MITSUBISHI ELECTRIC

Changes for the Better

for a greener tomorrow eco Changes

C Controller/Personal Computer Embedded Type
Servo System Controller

Unique Servo Control Available Through C Language Based Programming

**Connected to a C Controller via PCI Express®
for controlling MELSERVO-J4**

C Controller Interface Module

Embedded in a personal computer for controlling MELSERVO-J4

Position Board

High-speed Synchronous Network "SSCNET III/H" Through C Language Based Programming

High-response servo control is achieved in a combination of C Controller and the Interface Module or a personal computer and the Position Board.
The system that is completely configured by Mitsubishi products boosts reliability further.

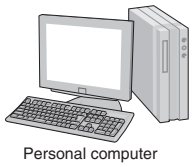
- C Controller or a personal computer is selectable
- Programmable controllers are not required in the system
- SSCNET III/H compatible servo amplifiers MR-J4-B are connectable
- Equipped with Point to Point positioning functionality as standard (set with Point table)
- High-speed processing (1 cycle startup, 0.22 ms/8 axes)
- Various API functions and a test tool are available
- Real-time OS is supported

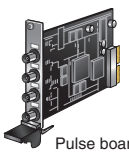
(Note): Contact your local sales office for details

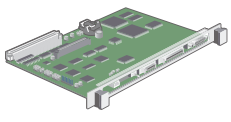
Advantages of Introducing C Controller/PC Embedded Type Servo System Controller

Current customer situation

- Seeking a higher performance of servos and a more advanced servo interface
- Seeking products with higher performance and added value, while maintaining the program assets.


Personal computer

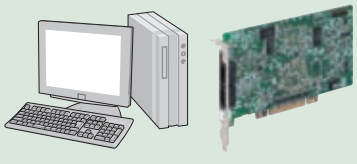

Pulse board

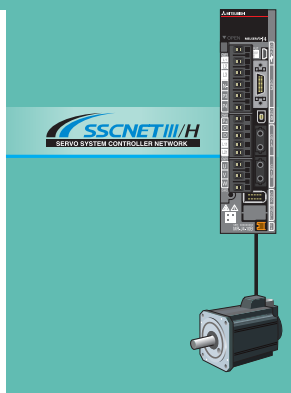

Microcomputer board

The system installed

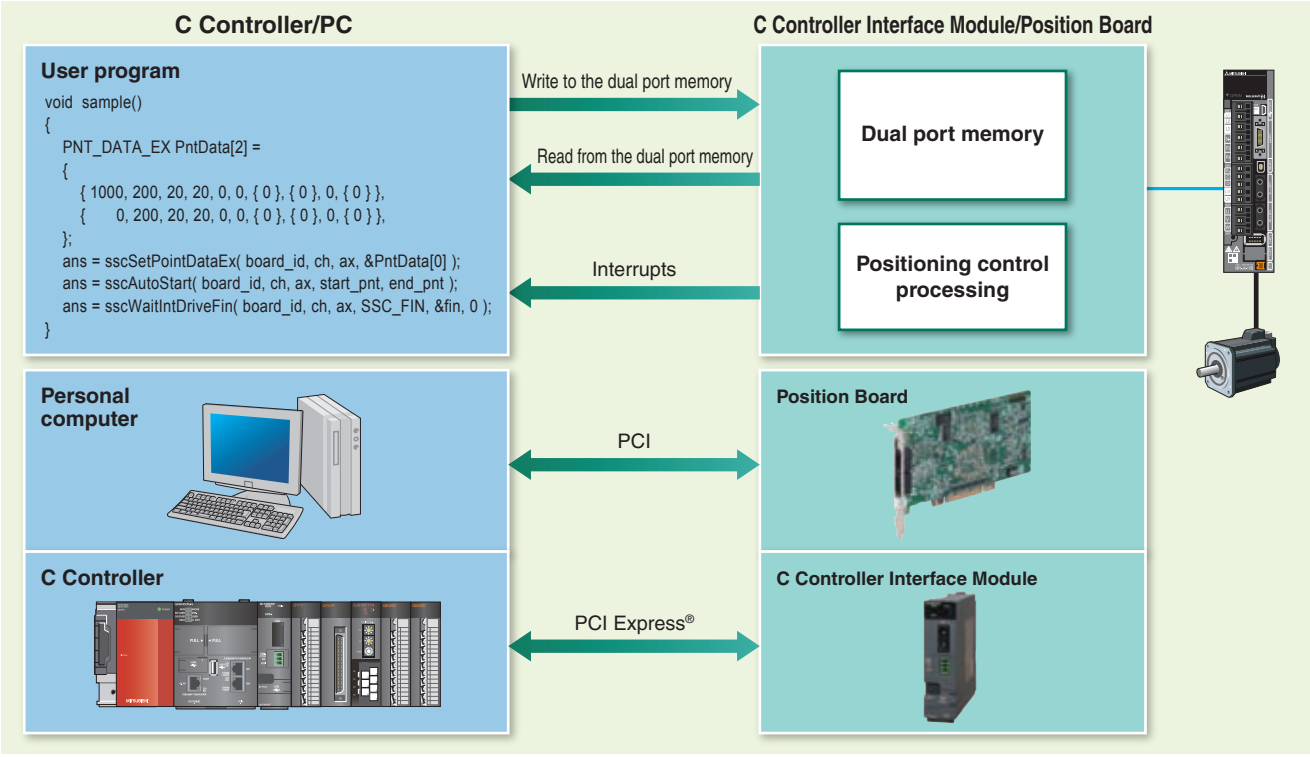
- **SSCNET III/H compatible servo amplifiers are connectable**
- **SSCNET III/H compatible servo amplifiers, digital I/F, reduced wiring, and absolute position system**

Boost reliability





Configuration



Configure a High-response Servo System in a Combination with a C Controller

C Controller Interface Module Q173SCCF

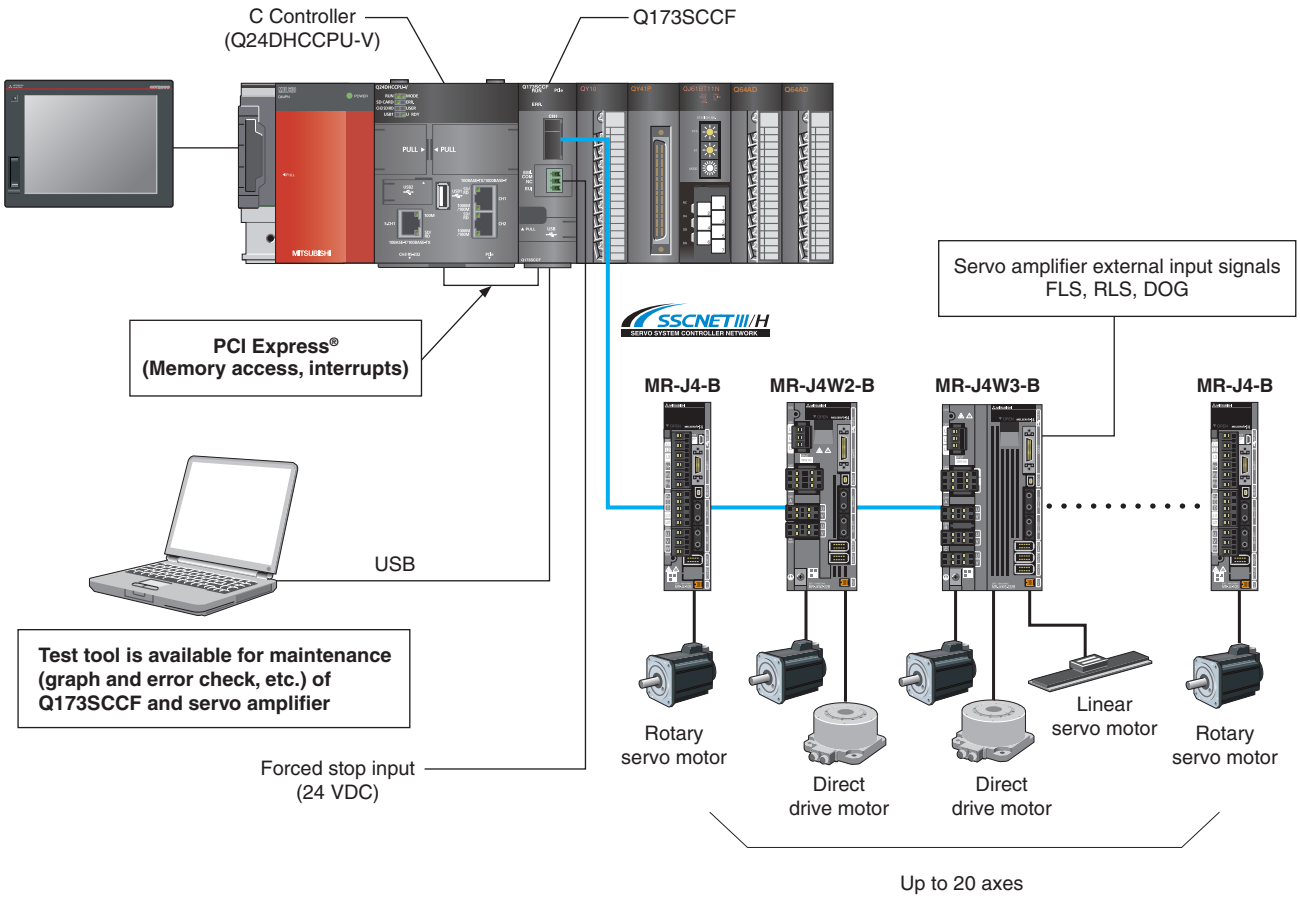

Q173SCCF

Connected directly to a C Controller through PCI Express®, this module is used for controlling MELSERVO-J4 SSCNET III/H compatible servo amplifiers, through a user program.

Features

- High-speed access and interrupt detection are achieved with PCI Express®.
- A system which is configured with a C Controller has more reliable and longer-term stable product supply than the conventional PC.
- Event-driven method programs, which use interrupts, are possible.
- Equipped with Positioning functionality using Point table.
- An API library is available for more efficient software development.
- This Interface Module will support C Controllers where Lineo uLinux is installed.
  (Note): Contact your local sales office for more details.

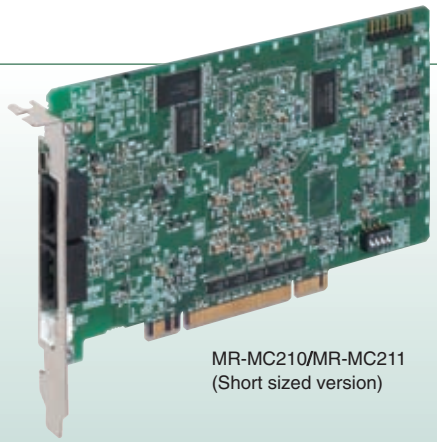
System Configuration



Configure a High-response Servo System by Embedding the Position Board in a PC

Position Board MR-MC210/MR-MC211

This board type controller is used for controlling MELSERVO-J4 SSCNET III/H compatible servo amplifiers, through a user program.

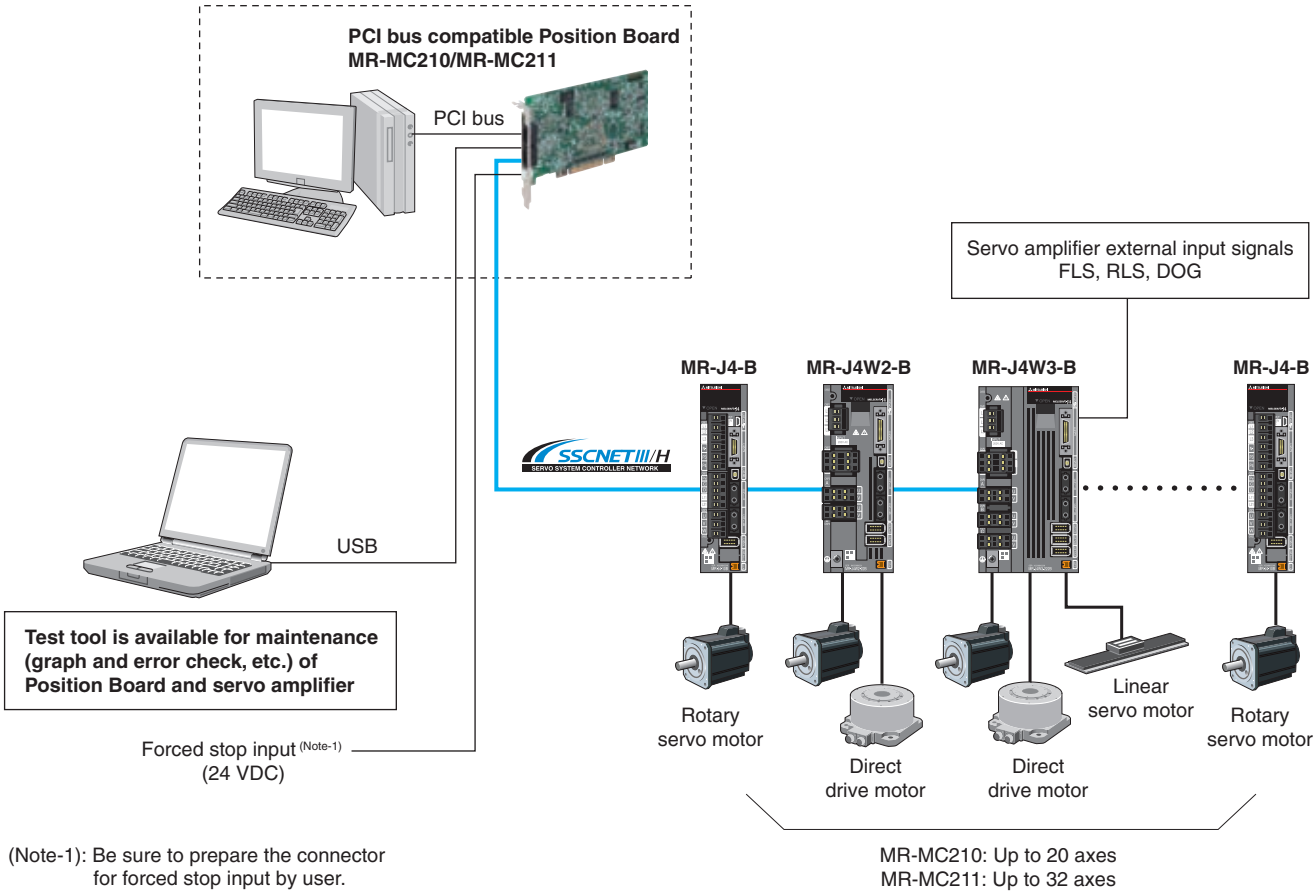


MR-MC210/MR-MC211
(Short sized version)

Features

- An SSCNET III/H servo system that is controlled by a personal computer can be configured.
- Various conventional boards and programs for PC can be effectively used.
- Event-driven method programs, which use interrupts, are possible.
- Equipped with Positioning functionality using Point table.
- An API library is available for more efficient software development.
- Real-time OS is supported.
  (Note): Contact your local sales office for more details.

System Configuration

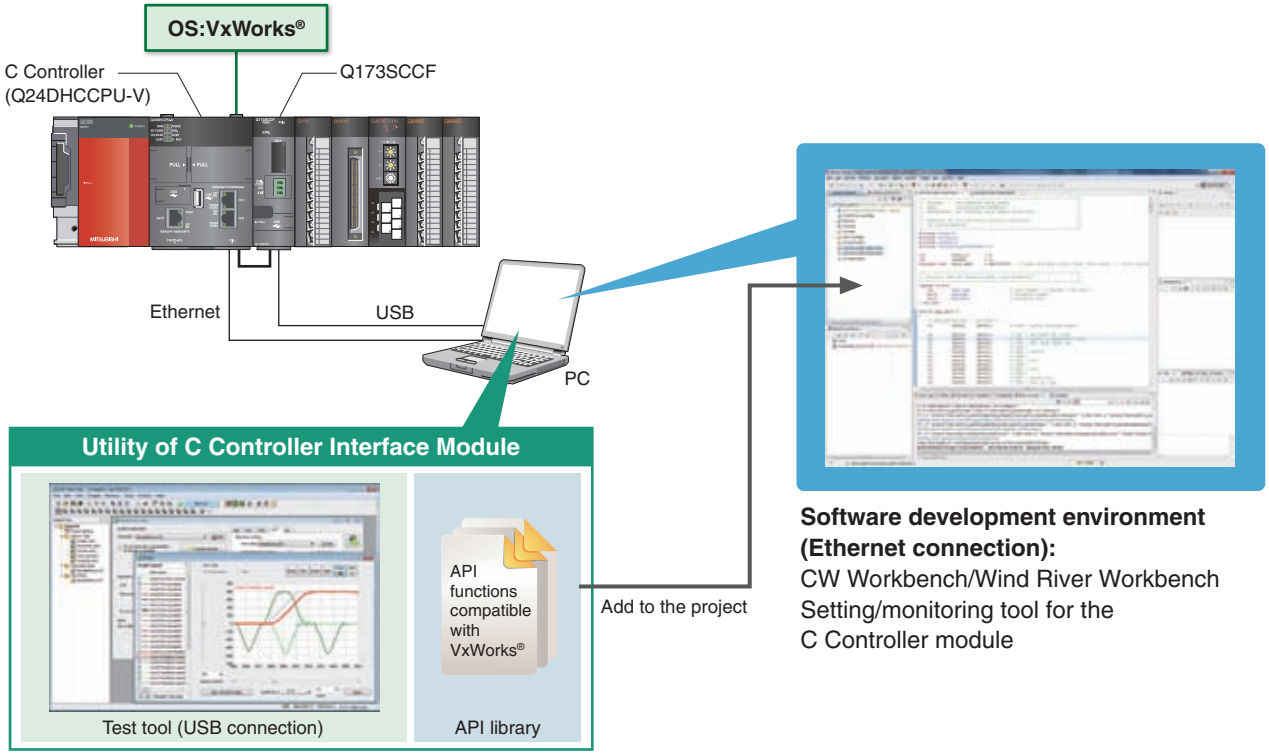


(Note-1): Be sure to prepare the connector for forced stop input by user.

Software Development Environment

[C Controller Interface Module]

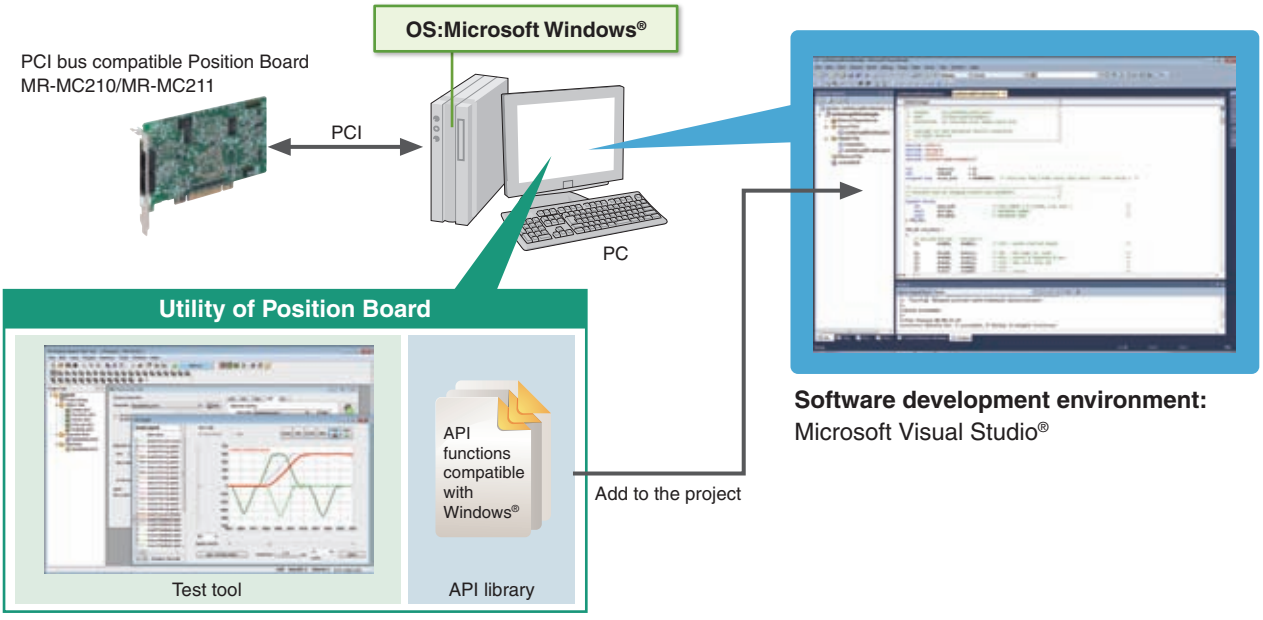
Create a user program by adding the positioning control API library to the project of the C Controller software development environment "CW Workbench". Also, since the OS for the C Controller (VxWorks®) has been pre-installed, you do not need to install it.



Software development environment (Ethernet connection):
CW Workbench/Wind River Workbench
Setting/monitoring tool for the
C Controller module

[Position Board]

Create a user program by adding the positioning control API library to the project of Microsoft Visual Studio® which is running on a Windows® OS PC.



Software development environment:
Microsoft Visual Studio®

(Note): Be sure to prepare the operating system software and software development environment by user.

Q173SCCF MR-MC21n

[Utility]

The utility for C Controller Interface Module/Position Board includes the following software that is necessary for application development.

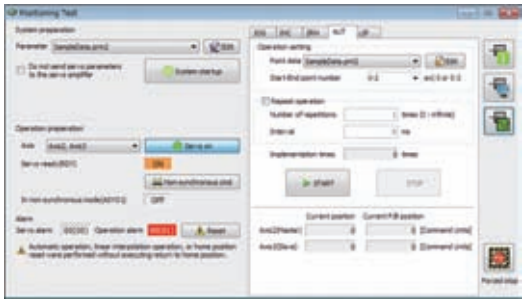
Test tool | **API library** | **Device driver (Position Board only)**

Test tool

This tool supports parameter and point data settings for application development, operation check such as servo adjustment and error analysis. MR Configurator2 can be started from the test tool, so servo adjustment is easily performed.

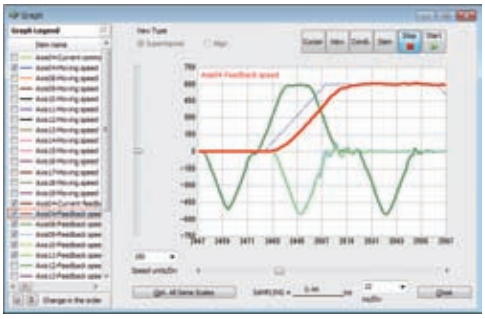
Easy test operation check

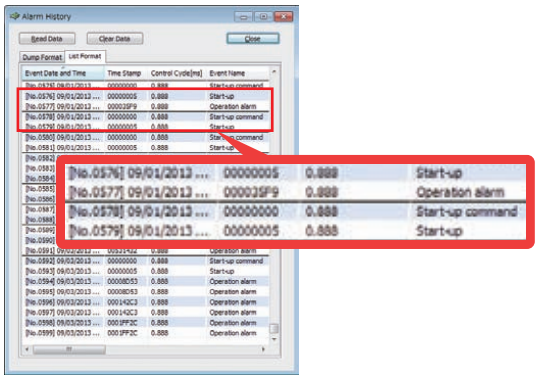
Test operation is easily performed by using Positioning test operation functions and Parameter/Point data setting functions, being useful for checking SSCNET III/H wiring and motor movement.



Maintenance

You can confirm the sampled waveform of monitor data (32 items) and bit data (16 items) to check the sequence of user programs and startup timing.
Error analysis is carried out with ease by reading the alarm history stored on the non-volatile memory.





API library

The API library is the API functions for creating applications for C Controllers or on a personal computer.
Servo amplifier initialization, parameter change, and startup in various operation modes are available.

Positioning Control

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The C language user program executes positioning operations by using the API library.
The operation is started with positioning data from the point data table and waits until an event occurs by interrupts.

User program

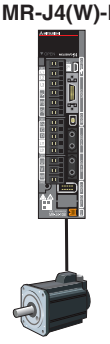
```
void sample()
{
    int    board_id      = 0;    /* Board ID */
    int    channel       = 1;    /* Channel No.*/
    int    axnum         = 1;    /* Axis No.*/
    int    start_pnt     = 0;    /* Start point No.*/
    int    end_pnt       = 1;    /* End point No.*/
    int    fin_status;
    int    ans;
    PNT_DATA_EX PntData[2] =
    {
        { 1000, 200, 20, 20, 0, 0, { 0 }, { 0 }, 0, { 0 } },
        {    0, 200, 20, 20, 0, 0, { 0 }, { 0 }, 0, { 0 } },
    };
    /* Point data setting */
    ans = sscSetPointDataEx( board_id, channel, axnum, start_pnt, &PntData[0] );
    ans = sscSetPointDataEx( board_id, channel, axnum, end_pnt, &PntData[1] );
    /* Operation start */
    ans = sscAutoStart( board_id, channel, axnum, start_pnt, end_pnt );
    /* Operation wait */
    ans = sscWaitIntDriveFin( board_id, channel, axnum, SSC_FIN_TYPE_SMZ, &fin_status, 0 );
}
```

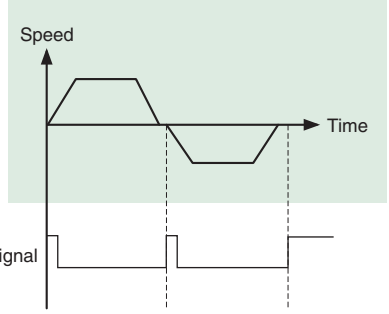
C Controller Interface Module/Position Board

Point Data

No.	Position data	Feed speed	Acceleration time constant	Deceleration time constant	Dwell	Auxiliary command	···
0	1000	200	20	20	0	Absolute position command, In-position stop	0
1	0	200	20	20	0	Absolute position command, In-position stop	0

MR-J4(W)-B



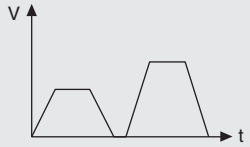


Various Optional Features for Point to Point Positioning Operation

[Deceleration check system]
When multiple points are specified, select the completion conditions of each point movement.

Ensuring passing the target position

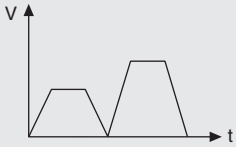
In-position stop



After In-position signal turns ON, operation proceeds to the next point.

Not waiting for motor stabilization

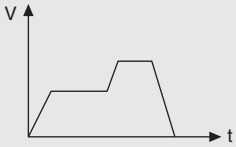
Smoothing stop



After completion of the position command output, operation proceeds to the next point.

Not stopping at a point

Continuous operation

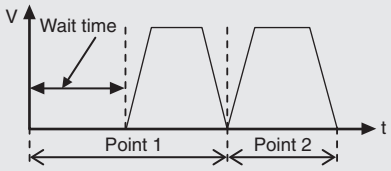


The current speed is changed to the command speed of the next point.

[Dwell time setting] Set the wait time between points

Wait time before the point movement operation starts

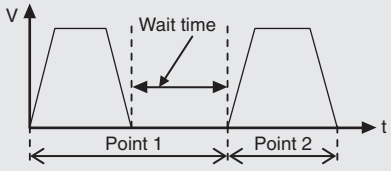
Pre-dwell



Operation starts after the specified wait time

Wait time after moving to the point

Dwell

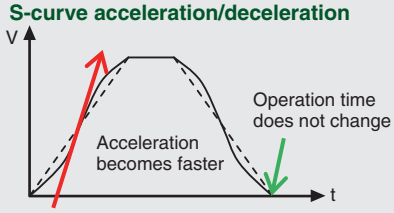


Operation is completed when the specified time has elapsed after moving to the point.

[S-curve acceleration/deceleration and smoothing filter] Vibration is suppressed with smooth speed changes

Same operation time duration

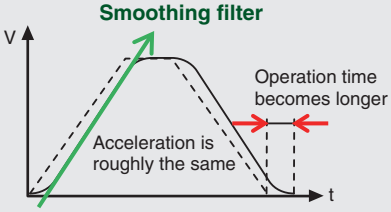
S-curve acceleration/deceleration



Maximum acceleration is faster than trapezoidal acceleration/deceleration.

Same maximum acceleration speed

Smoothing filter

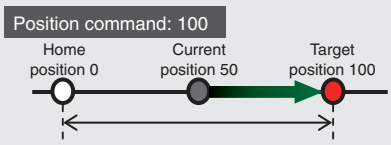


Maximum acceleration speed is roughly the same as trapezoidal acceleration/deceleration.

[Position command system] Specify the reference position of position commands

Target position with reference to the home position

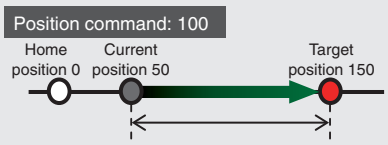
Absolute position command



Moves to the target position, "100" away from the home position.

Target position with reference to the current position

Relative position command

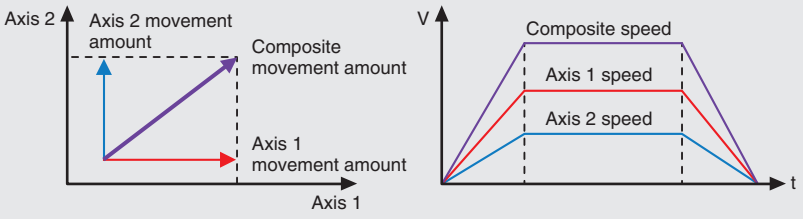


Moves to the target position, "100" away from the current position.

[Linear interpolation operation] Maximum of 8 groups (control cycle:0.88 ms), 2 to 4 axes per group in this operation

Interpolation operation with multiple axes

Linear interpolation operation



Tandem Operation

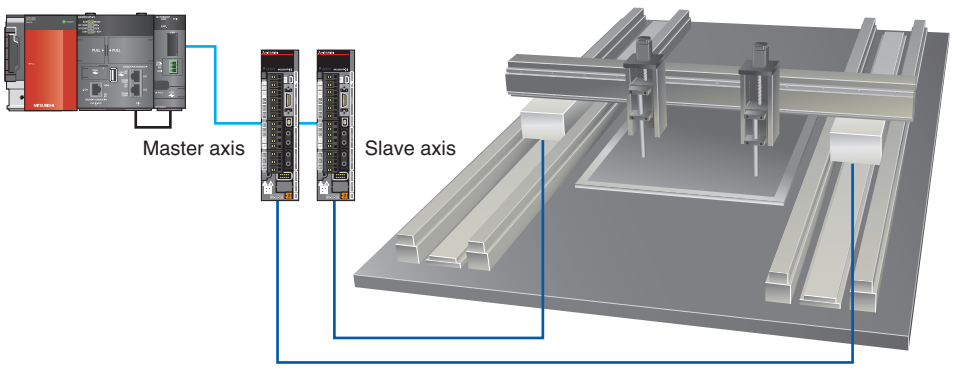
Q173SCCF MR-MC21n

With the operation start of the master axis, same commands start to be transmitted to both the master and slave axes, which achieves a tandem operation.

[Functions]

- Synchronous operation
- Check for deviations in synchronization
- Stop processing in case servo error occurs
- Simultaneous home position return of multiple axes
- JOG operation

Tandem operation system



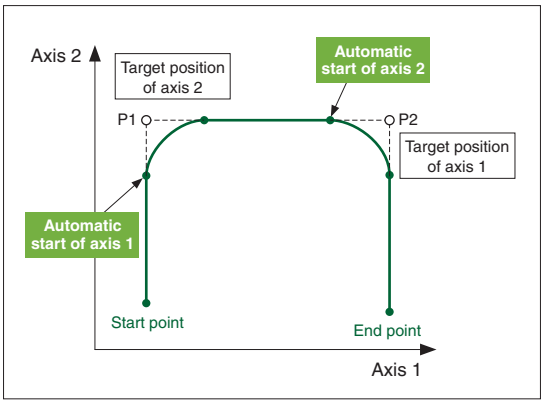
Other Axes Start Function

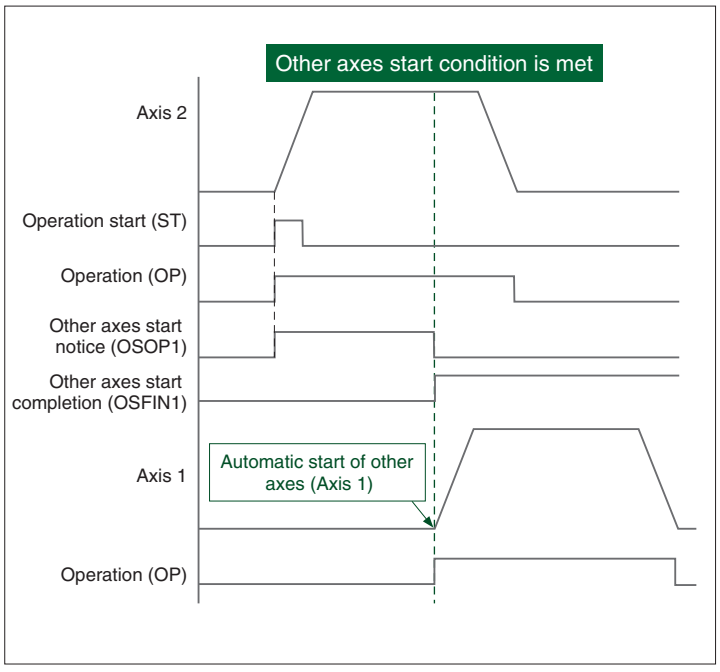
Q173SCCF MR-MC21n

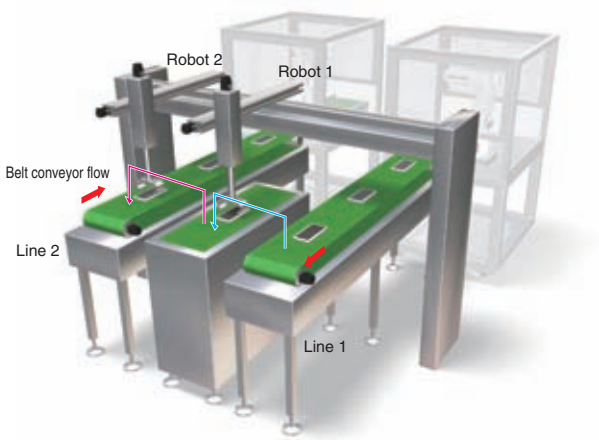
This function automatically starts other axes according to its startup condition and its operation pattern.
Tact time of assembly machines, etc. is shortened with this automatic startup via controllers.

Operation example

1. Axis 2 moves to P1 from its start point.
2. When axis 2 passes the specified point, axis 1 automatically starts.
3. Axis 2 reaches P1.
4. When axis 1 passes the specified point, axis 2 automatically starts.
5. Axis 1 reaches P2.
6. Axis 2 reaches the end point.







Application example:
Product handling equipment

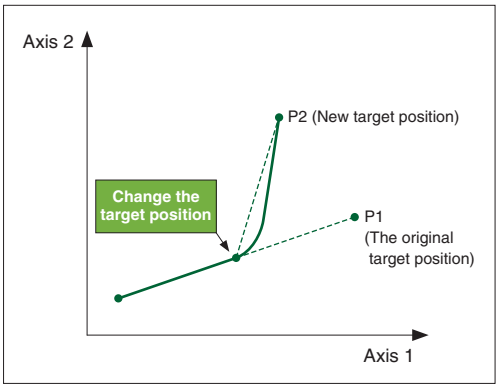
Position Change Function

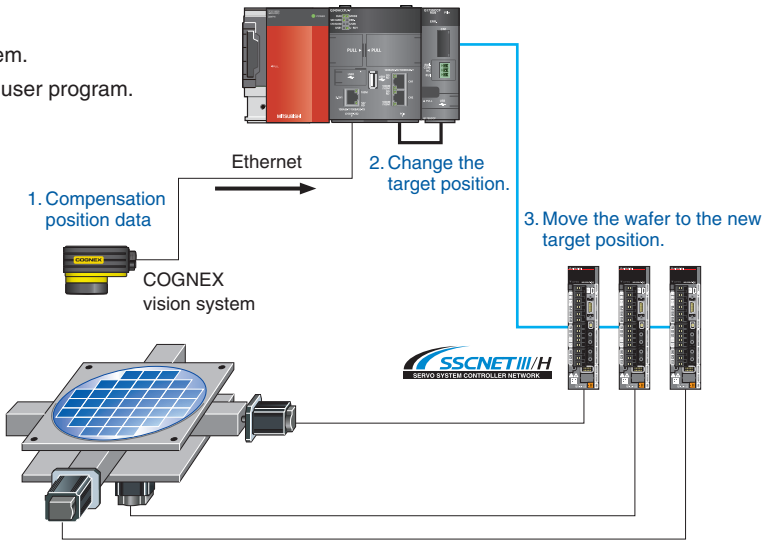
Q173SCCF MR-MC21n

While linear interpolation is performed, the target position can be changed by rewriting the position data of the point table and then turning ON Position change command (PCHG).
Thus, tact time is shortened by changing the target position during the operation.
The axes move to the new target position through an arc trace in order to maintain the speed.

Operation example

1. Detect the compensation position with the vision system.
2. The target position is changed from P1 to P2 with the user program.
3. Move the wafer to the new target position.





Pass Position Interrupt Function

Q173SCCF MR-MC21n

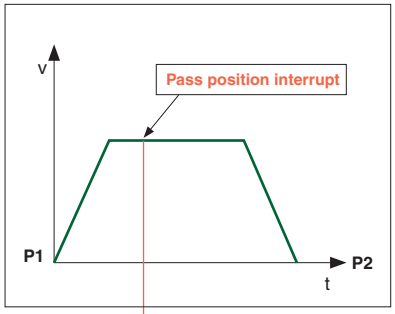
During automatic operation, interrupts are outputted when axes pass the specified position.
After that, the corresponding interrupt process of the user program is started.

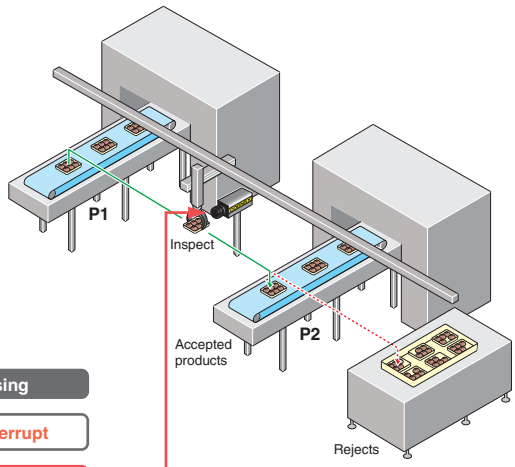
- High-speed event processing start on host side (OS) is possible based on the servo axis position
- A total of 64 points can be specified for pass position data of all axes

Operation example

1. As the axes are moving to P2 from P1, the interrupt occurs.
2. The vision camera takes photos of the work piece while processing the interrupts.
3. The position data is read.

The vision camera takes photo responding to the interrupts.
Thus by taking photos periodically with interrupts, more accurate position data is available.



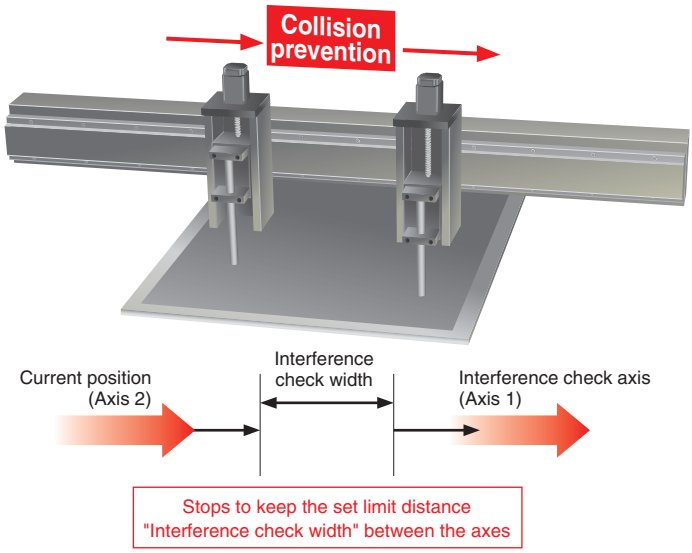


Application example: inspection machine

Interference Check Function

Q173SCCF MR-MC21n

The position of axes is constantly monitored.
If the distance between axes (relative position) is assumed to become smaller than the "Interference check width", the "Entering interference area error" occurs, and the axes are forced to stop to prevent collision.

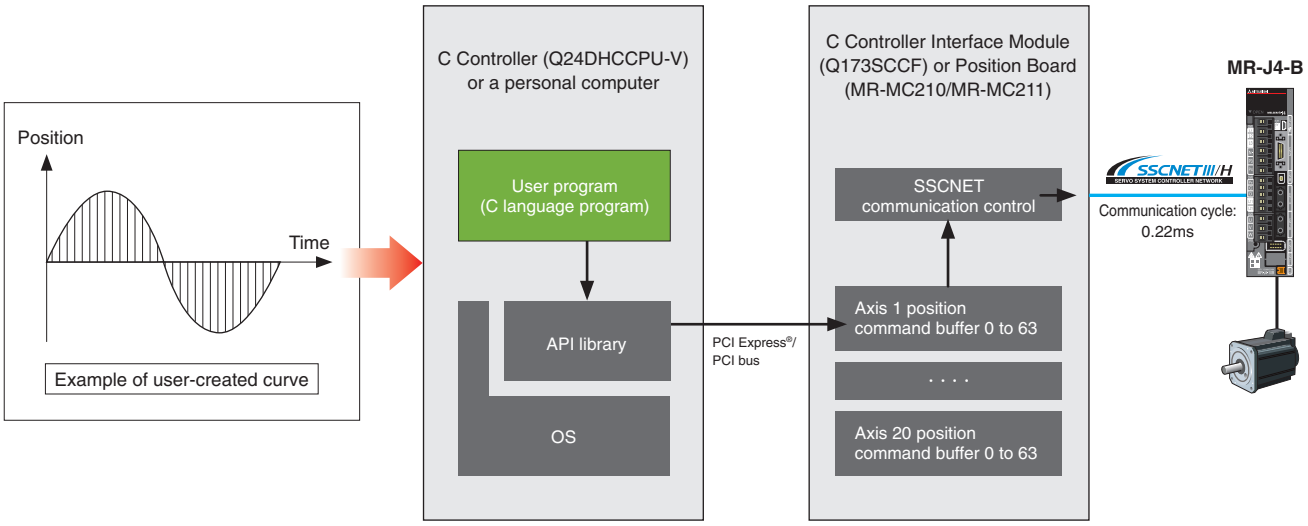


Interface Mode Function

Q173SCCF MR-MC21n

Various curve patterns are achieved with a user program using the interface mode, available as standard

The interface mode (sequential position command method) is available as standard to perform Motion control flexibly.
Curves created with a user program can be used as commands to servo amplifiers.



Main Basic Functions

Q173SCCF MR-MC21n

JOG operation — Operation function

When the movement direction is specified and the start operation signal is inputted, JOG operation is started in the designated direction and the movement continues until the start operation signal is turned OFF. JOG operation can be used without completing home position return.

Automatic operation — Operation function

The point table, where position data and feed speed are set, is used in this automatic operation. Once the start operation signal is turned ON, instructions are executed sequentially from the set start point number to the set end point number.

Electronic gear — Application function

This function adjusts the number of pulses outputted to the servo amplifiers so that a machine moves by the specified command unit in a program.

Acceleration/deceleration — Application function

Various acceleration/deceleration methods, such as linear acceleration/deceleration, smoothing filter, and S-curve acceleration/deceleration, are widely available. Select the suitable one for your machine.

Servo amplifier disconnect — Application function

The servo amplifier disconnect function enables an operation without connecting a servo amplifier. User programs can be debugged without servo amplifiers.

Position switch — Application function

The Position switch signal is turned ON when the axis is within setting range, set by the position switch upper limit and position switch lower limit parameters. This function can act as a switch or a sensor.

Home position search limit — Application function

This function is used while returning to the home position in the opposite direction of the home position return. If the movement exceeds the parameter set for the home position search limit, the home position search limit error occurs and the home position return operation is terminated.

Absolute position detection system — Application function

In the absolute position detection system, if the home position is determined at the system startup, there is no need to execute the home position return again because the absolute position is restored at system startup.

Incremental feed — Operation function

A fixed feed distance is implemented for each start operation signal (ST). The amount of feed is defined using the incremental feed movement amount. Incremental feed can be used without completing the home position return.

Home position return — Operation function

This function establishes the reference position (home position) when the positioning control is performed. Various methods are available, such as dog method, data set method, stopper method, scale home position signal detection method.

Stop operation function — Application function

Forced stop, operation stop, and rapid stop are available. These stop operations are executed in case of detecting a machine error.

Command change — Application function

Speed change, change of time constant, and position change are available. Each command can be changed during operation.

Gain switching — Application function

By turning ON the gain switching command signal (GAIN), the gain for the servo amplifier can be changed. This is used to switch the gain during rotation and while stopped, as well as switching gain proportionally to the amount of movement or speed.

Reconnect/disconnect — Maintenance

By turning ON the disconnection command, SSCNET III/H communication with the selected axis and later can be disconnected. The axes whose communication is disconnected become non-communicating axes, so their power supplies can be turned OFF and SSCNET III cables can be detached.

Alarm history — Maintenance

This function logs alarms, storing them even when power is turned OFF, being useful for analysis of machine alarms.

Log — Maintenance

This function logs event information such as operation startup, command change, and operation completion alarms, which are used for analyzing the timing of event occurrence.

Control specification

Function		Standard Mode			Interface Mode		
		MR-MC210	MR-MC211	Q173SCCF	MR-MC210	MR-MC211	Q173SCCF
System function	Number of control axes	Up to 20 axes	UP to 32 axes	Up to 20 axes	Up to 20 axes	UP to 32 axes	Up to 20 axes
	Control cycle	0.22ms/0.44ms/0.88ms (Select using parameters.)					
Operation functions (Note-1, 2)	JOG operation	Provided			—		
	Incremental feed	Provided			—		
	Automatic operation	Point table method, 1-axis control			—		
	Linear interpolation	Point table method, Up to 4 axes interpolation (Note-3)			—		
	Home position return	Dog method, Dog cradle method, Dog front end method, Data set method, Stopper method, Z-phase detection method, Limit switch combined method, Limit switch front end method, Scale home position signal detection method, Scale home position signal detection method 2			—		
		Home position reset (data set)			—		
Application functions 1	Electronic gear	Electronic gear numerator : 1 to 5242879 Electronic gear denominator : 1 to 589823			—		
	Speed units	Command unit/min, command unit/s, and r/min can be selected.			Command unit/min, command unit/s, and r/min can be selected. (the unit for speed of monitor output)		
	Acceleration/ deceleration	Command speed limits: 1 to speed limit Limits of start speed: 1 to speed limit Time constant limits: 0 to 20000 ms Separate setting of constants for deceleration and acceleration: Provided Separate setting of constants for each point: Provided Acceleration/deceleration method: Linear acceleration/deceleration, smoothing filter, start up speed, S-curve acceleration/deceleration (sine acceleration/deceleration)			—		
	Stop function	Forced stop, Operation stop, Rapid stop			Forced stop		
	Command change	Location, Speed, Time constant			—		
Application functions 2		Hardware stroke limit, Software stroke limit, Interlock, Rough match output, Torque limit, Backlash, Position switch, Interference check (Note-3), Home position search limit, Gain switching, PI-PID switching, Absolute position detection system, Home position return request, Other axes start, Digital input/output, Servo amplifier general input/output, Pass position interrupt, Tandem operation			Torque limit, Gain switching, PI-PID switch, Absolute position detection system, Digital input/output, Servo amplifier general input/output		
Auxiliary function	Monitor	Current command position, Current F/B position, Speed command, Position droop, Electrical current command, Servo alarm number, External signal status, etc.			Provided		
	High speed monitor	Current command position, Current feedback position, Moving speed, Feedback moving speed, External signal, Electrical current feedback			Provided		
	Interrupt	During start operation, Operation stoppage (During operation, in-position, during smoothing stop, rough match, etc.) When alarm occurs (servo alarm/operation alarm),etc.			Provided		
	Host PC watchdog	Provided (Check for the watchdog of the CPU of the host computer)			Provided		
	Parameter backup	Parameters can be saved to the flash ROM.			Provided		
	Test mode	By connecting MR Configurator2 via the controllers, the servo amplifier can be simply tested.			Provided		
	Reconnect/disconnect	Provided			Provided		
	Sampling	The maximum sampling point: 65536. (Ring buffer of 8192 points)			Provided		
	Log	History of operation start, alarms, etc., can be recorded.			Provided		
	Alarm history	Provided			Provided		
Board ID		0 to 3		—	—		

(Note-1): The Position Board can move within the limits of -2147483648 to 2147483647. Movement outside the limits is not covered with warranty. If software limits have been disabled, be careful not to move it outside of the physical limits.
(Note-2): For the absolute position detection system, the command limits of the position after calculation using the electronic gear are also -2147483648 to 2147483647. The moveable limits may be narrower than -2147483648 to 2147483647, depending on the electronic gear ratio.
(Note-3): Unavailable when the control cycle is 0.22 ms.

C Controller Interface Module specification

Item		Specification
Servo amplifier connection system		SSCNET III/H (1 system)
Maximum overall cable distance [m(ft.)]		SSCNET III/H: 2000 (6561.68)
Maximum distance between stations [m(ft.)]		SSCNET III/H : 100 (328.08)
Peripheral I/F		USB
Forced stop input signal (EMI) (Note-1)	Number of input points	1 point
	Input method	Positive Common/ Negative Common Shared Type (Photocoupler isolation)
	Rated input voltage/current	24 VDC/approx. 2.4 mA
	Operating voltage range	20.4 to 26.4 VDC (24 VDC +10%/–15%, ripple ratio 5% or less)
	ON voltage/current	17.5 VDC or more/2.0 mA or more
	OFF voltage/current	1.8 VDC or less/0.18 mA or less
	Input resistance	Approx. 10kΩ
	Response time	1ms or less (OFF to ON, ON to OFF)
	Recommended wire size	AWG16 to 26 (0.12 to 1.3 mm^2)
The number of Interface Module for one C Controller		1 module
Bus specification		PCI Express®
Number of I/O occupying points		0
Number of module occupied slots		1
5 VDC internal current consumption [A]		0.7
Mass [kg]		0.17
Exterior dimensions [mm(inch)]		98 (3.86) (H)×27.4 (1.08) (W)×115 (4.53) (D)

(Note-1): The input connector for external forced stop is enclosed in the C Controller module package.

Position Board specification

Item		Specification	
		MR-MC211	MR-MC210
Servo amplifier connection system		SSCNET III/H (2 systems)	SSCNET III/H (1 system)
Maximum overall cable distance [m(ft.)]		SSCNET III/H: 2000 (6561.68)	
Maximum distance between stations [m(ft.)]		SSCNET III/H : 100 (328.08)	
Peripheral I/F		USB	
Forced stop input signal (EMI) (Note-1)	Number of input points	1 point	
	Input method	Positive Common/ Negative Common Shared Type (Photocoupler isolation)	
	Rated input voltage/current	24 VDC/approx. 2.4 mA	
	Operating voltage range	20.4 to 26.4 VDC (24 VDC +10%/–15%, ripple ratio 5% or less)	
	ON voltage/current	17.5 VDC or more/2.0 mA or more	
	OFF voltage/current	1.8 VDC or less/0.18 mA or less	
	Input resistance	Approx. 10kΩ	
	Response time	1ms or less (OFF to ON, ON to OFF)	
	Recommended wire size	AWG22 to 28 (0.08 to 0.32 mm^2)	
The number of Position Boards for one computer		4	
Bus specification		PCI bus	
	Size [mm(inch)]	Short sized version (106.7(4.20)×167.6(6.60))	
5 VDC internal current consumption [A]		0.7	0.45
Mass [kg]		0.11	

(Note-1): Crimping tools and connectors are needed for cable fabrication. Be sure to prepare ones by user.

Position Board connector for forced stop input (cable-side)

Manufacture	Name	Model	Description
Molex	Housing	51103-0300	
	Terminal	50351-8100	Applicable wire size (AWG): 22, 24, 26, 28 Two terminals are needed for one housing
	Hand crimp tool	57295-5000	Applicable terminal: 50351

Dedicated library functions

Simpler programming by using a dedicated library suite for access to hardware.

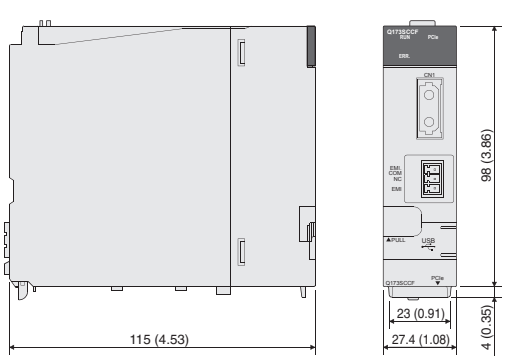
More than 100 functions are available for creating user application, such as operating functions, monitor functions, other axes start functions, pass position interrupt functions, sampling functions, and log functions.

Function Type	Function (some functions are omitted)	Function Content
Support Functions	sscGetLastError	Gets the detailed error codes.
Device Functions	sscOpen	Opens memory access port.
	sscClose	Closes memory access port.
Parameter Functions	sscResetAllParameter	Writes the initial values in all parameters before system startup.
	sscChangeParameter	Writes the parameter.
	sscCheckParameter	Reads the parameter set value.
	sscLoadAllParameterFromFlashROM	Loads all the parameters from a flash ROM before system startup.
	sscSaveAllParameterToFlashROM	Saves all the parameters into a flash ROM before system startup.
System Functions	sscReboot	Reboots the system.
	sscSystemStart	Starts the system.
	sscGetSystemStatusCode	Gets the system status code.
	sscReconnectSSCNET	Reconnects the SSCNET communication.
	sscDisconnectSSCNET	Disconnects the SSCNET communication.
Command/ Status Functions	sscSetCommandBitSignalEx	Arbitrarily sets the command bit.
	sscGetStatusBitSignalEx	Arbitrarily gets the status bit.
	sscWaitStatusBitSignalEx	Waits until the specified bit turns on/off.
Point Table Functions	sscSetPointDataEx	Sets the point data.
	sscCheckPointDataEx	Gets the point data.
	sscSetPointOffset	Sets the point number offset.
	sscGetDrivingPointNumber	Gets the operation point number.
Operating Functions	sscJogStart	Starts JOG operation.
	sscJogStop	Stops JOG operation.
	sscIncStart	Starts incremental feed.
	sscAutoStart	Starts automatic operation.
	sscHomeReturnStart	Starts home position return.
	sscLinearStart	Starts linear interpolation.
	sscDataSetStart	Starts the home position reset (data set).
	sscDriveStop	Stops operation.
	sscGetDriveFinStatus	Gets the operation completion status.
Change Functions	sscChangeAutoPosition	Changes position during automatic operation.
	sscChangeLinearPosition	Changes position during linear interpolation.
Alarm Functions	sscGetAlarm	Gets the alarm number.
	sscResetAlarm	Resets the alarm.
General Monitor Functions	sscSetMonitor	Starts monitoring.
	sscStopMonitor	Stops monitoring.
	sscGetMonitor	Gets monitoring data.
High Speed Monitor Functions	sscGetCurrentCmdPositionFast	Gets the current command position.
	sscGetCurrentFbPositionFast	Gets the current feedback position.
	sscGetIoStatusFast	Gets the external signal status.
	sscGetCmdSpeedFast	Gets the moving speed.
	sscGetFbSpeedFast	Gets the feedback moving speed.
	sscGetCurrentFbFast	Gets the current feedback.

Function Type	Function (some functions are omitted)	Function Content
User Watchdog Functions	sscWdEnable	Enables the user watchdog function.
	sscWdDisable	Disables the user watchdog function.
	sscChangeWdCounter	Updates the watchdog counter.
Other Axes Start Functions	sscSetOtherAxisStartData	Sets the data for starting other axes.
	sscGetOtherAxisStartData	Gets the data for starting other axes.
	sscOtherAxisStartAbortOn	Turns the other axes start cancel signal ON.
	sscOtherAxisStartAbortOff	Turns the other axes start cancel signal OFF.
	sscGetOtherAxisStartStatus	Gets the other axes start status.
Pass Position Interrupt Functions	sscSetIntPassPositionData	Sets the pass position interrupt condition data.
	sscSetStartingPassNumber	Sets the pass position condition start and end numbers.
	sscGetExecutingPassNumber	Gets the running pass position condition number.
Sampling Functions	sscStartSampling	Starts sampling.
	sscStopSampling	Stops sampling.
	sscGetSamplingStatus	Gets the sampling execution information.
	sscGetSamplingData	Gets the sampling data.
Log Functions	sscStartLog	Starts the log.
	sscStopLog	Stops the log.
	sscCheckLogStatus	Gets the running status of the log.
	sscReadLogData	Reads the log data.
	sscClearLogData	Clears (initializes) the log data.
	sscGetAlarmHistoryData	Gets alarm history data.
	sscClearAlarmHistoryData	Clears (initializes) the alarm history data.
Digital Input/Output Functions	sscGetDigitalInputDataBit	Gets the DI data of the designated digital input on 1-point basis.
	sscSetDigitalOutputDataBit	Sets the DO data of the designated digital output on 1-point basis.
Interrupt Functions	sscIntStart	Starts up the interrupt driver.
	sscIntEnd	Closes the interrupt driver.
	sscIntEnable	Enables interrupt output.
	sscIntDisable	Disables interrupt output.
	sscRegisterIntCallback	Registers the interrupt callback function.
	sscUnregisterIntCallback	Unregisters the interrupt callback function.
	sscResetIntEvent	Sets the interrupt event signal status to nonsignaled.
	sscSetIntEvent	Sets the interrupt event signal status to signaled.
	sscWaitIntEvent	Waits until the interrupt event status becomes signaled.
	sscResetIntOasEvent	Sets the status of the other axes start interrupt event to nonsignaled.
	sscSetIntOasEvent	Sets the status of the other axes start interrupt event to signaled.
	sscWaitIntOasEvent	Waits until the status of the other axes start interrupt event becomes signaled.
	sscResetIntPassPosition	Sets the status of the pass position interrupt event to nonsignaled.
	sscSetIntPassPosition	Sets the status of the pass position interrupt event to signaled.
	sscWaitIntPassPosition	Waits until the status of the pass position interrupt event becomes signaled.
	sscResetIntDriveFin	Sets the status of the operation completion interrupt event to nonsignaled.
	sscSetIntDriveFin	Sets the status of the operation completion interrupt event to signaled.
	sscWaitIntDriveFin	Waits until the status of the operation completion interrupt event becomes signaled.

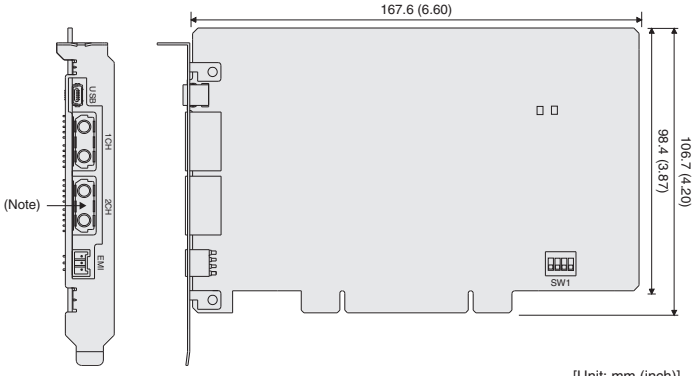
Exterior dimension

Q173SCCF



[Unit: mm (inch)]

MR-MC210/MR-MC211



(Note): MR-MC211 only

[Unit: mm (inch)]

Equipment list

Position Board MR-MC210/MR-MC211

Item	Model	Specification	Applicable standard
Position Board (Note-1)	MR-MC210	Up to 20 axes	CE, UL, KC
	MR-MC211	Up to 32 axes	CE, UL, KC
Position Board utility 2	MRZJW3-MC2-UTL	Test tool: for setup, debugging API library for PCI bus compatible Position Board Device driver	—
SSCNET III cable	MR-J3BUS□M	• Position Board ⇔ MR-J4(W)-_B/MR-J4(W)-_B ⇔ MR-J4(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	• Position Board ⇔ MR-J4(W)-_B/MR-J4(W)-_B ⇔ MR-J4(W)-_B • Standard cable for outside panel: 5m (16.40ft.), 10m (32.81ft.), 20m (65.62ft.)	—
	MR-J3BUS□M-B (Note-2)	• Position Board ⇔ MR-J4(W)-_B/MR-J4(W)-_B ⇔ MR-J4(W)-_B • Long distance cable: 30m (98.43ft.), 40m (131.23ft.), 50m (164.04ft.)	—
USB cable	MR-J3USBCBL3M	3m (9.84ft.)	—
MR Configurator2	SW1DNC-MRC2-E	Servo amplifier MR-J4 series setting and adjustment	—

(Note-1): Be sure to order the connector for forced stop by user.
(Note-2): Contact your local sales office for cables shorter than 30 m.

C Controller Interface Module Q173SCCF

Item	Model	Specification	Applicable standard
C Controller Interface Module	Q173SCCF	Up to 20 axes (forced stop input cable connector is provided)(Note-1)	CE, UL, KC
C Controller module	Q24DHCCPU-V	CPU : SH4A, Endian format: Little endian OS : VxWorks® 6.8.1	CE, UL, KC
C Controller Interface Module utility	SW1DNC-QSCCF-B	Test tool: for setup, debugging API library: Library for VxWorks®	—
SSCNET III cable	MR-J3BUS□M	• Q173SCCF ⇔ MR-J4(W)-_B/MR-J4(W)-_B ⇔ MR-J4(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	• Q173SCCF ⇔ MR-J4(W)-_B/MR-J4(W)-_B ⇔ MR-J4(W)-_B • Standard cable for outside panel: 5m (16.40ft.), 10m (32.81ft.), 20m (65.62ft.)	—
	MR-J3BUS□M-B (Note-2)	• Q173SCCF ⇔ MR-J4(W)-_B/MR-J4(W)-_B ⇔ MR-J4(W)-_B • Long distance cable: 30m (98.43), 40m (131.23), 50m(164.04)	—
PCI Express® cable	Q173PCIECBL05M	Q24DHCCPU-V ⇔ Q173SCCF Cable length: 0.5m (1.64ft.)	—
USB cable	MR-J3USBCBL3M	3m (9.84ft.)	—
MR Configurator2	SW1DNC-MRC2-E	Servo amplifier MR-J4 series setting and adjustment	—

(Note-1): Be sure to use the cable for forced stop. The forced stop cannot be released without using it.
Fabricate the cable for forced stop input since it is not provided with the module.
(Note-2): Contact your local sales office for cables shorter than 30 m.

Operation environment

C Controller Interface Module Q173SCCF/Position Board MR-MC210/MR-MC211 Test tool

The following tables show the test tool operation environment.
Refer to Mitsubishi IQ Platform C Controller catalogs and manuals for details.

Item		Description
Personal computer	Personal computer	A personal computer which Microsoft® Windows® is running on
	OS	Microsoft® Windows® 7 (64bit/32bit) [Service Pack 1] Microsoft® Windows Vista® (32bit) [Service Pack 2] Microsoft® Windows® XP (32bit) [Service Pack 3]
	CPU	Personal computer: Recommended Intel® Celeron® Processor 2.8GHz or more Laptop: Recommended Intel® Pentium® M Processor 1.7GHz or more
	Required memory	Recommended 1 GB or more (32-bit version) Recommended 2 GB or more (64-bit version)
Available hard disk capacity		When installing the test tool: HDD available capacity is 1GB or more. When operating the test tool: Virtual memory available capacity is 512MB or more.
Disk drive		CD-ROM compatible disk drive
Monitor		Resolution 1024 × 768 pixels or higher
Communication interface		USB port

Position Board MR-MC210/MR-MC211

Item		Description
Personal computer	Personal computer	A personal computer which Microsoft® Windows® is running on
	OS	Microsoft® Windows® 7 (64bit/32bit) [Service Pack 1] Microsoft® Windows Vista® (32bit) [Service Pack 2] Microsoft® Windows® XP (32bit) [Service Pack 3]
	CPU	Personal computer: Recommended Intel® Celeron® Processor 2.8GHz or more Laptop: Recommended Intel® Pentium® M Processor 1.7GHz or more
	Required memory	Recommended 1 GB or more (32-bit version) Recommended 2 GB or more (64-bit version)
Available hard disk capacity		When installing the test tool: HDD available capacity is 1GB or more. When operating the test tool: Virtual memory available capacity is 512MB or more.
Disk drive		CD-ROM compatible disk drive
Monitor		Resolution 1024 × 768 pixels or higher
Communication interface		PCI bus USB port

A global support network for MELSERVO users

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Across the globe, FA Centers provide customers with local assistance for purchasing Mitsubishi Electric products and with after-sales service. To enable national branch offices and local representatives to work together in responding to local needs, we have developed a service network throughout the world. We provide repairs, on-site engineering support, and sales of replacement parts. We also provide various services from technical consulting services by our expert engineers to practical training for equipment operations.

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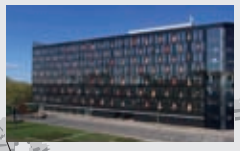

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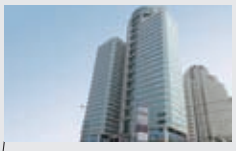

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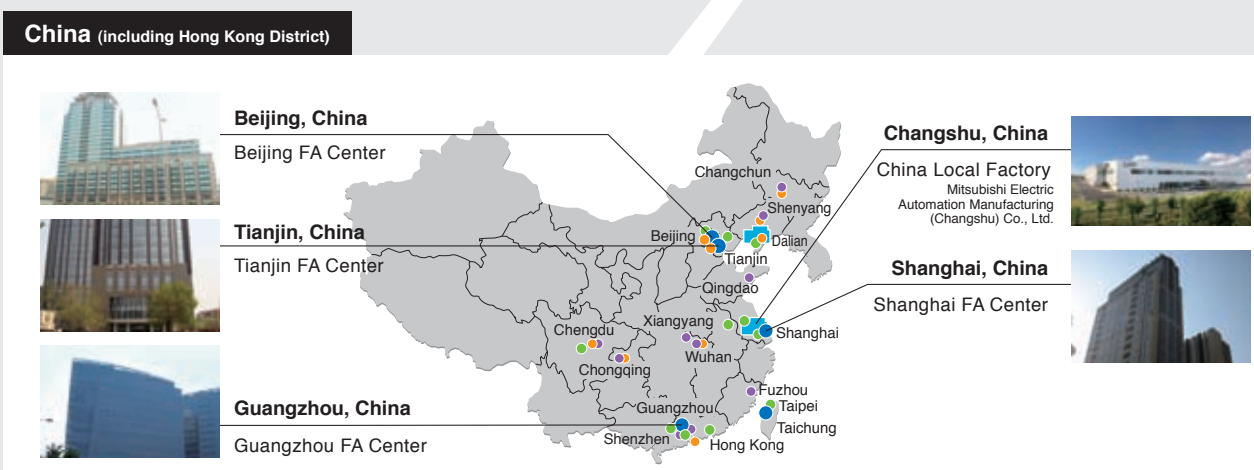

China (including Hong Kong District)

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Tianjin, China
Tianjin FA Center

Guangzhou, China
Guangzhou FA Center

Changshu, China
China Local Factory
Mitsubishi Electric Automation Manufacturing (Changshu) Co., Ltd.

Shanghai, China
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Conformity with global standards

Complies with EN, UL and CSA (c-UL) standards.

CE c UL us LISTED

Servo system controllers conform to global standards.

* This product is not subject to China Compulsory Certification (CCC).
* Mitsubishi servo system controller bears cULus Mark.
* Refer to "Servo Amplifier Instruction Manual" and "EMC Installation Guidelines" when your system needs to meet the EMC directive.

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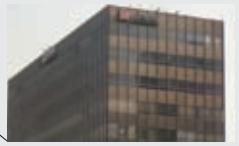

Jakarta, Indonesia
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Complies with Restriction of Hazardous Substances Directive (RoHS).

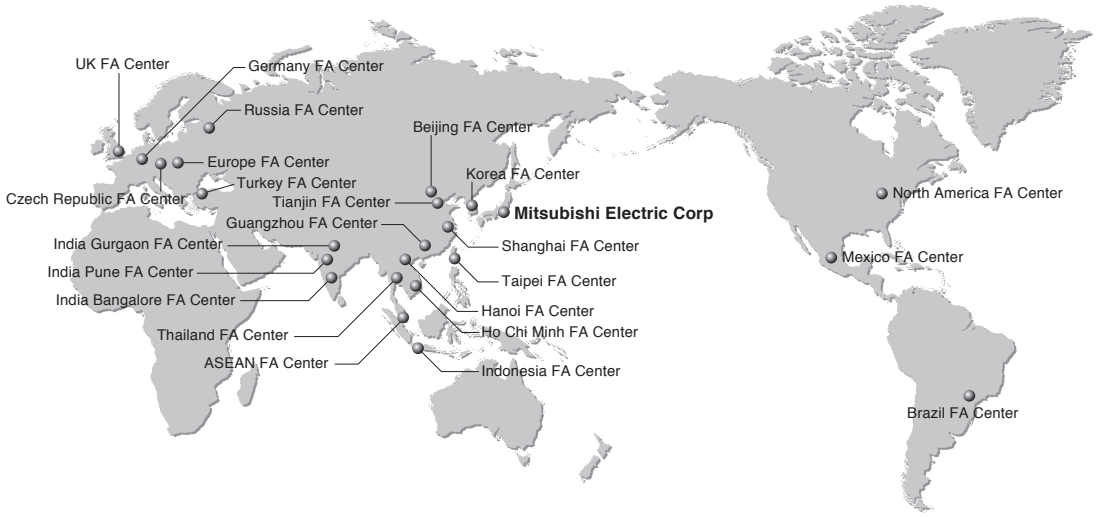
Human and environment-friendly Mitsubishi servo system controllers are compliant with RoHS Directive.

About RoHS directive
RoHS Directive requires member nations to guarantee that new electrical and electronic equipment sold in the market after July 1, 2006 do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. <G> mark indicating RoHS Directive compliance is printed on the package.

* Refer to "Servo Amplifier Instruction Manual" and "EMC Installation Guidelines" when your system needs to meet the EMC directive.

Our optional cables and connectors comply with "Measures for Administration of the Pollution Control of Electronic Information Products" (Chinese RoHS).

Global FA Centers



China

Shanghai FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD.
10F, Mitsubishi Electric Automation Center, No.1386 Hongqiao Road, Changning District, Shanghai, China
Tel: 86-21-2322-3030 Fax: 86-21-2322-3000 (9611#)

Beijing FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. Beijing Office
Unit 908, Office Tower 1, Henderson Centre, 18 Jianguomennei Avenue, Dongcheng District, Beijing, China
Tel: 86-10-6518-8830 Fax: 86-10-6518-3907

Tianjin FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. Tianjin Office
Room 2003 City Tower, No.35, Youyi Road, Hexi District, Tianjin, China
Tel: 86-22-2813-1015 Fax: 86-22-2813-1017

Guangzhou FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. Guangzhou Office
Room 1609, North Tower, The Hub Center, No.1068, Xingang East Road, Haizhu District, Guangzhou, China
Tel: 86-20-8923-6730 Fax: 86-20-8923-6715

Taiwan

Taipei FA Center
SETSUYO ENTERPRISE CO., LTD.
3F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan, R.O.C.
Tel: 886-2-2299-9917 Fax: 886-2-2299-9963

Korea

Korea FA Center
MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD.
B1F, 2F, 1480-6, Gayang-Dong, Gangseo-Gu, Seoul, 157-200, Korea
Tel: 82-2-3660-9630 Fax: 82-2-3663-0475

Thailand

Thailand FA Center
MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO., LTD.
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Tel: 66-2682-6522 to 6531 Fax: 66-2682-6020

ASEAN

ASEAN FA Center
MITSUBISHI ELECTRIC ASIA PTE. LTD.
307, Alexandra Road, Mitsubishi Electric Building, Singapore 159943
Tel: 65-6470-2480 Fax: 65-6476-7439

Indonesia

Indonesia FA Center
PT. MITSUBISHI ELECTRIC INDONESIA
Gedung Jaya 11th Floor, JL MH. Thamrin No.12, Jakarta, Pusat 10340, Indonesia
Tel: 62-21-3192-6461 Fax: 62-21-3192-3942

Vietnam

Hanoi FA Center
MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED Hanoi Branch
Unit 9-05, 9th Floor, Hanoi Central Office Building, 44B Ly Thuong Kiet Street, Hoan Kiem District, Hanoi City, Vietnam
Tel: 84-4-3937-8075 Fax: 84-4-3937-8076

Ho Chi Minh FA Center
MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED
Unit 01-04, 10th Floor, Vincom Center, 72 Le Thanh Ton Street, District 1, Ho Chi Minh City, Vietnam
Tel: 84-8-3910-5945 Fax: 84-8-3910-5947

India

India Pune FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD. Pune Branch
Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune, 411026, Maharashtra State, India
Tel: 91-20-2710-2000 Fax: 91-20-2710-2100

India Gurgaon FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD. Gurgaon Head Office
2nd Floor, Tower A & B, Cyber Greens, DLF Cyber City, DLF Phase - III, Gurgaon - 122002 Haryana, India
Tel: 91-124-463-0300 Fax: 91-124-463-0399

India Bangalore FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD. Bangalore Branch
Prestige Emerald, 6th Floor, Municipal No. 2, Madras Bank Road (Lavelle Road), Bangalore - 560001, Karnataka, India
Tel: 91-80-4020-1600 Fax: 91-80-4020-1699

America

North America FA Center
MITSUBISHI ELECTRIC AUTOMATION, INC.
500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.
Tel: 1-847-478-2100 Fax: 1-847-478-2253

Mexico

Mexico FA Center
MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch
Mariano Escobedo #69, Col.Zona Industrial, Tlalnepantla Edo, C.P.54030, México
Tel: 52-55-3067-7511 Fax: -

Brazil

Brazil FA Center
MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA.
Rua Jussara, 1750- Bloco B Anexo, Jardim Santa Cecilia, CEP 06465-070, Barueri - SP, Brasil
Tel: 55-11-4689-3000 Fax: 55-11-4689-3016

Europe

Europe FA Center
MITSUBISHI ELECTRIC EUROPE B.V. Polish Branch
32-083 Balice ul. Krakowska 50, Poland
Tel: 48-12-630-47-00 Fax: 48-12-630-47-01

Germany FA Center
MITSUBISHI ELECTRIC EUROPE B.V. German Branch
Gothaer Strasse 8, D-40880 Ratingen, Germany
Tel: 49-2102-486-0 Fax: 49-2102-486-1120

UK FA Center
MITSUBISHI ELECTRIC EUROPE B.V. UK Branch
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, U.K.
Tel: 44-1707-28-8780 Fax: 44-1707-27-8695

Czech Republic FA Center
MITSUBISHI ELECTRIC EUROPE B.V. Czech Branch
Avenir Business Park, Radlicka 751/113e, 158 00 Praha5, Czech Republic
Tel: 420-251-551-470 Fax: 420-251-551-471

Russia FA Center
MITSUBISHI ELECTRIC EUROPE B.V. Russian Branch St. Petersburg office
Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; 195027, St. Petersburg, Russia
Tel: 7-812-633-3497 Fax: 7-812-633-3499

Turkey FA Center
MITSUBISHI ELECTRIC TURKEY A.Ş Ümraniye Branch
Şerifali Mahallesi Nutuk Sokak No:5 TR-34775 Ümraniye, İstanbul, Türkey
Tel: 90-216-526-3990 Fax: 90-216-526-3995

FA Products

PLC | MELSEC-Q Series Universal Model

Introducing the high-speed QCPU (QnUDVCPU) for faster processing of large data volumes.

◎Realize high-speed, high-accuracy machine control with various iQ Platform compatible controllers and multiple CPUs.
◎Easily connect to GOTs and Programming tools using built-in Ethernet port.
◎25 models from 10k step small capacity to 1000k step large capacity, are available.
◎Seamless communication and flexible integration at any network level.

Product Specifications

Program capacity	10k steps to 1000k steps
Number of I/O points [X/Y], number of I/O device points [X/Y]	256 points to 4096 points/8192 points
Basic instruction processing speed (LD instruction)	120 ns to 1.9 ns
External connection interface	USB (all models equipped), Ethernet, RS-232, memory card, extended SRAM cassette
Function module	I/O, analog, high-speed counter, positioning, simple motion, temperature input, temperature control, network module
Module extension style	Building block type
Network	Ethernet, CC-Link IE controller network, CC-Link IE field network, CC-Link, CC-Link/LT, MELSECNET/H, SSCNETⅢ (/H), AnyWire, RS-232, RS-422

HMI | Graphic Operation Terminal GOT2000 Series GT27 Model

To the top of HMIs with further user-friendly, satisfactory standard features.

◎Comfortable screen operation even if high-load processing (e.g. logging, device data transfer) is running. (Monitoring performance is twice faster than GT16)
◎Actual usable space without using an SD card is expanded to 128MB for more flexible screen design.
◎Multi-touch features, two-point press, and scroll operations for more user-friendliness.
◎Outline font and PNG images for clear, beautiful screen display.

Product Specifications

Screen size	12.1", 10.4", 8.4" (15" coming soon)
Resolution	SVGA, VGA (XGA coming soon)
Intensity adjustment	32-step adjustment
Touch panel type	Analog resistive film
Built-in interface	RS-232, RS-422/485, Ethernet, USB, SD card
Applicable software	GT Works3
Input power supply voltage	100 to 240VAC (+10%, −15%), 24VDC (+25%, −20%)

Inverter | FR-A800 Series

High-functionality, high-performance inverter

◎Realize even higher responsiveness during real sensor-less vector control or vector control, and achieve faster operating frequencies.
◎The latest automatic tuning function supports various induction motors and also sensor-less PM motors.
◎The standard model is compatible with EU Safety Standards STO (PLd, SIL2). Add options to support higher level safety standards.
◎A variety of useful functions provide USB memory support and customization with a PLC function.

Product Specifications

Inverter capacity	200V class: 0.4kW to 90kW, 400V class: 0.4kW to 500kW
Control method	High-carrier frequency PWM control (Select from V/F, advanced flux vector, real sensor-less vector or PM sensor-less vector control), vector control (when using options)
Output frequency range	0.2 to 590Hz (when using V/F control or advanced flux vector control)
Regenerative braking torque (Maximum tolerable usage rate)	200V class: 0.4K to 1.5K (150% at 3%ED) 2.2K/3.7K (100% at 3%ED) 5.5K/7.5K (100% at 2%ED) 11K to 55K (20% continuous) 75K or more (10% continuous), 400V class: 0.4K to 7.5K (100% at 2%ED) 11K to 55K (20% continuous) 75K or more (10% continuous)
Starting torque	200% 0.3Hz (3.7K or less), 150% 0.3Hz (5.5K or more) (when using real sensor-less vector, vector control)

FA Products

Low Voltage Circuit Breakers | Mitsubishi WS-V Series Molded Case Circuit Breakers, Earth Leakage Circuit Breakers

Technologies based on long year experience realize more improved performance.

◎The new electronic circuit breakers can display various measurement items.

◎Improvement of breaking performance with new breaking technology “Expanded ISTAC”.

◎Compliance with global standard for panel and machine export.

◎Commoditization of internal accessories for shorter delivery time and stock reduction.

Product Specifications.

Frame	32-250A Frame
Applicable standard	Applicable to IEC, GB, UL, CSA, JIS and etc.
Expansion of UL listed product line-up	New line-up of 480VAC type with high breaking performance for SCCR requirement
Commoditization of internal accessories	Reduction of internal accessory types from 3 to 1
Commoditization for AC and DC circuit use	Common use of 32/63A frame in both AC and DC circuit
Compact size for easy to use	Thermal adjustable and electronic circuit breakers are same size as 250AF fixed type
Measuring Display Unit (MDU) breakers	MDU breakers measure, display and transmit energy date to realize energy management.

Magnetic Starter | MS-T Series

Exceed your expectations.

◎10A frame model is over 16% smaller with a width of just 36mm!!

◎New integrated terminal covers.

◎Reduce your coil inventory by up to 50%.

◎Be certified to the highest international levels while work is ongoing to gain other country.

Product specifications

Frame	10 A to 32 A
Applicable standards	Certification to various standards including IEC, JIS, CE, UL, TÜV, CCC.
Terminal cover	Standard terminal cover improves safety, simplifies ordering, and reduces inventory, etc.
Improved wiring	Wiring and operability are improved with streamlining wiring terminal BC specifications.
Operation coil rating	Wide range of operation coil ratings reduces number of coil types from 14 (N Series) to 7 types and simplifies selection.
Option units	Diverse lineup includes Auxiliary Contact Block, Operation Coil Surge Absorber Unit, Mechanical Interlock Unit.

Robot | MELFA F Series

High speed, high precision and high reliability industrial robot

◎Compact body and slim arm design, allowing operating area to be expanded and load capacity increased.

◎The fastest in its class using high performance motors and unique driver control technology.

◎Improved flexibility for robot layout design considerations.

◎Optimal motor control tuning set automatically based on operating position, posture, and load conditions.

Product Specifications

Degrees of freedom	Vertical:6 Horizontal:4
Installation	Vertical:Floor-mount, ceiling mount, wall mount (Range of motion for J1 is limited) Horizontal:Floor-mount
Maximum load capacity	Vertical:2-20kg Horizontal:3-20kg
Maximum reach radius	Vertical:504-1503mm Horizontal:350-1,000mm

CNC | Mitsubishi Numerical Control Unit C70 Series

iQ Platform compatible CNC to provide TCO reduction effect.

◎A CNC structured in building block method on iQ Platform.

◎High performance CNC integrated with high-speed PLC offers high-speed control to reduce cycle time.

◎A wide variety of FA products helps construct flexible lines.

Product specifications

Maximum number of control axes (NC axis + spindle + PLC axis)	16 axes
Maximum number of part system	Machining center system: 7 systems, Lathe system: 3 systems
Maximum number of NC axes per part system	8 axes
Maximum program capacity	2,000 kB (5,120 m)
Maximum number of files to store	124 files/252 files
Number of input/output points	4,096 points
Safety observation function	Safety signal comparison function, speed monitoring function, duplexed emergency stop

For detailed information, please refer to: http://www.mitsubishielectric.com/fa/worldwide/index.html

Three-Phase Motor | High Performance Energy-Saving Motor Super Line Premium Series SF-PR

High Efficiency & Compatible. New Launch of Super Line Premium Series SF-PR Model

◎Compared to general-purpose motor SF-JR model, generated loss is reduced by 37% on average, and it is compatible with highly efficient premium IE3.

◎Easy replacement is achieved as mounting dimension (frame number) is compatible with general-purpose motor SF-JR model.

◎One motor can accommodate different power sources of Japan and the U.S. Three ratings in Japan meet the Top Runner standards, while it corresponds to EISA in the U.S.

◎Can be driven by inverters as standard. Advanced magnetic-flux vector control by our FR-A800 achieves steady torque drive up to 0.5Hz.

Product Specifications

Number of poles	2-poles, 4-poles, 6-poles
Voltage·Frequency	200/200/220/230V 50/60/60/60Hz EISA 230V 60Hz or 400/400/440/460V 50/60/60/60Hz EISA 460V 60Hz
Exterior	Totally enclosed fan cooled type (inside, outside installation)
Protection system	IP44
Electrically-driven power system	Motor with 2-poles over 11kW is dedicated for a direct connection. Motors with 4-poles and 6-poles are for both direct and crossed belt connections.
Rotation direction	Counter-clock-wise (CCW) direction viewed from the edge of axis.
Compatible standard	JEC-2137-2000 (Efficiency is compatible with IEC 60034-30.)

Warranty

1. Warranty period and coverage

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 is repaired or replaced.

[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.

[Limitations]

(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;
- (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
- (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval
- (iii) 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
- (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
- (v) any replacement of consumable parts (battery, electrolytic capacitor, etc.)
- (vi) 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
- (vii) 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
- (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop 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 & Service, etc.

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

3. Service in overseas

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 responsibility for compensation against loss of opportunity, secondary loss, etc.

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. Application and use of the Product

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

(2) Our Servo System 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.

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001(standards for quality assurance management systems)

C Controller/Personal Computer Embedded Type Servo System Controller

⚠ Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

Country/Region	Sales office	Tel/Fax
USA	MITSUBISHI ELECTRIC AUTOMATION, INC. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.	Tel : +1-847-478-2100 Fax : +1-847-478-2253
Mexico	MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch Mariano Escobedo #69, Col.Zona Industrial, Tlalnepantla Edo, C.P.54030, México	Tel : +52-55-9171-7600 Fax : +52-55-9171-7649
Brazil	MITSUBISHI ELECTRIC DO BRASIL COMÉRCIO E SERVIÇOS LTDA. Rua Jussara, 1750- Bloco B Anexo, Jardim Santa Cecilia, CEP 06465-070, Barueri - SP, Brasil	Tel : +55-11-4689-3000 Fax : +55-11-4689-3016
Germany	MITSUBISHI ELECTRIC EUROPE B.V. German Branch Gothaer Strasse 8, D-40880 Ratingen, Germany	Tel : +49-2102-486-0 Fax : +49-2102-486-1120
UK	MITSUBISHI ELECTRIC EUROPE B.V. UK Branch Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, U.K.	Tel : +44-1707-28-8780 Fax : +44-1707-27-8695
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 Fax : +39-039-6053-312
Spain	MITSUBISHI ELECTRIC EUROPE, B.V. Spanish Branch Carretera de Rubí, 76-80-Apdo. 420, 08173 Sant Cugat del Vallés (Barcelona), Spain	Tel : +34-935-65-3131 Fax : +34-935-89-1579
France	MITSUBISHI ELECTRIC EUROPE B.V. French Branch 25, Boulevard des Bouvets, F-92741 Nanterre Cedex, France	Tel : +33-1-55-68-55-68 Fax : +33-1-55-68-57-57
Czech Republic	MITSUBISHI ELECTRIC EUROPE B.V. Czech Branch Avenir Business Park, Radlicka 751/113e, 158 00 Praha5, Czech Republic	Tel : +420-251-551-470 Fax : +420-251-551-471
Poland	MITSUBISHI ELECTRIC EUROPE B.V. Polish Branch ul. Krakowska 50, 32-083 Balice, Poland	Tel : +48-12-630-47-00 Fax : +48-12-630-47-01
Russia	MITSUBISHI ELECTRIC EUROPE B.V. Russian Branch St. Petersburg office Piskarevsky pr. 2, bld 2, lit "Sch", BC "Benua", office 720; RU-195027 St. Petersburg, Russia	Tel : +7-812-633-3497 Fax : +7-812-633-3499
Turkey	MITSUBISHI ELECTRIC TURKEY A.Ş Ümraniye Branch Şerifali Mahallesi Nutuk Sokak No:5 TR-34775 Ümraniye, İstanbul, Türkey	Tel : +90-216-526-3990 Fax : +90-216-526-3995
South Africa	ADROIT TECHNOLOGIES 20 Waterford Office Park, 189 Witkoppen Road, ZA-Fourways, South Africa	Tel : +27-11-658-8100 Fax : +27-11-658-8101
China	MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD. No.1386 Hongqiao Road, Mitsubishi Electric Automation Center, Changning District, Shanghai, China	Tel : +86-21-2322-3030 Fax : +86-21-2322-3000
Taiwan	SETSUYO ENTERPRISE CO., LTD. 6F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan, R.O.C.	Tel : +886-2-2299-2499 Fax : +886-2-2299-2509
Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD. 1480-6, Gayang-Dong, Gangseo-Gu, Seoul, 157-200, Korea	Tel : +82-2-3660-9510 Fax : +82-2-3664-8372/8335
Singapore	MITSUBISHI ELECTRIC ASIA PTE. LTD. 307, Alexandra Road, Mitsubishi Electric Building, Singapore 159943	Tel : +65-6473-2308 Fax : +65-6476-7439
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 to 6531 Fax : +66-2682-6020
Indonesia	PT. MITSUBISHI ELECTRIC INDONESIA Gedung Jaya 11th Floor, JL. MH. Thamrin No.12, Jakarta Pusat 10340, Indonesia	Tel : +62-21-3192-6461 Fax : +62-21-3192-3942
Vietnam	MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED Unit 01 - 04, 10th Floor, Vincom Center, 72 Le Thanh Ton Street, District 1, Ho Chi Minh City, Vietnam	Tel : +84-8-3910-5945 Fax : +84-8-3910-5947
India	MITSUBISHI ELECTRIC INDIA PVT. LTD. Pune Branch Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune, 411026, Maharashtra State, India	Tel : +91-20-2710-2000 Fax : +91-20-2710-2100
Australia	MITSUBISHI ELECTRIC AUSTRALIA PTY. LTD. 348 Victoria Road, P.O. Box 11, Rydalmere, N.S.W 2116, Australia	Tel : +61-2-9684-7777 Fax : +61-2-9684-7245

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BUILDING, 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS: 1-14, YADA-MINAMI 5, HIGASHI-KU, NAGOYA, JAPAN

L(NA)03097-A 1401 Printed in Japan (MDOC)

New publication, effective Jan. 2014.
Specifications are subject to change without notice.