Flexible customization
Applications for various requirements can be created. Applications pre-installed models are also available.

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 language type programs, based on the MELSEC system architecture, and utilize long term stable supply, high availability, advanced functionality, and flexible features.

High-speed processing that is not possible with a ladder program is realized while carrying out MELSEC Series module management and I/O control in the C/C++ language programs. These features are useful for a wide range of production site applications, including control, inspections, monitoring, conveyor, assembly, and communication gateways. Additionally, coordination with the IT system enables primary processing and analysis of data collected at the production site for real-time diagnosis. This makes it possible to detect the actual fault occurring, thereby enabling prompt troubleshooting, contributing to quality improvements and enhanced productivity.
MELSEC iQ-R Series

MELSEC-Q Series

C Controller module engineering tool CW Workbench

Development environments for embedded systems, which are usually expensive, are 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.
Resolve common drawbacks associated with embedded and industrial computers

The C Controller platform is a solution that realizes computer-level functionality without the burden of high maintenance costs usually associated with computers. In addition, by being based on the MELSEC control system, the C Controller has a robust design that is ideal for industrial environments.

**Common drawbacks associated with embedded and industrial computers**

- Discontinued production of boards & chips
- Limited developers
- Escalating maintenance costs due to failures
- Large physical space required
- Construction of an environment with network-connected external devices required

**Merits of using the C Controller**

- Highly reliable, long-term stable supply
- Utilization of C language programs
- Significantly reduces maintenance costs
- Reduced equipment size
- Simple construction of a seamless environment with network-connected external devices

**Old Platform (Micro computer/computer)**

- Disrupted product supply due to discontinued production
- Escalating management and maintenance costs

**New Platform (C Controller)**

- Stable product supply
- Lower maintenance and management costs allow resources to be focused on development

Easier to configure various control systems

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

Access to modules using dedicated functions
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 equipment

Semiconductor bonding machine can be migrated from computer or micro-computer based system to MELSEC platform system, enabling utilization of existing control programs by the C Controller.

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.

Semiconductor manufacturing system

A system realizing SECS communications between a semiconductor manufacturing equipment and the MES server can be constructed using a dedicated software.

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.

Conveyor

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

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 “data collection software” realizes management, analysis, and utilization of production site data, assisting in optimization of manufacturing systems with e-F@ctory.

**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.

**Assembly process data collection**

Using the C Controller for communications in the assembly processing system enables smooth coordination with the IT system.
Semiconductor manufacturing equipment

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

Conventional semiconductor bonding system uses a computer for executing control program 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 program without change, program modification is not necessary. 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
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 MELSEC iQ-R Series C Controller realizes higher performance control.

**System configuration**

- **GOT mobile**
- **GOT (HMI)**
- **Server**
- **Ethernet**

**Flexible high-speed I/O control module**

**High-speed digital I/O module**

**Movement pulse width calculation → Screw speed calculation**

**Injection molding**

- **C Controller**
- **Feedback control (encoder pulse)**
- **Material loading**
- **Servo torque control (screw movement amount instruction)**
- **Servo amplifier**
- **Servo motor**
- **Cylinder**
- **Screw**

---

**High-performance control**

**System construction with highly reliable, long-term stable supply MELSEC programmable controllers**

---

8
In the conventional system development, after device manufacturers and equipment manufacturers consult regarding communication specifications, the equipment manufacturers independently develop communication functionality. This process requires time for consultations concerning communication specifications as well as for reflecting these specifications in equipment. Issues such as increasing online testing hours due to errors in reflecting communications specifications can affect early production line start-up. These problems can be solved by installing the C Controller or C Intelligent function module “SECS/GEM communication software” pre-installed model in each equipment and distributing the setting files of the communication specifications for the “SECS/GEM communication software” to equipment manufacturers, resulting in early production line start-up. SECS/GEM communications can be realized without a computer nor program, dramatically reducing engineering costs.

### System configuration

![System configuration diagram]

- MES server
- Production instruction
- Production result
- Ethernet (SECS communication)
- C Intelligent function module + SECS/GEM communication software
- Equipment
- C Controller + SECS/GEM communication software
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 Controller 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

![System configuration diagram]

C Controller

Expressway monitoring facility 1

Expressway monitoring facility 2

Ethernet

Operation instruction

Sensor information

Vibration sensor

CO concentration detection sensor

Anemometer
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 Intelligent function module. 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**

- **Conveyor management** and conveyor control effectively done utilizing multiple modular feature
- **Robust and installable** within a small panel near the conveyor
Automated warehouse

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

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

![System configuration diagram]

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.
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**

- **GOT (HMI)**
- **Ethernet**
- **C Controller**
- **Test program**
- **Test result data**
- **CC-Link IE**
- **Servo amplifier**
- **Remote I/O**
- **Servo motor**
- **Switch**
The conventional system has a potential risk for tremendous loss resulting from a production stop due to sudden equipment failures. Periodic inspections are also required, increasing repair and maintenance costs. The C Controller “data collection software” pre-installed model can monitor signs of equipment abnormalities using collected sensor data, reducing repair and maintenance costs. Implementing this system can be done easily as the existing equipment can be used.

**Management and analysis of shop floor data for optimization of manufacturing with e-F@ctory**

**Predicts production equipment failures using collected sensor data**

**System configuration**

- **MES server**
  - Production data
  - Production instruction

- **Analysis server**
  - Sensor data/process results with analysis TAG
  - Ethernet
  - SPC monitoring
  - SPC monitors the deviation of principal components and residuals. Monitoring requires separate analysis tools.

- **C Controller (“data collection software” pre-installed model)**
  - Sensor data, power amount

- **Production facility 1**

- **Production facility 2**
Bearing deterioration diagnosis

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 μs 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 Controller. 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**
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**

- **Solar panel**
  - DC, voltage
- **Power conditioner**
  - AC, voltage
  - Alarm, fault notification
  - Power ON/OFF
- **Broadband router**
  - Ethernet
- **C Controller**
- **Cloud**
- **Internet**
- **Smartphone**
- **Megasolar monitoring screen**
- **Power company**
  - Sale of electricity

**Real-time monitoring of solar power plant status and measurements**

**Integrated monitoring of multiple power plants**

**Remote control**
Assembly process data collection

- Gateway computer is no longer necessary, reducing maintenance costs
- Real-time processing of multiple PLCs data and data coordination with IT system

The C Controller can be used for assembly process system communications in place of a gateway computer. Conventional computer-based production information management systems require frequent OS replacement and troubleshooting, resulting in significant costs and maintenance. The C Controller, however, can play multiple roles with a single module and reduce maintenance costs owing to its feature requiring no OS replacement and robust design. The C Controller can also process multiple programmable controllers data in real time and send the data to the IT system. Smooth coordination with the IT system contributes to improve work efficiency.

▶ System configuration

The diagram illustrates the system configuration, highlighting the integration of various components such as an operation instruction server, master data, actual production data, and various devices including GOT (HMI), barcode reader, indicator light, buzzer, electric screwdriver, Ethernet, and CC-Link IE. The C Controller is connected to these components, facilitating real-time data processing and coordination with the IT system.
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: www.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 CC-Link/CC-Link IE in that part of the world. For companies looking to increase their presence in their local area, CLPA is well placed to assist these efforts through offices in all major regions.
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

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.

The e-Manual viewer is a next-generation digital manual offered by Mitsubishi Electric that consolidates all manuals into an easy-to-use package with various useful features integrated into the viewer. The e-Manual is modeled around a centralized database allowing multiple manuals to be cross-searched at once, further reducing the time for reading individual product manuals when setting up a control system.

Key features include
- 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
- Automatic update of manual versions
- Search information across multiple manuals
- Visual navigation from hardware diagram showing various specifications
- Customizable by adding user notes and bookmarks
- Directly port sample programs within manuals to GX Works3

MITSUBISHI ELECTRIC FA e-Manual (tablet version)

The e-Manual application is available on iOS and Android™ tablets. e-Manual files are provided as in-app downloads.

Supported versions

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<thead>
<tr>
<th>OS</th>
<th>OS version</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>iOS</td>
<td>iOS 8.1 or later</td>
<td>Apple iPad 2, iPad (3rd generation), iPad (4th generation), iPad Air, iPad Air 2, iPad mini, iPad mini 2, iPad mini 3, iPad mini 4</td>
</tr>
<tr>
<td>Android™</td>
<td>Android™ 4.3/4.4/5.0</td>
<td>ASUS Nexus™7 (2013)*1</td>
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</table>

*1: When using a tablet not listed above, 7-inch (resolution of 1920x1200 dots (WUXGA)) or better is recommended.
### Performance specifications

<table>
<thead>
<tr>
<th>MELSEC-Q Series</th>
<th>MELSEC-iQ-R Series</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.5 mm</strong></td>
<td><strong>3.5 mm</strong></td>
</tr>
<tr>
<td><strong>C language (C/C++)</strong></td>
<td><strong>C language (C/C++)</strong></td>
</tr>
<tr>
<td><strong>10 times each</strong></td>
<td><strong>≤</strong></td>
</tr>
<tr>
<td><strong>®</strong></td>
<td><strong>®</strong></td>
</tr>
<tr>
<td><strong>2CH (10BASE-T/100BASE-TX/1000BASE-T)</strong></td>
<td><strong>2CH (10BASE-T/100BASE-TX)</strong></td>
</tr>
<tr>
<td><strong>®</strong></td>
<td><strong>®</strong></td>
</tr>
<tr>
<td><strong>C language (C/C++)</strong></td>
<td><strong>(installed by default)</strong></td>
</tr>
<tr>
<td><strong>Lineo uLinux ELITE</strong></td>
<td><strong>Class</strong></td>
</tr>
<tr>
<td><strong>Compliant with JIS B 3502 and IEC 61131-2 (147 m/s continuous vibration)</strong></td>
<td><strong>512 MB</strong></td>
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<tr>
<td><strong>®</strong></td>
<td><strong>®</strong></td>
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<tr>
<td><strong>SW4PVC-CCPU-E with standard RAM</strong></td>
<td><strong>512 MB (including OS)</strong></td>
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<tr>
<td><strong>®</strong></td>
<td><strong>®</strong></td>
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<tr>
<td><strong>C Controller (standard model)</strong></td>
<td><strong>SW3PVC-CCPU-E</strong></td>
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<tr>
<td><strong>®</strong></td>
<td><strong>®</strong></td>
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<tr>
<td><strong>C Controller (high-end model)</strong></td>
<td><strong>C Controller (standard model)</strong></td>
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<tr>
<td><strong>®</strong></td>
<td><strong>®</strong></td>
</tr>
<tr>
<td><strong>C Controller (OS non-mounted model)</strong></td>
<td><strong>C Controller (OS non-mounted model)</strong></td>
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<td><strong>®</strong></td>
<td><strong>®</strong></td>
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<tr>
<td><strong>C Intelligent function module</strong></td>
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<td><strong>R35UP06-V</strong></td>
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<td><strong>Q12CCPU-V</strong></td>
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### General specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>MELSEC-Q-R Series</th>
<th>MELSEC-Q Series</th>
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</thead>
<tbody>
<tr>
<td><strong>Series name</strong></td>
<td><strong>MELSEC-Q-R Series</strong></td>
<td><strong>MELSEC-Q Series</strong></td>
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<td><strong>Operating ambient temperature</strong></td>
<td>0...55°C (when a base unit other than an extended temperature range base unit is used)</td>
<td>0...55°C</td>
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<tr>
<td><strong>Storage ambient temperature</strong></td>
<td>-25...75°C</td>
<td>-25...75°C</td>
</tr>
<tr>
<td><strong>Storage ambient humidity</strong></td>
<td>5...95%, non-condensing</td>
<td>5...95%, non-condensing</td>
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<td><strong>Vibration resistance</strong></td>
<td>Compliant with JIS B 3502 and IEC 61131-2</td>
<td>Compliant with JIS B 3502 and IEC 61131-2</td>
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<tr>
<td><strong>Frequency</strong></td>
<td>Under intermittent vibration</td>
<td>Under intermittent vibration</td>
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<td><strong>Constant acceleration</strong></td>
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<td>8.4...150 Hz</td>
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<td><strong>Sweep count</strong></td>
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<td>10 times each in X, Y, Z directions</td>
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<td><strong>Shock resistance</strong></td>
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<td>Compliant with JIS B 3502 and IEC 61131-2</td>
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<td>No corrosive gases®, no flammable gases, no excessive conductive dust</td>
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<td>0...2000 m®</td>
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<tr>
<td><strong>Equipment class®</strong></td>
<td>Class II®</td>
<td>Class II®</td>
</tr>
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</table>

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

**2.** Enables standard MELSEC-Q-R Series modules to support extended operating ambient temperature of 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 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. No special coated product is available for Q24DHCCPU-V, Q24DHCCPU-VG, Q24DHCCPU-LS, or Q26DHCCPU-LS.

**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 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 Electric representative.

**6.** This index 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 II 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 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 non-conductive pollution occurs. A temporary conductivity caused by condensing must be expected occasionally.

**8.** Class II when the RQ extension base unit is used.
<table>
<thead>
<tr>
<th>C Controller (standard model)</th>
<th>C Controller (standard model)</th>
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<td>Q24DHCPCPU-LS</td>
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<tr>
<td>Q24DHCPCPU-V</td>
<td>Q24DHCPCPU-VG</td>
<td>Q24DHCPCPU-LS</td>
<td>Q24DHCPCPU-LS</td>
</tr>
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Little endian

- User CPU: Intel® ATOM™ Processor
  - System CPU: SH-4A
  - 512 MB
  - 382 MB
  - Max. 5 MB (total 5 MB with standard RAM)
  - 512 MB (including OS)
  - 8 GB (including OS)
  - 5 MB

VxWorks 6.8.1††

- (installed by default)
- Lineo uLinux™: kernel2.6.35, eT-Kernel/compact††
  - (not installed by default)

C language (C/C++)

- Script language (Ruby, PHP, Perl, Python)††

CW Workbench (SW1DND-CWWLQ24-E/EZ/EVZ)/Wind River Workbench3.2††

User Ethernet port: 2CH (10BASE-T/100BASE-TX/1000BASE-T)

System Ethernet port: 1CH (10BASE-T/100BASE-TX)

SD memory card (1 slot) - Analog RGB D-Sub15pin

3. VxWorks® 6.9, VxWorks® 6.8.1, VxWorks® 6.4, Wind River Workbench 3.3, Wind River Workbench 3.2, and Wind River Workbench 2.6.1 are products of Wind River Systems, Inc. Refer to the Wind River Systems, Inc. product manuals or contact Wind River Co., Ltd. (Japan office) for service and specifications of Wind River Systems products. Refer to the following web site for contact information of Wind River Co., Ltd.

http://www.windriver.com

*4. Must be separately purchased from Lineo Solutions, Inc.

*5. Must be separately purchased from eSOL Co., Ltd.

*6. Q26DHCCPU-LS does not support.

*7. When Lineo uLinux is used. The program language depends on the specifications of the 3rd Party partner OS.

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

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

*10. TYPE I cards are supported. A TYPE II card cannot be used. I/O cards such as modem cards cannot be used.

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