MITSUBISHI ELECTRIC

Motion controller
Safety signal module Q173DSXY

Safety Information

Thank you for purchasing the Mitsubishi Electric Motion controller.
The Motion controller is suitable for establishing safety observation
functions for general industrial machinery.

**Prior to use, please read both this manual and detailed manual
thoroughly and familiarize yourself with the product.**

REVISIONS

Print Date	∗Manual Number	Revision
Jan., 2012	IB(NA)-0300186-A	First edition
Jun., 2012	IB(NA)-0300186-B	Revision according to certification of safety standard [Partial correction] Section 1.1, 2.3, 2.4, 2.6, 7.1, 7.2 [Addition] Chapter 8
Jun., 2014	IB(NA)-0300186-C	Revision according to addition of safety communication function French translation added [Partial correction] Section 2.3, 2.6, 7.1
Mar., 2017	IB(NA)-0300186-D	Revision according to safety encoder [Partial correction] Section 2.3, 2.6, 4.2, 4.3, 4.4, 7.1, 7.5, WARRANTY
Aug., 2023	IB(NA)-0300186-E	Revision according to certification of Motion safety [Partial correction] Section 1.1, 2.2, 2.3, 2.4, 2.6, 2.7, 2.8, Chapter 3, Section 4.2, 7.1, 7.2, 7.3, 7.4, WARRANTY
Dec., 2023	IB(NA)-0300186-F	Revision according to certification of Motion safety [Partial correction] Section 2.2, 2.8, 7.1

1 About this manual

1.1 Related manuals

This manual describes the handling methods of the safety signal module (Q173DSXY) used for safety observation function of a Q17□DSCPU/Q17□DCPU-S1 Motion controller in a Q series PLC Multiple CPU system.
For detailed information of the products, refer to each user's manual or programming manual. The PDF data of the latest manual can be obtained from our website.

1.2 Purpose of this document

This manual instructs the technical staff of the machine manufacturer and/or of the machine operator on the safe handling of the safety signal module of the Motion controller.
This manual does not provide descriptions for the machines in which the Motion controller is, or will be, integrated.
Information of this kind will be found in the manuals for the machine.

2 On safety

This chapter deals with your own safety and the safety of the equipment operators.
• Please read this chapter carefully before beginning with the installation.

2.1 Qualified safety personnel

The Motion controller may only be installed by qualified safety personnel.
Qualified safety personnel are defined as persons who:
• have undergone the appropriate technical training and
• have been instructed by the responsible machine operator in the operation of the machine
  and the current valid safety guidelines and
• have access to the Motion controller manuals and have read and familiarized themselves
  with them and
• have access to the manuals for the protective devices (e.g. light curtains) connected to the
  Motion controller and have read and familiarized themselves with them.

2.2 Applications of the device

The Q series PLC Multiple CPU system is a configurable system for safety applications.
The safety signal module (Q173DSXY) is an I/O module that is required in a configuration for
using the safety observation function.
It is in compliance with the following standards (Declaration of conformity No.
BCN-B61008-077):
• in accordance with EN ISO 13849-1:2015 (Cat 3 PL d)
• in accordance with EN IEC 62061:2021(maximum SIL 2)
The degree of safety actually attained depends on the external circuit, the wiring, the
parameter configuration, and the choice of sensors and their location at the machine.
Opto-electronic and tactile safety sensors (e.g. light curtains, laser scanners, safety switches,
sensors, emergency-stop buttons) can be programmed. The corresponding actuators of the
machines or systems can be switched off safely via the switching outputs of the Motion
controller.

2.3 Correct use

⚠️ **CAUTION**

The Motion controller fulfills the requirements of industrial applications in accordance with the "Interference emission" basic specifications!
The Motion controller is therefore only suitable for use in an industrial environment and not for private use.

The Motion controller may only be used within specific operating limits (voltage, temperature, etc., refer to the technical data and to the section "Applications of the device"). It may only be used by specialist personnel and only at the machine at which it was mounted and initially commissioned by qualified personnel in accordance with the "Q173D(S)CPU/Q172D(S)CPU Motion controller Programming Manual (Safety Observation)" and "Q173D(S)CPU/Q172D(S)CPU Motion controller User's Manual".

The modules of the Motion controller are designed for Zone B industrial environments, in accordance with EN 61131-2.

Mitsubishi Electric Corporation accepts no claims for liability if the equipment is used in any other way or if modifications are made to the device, even in the context of mounting and installation.

In systems that use the safety signal module, the Motion CPUs and the PLC CPUs described in the list below, safety observation function is executed by writing safety parameters and safety sequence program to the Motion CPU and PLC CPU.
Set the parameters correctly. Incorrect setting may disable the protective functions such as safety observation functions.
Refer to "Q173D(S)CPU/Q172D(S)CPU Motion controller programming manual (Safety Observation)" for the details on how to set safety parameters and create safety sequence programs.

(1) Module list (safety observation function compatible products)

Product name	Model name
PLC CPU module (Note-1)	Q03UDCPU, Q04UDHCPU, Q06UDHCPU, Q10UDHCPU, Q13UDHCPU, Q20UDHCPU, Q26UDHCPU, Q03UDECPU, Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, Q26UDEHCPU, Q50UDEHCPU, Q100UDEHCPU
Motion CPU module	Q173DSCPU, Q172DSCPU, Q173DCPU-S1, Q172DCPU-S1
Safety signal module	Q173DSXY
Main base unit	Q35DB, Q38DB, Q312DB

(Note-1): Use the PLC CPU module for which the first five digits of the serial number are "10102" or later.

(2) Operating system software list (safety observation function compatible products)

Model name	Compatible CPU	Version
SW8DNC-SV22QJ, SW8DNC-SV13QJ	Q173DSCPU	"00A" or later [Note-2]
SW8DNC-SV22QL, SW8DNC-SV13QL	Q172DSCPU	"00E" or later [Note-3] "00G" or later [Note-4]
SW8DNC-SV22QA, SW8DNC-SV13QB	Q173DCPU-S1	"00N" or later [Note-1]
SW8DNC-SV22QC, SW8DNC-SV13QD	Q172DCPU-S1	"00S" or later [Note-2]

(Note-1): In the case of using only safety signal comparison function.
(Note-2): In the case of using both safety signal comparison function and speed monitoring function.
(Note-3): In the case of using safety observation functions with safety signal comparison function, speed monitoring function, and safety communication function.
(Note-4): In the case of using safety observation functions with safety signal comparison function, speed monitoring function, safety communication function, and safety encoder.

2.4 General protective notes and protective measures

Observe the protective notes and measures
Please observe the following items in order to ensure proper use of the Motion controller.

- When mounting, installing and using the Motion controller, observe the standards and directives applicable in your country.
- When using the Motion controller in countries of the EU, comply the system with the following directives.
  – Machinery Directive 2006/42/EC
  – EMC Directive 2014/30/EU
  – Low-Voltage Directive 2014/35/EU
  – Other work safety regulations/safety rules
- Manufacturers and owners of the machine on which a Motion controller is used are responsible for obtaining and observing all applicable safety regulations and rules.
  For Declaration of Conformity (DoC), MITSUBISHI ELECTRIC EUROPE B.V., declares that the Motion controllers are in compliance with the necessary requirements and the following standards. For a copy of the Declaration of Conformity, please consult your local Mitsubishi Electric representative.
  – Machinery Directive 2006/42/EC
  – EMC Directive 2014/30/EU
  – RoHS Directive 2011/65/EU, (EU)2015/863
- Observe the contents of "Q173D(S)CPU/Q172D(S)CPU Motion controller programming manual (Safety Observation)".
- The tests must be carried out by specialized personnel or specially qualified and authorized personnel and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time by third parties.

- The external voltage supply of the device must be capable of buffering brief main voltage failures of 20ms as specified in EN 60204-1 (Safety of machinery - Electrical equipment of machines - Part 1: General requirements).
- The system may not start up normally if power is restored immediately after shut down (within five seconds). Wait for five seconds or longer before restoring power.

2.5 Disposal

Disposal of unusable or irreparable devices should always occur in accordance with the applicable country-specific waste-disposal regulations (e.g. European Waste Code 16 02 14).

2.6 Transportation and storage

- The Motion controller is a precision machine, so do not drop it or apply strong impacts.
- Install the unit according to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller User's Manual" in a place where its mass can be withstood.
- Do not get on or place heavy objects on the product.

2.7 Maintenance and inspection

- Perform the daily and periodic inspections according to the "Q173D(S)CPU/Q172D(S)CPU Motion Controller User's Manual".
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detector function is correct.
- Do not burn or disassemble a Motion controller. Doing so may generate toxic gas.
- Any person other than a qualified technician whom our company recognizes should not attempt to disassemble and repair the units.

2.8 Residual risks

Define all risk assessments and residual risks for the whole machine to ensure safety. The company and/or individuals who constructed the system take responsibility for everything in terms of safety system installation and commission. In addition, to comply with EC Machinery Directive, the safety standard needs to be certified as the whole system. Execute all risk assessment and safety level verification for the equipment and the whole system. It is recommended to use a third-party certifier as a final certifier of the system.

The residual risk in safety observation function of this product is shown below.

• This function does not detect errors among the parameters and programs that are set by the user. Therefore, safety of machines cannot be secured unless the safety operation test is performed on the machines.
• At the shipment to end-users, confirm the safety related setting by monitoring status and displayed details of the programming tools and displays. Also, record and save the setting data of safety-related information and programming tools by using a check sheet, etc.
• Safety cannot be secured unless assembling, installation, wiring and adjustment of the machine are completed. For the installation, wiring and adjustment, follow the instructions in the user's manual of each module.
• Only qualified personnel are authorized to install, start-up, repair or service the machines in which components are installed. Only trained engineers should install and operate the equipment. (EN ISO 13849-1:2015 (Cat 3 PL d) Table F.1 No.5)
• Separate the wiring for safety observation function from other signal wirings.
  (EN ISO 13849-1:2015 (Cat 3 PL d) Table F.1 No.1)
• Protect the cables using appropriate methods (routing them in a cabinet, using a cable guard, etc.)
• Ushing the switches, relays, and sensors comply with the safety standards is recommended. In case of using a switch, relay, or sensor that does not comply with the safety standard, please apply them for the certifications.
• Keep the required clearance/creepage distance depending on voltage.
• The time to detect the safety observation error depends on the process cycle of safety observation of each CPU module.

The residual risk in each function of safety observation function is shown below.

(1) Safety signal comparison
- Make sure that the mounting location of the safety signal module, MT Developer2 number start device, and GX Works2/GX Developer I/O assignments are correctly set.
- When a signal error occurs, make sure that safety is secured within the signal mismatch permissible time that is set by a parameter.
- Even when a signal error occurs, the servo motor does not stop automatically. Give a (forced) stop command and execute a forced stop processing.
- Make sure that the ladder name to be written to a PLC CPU is not the same as that of sequence programs for safety observation.
- Make sure that the safety signal is properly input via two different paths.
- Make sure that the screws will not loosen after fixing the connector on the safety signal module.
- Make sure that all the modules are firmly inserted into the main base unit or extension base unit.
- Scan time processing must be within 100ms so that PLC CPU performs the comparison function within a certain process time. Make sure that the program contents can be handled in less than 100ms. If the scan time is 100ms or longer, a PLC CPU should be added for safety to distribute the load of the safety process.

(2) Speed monitoring function (SLS)

- Under the condition that the failure rate of the additional pulse encoder components (dotted line area in the diagram below) does not exceed 195FIT/395FIT the resulting PFD/PFH will be less than 195FIT/395FIT.
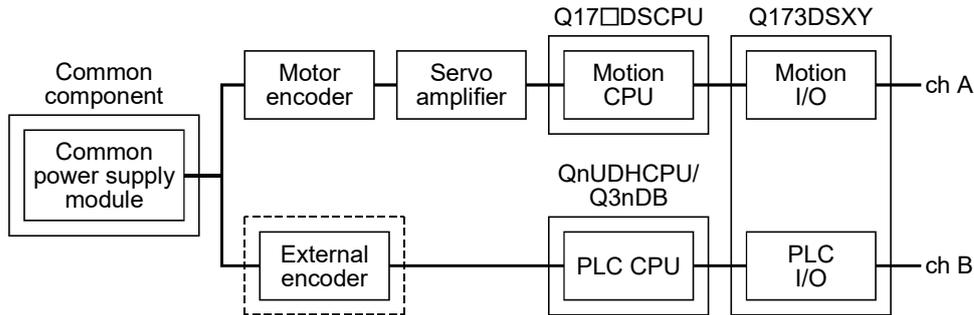
- Avoid the continuous use (about 8 hours) of the same Speed Monitor parameter block to prevent the accumulation of errors.
- Speed monitoring function guarantees the motor control (the motor rotation speed), but it does not guarantee the actual machine safety speed. Make sure to set parameters so that the safe speed of the machine is the same as the safety speed of the motor.
- When using speed monitoring function when there is no speed command from the Motion controller or the command speed is 0, using an external encoder (external auxiliary input pulses), or a safety encoder and switching to Safe Operating Stop (SOS) is required.
- The accuracy of safety speed observation depends on the performance of the external auxiliary input pulses or a safety encoder. Therefore, when using external auxiliary input pulses, the number of the external input pulses for safety speed must be determined considering the external auxiliary input pulses resolution and the allowance input pulse frequency.
- Check if the rotation speed of the monitored servo axis is the same as the actual speed by using a tachometer, etc. considering the speed includes an error caused by the encoder resolution of the external auxiliary input pulses.
- The defect of the mechanical section such as sliding of shaft and wearing of a timing belt, etc. is not covered. Be sure to eliminate the risk of mechanical section before operation.
- Speed monitoring error detection time is set in the unit of 10ms, but the time resolution in the actual operation is 25ms. Errors shorter than this time are not detected.
- Create sequence program so that Scan time is within 25ms to make sure that PLC CPU performs the safety observation function within a certain process time. If scan time is 25ms or longer, a PLC CPU should be added to distribute the load of the process.
- Safety observation error (shutdown signal OFF) does not occur during the time set by the safety observation parameters after speed is over the limit. Make sure that safety can be ensured during this period.
- The error occurs when detected speed is different between the motor encoder and the external auxiliary input pulse, and the time required to detect the error depends on the frequency of the external auxiliary input pulse. Determine the number of external input pulse considering the error detection risk.

(3) Safe Speed Monitor (SSM)
- If the safety output condition of SSM is used as a restart trigger, incidental start-up cannot be prevented. A restart interlock must comply with EN 60204-1. However, using it as the operation ready signal is possible.

(4) Shut-off function (STO, SS1)
- STO function disables energy supply to the servo motor by electrical shut-off. The function does not mechanically disconnect electricity from the motor. Therefore, it cannot prevent exposure to electric shock, install a magnetic contactor or a molded case circuit breaker to the main circuit power supply (L1, L2, and L3) of the servo amplifier.
- STO function can disable the energy to servo motor by the electrical shut-off. This function does not guarantee the procedure of stopping the servo motor and deceleration control.
- SS1 function only guarantees the delay time before STO becomes effective.
- If SS1 delay time is shorter than servo motor deceleration time, or forced stop function has an error, STO becomes effective during motor rotation, dynamic brake stop or free-run stop is activated.
- Even if STO function becomes effective with a STO switch, voltage may be left in the servo motor due to the inherent delay of the equipment.
- When the servo amplifier is replaced, make sure that new one is the same type as the old one. After installation, make sure to check the performance of safety observation function before operating the system.
- Check the safety at a certain cycle, or with machinery which is defined by the safety standard to prevent the accumulation of failures. Check the safety at least once a day regardless of system safety level.
- If a power module of a servo amplifier shorted at the upper and lower positions, the servo motor axis rotates half at maximum. For a linear servo motor, the primary side will move a distance of pole pitch.
- Make sure to supply STO input signals (STO1, STO2) from one power supply. Otherwise, the STO function may not function properly due to a sneak current, failing to bring the STO shut-off state.
- For the STO I/O signals of the STO function, supply power by using a safety extra low voltage (SELV) power supply with the reinforced insulation.

(5) Standstill monitoring (SOS, SS2)
- The position dependent safety observation function (SOS) is based on two independent safety-related sensors. One of them is part of the motor, which has a built-in encoder (for functional motion control); the other must be provided by the customer's application (e.g. an external sensor, PLG). For standstill monitoring when using a safety encoder, an external auxiliary pulse input signal is not necessary.
- During Safe Operating Stop, make sure that monitoring status is enabled by small oscillation before a certain period of time (about one hour) elapses in the stop status. However, an error cannot be detected in the check interval. (The derivation of failure until next check cannot be detected.) If stop time becomes long, use Safe Brake Control (SBC) as mechanical lock or perform Safe Torque Off (STO).
- Avoid the continuous use of Safe Operating Stop (SOS) for eight hours or more to prevent the accumulation of failures. If stop time becomes long, use Safe Brake Control (SBC) as mechanical lock or perform Safe Torque Off (STO).
- Encoder position feedback data does not guarantee the range out of the small oscillation. Therefore, make sure that motor encoder feedback position can operate normally in the machine mobile region. At least, the performance check of motor mobile region is required.
- The position assurance of the motor with SOS is 1.75 pulses with the external auxiliary input pulse conversion and 1 pulse with safety encoder.

(6) Safe Brake Control (SBC)
- This function guarantees only that power to mechanic brake is properly supplied. Abrasion of the brake cannot be detected. Make sure regularly that the mechanic brake operates.

(7) Safety Communication Function
- The safety communication function cannot detect an incorrect servo amplifier station number setting. Check that the station number setting for the Motion control program and the axis select rotary switch setting of servo amplifier match.
- For servo amplifiers that support the safety communication function, check that safety communication is connected.
- To ensure that the PLC CPU executes the safety communication function within the safety communication cycle, make a sequence program that is less than or equal to the value of the maximum scan time value below. If the scan time of the sequence program exceeds the value below, add more PLC CPUs and distribute the processes.

> Maximum scan time ≤ (safety communication cycle − 3.555[ms])

- Safety communication function can only be used with SSCNETIII/H communication. Safety communication function cannot be used with SSCNETIII communication.

3 Conditions of use for the product

(1) Motion controller complies with a safety standard, but this does not guarantee that Product will be free from any malfunction or failure. The user of this Product shall comply with any and all applicable safety standard, regulation or law and take appropriate safety measures for the system in which the Product is installed or used and shall take the second or third safety measures other than the Product. MELCO is not liable for damages that could have been prevented by compliance with any applicable safety standard, regulation or law.

(2) MELCO prohibits the use of Products with or in any application involving, and MELCO shall not be liable for a default, a liability for defect warranty, a quality assurance, negligence or other tort and a product liability in these applications.
1) power plants,
2) trains, railway systems, airplanes, airline operations, other transportation systems,
3) hospitals, medical care, dialysis and life support facilities or equipment,
4) amusement equipments,
5) incineration and fuel devices,
6) handling of nuclear or hazardous materials or chemicals,
7) mining and drilling,
8) and other applications where the level of risk to human life, health or property are elevated.

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

4 Product description

4.1 Safety signal module Q173DSXY

The safety signal module is the I/O combined module that has 20 input points $\times 2$ lines and 12 output points $\times 2$ lines. It fulfills the following tasks:
• Passing on the input information to the Motion CPU and PLC CPU.
• Receiving the control signals from the Motion CPU and PLC CPU and corresponding switching of the outputs
• Passing on the output information to the Motion CPU and PLC CPU.

Q173DSXY is not available separately from Motion CPU and PLC CPU. Please use with Motion CPU and PLC CPU.
Up to three safety signal modules can be used.
The safety signal module cannot be used on the extension base unit.

For Motion CPU 20 inputs/12 outputs (Note-1)
For PLC CPU   20 inputs/12 outputs
For Motion CPU 20 inputs/12 outputs
For PLC CPU   20 inputs/12 outputs
For Motion CPU 20 inputs/12 outputs
For PLC CPU   20 inputs/12 outputs

(Note-1): 1 output is controlled by the system as a shut-off signal.
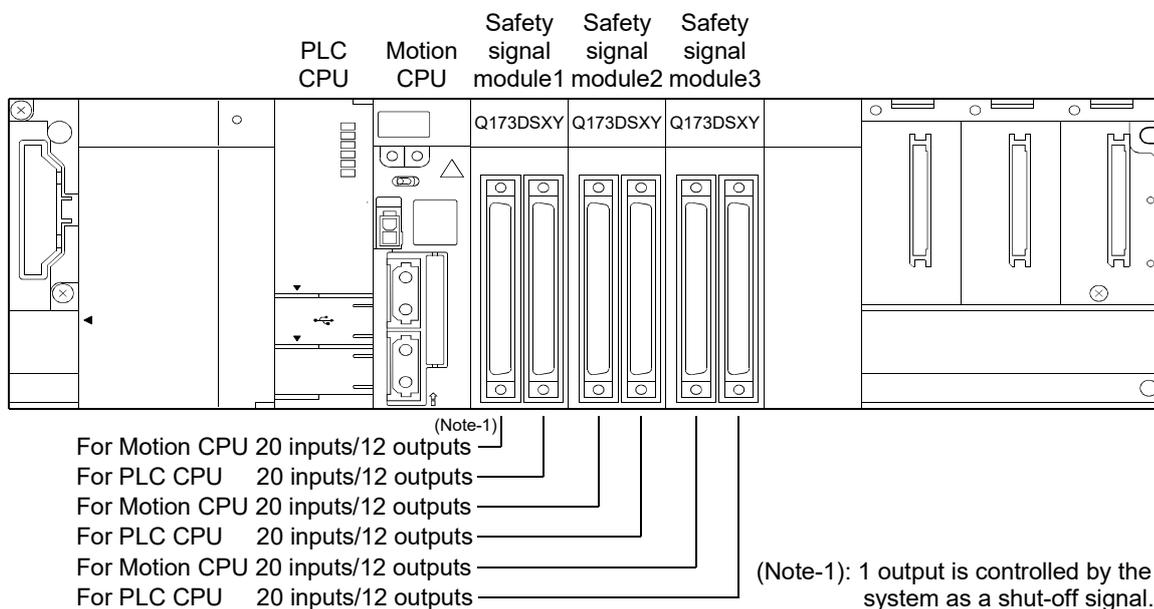
4.2 Name of parts

(1) PLC CPU module　QnUDE(H)CPU
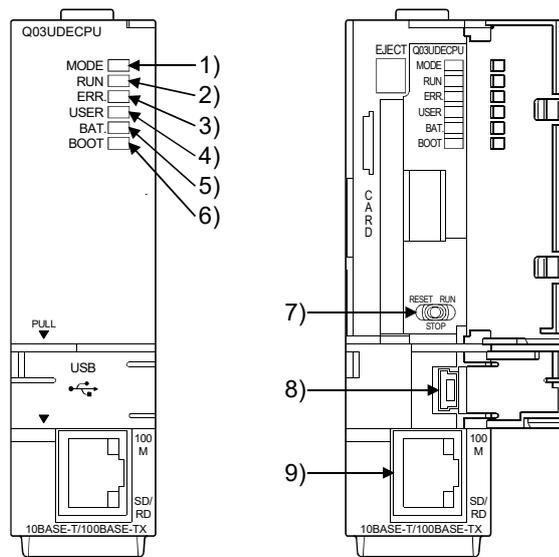
No.	Name	Application
1)	"MODE" LED	Indicates the mode of the CPU module.
2)	"RUN" LED	Indicates the operating status of the CPU module. ON　　: RUN OFF　: STOP
3)	"ERR." LED	ON　　: Detection of self-diagnosis error which will not stop operation. Flash : Detection of the error that stops operation. OFF　　: Normal
4)	"USER" LED	ON　　: Annunciator (F) turned ON. OFF　　: Normal
5)	"BAT." LED	ON (yellow)　　: Battery error of the memory card. Flash (yellow) : Battery error of the CPU module battery. ON (green)　　: After the restoration of data to the standard ROM, ON for 5 seconds. Flash (green) : When the backup is complete to the standard ROM. OFF　　　　　: Normal
6)	"BOOT" LED	ON　　: Start of boot operation. OFF　　: Non-execution of boot operation.
7)	RUN/STOP/RESET switch	RUN　　: Executes sequence program operation. STOP　: Stops sequence program operation. RESET : Performs hardware reset.
8)	USB connector [Note-1]	Connector for connection with USB-compatible peripheral device.
9)	Ethernet connector [Note-1]	Connector for connecting an Ethernet device.

(Note-1): Write the safety parameters and safety sequence program to CPU module by connecting the peripheral devices to this connector. Switch the destination to the PLC CPU or Motion CPU by setting of the peripheral devices.

(2) Motion CPU module   Q173DSCPU

Front face   Bottom
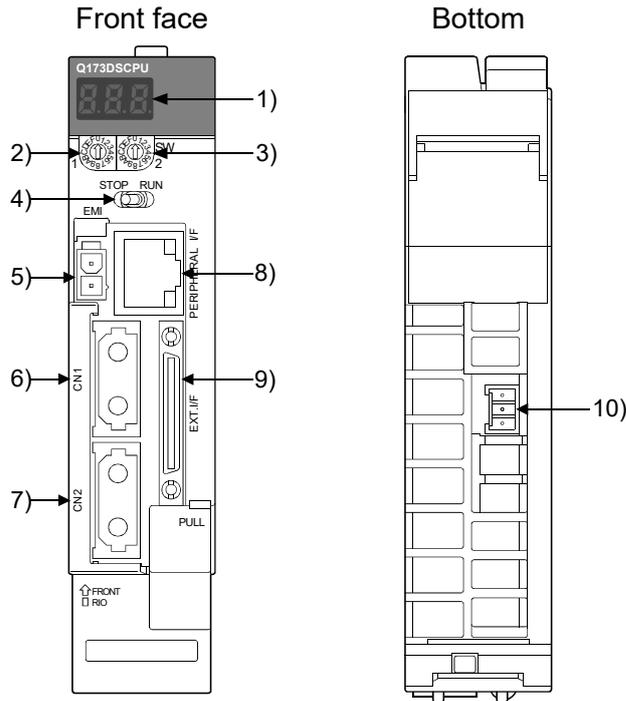
No.	Name	Application
1)	7-segment LED	Indicates the operating status and error information.
2)	Rotary function select 1 switch	Set the operation mode. (Normal operation mode, Installation mode, Mode operated by ROM, etc.)
3)	Rotary function select 2 switch (Note-1)	When writing user safety sequence program to Motion CPU, set rotary function select 2 switch to "1".
4)	RUN/STOP switch	RUN : Motion program is started. STOP : Motion program is stopped.
5)	Forced stop input connector (EMI)	Input to stop all axes of servo amplifier in a batch.
6)	SSCNETⅢ CN1 connector	Connector to connect the servo amplifier of line 1 (up to 16 axes).
7)	SSCNETⅢ CN2 connector	Connector to connect the servo amplifier of line 2 (up to 16 axes).
8)	PERIPHERAL I/F connector (Note-2)	For communication I/F with peripheral devices.
9)	Internal I/F connector	Connector to connect the manual pulse generator/incremental synchronous encoder, or to input the signals.
10)	RIO connector	Connector to connect the safety signal module (Q173DSXY).

(Note-1): In the case of monitoring or writing the safety sequence program of the Motion CPU, communicate from the peripheral devices (GX Works2/GX Developer) by setting the rotary function select 2 switch to "1". Turning ON the system's power supply again is not required at the rotary switch change.
"Other than 1" : Communication with MT Developer2 is possible.
(Used when writing safety parameters)
"1" : Communication with GX Works2/GX Developer is possible.
(Used when writing safety sequence program to the Motion CPU)
(Note-2): Write the safety parameters and safety sequence program to CPU module by connecting the peripheral devices in this connector. Switch the destination to the PLC CPU or Motion CPU by setting of the peripheral devices.

(3) Safety signal module Q173DSXY

Front face   Bottom
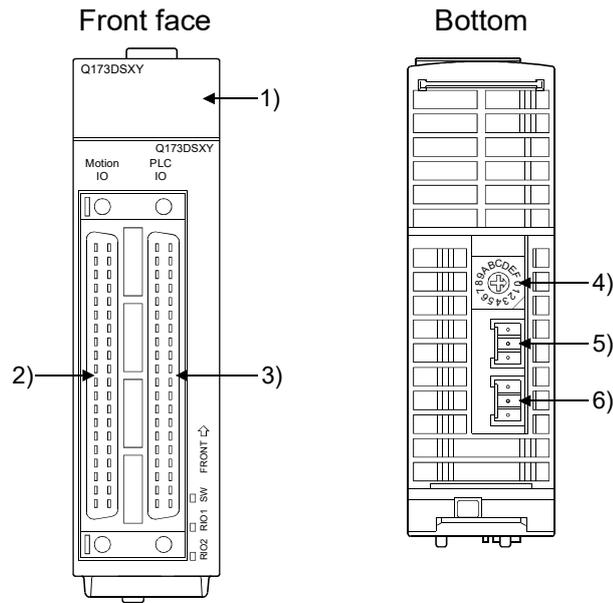
No.	Name	Application
1)	Input indicator LED	Display the input status from the external equipment. 0 to 1F: Display for I/O signal status of PLC CPU side.
2)	Motion IO connector	Input/output connector of the Motion CPU.
3)	PLC IO connector	Input/output connector of the PLC CPU.
4)	Rotary switch for station number setting	Set station number of safety signal module. Station number 1(Module 1) → Setting 0 Station number 2(Module 2) → Setting 1 Station number 3(Module 3) → Setting 2

5)	RIO1 connector	RIO communication connector to Motion CPU
		  For connection to Motion CPU (RIO) or safety signal module
		  (RIO2) installed on the left.

6)	RIO2 connector	RIO communication connector to Motion CPU
		  For connection to safety signal module (RIO1) installed on the
		  right.

• Connection example of the Motion CPU module and safety signal module

Motion CPU module
Bottom of
Q17☐DSCPU

Safety signal module1
Bottom of Q173DSXY
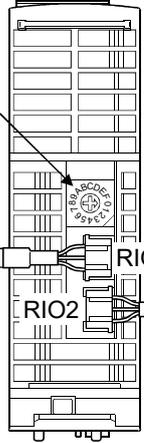
Safety signal module2
Bottom of Q173DSXY
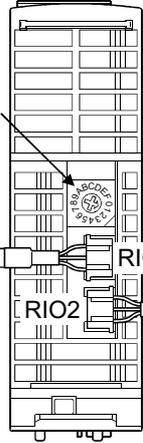
Safety signal module3
Bottom of Q173DSXY

RIO

SW setting "0"

SW setting "1"

SW setting "2"

RIO1

RIO1

RIO1

RIO cable
Q173DSXYCBL☐M

RIO2

RIO cable
Q173DSXYCBL☐M

RIO2

RIO cable
Q173DSXYCBL☐M

RIO2
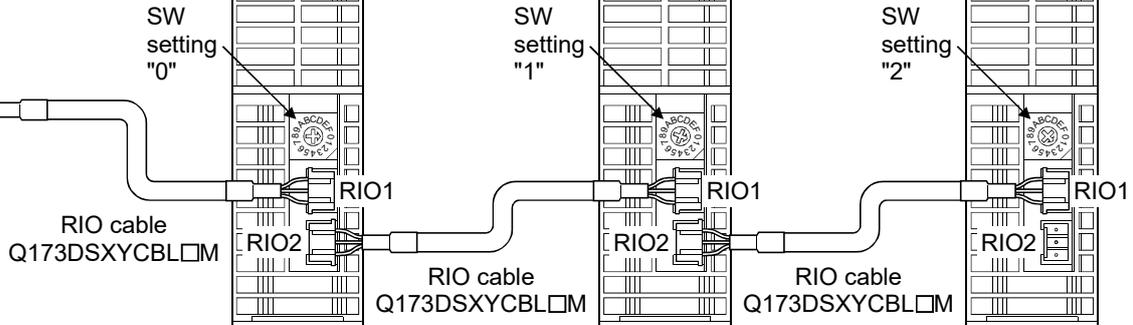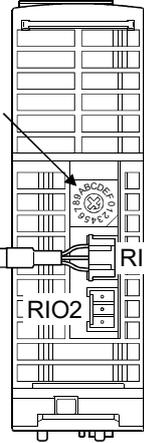
4.3 Pin layout of safety signal module connector

			Motion IO connector			PLC IO connector		
		Pin No.	Signal type	Signal name	Pin No.	Signal type	Signal name
		1B20	IN	MC-X00	2B20	IN	PLC-X00
		1B19	IN	MC-X01	2B19	IN	PLC-X01
		1B18	IN	MC-X02	2B18	IN	PLC-X02
		1B17	IN	MC-X03	2B17	IN	PLC-X03
		1B16	IN	MC-X04	2B16	IN	PLC-X04
		1B15	IN	MC-X05	2B15	IN	PLC-X05
		1B14	IN	MC-X06	2B14	IN	PLC-X06
		1B13	IN	MC-X07	2B13	IN	PLC-X07
		1B12	IN	MC-X08	2B12	IN	PLC-X08
		1B11	IN	MC-X09	2B11	IN	PLC-X09
		1B10 (Note-1), (Note-2)	IN/OUT	MC-Y0A/X0A	2B10 (Note-1), (Note-2)	IN/OUT	PLC-Y0A/X0A
		1B09 (Note-1)	IN/OUT	MC-Y0B/X0B	2B09 (Note-1)	IN/OUT	PLC-Y0B/X0B
		1B08	IN/OUT	MC-Y0C/X0C	2B08	IN/OUT	PLC-Y0C/X0C
		1B07	IN/OUT	MC-Y0D/X0D	2B07	IN/OUT	PLC-Y0D/X0D
		1B06	IN/OUT	MC-Y0E/X0E	2B06	IN/OUT	PLC-Y0E/X0E
		1B05	IN/OUT	MC-Y0F/X0F	2B05	IN/OUT	PLC-Y0F/X0F
		1B04	—	No connect	2B04	—	No connect
		1B03	—	No connect	2B03	—	No connect
		1B02	COM1	24VDC	2B02	COM1	24VDC
		1B01	COM1	24VDC	2B01	COM1	24VDC
		1A20	IN	MC-X10	2A20	IN	PLC-X10
		1A19	IN	MC-X11	2A19	IN	PLC-X11
		1A18	IN	MC-X12	2A18	IN	PLC-X12
		1A17	IN	MC-X13	2A17	IN	PLC-X13
		1A16	IN	MC-X14	2A16	IN	PLC-X14
		1A15	IN	MC-X15	2A15	IN	PLC-X15
		1A14	IN	MC-X16	2A14	IN	PLC-X16
		1A13	IN	MC-X17	2A13	IN	PLC-X17
		1A12	IN	MC-X18	2A12	IN	PLC-X18
		1A11	IN	MC-X19	2A11	IN	PLC-X19
		1A10 (Note-1)	IN/OUT	MC-Y1A/X1A	2A10 (Note-1)	IN/OUT	PLC-Y1A/X1A
		1A09 (Note-1)	IN/OUT	MC-Y1B/X1B	2A09 (Note-1)	IN/OUT	PLC-Y1B/X1B
		1A08	IN/OUT	MC-Y1C/X1C	2A08	IN/OUT	PLC-Y1C/X1C
		1A07	IN/OUT	MC-Y1D/X1D	2A07	IN/OUT	PLC-Y1D/X1D
		1A06	IN/OUT	MC-Y1E/X1E	2A06	IN/OUT	PLC-Y1E/X1E
		1A05	IN/OUT	MC-Y1F/X1F	2A05	IN/OUT	PLC-Y1F/X1F
		1A04	—	No connect	2A04	—	No connect
		1A03	—	No connect	2A03	—	No connect
		1A02	COM2	0V	2A02	COM2	0V
		1A01	COM2	0V	2A01	COM2	0V

Motion IO   PLC IO

1B20 1A20 2B20 2A20
1B19 1A19 2B19 2A19
1B18 1A18 2B18 2A18
1B17 1A17 2B17 2A17
1B16 1A16 2B16 2A16
1B15 1A15 2B15 2A15
1B14 1A14 2B14 2A14
1B13 1A13 2B13 2A13
1B12 1A12 2B12 2A12
1B11 1A11 2B11 2A11
1B10 1A10 2B10 2A10
1B09 1A09 2B09 2A09
1B08 1A08 2B08 2A08
1B07 1A07 2B07 2A07
1B06 1A06 2B06 2A06
1B05 1A05 2B05 2A05
1B04 1A04 2B04 2A04
1B03 1A03 2B03 2A03
1B02 1A02 2B02 2A02
1B01 1A01 2B01 2A01

Front view of the module

(Note-1): 0.2A output is possible. (Other pins are 0.1A output.)
(Note-2): Controlled by the system. (Normal safety observation function: ON, error detection: OFF)

4.4 External wiring diagram
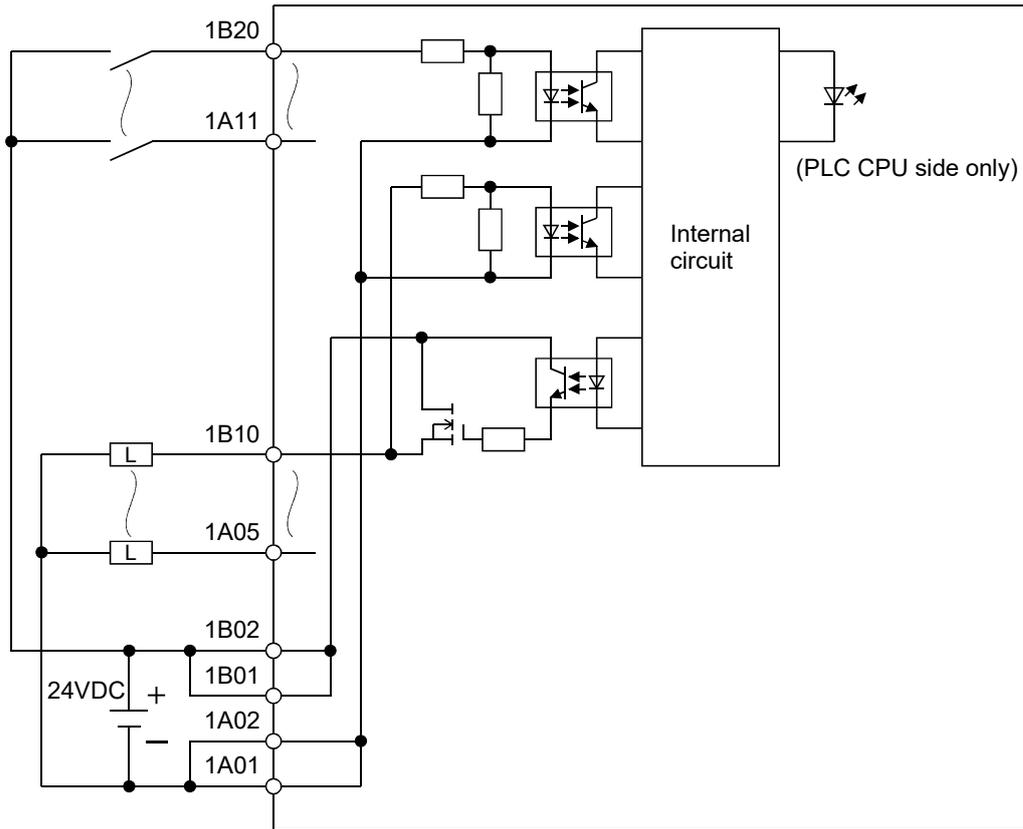
5 Installation and removal

5.1 Installation of the module
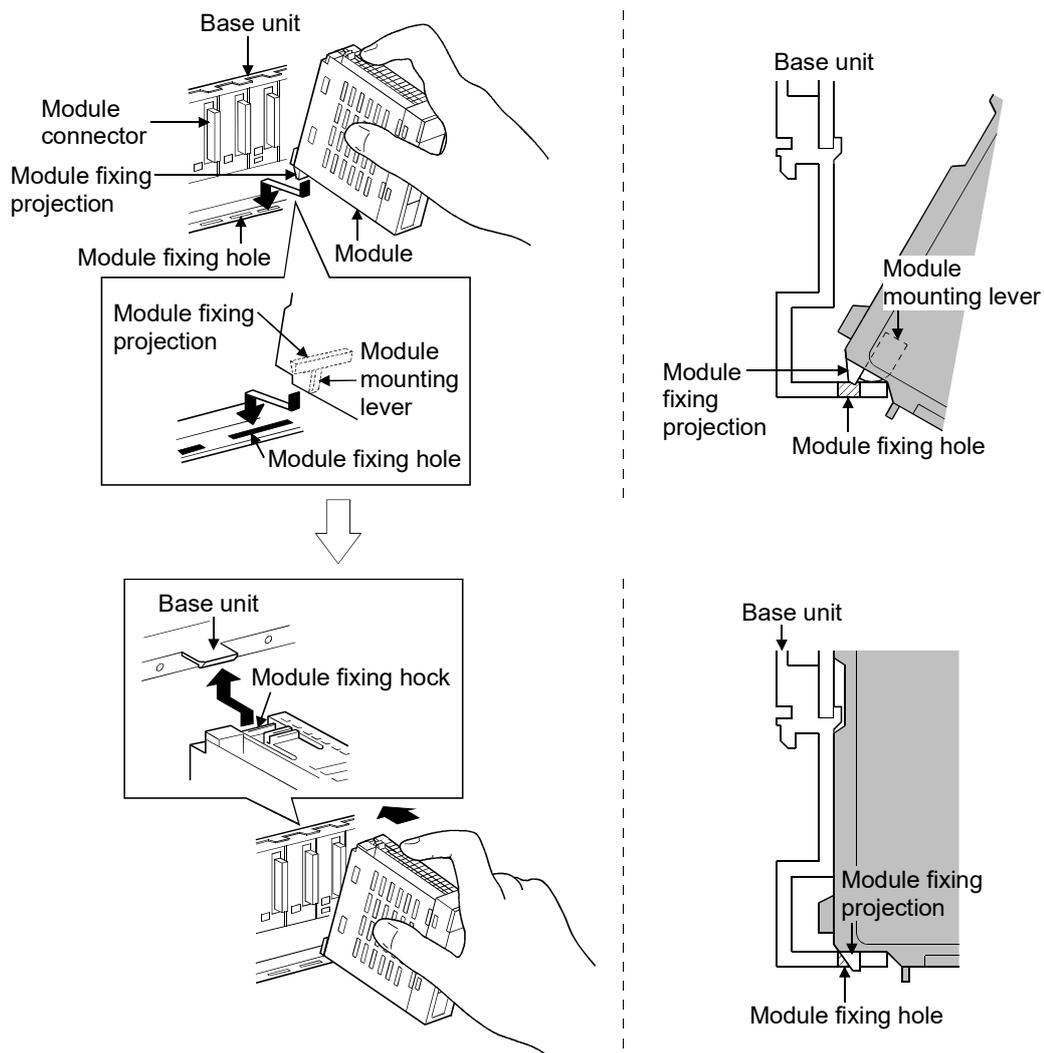
- When installing the module, always insert the module fixing projection into the module fixing hole of the base unit.
  At that time, securely insert the module fixing projection so that it does not come off from the module fixing hole.
  If the module is forcibly installed without the latch being inserted, the module connector and module will be damaged.
- 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)
  Screw the Motion CPU module to the main base unit using supplied fixing screws (M3×13).
- Do not install/remove the module onto/from base unit or terminal block more than 50 times, after the first use of the product. Doing so may cause the module to malfunction due to poor contact of connector.

5.2 Removal of the module
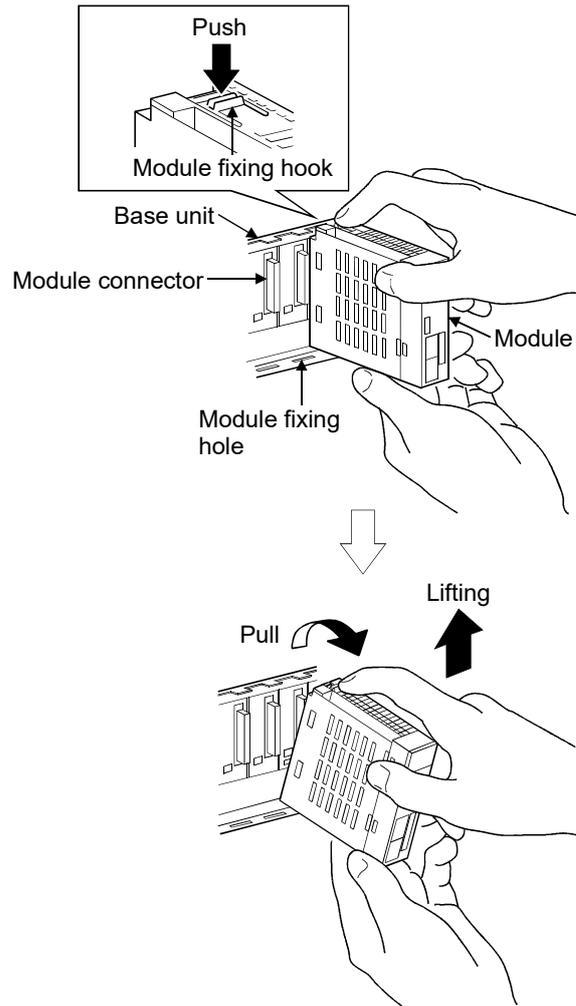
- When the module fixing screw is used, always remove the module by removing the module fixing screw and then taking the module fixing projection off the module fixing hole of the base unit.
  Attempting to remove the module by force may damage the module fixing projection.
- Do not touch the heat radiating fins of controller or module case, 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 with care.
- 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.

6 Wiring

⚠ CAUTION	**De-energize the entire system** The system could start up unexpectedly while you are connecting the devices.

- Measure the input voltage to safety signal module with the input connector part. Be sure to select DC power supply within the range of 21.6VDC to 26.4VDC included ripple voltage and spike voltage and wire.
- When wiring in the safety signal module, 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. Wire the cable correctly. Wrong wiring may damage the internal circuit.
- Always use a shield cable for connection of the 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 interference. (Separate them more than 100mm (3.94inch) away.)
- Connect the shield wire of the connection cable to the FG terminal of the external equipment.
- Securely tighten the cable connector fixing screws and fixing mechanisms. Insufficient fixing may lead to cables coming off during operation.
- Always wire the cables when power is OFF. Not doing so may damage the circuit of modules.
- Wire the cable correctly. The safety observation function may not work correctly with incorrect wiring. Please check the wiring and test sufficiently.

7 Technical data

7.1 Safety specification

Item	Specification
Category	Cat 3 (EN ISO13849-1:2015)
Safety Integrity Level	EN IEC 62061:2021(maximum SIL 2)
Performance Level	PL d (EN ISO13849-1:2015)
MTTFd	169 years or longer
DC	Low
PFH	2.17×10^{-8} hr^{-1}
Safety observation functions	Safety signal comparison, safety communication (IEC 61784-3:2010) STO, SS1, SS2, SOS, SLS, SBC, SSM (IEC 61800-5-2:2016)

(Note): Only processing block is included in the scope of safety specifications.
Input block (including sensor) and output block (contactor and safety servo STO function) are not included.

7.2 General specifications

Item	Specification
Operating ambient temperature	0 to 55°C (32 to 131°F)
Storage ambient temperature	-25 to 75°C (-13 to 167°F)
Operating ambient humidity	5 to 95% RH, non-condensing
Storage ambient humidity	5 to 95% RH, non-condensing
Vibration resistance	Compliant with JIS B 3502 and EN 61131-2:2007
Shock resistance	
Operating ambience	No corrosive gases
Operating altitude (Note-1)	2000m (6561.68ft.) or less
Mounting location	Inside control panel
Overvoltage category (Note-2)	II or less
Pollution degree (Note-3)	2 or less

(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 modules under pressure, please contact your 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 degree 2 is when only non-conductive pollution occurs. A temporary conductivity caused by condensing must be expected occasionally.
Mount the Motion controller on a cabinet which meets IP54 in the correct vertical direction to maintain pollution degree 2.

7.3 PLC CPU module QnUD(E)(H)CPU specifications

Item	Specification
Internal current consumption (5VDC) [A]	0.33 to 0.55
Exterior dimensions [mm(inch)]	98(H) × 27.4(W) × 89.3 to 115(D) (3.86(H) × 1.08(W) × 3.52 to 4.53(D))
Mass [kg]	0.20 to 0.24
Included items	Module × 1, Battery (Q6BAT) × 1

7.4 Motion CPU module Q17□DSCPU/Q17□DCPU-S1 specifications

Item	Specification
Internal current consumption (5VDC) [A]	1.30 to 1.75
Exterior dimensions [mm(inch)]	98 to 120.5(H) × 27.4(W) × 119.3 to 120.3(D) (3.86 to 4.74(H) × 1.08(W) × 4.7 to 4.74(D))
Mass [kg]	0.33 to 0.38 kg
Included items	Module × 1, Battery (Q6BAT) × 1, Battery holder unit (Q170DBATC) [Note-1] × 1, Battery cable (Q170DBATCBL05M) [Note-1] × 1, Safety Guidelines (IB-67423) × 1

(Note-1): Q17□DCPU-S1 only

7.5 Safety signal module Q173DSXY specifications

Item	Specification
Number of input point	32 points × 2 lines (PLC CPU control 32 points + Motion CPU control 32 points, Safety input 20 points × 2 lines, Feedback input for output 12 points × 2 lines)
Input isolation method	Photocoupler
Rated input voltage	24VDC (±10%, ripple rate within 5%)
Rated input current	Approx. 4mA
Input resistance	Approx. 8.2kΩ
ON voltage/ON current	20V or more/3mA or more
OFF voltage/OFF current	5V or less/1.7mA or less
Input response time	PLC CPU control I/O: 10ms (initial value of digital filter) Motion CPU control I/O: 15ms (CR filter)
Input common method	32 points/common (PLC I/O and Motion I/O are separated)
Input type	Type 1, Current sinking
Number of output point	12 points × 2 lines (PLC CPU control 12 points + Motion CPU control 12 points)
Output isolation method	Photocoupler
Rated load voltage	24VDC (±10%)
Maximum load current	(0.1A × 8 points, 0.2A × 4 points) × 2 lines Common current: 1.6A or less for each connector
Maximum inrush current	0.7A 10ms or less (0.2A output pin: 1.4A 10ms or less)
Output response time	1ms or less
Output common method	12 points/common (PLC I/O and Motion I/O are separated)
Output type	Current sourcing
External power supply	24VDC (±10%, ripple rate within 5%)
Operation indicator (input/output)	ON indication (LED) (indicates PLC CPU's 32 points)
Number of I/O occupying points	32 points (I/O allocation: I/O mix, 32 points)
Communication with PLC CPU	Parallel bus communication (Via main base unit)
Communication with Motion CPU	Serial communication (RS-485), Use a RIO cable Q173DSXYCBL01M (Attachment): 0.1m (0.33ft.), Q173DSXYCBL05M (Optional): 0.5m (1.64ft.)
Applicable wire size	0.3mm^2
Applicable connector for the external connection	A6CON1(Attachment), A6CON2, A6CON3, A6CON4(Optional)
Connector/terminal block conversion module	A6TBXY36 (Optional), FA-LTB40P (Optional: Mitsubishi Electric Engineering Co., Ltd. make)
Cable for connector/terminal block conversion module	AC50TB (included with A6TBXY36), FA-CBL□FMV-M (included with FA-LTB40P)
Number of modules	Up to 3 modules (installed only on main base unit)

Item	Specification
Internal current consumption (5VDC) [A]	0.2 (When TYP. all points ON)
Exterior dimensions [mm(inch)]	98(H) × 27.4(W) × 90(D) (3.86(H) × 1.08(W) × 3.54(D))
Mass [kg]	0.15
Included item	Module × 1, RIO cable (Q173DSXYCBL01M) × 1 I/O connector (A6CON1) × 2, This manual (IB-0300186) × 1

8 Example of checklist for user documentation

MITSUBISHI ELECTRIC

Motion controller installation checklist for manufacturer/installer

The following items must be satisfied by the initial test operation at least. The manufacturer/installer must be responsible for checking the standards in the items. Maintain and keep this checklist with related documents of machines to use this for periodic inspection.

1. Is it based on directive/standard applied to the machine?　　　Yes [　], No [　]
2. Is directive/standard contained in Declaration of Conformity (DoC)?　Yes [　], No [　]
3. Does the protection instrument conform to the category required?　　Yes [　], No [　]
4. Are electric shock protective measures (protection class) effective?　Yes [　], No [　]
5. Is the safety observation function checked (test of all the shut-off wiring)?
　　　　　　　　　　　　　　　　　　　　　　　　　Yes [　], No [　]

Checking the items is not a substitute for the first test operation or periodic inspection by professional engineers.

WARRANTY

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

1. Gratis Warranty Term and Gratis Warranty Range

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

[Gratis Warranty Term]

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

[Gratis Warranty Range]

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

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

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

2. Onerous Repair Term after Discontinuation of Production

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

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

3. Service in overseas countries

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

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

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

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

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

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

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

5. Change of Product specifications

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

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.

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

Country/ Region	Sales office/ Tel	Country/ Region	Sales office/ Tel
USA	MITSUBISHI ELECTRIC AUTOMATION, INC. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A. Tel : +1-847-478-2100	Turkey	MITSUBISHI ELECTRIC TURKEY A.Ş Ümraniye Branch Serifali Mah. Kale Sok. No:41 34775 Umraniye - Istanbul, Turkey Tel : +90-216-969-2500
Mexico	MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch Mariano Escobedo #69, Col. Zona Industrial, Tlalnepantla Edo. Mexico, C.P.54030 Tel : +52-55-3067-7500	UAE	MITSUBISHI ELECTRIC EUROPE B.V. Dubai Branch Dubai Silicon Oasis, P.O.BOX 341241, Dubai, U.A.E. Tel : +971-4-3724716
Brazil	MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA. Avenida Adelino Cardana, 293, 21 andar, Bethaville, Barueri SP, Brazil Tel : +55-11-4689-3000	South Africa	ADROIT TECHNOLOGIES 20 Waterford Office Park, 189 Witkoppen Road, Fourways, South Africa Tel : +27-11-658-8100
Germany	MITSUBISHI ELECTRIC EUROPE B.V. German Branch Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany Tel : +49-2102-486-0	China	MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. No.1386 Hongqiao Road, Mitsubishi Electric Automation Center, Shanghai, China Tel : +86-21-2322-3030
UK	MITSUBISHI ELECTRIC EUROPE B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, U.K. Tel : +44-1707-28-8780	Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. 7F-9F, Gangseo Hangang Xi-tower A, 401, Yangcheon-ro, Gangseo-Gu, Seoul 07528, Korea Tel : +82-2-3660-9530
Ireland	MITSUBISHI ELECTRIC EUROPE B.V. Irish Branch Westgate Business Park, Ballymount, Dublin 24, Ireland Tel : +353-1-4198800	Singapore	MITSUBISHI ELECTRIC ASIA PTE. LTD. 307, Alexandra Road, Mitsubishi Electric Building, Singapore 159943 Tel : +65-6473-2308
Italy	MITSUBISHI ELECTRIC EUROPE B.V. Italian Branch Centro Direzionale Colleoni-Palazzo Sirio Viale Colleoni 7, 20864 Agrate Brianza(Milano) Italy Tel : +39-039-60531	Thailand	MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO., LTD. 12th Floor, SV.City Building, Office Tower 1, No. 896/19 and 20 Rama 3 Road, Kwaeng Bangpongpang, Khet Yannawa, Bangkok 10120, Thailand Tel : +66-2682-6522
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Poland	MITSUBISHI ELECTRIC EUROPE B.V. Polish Branch ul. Krakowska 50, 32-083 Balice, Poland Tel : +48-12-347-65-00	India	MITSUBISHI ELECTRIC INDIA PVT. LTD. Pune Branch Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune-411026, Maharashtra, India Tel : +91-20-2710-2000
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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.