for a greener tomorrow

MITSUBISHI ELECTRIC
Changes for the Better

FACTORY AUTOMATION

C Controller/Personal Computer Embedded Type
Servo System Controllers

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.

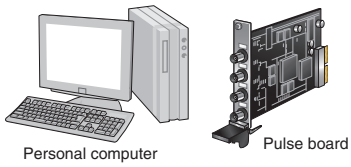
- You can select a C Controller or a personal computer for the system
- Programmable controllers are not required in the system
- SSCNET III/H compatible servo amplifiers MR-J4-B are connectable
- Equipped with Point to Point positioning functionality as standard (set with Point table)
- High-speed processing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

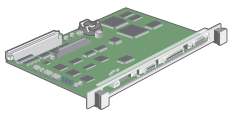
(Note): Contact your local Mitsubishi Electric office for details

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

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.

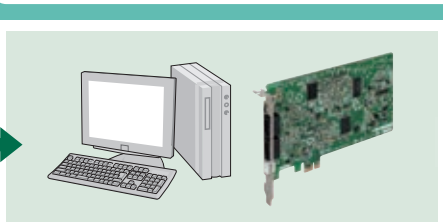




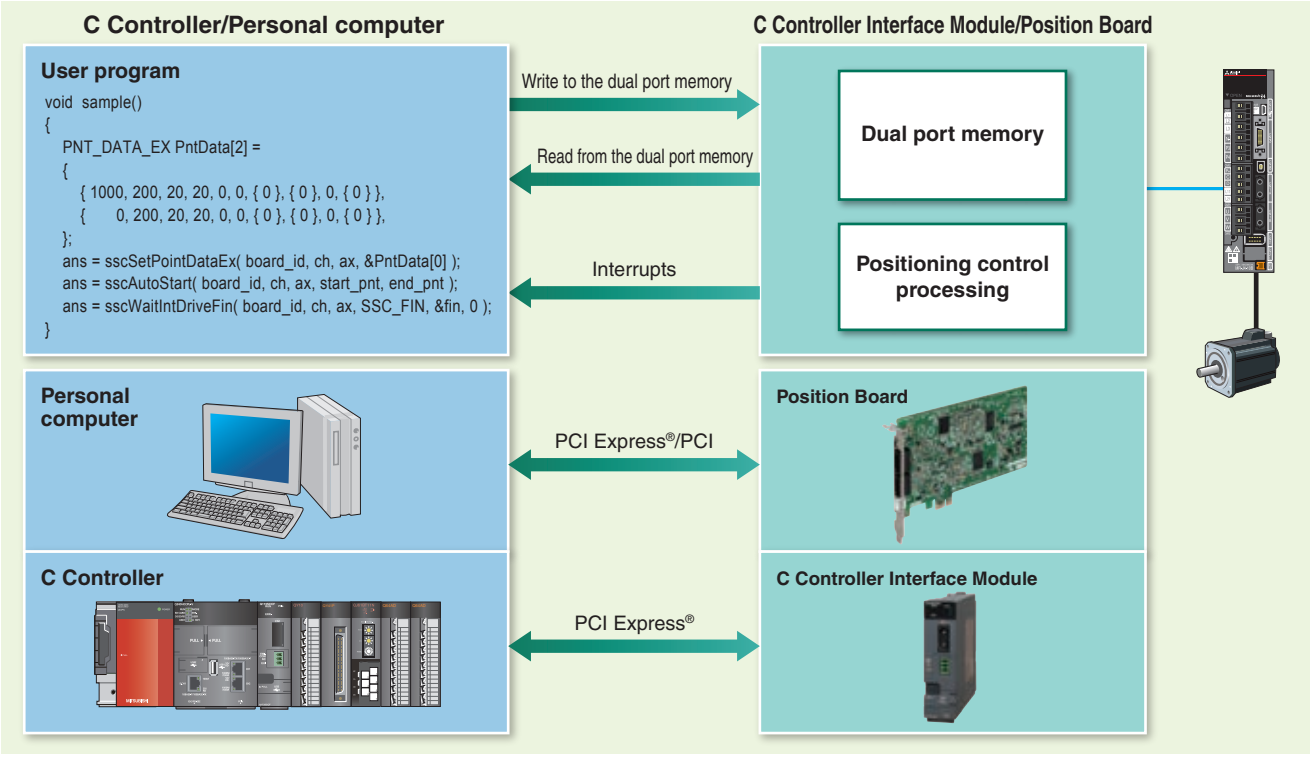
The system installed

- **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

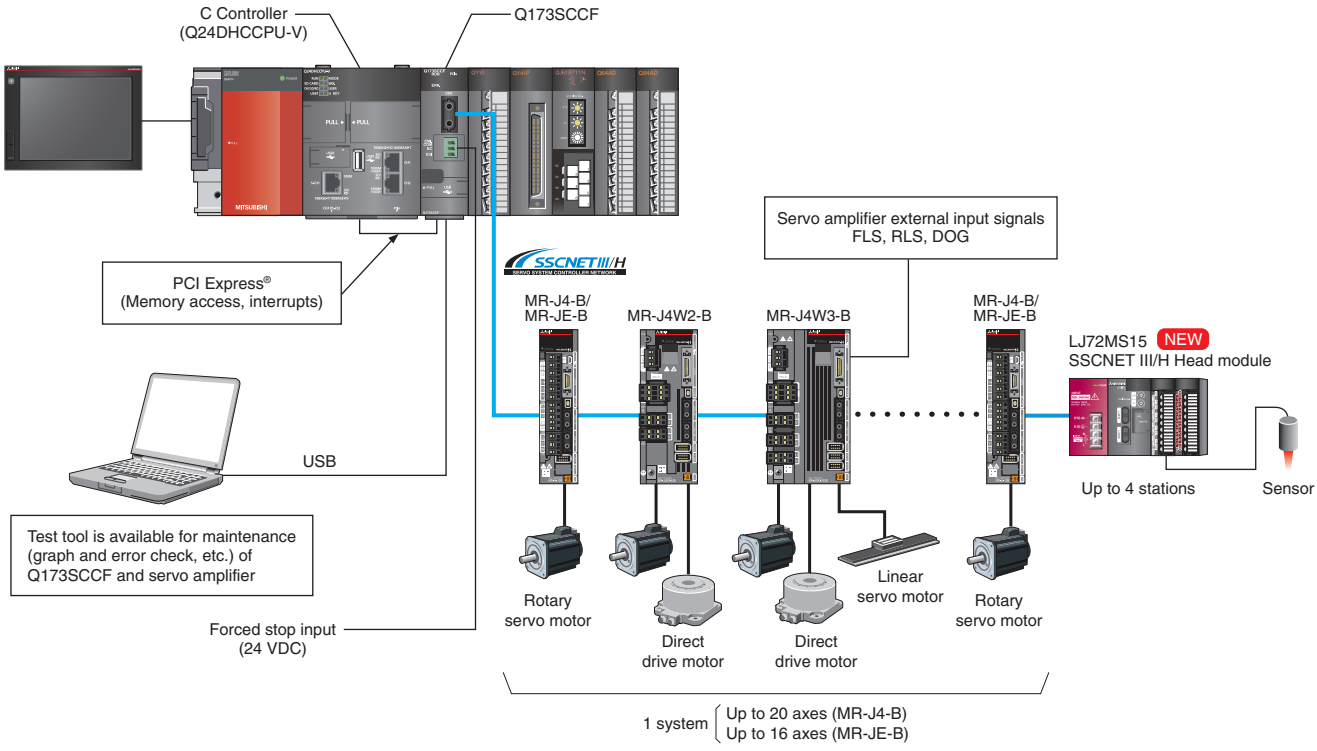
Q173SCCF

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

Features

- The system is configured with a C Controller that has a longer product life cycle on the market than the conventional PC.
- Event-driven programs, which use interrupts, can be created.
- Equipped with Positioning functionality using Point table.
- The SSCNET III/H Head module allows the Interface Module to connect remotely with various modules (I/O, analog, high-speed counter, etc.) via SSCNET III/H.
- An API library is available for more efficient software development.
- The Interface Module supports C Controllers where Lineo uLinux is installed.
  (Note): Contact your local Mitsubishi Electric office for more details.

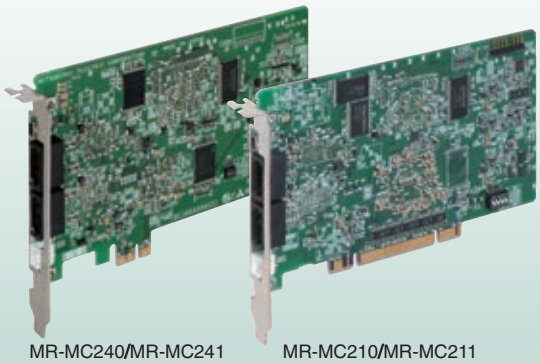
System Configuration



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

Position Board MR-MC240/MR-MC241, MR-MC210/MR-MC211

This board type controller is used for controlling MELSERVO-J4 SSCNET III/H compatible servo amplifiers, through a user program.
The PCI Express® compatible Position Board is a new addition to our product line.



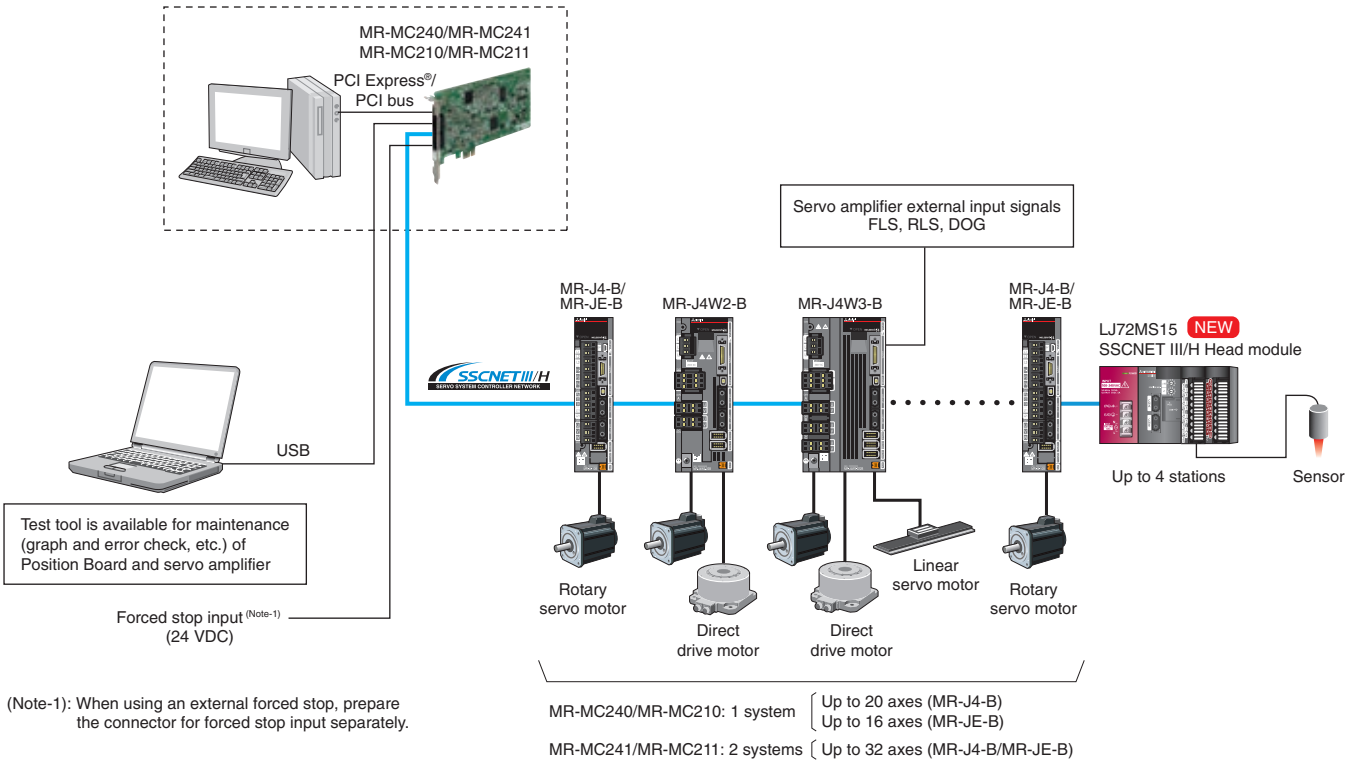
MR-MC240/MR-MC241
PCI Express®
(Short sized version)

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

Features

- Various existing assets such as boards and programs for PC can be effectively used.
- Event-driven programs, which use interrupts, can be created.
- Equipped with Positioning functionality using Point table.
- The SSCNET III/H Head module allows the Position Board to connect remotely with various modules (I/O, analog, high-speed counter, etc.) via SSCNET III/H.
- An API library is available for more efficient software development.
- Real-time OS (INtime®, RTX, etc.) is supported.
  (Note): Contact your local Mitsubishi Electric office for more details.

System Configuration

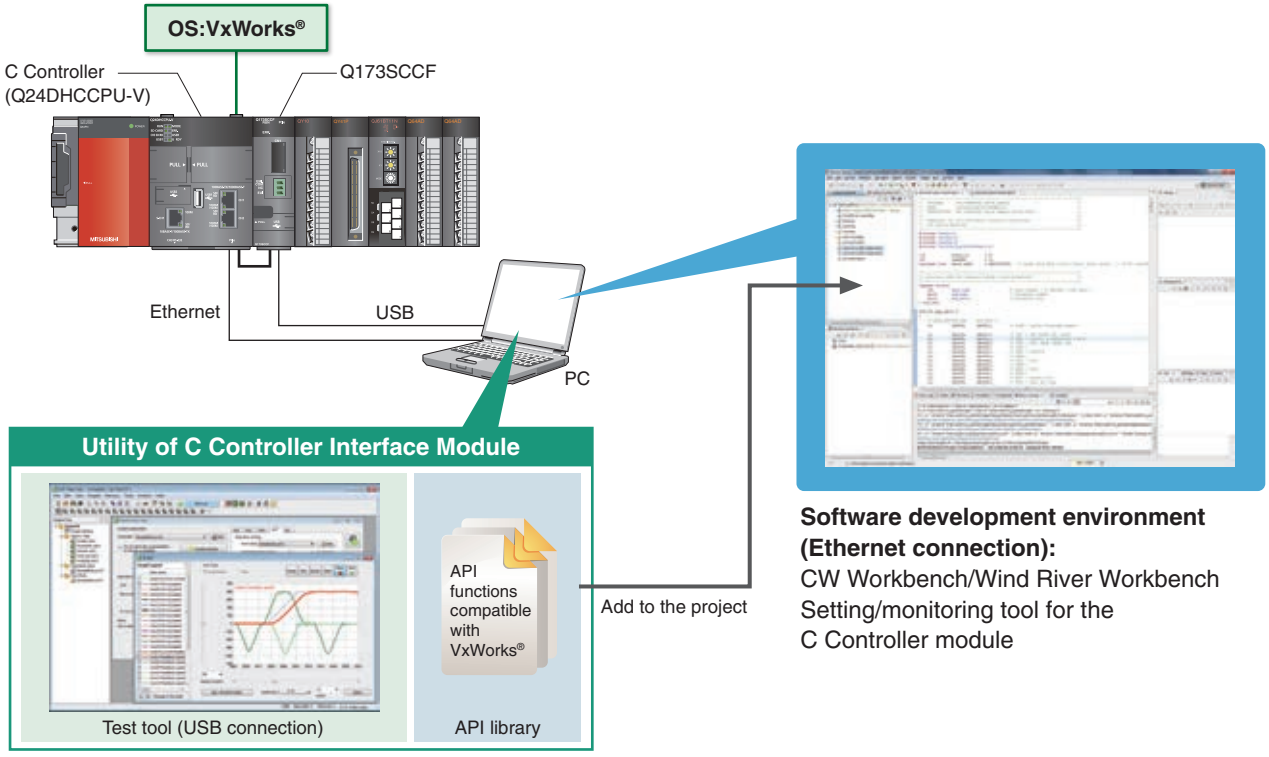


(Note-1): When using an external forced stop, prepare the connector for forced stop input separately.

Software Development Environment

[C Controller Interface Module]

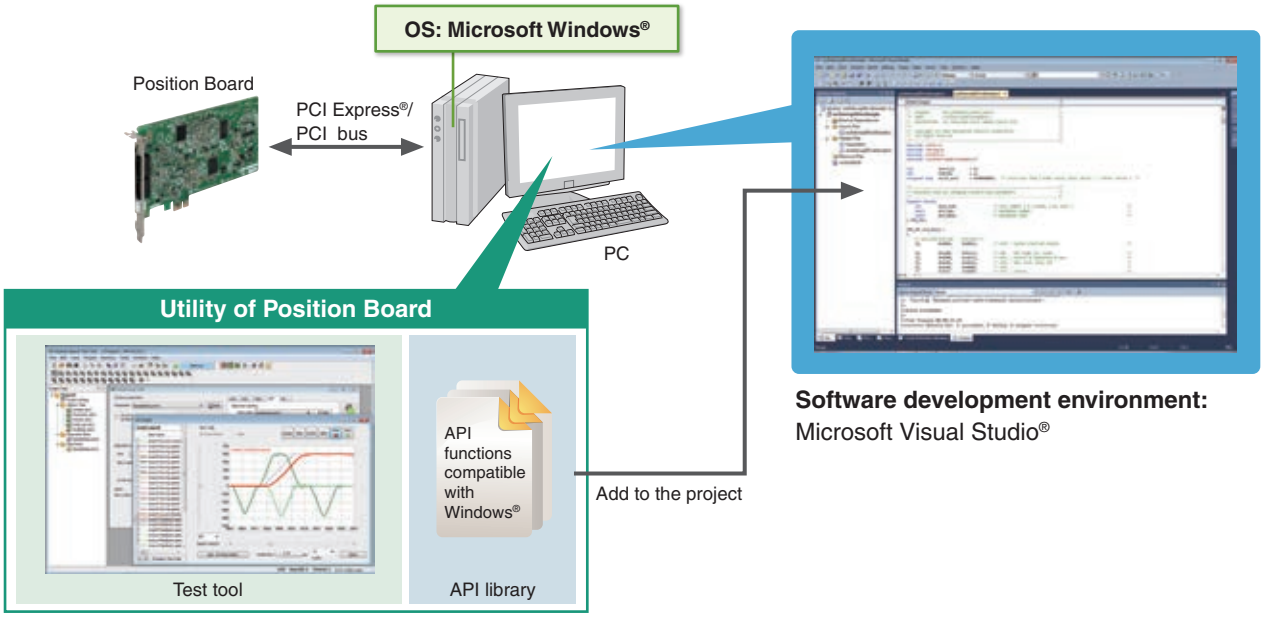
Create a user program by adding the positioning control API library to the project of the C Controller software development environment "CW Workbench". Also, since the OS for the C Controller (VxWorks®) has been pre-installed, you do not need to install it.



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 separately.

Q173SCCF MR-MC series

[Utility]

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

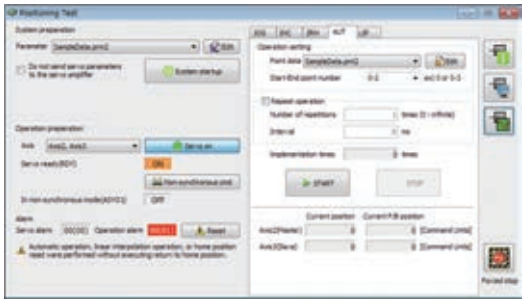
- Test tool
- API library
- Device driver

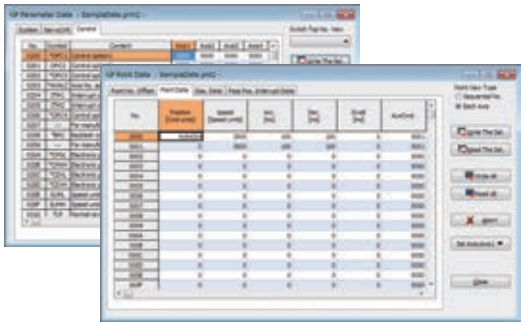
Test tool

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

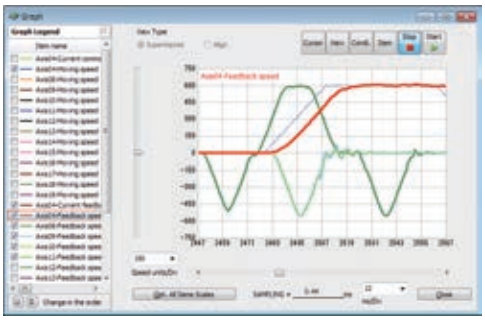
Test operation is easily performed by using Positioning test operation functions and Parameter/Point data setting functions. These functions are useful for checking SSCNET III/H wiring and motor movement.

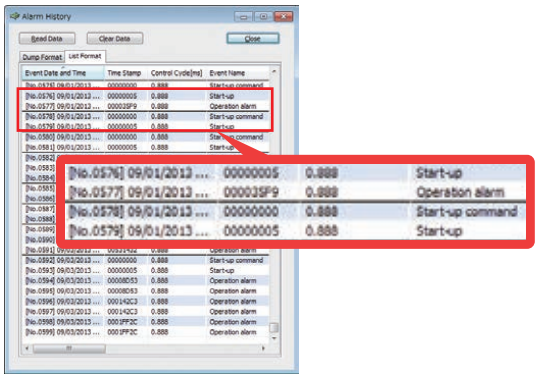




Maintenance

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, startup in various operation modes, and monitor, etc. are available.

Device driver

The device driver is software required when a C Controller/a personal computer accesses to the Interface Module/Position Board from a user program via PCI Express®/PCI bus. You do not have to separately prepare a device driver.

Positioning Control

Q173SCCF MR-MC series

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

User program

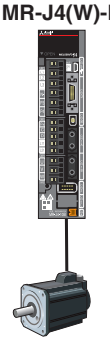
```
void sample()
{
    int    board_id      = 0;    /* Board ID */
    int    channel       = 1;    /* Channel No.*/
    int    axnum         = 1;    /* Axis No.*/
    int    start_pnt     = 0;    /* Start point No.*/
    int    end_pnt       = 1;    /* End point No.*/
    int    fin_status;
    int    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 );
}
```

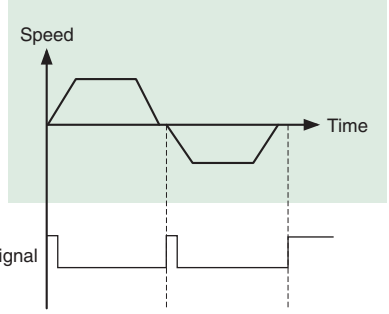
C Controller Interface Module/Position Board

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



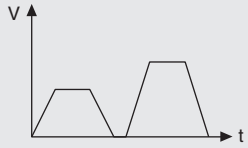


Various Optional Features for Point to Point Positioning Operation

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

Ensuring passage through the target position

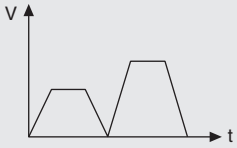
In-position stop



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

Not waiting for motor stabilization

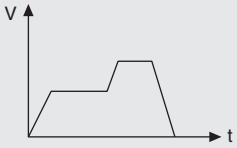
Smoothing stop



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

Not stopping at a point

Continuous operation

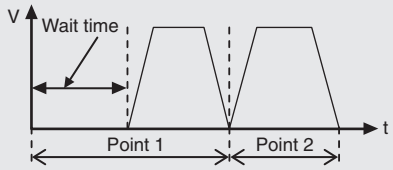


The current speed is changed to the command speed of the next point.

[Dwell time setting] Set the wait time between points

Wait time before the point movement operation starts

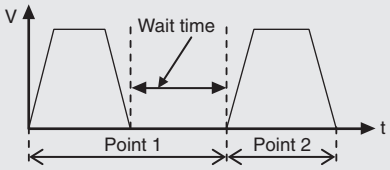
Pre-dwell



Operation starts after the specified wait time

Wait time after moving to the point

Dwell

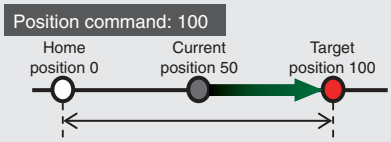


Operation is completed when the specified time has elapsed after moving to the point.

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

Target position with reference to the home position

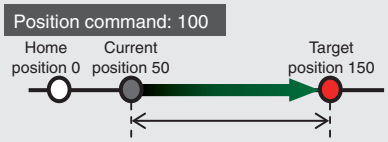
Absolute position command



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

Target position with reference to the current position

Relative position command

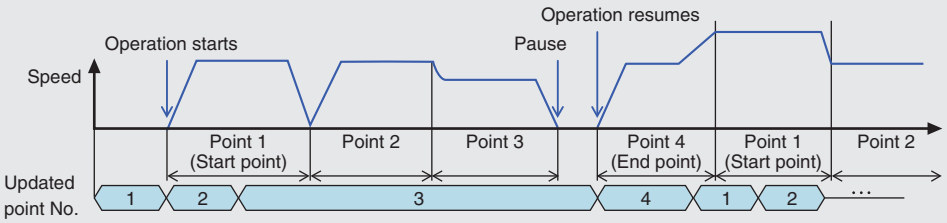


Moves to the target position, "100" away from the current position.

[Loop specification] Specify the loop start/end point No. with the point table NEW

Consecutive multi-point movement which exceeds the limit of settable point tables

Point table loop method

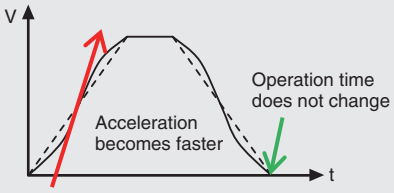


Once a point movement operation for the last point No. ends, another operation begins again from the start point No.
- Endless multi-point movement is possible by continuously updating the point table.
- The point movement operation stops by ending the update.
- The operation resumes automatically by starting the update.

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

Same operation time duration

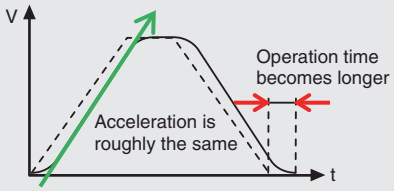
S-curve acceleration/deceleration



Maximum acceleration is faster than trapezoidal acceleration/deceleration.

Same maximum acceleration speed

Smoothing filter

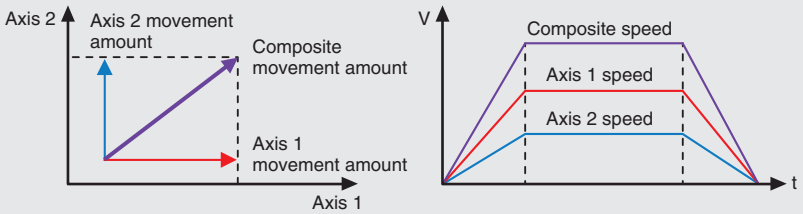


Maximum acceleration speed is roughly the same as trapezoidal acceleration/deceleration.

[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

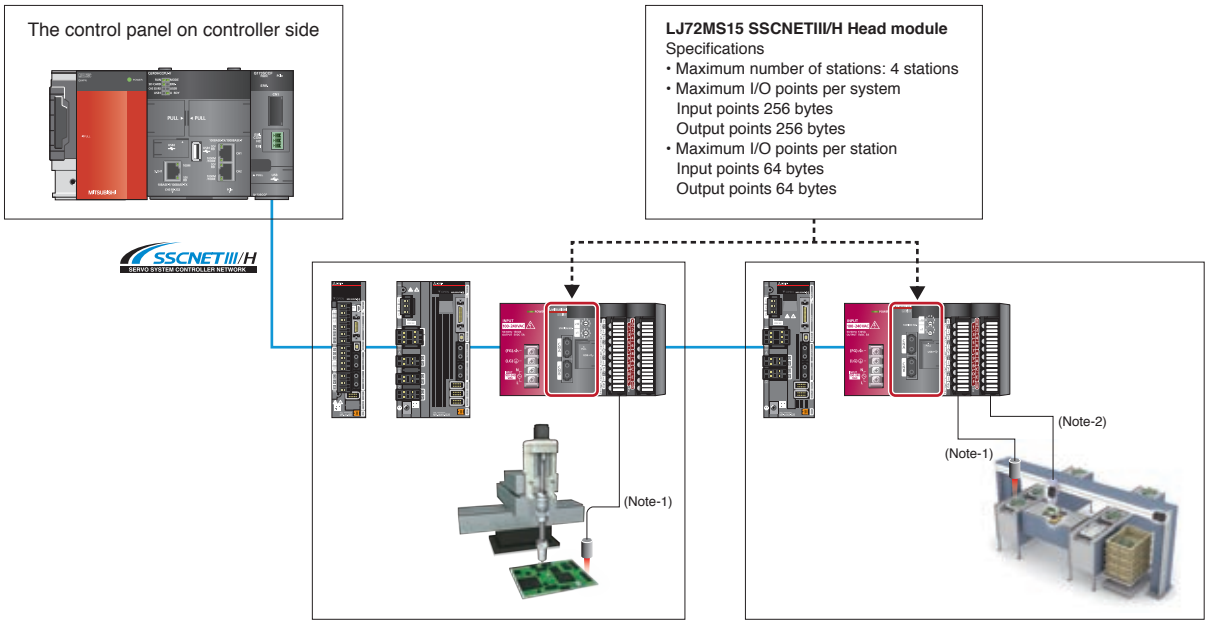


LJ72MS15 SSCNET III/H Head Module NEW

Q173SCCF MR-MC series

The SSCNET III/H Head module allows the controller to connect remotely with various modules (I/O, analog, high-speed counter, etc.) via SSCNET III/H.
Those remotely connected modules serve as the controller's remote stations, transmitting the inputs/outputs.
This results in reduced wiring since the controller receives the I/O and analog I/O signals directly from the servo amplifier side.

(Note): MELSOFT GX Works2 is required to set the Head module.



(Note-1): Sensor input/output signals for inspection devices, etc. can be read/written via the Head module.
(Note-2): Outputs the hand open/close signals.

Tandem Operation

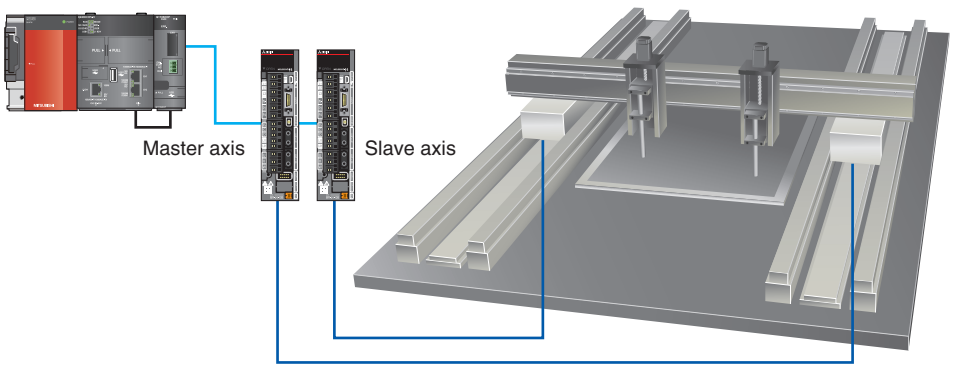
Q173SCCF MR-MC series

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

Tandem operation system



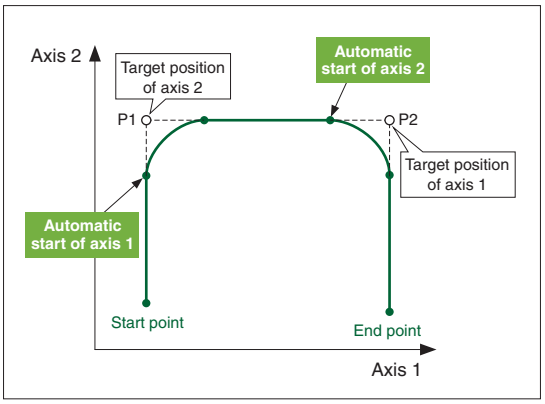
Other Axes Start Function

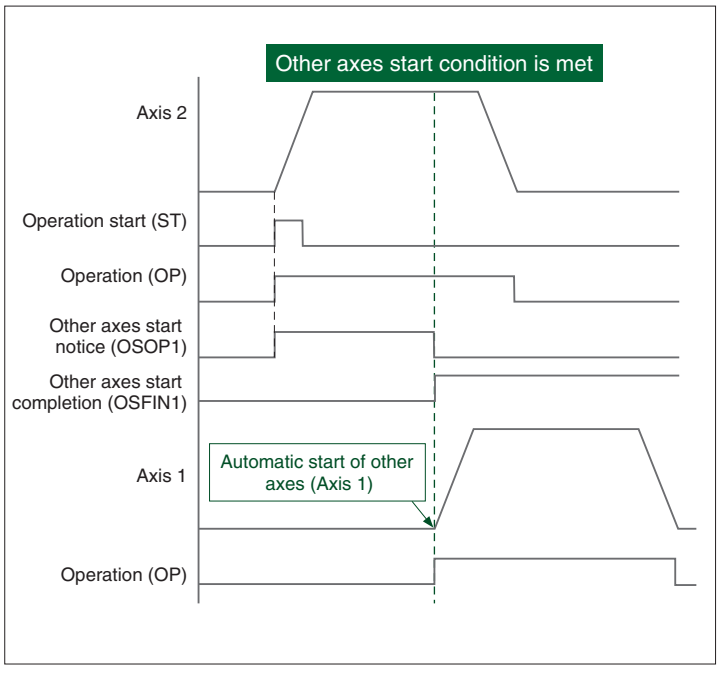
Q173SCCF MR-MC series

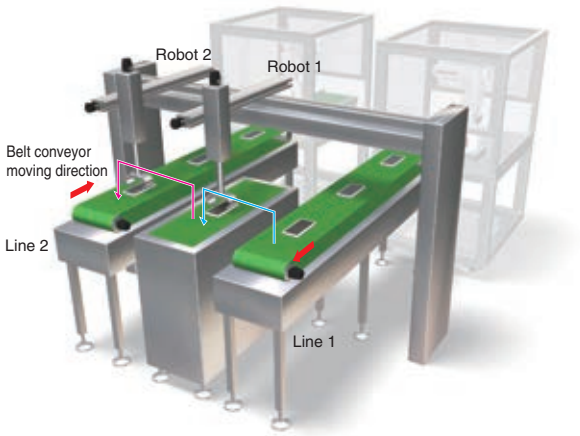
This function automatically starts other axes according to its startup condition and its operation pattern.
Tact time of assembly machines, etc. is shortened with this automatic startup via controllers.

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

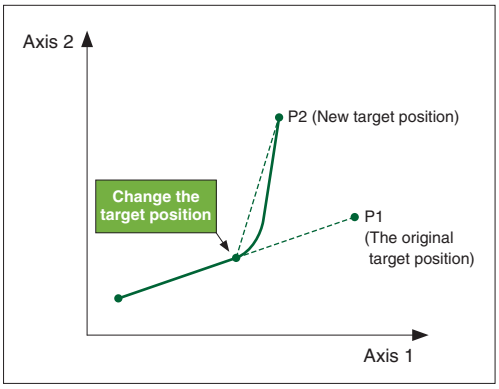
Position Change Function

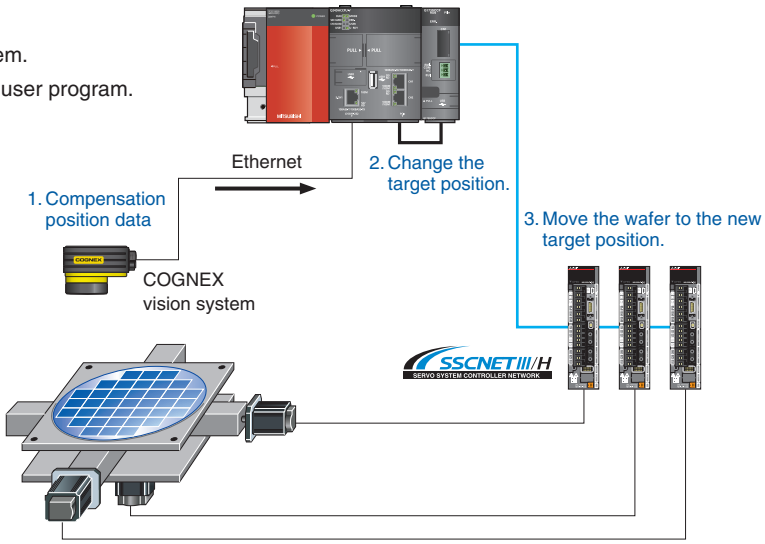
Q173SCCF MR-MC series

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 current 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

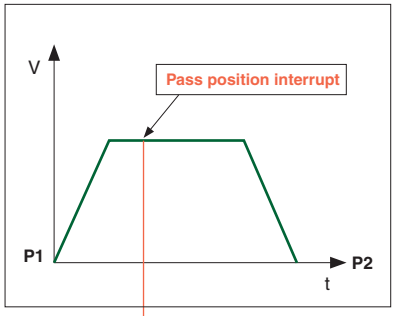
Q173SCCF MR-MC series

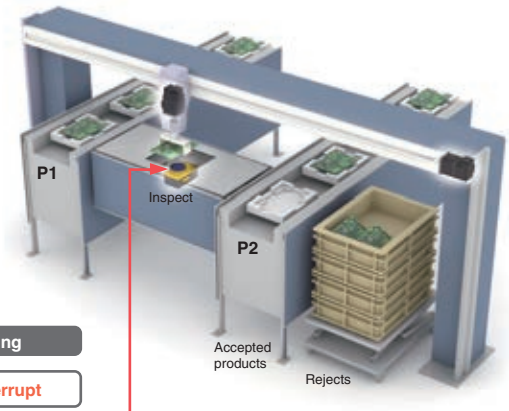
During automatic operation, interrupts are outputted when axes pass the specified position.
After that, the corresponding interrupt process of the user program is started.

- 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 workpiece according to 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.



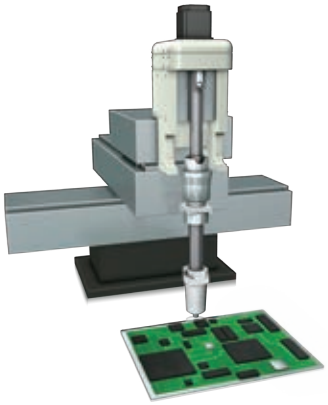


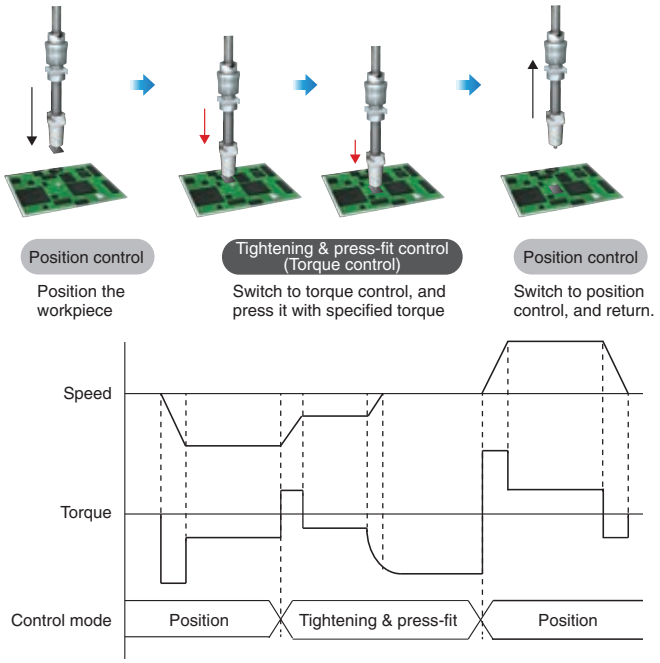
Application example: inspection machine

Tightening & Press-fit Control

Q173SCCF MR-MC series

The motor can be switched to torque control (tightening & press-fit mode) during positioning without stopping.
Since the current position is controlled even during the tightening & press-fit control, positioning operation based on the absolute position coordinates can be performed smoothly after switching back to positioning control.





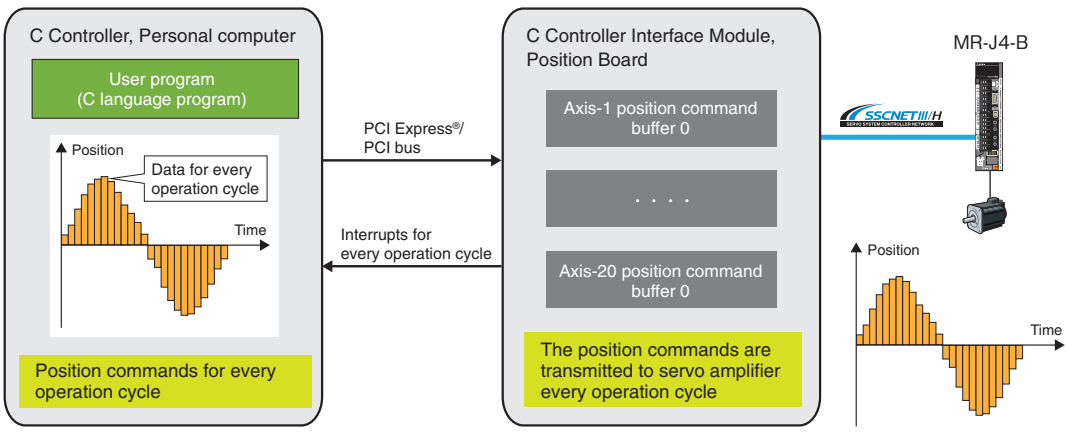
Interface Mode Function

Q173SCCF MR-MC series

This standard feature realizes unique control based on a C-language user program using SSCNET III/H

The interface mode function transmits the position commands received from a user program to servo amplifiers every operation cycle. This allows servo amplifier to be controlled using a user program.
Speed and torque controls are also available in this method.
So, a MR-J4-B can be controlled based on user programs created with your programming know-how of position/speed/torque commands while taking advantage of SSCNET III/H servo system synchronous network performance.

- The C Controller Interface Module or Position Board controls the SSCNET III/H processing. This allows the user-program side to focus on information processing, human machine interface, and Motion control.
- A personal computer with a real-time OS can perform fixed-cycle Motion control using interrupts at every operation cycle.
- Thanks to the position command buffers of up to 64 phases, even non-real-time OS (Windows® only) can perform at 0.22 ms (the fastest rate) cycle command operation; This enables further increase in accuracy in trajectory control.



Main Functions

Q173SCCF MR-MC series

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 to the set end point.

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 available. Select the suitable method 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.

Mark detection — Application function

The current position data of servo motor can be read when a mark detection signal is inputted from a servo amplifier.

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 set 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) for positioning control. Various methods are available, such as dog method, data set method, stopper method, and scale home position signal detection method.

Stop functions — Application function

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

Command change — Application function

Commands for speed/time constant/position can be changed, even during the 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 responding to the changes in movement amount or speed.

Connect/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 and keeps them even when power is turned OFF. This is 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 specifications

Function		Standard Mode			Interface Mode		
		MR-MC240 MR-MC210	MR-MC241 MR-MC211	Q173SCCF	MR-MC240 MR-MC210	MR-MC241 MR-MC211	Q173SCCF
System function	Number of control axes	Up to 20 (MR-J4-B) Up to 16 (MR-JE-B)	UP to 32	Up to 20 (MR-J4-B) Up to 16 (MR-JE-B)	Up to 20 (MR-J4-B) Up to 16 (MR-JE-B)	UP to 32	Up to 20 (MR-J4-B) Up to 16 (MR-JE-B)
	Control cycle	0.22ms/0.44ms/0.88ms (Select using parameters.)					
	Control mode	Position control, Tightening & press-fit control			Position control, Speed control, Torque control		
Operation functions (Note-1, 2)	JOG operation	Provided			—		
	Incremental feed	Provided			—		
	Automatic operation	Point table method, 1-axis control, Tightening & press-fit 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			Command unit/min, command unit/s, and r/min (the unit for speed of monitor output)		
	Acceleration/ deceleration	Command speed limits: 1 to speed limit value Start speed limits: 1 to speed limit value 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	Position, Speed, Time constant			—		
Application functions 2		Hardware stroke limit, Software stroke limit, Interlock, Rough match output, Torque limit, Backlash compensation, 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, Mark detection			Torque limit, Gain switching, PI-PID switching, Absolute position detection system, Digital input/output, Servo amplifier general input/output, Mark detection, Event detection		
Auxiliary function	Monitor	Current command position, Current feedback 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 easily tested.			Provided		
	Connect/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		
	External forced stop disabled	Provided			Provided		
Board ID		0 to 3		—	0 to 3		—

(Note-1): The movable range: -2147483648 to 2147483647. Movement outside the limits is not covered with warranty. If software limits have been disabled, be careful not to exceed the 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 specifications

Item		Specification
Servo amplifier connection system		SSCNET III/H (1 line)
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)
Number of Interface Modules for one C Controller		1
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 Interface Module package.

Position Board specifications

Item		Specification			
		MR-MC240	MR-MC241	MR-MC210	MR-MC211
Servo amplifier connection system		SSCNET III/H (1 line)	SSCNET III/H (2 lines)	SSCNET III/H (1 line)	SSCNET III/H (2 lines)
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)			
Number of Position Boards for one computer		4			
Bus specification		PCI Express®1.1 × 1 (Note-2)		PCI bus	
	Size [mm(inch)]	Short sized version (111.2(4.38) × 167.6(6.60))		Short sized version (106.7(4.20) × 167.6(6.60))	
Power supply voltage		3.3 VDC		5 VDC	
Current consumption [A]		1.1	1.5	0.45	0.7
Mass [kg]		0.11			

(Note-1): Crimping tools and connectors are needed for cable fabrication. Be sure to prepare ones separately.
(Note-2): Depending on the specifications of the personal computer, the PCI Express® slot may be directly connected to the CPU of the personal computer.
If the PCI Express® compatible Position Board is mounted to a PCI Express® slot that is directly connected to the CPU of the host controller, it may not be able to operate.
Mount the PCI Express® compatible Position Board to a PCI Express® slot that is not directly connected to the CPU of the personal computer (connected to a chipset).

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

Manufacturer	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.

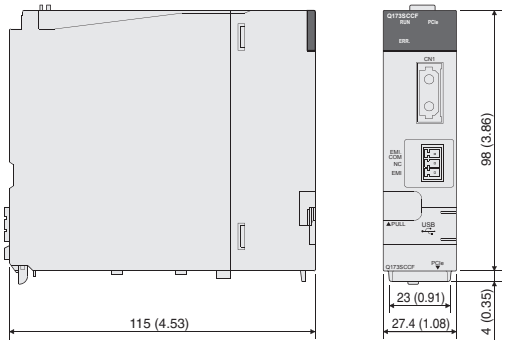
Function Type	Function (some functions are omitted)	Function Content
Support Functions	sscGetLastError	Gets the detailed error codes.
Device Functions	sscOpen	Opens memory access port.
	sscClose	Closes memory access port.
Parameter Functions	sscResetAllParameter	Writes the initial values in all parameters 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.

Specifications of C Controller Interface Module

Exterior dimensions

●Q173SCCF



[Unit: mm (inch)]

Operation environment for test tool

Item		Description
Personal computer	Personal computer	Microsoft® Windows® supported personal computer
	OS	Microsoft® Windows® 8.1 English version (64-bit/32-bit) Microsoft® Windows® 8 English version (64-bit/32-bit) Microsoft® Windows® 7 English version (64-bit/32-bit) [Service Pack 1] Microsoft® Windows Vista® English version (32-bit) [Service Pack 2] Microsoft® Windows® XP English version (32-bit) [Service Pack 3]
	CPU	Desktop PC: Intel® Celeron® Processor 2.8GHz or higher Laptop PC : Intel® Pentium® M Processor 1.7GHz or higher
	Required memory	1GB or more recommended (For 32-bit edition) 2GB or more recommended (For 64-bit edition)
Available hard disk space		When installing the test tool: Available hard disk space 1GB or more When operating the test tool: Available virtual memory space 512MB or more
Disk drive		CD-ROM supported disk drive
Monitor		Resolution 1024 × 768 pixels or higher
Communication interface		USB port

Development environment

Item	Description
User program OS	VxWorks® 6.8.1
Software development environment	C Controller Engineering Tool CW Workbench SW1DND-CWWLQ24-E/SW1DND-CWWLQ24-EZ/SW1DND-CWWLQ24-EVZ
	A product of Wind River Systems Inc. (Note-1) Wind River Workbench 3.2

(Note-1): Need to purchase the product separately.

Component list

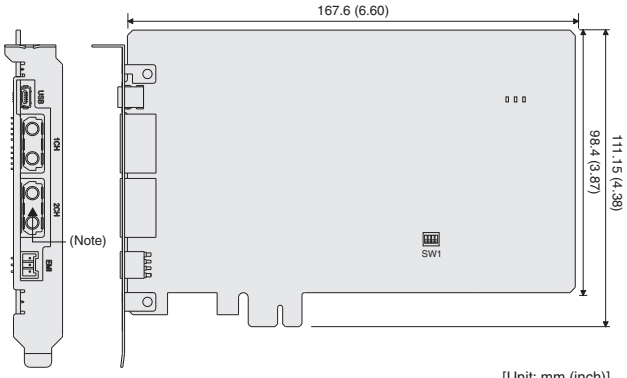
Item	Model	Specification			Applicable standard
C Controller Interface Module	Q173SCCF	Up to 20 axes (A forced stop input cable connector is provided.)			CE, UL, KC
C Controller Module	Q24DHCCPU-V	CPU : SH4A, Endian format: Little endian OS : VxWorks® 6.8.1			CE, UL, KC
C Controller Interface Module utility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

(Note-1): Contact your local Mitsubishi Electric office for cables shorter than 30m (98.43ft.).

Specifications of Position Board

Exterior dimensions

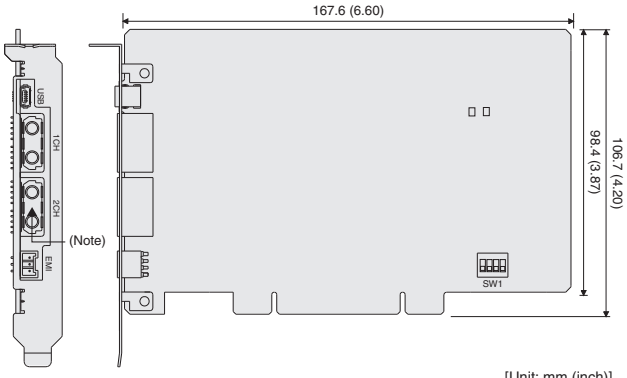
●MR-MC240/MR-MC241



[Unit: mm (inch)]

(Note): MR-MC241 only

●MR-MC210/MR-MC211



[Unit: mm (inch)]

(Note): MR-MC211 only

Operation environment for test tool

Item		Description
Personal computer	Personal computer	Microsoft® Windows® supported personal computer
	OS	Microsoft® Windows® 8.1 English version (64-bit/32-bit) Microsoft® Windows® 8 English version (64-bit/32-bit) Microsoft® Windows® 7 English version (64-bit/32-bit) [Service Pack 1] Microsoft® Windows Vista® English version (32-bit) [Service Pack 2] Microsoft® Windows® XP English version (32-bit) [Service Pack 3]
	CPU	Desktop PC: Intel® Celeron® Processor 2.8GHz or higher Laptop PC : Intel® Pentium® M Processor 1.7GHz or higher
	Required memory	1GB or more recommended (For 32-bit edition) 2GB or more recommended (For 64-bit edition)
Available hard disk space		When installing the test tool: Available hard disk space 1GB or more When operating the test tool: Available virtual memory space 512MB or more
Disk drive		CD-ROM supported disk drive
Monitor		Resolution 1024 × 768 pixels or higher
Communication interface		PCI/PCI Express® BUS USB port

Development environment

Item	Description
User program OS	The same OS as the test tool above.
Software development environment	Microsoft® Visual C++ 2013/2012/2010/2008/2005 Microsoft® Visual C# 2013/2012/2010/2008/2005 Microsoft® Visual Basic 2013/2012/2010/2008/2005 Embarcadero® C++ Builder® 2010/2009/2007

Component list

Item	Model	Specification			Applicable standard
Position Board (Note-1)	MR-MC240/MR-MC210	Up to 20 axes			CE, UL, KC
	MR-MC241/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 ⇔ Servo amplifier • Servo amplifier ⇔ Servo amplifier	Standard code 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		Standard cable for outside panel	5m (16.40ft.), 10m (32.81ft.), 20m (65.62ft.)	—
	MR-J3BUS□M-B (Note-2)		Long distance cable	30m (98.43ft.), 40m (131.23ft.), 50m (164.04ft.)	—
USB cable	MR-J3USBCBL3M	3m (9.84ft.)			—
MELSOFT MR Configurator2	SW1DNC-MRC2-E	Servo amplifier MELSERVO-J4 series setting and adjustment			—

(Note-1): When using an external forced stop, prepare the connector for forced stop separately.
(Note-2): Contact your local Mitsubishi Electric office for cables shorter than 30 m.

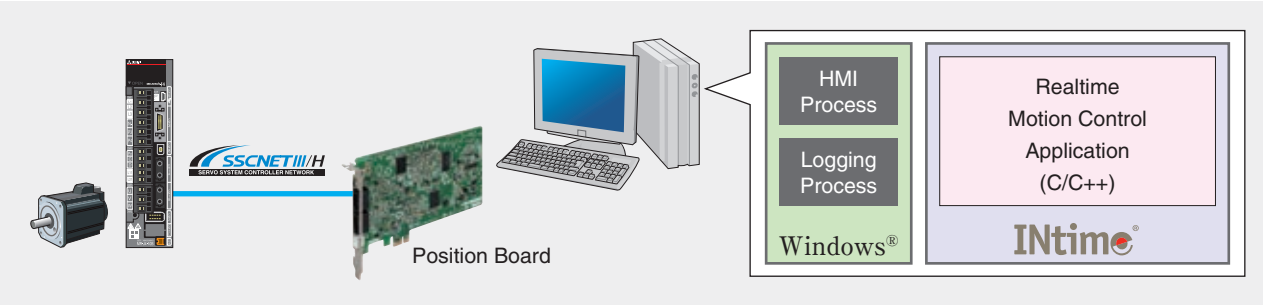
Partner Products

INtime®

TenAsys Corporation

Real-time motion control is realized by Windows® PC.

INtime® is the real-time OS products which extend real-time performance for Windows® PC.
Real-time control is realizable only by installing in usual Windows® PC.
Since parallel operation is carried out with Windows®, both the Windows® side processings, such as HMI and log file save, and the machine control processings which needs real-time performance are able to be realized on one set of hardware.
Since applications are developed by Microsoft Visual Studio®, it is easy to introduce.
By introducing a dedicated position board, the motion positioning operation which utilizes SSCNET is realizable.



(Note): Mitsubishi Electric has confirmed that the Position Board operates on the INtime®4.2/INtime®5.0. We also offer the API library/device driver for the Position Board control.
Contact your local Mitsubishi Electric office for more details.

An inquiry of a product

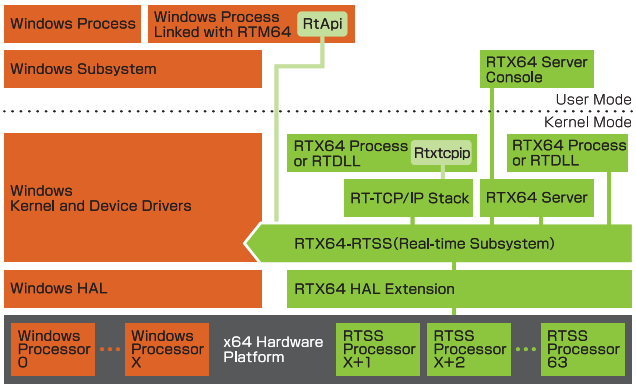
Micronet Company Micronet
URL : http://www.mnc.co.jp/english/
MAIL : bcd@mnc.co.jp

RTX/RTX64 (Real-time Extensions)

IntervalZero, Inc.

Transform Windows® into a Real-Time Operating System

RTX (32-bit) and RTX64 (64-bit) real-time software are key components of the IntervalZero RTOS Platform that comprises x86 and x64 multicore multiprocessors, the Windows® operating system, and real-time Ethernet to outperform real-time hardware such as DSPs and radically reduce the development costs for systems that require determinism or hard real-time.



Features

- Multicore SMP aware Real-time scheduler
- RTX64 is supported on the 64-bit versions of Windows®, including Windows® Embedded Standard
- Real-time Win32 like API
- Direct access to hardware(I/O, Memory)
- Direct memory addressing
  Non-Page Pool - up to 128Gbyte on a 64-bit system
- Single integrated development environment
  Visual Studio - C# managed code and C++ support
- Provides a real-time network driver and Virtual Network driver

IntervalZero's customer-centered philosophy combined with more than three decades of embedded software innovation, and the proven value of our RTX hard real-time software, which transforms Windows® into a real-time operating system (RTOS), have enabled us to build a global customer base of market-leading OEMs and end users in Industrial Automation, Medical Systems, Digital Media, Test & Measurement, Military & Aerospace, and other industries.

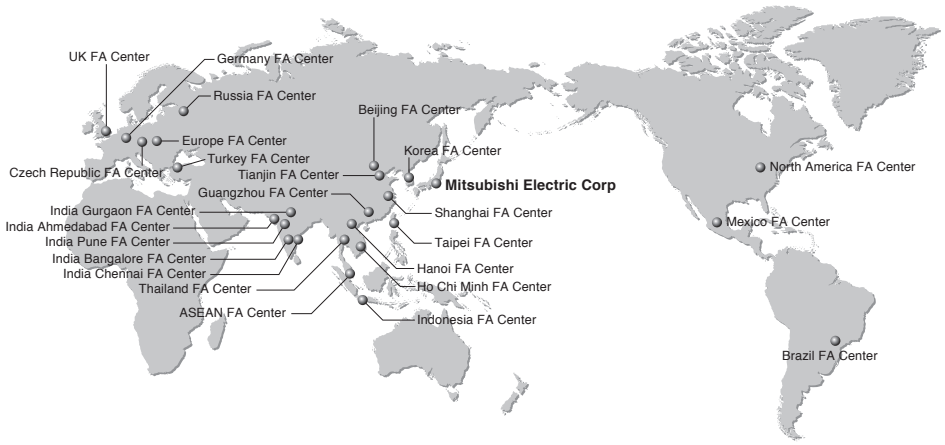
(Note): Mitsubishi Electric has confirmed that the Position Board operates on the RTX2011.
We also offer the API library/device driver for the Position Board control.
Contact your local Mitsubishi Electric office for more details.

An inquiry of a product

IntervalZero, Inc. IntervalZero
URL : http://www.intervalzero.com/

MEMO

Global FA Centers



China

Shanghai FA Center
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Tel: 90-216-526-3990 Fax: 90-216-526-3995

Conformity with Global Standards and Regulations

Servo system controllers conform to global standards.

(Note-1): This product is not subject to China Compulsory Certification (CCC).

(Note-2): Refer to "Servo Amplifier Instruction Manual" and "EMC Installation Guidelines" when your system needs to meet the EMC directive.

(Note-3): For corresponding standards and models, contact your local sales office.

Complies with EN, UL, CSA (c-UL) standards, and Korea Radio Wave Law (KC).

Conformity 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.

(Note): 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).

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.

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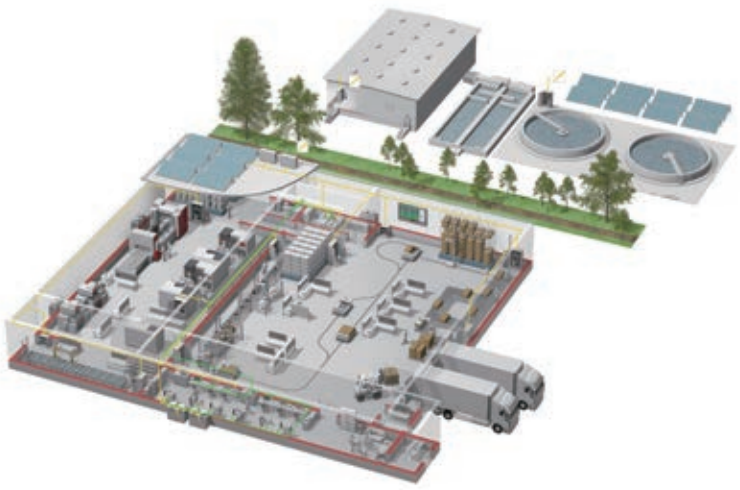
This publication explains the typical features and functions of the products herein and does not provide restrictions or other information related to usage and module combinations. Before using the products, always read the product user manuals. Mitsubishi Electric will not be held liable for damage caused by factors found not to be the cause of Mitsubishi Electric; opportunity loss or lost profits caused by faults in Mitsubishi Electric products; damage, secondary damage, or accident compensation, whether foreseeable or not, caused by special factors; damage to products other than Mitsubishi Electric products; or any other duties.

⚠ For safe use

- To use the products given in this publication properly, always read the relevant manuals before beginning operation.
- The products have been manufactured as general-purpose parts for general industries, and are not designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine or passenger-carrying vehicles, consult with Mitsubishi Electric.
- The products have been manufactured under strict quality control. However, when installing the products where major accidents or losses could occur if the products fail, install appropriate backup or fail-safe functions in the system.

YOUR SOLUTION PARTNER



Mitsubishi Electric offers a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines.

A NAME TO TRUST

Since its beginnings in 1870, some 45 companies use the Mitsubishi name, covering a spectrum of finance, commerce and industry.

The Mitsubishi brand name is recognized around the world as a symbol of premium quality.

Mitsubishi Electric Corporation is active in space development, transportation, semi-conductors, energy systems, communications and information processing, audio visual equipment and home electronics, building and energy management and automation systems, and has 237 factories and laboratories worldwide in over 121 countries.

This is why you can rely on Mitsubishi Electric automation solution - because we know first hand about the need for reliable, efficient, easy-to-use automation and control in our own factories.

As one of the world's leading companies with a global turnover of over 4 trillion Yen (over $40 billion), employing over 100,000 people, Mitsubishi Electric has the resource and the commitment to deliver the ultimate in service and support as well as the best products.

Low voltage: MCCB, MCB, ACB

Medium voltage: VCB, VCC

Power monitoring, energy management

Compact and Modular Controllers

Inverters, Servos and Motors

Visualization: HMIs, Software, MES connectivity

Numerical Control (NC)

Robots: SCARA, Articulated arm

Processing machines: EDM, Lasers, IDS

Air-conditioning, Photovoltaic, EDS

C Controller/Personal Computer Embedded Type Servo System Controllers

Country/Region	Sales office	Tel/Fax
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