MITSUBISHI ELECTRIC

Safety Guidelines

Q170MSCPU
Q170MSCPU-S1

Thank you for purchasing the Mitsubishi Electric Motion controller.
Prior to use, please read this and relevant manuals thoroughly to fully understand the product.

MODEL	Q170MS-U-HW

IB-0300615-A(2405)MEE

SAFETY PRECAUTIONS

(Please read these instructions before using this equipment.)
Before using this product, please read this manual and the relevant manuals introduced in this manual carefully and pay full attention to safety to handle the product correctly.
These precautions apply only to this product. Refer to the Users manual of the QCPU module to use for a description of the PLC system safety precautions.
In this manual, the safety instructions are ranked as "⚠DENGER" and "⚠CAUTION".

⚠ **DANGER**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on circumstances, procedures indicated by ⚠CAUTION may also be linked to serious results.
In any case, it is important to follow the directions for usage.
Please save this manual to make it accessible when required and always forward it to the end user.

1. Prevention of electric shocks

⚠DANGER

- Never open the front case or terminal covers while the power is ON or the unit is running, as this may lead to electric shocks.
- Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks.
- Never open the front case or terminal cover at times other than wiring work or periodic inspections even if the power is OFF. The insides of the Motion controller and servo amplifier are charged and may lead to electric shocks.
- Completely turn off the externally supplied power used in the system before mounting or removing the module, performing wiring work, or inspections. Failing to do so may lead to electric shocks.
- When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc.. Failing to do so may lead to electric shocks.
- Be sure to ground the Motion controller, servo amplifier and servo motor. (Ground resistance : 100 Ω or less) Do not ground commonly with other devices.
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after installing the Motion controller, servo amplifier and servo motor. Failing to do so may lead to electric shocks or damage.
- Never operate the switches with wet hands, as this may lead to electric shocks.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to electric shocks.
- Do not touch the Motion controller, servo amplifier or servo motor terminal blocks while the power is ON, as this may lead to electric shocks.
- Do not touch the built-in power supply, built-in grounding or signal wires of the Motion controller and servo amplifier, as this may lead to electric shocks.

2. For fire prevention

⚠CAUTION

- Install the Motion controller, servo amplifier, servo motor and regenerative resistor on incombustible. Installing them directly or close to combustibles will lead to fire.
- If a fault occurs in the Motion controller or servo amplifier, shut the power OFF at the servo amplifier's power source. If a large current continues to flow, fire may occur.
- When using a regenerative resistor, shut the power OFF with an error signal. The regenerative resistor may abnormally overheat due to a fault in the regenerative transistor, etc., and may lead to fire.
- Always take heat measures such as flame proofing for the inside of the control panel where the servo amplifier or regenerative resistor is installed and for the wires used. Failing to do so may lead to fire.
- Do not damage, apply excessive stress, place heavy things on or sandwich the cables, as this may lead to fire.

3. For injury prevention

⚠CAUTION

- Do not apply a voltage other than that specified in the instruction manual on any terminal. Doing so may lead to destruction or damage.
- Do not mistake the terminal connections, as this may lead to destruction or damage.
- Do not mistake the polarity (+/-), as this may lead to destruction or damage.
- Do not touch the heat radiating fins of controller or servo amplifier, regenerative resistor and servo motor, etc., while the power is ON and for a short time after the power is turned OFF. In this timing, these parts become very hot and may lead to burns.
- Always turn the power OFF before touching the servo motor shaft or coupled machines, as these parts may lead to injuries.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

4. Various precautions

Strictly observe the following precautions.
Mistaken handling of the unit may lead to faults, injuries or electric shocks.

(1) System structure

⚠CAUTION

- Always install a leakage breaker on the Motion controller and servo amplifier power source.
- If installation of an electromagnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always install the electromagnetic contactor.
- Install the emergency stop circuit externally so that the operation can be stopped immediately and the power shut off.
- Use the Motion controller, servo amplifier, servo motor and regenerative resistor with the correct combinations listed in the instruction manual. Other combinations may lead to fire or faults.
- Use the Motion controller, base unit and motion module with the correct combinations listed in the instruction manual. Other combinations may lead to faults.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the Motion controller, servo amplifier and servo motor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the Motion controller or servo amplifier if the abnormal operation of the Motion controller or servo amplifier differ from the safety directive operation in the system.
- In systems where coasting of the servo motor will be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use dynamic brakes.
- Make sure that the system considers the coasting amount even when using dynamic brakes.
- In systems where perpendicular shaft dropping may be a problem during the forced stop, emergency stop, servo OFF or power supply OFF, use both dynamic brakes and electromagnetic brakes.

⚠CAUTION

- The dynamic brakes must be used only on errors that cause the forced stop, emergency stop, or servo OFF. These brakes must not be used for normal braking.
- The brakes (electromagnetic brakes) assembled into the servo motor are for holding applications, and must not be used for normal braking.
- The system must have a mechanical allowance so that the machine itself can stop even if the stroke limits switch is passed through at the max. speed.
- Use wires and cables that have a wire diameter, heat resistance and bending resistance compatible with the system.
- Use wires and cables within the length of the range described in the instruction manual.
- The ratings and characteristics of the parts (other than Motion controller, servo amplifier and servo motor) used in a system must be compatible with the Motion controller, servo amplifier and servo motor.
- Install a cover on the shaft so that the rotary parts of the servo motor are not touched during operation.
- There may be some cases where holding by the electromagnetic brakes is not possible due to the life or mechanical structure (when the ball screw and servo motor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.

(2) Security

⚠CAUTION

- To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

(3) Parameter settings and programming

⚠CAUTION

- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servo motor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.
- The regenerative resistor model and capacity parameters must be set to values that conform to the operation mode, servo amplifier and servo power supply module. The protective functions may not function if the settings are incorrect.
- Set the mechanical brake output and dynamic brake output validity parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Set the stroke limit input validity parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Set the servo motor encoder type (increment, absolute position type, etc.) parameter to a value that is compatible with the system application. The protective functions may not function if the setting is incorrect.
- Set the servo motor capacity and type (standard, low-inertia, flat, etc.) parameter to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Set the servo amplifier capacity and type parameters to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Use the program commands for the program with the conditions specified in the instruction manual.
- Set the sequence function program capacity setting, device capacity, latch validity range, I/O assignment setting, and validity of continuous operation during error detection to values that are compatible with the system application. The protective functions may not function if the settings are incorrect.
- Some devices used in the program have fixed applications, so use these with the conditions specified in the instruction manual.
- The input devices and data registers assigned to the link will hold the data previous to when communication is terminated by an error, etc. Thus, an error correspondence interlock program specified in the instruction manual must be used.
- Use the interlock program specified in the intelligent function module's instruction manual for the program corresponding to the intelligent function module.

(4) Transportation and installation

⚠CAUTION

- Transport the product with the correct method according to the mass.
- Use the servo motor suspension bolts only for the transportation of the servo motor. Do not transport the servo motor with machine installed on it.
- Do not stack products past the limit.
- When transporting the Motion controller or servo amplifier, never hold the connected wires or cables.
- When transporting the servo motor, never hold the cables, shaft or detector.

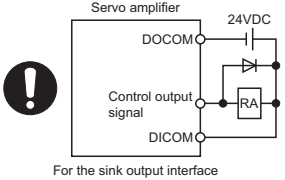
⚠CAUTION

- When transporting the Motion controller or servo amplifier, never hold the front case as it may fall off.
- When transporting, installing or removing the Motion controller or servo amplifier, never hold the edges.
- Install the unit according to the instruction manual in a place where the mass can be withstood.
- Do not get on or place heavy objects on the product.
- Always observe the installation direction.
- Keep the designated clearance between the Motion controller or servo amplifier and control panel inner surface or the Motion controller and servo amplifier, Motion controller or servo amplifier and other devices.
- Do not install or operate Motion controller, servo amplifiers or servo motors that are damaged or that have missing parts.
- Do not block the intake/outtake ports of the Motion controller, servo amplifier and servo motor with cooling fan.
- Do not allow conductive matter such as screw or cutting chips or combustible matter such as oil enter the Motion controller, servo amplifier or servo motor.
- The Motion controller, servo amplifier and servo motor are precision machines, so do not drop or apply strong impacts on them.
- Securely fix the Motion controller, servo amplifier and servo motor to the machine according to the instruction manual. If the fixing is insufficient, these may come off during operation.
- Always install the servo motor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.
- Use the Motion controller in an environment that meets the general specifications contained in this manual (☞ Page 14 General Specifications). Using this Motion controller in an environment outside the range of the general specifications could result in electric shock, fire, operation failure, or damage to or deterioration of the product.
- When coupling with the synchronous encoder or servo motor shaft end, do not apply impact such as by hitting with a hammer. Doing so may lead to detector damage.
- Do not apply a load larger than the tolerable load onto the synchronous encoder and servo motor shaft. Doing so may lead to shaft breakage.
- When not using the module for a long time, disconnect the power line from the Motion controller or servo amplifier.
- Place the Motion controller and servo amplifier in static electricity preventing vinyl bags and store.
- When storing for a long time, please contact with our sales representative.
  Also, execute a trial operation.
- When fumigants that contain halogen materials such as fluorine, chlorine, bromine, and iodine are used for disinfecting and protecting wooden packaging from insects, they cause malfunction when entering our products.
  Please take necessary precautions to ensure that remaining materials from fumigant do not enter our products, or treat packaging with methods other than fumigation (heat method).
  Additionally, disinfect and protect wood from insects before packing products.

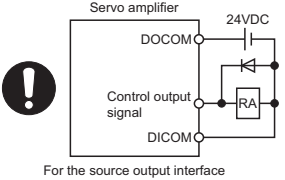
(5) Wiring

⚠CAUTION

- Correctly and securely wire the wires. Reconfirm the connections for mistakes and the terminal screws for tightness after wiring. Failing to do so may lead to run away of the servo motor.
- After wiring, install the protective covers such as the terminal covers to the original positions.
- Do not install a phase advancing capacitor, surge absorber or radio noise filter (option FR-BIF) on the output side of the servo amplifier.
- Correctly connect the output side (terminal U, V, W) and ground. Incorrect connections will lead the servo motor to operate abnormally.
- Do not connect a commercial power supply to the servo motor, as this may lead to trouble.
- Do not mistake the direction of the surge absorbing diode installed on the DC relay for the control signal output of brake signals, etc. Incorrect installation may lead to signals not being output when trouble occurs or the protective functions not functioning.



For the sink output interface



For the source output interface

- Do not connect or disconnect the connection cables between each unit, the encoder cable or PLC expansion cable while the power is ON.
- Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to the cables coming off during operation.
- Do not bundle the power line or cables.

(6) Trial operation and adjustment

⚠CAUTION

- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- Extreme adjustments and changes may lead to unstable operation, so never make them.
- When using the absolute position system function, on starting up, and when the Motion controller or absolute value motor has been replaced, always perform a home position return.
- Before starting test operation, set the parameter speed limit value to the slowest value, and make sure that operation can be stopped immediately by the forced stop, etc. if a hazardous state occurs.

(7) Usage methods

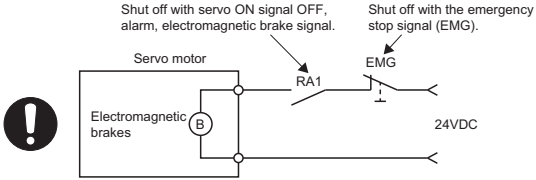
⚠CAUTION

- Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the Motion controller, servo amplifier or servo motor.
- Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- Do not attempt to disassemble and repair the units excluding a qualified technician whom our company recognized.
- Do not make any modifications to the unit.
- Keep the effect or electromagnetic obstacles to a minimum by installing a noise filter or by using wire shields, etc. Electromagnetic obstacles may affect the electronic devices used near the Motion controller or servo amplifier.
- When using the CE Mark-compliant equipment, refer to this manual for the Motion controllers and refer to the corresponding EMC guideline information for the servo amplifiers, inverters and other equipment.
- Use the Motion controller with the conditions described in this manual (☞ Page 15 Motion Controller (Q170MSCPU) Specifications).

(8) Corrective actions for errors

⚠CAUTION

- If an error occurs in the self diagnosis of the Motion controller or servo amplifier, confirm the check details according to the instruction manual, and restore the operation.
- If a dangerous state is predicted in case of a power failure or product failure, use a servo motor with electromagnetic brakes or install a brake mechanism externally.
- Use a double circuit construction so that the electromagnetic brake operation circuit can be operated by emergency stop signals set externally.



- If an error occurs, remove the cause, secure the safety and then resume operation after alarm release.
- The unit may suddenly resume operation after a power failure is restored, so do not go near the machine. (Design the machine so that personal safety can be ensured even if the machine restarts suddenly.)

(9) Maintenance, inspection and part replacement

⚠CAUTION

- Perform the daily and periodic inspections according to the instruction manual.
- Perform maintenance and inspection after backing up the program and parameters for the Motion controller and servo amplifier.
- Do not place fingers or hands in the clearance when opening or closing any opening.
- Periodically replace consumable parts such as batteries according to the instruction manual.
- Do not touch the lead sections such as ICs or the connector contacts.
- Before touching the module, always touch grounded metal, etc. to discharge static electricity from human body. Failure to do so may cause the module to fail or malfunction.
- Do not directly touch the module's conductive parts and electronic components. Touching them could cause an operation failure or give damage to the module.
- Do not place the Motion controller or servo amplifier on metal that may cause a power leakage or wood, plastic or vinyl that may cause static electricity buildup.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- When replacing the Motion controller or servo amplifier, always set the new module settings correctly.
- When the Motion controller or absolute value motor has been replaced, carry out a home position return operation using one of the following methods, otherwise position displacement could occur.
  1) After writing the servo data to the Motion controller using programming software, switch on the power again, then perform a home position return operation.
  2) Using the backup function of the programming software, load the data backed up before replacement.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
- Do not drop or impact the battery installed to the module. Doing so may damage the battery, causing battery liquid to leak in the battery. Do not use the dropped or impacted battery, but dispose of it.
- Do not short circuit, charge, overheat, incinerate or disassemble the batteries.
- The electrolytic capacitor will generate gas during a fault, so do not place your face near the Motion controller or servo amplifier.
- The electrolytic capacitor and fan will deteriorate. Periodically replace these to prevent secondary damage from faults. Replacements can be made by our sales representative.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.
- Do not burn or break a module and servo amplifier. Doing so may cause a toxic gas.

(10) About processing of waste

When you discard Motion controller, servo amplifier, a battery (primary battery) and other option articles, please follow the law of each country (area).

⚠CAUTION

- This product is not designed or manufactured to be used in equipment or systems in situations that can affect or endanger human life.
- When considering this product for operation in special applications such as machinery or systems used in passenger transportation, medical, aerospace, atomic power, electric power, or submarine repeating applications, please contact your nearest Mitsubishi sales representative.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices to forestall serious accidents when it is used in facilities where a breakdown in the product is likely to cause a serious accident.

(11) General cautions

- All drawings provided in the instruction manual show the state with the covers and safety partitions removed to explain detailed sections. When operating the product, always return the covers and partitions to the designated positions, and operate according to the instruction manual.

CONDITIONS OF USE FOR THE PRODUCT

(1) For the use of our Motion controller, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in Motion controller, and a backup or fail-safe function should operate on an external system to Motion controller when any failure or malfunction occurs.

(2) Our Motion controller is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

(3) Mitsubishi shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

To ensure that this product maintains EMC and Low Voltage Directives, please refer to the following manual.
Q170MSCPU Motion controller User's Manual (IB-030212)

CONTENTS

ABOUT MANUALS

The following manuals are also related to this product.
When necessary, order them by quoting the details in the tables below.

• Related Manuals

Manual name	Manual No. (Model code)
Q170MSCPU Motion controller User's Manual	IB-0300212 (1XB962)
Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)	IB-0300134 (1XB928)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)	IB-0300135 (1XB929)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)	IB-0300136 (1XB930)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)	IB-0300137 (1XB931)
Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)	IB-0300198 (1XB953)

PACKING LIST

The following items are included in the package for this product.
Confirm that all the items listed below are present before using this product.

Item	Quantity
Module (Battery (Q6BAT), 24VDC power supply connector and connector for forced stop input cable are attached)	1
Safety Guidelines (this manual)	1

1 SPECIFICATIONS

1.1 General Specifications

General specifications of the Motion controller are shown below.

Item	Specification					
Operating ambient temperature	0 to 55℃ (32 to 131℉)					
Storage ambient temperature	-25 to 75℃ (-13 to 167℉)					
Operating ambient humidity	5 to 95% RH, non-condensing					
Storage ambient humidity	5 to 95% RH, non-condensing					
Vibration resistance	Compliant with JIS B 3502 and IEC 61131-2	—	Frequency	Constant acceleration	Half amplitude	Sweep count
		Under intermittent vibration	5 to 8.4Hz	—	3.5mm (0.14inch)	10 times each in X, Y, Z directions
			8.4 to 150Hz	9.8m/s2	—	
		Under continuous vibration	5 to 8.4Hz	—	1.75mm (0.07inch)	—
			8.4 to 150Hz	4.9m/s^2	—	
Shock resistance	Compliant with JIS B 3502 and IEC 61131-2 (147m/s^2 , 3 times in each of 3 directions X, Y, Z)					
Operating ambience	No corrosive gases					
Operating altitude *1	2000m (6561.68ft.) or less					
Mounting location	Inside control panel					
Overvoltage category *2	Ⅱ or less					
Pollution level *3	2 or less					

*1 Do not use or store the Motion controller under pressure higher than the atmospheric pressure of altitude 0m. Doing so can cause an operation failure. When using the Motion controller under pressure, please contact with our sales representative.

*2 This indicates the section of the power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within premises.
Category Ⅱ applies to equipment for which electrical power is supplied from fixed facilities. The surge voltage withstand level for up to the rated voltage of 300V is 2500V.

*3 This index indicates the degree to which conductive material is generated in terms of the environment in which the equipment is used.
Pollution level 2 is when only non-conductive pollution occurs. A temporary conductivity caused by condensing must be expected occasionally.

1.2 Motion Controller (Q170MSCPU) Specifications

Specifications of the Motion controller are shown below.

Item		Specification
24VDC power supply	Input voltage*1*2	21.6 to 26.4VDC (24VDC +/-10%, ripple ratio 5% or less)
	Inrush current*3	100A 1ms or less (at 24VDC input)
	Max. input current	1.4A
5VDC internal power supply	Max. supplied current	4.5A (Included Q170MSCPU current consumption)
	Q170MSCPU current consumption	2.5A*6
Efficiency		80% (TYP)
Input method		Connector
Allowable momentary power failure immunity*4*5		10ms (at 24VDC input)
Mass [kg]		0.8
Exterior dimensions [mm (inch)]		186 (7.32)(H) × 52 (2.05)(W) × 135 (5.31)(D)

*1 Input power supply
Q170MSCPU is rated for use with a 24VDC input power only.
The Q170MSCPU breaks down when 28VDC or more input.

*2 Select 24VDC power supply and electric wire within the range of 21.6 to 26.4VDC including any input ripple or spike voltage measured at the input connector of the Q170MSCPU.

*3 Inrush current
Take care that the inrush current of several amperes may flow when the sharp square voltage is applied, or the power supply is turned ON with the mechanical switch. Turn ON the primary (AC side) of power supply. When selecting a fuse and breaker in the external circuit, take account of the blow out, detection characteristics and above matters.

*4 Allowable momentary power failure period
· An instantaneous power failure lasting less than 10ms* will cause 24VDC down to be detected, but operation will continue.
· An instantaneous power failure lasting in excess of 10ms* may cause the operation to continue or initial start to take place depending on the power supply load.
*: This is for a 24VDC input. This is 10ms or less for less than 24VDC.

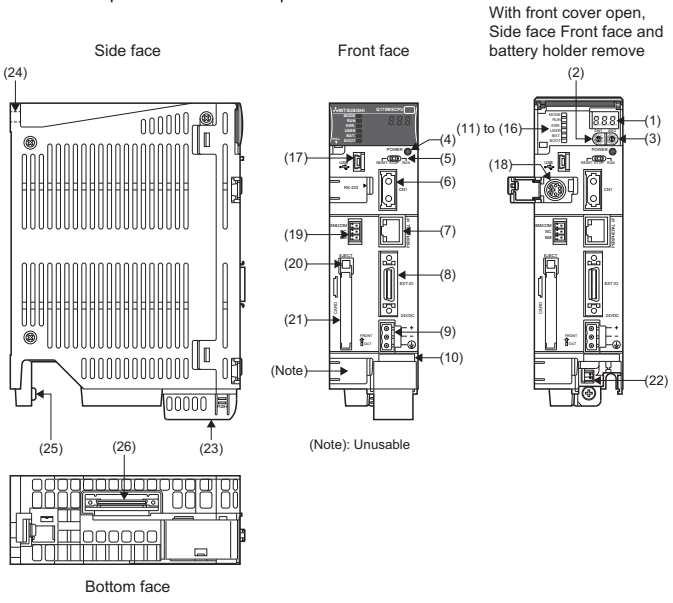
*5 Select 24VDC power supply with allowable momentary power failure period of 20ms or more.

*6 The current consumption (0.2[A]) of manual pulse generator/incremental synchronous encoder connected to the internal I/F connector is not included.

2 MOTION CONTROLLER (Q170MSCPU)

2.1 Names of Parts

This section explains the names of the parts of the Motion controller.



No.	Name	Application
(1)	7-segment LED	Indicates the operating status and error information.
(2)	Rotary function select 1 switch (SW1)	Set the operation mode. (Normal operation mode, Installation mode, Mode operated by ROM, etc) (Factory default in SW1 "0", SW2 "0" position)
(3)	Rotary function select 2 switch (SW2)	
(4)	POWER LED	ON (red): The internal power (5VDC) is ON. OFF: The internal power (5VDC) is OFF.
(5)	RUN/STOP/RESET switch	Move RUN/STOP to change the operating state of the Motion controller. RUN: Sequence program/Motion SFC program is started. STOP: Sequence program/Motion SFC program is stopped. RESET: Set the switch to the "RESET" position 1 second or more to reset the hardware.
(6)	SSCNETⅢ CN1 connector*1	Connector to connect the servo amplifier.

No.	Name	Application
(7)	PERIPHERAL I/F connector	For communication I/F with peripheral devices. • Upper LED Remains flashing: It communicates with the peripheral devices. OFF: It does not communicate with the peripheral devices. • Lower LED ON: Data transmission speed 100Mbps OFF: Data transmission speed 10Mbps
(8)	Internal I/F connector	Connector to connect the manual pulse generator/incremental synchronous encoder, or to input/output the signals. (Voltage-output/open-collector type, Differential-output type)
(9)	24VDC power supply connector	The DC power of 24VDC is connected.
(10)	Serial number display	Displays the serial number described on the rating plate.
(11)	MODE LED	Indicates the mode of the PLC CPU area. ON (green): Q mode
(12)	RUN LED	Indicates the operating status of the PLC CPU area. ON: During operation with the RUN/STOP/RESET switch set to "RUN". OFF: During stop with the RUN/STOP/RESET switch set to "STOP". When an error is detected and operation must be halted due to the error. Remains flashing: Parameters or programs are written with the RUN/STOP/RESET switch set to "STOP", and then the RUN/STOP/RESET switch is turned from "STOP" to "RUN".
(13)	ERR. LED	Indicates the operating status of the PLC CPU area. ON: Detection of self-diagnosis error which will not stop operation, except battery error. (When operation continued at error detection is set in the parameter setting.) OFF: Normal Remains flashing: Detection of error whose occurrence stops operation. Resetting with the RUN/STOP/RESET switch becomes valid.
(14)	USER LED	Indicates the operating status of the PLC CPU area. ON: Annunciator (F) turned ON OFF: Normal
(15)	BAT. LED	Indicates the operating status of the PLC CPU area. ON (yellow): Occurrence of battery error due to reduction in battery voltage of the memory card. ON (green): Turned ON for 5 seconds after restoring of data backup to the standard ROM by the latch data backup is completed. Remains flashing (green): Backup of data to the standard ROM by latch data backup is completed. OFF: Normal
(16)	BOOT LED	Indicates the operating status of the PLC CPU area. ON: Start of boot operation OFF: Non-execution of boot operation
(17)	USB connector	Connector to connect the peripheral devices for USB connection. (Connector type mini B) Connect with the dedicated cable for USB.
(18)	RS-232 connector	Connector to connect the peripheral devices for RS-232 connection. Connect with the dedicated cable (QC30R2) for RS-232.
(19)	Forced stop input connector (EMI) *2	Input to stop all axes of servo amplifier in a lump. EMI ON (opened): Forced stop EMI OFF (24VDC input): Forced stop release

No.	Name	Application
(20)	Memory card EJECT button	Used to eject the memory card from the Motion controller.
(21)	Memory card loading connector	Connector used to load the memory card to the Motion controller.
(22)	Battery connector	Connector to connect the Q6BAT.
(23)	Battery holder *3	Battery holder to set the Q6BAT.
(24)	Module fixing screw hole *4	Hole for screw used to fix to the control panel.
(25)	FG terminal	Ground terminal connected with the shield pattern of the printed circuit board.
(26)	Extension cable connector	Connector for connecting an extension cable (for signal communications with the extension base unit).

*1 Put the SSCNETⅢ cable in the duct or fix the cable at the closest part to the Motion controller with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on SSCNETⅢ connector.

*2 Be sure to use the cable for forced stop input. The forced stop cannot be released without using it. If the cable for forced stop input is fabricated on the customer side, make it within 30m (98.43ft.).

*3 Be sure to set the battery. The data in the RAM built-in Motion controller is not backed up if the battery cable is not set correctly.

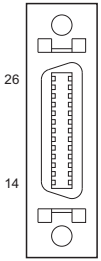
*4 Purchase the M5 screws.

2.2 Internal I/F Connector

Use the internal I/F connector on the front of the Motion controller to connect to manual pulse signals and incremental synchronous encoder signals.

The pin layout of the Q170MSCPU's internal I/F connector

The following is the pin layout of the internal I/F connector as viewed from the front.



Pin No.	Signal name	Pin No.	Signal name
26	HAL*1	13	HBL*1
25	HAH*1	12	HBH*1
24	HA*2	11	HB*2
23	No connect*6	10	SEL*3
22	SG	9	5V*7
21	No connect*6	8	No connect*6
20	No connect*6	7	No connect*6
19	No connect*6	6	No connect*6
18	No connect*6	5	No connect*6
17	DI3	4	DI4
16	DI1	3	DI2
15	COM1*4	2	COM2*5
14	DO1	1	DO2

*1 Differential-output type
Connect the A-phase signal to HAH, and the A-phase inverse signal to HAL.
Connect the B-phase signal to HBH, and the B-phase inverse signal to HBL.
*2 Voltage-output/open-collector type
Connect the A-phase signal to HA, and the B-phase signal to HB.
*3 Input type from manual pulse generator/Incremental synchronous encoder is switched by SEL.
Not connected: Voltage-output/open-collector type
SEL-SG connection: Differential-output type
*4 "COM1" is the common terminal of DI1, DI2, DI3 and DI4.
*5 "COM2" is the common terminal of DO1 and Do2.
*6 Do not connect anything to the terminals listed as "No connect".
*7 Do not use the 5V terminals for applications other than power supply for manual pulse generator/incremental synchronous encoder.

■Applicable connector model name

Type	Model		Manufacturer
	connector	connector case	
Soldering type connector (LD77MHIOCON)	10126-3000PE	10326-52F0-008	3M Japan Limited make

■Wire size

• AWG28

2.3 PERIPHERAL I/F Connector

The specifications of the PERIPHERAL I/F connector are shown below.

Item		Specification
Transmission	Data transmission speed	100Mbps/10Mbps
	Communication mode	Full-duplex/Half-duplex
	Transmission method	Base band
	Cable length [m(ft.)]	Up to 30 (98.43)

Point

Only a LAN connection is available for PERIPHERAL I/F connector. Connection via the Internet is not possible.

Corresponding Ethernet cables

The specifications of Ethernet cables used for connecting to the PERIPHERAL I/F connector are shown below.

Connection type	Cable type	Ethernet standard	Module name
Connection with HUB	Straight cable	10BASE-T	Compliant with Ethernet standards, category 5 or higher. • Shielded twisted pair cable (STP cable)
		100BASE-TX	
Direct connection	• Crossover cable • Straight cable	10BASE-T	
		100BASE-TX	

■Selection criterion of cable

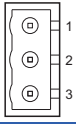
- Category
  5 or higher
- Diameter of lead
  AWG26 or higher
- Shield
  Copper braid shield and drain wire
  Copper braid shield and aluminium layered type shield

2.4 24VDC Power Supply Connector

24VDC power supply is supplied from the 24VDC power supply connector of the front face of the Motion controller.

The pin layout of the 24VDC power supply connector

The pins layout (from front view) and connection of the 24VDC power supply connector is shown below.

Pin layout	Pin No.	Signal name
	1	24V(+)
	2	24G
	3	FG

■**Applicable connector model name**

• FKC2.5/3-ST-5.08 connector (PHOENIX CONTACT make) (Attachment)

■**Conductor size for power line**

• 0.3 to 2.5mm^2 (AWG12 to AWG22)

2.5 Forced Stop Input Connector

The pin layout of the forced stop input connector

The pins layout (from front view) and connection of the forced stop input connector is shown below.

Pin layout	Pin No.	Signal name
	3	EMI.COM
	2	No connect *1
	1	EMI

*1 Do not connect anything to the terminals listed as "No connect".

■**Applicable connector model name**

• FK-MCP1.5/3-ST-3.81 connector (PHOENIX CONTACT make) (Attachment)

■**Conductor size for power line**

• 0.3 to 1.5mm^2 (AWG16 to AWG22)

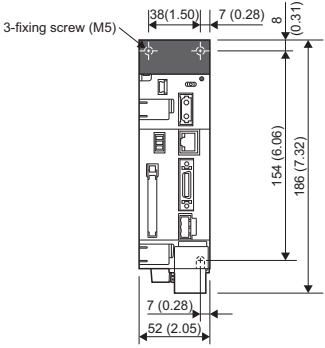
3 MODULE INSTALLATION

3.1 Mounting Position

When mounting the Motion controller to a panel or similar, fully consider its operability, maintainability and environmental resistance.

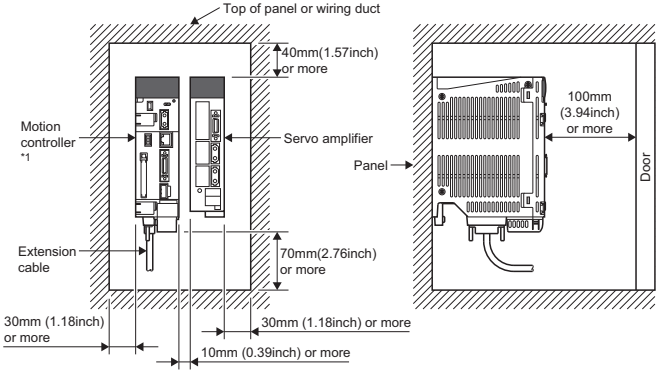
Motion controller fitting dimensions

The fixing hole dimensions for mounting the Motion controller to a panel are shown below.
[unit: mm (inch)]



Motion controller mounting position

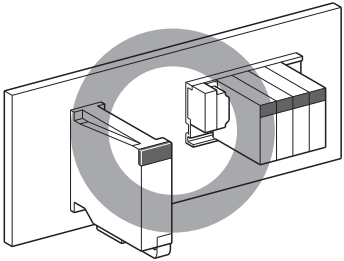
Keep the clearances shown below between the top/bottom faces of the module and other structures or parts to ensure good ventilation and facilitate module replacement.



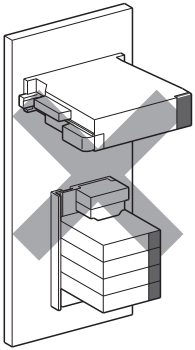
*1 Fit the Motion controller at the left side of the servo amplifier.

Motion controller mounting orientation

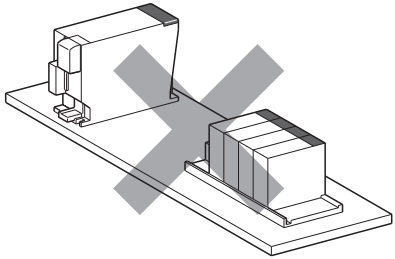
- Mount the Motion controller in the orientation shown below to ensure good ventilation for heat release.



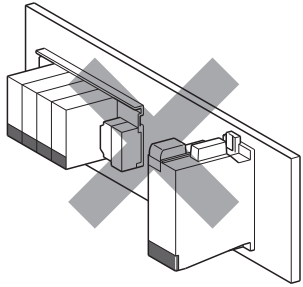
- Do not use it in either of the orientations shown below.



Vertical



Flat



Upside down

Mounting surface

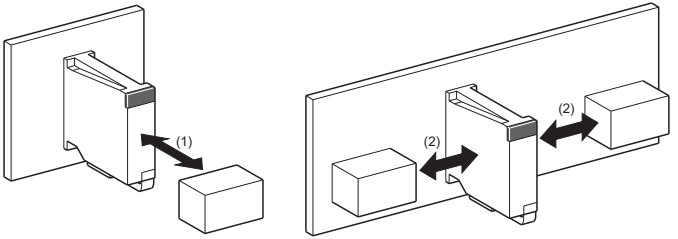
Mount the Motion controller on a flat surface.
If the mounting surface is not even, this may strain the printed circuit boards and cause malfunctions.

Mounting of unit in an area where the other devices are mounted

Avoid mounting base unit in proximity to vibration sources such as large magnetic contractors and no-fuse circuit breakers; mount those on a separate panel or at a distance.

Distances from the other devices

In order to avoid the effects of radiated noise and heat, provide the clearances indicated below between the Motion controller and devices that generate noise or heat (contactors and relays, etc.).

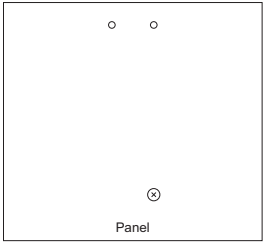


(1) In front of Motion controller: 100mm (3.94inch) or more
(2) On the right and left of Motion controller: 50mm (1.97inch) or more

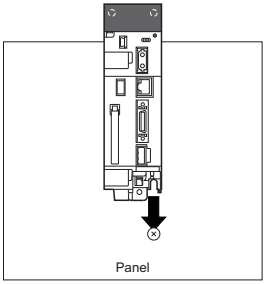
3.2 Mounting a Motion Controller to a Control Panel

This section describes how to mount a Motion controller to a control panel.

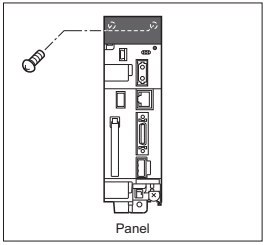
Mounting method



1. Fit the one Motion controller bottom mounting screw into the panel.



2. Place the bottom side notch of the Motion controller onto the bottom side screw.



3. Fit the mounting screws into the holes at the top of the Motion controller, then retighten all the mounting screws.

Point

Screw the Motion controller to the panel.

3.3 Mounting and Removal of the Battery Holder

Mounting and removal procedure of the battery holder to the Motion controller is shown below.

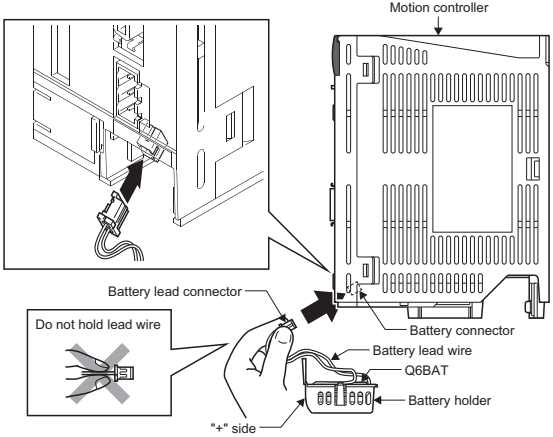
Handling the battery lead wire

■Precautions for mounting the battery

Set the battery to the battery holder correctly after confirming "+" side and "-" side for the battery.

■Precautions for handling the battery lead wire

Firmly hold the battery lead connector during connection or removal of the battery lead wire.



■Connection of the battery lead wire

When connecting a battery (Q6BAT) to the Motion controller, hold the battery lead connector and attach it to the battery connector. Be sure to insert it until it clicks.

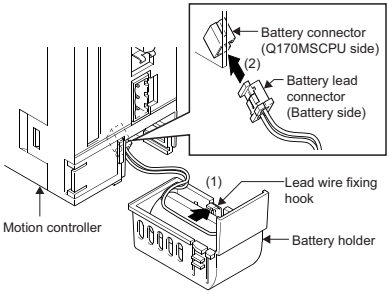
■Removal of the battery lead wire

When removing the battery lead wire, firmly hold the battery lead connector while pulling out the wire.

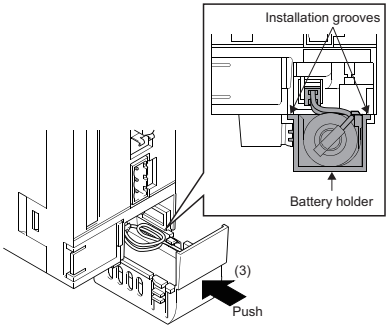
Point

- Forced removal of a connector while holding the battery lead wire will damage the battery connector or battery lead wire.
- The data in the RAM built-in Motion controller is not backed up if the battery connector is not connected correctly.

Mounting procedure

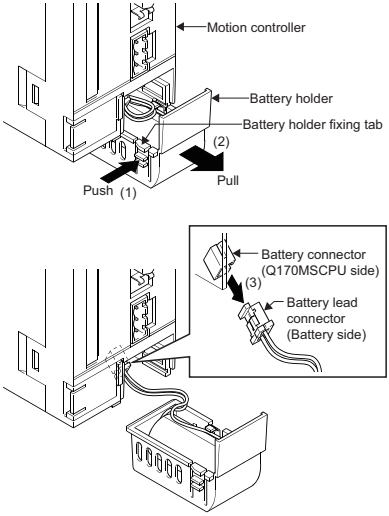


1. Anchor the lead wire to the lead wire fixing hook. (1)
2. Connect the battery lead connector to the battery connector. (2)



3. Adjust the battery holder to the installation grooves, and slide the battery holder in the direction of the arrow, taking care to not damage the lead wires. (Be sure to insert it until it clicks.) (3)
4. Make sure that the battery holder is installed in the Motion controller securely.

Removal procedure



1. Pull the battery holder while pushing the battery holder fixing tab, and remove the holder from the Motion controller. (1), (2)

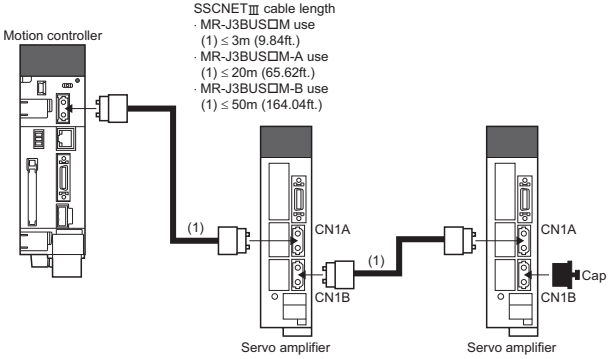
2. Remove the battery lead connector from battery connector. (3)

*: Do not pull on the lead wire forcibly to remove the connector.

3.4 Connection and Disconnection of Cable

SSCNETIII cable

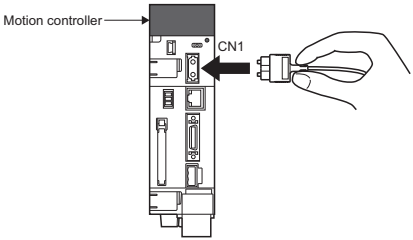
Between the Motion controller and servo amplifiers, or servo amplifier and servo amplifier connected by SSCNETⅢ cable. Up to 16 servo amplifiers can be connected.



*: It cannot communicate if the connection of CN1A and CN1B is mistaken.

Precautions for handling the SSCNETⅢ cable

- Do not stamp on the SSCNETⅢ cable.
- When laying the SSCNETⅢ cable, be sure to secure the minimum cable bend radius or more. If the bend radius is less than the minimum cable bend radius, it may cause malfunctions due to characteristic deterioration, wire breakage, etc.
- Firmly hold the cable connector tab during connection or disconnection of the SSCNETⅢ cable.



Connection of SSCNETⅢ cable

- When connecting the SSCNETⅢ cable to the Motion controller, hold the SSCNETⅢ cable connector tab and attach it to Motion controller SSCNETⅢ cable connector CN1. Be sure to insert it until it clicks.
- If the cord tip for the SSCNETⅢ cable is dirty, optical transmission is interrupted and it may cause malfunctions. If it becomes dirty, wipe with a bonded textile, etc. Do not use solvent such as alcohol.

Disconnection of SSCNETⅢ cable

- When disconnecting the SSCNETⅢ cable, hold either the connector or the SSCNETⅢ cable connector tab while pulling out the connector.
- After disconnection of SSCNETⅢ cable, be sure to put a cap (attached to Motion controller or servo amplifier) to the Motion controller and servo amplifier.
- For SSCNETⅢ cable, attach the tube for protection optical cord's end face on the end of connector.

Wiring process of SSCNETⅢ cable

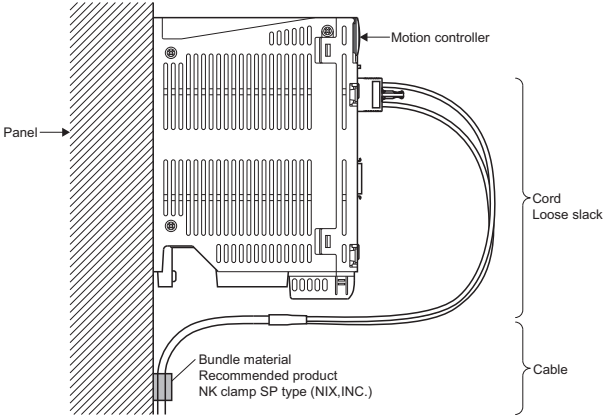
Put the SSCNETⅢ cable in the duct or fix the cable at the closest part to the Motion controller with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on SSCNETⅢ connector. Leave the following space for wiring.

■Putting cables in a duct

When putting cables in a duct, leave space for mounting the Motion controller.
(☞ Page 23 Motion controller mounting position)

■**Bundle fixing**

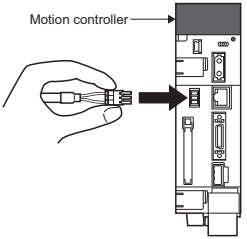
Optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. When bundling the cable, fix and hold it in position by using cushioning such as sponge or rubber which does not contain migratable plasticizing.
If using adhesive tape for bundling the cable, fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended.



Forced stop input cable

Precautions for handling the forced stop input cable

Firmly hold the forced stop input connector during connection or removal of the forced stop input cable.



Connection of the forced stop input cable

When connecting the forced stop input cable to the Motion controller, hold the cable connector and attach it to the Motion controller forced stop input connector.
Be sure to insert it until it clicks.

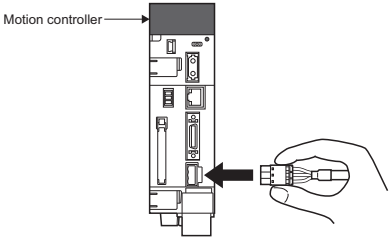
Removal of the forced stop input cable

When removing the forced stop input cable, firmly hold the connector while pulling out the cable.

24VDC power supply cable

Precautions for handling the 24VDC power supply cable

Firmly hold the 24VDC power supply connector during connection or removal of the 24VDC power supply cable.



Connection of the 24VDC power supply cable

When connecting the 24VDC power supply cable to the Motion controller, hold the cable connector and attach it to the Motion controller 24VDC power supply connector.
Be sure to insert it until it clicks.

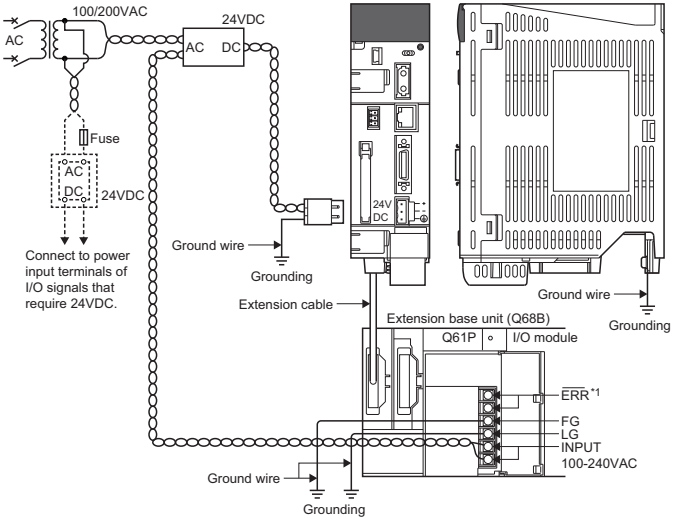
Removal of the 24VDC power supply cable

When removing the 24VDC power supply cable, firmly hold the connector while pulling out the cable.

4 WIRING

4.1 Connecting to the Power Supply

The following diagram shows the wiring example of power lines, grounding lines, etc. to the Motion controller.



*1 The operation of the $\overline{\text{ERR}}$ terminal is always OFF (open).

Point

- Use a different 24VDC power supply for the Motion controller and for I/O signals.
- Use a different 24VDC power supplies for the Motion controller and the electromagnetic brake of the servo motor.
- Motion controller and 24VDC power supply are an open type device and must be installed in a control panel for use. This not only ensures safety but also ensures effective shielding for Motion controller and 24VDC power supply generated electromagnetic noise.
- Use the thickest possible (up to 2mm^2) wires for the 100/200VAC and 24VDC power cables. Be sure to twist these wires starting at the connection terminals. For wiring a terminal block, be sure to use a solderless terminal. Use solderless terminals with insulation sleeves of 0.8mm (0.03inch) or less in thickness to prevent a short circuit when any screws are loosened. Also, only two solderless terminals can be connected per terminal block.
- Ensure that the earth terminals LG and FG are grounded. (Ground resistance : 100Ω or less) If not, the programmable controller may become susceptible to noise. Since the LG terminal has a half of the input voltage, touching this terminal may result in an electric shock.

APPENDIX

Appendix 1 Precautions When Transporting Batteries

When transporting lithium batteries, make sure to follow the transportation regulations.

Transport guidelines

Products are packed in compliance with the transportation regulations prior to shipment. When repacking any of the unpacked products for transportation, make sure to observe the IATA Dangerous Goods Regulations, IMDG (International Maritime Dangerous Goods) Code, and other local transportation regulations.
For details, please consult the shipping carrier used.

REVISIONS

*The manual number is given on the bottom left of the front cover.

Print date	*Manual number	Revision
May 2024	IB(NA)-0300615-A	First edition

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

We will repair any failure or defect hereinafter referred to as "failure" in our FA equipment hereinafter referred to as the "Product" arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

[Gratis Warranty Term]

The term of warranty for Product is thirty six (36) months after your purchase or delivery of the Product to a place designated by you or forty two (42) months from the date of manufacture whichever comes first "Warranty Period". Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

[Gratis Warranty Range]

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

(2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
1) A failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
2) A failure caused by any alteration, etc. to the Product made on your side without our approval
3) A failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
4) A failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
5) Any replacement of consumable parts (battery, fan, etc.)
6) A failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
7) A failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
8) Any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Onerous Repair Term after Discontinuation of Production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued.
The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product; However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

4. Exclusion of Loss in Opportunity and Secondary Loss from Warranty Liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

INFORMATION AND SERVICES

For further information and services, please contact your local Mitsubishi Electric sales office or representative.
Visit our website to find our locations worldwide.

MITSUBISHI ELECTRIC Factory Automation Global Website
Locations Worldwide
www.MitsubishiElectric.com/fa/about-us/overseas/

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The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.
In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

Country/ Region	Sales office/ Tel
USA	MITSUBISHI ELECTRIC AUTOMATION, INC. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A. Tel : +1-847-478-2100
Mexico	MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch Mariano Escobedo #69, Col. Zona Industrial, Tlalnepantla Edo. Mexico, C.P.54030 Tel : +52-55-3067-7500
Brazil	MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA. Avenida Adelino Cardana, 293, 21 andar, Bethaville, Barueri SP, Brazil Tel : +55-11-4689-3000
Germany	MITSUBISHI ELECTRIC EUROPE B.V. German Branch Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany Tel : +49-2102-486-0
UK	MITSUBISHI ELECTRIC EUROPE B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, U.K. Tel : +44-1707-28-8780
Ireland	MITSUBISHI ELECTRIC EUROPE B.V. Irish Branch Westgate Business Park, Ballymount, Dublin 24, Ireland Tel : +353-1-4198800
Italy	MITSUBISHI ELECTRIC EUROPE B.V. Italian Branch Centro Direzionale Colleoni-Palazzo Sirio Viale Colleoni 7, 20864 Agrate Brianza(Milano) Italy Tel : +39-039-60531
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