MITSUBISHI ELECTRIC

MOTION CONTROLLERS

Changes for the Better

MOTION CONTROLLER

Q series

Q170MSCPU

Q170MSCPU-S1

User's Manual

● 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 "DANGER" 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.

For Safe Operations

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 servomotor. (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 servomotor. 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 servomotor 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, servomotor 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 servomotor, 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 servomotor 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, servomotor 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 servomotor, 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 servomotor 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 servomotor 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 servomotor) used in a system must be compatible with the Motion controller, servo amplifier and servomotor.
- Install a cover on the shaft so that the rotary parts of the servomotor 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 servomotor are connected with a timing belt, etc.). Install a stopping device to ensure safety on the machine side.

(2) Parameter settings and programming

⚠CAUTION

- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servomotor 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 servomotor 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 servomotor 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.

⚠CAUTION

- 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.

(3) Transportation and installation

⚠CAUTION

- Transport the product with the correct method according to the mass.
- Use the servomotor suspension bolts only for the transportation of the servomotor. Do not transport the servomotor 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 servomotor, never hold the cables, shaft or detector.
- 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 servomotors that are damaged or that have missing parts.
- Do not block the intake/outtake ports of the Motion controller, servo amplifier and servomotor 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 servomotor.
- The Motion controller, servo amplifier and servomotor are precision machines, so do not drop or apply strong impacts on them.
- Securely fix the Motion controller, servo amplifier and servomotor to the machine according to the instruction manual. If the fixing is insufficient, these may come off during operation.

⚠CAUTION

- Always install the servomotor with reduction gears in the designated direction. Failing to do so may lead to oil leaks.
- Store and use the unit in the following environmental conditions.

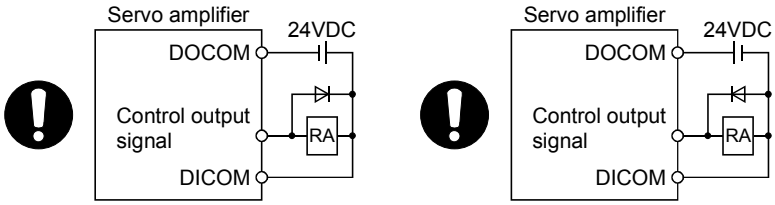
Environment	Conditions	
	Motion controller/Servo amplifier	Servomotor
Ambient temperature	According to each instruction manual.	0°C to +40°C (With no freezing) (32°F to +104°F)
Ambient humidity	According to each instruction manual.	80% RH or less (With no dew condensation)
Storage temperature	According to each instruction manual.	-20°C to +65°C (-4°F to +149°F)
Atmosphere	Indoors (where not subject to direct sunlight). No corrosive gases, flammable gases, oil mist or dust must exist	
Altitude	1000m (3280.84ft.) or less above sea level	
Vibration	According to each instruction manual	

- When coupling with the synchronous encoder or servomotor 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 servomotor 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 you disinfect or protect wooden packing from insects, take measures except by fumigation.
  Fumigating the Motion controller and servo amplifier or packing the Motion controller and servo amplifier with fumigated wooden packing can cause a malfunction of the Motion controller and servo amplifier due to halogen materials (such as fluorine, chlorine, bromine, and iodine) which are contained in fumigant.
- The Motion controller and servo amplifier must not be used with parts which contain halogen-series flame retardant materials (such as bromine) under coexisting conditions.

(4) 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 servomotor.
- 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 servomotor to operate abnormally.
- Do not connect a commercial power supply to the servomotor, 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 combing off during operation.
- Do not bundle the power line or cables.

(5) 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.

(6) Usage methods

⚠CAUTION

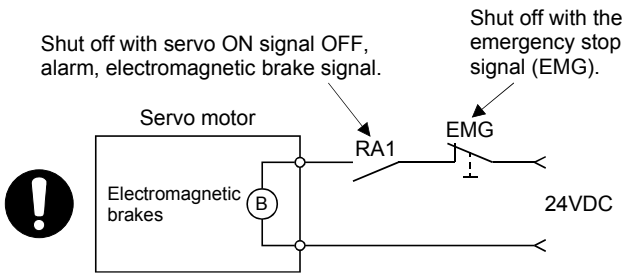
- Immediately turn OFF the power if smoke, abnormal sounds or odors are emitted from the Motion controller, servo amplifier or servomotor.
- Always execute a test operation before starting actual operations after the program or parameters have been changed or after maintenance and inspection.
- Do not 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 units with the following conditions.

Item	Conditions
Input power	According to each instruction manual.
Input frequency	According to each instruction manual.
Tolerable momentary power failure	According to each instruction manual.

(7) 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 servomotor 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.)

(8) 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.

(9) 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.

(10) 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.

REVISIONS

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

Print Date	* Manual Number	Revision
Apr., 2013	IB(NA)-0300212-A	First edition

Japanese Manual Number IB(NA)-0300205

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INTRODUCTION

Thank you for choosing the Mitsubishi Motion controller Q170MSCPU.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the Motion controller you have purchased, so as to ensure correct use.

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About Manuals

The following manuals are also related to this product.

In necessary, order them by quoting the details in the tables below.

Related Manuals

(1) Motion controller

Manual Name	Manual Number (Model Code)
Q170MSCPU Motion controller User's Manual This manual explains specifications of the Q170MSCPU Motion controller, Q172DLX Servo external signal interface module, Q173DPX Manual pulse generator interface module, Servo amplifiers, SSCNETⅢ cables, and the maintenance/inspection for the system, trouble shooting and others.	IB-0300212 (1XB962)
Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON) This manual explains the Multiple CPU system configuration, performance specifications, common parameters, auxiliary/applied functions, error lists and others.	IB-0300134 (1XB928)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC) This manual explains the functions, programming, debugging, error lists for Motion SFC and others.	IB-0300135 (1XB929)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE) This manual explains the servo parameters, positioning instructions, device lists, error lists and others.	IB-0300136 (1XB930)
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE) This manual explains the dedicated instructions to use the synchronous control by virtual main shaft, mechanical system program create mechanical module, servo parameters, positioning instructions, device lists, error lists and others.	IB-0300137 (1XB931)
Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control) This manual explains the dedicated instructions to use the synchronous control by synchronous control parameters, device lists, error lists and others.	IB-0300198 (1XB953)
Motion controller Setup Guidance (MT Developer2 Version1) This manual explains the items related to the setup of the Motion controller programming software MT Developer2.	IB-0300142 (—)

(2) PLC

Manual Name	Manual Number (Model Code)
QCPU User's Manual (Hardware Design, Maintenance and Inspection) This manual explains the specifications of the QCPU modules, power supply modules, base units, extension cables, memory card battery, and the maintenance/inspection for the system, trouble shooting, error codes and others.	SH-080483ENG (13JR73)
QnUCPU User's Manual (Function Explanation, Program Fundamentals) This manual explains the functions, programming methods and devices and others to create programs with the QCPU.	SH-080807ENG (13JZ27)
QCPU User's Manual (Multiple CPU System) This manual explains the Multiple CPU system overview, system configuration, I/O modules, communication between CPU modules and communication with the I/O modules or intelligent function modules.	SH-080485ENG (13JR75)
QnUCPU User's Manual (Communication via Built-in Ethernet Port) This manual explains functions for the communication via built-in Ethernet port of the CPU module.	SH-080811ENG (13JZ29)
MELSEC-Q/L Programming Manual (Common Instruction) This manual explains how to use the sequence instructions, basic instructions, application instructions and micro computer program.	SH-080809ENG (13JW10)
MELSEC-Q/L/QnA Programming Manual (PID Control Instructions) This manual explains the dedicated instructions used to exercise PID control.	SH-080040 (13JF59)
MELSEC-Q/L/QnA Programming Manual (SFC) This manual explains the system configuration, performance specifications, functions, programming, debugging, error codes and others of MELSAP3.	SH-080041 (13JF60)
I/O Module Type Building Block User's Manual This manual explains the specifications of the I/O modules, connector, connector/terminal block conversion modules and others.	SH-080042 (13JL99)
MELSEC-L SSCNETⅢ/H Head Module User's Manual This manual explains specifications of the head module, procedures before operation, system configuration, installation, wiring, settings, and troubleshooting.	SH-081152ENG (13JZ78)

(3) Servo amplifier

Manual Name	Manual Number (Model Code)
SSCNETⅢ/H interface MR-J4-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-J4-□B Servo amplifier.	SH-030106 (1CW805)
SSCNETⅢ/H interface Multi-axis AC Servo MR-J4W-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Multi-axis AC Servo MR-J4W□-□B Servo amplifier.	SH-030105 (1CW806)
SSCNETⅢ interface MR-J3-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for MR-J3-□B Servo amplifier.	SH-030051 (1CW202)
SSCNETⅢ interface 2-axis AC Servo Amplifier MR-J3W-□B Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for 2-axis AC Servo Amplifier MR-J3W-□B Servo amplifier.	SH-030073 (1CW604)
SSCNETⅢ Compatible Linear Servo MR-J3-□B-RJ004 Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Linear Servo MR-J3-□B-RJ004 Servo amplifier.	SH-030054 (1CW943)
SSCNETⅢ Compatible Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Fully Closed Loop Control MR-J3-□B-RJ006 Servo amplifier.	SH-030056 (1CW304)
SSCNETⅢ Interface Direct Drive Servo MR-J3-□B-RJ080W Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for Direct Drive Servo MR-J3-□B-RJ080W Servo amplifier.	SH-030079 (1CW601)
SSCNETⅢ interface Drive Safety integrated MR-J3-□B Safety Servo amplifier Instruction Manual This manual explains the I/O signals, parts names, parameters, start-up procedure and others for safety integrated MR-J3-□B Safety Servo amplifier.	SH-030084 (1CW205)

MEMO

1. OVERVIEW

1.1 Overview

This User's Manual describes the hardware specifications and handling methods of the Motion Controller Q170MSCPU for the Q series PLC Multiple CPU system.
The Manual also describes those items related to the specifications of the option module for the Motion controller, Manual pulse generator and cables.
In this manual, the following abbreviations are used.

Generic term/Abbreviation	Description
Q170MSCPU or Motion controller	Q170MSCPU/Q170MSCPU-S1 Motion controller
Q172DLX/Q173DPX or Motion module	Q172DLX Servo external signals interface module/ Q173DPX Manual pulse generator interface module
MR-J4(W)-□B	Servo amplifier model MR-J4-□B/MR-J4W-□B
MR-J3(W)-□B	Servo amplifier model MR-J3-□B/MR-J3W-□B
AMP or Servo amplifier	General name for "Servo amplifier model MR-J4-□B/MR-J4W-□B/MR-J3-□B/ MR-J3W-□B"
Multiple CPU system or Motion system	Abbreviation for "Multiple PLC system of the Q series"
PLC CPU area	PLC control area (CPU No.1) of Q170MSCPU/Q170MSCPU-S1 Motion controller
Motion CPU area	Motion control area (CPU No.2) of Q170MSCPU/Q170MSCPU-S1 Motion controller
CPUn	Abbreviation for "CPU No.n (n= 1 to 4) of the CPU module for the Multiple CPU system"
Operating system software	General name for "SW8DNC-SV□Q□"
SV13	Operating system software for conveyor assembly use (Motion SFC) : SW8DNC-SV13Q□
SV22	Operating system software for automatic machinery use (Motion SFC) : SW8DNC-SV22Q□
Programming software package	General name for MT Developer2/GX Works2/MR Configurator2
MELSOFT MT Works2	Abbreviation for "Motion controller engineering environment MELSOFT MT Works2"
MT Developer2 (Note-1)	Abbreviation for "Motion controller programming software MT Developer2 (Version 1.56J or later)"
GX Works2	Abbreviation for "Programmable controller engineering software MELSOFT GX Works2 (Version 1.98C or later)"
MR Configurator2 (Note-1)	Abbreviation for "Servo setup software package MR Configurator2 (Version 1.19V or later)"
Manual pulse generator or MR-HDP01	Abbreviation for "Manual pulse generator (MR-HDP01)"
SSCNETⅢ/H (Note-2)	High speed synchronous network between Motion controller and servo amplifier
SSCNETⅢ (Note-2)	
SSCNETⅢ(/H) (Note-2)	General name for SSCNETⅢ/H, SSCNETⅢ
Absolute position system	General name for "system using the servomotor and servo amplifier for absolute position"
Intelligent function module	General name for module that has a function other than input or output, such as A/D converter module and D/A converter module.
SSCNETⅢ/H head module (Note-2)	Abbreviation for "MELSOFT-L series SSCNETⅢ/H head module (LJ72MS15)"

(Note-1): This software is included in Motion controller engineering environment "MELSOFT MT Works2".
(Note-2): SSCNET: Servo System Controller NETwork

REMARK

For information about each module, design method for program and parameter, refer to the following manuals.

Item		Reference Manual
PLC CPU area, peripheral devices for PLC program design, I/O modules and intelligent function module		MELSEC-Q series PLC Manuals, Manual relevant to each module
Operation method for MT Developer2		Help of each software
SV13/SV22	• Multiple CPU system configuration • Performance specification • Design method for common parameter • Auxiliary and applied functions (common)	Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)
	• Design method for Motion SFC program • Design method for Motion SFC parameter • Motion dedicated PLC instruction	Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)
	• Design method for positioning control program in the real mode • Design method for positioning control parameter	Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)
SV22 (Virtual mode)	• Design method for mechanical system program	Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)
SV22 (Advanced synchronous control)	• Design method for synchronous control parameter	Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)

1.2 Comparison between Q170MSCPU and Q170MCPU

(1) Comparison of hardware

Item			Q170MSCPU	Q170MSCPU-S1	Q170MCPU
Power supply			Built-in (24VDC)		
PLC CPU area			Q03UDCPU or equivalent (30k steps)	Q06UDHCPU or equivalent (60k steps)	Q03UDCPU or equivalent (20k steps)
	Program capacity		30k steps (120 bytes)	60k steps (240 bytes)	30k steps (80 bytes)
	LD instruction processing speed		0.02μs	0.0095μs	0.02μs
Motion CPU area			Q172DSCPU or equivalent (16 axes)		Q172DCPU or equivalent (16 axes)
	Forced stop input		Use forced stop input terminal		
Base unit	Main base unit		None		
	Extension base unit		7 extensions (Up to 64 slots) (Note-1) (Q52B/Q55B/Q63B/Q65B/Q68B/Q612B usable)		1 extension (Q52B/Q55B usable)
		GOT bus connection	No restriction		• Extension base unit use: Connection after the extension base unit of stage 1 • Extension base unit not use: Direct bus connection to Motion controller
Motion module	Q172DLX		2 modules		
	Q172DEX		Unusable		
	Q173DPX (Note-2)		4 modules		3 modules
	Base unit for installation		Extension base unit		
Battery			Demand		
	Q6BAT		Packed together with Motion controller		
	Q7BAT (Large capacity)		Usable (sold separately)		
Multiple CPU system	Number of CPUs		2 modules		
	CPU No.1		PLC CPU area		
	CPU No.2		Motion CPU area		
	CPU No.3		—		
	CPU No.4		—		
Mounting method			Be sure to mount Motion controller on control panel by fixing screws		
Exterior dimensions [mm(inch)]			186 (7.32)(H) × 52 (2.05)(W) × 135 (5.31)(D)		178 (7.01)(H) × 52 (2.05)(W) × 135 (5.31)(D)
Medium of operating system software			The operating system software (SV22 (Virtual mode switching method)) is installed.		CD-ROM (1 disk)
Model of operating system software	SV13		SW8DNC-SV13QN		SW8DNC-SV13QG
	SV22		SW8DNC-SV22QN		SW8DNC-SV22QF
	SV43		—		—
Programming tool	PLC CPU area		GX Works2		
	Motion CPU area		MT Developer2		

Comparison of hardware (continued)

Item			Q170MSCPU	Q170MSCPU-S1	Q170MCPU
SSCNETⅢ	Communication speed		50Mbps		
	Transmission distance	Standard cable	Up to 20m (65.62ft.) between stations Maximum overall distance 320m(1049.87ft.) (20m (65.62ft.) ×16 axes)		
		Long distance cable	Up to 50m (164.04ft.) between stations Maximum overall distance 800m (2624.67ft.) (50m (164.04ft.) ×16 axes)		
	Servo amplifier		MR-J3-□B, MR-J3W-□B, MR-J3-□B-RJ004, MR-J3-□B-RJ006, MR-J3-□B-RJ080W, MR-J3-□B Safety		
SSCNETⅢ/H	Communication speed		150Mbps		Unusable
	Transmission distance	Standard cable	Up to 20m (65.62ft.) between stations Maximum overall distance 320m(1049.87ft.) (20m (65.62ft.) ×16 axes)		
		Long distance cable	Up to 100m (328.08ft.) between stations Maximum overall distance 1600m (5249.34ft.) (100m (328.08ft.) ×16 axes)		
	Servo amplifier		MR-J4-□B, MR-J4-□B-RJ, MR-J4W-□B		

(Note-1): Occupies 8 slots of the main base unit as empty slots.

(Note-2): When using the incremental synchronous encoder (SV22 use), you can use above number of modules. When connecting the manual pulse generator, you can use only 1 module.

(2) Comparison of SV13/SV22 Motion control specifications/ performance specifications

(a) Comparison of Motion control specifications

<table>
<tr><th colspan="2">Item</th><th>Q170MSCPU</th><th>Q170MSCPU-S1</th><th>Q170MCPU</th></tr>
<tr><td colspan="2">Number of control axes</td><td colspan="3">Up to 16 axes</td></tr>
<tr><td rowspan="2">Operation cycle (default)</td><td>SV13</td><td colspan="2">0.22ms/ 1 to 4 axes
0.44ms/ 5 to 10 axes
0.88ms/11 to 16 axes</td><td>0.44ms/ 1 to 6 axes
0.88ms/ 7 to 16 axes</td></tr>
<tr><td>SV22</td><td colspan="2">0.44ms/ 1 to 6 axes
0.88ms/ 7 to 16 axes</td><td>0.44ms/ 1 to 4 axes
0.88ms/ 5 to 12 axes
1.77ms/13 to 16 axes</td></tr>
<tr><td colspan="2">Interpolation functions</td><td colspan="3">Linear interpolation (Up to 4 axes), Circular interpolation (2 axes), Helical interpolation (3 axes)</td></tr>
<tr><td colspan="2">Control modes</td><td colspan="2">PTP(Point to Point) control, Speed control, Speed-position control, Fixed-pitch feed, Constant speed control, Position follow-up control, Speed control with fixed position stop, Speed switching control, High-speed oscillation control, Speed torque control, Synchronous control (SV22 (Virtual mode switching method/Advanced synchronous control method))</td><td>PTP(Point to Point) control, Speed control, Speed-position control, Fixed-pitch feed, Constant speed control, Position follow-up control, Speed control with fixed position stop, Speed switching control, High-speed oscillation control, Synchronous control (SV22)</td></tr>
<tr><td colspan="2">Acceleration/deceleration control</td><td colspan="3">Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration, Advanced S-curve acceleration/deceleration</td></tr>
<tr><td colspan="2">Compensation</td><td colspan="3">Backlash compensation, Electronic gear, Phase compensation (SV22)</td></tr>
<tr><td colspan="2">Programming language</td><td colspan="3">Motion SFC, Dedicated instruction, Mechanical support language (SV22) (Note-1)</td></tr>
<tr><td colspan="2">Servo program capacity</td><td colspan="3">16k steps</td></tr>
<tr><td colspan="2">Number of positioning points</td><td colspan="3">3200 points (Positioning data can be designated indirectly)</td></tr>
<tr><td rowspan="2">Peripheral I/F</td><td>USB/RS-232</td><td colspan="3">PLC CPU area control</td></tr>
<tr><td>PERIPHERAL I/F</td><td colspan="3">Motion CPU area control</td></tr>
<tr><td colspan="2" rowspan="2">Home position return function</td><td colspan="2">Proximity dog type (2 types), Count type (3 types), Data set type (2 types), Dog cradle type, Stopper type (2 types), Limit switch combined type, Scale home position signal detection type, Dogless home position signal reference type</td><td>Proximity dog type (2 types), Count type (3 types), Data set type (2 types), Dog cradle type, Stopper type (2 types), Limit switch combined type, Scale home position signal detection type</td></tr>
<tr><td colspan="3">Home position return re-try function provided, home position shift function provided</td></tr>
<tr><td colspan="2">JOG operation function</td><td colspan="3">Provided</td></tr>
<tr><td colspan="2">Manual pulse generator operation function</td><td colspan="3">Possible to connect 3 modules (Q173DPX use)
Possible to connect 1 module (Internal I/F use) (Note-2), (Note-3)</td></tr>
<tr><td colspan="2">Synchronous encoder operation function</td><td colspan="2">Possible to connect 12 modules (SV22 use) (Note-4)
(Q173DPX + Internal I/F + Via device (Note-5))
ABS synchronous encoder unusable</td><td>Possible to connect 8 modules (SV22 use) (Note-4)
(Q173DPX + Internal I/F)
ABS synchronous encoder unusable</td></tr>
<tr><td colspan="2">M-code function</td><td colspan="3">M-code output function provided, M-code completion wait function provided</td></tr>
<tr><td rowspan="2">Limit switch output function</td><td>SV13</td><td colspan="2">Number of output points 32 points
Watch data: Motion control data/Word device</td><td rowspan="2">Number of output points 32 points
Watch data: Motion control data/ Word device</td></tr>
<tr><td>SV22</td><td colspan="2">Virtual mode switching method:
Number of output points 32 points
Advanced synchronous control method:
Number of output points 64 points × 2 settings
Output timing compensation
Watch data: Motion control data/Word device</td></tr>
</table>

Comparison of Motion control specifications (continued)

Item		Q170MSCPU	Q170MSCPU-S1	Q170MCPU
ROM operation function		Provided		
External input signal		Q172DLX, External input signals (FLS/RLS/DOG) of servo amplifier, Internal I/F (DI), Bit device		Q172DLX or External input signals (FLS/RLS/DOG) of servo amplifier
High-speed reading function (Note-6)		Via internal I/F/input module, Via tracking of Q173DPX		
Forced stop		Motion controller forced stop (EMI connector, system setting), Forced stop terminal of servo amplifier		
Number of I/O points		Total 256 points (Internal I/F (Input 4 points, Output 2 points) + I/O module + Intelligent function module)		Total 256 points (Internal I/F (Input 4 points, Output 2 points) + I/O module)
Mark detection function		Provided		
Clock data setting		Clock synchronization between Multiple CPU		
Security function		Provided (Protection by software security key or password)		Provided (Protection by password)
All clear function		Provided		
Remote operation		Remote RUN/STOP, Remote latch clear		
Optional data monitor function	SSCNETⅢ	Up to 3 data/axis (Communication data: Up to 3 points/axis)		
	SSCNETⅢ/H	Up to 6 data/axis (Communication data: Up to 6 points/axis)		None
Digital oscilloscope function		Motion buffering method (Real-time waveform can be displayed) Sampling data: Word 16CH, Bit 16CH		Motion buffering method (Real-time waveform can be displayed) Sampling data: Word 4CH, Bit 8CH
Absolute position system		Made compatible by setting battery to servo amplifier. (Possible to select the absolute data method or incremental method for each axis)		
SSCNETⅢ communication (Note-7)	Communication method	SSCNETⅢ/H, SSCNETⅢ		SSCNETⅢ
	Number of lines	1 line		
Driver communication function (Note-8)		Provided		None
Number of Motion related modules	Q172DLX	2 modules usable		2 modules usable
	Q173DPX	4 modules usable (Note-9)		3 modules usable (Note-9)
PLC module which can be control by Motion CPU (area)		Interrupt module, Input module, Output module, Input/Output composite module, Analogue input module, Analogue output module, Analogue input/output module, High-speed counter module, Positioning module, Simple Motion module, Control unit of displacement sensor		Interrupt module, Input module, Output module, Input/Output composite module, Analogue input module, Analogue output module
Number of SSCNETⅢ/H head module connection stations		Up to 4 stations usable		Unusable

(Note-1): SV22 virtual mode only
(Note-2): When the manual pulse generator is used via the Q170MSCPU's internal I/F, the Q173DPX cannot be used.
(Note-3): When the operation cycle is 7.11ms or less, the manual pulse generator I/F built-in CPU can be used.
(Note-4): Any incremental synchronous encoder connected to the Q170MSCPU's internal I/F will automatically be assigned an Axis No. one integer greater than the number of encoders connected to any Q173DPX modules.
(Note-5): SV22 advanced synchronous control only
(Note-6): This cannot be used in SV22 advanced synchronous control of Q17MSCPU/Q170MSCPU-S1.
(Note-7): The servo amplifiers for SSCNET cannot be used.
(Note-8): Servo amplifier (MR-J3-□B) only
(Note-9): When using the incremental synchronous encoder (SV22 use), you can use above number of modules.
When connecting the manual pulse generator, you can use only 1 module.

(b) Comparison of Motion SFC performance specifications

Item			Q170MSCPU(-S1)	Q170MCPU
Motion SFC program capacity	Code total (Motion SFC chart + Operation control + Transition)		652k bytes	543k bytes
	Text total (Operation control + Transition)		668k bytes	484k bytes
Motion SFC program	Number of Motion SFC programs		256 (No.0 to 255)	
	Motion SFC chart size/program		Up to 64k bytes (Included Motion SFC chart comments)	
	Number of Motion SFC steps/program		Up to 4094 steps	
	Number of selective branches/branch		255	
	Number of parallel branches/branch		255	
	Parallel branch nesting		Up to 4 levels	
Operation control program (F/FS) / Transition program (G)	Number of operation control programs		4096 with F(Once execution type) and FS(Scan execution type) combined. (F/FS0 to F/FS4095)	
	Number of transition programs		4096(G0 to G4095)	
	Code size/program		Up to approx. 64k bytes (32766 steps)	
	Number of blocks(line)/program		Up to 8192 blocks (in the case of 4 steps(min)/blocks)	
	Number of characters/block		Up to 128 (comment included)	
	Number of operand/block		Up to 64 (operand: constants, word device, bit devices)	
	( ) nesting/block		Up to 32 levels	
	Descriptive expression	Operation control program	Calculation expression, bit conditional expression, branch/repetition processing	
		Transition program	Calculation expression/bit conditional expression/ comparison conditional expression	
	Instruction	Binary operation	=, +, -, *, /, %	
		Bit operation	~, &, |, ^, >>, <<	
		Standard function	SIN, COS, TAN, ASIN, ACOS, ATAN, SQRT, LN, EXP, ABS, RND, FIX, FUP, BIN, BCD	
		Type conversion	SHORT, USHORT, LONG, ULONG, FLOAT, UFLOAT, DFLT, SFLT	
		Bit device status	(None), !	
		Bit device control	SET, RST, DOUT, DIN, OUT	
		Logical operation	(None), !, *, +	
		Comparison operation	==, !=, <, <=, >, >=	
		Motion dedicated function	CHGV, CHGVS (Note-1), CHGT, CHGT2, CHGP	CHGV, CHGT
		Others	EI, DI, NOP, BMOV, FMOV, MULTW, MULTR, TO, FROM, RTO, RFROM, TIME	EI, DI, NOP, BMOV, FMOV, MULTW, MULTR, TO, FROM, TIME
		Vision system dedicated function	MVOPEN, MVLOAD, MVTRG, MVPST, MVIN, MVOUT, MVFIN, MVCLOSE, MVCOM	
		Data control	SCL, DSCL	—
		Program control	IF - ELSE - IEND, SELECT - CASE - SEND, FOR - NEXT, BREAK	
		Synchronous control dedicated function	CAMRD, CAMWR, CAMWR2, CAMMK, CAMPSCL	—

Comparison of Motion SFC performance specifications (continued)

<table>
<tr><th colspan="4">Item</th><th>Q170MSCPU(-S1)</th><th>Q170MCPU</th></tr>
<tr><td rowspan="7">Execute specification</td><td colspan="3">Number of multi execute programs</td><td colspan="2">Up to 256</td></tr>
<tr><td colspan="3">Number of multi active steps</td><td colspan="2">Up to 256 steps/all programs</td></tr>
<tr><td rowspan="4">Executed task</td><td colspan="2">Normal task</td><td colspan="2">Execute in main cycle of Motion controller</td></tr>
<tr><td rowspan="3">Event task (Execution can be masked.)</td><td>Fixed cycle</td><td>Execute in fixed cycle (0.22ms, 0.44ms, 0.88ms, 1.77ms, 3.55ms, 7.11ms, 14.2ms)</td><td>Execute in fixed cycle (0.44ms, 0.88ms, 1.77ms, 3.55ms, 7.11ms, 14.2ms)</td></tr>
<tr><td>External interrupt</td><td colspan="2">Execute when input ON is set among interrupt module QI60 (16 points).</td></tr>
<tr><td>PLC interrupt</td><td colspan="2">Execute with interrupt instruction (D(P).GINT) from PLC.</td></tr>
<tr><td colspan="2">NMI task</td><td colspan="2">Execute when input ON is set among interrupt module QI60 (16 points).</td></tr>
<tr><td colspan="4">Number of I/O points (X/Y)</td><td colspan="2">8192 points</td></tr>
<tr><td colspan="4">Number of real I/O points (PX/PY)</td><td>Total 256 points (Internal I/F (Input 4 points, Output 2 points) + I/O module + Intelligent function module)</td><td>256 points</td></tr>
<tr><td rowspan="9">Number of devices (Device In the Motion CPU (area) only) (Included the positioning dedicated device)</td><td colspan="3">Internal relays (M)</td><td colspan="2">12288 points</td></tr>
<tr><td colspan="3">Link relays (B)</td><td colspan="2">8192 points</td></tr>
<tr><td colspan="3">Annunciators (F)</td><td colspan="2">2048 points</td></tr>
<tr><td colspan="3">Special relays (SM)</td><td colspan="2">2256 points</td></tr>
<tr><td colspan="3">Data registers (D)</td><td>8192 points (Note-2)</td><td>8192 points</td></tr>
<tr><td colspan="3">Link registers (W)</td><td colspan="2">8192 points</td></tr>
<tr><td colspan="3">Special registers (SD)</td><td colspan="2">2256 points</td></tr>
<tr><td colspan="3">Motion registers (#)</td><td colspan="2">12288 points</td></tr>
<tr><td colspan="3">Coasting timers (FT)</td><td colspan="2">1 point (888μs)</td></tr>
<tr><td colspan="3">Multiple CPU area devices (U□\G)</td><td colspan="2">Up to 14336 points usable (Note-3)</td></tr>
</table>

(Note-1): SV22 advanced synchronous control only

(Note-2): 19824 points can be used for SV22 advanced synchronous control.

(Note-3): Usable number of points changes according to the system settings.

(c) Comparison of Mechanical system program specifications

<table>
<tr><th colspan="3">Item</th><th colspan="2">Q170MSCPU(-S1)</th><th colspan="2">Q170MCPU</th></tr>
<tr><td rowspan="6">Control units</td><td rowspan="2">Drive module</td><td>Virtual servomotor</td><td colspan="4" rowspan="2">PLS</td></tr>
<tr><td>Synchronous encoder</td></tr>
<tr><td rowspan="4">Output module</td><td>Roller</td><td colspan="4" rowspan="2">mm, inch</td></tr>
<tr><td>Ball screw</td></tr>
<tr><td>Rotary table</td><td colspan="4">degree</td></tr>
<tr><td>Cam</td><td colspan="2">mm, inch, degree, PLS</td><td colspan="2">mm, inch, PLS</td></tr>
<tr><td colspan="3">Program language</td><td colspan="4">Dedicated instructions (Servo program + mechanical system program)</td></tr>
<tr><td rowspan="13">Number of modules which can be set per CPU</td><td rowspan="2">Drive module</td><td>Virtual servomotor</td><td>16</td><td rowspan="2">Total 28</td><td>16</td><td rowspan="2">Total 24</td></tr>
<tr><td>Synchronous encoder</td><td>12</td><td>8</td></tr>
<tr><td rowspan="2">Virtual axis</td><td>Virtual main shaft</td><td>16</td><td rowspan="2">Total 32</td><td>16</td><td rowspan="2">Total 32</td></tr>
<tr><td>Virtual auxiliary input axis</td><td>16</td><td>16</td></tr>
<tr><td rowspan="6">Transmission module</td><td>Gear</td><td colspan="2">32</td><td colspan="2">32</td></tr>
<tr><td>Direct clutch</td><td colspan="2" rowspan="2">32</td><td colspan="2" rowspan="2">32</td></tr>
<tr><td>Smoothing clutch</td></tr>
<tr><td>Speed change gear</td><td colspan="2">32</td><td colspan="2">32</td></tr>
<tr><td>Differential gear</td><td colspan="2">16</td><td colspan="2">16</td></tr>
<tr><td>Differential gear to main shaft</td><td colspan="2">16</td><td colspan="2">16</td></tr>
<tr><td rowspan="4">Output module</td><td>Roller</td><td>16</td><td rowspan="4">Total 16</td><td>16</td><td rowspan="4">Total 16</td></tr>
<tr><td>Ball screw</td><td>16</td><td>16</td></tr>
<tr><td>Rotary table</td><td>16</td><td>16</td></tr>
<tr><td>Cam</td><td>16</td><td>16</td></tr>
<tr><td colspan="2" rowspan="6">Cam</td><td>Types</td><td colspan="4">Up to 256 (Note-1)</td></tr>
<tr><td>Resolution per cycle</td><td colspan="4">256 • 512 • 1024 • 2048 (Note-1)</td></tr>
<tr><td>Memory capacity</td><td colspan="4">132k bytes</td></tr>
<tr><td>Storage memory for cam data</td><td colspan="4">CPU internal RAM memory</td></tr>
<tr><td>Stroke resolution</td><td colspan="4">32767</td></tr>
<tr><td>Control mode</td><td colspan="4">Two-way cam/feed cam</td></tr>
</table>

(Note-1): Relation between a resolution per cycle of cam and type are shown below.

Resolution per cycle	256	512	1024	2048
Type	256	128	64	32

(3) Comparison of PLC CPU area control and performance

Item		Q170MSCPU	Q170MSCPU-S1	Q170MCPU
PLC CPU area		Q03UDCPU or equivalent (30k steps)	Q06UDHCPU or equivalent (60k steps)	Q03UDCPU or equivalent (20k steps)
Control method		Stored program repeat operation		
I/O control mode		Refresh mode		
Sequence control language		Relay symbol language (ladder), logic symbolic language (list), MELSAP3 (SFC), MELSAP-L, Structured text (ST)		
Processing speed (sequence instruction)	LD instruction	0.02 μs	0.0095 μs	0.02 μs
	MOV instruction	0.04 μs	0.019 μs	0.04 μs
	PC MIX value (instruction/μs)	28	60	28
	Floating point addition	0.12 μs	0.057 μs	0.12 μs
Total number of instructions		858		
Operation (floating point operation) instruction		Yes		
Character string processing instruction		Yes		
PID instruction		Yes		
Special function instruction (Trigonometric function, square root, exponential operation, etc.)		Yes		
Constant scan		0.5 to 2000ms (Setting available in 0.5ms unit.)		
Program capacity		30k steps (120k bytes)	60k steps (240k bytes)	20k steps (80k bytes)
CPU shared memory	QCPU standard memory	8k bytes		
	Multiple CPU high speed transmission area	32k bytes		
No. of I/O device points (X/Y)		8192 points		
No. of I/O points (X/Y)		4096 points		512 points (Up to 320 points (64 points × 5 modules) is usable with I/O module.)
Internal relay (M)	Points by default (changeable by parameters)	8192 points		
Latch relay (L)		8192 points		
Link relay (B)		8192 points		
Timer (T)		2048 points		
Retentive timer (ST)		0 points		
Counter (C)		1024 points		
Data register (D)		12288 points		
Link register (W)		8192 points		
Annunciator (F)		2048 points		
Edge relay (V)		2048 points		
Link special relay (SB)		2048 points		
Link special register (SW)		2048 points		
File register (R, ZR)		98304 points	393216 points	98304 points
Step relay (S)		8192 points		
Index register/Standard device register (Z)		20 points		
Index register (Z) (32-bit modification specification of ZR device)		Up to 10 points (Z0 to Z18) (Index register (Z) is used in double words.)		
Pointer (P)		4096 points		
Interrupt pointer (I)		256 points		
Special relay (SM)		2048 points		
Special register (SD)		2048 points		
Function input (FX)		16 points		
Function output (FY)		16 points		

Comparison of PLC CPU area control and performance (continued)

Item		Q170MSCPU	Q170MSCPU-S1	Q170MCPU
Function register (FD)		5 points		
Local device		Yes		
Device initial values		Yes		
Extension base unit	Number of extension	7 extensions (Up to 64 slots) (Note-1) (Q52B/Q55B/Q63B/Q65B/Q68B/Q612B usable)		1 extension (Q52B/Q55B usable)
	GOT bus connection	No restriction		• Extension base unit use: Connection after the extension base unit of stage 1 • Extension base unit not use: Direct bus connection to Motion controller
PLC type when program is made by GX Works2		Q03UDCPU	Q06UDHCPU	Q03UDCPU
Motion dedicated PLC instruction		D(P).DDRD, D(P).DDWR, D(P).SFCS, D(P).SVST, D(P).CHGT, D(P).CHGT2, D(P).CHGV, D(P).CHGVS (Note-2), D(P).CHGA, D(P).CHGAS (Note-2), D(P).GINT		D(P).DDRD, D(P).DDWR, D(P).SFCS, D(P).SVST, D(P).CHGT, D(P).CHGT2, D(P).CHGV, D(P).CHGA, D(P).GINT

(Note-1): Occupies 8 slots of the main base unit as empty slots.

(Note-2): SV22 advanced synchronous control only

1.3 Programming Software Version

The programming software versions that support Motion CPU are shown below.

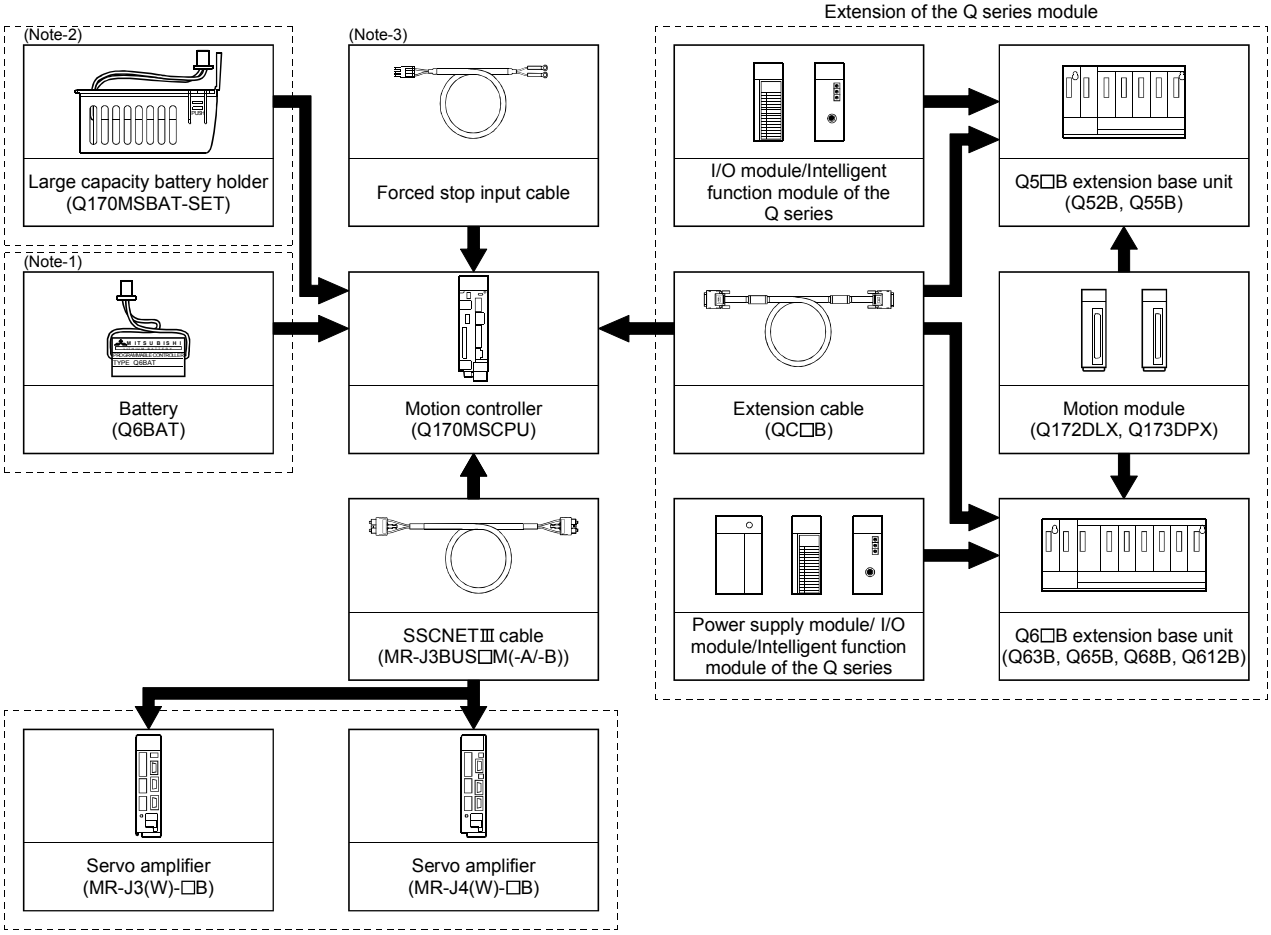
Motion CPU	MELSOFT MT Works2 (MT Developer2)	MR Configurator2
	SV13/SV22	
Q170MSCPU	1.56J	1.19V
Q170MSCPU-S1		

2. SYSTEM CONFIGURATION

This section describes the Motion controller (Q170MSCPU) system configuration, precautions on use of system and configured equipments.

2.1 Motion System Configuration

(1) Equipment configuration in Q170MSCPU system



It is possible to select the best according to the system.

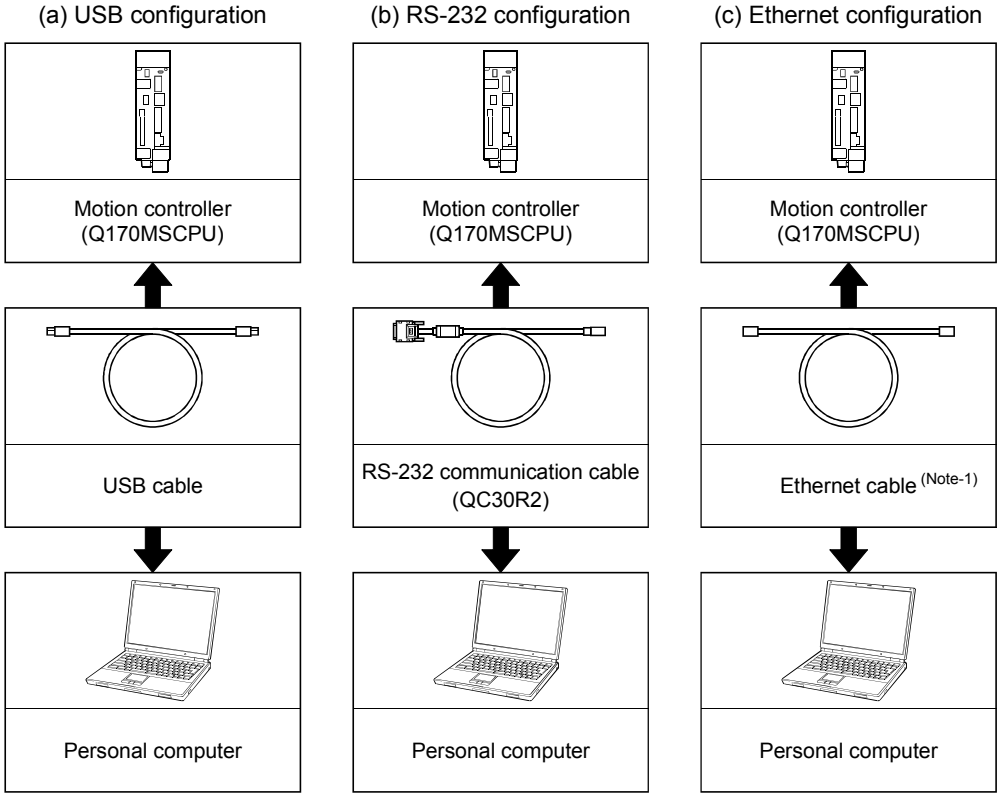
(Note-1): Be sure to install the Battery (Q6BAT) to the Battery holder.
(It is packed together with Q170MSCPU.)

(Note-2): Large capacity battery use (Q7BAT is included), sold separately.

(Note-3): Fabricate the forced stop input cable on the customer side.

(2) Peripheral device configuration for the Q170MSCPU

The following (a)(b)(c) can be used.



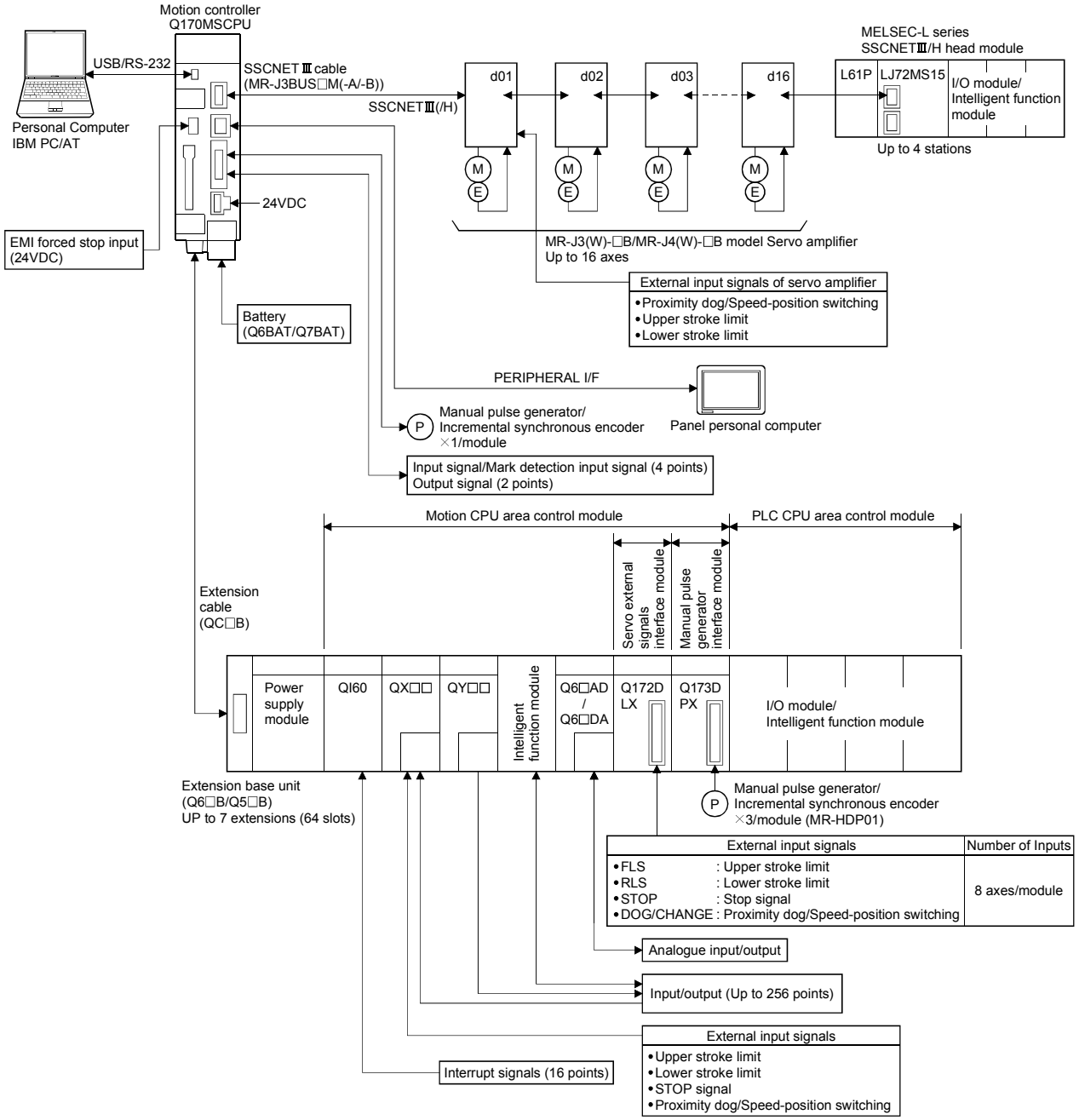
(Note-1): Corresponding Ethernet cables

Part name	Connection type	Cable type	Ethernet standard	Module name
Ethernet cable	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	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

2.1.1 Q170MSCPU System overall configuration



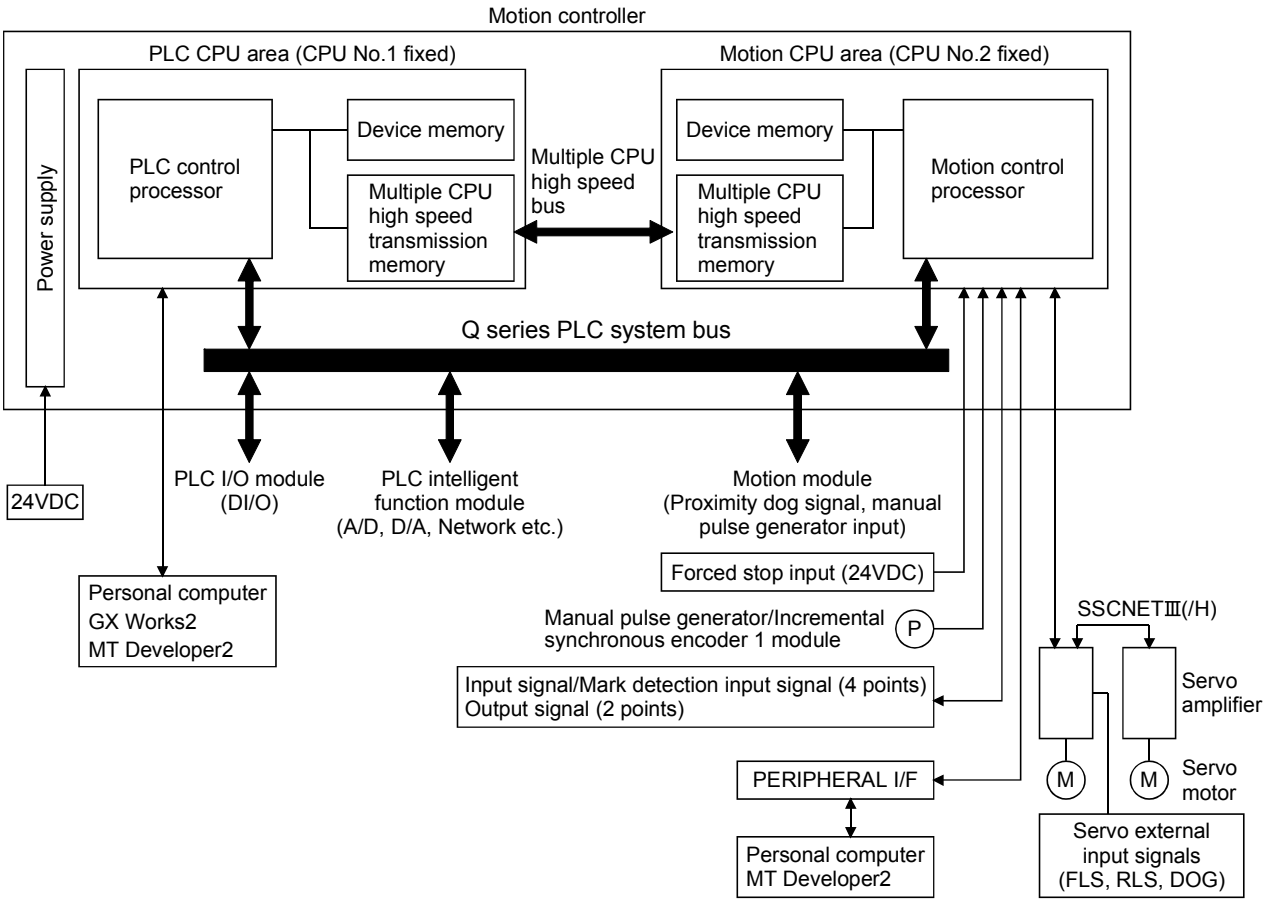
⚠CAUTION

- 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.
- The ratings and characteristics of the parts (other than Motion controller, servo amplifier and servomotor) used in a system must be compatible with the Motion controller, servo amplifier and servomotor.
- Set the parameter values to those that are compatible with the Motion controller, servo amplifier, servomotor and regenerative resistor model and the system application. The protective functions may not function if the settings are incorrect.

2.1.2 Q170MSCPU System internal configuration

(1) What is Multiple CPU system for Q170MSCPU ?

A Multiple CPU system for Q170MSCPU is a system in which between the PLC CPU area and Motion CPU area are connected with the Multiple CPU high speed bus in order to control the I/O modules and intelligent function modules.
PLC CPU area is fixed as CPU No.1, and Motion CPU area is fixed as CPU No.2.
And, the Motion CPU area controls the servo amplifiers connected by SSCNETⅢ cable.



(a) The device memory is the memory area for the bit devices (X, Y, M, etc.) and word devices (D, W, etc.).

(b) The Multiple CPU high speed transmission memory between the PLC CPU area and Motion CPU area can be communicated at 0.88ms cycles.

2.1.3 Function explanation of the Q170MSCPU Motion controller

(1) Whole

(a) The Multiple CPU high speed bus is equipped with between the PLC CPU area and Motion CPU area. With this reserved Multiple CPU high speed bus, data transfer of 0.88ms period is possible for up to 14k words.

(b) Data transfer between the PLC CPU area and Motion CPU area is possible by Multiple CPU high speed transmission memory or automatic refresh.

(c) The Multiple CPU high speed transmission cycle is synchronized with the motion control cycle thus optimizing the control system.

(2) PLC CPU area

(a) The I/O modules, analog I/O modules, pulse I/O modules, positioning modules, information modules and network can be controlled with the sequence program.

(b) The device data access and program start of the Motion CPU area can be executed by the Motion dedicated PLC instructions.

(c) The real-time processing can be realized by the Multiple CPU synchronous interrupt program.

(3) Motion CPU area

(a) Up to 16 axes servo amplifiers per 1 line can be controlled in Q170MSCPU.

(b) It is possible to set the program which synchronized with the motion operation cycle and executed at fixed cycle (0.22[ms], 0.44[ms], 0.88[ms], 1.77[ms], 3.55[ms], 7.11[ms], 14.2[ms]).

(c) It is possible to execute a download of servo parameters to servo amplifier, servo ON/OFF to servo amplifier and position commands, etc. by connecting between the Q170MSCPU and servo amplifier with SSCNETⅢ cable.

(d) It is possible to select the servo control functions/programming languages by installing the corresponding operating system software in the Q170MSCPU.

(e) Motion modules (Q172DLX/Q173DPX) are controlled with the Motion CPU area, and the signals such as stroke limit signals connected to Motion modules and incremental synchronous encoder(Note-1) can be used as motion control.

(f) The synchronous control can be executed by using the incremental synchronous encoder (up to 12 axes). The incremental synchronous encoder (1 axis) can also be used with Q170MSCPU's internal I/F.

(g) The stroke limit signals and proximity dog signals connected to the servo amplifiers can be used for the motion control.

(h) I/O controls (DI 4 points, DO 2 points) built-in Q170MSCPU (Motion CPU area) can be realized.

(i) PLC I/O modules and intelligent function modules (excluding some modules) can be controlled with the Motion CPU area.
(Refer to Section 2.3(2).)

(j) Wiring is reduced by issuing the external signal (upper/lower stroke limit signal, proximity dog signal) via the servo amplifier.

(Note-1): The incremental synchronous encoder can be used in SV22.
It cannot be used in SV13.

2.1.4 Restrictions on Motion controller

(1) Q170MSCPU Multiple CPU system is composed of the PLC CPU area (CPU No.1 fixed) and Motion CPU area (CPU No.2 fixed). Other CPU (CPU No.3, CPU No.4) cannot be set.

(2) It takes about 10 seconds to startup (state that can be controlled) of Motion controller. Make a Multiple CPU synchronous startup setting suitable for the system.

(3) Execute the automatic refresh of the Motion CPU area and PLC CPU area by using the automatic refresh of Multiple CPU high speed transmission area setting.

(4) The Motion modules, I/O modules and intelligent function modules, etc. can be installed on the extension base unit only.

(5) The CPU modules cannot be installed on the extension base unit.

(6) The synchronous encoder interface module Q172DEX/Q172EX(-S1/-S2/-S3) cannot be used.

(7) Be sure to control the Motion modules (Q172DLX, Q173DPX) with the Motion CPU area. They will not operate correctly if PLC CPU area is set by mistake.

(8) Q172LX/Q173PX(-S1) for Q173HCPU(-T)/ Q172HCPU(-T)/Q173CPUN(-T)/ Q172CPUN(-T)/Q173CPU/Q172CPU cannot be used.

(9) Motion CPU area cannot be set as the control CPU of Graphic Operation Terminal(GOT).

(10) Be sure to set the battery.

(11) There are following methods to execute the forced stop input.
- Use a EMI connector of Q170MSCPU.
- Use a device set in the forced stop input setting of system setting.

(12) Forced stop input for EMI connector of Q170MSCPU cannot be invalidated by the parameter.
When the device set in the forced stop input setting is used without use of EMI connector of Q170MSCPU, apply 24VDC voltage on EMI connector and invalidate the forced stop input of EMI connector.

(13) Be sure to use the cable for forced stop input. The forced stop cannot be released without using it. Fabricate the forced stop input cable on the customer side.

(14) Set "SSCNETⅢ/H" or "SSCNETⅢ" for every line in the SSCNET setting of system setting to communicate with the servo amplifiers.
MR-J4(W)-□B can be used by setting "SSCNETⅢ/H", and MR-J3(W)-□B can be used by setting "SSCNETⅢ".

(15) There are the following restrictions when "SSCNETⅢ" is set as communication method.
When the operation cycle is 0.2[ms], set the system setting and the axis select rotary switch of servo amplifier to "0 to 3".
If the axis select rotary switch of servo amplifier is set to "4 to F", the servo amplifiers are not recognized.
When the operation cycle is 0.4[ms], set the system setting and the axis select rotary switch of servo amplifier to "0 to 7".
If the axis select rotary switch of servo amplifier is set to "8 to F", the servo amplifiers are not recognized.
There is no restriction when "SSCNETⅢ/H" is set in the SSCNET setting.
(Note): The setting of axis select rotary switch differs according to the servo amplifier. Refer to the "Servo amplifier Instruction Manual" for details.

(16) Maximum number of control axes of servo amplifier is shown below.
• Operation cycle is 0.2[ms]: 4 axes per line
• Operation cycle is 0.4[ms]: 8 axes per line
There is no restriction when "SSCNETⅢ/H" is set in the SSCNET setting.

(17) When the operation cycle is "default setting", the operation cycle is set depending on the number of axes used. However, when "SSCNETⅢ" is set in the SSCNET communication setting and the number of axes used of servo amplifier is 9 axes or more per line, the operation cycle of 0.8 [ms] or more is set. (Refer to Section 2.5.1(2).)

(18) MR-J4W3-□B (Software version "A2" or before) and MR-J3W-□B does not supports operation cycle 0.2 [ms]. Set 0.4[ms] or more as operation cycle to use MR-J4W3-□B(Software version "A2" or before) and MR-J3W-□B.
MR-J4W3-□B (Software version "A3" or later) supports operation cycle 0.2 [ms]. However, when using operation cycle 0.2 [ms], some functions are restricted. Refer to the "Servo amplifier Instruction Manual" for details.

(19) If there is an axis which is not set at least 1 axis by system setting in applicable servo amplifier at MR-J4W-□B use, all axes connected to applicable servo amplifier and subsequent servo amplifiers cannot be connected. Set "Not used" to the applicable axis with a dip switch for the axis which is not used by MR-J4W-□B.

(20) The module name displayed by "System monitor" - "Product information list" of GX Works2 is different depending on the function version of Motion modules (Q172DLX, Q173DPX).

(Note): Even if the function version "C" is displayed, it does not correspond to the online module change.

Module name	Model display	
	Function version "B"	Function version "C"
Q172DLX	Q172LX	Q172DLX
Q173DPX	MOTION-UNIT	Q173DPX

(21) Use the Graphic Operation Terminal (GOT) that supports Q170MSCPU. (Refer to the "GOT1000 Series Connection Manual (Mitsubishi Products)".)

2.2 Checking Serial Number and Operating System Software Version

Checking for the serial number of Motion controller and Motion module, and the operating system software version are shown below.

2.2.1 Checking serial number

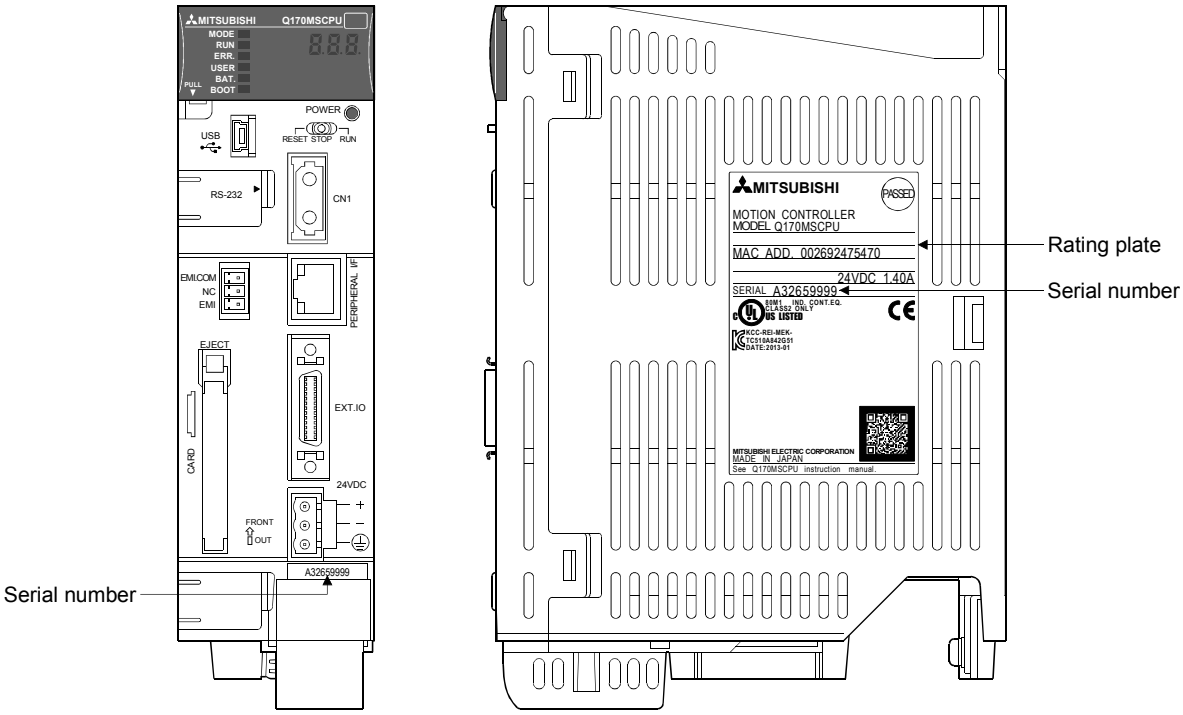
(1) Motion controller (Q170MSCPU)

(a) Rating plate

The rating plate is situated on the side face of the Motion controller.

(b) Front of Motion controller

The serial number is printed in the projection parts forward of the lower side of Motion controller.



(c) System monitor (product information list)

The serial number can be checked on the system monitor screen in GX Works2. (Refer to Section 2.2.2.)

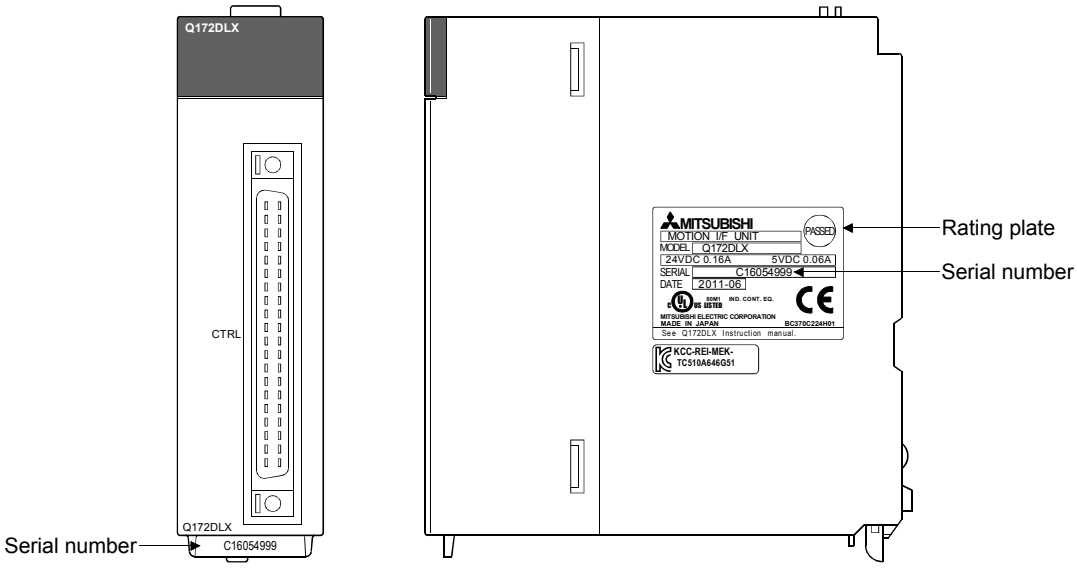
(2) Motion module (Q172DLX/Q173DPX)

(a) Rating plate

The rating plate is situated on the side face of the Motion module.

(b) Front of Motion module

The serial No. is printed in the projection parts forward of the lower side of Motion module.

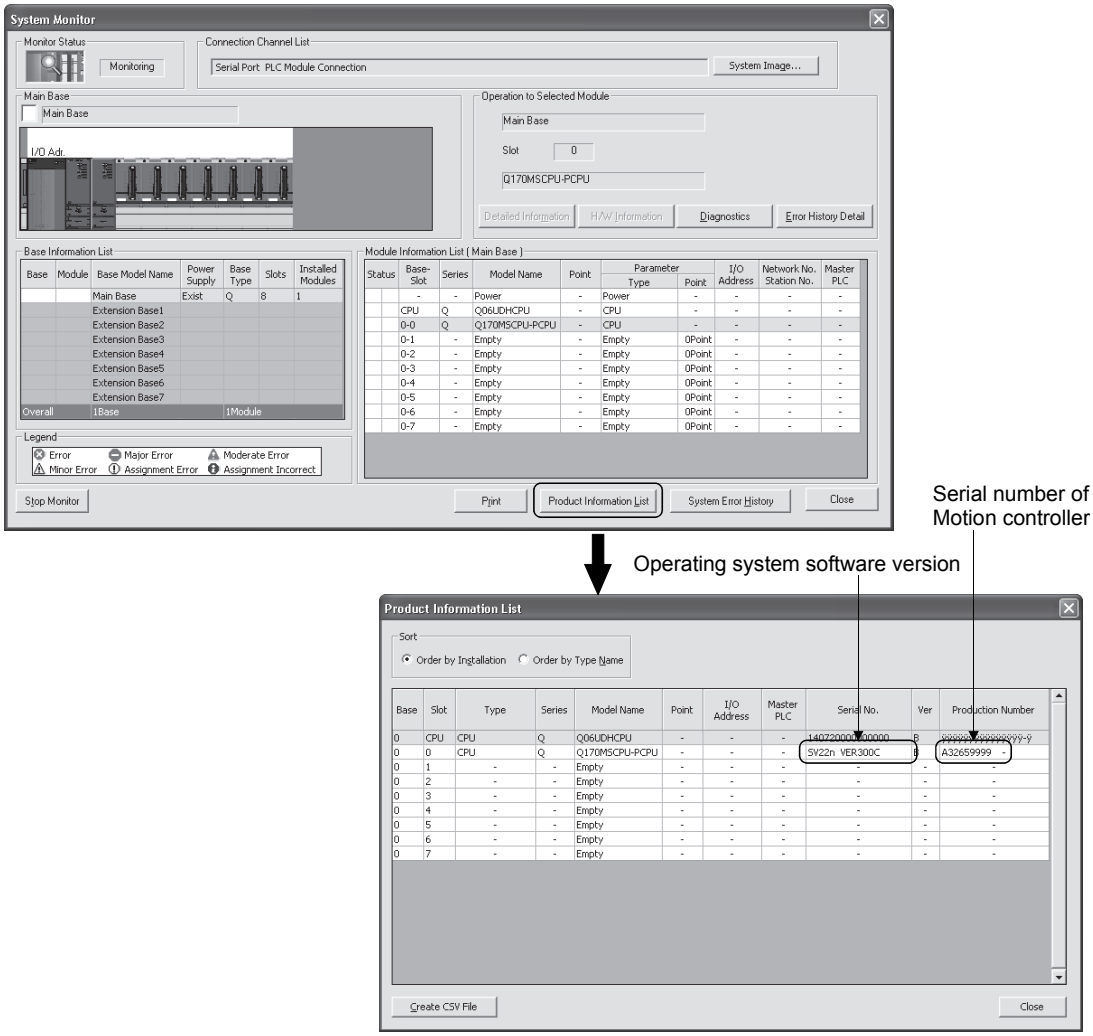


REMARK

The serial number display was corresponded from the Motion modules manufactured in early April 2008.

2.2.2 Checking operating system software version

The operating system software version can be checked on the system monitor screen in GX Works2.
Select [Product Information List] button on the system monitor screen displayed on [Diagnostics] – [System monitor] of GX Works2.



2.3 System Configuration Equipment

(1) Motion controller related module

Part name	Model name (Note-1)	Description	Current consumption 5VDC[A]	Remark
Motion controller	Q170MSCPU	Power supply, PLC CPU, Motion CPU, all-in-one type (Battery (Q6BAT), 24VDC power supply connector and connector for forced stop input cable (Note-2) are attached) • Motion CPU area Up to 16 axes control, Operation cycle 0.22[ms] or more, Servo program capacity 16k steps, Internal I/F (Incremental synchronous encoder interface 1ch, Input signal/Mark detection input signal 4 points, Output signal 2 points) • PLC CPU area Program capacity 30k steps, LD instruction processing speed 0.02μs	2.5 (Note-3)	
	Q170MSCPU-S1	Power supply, PLC CPU, Motion CPU, all-in-one type (Battery (Q6BAT), 24VDC power supply connector and connector for forced stop input cable (Note-2) are attached) • Motion CPU area Up to 16 axes control, Operation cycle 0.22[ms] or more, Servo program capacity 16k steps, Internal I/F (Incremental synchronous encoder interface 1ch, Input signal/Mark detection input signal 4 points, Output signal 2 points) • PLC CPU area Program capacity 60k steps, LD instruction processing speed 0.0095μs	2.5 (Note-3)	
Servo external signals interface module	Q172DLX	Servo external signal input 8 axes (FLS, RLS, STOP, DOG/CHANGE×8)	0.06	
Manual pulse generator interface module	Q173DPX	Manual pulse generator MR-HDP01/Incremental synchronous encoder interface ×3, Tracking input 3 points	0.38	
Manual pulse generator	MR-HDP01	Pulse resolution: 25PLS/rev(100PLS/rev after magnification by 4) Permitted axial loads Radial load: Up to 19.6N Thrust load: Up to 9.8N Permitted speed: 200r/min(Normal rotation), Voltage-output	0.06	
Battery	Q6BAT	For memory data backup of RAM built-in Motion controller Nominal current: 1800mAh	——	
Large capacity battery	Q7BAT	For memory data backup of RAM built-in Motion controller Nominal current: 5000mAh		
Large capacity battery holder	Q170MSBAT-SET	Battery holder for Q7BAT (Attachment Q7BAT)	——	
Internal I/F connector set	LD77MHIOCON	Incremental synchronous encoder/Mark detection signal interface connector (Not included with Q170MSCPU/Q170MSCPU-S1)	——	
Power supply module (Note-4)	Q61P	100 to 240VAC input, 5VDC 6A output	——	
	Q62P	100 to 240VAC input, 5VDC 3A/24VDC 0.6A output		
	Q63P	24VDC input, 5VDC 6A output		
	Q64PN	100 to 240VAC input, 5VDC 8.5A output		

Motion controller related module (continued)

Part name	Model name (Note-1)	Description	Current consumption 5VDC[A]	Remark
Extension base unit (Note-5)	Q52B	Number of I/O modules installed 2 slots, type not requiring power supply module	0.08	
	Q55B	Number of I/O modules installed 5 slots, type not requiring power supply module	0.10	
	Q63B	Number of I/O modules installed 3 slots	0.11	
	Q65B	Number of I/O modules installed 5 slots	0.11	
	Q68B	Number of I/O modules installed 8 slots	0.12	
	Q612B	Number of I/O modules installed 12 slots	0.13	
Extension cable	QC05B	Length 0.45m(1.48ft.)	——	
	QC06B	Length 0.6m(1.97ft.)		
	QC12B	Length 1.2m(3.94ft.)		
	QC30B	Length 3m(9.84ft.)		
	QC50B	Length 5m(16.40ft.)		
	QC100B	Length 10m(32.81ft.)		
SSCNETⅢ cable	MR-J3BUS□M	• Q170MSCPU ↔ MR-J4(W)-□B/MR-J4(W)-□B ↔ MR-J4(W)-□B/ MR-J4(W)-□B ↔ LJ72MS15 • Q170MSCPU ↔ MR-J3(W)-□B/MR-J3(W)-□B ↔ MR-J3(W)-□B • Standard cord for inside panel 0.15m(0.49ft.), 0.3m(0.98ft.), 0.5m(1.64ft.), 1m(3,28ft.), 3m(9.84ft.)	——	
	MR-J3BUS□M-A	• Q170MSCPU ↔ MR-J4(W)-□B/MR-J4(W)-□B ↔ MR-J4(W)-□B/ MR-J4(W)-□B ↔ LJ72MS15 • Q170MSCPU ↔ MR-J3(W)-□B/MR-J3(W)-□B ↔ MR-J3(W)-□B • Standard cable for outside panel 5m(16.40ft.), 10m(32.81ft.), 20m(65.62ft.)	——	
	MR-J3BUS□M-B (Note-6)	• Q170MSCPU ↔ MR-J4(W)-□B/MR-J4(W)-□B ↔ MR-J4(W)-□B/ MR-J4(W)-□B ↔ LJ72MS15 • Q170MSCPU ↔ MR-J3(W)-□B/MR-J3(W)-□B ↔ MR-J3(W)-□B • Long distance cable 30m(98.43ft.), 40m(131.23ft.), 50m(164.04ft.)	——	
SSCNETⅢ/H head module (Note-5)	LJ72MS15	Maximum link points: Input 64 bytes, Output 64 bytes Transmission cycle 222μs, 444μs, 888μs	0.55	

(Note-1): □=Cable length (015: 0.15m(0.49ft.), 03: 0.3m(0.98ft.), 05: 0.5m(1.64ft.), 1: 1m(3.28ft.), 2: 2m(6.56ft.), 3: 3m(9.84ft.), 5: 5m(16.40ft.), 10: 10m(32.81ft.), 20: 20m(65.62ft.), 25: 25m(82.02ft.), 30: 30m(98.43ft.), 40: 40m(131.23ft.), 50:50m(164.04ft.))

(Note-2): Be sure to use the cable for forced stop input. The forced stop cannot be released without using it. Cable for forced stop input is not attached to the Motion controller.

(Note-3): The manual pulse generator or incremental synchronous encoder that consumes less than 0.2[A] of current can be connected to the internal I/F connector.

(Note-4): Be sure to use the power supply module within the range of power supply capacity.

(Note-5): 5VDC internal current consumption of shared equipments with PLC might be changed. Be sure to refer to the MELSEC-Q/L series PLC Manuals.

(Note-6): Please contact your nearest Mitsubishi sales representative for the cable of less than 30m(98.43ft.).

(2) PLC module which can be controlled by Motion CPU area

Part name			Model name	Current consumption 5VDC[A] (Note-1)	Remark
Input module	AC		QX10	0.05 (TYP, All points ON)	Refer to the MELSEC-Q series PLC Manuals.
			QX10-TS	0.05 (TYP, All points ON)	
			QX28	0.05 (TYP, All points ON)	
	DC (Positive common)		QX40	0.05 (TYP, All points ON)	
			QX40-TS	0.05 (TYP, All points ON)	
			QX40-S1	0.06 (TYP, All points ON)	
			QX40H	0.08 (TYP, All points ON)	
			QX41	0.075 (TYP, All points ON)	
			QX41-S1	0.075 (TYP, All points ON)	
			QX41-S2	0.075 (TYP, All points ON)	
			QX42	0.09 (TYP, All points ON)	
			QX42-S1	0.09 (TYP, All points ON)	
	DC/AC		QX50	0.05 (TYP, All points ON)	
	DC sensor		QX70	0.055 (TYP, All points ON)	
			QX70H	0.08 (TYP, All points ON)	
			QX71	0.07 (TYP, All points ON)	
			QX72	0.085 (TYP, All points ON)	
	DC (Negative common)		QX80	0.05 (TYP, All points ON)	
			QX80-TS	0.05 (TYP, All points ON)	
			QX80H	0.08 (TYP, All points ON)	
			QX81	0.075 (TYP, All points ON)	
			QX81-S2	0.075 (TYP, All points ON)	
			QX82	0.09 (TYP, All points ON)	
			QX82-S1	0.09 (TYP, All points ON)	
			QX90H	0.08 (TYP, All points ON)	
Output module	Relay		QY10	0.43 (TYP, All points ON)	
			QY10-TS	0.43 (TYP, All points ON)	
			QY18A	0.24 (TYP, All points ON)	
	Triac		QY22	0.25 (TYP, All points ON)	
	Transistor	Sink Type	QY40P	0.065 (TYP, All points ON)	
			QY40P-TS	0.065 (TYP, All points ON)	
			QY41P	0.105 (TYP, All points ON)	
			QY42P	0.15 (TYP, All points ON)	
			QY50	0.08 (TYP, All points ON)	
		Independent	QY68A	0.11 (TYP, All points ON)	
		Source Type	QY80	0.08 (TYP, All points ON)	
			QY80-TS	0.08 (TYP, All points ON)	
			QY81P	0.095 (TYP, All points ON)	
			QY82P	0.16 (TYP, All points ON)	
	TTL•CMOS (Sink)		QY70	0.095 (TYP, All points ON)	
			QY71	0.15 (TYP, All points ON)	
Input/Output composite module	DC Input/ Transistor output		QH42P	0.13 (TYP, All points ON)	
			QX48Y57	0.08 (TYP, All points ON)	
			QX41Y41P	0.13 (TYP, All points ON)	
Interrupt module			QI60	0.06 (TYP, All points ON)	

PLC module which can be controlled by Motion CPU area (continued)

Part name		Model name	Current consumption 5VDC[A] (Note-1)	Remark
Analogue input module	Voltage input	Q68ADV	0.64	Refer to the MELSEC-Q series PLC Manuals.
	Current input	Q62AD-DGH	0.33	
		Q66AD-DG	0.42	
		Q68ADI	0.64	
	Voltage/current input	Q64AD	0.63	
		Q64AD-GH	0.89	
		Q68AD-G	0.46	
Analogue output module	Voltage output	Q68DAVN	0.38	
	Current output	Q68DAIN	0.38	
	Voltage/current output	Q62DAN	0.33	
		Q62DA-FG	0.37	
		Q64DAN	0.34	
		Q66DA-G	0.62	
Analogue input/output module		Q64AD2DA	0.17	
High-speed counter module	Differential input	QD62D	0.38	
	5/12/24VDC input/ Differential input	QD65PD2	0.23	
Positioning module	Open collector output	QD75P1	0.40	
		QD75P2	0.46	
		QD75P4	0.58	
	Differential output	QD75D1	0.52	
		QD75D2	0.56	
		QD75D4	0.82	
	SSCNETⅢ compatible	QD75MH1	0.15	Refer to the MELSEC-Q QD75MH Positioning Module User's Manual (Details).
		QD75MH2	0.15	
		QD75MH4	0.16	
Simple Motion module	SSCNETⅢ/H compatible	QD77MS2	0.60	Refer to the MELSEC-Q QD77MS Simple Motion Module User's Manual (Positioning Control).
		QD77MS4	0.60	
		QD77MS16	0.75	
Control unit of displacement sensor		UQ1-01	0.50	Refer to the manual of OPTEX FA CO., LTD.
		UQ1-02	0.50	

(Note-1): 5VDC internal current consumption of shared equipments with PLC might be changed.
Be sure to refer to the manuals of each module.

(3) PLC module which can be controlled by PLC CPU area

They are the same modules as the PLC modules which can be controlled by the universal model QCPU "Q03UDCPU (Q170MSCPU use)" or "Q06UDHCPU (Q170MSCPU-S1 use)".
Refer to the MELSEC-Q series PLC Manuals.

(4) Servo amplifier

Part name	Model name	Description	Remarks
MR-J4 series servo amplifier	MR-J4-□B		Refer to the servo amplifier instruction manuals.
	MR-J4-□B-RJ		
	MR-J4W-□B	For 2-axis type, 3-axis type	
MR-J3 series servo amplifier	MR-J3-□B		
	MR-J3W-□B	For 2-axis type	
	MR-J3-□B-RJ006	For fully closed control	
	MR-J3-□B-RJ004	For linear servo motor	
	MR-J3-□B-RJ080W	For direct drive motor	
	MR-J3-□B Safety	For drive safety servo	

(5) Operating system software

Application	Software package
Conveyor assembly use **SV13**	SW8DNC-SV13QN
Automatic machinery use **SV22**	SW8DNC-SV22QN

(Note-1): The operating system software (SV22 (Virtual mode switching method)) is installed at the time of product purchases.

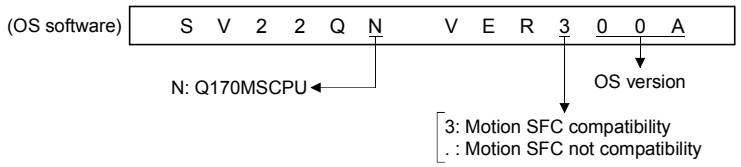
(6) Operating system type/version

(a) Confirmation method in MT Developer2

The operating system software type and version of connected CPU can be confirmed on the following screens.

1) Installation screen
2) CPU information screen displayed by menu bar [Help] → [CPU Information]

Example) When using Q170MSCPU, SV22 and OS version 00A.



(7) Programming software packages

(a) Motion controller engineering environment

Part name	Model name
MELSOFT MT Works2 (MT Developer2 (Note-1))	SW1DNC-MTW2-E

(Note-1): This software is included in Motion controller engineering environment "MELSOFT MT Works2".

(b) PLC software package

Model name	Software package
GX Works2	SW1DNC-GXW2-E

(c) Servo set up software package

Model name	Software package
MR Configurator2	SW1DNC-MRC2-E

POINTS

When the operation of Windows® is unclear in the operation of this software, refer to the manual of Windows® or guide-book from the other supplier.

2.4 General Specifications

General specifications of the Motion controller are shown below.

<table>
<tr><th>Item</th><th colspan="6">Specification</th></tr>
<tr><td>Operating ambient temperature</td><td colspan="6">0 to 55°C (32 to 131°F)</td></tr>
<tr><td>Storage ambient temperature</td><td colspan="6">-25 to 75°C (-13 to 167°F)</td></tr>
<tr><td>Operating ambient humidity</td><td colspan="6">5 to 95% RH, non-condensing</td></tr>
<tr><td>Storage ambient humidity</td><td colspan="6">5 to 95% RH, non-condensing</td></tr>
<tr><td rowspan="5">Vibration resistance</td><td rowspan="5">Compliant with JIS B 3502 and IEC 61131-2</td><td></td><td>Frequency</td><td>Constant acceleration</td><td>Half amplitude</td><td>Sweep count</td></tr>
<tr><td rowspan="2">Under intermittent vibration</td><td>5 to 9Hz</td><td>——</td><td>3.5mm (0.14inch)</td><td rowspan="2">10 times each in X, Y, Z directions (For 80 min.)</td></tr>
<tr><td>9 to 150Hz</td><td>9.8m/s^2</td><td>——</td></tr>
<tr><td rowspan="2">Under continuous vibration</td><td>5 to 9Hz</td><td>——</td><td>1.75mm (0.07inch)</td><td rowspan="2">—</td></tr>
<tr><td>9 to 150Hz</td><td>4.9m/s^2</td><td>——</td></tr>
<tr><td>Shock resistance</td><td colspan="6">Compliant with JIS B 3502 and IEC 61131-2 (147m/s^2, 3 times in each of 3 directions X, Y, Z)</td></tr>
<tr><td>Operating ambience</td><td colspan="6">No corrosive gases</td></tr>
<tr><td>Operating altitude (Note-1)</td><td colspan="6">2000m(6561.68ft.) or less</td></tr>
<tr><td>Mounting location</td><td colspan="6">Inside control panel</td></tr>
<tr><td>Overvoltage category (Note-2)</td><td colspan="6">II or less</td></tr>
<tr><td>Pollution level (Note-3)</td><td colspan="6">2 or less</td></tr>
</table>

(Note-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.

(Note-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.

(Note-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.

⚠CAUTION

- The Motion controller must be stored and used under the conditions listed in the table of specifications above.
- 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.

2.5 Specifications of Equipment

2.5.1 Q170MSCPU Motion controller

This section describes the specification of the Motion controller.

(1) Basic specifications of Q170MSCPU

Item		Specification
24VDC power supply	Input voltage (Note-1), (Note-2)	21.6 to 26.4VDC (24VDC +/ -10%, ripple ratio 5% or less)
	Inrush current (Note-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 (Note-6)
Efficiency		80% (TYP)
Input method		Connector
Allowable momentary power failure immunity (Note-4), (Note-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)

POINTS

(Note-1): Input power supply
Q170MSCPU is rated for use with a 24VDC input power only.
The Q170MSCPU breaks down when 28VDC or more input.

(Note-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.

(Note-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.

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

(Note-5): Select 24VDC power supply with allowable momentary power failure period of 20ms or more.

(Note-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 control specifications/performance specifications

(a) Motion control specifications

Item		Specification
Number of control axes		Up to 16 axes
Operation cycle (default)	SV13	0.22ms/ 1 to 4 axes 0.44ms/ 5 to 10 axes 0.88ms/ 11 to 16 axes
	SV22	0.44ms/ 1 to 6 axes 0.88ms/ 7 to 16 axes
Interpolation functions		Linear interpolation (Up to 4 axes), Circular interpolation (2 axes), Helical interpolation (3 axes)
Control modes		PTP (Point to Point) control, Speed control, Speed-position control, Fixed-pitch feed, Constant speed control, Position follow-up control, Speed control with fixed position stop, Speed switching control, High-speed oscillation control, Speed-torque control, Synchronous control (SV22 (Virtual mode switching method/Advanced synchronous control method))
Acceleration/deceleration control		Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration, Advanced S-curve acceleration/deceleration
Compensation		Backlash compensation, Electronic gear, Phase compensation (SV22)
Programming language		Motion SFC, Dedicated instruction, Mechanical support language (SV22) (Note-1)
Servo program capacity		16k steps
Number of positioning points		3200 points (Positioning data can be designated indirectly)
Peripheral I/F		USB/RS-232 (PLC CPU area control), PERIPHERAL I/F (Motion CPU area control)
Home position return function		Proximity dog type (2 types), Count type (3 types), Data set type (2 types), Dog cradle type, Stopper type (2 types), Limit switch combined type, Scale home position signal detection type, Dogless home position signal reference type
		Home position return re-try function provided, home position shift function provided
JOG operation function		Provided
Manual pulse generator operation function		Possible to connect 3 modules (Q173DPX use) Possible to connect 1 module (Q170MSCPU's internal I/F use) (Note-2), (Note-3)
Synchronous encoder operation function		Possible to connect 12 modules (SV22 use, Incremental only) (Note-4) (Q173DPX + Internal I/F + Via device (Note-5))
M-code function		M-code output function provided, M-code completion wait function provided
Limit switch output function	SV13	Number of output points 32 points Watch data: Motion control data/Word device
	SV22	Virtual mode switching method : Number of output points 32 points Advanced synchronous control method : Number of output points 64 points × 2 settings Output timing compensation Watch data: Motion control data/Word device
ROM operation function		Provided
External input signal		Q172DLX, External input signals (FLS/RLS/DOG) of servo amplifier, Internal I/F (DI), Bit device
High-speed reading function (Note-6)		Provided (Via internal I/F/input module, Via tracking of Q173DPX)
Forced stop		Motion controller forced stop (EMI connector, System setting), Forced stop terminal of servo amplifier
Number of I/O points		Total 256 points (Internal I/F (Input 4 points, output 2 points) + I/O module + Intelligent function module)
Mark detection function	Mark detection mode setting	Continuous detection mode, Specified number of detection mode, Ring buffer mode
	Mark detection signal	Internal I/F (DI), Bit device
	Mark detection setting	32 settings
Clock data setting		Clock synchronization between Multiple CPU

Motion control specifications (continued)

Item		Specification
Security function		Provided (Protection by software security key or password)
All clear function		Provided
Remote operation		Remote RUN/STOP, Remote latch clear
Optional data monitor function	SSCNETⅢ/H	Up to 6 data/axis (Communication data: Up to 6 points/axis)
	SSCNETⅢ	Up to 3 data/axis (Communication data: Up to 3 points/axis)
Digital oscilloscope function		Motion buffering method (Real-time waveform can be displayed) Sampling data: Word 16CH, Bit 16CH
Absolute position system		Made compatible by setting battery to servo amplifier. (Possible to select the absolute data method or incremental method for each axis)
SSCNETⅢ communication (Note-7)	Communication method	SSCNETⅢ/H, SSCNETⅢ
	Number of lines	1 line
Driver communication function (Note-8)		Provided
Number of Motion related modules	Q172DLX	2 modules usable
	Q173DPX	4 modules usable (Note-9)
Number of SSCNETⅢ head module communication stations		Up to 4 stations usable

(Note-1): SV22 virtual mode only

(Note-2): When the manual pulse generator is used via the Q170MSCPU's internal I/F, the Q173DPX cannot be used.

(Note-3): When the operation cycle is 7.11ms or less, the manual pulse generator I/F built-in CPU can be used.

(Note-4): Any incremental synchronous encoder connected to the Q170MSCPU's internal I/F will automatically be assigned an Axis No. one integer greater than the number of encoders connected to any Q173DPX modules.

(Note-5): SV22 advanced synchronous control only

(Note-6): This cannot be used in SV22 advanced synchronous control of Q17MSCPU/Q170MSCPU-S1.

(Note-7): The servo amplifiers for SSCNET cannot be used.

(Note-8): Servo amplifier (MR-J3-□B) only

(Note-9): When using the incremental synchronous encoder (SV22 use), you can use above number of modules.
When connecting the manual pulse generator, you can use only 1 module.

(b) Motion SFC performance specifications

Item				Specification
Motion SFC program capacity	Code total (Motion SFC chart + Operation control + Transition)			652k bytes
	Text total (Operation control + Transition)			668k bytes
Motion SFC program	Number of Motion SFC programs			256 (No.0 to 255)
	Motion SFC chart size/program			Up to 64k bytes (Included Motion SFC chart comments)
	Number of Motion SFC steps/program			Up to 4094 steps
	Number of selective branches/branch			255
	Number of parallel branches/branch			255
	Parallel branch nesting			Up to 4 levels
Operation control program (F/FS) / Transition program (G)	Number of operation control programs			4096 with F(Once execution type) and FS(Scan execution type) combined. (F/FS0 to F/FS4095)
	Number of transition programs			4096 (G0 to G4095)
	Code size/program			Up to approx. 64k bytes (32766 steps)
	Number of blocks(line)/program			Up to 8192 blocks (in the case of 4 steps(min)/blocks)
	Number of characters/block			Up to 128 (comment included)
	Number of operand/block			Up to 64 (operand: constants, word device, bit devices)
	( ) nesting/block			Up to 32 levels
	Descriptive expression	Operation control program		Calculation expression, bit conditional expression, branch/repetition processing
		Transition program		Calculation expression/bit conditional expression/ comparison conditional expression
Execute specification	Number of multi execute programs			Up to 256
	Number of multi active steps			Up to 256 steps/all programs
	Executed task	Normal task		Execute in main cycle of Motion controller
		Event task (Execution can be masked.)	Fixed cycle	Execute in fixed cycle (0.22ms, 0.44ms, 0.88ms, 1.77ms, 3.55ms, 7.11ms, 14.2ms)
			External interrupt	Execute when input ON is set among interrupt module QI60 (16 points).
			PLC interrupt	Execute with interrupt instruction (D(P).GINT) from PLC.
		NMI task		Execute when input ON is set among interrupt module QI60 (16 points).
Number of I/O points (X/Y)				8192 points
Number of real I/O points (PX/PY)				Total 256 points (Internal I/F (Input 4 points, Output 2 points) + I/O module + Intelligent function module)
Number of devices (Device In the Motion CPU area only) (Included the positioning dedicated device)	Internal relays (M)			12288 points
	Link relays (B)			8192 points
	Annunciators (F)			2048 points
	Special relays (SM)			2256 points
	Data registers (D)			8192 points (Note-1)
	Link registers (W)			8192 points
	Special registers (SD)			2256 points
	Motion registers (#)			12288 points
	Coasting timers (FT)			1 point (888μs)
	Multiple CPU area devices (U□\G)			Up to 14336 points (Note-2)

(Note-1): 19824 points can be used for SV22 advanced synchronous control.
(Note-2): Usable number of points changes according to the system settings.

(3) PLC control specifications

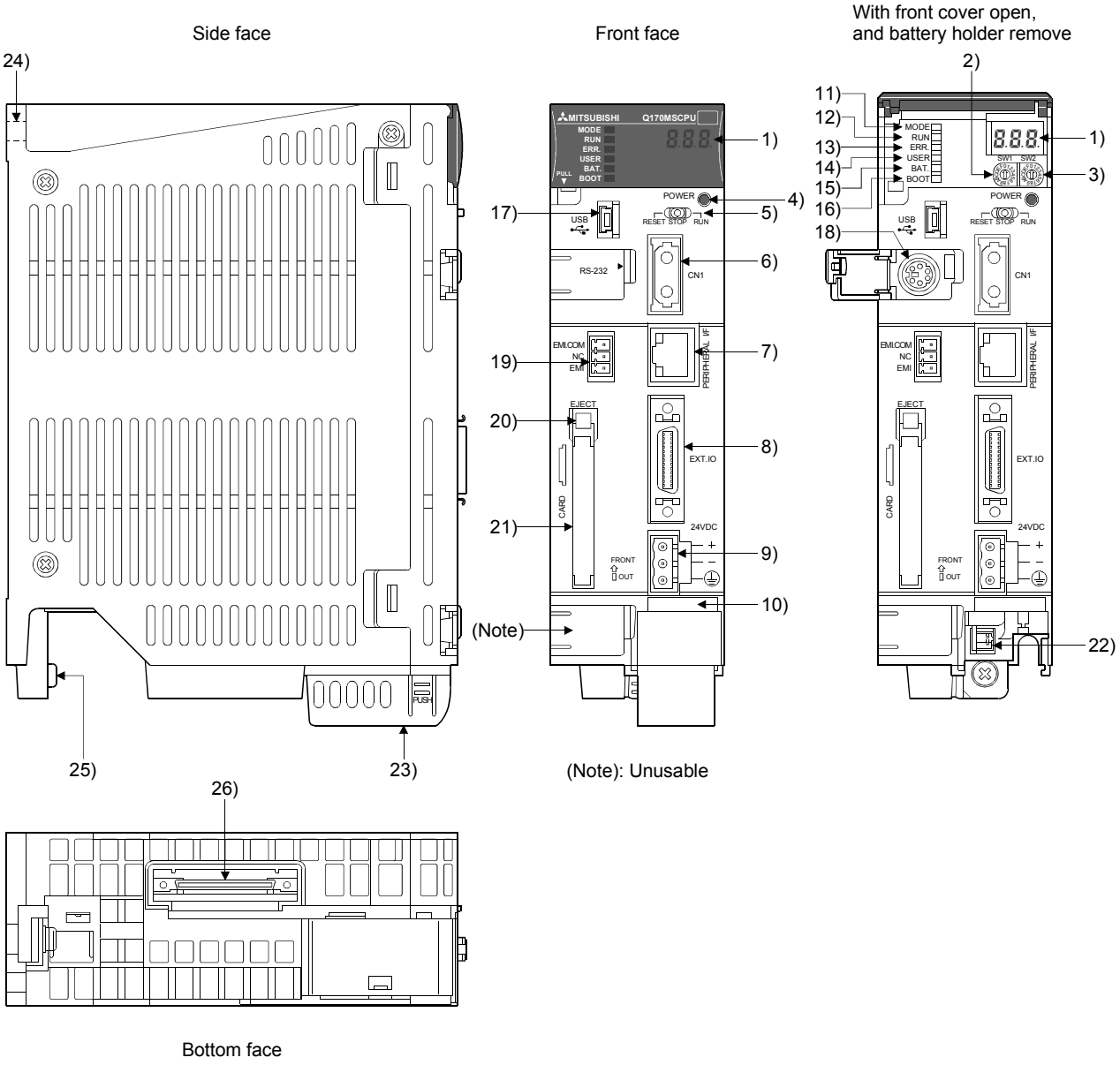
Item		Specification	
		Q170MSCPU	Q170MSCPU-S1
PLC CPU area		Q03UDCPU or equivalent	Q06UDHCPU or equivalent
Control method		Stored program repeat operation	
I/O control mode		Refresh mode	
Sequence control language		Relay symbol language (ladder), logic symbolic language (list), MELSAP3 (SFC), MELSAP-L, Structured text (ST)	
Processing speed (sequence instruction)	LD instruction	0.02 μs	0.0095 μs
	MOV instruction	0.04 μs	0.019 μs
	PC MIX value (instruction/μs)	28	60
	Floating point addition	0.12 μs	0.057 μs
Total number of instructions		858	
Operation (floating point operation) instruction		Yes	
Character string processing instruction		Yes	
PID instruction		Yes	
Special function instruction (Trigonometric function, square root, exponential operation, etc.)		Yes	
Constant scan		0.5 to 2000ms (Setting available in 0.5ms unit.)	
Program capacity		30k steps (120k byte)	60k steps (240k byte)
CPU shared memory	QCPU standard memory	8k bytes	
	Multiple CPU high speed transmission area	32k bytes	
No. of I/O device points (X/Y)		8192 points	
No. of I/O points (X/Y)		4096 points	
Internal relay (M)	Points by default (changeable by parameters)	8192 points	
Latch relay (L)		8192 points	
Link relay (B)		8192 points	
Timer (T)		2048 points	
Retentive timer (ST)		0 points	
Counter (C)		1024 points	
Data register (D)		12288 points	
Link register (W)		8192 points	
Annunciator (F)		2048 points	
Edge relay (V)		2048 points	
Link special relay (SB)		2048 points	
Link special register (SW)		2048 points	
File register (R, ZR)		98304 points	393216 points
Step relay (S)		8192 points	
Index register/Standard device register (Z)		20 points	
Index register (Z) (32-bit modification specification of ZR device)		Up to 10 points (Z0 to Z18) (Index register (Z) is used in double words.)	
Pointer (P)		4096 points	
Interrupt pointer (I)		256 points	
Special relay (SM)		2048 points	
Special register (SD)		2048 points	
Function input (FX)		16 points	
Function output (FY)		16 points	
Function register (FD)		5 points	
Local device		Yes	
Device initial values		Yes	

PLC control specifications (continued)

Item		Specification	
		Q170MSCPU	Q170MSCPU-S1
Extension base unit	Number of extensions	7 extension (Up to 64 slots) (Note-1) (Q52B/Q55B/Q63B/Q65B/Q68B/Q612B usable)	
PC type when program is made by GX Works2		Q03UDCPU	Q06UDHCPU

(Note-1): Occupies 8 slots of the main base unit as empty slots.

(4) Q170MSCPU names of parts



(Note): Unusable

Bottom face

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) • Each switch setting is 0 to F. (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 to RUN/STOP. RUN : Sequence program/Motion SFC program is started. STOP : Sequence program/Motion SFC program is stopped. • RESET (Momentary switch) Set the switch to the "RESET" position 1 second or more to reset the hardware.
6)	SSCNETⅢ CN1 connector (Note-1)	Connector to connect the servo amplifier.
7)	PERIPHERAL I/F connector	For communication I/F with peripheral devices. • Upper LED Remains flashing : It communicates with the peripheral devices. ON : It does not communicate with the peripheral devices. • Lower LED Data transmission speed ON : 100Mbps OFF : 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". • To turn ON the "RUN" LED after writing the program, carry out the following steps. 1) Set the RUN/STOP/RESET switch in the order of "RUN" to "STOP" to "RUN". 2) Reset with the RUN/STOP/RESET switch. 3) Power ON the Motion controller again. • To turn ON the "RUN" LED after writing the parameters, carry out the following steps. 1) Reset with the RUN/STOP/RESET switch. 2) Power ON the Motion controller again. (If the RUN/STOP/RESET is set in the order of "RUN" to "STOP" to "RUN" after changing the parameters, network parameters and intelligent function module parameters will not be updated.

No.	Name	Application
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) (Note-2)	Input to stop all axes of servo amplifier in a lump. EMI ON (opened) : Forced stop EMI OFF (24VDC input) : Forced stop release
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/Q7BAT.
23)	Battery holder (Note-3)	Battery holder to set the Q6BAT/Q7BAT.
24)	Module fixing screw hole (Note-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 transfer of signals to/from the extension base unit.

(Note-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.

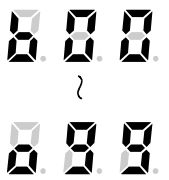
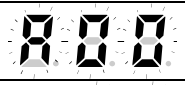
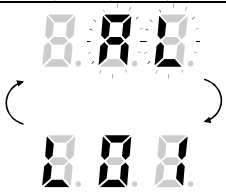
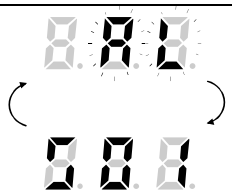
(Note-2): Be sure to use the cable for forced stop input. The forced stop cannot be released without using it. If the cable for forced stop input is fabricated on the customer side, make it within 30m(98.43ft.).

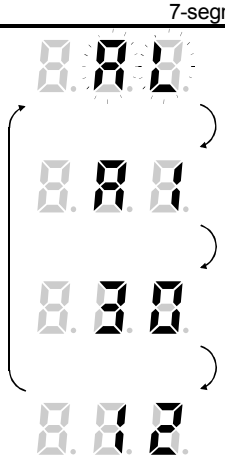
(Note-3): Be sure to set the battery. The data (Refer to Section 6.5.) of RAM built-in Motion controller are not backed up if the battery cable is not set correctly.

(Note-4): Purchase the M5 screws.

(5) 7-segment LED display

The LED displays/flashes in the combination with errors.

Item		7-segment LED		Remark
Start			Initializing	It takes about 10 seconds to initialize (RUN/STOP display). Execute the power cycle of the Motion controller if the operation stopped at initializing. It may be Motion controller's hardware fault when it is not improved. Explain the error symptom (LED display) and get advice from our sales representative for the modules with failure.
Normal			" ☀" remains flashing	Normal operation
Installation mode			Steady "INS" display, " ☀" remains flashing	Mode to install the operating system software via personal computer.
Operation mode	Mode operated by RAM		" ☀" remains flashing	Mode to operate based on the user programs and parameters stored in the RAM built-in Motion controller.
	Mode operated by ROM		Steady " . " display, " ☀" remains flashing	Mode to operate after the user programs and parameters stored in the FLASH ROM built-in Motion controller are read to the RAM built-in Motion controller.
STOP			Steady "STP" display	Stopped the Motion SFC program with the PLC READY flag (M2000) OFF.
RUN			Steady "RUN" display	Executed the Motion SFC with the PLC READY flag (M2000) ON.
Battery error	Early stage warning (2.7V or less)		Steady "BT1" display	Displayed at battery voltage 2.7V or less. Refer to Section "6.5 Battery".
	Final stage warning (2.5V or less)		Steady "BT2" display	Displayed at battery voltage 2.5V or less. Refer to Section "6.5 Battery".
Operating system software not installed			"A00" remains flashing	It becomes the status of installation mode when the operating system software is not installed.
System setting error			" AL" flashes 3 times ↓ Steady " L01" display	System setting error of the Motion controller Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details.
Servo error			" AL" flashes 3 times ↓ Steady " S01" display	Servo error of the Motion controller Refer to the Programming Manual of the operating system software used for details.
WDT error			Steady "..." display	Hardware fault or software fault Refer to the Programming Manual of the operating system software used for details.

Item	7-segment LED		Remark
Self diagnostic error (Error related for Multiple CPU)		" AL" flashes 3 times ↓ Steady " A1" display (Self-diagnosis error) ↓ 4-digits error code is displayed in two sequential flashes of 2-digits each. (ex. error code [3012])	Setting error of the Multiple CPU system Refer to the " Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details.

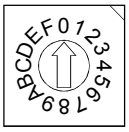
POINTS

(1) An error is displayed at the 7-segment LED, confirm the error code etc. using MT Developer2.

(2) Refer to the Motion CPU error batch monitor of MT Developer2 or error list of Programming Manual for error details.

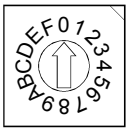
(6) Rotary switch assignment

(a) Rotary function select 1 switch (SW1)

Rotary switch	Setting (Note)	Mode	Description
	0	Normal mode	Normal operation mode
	A	Installation mode	Installed the operating system software using MT Developer2

(Note): Do not set other than the above setting.

(b) Rotary function select 2 switch (SW2)

Rotary switch	Setting (Note)	Mode	Description
	0	Mode operated by RAM	Normal operation mode (Operation by the setting data and parameters stored in the RAM built-in Motion controller.)
	6	Mode operated by ROM	Mode to operate based on the setting data and parameters wrote to the FLASH ROM built-in Motion controller.
	8	Ethernet IP address display mode	Mode to display the Ethernet IP address.
	C	SRAM clear	SRAM "0" clear

(Note): Do not set other than the above setting.

⚠CAUTION

● Be sure to turn OFF the Motion controller's power supply before the rotary switch setting change.

(7) Operation mode

(a) Rotary switch setting and operation mode

Rotary switch setting (Note-1)		Operation mode
SW1	SW2	
A	Any setting (Except C)	Installation mode
0	0	Mode operated by RAM
0	6	Mode operated by ROM
0	8	Ethernet IP address display mode
Any setting	C	SRAM clear (Note-2)

(Note-1): Do not set other the above setting.

(Note-2): The data (Refer to Section 6.5) of RAM built-in Motion controller are cleared.

(b) Operation mode overview

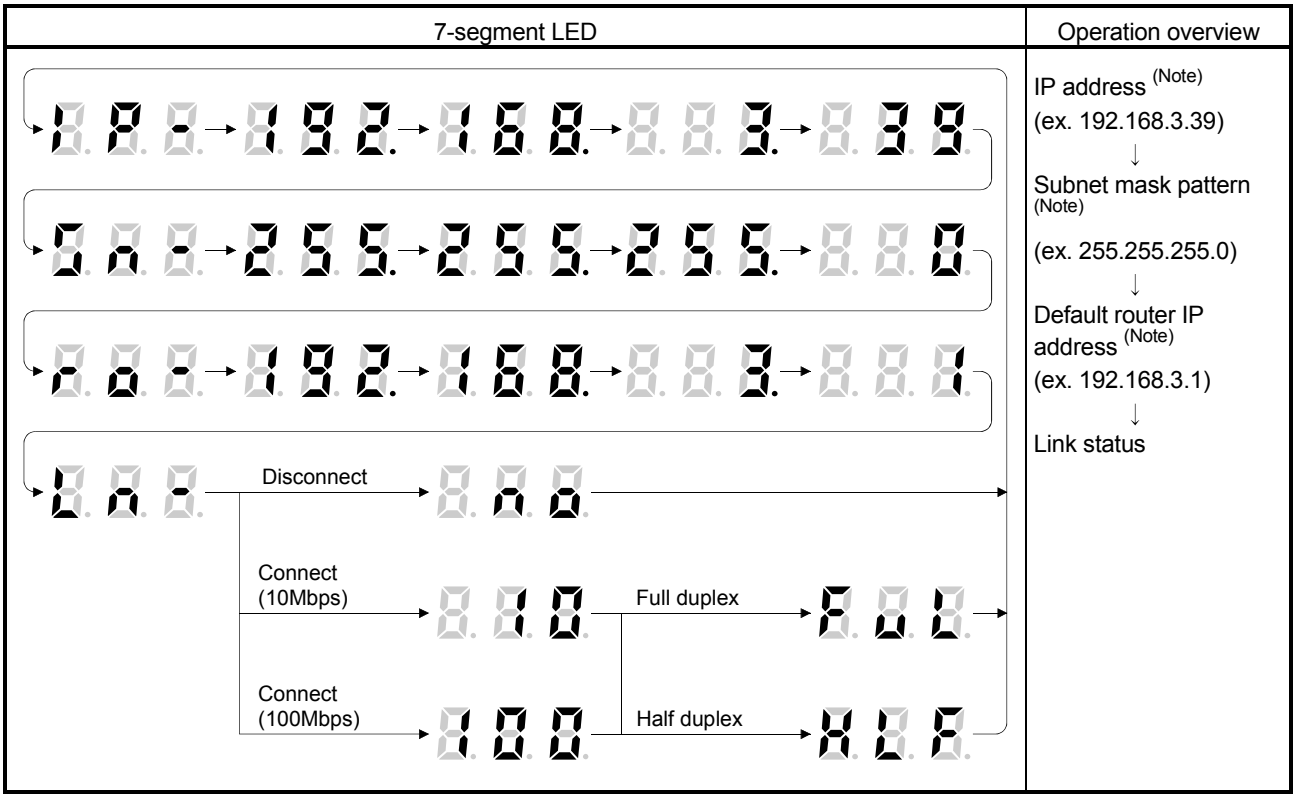
Operation mode	7-segment LED	Operation overview
Installation mode		• Steady "INS" display at the 7-segment LED. • Operating system software can be installed. • It is STOP status regardless of the RUN/STOP/RESET switch position at the front side of Motion controller. • The stop error "MULTI CPU DOWN (error code: 7000)" will occur at the PLC CPU area.
Mode operated by RAM		• " . " remains flashing in the first digit of 7-segment LED. • It operates based on the user programs and parameters stored in the RAM built-in Motion controller. • The user programs and parameters for the ROM operation can be written to the FLASH ROM built-in Motion controller.
Mode operated by ROM		• " . " remains flashing in the first digit and steady" . "display in the second digit of 7-segment LED. • Operation starts after the user programs and parameters stored in the FLASH ROM built-in Motion controller are read to the RAM built-in Motion controller at power supply on or reset of the Motion controller. If the ROM writing is not executed, even if the user programs and parameters are changed using the MT Developer2 during mode operated by ROM, operation starts with the contents of the FLASH ROM built-in Motion controller at next power supply on or reset. Also, If the ROM writing is not executed, even if the auto tuning data are reflected on the servo parameter of Motion controller by operation in the auto-tuning setting, operation starts with the contents of the FLASH ROM built-in Motion controller at next power supply on or reset.
Ethernet IP address display mode	Refer to next page (c)	• Refer to next page "(c) Ethernet IP address display mode overview". • It is STOP status regardless of the RUN/STOP/RESET switch position on the front side of Motion controller. • The stop error "MULTI CPU DOWN (error code: 7000)" will occur at the PLC CPU area.
SRAM clear		• " . " remains flashing in the first digit of 7-segment LED. • The data (Refer to Section 6.5) of RAM built-in Motion controller are cleared by turning ON the Motion controller's power supply after the rotary switch2 is set to "C".

POINTS

(1) Be sure to turn OFF the Motion controller's power supply before the rotary switch setting change.

(2) It is recommended to shift to the mode operated by ROM after the programs and parameters are fixed. The erasing of the programs and parameters can be avoided even if the battery decrease. (The ROM writing cannot be executed for the current position of the servo motor in the absolute position system, home position and latch device. Back up them beforehand using MT Developer2.)
Refer to Section 4.4 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of the ROM operation.

(c) Ethernet IP address display mode overview



(Note): When the Ethernet parameters are not written in the Motion controller, the addresses are displayed as follows.

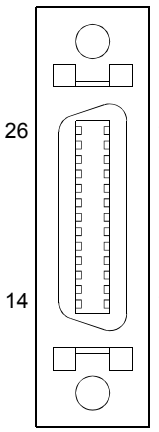
- IP address : 192.168.3.39
- Subnet mask pattern : 255.255.255.0
- Default router IP address : 192.168.3.1

(8) Internal I/F connector

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

Use the internal I/F connector on the front of the Q170MSCPU to connect to manual pulse signals and incremental synchronous encoder signals.

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



Internal I/F connector

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

- Applicable connector model name:
  Soldering type connector (LD77MHIOCON)
  10126-3000PE connector (Sumitomo 3M Limited make) (Optional)
  10326-52F0-008 connector case
- Wire size: AWG28

(Note-1): 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

(Note-2): Voltage-output/open-collector type
Connect the A-phase signal to HA, and the B-phase signal to HB.

(Note-3): 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.

(Note-4): "COM1" is the common terminal of DI1, DI2, DI3 and DI4.

(Note-5): "COM2" is the common terminal of DO1 and Do2.

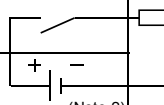
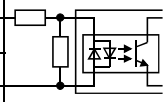
(Note-6): Do not connect to any of the terminal is explained as "No connect".

(b) Input signal/Mark detection

1) Specifications of input signal/mark detection input signal

Item		Specifications
Number of input points		4 points
Input method		Positive common/Negative common shared
Common terminal arrangement		4 points/common (Common contact: COM1)
Isolation method		Photocoupler
Rated input voltage		24VDC
Rated input current (I_{IN})		Approx. 5mA
Operating voltage range		21.6 to 26.4VDC (24VDC ±10%, ripple ratio 5% or less)
ON voltage/current		17.5VDC or more/3.5mA or more
OFF voltage/current		5VDC or less/0.9mA or less
Input resistance		Approx. 5.6kΩ
Response time	OFF to ON	1ms or less
	ON to OFF	

2) Interface between input signal/mark detection input signal

Input or output	Signal name		Pin No. 1	2	3	4	Wiring example	Internal circuit	Description
Input	Input/ Mark detection signal input	DI□(Note-1)	16	3	17	4			Signal input, Mark detection signal input
		COM1	15						

(Note-1): □=1 to 4

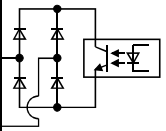
(Note-2): As for the 24VDC sign, both "+" and "-" are possible.

(c) Output signal

1) Specifications of output signal

Item		Specifications
Number of output points		2 points
Output method		Sink/Source type
Common terminal arrangement		2 points/common (Common contact: COM2)
Isolation method		Photocoupler
Rated load voltage		24VDC ±10%
Maximum load current (I_{out})		40mA/point, 80mA/common
External power supply		21.6 to 26.4VDC (24VDC ±10%, ripple ratio 5% or less)
Maximum voltage drop at ON (V_{dorp})		2.75VDC or less
OFF voltage/current		11VDC or less/1.7mA or less
Response time	OFF to ON	1ms or less
	ON to OFF	1ms or less (Rated load, resistance load)

2) Interface between output signal

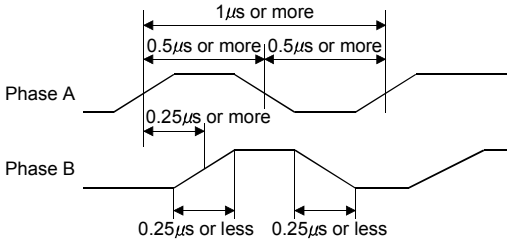
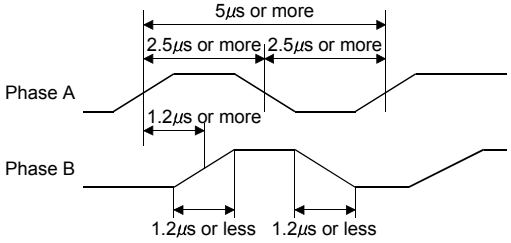
Input or output	Signal name		Pin No. 1	Pin No. 2	Wiring example	Internal circuit	Description
Output	Output	DO□(Note-1)	14	1	load		Signal output
		COM2	2		+ − 24VDC(Note-2)		

(Note-1): □=1 to 2

(Note-2): As for the 24VDC sign, both "+" and "-" are possible.

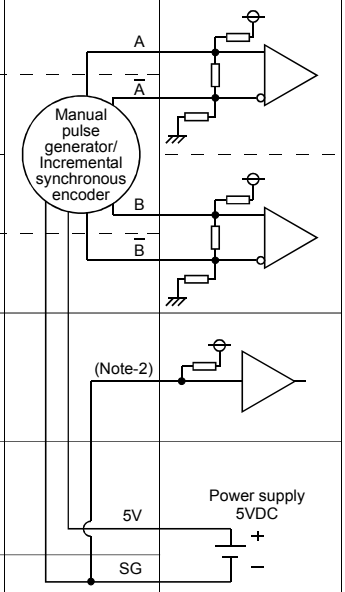
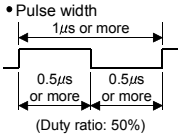
(d) Manual pulse generator/Incremental synchronous encoder input

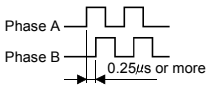
1) Specifications of manual pulse generator/incremental synchronous encoder

Item		Specifications
Signal input form		Phase A/Phase B
Differential-output type (26LS31 or equivalent)	Maximum input pulse frequency	1Mpps (After magnification by 4, up to 4Mpps)
	Pulse width	1μs or more
	Leading edge/trailing edge time	0.25μs or less
	Phase difference	0.25μs or more
	High-voltage	2.0 to 5.25VDC
	Low-voltage	0 to 0.8VDC
	Differential voltage	±0.2V
	Cable length	Up to 30m (98.43ft.)
	Example of waveform	 (Note): Duty ratio 50%
Voltage-output/ Open-collector type	Maximum input pulse frequency	200kpps (After magnification by 4, up to 800kpps)
	Pulse width	5μs or more
	Leading edge/trailing edge time	1.2μs or less
	Phase difference	1.2μs or more
	High-voltage	3.0 to 5.25 VDC
	Low-voltage	0 to1.0VDC
	Cable length	Up to 10m (32.81ft.)
	Example of waveform	 (Note): Duty ratio 50%

POINT
Use a manual pulse generator or an incremental synchronous encoder that consumes less than 0.2[A] of current.

2) Interface between manual pulse generator (differential-output type)/ incremental synchronous encoder

<table>
<tr><th>Input or Output</th><th colspan="2">Signal name</th><th>Pin No.</th><th>Wiring example</th><th>Internal circuit</th><th>Specification</th><th>Description</th></tr>
<tr><td rowspan="5">Input</td><td rowspan="2">Manual pulse generator, phase A</td><td>A+
HAH</td><td>25</td><td rowspan="5"> 
</td><td rowspan="5"></td><td rowspan="5">•Rated input voltage 5.5VDC or less
•HIGH level 2.0 to 5.25VDC
•LOW level 0.8VDC or less
•26LS31 or equivalent</td><td rowspan="5">For connection manual pulse generator/ incremental synchronous encoder Phases A, B
• Pulse width
 

(Duty ratio: 50%)
• Leading edge, Trailing edge time •••0.25μs or less
• Phase difference
 

(1) Positioning address increases if Phase A leads Phase B.
(2) Positioning address decreases if Phase B leads Phase A.</td></tr>
<tr><td>A-
HAL</td><td>26</td></tr>
<tr><td rowspan="2">Manual pulse generator, phase B</td><td>B+
HBH</td><td>12</td></tr>
<tr><td>B-
HBL</td><td>13</td></tr>
<tr><td colspan="2">Select type signal SEL</td><td>10</td></tr>
<tr><td rowspan="2">Power supply</td><td colspan="2">P5(Note-1)</td><td>9</td></tr>
<tr><td colspan="2">SG</td><td>22</td></tr>
</table>

(Note-1): The 5V(P5)DC power supply from the Q170MSCPU must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder. If a separate power supply is used, be sure it is 5V voltage. Anything else may cause a failure.

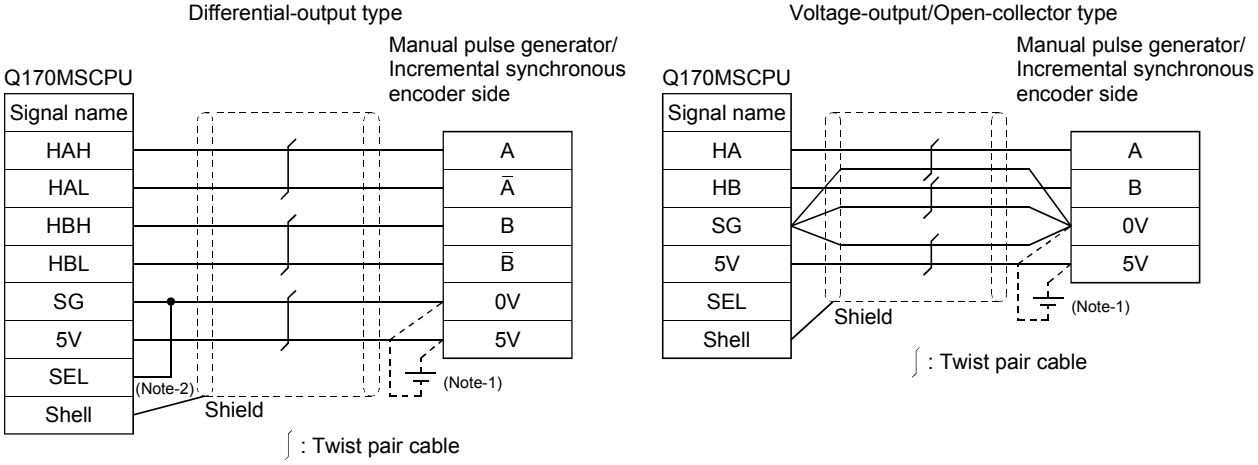
(Note-2): Connect SEL to the SG terminal if the manual pulse generator (differential-output type) /incremental synchronous encoder is used.

3) Interface between manual pulse generator (voltage-output/open-collector type)/incremental synchronous encoder

Input or Output	Signal name	Pin No.	Wiring example	Internal circuit	Specification	Description
Input	Manual pulse generator, phase A HA	24	A Manual pulse generator/ Incremental synchronous encoder B		•Rated input voltage 5.5VDC or less •HIGH level 3 to 5.25VDC/ 2mA or less •LOW level 1VDC or less/ 5mA or more	For connection manual pulse generator/ incremental synchronous encoder Phases A, B • Pulse width 5μs or more 2.5μs or more 2.5μs or more (Duty ratio: 50%) •Leading edge, Trailing edge time •••1.2μs or less •Phase difference Phase A Phase B 1.2μs or more (1) Positioning address increases if Phase A leads Phase B. (2) Positioning address decreases if Phase B leads Phase A.
	Manual pulse generator, phase B HB	11				
	Select type signal SEL	10	No connect			
Power supply	P5(Note-1)	9	5V	Power supply 5VDC + −		
	SG	22	SG			

(Note-1): The 5V(P5)DC power supply from the Q170MSCPU must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder.
If a separate power supply is used, be sure it is 5V voltage.
Anything else may cause a failure.

4) Connection examples of manual pulse generator/incremental synchronous encoder



(Note-1): The 5V(P5)DC power supply from the Q170MSCPU must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder.
If a separate power supply is used, be sure it is 5V voltage. Anything else may cause a failure.
(Note-2): Input type from manual pulse generator/incremental synchronous encoder switched by SEL.
Not connected: Voltage-output/open-collector type
SEL-SG connection: Difference-output type

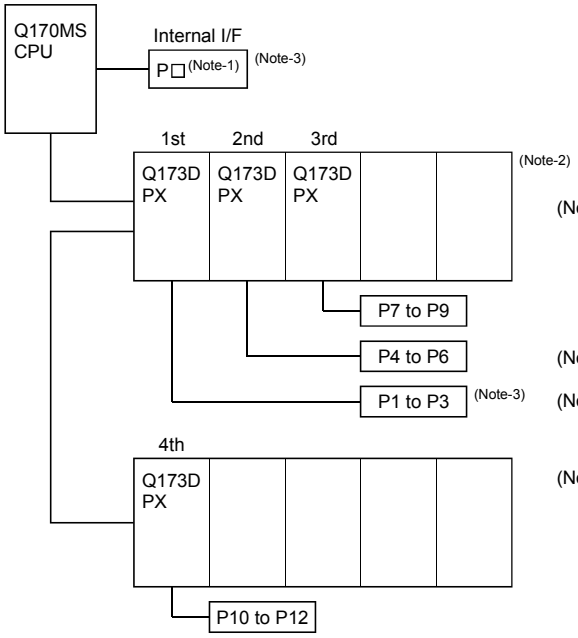
⚠CAUTION

- If a separate power supply is applied to the manual pulse generator/incremental synchronous encoder, be sure it is 5V voltage. Anything else may cause a failure.
- Always wire the cables when power is off. Not doing so may damage the circuit of modules.
- Wire the cable correctly. Wrong wiring may damage the internal circuit.

(e) Connection of manual pulse generator/incremental synchronous encoder
Manual pulse generators/incremental synchronous encoders of the voltage-output/open-collector type and differential-output type can be connected. Both connection methods are different. (Refer to this section (8)(a).)

Motion controller	Connectable manual pulse generator/ incremental synchronous encoder
Q170MSCPU (Internal I/F)	Up to 1 module

(f) Axis No. of manual pulse generator/incremental synchronous encoder
Any incremental synchronous encoder connected to the Q170MSCPU's internal I/F will automatically be assigned an axis No. one integer greater than the number of encoders connected to any Q173DPX modules.
The setting for the axis No. of manual pulse generator/incremental synchronous encoder used by the internal I/F and Q173DPX.



(Note-1): □ = Axis No.
The following Axis No.s are automatically set depending on the number of Q173DPX modules.
- 0: P1
- 1: P4
- 2: P7
- 3: P10

(Note-2): Q173DPX installed to the smallest slot number of the extension base unit is the 1st.
(Note-3): Axis No. P1 to P3 of the manual pulse generator can be used.

(Note): When the manual pulse generator is used with the internal I/F, do not set the Q173DPX in the system settings.

Axis No.	Number of Q173DPXs				
	0	1	2	3	4
P1	●	①	①	①	①
P2	—				
P3					
P4		●	②	②	②
P5		—			
P6					
P7			●	③	③
P8			—		
P9					
P10				●	④
P11				—	
P12					

●: Usable by internal I/F.
①: Usable only by the 1st Q173DPX
②: Usable only by the 2nd Q173DPX
③: Usable only by the 3rd Q173DPX
④: Usable only by the 4th Q173DPX
—: Unusable

POINTS

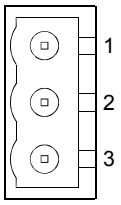
For advanced synchronous control method, set the axis No. of synchronous encoder in the synchronous encoder axis parameter.
Refer to the "Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)" for details.

(9) PERIPHERAL I/F connector

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)

(10) 24VDC power supply connector

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



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

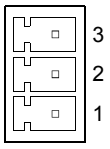
• Applicable connector model name
FKC2.5/3-ST-5.08 connector (PHOENIX CONTACT make) (Attachment)
• Conductor size for power line
0.3 to 2.5mm^2 (AWG12 to AWG22)

⚠CAUTION

- 24V(+) pin is upper side and 24G pin is lower side of 24VDC power supply connector (from front view) of Motion controller. If the polarity is wrong, the unit may be damaged.
- Twist 24V(+) and 24G for 24VDC power line.
- Power off the Motion controller before wiring 24VDC power supply.
- Use proper size wire for 24VDC power line.

(11) Forced stop input connector

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



Pin No.	Signal name
3	EMI.COM
2	No connect (Note-1)
1	EMI

(Note-1): Do not connect to any of the terminal is explained as "No connect".

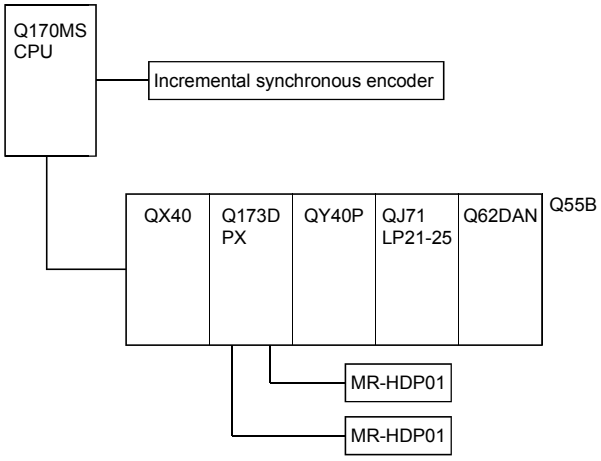
- Applicable connector model name
  FK-MCP1.5/3-ST-3.81 connector (PHOENIX CONTACT make) (Attachment)
- Conductor size for power line
  0.3 to 1.5mm^2 (AWG16 to AWG22)

(12) Selection of the modules used in the extension base unit

The modules used in the extension base unit are selected according to the total of current consumption of the modules, and peripheral devices (Manual pulse generator, Incremental synchronous encoder, etc.) supplied by the Motion controller and Motion controller internal power supply.
5VDC internal current consumption of shared equipments with PLC might be changed. Be sure to refer to the MELSEC-Q series PLC Manuals.

(a) Calculation example of module selection

<System configuration>



• 5VDC current consumption of each module

Q170MSCPU	: 2.50 [A]	QY40P	: 0.065 [A]
Incremental synchronous encoder	: 0.20 [A]	QJ71LP21-25	: 0.55 [A]
QX40	: 0.05 [A]	Q62DAN	: 0.33 [A]
Q173DPX	: 0.38 [A]	Q55B	: 0.10 [A]
MR-HDP01	: 0.06 [A]		

• Power consumption of overall modules

I_{5V} = 2.50 + 0.20 + 0.05 + 0.38 + 0.06 × 2 + 0.065 + 0.55 + 0.33 + 0.10
= 4.295 [A]

System configuration is possible because of the total of current consumption 4.295 [A] is the allowable value 4.5 [A] or less.

POINT

Configure the system in such a way that the total current consumption at 5VDC of all the modules is the allowable value 4.5 [A] or less.

2.5.2 Power supply module

(1) Power supply module specifications

Item		Q61P	Q62P	Q63P	Q64PN
Base loading position		Q series power supply module loading slot			
Applicable base unit		Q35DB, Q38DB, Q312DB, Q63B, Q65B, Q68B, Q612B			
Input power supply		100 to 240VAC (+10%/-15%) (85 to 264VAC)		24VDC (+30%/-35%) (15.6 to 31.2VDC)	100 to 240VAC (+10%/-15%) (85 to 264VAC)
Input frequency		50/60Hz ±5%		——	50/60Hz ±5%
Input voltage distortion factor		5% or less		——	5% or less
Max. input apparent power		130VA	105VA	45W	160VA
Inrush current		20A 8ms or less (Note-4)		100A 1ms or less (at 24VDC input)	20A 8ms or less (Note-4)
Rated output current	5VDC	6A	3A	6A	8.5A
	24VDC	——	0.6A	——	
External output voltage		——	24VDC±10%	——	
Overcurrent protection (Note-1)	5VDC	6.6A or more	3.3A or more	6.6A or more	9.9A or more
	24VDC	——	0.66A or more	——	
Overvoltage protection (Note-2)	5VDC	5.5 to 6.5V			
Efficiency		70% or more	65% or more	70% or more	
Allowable momentary power failure time (Note-3)		20ms or less		10ms or less (at 24VDC input)	20ms or less
Dielectric withstand voltage		Across inputs/LG and outputs/FG 2,830VAC rms/3 cycles (Altitude: 2000m (6561.68ft.))		500VAC across primary and 5VDC	Across inputs/LG and outputs/FG 2,830VAC rms/3 cycles (Altitude: 2000m (6561.68ft.))
Insulation resistance		Across inputs and outputs (LG and FG separated), across inputs and LG/FG, across outputs and LG/FG 10MΩ or more by insulation resistance tester (500VDC)		10MΩ or more by insulation resistance tester	Across inputs and outputs (LG and FG separated), across inputs and LG/FG, across outputs and LG/FG 10MΩ or more by insulation resistance tester (500VDC)
Noise immunity		• By noise simulator of 1,500Vp-p noise voltage, 1μs noise width and 25 to 60Hz noise frequency • Noise voltage IEC61000-4-4, 2kV		• By noise simulator of 500Vp-p noise voltage, 1μs noise width and 25 to 60Hz noise frequency	• By noise simulator of 1,500Vp-p noise voltage, 1μs noise width and 25 to 60Hz noise frequency • Noise voltage IEC61000-4-4, 2kV
Operation indicator		LED indication (Normal: ON (Green), Error: OFF)			
Fuse		Built-in (Unchangeable by user)			
Contact output section	Application	$\overline{\text{ERR}}$ contact			
	Rated switching voltage/current	24VDC, 0.5A			
	Minimum switching load	5VDC, 1mA			
	Response time	OFF to ON: 10ms or less. ON to OFF: 12ms or less.			
	Life time	Mechanical: 20 million times or more Electrical: 100 thousand times at rated switching voltage/current or more			
	Surge suppressor	None			
	Fuse	None			
Terminal screw size		M3.5 screw			

Power supply module specifications (continued)

Item	Q61P	Q62P	Q63P	Q64PN
Applicable wire size	0.75 to 2mm^2			
Applicable crimping terminal	RAV1.25 to 3.5, RAV2 to 3.5			
Applicable tightening torque	0.66 to 0.89 N•m			
Exterior dimensions [mm(inch)]	98(H) × 55.2(W) × 90(D) (3.86(H) × 2.17(W) × 3.54(D))			98(H) × 55.2(W) × 115(D) (3.86(H) × 2.17(W) × 4.53(D))
Mass [kg]	0.40	0.39	0.33	0.47

POINTS

(Note-1): Overcurrent protection

The overcurrent protection device shuts off the 5V, 24VDC circuit and stops the system if the current flowing in the circuit exceeds the specified value.

The LED of the power supply module is turned off or lights up in dim green when voltage is lowered. If this device is activated, switch the input power supply off and eliminate the cause such as insufficient current capacity or short. Then, a few minutes later, switch it on to restart the system.

The initial start for the system takes place when the current value becomes normal.

(Note-2): Overvoltage protection

The overvoltage protection device shuts off the 5VDC circuit and stops the system if a voltage of 5.5VDC or more is applied to the circuit.

When this device is activated, the power supply module LED is switched OFF.

If this happens, switch the input power OFF, then a few minutes later ON. This causes the initial start for the system to take place. The power supply module must be changed if the system is not booted and the LED remains OFF.

POINTS

(Note-3): Allowable momentary power failure period

(1) For AC input power supply

(a) An instantaneous power failure lasting less than 20ms will cause AC down to be detected, but operation will continue.

(b) An instantaneous power failure lasting in excess of 20ms may cause the operation to continue or initial start to take place depending on the power supply load.
Further, when the AC supply of the AC input module is the same as that of the power supply module, it prevents the sensor connected to the AC input module, which is ON at power-off, from turning OFF by switching off the power supply.
However, if only the AC input module is connected to the AC line, which is connected to the power supply, detection of the AC down for the power supply module may be delayed by the capacitor in the AC input module. Thus, connect a load of approx. 30mA per AC input module to the AC line.

(2) For DC input power supply

(a) An instantaneous power failure lasting less than 10ms(Note) will cause 24VDC down to be detected, but operation will continue.

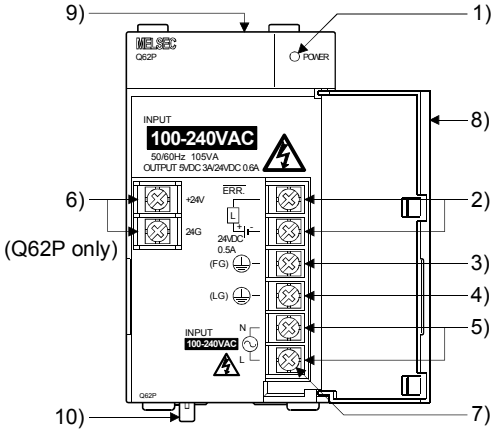
(b) An instantaneous power failure lasting in excess of 10ms(Note) may cause the operation to continue or initial start to take place depending on the power supply load.
(Note): This is for a 24VDC input. This is 10ms or less for less than 24VDC.

(Note-4): Inrush current
When power is switched on again immediately (within 5 seconds) after power-off, an inrush current of more than the specified value (2ms or less) may flow. Reapply power 5 seconds after power-off.
When selecting a fuse and breaker in the external circuit, take account of the blow out, detection characteristics and above matters.

(2) Names of Parts and Setting

This section describes the names of the parts of each power module.

- Q61P (100 to 240VAC input, 5VDC 6A output)
- Q62P (100 to 240VAC input, 5VDC 3A/24VDC 0.6A output)
- Q63P (24VDC input, 5VDC 6A output)
- Q64PN (100 to 240VAC input, 5VDC 8.5A output)



No.	Name		Application
1)	POWER LED	AC input power supply	ON (green) : Normal (5VDC output, momentary power failure within 20ms) OFF : • AC power supply is ON, however, the power supply module is out of order. (5VDC error, overload, internal circuit failure, blown fuse) • AC power supply is not ON • Power failure (including an momentary power failure of more than 20ms)
		DC input power supply	ON (green) : Normal (5VDC output, momentary power failure within 10ms) OFF : • DC power supply is ON, however, the power supply module is out of order. (5VDC error, overload, internal circuit failure, blown fuse) • DC power supply is not ON • Power failure (including an momentary power failure of more than 10ms)
2)	$\overline{\text{ERR}}$ terminals		• Normally OFF when loaded in an extension base unit.
3)	FG terminal		Ground terminal connected to the shield pattern of the printed circuit board.
4)	LG terminal		Grounding for the power supply filter. The potential of Q61P, Q62P, and Q64PN terminal is 1/2 of the input voltage.
5)	Power input terminals		• Power input terminals connected to a power supply of 100VAC to 200VAC. (Q61P, Q62P, Q64PN) • Power input terminals connected to a power supply of 24VDC. (Q63P)
6)	+24V, 24G terminals (Q62P only)		Used to supply 24VDC power to inside the output module. (using external wiring)
7)	Terminal screw		M3.5×7 screw
8)	Terminal cover		Protective cover of the terminal block
9)	Module fixing screw hole		Used to fix the module to the base unit. M3×12 screw (user-prepared) (Tightening torque : 0.36 to 0.48 N•m)
10)	Module mounting lever		Used to load the module into the base unit.

POINTS

(1) The Q63P is dedicated for inputting a voltage of 24VDC.
Do not input a voltage of except 24VDC into it or trouble may occur on the Q63P.

(2) Ensure that the earth terminals LG and FG are grounded.
(Ground resistance : 100 Ω or loss)
Since the LG terminal has a half of the input voltage, touching this terminal may result in an electric shock.

(3) When the Q61P, Q62P, Q63P or Q64PN is loaded on the extension base unit, a system error cannot be detected by the $\overline{\text{ERR}}$ terminal.
(The $\overline{\text{ERR}}$ terminal is always OFF.)

2.5.3 Extension base unit and extension cable

This section describes the specifications of the extension cables for the base units (Extension base unit), and the specification standards of the extension base unit. 5VDC internal current consumption of base unit might be changed. Be sure to refer to the MELSEC-Q series PLC Manuals.

(1) Extension base unit specifications

(a) Type not requiring power supply module

Item \ Type	Q52B	Q55B
Number of I/O modules	2	5
Possibility of extension	Extendable	
Applicable module	Q series modules	
5VDC internal current consumption [A]	0.08	0.10
Fixing hole size	M4 screw hole or ϕ4.5 hole (for M4 screw)	
Exterior dimensions [mm(inch)]	106(W)×98(H) ×44.1(D) (4.17(W)×3.86(H) ×1.74(D))	189(W)×98(H) ×44.1(D) (7.44(W)×3.86(H) ×1.74(D))
Mass [kg]	0.14	0.23
Attachment	Fixing screw M4×14 4 pieces	

(b) Type requiring power supply module

Item \ Type	Q63B	Q65B	Q68B	Q612B
Number of I/O modules	3	5	8	12
Possibility of extension	Extendable			
Applicable module	Q series modules			
5VDC internal current consumption [A]	0.11	0.11	0.12	0.13
Fixing hole size	M4 screw hole or ϕ4.5 hole (for M4 screw)			
Exterior dimensions [mm(inch)]	189(W)×98(H) ×44.1(D) (7.44(W)×3.86(H) ×1.74(D))	245(W)×98(H) ×44.1(D) (9.65(W)×3.86(H) ×1.74(D))	328(W)×98(H) ×44.1(D) (12.91(W)×3.86(H) ×1.74(D))	439(W)×98(H) ×44.1(D) (17.28(W)×3.86(H) ×1.74(D))
Mass [kg]	0.23	0.28	0.39	0.49
Attachment	Fixing screw M4 × 14 4 pieces (Note-1)			

(Note-1): The 5 base mounting screws are included with the Q68B and Q612B that have 5 base mounting holes.

(2) Extension cable specifications

The list below describes the specifications of the extension cables which can be used.

Item \ Type	QC05B	QC06B	QC12B	QC30B	QC50B	QC100B
Cable length [m(ft.)]	0.45(1.48)	0.6(1.97)	1.2(3.94)	3.0(9.84)	5.0(16.40)	10.0(32.81)
Application	Connection between the Motion controller and extension base unit, or connection between the extension base units.					
Mass [kg]	0.15	0.16	0.22	0.40	0.60	1.11

POINT

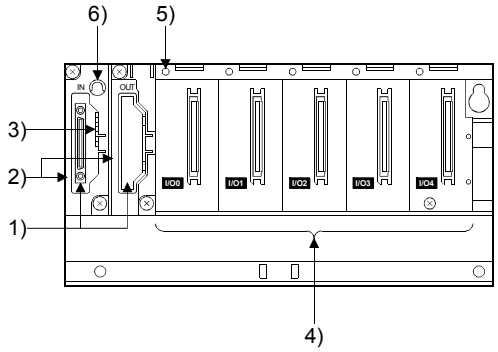
When the extension cables are used in combination, limit the overall length of the combined cable to 13.2m (43.31ft.).

(3) Names of parts of the extension base unit

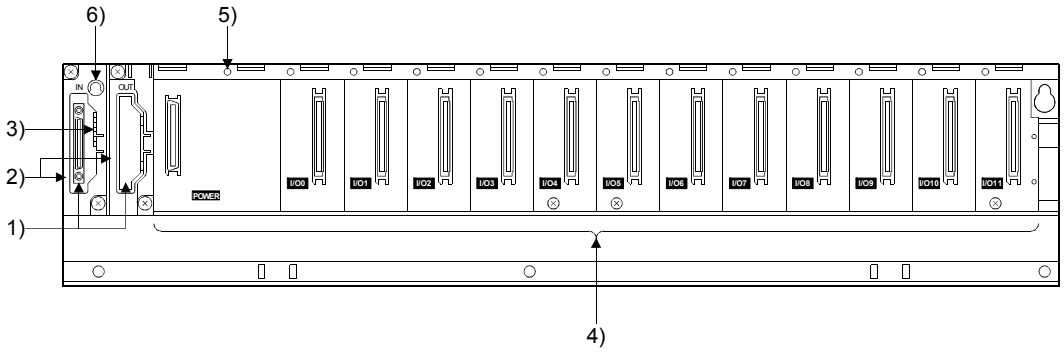
Names of parts of the extension base unit are described below.

(a) Extension base unit (Q5□B, Q6□B)

• Q52B, Q55B



• Q63B, Q65B, Q68B, Q612B

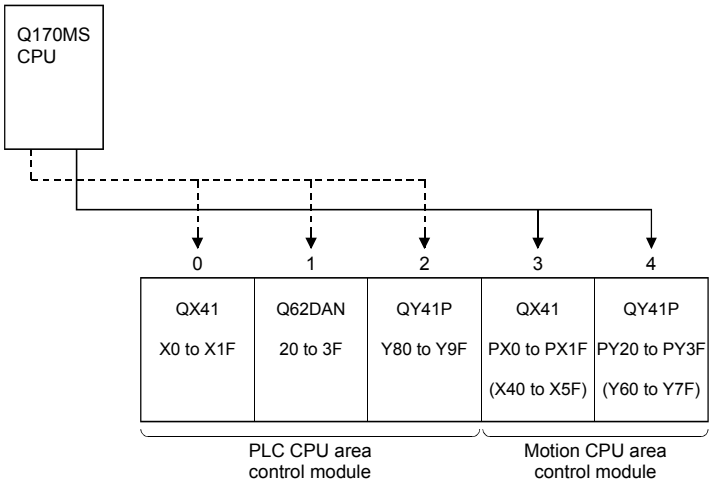


No.	Name	Application
1)	Extension cable connector	Connector for connecting an extension cable (for signal communications with the extension base unit)
2)	Base cover	Protective cover of extension cable connector. Before an extension cable is connected, the area of the base cover surrounded by the groove under the word "OUT" on the base cover must be removed with a tool such as nippers.
3)	Stage No. setting connector	Connector for setting the number of stages of extension base units.
4)	Module connector	Connector for installing the Motion modules, power supply module, I/O modules, and intelligent function module. To the connectors located in the spare space where these modules are not installed, attach the supplied connector cover or the blank cover module (QG60) to prevent entry of dirt.
5)	Module fixing screw hole	Screw hole for fixing the module to the extension base unit. Screw size: M3 ×12
6)	Base mounting hole	Hole for mounting this base unit onto the panel of the control panel (for M4 screw)

(4) I/O allocations

It is possible to allocate unique I/O No.s for each Motion CPU area independently of the PLC CPU area's I/O No.s.
ON/OFF data input to the Motion CPU area is handled via input devices PX□□, while ON/OFF data output from the Motion CPU area is handled via output devices PY□□.
It is not mandatory to match the I/O device PX/PY No.s used in the Motion program with the PLC I/O No.s; but it is recommended to make them match as much as possible.

The following figure shows an example of I/O allocation.



(Note-1): When the number of modules to be installed is 32 points.
(Note-2): When the PX/PY No. does not match the PLC I/O No.

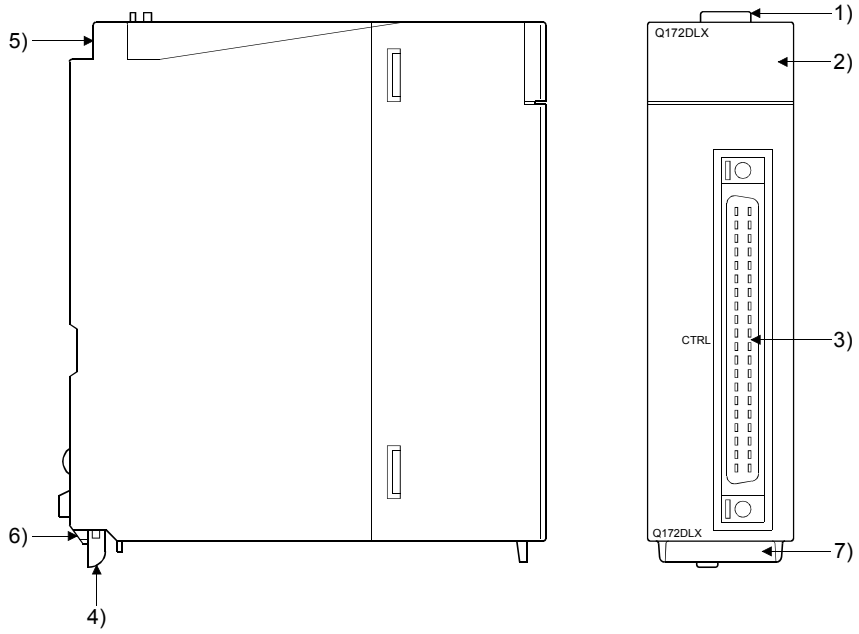
Refer to the Q173D(S)CPU/Q172D(S)CPU Motion Controller Programming Manual (COMMON) about the I/O allocation setting method of the Motion CPU area, and refer to APPENDIX 1.3 and the "QnUCPU User's Manual (Function Explanation, Program Fundamentals)" about the I/O allocation setting method of the PLC CPU area.

POINT
I/O device of the Motion CPU area can be set in the range PX/PY000 to PX/PYFFF. The real I/O points must be 256 points or less. (As for the I/O No., it is possible not to continue.)

2.5.4 Q172DLX Servo external signals interface module

Q172DLX receives external signals (servo external signals) required for positioning control.

(1) Q172DLX name of parts



No.	Name	Application
1)	Module fixing hook	Hook used to fix the module to the base unit. (Single-motion installation)
2)	Input indicator LED	Display the servo external input status from the external equipment. LED: 0 to 1F — Details: Display for servo external signal input status of each axis. The proximity dog/speed-position switching signal (DOG/CHANGE) does not turn ON without setting Q172DLX in the system setting.
3)	CTRL connector	The servo external signal input connector of each axis.
4)	Module mounting lever	Used to install the module to the base unit.
5)	Module fixing screw hole	Hole for the screw used to fix to the base unit. (M3×12 screw : Purchase from the other supplier)
6)	Module fixing projection	Projection used to fix to the base unit.
7)	Serial number display	Display the serial number described on the rating plate.

POINT

Input indicator LED of the proximity dog/speed-position switching signal (DOG/CHANGE) turns ON at the following conditions.

- Q172DLX is set on the system setting of MT Developer2.
- The proximity dog/speed-position switching signal (DOG/CHANGE) is input.

(2) Performance specifications

(a) Module specifications

Item	Specifications
Number of I/O occupying points	32 points(I/O allocation: Intelligent, 32 points)
Internal current consumption(5VDC) [A]	0.06
Exterior dimensions [mm(inch)]	98(H)× 27.4(W)×90(D) (3.86(H)×1.08(W)×3.54(D))
Mass [kg]	0.15

(b) Input

Item		Specifications
Number of input points		Servo external signals : 32 points (Upper stroke limit, Lower stroke limit, Stop input, Proximity dog/Speed-position switching signal) (4 points × 8 axes)
Input method		Sink/Source type
Common terminal arrangement		32 points/common (common terminal: B1, B2)
Isolation method		Photocoupler
Rated input voltage		12/24VDC
Rated input current		12VDC 2mA/24VDC 4mA
Operating voltage range		10.2 to 26.4VDC (12/24VDC +10/ -15%, ripple ratio 5% or less)
ON voltage/current		10VDC or more/2.0mA or more
OFF voltage/current		1.8VDC or less/0.18mA or less
Input resistance		Approx. 5.6kΩ
Response time of the Upper/Lower stroke limit and STOP signal	OFF to ON	1ms
	ON to OFF	
Response time of the proximity dog, Speed-position switching signal	OFF to ON	0.4ms/0.6ms/1ms (CPU parameter setting, Default 0.4ms)
	ON to OFF	
Operation indicator		ON indication (LED)
External connector type		40 pin connector
Applicable wire size		$0.3mm^2$
Applicable connector for the external connection		A6CON1 (Attachment), A6CON2, A6CON3, A6CON4 (Optional)
Applicable connector/ Terminal block converter module		A6TBXY36, A6TBXY54, A6TBX70 (Optional)

(3) Connection of servo external signals interface module

(a) Servo external signals

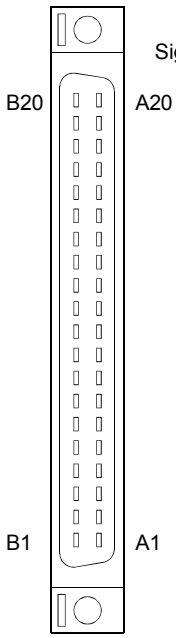
There are the following servo external signals.
(Upper stroke limit is limit value of address increase direction/lower stroke limit is limit value of an address decrease direction.)
The Q172DLX is assigned a set of input No.s per axis. Make the system setting of MT Developer2 to determine the I/O No.s corresponding to the axis No.s.

Servo external signal	Application	Number of points on one Q172DLX
Upper stroke limit input (FLS)	For detection of upper and lower stroke limits.	32 points (4 points/8 axes)
Lower stroke limit input (RLS)		
Stop signal input (STOP)	For stopping under speed or positioning control.	
Proximity dog/ Speed-position switching input (DOG/CHANGE)	For detection of proximity dog at proximity dog or count type home position return or for switching from speed to position switching control.	

(b) The pin layout of the CTRL connector

Use the CTRL connector on the front of the Q172DLX module to connect to servo external signals.

The following is the pin layout of the Q172DLX CTRL connector as viewed from the front.



CTRL connector

Signal No.	Pin No.	Signal Name	Pin No.	Signal Name	Signal No.
1	B20	FLS1	A20	FLS5	5
	B19	RLS1	A19	RLS5	
	B18	STOP1	A18	STOP5	
	B17	DOG1/CHANGE1	A17	DOG5/CHANGE5	
2	B16	FLS2	A16	FLS6	6
	B15	RLS2	A15	RLS6	
	B14	STOP2	A14	STOP6	
	B13	DOG2/CHANGE2	A13	DOG6/CHANGE6	
3	B12	FLS3	A12	FLS7	7
	B11	RLS3	A11	RLS7	
	B10	STOP3	A10	STOP7	
	B9	DOG3/CHANGE3	A9	DOG7/CHANGE7	
4	B8	FLS4	A8	FLS8	8
	B7	RLS4	A7	RLS8	
	B6	STOP4	A6	STOP8	
	B5	DOG4/CHANGE4	A5	DOG8/CHANGE8	
	B4	No connect	A4	No connect	
	B3	No connect	A3	No connect	
	B2	COM	A2	No connect	
	B1	COM	A1	No connect	

Applicable connector model name

A6CON1 type soldering type connector
FCN-361J040-AU connector (FUJITSU COMPONENT LIMITED)
FCN-360C040-B connector cover
} (Attachment)

A6CON2 type Crimp-contact type connector
A6CON3 type Pressure-displacement type connector
A6CON4 type soldering type connector
} (Optional)

DOG/CHANGE, STOP, RLS, FLS functions of each axis(1 to 8)

- DOG/CHANGE . . . . . Proximity dog/Speed-position switching signal
- STOP . . . . . Stop signal
- RLS . . . . . Lower stroke limit
- FLS . . . . . Upper stroke limit

For information about signal details, refer to the programming manual.

(Note): Connector/terminal block conversion modules and cables can be used at the wiring of CTRL connector.

A6TBXY36/A6TBXY54/A6TBX70 : Connector/terminal block converter module

AC□TB (□:Length [m]) : Connector/terminal block converter module cable

POINT

Signal No. 1 to 8 can be assigned to the specified axis. Make the assignment in the system settings of MT Developer2.

(4) Interface between CTRL connector and servo external signal

Input or Output	Signal name	Pin No.	LED	Wiring example	Internal circuit	Specification	Description
Input	FLS1	B20	0	Upper stroke limit input		•Supply voltage 12 to 24 VDC (10.2 to 26.4 VDC, stabilized power supply)	FLS
	FLS2	B16	4				
	FLS3	B12	8				
	FLS4	B8	C				
	FLS5	A20	10				
	FLS6	A16	14				
	FLS7	A12	18				
	FLS8	A8	1C				
	RLS1	B19	1	Lower stroke limit input			RLS
	RLS2	B15	5				
	RLS3	B11	9				
	RLS4	B7	D				
	RLS5	A19	11				
	RLS6	A15	15				
	RLS8	A11	19				
	RLS8	A7	1D			•High level 10.0 VDC or more/ 2.0mA or more	
	STOP1	B18	2				
	STOP2	B14	6				
	STOP3	B10	A				
	STOP4	B6	E				STOP
	STOP5	A18	12				
	STOP6	A14	16	Stop signal input			
	STOP7	A10	1A				
	STOP8	A6	1E			•Low level 1.8 VDC or less/ 0.18mA or less	
	DOG/CHANGE1	B17	3				
	DOG/CHANGE2	B13	7				
	DOG/CHANGE3	B9	B				
	DOG/CHANGE4	B5	F	Proximity dog/ Speed-position switching signal			DOG/CHANGE
	DOG/CHANGE5	A17	13				
	DOG/CHANGE6	A13	17				
	DOG/CHANGE7	A9	1B				
	DOG/CHANGE8	A5	1F				
	Power supply (Note)	B1 B2		− + 12VDC to 24VDC			Common terminals for servo external input signal.

(Note): As for the connection to power line (B1, B2), both "+" and "–" are possible.

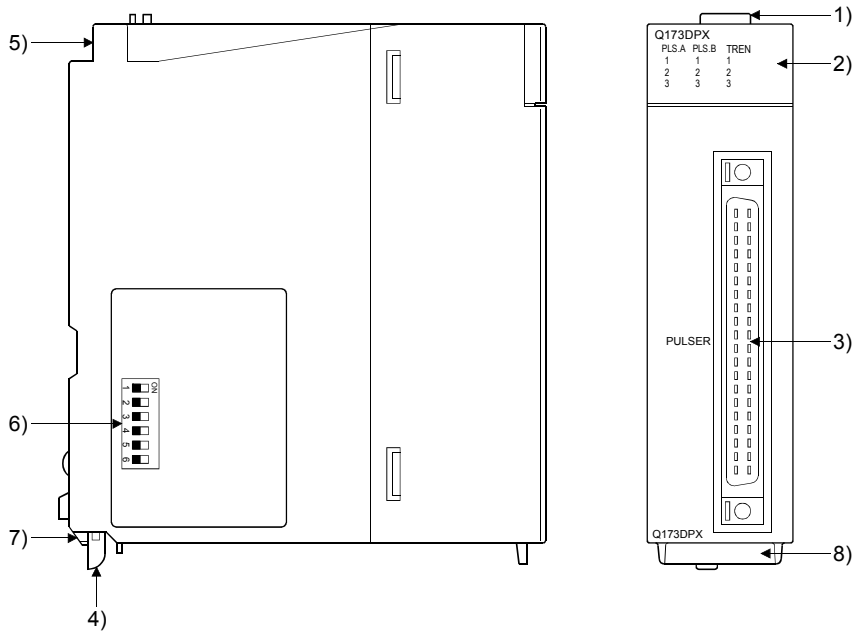
⚠CAUTION

- Always use a shield cable for connection of the CTRL connector and external equipment, and avoid running it close to or bundling it with the power and main circuit cables to minimize the influence of electromagnetic interface. (Separate them more than 200mm (0.66ft.) away.)
- Connect the shield wire of the connection cable to the FG terminal of the external equipment.
- Make parameter setting correctly. Incorrect setting may disable the protective functions such as stroke limit protection.
- Always wire the cables when power is off. Not doing so may damage the circuit of modules.
- Wire the cable correctly. Wrong wiring may damage the internal circuit.

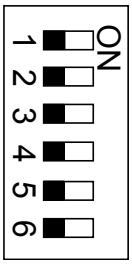
2.5.5 Q173DPX Manual pulse generator interface module

Q173DPX receives signals required for Manual pulse and Incremental synchronous encoder (Voltage-output/Open-collector type/Differential-output type) input.

(1) Q173DPX name of parts



No.	Name	Application
1)	Module fixing hook	Hook used to fix the module to the base unit. (Single-motion installation)
2)	Input indicator LED	Display the input status from the external equipment. LED: PLS.A 1 to 3, PLS.B 1 to 3 — Display for input signal status of manual pulse generator/incremental synchronous encoder phases A, B LED: TREN 1 to 3 — Display for signal status of tracking enable The manual pulse generator/incremental synchronous encoder phases A, B and tracking enable signal does not turn ON without setting Q173DPX in the system setting.
3)	PULSER connector	Input connector of the Manual pulse generator/Incremental synchronous encoder.
4)	Module mounting lever	Used to install the module to the base unit.
5)	Module fixing screw hole	Hole for the screw used to fix to the base unit (M3×12 screw : Purchase from the other supplier)

<table>
<tr><th>No.</th><th>Name</th><th colspan="2">Application</th></tr>
<tr><td rowspan="6">6)</td><td rowspan="6">Dip switches (Note-1)
 

(Factory default in OFF position)</td><td>Dip switch 1
Dip switch 2</td><td>Detection setting of TREN1 signal
SW1 SW2
OFF OFF
ON ON
ON OFF
TREN is detected at leading edge of TREN signal.
OFF ON
TREN is detected at trailing edge of TREN signal.</td></tr>
<tr><td>Dip switch 3
Dip switch 4</td><td>Detection setting of TREN2 signal
SW3 SW4
OFF OFF
ON ON
ON OFF
TREN is detected at leading edge of TREN signal.
OFF ON
TREN is detected at trailing edge of TREN signal.</td></tr>
<tr><td>Dip switch 5
Dip switch 6</td><td>Detection setting of TREN3 signal
SW5 SW6
OFF OFF
ON ON
ON OFF
TREN is detected at leading edge of TREN signal.
OFF ON
TREN is detected at trailing edge of TREN signal.</td></tr>
<tr><td>7)</td><td>Module fixing projection</td><td colspan="2">Projection used to fix to the base unit.</td></tr>
<tr><td>8)</td><td>Serial number display</td><td colspan="2">Display the serial number described on the rating plate.</td></tr>
</table>

(Note-1): The function is different depending on the operating system software installed.

⚠CAUTION

- Before touching the DIP switches, 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.

POINTS

Input indicator LED of the manual pulse generator/incremental synchronous encoder phases A, B and tracking enable signal turns ON at the following conditions.

(1) PLS.A 1 to 3, PLS.B 1 to 3
- Q173DPX is set in the system setting of MT Developer2.
- All axes servo ON command (M2042) turned on.
- Manual pulse generator enable flag (M2051, M2052, M2053) turned on.
- Manual pulse generator signal is input.

(2) TREN 1 to 3
- Q173DPX is set in the system setting of MT Developer2.
- The tracking enable signal is input.

(2) Performance specifications

(a) Module specifications

Item	Specifications
Number of I/O occupying points	32 points(I/O allocation: Intelligent, 32 points)
Internal current consumption(5VDC)[A]	0.38
Exterior dimensions [mm(inch)]	98(H)×27.4(W)×90(D) (3.86(H)×1.08(W)×3.54(D))
Mass [kg]	0.15

(b) Tracking enable signal input

Item		Specifications
Number of input points		Tracking enable signal : 3 points
Input method		Sink/Source type
Common terminal arrangement		1 point/common(Common contact: TREN.COM)
Isolation method		Photocoupler
Rated input voltage		12/24VDC
Rated input current		12VDC 2mA/24VDC 4mA
Operating voltage range		10.2 to 26.4VDC (12/24VDC +10/ -15%, ripple ratio 5% or less)
ON voltage/current		10VDC or more/2.0mA or more
OFF voltage/current		1.8VDC or less/0.18mA or less
Input resistance		Approx. 5.6kΩ
Response time	OFF to ON	0.4ms/0.6ms/1ms (CPU parameter setting, Default 0.4ms)
	ON to OFF	
Operation indicator		ON indication(LED)

(Note): Functions are different depending on the operating system software installed.

(c) Manual pulse generator/Incremental synchronous encoder input

Item		Specifications
Number of modules		3/module
Voltage-output/ Open-collector type	High-voltage	3.0 to 5.25VDC
	Low-voltage	0 to 1.0VDC
Differential-output type (26LS31 or equivalent)	High-voltage	2.0 to 5.25VDC
	Low-voltage	0 to 0.8VDC
Input frequency		Up to 200kpps (After magnification by 4)
Applicable types		• Voltage-output type/Open-collector type (5VDC), Recommended product: MR-HDP01 • Differential-output type: (26LS31 or equivalent)
External connector type		40 pin connector
Applicable wire size		$0.3mm^2$
Applicable connector for the external connection		A6CON1(Attachment) A6CON2, A6CON3, A6CON4 (Optional)
Cable length	Voltage-output/ Open-collector type	30m (98.43ft.) (Open-collector type: 10m (32.81ft.))
	Differential-output type	

(3) Connection of manual pulse generator

Manual pulse generators of the voltage-output/open-collector type and differential-output type can be connected. Both connection methods are different. (Refer to this section (5).)

When the manual pulse generator is connected to the Q173DPX, it cannot be connected to the internal I/F.

Motion controller	Connectable manual pulse generator
Q170MSCPU	Up to 3 modules (Q173DPX: Up to 1 module)

(4) Connection of incremental synchronous encoder

Incremental synchronous encoders of the voltage-output/Open-collector type and differential-output type can be connected. Both connection methods are different. (Refer to this section (5).)

Motion controller	Connectable synchronous encoder
Q170MSCPU	Up to 12 modules (Q173DPX: Up to 4 modules)
Q170MSCPU (Combination of Q173DPX and internal I/F (Note))	Up to 10 modules (Q173DPX: Up to 3 modules)

(Note): Refer to Section 2.5.1 for details of the internal I/F.

• Tracking enable signal

Tracking enable signal of Q173DPX is used to start the input from incremental synchronous encoders in the external input mode for the clutch.

The external input signal of the incremental synchronous encoder is indicated below.

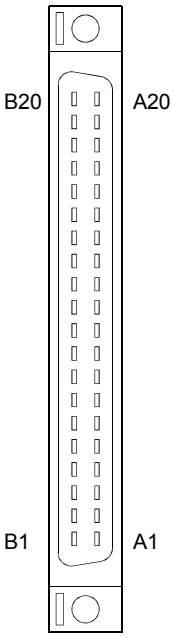
This signal is used as the input start signal, high-speed reading function or high-speed input request signal from incremental synchronous encoder.

External input signal of the incremental synchronous encoder	Application	Number of points on one Q173DPX
Tracking enable signal input	Input start function from incremental synchronous encoder	Each 1 point (Total 3 points)

(5) Connection of manual pulse generator interface module

(a) The pin layout of the PULSER connector

Use the PULSER connector on the front of the Q173DPX module to connect to manual pulse signals and incremental synchronous encoder signals.
The following is the pin layout of the Q173DPX PULSER connector as viewed from the front.



PULSER connector

	Pin No.	Signal Name	Pin No.	Signal Name	
2)	B20	HB1	A20	HA1	2)
	B19	SG	A19	SG	
	B18	5V	A18	HPSEL1	1)
3)	B17	HA1N	A17	HA1P	3)
	B16	HB1N	A16	HB1P	
2)	B15	HB2	A15	HA2	2)
	B14	SG	A14	SG	
	B13	5V	A13	HPSEL2	1)
3)	B12	HA2N	A12	HA2P	3)
	B11	HB2N	A11	HB2P	
2)	B10	HB3	A10	HA3	2)
	B9	SG	A9	SG	
	B8	5V	A8	HPSEL3	1)
3)	B7	HA3N	A7	HA3P	3)
	B6	HB3N	A6	HB3P	
	B5	No connect	A5	No connect	
	B4	TREN1-	A4	TREN1+	
	B3	TREN2-	A3	TREN2+	
	B2	TREN3-	A2	TREN3+	
4)	B1	FG	A1	FG	4)

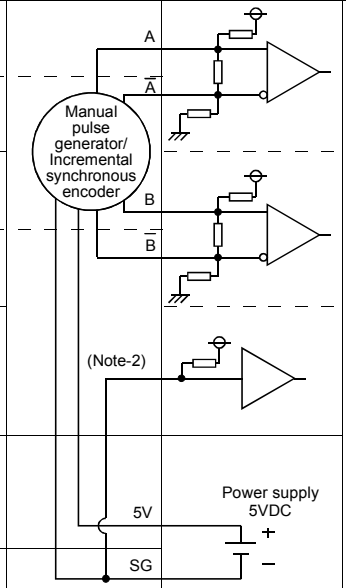
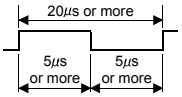
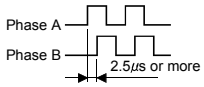
Applicable connector model name

A6CON1 type soldering type connector
FCN-361J040-AU connector (FUJITSU COMPONENT LIMITED)
FCN-360C040-B connector cover
} (Attachment)

A6CON2 type Crimp-contact type connector
A6CON3 type Pressure-displacement type connector
A6CON4 type soldering type connector
} (Optional)

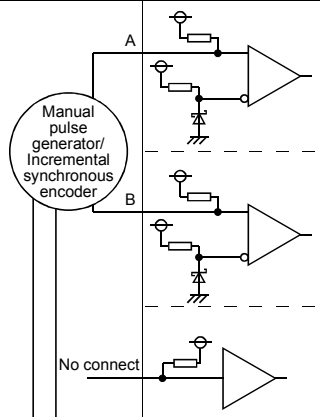
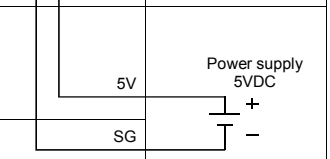
1): Input type from manual pulse generator/incremental synchronous encoder switched by HPSEL□.
Not connected : Voltage-output/open-collector type
HPSEL□-SG connection : Differential-output type
(Switching is possible for each input 1 to 3)
2): Voltage-output/open-collector type
Connect the A-phase signal to HA1/HA2/HA3, and the B-phase signal to HB1/HB2/HB3.
3): Differential-output type
Connect the A-phase signal to HA1P/HA2P/HA3P, and the A-phase inverse signal to HA1N/HA2N/HA3N.
Connect the B-phase signal to HB1P/HB2P/HB3P, and the B-phase inverse signal to HB1N/HB2N/HB3N.
4): Connect the shield cable between manual pulse generator/incremental synchronous encoder and Q173DPX at the FG signal.
5): Connector/terminal block conversion modules cannot be used.

(b) Interface between PULSER connector and manual pulse generator (Differential-output type)/Incremental synchronous encoder

Input or Output	Signal name		PIN No. 1	2	3	Wiring example	Internal circuit	Specification	Description
Input	Manual pulse generator, phase A	A+ HA□P	A17	A12	A7			•Rated input voltage 5.5VDC or less •HIGH level 2.0 to 5.25VDC/ 2mA or less •LOW level 0.8VDC or less •26LS31 or equivalent	For connection manual pulse generator Phases A, B •Pulse width  (Duty ratio: 50%±25%) •Leading edge, Trailing edge time •••1μs or less •Phase difference  (1) Positioning address increases if Phase A leads Phase B. (2) Positioning address decreases if Phase B leads Phase A.
		A− HA□P	B17	B12	B7				
	Manual pulse generator, phase B	A+ HA□P	A16	A11	A6				
		A− HA□P	B16	B11	B6				
	Select type signal HPSEL□		A18	A13	A8				
Power supply	P5(Note)		B18	B13	B8				
	SG		A19 B19	A14 B14	A9 B9				

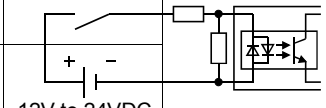
(Note-1): The 5V(P5)DC power supply from the Q173DPX must not be used if a separate power supply is applied to the Manual pulse generator/Incremental synchronous encoder.
If a separate power supply is used, be sure it is 5V voltage. Anything else may cause a failure.
(Note-2): Connect HPSEL□ to the SG terminal if the manual pulse generator (differential-output type) /incremental synchronous encoder is used.

(c) Interface between PULSER connector and manual pulse generator (Voltage-output/Open-collector type)/Incremental synchronous encoder.

Input or Output	Signal name	Pin No. 1	Pin No. 2	Pin No. 3	Wiring example	Internal circuit	Specification	Description
Input	Manual pulse generator, phase A HA□	A20	A15	A10			•Rated input voltage 5.5VDC or less •HIGH level 3 to 5.25VDC/ 2mA or less •LOW level 1VDC or less/ 5mA or more	For connection manual pulse generator Phases A, B •Pulse width 20μs or more 5μs or more 5μs or more (Duty ratio: 50%±25%) •Leading edge, Trailing edge time •••1μs or less •Phase difference Phase A Phase B 2.5μs or more (1) Positioning address increases if Phase A leads Phase B. (2) Positioning address decreases if Phase B leads Phase A.
Input	Manual pulse generator, phase B HB□	B20	B15	B10				
Input	Select type signal HPSEL□	A18	A13	A8				
Power supply	P5(Note)	B18	B13	B8				
Power supply	SG	A19 B19	A14 B14	A9 B9				

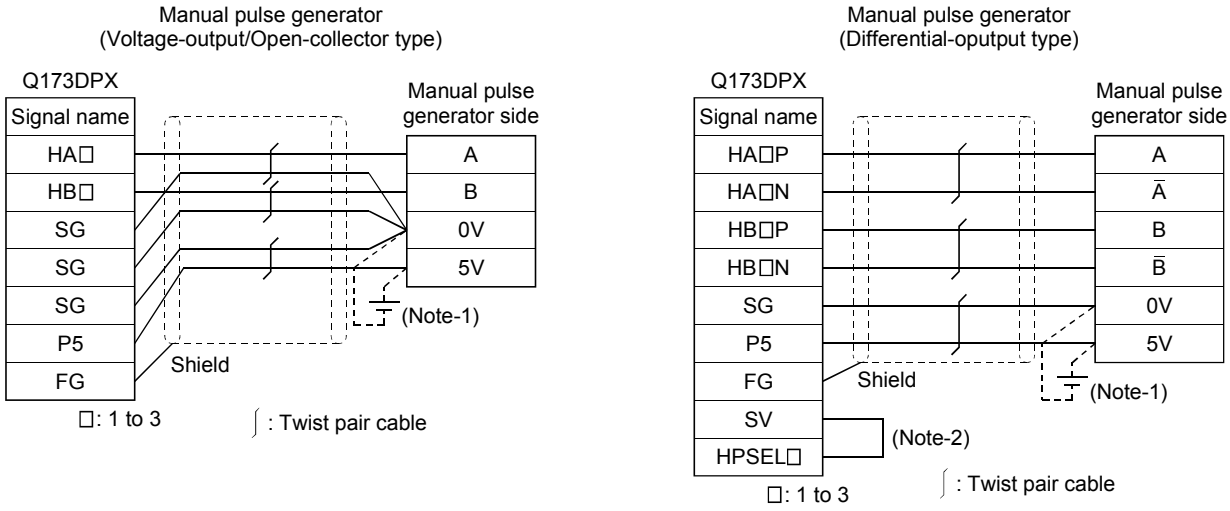
(Note-1) : The 5V(P5)DC power supply from the Q173DPX must not be used if a separate power supply is applied to the Manual pulse generator/Incremental synchronous encoder.
If a separate power supply is used, be sure it is 5V voltage. Anything else may cause a failure.

(d) Interface between PULSER connector and tracking enable signal

Input or Output	Signal name		Pin No. 1	Pin No. 2	Pin No. 3	Wiring example	Internal circuit	Specification	Description
Input	Tracking enable	TREN□+	A4	A3	A2				Tracking enable signal input.
		TREN□−	B4	B3	B2				

(Note): As for the connection to tracking enable (TREN□+, TREN□–), both "+" and "–" are possible.

(6) Connection examples of manual pulse generator



(Note-1): The 5V(P5)DC power supply from the Q173DPX must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder.
If a separate power supply is used, be sure it is 5V voltage. Anything else may cause a failure.

(Note-2): Connect HPSEL□ to the SG terminal if the manual pulse generator (differential-output type)/incremental synchronous encoder is used.

⚠CAUTION

- If a separate power supply is applied to the manual pulse generator/incremental synchronous encoder, be sure it is 5V voltage. Anything else may cause a failure.
- Always wire the cables when power is off. Not doing so may damage the circuit of modules.
- Wire the cable correctly. Wrong wiring may damage the internal circuit.
- P5 terminal is the power supply for the manual pulse generator. Do not apply a voltage and do not use it for other purposes.

2.5.6 Manual pulse generator

(1) Manual pulse generator specifications

Item	Specifications
Model name	MR-HDP01 (Note-1)
Ambient temperature	-10 to 60°C(14 to 140°F)
Pulse resolution	25PLS/rev(100 PLS/rev after magnification by 4)
Output method	Voltage-output/Output current : Up to 20mA
Power supply voltage	4.5 to 13.2VDC
Current consumption [mA]	60
Output level	"H" level: Power supply voltage (Note-2) -1V or more (with no load) "L" level: 0.5V or less (with maximum leading-in)
Life time	1,000,000 revolutions or more (at 200r/min)
Permitted axial loads	Radial load : Up to 19.6N, Thrust load : Up to 9.8N
Mass [kg]	0.4
Number of max. revolution	Instantaneous Up to 600r/min. normal 200r/min
Pulse signal status	2 signals : A phase, B : phase, 90° phase difference
Start friction torque	0.06N•m (20°C (68°F))

(Note-1): Use MR-HDP01 by connecting with internal I/F or Q173DPX or Q170MSCPU's internal I/F.

(Note-2): If a separate power supply is used, be sure it is 5VDC ± 0.25V voltage.

2.5.7 SSCNETⅢ cables

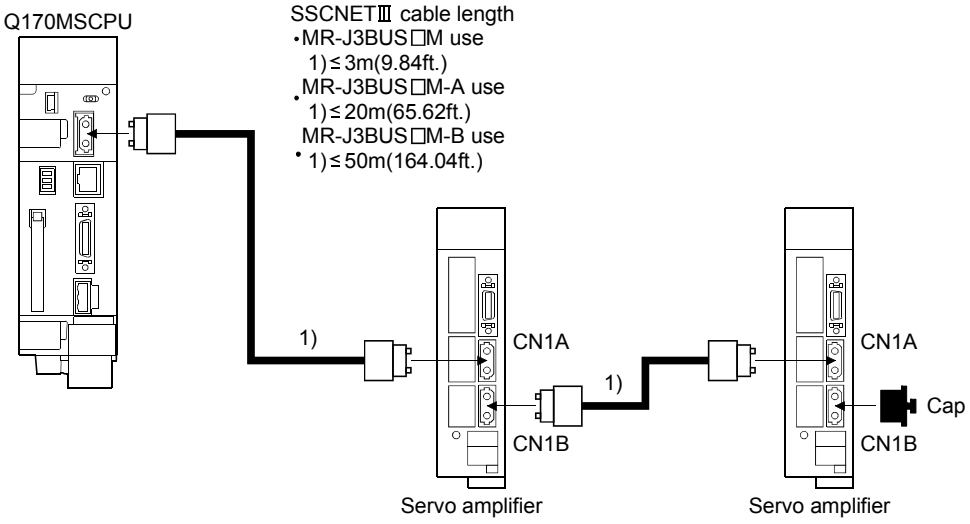
Between the Motion controller and servo amplifiers, or servo amplifier and servo amplifier connected by SSCNETⅢ cable. Up to 16 servo amplifies can be connected.

(1) SSCNETⅢ cable specifications

Model name		Cable length [m(ft.)]	Description
MR-J3BUS□M	MR-J3BUS015M	0.15 (0.49)	• Q170MSCPU ↔ Servo amplifier • Servo amplifier ↔ Servo amplifier
	MR-J3BUS03M	0.3 (0.98)	
	MR-J3BUS05M	0.5 (1.64)	
	MR-J3BUS1M	1 (3.28)	
	MR-J3BUS3M	3 (9.84)	
MR-J3BUS□M-A	MR-J3BUS5M-A	5 (16.40)	
	MR-J3BUS10M-A	10 (32.81)	
	MR-J3BUS20M-A	20 (65.62)	
MR-J3BUS□M-B	MR-J3BUS30M-B	30 (98.43)	
	MR-J3BUS40M-B	40 (131.23)	
	MR-J3BUS50M-B	50 (164.04)	

(2) Connection between the Q170MSCPU and servo amplifiers

Connect the SSCNETⅢ cables to the following connectors.
Refer to Section 4.2.1 for the connection and disconnection of SSCNETⅢ cable.

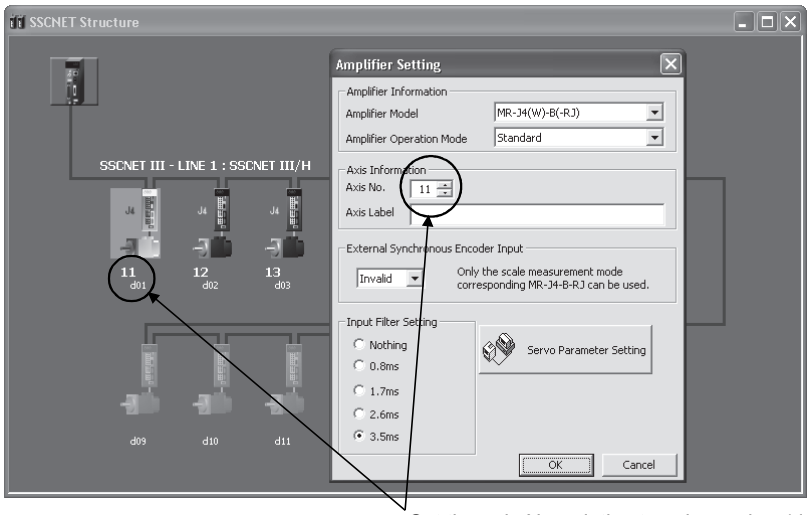


(Note): It cannot communicate if the connection of CN1A and CN1B is mistaken.

(3) Setting of the axis No. and axis select rotary switch of servo amplifier

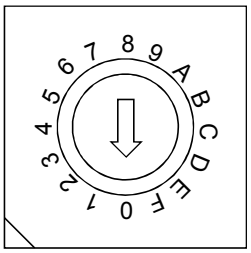
Axis No. is used to set the axis numbers of servo amplifiers connected to SSCNETⅢ connector in the program. Axis No. of 1 to 16 can be set.
Axis No. is set in the system setting of MT Developer2. Axis No. (1 to 16) is allocated and set for the setting axis number (d01 to d16) of servo amplifier.
Since the axis number (d01 to d16) of servo amplifier on the system setting screen corresponds to axis select rotary switch (0 to F) of servo amplifier, set the axis select rotary switch referring to the table below.

• Setting display of axis No.



Set the axis No. relative to axis number (dno.).

• Axis select rotary switch (Servo amplifier)



(Note): Correspondence between dno. and axis select rotary switch of servo amplifiers is shown below.

Correspondence between dno.s and axis select rotary switches of servo amplifier

dno. (Note)	Axis select rotary switch of servo amplifier
d01	"0"
d02	"1"
d03	"2"
d04	"3"
d05	"4"
d06	"5"
d07	"6"
d08	"7"

dno. (Note)	Axis select rotary switch of servo amplifier
d09	"8"
d10	"9"
d11	"A"
d12	"B"
d13	"C"
d14	"D"
d15	"E"
d16	"F"

(Note): The dno. is number of servo amplifier axis displayed with the system setting of MT Developer2. Axis No. is set relative to dno. in the system settings.

REMARK

The setting of axis select rotary switch is different depending on the servo amplifier. Refer to the "Servo amplifier Instruction Manual" for details.

2.5.8 Battery

This section describes the battery specifications and, handling precautions used in the Motion controller.

(1) Battery specifications

Item \ Model name	Q6BAT	Q7BAT
Classification	Manganese dioxide lithium primary battery	
Initial voltage [V]	3.0	
Nominal current [mAh]	1800	5000
Storage life	Actually 5 years (Room temperature)	
Lithium content [g]	0.49	1.52
Applications	For memory data backup of RAM built-in Motion controller	
Exterior dimensions [mm(inch)]	ϕ16(0.63)×32(1.26)	ϕ24(0.94)×52(2.05)

(Note): The following points are changed for lithium metal batteries transportation by sea or air due to Recommendations of the United Nations Rev. 15 and ICAO-TI 2009-2010 edition.

1) A package containing 24 cells or 12 batteries or less that are not contained in equipment are no longer exempt from the following: attachment of a handling label, submission of the Shipper's Declaration for Dangerous Goods, and a 1.2m drop test.
2) A battery handling label (size: 120 x 110mm) is required. Emergency telephone number must be filled out in the additional handling information of the Shipper's Declaration for Dangerous Goods.
3) New label design containing battery illustration must be used (in air transportation only).

Fig.2.1 Example of Label with Battery Illustration

• Transportation precaution for customers
Documentations like the handling label in the specified design and the Shipper's Declaration for Dangerous Goods are required for air and sea transportation. Please attach documentations like the handling label in the specified design and the Shipper's Declaration for Dangerous Goods to the package.

If you need the self-certification form for the battery safety test, contact Mitsubishi.
For more information, contact Mitsubishi.

(2) Data back-up of Motion controller by the battery

Be sure to set the battery to the Motion controller.
Set the battery (Q6BAT/Q7BAT) to battery holder.
The data (Refer to Section 6.5.) of RAM built-in Motion controller are not backed up without using the battery.
In the following status, the backup time after power OFF is 3 minutes.

- The Q6BAT/Q7BAT lead connector is disconnected.
- The lead wire of Q6BAT/Q7BAT is broken.

Table 2.1 Battery life of Q6BAT/Q7BAT

Motion controller	Battery type	Battery consumption (Note-1)	Battery life (Total power failure time) [h] (Note-2)				
			Power-on time ratio (Note-3)	Guaranteed value (Note-4) (MIN) (75°C (167°F))	Guaranteed value (Note-5) (TYP) (40°C (104°F))	Actual service value (Note-6) (Reference value) (TYP) (25°C (77°F))	Backup time after alarm
Q170MSCPU (Note-7)	Q6BAT	2	0%	13000	40000	43800	90 (After SM51/ SM52 ON)
			30%	18000	43800		
			50%	21000			
			70%	24000			
			100%	43800			
	Q7BAT (Large capacity)	2	0%	39000	43800		
			30%	43800			
			50%				
			70%				
			100%				
Q170MSCPU-S1	Q6BAT	1	0%	15300			
			30%	21000			
			50%	27900			
			70%	41500			
			100%	43800			
		2	0%	2600	7500	8800	
			30%	3700	10600	12500	
			50%	5100	14700	17400	
			70%	8400	23700	28000	
			100%	43800	43800	43800	
		3	0%	1400	4100	4800	
			30%	2100	5900	6900	
			50%	2900	8200	9600	
			70%	4800	13500	15800	
			100%	43800	43800	43800	

Table 2.1 Battery life of Q6BAT/Q7BAT (continued)

Motion controller	Battery type	Battery consumption (Note-1)	Battery life (Total power failure time) [h] (Note-2)				
			Power-on time ratio (Note-3)	Guaranteed value (Note-4) (MIN) (75°C (167°F))	Guaranteed value (Note-5) (TYP) (40°C (104°F))	Actual service value (Note-6) (Reference value) (TYP) (25°C (77°F))	Backup time after alarm
Q170MSCPU-S1	Q7BAT (Large capacity)	1	0%	43800	43800	43800	90 (After SM51/ SM52 ON)
			30%				
			50%				
			70%				
			100%				
		2	0%	7600	21500	25000	
			30%	10900	30400	35300	
			50%	15100	42000	43800	
			70%	24700	43800		
			100%	43800			
		3	0%	4100	11900	13750	
			30%	5900	17000	19500	
			50%	8200	23600	27000	
			70%	13600	38600	43800	
			100%	43800	43800		

(Note-1): The battery consumption represents consumption of the Motion controller battery energy.
The larger the battery consumption value is, the more battery per time unit is consumed.
Refer to the "QCPU User's Manual (Hardware Design, Maintenance and Inspection) for details.

(Note-2): The actual service value indicates the average value, and the guaranteed value indicates the minimum value.

(Note-3): The power-on time ratio indicates the ratio of Motion controller power-on time to one day (24 hours).
(When the total power-on time is 17 hours and the total power-off time is 7 hours, the power-on time ratio is 70%.)

(Note-4): The guaranteed value (MIN) ; equivalent to the total power failure time that is calculated based on the characteristics value of the memory (SRAM) supplied by the manufacturer and under the storage ambient temperature range of -25°C to 75°C (-13 to 167°F) (operating ambient temperature of 0°C to 55°C (32 to 131°F)).

(Note-5): The guaranteed value (TYP) ; equivalent to the total power failure time that is calculated based on the normal air-conditioned environment (40°C (104°F)).

(Note-6): The actual service value (Reference value) ; equivalent to the total power failure time that is calculated based on the measured value and under the storage ambient temperature of 25°C (77°F). This value is intended for reference only, as it varies with characteristics of the memory.

(Note-7): Battery consumption 1 cannot be used in Q170MSCPU.

POINTS

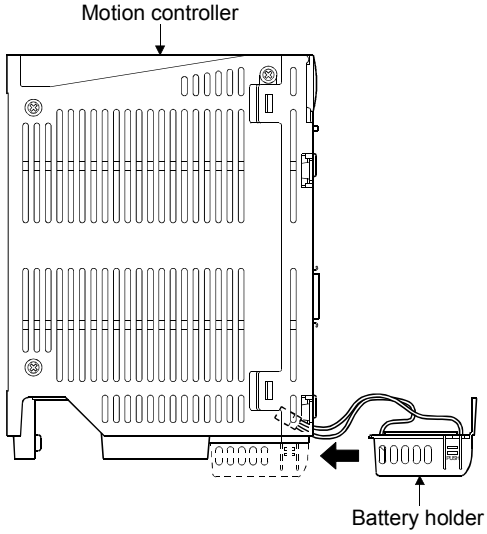
The self-discharge influences the life of battery without the connection to Motion controller. The battery should be exchanged approximately every 4 or 5 years. Exchange the battery with a new one in 4 to 5 years even if a total power failure time is guaranteed value or less.

⚠CAUTION

- Do not short a battery.
- Do not charge a battery.
- Do not disassemble a battery.
- Do not burn a battery.
- Do not overheat a battery.
- Do not solder the battery terminal.
- The data (Refer to Section 6.5.) of RAM built-in Motion controller are not backed up without using the battery.

(3) Connection procedure with Motion controller

Set the battery (Q6BAT/Q7BAT) to the battery holder, and connect the lead connector of battery to the battery connector of Motion controller.
Put the lead wire in the battery holder, and set it to the Motion controller.



Refer to Section 4.1.4 for the mounting and removal of the battery holder and the connection of the battery lead wire.

2.5.9 Forced stop input terminal

(1) Table of the forced stop input terminal specifications

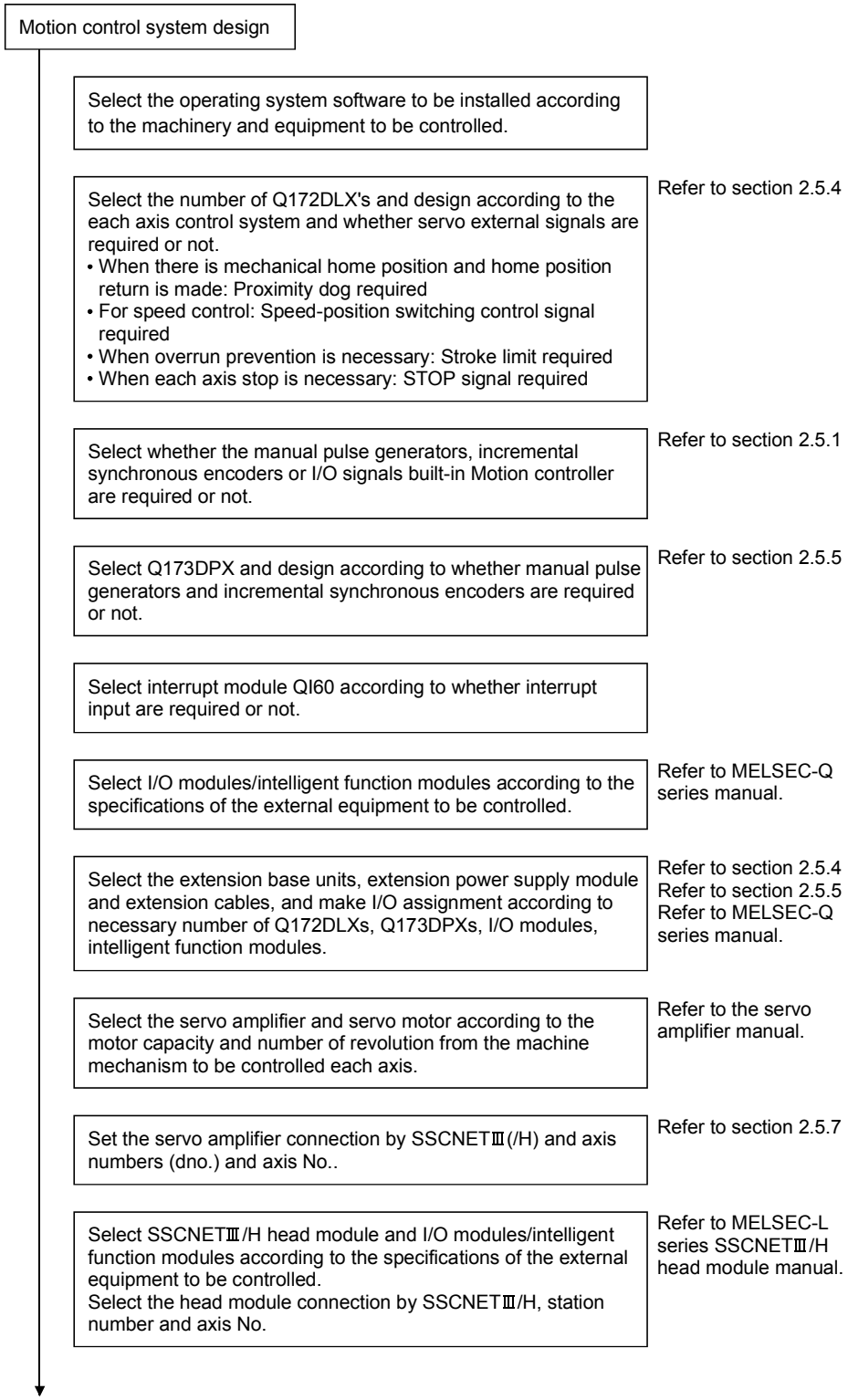
Item		Specifications
Number of input points		Forced stop signal : 1 point
Input method		Sink/Source type
Rated input current		2.4mA
Isolation method		Photocoupler
Operating voltage range		20.4 to 26.4VDC (+10/ -15%, ripple ratio 5% or less)
ON voltage/current		17.5VDC or more/2.0mA or more
OFF voltage/current		1.8VDC or less/0.18mA or less
Input resistance		Approx. 10kΩ
Response time	OFF to ON	1ms or less
	ON to OFF	
External connector type		3 pin connector
Recommended wire size		0.3 to 1.5mm^2 (AWG16 to AWG22)

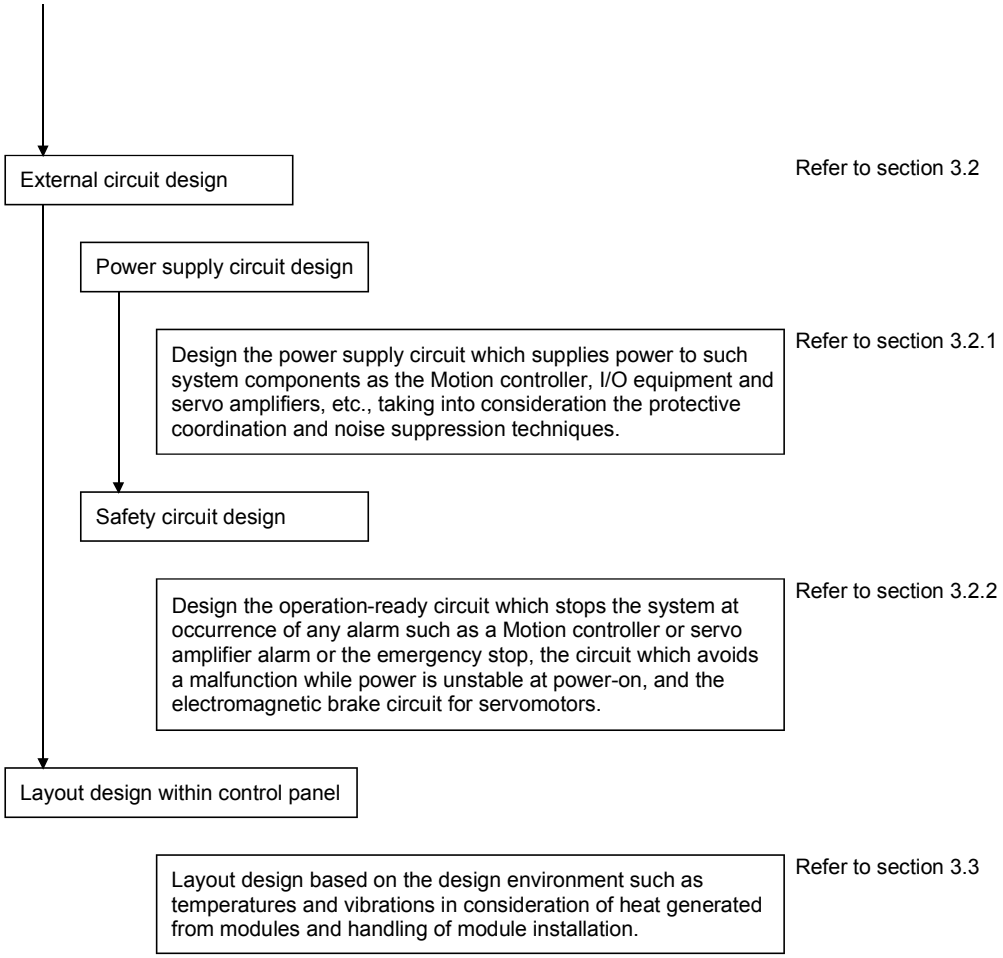
MEMO

3. DESIGN

3.1 System Designing Procedure

System designing procedure is shown below.





⚠CAUTION

- Provide appropriate circuits external to the Motion controller to prevent cases where danger may result from abnormal operation of the overall system in the event of an external power supply fault or Motion controller failure.
- Mount the Motion controller, servo amplifier, servomotor and regenerative resistor on incombustible. Mounting 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 mounted and for the wires used. Failing to do so may lead to fire.
- 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 polarity (+ / -), as this may lead to destruction or damage.

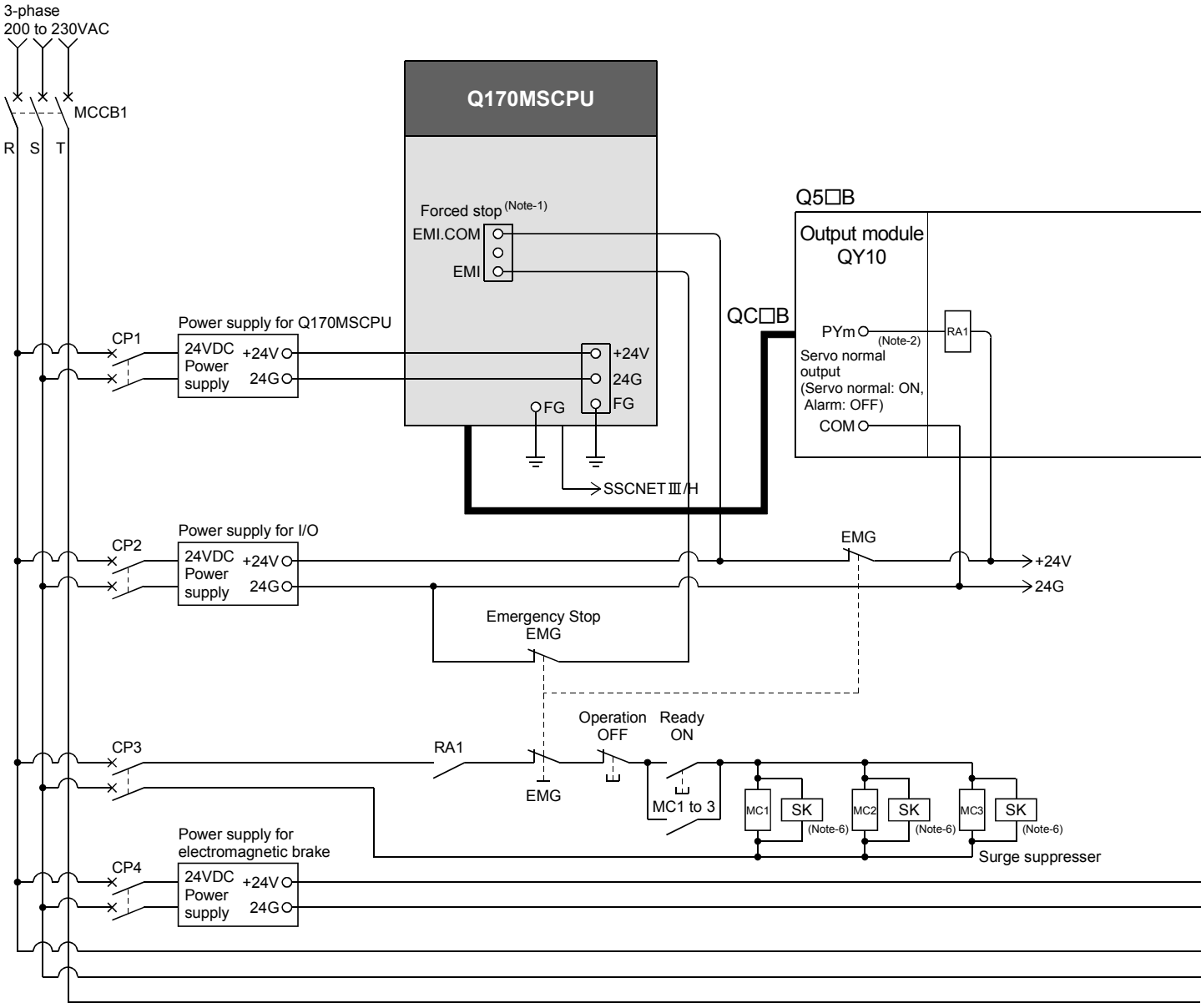
⚠CAUTION

- Do not touch the heat radiating fins of controller or servo amplifier, regenerative resistor and servomotor, 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 servomotor 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.
- Always mount a leakage breaker on the Motion controller and servo amplifier power source.
- If mounting of an electromagnetic contactor for power shut off during an error, etc., is specified in the instruction manual for the servo amplifier, etc., always mount the electromagnetic contactor.
- Mount an emergency stop circuit externally so that the operation can be stopped immediately and the power shut off.
- Use the Motion controller, servo amplifier, servomotor and regenerative resistor with the correct combinations listed in the instruction manual. Other combinations may lead to fire or faults.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the Motion controller, servo amplifier and servomotor, 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 servomotor will be a problem during the forced stop, the emergency stop, servo OFF or when the power is shut 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, the emergency stop, servo OFF or when the power is shut OFF, use both dynamic brakes and electromagnetic brakes.
- The dynamic brakes must be used only during the forced stop, the emergency stop and errors where servo OFF occurs. These brakes must not be used for normal braking.
- The brakes (electromagnetic brakes) assembled into the servomotor 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, servomotor) used in a system must be compatible with the Motion controller, servo amplifier and servomotor.
- Install a cover on the shaft so that the rotary parts of the servomotor 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 servomotor are connected with a timing belt, etc.). Mount a stopping device to ensure safety on the machine side.

3.2 External Circuit Design

As to the ways to design the external circuits of the Motion system, this section describes the method and instructions for designing the power supply circuits and safety circuits, etc. (Example: Q170MSCPU and MR-J4-☐B use)

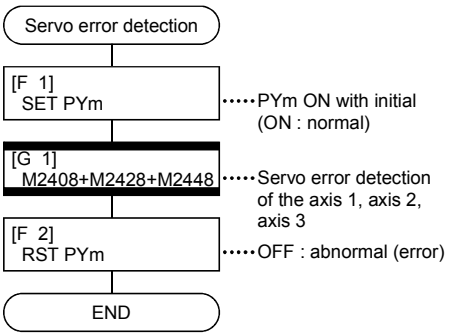
(1) Sample system circuit design for Motion CPU area

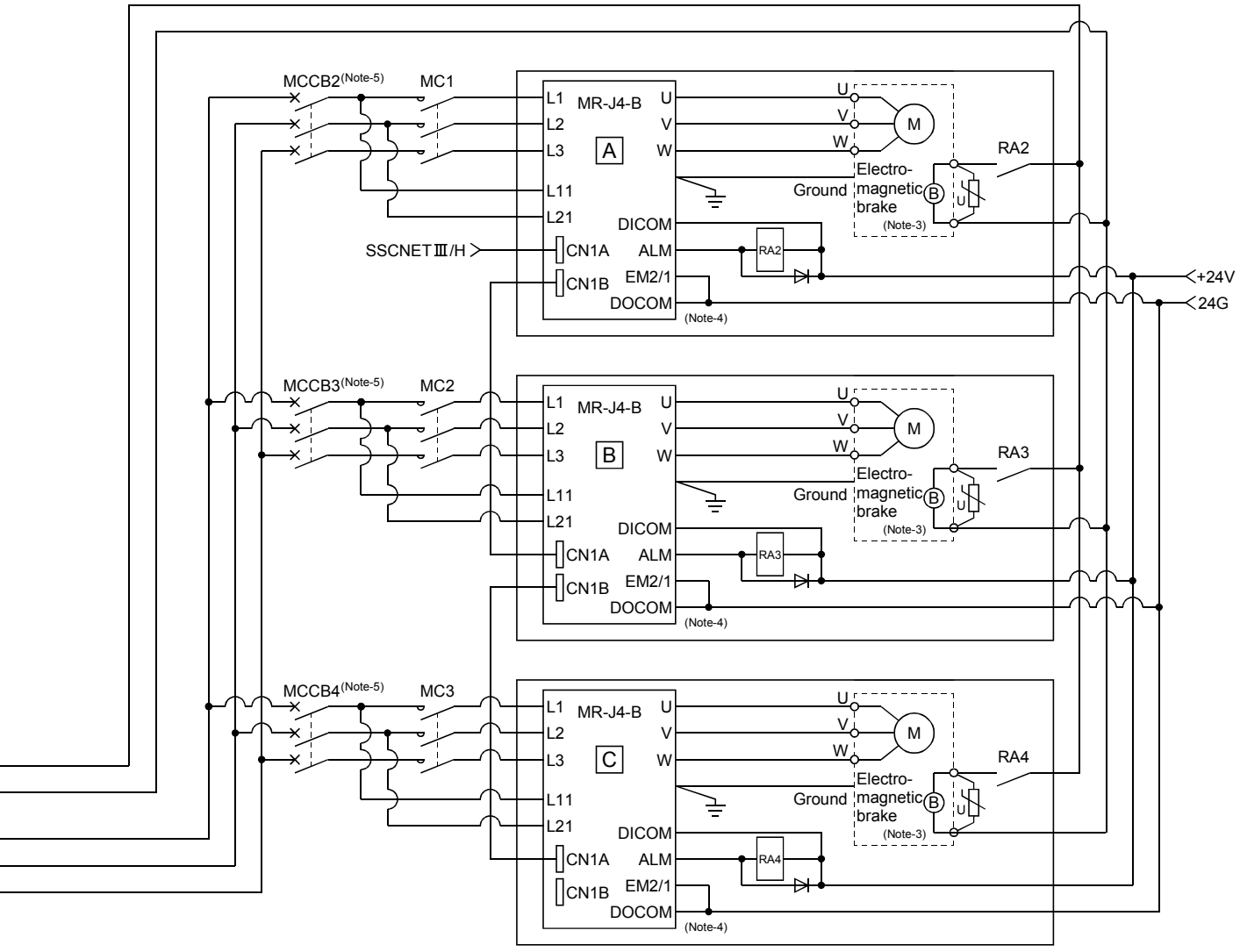


POINT

(1) (Note-1): Make the forced stop input cable within 30m(98.43ft.). The forced stop by the forced stop terminal of input module is also possible.
(2) (Note-2): Motion SFC program example is shown in the right record.
(3) (Note-3): It is also possible to use a full wave rectified power supply as the power supply for the electromagnetic brake.
(4) (Note-4): It is also possible to use forced stop signal of the servo amplifier.
(5) (Note-5): Refer to the servo amplifier instruction manuals for selection of the circuit breaker and electromagnetic contactor.
(6) (Note-6): The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier.
Refer to the servo amplifier instruction manual for selection of the surge suppressor.

<Example> For control axis 1, axis 2 and axis 3

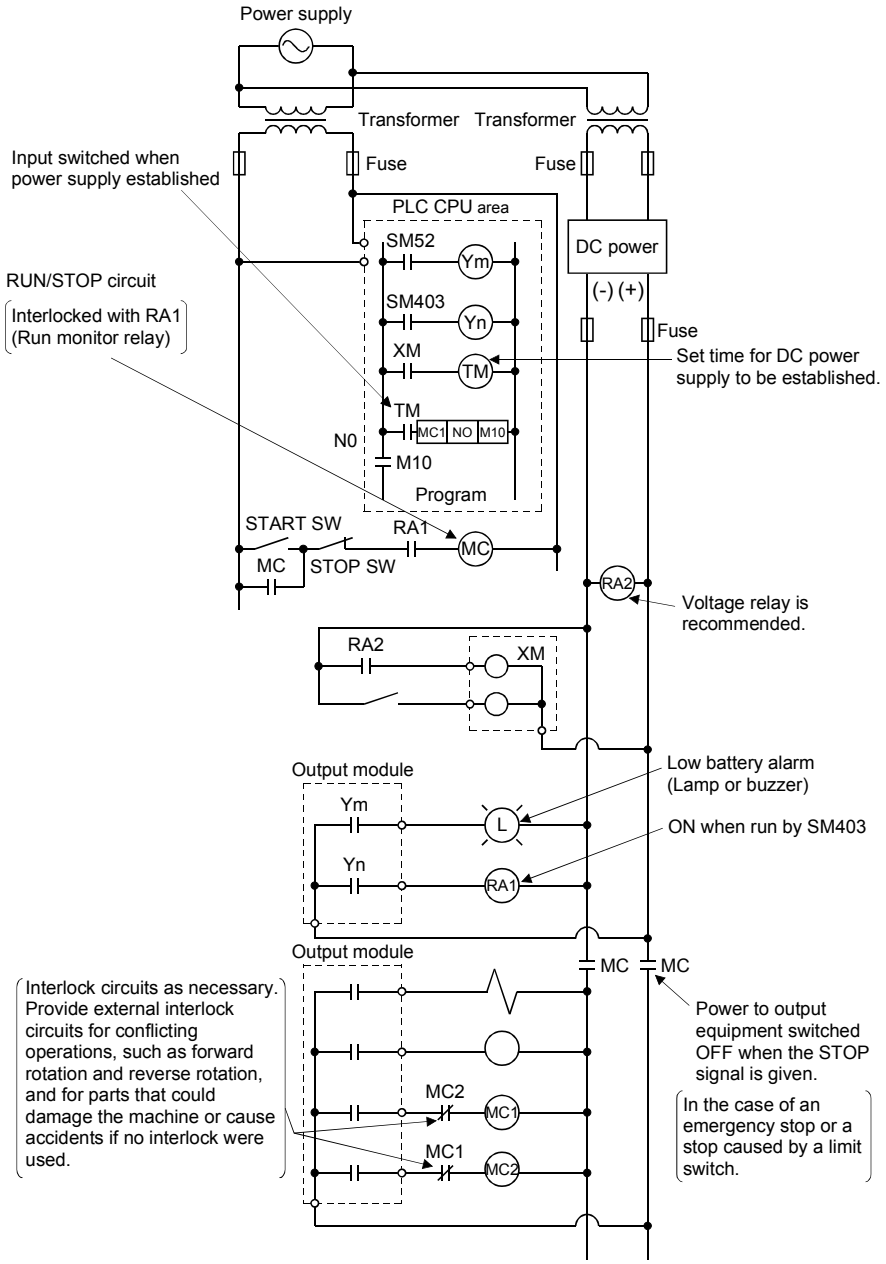




(Note-1): When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.
Example) When the control power supply L11/L21 of servo amplifier in above B figure is shut off, it is also not possible to communicate with the servo amplifier C.
If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

(Note-2): Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Motion controller. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.

(2) System design circuit example of the PLC CPU area



The start-up procedure is as follows

1) Switch the Motion controller power ON.
2) Set the Motion controller to RUN.
3) When DC power is established, RA2 goes ON.
4) Timer (TM) times out after the DC power reaches 100[%]. (The TM set value should be the period of time from when RA2 goes ON to the establishment of 100[%] DC voltage. Set this value to approximately 0.5 seconds.)
5) Turn ON the start switch.
6) When the electromagnetic contactor (MC) comes on, the output equipment is powered and may be driven by the program. (If a voltage relay is used at RA2, no timer (TM) is required in the program.)

3.2.1 Power supply circuit design

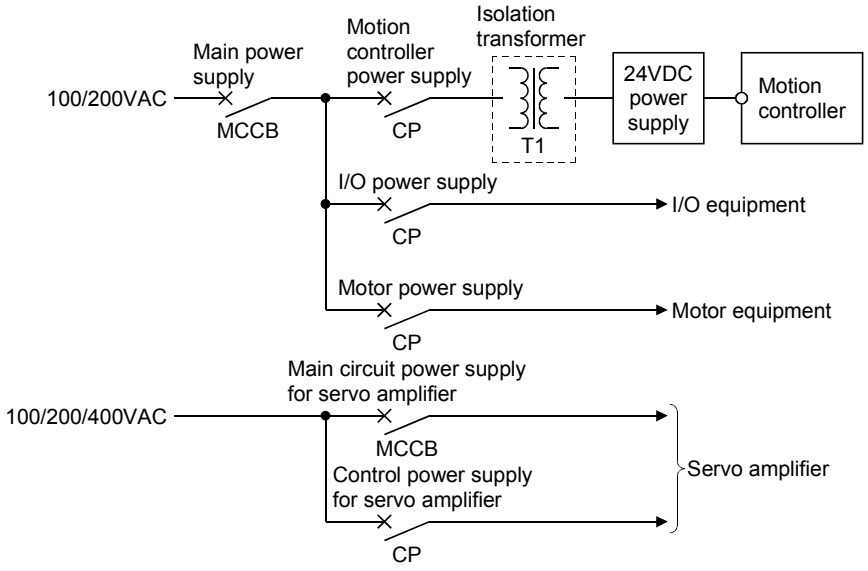
This section describes the protective coordination and noise suppression techniques of the power supply circuit.

(1) Separation and protective coordination (leakage current protection, over current protection) of power supply lines

Separate the lines for Motion controller's power supplies from the lines for I/O devices and servo amplifiers as shown below.

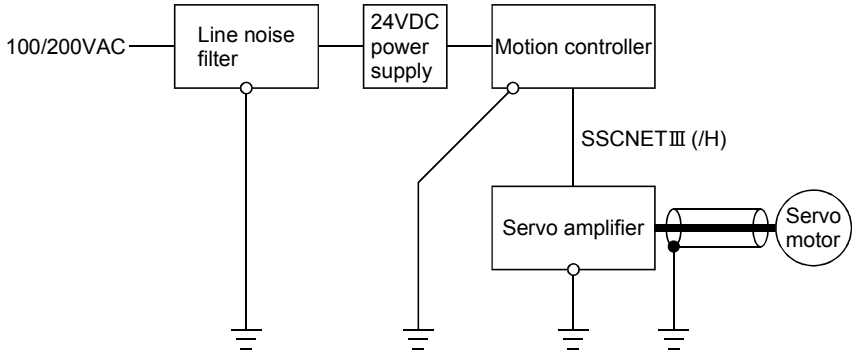
When there is much noise, connect an insulation transformer.

The Motion controller may malfunction as it is affected by various noises such as electric path noises from the power supply lines, and electromagnetic noises from conductors. To avoid such troubles, set the 24VDC power supply according to application.



(2) Grounding

The Motion controller may malfunction as it is affected by various noises such as electric path noises from the power supply lines, radiated and induced noises from other equipment, servo amplifiers and their cables, and electromagnetic noises from conductors. To avoid such troubles, connect the earthing ground of each equipment and the shield grounds of the shielded cables to the earth.
For grounding, use the exclusive ground terminal wire of each equipment or a single-point earth method to avoid grounding by common wiring, where possible, since noises may sneak from other equipment due to common impedances.



(Note): Be sure to ground the line noise filter, Motion controller, servo amplifier and servomotor. (Ground resistance : 100 Ω or less)

3.2.2 Safety circuit design

(1) Concept of safety circuits

When the Motion controller is powered on and off, normal control output may not be done momentarily due to a delay or a startup time difference between the Motion controller power supply and the external power supply (DC in particular) for the control target.

Also, an abnormal operation may be performed if an external power supply fault or Motion controller failure takes place.

To prevent any of these abnormal operations from leading to the abnormal operation of the whole system and in a fail-safe viewpoint, areas which can result in machine breakdown and accidents due to abnormal operations (e.g. emergency stop, protective and interlock circuits) should be constructed outside the Motion controller.

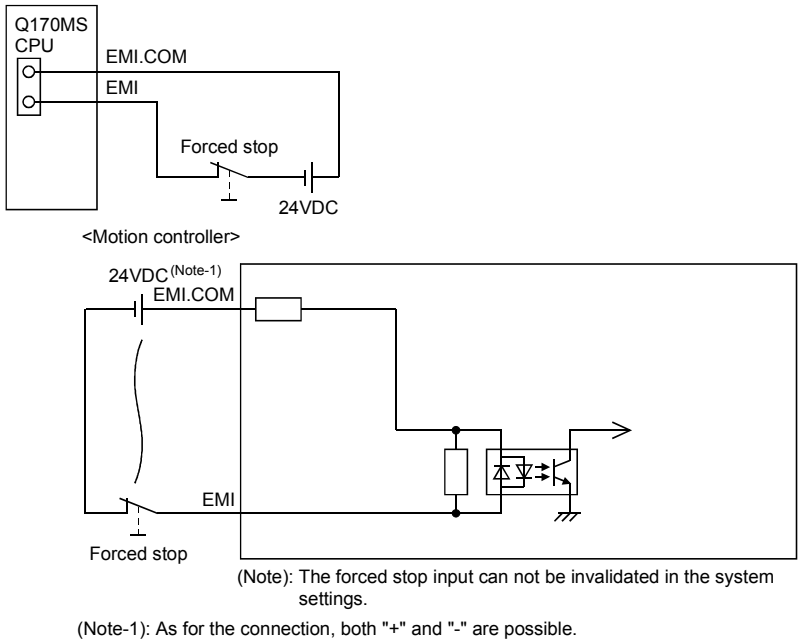
(2) Emergency stop circuit

The circuit should be constructed outside of the Motion controller or servo amplifier. Shut off the power supply to the external servo amplifier by this circuit, make the electromagnetic brakes of the servomotor operated.

(3) Forced stop circuit

(a) The forced stop of all servo amplifiers is possible in a lump by using the forced stop input of Motion controller. After forced stop, the forced stop factor is removed and the forced stop canceled.
(The servo error detection signal does not turn on with the forced stop.)
The forced stop input cannot be invalidated in the parameter setting of system setting.
Make the forced stop input cable within 30[m](98.43[ft.]).

The wiring example for the forced stop input of Motion controller is shown below.

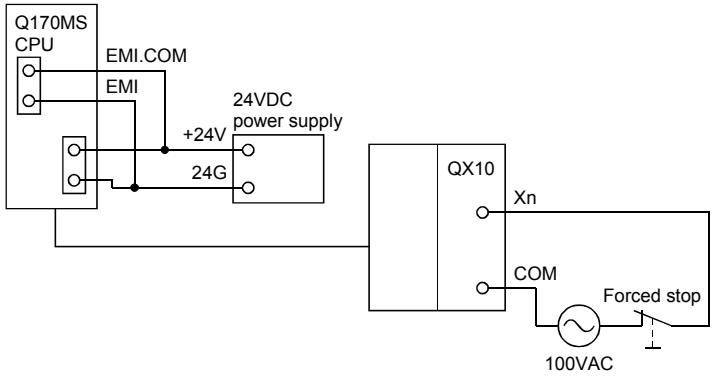


(Note): The forced stop input can not be invalidated in the system settings.

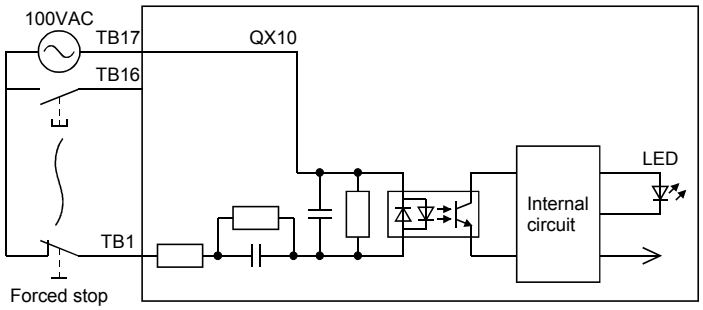
(Note-1): As for the connection, both "+" and "-" are possible.

(b) The forced stop of all servo amplifiers is possible in a lump by using the forced stop input of input modules. After forced stop, the forced stop factor is removed and the forced stop canceled.
(The servo error detection signal does not turn on with the forced stop.)
The forced stop input can be set by allocation of the device number in the parameter setting of system setting. When the device is used, apply 24VDC voltage on EMI connector and invalidate the forced stop input of EMI connector.

The wiring example that uses the forced stop input of input module (QX10) is shown below.



<Input module QX10>



(Note): The forced stop input can be set in the system settings.

(c) It is also possible to use the forced stop signal of the servo amplifier.
Refer to manual of the servo amplifier about servomotor capacity.

Operation status of the emergency stop and the forced stop are as follows.

Item	Operation of the signal ON	Remark
Emergency stop	Servo OFF	Shut off the power supply to the external servo amplifier by external circuit, make the servomotor stopped.
Forced stop		The servomotor is stopped according to the stop instruction from Motion controller to the servo amplifier.

3.3 Layout Design within the Control Panel

3.3.1 Mounting environment

Mount the Motion controller system in the following environment conditions.

(1) Ambient temperature is within the range of 0 to 55[°C] (32 to 131[°F]).

(2) Ambient humidity is within the range of 5 to 95[%]RH.

(3) No condensing from sudden temperature changes

(4) No corrosive or inflammable gas

(5) There must not be a lot of conductible dust, iron filings, oil mist, or salt, organic solvents.

(6) No direct sunlight

(7) No strong electrical or magnetic fields

(8) No direct vibrations or shocks on the Motion controller

3.3.2 Calculating heat generation by Motion controller

The ambient temperature inside the panel storing the Motion controller must be suppressed to an ambient temperature of 55°C(131°F) or less, which is specified for the Motion controller.
For the design of a heat releasing panel, it is necessary to know the average power consumption (heating value) of the devices and instruments stored inside.
Here the method of obtaining the average power consumption of system is described.
From the power consumption, calculate a rise in ambient temperature inside the control panel.

How to calculate average power consumption

The power consuming parts of the Motion controller are roughly classified into six blocks as shown below.

(1) Total power consumption for 5VDC logic circuits of all modules (including Motion controller)

This is a power to which each module consumes the current supplied by the 5VDC output circuit of the internal power supply.
(including the current consumption of the base unit.)

$W_{5V} = I_{5V} \times 5$ [W]

I_{5V}: Current consumption of 5VDC logic circuit of each module

(2) Power consumption of internal power supply

The power conversion efficiency of the internal power supply is approx. 80[%], while 20 [%] of the output power is consumed as heat. As a result, 1/4 of the output power is the power consumption.
Therefore the calculation formula is as follows.

$$W_{PW} = \frac{1}{4} \times W_{5V} \text{ [W]}$$

I_{5V}: Current consumption of 5VDC logic circuit of each module

(3) A total of 24VDC average power consumption of the internal output circuit and output module

The average power of the external 24VDC power is the total power consumption of the internal output circuit and each output module.

$W_{24V} = I_{24V} \times 24 \times$ Simultaneous ON rate [W]
I_{24V}: Average current consumption of external 24VDC power supply [A]
(Power consumption for simultaneous ON points)

(4) Average power consumption due to voltage drop in the output section of the internal output circuit and output module (Power consumption for simultaneous ON points)

$W_{OUT} = I_{OUT} \times$ Vdrop $\times$ Number of outputs $\times$ Simultaneous ON rate [W]

I_{OUT} : Output current (Current in actual use) [A]
Vdrop : Voltage drop in the internal output circuit and each output module [V]

(5) Average power consumption of the input section of the internal input circuit and input module (Power consumption for simultaneous ON points)

$W_{IN} = I_{IN} \times E \times$ Number of input points $\times$ Simultaneous ON rate [W]

I_{IN} : Input current (Effective value for AC) [A]
E : Input voltage (Voltage in actual use) [V]

(6) Power consumption of the external power supply section of the intelligent function module

$W_S = I_{+15V} \times 15 + I_{-15V} \times 15 + I_{24V} \times 24$[W]

I_{+15V}: Power consumption of the +15VDC external power supply section of the intelligent function module
I_{-15V} : Power consumption of the -15VDC external power supply section of the intelligent function module
I_{24V} : Power consumption of the 24VDC external power supply section of the intelligent function module

The total of the power consumption values calculated for each block is the power consumption of the overall Motion system

$W = W_{5V} + W_{PW} + W_{24V} + W_{OUT} + W_{IN} + W_S$ [W]

From this overall power consumption [W], calculate the heating value and a rise in ambient temperature inside the panel.

The outline of the calculation formula for a rise in ambient temperature inside the panel is shown below.

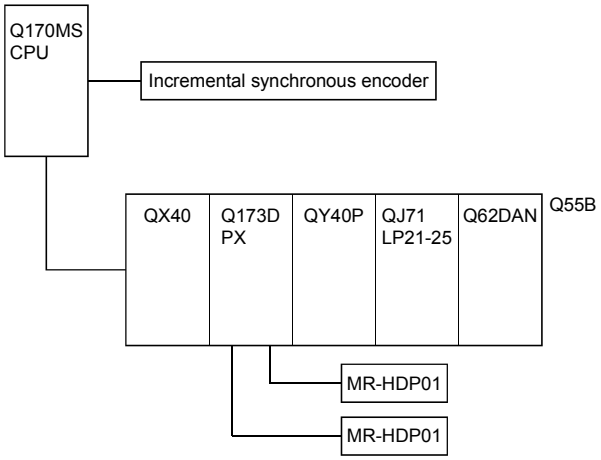
$$T = \frac{W}{UA} [^{\circ}C]$$

W : Power consumption of overall Motion system (value obtained above)
A : Surface area inside the panel [m^2]
U : When the ambient temperature inside the panel is uniformed by a fan 6
When air inside the panel is not circulated 4

POINT
If the temperature inside the panel has exceeded the specified range, it is recommended to mount a heat exchanger to the panel to lower the temperature. If a normal ventilating fan is used, dust will be sucked into the Motion controller together with the external air, and it may affect the performance of the Motion controller.

(7) Example of average power consumption calculation

(a) System configuration



(b) 5VDC/24VDC current consumption of each module

Model name	5VDC	24VDC
Q170MSCPU	2.50 [A]	0.08 [A] (Internal output circuit)
Incremental synchronous encoder	0.20 [A]	—
QX40 (Note)	0.05 [A]	—
Q173DPX	0.38 [A]	—
MR-HDP01	0.06 [A]	—
QY40P (Note)	0.065 [A]	1.60 [A]
QJ71LP21-25 (Note)	0.55 [A]	—
Q62DA (Note)	0.33 [A]	0.15 [A]
Q55B (Note)	0.10 [A]	—

(Note): 5VDC internal current consumption of shared equipments with PLC might be changed. Be sure to refer to the MELSEC-Q series PLC Manuals.

(c) Total power consumption for 5VDC logic circuits of all modules

$W_{5V} = (2.50 + 0.20 + 0.05 + 0.38 + 0.06 \times 2 + 0.065 + 0.55 + 0.33 + 0.10) \times 5$
$= 21.475$ [W]

(d) Power consumption of internal power supply

$W_{PW} = \frac{1}{4} \times 21.475 = 5.369$ [W]

(e) A total of 24VDC average power consumption of the internal output circuit and output module

$W_{24V} = (0.08 + 1.60) \times 24 \times 1 = 40.32$ [W]

(f) Average power consumption due to voltage drop in the output section of the internal output circuit and output module

$W_{OUT} = 0.04 \times 2.75 \times 2 \times 1 + 0.1 \times 0.2 \times 16 \times 1 = 0.54$ [W]

(g) Average power consumption of the input section of the internal input circuit and input module

$W_{IN} = 0.005 \times 24 \times 4 \times 1 + 0.004 \times 24 \times 16 \times 1 = 2.016$ [W]

(h) Power consumption of the external power supply section of the intelligent function module.

$W_S = 0.15 \times 24 = 3.60$ [W]

(i) Power consumption of overall system

W = 21.475 + 5.369 + 40.32 + 0.54 + 2.016 + 3.60= 73.32 [W]

3.4 Design Checklist

At the worksite, copy the following table for use as a check sheet.

Item	Sub Item	Design confirmation		Check
Module selection	Motion controller selection	Number of axes	axes	☐
		Manual pulse generator	pcs.	☐
		Incremental synchronous encoder	pcs.	☐
		Number of I/O points	points	☐
	Motion module selection	Manual pulse generator	pcs.	☐
		Incremental synchronous encoder	pcs.	☐
		Upper limit point	points	☐
		Lower limit point	points	☐
		STOP input point	points	☐
		Proximity dog input point	points	☐
		Speed switching input point	points	☐
		Tracking enable signal point	points	☐
		Q172DLX	modules	☐
		Q173DPX	modules	☐
	Extension base unit and extension cable selection	Number of I/O modules/intelligent function modules installed to extension base unit	modules	☐
		Distance between Motion controller and extension base unit	mm	☐
		Extension base unit selection		☐
		Extension cable selection		☐
External circuit design	Fail-safe circuit design	Avoidance of operation failure at power-on		☐
		Avoidance of hazard at Motion controller failure		☐
Layout design	Module layout design	Conformance with general specifications such as ambient temperature, humidity, dust, etc.		☐
		Total power consumption of base unit (Calculate the heating value)	W	☐
		Layout in consideration of clearances between enclosure's inside walls, other structures and modules and heats generated by modules within the control panel.		☐

4. INSTALLATION AND WIRING

4.1 Module Installation

4.1.1 Instructions for handling

⚠CAUTION

- Use the Motion controller in an environment that meets the general specifications contained in this manual. Using this Motion controller in an environment outside the range of the general specifications could result in electric shock, fire, operation failure, and damage to or deterioration of the product.
- When the modules are installed to the base unit while pressing the installation lever located at the bottom of module, insert the module fixing projection into the fixing hole in the base unit until it stops. Then, securely install the module with the fixing hole as a supporting point. Incorrect installation of the module can cause an operation failure, damage or drop.
  When using the Motion controller in the environment of much vibration, tighten the module with a screw. Tighten the screw in the specified torque range. Under tightening may cause a drop, short circuit or operation failure. Over tightening may cause a drop, short circuit or operation failure due to damage to the screw or module.
- Be sure to connect the extension cable to connectors of the base unit correctly. After connecting, check them for looseness. Poor connections could cause an input or output failure.
- Completely turn off the externally supplied power used in the system before installation or removing the module. Not doing so could result in electric shock or damage to the product.
- Do not install/remove the module onto/from base unit or terminal block more than 50 times, after the first use of the product. Failure to do so may cause the module to malfunction due to poor contact of connector.
- Do not directly touch the module's conductive parts and electronic components. Doing so may cause an operation failure or give damage to the module.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.
- Do not touch the heat radiating fins of controller or servo amplifier's, 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.
  Remove the modules while paying attention.

This section describes instructions for handling the Motion controller, motion, I/O and intelligent function modules, base units and so on.

(1) Module, terminal block connectors and pin connectors are made of resin; do not drop them or subject them to strong impact.

(2) Do not remove modules' printed circuit boards from the enclosure in order to avoid changes in operation.

(3) Tighten the module fixing screws and terminal block screws within the tightening torque range specified below.

Location of screw	Tightening torque range [N•m]
Motion controller fixing screw (M5 screw)	2.75 to 3.63 (Note-1)
Motion controller FG fixing screw (M4 × 12 screw)	0.82 to 1.11
Module fixing screw (M3 × 12 screw)	0.36 to 0.48
I/O module terminal block screw (M3 screw)	0.42 to 0.58
I/O module terminal block fixing screw (M3.5 screw)	0.68 to 0.92
Power supply module terminal screw (M3.5 screw)	0.68 to 0.92
Base unit fixing screw (M4 × 14 screw)	1.40 to 1.89 (Note-1)

(Note-1): Torque range applies when the mounting panel is 2mm(0.88inch) thick and a fastening nut is used to secure the screw from the back side of the panel.

(4) When using an extension cable, keep it away from the main circuit cable (high voltage and large current).
Keep a distance of 100mm or more from the main circuit.

(5) Be sure to fix a Motion controller or base unit to the panel using mounting screws. Not doing so could result in vibration that may cause erroneous operation.

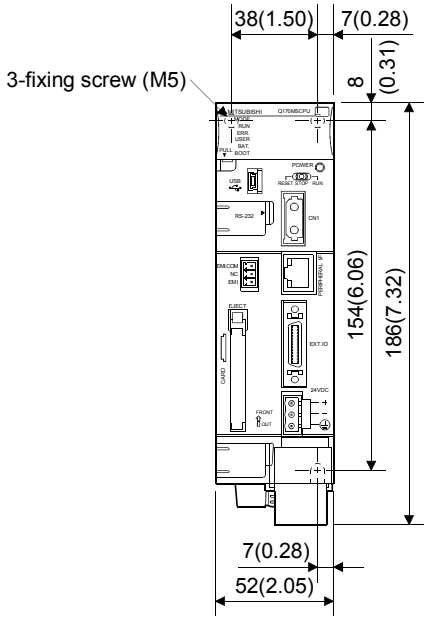
4.1.2 Instructions for mounting the modules

When mounting the Motion controller, base unit to an enclosure or similar, fully consider its operability, maintainability and environmental resistance.

(1) Fitting dimensions

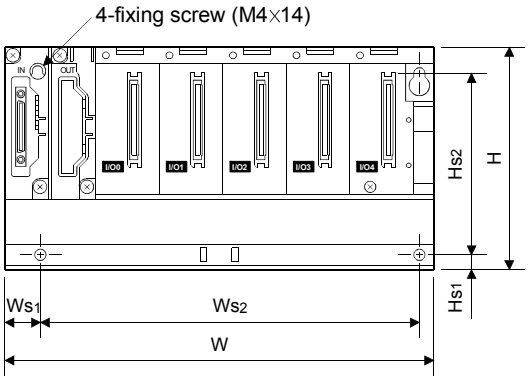
(a) Motion controller

[Unit: mm (inch)]

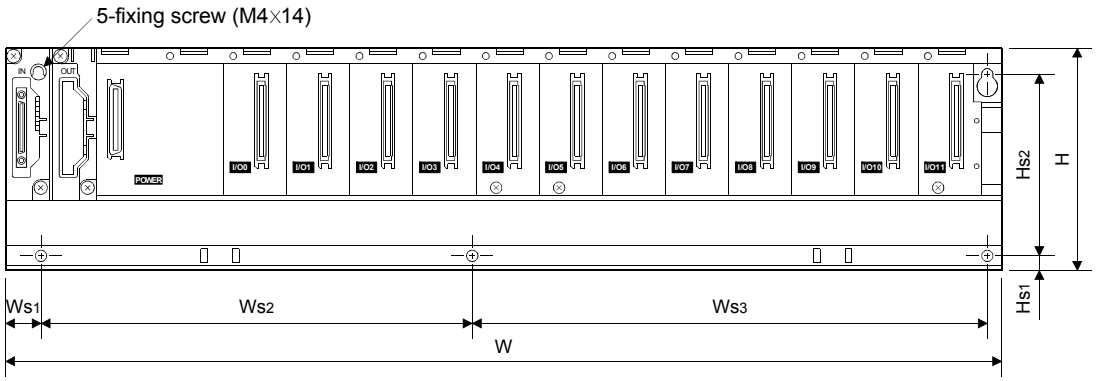


(b) Base unit

1) Q52B, Q55B



2) Q63B, Q65B, Q68B, Q612B,



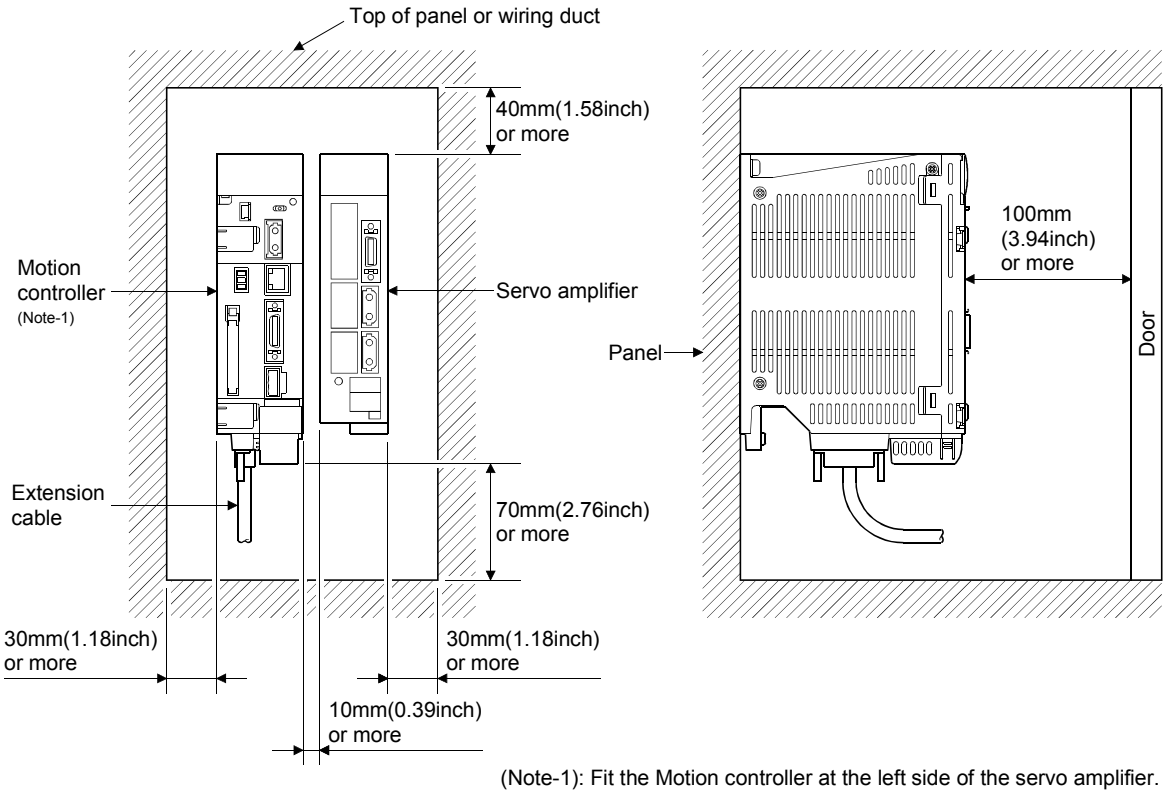
	Q52B	Q55B	Q63B	Q65B	Q68B	Q612B
W	106 (4.17)	189 (7.44)	189 (7.44)	245 (9.65)	328 (12.91)	439 (17.28)
Ws1	15.5 (0.61)					
Ws2	83.5 ± 0.3 (3.29 ± 0.01)	167 ± 0.3 (6.57 ± 0.01)	167 ± 0.3 (6.57 ± 0.01) (Ws2 + Ws3)	222.5 (8.76 ± 0.01) (Ws2 + Ws3)	190 ± 0.3 (7.48 ± 0.01)	190 ± 0.3 (7.48 ± 0.01)
Ws3	—	—			116 ± 0.3 (4.57 ± 0.01)	227 ± 0.3 (8.93 ± 0.01)
H	98 (3.86)					
Hs1	7 (0.28)					
Hs2	80 ± 0.3 (3.15 ± 0.01)					

[Unit: mm (inch)]

(2) Module mounting position

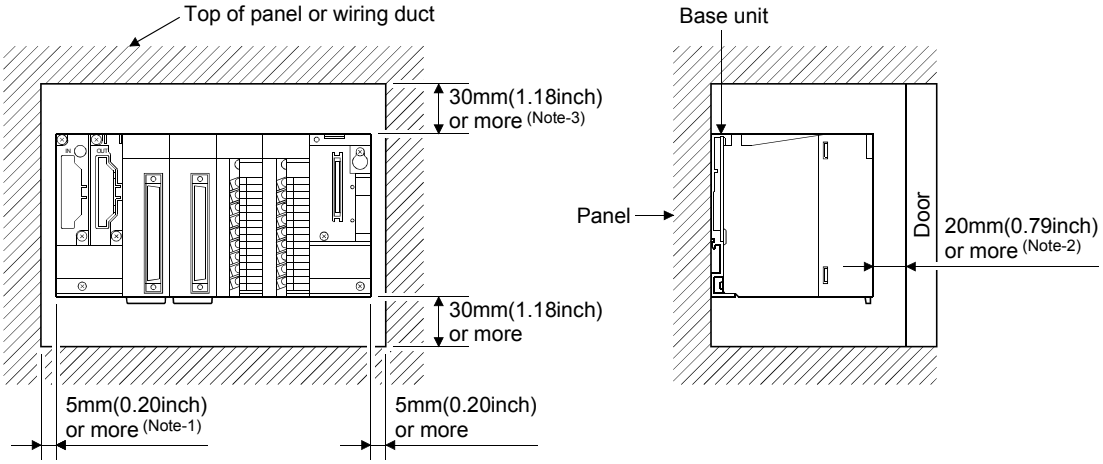
Keep the clearances shown below between the top/bottom faces of the module and other structures or parts to ensure good ventilation and facilitate module replacement.

(a) Motion controller



(Note-1): Fit the Motion controller at the left side of the servo amplifier.

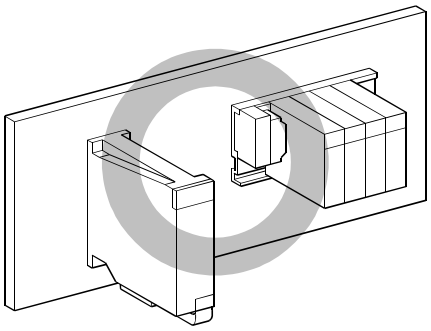
(b) Base unit



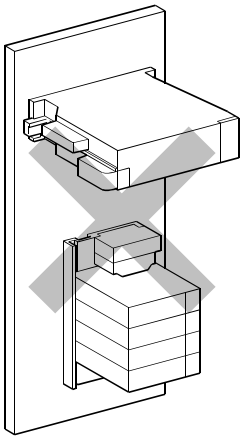
(Note-1): 20mm(0.79inch) or more when the adjacent module is not removed and the extension cable is connected.
(Note-2): 80mm(3.15inch) or more for the connector type.
(Note-3): For wiring duct with 50mm(1.97inch) or less height. 40mm(1.57inch) or more for other cases.

(3) Module mounting orientation

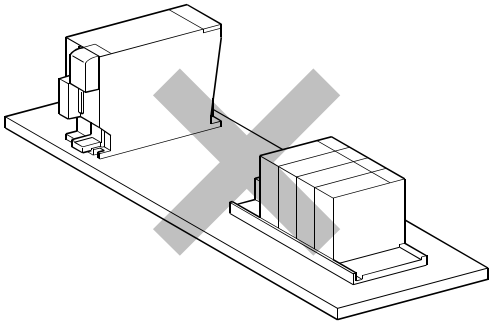
(a) Mount the Motion controller in the orientation shown below to ensure good ventilation for heat release.



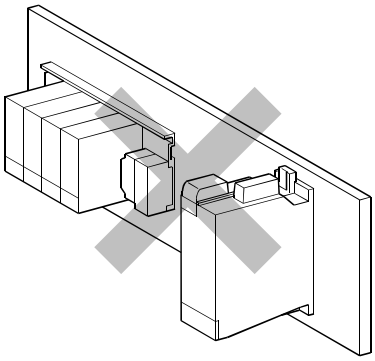
(b) Do not use it in either of the orientations shown below.



Vertical



Flat



Upside down

(4) Mounting surface

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

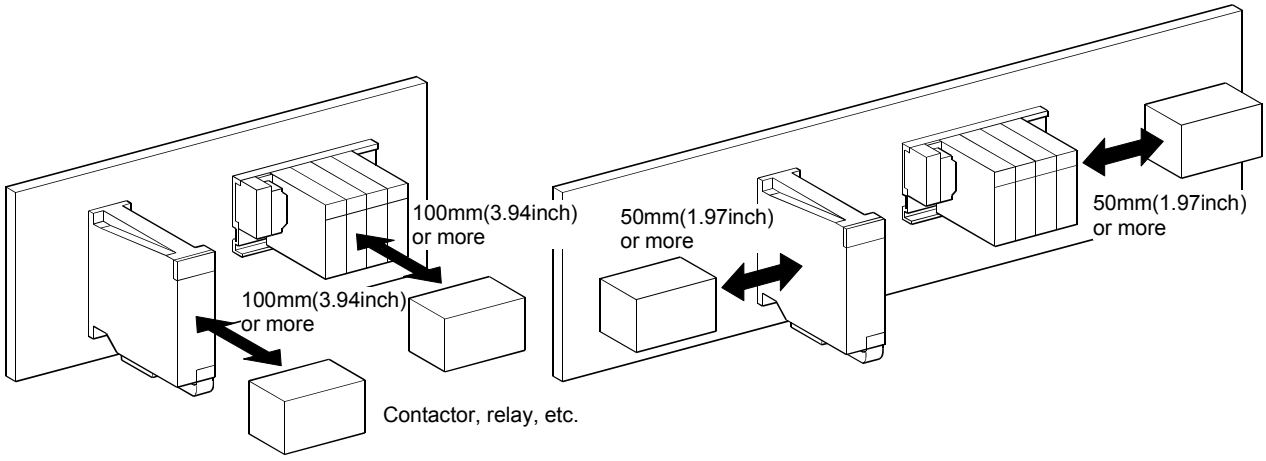
(5) Mounting of unit in an area where the other devices are mounted

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).

(6) 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/base unit and devices that generate noise or heat (contactors and relays, etc.).

- In front of Motion controller/base unit : 100mm (3.94inch) or more
- On the right and left of Motion controller/base unit : 50mm (1.97inch) or more

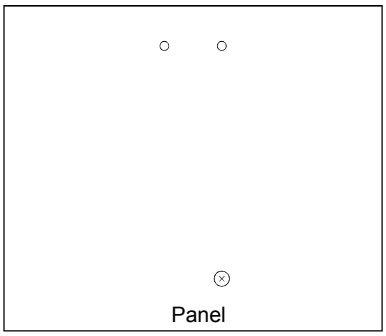


(7) Mounting method for the modules

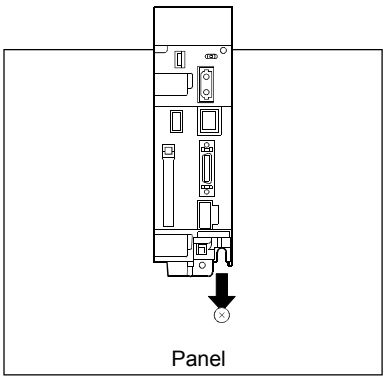
(a) Motion controller

Mount a Motion controller in the following procedure.

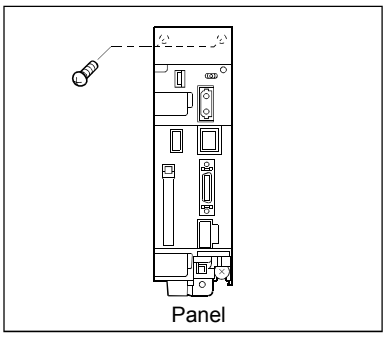
1) Fit the one Motion controller bottom mounting screws into the enclosure.



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 and then retighten the all mounting screws.



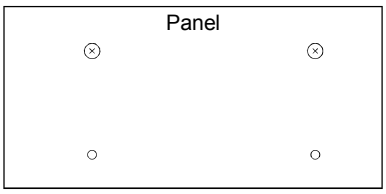
POINT
Screw the Motion controller to the panel.

⚠CAUTION

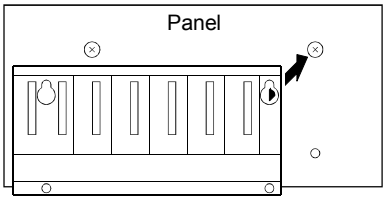
● Do not touch the heat radiating fins of controller or servo amplifier's, regenerative resistor and servomotor, etc. while the power is ON and for a short time after the power is turned OFF. In this timing, these parts become very hot and may lead to burns.
Remove the modules while paying attention.

(b) Base unit
Mount a base unit in the following procedure.

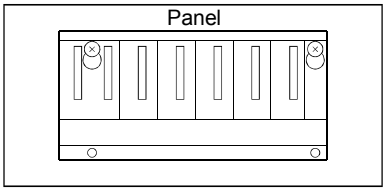
1) Fit the two base unit top mounting screws into the enclosure.



2) Place the right-hand side pear-shaped hole of the base unit onto the right-hand side screw.



3) Place the left-hand side pear-shaped hole of the base unit onto the left-hand side screw.



4) Fit the mounting screws into the holes at the bottom of the base unit, and then retighten the all mounting screws.

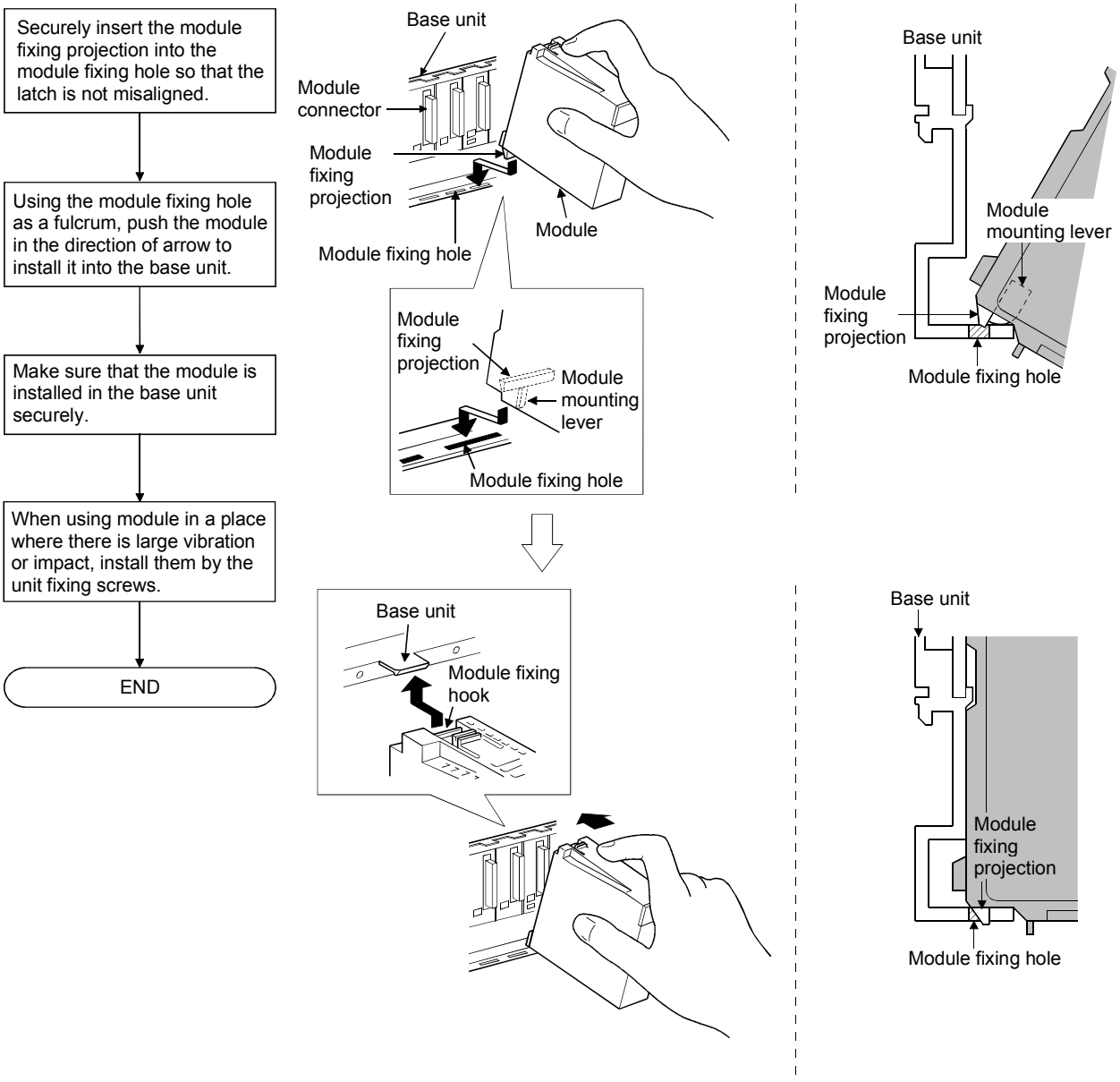
(Note): Mount a base unit to a panel, with no module installed in the right-end slot.
Remove the base unit after removing the module from the right-end slot.

4.1.3 Installation and removal of module to the base unit

This section describes how to install and remove a Motion module, I/O module, intelligent function module or another module to and from the base unit.

(1) Installation and removal of the module from base unit

(a) Installation



POINTS

(1) When installing the module, always insert the module fixing projection into the module fixing hole of the base unit.
At that time, securely insert the module fixing projection so that it does not come off from the module fixing hole.
If the module is forcibly installed without the latch being inserted, the module connector and module will be damaged.

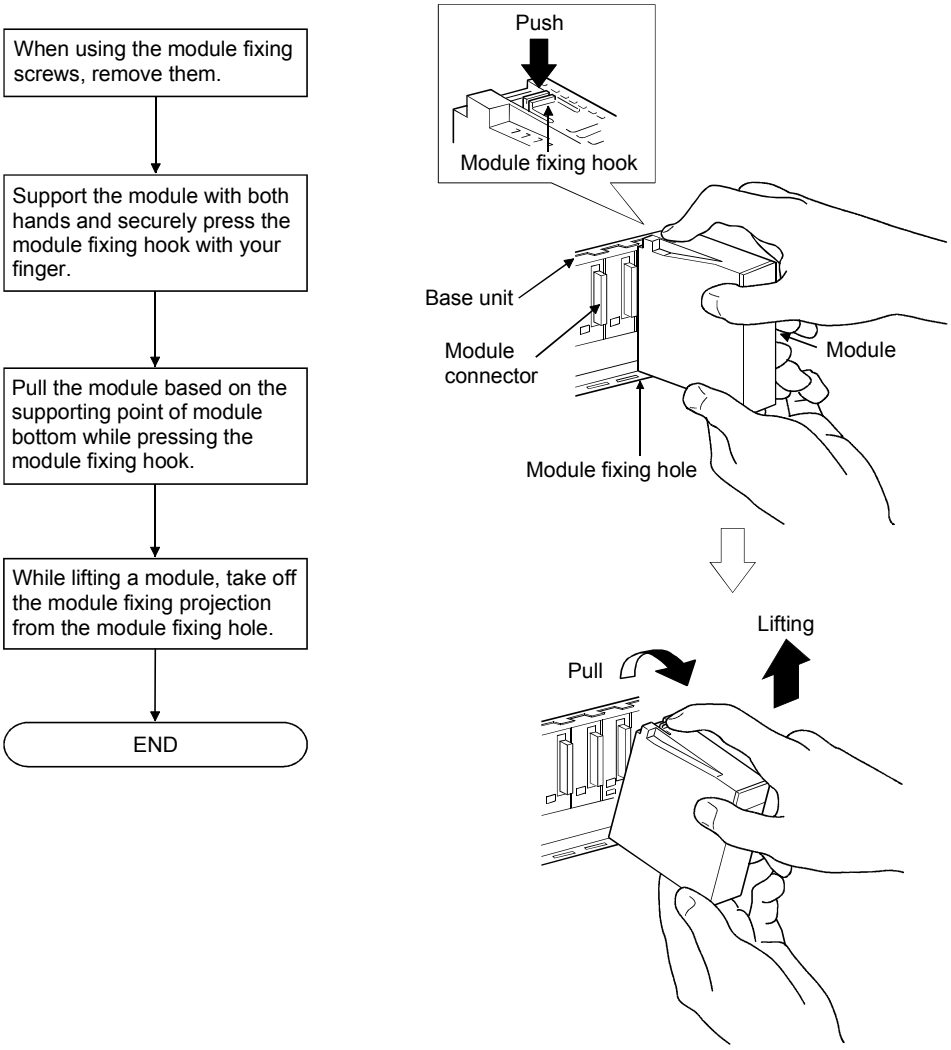
(2) When using the modules in a place where there is large vibration or impact, screw the module to the base unit.
Module fixing screw : M3×12 (user-prepared)

(3) Do not install/remove the module onto/from base unit or terminal block more than 50 times, after the first use of the product. Failure to do so may cause the module to malfunction due to poor contact of connector.

⚠CAUTION

● When the modules are installed to the base unit while pressing the installation lever located at the bottom of module, insert the module fixing projection into the fixing hole in the base unit until it stops. Then, securely install the module with the fixing hole as a supporting point. Incorrect installation of the module can cause an operation failure, damage or drop.
When using the Motion controller in the environment of much vibration, tighten the module with a screw.
Tighten the screw in the specified torque range. Under tightening may cause a drop, short circuit or operation failure. Over tightening may cause a drop, short circuit or operation failure due to damage to the screw or module.

(b) Removal



POINT

When the module fixing screw is used, always remove the module by removing the module fixing screw and then taking the module fixing projection off the module fixing hole of the base unit.
Attempting to remove the module by force may damage the module fixing projection.

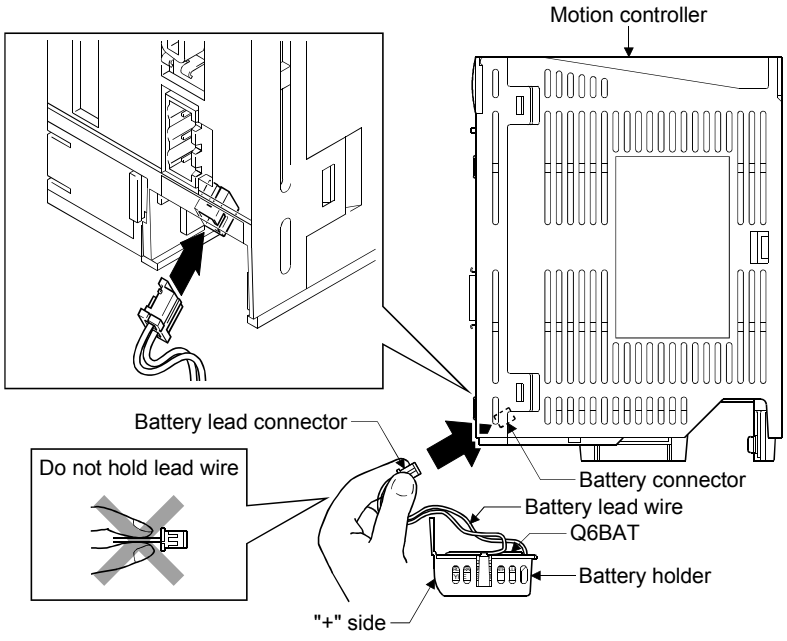
4.1.4 Mounting and removal of the battery holder

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

(1) Handling the battery lead wire

(a) Precautions for mounting the battery
Set the battery to the battery holder correctly after confirming "+" side and "-" side for the battery.

(b) Precautions for handling the battery lead wire
For connection or removal of the battery lead wire, do it surely while holding a battery lead connector.



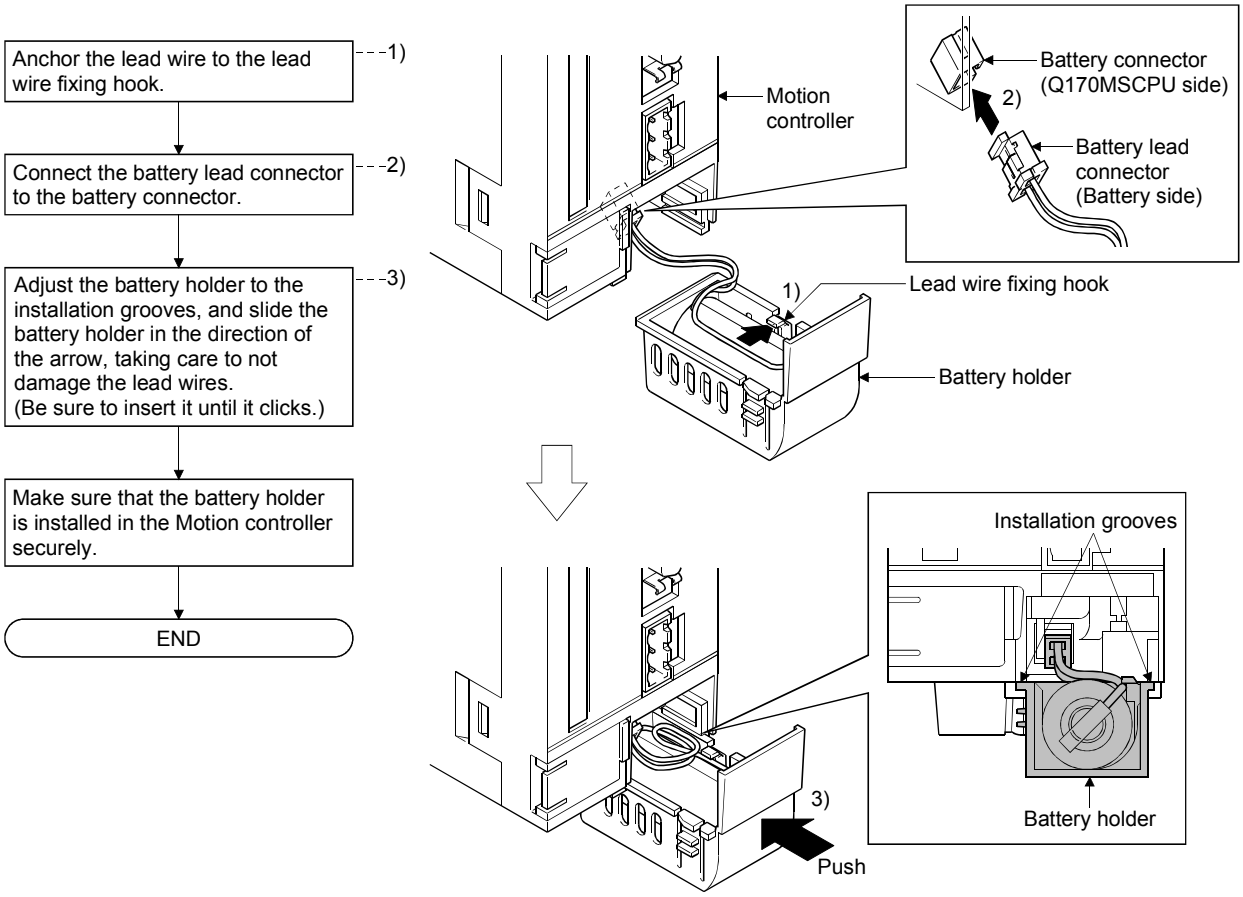
(c) Connection of the battery lead wire
For connection of a battery (Q6BAT/Q7BAT) to the Motion controller, connect it surely to a battery connector while holding a battery lead connector. Be sure to insert it until it clicks.

(d) Removal of the battery lead wire
For removal of the battery lead wire, pull out it while holding a battery lead connector.

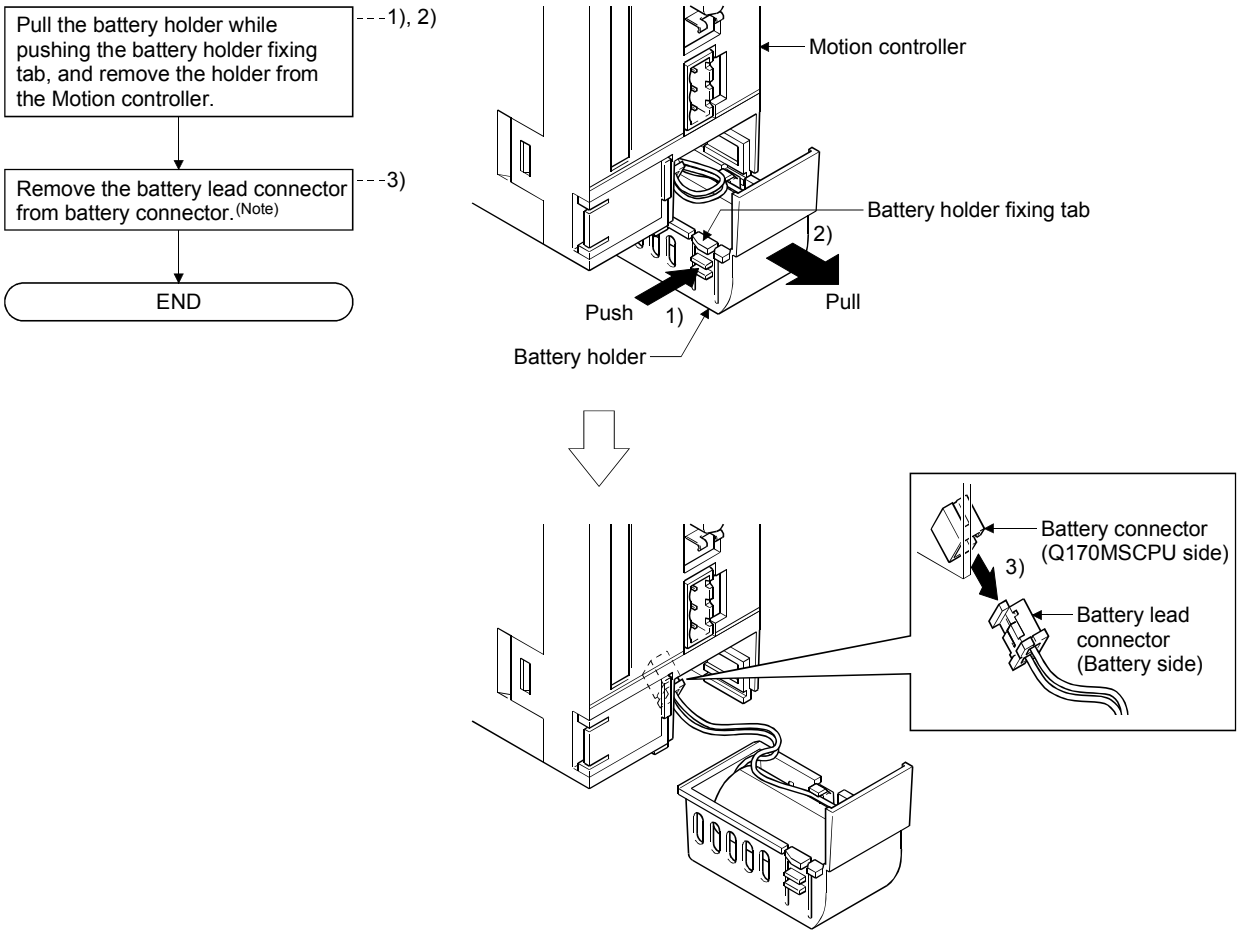
POINT
(1) Forced removal of a connector while holding the battery lead wire will damage the battery connector or battery lead wire.
(2) The data (Refer to Section 6.5) of RAM built-in Motion controller are not backed up if the battery connector is not connect correctly.

(2) Battery holder (For Q6BAT)

(a) Mounting



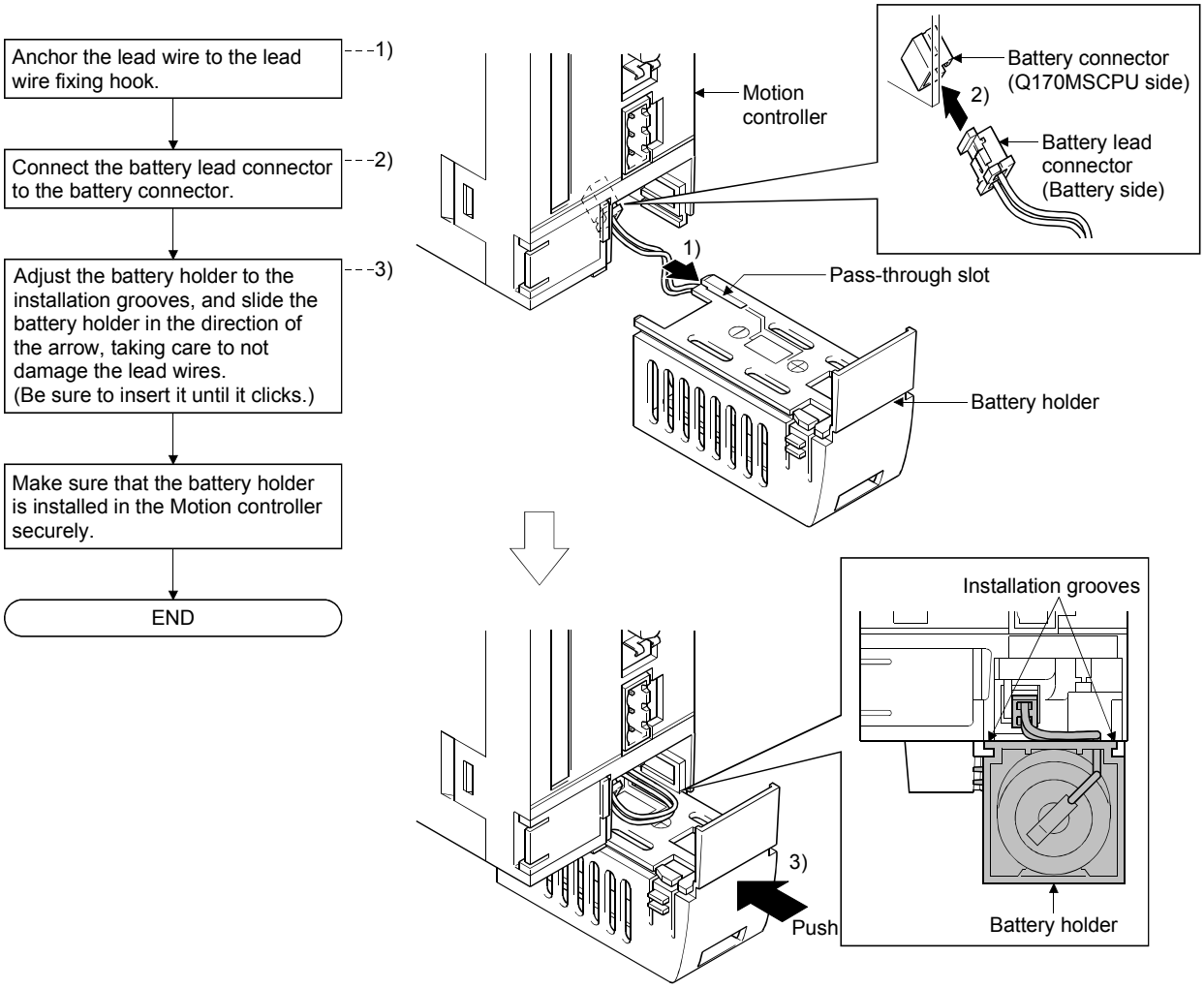
(b) Removal



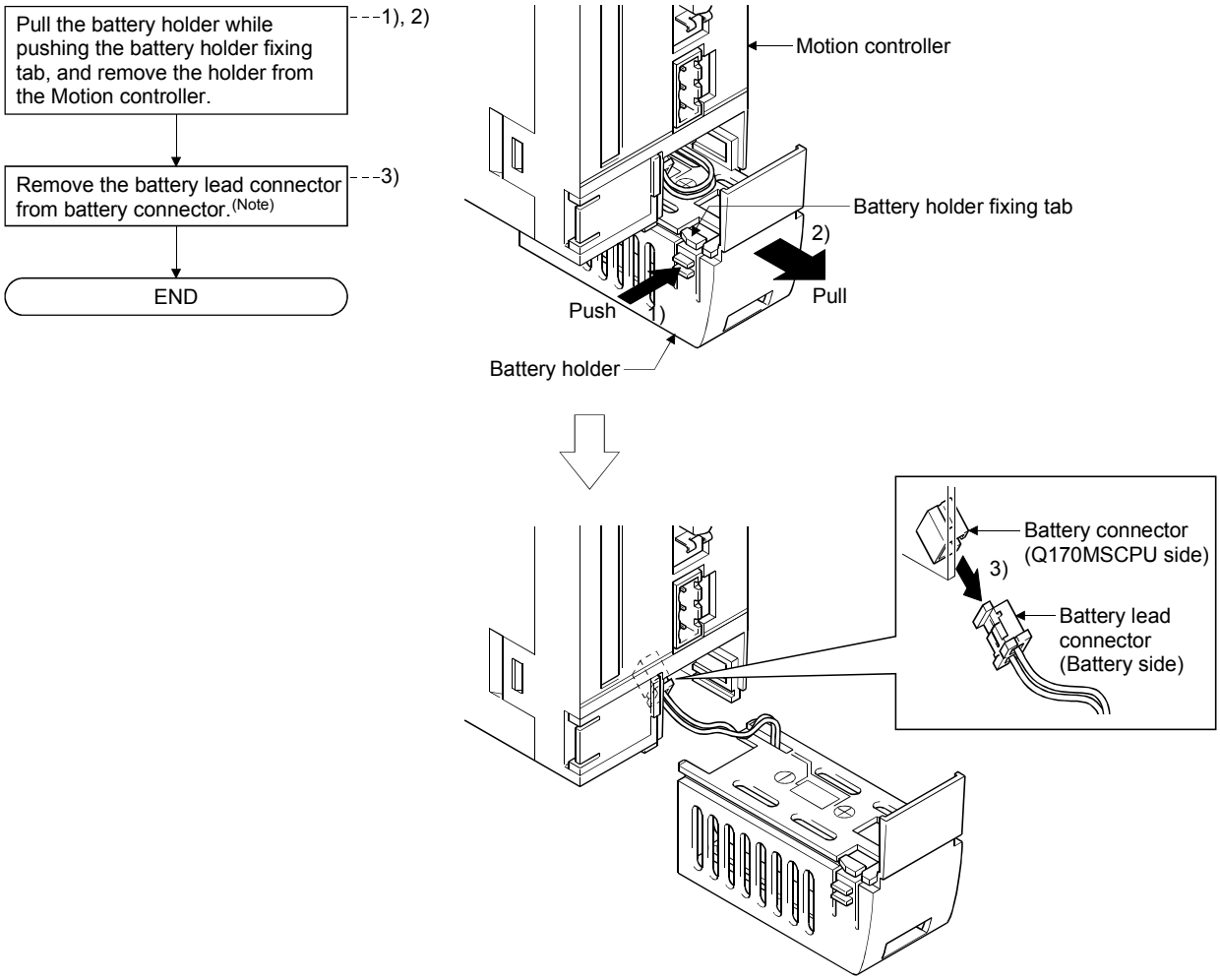
(Note): Do not pull on the lead wire forcibly to remove the connector.

(3) Battery holder (For Q7BAT)

(a) Mounting



(b) Removal



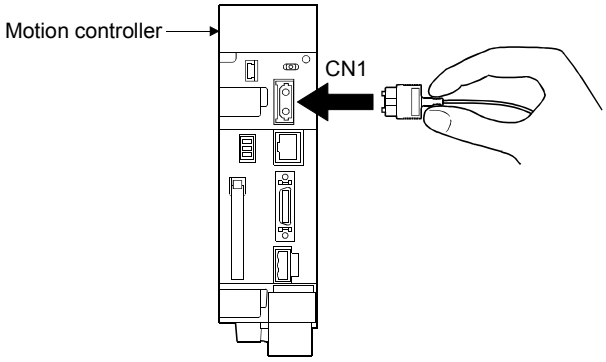
(Note): Do not pull on the lead wire forcibly to remove the connector.

4.2 Connection and Disconnection of Cable

4.2.1 SSCNETⅢ cable

(1) Precautions for handling the SSCNETⅢ cable

- Do not stamp 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.
- For connection and disconnection of SSCNETⅢ cable, hold surely a tab of cable connector.



(2) Connection of SSCNETⅢ cable

- For connection of SSCNETⅢ cable to the Motion controller, connect it to the SSCNETⅢ connector CN1 of Motion controller while holding a tab of SSCNETⅢ cable connector. 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.

(3) Disconnection of SSCNETⅢ cable

- For disconnection of SSCNETⅢ cable, pull out it while holding a tab of SSCNETⅢ cable connector or 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.

(4) Precautions of SSCNETⅢ cable wiring

SSCNETⅢ cable is made from optical fiber. If optical fiber is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. Especially, as optical fiber for MR-J3BUS□M and MR-J3BUS□M-A is made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part, which becomes high temperature, such as radiator or regenerative option of servo amplifier, or servo motor.
Be sure to use optical fiber within the range of operating temperature described in this manual.
Read described item of this section carefully and handle it with caution.

(a) Minimum bend radius

Make sure to lay the cable with greater radius than the minimum bend radius. Do not press the cable to edges of equipment or others. For SSCNETⅢ cable, the appropriate length should be selected with due consideration for the dimensions and arrangement of Motion controller and servo amplifier. When closing the door of control panel, pay careful attention for avoiding the case that SSCNETⅢ cable is hold down by the door and the cable bend becomes smaller than the minimum bend radius.

Model name of SSCNETⅢ cable	Minimum bend radius[mm(inch)]
MR-J3BUS□M	25(0.98)
MR-J3BUS□M-A	Enforced covering cord : 50 (1.97) Cord : 25 (0.98)
MR-J3BUS□M-B	Enforced covering cord : 50 (1.97) Cord : 30 (1.18)

(b) Tension

If tension is added on the SSCNETⅢ cable, the increase of transmission loss occurs because of external force which concentrates on the fixing part of SSCNETⅢ cable or the connecting part of SSCNETⅢ connector. At worst, the breakage of SSCNETⅢ cable or damage of SSCNETⅢ connector may occur. For cable laying, handle without putting forced tension. (Refer to "APPENDIX 4.1 SSCNETⅢ cables" for the tension strength.)

(c) Lateral pressure

If lateral pressure is added on the SSCNETⅢ cable, the cable itself distorts, internal optical fiber gets stressed, and then transmission loss will increase. At worst, the breakage of SSCNETⅢ cable may occur. As the same condition also occurs at cable laying, do not tighten up SSCNETⅢ cable with a thing such as nylon band (TY-RAP).
Do not trample it down or tuck it down with the door of control panel or others.

(d) Twisting

If SSCNETⅢ cable is twisted, it will become the same stress added condition as when local lateral pressure or bend is added. Consequently, transmission loss increases, and the breakage of SSCNETⅢ cable may occur at worst.

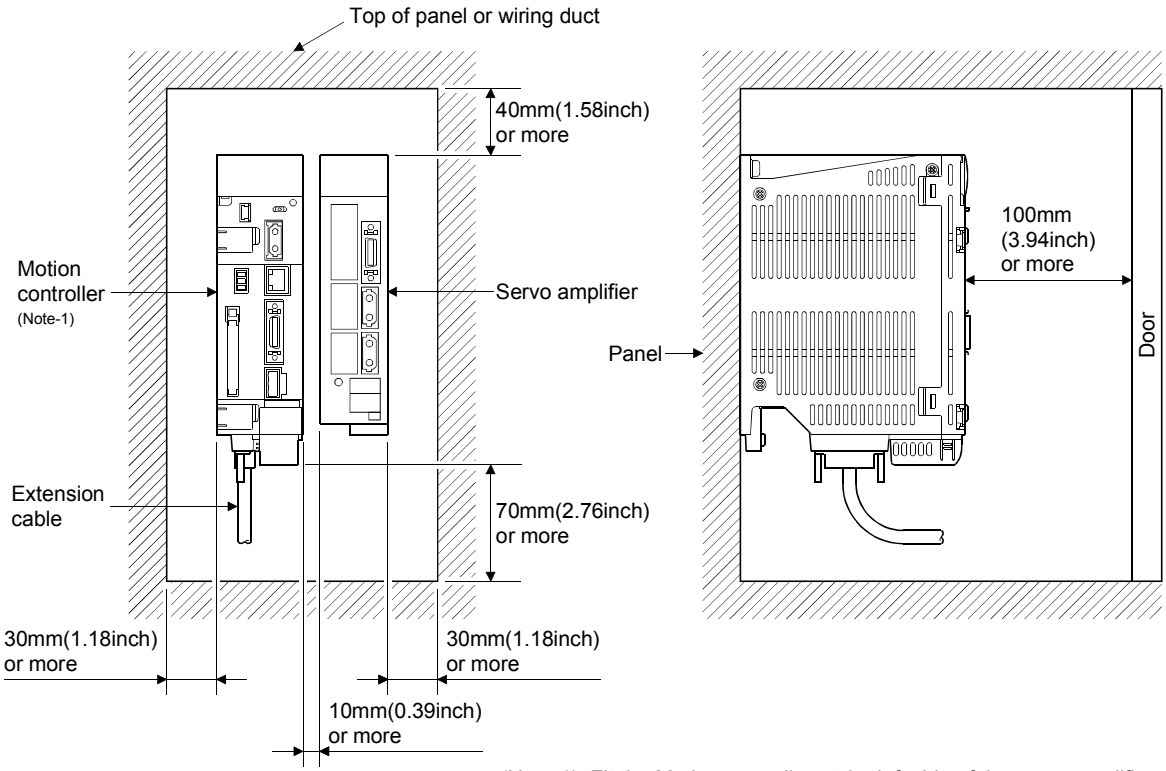
(e) Disposal

When incinerating optical cable (cord) used for SSCNETⅢ cable, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of SSCNETⅢ cable, request for specialized industrial waste disposal services who has incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

(f) 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 in the duct

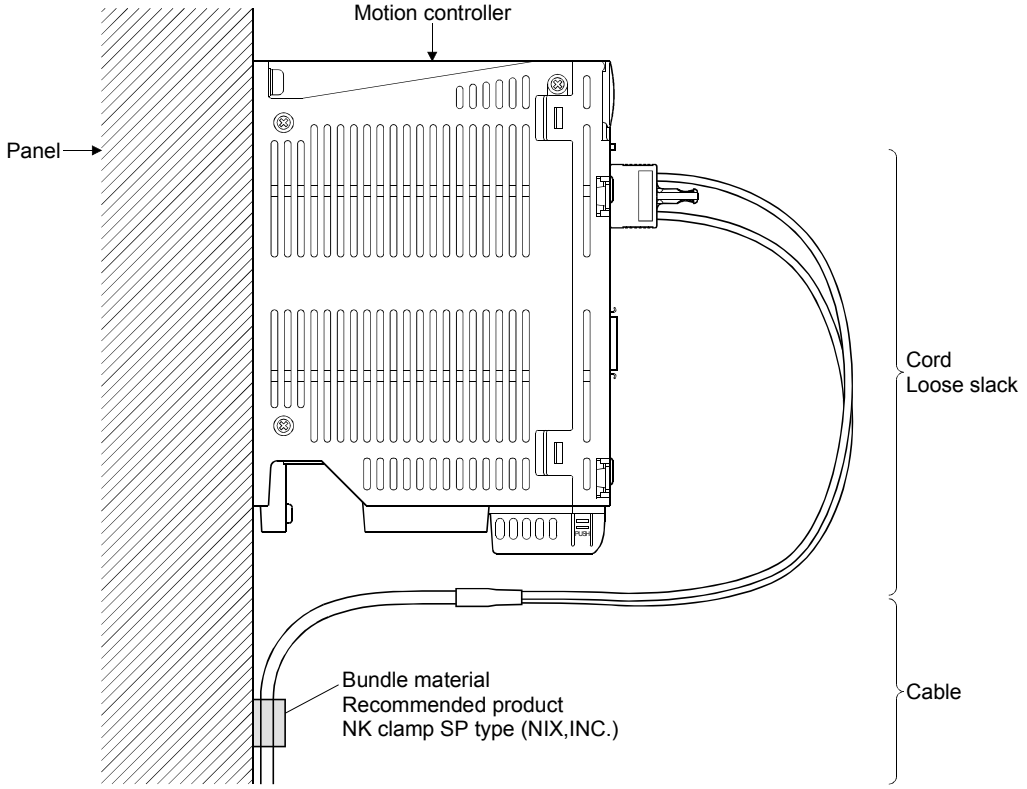


(Note-1): Fit the Motion controller at the left side of the servo amplifier.

• 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.



POINTS

(1) Be sure to connect SSCNETⅢ cable with the above connector. If the connection is mistaken, between the Motion controller and servo amplifier cannot be communicated.

(2) Forced removal of the SSCNETⅢ cable from the Motion controller will damage the Motion controller and SSCNETⅢ cables.

(3) After removal of the SSCNETⅢ cable, be sure to put a cap on the SSCNETⅢ connector. Otherwise, adhesion of dirt deteriorates in characteristic and it may cause malfunctions.

(4) Do not remove the SSCNETⅢ cable while turning on the power supply of Motion controller and servo amplifier.
Do not see directly the light generated from SSCNETⅢ connector of Motion controller or servo amplifier and the end of SSCNETⅢ cable. When the light gets into eye, may feel something is wrong for eye. (The light source of SSCNETⅢ cable complies with class1 defined in JISC6802 or IEC60825-1.)

(5) If the SSCNETⅢ cable is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or brakes, and optical transmission will not be available.
Be sure to take care enough so that the short SSCNETⅢ cable is added a twist easily.

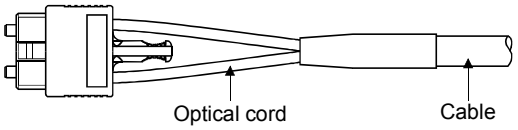
(6) Be sure to use the SSCNETⅢ cable within the range of operating temperature described in this manual. Especially, as optical fiber for MR-J3BUS□M and MR-J3BUS□M-A are made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier, or servomotor.

(7) When laying the SSCNETⅢ cable, be sure to secure the minimum cable bend radius or more.

(8) 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.
When laying cable, the 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.

POINTS

(9) Migrating plasticizer is used for vinyl tape. Keep the MR-J3BUS□M, and MR-J3BUS□M-A cables away from vinyl tape because the optical characteristic may be affected.



SSCNETⅢ cable	Cord	Cable
MR-J3BUS□M	△	
MR-J3BUS□M-A	△	△
MR-J3BUS□M-B	○	○

○: Normally, cable is not affected by plasticizer.
△: Phthalate ester plasticizer such as DBP and DOP may affect optical characteristic of cable.

Generally, soft polyvinyl chloride (PVC), polyethylene resin (PE) and fluorine resin contain non-migrating plasticizer and they do not affect the optical characteristic of SSCNETⅢ cable. However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect MR-J3BUS□M and MR-J3BUS□M-A cables (made of plastic). In addition, MR-J3BUS□M-B cable (made of quartz glass) is not affected by plasticizer.

(10) If the adhesion of solvent and oil to the cord part of SSCNETⅢ cable may lower the optical characteristic and machine characteristic. If it is used such an environment, be sure to do the protection measures to the cord part.

(11) When keeping the Motion controller or servo amplifier, be sure to put on a cap to connector part so that a dirt should not adhere to the end of SSCNETⅢ connector.

(12) SSCNETⅢ connector to connect the SSCNETⅢ cable is put a cap to protect light device inside connector from dust. For this reason, do not remove a cap until just before connecting SSCNETⅢ cable. Then, when removing SSCNETⅢ cable, make sure to put a cap.

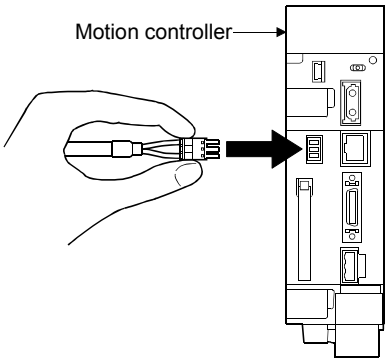
(13) Keep the cap and the tube for protecting light cord end of SSCNETⅢ cable in a plastic bag with a zipper of SSCNETⅢ cable to prevent them from becoming dirty.

(14) When exchanging the Motion controller or servo amplifier, make sure to put a cap on SSCNETⅢ connector. When asking repair of Motion controller or servo amplifier for some troubles, make also sure to put a cap on SSCNETⅢ connector. When the connector is not put a cap, the light device may be damaged at the transit. In this case, exchange and repair of light device is required.

4.2.2 Forced stop input cable

(1) Precautions for handling the forced stop input cable

For connection or removal of the forced stop input cable, do it surely while holding a connector of forced stop input cable.



(2) Connection of the forced stop input cable

For connection of a forced stop input cable to the Motion controller, connect it surely to a EMI connector of Motion controller while holding a connector. Be sure to insert it until it clicks.

(3) Removal of the forced stop input cable

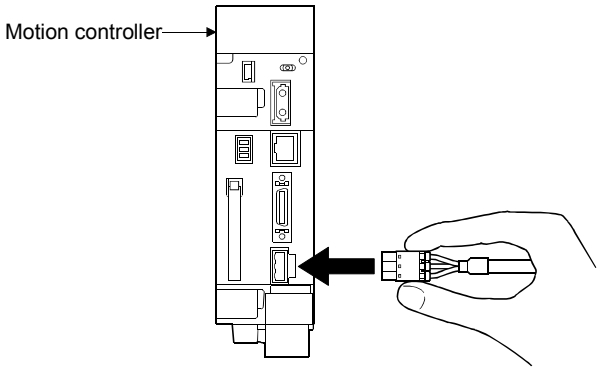
For removal of the forced stop input cable, pull out the cable while holding a connector.

POINTS
The following handling will damage the Motion CPU module or forced stop input cable. • Forced removal of the forced stop input cable from the CPU module. • The forced stop input cable is twined other cables. • Excessive power is applied at cable laying. Wire the cable correctly.

4.2.3 24VDC power supply cable

(1) Precautions for handling the 24VDC power supply cable

For connection or removal of the 24VDC power supply cable, do it surely while holding a connector of 24VDC power supply cable.



(2) Connection of the 24VDC power supply cable

For connection of a 24VDC power supply cable to the Motion controller, connect it surely to a 24VDC power supply connector of Motion controller while holding a connector. Be sure to insert it until it clicks.

(3) Removal of the 24VDC power supply cable

For removal of the 24VDC power supply cable, pull out the cable while holding a connector.

POINTS
Forced removal of the 24VDC power supply cable from the Motion controller will damage the Motion controller or 24VDC power supply cable.

4.3 Wiring

4.3.1 Instructions for wiring

⚠DANGER

- Completely turn off the externally supplied power used in the system before installation or placing wiring. Not doing so could result in electric shock or damage to the product.
- When turning on the power supply or operating the module after wiring, be sure that the module's terminal covers are correctly attached. Not attaching the terminal cover could result in electric shock.

⚠CAUTION

- Be sure to ground of the earth terminal FG and LG. Not doing so could result in electric shock or operation failure. (Ground resistance: 100Ω or less)
- When wiring in the Motion controller, be sure that it is done correctly by checking the product's rated voltage and the terminal layout. Connecting a power supply that is different from the rating or incorrectly wiring the product could result in fire or damage.
- External connections shall be crimped or pressure welded with the specified tools, or correctly soldered. Imperfect connections could result in short circuit, fire, or operation failure.
- Tighten the terminal screws within the specified torque range. If the terminal screws are loose, it could result in short circuit, fire, or operation failure. Tightening the terminal screws too far may cause damages to the screws and/or the module, resulting in drop, short circuit, or operation failure.
- Be sure there are no foreign matters such as sawdust or wiring debris inside the module. Such debris could cause fire, damage, or operation failure.
- The module has an ingress prevention label on its top to prevent foreign matter, such as wiring debris, from entering the module during wiring.
  Do not remove this label during wiring.
  Before starting system operation, be sure to remove this label because of heat dissipation.

This section describes instructions for the wiring of the power supply.
Refer to the "7 EMC directives" for grounding method and measure against noise.

(1) Power supply wiring

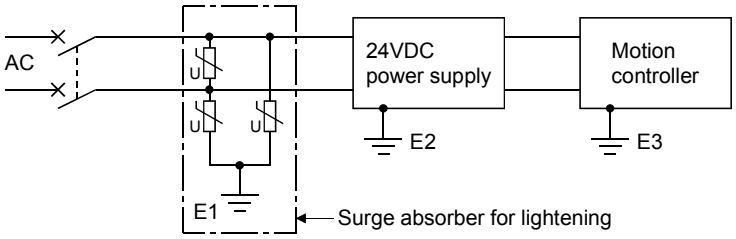
(a) 24VDC power supply wires should be twisted as dense as possible. Connect them with the shortest distance.
Also, to reduce the voltage drop to the minimum, use the thickest wires (Up to 2.0mm^2) possible.
Use the wires of the following core size for wiring.

Application	Recommended core size	AWG (Note-1)
24VDC power supply wires	0.3 to 2.5mm^2	AWG12 to AWG22
I/O equipment	0.3 to 0.75mm^2 (Outside diameter 2.8mm (0.11inch) or less)	AWG18 to AWG22
Ground wire	2.0mm^2 or more	AWG14 or less

(Note-1): AWG stands for "American Wire Gauge". AWG is a unit of the thickness of conducting wire.

(b) Do not bundle the 24VDC power supply wires with, or run them close to, the main circuit (high voltage, large current) and I/O signal lines (including common line).
Reserve a distance of at least 100mm (3.94inch) from adjacent wires.

(c) Momentary power failure may be detected or the Motion controller may be reset due to surge caused by lightning.
As measures against surge caused by lightning, connect a surge absorber for lightning as shown below.
Using the surge absorber for lightning can reduce the influence of lightning.



POINTS

(1) Separate the ground of the surge absorber for lightning (E1), 24VDC power supply (E2) and Motion controller (E3).
(2) Select a surge absorber for lightning whose power supply voltage does no exceed the maximum allowable circuit voltage even at the time of maximum power supply voltage elevation.

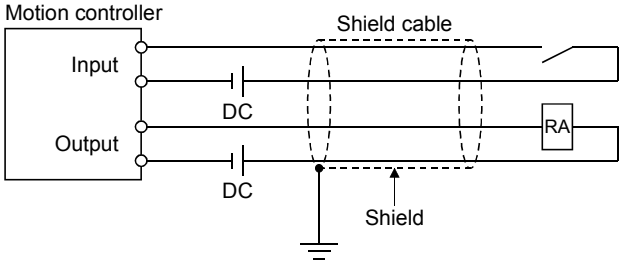
(2) Wiring of I/O equipment

(a) Insulation-sleeved crimping terminals cannot be used with the terminal block.
It is recommended to cover the wire connections of the crimping terminals with mark or insulation tubes.

(b) The wires used for connection to the terminal block should be 0.3 to 0.75mm^2 in core and 2.8mm (0.11inch) or less in outside diameter.

(c) Run the input and output lines away from each other.

(d) When the wiring cannot be run away from the main circuit and power lines, use a batch-shielded cable and ground it on the Motion controller side.
In some cases, ground it on the opposite side.



(e) Where wiring runs through piping, ground the piping without fail.

(f) Run the 24VDC input line away from the 100VAC and 200VAC lines.

(g) Wiring of 200m (656.17ft.) or longer distance will give rise to leakage currents due to the line capacity, resulting in a fault.
Refer to the troubleshooting chapter of the I/O Module User's Manual.

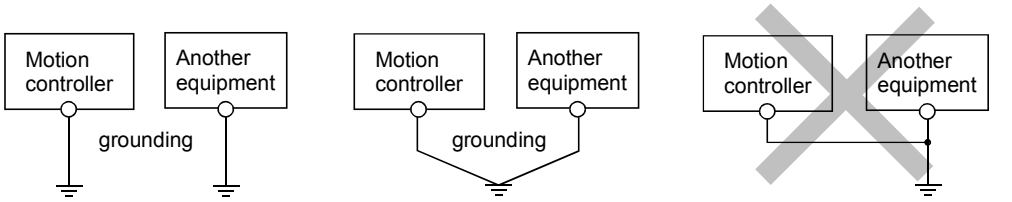
(h) As a countermeasure against the power surge due to lightning, separate the AC wiring and DC wiring and connect a surge absorber for lightning (Refer to Section 4.3.1(1)).
Failure to do so increases the risk of I/O device failure due to lightning.

(3) Grounding

For grounding, follow the steps (a) to (c) shown below.

(a) Use a dedicated grounding wire as far as possible.
(Ground resistance: 100Ω or less)

(b) When a dedicated grounding cannot be performed, use (2) Common Grounding shown below.

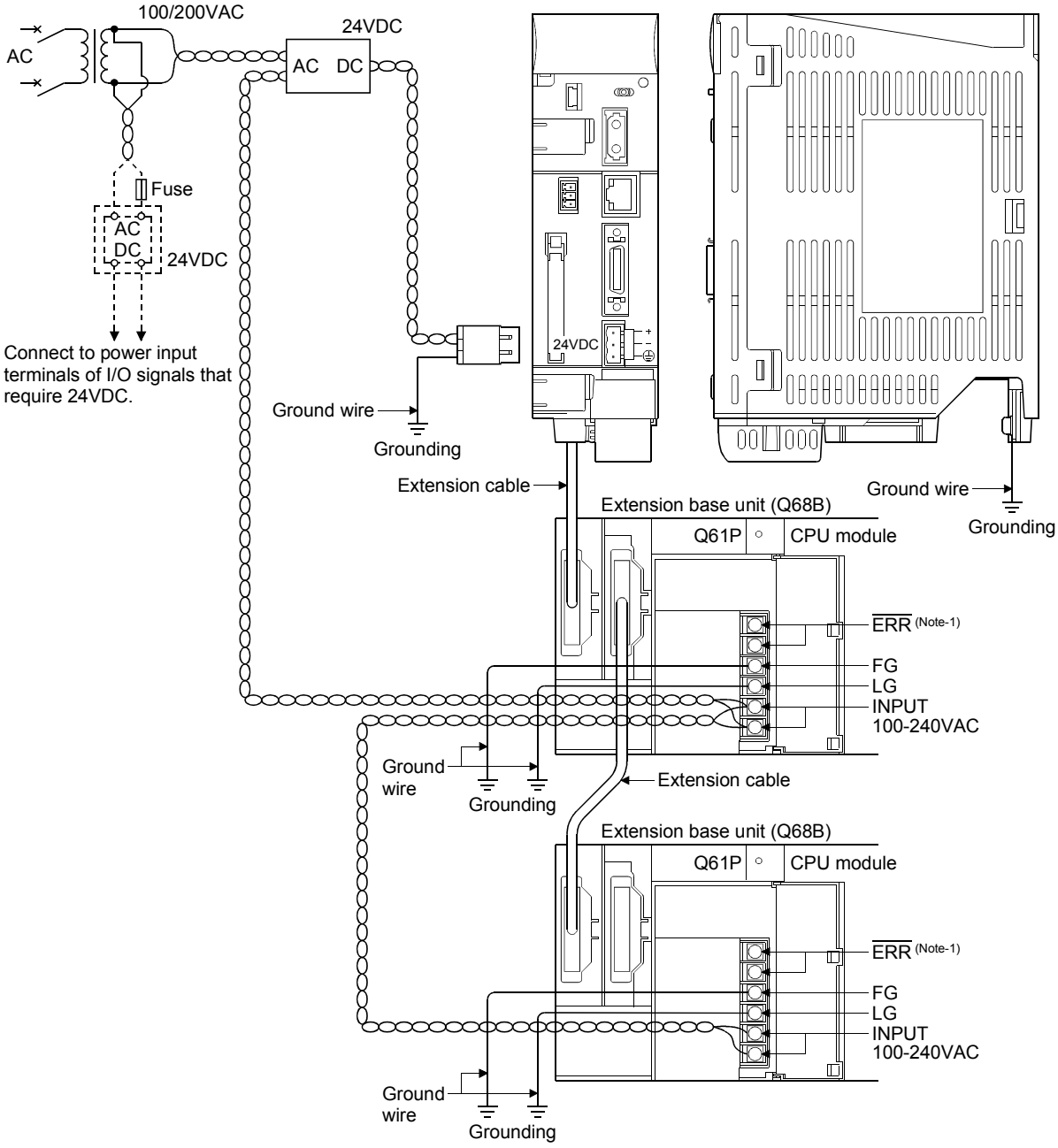


(1) Independent grounding.....Best (2) Common grounding.....Good (3) Joint grounding.....Not allowed

(c) For grounding a cable, use the cable of 2 mm^2 or more.
Position the ground-contact point as nearly to the Motion controller as possible, and reduce the length of the grounding cable as much as possible.

4.3.2 Connecting to the power supply

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



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

POINT

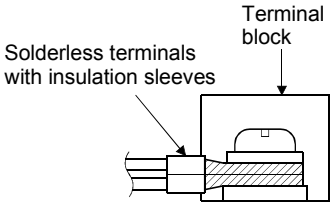
(1) Use a different 24VDC power supply for the Motion controller and for I/O signals.

(2) Use a different 24VDC power supplies for the Motion controller and the electromagnetic brake of the servo motor.

(3) Refer to Section 2.5.1(10) for the pin layout of 24VDC power supply connector, and refer to APPENDIX 4.3 for the connection diagram of 24VDC power supply cable.

(4) 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.

(5) 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. To prevent a short circuit should any screws loosen, use solderless terminals with insulation sleeves of 0.8mm (0.03inch) or less.
Also, only two solderless terminals can be connected per terminal block.



(6) 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.

(7) No system error can be detected by the $\overline{\text{ERR}}$ terminal of an extension base unit. (The $\overline{\text{ERR}}$ terminal is always set off.)

4.3.3 Wiring of connector

Specialised tools are not required for wiring the 24VDC power supply connector and forced stop input connector because plugs with spring connection are used.

(1) Applicable wire size and wire fabrication

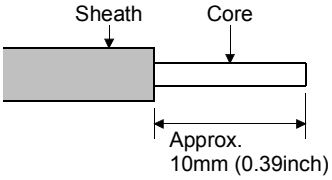
(a) Applicable wire size

The applicable wire size for 24VDC power supply connector and forced stop input connector are shown below.

Connector	Type	Applicable wire size
24VDC power supply connector	FKC-2.5/3-ST-5.08	0.3 t0 2.5mm^2 (AWG12 to AWG22)
Forced stop input connector	FK-MCP1.5/3-ST-3.81	0.3 t0 1.5mm^2 (AWG16 to AWG22)

(b) Wire fabrication

Strip the wire according to stripped length indicated in the figure below. Slide the sheath off the wire and gently twist and straighten the strands. When using the wire, be careful not to short with stray strands entering the neighbouring poles. Do not use solder on the wire's core as this may lead to insufficient contact.

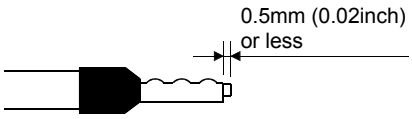


1) Using a ferrule

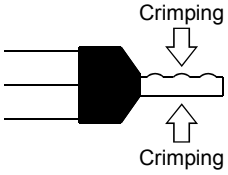
A ferrule can also be used to connect with the connector.
Use the ferrules in the table below for the 24VDC power supply connector and forced stop input connector.

Connector	Wire size	Ferrule model		Crimping tool	Manufacturer
		For 1 wire	For 2 wires		
24VDC power supply connector	AWG16	AI1.5-10 BK	AI-TWIN2×1.5-10 BK	CRIMPFOX-ZA3	PHOENIX CONTACT
	AWG14	AI2.5-10 BU	—		
Forced stop input connector	AWG21	AI0.5-10 WH			

• Cut the wire sticking out from the end of the ferrule to 0.5mm (0.02inch) or less.

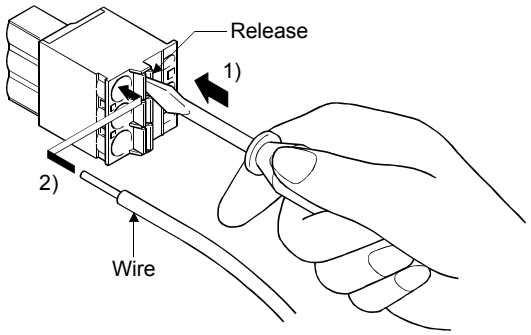


• When using a twin ferrule, be sure to insert the wire in a manner that will keep the insulation sleeve from interfering with the neighbouring poles. Be sure to crimp the ferrule.

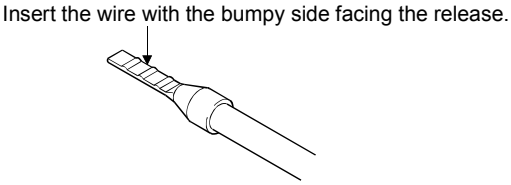


(2) Inserting wire

1) Press the connector release with a tool such as a flathead screwdriver.
2) While holding the release down, insert the wire all the way in.



(Note): When using a ferrule, make sure the bumpy side is facing towards the release.
When inserting 2 wires into one terminal, use a twin ferrule.



(3) Connecting the power supply

(a) Do not connect the power supply plug when wires are live.
The inrush current may damage the internal parts.

(b) In consideration of safety, the maximum number of modules to a power supply should be 4.
• Power supply (Recommended product)

Manufacturer	Model name
TDK-Lambda corporation	HWS30-24/A

5. START-UP PROCEDURES

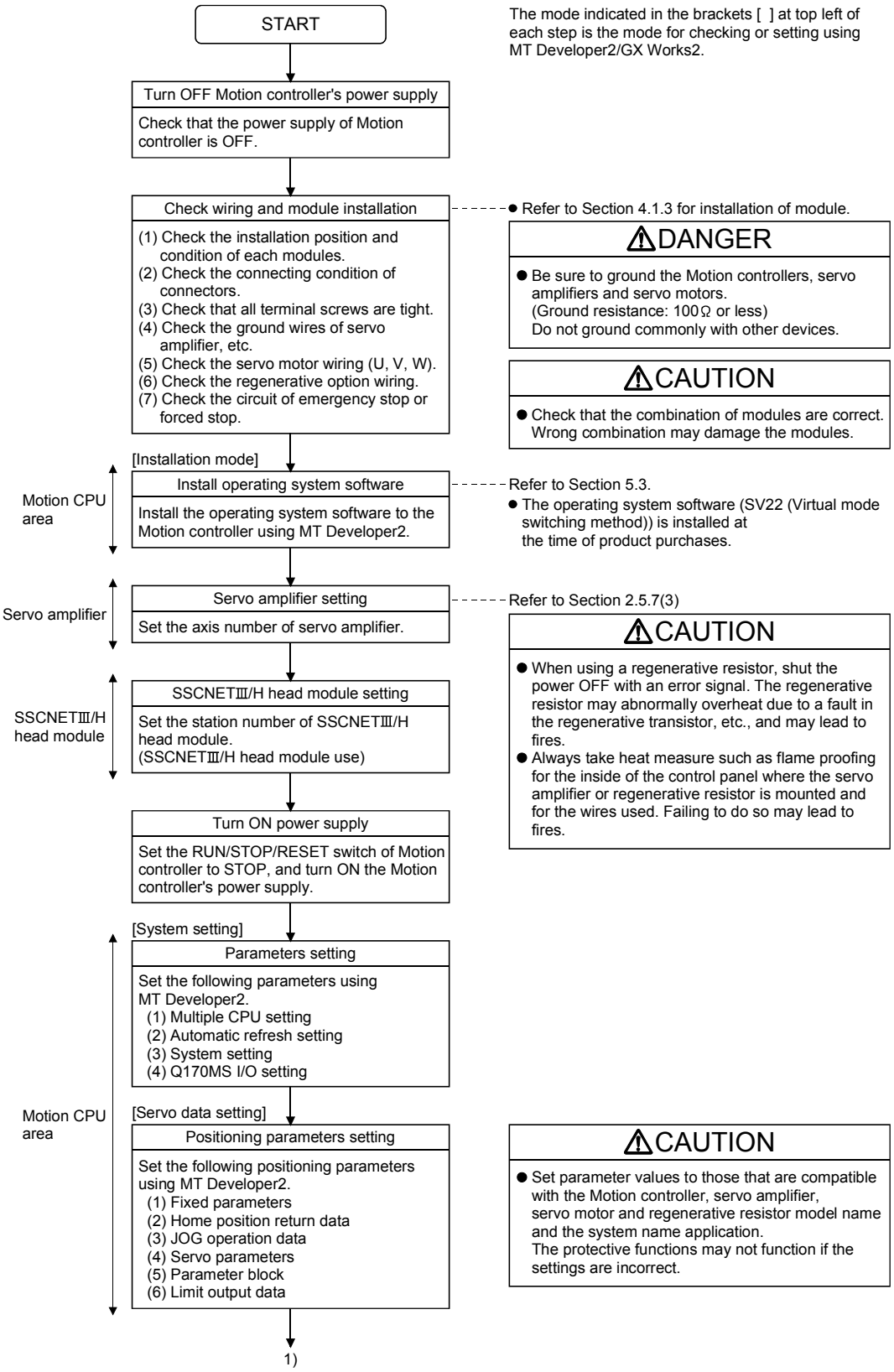
5.1 Check Items before Start-up

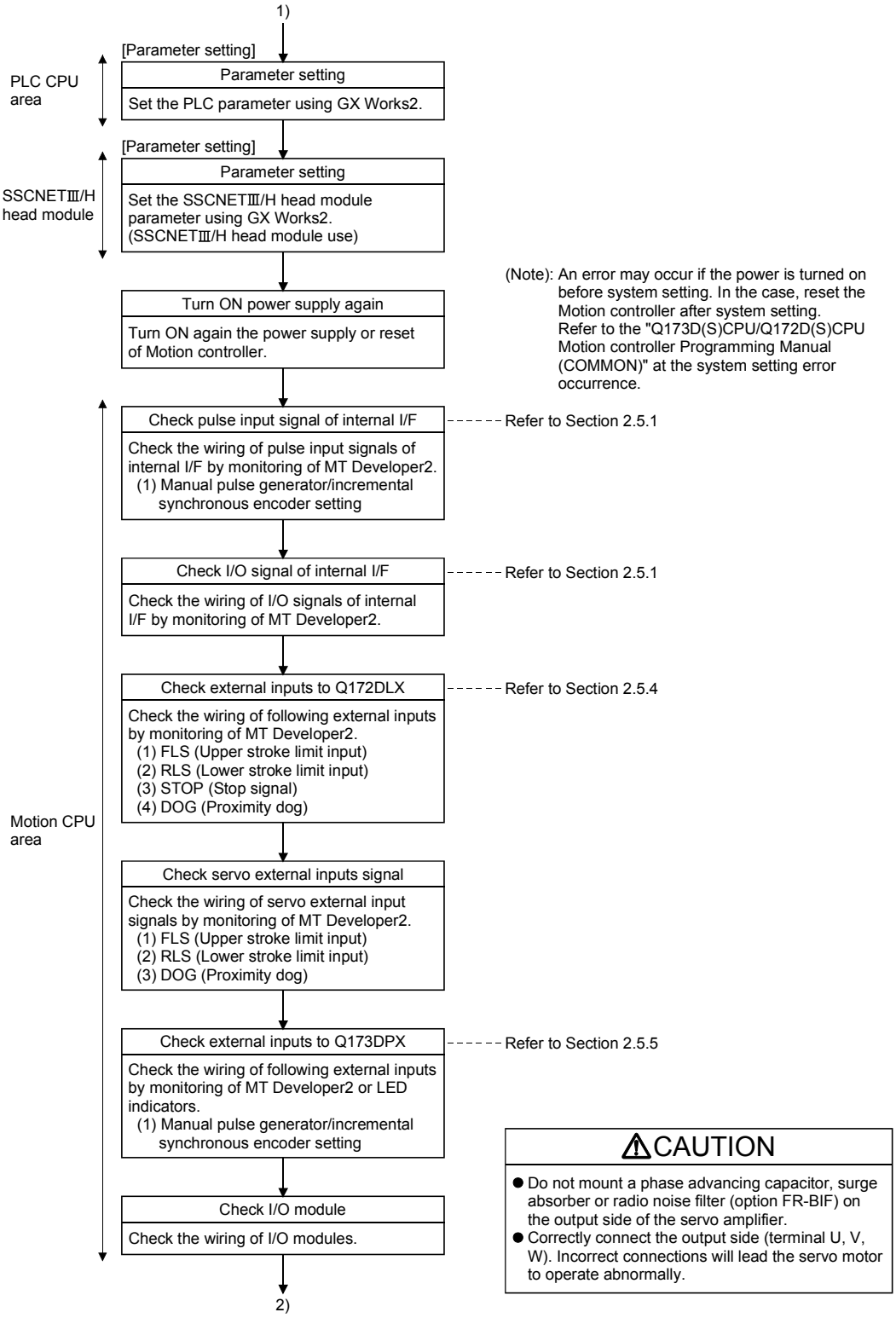
Table 5.1 Check items before start-up

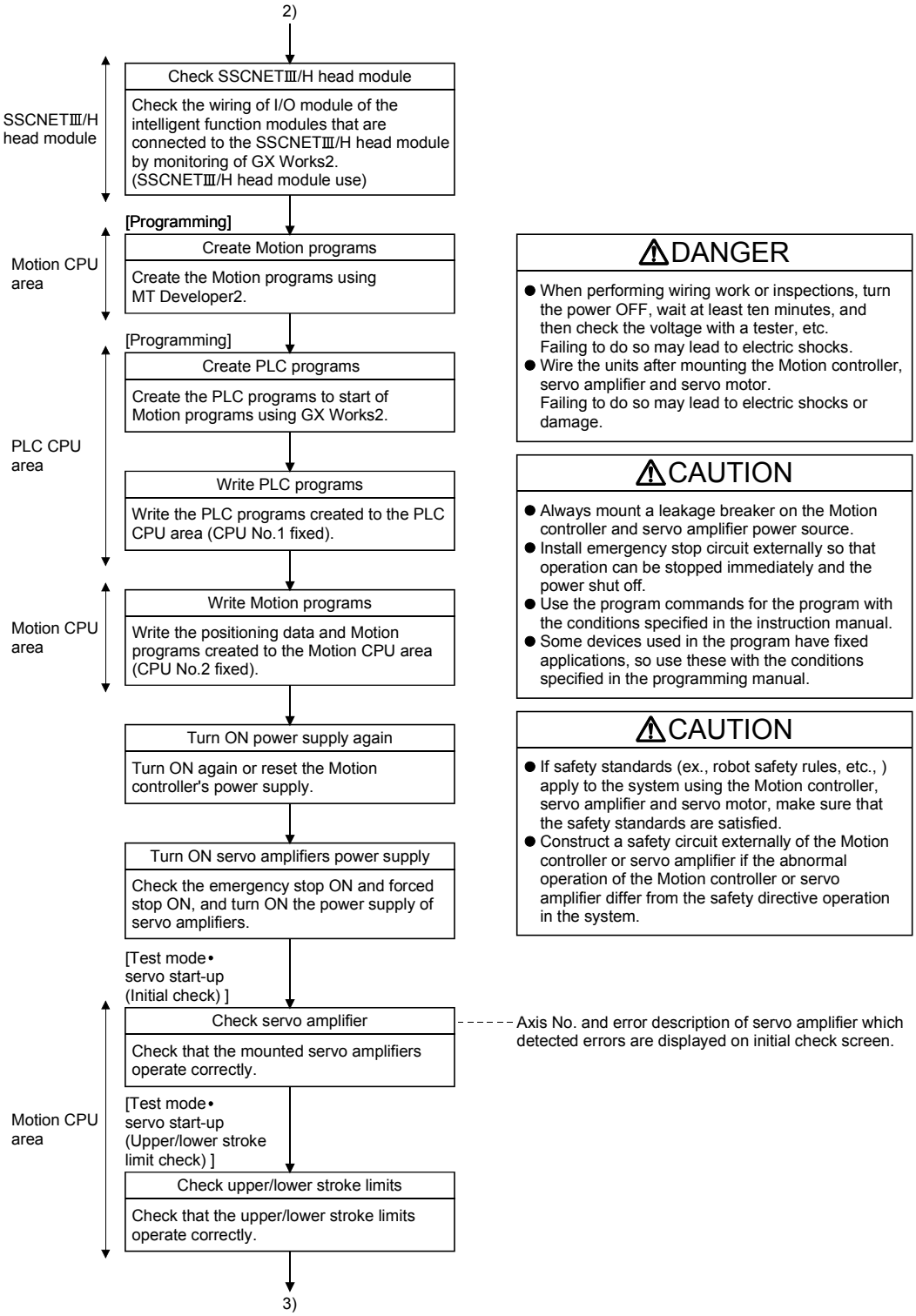
Part name	Confirmation Items	Check	Reference
Q170MSCPU Motion controller	(1) Check for looseness, rattling or distorted installation.	☐	4.1.2
	(2) Check that the module fixing screw tightening torque is as specified.	☐	4.1.1
	(3) Check that the wire sizes of cables are correct.	☐	4.3.1
	(4) Check that the power line is wired correctly.	☐	
	(5) Check that FG is wired correctly.	☐	4.3.2
	(6) Check that the FG terminal screws are tightened correctly.	☐	
	(7) Check that the FG terminal screws are tightening torque is as specified.	☐	4.1.1
	(8) Check that the 24VDC wires are twisted as closely as possible and run in the shortest distance.	☐	4.3.1
	(9) Check that cables are not binded to 24VDC wires, or run close to the power wires.	☐	
	(10) Check the grounding of the earth terminal FG.	☐	4.3
	(11) Check that the forced stop input is wired correctly.	☐	3.2
	(12) Check that the battery is installed.	☐	4.1.4
	(13) Check that the battery lead connector is connected correctly.	☐	
	(14) Check that the internal I/F is wired correctly.	☐	2.5.1
	(15) Check that the manual pulse generator/incremental synchronous encoder is wired correctly.	☐	
Extension base unit	(1) Check that the extension base unit is Q52B/Q55B (type not requiring power supply module) or Q63B/ Q65B/Q68B/Q612B (type requiring power supply module).	☐	2.5.3
	(2) Check that the model name of module is correct.	☐	2.3
	(3) Check that the damage for installed modules.	☐	
	(4) Check that the modules are installed correctly.	☐	4.1.3
	(5) Check for looseness, rattling or distorted installation.	☐	4.1.2
	(6) Check that the module fixing screw tightening torque is as specified.	☐	4.1.1
	(7) Check that the total I/O points of I/O modules and intelligent function modules do not exceed the I/O points of the Motion controller.	☐	Refer to the "Q173D(S)CPU /Q172D(S)CPU Motion controller Programming Manual (COMMON)", or "QCPU User's Manual (Hardware Design, Maintenance and Inspection).
Power supply module	(1) Check that the model name of power supply modules is correct.	☐	2.5.2
	(2) Check that the wire sizes of cables are correct.	☐	4.3.1
	(3) Check that the power line is wired correctly.	☐	
	(4) Check that FG and LG are wired correctly.	☐	4.3.2
	(5) Check that the terminal screws are tightened correctly.	☐	
	(6) Check that the terminal screws are tightening torque is as specified.	☐	4.1.1
	(7) Check that the 100VAC, 200VAC and 24VDC wires are twisted as closely as possible respectively and run in the shortest distance.	☐	4.3.1
	(8) Check that cables are not binded to 100VAC, 200VAC and 24VDC wires, or run close to the power wires.	☐	
	(9) Check the grounding of the earth terminal FG and LG.	☐	4.3.2

Part name	Confirmation Items	Check	Reference
Q172DLX Servo external signals interface module / Q173DPX Manual pulse generator interface module	(1) Check that the installation position of modules correspond to the system setting.	□	Refer to the "Q173D(S)CPU /Q172D(S)CPU Motion controller Programming Manual (COMMON).
	(2) Check that the connection with external equipments is correct.	□	2.5.4 2.5.5
I/O module	(1) Check that the wire size of cable is correct.	□	Refer to the I/O Module Type Building Block User's Manual
	(2) Check that the terminal block screws are tightened correctly.	□	
	(3) Check that the cables connected to each terminal of terminal block correspond to the signal names.	□	
	(4) Check that the external power supply are connected correctly. (24VDC, 5VDC)	□	
	(5) Check that the 100VAC, 200VAC and 24VDC wires are twisted as closely as possible respectively and run in the shortest distance.	□	4.3.1
	(6) Check that the 100VAC, 200VAC and 24VDC wires are not bind the cable together with and run close to the I/O wires.	□	
	(7) Check that the I/O wires are wired correctly.	□	
SSCNETⅢ cable	(1) Check that the model name of SSCNETⅢ cables is correct.	□	2.5.7
	(2) Check that the connecting position for connector of SSCNETⅢ cables are correct.		
	(3) Check that the SSCNETⅢ cables are connected correctly.	□	4.2.1
	(4) Check for looseness, rattling or distorted connection.	□	
	(5) Check that the minimum bend radius or more secured.	□	
	(6) Check that the MR-J3BUS□M or MR-J3BUS□M-A do not come in contact with wires/cables that use materials where the plasticizing material is contained.	□	

5.2 Start-up Adjustment Procedure




1)
[Parameter setting]
PLC CPU area
Parameter setting
Set the PLC parameter using GX Works2.
[Parameter setting]
SSCNETⅢ/H head module
Parameter setting
Set the SSCNETⅢ/H head module parameter using GX Works2. (SSCNETⅢ/H head module use)
Turn ON power supply again
Turn ON again the power supply or reset of Motion controller.
(Note): An error may occur if the power is turned on before system setting. In the case, reset the Motion controller after system setting. Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" at the system setting error occurrence.
Motion CPU area
Check pulse input signal of internal I/F
Refer to Section 2.5.1
Check the wiring of pulse input signals of internal I/F by monitoring of MT Developer2.
(1) Manual pulse generator/incremental synchronous encoder setting
Check I/O signal of internal I/F
Refer to Section 2.5.1
Check the wiring of I/O signals of internal I/F by monitoring of MT Developer2.
Check external inputs to Q172DLX
Refer to Section 2.5.4
Check the wiring of following external inputs by monitoring of MT Developer2.
(1) FLS (Upper stroke limit input)
(2) RLS (Lower stroke limit input)
(3) STOP (Stop signal)
(4) DOG (Proximity dog)
Check servo external inputs signal
Check the wiring of servo external input signals by monitoring of MT Developer2.
(1) FLS (Upper stroke limit input)
(2) RLS (Lower stroke limit input)
(3) DOG (Proximity dog)
Check external inputs to Q173DPX
Refer to Section 2.5.5
Check the wiring of following external inputs by monitoring of MT Developer2 or LED indicators.
(1) Manual pulse generator/incremental synchronous encoder setting
Check I/O module
Check the wiring of I/O modules.
2)
CAUTION
● Do not mount 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). Incorrect connections will lead the servo motor to operate abnormally.



⚠DANGER

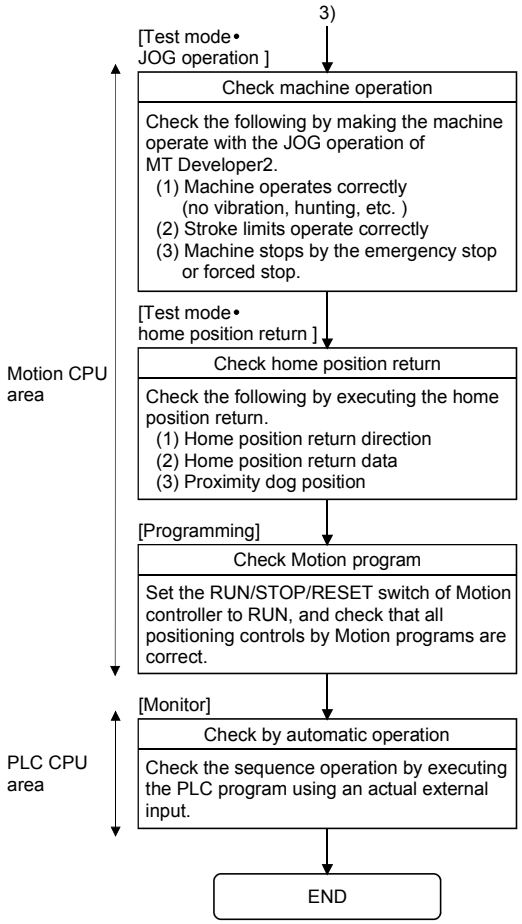
- When performing wiring work or inspections, turn the power OFF, wait at least ten minutes, and then check the voltage with a tester, etc.
  Failing to do so may lead to electric shocks.
- Wire the units after mounting the Motion controller, servo amplifier and servo motor.
  Failing to do so may lead to electric shocks or damage.

⚠CAUTION

- Always mount a leakage breaker on the Motion controller and servo amplifier power source.
- Install emergency stop circuit externally so that operation can be stopped immediately and the power shut off.
- Use the program commands for the program with the conditions specified in the instruction manual.
- Some devices used in the program have fixed applications, so use these with the conditions specified in the programming manual.

⚠CAUTION

- 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.



⚠CAUTION

- 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.
- Execute the test operation in the system that it is low-speed as much as possible and put forced stop, and confirm the operation and safety.

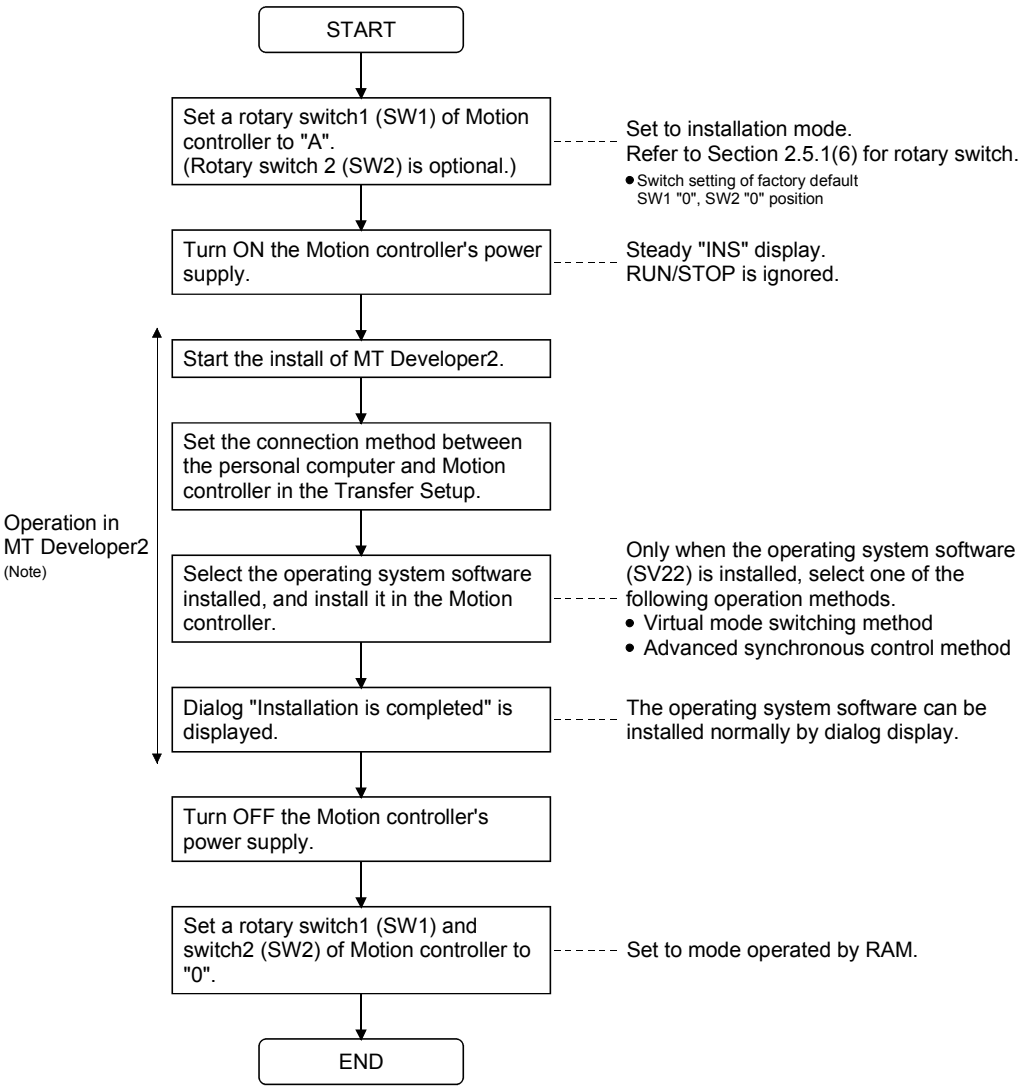
POINTS

(1) Make note of servo motor module names before the servo motor is mounted on a machine. The servo motor rating plate may not be visible after the servo motor is mounted.

(2) When the servo amplifier, servo motor is first turned on, check the operation before the servo motor is mounted on a machine to avoid an unexpected accidents such as machine breakage.

5.3 Operating System Software Installation Procedure

The operating system software must be installed to the Motion controller by using the peripheral device and MT Developer2.
The installation procedure is shown below.



(Note): Install the operating system software by screen of MT Developer2.
Refer to help of MT Developer2 for details.

POINTS

(1) When the software security key function is used in Motion controller, if the software security key of the operating system software already installed in Motion CPU is different from that embedded to the operating system software to be installed, "Clear all" is executed at installation. It is recommended to backup the data in advance using MT Developer2.

(2) The operating system software (SV22 (Virtual mode switching method)) is installed at the time of product purchase.

(3) The operating system software is installed to the Motion CPU area. It has already been installed to the PLC CPU area.
The PLC CPU area is never rewritten.

(4) Be sure to turn power supply OFF before changing rotary switch setting.

(5) Even if the operating system software is installed, the programs, parameters and absolute position data written in the Motion controller not rewritten.

(6) Do not do any of the following while installing operation system software. Doing so could result damage the Motion controller.
- Turn OFF the Motion controller's power supply.
- Change the RUN/STOP/RESET switch of Motion controller to RESET.
- Turn OFF the power supply of the personal computer.
- Pull out the personal computer's communication cable.

(7) Only when the operating system software (SV22) is installed on the Motion controller, select one of the following operation methods.
- Virtual mode switching method
- Advanced synchronous control method

To change the operation method after the operating system software is installed, install the operating system software (SV22) again, or change the operation method in "Change CPU operation method" of MT Developer2. Refer to help of MT Developer2 for details.

5.4 Trial Operation and Adjustment Checklist

At the worksite, copy the following table for use as a check sheet.

Work Step	Item	Check Items	Check
Before power supply ON	Installation of unit/module and basic wiring	Check that each module is installed correctly.	☐
		Check that each connector is connected correctly.	☐
		Check each terminal screw for looseness.	☐
		Check that the earth wires of Motion controller or servo amplifiers, etc. are correct.	☐
		Check that the servomotor wiring is correct.	☐
		Check that the regenerative option wiring is correct.	☐
		Check that the circuit of emergency stop and forced stop are correct.	☐
		Check that the wiring of each power supply and I/O are correct.	☐
		Check that the rotary switch setting is correct.	☐
Power supply ON/ Motion controller in STOP status	Installation of OS	Check that the operating system software is compatible.	☐
	System setting	Check that the system setting is correct.	☐
	Q172DLX/Servo amplifier external signal	Check that the upper/lower stroke limit inputs are correct.	☐
		Check that the STOP signal input is correct. (Q172DLX only)	☐
		Check that the proximity dog and speed/position switching signal input are correct.	☐
	Program/ positioning data	Check that the Motion program, PLC program and positioning data are stored in the Motion controller correctly.	☐
	Basic axis operations (Check each axis)	Check the communications with servo amplifiers.	☐
		Check that the rotation direction for JOG operation is correct.	☐
		Check that the upper/lower limit switches operate correctly.	☐
		Check that the rotation at maximum command speed is motor rating or less.	☐
		Check that the machine operates correctly by the JOG operation.	☐
		Check that the machine stops by the upper/lower stroke limit.	☐
		Check that the machine stops by the emergency stop or forced stop.	☐
		Check that the home position return is executed correctly.	☐
		Check that each positioning control of Motion program is operates correctly.	☐
Motion controller in RUN status	Manual operation	Check each operation in manual operation mode of system during Motion program execution.	
		Check that the machine operation stops immediately by the emergency stop or forced stop.	☐
		Check the operation of each actuator and confirmation limit switch.	☐
		Check that the emergency stop, forced stop and equipment alarm signals are correct.	☐
		Checks in compliance with control specifications specific to system and equipment.	☐
	Automatic operation	Check each operation in automatic operation mode of system during Motion program execution.	
		Check that the automatic operation motions.	☐
		Check that the machine operation stops immediately by the emergency stop or forced stop.	☐
		Check that the module or equipment alarm causes an immediate stop or cycle stop.	☐
		Check that the restoring operation can be performed after an alarm stop.	☐
		Make other checks in compliance with control specifications specific to system and equipment.	☐
	Torque check	Check that the acceleration/deceleration torque is maximum torque or less.	☐
		Check that the continuous effective load torque is rated torque or less.	☐

MEMO

6. INSPECTION AND MAINTENANCE

⚠DANGER

- Do not touch the terminals while power is on. Doing so could cause electric shock.
- Correctly connect the battery. Also, do not charge, disassemble, heat, place in fire, short circuit, or solder the battery.
  Mishandling of a battery may cause overheating, cracks or ignition which could result in injury and fire.
- Switch off all phases of the externally supplied power used in the system when cleaning the module or retightening the terminal or module mounting screws.
  Not doing so could result in electric shock.
  Under tightening of terminal screws can cause a short circuit or malfunction.
  Over tightening of screws can cause damages to the screws and/or the module, resulting in fallout, short circuits, or malfunction.
- The capacitor is mounted to the modules. Do not incinerate the modules so that the incineration of capacitor may cause burst.
  For disposal of the modules, request for specialized industrial waste disposal services who has incineration facility.

⚠CAUTION

- Read the manual carefully and pay careful attention to safety for the on-line operation (especially program change, forced stop or operation change) performed by connecting peripheral devices to the Motion controller during operation.
  Erroneous operation may cause machine breakage or accident.
- Never try to disassemble or modify module. It may cause product failure, operation failure, injury or fire.
- Use any radio communication device such as a cellular phone or a PHS phone more than 25cm (9.84 inch) away in all directions of the Motion controller.
  Failure to do so may cause a malfunction.
- Completely turn off the externally supplied power used in the system before installation or removing the module. Not doing so could result in electric shock, damage to the module or operation failure.
- Do not install/remove the module on to/from base unit or terminal block more than 50 times, after the first use of the product. Failure to do so may cause the module to malfunction due to poor contact of connector.
- 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.
- 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 damage the module.

In order that you can use the Motion controller in normal and optimal condition at all times, this section describes those items that must be maintained or inspected daily or at regular intervals.

6.1 Maintenance Works

6.1.1 Instruction of inspection works

In order that can use the Motion controller in safety and normal, those items that must be inspected list below.

⚠DANGER

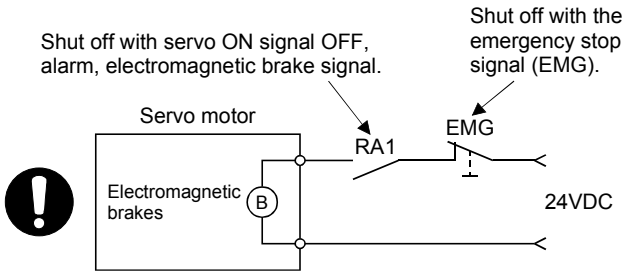
- Never open the front case or terminal covers while the power is ON or the unit is running, as this may lead to electric shocks.
- Never run the unit with the front case or terminal cover removed. The high voltage terminal and charged sections will be exposed and may lead to electric shocks.
- Never remove 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.
- 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.
- 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 or fire.
- Do not touch the Motion controller, servo amplifier or servomotor terminal blocks while the power is ON, as this may lead to electric shocks or fire.
- 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.

⚠CAUTION

- Be sure to ground the Motion controller, servo amplifier and servomotor. Do not ground commonly with other devices. (Ground resistance : 100 Ω or less)
- The wiring work and inspections must be done by a qualified technician.
- Wire the units after mounting the Motion controller, servo amplifier and servomotor. Failing to do so may lead to electric shocks or damage.
- 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.
- 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 unit settings correctly.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.

⚠CAUTION

- 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 change these to prevent secondary damage from faults. Replacements can be made by our sales representative.
- 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, in order to prevent that state, use a servomotor with electromagnetic brakes for maintenance or mount 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 restart 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.)
- 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.
- 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 servomotor, 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 servomotor 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.
- Do not bunch the control wires or communication cables with the main circuit or power wires, or lay them closely. They should be installed 100mm (3.94inch) or more from each other.
  Trying to bunch or install could result in noise that would cause operation failure.

6.2 Daily Inspection

The items that must be inspected daily are shown below.

Table 6.1 Daily Inspection

Item	Inspection item			Inspection	Criterion	Action
1	Mounting of Motion controller			Check that the fixing screws are not loose and the cover is not dislocated.	The screws and cover must be mounted securely.	Retighten the screws.
2	Mounting of base unit					
3	Installation of Motion modules and I/O modules			Check that the module is not dislocated and the unit fixing hook is engaged securely.	The module fixing hook must be engaged and installed correctly.	Securely engaged the module fixing hook.
4	Connecting conditions			Check for loose terminal screws.	Screws should not be loose.	Retighten the terminal screws.
				Check the distance between solderless terminals.	The proper clearance should be provided between solderless terminals.	Correct.
				Check the connector part of the cable.	Connections should not be loose.	Retighten the connector fixing screws.
5	Module indication LED	Motion controller	[POWER] LED	Check that the LED is ON.	The LED must be ON. (Abnormal if the LED is OFF.).	Refer to Section 2.5.1
			[MODE] LED	Check that the LED is ON.	The LED must be ON. (Abnormal if the LED is OFF or flickering.)	
			[RUN] LED	Check that the LED is ON in RUN status.	The LED must be ON. (Abnormal if the LED is OFF.)	
			[ERR.] LED	Check that the LED is OFF.	The LED must be OFF. (Abnormal if the LED is ON or flickering.)	
			[BAT.] LED	Check that the LED is OFF.	The LED must be OFF. (Abnormal if the LED is ON (yellow).)	
			Normal		Steady "RUN" display. (Abnormal if "RUN" does not display or incorrect display.)	
					Steady "STP" display. (Abnormal if "STP" does not display or incorrect display.)	
			Battery error warning (2.7V or less)		"BT1" does not display. (Abnormal if steady "BT1" display.)	Refer to Section 6.5
			Battery error warning (2.5V or less)		"BT2" does not display. (Abnormal if steady "BT2" display.)	
			WDT error		" . . . " does not display. (Abnormal if steady " . . ." display.)	Refer to Section 2.5.1
			Others		" AL" does not flash. (Abnormal if " . . ." flashes.)	
		I/O module	Input LED	Check that the LED is ON/OFF.	The LED must be ON when the input power is turned ON. The LED must be OFF when the input power is turned OFF. (Abnormal if the LED does not turn ON or turn OFF as indicated above.)	Refer to "I/O Module Type Building Block User's Manual".
			Output LED	Check that the LED is ON/OFF.	The LED must be ON when the output power is turned ON. The LED must be OFF when the output power is turned OFF. (Abnormal if the LED does not turn ON or turn OFF as indicated above.)	

6.3 Periodic Inspection

The items that must be inspected one or two times every 6 months to 1 year are listed below. When the equipment is moved or modified, or layout of the wiring is changed, also implement this inspection.

Table 6.2 Periodic Inspection

Item	Inspection item		Inspection	Criterion	Action
1	Ambient environment	Ambient temperature	Measure with a thermometer and a hygrometer. Measure corrosive gas.	0 to 55 °C (32 to 131 °F)	When the controller is used in the board, the ambient temperature in the board becomes the ambient temperature.
		Ambient humidity		5 to 95 % RH	
		Atmosphere		No corrosive gases	
2	Power voltage		Measure a voltage across the terminals of 24VDC.	21.6 to 26.4	Change the power supply.
3	Installation	Looseness, rattling	Move the module to check for looseness and rattling.	The module must be installed solidly.	Retighten the screws. If the Motion controller, Motion modules, or I/O modules are loose, fix it with screws.
		Adhesion of dirt and foreign matter	Check visually.	Dirt and foreign matter must not be present.	Remove and clean.
4	Connection	Looseness of terminal screws	Try to further tighten screws with a screwdriver.	Screws must not be loose.	Retighten the terminal screws.
		Proximity of solderless terminals to each other	Check visually.	Solderless terminals must be positioned at proper intervals.	Correct.
		Looseness of connectors	Check visually.	Connectors must not be loose.	Retighten the connector fixing screws.
5	Battery		Check the 7-segment LED at the front side of Motion controller.	Must be turned OFF "BT1" or "BT2" display.	Even if the lowering of a battery capacity is not shown, replace the battery with a new one if a service life time of the battery is exceeded.
			Check the length of term after purchasing the battery	Must not be used more than 5 years.	
			Check that SM51 or SM58 is turned OFF using MT Developer2 in monitor.	Must be turned OFF.	Replace the battery with a new one when SM51 or SM58 is ON.

6.4 Life

The following parts must be changed periodically as listed below.
However, if any part is found faulty, it must be changed immediately even when it has not yet reached the end of its life, which depends on the operating method and environmental conditions.
For parts replacement, please contact your sales representative.

Table 6.3 Life

Module name	Part name	Life guideline	Remark
Motion controller	Electrolytic capacitor	10 years	Life guideline is reference time. If faulty, it must be changed immediately even when it has not yet reached the life guideline.
Motion module			

(1) Capacitor

The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its in 10 years of continuous operation in normal air-conditioned environment.

6.5 Battery

The battery installed in the Motion controller is used for data retention during the power failure of the program memory and latch device.
The data stored in the RAM built-in Motion controller are shown below.

- PLC CPU area : Clock data, Latch devices (L), Devices of latch range, Error history and Data in standard RAM
- Motion CPU area : Programs, Parameters, Motion devices (#), Devices of latch range, and Absolute position data

Special relays (SM51, SM52, SM58 or SM59) of Motion CPU area turn on due to the decrease of battery voltage. Even if the special relays turn on, the program and retained data are not erased immediately.
However, if these relays are overlooked, the contents may be erased.
After relay SM51 or SM58 turns on, replace the battery quickly within the data retention time for power failure (3 minutes).

POINT

(1) SM51 or SM58 turns on when the battery voltage falls below the specified value, and remains ON even after the battery voltage is recovered to the normal value. SM51 or SM58 turns off by power supply on again or reset.

(2) After SM51, SM52, SM58 or SM59 turns on, replace the battery quickly.
- SM51 or SM52 turns on at the battery voltage 2.5V or less.
- SM58 or SM59 turns on at the battery voltage 2.7V or less.

(3) If SM51 turns on, the details for the data of RAM built-in Motion controller cannot be guaranteed.
It is recommended to back-up the data periodically.

(4) Whether or not to check the battery of Motion CPU can be set in the system basic setting of system setting. If "Perform battery check" is not set, a self-diagnosis error will not occur and the 7-segment LED "BT1" or "BT2" is not also displayed.
Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details.

6.5.1 Battery life

The battery life is shown below.

Table 6.4 Battery life of Q6BAT/Q7BAT

Motion controller	Battery type	Battery consumption (Note-1)	Battery life (Total power failure time) [h] (Note-2)				
			Power-on time ratio (Note-3)	Guaranteed value (Note-4) (MIN) (75°C (167°F))	Guaranteed value (Note-5) (TYP) (40°C (104°F))	Actual service value (Note-6) (Reference value) (TYP) (25°C (77°F))	Backup time after alarm (Note-7)
Q170MSCPU (Note-8)	Q6BAT (Note-9)	2	0%	13000	40000	43800	90 (After SM51/ SM52 ON)
			30%	18000	43800		
			50%	21000			
			70%	24000			
			100%	43800			
	Q7BAT (Large capacity) (Note-9)	2	0%	39000	43800		
			30%	43800			
			50%				
			70%				
			100%				
Q170MSCPU-S1	Q6BAT (Note-9)	1	0%	15300			
			30%	21000			
			50%	27900			
			70%	41500			
			100%	43800			
		2	0%	2600	7500	8800	
			30%	3700	10600	12500	
			50%	5100	14700	17400	
			70%	8400	23700	28000	
			100%	43800	43800	43800	
		3	0%	1400	4100	4800	
			30%	2100	5900	6900	
			50%	2900	8200	9600	
			70%	4800	13500	15800	
			100%	43800	43800	43800	

Table 6.4 Battery life of Q6BAT/Q7BAT (continued)

Motion controller	Battery type	Battery consumption (Note-1)	Battery life (Total power failure time) [h] (Note-2)				
			Power-on time ratio (Note-3)	Guaranteed value (Note-4) (MIN) (75°C (167°F))	Guaranteed value (Note-5) (TYP) (40°C (104°F))	Actual service value (Note-6) (Reference value) (TYP) (25°C (77°F))	Backup time after alarm
Q170MSCPU-S1	Q7BAT (Large capacity) (Note-9)	1	0%	43800	43800	43800	90 (After SM51/ SM52 ON)
			30%				
			50%				
			70%				
			100%				
		2	0%	7600	21500	25000	
			30%	10900	30400	35300	
			50%	15100	42000	43800	
			70%	24700	43800		
			100%	43800			
		3	0%	4100	11900	13750	
			30%	5900	17000	19500	
			50%	8200	23600	27000	
			70%	13600	38600	43800	
			100%	43800	43800		

(Note-1): The battery consumption represents consumption of the Motion controller battery energy.
The larger the battery consumption value is, the more battery per time unit is consumed.
Refer to the "QCPU User's Manual (Hardware Design, Maintenance and Inspection) for details.

(Note-2): The actual service value indicates the average value, and the guaranteed value indicates the minimum value.

(Note-3): The power-on time ratio indicates the ratio of Motion controller power-on time to one day (24 hours).
(When the total power-on time is 17 hours and the total power-off time is 7 hours, the power-on time ratio is 70%.)

(Note-4): The guaranteed value (MIN) ; equivalent to the total power failure time that is calculated based on the characteristics value of the memory (SRAM) supplied by the manufacturer and under the storage ambient temperature range of -25°C to 75°C (-13 to 167°F) (operating ambient temperature of 0°C to 55°C (32 to 131°F)).

(Note-5): The guaranteed value (TYP) ; equivalent to the total power failure time that is calculated based on the normal air-conditioned environment (40°C (104°F)).

(Note-6): The actual service value (Reference value) ; equivalent to the total power failure time that is calculated based on the measured value and under the storage ambient temperature of 25°C (77°F). This value is intended for reference only, as it varies with characteristics of the memory.

(Note-7): In the following status, the backup time after power OFF is 3 minutes.
- Q6BAT/Q7BAT lead connector is disconnected.
- Lead wire of Q6BAT/Q7BAT is broken.

(Note-8): Battery consumption 1 cannot be used in Q170MSCPU.

(Note-9): Set the battery (Q6BAT/Q7BAT) to battery holder.

POINT

(1) Do not use the battery exceeding its guaranteed life.

(2) When the battery hours (total power failure time) may exceed its guaranteed value, take the following measure.
- Perform ROM operation to protect a program even if the battery dies at the Motion controller's power-OFF.
- If SM51 turns on, the contents for the data (Refer to Section 6.5) of RAM built-in Motion controller cannot be guaranteed.
  It is recommended to back-up the data periodically.

(3) When the total power failure time exceeds its guaranteed value, and SM51, SM52, SM58 and SM59 of Motion CPU area turns on, immediately change the battery. Even if the alarm has not yet occurred, it is recommended to replace the battery periodically according to the operating condition

(4) The self-discharge influences the life of battery without the connection to the Motion controller. The battery should be exchanged approximately every 4 or 5 years. And, exchange the battery with a new one in 4 to 5 years even if a total power failure time is guaranteed value or less.

(5) It is recommended to shift to the mode operated by ROM after the programs and parameters are fixed. The erasing of the programs and parameters can be avoided even if the battery decrease. (The ROM writing cannot be executed for the current position of the servo motor in the absolute position system, home position and latch device. Back up them beforehand using MT Developer2.)
Refer to Section 4.4 of the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)" for details of the ROM operation.

6.5.2 Battery replacement procedure

When the battery has been exhausted, replace the battery with a new one in accordance with the procedure shown below.

POINTS

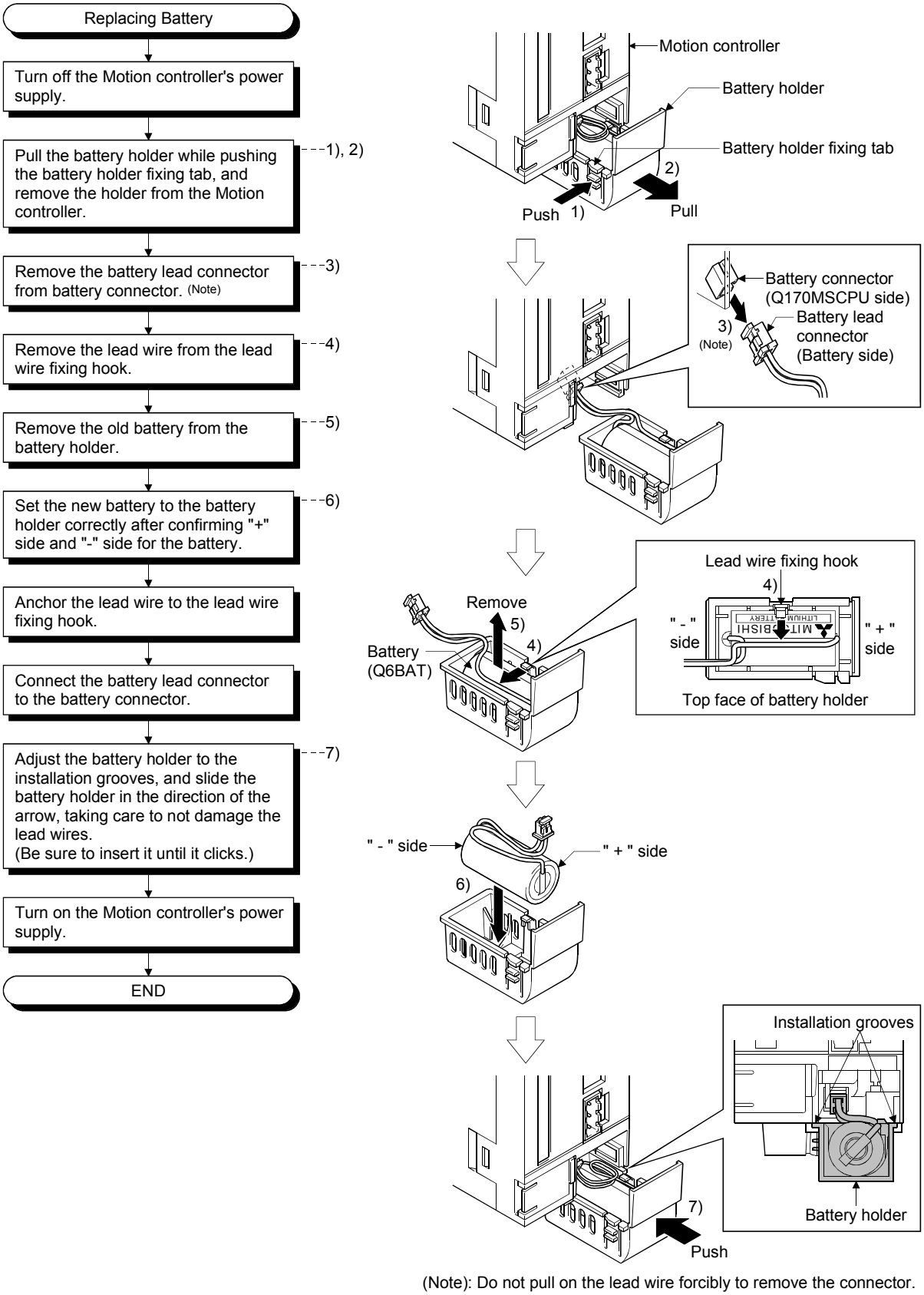
When replacing the battery, pay attention to the following.

(1) The Motion controller power supply must be on for 10 minutes or longer before dismounting the battery.

(2) Back up the data using MT Developer2 before starting replacement.

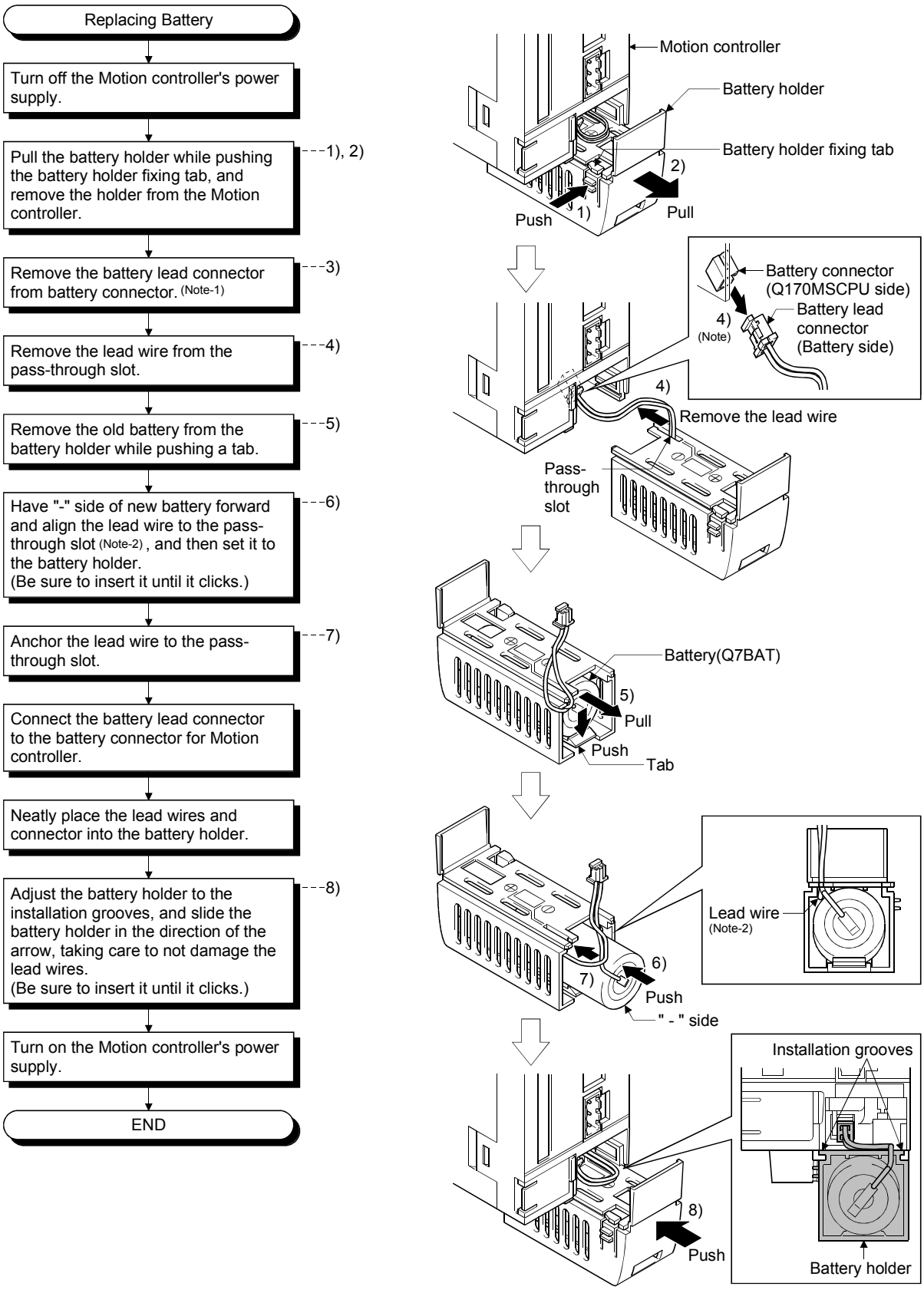
(3) Firstly back up the data stored in the Motion controller to the personal computer which is installed MT Developer2 then replace the battery with a new one. After setting the battery in the Battery holder, verify the backing up the data to the personal computer which is installed MT Developer2 and the data in the Motion controller, confirm the data is not changing.
In the following status, the backup time after power OFF is 3 minutes.
• The lead connector of Q6BAT/Q7BAT is disconnected.
• The lead wire of Q6BAT/Q7BAT is broken.

(1) Q6BAT



(Note): Do not pull on the lead wire forcibly to remove the connector.

(2) Q7BAT



(Note-1): Do not pull on the lead wire forcibly to remove the connector.
(Note-2): Tilt the battery not to hitch the lead wire to the battery holder.

6.5.3 Resuming operation after storing the Motion controller

When the operation is to be resumed after being stored with the battery removed or the battery has gone flat during storage, the contents for the data (Refer to Section 6.5) of RAM built-in Motion controller cannot be guaranteed.
Before resuming operation, write the contents for the data backed up prior to storage to RAM built-in Motion controller.

POINT
Before storing the Motion controller, always back up the contents for the data to RAM built-in Motion controller.

6.5.4 Symbol for the new EU Battery Directive

This section describes a symbol for the new EU Battery Directive (2006/66/EC) that is labeled batteries.

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!

6.6 Troubleshooting

This section describes the various types of trouble that occur when the system is operated, and causes and corrective actions of these troubles.

6.6.1 Troubleshooting basics

The basic three points that must be followed in the troubleshooting are as follows.

(1) Visual inspection

Visually check the following.

(a) Movement of machine (stopped condition, operating condition)
(b) Power supply on/off
(c) Status of input/output devices
(d) Installation condition of the Motion controller, I/O module, Motion module, intelligent function module, SSCNETⅢ cable, Synchronous encoder cable.
(e) State of wiring (I/O cables, cables)
(f) Display states of various types of indicators
  • MODE LED, RUN LED, ERR. LED, BAT LED, 7-segment LED (Installation mode, Operation mode, Battery error, STOP/RUN, etc.), etc.
(g) Status of setting of various types of switches (Setting of No. of stages of extension base, power interrupt hold-on status).

After checking (a) to (g), monitor the operating conditions of servomotors and error code using MT Developer2 and GX Works2.

(2) Check of trouble

Check to see how the operating condition varies while the Motion controller is operated as follows.

(a) Set the RUN/STOP/RESET switch of Motion controller to STOP.
(b) Reset the trouble with the RUN/STOP/RESET switch of Motion controller.
(c) Turn ON and OFF the Motion controller's power supply.

(3) Narrowing down the range of trouble occurrence causes

Estimate the troubled part in accordance with items (1) and (2) above.

(a) Motion controller or external devices
(b) Motion CPU area or PLC CPU area
(c) I/O module or others
(d) Servo program or Motion SFC program
(e) Sequence program

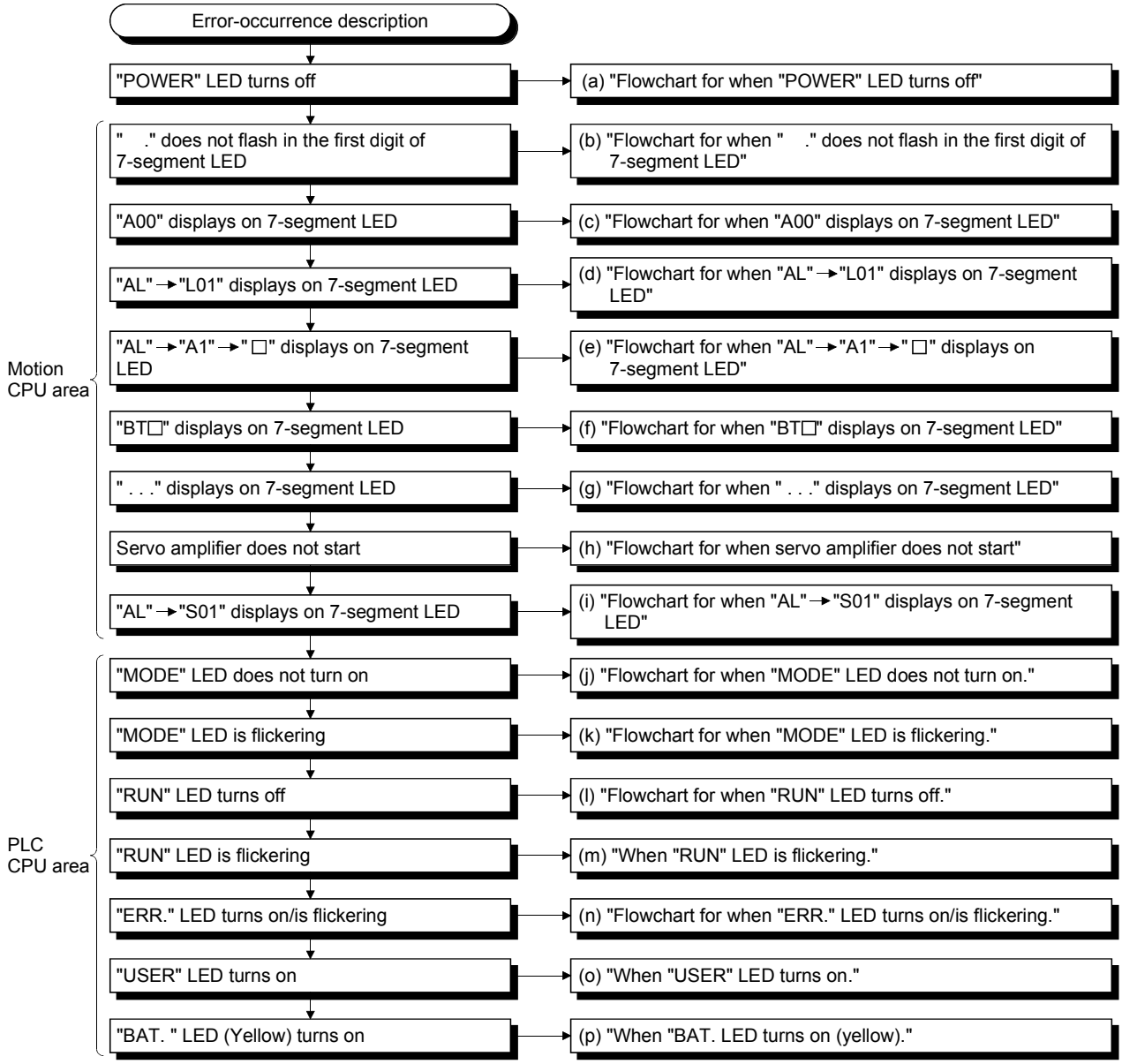
6.6.2 Troubleshooting of Motion controller

This section describes the contents of troubles for the error codes and corrective actions of the troubles.
As for troubleshooting of PLC CPU area, refer to the QCPU User's Manual (Hardware Design, Maintenance and Inspection) of their respective modules.
As for troubleshooting of I/O modules, refer to the "I/O Module Type Building Block User's Manual" of their respective modules.

POINT
Check that the operating system software is installed before starting the Motion controller.

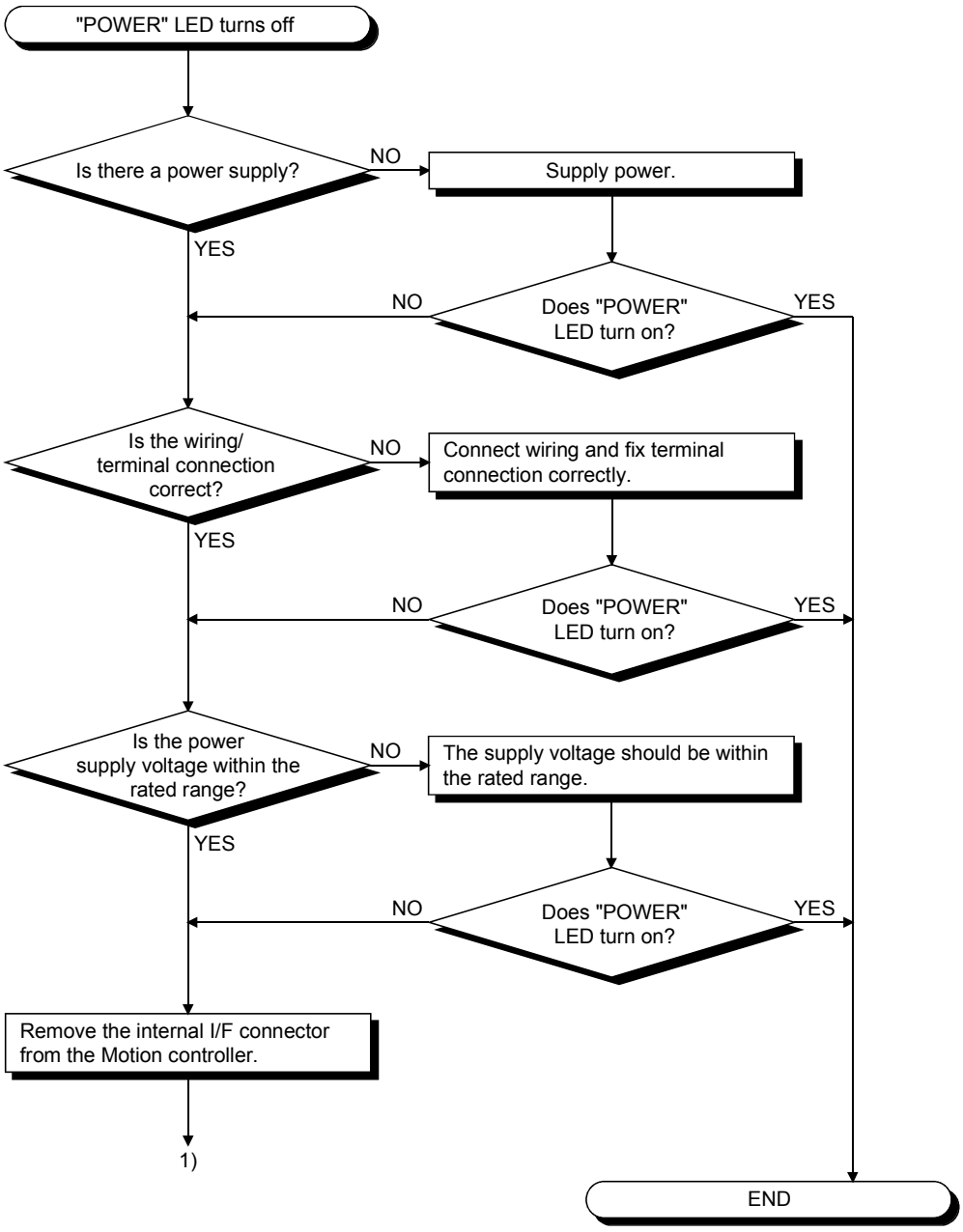
(1) Troubleshooting flowchart

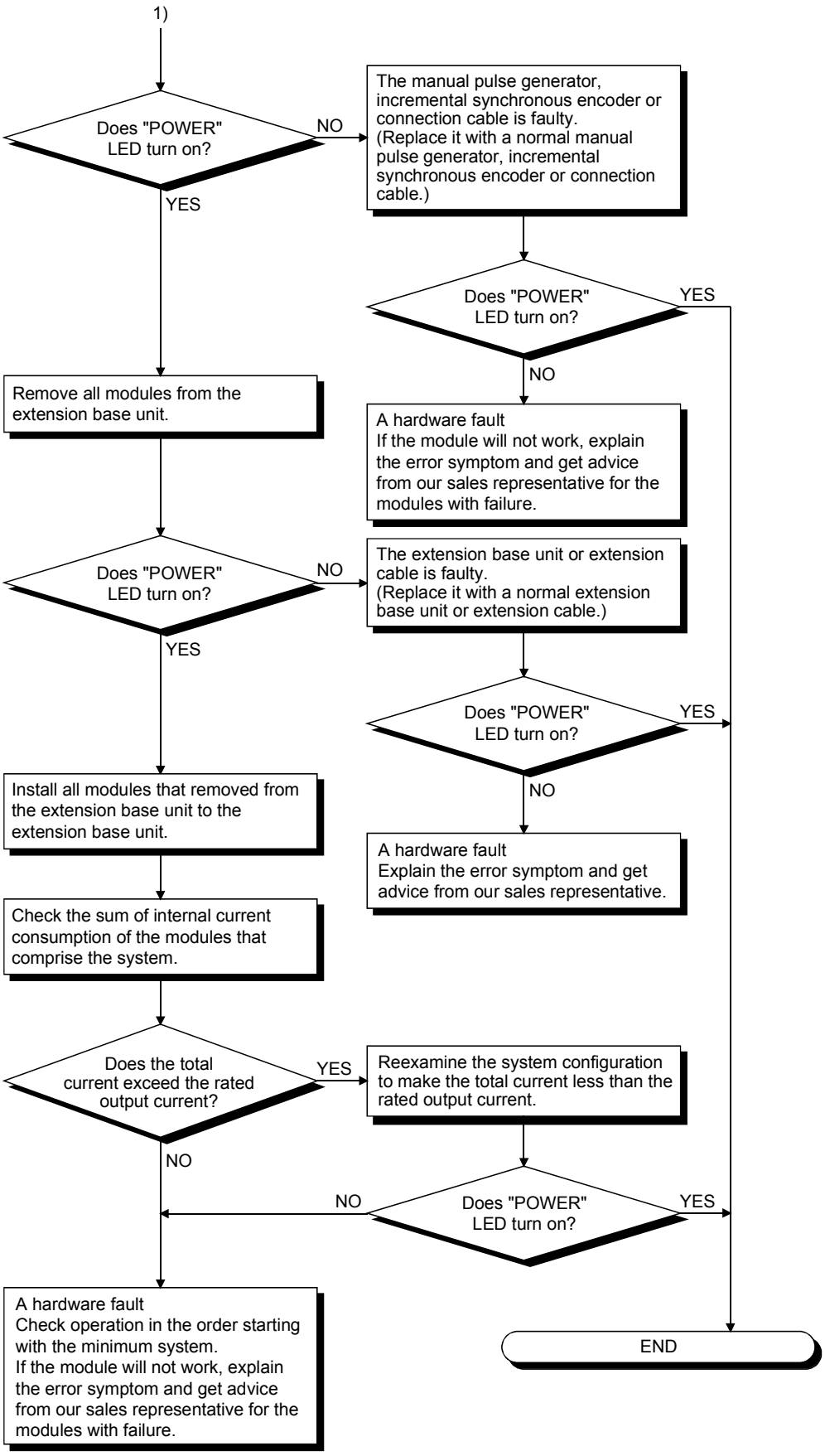
The following show the contents of the troubles classified into a variety of groups according to the types of events.



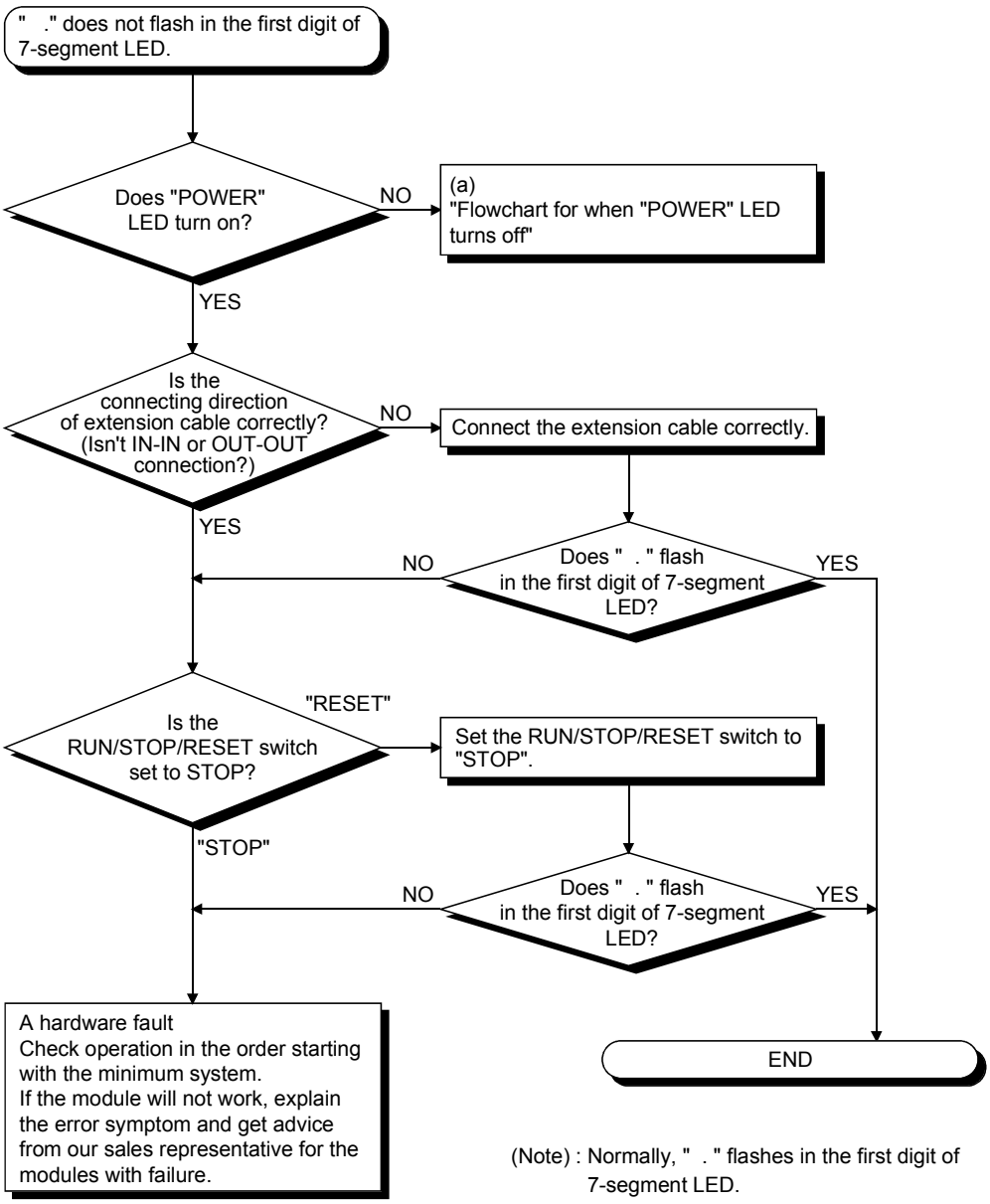
(a) Flowchart for when "POWER" LED turns off

The following shows the flowchart for when "POWER" LED turns off at the power supply ON or during operation.




1)
Does "POWER" LED turn on?
NO
The manual pulse generator, incremental synchronous encoder or connection cable is faulty. (Replace it with a normal manual pulse generator, incremental synchronous encoder or connection cable.)
YES
Does "POWER" LED turn on?
YES
NO
Remove all modules from the extension base unit.
A hardware fault
If the module will not work, explain the error symptom and get advice from our sales representative for the modules with failure.
Does "POWER" LED turn on?
NO
The extension base unit or extension cable is faulty. (Replace it with a normal extension base unit or extension cable.)
YES
Does "POWER" LED turn on?
YES
NO
Install all modules that removed from the extension base unit to the extension base unit.
A hardware fault
Explain the error symptom and get advice from our sales representative.
Check the sum of internal current consumption of the modules that comprise the system.
Does the total current exceed the rated output current?
YES
Reexamine the system configuration to make the total current less than the rated output current.
NO
Does "POWER" LED turn on?
NO
YES
A hardware fault
Check operation in the order starting with the minimum system.
If the module will not work, explain the error symptom and get advice from our sales representative for the modules with failure.
END

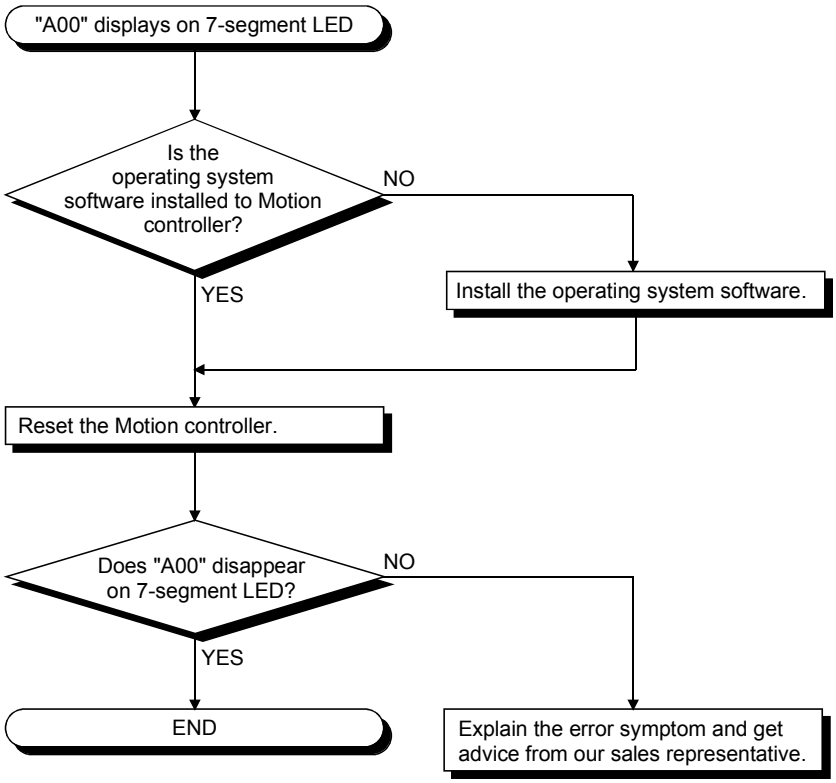
(b) Flowchart for when " ." does not flash in the first digit of 7-segment LED



(Note) : Normally, " . " flashes in the first digit of 7-segment LED.

(c) Flowchart for when "A00" displays on 7-segment LED

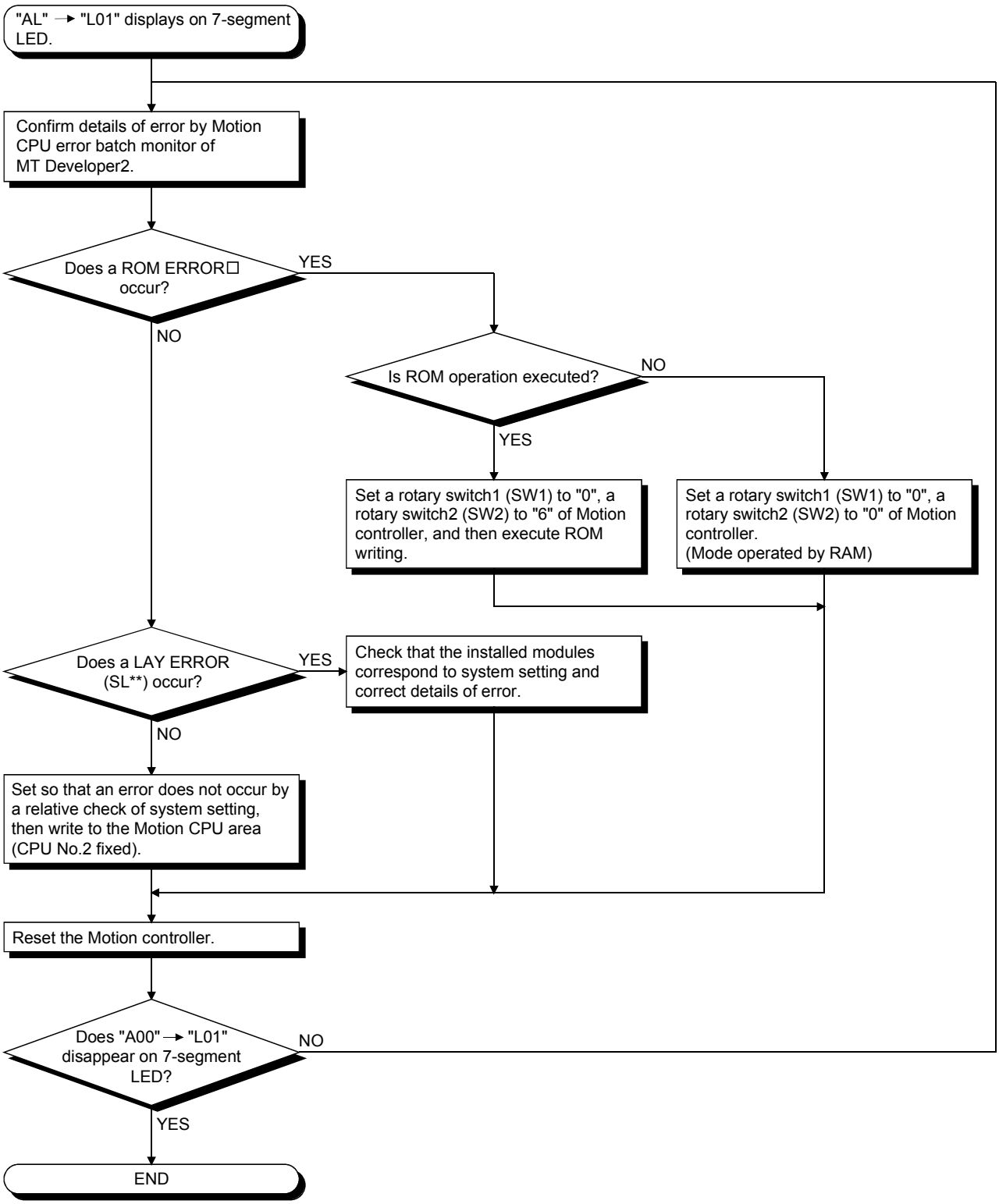
"A00" displays when the operating system software is not installed.
The following shows the flowchart for when "A00" displays on 7-segment LED at the power supply ON or operation start.



(d) Flowchart for when "AL" → "L01" displays on 7-segment LED

""AL" (flashes 3 times) → Steady "L01" display" displays at the system setting error occurrence.

The following shows the flowchart for when ""AL" (flashes 3 times) → Steady "L01" display" displays during operation.

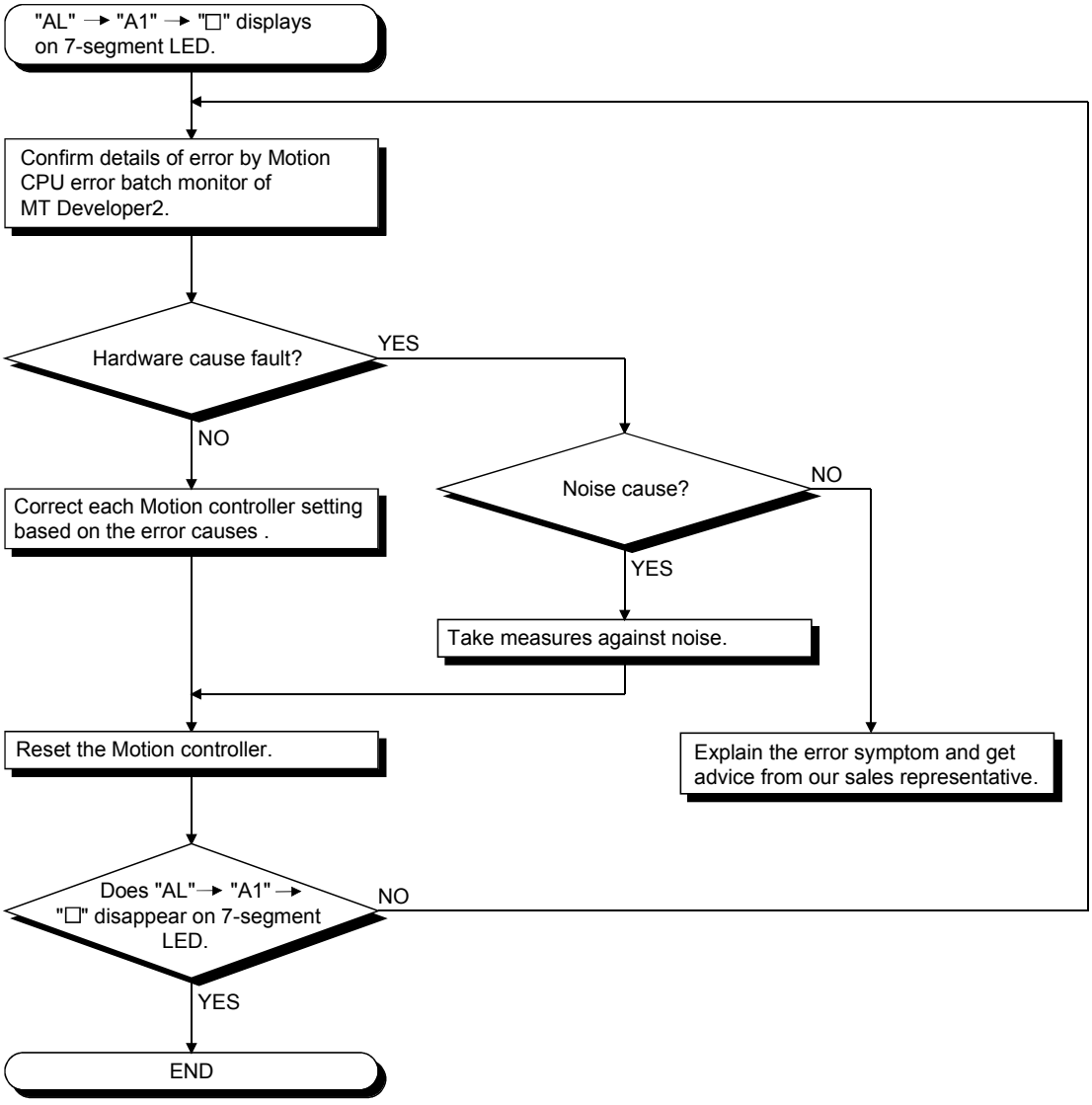


(e) Flowchart for when "AL" → "A1" → "□" displays on 7-segment LED.

""AL" (flashes 3 times) → Steady "A1" display → "□"" displays at the self-diagnosis error occurrence.

The following shows the flowchart for when ""AL" (flashes 3 times) → Steady "A1" display → "□"" displays during operation.

□: 4-digits error code is displayed in two sequential flashes of 2-digits each.



(f) Flowchart for when "BT□" displays on 7-segment LED

"BT1" or "BT2" displays when the battery voltage is lowered.

"BT1" or "BT2" displays at the following cases.

• BT1: Battery voltage 2.7V or less

• BT2: Battery voltage 2.5V or less

The following shows the flowchart for when "BT□" displays.

REMARK

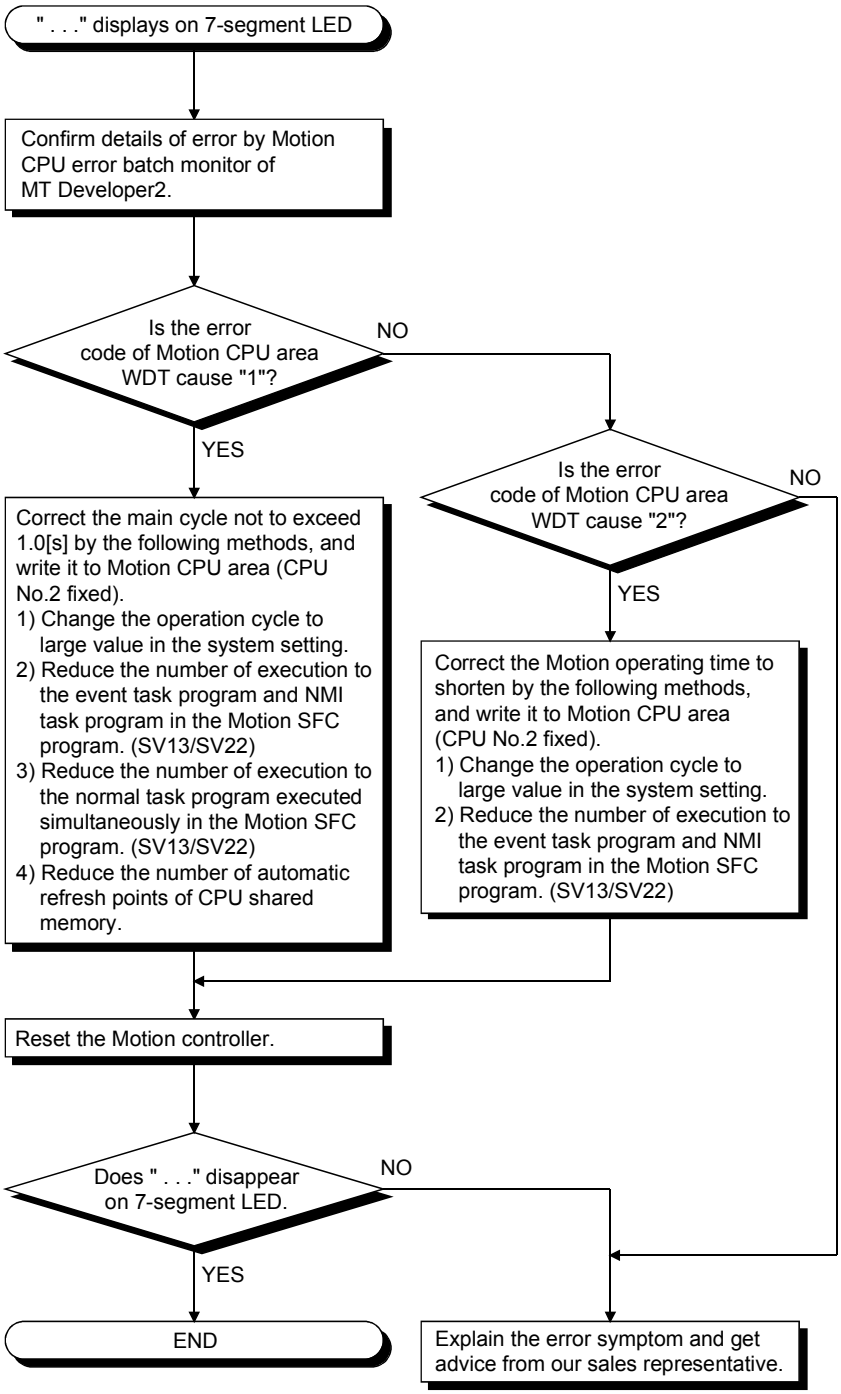
If SM51 turns on, the contents for the data (Refer to Section 6.5.) of RAM built-in Motion controller cannot be guaranteed.

It is recommended to back-up the battery periodically.

(g) Flowchart for when " . . ." displays on 7-segment LED

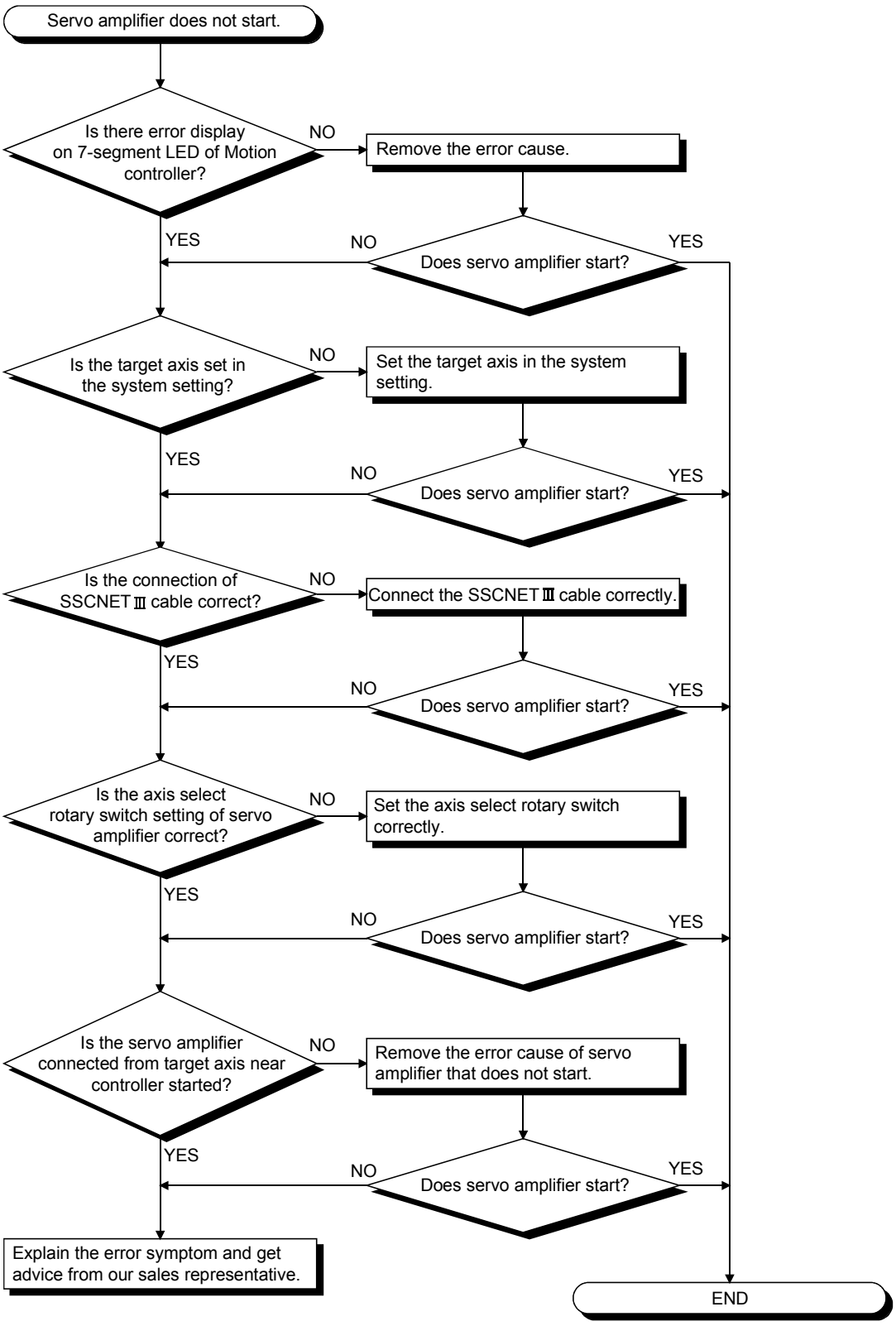
" . . ." displays at the WDT error occurrence.

The following shows the flowchart for when " . . ." displays on 7-segment LED during operation.



(h) Flowchart for when servo amplifier does not start

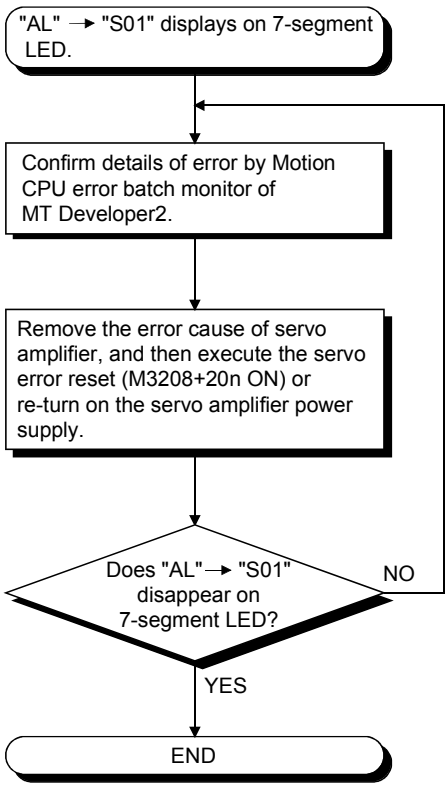
The following shows the flowchart for when servo amplifier does not start.



(i) Flowchart for when "AL" → "S01" displays on 7-segment LED

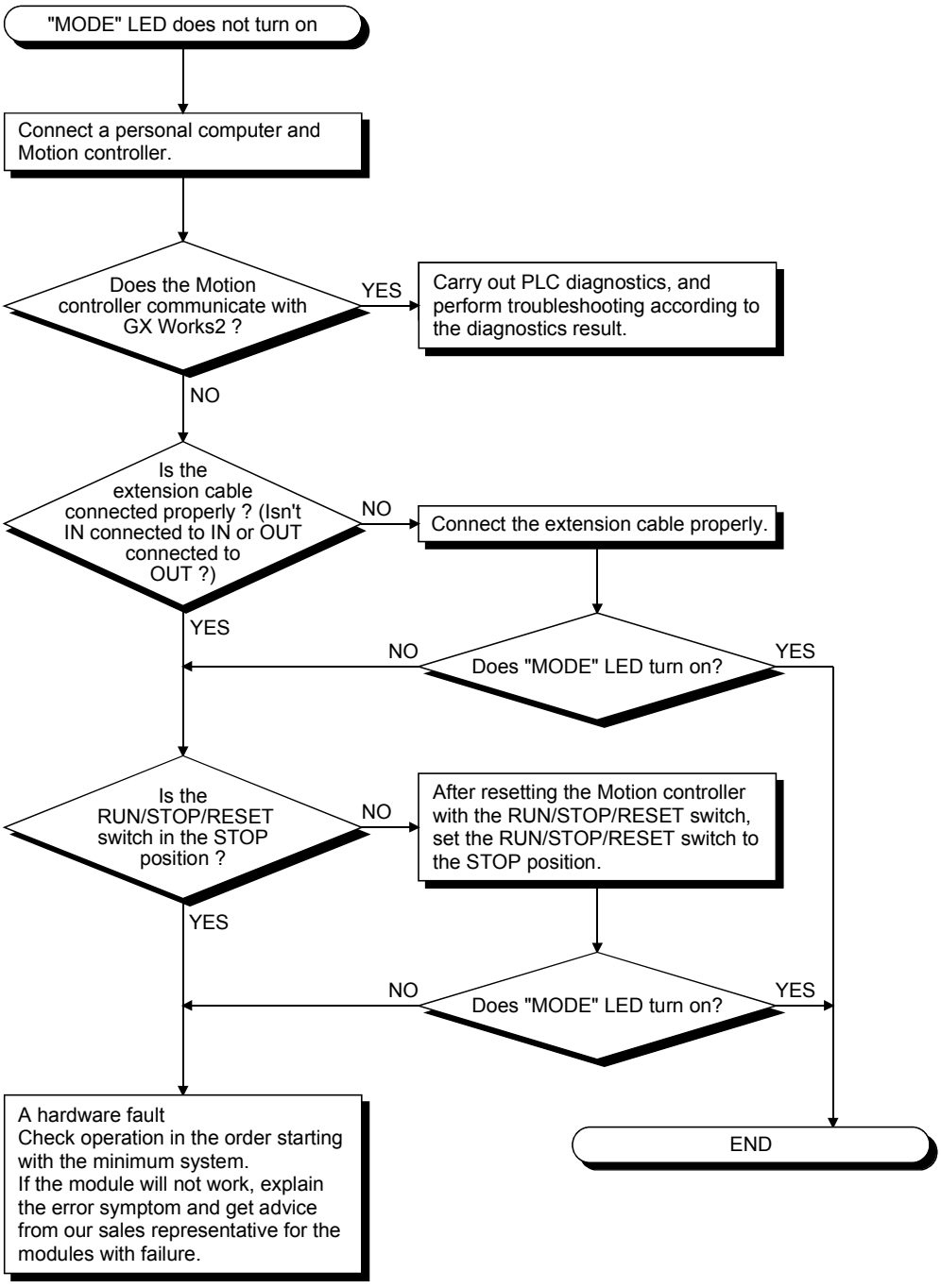
""AL" (flashes 3 times) → Steady "S01" display" displays at the servo error occurrence.

The following shows the flowchart for when ""AL" (flashes 3 times) → Steady "S01" display" displays on 7-segment LED during operation.



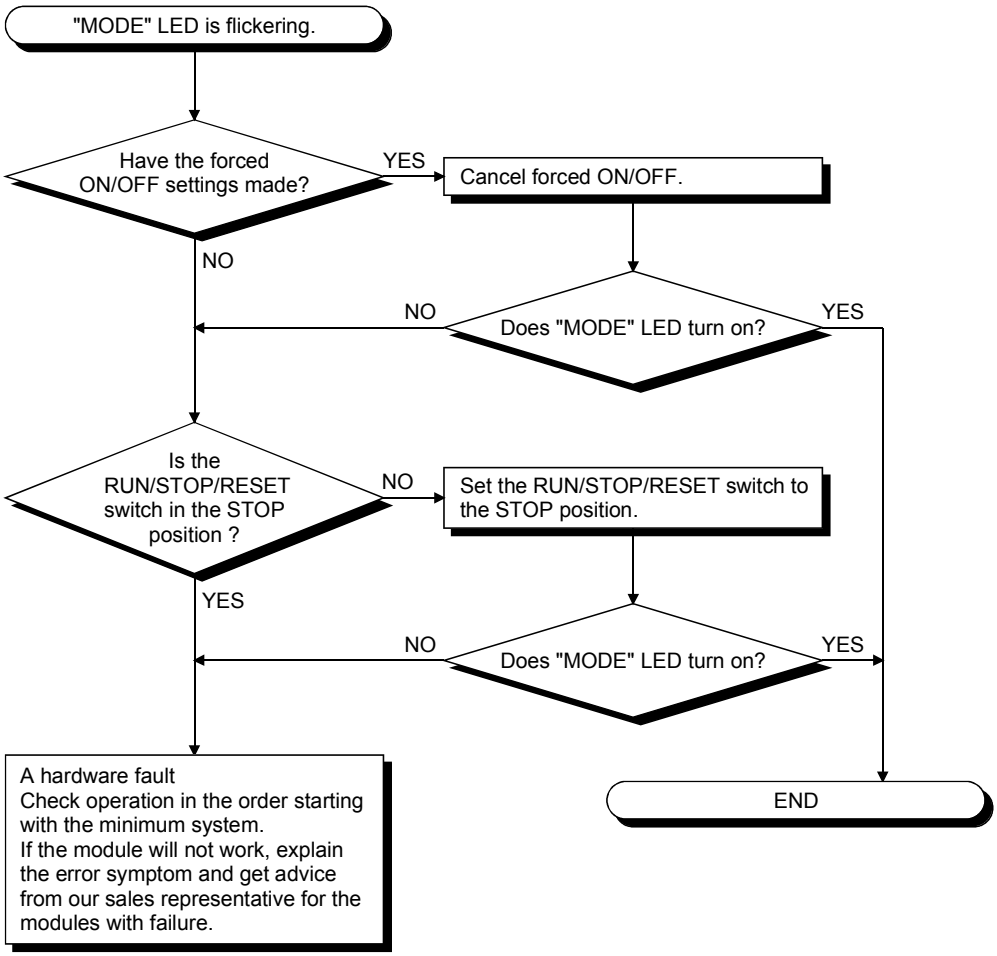
(j) Flowchart for when "MODE" LED does not turn on

The following shows the flowchart for when "MODE" LED does not turn on at Motion controller's power-on.



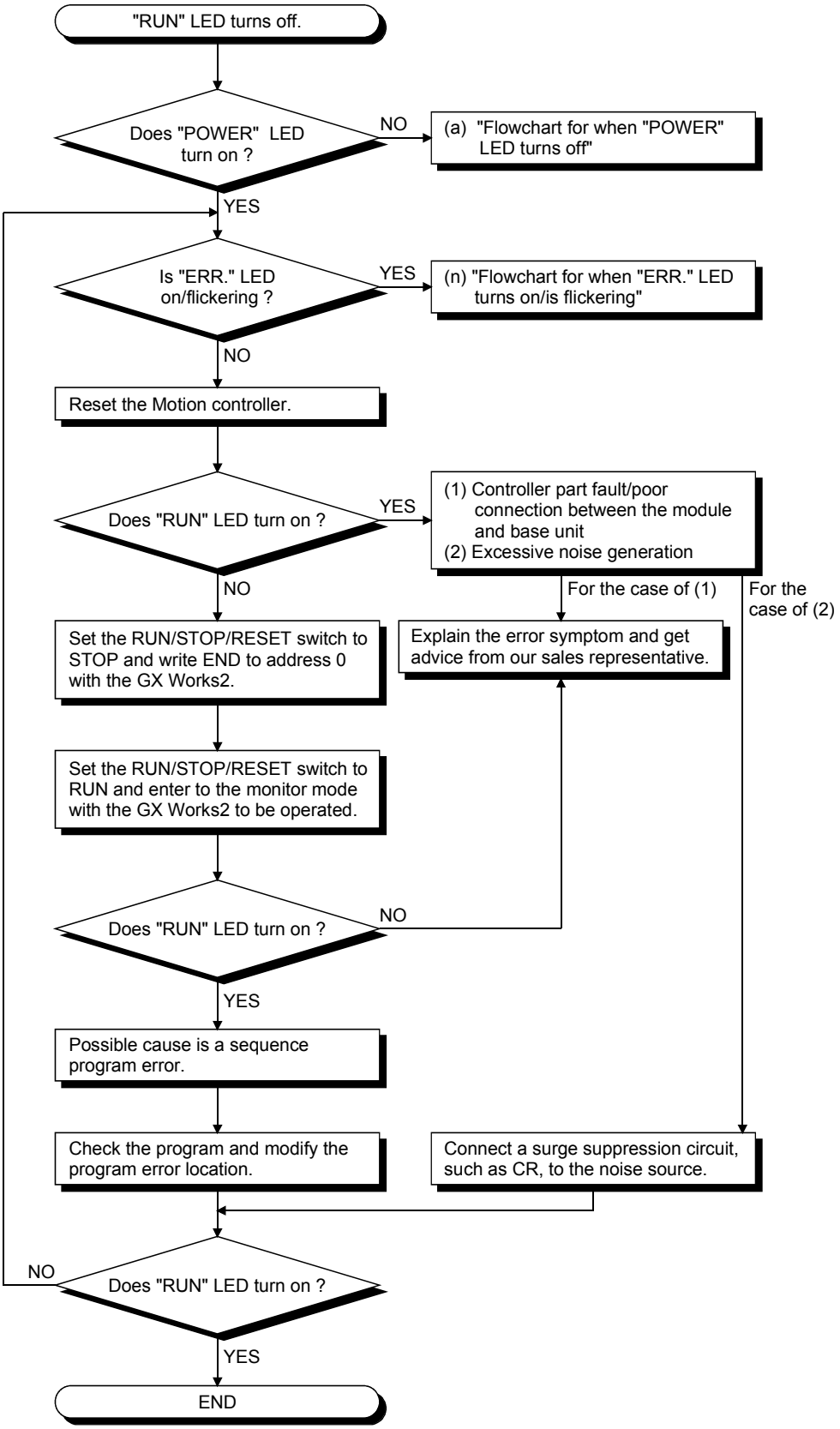
(k) Flowchart for when "MODE" LED is flickering

The following shows the flowchart for when "MODE" LED flickers at Motion controller's power-on, at operation start or during operation.



(l) Flowchart for when "RUN" LED turns off

The following shows the flowchart for when "RUN" LED turns off during operation.

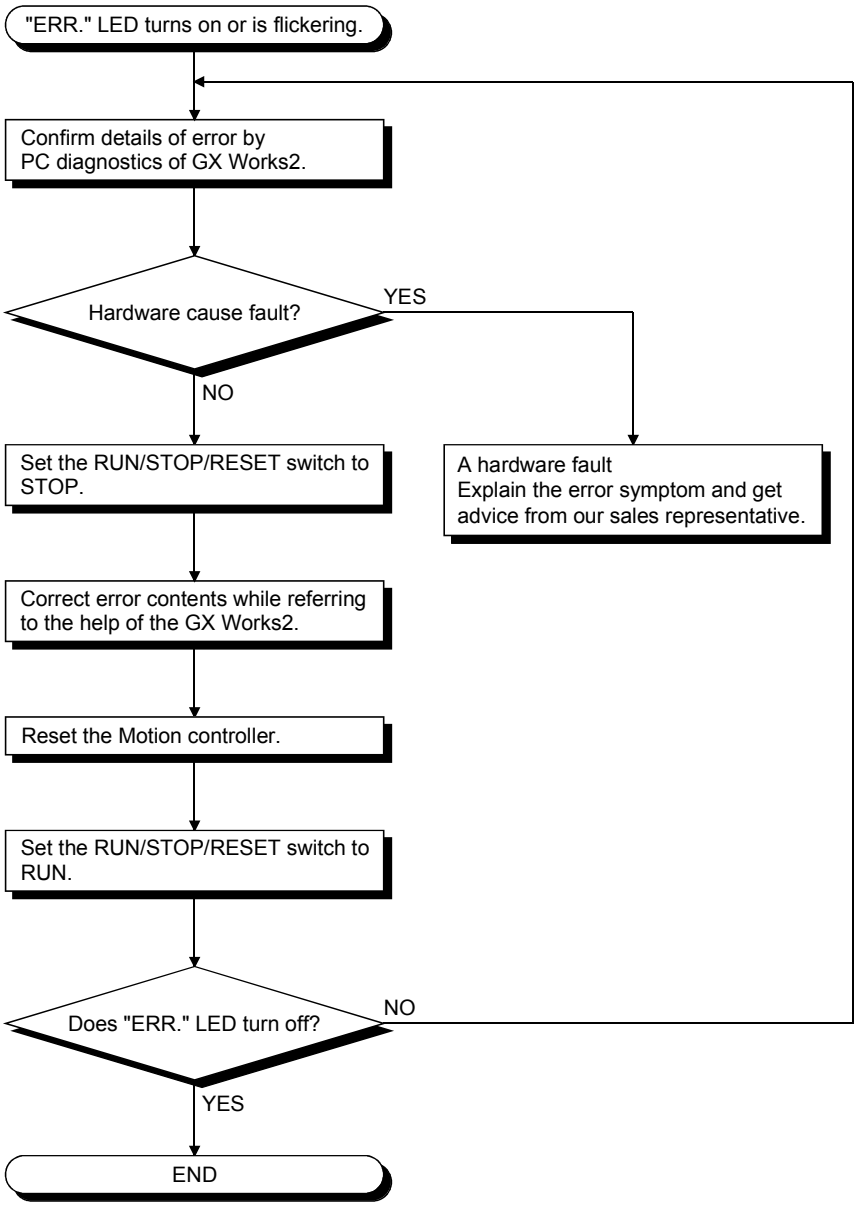


(m) When "RUN" LED is flickering

If the "RUN" LED flickers, follow the steps below.
When the programs or parameters are written into the Motion controller during STOP status and then the RUN/STOP/RESET switch is set from STOP to RUN, the RUN LED flickers.
Although this status does not mean the Motion controller error, the Motion controller stops the operation. To set the Motion controller into RUN status, reset the Motion controller using the RUN/STOP/RESET switch or set the RUN/STOP/RESET switch from STOP to RUN again.
With this setting, the RUN LED turns on.

(n) Flowchart for when "ERR." LED turns on/is flickering

The following shows the flowchart for when "ERR." LED turns on or flickers at Motion controller's power-on, at operation start or during operation.



(o) When "USER" LED turns on

If the "USER" LED turns on, follow the steps described below.
"USER" LED turns on when an error is detected by the CHK instruction or the annunciator (F) turns on.
If "USER" LED is on, monitor the special relays SM62 and SM80 in the monitor mode of GX Works2.

- When SM62 has turned ON
  The annunciator (F) is ON.
  Using SD62 to SD79, check the error cause.
- When SM80 has turned ON
  The "USER" LED turned ON by the execution of the CHK instruction.
  Using SD80, check the error cause.

Eliminate the error cause after confirming it.

The "USER" LED can be turned off by:

- Making a reset with the RUN/STOP/RESET switch; or
- Executing the LEDR instruction in the sequence program.

(p) When "BAT." LED turns on (yellow)

If "BAT." LED turns on (yellow), follow the steps described below.
"BAT." LED turns on (yellow) when a low battery capacity is detected.
If the "BAT." LED is on, monitor the special relays and special registers in the monitor mode of GX Works2 to check which of the SRAM card batteries was lowered in capacity. (SM51 to SM52, SD51 to SD52)
After confirmation, replace the battery with a new one, and reset the Motion controller with the RUN/STOP/RESET switch or run the LEDR instruction, and the "BAT." LED will turn off.

6.6.3 Confirming error code

The error codes and error contents can be read using GX Works2 and MT Developer2. Refer to the Operating Manual of GX Works2 and help of MT Developer2 for details of operating method.

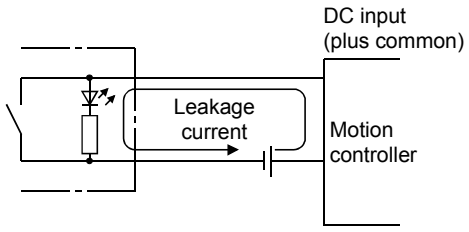
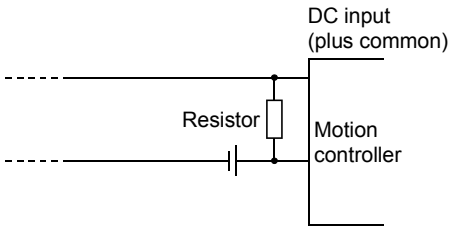
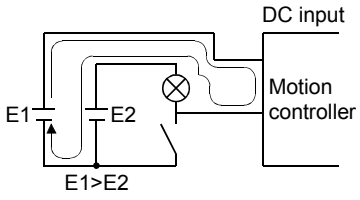
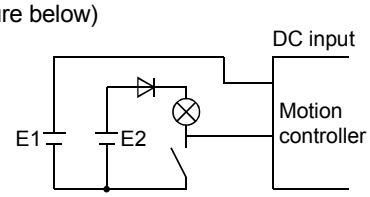
6.6.4 Internal I/O circuit troubleshooting

This section describes possible problems with internal I/O circuits and their corrective actions.

(1) Internal input circuit troubleshooting

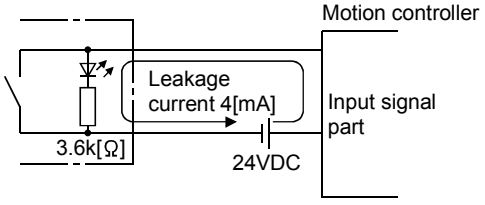
The following describes possible problems with internal input circuits and their corrective actions.

Internal Input Circuit Troubleshooting and Corrective Action

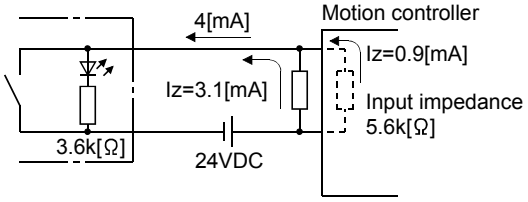
	Condition	Cause	Corrective action
Example 1	Internal input signal is not turned OFF.	• Drive by switch with LED indicator. 	• Connect an appropriate resistor so that the current across the Motion controller becomes lower than the off current.  (Note): A calculation example of the resistance to be connected is shown below.
Example 2	Internal input signal is not turned OFF.	• Sneak path due to the use of two power supplies. 	• Use only one power supply. • Connect a sneak path prevention diode. (Figure below) 

<Calculation example of Example 1>

If a switch with LED display is connected to Motion controller, and current of 4 [mA] is leaked.



(a) Because the condition for OFF voltage (0.9[mA]) of Motion controller is not satisfied. Connect a resistor as shown below.



(b) Calculate the connecting resistor value R as indicated below.
To satisfy the 0.9 [mA] OFF current of the Motion controller, the resistor R to be connected may be the one where 3.1 [mA] or more will flow.

I_R: Iz = Z(Input impedance): R

$$R \leqq \frac{Iz}{I_R} \times Z(\text{Input impedance}) = \frac{0.9}{3.1} \times 5.6 \times 10^3 = 1625[\Omega]$$

R < 1625 [Ω]
Assuming that resistor R is 1500 [Ω], the power capacity W of resistor R is:

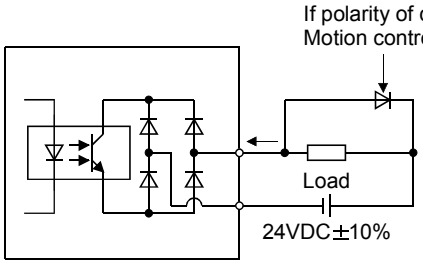
$$W = (\text{Input voltage})^2 \div R = 26.4^2 \div 1500 = 0.464 \text{ [W]}$$

(c) The power capacity of the resistor selected is 3 to 5 times greater than the actual current consumption. 1.5K [Ω], 2 to 3 [W] resistor may therefore be connected to the terminal in question.

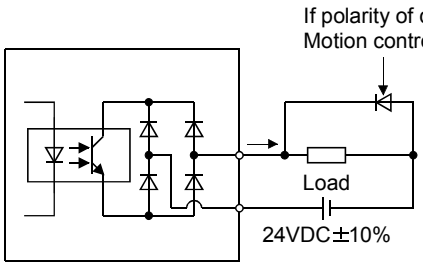
(2) Internal output circuit troubleshooting

The following describes possible problems with internal output circuits and their corrective actions.
A lamp, relay or photocoupler can be driven. Install a diode(D) for an inductive load (relay etc.), or install an inrush current suppressing resistor(R) for a lamp load. (Permissible current: 40mA or less, inrush current: 100mA or less)
A maximum of 2.6V voltage drop occurs in the servo amplifier.

(a) Circuit example of sink output



(b) Circuit example of source output



⚠CAUTION

● Do not mistake the polarity and " + / - " of diode, as this may lead to destruction or damage.

7. EMC DIRECTIVES

Compliance to the EMC Directive, which is one of the EU Directives, has been a legal obligation for the products sold in European countries since 1996 as well as the Low Voltage Directive since 1997.
Manufacturers who recognize their products are compliant to the EMC and Low Voltage Directives are required to declare that print a "CE mark" on their products.

(1) Authorized representative in Europe

Authorized representative in Europe is shown below.
Name : Mitsubishi Electric Europe BV
Address: Gothaer strase 8, 40880 Ratingen, Germany

7

7.1 Requirements for Compliance with the EMC Directive

The EMC Directive specifies that products placed on the market must be so constructed that they do not cause excessive electromagnetic interference (emissions) and are not unduly affected by electromagnetic interference (immunity)".
Section 7.1.1 through Section 7.1.4 summarize the precautions on compliance with the EMC Directive of the machinery constructed with the Motion controllers.
These precautions are based on the requirements and the standards of the regulation, however, it does not guarantee that the entire machinery constructed according to the descriptions will comply with above-mentioned directive. The method and judgement for complying with the EMC Directive must be determined by the person who construct the entire machinery.

7.1.1 Standards relevant to the EMC Directive

The standards relevant to the EMC Directive are listed in table below.

Certification	Test item	Test details	Standard value
EN61000-6-4:2007 EN61131-2:2007	EN55011:2007/A2:2007 Radiated emission(Note-1)	Radio waves from the product are measured.	30M-230MHz QP(Note-2): 40dBμV/m (10m (32.81ft.) in measurement range) 230M-1000MHz QP: 47dBμV/m (10m (32.81ft.) in measurement range)
	EN55011:2007/A2:2007(Note-3) (Power line) EN55022:2006/A1:2007(Note-4) (Electrical communication port) Conducted emission	Noise from the product to the power line and electrical communication port is measured.	AC power line 0.15M-0.5MHz QP : 79dBμV AV(Note-5) : 66dBμV 0.5M-30MHz QP: 73dBμV AV: 60dBμV Electrical communication port 0.15M-0.5MHz QP, AV: Logarithmic decrease 0.5M-30MHz QP: 87dBμV AV: 74dBμV
EN61000-6-2:2005 EN61131-2:2007	EN61000-4-2:1995 +A1:1998+A2:2001 Electrostatic discharge immunity	Immunity test in which electrostatic discharge is applied to the product.	8kV: 10 times at 1 second interval, Air discharge 4kV: 10 times at 1 second interval, Contact discharge
	EN61000-4-3:2006 Radiated immunity(Note-1)	Immunity test in which electric fields are radiated to the product.	80-1000MHz 10V/m, 1400M-2000MHz 3V/m, 2000M-2700MHz 1V/m, 80%AM modulation @1kHz
	EN61000-4-4:2004 Electrical fast transient/ burst (EFT/B) immunity	Immunity test in which burst noise is applied to the power cable and signal line.	AC power line: ±2kV/5kHz DC power line: ±2kV/5kHz I/O, communication line: ±1kV/5kHz
	EN61000-4-5:2006 Surge immunity	Immunity test in which surge is applied to the power line and signal line.	AC power line Common mode: ±2.5kV Differential mode: ±1.5kV DC power line Common mode: ±0.5kV Differential mode: ±0.5kV I/O, communication line Common mode: ±1kV
	EN61000-4-6:2007 +A:2001 Conducted immunity	Immunity test in which high frequency noise is applied to the power line and signal line.	0.15-80MHz, 80%AM modulation @1kHz, 10Vrms
	EN61000-4-11:2004(Note-3) Short interruptions immunity	Immunity test in which power supply has short interruptions.	0% of rated voltage, 250cycle
	EN61000-4-11:2004(Note-3) Voltage dip	Test in which voltage dip is applied to the power supply.	40% of rated voltage, 10cycle 70% of rated voltage, 25cycle
EN61131-2:2007	EN61131-2:2007(Note-3) Voltage dip immunity	Immunity test in which voltage dip is applied to the power supply.	0% of rated voltage, 0.5cycle 20 times

(Note-1): This product is an open type device (a device designed to be housed inside other equipment) and must be installed inside a conductive control panel.
The corresponding test has been done with the programmable controller installed inside a control panel.
(Note-2): QP : Quasi-peak value
(Note-3): For the AC power supply line.
(Note-4): For the electrical communication port.
(Note-5): AV: Average value

7.1.2 Installation instructions for EMC Directive

(1) Installation

Motion controller is an open type device and must be installed inside a control panel for use.
This not only ensures safety but also ensures effective shielding of Motion controller-generated electromagnetic noise.

(a) Control panel
1) Use a conductive control panel.
2) When attaching the control panel's top plate or base plate, expose bare metal surface and weld so that good surface contact can be made between the panel and plate.
3) To ensure good electrical contact with the control panel, mask the paint on the installation bolts of the inner plate in the control panel so that contact between surfaces can be ensured over the widest possible area.
4) Ground the control panel with a thick wire so that a low impedance connection to ground can be ensured even at high frequencies.
5) Holes made in the control panel must be 10cm (3.94inch) diameter or less. If the holes are 10cm (3.94 inch) or larger, radio frequency noise may be emitted.
In addition, because radio waves leak through a clearance between the control panel door and the main unit, reduce the clearance as much as practicable.
The leakage of radio waves can be suppressed by the direct application of an EMI gasket on the paint surface.

(2) Connection of power line and ground wire

It is necessary to use the Motion controller grounding terminal only when it is in the grounded condition. Be sure to ground the grounding for the safety reasons and EMC Directives.
Ground wire and power supply cable for the Motion controller system must be connected as described below.

(a) Provide a grounding point near the FG terminals. Ground the FG terminals (FG : Frame Ground) with the thickest and shortest wire possible. (The wire length must be 30cm (11.81inch) or shorter.) The FG terminals function is to pass the noise generated in the Motion controller system to the ground, so wire the ground wire as short as possible to ensure a low impedance.
The wire itself carries a large noise content and thus short wiring means that the wire is prevented from acting (noise emission) as an antenna.

(3) Cables

The cables extracted from the control panel contain a high frequency noise component. On the outside of the control panel, therefore, they serve as antennas to emit noise. To prevent noise emission, use shielded cables for the cables which are connected to the I/O modules and intelligent function modules and may be extracted to the outside of the control panel.
The use of a shielded cable also increases noise resistance.
The signal lines (including common line) of the programmable controller, which are connected to I/O modules, intelligent function modules and/or extension cables, have noise durability in the condition of grounding their shields by using the shielded cables. If a shielded cable is not used or not grounded correctly, the noise resistance will not meet the specified requirements.

(a) Grounding of shield section of shield cable

1) Ground the exposed shield section of the shielded cable close to the module. When the grounded cables and the not yet grounded cables are bundled, the cables might be induced to electromagnetic.
2) Ground the exposed shield section to spacious area on the control panel. A clamp can be used as shown in Figure 7.2.
In this case, mask the inner wall surface when coating the control panel, and contact the exposed shield section with the clamp at the exposed bare metal surface.

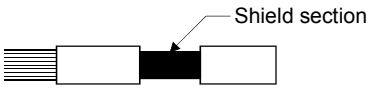


Figure 7.1 Part to be exposed

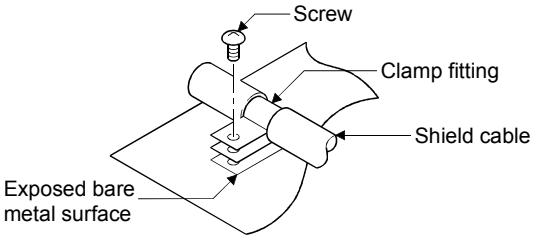


Figure 7.2 Shield grounding (Correct example)

Note) The method of grounding with a vinyl-coated wire soldered onto the shielded section of the shielded cable as in shown Figure 7.3 is not recommended. Doing so will raise the high-frequency impedance, resulting in loss of the shielding effect.

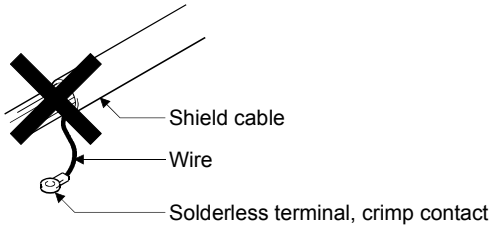


Figure 7.3 Shield grounding (Incorrect example)

(4) Precautions relevant to the electrostatic discharge

There is a weak part to electrostatic discharge in the surface of the module. 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.

7.1.3 Parts of measure against noise

(1) Ferrite core

A ferrite core has the effect of reducing noise in the 30MHz to 100MHz band.
It is not required to fit ferrite cores to cables, but it is recommended to fit ferrite cores if shield cables pulled out of the enclosure do not provide sufficient shielding effects.
Note that the ferrite cores must be fitted to the cables in the position immediately before they are pulled out of the enclosure. If the fitting position is improper, the ferrite will not produce any effect.

• Ferrite core (Recommended product)

Manufacturer	Model name
TDK	ZCAT3035-1330

(2) Noise filter (power supply line filter)

A noise filter is a component which has an effect on conducted noise.
The attachment of the noise filter to the power supply line of the servo amplifier and controller's power supply is effective for the reducing noise.
(The noise filter has the effect of reducing conducted noise of 10 MHz or less.)

• Noise ferrite (Recommended product)

Manufacturer	Model name
Mitsubishi electric	FR-BLF
Soshin Electric	HF3010A-UN

The precautions required when installing a noise filter are described below.

(a) Do not bundle the wires on the input side and output side of the noise filter. When bundled, the output side noise will be induced into the input side wires from which the noise was filtered.

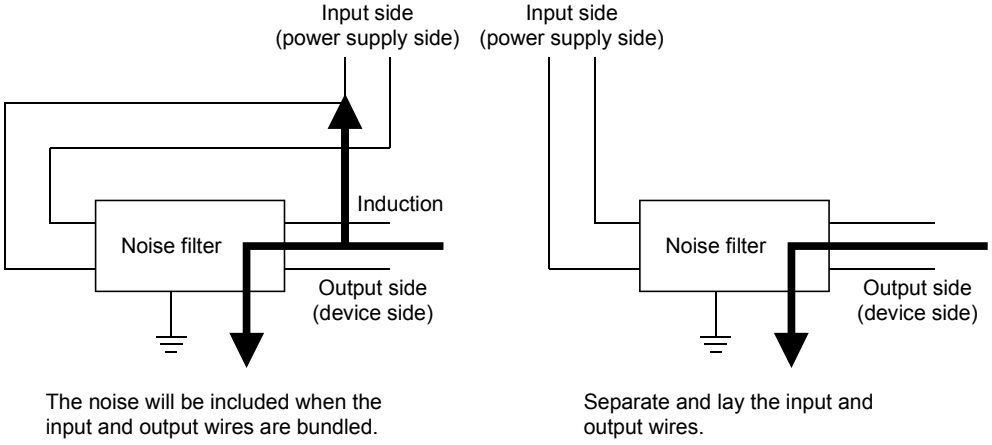


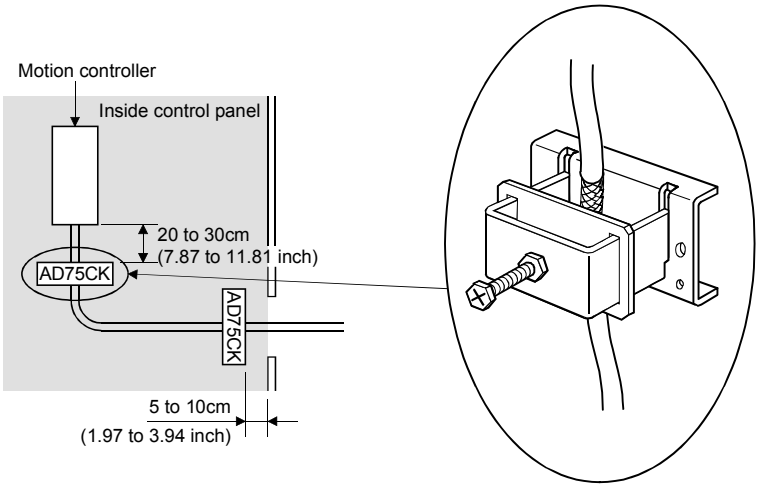
Figure 7.4 Precautions on noise filter

(b) Ground the noise filter grounding terminal to the control cabinet with the shortest wire possible (approx. 10cm (3.94 inch)).

(3) Cable clamp

It is also possible to ground the exposed shielded part of the cable to the panel with the AD75CK cable clamp (Mitsubishi).

- Ground the shield at a position 20 to 30cm (7.87 to 11.81 inch) away from the module.
- When the cables pulled out from the control panel, ground the cables at a position 5 to 10cm (1.97 to 3.94inch) near the input/output hole of the control panel with the cable clamp (AD75CK), etc.



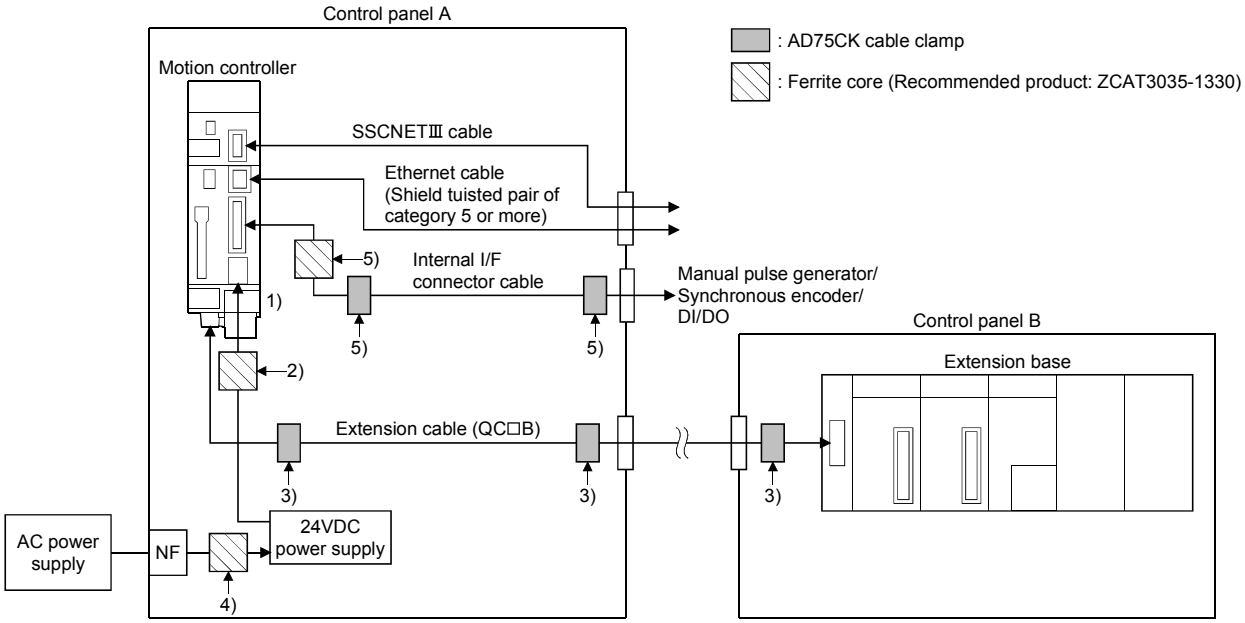
- Cable clamp (Recommended product)

Manufacturer	Model name
Mitsubishi electric	AERSBAN-DSET
	AERSBAN-ESET
	AD75CK

⚠CAUTION

● Do not ground the cable clamp to the top of control panel.
Doing so may lead to damage by drop of screws, etc. during installation or removing the cable clamp.

7.1.4 Example of measure against noise



1) Ground the FG terminal of the Motion controller and 24VDC power supply module to the control panel.
2) Measure against noise of the power supply cable (24VDC twisted cable)
   • Wire the power supply cable as short as possible using the twisted cable.
   • Install a ferrite core at a position 20 to 30cm (7.87 to 11.81inch) away from the product.
3) Measure against noise of the extension cable (QC□B)
   • Ground the cables at a position 20 to 30cm (7.87 to 11.81inch) away from the module with the cable clamp, etc.
   • When the cables are extracted from the control panel, ground the cables at a position 5 to 10cm (1.97 to 3.94inch) away from the exit/entrance of the control panel with the cable clamp, etc.
4) Install a ferrite core in the secondary side of NF. (Approx. 1 turn)
5) Measure against noise of the internal I/F connector cable
   • Install a ferrite core at a position 20 to 30cm (7.87 to 11.81inch) away from the module.
   • Ground the cables at a position 30 to 40cm (11.81 to 15.75inch) away from the module with the cable clamp, etc.
   • When the cables are extracted from the control panel, ground the cables at a position 5 to 10cm (1.97 to 3.94inch) away from the exit/entrance of the control panel with the cable clamp, etc.

(1) Refer to Section 2 for the following cables.
   • Ethernet cable
   • RS-232 communication cable
   • USB cable
   • SSCNETⅢ cable
   • Extension cable
   • Forced stop input cable

(2) Refer to APPENDIX 4.4 for the internal I/F connector cable.
   Correctly wire the internal I/F connector cable. Use the shielded twisted pair cable.

(3) In wiring inside the panel, the power line connected to the power or servo amplifier and the communication cable such as bus connection cable or network cable must not be mixed. If the cables are installed closely with each other for wiring reasons, using a separator (made of metal) can make the cables less influenced by noise.
   Mixing the power line and communication cable may cause malfunction due to noise.

APPENDICES

APPENDIX 1 Differences Between Q170MSCPU and Q173DSCPU/Q172DSCPU

This section describes the differences between Q170MSCPU and Q173DSCPU/Q172DSCPU, and the details of change.
The specifications of Q170MSCPU are equal to those of Q172DSCPU.
Refer to the following manuals for the specifications in common with Q172DSCPU.

Manual name	Manual number
Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (COMMON)	IB-0300134
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (Motion SFC)	IB-0300135
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV13/SV22) Programming Manual (REAL MODE)	IB-0300136
Q173D(S)CPU/Q172D(S)CPU Motion controller (SV22) Programming Manual (VIRTUAL MODE)	IB-0300137
Q173DSCPU/Q172DSCPU Motion controller (SV22) Programming Manual (Advanced Synchronous Control)	IB-0300198

APPENDIX 1.1 Differences of parameters

Table 1.1 Differences of parameters

Item		Q170MSCPU	Q173DSCPU/Q172DSCPU
System setting	Amplifier setting	[Axis No.] 1 to 16 [Amplifier type] • Communication type "SSCNETⅢ/H" use MR-J4(W)-B(-RJ) • Communication type "SSCNETⅢ" use MR-J3(W)-B MR-J3-B(S) Fully closed MR-J3(W)-B Linear MR-J3(W)-B DD motor	[Axis No.] Q173DSCPU: 1 to 32 Q172DSCPU: 1 to 16 [Amplifier type] • Communication type "SSCNETⅢ/H" use MR-J4(W)-B(-RJ) • Communication type "SSCNETⅢ" use MR-J3(W)-B MR-J3-B(S) Fully closed MR-J3(W)-B Linear MR-J3(W)-B DD motor
	Q170MS I/O setting/ CPU setting	[I/O setting] Used/Unused [First I/O No.] 0000 to 0FF0 [High-speed read setting] (Note-1) Used/Unused [Input signal detection direction] Valid on leading edge (Normal open)/ Valid on trailing edge (Normal close)	[Self CPU installation position setting] Self CPU Other CPU CPU (empty) [Input setting] Used/Unused [First input No.] 0000 to 0FF0 [High-speed read setting] (Note-1) Used/Unused [Input signal detection direction] Valid on leading edge (Normal open)/ Valid on trailing edge (Normal close) [Multiple CPU synchronous control setting] (Note-2) Independent CPU Master CPU Slave CPU [Status device setting] Set device to "Synchronous controlling", "Status for each CPU", and "Error status for CPU and axis". Bit device :X, Y, M, B, F Word device : D, W, #, U□\G

(Note-1): This cannot be set in SV22 advanced synchronous control.
(Note-2): SV22 advanced synchronous control only.

POINT

(1) Set "MR-J4-B" to use the MR-J4W-□B.
MR-J4W-□B is recognized as two servo amplifiers or three servo amplifiers. Set two axes or three axes as "MR-J4-B".
(2) Set "MR-J3-B" to use the MR-J3W-□B.
MR-J3W-□B is recognized as two servo amplifiers. Set two axes as "MR-J3-B".

APPENDIX 1.2 Differences of peripheral device interface

Table 1.2 Differences of peripheral device interface

Item		Q170MSCPU	Q173DSCPU/Q172DSCPU
USB		Connect to the USB connector/ RS-232 connector of PLC CPU area.	Connect to the PLC CPU module.
RS-232			
PERIPHERAL I/F	Direct connection	Connect to the PERIPHERAL I/F connector of Motion CPU area.	Connect to the PERIPHERAL I/F connector of Motion CPU module.
	Connection via HUB		

APPENDIX 1.3 Differences of CPU display and I/O assignment

Table 1.3 Differences of CPU display and I/O assignment

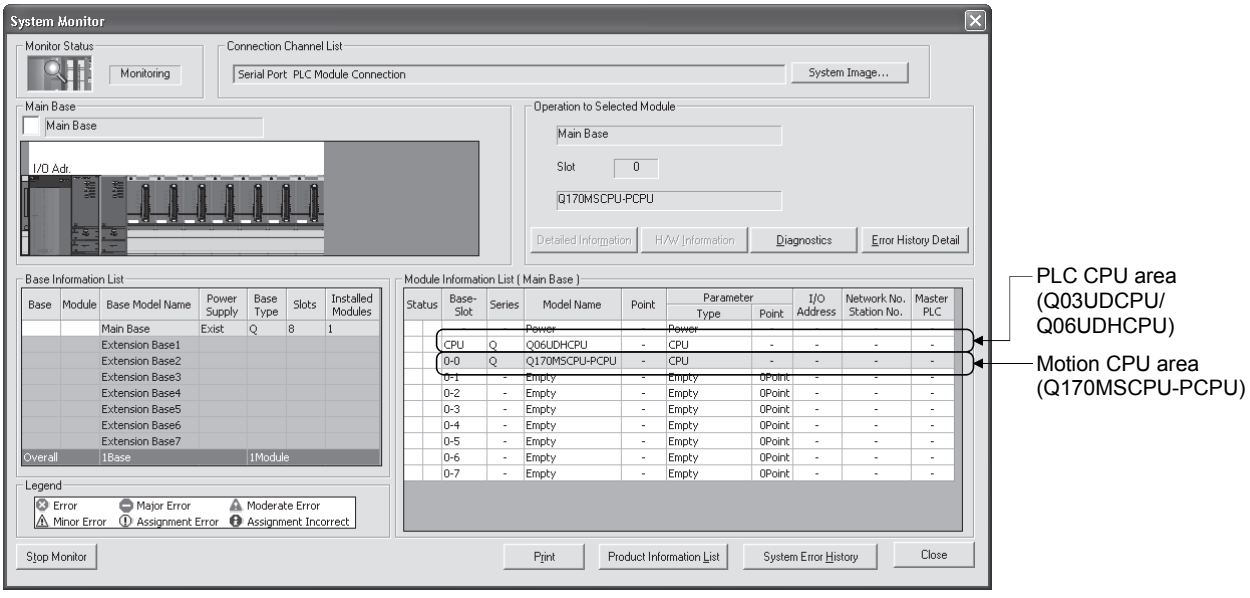
Item		Q170MSCPU	Q173DSCPU/Q172DSCPU
CPU display		• Motion CPU area : Q170MSCPU-PCPU • PLC CPU area : Q03UDCPU (Q170MSCPU use) Q06UDHCPU (Q170MSCPU-S1 use)	• Motion CPU : Q173DSCPU, Q172DSCPU • PLC CPU : Q06UDHCPU, etc.
I/O assignment setting	Base mode (Auto)	• The main base of eight slots corresponding is built into the Q170MSCPU. • 16 points are set to each empty slot. • First address of the extension base is "70".	• The main base and extension base are automatically determined. • I/O or empty slot, etc. is automatic determined, and the points are assigned.
	Base mode (Detail)	• I/O assignment points are individually assigned. When the first address of the extension base is set to address "0", the setting is as follows. • Main base: 8 slots • Number of points of each empty slot: 0 point	• I/O assignment points are individually assigned.

The CPU display and setting of I/O assignment are shown below.

(1) CPU display

Confirm the CPU display of the PLC CPU area and Motion CPU area on the System Monitor screen displayed on [Diagnostics] – [System monitor] of GX Works2.

PLC CPU area is displayed as " Q03UDCPU (Q170MSCPU use)/Q06UDHCPU (Q170MSCPU-S1 use)", and Motion CPU area is displayed as "Q170MSCPU-PCPU".



(2) Setting of I/O assignment

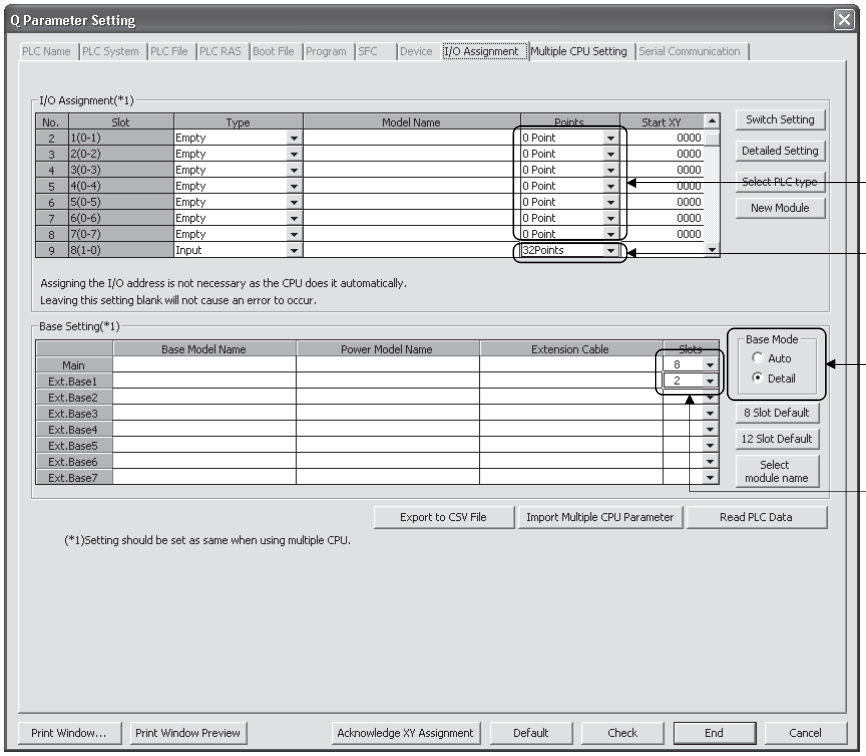
Set the I/O assignment points in [I/O assignment] of PC parameter of GX Works2.

(a) When the Base mode is set to "Auto" (default).

16 points are set to empty slot of the main base. Therefore, the first address of the extension base is set to "70".

(b) When the Base mode is set to "Detail".

The first address of the extension base is set to "0" by setting 0 point to the empty slot of the main base.



POINT

The first address of the extension base can be assigned from address "0" by using the sample data.
Refer to "APPENDIX 2.1" for details of the sample data.

APPENDIX 1.4 Differences of I/O signals

Table 1.4 Differences of I/O signals

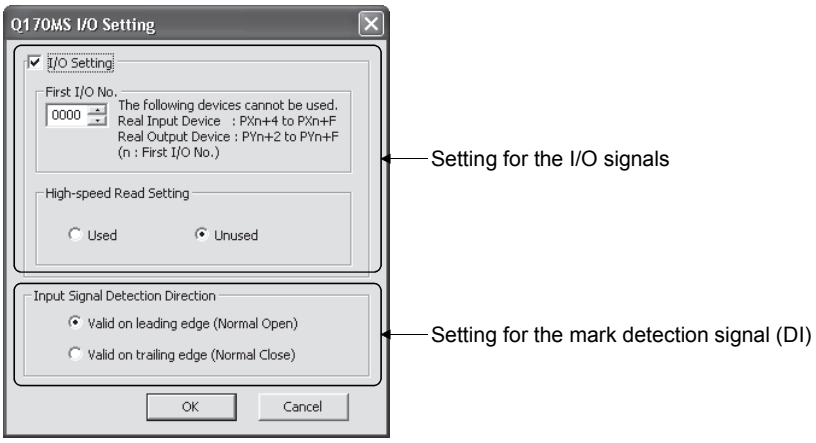
Item	Q170MSCPU	Q173DSCPU/Q172DSCPU
I/O signal	• Q170MSCPU's internal I/F (Note-1) (Input 4 points, output 2 points) • PLC I/O module • Intelligent function module	• Built-in interface in Motion CPU (Note-1) (Input 4 points) • PLC I/O module • Intelligent function module

(Note-1): Real input device (PX) or real output device (PY) is in units of 16 points.
- Real input (PX) : 4 points + Dummy (Unsable: Fixed at 0) 12 points
- Real output (PY): 2 points + Dummy (Unsable: Fixed at 0) 14 points

(Example) When the first I/O No. is set to 0(H).
- PX0 to PX3 (Real input), PX4 to PXF (Unsable: Fixed at 0)
- PY0 to PY1 (Real output), PY2 to PYF (Unsable: Fixed at 0)

(1) Q170MS I/O setting

The setting method for the I/O signals of internal I/F is shown below.



Item		Setting range	Initial value	Remarks
I/O setting		Used/Unused	Unused	Number of I/O points must be total of 256 points or less.
	First I/O No.	0000 to 0FF0 (in units of 16 points)	0000	
	High-speed read setting (Note-1)	Used/Unused	Unused	
Input signal detection direction		Valid on leading edge (Normal open)/ Valid on trailing edge (Normal close)	Valid on leading edge (Normal open)	Set the detection direction of the mark detection signal (DI).

(Note-1): This cannot be set in SV22 advanced synchronous control.

(2) Application of input signal

There are two kinds of applications of the input and mark detection for the Q170MSCPU's internal I/F.

The same signal can be used simultaneously by the input and mark detection.

I/O setting	Input signal	Mark detection
Used	Usable as the real input device (PX)	Usable as the real input device (PX) or mark detection signal (DI)
Unused	Unusable	Usable as the mark detection signal (DI)

(3) High-speed reading of specified data

This function is used to store the specified positioning data in the specified device (D, W, U□\G). The signal from input module controlled in the Motion CPU area is used as a trigger.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller Programming Manual (COMMON)" for the high-speed reading of specified data.

(a) Modules and signals to be used

Input module	Signal	Read timing	Number of settable points
Q173DPX	TREN	0.8[ms]	3
Internal I/F	PX device (Note-2)		4
PLC input module (Note-1)			8

(Note-1): Only one PLC input module can be used.

(Note-2): Either of the input signal of internal I/F (DI) and PLC input module can be used.

(4) Mark detection function

Any motion control data and all device data can be latched at the input timing of the mark detection signal. Also, data within a specific range can be latched by specifying the data detection range.

Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller Programming Manual (COMMON)" for the mark detection function.

(a) Mark detection signal

Set the input signal for mark detection.

1) Module input signal

a) Q170MSCPU's internal I/F

Input module	Signal	Signal No.	Detection accuracy [μs]	Signal detection direction (Leading edge/Trailing edge)
Q170MSCPU's internal I/F	DI	1 to 4	30	Set direction in the "Q170MS I/O Setting" of System Settings.

2) Bit device

Bit device	Setting range	Detection accuracy [μs]	Signal detection direction (Leading edge/Trailing edge)
X(PX)	0 to 1FFF (Note-1)	• Operation cycle 222[μs] : 222 • Operation cycle 444[μs] or more : 444	Set direction in the mark detection signal detection direction.
Y(PY)	0 to 1FFF		
M	0 to 8191 (Note-2)		
B	0 to 1FFF		
SM	0 to 1999		
U□\G	10000.0 to (10000+p-1).F (Note-3)		

(Note-1): The range of "PXn+4 to PXn+F" cannot be used (fixed at 0) for the input device (PXn+0 to PXn+F) allocated to the built-in interface in Motion CPU (DI). (n: First input No.)

(Note-2): The range of M0 to M12287 is valid in the SV22 advanced synchronous control.

(Note-3): "p" indicates the user setting area points of the Multiple CPU high speed transmission area for each CPU.

APPENDIX 2 Creation of Project

There are following methods to create the Q170MSCPU project.

(1) Create the new project.
(2) Convert the project for Q170MCPU/Q17□D(S)CPU/ Q17□HCPU(-T)/Q17□CPUN(-T)/Q17□CPU.
(3) Create the new project using the sample data.

Refer to the help of MT Developer2 for creation method of project.

The contents to create the project using the sample data describes in APPENDIX 2.1.

APPENDIX 2.1 Sample data

An easy setting can be achieved for the parameter setting such as the automatic refresh setting of Multiple CPU setting and I/O assignment setting by using the sample data.
Creation of project using the sample data is suitable for the machine control in the sequence program.
The sample data have two types (Motion CPU area, PLC CPU area).

(1) Overview

(a) Multiple CPU setting
An easy setting can be achieved for the automatic refresh setting of positioning dedicated signal between the PLC CPU area and Motion CPU area.

(b) I/O assignment setting
The main base of eight slots or equivalent is built into the Q170MSCPU.
All points of "empty slot" not used on the main base are set to "0" point by the sample data.

(c) Device comment
The name of positioning dedicated signal can be used as the device comment of the sequence program.

(2) How to use

The following methods to use the sample data are shown below.
• Divert the sample data.
• Overwrite the sample data to the created project.

(3) Setting description

Outline of overwrite sample data is shown table below.
Add the extension base units and each module according to the system.
Refer to this section (7) for details of the sample data.

CPU area	Item	Description	Programming software package	Project name
Motion CPU area	Base setting	• Extension base Stage1 to Stage 7	MT Developer2	SV13: Q170MS_SV13_MT2 SV22: Q170MS_SV22_MT2 (Note-1) Q170MS_SV22_AD_MT2 (Note-2)
	Multiple CPU setting	• Multiple CPU high speed transmission area setting • Automatic refresh setting of CPU No.1, 2		
PLC CPU area	I/O assignment	• Base setting No. of slots for the base unit used • I/O assignment Unit types, I/O points, I/O number • Base mode setting	GX Works2	SV13: Q170MS_SV13_GX2 SV22: Q170MS_SV22_GX2 (Note-1) Q170MS_SV22_AD_GX2 (Note-2)
	PLC system	Points occupied by empty slot		
	Multiple CPU settings	• No. of PLC • Multiple CPU high speed transmission area setting • Auto refresh setting of CPU No.1, 2		
	Device comment	Set the name of positioning dedicated signal to the comment of device.		

(Note-1): Project for virtual mode switching method.
(Note-2): Project for advanced synchronous control method.

(4) Precautions

(a) By using the sample data, the positioning dedicated signals of the Motion CPU area are changed to the device value of PLC CPU area by the automatic refresh. It needs to set again the automatic refresh setting after rewriting the sample data to transmit the data to the positioning dedicated signal using the Motion SFC program.

(b) The existing data are overwritten and erased by diverting the sample data to the created project.

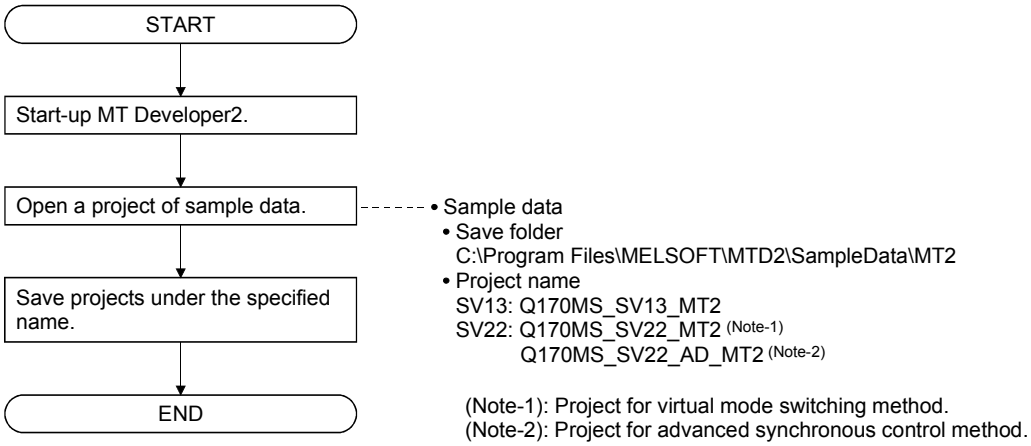
(c) The project PLC type used in the PLC CPU area is "Q03UD".
When using sample data for Q170MSCPU-S1, the PLC type needs to be changed to "Q06UDH" in the change PLC type of GX Works2.

(d) Sample data is only for workspace format project. There is no single file format project.

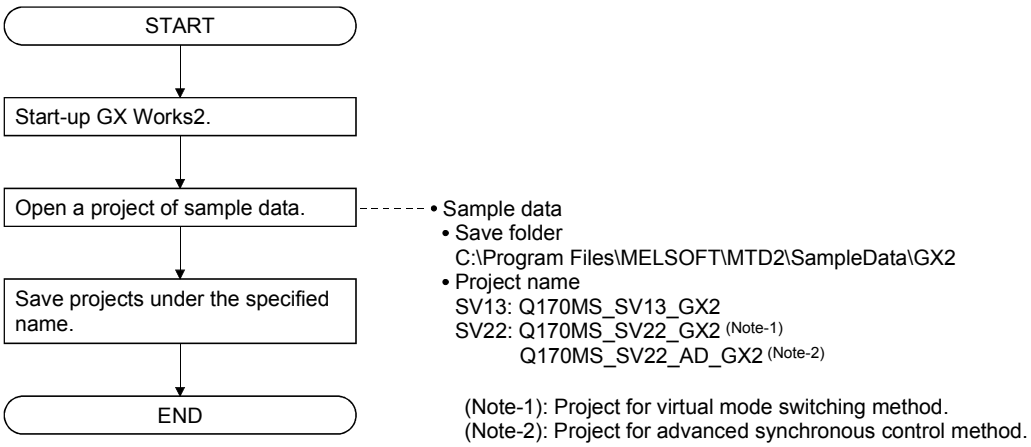
(5) Procedure for project creation

(a) When the sample data is diverted.

1) Motion CPU area

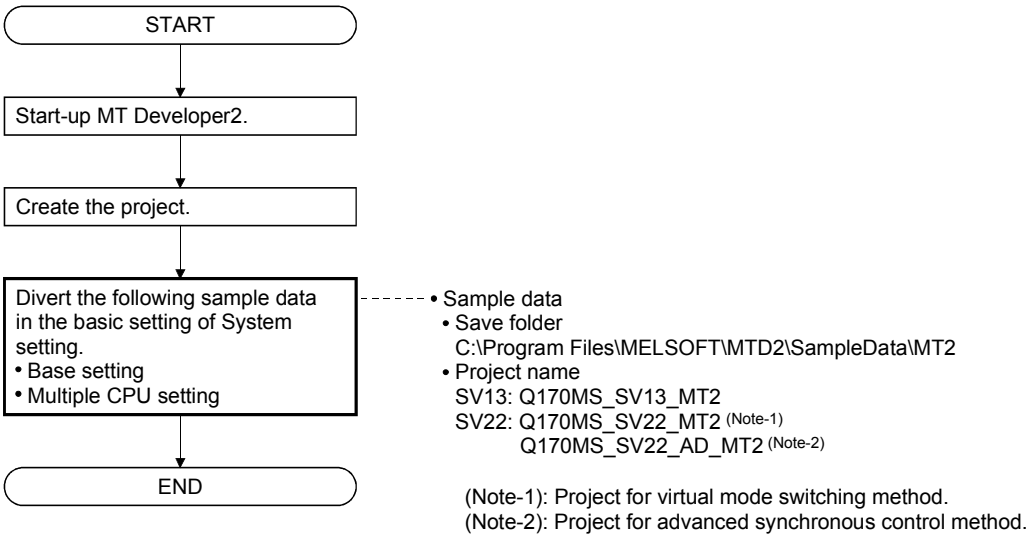


2) PLC CPU area

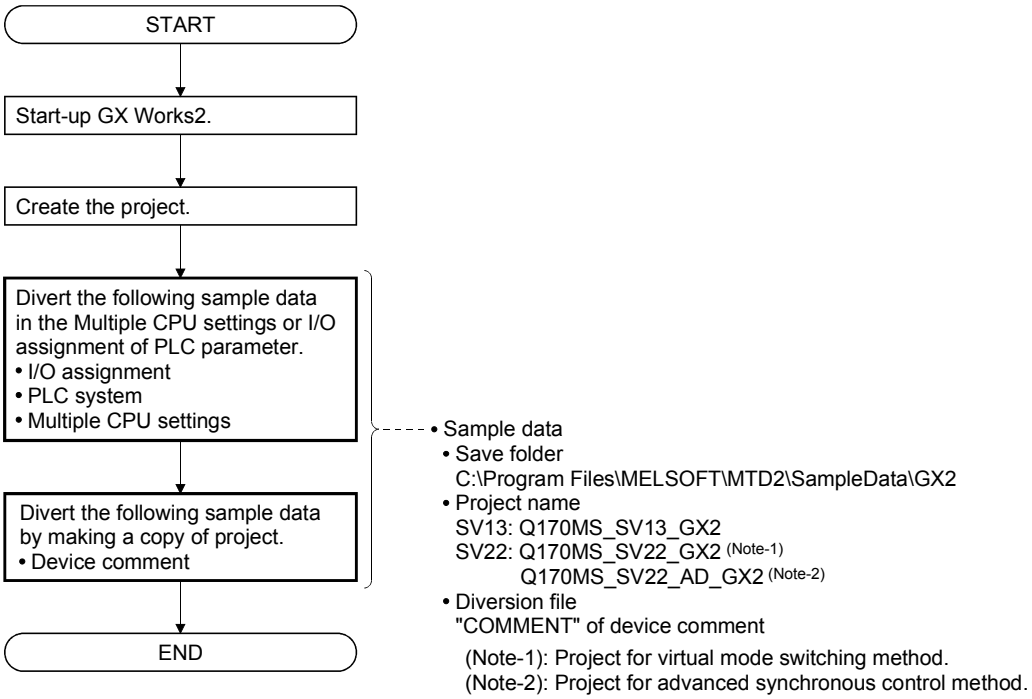


(b) When the sample data is overwritten to the created project.

1) Motion CPU area



2) PLC CPU area



POINT
The existing data are overwritten and erased by diverting the sample data to the created project.

(6) Operation procedure for sample data

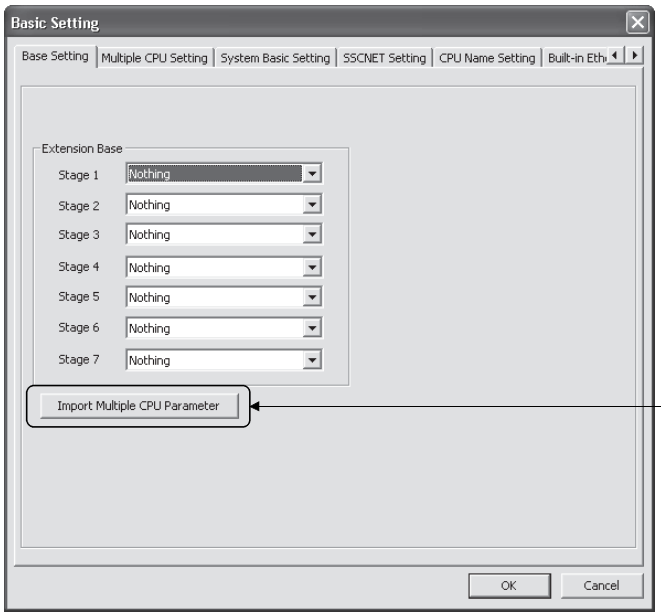
Refer to the help of MT Developer2 for details.

(a) Motion CPU area (MT Developer2)

1) Multiple CPU setting

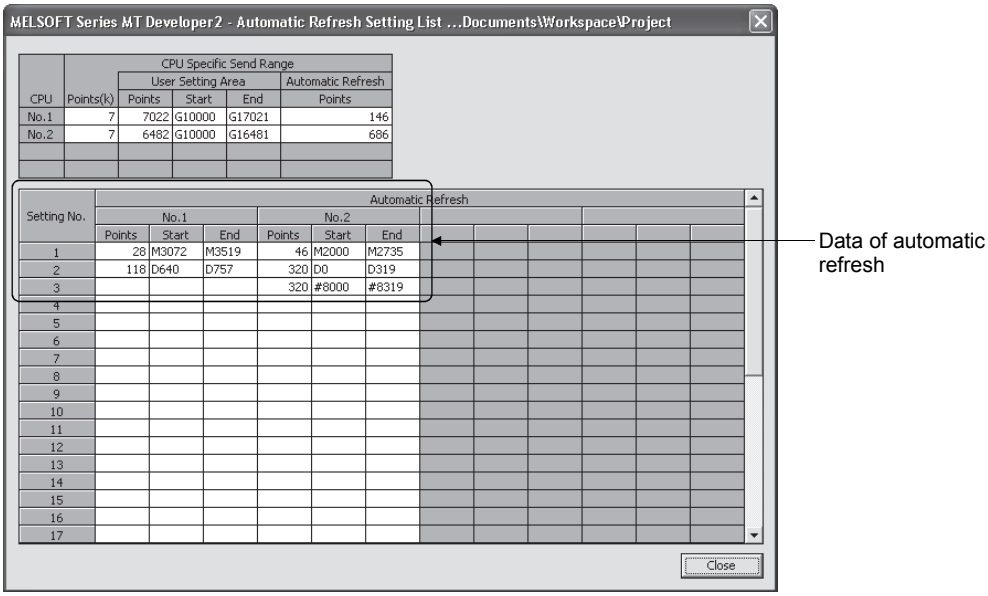
a) Diversion of sample data

Divert the sample data by selecting the [Import Multiple CPU Parameter] button of the base setting or Multiple CPU setting of the basic setting of system setting.



b) Confirm the sample data

Compare the Automatic Refresh Setting List screen with the contents of this section (7), and then confirm the sample data are diverted correctly.

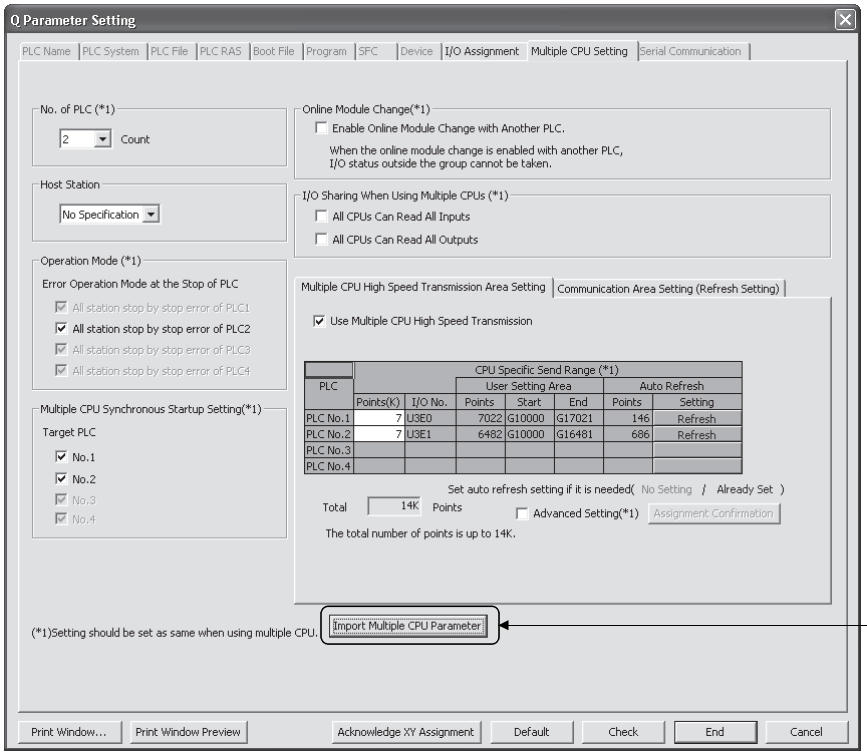


(b) PLC CPU area (GX Works2)

1) Multiple CPU settings / I/O assignment

a) Diversion of sample data

Divert the sample data by selecting the [Import Multiple CPU Parameter] button of the Multiple CPU settings or I/O assignment of the PLC parameter setting.

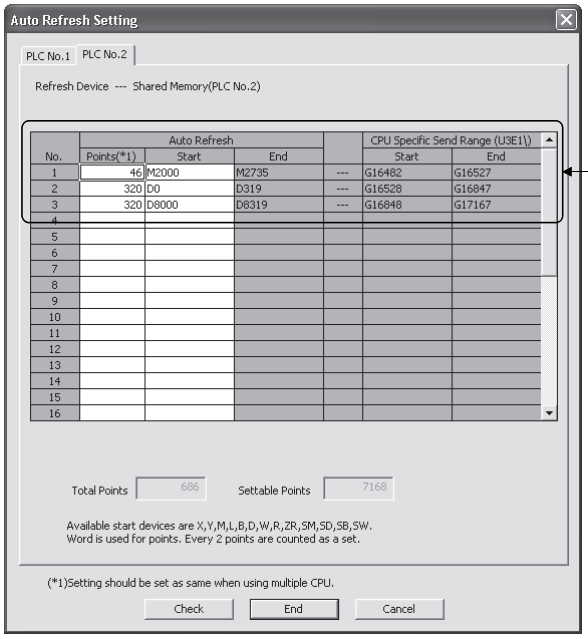


Select the [Import Multiple CPU Parameter] button

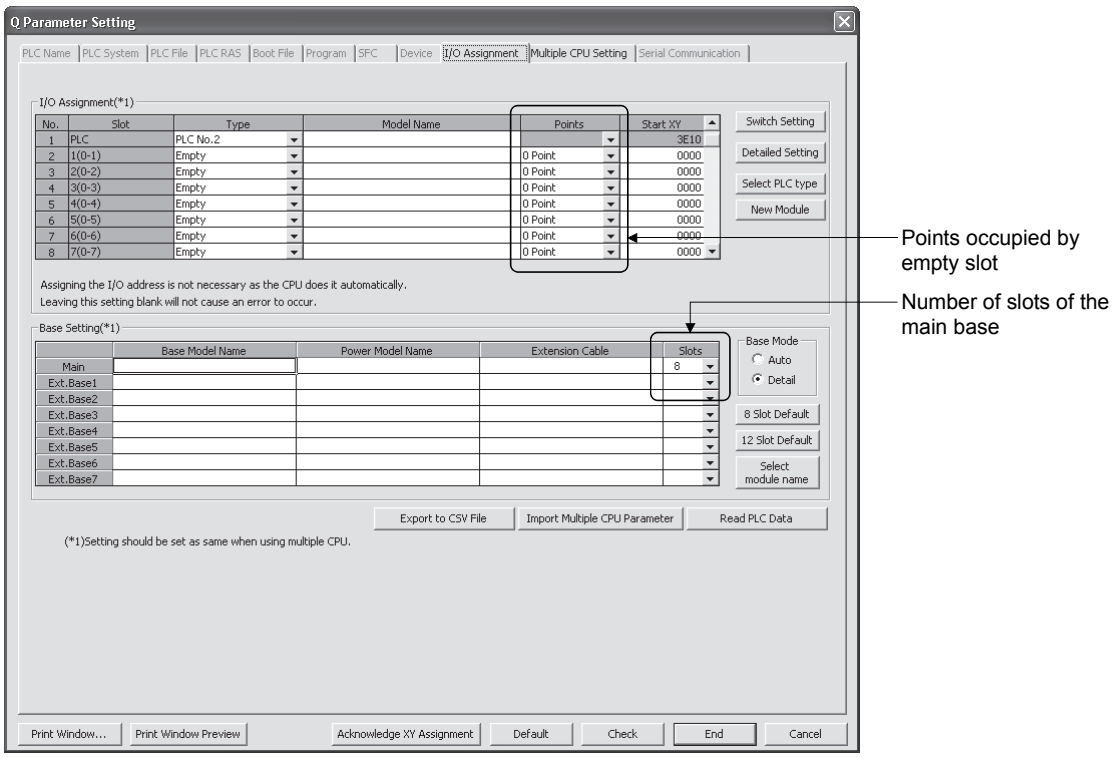
b) Confirm the sample data

Compare the Auto refresh settings screen with the contents of this section (7), and then confirm the sample data are diverted correctly.

• Multiple CPU settings



• I/O assignment



2) Device comment

The device comment data is allocated in the Multiple CPU high speed transmission area setting for the positioning dedicated signal.

The device can be used while confirming the comment to execute the control for the Motion CPU area in the PLC CPU area.

a) Diversion of device comment

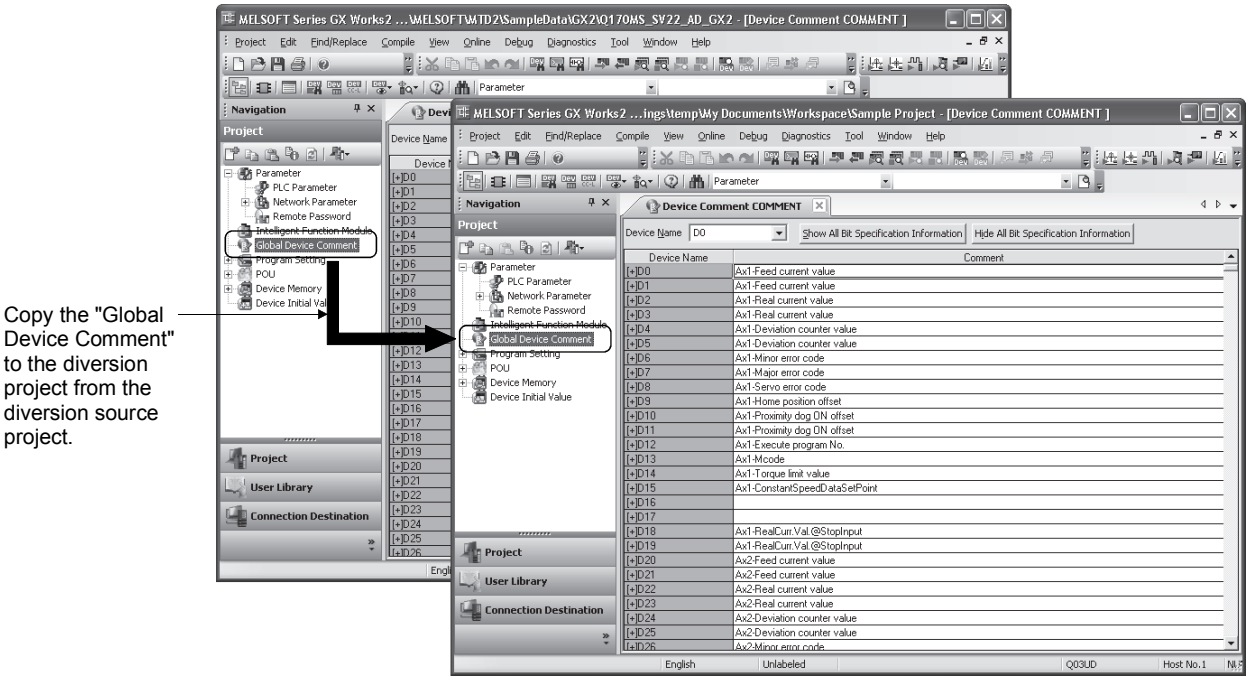
After opening the diversion source project (Sample data) and the diversion project, execute the following steps.

1.Operation of the diversion source project (Sample data) (Copy)

Select the "Global Device Comment" in the project view and then [Project] – [Object] – [Copy] of menu bar.

2.Operation of the diversion project (Paste)

Select the "Global Device Comment" in the project view and then "[Project] – [Object] – [Paste]" of menu bar.



(7) Description of sample data

(a) Motion CPU area

1) SV13 (Q170MS_SV13_MT2)

a) Base setting

Setting items		Description
Extension base	Stage 1	Nothing
	Stage 2	Nothing
	Stage 3	Nothing
	Stage 4	Nothing
	Stage 5	Nothing
	Stage 6	Nothing
	Stage 7	Nothing

b) Multiple CPU setting

Setting items	Description
Operating mode	All station stop by stop error of CPU 1/2
Multiple CPU synchronous startup setting	Set CPU No. 1/2 to synchronous startup

c) Multiple CPU high speed transmission area setting

CPU	CPU specific send range				
	Points (k)	User setting area			Automatic refresh
		Points	Start	End	Points
No.1	7	7022	G10000	G17021	146
No.2	7	6482	G10000	G16481	686

d) Automatic refresh setting

• CPU No.1 (Receive)

Setting No.	Automatic refresh				CPU specific send range(U3E0\)	
	Points	Start	End		Start	End
1	28	M3072	M3519	←	G17022	G17049
2	118	D640	D757	←	G17050	G17167

• CPU No.2 (Send)

Setting No.	Automatic refresh				CPU specific send range(U3E1\)	
	Points	Start	End		Start	End
1	46	M2000	M2735	→	G16482	G16527
2	320	D0	D319	→	G16528	G16847
3	320	#8000	#8319	→	G16848	G17167

2) SV22 (Q170MS_SV22_MT2) (Project for virtual mode switching method)

a) Base setting

Setting items		Description
Extension base	Stage 1	Nothing
	Stage 2	Nothing
	Stage 3	Nothing
	Stage 4	Nothing
	Stage 5	Nothing
	Stage 6	Nothing
	Stage 7	Nothing

b) Multiple CPU setting

Setting items	Description
Operating mode	All station stop by stop error of CPU 1/2
Multiple CPU synchronous startup setting	Set CPU No. 1/2 to synchronous startup

c) Multiple CPU high speed transmission area setting

CPU	CPU specific send range				
	Points (k)	User setting area			Automatic refresh
		Points	Start	End	Points
No.1	7	6978	G10000	G16977	190
No.2	7	5838	G10000	G15837	1330

d) Automatic refresh setting

• CPU No.1 (Receive)

Setting No.	Automatic refresh				CPU specific send range(U3E0\)	
	Points	Start	End		Start	End
1	28	M3072	M3519	←	G16978	G17005
2	44	M4800	M5503	←	G17006	G17049
3	118	D640	D757	←	G17050	G17167

• CPU No.2 (Send)

Setting No.	Automatic refresh				CPU specific send range(U3E1\)	
	Points	Start	End		Start	End
1	46	M2000	M2735	→	G15838	G15883
2	44	M4000	M4703	→	G15884	G15927
3	320	D0	D319	→	G15928	G16247
4	600	D800	D1399	→	G16248	G16847
5	320	#8000	#8319	→	G16848	G17167

3) SV22 (Q170MS_SV22_AD_MT2) (Project for advanced synchronous control method)

a) Base setting

Setting items		Description
Extension base	Stage 1	Nothing
	Stage 2	Nothing
	Stage 3	Nothing
	Stage 4	Nothing
	Stage 5	Nothing
	Stage 6	Nothing
	Stage 7	Nothing

b) Multiple CPU setting

Setting items	Description
Operating mode	All station stop by stop error of CPU 1/2
Multiple CPU synchronous startup setting	Set CPU No. 1/2 to synchronous startup

c) Multiple CPU high speed transmission area setting

CPU	CPU specific send range				
	Points (k)	User setting area			Automatic refresh
		Points	Start	End	Points
No.1	7	7022	G10000	G17021	146
No.2	7	6482	G10000	G16481	686

d) Automatic refresh setting

• CPU No.1 (Receive)

Setting No.	Automatic refresh				CPU specific send range(U3E0\)	
	Points	Start	End		Start	End
1	28	M3072	M3519	←	G17022	G17049
2	118	D640	D757	←	G17050	G17167

• CPU No.2 (Send)

Setting No.	Automatic refresh				CPU specific send range(U3E1\)	
	Points	Start	End		Start	End
1	46	M2000	M2735	→	G16482	G16527
2	320	D0	D319	→	G16528	G16847
3	320	#8000	#8319	→	G16848	G17167

(b) PLC CPU area

1) SV13 (Q170MS_SV13_GX2)

When using Q170MSCPU-S1, change the PLC type to "Q06UDH" in the change PLC type of GX Works2.

a) I/O assignment

• I/O assignment

Setting items		Description								
Slot		PLC	PLC	1	2	3	4	5	6	7
Type		PLC No.1	PLC No.2	Empty	Empty	Empty	Empty	Empty	Empty	Empty
Points				0 point	0 point	0 point	0 point	0 point	0 point	0 point
Start XY		3E00	3E10	0000	0000	0000	0000	0000	0000	0000
Switch setting	Switch 1			—	—	—	—	—	—	—
	Switch 2			—	—	—	—	—	—	—
	Switch 3			—	—	—	—	—	—	—
	Switch 4			—	—	—	—	—	—	—
	Switch 5			—	—	—	—	—	—	—
Detailed setting	Error time output mode	—	—	—	—	—	—	—	—	—
	Hardware error time PLC operation mode	—	—	—	—	—	—	—	—	—
	I/O response time	—	—	—	—	—	—	—	—	—
	Control PLC	—	—	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1

• Base setting

Setting items	Description
Slots (Main)	8
Base mode	Detail

b) Multiple CPU settings

	Setting items	Description
1	No. of PLC	2 modules
2	Host CPU number	No specification
3	Operating mode	All station stop by stop error of PLC1/PLC2
4	Multiple CPU synchronous startup setting	"PLC No.1", "PLC No.2" checked
5	Online module change	"Enable online module change with another PLC" not checked
6	Input sharing when using Multiple CPUs	"All CPUs can read all inputs" not checked
7	Output sharing when using Multiple CPUs	"All CPUs can read all outputs" not checked
8	Multiple CPU high speed transmission area setting	Use multiple CPU high speed communication

PLC	CPU specific send range					
			User setting area			Auto refresh
	point (k)	I/O No.	point	Start	End	point
No.1	7	U3E0	7022	G10000	G17021	146
No.2	7	U3E1	6482	G10000	G16481	686

c) Auto refresh settings

• PLC No.1

No.	Auto refresh				CPU specific send range(U3E0\)	
	Point	Start	End		Start	End
1	28	M3072	M3519	—	G17022	G17049
2	118	D640	D757	—	G17050	G17167

• PLC No.2

No.	Auto refresh				CPU specific send range(U3E1\)	
	Point	Start	End		Start	End
1	46	M2000	M2735	—	G16482	G16527
2	320	D0	D319	—	G16528	G16847
3	320	D8000	D8319	—	G16848	G17167

d) PLC system setting

Only "Points occupied by empty slot" is overwritten at the sample data diversion. The content before sample data diversion are retained without rewriting for the other data.

Setting items			Description
1	Timer limit setting	Low speed	100ms
		High speed	10.00ms
2	RUN-PAUSE contacts	RUN	Not used
		PAUSE	Not used
3	Latch data backup operation valid contact		Not used
4	Remote reset		"Allow" not checked
5	Output mode at STOP to RUN		"Previous state" checked
6	Floating point arithmetic processing		—
7	Intelligent function module setting		Not used
8	Module synchronization		"Synchronize intelligent module's pulse up" checked
9	Common pointer No.		Not used
10	Points occupied by empty slot		16 points
11	System interrupt settings	Interrupt counter start No.	—
		I28 Fixed scan interval	100.0ms
		I29 Fixed scan interval	40.0ms
		I30 Fixed scan interval	20.0ms
		I31 Fixed scan interval	10.0ms
12	Interrupt program / Fixed scan program setting		"High speed execution" not checked
13	A-PLC		Not checked
14	Service processing setting	Scan time rate	10%
15	CPU module change setting		Not used

2) SV22 (Q170MS_SV22_GX2) (Project for virtual mode switching method)
When using Q170MSCPU-S1, change the PLC type to "Q06UDH" in the change PLC type of GX Works2.

a) I/O assignment

• I/O assignment

Setting items		Description								
Slot		PLC	PLC	1	2	3	4	5	6	7
Type		PLC No.1	PLC No.2	Empty	Empty	Empty	Empty	Empty	Empty	Empty
Points				0 point	0 point	0 point	0 point	0 point	0 point	0 point
Start XY		3E00	3E10	0000	0000	0000	0000	0000	0000	0000
Switch setting	Switch 1			—	—	—	—	—	—	—
	Switch 2			—	—	—	—	—	—	—
	Switch 3			—	—	—	—	—	—	—
	Switch 4			—	—	—	—	—	—	—
	Switch 5			—	—	—	—	—	—	—
Detailed setting	Error time output mode	—	—	—	—	—	—	—	—	—
	Hardware error time PLC operation mode	—	—	—	—	—	—	—	—	—
	I/O response time	—	—	—	—	—	—	—	—	—
	Control PLC	—	—	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1

• Base setting

Setting items	Description
Slots (Main)	8
Base mode	Detail

b) Multiple CPU setting

	Setting items	Description
1	No. of PLC	2 modules
2	Host CPU number	No specification
3	Operating mode	All station stop by stop error of PLC1/PLC2
4	Multiple CPU synchronous startup setting	"PLC No.1", "PLC No.2" checked
5	Online module change	"Enable online module change with another PLC" not checked
6	Input sharing when using Multiple CPUs	"All CPUs can read all inputs" not checked
7	Output sharing when using Multiple CPUs	"All CPUs can read all outputs" not checked
8	Multiple CPU high speed transmission area setting	Use multiple CPU high speed communication

PLC	CPU specific send range					
			User setting area			Auto refresh
	point (k)	I/O No.	point	Start	End	point
No.1	7	U3E0	6978	G10000	G16977	190
No.2	7	U3E1	5838	G10000	G15837	1330

c) Auto refresh settings

• PLC No.1

No.	Auto refresh				CPU specific send range(U3E0\)	
	Point	Start	End		Start	End
1	28	M3072	M3519	—	G16978	G17005
2	44	M4800	M5503	—	G17006	G17049
3	118	D640	D757	—	G17050	G17167

• PLC No.2

No.	Auto refresh				CPU specific send range(U3E1\)	
	Point	Start	End		Start	End
1	46	M2000	M2735	—	G15838	G15883
2	44	M4000	M4703	—	G15884	G15927
3	320	D0	D319	—	G15928	G16247
4	600	D800	D1399	—	G16248	G16847
5	320	D8000	D8319	—	G16848	G17167

d) PLC system

Only "Points occupied by empty slot" is overwritten at the sample data diversion. The content before sample data diversion are retained without rewriting for the other data.

Setting items			Description
1	Timer limit setting	Low speed	100ms
		High speed	10.00ms
2	RUN-PAUSE contacts	RUN	Not used
		PAUSE	Not used
3	Latch data backup operation valid contact		Not used
4	Remote reset		"Allow" not checked
5	Output mode at STOP to RUN		"Previous state" checked
6	Floating point arithmetic processing		—
7	Intelligent function module setting		Not used
8	Module synchronization		"Synchronize intelligent module's pulse up" checked
9	Common pointer No.		Not used
10	Points occupied by empty slot		16 points
11	System interrupt settings	Interrupt counter start No.	—
		I28 Fixed scan interval	100.0ms
		I29 Fixed scan interval	40.0ms
		I30 Fixed scan interval	20.0ms
		I31 Fixed scan interval	10.0ms
12	Interrupt program / Fixed scan program setting		"High speed execution" not checked
13	A-PLC		Not checked
14	Service processing setting	Scan time rate	10%
15	CPU module change setting		Not used

3) SV22 (Q170MS_SV22_AD_GX2) (Project for advanced synchronous control method)
When using Q170MSCPU-S1, change the PLC type to "Q06UDH" in the change PLC type of GX Works2.

a) I/O assignment

• I/O assignment

Setting items		Description								
Slot		PLC	PLC	1	2	3	4	5	6	7
Type		PLC No.1	PLC No.2	Empty	Empty	Empty	Empty	Empty	Empty	Empty
Points				0 point	0 point	0 point	0 point	0 point	0 point	0 point
Start XY		3E00	3E10	0000	0000	0000	0000	0000	0000	0000
Switch setting	Switch 1			—	—	—	—	—	—	—
	Switch 2			—	—	—	—	—	—	—
	Switch 3			—	—	—	—	—	—	—
	Switch 4			—	—	—	—	—	—	—
	Switch 5			—	—	—	—	—	—	—
Detailed setting	Error time output mode	—	—	—	—	—	—	—	—	—
	Hardware error time PLC operation mode	—	—	—	—	—	—	—	—	—
	I/O response time	—	—	—	—	—	—	—	—	—
	Control PLC	—	—	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1	PLC No.1

• Base setting

Setting items	Description
Slots (Main)	8
Base mode	Detail

b) Multiple CPU settings

	Setting items	Description
1	No. of PLC	2 modules
2	Host CPU number	No specification
3	Operating mode	All station stop by stop error of PLC1/PLC2
4	Multiple CPU synchronous startup setting	"PLC No.1", "PLC No.2" checked
5	Online module change	"Enable online module change with another PLC" not checked
6	Input sharing when using Multiple CPUs	"All CPUs can read all inputs" not checked
7	Output sharing when using Multiple CPUs	"All CPUs can read all outputs" not checked
8	Multiple CPU high speed transmission area setting	Use multiple CPU high speed communication

PLC	CPU specific send range					
			User setting area			Auto refresh
	point (k)	I/O No.	point	Start	End	point
No.1	7	U3E0	7022	G10000	G17021	146
No.2	7	U3E1	6482	G10000	G16481	686

c) Auto refresh settings

• PLC No.1

No.	Auto refresh				CPU specific send range(U3E0\)	
	Point	Start	End		Start	End
1	28	M3072	M3519	—	G17022	G17049
2	118	D640	D757	—	G17050	G17167

• PLC No.2

No.	Auto refresh				CPU specific send range(U3E1\)	
	Point	Start	End		Start	End
1	46	M2000	M2735	—	G16482	G16527
2	320	D0	D319	—	G16528	G16847
3	320	D8000	D8319	—	G16848	G17167

d) PLC system setting

Only "Points occupied by empty slot" is overwritten at the sample data diversion. The content before sample data diversion are retained without rewriting for the other data.

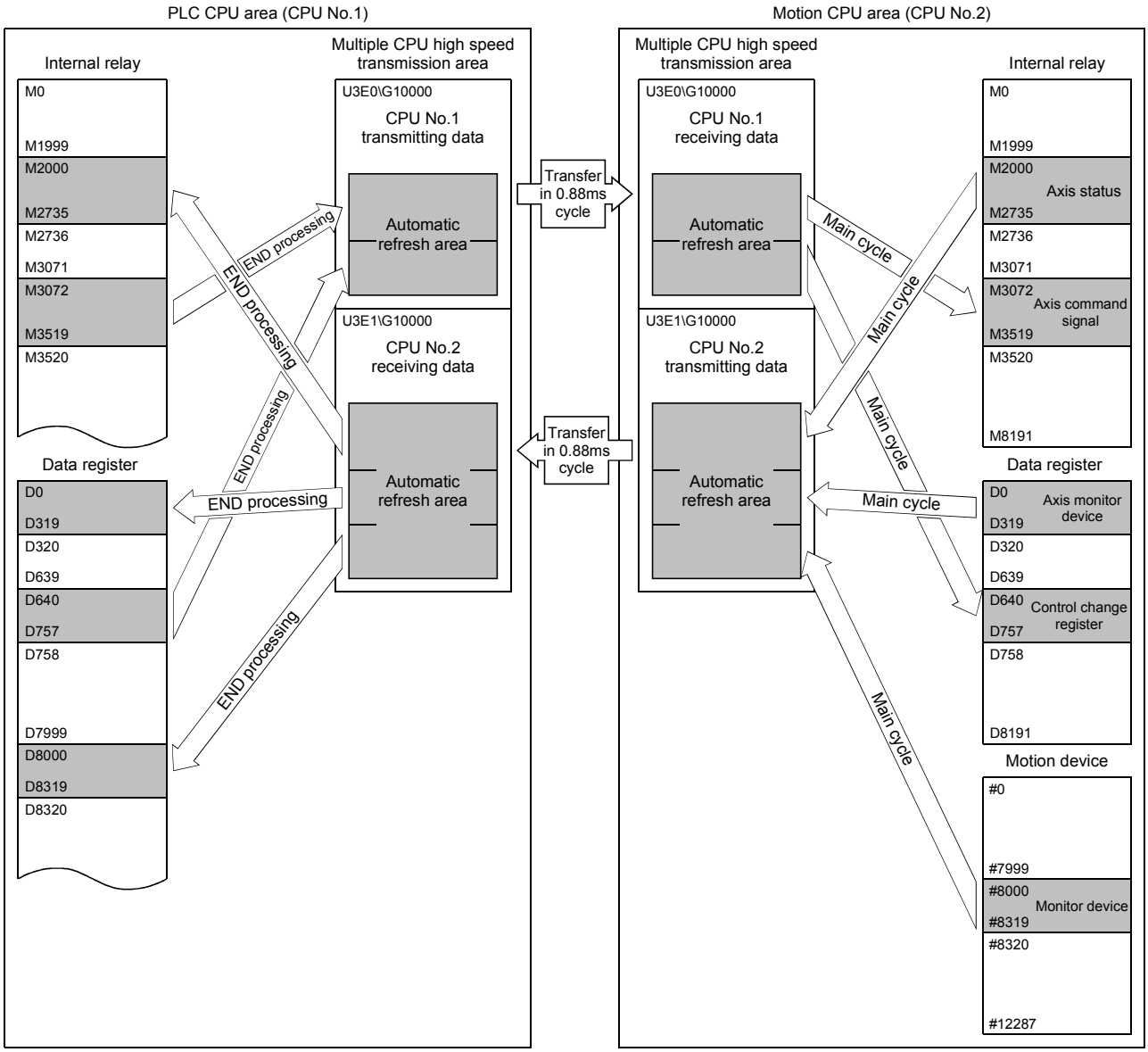
Setting items			Description
1	Timer limit setting	Low speed	100ms
		High speed	10.00ms
2	RUN-PAUSE contacts	RUN	Not used
		PAUSE	Not used
3	Latch data backup operation valid contact		Not used
4	Remote reset		"Allow" not checked
5	Output mode at STOP to RUN		"Previous state" checked
6	Floating point arithmetic processing		—
7	Intelligent function module setting		Not used
8	Module synchronization		"Synchronize intelligent module's pulse up" checked
9	Common pointer No.		Not used
10	Points occupied by empty slot		16 points
11	System interrupt settings	Interrupt counter start No.	—
		I28 Fixed scan interval	100.0ms
		I29 Fixed scan interval	40.0ms
		I30 Fixed scan interval	20.0ms
		I31 Fixed scan interval	10.0ms
12	Interrupt program / Fixed scan program setting		"High speed execution" not checked
13	A-PLC		Not checked
14	Service processing setting	Scan time rate	10%
15	CPU module change setting		Not used

(8) Automatic refresh of sample data

The data to the internal relay and data register of PLC CPU area are transmitted to the positioning dedicated signals of Motion CPU area via the Multiple CPU high speed transmission area.
The positioning dedicated signals of Motion CPU area can be controlled by only control of the sequence program of PLC CPU area.
And, add the special relays, special registers and user devices to the parameters of automatic refresh if required.

The flow for the data of automatic refresh that uses the sample data is shown below.

(Example) SV13 use



APPENDIX 3 Processing Times

The operation processing times are the same as Q172DSCPU for each operation control and transition instruction, and Motion dedicated PLC instruction.
Refer to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller (SV13/SV22) Programming Manual (Motion SFC)" for processing times.

APPENDIX 4 Cables

In this cable connection diagram, maker names of connectors are omitted. Refer to "APPENDIX 5.6 Connector" for maker names of connectors.

APPENDIX 4.1 SSCNETⅢ cables

Generally use the SSCNETⅢ cables available as our products.
Refer to APPENDIX 4.5 for long distance cable up to 100(328.08)[m(ft.)] and ultra-long bending life cable.

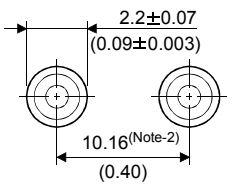
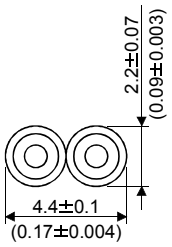
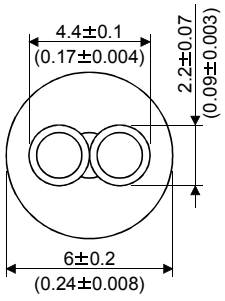
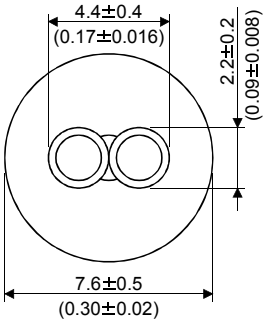
(1) Model explanation

Numeral in the column of cable length on the table is a symbol put in the "□" part of cable model. Cables of which symbol exists are available.

Cable model	Cable length [m(ft.)]											Flex life	Application/ remark
	0.15 (0.49)	0.3 (0.98)	0.5 (1.64)	1 (3.28)	3 (9.84)	5 (16.40)	10 (32.81)	20 (65.62)	30 (98.43)	40 (131.23)	50 (164.04)		
MR-J3BUS□M	015	03	05	1	3							Standard	Standard cord for inside panel
MR-J3BUS□M-A						5	10	20				Standard	Standard cable for outside panel
MR-J3BUS□M-B (Note-1)									30	40	50	Long flex	Long distance cable

(Note-1): For the cable of less than 30[m](98.43[ft.]), contact your nearest Mitsubishi sales representative.

(2) Specifications

		Description			
SSCNETⅢ cable model		MR-J3BUS□M		MR-J3BUS□M-A	MR-J3BUS□M-B
SSCNETⅢ cable length [m(ft.)]		0.15 (0.49)	0.3 to 3 (0.98 to 9.84)	5 to 20 (16.40 to 65.62)	30 to 50 (98.43 to 164.04)
Optical cable (Cord)	Minimum bend radius [mm(inch)]	25(0.98)		Enforced covering cord: 50 (1.97) Cord: 25 (0.98)	Enforced covering cord: 50 (1.97) Cord: 30(1.18)
	Tension strength [N]	70	140	420 (Enforced covering cord)	980 (Enforced covering cord)
	Temperature range for use [°C(°F)] (Note-1)	-40 to 80 (-40 to 176)			-20 to 70 (-4 to 158)
	Ambient	Indoors (no direct sunlight), No solvent or oil			
	External appearance [mm(inch)]				

(Note-1): This temperature range for use is the value for optical cable (cord) only.
(Note-2): Dimension of connector fiber insert location. The distance of two cords is changed by how to bend it.

POINTS

(1) If the end face of 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.
(2) Do not add impossible power to the connector of the SSCNETⅢ cable.
(3) When incinerating the SSCNETⅢ cable (optical fiber), hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of the SSCNETⅢ cable (optical fiber), request for specialized industrial waste disposal services who has incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

(a) MR-J3BUS□M

1) Model explanation

Type: MR-J3BUS□M-＊

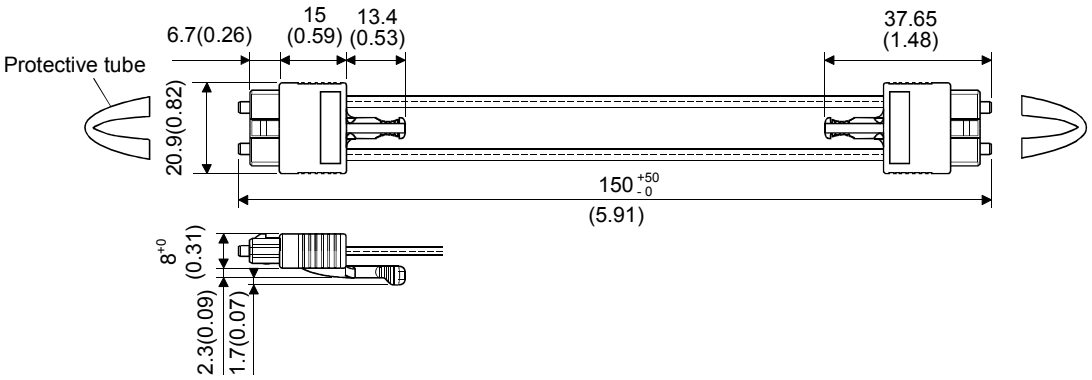
Symbol	Cable type
None	Standard cord for inside panel
A	Standard cable for outside panel
B	Long distance cable

Symbol	Cable length [m(ft.)]
015	0.15(0.49)
03	0.3(0.98)
05	0.5(1.64)
1	1(3.28)
3	3(9.84)
5	5(16.40)
10	10(32.81)
20	20(65.62)
30	30(98.43)
40	40(131.23)
50	50(164.04)

2) Exterior dimensions

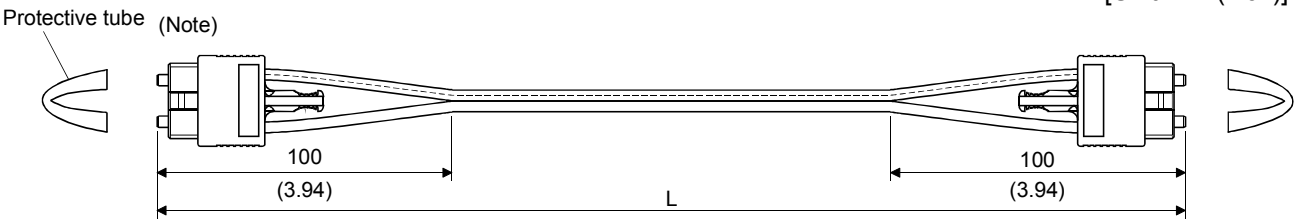
• MR-J3BUS015M

[Unit: mm(inch)]



• MR-J3BUS03M to MR-J3BUS3M
Refer to the table of this section (1) for cable length (L).

[Unit: mm(inch)]

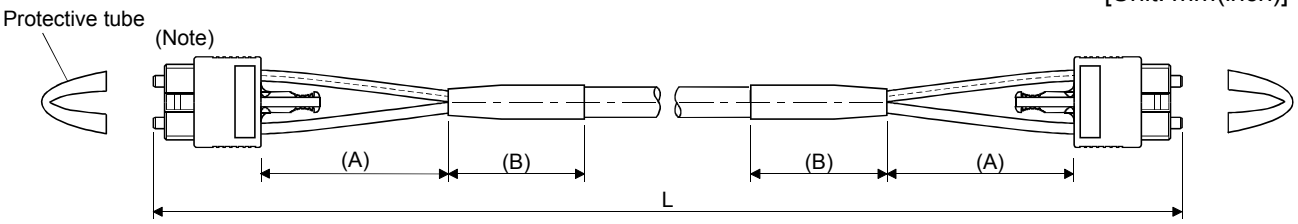


(Note): Dimension of connector part is the same as that of MR-J3BUS015M.

• MR-J3BUS5M-A to MR-J3BUS20M-A,MR-J3BUS30M-B to MR-J3BUS50M-B
Refer to the table of this section (1) for cable length (L).

SSCNETⅢ cable	Variation [mm(inch)]	
	A	B
MR-J3BUS5M-A to MR-J3BUS20M-A	100(3.94)	30(1.18)
MR-J3BUS30M-B to MR-J3BUS50M-B	150(5.91)	50(1.97)

[Unit: mm(inch)]



(Note): Dimension of connector part is the same as that of MR-J3BUS015M.

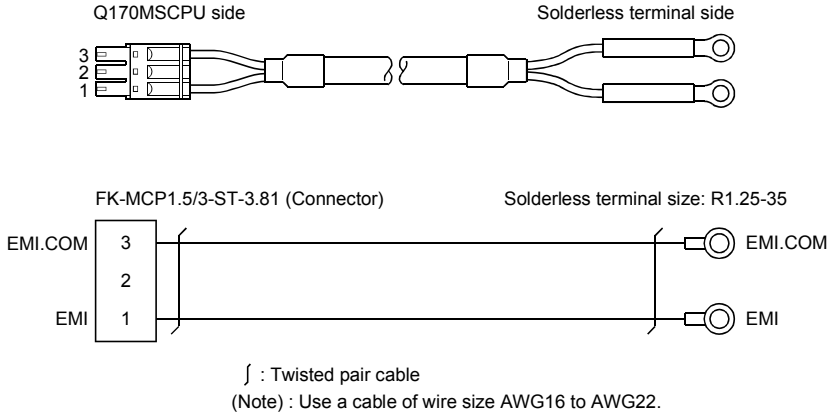
POINTS

Keep the cap and the tube for protecting light cord end of SSCNETⅢ cable in a plastic bag with a zipper of SSCNETⅢ cable to prevent them from becoming dirty.

APPENDIX 4.2 Forced stop input cable

Fabricate the forced stop input cable on the customer side.
Make the forced stop input cable within 30m(98.43ft.).

(1) Connection diagram

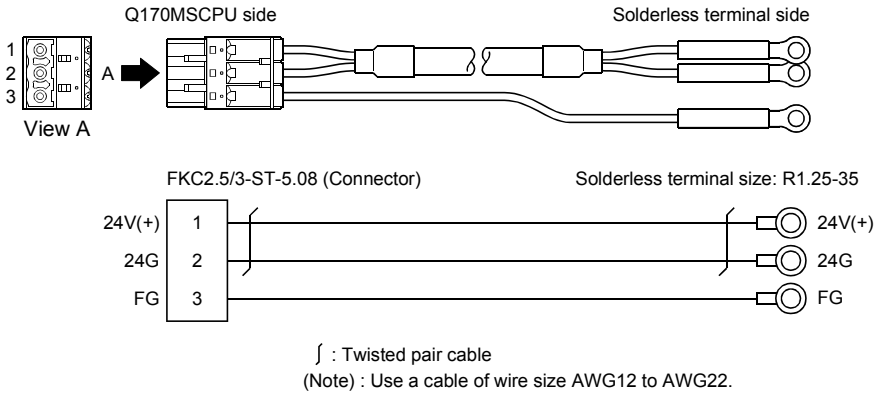


∫ : Twisted pair cable
(Note) : Use a cable of wire size AWG16 to AWG22.

APPENDIX 4.3 24VDC power supply cable

Fabricate the forced stop input cable on the customer side.

(1) Connection diagram



∫ : Twisted pair cable
(Note) : Use a cable of wire size AWG12 to AWG22.

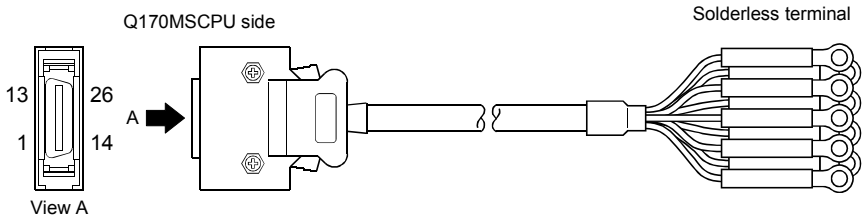
APPENDIX 4.4 Internal I/F connector cable

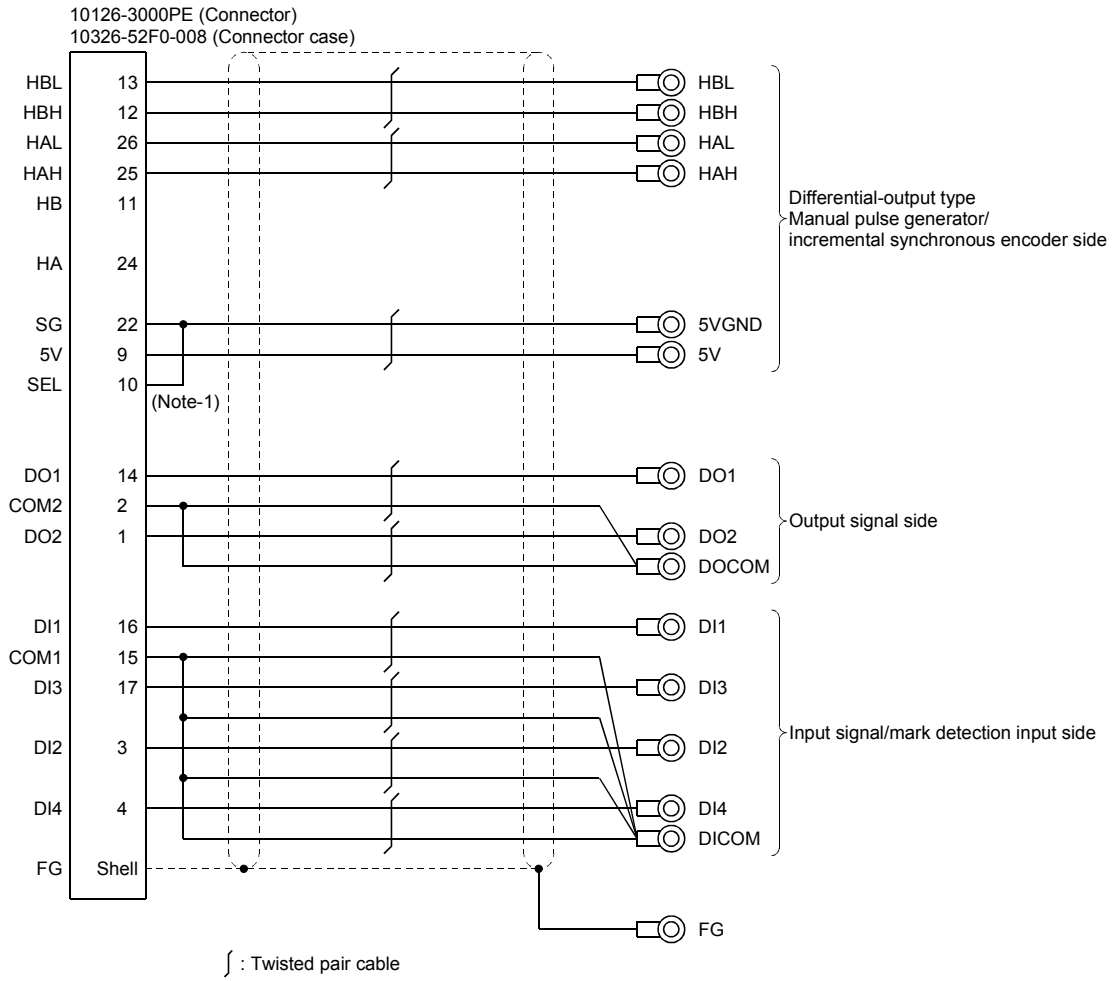
Fabricate the Q170MSCPU's internal I/F connector cable on the customer side.

(1) Differential-output type

(a) Connection diagram

Make the cable within 30m(98.43ft.).





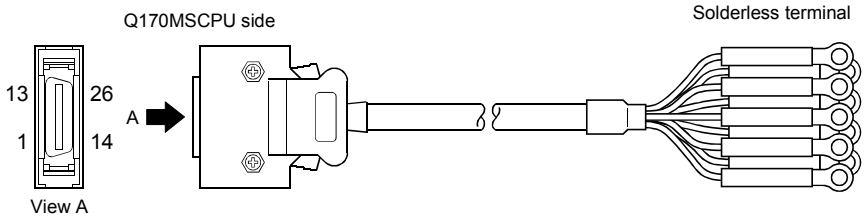
∫ : Twisted pair cable

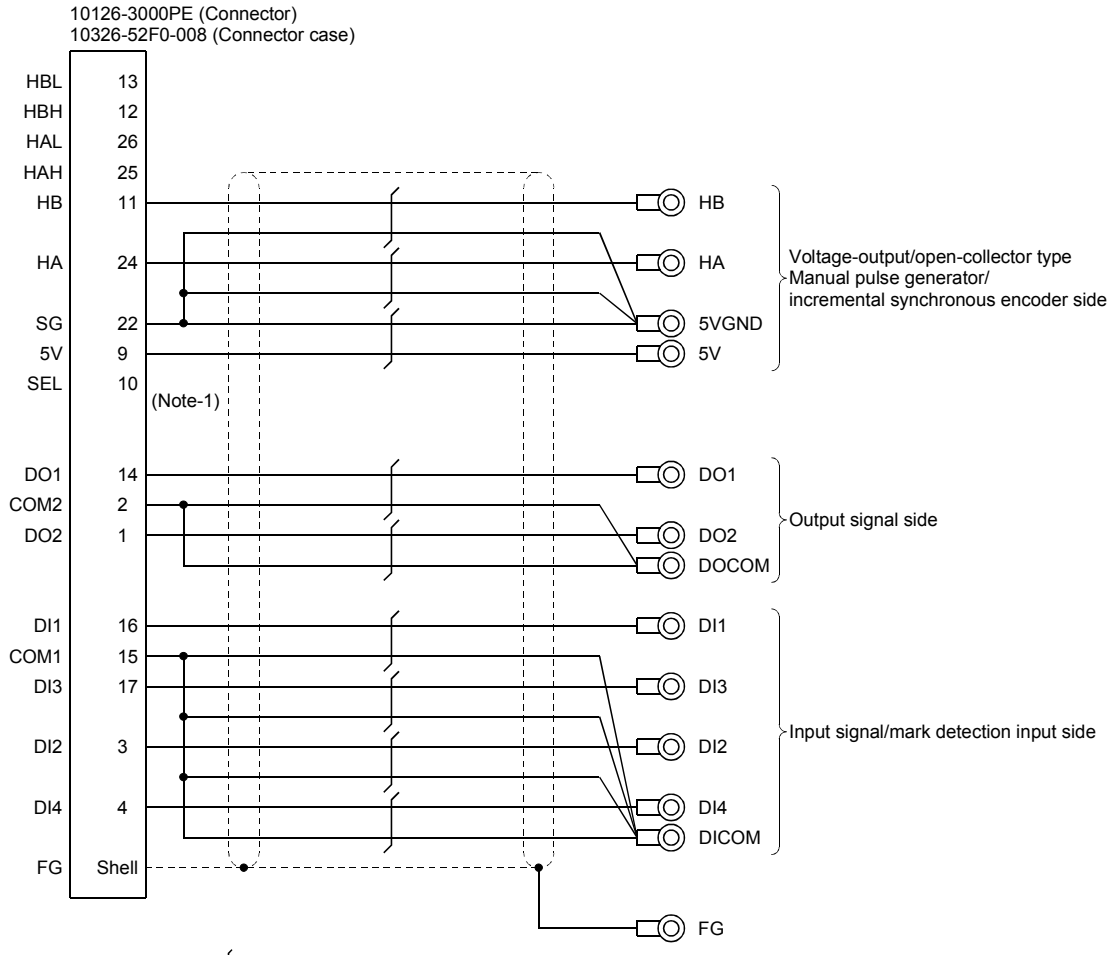
(Note-1): Connect SEL to the SG terminal if differential-output type is used.
(Note-2): Use cable of wire side AWG28.

(2) Voltage-output/Open-collector type

(a) Connection diagram

Make the cable within 10m(32.81ft.).





(Note-1): When voltage-output/open-collector type is used, open between SEL and SG.
(Note-2): Use cable of wire size AWG28.

⚠CAUTION

● When fabricating the internal I/F connector cable, do not make incorrect connection.
Doing so may cause an operation failure or damage the module.

APPENDIX 4.5 SSCNETⅢ cables (SC-J3BUS□M-C) manufactured by Mitsubishi Electric System & Service

POINTS

- For the details of the SSCNETⅢ cables, contact your local sales office.
- Do not look directly at the light generated from CN1A/CN1B connector of servo amplifier or the end of SSCNETⅢ cable. The light can be a discomfort when it enters the eye.

The cable is available per 1[m] up to 100[m]. The number of the length (1 to 100) will be in the □ part in the cable model.

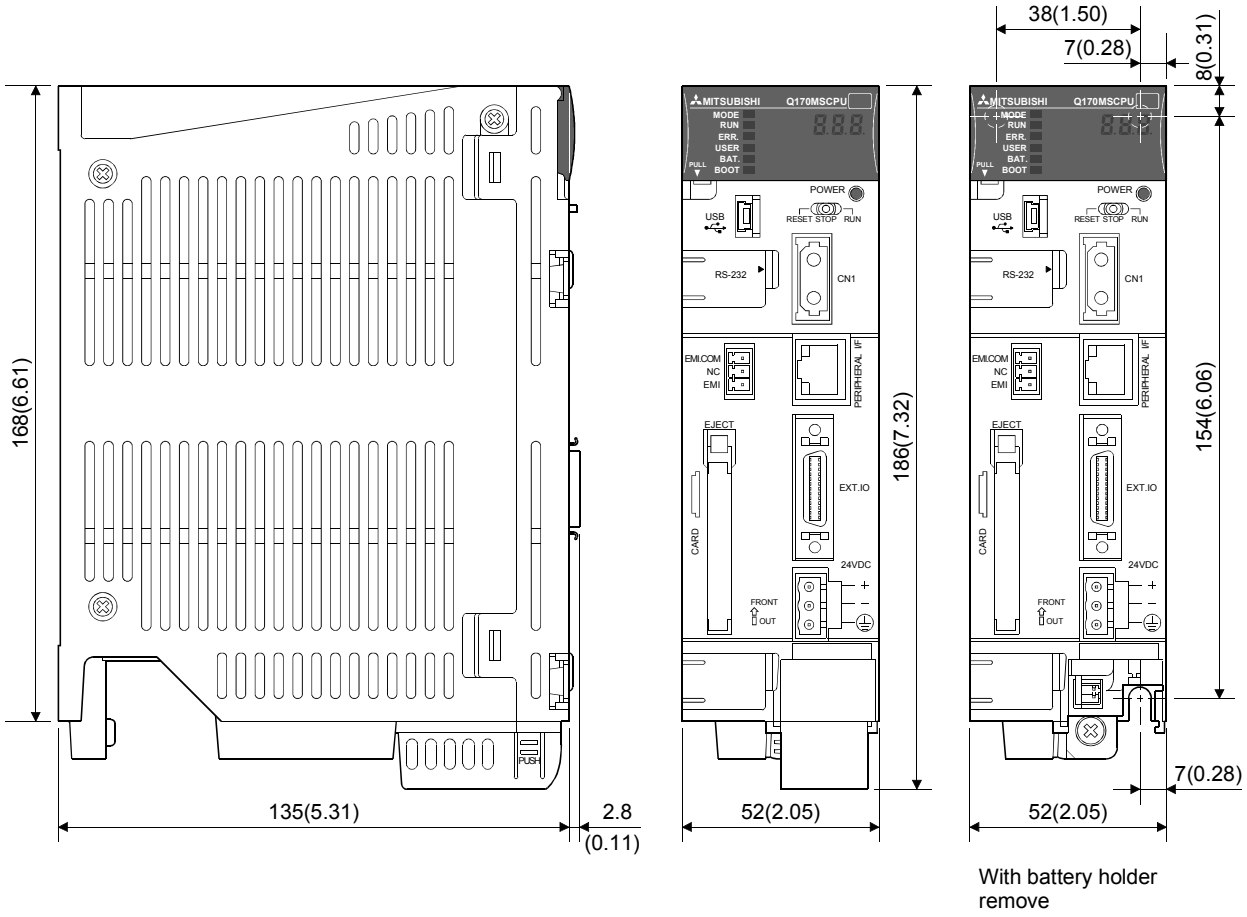
Cable model	Cable length [m(ft.)]	Bending life	Application/remark
	1 to 100 (3.28 to 328.08)		
SC-J3BUS□M-C	1 to 100	Ultra-long bending life	Long distance cable

APPENDIX 5 Exterior Dimensions

APPENDIX 5.1 Motion controller

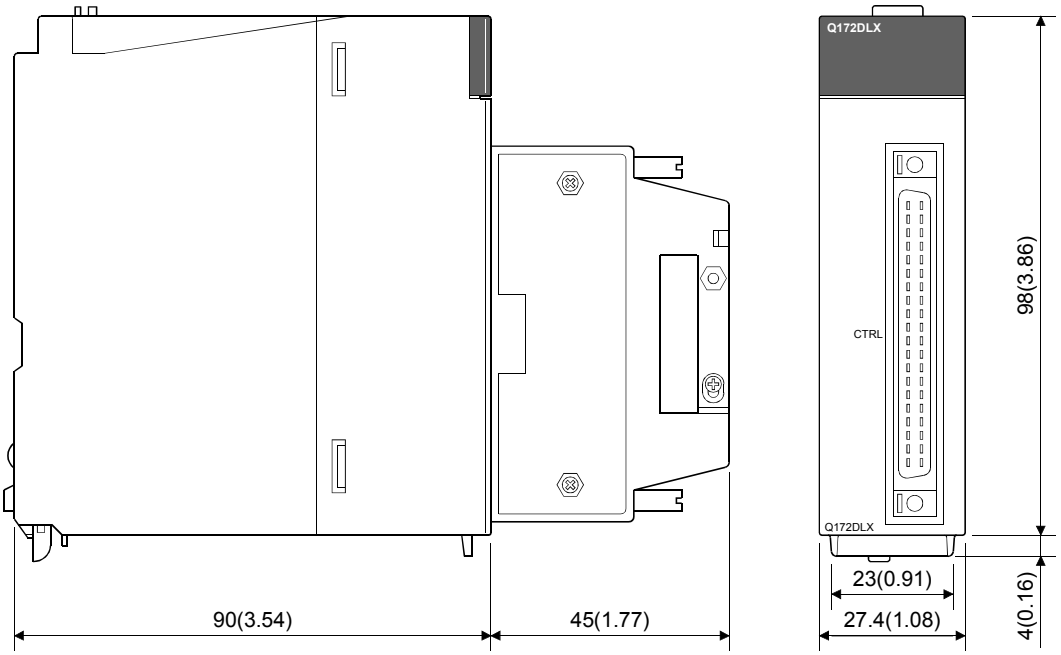
(1) Q170MSCPU/Q170MSCPU-S1

[Unit: mm (inch)]



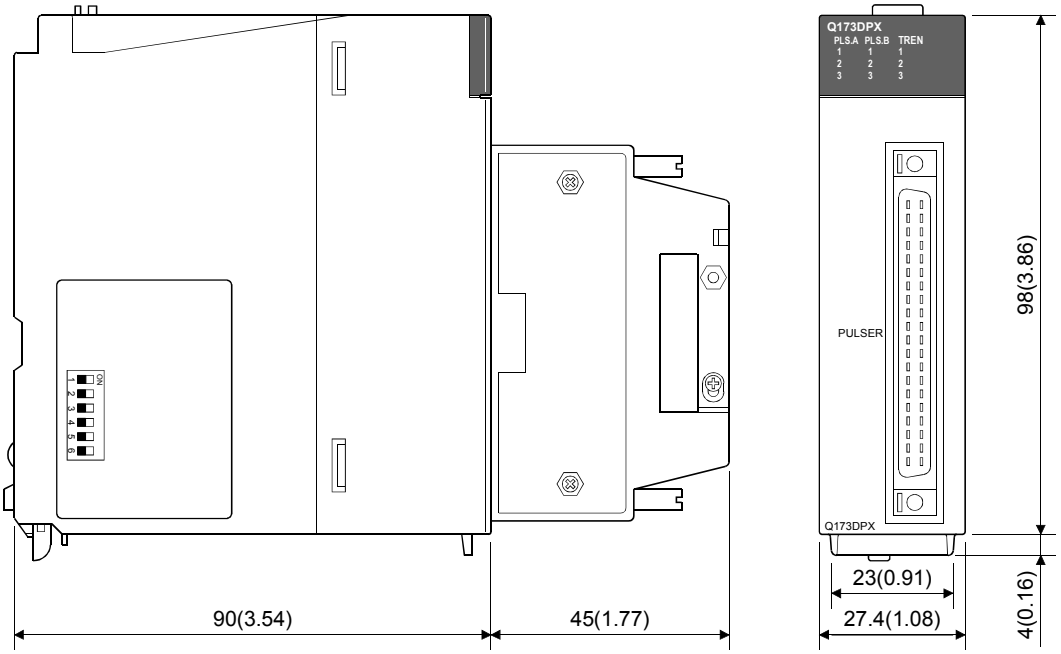
APPENDIX 5.2 Servo external signals interface module (Q172DLX)

[Unit: mm (inch)]



APPENDIX 5.3 Manual pulse generator interface module (Q173DPX)

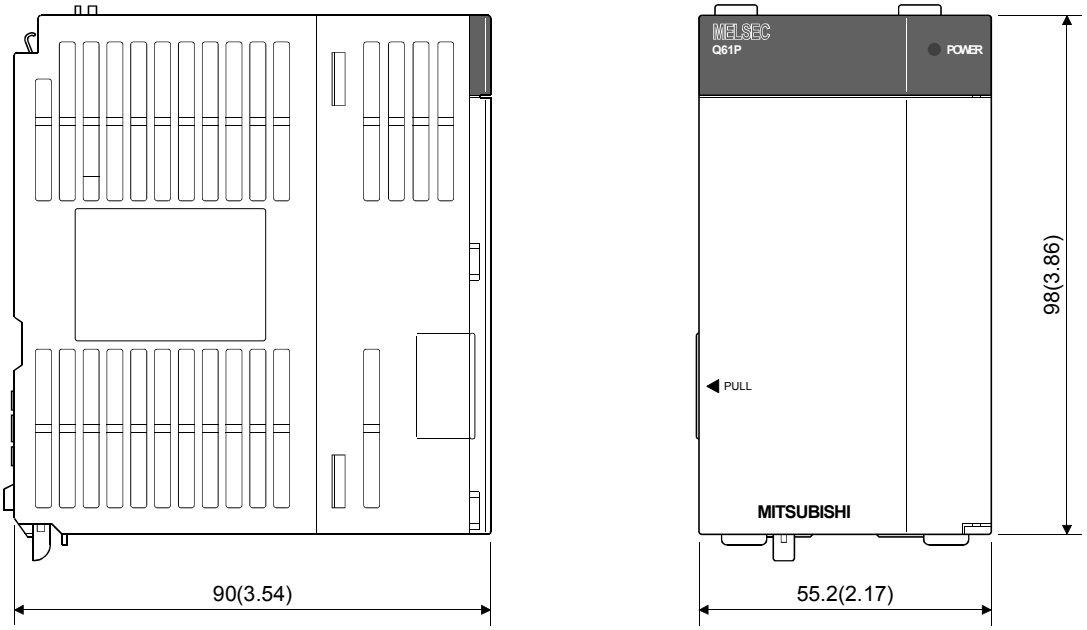
[Unit: mm (inch)]



APPENDIX 5.4 Power supply module

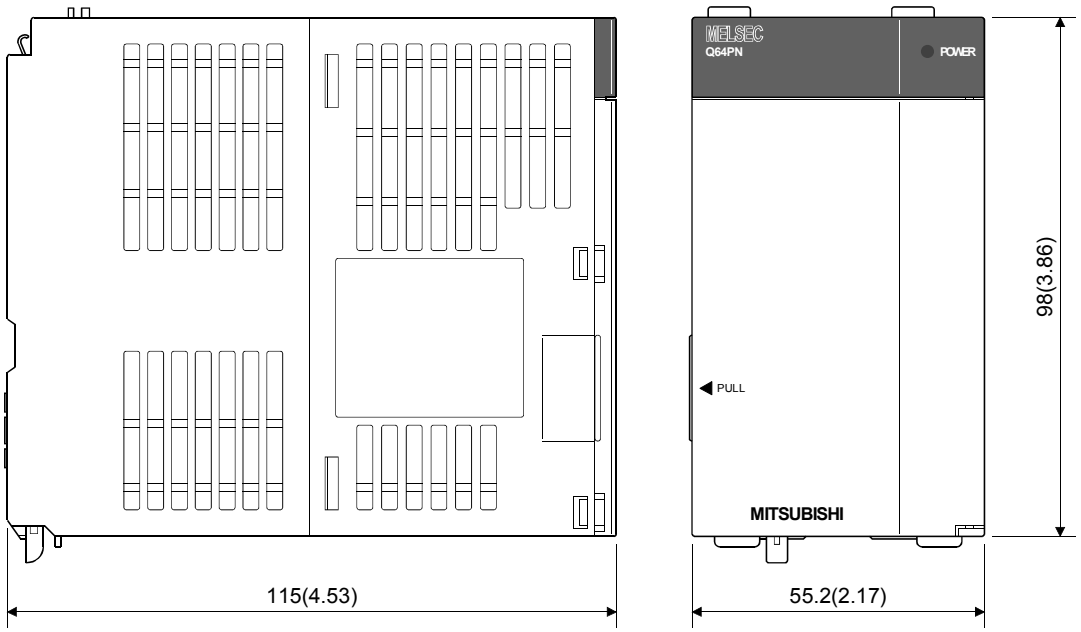
(1) Q61P, Q62P, Q63P

[Unit: mm (inch)]



(2) Q64PN

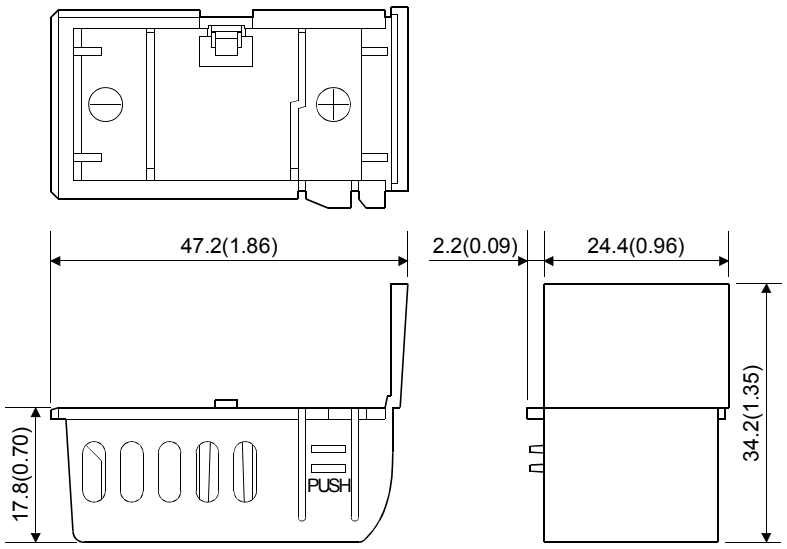
[Unit: mm (inch)]



APPENDIX 5.5 Battery holder

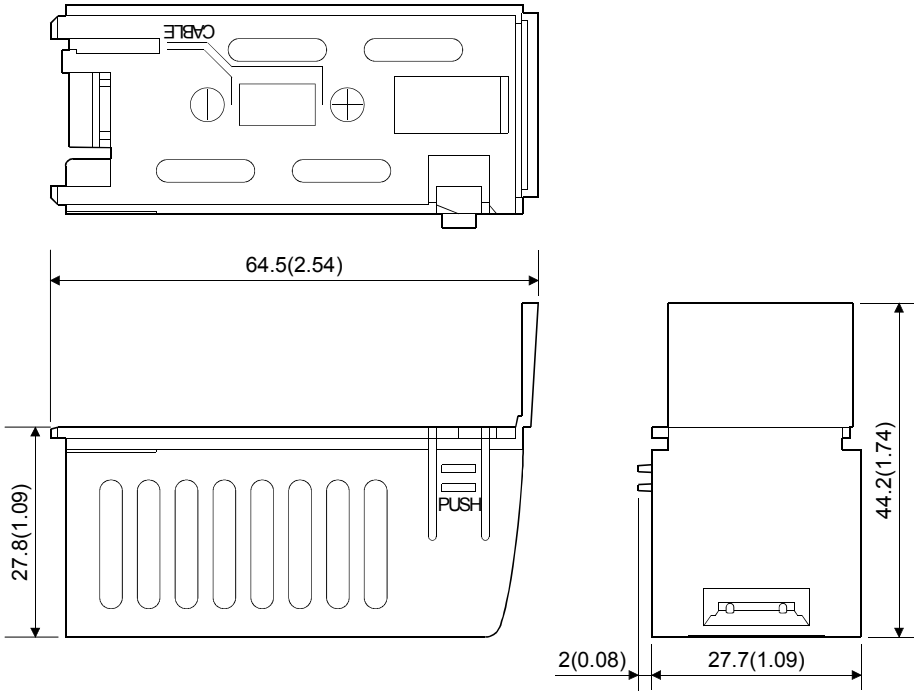
(1) Battery holder (For Q6BAT)

[Unit: mm (inch)]



(2) Battery holder (For Q7BAT)

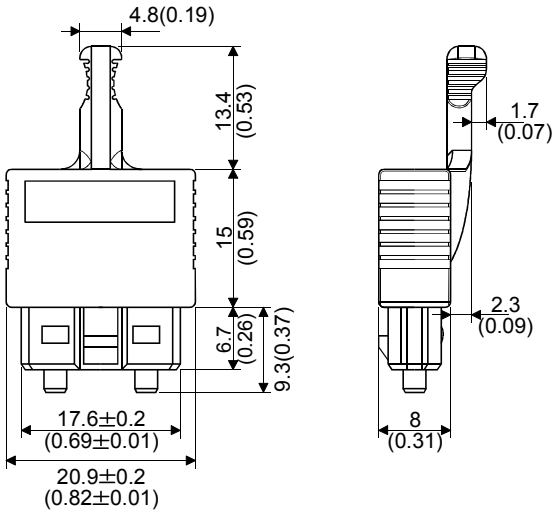
[Unit: mm (inch)]



APPENDIX 5.6 Connector

(1) SSCNETⅢ cable connector

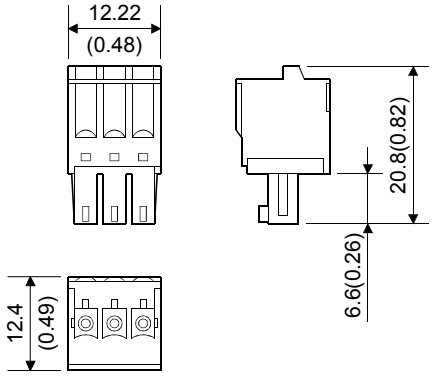
[Unit: mm (inch)]



(2) Forced stop input connector (PHOENIX CONTACT make)

Type Connector: FK-MCP1.5/3/ST-3.81

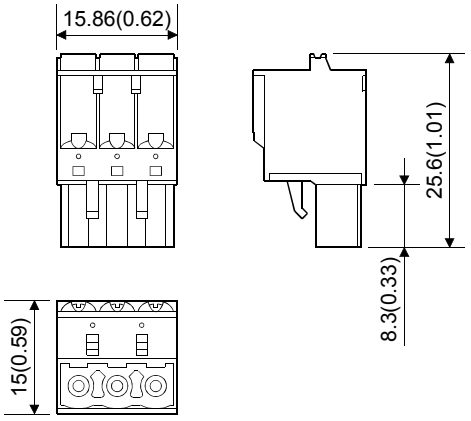
[Unit: mm (inch)]



(3) 24VDC power supply connector (PHOENIX CONTACT make)

Type Connector: FKC2.5/3-ST-5.08

[Unit: mm (inch)]



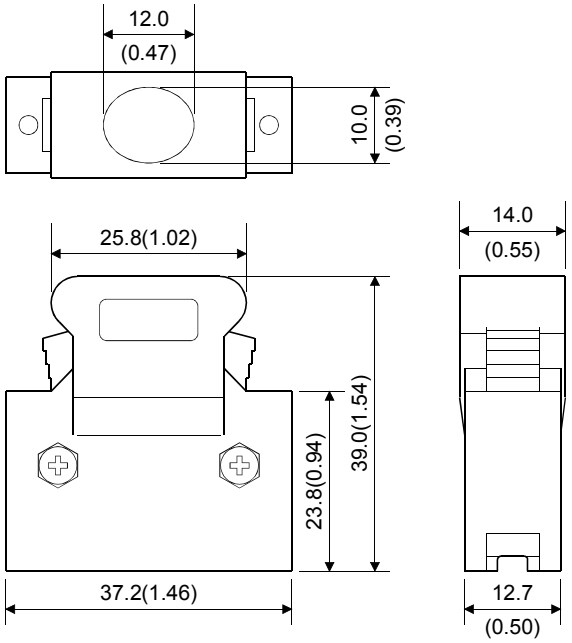
(4) Internal I/F connector (Sumitomo 3M Limited make)

Type	Type	
	Connector	Connector case
Soldering type (Quick release metal latch type) (LD77MHIOCON)	10126-3000PE	10326-52F0-008
Soldering type (Threaded type)	10126-3000PE	10326-52A0-008
Pressure-displacement type (Quick release metal latch type) (Note-1)	10126-6000EL	10326-3210-000

(Note-1): The following specialized tools are required.
These specialized tools are not provided by Mitsubishi. Please purchase them by customers.
• MDR assembly press for pressure-displacement type (Sumitomo 3M Limited)
Model name: 10960 (Hand press)
10962 (Fixture unit)
10963 (Fixture block)
10964-1 (Cable clamp (black) 14 - 50 position)

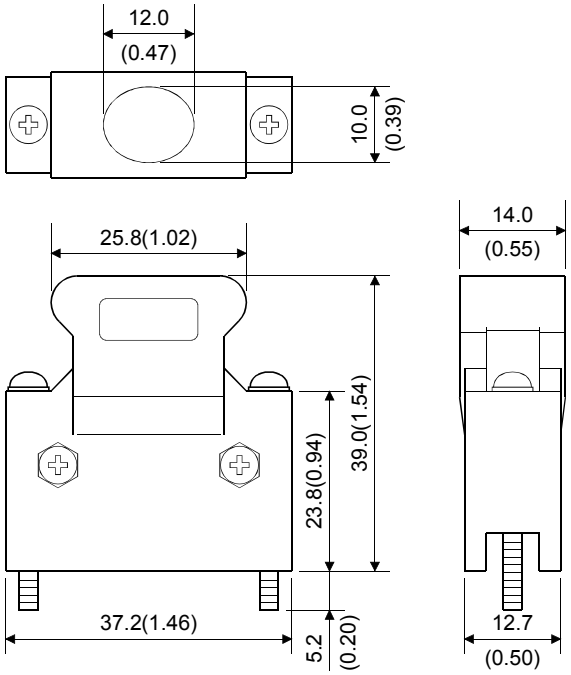
(a) Soldering type (Quick release metal latch type) (LD77MHIOCON)

[Unit: mm (inch)]



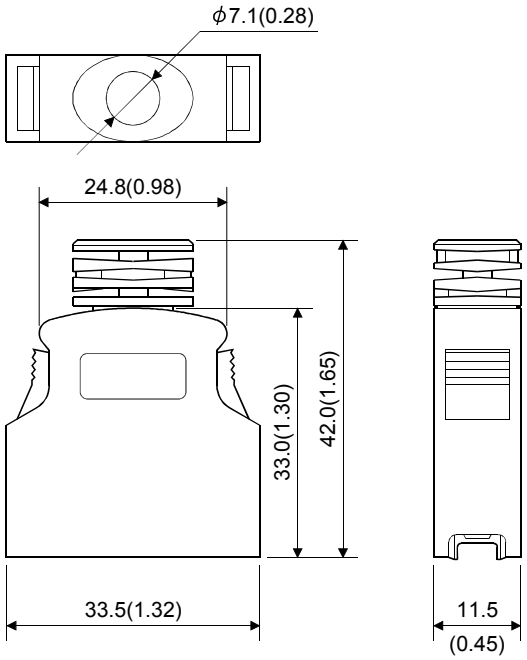
(b) Soldering type (Threaded type)

[Unit: mm (inch)]



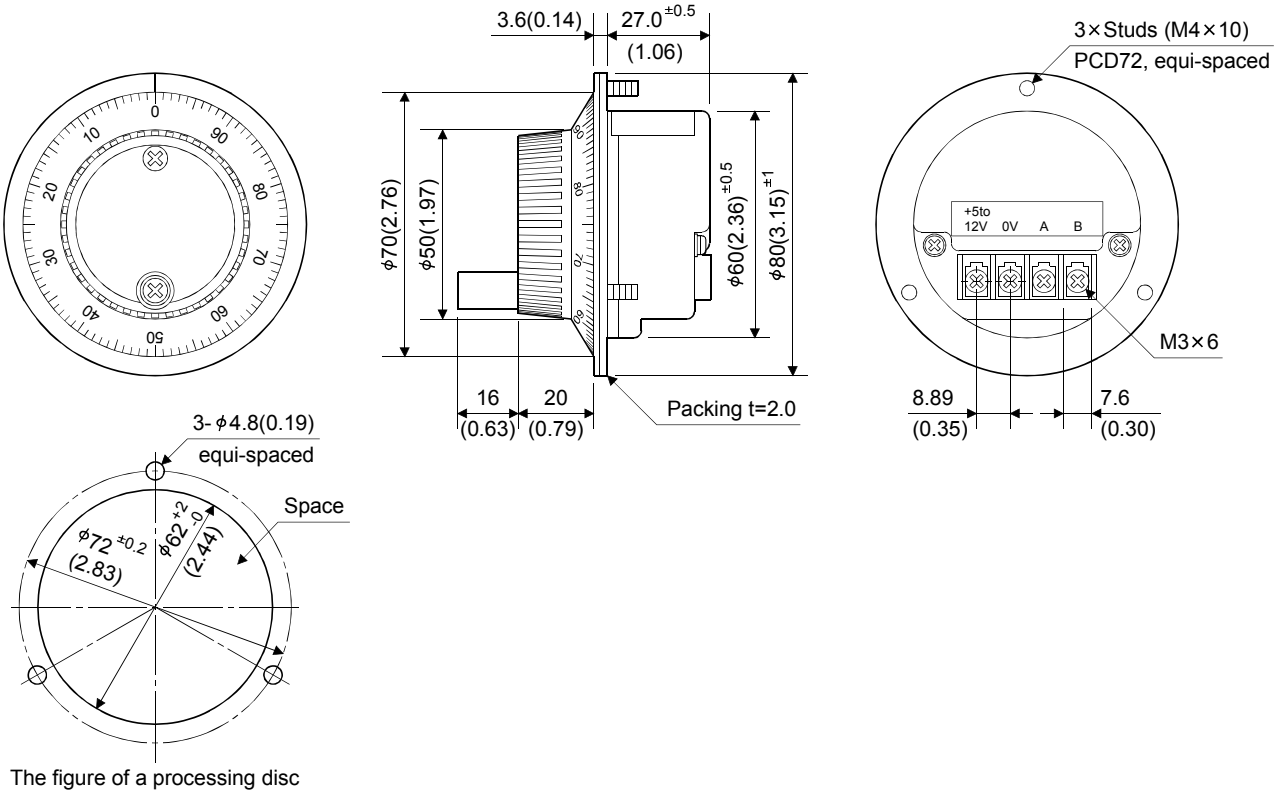
(c) Pressure-displacement type (Quick release metal latch type)

[Unit: mm (inch)]



APPENDIX 5.7 Manual pulse generator (MR-HDP01)

[Unit: mm (inch)]



The figure of a processing disc

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

Whether under or after the term of warranty, we assume no responsibility for any damages arisen from causes for which we are not responsible, any losses of opportunity and/or profit incurred by you due to a failure of the Product, any damages, secondary damages or compensation for accidents arisen under a specific circumstance that are foreseen or unforeseen by our company, any damages to products other than the Product, and also compensation for any replacement work, readjustment, start-up test run of local machines and the Product and any other operations conducted by you.

5. Change of Product specifications

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

6. Precautions for Choosing the Products

(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.

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MOTION CONTROLLER Qseries

User's Manual (Q170MSCPU)

MODEL	Q170MS-U-E
MODEL CODE	1XB962
IB(NA)-0300212-A(1304)MEE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN

When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.