Total system performance, not individual component specifications leads to maximum performance.
Our Factory Automation business is focused on "Automating the World" to make it a better, more sustainable environment supporting manufacturing and society, celebrating diversity and contributing towards an active and fulfilling role.

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.
OVERVIEW

- Concept 3
- Solutions 25
- Overview of Servo System Controllers 31

- Simple Motion Modules 35
  - Features 40
  - Specifications 57

- Motion Controllers 67
  - Features 70
  - Specifications 85

- Sensing Modules 93

- Engineering Environment 101

- Networks 107

- Servo Amplifiers MELSERVO-J4 111
  - e-F@ctory 115
  - CC-Link Partner Association (CLPA) 116
  - Mitsubishi Electric Servo System Partners 117
  - Global FA Centers 118
  - Conformity with Global Standards and Regulations 119
  - Warranty 120
Revolutionary, next-generation servo system controllers building a new era in automation

As the core for next-generation automation environment, realizing an automation controller with added value while reducing TCO*

To succeed in highly competitive markets, it’s important to build automation systems that ensure high productivity and consistent product quality. The MELSEC iQ-R Series has been developed from the ground up based on common problems faced by customers and rationalizing them into seven key areas: Productivity, Engineering, Maintenance, Quality, Connectivity, Security and Compatibility. Mitsubishi Electric is taking a three-point approach to solving these problems: **Reducing TCO**, increasing **Reliability** and **Reuse** of existing assets.

As a bridge to the next generation in automation, the MELSEC iQ-R Series is a driving force behind revolutionary progress in the future of manufacturing.

**Productivity**
- Improve productivity through advanced performance/functionality
  - New high-speed system bus realizing shorter production cycle
  - Super-high-accuracy motion control utilizing advanced multiple CPU features
  - Advanced servo amplifiers and motors offering industry leading level of performance

**Maintenance**
- Reduce maintenance costs and downtime utilizing easier maintenance features
  - Visualize entire plant data in real-time, contributing to preventative maintenance
  - Reduce downtime and easily locate error causes

**Engineering**
- Reducing development costs through intuitive engineering
  - Intuitive engineering environment covering the product development cycle
  - Simple point-and-click programming architecture
  - Easy debugging, from controllers to servo amplifiers

**Quality**
- Reliable and trusted MELSEC product quality
  - Robust design ideal for harsh industrial environments
  - Improve and maintain actual manufacturing quality
  - Conforms to main international standards

*TCO: Total cost of ownership*
Security

- Robust security that can be relied on
  - Protect intellectual property
  - Unauthorized access protection across distributed control network

Connectivity

- Seamless network reduces system costs
  - Seamless connectivity within all levels of manufacturing
  - Optical network “SSCNET III/H” providing high response and high reliability
  - “CC-Link IE Field Network” - Integration of IA components on ONE single network

Compatibility

- Extensive compatibility with existing products
  - High compatibility with existing servo system controllers
  - Utilize existing assets while taking advantage of cutting-edge technology
Faster Startup with Intuitive Operation

Programming efficiency matters when it comes to productivity. The MELSEC iQ-R series optimizes all procedures, from designing, debugging, to startup.

Speed Up

Equipped with advanced dual engines that are only possible with our cutting-edge iQ platform technology, the MELSEC iQ-R series takes a step further to accelerate the equipment revolution by collaborating with our partner companies. Now, a wide variety of SSCNET III/H compatible partner products are available, such as stepping motors and direct drive motors.

Ground-breaking Machine Innovation

High-speed system bus
Data exchange cycle with PLC CPU

SSCNET III/H communication speed
150Mbps

Speed frequency response of servo amplifier
2.5kHz

The MELSERVO-J4 series servo amplifier is an environmentally and user friendly product, while offering industry-leading level of performance. Connecting the amplifiers to "SSCNET III/H" optical network enables high-speed and high-accuracy control with the MR-J4 dedicated engine and high-resolution encoder.

Advanced Servo Amplifier Maximizes Drive Performance

Power Up

(Compared to previous model)

*1 Simple Motion module
*2 Motion controller

The MELSEC iQ-R series is provided with sophisticated dual engines: the PLC CPU engine for machine control and the Motion CPU engine for Motion control. The engines respectively process different types of control based on the characteristic of each engine while working together on data through a high-speed system bus. CPU loads are significantly distributed by these dual engines compared with a single engine, enabling any equipment to maximize its performance, even for a load change machine or multi-axis equipment.

Select the most suitable combination of CPU engines that can reduce cost and maximize machine performance to the fullest from our extensive product line. Efficiency in designing and debugging is also improved.

Dual Engines Revolutionize Machine Capability

Change Up

High-speed system bus
Approx. 40 × faster
Data exchange cycle with PLC CPU
Approx. 4 × faster
0.222ms

CPU buffer memory (fixed-cycle)
Approx. 1.7 × larger
24k words

Operation cycle
Approx. 1.5 × faster*2
6 axes/0.222ms

Device memory
Approx. 3 × larger
128k words

Cam working area
Approx. 16 × larger
16M bytes

Cam registration data
Approx. 4 × more
1024 cam data

Create machine systems with higher production and total overall performance that surpass your wildest imaginations with Mitsubishi Electric Servo System Controllers. With the iQ Platform at the center, higher FA performance is achieved through dual driving engines, improved Servo Amplifier and Network performance, and flexible cooperation of partner organizations.

Total system performance, not individual
Create machine systems with higher production and total overall performance that surpass your wildest imaginations with Mitsubishi Electric Servo System Controllers. With the iQ Platform at the center, higher FA performance is achieved through dual driving engines, improved Servo Amplifier and Network performance, and flexible cooperation of partner organizations.

Performance Maximization

Speed Up
Faster Startup with Intuitive Operation
Programming efficiency matters when it comes to productivity. The MELSEC iQ-R series optimizes all procedures, from designing, debugging, to startup.

Change Up
Dual Engines Revolutionize Machine Capability
The MELSEC iQ-R series is provided with sophisticated dual engines: the PLC CPU engine for machine control and the Motion CPU engine for Motion control. The engines respectively process different types of control based on the characteristic of each engine while working together on data through a high-speed system bus. CPU loads are significantly distributed by these dual engines compared with a single engine, enabling any equipment to maximize its performance, even for a load change machine or multi-axis equipment.

Select the most suitable combination of CPU engines that can reduce cost and maximize machine performance to the fullest from our extensive product line. Efficiency in designing and debugging is also improved.
Performance Maximization for Productivity.

Faster Startup with Intuitive Operation

Programming efficiency matters when it comes to productivity. The MELSEC iQ-R series optimizes all procedures, from designing, debugging, to startup.

Speed Up

Equipped with advanced dual engines that are only possible with our cutting-edge iQ platform technology, the MELSEC iQ-R series takes a step further to accelerate the equipment revolution by collaborating with our partner companies. Now, a wide variety of SSCNET III/H compatible partner products are available, such as stepping motors and direct drive motors.

Ground-breaking Machine Innovation

The MELSERVO-J4 series servo amplifier is an environmentally and user-friendly product, while offering industry-leading level of performance. Connecting the amplifiers to “SSCNET III/H” optical network enables high-speed and high-accuracy control with the MR-J4 dedicated engine and high-resolution encoder.

Advanced Servo Amplifier Maximizes Drive Performance

The MELSERVO-J4 series servo amplifier is an environmentally and user-friendly product, while offering industry-leading level of performance. Connecting the amplifiers to “SSCNET III/H” optical network enables high-speed and high-accuracy control with the MR-J4 dedicated engine and high-resolution encoder.

Power Up

The MELSEC iQ-R series is provided with sophisticated dual engines: the PLC CPU engine for machine control and the Motion CPU engine for Motion control. The engines respectively process different types of control based on the characteristic of each engine while working together on data through a high-speed system bus. CPU loads are significantly distributed by these dual engines compared with a single engine, enabling any equipment to maximize its performance, even for a load change machine or multi-axis equipment.

Select the most suitable combination of CPU engines that can reduce cost and maximize machine performance to the fullest from our extensive product line. Efficiency in designing and debugging is also improved.

Dual Engines Revolutionize Machine Capability

High-speed system bus

Data exchange cycle with PLC CPU

Approx. 40 x faster

0.222ms

CPU buffer memory (fixed-cycle)

Approx. 1.7 x larger

24k words

Operation cycle

Approx. 1.5 x faster*2

6 axes/0.222ms

Device memory

Approx. 3 x larger

128k words

Cam working area

Approx. 16 x larger

16M bytes

Cam registration data

Approx. 4 x more

1024 cam data

Create machine systems with higher production and total overall performance that surpass your wildest imaginations with Mitsubishi Electric Servo System Controllers. With the iQ Platform at the center, higher FA performance is achieved through dual driving engines, improved Servo Amplifier and Network performance, and flexible cooperation of partner organizations.

Gather Up

Ground-breaking Machine Innovation

Equipped with advanced dual engines that are only possible with our cutting-edge iQ platform technology, the MELSEC iQ-R series takes a step further to accelerate the equipment revolution by collaborating with our partner companies. Now, a wide variety of SSCNET III/H compatible partner products are available, such as stepping motors and direct drive motors.

CC-Link Partner Association (CLPA) was established to promote the worldwide adoption of the CC-Link open field network and to strongly support creation of FA integrated network system.
This software supports a whole product development cycle - from development, startup, debugging through maintenance for sequence programs, Simple Motion module parameters, and positioning/cam data.

All-Inclusive Software, from Sequence Program Creation to Simple Motion Module Setting

The graphical screen allows you to design a Motion system easily. Also, you can configure servo amplifier and module settings easily on the system setting screen, and check them at a glance.

1. Intuitive Operation
The items and axes needed to be displayed can be selected from various monitoring information. Servo adjustment and setup, data collection and waveform display that are synchronized to the Motion operation cycle are also available.

2. Synchronous control without complex programming
Synchronous control can be easily performed just by setting parameters, using software instead of controlling mechanically with physical gears, shafts, speed change gears or cam etc. For example, create a rough cam waveform on the graph and then make it more precise by adjusting the numerical values.

3. Advanced Monitoring, Setup, and Adjustment

4. Multiple Languages Supported
The language is supported for Japanese, English, and Chinese, helping engineering staff work in this globalized industry and enabling faster startup abroad on site.

Would you buy a car solely based on engine power? Fuel Efficiency? Crash test rating? Only a test drive will give you a true indication of the performance potential.

Test drive the MELSEC iQ-R Motion System with MR-J4 Servos and experience the performance.

component specifications leads to maximum performance

Total System Performance is Productivity.
The easy-to-use programming software allows you to work

Program creation is largely dependent on human skills; therefore an enormous amount of time is often spent on creating a servo program where high programming skills are required. To eliminate any programming hassle as much as possible, “MELSOFT GX Works3” introduces a more intuitive, efficient, and user-friendly programming environment, revolutionizing the way of programming.
This software supports a whole product development cycle - from development, startup, debugging through maintenance for sequence programs, Simple Motion module parameters, and positioning/cam data.

All-Inclusive Software, from Sequence Program Creation to Simple Motion Module Setting

MELSOFT GX Works3

The graphical screen allows you to design a Motion system easily. Also, you can configure servo amplifier and module settings easily on the system setting screen, and check them at a glance.

1. Intuitive Operation
   The graphical screen allows you to design a Motion system easily. Also, you can configure servo amplifier and module settings easily on the system setting screen, and check them at a glance.

2. Synchronous control without complex programming
   Synchronous control can be easily performed just by setting parameters, using software instead of controlling mechanically with physical gears, shafts, speed change gears or cam etc. For example, create a rough cam waveform on the graph and then make it more precise by adjusting the numerical values.

3. Advanced Monitoring, Setup, and Adjustment
   The items and axes needed to be displayed can be selected from various monitoring information. Servo adjustment and setup, data collection and waveform display that are synchronized to the Motion operation cycle are also available.

4. Multiple Languages Supported
   The language is supported for Japanese, English, and Chinese, helping engineering staff work in this globalized industry and enabling faster startup abroad on site.
A manufacturing plant is seldom stopped or taken offline and continuously produces the desired product or component. However, the control system occasionally requires maintenance; for example, at the time of a faulty product or system upgrade for manufacturing a new or updated component. At that time, thanks to the extensive maintenance functions embedded in the hardware and software, the user can trust the control system to handle transition into/out of the maintenance period for both preventive and post maintenance.

Preventive maintenance with a wide range of information collected throughout various manufacturing processes

- **Preventive maintenance**
  - Easily managing individual data of CPU modules and Simple Motion modules
  - Batch Data Management for Multiple Parameters and Programs
    - Multiple data from PLC CPUs, Simple Motion modules, and servo amplifiers can be collectively managed.
    - Equipment data can be easily managed.

- **Preventive maintenance**
  - Being informed of the lifespan of the capacitor and relay in a servo amplifier
  - Servo Amplifier Life Diagnosis Function Preventing System Downtime in Advance
    - This function displays:
      - Cumulative power-on time
      - Number of inrush current switching times
      - Target lifespan of capacitor and relay, etc.

- **Preventive maintenance**
  - Minimizing risks of machine failure
  - Utilizing Machine Aging Information for Preventive Maintenance
    - Estimated machine friction and vibration are displayed.
    - Comparing the current machine data and the initial machine data helps to find out the machine aging.

- **Preventive maintenance**
  - Preventing failure with advanced preventive maintenance beforehand.
Corrective maintenance by utilizing various operation and error information recorded for quick troubleshooting

**Corrective maintenance**
Quickly locating causes that stop the machine

**Digital Oscilloscope Function Performing Cause Analysis**
- Sampling can be performed without a personal computer connected.
- Sampling of current value, etc., for multiple axes is available.
- Sampled data path can be traced on 2-dimensional coordinate.

**Visualizing the Status of Alarm Occurrence with Large Capacity Drive Recorder of Servo Amplifier**
- Servo data (motor current and position command, etc.) of before and after the alarm occurrence are stored in non-volatile memory.
- Data are read during restoration for cause analysis.
- Check the waveform of 16 alarms in the alarm history.

IAM: Data are stored in non-volatile memory at alarm occurrence.
IAM: Waveform display
IAM: Alarm No. and waveforms at alarm occurrence are displayed.
IAM: Lowered bus voltage
IAM: It is revealed that the main circuit power is turned off.

**Corrective maintenance**
Quickly locating causes that prevent the machine from starting

**Event History for Quick Troubleshooting**
- Event history including program changes, errors occurred, power OFF, etc. can be saved.
- A list of the event history can be confirmed.
- Errors that have been made by mistake can be quickly detected.

**Corrective maintenance**
Easily identifying the location of errors

**Diagnosis and Troubleshooting Even with limited knowhow**
- Network errors are easily identified at a glance.
- Graphical representation of the network automatically created on the engineering software makes wiring and PLC errors clearly visible.
Quality

Reliable and trusted MELSEC product quality

The MELSEC iQ-R Series is based on two fundamental aspects of quality. “Quality of product” “Quality for application” These two characteristics are part of the main principle behind the MELSEC iQ-R Series. This new control system includes various features designed-in to provide a solution that not only improves the overall manufacturing productivity, but also maintains a high level of industrial quality that is ideal for the harsh and rugged environments that it is subjected to on a daily basis.

Assuring high-standard, highly reliable product

Electromagnetic compatibility (EMC) testing room (simulated test)

1. Conforms to stringent quality evaluations and tests that are based on robust industrial environments including EMC, LSI, temperature, vibration and HALT tests.

2. High manufacturing quality control through QR code based quality management system.

3. The front face has a wide and open design with an easy-to-use front cover.

Robust design ideal for harsh industrial environments

For high quality of MELSEC iQ-R Series Synonymous with the Mitsubishi Electric name, the MELSEC iQ-R Series is designed with high quality and reliability, which is a prerequisite for industrial applications. In addition, the overall aesthetics and usability enable easier maintenance that customers routinely expect.

For high environmental resistance For protection against aggressive atmosphere and gases, products with a conformal coating (IEC 60721-3-3:1994 Class 3C2) are available on request *1.

*1: Contact your local Mitsubishi Electric office or representative for further details.
Conforms to main international quality standards

The MELSEC iQ-R Series conforms to most of the main international standards that realizes applications requiring multiple global locations.

Improve and maintain actual manufacturing quality

4. Motion control processing, interrupt programs (PLC) and network transmission cycle (link scan) are synchronized. Also, as the graph shows, the signals between several modules, such as output modules can be synchronized.

Improve and maintain actual manufacturing quality

With inter-module synchronization, it’s now possible to precisely synchronize interrupt programs (PLC) with the network communications cycle (link scan). Any variations in data transmission response time (network transmission delay time) between the controller and other devices on the network are eliminated, realizing high integrity between manufacturing processes that are dependent on each other, ensuring high performance and processing.

MELSERVO-J4 series improving product quality even further

High-accuracy positioning and smooth constant-speed operation can be achieved with a combination of the MELSEC iQ-R series servo system controllers and MELSERVO-J4 series servo amplifiers. Vibration can be minimized with the advanced servo adjustment function, maintaining the product quality.
The MELSEC iQ-R Series is part of a family of products all interconnected across various levels of automation. Based on the seamless message protocol (SLMP*1), data flow transparently between the sensor level and the management level across multiple industry-standard automation networks. CC-Link IE, Asia’s No. 1 industrial network, realizes fast gigabit data transmission speeds, further optimizing the manufacturing cycle. In addition, the SSCNET III/H high-speed motion control network further enhance the factory-wide connectivity solution.

Optical network “SSCNET III/H” accelerating system response

“SSCNET III/H” enables the servo system controllers to synchronize to servo amplifiers by using an optimized data frame for a servo system. This network is suitable for printing machines, food machines, and processing machines which require highly synchronized operation.

**Highlights of SSCNET III/H**
- Optimized high-speed communications achieving a servo system of 150Mbps
- Cycle time as fast as 0.222 ms
- Synchronous communications allowing equipment to improve performance further
- Improved noise tolerance by optical communications
- Dramatically reduced wiring
- Central control with network
- Long distance wiring up to 3200 m
- SSCNET III/H compatible and SSCNET III compatible products connected in a same system

*SSCNET (Servo System Controller NETwork)*

The backbone of e-F@ctory, leveraging connectivity between the shop floor and IT

**Extensive visualization with advanced data connectivity**
- Big Data analytics requires deterministic data collection, which can be realized by incorporating two key features:
- SLMP that enables seamless connectivity between devices in the IT layer and on the shop floor; and a high-speed, large-capacity 1 Gbps communications network that enables the handling of large-data, such as production, quality and control data between different production processes.

**General, motion and safety control integrated into one network**
- CC-Link IE incorporates generic distributed control, synchronous motion control, and safety control enabling safety communications across multiple safety devices, all on the same network. The topology is quite versatile, based on twisted-pair cables, which enables flexibility in system configuration while helping to keep installation cost low.

**Comprehensive diagnosis realizing higher reliability**
- Disruptions to the control system are kept to a minimum via comprehensive diagnostics functions, high communications integrity owing to the noiseresistant characteristics of the optical cable, and communication re-routing capabilities made possible as the result of using a ring topology. Also, network errors can be rectified quickly by visualizing the network system image using the engineering software, and remotely from a GOT (HMI) directly on the machine or production line.
Security

Robust security that can be relied on

As technology becomes more complex and the distribution of manufacturing systems more global, the protection of intellectual property is even more significant. When shipping a finished product overseas, the last thing an OEM needs to consider is unauthorized copying or changing of the original project data. In addition to this, unauthorized access to the control system can have very serious implications to the control system and the end user, which can compromise the overall safety of the plant. The MELSEC iQ-R Series has a number of embedded features that help to maintain these requirements, such as hardware and software keys to protect intellectual property, and multi-level user access password hierarchy to protect the project at the design stage.

Powerful security features protecting intellectual property

Security key authentication protecting project data

The security key authentication prevents programs from being opened on personal computers where the security key has not been registered. Furthermore, because programs cannot be executed by CPU modules where the security key has not been registered, the integrity of customer technologies and other intellectual property is not compromised.

When using the Simple Motion module, the security key can be registered on an extended PLC CPU’s SRAM cassette and PLC CPU itself. Therefore, when replacing the CPU module, there is no need to re-register the security key, making replacement very simple.

When using Motion CPU, the security key is registered on Motion CPU.

Prevent unauthorized access across the network

The IP filter can be used to register the IP addresses of devices permitted to access the CPU module. As a result, access from non-registered devices can be blocked, thereby lowering the risk of program hacking and unauthorized access by a third party.

Another feature is a remote password function(Note-1) for password-based security. Passwords of up to 32 characters can be set to prevent unauthorized access to the CPU module via networks such as Ethernet.

(Note-1): The PLC CPU is provided with this function.
**Compatibility**

**Extensive compatibility with existing products**

Whenever introducing a new system or technology into an existing manufacturing plant or control system, utilization of existing assets as much as feasibly possible is a mandatory requirement with today’s manufacturing needs. The MELSEC iQ-R Series addresses these subtle but substantial needs with various system hardware support and engineering project compatibility to achieve an easy path to higher technology and improved performance capabilities.

**Utilize existing servo system controller assets**

**Replacement of iQ Platform compatible MELSEC-Q series with MELSEC iQ-R series**

The existing iQ Platform compatible MELSEC-Q series Simple Motion modules/Motion controllers can be replaced with the MELSEC iQ-R series.

**Utilization of existing MELSEC-Q series assets**

[MELSOFT MT Works2/MELSOFT GX Works3]

A simply conversion process is all it takes to enable the use of MELSEC-Q Series programs with the MELSEC iQ-R Series. Customers can effectively use the program assets they have accumulated, thereby reducing the overall engineering time.
Next-generation, Compact Servo System Controller with Extensive Built-in Functions

MELSEC iQ-F series

Designed on the concepts of outstanding performance, superior drive control and user centric programming, Mitsubishi Electric MELSEC-F Series has been reborn as the MELSEC iQ-F Series.

From stand alone use to networked system applications, MELSEC iQ-F Series brings your business to the next level of industry.

MELSEC iQ-F series
Simple Motion Module Debut

The newly reborn MELSEC iQ-F Series reaches to new areas of application with a high-speed system bus, extensive built-in functions and network support.
The next level of industry

The newly reborn MELSEC iQ-F Series reaches to new areas of application with a high-speed system bus, extensive built-in functions and network support.

Conveyance Food & Beverage Packaging

- Control up to 8 axes
- Include the synchronous encoder input and mark detection as standard features
- Equipped with a high-speed bus system that significantly reduces cycle time
- Parameters and servo data managed centrally via SSCNET III/H.
- Sophisticated servo amplifier and servo motor offering industry leading level of performance
- Optical network "SSCNET III/H" providing high response and high reliability

Productivity

Outstanding performance

- Easy setting without complex programming by GX Works3
- Easy programming via drag & drop
- All-in-one engineering tool reducing programming time

Connectivity

Network

- Parameters and servo data managed centrally via SSCNET III/H.
- Sophisticated servo amplifier and servo motor offering industry leading level of performance
- Optical network "SSCNET III/H" providing high response and high reliability

Engineering

Intuitive programming
iQ Platform for maximum return on investment

Minimize TCO, Seamless integration, Maximize productivity, Transparent communications: these are common items that highlight the benefits of the iQ Platform and e-F@ctory. The iQ Platform minimizes TCO at all phases of the automation life cycle by improving development times, enhancing productivity, reducing maintenance costs, and making information more easily accessible across the plant. Together with e-F@ctory, offering various best-in-class solutions through its e-F@ctory alliance program, the capabilities of the manufacturing enterprise is enhanced even further realizing the next level for future intelligent manufacturing plants.

Further reduce TCO while securing your manufacturing assets

**Automation Controller**
- Improve productivity and product quality
  1. High-speed system bus realizing improved system performance
  2. On-screen multi-touch control enabling smooth GOT (HMI) operations

**Integrated Network**
- Best-in-class integrated network optimizing production capabilities
  1. CC-Link IE supporting 1 Gbps high-speed communication
  2. Seamless connectivity within all levels of manufacturing with SLMP

**Centralized Engineering**
- Integrated engineering environment with system level features
  1. Automatic generation of system configuration
  2. Share parameters across multiple engineering software via MELSOFT Navigator
  3. Changes to system labels are reflected between PAC and HMI

**ERP (Enterprise resource planning)**
**MES (Manufacturing execution system)**

**PAC & HMI**
Integration of automation controller and HMI

**Network**
Integrated network through seamless connectivity

**Engineering**
Centralized engineering environment
Servo System Designed with Automation in Mind

The required characteristics of servo systems vary with the applications and industries. Not only the high-speed and high-accuracy, but also the functions in accordance with each of field-specific processes are necessary. Together with other FA-related products, Mitsubishi Electric offers a wide range of servo system product lines to satisfy the diversified application needs in various industries.

Automotive

Improve productivity and realize flexibility in different automotive assembly lines with high-accuracy motion control, including linear/circular interpolation and electric cam profile.

Automated warehouse

Realize advanced logistics coordination and eliminate errors in repetitive processes. Servo-based high-speed material handling and highly accurate positioning improve productivity and reduce energy consumption.

Food and beverage, CPG

Realize improvements in various packaging applications such as high-speed filling, which requires a highly accurate, continuous feed rate and precision.

Semiconductor

In today's semiconductor manufacturing process, wafer diameter is getting larger and components smaller. To meet the requirements of higher quality and productivity, Mitsubishi Electric's high-performance servos and high-resolution encoder achieve fast and accurate positioning at stable speeds.

Mounter

Flexible mounting of electronic components with high speed and density is demanded in printed circuit board applications. Mitsubishi Electric offers a high level of servo system solutions for rapid mounting of highly miniaturized components and for flexible mounting of irregular shapes.

Printing

Mitsubishi Electric provides high-accuracy synchronous system solutions for the paper feeding, printing, cutting, and assembly functions within the printing process, achieving high-speed and high-quality converting applications.
A complete system lineup to meet your production and manufacturing needs

Motion controllers and Simple Motion modules are flexibly coordinated with Mitsubishi Electric’s other product lines such as displays and programmable controllers as well as servo amplifiers and servo motors. Mitsubishi Electric allows you to freely create an advanced servo system.

**SOLUTION**

Mitsubishi Electric’s e-F@ctory concept utilizes both FA and IT technologies, through collaboration with e-F@ctory Alliance Partners, to reduce the total cost of development, production and maintenance, with the aim of achieving manufacturing that is a “step ahead of the times”.

**SOFTWARE**

**HUMAN MACHINE I/F**

**PROGRAMMABLE CONTROLLER**

**SERVO SYSTEM CONTROLLER**

**NETWORK**

**SERVO AMPLIFIER**

**SENSING MODULE**

**SERVO MOTOR**

**LOW-VOLTAGE SWITCHGEAR**
Mitsubishi Electric's integrated FA platform for achieving lateral integration of controllers & HMI, engineering environments and networks at production sites.

Programmable controller

Simple Motion module

Motion Controller

SSCNET III/H

Servo amplifier

Sensing module

Linear servo motor

Direct drive motor

Servo motor

Magnetic contactor

Molded-case circuit breaker
**CASE 1**  
**Vertical Form, Fill & Seal**

When the machine packs food, the whole process is synchronized by using advanced synchronous and cam controls. The packing film is cut using the registration mark as a reference with the mark detection function, improving the packaging quality. Additionally, cam data for the rotary knife axis can be easily created with the cam auto-generation function, achieving more efficient production.

**Main functions**
- Advanced synchronous control
- Cam control
- Cam auto-generation function
- Mark detection function

**Application examples**
- Horizontal form, fill & seal
- Labeling machines
- Wrap-around case packer
- Diaper manufacturing machines
- Packing machines
- Food/beverage bag filling machines

**CASE 2**  
**Liquid Filling Machines**

The machine can adjust the speed of the nozzle’s vertical motion according to the liquid level to be filled in the bottle by using advanced synchronous and cam controls. Different bottle shapes can be filled on the same conveyor line, enabling more efficient use of production equipment.

**Main functions**
- Advanced synchronous control
- Speed control
- Cam control

**Application examples**
- Vertical form, fill & seal
- Horizontal form, fill & seal
- Labeling machines
When the machine packs food, the whole process is synchronized by using advanced synchronous and cam controls. The packing film is cut using the registration mark as a reference with the mark detection function, improving the packaging quality. Additionally, cam data for the rotary knife axis can be easily created with the cam auto-generation function, achieving more efficient production.

The machine can adjust the speed of the nozzle’s vertical motion according to the liquid level to be filled in the bottle by using advanced synchronous and cam controls. Different bottle shapes can be filled on the same conveyor line, enabling more efficient use of production equipment.

**CASE 3**

**Converting Machines**

The film can be sent at constant tension, preventing it from stretching or shrinking. The speed or torque is compensated with the tension detector and tension meter for keeping the tension constant. The whole line can be synchronized by using advanced synchronous control while executing speed control simultaneously.

- **Main functions**
  - Speed-torque control
  - Advanced synchronous control

- **Application examples**
  - Packaging machines
  - Printing machines
  - Slitting machines
  - Wire drawing machines
  - Laminating machines

**CASE 4**

**Screw Tightening Machines**

The machine tightens screws by using speed-torque control (tightening & press-fit control). Since the current position is controlled even after switching from the position control to the speed-torque control, positioning based on the absolute position coordinates is possible when switching back to the position control.

- **Main functions**
  - Positioning control
  - Speed-torque control
    (tightening & press-fit control)

- **Application examples**
  - Vertical form, fill & seal
  - Press-fit machines
  - Caulking machines
CASE 5 Material Handling Machines

The machine can move workpieces easily from one line to another by using a combination of linear interpolation, 2-axis circular interpolation, and continuous path control.

Machine vibration is minimized and a shorter cycle time is achieved by setting the smooth acceleration period (Sin wave interval) and maximum acceleration period (Constant acceleration interval) with the advanced S-curve acceleration/deceleration function.

Main functions

- Positioning control
- Linear interpolation and circular interpolation
- Continuous path control
- S-curve acceleration/deceleration
- Advanced S-curve acceleration/deceleration

Application examples

- Material handling machines
- Pick and place robots
- Machines with frequent accelerations/decelerations

CASE 6 Sealing

The machine can coat the workpiece by using a combination of linear interpolation, 2-axis circular interpolation, and continuous path control.

A smooth path can be traced with the S-curve acceleration/deceleration function.

Main functions

- Continuous path control
- Linear interpolation
- Circular interpolation
- S-curve acceleration/deceleration

Application examples

- Sealing
- Dispensers
CASE 7  Printing Machines

The machine can carry out printing processes by using a combination of advanced synchronous control and speed-torque control. Also, with the robust filter function of servo amplifier, both high response and stability can be achieved for high inertia equipment such as a printing machine driven by belts and gears.

**Main functions**
- Advanced synchronous control
- Speed-torque control
- Robust filter
- Resonance suppression filter

**Application examples**
- Printing machines
- Sheet-fed offset printing machines
- Web-fed offset printing machines

CASE 8  Alignment Systems

The alignment time can be reduced by the system changing the target position during positioning, and starting positioning for the new target position with the workpiece data from the vision system. High-speed and high-accuracy positioning can be achieved, with the Motion controller and the vision system directly connected. For the Simple Motion module, the data from vision camera is read via the PLC CPU for position compensation.

**Main functions**
- Vision system
- Target position change function

**Application examples**
- Solar panel manufacturing equipment
- FPD manufacturing equipment
- Image processing systems for inspection
CASE 9  Synchronization of Input and Output with Servo Control

Various data, such as synchronous encoder values, sheet tension values, and text data, are inputted and outputted in accordance with the servo communication cycle, enabling a wide range of Motion control applications.

**Main functions**
- All-in-one network
- Synchronous communication
- Network diagnosis
- Motion mode
- I/O mode

**Application examples**
- Packaging machines
- Filling machines
- Labeling machines
- Packing machines
- Material handling machines

---

CASE 10  Flexible network topology

With a switching hub, multiple network topologies are supported including star, line, and star and line combinations. This flexibility allows additional equipment to be simply connected to any available port, with little concern for restrictions.

**Main functions**
- Line topology
- Star topology
- Star/line mixed topology

**Application examples**
- Packaging machines
- Filling machines
- Labeling machines
- Packing machines
- Material handling machines
**CASE11  Data Transmission to IT System**

Data of servo amplifiers and servo motors for each machine can be collected via CC-Link IE Field Network. The status of the entire product line can be visualized by batch management of the collected data. A CC-Link IE Field Network servo system supports to build IoT (Note-1) for your machine.

(Note-1): IoT (Internet of Things)

With a switching hub, multiple network topologies are supported including star, line, and star and line combinations. This flexibility allows additional equipment to be simply connected to any available port, with little concern for restrictions.

**CASE12  Monitoring of Servo Data**

Servo operation can be monitored with extensive monitor data (selectable from up to 50 items). The monitor items can be flexibly changed during operation. The operation status of servo amplifiers and servo motors (including partner products) acquired via CC-Link IE Network and SSCNET III/H are transferred and displayed on the host system or on any GOT screens created by customers.

### Monitoring Items

- **[Monitoring and data collection]**
  - Alarm history of servo amplifiers
  - Identification information of servo amplifiers and servo motors
  - Power consumption
  - 7-segment LED display status
  - Load ratio of servo motors • Speed
  - Temperature of various parts

- **[Preventive maintenance]**
  - Inrush relay ON/OFF number
  - Power ON cumulative time
  - Machine diagnosis information (the estimated friction value and the estimated vibration value)

(Note): Monitoring items and its specifications vary by model type.
Features of Motion Controller

Overview of Servo System Controllers

The Simple Motion module is an intelligent function module which performs positioning control by following the instructions of the PLC CPU.

- The positioning functions are used exactly in the same manner as those of Positioning modules.
- Linear interpolation control and other controls can be achieved easily just by writing positioning data to the buffer memory with sequence programs and function blocks.
- MELSOFT GX Works3, the engineering software, supports everything needed, from programming to servo adjustment.
- Positioning/advanced synchronous/cam controls can be performed with simple parameter settings and a start from a sequence program.

Features of Simple Motion Module

For high-accuracy positioning with synchronous control up to sec

Advanced control while being simple to use just like Positioning modules

- For configuring a servo system with synchronous control up to μsec precision
- For performing superior Motion control as a micro PLC
- For configuring a system covering from stand-alone use to networked system application with the micro PLC
The Simple Motion module is an intelligent function module which performs positioning control by following the instructions of the PLC CPU.

- MELSOFT GX Works3, the engineering software, supports everything needed, from programming to servo adjustment.
- Sequence programs and function blocks.
- Linear interpolation control and other controls can be achieved easily just by writing positioning data to the buffer memory.
- Positioning/advanced synchronous/cam controls can be performed with simple parameter settings and a start from a sequence program.
- The positioning functions are used exactly in the same manner as those of Positioning modules.

Features of Simple Motion Module

- For configuring a servo system with precision synchronous control up to ONE single network.
- MELSEC iQ-R series
  - Input axis module
  - Output axis module (Clutch)
  - Output axis module (Cam)
- Main shaft gear
- RD77GF4
- RD77GF16
- RD77GF32
- RD77MS2
- RD77MS4
- RD77MS8
- RD77MS16

Possible to control up to 192 axes by use of three R64MTCPU modules.
### Function Comparison of Simple Motion Module and Motion Controller

<table>
<thead>
<tr>
<th>Simple Motion module</th>
<th>Motion controller</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MELSEC iQ-R series</strong></td>
<td><strong>MELSEC iQ-F series</strong></td>
</tr>
<tr>
<td>RD77GF32/RD77GF16/RD77GF8/RD77GF4</td>
<td>RD77MS16/RD77MS4/RD77MS2</td>
</tr>
<tr>
<td>RD77GF32/RD77GF16/RD77GF8/RD77GF4</td>
<td>FXS-60SSC-S/FXS-40SSC-S</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Module type</strong></th>
<th>MR-J4-GF(-RJ)</th>
<th>MR-J4-B(-RJ)</th>
<th>MR-J4W_B-4</th>
<th>MR-J4W_B-8</th>
<th>MR-J4W_B-16</th>
<th>MR-J4W_B-32</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Servo amplifier</strong></td>
<td>MR-J4-GF(-RJ)</td>
<td>MR-J4-B(-RJ)</td>
<td>MR-J4W_B-4</td>
<td>MR-J4W_B-8</td>
<td>MR-J4W_B-16</td>
<td>MR-J4W_B-32</td>
</tr>
<tr>
<td><strong>Servo motor</strong></td>
<td>MR-J4-GF(-RJ)</td>
<td>MR-J4-B(-RJ)</td>
<td>MR-J4W_B-4</td>
<td>MR-J4W_B-8</td>
<td>MR-J4W_B-16</td>
<td>MR-J4W_B-32</td>
</tr>
<tr>
<td><strong>Command interface</strong></td>
<td>CC-Link IE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum number of control axes</strong></td>
<td>16/8/4 axes</td>
<td>8/4 axes</td>
<td>8 axes</td>
<td>32 axes</td>
<td>16 axes</td>
<td></td>
</tr>
<tr>
<td><strong>Operation cycle</strong></td>
<td>0.5 ms or longer</td>
<td>0.444 ms or longer</td>
<td>0.888 ms or longer</td>
<td>0.222 ms or longer</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Engineering environment</strong></td>
<td>MELSOFT GX Works3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Programming method</strong></td>
<td>Motion profile table</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Note-1): Available only with FX5-80SSC-S/FX5-40SSC-S
(Note-2): Use the safety observation function of a servo amplifier.
(Note-3): Available only with RD77GF and RD77MS
(Note-4): Available only with RD77MS2/RD77MS4/RD77MS8/RD77MS16/RD77MS32
## Simple Motion Module and Motion Controller

### Function Comparison of Simple Motion Module and Motion Controller

<table>
<thead>
<tr>
<th>Simple Motion Module</th>
<th>Motion Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>MELSEC IQ-R series</td>
<td>MELSEC IQ-F series</td>
</tr>
<tr>
<td>RD77GF32</td>
<td>FX5-80SSC-S</td>
</tr>
<tr>
<td>RD77GF16</td>
<td>RX5-40SSC-S</td>
</tr>
<tr>
<td>RD77GF8</td>
<td></td>
</tr>
<tr>
<td>RD77GF4</td>
<td></td>
</tr>
<tr>
<td>RD77MS16</td>
<td></td>
</tr>
<tr>
<td>RD77MS8</td>
<td></td>
</tr>
<tr>
<td>RD77MS4</td>
<td></td>
</tr>
<tr>
<td>RD77MS2</td>
<td></td>
</tr>
<tr>
<td>RD77GF4</td>
<td></td>
</tr>
<tr>
<td>RD77GF8</td>
<td></td>
</tr>
<tr>
<td>RD77GF16</td>
<td></td>
</tr>
<tr>
<td>RD77GF32</td>
<td></td>
</tr>
</tbody>
</table>

### Control Mode

- **Position control**
- **Torque control**
- **Advanced synchronous control**

### Positioning Control

- **Linear interpolation**
- **Circular interpolation**
- **Continuous path control**
- **Helical interpolation**
- **Speed position switching control (ABS)**
- **Position/offset switching control**

### Acceleration/Deceleration Control

- **Trapezoidal acceleration/deceleration**
- **S-curve acceleration/deceleration**

### Manual Control

- **JOG operation**
- **Manual pulse generator operation**
- **Inching operation**
- **JOG operation simultaneous start**

### Function that Changes the Control Details

- **Current value change**
- **Target position change**
- **Speed change**
- **Acceleration/deceleration time change**

### Home Position Return Method

- **Proximity dog method**
- **Scale home position signal detection method**
- **Count method (2 types)**
- **Data set method**
- **Driver home position return method**

### Auxiliary Function

- **Forced stop**
- **Software stroke limit**
- **Amplifier-less operation**
- **Optional data monitor**
- **Event history**
- **Safety observation**
- **Driver communication**
- **Cam auto-generation**

### Featured Functions

- **Driver communication**
- **Cam auto-generation**

### Notes

1. Available only with RD77MS and FX5-80SSC-S/FX5-40SSC-S
2. Available only with RD77GF and RD77MS
3. Use the safety observation function of a servo amplifier.
4. Available only with FX5-80SSC-S/FX5-40SSC-S
Simple Motion Modules

- Wide-range, sophisticated Motion control, such as advanced synchronous control, cam control, speed-torque control (tightening & press-fit control), can be achieved just with sequence programs including function blocks.
- All the functions of QD75MH are included in the Simple Motion module.
- Programming, servo adjustment, operation/maintenance for the Simple Motion modules are supported by ONE engineering software (MELSOFT GX Works3).

Superb Functionality for Wide-range Applications

(Applicable Functions)

(Note): The applicable function varies depending on the model.

Stacking cranes
Packing machines
FFD manufacturing device
Cutting machine
Screw tightening machines
Labeling machines
Pressing machines
Converting machines

Positioning
Advanced Sync.
Mark Detection
Tightening & Press-fit
Cam Auto-Generation
Command generation
axis
Energy Saving
Functional Safety
Driver Communication
Helical Interpolation
Command
Tightening & Press-fit
Driver Communication
Helical Interpolation
Command

35
All-in-One Engineering Software

This all-in-one software covers all aspects of the product development cycle - from system design, programming, to debugging and maintenance - maximizing efficiency while minimizing your effort.

**Easy system design**
- No need of manuals in system and parameter settings
  - MELSOFT GX Works3 includes everything needed from system configuration to servo parameter settings.
  - "One-point help" enables easy settings without manuals.

**Easy motion control**
- Increased usability in synchronous/positioning control settings
  - An array of sub functions helps you create positioning data.
  - Synchronous control is performed easily just by parameter settings.
  - Creation of a rough cam waveform on a graph via drag & drop, or direct numerical value input to the graph enables easy creation of cam data.

**Easy programming**
- Simple point-and-click programming
  - A sequence program is created effortlessly via drag & drop of module labels/FBs.

**Easy startup**
- Increased efficiency in debugging and maintenance
  - Servo adjustment is automatically completed using the One-touch tuning function.
  - Debugging of a program without an actual machine is possible by simulation.
  - The network errors are displayed by Network diagnostics.

**Outline**
- Simple Motion Modules
- Motion Controllers
- Sensing Modules
- Engineering Environment
- Networks
- Servo Amplifiers
MELSEC iQ-R series Simple Motion module
RD77MS16/RD77MS8/RD77MS4/RD77MS2
Achieving Various Control While Being Simple to Use Just Like Positioning Modules

System configuration

PLC CPU
Simple Motion module
Input module

GOT
Engineer environment
Programmable Controller Engineering Software
MELSOFT GX Works3

USB
Ethernet

MR-J4-B
Rotary servo motor
MR-J4W2-B
Direct drive motor
MR-J4W3-B
Linear servo motor
MR-MV200
Q171ENC-W8
Serial absolute synchronous encoder

FR-A800 (Note-1)
Inverter

Connecting either a manual pulse generator or an incremental synchronous encoder

External input signal cable

(Note-1): When using a partner product or the inverter FR-A800, use one whose version supports the Simple Motion module.
**SSCNET III/H compatible**

**MELSEC iQ-F series Simple Motion module**

**FX5-80SSC-S/FX5-40SSC-S**

Cutting-edge motion control packed in a compact module

---

**System configuration**

- **CPU module**
- **Simple Motion module**

### Connecting either

- A manual pulse generator or an incremental synchronous encoder

### External input signals (4 points)

- Forced stop input (24 V DC)

### External input signals via CPU

- FLS, RLS, DOG, STOP

### Engineering environment

**Programmable Controller Engineering Software**

**MELSOFT GX Works3**

**FX5-80SSC-S**: Up to 8 axes

**FX5-40SSC-S**: Up to 4 axes

---

(Note-1): When using a partner product or the inverter FR-A800, use one whose version supports the Simple Motion module
MELSEC iQ-R
CC-Link IE Field Network compatible
MELSEC iQ-R series Simple Motion module
RD77GF32/RD77GF16/RD77GF8/RD77GF4

Synchronous control up to μsec precision, suitable for high-accuracy positioning

System configuration

[Diagram showing system configuration with various modules and connections]

Device station: Up to 120 stations (including the number of servo amplifiers in motion mode)
(Note): A switching hub is required for star topology.
CC-Link IE Field Network Compatible Functions

Preventive maintenance

Machine diagnosis function detects changes in mechanical parts (ball screw, guide, bearing, belt, etc.) by analyzing changes in machine friction, load moment of inertia, unbalanced torque, and vibration components from the data inside a servo amplifier, supporting timely maintenance of these parts. In addition, the data are transferred to a host system and used to monitor the entire line.

Control mode

Two types of modes are available according to your needs:

- Motion mode for a wide range of motion control such as positioning of multiple axes, synchronous control, etc.
- I/O mode for positioning of one axis

Motion mode

This mode enables advanced motion control functions, such as positioning for multi-axis interpolation, synchronous control, and speed-torque control in combination with the Simple Motion module.

Maximum number of control axes: 32 axes

I/O mode

With the CC-Link IE Field Network, various field devices, such as servo amplifiers, I/O modules, and high-speed counter modules, can be connected flexibly.

Maximum number of control stations: 120 stations (including the number of servo amplifiers in motion mode)

CC-Link IE Field Network master station

The CC-Link IE Field Network Simple Motion module covers the functionality that a CC-Link IE Field Network master/local module provides (Note-1). The Simple Motion module can function as a master module, and is also equipped with link devices equivalent to a master/local module. This leads to reduced cost on system because it includes functions of both Simple Motion module and a master module.

(Note-1): Excludes the function of a sub-master station.

Maximum link points per network

<table>
<thead>
<tr>
<th>Item</th>
<th>RD77GF</th>
<th>Master module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote input (RX)/Remote output (RY)</td>
<td>16k points each (16384 points, 2k byte)</td>
<td>16k points each (16384 points, 2k byte)</td>
</tr>
<tr>
<td>Remote register (RWr)</td>
<td>4k points each (8192 points, 16k byte)</td>
<td>4k points each (8192 points, 16k byte)</td>
</tr>
</tbody>
</table>
Programming Environment

There are many works with software in the processes from machine design through its operation - system design, programming, debug, to maintenance. MELSOFT GX Works3 is equipped with various features that simplify those works.

System design

A system is simply and quickly designed just by selecting a module needed for your system via drag & drop. The parameter and positioning data windows appear by double-clicking on the desired module.

Programming

Various positioning controls such as linear interpolation can be performed just by writing positioning data to the buffer memory using a sequence program or a function block.
PLCopen® Motion Control FB

Simple Motion modules and servo amplifiers with built-in positioning are used to execute Motion control. Each device uses specific programming, thus the time and cost involved in understanding how each device works is a burden.

PLCopen® Motion Control FB is a standardized interface, which provides the following benefits:

- Reduced workload for programming, saving time and reducing costs.
- People other than the program designer can understand the programming, leading to reduced maintenance time.

Conforms to IEC 61131-3

GX Works3 realizes structured programming such as ladder and ST, making project standardization across multiple users even easier.

### Programming examples

The PLCopen® Motion Control FB enables positioning of devices requiring different control methods with the same programming.

[When using the Simple Motion module]

Device: RD77GF + MR-J4-GF  
FB: MC_MoveAbsolute + RD77

Positioning starts after setting the Simple Motion module such as the target position and speed.

[When using the servo amplifier with the built-in positioning function]

Device: R04ENCPU + MR-J4-GF  
FB: MC_MoveAbsolute + J4GFIO

Positioning starts after transferring data of a target position and speed from a master station to the servo amplifier with the built-in positioning function.

### Module Function Block (Module FB)

A program for positioning control is easily created via drag & drop of required FBs from a list of Mitsubishi Electric module FBs to the program editor screen.
Positioning control is easily executed using a Motion profile table.

To respond to various application needs, the Simple Motion module offers various control methods, such as linear interpolation, 2-axis circular interpolation, fixed-pitch feed, and continuous path control. Automatic operation can be executed easily by setting positioning addresses, speeds, 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.

The servo motor, rotating at the specified speed in the speed control, stops at the specified position when turning ON the speed-position switching signal.

Helical interpolation draws a helical path by a linear interpolation axis (Z-axis) following to 2-axis circular interpolation control (X-axis and Y-axis). For applications that require the boring of deep, large holes, usually the helical interpolation of the three axes must be taken into consideration.

Milling is done in a circle, with the X and Y axes synchronized to achieve the pre-set size. The depth of the hole is simultaneously controlled along the Z axis, ensuring minimal deviation in the cutting bit position.

The MELSOFT GX Works3 simulation enables a program operation to be checked without an actual machine even during the debugging process and hence a shorter startup time. In addition, multiple Simple Motion modules can be simulated at the same time.

For the MELSEC iQ-R series, events occurred on each module and servo amplifiers can be stored to the CPU module. Information of "WRITE" operation to the program, error information, and written data to the flash ROM, etc. is listed chronologically, which makes error cause investigation and restoration work smoother and quicker.

The cause of event can be easily identified through the event history which chronologically lists errors and operation for the CPU module.
Positioning control is easily executed using a Motion profile table.

**Basic positioning control**

- To respond to various application needs, the Simple Motion module offers various control methods, such as linear interpolation, 2-axis circular interpolation, fixed-pitch feed, and continuous path control.
- Automatic operation can be executed easily by setting positioning addresses, speeds, 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.

**Speed-position switching control**

The servo motor, rotating at the specified speed in the speed control, stops at the specified position when turning ON the speed-position switching signal.

**Helical interpolation**

Helical interpolation draws a helical path by a linear interpolation axis (Z-axis) following to 2-axis circular interpolation control (X-axis and Y-axis). For applications that require the boring of deep, large holes, usually the helical interpolation of the three axes must be taken into consideration.

- Milling is done in a circle, with the X and Y axes synchronized to achieve the pre-set size.
- The depth of the hole is simultaneously controlled along the Z axis, ensuring minimal deviation in the cutting bit position.
**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 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.

![Diagram of Target position change function](image)

**Block start**

The block-start executes multiple sequential positioning data set as block start data by a single start trigger, and is used in control that follows the same repetitive path.

![Diagram of Block start](image)

**Setting example of block start data**

<table>
<thead>
<tr>
<th>Block start data</th>
<th>Operation pattern</th>
<th>Start data No.</th>
<th>Special start instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First point</td>
<td>1: Continue</td>
<td>1</td>
<td>0: Block start</td>
<td>Move to P1</td>
</tr>
<tr>
<td>Second point</td>
<td>1: Continue</td>
<td>21</td>
<td>0: Block start</td>
<td>Draw a squircle (P1 to P1).</td>
</tr>
<tr>
<td>Third point</td>
<td>1: Continue</td>
<td>2</td>
<td>0: Block start</td>
<td>Move to P2</td>
</tr>
<tr>
<td>Fourth point</td>
<td>1: Continue</td>
<td>21</td>
<td>0: Block start</td>
<td>Draw a squircle (P2 to P2).</td>
</tr>
<tr>
<td>Eighth point</td>
<td>0: End</td>
<td>21</td>
<td>0: Block start</td>
<td>Draw a squircle (P4 to P4).</td>
</tr>
</tbody>
</table>
The advanced synchronous control is software-based synchronous control as an alternative to mechanical control, such as gear, shaft, clutch, speed change gear and cam. In addition, cam control becomes even easier with cam auto-generation function. The synchronous control can be flexibly started/ended for each axis, allowing the synchronous control axis and positioning control axis to be used within the same program.

### Advanced Synchronous Control

All axes are synchronized using a synchronous encoder axis or a servo input axis.

**Application examples**

- Packaging machines, printing machines, diaper manufacturing machines, tire molder
- Tandem configuration

Only two axes are in synchronization. The other axes are in positioning control.

#### Module configuration of synchronous control

The whole module configuration of the advanced synchronous control can be displayed in one screen, and monitoring of the target modules can be also viewed, which enables more efficient debugging.

- All the output axes that are connected to the main shaft main input axes modules can be displayed in the monitoring screen.
- Monitoring of each module can be performed, and parameter settings can also be made.
- Synchronous control is easily achieved just by setting parameters.
- Monitoring of the selected module can be performed.

- Double click the module to open the parameter setting screen.

---

**Outline**

- Simple Motion Modules
- Motion Controllers
- Sensing Modules
- Engineering Environment
- Networks
- Servo Amplifiers

**SERVO SYSTEM CONTROLLER**

---

46
**Input axis module**

A command generation axis, a servo input axis under control, or a synchronous encoder axis, can be set as an input axis module for synchronous control according to your application.

When the command generation axis is set as the input axis module, servo amplifiers can be connected for the number of control axes.

[Command generation axis]

The 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)

**When the servo input axis is set**

The master axis (Axis 1) of tandem operation is set as the input axis module of the synchronous control axis (Axis 2). Axis 2 is synchronously operated with Axis 1 by the commands given to Axis 1.

**When the synchronous encoder axis is set**

When the synchronous encoder axis is set as the input axis module, one packaging line can be synchronized with another line to achieve the integrated automation of a packaging machine.

**Clutch**

The clutch is a module that transmits command pulses from the main shaft or the auxiliary shaft to an output axis module. There are two ways of controlling a clutch: “ON control mode” or “OFF control mode”, which allow you to set the specific conditions to the starting and stopping of an axis.

[Time Chart]

<table>
<thead>
<tr>
<th>Clutch ON control mode</th>
<th>Clutch OFF control mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>No clutch</td>
<td>OFF control invalid</td>
</tr>
<tr>
<td>Clutch command ON/OFF</td>
<td>One-shot OFF</td>
</tr>
<tr>
<td>Clutch command leading edge</td>
<td>Clutch command leading edge</td>
</tr>
<tr>
<td>Clutch command trailing edge</td>
<td>Clutch command trailing edge</td>
</tr>
<tr>
<td>Address mode</td>
<td>Address mode</td>
</tr>
<tr>
<td>High speed input request</td>
<td>High speed input request</td>
</tr>
</tbody>
</table>
Cam functions

The output axis for synchronous control is operated with a cam. The following three operations can be performed with the cam functions: Linear operation, Two-way operation, and Feed operation; therefore any of the three can be selected to suit your application.

<table>
<thead>
<tr>
<th>Linear operation</th>
<th>Two-way operation</th>
<th>Feed operation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Linear operation in a cycle" /></td>
<td><img src="image2" alt="Reciprocating operation with a constant cam strokes range" /></td>
<td><img src="image3" alt="Cam reference position updated every cycle" /></td>
</tr>
</tbody>
</table>

Cam pattern creation

A wide variety of cam patterns can be easily created with GX Works3.

- Cam data can be created more freely and flexibly.
- Click the graph and drag it, which causes the waveform to automatically change according to the pointer’s movement.
- Stroke, speed, acceleration, and acceleration jerk can be set while checking graph change.
- Cam data can be imported and exported in CSV format.

Cam auto-generation

Cam data for a rotary knife can be automatically generated by parameter settings of sheet length, synchronization width, cam resolution, etc.

- Cam data can be imported and exported in CSV format.
- The created cam data are easily viewed as thumbnails.
- The screen for cam data creation opens by double-clicking the cam data to be edited.
In case that the synchronous position becomes misaligned after an emergency stop, etc., a new synchronous position is calculated from each axis position to restore the misalignment, and then the synchronous control can be restarted at the specified position based on the calculation.

1. In synchronous control analysis mode, the cam axis current feed value of each output axis (axis1. 2, 3) is updated based on the cam axis current value per cycle of input axis.

2. The output axes perform positioning based on those updated current feed values.

3. Turn OFF the synchronous control analysis mode, and turn ON the axes to perform synchronous control.
Speed control follows speed commands to keep speed constant, and torque control follows torque commands to keep torque constant. The Simple Motion module can be used for tension control, such as unwinding or rewinding. Positioning using absolute position coordinates can be smoothly performed even after switching back to position control because the current position is controlled during the speed-torque control.

**Speed-torque Control**

Speed-torque control (Tightening & press-fit control)

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

The actual position of the servo motor can be obtained based on the inputs from the sensor that detects the registration marks printed on the high-speed moving film. By compensating the rotary knife axis position errors based on those inputs from the sensor, the film can be cut at the constant cutting position.

Capture the current feed value, etc. with the mark sensor ON. (Mark Detection Function)

Calculate the compensation amount from the current feed value.

Start the auxiliary axis to compensate the error by adjusting the rotary knife.

Monitoring of Servo Data

Servo operation can be monitored with extensive monitor data (selectable from up to 50 items). The monitor items can be flexibly changed during operation. The operation status of servo amplifiers and servo motors (including partner products) acquired via CC-Link IE Field Network and SSCNET III/H is transferred and displayed on the host system or on the GOT screen created by a customer.

[Monitoring and data collection]
- Alarm history of servo amplifiers (Note)
- Power consumption, 7-segment LED display status (Note)
- Identification information of servo amplifiers and servo motors (Note)
- Load ratio of servo motors, Speed, Temperature of various parts, etc.

[Preventive maintenance]
- Inrush relay ON/OFF number (Note)
- Power ON cumulative time (Note)
- Machine diagnosis information (Note) (the estimated friction value and the estimated vibration value), etc.

(Note): Available only with RD77GF
**Driver Communication Function**

The driver communication function of the servo amplifiers enables the master axis to transmit its torque data to the following axes, and the servo motors of the following axes are driven on the basis of the transmitted torque data.

**Multi-Axis Adjustment Function**

The multi-axis adjustment function enables simpler servo adjustment and quicker startup for machines executing multi-axis simultaneous operation, such as a tandem configuration.

- Multi-axis simultaneous JOG operation by specifying speed and acceleration/deceleration time
- Multi-axis simultaneous positioning
- Multi-axis simultaneous tuning by the same settings
By wiring to MR-D30 functional safety unit (Note-1)

Safety level is Category 4 PL e, SIL 3 when the safety signals are inputted directly to MR-D30 functional safety unit. The safety observation function is operated on the MR-D30 by parameter setting, and therefore expansion of the safety observation function is possible independent of controllers.

<table>
<thead>
<tr>
<th>IEC/EN 61800-5-2:2007 function</th>
<th>Safety level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STO (Safe torque off)</td>
<td>Category 4 PL e, SIL 3</td>
</tr>
<tr>
<td>SS1 (Safe stop 1)</td>
<td></td>
</tr>
<tr>
<td>SS2 (Safe stop 2) (Note-2)</td>
<td></td>
</tr>
<tr>
<td>SOS (Safe operating stop)</td>
<td></td>
</tr>
<tr>
<td>SLS (Safety-limited speed)</td>
<td></td>
</tr>
<tr>
<td>SBC (Safe brake control)</td>
<td></td>
</tr>
<tr>
<td>SSM (Safe speed monitor)</td>
<td></td>
</tr>
</tbody>
</table>

(Note-1): Requires modules which support the functional safety. Refer to relevant manuals or catalogs for details.
(Note-2): Requires the use of a servo motor with functional safety.
(Note-3): Safety level is Category 3 PL d, SIL 2 when the servo motor with functional safety is not used.

By CC-Link IE Field Network (Note-1)

Safety signals are monitored by a combination of the safety CPU and RD77GF Simple Motion module. The safety CPU checks the safety signals received via the safety remote I/O module and outputs the safety signals (STO, etc.) to the servo amplifiers. Since the safety signals are outputted through CC-Link IE Field Network, wiring of the safety signals to each functional safety unit are not necessary.

<table>
<thead>
<tr>
<th>IEC/EN 61800-5-2:2007 function</th>
<th>Safety level</th>
</tr>
</thead>
<tbody>
<tr>
<td>STO (Safe torque off)</td>
<td>Category 4 PL e, SIL 3</td>
</tr>
<tr>
<td>SS1 (Safe stop 1)</td>
<td></td>
</tr>
<tr>
<td>SS2 (Safe stop 2) (Note-2)</td>
<td></td>
</tr>
<tr>
<td>SOS (Safe operating stop)</td>
<td></td>
</tr>
<tr>
<td>SLS (Safety-limited speed)</td>
<td></td>
</tr>
<tr>
<td>SBC (Safe brake control)</td>
<td></td>
</tr>
<tr>
<td>SSM (Safe speed monitor)</td>
<td></td>
</tr>
</tbody>
</table>

(Note-1): Requires modules which support the functional safety. Refer to relevant manuals or catalogs for details.
(Note-2): Requires the use of a servo motor with functional safety.
(Note-3): Safety level is Category 3 PL d, SIL 2 when the servo motor with functional safety is not used.
Safety level is Category 4 PL e, SIL 3 when the safety signals are inputted directly to MR-D30 functional safety unit.

The safety observation function is operated on the MR-D30 by parameter setting, and therefore expansion of the safety observation function is possible independent of controllers.

Functional Safety Productivity

Achieving Category 4 PL e, SIL 3

Safety signals are monitored by a combination of the safety CPU and RD77GF Simple Motion module. The safety CPU checks the safety signals received via the safety remote I/O module and outputs the safety signals (STO, etc.) to the servo amplifiers.

Since the safety signals are outputted through CC-Link IE Field Network, wiring of the safety signals to each functional safety unit are not necessary.

- By wiring to MR-D30 functional safety unit (Note-1)
- By CC-Link IE Field Network (Note-1)

The MR-MV200 optical hub unit can branch a single SSCNET III/H network line in three separate directions. This enables distribution of the SSCNET III/H compatible devices with flexible wiring arrangement. In addition, the distributed amplifier can be partly OFF for maintenance without stopping the whole system; thus, the machine availability can be improved.

- The SSCNET connect/disconnect function of the controller allows you to power off only the desired servo amplifiers.
- The optical hub unit is introduced just by making some changes in wiring without making any new settings.
- Longer-distance wiring becomes available by using the optical hub unit.

[System configuration example]

![System configuration example diagram]

(Note): Confirm that "SSCNET III/H" is selected in the system setting when using the optical hub unit.
## Various Functions

### JOG operation

While the JOG start signal is ON, the workpiece moves in the designated direction.

JOG operation can be executed without completing home position return.

### Home position return methods

Five types of home position return methods, the retry function and the shift function are available to establish a home position used as the machine reference point. Select any of these home position return methods that suits your machine type.

### Motion profile table operation

The operation is executed by the motion profile table method, in which position data and feed speed are set. Once the start signal is turned ON, the set commands are executed sequentially from the start point to the end point.

### Stop operation functions

Forced stop, axis stop, and forced stop for servo amplifiers are available. Utilize these stop operation functions based on your application.

### Stroke limit functions

This function is used to establish the physical movable range for a machine. The hardware stroke limit function and the software stroke limit function are available.

### Unlimited length feed

Unlimited length feed is performed by disabling the stroke limit function. This function is used for a rotary table, a belt conveyor, etc.

### Absolute position system

This function restores the absolute position of the designated axis. Once the home position return is executed at the start of the system, it is unnecessary to perform the home position return again when the power is turned ON next time.

### Amplifier-less operation

This function executes the positioning control by the Simple Motion module without connecting to servo amplifiers, thus enabling debugging of a user program and simulation of positioning operation on a personal computer.

### Step function

This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation is stopped at each of "automatic deceleration" or "positioning data".

### Skip function

This function stops the positioning being executed when the skip signal is inputted, and executes the next positioning. It is used for measurement with a sensor.

### M-code output function

This function issues commands for sub works corresponding to the M-code No. 0 to 65535 that is set for each positioning data. The commands are used for clamp or drill stop, tool change, etc.

### Execution data backup function

This function stores the "setting data", currently being executed, into the flash ROM/internal memory without a battery. The command for this function is executed on MELSOFT GX Works3 or a sequence program.

### External I/O signal logic switching function

This function switches I/O signal logic according to devices connected to the Simple Motion module, etc.

### External input signal setting function

This function allows you to set the input type, the input terminal, and the input filter for each external input signal (the upper/lower limit signal, the proximity dog signal, and the stop signal).
While the JOG start signal is ON, the workpiece moves in the designated direction. JOG operation can be executed without completing home position return.

**Home position return methods**

Five types of home position return methods, the retry function and the shift function are available to establish a home position used as the machine reference point. Select any of these home position return methods that suits your machine type.

**Motion profile table operation**

The operation is executed by the motion profile table method, in which position data and feed speed are set. Once the start signal is turned ON, the set commands are executed sequentially from the start point to the end point.

**Stroke limit functions**

This function is used to establish the physical movable range for a machine. The hardware stroke limit function and the software stroke limit function are available.

**Absolute position system**

This function restores the absolute position of the designated axis. Once the home position return is executed at the start of the system, it is unnecessary to perform the home position return again when the power is turned ON next time.

**Step function**

This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation is stopped at each of "automatic deceleration" or "positioning data".

**M-code output function**

This function issues commands for sub works corresponding to the M-code No. 0 to 65535 that is set for each positioning data. The commands are used for clamp or drill stop, tool change, etc.

**External input signal setting function**

This function allows you to set the input type, the input terminal, and the input filter for each external input signal (the upper/lower limit signal, the proximity dog signal, and the stop signal).

**Stop operation functions**

Forced stop, axis stop, and forced stop for servo amplifiers are available. Utilize these stop operation functions based on your application.

**Unlimited length feed**

This function performs unlimited length feed by disabling the stroke limit function. This function is used for a rotary table, a belt conveyor, etc.

**Amplifier-less operation**

This function executes the positioning control by the Simple Motion module without connecting to servo amplifiers, thus enabling debugging of a user program and simulation of positioning operation on a personal computer.

**Skip function**

This function stops the positioning being executed when the skip signal is inputted, and executes the next positioning. It is used for measurement with a sensor.

**Execution data backup function**

This function stores the "setting data", currently being executed, into the flash ROM/internal memory without a battery. The command for this function is executed on MELSOFT GX Works3 or a sequence program.

**External I/O signal logic switching function**

This function switches I/O signal logic according to devices connected to the Simple Motion module, etc.
## Control specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
<th>MELSEC iQ-R series</th>
<th>MELSEC iQ-F series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of control axes (Virtual servo amplifier axis included)</td>
<td></td>
<td>RD77GF32</td>
<td>RD77GF16</td>
</tr>
<tr>
<td></td>
<td>32 axes</td>
<td>16 axes</td>
<td>8 axes</td>
</tr>
<tr>
<td>Interpolation function</td>
<td>Linear interpolation (Up to 4 axes), Circular interpolation (2 axes), Helical interpolation (3 axes)</td>
<td>0.5, 1.0, 2.0, 4.0</td>
<td>0.444, 0.888, 1.777, 3.555</td>
</tr>
<tr>
<td>Control modes</td>
<td>Positioning control, Path control (Linear, arc, and helical), Speed control, Speed-torque control, Tightening &amp; press-fit control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceleration/deceleration process</td>
<td>Trapezoidal acceleration/deceleration, B-curve acceleration/deceleration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensation function</td>
<td>Backlash compensation, Electronic gear, Near pass function</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synchronous control</td>
<td>Synchronous encoder input, Cam, Phase compensation, Cam auto-generation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control unit</td>
<td>mm, inch, degree, pulse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of positioning data</td>
<td>600 data (positioning data No. 1 to 600)/axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backup</td>
<td>Parameters, positioning data, and block start data can be saved on flash ROM (battery-less backup)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home position return</td>
<td>Driver home position return method (Note-4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast home position return control</td>
<td>Provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-functions</td>
<td>(using sub-function of servo amplifier)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positioning control</td>
<td>Home position return method</td>
<td>Driver home position return method (Note-4)</td>
<td></td>
</tr>
<tr>
<td>Linear control</td>
<td>Linear interpolation (Up to 4 axes)</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Fixed-pitch feed</td>
<td>Fixed-pitch feed control (Up to 4 axes)</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>2-axis circular interpolation</td>
<td>Auxiliary point-specified circular interpolation</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Speed control</td>
<td>Speed control (Up to 4 axes)</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Speed-position switching</td>
<td>INC mode, ABS mode</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Position-speed switching</td>
<td>INC mode</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Current value change</td>
<td>Positioning data, current value changing start No.</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>NOP instruction</td>
<td></td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>JUMP instruction</td>
<td>Unconditional JUMP, Conditional JUMP</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>LOOP, LEND</td>
<td>Provided</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>High-level positioning</td>
<td>Block start, Condition start, Wait start, Simultaneous start, Repeated start</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Manual control</td>
<td>JOG operation</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Inching operation</td>
<td>Provided</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Manual pulse generator</td>
<td>Possible to connect 1 module (Incremental), Unit magnification (1 to 10000 times)</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Linear</td>
<td>Via internal interface</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Speed-torque</td>
<td>Speed control without positioning loops, Torque control, Tightening &amp; press-fit control (Note-4)</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Absolute position system</td>
<td>Made compatible by setting a battery to a servo amplifier</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Synchronous encoder interface</td>
<td>32CH</td>
<td>16CH</td>
<td>8CH</td>
</tr>
<tr>
<td>Internal interface</td>
<td>Provided (Incremental)</td>
<td>Provided (Incremental)</td>
<td>Provided</td>
</tr>
<tr>
<td>Via CPU (buffer memory)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Link device</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Via servo amplifier</td>
<td>32CH</td>
<td>16CH</td>
<td>8CH</td>
</tr>
<tr>
<td>Functions that limit control</td>
<td>Speed limit</td>
<td>Speed limit value, JOG speed limit value</td>
<td>Provided</td>
</tr>
<tr>
<td>Torque limit</td>
<td>Torque limit value same setting, torque limit value individual setting</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Forced stop</td>
<td>Valid/Invalid setting</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Hardware stroke limit</td>
<td>Movable range check with current feed value, movable range check with machine feed value</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Functions that change control details</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Override</td>
<td>0 to 300 [%]</td>
<td>1 to 300 [%]</td>
<td>Provided</td>
</tr>
<tr>
<td>Acceleration/deceleration time change</td>
<td>Provided</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Target position change</td>
<td>Target position address and speed are changeable</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>M-code output</td>
<td>WITH mode/AFTER mode</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Step function</td>
<td>Deceleration unit step, Data No. unit step</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Skip function</td>
<td>Via PLC CPU, Via external command signal</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Teaching function</td>
<td>Provided</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Other functions</td>
<td>Parameter initialization function</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>External input signal setting function</td>
<td>Internal interface</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Via CPU (buffer memory)</td>
<td>Provided (Incremental)</td>
<td>Provided (Incremental)</td>
<td>Provided</td>
</tr>
<tr>
<td>Link device</td>
<td>Provided (Incremental)</td>
<td>Provided (Incremental)</td>
<td>Provided</td>
</tr>
<tr>
<td>Via servo amplifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event history function</td>
<td>Provided</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Amplifier-less operation function</td>
<td>Provided</td>
<td>Provided</td>
<td>Provided</td>
</tr>
<tr>
<td>Mark detection function</td>
<td>Mark detection signal</td>
<td>Up to 32 points (Note-6)</td>
<td>Up to 16 points (Note-6)</td>
</tr>
<tr>
<td>Mark detection setting</td>
<td>Up to 32 settings</td>
<td>Up to 16 settings</td>
<td>Up to 16 settings</td>
</tr>
</tbody>
</table>
### Synchronous control specification (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MELSEC iQ-R series</td>
</tr>
<tr>
<td></td>
<td>RD77GF32</td>
</tr>
<tr>
<td>Functions that monitor servo data</td>
<td>Optional data monitor</td>
</tr>
<tr>
<td></td>
<td>Servo cyclic transmission</td>
</tr>
<tr>
<td></td>
<td>Servo transient transmission</td>
</tr>
<tr>
<td>Driver communication function</td>
<td>—</td>
</tr>
<tr>
<td>SSCNET connect/disconnect function</td>
<td>—</td>
</tr>
<tr>
<td>Digital oscilloscope function (byte)</td>
<td>Bit data</td>
</tr>
<tr>
<td></td>
<td>Word data</td>
</tr>
</tbody>
</table>

**Note:**
- (Note-1): Available only with RD77GF and RD77MS.
- (Note-2): Available only with RD77MS and FX5-80SSC-S/FX5-40SSC-S.
- (Note-3): The home position return method set in a driver (a servo amplifier) is used.
- (Note-4): 4-axis linear interpolation control is enabled only at the reference axis speed.
- (Note-5): The Mitsubishi Electric remote I/O module is required.
- (Note-6): 8CH word data and 8CH bit data can be displayed in real time.

### Synchronous control specification

#### Synchronous control

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of settable axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo input axis</td>
<td>32 axes/module</td>
</tr>
<tr>
<td></td>
<td>16 axes/module</td>
</tr>
<tr>
<td></td>
<td>8 axes/module</td>
</tr>
<tr>
<td>Synchronous encoder input axis</td>
<td>32 axes/module</td>
</tr>
<tr>
<td></td>
<td>16 axes/module</td>
</tr>
<tr>
<td></td>
<td>8 axes/module</td>
</tr>
<tr>
<td></td>
<td>4 axes/module</td>
</tr>
<tr>
<td>Composite main shaft gear</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Main shaft main input axis</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Main shaft sub input axis</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Main shaft gear</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Main shaft clutch</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Auxiliary shaft</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Auxiliary shaft gear</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Composite auxiliary shaft gear</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Speed change gear</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Output axis (Cam axis)</td>
<td>32 axes/module</td>
</tr>
<tr>
<td></td>
<td>16 axes/module</td>
</tr>
<tr>
<td></td>
<td>8 axes/module</td>
</tr>
<tr>
<td></td>
<td>4 axes/module</td>
</tr>
<tr>
<td></td>
<td>16 axes/module</td>
</tr>
<tr>
<td></td>
<td>8 axes/module</td>
</tr>
<tr>
<td></td>
<td>4 axes/module</td>
</tr>
<tr>
<td></td>
<td>2 axes/module</td>
</tr>
<tr>
<td></td>
<td>8 axes/module</td>
</tr>
</tbody>
</table>

#### Cam control

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MELSEC iQ-R series</td>
</tr>
<tr>
<td></td>
<td>RD77GF32</td>
</tr>
<tr>
<td>Memory capacity</td>
<td>Cam storage area</td>
</tr>
<tr>
<td></td>
<td>Cam working area</td>
</tr>
<tr>
<td>Number of registration</td>
<td>Up to 1024</td>
</tr>
<tr>
<td>Comment</td>
<td>Up to 256</td>
</tr>
</tbody>
</table>

**Cam data**

<table>
<thead>
<tr>
<th>Stroke ratio type</th>
<th>Maximum number of cam registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cam resolution</td>
<td>256</td>
</tr>
<tr>
<td>RD77GF</td>
<td>1024</td>
</tr>
<tr>
<td>RD77MS</td>
<td>256</td>
</tr>
<tr>
<td>FX5-40SSC-S</td>
<td>64</td>
</tr>
<tr>
<td>FX5-80SSC-S</td>
<td>128</td>
</tr>
</tbody>
</table>

**Stroke ratio**

<table>
<thead>
<tr>
<th>Coordinate data type</th>
<th>Maximum number of cam registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cam resolution</td>
<td>128</td>
</tr>
<tr>
<td>RD77GF</td>
<td>1024</td>
</tr>
<tr>
<td>RD77MS</td>
<td>256</td>
</tr>
<tr>
<td>FX5-40SSC-S</td>
<td>64</td>
</tr>
<tr>
<td>FX5-80SSC-S</td>
<td>128</td>
</tr>
</tbody>
</table>

**Cam auto-generation**

- Cam for rotary knife
- Easy stroke ratio cam
- Advanced stroke ratio cam
- Cam for rotary knife
Module specification

Simple Motion module RD77MS16/RD77MS8/RD77MS4/RD77MS2

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of control axes</strong>&lt;br&gt;(Virtual servo amplifier axis included)</td>
<td>Up to 16 axes&lt;br&gt;Up to 8 axes&lt;br&gt;Up to 4 axes&lt;br&gt;Up to 2 axes</td>
</tr>
<tr>
<td><strong>Servo amplifier connection method</strong></td>
<td>SSCNET III/H</td>
</tr>
<tr>
<td><strong>Maximum overall cable distance [m(ft.)]</strong></td>
<td>1600 (5249.34)</td>
</tr>
<tr>
<td><strong>Maximum distance between stations [m(ft.)]</strong></td>
<td>100 (328.08)</td>
</tr>
<tr>
<td><strong>Peripheral IF</strong></td>
<td>Via CPU module (USB, Ethernet)</td>
</tr>
<tr>
<td><strong>Manual pulse generator operation function</strong></td>
<td>Possible to connect 1 module</td>
</tr>
<tr>
<td><strong>Synchronous encoder operation function</strong></td>
<td>Possible to connect 4 modules&lt;br&gt;(Total of the internal interface, via CPU interface, and servo amplifier interface)</td>
</tr>
</tbody>
</table>

### Input signals (SIN)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of input points</strong></td>
<td>20 points&lt;br&gt;10 points</td>
</tr>
<tr>
<td><strong>Input method</strong></td>
<td>Positive common/Negative common shared (Photocoupler isolation)</td>
</tr>
<tr>
<td><strong>Rated input/output voltage/current</strong>&lt;br&gt;(Virtual servo amplifier axis included)</td>
<td>24 VDC/Approx. 5 mA</td>
</tr>
<tr>
<td><strong>Operating voltage range</strong></td>
<td>19.2 to 26.4 VDC (24 VDC ±10% to ±20%, ripple ratio 5% or less)</td>
</tr>
<tr>
<td><strong>ON voltage/current</strong></td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td><strong>OFF voltage/current</strong></td>
<td>7 VDC or less/1.0 mA or less</td>
</tr>
<tr>
<td><strong>Input resistance</strong></td>
<td>Approx. 6.8 kΩ</td>
</tr>
<tr>
<td><strong>Response time</strong></td>
<td>1 ms or less (OFF→ON, ON→OFF)</td>
</tr>
<tr>
<td><strong>Recommended wire size</strong></td>
<td>AWG24 (0.2 mm²)</td>
</tr>
</tbody>
</table>

### Forced stop input signal (EMI)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of input points</strong></td>
<td>1 point</td>
</tr>
<tr>
<td><strong>Input method</strong></td>
<td>Positive common/Negative common shared (photocoupler isolation)</td>
</tr>
<tr>
<td><strong>Rated input/output voltage/current</strong>&lt;br&gt;(Virtual servo amplifier axis included)</td>
<td>24 VDC/Approx. 5 mA</td>
</tr>
<tr>
<td><strong>Operating voltage range</strong></td>
<td>19.2 to 26.4 VDC (24 VDC ±10% to ±20%, ripple ratio 5% or less)</td>
</tr>
<tr>
<td><strong>ON voltage/current</strong></td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td><strong>OFF voltage/current</strong></td>
<td>7 VDC or less/1.0 mA or less</td>
</tr>
<tr>
<td><strong>Input resistance</strong></td>
<td>Approx. 6.8 kΩ</td>
</tr>
<tr>
<td><strong>Response time</strong></td>
<td>4 ms or less (OFF→ON, ON→OFF)</td>
</tr>
<tr>
<td><strong>Recommended wire size</strong></td>
<td>AWG24 (0.2 mm²)</td>
</tr>
</tbody>
</table>

### Signal input form

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input pulse frequency</strong>&lt;br&gt;(After magnification by 4, up to 4 MPulse/s)</td>
<td>Up to 1 MPulse/s&lt;br&gt;Up to 4 MPulse/s</td>
</tr>
<tr>
<td><strong>Pulse width</strong>&lt;br&gt;(After magnification by 4, up to 4 MPulse/s)</td>
<td>1 μs or more&lt;br&gt;0.25 μs or less</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>0.25 μs or more&lt;br&gt;0.25 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>5.5 VDC or less&lt;br&gt;0.02 V</td>
</tr>
<tr>
<td><strong>Differential voltage</strong></td>
<td>2.0 to 5.25 VDC/0 to 0.8 VDC&lt;br&gt;±0.2V</td>
</tr>
<tr>
<td><strong>Input pulse frequency</strong>&lt;br&gt;(After magnification by 4, up to 800 kPulse/s)</td>
<td>Up to 200 kPulse/s&lt;br&gt;Up to 800 kPulse/s</td>
</tr>
<tr>
<td><strong>Pulse width</strong>&lt;br&gt;(After magnification by 4, up to 800 kPulse/s)</td>
<td>5 μs or more&lt;br&gt;1.2 μs or less</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>1.2 μs or more&lt;br&gt;1.2 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>5.5 VDC or less&lt;br&gt;0.02 V</td>
</tr>
<tr>
<td><strong>High/Low-voltage</strong></td>
<td>3.0 to 5.25 VDC/0 mA or less, 0 to 1.0 VDC/5 mA or more&lt;br&gt;8.0 to 1.2 V</td>
</tr>
<tr>
<td><strong>Input pulse frequency</strong>&lt;br&gt;(After magnification by 4, up to 800 kPulse/s)</td>
<td>Up to 800 kPulse/s&lt;br&gt;Up to 800 kPulse/s</td>
</tr>
<tr>
<td><strong>Pulse width</strong></td>
<td>1 μs or more&lt;br&gt;0.25 μs or less</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>0.25 μs or less&lt;br&gt;0.25 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>5.5 VDC or less&lt;br&gt;0.02 V</td>
</tr>
<tr>
<td><strong>High/Low-voltage</strong></td>
<td>3.0 to 5.25 VDC/0 mA or less, 0 to 1.0 VDC/5 mA or more&lt;br&gt;8.0 to 1.2 V</td>
</tr>
</tbody>
</table>

### Manual pulse generator/Incremental synchronous encoder signal

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input pulse frequency</strong>&lt;br&gt;(After magnification by 4, up to 4 MPulse/s)</td>
<td>Up to 1 MPulse/s&lt;br&gt;Up to 4 MPulse/s</td>
</tr>
<tr>
<td><strong>Pulse width</strong>&lt;br&gt;(After magnification by 4, up to 4 MPulse/s)</td>
<td>1 μs or more&lt;br&gt;0.25 μs or less</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>0.25 μs or less&lt;br&gt;0.25 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>5.5 VDC or less&lt;br&gt;0.02 V</td>
</tr>
<tr>
<td><strong>Differential voltage</strong></td>
<td>2.0 to 5.25 VDC/0 to 0.8 VDC&lt;br&gt;±0.2V</td>
</tr>
<tr>
<td><strong>Input pulse frequency</strong>&lt;br&gt;(After magnification by 4, up to 800 kPulse/s)</td>
<td>Up to 200 kPulse/s&lt;br&gt;Up to 800 kPulse/s</td>
</tr>
<tr>
<td><strong>Pulse width</strong>&lt;br&gt;(After magnification by 4, up to 800 kPulse/s)</td>
<td>5 μs or more&lt;br&gt;1.2 μs or less</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>1.2 μs or less&lt;br&gt;1.2 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>5.5 VDC or less&lt;br&gt;0.02 V</td>
</tr>
<tr>
<td><strong>High/Low-voltage</strong></td>
<td>3.0 to 5.25 VDC/0 mA or less, 0 to 1.0 VDC/5 mA or more&lt;br&gt;8.0 to 1.2 V</td>
</tr>
</tbody>
</table>

### Voltage-output/Open-collector type (5 VDC)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input pulse frequency</strong>&lt;br&gt;(After magnification by 4, up to 800 kPulse/s)</td>
<td>Up to 200 kPulse/s&lt;br&gt;Up to 800 kPulse/s</td>
</tr>
<tr>
<td><strong>Pulse width</strong>&lt;br&gt;(After magnification by 4, up to 800 kPulse/s)</td>
<td>5 μs or more&lt;br&gt;1.2 μs or less</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>1.2 μs or less&lt;br&gt;1.2 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>5.5 VDC or less&lt;br&gt;0.02 V</td>
</tr>
<tr>
<td><strong>High/Low-voltage</strong></td>
<td>3.0 to 5.25 VDC/0 mA or less, 0 to 1.0 VDC/5 mA or more&lt;br&gt;8.0 to 1.2 V</td>
</tr>
</tbody>
</table>
| **Cable length** | Up to 10 meters (32.81 ft.)
| **Number of I/O occupying points** | 32 points<br>(I/O allocation: Intelligent function module, 32 points) |
| **Number of module occupying slots** | 1 |
| **5 VDC internal current consumption [A]** | 0.23<br>1.0 |
| **Mass [kg]** | 0.22 |
| **Exterior dimensions [mm(inch)]** | 106.0(4.17) (H) × 27.8(1.09) (W) × 110.0(4.33) (D) |

### Applicable CPU

**PLC CPU module**

R00CPU, R01CPU, R02CPU, R04CPU, R08CPU, R16CPU, R32CPU, R120CPU, R04ENCPU, R08ENCPU, R16ENCPU, R32ENCPU, R120ENCPU, R08FCPU, R16FCPU, R32FCPU, R120FCPU, R08SFCPU-SET, R16SFCPU-SET, R32SFCPU-SET, R120SFCPU-SET, R12CCPU-V

Depending on the combination of the modules, there are restrictions on the firmware version of the PLC CPU module. Refer to “MELSEC iQ-R Module Configuration Manual” for details.
### Simple Motion module FX5-80SSC-S/FX5-40SSC-S

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of control axes</strong> (Virtual servo amplifier axis included (Note-1))</td>
<td>Up to 8 axes</td>
</tr>
<tr>
<td><strong>Servo amplifier connection method</strong></td>
<td>SSCNET III/H</td>
</tr>
<tr>
<td><strong>Maximum overall cable distance [m(ft.)]</strong></td>
<td>800 (2624.67)</td>
</tr>
<tr>
<td><strong>Maximum distance between stations [m(ft.)]</strong></td>
<td>100 (328.08)</td>
</tr>
<tr>
<td><strong>Peripheral I/F</strong></td>
<td>Via CPU module (Ethernet)</td>
</tr>
<tr>
<td><strong>Manual pulse generator operation function</strong></td>
<td>Possible to connect 1 module</td>
</tr>
<tr>
<td><strong>Synchronous encoder operation function</strong></td>
<td>Possible to connect 4 modules (Total of the internal interface, via CPU interface, and servo amplifier interface)</td>
</tr>
</tbody>
</table>

#### Input signals (DI)

<table>
<thead>
<tr>
<th>Number of input points</th>
<th>4 points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input method</strong></td>
<td>Positive common/Negative common shared (photocoupler isolation)</td>
</tr>
<tr>
<td><strong>Rated input voltage/current</strong></td>
<td>24 VDC/Approx. 5 mA</td>
</tr>
<tr>
<td><strong>Operating voltage range</strong></td>
<td>19.2 to 26.4 VDC (24 VDC +10%−20%, ripple ratio 5% or less)</td>
</tr>
<tr>
<td><strong>ON voltage/current</strong></td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td><strong>OFF voltage/current</strong></td>
<td>7 VDC or less/1.0 mA or less</td>
</tr>
<tr>
<td><strong>Input resistance</strong></td>
<td>Approx. 6.8 kΩ</td>
</tr>
<tr>
<td><strong>Response time</strong></td>
<td>1 ms or less (OFF→ON, ON→OFF)</td>
</tr>
<tr>
<td><strong>Recommended wire size</strong></td>
<td>AWG24 (0.2 mm²)</td>
</tr>
</tbody>
</table>

#### Forced stop input signal (EM)

<table>
<thead>
<tr>
<th>Number of input points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input method</strong></td>
<td>Positive common/Negative common shared (Photocoupler isolation)</td>
</tr>
<tr>
<td><strong>Rated input voltage/current</strong></td>
<td>24 VDC/Approx. 5 mA</td>
</tr>
<tr>
<td><strong>Operating voltage range</strong></td>
<td>19.2 to 26.4 VDC (24 VDC +10%−20%, ripple ratio 5% or less)</td>
</tr>
<tr>
<td><strong>ON voltage/current</strong></td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td><strong>OFF voltage/current</strong></td>
<td>7 VDC or less/1.0 mA or less</td>
</tr>
<tr>
<td><strong>Input resistance</strong></td>
<td>Approx. 6.8 kΩ</td>
</tr>
<tr>
<td><strong>Response time</strong></td>
<td>4 ms or less (OFF→ON, ON→OFF)</td>
</tr>
<tr>
<td><strong>Recommended wire size</strong></td>
<td>AWG24 (0.2 mm²)</td>
</tr>
</tbody>
</table>

#### Manual pulse generator/Incremental synchronous encoder signal

<table>
<thead>
<tr>
<th>Input pulse frequency</th>
<th>Up to 1 Mpulse/s (After magnification by 4, up to 4 Mpulse/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse width</strong></td>
<td>1 μs or more</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>0.25 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>0.25 μs or more</td>
</tr>
<tr>
<td><strong>Rated input voltage</strong></td>
<td>5.5 VDC or less</td>
</tr>
<tr>
<td><strong>High/Low-voltage</strong></td>
<td>2.0 to 5.25 VDC/0.8 VDC</td>
</tr>
<tr>
<td><strong>Differential voltage</strong></td>
<td>±0.2V</td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>Up to 30 m (98.43 ft.)</td>
</tr>
</tbody>
</table>

#### Voltage-output/Open-collector type (5 VDC)

<table>
<thead>
<tr>
<th>Input pulse frequency</th>
<th>Up to 200 kpulse/s (After magnification by 4, up to 800 kpulse/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse width</strong></td>
<td>5 μs or more</td>
</tr>
<tr>
<td><strong>Leading edge/trailing edge time</strong></td>
<td>1.2 μs or less</td>
</tr>
<tr>
<td><strong>Phase difference</strong></td>
<td>1.2 μs or more</td>
</tr>
<tr>
<td><strong>Rated input voltage</strong></td>
<td>5.5 VDC or less</td>
</tr>
<tr>
<td><strong>High/Low-voltage</strong></td>
<td>3.0 to 5.25 VDC/2 mA or less, 0 to 1.0 VDC/5 mA or more</td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>Up to 10m (32.81 ft.)</td>
</tr>
</tbody>
</table>

#### 24 VDC external current consumption [A]

| Mass [kg] | 0.30 |
| Exterior dimensions [mm(inch)] | 90.0 (3.55)(H) × 50.0 (1.97)(W) × 83.0 (3.27)(D) |

(Note-1): When the command generation axis is set as the input axis module, servo amplifiers can be connected for the number of control axes.

### Applicable CPU

| PLC CPU module | FX5U, FX5UC |

Refer to “MELSEC iQ-F FX5U User’s Manual (Hardware)” for details.
Simple Motion module RD77GF32/RD77GF16/RD77GF8/RD77GF4

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of control axes</strong> (Virtual servo amplifier axis included)</td>
<td>Up to 32 axes, Up to 16 axes, Up to 8 axes, Up to 4 axes</td>
</tr>
<tr>
<td><strong>Servo amplifier connection system</strong></td>
<td>CC-Link IE Field Network</td>
</tr>
<tr>
<td><strong>Maximum distance between stations [m(ft.)]</strong></td>
<td>100(328.08)</td>
</tr>
<tr>
<td><strong>Peripheral I/F</strong></td>
<td>Via CPU module (USB, Ethernet)</td>
</tr>
<tr>
<td><strong>Manual pulse generator operation function</strong></td>
<td>Possible to connect 1 module (Link device)</td>
</tr>
<tr>
<td><strong>Synchronous encoder operation</strong></td>
<td>32 modules, 16 modules, 8 modules, 4 modules</td>
</tr>
<tr>
<td><strong>Number of I/O occupying points</strong></td>
<td>32 points (I/O allocation: Intelligent function module, 32 points)</td>
</tr>
<tr>
<td><strong>Number of module occupied slots</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>5 VDC internal current consumption [A]</strong></td>
<td>1.1</td>
</tr>
<tr>
<td><strong>Mass [kg]</strong></td>
<td>0.23</td>
</tr>
<tr>
<td><strong>Exterior dimensions [mm(inch)]</strong></td>
<td>106.0(4.17) (H) × 27.8(1.09) (W) × 110.0(4.33) (D)</td>
</tr>
<tr>
<td><strong>Applicable CPU</strong></td>
<td>PLC CPU module</td>
</tr>
<tr>
<td></td>
<td>R00CPU, R01CPU, R02CPU, R04CPU, R08CPU, R16CPU, R32CPU, R120CPU, R04ENCPU, R08ENCPU, R16ENCPU, R020ENCPU, R120ENCPU, R08PCPU, R16PCPU, R32PCPU, R120PCPU, R08SFCPU-SET, R16SFCPU-SET, R32SFCPU-SET, R120SFCPU-SET</td>
</tr>
</tbody>
</table>

Performance specifications of CC-Link IE Field Network

<table>
<thead>
<tr>
<th>Item</th>
<th>MELSEC iQ-R series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum link points per network</strong></td>
<td></td>
</tr>
<tr>
<td>Master station</td>
<td>RX 16k points (16384 points, 2 kbytes)</td>
</tr>
<tr>
<td>RY 16k points (16384 points, 2 kbytes)</td>
<td></td>
</tr>
<tr>
<td>RW</td>
<td>8k points (8192 points, 16 kbytes)</td>
</tr>
<tr>
<td>RWw</td>
<td>8k points (8192 points, 16 kbytes)</td>
</tr>
<tr>
<td>Local station</td>
<td>RX 2k points (2048 points, 256 bytes)</td>
</tr>
<tr>
<td>RY 2k points (2048 points, 256 bytes)</td>
<td></td>
</tr>
<tr>
<td>RW</td>
<td>1k points (1024 points, 2 kbytes)</td>
</tr>
<tr>
<td>RWw</td>
<td>1k points (1024 points, 2 kbytes)</td>
</tr>
<tr>
<td>Intelligent device station</td>
<td>RX 2k points (2048 points, 256 bytes)</td>
</tr>
<tr>
<td>RY 2k points (2048 points, 256 bytes)</td>
<td></td>
</tr>
<tr>
<td>RW</td>
<td>1k points (1024 points, 2 kbytes)</td>
</tr>
<tr>
<td>RWw</td>
<td>1k points (1024 points, 2 kbytes)</td>
</tr>
<tr>
<td>Remote device station</td>
<td>RX 128 points, 16 bytes</td>
</tr>
<tr>
<td>RY 128 points, 16 bytes</td>
<td></td>
</tr>
<tr>
<td>RW 64 points, 128 bytes</td>
<td></td>
</tr>
<tr>
<td>RWw 64 points, 128 bytes</td>
<td></td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td>1 Gbps</td>
</tr>
<tr>
<td><strong>Communications speed</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum distance between stations [m(ft.)]</strong></td>
<td>100(328.08) (conforms to ANSI/TIA/EIA-568-(Category 5e))</td>
</tr>
<tr>
<td><strong>Topology</strong></td>
<td>Line, star, line/star mixed</td>
</tr>
<tr>
<td><strong>Maximum number of networks</strong></td>
<td>239</td>
</tr>
</tbody>
</table>

(Nota-1): Use the cables recommended by CC-Link Partner Association for CC-Link IE Field Network. CC-Link IE Controller Network cables are not compatible with CC-Link IE Field Network. (Nota-2): A switching hub is required for star topology.

Ethernet cable specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet cable</td>
<td>The cable must meet the following standards:</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ-45 connector with shield</td>
</tr>
</tbody>
</table>
Optical hub unit MR-MV200

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power supply</td>
<td>Input voltage [V] 21.6 to 26.4 V DC (24 V DC±10%)</td>
</tr>
<tr>
<td></td>
<td>Input current [A] 0.2</td>
</tr>
<tr>
<td>Consumption power [W]</td>
<td>4.8</td>
</tr>
<tr>
<td>Mass [kg]</td>
<td>0.2</td>
</tr>
<tr>
<td>Mounting method</td>
<td>Directly mounted to the control panel or with DIN rail</td>
</tr>
<tr>
<td>Cable length [m(ft.)]</td>
<td>Up to 100 (328.08)</td>
</tr>
<tr>
<td>Number of optical hub units</td>
<td>Up to 16 units/line</td>
</tr>
<tr>
<td>Number of servo amplifiers</td>
<td>Up to 16 axes/line</td>
</tr>
<tr>
<td>Exterior dimensions [mm(inch)]</td>
<td>168.0 (6.61) (H) × 30.0 (1.18) (W) × 100.0 (3.94) (D)</td>
</tr>
</tbody>
</table>

(Note-1): MR-J4-B, MR-J4W2-B, and MR-J4W3-B are 1-axis, 2-axis and 3-axis amplifiers, respectively.
Exterior Dimensions

**RD77MS16/RD77MS8/RD77MS4**

- Top of panel, wiring duct, or other components: 100mm (3.94inch) or more
- 80mm (3.15inch) or more
- 70mm (2.76inch) or more
- 50mm (1.97inch) or more
- 40mm (1.57inch) or more

**RD77MS2**

- Top of panel, wiring duct, or other components: 100mm (3.94inch) or more
- 80mm (3.15inch) or more
- 70mm (2.76inch) or more
- 50mm (1.97inch) or more

**RD77GF32/RD77G16/RD77GF8/RD77GF4**

- Top of panel, wiring duct, or other components: 100mm (3.94inch) or more
- 80mm (3.15inch) or more
- 70mm (2.76inch) or more
- 50mm (1.97inch) or more

**FX5-80SSC-S/FX5-40SSC-S**

- 2-φ4.5 Mounting hole
- 27.8 (1.09)mm
- 8 (0.32)mm

**MR-MV200**

- Center of DIN rail
- 98 (3.86)mm
- 110 (4.33)mm
- 106 (4.17)mm
- 27.8 (1.09)mm
- 83 (3.27)mm

[Note-1]: Provide clearance of 30mm (1.18inch) or more when the height of a wiring duct is 50mm (1.97inch) or less. In other cases, provide clearance of 40mm (1.57inch) or more.

[Note-2]: Provide clearance of 20mm (0.79inch) or more when an extension cable is connected/removed without removing a power supply module.
Mounting

RD77MS16/RD77MS8/RD77MS4/RD77MS2
RD77GF32/RD77GF16/RD77GF8/RD77GF4

Top of panel, wiring duct, or other components

(Note-1): Provide clearance of 30mm (1.18inch) or more when the height of a wiring duct is 50mm (1.97inch) or less. In other cases, provide clearance of 40mm (1.57inch) or more.

(Note-2): Provide clearance of 20mm (0.79inch) or more when an extension cable is connected/removed without removing a power supply module.

FX5-80SSC-S/FX5-40SSC-S

Top of panel, wiring duct, or other components

5mm (0.2inch) or more 5mm (0.2inch) or more

50mm (1.97inch) or more 50mm (1.97inch) or more

30 mm (1.18inch) or more

80mm (3.15inch) or more

70mm (2.76inch) or more

50mm (1.97inch) or more

100mm (3.94inch) or more

70mm (2.76inch) or more
Components

Compliance with the indicated global standards and regulations is current as of the release date of this catalog. Contact your local sales office for the latest information.

Simple Motion module

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple Motion module</td>
<td>RD77MS16</td>
<td>Up to 16 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>RD77MS8</td>
<td>Up to 8 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>RD77MS4</td>
<td>Up to 4 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>RD77MS2</td>
<td>Up to 2 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>FX5-405SC-S</td>
<td>Up to 8 axes, FX2INC-100MPCB power supply cable 1m (3.28ft) enclosed</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>FX5-405SC-B</td>
<td>Up to 4 axes, FX2INC-100MPCB power supply cable 1m (3.28ft) enclosed</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>RD77GF32</td>
<td>Up to 32 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>RD77GF16</td>
<td>Up to 16 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>RD77GF8</td>
<td>Up to 8 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>RD77GF4</td>
<td>Up to 4 axes</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td>SSCNET III cable</td>
<td>MR-JBUS_M</td>
<td>Standard code for inside panel</td>
<td>0.15m (0.49ft), 0.3m (0.98ft), 0.5m (1.64ft), 1m (3.28ft), 3m (9.84ft)</td>
</tr>
<tr>
<td></td>
<td>MR-JBUS_M-A</td>
<td>Standard code for outside panel</td>
<td>5m (16.40ft), 10m (32.81ft), 20m (65.62ft)</td>
</tr>
<tr>
<td></td>
<td>MR-JBUS_M-B</td>
<td>Long distance cable</td>
<td>30m (98.43ft), 40m (131.23ft), 50m (164.04ft)</td>
</tr>
<tr>
<td>Manual pulse generator</td>
<td>MR-HDP01</td>
<td>Number of pulses per revolution: 25pulse/rev (100pulse/rev after magnification by 4), Permitted speed: 200r/min (Normal rotation)</td>
<td>—</td>
</tr>
<tr>
<td>Internal I/F connector set</td>
<td>LD77MHOCON</td>
<td>Incremental synchronous encoder/Mark detection signal interface connector set</td>
<td>—</td>
</tr>
<tr>
<td>Optical hub unit</td>
<td>MR-MVG200</td>
<td>Three branches/unit, DC power supply connector enclosed</td>
<td>CE, UL, KC</td>
</tr>
</tbody>
</table>

(Note-1): Order the A6CON1, A6CON2, and A6CON4 separately because the connectors are not included in the package.
(Note-2): “_” indicates cable length. (015: 0.15m (0.49ft), 03: 0.3m (0.98ft), 05: 0.5m (1.64ft), 1: 1m (3.28ft), 3: 3m (9.84ft), 5: 5m (16.40ft), 10: 10m (32.81ft), 20: 20m (65.62ft), 30: 30m (98.43ft), 40: 40m (131.23ft), 50: 50m (164.04ft))
(Note-3): For a long distance cable of up to 100m (328.08ft) or an ultra-long bending life cable, contact Mitsubishi Electric System & Service Co., Ltd.

Products on the market

Manual pulse generator on the market

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

<table>
<thead>
<tr>
<th>Product</th>
<th>Model</th>
<th>Description</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual pulse generator</td>
<td>UFD-M0-0025-ZZ1-B00E</td>
<td>Number of pulses per revolution: 25pulse/rev (100pulse/rev after magnification by 4), Permitted speed: 200r/min (Normal rotation)</td>
<td>Nemicon Corporation</td>
</tr>
</tbody>
</table>

Ethernet cable

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>Description</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet cable</td>
<td>SC-ESEW_S_M</td>
<td>: cable length (100 m max., unit of 1 m)</td>
<td>Double shielded cable (Category 5e)</td>
</tr>
<tr>
<td>For moving part, indoor</td>
<td>SC-ESEW_S_M-MV</td>
<td>: cable length (45 m max., unit of 1 m)</td>
<td>Double shielded cable (Category 5e)</td>
</tr>
<tr>
<td>For indoor/outdoor</td>
<td>SC-ESEW_S_M-L</td>
<td>: cable length (100 m max., unit of 1 m)</td>
<td>Double shielded cable (Category 5e)</td>
</tr>
</tbody>
</table>

For details, contact Mitsubishi Electric System & Service Co., Ltd.
OVERSEAS SERVICE SECTION (Email:osb.webmaster@melsc.jp)
The MELSEC iQ-R series is provided with sophisticated dual engines: the PLC CPU engine for machine control and the Motion CPU engine for Motion control. The engines respectively process different types of control based on the characteristic of each engine while working together on data through a high-speed system bus. CPU loads are significantly distributed by these dual engines compared with a single engine, enabling any equipment to maximize its performance, even for a load change machine or multi-axis equipment.

Select the most suitable combination of CPU engines that can reduce cost and maximize machine performance to the fullest from Mitsubishi Electric extensive product line. Efficiency in designing and debugging is also improved.

Now that “High-mix Low-volume” production is a big trend in the market, Motion controllers are expected to be used for various applications. The MELSEC iQ-R series Motion controller is capable of various controls such as positioning control, speed control, torque control, tightening & press-fit control, advanced synchronous control and cam control, etc. They are applied to various machines such as X-Y tables, converting machines, packing machines and filling machines.

A combination of Mitsubishi Electric advanced PLC system, servo amplifiers, servo motors, and servo networks offers exceptional solutions that allow you to maximize your system’s productivity.

Higher Basic Performance and Further Improved Total System Performance

- High-speed data communication (Data exchange cycle)
- High-speed system bus communication
- Operation cycle
  - Approx. 1.5 times faster
  - 6 axes/0.222ms
- Event task fixed cycle
  - Fastest
  - 0.222ms

SSCNET III/H compatible

MELSEC iQ-R series

Motion Controllers

- Now that “High-mix Low-volume” production is a big trend in the market, Motion controllers are expected to be used for various applications. The MELSEC iQ-R series Motion controller is capable of various controls such as positioning control, speed control, torque control, tightening & press-fit control, advanced synchronous control and cam control, etc. They are applied to various machines such as X-Y tables, converting machines, packing machines and filling machines.
- A combination of Mitsubishi Electric advanced PLC system, servo amplifiers, servo motors, and servo networks offers exceptional solutions that allow you to maximize your system’s productivity.

Higher Basic Performance and Further Improved Total System Performance

- High-speed system bus
  - Approx. 40 times faster
  - Data exchange cycle with PLC CPU
  - Approx. 4 times faster
  - 0.222ms
- Speed frequency response of servo amplifier
  - 2.5 kHz
- SSCNET III/H communication speed
  - 150 Mbps
- Event task fixed cycle
  - Fastest
  - 0.222 ms
The MELSEC iQ-R series is provided with sophisticated dual engines: the PLC CPU engine for machine control and the Motion CPU engine for Motion control. The engines respectively process different types of control based on the characteristic of each engine while working together on data through a high-speed system bus. CPU loads are significantly distributed by these dual engines compared with a single engine, enabling any equipment to maximize its performance, even for a load change machine or multi-axis equipment. Select the most suitable combination of CPU engines that can reduce cost and maximize machine performance to the fullest from Mitsubishi Electric extensive product line. Efficiency in designing and debugging is also improved.

Total System Performance, Not Individual Component Specifications Leads to Maximum Performance

The MELSEC iQ-R series is provided with sophisticated dual engines: the PLC CPU engine for machine control and the Motion CPU engine for Motion control. The engines respectively process different types of control based on the characteristic of each engine while working together on data through a high-speed system bus. CPU loads are significantly distributed by these dual engines compared with a single engine, enabling any equipment to maximize its performance, even for a load change machine or multi-axis equipment. Select the most suitable combination of CPU engines that can reduce cost and maximize machine performance to the fullest from Mitsubishi Electric extensive product line. Efficiency in designing and debugging is also improved.

Experience Powerful Performance of Multiple CPU with Ease of Use Just Like Using One CPU

You can select either the Motion CPU or the PLC CPU based on the application, allowing you to configure a system more flexibly. The easy-to-understand flowchart form is adopted by Motion SFC for Motion control programming. Also, the direct positioning start instruction allows you to program Motion controls, such as positioning and synchronous control, just with sequence programs.

Motion CPU Memory Expansion

- The cam working area has been expanded to 16M bytes, enabling you to use more cam data with higher resolution.
- The device memory has been increased to 128k words, so even multi-axis equipment requiring more devices can be applied.
- The cam data storage area has been expanded to 12M bytes. An SD card is also available for storing cam data.
Multiple CPU System for High-speed Motion Control

SSCNET III/H compatible MELSEC iQ-R series Motion controller

R64MTCPU/R32MTCPU/R16MTCPU

System configuration

MELSEC iQ-R series Motion controller

- R64MTCPU: 2 lines (Up to 64 axes)
- R32MTCPU: 2 lines (Up to 32 axes)
- R16MTCPU: 1 line (Up to 16 axes)

- MELSOFT MT Works2
- MELSOFT GX Works3

- Engineering environment
- Programmable Controller Engineering Software

- Motion Controllers

- Extension base unit (Up to 7 extensions)

- External input signals of a servo amplifier (FLS, RLS, DOG)

- Input (64 points): Synchronous input (32 points)/Interrupt input (64 points)/External input signals (FLS, RLS, DOG, STOP)

- Output signals (64 points), Synchronous output signals (32 points)

- Ance input/output

- Incremental synchronous encoder

- Manual pulse generator

- MR-J4-B / MR-J4W2-B / MR-J4W3-B

- MR-J4-B-RJ / MR-MT2000 series

- MR-MV200

- JR-171ENC-W8 Serial absolute synchronous encoder

- External input signals of a servo amplifier (FLS, RLS, DOG)

- Mitsubishi Electric Servo System Partners (Note-1)

(Note-1): When using a partner product or the inverter FR-A800, use one whose version supports the Motion controller.
Motion SFC Program

The Motion control program is described in flowchart form using the Motion SFC (Sequential Function Chart) format. The Motion SFC format program is suitable for event processing and allows the Motion CPU to perform batch control of multiple sequential machine operations, pursuing high event responsiveness.

**Flowchart description is easy to read and understand**
- The machine operation procedure is visualized in the program by using the flowchart descriptions.
- A process control program can be created easily, and control details can be visualized.

**Controlling sequential machine operation using the Motion CPU**
- Servo control, I/O control, and operation commands can be combined in the Motion SFC program.
- Motion SFC program can execute servo control by itself, eliminating the need of creating the sequence program for servo control.

A sequence program or a function block (FB) for scan processing

Motion SFC for event processing

Sequence control

Motion control

---

The machine operation procedure is visualized in the program by using the flowchart descriptions. A process control program can be created easily, and control details can be visualized.

Servo control, I/O control, and operation commands can be combined in the Motion SFC program. Motion SFC program can execute servo control by itself, eliminating the need of creating the sequence program for servo control.
An easy-to-understand program can be created by adding comments as an operation explanation.

Operation commands are detailed in a step by step format in a layered structure program.

Operation control step: Arithmetic operations and I/O control, etc., are carried out.
Transition (condition wait): The transition conditions are judged.
Motion control step: Servomotor positioning control and speed control are carried out.

While the sequence program runs using “Scan execution method” where all of the steps are scanned at all times, the Motion SFC program runs using “STEP execution method” where the steps are scanned following the “SHIFT” instruction, reducing operation process for high-speed processing and high-response control.
Positioning Control

A variety of positioning controls, such as PTP control, position follow-up, and continuous path control are available with the Motion controller.

Basic positioning control

- To respond to various applications, the Motion controller offers various control methods such as PTP control, speed control, speed-position switching control, continuous path control, position follow-up control, Speed control with fixed position stop, and high-speed oscillation control, etc.
- Powerful auxiliary functions are available such as M-codes, the target position change function, the acceleration/deceleration time change function, and the advanced S-curve acceleration/deceleration.
- Positioning operation can be activated by Motion SFC, or the direct positioning start instruction by the PLC CPU, etc.

Position follow-up control

With a one-time start, the operation continues until a stop command is inputted. If the word device value is changed in the middle of the operation, the positioning for the set address starts immediately.

Measure the height of the workpiece by a sensor. Set the measurement result to a device memory.

Based on the measurement result, calculate the distance between the spraying nozzle and the workpiece. Set the data to the specified device memory for the position follow-up.
Advanced Synchronous Control

The advanced synchronous control is software-based synchronous control as an alternative to mechanical control, such as gear, shaft, clutch, speed change gear and cam. In addition, cam control becomes even easier with cam auto-generation function.

- The synchronous control can be started/ended on axis-by-axis basis.
- Axes in synchronous and positioning controls can be used together in one program.
- Speed-torque control can be performed simultaneously with the synchronous control.
- Up to 192 axes can be synchronized by use of three R64MTCPU modules.

All axes are synchronized using a synchronous encoder axis or a servo input axis.

**Application examples**
- Packing machines
- Printing machines
- Diaper manufacturing machines
- Tire molder

Only two axes are in synchronization. Axis 2 is set as to synchronize to axis 1. The other axes are in positioning control.

**Application example**
- Tandem configuration

---

**Motion Controllers**

- Features

---

**Control flow**

**PLC CPU**

- Motion SFC program start request instruction
- Start program No. specification

**Motion CPU**

- Servo motor start
- Command generation axis start

---

**Application examples**

- Packing machines
- Printing machines
- Diaper manufacturing machines
- Tire molder

- Tandem configuration
The synchronous control is easily executed just by setting parameters.

- One of the following three can be set as the input axis: Synchronous encoder axis, Command generation axis, or Servo input axis.
- “Command generation axis” is not counted as a control axis; therefore all the control axes can be used as output axes.
- The cam axis can be operated in linear operation (a rotary table, a ball screw, etc.), two-way operation, or feed operation by setting cam No. and cam data.

The advanced synchronous control is software-based synchronous control as an alternative to mechanical control, such as gear, shaft, clutch, speed change gear and cam. In addition, cam control becomes even easier with cam auto-generation function.

- The synchronous control can be started/ended on axis-by-axis basis.
- Axes in synchronous and positioning controls can be used together in one program.
- Speed-torque control can be performed simultaneously with the synchronous control.
- Up to 192 axes can be synchronized by use of three R64MTCPU modules.

**Speed-torque control during synchronous control**

With the Motion controller, the output axis in the advanced synchronous control can perform the speed-torque control simultaneously. This control can be applied to unwinding/rewinding equipment, which needs synchronized operation.
Advanced Pressure Control

The machine is controlled so that the pressure commands match the pressure sensor values; therefore pressure is maintained constant even with a changing load. Each pressure process ("Feed", "Pressure maintaining", and "Pressure release") can be set with the Pressure Profile, and those processes can be tested on MELSOFT MT Works2, which makes a changeover and adjustment easy.

Application examples

- Injection machines
- Bonder

[Test operation example]
Tests can be carried out individually for each process of pressure control, which increases efficiency in debugging.
For example, the feed process is divided into multiple steps, and the pressure command can be sent for each step; so pressure can be tested in great details.

Vibration Suppression Command Filter

The filter function is used to suppress the vibration at the end of the workpiece and in the machine frame during positioning control. This filter is effective even for low-frequency vibration that cannot be suppressed by the machine resonance suppression filter or for when the frequency changes during operation.

For example, when the machine resonance frequency varies as the arm extends/returns, setting individual frequency for each case enables to suppress vibration by generating suitable commands.
The Motion controller controls a simple industrial robot by installing an add-on library "Machine Library". The robot is controlled by machine control with Cartesian space coordinates.

**Cartesian Robot**

![Cartesian Robot Diagram]

**Machine Library Name**

MCNTYP-R[001-006]  Machine Type No. (R001-R006)

---

**Direct Positioning Start Instruction (MP.SVSTD)**

Programming for Motion control (positioning, synchronous control, etc.) can be created just with sequence programs, eliminating the need of creating a servo program. Positioning is performed by positioning data being set to the PLC CPU device, followed by the MP.SVSTD instruction execution.

**PLC CPU**

```
M0 U3E1/G516.0  Command execution instruction
MP.SVSTD H3E1 D100 W0  MP.SVSTD
M0  Command 1 start accept
RST M0
```

**[Setting example]**

<table>
<thead>
<tr>
<th>Device</th>
<th>Content</th>
<th>Setting example</th>
</tr>
</thead>
<tbody>
<tr>
<td>W0</td>
<td>Positioning type/Number of points</td>
<td>0</td>
</tr>
<tr>
<td>W1</td>
<td>Setting of positioning data items</td>
<td>0</td>
</tr>
<tr>
<td>W2</td>
<td>Axis No.</td>
<td>1</td>
</tr>
<tr>
<td>W3</td>
<td>Control mode, Interpolation axis speed designation</td>
<td>0200H</td>
</tr>
<tr>
<td>W4</td>
<td>M-code</td>
<td>0</td>
</tr>
<tr>
<td>W5</td>
<td>Dwell time</td>
<td>0</td>
</tr>
<tr>
<td>W6</td>
<td>Torque limit value</td>
<td>300</td>
</tr>
<tr>
<td>W7</td>
<td>Command speed</td>
<td>100000</td>
</tr>
<tr>
<td>W8</td>
<td>Positioning address/movement amount</td>
<td>12345678</td>
</tr>
<tr>
<td>W9</td>
<td>Arc address</td>
<td>0</td>
</tr>
</tbody>
</table>
G-code Control

A G-code program is analyzed and executed by the Motion controller.
G-code control is applied to various types of path control such as drawing and cutting by a simple machine tool.
- G-code control is available by additionally installing the G-code control add-on library (provided for a fee).
- G-code programs can be edited on GOT and transmitted between GOT and a Motion controller.
- Up to 16 axes can perform G-code control (Simultaneous interpolation: Up to 4 axes)
- It is possible to switch between control by a servo program and by a G-code program.
- G-code control can be combined with other functions in the Motion controller such as Motion SFC program and synchronous control.
- A G-code program, which is in text format, can be edited with a generic editor.
- FTP transfer function allows transmission of data via a CC-Link IE compatible Ethernet interface module.

N10 G01 X800. Y430. F13800.
N12 G01 Y100.
N14 G01 X100.
N16 G01 Y350.

System Configuration

G-code control add-on library

GOT2000 (dedicated screen + user-created screen)

G-code control add-on library

G-code control add-on library

SD memory card/USB memory

G-code text data

G-code control add-on library

Installation

G-code control add-on library

G-code data transfer

Ethernet

Write data with MELSOFT MT Works2

FTP transfer

G-code text data

MR-J4-B/-RJ/MR-J4W-B

Partner products

(Motion Controllers)

(Motion Controllers)

(Motion Controllers)

(Motion Controllers)

(Motion Controllers)

(Motion Controllers)

(Rotary servo motor)

(Direct drive motor)

(Linear servo motor)

(Note-1): USB memory can be connected only to GOT2000.
### Functions

**Normal line control**
Controls the rotation of a rotating axis (C-axis) so that the tool is always in the normal direction.

- **Rotating axis (C-axis) center**
- **Tool tip position**

**Linear interpolation**

- Automatic deceleration of the feed speed
- Program path
- Work surface

**Circular interpolation**

- Rotating axis (C-axis) center
- Tool tip position

**Automatic corner override**
Reduces the load on the tool during inside corner cutting by automatic deceleration.

- **Automatic deceleration of the feed speed**
- Program path
- Work surface

**Tool radius compensation**
Compensates the path only for an amount of the tool radius.

- **Right compensation**
- **Left compensation**

### Editing and Reading/ Writing G-code Programs on GOT2000

G-code programs can be edited and read from/written to a Motion controller with GOT2000. The on-site operation without a personal computer helps to boost productivity.

**[Editing Motion programs]**
G-code programs from a Motion controller are displayed as a list and edited on GOT.

**[Input/output of Motion programs]**
G-code programs can be transmitted between GOT and Motion controllers, and the data originally saved in the controller can be deleted on GOT.

### Conversion from CAD Data into G-code

CAD data in DXF format is converted into a G-code program, and then the program is exported as G-code text data.

(Note-1): Contact your local sales office for details of the tool. In addition to conversion, it allows you to change the order of drawing. In order to edit the CAD data, CAD editing software is required.
Monitoring of Servo Data

Servo operation can be monitored with extensive monitor data (selectable from up to 50 items). The monitor items can be flexibly changed during operation. The operation status of servo amplifiers and servo motors (including partner products) acquired via SSCNET III/H is transferred and displayed on the host system or on the GOT screen created by a customer.

[Monitoring and data collection]
Alarm history of servo amplifiers, Power consumption, 7-segment LED display status, Identification information of servo amplifiers and servo motors, Load ratio of servo motors, Speed, Temperature of various parts, etc.

[Preventive maintenance]
Inrush relay ON/OFF number, Power ON cumulative time, Machine diagnosis information (the estimated friction value and the estimated vibration value), etc.

Vision System

COGNEX Vision system is directly connected to the Motion CPU via Ethernet using the built-in PERIPHERAL I/F. Alignment time is reduced with the target position change function which uses the workpiece position data from the vision system for high-speed Motion control.

Operation Example of Target Position Change Function

Y-axis

New target position

Original target position

X-axis
Digital Oscilloscope Function

Data collection and waveform display which are synchronized to the Motion operation cycle greatly help you check operation and perform troubleshooting.

- Probe items can be set by selecting the purpose from the list.
- 16CH word and 16CH bit data can be sampled, of which, 8CH words and 8CH bits can be displayed in real time.
- Sampling can be performed without having to connect the personal computer to the machine.
- Sampled data which are saved on an SD card can be analyzed on a personal computer.
- Sampled data path can be traced on 2-dimensional coordinate.

Set often-viewed data easily with the purpose-based probe setting by following instructions of the assistant function.

Programming with Labels

MELSOFT MT Works2 allows you to program with easy-to-understand names (labels) instead of using device names or CPU buffer memory. This programming method enables an easy program reuse and standardization of projects.

Example of using labels

The use of labels removes the need to remember devices when programming. Also, labels allow a different model/product to be used with the same program.

Using common labels with GOT

Since GOT uses common labels with the Motion controller, the screen can be designed with those labels without worries about devices. Additionally, when the device allocation is changed on the Motion controller side, there is no need to change a GOT project accordingly.

1. Create switch data using a label.
2. Access to the controller is requested via the label.
3. The label is converted to the corresponding device.
Ease of Use Achieved by a State-of-art CPU Buffer Memory

The high-speed, high-capacity CPU buffer memory revolutionizes the data exchange between CPUs. The PLC CPU and the Motion CPU each have a CPU buffer memory. And those buffer memories are efficiently utilized for two different purposes.

- The 2M words CPU buffer memory (Motion CPU side) is provided as standard, which is utilized for bulky data transmission and fast data updating.
- The CPU buffer memory (fixed-cycle communication area) allows 24 k words (4 CPUs in total) transmission between the PLC CPU and the Motion CPU every 0.222 ms. It is perfectly suited for receiving/transmitting highly synchronized data between multiple CPUs.

The Motion CPU and the PLC CPU are equipped with 2M words and 512k words CPU buffer memories respectively. They allow for bulky data transmission and fast data update.

Example of using PLC CPU buffer memory

Cam data such as cam data can be transferred by just a one-time transmission through the 512 k word buffer memory.

Example of using Motion CPU buffer memory

The data that is set on Motion CPU side can be reflected to the interlock in the sequence program without any delay.

Data can be transmitted every 0.222 ms between the PLC CPU and the Motion CPU. The CPU buffer memories (fixed-cycle communication area) are synchronized to the Motion control, optimizing the operation.

Advanced synchronous/cam controls

<table>
<thead>
<tr>
<th>Sequence program</th>
<th>PLC CPU</th>
<th>Motion CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU buffer memory</td>
<td>Direct data refelction</td>
<td>CPU buffer memory</td>
</tr>
<tr>
<td>CPU buffer memory (fixed-cycle)</td>
<td>CPU buffer memory (fixed-cycle)</td>
<td>4 times faster data exchange cycle</td>
</tr>
</tbody>
</table>

Motion SFC program

START
F10
K100
M10
END

Motion controllers

Features

81
The high-speed, high-capacity CPU buffer memory revolutionizes the data exchange between CPUs. The PLC CPU and the Motion CPU each have a CPU buffer memory. And those buffer memories are efficiently utilized for two different purposes.

- The 2M words CPU buffer memory (Motion CPU side) is provided as standard, which is utilized for bulky data transmission and fast data updating.
- The CPU buffer memory (fixed-cycle communication area) allows 24 k words (4 CPUs in total) transmission between the PLC CPU and the Motion CPU every 0.222 ms. It is perfectly suited for receiving/transmitting highly synchronized data between multiple CPUs.

The Motion CPU and the PLC CPU are equipped with 2M words and 512k words CPU buffer memories respectively. They allow for bulky data transmission and fast data update.

**Example of using PLC CPU buffer memory**

Bulky data such as cam data can be transferred by just a one-time transmission through the 512 k word buffer memory.

**Example of using Motion CPU buffer memory**

The data that is set on Motion CPU side can be reflected to the interlock in the sequence program without any delay.

**CPU buffer memory (Fixed-cycle communication area)**

Data can be transmitted every 0.222 ms between the PLC CPU and the Motion CPU. The CPU buffer memories (fixed-cycle communication area) are synchronized to the Motion control, optimizing the operation.
Bulky data such as cam data or digital oscilloscope data can be stored in an SD memory card, significantly expanding the capacity of the Motion CPU built-in memory.

- Data that is created on MELSOFT MT Works2 can be used by multiple Motion CPUs by saving it to an SD memory card.
- The digital oscilloscope data that is sampled automatically by a Motion CPU can be saved on an SD memory card. For example, when an error occurs, the data is sampled automatically. You can check the data later on a personal computer.

Applications can be changed just by inserting an SD memory card, even at a manufacturing field where MELSOFT MT Works2 cannot be prepared.

The Motion modules, previously required for the MELSEC-Q series system, are no longer needed since the functionality of those MELSEC-Q series Motion modules has been integrated into the MELSEC iQ-R series PLC CPU input modules. For example, external signals are inputted via the PLC CPU input module, and input pulses from a manual pulse generator or a synchronous encoder are inputted via the high-speed counter module.

The PLC CPU input module can receive external input signals (FLS, RLS, DOG, STOP) and mark detection signals, in addition to general input signals.

- External input signals of the servo amplifier (FLS, RLS, DOG, STOP) are inputted via the PLC CPU input module or a servo amplifier.
- Pulses of the incremental synchronous encoder are inputted via the high-speed counter module.
- Pulses of the serial absolute encoder are inputted via MR-J4-B-RJ servo amplifier.
Various Functions

Servo external input signals

The servo external input signals (FLS, RLS, DOG) can be controlled via a bit device in addition to via an input module and a servo amplifier. The logic and the validity of these signals can be set individually.

4 million pulse synchronous encoder

The “Q171ENC-W8" 4 million (22-bit) pulse synchronous encoder, compatible with the controller as standard, greatly improves the synchronous operation accuracy. High-accuracy control is achieved when used with MR-J4-B (adapting 4 million (22-bit) pulses resolution motors as standard).

Home position return methods

15 types of home position return methods are available, including the dogless home position return. Also, the retry function and the shift function are provided. Select any of these home position return methods that suits your machine type.

Speed control with fixed position stop

A servo motor, rotating at the specified speed, can stop at the specified position when turning ON the command of Speed control with fixed position stop. Both the speed and the duration of acceleration/deceleration can be changed to any value during operation, which is suitable for a spinner operation, etc.

Override

The override function changes the command speed for positioning control by a designated percentage. This is used for program and operation checks.

Parameter change function/Servo parameter change function

Motion CPU parameters and servo parameters can be individually changed during control operation through the Motion SFC program etc., without having to connect to a personal computer.

Phase compensation

In synchronous control with a synchronous encoder, the phase compensation function is used to compensate the delay time caused by a communication delay in the synchronous encoder data, etc.

Torque limit value change

The torque limit value during positioning or JOG operation is changed easily with the CHGT Motion dedicated instruction. The torque limit values for power running direction and regeneration direction can be set individually.

Servo amplifier control mode switching function

Control mode switch commands of the gain switching function, PI-PID control and control loop (fully closed, semi-closed) can be executed to the servo amplifier.

Target position change function

The target position can be changed during positioning, achieving shorter cycle time. The new target position can be specified by absolute address or movement amount from the current feed value when the target position change request is executed.

Safety system

The MR-D30 functional safety unit is used to achieve the functions (STO/SS1/SS2/SOS/SSB/SSC/SSM) according to IEC 61800-5-2:2007 without depending on a Motion controller in terms of performance or type. Those functions, provided with this unit, are compliant with “EN ISO 13849-1; Category 4 PL e" and “EN 62061; SIL CL 3" (Both EN ISO 13849-1 and EN 62061 are harmonized with European Machinery Directives).

Operation control program

A wide variety of functions are available: standard functions such as binary operation, bit operation, type conversion, and trigonometric in the Motion SFC; the command for the scaling function that is suitable for calculating coordinate conversions; the cam data reading/writing; the synchronous control dedicated instruction for cam auto generation; conditional branch control, such as IF and CASE, at an operation control step.

Multiple CPU advanced synchronous control

A large system can be configured thanks to the advanced synchronous control that allows up to 192-axis synchronization with high accuracy by use of three R64MTCPU.
## Control specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R64MTCPU</td>
</tr>
<tr>
<td>Maximum number of control axes</td>
<td>64 axes</td>
</tr>
<tr>
<td>Number of SSCNET III/H lines</td>
<td>2 lines</td>
</tr>
<tr>
<td>Operation cycle (Operation cycle settings)</td>
<td>0.222ms, 0.444ms, 0.888ms, 1.777ms, 3.555ms, 7.111ms</td>
</tr>
<tr>
<td>Interpolation function</td>
<td>Linear interpolation (Up to 4 axes), Circular interpolation (2 axes), Helical interpolation (3 axes)</td>
</tr>
<tr>
<td>Control modes</td>
<td>Positioning control, Speed control, Fixed-pitch feed control, Continuous path control, Position follow-up control, Speed control with fixed position stop, High-speed oscillation control, Cam control, Speed-torque control, Tightening &amp; Press-fit control, Advanced synchronous control, Pressure control, Machine control</td>
</tr>
<tr>
<td>Acceleration/deceleration process</td>
<td>Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration, Advanced S-curve acceleration/deceleration</td>
</tr>
<tr>
<td>Compensation function</td>
<td>Backlash compensation, Electronic gear, Phase compensation</td>
</tr>
<tr>
<td>Programming language</td>
<td>Motion SFC, Dedicated instruction, G-code</td>
</tr>
<tr>
<td>Servo program capacity</td>
<td>64k steps</td>
</tr>
<tr>
<td>Number of positioning points</td>
<td>6400 points (Positioning data can be set indirectly)</td>
</tr>
<tr>
<td>Home position return</td>
<td>Proximity dog method (2 methods), Count method (3 methods), Data set method (3 methods), Scale home position signal detection method, Dogless home position signal reference method, Driver home position return method</td>
</tr>
<tr>
<td>Positioning control</td>
<td>Linear interpolation (Up to 4 axes) (Vector speed, Reference axis speed, Long-axis speed)</td>
</tr>
<tr>
<td>Fixed-pitch feed</td>
<td>Fixed-pitch feed control (Up to 3 axes)</td>
</tr>
<tr>
<td>2-axis circular interpolation</td>
<td>Auxiliary point-specified, center point-specified, and radius-specified circular interpolation</td>
</tr>
<tr>
<td>Speed control</td>
<td>Speed control</td>
</tr>
<tr>
<td>Speed-position switching</td>
<td>INC mode, Speed control with fixed position stop</td>
</tr>
<tr>
<td>Current value change</td>
<td>Provided</td>
</tr>
<tr>
<td>Manual control</td>
<td>Provided</td>
</tr>
<tr>
<td>Manual pulse generator</td>
<td>Possible to connect up to 3 modules (with use of the high-speed counter), Unit magnification (1 to 10000 times)</td>
</tr>
<tr>
<td>Expansion control</td>
<td>Speed-torque control without positioning loops, Torque control, Tightening &amp; press-fit control</td>
</tr>
<tr>
<td>Absolute position system</td>
<td>Made compatible by setting a battery to a servo amplifier (Possible to select the absolute method or incremental method for each axis)</td>
</tr>
<tr>
<td>Synchronous encoder interface</td>
<td>Up to 12 CH</td>
</tr>
<tr>
<td>Functions that limit control</td>
<td>Speed limit, JOG speed limit value</td>
</tr>
<tr>
<td>Functions that change control details</td>
<td>Torque limit value same setting, Torque limit value individual setting</td>
</tr>
<tr>
<td>Functions that change control details</td>
<td>Motion controller forced stop, Forced stop terminal of servo amplifier</td>
</tr>
<tr>
<td>Functions that change control details</td>
<td>Provided</td>
</tr>
<tr>
<td>Functions that change control details</td>
<td>Provided</td>
</tr>
<tr>
<td>Target position change</td>
<td>Provided</td>
</tr>
<tr>
<td>All clear function</td>
<td>Delete all user data in Motion CPU</td>
</tr>
<tr>
<td>External input signal setting function</td>
<td>Servo amplifier input (FLS, RLS, DOG), bit</td>
</tr>
<tr>
<td>Event history function</td>
<td>Provided</td>
</tr>
<tr>
<td>Amplifier-less operation function</td>
<td>Provided</td>
</tr>
<tr>
<td>Mark detection function</td>
<td>Continuous Detection mode, Specified Number of Detections mode, Ring Buffer mode</td>
</tr>
<tr>
<td>Mark detection function</td>
<td>High-speed input request (Bit device, Input signals of servo amplifiers (DI1 to DI3))</td>
</tr>
<tr>
<td>Mark detection setting</td>
<td>64</td>
</tr>
<tr>
<td>Optional data monitor function</td>
<td>Up to 14 data/axis (Communication data: Up to 6 points/axis)</td>
</tr>
<tr>
<td>Driver communication function</td>
<td>Provided</td>
</tr>
<tr>
<td>File transmission at boot function</td>
<td>Provided</td>
</tr>
<tr>
<td>SSCNET connect/disconnect function</td>
<td>Provided</td>
</tr>
<tr>
<td>Digital oscilloscope function</td>
<td>Motion buffering method (Real-time waveform can be displayed)</td>
</tr>
<tr>
<td>Digital oscilloscope function</td>
<td>Sampling data (Word 16CH, Bit 16CH), Offline sampling</td>
</tr>
<tr>
<td>Limit switch output function</td>
<td>Up to 12 CH</td>
</tr>
<tr>
<td>Limit switch output function</td>
<td>64 points x 2 sections</td>
</tr>
<tr>
<td>Parameter change function</td>
<td>Motion control data, Word device</td>
</tr>
<tr>
<td>Servo amplifier control mode switching function</td>
<td>Gain switching function, PI-PID control, Control loop switching (semi closed loop control, fully closed loop control)</td>
</tr>
</tbody>
</table>
## Control specification (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of I/O points</td>
<td>Total of 4096 points (I/O modules)</td>
</tr>
<tr>
<td>Clock function</td>
<td>Provided</td>
</tr>
<tr>
<td>Security function</td>
<td>File password, Password for each Motion SFC program, Software security key function</td>
</tr>
<tr>
<td>Remote operation</td>
<td>Remote RUN/STOP</td>
</tr>
<tr>
<td>Vibration suppression command filter</td>
<td>Provided</td>
</tr>
</tbody>
</table>

(Note-1): The G-code control add-on library “SW10DND-GCD*” (provided for a fee) is required.  
(Note-2): The home position return method set in a driver (a servo amplifier) is used.  
(Note-3): Available with MR-J4_/B-RJ  
(Note-4): Available with MR-J3_/MR-J4_/B

## Motion SFC performance specification

<table>
<thead>
<tr>
<th>Item</th>
<th>specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of motion SFC programs</td>
<td>R64MTCPU</td>
</tr>
<tr>
<td>Motion SFC program capacity</td>
<td>Code total (Motion SFC chart + Operation control + Transition)</td>
</tr>
<tr>
<td>Number of Motion SFC programs</td>
<td>512 (No. 0 to 511)</td>
</tr>
<tr>
<td>Motion SFC chart size/program</td>
<td>Up to 64k bytes (including Motion SFC chart comments)</td>
</tr>
<tr>
<td>Number of Motion SFC steps/program</td>
<td>Up to 4094 steps</td>
</tr>
<tr>
<td>Number of selective branches/branch</td>
<td>255</td>
</tr>
<tr>
<td>Number of parallel branches/branch</td>
<td>255</td>
</tr>
<tr>
<td>Parallel branch nesting</td>
<td>Up to 4 levels</td>
</tr>
<tr>
<td>Operation control program (F/FS)</td>
<td>Number of operation control programs</td>
</tr>
<tr>
<td>Number of transition programs</td>
<td>4096 (G0 to G4095)</td>
</tr>
<tr>
<td>Code size/program</td>
<td>Up to approx. 128k bytes (65534 steps)</td>
</tr>
<tr>
<td>Number of blocks/line/program</td>
<td>Up to 8192 blocks (in the case of 8 steps/mblock)</td>
</tr>
<tr>
<td>Number of characters/block</td>
<td>Up to 1020 (Comment included)</td>
</tr>
<tr>
<td>Number of operands/block</td>
<td>Up to 510 (Operand: Constants, Word devices, Bit devices)</td>
</tr>
<tr>
<td>Parallel branch nesting</td>
<td>Up to 32 levels</td>
</tr>
<tr>
<td>Descriptive expression</td>
<td>Operation control program</td>
</tr>
<tr>
<td>Transition program</td>
<td>Calculation expression, Bit conditional expression, Comparison conditional expression</td>
</tr>
<tr>
<td>Execute specification</td>
<td>Normal task</td>
</tr>
<tr>
<td>Event task</td>
<td>Fixed cycle</td>
</tr>
<tr>
<td>External interrupt</td>
<td>Executes when the input set to the event task factor in the input module controlled by the Motion CPU (16 points) turns ON.</td>
</tr>
<tr>
<td>PLC interrupt</td>
<td>Executed with interrupt instruction (D(P).GINT, M(P).GINT) from PLC CPU</td>
</tr>
<tr>
<td>NMI task</td>
<td>Executes when the input set to the NMI task factor in the input module controlled by the Motion CPU (16 points) turns ON.</td>
</tr>
</tbody>
</table>

(Note-1): Internal relays (M): 12,288 points, data registers (D): 20,480 points (when using the Q series Motion compatible device assignment with R32MTCPU and R16MTCPU)

### Number of device points

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O (X/XY)</td>
<td>12,288 points</td>
</tr>
<tr>
<td>Internal relays (M)</td>
<td>49,152 points</td>
</tr>
<tr>
<td>Link relays (B)</td>
<td>8,192 points</td>
</tr>
<tr>
<td>Annunciators (F)</td>
<td>2,048 points</td>
</tr>
<tr>
<td>Special relays (SM)</td>
<td>4,096 points</td>
</tr>
<tr>
<td>Data registers (D)</td>
<td>57,344 points</td>
</tr>
<tr>
<td>Link registers (W)</td>
<td>8,192 points</td>
</tr>
<tr>
<td>Special registers (SD)</td>
<td>4,096 points</td>
</tr>
<tr>
<td>Motion registers (M)</td>
<td>12,288 points</td>
</tr>
<tr>
<td>CPU buffer memory (U3E.HG)</td>
<td>Up to 2,097,152 points</td>
</tr>
<tr>
<td>CPU buffer memory (fixed-cycle communication area) (U3E.HG)</td>
<td>Up to 12,288 points</td>
</tr>
<tr>
<td>Module access (U3E.HG)</td>
<td>Up to 268,435,456 points</td>
</tr>
</tbody>
</table>

(Note-1): Internal relays (M): 12,288 points, data registers (D): 20,480 points (when using the Q series Motion compatible device assignment with R32MTCPU and R16MTCPU)
### Advanced synchronous control specifications

#### Synchronous control

<table>
<thead>
<tr>
<th>Item</th>
<th>Input axis</th>
<th>Composite main shaft gear</th>
<th>Main shaft main input axis</th>
<th>Main shaft sub input axis</th>
<th>Main shaft gear</th>
<th>Main shaft clutch</th>
<th>Auxiliary shaft</th>
<th>Auxiliary shaft gear</th>
<th>Auxiliary shaft clutch</th>
<th>Composite auxiliary shaft gear</th>
<th>Speed change gear</th>
<th>Output axis (Cam axis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo input axis</td>
<td>64 axes/module</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>2/output axis</td>
<td>64 axes/module</td>
</tr>
<tr>
<td>Command generation axis</td>
<td>64 axes/module</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>2/output axis</td>
<td>32 axes/module</td>
</tr>
<tr>
<td>Synchronous encoder axis</td>
<td>12 axes/module</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
<td>2/output axis</td>
<td>16 axes/module</td>
</tr>
</tbody>
</table>

#### Cam control

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory capacity</td>
<td>Specifications</td>
</tr>
<tr>
<td>Storage file</td>
<td>Capacity of the standard ROM/SD memory card</td>
</tr>
<tr>
<td>Cam working area</td>
<td>16M bytes</td>
</tr>
<tr>
<td>Number of registration</td>
<td>Up to 1024 program items (depending on memory capacity, cam resolution and number of coordinates)</td>
</tr>
<tr>
<td>Comment</td>
<td>Up to 32 characters for each cam data</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cam data</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke ratio data type</td>
<td>Specifications</td>
</tr>
<tr>
<td>Number of cam registration</td>
<td>Cam resolution</td>
</tr>
<tr>
<td></td>
<td>256 1024 2048 4096 8192 16384 32768</td>
</tr>
<tr>
<td>Stroke ratio</td>
<td>-214,748,364 to 214,748,364 [%]</td>
</tr>
<tr>
<td>Coordinate data type</td>
<td>Specifications</td>
</tr>
<tr>
<td>Number of cam registration</td>
<td>Number of coordinates</td>
</tr>
<tr>
<td></td>
<td>512 1024 2048 4096 8192 16384 32768 65535</td>
</tr>
<tr>
<td>Coordinate data</td>
<td>Input value : -214,748,364 to 214,748,364</td>
</tr>
</tbody>
</table>

#### G-code control

<table>
<thead>
<tr>
<th>Function</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning</td>
<td>G00</td>
</tr>
<tr>
<td>Linear interpolation</td>
<td>G01</td>
</tr>
<tr>
<td>Circular interpolation</td>
<td>G02, G03</td>
</tr>
<tr>
<td>Dwell</td>
<td>G04</td>
</tr>
<tr>
<td>Exact stop check</td>
<td>G09, G61</td>
</tr>
<tr>
<td>Polar coordinate interpolation</td>
<td>G12.1, G13.1</td>
</tr>
<tr>
<td>Plane selection</td>
<td>G17, G18, G19</td>
</tr>
<tr>
<td>Tool radius compensation</td>
<td>G38, G39, G40, G41, G42</td>
</tr>
<tr>
<td>Normal line control</td>
<td>G40.1, G41.1, G42.1</td>
</tr>
<tr>
<td>Tool length compensation</td>
<td>G43, G44, G49</td>
</tr>
<tr>
<td>Local coordinate system setting</td>
<td>G52</td>
</tr>
<tr>
<td>Basic machine coordinate system</td>
<td>G53</td>
</tr>
<tr>
<td>Work coordinate system selection</td>
<td>G54, G55, G56, G57, G58, G59</td>
</tr>
<tr>
<td>High-accuracy control</td>
<td>G61.1</td>
</tr>
<tr>
<td>Automatic corner override</td>
<td>G62</td>
</tr>
<tr>
<td>Cutting mode</td>
<td>G64</td>
</tr>
<tr>
<td>Program coordinate rotation</td>
<td>G68, G69</td>
</tr>
<tr>
<td>Absolute value command</td>
<td>G90</td>
</tr>
<tr>
<td>Incremental value command</td>
<td>G91</td>
</tr>
<tr>
<td>Override</td>
<td>Specified with device</td>
</tr>
<tr>
<td>FIN signal wait function</td>
<td>G-code control device</td>
</tr>
<tr>
<td>Single block</td>
<td>G-code control device</td>
</tr>
<tr>
<td>Subprogram control</td>
<td>M98, M99</td>
</tr>
<tr>
<td>Variable command</td>
<td>Common variable</td>
</tr>
<tr>
<td>Operation command</td>
<td>IF - GOTO, IF - THEN - ELSE - ENDIF, WHILE - DO - END</td>
</tr>
<tr>
<td>Control command</td>
<td>IF - GOTO, IF - THEN - ELSE - ENDIF, WHILE - DO - END</td>
</tr>
</tbody>
</table>
### Module specification

**Motion CPU module R64MTCPU/R32MTCPU/R16MTCPU**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of control axes</td>
<td>R64MTCPU: Up to 64 axes</td>
</tr>
<tr>
<td></td>
<td>R32MTCPU: Up to 32 axes</td>
</tr>
<tr>
<td></td>
<td>R16MTCPU: Up to 16 axes</td>
</tr>
<tr>
<td>Servo amplifier connection method</td>
<td>SSCNET III/H (2 lines)</td>
</tr>
<tr>
<td></td>
<td>SSCNET III/H (1 line)</td>
</tr>
<tr>
<td>Maximum overall cable distance</td>
<td>R64MTCPU: 3200 (10498.69)</td>
</tr>
<tr>
<td></td>
<td>R32MTCPU: 1600 (5249.34)</td>
</tr>
<tr>
<td>Maximum distance between stations</td>
<td>R16MTCPU: 100 (328.08)</td>
</tr>
<tr>
<td>SSCNET communications</td>
<td></td>
</tr>
<tr>
<td>Number of sensing module</td>
<td>R64MTCPU: Up to 8 stations</td>
</tr>
<tr>
<td></td>
<td>R32MTCPU: Up to 4 stations</td>
</tr>
<tr>
<td></td>
<td>R16MTCPU: Up to 4 stations</td>
</tr>
<tr>
<td>PERIPHERAL I/F (Ethernet)</td>
<td></td>
</tr>
<tr>
<td>Data transmission speed</td>
<td>100Mbps/10Mbps</td>
</tr>
<tr>
<td>Transmission method</td>
<td>Base band</td>
</tr>
<tr>
<td>Cable length [m(ft.)]</td>
<td>Up to 30 (98.43)</td>
</tr>
<tr>
<td>Memory card slot</td>
<td>SD/SDHC memory card compatible</td>
</tr>
<tr>
<td>Memory capacity</td>
<td>Standard ROM</td>
</tr>
<tr>
<td></td>
<td>12 M bytes</td>
</tr>
<tr>
<td></td>
<td>SD memory card</td>
</tr>
<tr>
<td></td>
<td>Memory card capacity (Up to 32 G bytes)</td>
</tr>
<tr>
<td>Extension base unit</td>
<td>Up to 7</td>
</tr>
<tr>
<td>5 VDC internal current consumption</td>
<td>1.20</td>
</tr>
<tr>
<td>Mass [kg]</td>
<td>0.28</td>
</tr>
<tr>
<td>Exterior dimensions [mm(inch)]</td>
<td>106.0 (4.17) × 27.8 (1.09) × 110.0 (4.33)</td>
</tr>
</tbody>
</table>
### Exterior Dimensions

#### R64MTCPU/R32MTCPU

- **Exterior Dimensions**
  - **R64MTCPU**
    - [Unit: mm (inch)]
    - 110 (4.33) x 85.5 (3.35) x 42 (1.65)
  - **R32MTCPU**
    - [Unit: mm (inch)]
    - 110 (4.33) x 85.5 (3.35) x 42 (1.65)

#### R16MTCPU

- **Exterior Dimensions**
  - [Unit: mm (inch)]
  - 110 (4.33) x 85.5 (3.35) x 42 (1.65)

### Serial absolute synchronous encoder Q171ENC-W8

- **Specifications**
  - **Resolution**: 4,194,304 pulse/rev
  - **Direction of increasing addresses**: CCW (viewed from end of shaft)
  - **Protective construction**: Dustproof/Waterproof (IP67: Except for the shaft-through portion)
  - **Permitted axial loads**
    - Radial load: Up to 19.6N
    - Thrust load: Up to 9.8N
  - **Permitted speed**: 3600r/min
  - **Permitted angular acceleration**: 40000 rad/s²
  - **Ambient temperature**: -5 to 55°C (23 to 131°F)
  - **5VDC consumption current**: 0.25A
  - **Mass**: 0.6kg

### Manual pulse generator MR-HDP01

- **Specifications**
  - **Pulse resolution**: 25 pulse/rev
    - (100 pulse/rev after magnification by 4)
  - **Phase A, Phase B Output voltage**: Input voltage: -1V or more
  - **Output method**: Voltage output
  - **Output current**: Up to 20mA
  - **Life time**: 1,000,000 revolutions or more (at 200r/min)
  - **Permitted axial loads**
    - Radial load: Up to 19.6N
    - Thrust load: Up to 9.8N
  - **Maximum rotation speed**: 600r/min (Instantaneous maximum), 200r/min (Normal rotation)
  - **Ambient temperature**: -10 to 60°C (14 to 140°F)
  - **5VDC consumption current**: 0.06A
  - **Mass**: 0.4kg

(Nota) When using an external power supply, use 5VDC power supply.
Mounting

R64MTCPU/R32MTCPU/R16MTCPU

Top of panel, wiring duct, or other components

5mm (0.2inch) or more

5mm (0.2inch) or more

(Note-1): Provide clearance of 30mm (1.18inch) or more when the height of a wiring duct is 50mm (1.97inch) or less. In other cases, provide clearance of 40mm (1.57inch) or more.

(Note-2): Provide clearance of 20mm (0.79inch) or more when an extension cable is connected/removed without removing a power supply module.
## Components

Compliance with the indicated global standards and regulations is current as of the release date of this catalog. Contact your local sales office for the latest information.

### Motion controller R64MTCPU/R32MTCPU/R16MTCPU

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motion CPU module</td>
<td>R64MTCPU</td>
<td>Up to 64 axes, Operation cycle 0.222 ms or longer</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>R32MTCPU</td>
<td>Up to 32 axes, Operation cycle 0.222 ms or longer</td>
<td>CE, UL, KC</td>
</tr>
<tr>
<td></td>
<td>R16MTCPU</td>
<td>Up to 16 axes, Operation cycle 0.222 ms or longer</td>
<td>CE, UL, KC</td>
</tr>
</tbody>
</table>

### SSCNET III cable (Note-1)

- **MR-J3BUS_M**
  - Motion CPU module ⇔ Servo amplifier
  - Standard code for inside panel: 0.15m (0.49 ft.), 0.3m (0.98 ft.), 0.5m (1.64 ft.), 1m (3.28 ft.), 3m (9.84 ft.)
- **MR-J3BUS_M-A**
  - Motion CPU module ⇔ Servo amplifier: 5m (16.40 ft.), 10m (32.81 ft.), 20m (65.62 ft.)
- **MR-J3BUS_M-B (Note-1)**
  - Servo amplifier: 30m (98.43 ft.), 40m (131.23 ft.), 50m (164.04 ft.)

### Serial absolute synchronous encoder (Note-2)

- **Q171 ENC-W8**
  - Resolution: 4,194,304 pulses/rev, Permitted speed: 3600 r/min
  - Standard cable for outside panel:
    - 2m (6.56 ft.)
    - 5m (16.40 ft.)
    - 10m (32.81 ft.)
    - 20m (65.62 ft.)
    - 30m (98.43 ft.), 40m (131.23 ft.), 50m (164.04 ft.)

### Manual pulse generator

- **MR-HDP01**
  - Number of pulses per revolution: 25 pulses/rev (100 pulses/rev after magnification by 4), Permitted speed: 200 r/min (Normal rotation)

### Optical hub unit

- **MR-MV200**
  - Three branches/unit, DC power supply connector enclosed

(Note-1): "_" indicates cable length (015: 0.15m (0.49ft.), 03: 0.3m (0.98ft.), 05: 0.5m (1.64ft.), 1: 1m (3.28ft.), 3: 3m (9.84ft.), 5: 5m (16.40ft.), 10: 10m (32.81ft.), 20: 20m (65.62ft.), 30: 30m (98.43ft.), 40: 40m (131.23ft.), 50: 50m (164.04ft.))

(Note-2): For a long distance cable of up to 100m (328.08ft.) or an ultra-long bending life cable, contact Mitsubishi Electric System & Service Co., Ltd. OVERSEAS SERVICE SECTION (Email: osb.webmaster@melsc.jp)

## [Manual pulse generator on the market]

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

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual pulse generator</td>
<td>UFO-M2-0025-2Z1-B00E</td>
<td>Number of pulses per revolution: 25 pulses/rev (100 pulses/rev after magnification by 4), Permitted speed: 200 r/min (Normal rotation)</td>
<td>Nemicon Corporation</td>
</tr>
</tbody>
</table>

## Applicable CPU

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PLC CPU module</td>
<td>R00CPU, R01CPU, R02CPU, R04CPU, R08CPU, R16CPU, R32CPU, R120CPU, R04ENCPU, R08ENCPU, R16ENCPU, R32ENCPU, R120ENCPU, R08PCPU, R16PCPU, R32PCPU, R120PCPU, R12CCPU-V</td>
</tr>
</tbody>
</table>

(Note): Depending on the combination of the modules, there are restrictions on the firmware version of the PLC CPU module. Refer to "MELSEC IQ-R Module Configuration Manual" for details.

## Software for Motion controller

<table>
<thead>
<tr>
<th>Part</th>
<th>Model name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating system software</td>
<td>SW10UNC-RM1FW</td>
<td>Pre-installed before shipment</td>
</tr>
<tr>
<td>Machine Library</td>
<td>MONTYP-REL3</td>
<td>Contact your local sales office</td>
</tr>
<tr>
<td>Operating system software add-on library</td>
<td>SW100ND-GCD01</td>
<td>USB key (Number of licenses: 1)</td>
</tr>
<tr>
<td></td>
<td>SW100ND-GCDD05</td>
<td>USB key (Number of licenses: 5)</td>
</tr>
<tr>
<td></td>
<td>SW100ND-GCDC10</td>
<td>USB key (Number of licenses: 10)</td>
</tr>
<tr>
<td></td>
<td>SW100ND-GCD20</td>
<td>USB key (Number of licenses: 20)</td>
</tr>
<tr>
<td></td>
<td>SW100ND-GCD60</td>
<td>USB key (Number of licenses: 50)</td>
</tr>
</tbody>
</table>

(Note): When requesting more than 50 licenses, contact your local sales office.
Sensing Module **MR-MT2000** Series

High Speed and High Accuracy by Synchronization of I/O Signals with Motion Control

The sensing module MR-MT2000 series consists of one head module and four types of extension modules, the I/O module, pulse I/O module, analog I/O module, and encoder I/F module. The required extension modules can be selected according to your application.

- I/O with a fastest response time of 1μs
- High-accuracy analog I/O
- Pulse I/O for synchronous control
- Supporting open standard encoder I/Fs

Possible to use the Head module alone

Possible to use the Head module alone (4 modules maximum) (Note-1)

SSCNET III/H Head module MR-MT2010

Freely combinable according to application

Freely combinable according to application (4 modules maximum) (Note-1)

SSCNET III/H Head module MR-MT2010

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Number of Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O module MR-MT2100</td>
<td>12</td>
</tr>
<tr>
<td>Pulse I/O module MR-MT2200</td>
<td>2</td>
</tr>
<tr>
<td>Analog I/O module MR-MT2300</td>
<td>2</td>
</tr>
<tr>
<td>Encoder I/F module MR-MT2400</td>
<td>1</td>
</tr>
</tbody>
</table>

(Note-1): Up to two encoder I/F modules are connectable per Head module.
**I/O module**

**MR-MT2100**
- High-response input: 16 points
- High-response output: 16 points
- I/O synchronized with motion control
- A fastest response time of 1 μs
- Timing-latch input with 0.1 μs precision

**Analog I/O module**

**MR-MT2300**
- Input: 4CH
- Output: 4CH
- High-resolution I/O 16 bits
- Voltage range switching function

**Pulse I/O module**

**MR-MT2200**
- I/O: 2CH (selectable)
- Pulse command output
- General-purpose pulse input
- Pulse-coincidence output

**Encoder I/F module**

**MR-MT2400**
- Input: 2CH
- SSI
- Mitsubishi Electric serial I/F

---

**Application example in printing processes using sensing module**

Each I/O signal connected to the sensing module is synchronized with the Motion control cycle, enabling a processing with little variation to achieve high speed and high accuracy of equipment.

---

The sensing module is easily set with MELSOFT MT Works2.
Application examples to increase speed and accuracy

**Issue** High-accuracy mark detection on high-speed moving film

The sensing modules can read the current position using a highly accurate (within ± 1 μs) timing-latch input function, enabling high-accuracy, high-response mark detection. Input and output can be synchronized with the motion control cycle even with the Head module alone.

**Modules to be used**
- Head module: MR-MT2010
- I/O module: MR-MT2100

**Solution** High-response mark detection with I/O module

**Issue** High-accuracy imaging of high-speed moving workpieces

The sensing module triggers the shutter output based on the pulses counted from the sensor input, enabling an accurate, high-speed trigger control.

**Modules to be used**
- Head module: MR-MT2010
- Pulse I/O module: MR-MT2200

**Solution** Shutter output with little variation by using pulse I/O module

- Head module: MR-MT2010
- Pulse I/O module: MR-MT2200
Issue: High-accuracy imaging with little variation

Even when the speed of the conveyor fluctuates, an accurate imaging is possible because the pulse I/O module can output a signal based on the pulses counted up.

[Modules to be used]
- Head module: MR-MT2010
- Pulse I/O module: MR-MT2200

Solution: Shutter output with little variation by using pulse I/O module

Issue: Synchronization with post processes

The current feed value of a command generation axis can be transferred through link devices, and thus output pulses of the sensing module can be synchronized with the command generation axis. Post processes, such as an inspection machine and other external machines can be synchronized with a command generation axis even without a synchronous encoder.

[Modules to be used]
- Head module: MR-MT2010
- Pulse I/O module: MR-MT2200

Solution: Synchronization of machines in the entire system with pulse I/O module

Outline

- SERVO SYSTEM CONTROLLER
- Outline
- Simple Motion Controllers
- Servo Amplifiers
- Engineering Environment
- Networks
- Servo Accessories
### Issue
**Use of drivers not supporting SSCNET III/H**

Synchronous control is possible between the general-purpose pulse train driver and the servo amplifier by SSCNET III/H connection via the SSCNET III/H Sensing modules. (The driver is counted as a servo amplifier axis.)

[Nota]: MR-MT2100/2300/2400 cannot be used together with MR-MT2010/2200 when the general-purpose pulse train driver is used.

**[Modules to be used]**
- Head module: MR-MT2010
- Pulse I/O module: MR-MT2200

### Solution
**Operating general-purpose pulse train drivers with pulse I/O module**

### Issue
**Trigger output when the sensor input value exceeds the threshold value**

The Head module and the I/O module automatically output a digital signal when the input value of the analog I/O module exceeds the threshold value.

**[Modules to be used]**
- Head module: MR-MT2010
- Analog I/O module: MR-MT2300

### Solution
**Level output function by the Head module and I/O module**
**Issue** Load control by high-accuracy pressure detection

Reading pressure sensor data while synchronizing with the motion control cycle, enables I/Os with little variation and thus high-accuracy load control with a fully closed loop system.

**Modules to be used**
- Head module: MR-MT2010
- Analog I/O module: MR-MT2300

---

**Issue** Use of open standard encoders

The encoder I/F module supports various encoder I/Fs, enabling data input of various different encoders and configuring a fully closed loop system.

**Encoder I/Fs**
- SSI
- Mitsubishi Electric serial I/F

**Modules to be used**
- Head module: MR-MT2010
- Encoder I/F module: MR-MT2400
## Specifications

<table>
<thead>
<tr>
<th>Name</th>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSCNET III/H Head module MR-MT2010</td>
<td>Control circuit power supply input</td>
<td>Voltage 24 V DC, Permissible voltage fluctuation 24 V DC ± 10 %, Current capacity 1.0 A</td>
</tr>
<tr>
<td></td>
<td>Communications interface</td>
<td>SSCNET III/H</td>
</tr>
<tr>
<td>I/O module MR-MT2100</td>
<td>DI Number of input points</td>
<td>12 points</td>
</tr>
<tr>
<td></td>
<td>Input method</td>
<td>Sink input/source input (photocoupler isolation)</td>
</tr>
<tr>
<td></td>
<td>Input response time</td>
<td>ON to OFF: within 1 μs, OFF to ON: within 1 μs</td>
</tr>
<tr>
<td></td>
<td>DO Number of output points</td>
<td>2 points</td>
</tr>
<tr>
<td></td>
<td>Output method</td>
<td>Sink output (photocoupler isolation)</td>
</tr>
<tr>
<td></td>
<td>Output response time</td>
<td>ON to OFF: within 1 μs, OFF to ON: within 1 μs</td>
</tr>
<tr>
<td></td>
<td>Mass [kg]</td>
<td>0.2</td>
</tr>
<tr>
<td>Pulse I/O module MR-MT2200</td>
<td>DI Number of input points</td>
<td>16 points (Note-1)</td>
</tr>
<tr>
<td></td>
<td>Input method</td>
<td>Sink input/source input (photocoupler isolation)</td>
</tr>
<tr>
<td></td>
<td>Input response time</td>
<td>ON to OFF: within 1 μs, OFF to ON: within 1 μs</td>
</tr>
<tr>
<td></td>
<td>DO Number of output points</td>
<td>16 points (Note-1)</td>
</tr>
<tr>
<td></td>
<td>Output method</td>
<td>Sink output/source output (photocoupler isolation)</td>
</tr>
<tr>
<td></td>
<td>Output response time</td>
<td>ON to OFF: within 1 μs, OFF to ON: within 1 μs</td>
</tr>
<tr>
<td></td>
<td>Mass [kg]</td>
<td>0.2</td>
</tr>
<tr>
<td>Analog I/O module MR-MT2300</td>
<td>Number of pulse I/O channels</td>
<td>Output 2CH, input 2CH, I/O 1CH each (selectable)</td>
</tr>
<tr>
<td></td>
<td>Pulse output</td>
<td>Differential line driver output/open collector output</td>
</tr>
<tr>
<td></td>
<td>Input signal</td>
<td>Input frequency</td>
</tr>
<tr>
<td></td>
<td>Output signal</td>
<td>Output method</td>
</tr>
<tr>
<td></td>
<td>Input method</td>
<td>Input frequency</td>
</tr>
<tr>
<td></td>
<td>Output method</td>
<td>Output signal</td>
</tr>
<tr>
<td></td>
<td>Output frequency</td>
<td>Output method</td>
</tr>
<tr>
<td></td>
<td>DI Number of input points</td>
<td>7 points per axis (total of 14 points)</td>
</tr>
<tr>
<td></td>
<td>Input method</td>
<td>Sink input/source input (photocoupler isolation)</td>
</tr>
<tr>
<td></td>
<td>DO Number of output points</td>
<td>5 points per axis (total of 10 points) (Note-2)</td>
</tr>
<tr>
<td></td>
<td>Output method</td>
<td>Sink output/source output (photocoupler isolation)</td>
</tr>
<tr>
<td></td>
<td>Mass [kg]</td>
<td>0.2</td>
</tr>
<tr>
<td>Encoder I/F module MR-MT2400</td>
<td>Number of encoder channels</td>
<td>2CH (Note-3)</td>
</tr>
<tr>
<td></td>
<td>Supported encoder communications</td>
<td>SSI, Mitsubishi Electric serial I/F</td>
</tr>
<tr>
<td></td>
<td>Mass [kg]</td>
<td>0.2</td>
</tr>
</tbody>
</table>

(Note-1): When the module is used at the temperature exceeding 55 °C and up to 60 °C, keep the number of points turned on simultaneously to be 14 or less for each DI and DO.

(Note-2): Two of the five points and the pulse output (open collector output) are mutually exclusive.

(Note-3): Different encoder interfaces cannot be inputted for each channel. The same encoder interface should be used for both two channels.

### Applicable controllers

- Motion CPU module: R64MTCPU, R32MTCPU, R16MTCPU
- Position board: MR-MC200 series, MR-MC341

### Components

Compliance with the indicated global standards and regulations is current as of the release date of this catalog. Contact your local sales office for the latest information.

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing Module</td>
<td>SSCNET III/H Head module MR-MT2010</td>
<td>SSCNET III/H, input: 12 points, output: 2 points</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>I/O module</td>
<td>MR-MT2100</td>
<td>Input 16 points, output 16 points</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>Pulse I/O module</td>
<td>MR-MT2200</td>
<td>Total pulse I/O: 2CH</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>Analog I/O module</td>
<td>MR-MT2300</td>
<td>Analog input: 4CH, analog output: 4CH</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>Encoder I/F module</td>
<td>MR-MT2400</td>
<td>Encoder I/F: 2CH</td>
<td>UL, CE, KC, EAC</td>
</tr>
</tbody>
</table>
**Exterior Dimensions**

**SSCNET III/H Head module MR-MT2010**

**I/O module MR-MT2100**

**Pulse I/O module MR-MT2200**

**Analog I/O module MR-MT2300**

**Encoder I/F module MR-MT2400**

[Unit: mm (inch)]

- **SSCNET III/H Head module MR-MT2010**
  - Dimensions:
    - 95 (3.74) mm
    - [Additional dimensions]

- **I/O module MR-MT2100**
  - Dimensions:
    - 95 (3.74) mm
    - [Additional dimensions]

- **Pulse I/O module MR-MT2200**
  - Dimensions:
    - 95 (3.74) mm
    - [Additional dimensions]

- **Analog I/O module MR-MT2300**
  - Dimensions:
    - 95 (3.74) mm
    - [Additional dimensions]

- **Encoder I/F module MR-MT2400**
  - Dimensions:
    - 95 (3.74) mm
    - [Additional dimensions]
Fully supporting all your needs from model selection, system design, startup to maintenance with diverse software

Motion Controller Engineering Software
MELSOFT MT Works2

Comprehensibly supporting Motion controller design and maintenance
With features including Motion SFC programming, parameter settings, and the digital oscilloscope function, this software supports the engineering process—from system configuration and programming through debugging and maintenance of the Motion controller.

Programmable Controller Engineering Software
MELSOFT GX Works3

All-in-one tool for quick and easy startup
This software supports the engineering process—from creation of a sequence program, parameter settings of the Simple Motion module, and creation of a positioning data table and cam data through startup, debugging, and maintenance.

System Design

System configuration
Servo amplifiers and modules are set easily with the graphical system setting screen.

Module configuration
Each parameter is set from the module configuration screen.

Servo data setting
One-point help allows you to set parameters without manuals.

CC-Link IE Field configuration
Parameters for CC-Link IE Field Network are easy to be set.

Electronic gear setting
Reduction ratio setting

Entering just the machine specifications (reduction ratio, ball screw pitch, etc.) sets the electric gear.

Simulation can be executed without an actual machine during the debugging process.

User-friendly functions make Motion controller program development easier.

Various cam patterns are created more freely and flexibly.

The created cam data are easily viewed as thumbnails.

Multi-axis adjustment
The multi-axis adjustment function enables easy servo adjustment and quick startup for machines executing multi-axis simultaneous operation, such as a tandem configuration.
Motion Controller Engineering Software MELSOFT MT Works2
Programmable Controller Engineering Software MELSOFT GX Works3

System configuration
Servo amplifiers and modules are set easily with the graphical system setting screen.

Module configuration

■ Servo data setting
■ CC-Link IE Field configuration

One-point help allows you to set parameters without manuals. Entering just the machine specifications (reduction ratio, ball screw pitch, etc.) sets the electric gear. Parameters for CC-Link IE Field Network are easy to be set. Each parameter is set from the module configuration screen.

Electronic gear setting
Reduction ratio setting
Amplifier setting

Fully supporting all your needs from model selection, system design, startup to maintenance with diverse software

Comprehensibly supporting Motion controller design and maintenance
With features including Motion SFC programming, parameter settings, and the digital oscilloscope function, this software supports the engineering process—from system configuration and programming through debugging and maintenance of the Motion controller.

Motion Controller Engineering Software
MELSOFT MT Works2

All-in-one tool for quick and easy startup
This software supports the engineering process—from creation of a sequence program, parameter settings of the Simple Motion module, and creation of a positioning data table and cam data through startup, debugging and maintenance.

Programmable Controller Engineering Software
MELSOFT GX Works3

The synchronous control parameter is easily set using software instead of controlling mechanically with physical gears, shafts, speed change gears or cams.

Functions, such as Data setting assistant and Automatic calculation of auxiliary arc, simplify the setting input process of positioning data.

Synchronous control parameter
The synchronous control parameter is easily set using software instead of controlling mechanically with physical gears, shafts, speed change gears or cams.

Cam data creation
Various cam patterns are created more freely and flexibly.

Cam data list
The created cam data are easily viewed as thumbnails.

Simulation
Simulation can be executed without an actual machine during the debugging process.

User-friendly functions make Motion controller program development easier.

Positioning data setting
Functions, such as Data setting assistant and Automatic calculation of auxiliary arc, simplify the setting input process of positioning data.

Start up and Adjustment

■ Monitor
The required items and axes are selected from various monitoring information.

■ Digital oscilloscope
Data collection and waveform display which are synchronized with the Motion operation cycle greatly help you check operation and perform troubleshooting.

■ Multi-axis adjustment
The multi-axis adjustment function enables easy servo adjustment and quick startup for machines executing multi-axis simultaneous operation, such as a tandem configuration.

MT Works2 GX Works3
Select the most suitable servo motors, servo amplifiers, and regenerative options for your machine just by setting machine specifications and operation patterns. You can select a suitable combination from various results. This software also supports multi-axis systems, enabling you to set operation patterns and select options for multiple axes.
FA Integrated Engineering Software MELSOFT iQ Works

MELSOFT iQ Works is an integrated software suite consisting of GX Works3, MT Works2, GT Works3, RT ToolBox3, FR Configurator2, CW Configurator, and MR Configurator2, which are programming software for each respective product. Integration is further enhanced with MELSOFT Navigator as the central system configuration. The advantages of this powerful integrated software suite are that system design is made much easier with a substantial reduction in repetitive tasks, cutting down on errors while helping to reduce the overall TCO.

**System management software**
**MELSOFT Navigator**

System level graphic-based configuration tool that simplifies the system design by providing a visual representation of the system. System management features such as system-wide parameterization, labels and block reading of project data are also included.

**Programmable controller engineering software**
**MELSOFT GX Works3**

This programming and maintenance software includes many features such as graphic-based configuration, simple point and click programming architecture, and diagnostics function enabling easy troubleshooting, reducing engineering cost.

**HMI/GOT screen design software**
**MELSOFT GT Works3**

This graphic operation terminal (GOT) screen creation software is designed with three main features—simplicity, graphics design and operation ease—that help to create graphic screens in fewer steps.

**Motion controller engineering software**
**MELSOFT MT Works2**

This motion control design and maintenance software includes intuitive graphic-based programming together with a digital oscilloscope simulator, helping to reduce the motion system TCO.

**Servo setup software**
**MELSOFT MR Configurator2**

This servo setup software used for easy monitoring, diagnostics, registering parameters, and testing of the servo amplifier.

- **Robot engineering software**
  **MELSOFT RT ToolBox3**

- **Inverter setup software**
  **MELSOFT FR Configurator2**

- **C Controller setting and monitoring tool**
  **MELSOFT CW Configurator**
### Operating environment  
**MELSOFT MT Works2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OS</strong></td>
<td>Microsoft® Windows® 11 (Home, Pro, Enterprise, Education)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 10 (Home, Pro, Enterprise, Education, IoT Enterprise 2016 LTSB *)</td>
</tr>
<tr>
<td><em>1: 64-bit version only</em></td>
<td></td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>Windows® 11 Two or more cores on a compatible 64-bit processor or System on a Chip (SoC)</td>
</tr>
<tr>
<td></td>
<td>Windows® 10 Intel® Core™ 2 Duo 2 GHz or more recommended</td>
</tr>
<tr>
<td><strong>Required memory</strong></td>
<td>Windows® 11 4GB or more recommended</td>
</tr>
<tr>
<td></td>
<td>Windows® 10 For 64-bit edition: 2GB or more recommended, For 32-bit edition: 1GB or more recommended</td>
</tr>
<tr>
<td><strong>Monitor</strong></td>
<td>Resolution 1024 x 768 or more</td>
</tr>
</tbody>
</table>

(Note): Refer to Installation Instructions for precautions and restrictions regarding the operating environment.

### MELSOFT GX Works3

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OS</strong></td>
<td>Microsoft® Windows® 11 (Home, Pro, Enterprise, Education)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 10 (Home, Pro, Enterprise, Education, IoT Enterprise 2016 LTSB *, IoT Enterprise 2019 LTSC **)</td>
</tr>
<tr>
<td><em>1: 64-bit version only</em></td>
<td></td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>Windows® 11 Two or more cores on a compatible 64-bit processor or System on a Chip (SoC)</td>
</tr>
<tr>
<td></td>
<td>Windows® 10 Intel® Core™ 2 Duo 2 GHz or more recommended</td>
</tr>
<tr>
<td><strong>Required memory</strong></td>
<td>Windows® 11 4GB or more recommended</td>
</tr>
<tr>
<td></td>
<td>Windows® 10 For 64-bit edition: 2GB or more recommended, For 32-bit edition: 1GB or more recommended</td>
</tr>
<tr>
<td><strong>Monitor</strong></td>
<td>Resolution 1024 x 768 or more</td>
</tr>
</tbody>
</table>

(Note): Refer to Installation Instructions for precautions and restrictions regarding the operating environment.

### Engineering software list

<table>
<thead>
<tr>
<th>Product</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MELSOFT GX Works3</td>
<td>SW1DND-GXW3-E</td>
<td>• Programmable Controller Engineering Software (including GX Works2, GX Developer, PX Developer *) <em>2</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MITSUBISHI ELECTRIC FA Library</td>
</tr>
<tr>
<td>MELSOFT MT Works2</td>
<td>SW1DND-MTW2-E</td>
<td>• FA engineering software <em>3</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• System management software: MELSOFT Navigator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Programmable controller engineering software: MELSOFT GX Works3 (including GX Works2, GX Developer, PX Developer *) <em>2</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Motion controller engineering software: MELSOFT MT Works2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• HMI/GOT screen design software: MELSOFT GT Works3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Robot engineering software: MELSOFT RT ToolBox3 (for RT ToolBox3 mini) <em>3</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inverter setup software: MELSOFT FR Configurator2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Servo setup software: MELSOFT MR Configurator2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• C Controller setting and monitoring tool: MELSOFT CW Configurator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MITSUBISHI ELECTRIC FA Library</td>
</tr>
</tbody>
</table>

(Note-1): For detailed information about supported modules, refer to the manuals of the relevant software package.

(Note-2): Includes both programming tool and monitor tool for process control.

(Note-3): 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.
CC-Link IE Field Network is a single network which combines the versatility of Ethernet and highly accurate synchronous operation for Motion control. With the single network, various field devices, such as servo amplifiers, I/O modules, and high-speed counter modules, are connected flexibly. Various tasks, such as Simple Motion parameter settings, servo adjustment, and debugging as well as creating a sequence program, such as a function block (FB), are performed only with this all-in-one engineering software.

I/O mode easily drives a belt conveyor, a rotary table, a ball screw mechanism, etc. by using the built-in positioning function in a servo amplifier.

Motion mode enables advanced motion control functions, such as positioning for multi-axis interpolation, synchronous control, and speed-torque control in combination with the Simple Motion module.

I/O mode easily drives a belt conveyor, a rotary table, a ball screw mechanism, etc. by using the built-in positioning function in a servo amplifier.
CC-Link IE Field Network is a single network which combines the versatility of Ethernet and highly accurate synchronous operation for Motion control. With the single network, various field devices, such as servo amplifiers, I/O modules, and high-speed counter modules, are connected flexibly.

Various tasks, such as Simple Motion parameter settings, servo adjustment, and debugging as well as creating a sequence program, such as a function block (FB), are performed only with this all-in-one engineering software.

I/O mode easily drives a belt conveyor, a rotary table, a ball screw mechanism, etc. by using the built-in positioning function in a servo amplifier.

Motion mode enables advanced motion control functions, such as positioning for multi-axis interpolation, synchronous control, and speed-torque control in combination with the Simple Motion module.

With a switching hub, multiple network topologies are supported including star, line, and star and line combinations. This flexibility allows additional equipment to be simply connected to any available port, with little concern for restrictions.

The CC-Link IE Field Network is equipped with Motion function in the cyclic communication bandwidth. Synchronous communication with the servo amplifiers becomes possible, offering high-speed and high-accuracy positioning, synchronous control, and cam control.
Communication speed is increased to 150 Mbps full duplex (equivalent to 300 Mbps half duplex), three times faster than the conventional speed. System response is dramatically improved.

**Three Times Faster Communication Speed**

Three times faster communication speed is achieved with SSCNET III/H, offering technical advantages for machines in printing and food processing industry that require deterministic control.

**Cycle Time as Fast as 0.222 ms**

Smooth control of a machine is possible using high-speed serial communication with a cycle time of 0.222 ms.

**Improved noise tolerance by optical communication**

The fiber-optic cables thoroughly shut out noise that enters from the power cable or external devices. Noise tolerance is dramatically improved as compared to metal cables.
and response of 150 Mbps full-duplex baud rate SSCNET III/H optical networking.

**I/O Signals Synchronized with Motion Control**

MR-MT2000 series sensing modules including the I/O module, analog I/O module, pulse I/O module, and encoder I/F module are connected to SSCNET III/H. These various modules enable a faster, more accurate machine operation by synchronizing the I/Os of a general-purpose pulse train driver, sensor, and SSI encoder with the motion control.

**Central Control with Network**

Large amounts of servo data are exchanged in real-time between the controller and the servo amplifier. Using MR Configurator2 on a personal computer that is connected to the Motion controller or the Simple Motion module helps consolidate information, such as parameter settings and monitoring for the multiple servo amplifiers.

**Long Distance Wiring up to 3200 m (10498.69 ft.)**

Long distance wiring is possible up to 3200 m (10498.69 ft.) per system (maximum of 100 m (328.08 ft.) between stations x 32 axes), suitable for large-scale systems.

**SSCNET III/H Compatible and SSCNET III Compatible Products Connected in a Same System**

SSCNET III/H compatible and SSCNET III compatible servo amplifiers can be used together.

- **When using MR-J4 series servo amplifiers**
  - SSCNET III/H compatible controller
  - Communication speed: 150 Mbps

- **When using MR-J4 series + MR-J3 series servo amplifiers together**
  - SSCNET III/H compatible controller or SSCNET III compatible controller
  - Communication speed: 50 Mbps

(Note): The function and the performance become equivalent to those of MR-J3 when the SSCNET III compatible products are used together in the same system.

(Note): Reconnecting cables is not required.
Servos in harmony with man, machine and the environment

**Servo Amplifiers**

Compatible with the CC-Link IE Field Network and the SSCNET III/H, these servo amplifiers operate rotary/linear servo motors or direct drive motors as standard (Note). Multi-axis servo amplifiers are also available, achieving energy conservation, space-saving, and reduced wiring.

(Note): MR-J4-B-RJ/J010 servo amplifiers are compatible only with rotary servo motors.

**Servo Motor**

A variety of models are available to match various applications. These include rotary servo motors for high-torque output during high speed, linear servo motors for highly accurate tandem synchronous control, and direct drive motors for compact and rigid machine, and high-torque operations.

**Rotary servo motor**

- Small capacity, low inertia
  - HG-KR series
    - Capacity: 50 to 750 W
- Small capacity, ultra-low inertia
  - HG-MR series
    - Capacity: 50 to 750 W
- Medium capacity, medium inertia
  - HG-SR series
    - Capacity: 0.5 to 7 kW
- Medium/large capacity, low inertia
  - HG-JR series
    - Capacity: 0.5 to 55 kW
- Medium capacity, ultra-low inertia
  - HG-RR series
    - Capacity: 1 to 5 kW
- Ultra-compact size, ultra-small capacity
  - HG-AK series
    - Capacity: 10 to 30 W
- Medium capacity, flat type
  - HG-UR series
    - Capacity: 0.75 to 5 kW
- Ultra-large capacity
  - HG-JR series
    - Capacity: 110 to 220 kW

**Linear servo motor**

- Core type
  - LM-H3 series
    - Rating: 70 to 960 N
- Core type (natural/liquid cooling)
  - LM-F series
    - Rating: 300 to 3000 N (natural cooling)
    - Rating: 600 to 6000 N (liquid cooling)
- Core type with magnetic attraction counter-force
  - LM-K2 series
    - Rating: 120 to 2400 N
- Coreless type
  - LM-U2 series
    - Rating: 50 to 800 N

**Direct drive motor**

- Core type
  - LM-U2 series
    - Rating: 50 to 800 N
- Low-profile flange type
  - TM-RG2M series
    - Rating: 2 to 240 N-m
- Low-profile table type
  - TM-RU2M series
    - Rating: 2.2 to 9 N-m
- Coreless type
  - TM-RFM series
    - Rating: 2 to 240 N-m
Machine

Industry-Leading Level of Servo Amplifier Basic Performance

Speed frequency response of 2.5 kHz is achieved by applying our original high-speed servo control architecture evolved from the conventional two-degrees-of-freedom model adaptive control to the dedicated execution engine. Together with a high-resolution absolute position encoder of 4,194,304 pulses/rev, fast and accurate operation is enabled. The performance of the high-end machines is utilized to the fullest.

Improving Machine Performance with High-Performance Servo Motors

With improved processing speed, the rotary servo motors equipped with a high-resolution encoder enables high-accuracy positioning and smooth rotation.

One-Touch Tuning Function

Just turn on the one-touch tuning function to complete servo gain adjustment automatically, including machine resonance suppression filter, advanced vibration suppression control II (Note-1), and robust filter for maximizing your machine performance. This function also sets responsibility automatically, while the real-time auto tuning requires manual setting. Moreover, this function has a method (Note-2) which allows to create an optimum tuning command inside the servo amplifier.

(Note-1): The advanced vibration suppression control II automatically adjusts one frequency.
(Note-2): This method is supported by MR-J4-B/MR-J4W-B.

Advanced Vibration Suppression Control II

The advanced vibration suppression control II suppresses two types of low-frequency vibrations, owing to vibration suppression algorithm which supports three-inertia system. This function is effective in suppressing residual vibration with relatively low frequency of approximately 100 Hz or less generated at the end of an arm and in a machine, enabling a shorter settling time.

Application examples

- [Pick and place robots]
- [Automatic assembly equipment]
- [Material handling systems]
Functions Compliant with IEC/EN 61800-5-2

STO (Safe torque off) and SS1 (Safe stop 1) are integrated as standard, enabling the safety system to be configured easily in a machine.

- By using STO, it is not necessary to turn off the control power of the servo amplifier, resulting in a shorter restart time and eliminating the necessity of home position return.
- A magnetic contactor for preventing unexpected motor start is not needed.
- The safety level of STO is increased to SIL 3 from SIL 2.

(Note-1): Safety equipment (MR-J3-D05, safety programmable controller MELSEC QS/WS series, etc.) is required.
(Note-2): For MR-J4 series servo amplifier, magnetic contactors are not required to meet the STO requirements. However, this illustration has a magnetic contactor installed to prevent servo alarm (Note-2) and unexpected start is no longer required.
(Note-3): For Category 3 PL e, SIL 3, use compatible safety equipment and set the parameters. When MR-J3-D05 is used, safety level is Category 3 PL e, SIL 2.

Tough Drive Function

Vibration tough drive

Machine resonance suppression filter is automatically readjusted when a change in machine resonance frequency is detected by the servo amplifier, reducing unplanned downtime caused by age-related degradation.

Instantaneous power failure tough drive

When an instantaneous power failure is detected, this function allows the servo amplifier to use the electric energy charged in the main circuit capacitor in the servo amplifier to avoid an alarm occurrence, increasing the machine availability even with an unstable power supply.

Large Capacity Drive Recorder

- Servo data such as motor current and position command before and after the alarm occurrence are stored in non-volatile memory of the servo amplifier. Reading the servo data on MR Configurator2 helps you analyze the cause of the alarm.
- Check the waveform (analog 16 bits x 7 channels + digital 8 channels) x 256 points) of the past 16-time alarms in the alarm history.

Machine Diagnosis Function

This function detects changes in mechanical parts (ball screw, guide, bearing, belt, etc.) by analyzing changes in machine friction, load moment of inertia, unbalanced torque, and vibration components from the data inside a servo amplifier, supporting timely maintenance of these parts.

Servo setup software

MELSOFT 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.
The Environment

Space-Saving with Industry’s Smallest (Note) 3-axis Type

2-axis servo amplifier MR-J4W2-B requires 26% less installation space than two units of MR-J4-B. 3-axis servo amplifier MR-J4W3-B requires 30% less installation space than three units of MR-J4-B.

[Example of installation space for two units of each 100 W, 200 W, 400 W, and 750 W]

Energy-Conservation Achieved by LM-H3 Linear Servo Motor Series

LM-H3 has achieved a reduction of 25% (Note) in motor driving current due to a new magnetic design with optimized magnet form, contributing to power conservation for machines. The motor coil is lighter by approximately 12% (Note) as compared to the prior model, which also contributes to saving energy for driving the moving part.

(Note): For 720 N rated linear servo motor

Heritage

• MR-J4-B has the same mounting dimensions (Note-1) with MR-J3-B. HG rotary servo motor series has the same mounting dimensions (Note-2) and uses the same option cables for the power, the encoder (Note-3), and the electromagnetic brake as HF series or HC-RP/HC-UP series.

(Note-1): Mounting dimensions are smaller for servo amplifiers rated 200 V 5 kW, 400 V 3.5 kW, 200 V/400 V 11 kW, and 200 V/400 V 15 kW.

(Note-2): For replacing HA-LP series to HG-JR series, contact your local sales office.

(Note-3): HG-JR series of 11 kW to 55 kW uses a different encoder cable from HF-JP series.

Energy-Conservation with Common DC Bus Connection

When multiple servo amplifiers and drive units are connected to the MR-CV power regeneration converter unit by a common DC bus connection, the regenerative energy of one axis is used for driving other axes, contributing to energy-conservation. The multi-axis servo amplifier has the same effect.

For LM-H3, widths of the motor coil and the magnet are reduced by 10% from the prior model. Increased thrust to current ratio results in using the servo amplifier in smaller capacity, contributing to more compact machine (the reduction of materials).

Energy-Conservation with Common DC Bus Connection

- Converter section
- Driving section
- A-axis motor
- B-axis motor
- C-axis motor
- Regenerative energy of A-axis motor

For LM-H3, Narrower by 10% [LM-H2 series] [LM-H3 series]

- Servo motors
- Encoder cables
- Same mounting dimensions with MR-J3
- Same mounting dimensions with MR-J3
- Same cables with MR-J3
- Servo motor power cable
- Servo motor power cable
- Servo motor
- Servo motor

SSCNET III/H compatible and SSCNET III compatible servo amplifiers can be used together.

- Communication speed: 50 Mbps

Magnetic contactors are not required to meet the STO (Safe torque off) and SS1 (Note) (Safe stop 1) are integrated

Magnetic contactor

Servo motor

Servo amplifier

Commissioning

Machine Diagnosis Function

- Servo setup software
- reading/writing parameters, and
- supports a stable machine system

This powerful software tool

- guides, bearing, belt, etc.) by
- Machine diagnosis window
- servo amplifier, supporting timely
- components from the data inside a
- This multi-axis servo amplifier has the same effect.

- Servo setup software
- reading/writing parameters, and
- supports a stable machine system

This powerful software tool

- guides, bearing, belt, etc.) by
- Machine diagnosis window
- servo amplifier, supporting timely
- components from the data inside a
- This multi-axis servo amplifier has the same effect.
**e-F@ctory Solution**

e-F@ctory is Mitsubishi Electric’s integrated concept to build reliable and flexible manufacturing systems that enable users to achieve many of their high speed, information driven manufacturing aspirations. Through its partner solution activity, the e-F@ctory Alliance, and its work with open network associations such as The CC-Link Partners Association (CLPA), users can build comprehensive solutions based on a wide ranging “best in class” principle.

---

**e-F@ctory Alliance**

The e-F@ctory Alliance is a FA manufacturer partnering program that strongly links the connection compatibility of Mitsubishi Electric FA equipment utilizing excellent software and machinery offered by partners, thereby enabling systems to be built by systems integration partners and the proposal of optimal solutions to customers.
The CC-Link Partner Association (CLPA) was established to promote the worldwide adoption of the CC-Link open-field network. By conducting promotional activities such as organizing trade shows and seminars, conducting conformance tests, and providing catalogs, brochures and website information, CLPA activities are successfully increasing the number of CC-Link partner manufacturers and CC-Link-compatible products. As such, CLPA is playing a major role in the globalization of CC-Link.

Global influence of CC-Link continues to spread

CC-Link is supported globally by CLPA. With offices throughout the world, support for partner companies can be found locally. Each regional CLPA office undertakes various support and promotional activities to further the influence of CC-Link/CC-Link IE in that part of the world. For companies looking to increase their presence in their local area, CLPA is well placed to assist these efforts through offices in all major regions.

### Americas
- CLPA-Americas (Mexico office)
- CLPA-Americas (USA office)

### Asia-Pacific
- CLPA-China
- CLPA-Headquarter(Japan)
- CLPA-India
- CLPA-Korea
- CLPA-Taiwan
- CC-Link Promotion Center ASEAN (Singapore)
- CC-Link Promotion Center Thailand

### Europe, the Middle East and Africa
- CLPA-Europe(Germany)
- CLPA-Turkey

**Visit the CLPA website for the latest CC-Link information.**

**CLPA website**

[www.cc-link.org/en](http://www.cc-link.org/en)

6F Ozone Front Bldg. 3-15-58 Ozone
Kita-ku, Nagoya 462-0825, JAPAN
TEL: +81-52-919-1588 FAX: +81-52-916-8655
E-mail: info@cc-link.org

[CC-Link Promotion Center ASEAN](http://www.cc-link.org/en/ASEAN)

[CC-Link Promotion Center Thailand](http://www.cc-link.org/en/Thailand)
Servo system includes controllers, servo drivers, actuators, sensors, etc. The servo system takes a step further to accelerate the equipment revolution by collaborating with our partner companies. Now that a wide variety of partner products are available such as pressure-resistance, explosion-proof type motors, custom-made servo motors, magnetic type linear encoders, your system will be configured flexibly.

The Mitsubishi Electric Servo System Partner Association is a subcommittee of e-F@ctory Alliance.
Global FA Centers

EMEA

Europe FA Center
MITSUBISHI ELECTRIC EUROPE B.V., Polish Branch
Tel: +48-12-347-65-00

Germany FA Center
MITSUBISHI ELECTRIC EUROPE B.V., German Branch
Tel: +49-2102-486-0

UK FA Center
MITSUBISHI ELECTRIC EUROPE B.V., UK Branch
Tel: +44-1707-27-8780

Czech Republic FA Center
MITSUBISHI ELECTRIC EUROPE B.V., Czech Branch
Tel: +420-734-402-587

Italy FA Center
MITSUBISHI ELECTRIC EUROPE B.V., Italian Branch
Tel: +39-039-60531

Turkey FA Center
MITSUBISHI ELECTRIC TURKEY Elektrik Urunleri A.S.
Tel: +90-216-969-2500

Asia-Pacific

China
Beijing FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD.
Tel: +86-10-6518-8830

Guangzhou FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD.
Tel: +86-20-8923-6730

Shanghai FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD.
Tel: +86-21-2322-3030

Tianjin FA Center
MITSUBISHI ELECTRIC AUTOMATION (CHINA) LTD.
Tel: +86-22-2813-1015

Taiwan
Taipei FA Center
SETSUYO ENTERPRISE CO., LTD.
Tel: +886-2-2239-9917

Korea
Korea FA Center
MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD.
Tel: +82-2-3660-9830

Thailand
Thailand FA Center
MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO., LTD.
Tel: +66-2882-6522 to 31

ASEAN
ASEAN FA Center
MITSUBISHI ELECTRIC ASIA PTE. LTD.
Tel: +65-6470-2475

Malaysia
Malaysia FA Center
Tel: +60-3-7626-5080

Indonesia
Indonesia FA Center
PT. MITSUBISHI ELECTRIC INDONESIA
Tel: +62-21-2261-7797

Vietnam
Hanoi FA Center
MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED
Tel: +84-24-3937-8275

Ho Chi Minh FA Center
MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED
Tel: +84-28-3910-5945

Philippines
Philippines FA Center
MELCO Factory Automation Philippines Inc.
Tel: +63-(0)2-8256-8042

India
India Ahmedabad FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD.
Tel: +91-7965120063

India Bangalore FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD.
Tel: +91-80-4020-1600

India Chennai FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD.
Tel: +91-44-44554772

India Coimbatore FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD.
Tel: +91-124-463-0300

India Pune FA Center
MITSUBISHI ELECTRIC INDIA PVT. LTD.
Tel: +91-20-2710-2000

Americas

USA
North America FA Center
MITSUBISHI ELECTRIC AUTOMATION, INC.
Tel: +1-847-478-2100

Mexico
Mexico City FA Center
MITSUBISHI ELECTRIC AUTOMATION, INC.
Tel: +52-55-3067-7500

Mexico FA Center
MITSUBISHI ELECTRIC AUTOMATION, INC.
Tel: +52-55-3067-7599

Brazil
Brazil FA Center
MITSUBISHI ELECTRIC DO BRASIL COMERCIO E SERVICOS LTDA.
Tel: +55-11-4689-3000
Mitsubishi Electric servo system conforms to global standards.

(Note-1): Our servo system products are not subject to China Compulsory Certification (CCC).
(Note-2): Refer to relevant manuals and "EMC Installation Guidelines" when your system needs to meet the EMC directive.
(Note-3): Refer to "MELSEROV-J4 Series Catalog" for details of MR-J4 series conformity with global standards and regulations.
(Note-4): For corresponding standards and models, contact your local sales office.
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 controller/Simple Motion module, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in the Motion controller/Simple Motion module, and a backup or fail-safe function should operate on an external system to the Motion controller/Simple Motion module when any failure or malfunction occurs.

(2) Our Motion controller/Simple Motion module is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.

In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.

We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.

(3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.
Mitsubishi Electric’s product lineup, from various controllers and drives to energy-saving devices and processing machines, all help you to automate your world. They are underpinned by software, innovative data monitoring, and modelling systems supported by advanced industrial networking and Edgecross IT/OT connectivity. Together with a worldwide partner ecosystem, Mitsubishi Electric factory automation (FA) has everything to make IoT and Digital Manufacturing a reality.

With a complete portfolio and comprehensive capabilities that combine synergies with diverse business units, Mitsubishi Electric provides a one-stop approach to how companies can tackle the shift to clean energy and energy conservation, carbon neutrality and sustainability, which are now a universal requirement of factories, buildings, and social infrastructure.

We at Mitsubishi Electric FA are your solution partners waiting to work with you as you take a step toward the realization of sustainable manufacturing and society through the application of automation.
Let’s automate the world together!

Note: not all products are available in all countries
# SERVO SYSTEM CONTROLLERS MELSEC iQ-R SERIES/MELSEC iQ-F SERIES

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Sales office</th>
<th>Tel:</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>Mitsubishi Electric Automation, Inc.</td>
<td>+1-847-478-2100</td>
</tr>
<tr>
<td></td>
<td>500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>Mitsubishi Electric Automation, Inc. Mexico Branch</td>
<td>+52-55-3067-7500</td>
</tr>
<tr>
<td></td>
<td>Boulevard Miguel de Cervantes Saavedra 301, Torre Norte Piso 5, Int. 502, Ampliaciòn Granada, Miguel Hidalgo, Ciudad de Mexico, Mexico, C.P:11520</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>Mitsubishi Electric do Brasil Comercio e Servicos Ltda.</td>
<td>+55-11-4689-3000</td>
</tr>
<tr>
<td>Germany</td>
<td>Mitsubishi Electric Europe B.V. German Branch</td>
<td>+49-2102-486-0</td>
</tr>
<tr>
<td></td>
<td>Mitsubishi-Electric-Platz 1, 4082 Ratingen, Germany</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>Mitsubishi Electric Europe B.V. UK Branch</td>
<td>+44-1707-28-8780</td>
</tr>
<tr>
<td>Italy</td>
<td>Mitsubishi Electric Europe B.V. Italian Branch</td>
<td>+39-039-60531</td>
</tr>
<tr>
<td></td>
<td>Campus, Energy Park Via Energy Park 14, Vimercato 20871 (MB) Italy</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Mitsubishi Electric Europe B.V. Spanish Branch</td>
<td>+34-935-65-3131</td>
</tr>
<tr>
<td></td>
<td>Carretera de Rubi, 76-80-Apdo. 420, E-08174 Sant Cugat del Valles (Barcelona), Spain</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>Mitsubishi Electric Europe B.V. French Branch</td>
<td>+33-1-55-68-55-68</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Mitsubishi Electric Europe B.V. Czech Branch, Prague Office</td>
<td>+420-734-402-587</td>
</tr>
<tr>
<td></td>
<td>Pekarska 621/7, 155 00 Praha 5, Czech Republic</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>Mitsubishi Electric Europe B.V. Polish Branch</td>
<td>+48-12-347-65-00</td>
</tr>
<tr>
<td></td>
<td>ul. Krakowska 48, 32-083 Balice, Poland</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>Mitsubishi Electric Europe B.V. (Scandinavia)</td>
<td>+46-6-625-10-00</td>
</tr>
<tr>
<td></td>
<td>Hedvig Mollersgata 6, 223 55 Lund, Sweden</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>Mitsubishi Electric Turkey Elektrik Urunleri A.S.</td>
<td>+90-216-969-2500</td>
</tr>
<tr>
<td></td>
<td>Serilali Mah, Kale Sok. No:41 Umraniye / Istanbul, Turkey</td>
<td></td>
</tr>
<tr>
<td>UAE</td>
<td>Mitsubishi Electric Europe B.V. Dubai Branch</td>
<td>+971-4-3724716</td>
</tr>
<tr>
<td>South Africa</td>
<td>Adroit Technologies</td>
<td>+27-11-658-8100</td>
</tr>
<tr>
<td></td>
<td>20 Waterford Office Park, 189 Wilkoppen Road, Fourways, South Africa</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>Mitsubishi Electric Automation (China) Ltd.</td>
<td>+86-21-2322-3030</td>
</tr>
<tr>
<td></td>
<td>Mitsubishi Electric Automation Center, No.1386 Hongqiao Road, Shanghai, China</td>
<td></td>
</tr>
<tr>
<td>Taiwan</td>
<td>SETSUVO ENTERPRISE CO., LTD.</td>
<td>+886-2-2299-2499</td>
</tr>
<tr>
<td></td>
<td>5F, No.105, Wugong 3rd Road, Wugu District, New Taipei City 24889, Taiwan</td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>Mitsubishi Electric Automation Korea Co., Ltd.</td>
<td>+82-2-6103-9474</td>
</tr>
<tr>
<td></td>
<td>7F to 9F, Gangseo Hangang Xi-tower A, 401, Yangcheon-ro, Gangseo-Gu, Seoul, Korea</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>Mitsubishi Electric Asia Pte. Ltd.</td>
<td>+65-6473-2486</td>
</tr>
<tr>
<td></td>
<td>307 Alexandra Road, Mitsubishi Electric Building, Singapore 159943</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>Mitsubishi Electric Factory Automation (Thailand) Co., Ltd.</td>
<td>+66-2092-8600</td>
</tr>
<tr>
<td></td>
<td>101, True Digital Park Office, 5th Floor, Sukhumvit Road, Bang Chak, Prakanong, Bangkok, Thailand</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>PT. Mitsubishi Electric Indonesia</td>
<td>+62-21-3192-6461</td>
</tr>
<tr>
<td></td>
<td>Gedung Jaya 8th Floor, JL. MH. Thamrin No.12, Jakarta Pusat 10340, Indonesia</td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>Mitsubishi Electric Vietnam Company Limited</td>
<td>+84-28-3910-5945</td>
</tr>
<tr>
<td></td>
<td>11th &amp; 12th Floor, Viette Tower B, 265 Cach Mang Thang Tam Street, Ward 12, District 10, Ho Chi Minh City, Vietnam,</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>Mitsubishi Electric India Pvt. Ltd. Pune Branch</td>
<td>+91-20-4624-2100</td>
</tr>
<tr>
<td></td>
<td>ICC-Denv Gaurav Technology Park, Unit no 402, Fourth Floor, Survey no. 191-192 (P), Opp. Vallyah Nagar Bus Depot, Pune - 411018, Maharashtra, India</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>Mitsubishi Electric Australia Pty. Ltd.</td>
<td>+61-2-9684-7777</td>
</tr>
<tr>
<td></td>
<td>348 Victoria Road, P.O. Box 11, Rydalmere, N.S.W 2116, Australia</td>
<td></td>
</tr>
</tbody>
</table>

**Mitsubishi Electric’s e-F@ctory concept** utilizes both FA and IT technologies, to reduce the total cost of development, production and maintenance, with the aim of achieving manufacturing that is a “step ahead of the times”. It is supported by the e-F@ctory Alliance Partners covering software, devices, and system integration, creating the optimal e-F@ctory architecture to meet the end users needs and investment plans.