Introduction

This manual covers the items required for installing and connecting the MITSUBISHI CNC M700VS 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.

This manual notes a reference chapter as "Chapter: Section: Paragraph". (Example) For "1.3.1 List of Units":
"System Configuration: List of Configuration: List of Units"
("1.3.1 List of Units" included in "1.3 List of Configuration" of "1 System Configuration")

⚠️ 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 optional functions are added. Confirm the specifications issued by the machine tool builder before starting to 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.

The numerical control unit is configured of the control unit, display unit, operation board (keyboard unit, 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
- Operation board (keyboard unit, 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
Refer to the following documents.
M70V/M70V/E70 Series PLC Interface Manual .... IB-1500920
MDS-D2/DH2 Series Specifications Manual .... IB-1501124
MDS-D2/DH2 Series Instruction Manual .... IB-1501127
MDS-DM2 Series Specifications Manual .... IB-1501136
MDS-DM2 Series Instruction Manual .... IB-1501139
MDS-DJ Series Specifications Manual .... IB-1501130
MDS-DJ Series Instruction Manual .... IB-1501133
Safety Handbook (Original Instructions) .... IB-1501025
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.

This sign indicates prohibited behavior (must not do).

For example, ⚠️ indicates ”Keep fire away”.

This sign indicated a thing that is pompously (must do).

For example, ⚠️ indicates ”it must be grounded”.

The meaning of each pictorial sign is as follows.

<table>
<thead>
<tr>
<th>DANGER</th>
<th>CAUTION rotated object</th>
<th>CAUTION HOT</th>
<th>Danger Electric shock risk</th>
<th>Danger explosive</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td>⚠️</td>
<td>⚠️</td>
<td>⚠️</td>
<td>⚠️</td>
</tr>
<tr>
<td>Prohibited</td>
<td>Disassembly is prohibited</td>
<td>KEEP FIRE AWAY</td>
<td>General instruction</td>
<td>Earth ground</td>
</tr>
</tbody>
</table>
Mitsubishi CNC is designed and manufactured solely for applications to machine tools. Do not use this product in any applications other than those specified as above, especially those which are substantially influential on the public interest or which are expected to have significant influence on human lives or properties. We will review the acceptability of the abovementioned applications, if the customer agrees not to require a specific quality for a specific application. Please contact us for consultation.

1. Items related to prevention of electric shocks

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

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**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.

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

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not apply voltages to the connectors or terminals other than voltages indicated in the connection manual for the controller or specifications manual for the drive unit. Failure to observe this could cause bursting, damage, etc.</td>
</tr>
<tr>
<td>Incorrect connections could cause the devices to rupture or damage, etc. Always connect the cables to the indicated connectors or terminals.</td>
</tr>
<tr>
<td>Incorrect polarity (+ -) could cause the devices to rupture or damage, etc.</td>
</tr>
<tr>
<td>Persons wearing medical devices, such as pacemakers, must stay away from this unit. The electromagnetic waves could adversely affect the medical devices.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Do not enter the machine’s movable range during automatic operation. Keep your hands, feet or face away from the spindle during rotation.</td>
</tr>
</tbody>
</table>
4. General precautions
   Always follow the precautions below. Incorrect handling could result in faults, injuries or electric shocks, etc.

(1) Transportation and installation

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correctly transport the products according to the mass.</td>
</tr>
<tr>
<td>Use motor’s suspension bolts to transport the motor itself. Do not use it to transport the motor after installation onto the machine.</td>
</tr>
<tr>
<td>Do not stack the products exceeding the indicated limit.</td>
</tr>
<tr>
<td>Do not hold the cables, shaft or detector when transporting the motor.</td>
</tr>
<tr>
<td>Do not transport the controller or drive unit by suspending or holding the connected wires or cables.</td>
</tr>
<tr>
<td>Do not hold the front cover when transporting the unit, or the front cover could come off, causing the unit to drop.</td>
</tr>
<tr>
<td>Install on a non-combustible place where the unit’s or motor’s mass can be withstood according to the instruction manual.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>When installing the motor facing upwards, take measures on the machine side so that gear oil, etc., will not enter the motor shaft.</td>
</tr>
<tr>
<td>Do not remove the detector from the motor. (The detector installation screw is treated with sealing.)</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Do not get on the product or place heavy objects on it.</td>
</tr>
<tr>
<td>Provide prescribed distance between the controller/drive unit and inner surface of the control panel/other devices.</td>
</tr>
<tr>
<td>Do not install or operate the controller, drive unit or motor that is damaged or has missing parts.</td>
</tr>
<tr>
<td>Take care not to cut hands, etc. with the heat radiating fins or metal edges.</td>
</tr>
<tr>
<td>Do not block the intake/outtake ports of the motor with the cooling fan.</td>
</tr>
<tr>
<td>Install the controller’s display section and operation board section on the spot where cutting oil will not reach.</td>
</tr>
<tr>
<td>The controller, drive unit and motor are precision devices, so do not drop or apply thumping vibration and strong impacts on them.</td>
</tr>
<tr>
<td>Hard disk unit is a precision device, so do not drop or apply strong impacts on it.</td>
</tr>
<tr>
<td>Store and use the units according to the environment conditions indicated in each specifications manual.</td>
</tr>
<tr>
<td>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))).</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>When exporting the products, make sure to comply with the laws and regulations of each country.</td>
</tr>
<tr>
<td>CAUTION</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Securely fix the motor to the machine. The motor could come off during operation if insecurely fixed.</td>
</tr>
<tr>
<td>Always install the motor with reduction gear in the designated direction. Failure to observe this could result in oil leaks.</td>
</tr>
<tr>
<td>Always install a cover, etc., over the shaft so that the rotary section of the motor cannot be touched during motor rotation.</td>
</tr>
<tr>
<td>When installing a coupling to the servomotor shaft end, do not apply impacts by hammering, etc. The detector could be damaged.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Do not use a rigid coupling as an excessive bending load will be applied on the shaft and could cause the shaft to break.</td>
</tr>
<tr>
<td>Do not apply a load exceeding the tolerable level onto the motor shaft. The shaft or bearing could be damaged.</td>
</tr>
<tr>
<td>Before using this product after a long period of storage, please contact the Mitsubishi Service Station or Service Center. Following the UN recommendations, battery units and batteries should be transported based on the international regulations such as those determined by International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), International Maritime Organization (IMO) and U.S. Department of Transportation (DOT).</td>
</tr>
</tbody>
</table>
CAUTION

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

Do not install a phase advancing capacitor, surge absorber or radio noise filter on the output side of the drive unit.

Correctly connect the output side (terminal U, V, W). The motor will not run properly if incorrectly connected.

Always install an AC reactor per each power supply unit.

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

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.

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

Use wires and cables whose wire diameter, heat resistance level and bending capacity are compatible with the system.

Ground the device according to the requirements of the country where the device is to be used.

Wire the heat radiating fins and wires so that they do not contact.

When using the RS-232C device as a peripheral device, caution must be paid for connector connection/disconnection. Always use a double-OFF type AC power supply switch on the device side, and connect/disconnect the connector with the AC power supply on the device side OFF.
(3) Adjustments

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check and adjust programs and each parameter before starting operation. Failure to observe this could result in unpredictable operations depending on the machine.</td>
</tr>
<tr>
<td>Do not make drastic adjustments or changes as the operation could become unstable.</td>
</tr>
</tbody>
</table>

(4) Usage

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Turn OFF the power immediately if any smoke, abnormal noise or odor is generated from the controller, drive unit or motor.</td>
</tr>
<tr>
<td>Only a qualified technician may disassemble or repair this product.</td>
</tr>
<tr>
<td>Do not alter.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>Use the drive unit, motor and each regenerative resistor with the designated combination. Failure to observe this could result in fires or faults.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>For the system running via a timing belt, install a brake on the machine side so that safety can be ensured.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>When using the DC OFF type electromagnetic brake, be sure to install a surge absorber on the brake terminal.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>After changing programs/parameters, or after maintenance/inspection, always carry out a test operation before starting actual operation.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>When making detector cables, do not mistake connection. Failure to observe this could result in malfunction, runaway or fire.</td>
</tr>
</tbody>
</table>
(5) Troubleshooting

**CAUTION**

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

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

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

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

- If the battery voltage drop warning alarm occurs in the controller side, make sure to back up the machining programs, tool data and parameters, etc. with the input/output device before replacing the battery.

- Depending on the level of voltage drop, memory loss could have happened. In that case, reload all the data backed up before the alarm occurrence.
(6) Maintenance, inspection and part replacement

⚠️ CAUTION

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

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

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

⚠️ Do not perform a megger test (insulation resistance measurement) during inspection.

⚠️ Do not replace parts or devices while the power is ON.

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

⚠️ There may be a unit filled with substitute Freon in the heat radiating fins of the 37kW or smaller unit. Be careful not to break the heat radiating fins during maintenance or replacement.

(7) Disposal

⚠️ CAUTION

⚠️ Take the batteries and backlight 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 backlight for LCD according to the local laws.

(8) General precautions

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

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Handling of our product

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.
# Contents

## 1 System Configuration

1.1 System Basic Configuration Drawing ................................................................. 2
1.2 General Connection Diagram .............................................................................. 3
   1.2.1 Without Touch Panel .............................................................................. 3
   1.2.2 With Touch Panel .................................................................................. 4
   1.2.3 For 15-type display unit ........................................................................ 5
1.3 List of Configuration ......................................................................................... 6
   1.3.1 List of Units ........................................................................................... 6
   1.3.2 Durable Parts ....................................................................................... 8
   1.3.3 Replacements ...................................................................................... 9
   1.3.4 List of Cables ..................................................................................... 9

## 2 General Specifications

2.1 Environment Conditions .................................................................................... 12
2.2 Control Unit ...................................................................................................... 14
2.3 Display Unit ..................................................................................................... 26
2.4 Keyboard Unit .................................................................................................. 30
2.5 Operation Panel I/O Unit .................................................................................. 38
2.6 Remote I/O Unit .............................................................................................. 49
2.7 Scan I/O Unit ................................................................................................... 56
2.8 External Power Supply Unit ............................................................................. 67
2.9 Manual Pulse Generator ................................................................................... 69
2.10 Synchronous Feed Encoder .......................................................................... 71
2.11 Optical Communication Repeater Unit (FCU7-EX022) .................................. 72
2.12 MITSUBISHI CNC Machine Operation Panel ............................................... 75
   2.12.1 MITSUBISHI CNC Machine Operation Panel A .................................. 75
   2.12.2 MITSUBISHI CNC Machine Operation Panel B .................................. 82
2.13 Exclusive CF Cards for MITSUBISHI CNC ................................................... 86
   2.13.1 Precautions for Use of Commercially Available CF Cards ..................... 86

## 3 Installation

3.1 Heat Radiation Countermeasures ...................................................................... 88
3.2 Noise Countermeasures .................................................................................... 91
   3.2.1 Connection of FG (Frame Ground) .......................................................... 91
   3.2.2 Shield Clamping of Cables .................................................................... 92
   3.2.3 Connecting Spark Killers ....................................................................... 92
3.3 Unit Installation ................................................................................................ 93
   3.3.1 Display Unit .......................................................................................... 93
   3.3.2 Keyboard Unit ...................................................................................... 94
   3.3.3 Operation Panel I/O Unit ................................................................ ...... 94
   3.3.4 Control Panel Battery .......................................................................... 95
   3.3.5 CC-Link Unit ...................................................................................... 96

## 4 Connection

4.1 Precautions for Wiring ..................................................................................... 100
   4.1.1 Precautions when Connecting/Disconnecting Cables ............................... 100
   4.1.2 Precautions for Using Optical Communication Cable ......................... 103
      4.1.2.1 Optical Communication Cable Outline and Parts ............................. 103
      4.1.2.2 Precautions for Handling Optical Communication Cable ............. 103
      4.1.2.3 Precautions for Laying Optical Communication Cable .............. 104
   4.1.3 Precautions for Connecting 24V Power Supply ..................................... 104
4.2 Connection of Control Unit ............................................................................ 105
   4.2.1 Control Unit Connection System Drawing ............................................. 105
   4.2.2 Connecting with Power Supply ............................................................. 106
   4.2.3 Connecting with Emergency Stop Signal .............................................. 107
   4.2.4 Connecting with Operation Panel I/O Unit .......................................... 109
   4.2.5 Connecting with Drive Unit .................................................................. 110
      4.2.5.1 Connecting with MDS-D2/DH2 Series ......................................... 111
Appendix 1.29 G012 Cable ................................................................. 185
Appendix 1.30 G023/G024 Cable ...................................................... 186
Appendix 1.31 G071 Cable ................................................................. 187
Appendix 1.32 G214 Cable ................................................................. 188
Appendix 1.33 G300 Cable ................................................................. 189
Appendix 1.34 G301 Cable ................................................................. 190
Appendix 1.35 G380 Cable ................................................................. 191
Appendix 1.36 G395 Cable ................................................................. 192
Appendix 1.37 G396 Cable ................................................................. 193
Appendix 1.38 G460 Cable ................................................................. 194
Appendix 1.40 MR-PWS1CBL-A1-H / MR-PWS1CBL-A2-H Cable .... 196
Appendix 1.41 R-TM Terminator Connector ....................................... 197
Appendix 1.42 SH21 Cable ................................................................. 198
Appendix 1.43 SH41 Cable ................................................................. 199
Appendix 1.44 List of Cable Connector Sets ....................................... 200

Appendix 2 EMC Installation Guidelines ......................................... 201
Appendix 2.1 Introduction ................................................................. 202
Appendix 2.2 EMC Directives .......................................................... 202
Appendix 2.3 EMC Measures ........................................................... 203
Appendix 2.4 Panel Structure ........................................................... 203
  Appendix 2.4.1 Measures for Control Panel Body ......................... 203
  Appendix 2.4.2 Measures for Door ................................................. 204
  Appendix 2.4.3 Measures for Power Supply ................................ 204
Appendix 2.5 Measures for Wiring in Panel ..................................... 205
  Appendix 2.5.1 Precautions for Wiring in Panel ......................... 205
  Appendix 2.5.2 Shield Treatment of Cables ................................. 206
Appendix 2.6 EMC Countermeasure Parts ..................................... 208
  Appendix 2.6.1 Shield Clamp Fitting ............................................ 208
  Appendix 2.6.2 Ferrite Core .......................................................... 209
  Appendix 2.6.3 Surge Absorber .................................................... 210
  Appendix 2.6.4 Selection of Stabilized Power Supply ................. 212

Appendix 3 Restrictions for Lithium Batteries ............................... 213
Appendix 3.1 Restriction for Packing .............................................. 214
  Appendix 3.1.1 Target Products .................................................. 215
  Appendix 3.1.2 Handling by User ............................................... 216
  Appendix 3.1.3 Reference .......................................................... 217
Appendix 3.2 Products information data sheet (ER battery) .......... 218
Appendix 3.3 Issuing Domestic Law of the United States for Primary Lithium Battery Transportation ... 220
  Appendix 3.3.1 Outline of Regulation ....................................... 220
  Appendix 3.3.2 Target Products ................................................. 220
  Appendix 3.3.3 Handling by User .............................................. 220
  Appendix 3.3.4 Reference ......................................................... 220
Appendix 3.4 Restriction related to EU Battery Directive ............... 221
  Appendix 3.4.1 Important Notes ................................................. 221
  Appendix 3.4.2 Information for end-user ................................. 221

Appendix 4 Precautions for Compliance to UL/c-UL Standards .... 223
System Configuration
1 System Configuration

1.1 System Basic Configuration Drawing

(Note 1) Control unit is mounted on the back side of the display unit.
(Note 2) Operation panel I/O unit is mounted on the back side of the keyboard unit.
(Note 3) For the drive unit configuration, refer to the Instruction Manual of the drive unit you use.
1.2 General Connection Diagram

1.2.1 Without Touch Panel

(Note1) For information on how to connect the drive unit, refer to the drive unit's manual.

(Note2) For a connection of the MITSUBISHI CNC Machine Operation Panel, refer to "Connection: Connection of MITSUBISHI CNC Machine Operation Panel" to be described.
1.2.2 With Touch Panel

(Note1) For information on how to connect the drive unit, refer to the drive unit’s manual.

(Note2) For a connection of the MITSUBISHI CNC Machine Operation Panel, refer to "Connection : Connection of MITSUBISHI CNC Machine Operation Panel" to be described.

Dotted lines indicate the sections prepared by the machine tool builder.

<> Angle brackets indicate attached cable of unit.

...
1.2.3 For 15-type display unit

Dotted lines indicate the sections prepared by the machine tool builder.

<> Angle brackets indicates attached cable of unit.

(Note1) For information on how to connect the drive unit, refer to the drive unit's manual.

(Note2) For a connection of the MITSUBISHI CNC Machine Operation Panel, refer to "Connection : Connection of MITSUBISHI CNC Machine Operation Panel" to be described.
## 1.3 List of Configuration

### 1.3.1 List of Units

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type</th>
<th>Components</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NC functions and display controller For M720VS</td>
<td>FCU7-MU531</td>
<td>Main control card</td>
<td>Export Tarde Control Order and Foreign Exchange Order noncompliant unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Base card</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Front side memory I/F card</td>
<td></td>
</tr>
<tr>
<td>NC functions and display controller For M730VS</td>
<td>FCU7-MU541</td>
<td>Main control card</td>
<td>Export Tarde Control Order and Foreign Exchange Order noncompliant unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Base card</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Front side memory I/F card</td>
<td></td>
</tr>
<tr>
<td>NC functions and display controller For M750VS</td>
<td>FCU7-MA541</td>
<td>Main control card</td>
<td>Export Tarde Control Order and Foreign Exchange Order compliant unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Base card</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Front side memory I/F card</td>
<td></td>
</tr>
<tr>
<td><strong>Display unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.4-type color TFT (VGA:640*480)</td>
<td>FCU7-DU120-11</td>
<td>LCD panel Backlight inverter Menu keys Inverter cable LCD cable</td>
<td>Front side memory I/F is normally equipped with the control unit</td>
</tr>
<tr>
<td>10.4-type color TFT (VGA:640*480)</td>
<td>FCU7-DU140-11</td>
<td>LCD panel Backlight inverter Menu keys Inverter cable LCD cable</td>
<td>Front side memory I/F is normally equipped with the control unit</td>
</tr>
<tr>
<td>10.4-type color TFT touch panel (VGA:640*480)</td>
<td>FCU7-DU140-31</td>
<td>LCD panel Backlight inverter Menu keys Inverter cable LCD cable Backlight cable</td>
<td>Front side memory I/F is normally equipped with the control unit</td>
</tr>
<tr>
<td>15-type color TFT (XGA:1024*768)</td>
<td>FCU7-DU180-11</td>
<td>LCD panel Menu keys Menu key cable LCD cable (2 cables) Power cable Inverter cable Backlight cable PCB</td>
<td>Front side memory I/F is normally equipped with the control unit</td>
</tr>
<tr>
<td><strong>Keyboard unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keyboard for 8.4-type display unit Sheet keys</td>
<td>FCU7-KB024</td>
<td>Escutcheon, key switch G402 cable</td>
<td>ONG layout (for M system/L system, XYZ)</td>
</tr>
<tr>
<td>Keyboard for 8.4-type display unit Lathe system sheet keys</td>
<td>FCU7-KB025</td>
<td>Escutcheon, key switch G402 cable</td>
<td>ONG layout (for L system, XZF)</td>
</tr>
<tr>
<td>Keyboard for 8.4-type display unit Clear keys</td>
<td>FCU7-KB026</td>
<td>Escutcheon, key switch G402 cable</td>
<td>ONG layout (for M system/L system, XYZ)</td>
</tr>
<tr>
<td>Keyboard for 10.4-type display unit Sheet keys</td>
<td>FCU7-KB044</td>
<td>Escutcheon, key switch G402 cable</td>
<td>ONG layout (for M system/L system, XYZ)</td>
</tr>
<tr>
<td>Keyboard for 10.4-type display unit Clear keys</td>
<td>FCU7-KB046</td>
<td>Escutcheon, key switch G402 cable</td>
<td>ONG layout (for M system/L system, XYZ)</td>
</tr>
<tr>
<td>Keyboard for 10.4-type display unit Clear keys</td>
<td>FCU7-KB047</td>
<td>Escutcheon, key switch G402 cable</td>
<td>Full keyboard (for M system/L system)(in tandem)</td>
</tr>
<tr>
<td>Keyboard for 10.4-type display unit Clear keys</td>
<td>FCU7-KB048</td>
<td>Escutcheon, key switch G402 cable</td>
<td>ABC layout (for M system/L system)</td>
</tr>
</tbody>
</table>
## List of Configuration

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type</th>
<th>Components</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation panel I/O unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCU7-DX710</td>
<td>Base card</td>
<td>DI: 64-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Sink output</td>
<td></td>
<td>Terminator (R-TM)</td>
<td>DO: 64-points sink type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPG: 2ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupied stations (fixed): 1, 2, 7, 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RIO3 extensible stations: 3, 4, 5, 6</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCU7-DX720</td>
<td>Base card</td>
<td>DI: 96-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Sink output</td>
<td></td>
<td>Terminator (R-TM)</td>
<td>DO: 80-points sink type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add-on card</td>
<td>MPG: 2ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AO: 1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupied stations (fixed): 1, 2, 3, 7, 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RIO3 extensible stations: 4, 5, 6</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCU7-DX730</td>
<td>Base card</td>
<td>DI: 96-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Sink output</td>
<td></td>
<td>Terminator (R-TM)</td>
<td>DO: 80-points sink type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add-on card</td>
<td>MPG: 2ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AO: 1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupied stations (fixed): 1, 2, 3, 7, 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RIO3 extensible stations: 4, 5, 6</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCU7-DX711</td>
<td>Base card</td>
<td>DI: 64-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Source output</td>
<td></td>
<td>Terminator (R-TM)</td>
<td>DO: 64-points source type</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MPG: 2ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupied stations (fixed): 1, 2, 3, 7, 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RIO3 extensible stations: 4, 5, 6</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCU7-DX721</td>
<td>Base card</td>
<td>DI: 64-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Source output</td>
<td></td>
<td>Terminator (R-TM)</td>
<td>DO: 80-points source type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add-on card</td>
<td>MPG: 2ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AO: 1 point</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupied stations (fixed): 1, 2, 3, 7, 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RIO3 extensible stations: 4, 5, 6</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCU7-DX731</td>
<td>Base card</td>
<td>DI: 96-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Source output</td>
<td></td>
<td>Terminator (R-TM)</td>
<td>DO: 96-points source type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Add-on card</td>
<td>MPG: 2ch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupied stations (fixed): 1, 2, 3, 7, 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RIO3 extensible stations: 4, 5, 6</td>
</tr>
<tr>
<td><strong>Remote I/O unit</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX100</td>
<td>RX311</td>
<td>DI: 32-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Sink output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 32-points sink type (non-insulation) Number of occupied stations: 1</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX110</td>
<td>RX311+RX321-1</td>
<td>DI: 64-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Sink output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 48-points sink type (non-insulation) Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX120</td>
<td>RX311+RX321</td>
<td>DI: 64-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Sink output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 48-points sink type (non-insulation) AO: 1 point Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX140</td>
<td>RX311+RX341</td>
<td>DI: 32-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Sink output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 32-points sink type (non-insulation) AI: 4 points Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX101</td>
<td>RX312</td>
<td>DI: 32-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Source output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 32-points source type (non-insulation) Number of occupied stations: 1</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX111</td>
<td>RX312+RX322-1</td>
<td>DI: 64-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Source output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 48-points source type (non-insulation) Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX121</td>
<td>RX312+RX322</td>
<td>DI: 64-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Source output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 48-points source type (non-insulation) AO: 1 point Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input</td>
<td>FCUA-DX141</td>
<td>RX312+RX341</td>
<td>DI: 32-points 24V/0V common type</td>
</tr>
<tr>
<td>DO Source output</td>
<td></td>
<td>(photo coupler insulation)</td>
<td>DO: 32-points source type (non-insulation) AI: 4 points Number of occupied stations: 2</td>
</tr>
<tr>
<td><strong>Scan I/O card</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sink type</td>
<td>HR347</td>
<td>HR347</td>
<td>Scan DI/DO = 64 points</td>
</tr>
<tr>
<td>Source type</td>
<td>HR357</td>
<td>HR357</td>
<td>Scan DI/DO = 32 points</td>
</tr>
</tbody>
</table>
1 System Configuration

MITSUBISHI CNC

1.3.2 Durable Parts

<table>
<thead>
<tr>
<th>Control unit battery</th>
<th>O8BAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backlight for FCU7-DU120-11(*)</td>
<td>84LHS06(for unit version &quot;A&quot; to &quot;B&quot;)</td>
</tr>
<tr>
<td>Backlight for FCU7-DU140-11/31(*)</td>
<td>84LHS16(for unit version &quot;C&quot; and later)</td>
</tr>
<tr>
<td>Backlight for FCU7-DU180-11(*)</td>
<td>104LHS52</td>
</tr>
<tr>
<td>Touch panel protective sheet for FCU7-DU140-31</td>
<td>150LHS202</td>
</tr>
<tr>
<td>Key sheet for FCU7-KB024/044</td>
<td>999B039G51</td>
</tr>
<tr>
<td>Key sheet for FCU7-KB025</td>
<td>999B039G51</td>
</tr>
<tr>
<td>Key sheet for FCU7-KB026</td>
<td>999B039G51</td>
</tr>
</tbody>
</table>

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

(Note 1) Operation panel I/O unit can be mounted on the back side of the keyboard unit.

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

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

<table>
<thead>
<tr>
<th>Replacements</th>
<th>Part type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection fuse</td>
<td>LM40</td>
</tr>
<tr>
<td>Front memory I/F card CF-700 (with USB) (*)</td>
<td>FCU7-HN793</td>
</tr>
</tbody>
</table>

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

### 1.3.4 List of Cables

<table>
<thead>
<tr>
<th>Type</th>
<th>Application</th>
<th>Length (m) of cables provided by Mitsubishi</th>
<th>Max. cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNP2E-1-xM</td>
<td>Motor side PLUG cable</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td></td>
<td>Spindle side accuracy detector TS5690 cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNP3EZ-2P-xM</td>
<td>Spindle side detector cable OSE-1024 cable</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNP3EZ-3P-xM</td>
<td>Spindle side detector cable OSE-1024 cable</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNV22J-K1P-0.3M</td>
<td>Motor side detector relay cable (motor side)</td>
<td>0.3</td>
<td>0.3m</td>
</tr>
<tr>
<td></td>
<td>Lead out in direction of motor shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compatible with only IP65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNV22J-K2P-0.3M</td>
<td>Motor side detector relay cable (motor side)</td>
<td>0.3</td>
<td>0.3m</td>
</tr>
<tr>
<td></td>
<td>Lead out in opposite direction of motor shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compatible with only IP65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNV2E-6P-xM</td>
<td>Motor side detector cable (for A51/A74N[/A74]) / Ball screw side detector cable</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNV2E-7P-xM</td>
<td>Motor side detector cable (for A51/A74N[/A74]) / Ball screw side detector cable</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNV2E-8P-xM</td>
<td>For HF/HF-H, HF-KP (Tool spindle) Motor side detector cable (for A48/ A51/A74N[/A74]) / For HF-KP (Servo) Motor side detector relay cable (Drive unit side)</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNV2E-9P-xM</td>
<td>For HF/HF-H, HF-KP (Tool spindle) Motor side detector cable (for A48/ A51/A74N[/A74]) / For HF-KP (Servo) Motor side detector relay cable (Drive unit side)</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNV2E-D-xM</td>
<td>MDS-B-5D unit cable</td>
<td>2, 3, 4, 5, 7, 10, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNV2E-HP-xM</td>
<td>MDS-B-5HR unit cable</td>
<td>2, 3, 4, 5, 7, 10, 15, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>CNV2E-K1P-xM</td>
<td>Motor side detector cable Lead out in direction of motor shaft</td>
<td>2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td></td>
<td>Compatible with only IP65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CNV2E-K2P-xM</td>
<td>Motor side detector cable Lead out in opposite direction of motor shaft</td>
<td>2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td></td>
<td>Compatible with only IP65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DG21-xM</td>
<td>Battery cable (For drive unit - battery unit)</td>
<td>0.3</td>
<td>0.5m</td>
</tr>
<tr>
<td>DG22-xM</td>
<td>Battery cable (For drive unit - drive unit)</td>
<td>0.3, 0.5, 1, 2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td></td>
<td>(Note) This cable is required to supply the power from the battery unit to multiple drive units.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DG23-xM</td>
<td>Battery cable (For drive unit - battery box)</td>
<td>0.3, 0.5, 1, 2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td></td>
<td>(Note) The battery box side is connected using a bare conductor or a terminal bar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DG24-xM</td>
<td>5V supply / DO output cable (For drive unit - battery box)</td>
<td>0.3, 0.5, 1, 2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td></td>
<td>(Note) The battery box side is connected using a bare conductor or a terminal bar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F023 LxM</td>
<td>Manual pulse generator cable (5V): 1ch (for connection to operation panel I/O unit)</td>
<td>1, 2, 3, 5, 8, 10, 15, 20</td>
<td>20m</td>
</tr>
<tr>
<td>F024 LxM</td>
<td>Manual pulse generator cable (5V): 2ch (for connection to operation panel I/O unit)</td>
<td>1, 2, 3, 5, 8, 10, 15, 20</td>
<td>20m</td>
</tr>
<tr>
<td>F034 LxM</td>
<td>RS-232C I/F cable: 1ch (for control unit)</td>
<td>0.5, 1, 2, 3, 5, 8, 10</td>
<td>15m</td>
</tr>
<tr>
<td>F035 LxM</td>
<td>RS-232C I/F cable: 2ch (for control unit)</td>
<td>0.5, 1, 2, 3, 5, 8, 10</td>
<td>15m</td>
</tr>
<tr>
<td>F070 LxM</td>
<td>24VDC power cable</td>
<td>0.5, 1.5, 3, 5, 8, 10, 15, 20</td>
<td>30m</td>
</tr>
<tr>
<td>F110 LxM</td>
<td>24VDC power cable for PD25/PD27</td>
<td>0.5, 1.5, 3, 5, 8, 10, 15</td>
<td>15m</td>
</tr>
<tr>
<td>F120 LxM</td>
<td>Emergency stop cable</td>
<td>0.5, 1.5, 3, 5, 8, 10, 15, 20</td>
<td>30m</td>
</tr>
<tr>
<td>F170 LxM</td>
<td>UNCP/F switch cable for PD25/PD27</td>
<td>0.5, 1.5, 3, 5, 8, 10, 15</td>
<td>15m</td>
</tr>
<tr>
<td>F221 LxM</td>
<td>Analog output cable</td>
<td>1, 2, 3, 5, 8, 10, 15, 20</td>
<td>30m</td>
</tr>
<tr>
<td>F320 LxM</td>
<td>Manual pulse generator cable (12V): 1ch (for connection to operation panel I/O unit)</td>
<td>1, 2, 3, 5, 8, 10, 15, 20</td>
<td>50m</td>
</tr>
<tr>
<td>F321 LxM</td>
<td>Manual pulse generator cable (12V): 2ch (for connection to operation panel I/O unit)</td>
<td>1, 2, 3, 5, 8, 10, 15, 20</td>
<td>50m</td>
</tr>
<tr>
<td>Type</td>
<td>Application</td>
<td>Length (m) of cables provided by Mitsubishi</td>
<td>Max. cable length</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>F351</td>
<td>DI/DO cable (one side connector) (for operation panel I/O unit)</td>
<td>3</td>
<td>50m</td>
</tr>
<tr>
<td>FCUA-R030-xM</td>
<td>SKIP input cable</td>
<td>3, 7</td>
<td>20m</td>
</tr>
<tr>
<td>FCUA-R031-xM</td>
<td>Analog input/output cable (for remote I/O unit)</td>
<td>2, 3, 7</td>
<td>30m</td>
</tr>
<tr>
<td>FCUA-R050-xM</td>
<td>Synchronous encoder - control unit (straight, with connector)</td>
<td>3</td>
<td>30m</td>
</tr>
<tr>
<td>FCUA-R054-xM</td>
<td>Synchronous encoder - control unit (right angle, with connector)</td>
<td>3, 5, 10, 15, 20</td>
<td>30m</td>
</tr>
<tr>
<td>FCUA-R211-xM</td>
<td>Remote I/O (with terminal block) between remote I/O, remote I/O - CNC control unit, remote I/O - Operation panel I/O unit, remote I/O - MITSUBISHI CNC machine operation panel A</td>
<td>0.3, 1, 2, 5, 8, 10, 15, 20</td>
<td>30m (*)</td>
</tr>
<tr>
<td>FCUA-R300</td>
<td>DI/DO cable (one side connector) (for remote I/O unit)</td>
<td>3</td>
<td>50m</td>
</tr>
<tr>
<td>FCUA-R301-xM</td>
<td>DI/DO cable (both side connectors) (for remote I/O unit)</td>
<td>1, 2, 3, 5</td>
<td>50m</td>
</tr>
<tr>
<td>G011 LxM</td>
<td>Operation panel I/O interface cable</td>
<td>0.5</td>
<td>5m</td>
</tr>
<tr>
<td>G012 LxM</td>
<td>Operation panel I/O interface cable</td>
<td>1</td>
<td>1m</td>
</tr>
<tr>
<td>G023 LxM</td>
<td>Manual pulse generator cable (5V): 1ch (for connection to control unit)</td>
<td>1, 2, 3, 5, 8, 10, 15, 20</td>
<td>20m (*)</td>
</tr>
<tr>
<td>G024 LxM</td>
<td>Manual pulse generator cable (5V): 2ch (for connection to control unit)</td>
<td>1, 2, 3, 5, 8, 10, 15, 20</td>
<td>20m (*)</td>
</tr>
<tr>
<td>G071 LxM</td>
<td>DC24V relay cable for MITSUBISHI CNC machine operation panel</td>
<td>0.5</td>
<td>0.5m</td>
</tr>
<tr>
<td>G214</td>
<td>Remote I/O cable (NC for RIQ2 - remote I/O unit)</td>
<td>1, 5, 10, 20</td>
<td>20m</td>
</tr>
<tr>
<td>G300 LxM</td>
<td>LAN cross cable (Shielded cable is recommended when the length will be 1m or more)</td>
<td>1, 3, 5, 10</td>
<td>10m</td>
</tr>
<tr>
<td>G301 LxM</td>
<td>LAN straight cable (Shielded cable is recommended when the length will be 1m or more)</td>
<td>1</td>
<td>1m</td>
</tr>
<tr>
<td>G380 LxM</td>
<td>Optical communication cable for wiring between drive units (outside panel)</td>
<td>5, 10, 12, 15, 20, 25, 30</td>
<td>30m</td>
</tr>
<tr>
<td>G395 LxM</td>
<td>Optical communication cable for wiring between drive units (outside panel)</td>
<td>3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td>G396 LxM</td>
<td>Optical communication cable for wiring between NC-drive units</td>
<td>0.3, 0.5, 1, 2, 3, 5</td>
<td>10m</td>
</tr>
<tr>
<td>G460 LxM</td>
<td>Cable between MITSUBISHI CNC machine operation panel A and MITSUBISHI CNC machine operation panel B</td>
<td>0.5</td>
<td>0.5m</td>
</tr>
<tr>
<td>MR-BKS1CBLxM-A1-H</td>
<td>&lt;200V Series&gt; Brake cable for HF-KP Lead out in direction of motor shaft</td>
<td>2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td>MR-BKS1CBLxM-A2-H</td>
<td>&lt;200V Series&gt; Brake cable for HF-KP Lead out in opposite direction of motor shaft</td>
<td>2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td>MR-PWS1CBLxM-A1-H</td>
<td>&lt;200V Series&gt; Power cable for HF-KP Lead out in direction of motor shaft</td>
<td>2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td>MR-PWS1CBLxM-A2-H</td>
<td>&lt;200V Series&gt; Power cable for HF-KP Lead out in opposite direction of motor shaft</td>
<td>2, 3, 5, 7, 10</td>
<td>10m</td>
</tr>
<tr>
<td>R-TM</td>
<td>Terminator for remote I/O interface</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SH21 LxM</td>
<td>Power supply communication cable, Power backup unit communication cable</td>
<td>0.35, 0.7, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, 10, 15, 20, 30</td>
<td>-</td>
</tr>
<tr>
<td>SH41 LxM</td>
<td>Remote I/O cable between remote I/O, remote I/O - CNC control unit, remote I/O - Operation panel I/O unit, remote I/O - MITSUBISHI CNC machine operation panel A (between remote I/O units in a panel)</td>
<td>0.3, 0.5, 0.7</td>
<td>1m (*)</td>
</tr>
</tbody>
</table>

(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.
General Specifications
### 2.1 Environment Conditions

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit name</th>
<th>Control unit</th>
<th>Display unit</th>
<th>Keyboard unit</th>
<th>Operation panel</th>
<th>I/O unit</th>
<th>Machine operation panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>FCU7-MUS31/541 FCU7-MAS41</td>
<td>FCU7-DU120-11/140-x1/180-11</td>
<td>FCU7-KB024/025/026/029 044/046/047/048</td>
<td>FCU7-DX71x/72x/73x</td>
<td>FCU7-KB921/926</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>During operation</td>
<td>0 to 55°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>During storage</td>
<td>-20 to 60°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long term Ambient humidity</td>
<td>10 to 75% RH (with no dew condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short term</td>
<td>10 to 95% RH (with no dew condensation) (Note 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td></td>
<td>4.9m/s² or less (during operation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock resistance</td>
<td></td>
<td>29.4m/s² or less (during operation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working atmosphere</td>
<td></td>
<td>No corrosive gases, dust or oil mist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power voltage</td>
<td>24VDC ± 5%</td>
<td>3.3V/12VDC</td>
<td>5VDC</td>
<td>3.3V/5VDC</td>
<td>24VDC ± 5%(Note 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ripple noise 200mV (P-P)</td>
<td>(Provided by the control unit)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power capacity</td>
<td>24V 2.5A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.25A(Note 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instantaneous stop tolerance time</td>
<td>20ms</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20ms(min)(Note 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating value (max.)</td>
<td>16W</td>
<td>FCU7-DU120-11: 10W FCU7-DU140-x1: 12W FCU7-DU180-11: 13W</td>
<td>1.0W</td>
<td>FCU7-KB024/025/026/029 044/046/047/048</td>
<td>FCU7-KB921/926: 0.25A(Note 7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>1.0</td>
<td>FCU7-DU120-11: 1.5 FCU7-DU140-x1: 2.0 FCU7-DU180-11: 4.2</td>
<td>0.4</td>
<td>FCU7-KB024/025/026/029 044/046/047/048</td>
<td>FCU7-KB921: 1.2 FCU7-KB926: 0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outline dimension (mm)</td>
<td>235(W) x 173(H) x 103(D) (Depth from the plate mounting surface: 90)</td>
<td>FCU7-DU120-11: 260(W) x 200(H) FCU7-DU140-x1: 290(W) x 220(H) FCU7-DU180-11: 400(W) x 320(H)</td>
<td>FCU7-KB024/025/026: 140(W) x 200(H) FCU7-KB029: 260(W) x 140(H) FCU7-KB044/046/047/048: 120(W) x 180(H)</td>
<td>FCU7-KB921: 260(W) x 140(H) FCU7-KB926: 140(W) x 140(H)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 2.1 Environment Conditions

- **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/s² or less (during operation)
- **Shock resistance**: 29.4m/s² or less (during operation)

- **Working atmosphere**: No corrosive gases or dust

### Required power specifications

- **Input power voltage**: 24VDC ± 5% Ripple noise 200mV (P-P)
- **Power capacity**:
  - FCUA-DX10x: 24V 0.7A (Note 4)
  - FCUA-DX11x: 24V 1.5A (Note 4)
  - FCUA-DX12x: 24V 0.7A (Note 4)

- **Instantaneous stop tolerance time**: -

### Others

- **Heating value (max.)**:
  - FCUA-DX10x: 25W (Note 5)
  - FCUA-DX11x: 30W (Note 5)
  - FCUA-DX12x: 30W (Note 5)

- **Mass**:
  - 0.5kg
  - 0.6kg

---

**Notes**:

1. "Short term" means within one month.
2. For the current value of the I/O circuit, calculate with the number of points used and load.
3. For the heating value of the I/O circuit, calculate with the number of points used.
4. Allows only the amount to be consumed by control circuit.
5. Differs according to the number of machine input operation points and the load and number of points connected to the machine output. The maximum value applies when all points are ON.
6. MITSUBISHI CNC M700VS Series, which is an open equipment, must be installed within a sealed metal control panel.
7. FCU7-KB926 does not need 24VDC power supply input.
### 2.2 Control Unit

Dimension and names of parts

![Control Unit Diagram]

<table>
<thead>
<tr>
<th>No.</th>
<th>No.</th>
<th>Connector name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(1)</td>
<td>CF</td>
<td>Front CF card I/F</td>
</tr>
<tr>
<td>2</td>
<td>(2)</td>
<td>USB</td>
<td>Front USB memory I/F</td>
</tr>
<tr>
<td>3</td>
<td>(3)</td>
<td>INV</td>
<td>Display unit backlight inverter I/F</td>
</tr>
<tr>
<td>4</td>
<td>(4)</td>
<td>ADONCCB</td>
<td>Expansion card slot</td>
</tr>
<tr>
<td>5</td>
<td>(5)</td>
<td>LCD</td>
<td>Display unit signal I/F</td>
</tr>
<tr>
<td>6</td>
<td>(6)</td>
<td>EMG</td>
<td>External emergency stop input</td>
</tr>
<tr>
<td>7</td>
<td>(7)</td>
<td>DCIN</td>
<td>2AVDC input</td>
</tr>
<tr>
<td>8</td>
<td>(8)</td>
<td>CG71</td>
<td>Operation panel I/O unit I/F</td>
</tr>
<tr>
<td>9</td>
<td>(9)</td>
<td>LAN</td>
<td>Ethernet I/F</td>
</tr>
<tr>
<td>10</td>
<td>(10)</td>
<td>RIO1</td>
<td>Remote I/O unit I/F</td>
</tr>
<tr>
<td>11</td>
<td>(11)</td>
<td>MENUKEY</td>
<td>Menu key I/F</td>
</tr>
<tr>
<td>12</td>
<td>(12)</td>
<td>CG72</td>
<td>Remote I/O unit I/F</td>
</tr>
<tr>
<td>13</td>
<td>(13)</td>
<td>ENC</td>
<td>Encoder input 1ch (5V manual pulse generator input 2ch)</td>
</tr>
<tr>
<td>14</td>
<td>(14)</td>
<td>SIO1</td>
<td>RS-232C communication I/F 2ch</td>
</tr>
<tr>
<td>15</td>
<td>(15)</td>
<td>SIO2</td>
<td>RS-232C communication I/F 2ch</td>
</tr>
<tr>
<td>16</td>
<td>(16)</td>
<td>SKIP</td>
<td>Skip input 8ch</td>
</tr>
<tr>
<td>17</td>
<td>(17)</td>
<td>BAT</td>
<td>Battery (Q6BAT) I/F</td>
</tr>
<tr>
<td>18</td>
<td>(18)</td>
<td>OPT1</td>
<td>Optical communication I/F</td>
</tr>
<tr>
<td>19</td>
<td>(19)</td>
<td>OPT2</td>
<td>Optical communication I/F</td>
</tr>
<tr>
<td>20</td>
<td>(20)</td>
<td>FG</td>
<td>FG terminal</td>
</tr>
<tr>
<td>21</td>
<td>(21)</td>
<td>TP</td>
<td>Touch panel I/F</td>
</tr>
<tr>
<td>22</td>
<td>(22)</td>
<td>LED</td>
<td>Slide switch</td>
</tr>
<tr>
<td>23</td>
<td>(23)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Control unit is mounted on the back of the display unit.

(1) Front CF card I/F (CF)
   It is recommended to use CF cards of the original equipment manufactured parts. Mitsubishi is unable to guarantee
   the machine operation when a commercially available CF card or SD memory card (SD-CF adapter is required) is
   used. In that case, performance check must be made carefully by machine tool builder.
   (Refer to "General Specifications: Precautions for Use of Exclusive CF cards for MITSUBISHI CNC: Commercially
   Available CF cards").

(2) Front USB memory I/F (USB)
   Do not connect devices other than USB memories.
   When using a commercially available USB memory, performance check must be made by machine tool builder.

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

(4) Expansion card slot (ADONCCB)

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

(6) External emergency stop input (EMG)

<table>
<thead>
<tr>
<th></th>
<th>FG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
</tr>
<tr>
<td>2</td>
<td>EMG IN</td>
</tr>
<tr>
<td>3</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td>+24V</td>
</tr>
</tbody>
</table>

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

<Cable side connector type>
   Connector: 005057-9403
   Contact: 0016020103 x3
   Recommended manufacturer: MOLEX
(7) 24VDC input (DCIN)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>+24V</td>
<td>0V</td>
<td>FG</td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5 x3
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.

<table>
<thead>
<tr>
<th>[Stabilized power supply selection items]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Output Voltage fluctuation</td>
</tr>
<tr>
<td>Ripple noise</td>
</tr>
<tr>
<td>Power capacity</td>
</tr>
<tr>
<td>Output holding time</td>
</tr>
<tr>
<td>Overcurrent protection</td>
</tr>
</tbody>
</table>

[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.
(8) Operation panel I/O unit I/F (CG71)

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

* Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10126-3000VE
Shell: 10326-52F0-008
Recommended manufacturer: 3M

(9) Ethernet I/F (LAN)

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

* Connect connector case with FG pattern.

* Use cross cable (G300) when directly connecting a device such as a personal computer to the unit.

<Cable side connector type>
Connector: 5-569550-3
Recommended manufacturer: Tyco Electronics
(10) Remote I/O unit I/F (RIO1)
Up to eight remote I/O stations can be connected.

<table>
<thead>
<tr>
<th>1</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O TXRX1</td>
<td></td>
</tr>
<tr>
<td>I/O TXRX1*</td>
<td></td>
</tr>
<tr>
<td>0V</td>
<td></td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 1-178288-3
Contact: 1-175218-2 x3
Recommended manufacturer: Tyco Electronics

(11) Menu key I/F (MENUKEY)

(12) Remote I/O unit I/F (CG72)

<table>
<thead>
<tr>
<th>10</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

* Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M
(13) Encoder input 1ch/ 5V manual pulse generator input 2ch (ENC)
Synchronous feed encoder or 5V manual pulse generator can be connected to this connector.

*S Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M
(a) Input for synchronous feed encoder

<table>
<thead>
<tr>
<th>Specification of input part</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of pulse phases</strong></td>
</tr>
<tr>
<td><strong>Signal output of the encoder</strong></td>
</tr>
<tr>
<td><strong>Input voltage range</strong></td>
</tr>
<tr>
<td><strong>Differential-input voltage VIT+</strong></td>
</tr>
<tr>
<td><strong>Differential-input voltage VIT−</strong></td>
</tr>
<tr>
<td><strong>Power supply voltage</strong></td>
</tr>
<tr>
<td><strong>Current consumption</strong></td>
</tr>
<tr>
<td><strong>Number of pulses per rotation</strong></td>
</tr>
<tr>
<td><strong>Input frequency (rotation speed)</strong></td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
</tr>
</tbody>
</table>

A phase

A* phase

B phase

B* phase

Z phase

Z* phase

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

(b) Input for 5V manual pulse generator

<table>
<thead>
<tr>
<th>Specification of input part</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of pulse phases</strong></td>
</tr>
<tr>
<td><strong>Signal output of manual pulse generator</strong></td>
</tr>
<tr>
<td><strong>Signal voltage</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Power supply voltage</strong></td>
</tr>
<tr>
<td><strong>Current consumption</strong></td>
</tr>
<tr>
<td><strong>Number of pulses per rotation</strong></td>
</tr>
<tr>
<td><strong>Input frequency (rotation speed)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
</tr>
</tbody>
</table>

A(B) phase

B(A) phase

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

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

(14) Serial communication (RS-232C) I/F 2ch (SIO1)
(15) Serial communication (RS-232C) I/F 2ch (SIO2)

<table>
<thead>
<tr>
<th>Connector pin No.</th>
<th>Signal input</th>
<th>Power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>HA1A</td>
<td>+5V</td>
<td>0V</td>
</tr>
<tr>
<td>HA2A</td>
<td>+5V</td>
<td>0V</td>
</tr>
<tr>
<td>HA1B</td>
<td>+5V</td>
<td>0V</td>
</tr>
<tr>
<td>HA2B</td>
<td>+5V</td>
<td>0V</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>10</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>11</td>
</tr>
</tbody>
</table>

- | 0V | 0V |
- | RD1(RXD1) | SD1(TXD1) |
- | CS1(CTS1) | RS1(RTS1) |
- | DR1(DSR1) | ER1(DTR1) |
- | 0V | 0V |
- | NC | NC |
- | RD2(RXD2) | SD2(TXD2) |
- | CS2(CTS2) | RS2(RTS2) |
- | DR2(DSR2) | ER2(DTR2) |
- | NC | NC |

* Connect connector case with FG pattern.

**Cable side connector type**
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M
(16) Skip input 8ch (SKIP)

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

* Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M
(a) Skip signal input conditions

Use the input signal within the following condition ranges.

<table>
<thead>
<tr>
<th></th>
<th>24V common</th>
<th>0V common</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input voltage at external contact ON</td>
<td>6V or less</td>
</tr>
<tr>
<td>2</td>
<td>Input current at external contact ON</td>
<td>6mA or more</td>
</tr>
<tr>
<td>3</td>
<td>Input voltage at external contact OFF</td>
<td>20V or more, 25.2V or less</td>
</tr>
<tr>
<td>4</td>
<td>Input current at external contact OFF</td>
<td>2mA or less</td>
</tr>
<tr>
<td>5</td>
<td>Input resistance</td>
<td>Approx. 2.2kΩ</td>
</tr>
<tr>
<td>6</td>
<td>Input signal holding time (Ton)</td>
<td>2ms or more</td>
</tr>
<tr>
<td>7</td>
<td>Internal response time</td>
<td>0.08ms or less</td>
</tr>
<tr>
<td>8</td>
<td>Machine side contact capacity</td>
<td>+30V or more, 16mA or more</td>
</tr>
</tbody>
</table>

Connection to 24V common

Connection to 0V common

(Machine side)

(17) Battery (Q6BAT) I/F (BAT)
(18) Optical communication I/F (OPT1)
(19) Optical communication I/F (OPT2)

<Cable side connector type>
(POF type)
Connector: PF-2D101
Recommended manufacturer: Japan Aviation Electronics

(20) FG terminal (FG)

(21) Touch panel I/F (TP)

(22) LED

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>At fault</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>24VDCIN</td>
<td>DC24V input check</td>
<td>Not lit</td>
<td>(1) Failure of DC24V input</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) Fuse is disconnected near DCIN connector</td>
</tr>
<tr>
<td>DCOUT</td>
<td>Internal output voltage check</td>
<td>Not lit</td>
<td>(1) Failure of internal voltage output in control unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) Short circuit of DC5V output on CG71 or ENC or FAN connector</td>
</tr>
<tr>
<td>LCDON</td>
<td>DC12V output voltage check</td>
<td>Not lit</td>
<td>(1) Failure of DC12V output in control unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) 24VDC input voltage is +20V or less</td>
</tr>
<tr>
<td>PSEMG</td>
<td>External emergency stop status display</td>
<td>Lit (Red)</td>
<td>External emergency stop signal has inputted</td>
</tr>
<tr>
<td>WDER/WDERS</td>
<td>System error display</td>
<td>Lit (Red)</td>
<td>(1) Failure of control unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) SRAM data is broken</td>
</tr>
<tr>
<td>BATALM</td>
<td>Battery voltage drop</td>
<td>Lit (Red)</td>
<td>Battery voltage has dropped to 2.7V or less</td>
</tr>
</tbody>
</table>
(23) Slide switch

This is for MITSUBISHI exclusive use. Do not change the switch from the condition at the time of shipment from MITSUBISHI.

MITSUBISHI default settings differ depending on the display size as follows.

<table>
<thead>
<tr>
<th>Display size</th>
<th>Slide switch position</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.4-type, 15-type</td>
<td>Right</td>
</tr>
<tr>
<td>10.4-type</td>
<td>Left</td>
</tr>
</tbody>
</table>
2.3 Display Unit

Outline dimension

[FCU7-DU120-11 (8.4-type)]

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

<Panel cut dimension drawing>
[FCU7-DU140-11 (10.4-type)]

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

<Panel cut dimension drawing>
[FCU7-DU140-31 (10.4-type with touch panel)]

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

<Panel cut dimension drawing>
(Note 1) The above side view shows the state with the control unit mounted.
(Note 2) Consider the minimum radius value of optical communication cable for the bottom space. (Refer to "Connection : Precautions for Wiring : Precautions for Using Optical Communication Cable").
(Note 3) In consideration of the length of the cable, the keyboard unit should be mounted around the display unit where is possible to place with the cable length.

<Panel cut dimension drawing>
2.4 Keyboard Unit

Outline dimension

[FCU7-KB024 (8.4-type)]

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

<Panel cut dimension drawing>
[FCU7-KB025 (8.4-type)]

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

<Panel cut dimension drawing>
[FCU7-KB026 (Clear keys for 8.4-type)]

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

<Panel cut dimension drawing>
[FCU7-KB029 (In tandem for 8.4-type)]

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

<Panel cut dimension drawing>
[FCU7-KB044 (10.4-type)]

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

<Panel cut dimension drawing>
[FCU7-KB046 (Clear keys for 10.4-type)]

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

<Panel cut dimension drawing>
[FCU7-KB047 (Clear keys for 10.4-type/ QWERTY assignment)]

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

<Panel cut dimension drawing>
[FCU7-KB048 (Clear keys for 10.4-type)]

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

<Panel cut dimension drawing>
2.5 Operation Panel I/O Unit

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

(1) Number of DI/DO points that can be mounted on the machine operation panel is 64/64 as standard and 96/96 at the maximum. Both sink and source types are available. Operation panel I/O unit DI/DO uses equivalent serial link connections as those used for remote I/O.

(2) Remote I/O interface --- 1ch
Remote I/O unit, scan I/O card, etc. can be extended up to 4 stations.
(a) When FCU7-DX710/711 are used: Up to 4 stations, 128 points/128 points in total, are available.
(b) When FCU7-DX720/721/730/731 are used: Up to 3 stations, 96 points/96 points in total, are available.
(Note) The maximum number of stations that can be extended is described above whether DI/DO of the operation panel I/O unit is used or not.

(3) Manual pulse generator --- 2ch
5V and 12V manual pulse generators can be connected.

(4) Installation on the back side of the keyboard unit is possible. Allows space saving inside the operation panel.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type</th>
<th>Components</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| DI 24V/0V common input | FCU7-DX710 | Base card
Terminator (R-TM) | DI: 64-points 24V/0V common type
DO: 64-points sink type
MPG: 2ch
Occupied stations (fixed): 1, 2, 7, 8
RIO3 extensible stations: 3, 4, 5, 6 |
| DO Sink output | | | |
| AO Analog output | | | |
| DI 24V/0V common input | FCU7-DX720 | Base card
Terminator (R-TM)
Add-on card | DI: 96-points 24V/0V common type
DO: 80-points sink type
MPG: 2ch
AO: 1 point
Occupied stations (fixed): 1, 2, 3, 7, 8
RIO3 extensible stations: 4, 5, 6 |
| DO Sink output | | | |
| AO Analog output | | | |
| DI 24V/0V common input | FCU7-DX730 | Base card
Terminator (R-TM)
Add-on card | DI: 96-points 24V/0V common type
DO: 96-points sink type
MPG: 2ch
Occupied stations (fixed): 1, 2, 3, 7, 8
RIO3 extensible stations: 4, 5, 6 |
| DO Sink output | | | |
| AO Analog output | | | |
| DI 24V/0V common input | FCU7-DX711 | Base card
Terminator (R-TM) | DI: 64-points 24V/0V common type
DO: 64-points source type
MPG: 2ch
Occupied stations (fixed): 1, 2, 7, 8
RIO3 extensible stations: 3, 4, 5, 6 |
| DO Source output | | | |
| AO Analog output | | | |
| DI 24V/0V common input | FCU7-DX721 | Base card
Terminator (R-TM)
Add-on card | DI: 60-points 24V/0V common type
DO: 80-points source type
MPG: 2ch
AO: 1 point
Occupied stations (fixed): 1, 2, 3, 7, 8
RIO3 extensible stations: 4, 5, 6 |
| DO Source output | | | |
| AO Analog output | | | |
| DI 24V/0V common input | FCU7-DX731 | Base card
Terminator (R-TM)
Add-on card | DI: 96-points 24V/0V common type
DO: 96-points source type
MPG: 2ch
Occupied stations (fixed): 1, 2, 3, 7, 8
RIO3 extensible stations: 4, 5, 6 |

(Note 1) The station Nos. occupied by the operation panel I/O unit cannot be changed. If the unit has rotary switches, do not change the switch settings when shipped.
(Settings when shipped: CS1 -> 0/ CS2 -> 1/ CS3 -> 6)

(Note 2) Set the number of DI points that are simultaneously turned ON to be less than half of the total points. If many points are set to be simultaneously turned ON in high temperature, operation panel I/O unit may be deteriorated due to the heat.
Dimension and names of parts
[FCU7-DX710/ FCU7-DX711]

116 (Space required for wiring)

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

(Note) Use M3x25 screws (with spring washer and plain washer) when mounting the operation panel I/O unit.
(Note) (9) is not available for FCU7-DX731.

<Dimension drawing for installing on the panel>

<Installation on the back side of the keyboard>

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

(Note) Use M3x25 screws (with spring washer and plain washer) when mounting the operation panel I/O unit.
(1) Machine input (CG31)
   Digital input 32 points (1st station)
(2) Machine input (CG33)
   Digital input 32 points (2nd station)
(3) Machine input (CG35)
   Digital input 32 points (3rd station)
(Note) This is not available for FCU7-DX710/FCU7-DX711.

<Cable side connector type>
Connector: 7940-6500SC
Strain relief: 3448-7940
Recommended manufacturer: 3M

Each station has fixed input/output assignments. Refer to "PLC Interface Manual" for details.
(a) Outline of digital signal input circuit

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

**Input circuit**

### Input conditions

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

<table>
<thead>
<tr>
<th></th>
<th>24V common</th>
<th>0V common</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input voltage at external contact ON</td>
<td>6V or less</td>
</tr>
<tr>
<td>2</td>
<td>Input current at external contact ON</td>
<td>9mA or more</td>
</tr>
<tr>
<td>3</td>
<td>Input voltage at external contact OFF</td>
<td>20V or more, 25.2V or less</td>
</tr>
<tr>
<td>4</td>
<td>Input current at external contact OFF</td>
<td>2mA or less</td>
</tr>
<tr>
<td>5</td>
<td>Input resistance</td>
<td>Approx. 3.3kΩ</td>
</tr>
<tr>
<td>6</td>
<td>Tolerable chattering time (T1)</td>
<td>3ms</td>
</tr>
<tr>
<td>7</td>
<td>Input signal holding time (T2)</td>
<td>40ms or more (Note)</td>
</tr>
<tr>
<td>8</td>
<td>Input circuit operation delay time (T3 and T4)</td>
<td>3 to 16ms</td>
</tr>
<tr>
<td>9</td>
<td>Machine side contact capacity</td>
<td>30V or more, 16mA or more</td>
</tr>
</tbody>
</table>

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

---

<table>
<thead>
<tr>
<th>Connection to 24V common input</th>
<th>Connection to 0V common input</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="24V common connection diagram" /></td>
<td><img src="image" alt="0V common connection diagram" /></td>
</tr>
</tbody>
</table>

(E): External signal, (I): Internal signal
(4) Machine output (CG32)
Digital output 32 points (1st station)

(5) Machine output (CG34)
Digital output 32 points (2nd station)

(6) Machine output (CG36)
FCU7-DX730/DX731: Digital output 32 points (3rd station)
FCU7-DX720/DX721: Digital output 16 points (3rd station) (with analog output)
(Note) This is not available for FCU7-DX710/FCU7-DX711.

<Cable side connector type>
Connector: 7940-6500SC
Strain relief: 3448-7940
Recommended manufacturer: 3M

<table>
<thead>
<tr>
<th>CG32</th>
<th>CG34</th>
<th>CG36 (Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>20</td>
<td>O Y200</td>
<td>20</td>
</tr>
<tr>
<td>19</td>
<td>O Y201</td>
<td>19</td>
</tr>
<tr>
<td>18</td>
<td>O Y202</td>
<td>18</td>
</tr>
<tr>
<td>17</td>
<td>O Y203</td>
<td>17</td>
</tr>
<tr>
<td>16</td>
<td>O Y204</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>O Y205</td>
<td>15</td>
</tr>
<tr>
<td>14</td>
<td>O Y206</td>
<td>14</td>
</tr>
<tr>
<td>13</td>
<td>O Y207</td>
<td>13</td>
</tr>
<tr>
<td>12</td>
<td>O Y208</td>
<td>12</td>
</tr>
<tr>
<td>11</td>
<td>O Y209</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>O Y20A</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>O Y20C</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>O Y20D</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>O Y20E</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>O Y20F</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>COM</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>COM</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>24VDC</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>24VDC</td>
<td>1</td>
</tr>
</tbody>
</table>

(Note 1) FCU7-DX720/DX721 uses 16 points of digital outputs, Y240 to Y24F.
(Note 2) COM (3A, 3B, 4A, and 4B) is connected to 24VDC or GND (0V) inside the unit depending on the output type.
Sink type output (FCU7-DX710/DX720/DX730): GND (0V)
Source type output (FCU7-DX711/DX721/DX731): 24VDC

Each station has fixed input/output assignments. Refer to "PLC Interface Manual" for details.
(a) Outline of digital signal output circuit
The digital signal output circuit uses a sink type (DX7x0) or source type (DX7x1). Use within the specification ranges shown below.

Output circuit

Output conditions

<table>
<thead>
<tr>
<th>Insulation method</th>
<th>Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated load voltage</td>
<td>24VDC</td>
</tr>
<tr>
<td>Max. output current</td>
<td>60mA/point</td>
</tr>
<tr>
<td>Output delay time</td>
<td>40μs</td>
</tr>
</tbody>
</table>

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

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

⚠️ CAUTION

1. When using an inductive load such as a relay, always connect a diode in parallel to the load.
2. When using a capacitive load such as a lamp, always connect a protective resistor serially to the load to suppress rush currents.
(7) Keyboard I/F (NCKB)

(8) FG terminal (FG)

(9) Analog output 1ch (AO)

(Note) This is not available for FCU7-DX731.

* Connect connector case with FG pattern.

<Cable side connector type>
Plug: 10120-3000VE
Shell: 10320-52F0-008
Recommended manufacturer: 3M

Output circuit

Output conditions

<table>
<thead>
<tr>
<th>Output voltage</th>
<th>0V to ±10V (±5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>12bit (±10V × n/4096) (Note)</td>
</tr>
<tr>
<td>Load conditions</td>
<td>10kΩ load resistance</td>
</tr>
<tr>
<td>Output impedance</td>
<td>220Ω</td>
</tr>
</tbody>
</table>

(Note) n=(2^6 to 2^11)

Connector pin assignment

<table>
<thead>
<tr>
<th>1</th>
<th>AO*</th>
<th>GND</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>AO</td>
<td>Analog voltage output</td>
</tr>
</tbody>
</table>
(10) Manual pulse generator input 2ch (5V and 12V) (MPG)

5V manual pulse generator and 12V manual pulse generator can be connected to this connector. Connect the synchronous feed encoder to the ENC connector of the control unit.

* Connect connector case with FG pattern.

<Cable side connector type>
- Plug: 10120-3000VE
- Shell: 10320-52F0-008
- Recommended manufacturer: 3M

<Specification of input part>

<table>
<thead>
<tr>
<th></th>
<th>5V manual pulse generator</th>
<th>12V manual pulse generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pulse phases</td>
<td>Two phases (A phase, B phase, a phase difference 90 degrees)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Refer to the waveform below.)</td>
<td></td>
</tr>
<tr>
<td>Signal output of manual pulse generator</td>
<td>Voltage output, open collector output</td>
<td>Open collector output</td>
</tr>
<tr>
<td>Signal voltage</td>
<td>H level 3.5V to 5.25V</td>
<td>L level 0V to 0.5V</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>5VDC ± 10%</td>
<td>12VDC ± 10%</td>
</tr>
<tr>
<td>Current consumption</td>
<td>100mA or less</td>
<td>100mA or less</td>
</tr>
<tr>
<td>Number of pulses per rotation</td>
<td>25 pulse/rev, 100 pulse/rev</td>
<td></td>
</tr>
<tr>
<td>Input frequency (rotation speed)</td>
<td>1kHz or less (40r/s or less for 25 pulse/rev, 10r/s or less for 100 pulse/rev)</td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>20m or less</td>
<td>50m or less</td>
</tr>
</tbody>
</table>

A(B) phase

B(A) phase

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

T: A or B phase cycle
<Input/output circuit>

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

1 3

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

<Cable side connector type>

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

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

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

(Note) 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.

(12) Control unit I/F (CG71)
### (13) LED

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>At fault</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3VON</td>
<td>DC3V input check</td>
<td>Not lit</td>
<td>(1) Disconnection between control unit and operation panel I/O unit</td>
</tr>
<tr>
<td>5VON</td>
<td>DC5V input check</td>
<td>Not lit</td>
<td>(1) Disconnection between control unit and operation panel I/O unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) Short circuit of manual pulse generator cable</td>
</tr>
<tr>
<td>PACKETNG</td>
<td>RIO communication status check</td>
<td>Lit (Red)</td>
<td>(1) Partial disconnection between control unit and operation panel I/O unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2) Miswiring of extended I/O unit to RIO3</td>
</tr>
<tr>
<td>RIO1</td>
<td>RIO communication status check</td>
<td>Not lit</td>
<td></td>
</tr>
<tr>
<td>12VON</td>
<td>For manual pulse generator</td>
<td>Not lit</td>
<td>Short circuit of manual pulse generator cable</td>
</tr>
<tr>
<td>DOCOM</td>
<td>DC24V input check</td>
<td>Not lit</td>
<td>(1) Disconnection of 24V input</td>
</tr>
<tr>
<td></td>
<td>(for source output)</td>
<td></td>
<td>(2) Disconnection of protection fuse on the operation panel I/O unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Note) Sink output type does not have the LED for DOCOM.</td>
</tr>
</tbody>
</table>
2.6 Remote I/O Unit

The following eight types of signals can be input/output from the remote I/O unit (FCUA-DX1xx) according to the type and No. of contacts. Use serial link connections to connect the unit with the control unit or the operation panel I/O unit. Multiple remote I/O units can be used as long as the total number of occupied stations is eight or less.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Type</th>
<th>Components</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI 24V/0V common input DO Sink output</td>
<td>FCUA-DX100</td>
<td>RX311</td>
<td>DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points sink type (non-insulation) Number of occupied stations: 1</td>
</tr>
<tr>
<td>DI 24V/0V common input DO Sink output</td>
<td>FCUA-DX110</td>
<td>RX311+RX321-1</td>
<td>DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points sink type (non-insulation) Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input DO Sink output AO Analog output</td>
<td>FCUA-DX120</td>
<td>RX311+RX321</td>
<td>DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points sink type (non-insulation) AO: 1 point Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input DO Source output AO Analog output</td>
<td>FCUA-DX140</td>
<td>RX311+RX341</td>
<td>DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points source type (non-insulation) AO: 1 point Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input DO Source output</td>
<td>FCUA-DX101</td>
<td>RX312</td>
<td>DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points source type (non-insulation) Number of occupied stations: 1</td>
</tr>
<tr>
<td>DI 24V/0V common input DO Source output</td>
<td>FCUA-DX111</td>
<td>RX312+RX322-1</td>
<td>DI: 64-points 24V/0V common type (photo coupler insulation) DO: 48-points source type (non-insulation) Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input DO Source output AO Analog output</td>
<td>FCUA-DX121</td>
<td>RX312+RX322</td>
<td>DI: 32-points 24V/0V common type (photo coupler insulation) DO: 48-points source type (non-insulation) AO: 1 point Number of occupied stations: 2</td>
</tr>
<tr>
<td>DI 24V/0V common input DO Source output AI Analog input AO Analog output</td>
<td>FCUA-DX141</td>
<td>RX312+RX341</td>
<td>DI: 32-points 24V/0V common type (photo coupler insulation) DO: 32-points source type (non-insulation) AI: 4 points AO: 1 point Number of occupied stations: 2</td>
</tr>
</tbody>
</table>
Dimension and names of parts

[Front view]

1. (1)
2. (2)
3. (3)
4. (4)
5. (5)
6. (6)
7. (7)
8. (8)
9. (9)
10. (10)
11. (11)

(DX10x) (DX11x/DX12x) (DX14x)

[Bottom view]

1. (1)
2. (2)
3. (3)
4. (4)
5. (5)
6. (6)
7. (7)
8. (8)
9. (9)
10. (10)

(Front) (Rear)

[Side view]

<Installation dimension drawing>

1. (1)
2. (2)
3. (3)
4. (4)
5. (5)
6. (6)
7. (7)
8. (8)
9. (9)
10. (10)

Top Bottom

Mounting hole

2-M5 screw

DX10x DX11x/DX12x DX14x
(1) Machine input (DI-L)
(2) Machine input (DI-R)

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

**Input circuit**

![Connection Diagram](image)

**Input conditions**

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

<table>
<thead>
<tr>
<th></th>
<th>24V common</th>
<th>0V common</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input voltage at external contact ON</td>
<td>6V or less</td>
</tr>
<tr>
<td>2</td>
<td>Input current at external contact ON</td>
<td>9mA or more</td>
</tr>
<tr>
<td>3</td>
<td>Input voltage at external contact OFF</td>
<td>20V or more, 25.2V or less</td>
</tr>
<tr>
<td>4</td>
<td>Input current at external contact OFF</td>
<td>2mA or less</td>
</tr>
<tr>
<td>5</td>
<td>Input resistance</td>
<td>Approx. 2.2kΩ</td>
</tr>
<tr>
<td>6</td>
<td>Tolerable chattering time (T1)</td>
<td>3ms</td>
</tr>
<tr>
<td>7</td>
<td>Input signal holding time (T2)</td>
<td>40ms or more (Note)</td>
</tr>
<tr>
<td>8</td>
<td>Input circuit operation delay time (T3 and T4)</td>
<td>3 to 16ms</td>
</tr>
<tr>
<td>9</td>
<td>Machine side contact capacity</td>
<td>30V or more, 16mA or more</td>
</tr>
</tbody>
</table>

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

![Wiring Diagram](image)

(E) : External signal, (I) : Internal signal
(3) Machine output (DO-L)
(4) Machine output (DO-R)

The digital signal output circuit uses a sink type (DX1x0) or source type (DX1x1).
Use within the specification ranges shown below.

**Output circuit**

![Diagram of output circuit](image)

**Output conditions**

<table>
<thead>
<tr>
<th>Insulation method</th>
<th>Non-insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated load voltage</td>
<td>24VDC</td>
</tr>
<tr>
<td>Max. output current</td>
<td>60mA/point</td>
</tr>
<tr>
<td>Output delay time</td>
<td>40 μs</td>
</tr>
</tbody>
</table>

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

(Note 2) When using a capacitive load such as a lamp, always connect a protective resistor (R=150 Ω) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)
[Analog signal input/output (AlO)]

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

Output circuit

Output conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>0V to ±10V (±5%)</td>
</tr>
<tr>
<td>Resolution</td>
<td>12bit (±10V × n/4096) (Note)</td>
</tr>
<tr>
<td>Load conditions</td>
<td>10kΩ load resistance</td>
</tr>
<tr>
<td>Output impedance</td>
<td>220Ω</td>
</tr>
</tbody>
</table>

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

⚠️ CAUTION

1. When using an inductive load such as a relay, always connect a diode in parallel to the load.
2. When using a capacitive load such as a lamp, always connect a protective resistor serially to the load to suppress rush currents.
(5) Analog signal input/output (AIO)

(a) Outline of analog signal output circuit

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

Output conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>0V to ±10V (±5%)</td>
</tr>
<tr>
<td>Resolution</td>
<td>12bit (±10V × n/4096) (Note)</td>
</tr>
<tr>
<td>Load conditions</td>
<td>10kΩ load resistance</td>
</tr>
<tr>
<td>Output impedance</td>
<td>220Ω</td>
</tr>
</tbody>
</table>

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

(b) Outline of analog signal input circuit

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

Input conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. input rating</td>
<td>±15V</td>
</tr>
<tr>
<td>Resolution</td>
<td>-10 to +10V / 4096 = 4.88mV</td>
</tr>
<tr>
<td>Precision</td>
<td>Within ±25mV</td>
</tr>
<tr>
<td>AD input sampling time</td>
<td>14.2ms(AI0)/42.6ms(AI1 to 3)</td>
</tr>
</tbody>
</table>
(6) Transfer speed changeover switch (DS)

- Not used
- Not used

(7) Station No. changeover switch (CS)

- Selection of station No.

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

<table>
<thead>
<tr>
<th>1</th>
<th>I/O</th>
<th>TXRX</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>I/O</td>
<td>TXRX*</td>
</tr>
<tr>
<td>3</td>
<td>0V</td>
<td></td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 1-178288-3
Contact: 1-175218-2 x3
Recommended manufacturer: Tyco Electronics

(10) 24VDC input (DCIN)

<table>
<thead>
<tr>
<th>1</th>
<th>I</th>
<th>+24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
<td></td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5 x3
Recommended manufacturer: Tyco Electronics

(11) LED

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>At fault</th>
<th>Conditions</th>
</tr>
</thead>
</table>
| POWER Green (UP) | Internal output voltage (5VDC) check | Not lit | (1) Failure of 24VDC input  
(2) Fuse is disconnected  
(3) Failure of internal voltage output in I/O unit |
| ALM Red (DOWN) | RIO communication status check | Lit      | (1) Partial disconnection between control unit and remote I/O unit  
(2) Miswiring of connected remote I/O unit |
### 2.7 Scan I/O Unit

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

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

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

[HR347/ HR357]
(1) Scan type input/output (CF35)

<table>
<thead>
<tr>
<th>CF35</th>
<th>B</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>GND</td>
<td>25</td>
</tr>
<tr>
<td>24</td>
<td>O</td>
<td>24</td>
</tr>
<tr>
<td>23</td>
<td>O</td>
<td>23</td>
</tr>
<tr>
<td>22</td>
<td>O</td>
<td>22</td>
</tr>
<tr>
<td>21</td>
<td>I</td>
<td>21</td>
</tr>
<tr>
<td>20</td>
<td>I</td>
<td>20</td>
</tr>
<tr>
<td>19</td>
<td>I</td>
<td>19</td>
</tr>
<tr>
<td>18</td>
<td>I</td>
<td>18</td>
</tr>
<tr>
<td>17</td>
<td>I</td>
<td>17</td>
</tr>
<tr>
<td>16</td>
<td>I</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>I</td>
<td>15</td>
</tr>
<tr>
<td>14</td>
<td>I</td>
<td>14</td>
</tr>
<tr>
<td>13</td>
<td>I</td>
<td>13</td>
</tr>
<tr>
<td>12</td>
<td>GND</td>
<td>12</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>O</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>O</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>I</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>I</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>I</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

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

<Cable side connector type>
Connector: 7950-6500SC
Strain relief: 3448-7950
Recommended manufacturer: 3M

<table>
<thead>
<tr>
<th>LCxA/B</th>
<th>Common signals for scan DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDxA/B*</td>
<td>Data signals for scan DO</td>
</tr>
<tr>
<td>KYCx*</td>
<td>Common signals for scan DI</td>
</tr>
<tr>
<td>KYDx*</td>
<td>Data signals for scan DI</td>
</tr>
</tbody>
</table>

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>LED</th>
<th>Function</th>
<th>Color</th>
<th>Status</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>24IN</td>
<td>24VDC input check</td>
<td>Green</td>
<td>Lit</td>
<td>Not lit</td>
</tr>
<tr>
<td>5OUT</td>
<td>Internal output voltage check</td>
<td>Green</td>
<td>Lit</td>
<td>Not lit</td>
</tr>
<tr>
<td>ALM1</td>
<td>Communication error of the station designated by rotary switch &quot;SCAN1&quot;</td>
<td>Red</td>
<td>Not lit</td>
<td>Lit</td>
</tr>
<tr>
<td>ALM2</td>
<td>Communication error of the station designated by rotary switch &quot;SCAN2&quot;</td>
<td>Red</td>
<td>Not lit</td>
<td>Lit</td>
</tr>
<tr>
<td>ALM3</td>
<td>Communication error of the station designated by rotary switch &quot;DIO&quot;</td>
<td>Red</td>
<td>Not lit</td>
<td>Lit</td>
</tr>
</tbody>
</table>

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

(3) Rotary switch

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

### CF35

<table>
<thead>
<tr>
<th>Scan</th>
<th>DI:32</th>
<th>Scan</th>
<th>DO:32</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Address]</td>
<td></td>
<td>[Address]</td>
<td></td>
</tr>
<tr>
<td>X00</td>
<td></td>
<td>Y00</td>
<td></td>
</tr>
<tr>
<td>X1F</td>
<td></td>
<td>Y1F</td>
<td></td>
</tr>
</tbody>
</table>

### CF31

<table>
<thead>
<tr>
<th>Digital</th>
<th>DI:32</th>
<th>Digital</th>
<th>DO:32</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Address]</td>
<td></td>
<td>[Address]</td>
<td></td>
</tr>
<tr>
<td>X40</td>
<td></td>
<td>Y40</td>
<td></td>
</tr>
<tr>
<td>X5F</td>
<td></td>
<td>Y5F</td>
<td></td>
</tr>
</tbody>
</table>

### Rotary switch

<table>
<thead>
<tr>
<th>Rotary switch</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCAN1</td>
<td>For scan input/output station No. setting 32points/32points (Normally set to &quot;0&quot;)</td>
</tr>
<tr>
<td>SCAN2</td>
<td>For scan input/output station No. setting 32points/32points (Normally set to &quot;1&quot;)</td>
</tr>
<tr>
<td>DIO</td>
<td>For digital input/output station No. setting 32points/32points (Normally set to &quot;2&quot;)</td>
</tr>
</tbody>
</table>

(Note) Set each different station Nos. for SCAN1, SCAN2 and DIO. Up to 8 stations can be used in a part system. Set the Nos. from 0 to 7.
(4) Machine input (CF31)

Digital input

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

*Cable side connector type*

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

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

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

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

<table>
<thead>
<tr>
<th></th>
<th>24V common</th>
<th>0V common</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input voltage at external contact ON</td>
<td>6V or less</td>
</tr>
<tr>
<td>2</td>
<td>Input current at external contact ON</td>
<td>9mA or more</td>
</tr>
<tr>
<td>3</td>
<td>Input voltage at external contact OFF</td>
<td>20V or more, 25.2V or less</td>
</tr>
<tr>
<td>4</td>
<td>Input current at external contact OFF</td>
<td>2mA or less</td>
</tr>
<tr>
<td>5</td>
<td>Input resistance</td>
<td>Approx. 2.2kΩ</td>
</tr>
<tr>
<td>6</td>
<td>Tolerable chattering time (T1)</td>
<td>3ms</td>
</tr>
<tr>
<td>7</td>
<td>Input signal holding time (T2)</td>
<td>40ms or more (Note)</td>
</tr>
<tr>
<td>8</td>
<td>Input circuit operation delay time (T3 and T4)</td>
<td>3 to 16ms</td>
</tr>
<tr>
<td>9</td>
<td>Machine side contact capacity</td>
<td>30V or more, 16mA or more</td>
</tr>
</tbody>
</table>

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

[Connection to 24V common input]

[Connection to 0V common input]
(5) Machine output (CF33)

Digital output

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>O</td>
<td>Y40</td>
</tr>
<tr>
<td>19</td>
<td>O</td>
<td>Y41</td>
</tr>
<tr>
<td>18</td>
<td>O</td>
<td>Y42</td>
</tr>
<tr>
<td>17</td>
<td>O</td>
<td>Y43</td>
</tr>
<tr>
<td>16</td>
<td>O</td>
<td>Y44</td>
</tr>
<tr>
<td>15</td>
<td>O</td>
<td>Y45</td>
</tr>
<tr>
<td>14</td>
<td>O</td>
<td>Y46</td>
</tr>
<tr>
<td>13</td>
<td>O</td>
<td>Y47</td>
</tr>
<tr>
<td>12</td>
<td>O</td>
<td>Y48</td>
</tr>
<tr>
<td>11</td>
<td>O</td>
<td>Y49</td>
</tr>
<tr>
<td>10</td>
<td>O</td>
<td>Y4A</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>Y4B</td>
</tr>
<tr>
<td>8</td>
<td>O</td>
<td>Y4C</td>
</tr>
<tr>
<td>7</td>
<td>O</td>
<td>Y4D</td>
</tr>
<tr>
<td>6</td>
<td>O</td>
<td>Y4E</td>
</tr>
<tr>
<td>5</td>
<td>O</td>
<td>Y4F</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>24VDC</td>
</tr>
<tr>
<td>1</td>
<td>I</td>
<td>24VDC</td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 7940-6500SC
Strain relief: 3448-7940
Recommended manufacturer: 3M

* This is an example when SCAN1 is set to "0", SCAN2 to "1", and DIO to "2". Refer to "PLC Interface Manual" for details.
The HR357 output circuit is a source type (source output).

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

### Output conditions

<table>
<thead>
<tr>
<th>Insulation method</th>
<th>Non-insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated load voltage</td>
<td>24VDC</td>
</tr>
<tr>
<td>Max. output current</td>
<td>60mA/point</td>
</tr>
<tr>
<td>Saturation voltage</td>
<td>1.6V (standard)</td>
</tr>
<tr>
<td>Output delay time</td>
<td>40 $\mu$s</td>
</tr>
</tbody>
</table>

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

(Note 2) When using a capacitive load such as a lamp, always connect a protective resistor ($R=150 \Omega$) serially to the load to suppress rush currents. (Make sure that the current is less than the above tolerable current including the momentary current.)
(6) 24VDC input (DCIN)

1 3

<table>
<thead>
<tr>
<th>1</th>
<th>+24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0V</td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5 x3
Recommended manufacturer: Tyco Electronics

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

1 3

<table>
<thead>
<tr>
<th>1</th>
<th>I/O TXRX1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>I/O TXRX1*</td>
</tr>
<tr>
<td>3</td>
<td>0V</td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 1-178288-3
Contact: 1-175218-2 x3
Recommended manufacturer: Tyco Electronics
2.8 External Power Supply Unit

<table>
<thead>
<tr>
<th>Item</th>
<th>PD25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power voltage</td>
<td>200 to 230VAC</td>
</tr>
<tr>
<td></td>
<td>+10%~15%</td>
</tr>
<tr>
<td></td>
<td>50/60Hz ± 1Hz</td>
</tr>
<tr>
<td>Output current</td>
<td>3A</td>
</tr>
<tr>
<td>Dimension</td>
<td>130mm × 65mm × 230mm</td>
</tr>
<tr>
<td>Mass</td>
<td>1.5kg</td>
</tr>
<tr>
<td>Output holding time</td>
<td>300ms</td>
</tr>
</tbody>
</table>

(Note 1) PD25 will not be turned ON by the ON/OFF switch immediately after the power OFF. Wait at least 2 seconds, and then turn the power ON.

(Note 2) The power supply configuration for NC devices depends on the machine. Appropriate circuit protector must be selected by machine builder according to the load of the machine.

(Note 3) PD25 does not comply with 100VAC.

Dimension and names of parts

[PD25]

<Mounting direction and clearance>
Mount the external power supply unit vertically and so that it is visible from the front. Provide space for heat dissipation and ventilation.
2 General Specifications

(1) AC power input (ACIN)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>I</td>
<td>FG</td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 2-178128-3
Contact: 1-175218-5 × 3
Recommended manufacturer: Tyco Electronics

(2) ON/OFF switch (ON/OFF SW)
Switch ON (upward): 24VDC output
Switch OFF (downward): 24VDC output OFF

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

<table>
<thead>
<tr>
<th>1</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>P-ON</td>
</tr>
<tr>
<td>P-OFF</td>
<td></td>
</tr>
<tr>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>P-OFF</td>
<td></td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 1-178288-5
Contact: 1-175218-5 × 4
Recommended manufacturer: Tyco Electronics

(4) LED (POWER)
Green light at +24V output

(5) 24VDC output (DCOUT)

<table>
<thead>
<tr>
<th>1A</th>
<th>O</th>
<th>ACFAIL</th>
<th>1B</th>
<th>O</th>
<th>+24V</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A</td>
<td>0V</td>
<td></td>
<td>2B</td>
<td>0V</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td>NC</td>
<td></td>
<td>3B</td>
<td>FG</td>
<td></td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: 3-178127-6
Contact: 1-175218-5 (for AWG16) × 3, 1-175217-5 (for AWG22) × 2
Recommended manufacturer: Tyco Electronics
2.9 Manual Pulse Generator

[UFO-01-229]
5V Manual Pulse Generator (100 pulse/rev)

<Outline dimension drawing>

<Panel cut drawing>

Produced by NIDEC NEMICON CORPORATION
[HD60C]

12V Manual Pulse Generator (25 pulse/rev)

Installation of screws other than M3 x 6 not possible

<Panel cut dimension drawing>

(Divide equally by three)


2.10 Synchronous Feed Encoder

Dimension and names of parts

[OSE-1024-3-15-68]

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A phase</td>
<td>K</td>
<td>0V</td>
</tr>
<tr>
<td>B</td>
<td>Z phase</td>
<td>L</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>B phase</td>
<td>M</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>N</td>
<td>A phase</td>
</tr>
<tr>
<td>E</td>
<td>Case grounding</td>
<td>P</td>
<td>Z phase</td>
</tr>
<tr>
<td>F</td>
<td>-</td>
<td>R</td>
<td>B phase</td>
</tr>
<tr>
<td>G</td>
<td>-</td>
<td>S</td>
<td>-</td>
</tr>
<tr>
<td>H</td>
<td>+5V</td>
<td>T</td>
<td>-</td>
</tr>
<tr>
<td>J</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enlarged drawing of key

Cross section BB
Valid depth of key groove is 21mm

Caution plate

Enlarged drawing of key
2.11 Optical Communication Repeater Unit (FCU7-EX022)

When the distance of the optical communication cable between NC control unit and drive unit is over 30m, the communication can be performed by relaying the optical signal. Using up to two units, relay of the total length of up to 90m can be performed.

<Product features>
(a) When the distance of the optical communication cable between NC control unit and drive unit is over 30m, the communication can be performed by relaying the optical signal.
(b) The relay between NC control unit and drive unit can be performed for up to two channels.
(c) If the distance between NC control unit and drive unit is even within 30m, the cable can be divided by the relay in transporting the machine.
(d) Same mounting dimension as the remote I/O unit (DX unit).

⚠️ CAUTION
This unit cannot be used between drive units.

Dimension and Names of parts
(1) Optical communication I/F (OPT1IN, OPT1OUT, OPT2IN, OPT2OUT)

<Cable side connector type>
(POF type)
Connector: CF-2D101-S
Recommended manufacturer: Japan Aviation Electronics

(2) 24VDC input (DCIN)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0V(RG)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FG</td>
<td></td>
</tr>
</tbody>
</table>

<PCB side connector type>
Connector: 2-178293-5
Recommended manufacturer: Tyco Electronics

<Cable side connector type>
Connector: 2-178288-3
Contact: 1-175218-5
Recommended manufacturer: Tyco Electronics

(3) 24VDC output (DCOUT)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>O</td>
<td>AFAIL</td>
</tr>
<tr>
<td>A2</td>
<td>COM</td>
<td>B1</td>
</tr>
<tr>
<td>A3</td>
<td>NC</td>
<td>B2</td>
</tr>
<tr>
<td>B1</td>
<td>B3</td>
<td>FG</td>
</tr>
</tbody>
</table>

<PCB side connector type>
Connector: 3-178137-5
Recommended manufacturer: Tyco Electronics

<Cable side connector type>
Connector: 2-178127-6
Contact: 1-175218-5
Recommended manufacturer: Tyco Electronics
(4) Power OFF input (CF01)

- **PCB side connector type**
  - Connector: 53103-0230
  - Recommended manufacturer: MOLEX

- **Cable side connector type**
  - Connector: 005057-9402
  - Contact: 0016020103
  - Recommended manufacturer: MOLEX

(5) FG terminal (FG)

- **Cable side faston terminal type name**
  - Type name: 175022-1 (For AWG20-14 250 series)
  - Recommended manufacturer: Tyco Electronics
  - Terminal protection tube: 174817-2 (Yellow)

- **Unit side tab terminal shape**

(Note) The faston terminal "175022-1" of the cable side is a simple lock type. Make sure to insert until the simple lock pin is in the Φ second hole. Firmly press the simple lock release tab when unplugging it.
2.12 MITSUBISHI CNC Machine Operation Panel

2.12.1 MITSUBISHI CNC Machine Operation Panel A

Outline dimension

[FCU7-KB921 (MITSUBISHI CNC machine operation panel A)]
## Connector

### (1)(2) 24VDC input/output (DCIN/DCOUT)

<table>
<thead>
<tr>
<th>No.</th>
<th>Connector name</th>
<th>Function</th>
<th>No.</th>
<th>Connector name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>DCIN</td>
<td>24VDC input</td>
<td>(4)</td>
<td>FG</td>
<td>FG terminal</td>
</tr>
<tr>
<td>(2)</td>
<td>DCOUT</td>
<td>24VDC output</td>
<td>(5)</td>
<td>EXT</td>
<td>Relay wiring</td>
</tr>
<tr>
<td>(3)</td>
<td>RIOIN</td>
<td>Remote I/O</td>
<td>(6)</td>
<td>SUBP</td>
<td>Machine operation panel B switch</td>
</tr>
</tbody>
</table>

### <Cable side connector type>

Connector: 2-178288-3
Contact: 1-175218-5 x3
Recommended manufacturer: Tyco Electronics
(3) Remote I/O connected connector (RIOIN)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I/O</td>
<td>TXRX</td>
</tr>
<tr>
<td>2</td>
<td>I/O</td>
<td>TXRX*</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>0V</td>
</tr>
</tbody>
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<Cable side connector type>
Connector: 1-178288-3
Contact: 1-175218-2 x3
Recommended manufacturer: Tyco Electronics

(4) FG terminal (FG)

(5) Relay wiring (EXT)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B05</td>
<td>-</td>
<td>A05</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>B04</td>
<td>O</td>
<td>A04</td>
<td>O</td>
<td>Relay EMGCOM</td>
</tr>
<tr>
<td>B03</td>
<td>O</td>
<td>A03</td>
<td>O</td>
<td>Relay 6</td>
</tr>
<tr>
<td>B02</td>
<td>O</td>
<td>A02</td>
<td>O</td>
<td>Relay 4</td>
</tr>
<tr>
<td>B01</td>
<td>O</td>
<td>A03</td>
<td>O</td>
<td>Relay 2</td>
</tr>
</tbody>
</table>

<Cable side connector type>
Connector: HIF3BA-10D-2.54C
Contact: HIF3-2428SC
Recommended manufacturer: Hirose Electric
(6) Machine operation panel B switch (SUBP)

<table>
<thead>
<tr>
<th>B20</th>
<th>I</th>
<th>Relay EMGCOM</th>
<th>A20</th>
<th>I</th>
<th>Relay EMG</th>
</tr>
</thead>
<tbody>
<tr>
<td>B19</td>
<td>I</td>
<td>Relay 6</td>
<td>A19</td>
<td>I</td>
<td>Relay 5</td>
</tr>
<tr>
<td>B18</td>
<td>I</td>
<td>Relay 4</td>
<td>A18</td>
<td>I</td>
<td>Relay 3</td>
</tr>
<tr>
<td>B17</td>
<td>I</td>
<td>Relay 2</td>
<td>A17</td>
<td>I</td>
<td>Relay 1</td>
</tr>
<tr>
<td>B16</td>
<td>-</td>
<td>0V</td>
<td>A16</td>
<td>I</td>
<td>Spare SW(X75)</td>
</tr>
<tr>
<td>B15</td>
<td>-</td>
<td>0V</td>
<td>A15</td>
<td>I</td>
<td>Spare SW(X74)</td>
</tr>
<tr>
<td>B14</td>
<td>-</td>
<td>0V</td>
<td>A14</td>
<td>I</td>
<td>Spare SW(X73)</td>
</tr>
<tr>
<td>B13</td>
<td>-</td>
<td>0V</td>
<td>A13</td>
<td>I</td>
<td>Selector SW(X72)</td>
</tr>
<tr>
<td>B12</td>
<td>-</td>
<td>A12</td>
<td>G(X71)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B11</td>
<td>I</td>
<td>F(X6D)</td>
<td>A11</td>
<td>I</td>
<td>E(X6F)</td>
</tr>
<tr>
<td>B10</td>
<td>I</td>
<td>D(0V)</td>
<td>A10</td>
<td>I</td>
<td>C(X70)</td>
</tr>
<tr>
<td>B09</td>
<td>I</td>
<td>B(X6E)</td>
<td>A09</td>
<td>I</td>
<td>A(X6C)</td>
</tr>
<tr>
<td>B08</td>
<td>-</td>
<td>A08</td>
<td>G(X6B)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B07</td>
<td>I</td>
<td>F(X67)</td>
<td>A07</td>
<td>I</td>
<td>E(X66)</td>
</tr>
<tr>
<td>B06</td>
<td>I</td>
<td>D(0V)</td>
<td>A06</td>
<td>I</td>
<td>C(X6A)</td>
</tr>
<tr>
<td>B05</td>
<td>I</td>
<td>B(X68)</td>
<td>A05</td>
<td>I</td>
<td>A(X66)</td>
</tr>
<tr>
<td>B04</td>
<td>-</td>
<td>A04</td>
<td>G(X65)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B03</td>
<td>I</td>
<td>F(X61)</td>
<td>A03</td>
<td>I</td>
<td>E(X63)</td>
</tr>
<tr>
<td>B02</td>
<td>I</td>
<td>D(0V)</td>
<td>A02</td>
<td>I</td>
<td>C(X64)</td>
</tr>
<tr>
<td>B01</td>
<td>I</td>
<td>B(X62)</td>
<td>A01</td>
<td>I</td>
<td>A(X60)</td>
</tr>
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</table>

<Cable side connector type>
Connector: HIF3BA-40D-2.54C
Contact: HIF3-2428SC
Recommended manufacturer: Hirose Electric
(a) Wiring of machine operation panel B

<Wiring of rotary switch (SUBP)>

(Note1) 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

(Note2) A09 to 12 and B09 to 11 of SUBP are spares, so they do not need wiring.

(Note3) Select a rotary switch which guarantees 5V/1mA.

(Note4) Length of cables must be 0.5m or shorter.

(Note5) The numbers in the above diagram do not indicate the actual device numbers.
<Wiring of other switches (SUBP)>

(Note1) Wirings for selector switches must be directly soldered to terminals or use tab terminals (110 series).

(Note2) When wiring the emergency stop switch, the crimp terminal must be fastened with thread.

(Note3) For NCs whose control unit and display are integrated, wire the emergency stop switch directly to the EMG connector of the control unit. (Use F120 cable)
And for NCs whose control unit and display are separated, relay it by the machine operation panel I/F PCB HN232.

(Note4) Select a rotary switch which guarantees 5V/1mA.

(Note5) Length of cables must be 0.5m or shorter.

(Note6) The numbers in the above diagram do not indicate the actual device numbers.
<Connection when the selector SW has 3 notches>

<Connection when relaying wiring to control panel>
2.12.2 MITSUBISHI CNC Machine Operation Panel B

Outline dimension

[FCU7-KB926 (MITSUBISHI CNC machine operation panel B)]

<Panel cut drawing>
Connector

<table>
<thead>
<tr>
<th>No.</th>
<th>Switch</th>
<th>No.</th>
<th>Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Memory protection switch</td>
<td>(3)</td>
<td>Spindle override (RSW2)</td>
</tr>
<tr>
<td>(2)</td>
<td>Emergency stop button</td>
<td>(4)</td>
<td>Cutting override (RSW1)</td>
</tr>
</tbody>
</table>

(1) Memory protection switch

<table>
<thead>
<tr>
<th></th>
<th>Contact configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Contact 1 (Common)</td>
</tr>
<tr>
<td>NO</td>
<td>Contact 1 (A contact)</td>
</tr>
<tr>
<td>NC</td>
<td>Contact 1 (B contact)</td>
</tr>
<tr>
<td>C</td>
<td>Contact 2 (Common)</td>
</tr>
<tr>
<td>NO</td>
<td>Contact 2 (A contact)</td>
</tr>
<tr>
<td>NC</td>
<td>Contact 2 (B contact)</td>
</tr>
</tbody>
</table>

<Switch type>
Switch: HA1K-2C2B
Recommended manufacturer: IDEC
Connection: Terminal (#110 type)
(2) Emergency stop button

Switch: XA1E-BV422MR
Recommended manufacturer: IDEC
Connection: Thread terminal (M3)

(3) Spindle override (RSW2)

Switch: AC09-GX0/7L3B02
Recommended manufacturer: Fuji Electric
Connection: Connector

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

Connector: IL-7S-S3L-(N)
Contact: L-C2-10000
Recommended manufacturer: Japan Aviation Electronics
(4) Cutting override (RSW1)

A  O  Output signal 1
B  O  Output signal 3
C  O  Output signal 5
D -  Common terminal
E  O  Output signal 4
F  O  Output signal 2
G  O  Output signal 6

<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
2.13 Exclusive CF Cards for MITSUBISHI CNC

<table>
<thead>
<tr>
<th>Item</th>
<th>FCU7-CF256M</th>
<th>FCU7-CF002G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>256MB</td>
<td>2GB</td>
</tr>
<tr>
<td>Operation-guaranteed temperature</td>
<td>-40 °C to +85 °C</td>
<td></td>
</tr>
<tr>
<td>NAND Flash</td>
<td>SLC (Note)</td>
<td></td>
</tr>
</tbody>
</table>

(Note) 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 CF cards.

2.13.1 Precautions for Use of Commercially Available CF Cards

Mitsubishi is unable to guarantee the machine operation when a commercially available CF card or SD memory card (SD-CF adapter is required) is used. In that case, performance check must be made carefully by machine tool builder.

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

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

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

Please refer to the following method for heat radiation countermeasures.

Example of heat radiation countermeasures

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

Procedures for heat design and verification

1. Refer to "General Specification" for the heat generated by each unit.
2. Enclosed cabinet (thin steel plate) cooling capacity calculation equation
   \[ W_1 = U \times A \times \Delta T \]
   U: 6 W/m²°C
   A: Effective heat radiation area (m²) (Area where heat can be radiated from operation panel)
   ΔT: Internal temperature rise value (10°C)
   (Caution) 8 W/m²°C can be applied only when the operation panel is so small that the internal temperature stays uniform.
3. Points of caution for heat radiation countermeasures when designing mounting state
   - Consider convection in operation panel (eliminate heat spots)
   - Collect hot air at suction port of heat exchanger in operation panel.
4. Criterion for internal temperature rise distribution data
   - ΔT (average value) ≤ 10°C
   - ΔTmax (maximum value) ≤ 15°C
   - R (inconsistency ΔTmax - ΔTmin) ≤ 6°C
   (Evaluate existence of heat spots)
The following shows an example of calculation applied to heat radiation countermeasures for the operation panel when 8.4-type display unit is used. Because heat will accumulate in the upper portions of the unit, install an agitating fan as required.
Calculation example of panel internal heating value

(1) Calculation of unit heating value

Heating value (W)

Total heating value of units (W):

28W (= control unit + display unit + keyboard unit + operation panel I/O unit)

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

5.6W (=24V (total heating value when the 32 points are simultaneously turned ON) × 7.3mA × 32)

... 24V (current consumption per point of the operation panel I/O unit DI) divided by 3.3kΩ ≈ 7.3mA

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

(2) Calculation of operation panel cooling capacity

Tolerance value for temperature rise (⊿t)

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

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

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

Heat radiation area (A)

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

Heat radiation area A = 0.71mm²

(≈ 0.6 × 0.12 + 0.6 × 0.5 × 2 - (0.26 + 0.14) × 0.2 + 0.12 × 0.5 × 2)

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

Operation panel cooling capacity (W1)

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

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

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

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

(4) Confirmation with the actual machine

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

3.2.1 Connection of FG (Frame Ground)

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

(Note) "24VDC" represents (+) side of 24V stabilized power supply, while "0V(RG)" represents (-) side. "FG" (Frame Ground) corresponds to the general expression "PE" (Protective Earth).
3.2.2 Shield Clamping of Cables
The shield cables connected to the units must be properly connected to the ground with clamp fittings and the like in order to stabilize the system's operation while preventing malfunctioning due to exogenous noise. (Refer to "EMC Installation Guidelines: EMC Countermeasure Parts: Shield Clamp Fitting").

3.2.3 Connecting Spark Killers
Connect a spark killer on the coil or the contact in parallel for noise countermeasures. Use spark killers which are 0.33 to 0.1 μF, 10 to 120 Ω.
3.3 Unit Installation

3.3.1 Display Unit

Mount 8.4-type display unit and 10.4-type display unit with four fixing screws and the 15-type display unit with eight fixing screws.

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

[8.4-type display unit/10.4-type display unit]
3.3.2 Keyboard Unit

Mount the keyboard unit with four fixing screws.

(Note 1) Refer to “General Specifications: Keyboard Unit” for the panel cut dimension drawing and the screw hole position.

(Note 2) A clear protective film covers the sheet keys of the keyboard at the time of shipment. Make sure to remove the sheet before use.

3.3.3 Operation Panel I/O Unit

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

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

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

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

[Installation method]

1. Check that the machine power is turned OFF. (If the power is not OFF, turn it OFF.)
2. Confirm that the control unit LED, 7-segment display, etc., are all OFF.
3. Open the battery cover of the control unit. Pull the right side of the battery cover toward front.
4. Fit the new battery into the battery holder.
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.
3.3.5 CC-Link Unit

(Note) For details on how to install the optional unit, refer to the installation procedure sheet attached to the optional unit.

This chapter explains how to install CC-Link unit alone as an example.
If installing CC-Link unit as a second optional unit, refer to the installation procedure sheet.

(1) Remove the ADONCCB connector's cover of the control unit.
(2) Connect the CC-Link unit to the control unit's ADONCCB connector.
(3) Fix the CC-Link unit with two screws (on the upper right and the bottom left) and mount the back cover.
[Where to connect the CC-Link]

Connect the ADONCCB BOT connector on the back side of the CC-Link unit to the ADONCCB connector on the control unit.

[Back cover installation]

(1) Insert the three tabs on the bottom edge of the cover into the control unit.

(2) Insert two snap-fits on the top right and left edges of the cover into the control unit.

(Back side of the CC-Link Unit)
Connection
4.1 Precautions for Wiring

4.1.1 Precautions when Connecting/Disconnecting Cables

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

Disconnect each cable with the following procedures.

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

⚠️ CAUTION

1. Do not connect or disconnect the 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.

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.
4.1.2 Precautions for Using Optical Communication Cable

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

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

4.1.2.1 Optical Communication Cable Outline and Parts

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

4.1.2.2 Precautions for Handling Optical Communication Cable

(1) A protective cap is attached to the optical module and optical communication cable mounted on the PCB when the system is delivered. Leaving this protective cap unattached could result in connection faults from the adherence of dirt and dust. Do not remove the protective cap when not connecting the cable. If dirty, wipe off lightly with a piece of dry gauze, etc. (Do not use solvents such as alcohol as the optical fiber material could melt.)

(2) Hold the connector section when connecting or disconnecting the optical connector. Holding the fiber cord will result in force exceeding the tolerable tension on the fiber cord and connector connection section, and could cause the fiber cord to dislocate from the optical connector thereby inhibiting use.

(3) The optical connector cannot be connected in reversed. Check the connector orientation when connecting the optical communication cable to the optical module. Align the connector lock lever with the lock holes on the PCB's optical module, and press the connector straight in. Confirm that the lock lever connects with the optical module and that a "click" is heard.

(4) When disconnecting the optical communication cable from the PCB, press the lock release buttons on the lock lever, and pull out the cable while holding the connector section. The connector could be damaged if the cable is pulled without pressing down on the lock release buttons.

(5) Do not apply excessive force onto the optical communication cable by stepping on it or dropping tools, etc., on it.
4.1.2.3 Precautions for Laying Optical Communication Cable

1. Do not apply a force exceeding the cable's tolerable tension. Binding the cables too tight with tie-wraps could result in an increased loss or a disconnection. Use a cushioning material such as a sponge or rubber when bundling the cables and fix so that the cables do not move.

2. Do not connect the cables with a radius less than the tolerable bending radius. Excessive stress could be applied near the connector connection section and cause the optical characteristics to drop. The cable bending radius should be 10 times or more than the outer diameter at the reinforced sheath, and 20 times or more than the outer diameter at the fiber cord section.

3. Do not apply torsion to the optical communication cable. Laying a twisted cable could cause the optical characteristics to drop.

4. When laying the cables in a conduit, avoid applying stress on the fiber cord and connector connection section. Use the tensile end such as a pulling eye or cable grip, etc.

5. Fix the reinforced sheath with a cable clamp so that the mass of the optical communication cable is not directly applied on the fiber cord and connector connection section.

6. Never bundle the cables with vinyl tape. The plasticizing material in the vinyl tape could cause the POF cable to break.

7. Loop the excessive cable with twice or more than the minimum bending radius.

4.1.3 Precautions for Connecting 24V Power Supply

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

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

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

4.2.1 Control Unit Connection System Drawing

(Note) Connect the "TP" when the unit is display unit with touch panel or 15-type display unit.
4.2.2 Connecting with Power Supply

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

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

- **(Note 1)** Rush current may occur to lead welding on the contacts, when a magnetic switch such as relay directly controls 24VDC’s ON/OFF during 24V power supply to the control unit. Use relay with large heat capacity of contacts to control 24VDC’s ON/OFF.
- **(Note 2)** Make a short-circuit between 0V and FG on the terminal to cut noise.

**Related items**
- Cable drawing: "Cable: F070 Cable"
- Connector pin assignment: "General Specifications: Control Unit" (DCIN connector)

(2) When using PD25 power supply unit

- **(Note)** MITSUBISHI CNC 700VS series does not employ ACFAIL function. (CF01 is not connected.)

**Related items**
- Cable drawing: "Cable: F110 Cable", "Cable: F170 Cable"
- Connector pin assignment: "General Specifications: Control Unit" (DCIN connector)
4.2.3 Connecting with Emergency Stop Signal

Connect the emergency stop switch to EMG connector by F120 cable.

Besides the emergency stop input from the NC controller, double-protection when an emergency stop occurs can be provided by directly inputting an external emergency stop to the drive unit. Even if the emergency stop is not input from NC for some reason, the contactors can be shut off by the external emergency stop input.

Outlines are shown below. For more details, refer to the Instruction Manual of each drive unit.

<Related items>
Cable drawing: "Cable: F120 Cable"

<Power supply unit (MDS-D2-CV) external emergency stop: Example>
<Drive unit (MDS-DJ-V1) 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.
4.2.4 Connecting with Operation Panel I/O Unit

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

**<Related items>**
- Cable drawing: "Cable G011 Cable"
- Connector pin assignment: "General Specifications: Control Unit" (CG71 connector)
4.2.5 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. Up to 16 axes can be connected per system. 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**

<table>
<thead>
<tr>
<th>Cable</th>
<th>Panel internal wiring</th>
<th>Panel external wiring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under 10m</td>
<td>10 to 30m</td>
</tr>
<tr>
<td>G396</td>
<td>O</td>
<td>x</td>
</tr>
<tr>
<td>G395</td>
<td>O</td>
<td>x</td>
</tr>
<tr>
<td>G380</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

(Note) Wiring of over 30m can be applied when relaying the optical signal by optical communication repeater unit. Refer to the specification manual of the drive unit for the details of the optical communication repeater unit.
4.2.5.1 Connecting with MDS-D2/DH2 Series

⚠️ 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 bending radius within 80mm.

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-DH2-CV.

3. A spindle drive unit that controls the high-speed synchronous tapping (OMR-DD control) has to be connected on the farther side from the NC than the subject synchronous tapping control.

💡 POINT

Axis Nos. are determined by the rotary switch for setting the axis No. (Refer to the instruction 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

The optical communication cables from the NC to the final drive unit must be within 30m.
(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) When using one power supply unit”.

![Connections when using two power supply units within a single NC communication bus system](image)

**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.
4.2.5.2 Connecting with MDS-DM2 Series

⚠️ 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 bending radius within 80mm.

2. A spindle drive unit that controls the high-speed synchronous tapping (OMR-DD control) has to be connected on the farther side from the NC than the subject synchronous tapping control. Thus, if you use an MDS-DM2 unit for servo control of the high-speed synchronous tapping, combinable spindle drive is that of the MDS-DM2 unit only.

(1) When using only MDS-DM2-SPV Series

(2) When using the MDS-D2 unit together

POINT

For MDS-DM2-SPV Series, axis Nos. are fixed as follows.

1st axis : spindle
2nd axis : servo L axis
3rd axis : servo M axis
4th axis : servo axis (only MDS-DM2-SPV3)
4.2.5.3 Connecting with MDS-DJ Series

**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 bending radius within 80mm.
2. A spindle drive unit that controls the high-speed synchronous tapping (OMR-DD control) has to be connected on the farther side from the NC than the subject synchronous control.

**POINT**

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

< Connection >

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

CN1B:CN1A connector on next stage's drive unit

---

The optical communication cables from the NC to the final drive unit must be within 30m.
4.2.6 Connecting with Optical Communication Repeater Unit

⚠️ CAUTION
Optical Communication Repeater Unit cannot be used to connect between two Servo Drive Units.

(1) Connection example

For the 1st part system, connect the control unit to OPT1IN and the drive unit to OPT1OUT.
For the 2nd part system, connect the control unit to OPT2IN and the drive unit to OPT2OUT.
(Note) The figure below is an example of the two part system's optical communication.

---

L1: Distance between the drive unit and the control unit.
L2: Distance between the drive unit and the optical communication repeater unit. (The wire length of G380 cable)
L3: Distance between the optical communication repeater unit and the control unit. (The wire length of G380 cable)

<Related items>
- Cable drawing "Cable: F070 Cable", "Cable: G380 Cable"
- Connector pin assignment: "General Specifications: Optical Communication Repeater Unit" (DCIN connector, OPT1IN connector, OPT1OUT connector, OPT2IN connector, OPT2OUT connector)
(2) **Power Supply Sequence**

The diagram below shows the timing of power ON/OFF of the drive unit 200VAC (400VAC), the optical communication repeater unit, and the control unit.

**[Power ON]**
Turn the power ON in the following order; drive unit -> optical communication repeater unit -> control unit.
If the control unit is powered ON before the optical communication repeater unit, the initial communication with the drive unit may fail and cause an alarm.

**[Power OFF]**
Turn the power OFF in the following order; control unit -> optical communication repeater unit -> drive unit.
Set aside more than 8ms the time difference between the power OFF of the control unit and the power OFF of the optical communication repeater unit.
If the optical communication repeater unit is powered OFF before the drive unit, or the time lag is less than 8ms, data acquisition from the drive unit may fail and cause an alarm.

![Diagram of power supply sequence]

- **t1**: Time lag between the power-ON of the drive unit and the optical communication repeater unit
- **t2**: Time lag between the power-ON of the optical communication repeater unit and the control unit
- **t3**: Time lag between the power-OFF of the optical communication repeater unit and the control unit
4.2.7 Connecting with I/O Devices via CC-Link

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

(Note) CC-Link is an option unit.

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

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

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

1. Remove the sheath of the cable and isolate each internal wire from the shield mesh.
2. Remove the shield mesh and the coat of each internal wire. Twist the core wires.

3. In the intermediate station, twist together the same wires or the shield meshes of the cables from/to the previous/next station.
4. In the final station, process the provided terminator as follows to attach to the station.

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

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

(Note 1) Do not solder-plate the core wire, which leads a defective cable contact.
(Note 2) Make sure the lead wires are kept inserted when mounting the terminator.
4.2.8 Connecting with RS-232C Device

(1) Connect the RS-232C device to the connector SIO1/SIO2.

Cable drawing: "Cable: F034/F035 Cable"
Connector pin assignment: "General Specifications: Control Unit" (SIO connector)
(2) Example of wiring connections to the RS-232C device
When connecting to the RS-232C device, refer to the following diagrams and cross the wiring for the transmission signals.

- **Hand shaking upon RS/CS, ER/DR signals**
- **No hand shaking upon RS/CS, ER/DR signals**
4.2.9 Connecting with Skip Signal (Sensor)
Connect skip signals to the connector SKIP.
Skip signals are used for processing high-speed signals. Always shield the cable.

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

(1) Connection of skip signal cable

<0V connection at COM terminal>
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.).

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: FCUA-R930 Cable"
Connector pin assignment: "General Specifications: Control Unit" (SKIP connector)
4.2.10 Connecting with Synchronous Feed Encoder/ Manual Pulse Generator

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

<Related items>
- Cable drawing: "Cable: FCUA-R050/R054 Cable" and "Cable: G023/G024 Cable"
- Connector pin assignment: "General Specifications: Control Unit" (ENC connector)

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

4.2.10.1 Handle Numbers

Unit configuration decides handle Nos.
*ENC*: Connector on control unit *MPG*: Connector on operation panel I/O unit

<table>
<thead>
<tr>
<th>Operation panel I/O unit (FCU7-DX71x/ DX72x/ DX73x/DX621)</th>
<th>1st handle</th>
<th>2nd handle</th>
<th>3rd handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used</td>
<td>&quot;MPG&quot; 1ch</td>
<td>&quot;MPG&quot; 2ch</td>
<td>&quot;ENC&quot; 1ch (Note)</td>
</tr>
<tr>
<td>Not used</td>
<td>&quot;ENC&quot; 1ch</td>
<td>&quot;ENC&quot; 2ch</td>
<td>-</td>
</tr>
</tbody>
</table>

(Note) If one handle is only connected to "MPG", the handle connected to "ENC" 1ch will still be treated as the 3rd handle. "ENC" 2ch is not employed when an operation panel I/O unit is used.
4.2.11 Connecting with Safety Observing I/O Device

Safety observing functions follow "IEC61800-5-2/EN61800-5-2", and safety of the functions complies with "EN ISO13849-1:2008 (PL d, Category 3)". However, make sure to check the safety of the machine by using "risk assessment".

With this function, the following executions can be realized.

1. Open the door without shutting the motor drive power OFF.
2. Operate under the safety speed or lower while the door is opened.

Refer to the "Safety Handbook (Original Instructions)" (IB-1501025) for the details of the connection with the safety observing I/O devices.

Refer to the instruction manual of the drive unit for the details of the connection with the drive unit.

4.2.11.1 Connection diagram using I/O unit

Connect safety observing I/O device as the example below. (Below is an example where an MDS-DJ series drive unit is used.)
4.2.11.2 Connection diagram using the STO-compatible drive system

STO (Safe Torque Off) is a function to execute the gate shutdown by drive unit's internal circuit. This function can be substituted for one of the two contactors that were used for the redundant power shutdown. However, the STO function can be substituted for one of the contactors.
### 4.3 Connection of Operation Panel I/O Unit

#### 4.3.1 Operation Panel I/O Unit Connection System Drawing

<table>
<thead>
<tr>
<th>Operation panel I/O unit</th>
<th>Control unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG71</td>
<td>CG71</td>
</tr>
<tr>
<td>R/O3</td>
<td>Remote I/O unit, scan I/O unit card MITSUBISHI CNC Machine operation panel</td>
</tr>
<tr>
<td>CG31</td>
<td>Machine control panel, switchboard, etc.</td>
</tr>
<tr>
<td>CG32</td>
<td>Machine control panel, switchboard, etc.</td>
</tr>
<tr>
<td>CG33</td>
<td>Machine control panel, switchboard, etc.</td>
</tr>
<tr>
<td>CG34</td>
<td>Machine control panel, switchboard, etc.</td>
</tr>
<tr>
<td>CG35</td>
<td>Machine control panel, switchboard, etc.</td>
</tr>
<tr>
<td>CG36</td>
<td>Machine control panel, switchboard, etc.</td>
</tr>
<tr>
<td>AO</td>
<td>Machine control panel, switchboard, etc.</td>
</tr>
<tr>
<td>MPG</td>
<td>12V manual pulse generator</td>
</tr>
<tr>
<td></td>
<td>5V manual pulse generator</td>
</tr>
<tr>
<td>NCKB</td>
<td>Keyboard unit</td>
</tr>
</tbody>
</table>
4.3.2 Connecting with Keyboard Unit

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

(Note) Firmly insert the connection cable until it is locked.
4.3.3 Connecting with Manual Pulse Generator (MPG)

Both 5V power supply type (UFO-01-2Z9) 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: F023/F024 Cable”
Connector pin assignment: “General Specifications: Operation Panel I/O Unit” (MPG connector)
4.3.3.1 Handle Numbers

Unit configuration decides handle Nos.
"ENC": Connector on control unit "MPG": Connector on operation panel I/O unit

<table>
<thead>
<tr>
<th>Operation panel I/O unit (FCU7-DX71x/ DX72x/ DX73x/DX621)</th>
<th>1st handle</th>
<th>2nd handle</th>
<th>3rd handle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used</td>
<td>&quot;MPG&quot; 1ch</td>
<td>&quot;MPG&quot; 2ch</td>
<td>&quot;ENC&quot; 1ch (Note)</td>
</tr>
<tr>
<td>Not used</td>
<td>&quot;ENC&quot; 1ch</td>
<td>&quot;ENC&quot; 2ch</td>
<td>-</td>
</tr>
</tbody>
</table>

(Note) If one handle is only connected to "MPG", the handle connected to "ENC" 1ch will still be treated as the 3rd handle. "ENC" 2ch is not employed when an operation panel I/O unit is used.

4.3.4 Connecting with Machine Operation Panel

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

<Related items>
Cable drawing: "Cable: F351 Cable"
Connector pin assignment: "General Specifications: Operation Panel I/O Unit" (CG31/CG32/CG33/CG34/CG35/CG36 connector)
4.3.4.1 Wiring for 24V Common Input

For connection details, refer to the descriptions on machine input connector pin assignment in "(1) Machine input (CG31)", "(2) Machine input (CG33)", and "(3) Machine input (CG35)" under Section "General Specifications: Operation Panel I/O Unit".

Sink type

Control unit

(Machine side) CG31/CG33/CG35
4.3.4.2 Wiring for 0V Common Input

For connection details, refer to the descriptions on machine input connector pin assignment in "(1) Machine input (CG31)", "(2) Machine input (CG33)", and "(3) Machine input (CG35)" under Section "General Specifications: Operation Panel I/O Unit".
4.3.4.3 Wiring for Sink Type Output (FCU7-DX710/DX720/DX730)

Operation panel I/O unit

(Card name : HN341/HN361/HN362)

Machine side

- Connect +24V to either or both of the flat connector 1B, 2B (24VDC). (*1)
- Connect 0V (GND) to the flat connector 3A, 3B, 4A, 4B (GND). (*2)
- Decide the number of GNDs to wire with regard to the total amount of each connector's maximum output current and the voltage drop by the cables. The rated current is 1A per connector pin.
- Connect 0V (GND) to the flat connector 1A, 2A (GND). (*3)
- When large current flows due to small amount of connected load, fuse may be blown out or 24V power supply voltage may drop. In order to secure the appropriate current value, watch the connected load.

(Note 1) Connect +24V to either or both of the flat connector 1B, 2B (24VDC). (*1)
(Note 2) Connect 0V (GND) to the flat connector 3A, 3B, 4A, 4B (GND). (*2)
(Note 3) Connect 0V (GND) to the flat connector 1A, 2A (GND). (*3)
(Note 4) When large current flows due to small amount of connected load, fuse may be blown out or 24V power supply voltage may drop. In order to secure the appropriate current value, watch the connected load.
4.3.4.4 Wiring for Source Type Output (FCU7-DX711/DX721/DX731)

Operation panel I/O unit

(Card name : HN351/HN371/HN372) Machine side

<table>
<thead>
<tr>
<th>CG32 (CG34,CG36)</th>
<th>24VDC</th>
<th>24VDC</th>
<th>24VDC</th>
<th>24VDC</th>
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<tbody>
<tr>
<td></td>
<td>1B</td>
<td>2B</td>
<td>3A</td>
<td>3B</td>
<td>4A</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y215</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y216</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y217</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Y218</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Y219</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y21A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y21B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y21C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y21D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y21E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y21F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Note 1) Connect +24V to either or both of the flat connector 1B, 2B (24VDC). (*1)
(Note 2) Connect +24V (GND) to the flat connector 3A, 3B, 4A, 4B (24VDC). (*1)
Decide the number of 24VDCs to wire with regard to the total amount of each connector's maximum output current and the voltage drop by the cables. The rated current is 1A per connector pin.
(Note 3) Connect 0V (GND) to the flat connector 1A, 2A (GND). (*2)
(Note 4) When large current flows due to small amount of connected load, fuse may be blown out or 24V power supply voltage may drop. In order to secure the appropriate current value, watch the connected load.
4.3.4.5 Outline of Analog Signal Output Circuit

The analog signal output circuit can be used only for the FCU7-DX720/DX721.
4.4 Connection of Remote I/O Unit

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

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

When connecting directly to the control unit

<table>
<thead>
<tr>
<th>Station No.</th>
<th>Rotary switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

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

When using MITSUBISHI CNC Machine operation panel, RIO station No. "4" to "6" will be occupied.
When connecting to the operation panel I/O unit

Control unit
FCU7-MUS31/ FCU7-MU541/ FCU7-MA541

Operation panel I/O unit
FCU7-DX710/711

Remote I/O unit
FCUA-DX1xx

Max. 4 channels
Max. input: 128 points (X240 to X2BF)
Max. output: 128 points (Y240 to Y2BF)

Max. 3 channels
Max. input: 96 points (X260 to X2BF)
Max. output: 96 points (Y260 to Y2BF)

(Note) Operation panel I/O unit occupies the specified Nos. of stations. (Station No. 7 and 8 are reserved for manual pulse generator.)
RI03 can use either four stations (3rd to 6th) or three stations (4th to 6th) which depends on the operation panel I/O unit type.
4.4.2 Station No. Setting when Using Multiple Remote I/O Units

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

<table>
<thead>
<tr>
<th>Unit type</th>
<th>Number of occupied stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCUA-DX10x</td>
<td>1</td>
</tr>
<tr>
<td>FCUA-DX11x</td>
<td>2</td>
</tr>
<tr>
<td>FCUA-DX12x</td>
<td>2</td>
</tr>
<tr>
<td>FCUA-DX14x</td>
<td>2</td>
</tr>
</tbody>
</table>

When using multiple remote I/O units, a characteristic station No. must be set for each unit. The FCUA-DX10x unit has one rotary switch, FCUA-DX11x, DX12x and DX14x unit have two. Each of these switches must be set to a characteristic station No. within a range of 0 to 7 (2 or 3 to 5 when connected to the operation panel I/O unit).

When connecting directly to the control unit

Setting example 1

Total number of occupied stations: 1

Setting example 2

Number of occupied stations: 1 2
Total number of occupied stations: 3
Setting example 3

FCUA-DX110/111
or
FCUA-DX120/121

Number of occupied stations: 2 2 2 2
Total number of occupied stations: 8 (Maximum configuration)
When connecting to the operation panel I/O unit
Station No. 1, 2, 7, 8 (or 1, 2, 3, 7, 8) are occupied by the operation panel I/O unit. (Station No. 7 and 8 are reserved for manual pulse generator.)

The maximum numbers of stations and I/O points assigned to remote I/O unit(s) via RIO3 are as follows.

<table>
<thead>
<tr>
<th>Operation panel I/O unit type</th>
<th>Max. number of stations (RIO3 connection)</th>
<th>Max. number of I/O points (RIO3 connection)</th>
<th>Remote I/O Rotary switch Setting range</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCU7-DX710</td>
<td>4 stations (No. 3 to 6)</td>
<td>128 points/128 points</td>
<td>2 to 5</td>
</tr>
<tr>
<td>FCU7-DX711</td>
<td>4 stations (No. 3 to 6)</td>
<td>128 points/128 points</td>
<td>2 to 5</td>
</tr>
<tr>
<td>FCU7-DX720/730/721/731</td>
<td>3 stations (No. 4 to 6)</td>
<td>96 points/96 points</td>
<td>3 to 5</td>
</tr>
</tbody>
</table>

**Setting example 1**

FCU7-DX710/711

![Diagram of FCU7-DX710/711 and FCUA-DX100/101]

Number of occupied stations: 1

Total number of occupied stations: 1

**Setting example 2**

FCU7-DX710/711

![Diagram of FCU7-DX710/711 and FCUA-DX110/111 or FCUA-DX120/121]

Number of occupied stations: 2

Total number of occupied stations: 4 (Maximum configuration)
Setting example 3

FCU7-DX720/721
/730/731 + FCUA-DX100/101 + FCUA-DX110/111
or FCUA-DX120/121

Number of occupied stations: 1

2

Total number of occupied stations: 3 (Maximum configuration)
4.4.3 Connecting FCUA-DX10x/14x Unit with Machine Control Signal

<table>
<thead>
<tr>
<th>Type of machine input/output signal and number of points</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 points</td>
<td>32 points</td>
<td></td>
</tr>
</tbody>
</table>

<Outline of connection>

Connection to 24V common (example)

Connection to 0V common (example)

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

Machine side control panel, etc.

24VDC(+)
0V(RG)

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

<Adaptive connector>

DCIN (CN220)
RIO1/RIO2 (CN211)
DI-L/DO-L (CN300)
Terminator (R-TM)

(Note 1) ( ) is the MITSUBISHI original type name.
(Note 2) Refer to "Cable: R-TM Terminator Connector" for the details of R-TM.
4.4.4 Connecting FCUA-DX14x Unit with Analog Input/Output Signal

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

**Input/output circuit**

**CAUTION**

1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.
4.4.5 Connecting FCUA-DX11x Unit with Machine Control Signal

<table>
<thead>
<tr>
<th>Type of machine input/output signal and number of points</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>64 points</td>
<td></td>
<td>48 points</td>
</tr>
</tbody>
</table>

<Outline of connection>

Connection to 24V common (example)

- 24VDC(+) to A3, B3, COM
- 0V (RG) to B1, B2, A1, A2
- 24VDC(+) to DI-L/R
- DO-L/R to Output circuit
  - Sink type
- RIO1, RIO2, DCIN to Control circuit
- Stabilized power supply
  - 24VDC(+) 0V FG

Connection to 0V common (example)

- 24VDC(+) to A3, B3, COM
- 0V (RG) to B1, B2, A1, A2
- 24VDC(+) to DI-L/R
- DO-L/R to Output circuit
  - Sink type
- RIO1, RIO2, DCIN to Control circuit
- Stabilized power supply
  - 24VDC(+) 0V FG

**CAUTION**

1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.
4.4 Connection of Remote I/O Unit

**<Signal assignment>**

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

**<Adaptive connector>**

- **DCIN (CN220)**
  - Connector: 2-178288-3
  - Contact: 1-175218-5
  - Manufacturer: Tyco Electronics

- **RIO1/RIO2 (CN211)**
  - Connector: 1-178288-3
  - Contact: 1-175218-2
  - Manufacturer: Tyco Electronics

- **DI-L/DO-L (CN300)**
  - Solderless type connector: 7940-6500SC
  - Manufacturer: 3M

- **DI-R/DO-R**
  - Solderless type connector: 7940-6500SC
  - Manufacturer: 3M

- **Terminator (R-TM)**
  - Connector: 1-178288-3
  - Contact: 1-175218-2
  - Manufacturer: Tyco Electronics

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

(Note 2) Refer to "Cable: R-TM Terminator Connector" for the details of R-TM.
4.4.6 Connecting FCUA-DX12x Unit with Machine Control Signal

**<Outline of connection>**

**Connection to 24V common (example)**

- **24VDC(+)**
  - DI-L/R
  - 0V (RG)
  - FCUA-DX120
  - A3
  - B3
  - 2.2kΩ
  - Input circuit
  - Sink type
  - DO-L/R
  - B4
  - A4
  - DAC
  - Control circuit
  - Stabilized power supply
  - 24VDC(+) 0V FG

**Connection to 0V common (example)**

- **0V(RG)**
  - FCUA-DX121
  - A3
  - B3
  - 2.2kΩ
  - Input circuit
  - Source type
  - DO-L/R
  - B4
  - A4
  - DAC
  - Control circuit
  - Stabilized power supply
  - 24VDC(+) 0V FG

---

**CAUTION**

1. Connect the cable to the designated connector. Incorrect connections could damage the device.
2. Do not connect or disconnect the connection cables between each unit while the power is ON.
4.4 Connection of Remote I/O Unit

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

<Signal assignment>

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

<Adaptive connector>

Machine side control panel, etc.

24VDC(+) 0V

24VDC(+) 0V

24VDC(+) 0V

24VDC(+) 0V

Control unit

Operation panel I/O unit

Remote I/O unit

<CAUTION>

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

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

(Note 2) Refer to "Cable: R-TM Terminator Connector" for the details of R-TM.
4.5 Connection of MITSUBISHI CNC Machine Operation Panel

(Note) In this chapter "MITSUBISHI CNC Machine operation panel" is shortened to Machine operation panel.

Connect Machine operation panel A to the remote I/O unit I/F of control unit or operation panel I/O unit.
- Machine operation panel A (RIOIN) - cable (FCUA-R211 or SH41) - control unit (RIO1)
- Machine operation panel A (RIOIN) - cable (G214) - control unit (CG72)
- Machine operation panel A (RIOIN) - cable (FCUA-R211 or SH41) - operation panel I/O unit (RIO3)

When supplying power to control unit from Machine operation panel A, the following connection is necessary.
- Machine operation panel A (DCOUT) - cable (G071) - control unit (DCIN)

Connect Machine operation panel B to Machine operation panel A and control unit as follows.
- Machine operation panel B - cable (G460) - Machine operation panel A (SUBP)
- Machine operation panel B - cable (F120) - control unit (EMG)

[When connecting to operation panel I/O unit (RIO3)]

<Related items>

Cable drawing: "Cable: F120 Cable"
- "Cable: FCUA-R211 Cable"
- "Cable: G460 Cable"
- "Cable: SH41 Cable"
- "Cable: G214 Cable"
- "Cable: G011 Cable"

Connector pin assignment: "General Specifications: Operation panel I/O unit" (RIO3 connector/DCIN connector/DCOUT connector/RIOIN connector/SUBP connector/EMG connector/CG71 connector)
<Software Interface>

Machine operation panel occupies RIO station No. 4 to 6. The device numbers for switch and LED on operation panel are fixed as listed below.

The following lists the devices for using the RIO 1st channel.

### Table: Device No. for Machine operation panel

<table>
<thead>
<tr>
<th>Station</th>
<th>Device No.</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X00 ~ X1F/Y00 ~ Y1F</td>
<td>Machine operation panel B (Switch)</td>
</tr>
<tr>
<td>2</td>
<td>X20 ~ X3F/Y20 ~ Y3F</td>
<td>Machine operation panel A (Key switch/LED)</td>
</tr>
<tr>
<td>3</td>
<td>X40 ~ X5F/Y40 ~ Y5F</td>
<td>Machine operation panel A (Key switch/LED)</td>
</tr>
<tr>
<td>4</td>
<td>X60 ~ X7F/Y60 ~ Y7F</td>
<td>16 points vacant</td>
</tr>
<tr>
<td>5</td>
<td>X80 ~ X9F/Y80 ~ Y9F</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>XA0 ~ XBF/YA0 ~ YBF</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>XC0 ~ XDF/YC0 ~ YDF</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>XE0 ~ XFF/YE0 ~ YFF</td>
<td></td>
</tr>
</tbody>
</table>

(1) **Machine operation panel B (Switch)**

Machine operation panel B is equipped with rotary switches (cutting override, spindle override) and a selector switch (memory protection key), and an emergency stop button. Direct wiring connection will be applied to the emergency stop button, and device numbers for other switches are defined as listed below.

(a) **Cutting override (6bit)**

21 position code list

<table>
<thead>
<tr>
<th>Device No.</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X60</td>
<td>X61</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
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<td>5</td>
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<td>6</td>
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<td>7</td>
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<td>9</td>
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<td>11</td>
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<td>12</td>
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<td>14</td>
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<td>17</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>
(b) Spindle override (6bit)

8 position code list

<table>
<thead>
<tr>
<th>Setting value</th>
<th>X66</th>
<th>X67</th>
<th>X68</th>
<th>X69</th>
<th>X6A</th>
<th>X6B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

(c) Memory protection switch (1bit)

Memory protection switch X6C
Spare X6D - X6F

(2) Machine operation panel A (Key switch/LED)

Machine operation panel A is equipped with 55 switches and 55 LEDs.
They are allocated X device and Y device as in the figure below.

(Note1) If the stations of Machine operation panel and other RIO unit overlap, all the connections of the overlapping RIOs will be invalidated and cannot be used. Stations which do not overlap can be used.

(Note2) Refer to the last page "Table: Device No. for Machine operation panel" for the device No. when connecting to RIO2 and RIO3.
4.6 Connection of Scan I/O card

(1) External power supply (DCIN)

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

- Output: 24VDC±5%
- Ripple: ±5%(P-P)
- Rated output current: 2.5A

* The rated output current is the value when using 60mA × 32 points for the machine output. Prepare a power supply that satisfies the 24VDC output's total output current and control current (0.5A).

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

(a) Connection of the RIO3A connector

Connect the RIO3A to the RIO1,CG72(RIO2) connector of the control unit or the RIO3 of the operation panel I/O unit.

(b) Connection of the RIO3B connector

Multiple remote I/O units can be used, as long as the total No. of occupied stations connected with serial links is less than eight. (Refer to "Connection: Connection of Remote I/O Unit" for details.) HR357 occupies three stations, so the remote I/O units can be connected to the RIO3B in combinations of 5 stations or less. Connect a terminator to the RIO3B when it is not connected to any device.
4 Connection
Appendix 1

Cable
Symbols for writing cable drawings

1. indicates twisted pair.
2. indicates the shield sheath.
3. indicates shield clamping to the grounding plate.
4. In the cable drawings, the partner of the twisted pair cable is given a priority, so the pin No. of the connectors at both ends are not necessary in number of order.
5. Equivalent parts can be used for the connector, contact and wire material.
Appendix 1.1 Cable Wire and Assembly

(1) Cable wire

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

(a) Heat resistant specifications cable

<table>
<thead>
<tr>
<th>Wire type (special order part)</th>
<th>Finish outer diameter</th>
<th>Sheath material</th>
<th>No. of pairs</th>
<th>Configuration</th>
<th>Conductive resistance</th>
<th>Withstand voltage</th>
<th>Insulation resistance</th>
<th>Heat resistance temperature</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD20285 Compound 6-pair shielded cable</td>
<td>8.7mm</td>
<td>Heat resistant PVC</td>
<td>2 (0.5mm²)</td>
<td>100 strands/0.08mm</td>
<td>40.7 Ω/km or less</td>
<td>500VAC/1min</td>
<td>1000MΩ/km or more</td>
<td>105°C</td>
<td>70 × 10⁴ times or more at R200</td>
</tr>
<tr>
<td></td>
<td>4 (0.2mm²)</td>
<td>40 strands/0.08mm</td>
<td>103 Ω/km or less</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) General-purpose heat resistant specifications cable

<table>
<thead>
<tr>
<th>Wire type (special order part)</th>
<th>Finish outer diameter</th>
<th>Sheath material</th>
<th>No. of pairs</th>
<th>Configuration</th>
<th>Conductive resistance</th>
<th>Withstand voltage</th>
<th>Insulation resistance</th>
<th>Heat resistance temperature</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD20032 Compound 6-pair shielded cable</td>
<td>8.7mm</td>
<td>PVC</td>
<td>2 (0.5mm²)</td>
<td>100 strands/0.08mm</td>
<td>40.7 Ω/km or less</td>
<td>500VAC/1min</td>
<td>1000MΩ/km or more</td>
<td>60°C</td>
<td>100 × 10⁴ times or more at R200</td>
</tr>
<tr>
<td></td>
<td>4 (0.2mm²)</td>
<td>40 strands/0.08mm</td>
<td>103 Ω/km or less</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

Compound 6-pair cable structure drawing

Core identification

<table>
<thead>
<tr>
<th>Pair No.</th>
<th>Insulator color</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>A1 (0.5mm²)</td>
<td>Red White</td>
</tr>
<tr>
<td>A2 (0.5mm²)</td>
<td>Black White</td>
</tr>
<tr>
<td>B1 (0.2mm²)</td>
<td>Brown Orange</td>
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<tr>
<td>B2 (0.2mm²)</td>
<td>Blue Green</td>
</tr>
<tr>
<td>B3 (0.2mm²)</td>
<td>Purple White</td>
</tr>
<tr>
<td>B4 (0.2mm²)</td>
<td>Yellow White</td>
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</tbody>
</table>
(2) **Cable assembly**

Assemble the cable with the cable shield wire securely connected to the ground plate of the connector.
Appendix 1.2 CNP2E-1 Cable

Max. cable length: 30m
Application: Motor side PLG cable
Spindle side accuracy detector
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".

Case

grounding

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

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

<note>
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)>
Appendix 1.3 CNP3EZ-2P/CNP3EZ-3P Cable

Max. cable length: 30m
Application: Spindle side detector 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)

Case grounding

<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)

Case grounding

<Cable connection diagram (for 15m to 30m)>
Appendix 1.4 CNV22J-K1P / CNV22J-K2P Cable

Max. cable length: 0.3m
Application: For HF-KP (Servo) Motor side detector relay cable (motor side)
Compatible with only IP65
CNV22J-K1P (load side angle)
CNV22J-K2P (reverse load side angle)

Servo drive unit side connector
(DDK)
Plug: CM10-CR10P-M

Servo motor detector/
Ball screw side detector side connector
Plug: 1747464-1
Contact: 167435-4

Case ground

**Cable connection diagram**
Appendix 1.5 CNV2E-6P/CNV2E-7P Cable

Max. cable length: 30m
Application: Motor side detector cable (for A51/A74N(A74))/Ball screw side detector cable
CNV2E-6P (Straight)

CNV2E-7P (Angle)

Drive unit side connector
Receptacle: 36210-0100PL
Shell kit: 36310-3200-008
Connector set: 54599-1019

Motor detector/
Ball screw side detector side connector
Plug: CM10-SP10S-M(D6) (Straight)
CM10-AP10S-M(D6) (Angle)
Contact: CM10-#22SC(S1)(D8)

Case
grounding

Shake

<Diagram of connection diagram (for 15m or less)>
Appendix 1.6 CNV2E-8P/CNV2E-9P Cable

Max. cable length: 30m
Application: For HF/HF-H, HF-KP (Tool spindle) Motor side detector cable (for A48/A51/A74N/A74) / For HF-KP (Servo) Motor side detector 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 detector/
Ball screw side detector side connector
(DDK)
Plug: CMV1-SP10S-M2 (Straight)
CMV1-AP10S-M2 (Angle)
Contact: CMV1-#22ASC-S1

Case
grounding

Motor detector/
Ball screw side detector side connector
(DDK)
Plug: CMV1-SP10S-M2 (Straight)
CMV1-AP10S-M2 (Angle)
Contact: CMV1-#22ASC-S1

Case
grounding

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

<Pipe connection diagram (for 15m to 30m)>
Appendix 1.7 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

0.5mm²
0.2mm²
0.5mm²
0.2mm²

<Diagram of cable connection>

Case grounding

PE
Appendix 1.8 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: RM15WTP-8S
Clamp: RM15WTP-CP (10)

Case
grounding

P5(+5V)
LG
RQ
RQ*
SD
SD*
PE

0.5mm²
0.5mm²
0.2mm²
0.2mm²
0.5mm²

<Diagram of cable connection>

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: RM15WTP-8S
Clamp: RM15WTP-CP (10)

Case
grounding

P5(+5V)
LG
RQ
RQ*
SD
SD*
PE

0.5mm²
0.5mm²
0.2mm²
0.2mm²
0.5mm²

<Diagram of cable connection>
Appendix 1.9 CNV2E-K1P / CNV2E-K2P Cable

Max. cable length: 10m
Application: For HF-KP (Servo) Motor side detector cable
Compatible with only IP65
CNV2E-K1P (load side angle)
CNV2E-K2P (reverse load side angle)

![Cable connection diagram]

Servo drive unit side connector (3M)
- Receptacle : 36210-0100PL
- Shell kit : 36310-3200-008
- Connector set : 54599-1019

Servo motor detector connector (Tyco Electronics AMP)
- Connector : 1674320-1

<table>
<thead>
<tr>
<th>P5</th>
<th>1</th>
<th>3</th>
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<td></td>
<td>9</td>
<td>SD</td>
</tr>
</tbody>
</table>
Appendix 1.10 DG21 Cable

Max. cable length: 5m
Application: Battery cable (For drive unit - battery unit)

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

Drive unit side connector (Hirose Electric)
Connector: DF1B-2S-2.5R
Contact: DF1B-242S3CA

Battery unit side connector (3M)
Connector: 10120-3000VE
Shell kit: 10320-52F0-006

BT
LG

0.2mm²

Case grounding

(Cable connection diagram between drive unit and MDS-A-BT/ A6BAT(MR-BAT)(MDS-BTCASE)>
Appendix 1.11 DG22 Cable

Max. cable length: 10m
Application: Battery cable (For drive unit - drive unit)

(Note) This cable is required to supply the power from the battery unit to multiple drive units.

<Diagram of cable connection between drive unit and drive unit>

Drive unit side connector
(Hirose Electric)
Connector: DF1B-2S-2.5R
Contact: DF1B-2428SCA

Drive unit side connector
(Hirose Electric)
Connector: DF1B-2S-2.5R
Contact: DF1B-2428SCA

0.2mm²
Appendix 1.12 DG23 Cable

Max. cable length: 10m
Application: Battery cable (For drive unit - battery box)

(Note) The battery box side is connected using a bare conductor or a terminal bar.

![DG23 cable connection diagram (Connection cable between drive unit and MDS-BTBOX-36)]
Appendix 1.13 DG24 Cable

Max. cable length: 10m
Application: 5V supply/DO output cable (For drive unit - battery box)

(Note) The battery box side is connected using a bare conductor or a terminal bar.

<DG24 cable connection diagram (Connection cable for alarm output between drive unit and MDS-BTBOX-36)>
(For MDS-D2/DH2)

<DG24 cable connection diagram (Connection cable for alarm output between drive unit and MDS-BTBOX-36)>
(For MDS-DM2)
Appendix 1.14 F023/F024 Cable

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

[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.

---

<table>
<thead>
<tr>
<th>Cable name</th>
<th>1ch</th>
<th>2ch</th>
</tr>
</thead>
<tbody>
<tr>
<td>F023 cable</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>F024 cable</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

○ : Usable channel
Appendix 1.15 F034/F035 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 (for control unit)

(Note 1) Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.
(Note 2) Signal names in parentheses "( )" are generally used.
(Note 3) Connect to the serial communication connector of the control unit. Use G031/G032 cable when connecting to the serial communication connector of the display unit.
Appendix 1.16 F070 Cable

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

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

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

Crimp terminal: V1.25-3 or V1.25-4 × 2
Recommended manufacturer: JST
Appendix 1.17 F110 Cable

Max. cable length: 15m
Application: 24VDC power cable for PD25/PD27

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

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

[CF01]
Connector: 005057-9402
Contact: 0016020103 × 2
Recommended manufacturer: MOLEX

Wire material:
UL2464 2 × 22AWG+2 × 16AWG SS-95138
Recommended manufacturer: DDK
Appendix 1.18 F120 Cable

Max. cable length: 30m
Application: Emergency stop cable

[EMG]
Connector: 005057-9403
Contact: 0016020103 × 3
Recommended manufacturer: MOLEX

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

Crimp terminal: V1.25-3 × 2
Recommended manufacturer: JST
Appendix 1.19 F170 Cable

Max. cable length: 15m
Application: ON/OFF switch cable for PD25/PD27

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

Wire material: DPVVS/3P × 0.3mm²
Recommended manufacturer: Bando Electric Wire
Crimp terminal: V1.25-3 or V1.25-4
Recommended manufacturer: JST

(Note) Select the crimp terminal suitable for the terminal block and switch you use.
Appendix 1.20 F221 Cable

Max. cable length: 30m
Application: Analog output

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

Wire material: B-22(19) × 2SJ-1 × 9
Recommended manufacturer: Sumitomo Electric Industries
Crimp terminal: V1.25-3
Recommended manufacturer: JST

(Note 1) Follow the instruction of the machine side in connecting the shield. Do not connect on the base I/O unit side.
(Note 2) Select the crimp terminal suitable for the terminal block you use.
Appendix 1.21 F320/F321 Cable

Max. cable length: 50m
Application: Manual Pulse Generator (12V spec)

(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.

<table>
<thead>
<tr>
<th>Cable name</th>
<th>1ch</th>
<th>2ch</th>
</tr>
</thead>
<tbody>
<tr>
<td>F320 Cable</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>F321 Cable</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

O : Usable channel
Appendix 1.22 F351 Cable

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

CG31, CG32, CG33, CG34, CG35, CG36

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

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

(Note) This cable is used to connect the operation panel I/O unit. Select FCUA-R300, which doesn’t have strain relief, when connecting to remote I/O unit.
Appendix 1.23 FCUA-R030 Cable

Max. cable length: 20m
Application: SKIP input cable

[Note] Fold the cable shield over the sheath, and wrap copper foil tape over it. Connect the wound copper foil tape to GND plate of the connector.
Appendix 1.24 FCUA-R031 Cable

Max. cable length: 30m
Application: Analog input/output (for remote I/O unit)

(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.

[AIO]

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

Wire material: UL1061-2464
AWG24 × 6P
Recommended manufacturer: Oki Electric Cable
Crimp terminal: V1.25-3 × 10

(AIO)

FG

2 12
1 11
11 3
3 5
5 13
13 15
15 7
7 AI0

AI0 GND
AI1 GND
AI2 GND
AI3 GND
AO GND
GND
Appendix 1.25 FCUA-R050/R054 Cable

Max. cable length: 30m
Application: Synchronous encoder - control unit

(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.
Appendix 1.26 FCUA-R211 Cable

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

Application: Remote I/O (with terminal block)
- between remote I/O,
- remote I/O-CNC control unit,
- remote I/O-Operation panel I/O unit,
- remote I/O-MITSUBISHI CNC machine operation panel A

(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.
Appendix 1.27 FCUA-R300/FCUA-R301 Cable

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

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

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

<table>
<thead>
<tr>
<th>Terminal block BX1F</th>
<th>FCUA-DX1xx</th>
<th>Terminal block BX1F</th>
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<td>40</td>
<td>B20</td>
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Appendix 1.28 G011 Cable

Max. cable length: 0.5m
Application: Connection between NC unit and operation panel I/O unit

(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.

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

Wire material: UL20276 AWG28 × 13P
Recommended manufacturer: Toyokuni Electric Cable
Appendix 1.29 G012 Cable

Max. cable length: 1m
Application: Connection between NC unit and operation panel I/O unit

(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.
Appendix 1.30 G023/G024 Cable

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

Application: Manual Pulse Generator cable (5V) (for connection to control unit)

(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.

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<tr>
<th>Cable name</th>
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<th>2ch</th>
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<tr>
<td>G024 cable</td>
<td>□</td>
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</table>

□ : Usable channel

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

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

[1ch][2ch]
Crimp terminal: V1.25-3 × 8
Recommended manufacturer: JST
Appendix 1.31 G071 Cable

Max. cable length: 0.5m
Application: 24VDC relay cable for MITSUBISHI CNC machine operation panel

DCOUT

DCIN

[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.
Appendix 1.32 G214 Cable

Max. cable length: 20m cable
Application: Remote I/O (NC for RIO2 - remote I/O unit)

Wire material: UL multicore soft cable UL2464 AWG24 3-core shielded cable
Manufacturer: Shinko Electric Wire Co., Ltd
(If this cable is unavailable, find an equivalent one.)

Connector: 1-178288-3 Case: 1-175217-2 x 3
Manufacturer: Tyco Electronics
Crimp terminal: R1.25-5

(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.
### Appendix 1.33 G300 Cable

**Max. cable length:** 10m  
**Application:** LAN cross cable (Shielded cable is recommended when the length will be 1m or more)

![LAN Cross Cable Diagram]

<table>
<thead>
<tr>
<th>LAN</th>
<th>White</th>
<th>Green</th>
<th>White</th>
<th>Green</th>
<th>White</th>
<th>Green</th>
<th>White</th>
<th>Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TD+</td>
<td>2</td>
<td>TD-</td>
<td>1</td>
<td>RD+</td>
<td>3</td>
<td>RD-</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>CMTR</td>
<td>5</td>
<td>CMTR</td>
<td>4</td>
<td>CMTR</td>
<td>5</td>
<td>CMTR</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>CMTT</td>
<td>8</td>
<td>CMTT</td>
<td>7</td>
<td>CMTT</td>
<td>8</td>
<td>CMTT</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>White</td>
<td>Green</td>
<td>White</td>
<td>Green</td>
<td>White</td>
<td>Brown</td>
<td>Blue</td>
<td>Blue</td>
</tr>
</tbody>
</table>

**Recommended manufacturer:** Tyco Electronics

**Wire material:** LAN category 5 twisted pair x 4P

---

**[LAN]**  
Connector: 5-568530
Appendix 1.34 G301 Cable

Max. cable length: 1m  
Application: LAN straight cable (Shielded cable is recommended when the length will be 1m or more)

[TD+] 1  Green  1 TD+  
       2 Green  2 TD-  
       3 White  3 RD+  
       6 Orange 6 RD-  
[CMTR] 4 Blue  4 CMTR  
       5 White  5 CMTR  
[CMTT] 7 White Brown 7 CMTT  
       8 Brown  8 CMTT

[LAN]  
Connector: 5-558530  
Recommended manufacturer: Tyco Electronics  
Wire material: LAN category 5 twisted pair x 4P
Appendix 1.35 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.

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

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

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

<table>
<thead>
<tr>
<th>Cable</th>
<th>Minimum bending radius: R</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-core cable (section with reinforced sheath)</td>
<td>50mm</td>
</tr>
<tr>
<td>2-core cable (section without reinforced sheath)</td>
<td>25mm</td>
</tr>
</tbody>
</table>

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

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

Diagram showing the cable sections with and without reinforced sheath.
Appendix 1.36 G395 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.

(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.

<table>
<thead>
<tr>
<th>Cable</th>
<th>Minimum bending radius: R</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-core cable (section with reinforced sheath)</td>
<td>50mm</td>
</tr>
<tr>
<td>2-core cable (section without reinforced sheath)</td>
<td>30mm</td>
</tr>
</tbody>
</table>

Connector: PF-2D103
Recommended manufacturer: Japan Aviation Electronics
Wire material: ESCA Premium
Recommended manufacturer: MITSUBISHI RAYON
Appendix 1.37 G396 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.

(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.

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

<table>
<thead>
<tr>
<th>Cable</th>
<th>Minimum bending radius: R</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-core parallel cord</td>
<td>30mm</td>
</tr>
</tbody>
</table>

Wire material: ESCA Premium
Recommended manufacturer: MITSUBISHI RAYON
Appendix 1.38 G460 Cable

Max. cable length: 0.5m
Application: Cable between MITSUBISHI CNC machine operation panel A and MITSUBISHI CNC machine operation panel B

(Note) Coat the connector [SW-NO][SW-C] with an insulation.
Appendix 1.39 MR-BKS1CBL-A1-H / MR-BKS1CBL-A2-H Cable

Max. cable length: 10m
Application: <200V Series> Brake cable for HF-KP
MR-BKS1CBL-A1-H (load side angle)
MR-BKS1CBL-A2-H (reverse load side angle)

![Cable connection diagram]

Servo motor brake connector
(Japan Aviation Electronics)
Connector: JN4FT02SJ1
Hood, Socket insulator,
Bushing and Ground nut
Contact: ST-TMH-S-C1B-100(A534G)
Crimp tool: CT160-3TMH5B

AWG 20

B1

AWG 20

B2

<Cable connection diagram>
Appendix 1.40 MR-PWS1CBL-A1-H / MR-PWS1CBL-A2-H Cable

Max. cable length: 10m
Application: <200V Series> Power cable for HF-KP
  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
Hood, Socket insulator,
Bushing and Ground nut
Contact: ST-TMH-S-C1B-100(A334G)
Crimp tool: CT160-3TM5B

<table>
<thead>
<tr>
<th>AWG 19 (Red)</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG 19 (White)</td>
<td>V</td>
</tr>
<tr>
<td>AWG 19 (Black)</td>
<td>W</td>
</tr>
<tr>
<td>AWG 19 (Green/ Yellow)</td>
<td></td>
</tr>
</tbody>
</table>

<Cable connection diagram>
Appendix 1.41 R-TM Terminator Connector

Application: Terminator for OPI interface

(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 100 Ω terminator with a black insulation tube.

(Note 3) Stamp the connector name “R-TM” in white on the rear of the connector.
Appendix 1.42 SH21 Cable

Max. cable length: 30m
Application: Power supply communication cable
Power backup unit communication cable
Cable for Auxiliary axis/Servo drive units

(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.
Appendix 1.43 SH41 Cable

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

Application: Remote I/O cable
- between remote I/O,
- remote I/O-CNC control unit,
- remote I/O-Operation panel I/O unit,
- remote I/O-MITSUBISHI CNC machine operation panel A
(between remote I/O units in a panel)

[RI01, RI02, RI03]
Connector: 1-178288-3
Contact: 1-175218-2 × 3
Recommended manufacturer: Tyco Electronics

Wire material: MVVS 3C × 0.5mm² (MIC 3C × 0.5mm²)
Recommended manufacturer: Takeuchi Densen

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

(Note 1) Protect both ends of the cable with insulated bushing.

(Note 2) RI01 and RI03 can be used commonly.

(Note 3) Use this cable for short applications, such as bridging the remote I/O units in the same panel. Normally use the FCUA-R211 cable with high noise withstand level.
## Appendix 1.44 List of Cable Connector Sets

<table>
<thead>
<tr>
<th>Type</th>
<th>Application</th>
<th>Type</th>
<th>Package contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCUA-CS000</td>
<td>Control unit - General I/O units</td>
<td>Connector (3M) 10120-3000VE x 2pcs.</td>
<td>Shell kit (3M) 10320-52F0-008 x 2pcs.</td>
</tr>
<tr>
<td>FCUA-CS301</td>
<td>Remote I/O unit - terminal block</td>
<td>Connector (3M) 7940-6500SC x 4pcs.</td>
<td>Strain relief (3M) 3448-7940 x 2pcs.</td>
</tr>
<tr>
<td>FCUA-CN200</td>
<td>200VAC power supply connector (for power supply unit PD25/PD27)</td>
<td>Connector (Tyco Electronics) 2-178288-3 x 1pc.</td>
<td>Tin contact (Tyco Electronics) 1-175218-5 x 3 pcs.</td>
</tr>
<tr>
<td>FCUA-CN200</td>
<td>24VDC power supply connector for power supply unit (PD25/PD27) (with power OFF detection)</td>
<td>Connector (Tyco Electronics) 3-178127-6 x 1pc.</td>
<td>Tin contact (Tyco Electronics) 1-175218-5 x 6 pcs.</td>
</tr>
<tr>
<td></td>
<td>1-178288-5 1-175218-5 x 6 pcs.</td>
<td>Connector (Tyco Electronics) 1-178288-5 x 1pc.</td>
<td>Tin contact (Tyco Electronics) 1-175218-5 x 6 pcs.</td>
</tr>
<tr>
<td></td>
<td>1-178288-5 1-175218-5 x 6 pcs.</td>
<td>Connector (MOLEX) 005057-9403 x 1pc.</td>
<td>Gold contact (MOLEX) 0016020103 x 3 pcs.</td>
</tr>
<tr>
<td>005057-9403</td>
<td>Emergency stop connector</td>
<td>Connector (MOLEX) 005057-9403 x 1pc.</td>
<td>Gold contact (MOLEX) 0016020103 x 3 pcs.</td>
</tr>
<tr>
<td>FCUA-CN211</td>
<td>Remote I/O communication connector</td>
<td>Connector (Tyco Electronics) 1-178288-3 x 1pc.</td>
<td>Gold contact (Tyco Electronics) 1-175218-2 x 3pcs.</td>
</tr>
<tr>
<td>FCUA-CN220</td>
<td>24VDC power supply connector</td>
<td>Connector (Tyco Electronics) 2-178288-3 x 1pc.</td>
<td>Tin contact (Tyco Electronics) 1-175218-5 x 3pcs.</td>
</tr>
<tr>
<td>FCUA-CN300</td>
<td>DIO connector</td>
<td>Connector (3M) 7940-65000SC x 2pcs.</td>
<td></td>
</tr>
</tbody>
</table>

200
Appendix 2

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.

**Appendix 2.1 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.

**Appendix 2.2 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.

<table>
<thead>
<tr>
<th>Class</th>
<th>Name</th>
<th>Details</th>
<th>EN Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission</td>
<td>Radiated noise</td>
<td>Restriction of electromagnetic noise radiated through the air</td>
<td>EN61000-6-4 (General industrial machine)</td>
</tr>
<tr>
<td></td>
<td>Conductive noise</td>
<td>Restriction of electromagnetic noise discharged from power supply line</td>
<td>EN61800-3 (Motor control unit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>EN55011 (CLASS: A)</td>
</tr>
<tr>
<td>Immunity</td>
<td>Static electricity electrical discharge</td>
<td>(Example) Regulation of withstand level of static electricity electrical discharge accumulated in human body</td>
<td>EN61000-4-2</td>
</tr>
<tr>
<td></td>
<td>Radiation immunity</td>
<td>(Example) Simulation of immunity from digital wireless telephones</td>
<td>EN61000-4-3</td>
</tr>
<tr>
<td></td>
<td>Burst immunity</td>
<td>(Example) Regulation of withstand level of noise from relay or plug and play</td>
<td>EN61000-4-4</td>
</tr>
<tr>
<td></td>
<td>Conductive immunity</td>
<td>(Example) Regulation of withstand level of noise flowed from power supply wires, etc.</td>
<td>EN61800-3 (Motor control unit)</td>
</tr>
<tr>
<td></td>
<td>Power supply frequency magnetic field</td>
<td>(Example) Regulation of electromagnetic noise of 50/60Hz power supply frequency</td>
<td>EN61000-4-8</td>
</tr>
<tr>
<td></td>
<td>Power supply dip (fluctuation)</td>
<td>(Example) Regulation of power voltage drop withstand level</td>
<td>EN61000-4-11</td>
</tr>
<tr>
<td></td>
<td>Surge</td>
<td>(Example) Regulation of withstand level of noise caused by lightning</td>
<td>EN61000-4-5</td>
</tr>
</tbody>
</table>
Appendix 2.3 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.

Appendix 2.4 Panel Structure

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

Appendix 2.4.1 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.
Appendix 2.4.2 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.

Appendix 2.4.3 Measures for Power Supply

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

(Note 1) The conductive noise can be suppressed by inserting a noise filter, but the radiated noise will flow out.
(Note 2) The conductive and radiated noise can both be suppressed by adding a partition plate to the noise filter.
Appendix 2.5 Measures for Wiring in Panel

Cables act as antennas to propagate unnecessary noise, and thus must be appropriately shielded and treated. The following measures must be sufficiently considered for the cables (SH21/G018/F012/FCUA-R211) that carry out high-speed communication.

Appendix 2.5.1 Precautions for Wiring in Panel

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

2. Always connect the grounding wire to the FG terminal indicated on the device.

3. Keep the distance between the drive line and detector cable to the drive section motor as far apart as possible when wiring.

4. Do not lead the power supply wire around the panel without using a filter.
Appendix 2.5.2 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 [F110/F070 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 Counterm easure 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 [FCUA-R211 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) **Servo communication cable [SH21 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.

(4) **Ethernet 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.
Appendix 2.6 EMC Countermeasure Parts

Appendix 2.6.1 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.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Enclosed fittings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Plate #D</td>
<td>100</td>
<td>86</td>
<td>30</td>
<td>Clamp fitting A × 2</td>
</tr>
<tr>
<td>Ground Plate #E</td>
<td>70</td>
<td>56</td>
<td>-</td>
<td>Clamp fitting B × 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>L1 (maximum dimension when it is open)</th>
<th>L2 (reference dimension)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clamp fitting A</td>
<td>25</td>
<td>(77)</td>
</tr>
<tr>
<td>Clamp fitting B</td>
<td>12</td>
<td>(54)</td>
</tr>
</tbody>
</table>

- Outline drawing

*N Screw hole for wiring to earthing plate in cabinet.

(Note 1) Screw hole for wiring to earthing plate in cabinet.

(Note 2) The earthing plate thickness is 1.6mm.
Appendix 2.6.2 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

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

*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.
Appendix 2.6.3 Surge Absorber

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

1) Part name: RAV-781BYZ-2
   Manufacturer: OKAYA ELECTRIC INDUSTRIES

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

![Illustration of RAV-781BYZ-2](image)

2) Part name: RAV-781BXZ-4
   Manufacturer: OKAYA ELECTRIC INDUSTRIES

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

![Illustration of RAV-781BXZ-4](image)
(3) Example of surge absorber installation

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

**CAUTION**

1. The wires from the surge absorber should be connected without extensions.
2. If the surge absorber cannot be installed just with the enclosed wires, keep the wiring length of A and B to 2m or less. If the wires are long, the surge absorber’s performance may drop and inhibit protection of the devices in the panel.
3. Surge absorber to be selected varies depending on input power voltage.
Appendix 2.6.4 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

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

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
Appendix 3

Restrictions for Lithium Batteries
Appendix 3.1 Restriction for Packing

The United Nations Dangerous Goods Regulations "Article 12" became effective from 2003. When transporting lithium batteries with means subject to the UN Regulations, such as by air transport, measures corresponding to the Regulations must be taken.

The UN Regulations classify the batteries as dangerous goods (Class 9) or not dangerous goods according to the lithium 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 this section "Handling by User".

The followings are restrictions for transportation. Each restriction is specified based on the recommendation of the United Nations.

<table>
<thead>
<tr>
<th>Area</th>
<th>Transportation method</th>
<th>Restriction</th>
<th>Special clause</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>Air</td>
<td>ICAO, IATA</td>
<td>-</td>
</tr>
<tr>
<td>World</td>
<td>Marine</td>
<td>IMO</td>
<td>188</td>
</tr>
<tr>
<td>United States</td>
<td>All (air, marine, land)</td>
<td>DOT</td>
<td>49 CFR 173.185</td>
</tr>
<tr>
<td>Europe</td>
<td>land</td>
<td>RID, ADR</td>
<td>188</td>
</tr>
</tbody>
</table>
Appendix 3.1.1 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 (Class 9).

In order to avoid an accidental actuation during the transportation, all lithium battery products incorporated in a machinery or device must be fixed securely and must be shipped with wrapped over the outer package as to prevent damage or short-circuits.

(1) Materials falling under Class 9

<table>
<thead>
<tr>
<th>Mitsubishi type (Type for arrangement)</th>
<th>Battery type</th>
<th>Lithium metal content</th>
<th>Number of incorporated ER6V batteries</th>
<th>Application (Data backup)</th>
<th>Battery class</th>
<th>Outline dimension drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR23500SE-CJ5</td>
<td>CR23500SE-CJ5</td>
<td>1.52g</td>
<td>-</td>
<td>For NC SRAM (M500)</td>
<td>Battery cell</td>
<td>Refer to “Battery Option” in the specification manual for drive unit you are using for the outline dimension drawing for servo.</td>
</tr>
</tbody>
</table>

(2) Materials not falling under Class 9

<table>
<thead>
<tr>
<th>Mitsubishi type (Type for arrangement)</th>
<th>Battery type</th>
<th>Lithium metal content</th>
<th>Number of incorporated ER6V batteries</th>
<th>Application (Data backup)</th>
<th>Battery class</th>
<th>Outline dimension drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR2032 (for built-in battery)</td>
<td>CR2032</td>
<td>0.067g</td>
<td>-</td>
<td>For NC SRAM/</td>
<td>Battery cell</td>
<td>Refer to “Battery Option” in the specification manual for drive unit you are using for the outline dimension drawing for servo.</td>
</tr>
<tr>
<td>CR2450 (for built-in battery)</td>
<td>CR2450</td>
<td>0.173g</td>
<td>-</td>
<td>For NC SRAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER6, ER6V series (for built-in battery)</td>
<td>ER6, ER6V</td>
<td>0.65g</td>
<td>-</td>
<td>For NC SRAM/ servo detector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABBAY(MR-BAY)</td>
<td>ER17330V</td>
<td>0.48g</td>
<td>-</td>
<td>For servo detector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>QBBAY</td>
<td>QBBAY</td>
<td>0.49g</td>
<td>-</td>
<td>For NC SRAM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(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.

(Example) Rating nameplate for battery units
Appendix 3.1.2 Handling by User

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

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

When shipping isolated lithium battery products

(1) Reshipping in Mitsubishi UN packaging (Class 9)

Mitsubishi packing applies package specifications complying with the UN Packing Instruction. The user only needs to add the following details before shipping. (Consult with the shipping company for details.)

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

[1] Proper shipping name (Lithium batteries)
[2] UN NO. (UN3090 for isolated battery, UN3091 for battery incorporated in a device or included)
[3] Shipper and consignee's address and name

Example of completing form

<table>
<thead>
<tr>
<th>SHIPPER:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipper information</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONSIGNEE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consignee information</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROPER SHIPPING NAME</th>
<th>LITHIUM BATTERIES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UN NO.</th>
<th>CLASS</th>
<th>SUBSIDIARY RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN3090</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Packing Group: II   Packing Inst.: 903

[4] A care label with a telephone number for additional information (120×110mm)
(A care label is to be attached on the outer package. Shipping less than or equal to 4 isolated batteries incorporated in machinery does not need care label.)

Lithium battery care label (Air transportation sample)

(b) Preparation of shipping documents and declaration of dangerous goods
For information required in description, refer to "Product information data sheet".
(2) When packaged by user
The user must follow UN Regulations when packing, preparing for shipping and preparing the indications, etc.
(a) Packing a lithium battery falling under Class 9
   [2] Prepare for shipping as explained in "(1) Reshipping in Mitsubishi UN packaging".
       The Ship Equipment Inspection Society of Japan http://www.hakuyohin.or.jp/english.html
(b) Packing a lithium battery not falling under Class 9
   [1] Cells and batteries are separated so as to prevent short circuits and are stored in a strong outer
       packaging (12 batteries or less, 24 battery cells or less).
   [2] Prepare for the certificates or test results showing compliance to drop test from 1.2m in height.
       (The safety test results have been obtained from the battery manufacturer. Consult with Mitsubishi when
       the safety test results are required.)
   [3] Prepare for shipping as explained in "(1) Reshipping in Mitsubishi UN packaging (Class 9)".

■ When shipping lithium batteries incorporating in a device or machinery
Dedicated packaging (UN packaging) is not required for batteries incorporated in device or machinery. Yet, make sure
to fix the contents securely before the transportation as to prevent damage and short-circuit.
If machinery and devices which incorporates lithium battery is not waterproof, package must be waterproof material.
Check with your shipping company for details on packing and transportation.

Appendix 3.1.3 Reference
Refer to the following materials for details on the regulations and responses.
Guidelines regarding transportation of lithium batteries and lithium ion batteries (Edition 2)..... Battery Association of Japan
Appendix 3 Restrictions for Lithium Batteries

Appendix 3.2 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 the previous section "Restriction for Packing".

(1) Outline of hazard

<table>
<thead>
<tr>
<th>Principal hazard and effect</th>
<th>Not found.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific hazard</td>
<td>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.</td>
</tr>
<tr>
<td>Environmental effect</td>
<td>Not found.</td>
</tr>
</tbody>
</table>

(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**

<table>
<thead>
<tr>
<th>Appropriate storage condition</th>
<th>Avoid direct sunlight; high temperature and high humidity. (Recommended temp. range: +5 to +35°C, humidity: 70%RH or less)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material to avoid</td>
<td>Flammable or conductive material (Metal: may cause a short-circuit)</td>
</tr>
</tbody>
</table>

(6) Physical/chemical properties

**Appearance**

<table>
<thead>
<tr>
<th>Physical form</th>
<th>Solid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>Cylinder type</td>
</tr>
<tr>
<td>Smell</td>
<td>Odorless</td>
</tr>
<tr>
<td>pH</td>
<td>Not applicable (insoluble)</td>
</tr>
</tbody>
</table>

| Boiling point/Boiling range, Melting point, Decomposition temperature, Flash point | No information |
(7) Stability and reactivity

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

(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.

<b>Lithium metal</b>

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

<b>Thionyl chloride</b>

| Acute toxicity | L<sub>50</sub>: 500ppm (inhaled administration to rat) |
| Local effect   | The lungs can be damaged by chronic cough, dyspnea and asthma. |

<b>Aluminum chloride</b>

| Acute toxicity | L<sub>50</sub>: 3700ppm (oral administration to rat) |
| Local effect   | Not found. |

<b>Lithium chloride</b>

| Acute toxicity | L<sub>50</sub>: 520ppm (oral administration to rat) |
| Local effect   | The central nerves and kidney can be influenced. |

<b>Carbon black</b>

| Acute toxicity | L<sub>50</sub>: 2000mg/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.
Appendix 3.3 Issuing Domestic Law of the United States for Primary Lithium Battery Transportation

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

Appendix 3.3.1 Outline of Regulation

1) Transporting primary lithium battery by passenger aircraft is forbidden.
   (a) Excluding primary lithium battery for personal use in a carry-on or checked luggage (Lithium metal content should be not more than 5g for cell and 25g for battery. For details on the lithium metal content, refer to "Transportation Restrictions for Lithium Batteries: Target Products").

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

Appendix 3.3.2 Target Products

All NC products for which the lithium batteries are used are subject to the regulation. (Refer to the table of "Target Products" from the previous section "Restriction for Packing").

Appendix 3.3.3 Handling by User

The "Target Products" from the previous section "Outline of Regulation" described above is solely Mitsubishi's opinion. The shipper must confirm orders of "Transportation Restrictions for Lithium Batteries: Reference" described below for transportation method corresponding the regulation. These should be checked by the company commissioned for the actual lithium battery transportation.

1) Indication of exterior box

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

Display example

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

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

(b) The height (size) of characters to be displayed is prescribed depending on the packaging mass. (When the total mass is over 30kg: at least 12mm, When the total mass is less than 30kg: at least 6mm)

Appendix 3.3.4 Reference

1) 49CFR (Code of Federal Regulation, Title49) (173.185 Lithium batteries and cells.)
Search from the following URL.
http://www.gpoaccess.gov/cfr/index.html

2) DOT regulation body (Department of Transportation)
Search "69fr-75207.pdf" from the following URL.
http://phmsa.dot.gov/hazmat
Appendix 3.4 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.

Appendix 3.4.1 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).

Appendix 3.4.2 Information for end-user

![Figure 1](image)

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!
Appendix 3 Restrictions for Lithium Batteries
Appendix 4

Precautions for Compliance to UL/c-UL Standards
Observe the following matters to comply with UL/c-UL Standards.
Refer to "Instruction Manual for Compliance with UL/c-UL Standard" (BNP-B2429-003) for details.

(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.
   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.
<table>
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<tr>
<th>Date of revision</th>
<th>Manual No.</th>
<th>Revision details</th>
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<tbody>
<tr>
<td>Nov. 2008</td>
<td>IB(NA)1500898-A</td>
<td>First edition created.</td>
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<tr>
<td>Jan. 2009</td>
<td>IB(NA)1500898-B</td>
<td>Mistakes were corrected.</td>
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</table>
| Aug. 2010       | IB(NA)1500898-C | The following units were added.  
- FCU7-KB029 (Keyboard unit)  
- FCU7-EX022 (Optical communication repeater unit)  
- FCU7-KB921/KB926 (MITSUBISHI CNC machine operation panel)  

The following cables were added.  
- CNV22J-K1P/K2P (Detector extension cable for HF-KP motor)  
- G071 (DC24V relay cable for MITSUBISHI CNC machine operation panel)  
- G460 (Cable between MITSUBISHI CNC machine operation panel A and MITSUBISHI CNC machine operation panel B)  

The following sections were added.  
- 2.11 Optical Communication Repeater Unit  
- 2.12 MITSUBISHI CNC Machine Operation Panel  
- 4.2.6 Connecting with Optical Communication Repeater Unit  
- 4.5 Connection of MITSUBISHI CNC Machine Operation Panel  
- 8.3 CNV22J-K1P / CNV22J-K2P cable  
- 8.26 G071 cable  
- 8.33 G460 cable  

According to the addition of new sections, the following section No. were changed.  
- From "2.11" to "2.13"  
- From "4.2.6 - 4.2.9" to "4.2.7 - 4.2.10"  
- From "4.5" to "4.6"  
- Throughout Chapter 8  

Mistakes were corrected. |
| Nov. 2011       | IB(NA)1500898-D | "Handling of our product" was added.  
Following unit was added.  
- FCU7-HN747(DeviceNet/FL-net)  

Following cables were added.  
- DG23 (Battery cable)  
- DG24 (5V supply/DO output cable)  
- FCUA-R031 (Analog input/output cable)  

Following chapters were added.  
- 4.3.4.1 Wiring the Sink Type Input  
- 4.3.4.2 Wiring the Source Type Input  
- 8.11 DG23 Cable  
- 8.12 DG24 Cable  
- 8.22 FCUA-R031 Cable  

Chapter numbers were changed as the new chapters are added.  
- "4.3.4.1 to 4.3.4.2" are changed to "4.3.4.3 to 4.3.4.4".  
- "8.11 to 8.20" are changed to "8.13 to 8.22"  
- "8.21 to 8.39" are changed to "8.24 to 8.42"  

Mistakes were corrected. |
<table>
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<tr>
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</tr>
</thead>
</table>
- Corrected contents of 4.2.5.1 to 4.2.5.3.  
- Revised related explanation, etc.  
Connector set was added to "1.3.1 List of Units".  
"(11) LED" was added to "2.6 Remote I/O Unit".  
Chapter 2.12 was revised and chapter name was changed to "2.13 Exclusive CF Cards for MITSUBISHI CNC".  
"4.2.10.1 Handle Numbers" and "4.3.3.1 Handle Numbers" were added.  
"4.2.11 Connecting with Safety Observing I/O Device" was added.  
"8.3 CNP3EZ-2P/CNP3EZ-3P Cable" were added.  
Reviewed application name of cable.  
Reviewed "8.43 List of Cable Connector Sets" in keeping with connector set added to "1.3.1 List of Units". |
| Dec. 2013        | IB(NA)1500898-F | Following units were added.  
- FCU7-DU180-11 (Display unit)  
Following chapters were added.  
- 1.2.3 For 15-type display unit  
The construction of chapters were revised.  
- "5 EMC Installation Guidelines" to "Appendix 2".  
- "6 Restriction for Lithium Batteries" to "Appendix 3".  
- "7 Precautions for Compliance to UL/c-UL Standards" to "Appendix 4".  
- "8 Cable" to "Appendix 1". |
| Feb. 2014        | IB(NA)1500898-G | Following cable was added.  
- G012 cable (Operation panel I/O interface cable)  
Following chapters were revised.  
- "4.2.3 Connecting with Emergency Stop Signal"  
- "Appendix 1.35 G380 Cable"  
- "Appendix 1.36 G395 Cable"  
- "Appendix 1.37 G396 Cable"  
The title of the chapter was revised.  
- "4.2.5 Connecting with Drive Unit"  
Mistakes were corrected. |
| Jun. 2015        | IB(NA)1500898-H | Explanation of slide switch was added to "2.2 Control Unit". |
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Notice

Every effort has been made to keep up with software and hardware revisions in the contents described in this manual. However, please understand that in some unavoidable cases simultaneous revision is not possible. Please contact your Mitsubishi Electric dealer with any questions or comments regarding the use of this product.

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<th>M700VS Series</th>
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Specifications are subject to change without notice.