

## C Controller/C Intelligent Function Module Consolidated Catalog

**e-Factory**



# GLOBAL IMPACT OF MITSUBISHI ELECTRIC



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

## ***Changes for the Better***

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.

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.

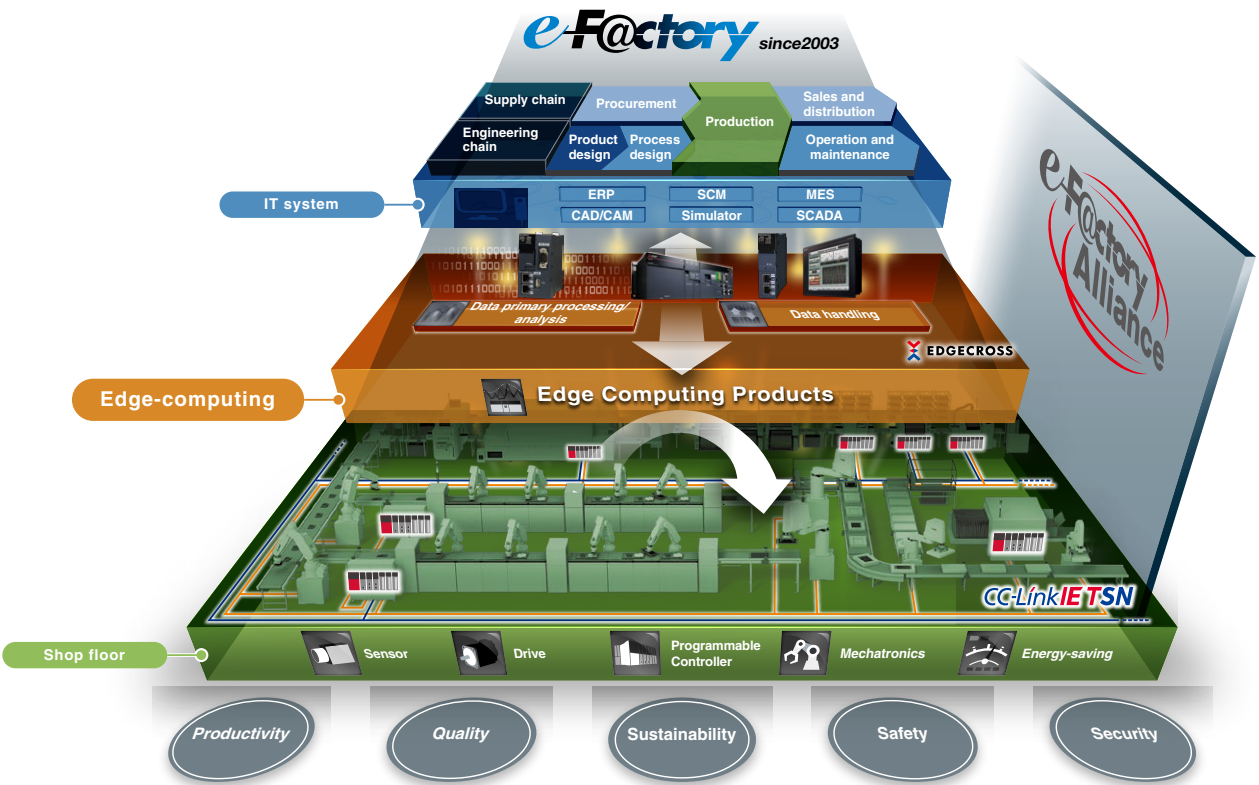


# Maximizing productivity and reducing total cost while adding value across the manufacturing enterprise

e-F@ctory is the Mitsubishi Electric solution for adding value across the 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 in combination with various best-in-class partner products through its alliance program, offering solutions to reduce total cost while improving operations, production yield, and efficient management of the supply chain.



## FA integrated solution reducing total cost



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# C Controller

## Open platform controller utilized for production site innovation edge computing

The C Controller and C Intelligent function modules are open platform controllers that can execute C/C++ programs, based on the MELSEC system architecture, and utilize long-term stable supply, high availability, advanced functionality, and flexible features.

High-speed complex processing that is not possible with a ladder program is realized while carrying out MELSEC Series module management and I/O control in C/C++ programs.

Data collected on the shop floor such as control, inspection, monitoring, conveyance, assembly, and communication gateway are primary processed and analyzed to diagnose in real-time. This makes it possible to detect the actual fault occurring at an early stage, thereby enabling prompt troubleshooting, contributing to quality improvements and enhanced productivity.

Various control systems can be configured by combining the C Controller with MELSEC iQ-R Series modules, 3rd party products, open source applications, and customer's program assets.





## SELECTION GUIDE

### ■ C Controller

#### Real-time control



- **Real-time control**

Embedded with VxWorks®, the C Controller realizes real-time control which may not be possible with a general-purpose OS.

- **High-speed processing**

C language (C/C++) based programming realizes a high-speed processing.

- **Easier system configuration**

The module can be immediately utilized as the C Controller dedicated functions are pre-installed.

### ■ C intelligent function module

#### Information processing



- **Distributed control with CPU module**

Control processing is done in the CPU module and information processing in the C intelligent function module, reducing overall processing time.

- **Extend functions of the existing facility**

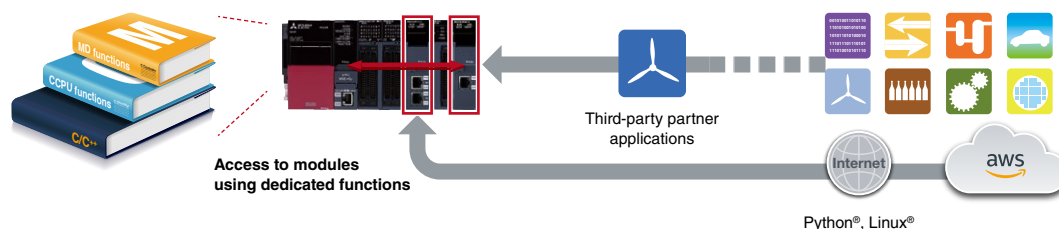
Functions such as complicated processing and protocol conversion matching with systems can be added.

- **Multiple operating systems supported**

Linux® that allows development of various applications and VxWorks® that improves data analysis accuracy are pre-installed.

## Linux®/VxWorks® realizes easier configuration of various control systems

Dedicated functions and communications library are provided, enabling access to the control system modules. In addition, various partner applications are available, supporting different manufacturing equipment features. By utilizing the information community of Debian GNU/Linux allows machines to adopt the latest data processing technology (software package). Key features such as remote operation, predictive maintenance, and remote maintenance of machines can be easily implemented through connection with third-party cloud services.



# Easier to configure various control systems

## Innovative open platform, C Controller

Highly customizable solution enables the integration of partner products, open source applications, and OS-independent capabilities onto a generic open platform.

### Semiconductor manufacturing process

#### Bonding machine

A computer based system can be migrated to the MELSEC based environment. Existing control program can be ported to the C Controller.

#### Chip resistor manufacturing machine

The machine's status of chip resistor manufacturing processes (screen printing, chip breaking, and taping) can be synchronized with the C controller.

#### Semiconductor manufacturing system

A system executing SECS communication between a semiconductor machine and MES server can be configured. Use SECS/GEM communication software to configure the system.

### Injection molding



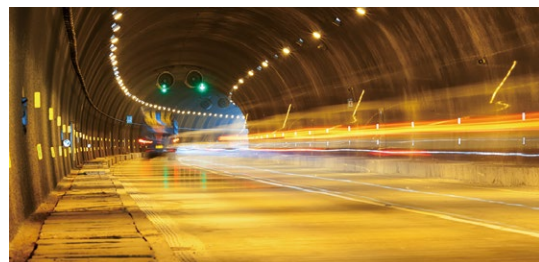
High-performance control is realized with the C Controller. Comparing to the prescribed injection patterns, the screw movement amount can be calculated at high speed.

### Conveyor



Effective conveyor management and conveyor control utilizing multiple modular feature. Installing in a panel near the conveyor can save space.

### Expressway monitoring and analysis



Monitors and analyzes expressway vibration and vehicle exhaust gases. With its robust feature, the C Controller can continuously and stably operate in harsh environments.

### Automated warehouse



The C Controller can be connected with multiple automated warehouse controllers. Long-term stable supply and robust operation are ensured.





### **Inspection machine**



Replacing a computer with the C Controller and GOT (HMI) increases durability and eliminates computer replacement costs.

### **Production data collection**



Using the C intelligent function module as an IT gateway enables production data collection, realizing efficient coordination with the IT system.

### **Bearing deterioration diagnosis**



Bearing deterioration status can be diagnosed. High-speed data analysis processing such as FFT calculations can be realized.

### **Solar power measurement and display**



The C Controller can be used for solar panel measurement unit. Power generation status is measured and displayed on a monitoring screen, etc.

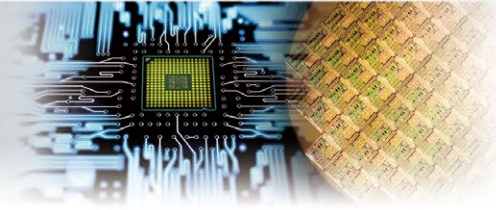
### **Automobile welding line/predictive maintenance**



A cloud-based predictive maintenance system can be easily configured with the C intelligent function module utilizing AWS IoT Greengrass.

```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );  
if( fd2 != ERROR){  
    if( bind(fd2, (struct sockaddr *)&serv_ad,  
            listen(fd2,1));
```

## Semiconductor manufacturing process

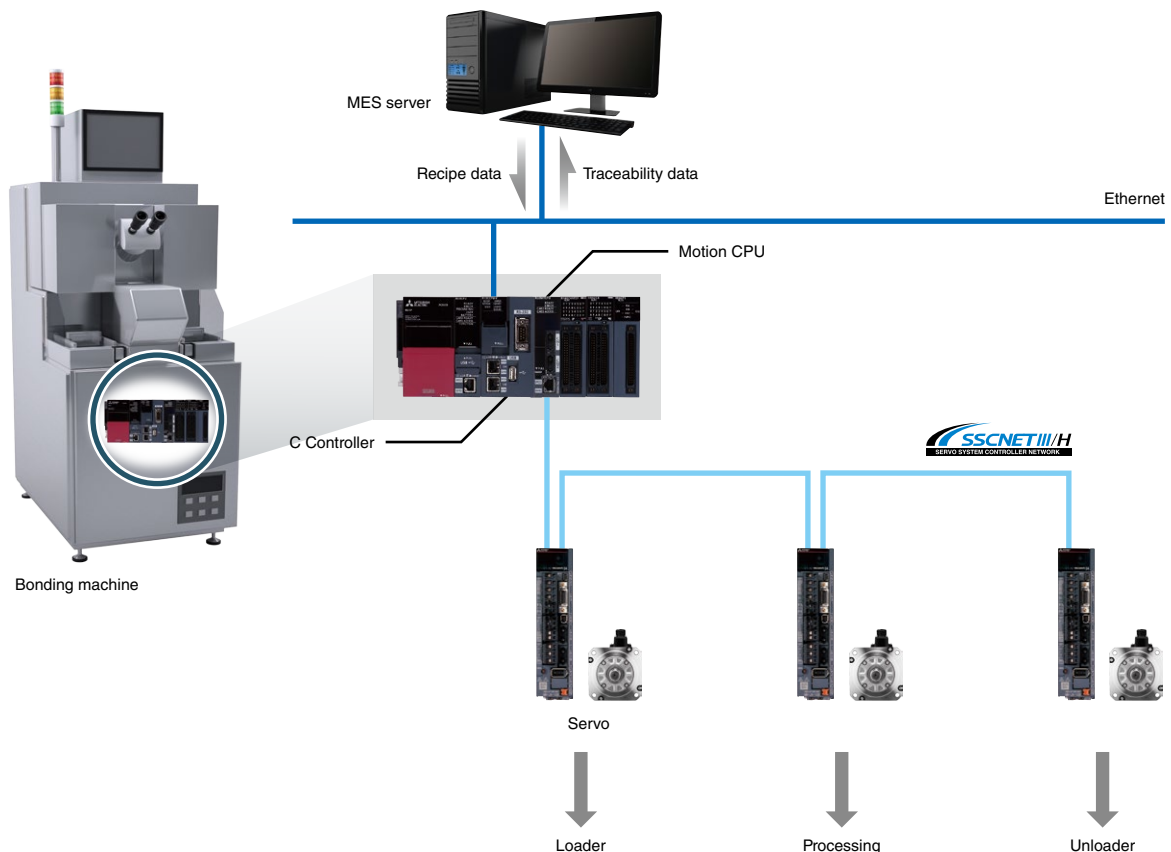


## Bonding machine

- Bonding processing utilizing control programs executed by computer
- Reduces production cycle time per chip, realizing increased productivity

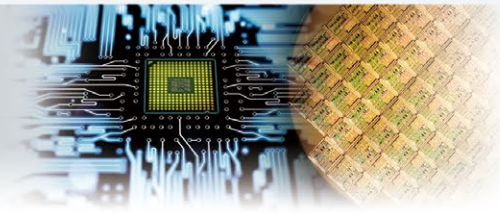
Conventional bonding machines use computers for executing control programs for bonding processing. Using the C Controller enables bonding processing while executing multiple tasks such as camera alignment, bonding settings, and calculation routines. Since the C Controller can utilize control programs without change, program modification is unnecessary. Capable of high-speed instruction to the motion CPU (0.88 ms), the C Controller can reduce production cycle time per chip, realizing increased productivity. Stable product supply is guaranteed, reducing maintenance risks.

### ► System configuration





## Semiconductor manufacturing process

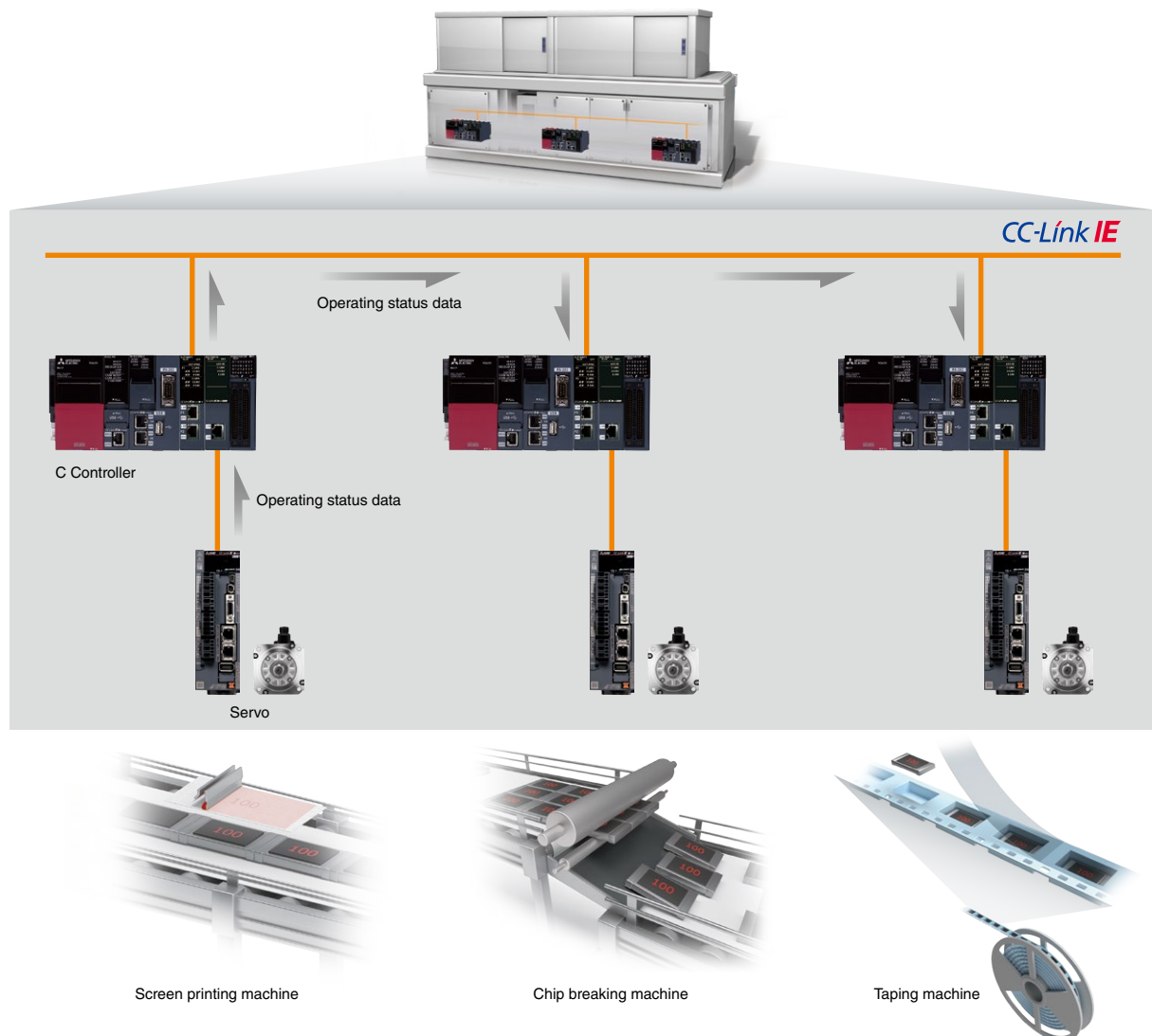


# Chip resistor manufacturing machine

- Real-time synchronization of machine's status in each process
- Motor control in parallel with real-time synchronization

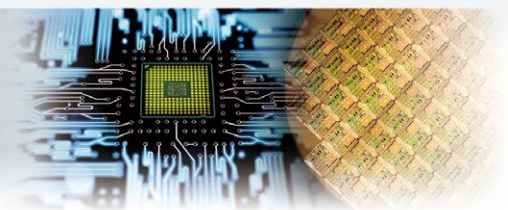
The machine's status of chip resistor manufacturing processes (screen printing, chip breaking, and taping) can be synchronized with the C controller. While synchronizing between the C Controllers, speed calculation and control of the servo motors are possible, improving operating ratio to 30%.

## ► System configuration



```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );  
if( fd2 != ERROR){  
    if( bind(fd2, (struct sockaddr *)&serv_ad  
        listen(fd2,1);
```

## Semiconductor manufacturing process

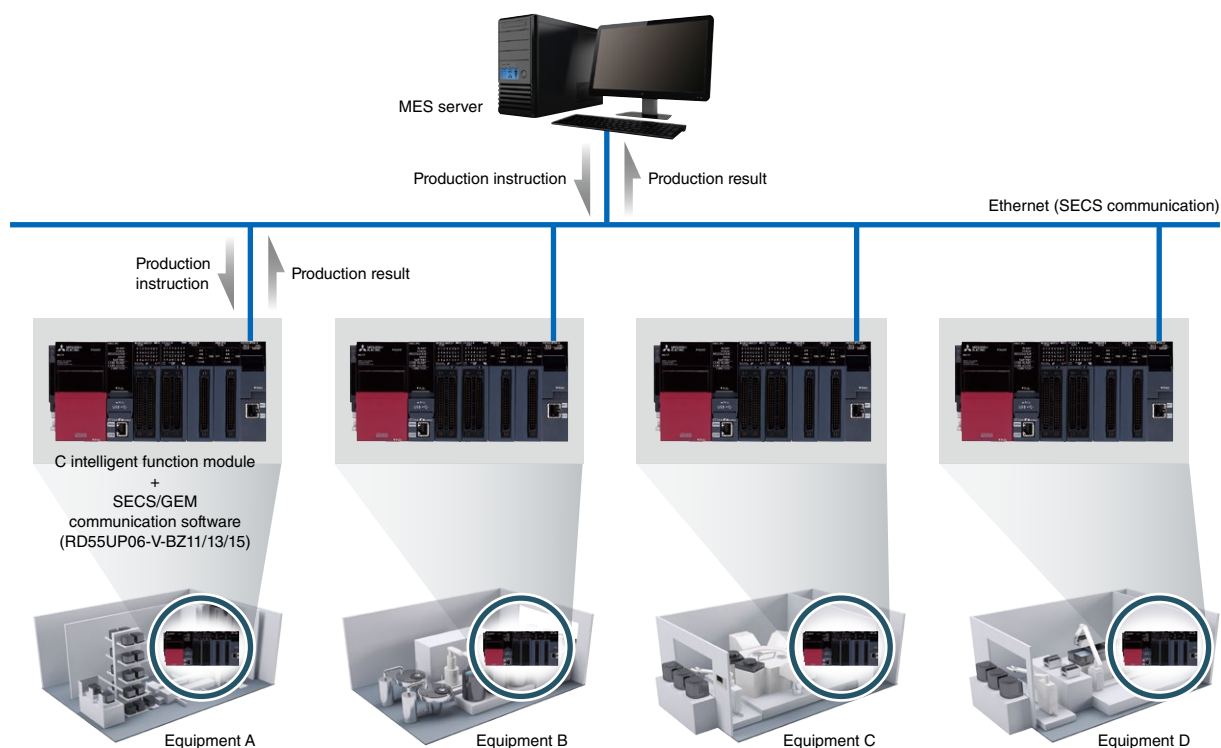


## Semiconductor manufacturing system

- Realizing SECS/GEM communication without a computer nor program
- Standardization of communication specifications realizes early start-up

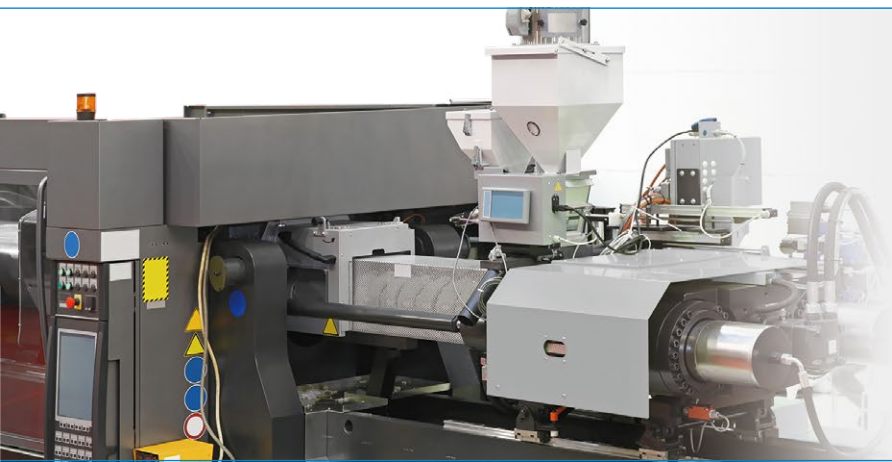
Installing the C intelligent function module pre-installed with “SECS/GEM communication software” in each equipment and distributing the setting files of the communication specifications for the “SECS/GEM communication software” to equipment manufacturers result in early production line start-up. SECS/GEM communication can be realized without a computer nor program, dramatically reducing engineering costs. Issues in the existing system such as increase in online test times due to errors in reflecting communication specifications can be solved.

### ► System configuration





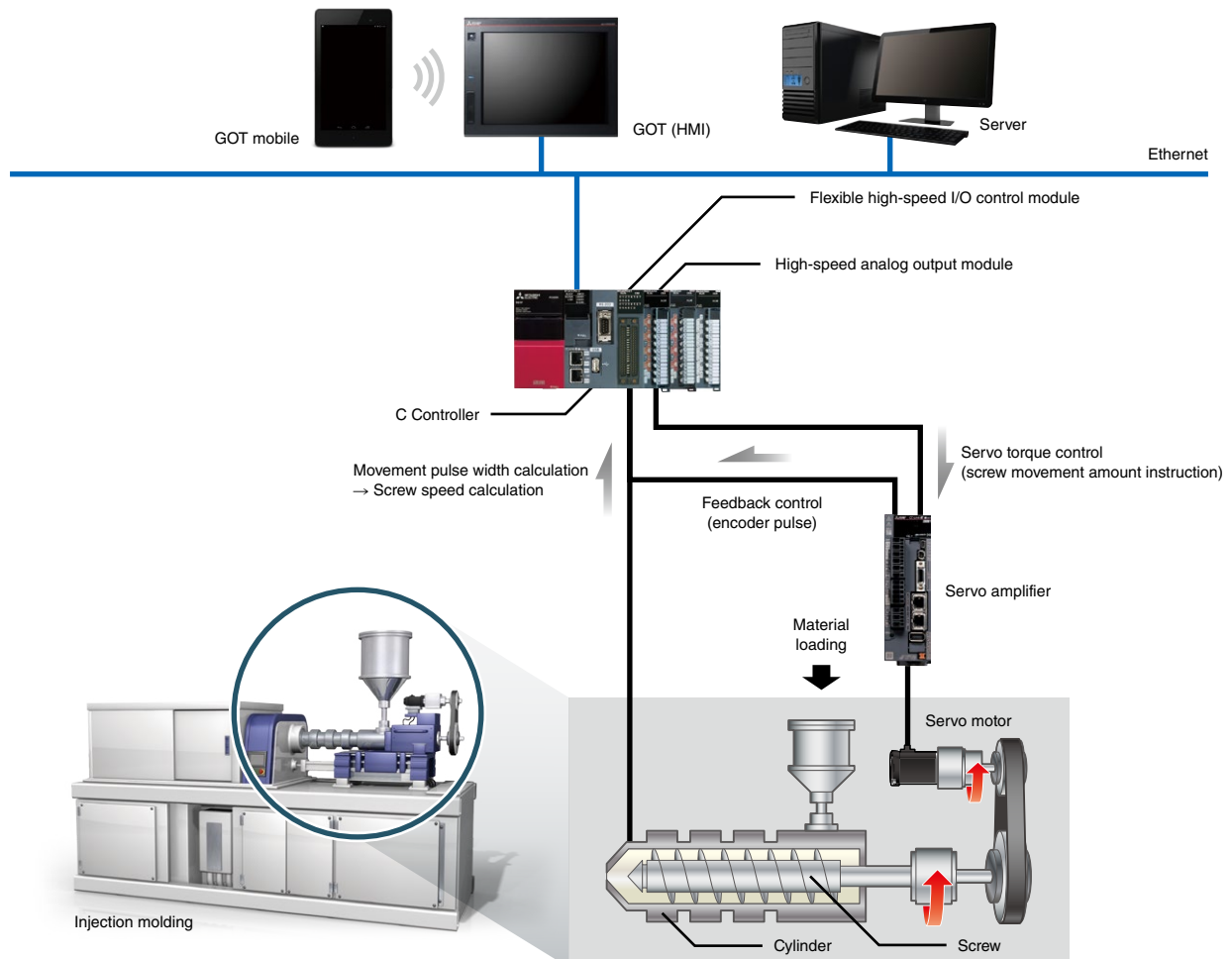
# Injection molding



- High-performance control
- System construction with highly reliable, long-term stable supply MELSEC programmable controllers

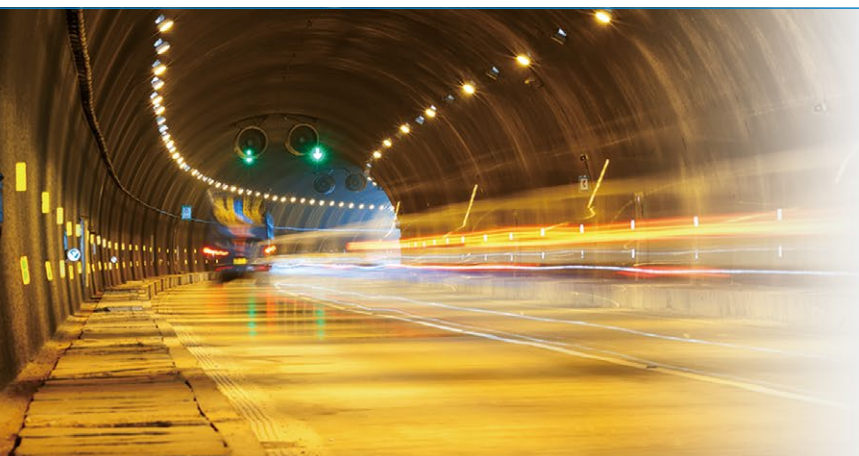
The C Controller can control the screw movement amount by comparing the screw speed calculated from the screw movement pulse width with the prescribed injection patterns. First, the flexible high-speed I/O control module processes microsecond fast pulse width measurement by hardware logic-driven control. Then the C Controller performs high-speed calculation of the screw movement amount by comparing the calculated screw speed and feedback encoder pulse with the prescribed injection patterns. The C Controller realizes higher performance control.

## ► System configuration



```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );  
if( fd2 != ERROR){  
    if( bind(fd2, (struct sockaddr *)&serv_ad  
        listen(fd2,1);
```

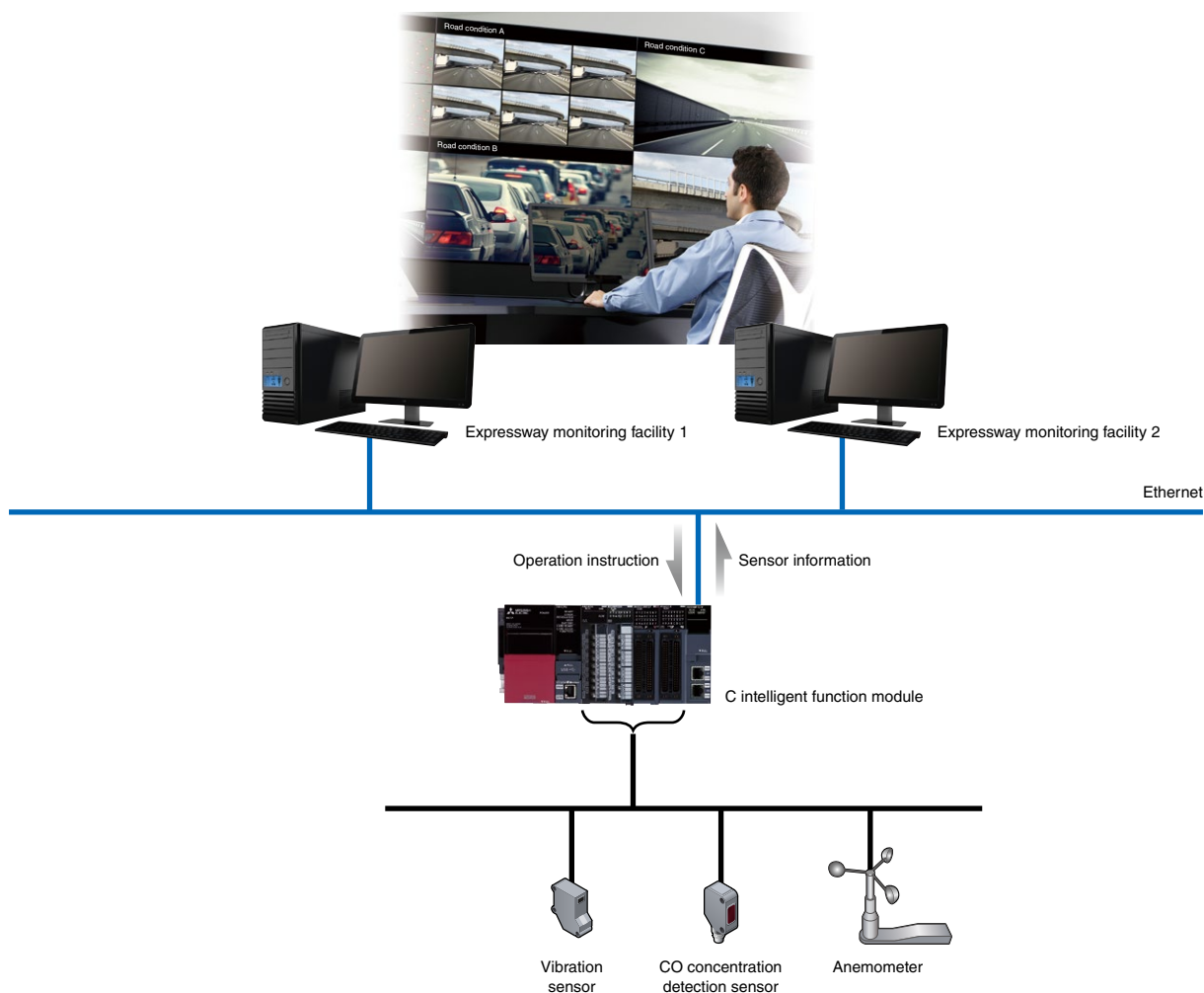
## Expressway monitoring and analysis



- Robust operation in hazardous environments (vibration, exhaust gases, and high temperatures)
- Lower maintenance costs with no micro computer required

Monitoring and analysis of expressway vibration and vehicle exhaust gases require robust equipment that can collect data from vibration sensors and CO concentration detection sensors. The C intelligent function module can stably and continuously operate in such harsh environments. Furthermore, as compared to micro computer-based system, reduction in power consumption, installation space, and maintenance costs is realized.

### ► System configuration





# Conveyor

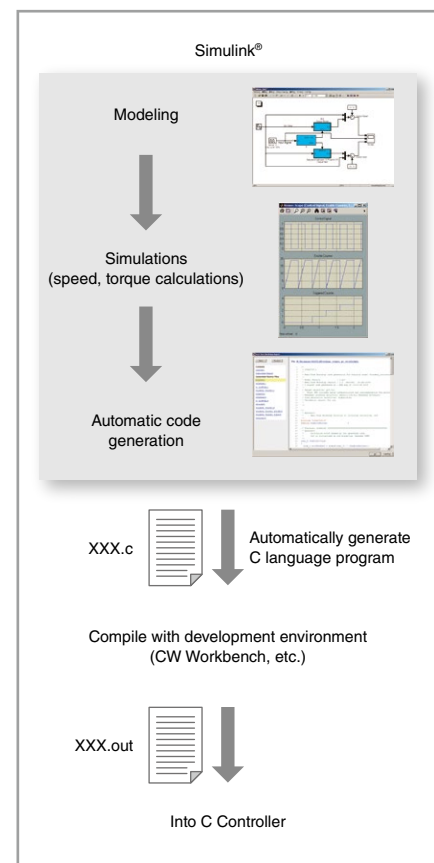
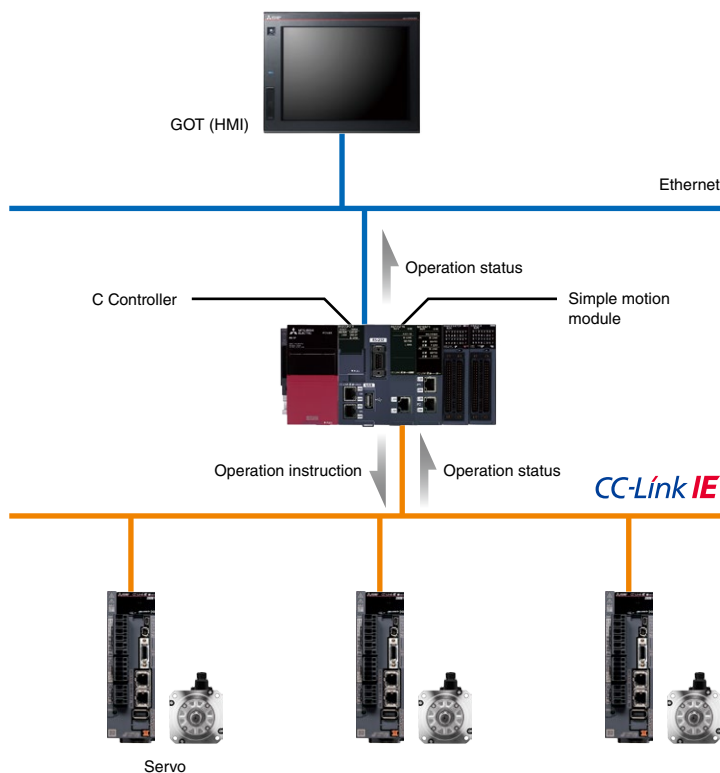


■ Conveyor management and conveyor control effectively done utilizing multiple modular feature

■ Robust and installable within a small panel near the conveyor

Conveyor destination management requires calculation of optimal conveyor routes to the destination as instructed through communications with the IT system, acquisition of conveyor control status in accordance with calculated results, and conveyor control instructions. To realize this, high-speed communications with conveyor controlling products in addition to data processing in highly versatile C and C++ programming languages are necessary. The system can be configured with the programmable controller CPU, simple motion module, and C Controller. In the conveyor control system with a GOT (HMI) installed, conveyor operation is enabled even when communications with the IT system are not enabled. These robust modules can be installed within a control panel together with a GOT (HMI), resulting in minimum use of space. Furthermore, speed and torque required for conveyor control can be calculated in model based design environment using MATLAB®/Simulink®, realizing high-speed conveyor control system.

## ► System configuration



```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_ad,
        listen(fd2,1));
```

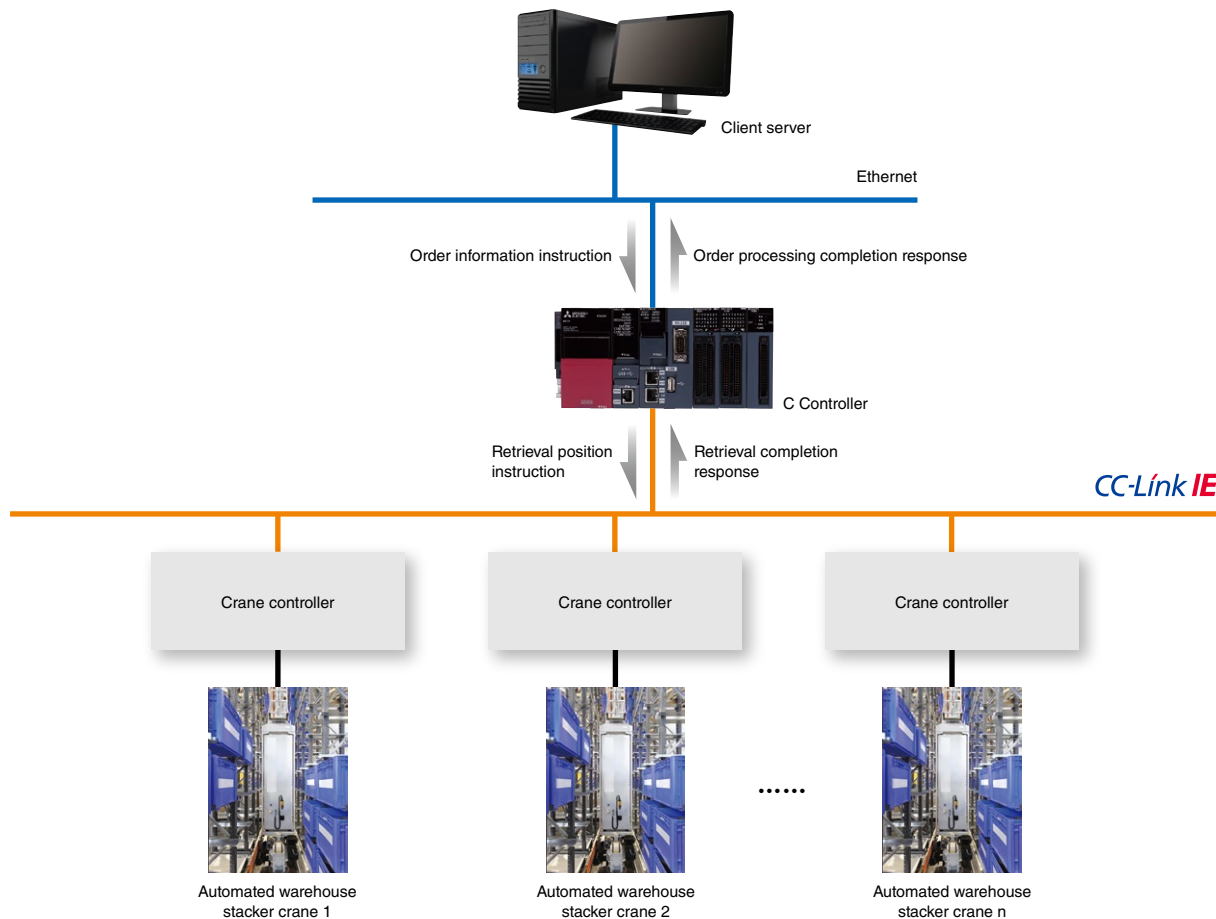
## Automated warehouse



- Long-term stable supply and continuous operation significantly reduce maintenance costs
- Connection with multiple automated warehouse controllers

In the conventional system, production information, inventory information, and entering and dispatching from warehouse are managed using a process computer, and the information is conveyed to the automated warehouse controllers to control the stacker cranes and storage retrieval vehicles. Continuous operation of the process computer can lead to faults, requiring significant time and costs for system restoration. Replacing the process computer with the robust C Controller enables stable and continuous operation, significantly reducing maintenance costs.

### ► System configuration



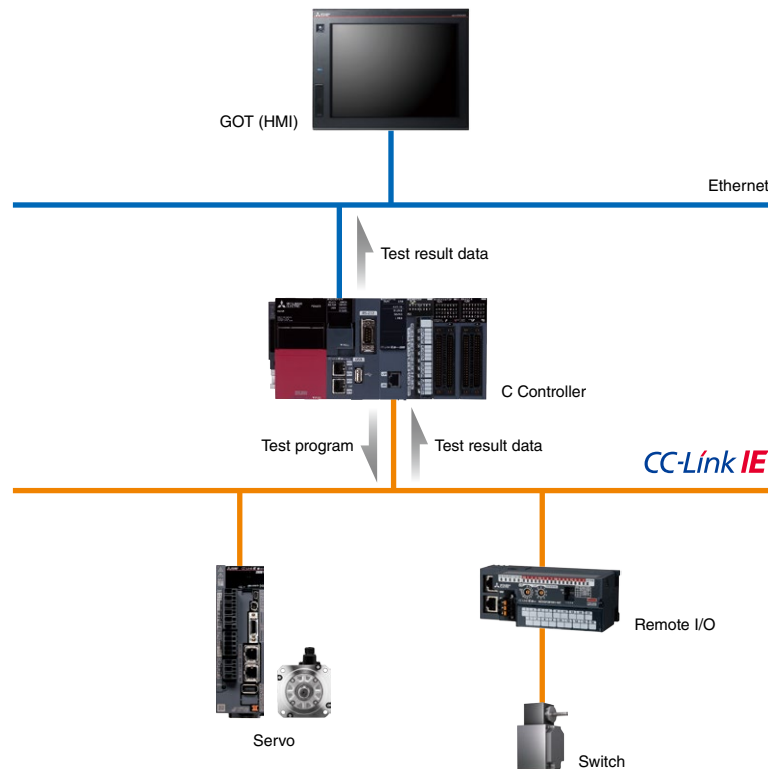
# Inspection machine



- Increased durability and reduced downtime
- Eliminates periodic computer setup costs associated with computer replacement

The conventional system can suffer from down-time resulting from computer faults and require periodic setup associated with computer replacement (OS version updates not resulting from faults), leading to low operating rate of test equipment as well as increased cost. Replacing a computer with the C Controller and GOT (HMI) increases durability, reducing downtime. Computer replacement is no longer necessary, reducing periodic setup cost.

## ► System configuration





```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_ad,
        listen(fd2,1));
```

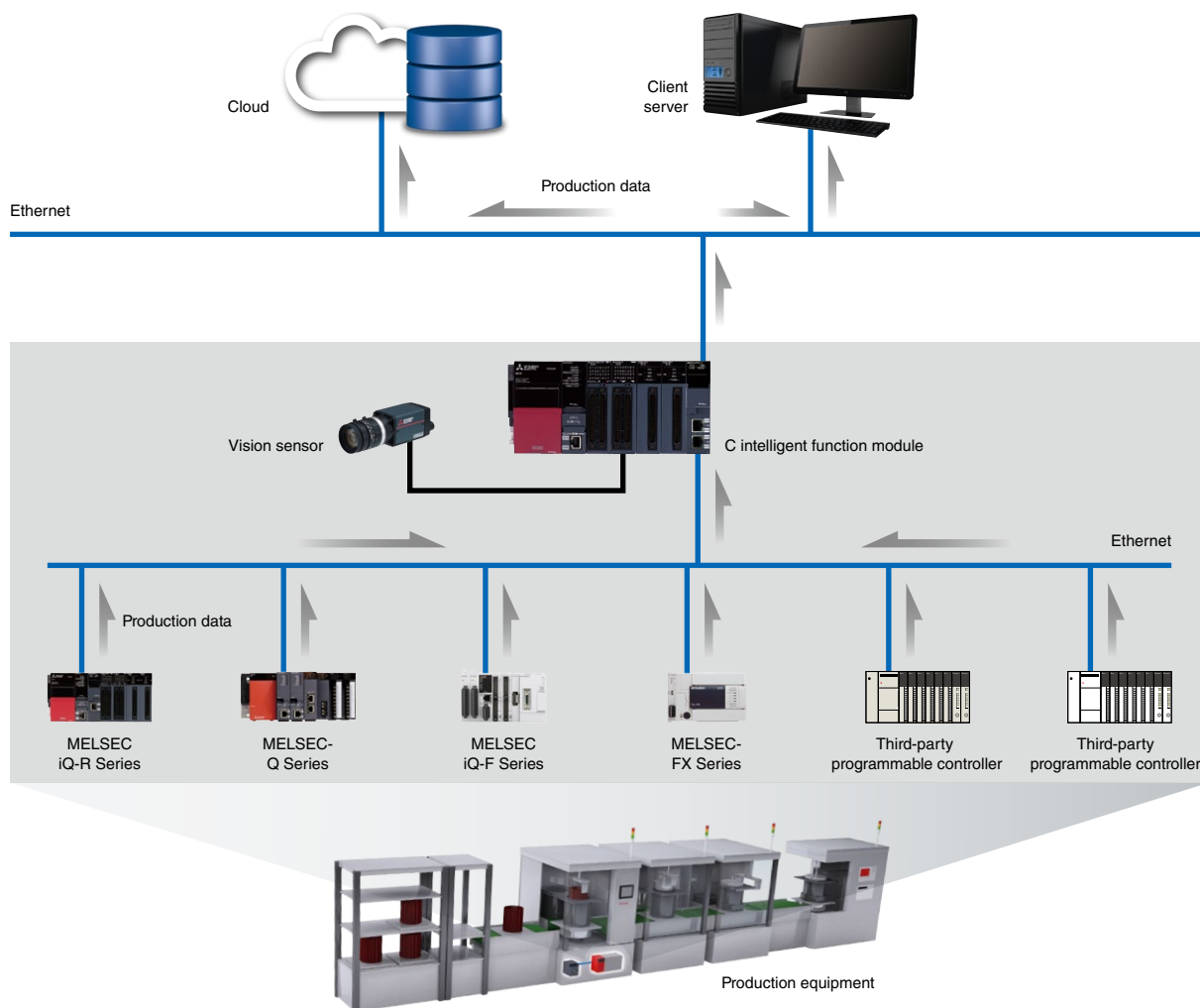
## Production data collection



- **Production data collection and direct access to IT system as an IT gateway**
- **Smooth connection with third-party programmable controllers**

The C intelligent function module allows data communications between the manufacturing-level and IT-level systems. With its interconnectivity with third-party programmable controllers, the C Controller intelligent function module can be installed in the production equipment where third-party devices are used. Having two Ethernet ports, the RD55UP12-V can be used as an IT gateway, separating the IT system network from the shop floor network.

### ► System configuration



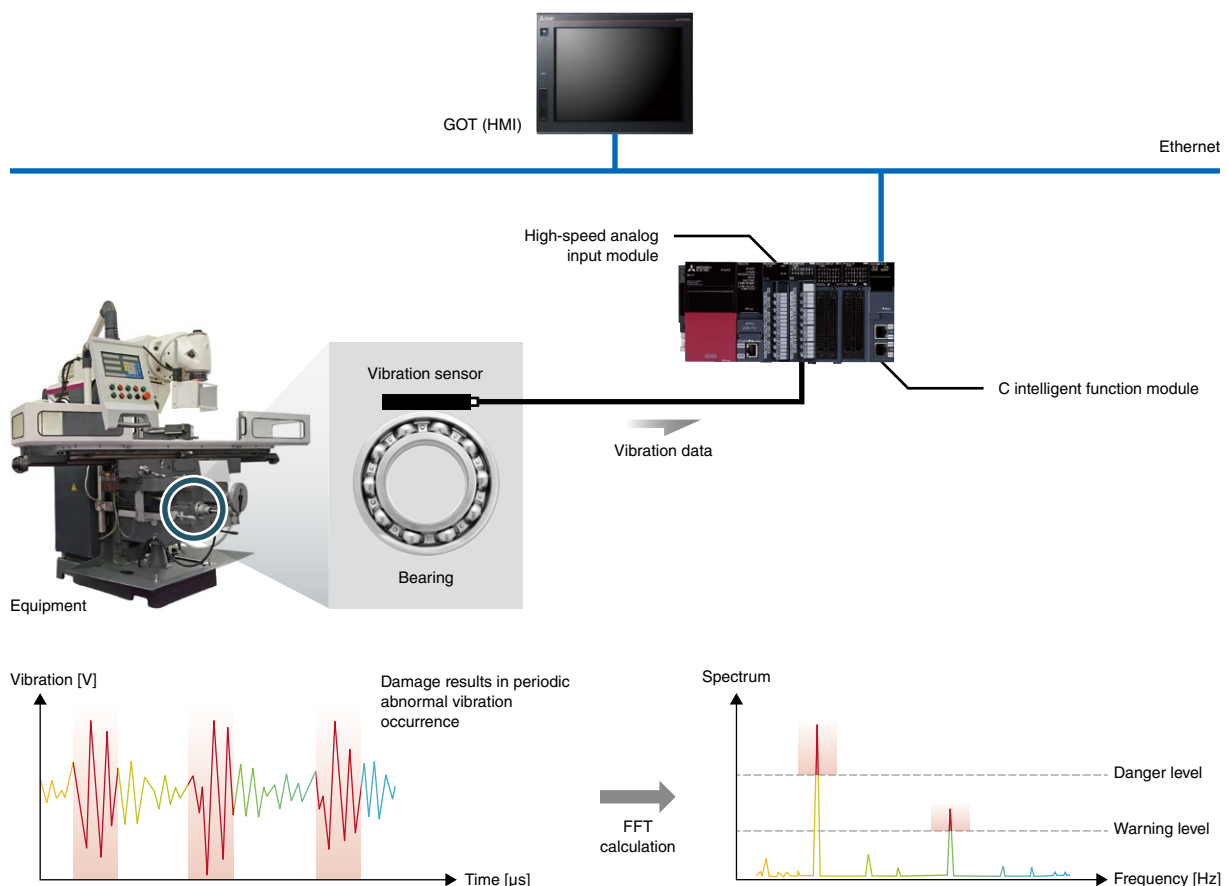
# Bearing deterioration diagnosis

- Diagnosis of deterioration status
- Easy data analysis processing such as FFT\*1 calculations

Abnormal vibrations occur when balls (rolling elements) contact with the inner or outer race due to damage of bearings. Vibration sensor (acceleration pick-up sensors) data is sampled at high speed (max. 5  $\mu$ s sampling cycle) by the MELSEC iQ-R Series high-speed analog I/O module, and the collected vibration data is processed for frequency analysis (FFT analysis) by the C intelligent function module. This is useful for monitoring equipment deterioration and detecting any fault developing, allowing condition-based maintenance including part replacement, repair, and update before the equipment stops. Implementing this system provides reduced failure rates and improved equipment reliability, reducing overall maintenance costs.

\*1. Fast Fourier Transform: A high-speed processing for converting time-based data into frequency-based data to calculate frequency components in the collected data

## ► System configuration



```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );  
if( fd2 != ERROR){  
    if( bind(fd2, (struct sockaddr *)&serv_ad,  
            listen(fd2,1);
```

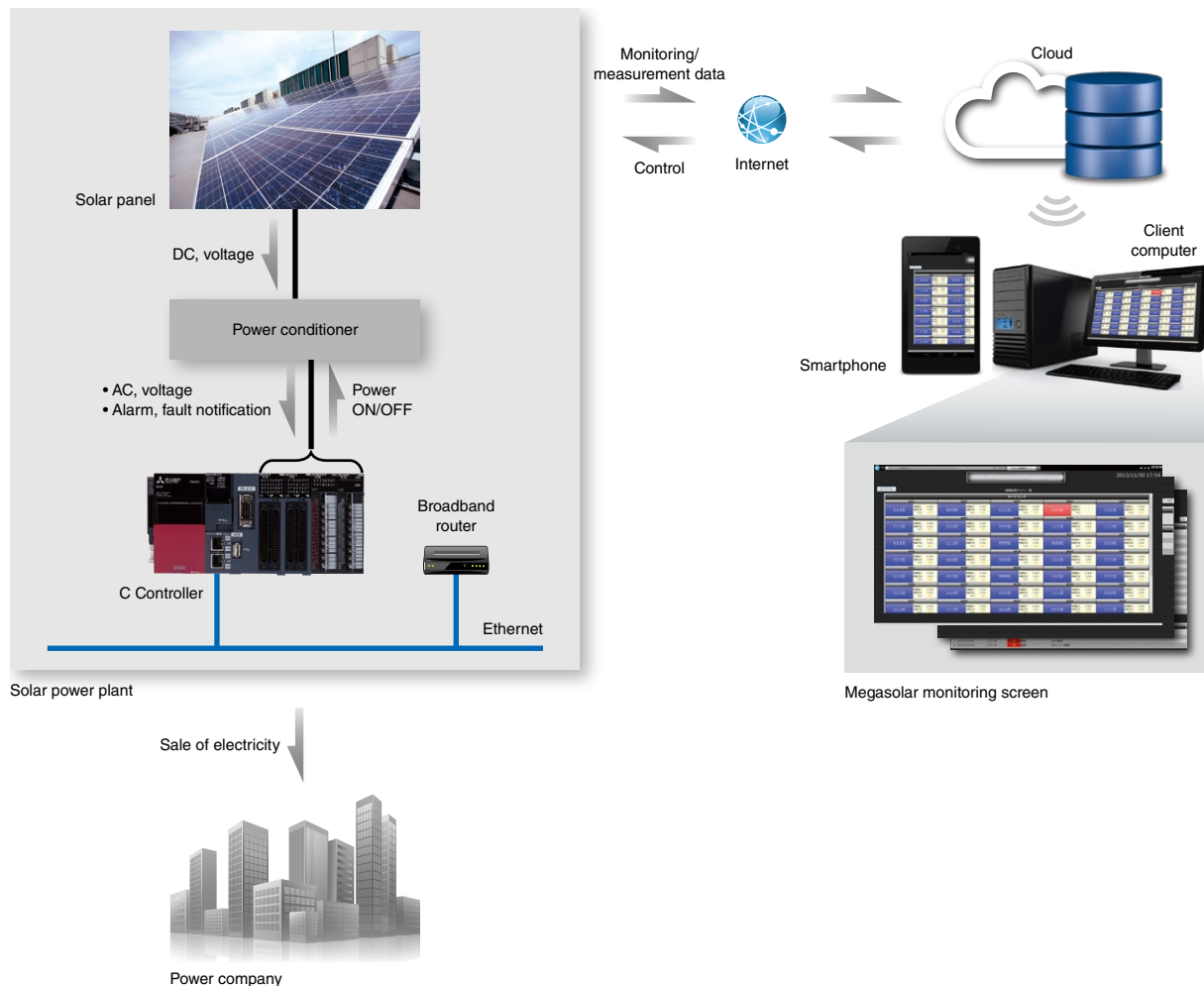
## Solar power measurement and display



- Real-time monitoring of solar power plant status and measurements
- Integrated monitoring of multiple power plants
- Remote control

Solar power plants require high-reliability infrastructure and equipment that should not stop by failure or other impacts. Implementation of the C Controller enables stable and continuous operation and also allows real-time data collection by string monitoring, camera-based monitoring, and weather monitoring. Additionally, even if a power failure occurs due to lightning and such, the system can be restored by remote operation via a cloud server. The C Controller can be installed within a control panel where measuring equipment, power conditioner, and other equipment are stored, realizing minimum use of space.

### ► System configuration





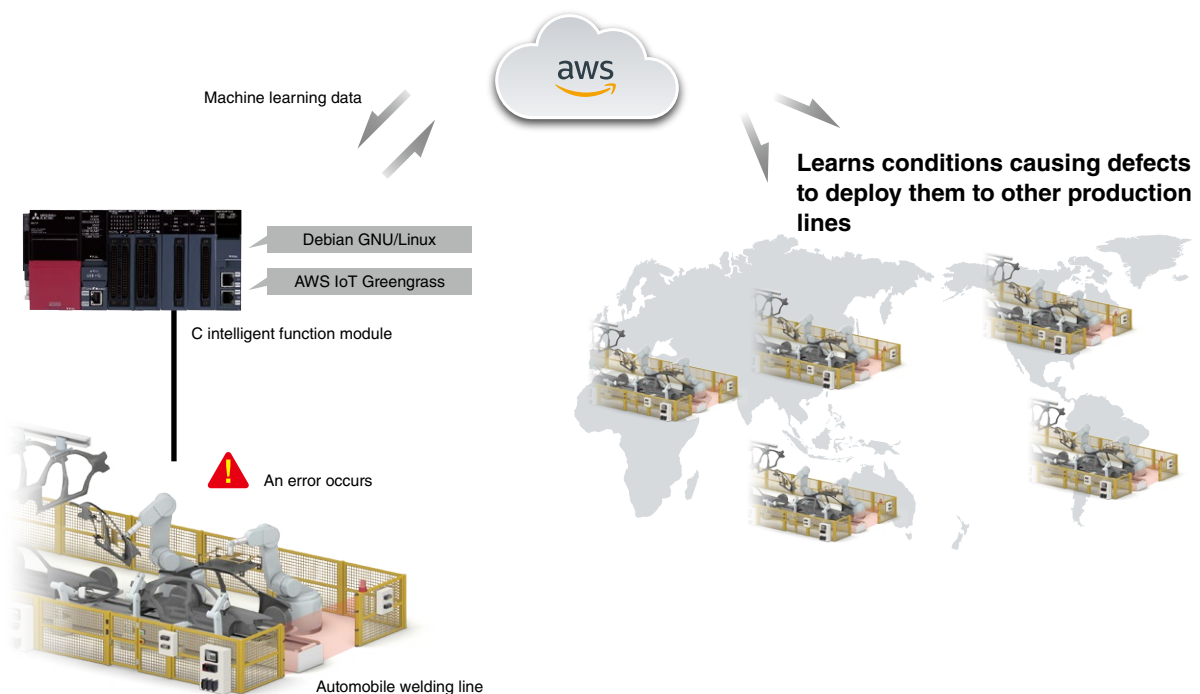
# Automobile welding line/predictive maintenance






- Easily configure cloud-connected predictive maintenance systems
- Maintenance costs reduction by deploying machine learning data to other production lines

The C intelligent function module can connect with AWS IoT Greengrass provided by Amazon Web Services (abbreviated as AWS), realizing a predictive maintenance system connected to the cloud. When an error is detected at a production line, the error pattern is learned. The machine learning data is deployed to other production lines for inference, reducing maintenance costs.

## ► System configuration



```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_ad
        listen(fd2,1);
```

Item			
Model	C Controller R12CCPU-V	C intelligent function module RD55UP06-V	C intelligent function module RD55UP12-V
Hardware			
Endian format	Little endian	Little endian	
MPU	Arm® Cortex®-A9 Dual Core	Arm® Cortex®-A9 Dual Core	
RAM	256 MB	128 MB	1 GB
Standard ROM	16 MB	12 MB	
Backup RAM	4 MB	-	
Software			
OS	VxWorks® 6.9*1 (installed by default)	VxWorks® 6.9*1 (installed by default) Debian GNU/Linux	
Programming language	C language (C/C++)	C language (C/C++)	
Programming development environment	CW Workbench (SW1DND-CWWR-E/EZ/EVZ)/ Wind River® Workbench 3.3*1	CW Workbench (SW1DND-CWWR-E/EZ/EVZ)/ Wind River® Workbench 3.3*1/TimeStorm®/Visual Studio®	
Setting/monitoring tool	CW Configurator (SW1DND-RCCPU-E)	GX Works3*2 (SW1DND-GXW3-E)	
Communication interface			
Ethernet*3	2CH (10BASE-T/ 100BASE-TX/1000BASE-T)	1CH (10BASE-T/ 100BASE-TX/1000BASE-T)	2CH (10BASE-T/ 100BASE-TX/1000BASE-T)
Memory card	SD memory card (1 slot)	SD memory card (1 slot)	
Multiple CPU function			
Motion CPU control instruction	●	-	
Interrupt issue to Motion CPU	●	-	
Data communications using CPU shared memory	●	-	
Synchronous event notification	●	-	
Data communications using multiple CPU high speed transmission area	●	-	
HMI access function			
Connection with device function	●	●	
Self-diagnostic function			
Self-diagnostic function	●	●	
Hardware self-diagnostic function	●	●	
Other functions, features			
Dedicated library function	●	●	
Separate complex processing from programmable controller	-	●	
Data sampling in each sequence scan	-	●	
Data analysis library	●	●	
SLMP communication	●	●	
Dot-matrix/7-segment LED display	●	-	
MRAM	●	-	
Access level hierarchy setting	●	●	
Service setting	●	●	
Interrupt process function	●	●	
Dual core	●	●	

\*1. VxWorks® 6.9, VxWorks® 6.8.1, VxWorks® 6.4, Wind River® Workbench 3.3, Wind River® Workbench 3.2, Wind River® Workbench 2.6.1 are products of Wind River Systems, Inc. Refer to the Wind River Systems, Inc. product manuals for the service and specifications. Refer to the following web site for contact information of Wind River Systems, Inc.  
<http://www.windriver.com>

\*2. Setting and monitoring of the module is integrated within the GX Works3 engineering software.

\*3. Please refer to the relevant manufacturer for details on the number of connectable stages when using a switching hub.

```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_ad
        listen(fd2,1);
```

R12-V : R12CCPU-V

RD55-V : RRD55UP06-V, RD55UP12-V

## Real-time

### Polling processing is unnecessary R12-V

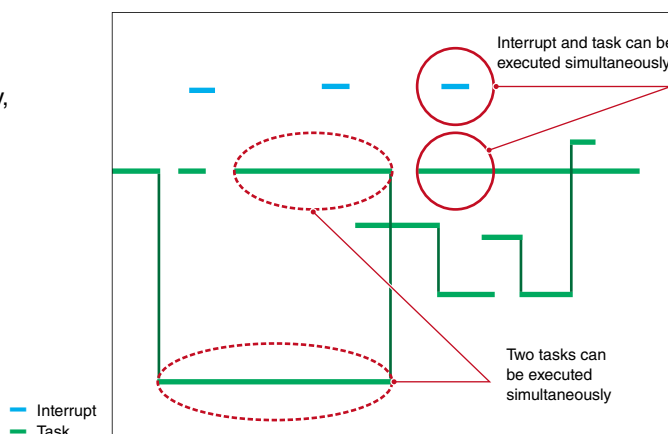
The C Controller supports event-driven programs, just like its counterpart personal/microcomputers do. The C Controller directly receives an interrupt command from the intelligent function module on the same base, minimizing polling process and accelerating the response speed, while reducing the load on CPU.

→Interrupt processing function

### Simultaneously execute two tasks allowing load distribution R12-V

Dual core CPU enables to execute two tasks simultaneously. In addition, an interrupt service routine and a task can be executed simultaneously, realizing load distribution of CPU.

→Dual core



## Cutting-edge information processing technology

### Utilize IoT information processing technology RD55-V

The C Controller pre-installed with Debian GNU/Linux provided by Lineo Solutions, Inc. realizes utilization of extensive information processing technology. Debian GNU/Linux communities are actively working to update software packages. Extensive software packages are provided for free, allowing utilization of new information technology.





```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_ad,
        listen(fd2,1);
```

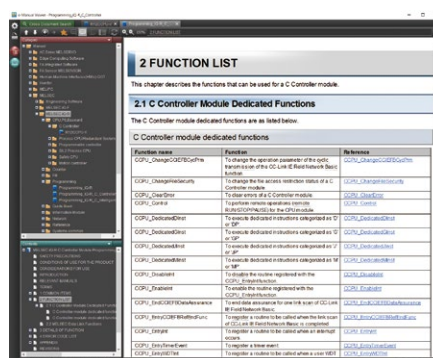
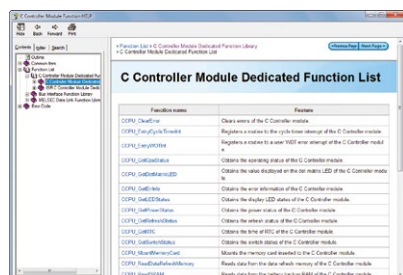
## Productivity

R12-V RD55-V

### Easily access to MELSEC platform hardware using dedicated functions

Applications handling programmable controller modules such as accessing to the C Controller, I/O modules, intelligent function modules, network modules, programmable controller CPUs, and motion CPUs can be created using dedicated functions. Four functions “CCPU/CITL function,” “QBF function,” “QBF function for ISR (interrupt Service Routine),” and “MD function” are available.

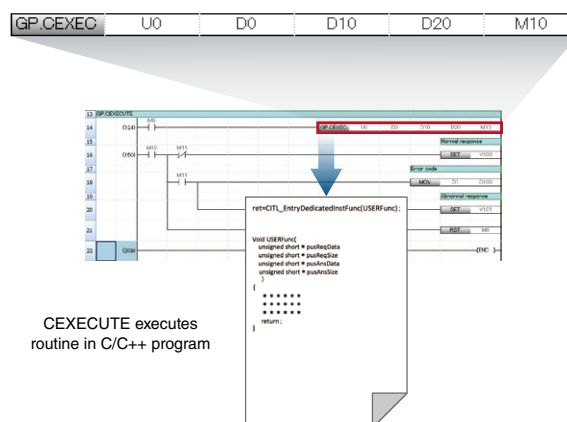
→Dedicated library function



### Complex processing realized in C/C++ RD55-V

The C intelligent function module realizes data processing and numerical analysis processing which are difficult in ladder form. For example, while the standard programmable controller CPU module performs basic control, the C intelligent function module executes complex arithmetic equations. Reduction in the programmable controller CPU load as well as high-speed arithmetic processing are realized.

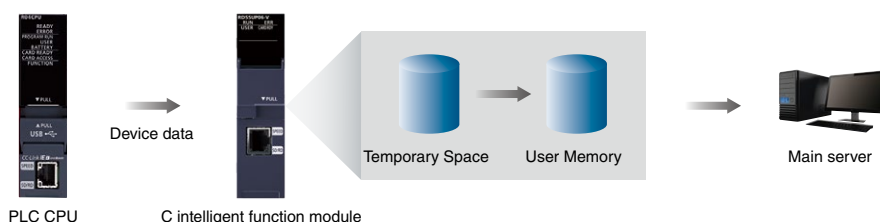
→Complex processing realized in C/C++



### Collect specified device data in real-time RD55-V

Previously specified device data can be transferred to the C intelligent function module at END processing of every program scan in the programmable controller CPU. Stored data in the temporary area can be retrieved with a dedicated function of the C intelligent function module, then transferred to the user secured memory. The data can be saved in a SD memory card or transferred to the upper level server at any time.

→Data sampling in each sequence scan



```

/* TCP=0, UDP=1 */
dr, sizeof(serv_addr)) {
    print("Error = %d\n", r);
}

newsockfd = accept(fd2, (struct sockaddr *)&cli_addr, &clilen);
if(newsockfd < 0){
    (cli_addr);
}

len = fioRead(newsockfd, c
if(len > 0){

```

R12-V RD55-V

## Analytical processing by data analysis/statistical analysis functions

Functions which realize analysis within the controller are available; data analysis functions such as FFT calculation\*1 used for vibration analysis and statistical analysis functions such as MT system used for preventive maintenance of the facility. In addition, some functions are available with the C intelligent function module as FBs which can be used with the programmable controller.

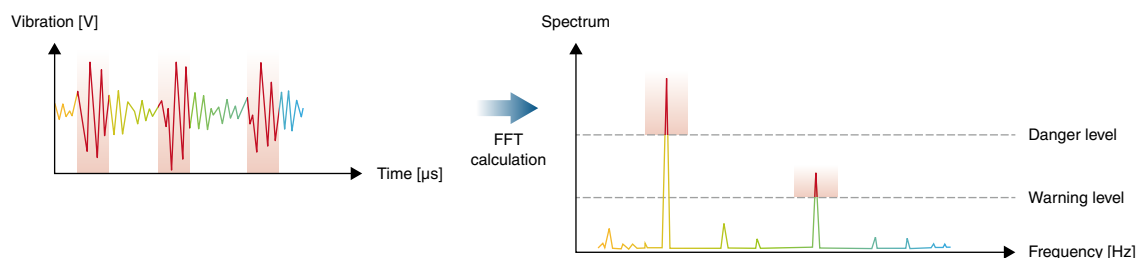
→Data analysis library

### Function list\*2

Data analysis function	Function	FB
Digital filter operation	●	●
Envelope calculation	●	●
FFT analysis	●	●
Calculation of specified wave cross points	●	-
Calculation of specified wave peak values (max., min.)	●	-
Calculation of specified wave RMS (root mean square)	●	-
Upper/lower limit check	●	-
Upper/lower wave limit check	●	-

Statistical analysis function	Function	FB
Least-squares method calculation	●	●
Moving average value calculation	●	-
Standard deviation value calculation	●	-
Variance value calculation	●	-
MT system Unit space determination	●	●
MT system Mahalanobis distance calculation	●	●
Multiple regression analysis	●	●

### Processing by FFT calculation



\*1. Fast Fourier Transform: A high-speed processing for converting time-based data into frequency-based data to calculate frequency components in the collected data

\*2. For details of functions, refer to the MELSEC IQ-R C Controller/C intelligent function module programming manual (data analysis) (SH-081756).

## Robust security

### Prevent unauthorized access by access level hierarchy and lock out setting

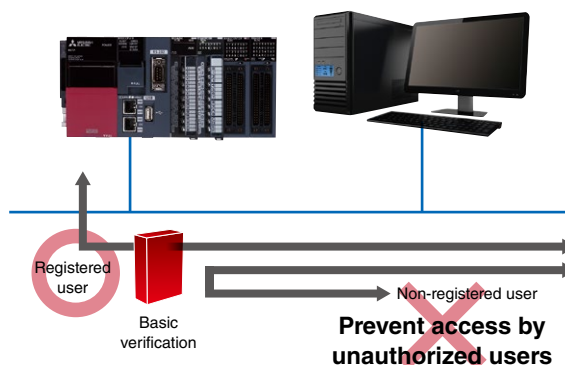
R12-V RD55-V

Login user setting and account lockout\*3 setting when accessing via the CW Configurator\*4, GX Works3\*5, FTP, and Telnet can be made. Unauthorized access can be prevented by having different access levels (administrator, field operator, etc.) corresponding to accessible functions (read, write, execute).

→Access level hierarchy setting

In addition, the service status (enabling/disabling services) can be set. Security is enhanced with this function.

→Service stop function



\*3. Setting to limit the number of account verification errors occurs in succession. If the account verification successively fails more than the set number of times, the verification will be denied (locked out) for a set time.

\*4. R12CCPU-V is supported.

\*5. RD55UP06-V and RD55UP12-V are supported.

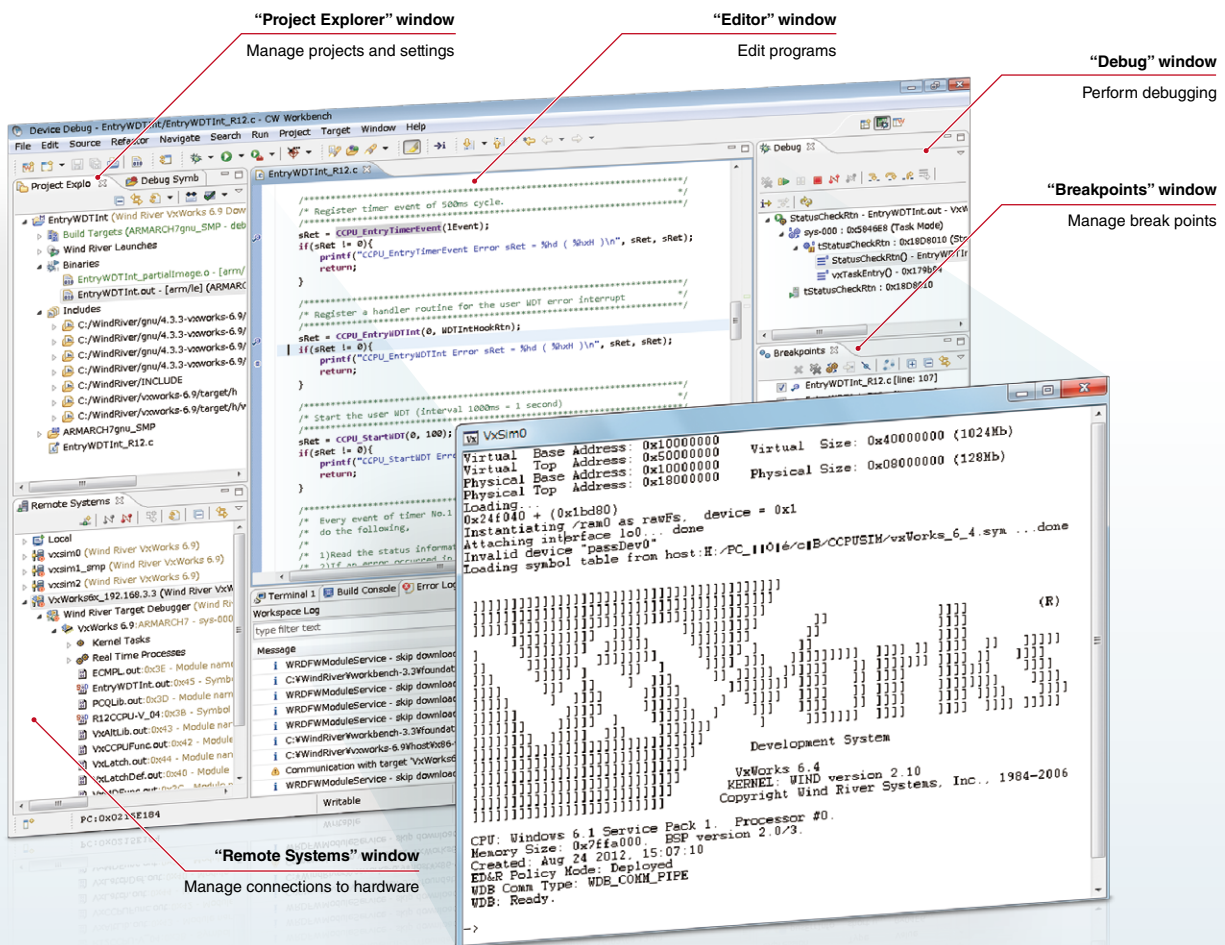
## CW Workbench R12-V RD55-V

• SW1DND-CWWR-E

## CW-Sim/CW-Sim Standalone R12-V RD55-V

• SW1DND-CWSIMR-EZ • SW1DNC-CWSIMSAR-E

CW Workbench has all of the basic functionality such as a code editor, compiler, debugger, and simulator. When CW-Sim license is purchased, VxWorks® simulation is possible without the C Controller.



## Reduced installation costs and easier application development

Development environment for embedded system, which is usually expensive, is now easily realized using this tool. CW Workbench has all of the basic functionality such as a code editor, compiler, debugger, and simulator supporting user application development.

## Support for multiple languages using plug-in

Based on the Eclipse platform, CW Workbench supports multiple languages and its functionality can be expanded using third-party plug-ins such as source code management.

## Simulation without the C Controller

CW-Sim/CW-Sim Standalone enables VxWorks® simulation without the C Controller, allowing to improve program quality and equipment safety before actually operating the equipment. It is useful for debugging of the system configured with multiple C Controllers and providing training.

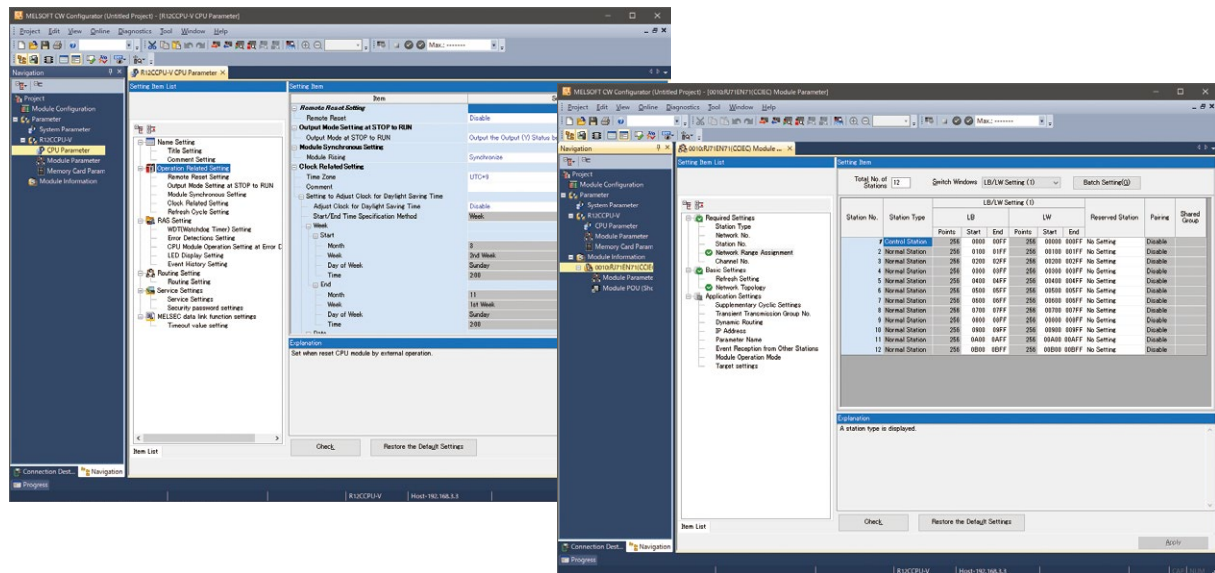


# CW Configurator R12-V

- SW1DND-RCCPU-E

## Parameter settings without programs

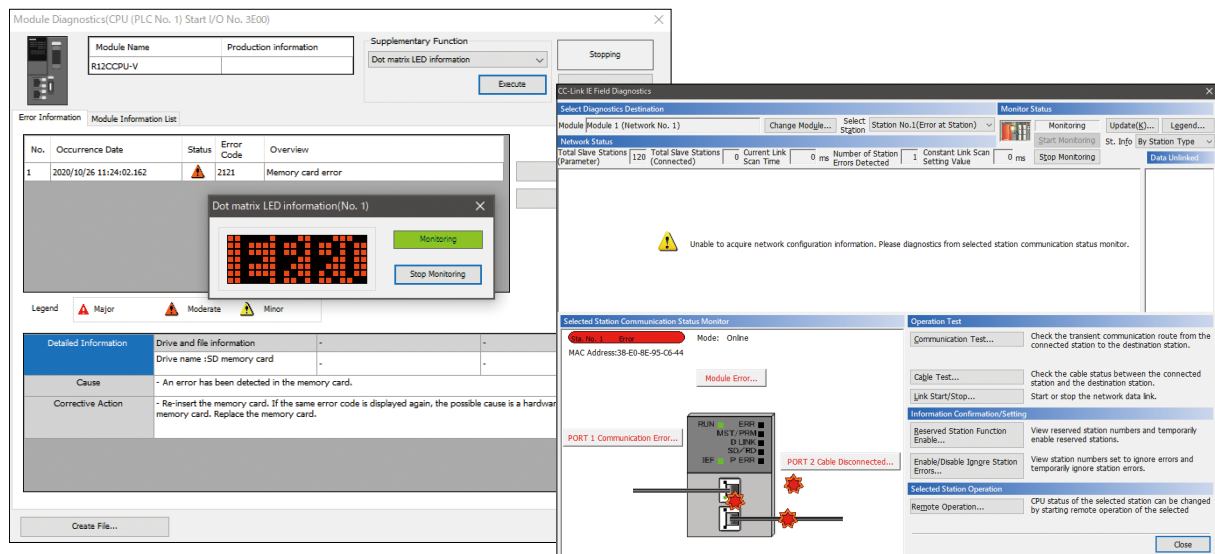
The C Controller system as well as parameters\*<sup>1</sup> of network modules such as CC-Link IE Field Network\*<sup>2</sup>, CC-Link IE Control Network and CC-Link and intelligent function modules managed by the C Controller can be setup without programs.



- \*<sup>1</sup>. SW3PVC-CCPU do not support configuration of Intelligent function module parameters.  
 \*<sup>2</sup>. SW3PVC-CCPU do not support configuration of CC-Link IE Field Network parameters.

## Diagnostics without programs

Troubleshooting is easy as errors occurred in the C Controller and historical events within the user application can be checked and also cable disconnection and network status can be detected by network diagnostics\*<sup>3</sup>.



- \*<sup>3</sup>. SW3PVC-CCPU do not support diagnostics of the CC-Link IE Field Network.

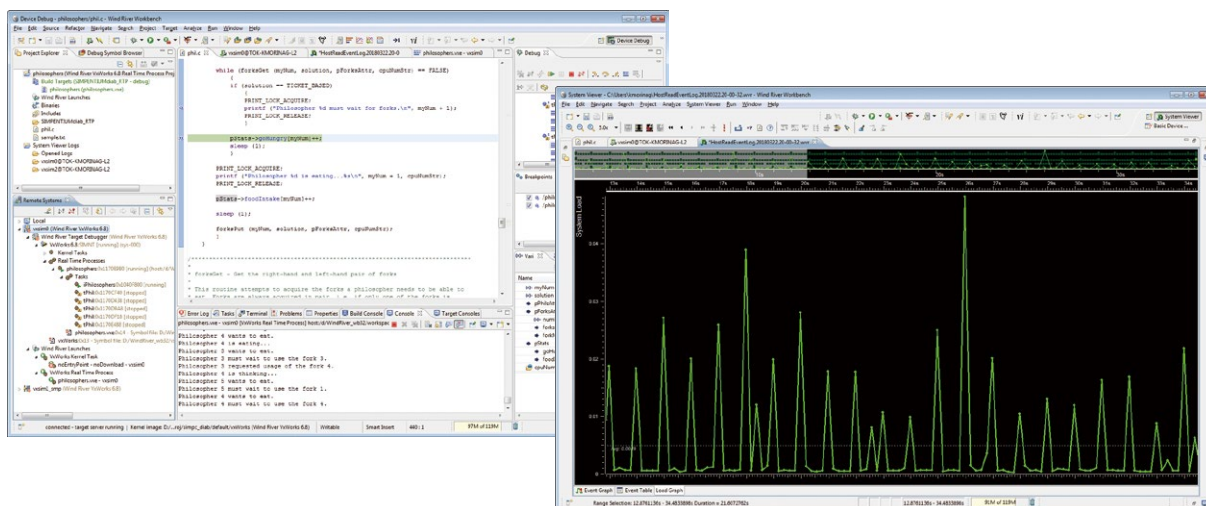
## Wind River® Workbench R12-V RD55-V



Wind River Systems, Inc.

### Incorporate advanced runtime analysis tools

In addition to basic functions for program editing, compiling, and source code debugging, Wind River® Workbench incorporates advanced run-time analysis tools. When detailed analysis is required, various tools are available for revealing the complex interactions of tasks and interrupts, realizing a far more specified way of analyzing and debugging the application.



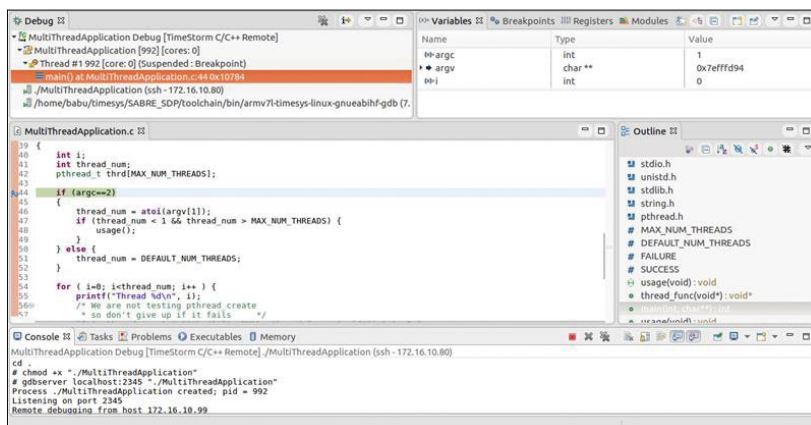
## TimeStorm® RD55-V



Lineo Solutions, Inc.

### Python® and C/C++ development environment

TimeStorm® is a GUI based integrated development environment supporting various programming languages such as Python® and C/C++. Source code editing and build can be performed as well as debug by connecting with the C intelligent function module. In addition, the development host supports both Linux® and Windows®, realizing efficient development.



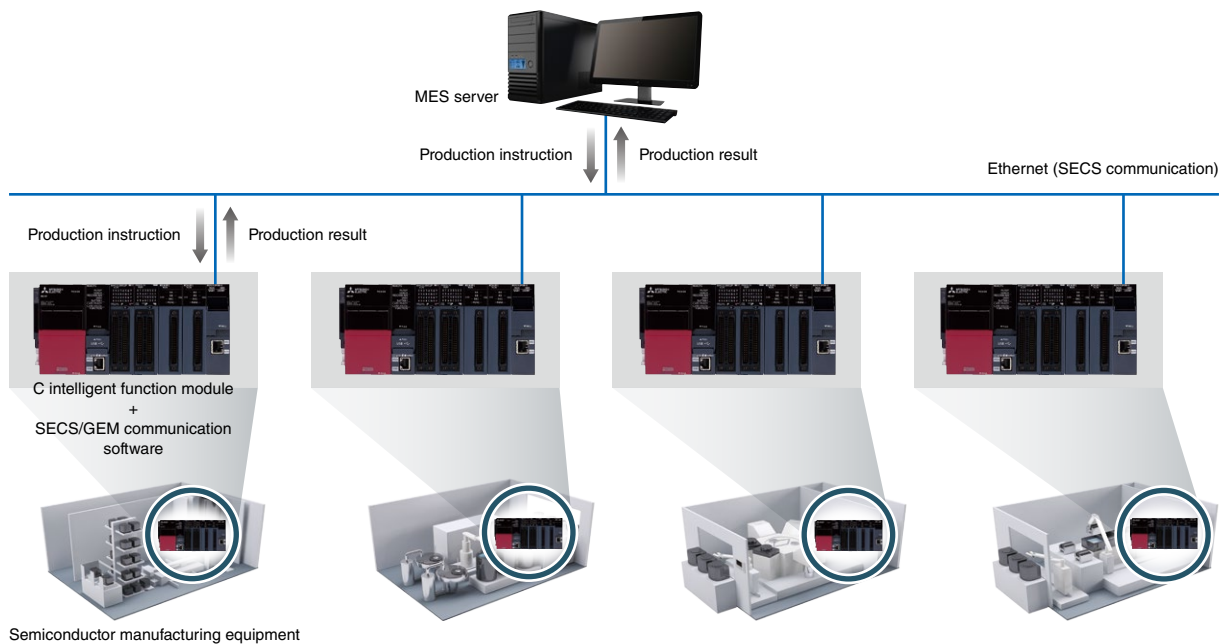
```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_
        listen(fd2,1);
```

• RD55UP06-V-BZ10/-BZ12/-BZ14

## SECS/GEM Communication Software

**Realizes SECS/GEM communication with the upper-level server without a computer and programs**

- Realizes high reliability and easier maintenance without a gateway computer, reducing maintenance costs
- SECS/GEM communication\*1 is realized without a program, reducing engineering costs
- Stable SECS/GEM communication is realized without affecting machine control performance



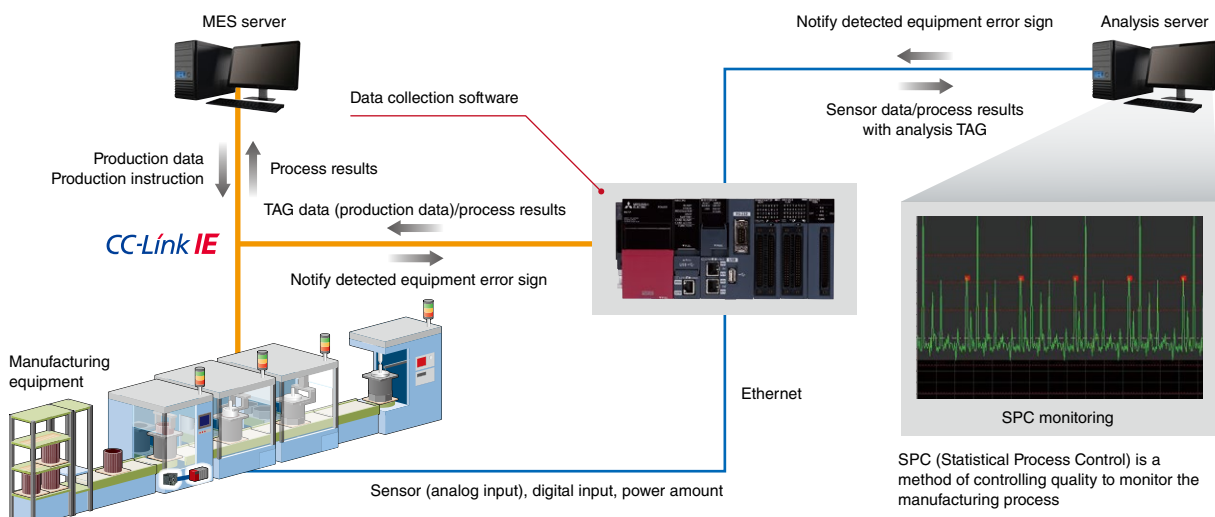
\*1. SECS/GEM communication simulator enables SECS communication simulation. For details, please refer to the relevant manual.

• R12CCPU-V-BZ18/-BZ1A

## Data Collection Software

**Shop floor data management/analysis/utilization optimizes manufacturing**

- Equipment data collection is realized just by setting, supporting visualization of the system at a low cost
- When abnormal data is detected, equipment process operation without going through a MES server is enabled, thereby improving operation rate

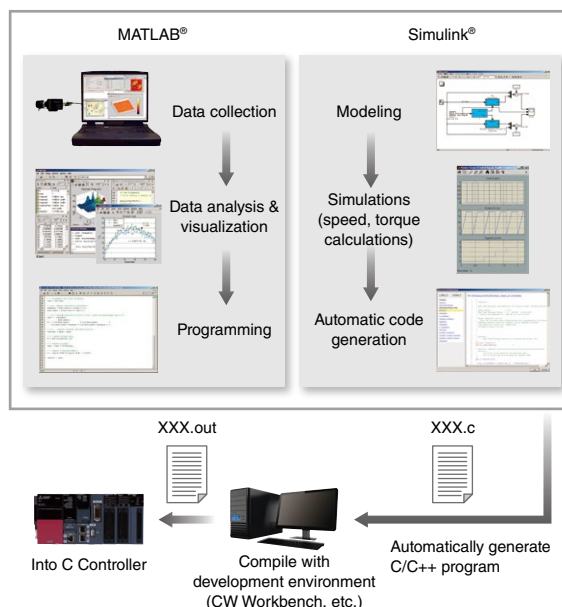


```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_ad
        listen(fd2,1);
```

## MATLAB®/Simulink® R12-V

### Automatic C/C++ program generation directly from MATLAB®/Simulink®

By using MATLAB®/Simulink®, applications can be developed using high-level language for numerical computation, such as linear algebra, statistics, and Fourier analysis, together with visualization based product development. Simulation and model-based design can be achieved to root out problems and errors at the design stage before commissioning. Overall, a far more efficient C/C++ program can be automatically generated reducing the possibility of human induced errors being introduced.



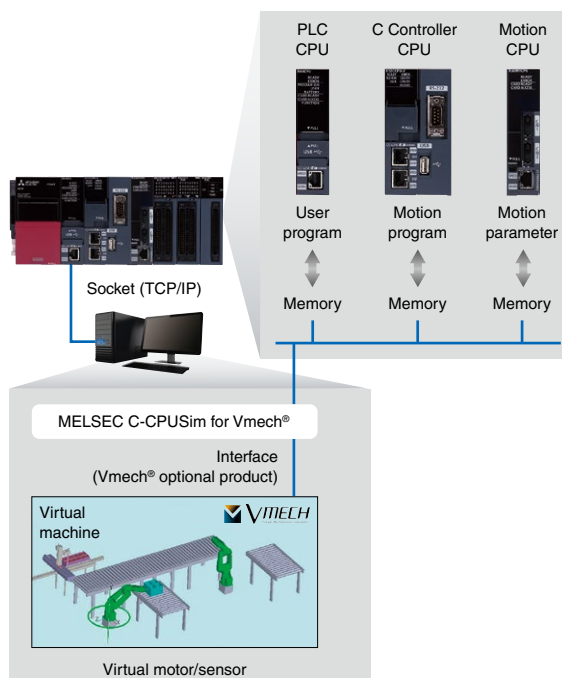
## MathWorks

<https://mathworks.com>

## Vmech® R12-V

### Development using virtual mechanical models without actual devices

By utilizing 3D-CAD data, a virtual manufacturing line with machines (digital mock-up) can be created and machine performance can be simulated. Software debugging is possible while the product is still in design, enabling front-loading of machine performance verification, thus realizing a shorter development schedule. In addition, faulty performance verification which is difficult with actual devices can be virtually done helping to improve software quality.



## Lattice Technology Co., Ltd.

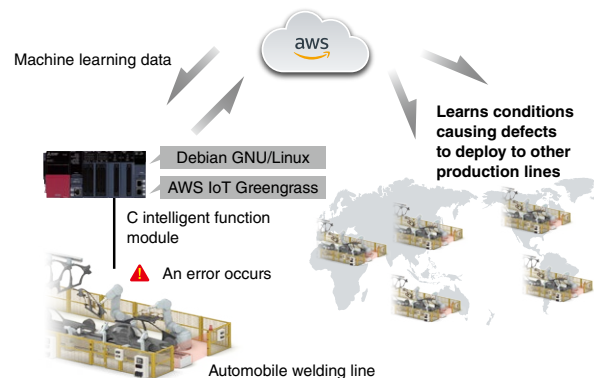
<https://www.lattice3d.com>



## AWS IoT Greengrass RD55-V

### Predictive maintenance with advanced machine learning service

AWS IoT Greengrass can create optimized models based on a large amount of machine learning data on the cloud, realizing systems that can detect errors on the edge. Predictive maintenance systems utilizing advanced machine learning service can be easily configured with the C intelligent function module. Therefore, maintenance costs can be reduced with this system.



**Amazon Web Services, Inc.**  
<https://aws.amazon.com/manufacturing/>

# Extensive global support coverage providing expert help whenever needed

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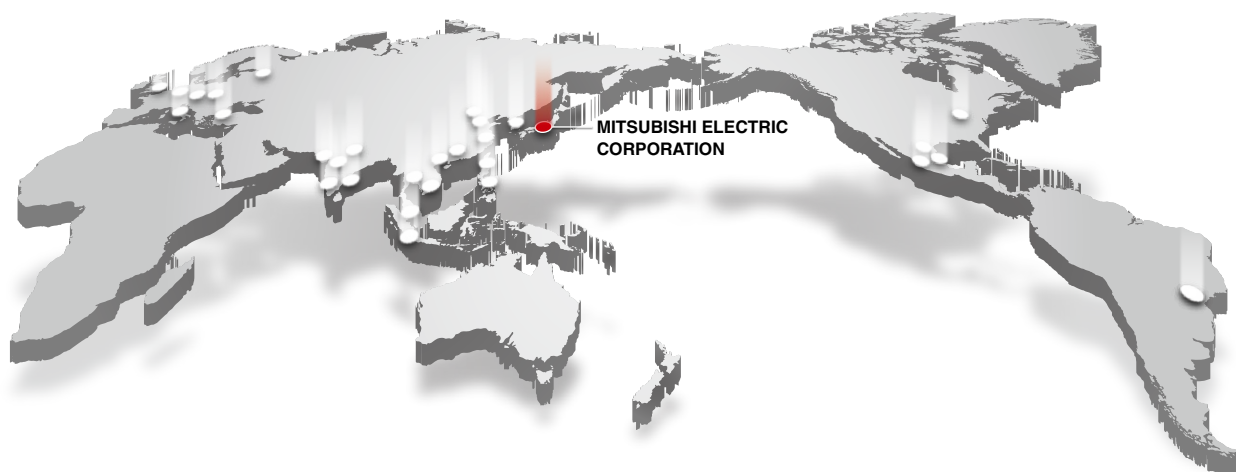
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##### Brazil FA Center

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# Factory Automation Global website

Mitsubishi Electric Factory Automation provides a mix of services to support its customers worldwide. A consolidated global website is the main portal, offering a selection of support tools and a window to its local Mitsubishi Electric sales and support network.

## ■ From here you can find:

- Overview of available factory automation products
- Library of downloadable literature
- Support tools such as online e-learning courses, terminology dictionary, etc.
- Global sales and service network portal
- Latest news related to Mitsubishi Electric factory automation

**Mitsubishi Electric Factory Automation  
Global website:**  
**[www.MitsubishiElectric.com/fa](http://www.MitsubishiElectric.com/fa)**



## Online e-learning

An extensive library of e-learning courses covering the factory automation product range has been prepared. Courses from beginner to advanced levels of difficulty are available in various languages.



## ■ Beginner level

Designed for newcomers to Mitsubishi Electric Factory Automation products gaining a background of the fundamentals and an overview of various products related to the course.

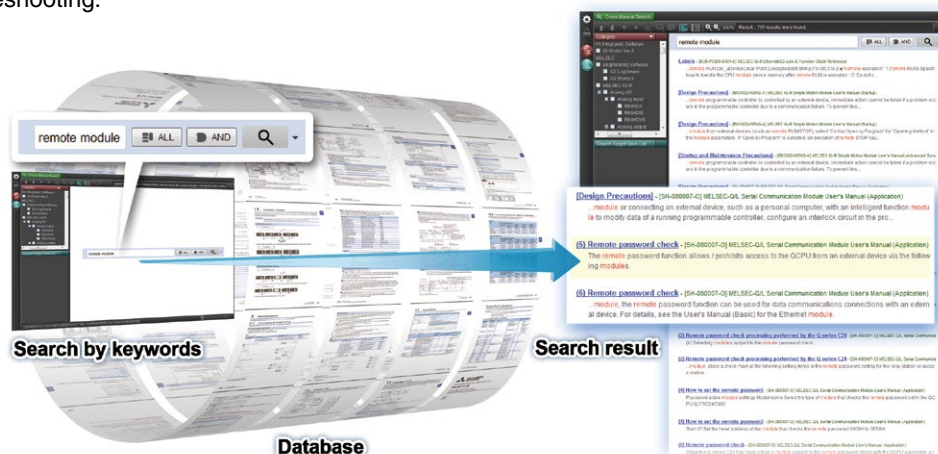
## ■ Basic to Advanced levels

These courses are designed to provide education at all levels. Various different features are explained with application examples providing an easy and informative resource for in-house company training.

# Innovative next-generation, e-Manual

## e-Manual Viewer

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



### ■ Key features included

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

Windows®



iOS

Download on the App Store



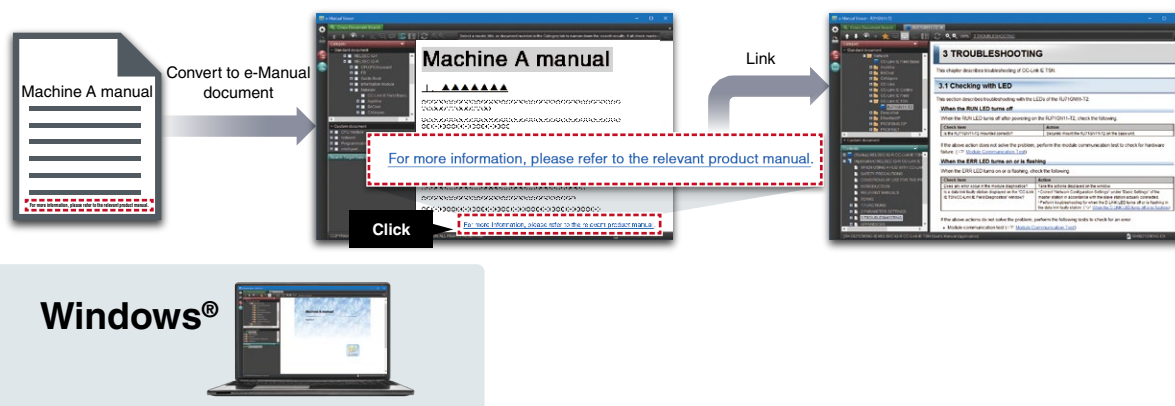
Android™

GET IT ON Google Play



## e-Manual Create

e-Manual Create is software for converting word files and chm files to e-Manual documents. e-Manual Create allows users to directly refer to Mitsubishi Electric e-Manuals from user's customized device maintenance manuals and such, supporting quick troubleshooting and reduction in document creation process.



Windows®



\* To obtain the Windows® version of e-Manual Viewer and e-Manual Create, please contact your local Mitsubishi Electric sales office or representative.



```
fd2 = socket( AF_INET, SOCK_STREAM, 0 );
if( fd2 != ERROR){
    if( bind(fd2, (struct sockaddr *)&serv_ad
        listen(fd2,1);
```

## General specifications

Item	Specifications*1					
Operating ambient temperature	0...55°C (when a base unit other than an extended temperature range base unit is used)					
	0...60°C (when an extended temperature range base unit is used)*2					
Storage ambient temperature	-25...75°C					
Operating ambient humidity	5...95%RH, non-condensing					
Storage ambient humidity						
Vibration resistance	Compliant with JIS B 3502 and IEC 61131-2	Under intermittent vibration	Frequency	Constant acceleration	Half amplitude	Sweep count
			5...8.4 Hz	-	3.5 mm	10 times each in X, Y, Z directions
		Under continuous vibration	8.4...150 Hz	9.8 m/s <sup>2</sup>	-	-
			5...8.4 Hz	-	1.75 mm	-
			8.4...150 Hz	4.9 m/s <sup>2</sup>	-	-
Shock resistance	Compliant with JIS B 3502 and IEC 61131-2 (147 m/s <sup>2</sup> , 3 times each in directions X, Y, Z)					
Operating atmosphere	No corrosive gases*3, no flammable gases, no excessive conductive dust					
Operating altitude*4	0...2000 m*5					
Installation location	Inside a control panel					
Overvoltage category*6	≤ II					
Pollution degree*7	≤ 2					
Equipment class	Class 1					

\*1. When inserting a commercially available SD memory card into the C Controller, follow the lower specifications of the C Controller or the SD memory card.

\*2. Enables standard MELSEC iQ-R Series modules to support extended operating ambient temperature to 0 to 60°C, ensuring the same performance as the standard operating ambient temperature (0 to 55°C). When requiring to use in an ambient temperature environment higher than 60°C, please consult your local Mitsubishi Electric representative.

\*3. The special coated product, which meets the regulation (JIS C 60721-3-3/IEC 60721-3-3 3C2) related to corrosive gas, is available for the use in a corrosive gas environment.

\*4. Do not use or store the programmable controller under pressure higher than the atmospheric pressure of altitude 0 m. Doing so may cause malfunction. When using the programmable controller under pressure, please consult your local Mitsubishi Electric representative.

\*5. When used at an altitude higher than 2000 m, the upper limits of the permissible voltage and the operating ambient temperature become lower. Please consult your local Mitsubishi Electric representative.

\*6. This indicates the section of the power supply to which the equipment is assumed to be connected between the public electrical power distribution network and the machinery within premises. Category 2 applies to equipment for which electrical power is supplied from fixed facilities. The surge voltage withstand level for up to the rated voltage of 300 V is 2500 V.

\*7. This index indicates the degree to which conductive material is generated in terms of the environment in which the equipment is used. Pollution level 2 is when only non-conductive pollution occurs. A temporary conductivity caused by condensing must be expected occasionally.

## Product List

Product	Model	Outline
C Controller CPU	R12CCPU-V	No. of I/O points: 4096 points, endian format: little endian, removable storage: SD memory card, OS: VxWorks® Version 6.9, RAM: 256 MB
C intelligent function module	RD55UP06-V	No. of I/O points: 32 points, endian format: little endian, removable storage: SD memory card, OS: VxWorks® Version 6.9, RAM: 128 MB
	RD55UP12-V	No. of I/O points: 32 points, endian format: little endian, removable storage: SD memory card, OS: VxWorks® Version 6.9, RAM: 1 GB
Pre-installed model	RD55UP06-V-BZ10	SECS/GEM communication software for NON-GEM
	RD55UP06-V-BZ12	SECS/GEM communication software for GEM
	RD55UP06-V-BZ14	SECS/GEM communication software for GEM ADVANCED
	R12CCPU-V-BZ18	Data collection software
	R12CCPU-V-BZ1A	Data collection software Light
Pre-installed model related software	SW1DNC-SECSSIM-E	SECS/GEM communication simulator

## Option List

Type	Model	Outline
Option	NZ1MEM-2GBSD	SD memory card, capacity: 2 GB
	NZ1MEM-4GBSD	SDHC memory card, capacity: 4 GB
	NZ1MEM-8GBSD	SDHC memory card, capacity: 8 GB
	NZ1MEM-16GBSD	SDHC memory card, capacity: 16 GB

## Engineering tool for C Controller module

Type	Model	Outline
CW Workbench*8	SW1DND-CWWR-E	C Controller/C intelligent function module engineering tool software package, product with license for R12CCPU-V, RD55UP06-V
	SW1DND-CWWR-EZ	Additional license product for R12CCPU-V, RD55UP06-V
	SW1DND-CWWR-EVZ	Update license product for R12CCPU-V, RD55UP06-V
CW-Sim	SW1DND-CWSIMR-EZ	VxWorks® simulator for CW Workbench, additional license product for R12CCPU-V, RD55UP06-V

\*8. CW Workbench is available as a one-month trial version. For more information, please contact your local Mitsubishi Electric office or sales representative.

## Setting/monitoring tools for C Controller module

Type	Model	Outline
MELSOFT CW Configurator	SW1DND-RCCPU-E	Setting/monitoring tool for C Controller

## Software selection

Module	Programming development environment	Setting/monitoring tool
R12CCPU-V	CW Workbench (SW1DND-CWWR-E/EZ/EVZ) or	CW Configurator (SW1DND-RCCPU-E)
RD55UP06-V, RD55UP12-V	Wind River® Workbench 3.3	GX Works3 (SW1DND-GXW3-E)
RD55UP06-V, RD55UP12-V*9	TimeStorm®, Visual Studio®	GX Works3 (SW1DND-GXW3-E)

\*9. When using Debian GNU/Linux

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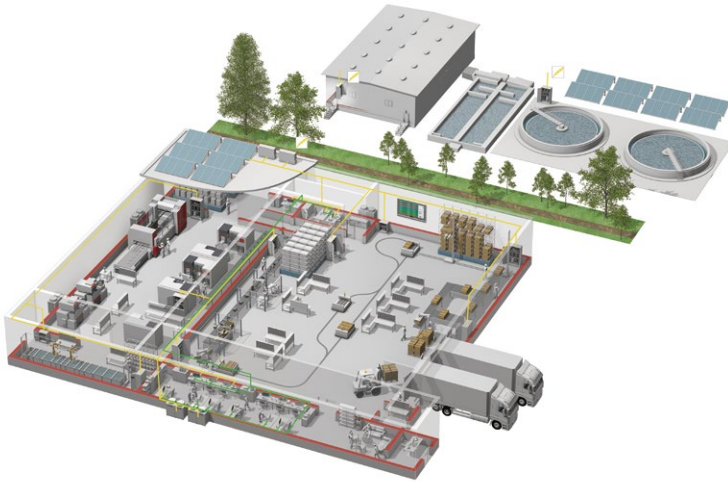
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- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine or passenger-carrying vehicles, consult with Mitsubishi Electric.
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# YOUR SOLUTION PARTNER



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

## A NAME TO TRUST

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

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

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

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

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



Low voltage: MCCB, MCB, ACB



Medium voltage: VCB, VCC



Power monitoring, energy management



Compact and Modular Controllers



Inverters, Servos and Motors



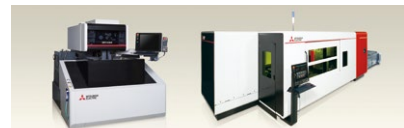
Visualisation: HMIs



Numerical Control (NC)



Industrial / Collaborative Robots



Processing machines: EDM, Lasers, IDS



Transformers, Air conditioning, Photovoltaic systems

\* Not all products are available in all countries.

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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).



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