



FACTORY AUTOMATION

Mitsubishi Electric AC Servo System MELSEC iQ-R Series Motion Module RD78G Simple Motion Mode



MELSEC iQ-R
series

MITSUBISHI ELECTRIC SERVO SYSTEM
MELSERVO-J5



CC-Link I^ETSN

**Taking evolution to the next step with
Simple Motion mode**

GLOBAL IMPACT OF MITSUBISHI ELECTRIC



Through Mitsubishi Electric's vision, "Changes for the Better" are possible for a brighter future.

Changes for the Better

"Changes for the Better" represents the Mitsubishi Electric Group's attitude to "always strive to achieve something better", as we continue to change and grow. Each one of us shares a strong will and passion to continuously aim for change, reinforcing our commitment to creating "an even better tomorrow".

Mitsubishi Electric is involved in many areas including the following:

Energy and Electric Systems

A wide range of power and electrical products from generators to large-scale displays.

Electronic Devices

A wide portfolio of cutting-edge semiconductor devices for systems and products.

Home Appliance

Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems

Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems

Maximizing productivity and efficiency with cutting-edge automation technology.

Our advances in AI and IoT are adding new value to society in diverse areas from automation to information systems. The creation of game-changing solutions is helping to transform the world, which is why we are honored to be recognized in the 2019 'Forbes Digital 100' as one of world's most influential digital corporations.



Established February 2nd 1921 Mitsubishi Electric celebrates 100 years of serving society through practical, innovative technology solving the issues of the day.



Maximize system performance



OVERVIEW

| | |
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Taking evolution to the next step with Simple Motion mode

MELSEC iQ-R series



CC-Link I^ETSN



Heritage

Usability



Easy-To-Use Simple Motion Mode

The Simple Motion mode is an easy-to-use function that provides the same usability as the previous models (Simple Motion module RD77MS/QD77MS) when RD78G Motion module is used with MR-J5-G servo amplifier. By selecting the Simple Motion mode on GX Works3, positioning control and synchronous control can be easily executed.

[Motion profile table]

- Motion profile table
(Same as the Simple Motion module's)
- Reuse of the existing projects

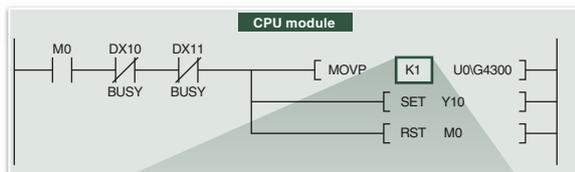
Positioning



[Synchronous control parameters]

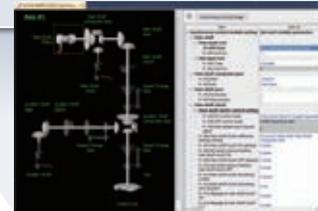
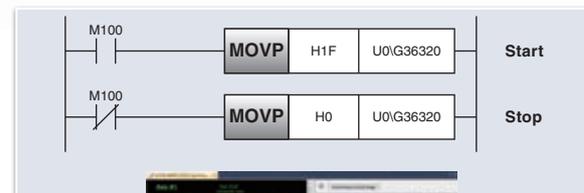
- Easy synchronous control by setting parameters and turning ON a start signal.

Sync Control



| No. | Operation pattern | Control system | Acceleration time No. | Deceleration time No. | Positioning address | Command speed |
|-----|-------------------|-------------------|-----------------------|-----------------------|---------------------|----------------|
| 1 | 1: CONT | 0Bh: INC Linear 2 | 0: 1000 | 0: 1000 | 200000.0 μm | 20000.0 mm/min |
| 2 | 0: END | 0Bh: INC Linear 2 | 0: 1000 | 0: 1000 | -200000.0 μm | 10000.0 mm/min |

Motion profile table

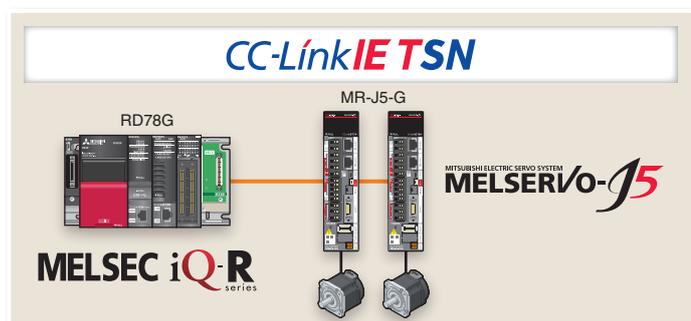
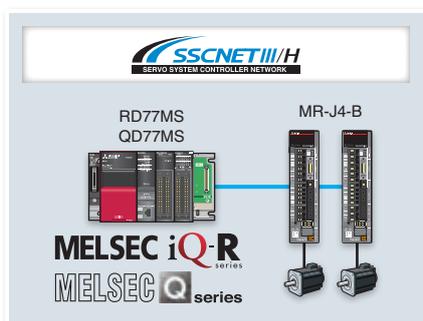


Heritage

Utilization of Existing Programs



The existing MELSEC iQ-R/MELSEC-Q series devices and programs are reusable in a new system of RD78G Motion module that supports the Simple Motion mode.



MITSUBISHI ELECTRIC SERVO SYSTEM
MELSERVO-J5



Progressiveness



Improved Performance

[Compatible with the open integrated network CC-Link IE TSN]

- Connects up to 121 stations (including the master station)
- Supports line, start, and line/start mixed topologies
- Connects servo amplifiers and remote I/O modules
- Connects TCP/IP devices (sensors, vision system sensors)
- Synchronizes time among multiple modules

CC-Link IE TSN

Minimum operation cycle



Progressiveness Maintainability

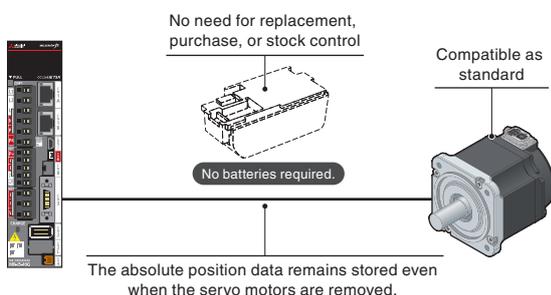


Connecting A High-Performance Servo Amplifier MR-J5-G

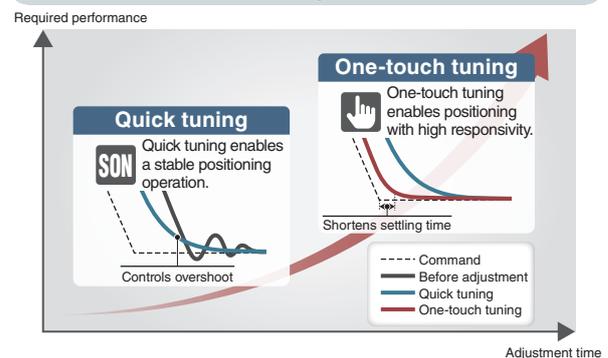
RD78G connects MR-J5-G servo amplifier via CC-Link IE TSN and enables high-speed, high-precision motion control.

- Command communication cycle of $\geq 31.25 \mu$ s and speed frequency response of 3.5 kHz enable advanced motion control.
- With use of Maisart, Mitsubishi Electric's AI technology, the servo amplifier monitors age-related deterioration of ball screws, belts, and gears.
The servo amplifier detects signs of failure and outputs a warning, which prevents downtime of machines due to a sudden failure.
- The HK series rotary servo motors are equipped with a batteryless absolute position encoder as standard, reducing maintenance cost.
- Various servo tuning features, such as quick tuning and one-touch tuning, are available.

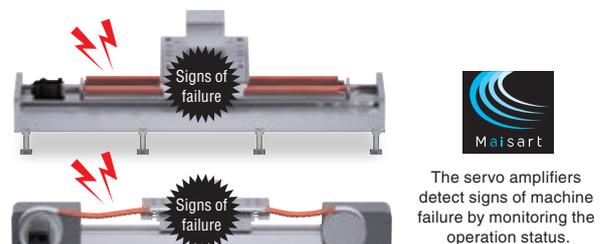
Batteryless absolute position encoder as standard



Servo tuning function



Machine diagnosis (predictive maintenance)



Maisart is Mitsubishi Electric's brand of AI technology. The name stands for "Mitsubishi Electric's AI creates the State-of-the-ART in technology." This means that we are using our proprietary AI technology to make everything smarter.

Simple Motion Mode Simple Motion

CC-Link IE TSN

Motion Module

MELSEC iQ-R
series

RD78G

MELSEC iQ-F
series

FX5-SSC-G

NEW



* When using RD78G, select the operation mode from Simple Motion mode or PLCopen® motion control FB mode.

Combined with a CC-Link IE TSN-compatible servo amplifier, the Motion modules create a high-performance servo system that improves machine capability.

- Executes positioning control with the motion profile table and synchronous control with parameter settings
- Connects remote I/O modules and FR-A800-GN inverters via CC-Link IE TSN. The data of these devices can be read/written by a CPU module.
- Enables safety communication when RD78G is combined with a safety CPU and MR-J5-G-RJ
- Eliminates the redundant wiring required for functional safety, contributing to reduced wiring
- Possible to reuse existing projects of a Simple Motion module for driving MR-J5-G servo amplifier

Product Lines



MELSEC iQ-R
series

RD78G4

RD78G8

RD78G16

- Maximum number of control axes:
16 axes/module (RD78G16)
- Minimum operation cycle*1: 250 [μs]
- Compatible servo amplifiers

MR-J5-G MR-J5D-G4



MELSEC iQ-F
series

FX5-40SSC-G

NEW

FX5-80SSC-G

NEW

- Maximum number of control axes:
4 axes/module (FX5-40SSC-G),
8 axes/module (FX5-80SSC-G)
- Minimum operation cycle*1: 500 [μs]
- Maximum number of connected modules*2:
4 modules/system
- Compatible servo amplifiers*3 **MR-J5-G**

*1. The operation cycle varies by the number of control axes and the models.

*2. This refers to the total number of the Motion modules and one FX5-CCLGN-MS (master station).

*3. MR-J5D-G4 is planned for a future support.

Firmware of RD78G Motion Module

The Simple Motion mode is supported by RD78G with firmware version 16 or later.

To obtain the firmware update files, contact your local sales office.

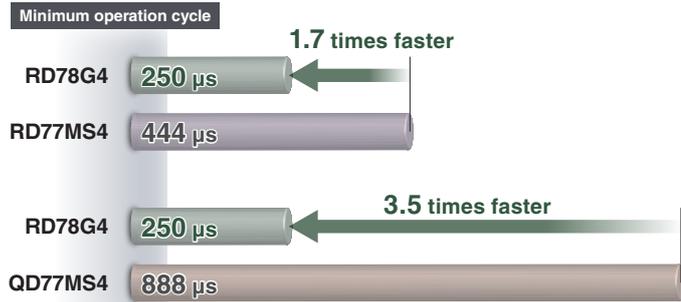


Simple Motion mode

RD78G Motion module
firmware version 16 or later

Improved Performance

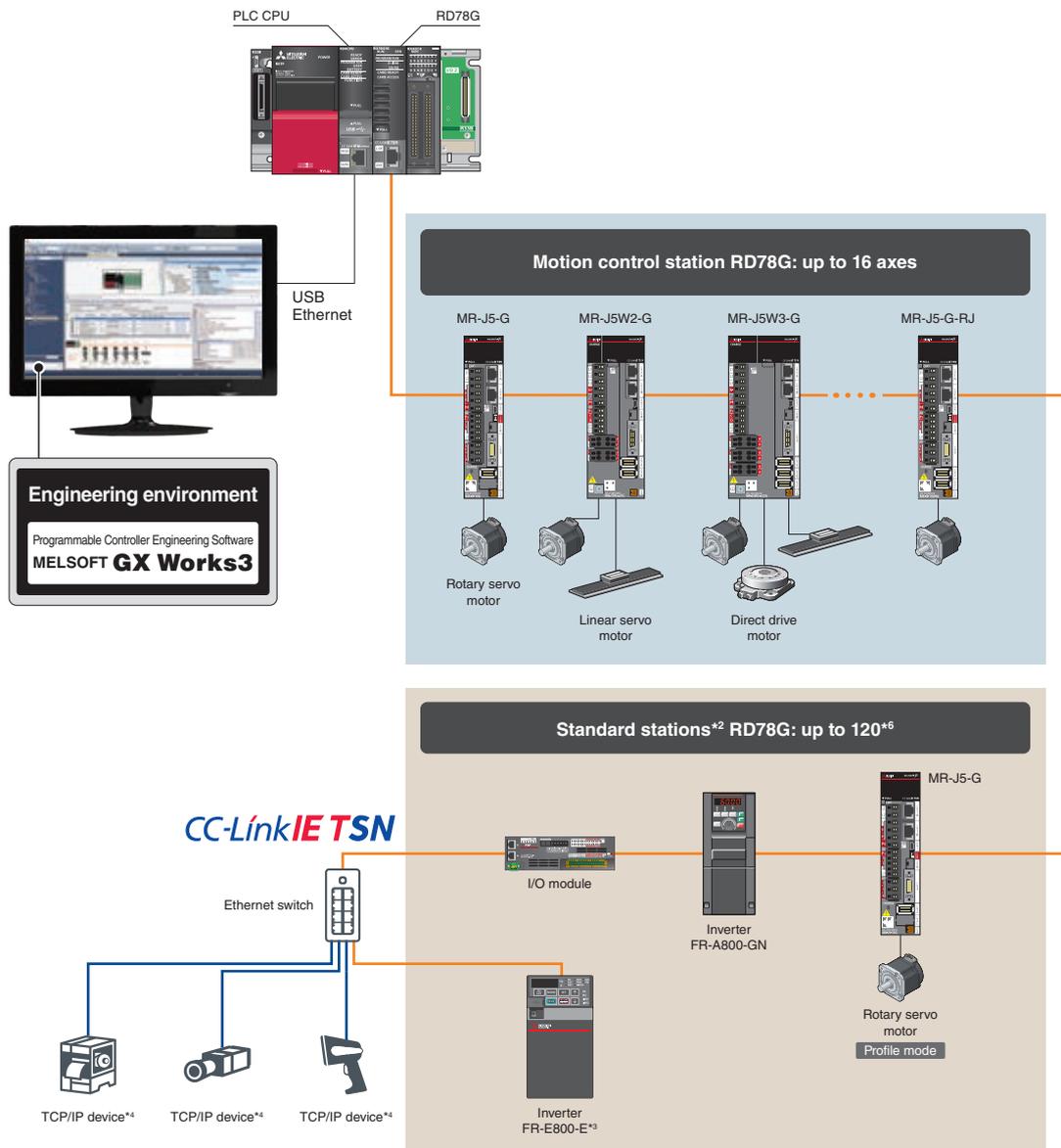
The minimum operation cycle of RD78G in Simple Motion mode is 1.7 to 3.5 times faster than that of the previous models. The data from the servo amplifiers and input/output signals can be received at high speeds, which reduces the cycle time.



System Configuration

The Motion module can function as a master station of CC-Link IE TSN.*1

This feature enables users to create a system more flexibly by connecting various devices, such as servo amplifiers, remote I/O modules, and TCP/IP devices, to the Motion module.*5



*1. The Motion modules are not provided with the following functions: sub-master station, local station, multi-master configuration, and backup/restore function.

*2. Standard stations refer to slave stations other than motion control stations on CC-Link IE TSN.

*3. When connecting FR-E800-E to RD78G, set the communication speed of CC-Link IE TSN to 100 Mbps.

*4. TCP/IP devices are not included in the standard stations.

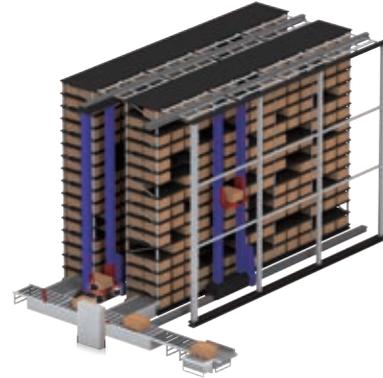
*5. When Class B and A devices are mixed in the same system, up to eight Class B devices can be connected. Refer to manuals for precautions when Class B and A devices are mixed.

*6. RD78G can connect up to 120 devices, which is the total number of the motion control stations and standard stations.

Positioning Control

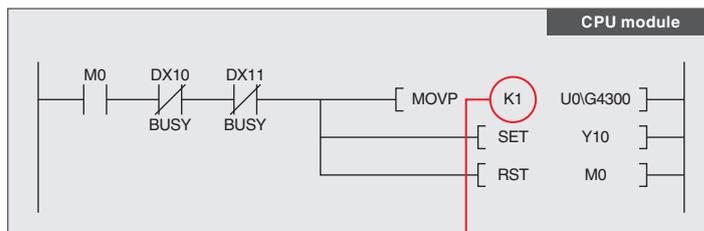
Positioning control is easily executed using a motion profile table.

- To meet various application needs, the Motion module offers various types of positioning control, such as linear interpolation, 2-axis circular interpolation, fixed-pitch feed, and continuous path control.
- An automatic operation can be executed easily by setting the positioning address, the speed, and other setting items in a sequence program.
- Powerful sub-functions, such as M-code output, skip, speed change, and target position change functions, are available.



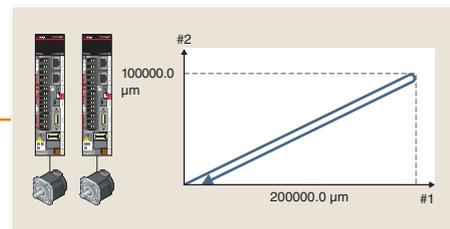
Programming

The Motion module easily executes positioning operation with the instruction in a sequence program that starts a positioning data of the motion profile table. To meet various application needs, the Motion module offers various types of control, such as linear interpolation, two-axis circular interpolation, fixed-pitch feed, and continuous path control.



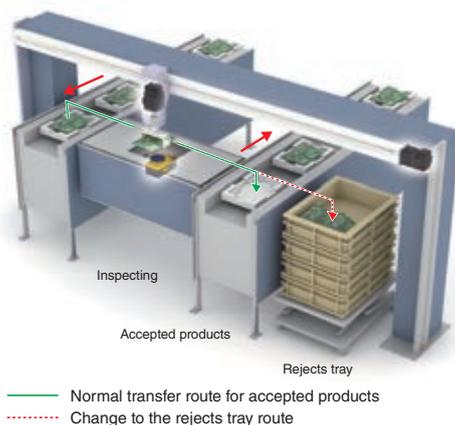
Motion profile table

| No. | Operation pattern | Control system | Acceleration time No. | Deceleration time No. | Positioning address | Command speed |
|-----|-------------------|-------------------|-----------------------|-----------------------|-------------------------|----------------|
| 1 | 1: CONT | 0Bh: INC Linear 2 | 0: 1000 | 0: 1000 | 200000.0 μm | 20000.0 mm/min |
| 2 | 0: END | 0Bh: INC Linear 2 | 0: 1000 | 0: 1000 | -200000.0 μm | 10000.0 mm/min |

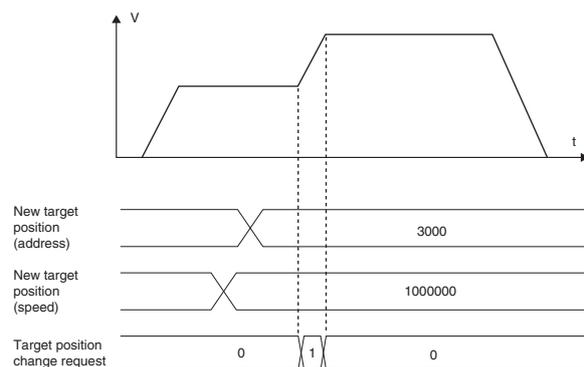


Target Position Change Function

The target position can be changed at any time even when the products are being moved (1-axis linear control). The product is examined with the vision system while being moved to the next line. If a faulty product is found, the target position is changed so that the faulty product is put in a separate tray for those rejected.



[Time chart]

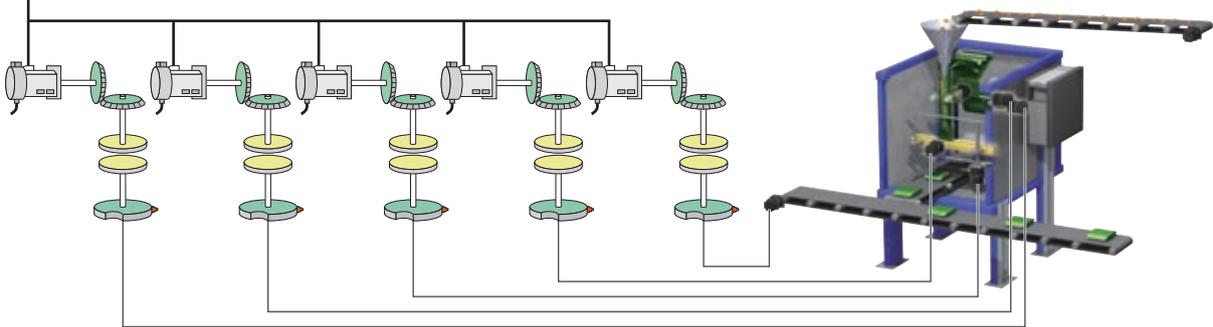


Synchronous Control

Synchronous control can be achieved using software instead of controlling mechanically with gear, shaft, clutch, speed change gear or cam, etc.

- Synchronous control can be flexibly started/ended for each axis, enabling the synchronous control axis and positioning control axis to be used within the same program.
- Command generation axis, servo input axis, or synchronous encoder axis can be set as the input axis.
- The output axis is operated with a cam. The following three operations can be performed with the cam functions: linear operation, two-way operation, and feed operation.
- An incremental synchronous encoder*1 can be connected via MR-J5-G(-RJ)/MR-J5W2-G servo amplifier.

Command generation axis



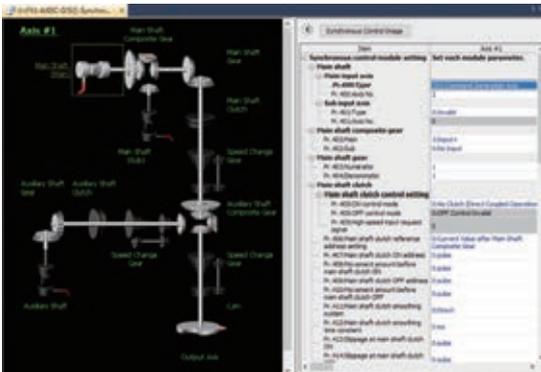
*1. When configuring an absolute position system, use an encoder of HK series servo motors.

[Command generation axis]

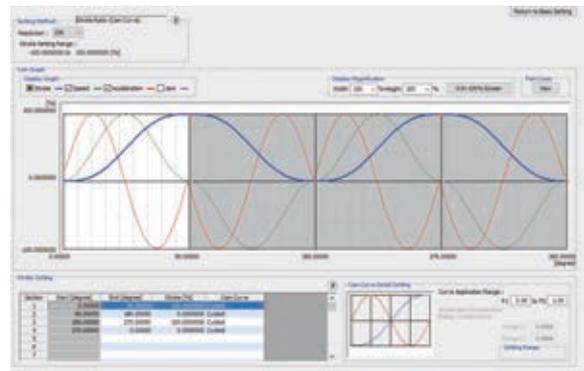
Command generation axis is the axis that performs only the command generation.

It is controlled independently of other axes connected to servo amplifiers. (not counted as a control axis)

Parameter Settings



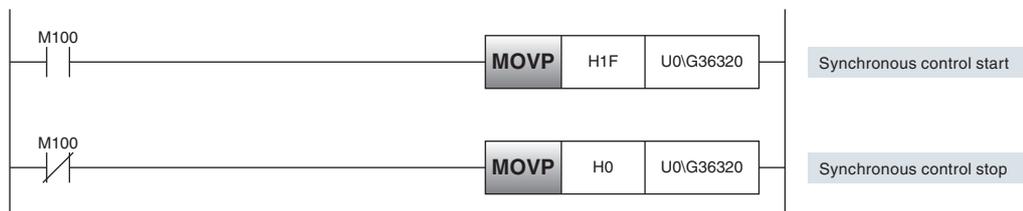
Synchronous control is executed by setting parameters of the input axis, output axis, gear, and clutch for synchronous control and turning on the synchronous control start signal.



The cam graph can be flexibly and easily created through drag & drop. The waveform is changed according to the pointer's movement.

Start/Stop

Synchronous control can be executed after synchronous parameters are set for each output axis. When synchronous control start signal is turned on, the synchronous control parameters are analyzed, and the status is changed to during synchronous control. The output axis is operated by the commands transmitted from the input axis.

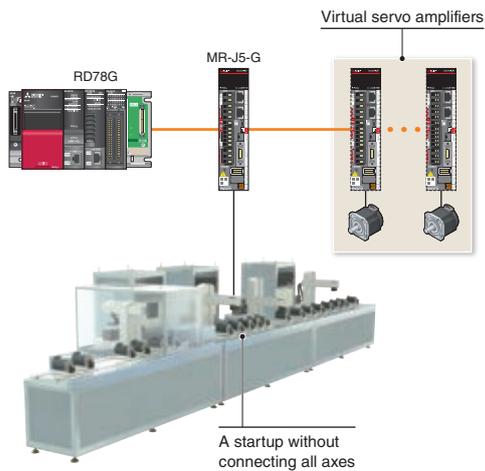


Auxiliary Functions

Virtual Servo Amplifier

The virtual servo amplifier function enables operations of a virtual servo amplifier as if an actual unit is connected. When the virtual servo amplifier is set as a servo input axis of synchronous control, the Motion module executes synchronous control with virtually generated input commands.

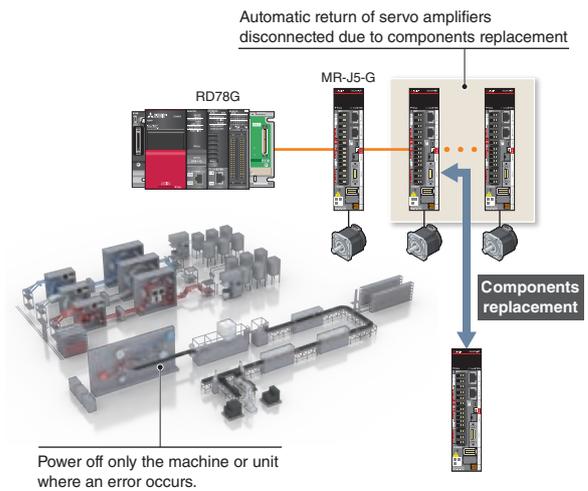
In addition, this function is used to simulate an axis without an actual connection.



Automatic Return

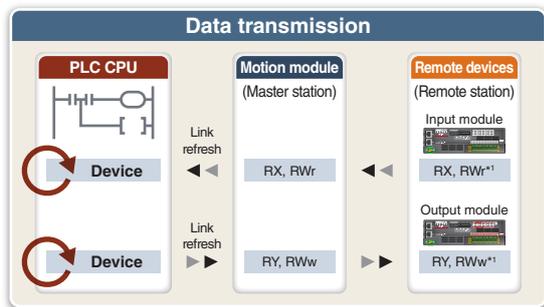
When slave stations are back to normal status after disconnected due to a data link error, this function automatically returns the disconnected stations to the network and restarts data link.

When defective components need to be replaced in one of the machines in a production line or one of the units in a machine, only the machine or the unit can be partly turned off without powering off the whole system.

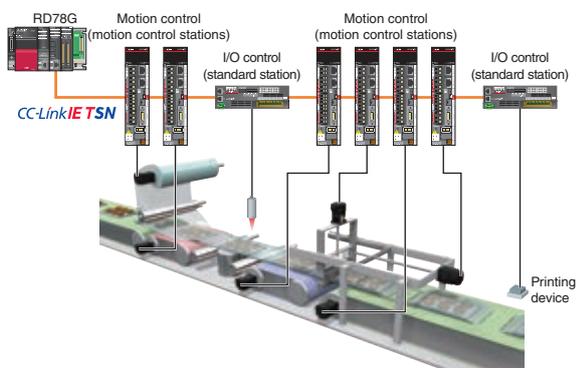


Read/Write Operation of Standard Stations

- The PLC CPU sends/receives link devices to/from standard stations (remote stations other than the motion control stations) through a Motion module.
- One-to-one communication is possible between the master and remote stations.
- The PLC CPU can be programmed using the signals of the remote stations.



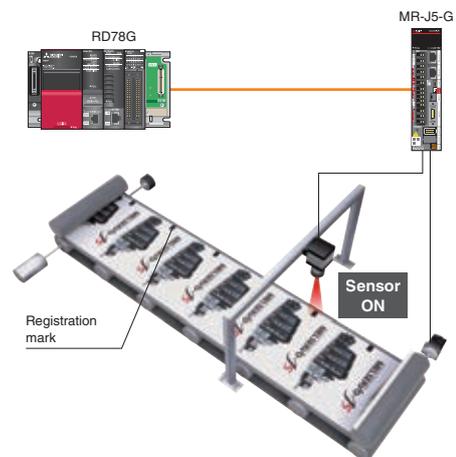
*1. RX and RY are not available for some remote devices.



Mark Detection

This function latches data responding to a trigger signal input to a servo amplifier.

The compensation amount is calculated based on the latched data, and the error is compensated using a compensation axis.



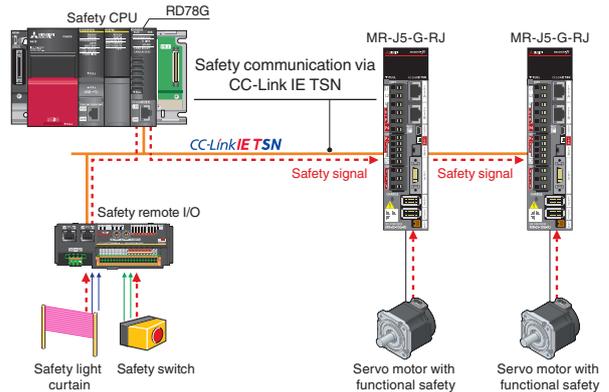
Benefits of Migration to RD78G (Simple Motion Mode)

When migrating to RD78G (Simple Motion mode) from the previous models, the new controller offers improved performance and the ability to connect various devices, such as MELSEC iQ-R series PLC CPUs, the high-performance servo amplifiers, and remote devices via CC-Link IE TSN. The capabilities and improved features of these connected devices can be utilized in the new system.

Servo Amplifier Features

CC-Link IE TSN safety communication function

- RD78G enables safety communication when combined with a safety CPU and MR-J5-G-RJ.
- Wiring the safety signals to the servo amplifiers is not necessary.



Safety sub-functions of servo amplifier

- MR-J5-G-RJ supports safety sub-functions*1, STO/SS1/SS2/SOS/SBC/SLS/SSM/SDI/SLI/SLT.
- The functional safety encoders provide the servo motor positions and speeds necessary for the safety sub-functions at a safety level of Category 4 PL e, SIL 3.

| Servo amplifier | | MR-J5-G-RJ | | | |
|-----------------------------------------------|------------------------------|--------------------------------------------|--------------------|------------------------------------------------------------------------------------------------|--------------------|
| | | Servo motor with functional safety (HK_WS) | | Rotary servo motor (HK series), linear servo motor (LM series), direct drive motor (TM series) | |
| Functional safety category (IEC/EN 61800-5-2) | | Cat. 4 PL e, SIL 3 | Cat. 3 PL d, SIL 2 | Cat. 4 PL e, SIL 3 | Cat. 3 PL d, SIL 2 |
| STO | Safe torque off | ● | – | ● | – |
| SS1-t | Safe stop 1, time controlled | ● | – | ● | – |
| SS1-r *2 | Safe stop 1, ramp monitored | ● | – | – | ● |
| SS2-t *2 | Safe stop 2, time controlled | ● | – | – | – |
| SS2-r *2 | Safe stop 2, ramp monitored | ● | – | – | – |
| SOS *2 | Safe operating stop | ● | – | – | – |
| SBC | Safe brake control | ● | – | ● | – |
| SLS *2 | Safely-limited speed | ● | – | – | ● |
| SSM *2 | Safe speed monitor | ● | – | – | ● |
| SDI *2 | Safe direction | ● | – | – | ● |
| SLI *2 | Safely-limited increment | ● | – | – | – |
| SLT | Safely-limited torque | – | ● | – | ● |

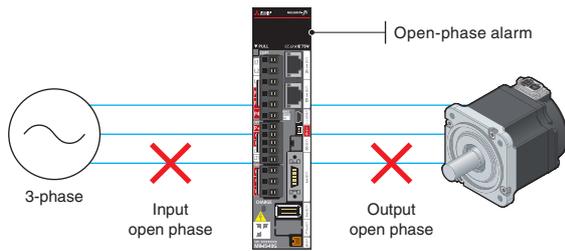
*1. There are some restrictions on the functional safety. Refer to "Safety Sub-Functions" in section 1 of "MELSERVO-J5 catalog (L(NA)03179ENG)" for details.

*2. A fully closed loop system does not support SS1-r, SS2, SOS, SLS, SSM, SDI, and SLI.

Servo Amplifier Features

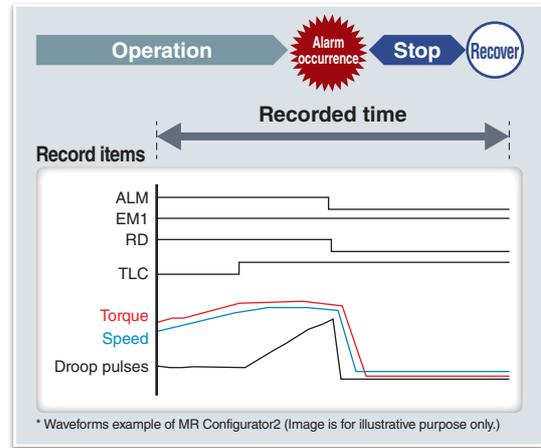
Disconnection detection

The servo amplifiers are equipped with both input open-phase detection and output open-phase detection. Input open-phase detection detects an open phase of the main circuit power supply of the servo amplifier, and output open-phase detection detects an open phase of the servo motor power supply. The alarm can be distinguished from other alarms such as the overload alarm, reducing the time required to restore the system. MR-J5D-G4 drive units support only output open-phase detection.



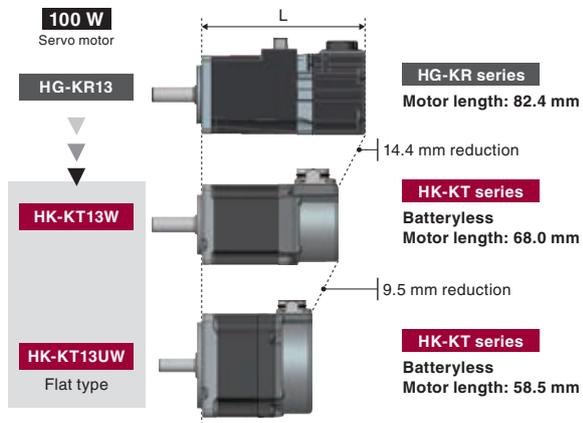
Drive recorder of servo amplifier

The Motion module collects data from the drive recorder of MR-J5-G through TCP/IP communications, which reduces troubleshooting time.



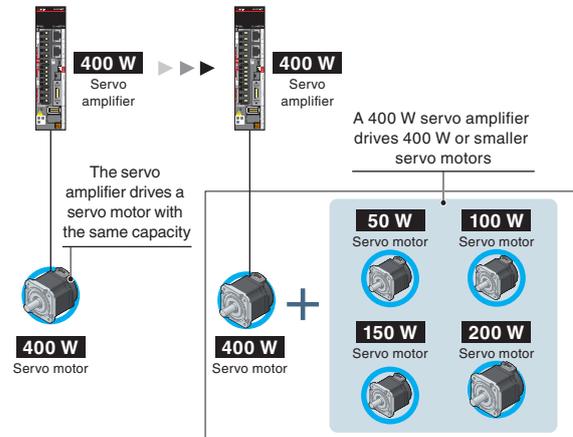
Compact servo motors with a batteryless absolute position encoder

HK-KT series servo motors come equipped with a batteryless absolute position encoder and are more compact than the previous generation HG-KR series. Flat types are also available in the HK-KT product line, contributing to a compact machine design.



Drives smaller capacity servo motors

Servo amplifiers are able to drive servo motors with a smaller capacity than the servo amplifier being used, reducing the kinds of spare parts that are needed.

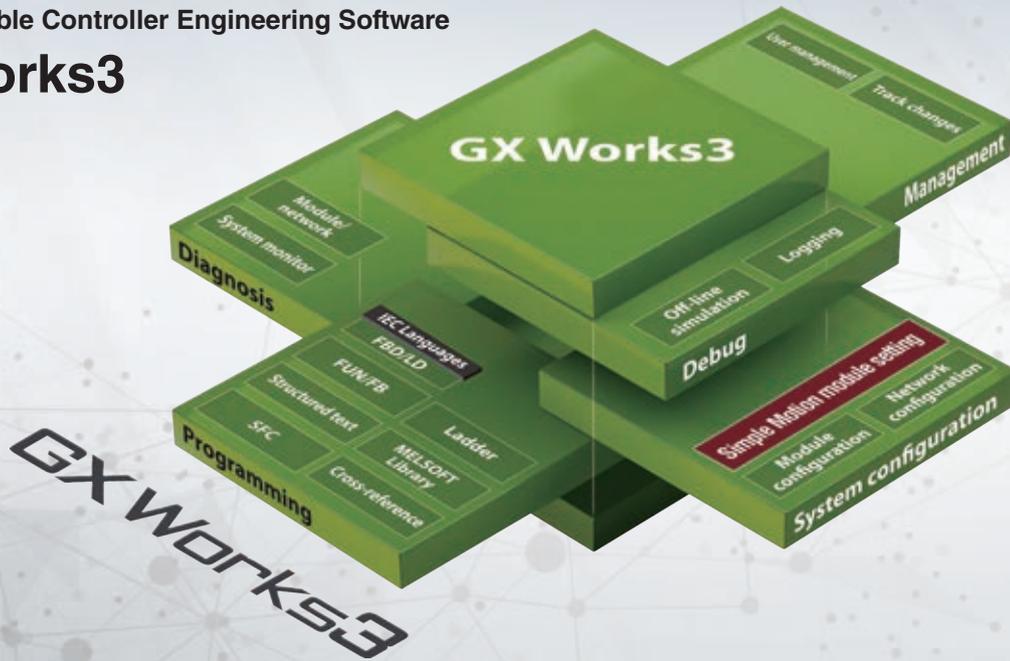


MEMO

One software, many possibilities

Programmable Controller Engineering Software

GX Works3



MELSOFT GX Works3 has a variety of features which help users create projects and conduct maintenance more flexibly and easily. Our variety of engineering software (GX Works3, sizing software, and model selection software, etc.) fully covers all stages of development processes from parameter settings to maintenance of Motion module, servo amplifier, and servo motors.

GX Works3

This software supports overall development processes for PLC CPUs from system design to maintenance.

Servo Setup Software MR Configurator2

Tuning, monitor display, diagnosis, reading/writing parameters, and test operations are easily performed on a personal computer. This powerful software tool supports a stable machine system and optimum control, and moreover, shortens setup time.

Model Selection Software

Servo amplifiers, servo motors, and indispensable options such as encoder cables can all be selected.

Simple Motion Module Setting

This software covers various development processes for the Motion module from parameter settings, debug, to maintenance.

Drive System Sizing Software "Motorizer"

The most suitable servo motors, servo amplifiers, and regenerative options for your machine can be selected just by setting machine specifications and operation patterns.



Engineering Environment

Our variety of engineering software (GX Works3, sizing software, model selection software, etc.) fully covers all stages of development processes from parameter settings to maintenance of Motion modules, servo amplifiers, and servo motors.

System Design

System Design

Module configuration



Network configuration

- Module configuration
- Network configuration
- Data settings for servo amplifiers
- Settings for remote I/O

Programming (Positioning)

Programming

Positioning data setting



Offline simulation

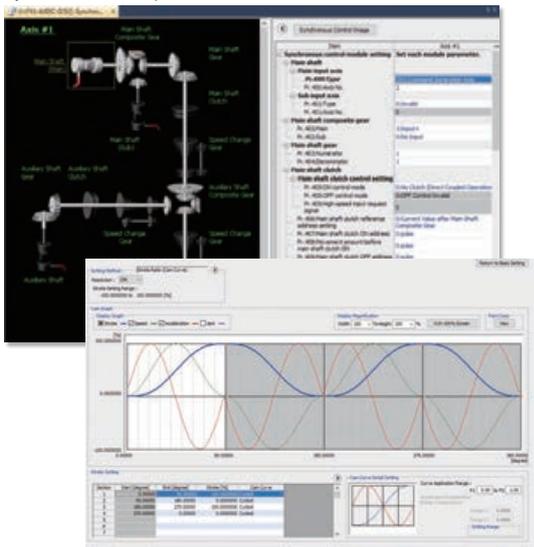
Automatic calculation of command speed

- Programming with Ladder, SFC, FBD/LD
- Positioning data settings
- Offline simulation, automatic calculation of command speed

Programming (Synchronous Control)

Programming

Synchronous control parameter



Cam data creation

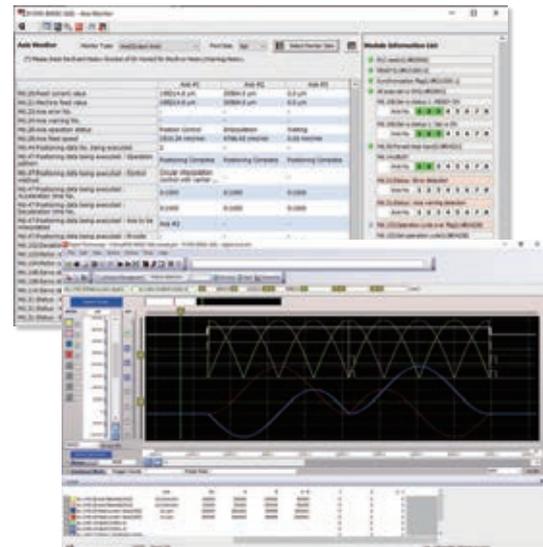
- Synchronous control parameter
- Cam data creation, cam data list

Debug/Maintenance

Debug

Maintenance

Axis monitor



Digital oscilloscope

- Event history
- Current value history, start history, axis monitor
- Servo monitor
- Digital oscilloscope

Motion Module (Simple Motion Mode)

Control specifications

| Item | | Specifications |
|----------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | RD78G |
| Maximum number of control axes | | 4, 8, 16 axes |
| Operation cycle (operation cycle setting) | [μ s] | 250, 500, 1000, 2000, 4000 |
| Interpolation function | | Linear interpolation (up to 4 axes), 2-axis circular interpolation, helical interpolation |
| Control method | | Positioning control, path control (linear, arc, and helical), speed control, speed-torque control, synchronous control, continuous operation to torque control |
| Acceleration/deceleration process | | Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration |
| Compensation function | | Backlash compensation, electronic gear, near pass function |
| Synchronous control | | Synchronous encoder input, command generation axis, cam, phase compensation, cam auto-generation |
| Cam control | Maximum number of cam registrations | 256 (depending on the memory capacity, cam resolution, and number of coordinates) |
| | Cam data | Stroke ratio data format, coordinate data format |
| | Cam auto-generation | Cam auto-generation for rotary knife |
| Positioning control method | | Motion profile table |
| Control unit | | mm, inch, degree, pulse |
| Number of positioning data | | 600 data (positioning data No. 1 to 600)/axis (Can be set with MELSOFT GX Works3 or a sequence program (No. 1 to 600).) |
| Backup | | Parameters, positioning data, and block start data can be saved on flash ROM (batteryless backup) |
| Home position return | | Driver home position return ^(Note 1) |
| Positioning control | | Linear interpolation control (Up to 4 axes ^(Note 2) (vector speed, reference axis speed)), fixed-pitch feed control (up to 4 axes), 2-axis circular interpolation (auxiliary point-specified, central point-specified), helical interpolation control, speed control (up to 4 axes), speed-position switching control (INC mode, ABS mode), position-speed switching control (INC mode), current value change (positioning data, start No. for a current value changing) NOP instruction, JUMP instruction (conditional, unconditional), LOOP, LEND, high-level positioning control (block start, condition start, wait start, simultaneous start, repeated start) |
| Manual control | | JOG operation, inching operation, manual pulse generator operation (up to 1 module (incremental), unit magnification (1 to 10000 times), via a CPU (buffer memory)) |
| Speed-torque control | | Speed control not including position loop, torque control, continuous operation to torque control |
| Absolute position system | | Provided |
| Synchronous encoder operation function | | Up to the number of axes of the connected servo amplifiers (via a CPU or a servo amplifier) |
| Speed limit | | Speed limit value, JOG speed limit value |
| Torque limit function | | Torque limit value same setting, torque limit value individual setting |
| Forced stop | | Via buffer memory, valid/invalid setting |
| Software stroke limit function | | Movable range check with feed current value or with machine feed value |
| Hardware stroke limit function | | Provided |
| Speed change | | Provided |
| Override | [%] | 0 to 300 |
| Acceleration/deceleration time change | | Provided |
| Torque limit change | | Provided |
| Target position change | | Speed to a target position address and a target position is changeable. |
| M-code output function | | WITH mode/AFTER mode |
| Other functions | Step function | Deceleration unit step, data No. unit step |
| | Skip function | Via a CPU or an external command signal |
| Parameter initialization function | | Provided |
| External input signal select function | | Via a CPU or a servo amplifier |
| Mark detection function | | Continuous detection mode, specified number of detections mode, ring buffer mode |
| | Mark detection signal | Up to the number of axes of the connected servo amplifiers |
| | Mark detection setting | 16 settings |
| Optional data monitor function | | Up to 4 points/axis |
| Automatic return | | Provided |
| Digital oscilloscope function | | Bit data: 16 channels, word data: 16 channels ^(Note 3) |

- Notes: 1. The home position return method set in a driver (servo amplifier) is used.
2. 4-axis linear interpolation control is enabled only at the reference axis speed.
3. Eight channels of each word data and bit data can be displayed in real time.

Simple Motion module specifications (RD77MS/QD77MS)

: Items that differ from RD78G

| Item | Specifications | | |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| | RD77MS | QD77MS | |
| Maximum number of control axes | 2, 4, 8, 16 axes | 2, 4, 16 axes (QD77MS2 and QD77MS4 use the buffer memory assignment for 4 axes) | |
| Operation cycle (operation cycle setting) [μs] | 444, 888, 1777, 3555 | 888, 1777 | |
| Interpolation function | Linear interpolation (up to 4 axes), 2-axis circular interpolation, helical interpolation | Linear interpolation (up to 4 axes), 2-axis circular interpolation | |
| Control method | Positioning control, path control (linear, arc, and helical), speed control, speed-torque control, synchronous control, continuous operation to torque control | | |
| Acceleration/deceleration process | Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration | | |
| Compensation function | Backlash compensation, electronic gear, near pass function | | |
| Synchronous control | Synchronous encoder input, cam, phase compensation, cam auto-generation | Synchronous encoder input, command generation axis, cam, phase compensation, cam auto-generation | |
| Cam control | Maximum number of cam registrations | 256 (depending on the memory capacity, cam resolution, and number of coordinates) | |
| | Cam data | Stroke ratio data format, coordinate data format | |
| | Cam auto-generation | Cam auto-generation for rotary knife | |
| Positioning control method | Motion profile table | | |
| Control unit | mm, inch, degree, pulse | | |
| Number of positioning data | 600 data (positioning data No. 1 to 600)/axis (Can be set with MELSOFT GX Works3 or a sequence program (No. 1 to 100)) | 600 data (positioning data No. 1 to 600)/axis (Can be set with MELSOFT GX Works2 or a sequence program (QD77MS16 (No. 1 to 100), QD77MS2/QD77MS4 (No. 1 to 600))) | |
| Backup | Parameters, positioning data, and block start data can be saved on flash ROM (batteryless backup) | | |
| Home position return | Proximity dog method, count method 1, count method 2, data set method, scale home position signal detection method, driver home position return ^(Note 1) | Proximity dog method, count method 1, count method 2, data set method, scale home position signal detection method | |
| Positioning control | Linear interpolation control (Up to 4 axes ^(Note 2) (vector speed, reference axis speed)), fixed-pitch feed control (up to 4 axes), 2-axis circular interpolation (auxiliary point-specified, central point-specified), helical interpolation control, speed control (up to 4 axes), speed-position switching control (INC mode, ABS mode), position-speed switching control (INC mode), current value change (positioning data, start No. for a current value changing) NOP instruction, JUMP instruction (conditional, unconditional), LOOP, LEND, high-level positioning control (block start, condition start, wait start, simultaneous start, repeated start) | | |
| Manual control | JOG operation, inching operation, manual pulse generator operation (up to 1 module (incremental), unit magnification (1 to 10000 times), via an internal interface) | | |
| Speed-torque control | Speed control not including position loop, torque control, continuous operation to torque control | | |
| Absolute position system | Supported when a battery is mounted on a servo amplifier | | |
| Synchronous encoder operation function | Up to 4 channels Via an internal interface, a CPU (buffer memory), or a servo amplifier | | |
| Speed limit | Speed limit value, JOG speed limit value | | |
| Torque limit function | Torque limit value same setting, torque limit value individual setting | | |
| Forced stop | Via an internal interface or a buffer memory, valid/invalid setting | | |
| Software stroke limit function | Movable range check with feed current value or with machine feed value | | |
| Hardware stroke limit function | Provided | | |
| Speed change | Provided | | |
| Override [%] | 0 to 300 | 1 to 300 | |
| Acceleration/deceleration time change | Provided | | |
| Torque limit change | Provided | | |
| Target position change | Speed to a target position address and a target position is changeable. | | |
| M-code output function | WITH mode/AFTER mode | | |
| Other functions | Step function | Deceleration unit step, data No. unit step | |
| | Skip function | Via a CPU or an external command signal | |
| Parameter initialization function | Provided | | |
| External input signal select function | Via an internal interface, a CPU (buffer memory), or a servo amplifier | | |
| Mark detection function | Continuous detection mode, specified number of detections mode, ring buffer mode | | |
| | Mark detection signal | 20 | 4 (2 points for QD77MS2) |
| | Mark detection setting | 16 | 16 (4 settings for QD77MS4/QD77MS2) |
| Optional data monitor function | Up to 4 points/axis | | |
| Automatic return | Connect/disconnect function of SSCNET communication | | |
| Digital oscilloscope function | Bit data: 16 channels, word data: 16 channels ^(Note 3) | Bit data: 16 channels, word data: 16 channels ^(Note 3) (For QD77MS4, QD77MS2, Bit data: 8 channels, word data: 4 channels) | |

Notes: 1. The home position return method set in a driver (servo amplifier) is used.
2. 4-axis linear interpolation control is enabled only at the reference axis speed.
3. Eight channels of each word data and bit data can be displayed in real time.

Synchronous Control Specifications

Synchronous control

| Item | Number of settable axes | | |
|-----------------------------------------------------|-------------------------|--------|---------|
| | RD78G4 | RD78G8 | RD78G16 |
| Servo input axis [axes/module] | 4 | 8 | 16 |
| Synchronous encoder input axis [axes/module] | 4 | 8 | 16 |
| Command generation axis [axes/module] | 4 | 8 | 16 |
| Composite main shaft gear [module/output axis] | | 1 | |
| Main shaft main input axis [module/output axis] | | 1 | |
| Main shaft sub input axis [module/output axis] | | 1 | |
| Main shaft gear [module/output axis] | | 1 | |
| Main shaft clutch [module/output axis] | | 1 | |
| Auxiliary shaft [module/output axis] | | 1 | |
| Auxiliary shaft gear [module/output axis] | | 1 | |
| Auxiliary shaft clutch [module/output axis] | | 1 | |
| Auxiliary shaft composite gear [module/output axis] | | 1 | |
| Speed change gear [module/output axis] | | 1 | |
| Output axis (cam axis) [axes/module] | 4 | 8 | 16 |

Cam control

| Item | | Specifications | | | | | | | | | | | |
|---------------------------------|------------------------|---------------------------------------|----------------------------------------------------------------------|--------|-----|------|------|---------|------|-------|-------|-------|-------|
| | | RD78G4 | | RD78G8 | | | | RD78G16 | | | | | |
| Memory capacity | Cam storage area | 256k bytes | | | | | | | | | | | |
| | Cam working area | 1M bytes | | | | | | | | | | | |
| Maximum number of registrations | | 256 | | | | | | | | | | | |
| Comment | | Up to 32 characters for each cam data | | | | | | | | | | | |
| Cam data | Stroke ratio data type | Maximum number of cam registrations | Cam resolution | 256 | 512 | 1024 | 2048 | 4096 | 8192 | 16384 | 32768 | | |
| | | | RD78G | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | | |
| | Coordinate data type | Maximum number of cam registrations | Cam resolution | 128 | 256 | 512 | 1024 | 2048 | 4096 | 8192 | 16384 | 32768 | 65535 |
| | | | RD78G | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | - | - |
| | | Coordinate data | Input value: 0 to 2147483647 Output value: -2147483648 to 2147483647 | | | | | | | | | | |
| Cam auto-generation | | Cam for rotary knife | | | | | | | | | | | |

■Products on the Market

Manual Pulse Generator

Mitsubishi Electric has confirmed the operation of the following manual pulse generator. Contact the manufacturer for details.

| Product name | Model | Description | Manufacturer |
|--------------------------------------------|------------|------------------------------------------------------------------------------------------|-----------------------------|
| Manual pulse generator ^(Note 1) | RE46A2CO2B | Number of pulses per revolution: 25 pulses/rev (100 pulses/rev after magnification by 4) | Tokyo Sokuteikizai Co.,Ltd. |

Notes: 1. Connect the manual pulse generator to a CPU module or a high-speed pulse input/output module. Refer to user's manuals and each product manual for details.

Motion Module

CC-Link IE TSN

| | |
|-----------------------------------------------------------|----------------------------------------------------------------------------|
| Item | Motion module |
| | Simple Motion mode |
| | RD78G |
| Communications speed | [bps] 1 G/100 M ^(Note 1) |
| Maximum number of connectable stations per network | 121 stations (including the master station) |
| Connection cable | Ethernet cable (category 5e or higher, double shielded/STP) straight cable |
| Maximum distance between stations | [m] 100 |
| Maximum number of networks | 239 |
| Topology ^(Note 2) | Line, star, line/star mixed topologies |
| Communications method | Time-sharing method |
| Maximum transient transmission capacity | 1920 bytes |
| Maximum link points per network | |
| RX/RX | 16K points |
| RWr/RWw | 8K points |
| Maximum link points per station | |
| RX/RX | 16K points |
| RWr/RWw | 8K points |
| Safety communications | |
| Maximum number of safety connectable stations per network | 1814 connections |
| Maximum number of safety connections per station | 120 connections |
| Maximum number of link points per safety connection | 8 words (input: 8 words, output: 8 words) |

Notes: 1. A 1 Gbps device and a 100 Mbps device cannot be used on the same network.
2. Use a switching hub (certified class: B) for star topology.

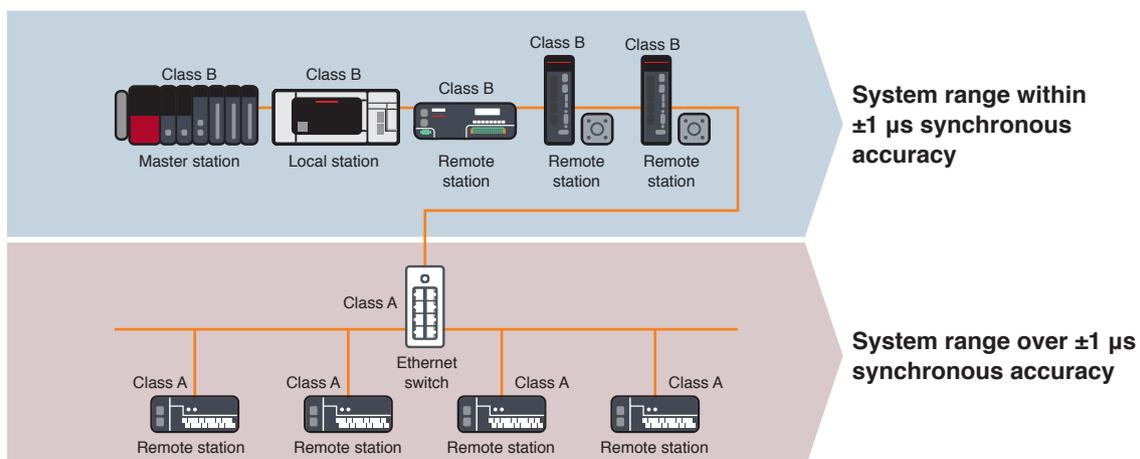
[Note when connecting devices]

Connect class A remote stations after class B remote stations.

Certified Class

CC-Link IE TSN certifies nodes and switches to a specific class level according to its functionality and performance classification. Products can be classified as either class A or B. For the certified classification of each product, please check the CC-Link partner association website or the relevant product catalog or manual. Supported functions and system configuration may differ according to the certified class of products used. For example, products compatible with certified class B are necessary to configure a high-speed motion control system. For details of configuring systems with both class A and class B devices, please refer to relevant master product manual.

System configuration



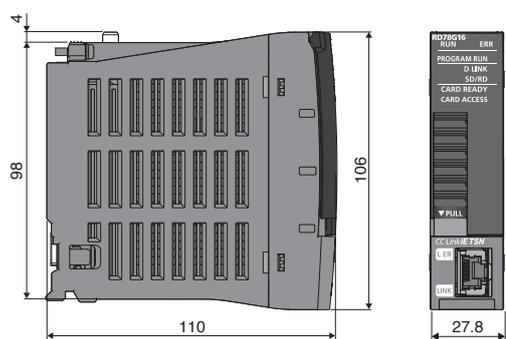
- Synchronous accuracy of a system varies relative to the combination of connected devices and switches certification class
- Use class B Ethernet switch when configuring a star topology with class B devices
- Use class B devices when configuring a system within ±1 μs high-accuracy synchronization, connect class A devices to a separate branch line from class B devices (for details of system configuration, please refer to relevant master product manual)

Motion module

Module specifications RD78G

| Item | RD78G |
|-----------------------------------------|------------------------------------------------------|
| Maximum number of control axes | RD78G4: 4 axes RD78G8: 8 axes RD78G16: 16 axes |
| Maximum number of connectable stations | 121 stations (including the master station) |
| Servo amplifier connection method | CC-Link IE TSN |
| CC-Link IE TSN certified class | B |
| Maximum distance between stations [m] | 100 |
| PERIPHERAL I/F | Via CPU module (USB, Ethernet) |
| Extended memory | SD memory card |
| Number of ports for CC-Link IE TSN | 1 port |
| Number of I/O points occupied | 32 points |
| Number of slots occupied | 1 slot |
| 5 V DC internal current consumption [A] | 1.93 |
| Mass [kg] | 0.26 |
| Dimensions [mm] | 106.0 (H) × 27.8 (W) × 110.0 (D) |

Dimensions RD78G4/RD78G8/RD78G16



[Unit: mm]

Engineering Software

MELSOFT GX Works3 operating environment ^(Note 1)

| Item | Description |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OS | Microsoft® Windows® 10 (Home, Pro, Enterprise, Education, IoT Enterprise 2016 LTSB ^(Note 2)) (64 bit/32 bit) Microsoft® Windows® 8.1 (64 bit/32 bit), Microsoft® Windows® 8.1 (Enterprise, Pro) (64 bit/32 bit) Microsoft® Windows® 7 (Enterprise, Ultimate, Professional, Home Premium) (64 bit/32 bit) |
| Personal computer | Windows® supported personal computer |
| CPU | Intel® Core™2 Duo Processor 2 GHz or more recommended |
| Required memory | For 64-bit edition: 2 GB or more recommended For 32-bit edition: 1 GB or more recommended |
| Free hard disk space | For installation: 17 GB or more free hard disk capacity For operation: 512 MB or more free virtual memory capacity |
| Optical drive | DVD-ROM supported disk drive |
| Monitor | Resolution 1024 × 768 pixels or higher |

Notes: 1. Refer to Installation Instructions for precautions and restrictions regarding the operating environment.
2. The 32-bit edition is not supported.

Engineering software list

| Item | Model | Description | |
|-------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| MELSOFT GX Works3 | SW1DND-GXW3-E | •Programmable Controller Engineering Software [MELSOFT GX Works3 ^(Note 1, 2) , GX Works2, GX Developer, PX Developer] •MITSUBISHI ELECTRIC FA Library | DVD-ROM |
| MELSOFT iQ Works | SW2DND-IQWK-E | FA engineering software ^(Note 3) • System Management Software [MELSOFT Navigator] • Programmable Controller Engineering Software [MELSOFT GX Works3 ^(Note 1, 2) , GX Works2, GX Developer, PX Developer] • Motion Controller Engineering Software [MELSOFT MT Works2] • Screen Design Software [MELSOFT GT Works3] • Robot Programming Software [MELSOFT RT ToolBox3 ^(Note 4)] • Inverter Setup Software [MELSOFT FR Configurator2] • MITSUBISHI ELECTRIC FA Library | DVD-ROM |

Notes: 1. MELSOFT GX Works3 with version 1.075D or later and MR Configurator2 with version 1.100E or later are required.
2. The MELSOFT GX Works3 menu is switchable between Japanese, English, and simplified Chinese.
3. Refer to each product manual for the software supported by the model.
4. RT ToolBox3 mini (simplified version) will be installed if iQ Works product ID is used. When RT ToolBox3 (with simulation function) is required, please purchase RT ToolBox3 product ID.

● Servo system controller

| Item | Model | Application | Standard |
|-----------------------------------|---------|-----------------------------------------------------------------------|------------|
| Motion module ^(Note 1) | RD78G4 | Maximum number of control axes: 4 axes CC-Link IE TSN master station | CE, UL, KC |
| | RD78G8 | Maximum number of control axes: 8 axes CC-Link IE TSN master station | CE, UL, KC |
| | RD78G16 | Maximum number of control axes: 16 axes CC-Link IE TSN master station | CE, UL, KC |

Notes: 1. The Simple Motion mode is supported by RD78G with firmware version 16 or later.
To obtain the firmware update files, contact your local sales office.

● Engineering software

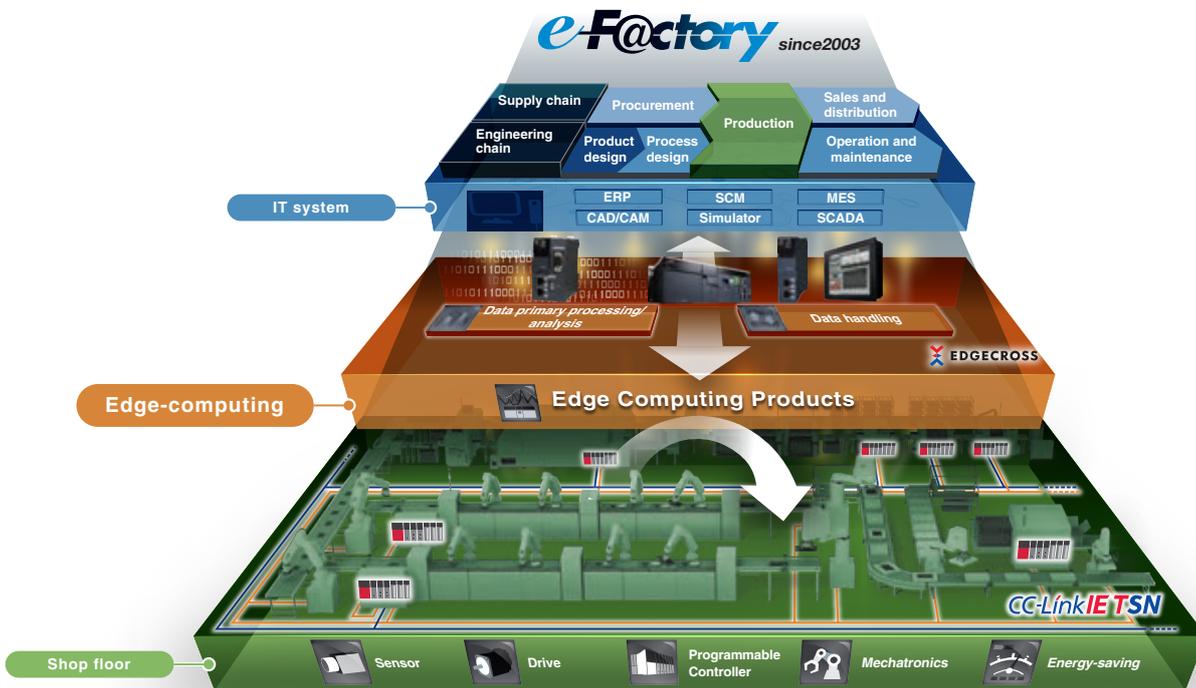
| Item | Model | Application |
|-------------------|---------------|----------------------------------------------|
| MELSOFT iQ Works | SW2DND-IQWK-E | FA Engineering Software |
| MELSOFT GX Works3 | SW1DND-GXW3-E | Programmable Controller Engineering Software |

Mitsubishi Electric Solutions

e-F@ctory

Maximize productivity and reduce costs with an intelligent smart factory solution

Intelligent smart factories utilize high-speed networks with large data bandwidths to meet current manufacturing needs. The combination of CC-Link IE TSN and Mitsubishi Electric's e-F@ctory solution ensures robust integration between IT and factory automation systems, providing an intelligent smart factory solution that reduces total cost while improving operations, production yield, and efficient management of the supply chain. e-F@ctory is the Mitsubishi Electric solution for adding value across the manufacturing enterprise by enhancing productivity, thereby simultaneously reducing maintenance and operating costs, and enabling the seamless flow of information throughout the plant. e-F@ctory uses a combination of factory automation and IT technologies in combination with various best-in-class partner products through its alliance program.



e-F@ctory

CC-Link IE TSN

- IT integration
- Open technology

- High speed, Time synchronization
- Network integration

MELSEC iQ-R series

MELSEC iQ-F series

MITSUBISHI ELECTRIC SYNO SYSTEM MELSERVO-J5

FREQROL-A800/E800

GOT2000

MELFA FR SERIES

MITSUBISHIELECTRIC CNC C80



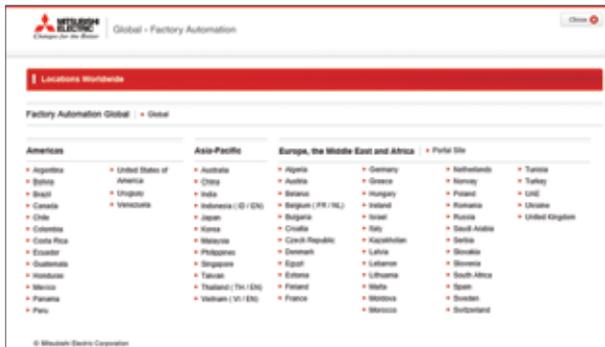
Mitsubishi Electric FA Global Website

Mitsubishi Electric Factory Automation provides a mix of services to support its customers worldwide, through a consolidated global website. It offers a selection of support tools and a window to its local Mitsubishi Electric sales and support network.

Global & Local Websites

Mitsubishi Electric Factory Automation
Global website
www.MitsubishiElectric.com/fa

 Worldwide



Local websites



Global website

e-Manual Viewer

The e-Manual viewer is a next-generation digital manual offered by Mitsubishi Electric that consolidates factory automation products manuals into an easy-to-use package with various useful features integrated into the viewer. The e-Manual allows multiple manuals to be cross-searched at once, further reducing time for setting up products and troubleshooting.



Key features included

- One-stop database containing all required manuals, with local file cache
- Included with GX Works3 engineering software
- Also available in tablet version
- Easily download manuals all at once
- Multiple users can share the latest manuals and knowhow with document sharing function
- Directly port sample programs within manuals to GX Works3
- Downloaded manuals are usable offline

Windows®



iOS



Android™



Servo system controller

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]

For terms of warranty, please contact your original place of purchase.

[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, fan, smoothing 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 and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

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

4. Exclusion of loss in opportunity and secondary loss from warranty liability

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

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

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

6. Application and use of the Product

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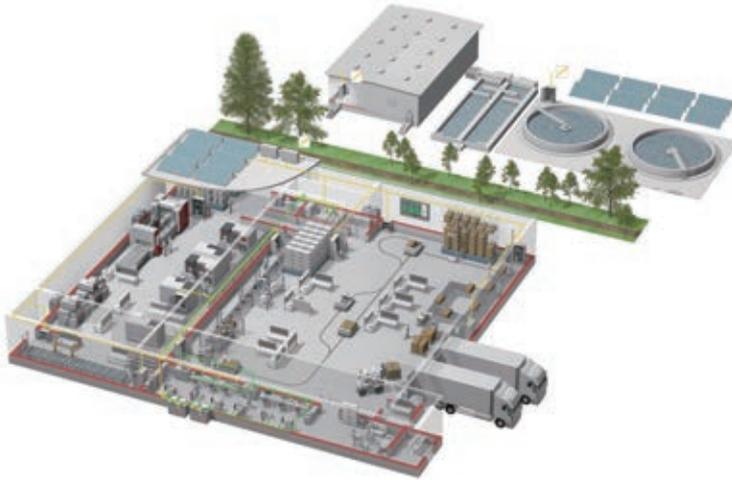
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MEMO

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

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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, established in 1921, 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 183 factories, laboratories and offices worldwide in over 140 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 146,000 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



Numerical Control (NC)



Industrial / Collaborative Robots



Processing machines: EDM, Lasers, IDS



Transformers, Air conditioning, Photovoltaic systems

* Not all products are available in all countries.

Mitsubishi Electric AC Servo System MELSEC iQ-R series Motion Module

Simple Motion Mode

| Country/Region | Sales office | |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| USA | Mitsubishi Electric Automation, Inc. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A. | Tel : +1-847-478-2100 |
| Mexico | Mitsubishi Electric Automation, Inc. Mexico Branch Boulevard Miguel de Cervantes Saavedra 301, Torre Norte Piso 5, Ampliacion Granada, Miguel Hidalgo, Ciudad de Mexico, Mexico, C.P.11520 | Tel : +52-55-3067-7512 |
| Brazil | Mitsubishi Electric do Brasil Comercio e Servicos Ltda. Avenida Adelino Cardana, 293, 21 andar, Bethaville, Barueri SP, Brazil | Tel : +55-11-4689-3000 |
| Germany | Mitsubishi Electric Europe B.V. German Branch Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany | Tel : +49-2102-486-0 |
| UK | Mitsubishi Electric Europe B.V. UK Branch Travellers Lane, UK-Hatfield, Hertfordshire, AL10 8XB, U.K. | Tel : +44-1707-28-8780 |
| Italy | Mitsubishi Electric Europe B.V. Italian Branch Centro Direzionale Colleoni - Palazzo Sirio, Viale Colleoni 7, 20864 Agrate Brianza (MB), Italy | Tel : +39-039-60531 |
| Spain | Mitsubishi Electric Europe B.V. Spanish Branch Carretera de Rubi, 76-80-Appdo. 420, E-08174 Sant Cugat del Valles (Barcelona), Spain | Tel : +34-935-65-3131 |
| France | Mitsubishi Electric Europe B.V. French Branch 25, Boulevard des Bouvets, 92741 Nanterre Cedex, France | Tel : +33-1-55-68-55-68 |
| Czech Republic | Mitsubishi Electric Europe B.V. Czech Branch, Prague Office Pekarska 621/7, 155 00 Praha 5, Czech Republic | Tel : +420-255-719-200 |
| Poland | Mitsubishi Electric Europe B.V. Polish Branch ul. Krakowska 48, 32-083 Balice, Poland | Tel : +48-12-347-65-00 |
| Russia | Mitsubishi Electric (Russia) LLC St. Petersburg Branch Startovaya street, 8, BC "Aeroplaza", office 607; 196210, St. Petersburg, Russia | Tel : +7-812-449-51-34 |
| Sweden | Mitsubishi Electric Europe B.V. (Scandinavia) Hedvig Mollersgata 6, 223 55 Lund, Sweden | Tel : +46-8-625-10-00 |
| Turkey | Mitsubishi Electric Turkey A.S. Umraniye Branch Serifali Mah. Kale Sok. No:41 34775 Umraniye - Istanbul, Turkey | Tel : +90-216-969-2500 |
| UAE | Mitsubishi Electric Europe B.V. Dubai Branch Dubai Silicon Oasis, P.O.BOX 341241, Dubai, U.A.E. | Tel : +971-4-3724716 |
| South Africa | Adroit Technologies 20 Waterford Office Park, 189 Witkoppen Road, Fourways, South Africa | Tel : +27-11-658-8100 |
| China | Mitsubishi Electric Automation (China) Ltd. Mitsubishi Electric Automation Center, No.1386 Hongqiao Road, Shanghai, China | Tel : +86-21-2322-3030 |
| Taiwan | SETSUYO ENTERPRISE CO., LTD. 6F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan | Tel : +886-2-2299-2499 |
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