Total system performance, not individual component specifications leads to maximum performance
Global Player

GLOBAL IMPACT OF MITSUBISHI ELECTRIC

We bring together the best minds to create the best technologies. At Mitsubishi Electric, we understand that technology is the driving force of change in our lives. By bringing greater comfort to daily life, maximizing the efficiency of businesses and keeping things running across society, we integrate technology and innovation to bring changes for the better.

Through Mitsubishi Electric’s vision, “Changes for the Better” are possible for a brighter future.

Changes for the Better

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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

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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.

*TCO: Total cost of ownership

---

**Productivity**
- New high-speed system bus realizing shorter production cycle
- Utilize the sophisticated Motion control for extensive applications
- Advanced servo amplifiers and motors offering industry leading level of performance
- Visualize entire plant data in real-time, contributing to preventative maintenance
- Reduce downtime and easily locate error causes

**Engineering**
- Intuitive engineering environment covering the product development cycle
- All-in-one engineering package reducing product development time
- Easy debugging, from controllers to servo amplifiers

**Maintenance**
- Improve and maintain actual manufacturing quality
- Ease of use realized with Universal Design
- Conforms to main international standards

---

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

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*TCO: Total cost of ownership
High compatibility with existing servo system controllers
Utilize existing assets while taking advantage of cutting-edge technology

Connectivity

- 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

Security

- Protect intellectual property
- Unauthorized access protection across distributed control network

Compatibility

- New high-speed system bus realizing shorter production cycle
- Utilize the sophisticated Motion control for extensive applications
- Advanced servo amplifiers and motors offering industry leading level of performance
- Visualize entire plant data in real-time, contributing to preventative maintenance
- Reduce downtime and easily locate error causes
- Intuitive engineering environment covering the product development cycle
- All-in-one engineering package reducing product development time
- Easy debugging, from controllers to servo amplifiers

SERVO SYSTEM CONTROLLER

Revolutionary

- Reduce TCO
- Reuse
- Reliability

Compatibility

- High compatibility with existing servo system controllers
- Utilize existing assets while taking advantage of cutting-edge technology
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

Gather Up

High-speed system bus

Data exchange cycle with PLC CPU

(Compared to previous model)

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

Mitsubishi Electric servo system partner companies (in alphabetical order)

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
Performance Maximization

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.

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Performance Maximization for Productivity.

Faster Startup with Intuitive Operation

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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

(SCNII/H communication speed)

150Mbps

Speed frequency response of servo amplifier

2.5kHz

Operation cycle

Approx. 40 × faster

SSCNET III/H partner products

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 PA integrated network system.

Mitsubishi Electric servo system partner companies (in alphabetical order)

- Asahi Engineering Co., Ltd
- HOKUYO
- IAI
- Murata
- NIKko
- SANYO DENKI
- ShinMaywa
- TESsEA
- THK
- MITSUBISHI ELECTRIC ENGINEERING

Power Up

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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.

Gather Up

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High-speed system bus

Data exchange cycle with PLC CPU

Approx. 4 × faster

0.222ms CPU buffer memory

(Compared to previous model)

Operation cycle

Approx. 1.5 × faster

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
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.

The easy-to-use programming software allows you to work more intuitively, freely, and flexibly

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

The language can be switched to Japanese, English, and Chinese, supporting engineering staff working in this globalized industry and enabling faster startup abroad on site.

4. Multiple Languages Switching

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.

Total System Performance is Productivity.
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.

**MELSOFT GX Works3**

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

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**
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4. **Multiple Languages Switching**
   The language can be switched to Japanese, English, and Chinese, supporting engineering staff working in this globalized industry and enabling faster startup abroad on site.
**Maintenance**

Reduce maintenance costs and downtime utilizing

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**

Being Informed of the lifespan of the machine with a huge load and frequent acceleration

Utilizing Machine Aging Information for Preventive Maintenance

- Estimated machine friction and vibration are displayed.
- Machine aging is displayed by comparing the initial machine operation data with that after years of usage.

---

Support the preventive maintenance of the servo amplifier.

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Prevent machine 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 trajectory 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.

- **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.

- **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.

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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

Robust design ideal for harsh industrial environments

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.

Classification according to IEC 60721-3-3 Class 3C2

For protection against aggressive atmosphere and gases, products with a conformal coating (IEC 60721-3-3 Class 3C2) are available on request (Note-1).

(Note-1): Please contact your local Mitsubishi Electric office or representative for further details.

Ease of use in quality

The front face has a wide and open design with an easy-to-use front cover, which helps you reduce wiring errors and contributes to more efficient work.
Conforms to main international quality standards

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

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.
Connectivity

Seamless network reduces system costs

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.


Optimal network proposals for each level

**CC-Link IE Control**

CC-Link IE Control is a high-reliability distributed control network designed to handle very large data communications (128 K word) over a high-speed (1Gbps) dual-loop optical cable topology.

**CC-Link IE Field**

CC-Link IE Field is a versatile gigabit Ethernet-based network integrating controller, I/O control, safety control, and motion control in a flexible wiring topology supporting star, ring, and line configurations.

**CC-Link**

CC-Link is a high-speed and highly reliable deterministic I/O control network that realizes reduced wiring while offering multi-vendor compatible products.

**AnyWire**

AnyWire is a sensor level distributed control network that is designed to reduce installation costs by utilizing general-purpose wiring and robot cables.
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 at 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*1 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.

*Note-1: Motion controllers only
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, there is no need to re-register the security key, making replacement easier. 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.
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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 new 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

SERVO SYSTEM CONTROLLER

Productivity

- 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 tact time

Connectivity

- 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" of providing high response and high reliability

Engineering

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

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.
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

Responding to expanding applications such as semiconductor and LCD manufacturing, packing machines, and cap tightening machines, 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

HUMAN MACHINE I/F

SOFTWARE

SERVO SYSTEM CONTROLLER

NETWORK

SERVO AMPLIFIER

LOW-VOLTAGE SWITCHGEAR

SERVO MOTOR

e-F@ctory is the Mitsubishi Electric solution for improving the performance of any manufacturing enterprise by enhancing productivity, and reducing the maintenance and operation costs together with seamless information flow throughout the plant.
Mitsubishi Electric’s integrated FA platform for achieving lateral integration of controllers & HMI, engineering environments and networks at production sites.

Programmable controller

MELSEC iQ-R series Programmable controller

MELSEC iQ-F series Programmable controller

Simple Motion module

SSCNET III/H compatible
MELSEC iQ-F series
Simple Motion module

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

NEW

Motion Controller

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

R64MTCPU
R32MTCPU
R16MTCPU

Servo amplifier

SSCNET III/H compatible
MR-J4W2-B
MR-J4W3-B
MR-J4W2-0303B6

2-axis servo amplifier
Ultra-small capacity
MR-J4W2-B
MR-J4W3-B

SSCNET III/H compatible
MR-J4-GF
MR-J4-GF-RJ

SSCNET III/H compatible
MR-J4-B
MR-J4-B-RJ

Servo motor

Core type
LM-H3 series
Rating: 70 to 960 N

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

Linear servo motor

Direct drive motor

Low-profile flange type
TM-RG2M series
Rating: 4.5 Nm and 9 Nm

Low-profile table type
TM-RU2M series
Rating: 4.5 Nm and 9 Nm

TM-RFM series
Rating: 2 to 240 Nm

Small capacity, low inertia
HG-KN series
Capacity: 0.5 to 3 kV

Medium capacity, medium inertia
HG-SN series
Capacity: 0.5 to 3 kV

Magnetic contactor

MS-T

Molded-case circuit breaker

WS-V
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

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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

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**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
The machine can move workpieces easily from one line to another by using a combination of linear interpolation, 2-axis circular interpolation, and continuous trajectory control. Machine vibration is minimized and a shorter tact 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 trajectory control
- S-curve acceleration/deceleration
- Advanced S-curve acceleration/deceleration

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

The machine can coat the workpiece by using a combination of linear interpolation, 2-axis circular interpolation, and continuous trajectory control. A smooth trajectory can be traced with the S-curve acceleration/deceleration function.

**Main functions**
- Continuous trajectory 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

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**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
- LCD manufacturing equipment
- Image processing systems for inspection
CASE 9  Synchronization of Input and Output with Servo Control

In a single network, input and output are synchronized with the command communication cycle of the servo amplifier. For example, input from a synchronous encoder and output to a printing machine are synchronized in the same network. CC-Link IE Field Network enables 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

Star, line, and star/line mixed topologies are available for a network configuration with a switching hub. An easy topology created only by a cable being connected to a free port of the switching hub allows field devices to be added to the system more flexibly.

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 are collected via CC-Link IE Field Network. The status of the entire product line can be visualized by batch management of the collected data at the host system, supporting to build IoT (Note-1) for your machine.

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

Star, line, and star/line mixed topologies are available for a network configuration with a switching hub. An easy topology created only by a cable being connected to a free port of the switching hub allows field devices to be added to the system more flexibly.

**CASE12 Monitoring of Servo Data**

Monitoring and modifying servo data of up to 50 monitoring items successively during operation is possible. The operation status of servo amplifiers and servo motors (including partner products) acquired via CC-Link IE Network and SSCNET III/H (including partner products) are transferred to the host system or to any GOT screens created by customers, and are displayed.

**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

Perfectly Coordinated with Customer Needs and Applications

Features of Simple Motion Module

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.

Advanced control while being simple to use just like Positioning modules

<table>
<thead>
<tr>
<th>MELSEC iQ-R</th>
<th>CC-Link IE Field Network compatible MELSEC iQ-R series</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD77GF32</td>
<td>NEW</td>
</tr>
<tr>
<td>RD77GF16</td>
<td></td>
</tr>
<tr>
<td>RD77GF8</td>
<td></td>
</tr>
<tr>
<td>RD77GF4</td>
<td></td>
</tr>
</tbody>
</table>

- For configuring a servo system with ONE single network
- For high-accuracy positioning with synchronous control up to μsec precision

<table>
<thead>
<tr>
<th>MELSEC iQ-R</th>
<th>SSCNET II/H compatible MELSEC iQ-R series</th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

- For easily performing a wide-range of Motion control, such as advanced synchronous control, cam control, and speed-torque control (tightening & press-fit control) with the sequence programs, such as function blocks

<table>
<thead>
<tr>
<th>MELSEC iQ-F</th>
<th>SSCNET II/H compatible MELSEC iQ-F series</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX5-80SSC-S</td>
<td>NEW</td>
</tr>
<tr>
<td>FX5-40SSC-S</td>
<td></td>
</tr>
</tbody>
</table>

- 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 with the positioning functions.

Features of Simple Motion Module

- For high-accuracy positioning with precision
- For configuring a servo system with one single network
- Advanced control while being simple to use just like Positioning modules
- Possible to control up to 192 axes by use of three R64MTCPU modules

Features of Motion Controller

The Motion controller is a CPU module used with the PLC CPU for Motion control.

- Using Motion SFC programs, the Motion CPU separately controls operation from the PLC CPU. Thus CPU loads are distributed, achieving advanced Motion control.
- Various advanced Motion controls, such as tightening & press-fit, cam, and advanced synchronous controls can be performed in addition to basic controls including positioning, speed and torque controls.
- COGNEX vision system can be directly connected to the controller with Ethernet.

Advanced Motion control
### Overview of Servo System Controllers

#### 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</td>
<td>RD77MS16</td>
</tr>
<tr>
<td>RD77GF16</td>
<td>RD77MS8</td>
</tr>
<tr>
<td>RD77GF8</td>
<td>RD77MS4</td>
</tr>
<tr>
<td>RD77GF4</td>
<td>RD77MS2</td>
</tr>
<tr>
<td>RD77GF4</td>
<td>RD77MS16</td>
</tr>
<tr>
<td>RD77GF8</td>
<td>RD77MS8</td>
</tr>
<tr>
<td>RD77GF16</td>
<td>RD77MS4</td>
</tr>
<tr>
<td>RD77GF32</td>
<td>RD77MS2</td>
</tr>
</tbody>
</table>

#### Module type

- **Module type**: Intelligent function module
- **CPU module**: CPU module

#### Servo amplifier

- **MR-J4-GF(-RJ)**
- **MR-J4-B(-RJ)**
- **MR-J4B(-RJ)**
- **MR-JE-B**

#### Servo motor

- **MR-J4-GF(-RJ)**
- **MR-J4B(-RJ)**
- **MR-JE-B**

#### Command interface

- **CC-Link IE**
- **1 line**

#### Maximum number of control axes

- 32/16/8/4 axes
- 16/8/4/2 axes
- 8/4 axes
- 64 axes
- 32 axes
- 16 axes

#### Operation cycle

- 0.5 ms or longer
- 0.444 ms or longer
- 0.888 ms or longer
- 0.222 ms or longer

#### Engineering environment

- **MELSOFT GX Works3**
- **MELSOFT MT Works2**

#### Programming method

- **Motion profile table**
- **Motion SFC**
- **Direct positioning start instruction**

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(Note-1): Available only with RD77MG and RD77MS
(Note-2): Available only with RD77MG and FX5-40SSC-S/FX5-80SSC-S
(Note-3): Use the safety observation function of a servo amplifier.
(Note-4): Available only with FX5-40SSC-S/FX5-80SSC-S

**Featured functions**
- Driver home position
- Scale home position signal
- Driver communication (Note-1)
- Event history
- Software stroke limit
- Stopper method (2 types)
- Data set method (3 types)
- Data set method (3 types)
- Driver communication (Note-1)
- Driver home position
- CAM auto-generation
- Hardware stroke limit
- Unlimted length feed
- Vibration Suppression
- Command Filter
- Machine control
- Mark detection
- Reference method
- Simultaneous start
- Fixed position stop
- Security key
- Vision system
- Digital oscilloscope
- Security key
### Simple Motion module

<table>
<thead>
<tr>
<th>Function</th>
<th>MELSEC iQ-R series</th>
<th>MELSEC iQ-F series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position control</td>
<td>RD77GF32 RD77GF4</td>
<td>RD77MS16 RD77MS4 RD77MS2</td>
</tr>
<tr>
<td>Speed control</td>
<td>FXS-80SSC-S FXS-40SSC-S</td>
<td></td>
</tr>
</tbody>
</table>

### Motion controller

<table>
<thead>
<tr>
<th>Function</th>
<th>MELSEC iQ-R series</th>
<th>MELSEC iQ-F series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position control</td>
<td>R8MTCPU</td>
<td>R32MTCPU</td>
</tr>
<tr>
<td>Speed control</td>
<td></td>
<td>R16MTCPU</td>
</tr>
</tbody>
</table>

### Control mode

- Position control
- Torque control
- Advanced synchronous control
- Cam control

### Positioning control

- Linear interpolation
- Circular interpolation
- Continuous trajectory control
- Helical interpolation
- Speed/position switching control (ABS)
- Speed/position switching control (INC)
- Position/speed switching control

### Acceleration/deceleration control

- Trapezoidal acceleration/deceleration
- S-curve acceleration/deceleration
- Advanced S-curve acceleration/deceleration

### Manual control

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

### Function that changes the control details

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

### Home position return method

- Proximity dog method
- Scale home position signal detection method
- Driver home position signal detection method
- Data set method

### Auxiliary function

- Forced stop
- Hardware stroke limit
- Absolute position system
- Unlimited length feed
- Mark detection
- M-code output
- Digital oscilloscope
- Driver communication
- Cam auto-generation

(Note-1): Available only with RD77MS and FXS-40SSC-S/FXS-80SSC-S
(Note-2): Available only with RD77GF and RD77MS
(Note-3): Use the safety observation function of a servo amplifier.
(Note-4): Available only with FXS-40SSC-S/FXS-80SSC-S
● 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

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

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.
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

Simple Motion module
Input module
GOT
USB
Ethernet
Programming environment
Programmable Controller Engineering Software
MELSOFT GX Works3
PLC CPU
MR-J4-B
MR-J4W2-B
MR-J4W3-B
MR-MV200
MR-J4-B-RJ
MR-J4W3-B
MR-J4W2-B
MR-J4-B
MR-MV200
MR-J4-B-RJ
FR-A800
Inverter
External input signal cable
[External input signals via CPU] (Note-1)
FLS, RLS, DOG, STOP
[External input signals of a servo amplifier] (Note-1)
FLS, RLS, DOG
[External input signals] (Note-1)
FLS, RLS, DOG, STOP, Forced stop input (24 VDC)

(Note-1): An input destination of external input signals (FLS, RLS, DOG, STOP) is changed by parameters.
(Note-2): When using a partner product or the inverter FR-A800, use one whose version supports the Simple Motion module.
Cutting-edge motion control packed in a compact module

System configuration

- SSCNET III/H compatible
- MELSEC iQ-F series Simple Motion module
- FX5-80SSC-S / FX5-40SSC-S

**Engineering environment**

- Programmable Controller Engineering Software MELSOFT GX Works3

**Connectors**

- Ethernet
- CPU module
- Simple Motion module
- GOT

**External input signals**

- 4 points
- Forced stop input (24 V DC)
- [External input signals via CPU] (Note-1) FLS, RLS, DOG, STOP

**Inverters**

- FR-A800 (Note-2)
- MR-J4-B
- MR-J4W2-B
- MR-J4-B-RU

**Servo Amplifiers**

- Linear synchronous encoder
- rotary synchronous encoder

**Note:**

- (Note-1): An input destination of external input signals (FLS, RLS, DOG, STOP) is changed by parameters.
- (Note-2): When using a partner product or the inverter FR-A800, use one whose version supports the Simple Motion module.
MELSEC iQ-R series Simple Motion module

RD77GF32 NEW /RD77GF16/RD77GF8/RD77GF4

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

**System configuration**

- **External input signal (Note-1)**
  - Rotary servo motor
  - Linear servo motor
  - Direct drive motor

- **USB/Ethernet**

- **RD77GF PLC CPU**

- **Safety CPU**

- **GOT**

- **Engineering environment**
  - Programmable Controller Engineering Software
  - MELSOFT GX Works3

- **Head module**
- **HMI (GOT)**
- **Inverter**
- **Remote I/O module**
- **Local station**
- **Analog module**
- **CC-Link IE Field-AnyWire ASLINK Bridge module**
- **High-speed counter module**
- **CC-Link-AnyWire DB A20 Bridge module**
- **Bridge module**

- **MR-J4-GF Motion mode: Up to 32 axes**

- **MR-J4-GF-RJ**
  - External input signals of a servo amplifier (Note-1)
  - FLS, RLS, DOG
  - Safety remote I/O
  - Servo motor/servo motor with functional safety

- **Products available soon**

- **Slave station**: Up to 120 stations (Including the number of motion mode compatible servo amplifiers)

(Note-1): An input destination of external input signals (FLS, RLS and DOG) is changed by parameters.

(Note-2): GX Work3 is required for safety communications.

(Note): A switching hub is required for star topology.
CC-Link IE Field Compatible Functions

Preventive maintenance

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

CC-Link IE Field Network master station

The CC-Link IE Field Network compatible Simple Motion module is equipped with functions as a link device and a master station equivalent to a CC-Link IE field Network master/local module. (Note-1)

Suppressing the cost of a system configuration is possible since this module is used not only for Motion control, but also as a master station of the network.

(Note-1): The sub-master function is not supported.

<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 (R00w, R00n)</td>
<td>8k points each (8192 points, 16k byte)</td>
<td>8k 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 a built-in positioning function are used to execute Motion control, and programming according to devices to be used, is required and hence a long design time and high costs to understand usage and programming of the devices.

The PLCopen® Motion Control FB has a standardized interface providing the following benefits;
- The time and costs are suppressed by the burden reduction of programming.
- A maintenance time can be reduced since the program is easily understood by any person other than a programming designer.

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]
Devices : RD77GF + MR-J4-GF
FB : MC_MoveAbsolute + RD77
Positoning 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]
Devices : R04ENCPU + MR-J4-GF
FB : MC_MoveAbsolute + J4GFIO
Positoning 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.
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, this simulation function can be used for several Simple Motion modules.

**Simulation**

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

**Event history**

The cause of event can be easily identified through the event history which chronologically lists errors and operation for the CPU module.
Positioning Control

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 functions, such as linear interpolation, 2-axis circular interpolation, fixed-pitch feed, and continuous trajectory 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, 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 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 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 simply started/ended for each axis, allowing the synchronous control axis and positioning control axis to be used within the same program.

### Advanced Synchronous Control

- Only two axes are in synchronization.
- The other axes are in positioning control.
- All axes are synchronized using a synchronous encoder axis or a servo input axis.

### Application

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

### Productivity

**RD77MS**

**FX5SSC**

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 on each module can be performed, and parameter settings can be made.
- Synchronous control is easily achieved just by setting parameters.
- Monitoring on the selected module can be performed.
  - Double click the module to open the parameter setting screen.

### 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 rejects.

![Target position change function diagram](image)

- **Normal transfer route for accepted products**
- **Change to the rejects tray route**

### 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.

![Block start diagram](image)

- Positioning starts from “First point” in block start data to draw four squircles.

### 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>

### Features

- **Simple Motion Modules**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
</table>

- **Productivity**

**RD77GF**

**RD77GF**
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 simply started/ended for each axis, allowing the synchronous control axis and positioning control axis to be used within the same program.

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

- **Application** Packaging machines, printing machines, diaper manufacturing machines, tire molder, etc.

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

- **Application** Tandem configuration, etc.

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 on each module can be performed, and parameter settings can be made.
- Monitoring on the selected module can be performed.
- Synchronous control is easily achieved just by setting parameters.

Double click the module to open the parameter setting screen.
### Simple Motion Modules

#### 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**

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.

### Cam pattern creation

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

**[Cam Data Creation Screen]**

- 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 Data List]**

- 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.

### Cam auto-generation

Cam data for a rotary knife can be automatically generated by input of the sheet length, synchronization width, cam resolution, etc. to the specified device memory.
Speed control follows a speed command to control speed constant, and torque control follows a torque command to control torque constant. The Simple Motion module can be used for tension control, such as unwinding or rewinding.

### Speed-torque 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.

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.

### Restarting synchronous control

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.
Speed control follows a speed command to control speed constant, and torque control follows a torque command to control 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**

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.

**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.
More than two axes can be driven with a combination of the driver communication function and the master-slave operation function of the servo amplifier. When the controller transmits speed control commands to the master axis, the torque command corresponding to that speed control is transmitted to the slave axes via the driver communication function.

**Master-slave Operation Function**

- **Speed control**
  - Master axis
  - Torque control
  - Slave axis

- **Position control**
  - Master axis
  - Torque control
  - Slave axis
  - Torque control
  - Slave axis
  - Torque control
  - Slave axis

**Productivity**

<table>
<thead>
<tr>
<th>RD77MS</th>
<th>FX5SSC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**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 cutter 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**

Monitoring and modifying the servo data of up to 50 monitoring items successively during operation is possible. The operation status of servo amplifiers and servo motors (including partner products) acquired via SSCNET III/H is transferred to the host system or to the GOT screen created by a customer, and are displayed.

[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
Master-slave Operation Function

More than two axes can be driven with a combination of the driver communication function and the master-slave operation function of the servo amplifier. When the controller transmits speed control commands to the master axis, the torque command corresponding to that speed control is transmitted to the slave axes via the driver communication function.

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
**Functional Safety**

### Achieving Category 4 PL e, SIL 3

**By wiring to MR-D30 functional safety unit**

Category 4 PL e, SIL 3 is achieved when the safety signals are inputted directly to MR-D30 functional safety unit (Note-3).

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-1)</td>
<td></td>
</tr>
<tr>
<td>SOS (Safe operating stop) (Note-1)</td>
<td></td>
</tr>
<tr>
<td>SLS (Safety-limited speed) (Note-2)</td>
<td></td>
</tr>
<tr>
<td>SBC (Safe brake control)</td>
<td></td>
</tr>
<tr>
<td>SSM (Safe speed monitor) (Note-2)</td>
<td></td>
</tr>
</tbody>
</table>

(Note-1): SS2 and SOS are achievable with the use of the servo motor with functional safety.
(Note-2): The safety level would be Category 3 PL d, SIL 2 when the servo motor with functional safety is not used.
(Note-3): Use MR-D30 with software version A1 or later.

**By CC-Link IE Field Network** **Available soon**

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.

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(Note-1): SS2 and SOS are achievable with the use of the servo motor with functional safety.
(Note-2): The safety level would be Category 3 PL d, SIL 2 when the servo motor with functional safety is not used.
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]

(Note): Be sure to confirm that "SSCNET III/H" is selected in the system setting when introducing 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 used without completing home position return.

**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 instructions 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 will be unnecessary to carry out 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).

**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.

**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**
Unlimited length feed is performed 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 carries out 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.
While the JOG start signal is ON, the workpiece moves in the designated direction. JOG operation can be used without completing home position return.

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.

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 instructions are executed sequentially from the start point to the end point.

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.

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

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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>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of control axes (Virtual servo amplifier axis included)</td>
<td>MELSEC iQ-R series: 32 axes, 16 axes, 8 axes, 4 axes MELSEC iQ-F series: 16 axes, 8 axes, 4 axes, 2 axes, 8 axes, 4 axes</td>
</tr>
<tr>
<td>Operation cycle (Operation cycle settings) [ms]</td>
<td>0.5, 1.0, 2.0, 4.0, 0.444, 0.888, 1.777, 3.555, 0.888, 1.777</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, Trajectory control (Linear, arc, and helical), Speed control, Speed-torque control, Tightening &amp; Press-fit control</td>
</tr>
<tr>
<td>Acceleration/deceleration process</td>
<td>Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration</td>
</tr>
<tr>
<td>Compensation function</td>
<td>Backlash compensation, Electronic gear, Near pass function</td>
</tr>
<tr>
<td>Synchronous control</td>
<td>Synchronous encoder input, Cam, Phase compensation, Cam auto-generation</td>
</tr>
<tr>
<td>Control unit</td>
<td>mm, inch, degree, pulse</td>
</tr>
<tr>
<td>Number of positioning data</td>
<td>600 data (positioning data No. 1 to 600)/axis</td>
</tr>
<tr>
<td>Backup</td>
<td>Parameters, positioning data, and block start data can be saved on flash ROM (battery-less backup)</td>
</tr>
</tbody>
</table>

### Home position return

<table>
<thead>
<tr>
<th>Sub-functions</th>
<th>Provided (using sub-function of servo amplifier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear control</td>
<td>Linear interpolation (Up to 4 axes) (Vector speed, Reference axis speed)</td>
</tr>
<tr>
<td>Fixed-pitch feed</td>
<td>Fixed-pitch feed control (Up to 4 axes)</td>
</tr>
<tr>
<td>2-axis circular interpolation</td>
<td>Auxiliary point-specified circular interpolation, Central point-specified circular interpolation</td>
</tr>
<tr>
<td>Speed control</td>
<td>Speed control (Up to 4 axes)</td>
</tr>
<tr>
<td>Speed-position switching</td>
<td>INC mode, ABS mode</td>
</tr>
<tr>
<td>Position-speed switching</td>
<td>INC mode</td>
</tr>
<tr>
<td>Current value change</td>
<td>Positioning data, Start No. for a current value changing</td>
</tr>
<tr>
<td>NOP instruction</td>
<td>Provided</td>
</tr>
<tr>
<td>JUMP instruction</td>
<td>Unconditional JUMP, Conditional JUMP</td>
</tr>
<tr>
<td>LOOP, LEND</td>
<td>Provided</td>
</tr>
<tr>
<td>High-level positioning</td>
<td>Block start, Condition start, Wait start, Simultaneous start, Repeated start</td>
</tr>
</tbody>
</table>

### Manual control

<table>
<thead>
<tr>
<th>Sub-functions</th>
<th>Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOG operation</td>
<td>Provided</td>
</tr>
<tr>
<td>Inching operation</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>
</tr>
<tr>
<td>Link device</td>
<td>Via internal interface</td>
</tr>
<tr>
<td>Speed-torque</td>
<td>Speed control without positioning loops, Torque control, Tightening &amp; press-fit control</td>
</tr>
</tbody>
</table>

### Absolute position system

Made compatible by setting a battery to servo amplifier

### Synchronous encoder interface

<table>
<thead>
<tr>
<th>Interface</th>
<th>32CH</th>
<th>16CH</th>
<th>8CH</th>
<th>4CH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal interface</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>1CH (Incremental)</td>
</tr>
<tr>
<td>Via CPU (buffer memory)</td>
<td>Provided (Incremental)</td>
<td>Provided (Incremental)</td>
<td>Provided (Incremental)</td>
<td>Provided (Incremental)</td>
</tr>
<tr>
<td>Via servo amplifier</td>
<td>32CH</td>
<td>16CH</td>
<td>8CH</td>
<td>4CH (Absolute)</td>
</tr>
</tbody>
</table>

### Functions that limit control

<table>
<thead>
<tr>
<th>Sub-functions</th>
<th>Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed limit</td>
<td>Speed limit value, JOG speed limit value</td>
</tr>
<tr>
<td>Torque limit</td>
<td>Torque limit value same setting, torque limit value individual setting</td>
</tr>
<tr>
<td>Forced stop</td>
<td>Valid/Invalid setting</td>
</tr>
<tr>
<td>Hardware stroke limit</td>
<td>Movable range check with current feed value, movable range check with machine feed value</td>
</tr>
<tr>
<td>Speed change</td>
<td>Provided</td>
</tr>
</tbody>
</table>

### Functions that change control details

<table>
<thead>
<tr>
<th>Sub-functions</th>
<th>Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Override</td>
<td>0 to 300 [%]</td>
</tr>
<tr>
<td>Acceleration/deceleration time change</td>
<td>Provided</td>
</tr>
<tr>
<td>Torque change</td>
<td>Provided</td>
</tr>
<tr>
<td>Target position change</td>
<td>Target position address and speed are changeable</td>
</tr>
</tbody>
</table>

### Other functions

<table>
<thead>
<tr>
<th>Sub-functions</th>
<th>Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-code output</td>
<td>WITH mode/AFTER mode</td>
</tr>
<tr>
<td>Step function</td>
<td>Deceleration unit step, Data No. unit step</td>
</tr>
<tr>
<td>Skip function</td>
<td>Via PLC CPU, Via external command signal</td>
</tr>
<tr>
<td>Teaching function</td>
<td>Provided</td>
</tr>
</tbody>
</table>

### Parameter initialization function

Provided

### External input signal setting function

<table>
<thead>
<tr>
<th>Sub-functions</th>
<th>Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal interface</td>
<td>—</td>
</tr>
<tr>
<td>Via CPU (buffer memory)</td>
<td>Provided</td>
</tr>
<tr>
<td>Link device</td>
<td>Provided</td>
</tr>
<tr>
<td>Via servo amplifier</td>
<td>Provided</td>
</tr>
</tbody>
</table>

### Amplifier-less operation function

Provided

### Mark detection function

<table>
<thead>
<tr>
<th>Sub-functions</th>
<th>Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark detection signal</td>
<td>Up to 32 points (Note-5)</td>
</tr>
<tr>
<td>Mark detection setting</td>
<td>Up to 32 settings</td>
</tr>
</tbody>
</table>

(Note-5) 
(Note-6)


## 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>RD77GF32</td>
<td>—</td>
</tr>
<tr>
<td>RD77GF16</td>
<td>—</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>FX5-80SSC-S</td>
<td>—</td>
</tr>
<tr>
<td>FX5-40SSC-S</td>
<td>—</td>
</tr>
<tr>
<td>Digital oscilloscope function</td>
<td>Bit data</td>
</tr>
<tr>
<td>RD77GF32</td>
<td>16CH</td>
</tr>
<tr>
<td>RD77GF16</td>
<td>16CH</td>
</tr>
<tr>
<td>RD77GF8</td>
<td>16CH</td>
</tr>
<tr>
<td>RD77GF4</td>
<td>16CH</td>
</tr>
<tr>
<td>RD77MS16</td>
<td>16CH</td>
</tr>
<tr>
<td>RD77MS8</td>
<td>16CH</td>
</tr>
<tr>
<td>RD77MS4</td>
<td>16CH</td>
</tr>
<tr>
<td>RD77MS2</td>
<td>16CH</td>
</tr>
<tr>
<td>FX5-80SSC-S</td>
<td>16CH</td>
</tr>
<tr>
<td>FX5-40SSC-S</td>
<td>16CH</td>
</tr>
</tbody>
</table>

(Note-1): Available only with RD77GF and RD77MS.
(Note-2): Available only with RD77MS and FX5-40SSC-S/FX5-80SSC-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

<table>
<thead>
<tr>
<th>Item</th>
<th>Number of settable axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo input axis</td>
<td>MELSEC iQ-R series</td>
</tr>
<tr>
<td>RD77GF32</td>
<td>32 axes/module</td>
</tr>
<tr>
<td>RD77GF16</td>
<td>16 axes/module</td>
</tr>
<tr>
<td>RD77GF8</td>
<td>8 axes/module</td>
</tr>
<tr>
<td>RD77GF4</td>
<td>4 axes/module</td>
</tr>
<tr>
<td>RD77MS16</td>
<td>32 axes/module</td>
</tr>
<tr>
<td>RD77MS8</td>
<td>16 axes/module</td>
</tr>
<tr>
<td>RD77MS4</td>
<td>8 axes/module</td>
</tr>
<tr>
<td>RD77MS2</td>
<td>4 axes/module</td>
</tr>
<tr>
<td>FX5-80SSC-S</td>
<td>32 axes/module</td>
</tr>
<tr>
<td>FX5-40SSC-S</td>
<td>16 axes/module</td>
</tr>
</tbody>
</table>

Synchronous encoder input axis

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<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 clutch</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Auxiliary shaft composite gear</td>
<td>1 module/output axis</td>
</tr>
<tr>
<td>Speed change gear</td>
<td>2 modules/output axis</td>
</tr>
<tr>
<td>Output axis (Cam axis)</td>
<td>MELSEC iQ-R series</td>
</tr>
<tr>
<td>RD77GF32</td>
<td>32 axes/module</td>
</tr>
<tr>
<td>RD77GF16</td>
<td>16 axes/module</td>
</tr>
<tr>
<td>RD77GF8</td>
<td>8 axes/module</td>
</tr>
<tr>
<td>RD77GF4</td>
<td>4 axes/module</td>
</tr>
<tr>
<td>RD77MS16</td>
<td>32 axes/module</td>
</tr>
<tr>
<td>RD77MS8</td>
<td>16 axes/module</td>
</tr>
<tr>
<td>RD77MS4</td>
<td>8 axes/module</td>
</tr>
<tr>
<td>RD77MS2</td>
<td>4 axes/module</td>
</tr>
<tr>
<td>FX5-80SSC-S</td>
<td>32 axes/module</td>
</tr>
<tr>
<td>FX5-40SSC-S</td>
<td>16 axes/module</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory capacity</td>
<td>Cam storage area 3 M bytes</td>
</tr>
<tr>
<td>Cam working area</td>
<td>16 M bytes</td>
</tr>
<tr>
<td>Number of registration</td>
<td>Up to 1024</td>
</tr>
<tr>
<td>Coordinate data type</td>
<td>Cam resolution</td>
</tr>
<tr>
<td>RD77GF</td>
<td>256</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>

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

<table>
<thead>
<tr>
<th>Coordinate data type</th>
<th>Maximum number of cam registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>RD77GF</td>
<td>1024</td>
</tr>
<tr>
<td>RD77MS</td>
<td>1024</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.
## Module specification

**Simple Motion module RD77MS16/RD77MS8/RD77MS4/RD77MS2**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input signals (I/O)</strong></td>
<td></td>
</tr>
<tr>
<td>Number of input points</td>
<td>RD77MS16</td>
</tr>
<tr>
<td>Input method</td>
<td>20 points</td>
</tr>
<tr>
<td>Rated input voltage/current</td>
<td>24 VDC/Approx. 5 mA</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>19.2 to 26.4 VDC (24 VDC +10%/−20%, ripple ratio 5% or less)</td>
</tr>
<tr>
<td>ON voltage/current</td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td>OFF voltage/current</td>
<td>7 VDC or less/1.0 mA or less</td>
</tr>
<tr>
<td>Input resistance</td>
<td>Approx. 6.8 kΩ</td>
</tr>
<tr>
<td>Response time</td>
<td>1 ms or less (OFF→ON, ON→OFF)</td>
</tr>
<tr>
<td>Recommended wire size</td>
<td>AWG24 (0.2 mm²)</td>
</tr>
</tbody>
</table>

| **Forced stop input signal (EMI)** | |
| Number of input points | 1 point | |
| Input method | Positive common/Negative common shared (photocoupler isolation) | |
| Rated input voltage/current | 24 VDC/Approx. 5 mA | |
| Operating voltage range | 19.2 to 26.4 VDC (24 VDC +10%/−20%, ripple ratio 5% or less) | |
| ON voltage/current | 17.5 VDC or more/3.5 mA or more | |
| OFF voltage/current | 7 VDC or less/1.0 mA or less | |
| Input resistance | Approx. 6.8 kΩ | |
| Response time | 4 ms or less (OFF→ON, ON→OFF) | |
| Recommended wire size | AWG24 (0.2 mm²) | |

| **Manual pulse generator/Incremental synchronous encoder signal** | |
| Differential output type (26LS31 or equivalent) | RD77MS16 | RD77MS8 | RD77MS4 | RD77MS2 |
| Input pulse frequency | Up to 1 Mpulse/s (After magnification by 4, up to 4 Mpulse/s) | |
| Pulse width | 1μs or more | |
| Leading edge/trailing edge time | 0.25μs or less | |
| Phase difference | 0.25μs or more | |
| Rated input voltage | 5.5 VDC or less | |
| High/Low-voltage | 2.0 to 5.25 VDC/0 to 0.8 VDC | |
| Differential voltage | ±0.2V | |
| Cable length | Up to 30m (98.43 ft.) | |

| Voltage-output/Open-collector type (5 VDC) | RD77MS16 | RD77MS8 | RD77MS4 | RD77MS2 |
| Input pulse frequency | Up to 200 kpulse/s (After magnification by 4, up to 800 kpulse/s) | |
| Pulse width | 5μs or more | |
| Leading edge/trailing edge time | 1.2μs or less | |
| Phase difference | 1.2μs or more | |
| Rated input voltage | 5.5 VDC or less | |
| High/Low-voltage | 3.0 to 5.25 VDC/2 mA or less, 0 to 1.0 VDC/5 mA or more | |
| Cable length | Up to 10m (32.81 ft.) | |

| Number of I/O occupying points | 32 points (I/O allocation: Intelligent function module, 32 points) | |
| Number of module occupied slots | 1 | |
| 5 VDC internal current consumption [A] | 1.0 | |
| Mass [kg] | 0.23 | 0.22 | |
| Exterior dimensions [mm/inch] | 106.0(4.17) (H) x 27.8(1.09) (W) x 110.0(4.33) (D) | |

## Applicable CPU

### PLC CPU module

- R04CPU, R08CPU, R16CPU, R32CPU, R120CPU
- R04ENCPU, R08ENCPU, R16ENCPU, R32ENCPU, R120ENCPU
- R08PCPU, R16PCPU, R32PCPU, R120PCPU
- R08SFCPU-SET, R16SFCPU-SET, R32SFCPU-SET, R120SFCPU-SET, R12CCPU-V

(Note): 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>FX5-80SSC-S</th>
<th>FX5-40SSC-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of control axes (Virtual servo amplifier axis included)</td>
<td>Up to 8 axes</td>
<td>Up to 4 axes</td>
</tr>
<tr>
<td>Servo amplifier connection method</td>
<td>SSCNET III/H</td>
<td>SSCNET III/H</td>
</tr>
<tr>
<td>Maximum overall cable distance [m(ft.])</td>
<td>800 (2624.67)</td>
<td>400 (1312.32)</td>
</tr>
<tr>
<td>Maximum distance between stations [m(ft.)]</td>
<td>100 (328.08)</td>
<td>100 (328.08)</td>
</tr>
<tr>
<td>Peripheral I/F</td>
<td>Via CPU module (Ethernet)</td>
<td>Via CPU module (Ethernet)</td>
</tr>
<tr>
<td>Manual pulse generator operation function</td>
<td>Possible to connect 1 module</td>
<td>Possible to connect 1 module</td>
</tr>
<tr>
<td>Synchronous encoder operation function</td>
<td>Possible to connect 4 modules (Total of the internal interface, via CPU interface, and servo amplifier interface)</td>
<td>Possible to connect 4 modules (Total of the internal interface, via CPU interface, and servo amplifier interface)</td>
</tr>
<tr>
<td>Input signals (DI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of input points</td>
<td>4 points</td>
<td>4 points</td>
</tr>
<tr>
<td>Input method</td>
<td>Positive common/Negative common shared (photocoupler isolation)</td>
<td>Positive common/Negative common shared (photocoupler isolation)</td>
</tr>
<tr>
<td>Rated input voltage/current</td>
<td>24 VDC/Approx. 5 mA</td>
<td>24 VDC/Approx. 5 mA</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>19.2 to 26.4 VDC (24 VDC +10%/-20%, ripple ratio 5% or less)</td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td>ON voltage/current</td>
<td>17.5 VDC or more/3.5 mA or more</td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td>OFF voltage/current</td>
<td>7 VDC or less/1.0 mA or less</td>
<td>7 VDC or less/1.0 mA or less</td>
</tr>
<tr>
<td>Input resistance</td>
<td>Approx. 6.8 kΩ</td>
<td>Approx. 6.8 kΩ</td>
</tr>
<tr>
<td>Response time</td>
<td>1 ms or less (OFF→ON, ON→OFF)</td>
<td>4 ms or less (OFF→ON, ON→OFF)</td>
</tr>
<tr>
<td>Recommended wire size</td>
<td>AWG24 (0.2 mm²)</td>
<td>AWG24 (0.2 mm²)</td>
</tr>
<tr>
<td>Forced stop input signal (EM)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of input points</td>
<td>1 point</td>
<td>1 point</td>
</tr>
<tr>
<td>Input method</td>
<td>Positive common/Negative common shared (photocoupler isolation)</td>
<td>Positive common/Negative common shared (photocoupler isolation)</td>
</tr>
<tr>
<td>Rated input voltage/current</td>
<td>24 VDC/Approx. 5 mA</td>
<td>24 VDC/Approx. 5 mA</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>19.2 to 26.4 VDC (24 VDC +10%/-20%, ripple ratio 5% or less)</td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td>ON voltage/current</td>
<td>17.5 VDC or more/3.5 mA or more</td>
<td>17.5 VDC or more/3.5 mA or more</td>
</tr>
<tr>
<td>OFF voltage/current</td>
<td>7 VDC or less/1.0 mA or less</td>
<td>7 VDC or less/1.0 mA or less</td>
</tr>
<tr>
<td>Input resistance</td>
<td>Approx. 6.8 kΩ</td>
<td>Approx. 6.8 kΩ</td>
</tr>
<tr>
<td>Response time</td>
<td>4 ms or less (OFF→ON, ON→OFF)</td>
<td>4 ms or less (OFF→ON, ON→OFF)</td>
</tr>
<tr>
<td>Recommended wire size</td>
<td>AWG24 (0.2 mm²)</td>
<td>AWG24 (0.2 mm²)</td>
</tr>
<tr>
<td>Signal input form</td>
<td>Phase A/Phase B (magnification by 4/2), PULSE/SIGN</td>
<td>Phase A/Phase B (magnification by 4/2), PULSE/SIGN</td>
</tr>
<tr>
<td>Differential output type</td>
<td>2BSL31 or equivalent</td>
<td>2BSL31 or equivalent</td>
</tr>
<tr>
<td>Input pulse frequency</td>
<td>Up to 1 Mpulse/s (After magnification by 4, up to 4 Mpulse/s)</td>
<td>Up to 200 kpulse/s (After magnification by 4, up to 800 kpulse/s)</td>
</tr>
<tr>
<td>Pulse width</td>
<td>1 μs or more</td>
<td>5 μs or more</td>
</tr>
<tr>
<td>Leading edge/trailing edge time</td>
<td>0.25 μs or less</td>
<td>1.2 μs or less</td>
</tr>
<tr>
<td>Phase difference</td>
<td>0.25 μs or more</td>
<td>1.2 μs or more</td>
</tr>
<tr>
<td>Rated input voltage</td>
<td>5.5 VDC or less</td>
<td>5.5 VDC or less</td>
</tr>
<tr>
<td>High/Low-voltage</td>
<td>2.0 to 5.25 VDC to 0.8 VDC</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>Differential voltage</td>
<td>±0.2 V</td>
<td>±10 mV</td>
</tr>
<tr>
<td>Cable length</td>
<td>Up to 30 m (98.43ft.)</td>
<td>Up to 10m (32.81ft.)</td>
</tr>
</tbody>
</table>

(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

(Note): Refer to "MELSEC iQ-R Module Configuration Manual" 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</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>32 modules</td>
</tr>
<tr>
<td><strong>Synchronous encoder operation</strong></td>
<td>32 points</td>
</tr>
<tr>
<td><strong>Number of I/O occupying points</strong></td>
<td>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>
</tbody>
</table>

**Applicable CPU**

PLC CPU module

R04CPU, R08CPU, R16CPU, R32CPU, R120CPU
R04ENCPU, R08ENCPU, R16ENCPU, R32ENCPU, R120ENCPU
R08CPU, R16CPU, R32CPU, R120CPU
R08SFCPU-SET, R16SFCPU-SET, R32SFCPU-SET, R120SFCPU-SET

(Note): Refer to “MELSEC iQ-R Module Configuration Manual” for details.

**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>RD77GF32</td>
</tr>
<tr>
<td>RX</td>
<td>16k points (16384 points, 2 kbytes)</td>
</tr>
<tr>
<td>RY</td>
<td>16k points (16384 points, 2 kbytes)</td>
</tr>
<tr>
<td>RW</td>
<td>8 points (8192 points, 16 bytes)</td>
</tr>
<tr>
<td>RWW</td>
<td>8 points (8192 points, 16 bytes)</td>
</tr>
</tbody>
</table>

**Maximum link points per station**

| Master station             | RX | 16k points (16384 points, 2 kbytes) |
| Local station              | RX | 2k points (2048 points, 256 bytes) |
|                           | RY | 2k points (2048 points, 256 bytes) |
|                           | RW | 1k points (1024 points, 2 kbytes) |
|                           | RWW| 1k points (1024 points, 2 kbytes) |
| Intelligent device station | RX | 2k points (2048 points, 256 bytes) |
|                           | RY | 2k points (2048 points, 256 bytes) |
|                           | RW | 1k points (1024 points, 2 kbytes) |
|                           | RWW| 1k points (1024 points, 2 kbytes) |
| Remote device station      | RX | 128 points, 16 bytes               |
|                           | RY | 128 points, 16 bytes               |
|                           | RW | 64 points, 128 bytes               |
|                           | RWW| 64 points, 128 bytes               |

**Ethernet**

**Communications speed**

1 Gbps

**Connection cable**

1000BASE-T Ethernet cable (Category 5e or higher).

**Maximum distance between stations [m(ft.)]**

100(328.08) (conforms to ANSI/TIA/EIA-568-C.1 (Category 5e))

**Topology**

Line type, star type, line/star mixed type

**Overall cable distance**

12000(39370.08) (When 1 master station and 120 slave stations are connected)

**Maximum stations per network**

121 stations (1 master station, 120 slave stations)

**Maximum number of networks**

239

(Note-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.

(Note-2): A switching hub is required for star type topology.

**Ethernet cable specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard</strong></td>
<td>Category 5e or higher. (double shielded/STP) straight cable</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>RJ-45 connector with shield</td>
</tr>
</tbody>
</table>

The cable must meet the following standards:

- IEEE802.3 (1000BASE-T)
- ANSI/TIA/EIA-568-B (Category 5e)
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 (Note-1)</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

![Diagram of RD77MS16/RD77MS8/RD77MS4](image)

- [Unit: mm (inch)]
- 110 (4.33)
- 27.8 (1.09)

#### RD77MS2

![Diagram of RD77MS2](image)

- [Unit: mm (inch)]
- 110 (4.33)
- 27.8 (1.09)

#### RD77GF32/RD77G16/RD77GF8/RD77GF4

![Diagram of RD77GF32/RD77G16/RD77GF8/RD77GF4](image)

- [Unit: mm (inch)]
- 110 (4.33)
- 27.8 (1.09)

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

![Diagram of FX5-80SSC-S/FX5-40SSC-S](image)

- [Unit: mm (inch)]
- 83 (3.27)
- 40 (1.57)

#### MR-MV200

![Diagram of MR-MV200](image)

- [Unit: mm (inch)]
- 100 (3.94)
- 48 (1.89)
- 94 (3.70)

(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

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.

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

Top of panel, wiring duct, or other components

50mm (1.97inch) or more

50mm (1.97inch) or more

100mm (3.94inch) or more

70mm (2.76inch) or more
### Components

#### 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 (Note-1)</td>
<td>Up to 16 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>RD77MS8 (Note-1)</td>
<td>Up to 8 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>RD77MS4 (Note-1)</td>
<td>Up to 4 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>RD77MS2 (Note-1)</td>
<td>Up to 2 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>FX5-80SSC-B</td>
<td>Up to 8 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>FX5-40SSC-B</td>
<td>Up to 4 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>RD77GF32</td>
<td>Up to 32 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>RD77GF16</td>
<td>Up to 16 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>RD77GF8</td>
<td>Up to 8 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Simple Motion module</td>
<td>RD77GF4</td>
<td>Up to 4 axes</td>
<td>CE, UL, KC, EAC</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.

(Note-4): Use this connector set for FX5-40SSC-S/FX5-80SSC-S.

#### SSCNET III cable (Note-1)

- MR-JBUS_M
- MR-JBUS_M-A
- MR-JBUS_M-B (Note-1)

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<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>SSCNET III cable</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>SSCNET III cable</td>
<td>MR-JBUS_M-B (Note-1)</td>
<td>Long distance cable</td>
<td>30m (98.43ft.), 40m (131.23ft.), 50m (164.04ft.)</td>
</tr>
</tbody>
</table>

(Note-1): 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.

#### Manual pulse generator

- MR-HDP01

<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>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>Nemicon Corporation</td>
</tr>
</tbody>
</table>

#### Internal IF connector set (Note-1)

- LD77MHIOCON

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal IF connector set</td>
<td>LD77MHIOCON</td>
<td>Incremental synchronous encoder/Mark detection signal interface connector set</td>
<td>CE, UL, KC, EAC</td>
</tr>
</tbody>
</table>

(Note-1): Use this connector set for FX5-40SSC-S/FX5-80SSC-S.

#### Optical hub unit

- MR-MV200

<table>
<thead>
<tr>
<th>Part</th>
<th>Model</th>
<th>Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical hub unit</td>
<td>MR-MV200</td>
<td>Three branches/unit, DC power supply connector enclosed</td>
<td>CE, UL, KC, EAC</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.

(Note-4): Use this connector set for FX5-40SSC-S/FX5-80SSC-S.

### Products on the market

#### Manual pulse generator on the market

Mitsubishi Electric has confirmed the operation of the following manual pulse generators. Contact each 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>UFO-M2-0025-2Z1-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>Note</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>Ethernet cable</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>Ethernet cable</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.

(Sales office) FA PRODUCT DIVISION mail: 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.

SSCNET III/H compatible

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

- High-speed system bus
  - Approx. 40 times faster
  - Operation cycle
    - Approx. 1.5 times faster
    - 6 axes/0.222ms

- 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

(Compared to previous model)

Motion Controllers

- Packing machines
- Alignment systems
- Converting machines
- Simple industrial robots
- Tandem configuration
- Printing machines
- Screw tightening machines
- Pressing machines

- Advanced Sync
- Advanced Sync
- Advanced Sync
- Advanced Sync

- Mark Detection
- Vision
- Speed, Torque
- Advanced Sync
- Energy Saving
- Machine control
- Tandem operation
- Speed, Torque
- Advanced Sync
- Tightening & Press
- Driver Connection
- Master-slave
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. SD card is also available for storing cam data.
Multiple CPU System for High-speed Motion Control

R64MTCPU/R32MTCPU/R16MTCPU

System configuration

- MELSEC iQ-R series Motion controller
- SSCNET III/H compatible
- Motion SFC Program
- PLC CPU Motion CPU

Event processing
- Motion SFC for event processing
- A sequence program or a function block (FB) for scan processing

Motion control
- Sequence control
- Scan processing
- Device memory
- CPU buffer memory
- (fixed-cycle)

Motion SFC program
- Servo control, I/O control, and operation commands can be combined
- Can execute servo control by itself, eliminating the need for creating the sequence program for servo control

Controlling sequential machine operation using the Motion CPU
- 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.

Engineering environment
- Motion Controller Engineering Software
- Programmable Controller Engineering Software

Input (64 points):
- Synchronous input (32 points)/Interrupt input (64 points)/External input signals (Note-1) (FLS, RLS, DOG, STOP)

Output signals (64 points), Synchronous output signals (32 points)
- Manual pulse generator
- Incremental synchronous encoder
- Analogue input/output
- OI Slave Devices

Extension base unit (UP to 7 extensions)
- External input signals of a servo amplifier (Note-1) (FLS, RLS, DOG)

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

(Note-1): An input destination of external input signals (FLS, RLS, DOG) is changed by parameters.

(Note-2): When using a partner product or the inverter FR-A800, use one whose version supports the Motion controller. (Refer to MELSEC iQ-R Motion Controller User's Manual.)
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

Sequence control

Motion SFC for event processing

Motion control

Event processing

START

P10

F10

F20

G100

F30

G200

K100

G300

F150

P10
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.

Reduced display

Comment display

Enlarged display

Motion SFC Description

- 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.

- Operation start
- Data calculation
- Work ready
- Start accept OFF confirmation

Motion SFC scanning method

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.

Motion SFC scanning method

Scanning all the steps in the sequence program

Scanning only active steps following the transition conditions in Motion SFC program.
Positioning Control

A variety of positioning controls, such as PTP control, position follow-up, and continuous trajectory 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 trajectory 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 can be achieved using software instead of controlling mechanically with physical gears, shafts, clutches, speed change gears or cams etc. Additionally, a cam is easily created with the 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

**Control flow**

**PLC CPU**

Sequence program

- Motion SFC program
- Start request instruction
- Target CPU (No.2) specification

Start of Motion SFC

Data exchange through CPU buffer memory, etc.

**Motion CPU**

Motion SFC program

- Servo motor start
- Axis 2
- Axis 1

Command generation axis start

Application examples

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

Application example

- 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 can be achieved using software instead of controlling mechanically with physical gears, shafts, clutches, speed change gears or cams etc. Additionally, a cam is easily created with the 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 corresponding 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 the machine frame vibration 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 differs when 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

<table>
<thead>
<tr>
<th>Machine Type No.</th>
<th>R001</th>
<th>R002</th>
<th>R003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear axis-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear axis-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear axis-3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Vertical Articulated Robot

<table>
<thead>
<tr>
<th>Machine Type No.</th>
<th>R004</th>
<th>R005</th>
<th>R006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint axis-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint axis-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint axis-3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Machine Library Name

MCNTYP-R□□□→ 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

<table>
<thead>
<tr>
<th>M0</th>
<th>U3E1/G516.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command execution instruction</td>
<td>start accept</td>
</tr>
</tbody>
</table>

### 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>–</td>
<td>0</td>
</tr>
<tr>
<td>W4</td>
<td>Control mode, Interpolation axis speed designation</td>
<td>0200H</td>
</tr>
<tr>
<td>W5</td>
<td>M-code</td>
<td>0</td>
</tr>
<tr>
<td>W6</td>
<td>Dwell time</td>
<td>0</td>
</tr>
<tr>
<td>W7</td>
<td>Torque limit value</td>
<td>300</td>
</tr>
<tr>
<td>W8</td>
<td>Command speed</td>
<td>100000</td>
</tr>
<tr>
<td>W9</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>WA</td>
<td>Positioning address/movement amount</td>
<td>12345678</td>
</tr>
<tr>
<td>WB</td>
<td>Arc address</td>
<td>0</td>
</tr>
</tbody>
</table>
Monitoring and modifying the servo data of up to 50 monitoring items successively during operation is possible. The operation status of servo amplifiers and servo motors (including partner products) acquired via SSCNET III/H is transferred to the host system or to the GOT screen created by a customer, and are displayed.

[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

X-axis

Original target position

New target position
Monitoring and modifying the servo data of up to 50 monitoring items successively during operation is possible. The operation status of servo amplifiers and servo motors (including partner products) acquired via SSCNET III/H is transferred to the host system or to the GOT screen created by a customer, and are displayed.

### 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.

---

**COGNEX Vision System**

**Operation Example of Target Position Change Function**

X-axis

Y-axis

Original target position

New target position

COGNEX Vision system is directly connected to the Motion CPU via Ethernet using the built-in PERIPHRAL 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.

### 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 a SD card can be analyzed on a personal computer.
- Sampled data trajectory 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.

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 high-speed, high-capacity CPU buffer memory revolutionizes the data exchange between CPUs.

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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.
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.

### Features
- 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

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

LJ72MS15 SSCNET III/H Head Module

Specifications
- Maximum number of stations: 4 stations
- Maximum I/O points per system
  - Input points 256 bytes
  - Output points 256 bytes
  - Input points 64 bytes
  - Output points 64 bytes

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

SSCNET III/H Field Devices

SSCNET III/H field devices include the sensing module MR-MT2000 series and the MELSEC-L series SSCNET III/H head module. The sensing module MR-MT2000 series increase speed and accuracy of equipment by using high-response I/O synchronized with a motion control cycle. The MELSEC-L series SSCNET III/H head module is suitable for equipment with many I/O points because various modules of a programmable controller can be connected to the MELSEC-L series SSCNET III/H head module. Different types of field devices are prepared and selectable according to customer’s needs.

<table>
<thead>
<tr>
<th>Name</th>
<th>Sensing module</th>
<th>MELSEC-L series SSCNET III/H head module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection method</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Features   | ● High-response I/O
  Mark sensor
  Acceleration sensor
  Shutter output, etc.
  ● Synchronization with motion control cycle | ● Connection with various modules
  I/O module
  Analog module
  Temperature input module, etc. |

Different types of field devices are prepared and selectable according to customer’s needs.
External Input of Motion CPU

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.

SD Memory Card

Bulky data such as cam data or digital oscilloscope data can be stored in a 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 a SD memory card.

- The digital oscilloscope data that is sampled automatically by a Motion CPU can be saved on a SD memory card. For example, when an error occurs, the data is sampled automatically. You can check the data later on a personal computer.

Boot operation with a SD memory card

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

#### Home position return methods
15 types of home position return methods are available, including the dogless home position return, which is newly available. Also, the retry function and the shift function are provided. Select any of these home position return methods that suit 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.

#### 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 tact 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/SBC/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).

#### Battery-free data saving
Since parameters and Motion SFC programs are saved in the non-volatile memory, the Motion CPU can save data without a battery. (Note): The PLC CPU requires a battery. If an absolute position system is configured, the servo amplifier needs a battery.

#### Add-on function
The add-on library is installed to the Motion CPU to expand the functionality of the Motion controller such as “Machine control function”. (Note): Contact your local Mitsubishi Electric office for the add-on library.
### 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 trajectory 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, Backlash compensation, Electronic gear, Phase compensation</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</td>
</tr>
<tr>
<td>Servo program capacity</td>
<td>32k 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>Home position return method</td>
</tr>
<tr>
<td>Auxiliary functions</td>
<td>Home position return retry function, Home position shift function</td>
</tr>
<tr>
<td>Positioning control</td>
<td>Linear control</td>
</tr>
<tr>
<td>Auxiliary functions</td>
<td>Linear interpolation (Up to 4 axes) (Vector speed, Reference axis speed, Long-axis speed)</td>
</tr>
<tr>
<td>2-axis circular interpolation</td>
<td>Auxiliary point-specified, central point-specified, and radius-specified circular interpolation</td>
</tr>
<tr>
<td>Speed control</td>
<td>Speed control for the specified axis</td>
</tr>
<tr>
<td>Speed-position switching</td>
<td>INC mode, Speed control with fixed position stop</td>
</tr>
<tr>
<td>JoG operation</td>
<td>Provided</td>
</tr>
<tr>
<td>Manual pulse generator</td>
<td>Provided</td>
</tr>
<tr>
<td>Manual position control</td>
<td>Provided</td>
</tr>
<tr>
<td>Expansion control</td>
<td>Speed-torque</td>
</tr>
<tr>
<td>Absolute position system</td>
<td>Made compatible by setting a battery to servo amplifier</td>
</tr>
<tr>
<td>Synchronous encoder interface</td>
<td>Speed-torque</td>
</tr>
<tr>
<td>Functions that change control details</td>
<td>Speed limit, Torque limit, Override, Forced stop, Software stroke limit, Hardware stroke limit, Speed change, Acceleration/deceleration time change, Torque change, Target position change</td>
</tr>
<tr>
<td>Other functions</td>
<td>M-code output, M-code completion wait</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 setting</td>
<td>High-speed input request (Bit device, Input signals of servo amplifiers (DI1 to DI3))</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) Sampling data (Word 16CH, Bit 16CH), Offline sampling</td>
</tr>
<tr>
<td>Limit switch output function</td>
<td>Number of output points</td>
</tr>
<tr>
<td>Watch data</td>
<td>Provided</td>
</tr>
<tr>
<td>Parameter change function</td>
<td>Provided</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>
<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 home position return method set in a driver (a servo amplifier) is used. (Note-2): Available with MR-J4-_B-RJ (Note-3): Available with MR-J3-_B/MR-J4-_B
### Motion SFC performance specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motion SFC program capacity</strong></td>
<td></td>
</tr>
<tr>
<td>Code total (Motion SFC chart + Operation control + Transition)</td>
<td>8192k bytes</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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation control program (F/FS) / Transition program (G)</strong></td>
<td></td>
</tr>
<tr>
<td>Number of operation control programs</td>
<td>4096 with F (Once execution type) and FS (Scan execution type) combined (F/F00 to F/F4095)</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 (min)/block)</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>( ) nesting/block</td>
<td>Up to 32 levels</td>
</tr>
<tr>
<td>Descriptive expression</td>
<td>Operation control program: Calculation expression, Bit conditional expression, Branches/repetition processing</td>
</tr>
<tr>
<td>Transition program: Calculation expression, Bit conditional expression, Comparison conditional expression</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Execute specification</strong></td>
<td></td>
</tr>
<tr>
<td>Number of multi executed programs</td>
<td>Up to 512</td>
</tr>
<tr>
<td>Number of multi active steps</td>
<td>Up to 1024 steps per all programs</td>
</tr>
<tr>
<td>Normal task</td>
<td>Executed in Motion main cycle</td>
</tr>
<tr>
<td>Event task</td>
<td>Executed in fixed cycle (0.222 ms, 0.444 ms, 0.888 ms, 1.777 ms, 3.555 ms, 7.111 ms, 14.222 ms)</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>

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of device points</strong></td>
<td></td>
</tr>
<tr>
<td>IO (X/Y)</td>
<td>12,288 points</td>
</tr>
<tr>
<td>Internal relays (M)</td>
<td>49,152 points (Note 1)</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 (Note 1)</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 (#)</td>
<td>12,288 points</td>
</tr>
<tr>
<td>CPU buffer memory (U3E&lt;&lt;G)</td>
<td>Up to 2,097,152 points</td>
</tr>
<tr>
<td>CPU buffer memory (fixed-cycle communication area)(U3E&lt;&lt;HG)</td>
<td>Up to 12,288 points</td>
</tr>
<tr>
<td>Module access(U3E&lt;&lt;G)</td>
<td>Up to 268,435,456 points</td>
</tr>
</tbody>
</table>

(Nota 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>R64MTCPU</th>
<th>R32MTCPU</th>
<th>R16MTCPU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input axis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Servo input axis</td>
<td>64 axes/module</td>
<td>32 axes/module</td>
<td>16 axes/module</td>
</tr>
<tr>
<td>Command generation axis</td>
<td>64 axes/module</td>
<td>32 axes/module</td>
<td>16 axes/module</td>
</tr>
<tr>
<td>Synchronous encoder axis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Composite main shaft gear</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main shaft main input axis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main shaft sub input axis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main shaft gear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main shaft clutch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary shaft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary shaft clutch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auxiliary shaft composite gear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed change gear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output axis (Cam axis)</td>
<td>64 axes/module</td>
<td>32 axes/module</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><strong>Memory capacity</strong></td>
<td></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><strong>Number of registration</strong></td>
<td></td>
</tr>
<tr>
<td>Up to 1024 program items (depending on memory capacity, cam resolution and number of coordinates)</td>
<td></td>
</tr>
<tr>
<td><strong>Comment</strong></td>
<td></td>
</tr>
<tr>
<td>Up to 32 characters for each cam data</td>
<td></td>
</tr>
</tbody>
</table>

#### Cam data

<table>
<thead>
<tr>
<th>Stroke ratio data type</th>
<th>Number of cam registration</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cam resolution</td>
<td>256 512 1024 2048 4096</td>
<td>8192 16384 32768</td>
</tr>
<tr>
<td>Maximum number of cam registration</td>
<td>1024</td>
<td>512 256 128</td>
</tr>
<tr>
<td>Stroke ratio</td>
<td>-214,748,364.8 to 214,748,364.7 [%]</td>
<td></td>
</tr>
<tr>
<td>Coordinate data type</td>
<td>Number of cam registration</td>
<td>Specifications</td>
</tr>
<tr>
<td>Number of coordinates</td>
<td>512 1024 2048 4096 8192</td>
<td>16384 32768 65535</td>
</tr>
<tr>
<td>Maximum number of cam registration</td>
<td>1024</td>
<td>512 256 128 64 32</td>
</tr>
<tr>
<td>Coordinate data</td>
<td>Input value: 0 to 2147483647</td>
<td>Output value: -2147483648 to 2147483647</td>
</tr>
</tbody>
</table>

#### Cam auto-generation

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

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>R64MTCPU</strong></td>
</tr>
<tr>
<td>Number of control axes</td>
<td>Up to 64 axes</td>
</tr>
<tr>
<td>Servo amplifier connection method</td>
<td>SSCNET III/H (2 lines)</td>
</tr>
<tr>
<td>Maximum overall cable distance (m(ft.))</td>
<td>3200 (10498.69)</td>
</tr>
<tr>
<td>Maximum distance between stations (m(ft.))</td>
<td>100 (328.08)</td>
</tr>
<tr>
<td>SSCNET communications</td>
<td></td>
</tr>
<tr>
<td>Number of sensing module connection stations</td>
<td>Up to 8 stations</td>
</tr>
<tr>
<td>Number of SSCNET III/H head module connection stations</td>
<td>Up to 8 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></td>
</tr>
<tr>
<td>Standard ROM</td>
<td>12 M bytes</td>
</tr>
<tr>
<td>SD memory card</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 [A]</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) (H) x 27.8 (1.09) (W) x 110.0 (4.33) (D)</td>
</tr>
</tbody>
</table>
## Sensing module MR-MT2000 series

<table>
<thead>
<tr>
<th>Name</th>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SSCNETIII/H Head module MR-MT2010</strong></td>
<td>Control circuit</td>
<td>Power supply input&lt;br&gt;Voltage&lt;br&gt;24 V DC&lt;br&gt;Permissible voltage fluctuation&lt;br&gt;±10 %&lt;br&gt;Current capacity&lt;br&gt;1.0 A&lt;br&gt;Communications interface&lt;br&gt;SSCNET III/H&lt;br&gt;DI&lt;br&gt;Number of input points&lt;br&gt; sank input/source input (photocoupler isolation)&lt;br&gt;input response time&lt;br&gt;ON to OFF: within 1 μs&lt;br&gt;OFF to ON: within 1 μs&lt;br&gt;DO&lt;br&gt;Number of output points&lt;br&gt; sank output (photocoupler isolation)&lt;br&gt;Output response time&lt;br&gt;ON to OFF: within 1 μs&lt;br&gt;OFF to ON: within 1 μs&lt;br&gt;Mass [kg]&lt;br&gt;0.2</td>
</tr>
<tr>
<td><strong>I/O module MR-MT2100</strong></td>
<td>DI&lt;br&gt;Number of input points&lt;br&gt; sank input/source input (photocoupler isolation)&lt;br&gt;input response time&lt;br&gt;ON to OFF: within 1 μs&lt;br&gt;OFF to ON: within 1 μs&lt;br&gt;DO&lt;br&gt;Number of output points&lt;br&gt; sank output/source output (photocoupler isolation)&lt;br&gt;Output response time&lt;br&gt;ON to OFF: within 1 μs&lt;br&gt;OFF to ON: within 1 μs&lt;br&gt;Mass [kg]&lt;br&gt;0.2</td>
<td></td>
</tr>
<tr>
<td><strong>Pulse I/O module MR-MT2200</strong></td>
<td>Number of pulse I/O channels&lt;br&gt;Output 2CH, Input 2CH, I/O 1CH each (selectable)&lt;br&gt;Pulse output&lt;br&gt;Output signal&lt;br&gt;Differential line driver output/open collector output&lt;br&gt;Maximum frequency&lt;br&gt;4M pulse/s (A-phase/B-phase pulse train 4 multiples)&lt;br&gt;1M pulse/s (forward/reverse rotation pulse train, signed pulse train)&lt;br&gt;Open collector output&lt;br&gt;200k pulse/s (A-phase/B-phase pulse train 4 multiples)&lt;br&gt;50k pulse/s (forward/reverse rotation pulse train, signed pulse train)&lt;br&gt;Pulse input&lt;br&gt;Input signal&lt;br&gt;Differential line driver input&lt;br&gt;Maximum frequency&lt;br&gt;4M pulse/s (A-phase/B-phase pulse train 4 multiples)&lt;br&gt;1M pulse/s (forward/reverse rotation pulse train, signed pulse train)&lt;br&gt;DI&lt;br&gt;Number of input points&lt;br&gt;7 points per axis (total of 14 points)&lt;br&gt;Input method&lt;br&gt;Sink input/source input (photocoupler isolation)&lt;br&gt;DO&lt;br&gt;Number of output points&lt;br&gt;5 points per axis (total of 10 points)&lt;br&gt;Output method&lt;br&gt;Sink output/source output (photocoupler isolation)&lt;br&gt;Mass [kg]&lt;br&gt;0.2</td>
<td></td>
</tr>
<tr>
<td><strong>Analog I/O module MR-MT2300</strong></td>
<td>Analog input&lt;br&gt;Number of input channels&lt;br&gt;4CH&lt;br&gt;Input voltage range&lt;br&gt;-10 to 10 V DC (selectable)&lt;br&gt;Resolution&lt;br&gt;±0.334 mV (at 25 °C)/±0.167 mV (at 0 °C to 60 °C)&lt;br&gt;Conversion accuracy&lt;br&gt;±0.1 % (at 25 °C)/±0.3 % (at 0 °C to 60 °C)&lt;br&gt;Analog output&lt;br&gt;Number of output channels&lt;br&gt;4CH&lt;br&gt;Output voltage range&lt;br&gt;-10 to 10 V DC&lt;br&gt;Resolution&lt;br&gt;±0.319 mV&lt;br&gt;Conversion accuracy&lt;br&gt;±0.4 % (at 25 °C)/±0.5 % (at 0 °C to 60 °C)&lt;br&gt;Mass [kg]&lt;br&gt;0.2</td>
<td></td>
</tr>
<tr>
<td><strong>Encoder I/F module MR-MT2400</strong></td>
<td>Number of encoder channels&lt;br&gt;2CH (Note:3)&lt;br&gt;Supported encoder communications&lt;br&gt;SSI, EnDat 2.2 (Note:4), HIPERFACE DSL® (Note:4), Analog Sin/Cos (Note:4), Mitsubishi Electric serial I/F (Note:4)&lt;br&gt;Mass [kg]&lt;br&gt;0.2</td>
<td></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 for each DI and DO.<br>(Note-2): Two of the five points and the pulse output (open collector output) are mutually exclusive.<br>(Note-3): Different encoder interfaces cannot be inputted for each channel. The same encoder interface should be used for both two channels.<br>(Note-4): Will be supported in the future.
SERVO SYSTEM CONTROLLER

**Exterior Dimensions**

R64MTCPU/R32MTCPU

R16MTCPU

---

Serial absolute synchronous encoder Q171ENC-W8

---

Manual pulse generator MR-HDP01

---

**Item** | **Specifications**
--- | ---
Resolution | 4,194,304 pulse/rev
Direction of increasing address | 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 | 3600 r/min
Permitted angular acceleration | 40000 rad/s²
Ambient temperature | -5 to 55°C (23 to 131°F)
5 VDC consumption current | 0.25A
Mass | 0.6kg

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

---

**Item** | **Specifications**
--- | ---
Pulse resolution | 25P pulse/rev
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 200 r/min)
Permitted axial loads | Radial load: Up to 19.6N
 | Thrust load: Up to 9.8N
Maximum rotation speed | 600 r/min (Instantaneous maximum), 200 r/min (Normal rotation)
Ambient temperature | -10 to 60°C (14 to 140°F)
5 VDC consumption current | 0.06A
Mass | 0.4kg
Mounting

R64MTCPU/R32MTCPU/R16MTCPU

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.
## Component

**Motion controller R64MTCPU/R32MTCPU/R16MTCPU**

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motion CPU module</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>SSCNET III cable</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Serial absolute synchronous encoder</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>Manual pulse generator</td>
<td>—</td>
</tr>
<tr>
<td>Optical hub unit</td>
<td>CE, UL, KC, EAC</td>
</tr>
</tbody>
</table>

### Motion CPU module
- **R64MTCPU**
  - Up to 64 axes, Operation cycle 0.222 ms or longer
  - CE, UL, KC, EAC
- **R32MTCPU**
  - Up to 32 axes, Operation cycle 0.222 ms or longer
  - CE, UL, KC, EAC
- **R16MTCPU**
  - Up to 16 axes, Operation cycle 0.222 ms or longer
  - CE, UL, KC, EAC

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

### Serial absolute synchronous encoder
- **Q171ENC-W8**
  - Resolution: 4,194,304 pulse/rev, Permitted speed: 3600r/min
  - CE, UL, KC, EAC

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

### Optical hub unit
- **MR-MV200**
  - Three branches/unit, DC power supply connector enclosed
  - CE, UL, KC, EAC

### Sensing module MR-MT2000 series

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSCNET III/H Head module</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>I/O module</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>Pulse I/O module</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>Analog I/O module</td>
<td>UL, CE, KC, EAC</td>
</tr>
<tr>
<td>Encoder I/F module</td>
<td>UL, CE, KC, EAC</td>
</tr>
</tbody>
</table>

### Applicable CPU

| PLC CPU module | R04CPU, R08CPU, R16CPU, R32CPU, R120CPU, R08PCPU, R16PCPU, R32PCPU, R120PCPU, R12CPU-CPU-V |

### Software for Motion controller

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Model name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating system software</td>
<td>SW10DNC-RMTFW</td>
<td>Pre-installed before shipment</td>
</tr>
<tr>
<td>Machine Library</td>
<td>MCNTYP-R</td>
<td>Contact your local Mitsubishi Electric office.</td>
</tr>
</tbody>
</table>
Fully supporting all your needs from model selection, system design, startup to maintenance with diverse software.

Motion Controller Engineering Software
MELSOFT MT Works2

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

- **Positioning data setting**
  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.

- **Simulation**
  The MELSOFT GX Works3 can simulate the program on a personal computer without an actual machine during the debugging process.

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

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

- **Programmable Controller Engineering Software**
  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.

**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.
Select the most suitable motor for your machine

Capacity selection software **MRZJW3-MOTSZ111E**

Select the most suitable servo amplifier, servo motor, and regenerative option for your machine, just by setting machine specifications and operation pattern.

Select the operation pattern from either position control mode or speed control mode. The capacity selection software is available for free download. Contact your local sales office for more details.
FA Integrated Engineering Software MELSOFT iQ Works

MELSOFT iQ Works is an integrated software suite consisting of GX Works3, MT Works2, GT Works3, RT ToolBox2 mini and FR Configurator2, which are programming software for each respective product. Integration is further enhanced with MELSOFT Navigator as the central system configuration incorporating an easy-to-use, graphical user interface with additional project-sharing features such as system labels and parameters. The advantages of this powerful integrated software suite are that system design is made much easier with a substantial reduction in repetitious 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

GX Works3 is the latest generation of programming and maintenance software offered by Mitsubishi Electric specifically designed for the MELSEC iQ-R series control system. It includes many new features such as graphic-based system configuration, integrated motion control setup, multiple language support, providing an intuitive engineering environment solution.

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.

Robot engineering software
MELSOFT RT ToolBox2 mini

This robot setup software supports various steps from programming, to commissioning, evaluation, and maintenance. In addition, improved preventative maintenance is realized through the use of an integrated 3D robot simulator.

Inverter setup software
MELSOFT FR Configurator2

This software simplifies the setup and maintenance of AC Inverters. Parameters can be registered easily and distributed to multiple inverters when replacing, and activation of the PLC function all from one setup screen.

Outline

Simple Motion

Motion Controllers

Engineering Environment

Networks

Servo Amplifiers

System management software
MELSOFT Navigator

Motion controller engineering software
MELSOFT MT Works2

Robot engineering software
MELSOFT RT ToolBox2 mini

Inverter setup software
MELSOFT FR Configurator2
# Operating environment

## MELSOFT MT Works2

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Microsoft® Windows® 10 (Home, Pro, Enterprise, Education) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 8.1 (64bit/32bit), Microsoft® Windows® 8.1 (Enterprise, Pro) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 8 (64bit/32bit), Microsoft® Windows® 8 (Enterprise, Pro) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 7 (Enterprise, Ultimate, Professional, Home Premium, Starter) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows Vista® (Enterprise, Ultimate, Business, Home Premium, Home Basic) (32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® XP Service Pack3 (Professional, Home Edition) (32bit)</td>
</tr>
<tr>
<td>CPU</td>
<td>Desktop: Intel® Celeron® Processor 2.8 GHz or more recommended</td>
</tr>
<tr>
<td></td>
<td>Laptop: Intel® Pentium® M Processor 1.7 GHz or more recommended</td>
</tr>
<tr>
<td>Required memory</td>
<td>For 32-bit edition: 1GB or more recommended</td>
</tr>
<tr>
<td></td>
<td>For 64-bit edition: 2GB or more recommended</td>
</tr>
<tr>
<td>Available hard disk capacity</td>
<td>When installing MT Developer2: HDD available capacity is 3GB or more.</td>
</tr>
<tr>
<td></td>
<td>When operating MT Developer2: Virtual memory available capacity is 512MB or more.</td>
</tr>
<tr>
<td>Optical drive</td>
<td>DVD-ROM supported disk drive</td>
</tr>
<tr>
<td>Monitor</td>
<td>Resolution 1024 x 768 dots or higher</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>OS</td>
<td>Microsoft® Windows® 10 (Home, Pro, Enterprise, Education) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 8.1 (64bit/32bit), Microsoft® Windows® 8.1 (Enterprise, Pro) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 8 (64bit/32bit), Microsoft® Windows® 8 (Enterprise, Pro) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 7 (Enterprise, Ultimate, Professional, Home Premium, Starter) (64bit/32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows Vista® (Enterprise, Ultimate, Business, Home Premium, Home Basic) (32bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® XP Service Pack3 (Professional, Home Edition) (32bit)</td>
</tr>
<tr>
<td>CPU</td>
<td>Intel® Core™2 Duo Processor 2 GHz or more recommended</td>
</tr>
<tr>
<td>Required memory</td>
<td>For 32-bit edition: 1GB or more recommended</td>
</tr>
<tr>
<td></td>
<td>For 64-bit edition: 2GB or more recommended</td>
</tr>
<tr>
<td>Available hard disk capacity</td>
<td>When installing MELSOFT GX Works3: HDD available capacity is 5GB or more.</td>
</tr>
<tr>
<td>Optical drive</td>
<td>DVD-ROM supported disk drive</td>
</tr>
<tr>
<td>Monitor</td>
<td>Resolution 1024 x 768 dots or higher</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>Sequence program creation, Simple Motion module parameter settings</td>
</tr>
<tr>
<td>MELSOFT MT Works2</td>
<td>SW1DND-MTW2-E</td>
<td>Parameter settings and program creation for Motion controllers</td>
</tr>
<tr>
<td>MELSOFT iQ Works</td>
<td>SW2DND-IQWK-E</td>
<td>FA Engineering Software Note-1</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]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Motion Controller Engineering Software [MELSOFT MT Works2]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Screen Design Software [MELSOFT GT Works3]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Robot Total Engineering Support Software [MELSOFT RT ToolBox2 mini]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inverter Setup Software [MELSOFT FR Configurator2]</td>
</tr>
</tbody>
</table>

(Note-1): Refer to each product manual for software needed for the model.
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 with no restriction.

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.

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.
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Star, line, and star/line mixed topologies are available for a network configuration with a switching hub. An easy topology created only by a cable being connected to a free port of the switching hub allows field devices to be added to the system more flexibly.

The CC-Link IE Field Network is newly equipped with Motion function in the cyclic communications bandwidth. Synchronous communications with the servo amplifiers become possible, offering high-speed and high-accuracy positioning, synchronous control, and cam control.
Communications 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.

Synchronous communications are achieved with SSCNET III/H, offering technical advantages for machines in printing and food processing industry that require deterministic control.

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

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.

Synchronous communications are achieved with SSCNET III/H, offering technical advantages for machines in printing and food processing industry that require deterministic control. The blazingly fast speed

<table>
<thead>
<tr>
<th>Network communications speed</th>
<th>Baud rate [Mbps]</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSCNET III/H MR-J4</td>
<td>150</td>
</tr>
<tr>
<td>SSCNET III MR-J3</td>
<td>50, 100, 150</td>
</tr>
</tbody>
</table>

Timing of servo amplifier processing

Cycle Time as Fast as 0.222 ms

3 times faster

Network Topology

Star, line, and star/line mixed topologies are available for a network configuration with a switching hub.

Improved noise tolerance by optical communications

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.

Star topology

Line topology

Star/line mixed topology
Communications 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.

Synchronous communications are achieved with SSCNET III/H, offering technical advantages for machines in printing and food processing industry that require deterministic control.

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

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

(Drawings) Available when all axes are connected via SSCNET III/H

Large amounts of servo data are exchanged in real-time between the controller and the servo amplifier. Using MELSOFT 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.

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

When using MR-J4 series + MR-J3 series servo amplifiers together

(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.
Servos in harmony with man, machine and the environment

**Servo Amplifiers**

MITSUBISHI SERVO AMPLIFIERS & MOTORS

**MELSERVO J4**

Compatible with the advanced high-speed Motion network “SSCNET III/H”, these servo amplifiers operate rotary/linear servo motors or direct drive motors as standard. Multi-axis servo amplifiers are also available, achieving energy conservation, space-saving, and reduced wiring.

(Note): MR-J4-B-RJ010 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

- **Medium/large capacity, low inertia**
  - HG-JR series
  - Capacity: 0.5 to 55 kW

- **Small capacity, ultra-low inertia**
  - HG-MR series
  - Capacity: 50 to 750 W

- **Medium capacity, medium inertia**
  - HG-SR series
  - Capacity: 0.6 to 7 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 35 W

- **Medium capacity, flat type**
  - HG-UR series
  - Capacity: 0.75 to 5 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: 650 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**

- **Low-profile flange type**
  - TM-RG2M series
  - Rating: 4.5 N·m and 9 N·m

- **Low-profile table type**
  - TM-RU2M series
  - Rating: 2 to 240 N·m

**CC-Link IE Field Network compatible servo amplifiers with Motion**

- MR-J4-GF series
  - Rating: 70 to 960 N

- LM-H3 series
  - Capacity: 18 bits = 262,144 pulses/rev

- LM-F series
  - Capacity: 22 bits = 4,194,304 pulses/rev

(Note): The advanced vibration suppression control II automatically adjusts one frequency.

**Servo amplifier control loop**

- Built-in dedicated execution engine

**Model-based control**

- Enhanced droop pulses

**One-touch tuning window**

- Improved processing speed

- Speed frequency response is increased to 2.5 kHz.

**Advanced One-touch Tuning Function**

- Two-degrees-of-freedom model adaptive control and evolved from the conventional

**Improving Machine Performance with High-performance Servo Motors**

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Speed</td>
</tr>
<tr>
<td>Operation is unstable.</td>
<td>Operation is not following command</td>
</tr>
<tr>
<td>Time</td>
<td>Time</td>
</tr>
<tr>
<td>Speed</td>
<td>Speed</td>
</tr>
<tr>
<td>Settling time</td>
<td>Settling time</td>
</tr>
</tbody>
</table>

**Advanced Vibration Suppression Control II**

- Torque suppression algorithm which supports frequency vibrations owing to vibration control II suppresses two types of low frequency vibrations at the same time.

**Settling time comparison with the prior model**

(Note): The result is based on our evaluation condition.
Industry-leading Level of Servo Amplifier Basic Performance

Our original high-speed servo control architecture is evolved from the conventional two-degrees-of-freedom model adaptive control and applied to the dedicated execution engine. Speed frequency response is increased to 2.5 kHz. Compatible servo motors are equipped with a high-resolution absolute position encoder of 4,194,304 pulses/rev (22-bit), enabling high-speed and high-accuracy operation. The performance of the high-end machine is utilized to the fullest.

Improving Machine Performance with High-performance Servo Motors

Rotary servo motors achieve high-accuracy positioning and smooth rotation with a high-resolution encoder and improved processing speed.

Advanced One-touch Tuning Function

Servo gain adjustment is complete just by turning on the one-touch tuning function. With this function, machine resonance filter, advanced vibration suppression control II (Note), and robust filter are automatically adjusted to maximize your machine performance. This function also sets responsiveness automatically while the real-time auto tuning requires manual setting.

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. Adjustment is easily performed on MR Configurator2.

(Note): The result is based on our evaluation condition.
Functions According to IEC/EN 61800-5-2

STO (Safe torque off) and SS1 (Note-1) (Safe stop 1) are integrated as standard, enabling the safety system to be configured easily in the machine. (SIL 2)

- Turning off the control power of servo amplifier is not required, cutting out the time for restart. Additionally, home position return is not required.
- Magnetic contactor for preventing unexpected motor start is not required. (Note-2)

(Note-1): Safety equipment (MR-J3-D05, safety programmable controller MELSEC QS/WS series, etc.) is required. (Note-2): MR-J4 series servo amplifiers do not require a magnetic contactor to satisfy the requirements of STO. However, the figure shows a magnetic contactor installed to prevent servo alarms and a risk of electric shock.

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. Losses from the machine stop due to age-related deterioration are reduced.

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.

Machine Diagnosis Function

This function detects changes of machine parts (ball screw, guide, bearing, belt, etc.) by analyzing machine friction, load moment of inertia, unbalanced torque, and changes in vibration component from the data inside the servo amplifier, supporting timely maintenance of the driving 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 start-up support tool achieves a stable machine system, optimum control, and short setup time.
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.

[Installation space: Configuration example of installing two units of 100 W, 200 W, 400 W, and 750 W each]

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

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 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

<table>
<thead>
<tr>
<th>Motor Driving Power</th>
<th>Space Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced by 25%</td>
<td>Narrower by 10%</td>
</tr>
</tbody>
</table>

### 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 power of one axis is used for driving other axes, contributing to energy-conservation.

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 optional 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 200 V 5 kW, 400 V 3.5 kW, 200 V/400 V 11 kW, and 200 V/400 V 15 kW servo amplifiers.

(Note-2): For a replacement of HA-LP series with HG-JR series, contact your local sales office.

(Note-3): An encoder cable is incompatible with HG-JR series from 11 kW to 55 kW.

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

- Parameters are automatically converted by changing MR-J3-B to MR-J4-B with MELSOFT MT Works2 (Note-1).

(Note-1): Update your MT Works2 to the latest version.
Maximizing productivity and reducing costs across the entire enterprise

e-F@ctory is the Mitsubishi Electric solution for improving the performance of any manufacturing enterprise by enhancing productivity, and reducing the maintenance and operations costs together with seamless information flow throughout the plant. e-F@ctory uses a combination of factory automation and IT technologies, offering solutions to reduce the total cost of development, production, and maintenance by supporting advanced Monozukuri*.

The e-F@ctory Alliance is an ecosystem offering best-in-class solutions by combining products between Mitsubishi Electric and its various partners. Close collaboration with such partners broaden the choices for the customer and realize the best solution possible.

Reduce energy costs
e&eco-F@ctory (energy saving solution)

Modern manufacturing depends much on reducing energy costs as a way to realize an efficient manufacturing enterprise. e-F@ctory supports this by allowing visualization of real-time energy usage, helping to reduce the overall energy consumption.

Integrate FA and IT systems at low cost
Connecting enterprise with the shop floor

e-F@ctory solutions provide direct connectivity from the shop floor to enterprise, such as Manufacturing Execution System (MES) without requiring a gateway computer. This enables leaner operations, improved yield, and efficient management of the supply chain.

Reduce development, production, and maintenance costs

iQ Platform

The iQ Platform minimizes costs at all phases of the automation life cycle by improving development times, enhancing productivity, reducing maintenance costs, and making information more easily accessible. Integration is at the heart of the iQ Platform, with a highly intelligent controller platform as the core, combined with a seamless communication network and an integrated engineering environment.

Reduce setup and maintenance costs

iQ Sensor Solution

Easily setup and maintain various types of sensors. Maintenance and design costs can be reduced as compatible iQSS partner sensors can be managed together.

Best-in-class solutions across the ecosystem

e-F@ctory Alliance

The e-F@ctory Alliance is an ecosystem offering best-in-class solutions by combining products between Mitsubishi Electric and its various partners. Close collaboration with such partners broaden the choices for the customer and realize the best solution possible.
CC-Link Partner Association (CLPA) - Actively promoting worldwide adoption of CC-Link networks

Proactively supporting CC-Link, from promotion to specification development

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.

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

URL: http://www.cc-link.org

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

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 the network in that part of the world. For companies looking to increase their presence in Asia, CLPA is well placed to assist these efforts through offices in all major Asian regions.
The Mitsubishi Electric Servo System consists of controllers with our cutting-edge iQ platform technology, servo drivers, actuators, sensors, etc., taking one step further to accelerate machine innovation by collaborating with our partner companies. Now that a wide variety of partner products are available such as stepping motors, direct drive motors, vision system, and software, you can configure your system more flexibly than ever before.

The Mitsubishi Electric Servo System Partner Association is a subcommittee of e-F@ctory Alliance.
Servo system controllers conform to global standards.
(Note-1): This product is 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): For corresponding standards and models, contact your local sales office.

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

Conformity with Restriction of Hazardous Substances Directive (RoHS)

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

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

(Note): Refer to relevant manuals and "EMC Installation Guidelines" when your system needs to meet the EMC directive.

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

Precautions before use

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

For safe use

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

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

**[Term]**

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

**[Limitations]**

(1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.

   It can also be carried out by us or our service company upon your request and the actual cost will be charged.

   However, it will not be charged if we are responsible for the cause of the failure.

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

(3) Even during the term of warranty, the repair cost will be charged on you in the following cases;

   (i) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem

   (ii) a failure caused by any alteration, etc. to the Product made on your side without our approval

   (iii) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry

   (iv) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced

   (v) any replacement of consumable parts (battery, electrolytic capacitor, etc.)

   (vi) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters

   (vii) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company

   (viii) any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

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

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

3. Service in overseas

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

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

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

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

We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.
Mitsubishi Electric offers a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines.

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

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

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

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

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

* Not all products are available in all countries.
<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Sales office</th>
<th>Tel/Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>Mitsubishi Electric Automation, Inc. 500 Corporate Woods Parkway, Vernon Hills, IL 60061, U.S.A.</td>
<td>Tel: +1-847-478-2100 Fax: +1-847-478-2253</td>
</tr>
<tr>
<td>Mexico</td>
<td>Mitsubishi Electric Automation, Mexico, Mexico City</td>
<td>Tel: +52-55-3067-7500 Fax: +52-55-3067-7500</td>
</tr>
<tr>
<td>Brazil</td>
<td>Mitsubishi Electric do Brasil Comercio e Servicos Ltda. Avenida Adelino Cardana, 293, 21 andar, Bethaville, Barueri SP, Brazil</td>
<td>Tel: +55-11-4689-3000 Fax: +55-11-4689-3016</td>
</tr>
<tr>
<td>Germany</td>
<td>Mitsubishi Electric Europe B.V. German Branch Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany</td>
<td>Tel: +49-2102-486-0 Fax: +49-2102-486-1120</td>
</tr>
<tr>
<td>UK</td>
<td>Mitsubishi Electric Europe B.V. UK Branch Travellers Lane, UK-Hatfield, Hertfordshire, AL10 8X8, U.K.</td>
<td>Tel: +44-1707-28-8780 Fax: +44-1707-27-8695</td>
</tr>
<tr>
<td>Italy</td>
<td>Mitsubishi Electric Europe B.V. Italian Branch Centro Direzionale Colleoni - Palazzo Sirio, Viale Colleoni 7, 20864 Agrate Brianza (MB), Italy</td>
<td>Tel: +39-039-6053-1 Fax: +39-039-6053-312</td>
</tr>
<tr>
<td>Spain</td>
<td>Mitsubishi Electric Europe B.V. Spanish Branch Carretera de Rubi, 76-80-Apodo. 420, 08190 Sant Cugat del Valles (Barcelona), Spain</td>
<td>Tel: +34-935-66-3131 Fax: +34-935-89-1579</td>
</tr>
<tr>
<td>France</td>
<td>Mitsubishi Electric Europe B.V. French Branch 25, Boulevard des Bouvets, 92741 Nanterre Cedex, France</td>
<td>Tel: +33-1-55-68-55-68 Fax: +33-1-55-68-57-57</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Mitsubishi Electric Europe B.V. Czech Branch Avenir Business Park, Radlicka 75/113e, 158 00 Praha 5, Czech Republic</td>
<td>Tel: +420-251-551-470 Fax: +420-251-551-471</td>
</tr>
<tr>
<td>Poland</td>
<td>Mitsubishi Electric Europe B.V. Polish Branch ul. Krakowska 50, 32-083 Balice, Poland</td>
<td>Tel: +48-12-347-65-00 Fax: +48-12-630-47-01</td>
</tr>
<tr>
<td>Russia</td>
<td>Mitsubishi Electric (Russia) LLC St. Petersburg Branch Piskarevsky pr. 2, bld 2, lt &quot;Sch&quot;, BC &quot;Benua&quot;, office 720, 195027 St. Petersburg, Russia</td>
<td>Tel: +7-812-633-3497 Fax: +7-812-633-3499</td>
</tr>
<tr>
<td>Sweden</td>
<td>Mitsubishi Electric Europe B.V. (Scandinavia) Fjellevagen 6, SE-22736 Lund, Sweden</td>
<td>Tel: +46-8-625-10-00 Fax: +46-46-39-70-18</td>
</tr>
<tr>
<td>Turkey</td>
<td>Mitsubishi Electric Turkey A.S. Umranieh Branch Senfall Mahallesi Nutuk Sokak No:5, TR-34775 Umranieh / Istanbul, Turkey</td>
<td>Tel: +90-216-526-3990 Fax: +90-216-526-3995</td>
</tr>
<tr>
<td>UAE</td>
<td>Mitsubishi Electric Europe B.V. Dubai Branch Dubai Silicon Oasis, P.O. BOX 341241, Dubai, U.A.E.</td>
<td>Tel: +971-4-3724716 Fax: +971-4-3724721</td>
</tr>
<tr>
<td>South Africa</td>
<td>Adroll Technologies 20 Waterford Office Park, 189 Wilkoppens Road, Fourways, South Africa</td>
<td>Tel: +27-11-658-0100 Fax: +27-11-658-0101</td>
</tr>
<tr>
<td>China</td>
<td>Mitsubishi Electric Automation (China) Ltd. Tel: +86-21-2322-3030 Fax: +86-21-2322-3000</td>
<td></td>
</tr>
<tr>
<td>Taiwan</td>
<td>SETSUUYO ENTERPRISE CO., LTD. 6F, No.105, Wugong 3rd Road, Wuji District, New Taipei City 24889, Taiwan</td>
<td>Tel: +886-2-2939-2499 Fax: +886-2-2939-2509</td>
</tr>
<tr>
<td>Korea</td>
<td>Mitsubishi Electric Automation Korea Co., Ltd. 7F-9F, Gangseo Hangang Xi-lower A, 401, Yangcheon-ro, Gangseo-Gu, Seoul 07526, Korea</td>
<td>Tel: +82-2-3600-9510 Fax: +82-2-3600-8056</td>
</tr>
<tr>
<td>Singapore</td>
<td>Mitsubishi Electric Asia Pte. Ltd. 307 Alexandra Road, Mitsubishi Electric Building, Singapore 159943</td>
<td>Tel: +65-6473-2308 Fax: +65-6475-7439</td>
</tr>
<tr>
<td>Thailand</td>
<td>Mitsubishi Electric Factory Automation (Thailand) Co., Ltd. 12th Floor, SV.City Building, Office Tower 1, No. 896/19 and 20 Rama 3 Road, Kwaeng Bangpangpong, Khet Yannawa, Bangkok 10120, Thailand</td>
<td>Tel: +66-2682-6522 to 6531 Fax: +66-2682-6020</td>
</tr>
<tr>
<td>Indonesia</td>
<td>PT. Mitsubishi Electric Indonesia Gedung Jaya 11th Floor, JL. MH. Thamrin No.12, Jakarta Pusat 10340, Indonesia</td>
<td>Tel: +62-21-3192-6461 Fax: +62-21-3192-3942</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Mitsubishi Electric Vietnam Company Limited Unit 01-04, 10th Floor, Vincom Center, 72 Thanh Ton Street, District 1, Ho Chi Minh City, Vietnam</td>
<td>Tel: +84-8-3910-5945 Fax: +84-8-3910-5947</td>
</tr>
<tr>
<td>India</td>
<td>Mitsubishi Electric India Pvt. Ltd. Pune Branch Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune - 411026, Maharashtra, India</td>
<td>Tel: +91-20-2710-2000 Fax: +91-20-2710-2100</td>
</tr>
<tr>
<td>Australia</td>
<td>Mitsubishi Electric Australia Pty. Ltd. 348 Victoria Road, P.O. Box 11, Rydalmere, N.S.W 2116, Australia</td>
<td>Tel: +61-2-9684-7777 Fax: +61-2-9684-7245</td>
</tr>
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Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO 14001 (standards for environmental management systems) and ISO 9001 (standards for quality assurance management systems).