	Personal computer unit connection
(3)	CG33	Machine signal input	(11)	NCKB	Keyboard I/F
(4)	CG34	Machine signal output	(12)	SDI	Safety machine input
(5)	MPG	Manual pulse generator input	(13)	CJ71	Graphic control unit I/F
(6)	RIO3EXT	Remote I/O 2.0 communication	(14)	FG	FG terminal
(7)	RIO3	Remote I/O 2.0 communication	(15)	OPKB	Scan input Scan output
(8)	EMG	Emergency stop connection			

(Note 1) CJ71 is only for FCU8-DX730.

⚠ CAUTION

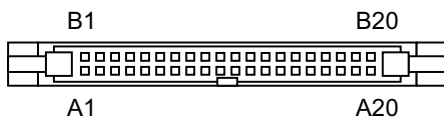
- ⚠ Do not apply any voltage to the connectors other than voltage specified in this manual. Failure to observe this could cause bursting, damage, etc.
- ⚠ Connect the cables to the designated connectors. Incorrect connections could damage the device.
- ⚠ 12V, 5V, and 3.3V output from connectors are to supply the power for dedicated peripheral devices. Do not use for other equipment to supply the power since we do not guarantee the NC operation by voltage down or noise sneaking.

(1) CG31 (Machine signal input)

Digital input 32 points (1st station)

(3) CG33 (Machine signal input)

Digital input 32 points (2nd station)



CG31						CG33					
B			A			B			A		
20		X200	20		X210	20		X220	20		X230
19		X201	19		X211	19		X221	19		X231
18		X202	18		X212	18		X222	18		X232
17		X203	17		X213	17		X223	17		X233
16		X204	16		X214	16		X224	16		X234
15		X205	15		X215	15		X225	15		X235
14		X206	14		X216	14		X226	14		X236
13		X207	13		X217	13		X227	13		X237
12		X208	12		X218	12		X228	12		X238
11		X209	11		X219	11		X229	11		X239
10		X20A	10		X21A	10		X22A	10		X23A
9		X20B	9		X21B	9		X22B	9		X23B
8		X20C	8		X21C	8		X22C	8		X23C
7		X20D	7		X21D	7		X22D	7		X23D
6		X20E	6		X21E	6		X22E	6		X23E
5		X20F	5		X21F	5		X22F	5		X23F
4		NC	4		NC	4		NC	4		NC
3		DICOM	3		DICOM	3		DICOM	3		DICOM
2		+24V	2		0V	2		+24V	2		0V
1		+24V	1		0V	1		+24V	1		0V

The input/output assignment is modifiable using a parameter. Refer to "20.6.4.2 Arbitrary Device Assignment" for details.

<Cable side connector type>

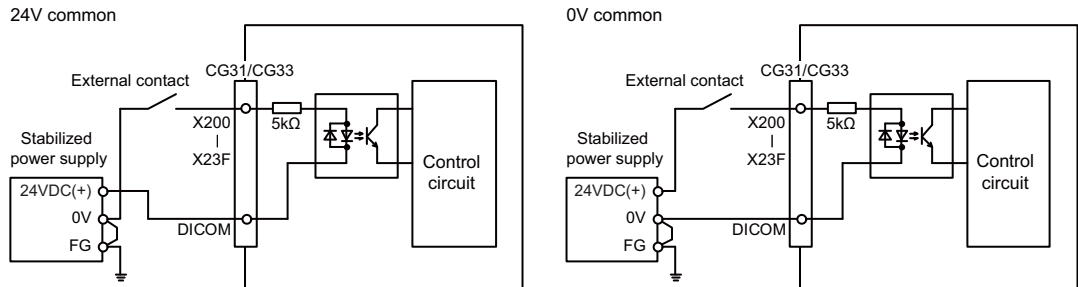
- Connector : XG4M-4030 / 7940-6500SC
- Strain relief : XG4T-4004 / 3448-7940
- Recommended manufacturer : OMRON / 3M

(a) Outline of digital signal input circuit

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

Follow the wiring diagram below for each type.

Input circuit

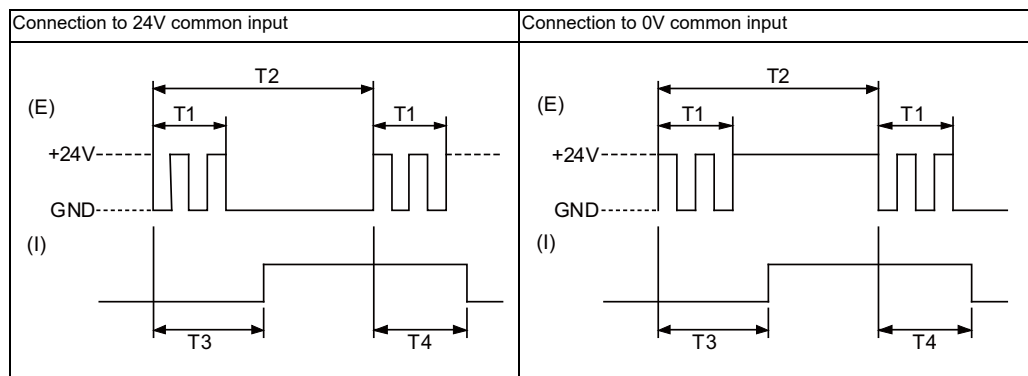


Input conditions

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

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

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



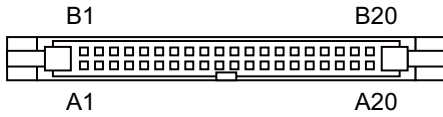
(E) : External signal, (I):Internal signal

(2) CG32 (Machine signal output)

Digital output 32 points (1st station)

(4) CG34 (Machine signal output)

Digital output 32 points (2nd station)



[FCU8-DX830 / FCU8-DX837 / FCU8-DX730]

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

[FCU8-DX834]

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

The input/output assignment is modifiable using a parameter. Refer to "20.6.4.2 Arbitrary Device Assignment" for details.

<Cable side connector type>

Connector : XG4M-4030 / 7940-6500SC

Strain relief : XG4T-4004 / 3448-7940

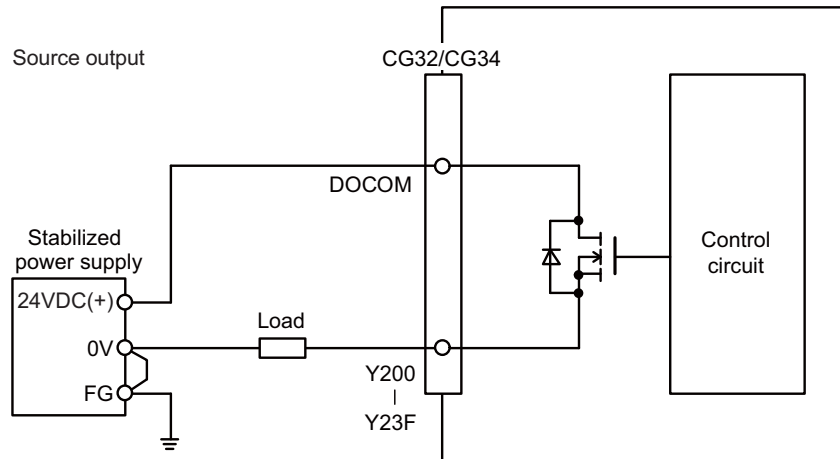
Recommended manufacturer : OMRON / 3M

(a) Outline of digital signal output circuit

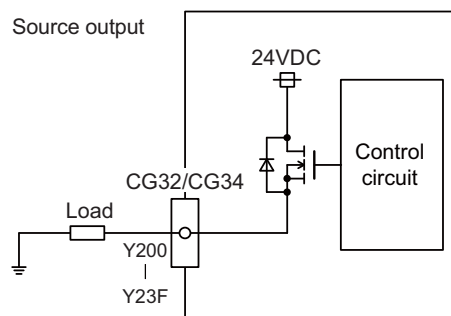
Use within the specification ranges shown below.

Output circuit

[FCU8-DX830 / FCU8-DX837 / FCU8-DX730]



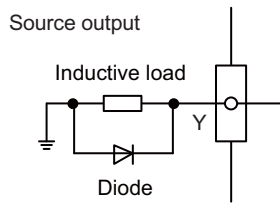
[FCU8-DX834]



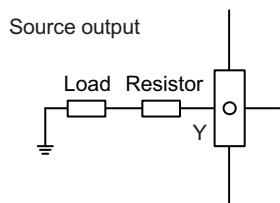
Output conditions

Insulation method	Non-insulation
Rated load voltage	24VDC
Max. output current	0.2A/point 3.8A or less in the whole unit
Output delay time	40μs

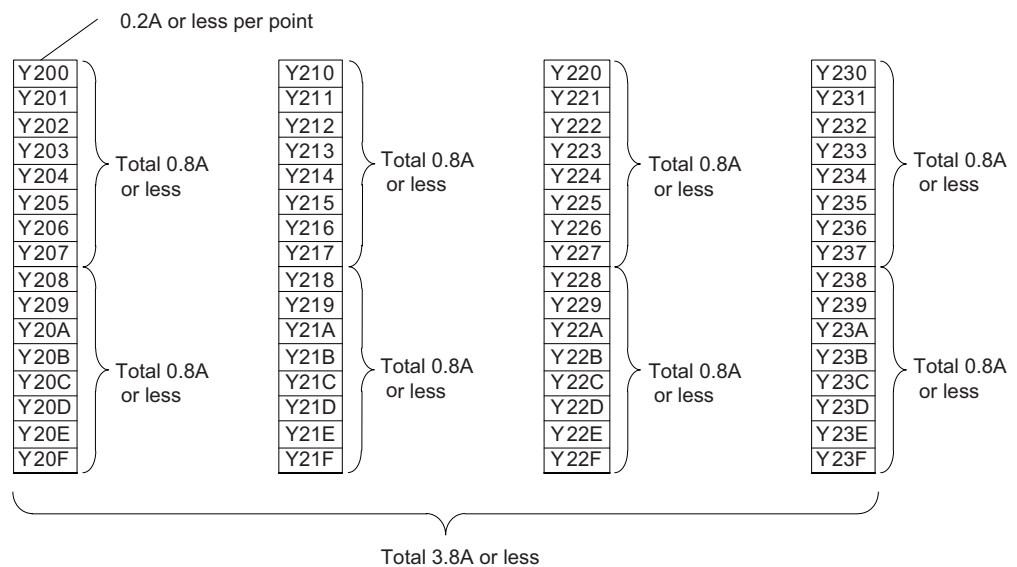
(Note 1) When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, twice or more the load current) in parallel to the load.



(Note 2) When the rush current exceeds the maximum output current, always connect a protective resistor ($R=150\Omega$) serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



(Note 3) 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 and Y238 to Y23F less than 0.8A.

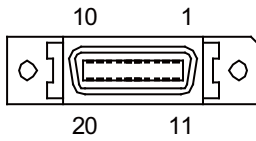


CAUTION

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.

(5) MPG (Manual pulse generator input)

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



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

- Connect connector case with FG pattern.

<Cable side connector type>

Plug : 10120-3000PE

Shell : 10320-52F0-008

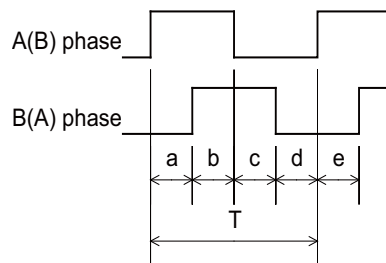
Recommended manufacturer : 3M

(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±0.05N·m)

<Specification of input part>

	5V manual pulse generator	12V 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 3.5V to 5.25V L level 0V to 0.5V	
Power supply voltage	5VDC±10%	12VDC±10%
Current consumption	100mA or less	
Number of pulses per rotation	25 pulse/rev, 100 pulse/rev	
Input frequency (rotation speed)	1kHz or less (2400r/min or less for 25pulse/rev, 600r/min or less for 100pulse/rev)	
Cable length	20m or less	50m or less

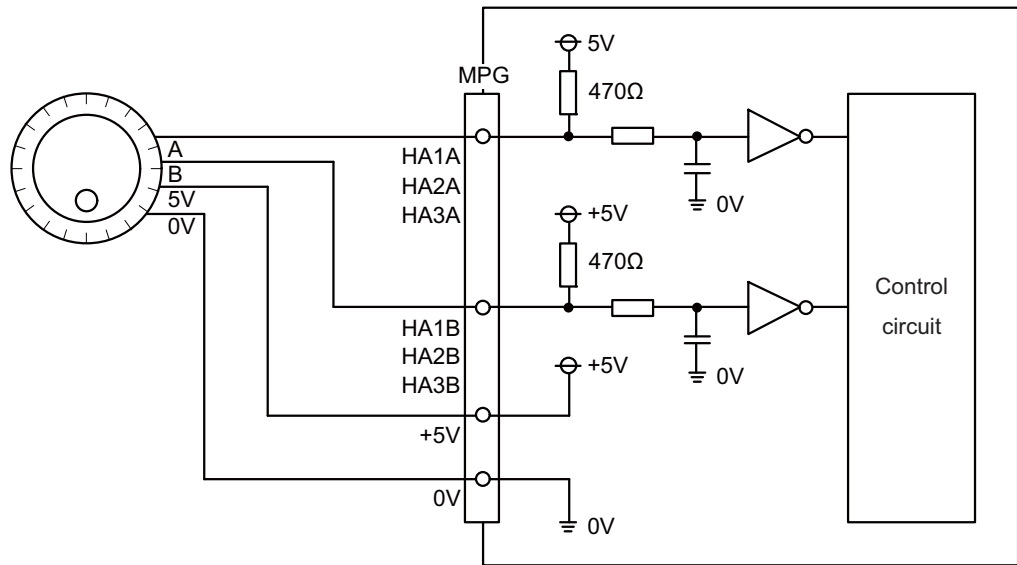


a.b.c.d.e: A phase or B phase rising edge (falling edge) phase difference = $T/4 \pm T/10$

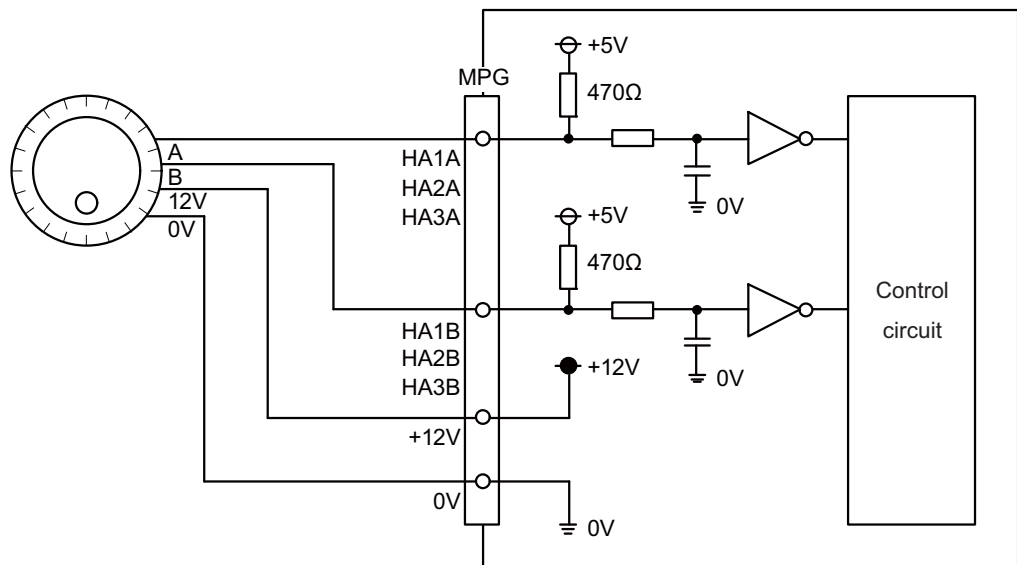
T: A or B phase cycle

<Input/output circuit>

(a) 5V manual pulse generator

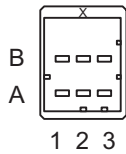


(b) 12V manual pulse generator



(6) RIO3EXT (Remote I/O 2.0 communication)

(7) RIO3 (Remote I/O 2.0 communication)



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

<Cable side connector type>

Connector : 1-1318119-3
 Contact : 1318107-1 x6
 Recommended manufacturer : Tyco Electronics

Refer to the following chart for the maximum number of connecting stations and I/O points to the connector RIO3.

Operation panel I/O unit type	Max. number of stations (RIO3 connection)	Max. number of I/O points (RIO3 connection)
FCU8-DX830/DX834/DX837	49 stations (5th, 6th, 15th to 19th, and 23rd to 64th stations can be used)	1568 points/ 1568 points

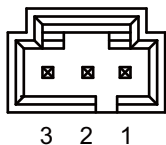
Refer to the following chart for the maximum number of connecting stations and I/O points to the connector RIO3EXT.

Operation panel I/O unit type	Max. number of stations (RIO3EXT connection)	Max. number of I/O points (RIO3EXT connection)
FCU8-DX730 (*)	51 stations (3rd to 6th, 15th to 19th, and 23rd to 64th stations can be used)	1632 points/ 1632 points

(*) FCU8-DX730 occupies 11 stations, but 13 stations are occupied in total since the graphic control unit occupies 2 stations.

(Note 1) Refer to the section "General Specifications: Remote I/O Unit" for the number of occupying stations and I/O points of remote I/O units.

(8) EMG (Emergency stop connection)



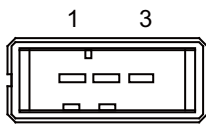
1		FG
2	I	EMG IN
3	O	+24V

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

<Cable side connector type>

Connector : 50-57-9403
 Contact : 0016020103
 Recommended manufacturer : MOLEX

(9) DCIN (24VDC input)



1	I	+24V
2		0V
3		FG

<Cable side connector type>

Connector : 2-178288-3

Contact : 1-175218-5

Recommended manufacturer : Tyco Electronics

(a) Specifications of power supply

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

[Stabilized power supply selection items]

Item		Standard setting
Output	Voltage fluctuation	±5% or less of 24VDC
	Ripple noise	200mV (P-P)
Power capacity		Calculate the current value as a reference of maximum current consumption for the unit which uses the power supply.
Output holding time		20ms
Overcurrent protection		Required

[Standards]

Safety Standards: UL1950, CSA C22.2 No.234 approved, IEC950 compliant

Noise Terminal Voltage: FCC Class A, VCCI-Class A

High Harmonics Current Restrictions: IEC61000-3-2

(Note) 24VDC voltage may drop instantaneously due to rush current at the beginning of 24V power supply to the 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

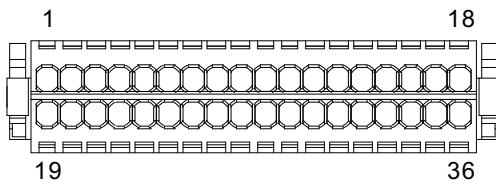
- Using a stabilized power supply without overcurrent protection may cause the unit's failure due to miswiring of 24V.

(10) KEYUSB (Personal computer unit connection)

(11) NCKB

(12) SDI (Safety machine input)

(Note) SDI is only for FCU8-DX837.



18	I	IO24VB	36		IO0VB
17	I	IO24VA	35		IO0VA
16	I	SX07B	34		COMB+
15	I	SX07A	33		COMA+
14	I	SX06B	32		COMB+
13	I	SX06A	31		COMA+
12	I	SX05B	30		COMB+
11	I	SX05A	29		COMA+
10	I	SX04B	28		COMB+
9	I	SX04A	27		COMA+
8	I	SX03B	26		COMB+
7	I	SX03A	25		COMA+
6	I	SX02B	24		COMB+
5	I	SX02A	23		COMA+
4	I	SX01B	22		COMB+
3	I	SX01A	21		COMA+
2	I	SX00B	20		COMB+
1	I	SX00A	19		COMA+

<Cable side connector type>

Connector : 713-1118/037-000

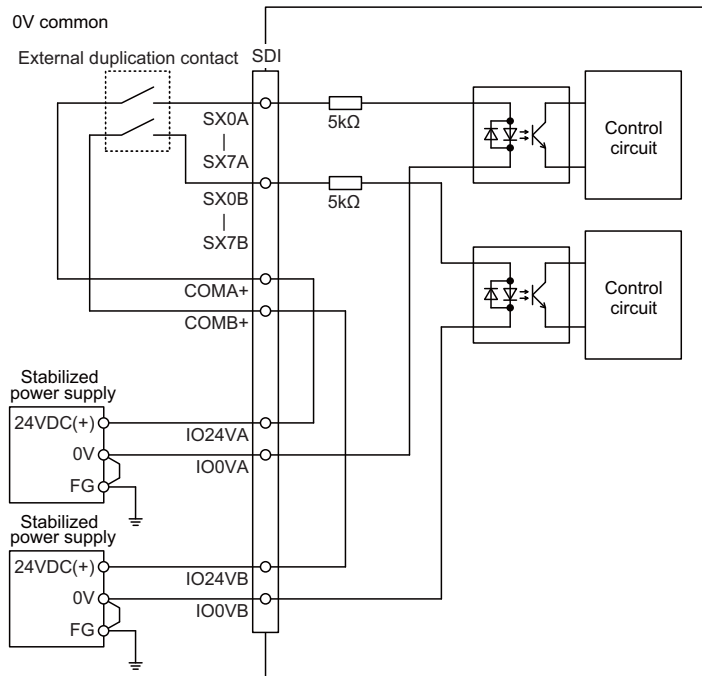
Recommended manufacturer : WAGO

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

(a) Outline of digital signal input circuit

Follow the wiring diagram below.

Input circuit



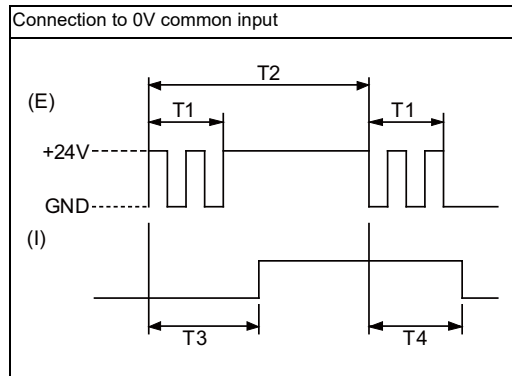
(Note) This circuit drawing is an example when two stabilized power supplies are used. Set up stabilized power supply depending on a performance level realized with a machine tool.

Input conditions

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

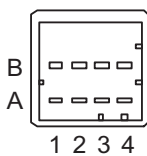
		0V common
1	Input voltage at external contact ON	18V or more, 25.2V or less
2	Input current at external contact ON	3mA or more
3	Input voltage at external contact OFF	3.8V or less
4	Input current at external contact OFF	0.7mA or less
5	Input resistance	5kΩ
6	Tolerable chattering time (T1)	3ms
7	Input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

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



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

(13) CJ71 (Graphic control unit I/F)



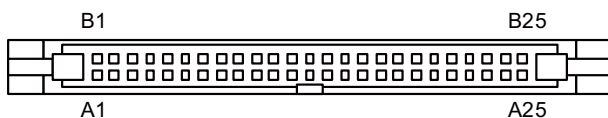
A1	I/O	TXRXD	B1	I/O	TXRXD*
A2	-	+5V	B2	-	+3.3V
A3	-	-	B3	-	0V
A4	-	FG	B4	-	0V

<Cable side connector type>

Connector : 2-1318119-4
Contact : 1318107-1
Recommended manufacturer : Tyco Electronics

(14) FG (FG terminal)

(15) OPKB (Scan input, Scan output)



OPKB					
B			A		
25		0V	25		0V
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		0V	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		0V

<Cable side connector type>

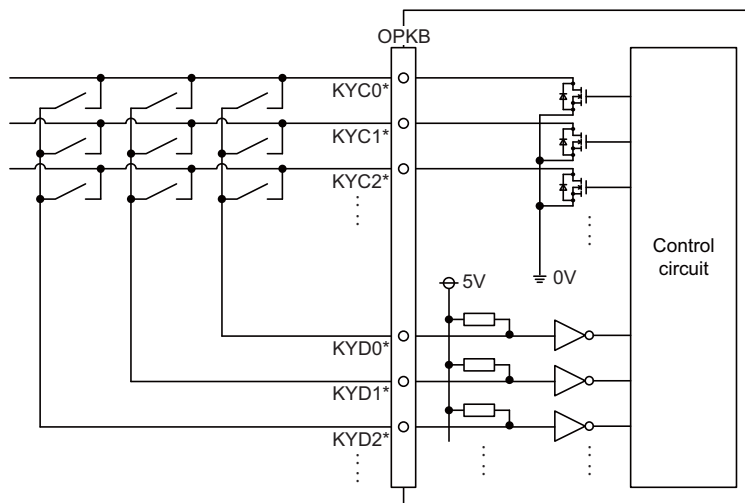
Connector : XG4M-5030 / 7950-6500SC

Strain relief : XG4T-5004 / 3448-7950

Recommended manufacturer : OMRON / 3M

(a) Outline of scan input circuit

Input circuit



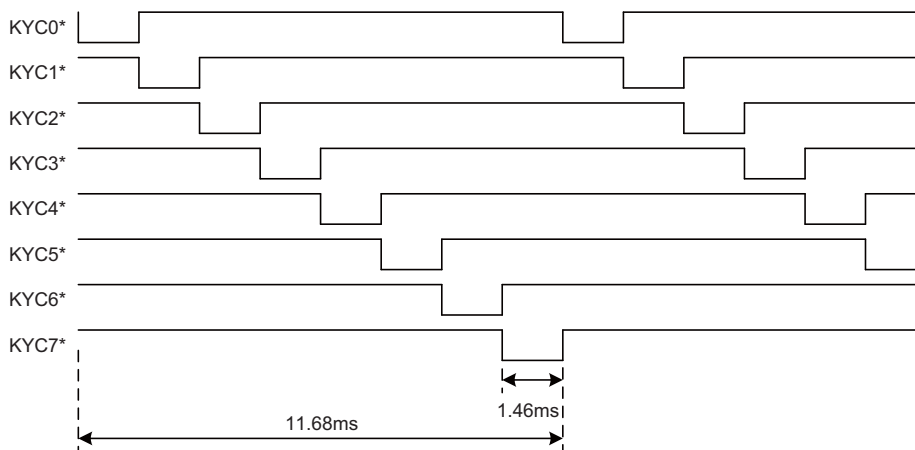
Input conditions

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)

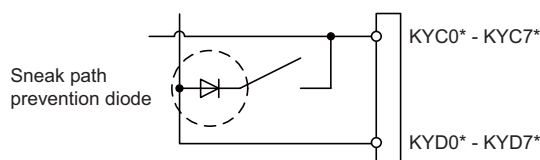
(*1) Note that "11.68 ms or more" is a guide of the "Input signal holding time". The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.

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

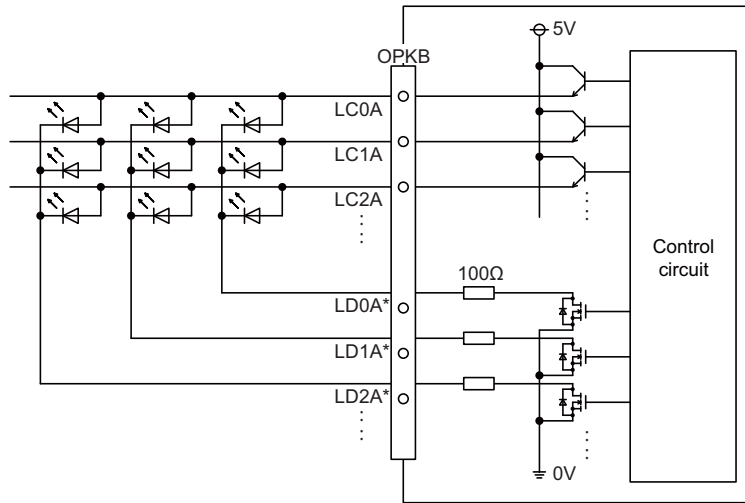


(Note) To perform a scan input, connect a sneak path prevention diode as illustrated below. Input signals may not be read correctly without the sneak path prevention diode.



(b) Outline of scan output circuit

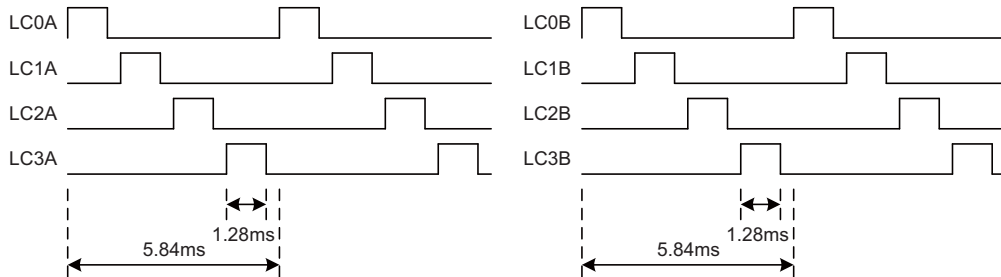
Output circuit



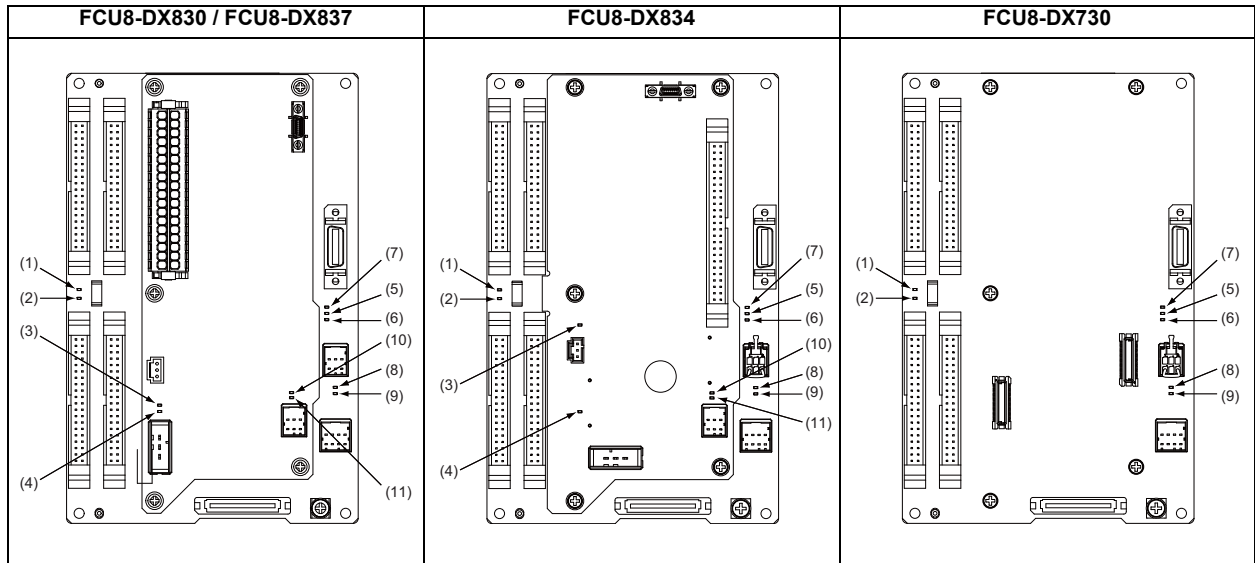
Output conditions

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.



[LED]



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 24VDC input (DOCOM) of CG32/CG34 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)	24VDCIN	Energization status of 24VDC input of DCIN connector	Green	Lit	Not lit	Lit when a current is applied.
(5)	5VIN	5V power supply circuit status	Green	Lit	Not lit	Lit when the circuit is normally operated.
(6)	3VIN	3.3V power supply circuit status	Green	Lit	Not lit	Lit when the circuit is normally operated.
(7)	12VON	12V 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.

4.11 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.

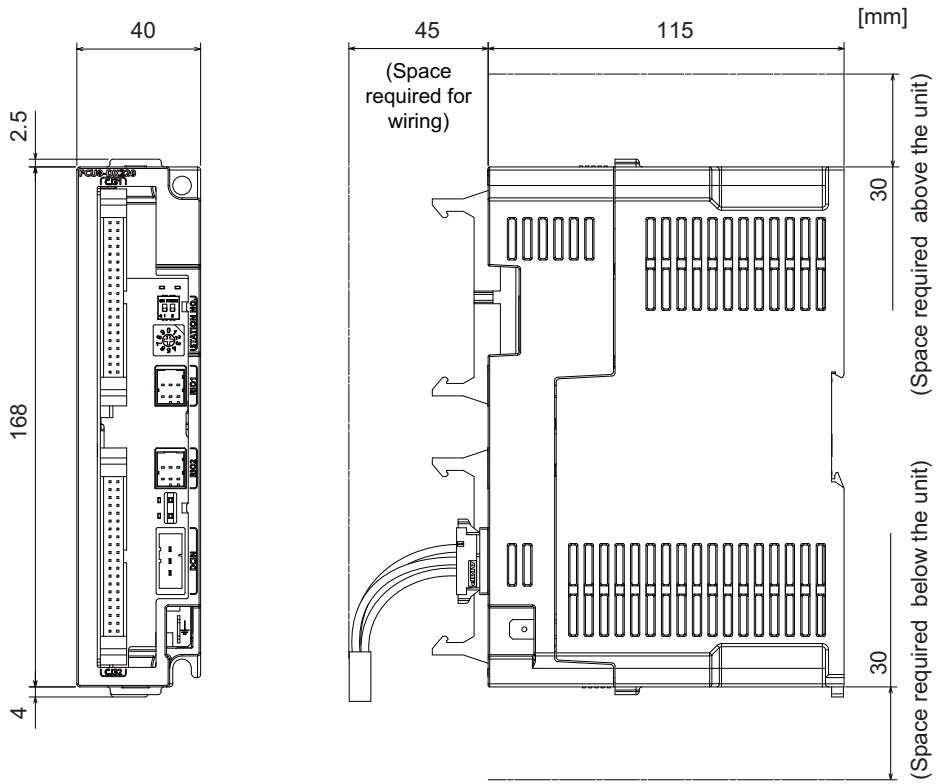
(Note) The maximum connectable number of remote I/O units is 32.

4.11.1 List of Units

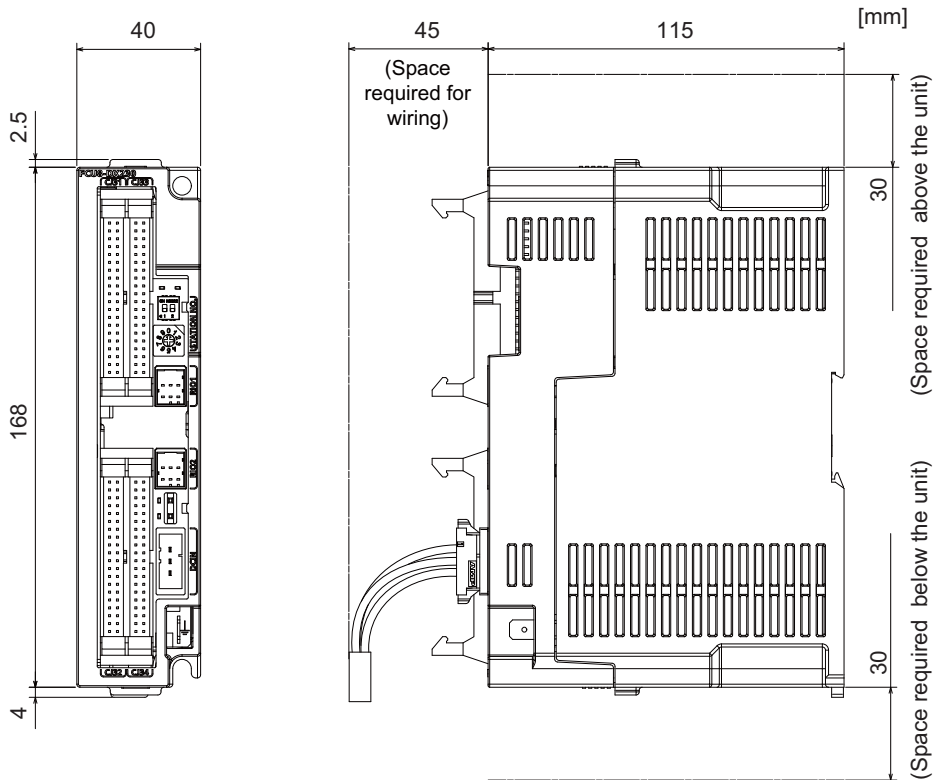
Classification	Type	Components	Remarks
DI 24V/0V common input [32 points] DO Source output [32 points]	FCU8-DX220	Base card RIO 2.0 connector set	DI: 32-points 24V/0V common type Do: 32-points source type (200mA/point) Number of occupied stations: 1
DI 24V/0V common input [64 points] DO Source output [48 points]	FCU8-DX230	Base card RIO 2.0 connector set	DI: 64-points 24V/0V common type DO: 48-points source type (200mA/point) Number of occupied stations: 2
DI 24V/0V common input DO Source output [48 points] AO Analog output [1 point]	FCU8-DX231	Base card RIO 2.0 connector set	DI: 64-points 24V/0V common type DO: 48-points source type (200mA/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 0V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213	Base card RIO 2.0 connector set	DI: 16-points 0V common type (3mA/point) DO: 8-points source type (2A/point) Number of occupied stations: 1
DI 0V common input [16 points] DO Source output (large capacity) [8 points]	FCU8-DX213-1	Base card RIO 2.0 connector set	DI: 16-points 0V common type (9mA/point) DO: 8-points source type (2A/point) Number of occupied stations: 1
Safety DI 0V common input [8 points] Safety DO Source output (large capacity) [4 points]	FCU8-DX654	Base card RIO 2.0 connector set	Safety DI: 8-points 0V common type (3mA/point) Safety DO: 4-points source type (2A/point) Number of occupied stations: 2
Safety DI 0V 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-points 0V common type (9mA/point) Safety DO: 4-points source type (2A/point) Number of occupied stations: 2
DI 24V/0V common input [32points] DO Source output [32 points] Safety DI 0V common input [8 points] (Note 1) Safety relay output [4 points] (Note 2)	FCU8-DX651	Base card Add-on card RIO 2.0 connector set	DI: 32-points 24V/0V common type Do: 32-points source type (200mA/point) Safety DI: 8-points 0V common type Safety relay: 4-points (non-voltage contact) Relay contact welding detection Number of occupied stations: 3 (Note 1) Safety DI uses 16 points of terminal because of the duplication wiring. (Note 2) Safety relay output uses 8 points of terminal because of the duplication wiring.
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] (Note 3)	FCU8-DX409	Base card RIO 2.0 connector set	Multi-analog input: 4 points (Note 3) Voltage input, current input, thermocouple input and resistance temperature detector input are selected for each CH. Number of occupied stations: 4

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

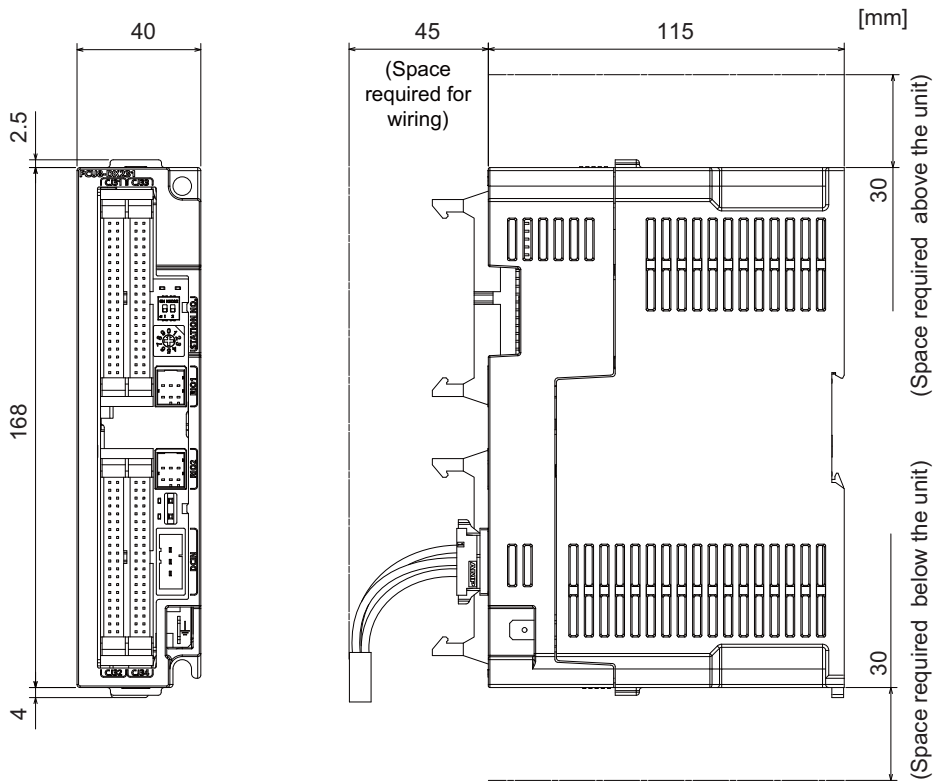
[Outline dimension : FCU8-DX220]



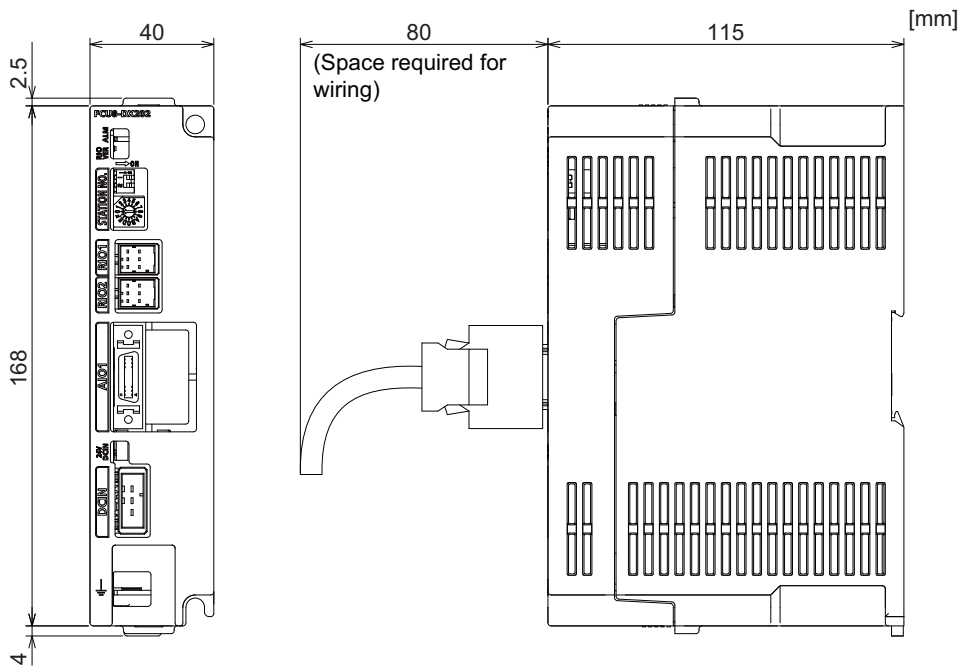
[Outline dimension : FCU8-DX230]



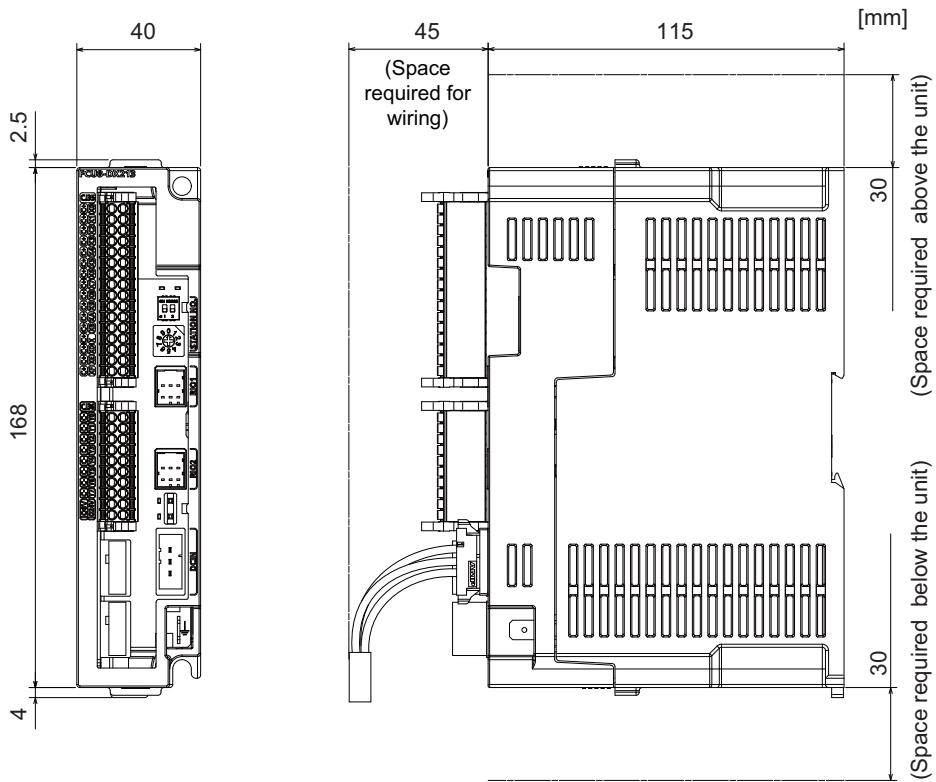
[Outline dimension : FCU8-DX231]



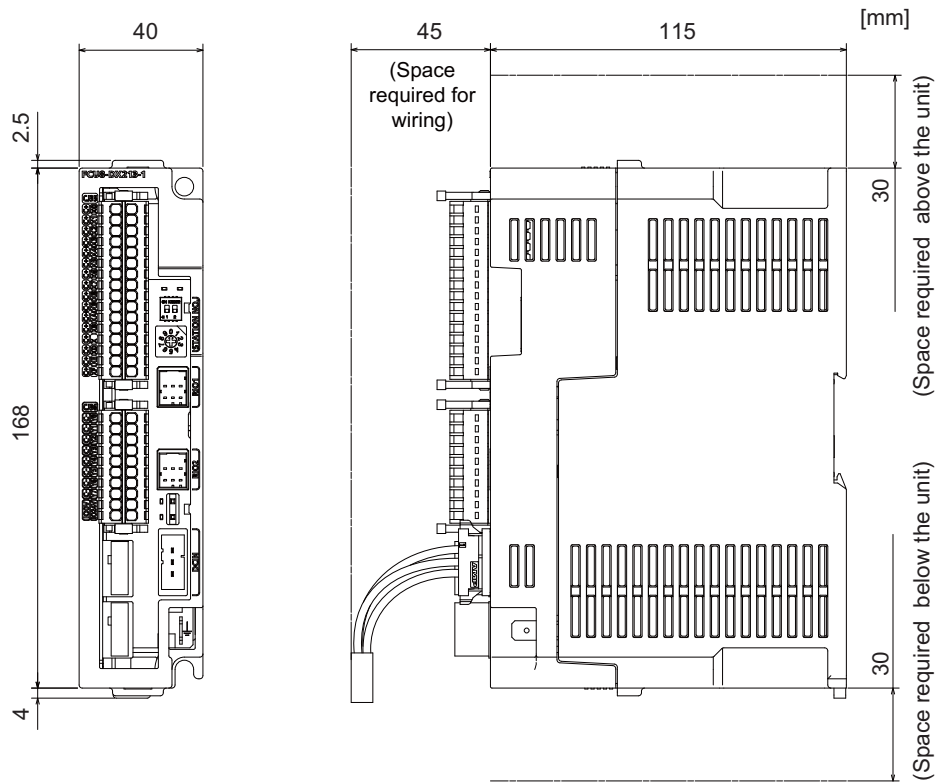
[Outline dimension : FCU8-DX202]



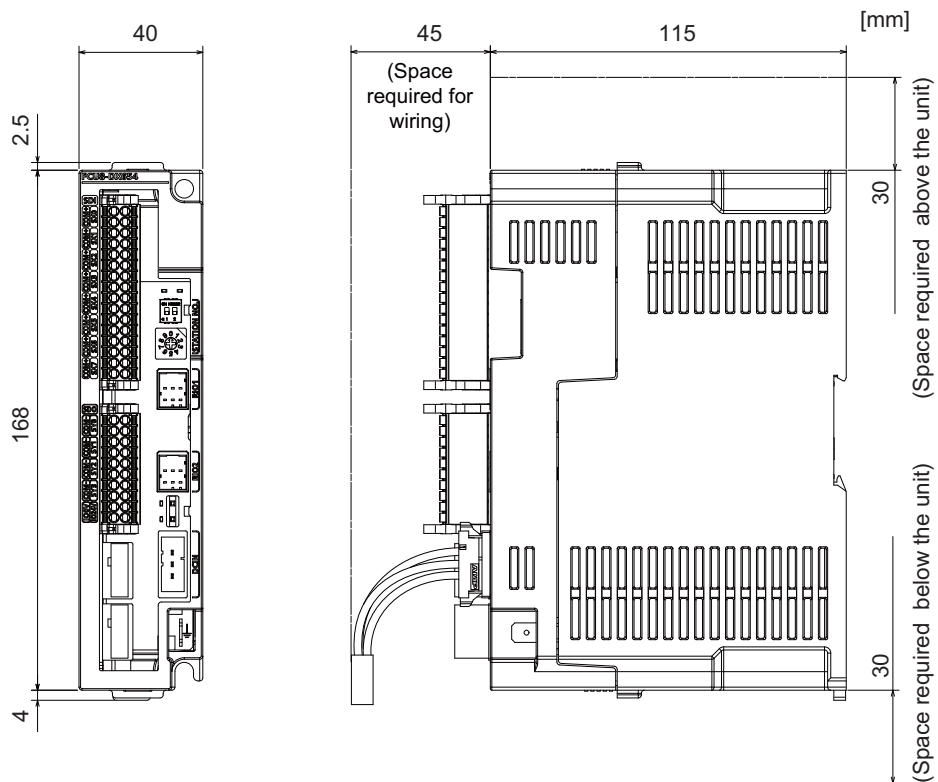
[Outline dimension : FCU8-DX213]



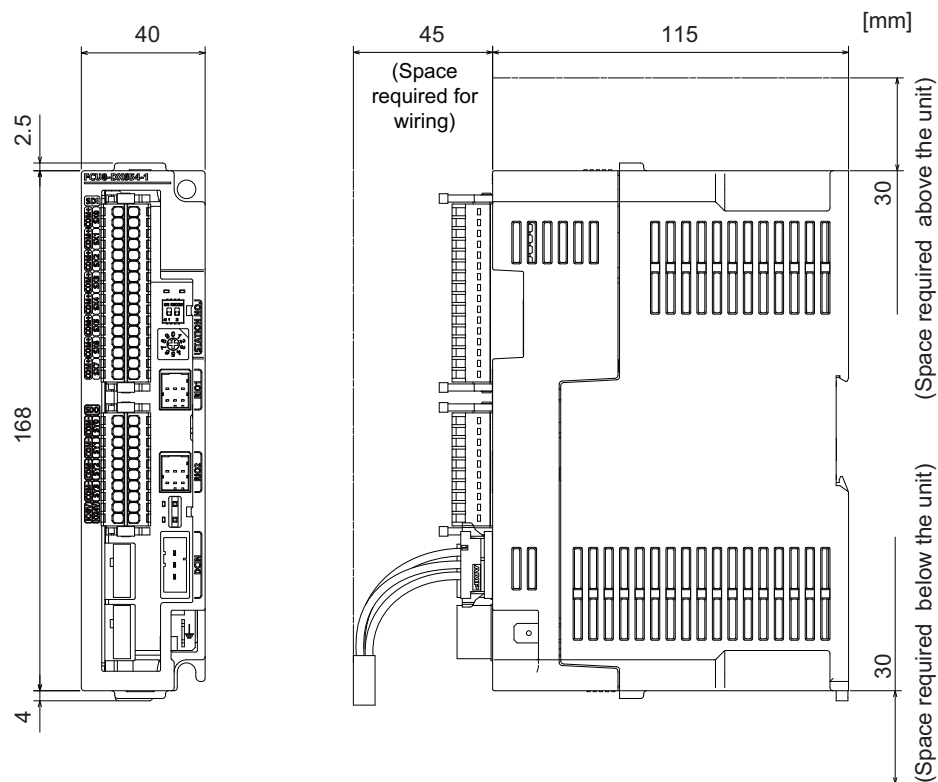
[Outline dimension : FCU8-DX213-1]



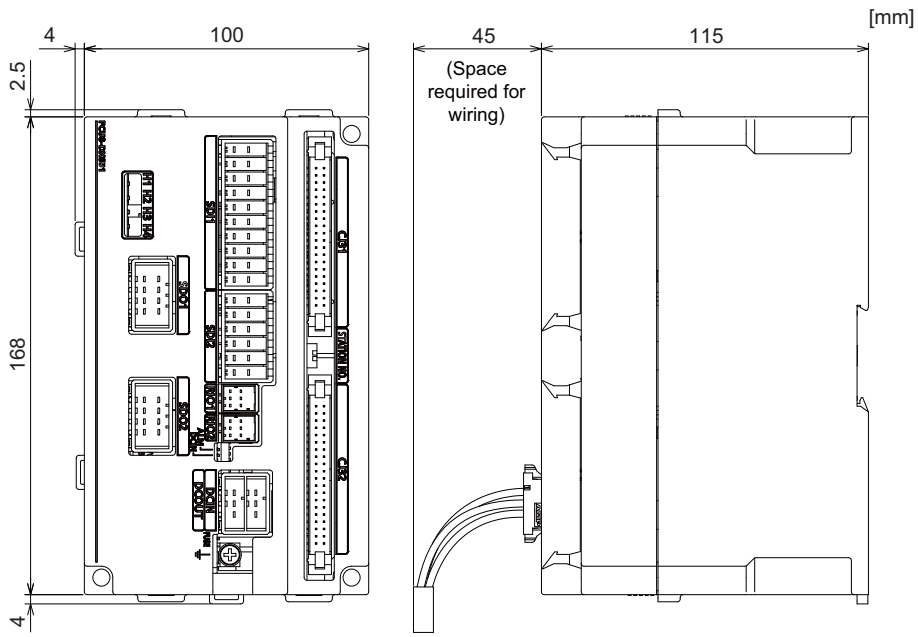
[Outline dimension : FCU8-DX654]



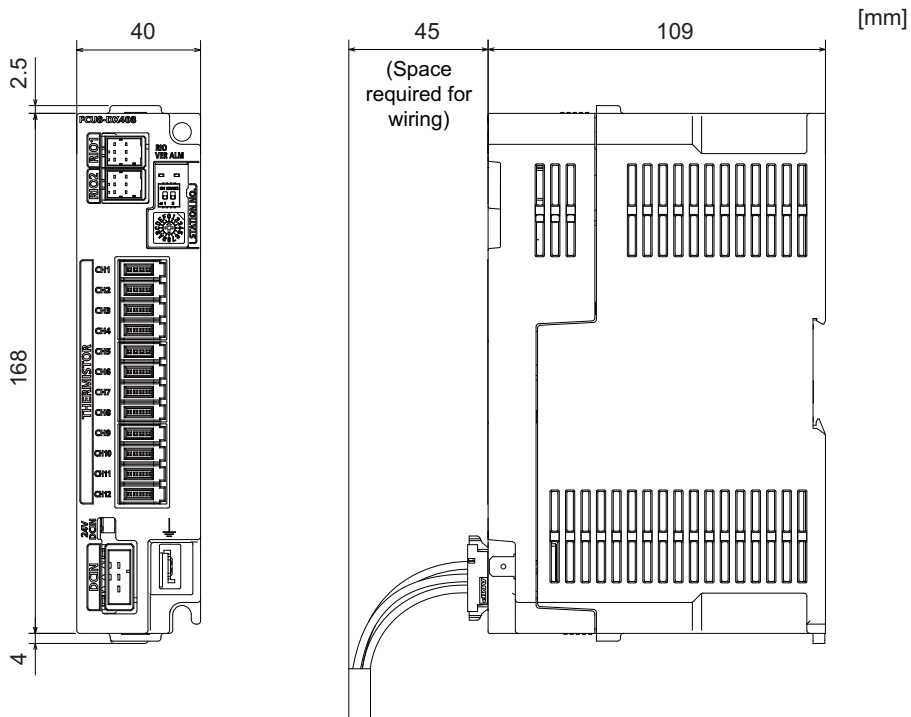
[Outline dimension : FCU8-DX654-1]



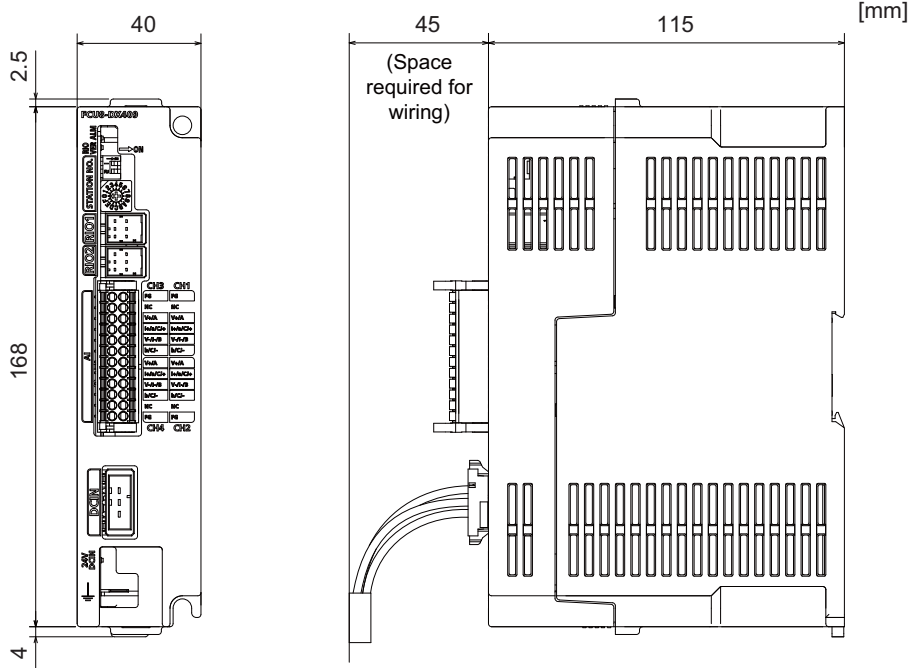
[Outline dimension : FCU8-DX651]



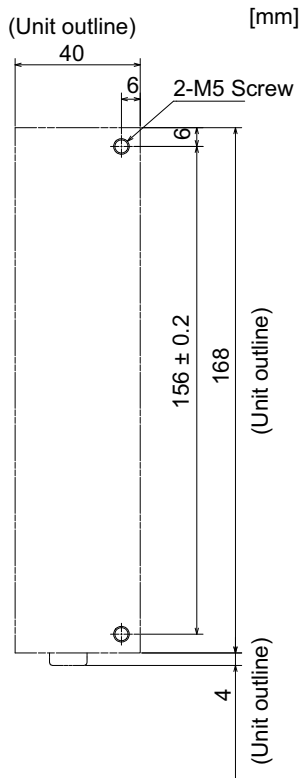
[Outline dimension : FCU8-DX408]



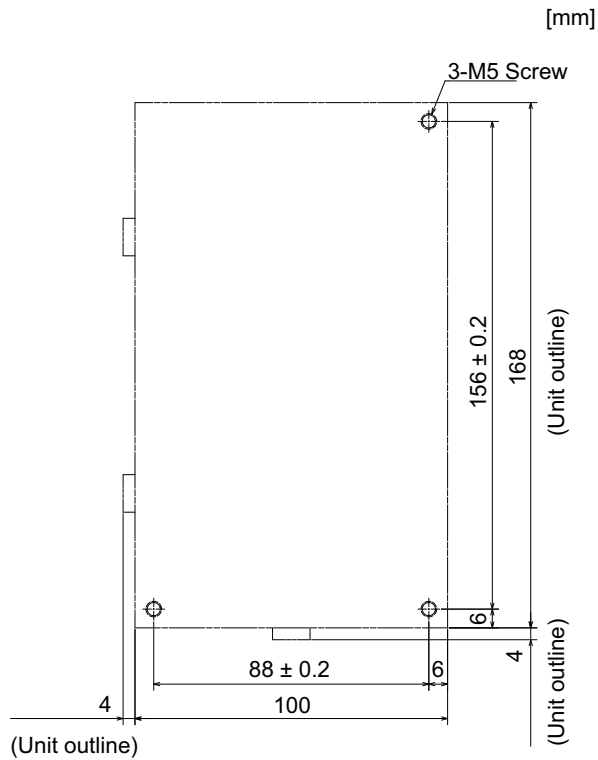
[Outline dimension : FCU8-DX409]



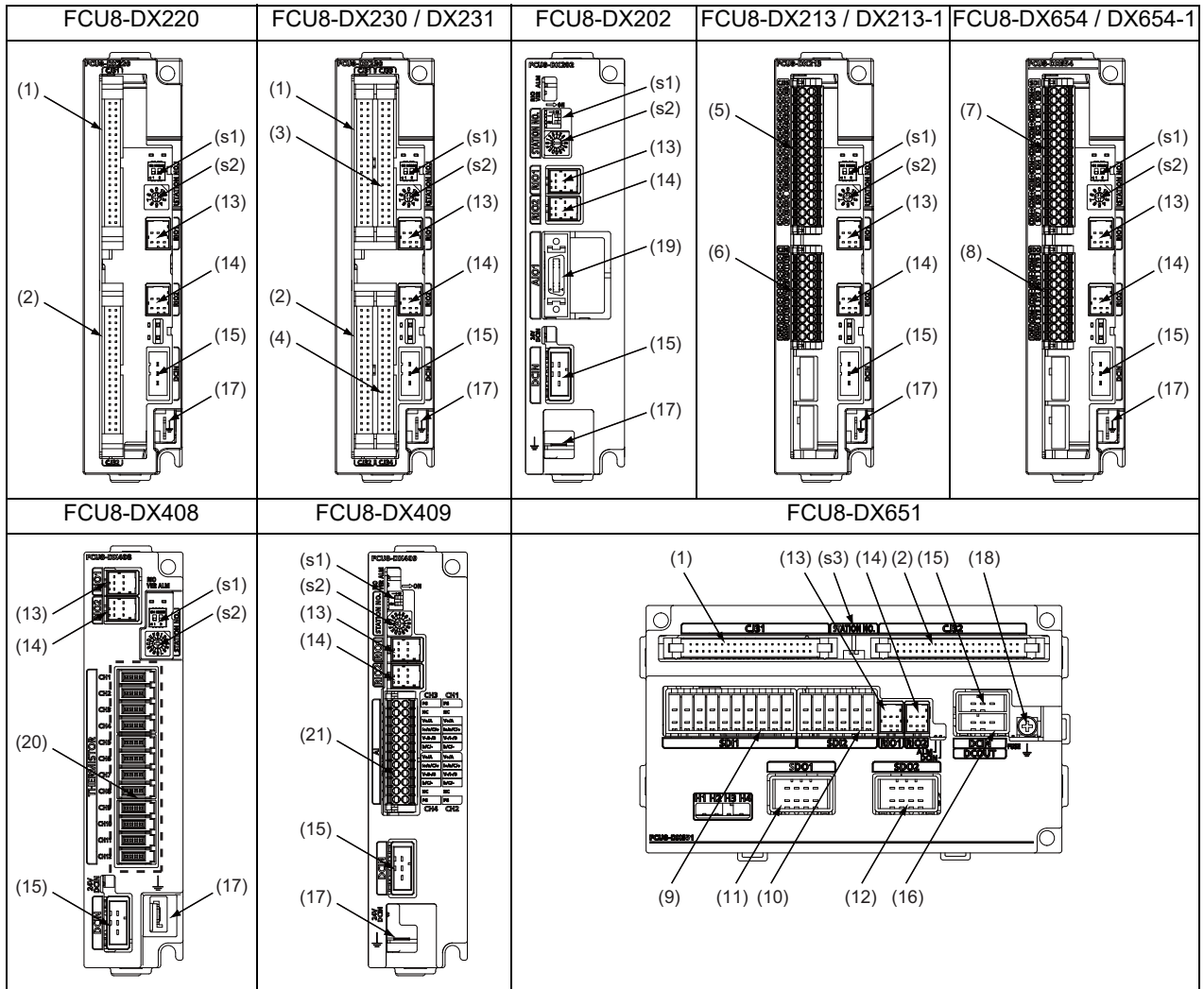
[Installation dimension : FCU8-DX220 / FCU8-DX230 / FCU8-DX231 / FCU8-DX202 /
FCU8-DX213 / FCU8-DX213-1 / FCU8-DX654 / FCU8-DX654-1 / FCU8-DX408 / FCU8-DX409]



[Installation dimension : FCU8-DX651]



[Connector]



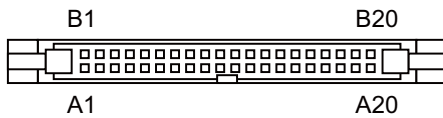
No.	Connector name	Function	No.	Connector name	Function
(1)	CJ31	Machine signal input	(12)	SDO2	Safety relay output
(2)	CJ32	Machine signal output	(13)	RIO1	Remote I/O 2.0 communication
(3)	CJ33	Machine signal input	(14)	RIO2	Remote I/O 2.0 communication
(4)	CJ34	Machine signal output	(15)	DCIN	24VDC input
(5)	CJ35	Machine signal input	(16)	DCOUT	24VDC output
(6)	CJ36	Machine signal output	(17)	FG	FG terminal
(7)	SDI	Safety machine signal input	(18)	FG	FG terminal (M4 screw)
(8)	SDO	Safety machine signal output	(19)	AIO1	Analog input Analog output
(9)	SDI1	Safety DI input	(20)	THERMISTOR	Thermistor input
(10)	SDI2	Safety DI input	(21)	AI	Multi-analog input
(11)	SDO1	Safety relay output			

No.	Switch name	Function
(s1)		Station No. group setting switch
(s2)	STATION No.	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.
- ⚠ Connect the cables to the designated connectors. Incorrect connections could damage the device.
- ⚠ 12V, 5V, and 3.3V output from connectors are to supply the power for dedicated peripheral devices. Do not use for other equipment to supply the power since we do not guarantee the NC operation by voltage down or noise sneaking.

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



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

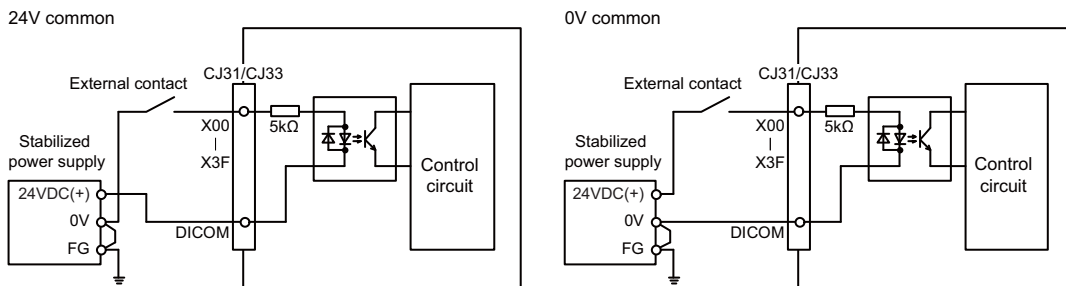
<Cable side connector type>

- Connector : XG4M-4030 / 7940-6500SC
- Strain relief : XG4T-4004 / 3448-7940
- Recommended manufacturer : OMRON / 3M

(a) Outline of digital signal input circuit

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

Input circuit

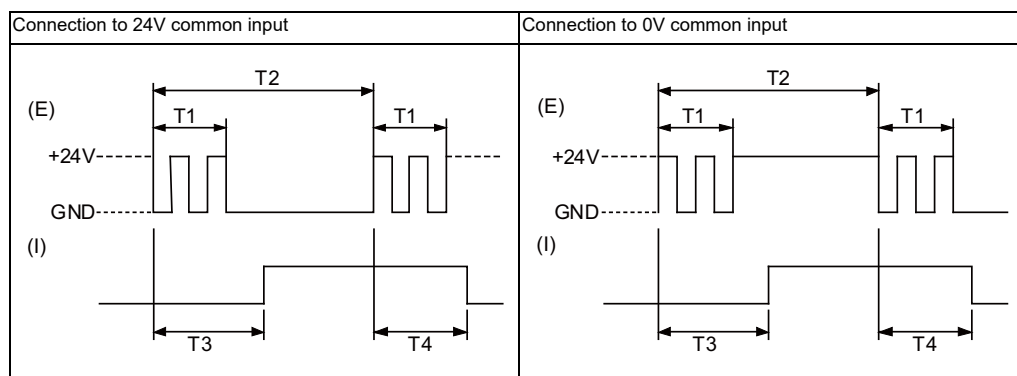


Input conditions

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

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

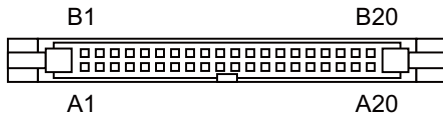
(*1) Note that "40 ms or more" is a guide of the "Input signal holding time". The input signal is recognized only when its "ON" state is held longer than the ladder processing cycle time.



(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		+24V	2		0V	2		+24V	2		0V	2		+24V	2		0V
1		+24V	1		0V	1		+24V	1		0V	1		+24V	1		0V

<Cable side connector type>

Connector : XG4M-4030 / 7940-6500SC

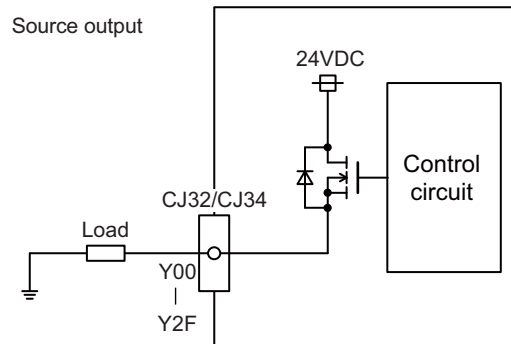
Strain relief : XG4T-4004 / 3448-7940

Recommended manufacturer : OMRON / 3M

(a) Outline of digital signal output circuit

Use within the specification ranges shown below.

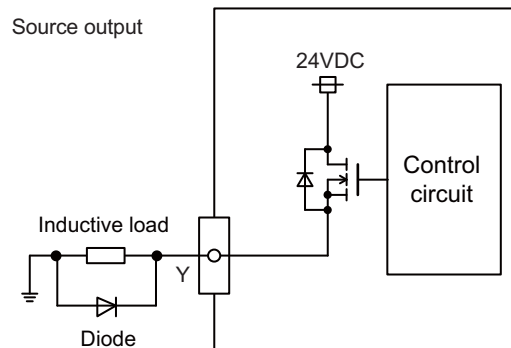
Output circuit



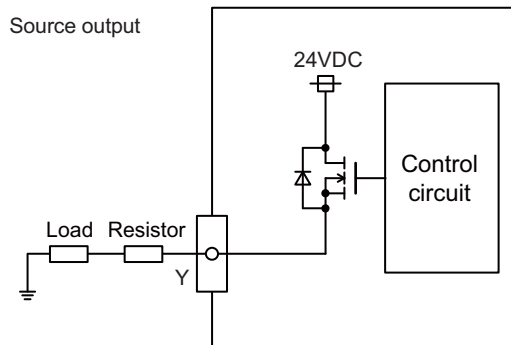
Output conditions

Insulation method	Non-insulation
Rated load voltage	24VDC
Max. output current	0.2A/point 3.2A or less in the whole unit
Output delay time	40μs

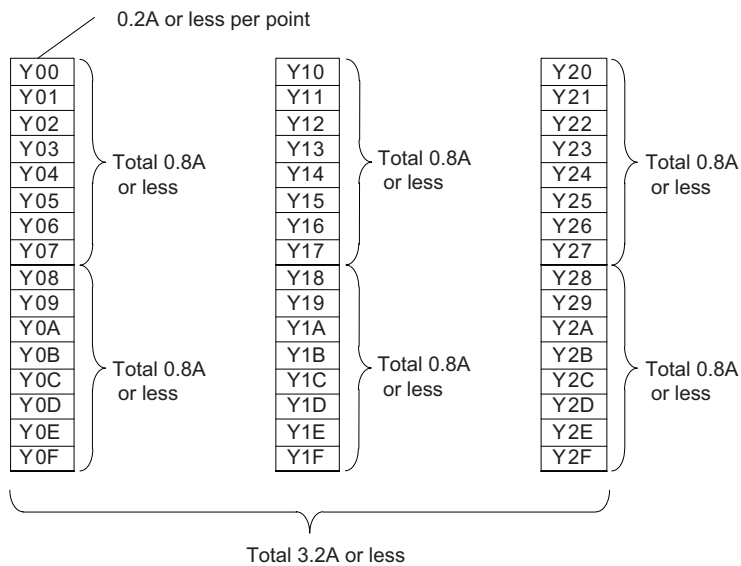
(Note 1) When using an inductive load such as a relay, always connect a diode (voltage resistance 100V or more, twice or more the load current) in parallel to the load.



(Note 2) When the rush current exceeds the maximum output current, always connect a protective resistor ($R=150\ \Omega$) serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



(Note 3) 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.



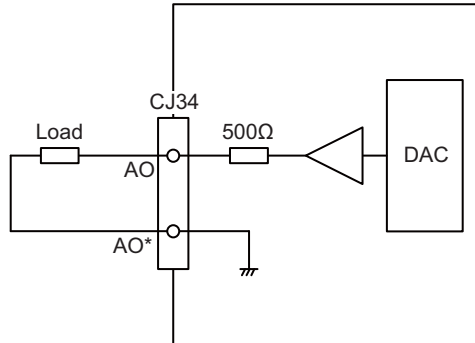
CAUTION

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.

(b) Outline of analog signal output circuit

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

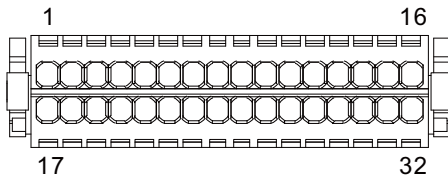
Output circuit



Output conditions

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

(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

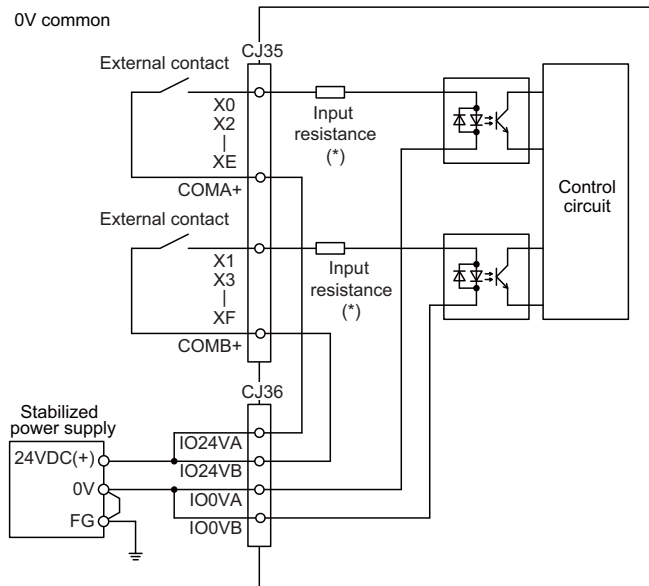
Recommended manufacturer : WAGO

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

(a) Outline of digital signal input circuit

Follow the wiring diagram below.

Input circuit

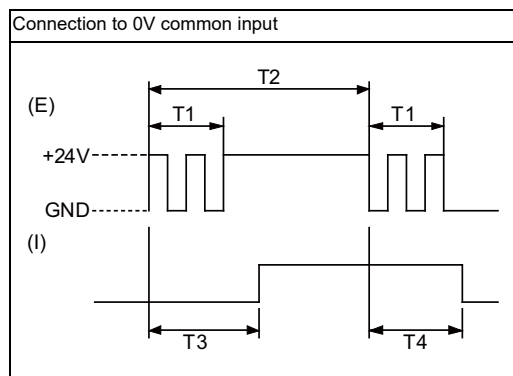


Input conditions

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

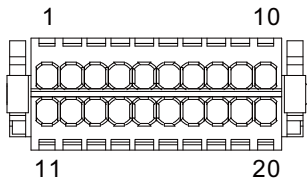
		For DX213	For DX213-1
1	Input voltage at external contact ON	18V or more, 25.2V or less	
2	Input current at external contact ON	3mA or more	9mA or more
3	Input voltage at external contact OFF	3.8V or less	4.0V or less
4	Input current at external contact OFF	0.7mA or less	1.5mA or less
5	Input resistance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

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



(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

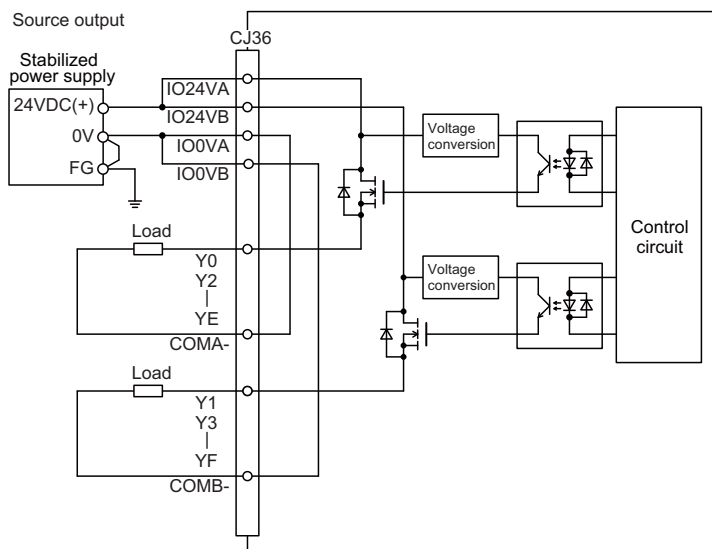
Recommended manufacturer : WAGO

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

(a) Outline of digital signal output circuit

Use within the specification ranges shown below.

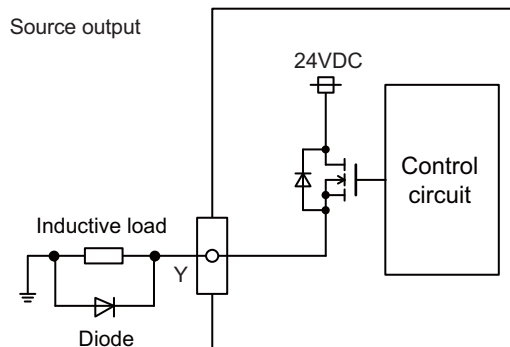
Output circuit



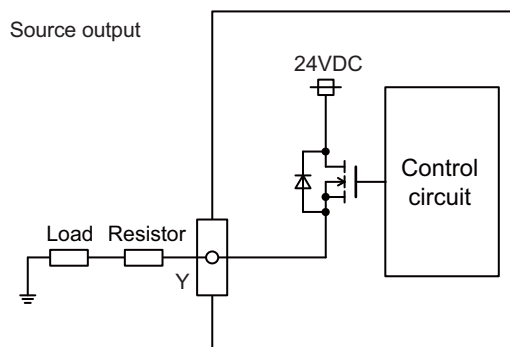
Output conditions

Insulation method	Photo coupler insulation
Rated load voltage	24VDC
Max. output current	2A/point 8A or less in the whole unit
Output delay time	400μs

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



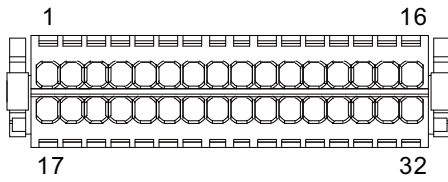
(Note 2) When the rush current exceeds the maximum output current, always connect a protective resistor ($R=150\ \Omega$) serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



⚠ CAUTION

1. When using an inductive load such as a relay, always connect a diode in parallel to the load 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

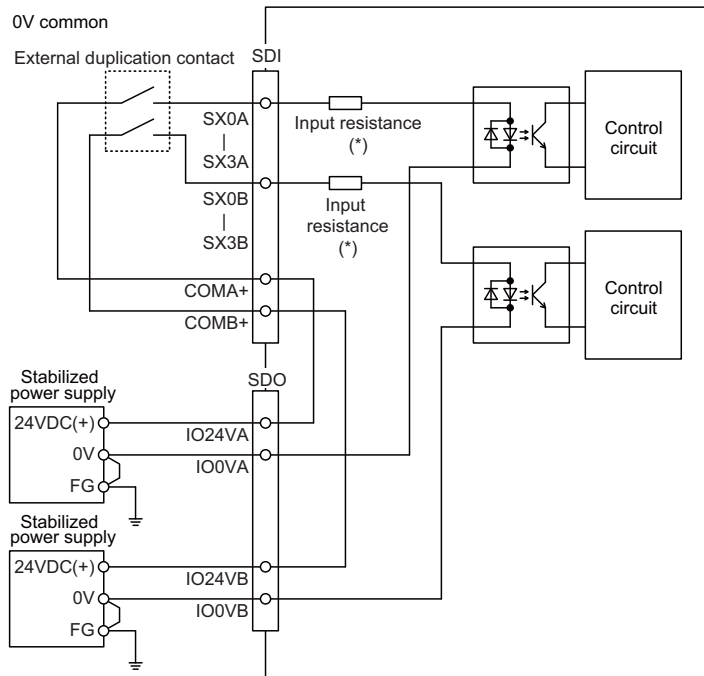
Recommended manufacturer : WAGO

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

(a) Outline of digital signal input circuit

Follow the wiring diagram below.

Input circuit

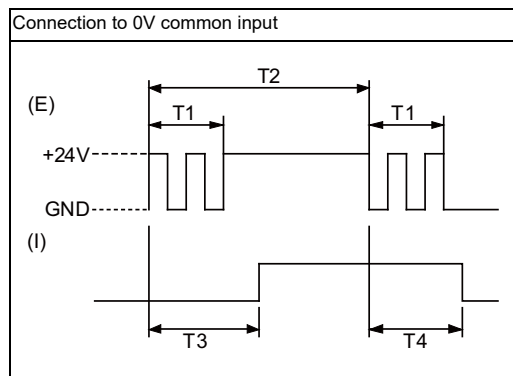


Input conditions

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

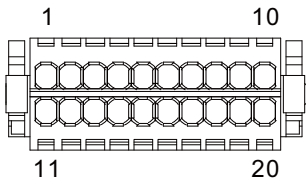
		For DX654	For DX654-1
1	Input voltage at external contact ON	18V or more, 25.2V or less	
2	Input current at external contact ON	3mA or more	9mA or more
3	Input voltage at external contact OFF	3.8V or less	4.0V or less
4	Input current at external contact OFF	0.7mA or less	1.5mA or less
5	Input resistance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

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



(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

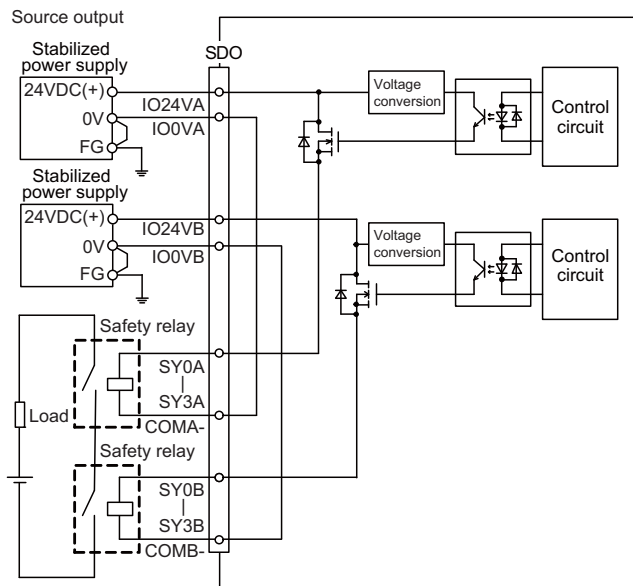
Recommended manufacturer : WAGO

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

(a) Outline of digital signal output circuit

Use within the specification ranges shown below.

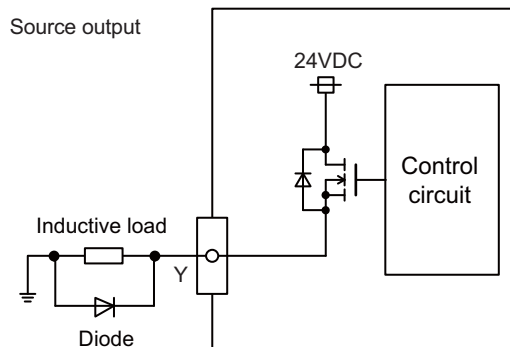
Output circuit



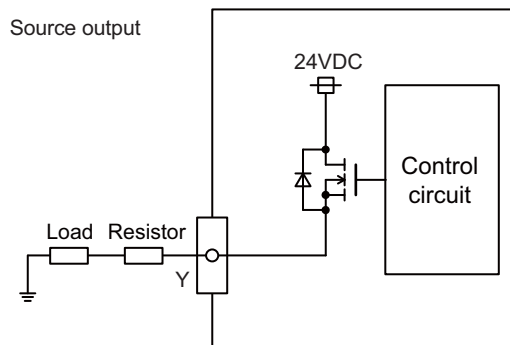
Output conditions

Insulation method	Photo coupler insulation
Rated load voltage	24VDC
Max. output current	2A/point 8A or less in the whole unit
Output delay time	400μs

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



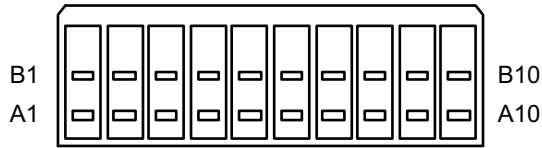
(Note 2) When the rush current exceeds the maximum output current, always connect a protective resistor ($R=150\ \Omega$) serially to the load to suppress rush currents. Make sure that the current is less than the maximum output current including the momentary current.



⚠ CAUTION

1. When using an inductive load such as a relay, always connect a diode in parallel to the load 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)

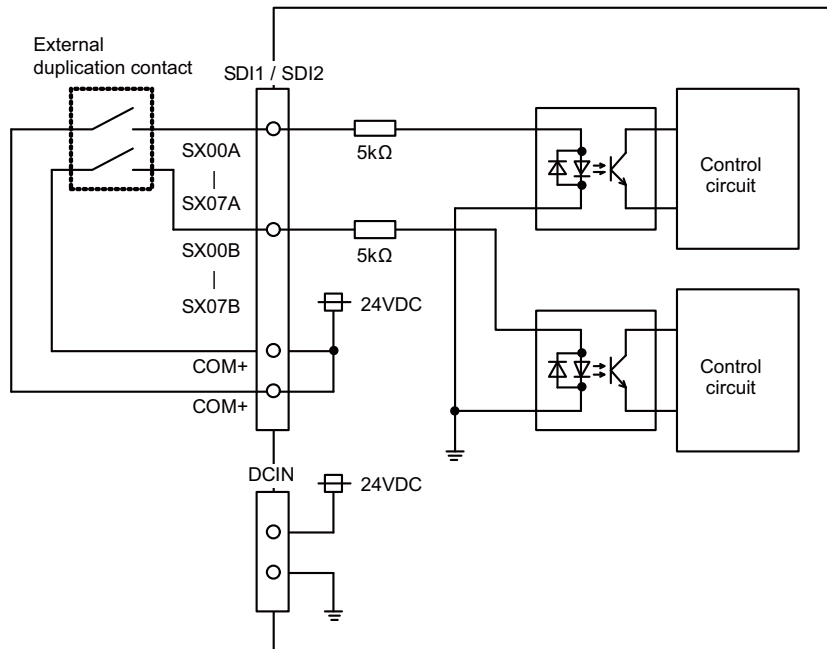
Contact : 175218-2

Recommended manufacturer : Tyco Electronics

(a) Outline of digital signal input circuit

Follow the wiring diagram below.

Input circuit

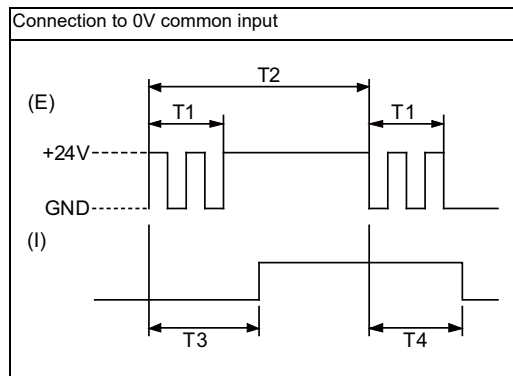


Input conditions

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

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

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



(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>

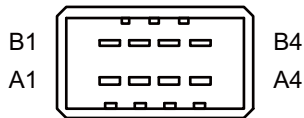
- Connector : 175362-1 (2-pole type)
- Connector : 175363-1 (4-pole type)
- Connector : 1318095-1 (6-pole type)
- Contact : 175218-2
- Recommended manufacturer : Tyco Electronics

(a) 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

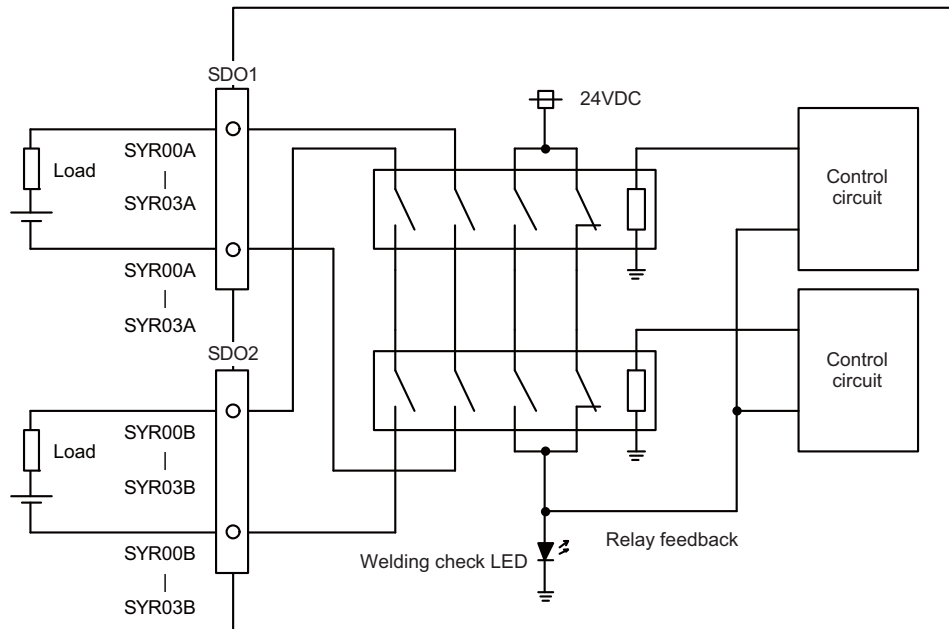
<Cable side connector type>

- Connector : 178289-4
- Contact : 175218-2
- Recommended manufacturer : Tyco Electronics

(a) 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	250VAC, 125VDC
Rated current	6A
Min. applicable load	1mA, 5VDC
Operation time	20ms or less (contact bounce not included)
Response time	8ms or less (contact bounce not included)
Return time	20ms or less (contact bounce not included)
Life	100,000 times or more with 250VAC 6A resistant load (opening/closing frequency: 20 times/min)
	100,000 times or more with 30VDC 6A resistant load (opening/closing frequency: 20 times/min)
	500,000 times or more with 250VAC 1A resistant load (opening/closing frequency: 30 times/min)
	500,000 times or more with 30VDC 1A resistant load (opening/closing frequency: 30 times/min)
	100,000 times or more with 15AC:240VAC 2A induction load (opening/closing frequency: 20 times/min, $\cos\phi=0.3$)
	100,000 times or more with 13DC:24VDC 1A induction load (opening/closing frequency: 20 times/min, L/R=48ms)
Max. operation frequency	20 times/min

Precautions

(1) 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.

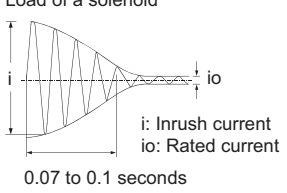
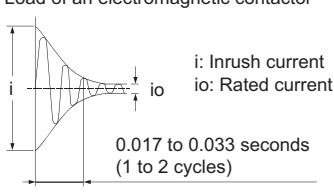
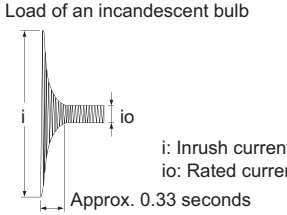
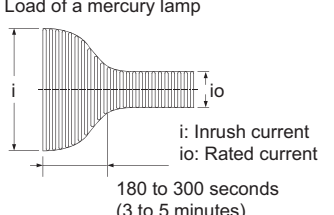
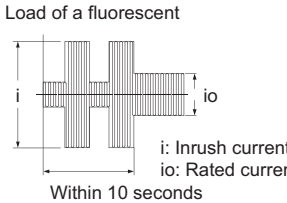
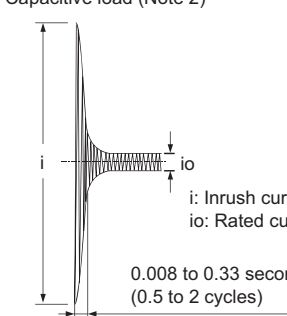
The inrush current generated by a connected load can lead to contact welding of the module. To prevent shortening of the relay life and contact welding, take the following measures:

- 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, i_o , fall within the range of the rated switching current described in the module specifications.

In some loads, the inrush current flows for a long time.

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

(Note 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.

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

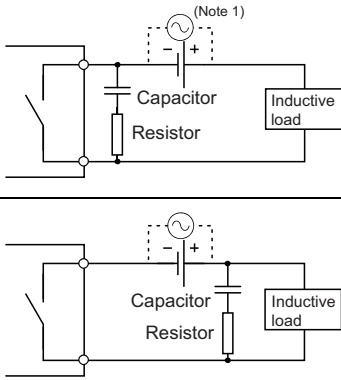
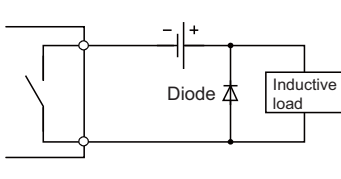
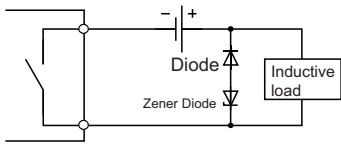
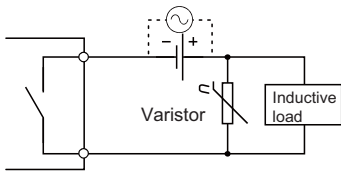
(2) Measures against back EMF

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.

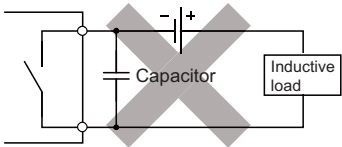
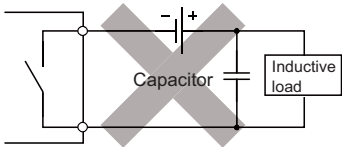
The following table shows typical examples of the contact protection circuit.

Circuit example	Element selection criteria	Remarks
<p>Capacitor + resistance method (CR method)</p> 	<p>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.</p> <ul style="list-style-type: none"> • Capacitor: 0.5 to 1 (μF) for a load current of 1A • Resistance: 0.5 to 1 (Ω) for a power supply voltage of 1V <p>Use a capacitor whose withstand voltage is higher than the rated voltage. In an AC circuit, use a capacitor with no polarity.</p>	<p>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.</p>
<p>Diode method</p> 	<p>Use a diode that satisfies the following conditions:</p> <ul style="list-style-type: none"> • 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. 	<p>The recovery time is delayed than the CR method.</p>
<p>Diode + zener diode method</p> 	<p>Use a zener diode whose zener voltage is higher than the power supply voltage.</p>	<p>This method is suitable for the case where the diode method results in a substantial delay in the recovery time.</p>
<p>Varistor method</p> 	<p>Select a varistor whose cut-off voltage (Vc) satisfies the following conditions:</p> <ul style="list-style-type: none"> • $V_c > \text{power supply voltage} \times 1.5 \text{ (V)}$ • $V_c > \text{power supply voltage} \times 1.5 \text{ (V)} \times \sqrt{2}$ (on AC power supply) <p>Note that selecting an element of a too high Vc leads to a weaker effect.</p>	<p>The recovery time is a little delayed.</p>

(Note 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

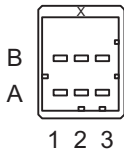
• Avoid using contact protection circuits like the following. Although highly effective in reducing the arc at current cutoff, a charge current flows into the capacitor when the contact turns on or off, which leads to the risk of contact welding. A DC inductive load, generally considered to be more difficult 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)

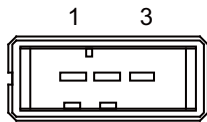


A			B		
1	I/O	TXRXD	1	I/O	TXRXD*
2		NC	2		0V
3		FG	3		NC

<Cable side connector type>

Connector : 1-1318119-3
 Contact : 1318107-1 x6
 Recommended manufacturer : Tyco Electronics

(15) DCIN (24VDC input)

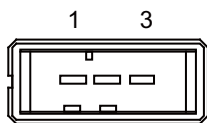


1	I	+24V
2		0V
3		FG

<Cable side connector type>

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

(16) DCOUT (24VDC output)



1	O	+24V
2		0V
3		FG

<Cable side connector type>

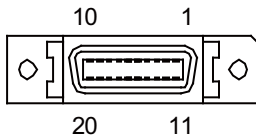
Connector : 2-178288-3
 Contact : 1-175218-5
 Recommended manufacturer : Tyco Electronics

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

- Connect connector case with FG pattern.

<Cable side connector type>

Plug : 10120-3000PE

Shell : 10320-52F0-008

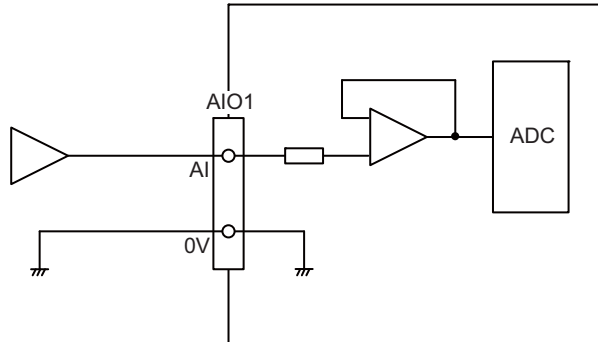
Recommended manufacturer : 3M

(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±0.05N·m)

(a) Outline of analog signal input circuit

Input circuit



Input conditions

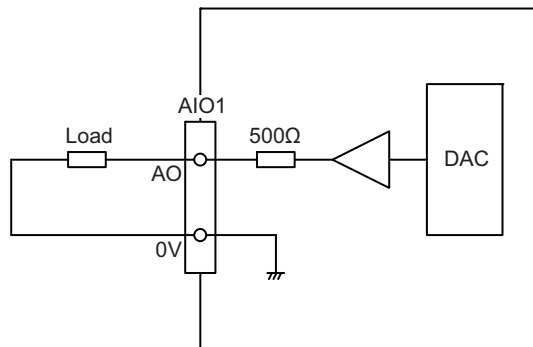
Analog input voltage	-10 to 10V
Max. input rating (Note 1)	±15V
Resolution	$ -10 \text{ to } +10\text{V} / 4095 = 4.88\text{mV}$
Precision	Within ±25mV (Note 2)
Tolerance	±0.35V

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

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

(b) Outline of analog signal output circuit

Output circuit

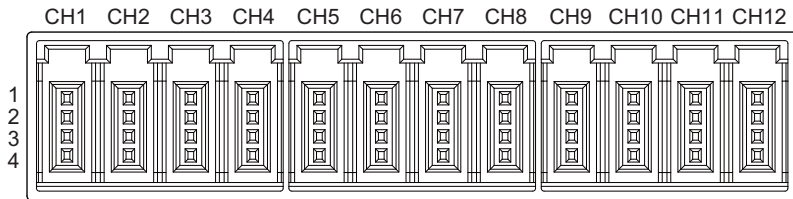


Output conditions

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

(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

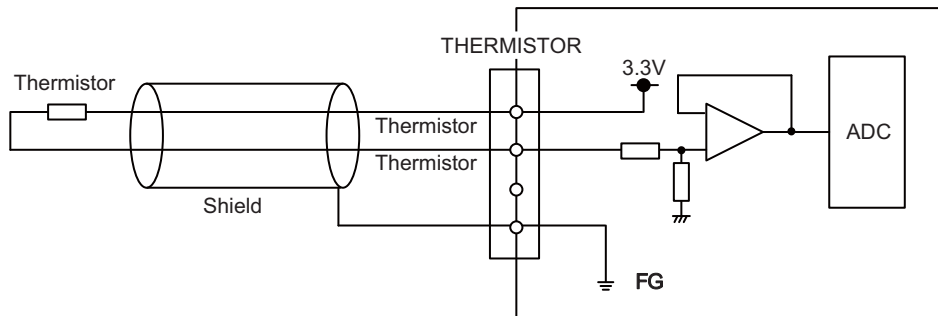
	CH7	CH8	CH9	CH10	CH11	CH12
1	FG	FG	FG	FG	FG	FG
2	NC	NC	NC	NC	NC	NC
3	Thermistor CH7	Thermistor CH8	Thermistor CH9	Thermistor CH10	Thermistor CH11	Thermistor CH12
4	Thermistor CH7	Thermistor CH8	Thermistor CH9	Thermistor CH10	Thermistor CH11	Thermistor CH12

<Cable side connector type>

Connector : 37104-2165-000FL

Recommended manufacturer : 3M

(a) Outline of the thermistor input circuit



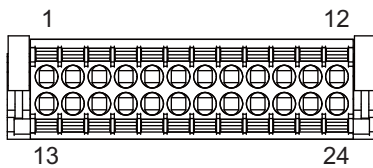
Measurement temperature	-10.0 to +150.0 °C
Resolution	0.1 °C
Accuracy	±1.5 °C (Measurement temperature -10 to +10 °C) ±1.0 °C (Measurement temperature +10 to +70 °C) ±1.5 °C (Measurement temperature +70 to +110 °C) ±2.0 °C (Measurement temperature +110 to +130 °C) ±2.5 °C (Measurement temperature +130 to +150 °C)
Thermal responsiveness (Note 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

(Note 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 2) Do not connect any thermistor other than PT3C-51F-M2 made by SHIBAURA ELECTRONICS Co., Ltd.

(21) AI (Multi-analog input)



13		FG	1		FG
14		NC	2		NC
15	CH3	V+/A	3	CH1	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

Recommended manufacturer : Phoenix Contact

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

(a) 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.

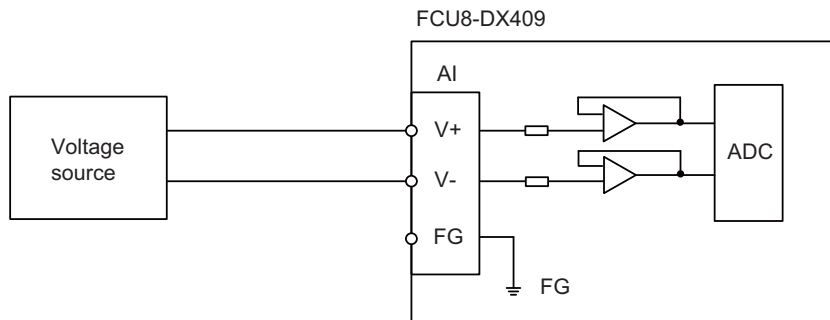
All CHs (CH1 to CH4) are set to the voltage measurement mode when the machine is delivered.

Precautions

- Input the signal within the appropriate input range 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.

(a-1) Outline of voltage input circuit

Input circuit



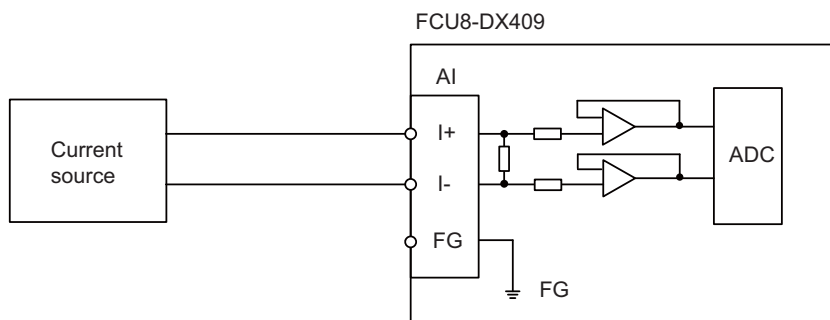
Input conditions

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

Input voltage range	-10V to +10V
Max. input rating	±13V
Resolution	$ -10V \text{ to } +10V / 64000 = 312.5\mu\text{V}$
Max. input delay (AI input to R register output)	40ms
Disconnection detection function	Not provided
Precision	± 0.5%FS (FS : Full Scale)

(a-2) Outline of current input circuit

Input circuit



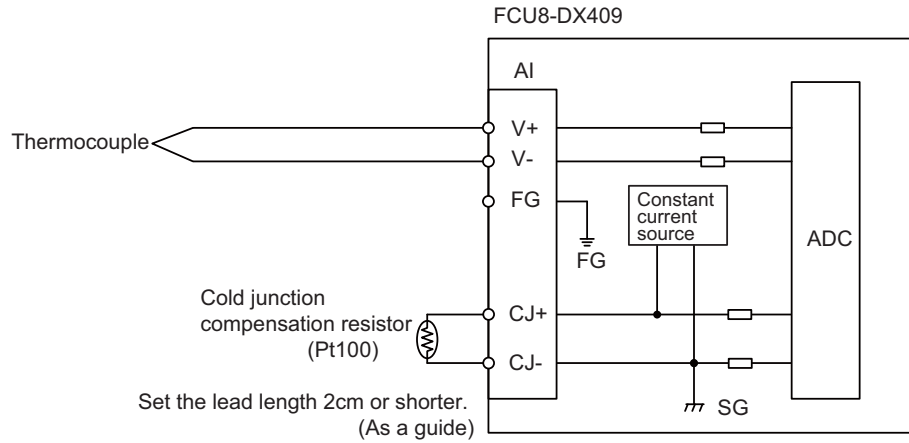
Input conditions

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

Input current range	-20mA to +20mA
Max. input rating	±30mA
Resolution	$ -20\text{mA to } +20\text{mA} / 32000 = 1.25\mu\text{A}$
Max. input delay (AI input to R register output)	40ms
Disconnection detection function	Not provided
Precision	±0.5%FS (FS : Full Scale)

(a-3) Outline of thermocouple input circuit

Input circuit



Input conditions

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

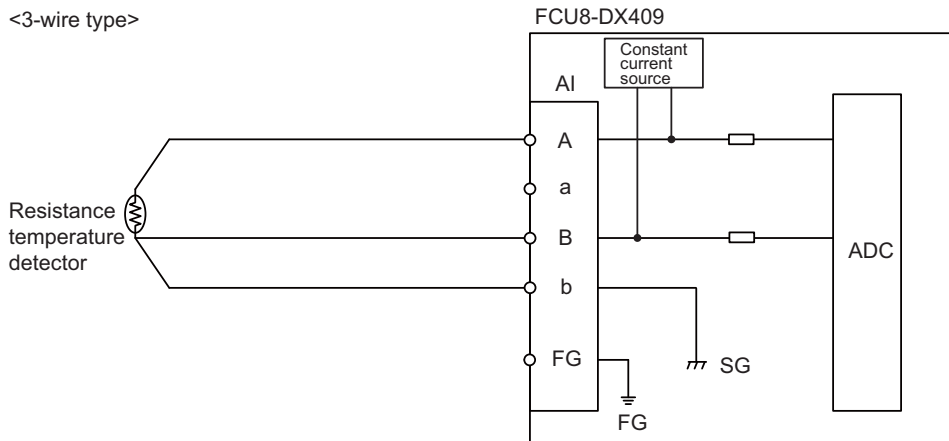
Input temperature range		-40°C to +600°C
Resolution		0.1°C
Cold junction compensation		Use Pt100.
Cold junction compensation precision		±1°C
Max. input delay (AI input to R register output)		40ms
Disconnection detection function		Provided
Precision (Note)	K type	± 3°C (Measurement temperature -40 to +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)

(Note) Refer to "(a-5) Supplement: Overall precision of temperature measurement".

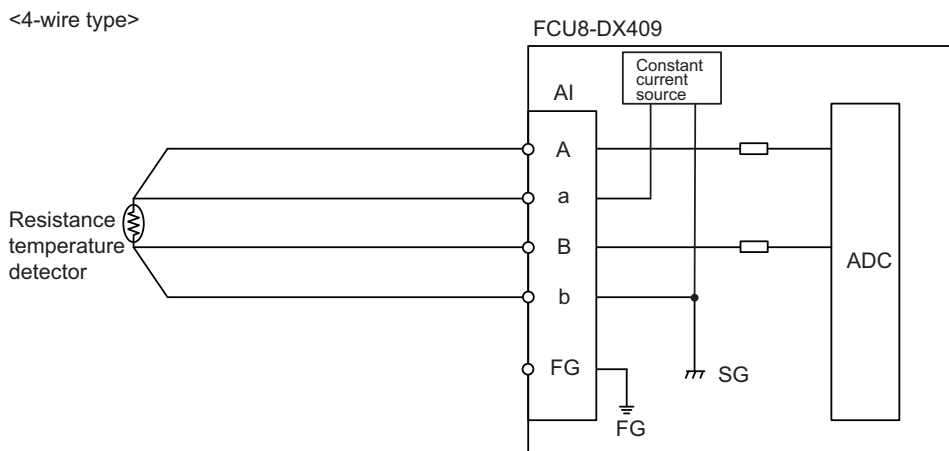
(a-4) Outline of resistance temperature detector input circuit

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)		40ms
Disconnection detection function		Provided
Precision (Note)	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)

(Note) Refer to "(a-5) Supplement: Overall precision of temperature measurement".

(a-5) Supplement: Overall precision of temperature measurement

The precision shown in (a-3) and (a-4) 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 ($\pm 1^{\circ}\text{C}$).

<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.

(Note) According to the thermocouple standard (IEC60584-1), K-type or Class2 thermocouple precision is

" $\pm 2.5^{\circ}\text{C}$ or 0.75% of the measurement temperature, whichever has the greater value"

$$\begin{aligned} \text{(Overall precision)} &= \pm 3 [^{\circ}\text{C}] \pm 2.5 [^{\circ}\text{C}] \\ &= \pm 5.5 [^{\circ}\text{C}] \end{aligned}$$

<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.

(Note) According to the Platinum RTD standard (IEC60751), Pt100 or ClassA precision is

" $\pm (0.15 + 0.002 |t|) [^{\circ}\text{C}]$ t: Measurement temperature"

$$\begin{aligned} \text{(Overall precision)} &= \pm 1.5 [^{\circ}\text{C}] \pm (0.15 + 0.002 \times 100) [^{\circ}\text{C}] \\ &= \pm 1.85 [^{\circ}\text{C}] \end{aligned}$$

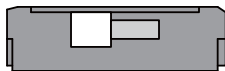
(s1) STATION No. (Station No. group setting switch)



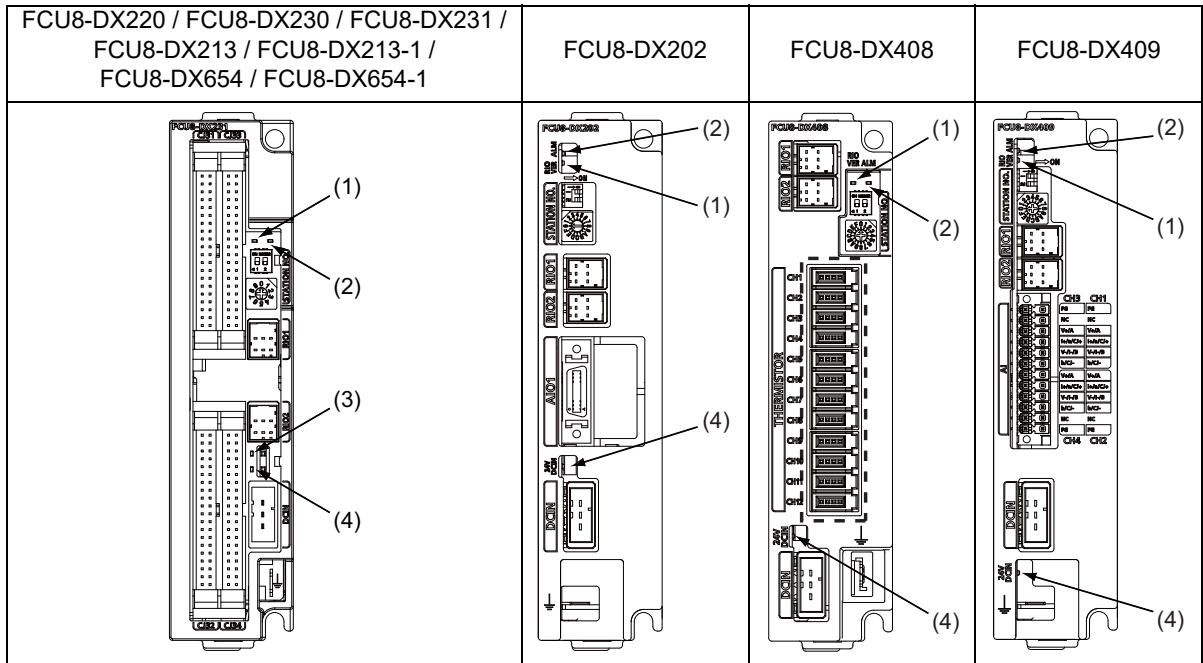
(s2) STATION No. (Station No. setting switch)



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

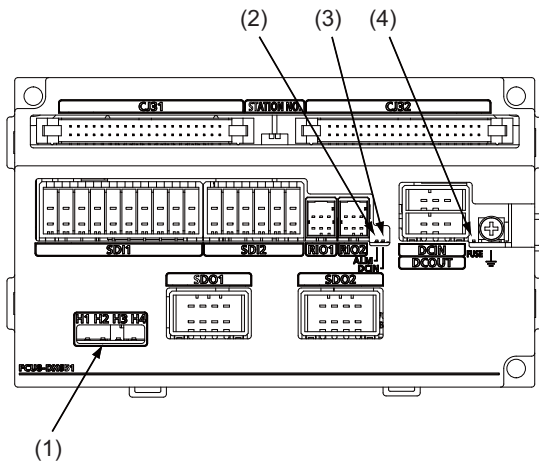


[LED : FCU8-DX220 / FCU8-DX230 / FCU8-DX231 / FCU8-DX202 /
FCU8-DX213 / FCU8-DX213-1 / FCU8-DX654 / FCU8-DX654-1 / FCU8-DX408 / FCU8-DX409]



No.	Name	Function	Color	Status		Details
				Normal	At fault	
(1)	RIOVER	RIO communication status	Green	Lit during RIO 2.0 communication Not lit during RIO 1.0 communication		
(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)	24VDCIN	Energization status of 24VDC input of DCIN connector	Green	Lit	Not lit	Lit when a current is applied.

[LED : FCU8-DX651]

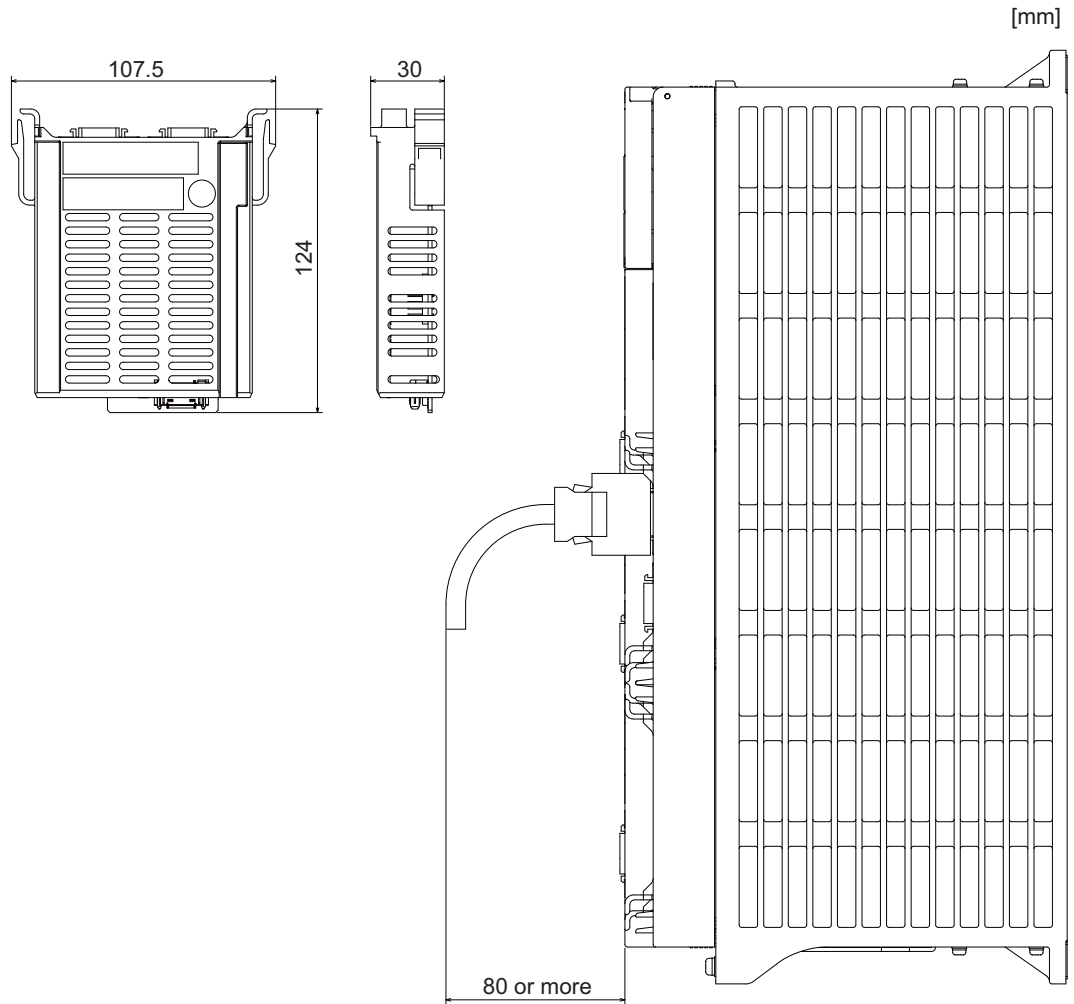


No.	Name	Function	Color	Status		Details
				Normal	At fault	
(1)	H1	Safety relay output SYR00 status	Green	Lit	Not lit	Not lit when a relay has been blown out.
	H2	Safety relay output SYR01 status	Green	Lit	Not lit	Not lit when a relay has been blown out.
	H3	Safety relay output SYR02 status	Green	Lit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

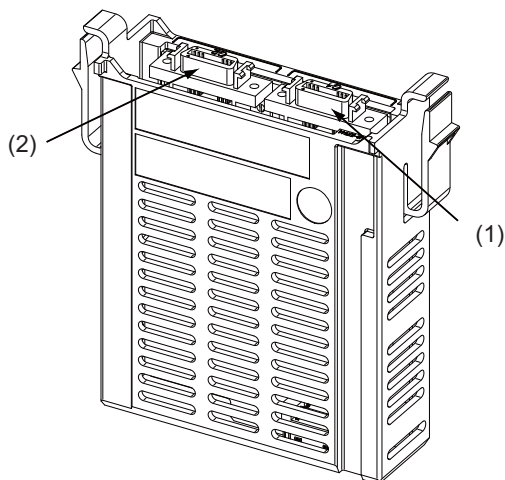
4.12 Function Expansion Unit

4.12.1 Encoder (Manual Pulse Generator) I/F Expansion (FCU8-EX544)

[Outline dimension]



[Connector]



No.	Connector name	Function
(1)	ENC	Encoder input
(2)	MPG	5V manual pulse generator input

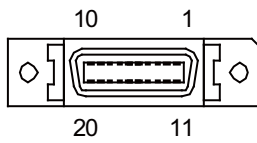
⚠ CAUTION

⚠ 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.

(1) ENC (Encoder input)

Synchronous feed encoder can be connected to this connector.



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

- Connect connector case with FG pattern.

<Cable side connector type>

Plug : 10120-3000PE

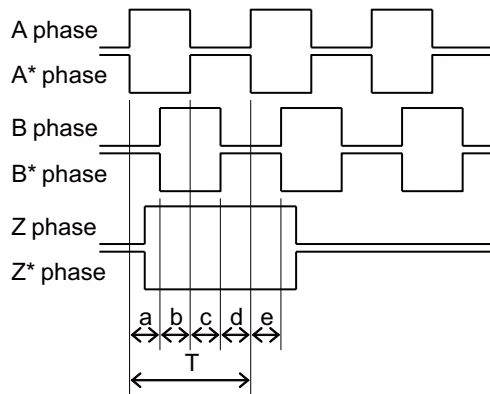
Shell : 10320-52F0-008

Recommended 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±0.05N·m)

Specification of input part

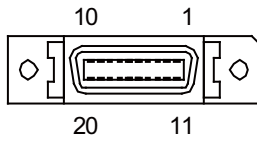
Number of pulse phases		Three phases (A phase, B phase, a phase difference 90 degrees, Z phase) (Refer to the waveform below.)
Signal output of the encoder		RS422 differential driver output
Signal voltage	Input voltage range	0V to 5.25V
	Differential-input voltage VIT+	0.2V to 5.25V
	Differential-input voltage VIT-	-5.25V to -0.2V
Power supply voltage		5VDC±10%
Current consumption		200mA or less
Number of pulses per rotation		1024 pulse/rev
Input frequency (rotation speed)		136kHz or less (8000r/min or less)
Cable length		50m or less



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

(2) MPG (5V manual pulse generator input)

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



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

- Connect connector case with FG pattern.

<Cable side connector type>

Plug : 10120-3000PE

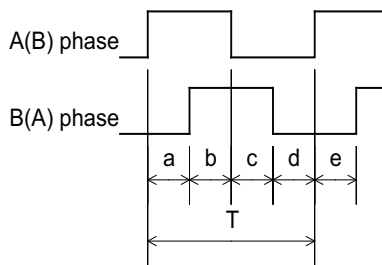
Shell : 10320-52F0-008

Recommended 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±0.05N·m)

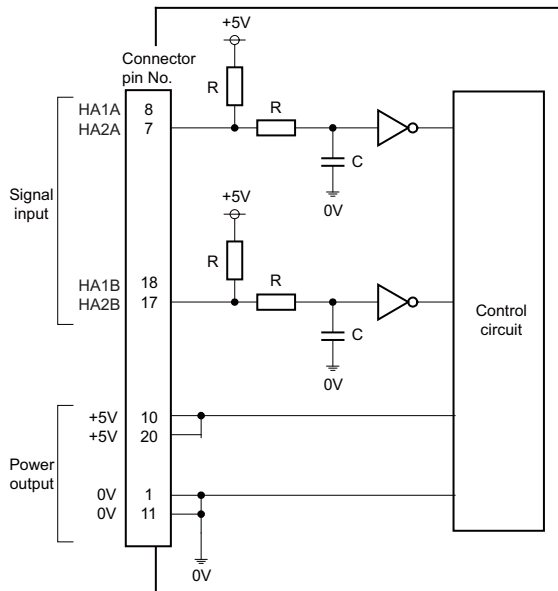
Specification of input part

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 3.5V to 5.25V L level 0V to 0.5V
Power supply voltage	5VDC±10%
Current consumption	100mA or less
Number of pulses per rotation	25 pulse/rev, 100 pulse/rev
Input frequency (rotation speed)	1kHz or less (2400r/min or less for 25pulse/rev, 600r/min or less for 100pulse/rev)
Cable length	20m or less



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

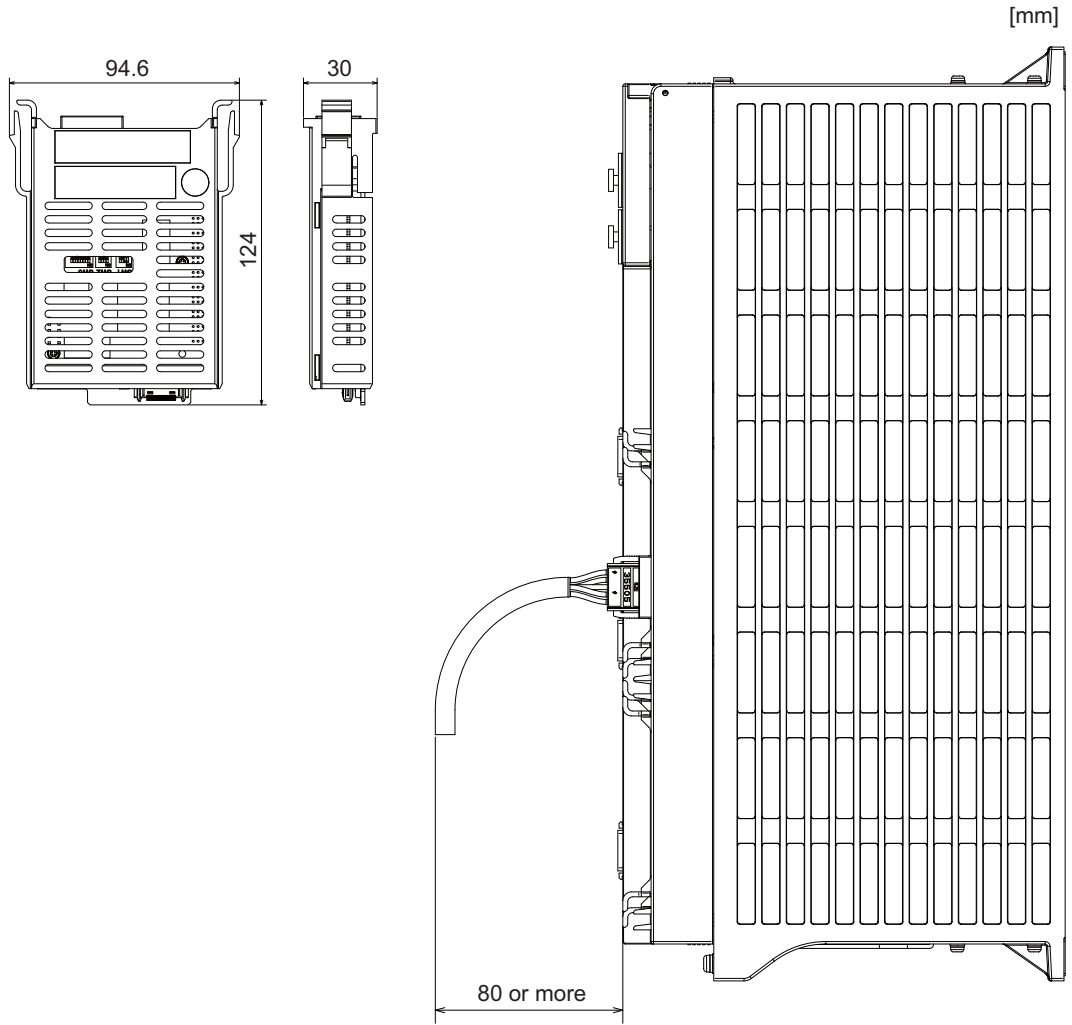
Input/output circuit



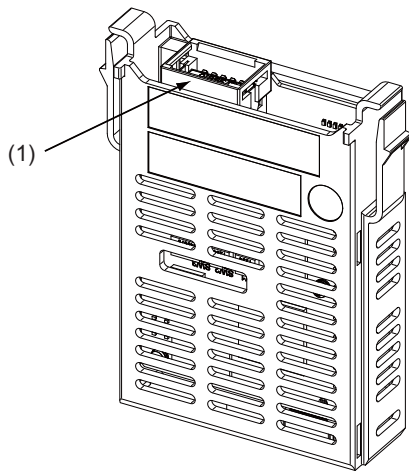
4.13 Communication Expansion Unit

4.13.1 CC-Link (FCU8-EX561)

[Outline dimension]



[Connector]



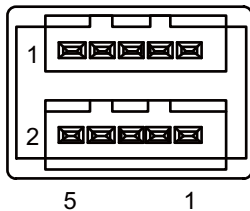
No.	Connector name	Function
(1)	CCL	CC-Link communication

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.

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

(1) CCL (CC-Link communication)



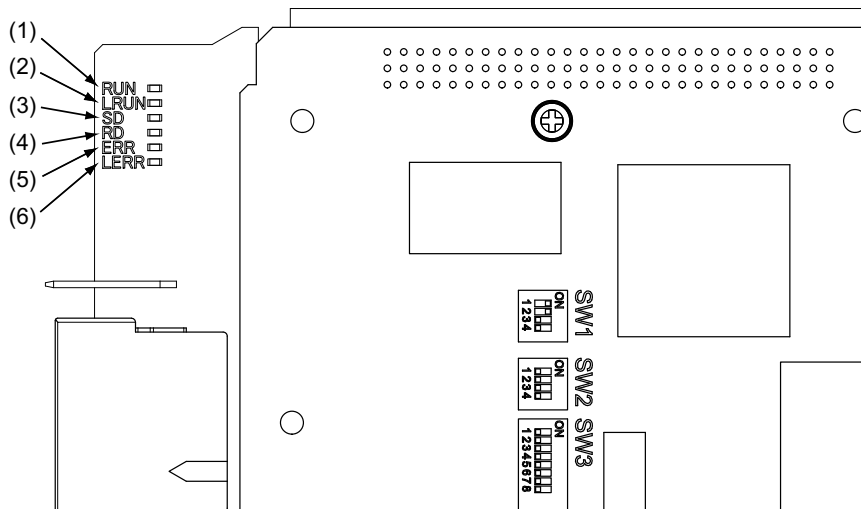
1	I/O	DA
2	I/O	DB
3		DG
4		NC
5		SLD

<Cable side connector type>

Connector : 35505-6000-BOM GF

Recommended manufacturer : 3M

[LED]

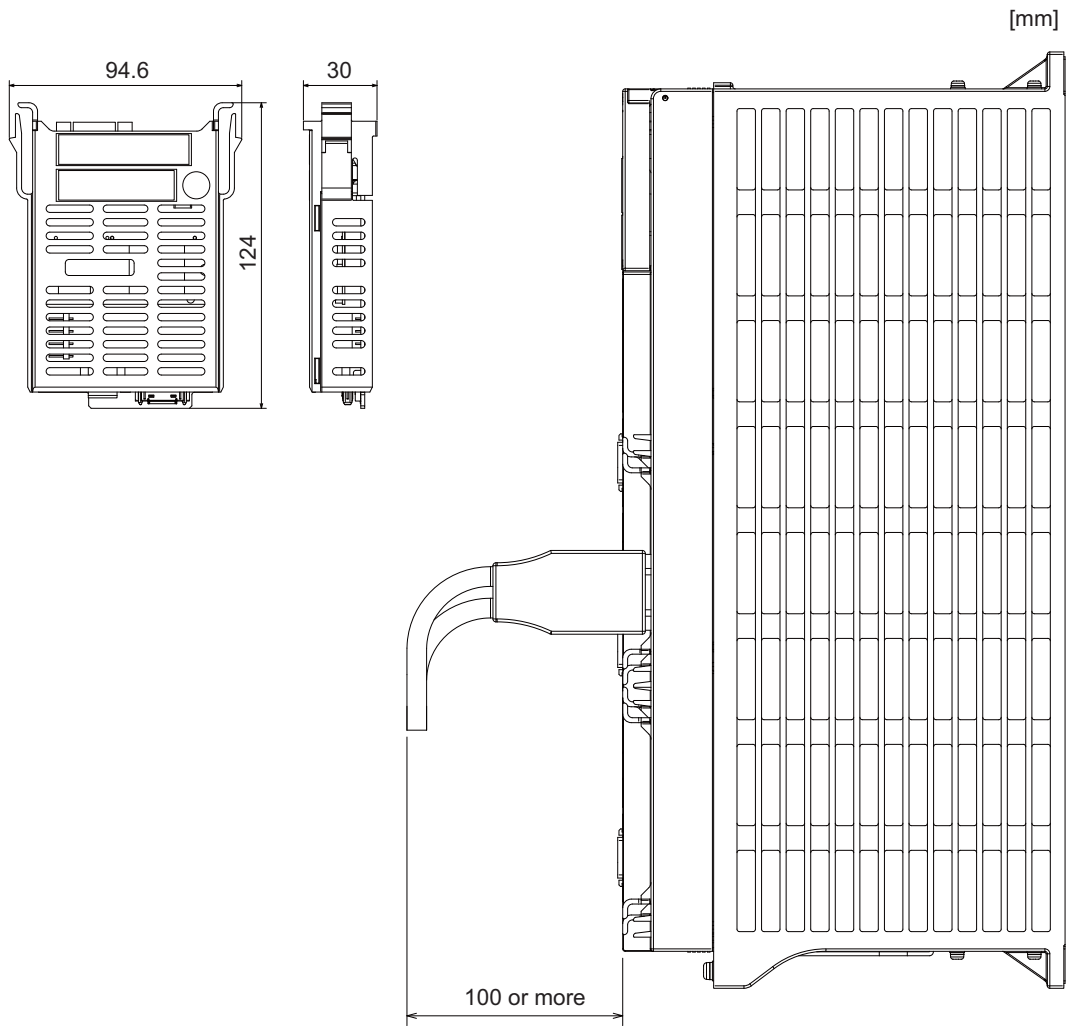


No.	Name	Color	Status	Details
(1)	RUN	Green	Lit	CC-Link module in the normal state
			Not lit	Watchdog timer error
(2)	LRUN	Green	Lit	Data link in process of execution
(3)	SD	Green	Lit	During data transmission
(4)	RD	Green	Lit	During data reception
(5)	ERR	Red	Lit	Switch setting error (LERR is also lit), overlapping of master, parameter error, communication error
			Flashing	Other station data link error (when it is master station)
(6)	LERR	Red	Lit	Data link communication error
			Flashing	Station and mode change during operation

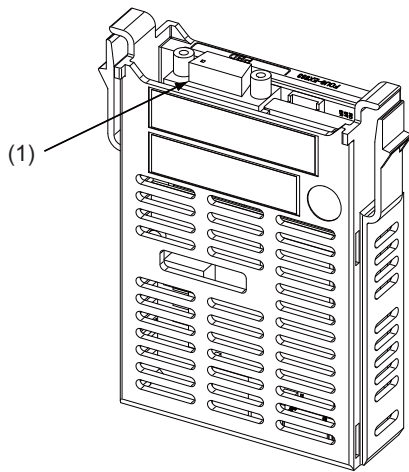
(Note 1) All LED (RUN, LRUN, SD, RD, ERR, LERR) are lit during resetting of the CC-Link module.

4.13.2 PROFIBUS-DP (FCU8-EX563)

[Outline dimension]



[Connector]

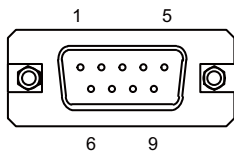


No.	Connector name	Function
(1)	PBD	PROFIBUS-DP

⚠ 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.
- ⚠ Connect the cables to the designated connectors. Incorrect connections could damage the device.
- ⚠ 5V output from connectors are to supply the power for dedicated peripheral devices. Do not use for other equipment to supply the power since we do not guarantee the NC operation by voltage down or noise sneaking.

(1) PBD (PROFIBUS-DP communication)



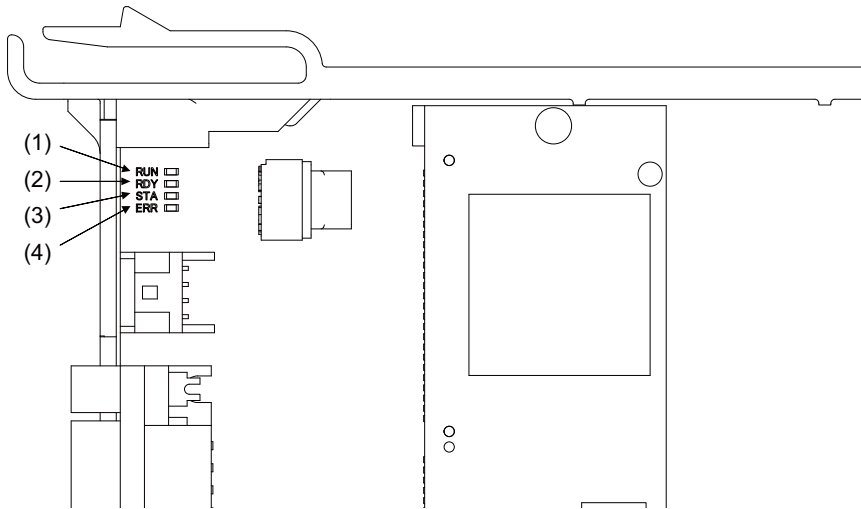
1		NC	6		+5V
2		NC	7		NC
3	I/O	RXD/TXD-P	8	I/O	RXD/TXD-N
4	I/O	CNTR-P	9		NC
5		0V			

<Cable side connector type>

Connector : 6GK1 500-0FC10

Recommended manufacturer : Siemens

[LED]



Name	Color	Status	Details
(1) RUN (Green) (2) RDY (Yellow) (Module status)	Green	Lit	Lit when PROFIBUS-DP module is normally operated
	Green/yellow	Flashing	Boot standby
	Yellow	Lit	Boot error
	-	Lit	No power supply, module failure
(3) STA (Green) (4) ERR (Red) (Communication status)	Green	Lit regularly	Configuration successful, communication unestablished
	Green	Lit randomly	Configuration failure, stuck error
	Green	Lit	Communicating with slave(s)
	Red	Flashing	Communication is interrupted with at least one slave
	Red	Lit	Communication is interrupted with all the slaves

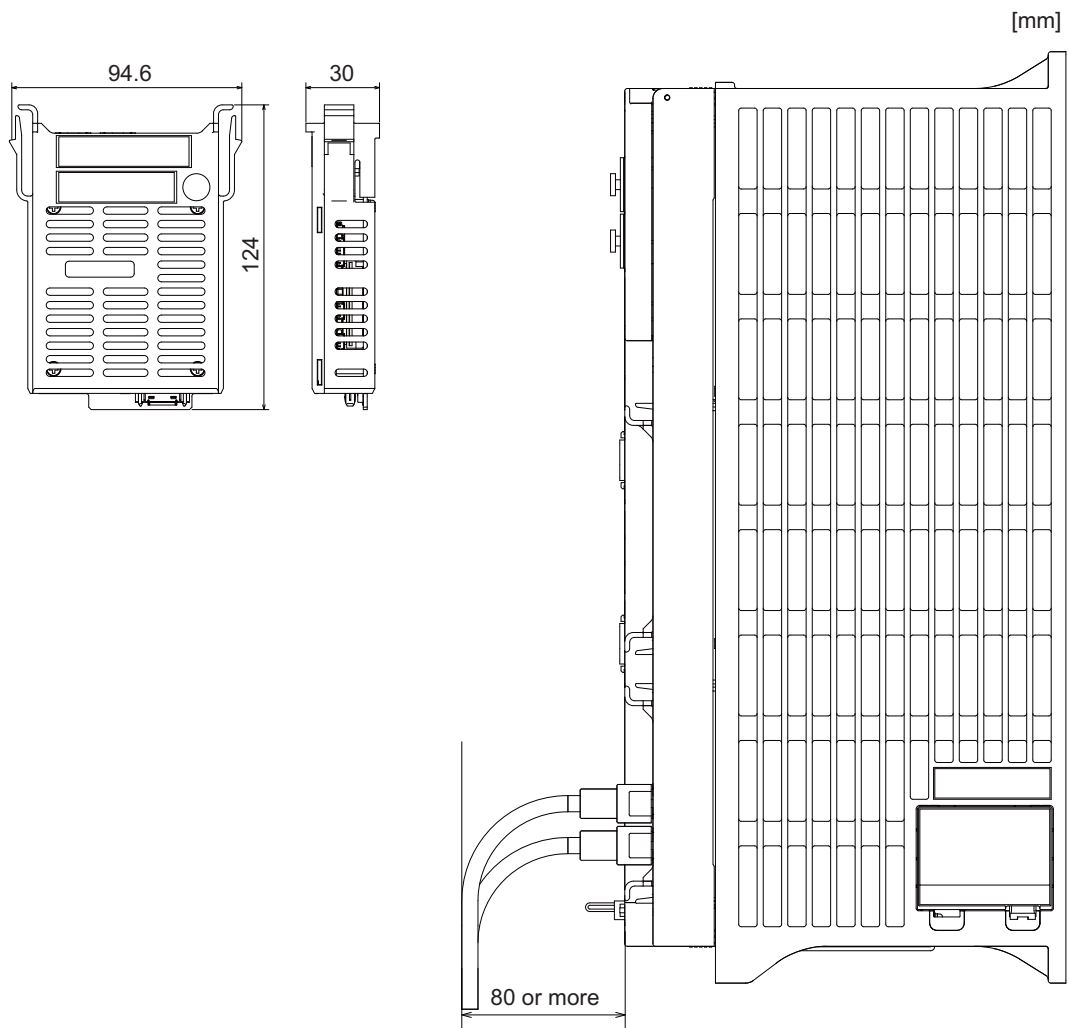
(Note 1) All LED (RUN, RDY, STA and ERR) are lit during the reset of PROFIBUS-DP module.

(Note 2) The status of PROFIBUS-DP module is displayed by the combination of RUN/RDY.

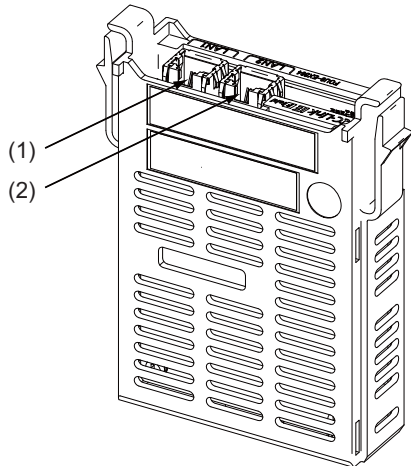
(Note 3) The status of PROFIBUS-DP communication is displayed by the combination of STA/ERR.

4.13.3 CC-Link IE Field (FCU8-EX564)

[Outline dimension]



[Connector]

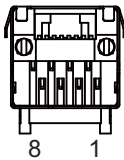


No.	Connector name	Function
(1)	LAN1	CC-Link IE Field communication
(2)	LAN2	

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

- (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-

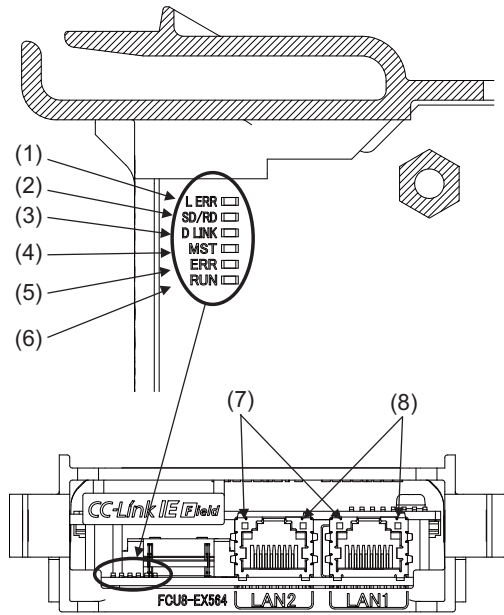
- Connect connector case with FG pattern.

<Cable side connector type>

Connector : J00026A0165

Recommended manufacturer : Japan Telegartner

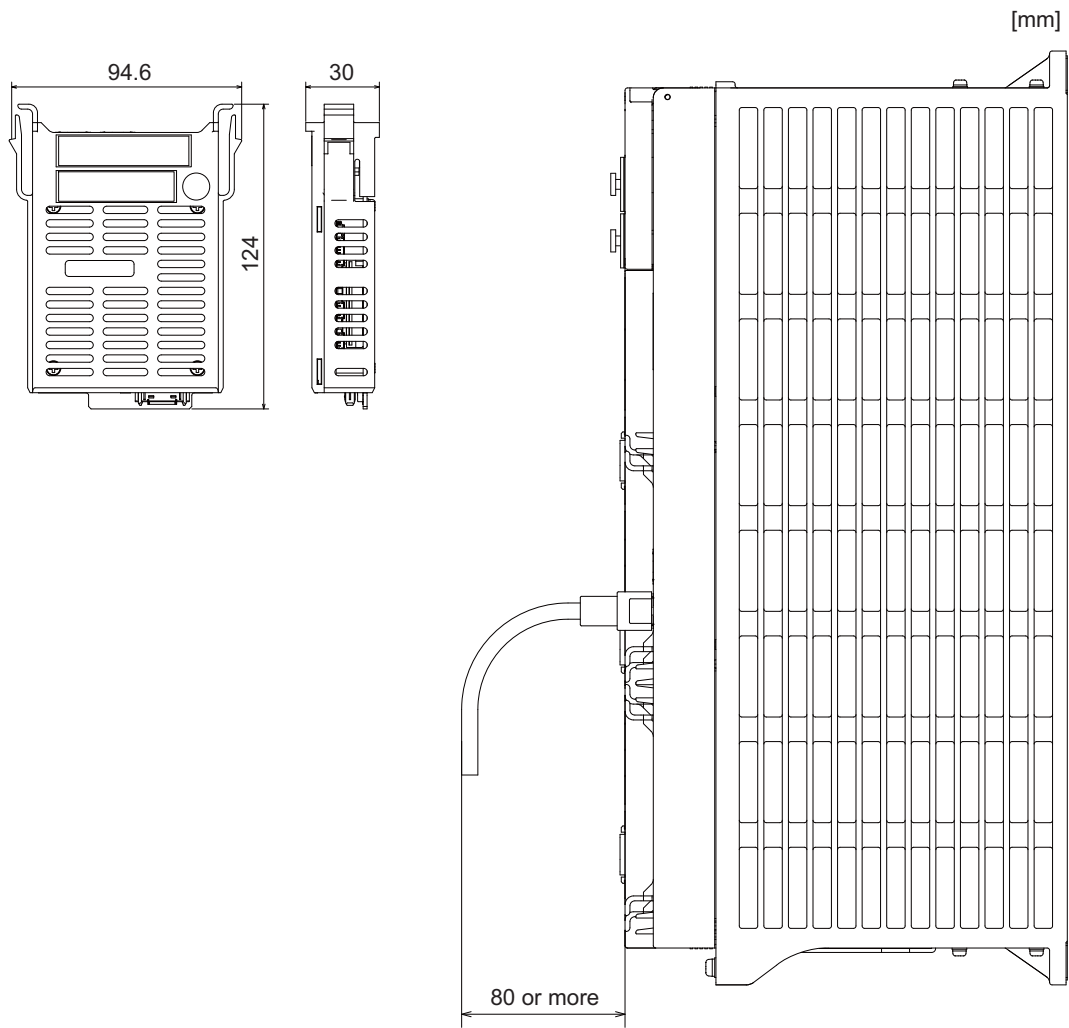
[LED]



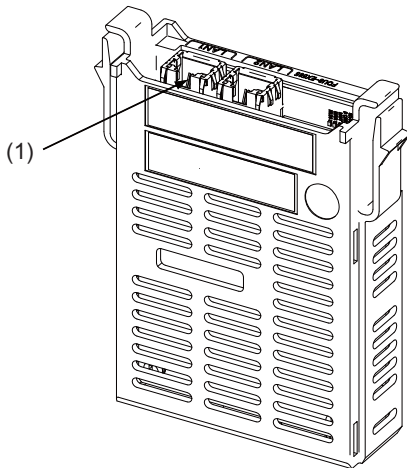
No.	Name	Color	Status	Details
(1)	L ERR	Red	Not lit	Normal data received and loopback not performed
			Lit	Abnormal data received or loopback being performed
(2)	SD/RD	Green	Lit	Data being sent or received
			Not lit	Data not sent nor received
(3)	D LINK	Green	Lit	Data link (cyclic transmission being 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

4.13.4 EtherNet/IP (FCU8-EX565)

[Outline dimension]



[Connector]



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

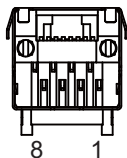
(Note) On this unit, EtherNet/IP function is supported by the "LAN1" port only. LAN2 does not support EtherNet/IP function.

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.

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

(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

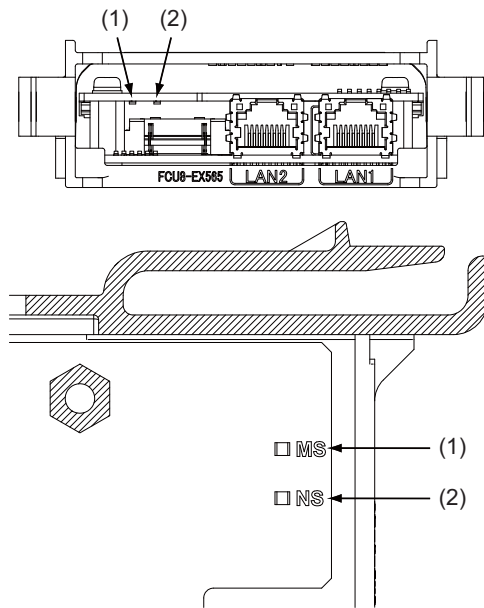
- Connect connector case with FG pattern.

<Cable side connector type>

Connector : J00026A0165

Recommended manufacturer : Japan Telegärtner

[LED]

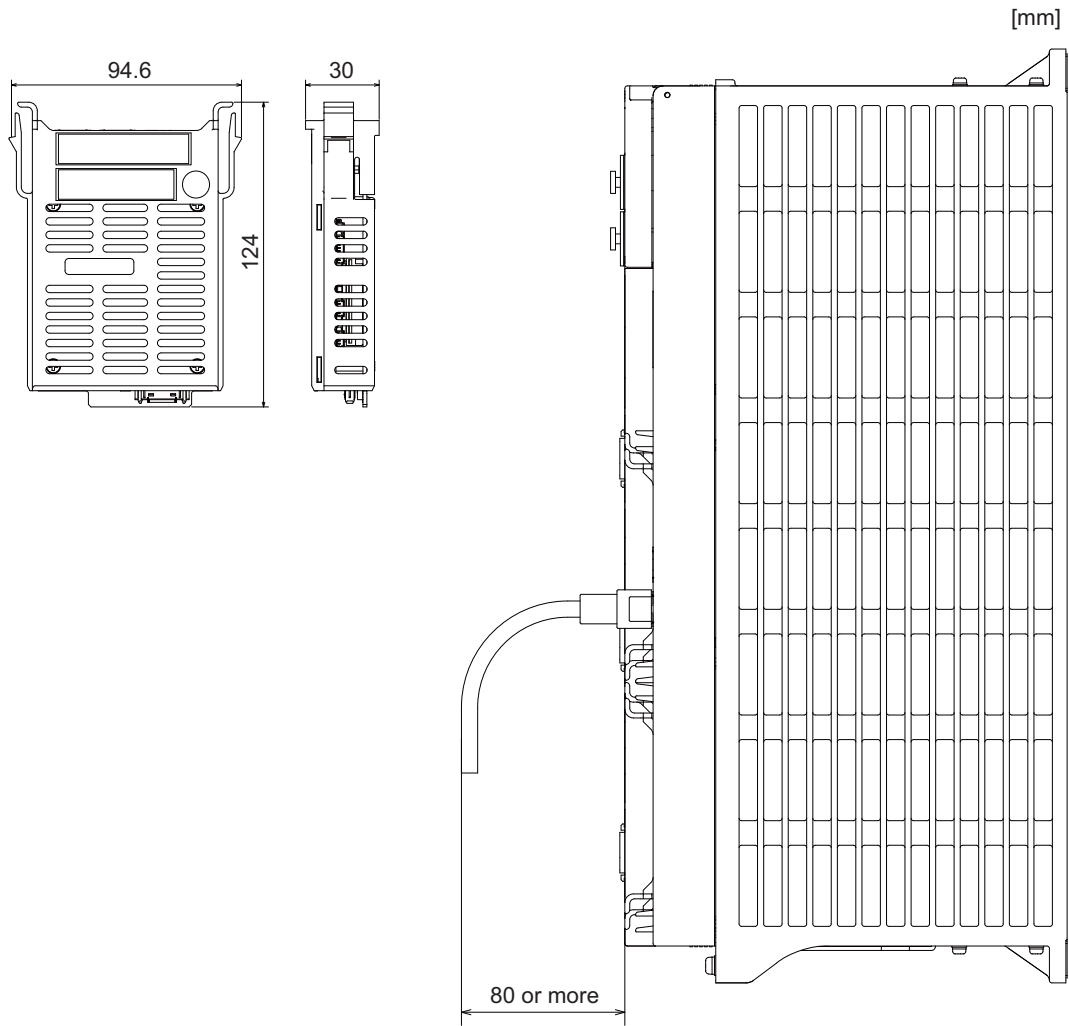


No.	Name	Green LED	Red LED	Details
(1)	MS (Green/Red) (Module status)	Flashing	Flashing	In self-test
		Flashing	Not lit	Waiting for initialization
		Lit	Not lit	Normal operation
		Not lit	Flashing	Recoverable failure
		Not lit	Lit	Unrecoverable failure (The hardware needs to be replaced.)
(2)	NS (Green/Red) (Communication status)	Flashing green/red (alternately)		In self-diagnosis
		Not lit	Not lit	No IP address
		Flashing	Not lit	No connection
		Lit	Not lit	Normal operation
		Not lit	Flashing	Connection time out
		Not lit	Lit	IP address duplication

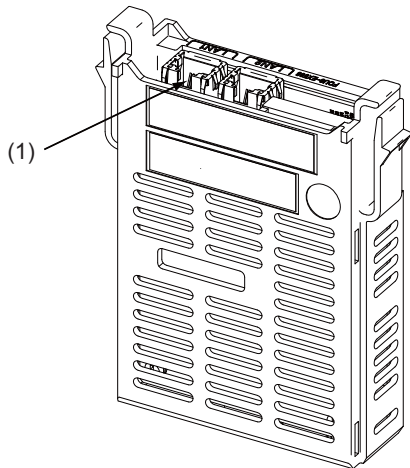
(Note 1) Ignore LED which is not written in the table above.

4.13.5 FL-net (FCU8-EX568)

[Outline dimension]



[Connector]



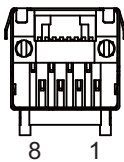
No.	Connector name	Function
(1)	LAN1	FL-net communication

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

(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

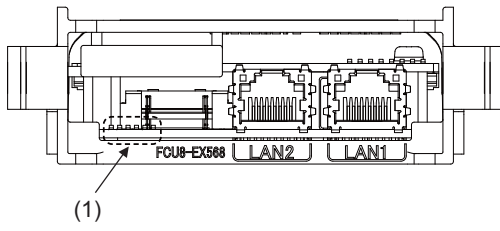
- Connect connector case with FG pattern.

<Cable side connector type>

Connector : J00026A0165

Recommended manufacturer : Japan Telegärtner

[LED]

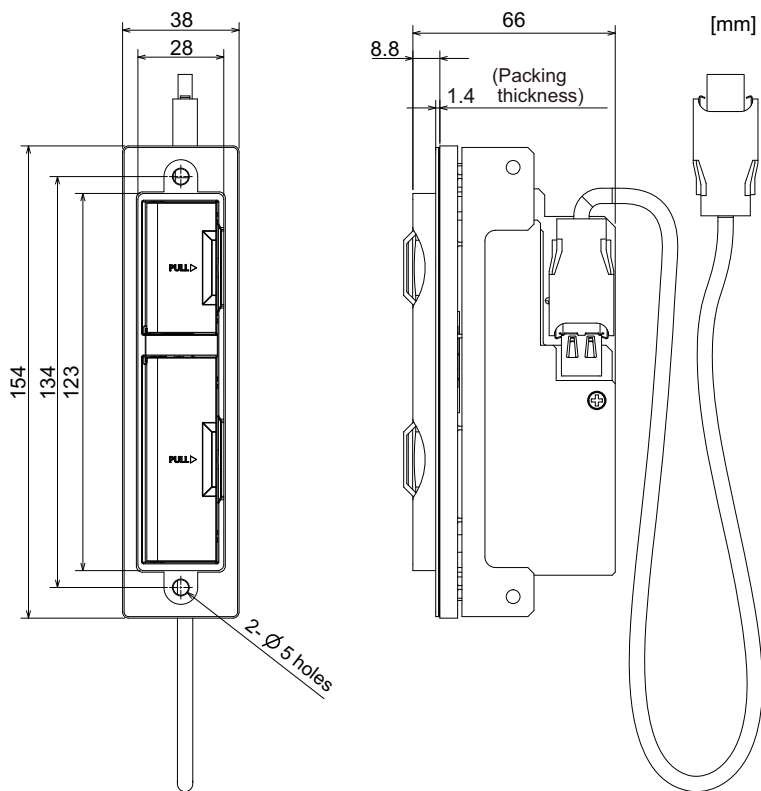


(1) Ignore LED of FCU8-EX568. (This is used by MITSUBISHI.)

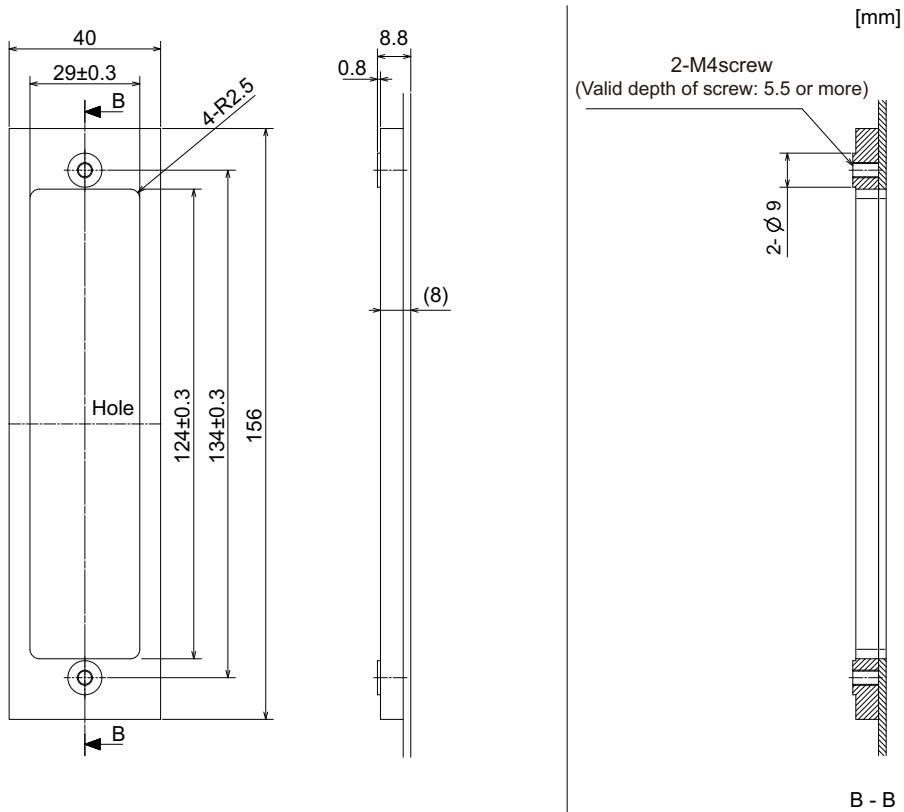
4.14 Side Memory I/F Unit

(Note) Side memory I/F unit is only for 19-type display unit.

[Outline dimension]



[Installation dimension]

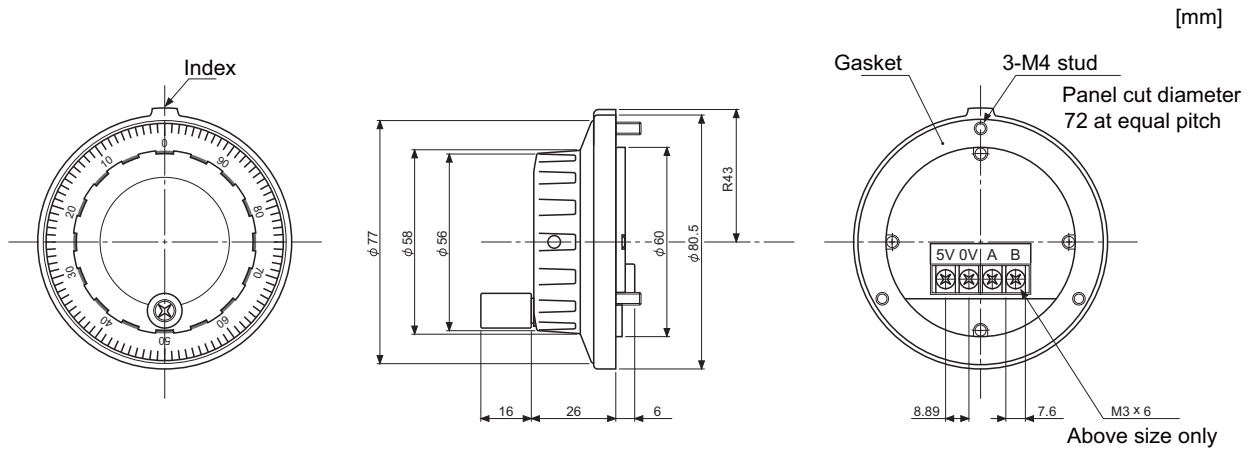


4.15 Manual Pulse Generator

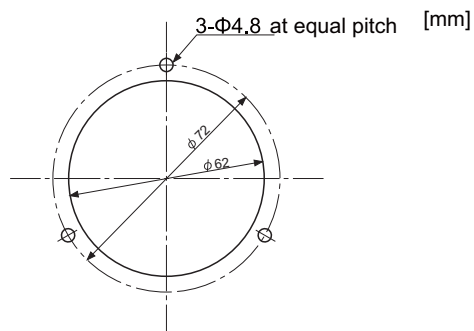
4.15.1 5V Manual Pulse Generator (UFO-01-2Z9)

100 pulse/rev

[Outline dimension]



[Panel cut dimension]

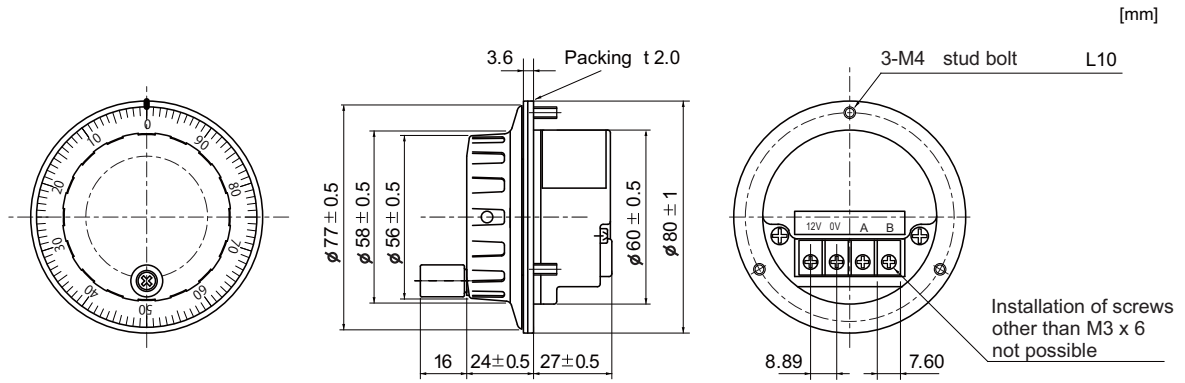


Produced by NIDEC NEMICON CORPORATION

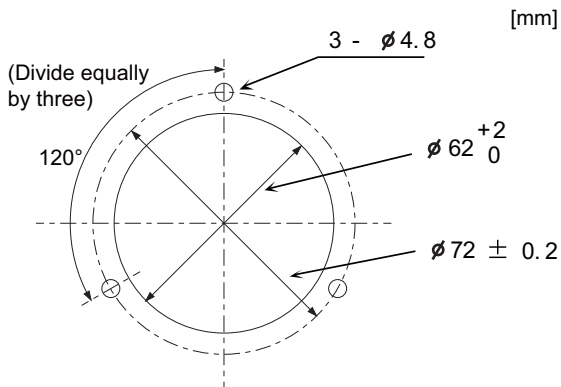
4.15.2 12V Manual Pulse Generator (HD60C)

25 pulse/rev

[Outline dimension]



[Panel cut dimension]

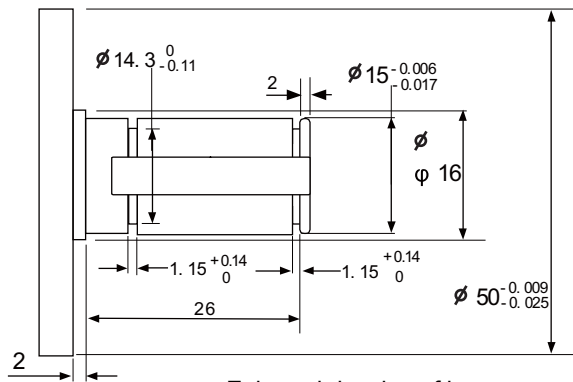
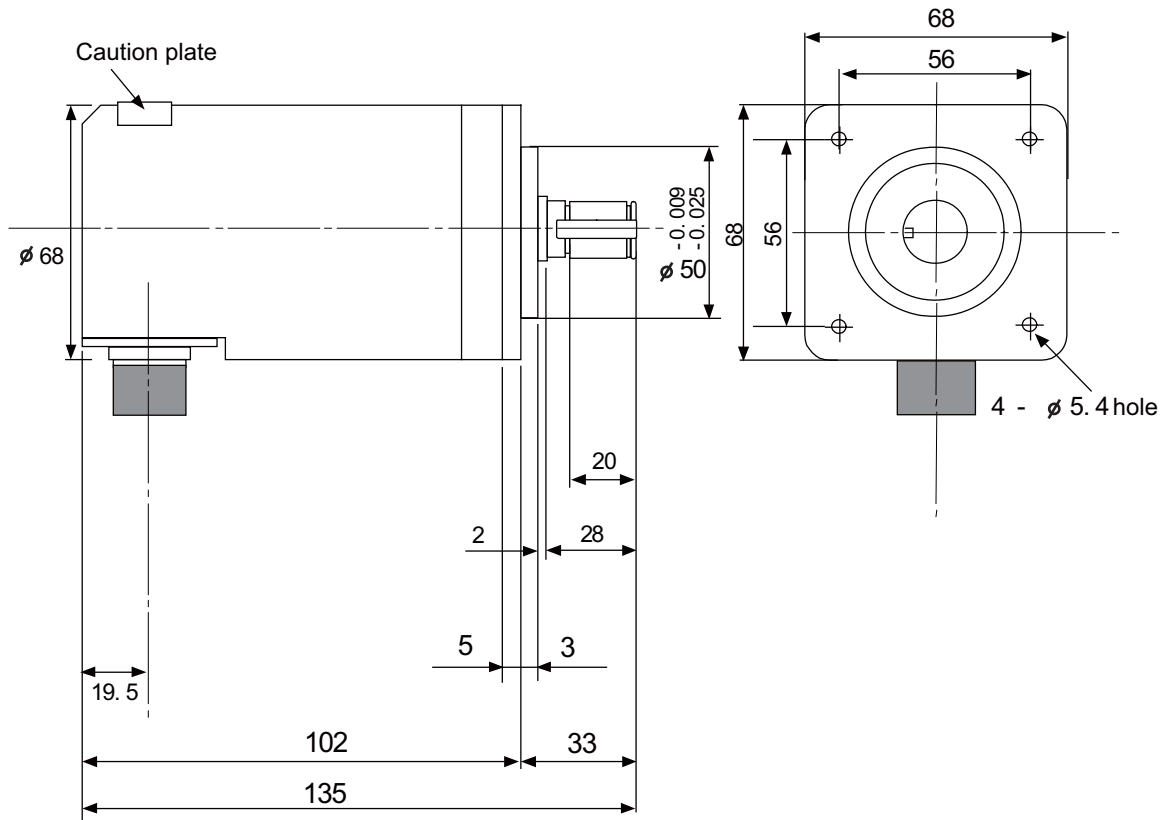


4.16 Synchronous Feed Encoder

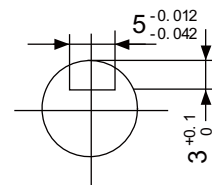
4.16.1 Synchronous Feed Encoder (OSE-1024-3-15-68)

[Outline dimension]

[mm]

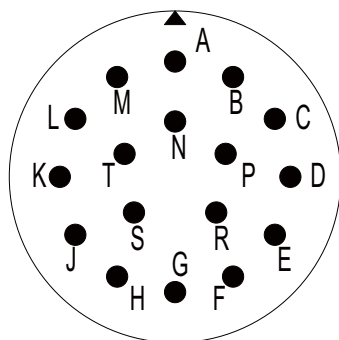


Enlarged drawing of key



Cross section BB
Valid depth of key groove is 21mm

[Connector]



Connector pin assignment

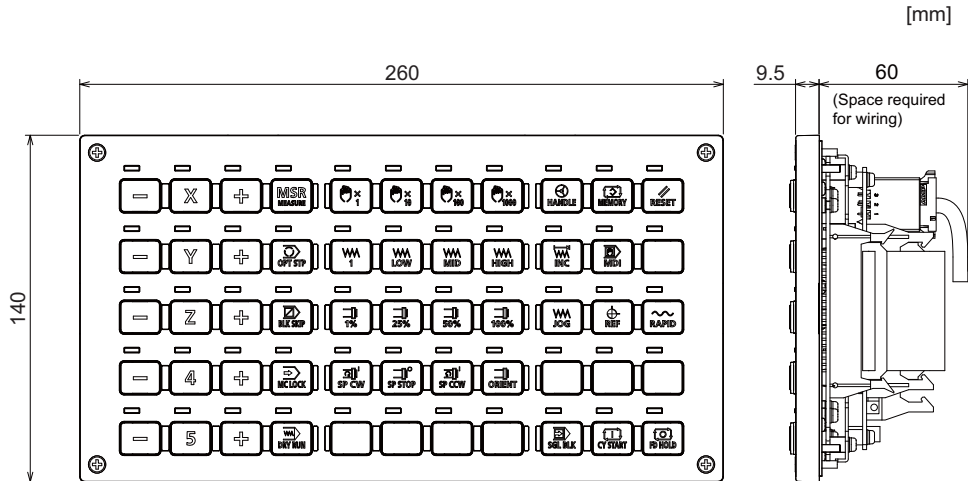
Pin	Function	Pin	Function
A	A phase	K	0V
B	Z phase	L	-
C	B phase	M	-
D	-	N	A phase reverse
E	Case grounding	P	Z phase reverse
F	-	R	B phase reverse
G	-	S	-
H	+5V	T	-
J	-		

4.17 MITSUBISHI CNC Machine Operation Panel

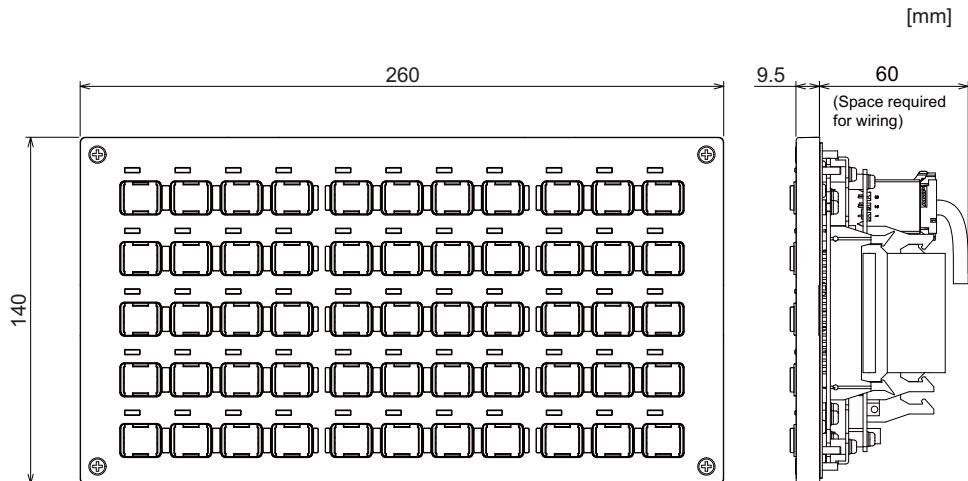
4.17.1 Main Panel A , B

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

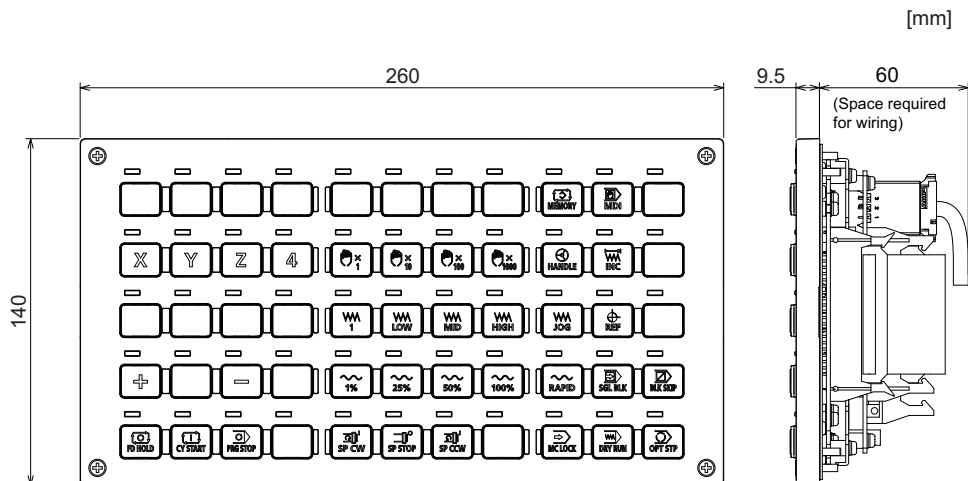
[Outline dimension : FCU8-KB921]



[Outline dimension : FCU8-KB922]

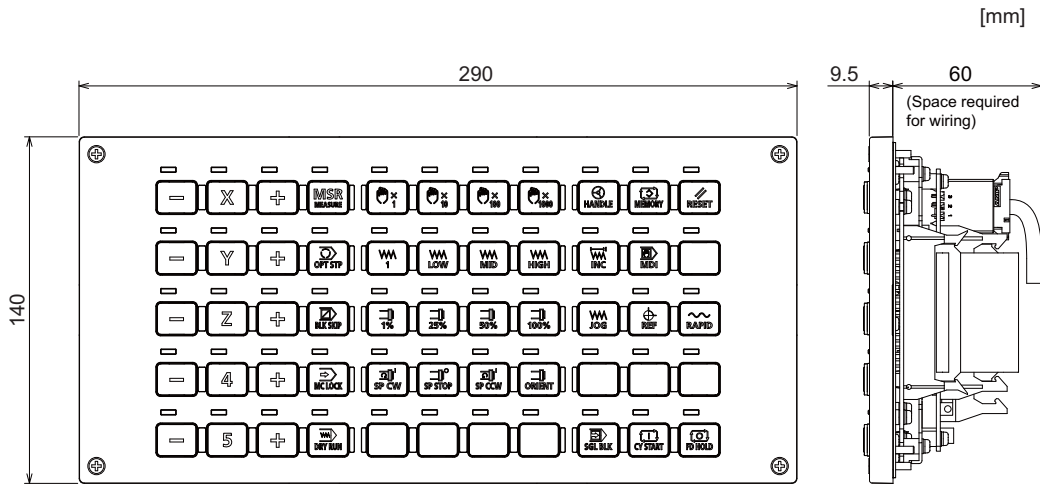


[Outline dimension : FCU8-KB925]

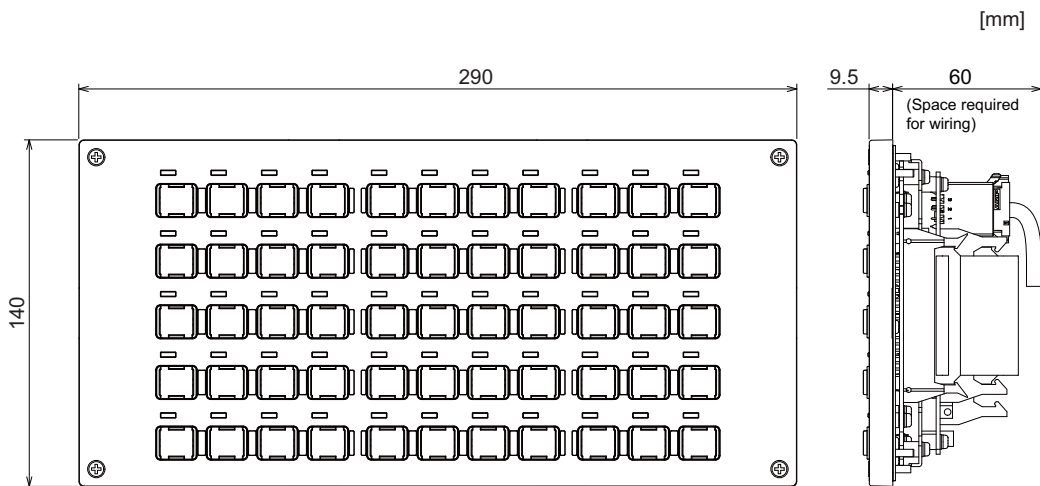


4 General Specifications

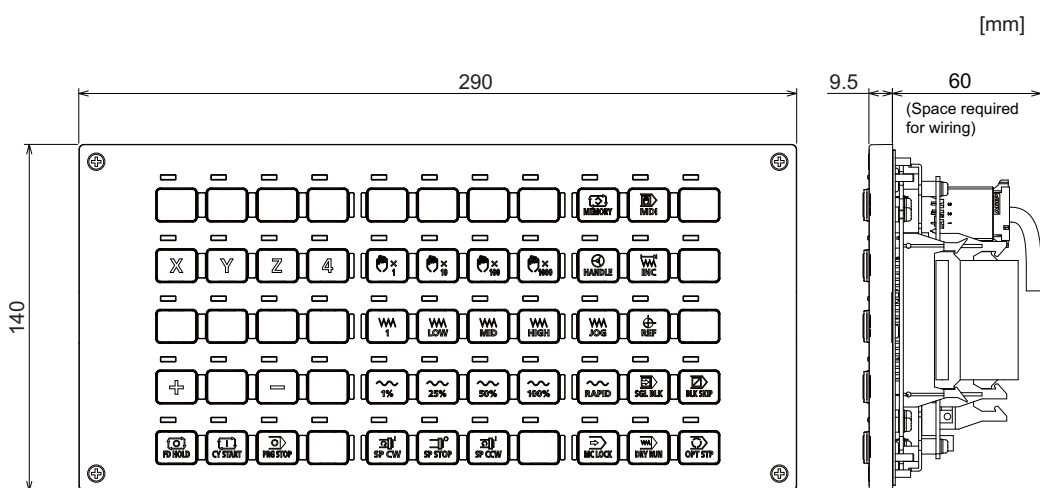
[Outline dimension : FCU8-KB923]



[Outline dimension : FCU8-KB924]

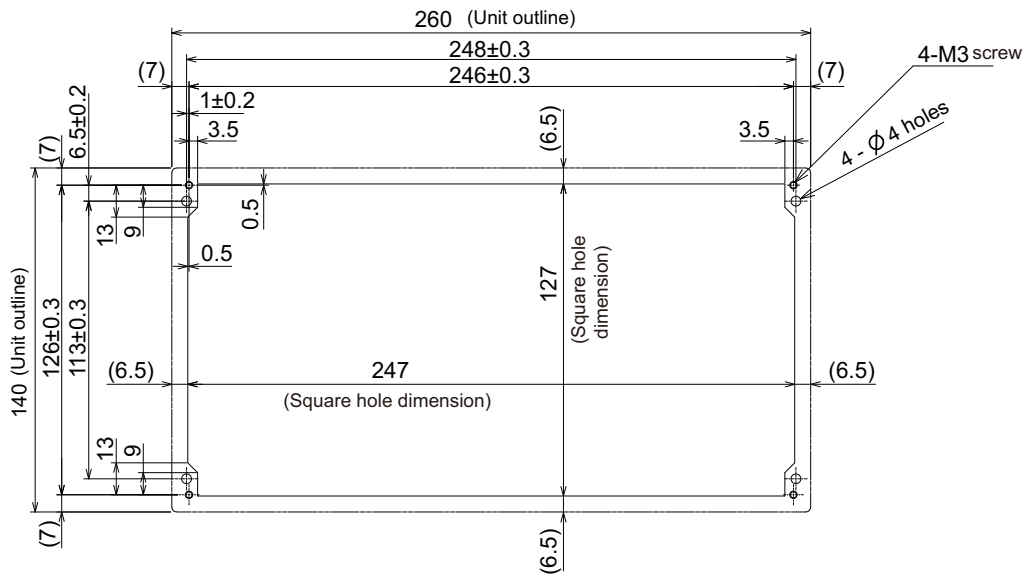


[Outline dimension : FCU8-KB926]



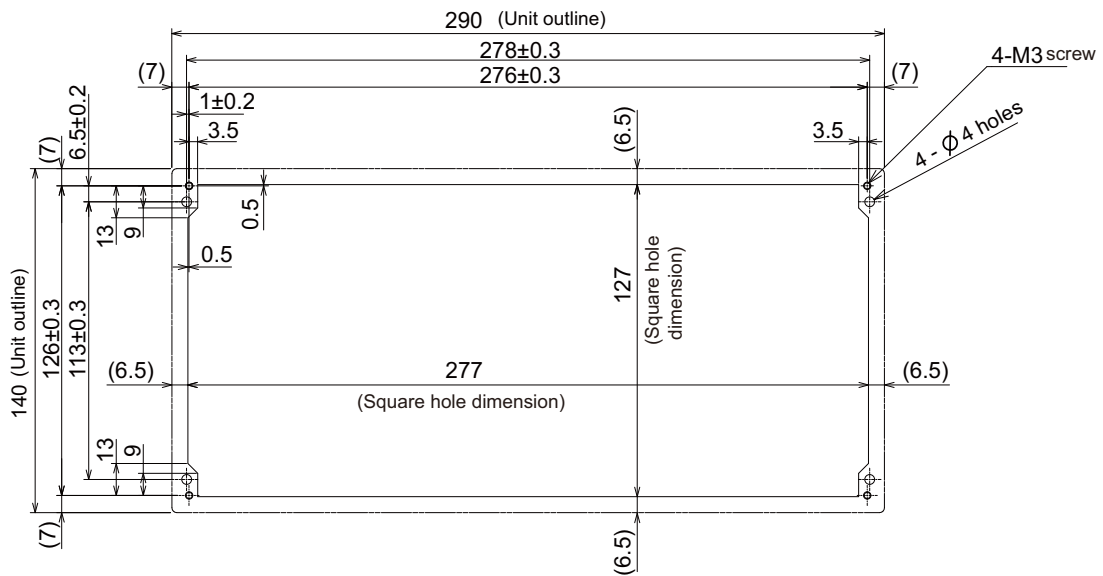
[Panel cut dimension : FCU8-KB921 / FCU8-KB922 / FCU8-KB925]

[mm]

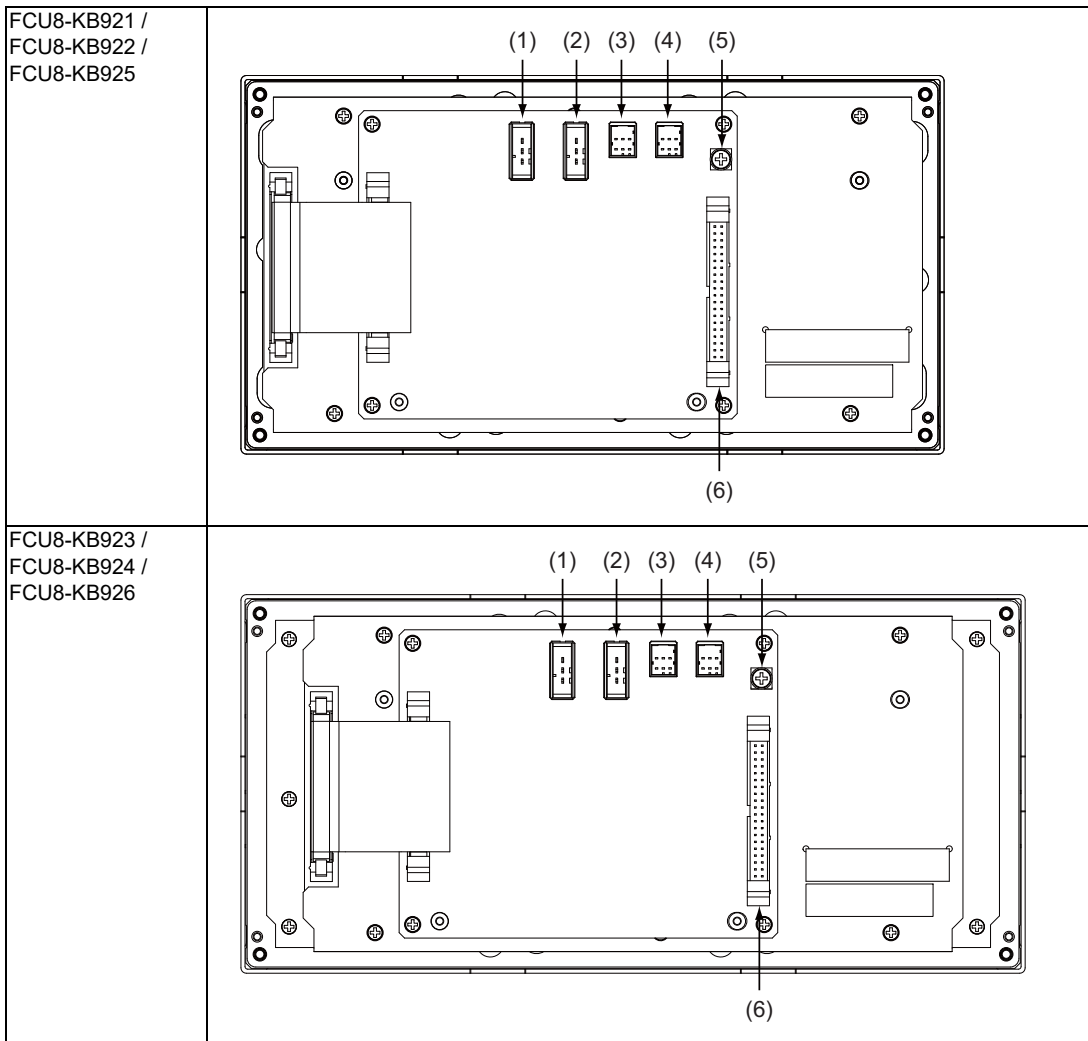


[Panel cut dimension : FCU8-KB923 / FCU8-KB924 / FCU8-KB926]

[mm]

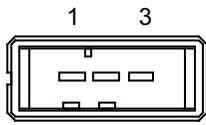


[Connector]



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

(1) DCIN (24VDC input)



1	I	+24V
2		0V
3		FG

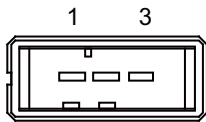
<Cable side connector type>

Connector : 2-178288-3

Contact : 1-175218-5

Recommended manufacturer : Tyco Electronics

(2) DCOUT (24VDC output)



1	O	+24V
2		0V
3		FG

<Cable side connector type>

Connector : 2-178288-3

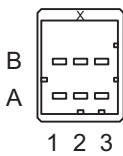
Contact : 1-175218-5

Recommended manufacturer : Tyco Electronics

(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		0V
3		FG	3		NC

<Cable side connector type>

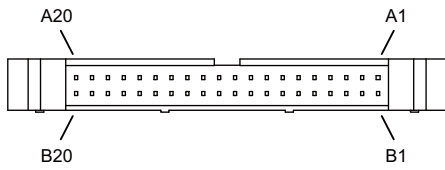
Connector : 1-1318119-3

Contact : 1318107-1

Recommended manufacturer : Tyco Electronics

(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		0V	A16	I	Spare SW(ZR5423[5])
B15		0V	A15	I	Spare SW(ZR5423[4])
B14		0V	A14	I	Spare SW(ZR5423[3])
B13		0V	A13	I	Memory protection (ZR5423[2])
B12		NC	A12	I	RSW3_G(ZR5423[1])
B11	I	RSW3_F(ZR5422[D])	A11	I	RSW3_E(ZR5422[F])
B10	I	RSW3_D(0V)	A10	I	RSW3_C(ZR5423[0])
B9	I	RSW3_B(ZR5422[E])	A9	I	RSW3_A(ZR5422[C])
B8		NC	A8	I	RSW2_G(ZR5422[B])
B7	I	RSW2_F(ZR5422[7])	A7	I	RSW2_E(ZR5422[9])
B6	I	RSW2_D(0V)	A6	I	RSW2_C(ZR5422[A])
B5	I	RSW2_B(ZR5422[8])	A5	I	RSW2_A(ZR5422[6])
B4		NC	A4	I	RSW1_G(ZR5422[5])
B3	I	RSW1_F(ZR5422[1])	A3	I	RSW1_E(ZR5422[3])
B2	I	RSW1_D(0V)	A2	I	RSW1_C(ZR5422[4])
B1	I	RSW1_B(ZR5422[2])	A1	I	RSW1_A(ZR5422[0])

RSW1: Cutting override switch

RSW2: Rapid traverse override switch

RSW3: Spare switch

<Cable side connector type>

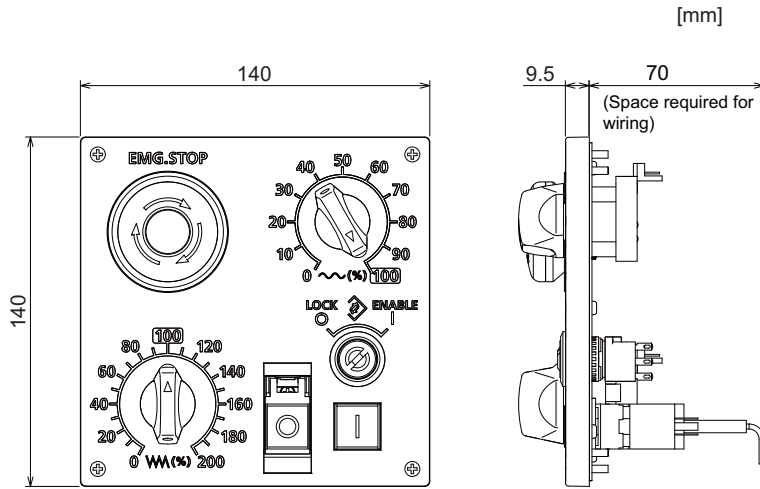
Connector : HIF3BA-40D-2.54C

Contact : HIF3-2428SC

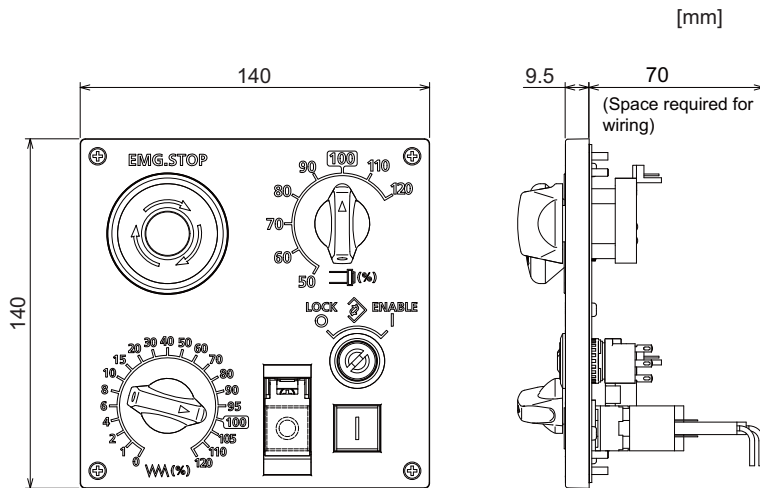
Recommended manufacturer : Hirose Electric

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

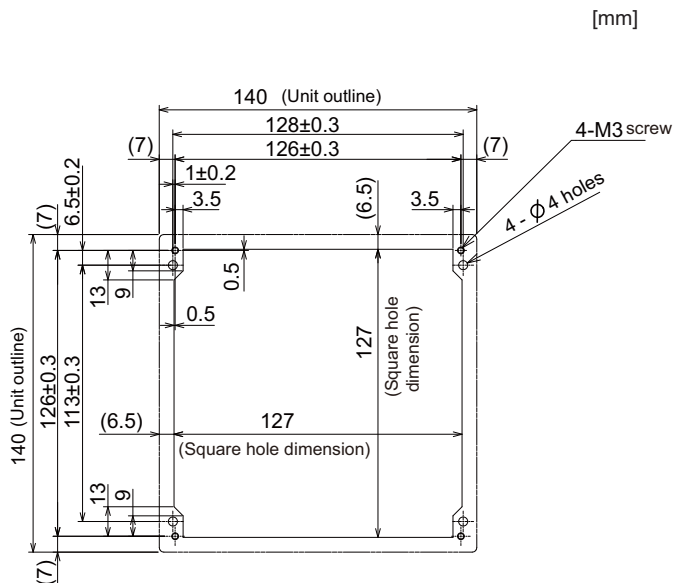
[Outline dimension : FCU8-KB931]



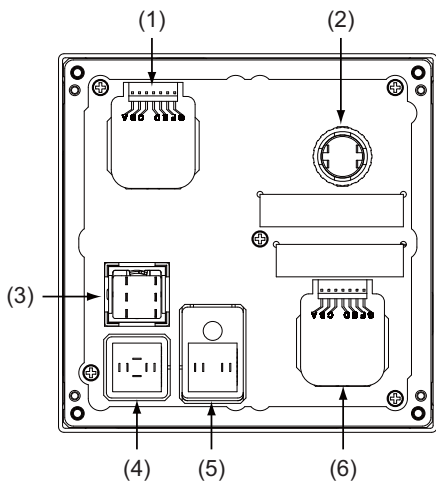
[Outline dimension : FCU8-KB941]



[Panel cut dimension : FCU8-KB931 / FCU8-KB941]

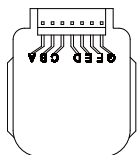


[Connector]



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

<Switch type>

Switch : AC09-GY0/10L3B02
 Recommended manufacturer : Fuji Electric
 Connection : Connector

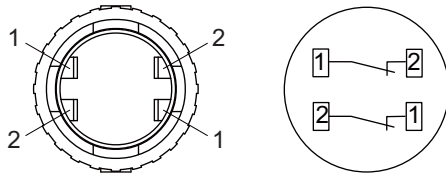
<Switch side connector type>

Connector : IL-7P-S3EN2
 Recommended manufacturer : Japan Aviation Electronics

<Cable side connector type>

Connector : IL-7S-S3L-(N)
 Contact : IL-C2-10000
 Recommended manufacturer : Japan Aviation Electronics

(2) Emergency stop switch



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

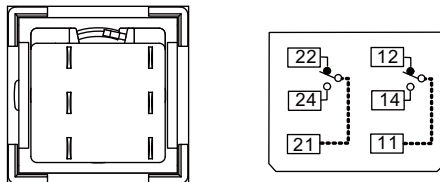
<Switch type>

Switch : XA1E-BV4U02TR
 Recommended manufacturer : IDEC
 Connection : Terminal

<Cable side connector type>

Connector: Faston terminal #110
 Recommended 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)

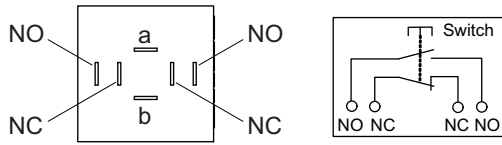
<Switch type>

Switch :LB6K-2ST2B
 Recommended manufacturer : IDEC
 Connection : Terminal

<Cable side connector type>

Connector: Faston terminal #110
 Recommended 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.

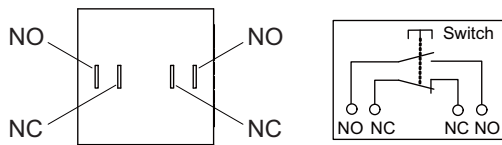
<Switch type>

Switch : AH165-SLW11X3/0063
 Recommended manufacturer : IDEC
 Connection : Terminal

<Cable side connector type>

Connector: Faston terminal #110
 Recommended 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.

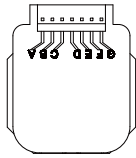
<Switch type>

Switch : AH165-SLB11X3/0063
 Recommended manufacturer : IDEC
 Connection : Terminal

<Cable side connector type>

Connector: Faston terminal #110
 Recommended manufacturer : -

(6) Cutting override



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

<Switch type>

Switch : AC09-GY0/20L3B02

Recommended manufacturer : Fuji Electric

Connection : Connector

<Switch side connector type>

Connector : IL-7P-S3EN2

Recommended manufacturer : Japan Aviation Electronics

<Cable side connector type>

Connector : IL-7S-S3L-(N)

Contact : IL-C2-10000

Recommended manufacturer : Japan Aviation Electronics

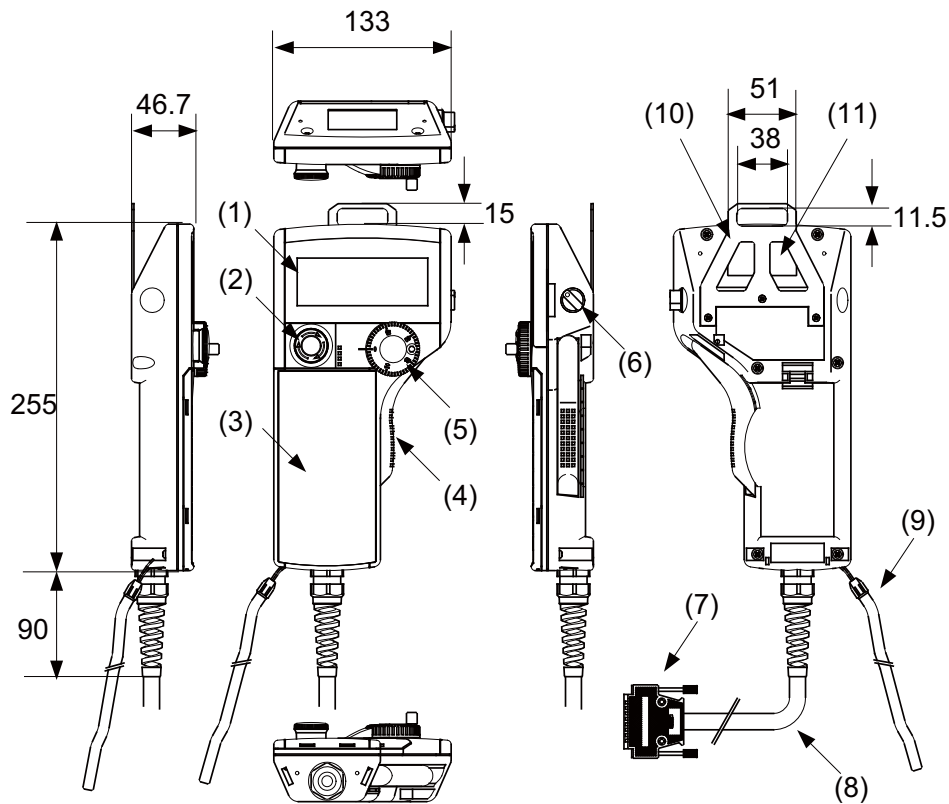
4.18 Handy Terminal

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

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

(Note 2) 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: 24VDC, 1A Contact configuration: 2b contacts (IDEC Corporation: HA1E-V2S2VR)	(8)	-	Host interface cable (5m)
(3)	-	Membrane switch (Note)	(9)	-	Simplified hand strap (IDEC Corporation: HG9Z-PS1)
(4)	SW2	Enable switch Contact rating/ Contact: 24VDC, 50mA Contact configuration: 3 position contact × 2 (OFF-ON-OFF) (IDEC Corporation: HE3B-M2)	(10)	-	Panel hanging fitting (IDEC Corporation: HG9Z-TK1)
(5)	SW4	Manual pulse generator Output: Open collector 4.7kΩ pull-up resistor is connected. (TOKYO SOKUTEIKIZAI CO., LTD: RE19PH50C16RR)	(11)	-	Serial number plate
(6)	SW6	Selector switch			

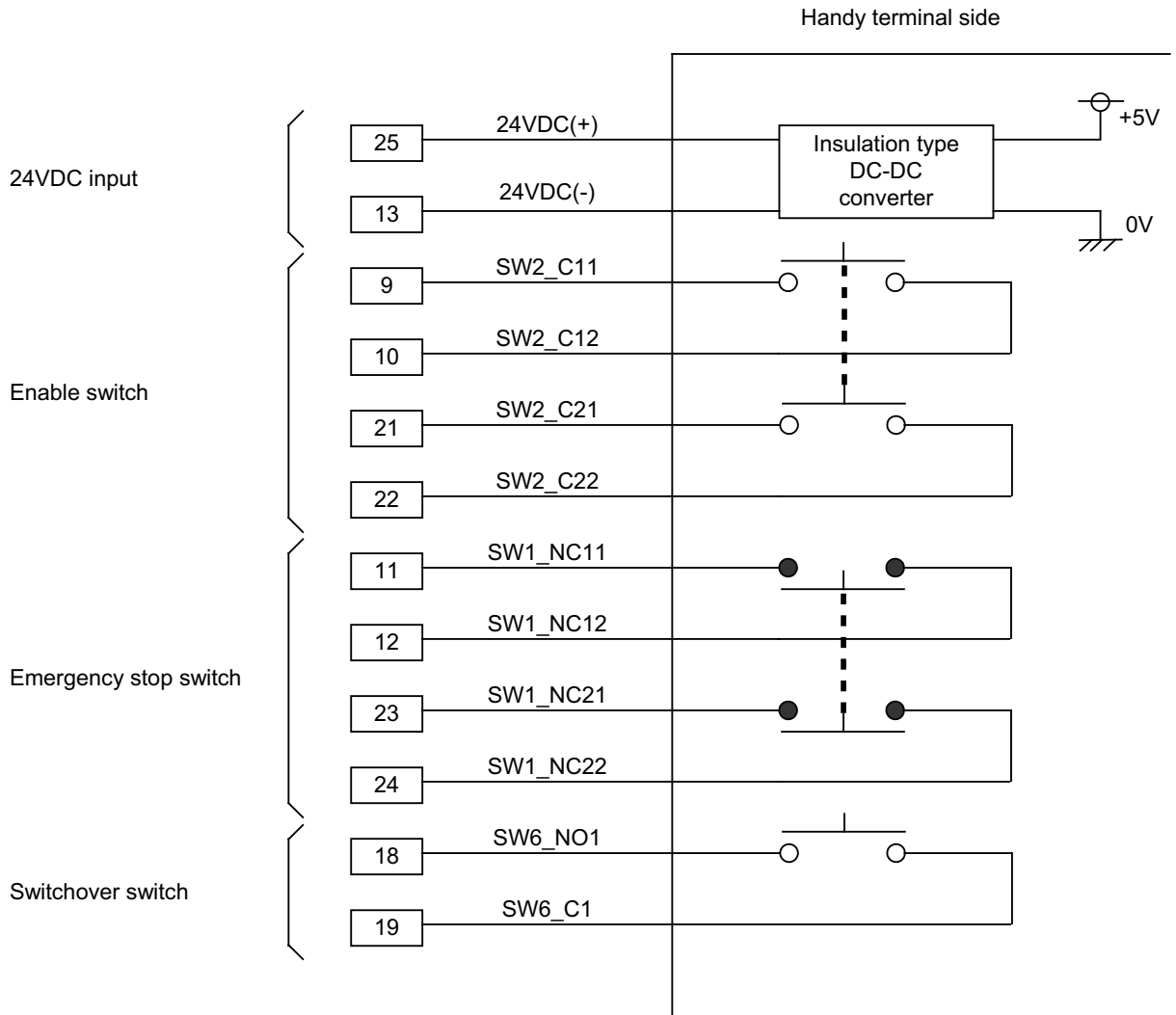
(Note) Do not press multiple switches simultaneously: When three or more switches are pressed simultaneously, unpressed switches are also detected as pressed ones.

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	0V	-	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	24VDC(-)	I	24VDC 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	0V	-	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	24VDC(+)	I	24VDC input

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

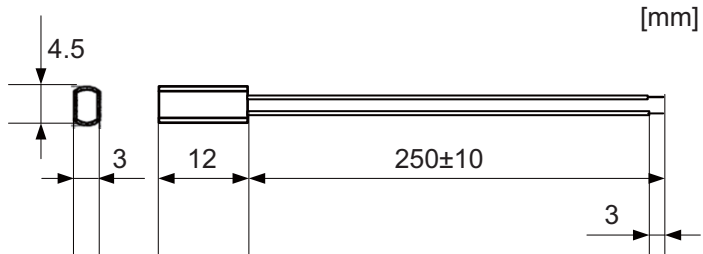
Terminal connections



4.19 Thermistor

4.19.1 Thermistor(PT3C-51F-M2)

[Outline dimension]



Made by SHIBAURA ELECTRONICS Co., Ltd.

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

4.20 Exclusive SD Cards for MITSUBISHI CNC

Item		FCU8-SD001G	FCU8-SD004G
Capacity		1GB	4GB
NAND Flash		SLC (Note 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)	

- (Note 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), which is commonly applied to SD cards.
- (Note 2) Do not touch the terminal part with fingers, etc. when handling the SD cards. The contermination of the terminal part of SD card causes a contact failure or a trouble.

4.21 Specifications and Precautions of USB/SD/LAN Interface

4.21.1 USB Interface (Personal Computer Unit, Side Memory I/F Unit)

Standards	USB3.0	USB2.0
Data transfer speed (Note)	Super Speed (5Gbps) High Speed (480Mbps) Full Speed (12Mbps) Low Speed (1.5Mbps)	High Speed (480Mbps) Full Speed (12Mbps) Low Speed (1.5Mbps)
Power supply to USB device	Supply voltage: 5V ± 5% Supply current: Max. 900mA/port	Supply voltage: 5V ± 5% Supply current: Max. 500mA/port (However, max. 200mA/port for side memory I/F unit)
Number of free ports	Personal computer unit × 2	Personal computer unit × 4, Side memory I/F unit × 1
Max. cable length	3m (During Super Speed. 5m for up to High Speed)	5m

(Note 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 2) Side memory I/F unit is only for 19-type display unit.

(Note 3) Do not connect devices other than the USB memory to the front memory I/F of the graphic control unit.

(1) Precautions for use of commercially available USB keyboards and mice(Only for the display unit with the computer.)

MITUBISHI will not provide performance guarantee and maintenance for commercially available USB keyboards and mice. In case of using one of them, careful performance check must be required by the machine tool builder. Commercially available devices may not be compatible with MITSUBISHI units or suitable FA environment for temperature- or noise-wise.

Commercially available USB keyboards/mice are susceptible to noise, etc., and may cause a malfunction in the unit that may lead to an accident. Do not use them while the machine is operated.

(2) Precautions for use of other commercially available USB devices(Only for the display unit with the computer.)

When connecting a commercially available USB device that requires power exceeding the maximum current, select the one of which power can be supplied from an outside source.

MITSUBISHI will not provide performance guarantee and maintenance for commercially available USB printer, USB floppy disk, USB memory, USB hub, USB-CD drive, USB-DVD drive, and other USB devices. Commercially available devices may not be compatible with MITSUBISHI units or suitable FA environment for temperature- or noise-wise.

In the case of using one of them, careful performance check must be required by the machine tool builder, and necessary noise countermeasures, such as executing EMI countermeasures or adding the ferrite cores, must be taken.

(3) Precautions for insertion/removal of USB memory

When inserting/removing an USB memory, turn the MITUBISHI 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 MITUBISHI will not guarantee the broken or lost data.

(4) Precaution for operation with front-side USB memory

A USB memory to be used has to be supported USB2.0 Hi-Speed (480Mbps).

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.

4.21.2 SD Interface (Control Unit, Side Memory I/F Unit)

Standards	SD/SDHC (Note)
Transfer speed	According to the connecting SD card
Capacity	32GB
Number of free ports	Control unit × 1, Side memory I/F unit × 1

(Note 1) SDXC is not supported.

(Note 2) Side memory I/F unit is only for 19-type display unit.

(1) Precautions for use of commercially available SD card

MITUBISHI will not provide performance guarantee and maintenance for commercially available SD card, mini SD card or micro SD card (requires converting adapter). In case of using one of them, careful performance check must be required by the machine tool builder.

Commercially available devices may not be compatible with MITSUBISHI units or suitable FA environment for temperature- or noise-wise.

(2) Precautions for insertion/removal of SD card

When inserting/removing an SD card, turn the MITUBISHI 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 MITUBISHI will not guarantee the broken or lost data.

4.21.3 LAN Interface (Control Unit, Personal Computer Unit)

Standards	1000BASE-T / 100BASE-TX / 10BASE-T
Data transfer speed (Note)	1000Mbps / 100Mbps / 10Mbps
Number of free ports	Control unit × 1, Personal computer unit × 1
Max. cable length	100m

(Note 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 2) When using half-duplex communication, the response time may become long depending on the opposite device.

Use full-duplex communication to connect with the opposite device via a switching HUB.

(1) 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.

5

Installation

5.1 Heat Radiation Countermeasures

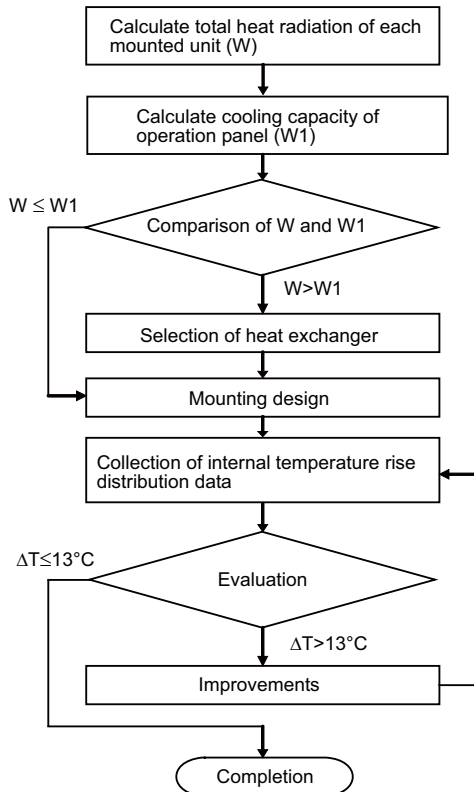
Please refer to the following method for heat radiation countermeasures.

Example of heat radiation countermeasures

<Hypothetical conditions>

- (1) Average internal temperature of operation panel: $T \leq 58^{\circ}\text{C}$
- (2) Peripheral temperature of operation panel : $T_a \leq 0^{\circ}\text{C}$ to 45°C
- (3) Internal temperature rise value : $\Delta T = T - T_a$ (max) = 13°C

Procedures for heat design and verification



<Supplement>

- (1) Refer to "General Specification" for the heat generated by each unit.
- (2) Enclosed cabinet (thin steel plate) cooling capacity calculation equation

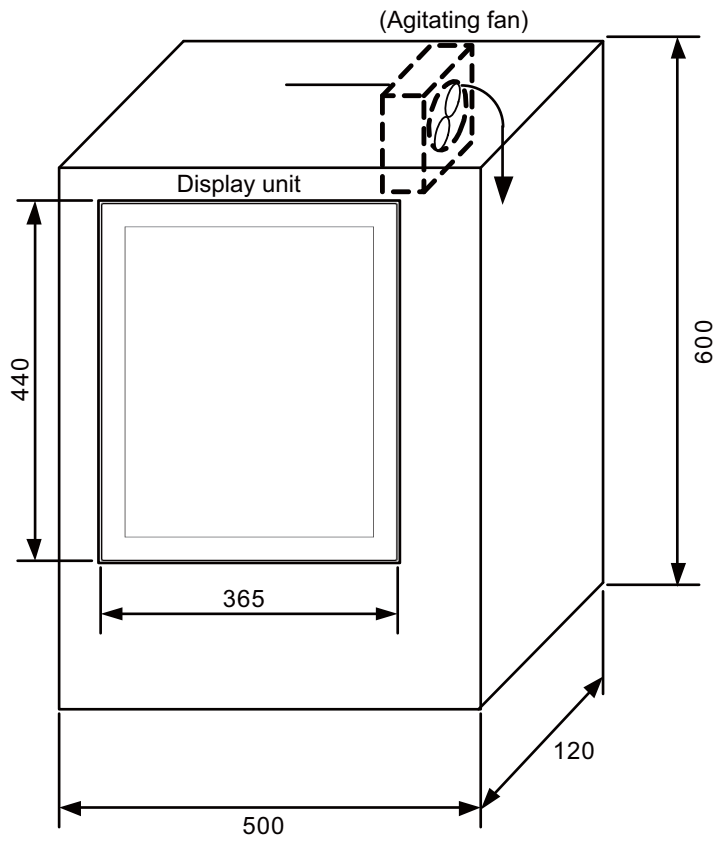
$$W1 = U \times A \times \Delta T$$

$$U: 6 \text{ W/m}^2\text{C}$$

$$A: \text{Effective heat radiation area (m}^2\text{) (Area where heat can be radiated from operation panel)}$$

$$\Delta T: \text{Internal temperature rise value (13}^{\circ}\text{C)}$$
 (Caution) $8 \text{ W/m}^2\text{C}$ can be applied only when the operation panel is so small that the internal temperature stays uniform.
- (3) Points of caution for heat radiation countermeasures when designing mounting state
 - Consider convection in operation panel (eliminate heat spots)
 - Collect hot air at suction port of heat exchanger in operation panel.
- (4) Criterion for internal temperature rise distribution data
 - ΔT (average value) $\leq 13^{\circ}\text{C}$
 - ΔT_{max} (maximum value) $\leq 15^{\circ}\text{C}$
 - R (inconsistency $\Delta T_{\text{max}} - \Delta T_{\text{min}}$) $\leq 6^{\circ}\text{C}$
 - (Evaluate existence of heat spots)

The following shows an example of calculation applied to heat radiation countermeasures for the operation panel when 19-type display unit is used. Because heat will accumulate in the upper portions of the unit, install an agitating fan as required.



Calculation example of panel internal heating value

(1) Calculation of unit heating value (In the case of FCU8-DU191-75 + FCU8-DX837)

Heating value (W)

Total heating value of units (W) :

26.1W (= display unit + operation panel I/O unit)

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

9.2W (= 24V (total heating value when the 80 points are simultaneously turned ON) × 4.8mA × 80)

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

Total heating value W = 35.3W (26.1 + 9.2)

(2) 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

$$= 0.643 \text{ mm}^2 (\approx 0.5 \times 0.12 + 0.6 \times 0.5 \times 2 + 0.6 \times 0.12 \times 2 - 0.44 \times 0.365)$$

(Top surface) (Front, rear surface) (Both sides surface) (Unit surface)

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 = 50.2W (6 × A × ΔT)

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

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

(4) Confirmation with the actual machine

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

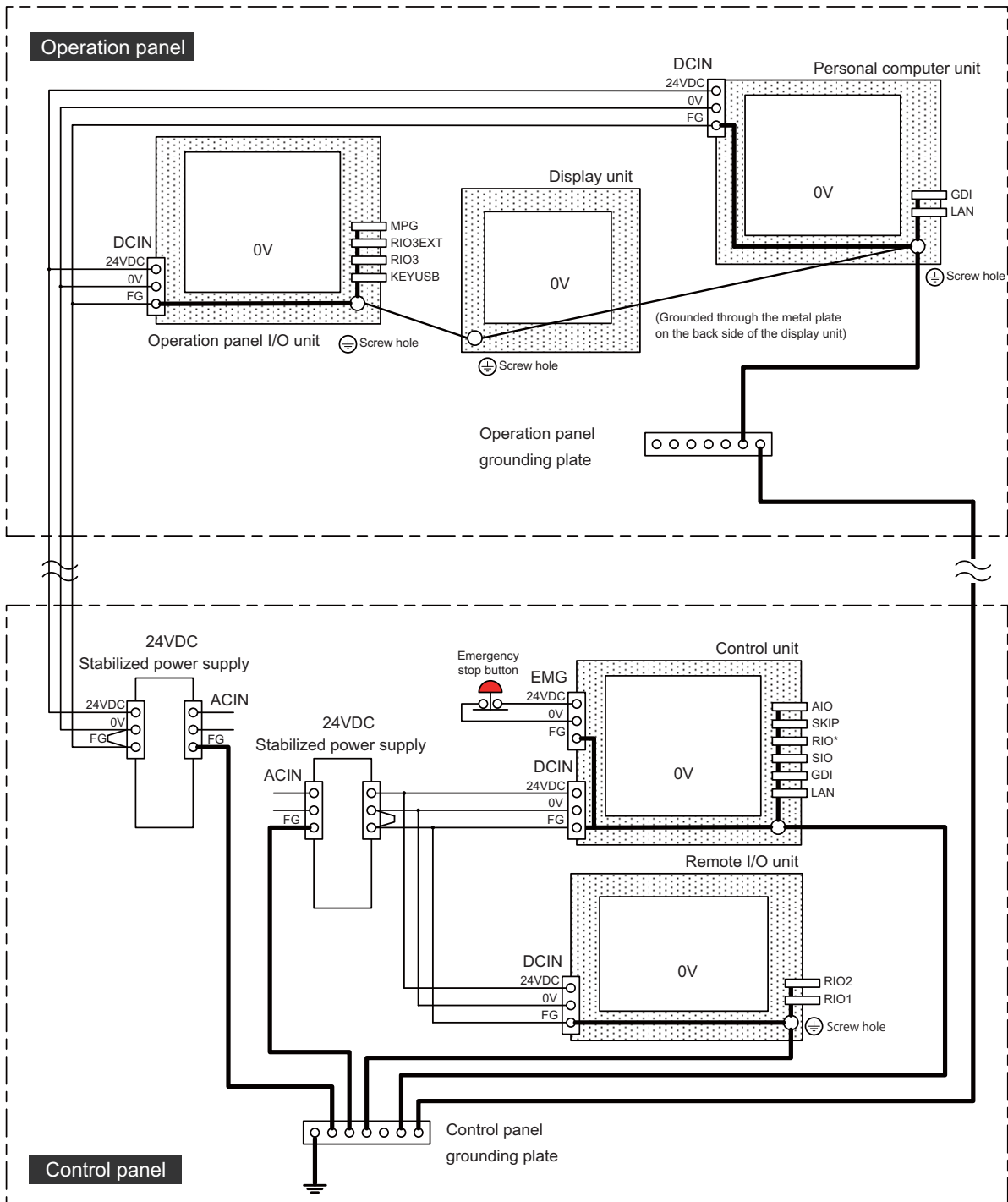
Be sure to confirm the temperature rise value in the operation panel when the machine is running.



5.2 Noise Countermeasures

5.2.1 Connection of Frame Ground (FG)

The frame should basically be grounded at one ground point.

Because the personal computer unit and the operation panel I/O unit are located in a place away from the electric cabinet, connect the ground terminal of the personal computer to the grounding plate of the operation section and connect the grounding plate of the operation panel to the grounding plate of the electric cabinet. (Be sure to ground the ground terminal of the personal computer otherwise the influence is exerted on the usability of the touchscreen.) Connect 0V (common) and FG on the 24VDC power supply.



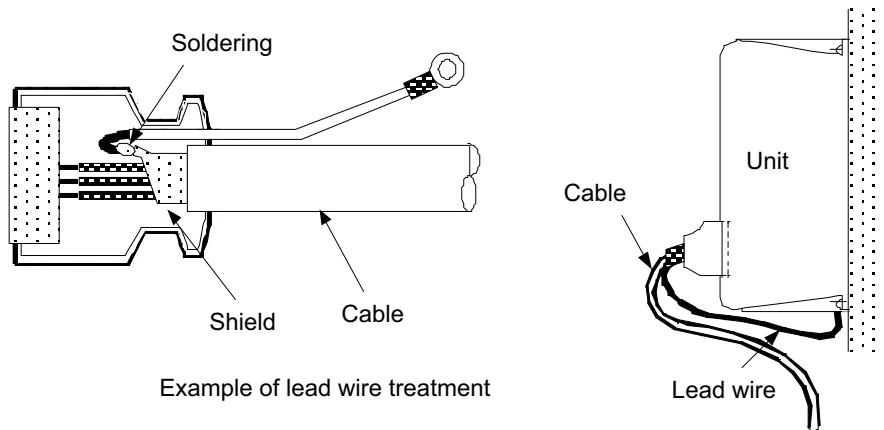
 : Indicates that the metal case of connector is connected to FG  according to the pattern on PCB.

5.2.2 Shield Clamping of Cables

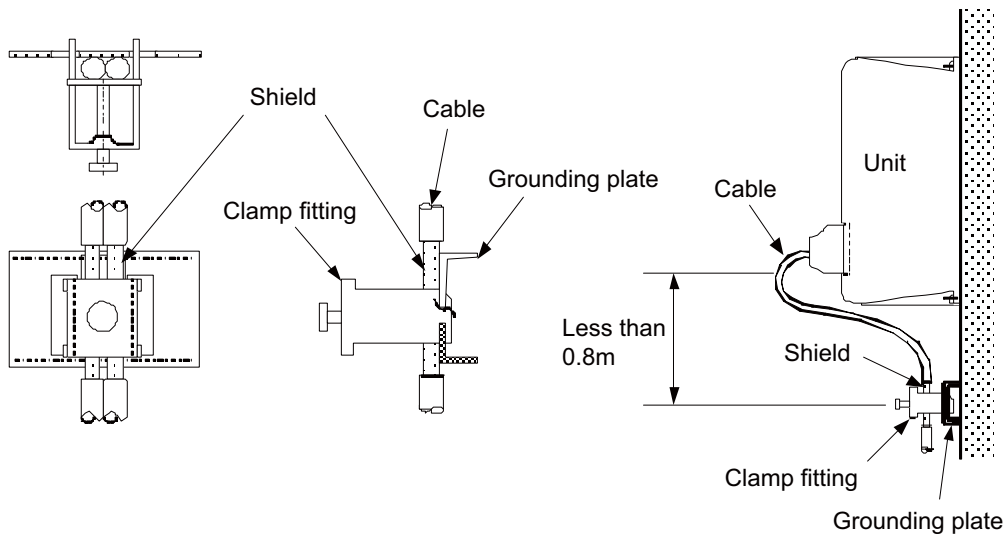
The shield of the shield cable connected to the control unit and drive unit must be connected to the grounding plate to stabilize operation while preventing malfunctioning due to noise.

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 connection with clamp fitting]



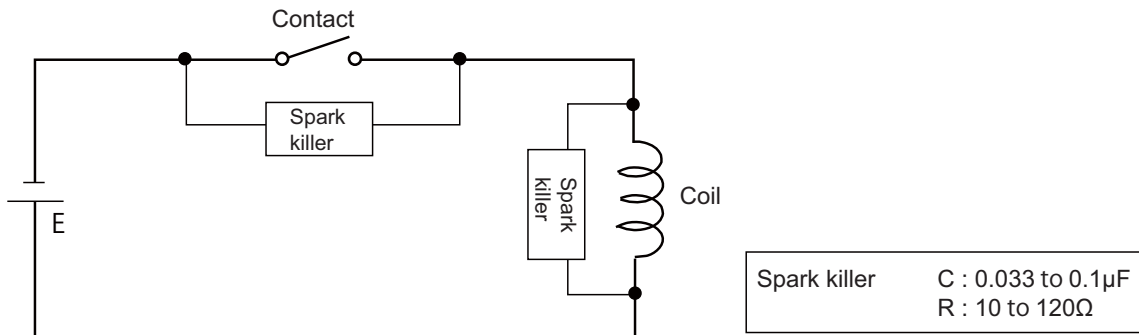
- (1) Peel part of the cable sheath and expose the shield as shown in the drawing.
Press the exposed part against the grounding plate with the cable clamp fittings.
- (2) If the cable is thin, clamp several together in a bunch.
- (3) Use adequate force when tightening the cable so that the wire material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

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.

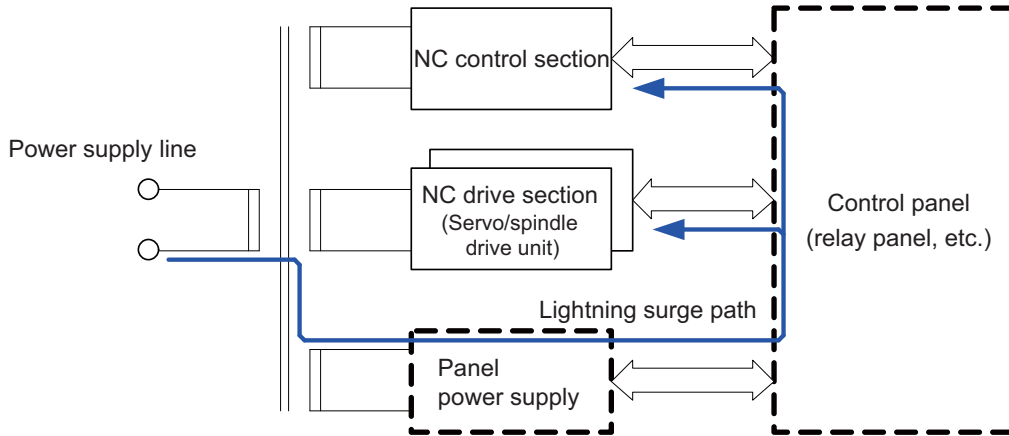


5.2.4 Lightning Surge Protection Countermeasure

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, MITSUBUSHI NC unit has the surge absorber for the control power supply of the NC control section and the NC 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.



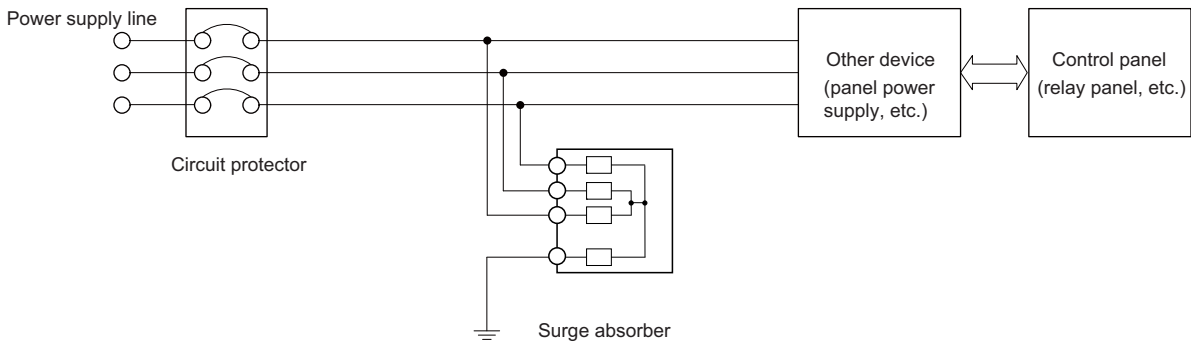
Path of damage caused by lightning surge

(1) Protection countermeasure 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

(2) Product example of surge absorber

Case of OKAYA ELECTRIC INDUSTRIES surge absorber

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

(Note) Refer to "EMC Installation Guidelines: EMC Countermeasure Parts: Surge Absorber" for the outline, etc. Refer to the manufacturer catalog for detailed characteristics, outline and connection methods of the surge absorber.

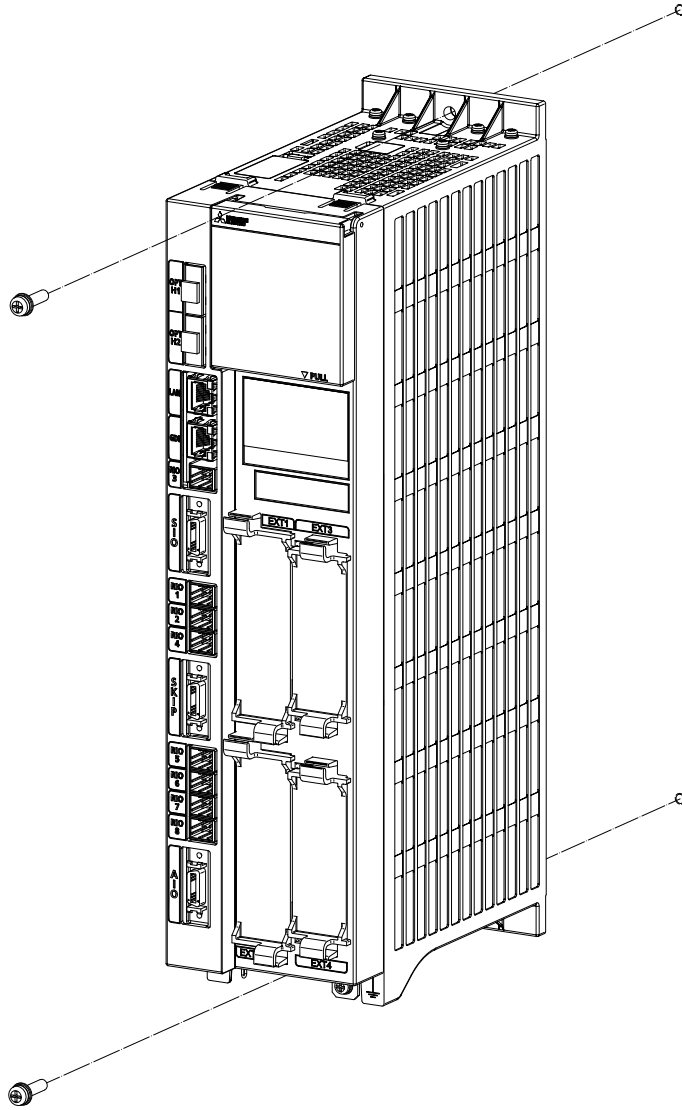
5.3 Unit Installation

5.3.1 Control Unit

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

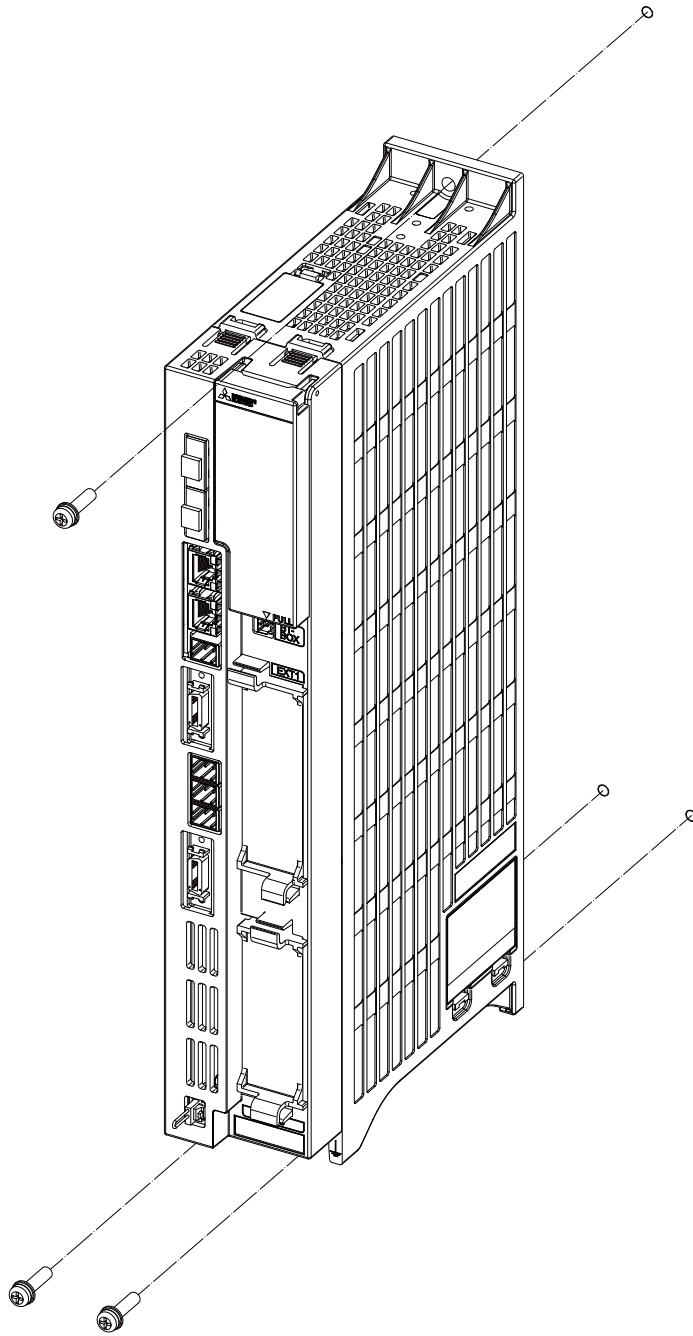
(Note) Refer to "General Specifications: Control Unit" for the installation dimension and the screw hole position.

[FCU8-MU042 / FCU8-MA041]



Fixing screw : M5 (2 pcs)

[FCU8-MU044]



Fixing screw : M5 (3 pcs)

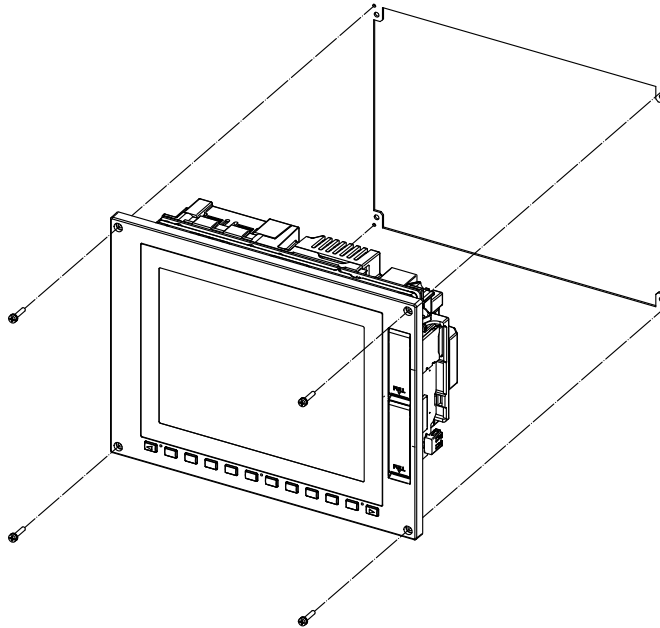
5.3.2 Display Unit

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

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

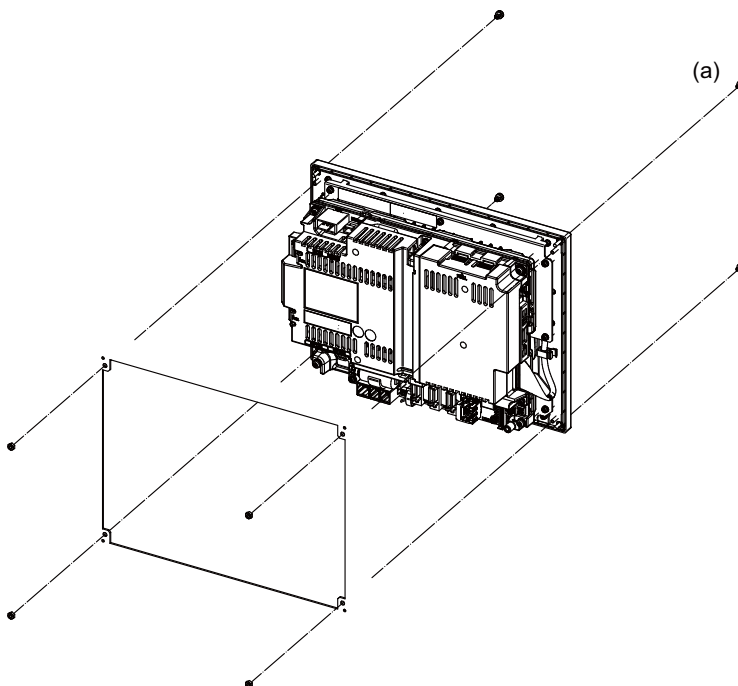
[FCU8-DU121 (8.4-type display unit)]

- Fixed on the front side



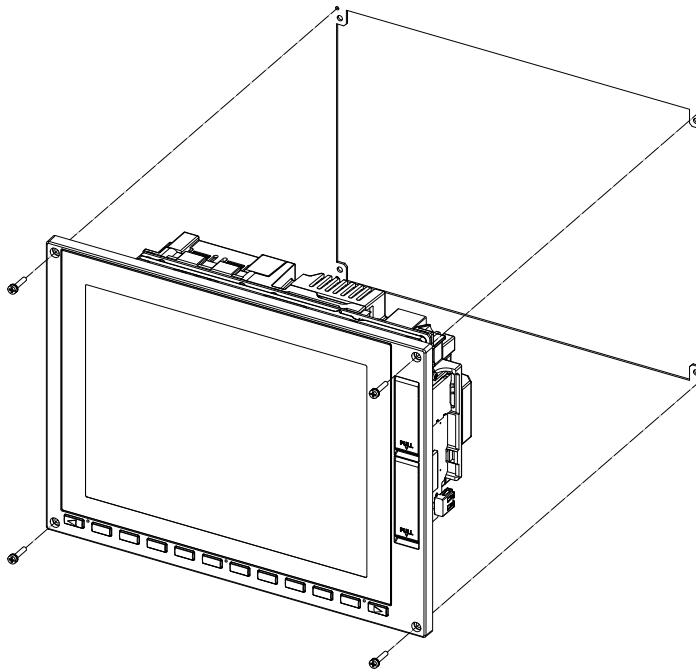
Fixing screw: Cheese head screw M3 (4 pcs).
(Fixing screws are provided with the unit.)

- Fixed on the back side



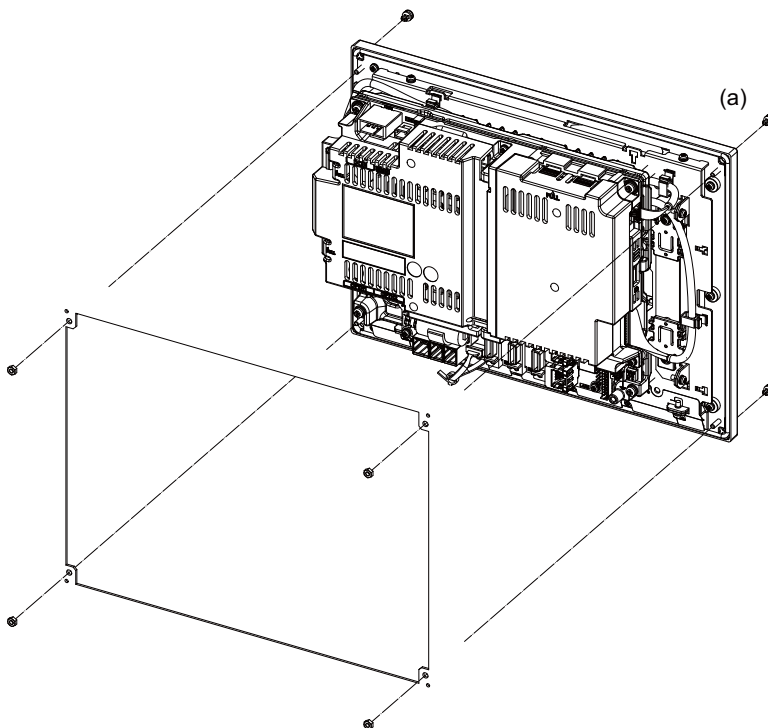
Fixture: M3 nut (4 pcs).
(4 pcs of the screw caps (a) are provided with the unit.)

[FCU8-DU141 (10.4-type display unit)]
- Fixed on the front side



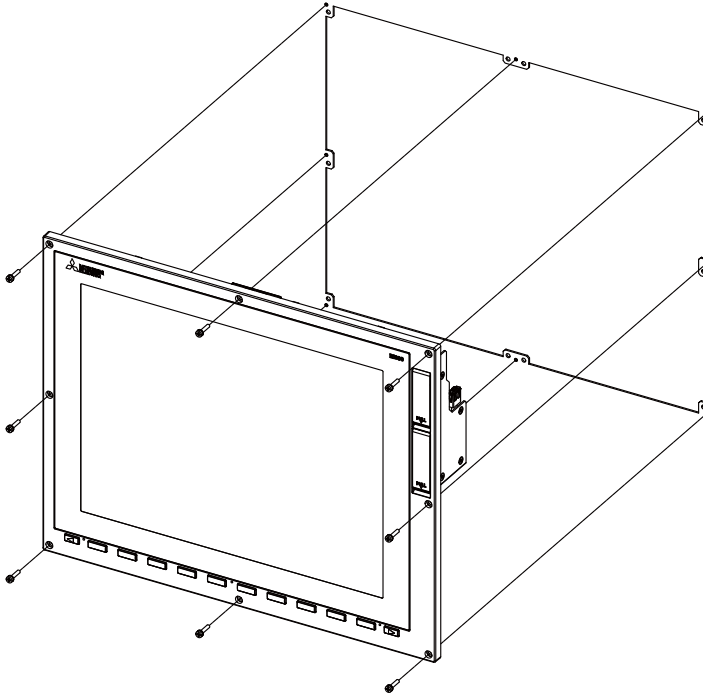
Fixing screw: Cheese head screw M3 (4 pcs).
(Fixing screws are provided with the unit.)

- Fixed on the back side



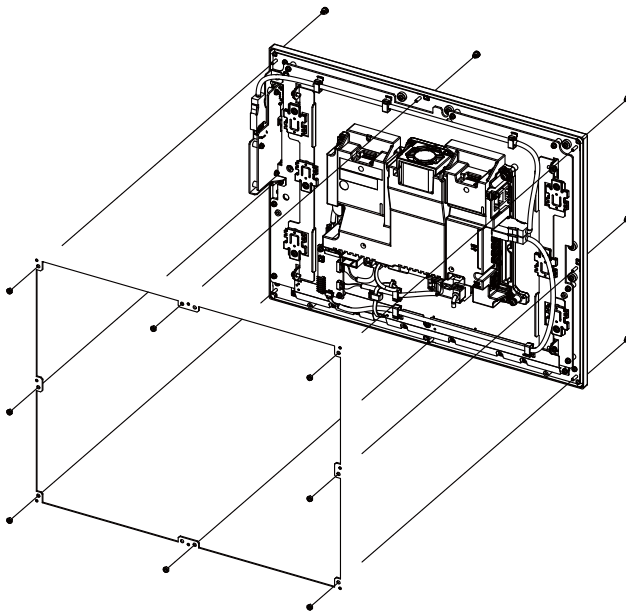
Fixture: M3 nut (4 pcs).
(4 pcs of the screw caps (a) are provided with the unit.)

[FCU8-DU181 (15-type display unit)]
- Fixed on the front side



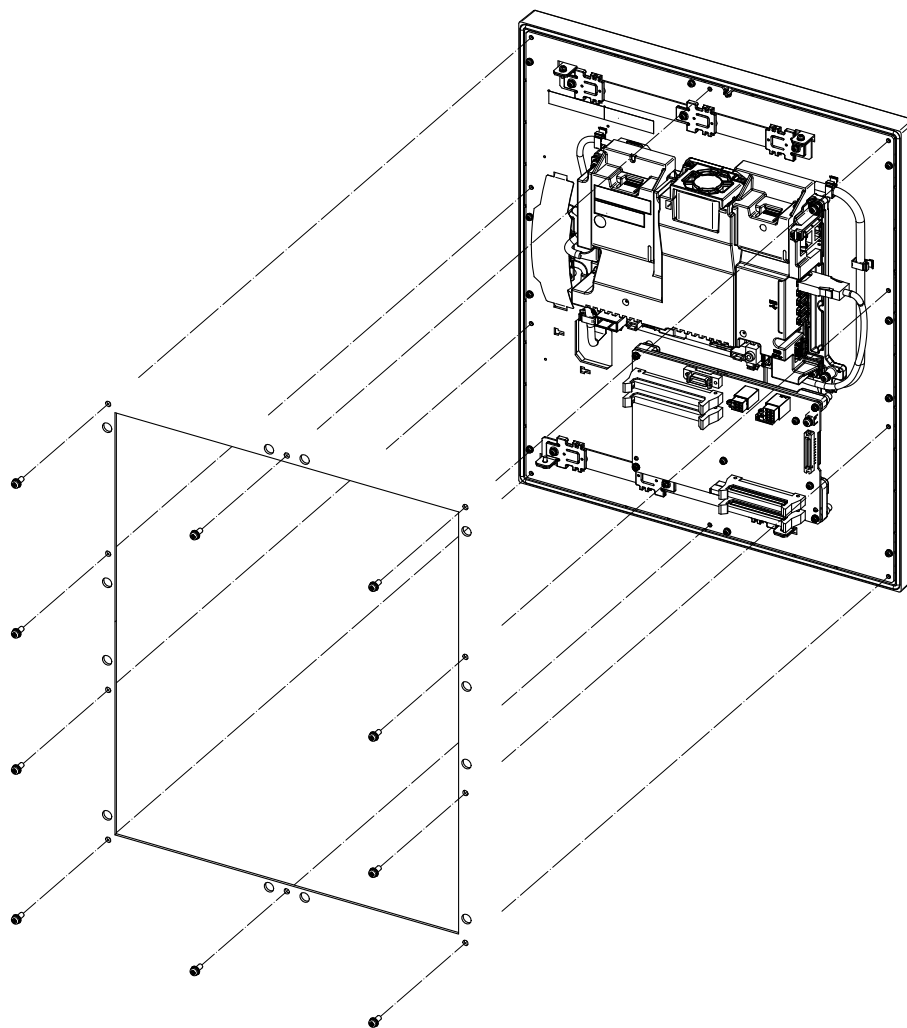
Fixing screw: Cheese head screw M3 (8pcs).
(Fixing screws are provided with the unit.)

- Fixed on the back side



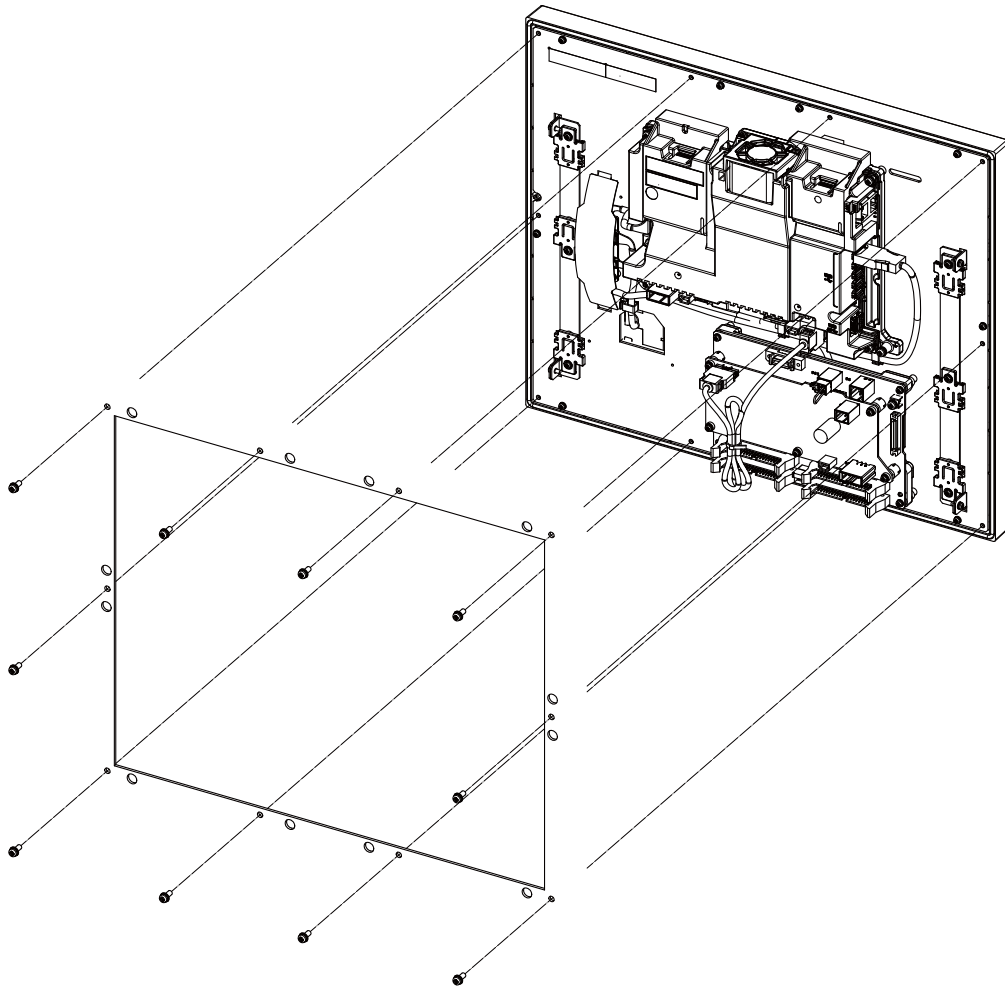
Fixture: M3 nut (8pcs).
(8 pcs of screw caps are provided with the unit.)

[FCU8-DU191 (19-type display unit)]



Fixing screw: Use M4×10 with spring washer and plain washer (10 screws).

[FCU8-DU192 (19-type display unit)]



Fixing screw: Use M4×10 with spring washer and plain washer (10 screws).

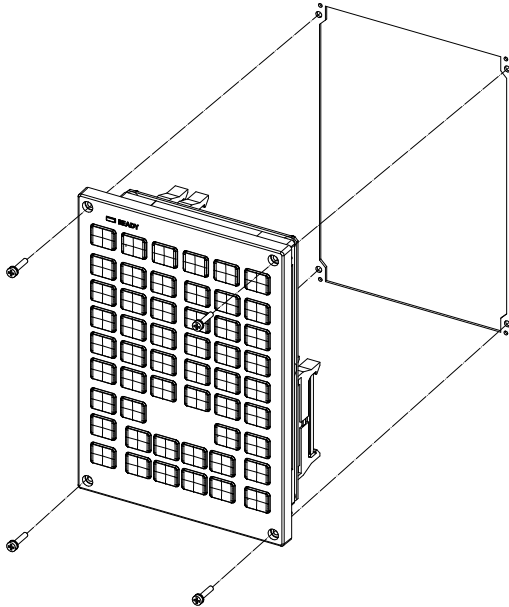
5.3.3 Keyboard Unit

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

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

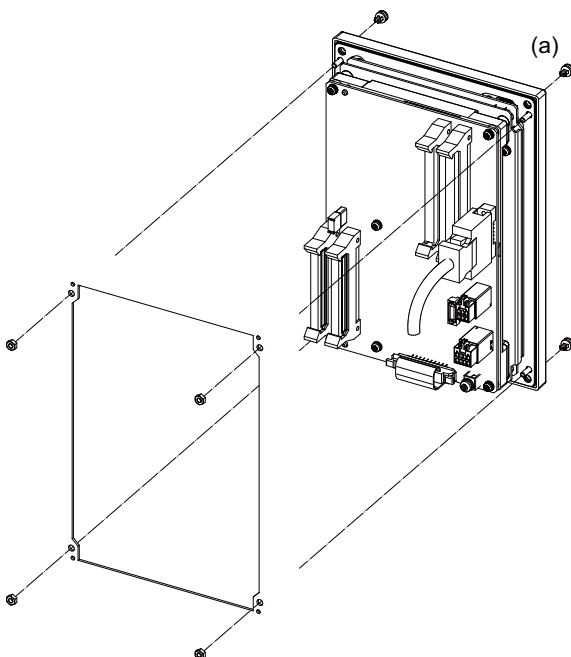
[FCU8-KB026/KB028]

- Fixed on the front side



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

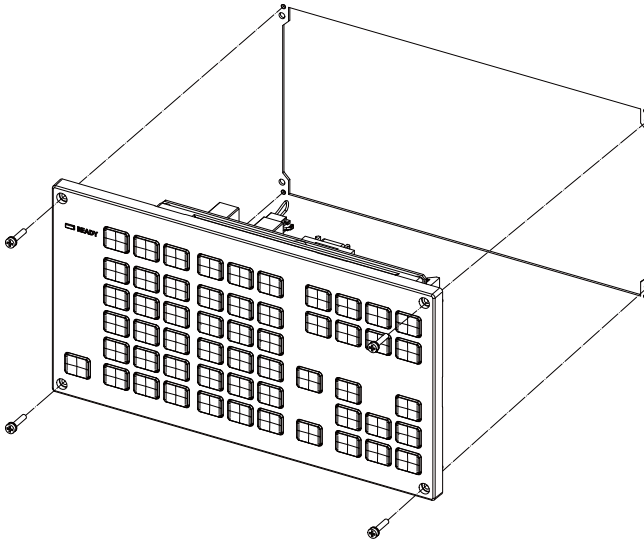
- Fixed on the back side



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

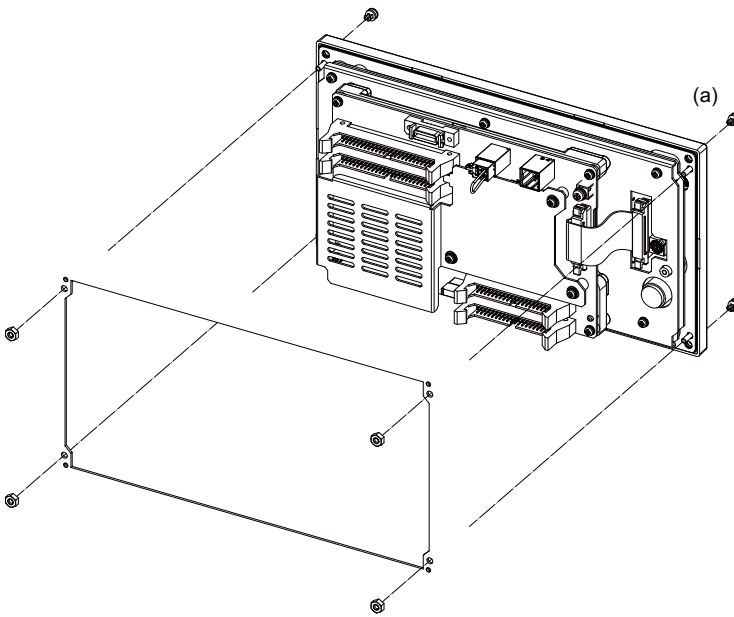
[FCU8-KB029]

- Fixed on the front side



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

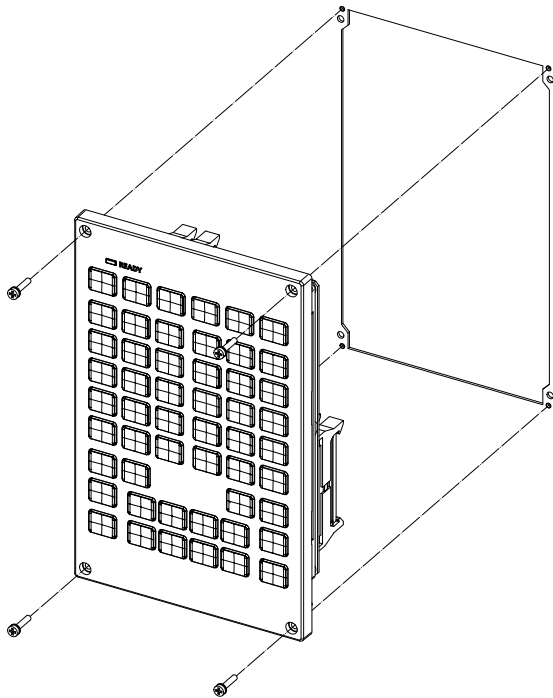
- Fixed on the back side



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

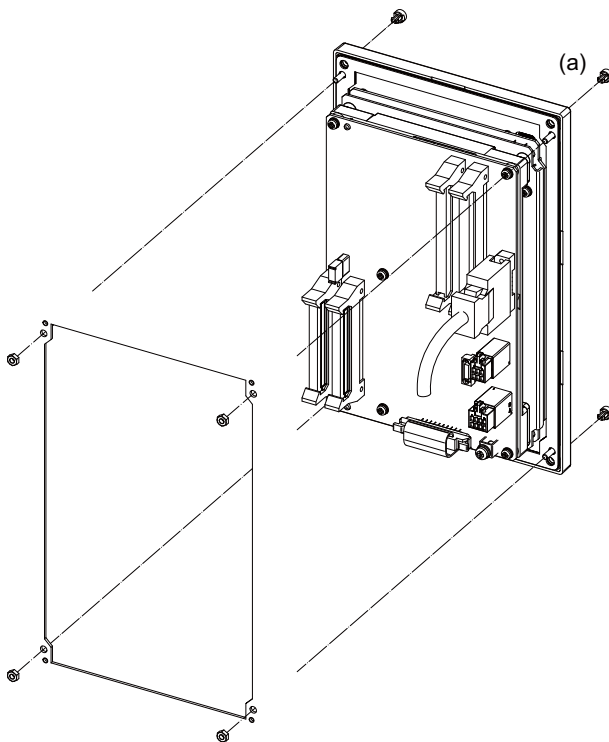
[FCU8-KB041/KB046]

- Fixed on the front side



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

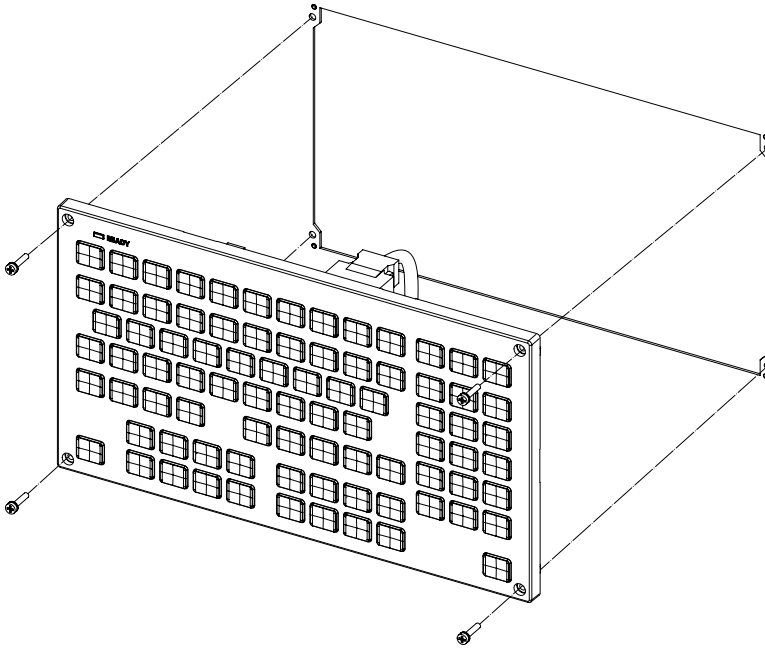
- Fixed on the back side



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

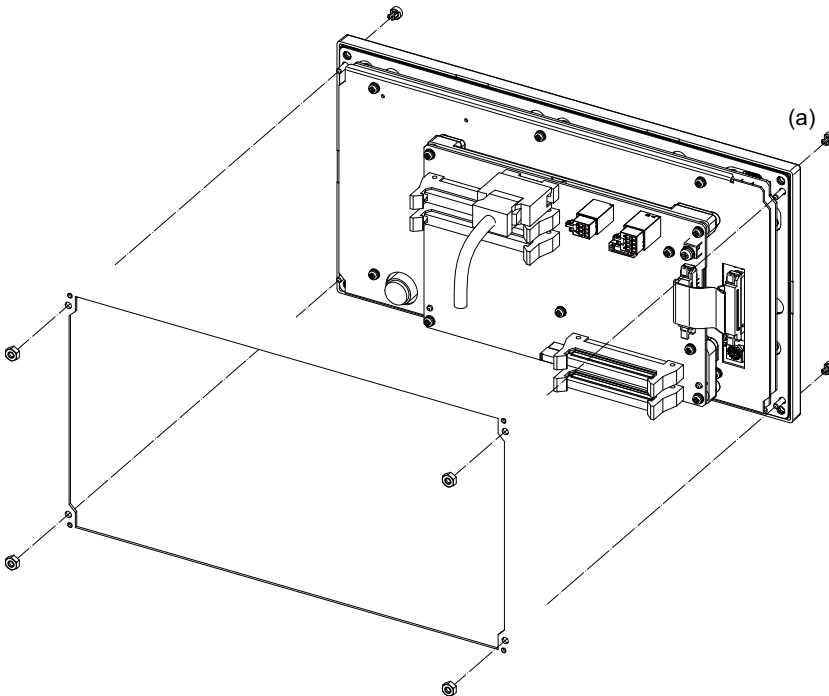
[FCU8-KB047]

- Fixed on the front side



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

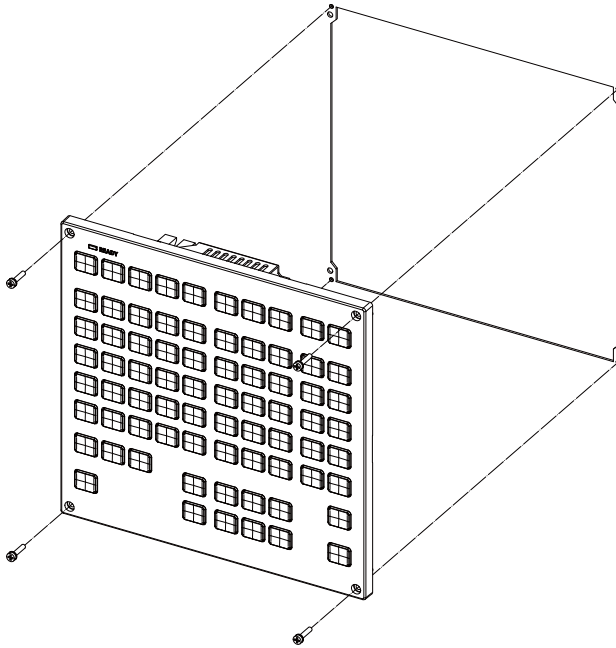
- Fixed on the back side



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

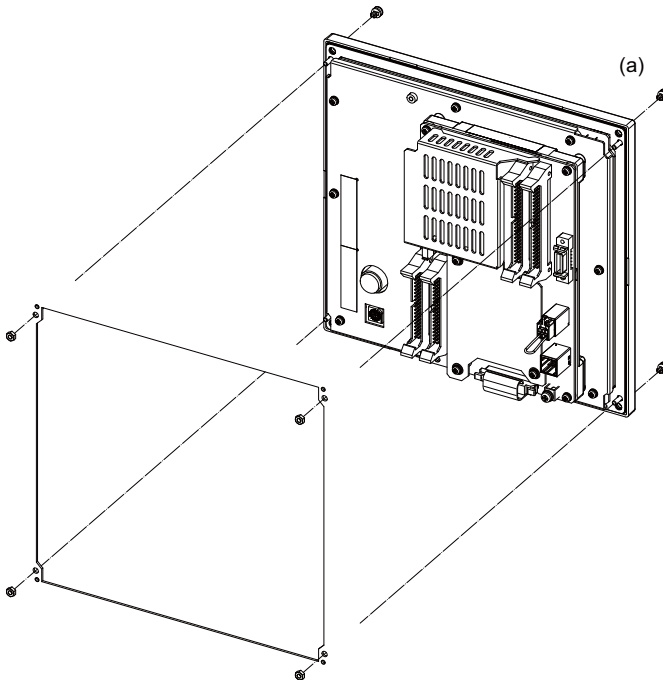
[FCU8-KB048]

- Fixed on the front side



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

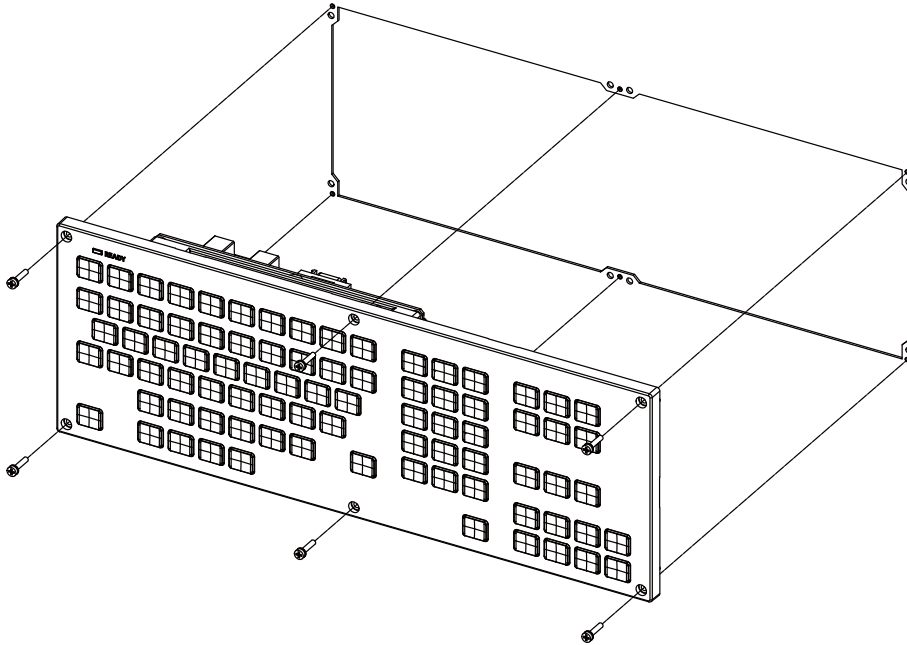
- Fixed on the back side



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

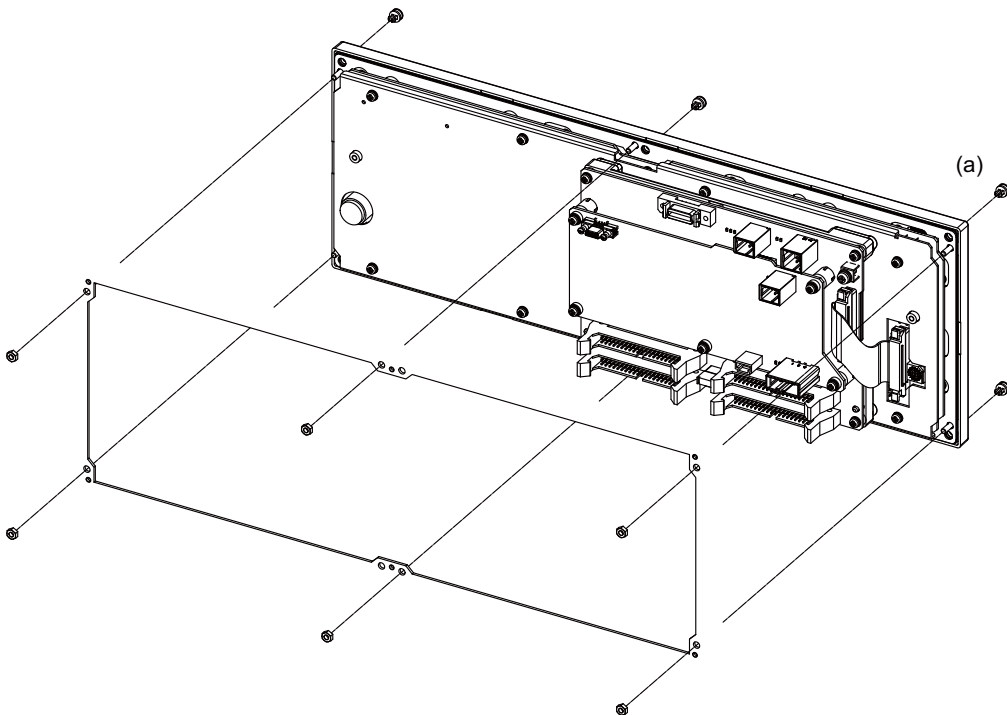
[FCU8-KB083]

- Fixed on the front side



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

- Fixed on the back side



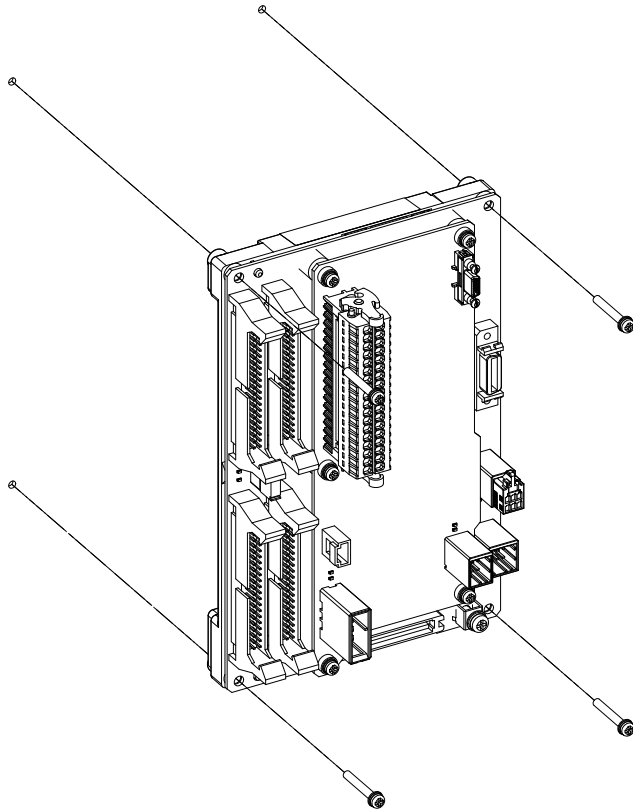
Fixture: M3 nut (6 pcs).
(6 pcs of screw caps (a) are provided with the unit.)

5.3.4 Operation Panel I/O Unit

Mount the operation panel I/O unit with the prescribed number of fixing screws.

(Note) Refer to "General Specifications: Operation Panel I/O Unit" for the installation dimension and the screw hole position.

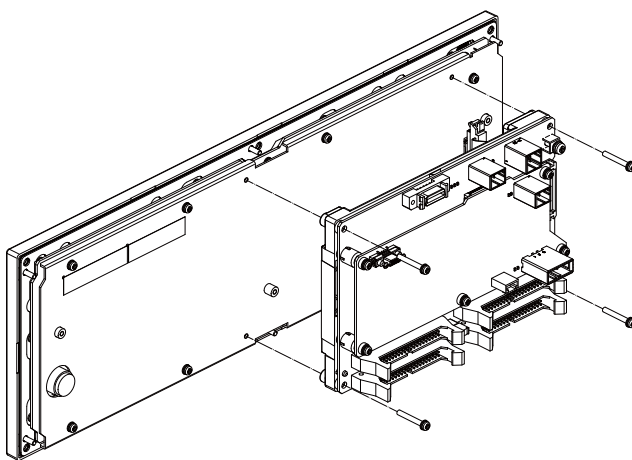
[FCU8-DX830 / FCU8-DX834 / FCU8-DX837 / FCU8-DX730]



Fixing screw: M3 (4 pcs)

Installation on the back side of the keyboard

Operation panel I/O unit can be installed on the back side of the keyboard.



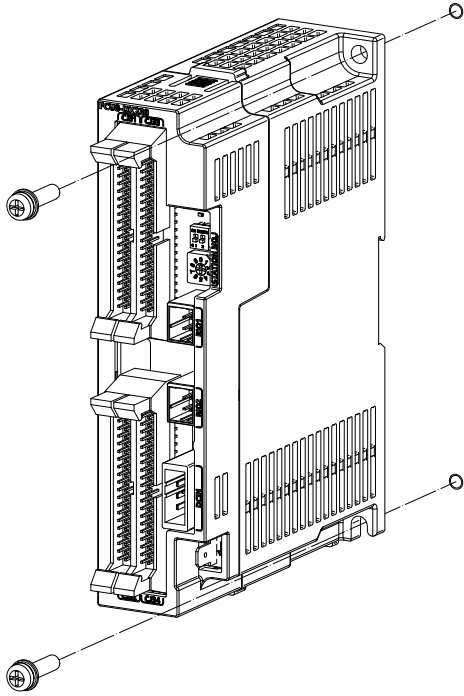
Fixing screw: M3 (4 pcs)

5.3.5 Remote I/O Unit

Mount the remote I/O unit with the prescribed number of fixing screws.

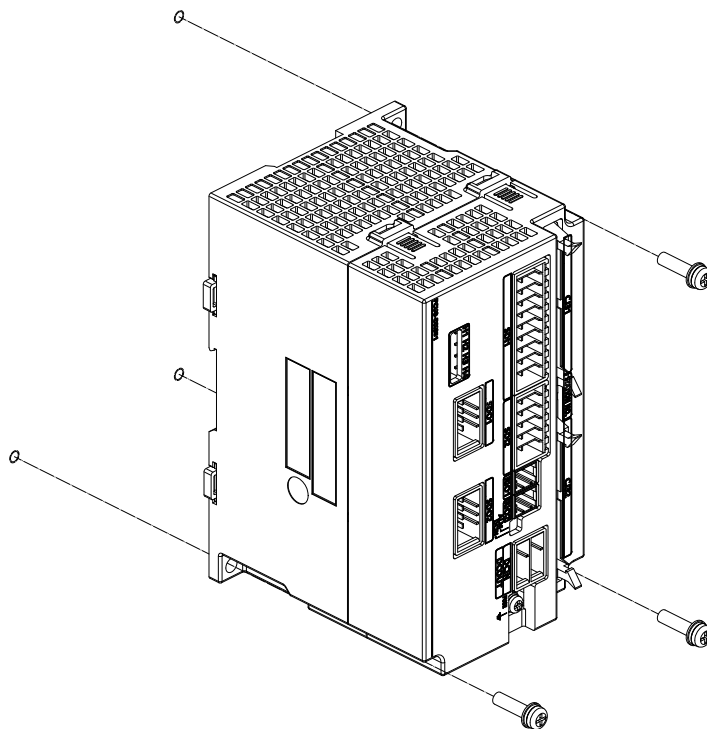
(Note) Refer to "General Specifications: Remote I/O Unit" for the installation dimension and the screw hole position.

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



Fixing screw: M5 (2pcs)

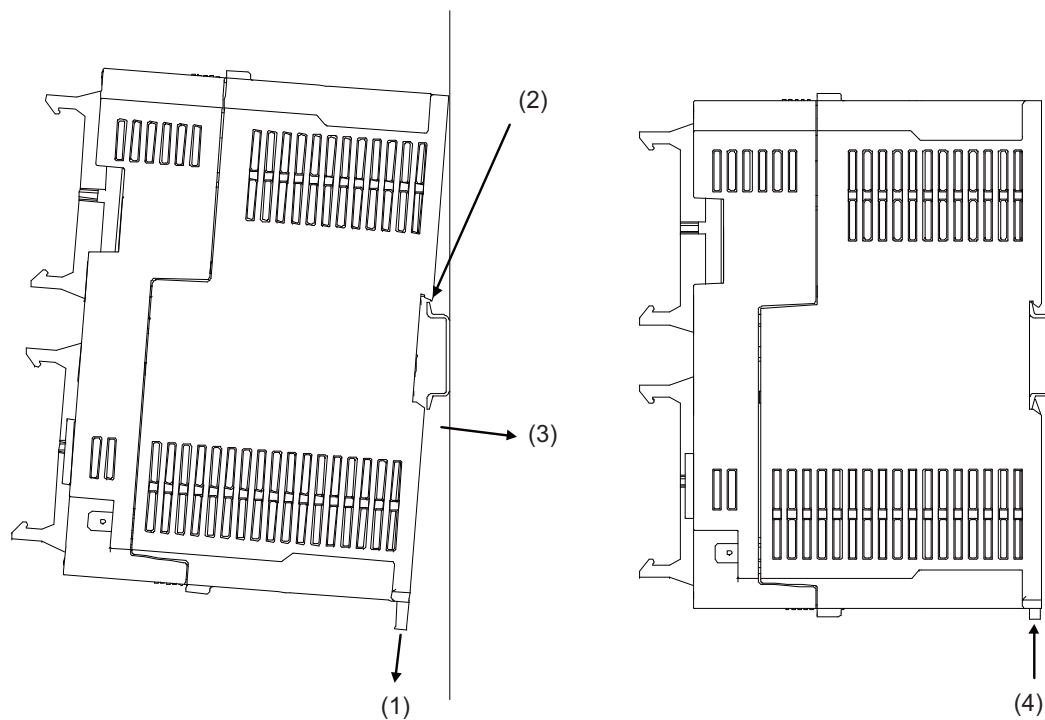
[FCU8-DX651]



Fixing screw: M5 (3pcs)

[Install 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

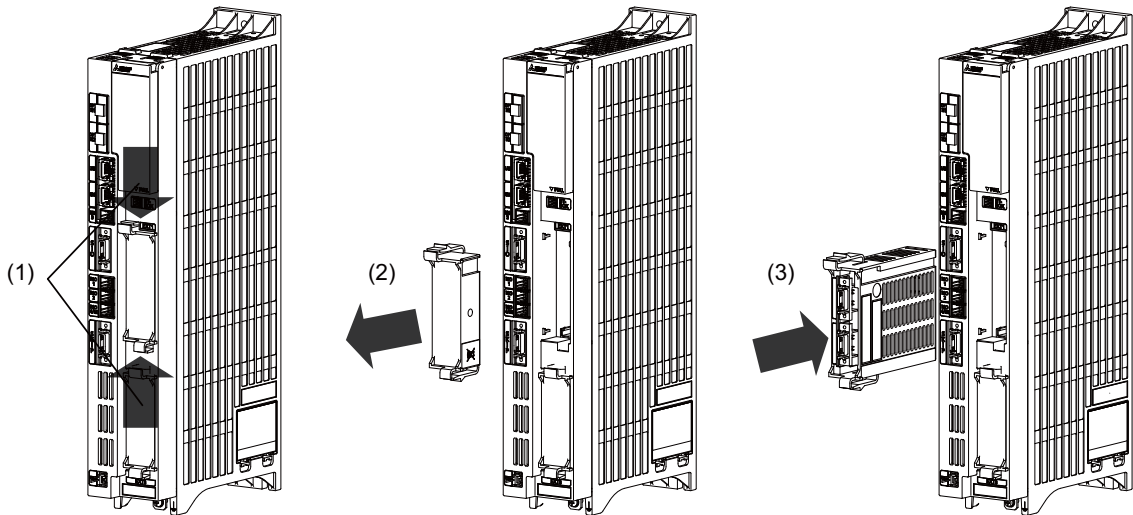
- TH35-7.5Fe : 7.5
- TH35-7.5AL : 7.5
- TH35-15Fe : 15

5.3.6 Function Expansion Unit

Connect the function expansion unit to the expansion slot 1 (EXT1) or expansion slot 2 (EXT2) of the control unit.

- (1) Push the tabs at the top and bottom of the cover attached to the expansion slot of the control unit.
- (2) Remove the cover of the expansion slot.
- (3) Insert the expansion unit into the expansion slot.

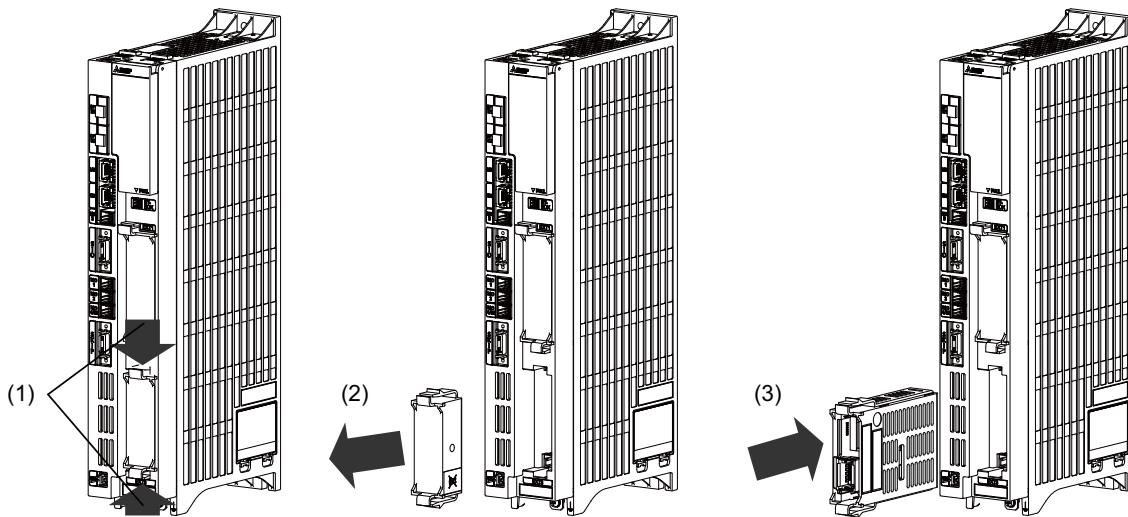
The expansion unit is fixed with the tabs.



5.3.7 Communication Expansion Unit

Connect the communication expansion unit to the expansion slot 3 (EXT3) or expansion slot 4 (EXT4) of the control unit. Install the communication expansion unit as follows:

- (1) Push the tabs at the top and bottom of the cover attached to the expansion slot of the control unit.
 - (2) Remove the cover of the expansion slot.
 - (3) Insert the expansion unit into the expansion slot.
- The expansion unit is fixed with the tabs.



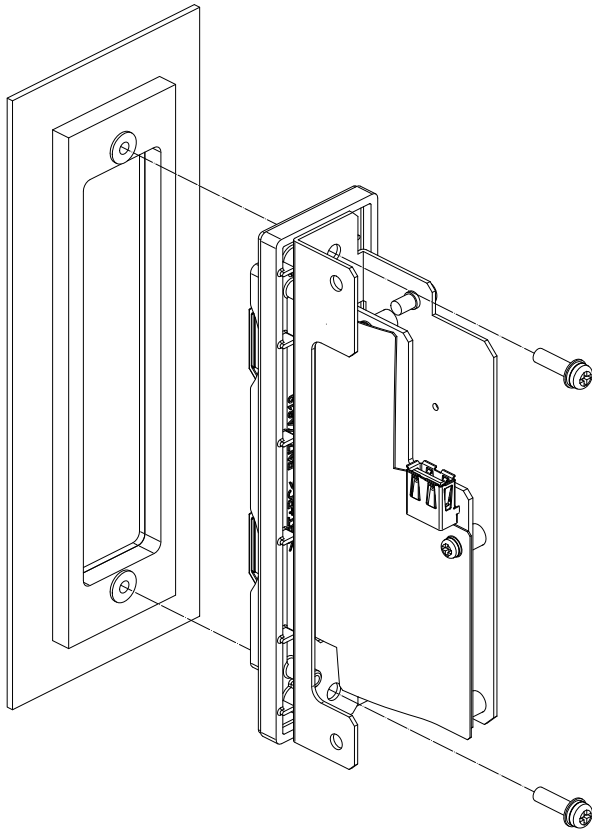
5.3.8 Side Memory I/F Unit

Mount the side memory I/F unit with two fixing screws.

(Note 1) Refer to "General Specifications: Side Memory I/F Unit" for the installation dimension and the screw hole position.

(Note 2) Side memory I/F unit is only for 19-type display unit.

[FCU8-EP201-2]



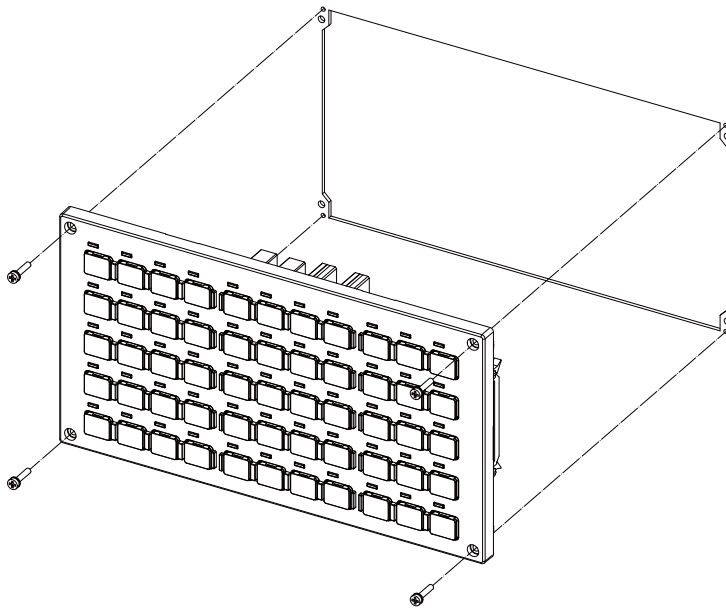
5.3.9 MITSUBISHI CNC Machine Operation Panel

Mount the MITSUBISHI CNC machine operation panel (main panel and sub panel) with the prescribed number of fixing screws.

(Note) Refer to "General Specifications: MITSUBISHI CNC Machine Operation Panel" for the panel cut dimension drawing and the screw hole position.

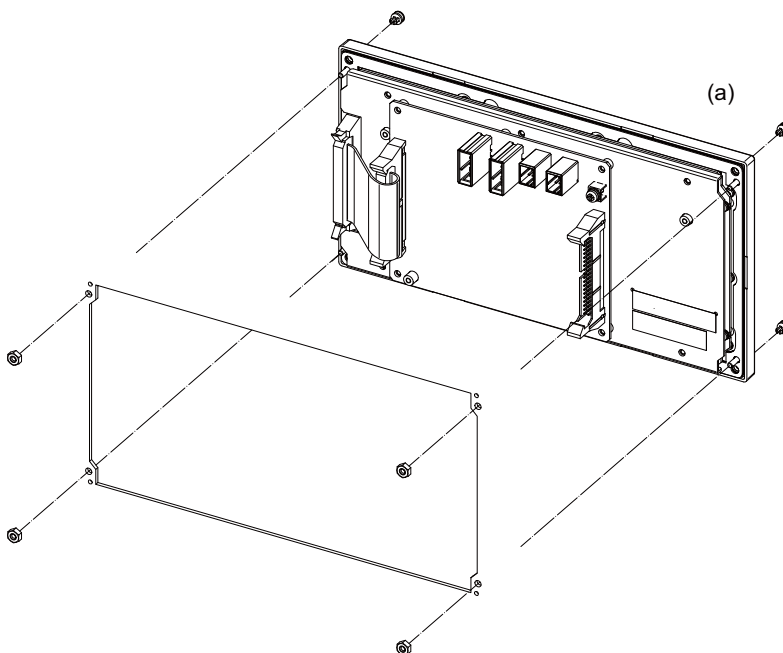
[FCU8-KB921/KB922/KB923/KB924/KB925/KB926]

- Fixed on the front side



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

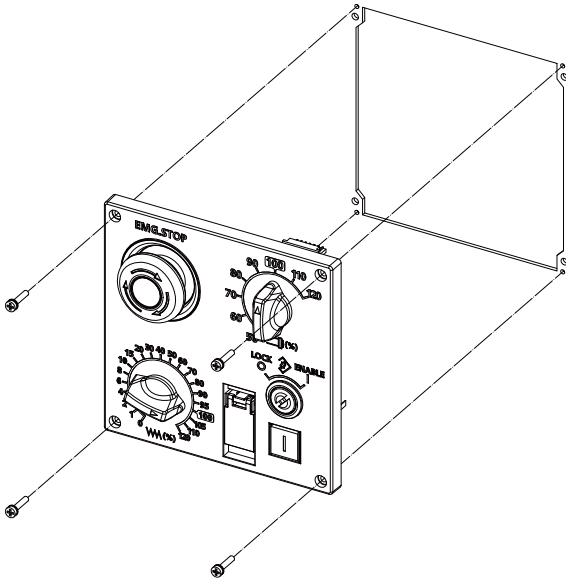
- Fixed on the back side



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

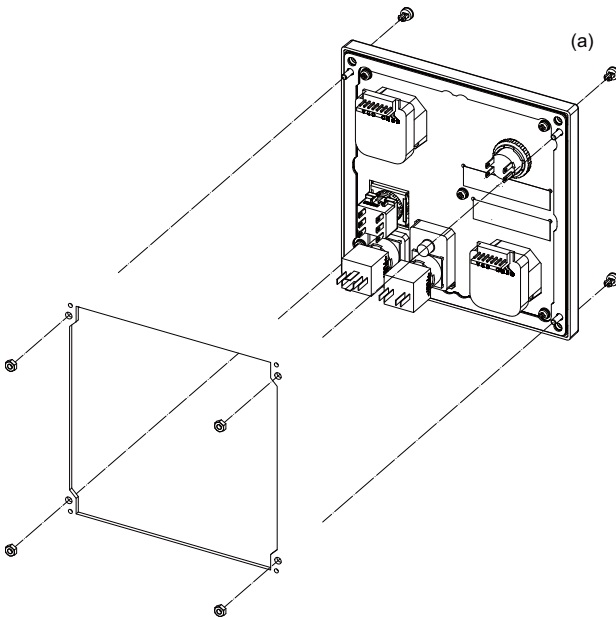
[FCU8-KB931/FCU8-KB941]

- Fixed on the front side



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

- Fixed on the back side



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

Precautions for Connecting

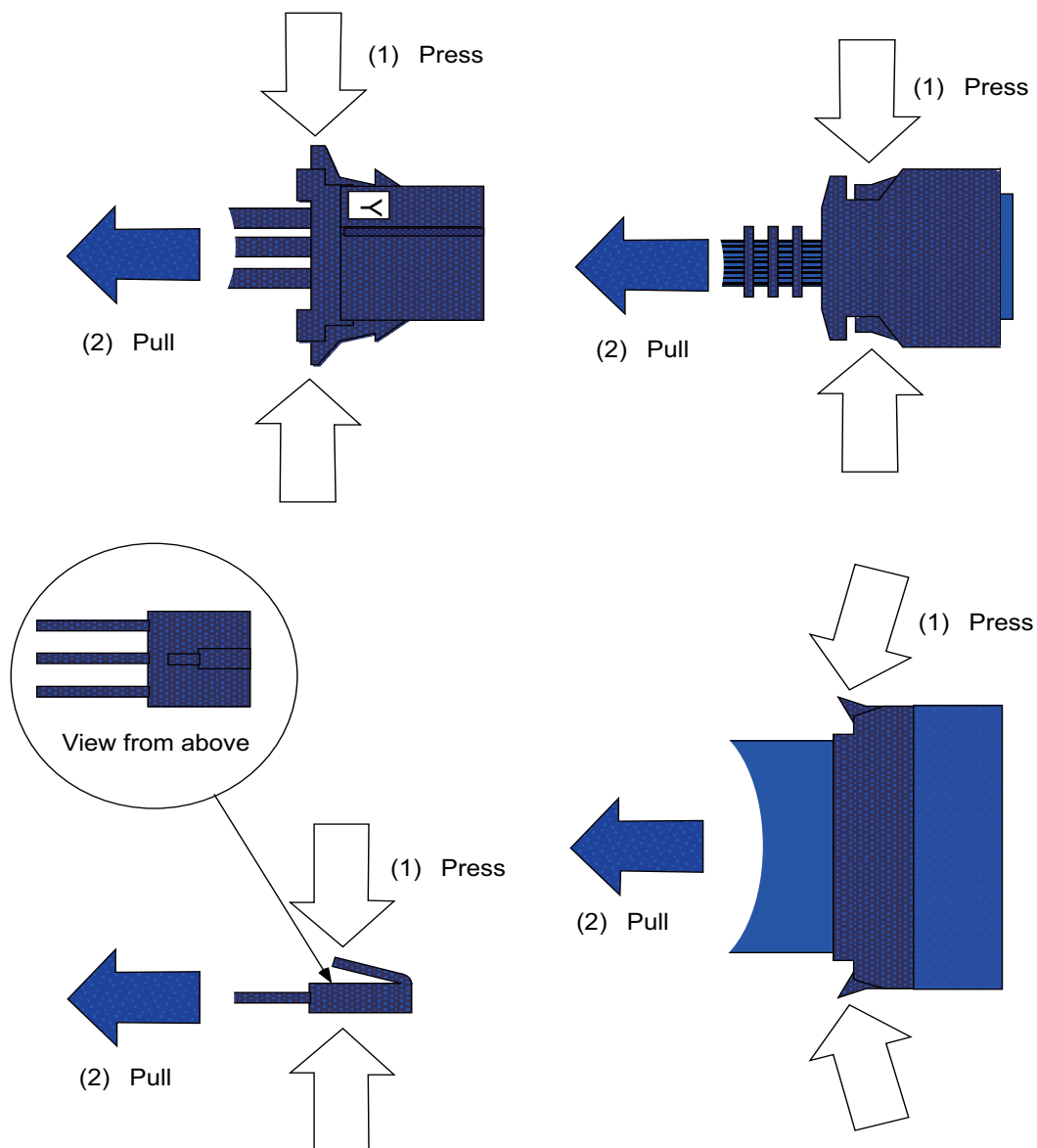
6.1 Precautions for Wiring

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.

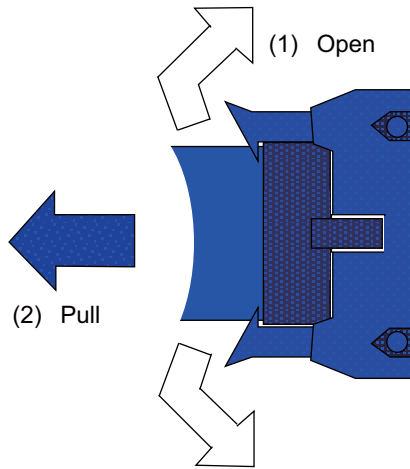
- (a) For the following type of connector, press the tabs with a thumb and forefinger in the direction of the arrow, and pull the connector off.



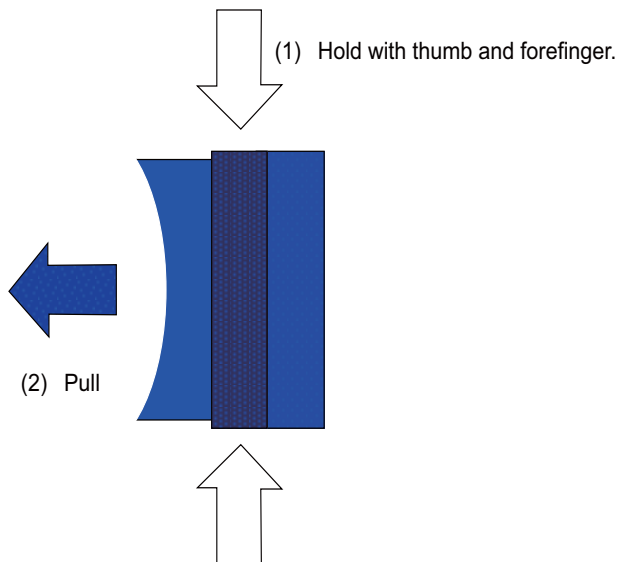
⚠ CAUTION

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

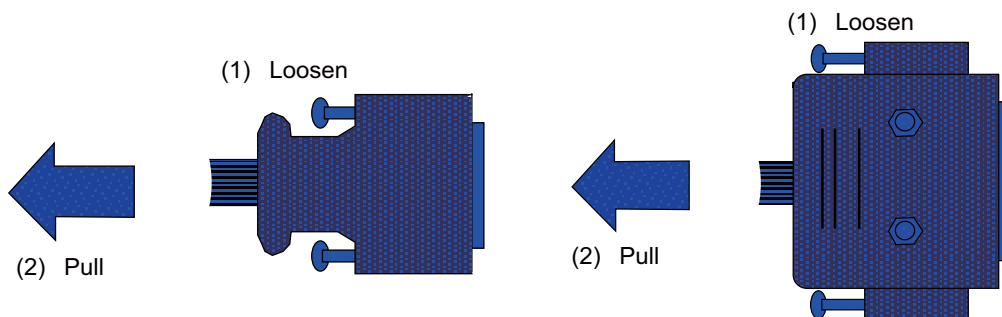
- (b) For a flat cable type connector with latches, open the latches in the directions of the arrows, and pull the connector off.



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



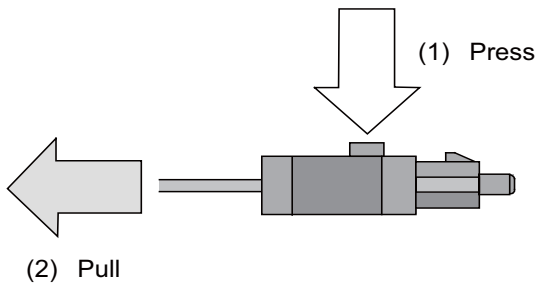
- (d) For the screw fixed type connector, loosen the two fixing screws, and pull the connector off.



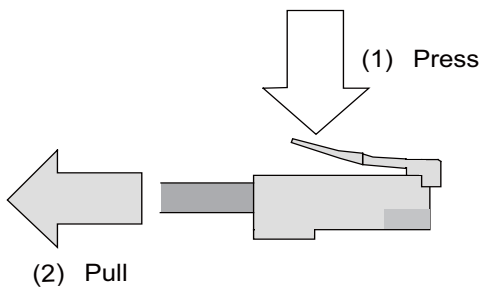
CAUTION

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

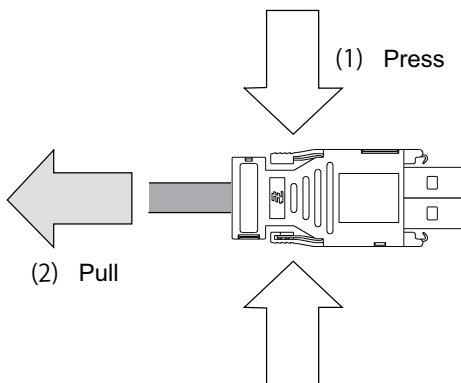
(e) For the optical cable connector, pull off while holding down the lock button.



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



(g) For the USB connector, pull off while holding down the locked latch.



⚠ CAUTION

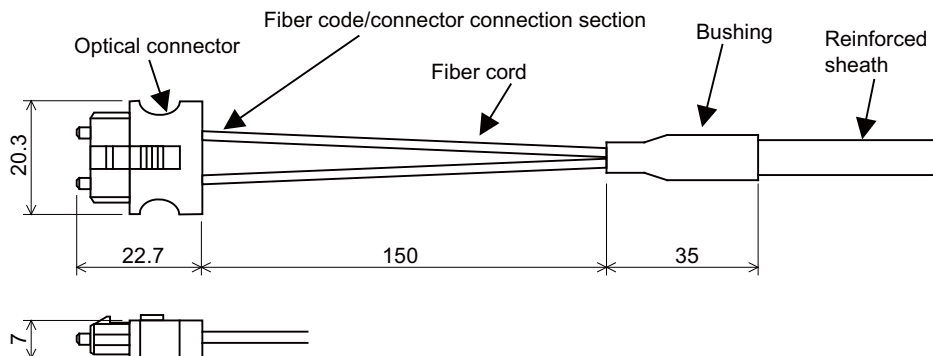
- 1. Do not connect or disconnect the cables between units while the power is ON.
- 2. Do not pull the cables when connecting/disconnecting it.

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

Optical communication cable outline and parts



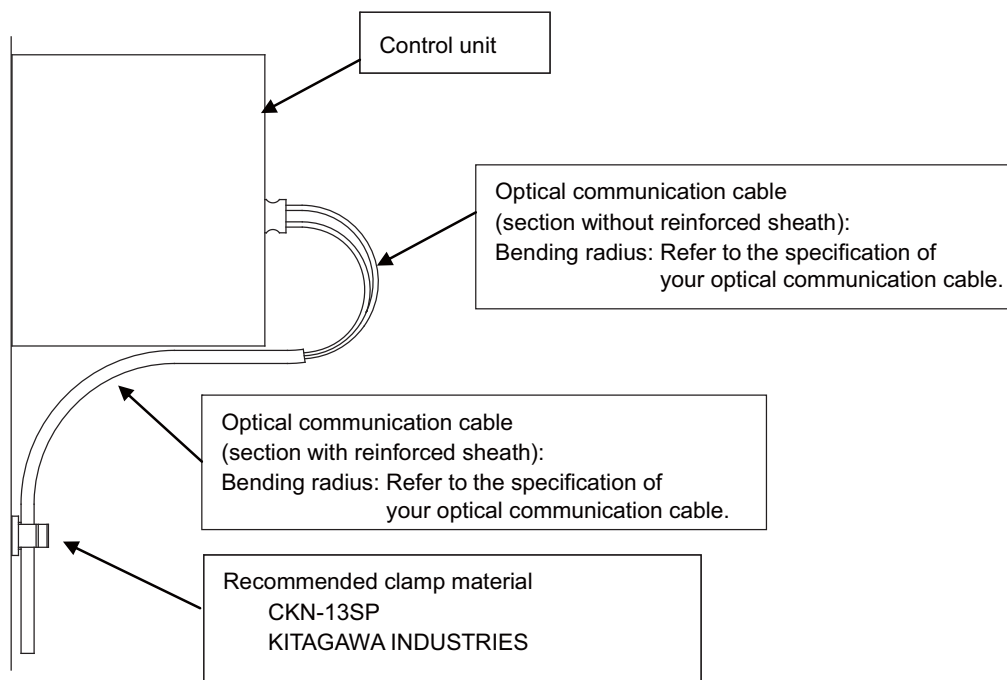
To ensure the system performance and reliability, purchase the optical communication cable from Mitsubishi. A machining drawing is given in "Cable" as reference, but the purchased optical communication cable cannot be cut or connected by the machine tool builder.

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.

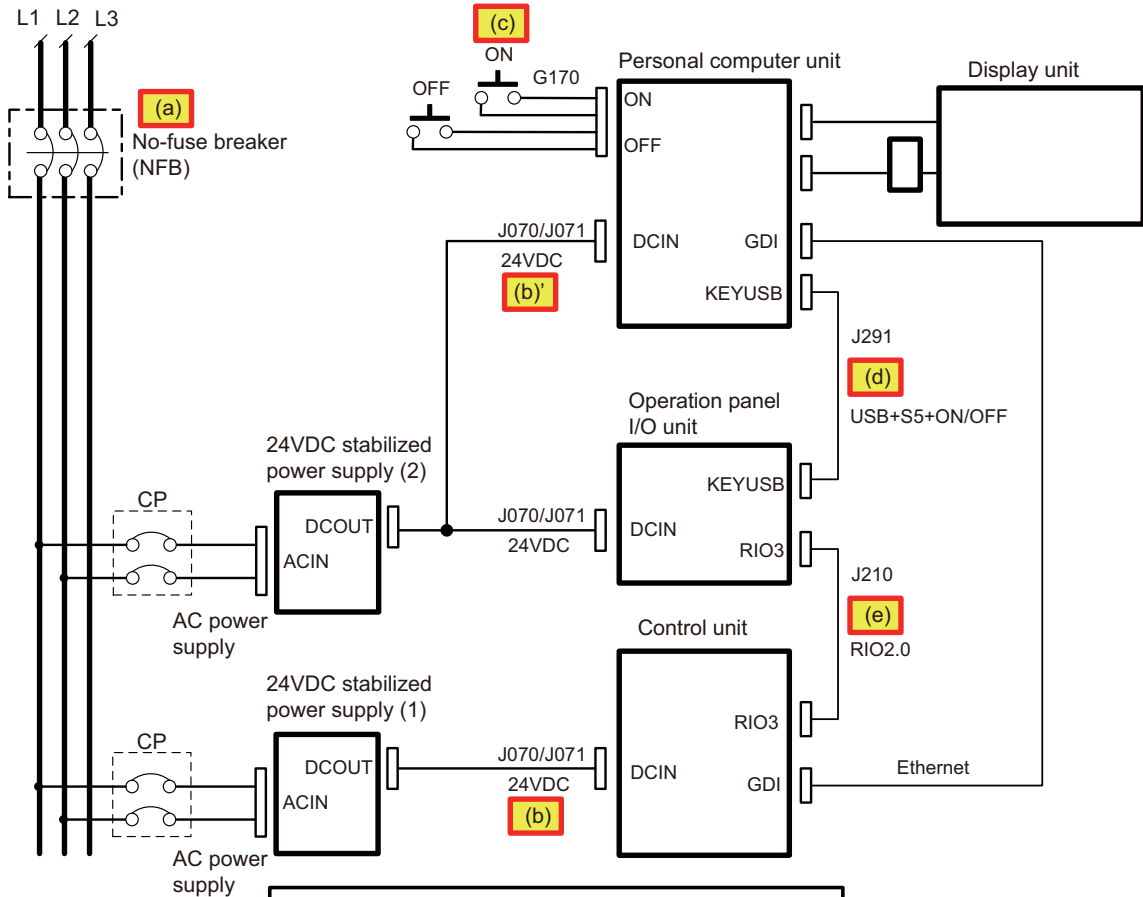
**6.1.3 Precautions for Connecting 24V Power Supply**

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

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

6.2 Turning the Power ON/OFF

(1) To turn the power ON



(a) The main breaker is turned ON and AC power is input to stabilized power supplies (1) and (2).

(b) 24VDC is input to the control unit and the startup of the control unit starts. The startup is temporarily stopped when RIO communication gets ready.

(b)' 24VDC is input and the operation panel I/O starts up. The personal computer unit waits for startup until the ON switch is pressed.

(c) The startup of personal computer unit starts when the ON switch is pressed.
 (d) ON signal is notified to USB+S5+ON/OFF.
 (e) ON signal is notified to RIO 2.0.

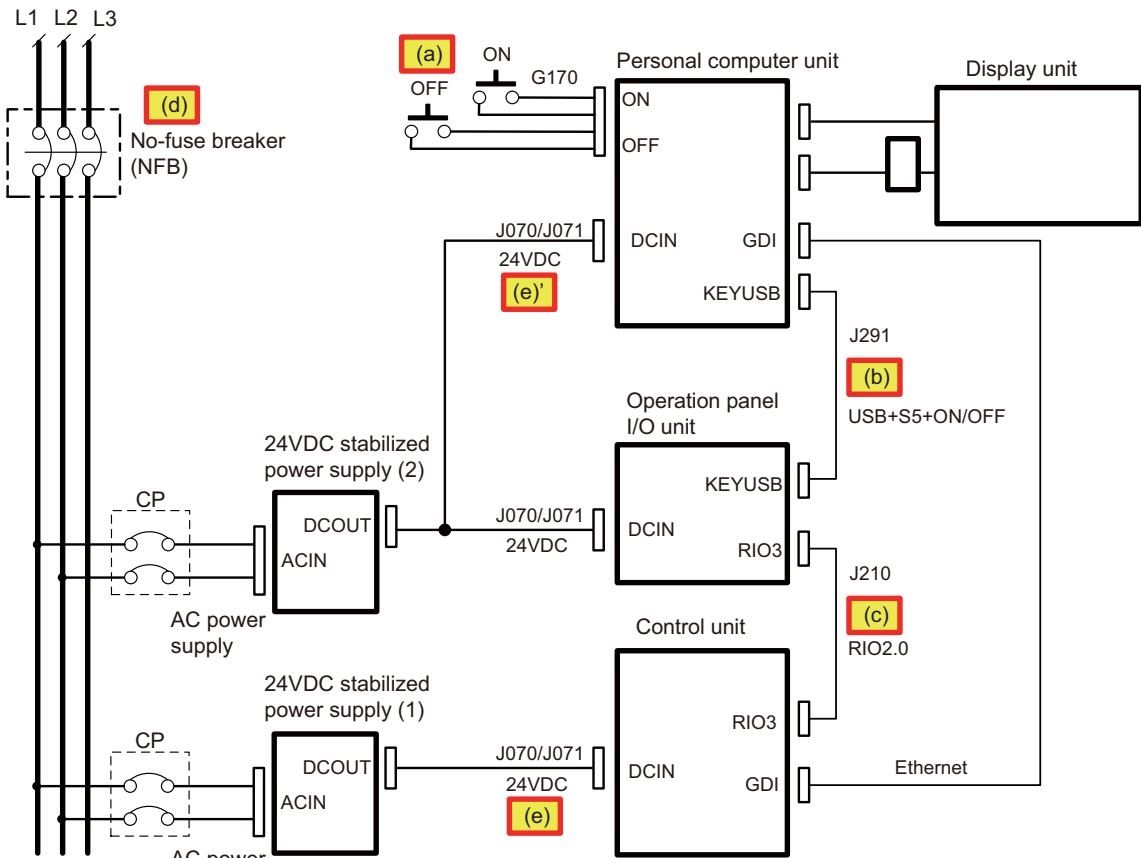
The startup of control unit restarts.

The startup of the personal computer unit is completed. Startup completion signal (S5STATE) is notified to the control unit through (d) and (e).

Control unit servo ready (RDYON)

NC control section startup is completed.

(2) To turn the power OFF



(a) The OFF switch is pressed.

The shutdown of the personal computer unit starts.
 The personal computer unit notifies S5 signal to the operation panel I/O through (b).
 S5 signal is notified to the trigger and the power-down request is notified to the control unit through (c).

The control unit receives the power-down request. Control unit RDYOFF

Power supply ON sequence becomes the wait state again for the ON switch to be pressed.

(d) The main breaker is turned OFF.

AC power supply is shut OFF, and then 24VDC (e) and (e)' are shut OFF.

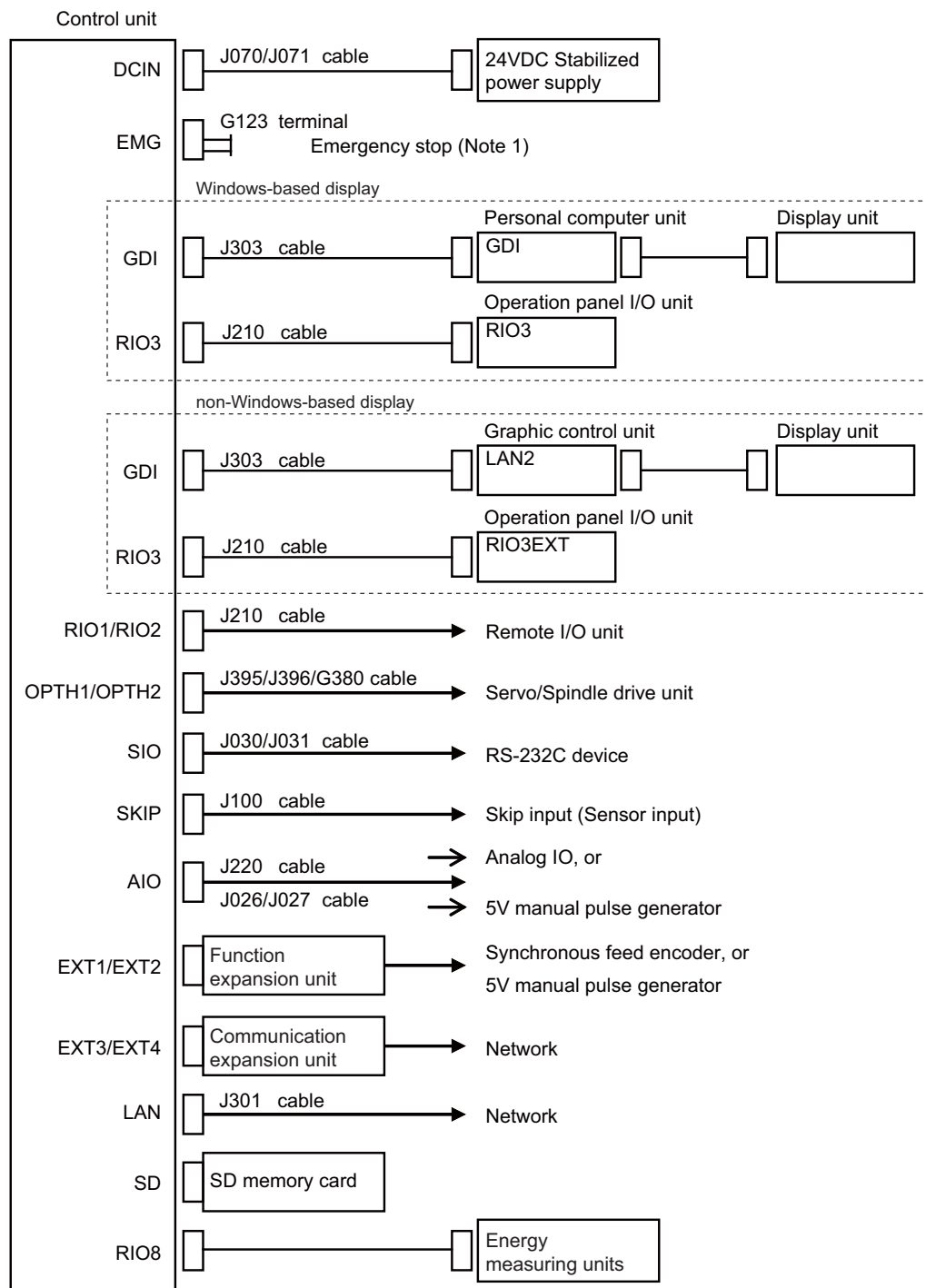
NC control section power OFF is completed.

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

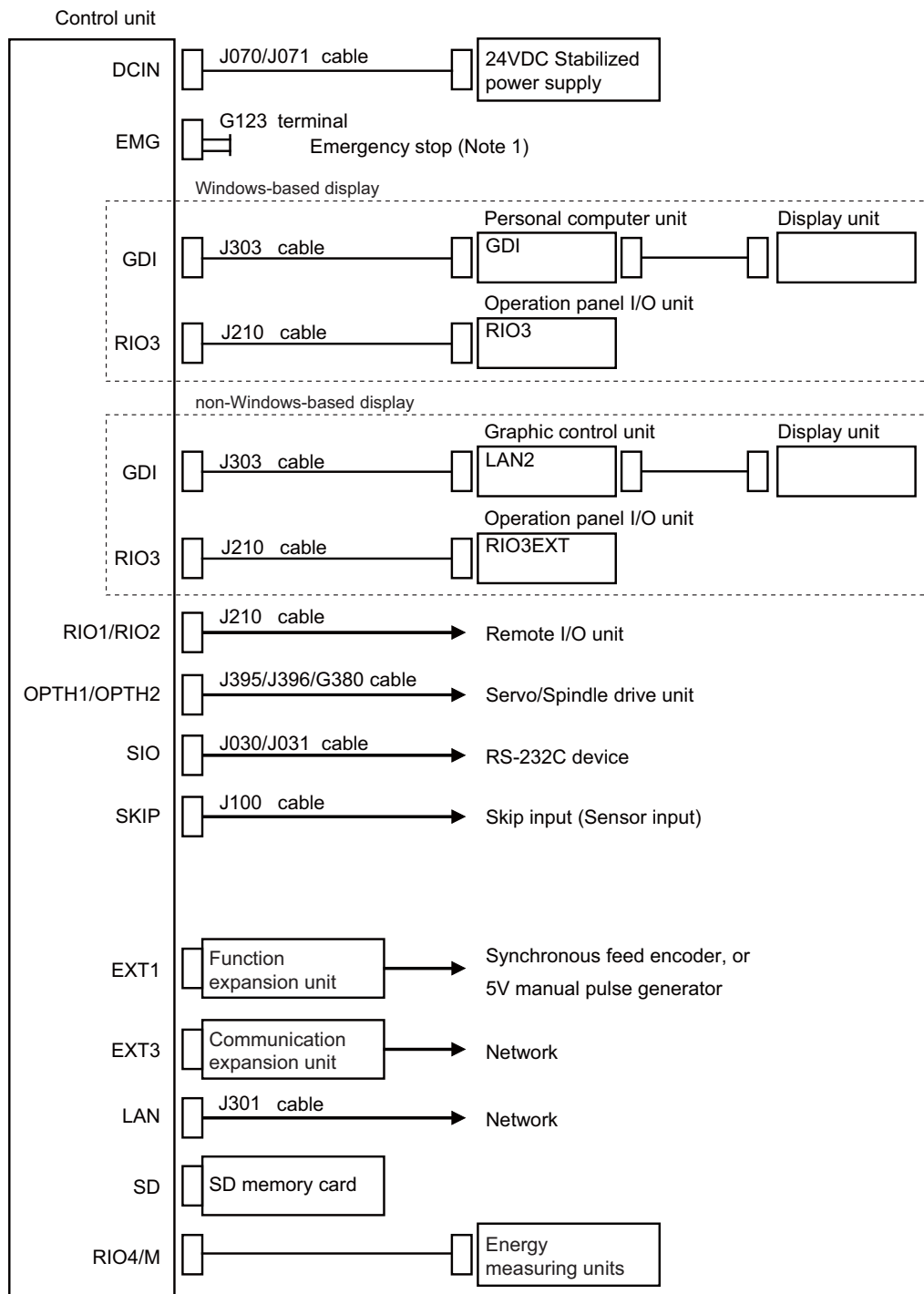
7.1.1 M800W



(Note 1) Use when installing an emergency stop switch in the electric cabinet. (Connection cable: J120 cable)
 When not used, connect the terminal connector (G123 cable).
 G123 terminal cable comes with the control unit.

(Note 2) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

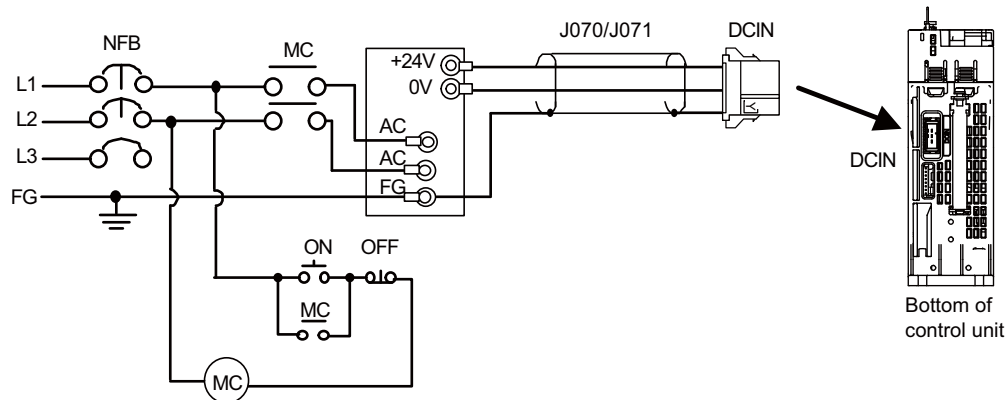
7.1.2 M80W



(Note 1) Use when installing an emergency stop switch in the electric cabinet. (Connection cable: J120 cable)
 When not used, connect the terminal connector (G123 cable).
 G123 terminal cable comes with the control unit.

7.2 Connecting with Power Supply

Connect a general-purpose 24VDC 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 24VDC's ON/OFF during 24V power supply to the control unit. Use relay with large heat capacity of contacts to control 24VDC's ON/OFF.

<Related items>

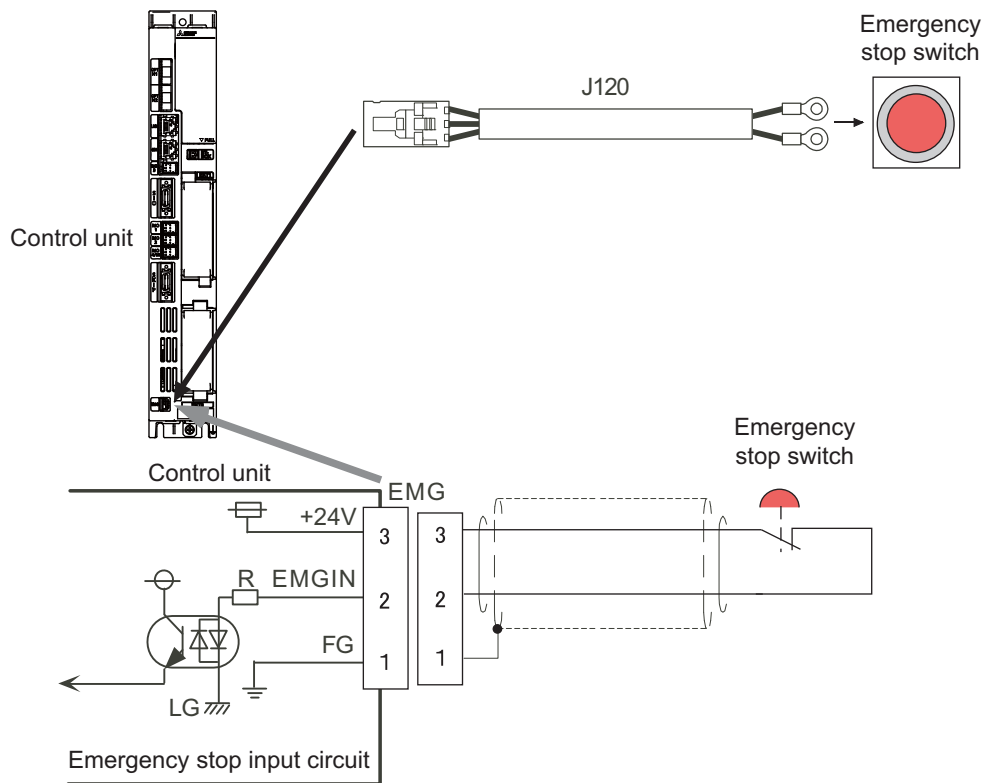
Cable drawing "Cable : J070/J071 Cable"

Connector pin assignment: "General Specifications: Control Unit" (DCIN connector)

7.3 Connecting with Emergency Stop Signal

Connect the emergency stop switch to EMG connector of the control unit.

(Note) For M800W, EMG connector is allocated on the bottom of the control unit.



<Related items>

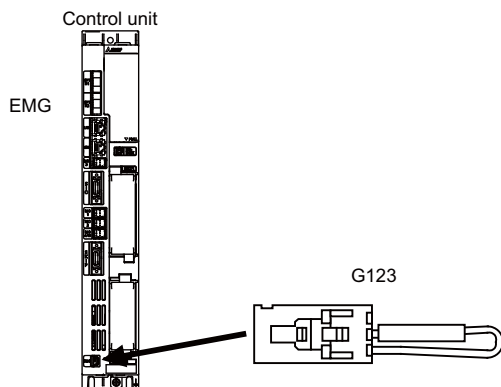
Cable drawing: "Cable: J120 Cable"

Connector pin assignment: "General Specifications: Control Unit" (ENC connector)

<When not using control unit side emergency stop input signal (EMG)>

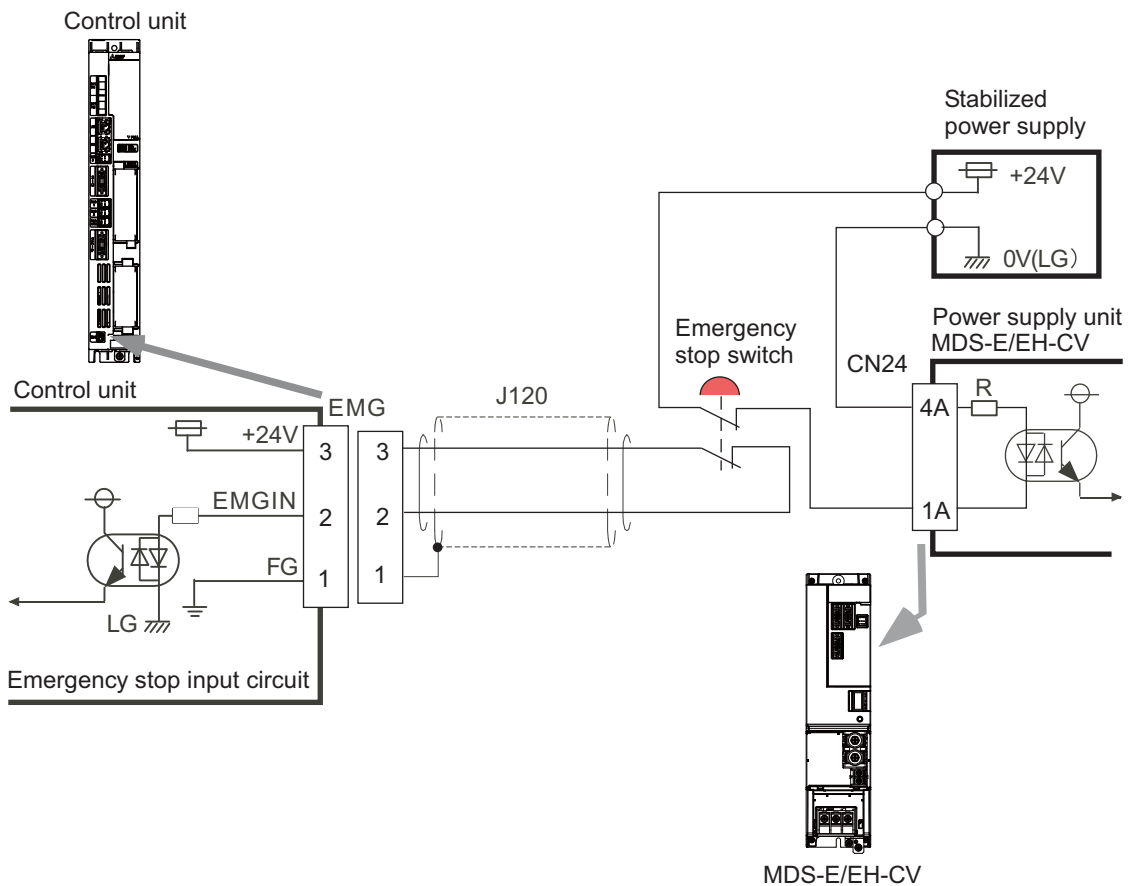
When not using control unit side emergency stop input signal, such as when operation panel I/O unit side emergency stop input signal (EMG) is used, invalidate the input signal by using terminal cable G123.

G123 cable comes with the control unit.

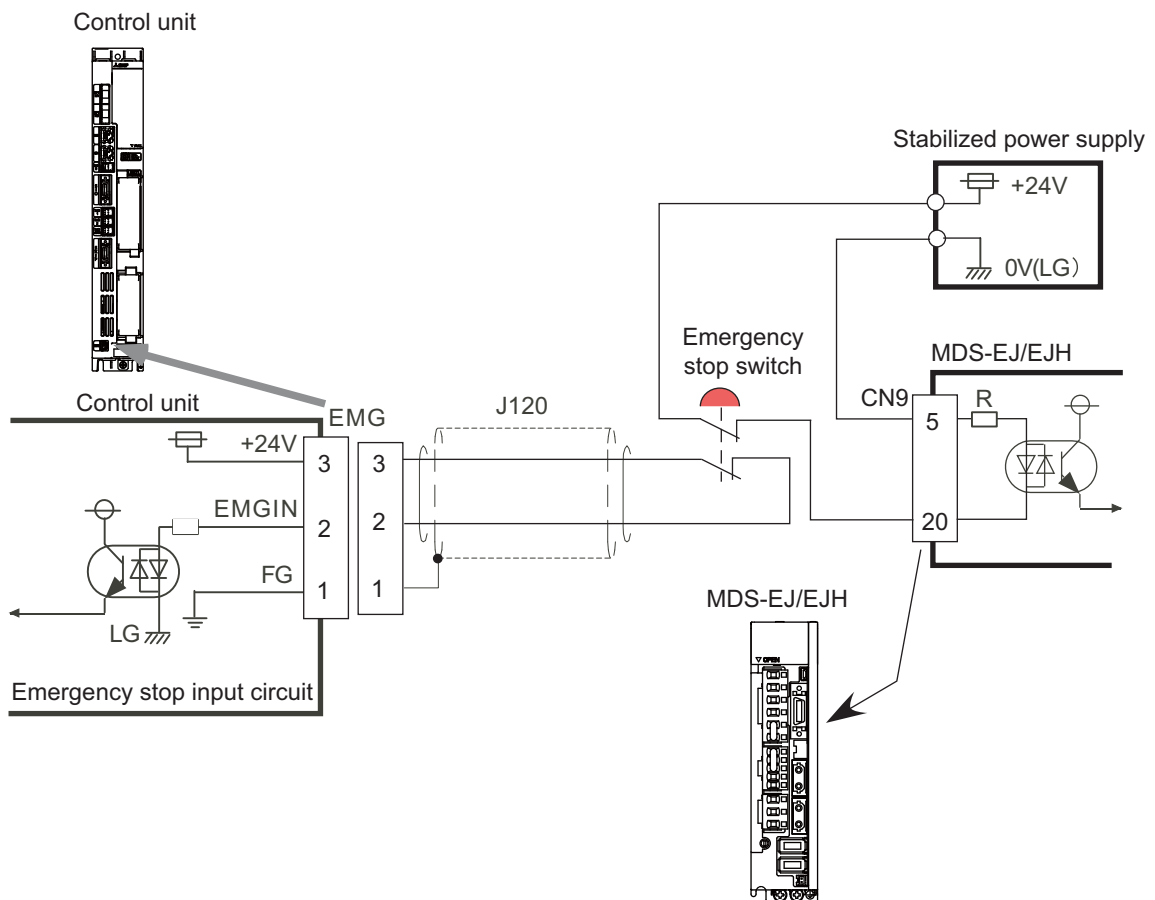


ISO13849-1 (PLd, Cat.3) and IEC62061 (SIL CL2) can be realized by using the safety remote I/O unit (directly wiring the external emergency stop redundantly). Refer to "Smart safety observation" (BNP-C3072-022) for details.

<Power supply unit (MDS-E/EH-CV) external emergency stop: Example>



<Drive unit (MDS-EJ/EJH) external emergency stop: Example>

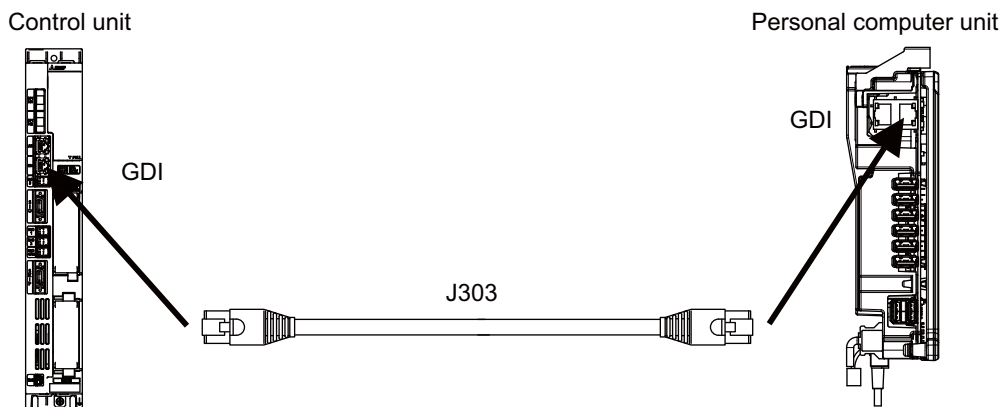


<Caution>

- (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 Personal Computer Unit

Connect the personal computer unit to GDI connector of the control unit.

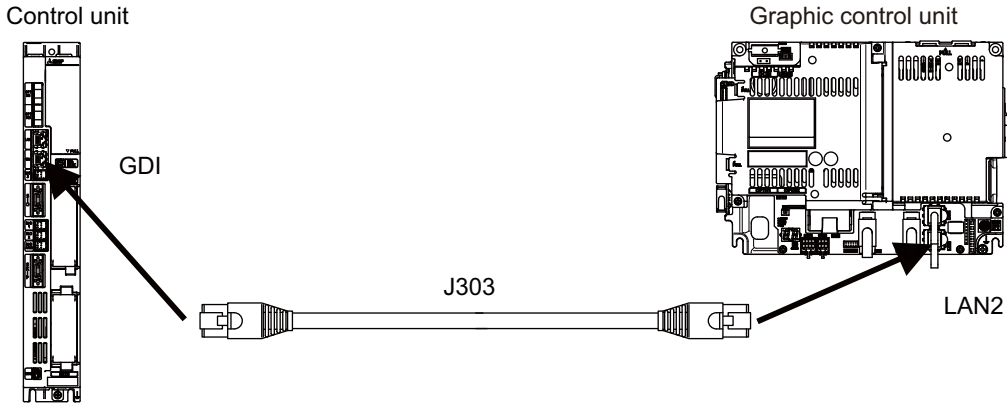


<Related items>

- Cable drawing "Cable : J303 Cable"
- Connector pin assignment: "General Specifications: Control Unit" (GDI connector)

7.5 Connecting with Graphic Control Unit

Connect the graphic control unit to GDI connector of the control unit.



<Related items>

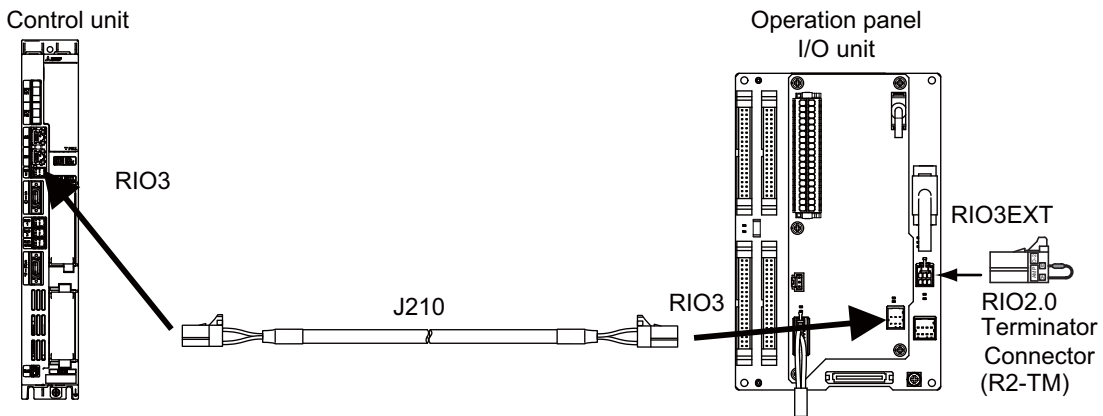
Cable drawing "Cable : J303 Cable"

Connector pin assignment: "General Specifications: Control Unit" (GDI connector)

7.6 Connecting with Operation Panel I/O Unit

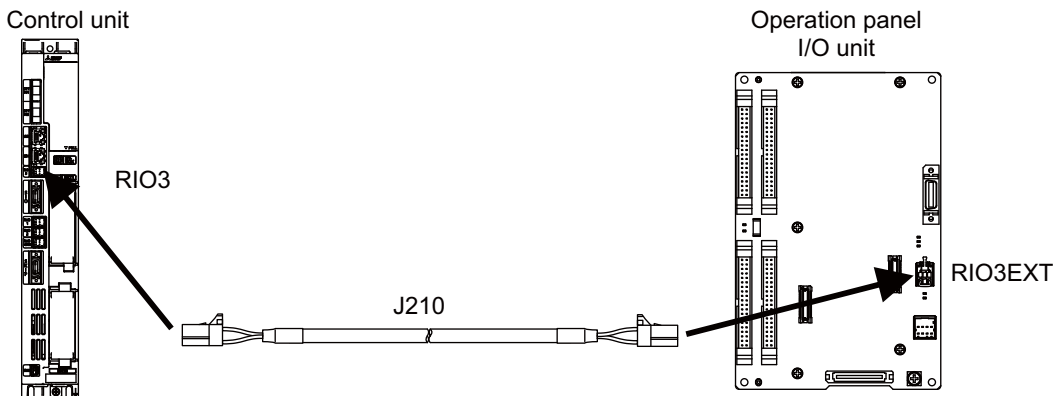
[Windows-based display]

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



[Non-Windows-based display]

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



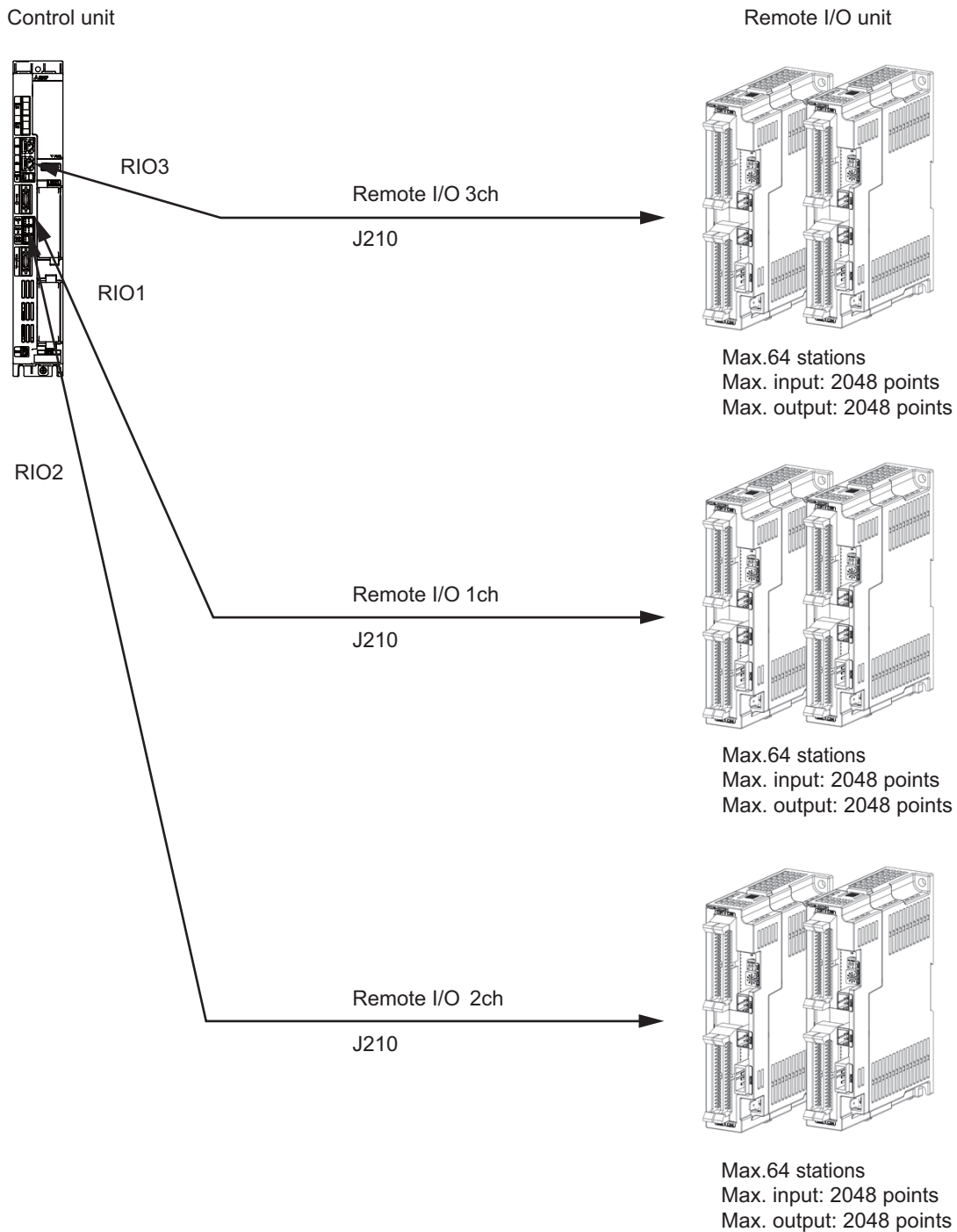
<Related items>

Cable drawing "Cable : J210 Cable"

Connector pin assignment: "General Specifications: Control Unit" (RIO3 connector)

7.7 Connecting with Remote I/O Unit

Connect the remote I/O unit to RIO1 or RIO2 connector of the control unit.



(Note) Connect the J210 cable to the RIO1, RIO2, or RIO3 connector of the control unit.
Check the connector position with the actual machine.

<Related items>

Cable drawing "Cable : J210 Cable"

Connector pin assignment: "General Specifications: Control Unit" (RIO1 connector, RIO2 connector, RIO3 connector)

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

Cable application table

Cable	Panel internal wiring		Panel external wiring	
	Under 10m	10 to 30m	10m or less	10 to 30m
J396	○	×	×	×
J395	○	×	○	×
G380	○	○	○	○

7.8.1 Connecting with Drive Unit MDS-E/EH Series

7.8.1.1 Connection of Optical Communication Cables

CAUTION

1. Connect the NC and the drive units by the optical communication cables. The distance between the NC and the final drive unit must be within 30m and the specified bending radius (for wiring inside panel: 25mm, and for wiring outside panel: 50mm) or more.
2. For the main circuit wiring of the drive unit and power supply unit, the drive unit of 200V series is to be wired with MDS-D2-CV, and the drive unit of 400V series is to be wired with MDS-EH-CV.

POINT

Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the manual of drive unit.) The axis No. has no relation to the order for connecting to the NC.

(1) When Using One Power Supply Unit

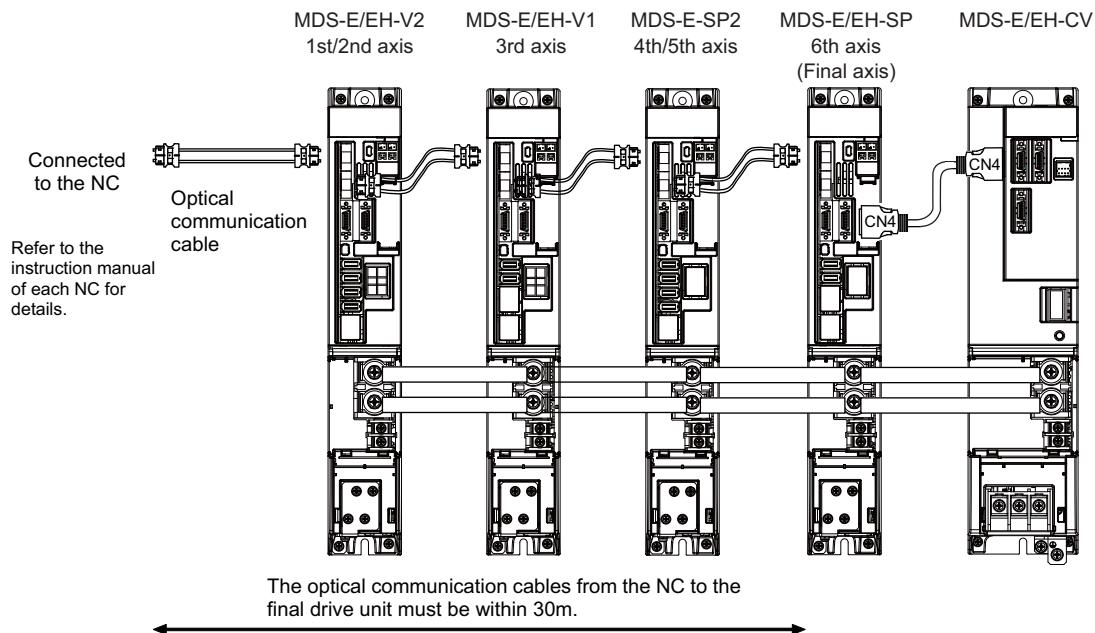
Connect the largest-capacity spindle drive unit to the final axis of the NC communication bus in order to control the power supply unit. The spindle drive unit must be installed adjacent to the power supply unit. In the system with servo only, a servo drive unit for controlling unbalance axis must be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

< Connection >

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

CN1B : CN1A connector on next stage's drive unit

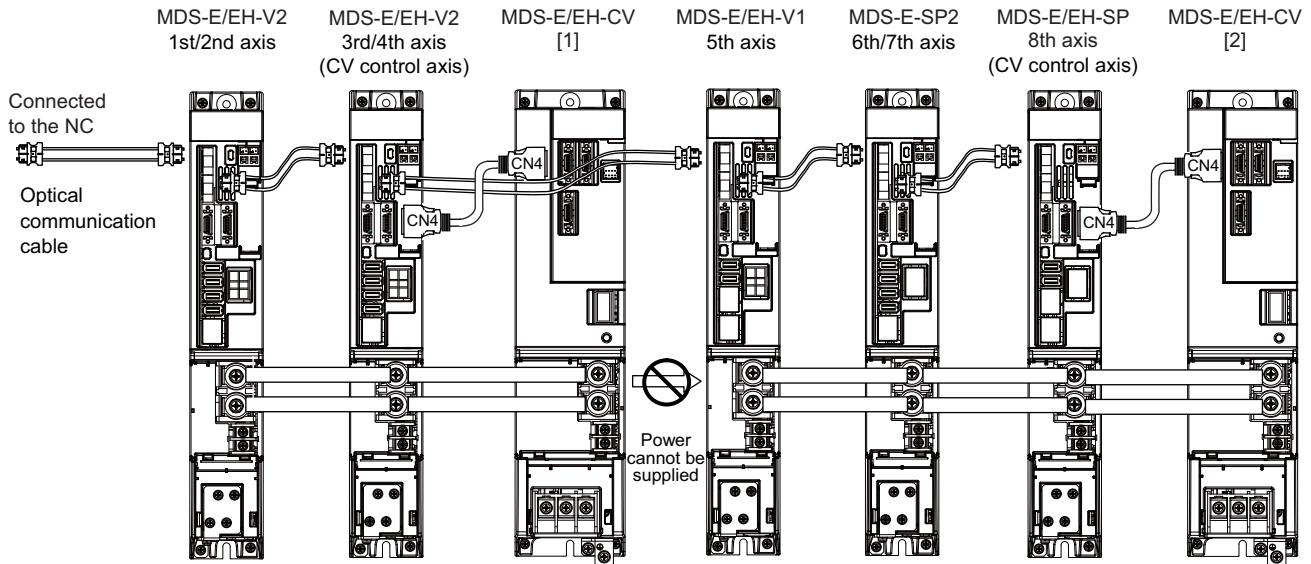
CN4 : Connector for communication between power supply unit (master side) and drive unit



Connection when using one power supply unit

(2) When Using Two or More Power Supply Units within a Single NC Communication Bus System

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



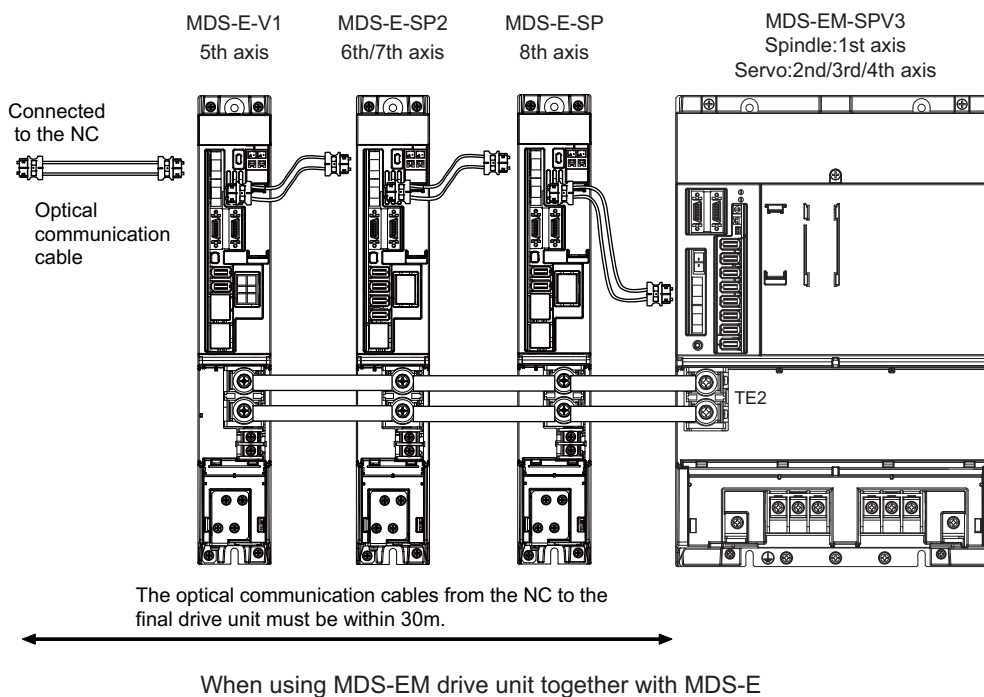
Connections when using two power supply units within a single NC communication bus system

⚠ CAUTION

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

(3) 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.



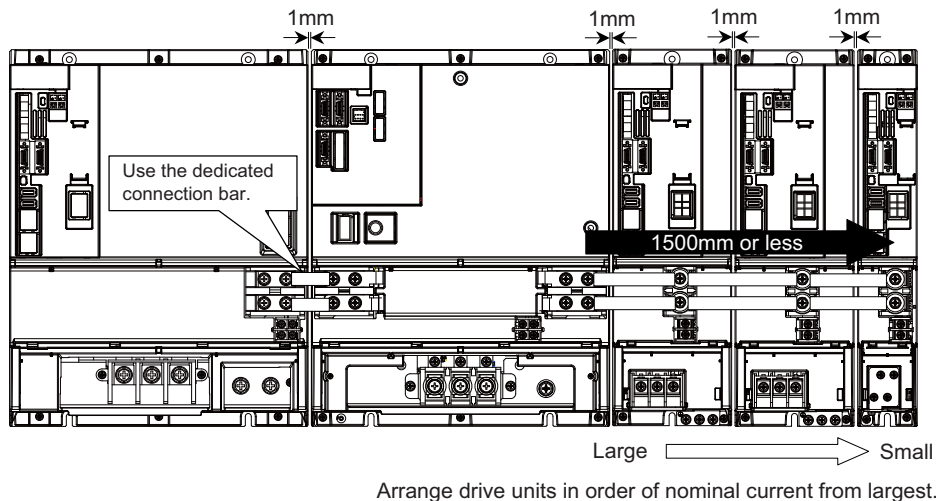
⚠ CAUTION

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 MDS-EM/EMH unit, install the optical communication cables in a manner that makes MDS-EM/EMH unit 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, and connections for other drive units should be such that the total TE2 wiring length is 800mm or less.

7.8.1.2 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 1500mm or less.
For the arrangement of 1500mm 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 1mm.



POINT

1. Arrange large capacity drive units at the left of the power supply unit with the clearance between the drive units being 1mm.
2. Power supply units equivalent to the number of large capacity drive units are required.
3. When arranging the drive unit at the right of the large capacity power supply unit, remove the side protection cover of the power supply unit.
4. MDS-E-SP-400/640, MDS-EH-SP-200/320/480/600, and MDS-EH-V1-200 are the large capacity drive units.

7.8.2 Connecting with Drive Unit MDS-EM/EMH Series

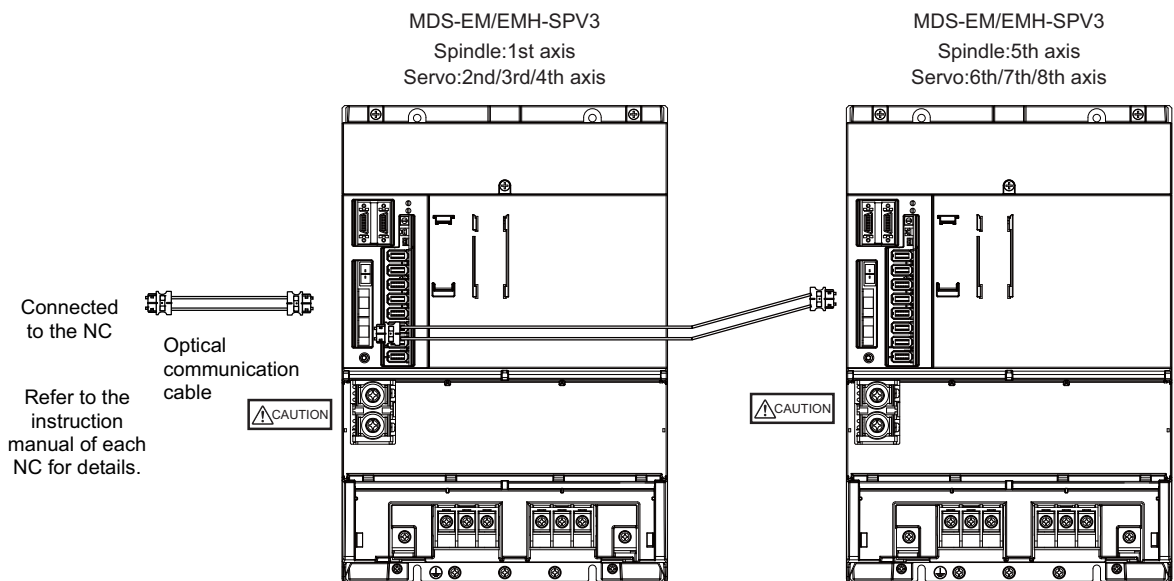
CAUTION

Connect the NC and the drive units by the optical communication cables. The distance between the NC and the final drive unit must be within 30m and the specified bending radius (for wiring inside panel: 25mm, and for wiring outside panel: 50mm) or more.

POINT

Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the manual of drive unit.) The axis No. has no relation to the order for connecting to the NC.

(1) When using only MDS-EM/EMH-SPV Series

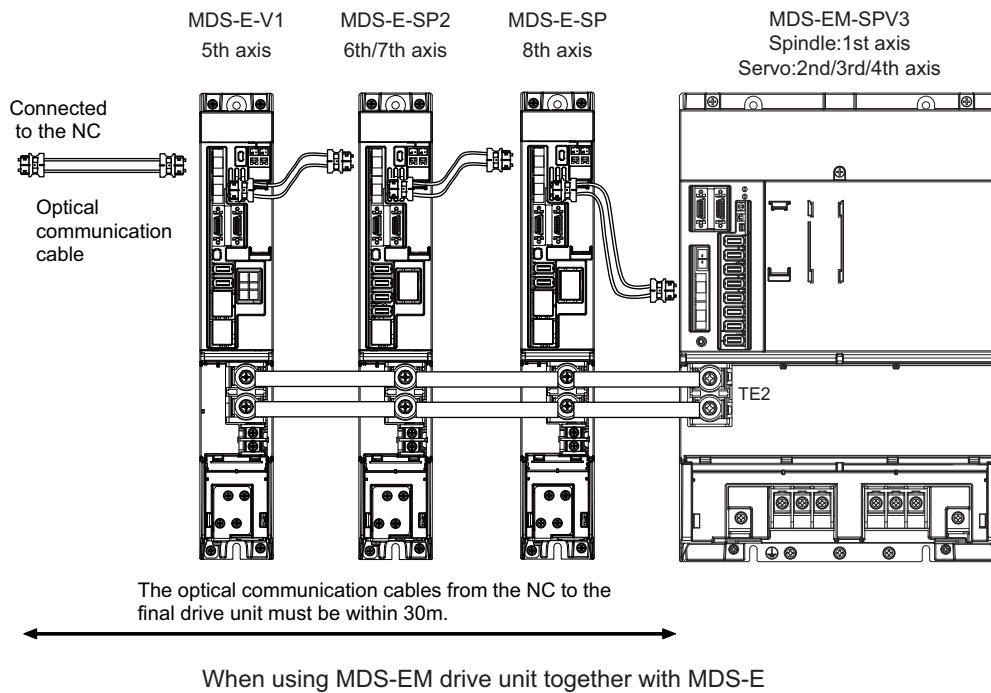


CAUTION

Confirm that the TE2 (L+, L-) wiring is not connected to other power supply before turning the power ON.

(2) When using the MDS-E/EH unit together

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.

**⚠ 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".

7.8.3 Connecting with Drive Unit MDS-EJ/EJH Series

CAUTION

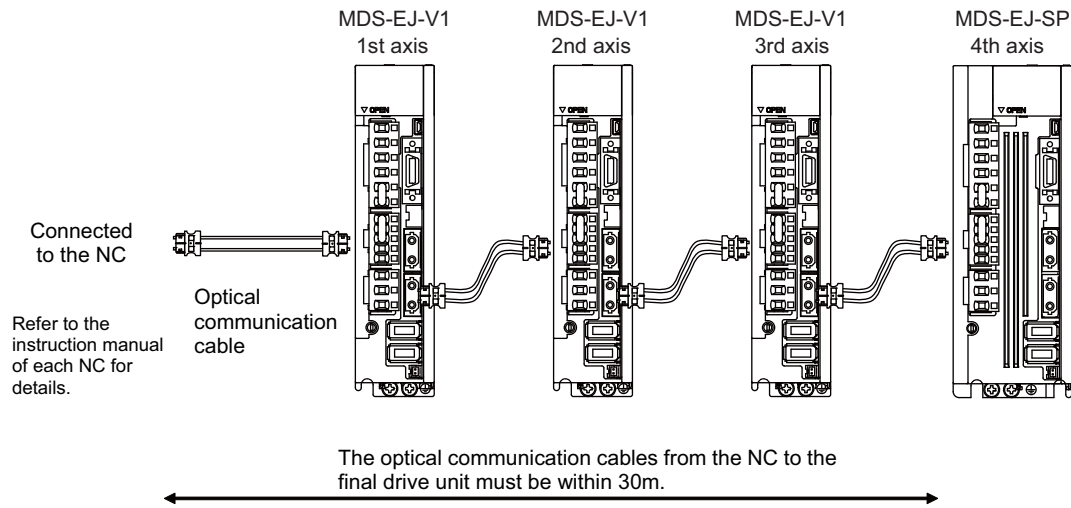
Connect the NC and the drive units by the optical communication cables. The distance between the NC and the final drive unit must be within 30m and the specified bending radius (for wiring inside panel: 25mm, and for wiring outside panel: 50mm) or more.

POINT

Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the manual of drive unit.)
The axis No. has no relation to the order for connecting to the NC.

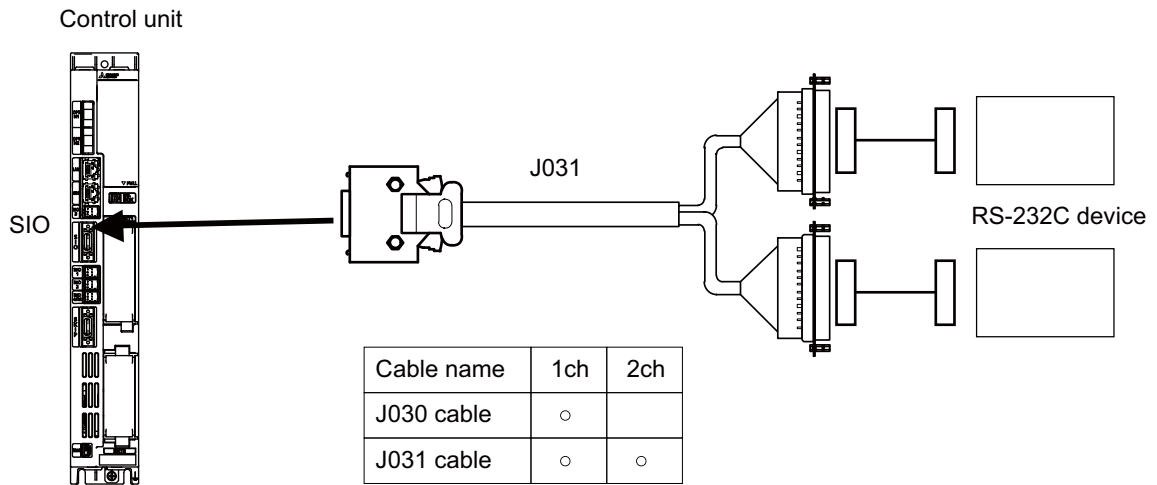
CN1A: CN1B connector on NC or previous stage's drive unit

CN1B: CN1A connector on next stage's drive unit



7.9 Connecting with RS-232C Device

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



<Related items>

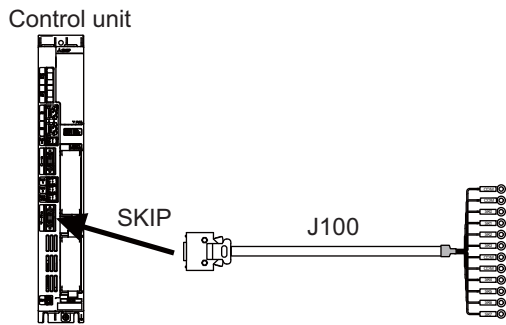
Cable drawing: "Cable: J030/J031 Cable"

Connector pin assignment: "General Specifications: Control Unit" (SIO connector)

7.10 Connecting with Skip Signal (Sensor)

Connect the skip signals to SKIP connector of the control unit.

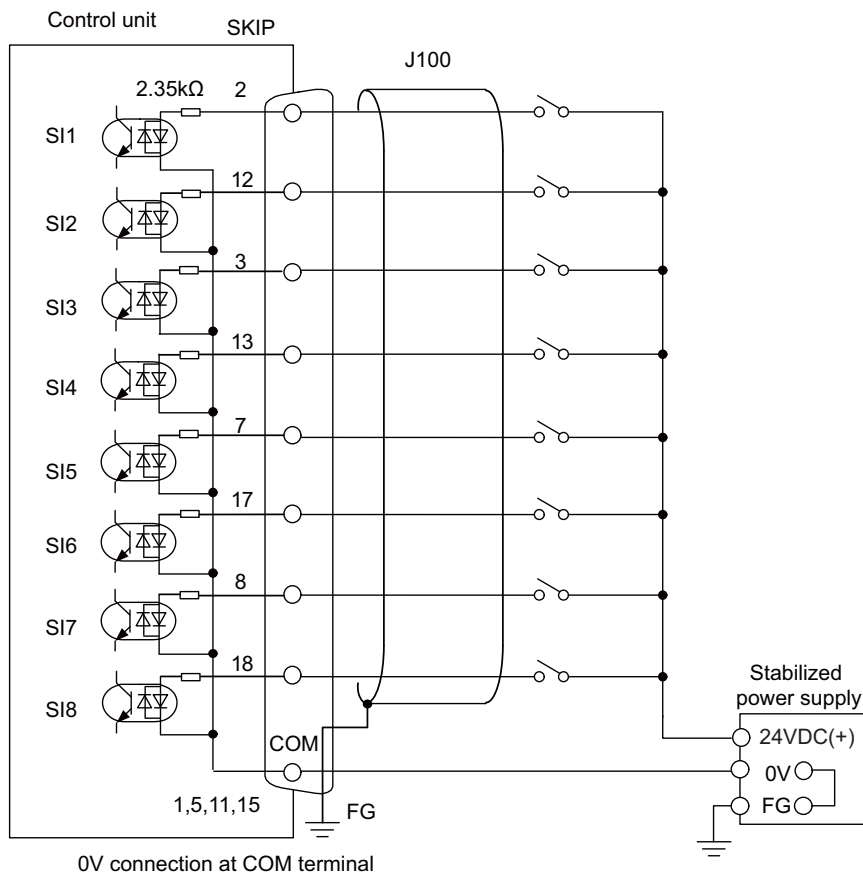
Skip signals are used for processing high-speed signals. Always shield the cable.



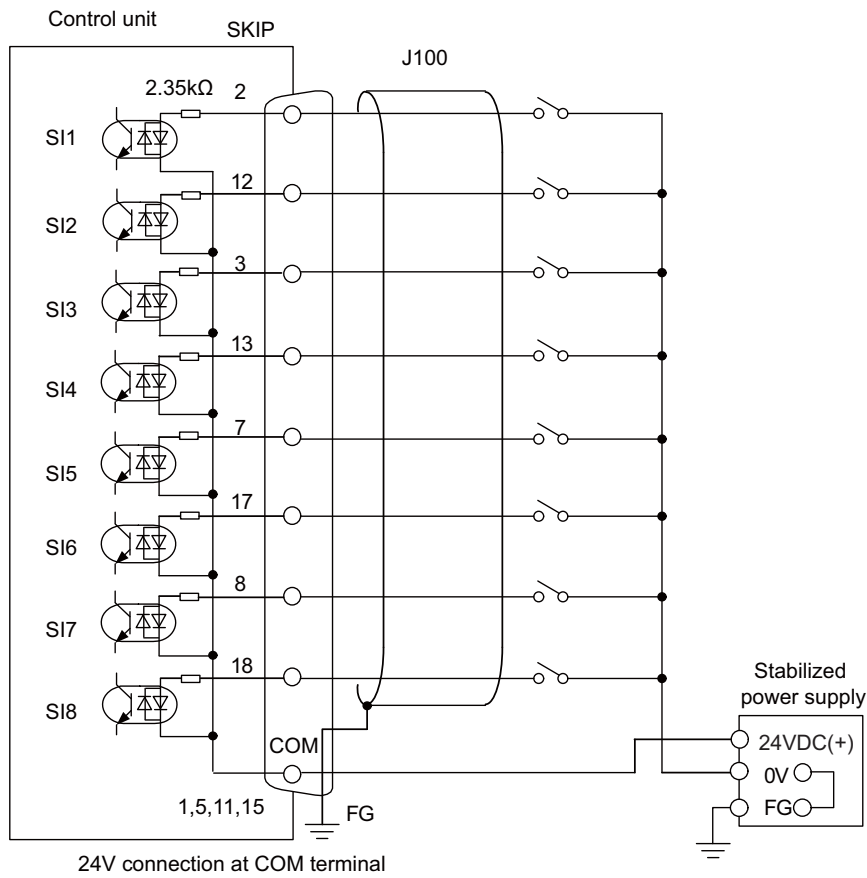
(Note) Connecting the skip signal cable to a wrong connector causes a damage on the control unit when turning ON the skip signal power supply. Confirm the wiring before turning the power ON.

(1) Connection of skip signal cable

<0V connection at COM terminal>



<24V connection at COM terminal>



- (Note 1) NC recognizes input signals of 2ms or more as the valid skip signals. If machine contacts (relay, etc.) are used, malfunctions will occur due to chattering. Use semiconductor contacts (transistor, etc.).
- (Note 2) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.

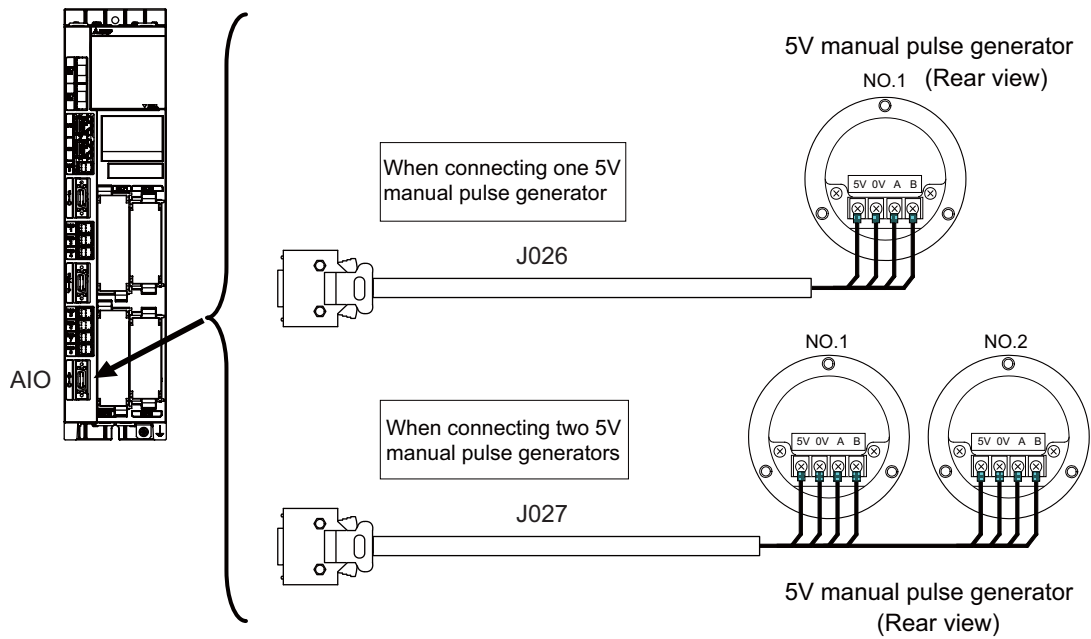
<Related items>

Cable drawing: "Cable: J100 Cable"

Connector pin assignment: "General Specifications: Control Unit" (SKIP connector)

7.11 Connecting with Manual Pulse Generator

Connect the 5V power supply type manual pulse generator (2ch) to AIO connector of the control unit.



<Related items>

Cable drawing: "Cable: J026/J027 Cable"

Connector pin assignment: "General Specifications: Control Unit" (AIO connector)

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

7.11.1 Handle Numbers

There are two types of the handle numbers assignment: automatic assignment and arbitrary assignment.

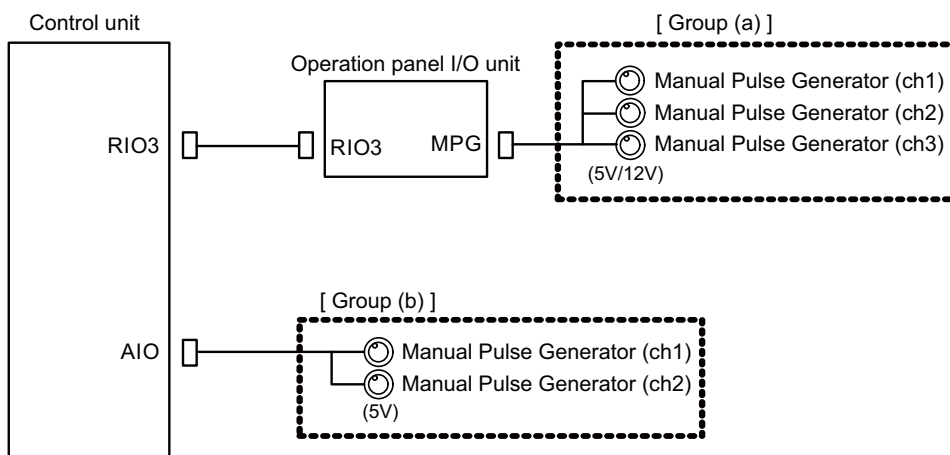
[Automatic assignment]

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.

"AIO": Connector on control unit (two channels), "MPG": Connector on operation panel I/O unit (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 (c) ch1	Group (c) ch2	



(Note 1) M80W does not include A10 connector.

(Note 2) The manual pulse generator connected to FCU8-EX544 is not subject to the automatic arbitrary assignment.

[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)".

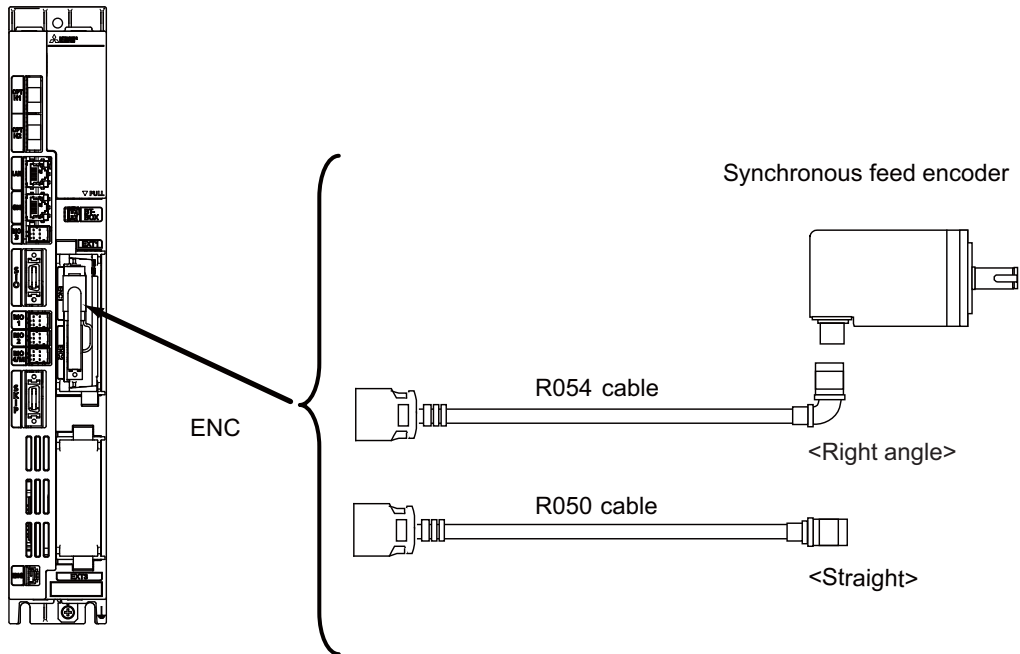
The manual pulse generator connected to FCU8-EX544 also follows the above parameter setting.

7.12 Connecting Device via Function Expansion Unit

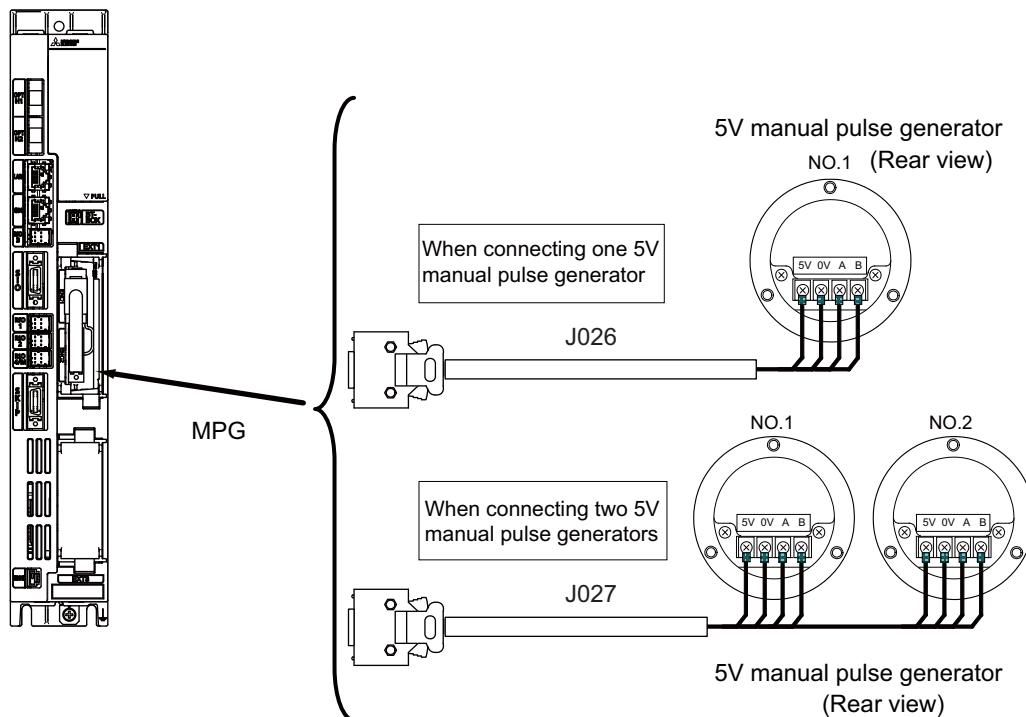
Mount the function expansion unit onto the dedicated slot of the control unit.

7.12.1 Connecting Device via Encoder (Manual Pulse Generator) I/F Expansion Unit

(1) Connecting with synchronous feed encoder



(2) Connection of manual pulse generator



7.13 Connecting I/O Device via Communication Expansion Unit

Mount the communication expansion unit onto the dedicated slot of the control unit.

(Note) The available combinations of the communication 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
Case 2		FCU8-EX563 : PROFIBUS-DP
Case 3	FCU8-EX561 : CC-Link	FCU8-EX564 : CC-Link IE Field
Case 4		FCU8-EX565 : EtherNet/IP
Case 5		FCU8-EX568 : FL-net
Case 6		FCU8-EX563 : PROFIBUS-DP
Case 7		FCU8-EX564 : CC-Link IE Field
Case 8	FCU8-EX564 : CC-Link IE Field	FCU8-EX565 : EtherNet/IP
Case 9		FCU8-EX568 : FL-net
Case 10		FCU8-EX565 : EtherNet/IP
	FCU8-EX568 : FL-net	FCU8-EX568 : FL-net

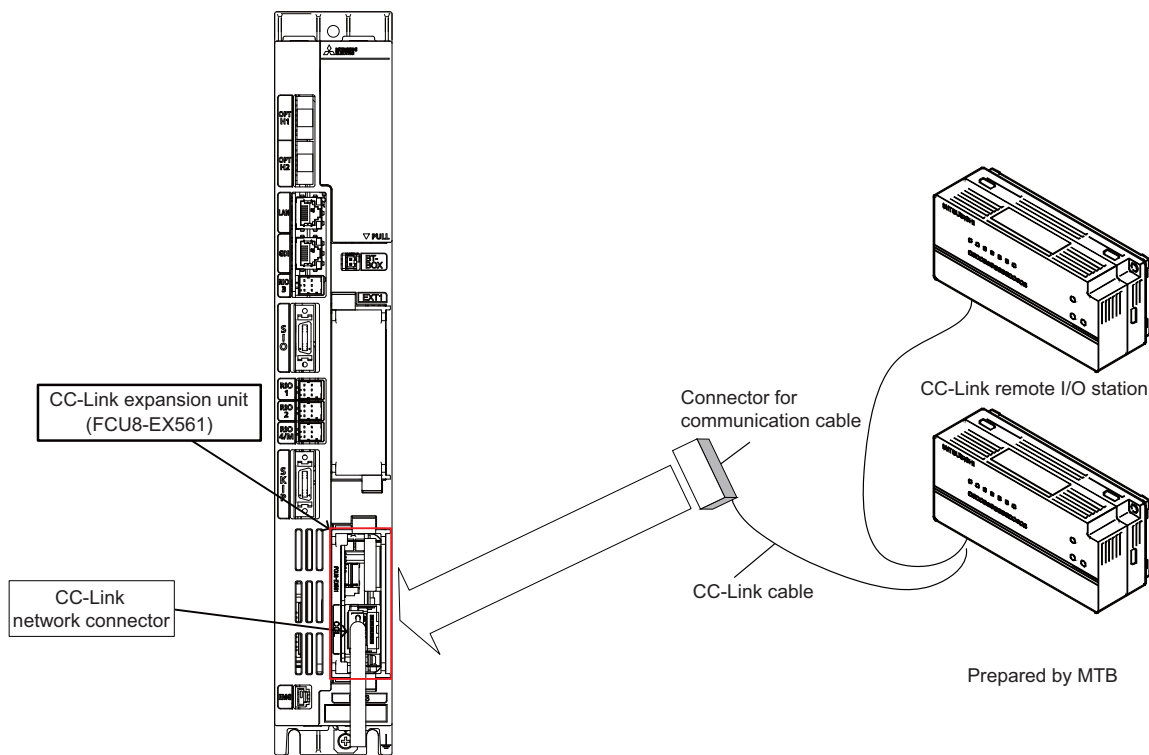
7.13.1 Connecting I/O Device via CC-Link

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.

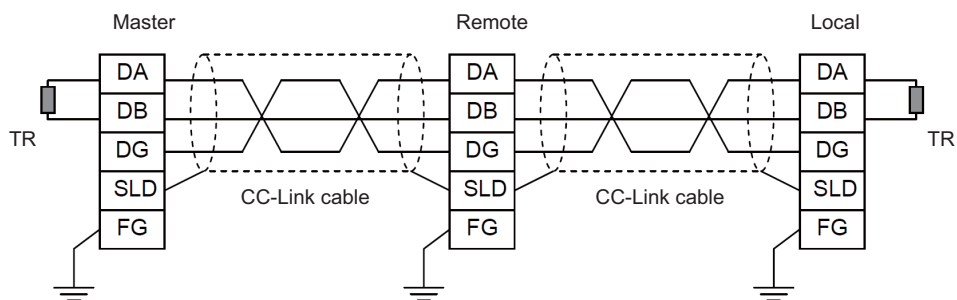
Use the Ver.1.10-compatible CC-Link dedicated cable as the communication cable. CC-Link system cannot provide its performance with the Ver.1.10-incompatible cable, because it may cause the restrictions such as the reduction of maximum cable length, increment of cable length between stations, and unusability of mixed wire materials from the different manufacturers.

Make sure to attach the terminator to the final station unit.



[Connection of terminator]

Excerpt from CC-Link cable wiring manual (published by CC-Link partner association).



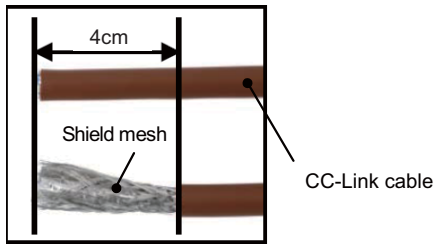
(Note 1) Unless the CC-Link dedicated cable is used, CC-Link system does not guarantee its operation. For the specifications of the CC-Link dedicated cable and the inquiries, see the homepage of the CC-Link Partner Association (<http://www.cc-link.org/>). (Click "Product Information".)

(Note 2) The value of the terminator that can be used for Ver.1.10-compatible CC-Link dedicated cable is 110 Ω.

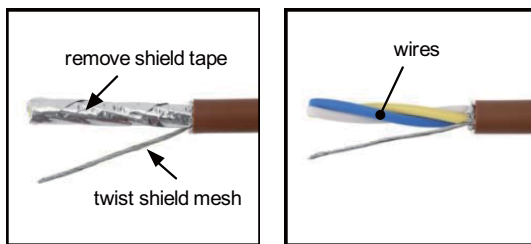
(Note 3) The terminator attaching to the communication connector on the CC-Link expansion unit side is the connector type which has built-in resistance. The communication connector has a two-level structure, however there is no difference in the specification attaching the cable to either one.

[CC-Link cable connecting procedure]

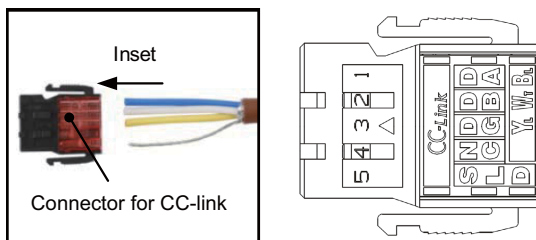
- (1) Remove the sheath of the CC-Link cable about 4cm.



- (2) Isolate the shield mesh and the wires covered with shield tape. Remove the shield tape from wires.

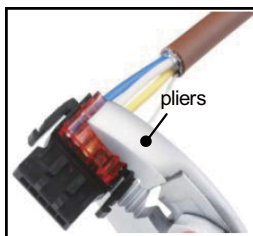


- (3) Insert the wires to the connector for CC-Link as below.

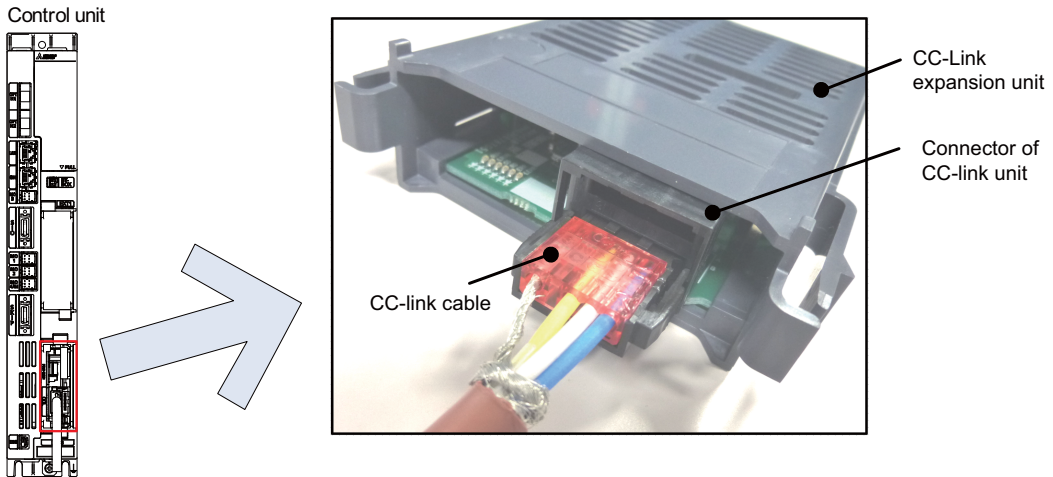


- 1pin Blue wire (cover notation: DA B)
- 2pin White wire (cover notation: DB W)
- 3pin Yellow wire (cover notation: DG Y)
- 4pin No connect
- 5pin Shield wire (cover notation: SLD)

- (4) Press the connector with the use of a pliers. Check that the clamp point is flat to the connector for CC-Link.

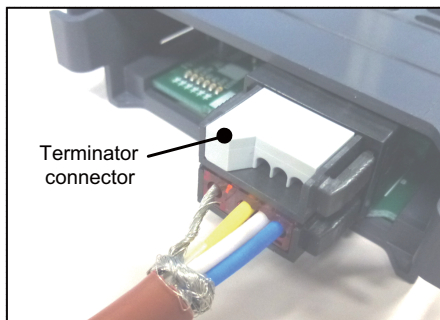


- (5) Insert the CC-Link cable into the connector of CC-Link unit.



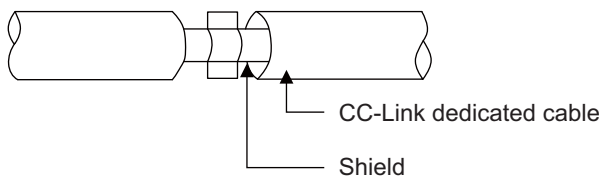
(Note) Connector of CC-Link unit is two-step structure. It is not different even if attach the cable to whichever.

- (6) Insert the terminator to the connector of CC-Link unit as in the figure.
In the final station, the terminator connector is required.



[Noise countermeasures of CC-Link dedicated cable]

When the CC-Link expansion unit is being used, expose the cable by removing a part of the cable sheath and make sure to 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 item>

Shield clamp fitting: "EMC Installation Guidelines: EMC Countermeasure Parts: Shield Clamp Fitting"

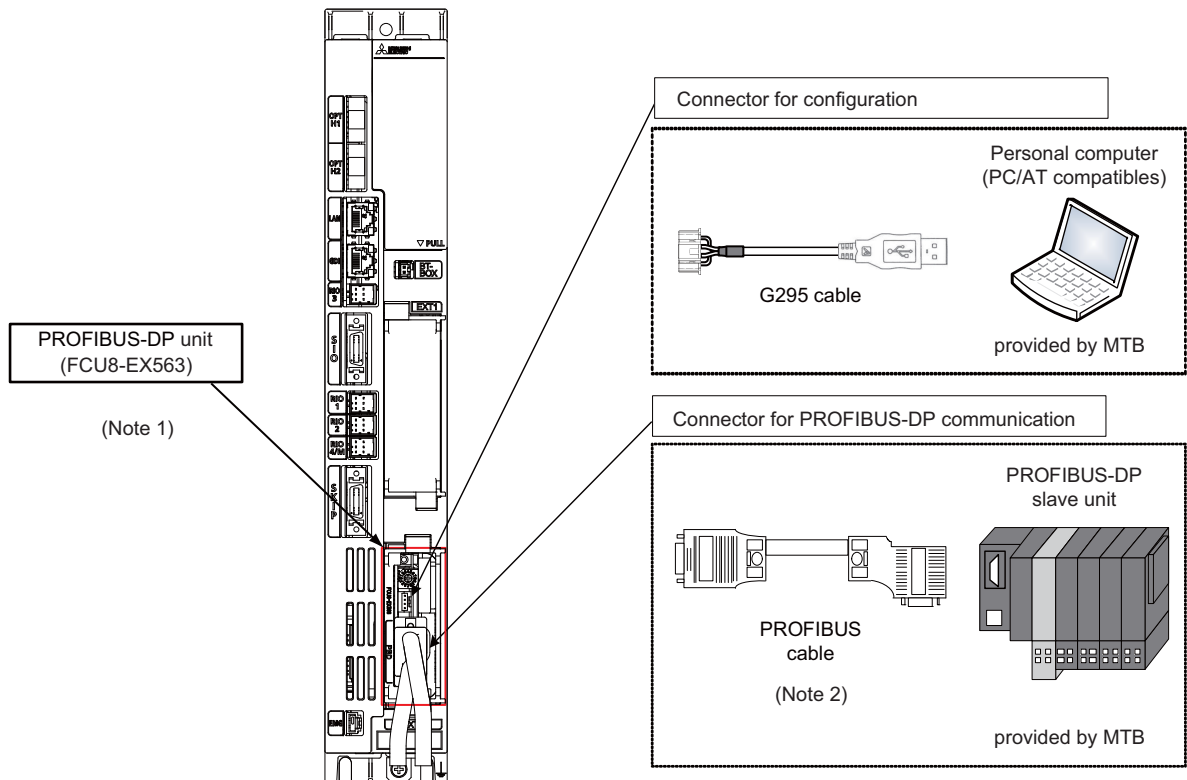
7.13.2 Connecting I/O Device via PROFIBUS-DP

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 unit to the configuration software- installed personal computer (PC/AT compatible machine).

(Note) The communication parameters, etc. at the time of setup are required to be backed up for maintenance.



(Note 1) Use the rotary switch of PROFIBUS-DP unit with the initial value "0".

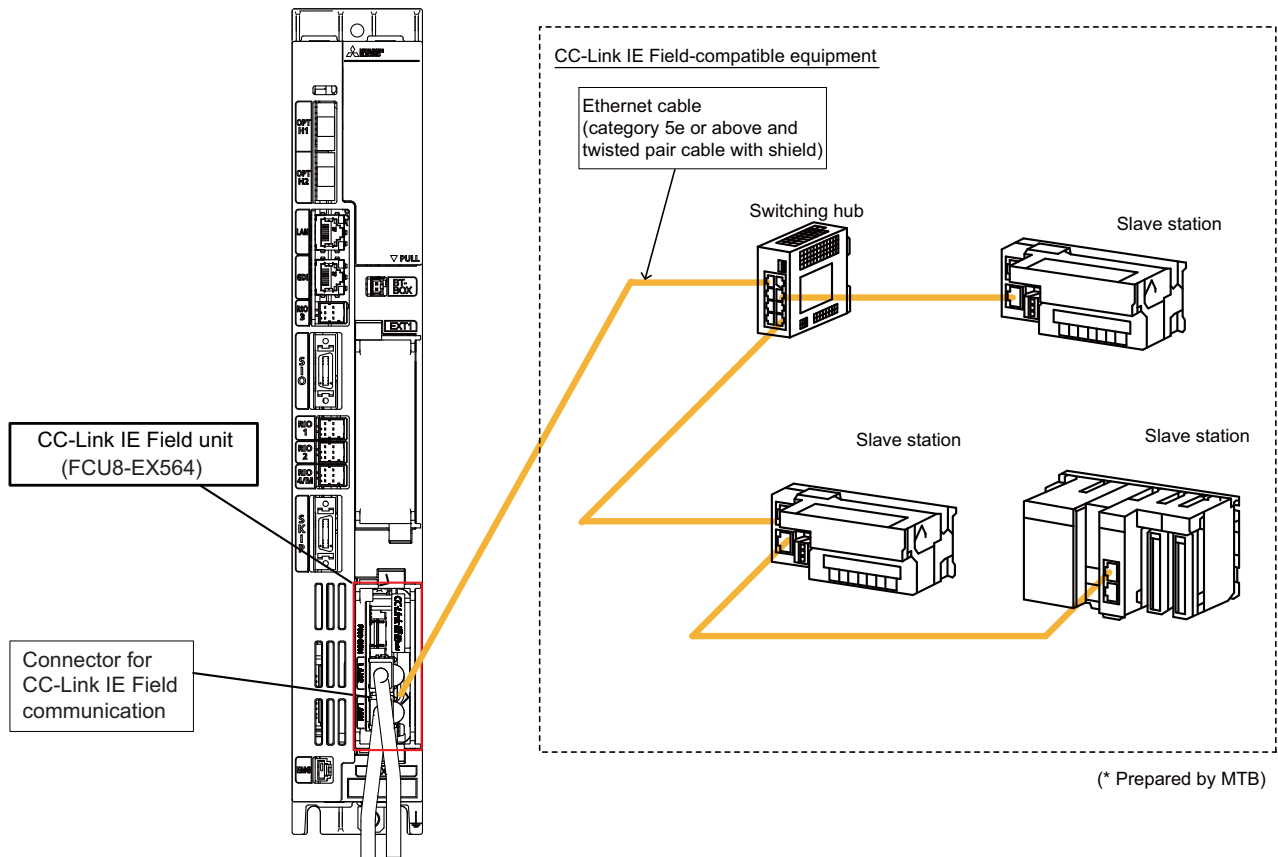
(Note 2) The performance is not guaranteed unless the PROFIBUS dedicated cable is used. For the specifications of the PROFIBUS dedicated cable or for contact information for any inquiries, see the homepage of PROFIBUS & PROFINET International (PI) (<http://www.profibus.com/>).

Contact information for inquiries related to the configuration software is as follows.

<p>Hilscher Gesellschaft für Systemautomation mbH Rheinstraße 78 D-65795 Hattersheim Germany TEL: +49-6190-9907-0 FAX: +49-6190-9907-50</p>	<p>Contact in Japan: Euro-Far East Co., Ltd Lilas Nogisaka Bldg. #901 Minami Aoyama 1-15-18 Minato-ku, Tokyo 107-0061 JAPAN TEL: 03-3470-8769 FAX: 03-3478-8648</p>
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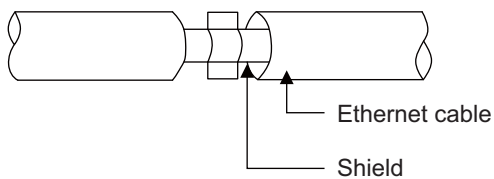
7.13.3 Connecting I/O Device via CC-Link IE Field

The expansion unit FCU8-EX564 functions as master station or slave (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 "M800/M80 Series CC-Link IE Field (Master/local) Specifications manual".



[Noise countermeasures of ethernet cable]

When the CC-Link IE Field expansion unit is being used, expose the cable by removing a part of the cable sheath and make sure to use the shield clamp for the exogenous noise countermeasure.



When you cannot use the shield clamp, make sure to install a ferrite core as a substitute to ethernet cable (near the expansion unit).

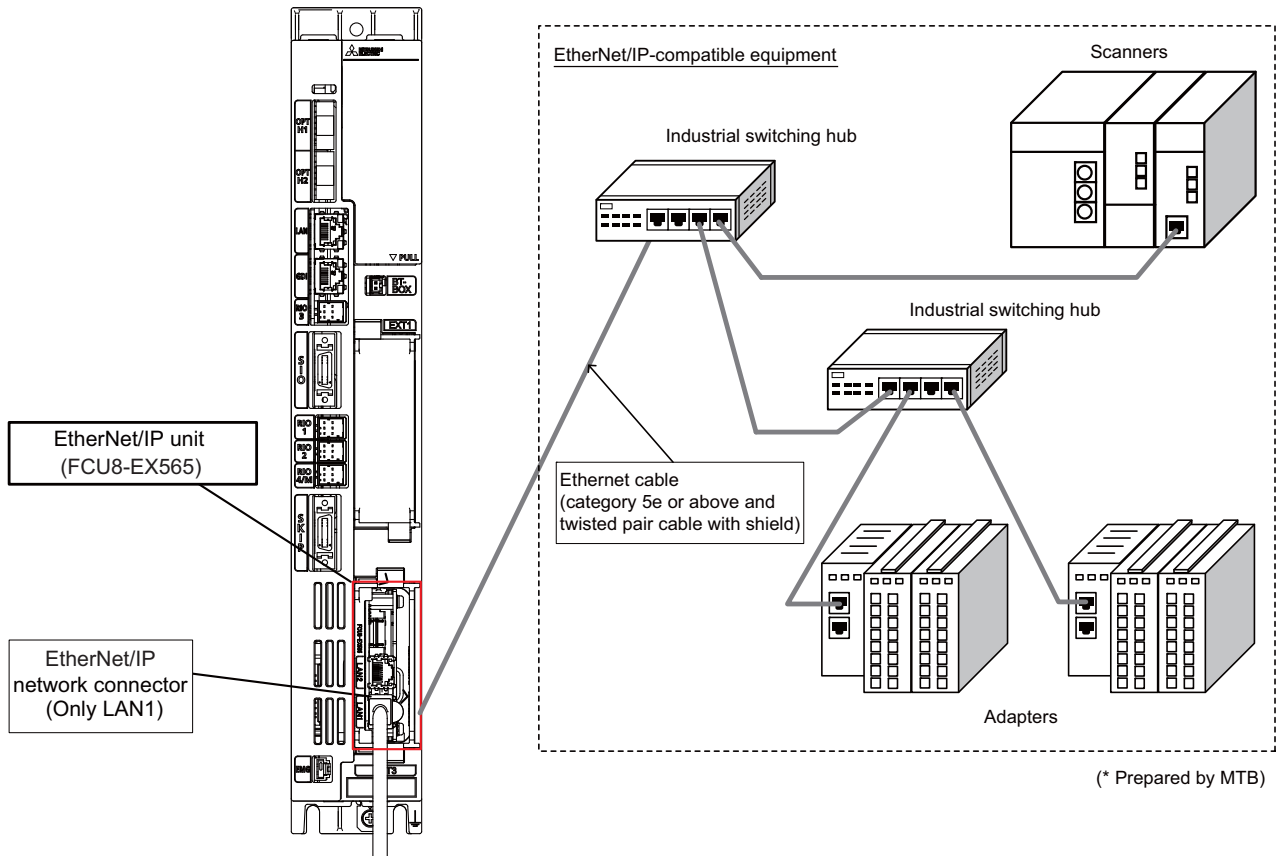
<Related item>

Shield clamp fitting: "EMC Installation Guidelines: EMC Countermeasure Parts: Shield Clamp Fitting"

Ferrite core: "EMC Installation Guidelines: EMC Countermeasure Parts: Ferrite Core"

7.13.4 Connecting I/O Device via EtherNet/IP

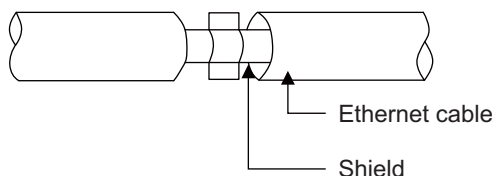
The expansion unit FCU8-EX565 functions as a scanner or an adapter of EtherNet/IP. Connect the EtherNet/IP-compatible equipment with an ethernet cable (category 5e or above and twisted pair shield cable). For details, refer to "M800/M80 Series EtherNet/IP Specifications manual".



(Note 1) EtherNet/IP 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.

[Noise countermeasures of ethernet cable]

When the EtherNet/IP expansion unit is being used, expose the cable by removing a part of the cable sheath and make sure to use the shield clamp for the exogenous noise countermeasure.



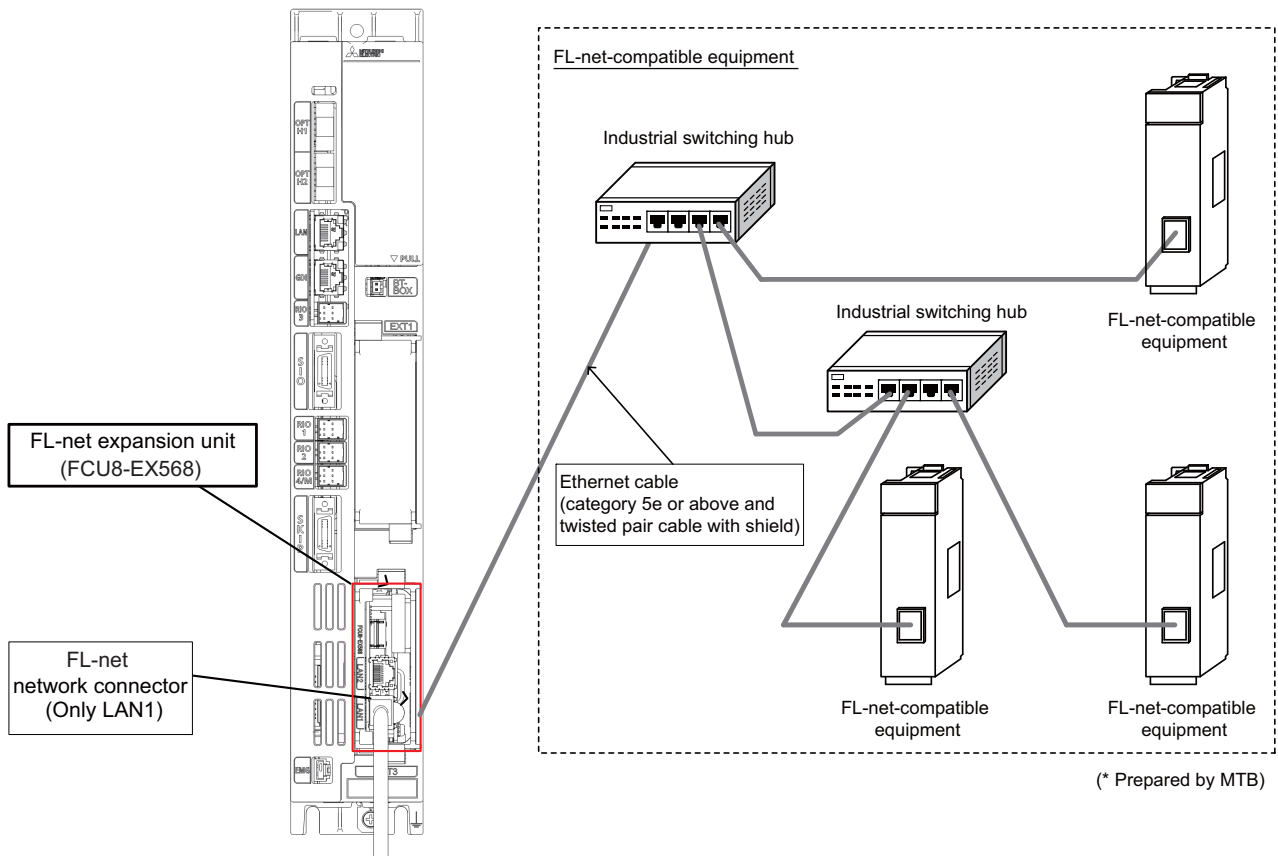
When you cannot use the shield clamp, make sure to install a ferrite core as a substitute to ethernet cable (near the expansion unit).

<Related item>

- Shield clamp fitting: "EMC Installation Guidelines: EMC Countermeasure Parts: Shield Clamp Fitting"
- Ferrite core: "EMC Installation Guidelines: EMC Countermeasure Parts: Ferrite Core"

7.13.5 Connecting I/O Device via FL-net

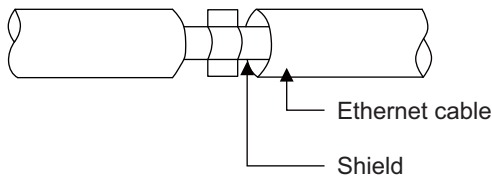
The expansion unit FCU8-EX568 functions as a node of FL-net. Connect the FL-net-compatible equipment with an ethernet cable (category 5e or above and twisted pair shield cable).



(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.

[Noise countermeasures of ethernet cable]

When the FL-net expansion unit is being used, expose the cable by removing a part of the cable sheath and make sure to use the shield clamp for the exogenous noise countermeasure.



When you cannot use the shield clamp, make sure to install a ferrite core as a substitute to ethernet cable (near the expansion unit).

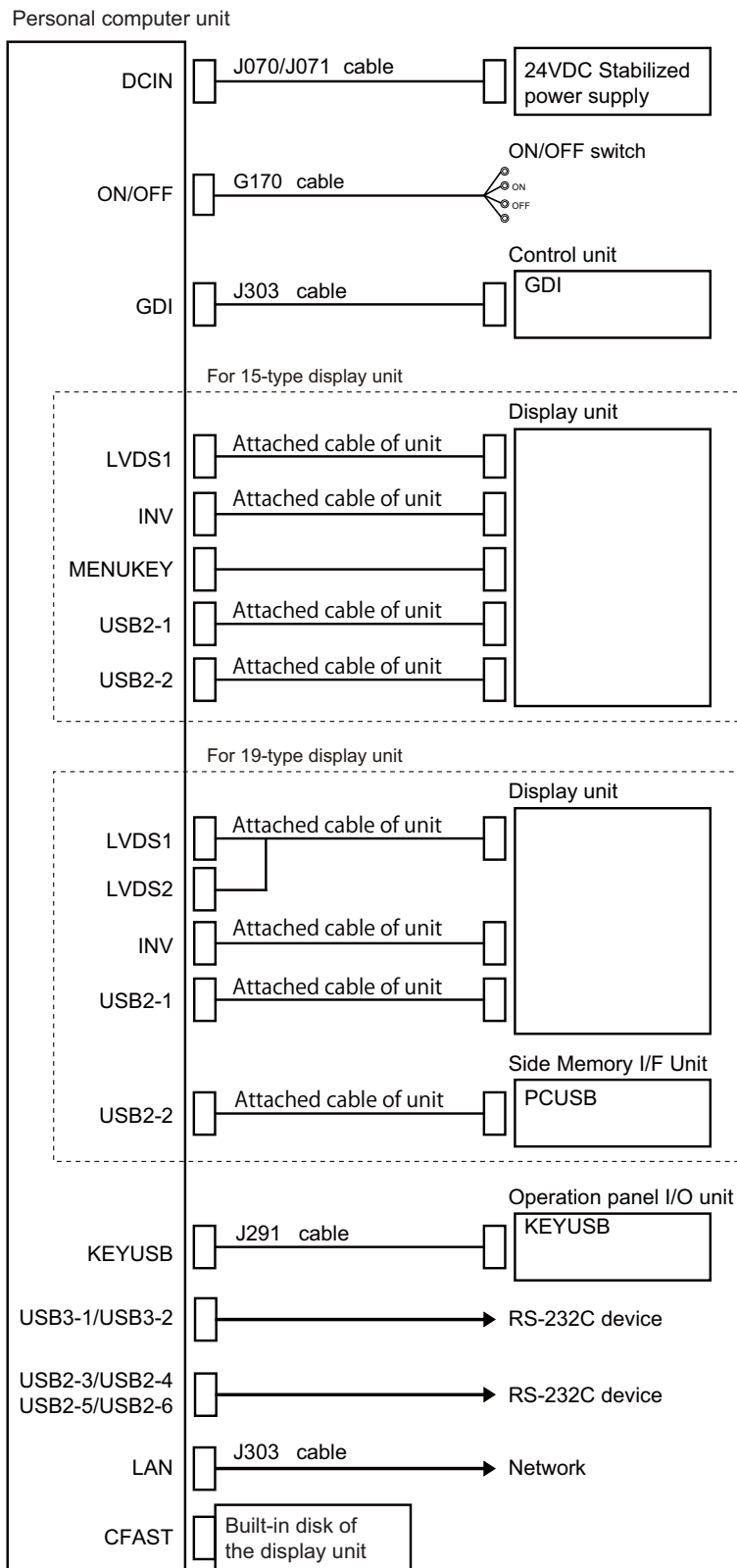
<Related item>

Shield clamp fitting: "EMC Installation Guidelines: EMC Countermeasure Parts: Shield Clamp Fitting"

Ferrite core: "EMC Installation Guidelines: EMC Countermeasure Parts: Ferrite Core"

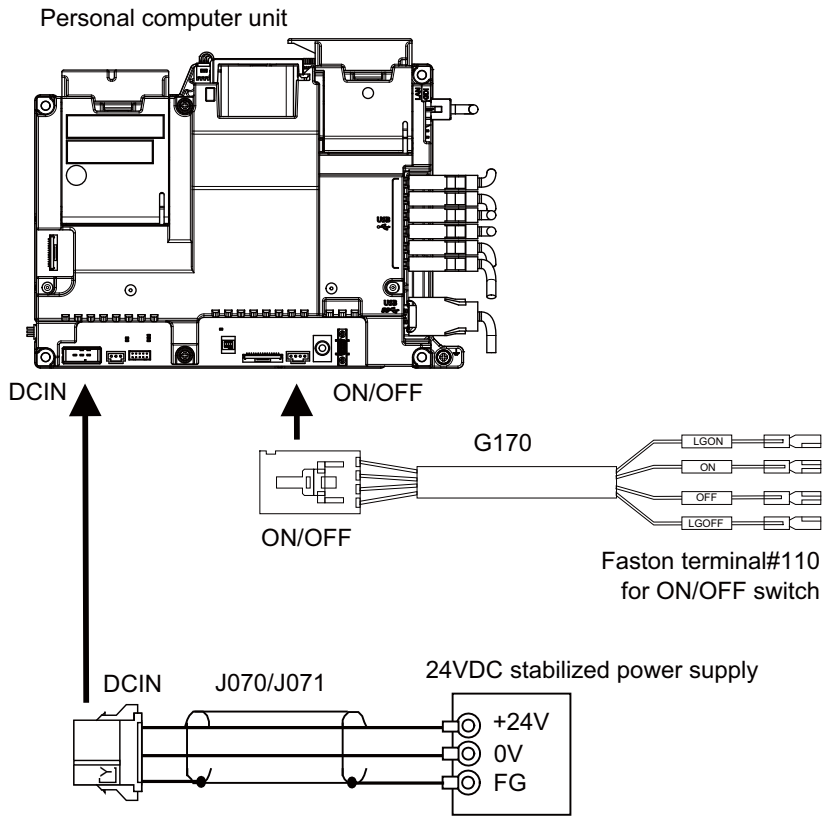
Connection of Personal Computer Unit

8.1 Personal Computer Unit Connection System Drawing



8.2 Connecting with Power Supply

Connect 24VDC power supply (general-purpose stabilized power supply) to the personal computer unit.



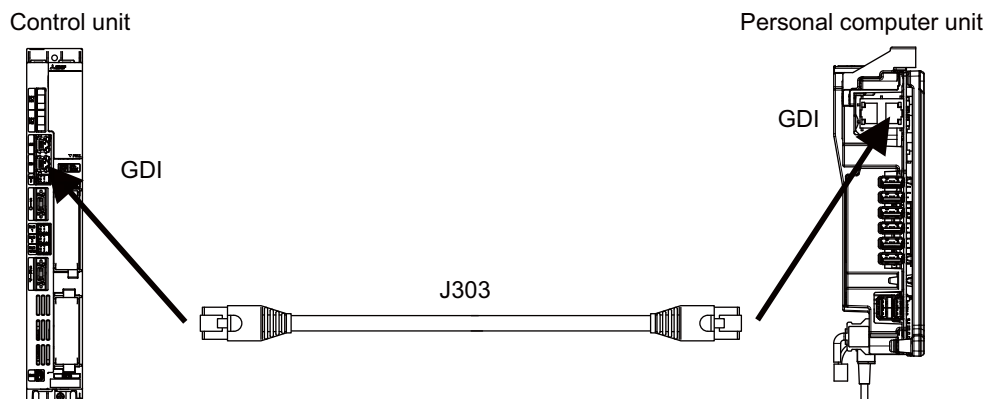
<Related items>

Cable drawing "Cable : J070/J071 Cable", "Cable : G170 Cable"

Connector pin assignment: "General Specifications: Personal Computer Unit" (DCIN connector, ON/OFF connector)

8.3 Connecting with Control Unit

Connect the control unit to GDI connector of the personal computer unit.



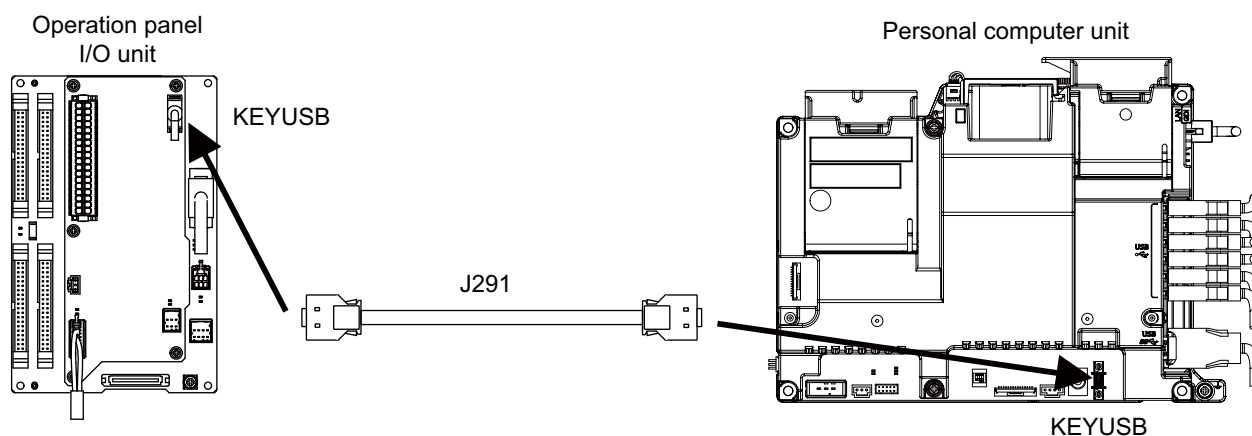
<Related items>

Cable drawing "Cable : J303 Cable"

Connector pin assignment: "General Specifications: Personal Computer Unit" (GDI connector)

8.4 Connecting with Operation Panel I/O Unit

Connect the operation panel I/O unit to KEYUSB connector of the personal computer unit.



<Related items>

Cable drawing "Cable : J291 Cable"

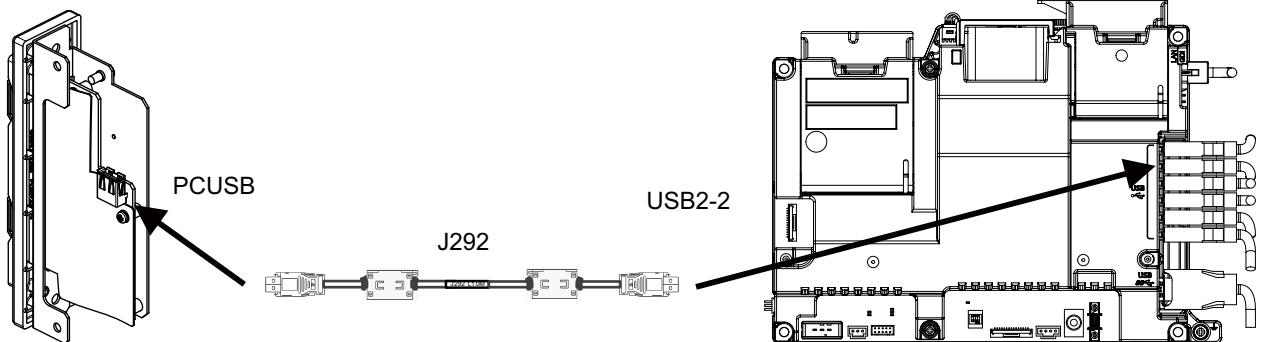
Connector pin assignment: "General Specifications: Personal Computer Unit" (KEYUSB connector)

8.5 Connecting with Side Memory I/F Unit

Connect the side memory I/F unit to the USB-2 connector of the personal computer unit.

Side memory I/F unit

Personal computer unit



J292 cable is provided with the side memory I/F unit.

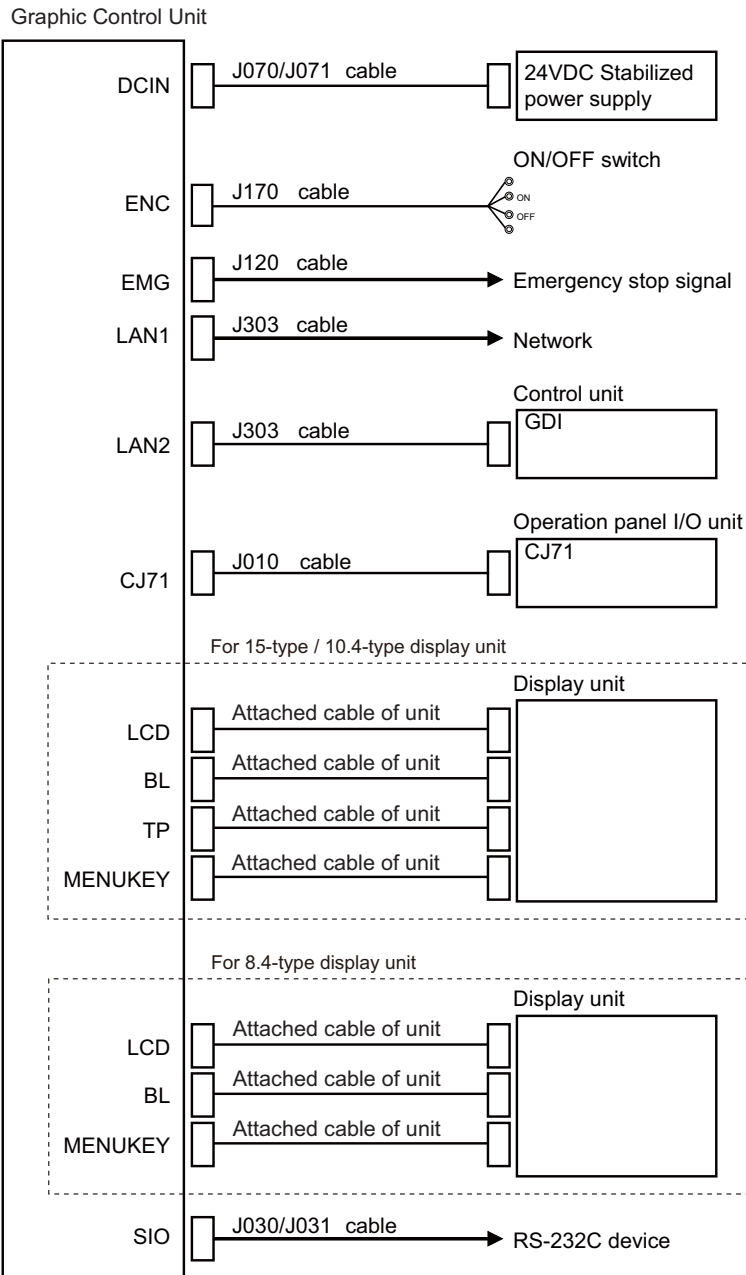
(Note 1) Do not use the commercially available USB cable, or it may cause the malfunction.

(Note 2) The side memory I/F unit can be connected to USB2- to USB2-6 connectors.

(Note 3) Side memory I/F unit is only for 19-type display unit.

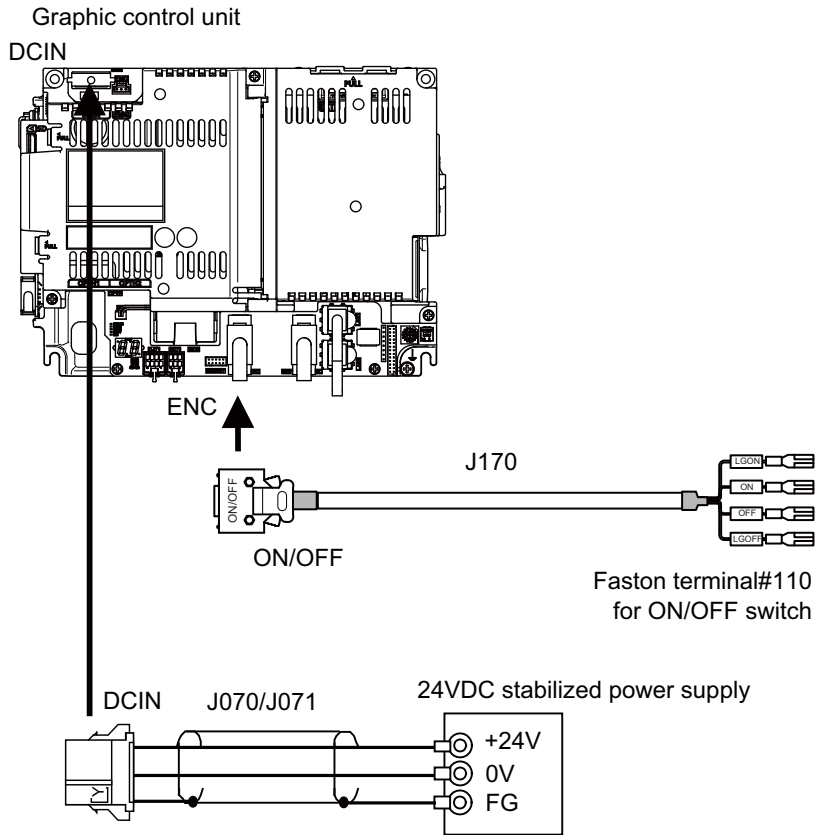
Connection of Graphic Control Unit

9.1 Graphic Control Unit Connection System Drawing



9.2 Connecting with Power Supply

Connect 24VDC power supply (general-purpose stabilized power supply) to the graphic control unit.



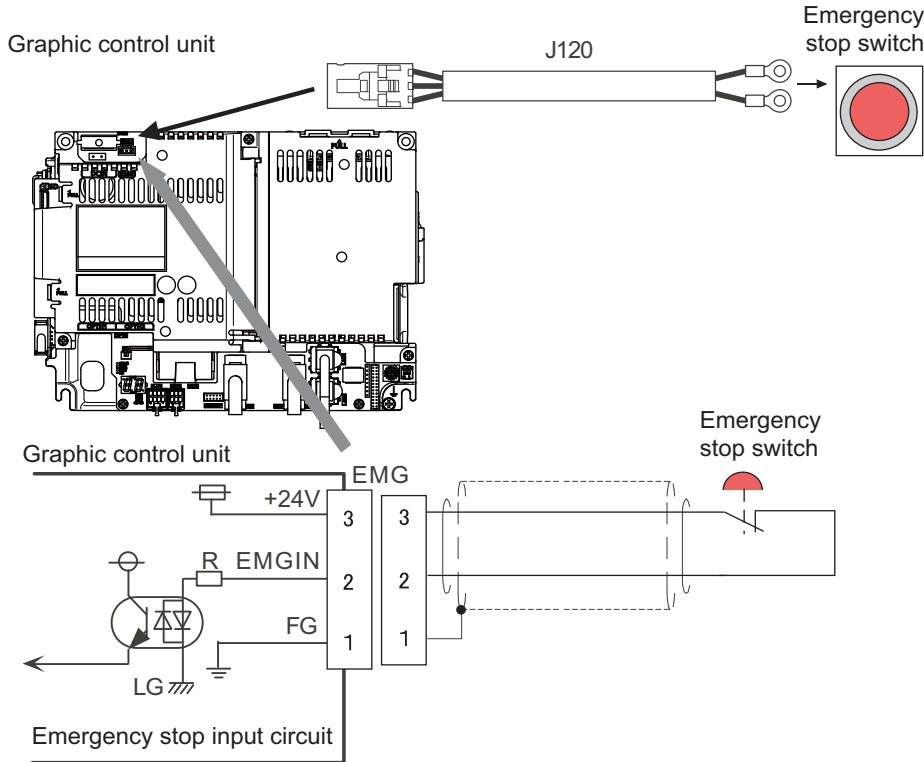
<Related items>

Cable drawing "Cable : J070/J071 Cable", "Cable : J170 Cable"

Connector pin assignment: "General Specifications: Graphic Control Unit" (DCIN connector, ENC connector)

9.3 Connecting with Emergency Stop Signal

Connect the emergency stop switch to EMG connector of the graphic control unit.



<Related items>

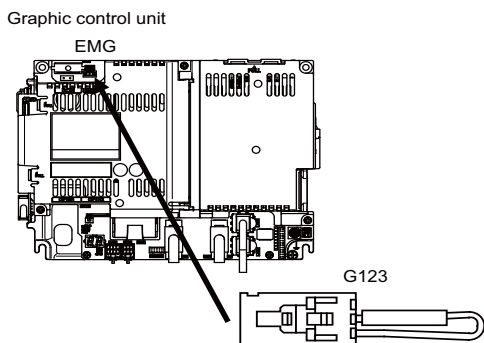
Cable drawing: "Cable: J120 Cable"

Connector pin assignment: "General Specifications: Graphic Control Unit" (EMG connector)

<When not using graphic control unit side emergency stop input signal (EMG)>

When not using graphic control unit side emergency stop input signal (EMG), such as when control unit side emergency stop input signal (EMG) is used, invalidate the input signal by using terminal cable G123.

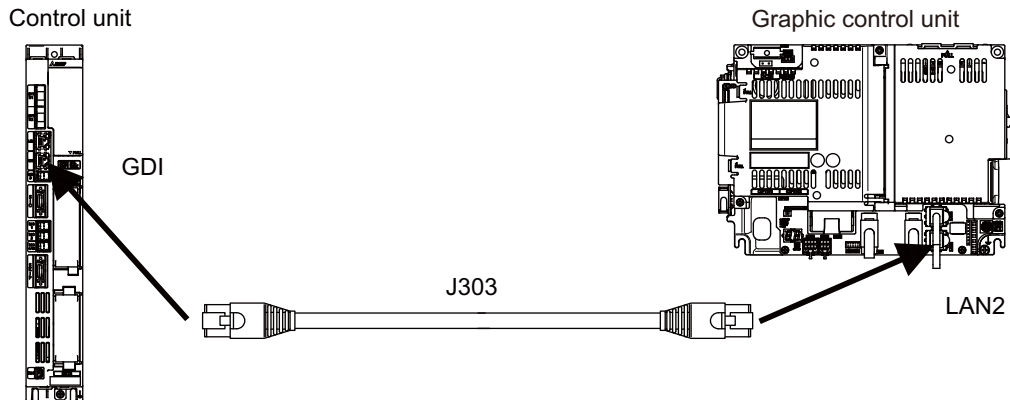
Note that G123 cable does not come with the graphic control unit. (G123 cable comes with the control unit.)



(Note) When installing emergency stop switch at operation panel and electric cabinet each, both emergency stop input signals (EMG), the signal at the graphic control unit side and at the control unit side, can be used.

9.4 Connecting with Control Unit

Connect the control unit to LAN2 connector of the graphic control unit.



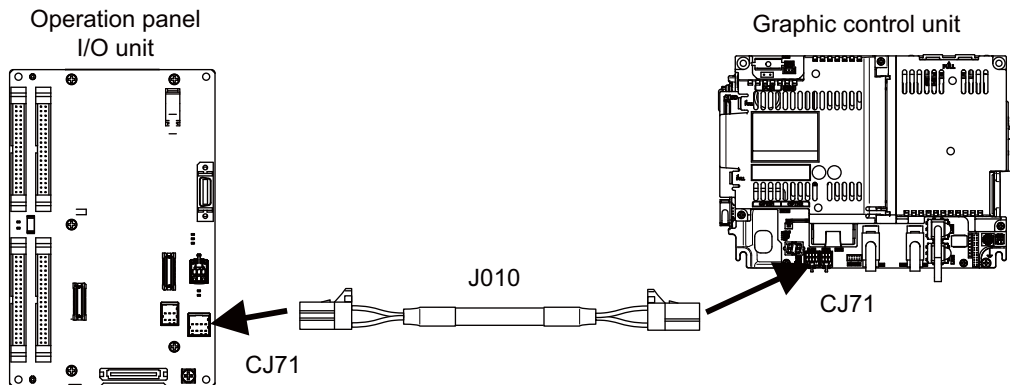
<Related items>

Cable drawing "Cable : J303 Cable"

Connector pin assignment: "General Specifications: Graphic Control Unit" (LAN2 connector)

9.5 Connecting with Operation Panel I/O Unit

Connect the graphic control unit to CJ71 connector of the personal computer unit.



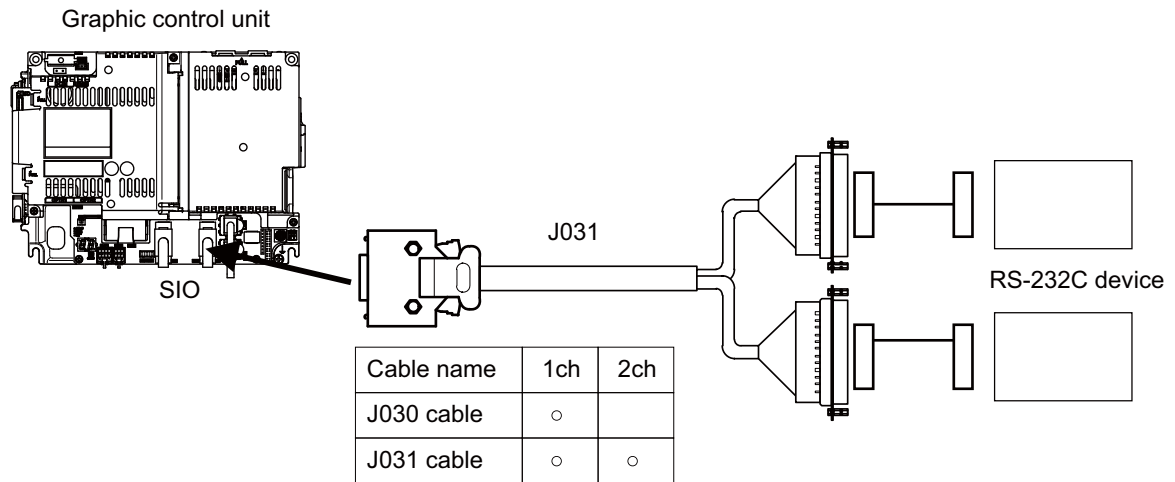
<Related items>

Cable drawing "Cable : J010 Cable"

Connector pin assignment: "General Specifications: Graphic Control Unit" (CJ71 connector)

9.6 Connecting with RS-232C Device

Connect the RS-232C device to SIO connector of the graphic control unit.



<Related items>

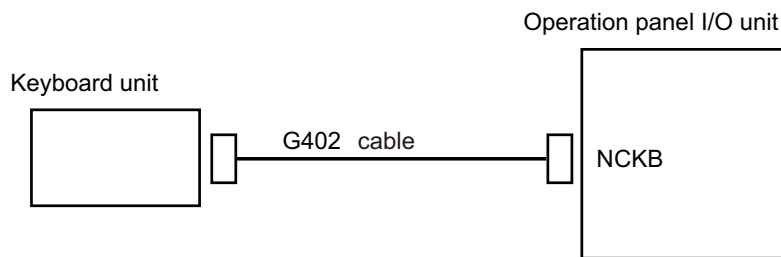
Cable drawing: "Cable: J030/J031 Cable"

Connector pin assignment: "General Specifications: Graphic Control Unit" (SIO connector)

Connection of Keyboard Unit

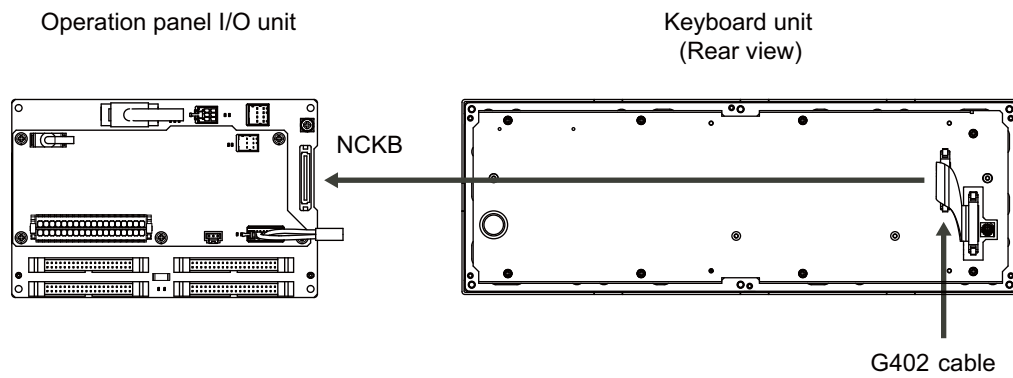
The method for connecting to each unit and device from the keyboard unit is briefly explained in this chapter.

10.1 Keyboard Unit Connection System Drawing



10.2 Connecting with Operation Panel I/O Unit

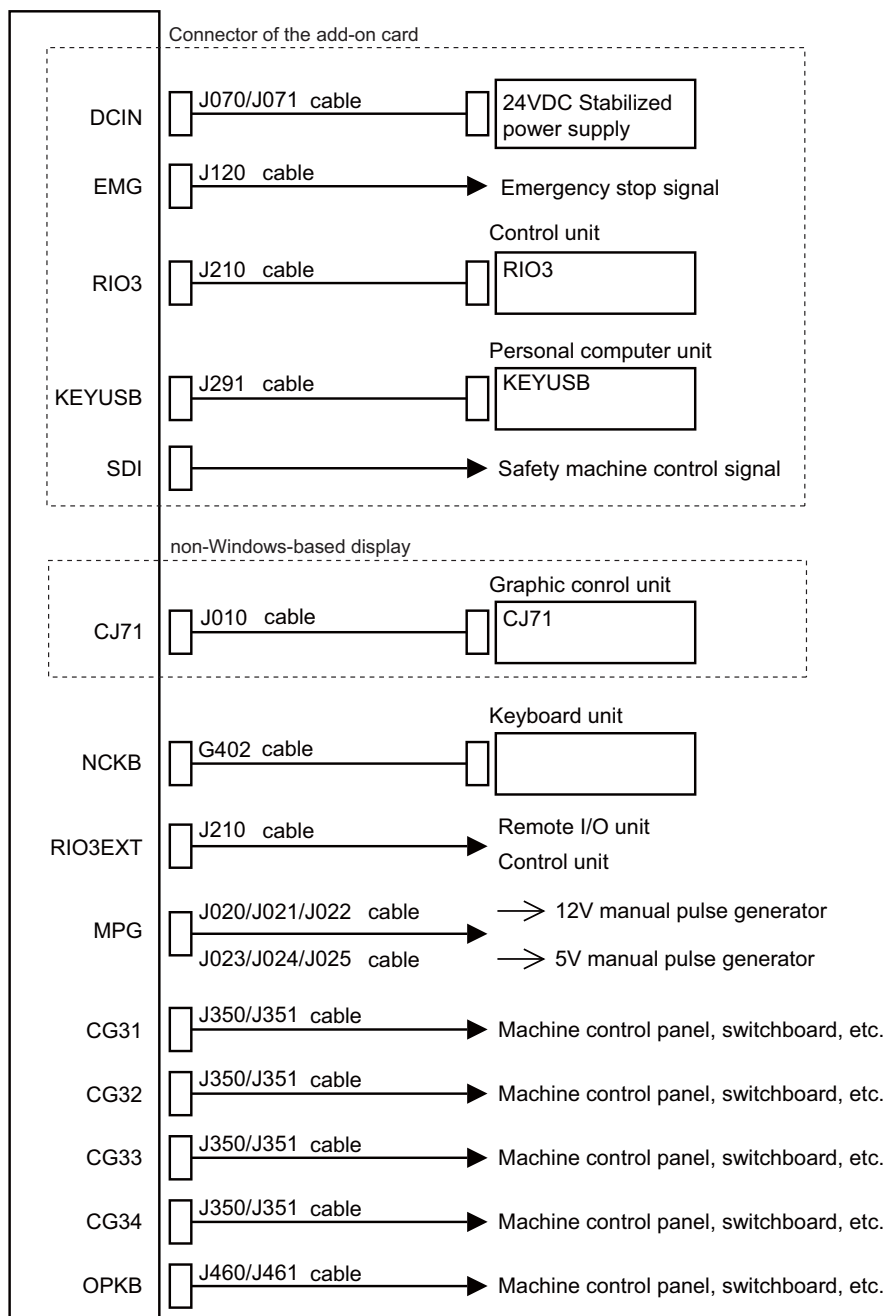
Connect the operation panel I/O unit to connector of the keyboard unit.



Connection of Operation Panel I/O Unit

11.1 Operation Panel I/O Unit Connection System Drawing

Operation panel I/O unit



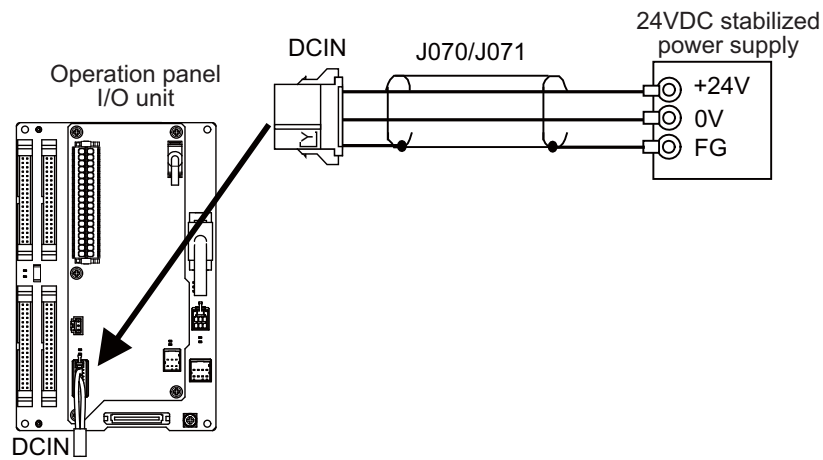
(Note 1) The mounted connector differs depending on the unit. Refer to the following chapter for which of the connector is mounted.

"General specifications: Operational Panel I/O Unit"

(Note 2) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

11.2 Connecting with Power Supply

Connect 24VDC power supply (general-purpose stabilized power supply) to the operation panel I/O unit.



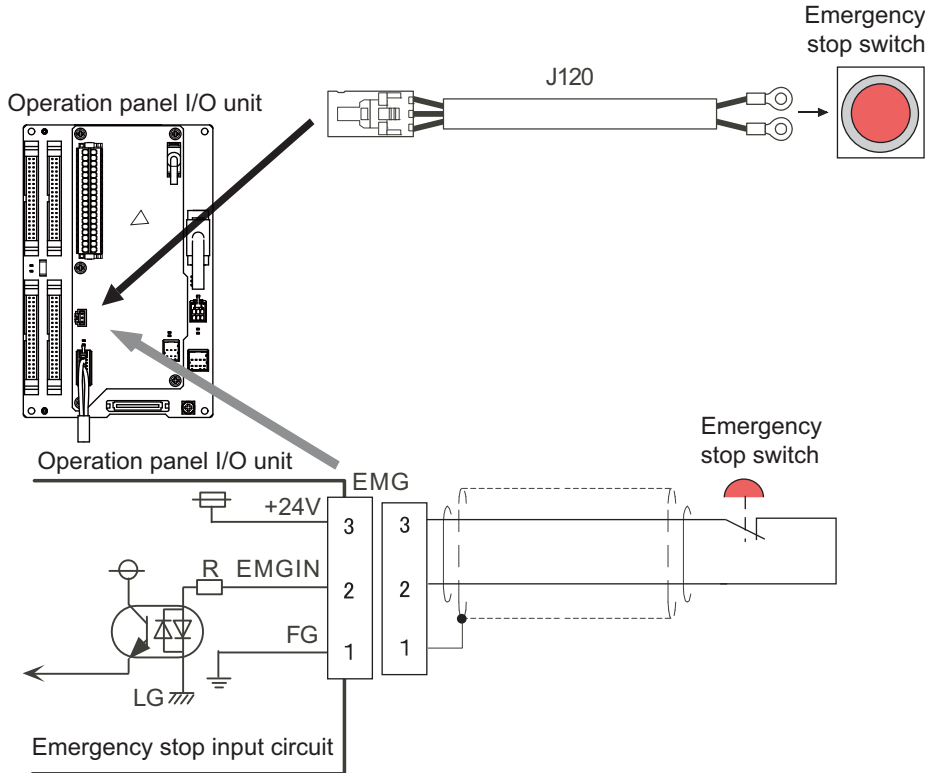
<Related items>

Cable drawing: "Cable: J070/J071 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (DCIN connector)

11.3 Connecting with Emergency Stop Signal

Connect the emergency stop switch to EMG connector of the operation panel I/O unit.



<Related items>

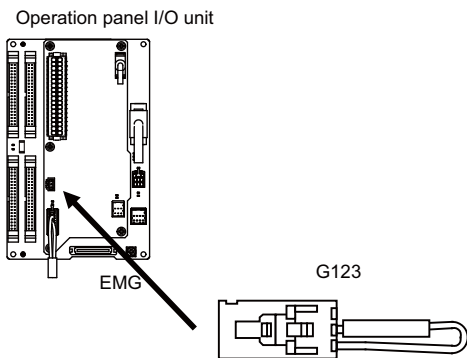
Cable drawing: "Cable: J120 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (EMG connector)

<When not using operation panel I/O unit side emergency stop input signal (EMG)>

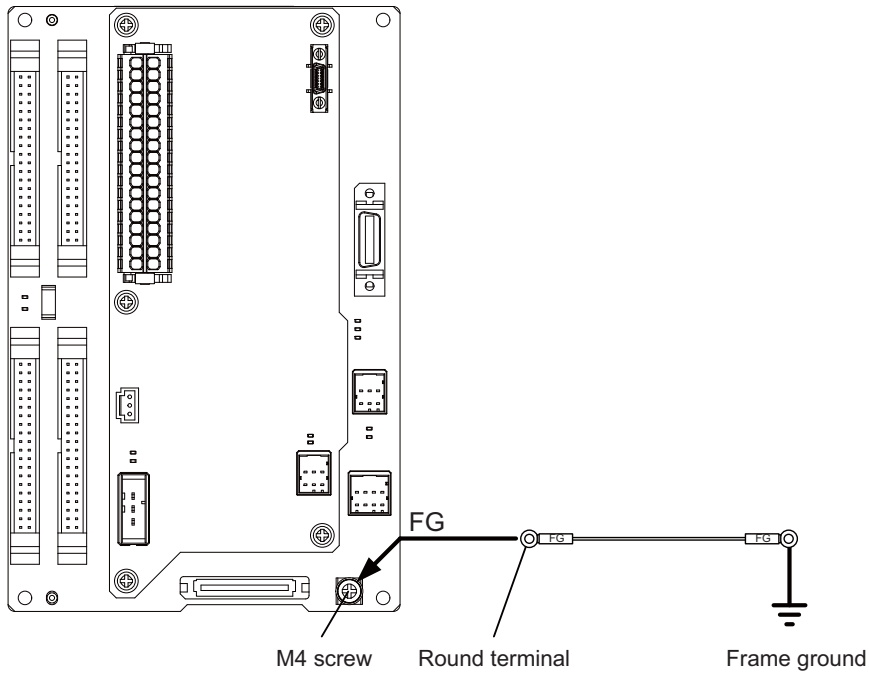
When not using operation panel I/O unit side emergency stop input signal (EMG), such as when control unit side emergency stop input signal (EMG) is used, invalidate the input signal by using terminal cable G123.

Note that G123 cable does not come with the operation panel I/O unit. (G123 cable comes with the control unit.)



(Note) When installing emergency stop switch at operation panel and electric cabinet each, both emergency stop input signals (EMG), the signal at the operating panel I/O unit side and at the control unit side, can be used.

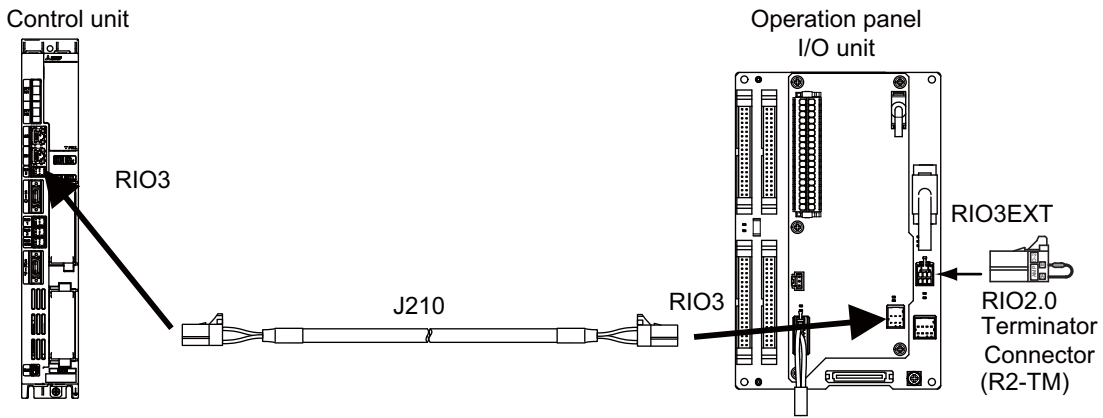
11.4 Connecting with Frame Ground



11.5 Connecting with Control Unit

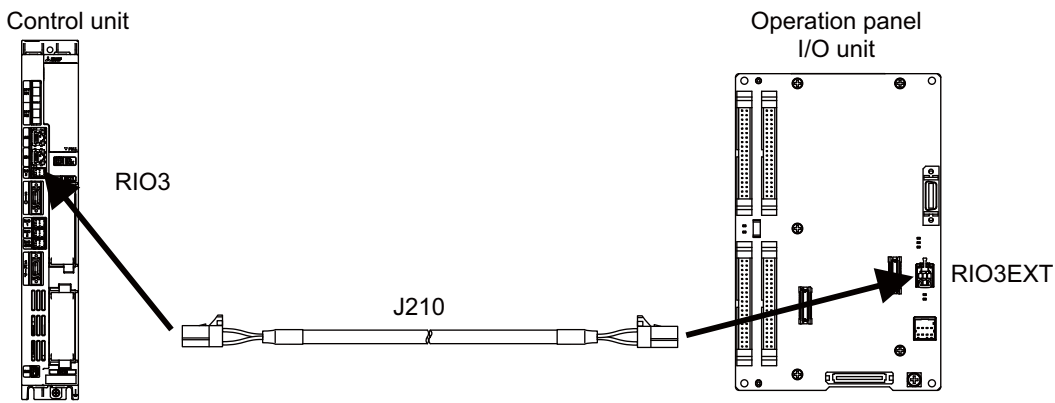
[Windows-based display]

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



[Non-Windows-based display]

Connect the control unit to RIO3EXT connector of the operation panel I/O unit.



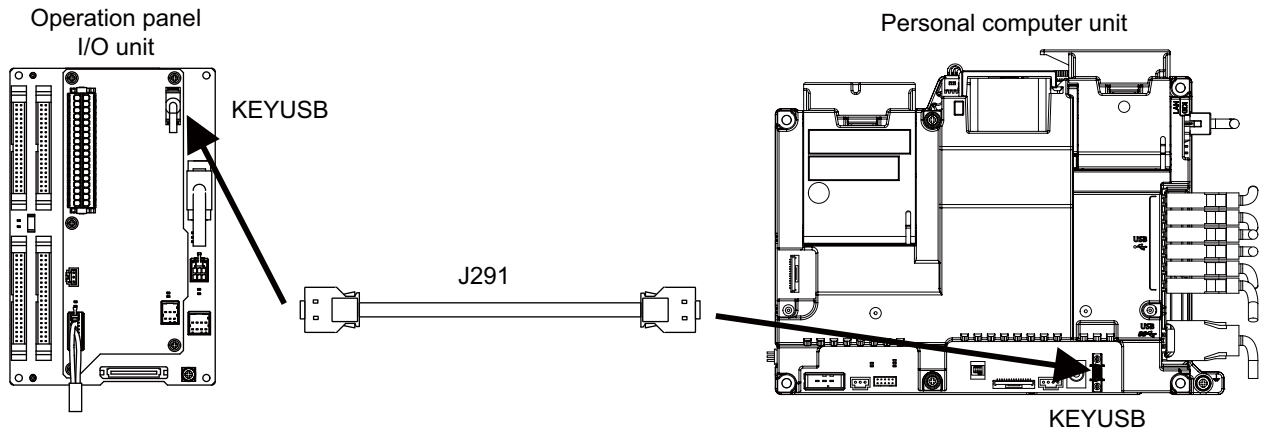
<Related items>

Cable drawing: "Cable: J210 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (RIO3 connector, RIO3EXT connector)

11.6 Connecting with Personal Computer Unit

Connect the personal computer unit to KEYUSB connector of the operation panel I/O unit.



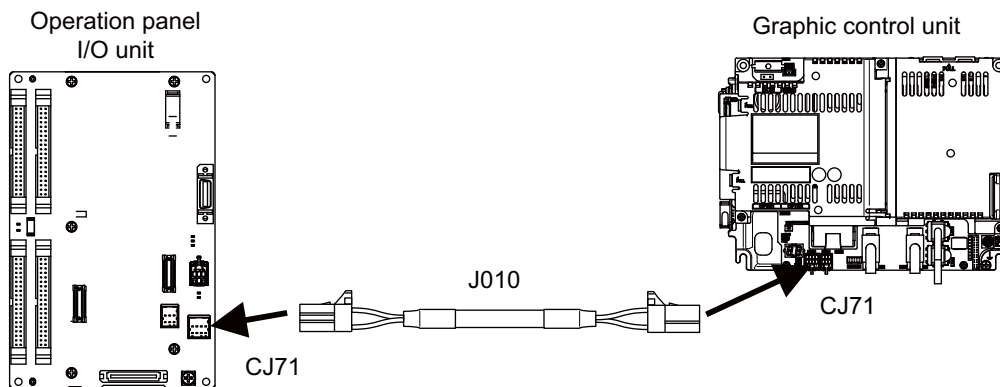
<Related items>

Cable drawing: "Cable: J291 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (KEYUSB connector)

11.7 Connecting with Graphic Control Unit

Connect the personal computer unit to CJ71 connector of the graphic control unit.



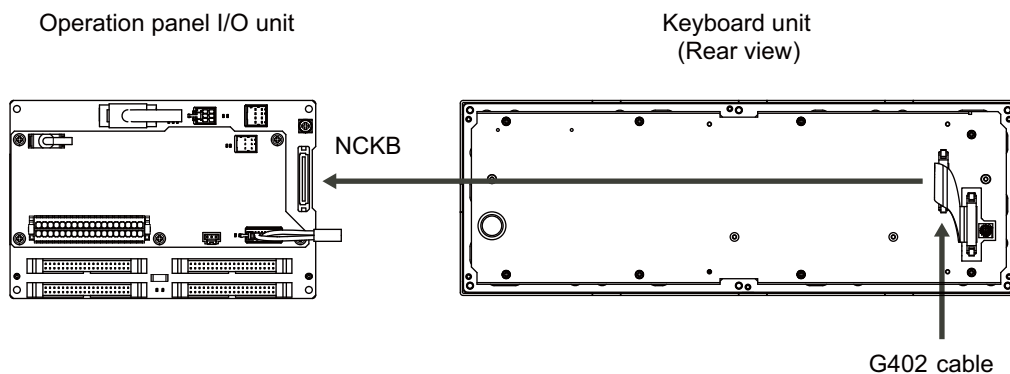
<Related items>

Cable drawing: "Cable: J010 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (CJ71 connector)

11.8 Connecting with Keyboard Unit

Connect the keyboard unit to NCKB connector of the operation panel I/O unit.

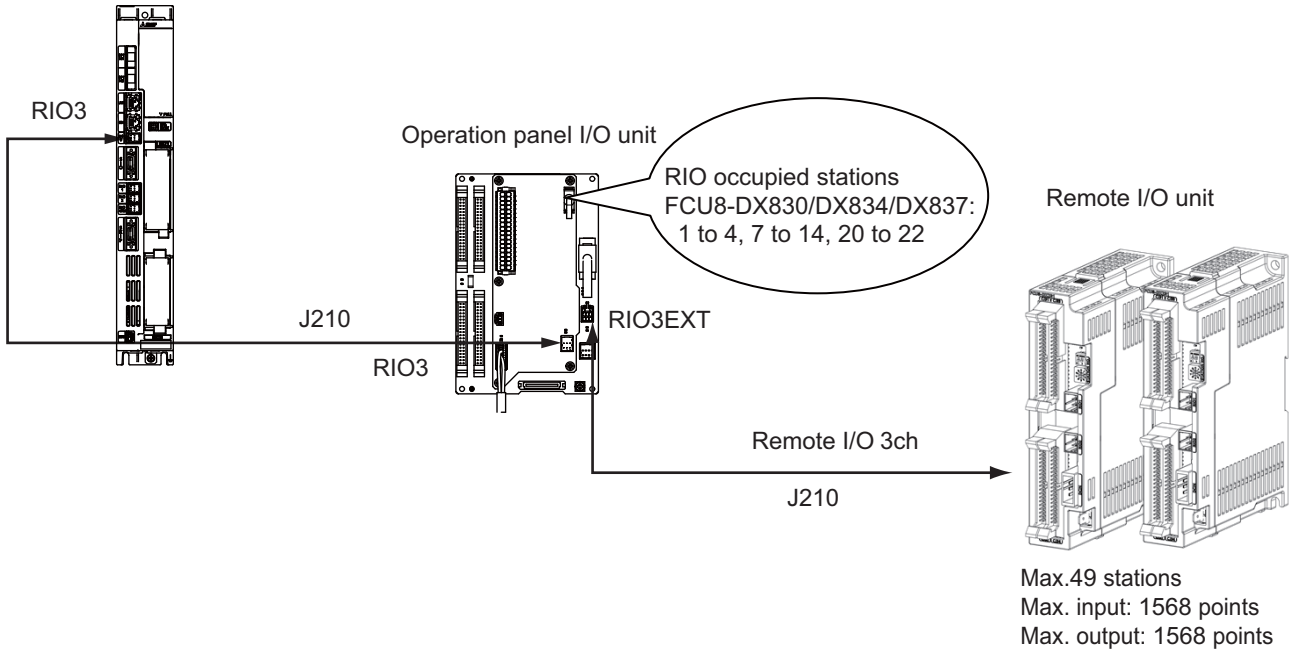


11.9 Connecting with Remote I/O Unit

[Windows-based display]

Connect the remote I/O unit to RIO3EXT connector of the operation panel I/O unit.

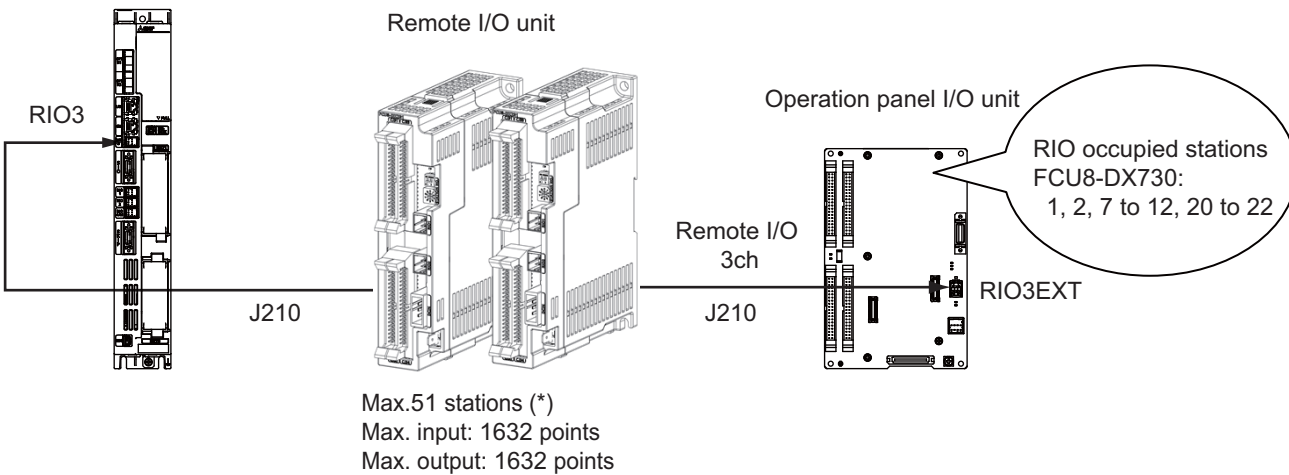
Control unit



[Non-Windows-based display]

When connecting a remote I/O unit to the 3rd RIO channel, insert it between the control unit and operation panel I/O unit.

Control unit



(*) FCU8-DX730 occupies 11 stations, but 13 stations are occupied in total since the graphic control unit occupies 2 stations.

<Related items>

Cable drawing: "Cable: J210 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (RIO3 connector, RIO3EXT connector)

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

11.10 Connecting with Manual Pulse Generator (MPG)

Connect the manual pulse generator to MPG connector of the operation panel I/O unit.

Both 5V power supply type (UFO-01-2Z9) and 12V power supply type (HD60C) manual pulse generator can be used.

Take the maximum cable length, etc. into consideration when selecting.

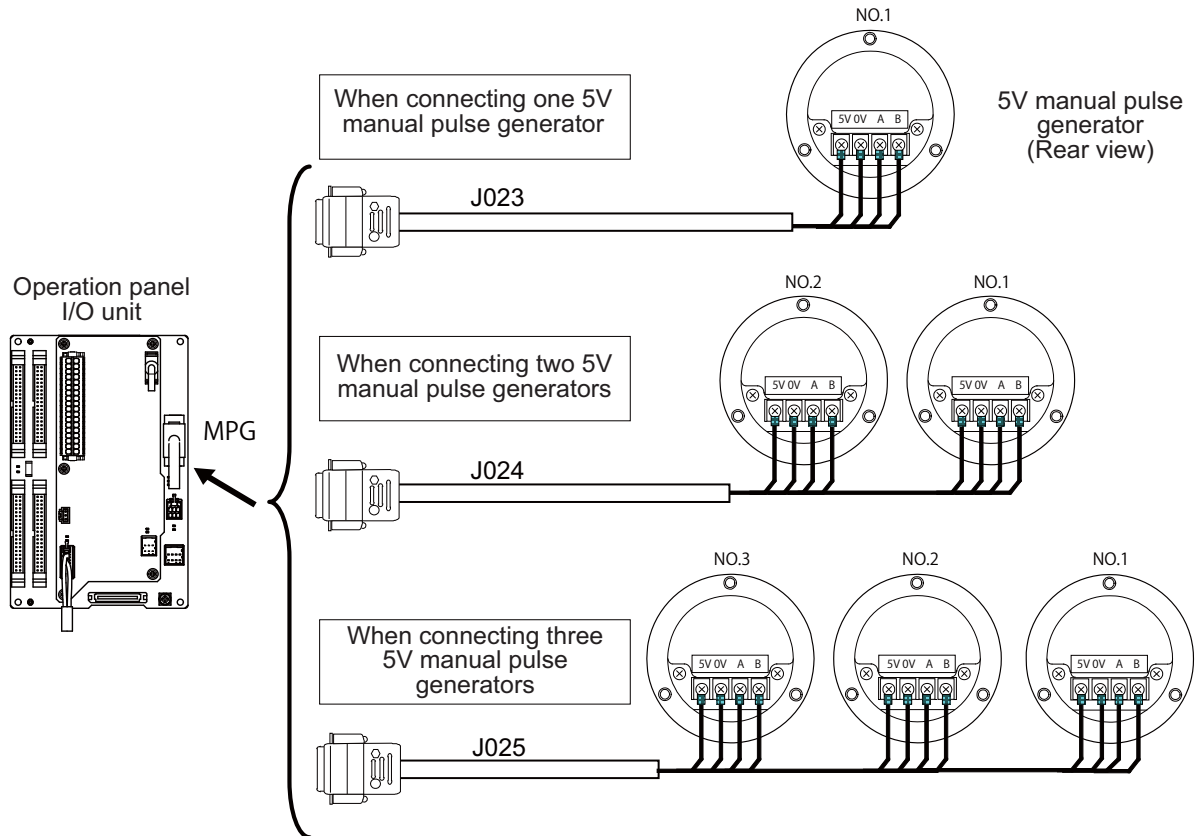
(Note) Set one of the following parameters which is suitable for your manual pulse generator.

- 5V manual pulse generator (UFO-01-2Z9) : #1240 set12/bit0 = 1 (100 pulse/rev)

- 12V manual pulse generator (HD60C) : #1240 set12/bit0 = 0 (25 pulse/rev)

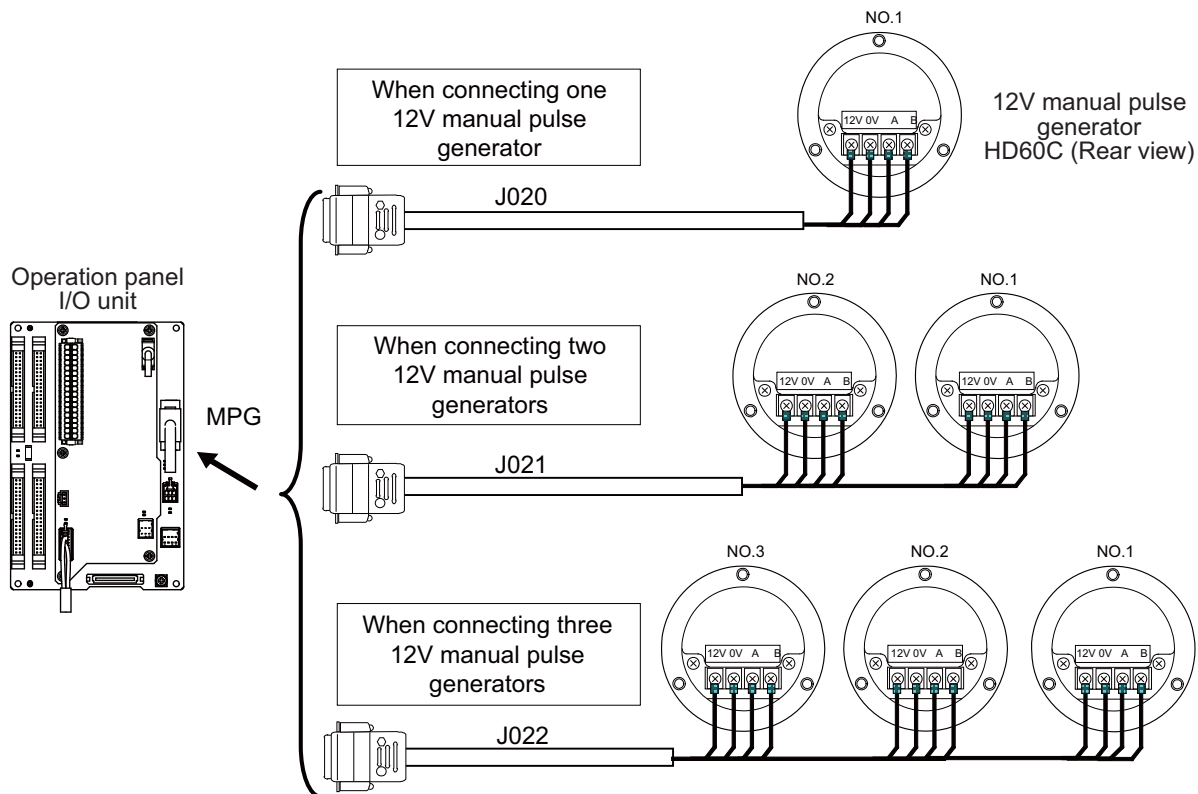
(1) Connecting with 5V manual pulse generator (maximum cable length: 20m)

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



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

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



(Note 1) When selecting a manual pulse generator, make sure that its case and 0V terminal are insulated.

(Note 2) Select 25pulse/rev or 100pulse/rev on the parameter screen.

<Related items>

Cable drawing: "Cable: J020/J021/J022 Cable" and "Cable: J023/J024/J025 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (MPG connector)

11.10.1 Handle Numbers

There are two types of the handle numbers assignment: automatic assignment and arbitrary assignment.

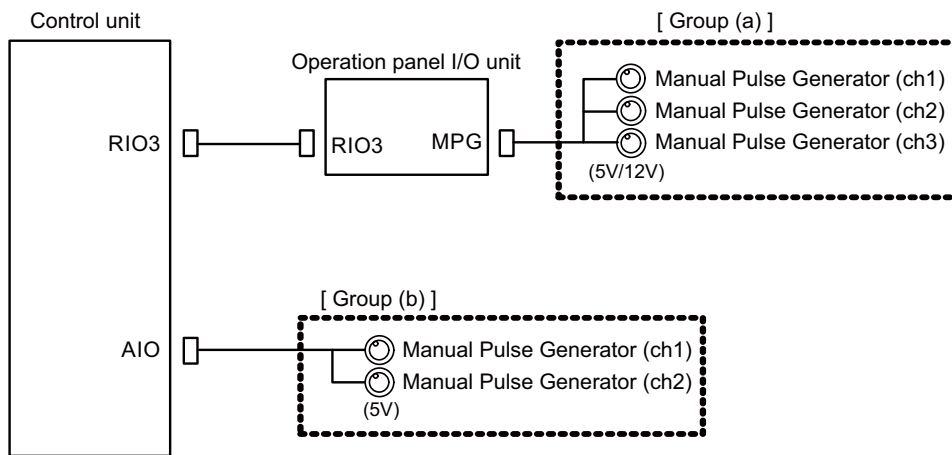
[Automatic assignment]

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.

"AIO": Connector on control unit (two channels), "MPG": Connector on operation panel I/O unit (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 (c) ch1	Group (c) ch2	



(Note 1) M80W does not include A10 connector.

(Note 2) The manual pulse generator connected to FCU8-EX544 is not subject to the automatic arbitrary assignment.

[Arbitrary assignment]

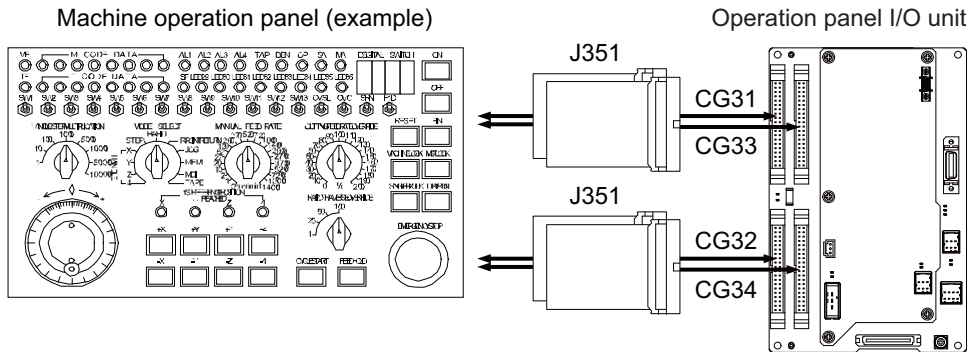
Assign the handle I/F arbitrary according to the setting values of the parameters "#1395 H1_pno (1st handle selection)" to "#1397 H3_pno (3rd handle selection)".

The manual pulse generator connected to FCU8-EX544 also follows the above parameter setting.

11.11 Connecting with Machine Operation Panel

Connect the machine operation panel to CG31/CG32/CG33/CG34 connector of the operation panel I/O unit.

[FCU8-DX830/DX730]

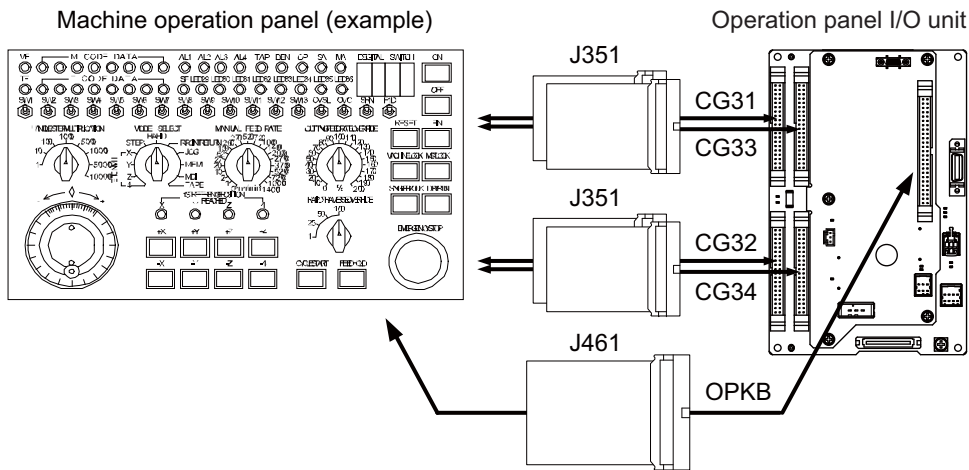


<Related items>

Cable drawing: "Cable: J351 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (CG31/CG32/CG33/CG34 connector)

[FCU8-DX834]

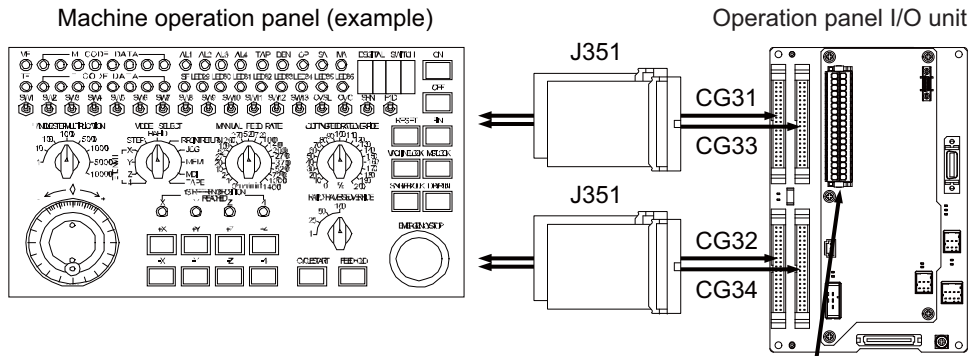


<Related items>

Cable drawing: "Cable: J351 Cable" and "Cable: J461 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (CG31/CG32/CG33/CG34/OPKB connector)

[FCU8-DX837]



<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
Recommended manufacturer	: WAGO
<Bar terminal type>	
Bar terminal	: 216 series
Recommended manufacturer	: WAGO

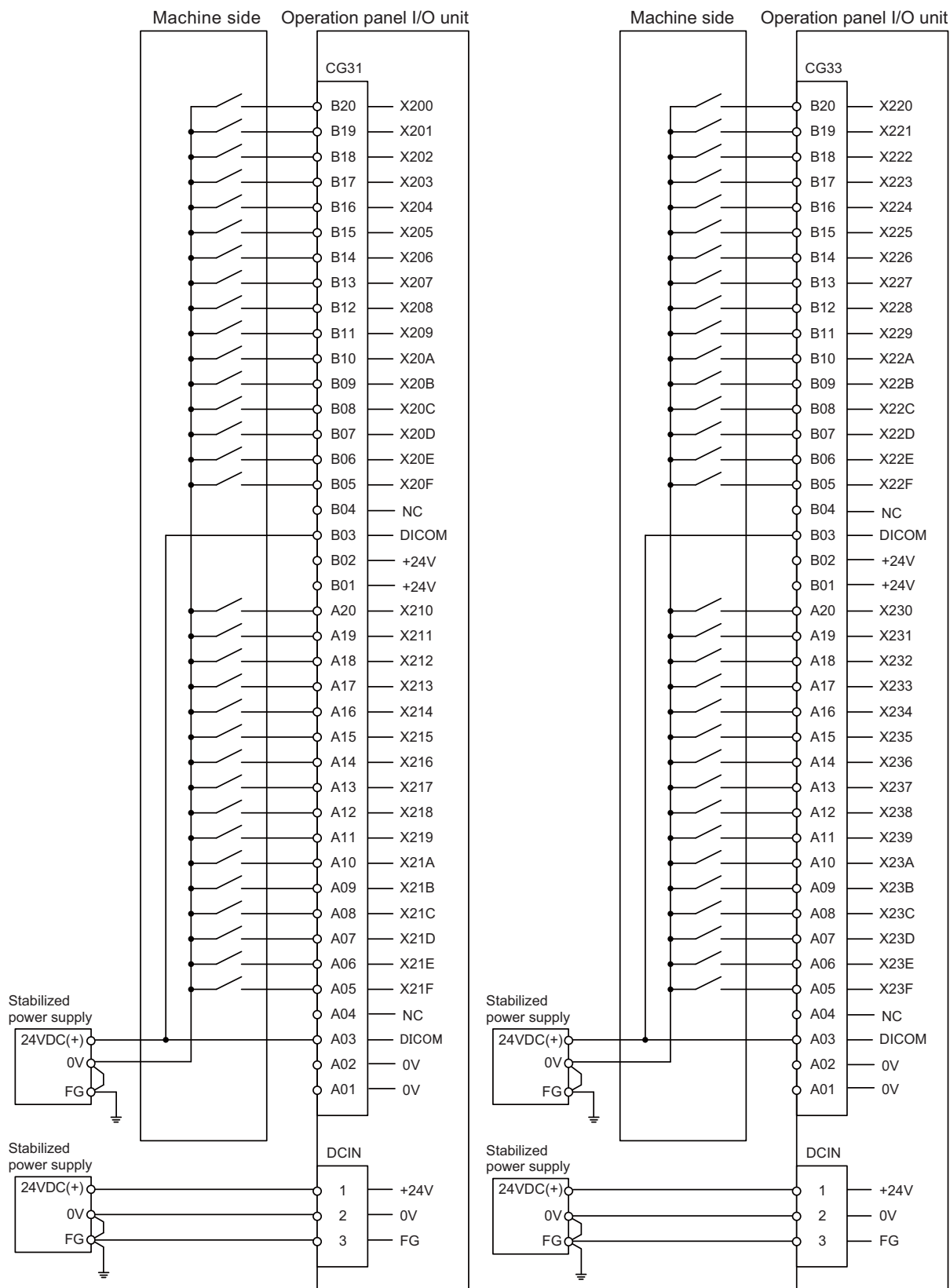
<Related items>

Cable drawing: "Cable: J351 Cable"

Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (CG31/CG32/CG33/CG34/SDI connector)

11.11.1 Wiring for 24V Common Input

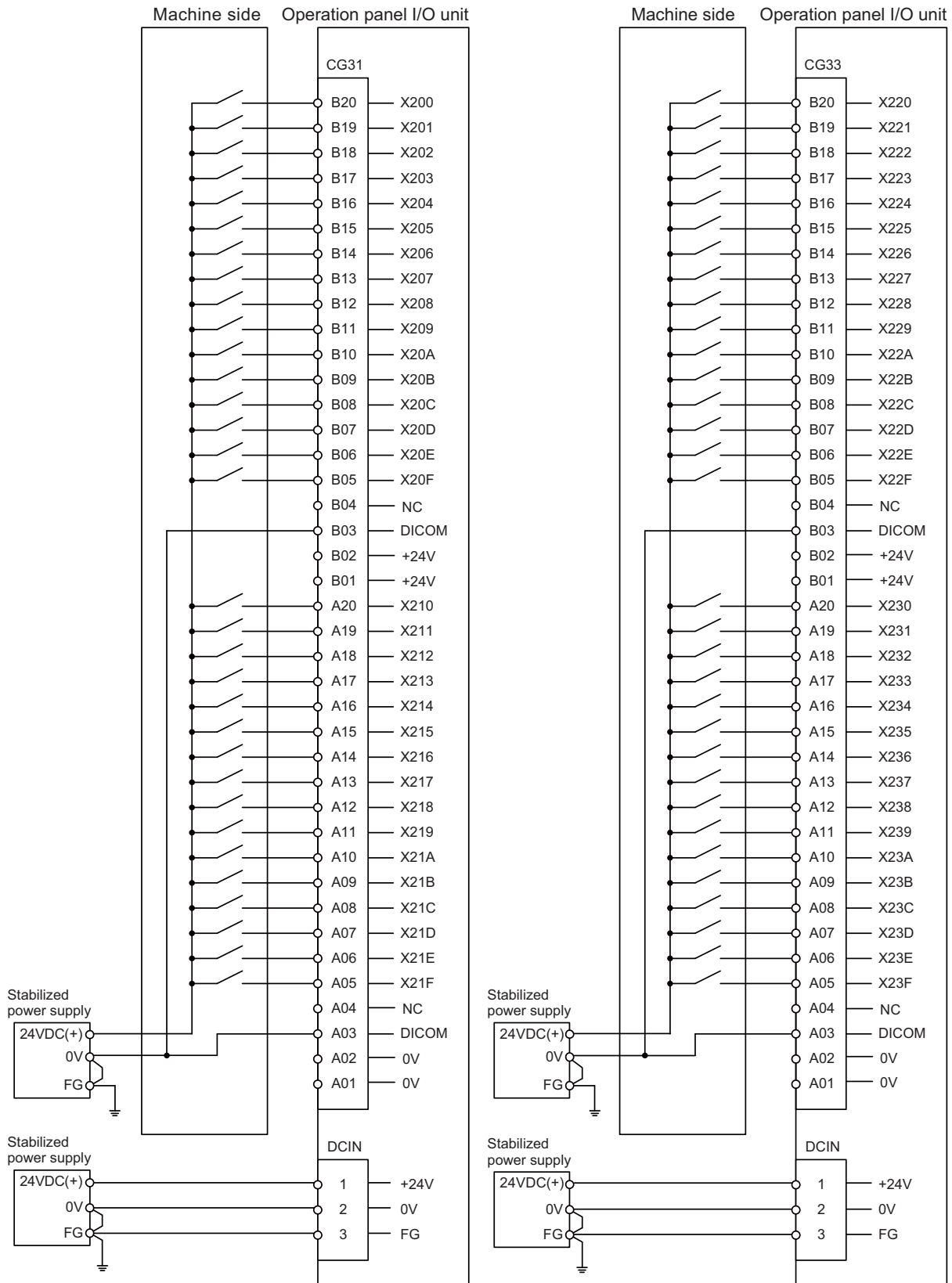
[Machine input 24V common]



For connection details, refer to the descriptions on machine input connector pin assignment in "(1) Machine signal input (CG31)" and "(3) Machine signal input (CG33)" of "General Specifications: Operation Panel I/O Unit".

11.11.2 Wiring for 0V Common Input

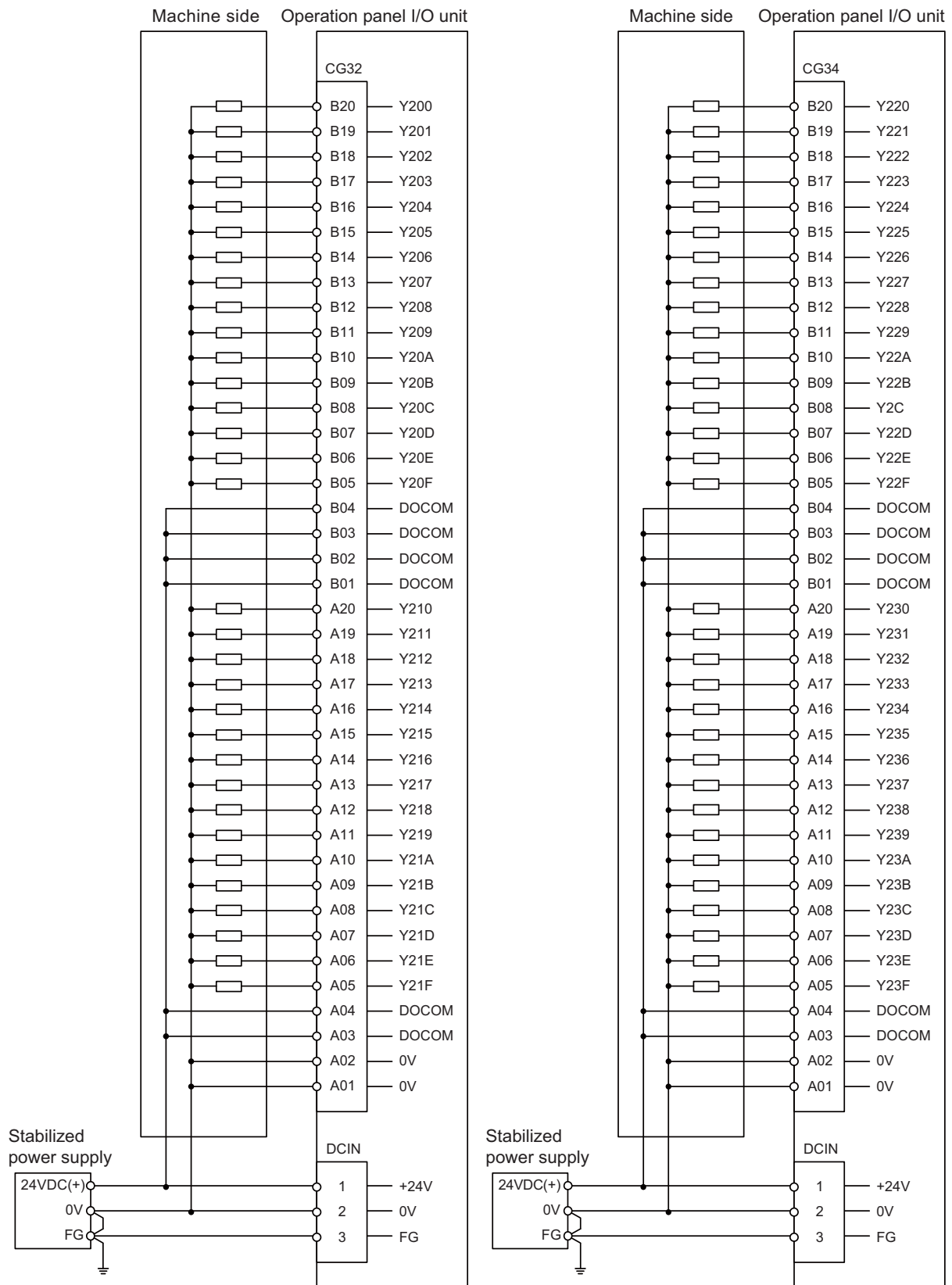
[Machine input 0V common]



For connection details, refer to the descriptions on machine input connector pin assignment in "(1) Machine signal input (CG31)" and "(3) Machine signal input (CG33)" of "General Specifications: Operation Panel I/O Unit".

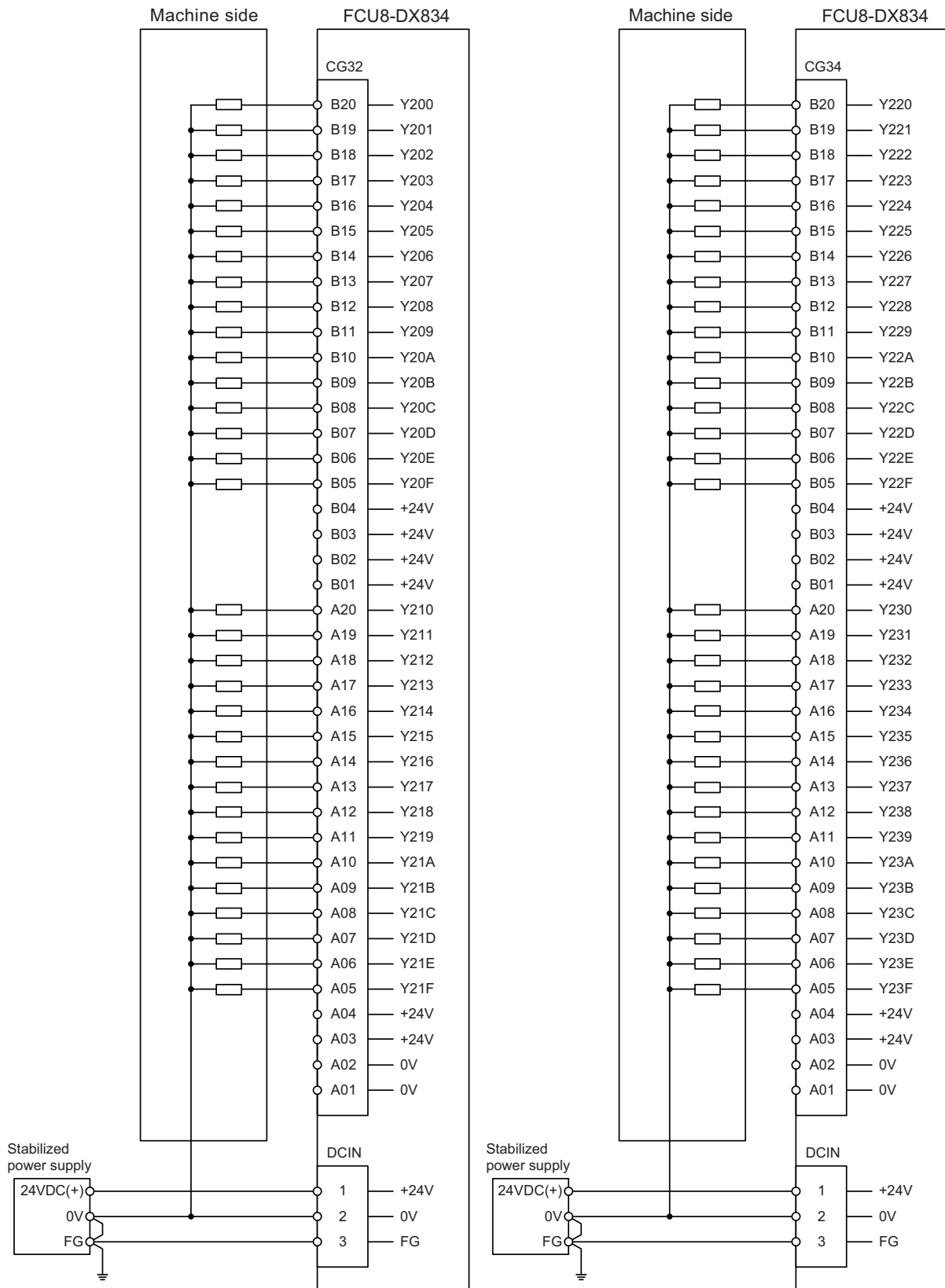
11.11.3 Wiring for Source Type Output

[FCU8-DX830 / FCU8-DX837 / FCU8-DX730]



For connection details, refer to the descriptions on machine output connector pin assignment in "(2) Machine signal output (CG32)" and "(4) Machine signal output (CG34)" of "General Specifications: Operation Panel I/O Unit".

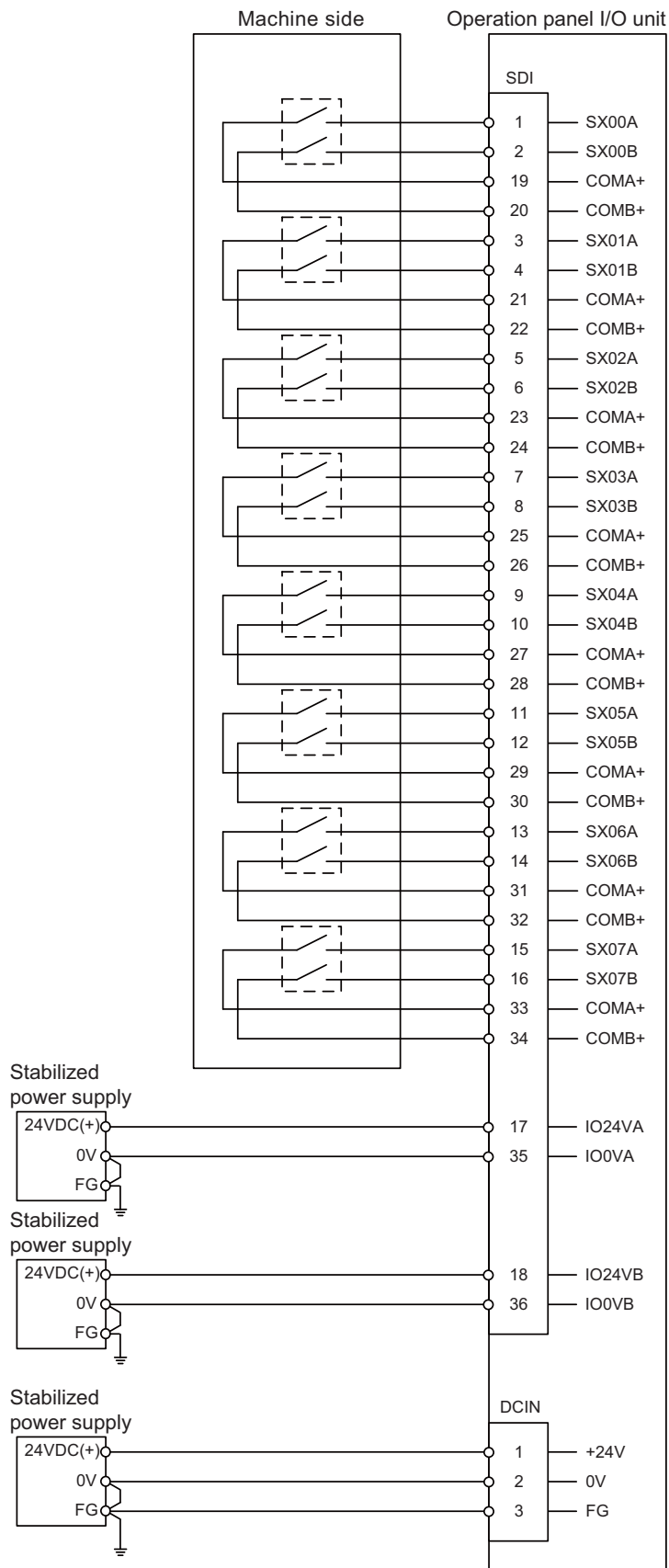
[FCU8-DX834]



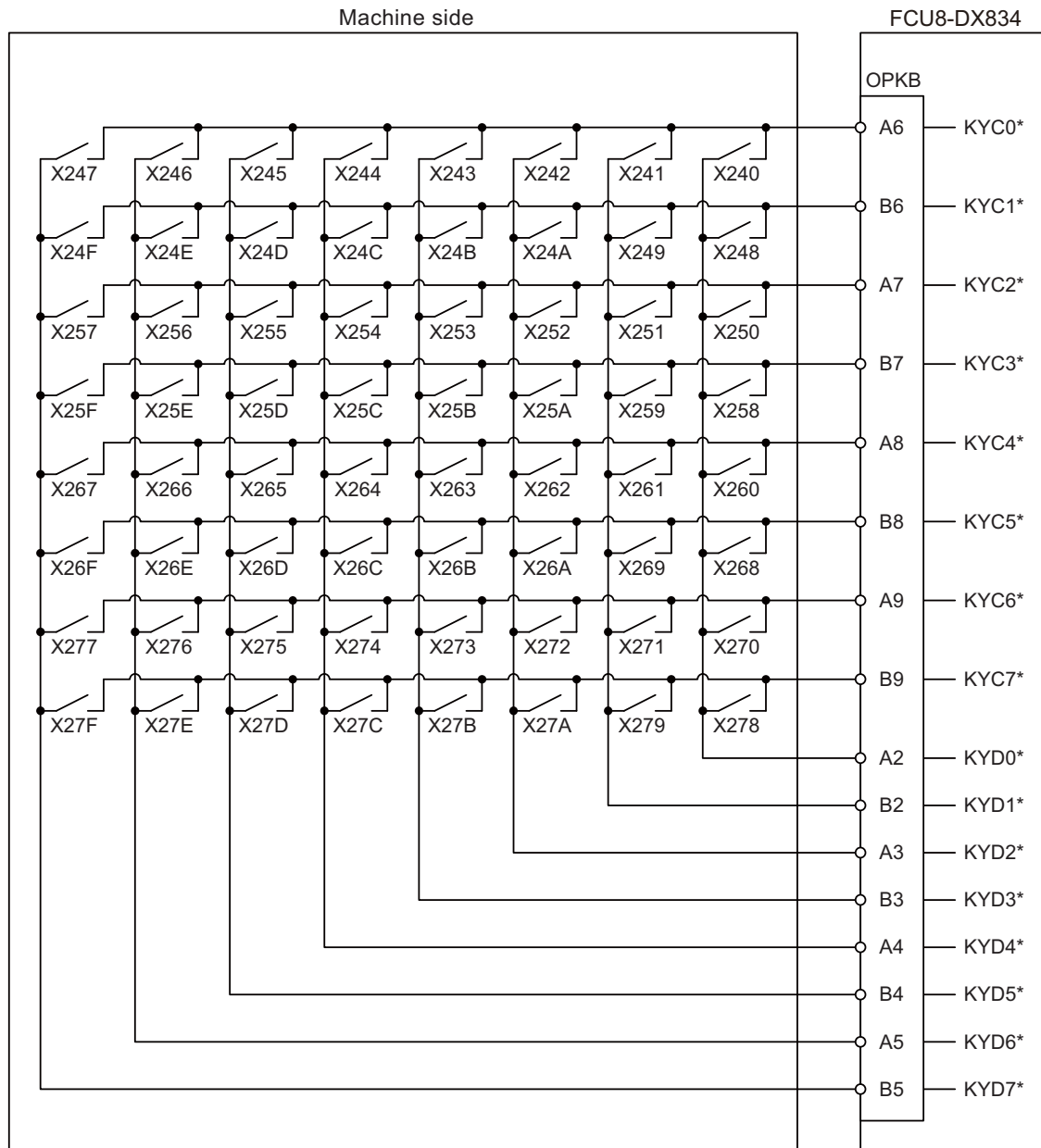
For connection details, refer to the descriptions on machine output connector pin assignment in "(2) Machine signal output (CG32)" and "(4) Machine signal output (CG34)" of "General Specifications: Operation Panel I/O Unit".

11.11.4 Connecting with Safety Machine Control Signal (FCU8-DX837)

[Safety DI input]

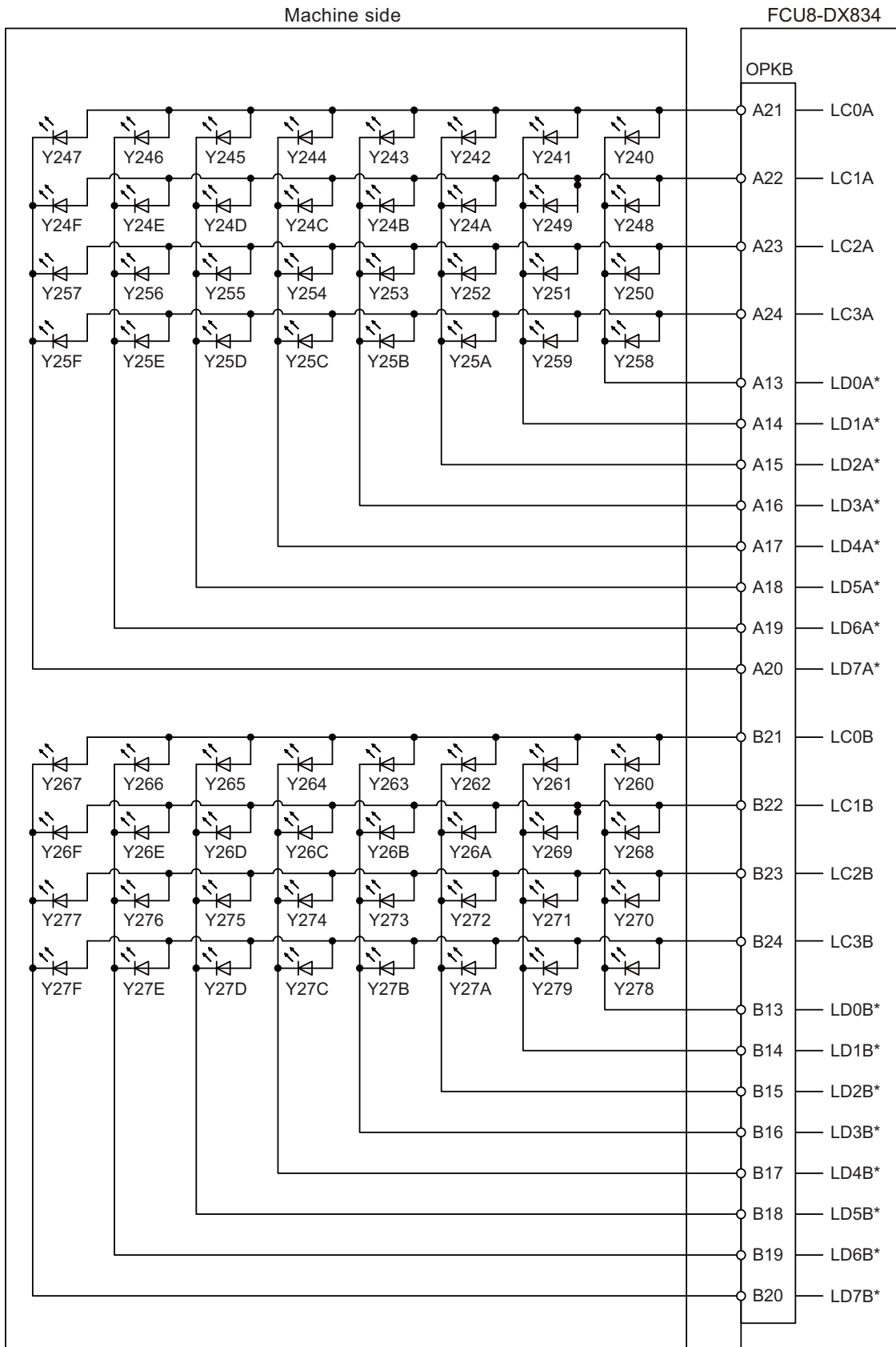


11.11.5 Connection with the scan input signal (FCU8-DX834)



For connection details, refer to the descriptions on machine output connector pin assignment in "(15) OPKB (Scan input, Scan output)" of "General Specifications: Operation Panel I/O Unit".

11.11.6 Connection with the scan output signal (FCU8-DX834)

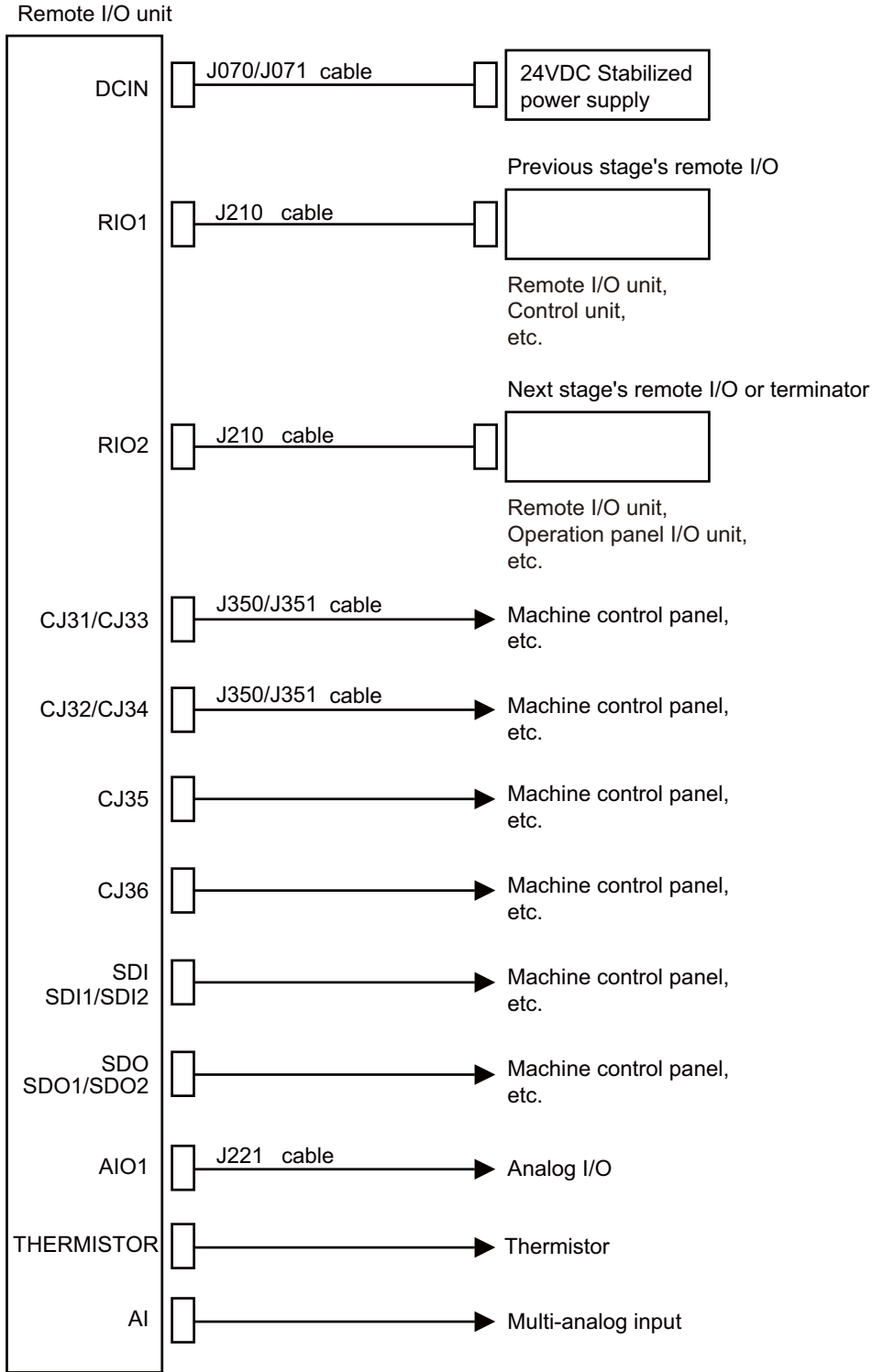


For connection details, refer to the descriptions on machine output connector pin assignment in "(15) OPKB (Scan input, Scan output)" of "General Specifications: Operation Panel I/O Unit".

Connection of Remote I/O Unit

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

12.1 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.

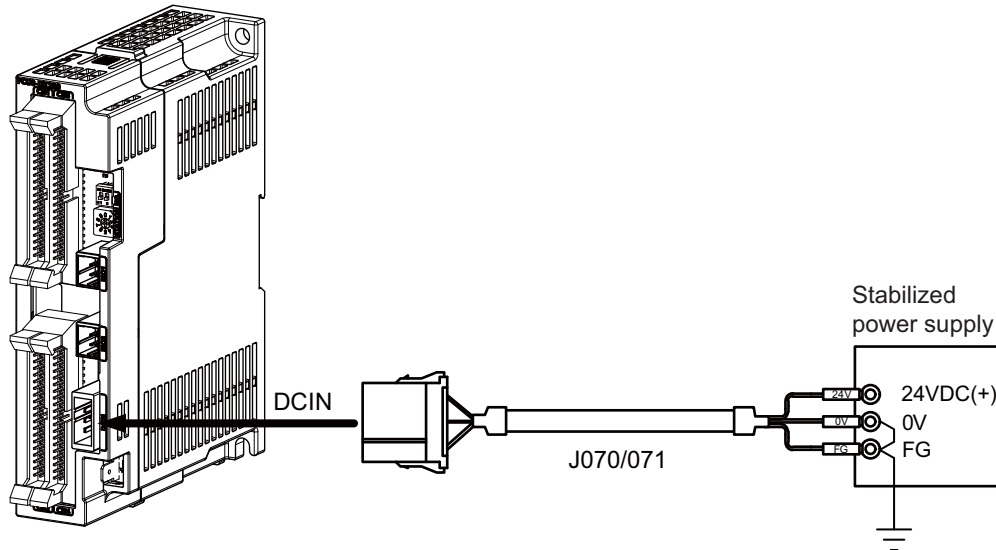
"General Specifications: Remote I/O unit"

(Note 2) For the connection of MITSUBISHI CNC machine operation panel, refer to the chapter "Connection of MITSUBISHI CNC Machine Operation Panel".

12.2 Connecting with Power Supply

Connect 24VDC 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-DX654 / FCU8-DX654-1 / FCU8-DX408 / FCU8-DX409]

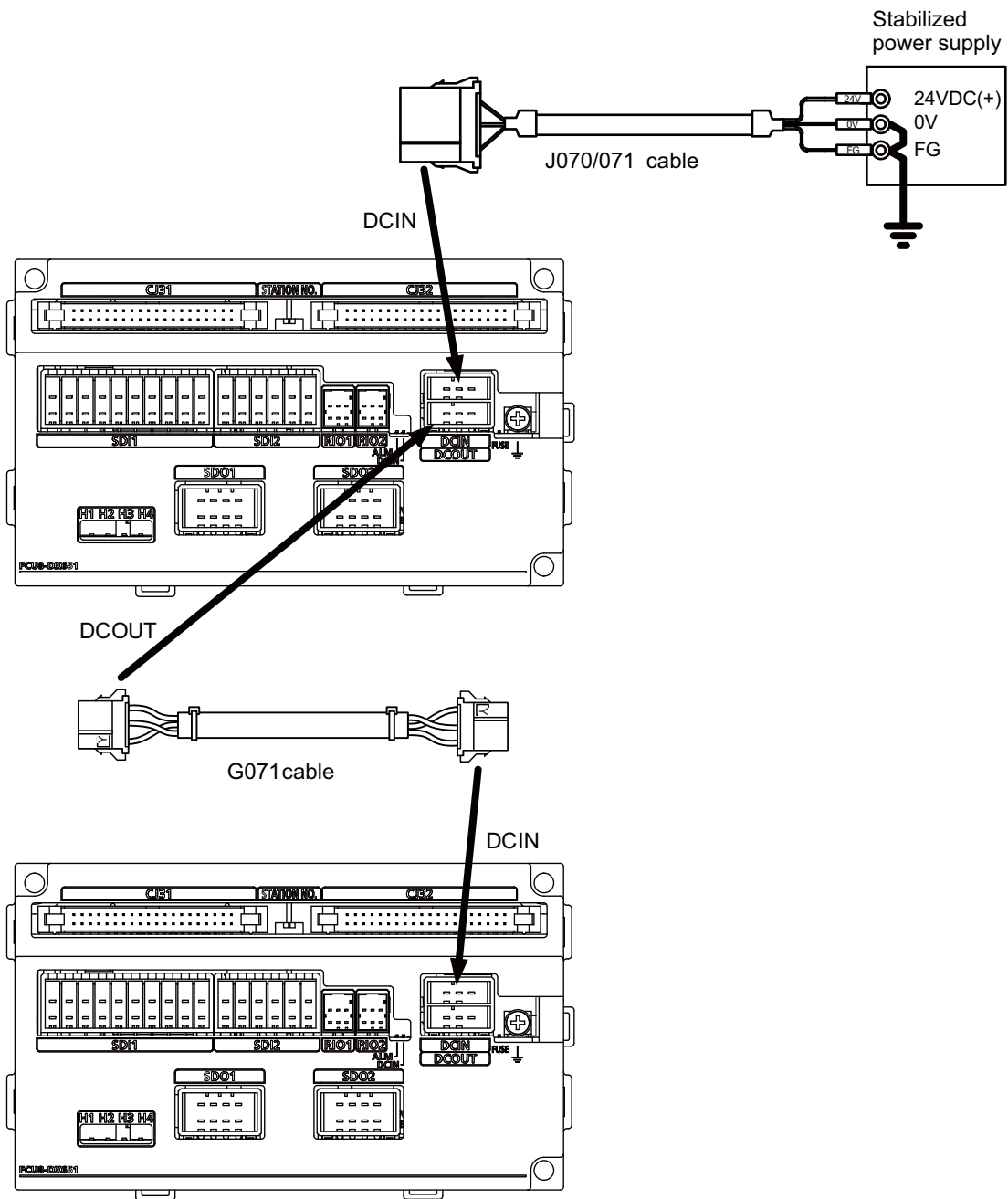


<Related items>

Cable drawing "Cable : J070/J071 Cable"

Connector pin assignment: "General Specifications: Remote I/O Unit" (DCIN connector)

[FCU8-DX651]



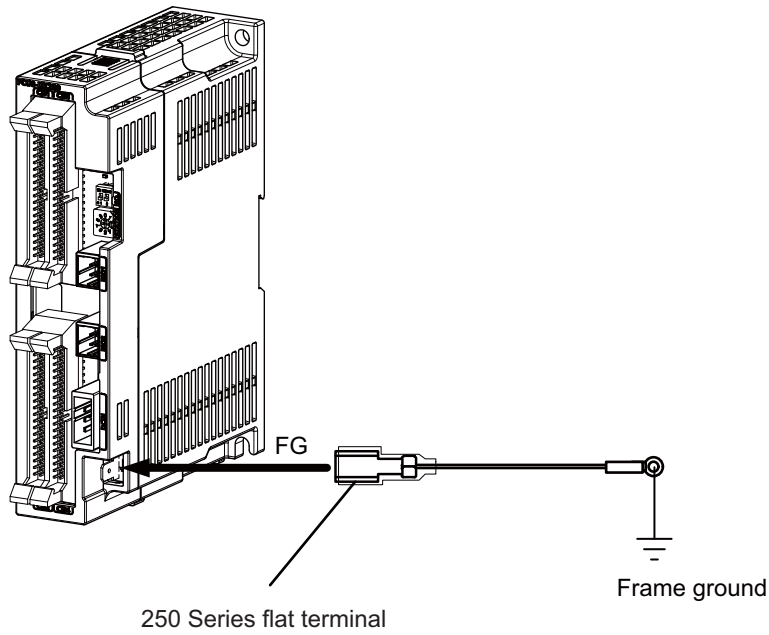
<Related items>

Cable drawing "Cable : J070/J071 Cable", "Cable : G071 Cable"

Connector pin assignment: "General Specifications: Remote I/O Unit" (DCIN connector)

12.3 Connecting with Frame Ground

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



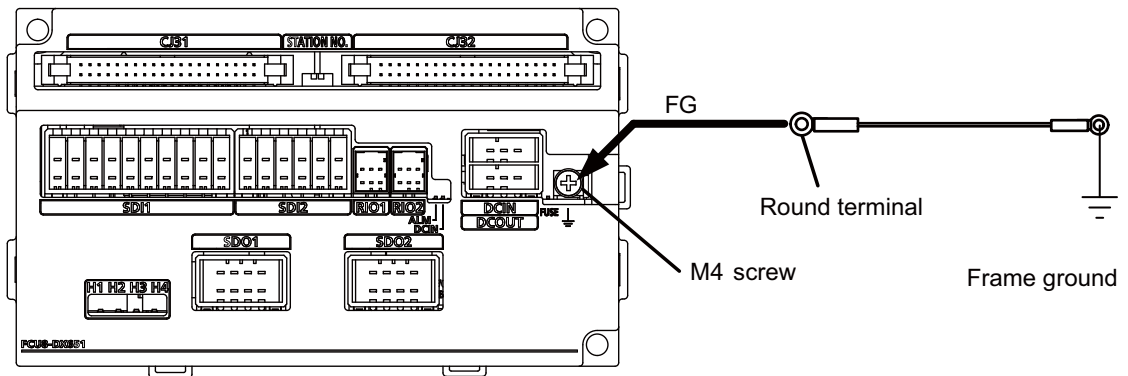
<Flat terminal type>

Flat terminal: 175021-1 / 175023-1

Protection cover: 174817-2

Recommended manufacturer : Tyco Electronics

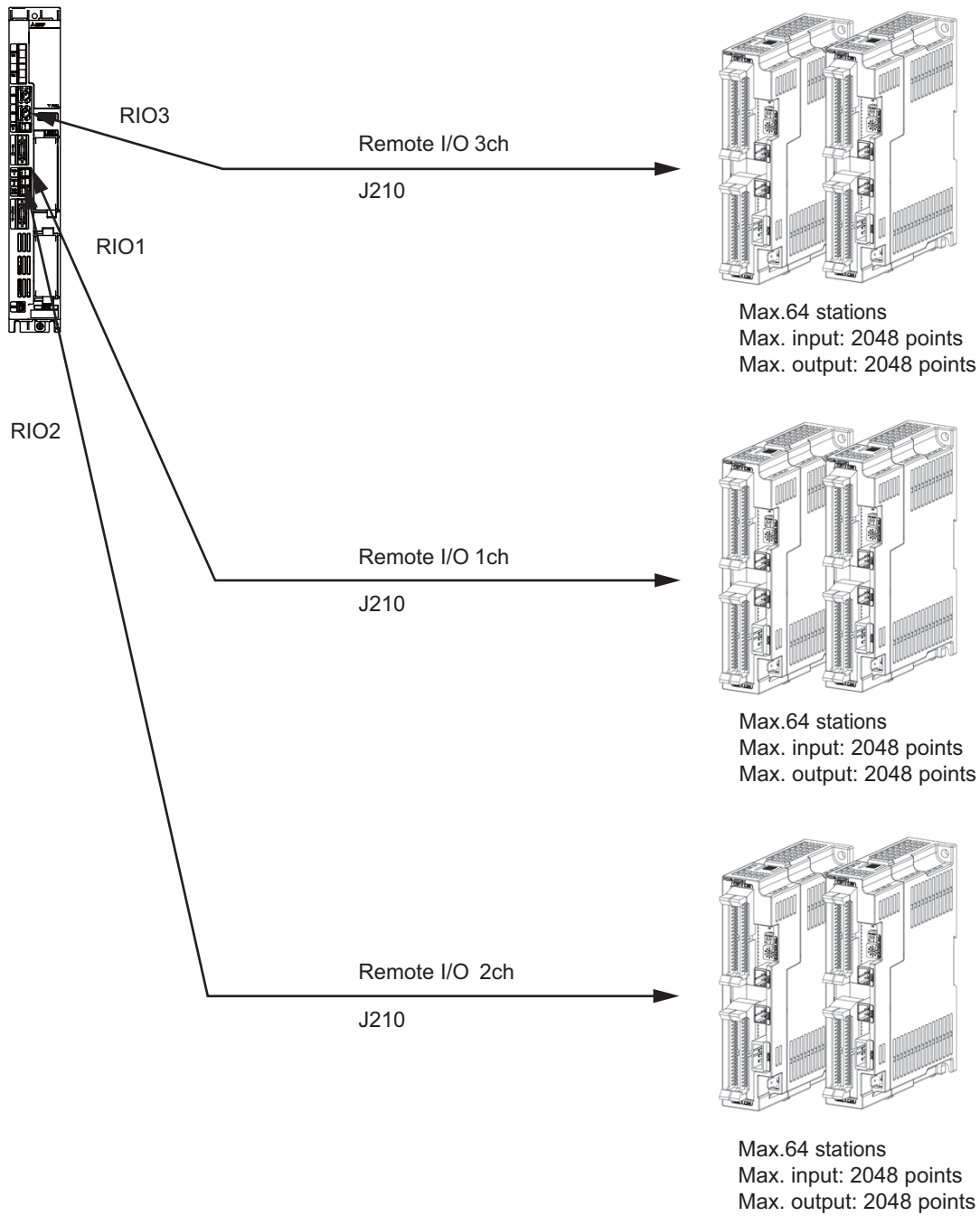
[FCU8-DX651]



12.4 Connecting with Control Unit

Control unit

Remote I/O unit

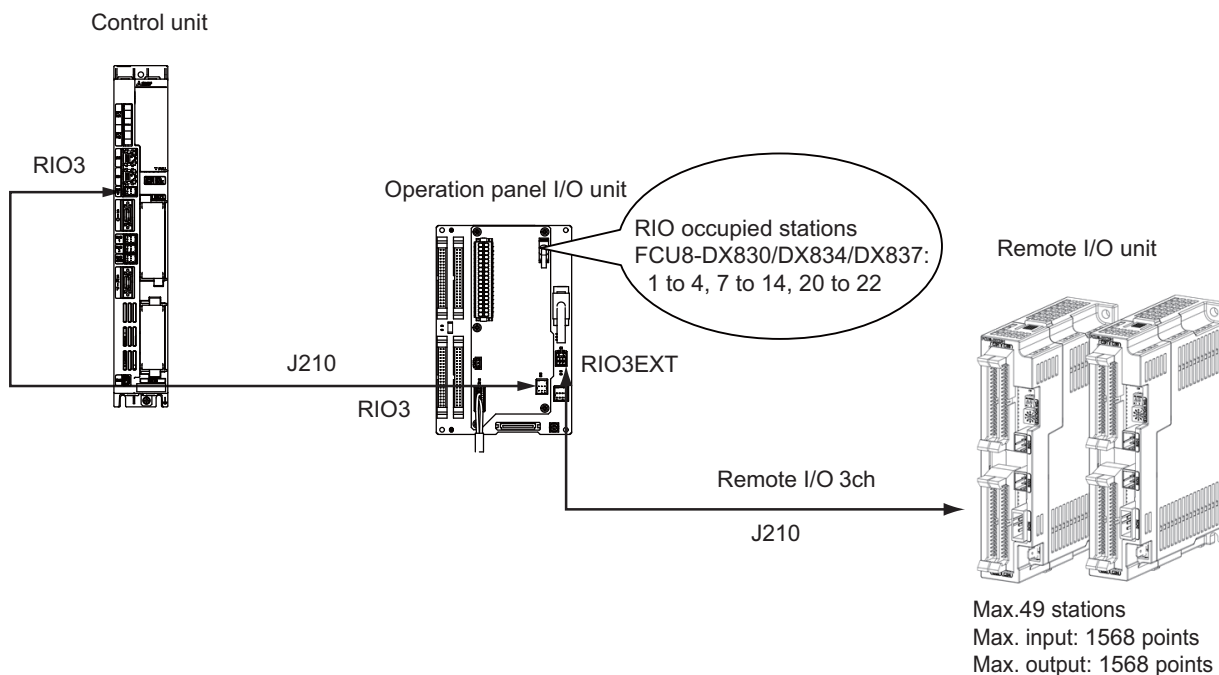


(Note) Connect the J210 cable to the RIO1, RIO2, or RIO3 connector of the control unit.
Check the connector position with the actual machine.

Refer to "20.6.2 Connection and Station No. Setting on Remote I/O Unit" for the station No. setting.

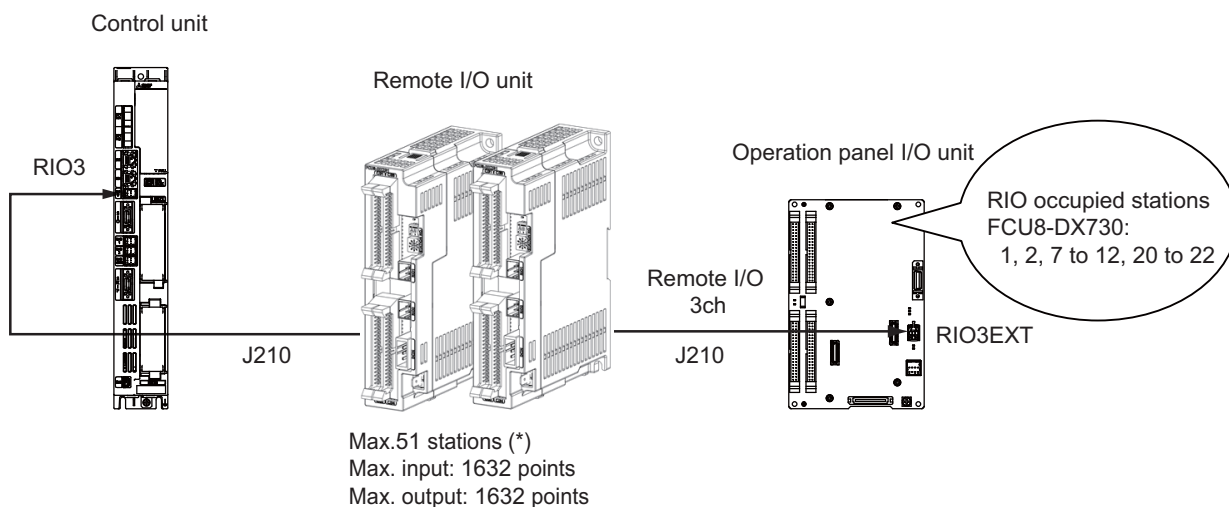
12.5 Connecting with Operation Panel I/O Unit

[Windows-based display]



[Non-Windows-based display]

When connecting a remote I/O unit to the 3rd RIO channel, insert it between the control unit and operation panel I/O unit.



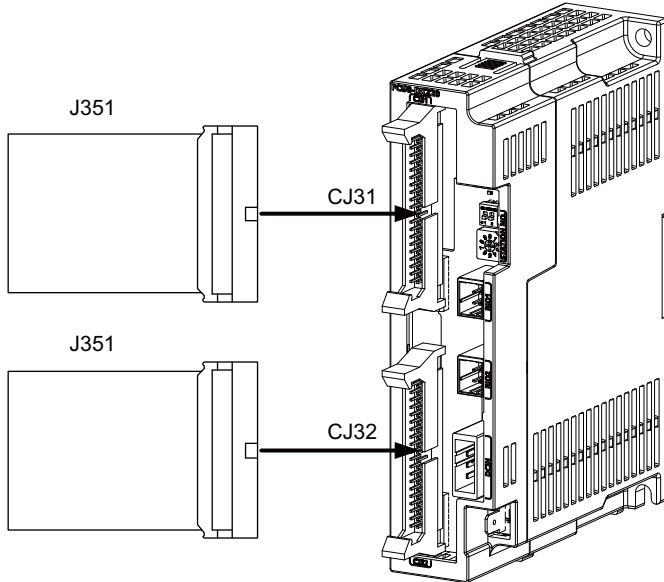
(*) FCU8-DX730 occupies 11 stations, but 13 stations are occupied in total since the graphic control unit occupies 2 stations.

Refer to "20.6.2 Connection and Station No. Setting on Remote I/O Unit" for the station No. setting.

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

12.6 Connecting with Machine Control Signal (FCU8-DX220 / FCU8-DX230 / FCU8-DX231 / FCU8-DX651)

[FCU8-DX220]

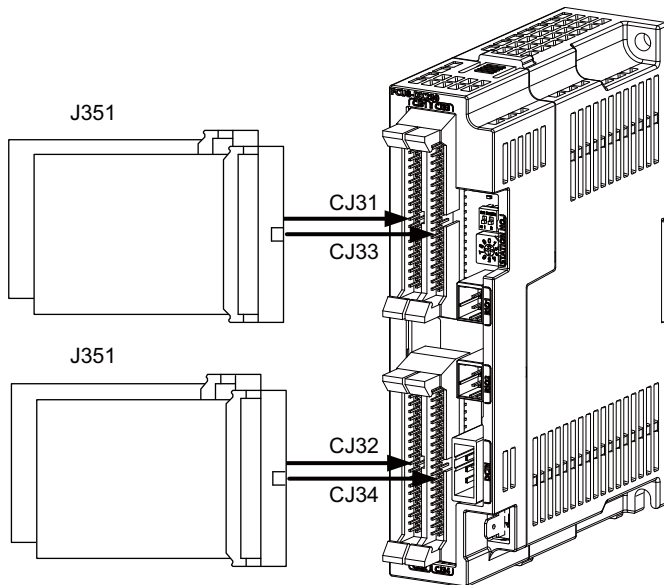


<Related items>

Cable drawing: "Cable: J351 Cable"

Connector pin assignment: "General Specifications: Remote I/O Unit" (CJ31/CJ32 connector)

[FCU8-DX230 / FCU8-DX231]



<Related items>

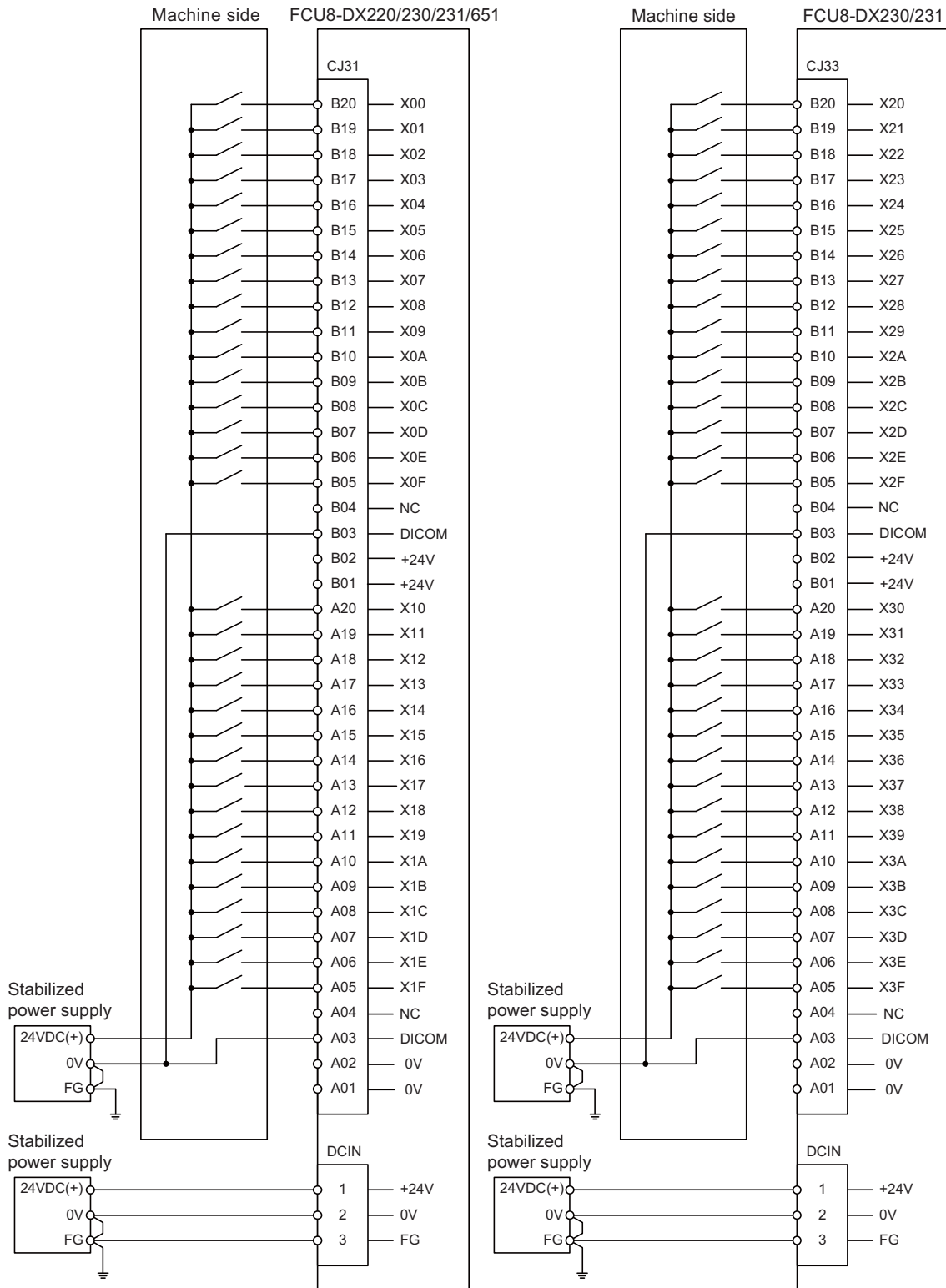
Cable drawing: "Cable: J351 Cable"

Connector pin assignment: "General Specifications: Remote I/O Unit" (CJ31/CJ32/CJ33/CJ34 connector)

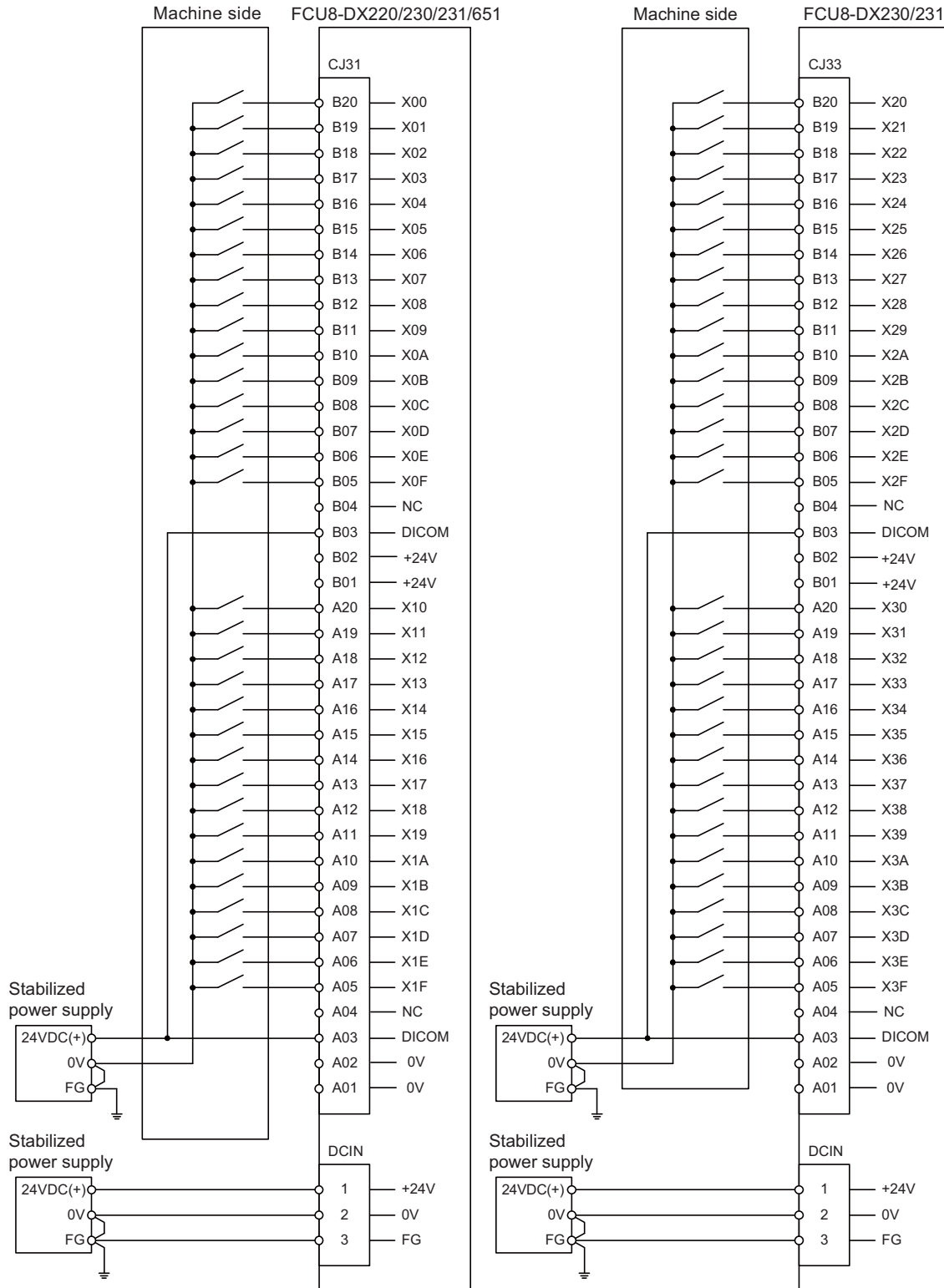
⚠ CAUTION

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

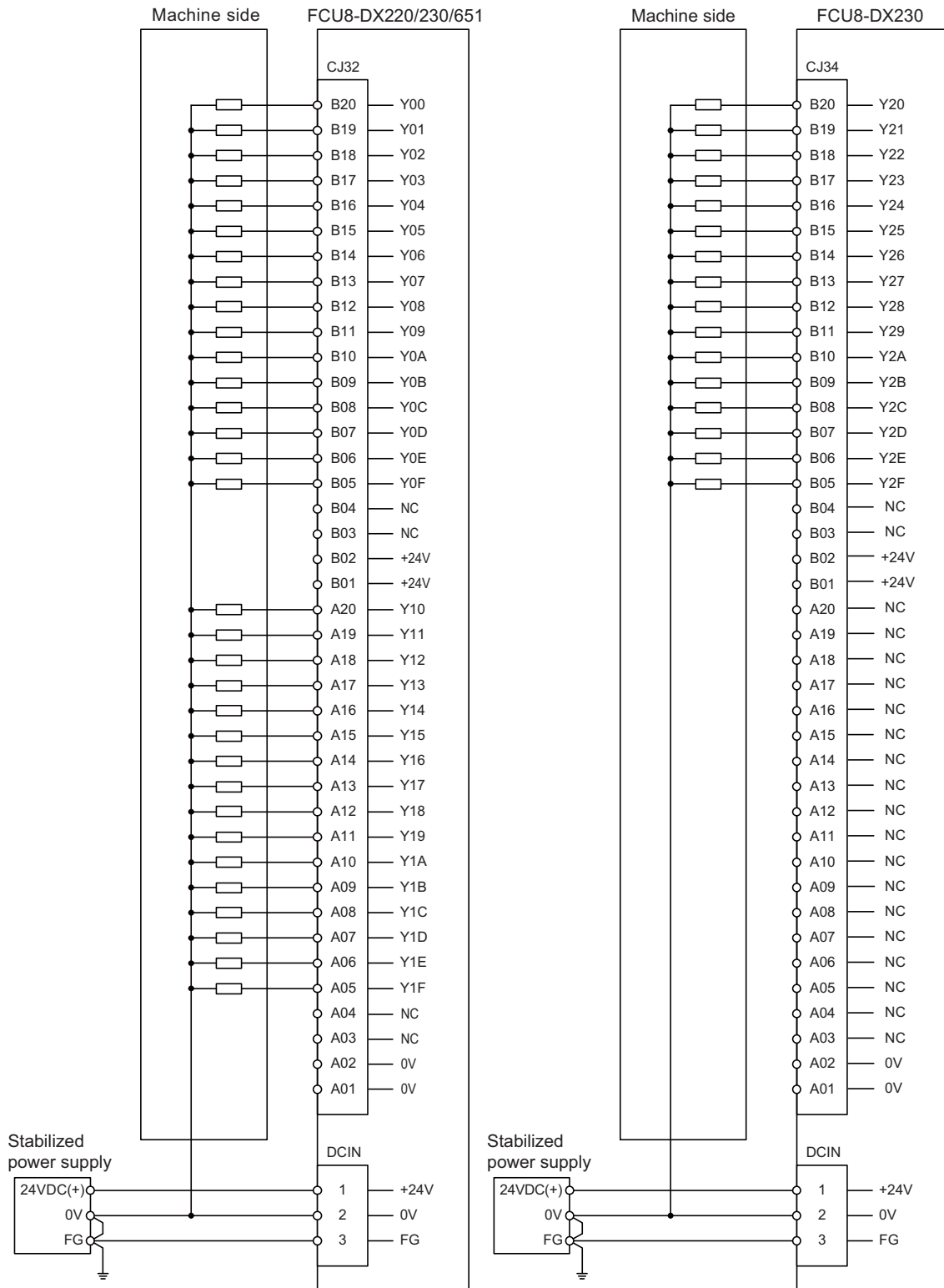
[Machine input 0V common]



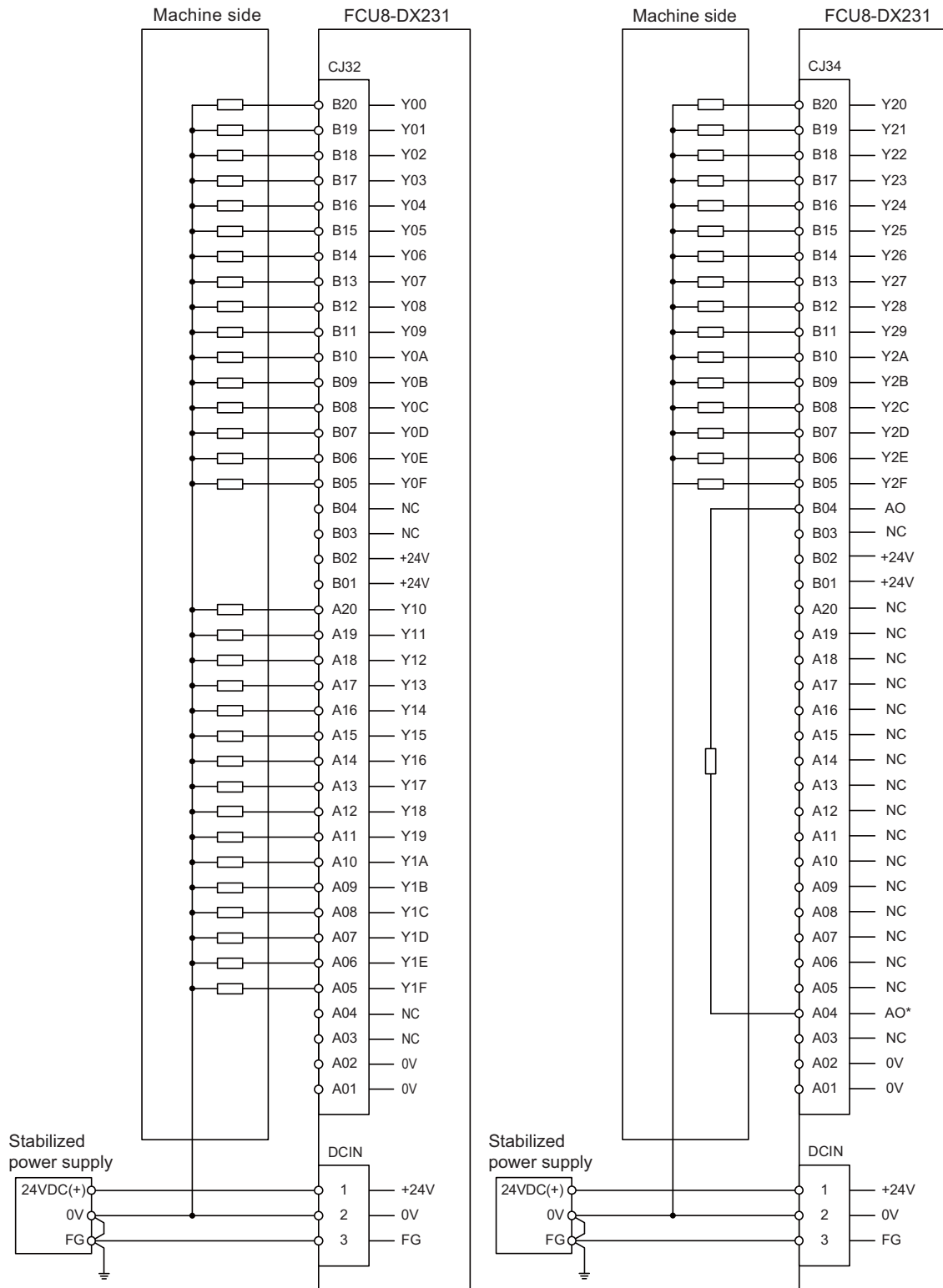
[Machine input 24V common]



[Machine output : FCU8-DX220 / FCU8-DX230 / FCU8-DX651]



[Machine output : FCU8-DX231]



12.7 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
Recommended manufacturer	: WAGO

<Bar terminal type>

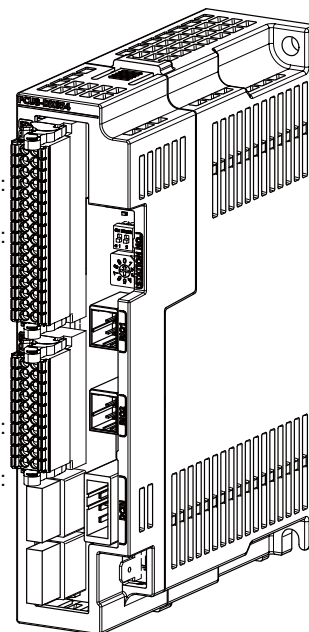
Bar terminal	: 216 series
Recommended manufacturer	: WAGO

FCU8-DX213 / 213-1 :
CJ35

FCU8-DX654 / 654-1 :
SDI

FCU8-DX213 / 213-1 :
CJ36

FCU8-DX654 / 654-1 :
SDO



<Related items>

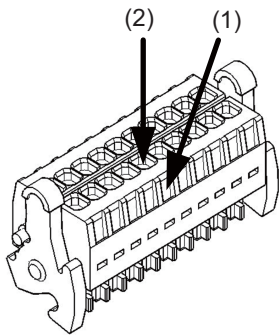
Connector pin assignment: "General Specifications: Remote I/O Unit" (CJ35/CJ36/SDI/SDO connector)

CAUTION

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

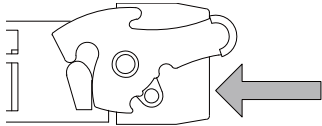
[Mounting the wire]

- (1) Insert a slotted screwdriver (blade width: 2.5mm).
- (2) Insert the wire and then pull the screwdriver out.

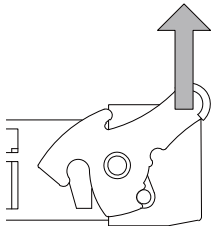


[Mounting the connector]

- (1) Push the connector to the lock lever position.

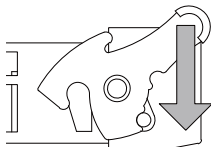


- (2) Push the right and left lock levers up simultaneously.

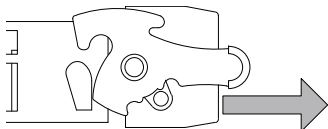


[Removing the connector]

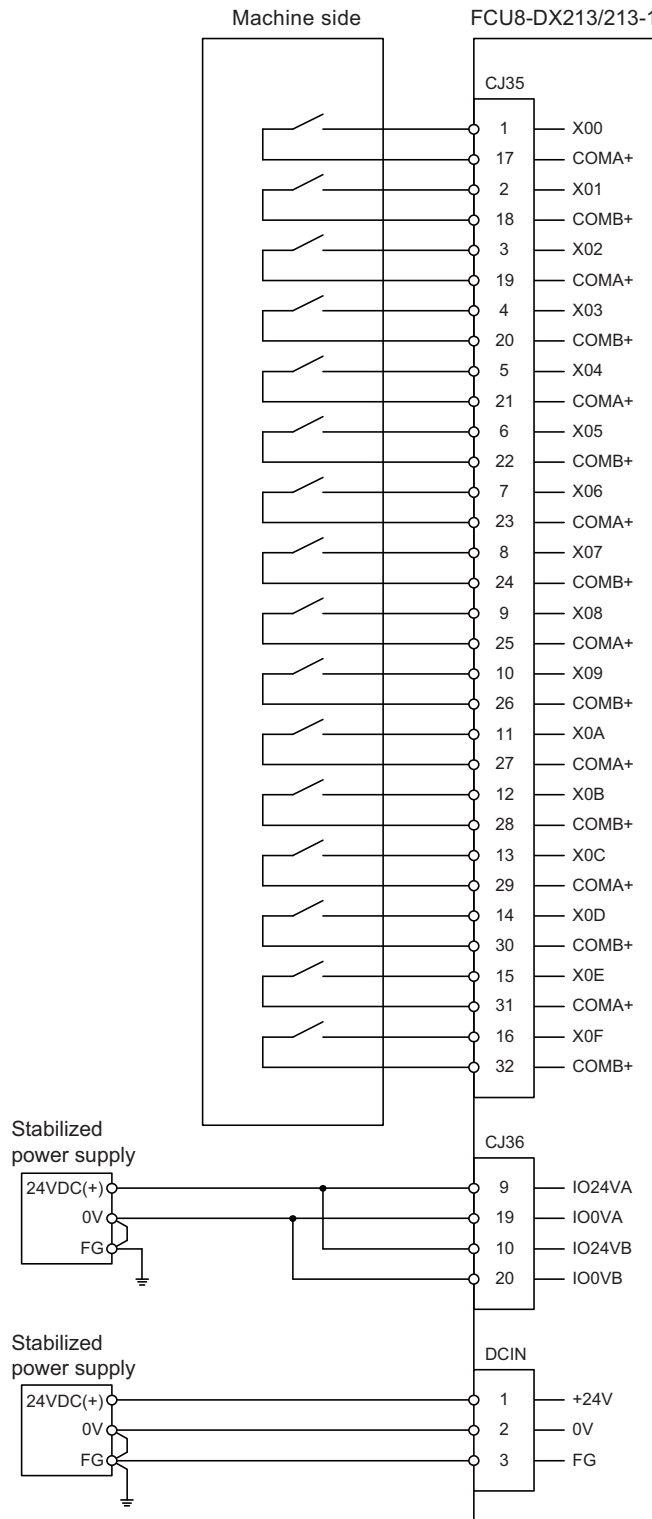
- (1) Push the right and left lock levers down simultaneously.



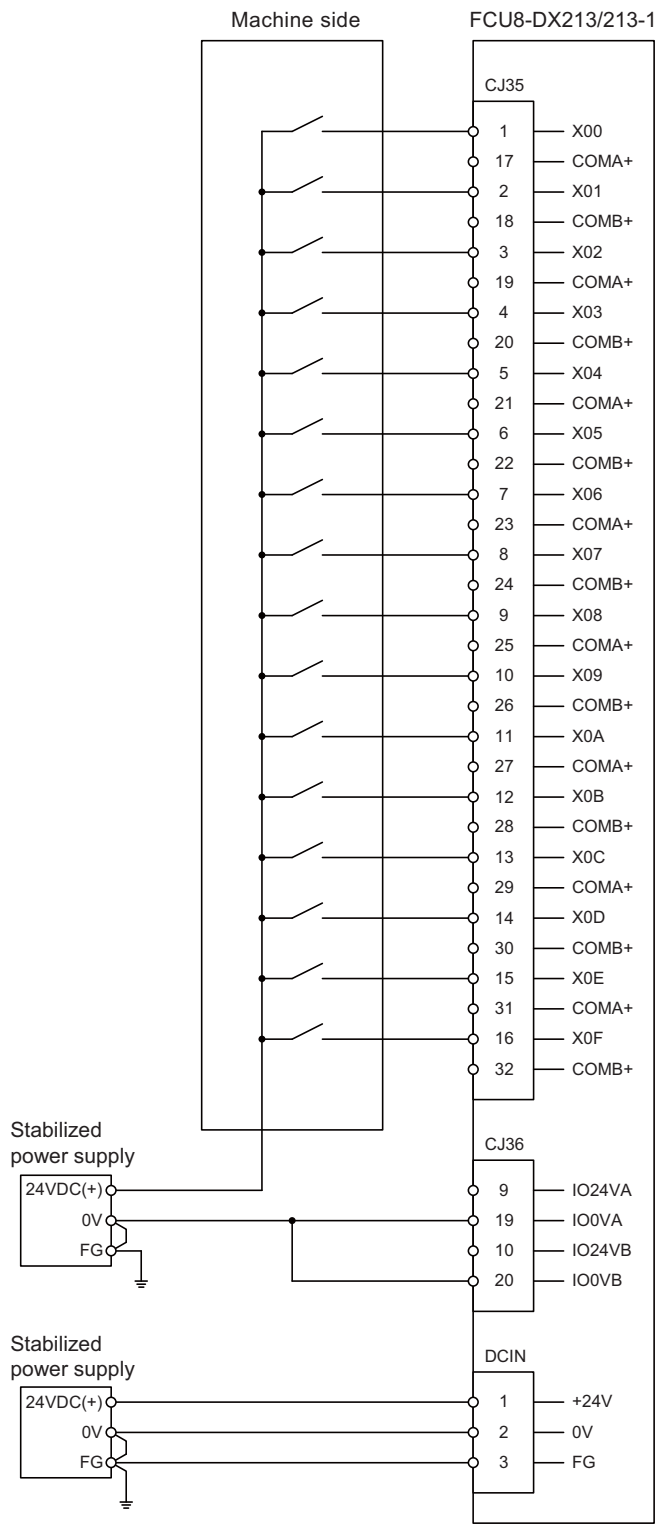
- (2) Release the lock and pull the connector out.



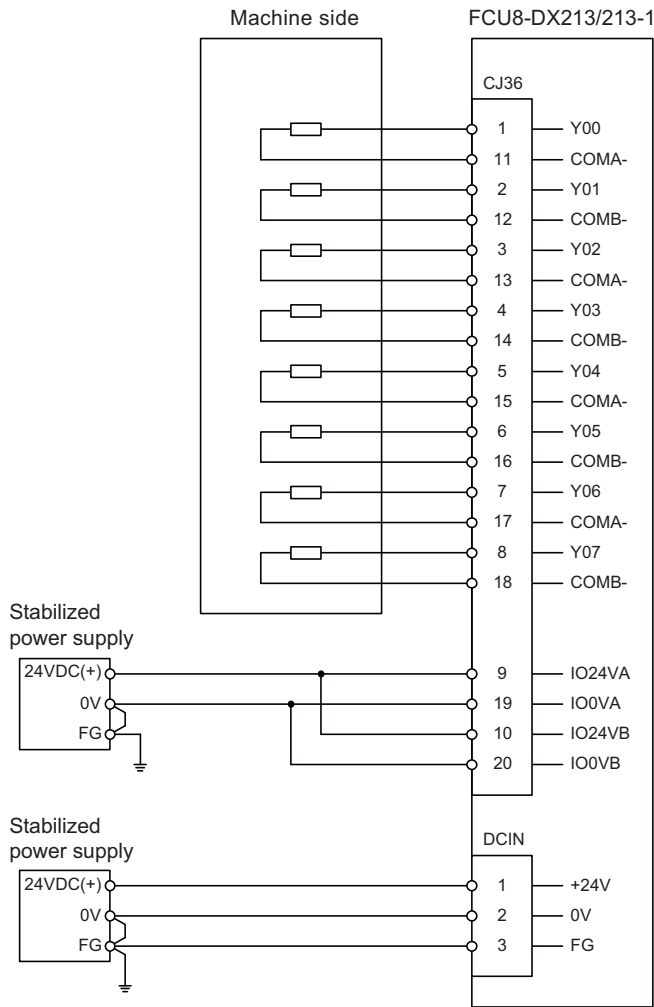
[Machine input (wiring example 1) : FCU8-DX213 / FCU8-DX213-1]



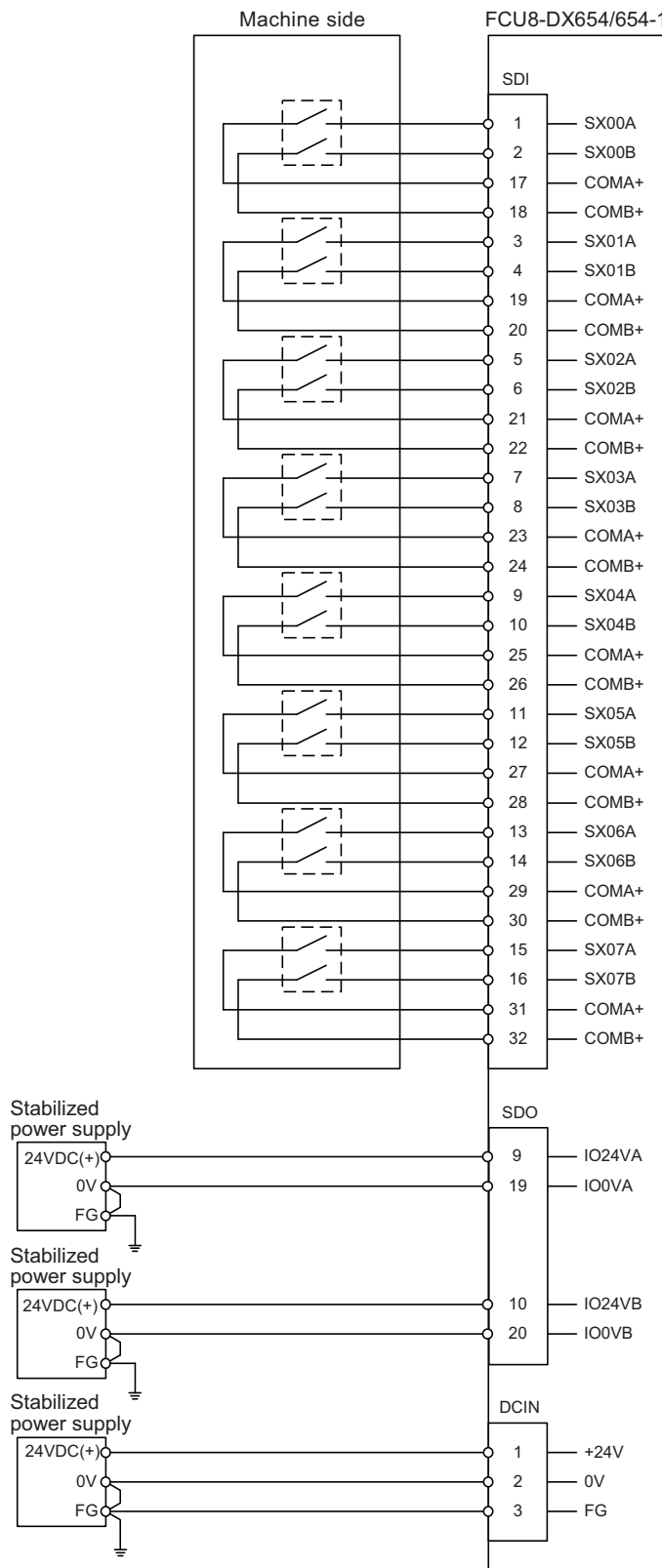
[Machine input (wiring example 2) : FCU8-DX213 / FCU8-DX213-1]



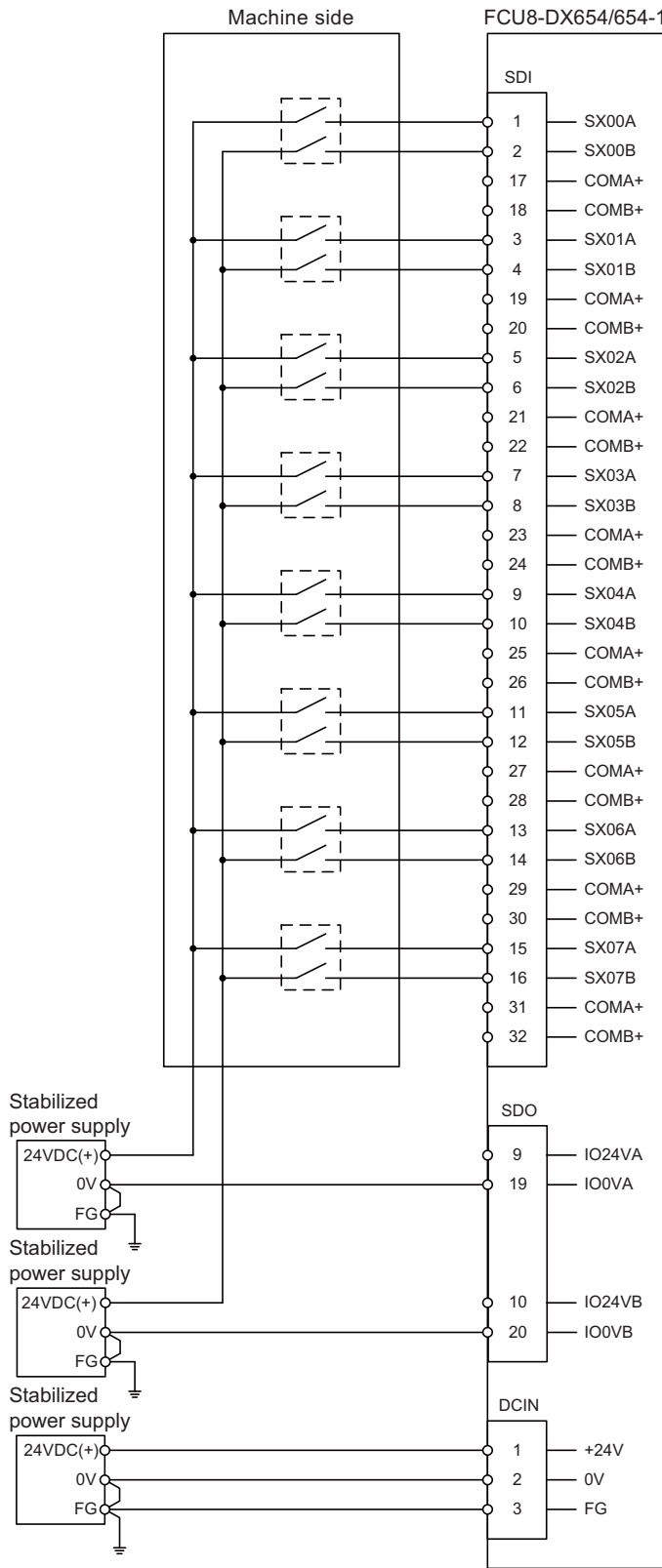
[Machine output : FCU8-DX213 / FCU8-DX213-1]



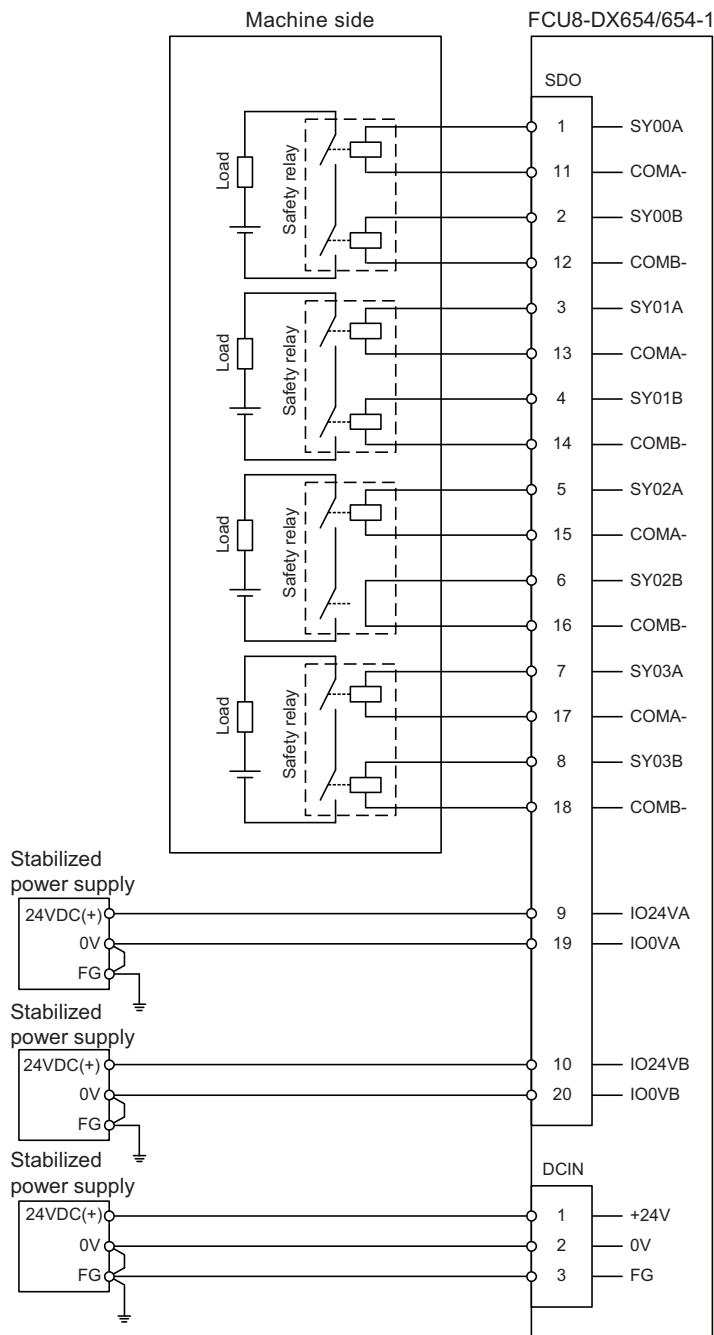
[Safety machine input (wiring example 1) : FCU8-DX654 / FCU8-DX654-1]



[Safety machine input (wiring example 2) : FCU8-DX654 / FCU8-DX654-1]



[Safety machine output : FCU8-DX654 / FCU8-DX654-1]

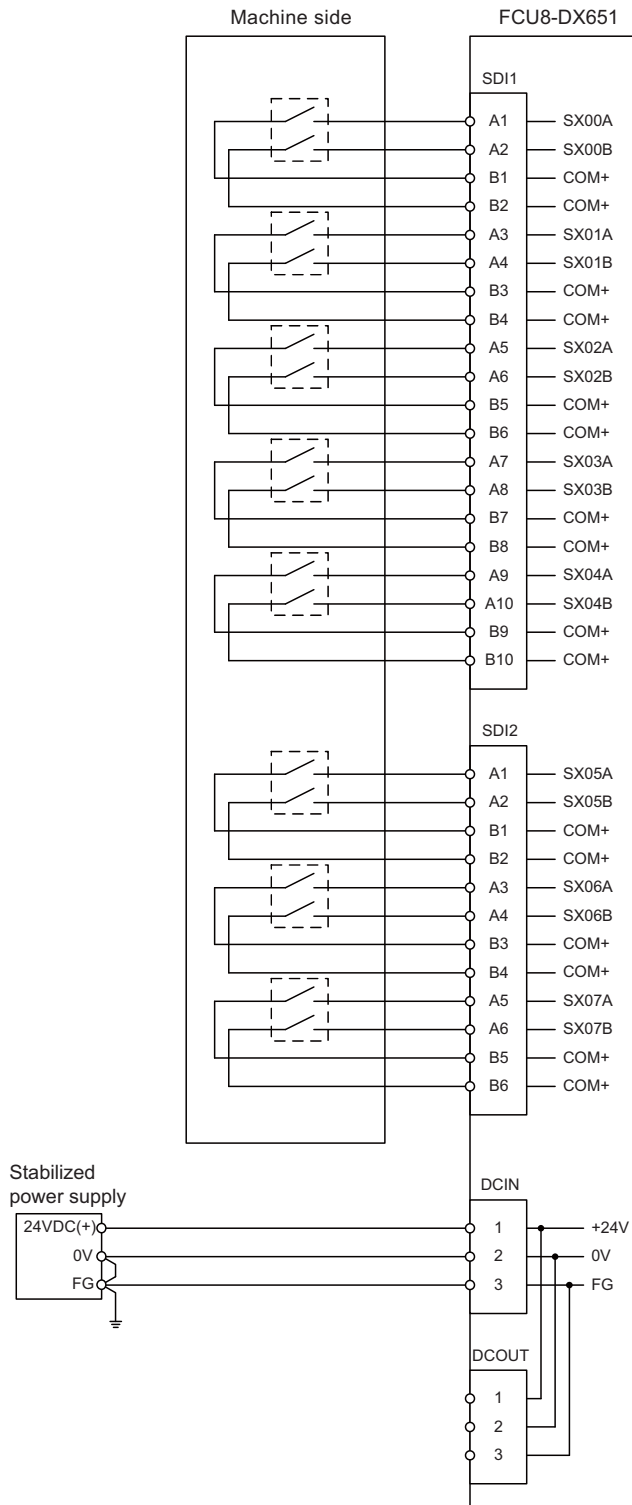


12.8 Connecting with Safety Machine Control Signal (FCU8-DX651)

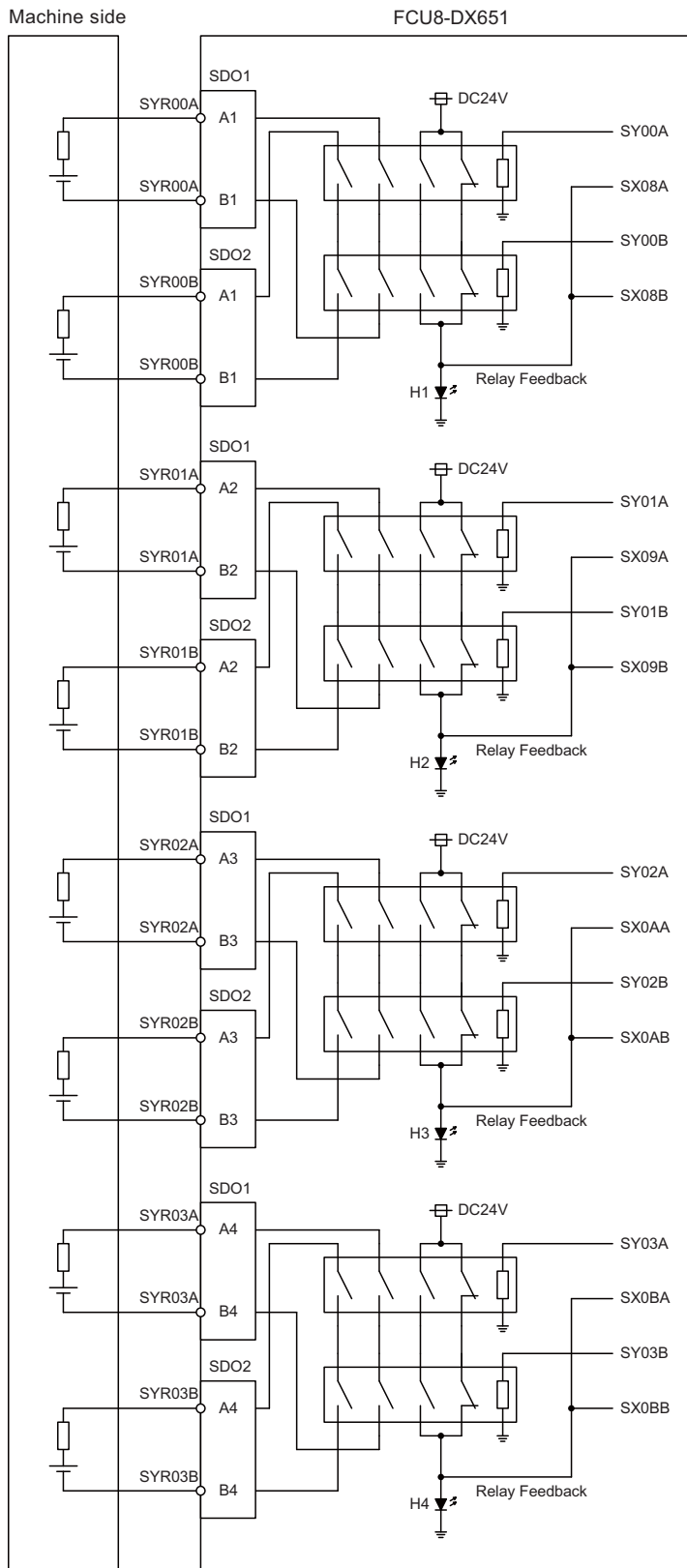
⚠ CAUTION

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

[Safety DI input]

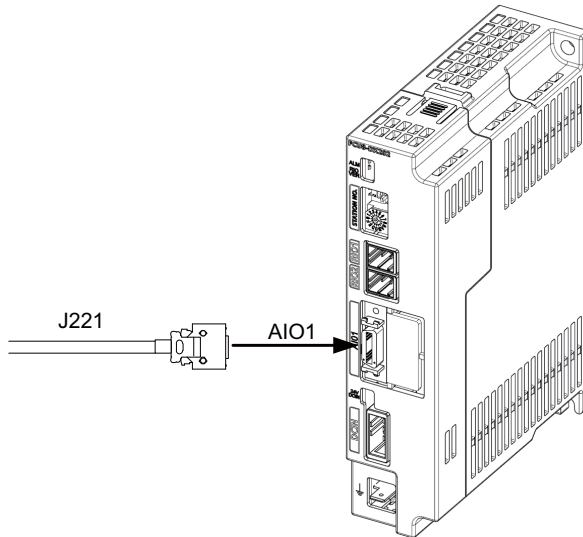


[Safety relay output]



12.9 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.

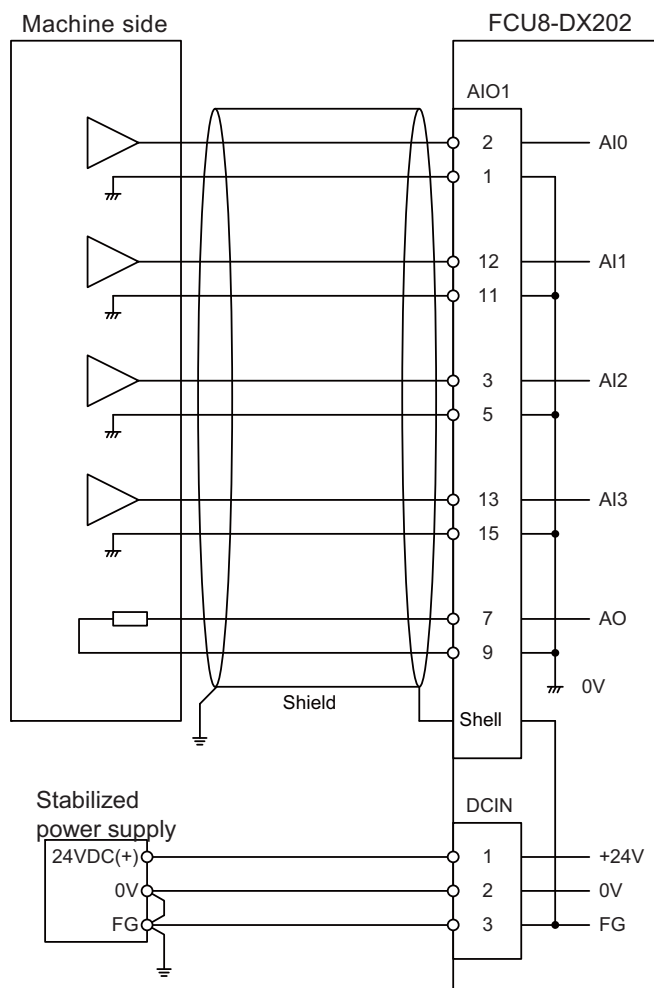


<Related items>

Cable drawing "Cable : J221 Cable"

Connector pin assignment: "General Specifications: Remote I/O Unit" (AIO1 connector)

Input/output circuit



CAUTION

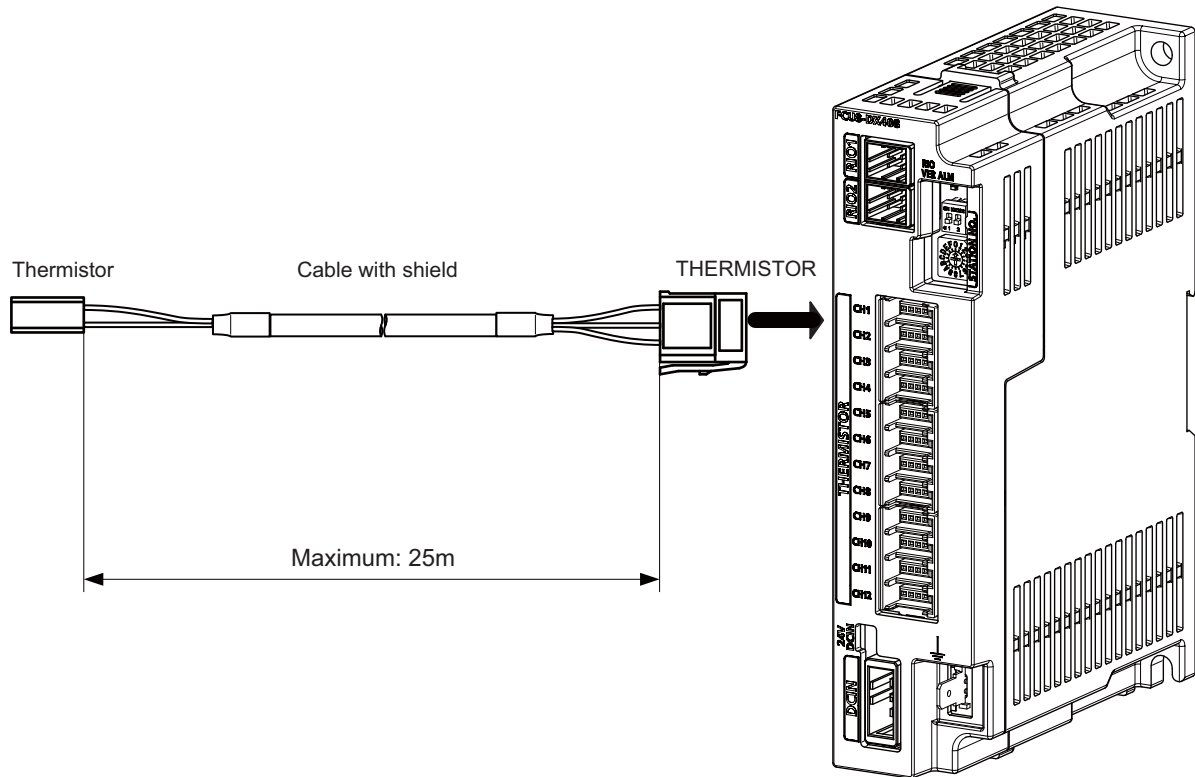
1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.

12.10 Connecting with Thermistor (FCU8-DX408)

Connect the thermistor with THERMISTOR connector.

The maximum cable length is 25m.

The recommended shield cable is "HK-SB/20276XL, black, LF 1P X 22AWG" made by Taiyo Cabletec.



<Related items>

Connector pin assignment: "General Specifications: Remote I/O Unit" (THERMISTOR connector)

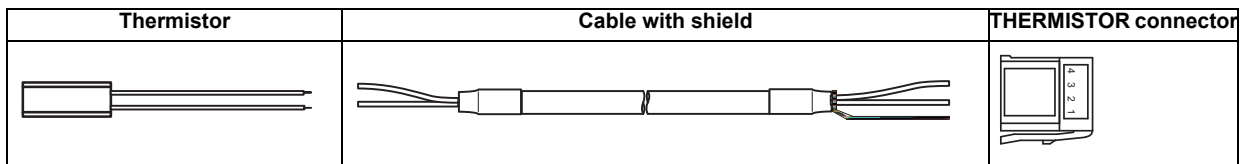


Note

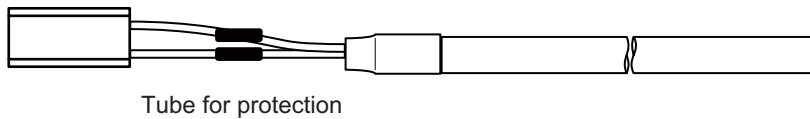
1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.
3. Use the cable with shield and ground it in order to reduce the influence of noise.

[Thermistor cable connecting procedure]

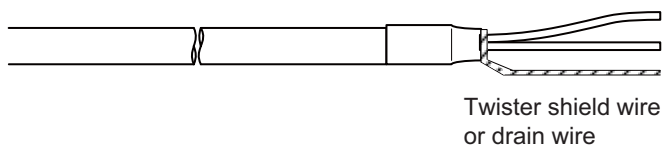
The thermistor cable has the following configuration:



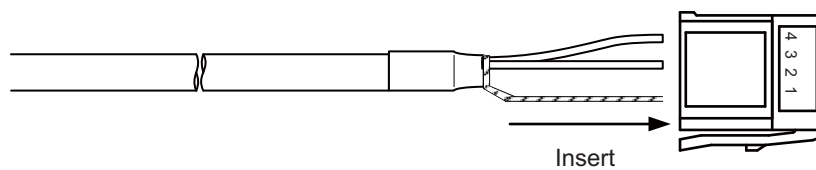
- (1) Solder the thermistor to the shield cable and cover the joint surface with the protection tube.



- (2) Twist the shield of the cable or pull out the drain wire.



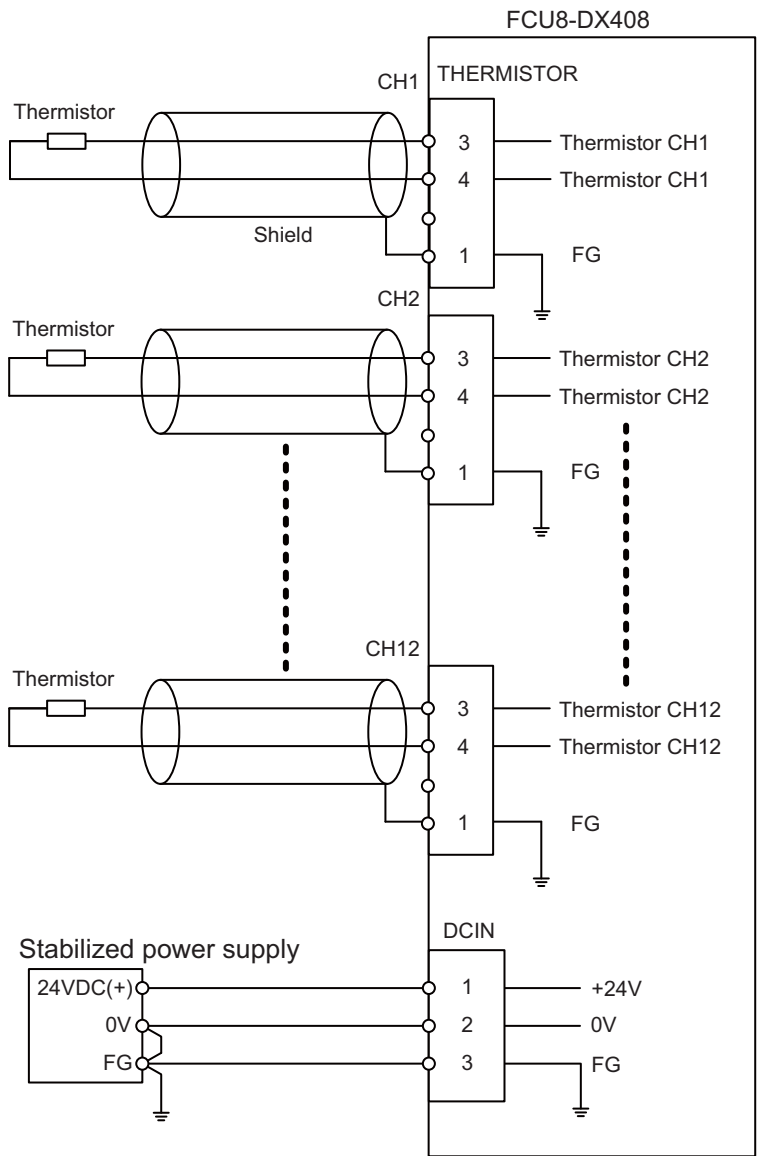
- (3) Insert the wire into the THERMISTOR connector as follows:



- 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]



12.11 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 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.

Prepare the thermocouple, resistance temperature detector and cable with shield.

Precautions

- 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 connection cables between each unit while the power is ON.

AI : DFMC1,5/12-ST-3,5-LR (Phoenix Contact)

<Applicable cable>

- Solid wire : 0.2-1.5mm²
- Twisted wire : 0.2-1.5mm²
- Bar terminal with insulation collar : 0.25-0.75mm²
- Bar terminal without insulation collar : 0.25-1.5mm²
- Stripping line length : 10mm

<Wire mounting tool (driver) type>

- Type : SZS 0,4X2,5 VDE
- Recommended manufacturer: Phoenix Contact

<Bar terminal type>

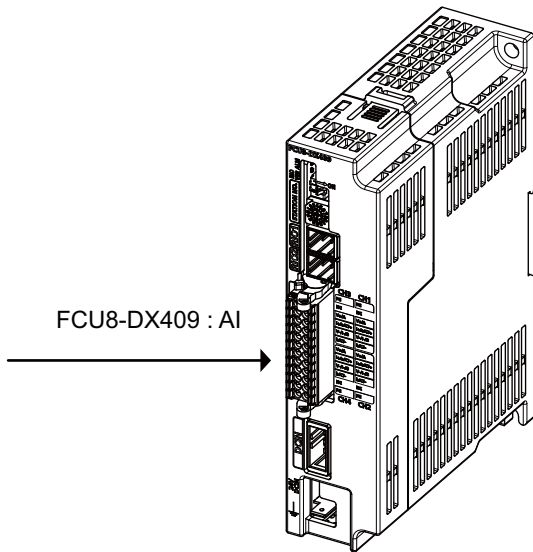
- Type : AI series
- Recommended manufacturer: Phoenix Contact

<Crimp tool type>

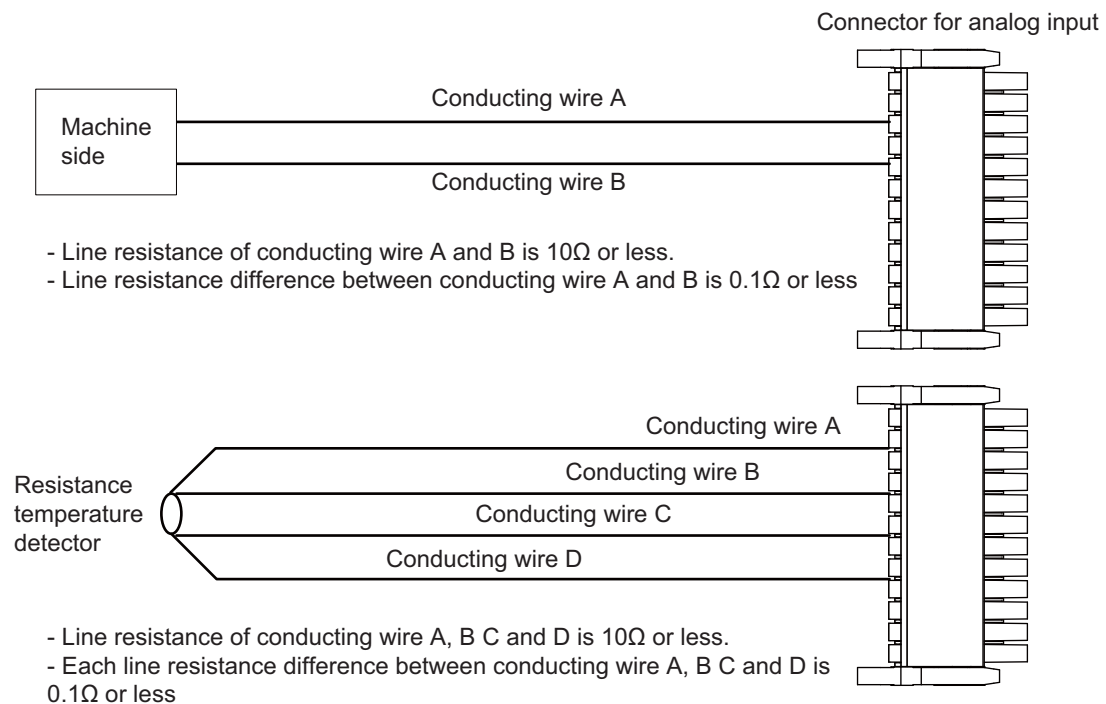
- Type : CRIMPFOX 6
- Recommended manufacturer: Phoenix Contact

<Recommended cable with shield material>

- Type : HK-SB/20276XL LF
- Recommended manufacturer: Taiyo Cabletec
- (Select the wire diameter from AI connector specification.)

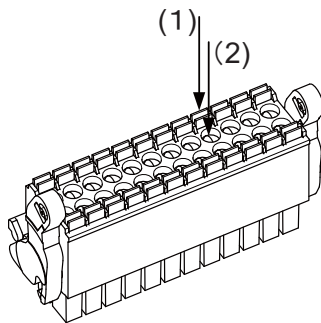


Maximum cable length is 50m. Line resistance is 10Ω or less, and line resistance difference is 0.1Ω or less (see below).

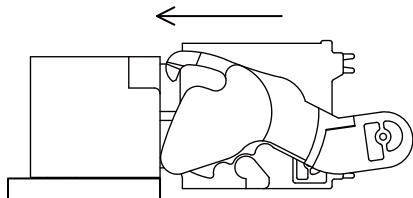


[Mounting the wire]

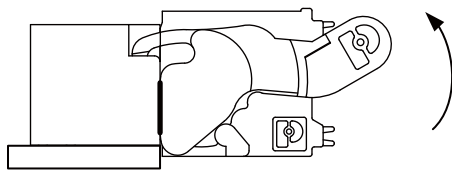
- (1) Push in the wire opening lever (orange) using a slotted screwdriver (blade width: 2.5mm).
- (2) Insert the wire and then pull the screwdriver out of the wire opening lever.

**[Mounting the connector]**

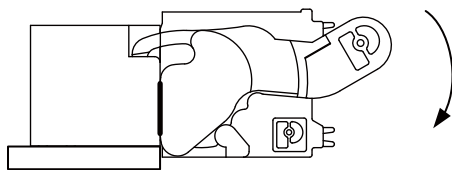
- (1) Push the connector to the lock and release (LR) lever position.



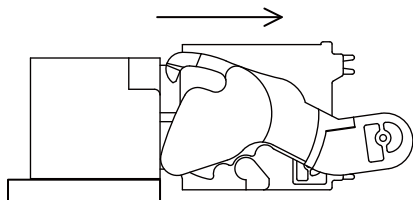
- (2) When the connector is pushed in to the end, the LR lever is applied. If the lever is loose, lift up the latch and tighten the lever.

**[Removing the connector]**

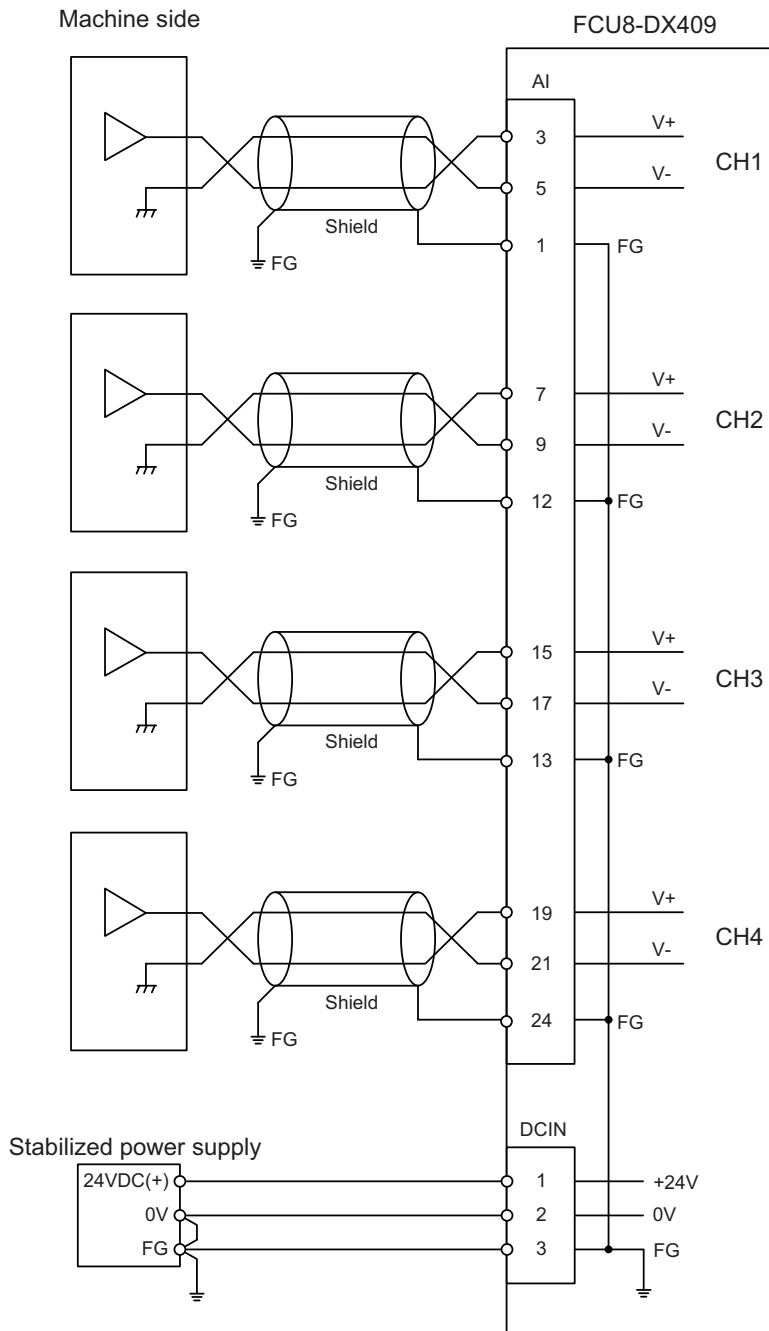
- (1) Push the lock and release (LR) levers down simultaneously.



- (2) After unlocking (the connector is pushed out by the LR lever and left half-inserted), pull out the connector.

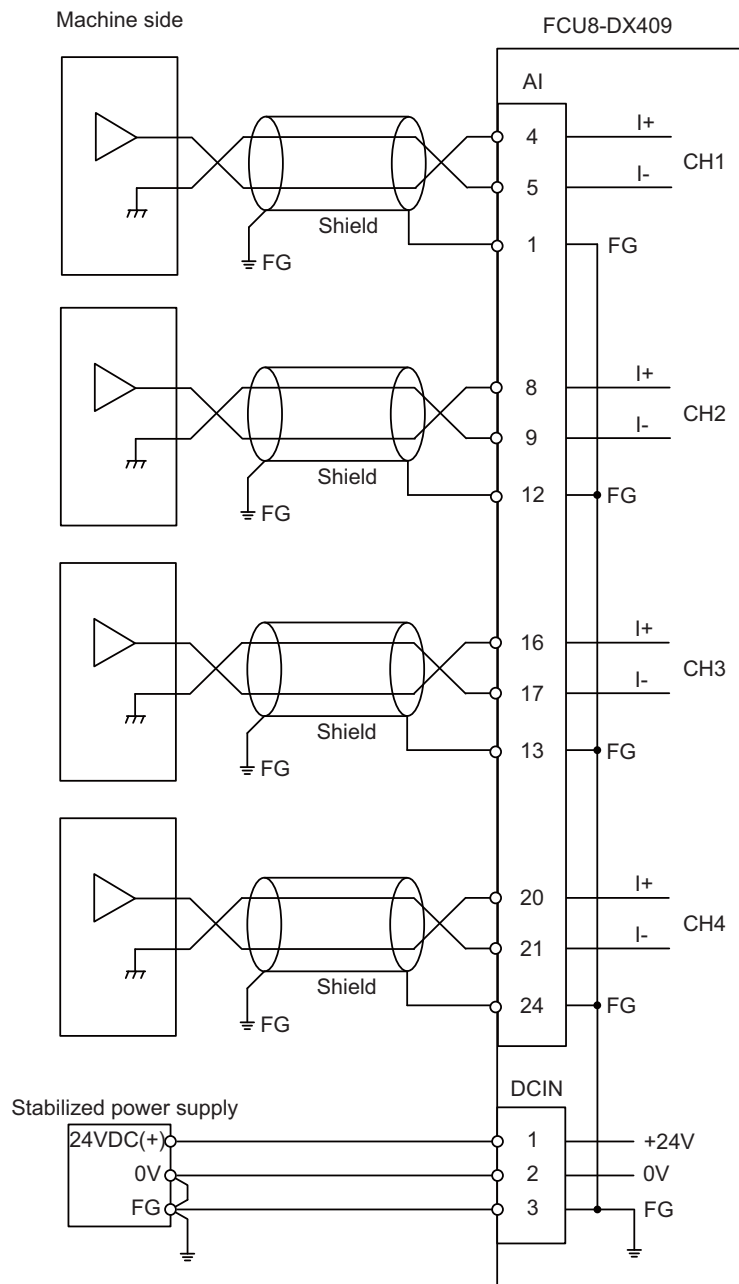


(a) Connecting with the voltage input signal



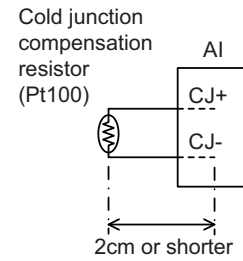
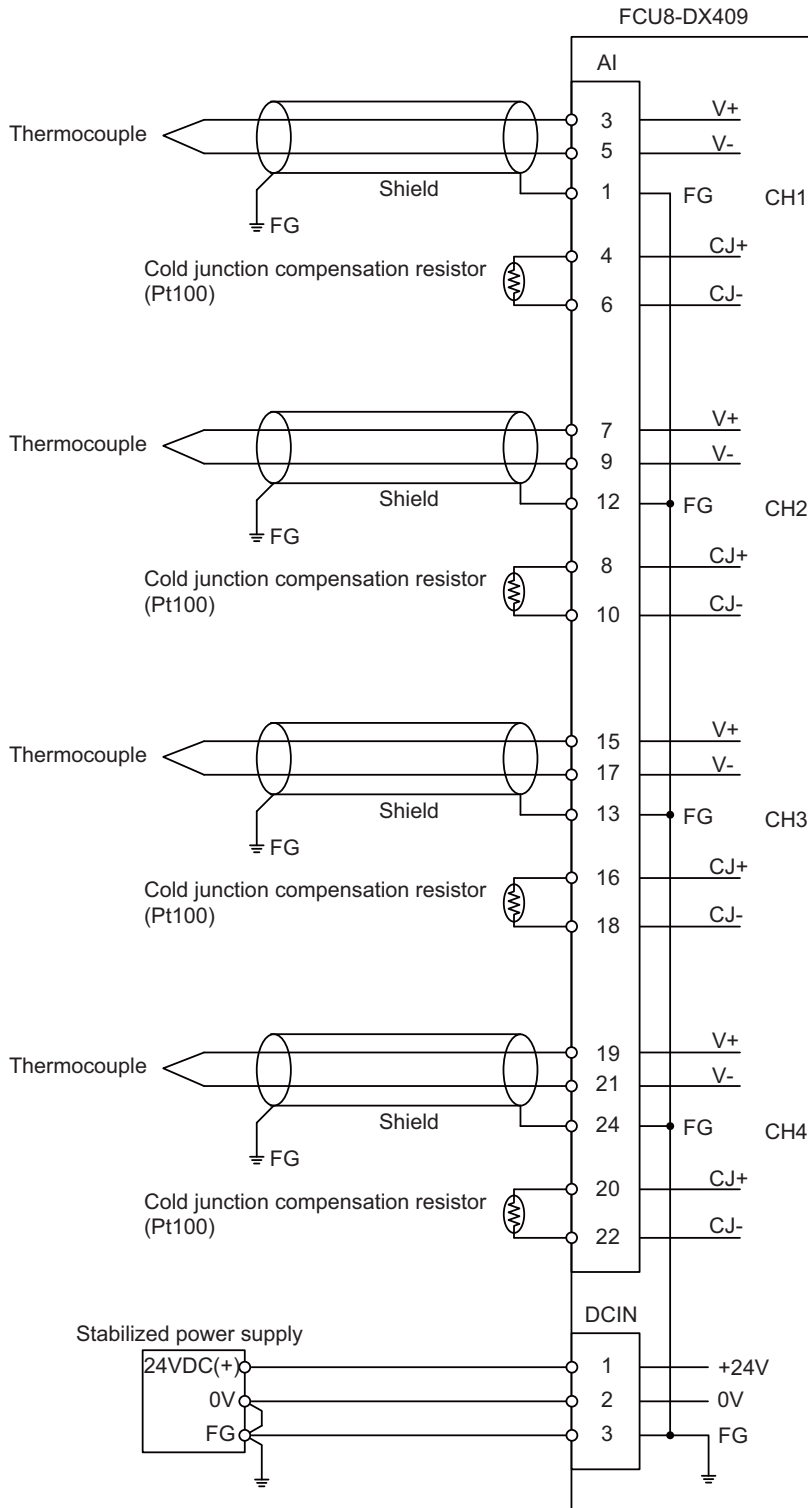
- Use the twisted cable with shield to reduce the influence of noise.
- Connect the shield to FG pin of AI connector. Ground the machine side, too.
- Do not connect or disconnect the cables between units while the power is ON.

(b) 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.

(c) Connecting with the thermocouple input signal



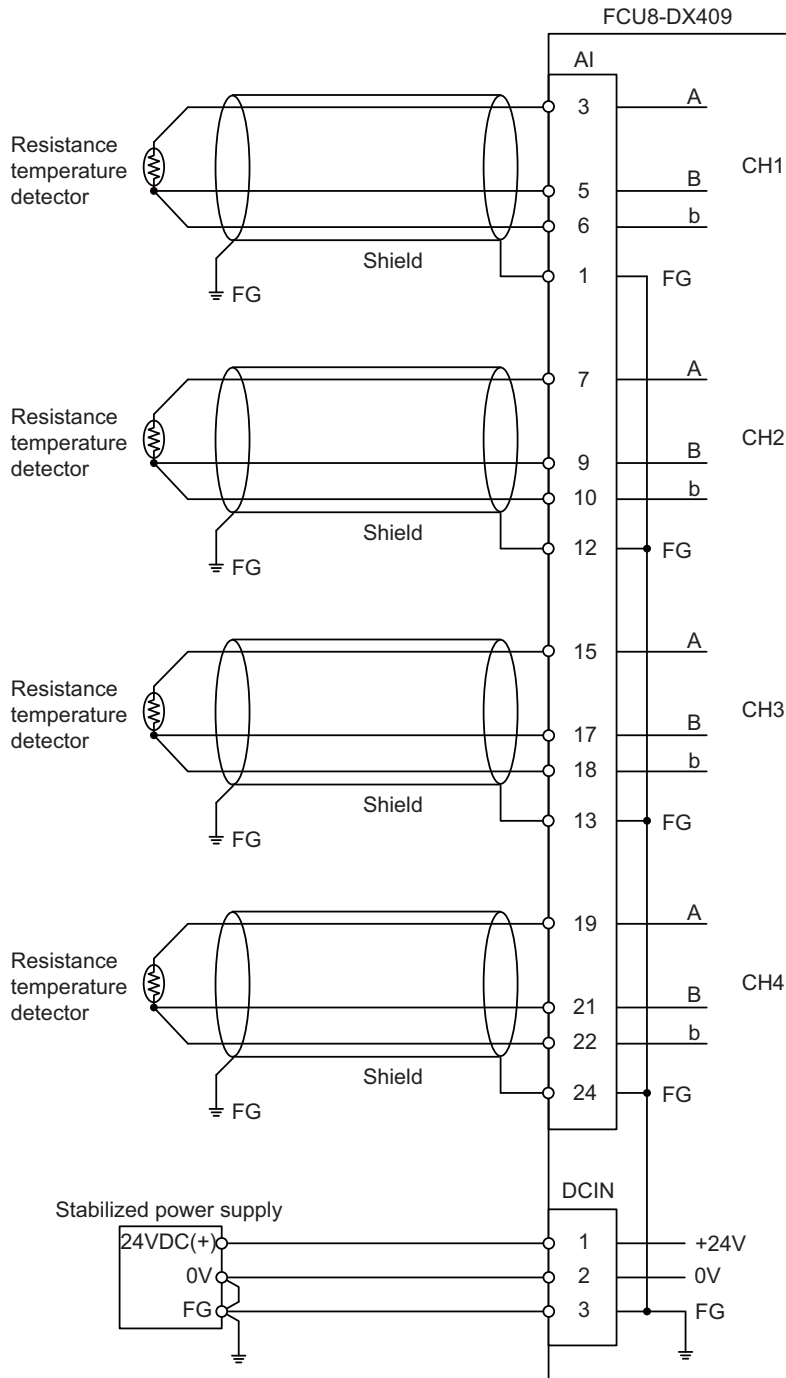
Set the lead length 2cm or shorter including the length to insert to AI connector. (As a guide)

- 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 resistor as short as possible (2 cm or shorter as a guide).

(d) Connecting with the resistance temperature detector input signal

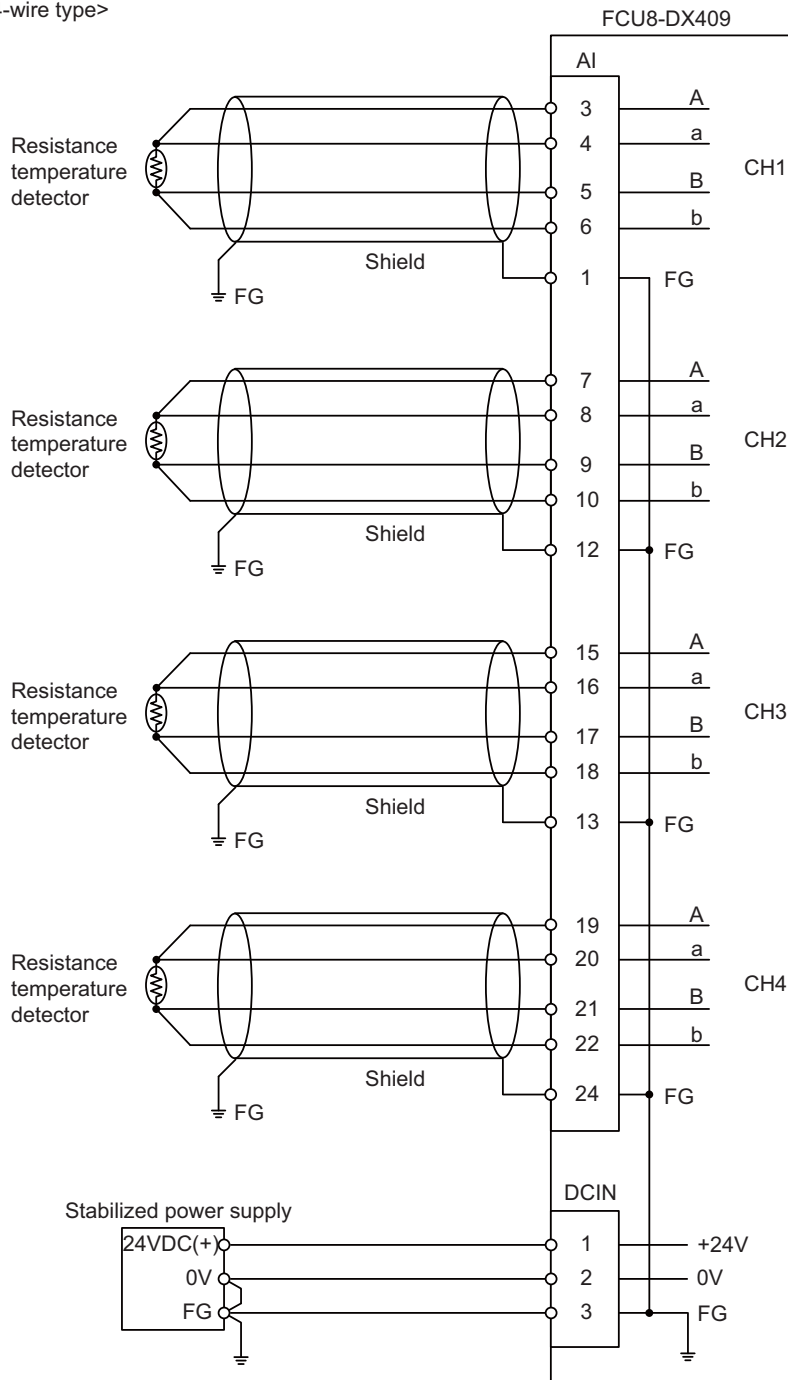
There are 3-wire type and 4-wire type for the connecting method of resistance temperature detector.

<3-wire type>



- Use the twisted 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>



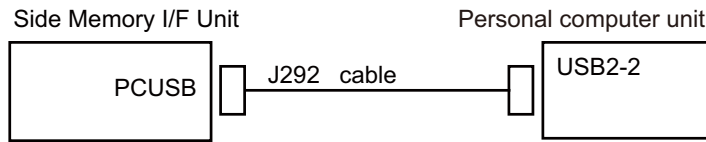
- Use the twisted cable with shield to reduce the influence of noise.
- Connect the shield to FG pin of AI connector. Ground the cold junction compensation resistor side, too.
- Do not connect or disconnect the cables between units while the power is ON.

Connection of Side Memory I/F Unit

The method for connecting to each unit and device from the side memory I/F unit is explained in this chapter.

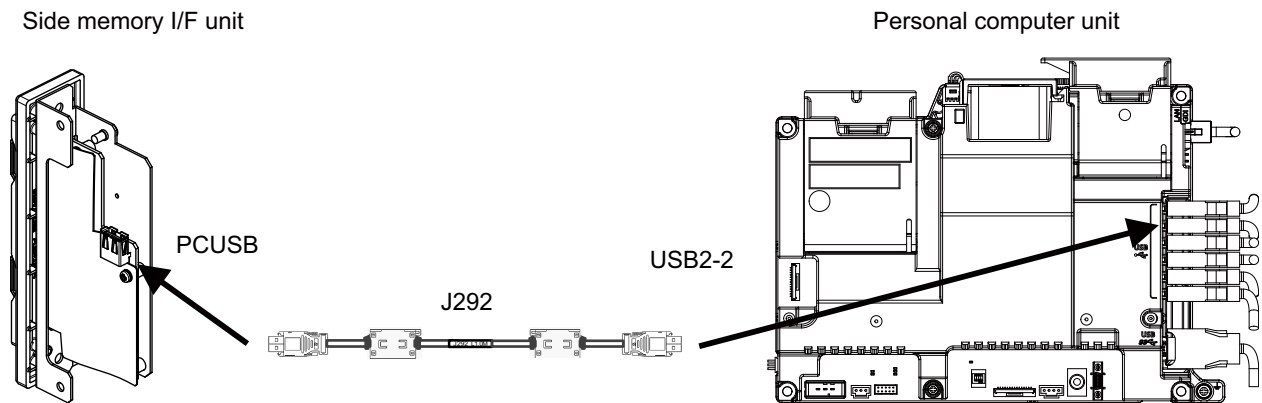
(Note) Side memory I/F unit is only for 19-type display unit.

13.1 Side Memory I/F Unit Connection System Drawing



13.2 Connecting with Personal Computer Unit

Connect the personal computer unit to the connector of the side memory I/F unit.

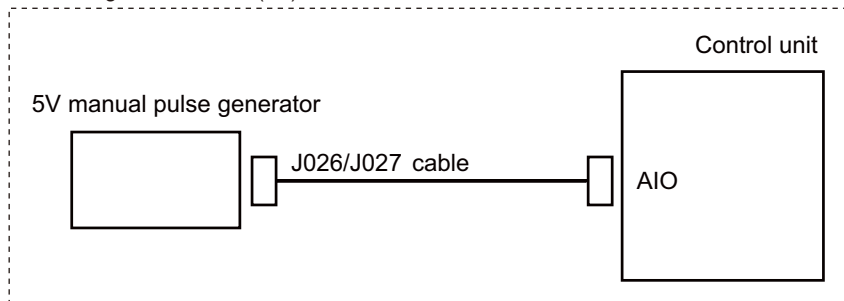


Connection of Manual Pulse Generator

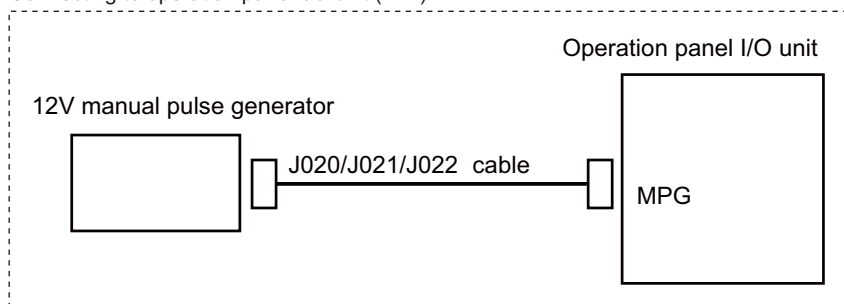
The method for connecting to each unit and device from the manual pulse generator is briefly explained in this chapter.

14.1 Manual Pulse Generator Connection System Drawing

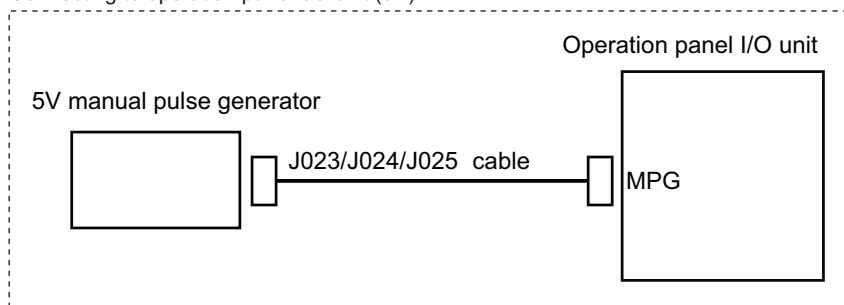
Connecting to control unit (5V)



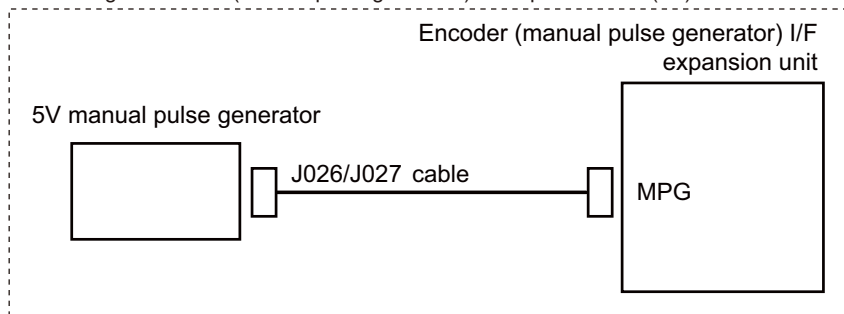
Connecting to operation panel I/O unit (12V)



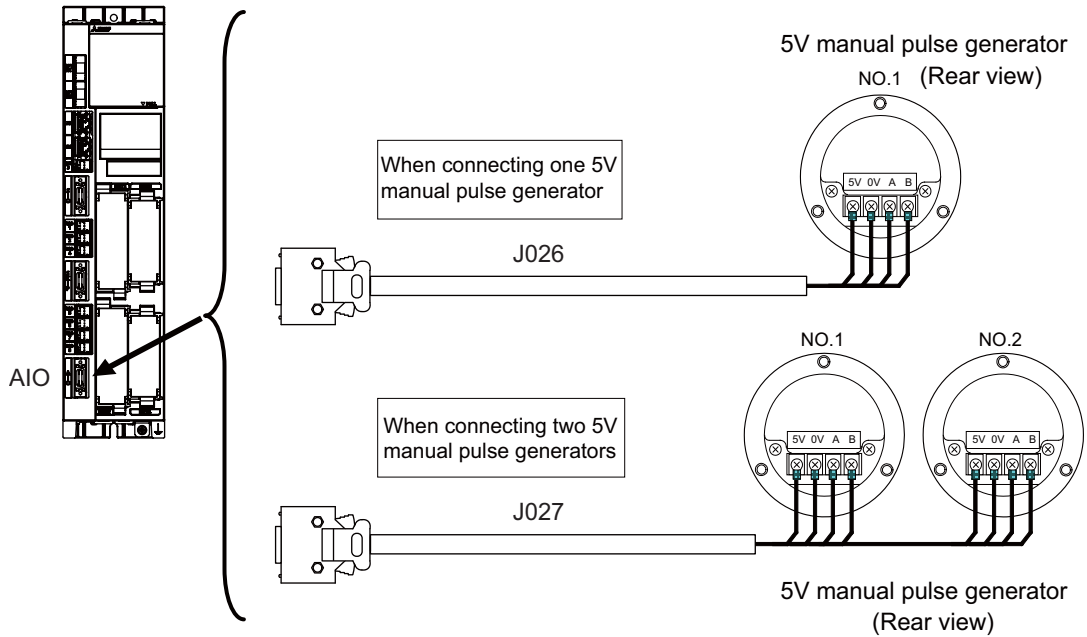
Connecting to operation panel I/O unit (5V)



Connecting to Encoder (manual pulse generator) I/F expansion unit (5V)

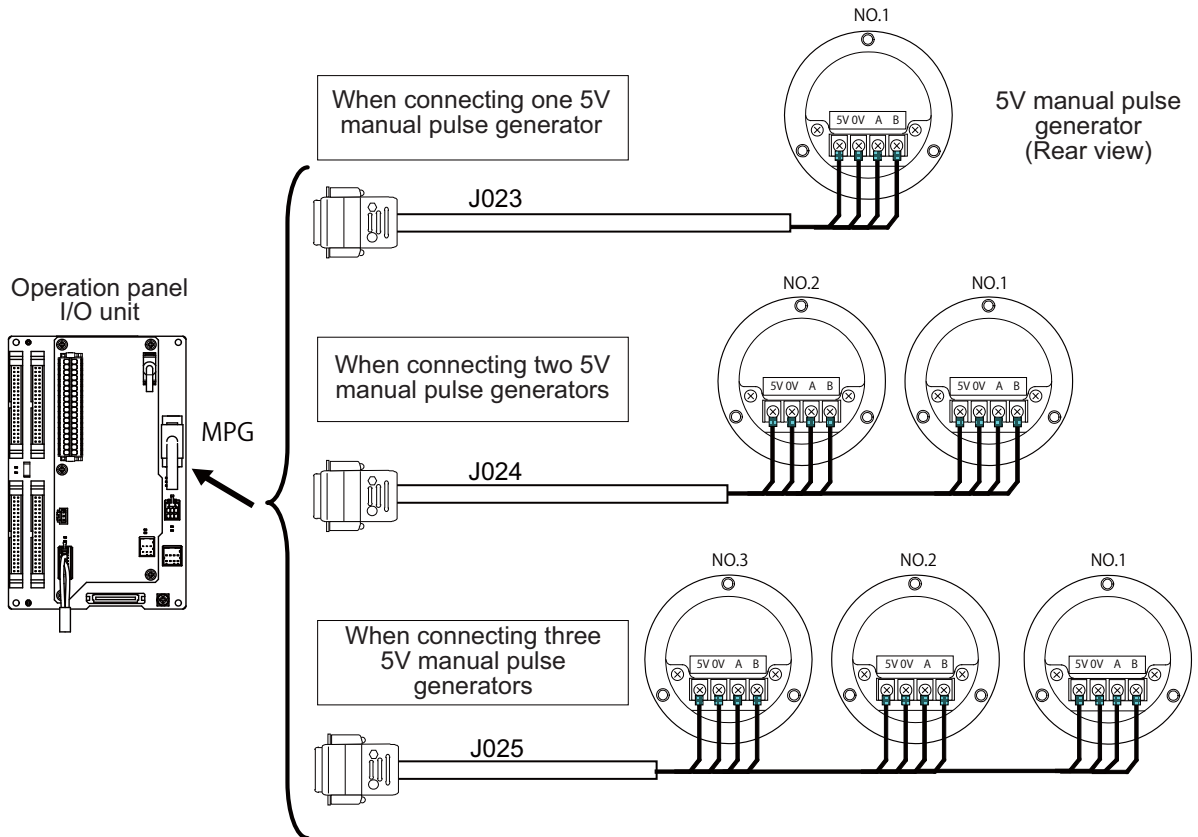


14.2 Connecting with Control Unit

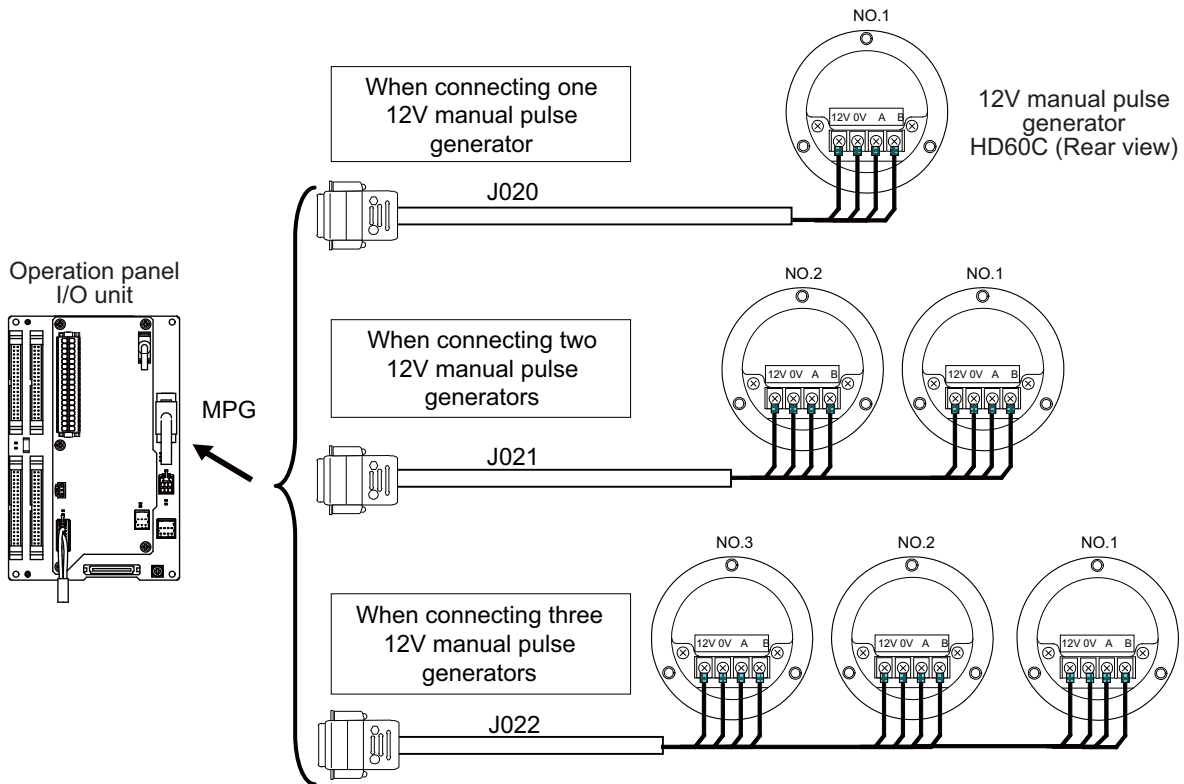


14.3 Connecting with Operation Panel I/O Unit

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



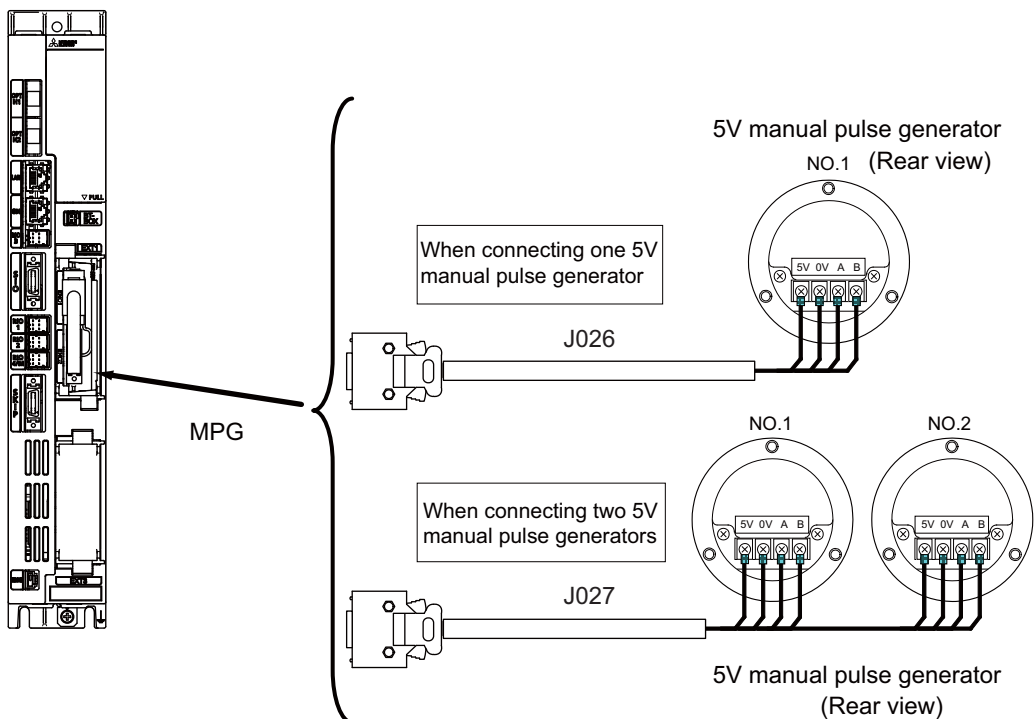
(2) 12V manual pulse generator (maximum cable length: 50m)



(Note 1) When selecting a manual pulse generator, make sure that its case and 0V terminal are insulated.

(Note 2) Select 25pulse/rev or 100pulse/rev on the parameter screen.

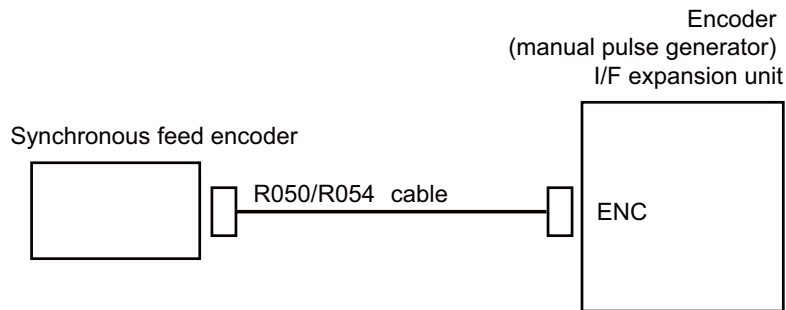
14.4 Connecting with Encoder (Manual Pulse Generator) I/F Expansion Unit



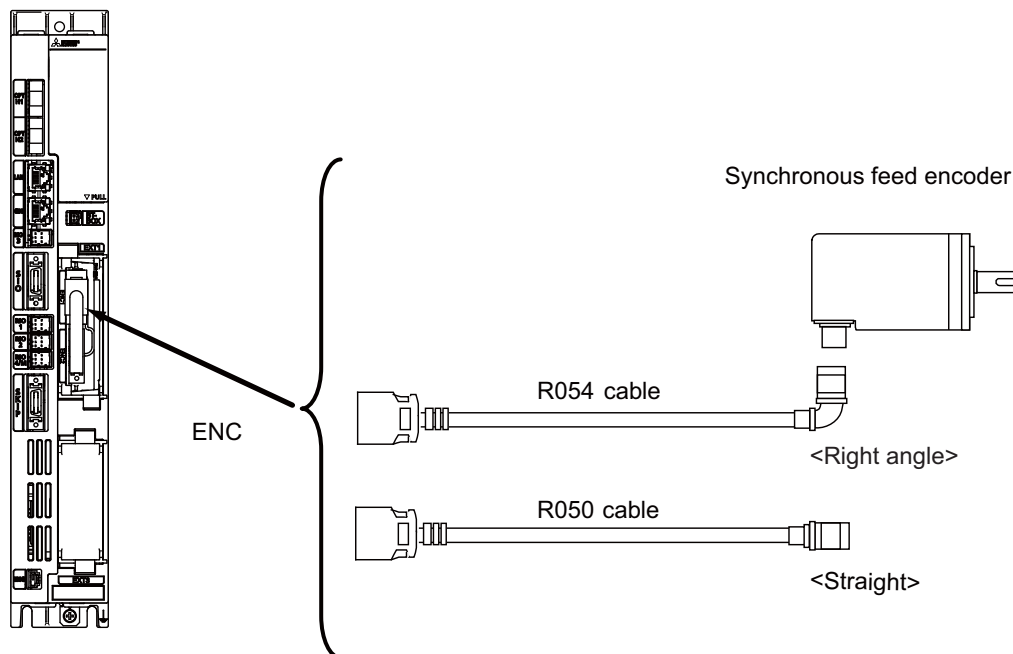
Connection of Synchronous Feed Encoder

The method for connecting to each unit and device from the synchronous feed encoder is explained in this chapter.

15.1 Synchronous Feed Encoder Connection System Drawing



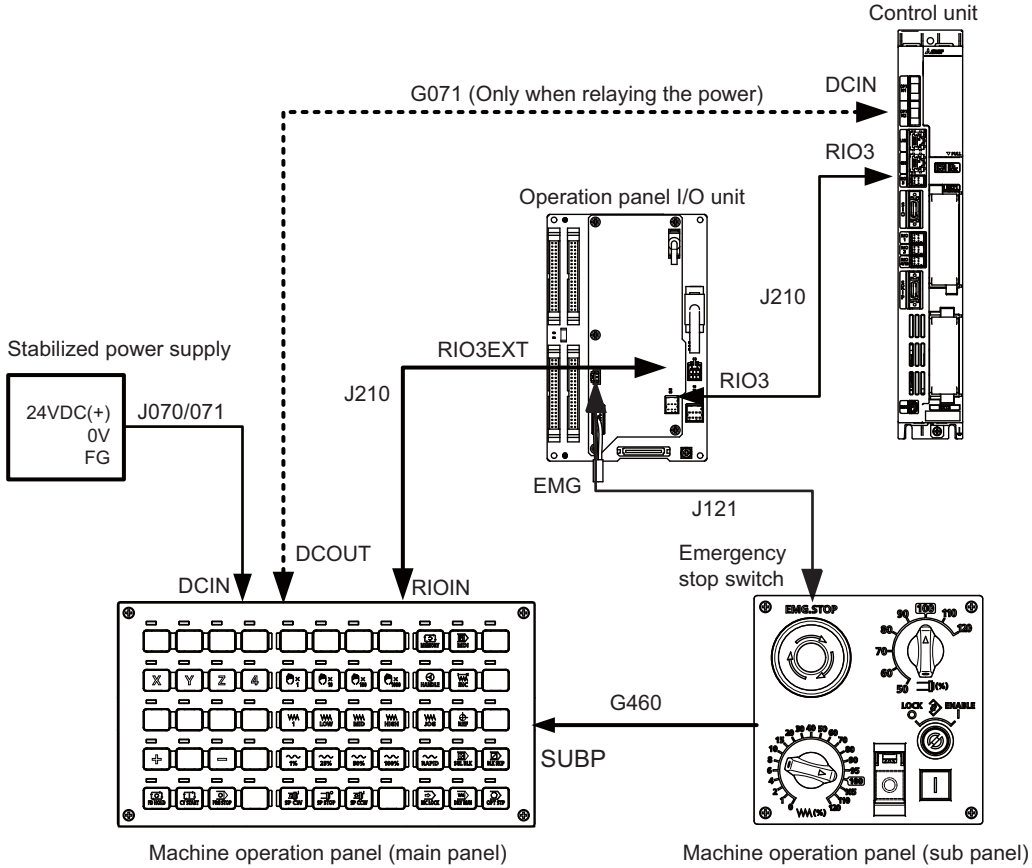
15.2 Connecting with Encoder (Manual Pulse Generator) I/F Expansion Unit



Connection of MITSUBISHI CNC Machine Operation Panel

This chapter briefly explains how to connect the MITSUBISHI CNC machine operation panel to each unit and device.
 (Note) In this chapter "MITSUBISHI CNC Machine operation panel" is shorten to Machine operation panel.

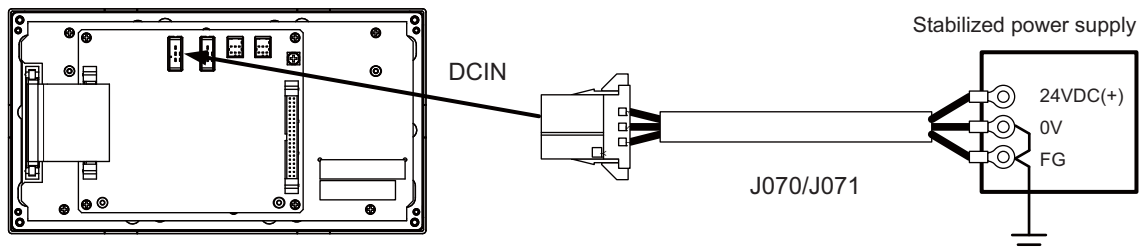
16.1 Machine Operation Panel Connection System Drawing



16.2 Connecting with Power Supply

Connect 24VDC power supply (general-purpose stabilized power supply) to the main panel of the machine operation panel.

[FCU8-KB921/KB922/KB923/KB924/KB925/KB926]



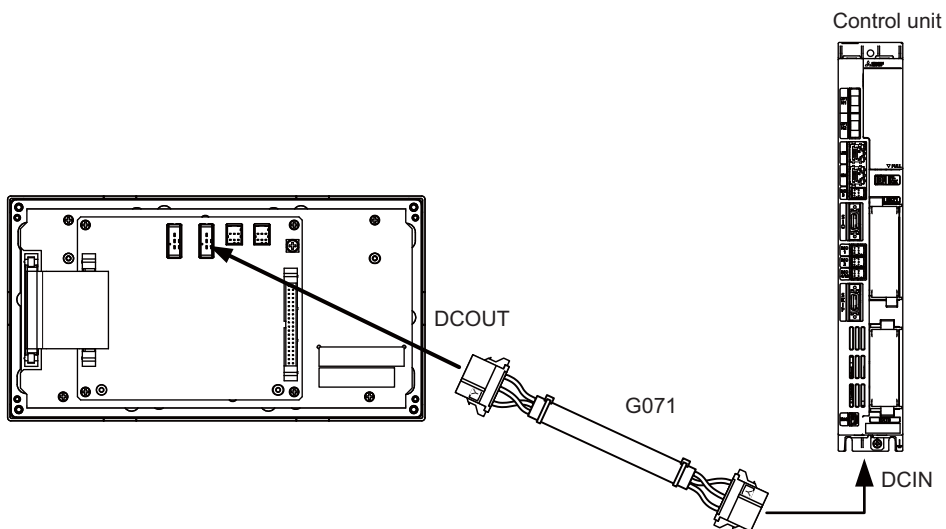
<Related items>

Cable drawing: "Cable: J070/J071 Cable"

Connector pin assignment: "General Specifications: MITSUBISHI CNC Machine Operation Panel: Main Panel A,B" (DCIN connector)

When sharing the 24VDC power supply with the control unit, connect a 24VDC relay cable.

[FCU8-KB921/KB922/KB923/KB924/KB925/KB926]



<Related items>

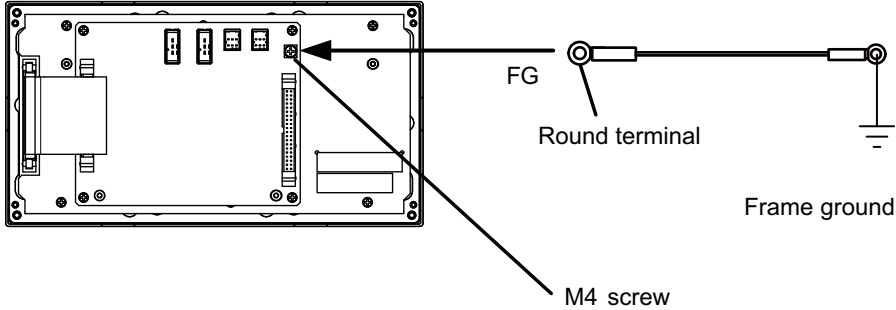
Cable drawing: "Cable: G071 Cable"

Connector pin assignment: "General Specifications: MITSUBISHI CNC Machine Operation Panel: Main Panel A,B" (DCOUT connector)

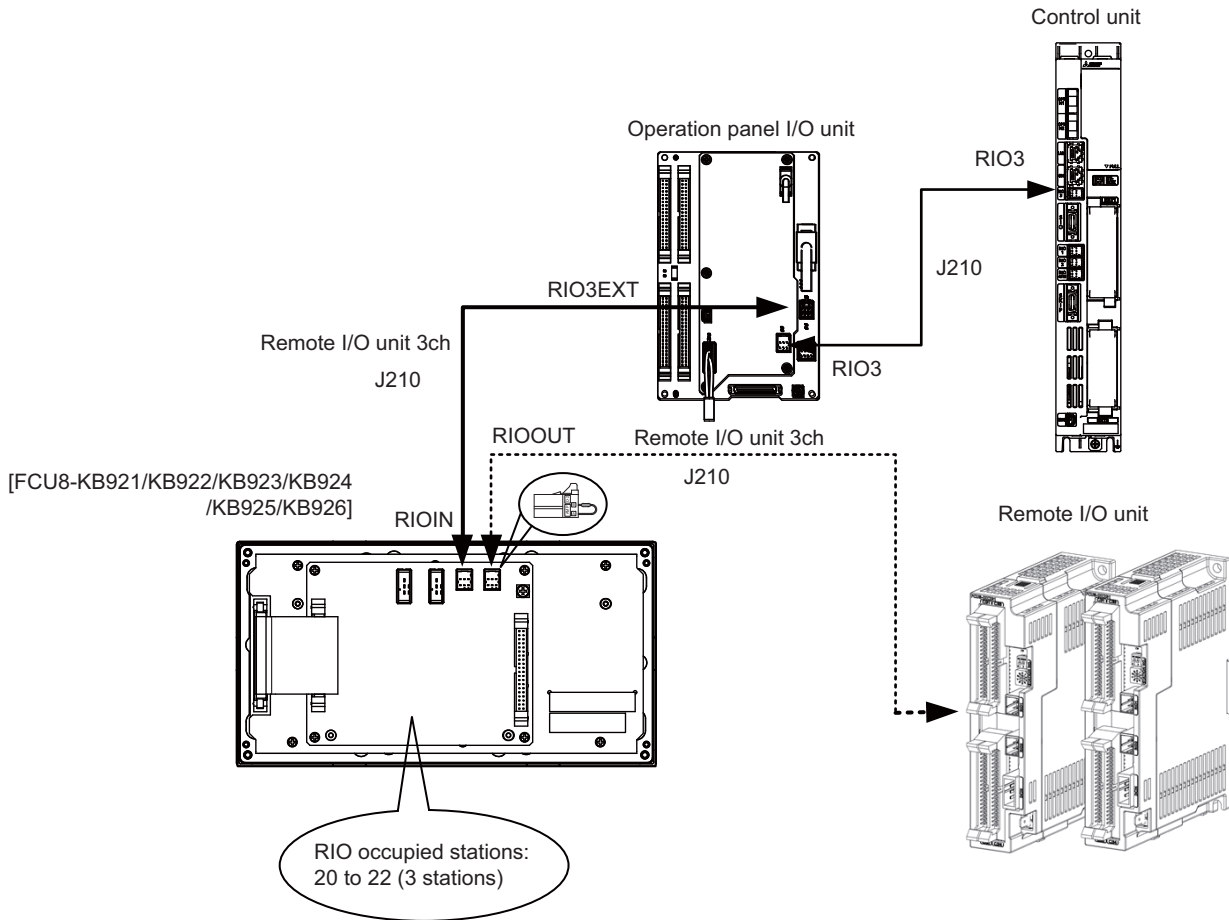
16.3 Connecting with Frame Ground

Connect 24VDC power supply (general-purpose stabilized power supply) to the main panel of the machine operation panel.

[FCU8-KB921/KB922/KB923/KB924/KB925/KB926]



16.4 Connecting with Operation Panel I/O Unit



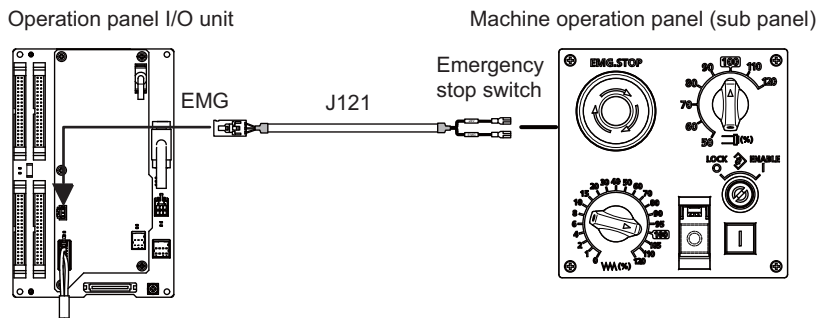
When the remote I/O unit on the next stage is not relayed, connect the R2-TM terminal.

<Related items>

Cable drawing: "Cable: J210 Cable"

Connector pin assignment: "General Specifications: MITSUBISHI CNC Machine Operation Panel: Main Panel A,B" (RIOIN/RIOOUT connector)

16.5 Connecting Emergency Stop Switch

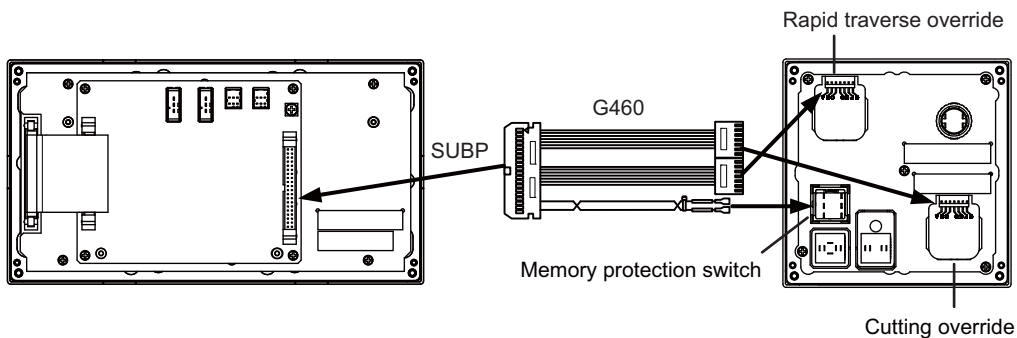


<Related items>

Cable drawing: "Cable: J121 Cable"

Connector pin assignment: "General Specifications: MITSUBISHI CNC Machine Operation Panel: Sub Panel A" (emergency stop switch)

16.6 Connecting with Sub Panel



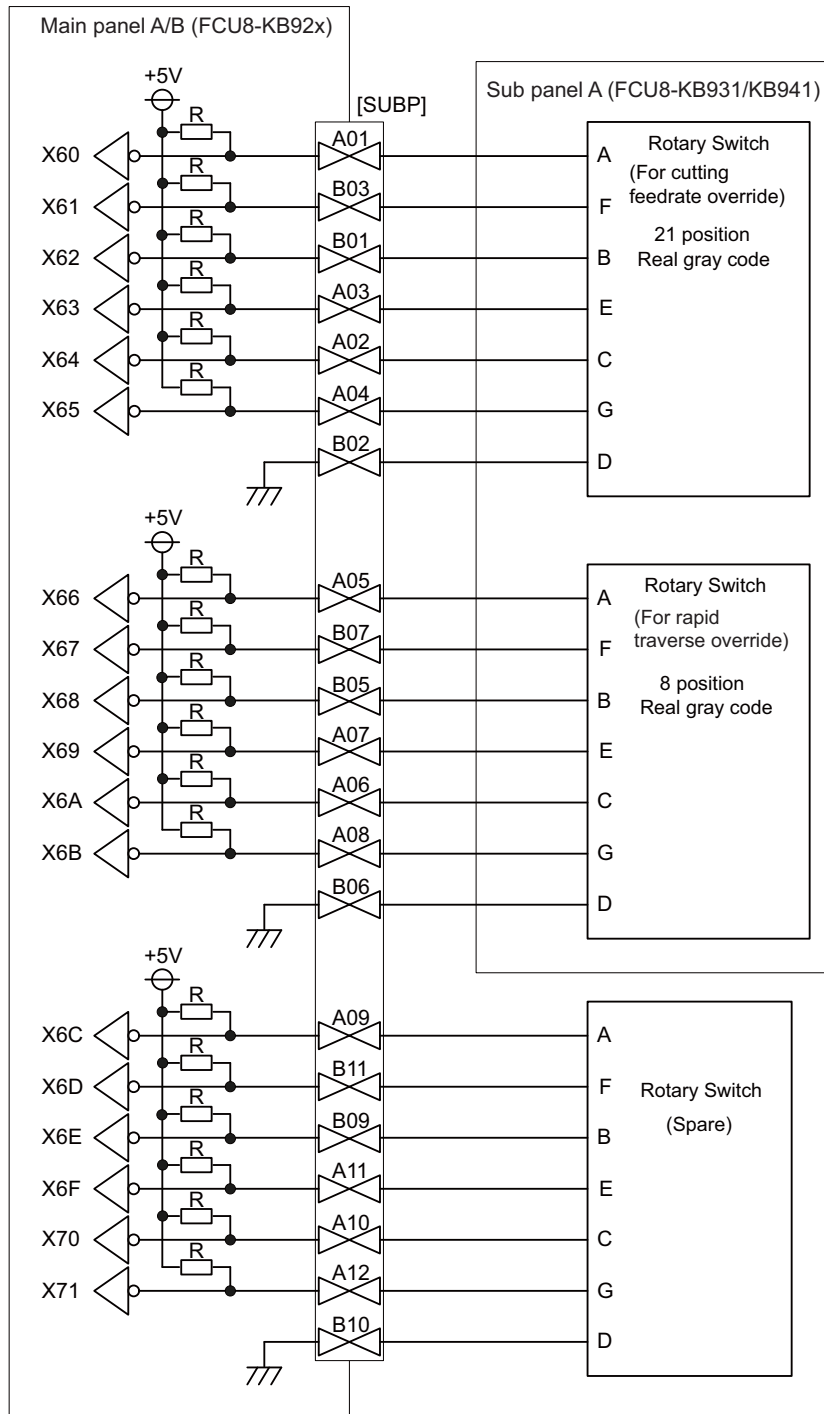
<Related items>

Cable drawing: "Cable: G460 Cable"

Connector pin assignment: "General Specifications: MITSUBISHI CNC Machine Operation Panel: Main Panel A,B" (SUBP connector)

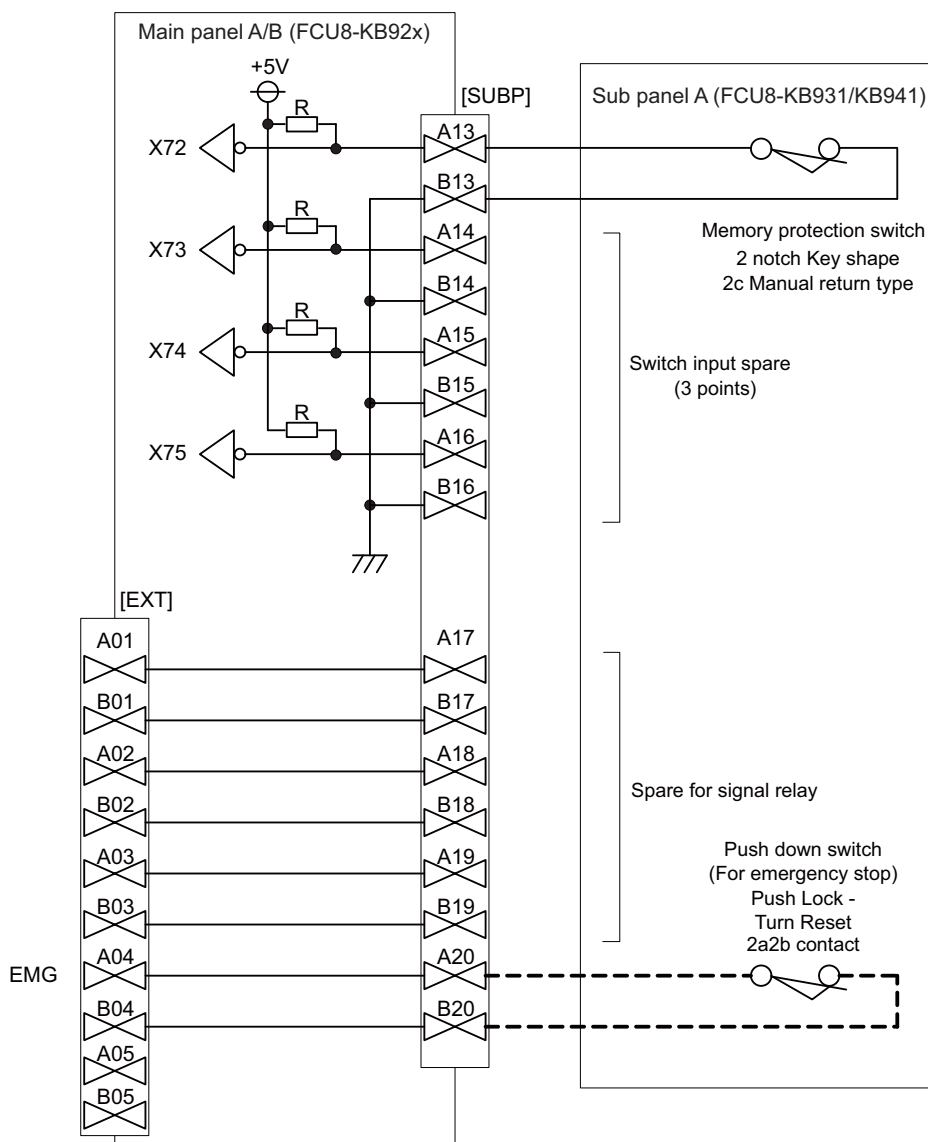
Connector pin assignment: "General Specifications: MITSUBISHI CNC Machine Operation Panel: Sub Panel A" (rapid traverse override, cutting override, memory protection switch)

<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, 0.5m) Fuji Electric
- (Note 2) A09 to 12 and B09 to 11 of SUBP are spares, so they do not need wiring.
- (Note 3) Select a rotary switch which guarantees 5V/1mA.
- (Note 4) Length of cables must be 0.5m or shorter.
- (Note 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).
- (Note 2) When wiring the emergency stop switch, the crimp terminal must be fastened with thread.
- (Note 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.
- (Note 4) Select a rotary switch which guarantees 5V/1mA.
- (Note 5) Length of cables must be 0.5m or shorter.
- (Note 6) The numbers in the above diagram do not indicate the actual device numbers.

16.7 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:

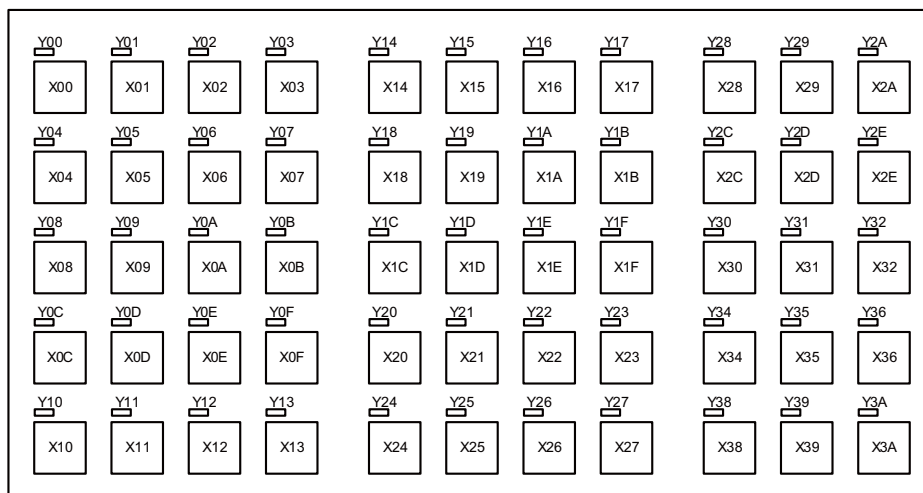
Channel No.	No	Device		Function	
RIO1	#1	20th station	Input: ZR5022/ZR5023	[Input] Reading switch data of the sub panel	
	#2	21st station	Input: ZR5024/ZR5025	[Input] Reading key data of the main panel (55 points) [Output] LED lighting control (55 points)	
			Output: ZR6024/ZR6025		
	#3	22nd station	Input: ZR5026/ZR5027		
			Output: ZR6026/ZR6027		
	RIO2	#1	20th station		Input: ZR5222/ZR5223
#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	
	#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		

(1) 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")

(Note 2) While the key switch is pressed, "1" is input in the ZR device.

<Device No. of LED>

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")

(2) 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:

(a) Cutting override (6bit)

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

(b) Rapid traverse override (6bit)

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	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

(c) Memory protection switch (1bit)

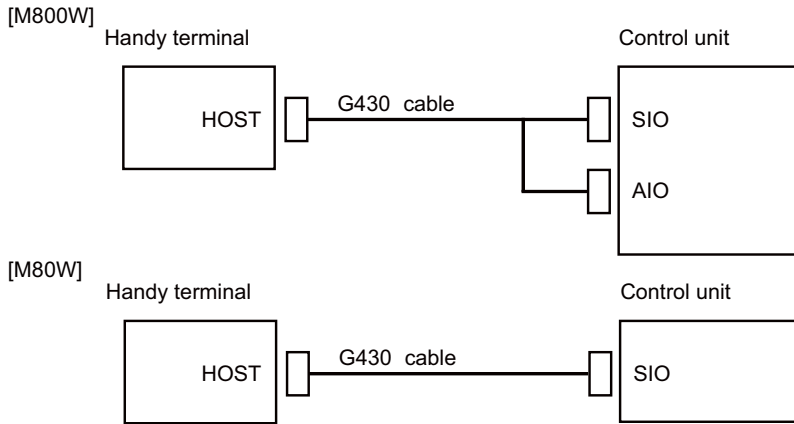
Setting value	Device
	ZR5\$23[2]
LOCK	0
ENABLE	1

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

Connection of Handy Terminal

This chapter briefly explains how to connect the handy terminal to each unit and device.

17.1 Handy Terminal Connection System Drawing

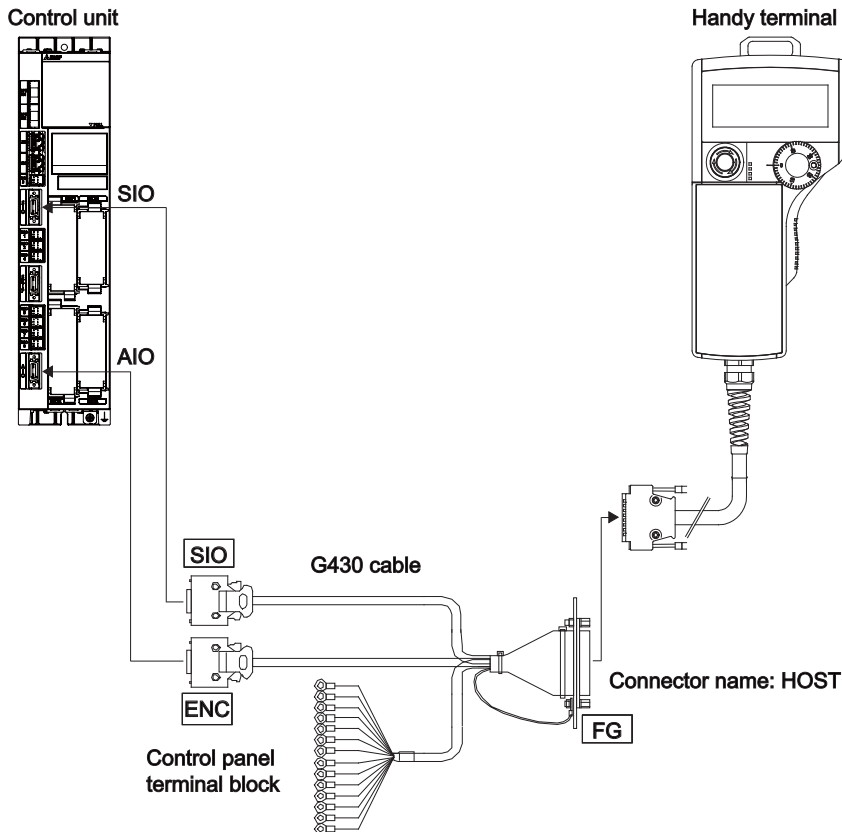


(Note) When the handle of handy terminal is used on M80W, connect ENC connector of G430 cable to MPG connector of the operation panel I/O unit. Because the pin assignment of ENC connector of G430 is different from that of MPG connector of the operation panel I/O unit, conversion is required. The conversion cable needs to be prepared by the MTB.

17.2 Connecting with Control Unit

Connect the handy terminal to SIO connector and AIO connector (M800W only) of the control unit. Also, connect the emergency stop switch (SW1), enable switch (SW2), selector switch (SW) and 24VDC input to the control panel terminal block.

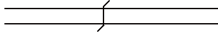
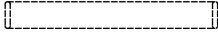
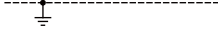
[Example connection of M800W]



18

Cable

18.1 Symbols for Writing Cable Drawings

- (1)  indicates twisted pair.
- (2)  indicates the shield sheath.
- (3)  indicates shield clamping to the grounding plate.
- (4) In the cable drawings, the partner of the twisted pair cable is given a priority, so please be aware that the pin No. of the connectors at both ends are not necessarily in sequential order.
- (5) Equivalent parts can be used for the connector, contact and wire material.
- (6) The tolerances of the cables provided by MITSUBISHI are as follows:

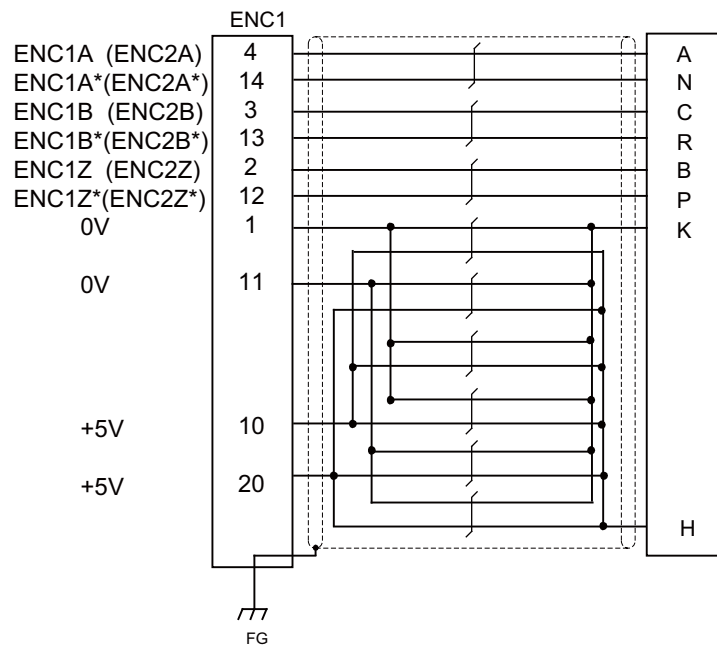
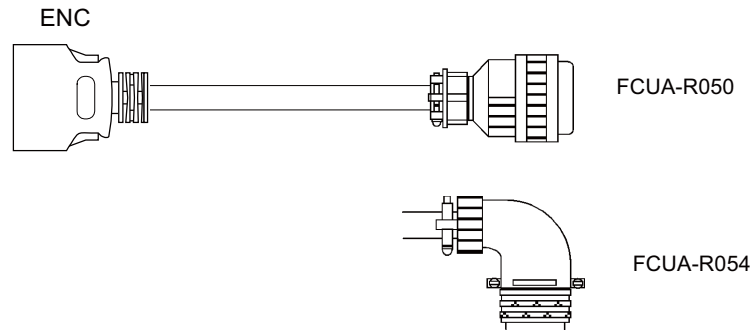
Cable length (mm)	Tolerances (mm)
~ 600	±30
601 ~ 1000	±50
1001 ~ 5000	±100
5001 ~ 10000	±150
10001 ~ 15000	±200
15001 ~ 20000	±300

18.2 Cable Relating to NC

18.2.1 FCUA-R050/R054 Cable

Max. cable length: 30m

Application: Synchronous encoder - control unit



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

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

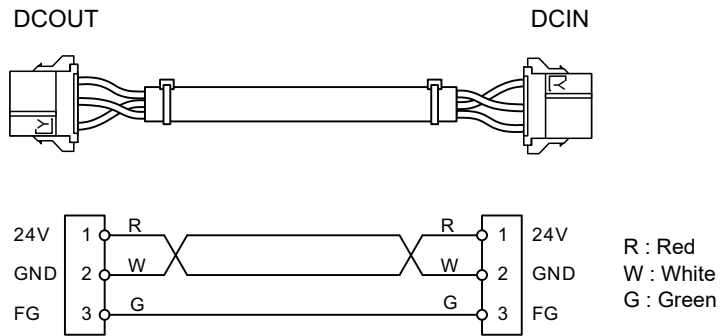
[FCUA-R050 cable]
 Connector: MS3106B20-29S
 Cable clamp: MS3057-12A
 Recommended manufacturer:
 ITT Cannon
 [FCUA-R054 cable]
 Connector: MS3108B20-29S
 Cable clamp: MS3057-12A
 Recommended manufacturer:
 ITT Cannon

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

18.2.2 G071 Cable

Max. cable length: 1m

Application: 24VDC relay cable for MITSUBISHI CNC machine operation panel



[DCOUT]
 Connector: 2-178288-3
 Contact: 1-175218-5 x 3
 Recommended manufacturer: Tyco Electronics

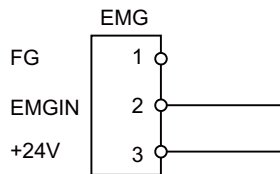
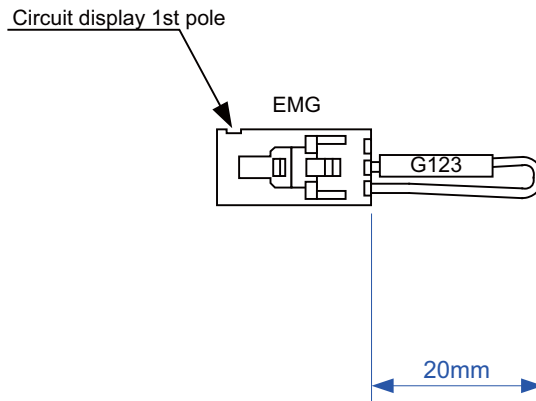
Wire material: UL1264 AWG16
 (Red, White, Green)

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

(Note) These cables are available only when wired to a same control panel.

18.2.3 G123 Cable

Application: Cable for emergency stop release



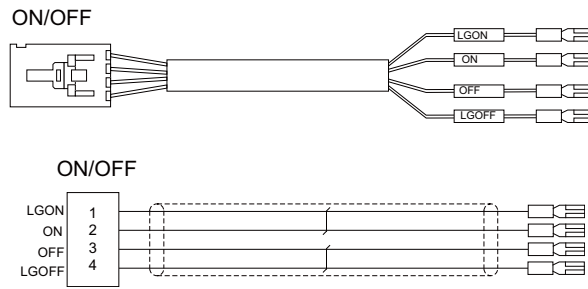
Wire material : UL1007 AWG22

[EMG]
 Connector : 50-57-9403
 Contact : 0016020103
 Recommended manufacturer : MOLEX

18.2.4 G170 Cable

Max. cable length: 15m

Application: ON/OFF switch cable (ON/OFF switch - display unit)



[ON/OFF]

Connector: 50-57-9404

Contact: 0016020103

Recommended manufacturer: MOLEX

Wire material: DPVVS 4P x 0.2SQ

Recommended manufacturer: Bando

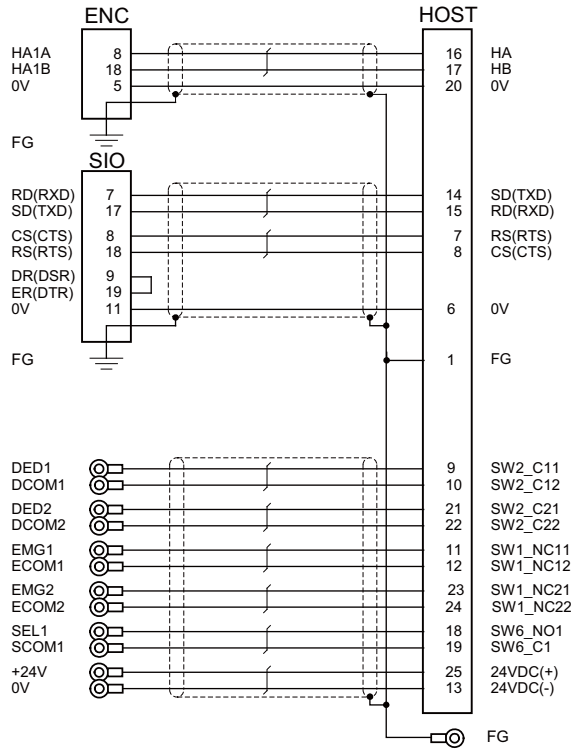
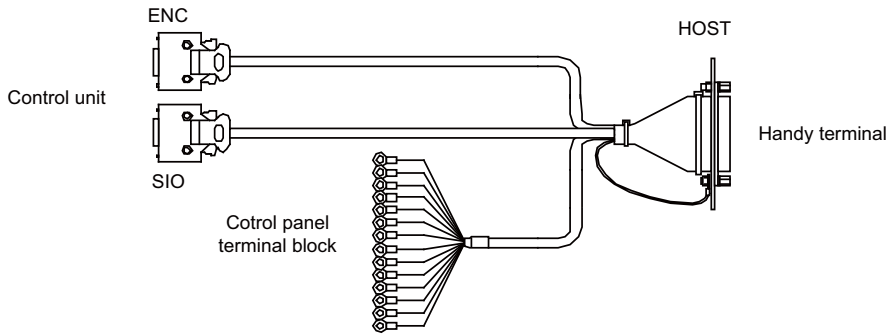
Electric Wire

Faston terminal #110 x 4

18.2.5 G430 Cable

Max. cable length: 10m

Application: For connection to handy terminal



[ENC][SIO]

Plug: 10120-3000VL

Shell: 10320-52F0-008

Recommended manufacturer: 3M

Wire material: UL1061-2464 AWG28 x 3P

Recommended manufacturer: Oki Electric Cable

[Control panel terminal block]

Crimp terminal: R1.25-3.5

Recommended manufacturer: JST

Wire material: UL1061-2464 AWG24 x 8P

Recommended manufacturer: Oki Electric Cable

FG terminal

Crimp terminal: V1.25-4

Recommended manufacturer: JST

Wire material: UL1061-2464

AWG18(Green)

Recommended manufacturer: Oki

Electric Cable

[HOST]

Plug: CDB-25S

Contact: CD-SC-221 x21

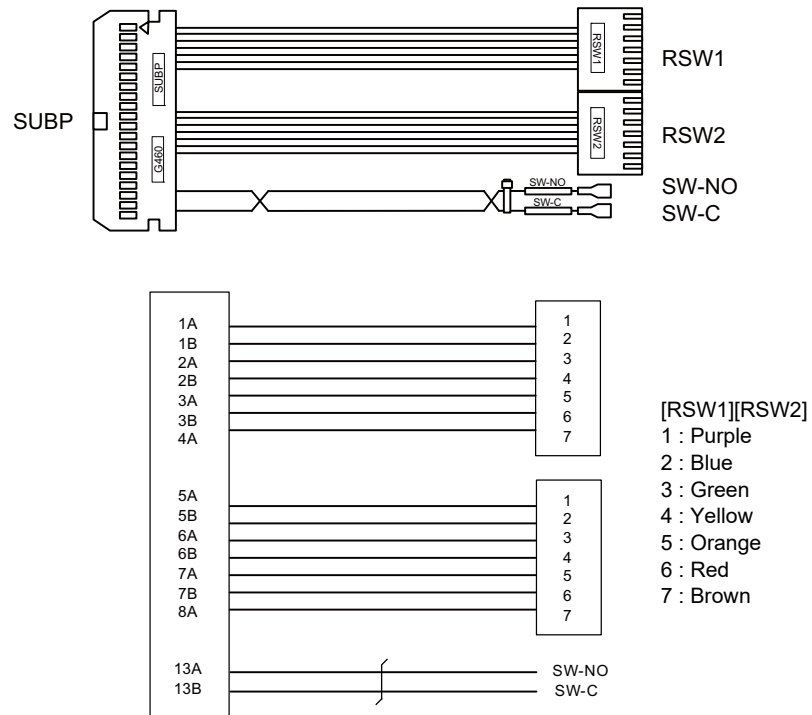
Recommended manufacturer: Hirose Electric

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

18.2.6 G460 Cable

Max. cable length: 0.5m

Application: Cable for MITSUBISHI CNC machine operation panel (cable between main panel and sub panel)



[SUBP]
 Connector: HIF3BA-40D-2.54C
 Contact: HIF3-2428SC x 16
 Recommended manufacturer: Hirose Electric

Wire material: UL1007 AWG24
 (Red, Black)

[RSW1][RSW2]
 Connector with cable : ACX011-705 x 2
 Contact: 1-175218-5 x 3
 Recommended manufacturer: Fuji Electric

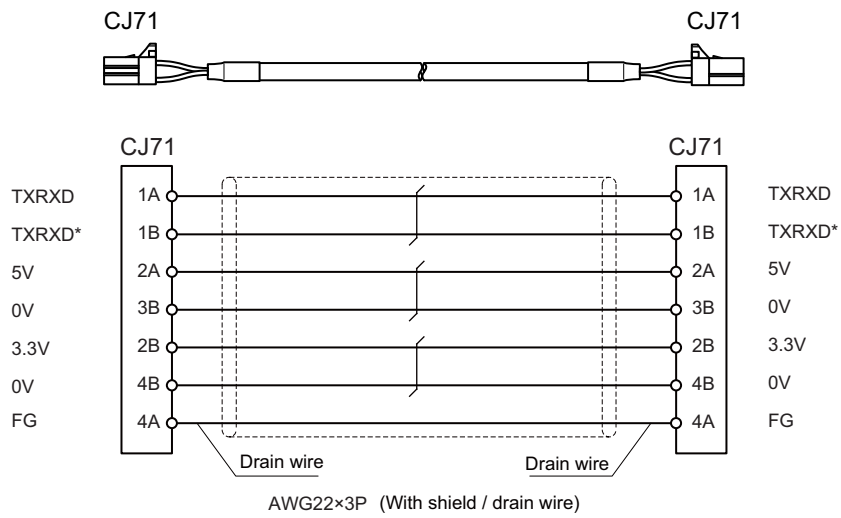
[SW-NO][SW-C]
 Connector: STO-01T-110N
 Recommended manufacturer: JST

(Note) Coat the connector [SW-NO][SW-C] with an insulation.

18.2.7 J010 Cable

Max. cable length: 1m

Application: Operation panel I/O interface cable



[CJ71]

Connector : 2-1318119-4

Contact : 1318107-1

Recommended manufacturer :

Tyco Electronics

Wire material : HRZEV-SB-A(20276) AWG22×3P

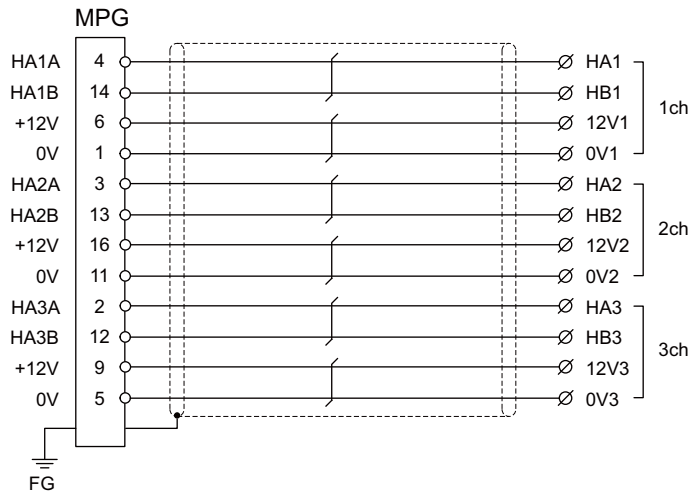
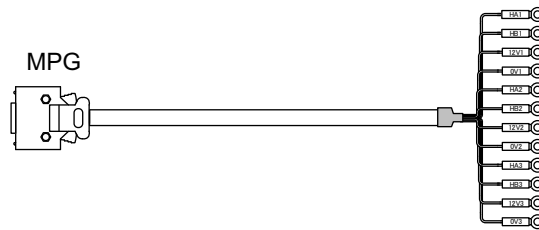
Recommended manufacturer : DYDEN

(Note) Use the wire material of which impedance characteristics is 110 Ω.

18.2.8 J020/J021/J022 Cable

Max. cable length: 50m

Application: Manual Pulse Generator cable (12V)



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

Wire material :
 UL2464 U-TKVVBS AWG24 × 6P
 Recommended manufacturer :
 Tachii Electric Wire

[1ch][2ch][3ch]
 Crimp terminal : R1.25-3 × 12
 Recommended manufacturer : JST

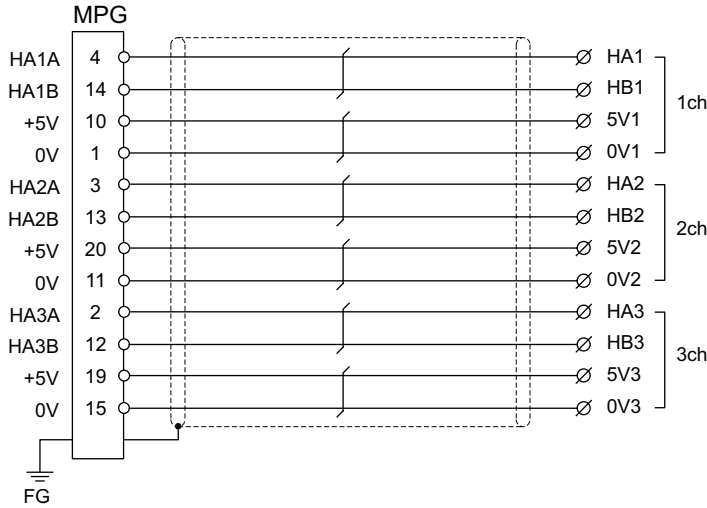
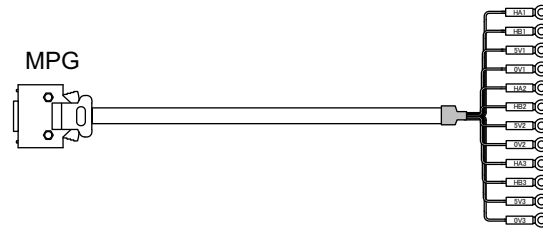
Cable name	1ch	2ch	3ch
J020 cable	○		
J021 cable	○	○	
J022 cable	○	○	○
○ : Usable channel Unconnectable to control unit side			

- (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.
- (Note 2) The cables for 1ch and 2ch are compatible with F320 or F321 cable of the conventional model.
- (Note 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±0.05N·m)

18.2.9 J023/J024/J025 Cable

Max. cable length: 20m

Application: Manual Pulse Generator cable (5V)



[MPG]

Connector : 10120-3000PE

Case : 10320-52F0-008

Recommended manufacturer : 3M

Wire material :

UL2464 U-TKVVBS AWG22 × 6P

Recommended manufacturer :

Tachii Electric Wire

[1ch][2ch][3ch]

Crimp terminal : V1.25-3 × 12

Recommended 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.

(Note 2) The cables for 1ch and 2ch are compatible with F023 or F024 cable of the conventional model.

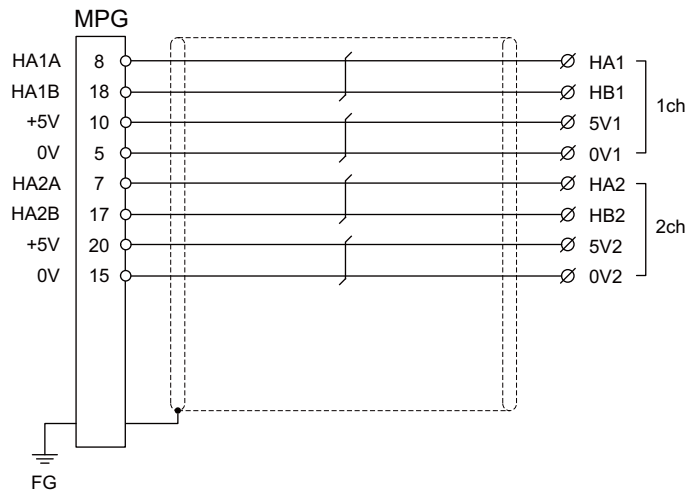
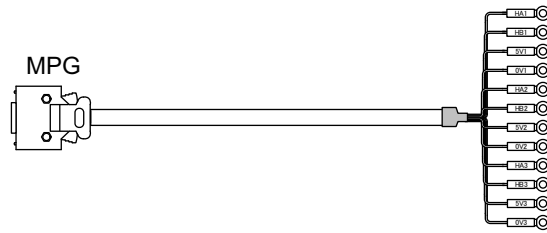
(Note 3) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.

(Manufacturer recommended tightening torque: 0.20±0.05N·m)

18.2.10 J026/J027 Cable

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

Application: Manual Pulse Generator cable (5V)



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

Wire material :
 UL2464 U-TKVVBS AWG22 × 6P
 Recommended manufacturer :
 Tachii Electric Wire

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

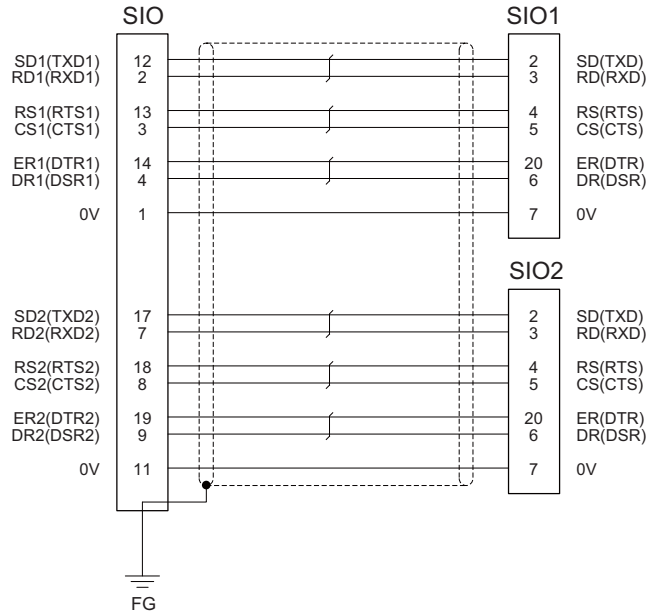
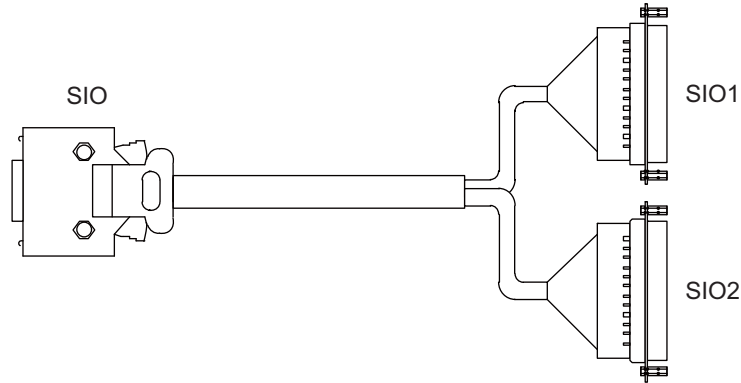
Cable name	1ch	2ch
J026 cable	○	
J027 cable	○	○
○ : Usable channel Unconnectable to operation board side		

- (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.
- (Note 2) The cables are compatible with G023 or G024 cable of the conventional model.
- (Note 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±0.05N·m)

18.2.11 J030/J031 Cable

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

Application: RS232C I/F cable



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

Wire material: 2464C BIOS-CL3-26
 07P
 Recommended manufacturer:
 Bando Electric Wire

[SIO1][SIO2]
 Connector: CDB-25S
 Contact: CD-SC-111
 Lock nut: HD-LNA
 Recommended manufacturer:
 Hirose Electric

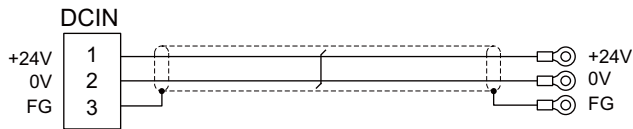
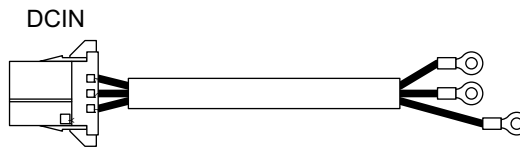
Cable name	SIO1	SIO2
J030 cable	○	
J031 cable	○	○
○ : Usable channel		

- (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.
- (Note 2) Signal names in parentheses "()" are generally used.
- (Note 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±0.05N·m)

18.2.12 J070/J071 Cable

Max. cable length: 15m(J070) / 20m(J071)

Application: 24VDC power cable



[DCIN]

Connector : 2-178288-3

Contact : 1-175218-5

Recommended manufacturer :
Tyco Electronics

[J070 cable]

Wire material : 2464C BIOS-CL3-16 02C × 16AWG(26/0.26)

Recommended manufacturer : BANDO DENSEN

[J071 cable]

Wire material :

UL2464-SB TEW 2×14AWG(41/0.26)LF Black × White

Recommended manufacturer : Hitachi Metals

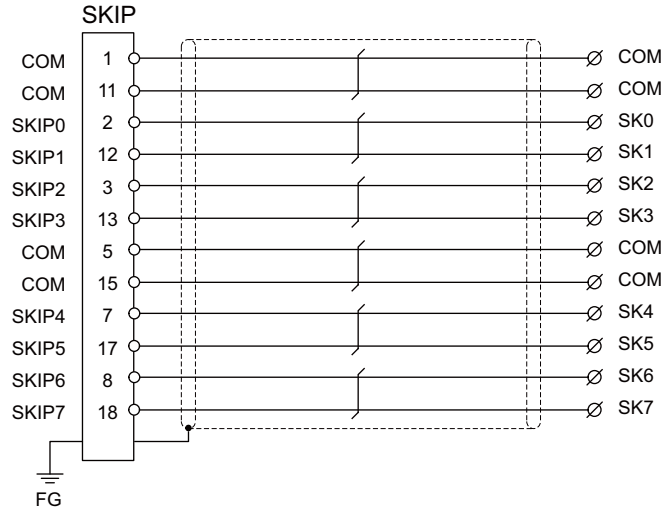
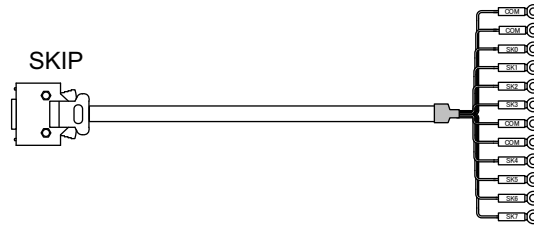
Crimp terminal : R1.25-4 × 3

Recommended manufacturer :
JST

18.2.13 J100 Cable

Max. cable length: 20m

Application: Skip



[SKIP]

Connector : 10120-3000PE

Case : 10320-52F0-008

Recommended manufacturer : 3M

Wire material :

UL2464 U-TKVBS AWG24 × 6P

Recommended manufacturer :

Tachii Electric Wire

Crimp terminal : R1.25-3.5 × 12

Recommended manufacturer : JST

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

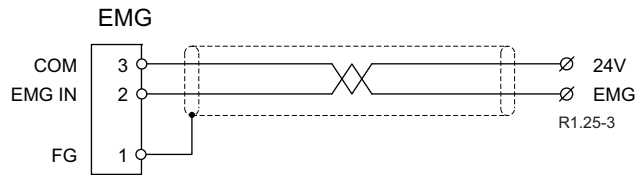
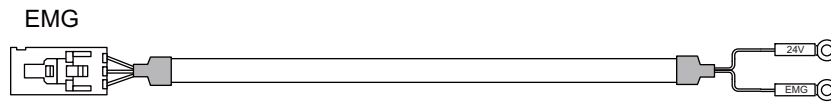
(Note 2) When using the jackscrew M2.6-type 10320-52A0-008 for the shell, do not fasten the screws too tightly otherwise the connector and the PCB may be damaged.

(Manufacturer recommended tightening torque: 0.20±0.05N·m)

18.2.14 J120 Cable

Max. cable length: 30m

Application: Emergency stop cable



[EMG]

Connector : 50-57-9403

(former model number: 51030-0330)

Contact : 0016020103

(former model number: 50084-8160)

Recommended manufacturer : MOLEX

Wire material :

2464C BIOS-CL3-22 01P

Recommended manufacturer :

BANDO DENSEN

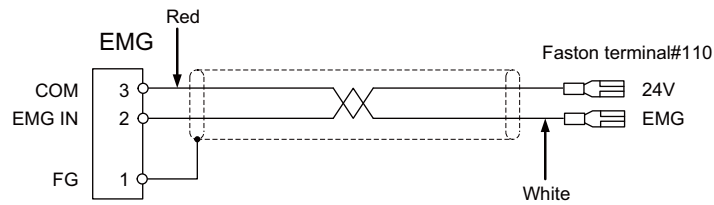
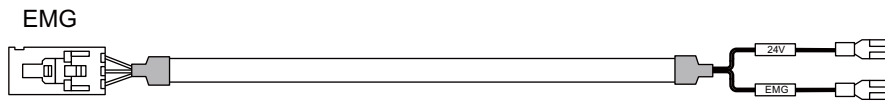
Crimp terminal : V1.25-3 × 2

Recommended manufacturer : JST

18.2.15 J121 Cable

Max. cable length: 30m

Application: Emergency stop cable for MITSUBISHI CNC machine operation panel



[EMG]

Connector : 50-57-9403

Contact : 0016020103

Recommended manufacturer : MOLEX

Wire material :

2464C BIOS-CL3-22 01P

Recommended manufacturer :

BANDO DENSEN

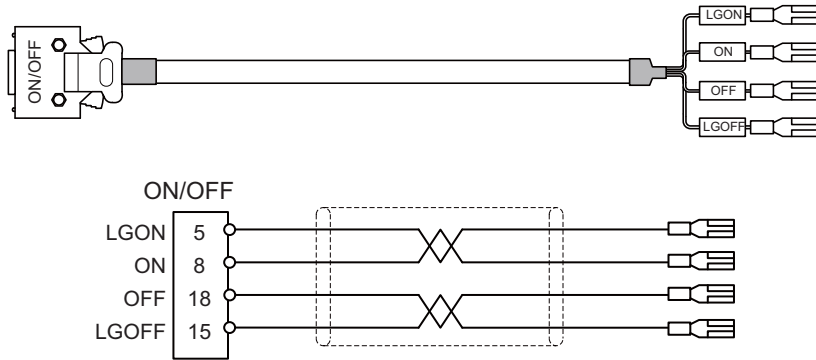
Crimp terminal : Faston terminal #110 with

insulating coating

18.2.16 J170 Cable

Max. cable length : 15m

Application : ON/OFF switch cable (ON/OFF switch - Graphic control unit)



[ON/OFF]

Connector : 10120-3000PE

Case : 10320-52F0-008

Recommended manufacturer : 3M

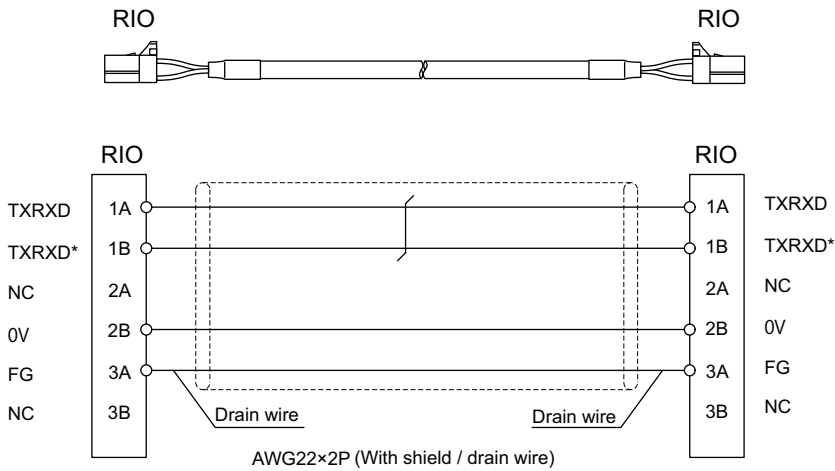
Wire material : UL1007 AWG22 Red White

Faston terminal #110 x 4

18.2.17 J210 Cable

Max. cable length: 50m

Application: Remote I/O 2.0 communication cable



[RIO]

Connector : 1-1318119-3

Contact : 1318107-1

Recommended manufacturer : Tyco Electronics

Wire material : HK-SB/20276XL Black LF 2P x 22AWG

Recommended manufacturer :

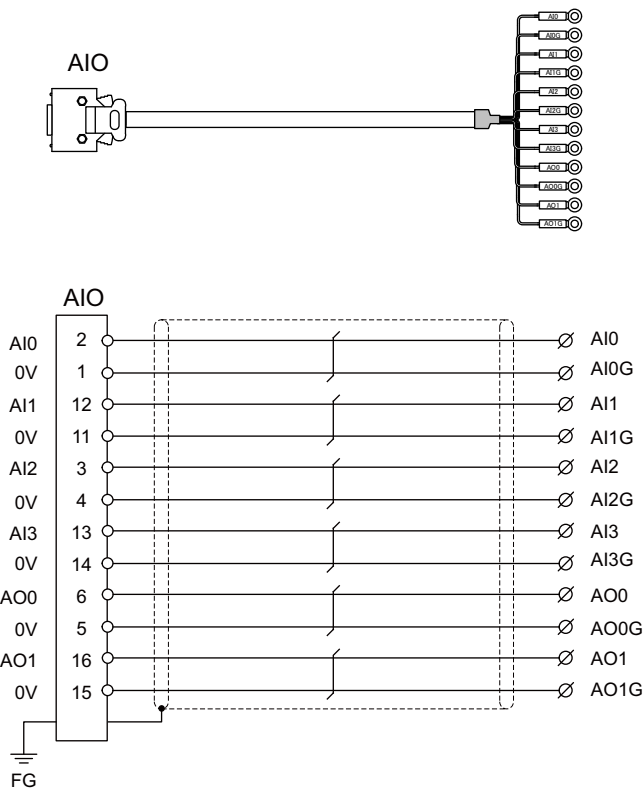
Taiyo Cabletec

(Note 1) Use the wire material of which impedance characteristics is 110Ω.

18.2.18 J220 Cable

Max. cable length: 30m

Application: Analog output cable



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

Wire material :
 UL2464 U-TKVVBS AWG24 × 6P
 Recommended manufacturer :
 Tachii Electric Wire

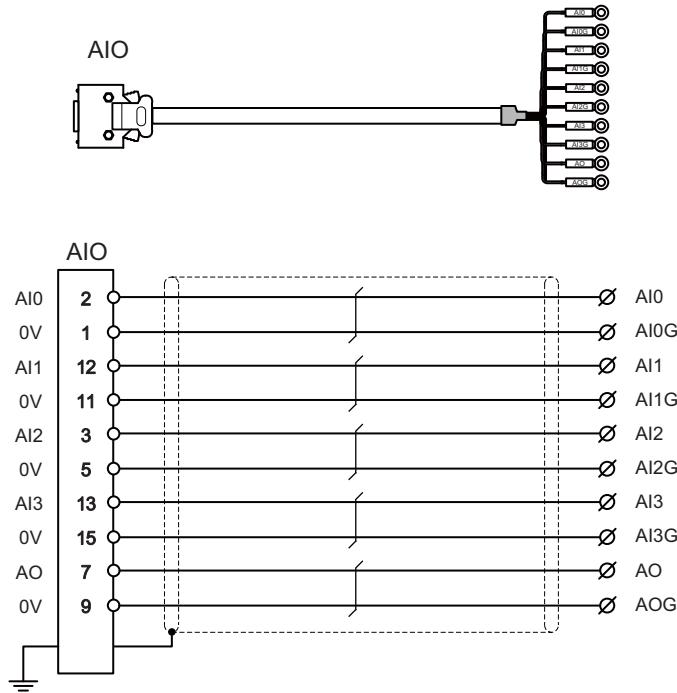
Crimp terminal : R1.25-3.5 × 12
 Recommended manufacturer : JST

- (Note 1) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.
- (Note 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±0.05N·m)

18.2.19 J221 Cable

Max. cable length: 30m

Application: Analog input/output cable (for remote I/O unit)



[AIO]

Connector : 10120-3000PE

Case : 10320-52F0-008

Recommended manufacturer : 3M

Wire material :

UL2464 U-TKVVBS AWG24 × 6P

Recommended manufacturer :

Tachii Electric Wire

Crimp terminal : R1.25-3.5 x 10

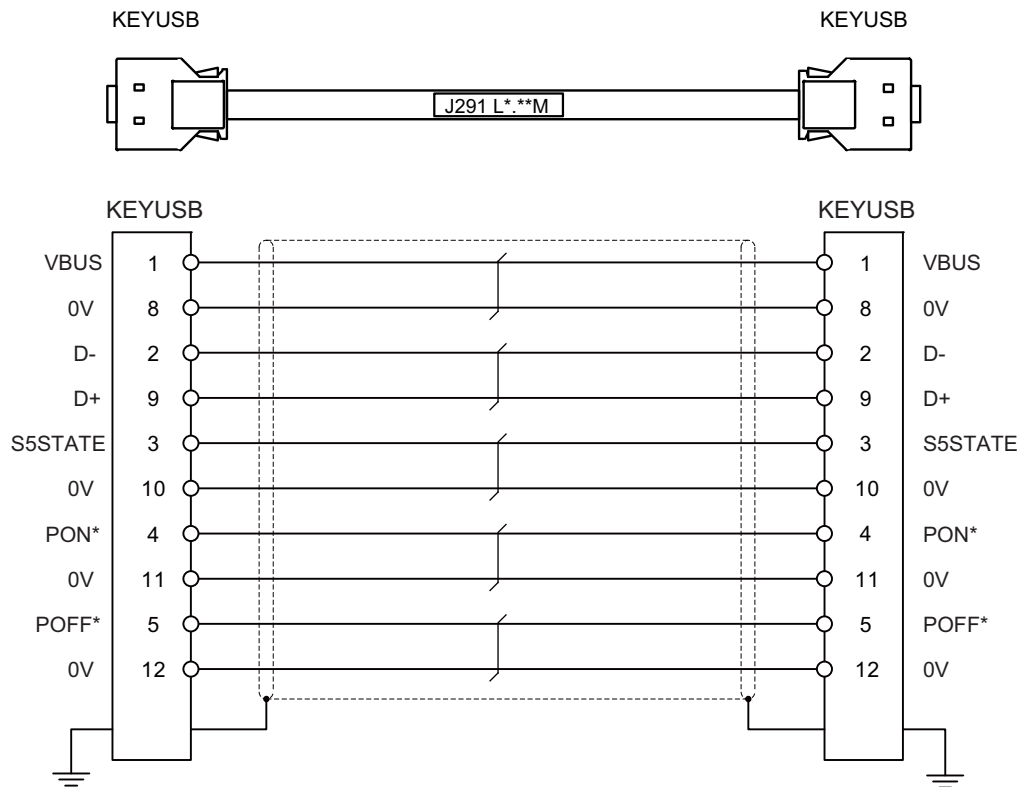
Recommended manufacturer : JST

- (Note 1) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.
- (Note 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±0.05N·m)
- (Note 3) FCUA-R031 cable of the conventional models is also available to use.
- (Note 4) For FCUA-R031, AOG and AI3G share the pin #15. For J221, however, AOG uses the pin #9.

18.2.20 J291 Cable

Max. cable length: 1m

Application: Connection cable between personal computer unit and operation panel I/O unit



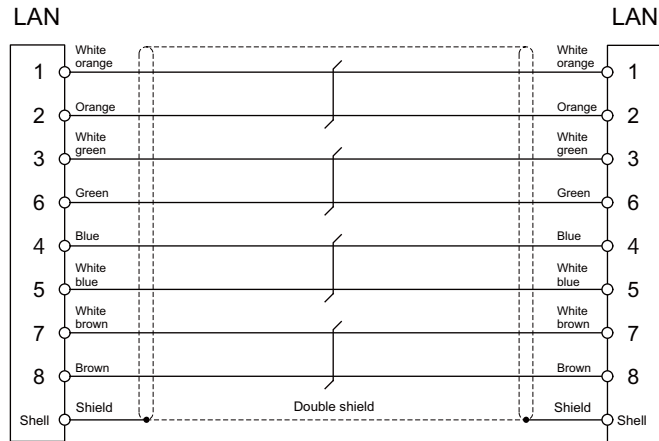
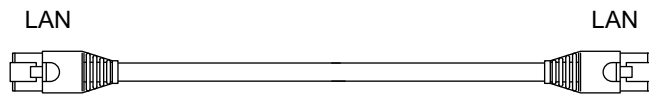
[KEYUSB]
 Connector : HDR-E14MAG1+ *HTK
 Case : HDR-E14LPN5 *HTK
 Recommended manufacturer :
 HONDA TSUSHIN KOGYO

Wire material :
 BIOS (AWG#30 corresponding to UL20276)-AWG30-10P
 Recommended manufacturer :
 Bando Electric Wire

18.2.21 J303 Cable

Max. cable length: 50m

Application: LAN straight cable



[LAN]

Connector : J00026A0165

Boot : B00080F0090

Recommended manufacturer :

JAPAN Telegärtner

Wire material :

FANC-IEF-SB 24AWG × 4P

Recommended manufacturer :

Kuramo Electric

18.2.22 J350 Cable

Max. cable length: 50m

Application: DI/DO

CJ31,CJ32,CJ33,CJ34,
CG31,CG32,CG33,CG34



[CJ31,CJ32,CJ33,CJ34,CG31,CG32,CG33,CG34]
Connector: XG4M-4030 / 7940-6500SC
Strain relief: XG4T-4004 / 3448-7940
Recommended manufacturer: OMRON / 3M

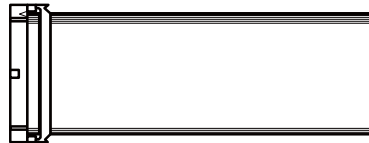
Wire material: UL2651 AWG28x40 (FLEX-S(40)-7/0.127 7030
2651P)
Recommended manufacturer: Oki Electric Cable

18.2.23 J351 Cable

Max. cable length: 50m

Application: DI/DO

CJ31,CJ32,CJ33,CJ34,
CG31,CG32,CG33,CG34



[CJ31,CJ32,CJ33,CJ34,CG31,CG32,CG33,CG34]
Connector: XG4M-4030 / 7940-6500SC
Strain relief: XG4T-4004 / 3448-7940
Recommended manufacturer: OMRON / 3M

Wire material: UL2651 AWG28x40 (FLEX-S(40)-7/0.127 7030
2651P)
Recommended manufacturer: Oki Electric Cable

18.2.24 J460 Cable**Max. cable length: 50m****Application: DI/DO**

CJ37,CJ39



[CJ37,CJ39]

Connector: XG4M-5030 / 7950-6500SC

Strain relief: XG4T-5004 / 3448-7950

Recommended manufacturer: OMRON / 3M

Wire material: UL2651 AWG28x50 (FLEX-S(50)-7/0.127 7030 2651P)

Recommended manufacturer: Oki Electric Cable

(Note) This cable is used to connect the operation panel I/O unit.

18.2.25 J461 Cable**Max. cable length: 50m****Application: DI/DO**

CJ37,CJ39



[CJ37,CJ39]

Connector: XG4M-5030 / 7950-6500SC

Strain relief: XG4T-5004 / 3448-7950

Recommended manufacturer: OMRON / 3M

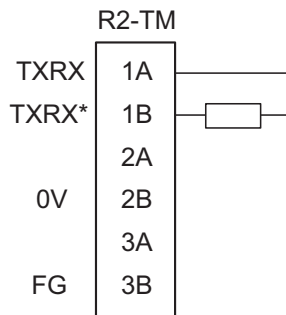
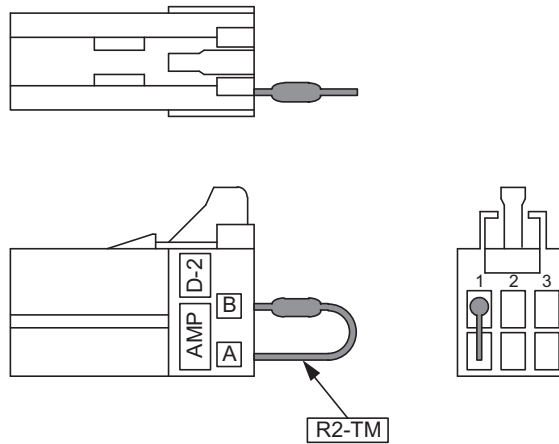
Wire material: UL2651 AWG28x50 (FLEX-S(50)-7/0.127 7030 2651P)

Recommended manufacturer: Oki Electric Cable

(Note) This cable is used to connect the operation panel I/O unit.

18.2.26 R2-TM Terminator Connector

Application: Terminator for OPI interface



[R2-TM]
 Connector: 1-1318119-3
 Contact: 1318108-1
 Recommended manufacturer: Tyco Electronics
 Resistor: 110Ω 1/4W

- (Note 1) The parts used shall be Mitsubishi recommended parts. Equivalent parts may be used providing they are compatible with the specifications.
- (Note 2) Cover the 110Ω terminator with a black insulation tube.
- (Note 3) Stamp the connector name "R2-TM" in white on the rear of the connector.

18.3 Cable Relating to Drive Unit

18.3.1 Cable Wire and Assembly

(1) Cable wire

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

(a) Heat resistant specifications cable

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

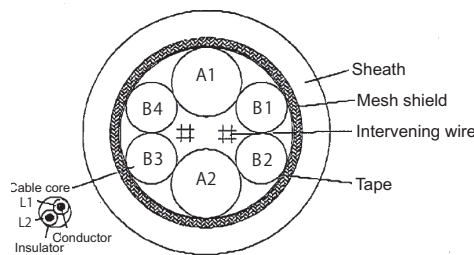
(b) General-purpose heat resistant specifications cable

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

(Note 1) Bando Electric Wire (<http://www.bew.co.jp/>)

(Note 2) The Mitsubishi standard cable is the (a) Heat resistant specifications cable. When the working environment temperature is low and so higher flexibility is required, use the (b) General-purpose heat resistant specifications cable.

Compound 6-pair cable structure drawing

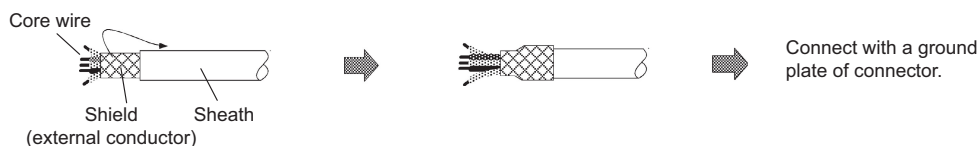


Core identification

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

(2) Cable assembly

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



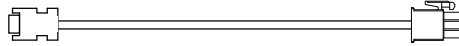
18.3.2 CNP2E-1 Cable

Max. cable length: 30m

Application: Motor side PLG cable

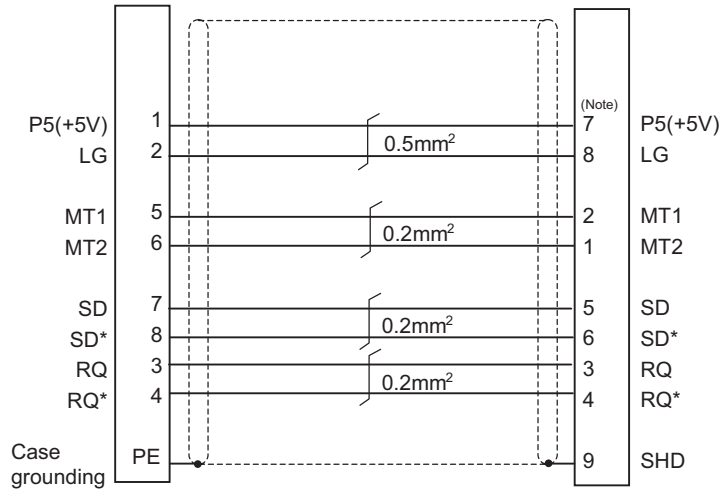
Spindle side accuracy encoder

TS5690 cable



Spindle drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019

Spindle motor side connector
(Tyco Electronics)
Connector: 172169-1
Contact: 170363-1(AWG26-22)
170364-1(AWG22-18)

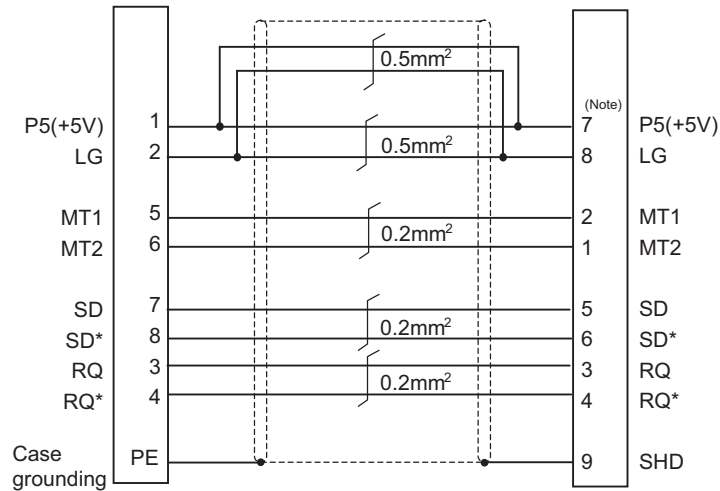


(Note) For the pin "7" or "8", use the contact "170364-1".
For the other pins, use the contact "170363-1".

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

Spindle drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019

Spindle motor side connector
(Tyco Electronics)
Connector: 172169-1
Contact: 170363-1(AWG26-22)
170364-1(AWG22-18)



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

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

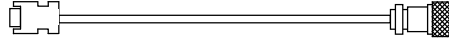
18.3.3 CNP3EZ-2P/CNP3EZ-3P Cable

Max. cable length: 30m

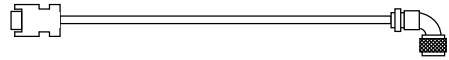
Application: Spindle side encoder cable

OSE-1024 cable

CNP3EZ-2P (Straight)

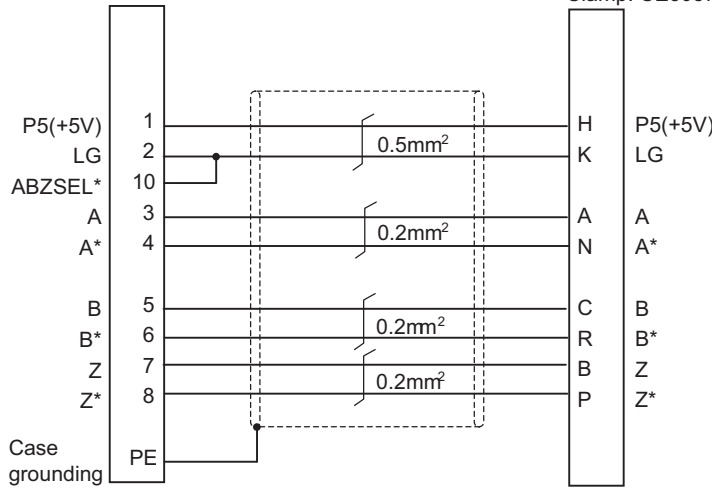


CNP3EZ-3P (Angle)



Spindle drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019

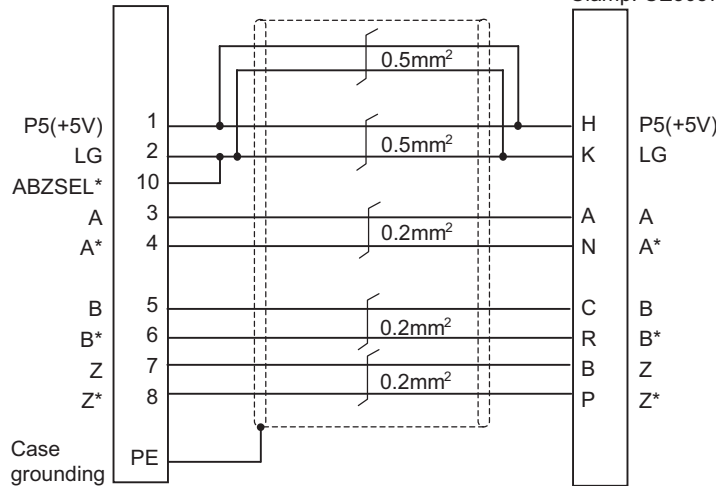
Spindle motor side connector
(DDK)
Connector: MS3106A20-29S (D190)
Back shell: CE02-20BS-S (straight)
CE-20BA-S (angle)
Clamp: CE3057-12A-3



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

Spindle drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019

Spindle motor side connector
(DDK)
Connector: MS3106A20-29S (D190)
Back shell: CE02-20BS-S (straight)
CE-20BA-S (angle)
Clamp: CE3057-12A-3



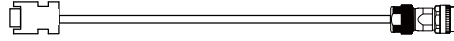
<Cable connection diagram (for 15m to 30m)>

18.3.4 CNV2E-8P/CNV2E-9P Cable

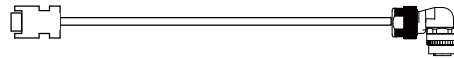
Max. cable length: 30m

Application: For HF/HF-H, HF-KP (Tool spindle) Motor side encoder cable (for A48/A51/A74N(/A74)) /
For HF-KP (Servo) Motor side encoder relay cable (Drive unit side) (CNV2E-8P)

CNV2E-8P (Straight)

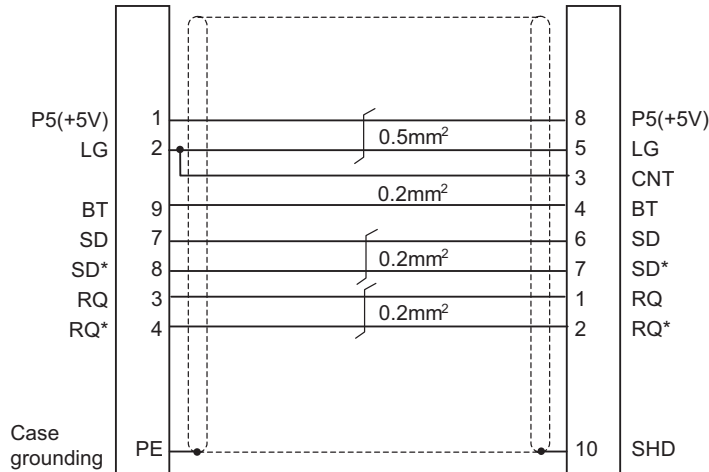


CNV2E-9P (Angle)



Drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019

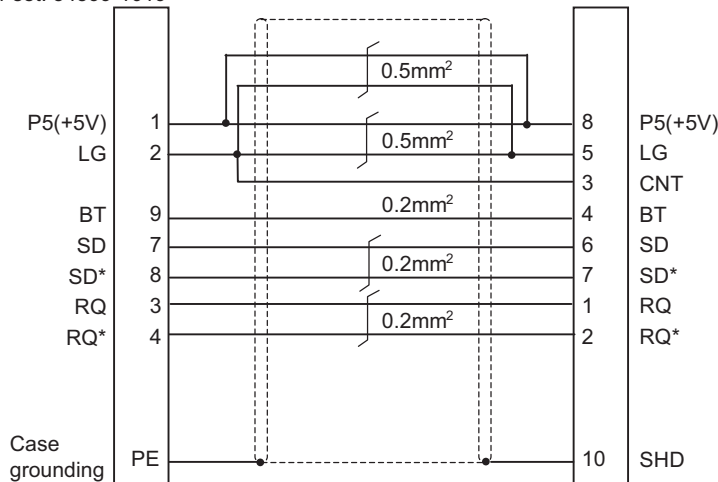
Motor encoder/
Ball screw side encoder side connector
(DDK)
Plug: CMV1-SP10S-M2 (Straight)
CMV1-AP10S-M2 (Angle)
Contact: CMV1-#22ASC-S1



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

Drive unit side connector
(3M)
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
(MOLEX)
Connector set: 54599-1019

Motor encoder/
Ball screw side encoder side connector
(DDK)
Plug: CMV1-SP10S-M2 (Straight)
CMV1-AP10S-M2 (Angle)
Contact: CMV1-#22ASC-S1



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

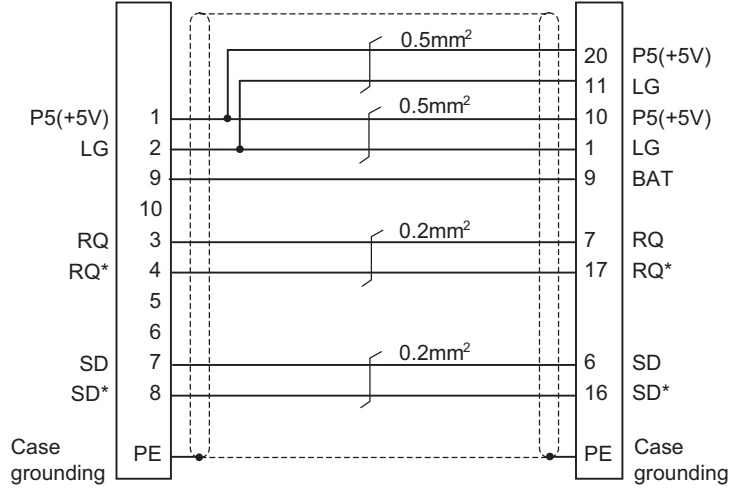
18.3.5 CNV2E-D Cable

Max. cable length: 30m
 Application: MDS-B-SD unit cable



Drive unit side connector
 (3M)
 Receptacle: 36210-0100PL
 Shell kit: 36310-3200-008
 (MOLEX)
 Connector set: 54599-1019

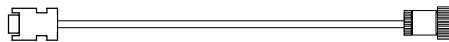
MDS-B-SD unit side connector
 (3M)
 Connector: 10120-3000VE
 Shell kit: 10320-52F0-008



<Cable connection diagram>

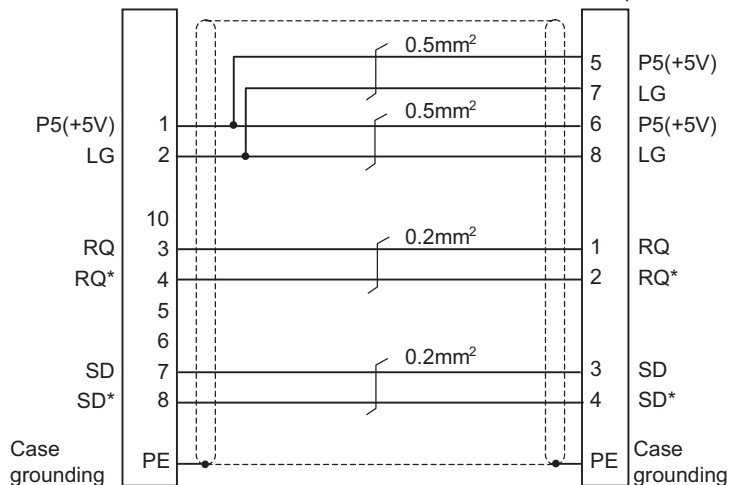
18.3.6 CNV2E-HP Cable

Max. cable length: 30m
 Application: MDS-B-HR unit cable



Drive unit side connector
 (3M)
 Receptacle: 36210-0100PL
 Shell kit: 36310-3200-008
 (MOLEX)
 Connector set: 54599-1019

MDS-B-HR unit side connector
 (Hirose Electric)
 Plug: RM15WTPZ-8S(71)
 Clamp: JR13WCCA-10(72)



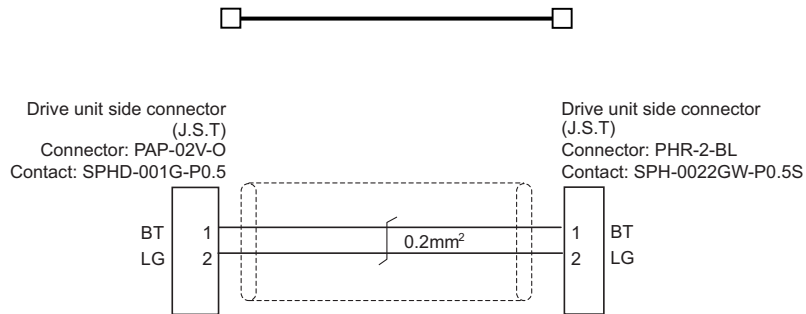
<Cable connection diagram>

18.3.7 DG30 Cable

Max. cable length: 10m

Application: Battery cable

(drive unit - battery box, drive unit - drive unit)



18.3.8 G380 Cable

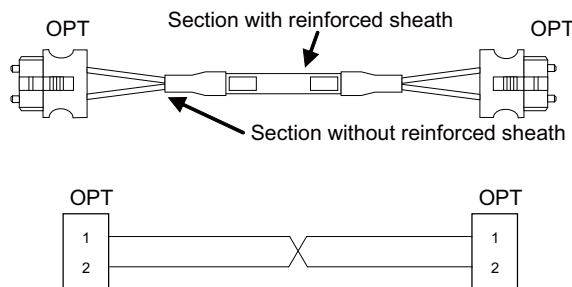
Max. cable length: 30m

Application: Optical communication cable

for wiring between drive units (outside panel)

for optical communication repeater unit

Use when the cable length is 10m or more to 30m or less.



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

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

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

- (Note 1) Binding the cables too tight with tie-wraps could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move. Recommended clamp material: KKN-13SP KITAGAWA INDUSTRIES.
- (Note 2) Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the PCF cable reinforced sheath to damage.
- (Note 3) Loop the excessive cable with twice or more than the minimum bending radius.

18.3.9 J395 Cable

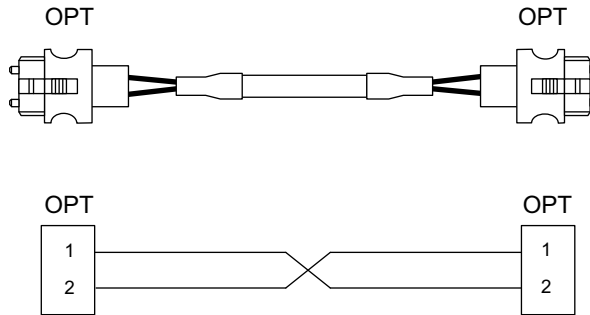
Max. cable length: 10m

Application: Optical communication cable

for wiring between drive units (outside panel)

for wiring between NC-drive units

Use when wiring outside of the panel with a cable of 10m or less.



[OPT]

Connector : LGP-Z0007PK

Recommended manufacturer :
HONDA TSUSHIN KOGYO

Wire material : PFDU-CL1002-22E60VT

Recommended manufacturer : TORAY

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

- (Note 1) Binding the cables too tight with tie-wraps could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move. Recommended clamp material: CKN-13SP KITAGAWA INDUSTRIES.
- (Note 2) Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the POF cable to break.
- (Note 3) Loop the excessive cable with twice or more than the minimum bending radius.

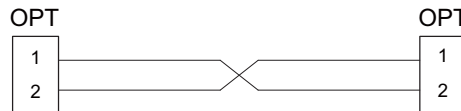
18.3.10 J396 Cable

Max. cable length: 10m

Application: Optical communication cable

for wiring between drive units (inside panel)

Use when wiring in the panel with a cable of 10m or less.



[OPT]

Connector : LGP-Z0007PK

Wire material : PFDU-CD1002-18E22T

Recommended manufacturer :
HONDA TSUSHIN KOGYO

Recommended manufacturer : TORAY

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

- (Note 1) Binding the cables too tight with tie-wraps could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move. Recommended clamp material: CKN-13SP KITAGAWA INDUSTRIES.
- (Note 2) Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the POF cable to break.
- (Note 3) Loop the excessive cable with twice or more than the minimum bending radius.

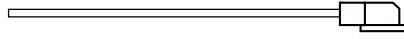
18.3.11 MR-BKS1CBL-A1-H / MR-BKS1CBL-A2-H Cable

Max. cable length: 10m

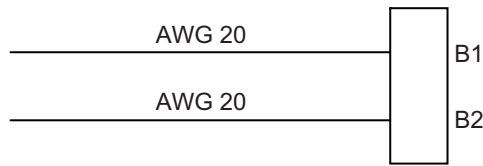
Application: <200V Series> Brake cable for HG96

MR-BKS1CBL-A1-H (load side angle)

MR-BKS1CBL-A2-H (reverse load side angle)



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

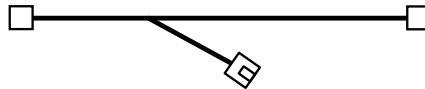


<Cable connection diagram>

18.3.12 MR-BT6V2CBL Cable

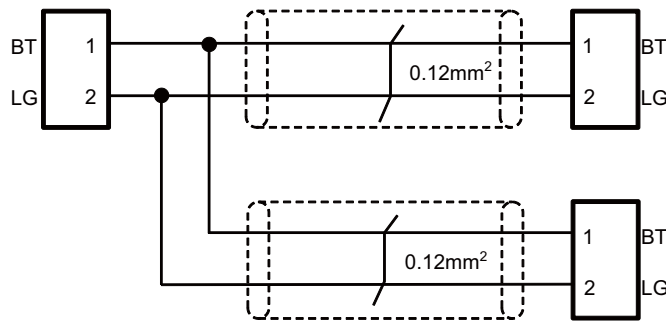
Max. cable length: 1m

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

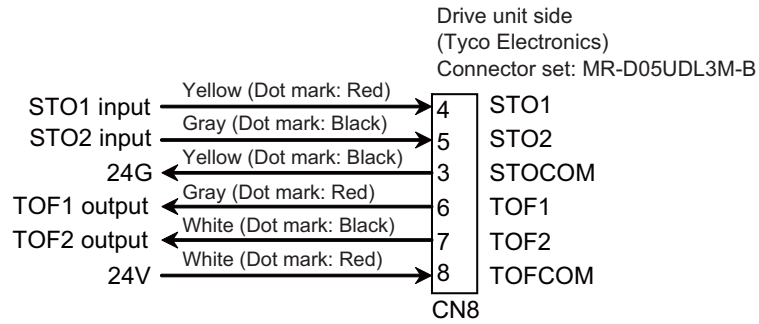


Battery unit side connector
(J.S.T)
Connector: PALR-02VF
Contact: SPAL-001T-P0.5

18.3.13 MR-D05UDL3M-B Cable

Max. cable length: 3m

Application: STO cable



18.3.14 MR-PWS1CBL-A1-H / MR-PWS1CBL-A2-H Cable

Max. cable length: 10m

Application: <200V Series> Power cable for HG96

MR-PWS1CBL-A1-H (load side angle)

MR-PWS1CBL-A2-H (reverse load side angle)



Servo motor power supply connector
(Japan Aviation Electronics)
Connector: JN4FT04SJ1-R
Hood, Socket insulator,
Bushing and Grand nut
Contact: ST-TMH-S-C1B-100(A534G)
Crimp tool: CT160-3TM5B



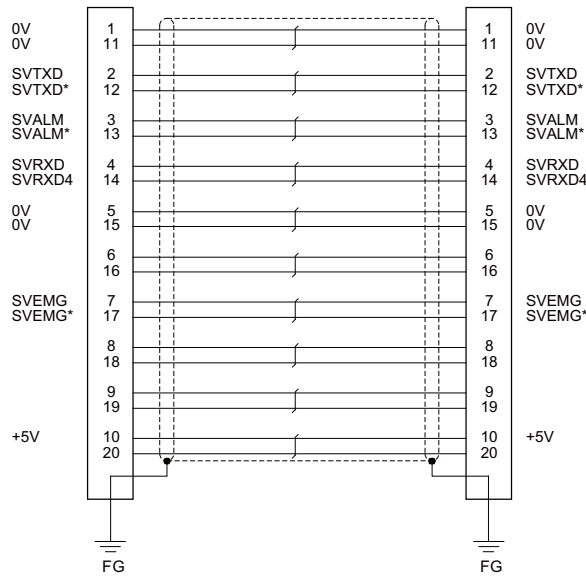
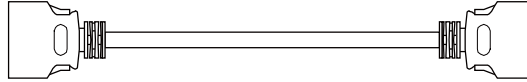
<Cable connection diagram>

18.3.15 SH21 Cable

Max. cable length: 30m

Application: Power supply communication cable
 Power backup unit communication cable

CN4, CN9



[CN4,CN9]








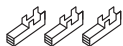


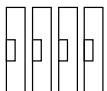
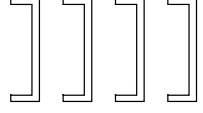

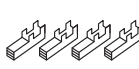
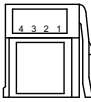
Plug: 10120-3000PE
 Shell: 10320-52F0-008
 Recommended manufacturer: 3M

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

Plug: 10120-3000PE
 Shell: 10320-52F0-008
 Recommended 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.
- (Note 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±0.05N·m)

18.4 List of Cable Connector Sets

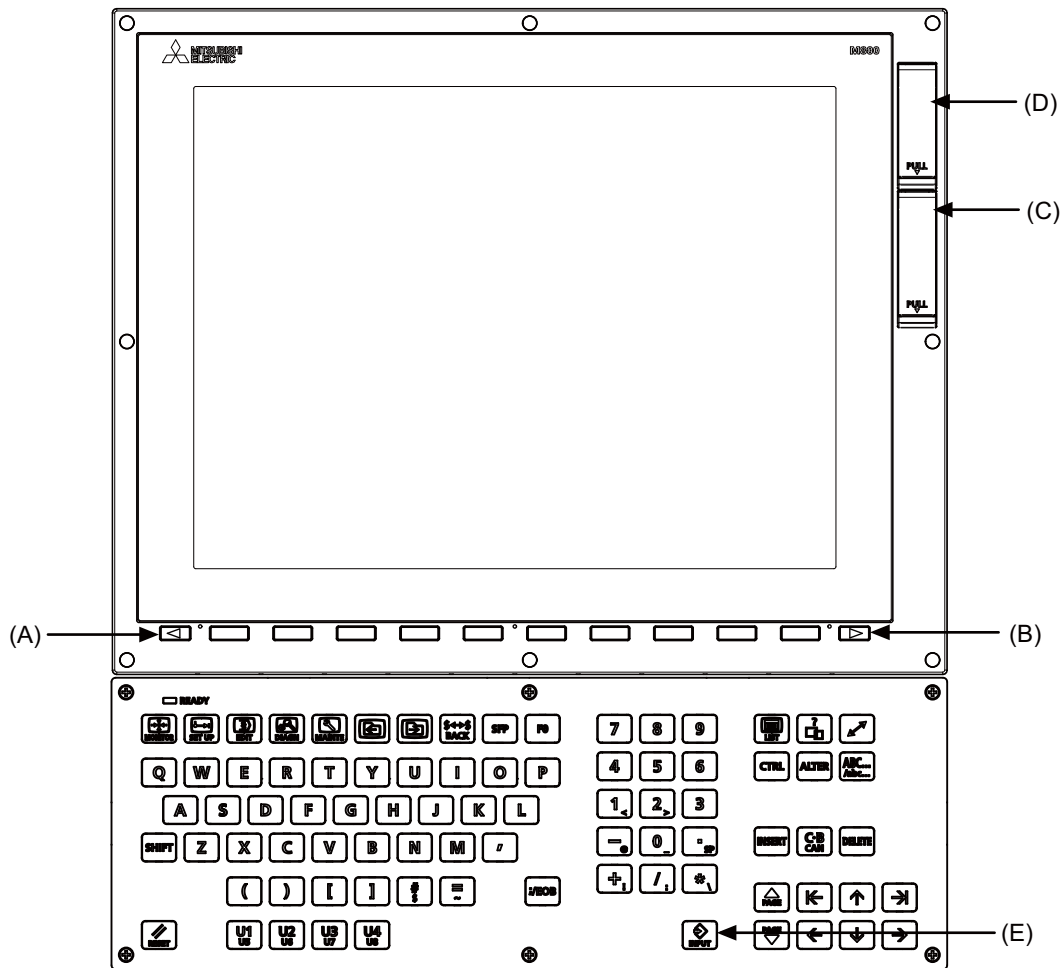
Type	Application	Package contents	
FCUA-CS000	General I/O units (For SKIP,SIO,MPG,AIO)	Connector (3M) 10120-3000PE x 2pcs. 	Shell kit (3M) 10320-52F0-008 x 2pcs. 
005057-9403 0016020103 x 3 pcs.	Emergency stop connector (For EMG)	Connector (MOLEX) 50-57-9403 x 1pc. 	Gold contact (MOLEX) 0016020103 x 3 pcs. 
RIO2 CON	Connector kit for RIO 2.0 unit	Connector (Tyco Electronics) 1-1318119-3 x 2pcs.  Connector (Tyco Electronics) 2-178288-3 x 1pc. 	Contact (Tyco Electronics) 1318107-1 x 8pcs.  Contact (Tyco Electronics) 1-175218-5 x 3pcs. 
FCUA-CN220	24VDC power supply connector (For DCIN)	Connector (Tyco Electronics) 2-178288-3 x 1pc. 	Contact (Tyco Electronics) 1-175218-5 x 3pcs. 
7940-6500SC x 4pcs. 3448-7940 x 4pcs.	DI/DO connector (for operation panel I/O unit) (for remote I/O unit)	Connector (3M) 7940-6500SC x 4pcs. 	Strain relief (3M) 3448-7940 x 4pcs. 
005057-9404 0016020103 x 4pcs.	ON/OFF switch connector	Connector (MOLEX) 50-57-9404 x 1pc. 	Contact (MOLEX) 0016020103 x 4pcs. 
37104-2165-000FL 10P	THERMISTOR connector (For thermistor input unit)	Connector (3M) 37104-2165-000FL x 10pcs. 	

Setup Outline

19.1 Hardware Configuration

The following shows the hardware names used in this manual.

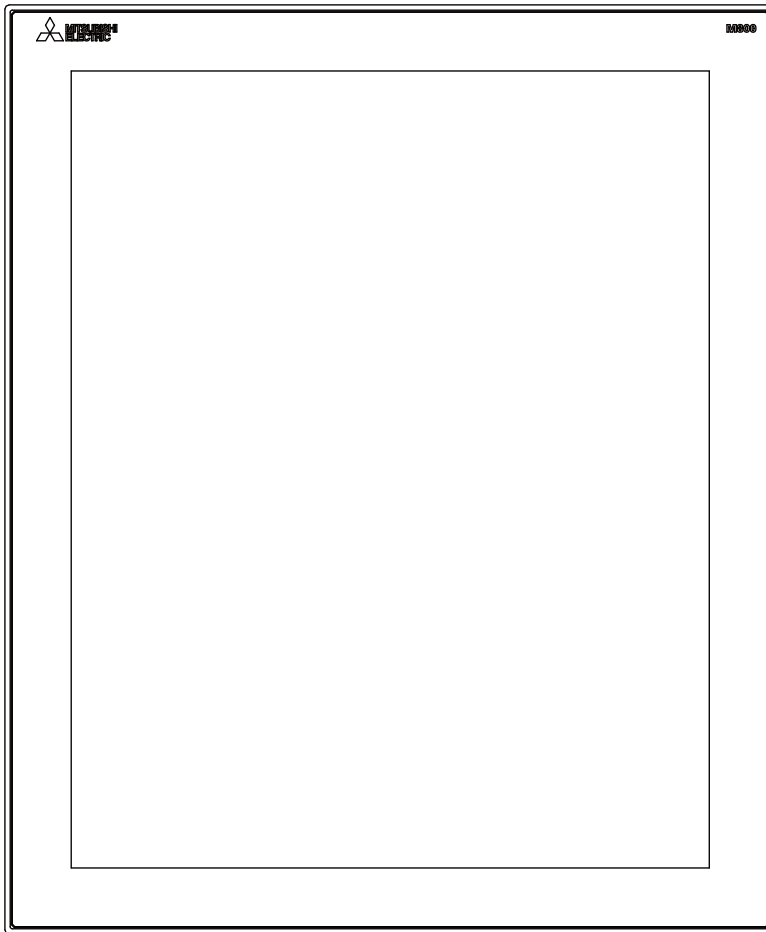
[Example of 15-type]



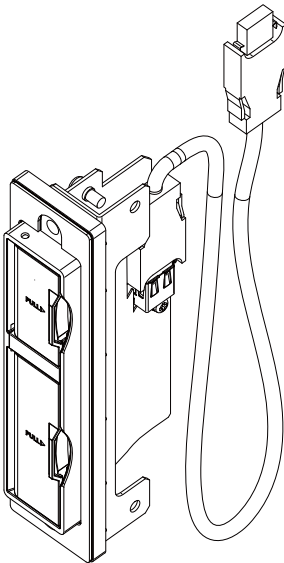
- (A) Cancel key
- (B) Menu changeover key
- (C) Front-side SD card I/F
- (D) USB Interface
- (E) [INPUT] key

[Example of 19-type]

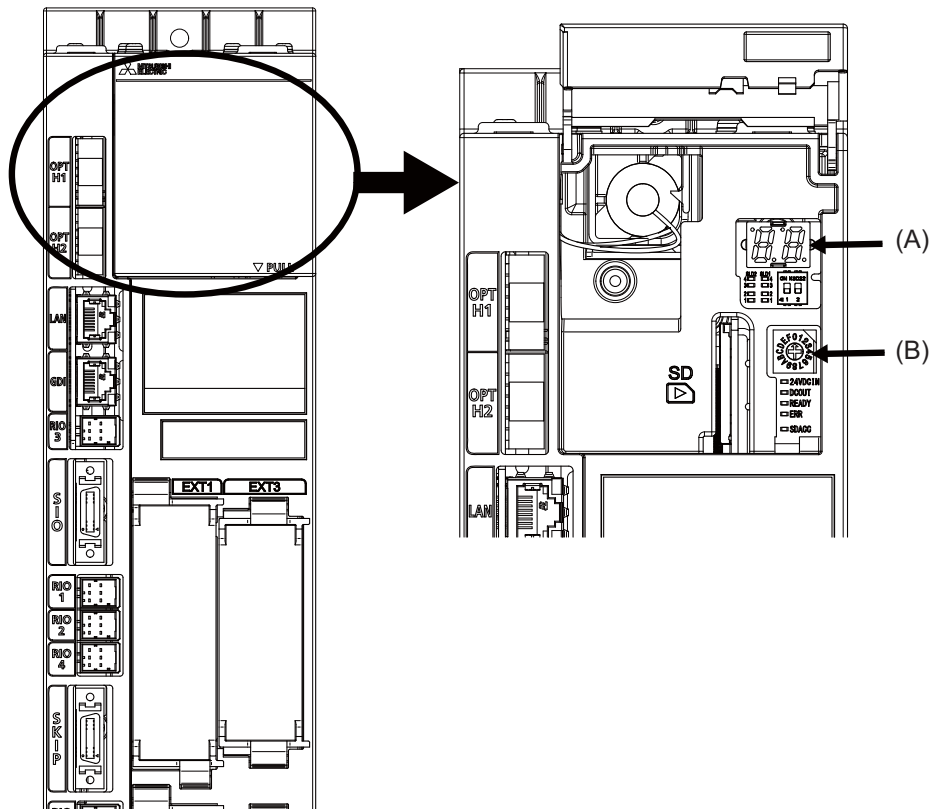
Display unit



Memory card interface



Control unit



- (A) 7-segment LED
- (B) Rotary switch

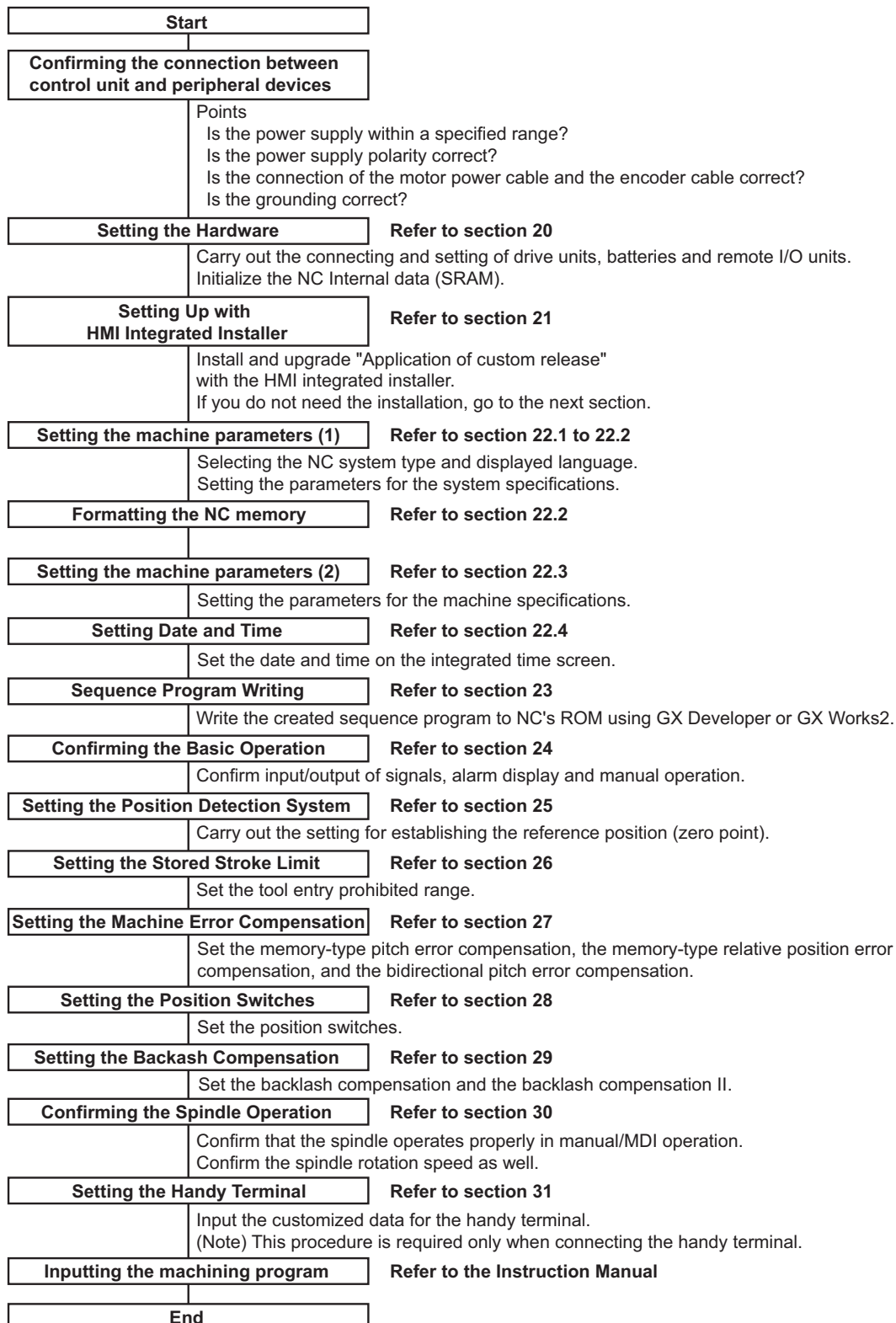
19.2 Flow of Initial Setup

The following flow chart shows the procedures of the initial setup.

(Note) When setting up with backup files, refer to the chapter of "Data Backup and Restoration".

WARNING

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



For other settings, refer to the following chapters:

- Setting the Deceleration Check
- Adjust S-analog Screen
- Device Open Parameter Screen
- SRAM Open Parameter Screen
- Data Backup and Restoration

When using the system lock, refer to the chapter of "Appendix 1: Setting the System Lock".

When using the protection setting, refer to the chapter of "Appendix 2: Protection Setting".

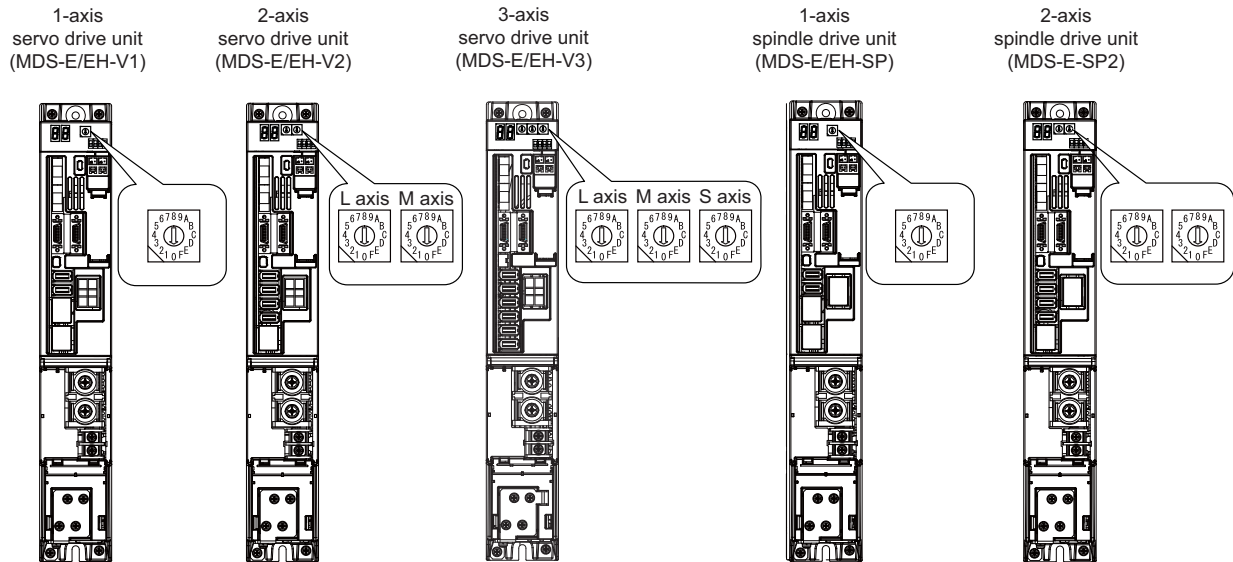
Setting the Hardware

20.1 Setting Drive Unit MDS-E/EH Series

20.1.1 Setting the Rotary Switch

Set the axis number with the rotary switch.

<Drive unit>

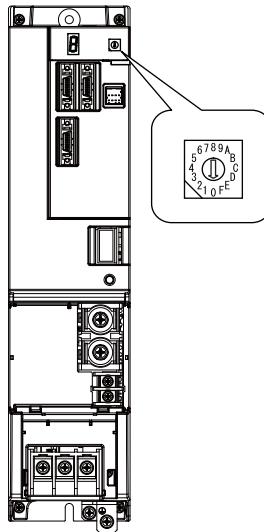


MDS-E/EH-V1/V2/SP, MDS-E/EH-V3/SP2 setting

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)

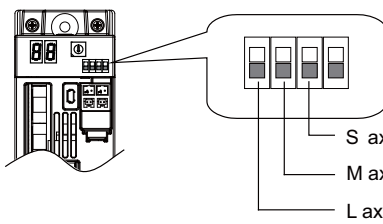


MDS-E/EH-CV setting

Rotary switch setting	Setting items
0	Normal setting
1 ~ 3	Setting prohibited
4	External emergency stop setting
5 ~ F	Setting prohibited

20.1.2 Setting DIP Switch

As a standard setting, turn the all DIP switches OFF.



The switches are OFF when facing bottom as illustrated.

- S axis Setting unused axis
- M axis Setting unused axis
- L axis Setting unused axis

Unused axis can be set by turning the switches ON.
When there is unused axis for the drive unit,
set unused axis.

CAUTION

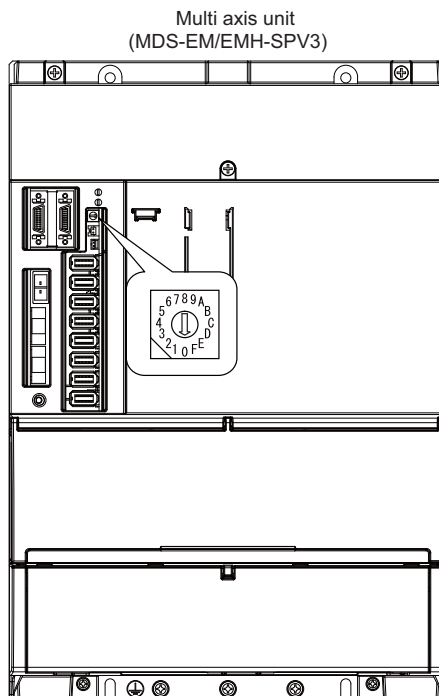
An axis set unused is not included in the functional safety.

20.2 Setting Drive Unit MDS-EM/EMH Series

20.2.1 Setting the Rotary Switch

Set the axis number with the rotary switch.

< Drive unit >



MDS-EM/EMH-SPV3 setting

Rotary switch setting	Axis configuration	Spindle	Servo		
			L-axis	M-axis	S-axis
0	Spindle + Servo 3 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 + Servo 2 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	-	-	-	-

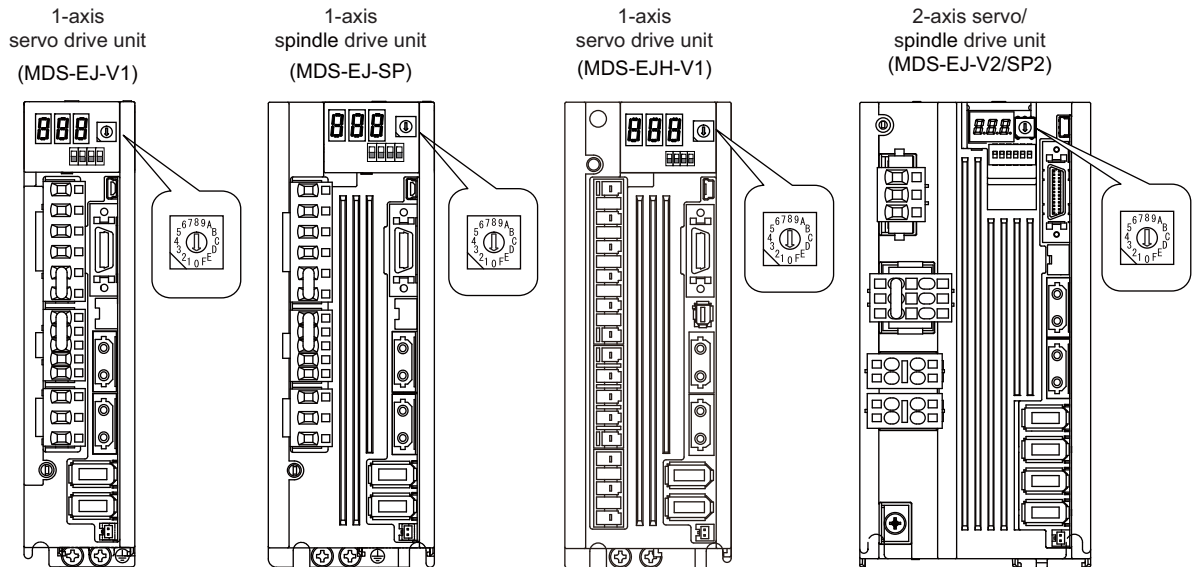
CAUTION

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.

20.3 Setting Drive Unit MDS-EJ/EJH Series

20.3.1 Setting the Rotary Switch

Set the axis number with the rotary switch.



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	

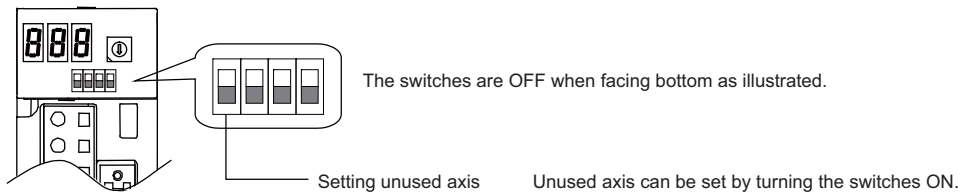
(Note 1) As for 2-axis drive unit, one rotary switch sets the L and M axes to the consecutive axis Nos.

(Note 2) As for 2-axis drive unit, the rotary switch setting "F" is prohibited.

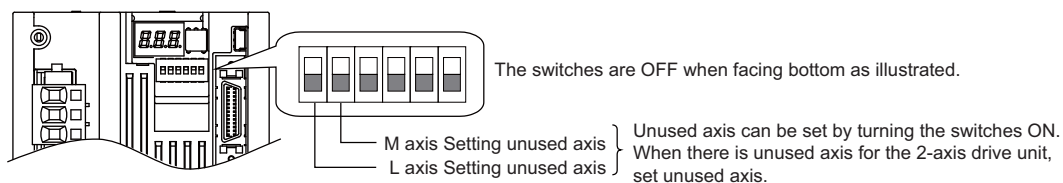
20.3.2 Setting the DIP Switch

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.

20.4 Setting Up without Connecting to the Motor/Drive Units at the Startup 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 detach 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) Do (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 axis) to the axis 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 axis: Set "#3024 sout" to "0".

After connecting to the drive unit, make sure to set "#2018 no_srv" to "0" and "#3024 sout" to "1".

20.5 Connecting the Batteries

20.5.1 Control Unit Battery

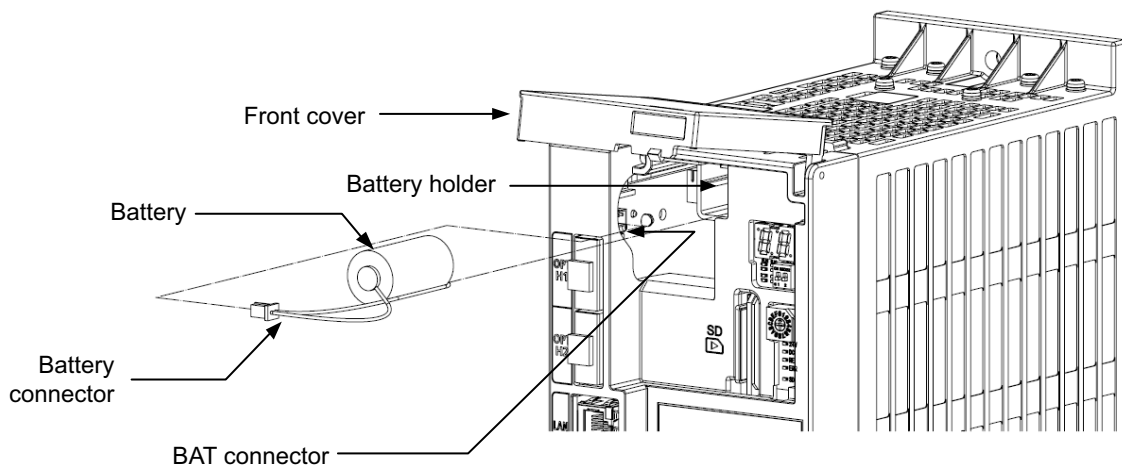
⚠ The battery is not connected when the machine is delivered. Be sure to connect the battery before starting up.

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

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

[Installation method]

- (1) Check that the machine power is turned OFF. (If the power is not OFF, turn it OFF.)
- (2) Confirm that the control unit LED, 7-segment display, etc., are all OFF.
- (3) Open the 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.



[Precautions for handling battery]

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


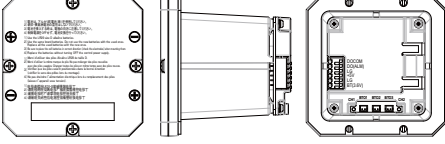
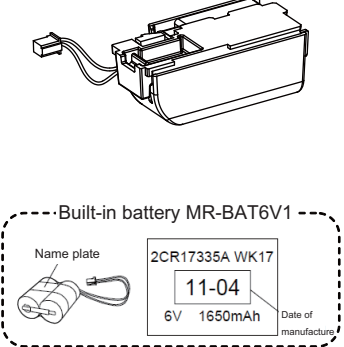
⚠ CAUTION

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

20.5.2 Servo Drive Unit Battery

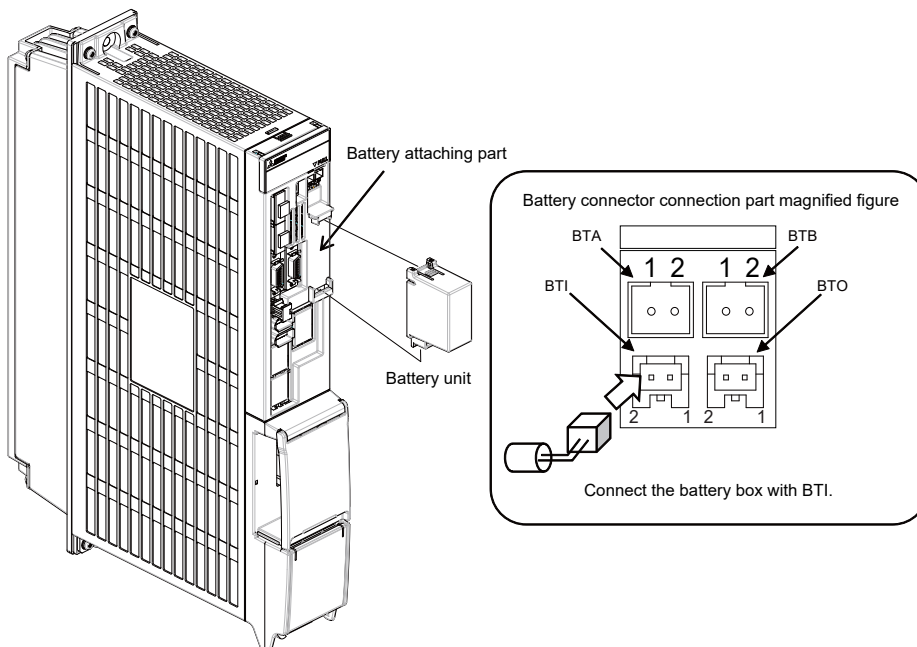
(Note) The battery connection is not necessary unless the drive unit employs absolute position detection. (Spindle drive unit does not require the battery, because the unit does not employ absolute position detection.)

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	-	○

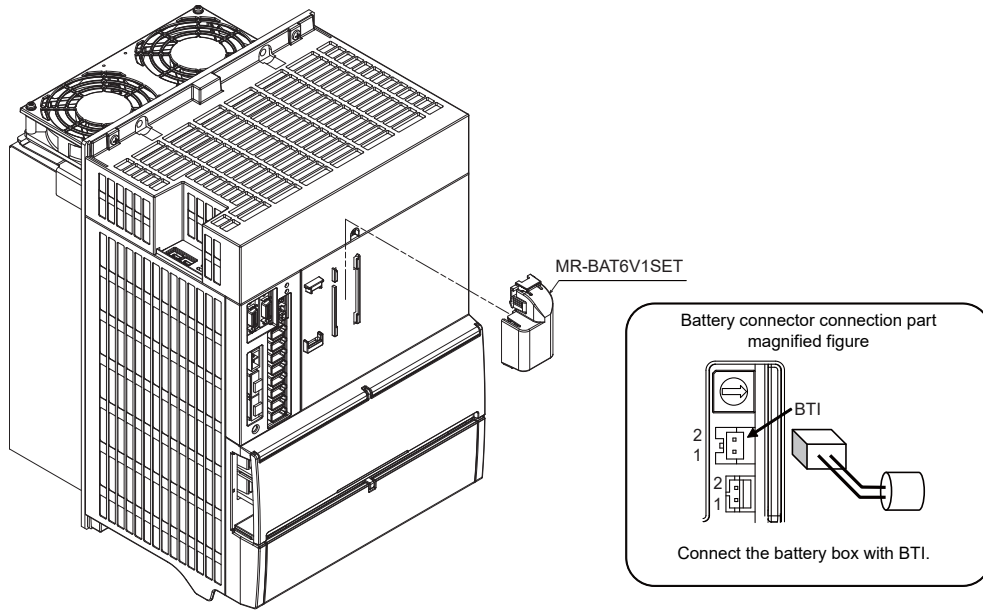
MDS-E/EH-Vx

Connect the battery connector to the connector BTI of the drive unit.



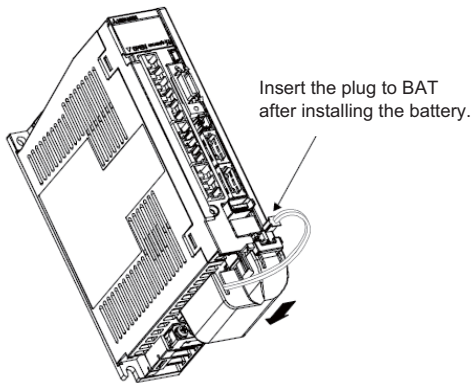
MDS-EM

Connect the battery connector to the connector BTI of the drive unit.



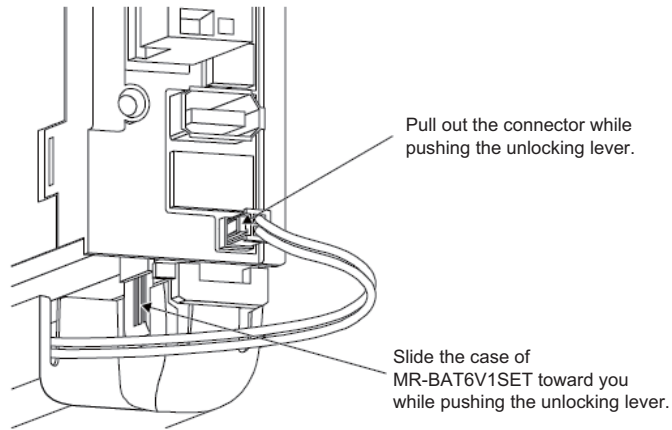
MDS-EJ/EJH-Vx

Connect the battery connector to the connector BAT of the drive unit.



Insert the plug to BAT after installing the battery.

Installation



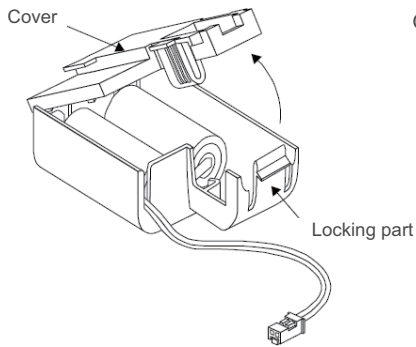
Pull out the connector while pushing the unlocking lever.

Slide the case of MR-BAT6V1SET toward you while pushing the unlocking lever.

Removal

Replacing the built-in battery

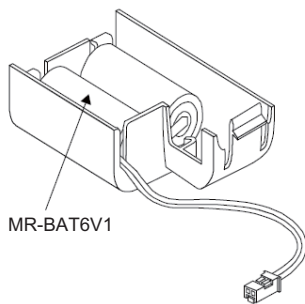
MR-BAT6V1SET that reached the end of the life can be reused by replacing the MR-BAT6V1 battery.



Cover

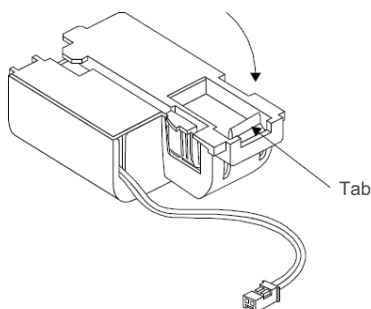
Locking part

Open the cover while pushing the locking part.



MR-BAT6V1

Replace the built-in battery with a new battery for MR-BAT6V1.



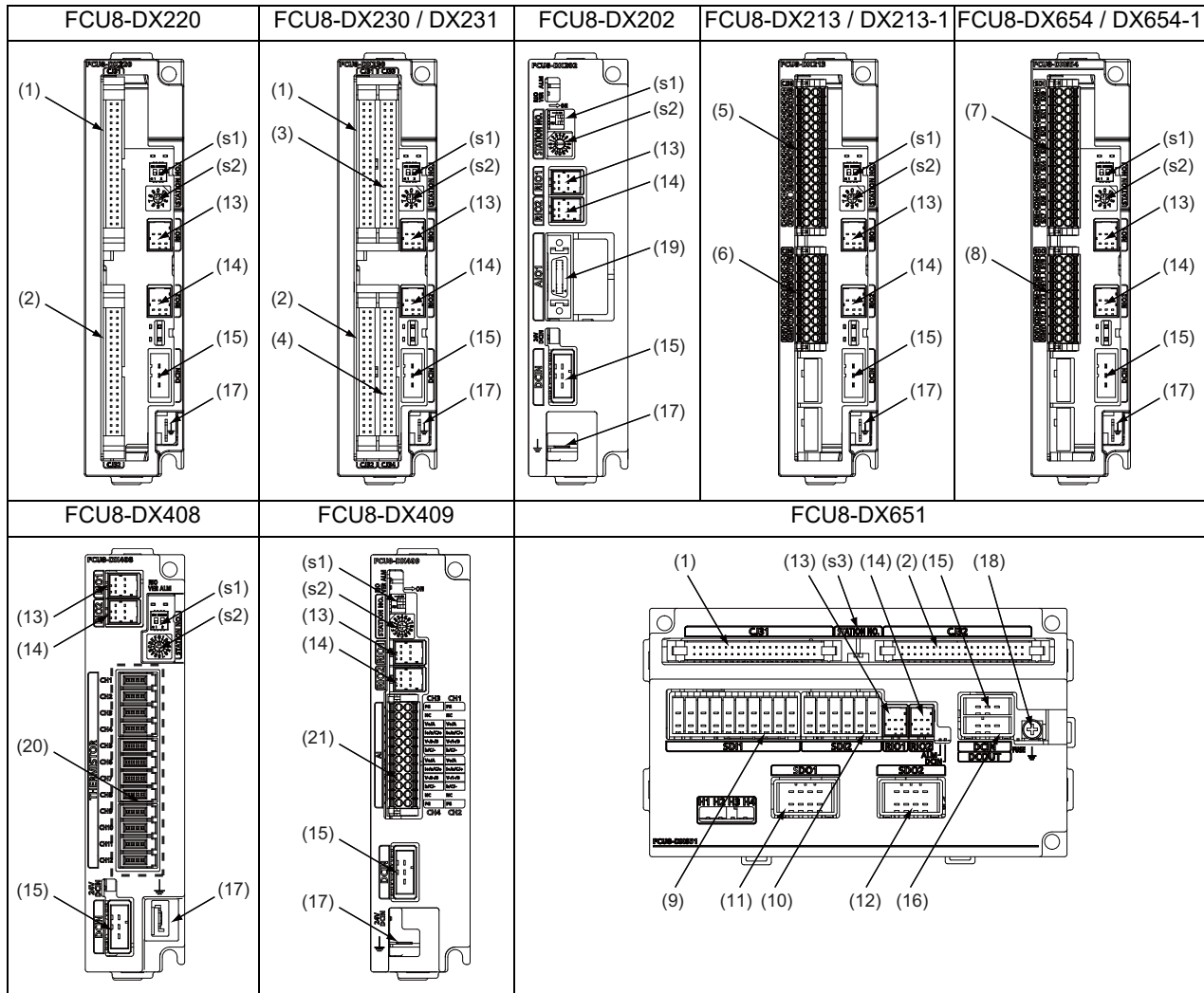
Tab

Close the cover by pushing until it is fixed with the tab of the locking part.

20.6 Connecting and Setting the Remote I/O Unit

20.6.1 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) for unit No. setting, which links the device Nos. (with X/Y).



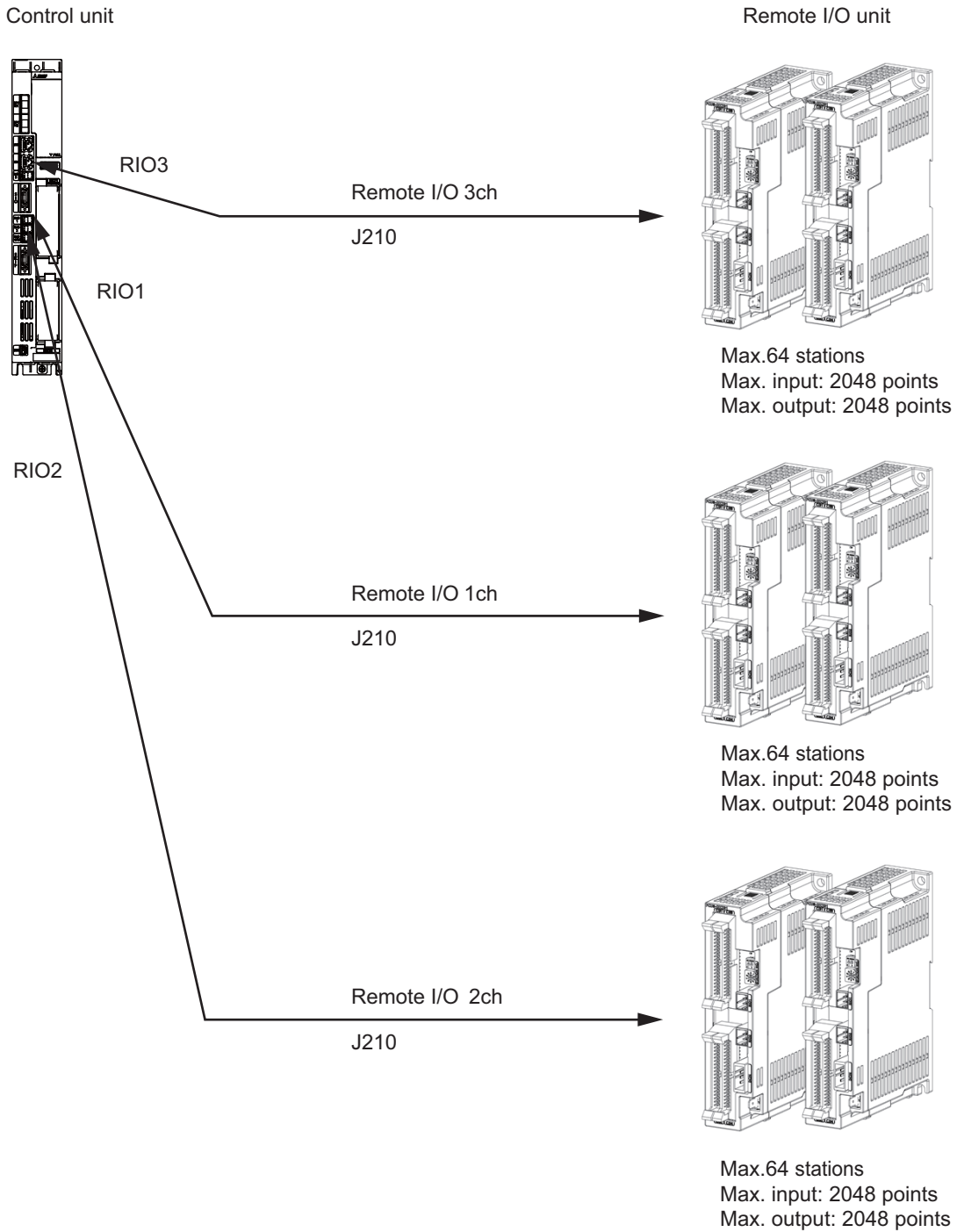
No.	Connector name	Function	No.	Connector name	Function
(1)	CJ31	Machine signal input	(12)	SDO2	Safety relay output
(2)	CJ32	Machine signal output	(13)	RIO1	Remote I/O 2.0 communication
(3)	CJ33	Machine signal input	(14)	RIO2	Remote I/O 2.0 communication
(4)	CJ34	Machine signal output	(15)	DCIN	24VDC input
(5)	CJ35	Machine signal input	(16)	DCOUT	24VDC output
(6)	CJ36	Machine signal output	(17)	FG	FG terminal
(7)	SDI	Safety machine signal input	(18)	FG	FG terminal (M4 screw)
(8)	SDO	Safety machine signal output	(19)	AIO1	Analog input Analog output
(9)	SDI1	Safety DI input	(20)	THERMISTOR	Thermistor input
(10)	SDI2	Safety DI input	(21)	AI	Multi-analog input
(11)	SDO1	Safety relay 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-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

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

When connecting directly to the control unit

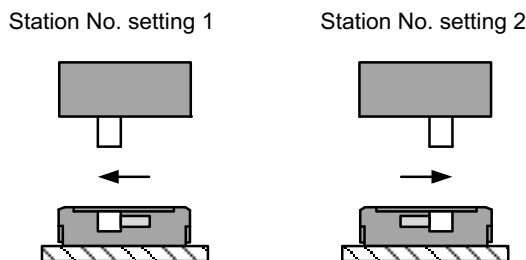


(Note) Connect the J210 cable to the RIO1, RIO2, or RIO3 connector of the control unit.
Check the connector position with the actual machine.

(Note 1) 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	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-DX561 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.

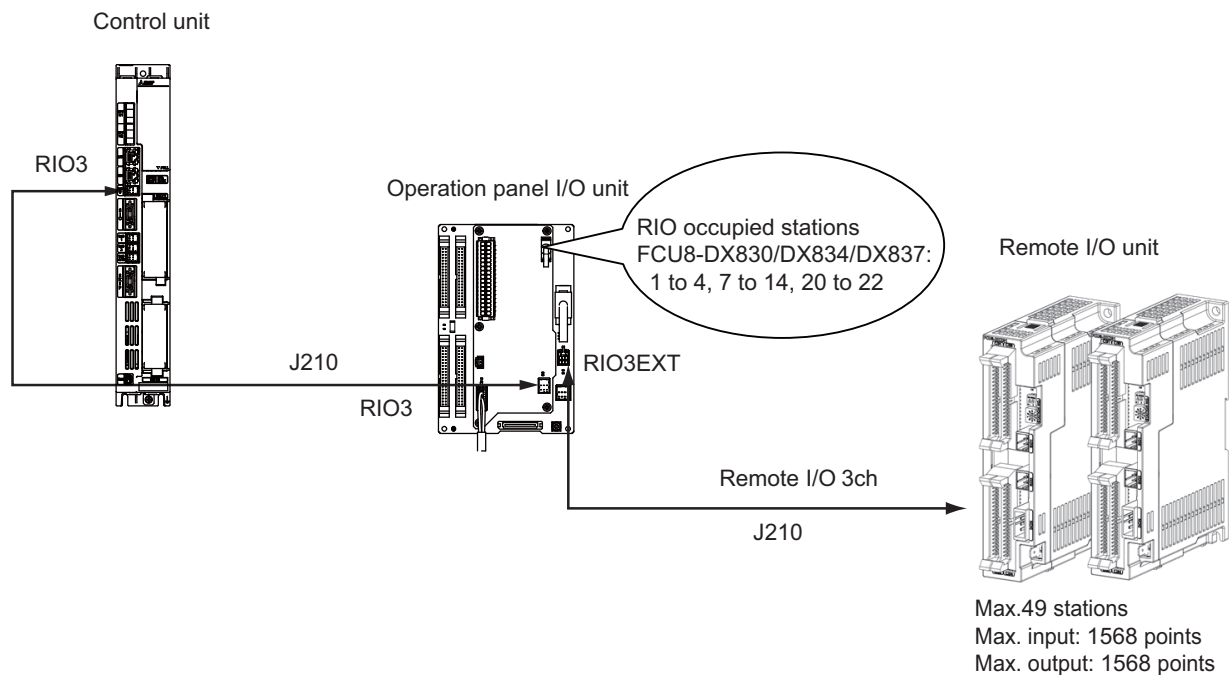


Device	Station No. setting 1	Station No. setting 2
DI/DO	Station No. 1	Station No. 4
Safety DI (SX00A to SX07A) /Safety relay output (SY00A to SY03A) /Relay feedback (SX08A to SX0BA)	Station No. 2	Station No. 5
Safety DI (SX00B to SX07B) /Safety relay output (SY00B to SY03B) /Relay feedback (SX08B to SX0BB)	Station No. 3	Station No. 6

(Note 2) Refer to "20.6.4 PLC Device Assignment of Digital Signal (DI/DO)" for device No. assignment.

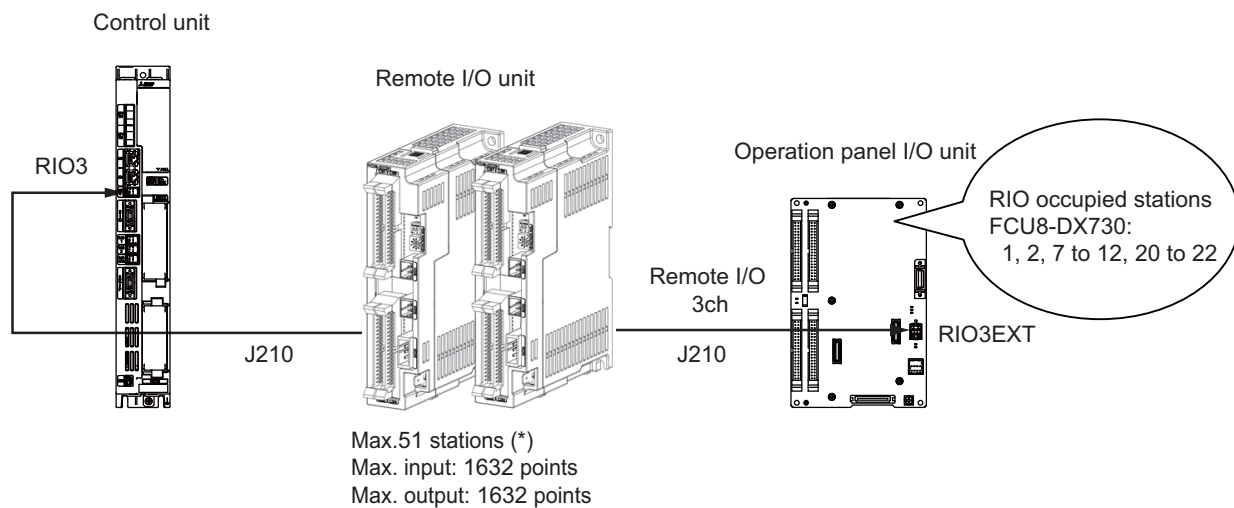
When connecting to the operation panel I/O unit

[Windows-based display]



[Non-Windows-based display]

When connecting a remote I/O unit to the 3rd RIO channel, insert it between the control unit and operation panel I/O unit.



(*) FCU8-DX730 occupies 11 stations, but 13 stations are occupied in total since the graphic control unit occupies 2 stations.

(Note 1) For FCU8-DX830/DX834/DX837, station No. 1 to 4, 7 to 14 and 20 to 22 of 64 stations are occupied, and the extensible stations are station No. 5, 6, 15 to 19 and 23 to 64.

(Note 2) FCU8-DX730 occupies the stations No. 1, 2, 7 to 12 and 20 to 22 out of the 64 stations in total. The stations No. 13 and 14 are occupied by the graphic control unit. Thus the extensible stations are station No. 3 to 6, 15 to 19 and 23 to 64.

(Note 3) Refer to "20.6.4 PLC Device Assignment of Digital Signal (DI/DO)" for device No. assignment.

(Note 4) The maximum connectable number of remote I/O units is 32.

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

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

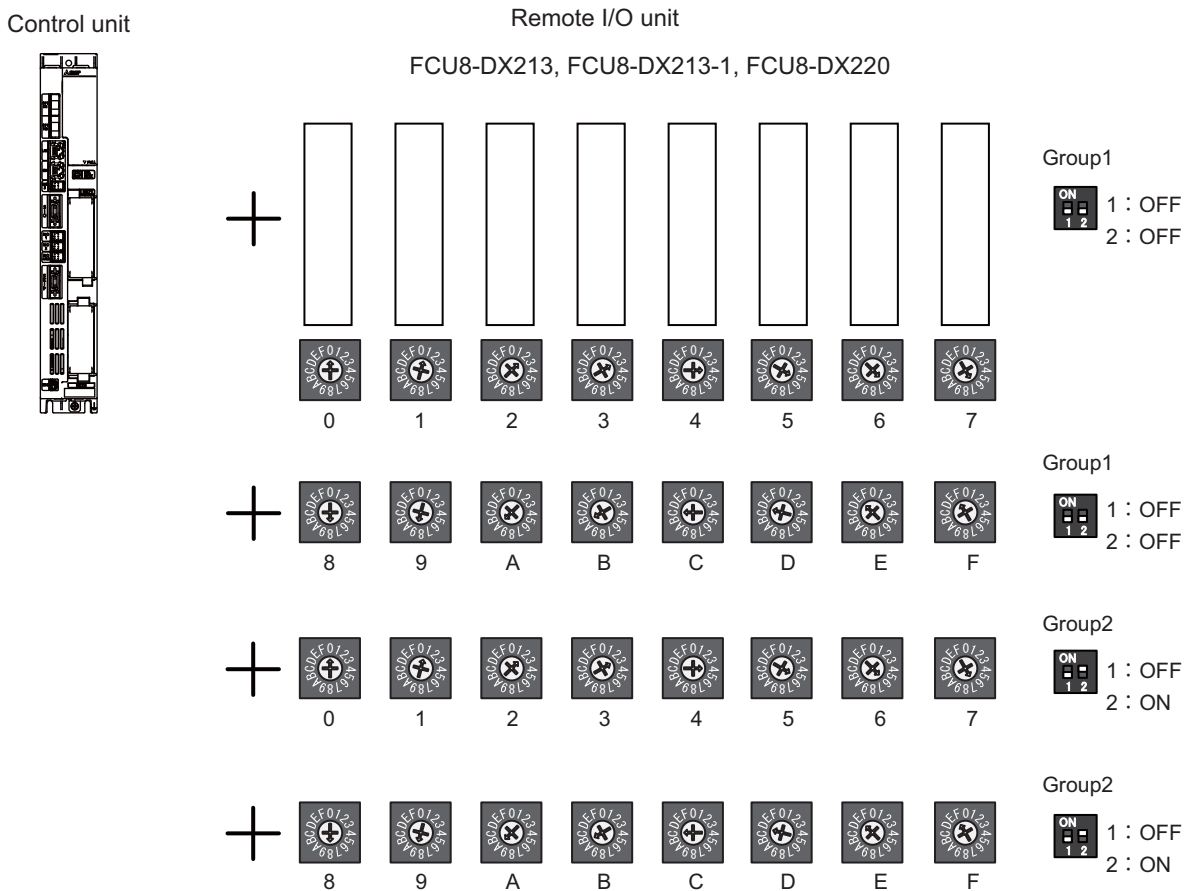
Unit type	Number of occupied stations
FCU8-DX220	1
FCU8-DX230	2
FCU8-DX231	2
FCU8-DX202	1
FCU8-DX213/DX213-1	1
FCU8-DX654/DX654-1	2
FCU8-DX651	3
FCU8-DX408 (Note 2)	3
FCU8-DX409 (Note 3)	4

When using 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.
- (Note 2) Only one FCU8-DX408 unit can be connected in the entire system.
- (Note 3) The maximum connectable number of FCU8-DX409 is four.

When connecting directly to the control unit

Setting example 1



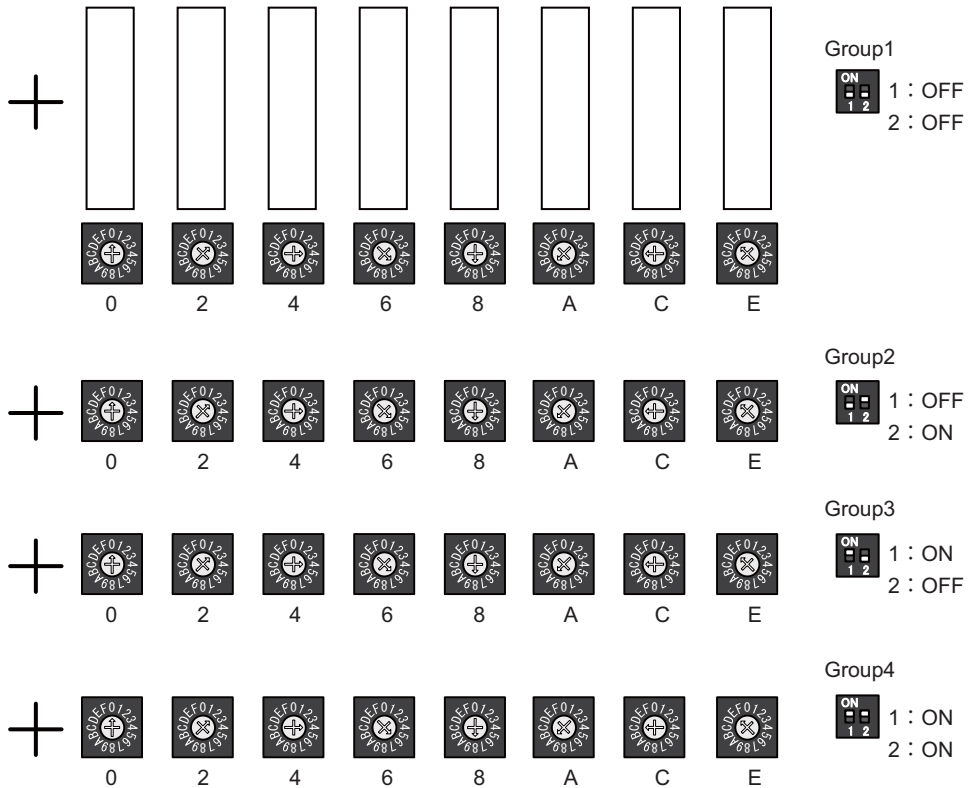
Setting example 2

Control unit



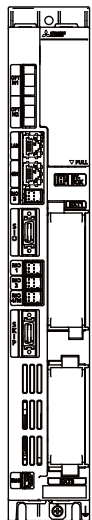
Remote I/O unit

FCU8-DX23□, FCU8-DX654, FCU8-DX654-1



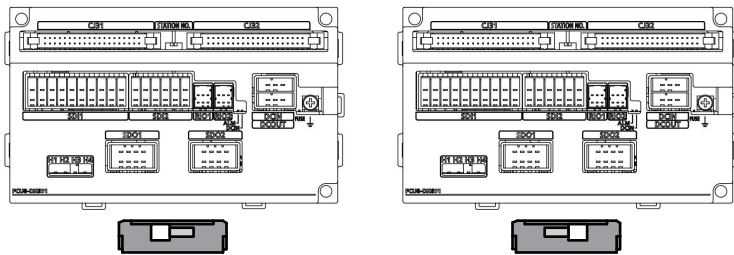
Setting example 3

Control unit



Safety remote I/O unit
with built-in relay

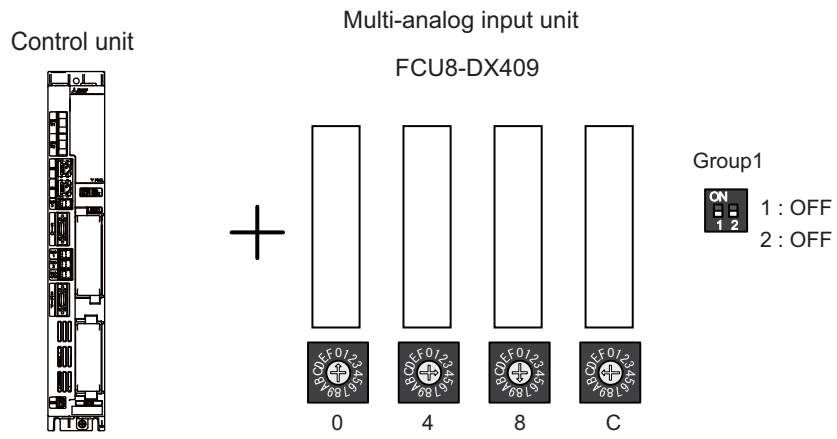
FCU8-DX651



Station No. setting 1

Station No. setting 2

Setting example 4



When connecting to the operation panel I/O unit

Operation panel I/O unit occupies 15 stations among station No. 1 to 64.
Therefore, RIO3 can occupy up to 49 stations, as shown below.

Operation panel I/O unit type	Max. number of stations (RIO3 connection)	Max. number of I/O points (RIO3 connection)
FCU8-DX830/DX834/DX837	49 stations	Input:1568 points, Output:1568 points

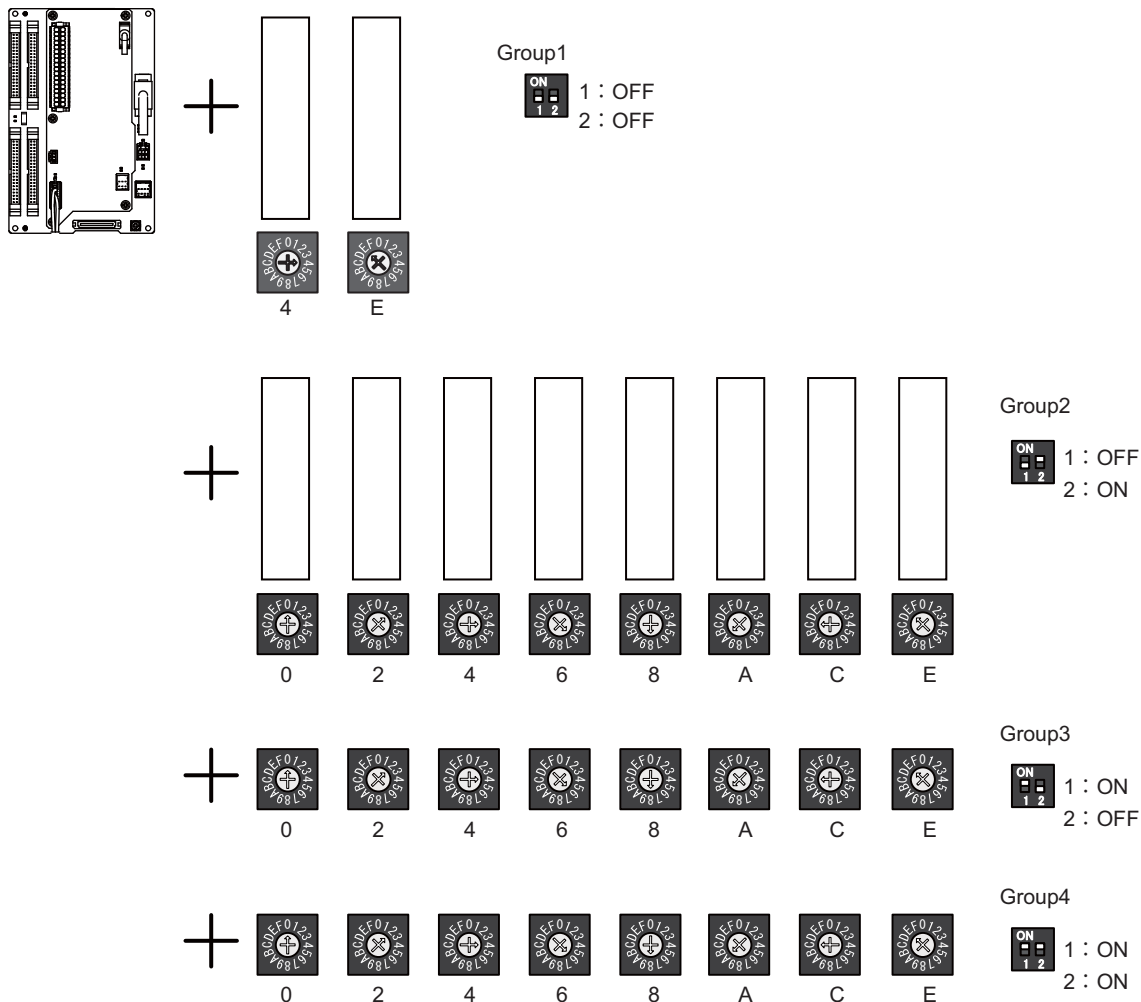
The connector RIOEXT3 can occupy up to 51 stations, as shown below.

Operation panel I/O unit type	Max. number of stations (RIO3EXT connection)	Max. number of I/O points (RIO3EXT connection)
FCU8-DX730 (*)	51 stations	Input:1632 points, Output:1632 points

(*) FCU8-DX730 occupies 11 stations, but 13 stations are occupied in total since the graphic control unit occupies 2 stations.

Setting example 1

Operation panel I/O unit Remote I/O unit
FCU8-DX23□, FCU8-DX654, FCU8-DX654-1



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

20.6.4 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" = 0

Settings are not required because the assignment to the fixed PLC devices are automatically performed.

Refer to "20.6.4.1 Fixed Device Assignment" for details.

[Arbitrary Device assignment]: Parameter "#53001 RIO dev assign" = 1

Set the PLC devices which are assigned to the DI/DO of each remote I/O unit station by the parameters.

Refer to "20.6.4.2 Arbitrary Device Assignment" for details.

20.6.4.1 Fixed Device Assignment

- (1) 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.
- (2) PLC devices assigned for each remote I/O unit station at the time of the fixed device assignment are as follows:

Channel No.		Station 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) Do not use the input/output signals of the system-occupied stations of RIO3 and operation panel I/O unit-connected channels.

- (3) 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.
 - (a) 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.
 - (b) 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.
 - (c) The parameter and R register numbers for the high-speed input/output designation are as follows:

Channel No.		Station 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.

(Note 2) Refer to "PLC Programming Manual" for details of the setting method.

20.6.4.2 Arbitrary Device Assignment

Parameter setting for device arbitrary assignment

- (1) 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.
- (2) 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.
- (3) Turn the power OFF and ON to enable arbitrary device assignment after the parameter settings.
- (4) Set the input/output device assignment and high-speed input/output specification by the parameters for each station of all remote units which have DI/DO function (except safety DI/DO). If all stations have not been set, the alarm "Y05 Initial parameter error" will be issued when the power turns ON.

Name	Parameter set No. (Note 1)								
	#1	...	#64	#65	...	#128	#129	...	#182
Target channel No. #n	#53011	...	#53641	#53651	...	#54281	#54291	...	#54821
Target station No. #n (Note 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

(Note 1) A set of RIO assignment parameters consists of eight parameters (from target channel number to high-speed output specification) for one station.

(Note 2) Arbitrary device assignment cannot be performed for the system-occupied stations of RIO3 and operation panel I/O unit-connected channels.

- (5) 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 However, X400 to X5FF is invalid when PROFIBUS specification is added.	Hexadecimal
Y	Bit	-	○	Y0000 to Y05FF However, Y400 to Y5FF is invalid when PROFIBUS specification is added.	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 can not 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.

(Note 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.

- (6) 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.

- (7) 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 alarm "Y05 Initial parameter error" will be issued.
- (8) High-speed input/output specification can be set by R registers below as well as the RIO assignment parameters.

Channel No.		Station 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.
 - (Note 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.
 - (Note 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.
 - (Note 4) The above settings are invalid with fixed device assignment.
- (9) In the following cases, the alarm "Y05 Initial parameter error" will be issued when the power is turned ON. The number of the RIO assignment parameter with illegal setting state will be 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 station of RIO1 are set redundantly to the RIO assignment parameter #1 to #5 as shown in the table below. (Both the 1st and 2nd stations are connected to 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" will be displayed on the alarm "Y05 Initial parameter error". Duplication error of RIO1 second station will be detected first because the RIO assignment parameter is checked from the top. Between the parameter set #2 and #3 to which second station of RIO1 are set, parameter set #3 which is the latter will be 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) However, these (a) to (f) will not be issued with the alarm "Y05 Initial parameter error" in the following cases:

- "0" has been set to the target channel.
- Remote I/O unit with DI/DO function are not connected to the station which has been 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 PLC device are set redundantly to the RIO assignment parameter #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 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" will be displayed on the alarm "Y05 Initial parameter error". Duplication error of X200 will be detected first because the RIO assignment parameter is checked from the top. Between the parameter set #2 and #3 to which the X200 are set, parameter set #3 which is the latter will be displayed as the alarm.

- (10) PLC fixed signals (stroke end +/- and reference position return near-point detection) acquire the input signals from the RIO units assigned to the fixed devices when the arbitrary RIO assignment has been performed.

Operating parameter setting screen

- (1) RIO assignment parameter setting rule
 - (a) 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.
 - (b) 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.
 - (c) 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).
 - (d) 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.
 - (e) 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 will not be checked.
 - (f) The RIO assignment parameter setting values are retained even when the fixed device assignment and arbitrary device assignment are switched.

- (2) RIO assignment parameter setting state check
 - (a) 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 will not be checked at the fixed device assignment.
 - (b) 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.
 - (c) The value of "Device Setting Check" goes back to "0" after the check for the RIO parameter setting state is completed.
 - (d) The RIO assignment parameter setting state of each remote I/O unit station with the analog input/output and safety DI/DO functions will not be checked.
 - (e) The setting state of the parameter set which has been set as the station unconnected to the NC control unit will not be checked.
 - (f) The setting state of the parameter sets of which the target channel number has been set to "0" will not be checked.

20.6.5 Analog Input/Output Interface

- (1) Up to 8 channels for analog input channel and up to 4 channels for analog output channel are available. The following units have the analog input/output function:
 - (a) Built-in AI/AO of the main body
 - (b) AI card to be inserted to the expansion slot of the main body
 - (c) Remote I/O unit with AI/AO
 - (d) Remote unit with AO
 - (e) Expansion card with AI/AO
- (2) When an analog voltage is input to the analog input channel, the value according to the voltage can be read out from the file register (analog input n (AI_n)).
- (3) When the data is set in the file register (analog output n (AO_n)), the analog voltage according to the set data is output from the analog output channel.
- (4) When the built-in AI/AO is provided, the channels can be assigned to the file registers of analog input n (AI_n) and analog output n (AO_n) in the ascending order of the station numbers of RIO unit corresponding to analog input/output.
- (5) When there is no built-in AI/AO, the channels are assigned in the ascending order of the station numbers of RIO units.
- (6) The relation of the analog input/output and the file register is shown below.

[PLC input signals]

When the analog voltage is input to the designated connector of the remote I/O unit with analog input or the built-in AI/AO of main body, the data according to the input voltage can be read out from the file register.

Channel	File register	Data update cycle
AI0	R0	For the remote I/O unit with the analog input function, each channel is input per PC high-speed cycle. When one station has four channels, all channels are input completely in four PC high-speed cycles.
AI1	R1	
AI2	R2	
AI3	R3	
AI4	R4	For the built-in AI/AO, all channels are input per PC high-speed cycle. All analog input of four channels are input completely in one PC high-speed cycle.
AI5	R5	
AI6	R6	
AI7	R7	

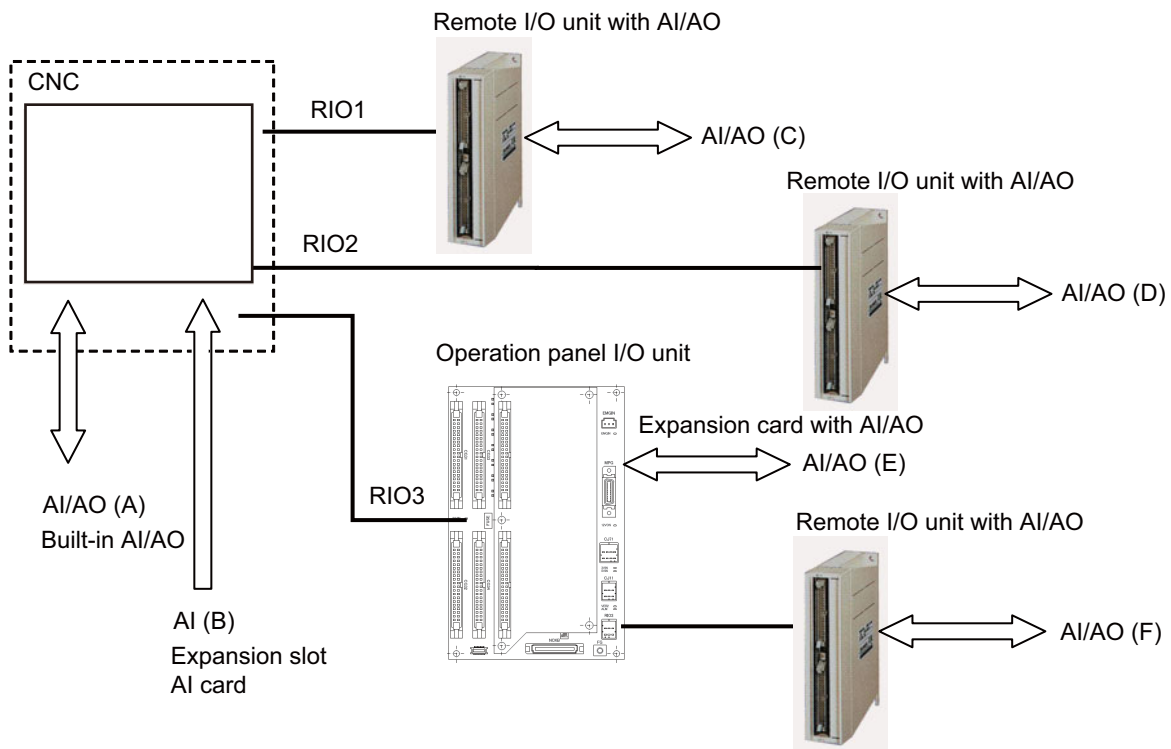
[PLC output signals]

By setting data to file registers, the analog voltage can be output from the designated connector of the remote I/O unit with analog output or the built-in AI/AO of main body.

Channel	File register(R)
A00	R200
A01	R201
A02	R202
A03	R203

- (7) The example of the configuration for the analog input/output and the assignment order are illustrated on the next page.

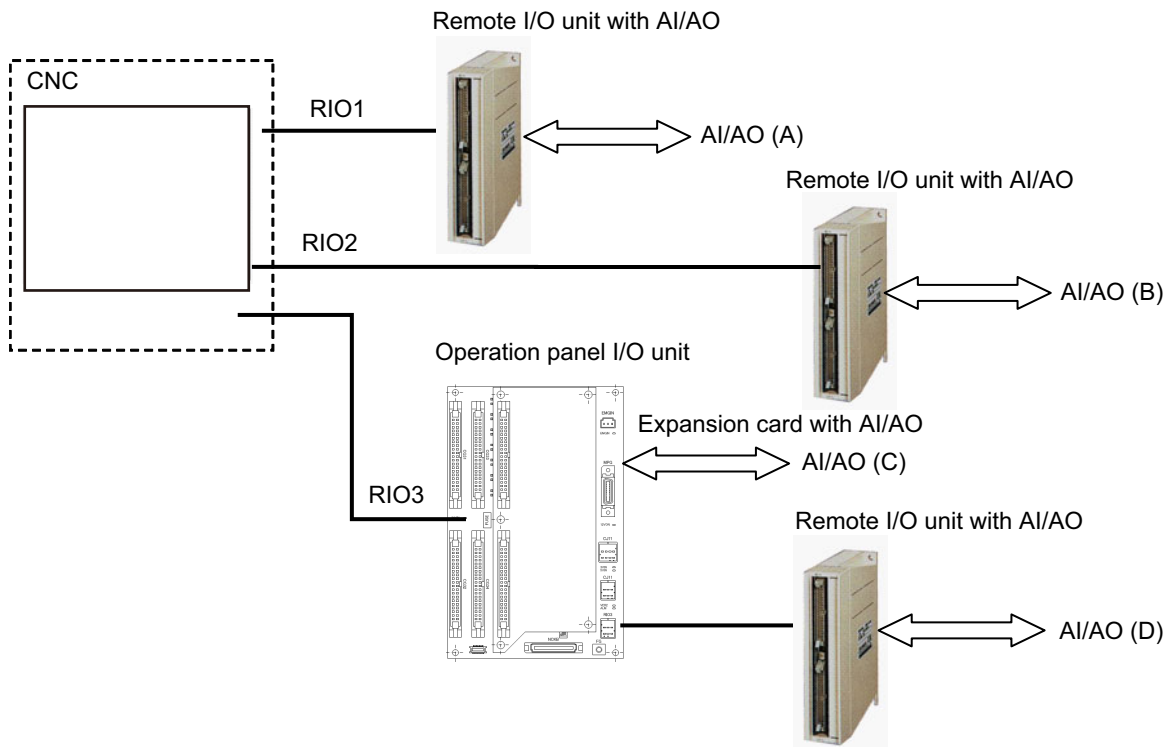
With built-in AI/AO and expansion slot AI card



- (A) Built-in AI/AO of the main body
- (B) Expansion slot AI card of the main body
- (C) RIO1 remote I/O unit with AI/AO
- (D) RIO2 remote I/O unit with AI/AO
- (E) RIO3 expansion card with AI/AO
- (F) RIO3 remote I/O unit with AI/AO

- * Up to 8 points of analog input channel can be used in the connection order (A) > (B) > (C) > (D) > (E) > (F).
 - Use RIO1/RIO2/RIO3 ((C) to (F)) in the ascending order of the station numbers of RIO units.
 - 9th and succeeding channels are unavailable even when they are connected.
- * Up to 4 points of analog output channel can be used in the connection order (A) > (C) > (D) > (E) > (F).
 - Use RIO1/RIO2/RIO3 ((C) to (F)) in the ascending order of the station numbers of RIO units.
 - 5th and succeeding channels are unavailable even when they are connected.

Without built-in AI/AO



- (A) RIO1 remote I/O unit with AI/AO
- (B) RIO2 remote I/O unit with AI/AO
- (C) RIO3 expansion card with AI/AO
- (D) RIO3 remote I/O unit with AI/AO

- * Up to 8 points of analog input channel can be used in the connection order (A) > (B) > (C) > (D).
 - Use RIO1/RIO2/RIO3 ((B) to (D)) in the ascending order of the station numbers of RIO units.
 - 9th and succeeding channels are unavailable even when they are connected.
- * Up to 4 points of analog output channel can be used in the connection order (A) > (B) > (C) > (D).
 - Use RIO1/RIO2/RIO3 ((B) to (D)) in the ascending order of the station numbers of RIO units.
 - 5th and succeeding channels are unavailable even when they are connected.

20.6.6 Thermistor Input Interface

- (1) By connecting the remote I/O unit with thermistor, up to 12 points of thermistor input are available.
For details on the unit which has thermistor input function, refer to "General Specifications: Remote I/O Unit".
- (2) Up to 12 points of thermistor are detected in the ascending order of the channel No. and station No. of the remote I/O unit. The file registers which output the temperature information are assigned to the 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 signal]

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.

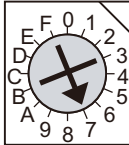
Channel	File register	Data update cycle
TI0	ZR13028	The thermistor voltage acquired with the thermistor input-equipped remote I/O unit is input after converted to a temperature value per PLC medium-speed cycle. One station of remote I/O has 4 thermistor inputs, thus 4 PLC medium-speed cycles are required 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	

20.7 Initializing the NC Internal Data (SRAM)

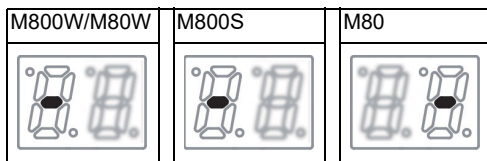
The initialization does not affect the settings of the option parameters.

(Note) The DIP switches next to the rotary switch are for our adjustment. Do not change them after the shipment. Normally the switches No. 1 and 2 are in OFF state (downward).

(1) With the NC power OFF, turn the rotary switch to "7". Then, turn the power ON.

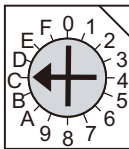


(2) Turn the power OFF after one of the two 7-segment LEDs (see below) displays "-" (hyphen).



(Note) Ignore the display on the side not marked with "-" in the above 7-segment LED displays.

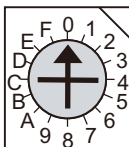
(3) Change the rotary switch to "C" and then turn the power ON.



(4) The 7-segment LED display changes as "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 ON again.

(Note 1) After the initializing and 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
```

(Note 2) The initial screen after the initialization is displayed in English. Refer to "Selecting the NC System Type and Displayed Language" for how to set a language to display.

Setting Up with HMI Integrated Installer

Install and upgrade "Custom release applications" with HMI integrated installer.
If you do not need the installation, go to the next section.

21.1 Outline of HMI Integrated Installer

"HMI integrated installer" is a function to install and upgrade "Custom release applications" with the data in the memory card.

The integrated installer has two methods to install and upgrade the applications:

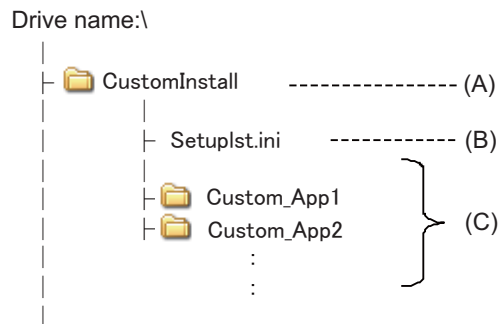
- Starting an installer (EXE file) which has been prepared to install the applications (This method is called "Installer start method".)
- Copying, deleting and setting the registry of the specified file (directory) with the integrated installer to install the applications (This method is called "File copy method".)

Both methods require the following files in the memory card to install or upgrade the applications.

- Installation environment for each application (EXE file, a file to copy, etc.)
- A setting file which collects the information on installation for applications (The setting file is called "setup application list".)

21.2 Memory Card for Upgrade

The directory configuration of the memory card for the upgrade is as follows.



- (A) Directory for custom release applications (The name is fixed to "CustomInstall".)
- (B) Setup application list for custom release applications (The name is fixed to "Setup1st.ini".)
- (C) Directories in which installation environment is stored for each custom release application (Set any name.)
Files required for the installation are stored in the directories.

21.3 Operation Methods

The following shows how to install the applications.

- (1) Prepare the memory card which contains the installation environment for "custom release applications". Insert the memory card into the memory card interface on front of the display unit.
- (2) Enter the password on the Mainte screen.
 - (a) On the Mainte screen, select [Mainte] and then [Psswd input].
 - (b) Enter the machine parameter password in the setting area and press the [INPUT] key.
- (3) Select [HMI verup] on the Mainte screen. The [HMI verup] menu will be highlighted, and a message will appear to confirm the PLC stop.
- (4) Press [Y] or the [INPUT] key. After PLC is stopped, HMI integrated installer will start and the screen will appear. When the memory card contains the installation environment for "custom release applications", names of the applications that can be installed will be displayed in the application list.
- (5) Select an application to install from the displayed application list.
- (6) Select [Install start]. The [Install start] menu will be highlighted, and a message will appear to confirm the application installation. The [Y] button shows selected.
 - (Note) If no application has been selected before the [Install start] menu is selected, an error message will appear and the [Install start] menu will be unhighlighted.
- (7) Press the [INPUT] key. Or touch the [Y] button which shows selected. The installation of the selected application will be started.
 - (Note 1) If no USB keyboard is connected to the 19-type display unit, the display shows a screen keyboard. Use this keyboard for key operation.
 - (Note 2) When the [N] button or another menu is touched, the [Install start] menu will be unhighlighted and the application will not be installed.
 - (Note 3) While installing, all menus will be grayed out and cannot be selected.
 - (Note 4) All tasks except the system-related are quitted immediately before the installation of the selected application. Quit all unnecessary tasks before starting the integrated installer.
- (8) After the application has been installed, turn the power ON and OFF.

Setting the Parameters and Date/Time

⚠ WARNING

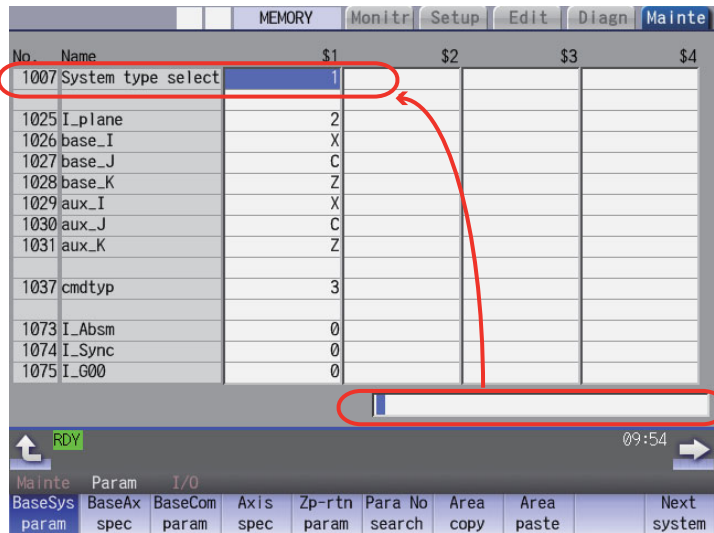
Confirm the emergency stop state before carrying out the steps in this chapter.

Refer to the section of "Alarm/Parameter Manual" for the details of the parameters.
You can also refer to the parameter guidance display.
Normally, the initial setting of NC is performed with NC Configurator2.
NC Configurator2 is a tool for supporting the parameter setting of NC.
For the details, refer to "NC Configurator2 Instruction Manual"(IB-1501046).

22.1 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 [Pswd input].
Enter the machine parameter password in the setting area and press the [INPUT] key.
(Note 1) To enter the character "A", press the shift key and then "A" key. Do not press both keys at the same time.
(Note 2) 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.

22.2 Setting the Parameters for the System Specifications

- (1) On the Mainte screen, select [Mainte] and then [Psswd input]. Enter the machine parameter 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 password for the machine parameter 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 password for the machine parameter and then press [INPUT].

Select [Param] again on the Mainte screen. Set the following parameters.

```
"#1010 srvunit(Output unit(servo))"
"#1013 axname(Axis name)"
(Note) 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)"
(Note) 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.

22.3 Setting the Parameters for the Machine Specifications

- (1) On the Mainte screen, select [Mainte] and then [Psswd input]. Enter the machine parameter password in the setting area and press the [INPUT] key.
(Note 1) 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 (Base axis I)"
 "#1027 base_J (Base axis J)"
 "#1028 base_K (Base axis K)"
 "#1029 aux_I (Flat axis I)"
 "#1030 aux_J (Flat axis J)"
 "#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 number of axes in the part system is nine or more
 - When you want to change the assignment of axis device

[Device]

\$1	\$2	\$3	\$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
#1603	1	2	3	4	5	6	7	8
	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16
#1603	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))"
 "#2007 G0tL (G1 time constant)"
 "#2008 G1t1(G1 time constant (primary delay))"

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".

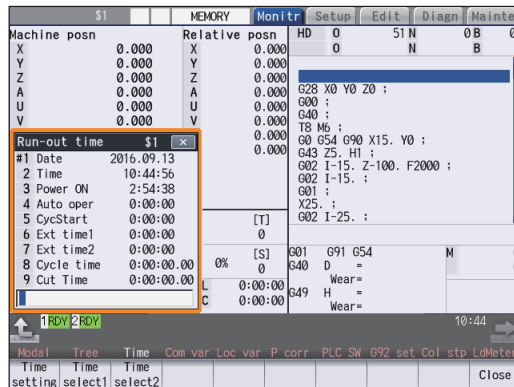
- (3) Turn the power OFF and ON.

22.4 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 self diagn screen, and set the battery used years to "0".

(Note) If battery used years is not cleared, passed years from default date (2014/4/1) will be displayed on battery used years.

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.

Refer to the "PLC Development Manual" for details.

23.1 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.

23.2 Setting the Ethernet Communication

23.2.1 Confirming the IP Address for CNC

Confirm the IP address set for the CNC. IP address is set to the following parameter.

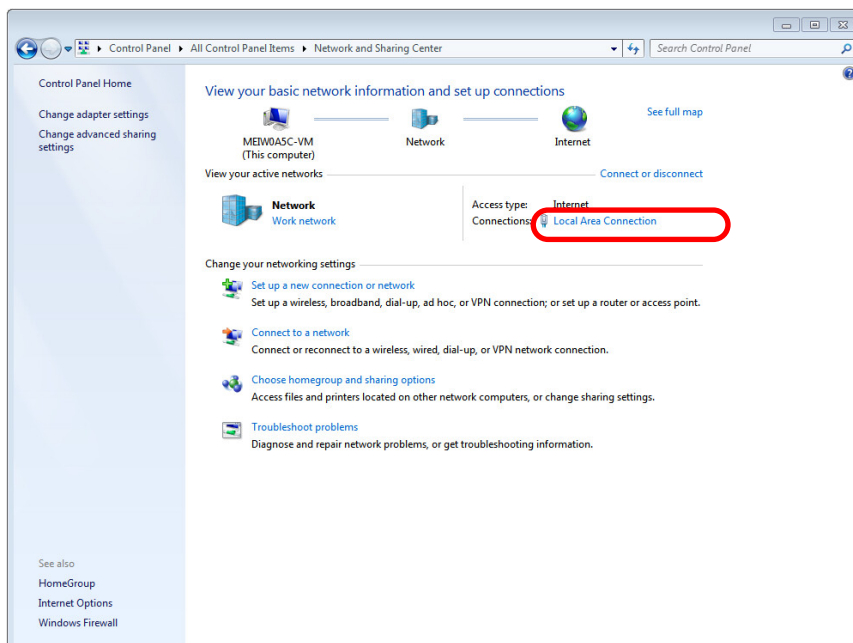
Basic common parameter	Item	Content	Setting example
#1926	Global IP address	IP address for CNC seen from an external source	192.168.200.1
#1927	Global Subnet mask	Subnet mask of #1926	255.255.255.0

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.

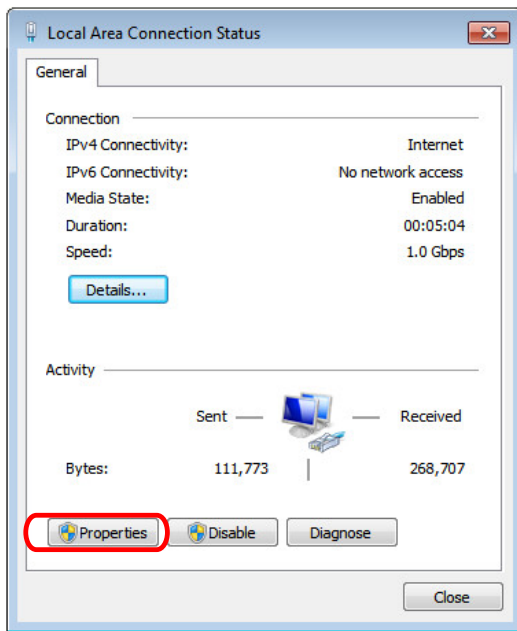
23.2.2 Setting the IP Address for PC Side

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.

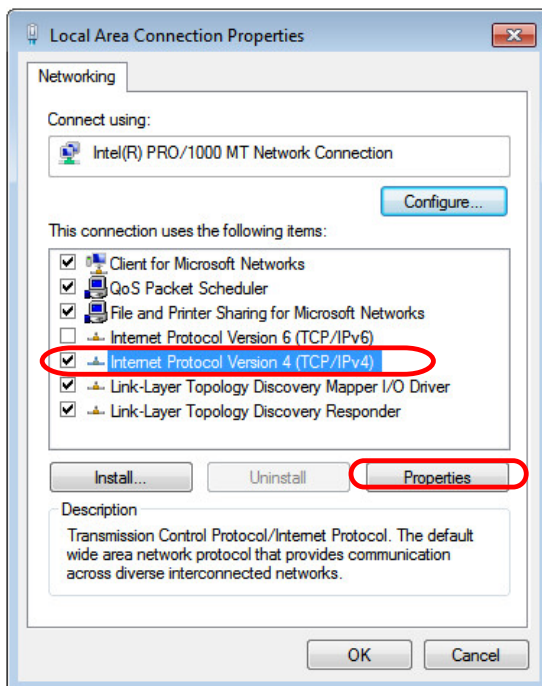
- (1) Select [Start] - [Control Panel] - [Network and Internet] - [Network and Sharing Center] from task bar.
- (2) "Network and Sharing Center" is displayed. Click [Local Area Connection].



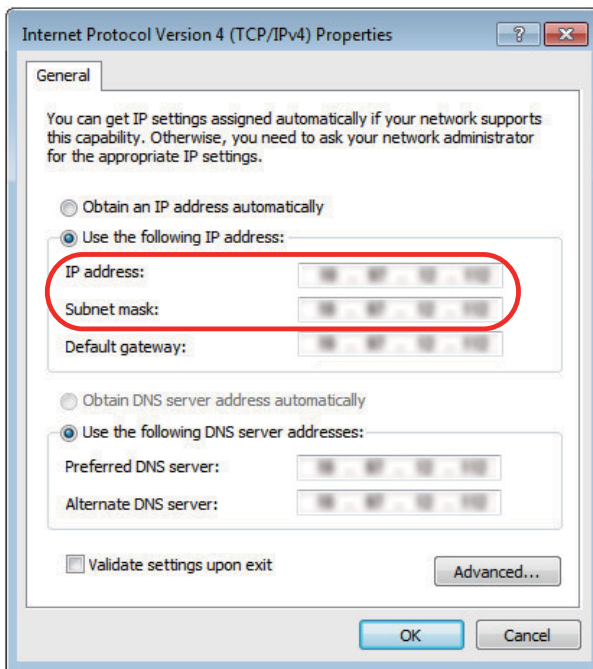
(3) "Local Area Connection Status" is displayed. Click [Properties].



(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.



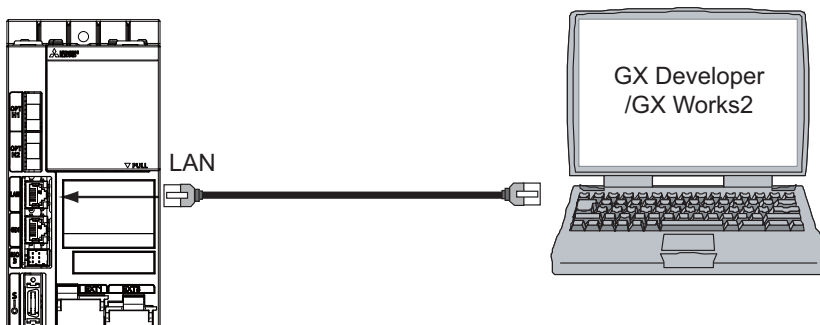
- (6) Set the following addresses. (Note)
 (Example) IP address: 192.168.200.2
 Subnet mask: 255.255.255.0

(Note) In the section "23.2.1 Confirming the IP Address for CNC", set an IP address in the range of "192.168.200.0" to "192.168.200.255", 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.

23.3 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.
 (Note 2) It is recommended to use GX Works2 Version 1.570U and later.
 (Note 3) Use a cross LAN cable for the communication.
 (Note 4) Carry out the Ethernet communication setting (IP address and so on) on the personal computer before connecting it to NC.

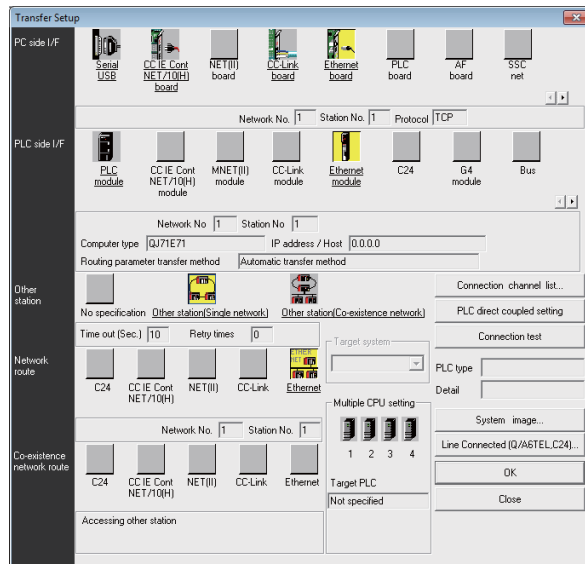
23.4 Setting the Communication with GX Developer

- (1) Perform the following operations with GX Developer to start the setup screen.
[Online] -> [Transfer setup...]
- (2) Set the following items in order.
 - (a) 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
PLC side I/F	Ethernet unit	
Type name	QJ71E71	*2
Station No.	1	*2
IP address	IP address of CNC	*2
Routing parameter conversion method	Automatic conversion method	*2
Other station	Other station (Single network)	
Time out check (sec.)	Arbitrary time (from about 10 sec.)	*3
Number of retry	0	*3
Network communication path	Ethernet	
Access to the Ethernet unit that is set with PLC side I/F		*4

- *1: The setting items are displayed by double-clicking the Ethernet board selection field.
- *2: The setting items are displayed by double-clicking the Ethernet unit selection field.
- *3: The setting items are displayed by double-clicking the other station (Single network) selection field.
- *4: The setting items are displayed by double-clicking the Ethernet unit selection field.

■ SW8D5C-GPPW setting screen



(b) For the user safety sequence

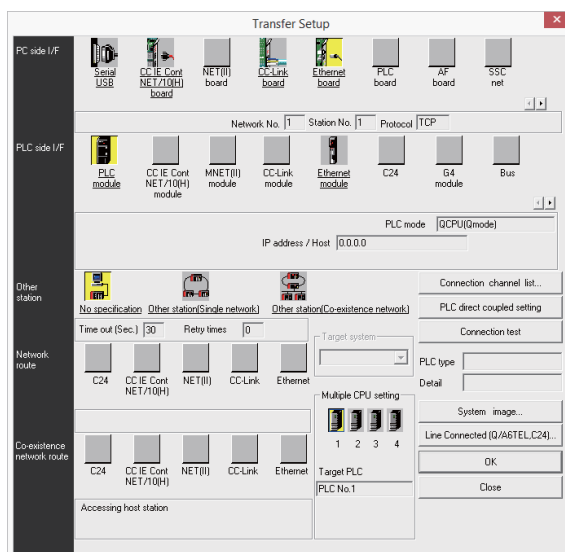
Setting item	Setting content	Remark
PC side I/F	Ethernet board	
Network No.	1	*1
Station No.	1	*1
Protocol	TCP	*1
PLC side I/F	CPU unit	
CPU mode	QCPU (Q mode)	*2
Ethernet port direct connection	Not check	*2
IP address	IP address of CNC	*2
Other station	No other station designated	
Time out check (sec.)	Arbitrary time (Approx. 10 sec. or more)	*3
Number of retry	0	*3
Multi CPU		
	For the user safety sequence 1, select No. 1.	
	For the user safety sequence 2, select No. 2.	

*1: The setting items are displayed by double-clicking the Ethernet board selection field.

*2: The setting items are displayed by double-clicking the Ethernet unit selection field.

*3: The setting items are displayed by double-clicking the other station (Single network) selection field.

■ SW8D5C-GPPW setting screen



(3) Press the "Connection test" button after completing the setting.

If the connection has succeeded, the message "Successfully connected with the Q26UDHCPU." will be displayed and the multiple CPU connection status will be displayed at the bottom of the message. This display indicates connection status for each project.

23.5 Setting the Parameters on GX Developer

(Note) 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.

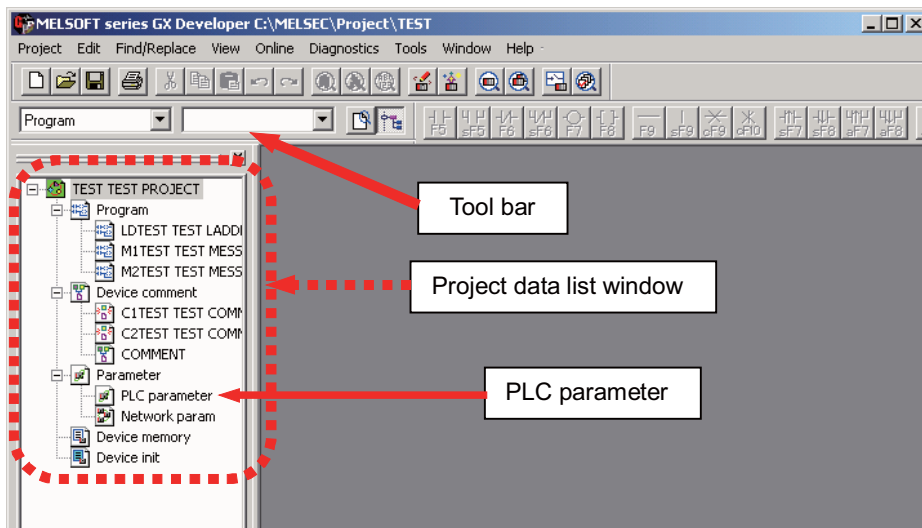
For details of the parameter settings, refer to the "PLC Development Manual".

23.5.1 Parameter Setting Screen

- (1) Displaying the project data list and parameter setting screen

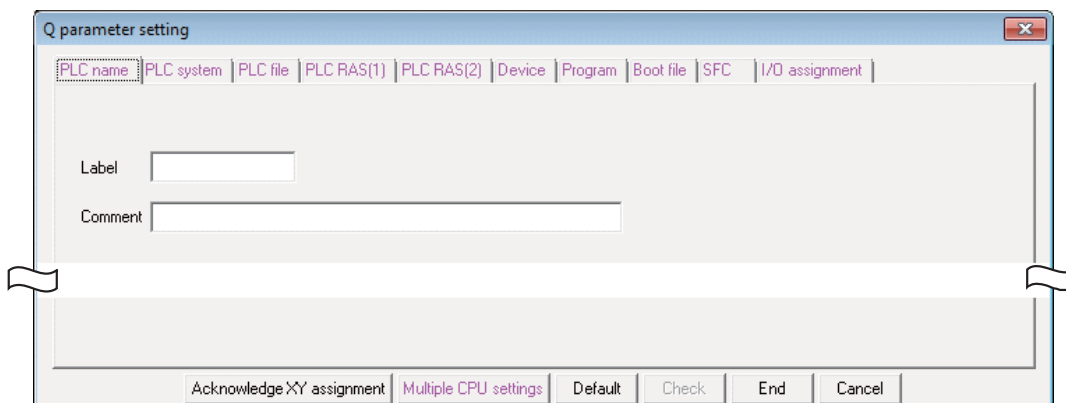
Display the "Project data list" window with the following operations. Double-click on "PLC parameter" to open the parameter setting screen. The same operation can be carried out by designating the data type "Parameter" and the data name "PLC parameter" from the tool bar.

[View] -> [Project data list] and then double-click "PLC parameter".



- (2) Displaying the parameter setting screen

Perform the following operations to display the parameter setting screen. The characters of tab in "red" show that the settings are the initial values.



23.5.2 Setting the Number of 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 when 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.

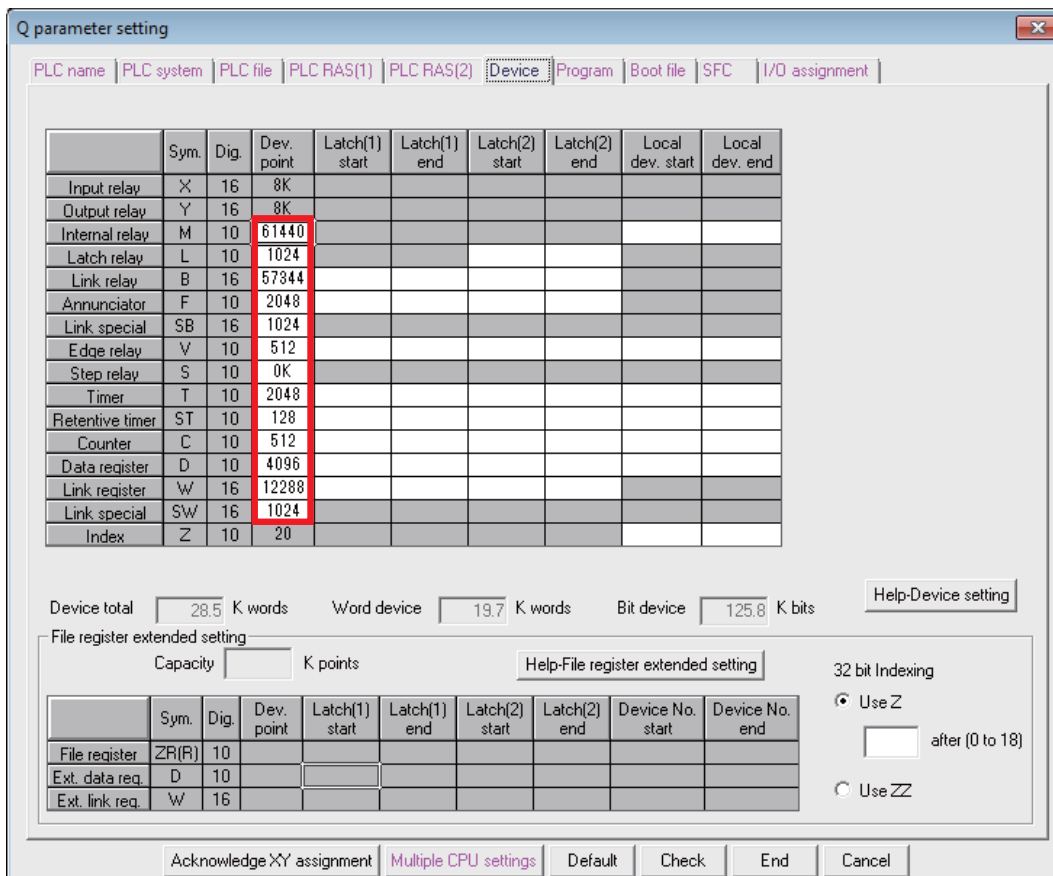
(1) Select the tab [Device].

The device range usable for each project changes in the multi-project environment. Input the points "number of device points + number of common points" which have been set on "Device setting screen of built-in PLC built-in editing function" as the number of device points for the parameters.

An error occurs when the number of device points is wrong.

(2) Input the numerical values for device points on the screen below and click [End].

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. After the setting for the number of device points is completed, press "End" to finish the edit.



(Note) If a value other than the designated values is input, an error occurs at the download to a CNC controller.

23.5.3 Setting the Number of Common Pointer Points

The number of common pointer points for each sequence program must be set for creating the sequence program with the multi-program method. This operation is required every time when a new project is created, and the parameter file must be written to the CNC controller.

(Note) When common pointer No. is not set, "P1800" is set.

- (1) Select the tab "PLC system".
- (2) Input the value for "Common pointer No." on the screen below and click [End].

The screenshot shows the 'Q parameter setting' dialog box with the 'PLC system' tab selected. The 'Common pointer No. P' field is highlighted with a red arrow pointing to the 'After (0-4095)' label. The dialog box contains various settings for the PLC system, including timer limits, RUN-PAUSE contacts, system interrupt settings, and service processing settings.

Q parameter setting

PLC name: PLC system | PLC file | PLC RAS(1) | PLC RAS(2) | Device | Program | Boot file | SFC | I/O assignment

Timer limit setting

Low speed: 100 ms (1ms-1000ms)

High speed: 10.00 ms (0.01ms-100ms)

Common pointer No. P: [] After (0-4095)

Points occupied by empty slot (*): 16 Points

RUN-PAUSE contacts

RUN: X [] (X0-X1FFF)

PAUSE: X [] (X0-X1FFF)

Latch data backup operation valid contact

Device name: []

System interrupt settings

Interrupt counter start No. C: [] (0-768)

Fixed scan interval (0.5ms-1000ms)

I28: 100.0 ms | I29: 40.0 ms | I30: 20.0 ms | I31: 10.0 ms

High speed interrupt setting

Remote reset

Allow

Interrupt program / Fixed scan program setting

High speed execution

A-PLC

Use special relay / special register from SM/SD1000

Service processing setting

Execute the process as the scan time proceeds. 10 %

Specify service process time. [] ms (0.2ms-1000ms)

Specify service process execution counts. [] times (1-10 times)

Execute it while waiting for constant scan setting.

PLC module change setting

PLC module change setting

Intelligent function module setting

Interrupt pointer setting

Module synchronization

Synchronize intelligent module's pulse up

(*Settings should be set as same when using multiple CPU.)

Acknowledge XY assignment | Multiple CPU settings | Default | Check | End | Cancel

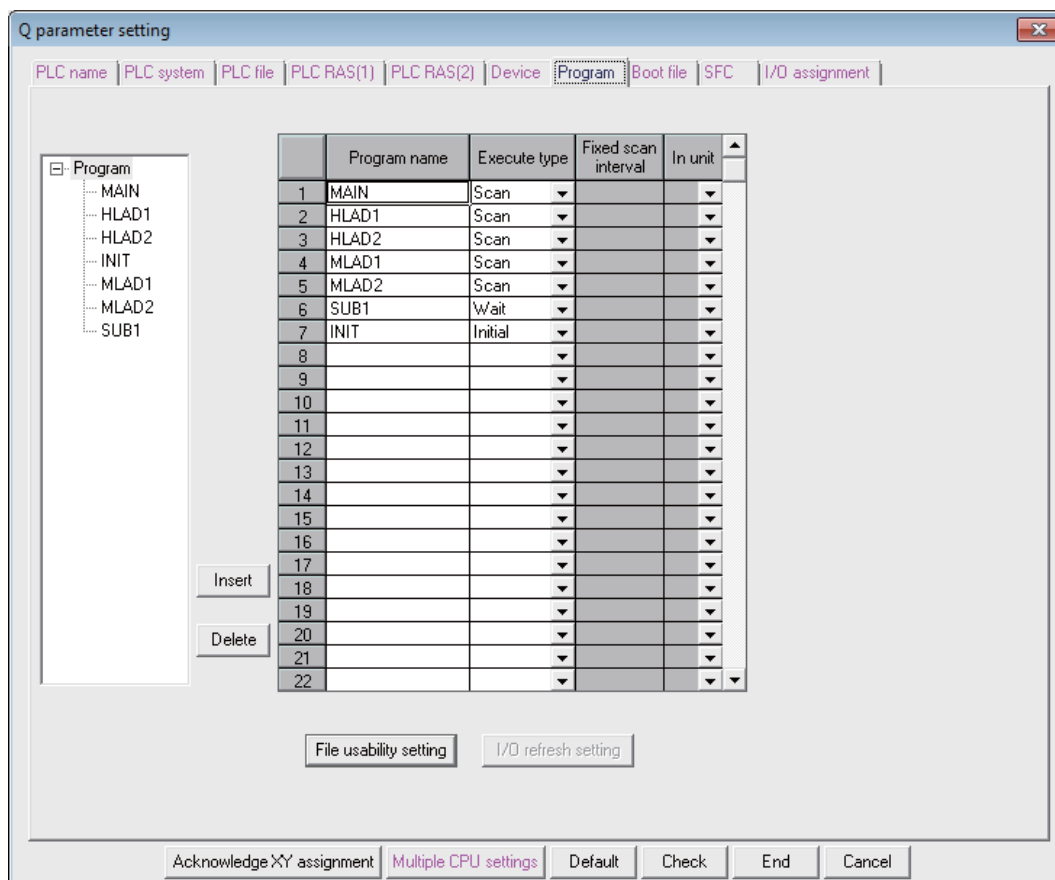
23.5.4 Setting the Program Execution Order

When creating the sequence programs with the multi-program method, the execution method and execution order of each sequence program must be set. This operation is carried out before the sequence program is executed with the CNC controller. The parameter file must be written to the CNC controller.

For details on each setting item, refer to the "PLC Programming Manual".

(Note) If this operation is not completed when using the multi-program method, an error will occur when RUN is executed in the sequence program.

- (1) Select the [Program] tab
- (2) Select the sequence program name to be registered for execution from the program list on the left of the following screen, and then press the "Insert" button. Select the execution mode from the registration program list on the right side. After registering all sequence programs to be executed, click on [End].



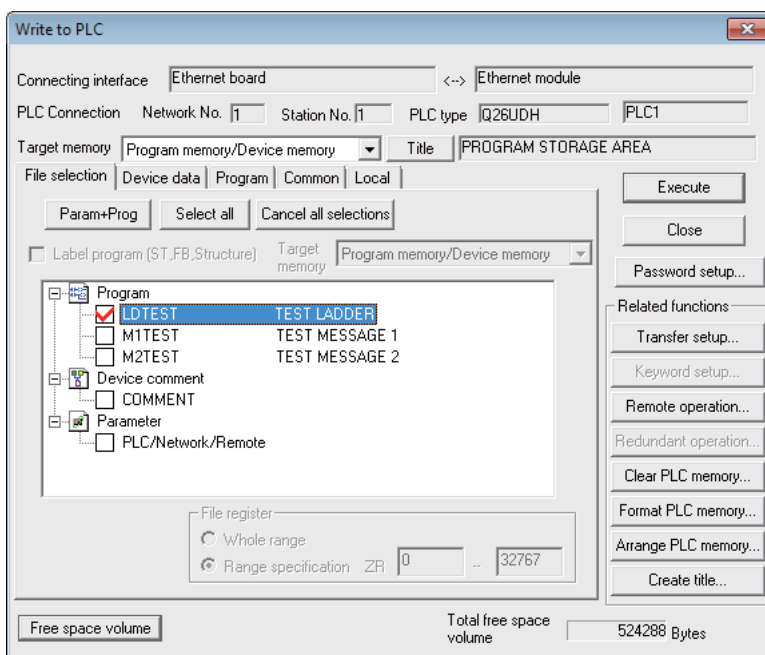
23.6 Writing a Sequence Program with GX Developer

(Note) This operation is for performing writing in the temporary storage area of CNC (RAM inside CNC). The temporary storage area (RAM inside CNC) does not hold data after the power is turned OFF. If the data need to be held even after the power OFF, write the sequence program in ROM inside CNC following the procedure described in "Writing a Sequence Program to ROM with GX Developer".

[Operation procedure for a project "without labels"]

The following is the operation procedure for a project in which labels are not used.

- (1) Perform the following operation with GX Developer to start the operation screen.
[Online] -> [Write to PLC...]
- (2) Select a sequence program file for writing in the [File selection] tab of the screen below and click [Execute].
RUN/STOP for PLC can be commanded on [Remote operation...] of "Related functions".

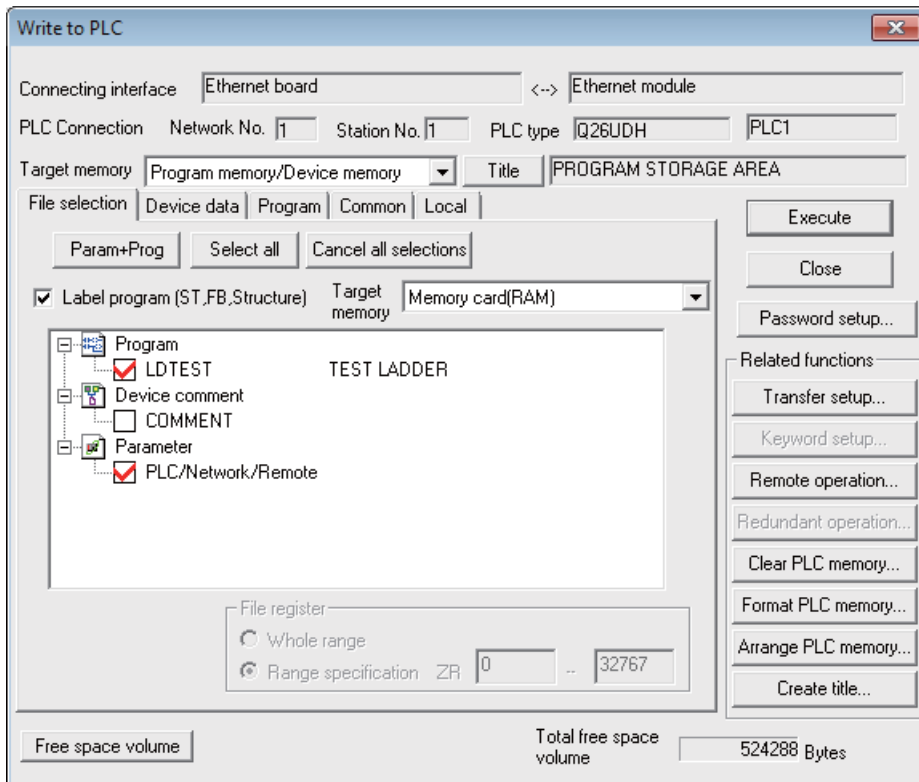


(Note) Only "Program memory/Device memory" is valid for "Target memory".
Do not carry out the setting for other tabs than [File selection] ([Device data], [Program], [Common], [Local]).

[Operation procedure for a project "with labels"]

The following is the operation procedure for label programming.

- (1) Perform the following operation from GX Developer to start the operation screen.
[Online] -> [Write to PLC]
- (2) On the following screen, choose the sequence program file to be written from the [File selection] tab and click [Execute].
PLC RUN/STOP can be commanded with [Remote operation] under "Related functions".



(Note 1) As [Target memory] for writing sequence programs, only "Program memory/Device memory" is valid.

(Note 2) Do not set the other tabs ([Device data], [Program], [Common], [Local]) than [File selection].

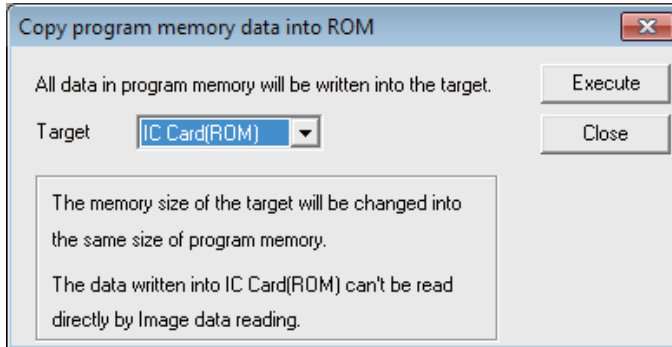
(Note 3) As [Target memory] for writing label programs, only "Program memory/Device memory" or "Memory card(RAM)" is valid.

When writing label programs, one "symbolic information file" is written to NC.

23.7 Writing a Sequence Program to ROM with GX Developer

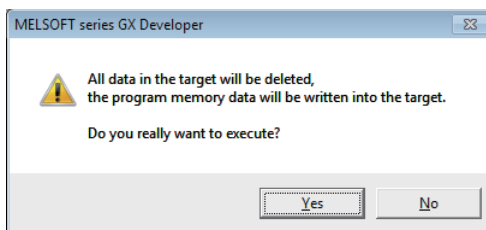
[Operation procedure]

- (1) Perform the following operation with GX Developer to start the operation screen.
[Online] -> [Write to PLC (Flash ROM)] -> [Copy program memory data into ROM]

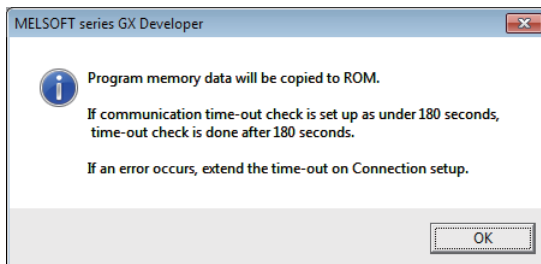


(Note) Only "IC Card (ROM)" is valid for "Target".

- (2) Click [Execute] and the dialog below is displayed.

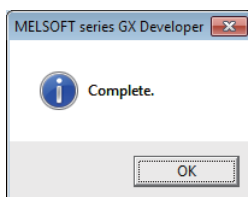


- (3) Click [Yes] and the dialog below is displayed.



(Note) Once "OK" is clicked on the dialog above, PLC program of ROM inside CNC on the CNC controller is overwritten/deleted. Confirm sufficiently before the execution.

- (4) When the execution is completed, the dialog below is displayed. Click [OK].



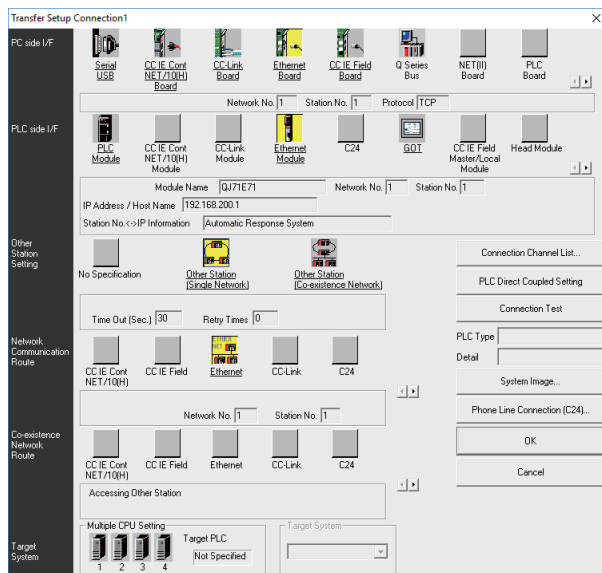
23.8 Setting the Communication with GX Works2

- (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.

Item	Setting	Note
PC side I/F	Ethernet Board	
Network No.	1	(Note1)
Station No.	1	(Note1)
Protocol	TCP	(Note1)
PLC side I/F	Ethernet Module	
Type name	QJ71E71	(Note2)
Station No.	1	(Note2)
IP Address	IP address of CNC	(Note2)
IP Input Format	DEC.	(Note2)
Station No. <-> IP information	Automatic Response System	(Note2)
Other Station Setting	Other Station (Single Network)	
Check at communication time (sec.)	Any time period (from about 10 seconds)	(Note3)
Retry times	0	(Note3)
Network Communication Route Detailed setting of Ethernet		
Access to Ethernet module set on PCL side I/F		(Note4)

- (Note1) Double-click [Ethernet Board] to display the setting item.
 (Note2) Double-click [Ethernet Module] to display the setting item.
 (Note3) Double-click [Other Station (Single network)] to display the setting item.
 (Note4) Double-click [Ethernet] to display the setting item.

■ Transfer Setup Connection 1 screen



After setting the connection, press [Connection Test].

If connection is successful, the message “Connected with Q26UDCPU” is displayed with the multi-CPU connection status underneath, which indicates the connection status of each project.

23.9 Setting the Parameters on GX Works2

(Note) 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.

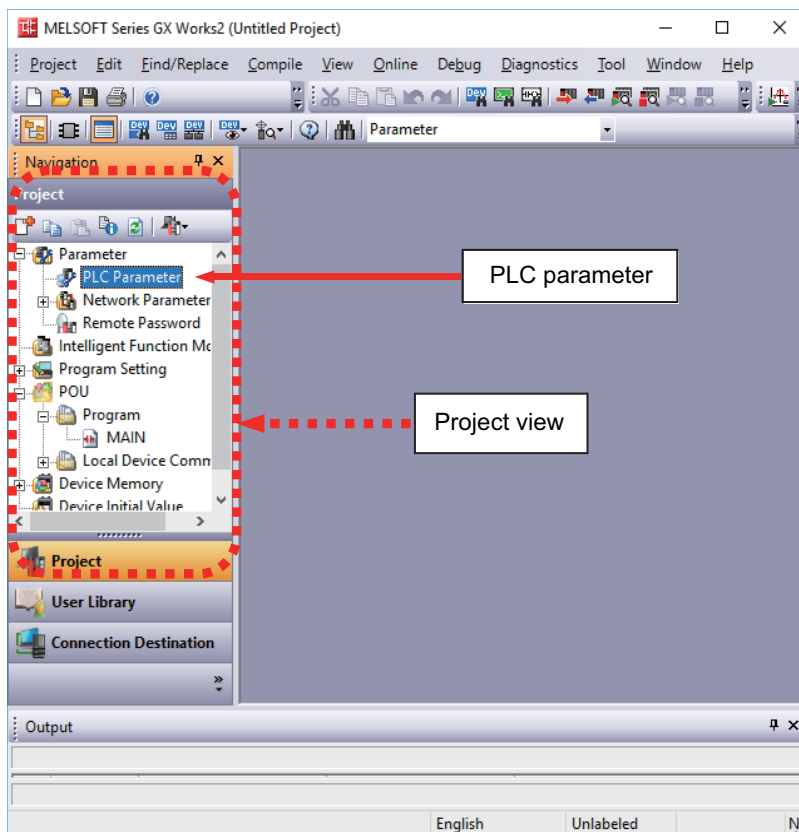
For details of the parameter settings, refer to the "PLC Development Manual".

23.9.1 Parameter Setting Screen

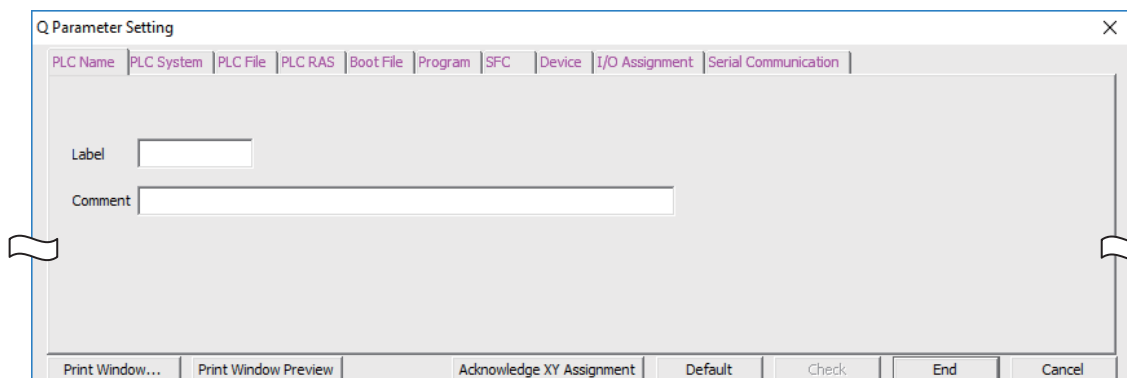
(1) Displaying parameter setting screen

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.



23.9.2 Setting Device Points

After creating an area (project) to manage sequence programs, set the number of the device points used in the project. This operation is required every time a new project is created. For details on each setting item, refer to the "PLC Programming Manual".

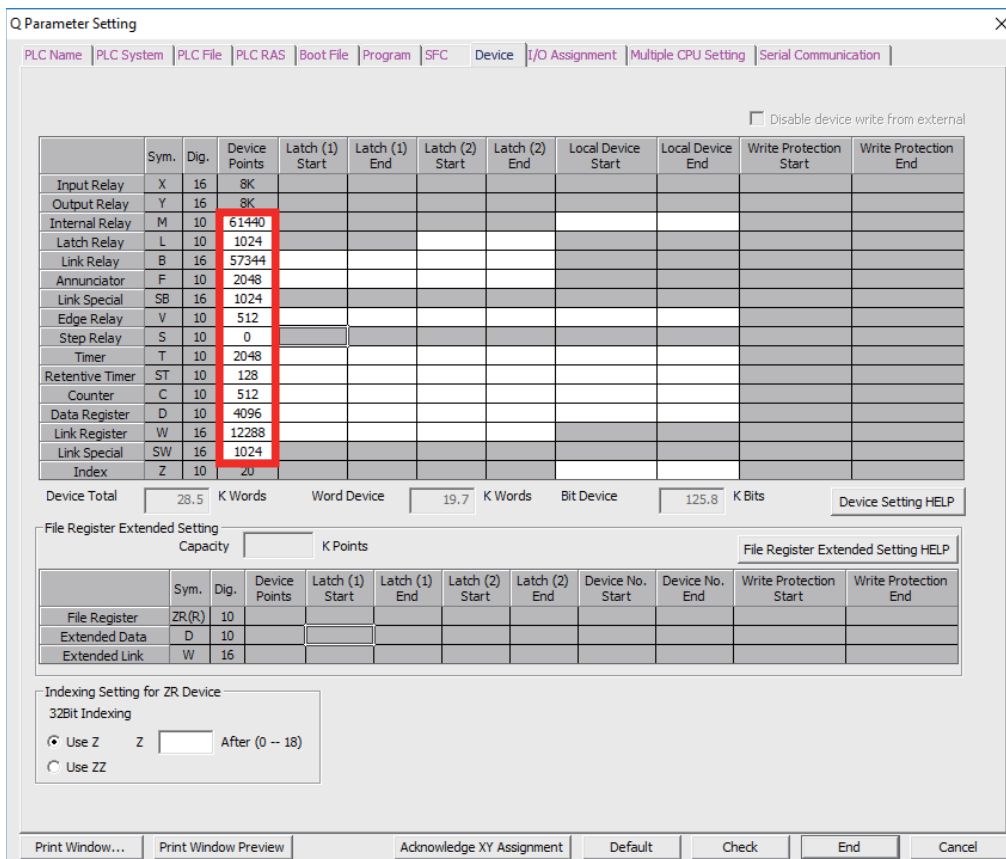
(Note) Without this operation, an error occurs when sequence programs are downloaded to the CNC controller.

(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). Setting wrong device points incurs an error. The range of devices that can be used in each project varies in multi-project environment.

(2) Enter the device points, and click [End] on the following screen.

Enter the number of devices in the project currently connected to inside the red line indicated in the figure below. 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.

23.9.3 Setting Common Pointer No.

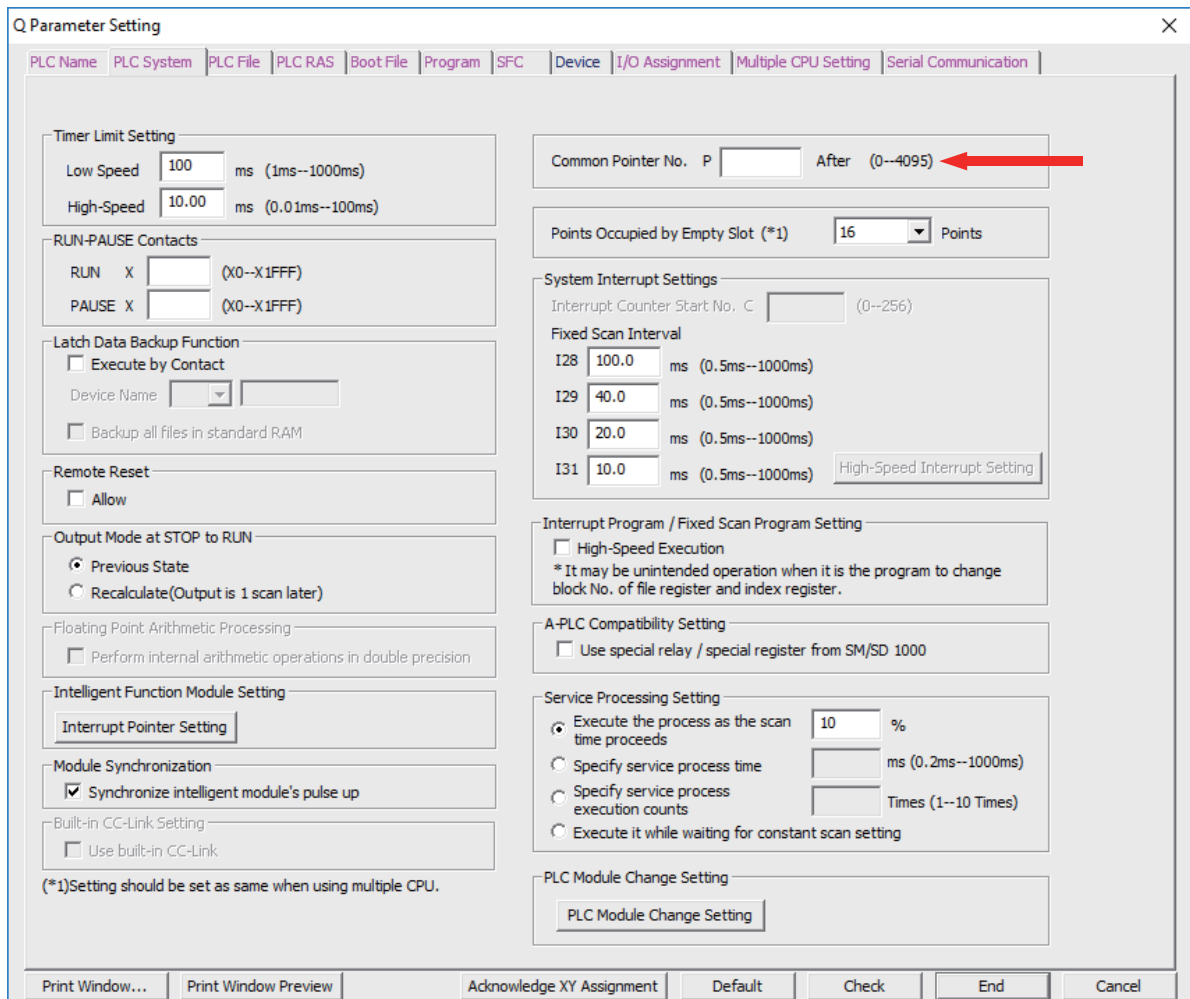
Set the pointer No. common to sequence programs when creating sequence programs in multi-program method. This operation is required every time a new project is created, and parameter files must be written to the CNC controller.

(Note) When not set, Common Pointer No. is set as P1800.

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.

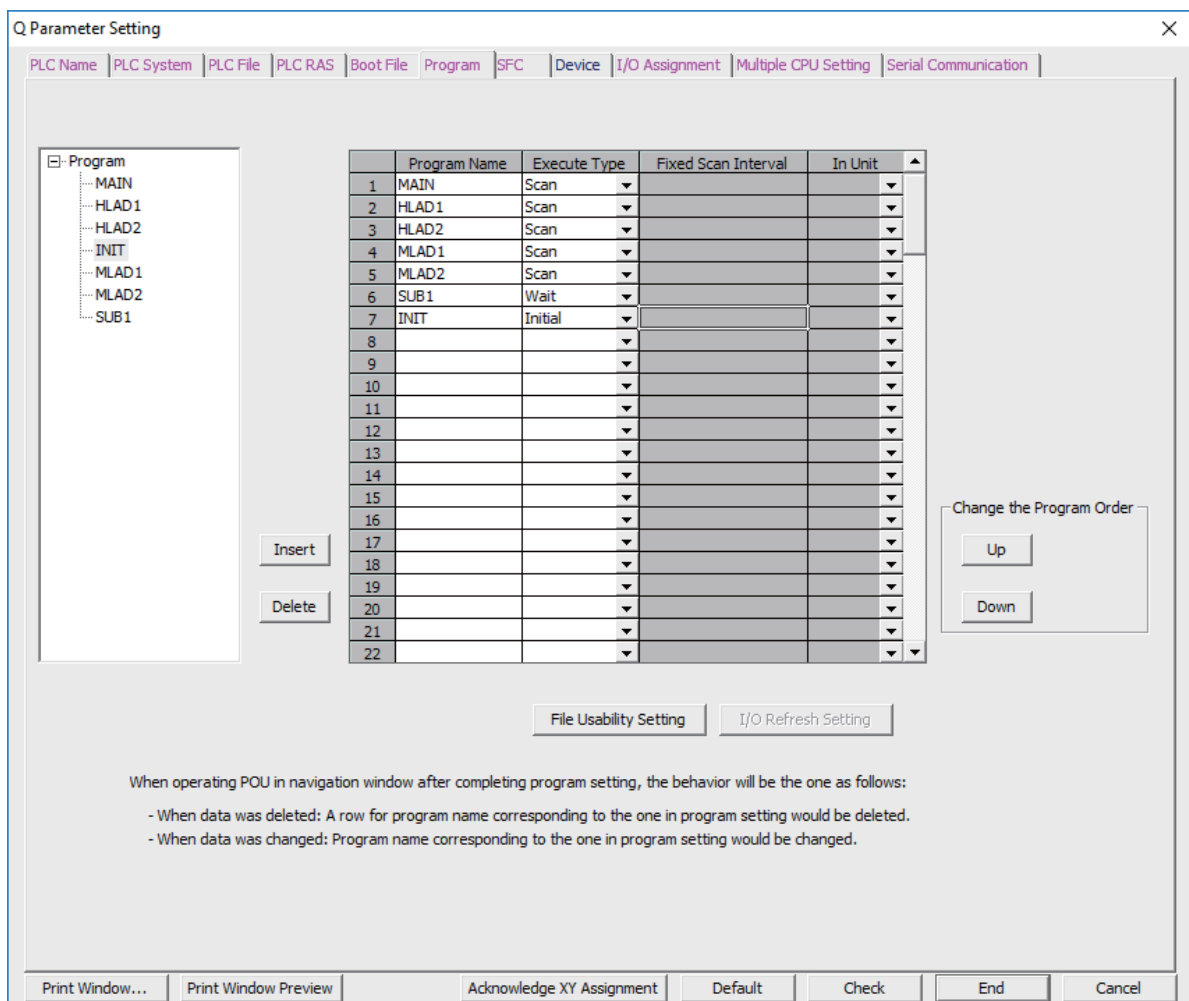


23.9.4 Setting Program Executing Order

When creating sequence programs in multi-program method, set the execution method and execution order of sequence programs. 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) Without this operation, an error occurs on the RUN of sequence programs when multi-program method is in use.

- (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].



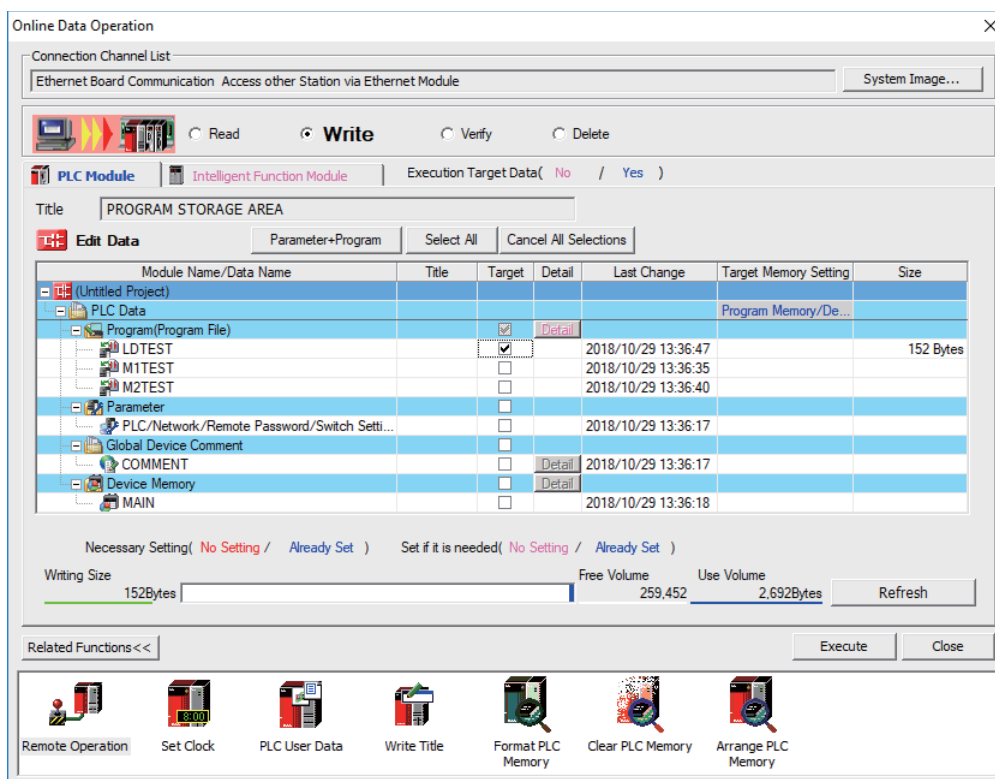
23.10 Writing a Sequence Program with GX Works2

(Note) This operation writes data to the temporary storage in the CNC (RAM in CNC). Data in temporary storage (RAM in CNC) are not retained after power OFF. To retain data after power OFF, write sequence programs to the ROM in the CNC according to "Writing a Sequence Program to ROM with GX Works2".

[Operating procedure for simple projects (without labels)]

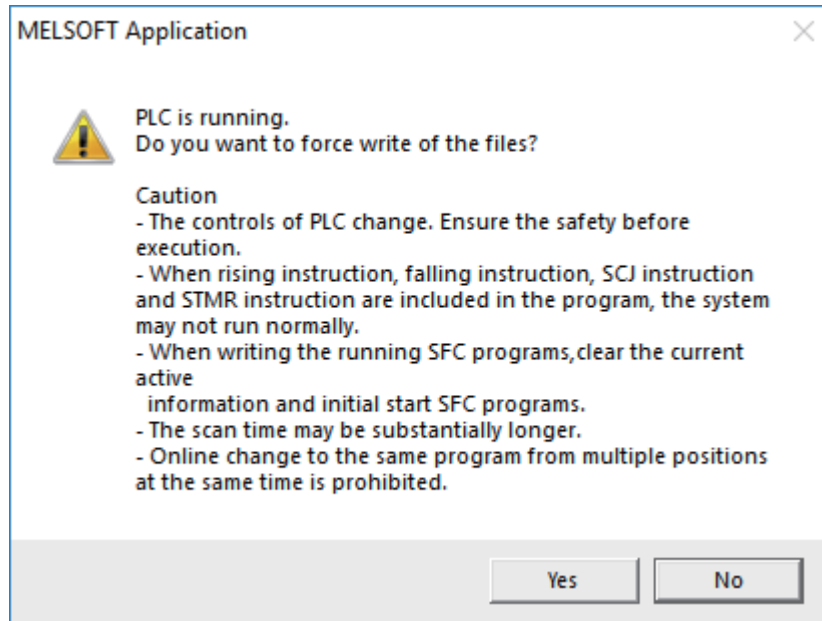
The following is the operation procedure for a project in which labels are not used.

- (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].

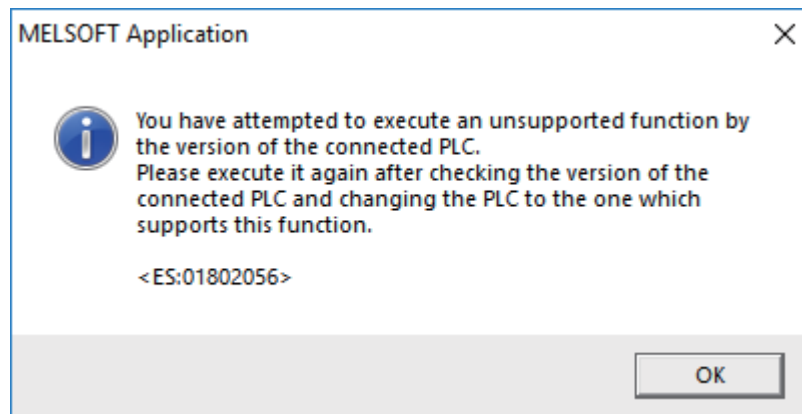


(Note1) [Program Memory/Device Memory] is the only valid option for [Target Memory Setting].

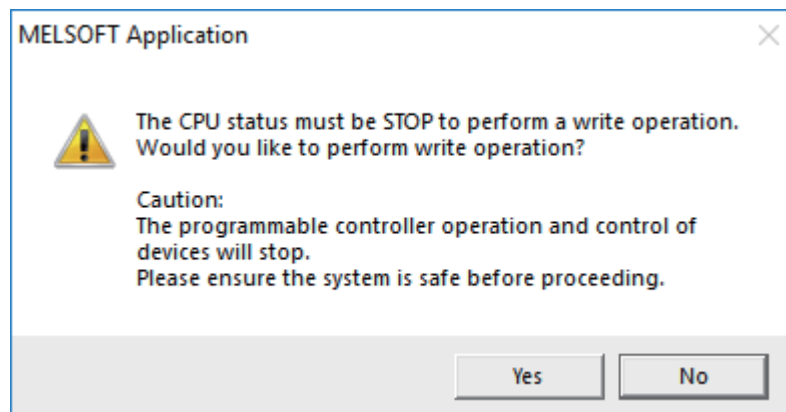
- (Note2) If an attempt is made to remove the check from parameter and write sequence programs during PLC is running, the prompt "PLC is running. Do you want to force write of the files?" is displayed.



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.



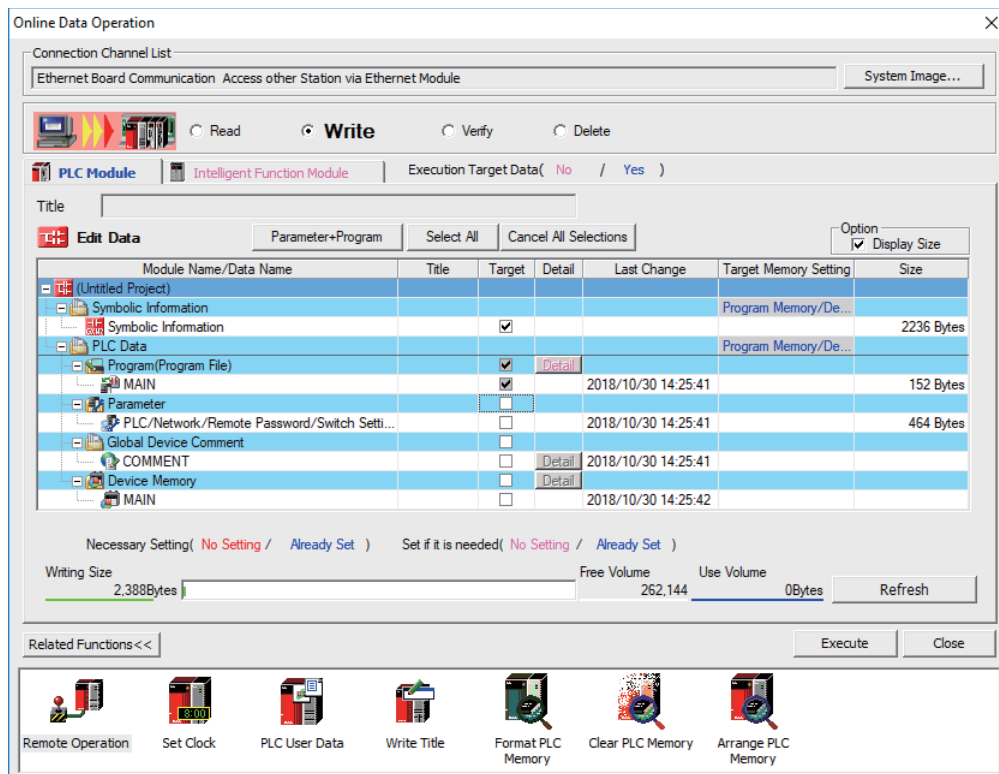
Click [No], and click [Yes] to the prompt: "The CPU status must be STOP to perform a write operation. Would you like to perform write operation?"



[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 the 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].

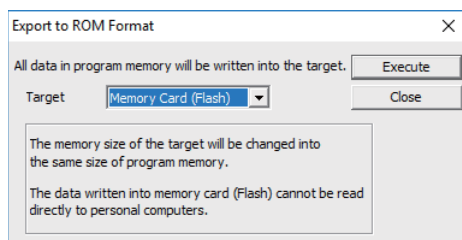


- (Note1) Program Memory/Device Memory] is the only valid option for [Target Memory Setting].
- (Note2) Since device memory cannot be written to the CNC controller, unselect the checkbox for device memory.
- (Note3) Make sure to write parameters at the same time when the symbolic information is to be written. If parameters are not written, the project has not been compiled when the symbolic information is read.
- (Note4) If an attempt is made to remove the check from the parameter and to write sequence programs while PLC is running, the prompt "PLC is running. Do you want to force write of the files?" is displayed. 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?" is displayed.

23.11 Writing a Sequence Program to ROM with GX Works2

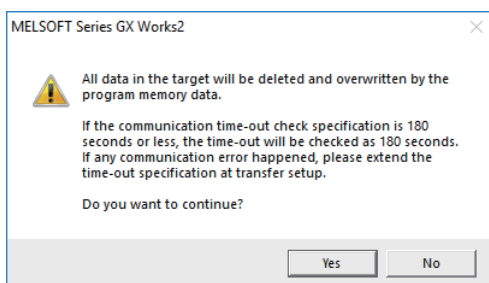
[Operation procedure]

- (1) Start the operation screen by the following operation on GX Works2.
[Online] -> [Export to ROM Format]



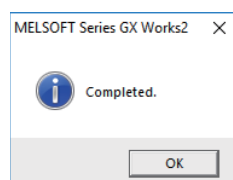
(Note) Only [memory card (Flash)] is valid as [Target].

- (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 overwrite and deleted. This should be done with extreme caution.

- (3) Writing is completed when the following dialog is displayed. Click [OK].



23.12 Setting the PLC Parameters

Select [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 communication valid	-	-	-	-

(Note 1) Be sure to set the bits indicated - and blanks to 0.

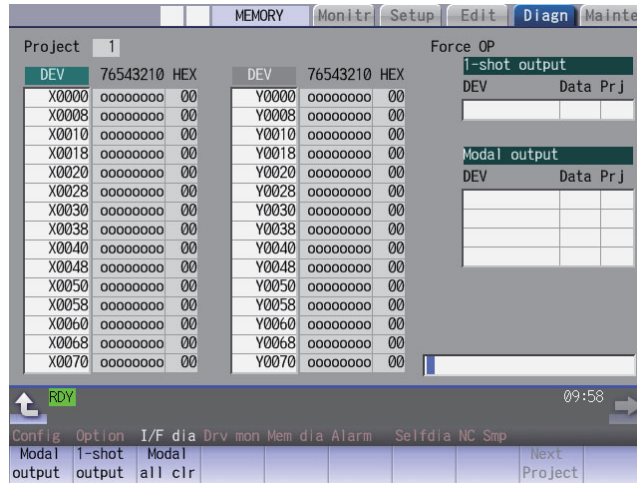
(Note 2) Functions marked with ■ may not be available for some machine types.

Confirming the Basic Operation

24.1 Checking Inputs/Outputs and Alarms

(1) Checking the input signals

- (a) Select [I/F dia] on the Diagn screen.
- (b) Confirm that signals turn ON/OFF properly on the IF Diagnosis screen.



(2) Checking the alarm display

- (a) Select [Alarm] on the Diagn screen.
- (b) Check any other alarm than "Emergency stop EXIN" displayed on the Alarm screen.



24.2 Confirming Manual Operation

24.2.1 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 2)
(Note 1) If any abnormal noise or vibration occurs, execute an emergency stop and take a measure against vibration. (Refer to "First Measure Against Vibration".)
(Note 2) 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.

24.2.2 Using JOG Feed

- (1) Select JOG mode.
- (2) Set the manual feed rate to 100mm/min.
- (3) Cancel the emergency stop. Confirm the operation status displays "RDY". (Note 2)
(Note 1) If any abnormal noise or vibration occurs, execute an emergency stop and take a measure against vibration. (Refer to "First Measure Against Vibration".)
(Note 2) 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.

24.3 Servo Simplified Adjustment

24.3.1 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".

	MEMORY	Monitr	Setup	Edit	Diagn	Mainte
Gain (1/s)	0	0	0	0		
Droop (i)	0	0	0	0		
Speed (r/min)	0	0	0	0		
Feedrate (mm/s)	0	0	0	0		
Load current (%)	0	0	0	0		
Max current 1 (%)	0	0	0	0		
Max current 2 (%)	0	0	0	0		
Max current 3 (%)	0	0	0	0		
Over load (%)	0	0	0	0		
Regen load (%)	0	0	0	0		
Est disturb torq(%)	0	0	0	0		
Max disturb torq(%)	0	0	0	0		
Load inertia R (%)	0	0	0	0		
AFLT frequency (Hz)	0	0	0	0		
AFLT gain (dB)	0	0	0	0		
LED display	00	00	00	00		

(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)".

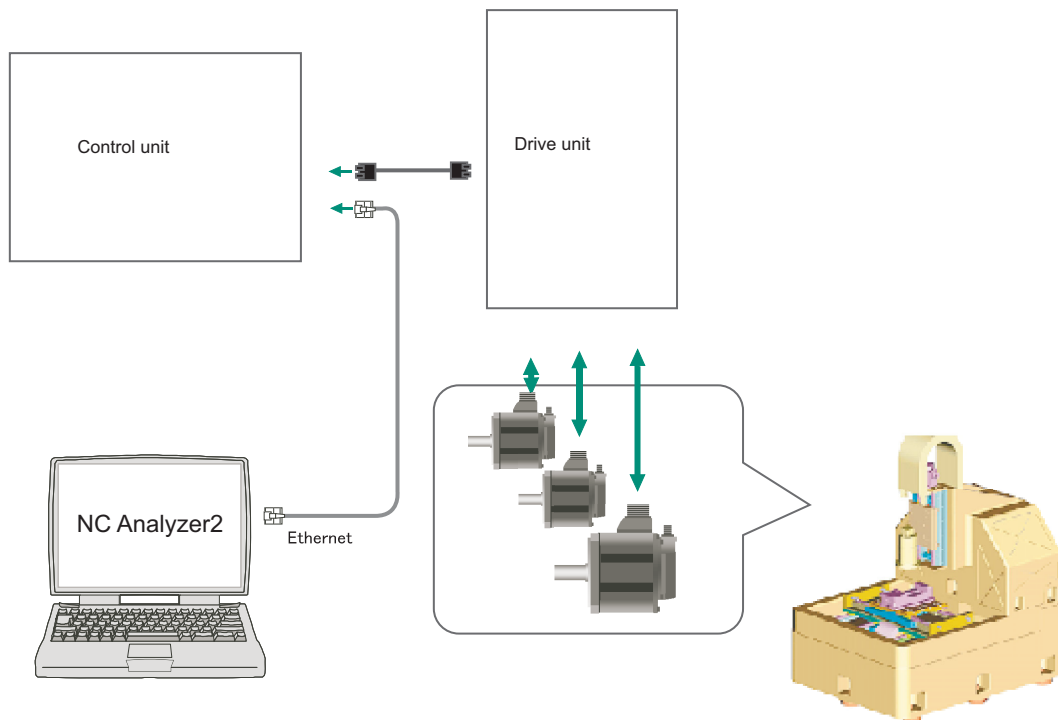
No.	Name	X	Z	C
2238	SV038(FHz1)	0	0	0
2239	SV039(LMCD)	0	0	0
2240	SV040(LMCT/Icy)	0	0	0
2241	SV041(LMC2)	0	0	0
2242	SV042(OVS2)	0	0	0
2243	SV043(OBS1)	0	0	0
2244	SV044(OBS2)	0	0	0
2245	SV045(TRUB/Ib1)	0	0	0
2246	SV046(FHz2)	0	0	0
2247	SV047(EC1)	100	100	100
2248	SV048(EMGr1)	0	0	0
2249	SV049(PGN1sp)	15	15	15
2250	SV050(PGN2sp)	0	0	0
2251	SV051(DFBT)	0	0	0
2252	SV052(DFBN)	0	0	0

(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.

24.3.2 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, create a program by the program creation function or use an arbitrary machining program.

(*2) Two or more NC axes in the same system are needed.

For details, refer to "NC Analyzer2 Instruction Manual" (IB-1501501326).

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.

25.1 Adjusting the Absolute Position Detection System

There are four types of the absolute position zero point initialization set: "marked point alignment method", "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 initialization set.

The required components differ depending on the detection method.

	Marked point alignment method I	Marked point alignment method II	Machine end stopper method	Dog type
Required component	None	None	Machine end stopper	Dog, dog-sensor
#2049 type	2	4	1	3
Basic position	The first grid point which is returned from where the mark is aligned.	The position where the marks are aligned.	The position where the table is pushed against the machine end stopper. Or the first grid pointed which is returned from where the table is pushed against the machine end stopper.	The first grid point after the dog OFF.
Reference	25.1.1 Basic Position Alignment Method I	25.1.2 Basic Position Alignment Method II	25.1.3 Machine End Stopper Method: Automatic Initialization 25.1.4 Machine End Stopper Method: Manual Initialization	25.1.5 Dog-type

Each method has the following characteristics

(1) Marked point alignment method I

Align the table side's mark and the machine side's mark.

The first grid point which is returned from 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.

(2) Marked point alignment method II

Align the table side's mark and the machine side's mark.

The 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.

(3) Machine end stopper method

[When #2059 zervas = 0]

Push the table against the machine end stopper.

The position where the table is pushed against the machine end stopper is determined as the basic position.

[When #2059 zervas = 1]

Push the table against the machine end stopper.

The first grid point which is returned from where the table is pushed against the machine end stopper is determined 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.

(4) Dog method

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.

The parameters for the approach speed and grid mask amount etc. need to be adjusted.

25.1.1 Basic Position Alignment Method I

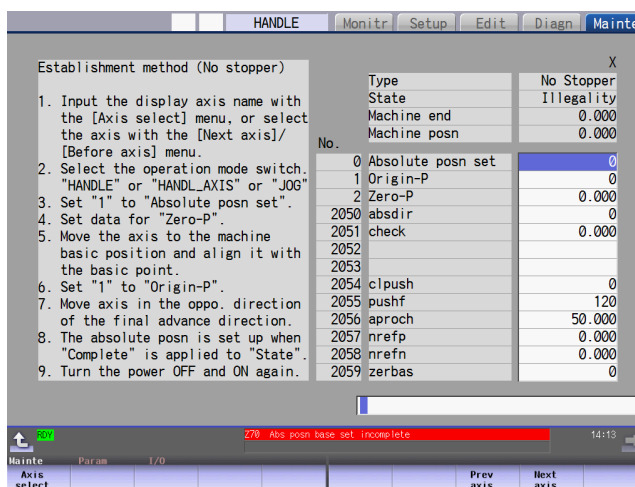
- (1) Preparations
Set the parameters on the [Abs.Posit.Param.] screen.
- ➔ #2049 type (absolute position detection type) = 2 (marked point alignment method)
#2050 absdir (basic point of Z direction) = 0/1
#2059 zerbas (select zero point parameter and basic point) = 0 (position where the axis was stopped) (* 1)
The parameters other than #2049 type can also be set on [Absolute position setting screen].

- (2) Turn the power OFF and ON.
(Only when #2049 has been reset.)

The following are the operations on [Absolute position setting screen].(Select [Mainte] - [To Abs pos])

- (3) Select the axis set to type 2 on the [Abs.Posit.Param.] screen.

Select the menu [Axis select], enter the axis name (#1022 axname2 (display axis name)) in the input area and then press [INPUT].

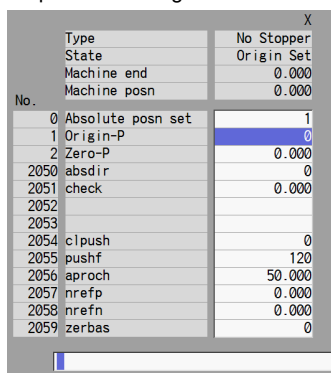


- (4) Select "HANDLE", "HANDL_AXIS", or "JOG" for the mode selection of machine operation switch.

- (5) Confirm that the cursor is placed on "Absolute posn set", input "1" in the input area and press the [INPUT] key.



The input value is registered in the "Absolute posn set" area.



25 Setting the Position Detection System

- (6) Move the cursor to "Zero-P" with the [↑] and [↓] keys. Enter the value in the input area and press the [INPUT] key. *2



The input value is registered in the "Zero-P" area.

		X
Type		No Stopper
State		Origin Set
Machine end		0.000
Machine posn		0.000
No.		
0	Absolute posn set	1
1	Origin-P	0
2	Zero-P	30.000
2050	absdir	0
2051	check	0.000
2052		
2053		
2054	clpush	0
2055	pushf	120
2056	aproch	50.000
2057	nrefp	0.000
2058	nrefn	0.000
2059	zerbas	0

- (7) Move the axis toward the mechanical basic position and align it to the marked point.



State: [Origin set]
Machine position: Not passed -> Current machine position

- (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 is registered in the "Origin-P" area.

		X
Type		No Stopper
State		Origin Set
Machine end		0.000
Machine posn		0.000
No.		
0	Absolute posn set	1
1	Origin-P	1
2	Zero-P	30.000
2050	absdir	0
2051	check	0.000
2052		
2053		
2054	clpush	0
2055	pushf	120
2056	aproch	50.000
2057	nrefp	0.000
2058	nrefn	0.000
2059	zerbas	0

- (9) Move the axis in the direction designated with the absolute position parameter "#2050 absdir".



State: [Ret. Ref. P.]
Machine end: Distance between the mechanical basic position and the first grid point
Machine position: Current machine position

- (10) The axis reaches the first grid point.

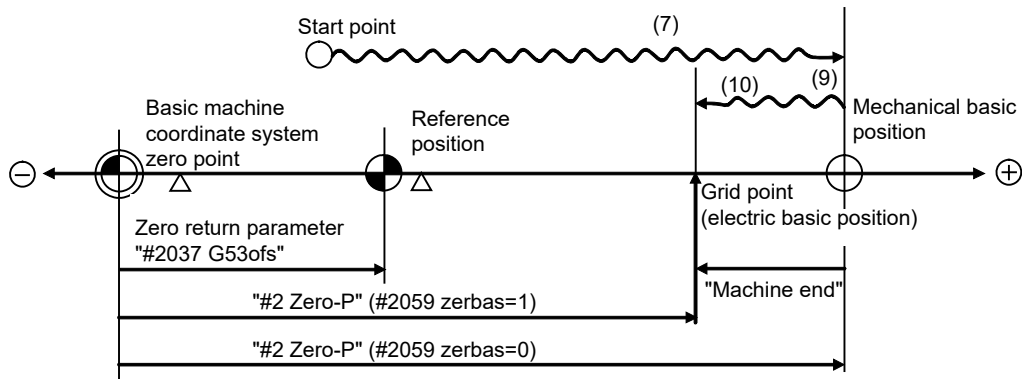


The axis stops automatically.
State: [Complete]
Machine position: Current machine position

The zero point initialization is now complete. After initializing all axes, turn the power OFF and ON.

*1 If "#2059 zerbas = 0 (position where the axis was stopped in the stopper method (grid point immediately before stopper = mechanical basic position))" is set, the condition will be as follows at the procedure (7):
State: [Complete], Machine end: 0.000, Machine position: Current machine position.

*2 The operation order is slightly different when "#2059 zerbas = 1 (grid point just before stopper)" is set. Set the procedure (6) "Zero-P" after "Complete" is displayed on "State" of the procedure (10).



- (7), (9) and (10) in this diagram correspond to the operation procedure.
- Select either one of "#2 Zero-P" with the parameter.

- (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.
- (Note 2) If aligning axis on the marked point is attempted without passing the grip point once after turning the power ON, the operation message "Not passed on grid" will appear. Return to a point before the last grid, and then repeat from step of aligning the axis on the marked point.
- (Note 3) If the first grid point is covered by the grid mask (#2028 grmask) as a result of return to the electric basic position, the axis stops at the next grid point.
Note that zero-point shift amount (#2027 G28sft) is invalid.
- (Note 4) Reconfirm the "absdir" setting if the machine does not move in the direction of "#2050 absdir". The machine will move only in the positive direction when set to "0", and the negative direction when set to "1".

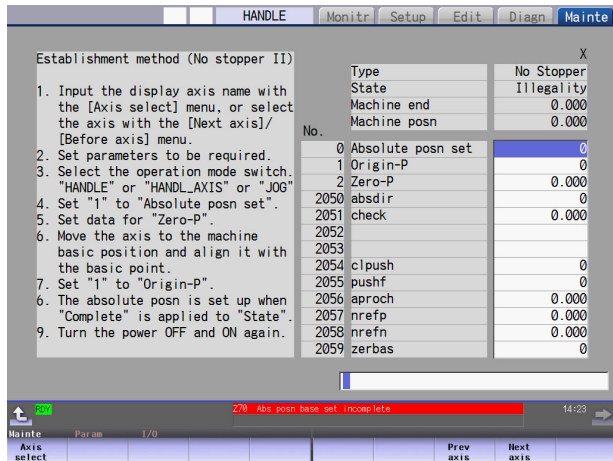
25.1.2 Basic Position Alignment Method II

- (1) Preparations
Set the parameters on the [Abs.Posit.Param.] screen. ➔ #2049 type (absolute position detection type) = 4 (marked point alignment method II)
#2059 zerbas (zero return parameter) = 0 (position where the axis was stopped)
The parameters other than #2049 type can also be set in [Absolute position setting screen].
- (2) Turn the power OFF and ON.
(Only when #2049 has been reset.)

The following are the operations on [Absolute position setting screen].(Select [Mainte] - [To Abs pos])

- (3) Select the axis set to type 4 on the [Abs.Posit.Param.] screen.

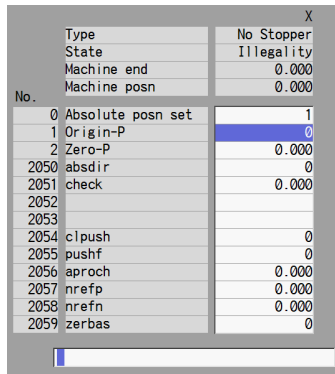
Select the menu [Axis select], enter the axis name (#1022 axname2 (display axis name)) in the input area and then press [INPUT]. ➔



- (4) Select "HANDLE", "HANDL_AXIS", or "JOG" for the machine operation switch.

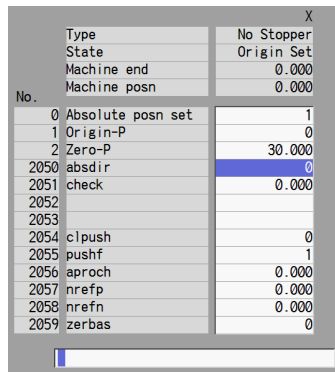
- (5) Confirm that the cursor is placed on "Absolute posn set", input "1" in the input area and press the [INPUT] key. ➔

The input value is registered in the "Absolute posn set" area.



- (6) Move the cursor to "Zero-P" with the [↑] and [↓] keys.
Enter the value in the input area of "Zero-P" and press the [INPUT] key.
(* 1)

The input value is registered in the "Zero-P" area.



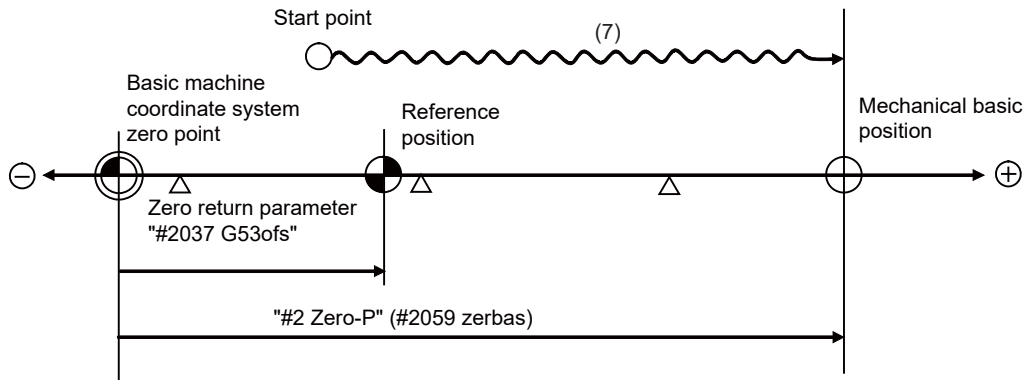
- (7) Move the axis toward the mechanical basic position and align it to the marked point. ➡ State: [Origin set]

- (8) Move the cursor to "Origin-P" with the [↑] and [↓] keys. ➡ The input value is registered in the "Origin-P" area.
 Input "1" in the input area and press the [INPUT] key. State: [Complete]
 Machine end: 0.000
 Machine position: Value set for "Zero-P"

		X
Type		No Stopper
State		Complete
Machine end		0.000
Machine posn		0.000
No.		
0	Absolute posn set	1
1	Origin-P	1
2	Zero-P	30.000
2050	absdir	0
2051	check	0.000
2052		
2053		
2054	clpush	0
2055	pushf	0
2056	aprouch	0.000
2057	nrefp	0.000
2058	nrefn	0.000
2059	zerbas	0

The zero point initialization is now complete. After initializing all axes, turn the power OFF and ON.

*1 The operation order is slightly different when "#2059 zerbas = 1 (grid point just before stopper)" is set. Set the procedure (6) "Zero-P" after "Complete" is displayed on "State" of the procedure (8).



- "#2 Zero-P" is not influenced by the parameter (#2059 zerbas = 1).

- (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.
- (Note 2) If aligning 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 appear. Return to a point before the last grid, and then repeat from the step of aligning the axis on the marked point.
- (Note 3) If the first grid point is covered by the grid mask (#2028 gmask) as a result of return to the electric basic position, the axis stops at the next grid point. Note that the zero point shift (#2027 G28sft) is invalid.
- (Note 4) This method is not interfered by the setting of "#2059 zerbas", and the basic position is always where the marked point alignment is attempted.

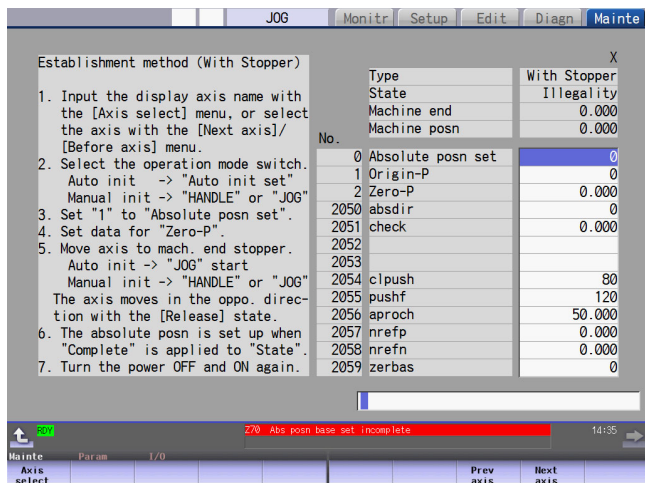
25.1.3 Machine End Stopper Method: Automatic Initialization

- (1) Preparations
Set the parameters on the [Abs.Posit.Param.] screen. ➔ #2049 type (absolute position detection type) = 1 (stopper method)
#2054 clpush (current limit) = 0 to 100
#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
(position where the axis was stopped)*1
The parameters other than #2049 type can also be set on [Absolute position setting screen].
- (2) Turn the power OFF and ON.
(Only when #2049 has been reset.)

The following are the operations on [Absolute position setting screen].(Select [Mainte] - [To Abs pos])

- (3) Select the axis set to type 1 on the [Abs.Posit.Param.] screen.

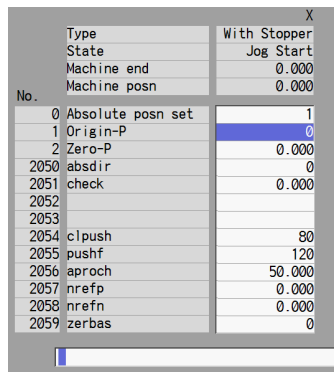
Select the menu [Axis select], enter the axis name (#1022 axname2 (display axis name)) in the input area and then press [INPUT]. ➔



- (4) Select the "Auto init set" mode of machine operation switch.

- (5) Confirm that the cursor is placed on "Absolute posn set", input "1" in the input area and press the [INPUT] key. ➔

The input value is registered in the "Absolute posn set" area.



- (6) Move the cursor to "Zero-P" with the [↑] and [↓] keys. Enter the value in the input area and press the [INPUT] key. *2



The input value is registered in the "Zero-P" area.

		X	
Type		With Stopper	
State		Jog Start	
Machine end		0.000	
Machine posn		0.000	
No.			
0	Absolute posn set		1
1	Origin-P		0
2	Zero-P	30.000	
2050	absdir		0
2051	check		0.000
2052			
2053			
2054	clpush		80
2055	pushf		120
2056	aproch		50.000
2057	nrefp		0.000
2058	nrefn		0.000
2059	zerbas		0

- (7) Start JOG operation.



State: [Stopper1]
Machine position: Not passed -> Current machine position

Hereafter, the images for operations are omitted.

- (8) The axis moves toward the machine end stopper at the "push speed".



State: [Stopper1]
Machine position: Current machine position

- (9) 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 "push speed".



State: [Zero-P. Rel.]
Machine position: Current machine position

- (10) After the axis arrives at the approach point, the axis moves toward the machine end stopper at the "push speed".



State: [Stopper2]
Machine position: Current machine position

- (11) After the axis pushes against the machine end stopper and the current reaches its limit continually during the given time period, the axis returns toward the grid point immediately before the stopper at the "push speed".



State: [Ret. Ref. P.]
Machine position: Current machine position

- (12) The axis reaches the grid point immediately before the stopper.



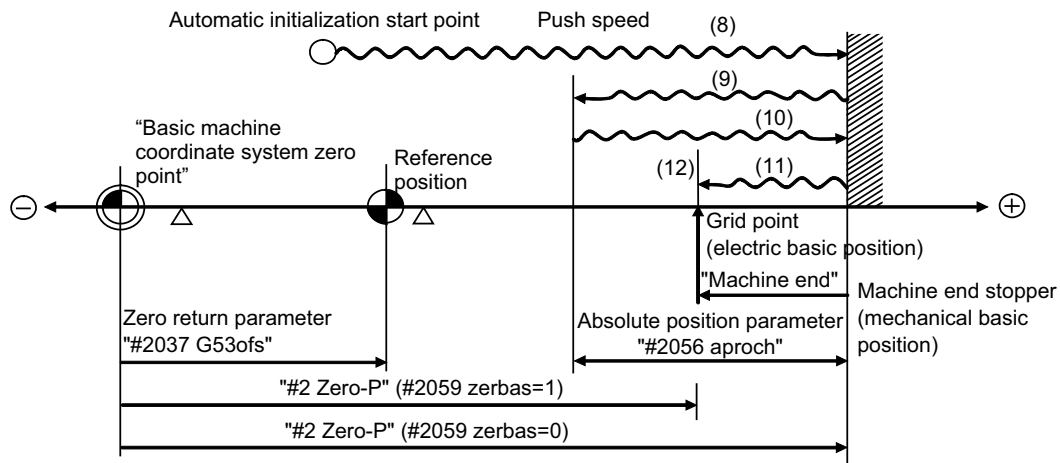
State: [Complete]
Machine end: Distance between the machine end stopper and the grid point immediately before the stopper
Machine position: Current machine position

The zero point initialization is now complete. After initializing all axes, turn the power OFF and ON.

*1 If "#2059 zerbas = 0 (position where the axis was stopped in the stopper method (grid point immediately before stopper = machine end stopper))" is set, the axis will push against the machine end stopper of the procedure (11) and will stop automatically after the current reaches its limit continually during given time period. The condition will be as follows:

State: [Complete], Machine end: 0.000, Machine position: Current machine position.

*2 The operation order is slightly different when "#2059 zerbas = 1 (grid point just before stopper)" is set. Set the procedure (6) "Zero-P" after "Complete" is displayed on "State" of the procedure (12).



- (8) to (12) in this diagram correspond to the operation procedure.
- Select either one of "#2 Zero-P" with the parameter.

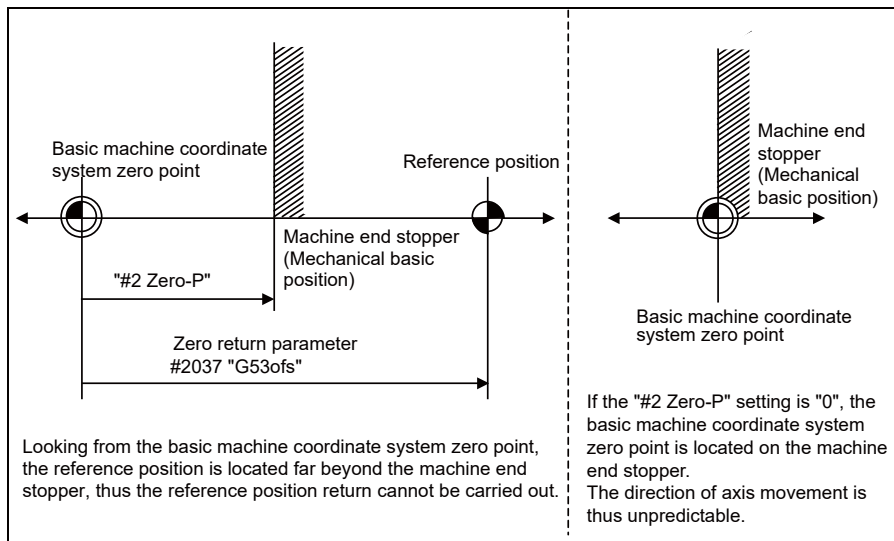
- (Note 1) To change just the basic machine coordinate zero point, set "#0 Absolute posn set" and "#2 Zero-P", and then turn the power OFF and ON.
- (Note 2) If pressing against the machine end is attempted without passing the grip point once after turning the power ON, the operation message "Not passed on grid" will appear. Return to a point before the last grid, and then repeat from step of pressing against the machine end stopper.
- (Note 3) If the first grid point is covered by the grid mask (#2028 grmask) as a result of return to the electric basic position, the axis stops at the next grid point.
Note that zero-point shift amount (#2027 G28sft) is invalid.
- (Note 4) Acceleration/deceleration during movement at the specified push speed is performed in smoothing-off (stepfeed) mode.
- (Note 5) If "0" is specified for "#2056 aproch" of the absolute position parameters, the machine zero point is regarded as the approach point.
- (Note 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.

(Note7) 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.

In the above cases, if the "#2 Zero-P" setting is inappropriate, this means that the relation of "#2 Zero-P" and Zero return parameter "#2037 G53ofs" is inappropriate. That is, if "#2 Zero-P" is smaller than the "#2037 G53ofs", the machine end stopper will be located between the basic machine coordinate system zero point and reference position; this disables automatic initialization. (Refer to the following left figure.)

If "#2 Zero-P" is set to "0", the machine end stopper direction is unpredictable; this also disables automatic initialization. (Refer to the following right figure.)



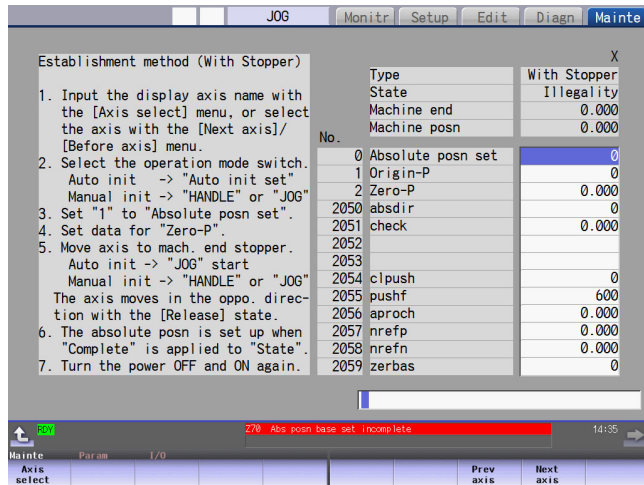
25.1.4 Machine End Stopper Method: Manual Initialization

- (1) Preparations
Set the parameters on the [Abs.Posit.Param.] screen. ➔ #2049 type (absolute position detection type) = 1 (stopper method)
#2054 clpush (current limit) = 0 to 100
#2059 zerbas (select zero point parameter and basic point) = 0
(position where the axis was stopped) *1
The parameters other than "#2049 type" can also be set on [Absolute position setting screen].
- (2) Turn the power OFF and ON.
(Only when "#2049 type" has been reset.)

The following are the operations on [Absolute position setting screen].(Select [Mainte] - [To Abs pos])

- (3) Select the axis set to type 1 on the [Abs.Posit.Param.] screen.

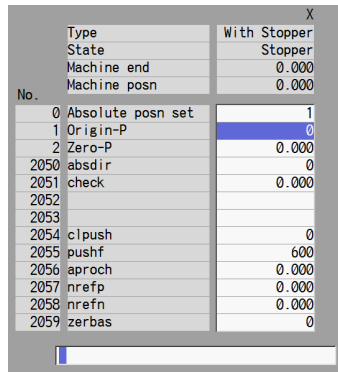
Select the menu [Axis select], enter the axis name (#1022 axname2 (display axis name)) in the input area and then press [INPUT]. ➔



- (4) Select "HANDLE" or "JOG" for the mode selection of machine operation switch.

- (5) Confirm that the cursor is placed on "Absolute posn set", input "1" in the input area and press the [INPUT] key. ➔

The input value is registered in the "Absolute posn set" area.



- (6) Move the cursor to "Zero-P" with the [↑] and [↓] keys. Enter the value in the input area and press the [INPUT] key. (*2)



The input value is registered in the "Zero-P" area.

Type	With Stopper	X
State	Stopper	
Machine end		0.000
Machine posn		0.000
No.		
0	Absolute posn set	1
1	Origin-P	0
2	Zero-P	30.000
2050	absdir	0
2051	check	0.000
2052		
2053		
2054	clipush	0
2055	pushf	600
2056	aproch	0.000
2057	hrefp	0.000
2058	nrefn	0.000
2059	zerbas	0

- (7) Move the axis toward the machine end stopper.



State: [Stopper]
 Machine end: Distance between the machine end stopper and the grid point immediately before the stopper
 Machine position: Not passed -> Current machine position

Hereafter, the images for operations are omitted.

- (8) Press the axis against the machine end stopper.



State: [Stopper]
 Machine position: Current machine position

- (9) The current limit is reached continually during the given time period.



State: [Release]
 Machine position: Current machine position

- (10) Move the axis in the counter direction.



State: [Ret. Ref. P.]
 Machine position: Current machine position

- (11) The axis reaches the grid point immediately before the stopper.



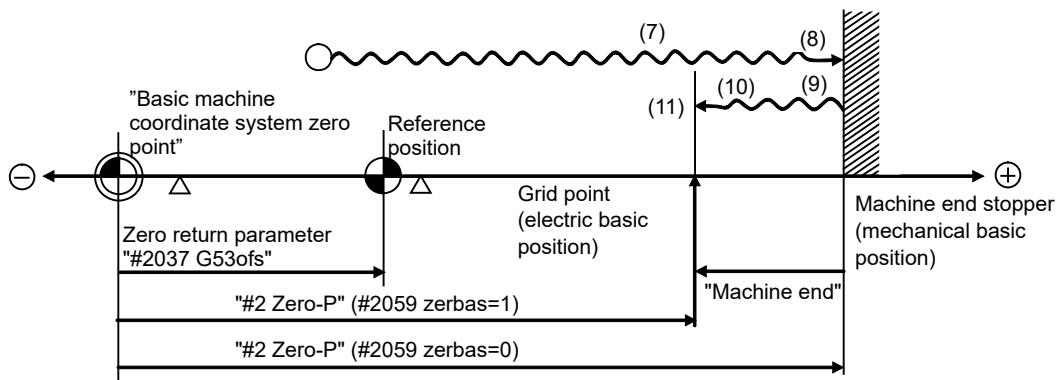
State: [Complete]
 Machine position: Current machine position

The zero point initialization is now complete. After initializing all axes, turn the power OFF and ON.

*1 If "#2059 zerbas = 0 (position where the axis was stopped in the stopper method (grid point immediately before stopper = machine end stopper))" is set, the axis will stop automatically at the procedure (9) without moving in the opposite direction. The condition will be as follows:

State: [Complete], Machine end: 0.000, Machine position: Current machine position.

*2 The operation order is slightly different when "#2059 zerbas = 1 (grid point just before stopper)" is set. Set the procedure (6) "Zero-P" after "Complete" is displayed on "State" of the procedure (11).



- (7) to (11) in this diagram correspond to the operation procedure.
- Select either one of "#2 Zero-P" with the parameter.

- (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.
- (Note 2) If pressing against the machine end is attempted without passing the grip point once after turning the power ON, the operation message "Not passed on grid" will appear. Return to a point before the last grid, and then repeat from step of pressing against the machine end stopper.
- (Note 3) If the first grid point is covered by the grid mask (#2028 grmask) as a result of return to the electric basic position, the axis stops at the next grid point.
Note that zero-point shift amount (#2027 G28sft) is invalid.

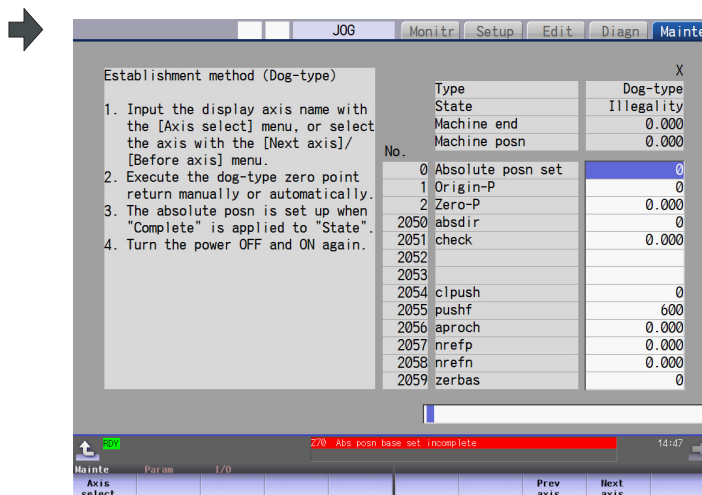
25.1.5 Dog-type

- (1) Preparations
Set the parameters on the [Abs.Posit.Param.] screen. → #2049 type (absolute position detection type) = 3 (dog-type)
- (2) Turn the power OFF and ON.
(Only when "#2049 type" has been reset.)

The following are the operations on [Absolute position setting screen].(Select [Mainte] - [To Abs pos])

- (3) Select the axis set to type 3 on the [Abs.Posit.Param.] screen.

Select the menu [Axis select], enter the axis name (#1022 axname2 (display axis name)) in the input area and then press [INPUT].



- (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 initialization 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.
- (Note 2) With dog-type reference position return, reference position return can be executed again even if the [State] is "Complete".

25.1.6 Setting the Grid Interval and the Reference Encoder for Grid Interval

Set the parameters "#2041 grspcref (reference encoder for grid interval)" and "#2049 grspc (grid interval)" according to the machine configuration.

(1) For semi-closed loop control

Set "0" (grid interval by the motor-end) to the reference encoder for grid interval.

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 the machine-end), the grid interval will be required to set the moving amount calculation value per a motor rotation (" $\#2201$ SV001 PC1" / " $\#2202$ SV002 PC2" x " $\#2218$ SV018 PIT").

(2) For full-closed loop control

Set "1" (grid interval by the machine-end) to the reference encoder for grid interval.

Set the grid interval same value as the Z phase pitch.

If the reference encoder for grid interval selection is set to "0" (grid interval by the motor-end), the grid interval will be required to set the moving amount calculation value per Z phase pitch (" $\#2202$ SV002 PC2" / " $\#2201$ SV001 PC1" x the Z phase pitch of the machine-end).

Parameter settings of "Specify an encoder 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-end	same value as the ball screw pitch	unnecessary
	1: grid interval by the machine-end	calculation value of " $\#2201$ SV001 PC1" / " $\#2202$ SV002 PC2" x " $\#2218$ SV018 PIT"	necessary
Full-closed	0: grid interval by the motor-end	calculation value of " $\#2202$ SV002 PC2" / " $\#2201$ SV001 PC1" x the Z phase pitch of the machine-end	necessary
	1: grid interval by the machine-end	same value as the Z phase pitch	unnecessary

* If the grid interval is set to "0", the ball screw pitch ($\#2218$ SV018 PIT) will be used instead of the grid interval.

25.1.7 Precautions Common for the Initialization 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.

25.1.8 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 (mechanical basic position or electrical basic position) looking from the basic machine coordinate system zero point.

<p>(Example 1) To set the zero point at 50.0mm before absolute position origin point on + end</p>	
<p>(Example 2) To set the zero point at 400.0mm before the machine basic position or absolute position origin point on - end.</p>	
<p>(Example 3) To set the basic machine coordinate system 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 mechanical basic position to the previous grid point. (Note that when setting the electrical basic position coordinate value in "#2 Zero-P", the "Machine end" value does not need to be considered.)</p>	
<p>To set the third grid point as the zero point when the "Machine end" display is -5.3 at the + end basic position. (Example of 10.0mm grid interval.)</p>	

(2) Setting the reference position

The reference position can be set as shown below by setting the "#2037 G53ofs".

<p>(Example 1) To set the reference position to the same position as the basic machine coordinate system zero point.</p>	
<p>(Example 2) To set the reference position at a position 200.0mm to the + side from the basic machine coordinate zero point. (To set the basic machine coordinate system zero point 300.0mm front of the absolute position origin point.)</p>	

(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.

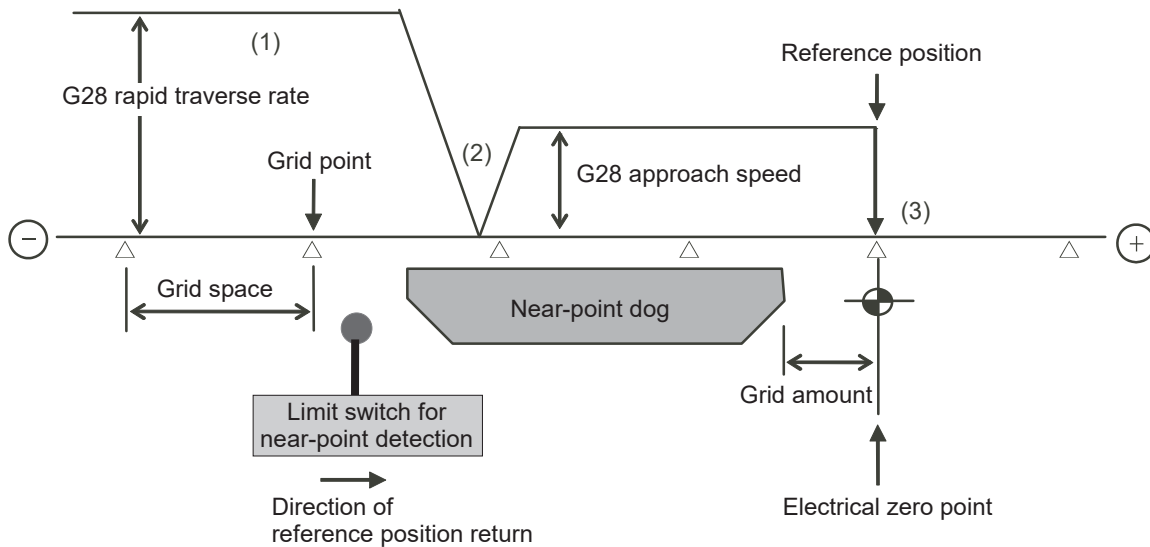
25.2 Adjustment of Reference Position Return in Relative Position Detection System

25.2.1 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) 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.

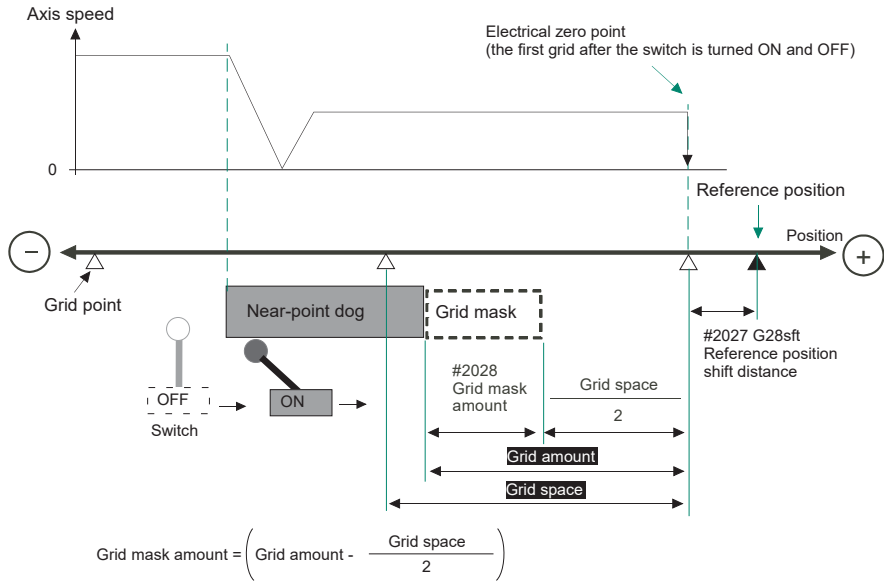
25.2.2 Dog-type Reference Position Return Adjustment Procedures

Adjust the dog-type reference position return with the following steps.

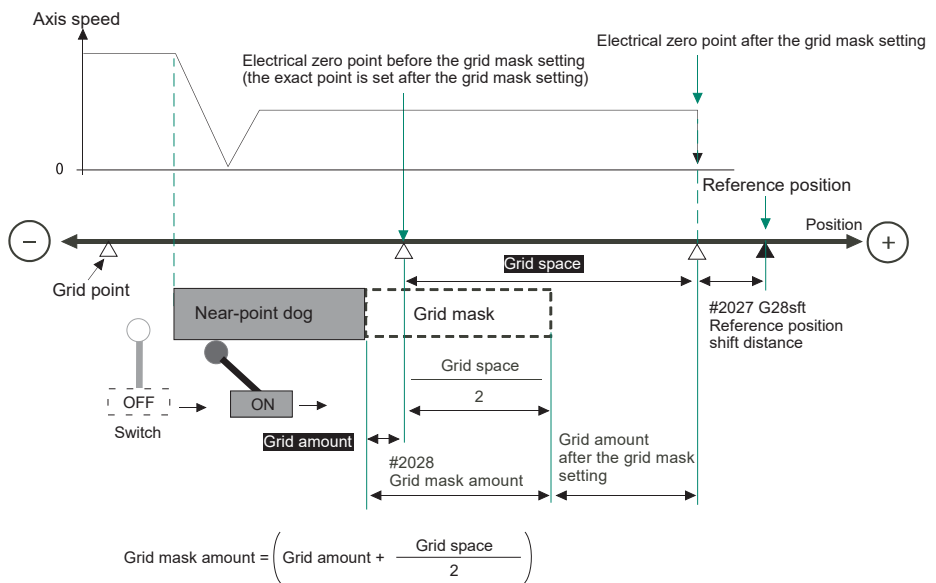
- (1) Select [Param] menu from the maintenance screen, and then select zero point parameter screen by pressing the page up/down keys.
The [zero point parameter] screen appears.
- (2) Set the following parameters to "0" on the [zero point parameter] screen.
Reference position shift amount (#2027 G28sft)
Grid mask amount (#2028 grmask)
- (3) Turn the power OFF and ON, and then execute reference position return.
(Note) Use the switches on the machine operation panel to command "reference position return mode" and operate the axis movement. The GOT project and 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 amnt".

(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



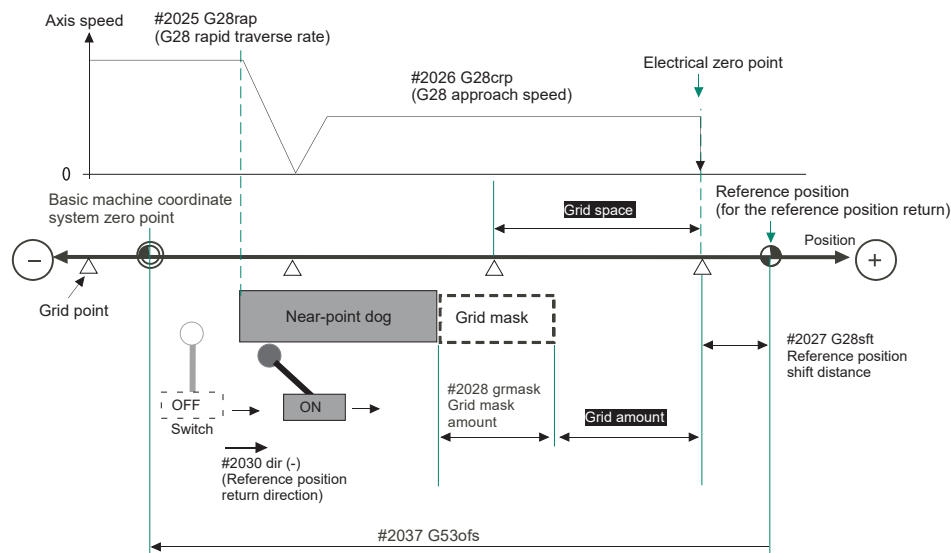
- When $\frac{\text{Grid space}}{2}$ is larger than the grid amount



(6) Set the determined grid mask amount for "#2028 grmask" of the [ZERO-RTN PARAM] screen.

- (7) Turn the power OFF and ON, and then execute 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 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 of "#2025 G28rap G28 rapid traverse rate".
The parameter "#2025 G28rap G28 rapid traverse rate" is usually set the maximum speed, which makes the high-speed movement in the 2nd reference position return 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 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 setting the grid mask amount.

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>

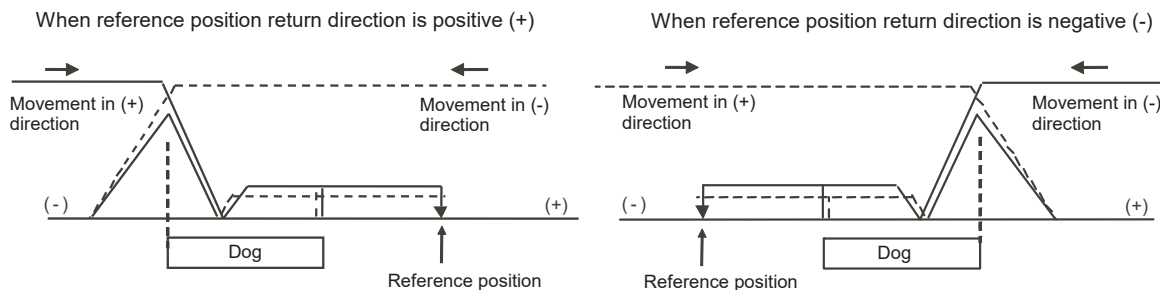
- (1) When linear feed mechanism is a ball screw:
The movement amount per motor rotation = the motor side gear ration / the machine side gear ratio x the ball screw pitch
- (2) When linear feed mechanism is a rack and pinion:
The movement amount per motor rotation = the motor side gear ration / the machine side gear ratio x number of pinion gear teeth x the rack pitch
- (3) 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 (-))

The direction of the (axis) movement, after the dog-type reference position return is executed and the limit switch kicks the dog and decelerate to stop, is set to either positive "0" or negative "1".

Set "0" if the reference position is in the positive direction from the near-point dog.

Set "1" if the reference position is in the negative direction from the near-point dog.

**Axis with no reference position (#2031 noref)**

Set the axis to carry out dog-type reference position return and the axis for absolute position detection to "0".

Set the axis without carrying out reference position return during the relative position detection 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 "0" is set, the reference position will be the position of the basic machine coordinate system zero point.

In "G53ofs" 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.

Selection of 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)

Setting the Tool Entry Prohibited Range

Following functions are available for setting a tool entry prohibited range to detect over travels (OT).

- (1) Stroke end (H/W OT)
The limit switch signal will detect the stroke end and limit the movement of the axis.
- (2) Stored stroke limit (S/W OT)
Prohibited ranges are set with parameters.



When stroke end (H/W OT) is set, the axis will move the distance required to decelerate and stop after H/W OT is activated.

When stored stroke limit (S/W OT) is set, the axis will stop before the prohibited range of S/W OT including the deceleration distance.

For safety, set the stroke end (H/W OT) and also, the stored stroke limit (S/W OT).

WARNING

Stroke end (H/W OT) and stored stroke limit (S/W OT) must always be set. If not, the tool may hit the machine end.

26.1 Stroke End (H/W OT)

The axis movement is controlled by the limit switch which detects the stroke end.

Signal device No. is allocated by the following parameters.

Parameter "#2074" and "#2075" will be valid only when "#1226 aux10/bit" is set to "1".

#1226 aux10/bit5: Set to "1" (assigning the dog signal is valid).

#2074 H/W OT+: Set the input device for assigning the OT (+) signal. (Setting range 0000 to 02FF (Hexadecimal))

#2075 H/W OT-: Set the input device for assigning the OT (-) signal. (Setting range 0000 to 02FF (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.

(Note 2) When parameter "#1226 aux10/bit5" is set to "1", do not set the same device No. to #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).

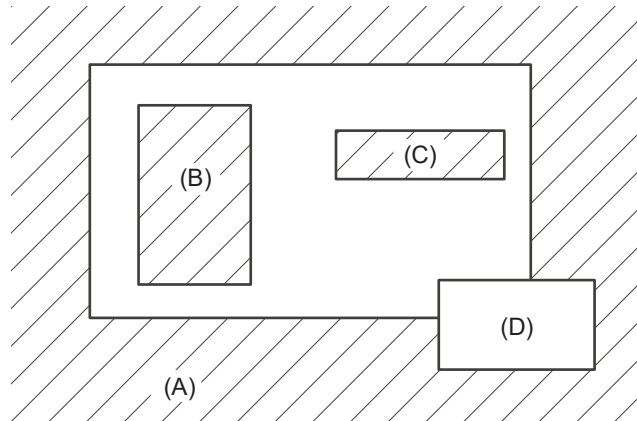
26.2 Stored Stroke Limit (S/W OT)


26.2.1 Outline


Three tool entry prohibited ranges can be set with stored stroke limit I, stored stroke limit II, IIB and stored stroke limit IB. Part of the prohibited range on the outside of stored stroke limit I can turn into a moveable range with stored stroke limit IC.

Set the parameters to select the entry prohibited range, stored stroke limit II or IIB.

(II: Prohibits entering outside the range IIB: Prohibits entering inside the range)



 : Moveable range

 : Prohibited range

(A): Prohibited range by stored stroke limit I

(B): Prohibited range by stored stroke limit IIB

(C): Prohibited range by stored stroke limit IB

(D): Moveable range by stored stroke limit IC

If the axis is moving over the set range, an alarm will appear and the axis will decelerate to a stop.

If the prohibited range is entered and an alarm occurs, movement will be possible only in the direction opposite the entry direction.

Valid Conditions of Stored Stroke Limit

When using the relative position detection system, the stored stroke limit is invalid until the reference position return is completed after the power is turned ON.

The stored stroke limit can be validated even if the reference position return is not yet completed, by setting "#2049 type (Absolute position detection method)" to "9".

(Note) If the absolute position detection is valid when using the absolute position detection system, the stored stroke limit will be validated immediately after the power is turned ON.

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 has been validated while the reference position return has 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.

(Note) While the reference position return has not been completed, only the manual and handle feed mode allow the axis movement. Automatic operation is validated after the reference position return is completed.

 **CAUTION**

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

26 Setting the Tool Entry Prohibited Range

The stored stroke limits I, II, IIB, IB and IC are handled as follows.

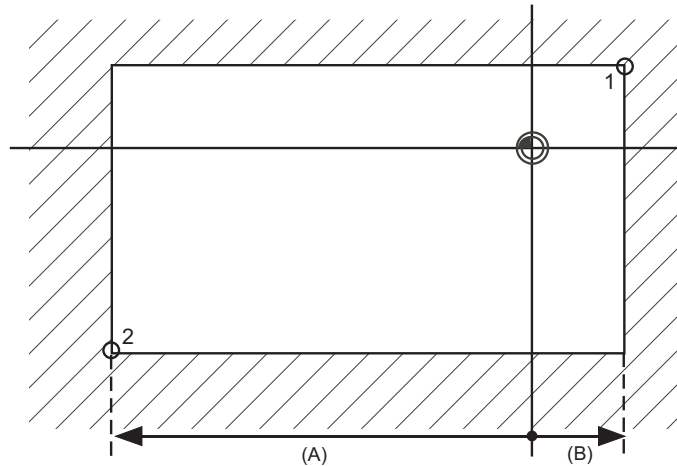
Type	Prohibited range	Description	Range setting parameters	Validating conditions
I	Outside	- Set by the machine tool builder. - When used with II, the confined range designated by the two functions becomes the movement valid range.	"#2013 OT - (Soft limit I -)" "#2014 OT + (Soft limit I +)"	- Reference position return is completed. - #2013 and #2014 are not set to the same value.
II	Outside	- Set by the user. - Select II or IIB with the parameters.	- "#8210 OT-INSIDE" = "0" - Used with I.	- Reference position return is completed. - #8204 and #8205 are not set to the same value. - "#8202 OT-CHECK OFF" = "0"
IIB	Inside		- "#8210 OT-INSIDE" = "1"	
IB	Inside	- Set by the machine tool builder.	"#2061 OT_1B- (Soft limit IB-)" "#2062 OT_1B+ (Soft limit IB +)"	- Reference position return is completed. - #2061 and #2062 are not set to the same value.
IC	Outside	- Set by the machine tool builder.	"#2061 OT_1B- (Soft limit IB-)" "#2062 OT_1B+ (Soft limit IB +)"	- Reference position return is completed. - #2061 and #2062 are not set to the same value. - "#2063 OT_1Btype (Soft limit IB type)" = "2"


- The stroke check will not be executed when both maximum and minimum value are set to the same value.
- This function is valid after the reference position return if the system does not apply the absolute position detection system.
- Before the machine enters the prohibited range, an error "M01 Operation error 0007" (S/W stroke end) will occur, and the machine movement will stop. 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 range.
- The distance between the prohibited range and stop position will depend on the feedrate, etc.


26.2.2 Stored Stroke Limit I

This is a stroke limit function used by the machine tool builder. The boundary is set with the parameters ("#2013 OT - (Soft limit I -)" and "#2014 OT + (Soft limit I +)"). The outside of the set boundary is the prohibited range. The outside of the set boundary is the prohibited range.

When used with the stored stroke limit II function, the confined range designated by the two functions becomes the moveable range.



 : Moveable range

 : Prohibited range

(A): Set value for (-) side

(B): Set value for (+) side

Point 1: "#2014 OT+ (Soft limit I +)" and

Point 2: "#2013 OT- (Soft limit I -)" are set with the coordinate values in the basic machine coordinate system.

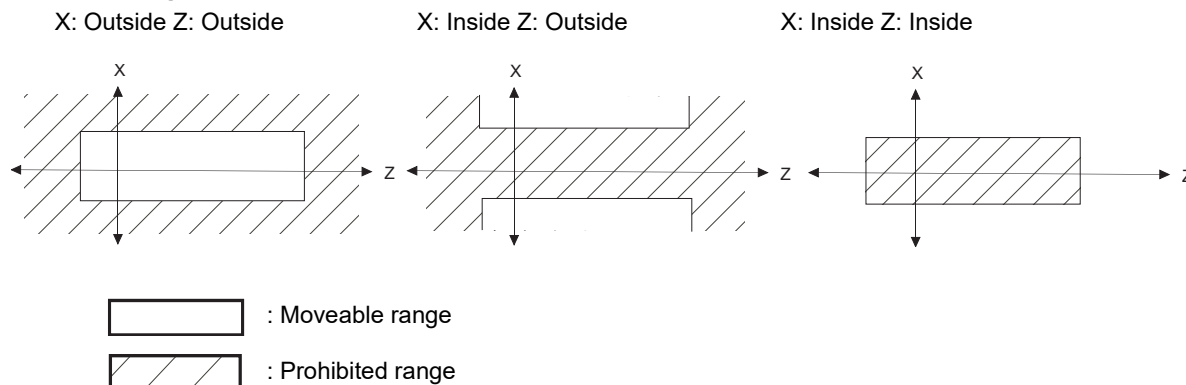
(Note 1) This function will be invalid if the same value excluding "0" is set for both "#2013 OT -" and "#2014 OT +".

26.2.3 Stored Stroke Limit II

The boundary is set with 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 range. Whether the inside or outside of the range is prohibited is determined by "#8210 OT-INSIDE". When the inside is selected, this function is called stored stroke limit IIB.

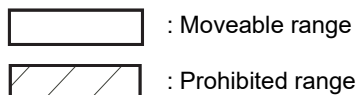
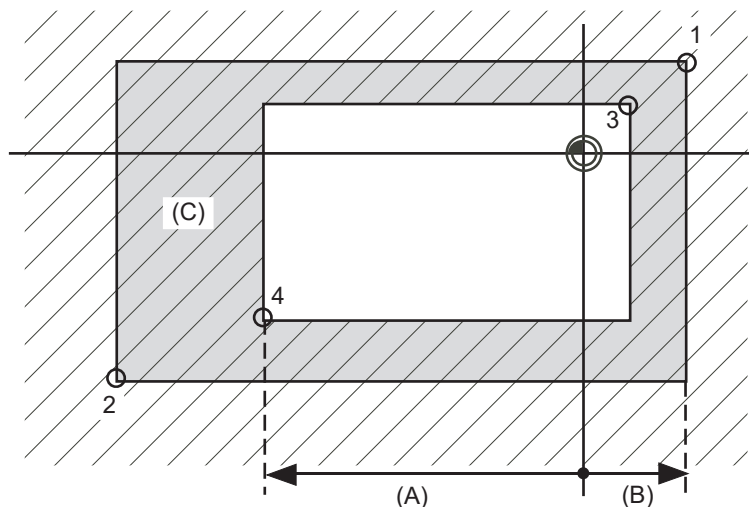
When using program commands, entry of the tool into the prohibited range is prohibited with G22, and entry into the prohibited range is enabled with G23. The stored stroke limit II can be invalidated for each axis with setting "#8202 OT-CHECK OFF" to "1".

Prohibited range



(1) Stored stroke limit II (When prohibited range is on outside)

When used with the stored stroke limit I function, the narrow range designated by the two types becomes the movement valid range.



(A): Set value for (-) side

(B): Set value for (+) side

(C): Prohibited range by stored stroke limit II

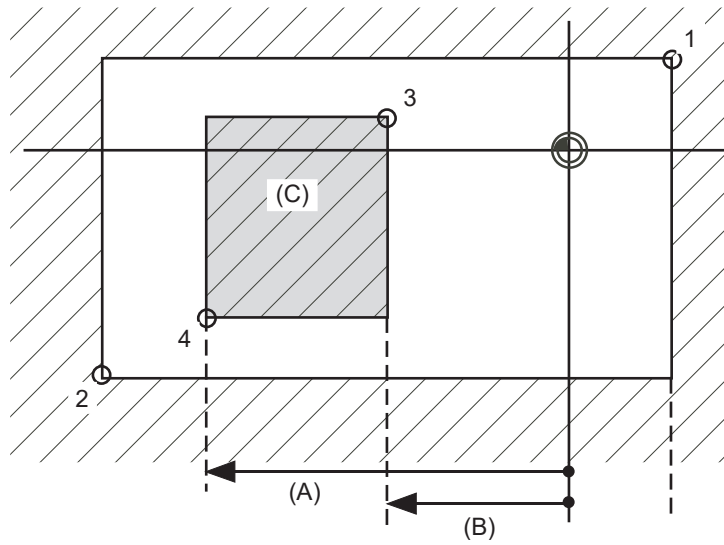
Point 3: "#8205 OT-CHECK-P" and


Point 4: "#8204 OT-CHECK-N" are set with the coordinate values in the basic machine coordinate system.


Points 1 and 2 are the prohibited range set with stored stroke limit I.

(2) **Stored stroke limit IIB (When prohibited range is on inside)**

A range except for that of the stored stroke limit I becomes the movement prohibited range.



 : Moveable range

 : Prohibited range

(A): Set value for (-) side

(B): Set value for (+) side

(C): Prohibited range by stored stroke limit IIB

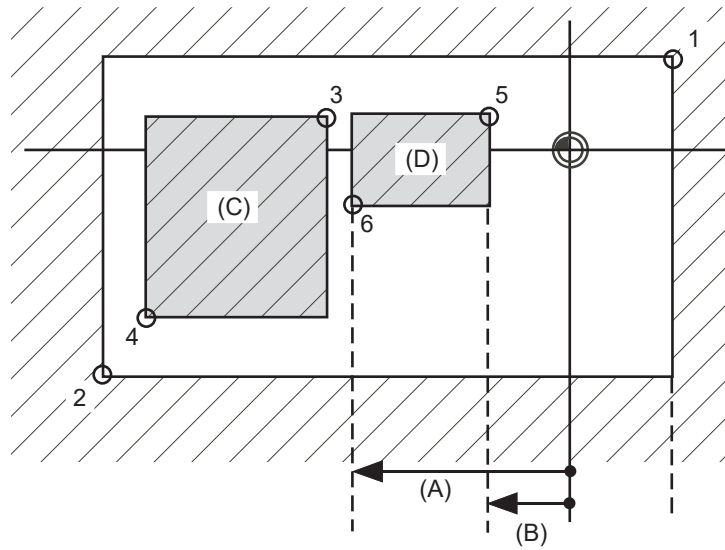
Point 3: "#8205 OT-CHECK-P" and


Point 4: "#8204 OT-CHECK-N" are set with the coordinate values in the basic machine coordinate system.

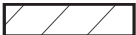
Points 1 and 2 are the prohibited range set with stored stroke limit I.

26.2.4 Stored Stroke Limit IB

The boundary is set for each axis with the axis parameters "#2061 OT_1B-" and "#2062 OT_1B+". The inside of the set boundary is the prohibited range.



 : Moveable range

 : Prohibited range

Point 5: "#2062 OT_1B+ (Soft limit IB+)" and

Point 6: "#2061 OT_1B- (Soft limit IB-)" are set with the coordinate values in the basic machine coordinate system.

(A): Set value for (-) side

(B): Set value for (+) side

(C): Prohibited range by stored stroke limit II

(D): Prohibited range by stored stroke limit IB

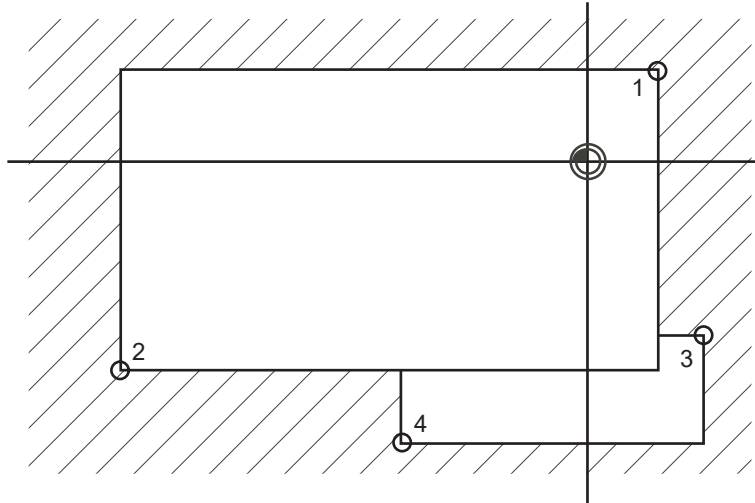
Points 1 and 2 are the prohibited range set with stored stroke limit I.


Points 3 and 4 are the prohibited range set with stored stroke limit IIB.


26.2.5 Stored Stroke Limit IC

The boundary is set for each axis with the axis parameters "#2061 OT_1B-" and "#2062 OT_1B+". The inside of the set boundary is the machine movement valid range.

This is valid when the axis parameter "#2063 OT_1Btype (Soft limit IB type)" is set to "2". Cannot be used with soft limit IB.



 : Moveable range

 : Prohibited range

Point 3: "#2062 OT_1B+ (Soft limit IB+)" and

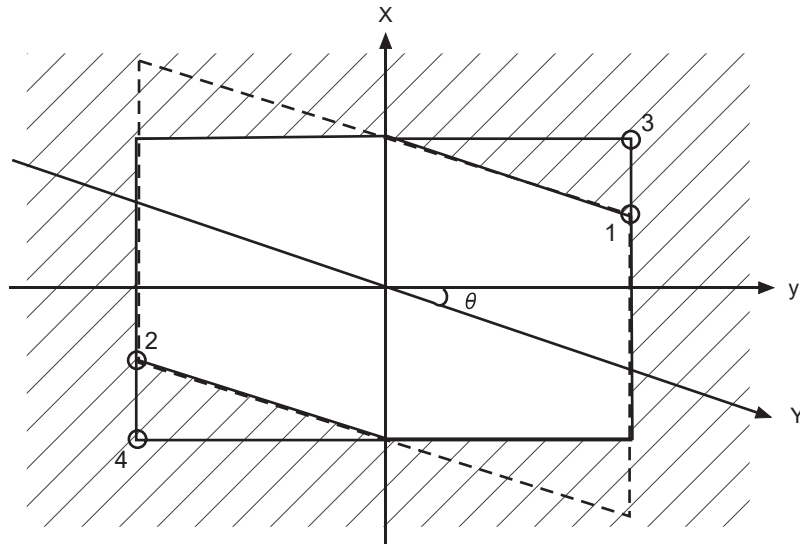
Point 4: "#2061 OT_1B- (Soft limit IB-)" are set with the coordinate values in the basic machine coordinate system.


Points 1 and 2 are the prohibited range set with stored stroke limit I.


26.2.6 Movable Range during Inclined Axis Control

By setting "#2063 OT_1Btype" to "3", the inclined axis control axis can be checked with the program coordinates using the stored stroke limit IB/IC range setting ("#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 range that does not fit into either of the following two prohibited ranges will be the movable range.



 : Moveable range

 : Prohibited range

Point 3: "#2062 OT_1B+ (Soft limit IB+)" and

Point 4: "#2061 OT_1B- (Soft limit IB-)" are set with the coordinate values in the basic machine coordinate system.

Points 1 and 2 are the prohibited range set with stored stroke limit I.

26.2.7 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 range's parameters, which does not contain the 0 point of the basic machine coordinate system, is the entry prohibited range.

The prohibited range parameters for the rotation 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 in the same manner 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 range parameter)

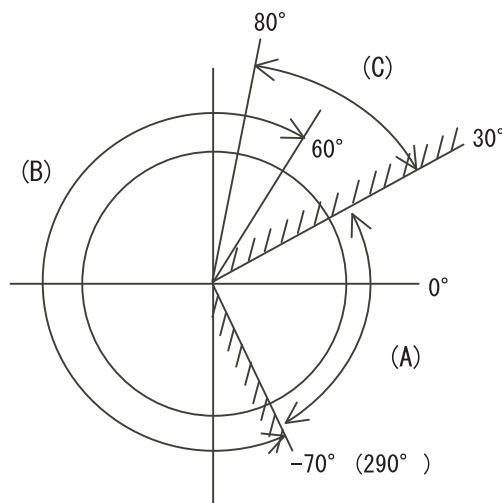
#2013 OT -: -70.000°

#2014 OT +: 60.000°

Stored stroke limit II (maximum value and minimum value of prohibited range parameter)

#8204 OT-CHECK-N: 30.000°

#8205 OT-CHECK-P: 80.000°



(A): Moveable range

(B): Prohibited range by stored stroke limit I

(C): Prohibited range by stored stroke limit II

(Note) Do not use stored stroke limits IB, IIB or IC. Invalidate stored stroke limits IB, IIB and IC by setting the parameters as shown below.

#8210 OT INSIDE: 0 (stored stroke limit II valid, IIB invalid)

#2061, #2062 set to same value (stored stroke limits IB and IC invalid)

26.2.8 Changing the Area for the Stored Stroke Limit I

The range of the stored stroke limit I can be changed to the value set to R register for each axis. When "Stored stroke limit I change request" signal is turned ON, the range 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 by with the R register values.

Refer to "PLC Programming Manual" and "PLC Interface Manual" for details.

26.2.9 Precautions

- (1) If the maximum value and minimum value of the stored stroke limit's prohibited range are set to the same value, the following will occur.
 - (a) When the maximum value and minimum value are set to "0", if the outside is the prohibited range, the entire range will be prohibited. If the inside is the prohibited range, the entire range will be the moveable range.
 - (b) If data other than 0 is set for the maximum value and minimum value, the entire range will be the moveable range.
- (2) The stored stroke limit IC is valid when the axis parameter #2063 is changed. If changed during automatic operation, the function will be validated after the smoothing for all axes reaches 0.
- (3) Make sure that the lower limit value of the stored stroke limit IC setting value is "smaller than the upper limit value".
- (4) To set the inside of the specified range as a prohibited range, set the parameters as follow:

EX. There are 2 methods to set 10° to 70° as a prohibited range.

(Method 1) #2013 OT-: 70° #2014 OT+: 370°

(Method 2) #2013 OT-: 370° #2014 OT+: 70°

Setting the Machine Error Compensation

27.1 Memory-type Pitch Error Compensation/Memory-type Relative Position Error Compensation

27.1.1 Outline

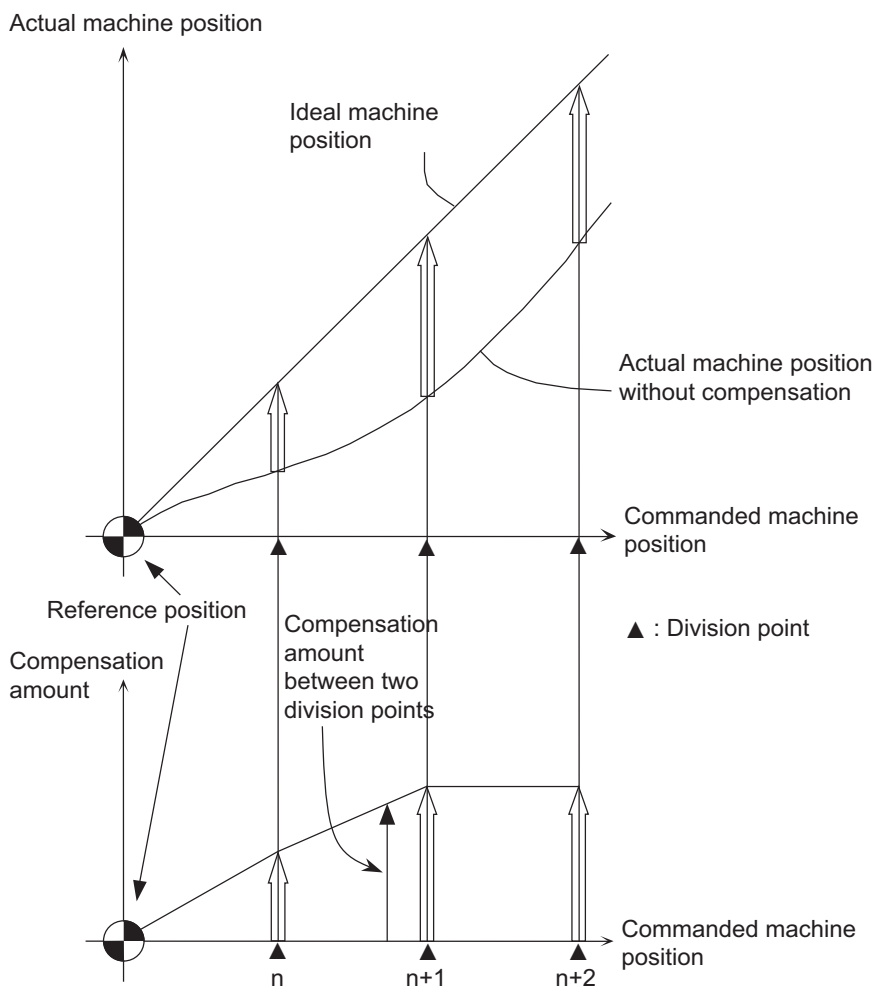
(1) Memory-type pitch error compensation

According to the specified parameters, this method compensates an axis feed error caused by a ball screw pitch error, etc.

You can set 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

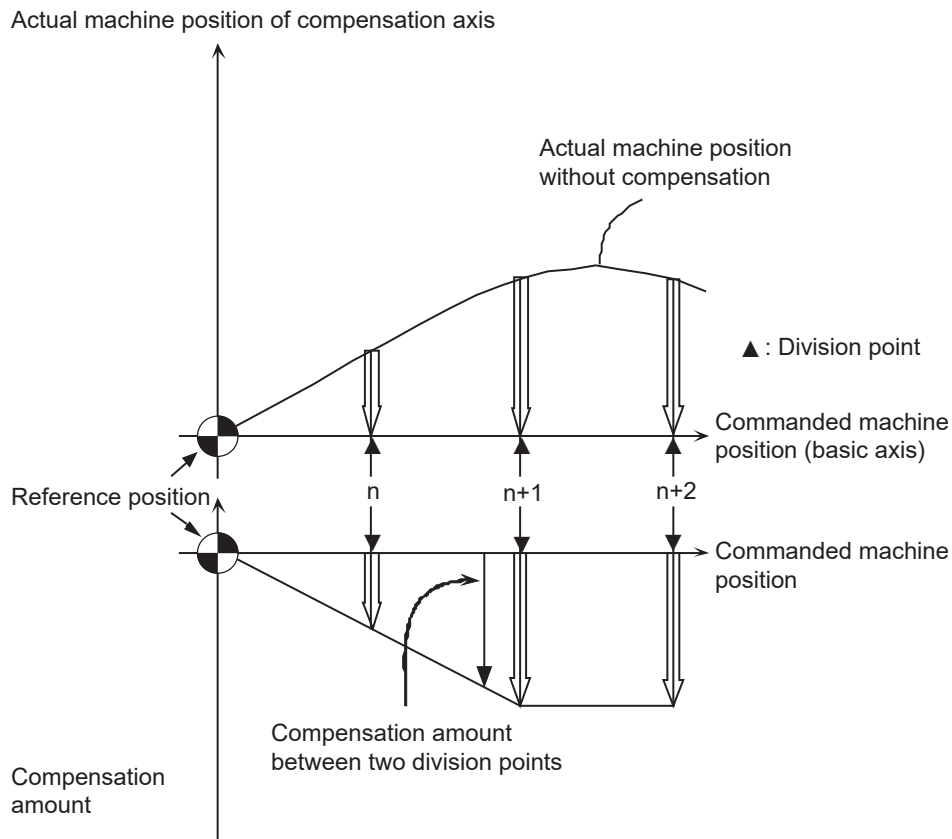
(2) Memory-type relative position error compensation

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

27.1.2 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

(1) 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.

$$\text{Compensation amount} = (\text{Commanded position} - \text{Actual machine position}) \times 2$$

The unit of compensation amount depends on the setting of machine error compensation unit (parameter "#1006 mcmpunit").

The following shows examples when the parameter #1006 is set to "B".

(Example 1) Feeding an axis from the reference position to the position moved by +100 mm (See the left figure below.)

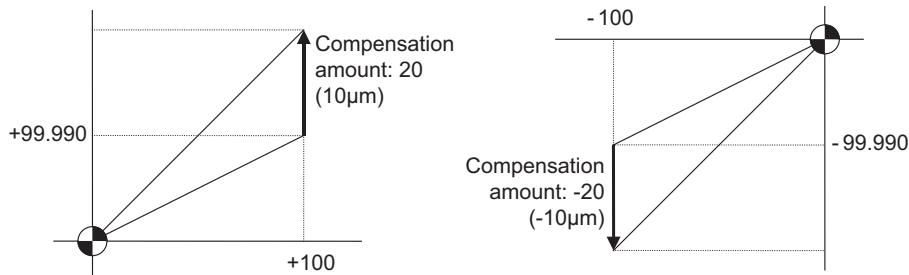
When the actual machine position is 99.990 mm, the compensation amount at the position moved by +100 mm is "20".

$$(100000 - 99990) \times 2 = 20$$

(Example 2) Feeding an axis from the reference position to the position moved by -100 mm (See the right figure below.)

When the actual machine position is -99.990 mm, the compensation amount at the position moved by -100 mm is "-20".

$$(-100000 - (-99990)) \times 2 = -20$$



(2) Incremental amount method

The compensation amount at the division point "n" is calculated for the axis that moves by "interval between division points" specified with #4007. The formula for calculating the compensation amount differs depending on whether the division point "n" is on the positive side or the negative side from the reference position.

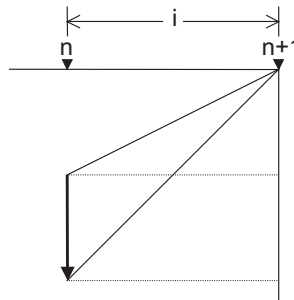
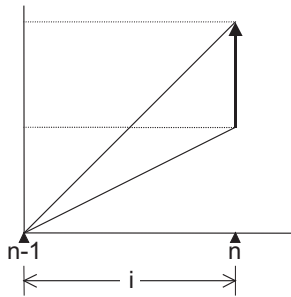
[On the positive side]

$$\begin{aligned} \text{Actual travel amount} &= (\text{Actual machine position of division point "n"}) \\ &\quad - (\text{Actual machine position of division point "n-1"}) \text{ (See the left figure below.)} \\ \text{Compensation amount} &= (\text{Interval between division points} - \text{Actual travel amount}) \times 2 \end{aligned}$$

[On the negative side]

$$\begin{aligned} \text{Actual travel amount} &= (\text{Actual machine position of division point "n"}) \\ &\quad - (\text{Actual machine position of division point "n+1"}) \text{ (See the left figure below.)} \\ \text{Compensation amount} &= (\text{Interval between division points} + \text{Actual travel amount}) \times 2 \end{aligned}$$

In both cases, the unit of compensation amount depends on the setting of the machine error compensation unit (parameter "#1006 mcmpunit").



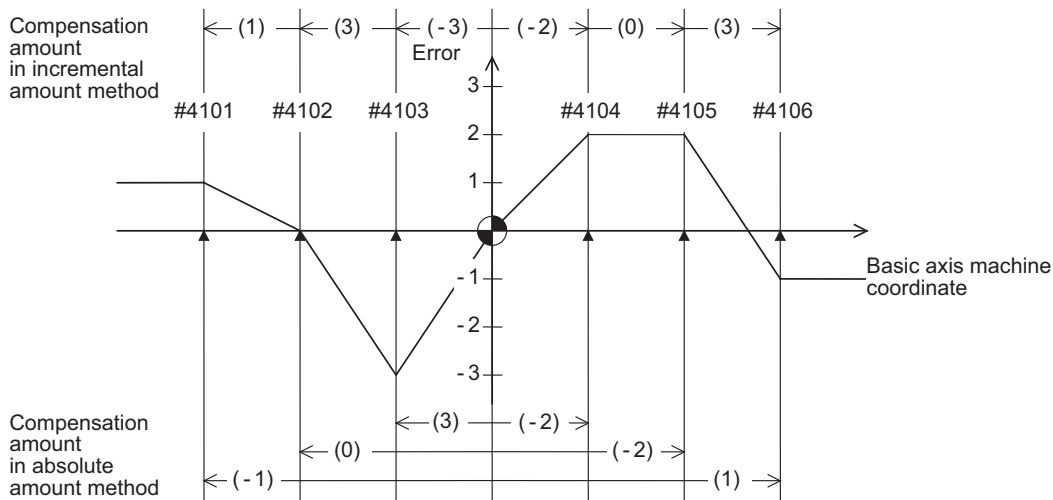
n : Division point compensation number
i : Division interval

Unit of compensation amount : Machine error compensation unit (#1006)
Range of compensation amount : -128 to 127

27.1.3 Setting Method

27.1.3.1 Using a Linear Axis as Basic Axis

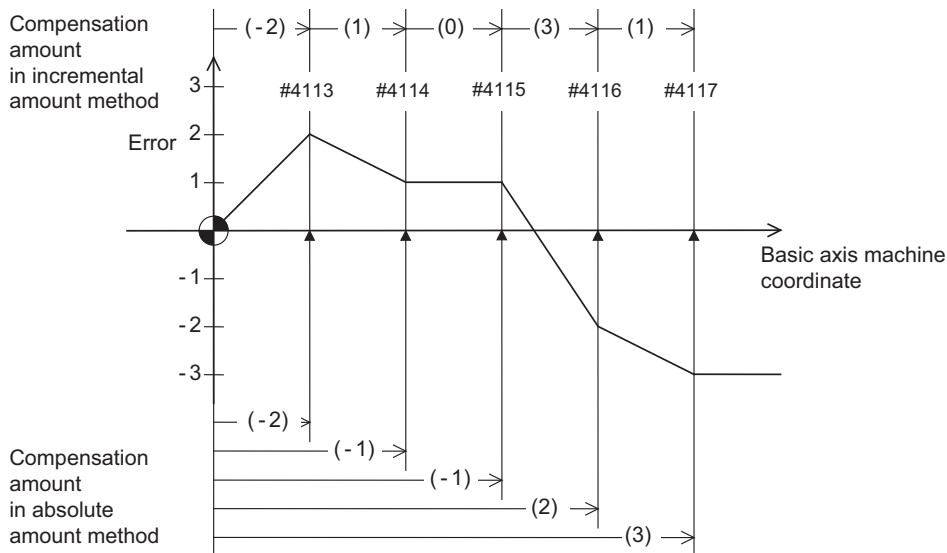
(1) When "mdvno" or "pdvno" exists at both ends of "rdvno"



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		

The compensation beyond the setting range ("mdvno" to "pdvno") will be based on the compensation amount at "mdvno" or "pdvno".

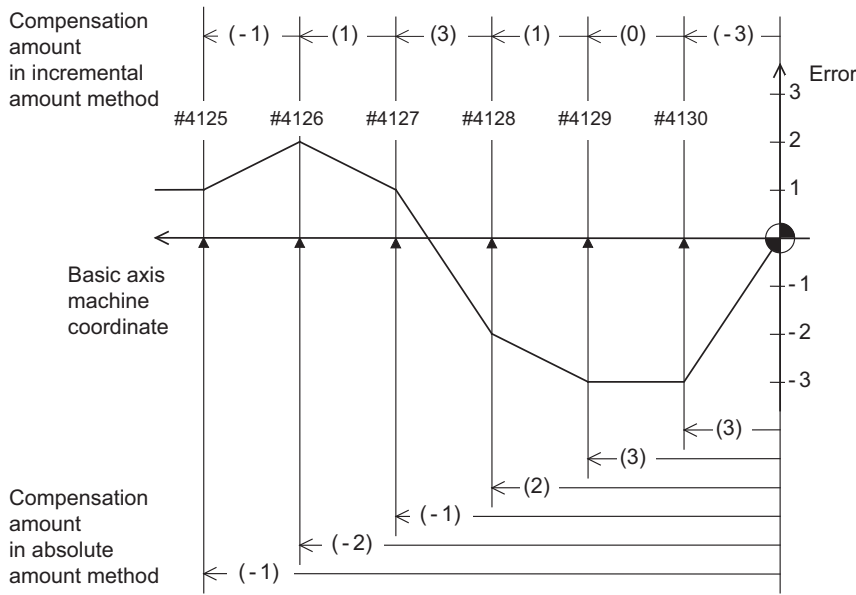
(2) When the range compensated is only the positive range



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

When the machine position is beyond "pdvno", the compensation 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.

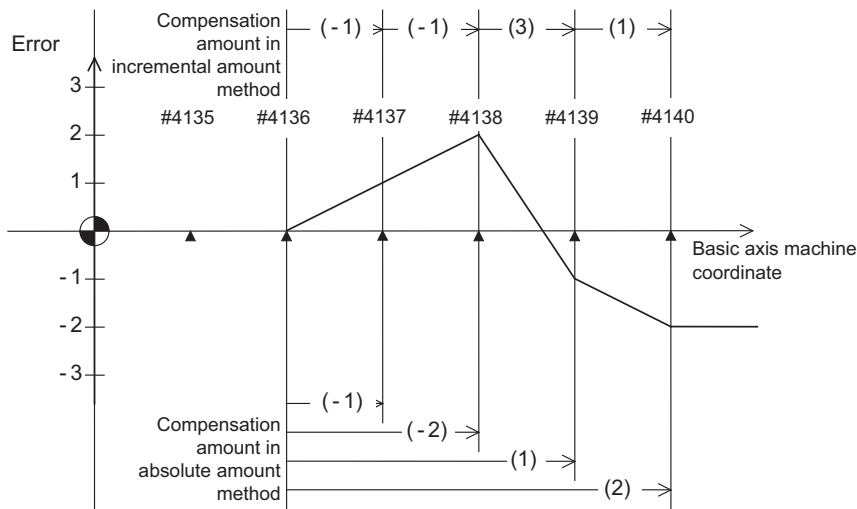
(3) When the range compensated is only the negative range



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

When the machine position is beyond "mdvno", the compensation will be based on the compensation amount at "mdvno".

(4) When compensation is executed in a range that contains no reference position

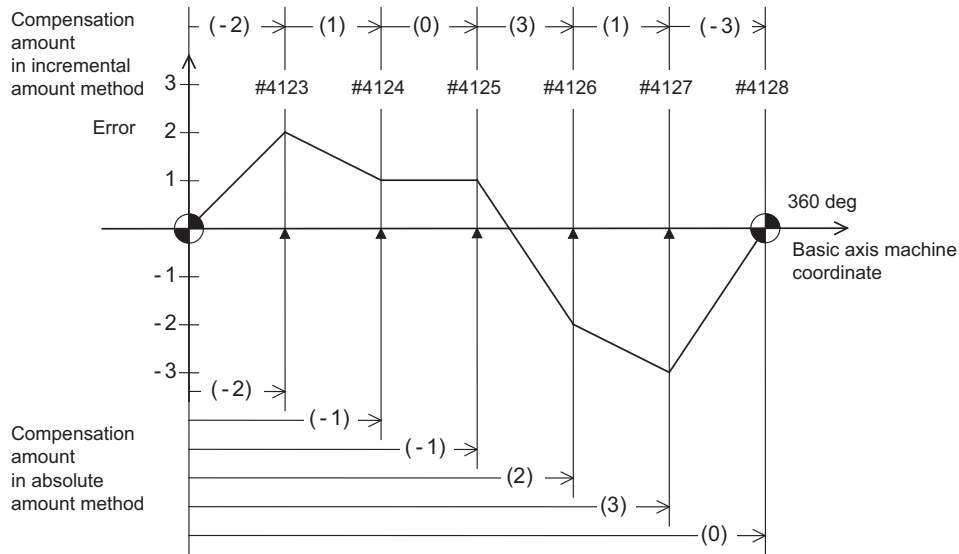


Division point number		#4135	#4136	#4137	#4138	#4139	#4140	rdvno	4134
Compensation amount	Incremental amount method			-2	-2	6	2	mdvno	4136
	Absolute amount method			-2	-4	2	4	pdvno	4140

In this case, the 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.

27.1.3.2 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".

27.2 Bidirectional pitch error compensation

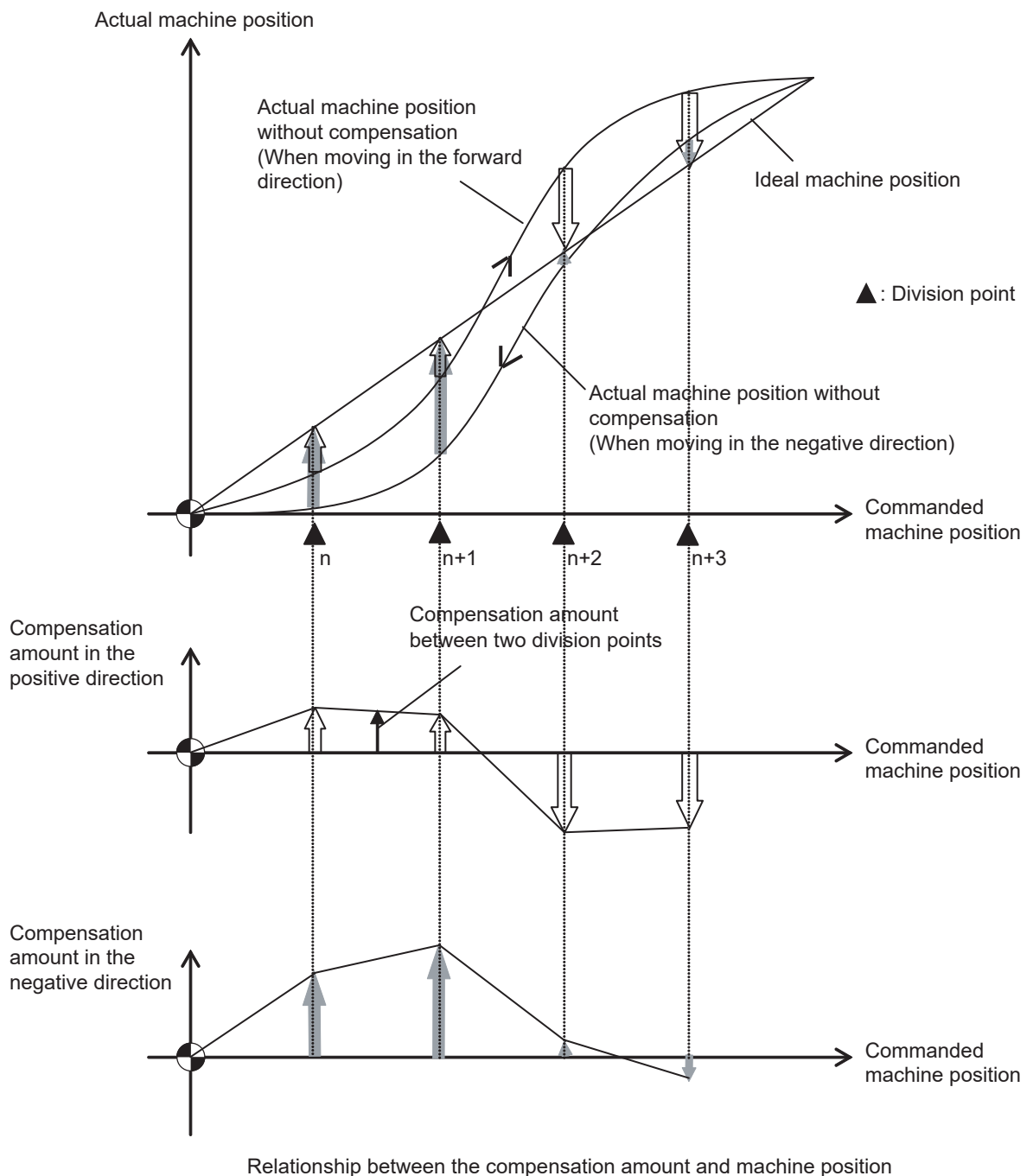
27.2.1 Outline

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.



27.2.2 Setting Method

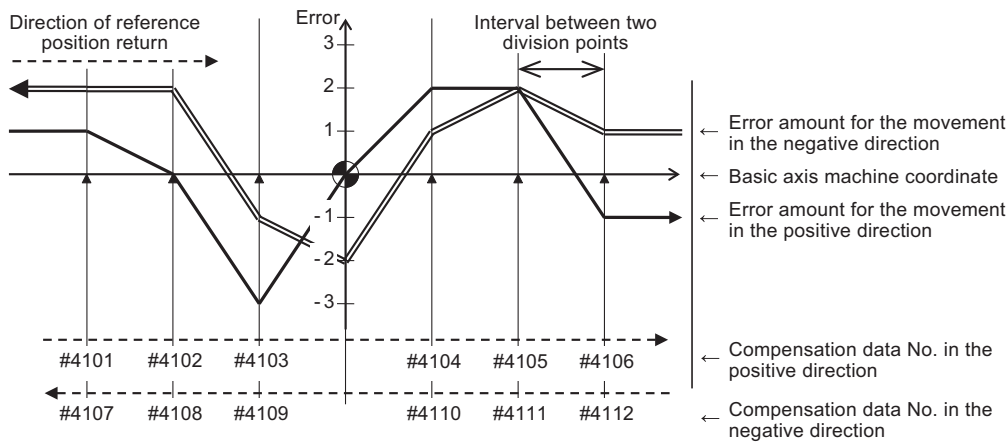
27.2.2.1 When the basic axis is a linear axis

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.

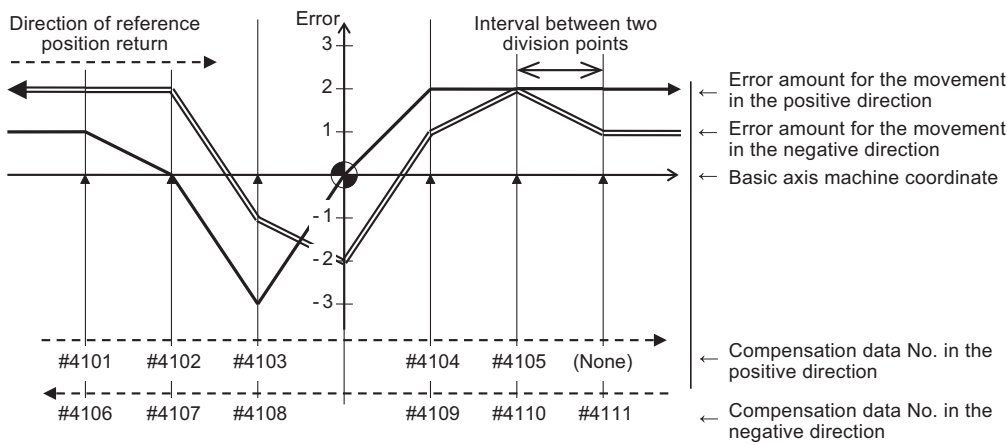
As shown in the figure below, compensation range is divided into equal intervals based on the reference position, and compensation data Nos. are allocated for each movement in positive and negative directions. For both positive and negative directions, numbers are allocated from the division point on 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 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) Among the division points in the positive direction, set the compensation No. of the division point which is one point far from the reference position in the negative direction to "#4003 rdvno".
- (4) Set the first and the last compensation Nos. allocated to division points to the parameters "#4004 mdvno" and "#4005 pdvno".
- (5) Set the compensation magnification to "#4006 sc".
- (6) Set the interval between two division points to "#4007 spcdv".
- (7) Set "#4008 twopc" to "1". The function bidirectional pitch error compensation is enabled.
- (8) For "#4009 refcmp", set the following compensation amounts after the measuring the actual machine position in "Setting pitch error compensation data".

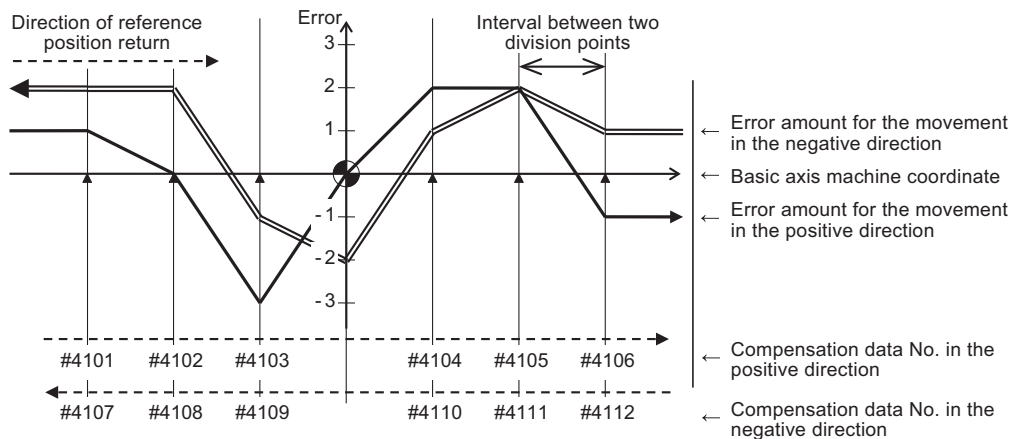
[When the parameter "#2023 dir (-)" is set to "0"]

Compensation amount =
 - (Actual machine position for the reference position when the direction of travel is negative) × 2

[When the parameter "#2023 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 (parameter "#1006 mcmpunit").



Bidirectional pitch error (linear axis)

[Parameter setting]

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

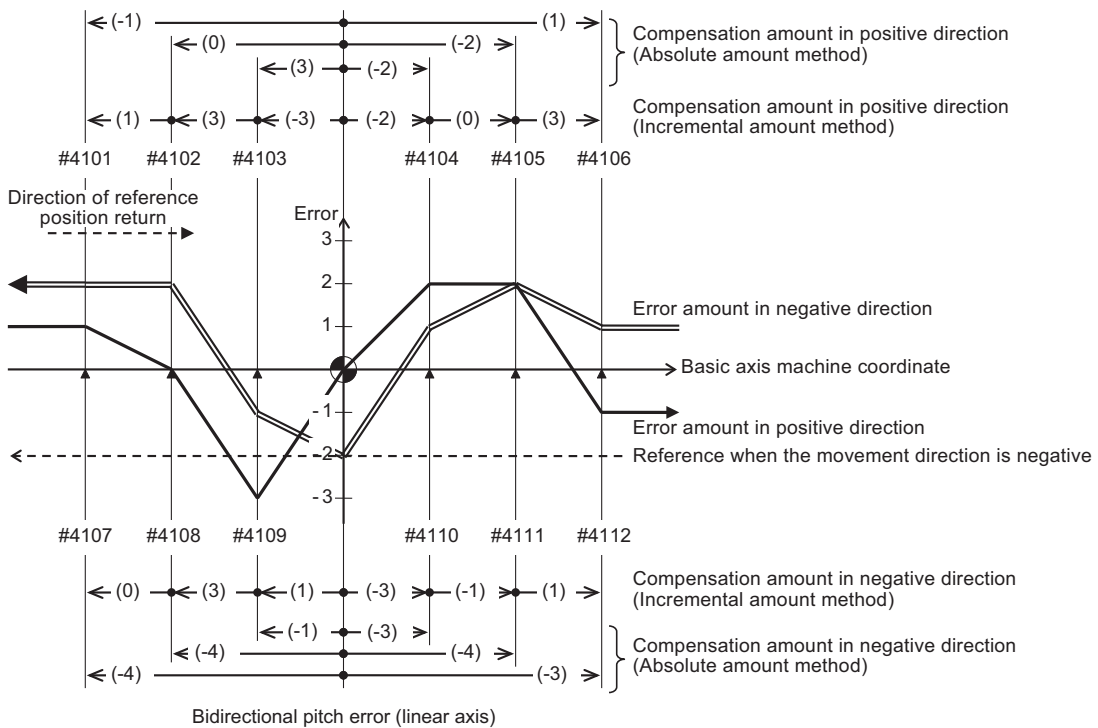
Setting pitch error compensation data

- 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)	Calculate compensation amount at the division point "n" when the position moved by "interval between two division points" which was set to #4007. The calculation formula of the compensation amount differs depending on whether the division point "n" is on positive side or 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 two 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 two division points + Actual travel amount) × 2

(*1) Compensation amount unit depends on the setting of the machine error compensation unit (parameter "#1006 mcmpunit").

- Set the calculated compensation amount to the parameter of compensation No. allocated to each division point.



[Compensation amount settings]

Movement direction		Positive						Negative					
Compensation data No.		#4101	#4102	#4103	#4104	#4105	#4106	#4107	#4108	#4109	#4110	#4111	#4112
Compensation amount	Incremental amount method	-2	0	6	-4	-4	2	-8	-8	-2	-6	-8	-6
	Absolute amount method	2	6	-6	-4	0	6	0	6	2	-6	-2	2

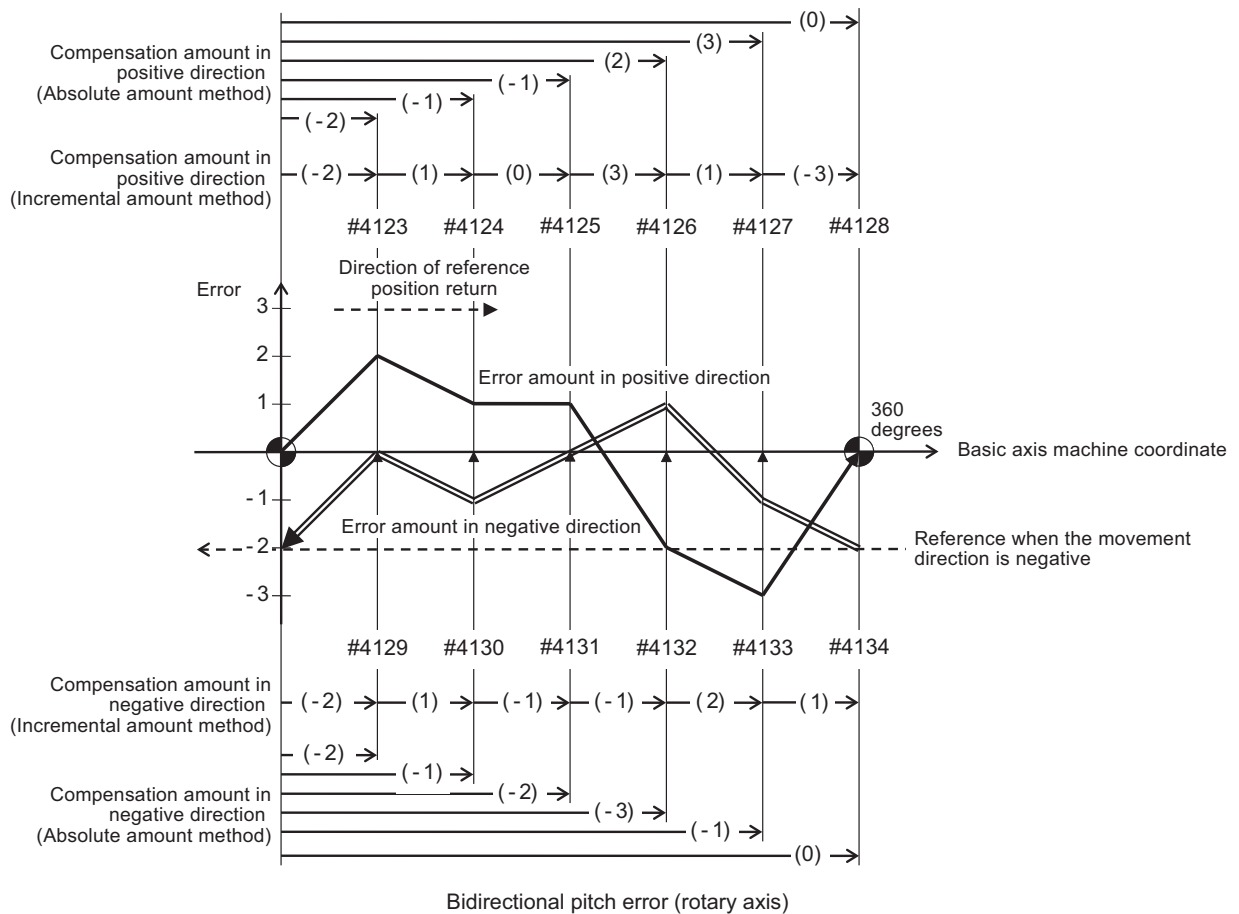
27.2.2.2 When the basic axis is a rotary axis

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 compensation amount being set in the incremental amount method will always be "0".
- The compensation amount of the last point in the absolute amount method (360 degrees) will always be "0".



[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 No.		#4123	#4124	#4125	#4126	#4127	#4128	#4129	#4130	#4131	#4132	#4133	#4134
Compensation amount	Incremental amount method	-4	-2	-2	4	6	0	-4	-2	-4	-6	-2	0
	Absolute amount method	-4	2	0	6	2	-6	-4	2	-2	-2	4	2
Movement direction		Positive						Negative					

Setting the Position Switches

28.1 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).

Position switch Nos. of PSW1 to PSW24 and signal devices

	<axis>	<dog1>	<dog2>	<check>	Part system 1	Part system 2
PSW1	#7501	#7502	#7503	#7504	X1D00	X1D20
PSW2	#7511	#7512	#7513	#7514	X1D01	X1D21
PSW3	#7521	#7522	#7523	#7524	X1D02	X1D22
PSW4	#7531	#7532	#7533	#7534	X1D03	X1D23
:	:	:	:	:	:	:
PSW24	#7731	#7732	#7733	#7734	X1D17	X1D37

Position switches (PSW1 - PSW24) are used to set virtual dog coordinates (dog1 and dog2) on the coordinate axes, whose names are preset with <axis>, as alternatives for the dog switches provided on the machine axis.



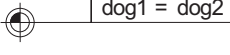
When the machine reaches the specified area, a signal is output to the corresponding device of the PLC interface.

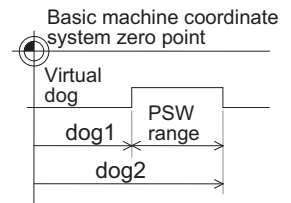
Whether the machine has moved into the area specified with the position switches can be judged at high speed by setting parameters.

To judge the entry of the machine to the area, set parameters 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.

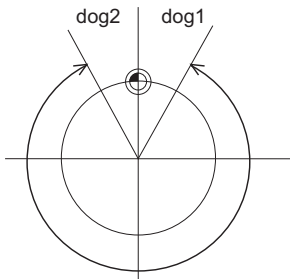
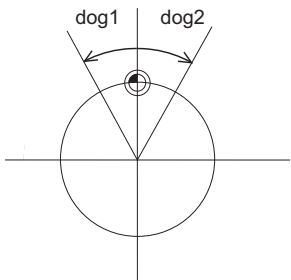
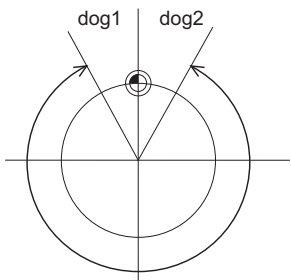
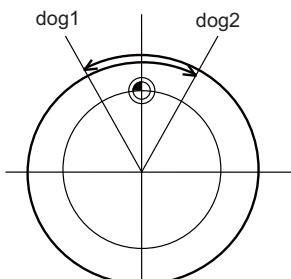
For description of the parameter, refer to "Alarm/Parameter Manual".

28.2 Setting and Operation Examples of dog1 and dog2

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

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.
		(Example) dog1 = -30.000 dog2 = 30.000	Signal is output in the same manner even if dog1 is in the negative area.
dog1 > dog2		(Example) dog1 = 330.000 dog2 = 30.000	A signal is output when the machine reaches between dog2 and dog1.
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.

28.3 Canceling the Position Switch

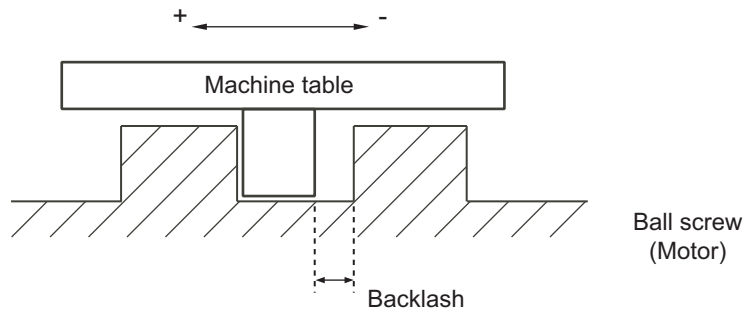
Enter a position switch number to be canceled (#75*1) in "# ()" and a slash in "DATA ()" on the setting field, then press the [INPUT] key. Axis name of the specified position switch will be deleted, and the position switch is disabled. However, the data in <dog1> and <dog2> are still retained in a memory. To enable the position switch again, only an axis name is required for setting.

Setting the Backlash Compensation

29.1 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.

(1) 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.

(2) 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.

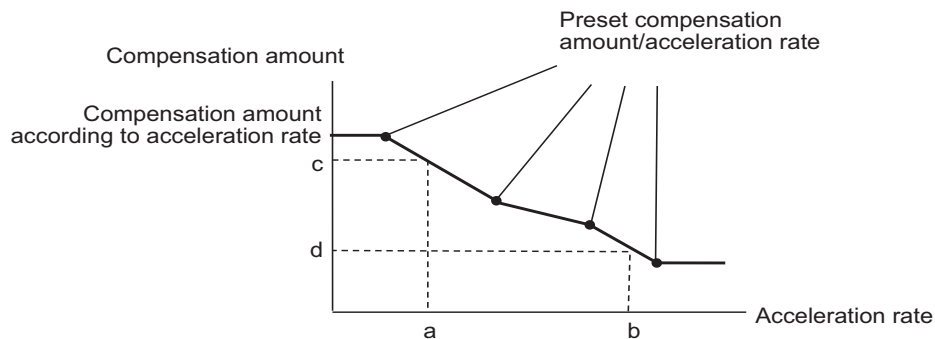
29.2 Backlash Compensation II

This function reduces quadrant error caused by the backlash when the traversing direction is reversed in machines where semi-closed loop control is implemented.

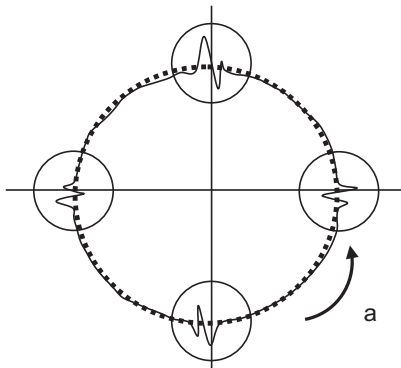
Acceleration rate at axis direction reversal varies depending on the change of circular radius and commanded speed at machining.

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.

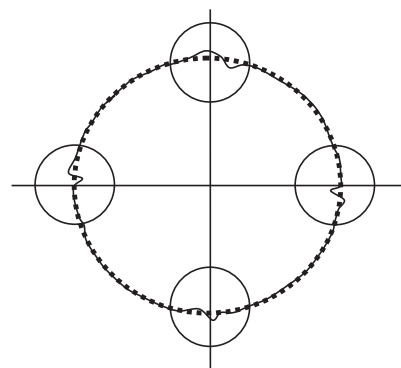
Compensation based on the acceleration rate at a direction reversal improves machining accuracy. For the range between the acceleration rates defined in parameters, the error is compensated using the compensation amount obtained through linear interpolation.



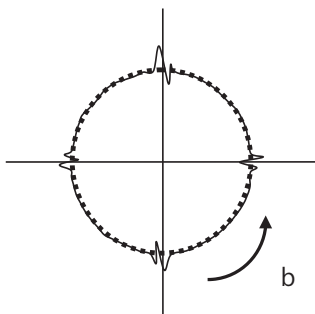
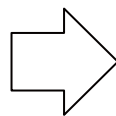
[Before the compensation]



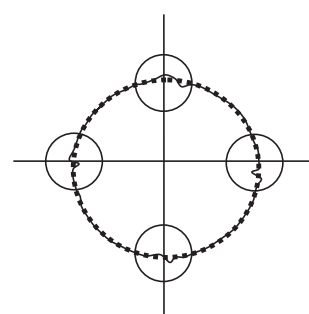
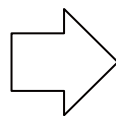
[After the compensation]



Compensation amount "c"



Compensation amount "d"



29.2.1 Enabling Conditions for Backlash Compensation II

Backlash compensation II is enabled when all the following conditions are satisfied.

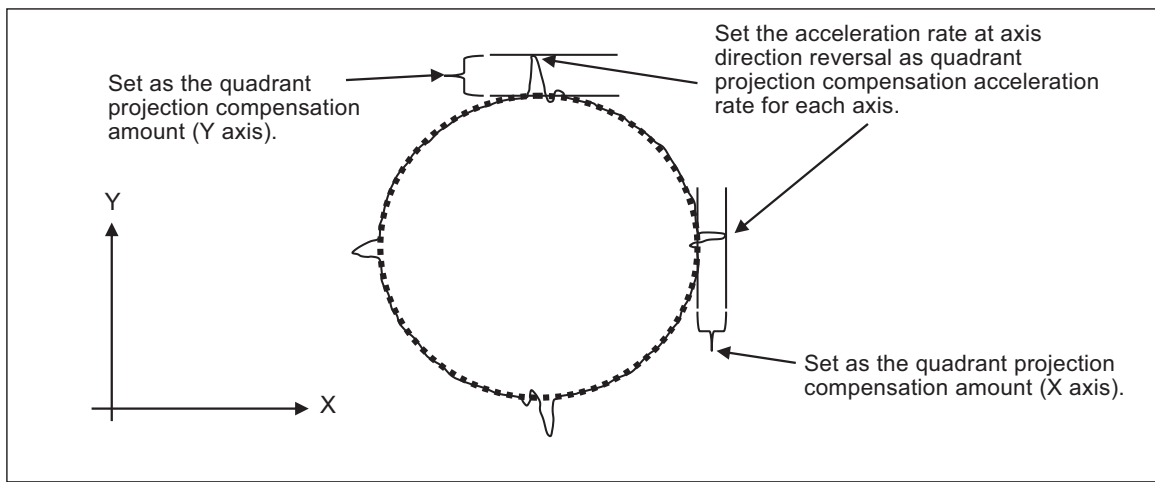
- (1) Backlash compensation II option is ON.
- (2) Parameter "#14360 valBL2" (backlash compensation II valid) is ON.
- (3) Parameter "#14361 BL2_a1" (backlash compensation II acceleration rate 1) is other than "0".

Backlash compensation II can be specified valid/invalid status for each axis.

29.2.2 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

29.2.2.1 Setting the backlash compensation II acceleration rate

For the backlash compensation II acceleration rate, set the acceleration rate ($\mu\text{ m/s}^2$) 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 a backlash compensation II acceleration rate which is not used.

(Example) When there are three compensation patterns, set the parameter "#14367 BL2_a4" to "0".

29.2.2.2 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"

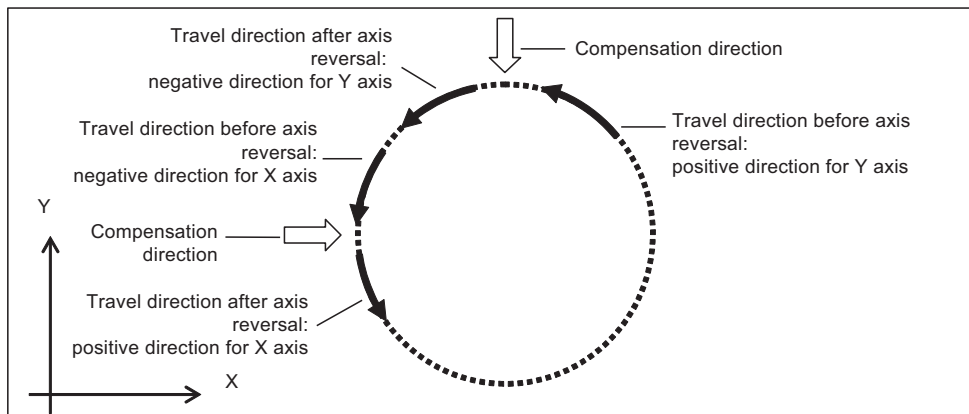
Backlash compensation II compensation amount 3: "#14366 BL2_c3"

Backlash compensation II compensation amount 4: "#14368 BL2_c4"

Set compensation amounts corresponding to acceleration rates which have been set in the previous chapter "Setting backlash compensation II acceleration rate" in these parameters (#14326 to #14368).

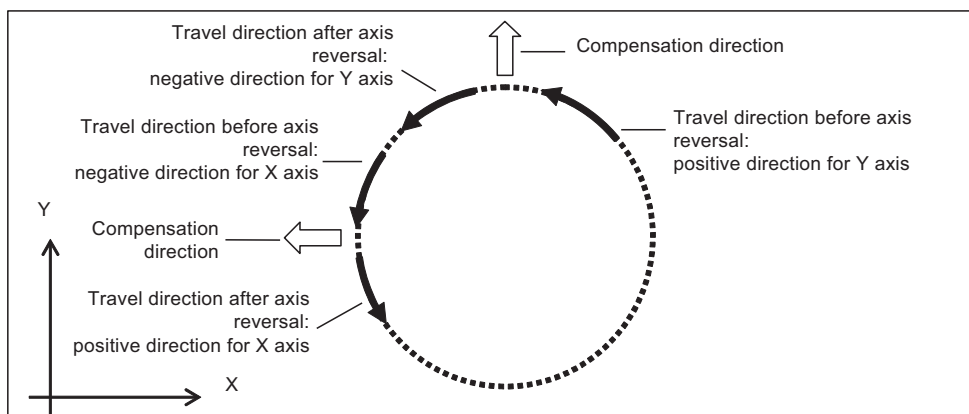
(Example) Set a compensation amount which corresponds to backlash compensation II acceleration 2 in the parameter #14364 (backlash compensation II compensation amount 2).

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

29.2.2.3 Precautions for setting parameters

For the backlash compensation II acceleration rates, set a value greater than "0" from acceleration rate 1 to 4 in ascending order.

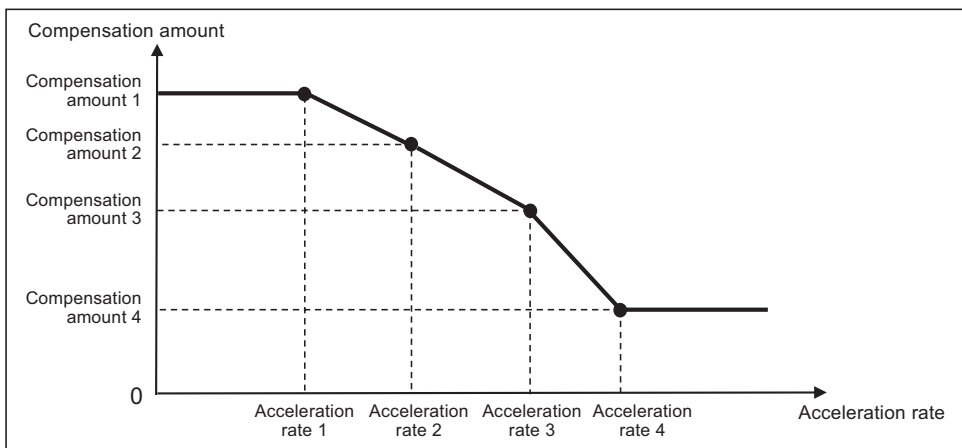
Parameters are enabled when the backlash compensation II acceleration rates are set in ascending order.

The following describes the relationship between setting patterns and parameters to be enabled.

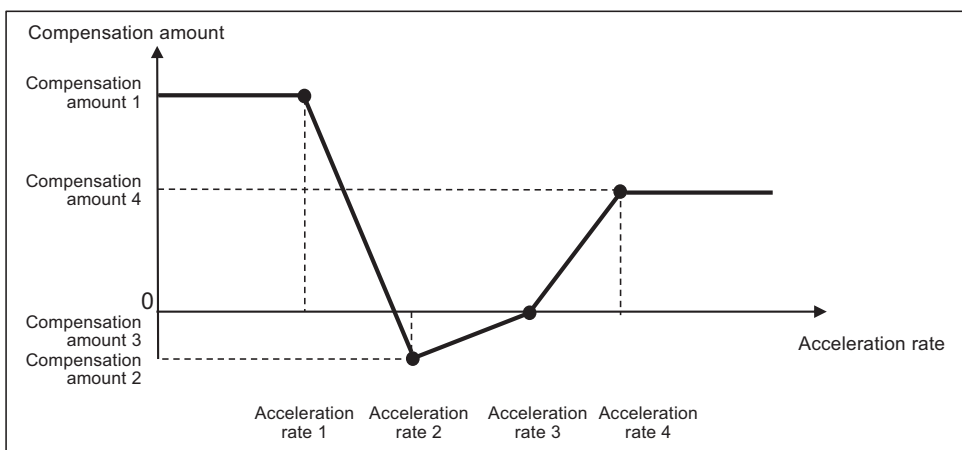
- (1) When the value of acceleration rate 1 is greater than "0", and the values of acceleration rate 1 to 4 are in ascending order

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.

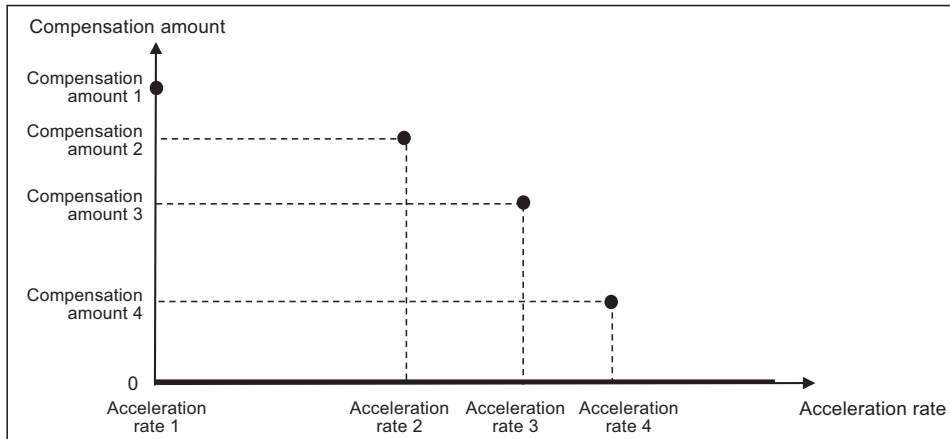


When compensation amounts are not in ascending order

(2) 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".



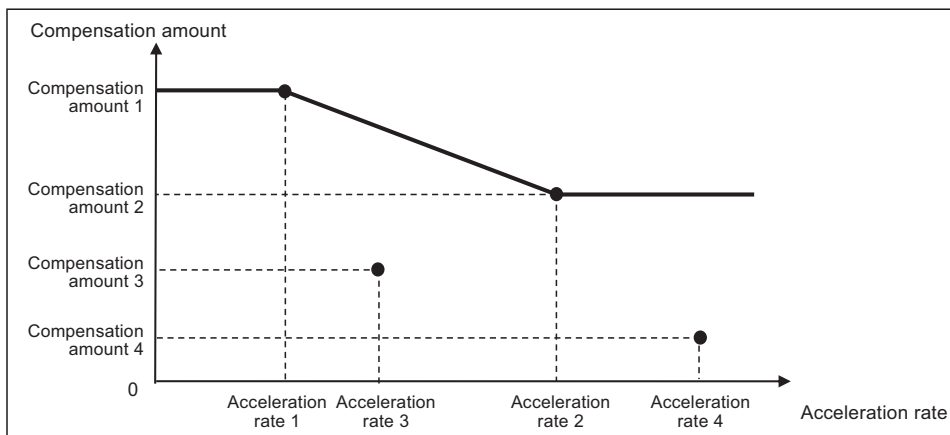
(3) When part of setting values of acceleration rate 1 to 4 are set in ascending order

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.

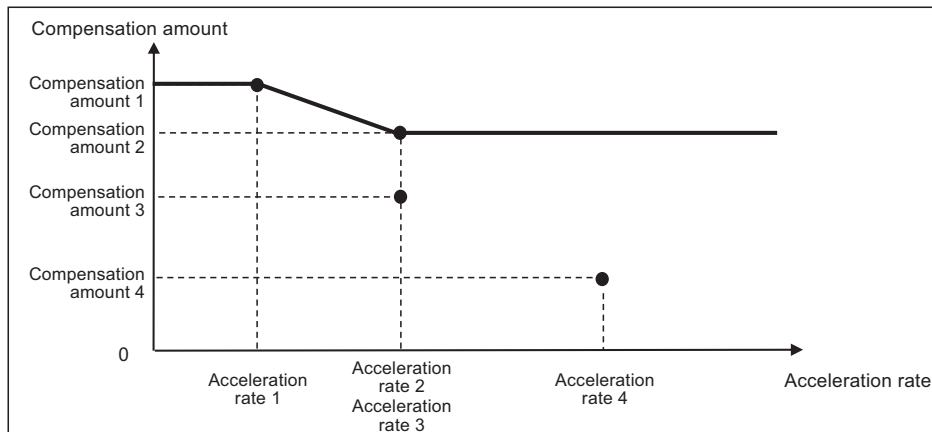
For example, when there are two compensation patterns, "0" is set to the acceleration rate 3.

(4) When consecutive acceleration rates are set to the same value

Ascending order in acceleration rate setting refers to the case where subsequent values become greater than the previous ones. Therefore, as same as (3), when the acceleration rates are no longer arranged in ascending order, corresponding parameters 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.



Confirming the Spindle Operation

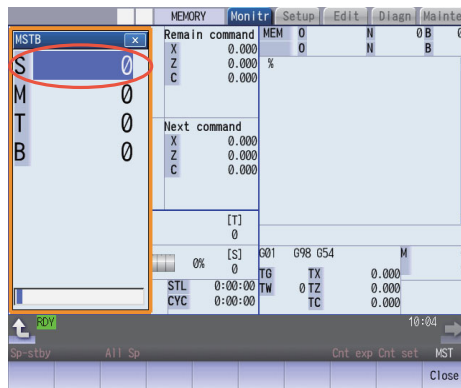
Confirm that the spindle operates properly in manual/MDI operation. Confirm the spindle rotation speed as well.

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.

30.1 In Manual Operation (with Manual Numerical Command)

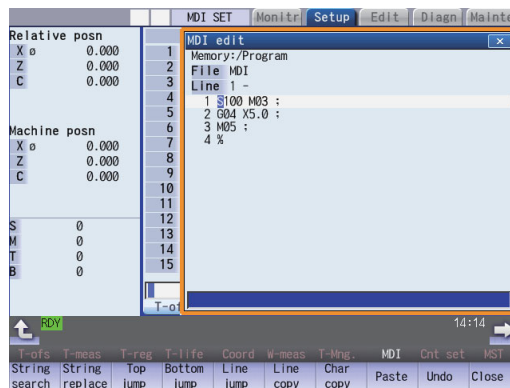
- (1) Select [MST] on the Monitr screen. Enter a spindle rotation speed (ex. 100r/min) in "S" field.



- (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.

30.2 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 100r/min for 5 seconds)

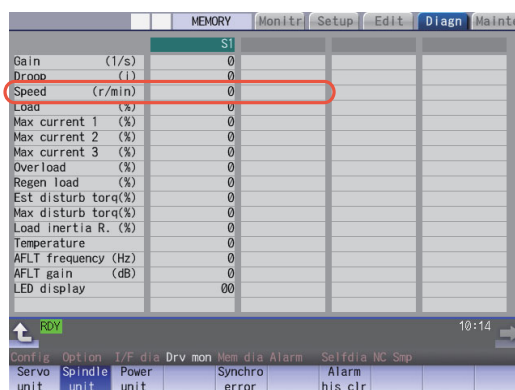
```
S100 M03 ;
G04 X5.0 ;
M05 ;
```

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".

30.3 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.

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-L*).

Create the customized data with "NC Designer HT" and download it to the handy terminal.

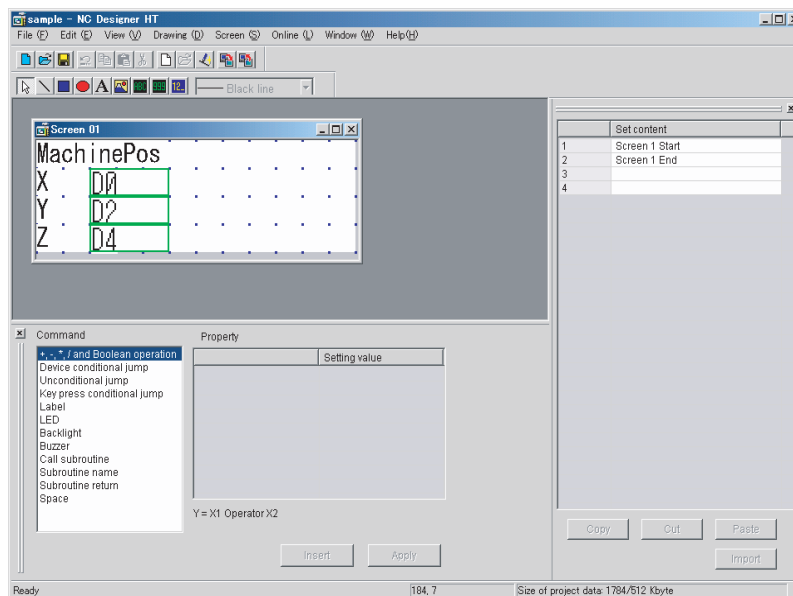
There are two methods to input customized data for the handy terminal.

- (1) Connecting a personal computer and the handy terminal and inputting the data from "NC Designer HT"
- (2) Connecting NC and the handy terminal and inputting the data from a SD card

31.1 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.

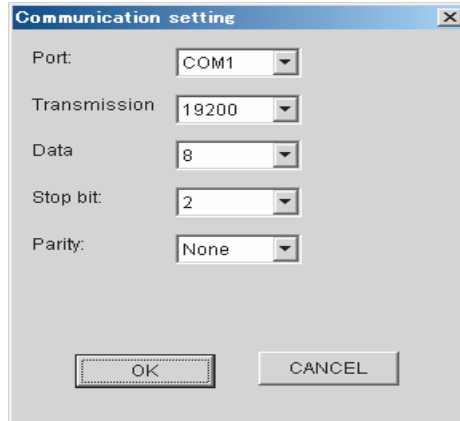
- (1) Start the customized data creation tool "NC Designer HT" to create the project data (*.p1t).



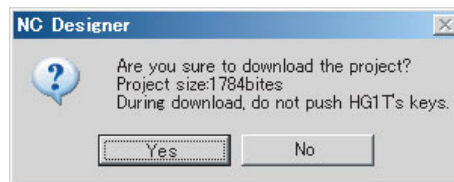
- (2) Connect a personal computer and the handy terminal via serial RS-232C.

- (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



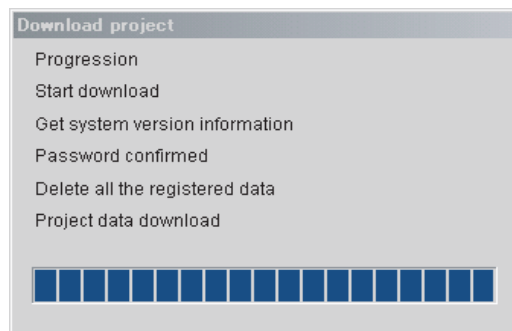
- (4) Select [Online] - [Download] from the menu of "NC Designer HT".
- (5) The following dialog box is displayed. Select "Yes".



- (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.



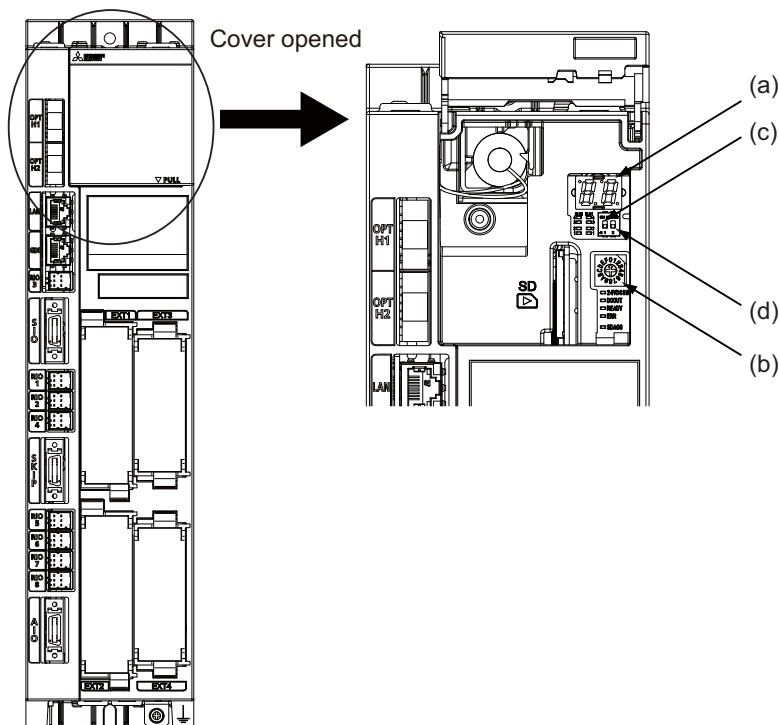
31.2 Inputting the Data from NC

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. (*)
- (8) When the display of LED on the control unit becomes "En", turn OFF the NC.
- (9) Remove the SD card and return the rotary switch.

(*) 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.

Setting the Deceleration Check

32.1 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.

(1) Deceleration check during rapid traverse

The deceleration check is always carried out at the block end (before executing the next block) during rapid traverse.

(2) Deceleration check during cutting feed

The deceleration check is carried out at the block end (before executing the next block) during cutting feed when any one of the following conditions is valid.

- (a) When the error detect switch is ON.
- (b) When G09 (exact stop check) is commanded in the same block.
- (c) When G61 (exact stop check mode) has been selected.

(3) Selection of 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).

(a) Operation list

This table shows the operation list for each movement command set.

Succeeding block	Current 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 G09 or G61 is valid.

(2) When the block commands G01 -> G00 are executed, #1502 G0lpfg 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 G1lpfg 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 "Deceleration Check for Opposite Direction Movement Reversal" for the details of opposite direction movement reversal.

×: Deceleration check is invalid

(b) Selecting the deceleration check method

There are three methods for the deceleration check, and the method is selected by the parameter.

1) For the execution block with the rapid traverse command (G00/G53)

Parameter #1193 inpos	Deceleration check method	Determination condition
0	Command deceleration check	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

2) For the execution block with the cutting feed command (G01/G02/G03)

Parameter			Deceleration check method	Determination condition
#1306 InpsTyp (G0/G1 common)	#1389 G1SmthChk	#1223 aux07/BIT1		
0 (cutting block)	0	0	Command deceleration check	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

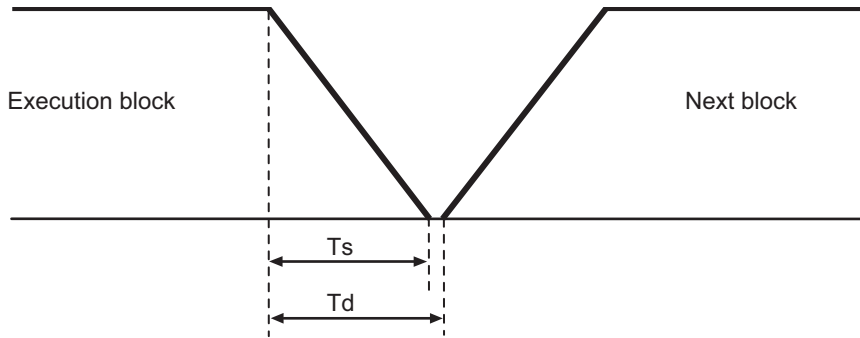
When the parameter "#1306 InpsTyp" is "1", the deceleration check method will be the same as the method of 1) rapid traverse regardless of the value of the parameter "#1389 G1SmthChk".

32.2 Deceleration Check Method

(1) Command deceleration check

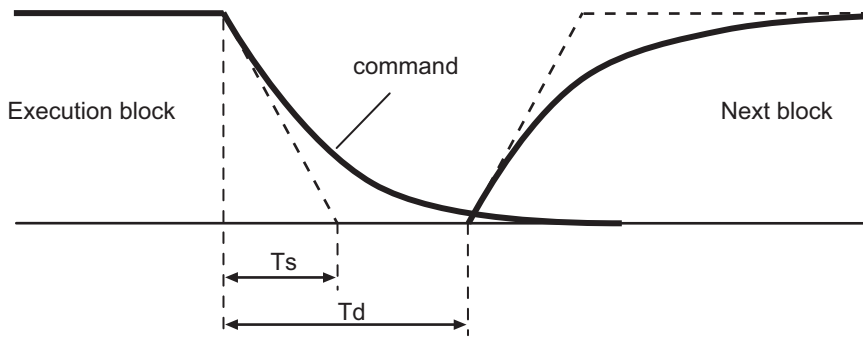
After interpolation for one block has been completed, the completion of the command system deceleration is confirmed before execution of the next block. The required time for the deceleration check is equal to the longest one of the deceleration check time for the simultaneously commanded axes, which are determined according to the acceleration/deceleration mode and time constant.

(a) For linear acceleration/deceleration



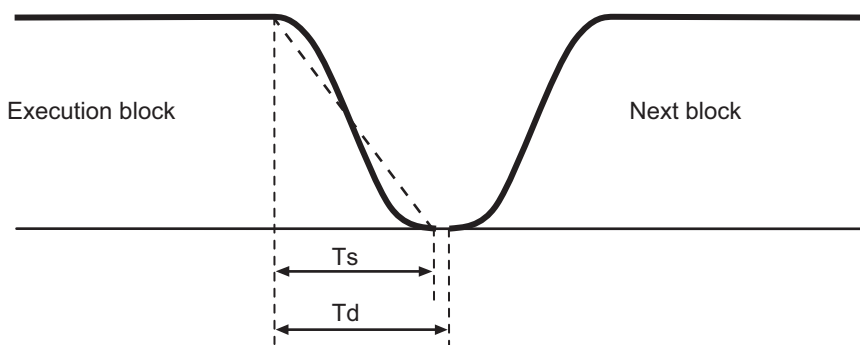
Ts : Liner acceleration/deceleration time constant
 Td : Deceleration check time $Td = Ts + \alpha$ (0 to 10ms)

(b) For exponential acceleration/deceleration



Ts : Exponential acceleration/deceleration time constant
 Td : Deceleration check time $Td = Ts \times 2 + \alpha$ (0 to 10ms)

(c) For soft acceleration/deceleration



Ts : Soft acceleration/deceleration time constant
 Td : Deceleration check time $Td = Ts + \alpha$ (0 to 10ms)

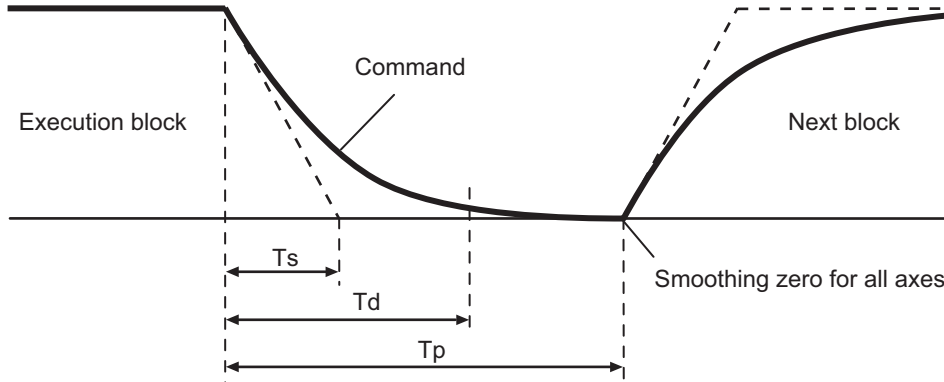
The deceleration check time required during rapid traverse is the longest rapid traverse deceleration check time of all axes. This check time is determined by the rapid traverse acceleration/deceleration mode and rapid traverse acceleration/deceleration time constant of simultaneously commanded axes.

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.

(2) 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

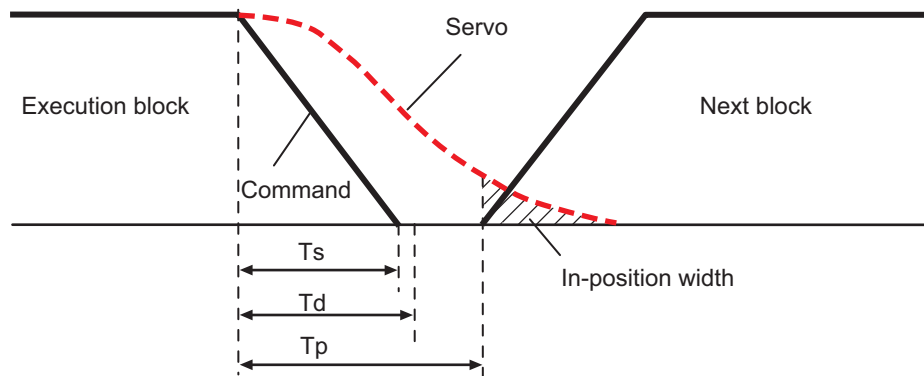


T_s : Exponential acceleration/deceleration time constant
 T_d : Deceleration check time
 T_p : Waiting time for block completion

(3) 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



T_s : Linear acceleration/deceleration time constant
 T_d : Deceleration check time
 T_p : Waiting time for block completion

If the SV024 setting value is larger, in-position check will end when the SV024 setting value is established.

32.3 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.

- (1) 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 G0lpfg).

	Same direction	Opposite direction
G0lpfg:0		
G0lpfg:1		

- (2) 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
G0lpfg:0		
G0lpfg:1		

32.4 Parameter

- (1) Designating deceleration check
Base specification parameter

#	Item	Details	Setting range	
1193	inpos	The definitions are changed with the setting of "#1306 InpsTyp Deceleration check specification type".		
		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 The deceleration check is not performed for the commands except 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", and G1+G9 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 (when #1306 InpsTyp=1). 0: Follow the setting of Aux07/BIT1 1: Apply smoothing check method	0 / 1	

- (2) Deceleration check during opposite direction travel
Base specification parameter

#	Item	Details	Setting range
1502	G0lpfg	G1 -> G0 deceleration check Select whether to perform a deceleration check when the travel direction is changed from G1 to G0. 0: Not perform 1: Perform	0 / 1
1503	G1lpfg	G1 -> G1 deceleration check Select whether to perform a deceleration check when the travel direction is changed from G1 to G1. 0: Not perform 1: Perform	0 / 1

(3) Designation of in-position check width

(a) Servo parameter

#	Item		Details	Setting range
2224	SV024 INP	In-position detection width	Set the in-position detection width. Set the 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 width	Set the in-position detection width. Set the positioning accuracy required to the machine. Lower setting value increases the positioning accuracy, but prolongs the cycle time (settling time). The standard setting is "875".	0 to 32767 (1deg/1000)

(b) Axis specification parameter

#	Item		Details	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 "0" is set, 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 "0" is set, this parameter will be invalid: only SV024 will be available.	0.000 to 99.999 (mm)

32.5 Relation with Other Functions

- (1) Tool compensation
When the tool compensation is performed, the deceleration check will be operated on the block after compensation.
- (2) 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.
- (3) 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.
- (4) High-speed machining mode
When the axis movement reverses to the opposite direction in G01 to G01 successive block during the high-speed machining mode, the commanded deceleration will not be performed even if G1lpfg has been set to "1". When the axis movement reverses to the opposite direction in G01 to G00 successive block, it follows the setting of G0lpfg.
- (5) 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.
- (6) 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

32.6 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. Confirm the DEN (motion command completion) signal with PLC before the execution of the MSTB command which needs to be executed after the completion of the axis movement.
- (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) Deceleration check for opposite direction movement reversal
 - When deceleration check is valid (G0lpfg=1), deceleration check will be executed when the axis reverses its movement to the opposite direction at the G1 -> G0 successive block regardless of whether G0 non-interpolation is ON or OFF.
 - When deceleration check is valid (G0lpfg=1), deceleration check will be executed when the axis reverses its movement to the opposite direction at the G1 -> G0 successive block even in the fixed cycle.
 - 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 base specification parameter's simple zero point return "#1222 aux06/bit7" is valid, the base specification parameter G1 -> G0 deceleration check (G0lpfg) 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.)
- (7) Designating in-position width
 - The in-position width (programmable in-position check width) designated in the machining program has a priority over the in-position width set in the parameters (SV024, G0inps, G1inps).
 - When error detect is ON, in-position check will be forcibly carried out.
- (8) 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

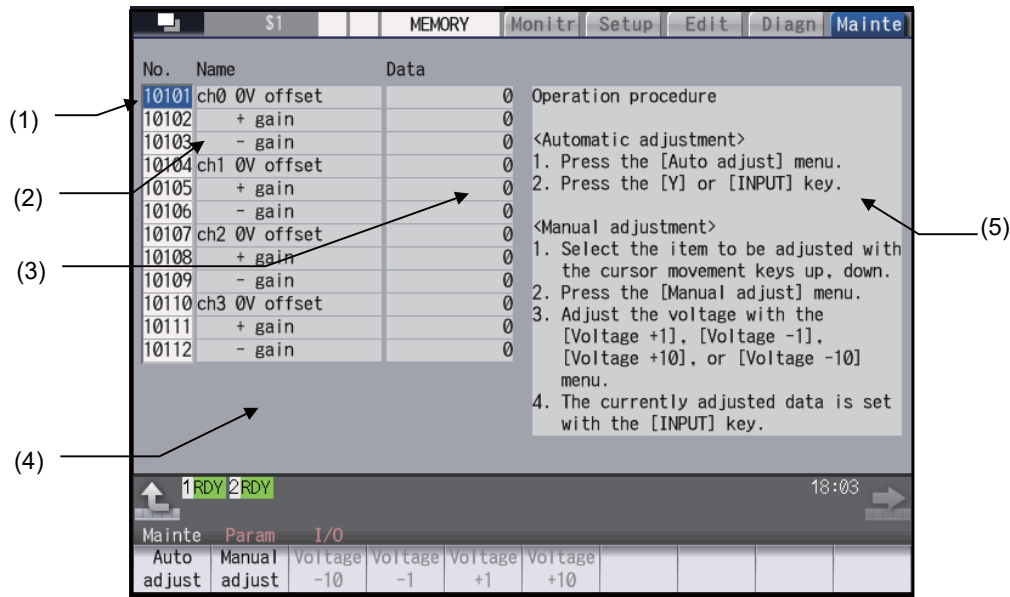
Parameter	Parameter	Other than rapid traverse command (G1: other than G0 command)	
G1SmthChk(#1389)	AUX07/BIT-1 (#1223/BIT-1)	G1 → G0 (G1+G9 → XX)	G1 → G1
0	0	In-position check (Applicable only to SV024)	No deceleration check
	1		
1	0	Smoothing check	
	1		

(Note 1) When G1 command is issued, the in-position check is performed regardless of the deceleration check parameter.

(Note 2) XX expresses all commands.

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.	


33.1 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 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 the menu [Psswd input].
- (3) Enter the machine tool builder password.
- (4) Press the menu [PLC STOP] and then press [Y] key.  The PLC is stopped.

33.2 Performing Automatic Adjustments

Automatic adjustment will execute "0V offset adjustment" and "+ gain adjustment" for the remote I/O analog outputs (max. 4ch) connected to the main unit. The - gain will be handled as the + gain.

Operation methods

- (1) Press the menu [Auto adjust].  An operation message "Execute? (Y/N)" appears.
- (2) Press the [Y] or [INPUT] key.  Automatic adjustment begins, and an operation message "Auto adjust execution" 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 the automatic adjustment is completed, an operation message "Auto adjust complete" appears.

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.

33.3 Performing Manual Adjustments

Adjusting the ch0 0V offset

- (1) Use the [↑] [↓] keys to move the cursor to item "#10101", then press the [Manual adjust] menu button.
 - ➔ The current setting value is displayed at "Current adjust data". A 0V analog voltage is output to ch0 at this time.
- (2) Monitor the analog voltage.
 - ➔ Adjust the 0V offset until the analog voltage is $0V \pm 3.5mV$. The setting range -999 to 999.
- (3) <For plus-voltage>
 - Press the menu [Voltage +1] or [Voltage +10]
 - ➔ "Current adjust data" is adjusted downward in decrements of 1 each time the menu [Voltage +1] is pressed.
 - "Current adjust data" is adjusted downward in decrements of 10 each time the menu [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 the menu [Voltage +1] is pressed.
 - "Current adjust data" is adjusted upward in increments of 10 each time the menu [Voltage +10] is pressed.

(Note) "Current adjust data" range is -999 to 999.
The adjustments cannot exceed this range.
- (4) Press the [INPUT] key.
 - ➔ "Current adjust data" is set as "ch0 0V offset", and the 0V offset result is enabled.

Adjusting the ch0 + gain

- (1) Use the [↑] [↓] keys to move the cursor to item "#10102", then press the menu [Manual adjust].
 - ➔ The current setting value is displayed at "Current adjust data". A ch0 +10V analog voltage is output at this time.
- (2) Monitor the analog voltage.
 - ➔ Adjust the + gain until the monitor voltage is $10V \pm 3.5mV$. 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" is set as "ch0 + gain", and the adjustment result is enabled.

Adjusting the ch0 - gain

- (1) Use the [↑] [↓] keys to move the cursor to item "#10103", then press the menu [Manual adjust].
➔ The current setting value is displayed at "Current adjust data". A ch0 -10V analog voltage is output at this time.
- (2) Monitor the analog voltage.
➔ Adjust the - gain until the monitor voltage is $-10V \pm 3.5mV$. 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" is set as "ch0 - gain", and the adjustment result is enabled.

Device Open Parameter Screen

34 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).

The screenshot shows the 'Device Open Parameter Screen' with a menu bar at the top containing 'MEMORY', 'Monitor', 'Setup', 'Edit', 'Diagn', and 'Mainte'. The main area contains a table with columns: No., Device, Data typ, Data no, Disp typ, and Comment. Below the table is a text field for 'Devices possible to set:' with the value 'R8300-R9799/R18300-R19799/R28300-R29799'. At the bottom, there are status indicators '1RDY 2RDY', a time display '18:03', and a navigation bar with buttons for 'Line copy', 'Line paste', 'All clear', 'Group search', and 'Group details'.

No.	Device	Data typ	Data no	Disp typ	Comment
40001	R08300	WORD	100	00000000	
40002	R08400	BYTE	200	10000001	
40003	R08500	WORD	100	01000010	
40004	R08700	WORD (BIT)	100	00100011	
40005	R18300	WORD	100	00010000	
40006	R18400	BYTE	200	10000000	
40007	R18500	DWORD	100	01000000	
40008	R18700	WORD (BIT)	100	00100000	
40009	R28300	WORD	100	00010000	
40010	R28400	BYTE	200	00000001	
40011	R28500	DWORD	100	00000010	
40012	R28700	WORD (BIT)	100	00100011	
40013					

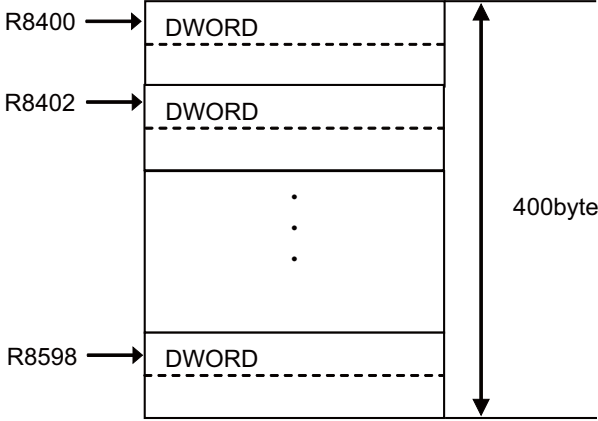
Devices possible to set:
R8300-R9799/R18300-R19799/R28300-R29799

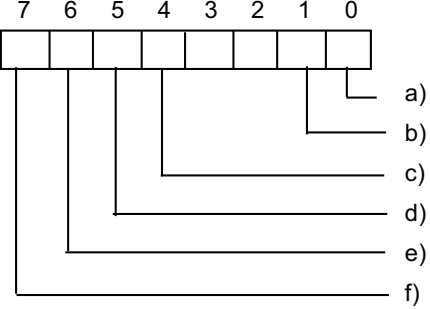
1RDY 2RDY 18:03

Mainte Param I/O

Line copy Line paste All clear Group search Group details

Display items

Display items	Details	Setting range
(1) Parameter No.	Display the parameter No.(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	Set the data type (BYTE, WORD, DWORD, WORD(BIT)) of the allocation area. BYTE: The area is secured per 1-byte. WORD: The area is secured per 2-byte. DWORD: The area is secured per 4-byte. WORD(BIT): The area is secured per 2-byte. 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], [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. (Note) 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 It depends on the device allocation and the data type.

Display items	Details	Setting range
(5) Display format	<p>Designate the display format of the data, the restriction of display, and the state of input protection.</p>  <p>a) Cancellation of 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. (Note) 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.</p> <p>b) Cancellation of restriction on display 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.</p> <p>c) BCD format 1: Valid Display the group detail screen data in BCD format. 0: Invalid</p> <p>d) BIT format 1: Display the group detail screen data in BIT format. 0: Invalid</p> <p>e) HEX format (Hexadecimal format) 1: Valid Display the group detail screen data in HEX format. 0: Invalid</p> <p>f) Sign (Decimal format only) 1: Without sign Display the group detail screen data in decimal format without sign. 0: With sign Display the group detail screen data in decimal format with sign. (Note) When "BCD format", "HEX format" and "BIT format" are all set to "0", the display format of the data is the decimal format.</p>	
(6) Group comment	<p>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.</p> <p>a) When defining a group comment Comment of each group will be displayed. It will be displayed regardless of device allocation and the setting of number of data.</p> <p>b) When not define a group comment A comment of the device which is set with "(2) device allocation" will be displayed.</p>	

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 the [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 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 parameter No. set is a 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 for 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	Change the display format to the HEX format. 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 the 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. (Note) 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 parameter No. set is a 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.

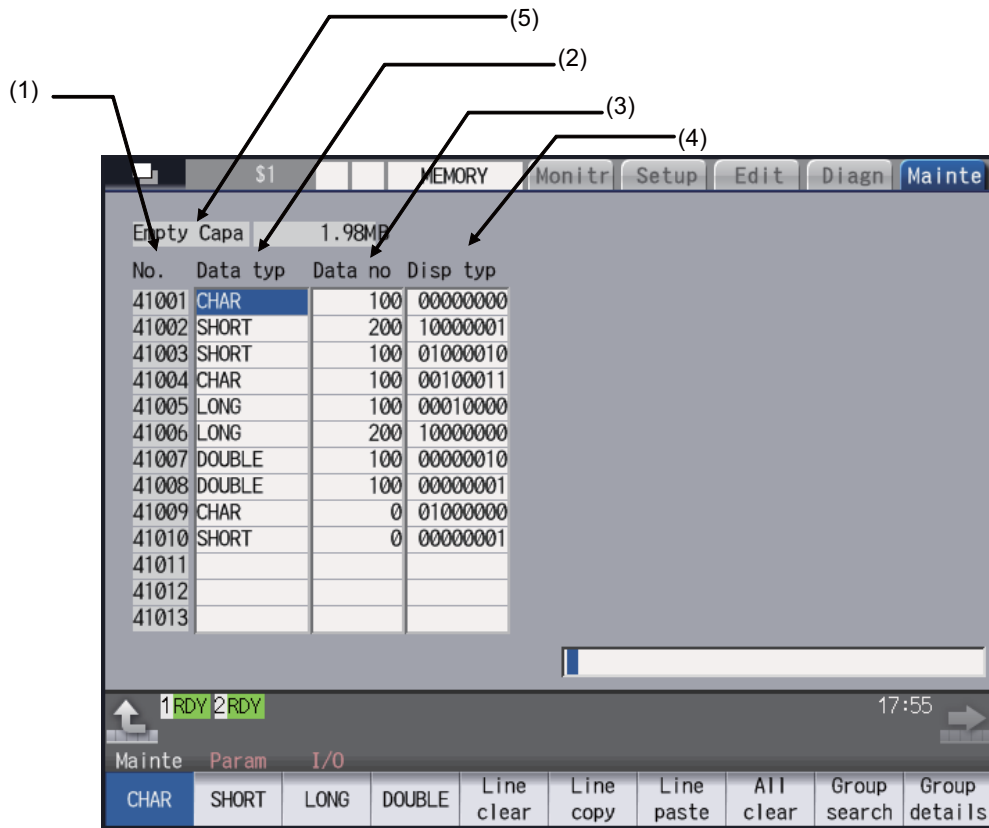
Menu for inputting the data type

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	Input "WORD" to the data type. When the display format is BIT format, it will be changed to the desimal format with sign.
DWORD	Input "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 the line where the cursor is placed. If the data of the line is changed after the [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. (Note) Data of the group detail will not be cleared.
Group search	When parameter No. is set and press [INPUT] key, the group will be displayed with the parameter No. set is a 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 a cursor is placed is not set, it will be invalid.

SRAM Open Parameter Screen

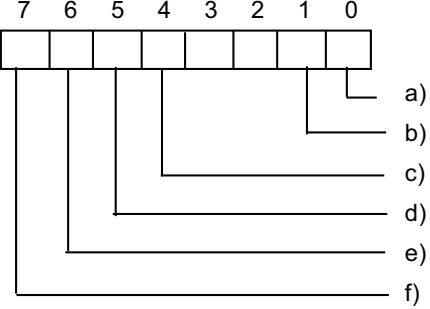
SRAM open area for a machine tool builder can be set or changed.

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) No.	Display the parameter No.(maximum of 100).	-
(2) Data type	<p>Set the data type (CHAR, SHORT, LONG, DOUBLE) of the allocation area.</p> <p>CHAR: 1-byte integer type. The area is saved per 1-byte. SHORT: 2-byte integer type. The area is secured per 2-byte. LONG: 4-byte integer type. The area is secured per 4-byte. DOUBLE: 8-byte real type. The area is secured per 8-byte.</p> <p>Target group setting (No. of data, display format) will be cleared if "0" is designated.</p> <p>The data type can also be designated by pressing the menu [CHAR], [SHORT], [LONG] or [DOUBLE].</p> <p>The data set will be valid after formatting and then turning the power ON again.</p> <p>If the power is turned ON without formatting after the setting, an error "Z40 Format mismatch" will be displayed. The error will be kept displayed even the power is turned ON again until the reformatting is completed.</p>	<p>0</p> <p>1:CHAR 2:SHORT 3:LONG 4:DOUBLE</p>
(3) Number of data	<p>Set the number of data in the allocated area.</p> <p>Number of data available to designate varies depending on the unit and the free space designated by the data type.</p> <ul style="list-style-type: none"> - Target group will be invalid if the number of data is "0". - 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, a error "Z40 Format mismatch" will be displayed. The error will be kept displayed even the power is turned ON again until the reformatting is completed. 	<p>0 to 9999999</p> <p>Depends on the data type and the amount of free space.</p>

Display item	Details	Setting range
(4) Display format	<p>Designate the display format of the data, display limitation and the state of the input protection.</p>  <p>a) Cancellation of 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.</p> <p>b) Cancellation of restriction on display 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.</p> <p>c) BCD format 1: Valid Display the group detail screen data in BCD format. 0: Invalid</p> <p>d) BIT format 1: Display the group detail screen data in BIT format. 0: Invalid</p> <p>e) HEX format (Hexadecimal format) 1: Valid Display the group detail screen data in HEX format. 0: Invalid</p> <p>f) Sign (Decimal format only) 1: Without sign Display the group detail screen data in decimal format without sign. 0: With sign Display the group detail screen data in decimal format with sign.</p> <p>- 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 format is set to "1", the data display format will be decimal format with sign. - If the data type is "DOUBLE", it will be decimal format with sign.</p>	
(5) Amount of free space	<p>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.</p>	

Menu when inputting the data type

Menu	Details
CHAR	Input CHAR into the data type.
SHORT	Input SHORT into the data type.
LONG	Input LONG into the data type.
DOUBLE	Input 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 the line where the cursor is placed. If the data of the line is changed after the [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 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 number of data

Menu	Details
Line clear	Delete a group in a line where a cursor is placed.
Line copy	Copy the data of one line where a cursor is placed.
Line paste	Writes the contents of the data copied (one line) into the line where the cursor is placed. If the data of the line is changed after the [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 information, where a 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	Change the display format to the hexadecimal format.
BIT	Change the display format to the BIT format.
BCD	Change the display format to the BCD format.
Enable display	Change whether to show the group detail screen to the users.
Cancel protect	Change whether the input protection check is valid or not.
Line clear	Delete a group of the 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 the 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. (Note) 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. set 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.

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 are available in all backup and restoration.

- HD (Hard disk (for Windows-based display unit only))
- Memory card (Front-side SD card)
- DS (Control unit-side SD card)
- USB memory

The master data backup and restoration are used for backing up and restoring the initial state data set by MTB. The built-in memory is used for the master data backup and restoration regardless of the selected device.

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 and so on
	ALL.PRM (*1)	Parameters
	ASSEMBLY.INF (*1)	System configuration
Ladder	USERPLC.LAD	User PLC program
	EIPCONFDATA.BIN	EtherNet/IP configuration file
	PLCMMSG_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	C language module created by user
Custom data	-	Custom screen data (Custom screen modules, setting files (Config.ini/ customdef.ini/customload.txt) and PLC alarm messages)

(*1) These data can be backed up only, cannot be restored.

(*2) "XXX" indicates the abbreviation for each language.

For the input/output function for separate files, refer to the "Instruction Manual".

36.1 All Backup

The following explains the procedure to backup the various NC data to the memory card in a batch.

[Note]

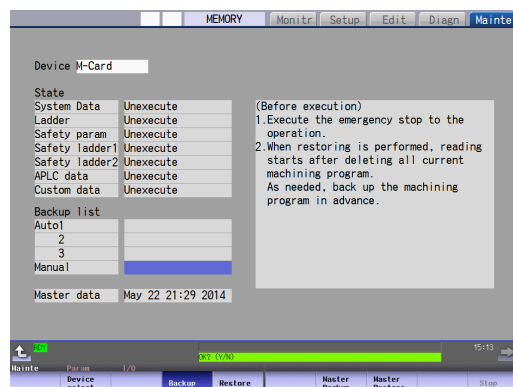
- (1) APLC data can be backed up only when the APLC release specification is valid.

Operation method


- (1) Press the menu [Backup].



The all backup screen is displayed.



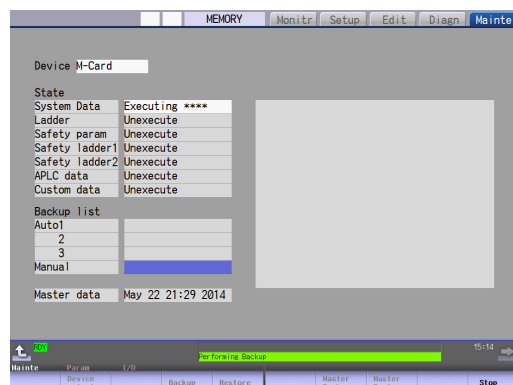
<Note>

- Press the  to cancel this process.

- (2) Press [Y], [y] or [INPUT].



The backup starts. "Executing" and "*" are displayed for the state of file under processing.



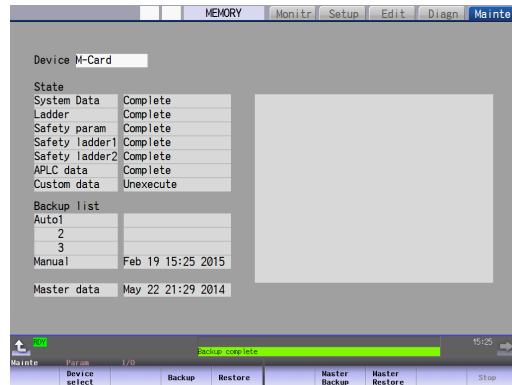
<Note>

- If any NC data file exists in the backup folder, the confirmation message "Overwrite this file? (Y/N)" appears. Press [Y], [y] or [INPUT] to start the backup.
- If the 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.

(3) The backup is completed without error.



The states of backup-complete files turn to "Complete", the date displayed in "Backup list" will be updated.



<Note>

- If the APLC release specification is invalid, the APLC data cannot be backed up and "Unexecute" is 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.
- (3) On the Windows-based display unit, if the size (the size in the actual memory) of custom data exceeds 48MB, the operation message "Skipped custom data due to over capacity" appears and the custom data cannot be backed up. Note that the size in the actual memory and the size on Windows may differ.

36.2 All Restoration

The following explains the procedure to restore the various NC data backed up to memory card in a batch.

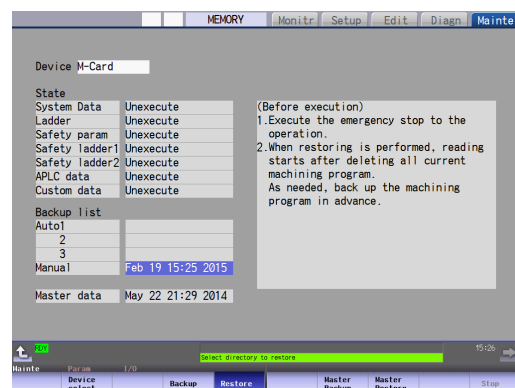
The files which has been automatically backed up can be restored only when the device set by the parameter "#8919 Auto backup device" is selected.

[Note]


- (1) The presence/absence of each file (system data, ladder and APLC data) for the transfer destination is not checked when the restoration is executed.
- (2) Each file for the system data, ladder, APLC data and custom data are rewritten when the restoration is executed.
- (3) In the following cases, an error message appears and the restoration is not 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.
- (4) APLC data can be restored only when the APLC release specification is valid.
- (5) When smart safety observation is valid, entering the safety password is required. If the safety password is not entered, the safety parameters and the safety ladders are cannot be restored. Operate from the procedure (3) when the smart safety observation is invalid.

Operation method

- (1) Press the menu [Psswd input] on the Mainte screen.
- (2) Enter the safety password.
- (3) Set the device to memory card on the all backup screen. ➔ Memory card is selected as the restoration source device.
- (4) Press the menu [Restore]. ➔ The all restoration screen is displayed.



<Note>

- Press the  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.

- (5) 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-> ...

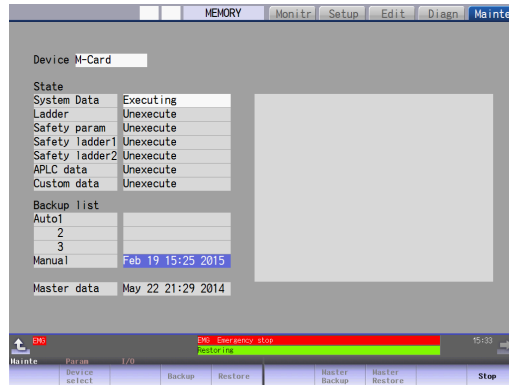
➔ The operation message "OK? (Y/N)" appears.

<Note>

- If there are no files at the position where the cursor moved to, the operation message "Select directory to restore" appears. Select the file again and then press the [INPUT] key.

- (6) Press [Y], [y] or [Input].

➔ The restoration starts. "Executing" and "*" are displayed for the state of file under processing.



<Note>

- If PLC is in operation, the "PLC running. Does it stop? (Y/N)" message is displayed. Press [Y], [y] or [INPUT] to continue the restoration.
- If the tool data is being sorted, the operation message "File access error" is displayed and the restoration cannot be executed.
- For the custom data, the restoration cannot be canceled during its execution.

- (7) The restoration is completed without error.

➔ The states of restoration-complete files turn to "Complete", the operation message "Restore complete" appears. "Unexecute" is displayed for the file which could not be restored, for instance, due to the nonexistence of the file.

[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.
- (3) If you attempt to restore custom data on a Windows-based display while custom data has been installed in the NC, the message "File access error" appears which may disable restoration. Thus, use the integrated installer to delete custom data from the NC before restoring custom data.

Appx.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.

37.1 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.

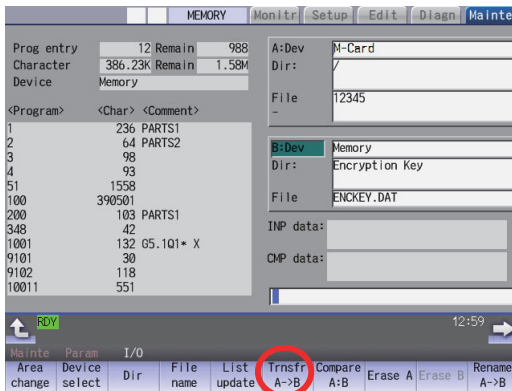
- (1) Set "#1249 set21/bit2" to "1".
- (2) Save the encryption key file on a SD card (or USB memory).
- (3) Insert the SD card (or USB memory) card into the control unit.
- (4) Select [Input/Output] on the Mainte screen.
- (5) Enter an encryption key in the Input/output screen.
 - (a) Set the device name, directory and file name in the "A:Dev" area.
 - (b) Set "Memory" for the device section and "/CRE" for the directory section of the "B:Dev" area.

Contents in the directory and file name sections will be written over.

Directory section: "Encryption Key"

File name section: "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, "Setting complete normally" appears.
 If the encryption key has not been set, the message "Can't write file for dev B" appears.
 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 alphabet)

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, an alarm message "Z41 Decryption code is missing" appears. To enable the system lock, go on to the "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.

37.2 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 a 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" from "B:Dev" device section and press [Dir] to display [Decrypt code] on menu key of the screen.

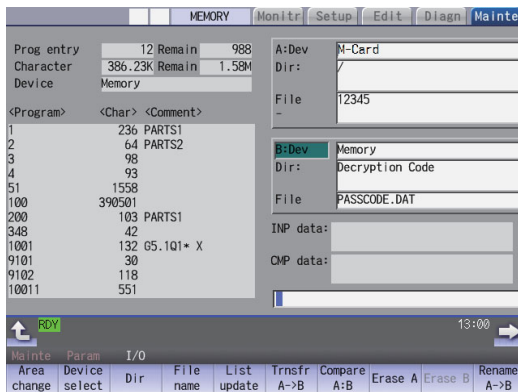
Contents in the directory section and file name section will be written over by pressing [Decryption code].

Directory section: "Decryption Code"

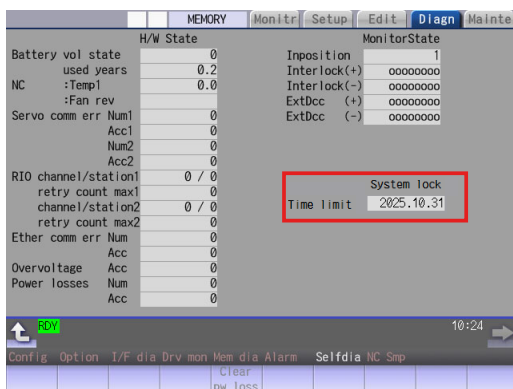
File name section: "PASSCODE.DAT"

Setting "Memory" in the device section and "/RLS" in the directory section of the "B:Dev" area will be the same.

- (c) Press the menu key [Trnsfr A->B].



- (d) When a confirmation message appears, press either [Y] or [INPUT].
 - If the decryption code has successfully been set, "Setting complete normally" appears.
 - If the warning message is on the screen, this message will be removed.
 - If an alarm is activated, the alarm message will be deleted but SA will not turn ON. Turn ON the NC power again.
 - If the decryption code is wrong, the message "Can't write file for dev B" will appear.
 - The "Executing automatic operation" error occurs during program operation, and setting the code is disabled.
- (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.

37.3 Display of Time Limit Warning and Alarm Notification

- (1) As the expiration date approaches, 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 can be performed before the expiration date and time.
- (2) If the expiration date and time have passed, the alarm message "Z65 Valid term has been expired" appears, which disables cycle start operation. 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.

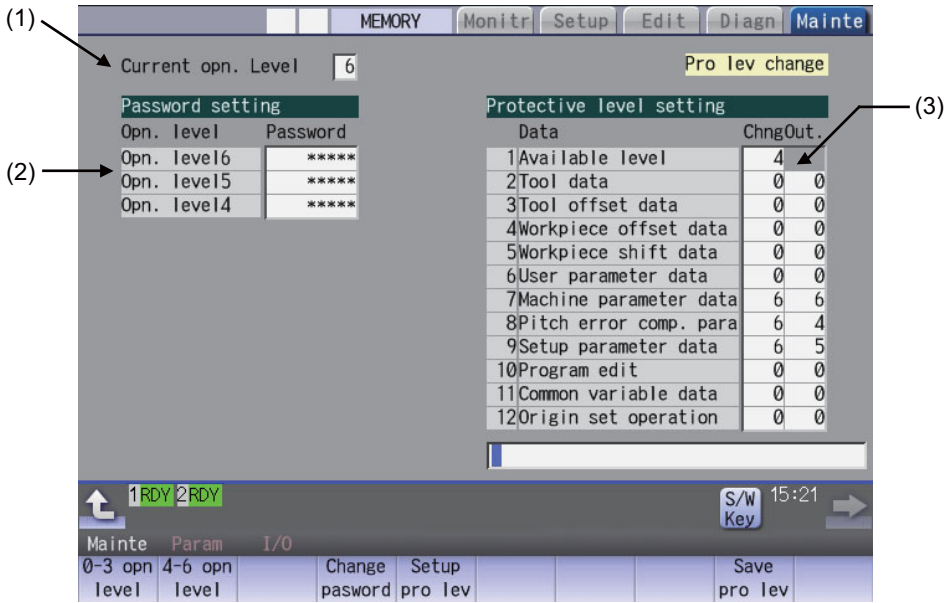
37.4 Caution

- (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.
When you advance date and time to the expiration date, set "#1724 cfg24/bit2" (System lock date and time setting permission) to "1". This parameter is set to "0" when the power is turned ON or at the 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 you turn OFF and ON the power after the time limit has expired, "EMG Emergency stop LINE" may appear 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.
- (5) If you upgrade the M8 Series software version from C3 or older to C4, perform the upgrading work after canceling system lock.
- (6) When you upgrade the M8 Series software version from C3 or older to C5 or later with system lock enabled, the password for the system lock is automatically expanded to 8 digits. To issue a decryption code, add "0000" to the head of the conventional encryption key. Moreover, use the "System Lock Pass Code Maker" (BND-2201W000-A0 or later) to issue the decryption code.
- (7) When you downgrade the M8 Series software version from C4 or later to C3 or older, you cannot perform the downgrade work with system lock enabled. To downgrade from version C4 or later to version C3 or older, cancel system lock and then perform the downgrade work.
- (8) When you temporarily disable the system lock function in version D6 or earlier of M8 CNC, set a past date and time on the integrated time screen, and then reset the expiration date, the expiration date may be set to "1970.1.1".
The expiration date will be set correctly following the procedure below.
 - (a) Disable the System lock function.
 - (b) Update the CNC to S/W version D7 or later.
 - (c) Set the expiration date.
 - (d) Turn the CNC power ON.

Appx.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.

38.1 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 to change data (including a case to input a file). Output: Specify the protection level to output a file.

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. Which of the operation level between 0 and 3 being switched is followed by the PLC signal 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 items	Objects to be protected			Initial value		Setting range	
		Change	Output	Change	Output	Change	Output
Available level	Table for protection level setting on this screen Table for protection level setting cannot be changed by the operation level which is lower than the set protection level.	○	-	4	-	4-6	-
Tool data	Tool management data Tool registration Tool life management data	○	-	0	0	0-6	0-6
	All tool data files (TOOLALL.DAT) Tool life management data files (TLIFE.TLF) Tool management data files (TOOLMNG.DAT)	○	○				
Tool offset data	Tool compensation amount data Tool measurement data	○	-	0	0	0-6	0-6
	Tool offset data files (TOOL.OFS)	○	○				
Workpiece offset data	Coordinate system offset data Workpiece installation error compensation data Workpiece position offset for rotary axis Workpiece measurement data	○	-	0	0	0-6	0-6
	Workpiece offset data files (WORK.OFS)	○	○				
Workpiece shift data	Workpiece shift data	○	-	0	0	0-6	0-6
	All tool data files (TOOLALL.DAT)	○	○				
User parameter data	User parameter data Barrier data	○	-	0	0	0-6	0-6
	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)	○	-	6	0	0-6	0-6
	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)	○	○				
Pitch error compensation parameter	Error compensation parameter data Error data	○	-	6	0	0-6	0-6
	Parameter files (ALL.PRM)	○	○				

Display items	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])	-	○				
	Batch backups (menu [Restore]) Batch backups (menu [Master Restore]) HMI environment setting Memory format All erasure of machining programs 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 (Note 1) Machine tool builder macro variables WE measurement macro writing Machine tool builder macro ROM write Security function	○	-	6	0	0-6	0-6
	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)	○	○				
Program editing	Program editing (only for memory) Buffer correction	○	○ (Note 2)	0	0	0-6	0-6
	Machining program files (PRG/USER) Fixed cycle program (PRG/FIX)	○	○				
Common variable data	Common variable data (Note 3)	○	-	0	0	0-6	0-6
	Common variable data files (COMMON.VAR)	○	○				
Origin set operation	G92 set	○	-	0	0	0-6	0-6
Operator mail notification data	Operator mail notification setting Email communication address file Email communication setting file	○	-	0	0	0-6	0-6
	Email communication log file on input/output screen Email communication address file Email communication setting file	-	○				

(Note 1) When the protection level set for "Chng" of "Setup parameter data" is any of 0 to 3, if all the following conditions are met, PLC on-board can be started but it cannot be edited.

- Operation level is "3" or lower
- Operation level is at the protection level or higher

(Note 2) When the set protection level 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.

(Note 3) The common variables protected in #12111 to #12114 cannot be configured or changed regardless of the operation level or the protection level.

(Note 4) For specifications on inputting and outputting files which are objects to be protected, refer to "Instruction Manual".

(Note 5) Following operations are available to operate at the protection level 6 and over.

- 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

38.2 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. |

38.3 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 both cases, the highlighted menu returns to normal, and the cursor disappears, too. |

38.4 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 has changed" is displayed, and the highlighted menu [Change pasword] 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.

(Note 2) Changing the password is available only for the lower operation level than the current one.

38.5 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.

38.6 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.)

(Note 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".)

(Note 3) When changing the protection level during input-output, an error may occur in the middle of the input-output.

38.7 Saving the Protection Level Setting

Operation Methods

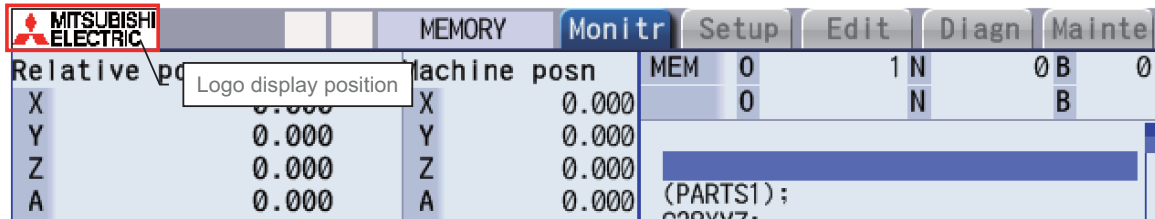
- | | | | |
|-----|--------------------------------|---|---|
| (1) | Press the menu [Save pro lev]. | ➔ | The operation message "Save the protective level setting? (Y/N)" is displayed. |
| (2) | Press the [Y] or [INPUT] key. | ➔ | The operation message "Protective level setting has been saved." is displayed.
The displayed message "Pro lev change" on the upper right of the screen is disappeared. |

(Note 1) After changing the protection level, 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.

(Note 2) After changing the protection level, if you turn the power OFF without saving the change, the changed protection level is canceled.

Appx.3: Displaying Original Logo On Standard Screen

A logo that machine tool builders create can be displayed on the upper left of the standard screen. In order 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	Windows-based display	D:\Custom
	non-Windows-based display	\Custom\
Size (Note 1)	VGA	22×80 pixels
	XGA	32×135 pixels
Number of colors (Note 2)	16 bits	

(Note 1) 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.

(Note 2) 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.

Appx.4: 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.

40.1 Introduction

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

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

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

Mitsubishi is carrying out tests to confirm the compliance to the EMC Directives under the environment described in this manual. However, the level of the noise will differ according to the equipment type and layout, control panel structure and wiring lead-in, etc.

Thus, we ask that the final noise level be confirmed by the machine manufacturer.

40.2 EMC Directives

The EMC Directives largely regulate the following two items.

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

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

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

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

40.3 EMC Measures

The main items relating to EMC measures include the following.

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

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

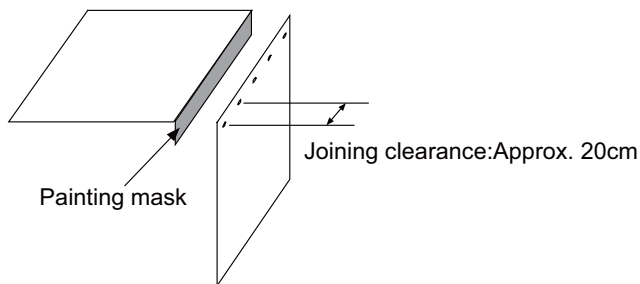
- (1) Accurately ground the devices.
- (2) Use shielded cables.
- (3) Increase the electrical seal of the panel. Reduce the gaps and holes.

40.4 Panel Structure

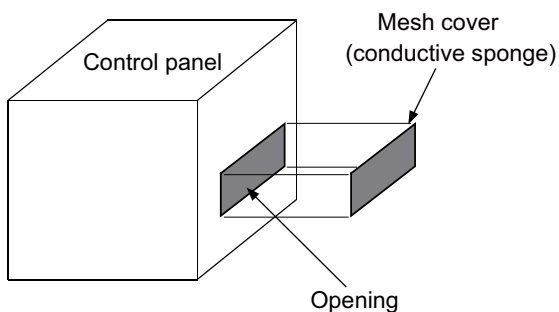
The design of the panel is a very important factor for the EMC measures, so take the following measures into consideration.

40.4.1 Measures for Control Panel Body

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



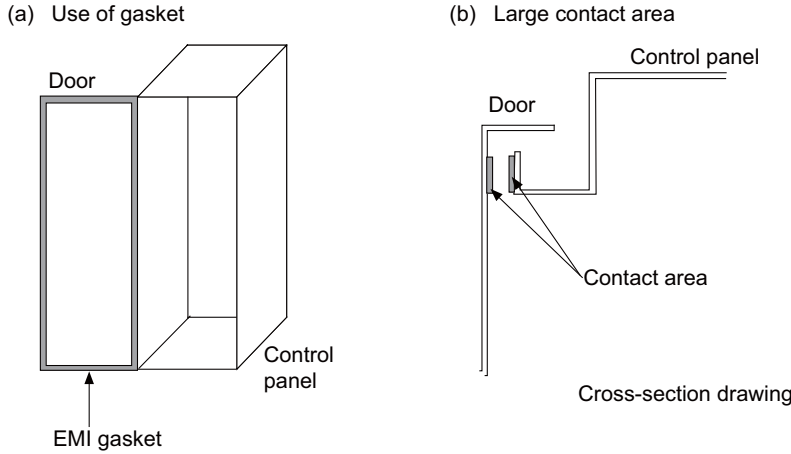
- (3) Note that if the plate warps due to the screw fixing, etc. By creating a clearance, noise could leak from that place.
- (4) Plate (nickel tin) the metal plate surface at the grounding plate, and connect the connections with a low impedance.
- (5) If there is a large opening, such as ventilation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



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

40.4.2 Measures for Door

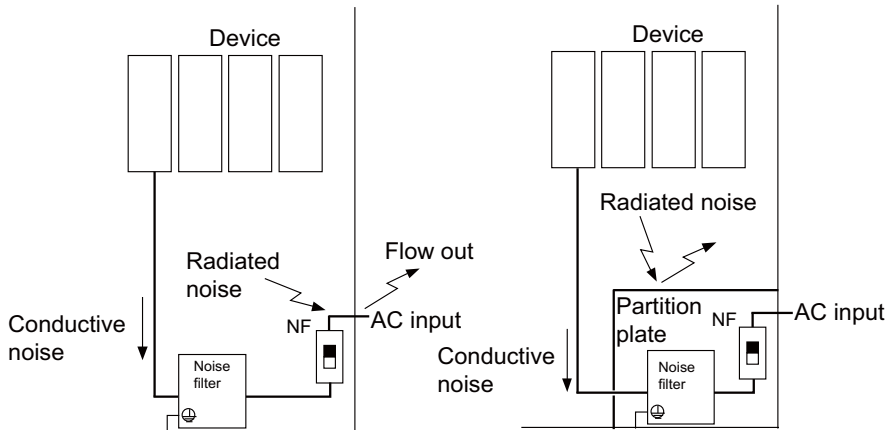
- (1) Use metal for all members configuring the panel.
- (2) When joining the door, use a gasket to lower the impedance of the contacting sections, or use a structure with a large contact area as shown below.
- (3) The EMI gasket or conductive packing must contact the metal surface uniformly and at the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



- (Note 1) When not using a gasket, ground the control panel grounding with a grounding wire to lower the door's impedance.
- (Note 2) Using screws to fix the plates that have been painted (attachment of packing) is the same as an insulated state. Peel the paint and fix the screws.

40.4.3 Measures for Power Supply

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



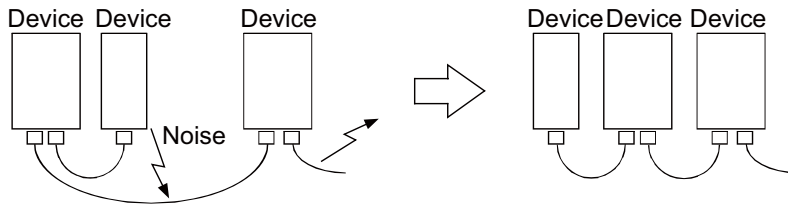
- (Note 1) The conductive noise can be suppressed by inserting a noise filter, but the radiated noise will flow out.
- (Note 2) The conductive and radiated noise can both be suppressed by adding a partition plate to the noise filter.

40.5 Measures for Wiring in Panel

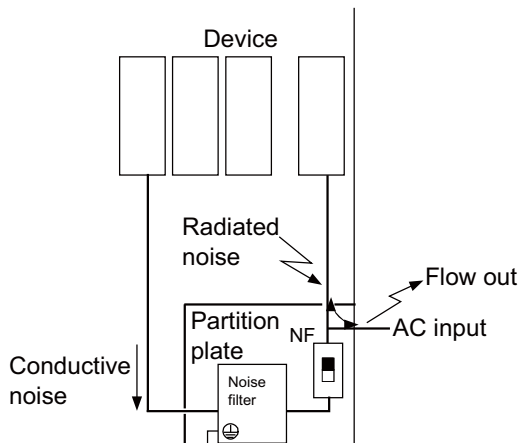
Cables act as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated. The following measures must be sufficiently considered for the cables (J210/J303) that carry out high-speed communication.

40.5.1 Precautions for Wiring in Panel

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



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

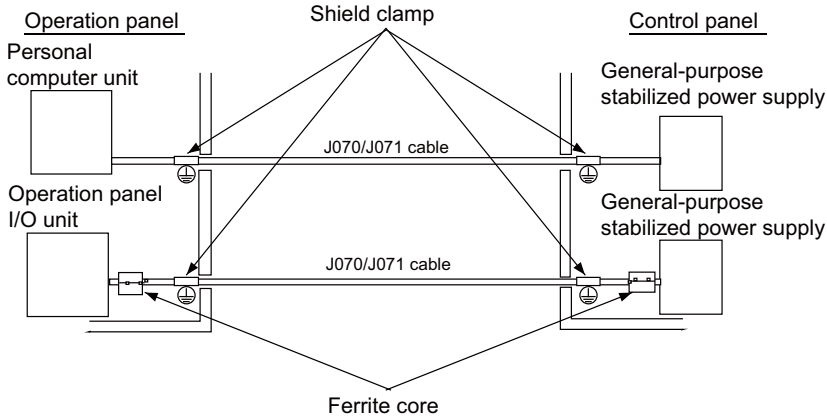


40.5.2 Shield Treatment of Cables

Use shielded cables for the cables wired outside the panel.

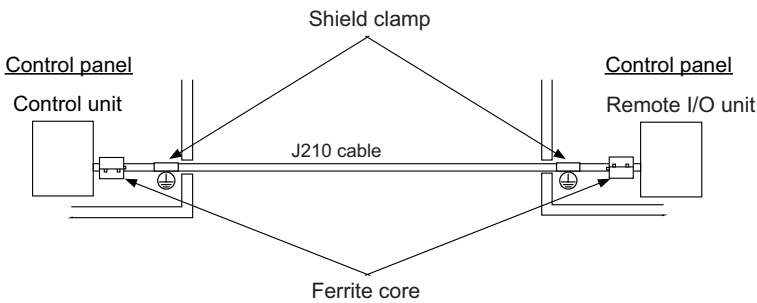
Use a shield clamp within 10cm of the lead-out port from the panel. (Refer to "EMC Countermeasure Parts: Shield Clamp Fitting".)

(1) DC power supply cable [J070/J071 cable]



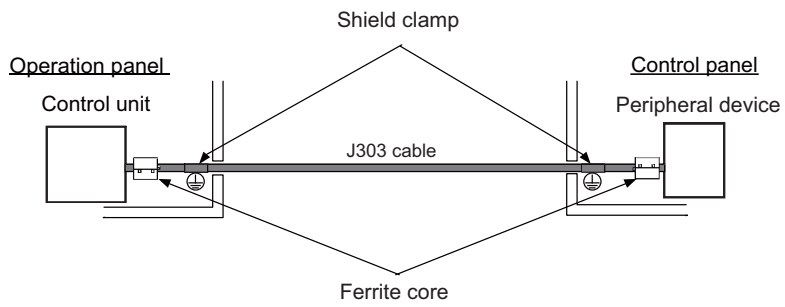
- Use a shield clamp within 10cm from the panel's inlet/outlet.
- When using a ferrite core, install it on both ends of the connected units.
- Always install a ferrite core (Refer to "EMC Countermeasure Parts: Ferrite Core".) on the general-purpose stabilized power supply. The ferrite core may not be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

(2) Remote I/O cable [J210 cable]



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

(3) LAN cable [J303 cable]



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

40.6 EMC Countermeasure Parts

40.6.1 Shield Clamp Fitting

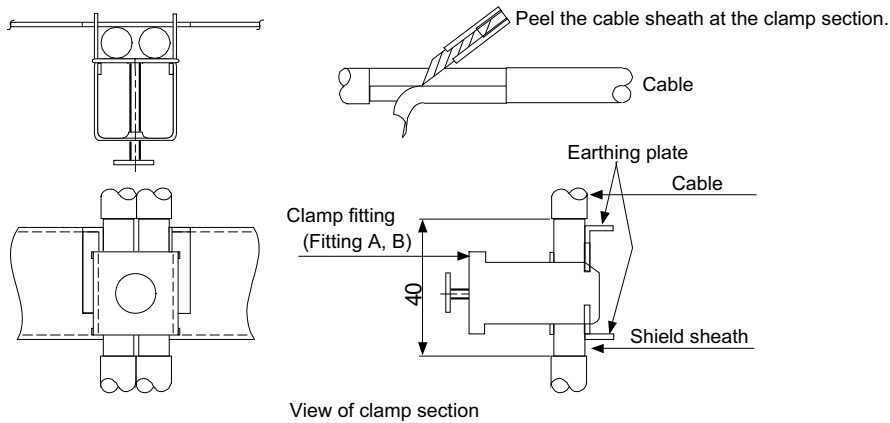
The effect can be improved by directly connecting the cable's shield sheath to the grounding plate as shown below. Install the grounding plate near the outlet (within 10cm) of each panel, and press against the grounding plate with the clamp fitting.

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.

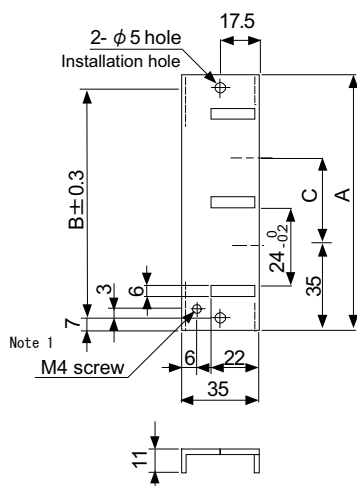
	A	B	C	Enclosed fittings
Ground Plate #D	100	86	30	Clamp fitting A×2
Ground Plate #E	70	56	-	Clamp fitting B×1

	L1 (maximum dimension when it is open)	L2 (reference dimension)
Clamp fitting A	25	(77)
Clamp fitting B	12	(54)

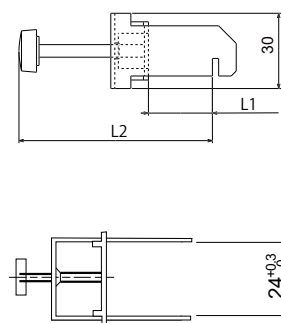


• Outline drawing

Earthing plate



Clamp fitting



[Unit: mm]

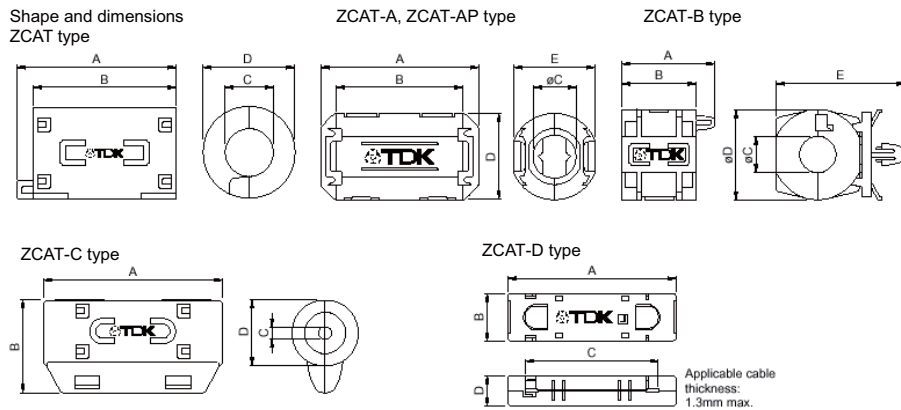
(Note 1) Screw hole for wiring to earthing plate in cabinet.
 (Note 2) The earthing plate thickness is 1.6mm.

40.6.2 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	-	7max.	6
ZCAT1518-0730(BK)*2	22±1	18±1	7±1	15±1	-	7max.	6
ZCAT2017-0930-M(-BK)	21±1	17±1	9±1	20±1	-	9max.	11
ZCAT2032-0930-M(-BK)*1	36±1	32±1	9±1	19.5±1	-	9max.	22
ZCAT2032-0930(-BK)*2	36±1	32±1	9±1	19.5±1	-	9max.	22
ZCAT2132-1130-M(-BK)*1	36±1	32±1	11±1	20.5±1	-	11max.	22
ZCAT2132-1130(-BK)*2	36±1	32±1	11±1	20.5±1	-	11max.	22
ZCAT3035-1330-M(-BK)*1	39±1	34±1	13±1	30±1	-	13max.	63
ZCAT3035-1330(-BK)*2	39±1	34±1	13±1	30±1	-	13max.	63
ZCAT1525-0430AP-M(-BK)	25±1	20±1	4±1	15±1	11.5±1	2.5 to 4(USB)	7
ZCAT1325-0530A-M(-BK)*1	25±1	20±1	5±1	12.8±1	11.2±1	3 to 5(USB)	7
ZCAT1325-0530A(-BK)	25±1	20±1	5±1	12.8±1	11.2±1	3 to 5(USB)	7
ZCAT1730-0730A-M(-BK)	30±1	23±1	7±1	16.5±1	15±1	4 to 7(USB)	12
ZCAT2035-0930A-M(-BK)*1	35±1	28±1	9±1	19.5±1	17.4±1	6 to 9	22
ZCAT2035-0930A(-BK)	35±1	28±1	9±1	19.5±1	17.4±1	6 to 9	22
ZCAT2235-1030A-M(-BK)	35±1	28±1	10±1	21.5±1	20±1	8 to 10	27
ZCAT2436-1330A-M(-BK)	36±1	29±1	13±1	23.5±1	22±1	10 to 13	29
ZCAT2017-0930B-M(-BK)	21±1	17±1	9±1	20±1	28.5±1	9max.	12
ZCAT2749-0430C-M(-BK)	49±1	27±1	4.5±1	19.5±1	-	4.5max.	26
ZCAT4625-3430D(-BK)	45.5±1	24.5±1	34±1	12±1	-	26 For core flat cable	32
ZCAT4625-3430DT(-BK)*3	45.5±1	24.5±1	34±1	13±1	-	26 For core flat cable	32
ZCAT6819-5230D(-BK)	67.5±1	18.5±1	52±1	16±1	-	40 For core flat cable	58
ZCAT6819-5230DT(-BK)*3	67.5±1	18.5±1	52±1	17±1	-	40 For core flat cable	58

*1 The M stamp is attached.

*2 A fixing band is attached at shipment.

*3 The core is fixed with double-sided tape. (The tape is enclosed with the part.)

● ZCAT-B type: Cabinet fixing type installation hole φ4.8 to 4.9mm, plate thickness 0.5 to 2mm

● ZCAT-AP, ZCAT-C type: Structure that prevents easy opening after case is closed.

40.6.3 Surge Absorber

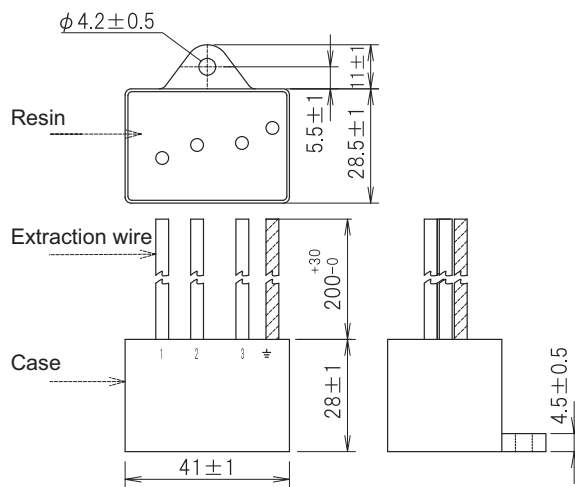
Make sure that the surge does not directly enter the AC line of the general-purpose stabilized power supply (user-prepared) supplying power to the control unit and DIO. Select the following product or equivalent for the surge absorber. Refer to the manufacturer catalog for detailed characteristics, outline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

(1) Part name: RSPD-250-U4

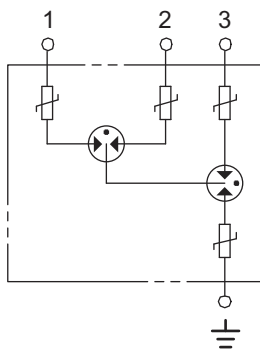
Manufacturer: OKAYA ELECTRIC INDUSTRIES

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

Outline drawing



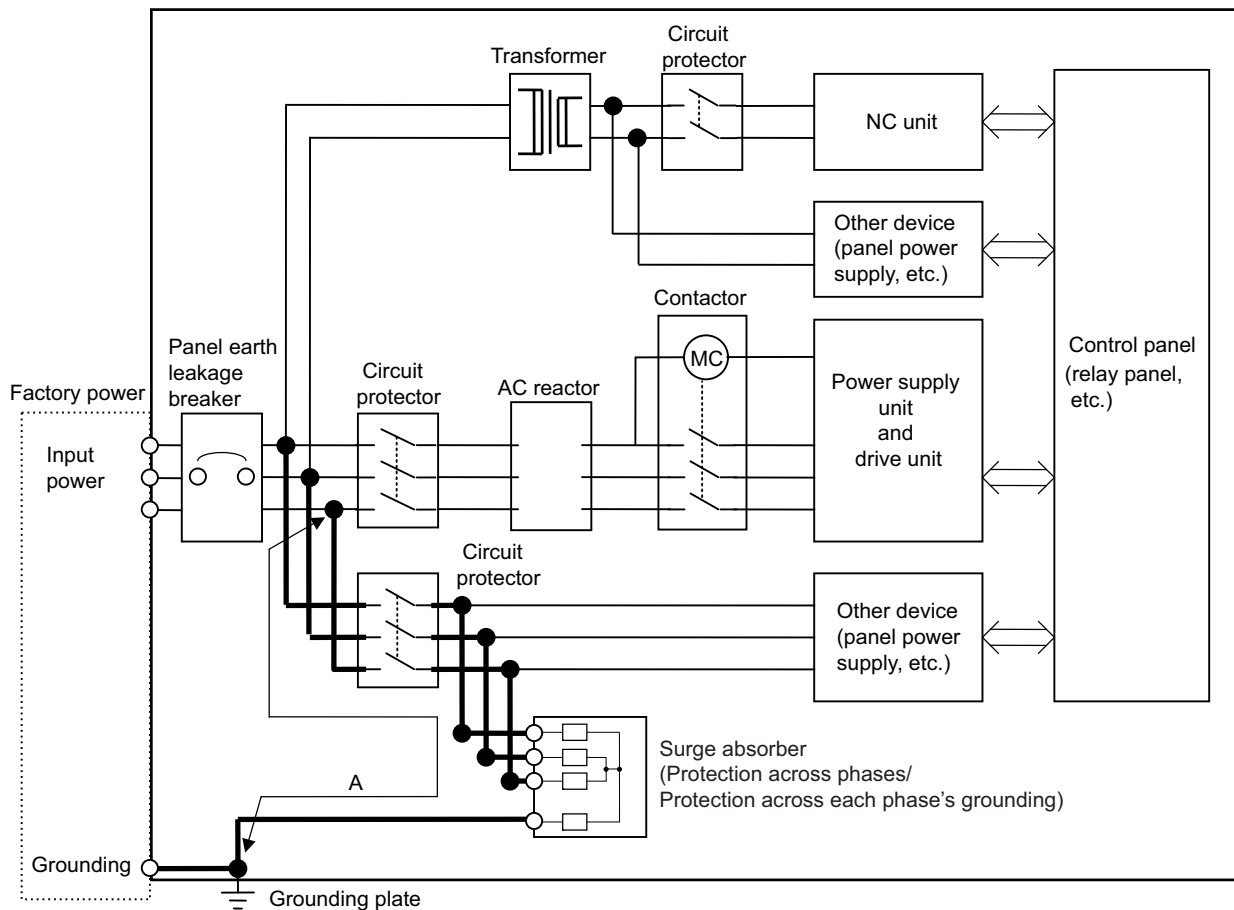
Circuit drawing



(2) Example of surge absorber installation

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

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



Surge absorber installation

⚠ CAUTION

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

40.6.4 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 24VDC output
	Ripple noise	120mV (max.)	
	Spike noise	500mV (max.)	
Output current		---	Refer to the maximum current consumption of the unit in use and calculate.
Output holding time		20ms (min)	Instantaneous power failure time (AC side)

Standards

Safety Standards: UL1950, CSA C22.2 No. 234 approved, IEC950 compliant

Noise Terminal Voltage: FCC Class A, VCCI-Class A

High Harmonics Current Restrictions: IEC61000-3-2

Appx.5: Restrictions for Lithium Batteries

41.1 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 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	-

41.1.1 Target Products

The following Mitsubishi NC products use lithium batteries. If the lithium metal content exceeds 1g for battery cell and 2g for battery, the battery is classified as dangerous good (Class9).

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 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	1.52g	-	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 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	0.067g	-	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	0.173g	-	For NC SRAM		
ER6, ER6V series (for built-in battery)	ER6, ER6V	0.65g	-	For NC SRAM/ servo encoder		
MR-BAT	ER17330V	0.48g	-	For servo encoder		
Q6BAT	Q6BAT	0.57g	-	For NC SRAM		
MDS-BAT6V1SET MR-BAT6V1SET	2CR17335A	1.2g	2	For servo encoder	Battery	

(Note) 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.

41.1.2 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/>

41.1.3 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/>

41.2 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 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 swallowed, consult a doctor immediately.

(3) Fire-fighting measure

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

(4) Measure for leakage

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

(5) Handling and storage

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

(6) Physical/chemical properties

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

(7) Stability and reactivity

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

(8) Toxicological information

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

< Lithium metal >

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

< Thionyl chloride >

Acute toxicity	LC ₅₀ : 500ppm (inhaled administration to rat)
Local effect	The lungs can be damaged by chronic cough, dyspnea and asthma.

< Aluminum chloride >

Acute toxicity	LD ₅₀ : 3700ppm (oral administration to rat)
Local effect	Not found.

< Lithium chloride >

Acute toxicity	LD ₅₀ : 526ppm (oral administration to rat)
Local effect	The central nerves and kidney can be influenced.

< Carbon black >

Acute toxicity	LD ₅₀ : 2,000mg/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.

41.3 Forbiddance of Transporting Lithium Battery by Passenger Aircraft Provided in the Code of Federal Regulation

This regulation became effective from Dec.29, 2004. This law is a domestic law of the United States, however it also applies to the domestic flight and international flight departing from or arriving in the United States. Therefore, when transporting lithium batteries to the United State, or within the United State, the shipper must take measures required to transport lithium batteries. Refer to the Federal Register and the code of Federal Regulation 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"

41.4 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 Meterial-special handling may apply. See <http://www.dtsc.ca.gov/hazardouswaste/perchlorate>"

41.5 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 are subjected to this restriction.

41.5.1 Important Notes

Follow the instruction bellow as shipping products incorporating MITSUBISHI device.

- (1) When shipping products incorporating MITSUBISHI 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).

41.5.2 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 centre.

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

Appx.6: Precautions for Compliance to UL/c-UL Standards

- (1) Selection of external 24VDC 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 24VDC to each unit is a UL-approved part of SELV/limited power LPS or Class 2.

Use a UL-approved part for the stabilized power supply unit supplying 24VDC to each unit.

- (2) Unit ambient temperature

This NC system complies with the UL Standards on the condition that the unit is used at a temperature less than the maximum ambient temperature given in "Environment Conditions" section. Make sure that the maximum ambient temperature of each unit does not exceed the temperature given in "Environment Conditions" section.

Revision History

Date of revision	Manual No.	Revision details
Mar. 2015	IB(NA)1501268-A	First edition created.
Aug. 2015	IB(NA)1501268-B	<p>- The following units were added. FCU8-DU181-34 (15-type Display Unit) FCU8-KB083 (Keyboard for 15-type Display Unit) FCU8-DX213 (Remote I/O Unit)</p> <p>- The following chapters and sections were added. 2.1 General Connection Diagram [15-type] 3.4 Keyboard Unit 3.10 Cable Connector Sets 5.3.3 Keyboard Unit 6.5 Connection of Keyboard Unit 6.6.6 Connecting with Keyboard Unit 7.4.11 MR-BT6V2CBL Cable 7.4.12 MR-D05UDL3M-B Cable 7.5 List of Cable Connector Sets 9.4 Connecting and Setting Drive Unit MDS-EM Series</p> <p>- Chapter number change Chapter 8 to 10 were changed into Appendix 1 to 3. Chapter 11 to 22 were changed into 8 to 19.</p> <p>- Mistakes were corrected.</p>
Apr. 2016	IB(NA)1501268-C	<p>- The following units were added. FCU8-MU044 (M80W Control Unit) FCU8-DU121-12 (8.4-type Display Unit) FCU8-DU141-31 (10.4-type Display Unit) FCU8-DU141-32 (10.4-type Display Unit) FCU8-DU181-31 (15-type Display Unit) FCU8-DU181-32 (15-type Display Unit) FCU8-DU181-36 (15-type Display Unit) FCU8-DU191-77 (19-type Display Unit) FCU8-DU192-75 (19-type Display Unit) FCU8-DU192-77 (19-type Display Unit) FCU8-GC211 (Graphic Control Unit) FCU8-KB026 (Keyboard for 8.4-type Display Unit) FCU8-KB028 (Keyboard for 8.4-type Display Unit) FCU8-KB029 (Keyboard for 8.4-type Display Unit) FCU8-KB041 (Keyboard for 10.4-type Display Unit) FCU8-KB046 (Keyboard for 10.4-type Display Unit) FCU8-KB047 (Keyboard for 10.4-type Display Unit) FCU8-KB048 (Keyboard for 10.4-type Display Unit) FCU8-DX730 (Operation Panel I/O Unit) FCU8-DX202 (Remote I/O Unit) FCU8-EX544 (Encoder (Manual Pulse Generator) I/F Expansion Unit) FCU8-EX563 (PROFIBUS-DP Expansion Unit)</p> <p>- The following chapters and sections were added. 2.1.3 M800W, Windows-less display (10.4-type/15-type) 2.2 General Connection Diagram [M80W] 3.2 Control Unit [M80W] 3.4 Display Unit [M80W] 3.6 Graphic Control Unit 3.8 Keyboard Unit [M80W] 3.11 Function Expansion Unit 3.15 Synchronous Feed Encoder 3.17 Genuine Memory Card</p> <p>(Continue to the next page)</p>

Date of revision	Manual No.	Revision details
Apr. 2016	IB(NA)1501268-C	<p>(Continued from the previous page)</p> <p>4.2 Environment Conditions [M80W] 4.4 Control Unit [M80W] 4.6 Display Unit [M80W] 4.8 Graphic Control Unit 4.9.1 Keyboard for 8.4-type Display Unit (FCU8-KB026) 4.9.2 Keyboard for 8.4-type Display Unit (FCU8-KB028) 4.9.3 Keyboard for 8.4-type Display Unit (FCU8-KB029) 4.9.4 Keyboard for 10.4-type Display Unit (FCU8-KB041) 4.9.5 Keyboard for 10.4-type Display Unit (FCU8-KB046) 4.9.6 Keyboard for 10.4-type Display Unit (FCU8-KB047) 4.9.7 Keyboard for 10.4-type Display Unit (FCU8-KB048) 4.12 Function Expansion Unit 4.13.2 PROFIBUS-DP (FCU8-EX563) 4.16 Synchronous Feed Encoder 4.17 Exclusive SD cards for MITSUBISHI CNC 5.3.6 Function Expansion Unit 7.5 Connecting with Graphic Control Unit 7.12 Connecting Device via Function Expansion Unit 7.13.2 Connecting I/O Device via PROFIBUS-DP 9 Connecting with Graphic Control Unit 11.6 Connecting with Graphic Control Unit 12.9 Connecting with Analog I/O Signal (FCU8-DX202) 14.4 Connecting with Encoder (Manual Pulse Generator) I/F Expansion Unit 15 Connection of Synchronous Feed Encoder 16.2.1 FCUA-R050/R054 Cable 16.2.4 J010 Cable 16.2.12 J170 Cable 16.2.15 J221 Cable 29 Appx.2: Protection setting</p> <p>- Chapter composition change Title of chapter 6 was changed into "Precautions for Connecting" Former 6.3 to 6.9 were changed into independent chapters (Chapter 7, 8, and 10 to 14) Explanations for connection of drive unit in former 9.3 to 9.5 were moved to a new chapter 7 Former chapter numbers 7 to 19 were changed into 16 to 27 due to chapters addition and the change of chapter 6 Former 7.2 was moved to a new section 16.3.1</p> <p>- Chapter number change Chapter 17 was changed into Chapter 28 Appendix 1 to 3 were changed into Chapter 30 to 32</p> <p>- Chapter title Change Some of chapter titles were changed to correspond with M80W and Windows-less Display</p> <p>- Mistakes were corrected.</p>

Date of revision	Manual No.	Revision details
Oct. 2016	IB(NA)1501268-D	<p>The contents were corrected to correspond with the system software C1 version.</p> <ul style="list-style-type: none"> - The following chapters and sections were added. <ul style="list-style-type: none"> 11.4 Connecting with Frame Ground 16.3.12 MR-BKS1CBL-A1-H/MR-BKS1CBL-A2-H Cable 16.3.15 MR-PWS1CBL-A1-H/MR-PWS1CBL-A2-H Cable 27 Adjust S-analog Screen 28 Device Open Parameter Screen 29 SRAM Open Parameter Screen - Chapter number change Due to addition of the chapters as above, the existing chapters were renumbered. - Correspond with MDS-EMH. - Mistakes were corrected.
Mar. 2017	IB(NA)1501268-E	<p>The contents were corrected to correspond with the system software C3 version.</p> <ul style="list-style-type: none"> - The following units were added. <ul style="list-style-type: none"> FCU8-DX213-1 (Remote I/O unit) FCU8-DX654-1 (Remote I/O unit) FCU8-DX408 (Remote I/O unit) FCU8-EX565 (Communication expansion unit) FCU8-KB921 (MITSUBISHI CNC Machine operation panel) FCU8-KB923 (MITSUBISHI CNC Machine operation panel) FCU8-KB931 (MITSUBISHI CNC Machine operation panel) Handy terminal - The following chapters and sections were added. <ul style="list-style-type: none"> 3.16 MITSUBISHI CNC Machine Operation Panel 3.17 Handy Terminal 3.19 Thermistor Sets 4.13.3 EtherNet/IP (FCU8-EX565) 4.17 MITSUBISHI CNC Machine Operation Panel 4.18 Handy Terminal 4.19 Thermistor 5.3.9 MITSUBISHI CNC Machine Operation Panel 7.13.3 Connecting I/O Device via EtherNet/IP 12.10 Connecting with Thermistor (FCU8-DX408) Chapter 16 Connection of MITSUBISHI CNC Machine Operation Panel Chapter 17 Connection of Handy Terminal 18.2.2 G071 Cable 18.2.5 G430 Cable 18.2.6 G460 Cable 18.2.15 J121 Cable 25.1.6 Setting the Grid Interval and the Reference Encoder for Grid Interval Chapter 28 Setting Handy Terminal - Chapter number change Due to addition of the chapters as above, the existing chapters were renumbered. - Chapter title change Some of chapter titles were changed due to addition of the Remote I/O unit. - Mistakes were corrected.

Date of revision	Manual No.	Revision details
Nov. 2017	IB(NA)1501268-F	<p>The descriptions of M800 Series/M80 Series were revised in response to S/W version C7.</p> <ul style="list-style-type: none"> - The following units were added. FCU8-KB922 (MITSUBISHI CNC Machine operation panel) FCU8-KB924 (MITSUBISHI CNC Machine operation panel) - The following cable was deleted. CNV2E-MB (Cable for MBE405W/MBA405W) - The following chapter was deleted. 18.3.7 CNV2E-MB Cable - The following chapters were added. 20.6.6 Thermistor Input Interface 36 Appx.3: Displaying Original Logo On Standard Screen - The following contents were changed. 3.16 MITSUBISHI CNC Machine Operation Panel 3.23 List of Cables 4.1.1 Environment Conditions inside the Operation Panel 4.2.1 Environment Conditions inside the Operation Panel 4.15.2 12V Manual Pulse Generator (HD60C) 4.17.1 Main Panel A , B (FCU8-KB921 / FCU8-KB922 , FCU8-KB923 / FCU8-KB924) 5.3.9 MITSUBISHI CNC Machine Operation Panel 12.2 Connecting with Power Supply 16.1 Machine Operation Panel Connection System Drawing 16.2 Connecting with Power Supply 16.3 Connecting with Frame Ground 16.4 Connecting with Operation Panel I/O Unit 20.3.1 Setting the Rotary Switch 20.3.2 Setting the DIP Switch 20.7 Initializing the NC Internal Data (SRAM) 22.3 Setting the Parameters for the Machine Specifications 23.5.2 Setting the Number of Device Points 34.1 Setting the Encryption Key 34.3 Display of Time Limit Warning and Alarm Notification 34.4 Caution 35.1 Protect Setting Screen 37.4.3 Measures for Power Supply 38.1 Restriction for Packing 39 Appx.6: Precautions for Compliance to UL/c-UL Standards - The following chapter numbers were corrected. Due to addition of the chapters as above, the existing chapter numbers/chapter titles were corrected. 37 Appx.4: EMC Installation Guidelines 38 Appx.5: Restrictions for Lithium Batteries 39 Appx.6: Precautions for Compliance to UL/c-UL Standards - Mistakes were corrected.

Date of revision	Manual No.	Revision details
Mar. 2018	IB(NA)1501268-G	<p>The descriptions were revised in response to the addition of units.</p> <ul style="list-style-type: none"> - The following units were added. FCU8-DX409 (Remote I/O unit) FCU8-EX564 (Communication expansion unit) FCU8-KB925 (MITSUBISHI CNC Machine operation panel) FCU8-KB926 (MITSUBISHI CNC Machine operation panel) FCU8-KB941 (MITSUBISHI CNC Machine operation panel) - The following chapters were added. 4.13.3 CC-Link IE Field (FCU8-EX564) 7.13.3 Connecting I/O Device via CC-Link IE Field 12.11 Connecting with Multi-analog Input Signal (FCU8-DX409) - The following contents were changed. 3.10 Remote I/O Unit 3.12 Communication Expansion Unit 3.16 MITSUBISHI CNC Machine Operation Panel 4.1.1 Environment Conditions inside the Operation Panel 4.1.2 Environment Conditions inside the Control Panel 4.2.1 Environment Conditions inside the Operation Panel 4.2.2 Environment Conditions inside the Control Panel 4.11 Remote I/O Unit 4.13.1 CC-Link (FCU8-EX561) 4.13.2 PROFIBUS-DP (FCU8-EX563) 4.13.4 EtherNet/IP (FCU8-EX565) 4.17.1 Main Panel A , B (FCU8-KB921 / FCU8-KB922 / FCU8-KB925 , FCU8-KB923 / FCU8-KB924 / FCU8-KB92) 4.17.2 Sub Panel A (FCU8-KB931 / FCU8-KB94) 5.3.5 Remote I/O Unit 5.3.9 MITSUBISHI CNC Machine Operation Panel 7.8.2 Connecting with Drive Unit MDS-EM/EMH Series 7.13.4 Connecting I/O Device via EtherNet/IP 12.1 Remote I/O Unit Connection System Drawing 12.2 Connecting with Power Supply 12.3 Connecting with Frame Ground 16.2 Connecting with Power Supply 16.3 Connecting with Frame Ground 16.4 Connecting with Operation Panel I/O Unit 16.6 Connecting with Sub Panel 20.2.1 Setting the Rotary Switch 20.5.2 Servo Drive Unit Battery 20.6.1 Outline of the Remote I/O Unit 20.6.2 Connection and Station No. Setting on Remote I/O Unit 20.6.3 Station No. Setting when Using Multiple Remote I/O Units 33 Data Backup and Restoration 35.1 Protect Setting Screen - The chapter numbers were corrected. Due to addition of the chapters as above, the existing chapter numbers/chapter titles were corrected. - Mistakes were corrected.

Date of revision	Manual No.	Revision details
Mar. 2019	IB(NA)1501268-H	<p>The descriptions of M800 Series/M80 Series were revised in response to S/W version E0.</p> <ul style="list-style-type: none"> - The following chapters and sections were added. 7.8.1.2 Drive Unit Arrangement - The following chapters and sections were added. 7.8.1.1 Connection of Optical Communication Cables Due to addition of section 7.6.1.2, only the chapter title was added. - The following contents were changed. 2.1.1 M800W, Windows-based Display (15-type) 2.1.2 M800W, Windows-based Display (19-type) 2.1.3 M800W, Non-Windows-based Display (10.4-type / 15-type) 2.2.1 M80W, Windows-based Display (15-type) 2.2.2 M80W, Windows-based Display (19-type) 2.2.3 M80W, Non-Windows-based Display (8.4-type /10.4-type /15-type) 3.9 Operation Panel I/O Unit 3.18 Cable Connector Sets 3.22 Replacements 4.10 Operation Panel I/O Unit 4.10.1 List of Units 4.10.2 FCU8-DX830 / FCU8-DX837 / FCU8-DX730 7.8.1.1 Connection of Optical Communication Cables 7.8.2 Connecting with Drive Unit MDS-EM/EMH Series 7.8.3 Connecting with Drive Unit MDS-EJ/EJH Series 11.9 Connecting with Remote I/O Unit 12.5 Connecting with Operation Panel I/O Unit 16.1 Machine Operation Panel Connection System Drawing 16.4 Connecting with Operation Panel I/O Unit 16.5 Connecting Emergency Stop Switch 18.4 List of Cable Connector Sets 19.2 Flow of Initial Setup 20.1.1 Setting the Rotary Switch 20.5.2 Servo Drive Unit Battery 20.6.2 Connection and Station No. Setting on Remote I/O Unit 20.6.3 Station No. Setting when Using Multiple Remote I/O Units 22.3 Setting the Parameters for the Machine Specifications 23 PLC Program Writing 23.2.2 Setting the IP Address for PC Side 23.4 Setting the Communication with GX Developer 23.5.4 Setting the Program Execution Order 25.2.2 Dog-type Reference Position Return Adjustment Procedures 34.4 Caution 37.6.3 Surge Absorber 38.1.1 Target Products - Mistakes were corrected.

Date of revision	Manual No.	Revision details
Sep. 2019	IB(NA)1501268-J	<p>The descriptions of M800 Series/M80 Series were revised in response to S/W version E1.</p> <ul style="list-style-type: none"> - The following units were added. FCU8-DX834 (Operation panel I/O unit) FCU8-EX568 (FL-net expansion unit) - The following cables were added. J460 (DI/DO cable) J461 (DI/DO cable) - The following chapters were added. 3.24 System Type 4.13.5 FL-net (FCU8-EX568) 7.13.5 Connecting I/O Device via FL-net 11.11.5 Connection with the scan input signal (FCU8-DX834) 11.11.6 Connection with the scan output signal (FCU8-DX834) 18.2.24 J460 cable 18.2.25 J461 cable 23.8 Setting the Communication with GX Works2 23.9 Setting the Parameters on GX Works2 23.10 Writing a Sequence Program with GX Works2 23.11 Writing a Sequence Program to ROM with GX Works2 27 Setting the Machine Error Compensation 28 Setting the Position Switches 29 Setting the Backlash Compensation - The following contents were changed. 2.1.1 M800W, Windows-based Display (15-type) 2.1.2 M800W, Windows-based Display (19-type) 2.2.1 M80W, Windows-based Display (15-type) 2.2.2 M80W, Windows-based Display (19-type) 3.9 Operation Panel I/O Unit 3.12 Communication Expansion Unit 3.23 List of Cables 4.1.1 Environment Conditions inside the Operation Panel 4.2.1 Environment Conditions inside the Operation Panel 4.5.1 10.4-type (FCU8-DU141-31) 4.5.2 15-type (FCU8-DU181-31) 4.5.3 15-type (FCU8-DU181-34) 4.5.4 19-type (FCU8-DU191-75) 4.5.5 19-type (FCU8-DU192-75) 4.6.1 8.4-type (FCU8-DU121-12) 4.6.2 10.4-type (FCU8-DU141-32) 4.6.3 15-type (FCU8-DU181-32) 4.6.4 15-type (FCU8-DU181-36) 4.6.5 19-type (FCU8-DU191-77) 4.6.6 19-type (FCU8-DU192-77) 4.10 Operation Panel I/O Unit 4.10.1 List of Units 4.10.2 FCU8-DX830 / FCU8-DX834 / FCU8-DX837 / FCU8-DX730 4.11.2 FCU8-DX220 / FCU8-DX230 / FCU8-DX231 / FCU8-DX202 / FCU8-DX213 / FCU8-DX213-1 / FCU8-DX654 / FCU8-DX654-1 / FCU8-DX651 / FCU8-DX408 / FCU8-DX409 4.12.1 Encoder (Manual Pulse Generator) I/F Expansion (FCU8-EX544) 5.3.4 Operation Panel I/O Unit <p>(Continue to the next page)</p>

Date of revision	Manual No.	Revision details
Sep. 2019	IB(NA)1501268-J	<p>(Continued from the previous page)</p> <p>7.13 Connecting I/O Device via Communication Expansion Unit 11.1 Operation Panel I/O Unit Connection System Drawing 11.9 Connecting with Remote I/O Unit 11.11 Connecting with Machine Operation Panel 11.11.3 Wiring for Source Type Output 12.5 Connecting with Operation Panel I/O Unit 12.11 Connecting with Multi-analog Input Signal (FCU8-DX409) 19.2 Flow of Initial Setup 20.6.2 Connection and Station No. Setting on Remote I/O Unit 20.6.3 Station No. Setting when Using Multiple Remote I/O Units 23 Sequence Program Writing 23.1 Writing PLC Program using the SD Card 23.2.2 Setting the IP Address for PC Side 23.3 Connecting the Control Unit and a Personal Computer 23.4 Setting the Communication with GX Developer 23.6 Writing a PLC Program with GX Developer 23.7 Writing a PLC Program to ROM with GX Developer 36 Data Backup and Restoration 37.3 Display of Time Limit Warning and Alarm Notification 37.4 Caution 38.1 Protect Setting Screen</p> <p>- The chapter numbers were corrected. Due to addition of the chapters as above, the existing chapter numbers were corrected.</p> <p>- The chapter titles were corrected. The expression "PLC Program" included in the titles in the chapter 23 was changed to "Sequence Program".</p> <p>- Mistakes were corrected.</p>

Global Service Network

AMERICA

MITSUBISHI ELECTRIC AUTOMATION INC. (AMERICA FA CENTER)

Central Region Service Center (Chicago)
500 CORPORATE WOODS PARKWAY, VERNON HILLS, ILLINOIS 60061, U.S.A.
TEL: +1-847-478-2500 / FAX: +1-847-478-2650

Minneapolis, MN Service Satellite
Detroit, MI Service Satellite
Grand Rapids, MI Service Satellite
Lima, OH Service Satellite
Cleveland, OH Service Satellite
Indianapolis, IN Service Satellite
St. Louis, MO Service Satellite

South/East Region Service Center (Georgia)
1845 SATELLITE BOULEVARD STE. 450, DULUTH, GEORGIA 30097, U.S.A.
TEL: +1-678-258-4529 / FAX: +1-678-258-4519

Charleston, SC Service Satellite
Charlotte, NC Service Satellite
Raleigh, NC Service Satellite
Dallas, TX Service Satellite
Houston, TX Service Satellite
Hartford, CT Service Satellite
Knoxville, TN Service Satellite
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Baltimore, MD Service Satellite
Pittsburg, PA Service Satellite
Newark, NJ Service Satellite
Syracuse, NY Service Satellite
Ft. Lauderdale, FL Service Satellite
Lafayette, LA Service Satellite

Western Region Service Center (California)
5900-B KATELLA AVE. - 5900-A KATELLA AVE. CYPRESS, CALIFORNIA 90630, U.S.A.
TEL: +1-714-699-2625 / FAX: +1-847-478-2650

San Francisco, CA Service Satellite
Seattle, WA Service Satellite
Denver, CO Service Satellite

Canada Region Service Center (Toronto)
4299 14TH AVENUE MARKHAM, ONTARIO L3R 0J2, CANADA
TEL: +1-905-754-3805 / FAX: +1-905-475-7935

Edmonton, AB Service Satellite
Montreal, QC Service Satellite

Mexico Region Service Center (Querétaro)
Parque Tecnológico Innovación Querétaro, Lateral Carretera Estatal 431, Km 2+200, Lote 91 Modulos 1 y 2
Hacienda la Machorra, CP 76246, El Marqués, Querétaro, México
TEL: +52-442-153 4250

Monterrey, NL Service Satellite
Mexico City, DF Service Satellite
Aguascalientes, AGS, Service Satellite

BRAZIL

MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA.

Votorantim Office
AV. GISELE CONSTANTINO, 1578. PARQUE BELA VISTA, VOTORANTIM-SP, BRAZIL. CEP:18.110-650
TEL: +55-15-3023-9000

Blumenau Santa Catarina office
MAQSERVICE – Canoas, RS Service Satellite

EUROPE

MITSUBISHI ELECTRIC EUROPE B.V.

European Service Headquarters (Dusseldorf, GERMANY)
Mitsubishi-Electric-Platz 1 40882 RATINGEN, GERMANY
TEL: +49-2102-486-5000 / FAX: +49-2102-486-5910

South Germany Service Center (Stuttgart)
SCHELMENWASENSTRASSE 16-20, 70567 STUTTGART, GERMANY
TEL: + 49-711-770598-123 / FAX: +49-711-770598-141

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

France Service Satellite (Lyon)
120, ALLEE JACQUES MONOD 69800 SAINT PRIEST FRANCE
TEL: +33-1-41-02-83-13 / FAX: +33-1-49-01-07-25

Italy Service Center (Milan)
PALAZZO SIRIO INGRESSO 1, VIA COLLEONI, 7, 20864 AGRATE BRIANZA(MI), ITALY
TEL: +39-039-6053-342 / FAX: +39-039-6053-206

Italy Service Satellite (Padova)
VIA G. SAVELLI, 24 - 35129 PADOVA, ITALY
TEL: +39-039-6053-342 / FAX: +39-039-6053-206

U.K. Service Center
TRAVELLERS LANE, HATFIELD, HERTFORDSHIRE, AL10 8XB, U.K.
TEL: +49-2102-486-5000 / FAX: +49-2102-486-5910

Spain Service Center
CTRA. RUBI, 76-80 8174 SAINT CUGAT DEL VALLES, BARCELONA SPAIN
TEL: +34-935-65-2236 / FAX: +34-935-89-1579

Poland Service Center
UL.KRAKOWSKA 50, 32-083 BALICE, POLAND
TEL: +48-12-347-6500 / FAX: +48-12-630-4701

Hungary Service Center
MADARASZ IRODAPARK, MADARASZ VIKTOR UT 47-49, 1138 BUDAPEST, HUNGARY
TEL: +48-12-347-6500 / FAX: +48-12-630-4701

Turkey Service Center
MITSUBISHI ELECTRIC TURKEY A.Ş
SERIFALI MAHALLESİ NUTUK SOKAK. NO.41 34775
UMRANIYE, ISTANBUL, TURKEY
TEL: +90-216-969-2500 / FAX: +90-216-526-3995

Czech Republic Service Center
AutoCont Control Systems s.r.o (Service Partner)
KAFKOVA 1853/3, 702 00 OSTRAVA 2, CZECH REPUBLIC
TEL: +420-59-5691-185 / FAX: +420-59-5691-199

Russia Service Center
MITSUBISHI ELECTRIC RUSSIA LLC
LETNIKOVSKAYA STREET 2, BLD.1, 5TH 115114 MOSCOW, RUSSIA
TEL: +7-495-721-2070 / FAX: +7-495-721-2071

Sweden Service Center
HAMMARBACKEN 14, P.O.BOX 750 SE-19127, SOLLENTUNA, SWEDEN
TEL: +46-8-6251000 / FAX: +46-8-966877

Bulgaria Service Center
AKHNATON Ltd. (Service Partner)
4 ANDREJ LJAPCHEV BLVD. POB 21, BG-1756 SOFIA, BULGARIA
TEL: +359-2-8176009 / FAX: +359-2-9744061

Ukraine Service Center (Kiev)
CSC Automation Ltd. (Service Partner)
4 B. YEVHENA SVERSTYUKA STR., 02002 KIEV, UKRAINE
TEL: +380-44-494-3344 / FAX: +380-44-494-3366

Belarus Service Center
TECHNIKON Ltd. (Service Partner)
NEZAVISIMOSTI PR.177, 220125 MINSK, BELARUS
TEL: +375-17-393-1177 / FAX: +375-17-393-0081

South Africa Service Center
MOTIONTRONIX (Service Partner)
P.O. BOX 9234, EDLEEN, KEMPTON PARK GAUTENG, 1625, SOUTH AFRICA
TEL: +27-11-394-8512 / FAX: +27-11-394-8513

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

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

Philippines Service Center

Flexible Automation system corporation (Service Partner)
UNIT NO.411, ALABAMG CORPORATE CENTER KM 25. WEST SERVICE ROAD
SOUTH SUPERHIGHWAY, ALABAMG MUNTINLUPA METRO MANILA, PHILIPPINES 1771
TEL: +63-2-807-2416 / FAX: +63-2-807-2417

VIETNAM**MITSUBISHI ELECTRIC VIETNAM CO.,LTD.**

Vietnam Ho Chi Minh Service Center
UNIT 01-04, 10TH FLOOR, VINCOM CENTER 72 LE THANH TON STREET, DISTRICT1,
HO CHI MINH CITY, VIETNAM
TEL: +84-28-3910 5945 / FAX: +84-28-3910 5947

Vietnam Hanoi Service Center

24TH FLOOR, HANDICO TOWER, PHAM HUNG ROAD, ME TRI HA, ME TRI WARD,
NAM TU LIEM DISTRICT, HA NOI CITY, VIETNAM
TEL: +84-24-3937-8075 / FAX: +84-24-3937-8076

INDONESIA**PT. MITSUBISHI ELECTRIC INDONESIA**

Indonesia Service Center (Cikarang)
JL. KENARI RAYA BLOK G2-07A, DELTA SILICON 5, LIPPO CIKARANG - BEKASI 17550, INDONESIA
TEL: +62-21-2961-7797 / FAX: +62-21-2961-7794

MALAYSIA**MITSUBISHI ELECTRIC SALES MALAYSIA SDN. BHD.**

Malaysia Service Center (Kuala Lumpur Service Center)
LOT 11, JALAN 219, P.O BOX 1036, 46860 PETALING JAYA, SELANGOR DARUL EHSAN. MALAYSIA
TEL: +60-3-7960-2628 / FAX: +60-3-7960-2629
Johor Bahru Service Satellite

THAILAND**MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO.,LTD.**

Thailand Service Center (Bangkok)
101 TRUE DIGITAL PARK OFFICE, 5TH FLOOR, SUKHUMVIT ROAD, BANGKOK 10260, THAILAND
TRUE DIGITAL PARK SUKHUMVIT 101
TEL: +66-2-092-8600 / FAX: +66-2-043-1231-33
Bowin Service Center (Chonburi)
Korat Service Center

INDIA**MITSUBISHI ELECTRIC INDIA PVT., LTD.**

CNC Technical Center (Bangalore)
PLOT NO. 56, 4TH MAIN ROAD, PEENYA PHASE 3,
PEENYA INDUSTRIAL AREA, BANGALORE 560058, KARNATAKA, INDIA
TEL: +91-80-4655-2121 / FAX: +91-80-4655-2147
Chennai Service Satellite
Coimbatore Service Satellite
Hyderabad Service Satellite

North India Service Center (Gurgaon)

2ND FLOOR, TOWER A&B, DLF CYBER GREENS, DLF CYBER CITY,
DLF PHASE-III, GURGAON- 122 002, HARYANA, INDIA
TEL: +91-124-4630 300 / FAX: +91-124-4630 399
Ludhiana Service Satellite
Panthenagar Service Satellite
Delhi Service Satellite
Jamshedpur Service Satellite
Manesar Service Satellite

West India Service Center (Pune)

ICC-Devi GAURAV TECHNOLOGY PARK, UNIT NO.402, FOURTH FLOOR, NORTH WING,
SURVEY NUMBER 191-192 (P), NEXT to INDIAN CARD CLOTHING COMPANY Ltd,
OPP. VALLABH NAGAR, PIMPRI, PUNE- 411 018, MAHARASHTRA, INDIA
TEL: +91-20-6819 2274 / FAX: +91-20-4624 2100
Kolhapur Service Satellite
Aurangabad Service Satellite
Mumbai Service Satellite

West India Service Center (Ahmedabad)

204-209, 2ND FLOOR, 31FIVE, CORPORATE ROAD PRAHLADNAGAR,
AHMEDABAD -380015, GUJARAT, INDIA
TEL: +91-79-6777 7888
Rajkot Service Satellite

CHINA**MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. (CHINA FA CENTER)**

China Shanghai Service Center
1-3,5-10,18-23/F, NO.1386 HONG QIAO ROAD, CHANG NING QU,
SHANGHAI 200336, CHINA
TEL: +86-21-2322-3030 / FAX: +86-21-2322-3000*8422

China Qingdao Service Center**China Suzhou Service Center****China Wuhan Service Center****China Ningbo Service Center****China Jinan Service Partner****China Hangzhou Service Partner****China Suzhou Service Partner****China Beijing Service Center**

5/F, ONE INDIGO, 20 JIUXIANQIAO ROAD CHAOYANG DISTRICT,
BEIJING 100005, CHINA
TEL: +86-10-6518-8830 / FAX: +86-10-6518-2938
China Beijing Service Partner

China Tianjin Service Center

UNIT 2003, TIANJIN CITY TOWER, NO 35 YOUYI ROAD, HEXI DISTRICT,
TIANJIN 300061, CHINA
TEL: +86-22-2813-1015 / FAX: +86-22-2813-1017

China Xian Service Center**China Changchun Service Partner****China Chengdu Service Center**

1501-1503, 15F, GUANG-HUA CENTRE BUILDING-C, NO.98 NORTH GUANG HUA 3th RD,
CHENGDU, 610000, CHINA
TEL: +86-28-8446-8030 / FAX: +86-28-8446-8630

China Shenzhen Service Center

LEVEL8, GALAXY WORLD TOWER B, 1 YABAO ROAD, LONGGANG DISTRICT,
SHENZHEN 518129, CHINA
TEL: +86-755-2399-8272 / FAX: +86-755-8229-3686

China Dongguan Service Center**China Dongguan Service Partner****China Xiamen Service Partner****China Dalian Service Center**

DONGBEI 3-5, DALIAN ECONOMIC & TECHNICAL DEVELOPMENTZONE, LIAONING PROVINCE,
116600, CHINA
TEL: +86-411-8765-5951 / FAX: +86-411-8765-5952

KOREA**MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. (KOREA FA CENTER)**

Korea Service Center
8F GANGSEO HANGANG XI-TOWER A, 401 YANGCHEON-RO, GANGSEO-GU,
SEOUL 07528 KOREA
TEL: +82-2-3660-9609 / FAX: +82-2-3664-8668
Korea Daegu Service Satellite

TAIWAN**MITSUBISHI ELECTRIC TAIWAN CO., LTD. (TAIWAN FA CENTER)**

Taiwan Taichung Service Center
NO.8-1, INDUSTRIAL 16TH RD., TAICHUNG INDUSTRIAL PARK, SITUN DIST.,
TAICHUNG CITY 40768, TAIWAN
TEL: +886-4-2359-0688 / FAX: +886-4-2359-0689

Taiwan Taipei Service Center

10F, NO.88, SEC.6, CHUNG-SHAN N. RD., SHI LIN DIST., TAIPEI CITY 11155, TAIWAN
TEL: +886-2-2833-5430 / FAX: +886-2-2833-5433

Taiwan Tainan Service Center

11F-1., NO.30, ZHONGZHENG S. ROAD, YONGKANG DISTRICT, TAINAN CITY 71067, TAIWAN
TEL: +886-6-252-5030 / FAX: +886-6-252-5031

OCEANIA**MITSUBISHI ELECTRIC AUSTRALIA PTY. LTD.**

Oceania Service Center
348 VICTORIA ROAD, RYDALMERE, N.S.W. 2116 AUSTRALIA
TEL: +61-2-9684-7269 / FAX: +61-2-9684-7245

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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MITSUBISHI CNC

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HEAD OFFICE : TOKYO BLDG.,2-7-3 MARUNOUCHI,CHIYODA-KU,TOKYO 100-8310,JAPAN

MODEL	M800W/M80W Series
MODEL CODE	100-433
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