

Data Collection/Analysis Solutions

e-Factory



Take Production One Step Further
with Data Collection and Utilization

GLOBAL IMPACT OF MITSUBISHI ELECTRIC



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

Changes for the Better

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

Mitsubishi Electric is involved in many areas including the following:

Energy and Electric Systems

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

Electronic Devices

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

Home Appliance

Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems

Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems

Maximizing productivity and efficiency with cutting-edge automation technology.

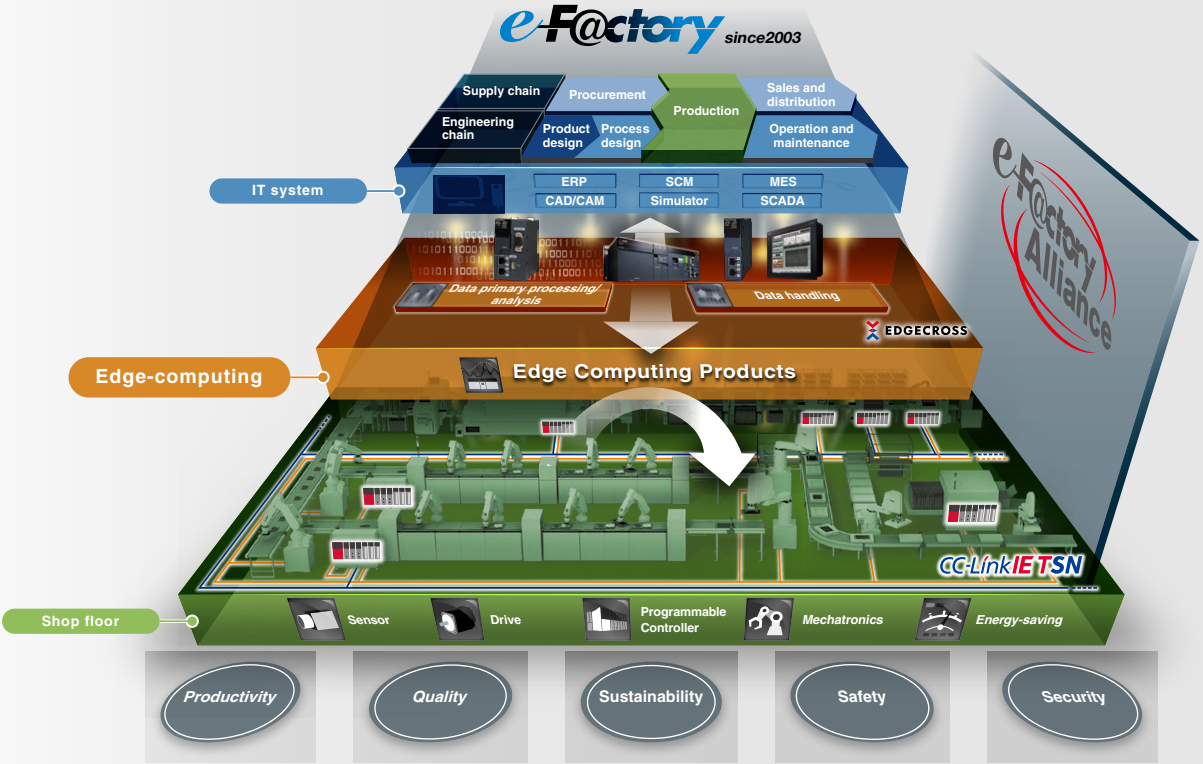
Our advances in AI and IoT are adding new value to society in diverse areas from automation to information systems. The creation of game-changing solutions is helping to transform the world, which is why we are honored to be recognized in the 2019 "Forbes Digital 100" as one of world's most influential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



FA-IT Integrated Solution



The “e-F@ctory” FA-IT integrated solution proposes ways of utilizing FA and IT technologies that reduce the total cost of development, production, and maintenance activities, continuously support customer kaizen activities, and promote monozukuri that is one step ahead.



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Data Collection/Analysis Solutions

The Cycle for shop floor Improvement With Data Utilization

Targets Setting

What is the issue?
What is the current status?
What needs to be solved?

Point

Clarify what issues should be solved.

1 Data collection

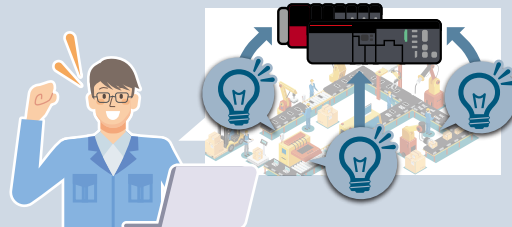
What kind of data should be collected and how?

Point

Select and collect data based on knowledge in equipment and production processes.

Factor analysis, data selection, and data collection

Select, collect, and accumulate the data necessary for solving the shop floor issues based on the engineer's wealth of experience, intuition, and knowledge.



4 Diagnosis

Data diagnosis based on the analysis results

Point

Evaluate the improvements made and issues solved and create a continuous cycle for improvements.

Improvements using a diagnostic system

Create diagnostic rules based on the analysis results, diagnose the collected data in real time, and provide the shop floor with feedback.



Create diagnostic rules



Real-time diagnosis



Feedback

Improving productivity, quality, and energy efficiency by utilizing shop floor data to find the key to solving production issues and promoting improvements

Identify managerial issues

- Productivity improvement
- Quality improvement
- Energy saving & conservation

Break down the issues

Break down each managerial issue into more specific shop floor issues for which solutions can be devised.



Application of data collection/analysis solutions

② Visualization

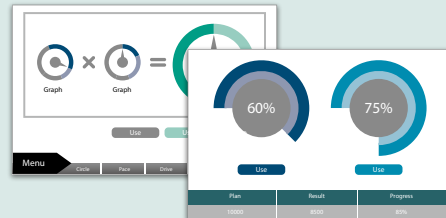
Visualization of collected data and confirmation of the effectiveness of improvements

Point

Quantify the current situation and gain awareness.

Data visualization

Display the collected data in an easily viewable format, to provide a visual indication of the status of the shop floor.



③ Analysis

Factor analysis from collected data

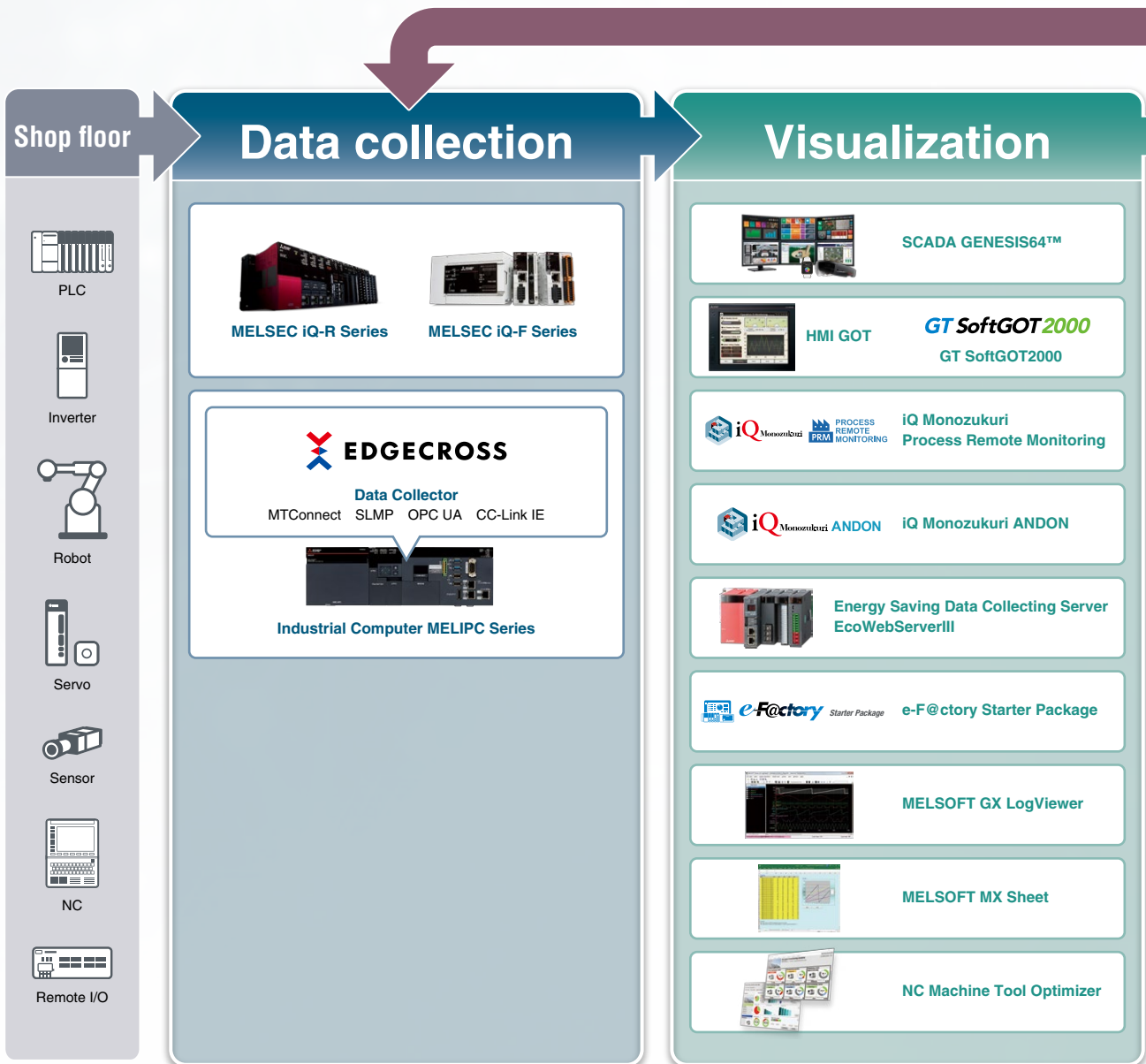
Point

Find the factors necessary for improving the shop floor and solving issues.

Data analysis

Use the collected data to analyze problem-solving factors.





Use Cases

- | | | |
|---------------|--|-----------------------------------|
| Case 1 | Collecting data from the old type of Mitsubishi Electric PLC or other vendor's PLC | P.8 >>> |
| Case 2 | Utilizing the data from the PLC with an IT system | P.9 >>> |
| Case 3 | Collecting highly precise data to improve the accuracy of analysis | P.10 >>> |
| Case 4 | Collecting data from the equipment and devices made by various manufacturers | P.11 >>> |
| Case 5 | Using the collected data in reports | P.12 >>> |
| Case 6 | Visualizing logging data easily | P.13 >>> |
| Case 7 | Checking the collected data at the shop floor | P.14 >>> |
| Case 8 | Checking the status of equipment on the shop floor from an office or a remote location | P.15 >>> |

Analysis



MELSOFT MaiLab



System Recorder



Energy Saving Support Software
EcoAdviser

Diagnosis



iQ Monozukuri
Tool Wear Diagnosis for Machine Tools



iQ Monozukuri
Rotary Machine Vibration Diagnosis

Solutions

MELFA
Smart Plus MELFA Smart Plus

Solutions

GOT Drive GOT Drive

Case
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Analyzing the cause to resolve the recurring error permanently

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Case
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Analyzing energy savings from power consumption and production volume

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Using AI to create learning models for quality improvement and predictive maintenance

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Replacing tools of machine tools only when necessary

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Visualizing and analyzing a wide variety of machine tools made by different manufacturers

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Performing analysis and diagnosis with a PLC

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Eliminating the performance gap between experts and inexperienced workers

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Conducting predictive maintenance on equipment by diagnosing vibration data

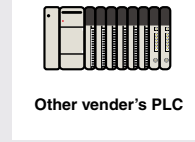
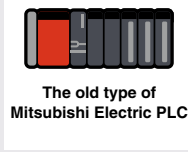
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Case 1

Collecting data from the old type of Mitsubishi Electric PLC or other vender's PLC



- The data need to be collected easily without programming



- Other vender's PLC are being used

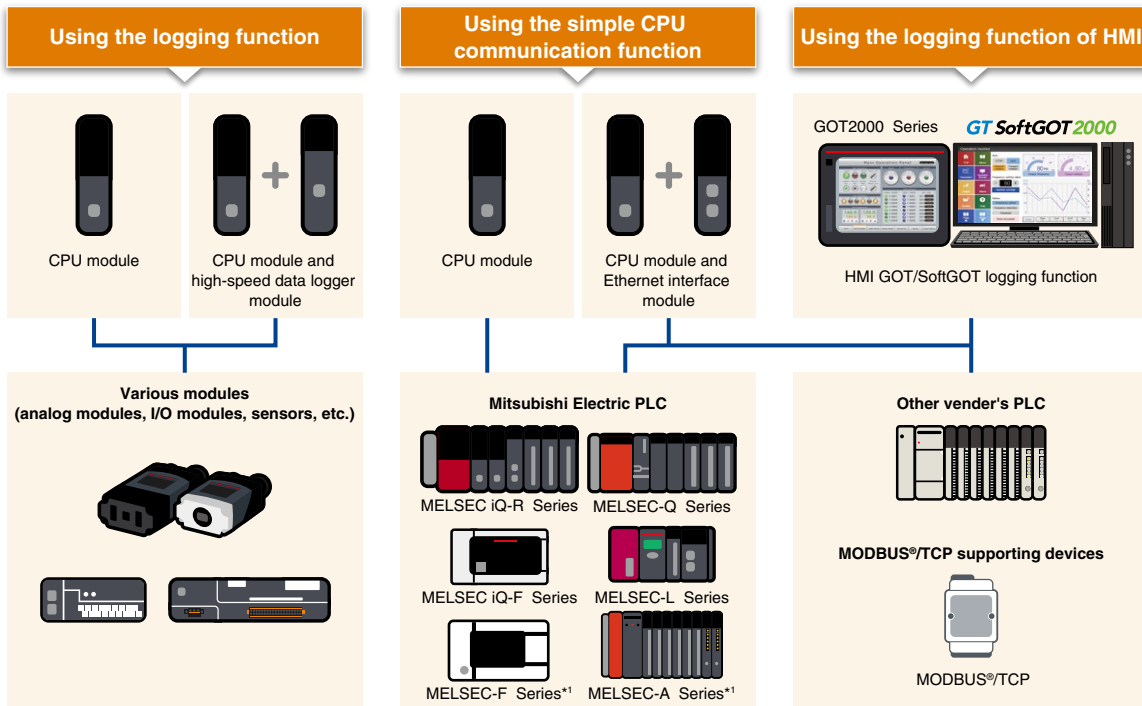
- The old type of Mitsubishi Electric PLC are still being used

Solution

Collecting data from various devices and Other vender's PLC with the logging function and the simple CPU communication function.



Data can be collected from various devices connected to PLC with simple parameter settings.
Data collection from Mitsubishi Electric PLC and Other vender's PLC is also possible.



*1. Only an Ethernet interface module, HMI GOT/SoftGOT are supported.

Refer to "Product and Solution Introduction" for product details and function comparisons.

MELSEC iQ-R Series

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MELSEC iQ-F Series

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High-speed data logger module

P.26 >>>

Ethernet interface module

P.27 >>>

HMI GOT

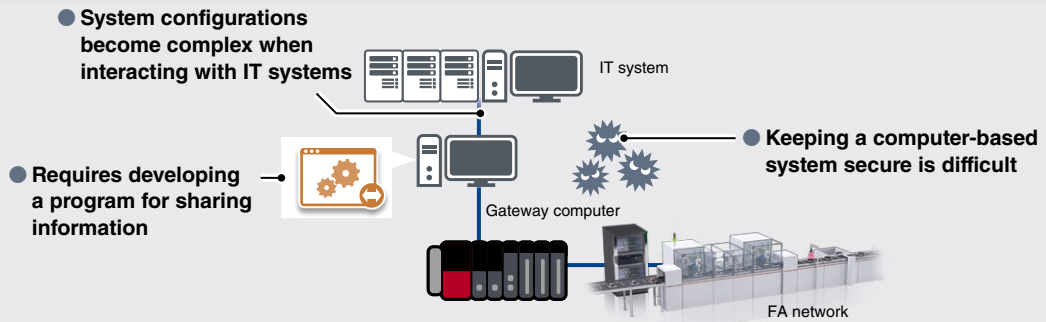
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GT SoftGOT2000

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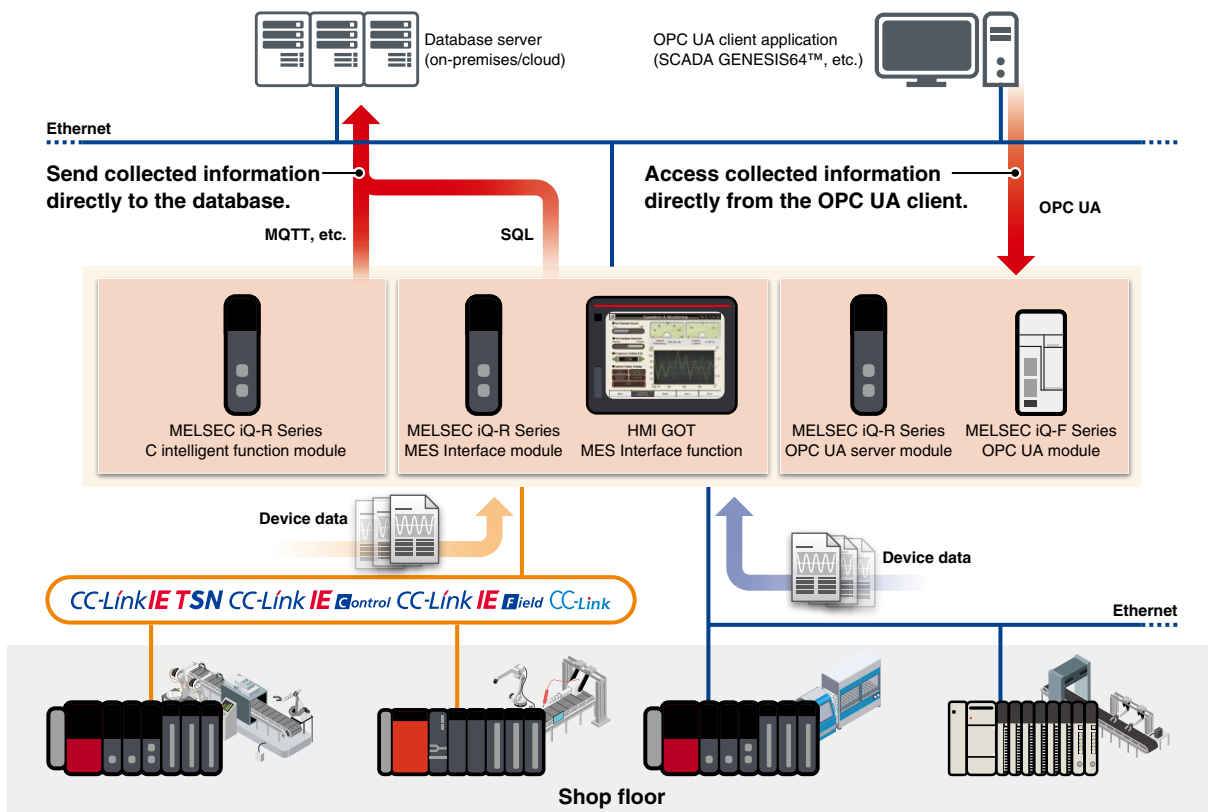
Case 2

Utilizing the data from the PLC with an IT system



Solution

Access the IT system directly from the shop floor with FA-IT information interactive products, and utilize the data.



Refer to "Product and Solution Introduction" for product details and function comparisons.

MES Interface module

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HMI GOT

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OPC UA server module

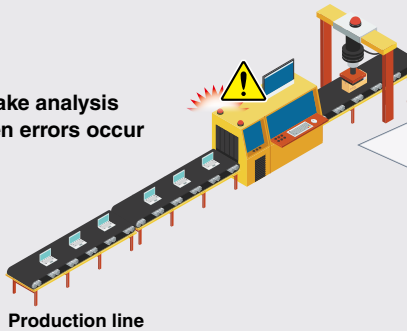
P.28 >>>

Case 3

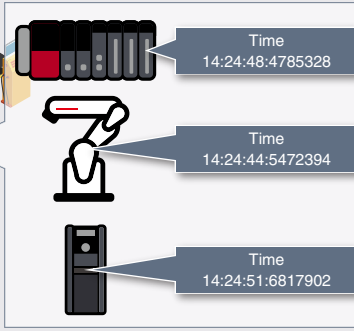
Collecting highly precise data to improve the accuracy of analysis



- Need to make analysis easier when errors occur



Production line



- The times in each device vary when there is no time synchronization

Solution

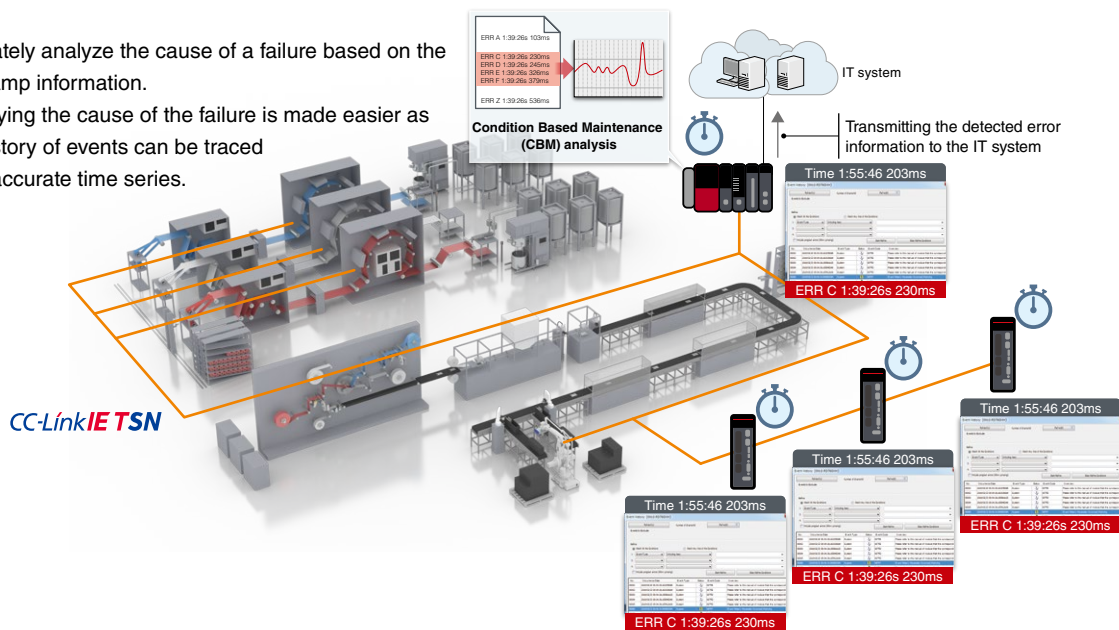
Use CC-Link IE TSN for highly precise time synchronization and make analysis based on accurate time-series data.



Accurate timestamp information and improvement in the accuracy of analysis

- By using the time synchronization protocol prescribed by TSN, time lags between devices supported by CC-Link IE TSN are corrected to achieve highly precise time synchronization. The time information of each master and device is synchronized to the microsecond. So if a failure was to occur in the network, an accurate sequence of events leading up to the failure can be traced when analyzing the operation.
- IT systems can receive shop floor information with more accurate timestamps. This improves the performance of data analysis applications that use AI, and the accuracy of the functions they provide such as predictive maintenance.

- 1 Accurately analyze the cause of a failure based on the timestamp information.
- 2 Identifying the cause of the failure is made easier as the history of events can be traced in an accurate time series.



Refer to "Product and Solution Introduction" for product details and function comparisons.

Open integrated network
CC-Link IE TSN

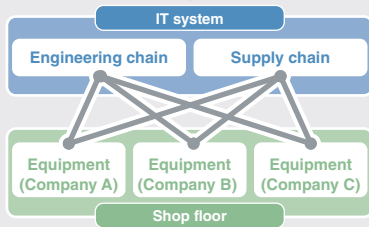
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Case 4

Collecting data from the equipment and devices made by various manufacturers



Complex equipment and networks



Equipment modification costs



Risks of modifying existing equipment

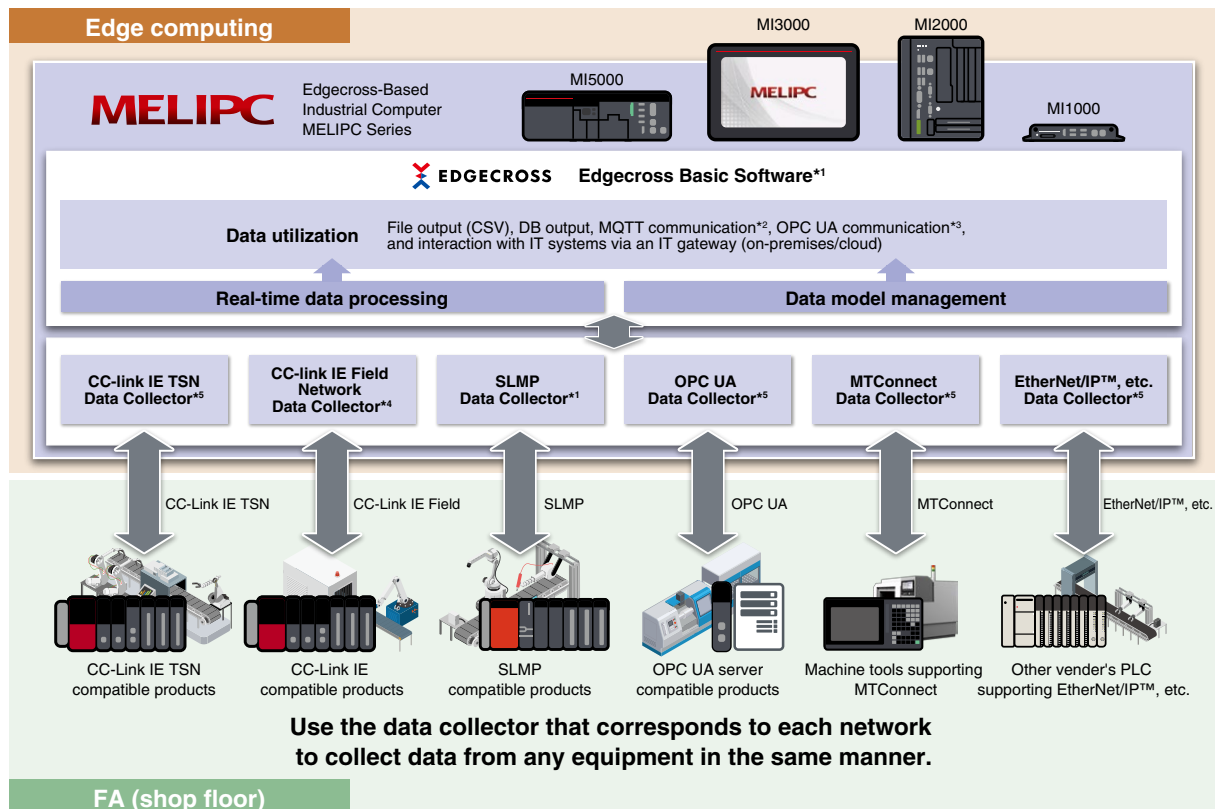


Solution

Install the industrial computer MELIPC to an existing system to enable the collection of data from various equipment and extend data utilization capabilities.



Edge computing



*1. Pre-installed in all MELIPC models
 *2. Supports real-time data processing only
 *3. Supports data model management only

*4. Pre-installed in MELIPC MI5000 only
 *5. Sold separately

Refer to "Product and Solution Introduction" for product details and function comparisons.

Industrial Computer MELIPC Series

P.36 >>>

Data Collector

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Edgexcross

P.65 >>>

Edgexcross is an open edge computing software platform that enables collaboration between FA and IT.



Edgexcross Consortium
<https://www.edgexcross.org/en/>

Case 5

Using the collected data in reports



- Need to automatically compile shop floor status on a computer without printing reports
- Need to create daily reports automatically with a computer

Solution

Create ledgers for daily reports with numerical values and graphs in preset layouts.

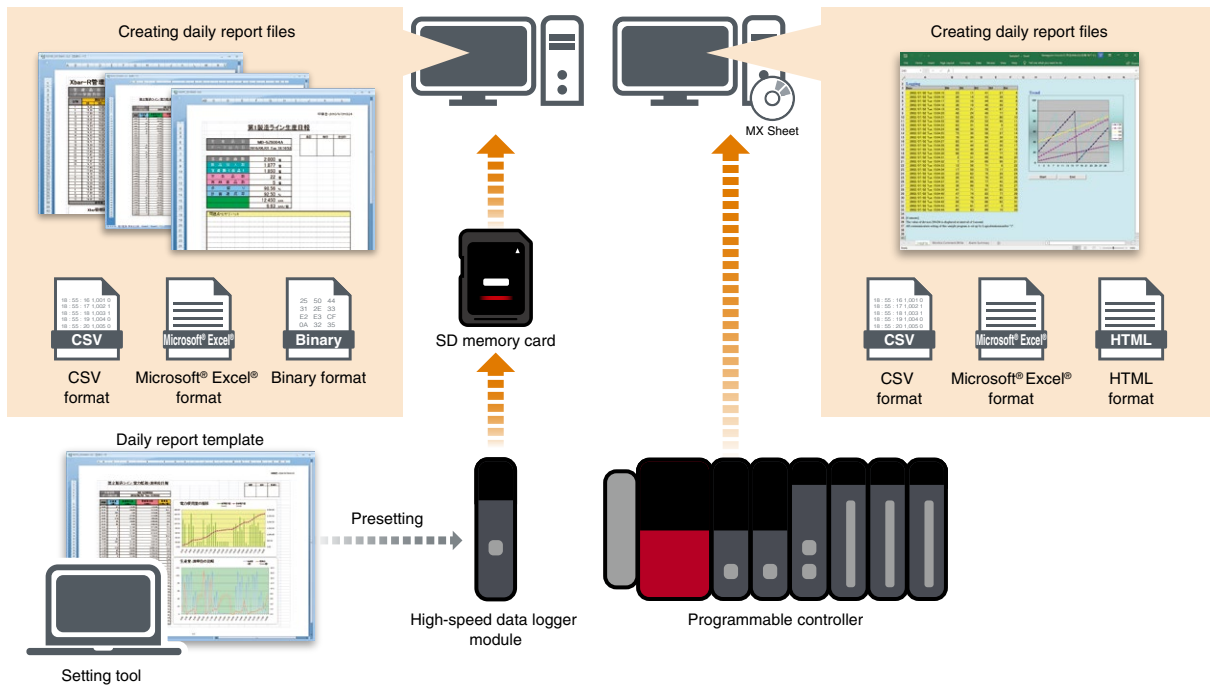


High-speed data logger module

Creates daily reports by importing the logging data to off-the-shelf software such as Excel®.

MX Sheet

Automatically creates daily reports and ledgers for specified time frames or by triggers from a programmable controller.



Refer to “Product and Solution Introduction” for product details and function comparisons.

High-speed data logger module

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MELSOFT MX Sheet

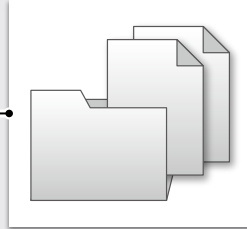
P.37 >>>

Case 6

Visualizing logging data easily



● Logging data is available but not effectively used



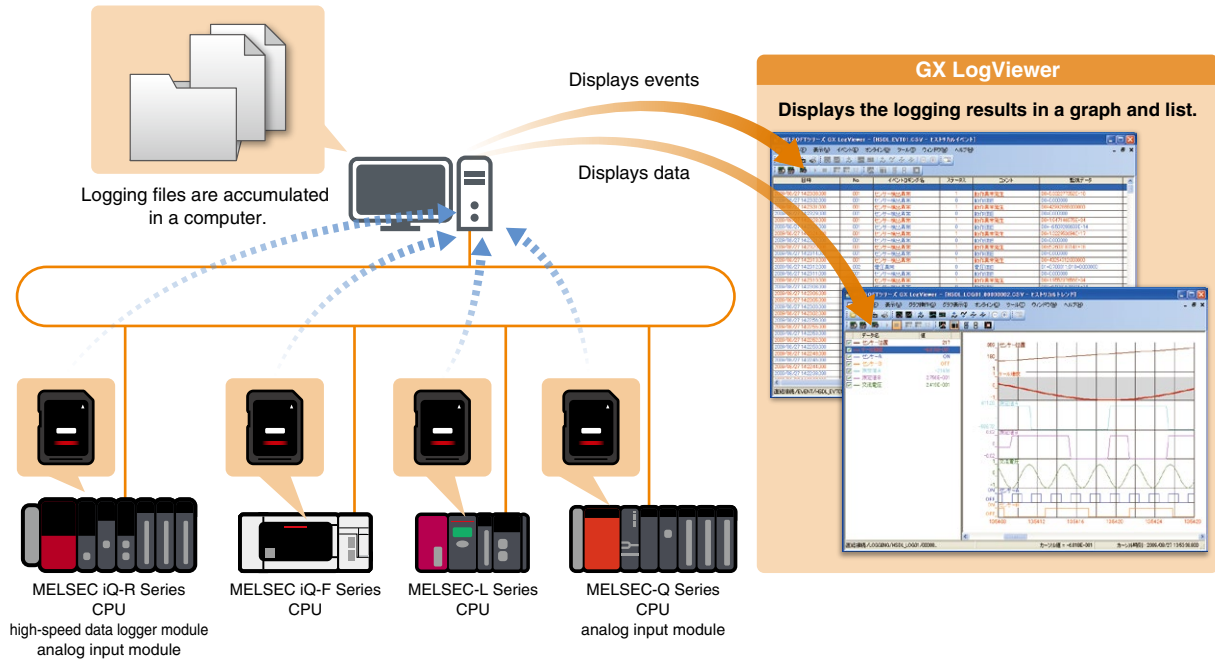
● Visualizing the data with spreadsheet software takes time and effort

Solution

GX LogViewer imports the collected logging data and displays the data in clearly visualized formats.



Large amounts of accumulated data and events are displayed and analyzed with a simple operation, increasing the efficiency of data checking.



Refer to "Product and Solution Introduction" for product details and function comparisons.

MELSOFT GX LogViewer

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Data collection

Visualization

Analysis

Diagnosis

Case 7

Checking the collected data at the shop floor



- Need to check the collected data at the shop floor with minimal time and money spent on configuring a system

Solution

Visualize the operation status with an shop floor GOT.



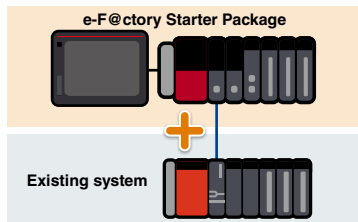
e-F@ctory Starter Package visualizes the shop floor on HMI GOT



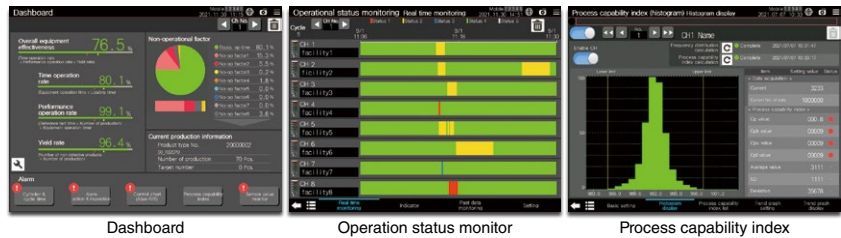
The e-F@ctory Starter Package includes a lot of projects file for the MELSEC iQ-R/iQ-F Series PLC*1 and the GOT2000 Series human-machine interface. Programs for visualization and simple analysis are provided in sample project format, allowing IoT to be integrated at the shop floor with basic settings such as device assignment and parameter registration. The e-F@ctory Starter Package removes issues that come with IoT system integration, such as time that spent on evaluating options or budget requirements.

*1. Some functions are not supported by MELSEC iQ-F Series.

System configuration example (when adding the function to an existing system)



Screen example for GOT2000 Series*2

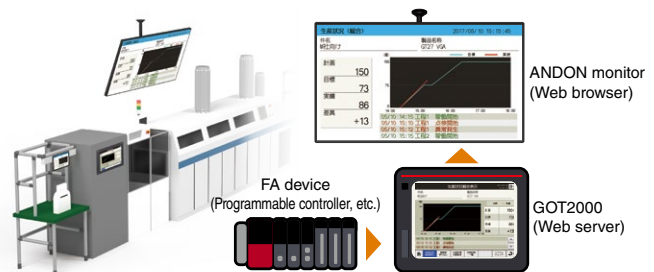


*2. The screen images are subject to change without notice.

Easy configuration of an ANDON system with iQ Monozukuri ANDON

iQ Monozukuri ANDON is an application package that enables an ANDON system to be built with GOT2000 Series.

The ANDON display allows operators to share information and improve productivity.



Refer to "Product and Solution Introduction" for product details and function comparisons.

e-F@ctory Starter Package

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iQ Monozukuri ANDON

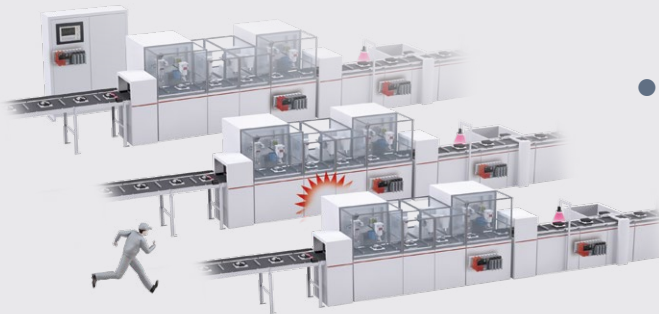
P.42 >>>

HMI GOT

P.39 >>>

Case 8

Checking the status of equipment on the shop floor from an office or a remote location



- Need to understand the status of the shop floor and promptly address problems from an office or a remote location when they occur

Solution

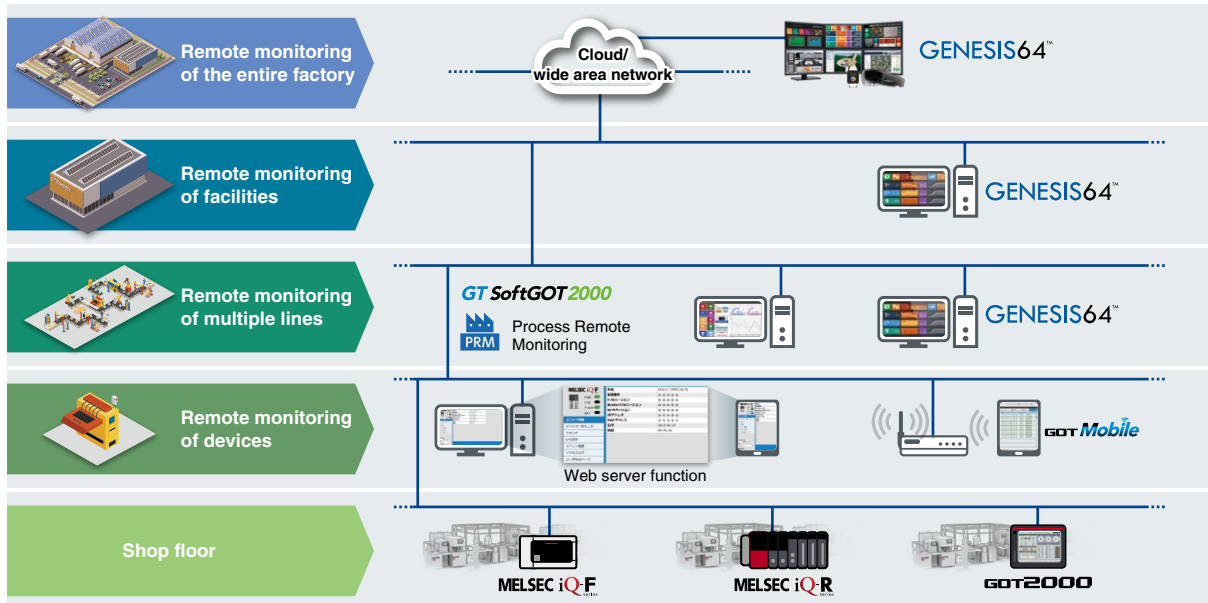
Remotely monitor everything from devices to the entire factory in detail.



A wide selection of products and functions to suit remote monitoring at all operating levels

Operating level	Products and functions
Detailed integrated remote monitoring from a device to the entire factory	GENESIS64™ (SCADA software)
Easy remote monitoring from a device to multiple lines	GT SoftGOT2000 (HMI software) iQ Monozukuri Process Remote Monitoring
Simple remote monitoring of devices via a web browser	GOT Mobile Function (Function of GOT2000 Series*/GT SoftGOT2000) Web server function (Function of MELSEC iQ-R/iQ-F Series CPU modules)

*1. Not supported by some models



Refer to "Product and Solution Introduction" for product details and function comparisons.

MELSEC iQ-R Series

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MELSEC iQ-F Series

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HMI GOT

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GT SoftGOT2000

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SCADA GENESIS64™

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iQ Monozukuri
Process Remote Monitoring

P.41 >>>

Case 9

Analyzing the cause to resolve the recurring error permanently



● The operating conditions at the time of an equipment shutdown are unknown, which makes investigating the cause difficult

Solution

Record all operation data and video data of machines and devices so conditions at the time of the error can be recreated, allowing users to identify the root of the problem.

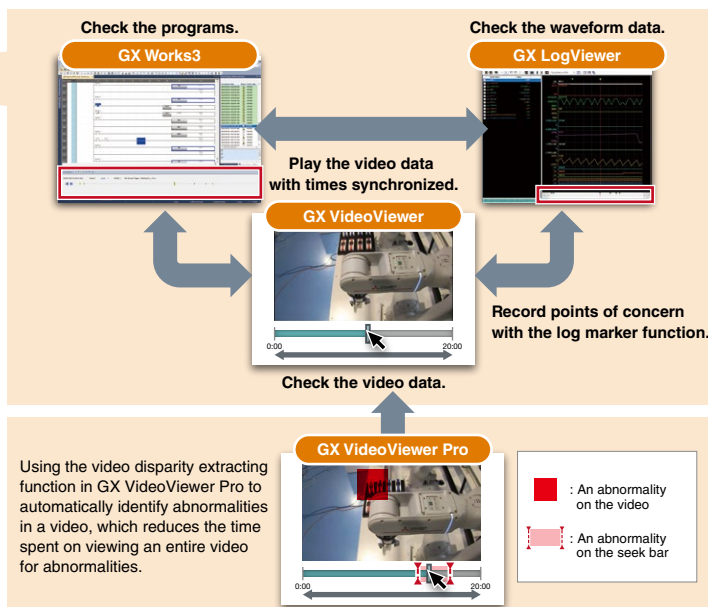
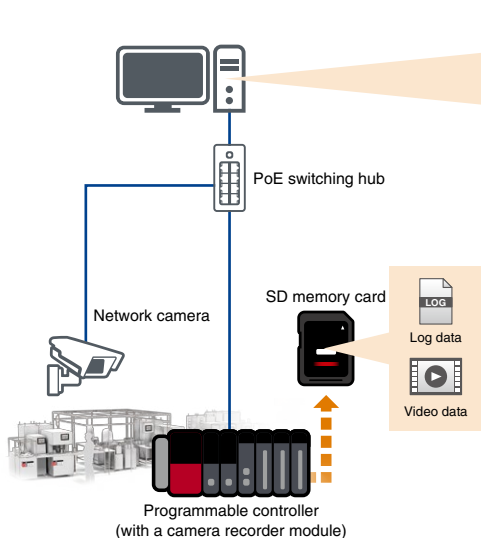


Record everything

- ① A Recorder module automatically collects all device/label data before and after a failure for every scan, and adds timestamps to the data.
- ② A camera recorder module stores video data captured by a network camera in addition to ①.
- ③ A wide variety of cameras are available.

Easy analysis

- ① Display and analyze all the data with time synchronization.
- ② Add check points using the log marker function so points of concern can be reviewed promptly. Share the check points with multiple workers.



Refer to "Product and Solution Introduction" for product details and function comparisons.

Case 10

Visualizing and analyzing a wide variety of machine tools made by different manufacturers

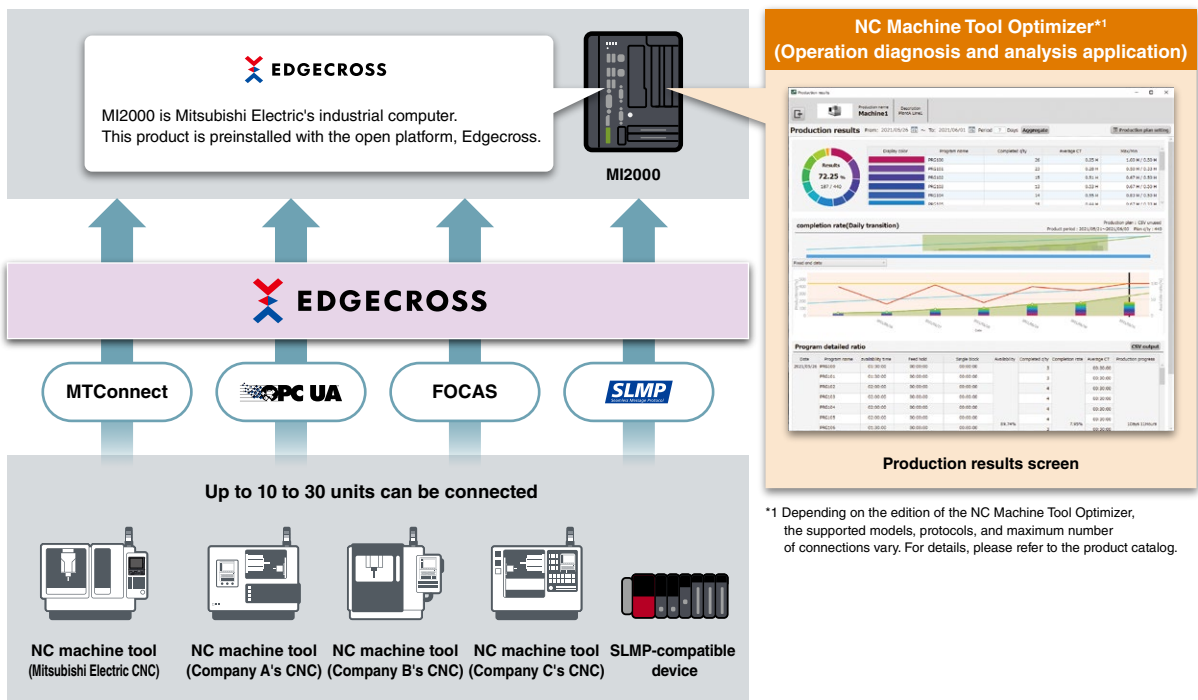


Data collection

- The performance of each machine tool is not fully understood, and there could be ways to improve performance
- A variety of old and new multi-vendor equipment are in operation, and collecting data from all equipment is complicated

Solution

Manage multi-vendor machine tools and multiple locations with the same index to help promote shop floor improvements and increase productivity.



Refer to "Product and Solution Introduction" for product details and function comparisons.

NC Machine Tool Optimizer	P.45 >>>	Industrial Computer MELIPC Series	P.36 >>>
Data Collector	P.36 >>>	Edgecross	P.65 >>>

Data collection

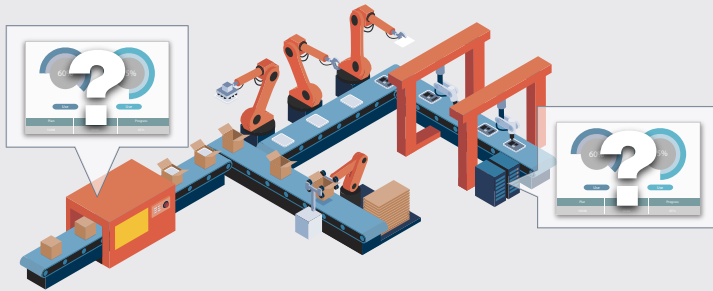
Visualization

Analysis

Diagnosis

Case 11

Analyzing energy savings from power consumption and production volume



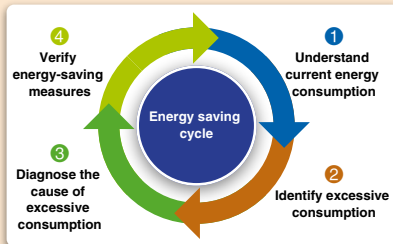
- Need to display energy-saving signage at the production shop floor
- Need to display energy-saving signage on the production line

Solution

Visualize and analyze data with a particular focus on energy savings.



A wide range of analysis is possible with the utilization of AI technology when collecting energy-related data such as power consumption and the production-related data stored in PLC.



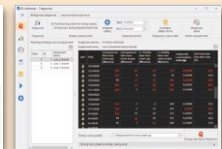
EcoAdviser

Maisart

Equipped with the AI technology of Mitsubishi Electric "Maisart", the system provides total support for energy saving activities from understanding the current condition, identification/factor diagnosis of energy-losses to effect verification of energy saving measures.

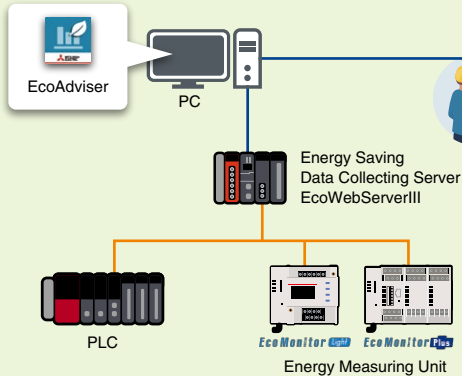


Dashboard screen

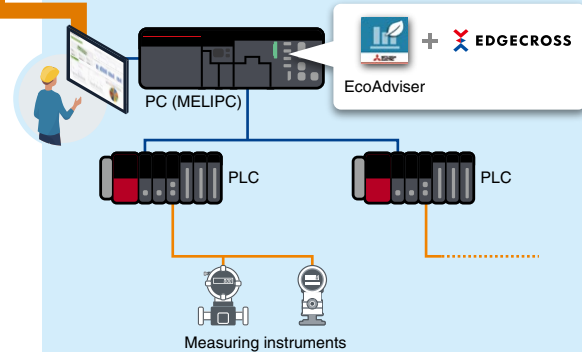


Excessive energy consumption diagnosis screen

When collecting measurement data from an Energy-Saving Data Collecting server "EcoWebServer III"



When collecting measurement data from Edgexcross



Refer to "Product and Solution Introduction" for product details and function comparisons.

Energy Saving Support Software
EcoAdviser

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Energy Saving Data Collecting Server
EcoWebServerIII

P.44 >>>

Energy measuring module

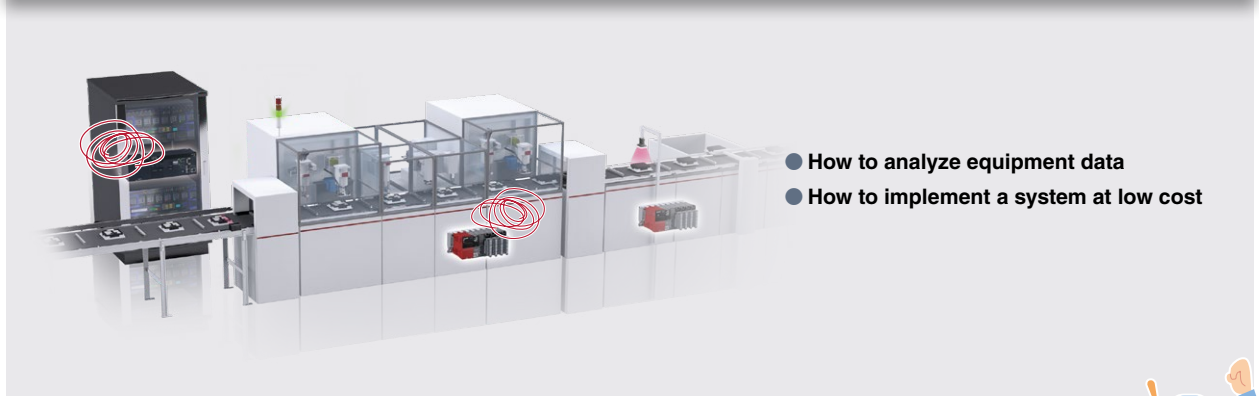
P.33 >>>

Edgexcross

P.65 >>>

Case 12

Performing analysis and diagnosis with a PLC



- How to analyze equipment data
- How to implement a system at low cost

Solution

Analyze and diagnose quickly and at low cost with free sample projects (e-F@ctory Starter Package) equipped with various analysis/diagnosis methods.



e-F@ctory Starter Package



Benefits of e-F@ctory Starter Package

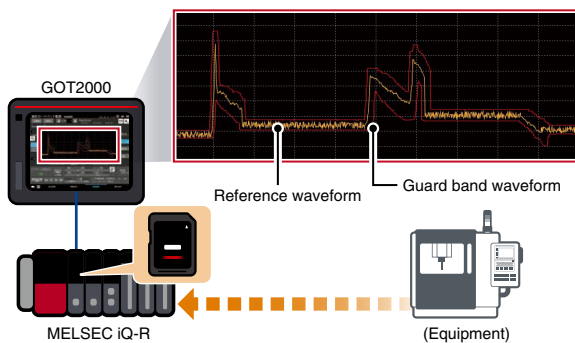
- 1 Low initial costs
 - Initial costs are low because creating sequence programs and screen data from scratch is not required.
- 2 Easy IoT implementation for equipment
 - IoT functions can be added with basic settings*1.

*1. Device assignment, parameter registration, etc.

Wave guard band monitoring

● Features

- Guard band waveforms are created from a reference waveform, and the input waveform data is monitored.
- Created guard band waveforms can be saved and read in CSV format. Guard band waveforms created by a computer can also be read.

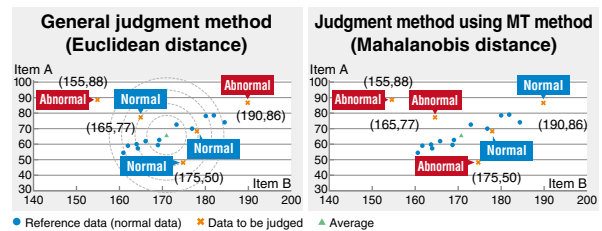


MT method*2 simple diagnosis

● What is MT method?

- The MT method is a method of multivariate analysis for detecting anomalies.
- In this method, a reference (unit space) is created from the normal data, and normality/anomaly is judged from the degree of deviation (Mahalanobis distance) between the reference and the measured data quantified.

*2. MT stands for Mahalanobis-Taguchi.



● Features

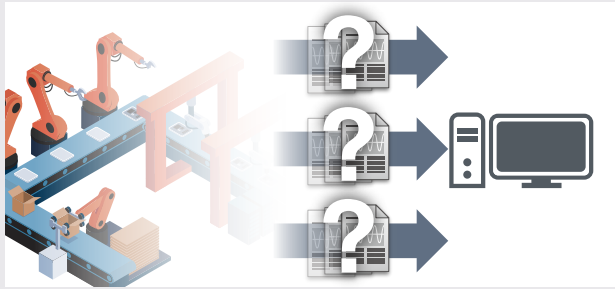
- PLC calculates feature quantities of time-series and vibration data, and the Mahalanobis distances are monitored by the MT method.
- PLC and GOT are the only devices required to collect, visualize, analyze, and diagnose data. These devices are readily available and require low maintenance, thus integration at the shop floor simple.



Refer to "Product and Solution Introduction" for product details and function comparisons.

Case 13

Using AI to create learning models for quality improvement and predictive maintenance



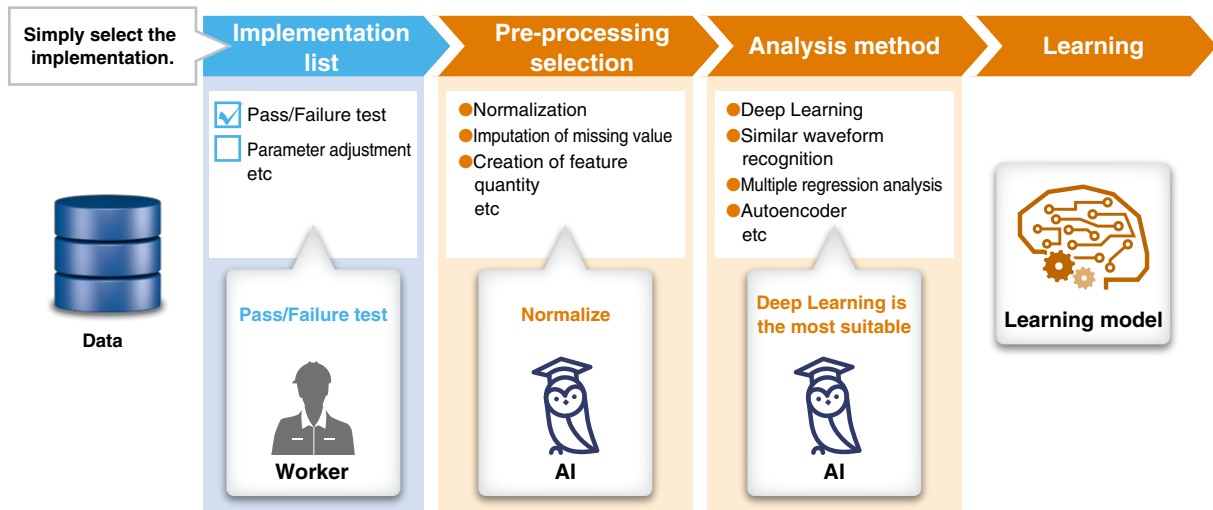
- Identifying the required production data from large amounts of data is difficult
- With so many analysis methods available, finding the most appropriate method is difficult

Solution

Use MELSOFT MaiLab to automatically execute everything from pre-processing of data and selection of analysis method to creation of learning models.



AutoML^{*1} function of MELSOFT MaiLab automatically executes everything from pre-processing to model creation



*1. AutoML stands for Auto Machine Learning.

Selection results are ready for confirmation!

Automatic evaluation of the learning models created



Contribution of variables

Contribution is a value that indicates the extent to which an explanatory variable (a variable that contributes to an outcome) influences the prediction results. As the top 10 variables that contributed the most to outcomes are shown, the correlation between data can be understood without actually conducting any data analysis.

* The displayed explanatory variables include those automatically-created variables by MELSOFT MaiLab.

Learning results (score)

The learning results are scored from 0 to 100. These scores are used to evaluate the reliability of a learning model, thus no specialized knowledge is required.

* If the score is too low, consider revising the learning level and re-learning as required.

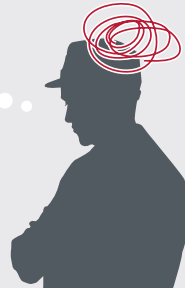
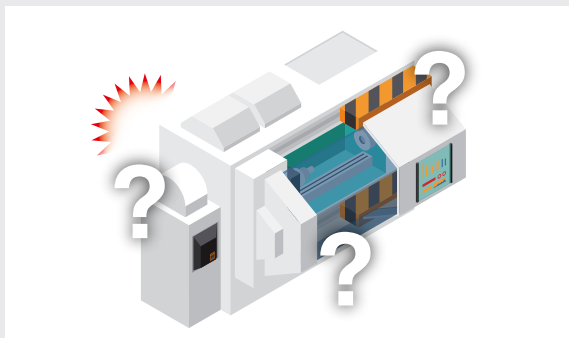
Refer to "Product and Solution Introduction" for product details and function comparisons.

MELSOFT MaiLab

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Case 14

Eliminating the performance gap between experts and inexperienced workers



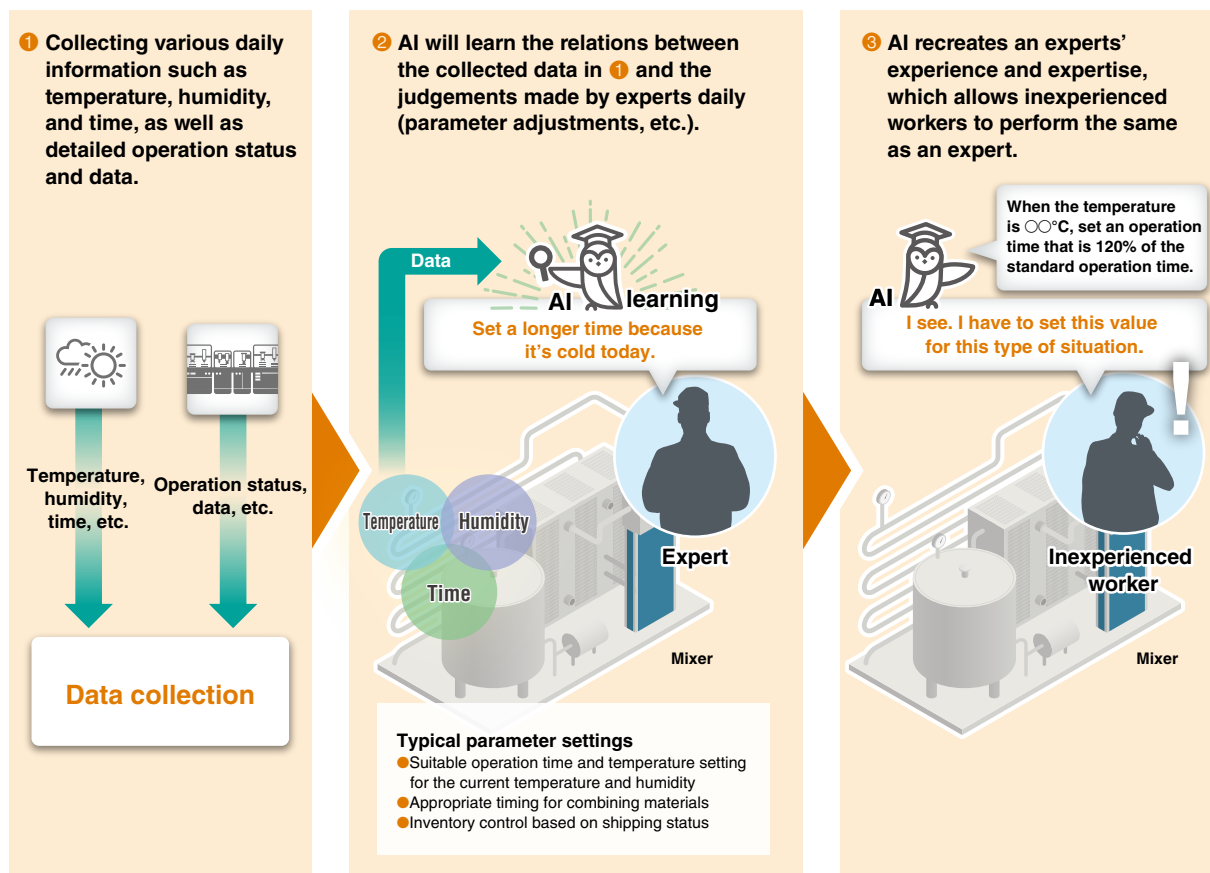
- There are some tasks only experts can handle
- Passing on the skills of experts is difficult

Solution

Use AI to compensate for the performance gap between experts and inexperienced workers.



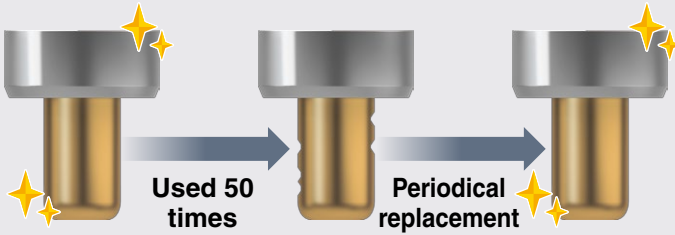
MELSOFT MaiLab can recreate the years of experience and expertise of experts



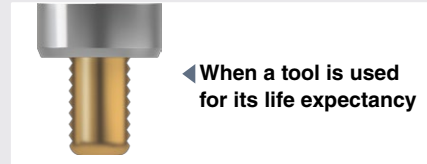
Refer to "Product and Solution Introduction" for product details and function comparisons.

Case 15

Replacing tools of machine tools only when necessary



As cutting tools are replaced periodically, some tools are replaced before their life expectancy, and replacement costs build up



Solution

Predict cutting tool life based on usage conditions to determine a replacement time so tools can be used for their life expectancy while maintaining a high precision for machining.



iQ Monozukuri Tool Wear Diagnosis for Machine Tools



Tool life diagnosis

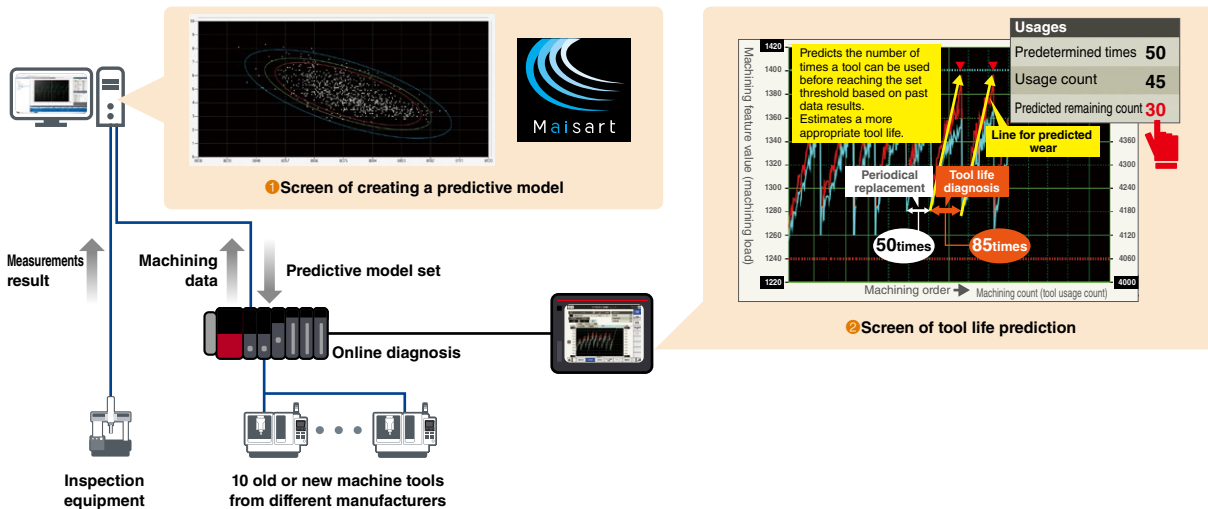
By collecting data from the CNC in real time and knowing the trends of the cutting/grinding parts, the system automatically detects changes caused by tool wear and tool defects or breakage. The number of tool replacements are reduced when compared to periodic replacements, and a high precision of machining is maintained.

Creating a machining prediction model by machine learning

By successfully detecting minute changes in the tool edge, the AI technology learns*1 the relations between the characteristics of the cutting/grinding parts and the machining dimensions and surface roughness to create a machining predictive model.

With this predictive model, any faults previously undetected in sampling inspections are detected, and defects occurring before a machining inspection takes place can be prevented.

*1. Machine learning is possible for engineers with no experience in data science when using Advanced Data Science Tool (sold separately). Advanced Data Science Tool is a software that interacts with iQ Monozukuri Tool Wear Diagnosis for Machine Tools, enabling big data to be utilized on a computer.



Refer to "Product and Solution Introduction" for product details and function comparisons.

iQ Monozukuri Tool Wear Diagnosis for Machine Tools

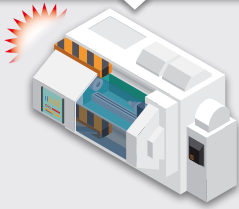
P.50

Case 16

Conducting predictive maintenance on equipment by diagnosing vibration data



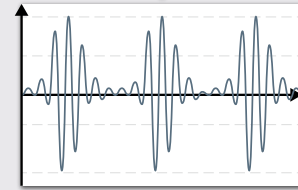
Repairs are made after the failure



Equipment must be stopped and taken apart to identify the faulty area and causes



Not sure how to utilize the vibration data



Solution

The equipment abnormalities can be detected by analyzing and diagnosing the vibration data.



Vibrations can be easily analyzed for predictive maintenance while keeping initial costs low

Diagnose the rotating mechanisms of equipment with minimal knowledge about vibration analysis and diagnosis

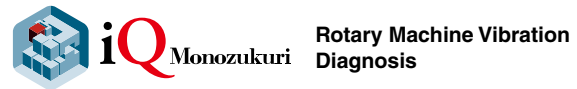


The e-F@ctory Starter Package includes sample projects for the MELSEC iQ-R Series and the GOT2000 Series.

This package enables general vibration analysis, including frequency analysis and vibration intensity monitoring of each frequency band, allowing it to be used for various equipment.

● Suitable equipment

Equipment where changes in vibration when abnormalities occur, such as glass cutting equipment or grinders.



Projects which have been verified to work with MELSEC iQ-R Series and GOT2000 Series are provided as a package.

Simply connect the necessary devices, install the programs and screen data in the package, and detect abnormalities in equipment with rotating mechanisms by making only the necessary settings. The location of abnormalities can also be assessed with a precise diagnosis.

● Suitable equipment

Equipment that can continue to rotate in the same direction for a fixed time, at a fixed speed, and with a fixed load, such as motors, fans, compressors, pumps, reduction and increase drives, conveyors, converting machines (excluding equipment where impact vibrations occur, such as press machines, and equipment that generates vibration due to self-propelled operation, such as AGVs)



Refer to "Product and Solution Introduction" for product details and function comparisons.

e-F@ctory Starter Package

P.48

iQ Monozukuri Rotary Machine Vibration Diagnosis

P.49

Data collection

Visualization

Analysis

Diagnosis

MELSEC iQ-R Series/iQ-F Series CPU module

The CPU module has a data logging function that saves data specified by a dedicated setting tool to the SD memory card inserted in the CPU module.

The saved CSV files can be used to create various materials, such as daily reports, ledgers, and reports, and are effective for data analysis at startup and traceability.



MELSEC iQ-R series

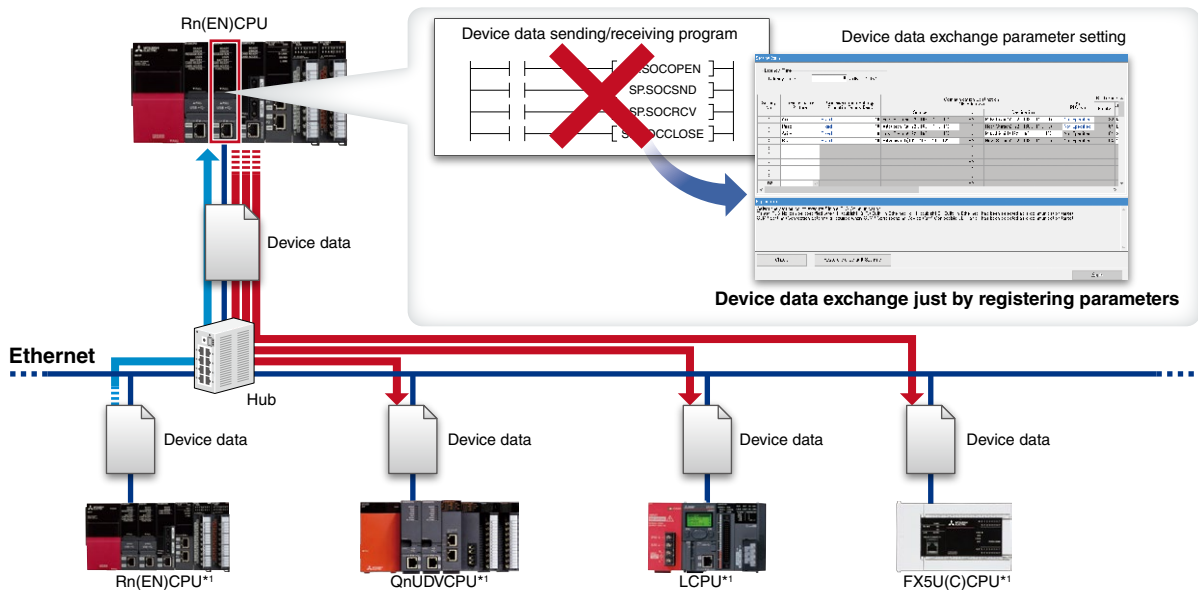
MELSEC iQ-F series



Transfer of device data without programming by Simple CPU communication function

Device data, such as production data, can be transferred without programming with a simple setting on GX Works3.

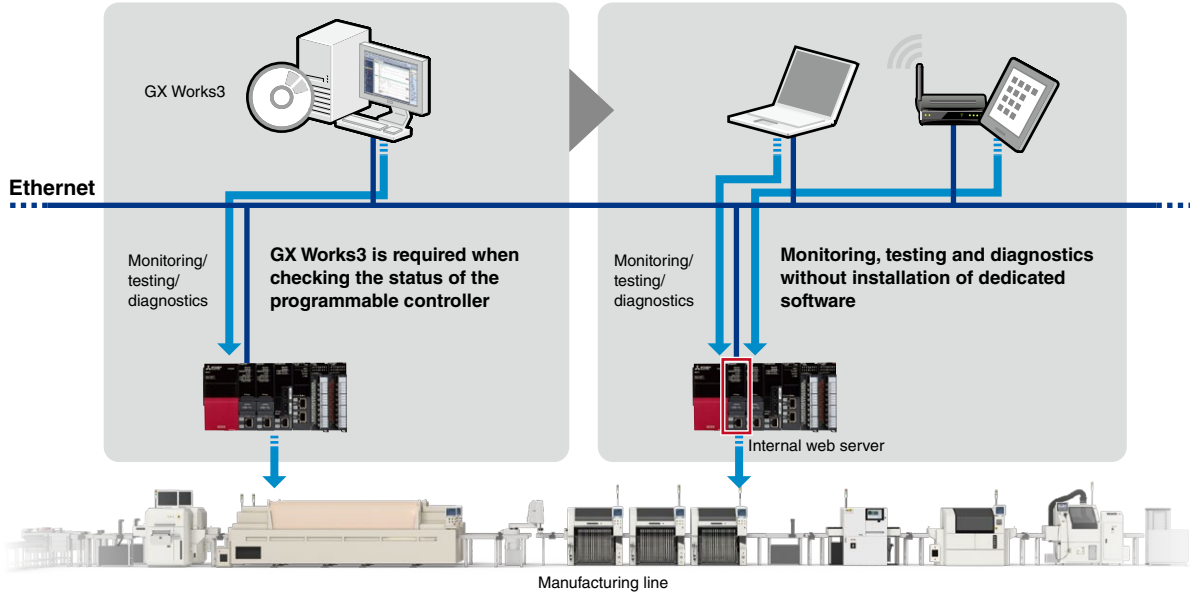
MELSEC iQ-R series can communicate not only with the same series systems but also with existing systems using different series such as iQ-F series, Q series, and L series.



*1. Supported by the embedded Ethernet port only.

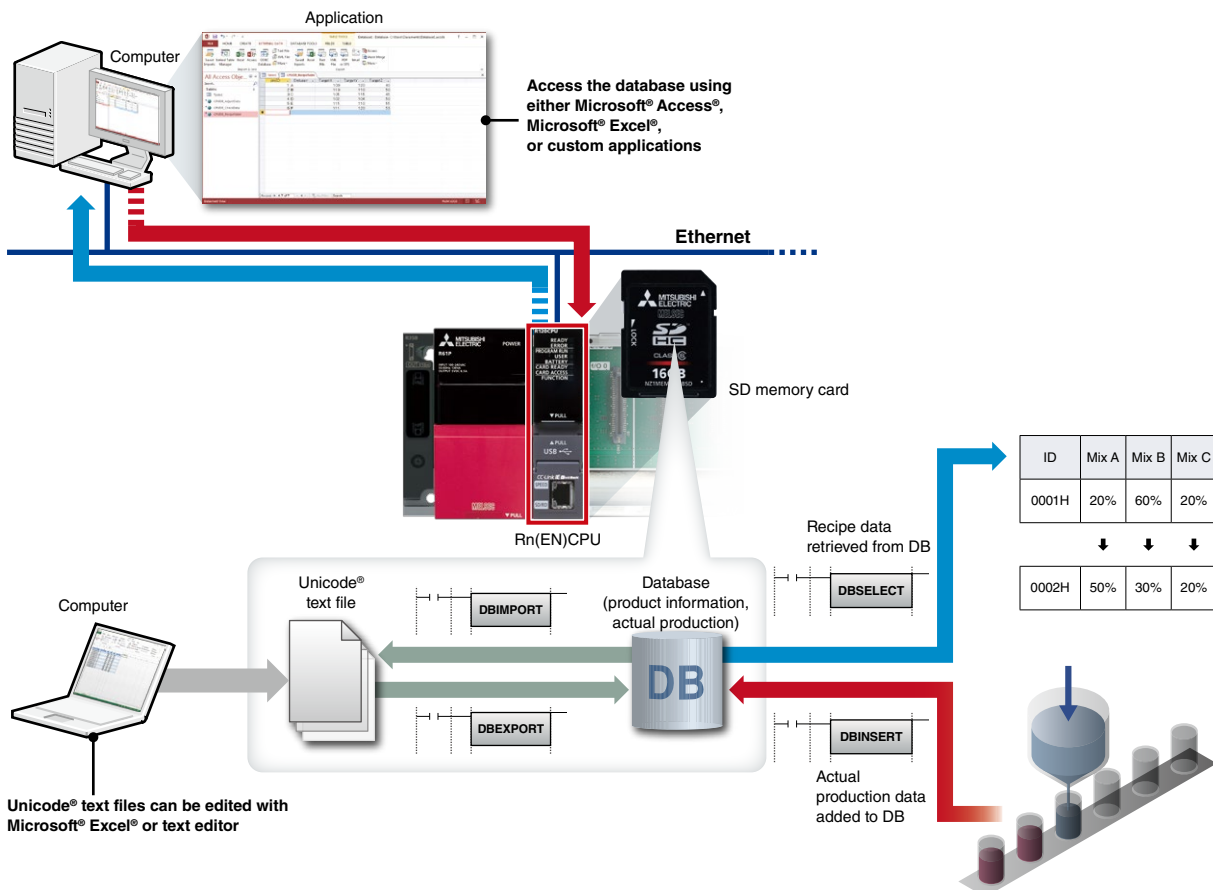
Basic diagnostics utilizing CPU internal web server

CPU diagnostics and device monitoring can be easily done via a web browser on a computer or tablet computer, without requiring to install GX Works3 realizing easier diagnostics when an error occurs.



Data management by an internal database function of the CPU module

The CPU includes an internal database that can be installed into the SD memory card. This feature allows, for example, a selection of database commands that can add/delete/change records to be utilized for simple recipe functions. It is also much easier to import/export Unicode® files for use in spreadsheets. Accessing the CPU internal database data from a computer equipped with Microsoft® Access® or Excel® is also supported. The CPU internal database is especially useful for the food and beverage industry where multiple product variations are produced using the same machine process.

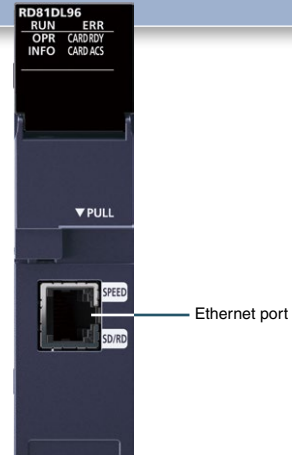


High-Speed Data Logger Module

RD81DL96

File server interaction

Logging various data through production processes enhances shop floor traceability. High-speed data logger modules save logging data in Unicode®/CSV/BIN files and create a wide variety of graphical documents such as reports and ledgers in Microsoft® Excel® files. The module also sends the logging files to server computers (an FTP server or a Windows® shared folder).

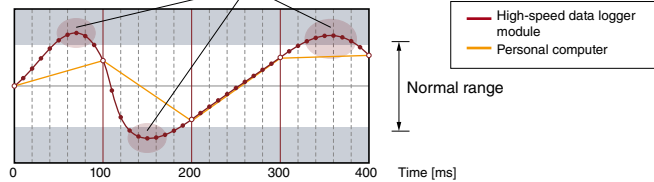


Data logging synchronized with sequence scanning

High-speed data logger modules collect data in each sequence scan and at every millisecond and thus can log any changes in the specified control data.

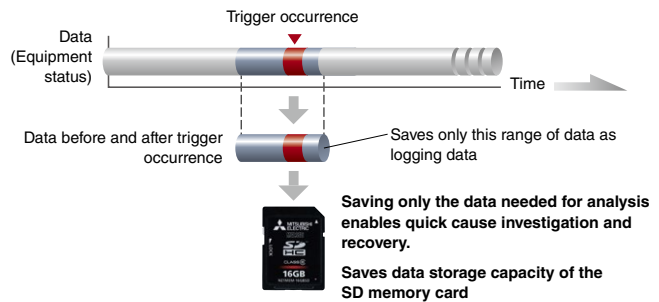
Data collection with the MELSEC iQ-R series high-speed data logger module (High-speed collection function: 0.5 ms at fastest)

Areas where conventional logging has failed to capture the cause of errors



Quick analysis when troubles occur

By narrowing down and extracting only the data before and after the trigger occurrence, quick cause investigation and recovery are enabled.



Contribution to operation and trend analysis and preventive maintenance

Without a ladder program, high-speed data logger modules log the number of times and duration a condition is satisfied.

Having the operation times and duration as data contributes to analyzing the operation status and trends of the equipment and preventive maintenance (life prediction).

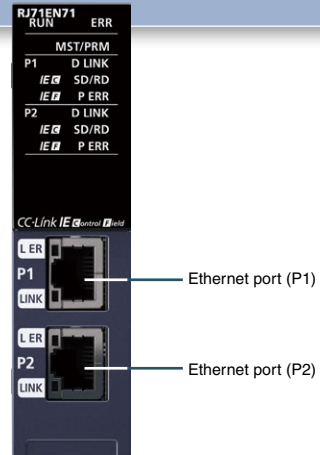
Ethernet Interface Module

RJ71EN71

1 Gbps/100 Mbps/10 Mbps, multiple network type

CC-Link IE Control
CC-Link IE Field

The Ethernet interface module has two communication ports for generic Ethernet, CC-Link IE Control (twisted pair cable), and CC-Link IE Field.

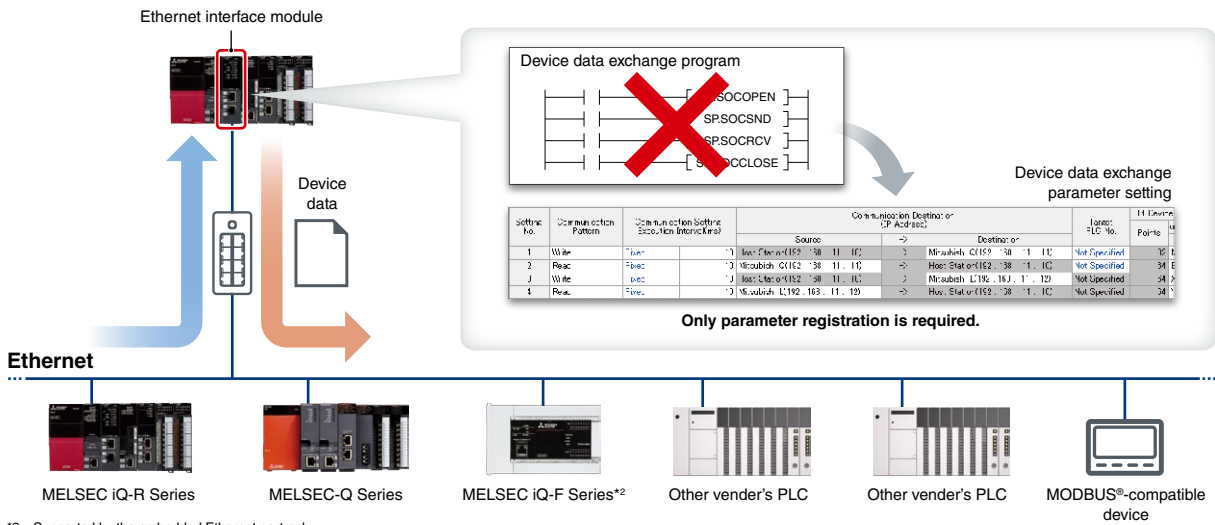


Easy data sharing with other vander's PLC without programs

Communication without a program

- The Ethernet interface module allows device data exchange by parameter registration with Mitsubishi Electric PLC as well as other vander's PLC (simple CPU communication function)*1
- Data collection is easier without changing programs of the existing PLC

*1. For the list of connectable devices, please see the link below.
www.MitsubishiElectric.com/fa/ref/ref.html?k=plcr&pmerit=simple_cpu_com

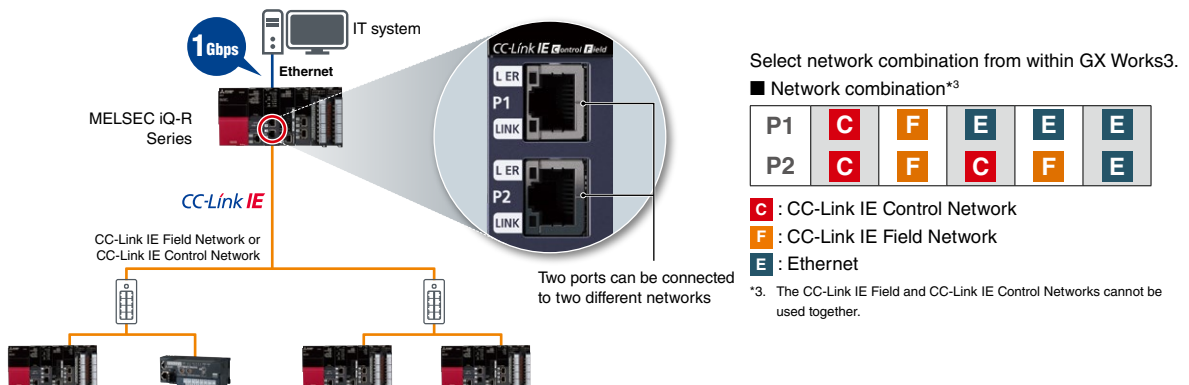


*2. Supported by the embedded Ethernet port only.

Dual Ethernet ports support two networks

Multiple network compatibility

- Equipped with two Ethernet ports, the module enables Ethernet, CC-Link IE Control Network, and CC-Link IE Field Network communications. Different networks can be simultaneously connected to the two Ethernet ports



OPC UA Server Module

RD810PC96

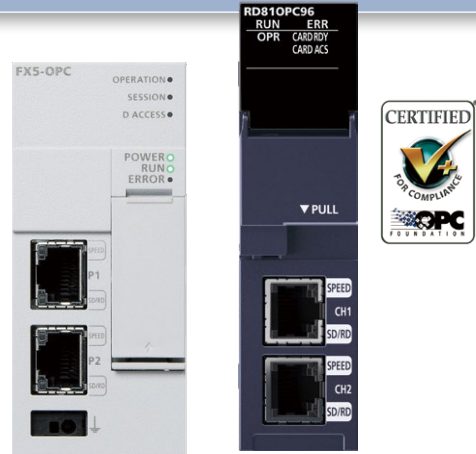
Embedded OPC UA server



FX5-OPC

OPC UA module

OPC UA server module is an embedded OPC UA server that can be connected to the MELSEC iQ-R/iQ-F Series. This module integrates the OPC UA server directly into the equipment control system as a robust alternative to a computer-based configuration. OPC Unified Architecture (OPC-UA) is a platform-independent communications standard developed by the OPC Foundation that ensures reliable and secure data communications between the manufacturing-level and IT-level systems.



Robust security with protection against unauthorized data access

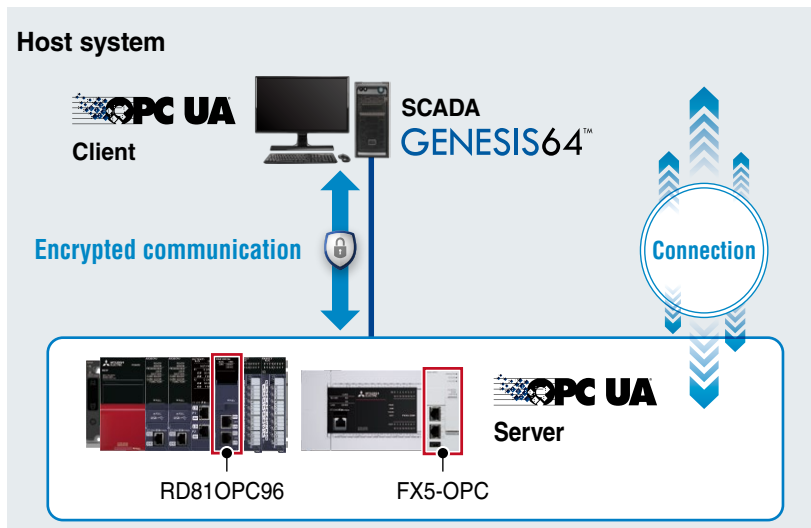
OPC UA security functions such as certificate, encryption, and signature can be set based on system requirements. In addition, RD80OPC96 can further enhance the security level by separating the network between OPC UA server-embedded control system and client IT system.

Configuration of a reliable system by embedded OPC UA server

The OPC UA server module improves reliability by eliminating the requirement for a computer-based server, which can be vulnerable to high security risks such as computer viruses. Less hardware maintenance is required, reducing overall system cost as industrial control systems have a longer product service life compared to computers. Efficient tag data management is available by utilizing data structure format and storage of tag names within the equipment. Necessary data can be accessed easily when configuring a high-level system.

Simple setting of OPC UA tags

Label data of a programmable controller CPU can be registered as OPC UA tags by using the easy-to-use Engineering tool, reducing overall development time.



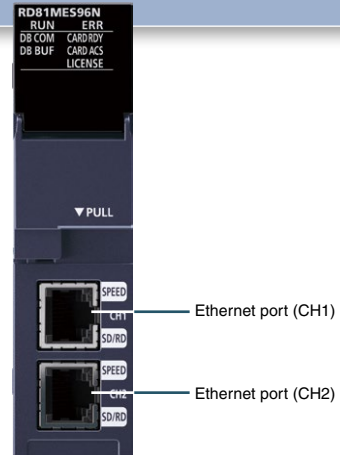
MES Interface Module

RD81MES96N

Database connection

MES Interface modules connect the databases of programmable controller control systems and IT systems, enhancing machine productivity and maintaining manufacturing quality. As SQL*¹ sentences are automatically generated on the wizard-based configuration tool, there is no need to develop dedicated programs to enable communication with the database server. Moreover, as the transfer of large data is available, the takt time and the traceability of equipment are enhanced, meeting the ever-changing manufacturing demands and trends.

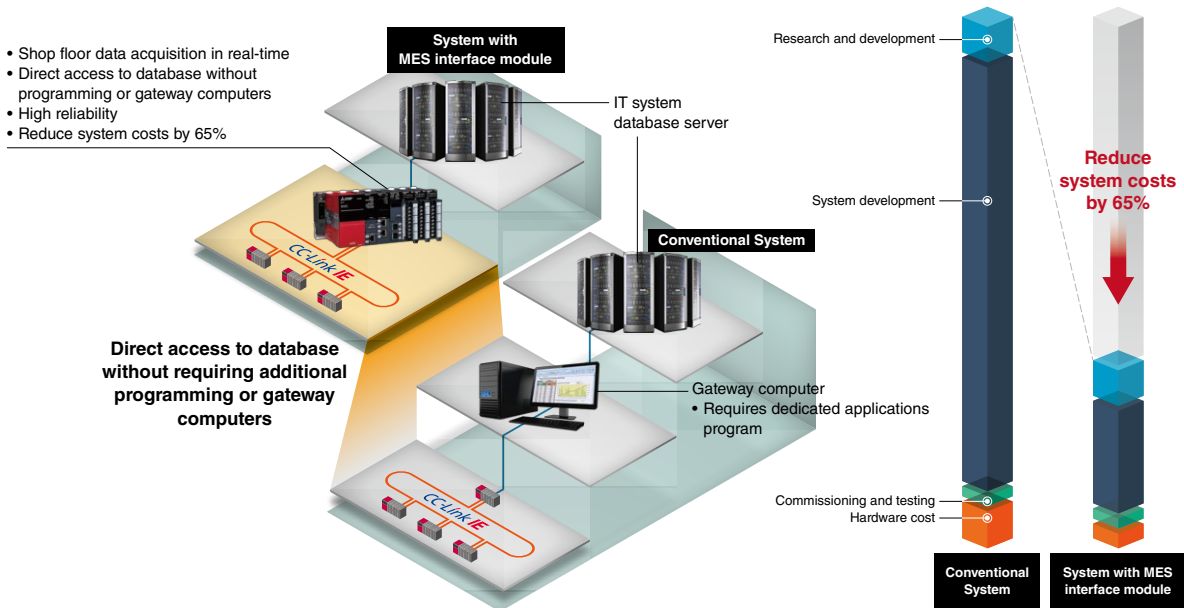
*1. SQL stands for Structured Query Language. It is a programming language designed for carrying out operations for relational database.



65% reduction in system configuration costs*²

MES interface modules enable direct connectivity between IT database servers and PLC on the shop floor, eliminating the need for gateway computers or specified programs. Being much more reliable than computers, the MES Interface saves on maintenance costs typical of computers.

*2. Assumption based on a typical control architecture.



C Controller Module/C Intelligent Function Module

R12CCPU-V

Memory: 256 MB

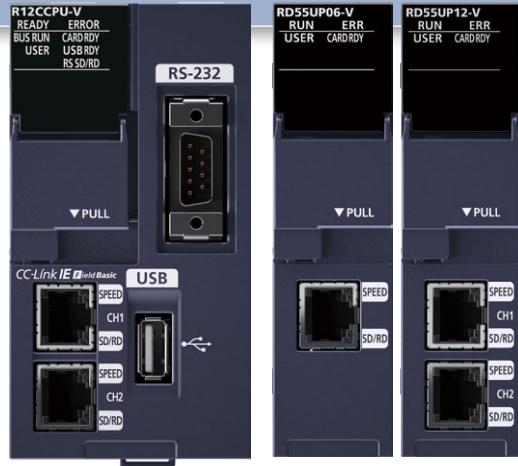
RD55UP06-V

C/C++ program execution, RAM: 128 MB

RD55UP12-V

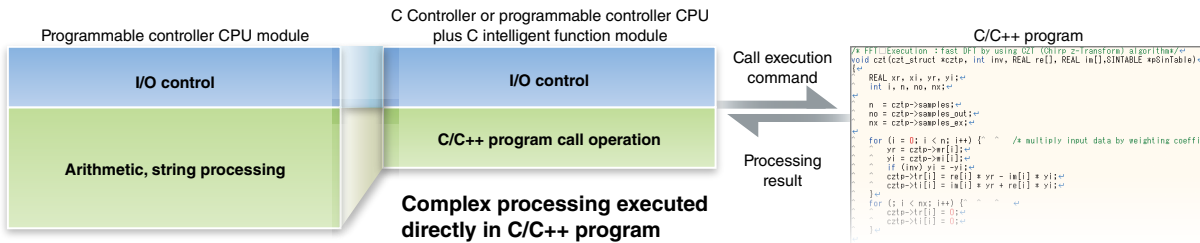
C/C++ program execution, RAM: 1 GB

By cooperating with programmable controller CPUs, C intelligent function modules can achieve function expansion and IoT. Control processing is executed in the programmable controller CPU and information processing in the C intelligent function module, performing higher processing abilities and functions than the programmable controller CPU doing both tasks independently. Being supported by several operating systems, C intelligent function modules can run Linux® (used for application development) and VxWorks® (used for precise data analysis), making operations such as complicated processing and protocol conversion viable based on system requirements.



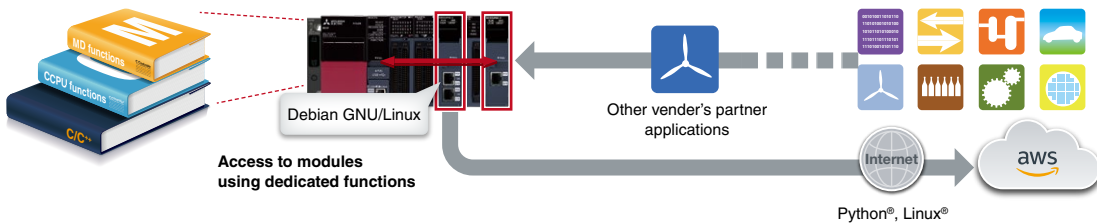
Complicated processing assisted by C/C++

Although I/O control is an easy-to-configure ladder program, it takes development time and requires appropriate maintenance to process complicated technical computing and strings. On the other hand, C intelligent function modules have a better performance on executing C/C++ programs and interrupt processing than ladder programs. Besides, the configuration of a complicated ladder program can be assisted by C/C++, reducing the overall capacity of the program and allowing the complicated program to be created in an easier way. In addition, using the C intelligent function module on the processing part of a ladder program can prevent leakage of technology.



Linux®/VxWorks®-supported for various system configurations

Dedicated functions and communications libraries are provided, enabling access to the control system modules. In addition, various partner applications are available, supporting different manufacturing equipment features. 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 other vendor cloud services.



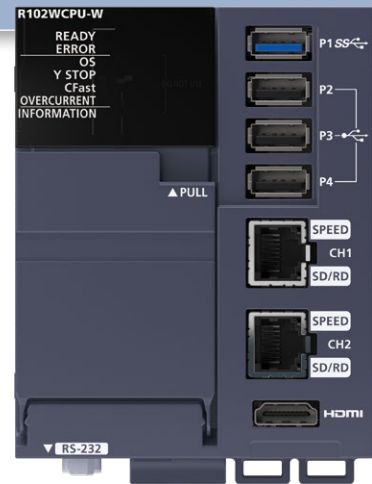
WinCPU Module

R102WCPU-W

Windows® application interaction

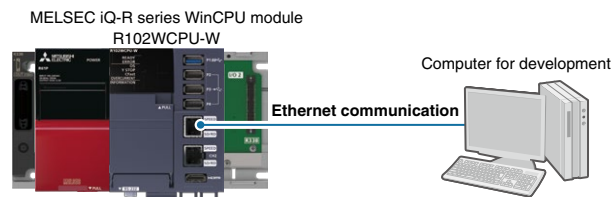
WinCPU modules operate Windows® OS on the MELSEC base unit. Previously, linking a CPU unit with a Windows® application required a personal computer with Windows, but with the WinCPU modules, a personal computer is no longer necessary.

The WinCPU modules come with the Edgexross basic software pre-installed.



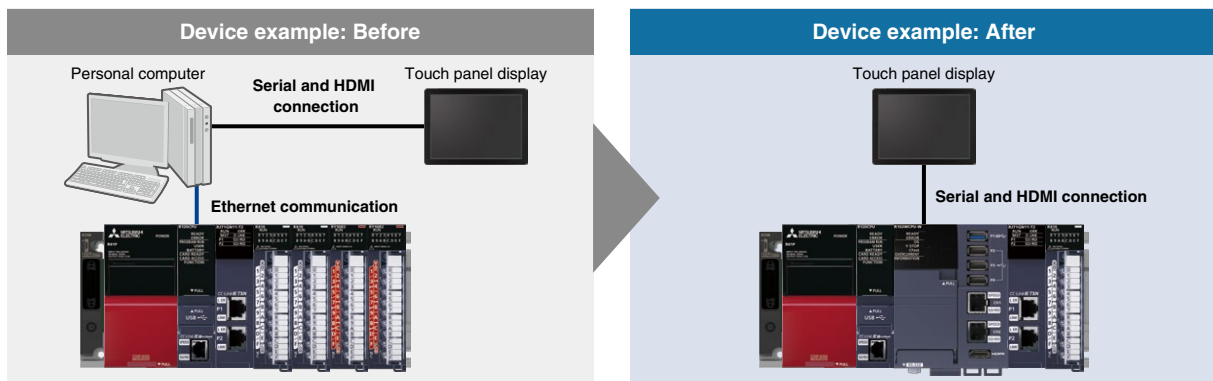
Utilization of the Windows® development environment

Using Visual Studio®, which is the Windows® development environment, enables information processing and display on PLC.



Operation with only a programmable controller

Operation with a programmable controller and a personal computer can be integrated into the programmable controller, enabling the conventional Windows® assets to be utilized.



CC-Link IE TSN Master/Local Module

RJ71GN11-T2

1 Gbps/100 Mbps, master/local station

CC-Link IE TSN master/local modules support control communication that requires real-time performance and TCP/IP communication and allow both communications simultaneously, maximizing the performance and functionality of CC-Link IE TSN.

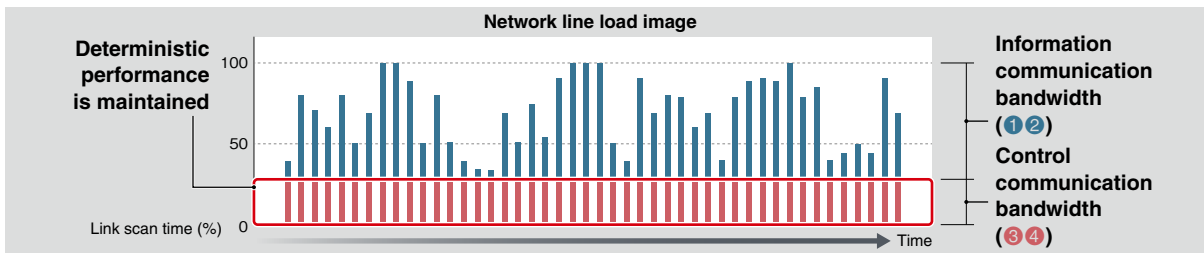
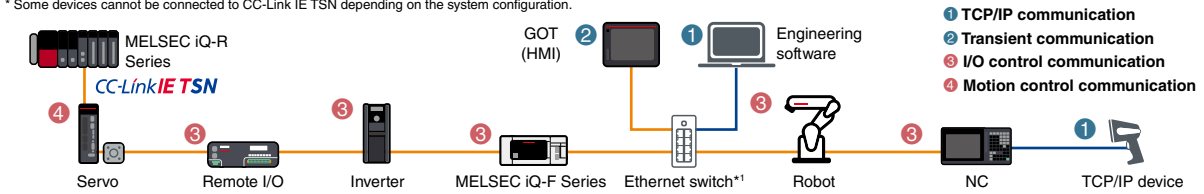


Deterministic control even when mixed with TCP/IP communication



- Deterministic performance of cyclic communication is maintained even when mixed with slower information data (non real-time)
- TCP/IP communication devices can be used without affecting overall control

* Some devices cannot be connected to CC-Link IE TSN depending on the system configuration.

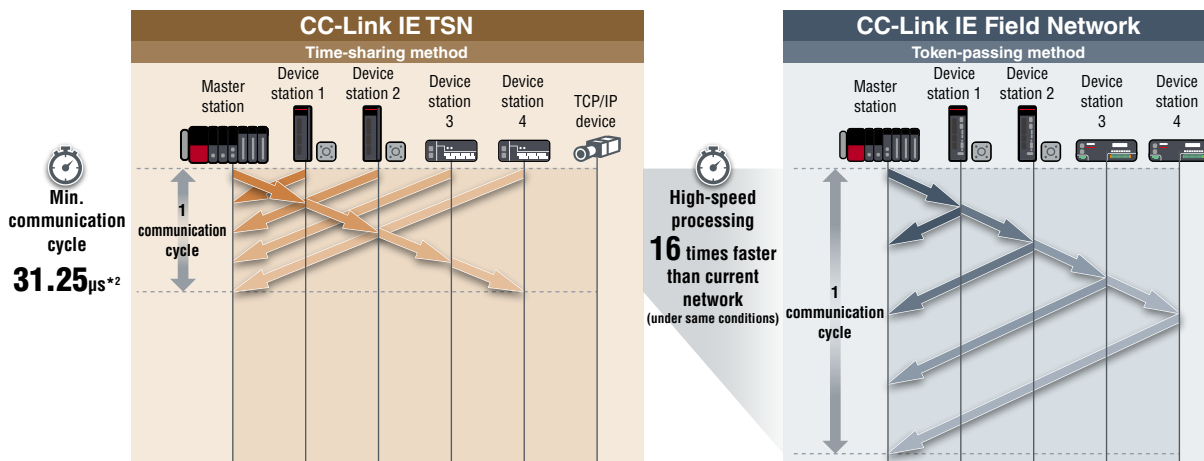


*1. Class B managed Ethernet switch supporting CC-Link IE TSN recommended by the CC-Link Partner Association

Reducing overall operating time with high-speed link scan



- The advanced protocol built into CC-Link IE TSN is complemented by the time-sharing method functionality that enables simultaneous communications between network stations
- Fast communication cycle time of just 31.25 μs*2 and high-speed processing 16 times faster than current network performance are achieved, resulting in high-speed and high-accuracy motion control
- Productivity is simultaneously improved owing to a substantial increase in control performance, which reduces overall operating time and enables high-speed and large capacity data communication



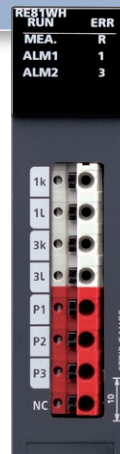
*2. This value is achieved when fast operation mode of the motion module (RD78GH) is used. For details, please refer to the "MELSEC iQ-R Motion Module User's Manual (Application) (IB-0300411ENG)".
 *3. Comparison with CC-Link IE Field Network Motion
 *4. Comparison with CC-Link IE Field Network

Energy Measuring Module

RE81WH

Energy measuring

The energy measuring module is ideal for energy saving, facility monitoring, and quality control at the shop floor. Improved productivity of both equipment and the production line can be achieved by synchronizing the monitoring of consumed energy and specific energy consumption management with the control program.

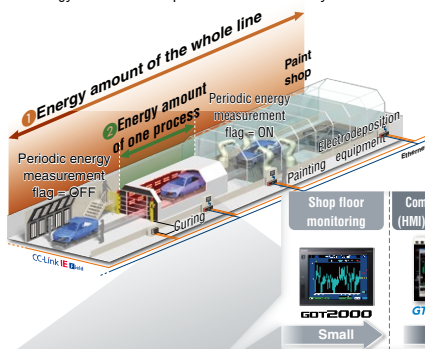


Contribution to energy consumption and productivity improvement of the product line by energy measurement synchronized with the control program

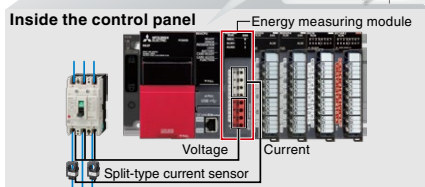
Managing both energy amount and production data (production volume, non-defective volume, etc.) of the facility realizes specific energy consumption management according to model and process. By visualizing the points where specific energy consumption are deteriorating, problems at shop floor can be detected in real time, allowing operation improvement. The energy consumption during production and non-production can be collected by turning on the measurement flag during production using the periodic electric energy measurement function. Monitoring wasteful standby energy during non-production helps to realize energy saving.

Automotive manufacturing line

Capable of measuring the "1 energy amount of the whole line" and "2 energy amount of one process" simultaneously



1. Collecting the energy consumption and standby energy of each process such as electroplating, painting and curing
2. Productivity improvement through specific energy consumption*1 management of each process
3. Enhancing equipment fault monitoring and traceability by monitoring fluctuation of current, voltage, frequency, etc. of paint robots
4. Quality control by detecting heater disconnection (current measurement, etc.) during curing process
5. Equipment fault monitoring by monitoring the currents of auxiliary equipment (exhaust fan, pump, etc.)



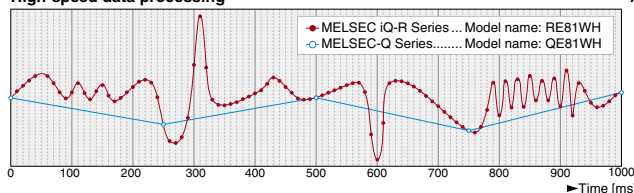
*1. The specific energy consumption is a numerical value displayed by "dividing energy consumption by production volume," which is one type of index that measures energy productivity.

Faster data measurement refresh cycle (10 ms)

Energy measuring modules are capable of detailed energy measurement for individual production equipment. Using only one module, highly detailed information such as electric energy (consumption and regeneration), reactive energy, current*2, voltage*2, electric power, power factor, frequency, harmonic current, and harmonic voltage can be measured. With constant current monitoring of motors and other devices, it is possible to avoid line stoppages and downtime; thereby reducing delivery time issues due to production stoppages as well as maintenance related labor and costs. Moreover, by detecting abnormal voltage or current in manufacturing equipment and removing products manufactured during the time of abnormality, shipping defective products can be prevented.

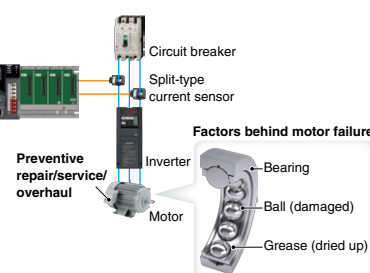
*2. Waveform data for current and voltage can also be obtained.

High-speed data processing



Alarm status confirmation/ alarm occurrence record Trend analysis

- Recording of maximum and minimum values
- 2 types of upper/lower-limit alarm monitoring
- Alarm status is stored in buffer memory, eliminating complex ladder programming



System Recorder

MELSEC iQ-R Recorder/ Camera recorder Module is a dedicated logging module for Mitsubishi Electric's "System Recorder" post-maintenance solution, which significantly reduces machine downtime through "complete recording" and "easy analysis" of system operating status during error occurrence.

Data from before/after certain preset triggers can be scanned every time and collected with timestamps. When setting recording, there's no need to worry about the target for data collection, and swift recovery is supported.



System Recorder Using Recorder/ Camera recorder module (post-maintenance solution)

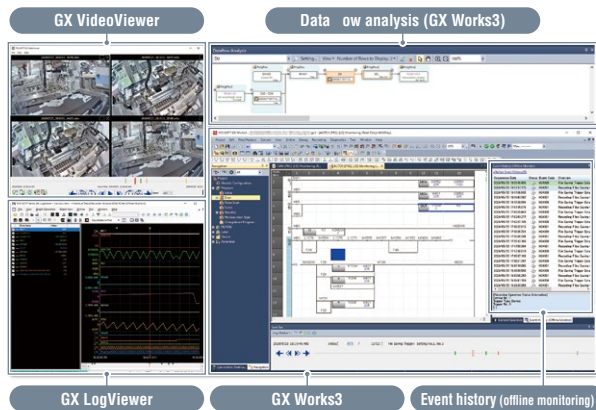
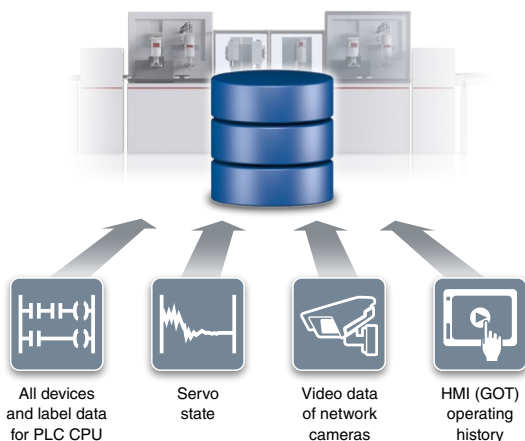
Significantly reduces machine downtime with "complete recording" and "easy analysis" of system operating status during error

Complete recording

- Complete recording of all data required for error analysis
- Complete system recording
- Complete prolonged recording

Easy analysis

- Display all data on the same timeline
- Expresses influencing factors in straightforward terms
- High-productivity programs also offer speedy solutions



Complete recording

When problems arise for equipment with multiple devices, it is necessary to find out the facts before and after such an occurrence (when, where, and what happened) in order to recover normal operation.

Mitsubishi Electric's system recorder can record the entire process condition and offer an operations log for control data of multiple equipment and devices, allowing the reproduction (or playback) of the process offline, helping to highlight and show the actual cause of failure.



Want to record video and data

Recording function (MELSEC iQ-R Series)

- **All device/label logging per sequence scan**
Recorder Unit exhaustively records changes in all devices/labels
- **All labels/FB logging of the PLC**
Unconsciously records all device addresses/system configurations
- **Event history**
Records device/label operations from external devices
- **General-purpose network camera video**
Records visual information such as work behavior and user's behavior

Also want to record drive system conditions

MELSERVO-J5 Series/MELSEC iQ-R Series Motion module

- **All device/label logging per sequence scan**
Timestamped and accurate recording of motion control data that operates faster than a PLC scan

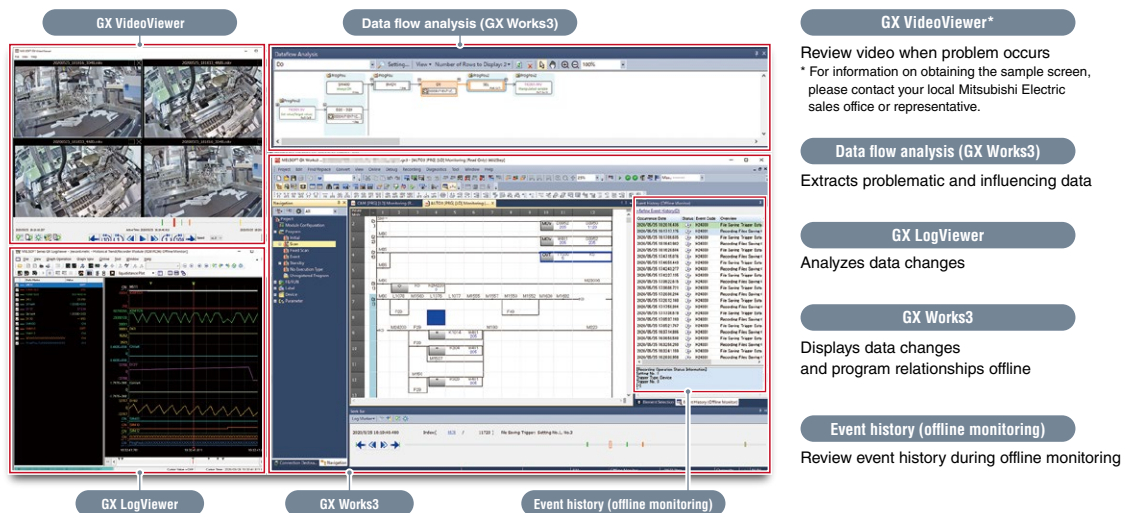
Also want to record users' operations

GOT2000 Series

- **Records HMI (GOT) operation history and alarm history**
Records operation history of shop floor workers and alarm information for connected devices

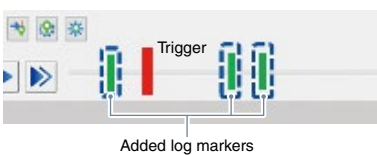
Easy analysis

The collected data through complete recording (recording file) can be reproduced offline together with program operation transition. Moreover, by confirming data together with camera video footage, this function enables marking of potentially problematic points (time of error occurrence) from the video. The reviewer can share the equipment conditions at the marked time with shop floor workers, maintenance personnel and designers, thus smoothly communicating to ensure everyone has the same understanding of the error occurrence status from vast amounts of video data and, ultimately, easily identifying the cause of the error.



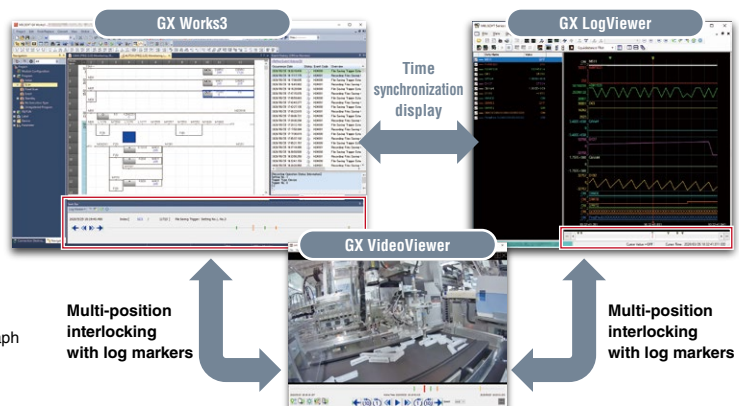
Conceptual Image of Function

- 1 Use the "Add Marking" button to add log markers to points requiring attention



- 2 Share points requiring attention between tools

- GX Works3** Circuit monitor toolbar
- GX LogViewer** Top of waveform display graph
- GX VideoViewer** Video display seek bar



Industrial Computer MELIPC Series

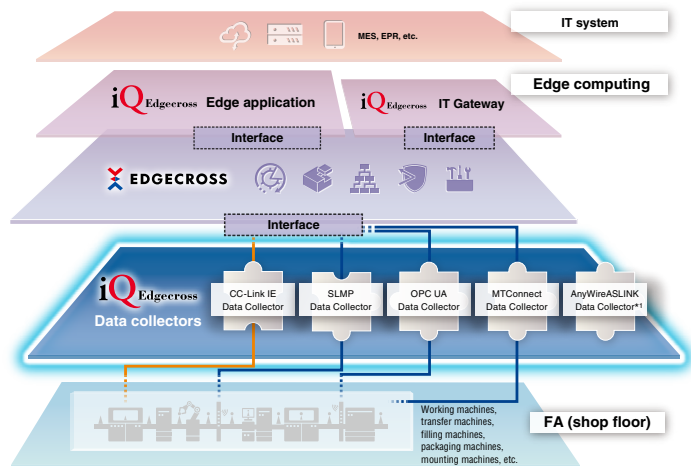
The MELIPC Series realizes “real-time control” for device control and “Edge computing” enabling data collection/analysis in the middle level between the IT system and shop floor. A wide range of products from a high-end model supporting CC-Link IE Field Network capable of high-performance processing and high-speed communications to simple and compact range models are available. The MELIPC corresponds with requirements such as real-time control, preventative maintenance, and quality improvement on the shop floor, contributing to productivity enhancement through utilization of production data.



Data Collector

Data collector is software that collects data for Edgexross from machines and devices supporting different FA networks.

Data collector can connect to various FA networks, enabling data collection from existing equipment and various devices without programming.



*1. For details on the AnyWireASLINK data collector, visit the following website:
<https://www.anywire.jp/en/anywireaslink/>

Data collection and utilization across networks

The MELIPC series with pre-installed Edgexross Basic Software, using various data collectors, utilizes real-time data and interacts with IT systems by collecting data from shop floor.



List of Mitsubishi Electric data collectors compatible with MELIPC

Item	MI5000	MI3000	MI2000	MI1000
CC-Link IE Field Network Data Collector (For MELIPC MI5122-VW)	●	-	-	-
CC-Link IE Field Network Data Collector*2	-	●	●	-
CC-Link IE Controller Network Data Collector*2	-	●	●	-
CC-Link IE TSN Data Collector	●	●	●	●
SLMP Data Collector	●	●	●	●
OPC UA Data Collector	●	●	●	●
MTConnect Data Collector	●	●	●	●

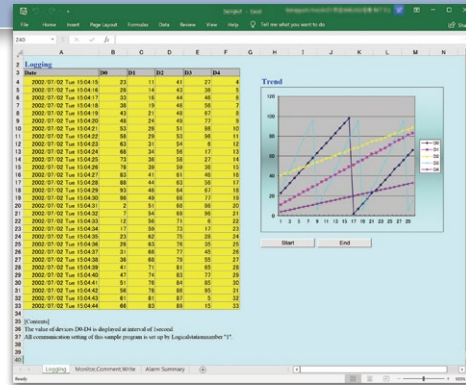
*2. The network interface board by Mitsubishi Electric is required separately.

MELSOFT MX Sheet

MX Sheet is software that monitors, logs, collects alarm data, and changes setting values of PLC and Motion controllers using the familiar Excel® forms.*1

Operation can be easily set up on the Excel® file without programming. Production/operation/error status can be checked on Excel® files, easily implementing IoT in your system.

*1. To use MX Sheet, MX Component is required.
A value-priced set (MX Works) is available, including MX Sheet and MX Component.



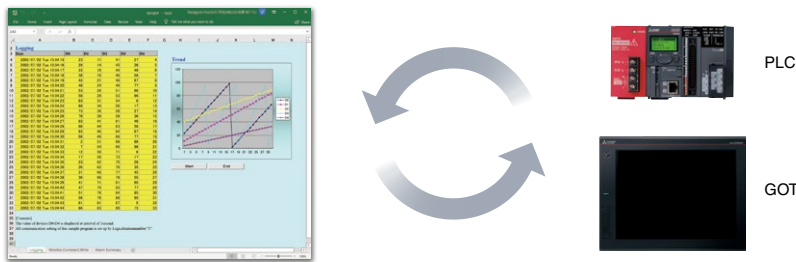
Easy setting without programming

All the settings to operate MX Sheet can be easily configured from Excel® menus. MX Sheet enables communications between PLC and Excel® without programming.



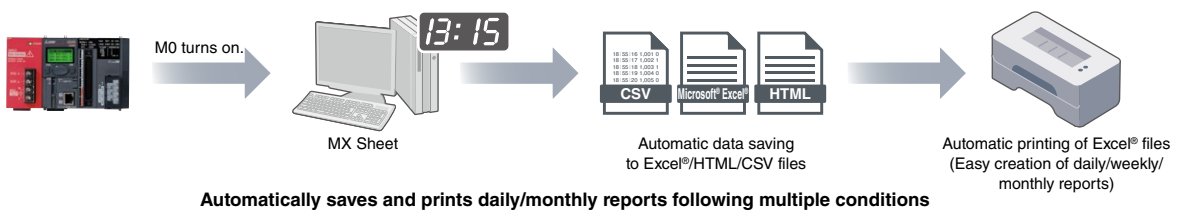
Direct connection between offices and shop floor

MX Sheet monitors and logs the device data in PLC in real time and exports the data to Excel®. MX Sheet also transfers recipe data to the PLC.



Automatic creation of daily reports and ledgers

The displayed data on Excel® is automatically saved/printed at a specified time or based on a trigger condition of PLC. Creating daily reports or test result lists can be automated.



Excel® 64-bit version supported

MX Sheet supports Excel® 64-bit version. (Use MX Sheet with version 3 or later.)

GX LogViewer

SW1DNN-VIEWER

Visualizing production process

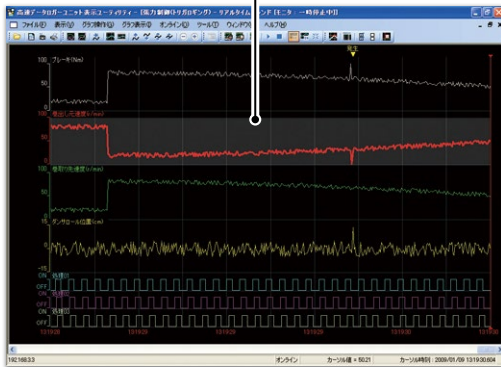
GX LogViewer is a tool to display and analyze large-volume collected data with a simple operation. This tool is useful to find an error cause and improve the availability of your system.



Visual display of collected data

Collected data are displayed in clearly visualized formats, increasing the efficiency of data checking.

Check changes in data easily.



Trend graph display
Displays collected data by a data logging function in a graph

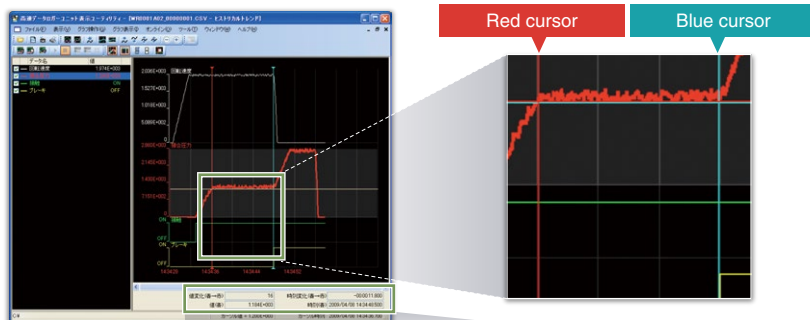
Check the events occurred and recovery history.



Event list display
Displays collected data by an event logging function in a list

Instant view of data changes (multiple cursor function)

Two cursors show the data changes within a specified time with a simple operation.



値変化(青→赤)	16	時刻変化(青→赤)	-00:00:11.800
値(青)	1.184E+003	時刻(青)	2009/04/08 14:34:48.500

Quickly check the change in value and time between the cursors

HMI GOT

GOT2000

Graphic Operation Terminal

GOT enables visualization of shop floor

The GOT2000 has a variety of monitor functions and is easy to operate. The GOT2000 can also be connected to various FA equipment at shop floor, improving visualization accessibility and reducing total cost of ownership.



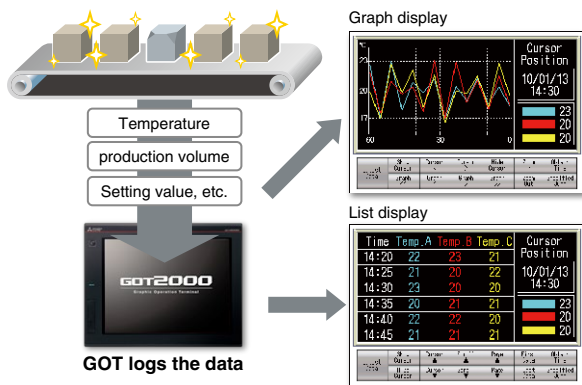
Confirmation without a personal computer of logging collected data at the shop floor

● Logging function

GT27 | GT25 | GT21 | GT SoftGOT2000

GOT collects the data from PLC and temperature controllers, logging and displaying the collected data in a graph and list. You can check the data which was collected when an error occurred to identify and analyze the cause of the error.

* Excluding T2104-PMBLS and GT2103-PMBLS

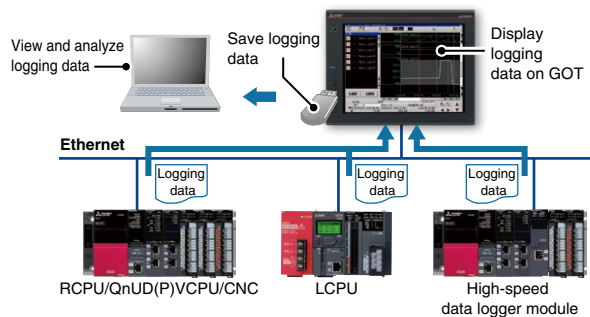


● Log viewer function

GT27 | GT25 | GT21 | GT SoftGOT2000

GOT displays the logging collected data by the data logging function of programmable controller CPUs.

The logging data can be copied to a USB memory device attached to a USB interface on the front (or the backside) of the GOT. It reduces the need to remove a memory card from a CPU or high-speed data logger module to retrieve the logging data.



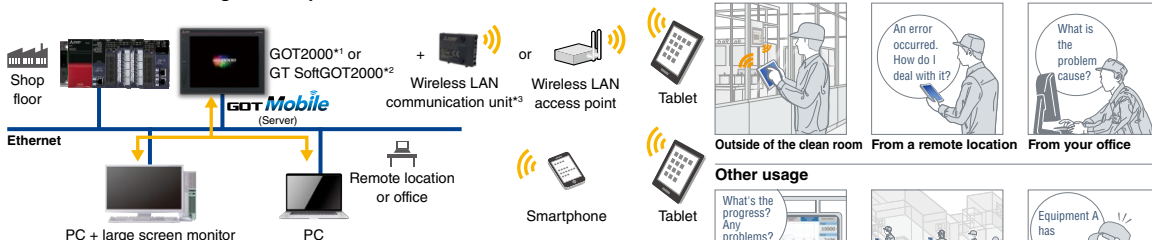
GOT Mobile function GT27 *1 | GT25 *1 | GT21 | GT SoftGOT2000 *2



Use a web browser on tablets to check the equipment status from a remote location.

Multiple*1*2 information devices (clients) can simultaneously access GOT so that you can view and operate a different screen on each device.

Simultaneous monitoring on multiple*1*2 information devices



*1. If the GOT Mobile server is GOT2000 (GT27, GT25), up to five information devices can monitor a single GOT simultaneously.

A separate GOT Mobile function license (GT25-WEBSKEY-□) for GOT2000 is required.

*2. If the GOT Mobile server is GT SoftGOT2000, up to 15 information devices can monitor a single GT SoftGOT2000 module simultaneously.

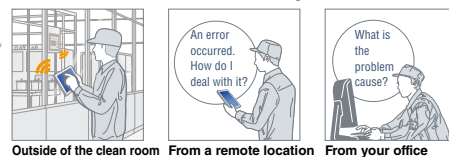
A separate GOT Mobile function license (SGT2K-WEBSKEY-□) for GT SoftGOT2000 is required.

*3. The wireless LAN communication unit cannot be used with GT2505, GT25 handy, or GT SoftGOT2000. A separate access point is required.

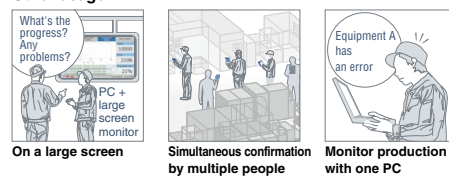
■ Safety Precautions

When using the remote control function, ensure the safety of the field site by being prepared to handle unexpected situations such as communication delays and interruptions.

Check the status of the worksite using a web browser.



Other usage



GT SoftGOT2000

GT SoftGOT2000

Make visualization of production accessible

GT SoftGOT2000 is the HMI software that runs on personal computers and panel computers. It enables monitoring of shop floor FA equipment from personal computers and panel computers in a remote location.

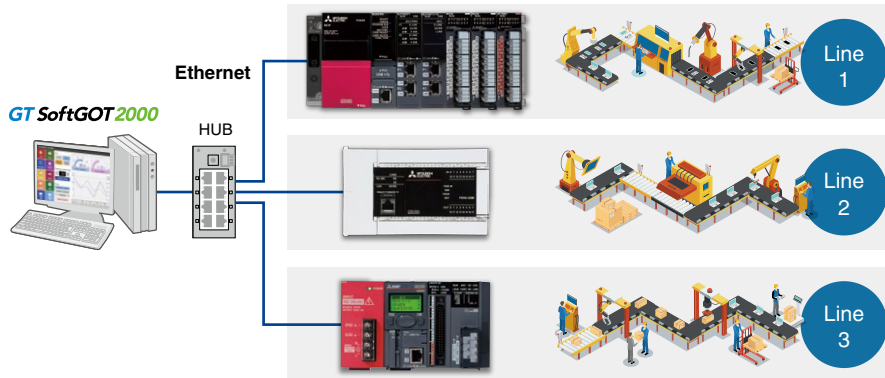
* GT SoftGOT2000 is software included in GT Works3. A separate license key (GT27-SGTKEY-U) must be installed during use. For the details, contact your local sales office.



GT SoftGOT2000 license key (for USB port)

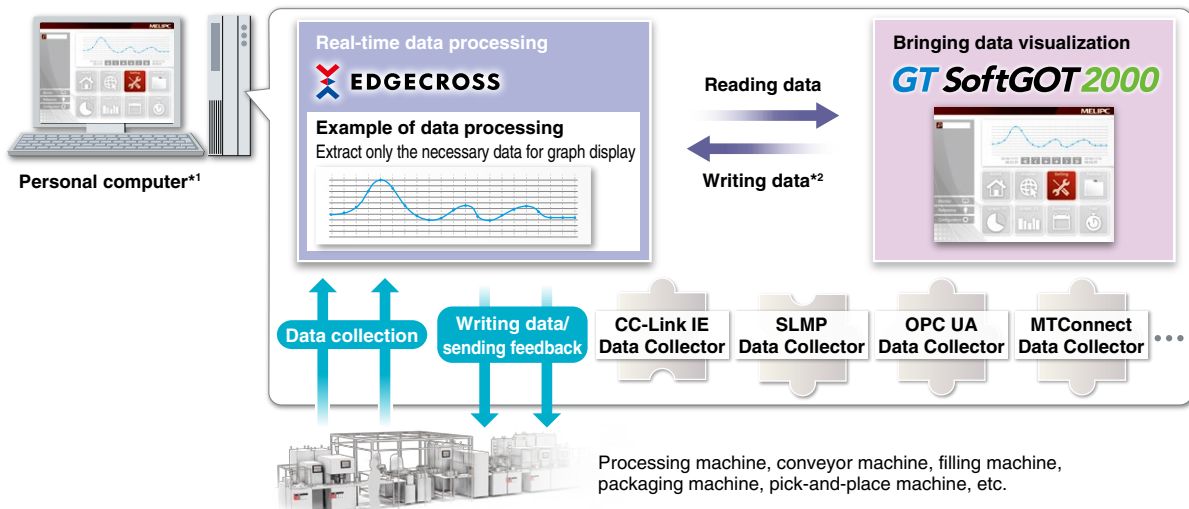
As a remote monitoring tool from your office

Various information on the shop floor can be checked on a personal computer in your office. Using multiple modules of GT SoftGOT2000 or connecting a single module of GT SoftGOT2000 to more than one device via a multi-channel connection enables a monitoring system for multiple lines.



Visualization of shop floor information by interacting with Edgecross

Edgecross is the open software platform in Japan in the edge computing field that coordinates factory automation and IT systems. Edgecross analyzes and diagnoses data near the shop floor, enabling various functions such as real-time feedback, data collection, and data transmission/reception to/from facilities and equipment regardless of vendors or network types. The collected data by Edgecross can be easily visualized and analyzed using various functions such as trend graph display on GT SoftGOT2000.



*1. Edgecross Basic Software, Data Collector, and GT SoftGOT2000 need to be installed on a personal computer.

*2. MELSOFT GT OPC UA Client software needs to be installed in order to write data from GT SoftGOT2000 to Edgecross Basic Software.

iQ Monozukuri Process Remote Monitoring



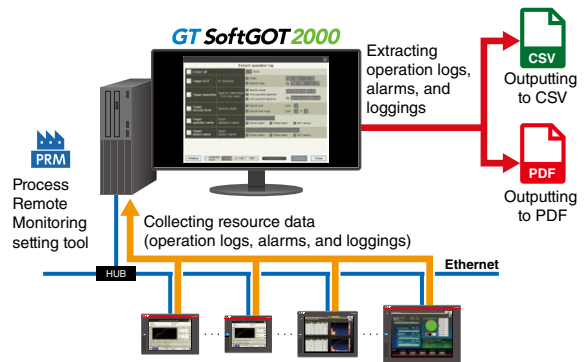
Easily introduce IoT technologies to the shop floor

iQ Monozukuri Process Remote Monitoring is an application package to easily introduce IoT technologies to the shop floor, collect and visualize information of multiple devices, and collectively manage the information. Manufacturing process and productivity of the whole production can be improved by analyzing the data displayed on GT SoftGOT2000. The operation status of the shop floor and the information such as operation logs and alarms can be collected from each device via an shop floor GOT.



Collecting and managing resource data of multiple kinds of equipment in a batch

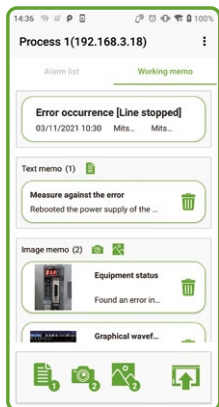
Resource data of operation logs, alarms, and loggings collected with GOTs on each equipment can be collected and managed in a batch. By extracting information that matches conditions such as date or operators from the stored data and outputting the information to a CSV file or a PDF file, the tendency of alarms can be analyzed.



Enabling the sharing of site information using the mobile app Pocket GOT

Working memos and site photos made using the mobile app Pocket GOT can be saved to a GOT. The data can then be collected and displayed using iQ Monozukuri Process Remote Monitoring on a personal computer, allowing all comments made by operators to be checked, and reports to be created and managed remotely.

Pocket GOT: working memo screen

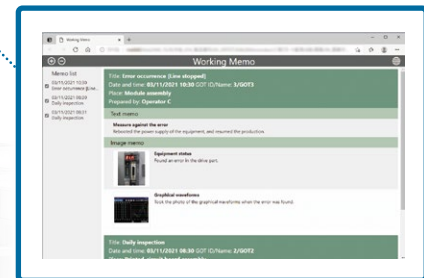


(2) Mobile app Pocket GOT

Share information using Process Remote Monitoring



Process Remote Monitoring: working memo check screen



(1) Mobile terminal (OS: Android™)
Enter working memos on mobile terminal



(8) Wireless LAN communication unit



(3) GOT2000



(7) SD memory card



(4) iQ Monozukuri Process Remote Monitoring license
(5) Personal computer
(6) GT SoftGOT2000

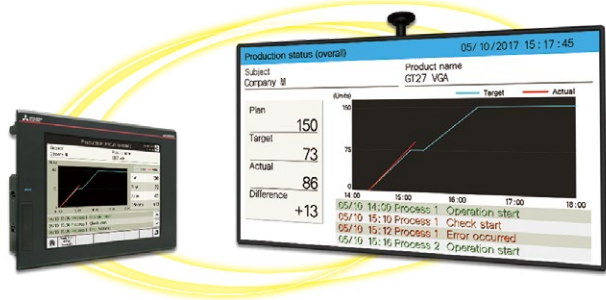
iQ Monozukuri ANDON



Improve productivity by sharing information between workers

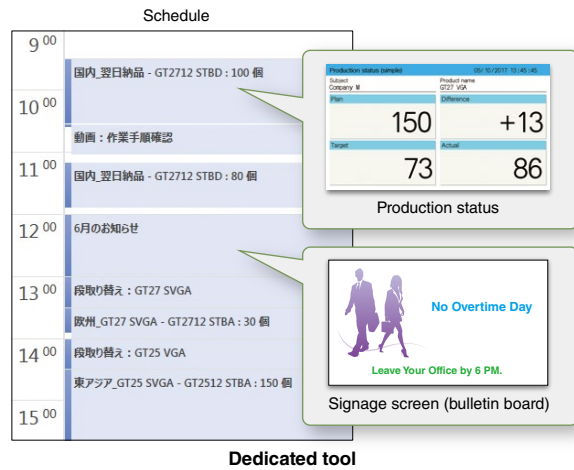
This simple ANDON package easily enables visualization of shop floor using GOT2000.

Information obtained from production equipment is displayed on the monitor for ANDON via GOT2000, allowing sharing of the shop floor information to enable visualization.



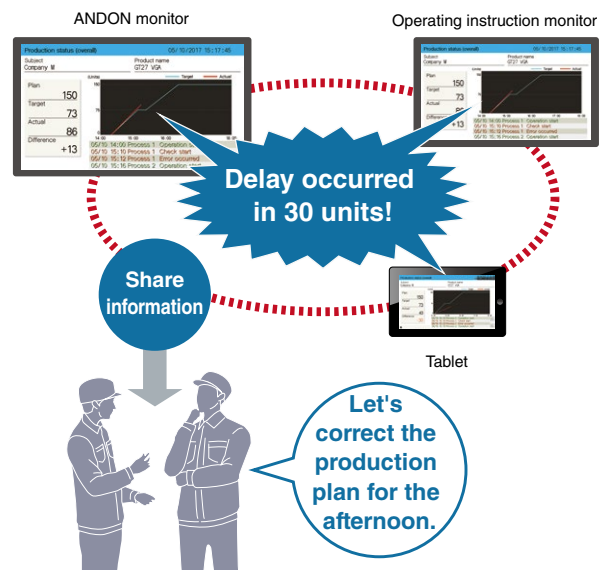
Easy system configuration without technical knowledge of ANDON

With various template screens and dedicated tools for easy setup, the ANDON system can be configured without technical knowledge.



Smooth operation with information sharing

By sharing information among site workers, the site manager, and the maintenance personnel at the office, operation processes can be reviewed and corrected smoothly in the event of a problem.



SCADA GENESIS64™

GENESIS64™

SCADA GENESIS64™ is an IoT platform that unitarily manages FA and IT data and monitors and analyzes various data. SCADA GENESIS64™ provides the most suitable monitoring integration solutions for customers' needs, such as factory automation, smart building, and social infrastructure system.



Concept

● CONNECT

GENESIS64™ supports industry-standard open protocols such as OPC™ and MODBUS®, making connection with a variety of devices easy.

In addition, since it can be read and written with various general-purpose databases, GENESIS64™ greatly contributes to the integration of FA and IT systems.

* Edgexcross enables connection to more devices.

● VISUALIZE

Secure, real-time visualization on any device is critical to keeping operations running smoothly. GENESIS64™ scales from desktops to browsers, tablets, smartphones, and wearable devices.

● CONTEXTUALIZE

Asset-based organization and navigation facilitates data normalization, comparisons, and situational awareness to get to the root cause quicker through contextualized and actionable information.

● DATA UTILIZATION

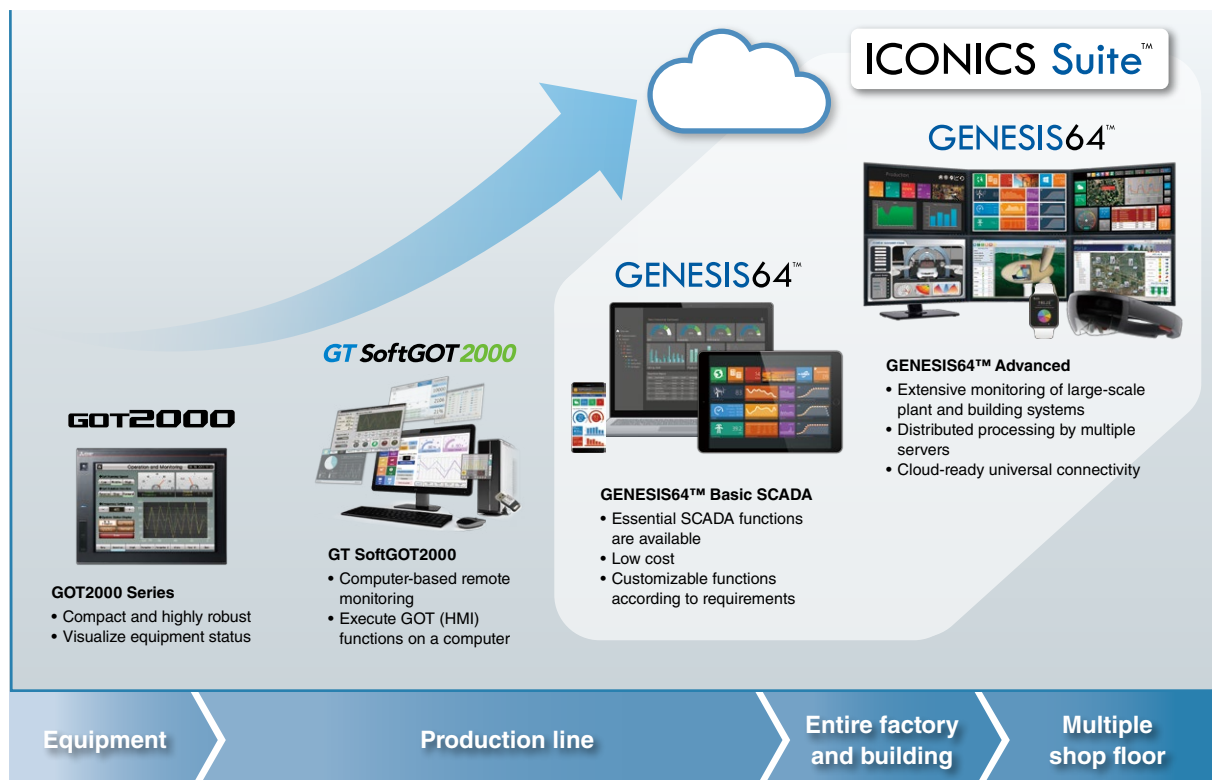
Improve operational productivity and quality with interactive analytics. Industry applications include OEE*¹, SPC*², energy, and fault detection to provide insight from edge to cloud.

*1. OEE: Overall Equipment Effectiveness

*2. SPC: Statistical Process Control

Mitsubishi Electric Visualization products

Flexible HMI solutions that scale to fit your needs



EcoAdviser Energy Saving Support Software EcoWebServerIII Energy Saving Data Collecting Server



MES3-255C-DM-EN

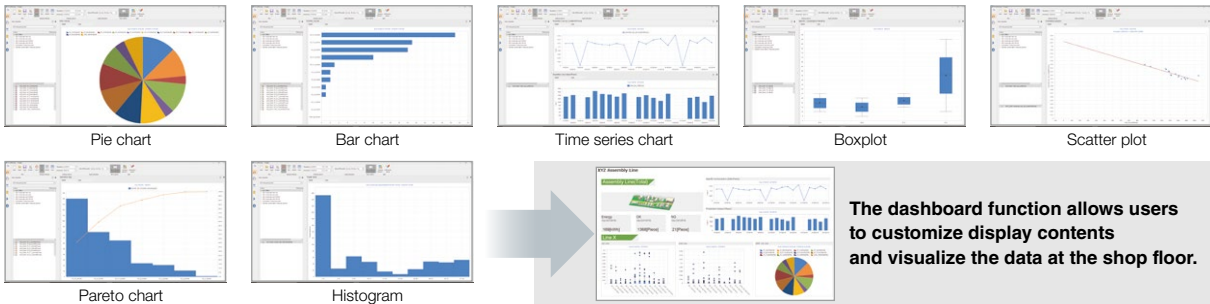


EcoWebServerIII and EcoAdviser visualize energy data without extra engineering costs.

EcoWebServerIII collects energy and production data via a network. EcoAdviser with AI technology comprehensively supports energy saving by identifying current and excessive energy consumption, analyzing factors, and verifying the effects of energy-saving measures.

[Current consumption] Understand the current energy consumption with various graphs

Seven graphs are available for various analysis purposes, such as understanding the current and specific energy consumption and further applied analysis.



The dashboard function allows users to customize display contents and visualize the data at the shop floor.

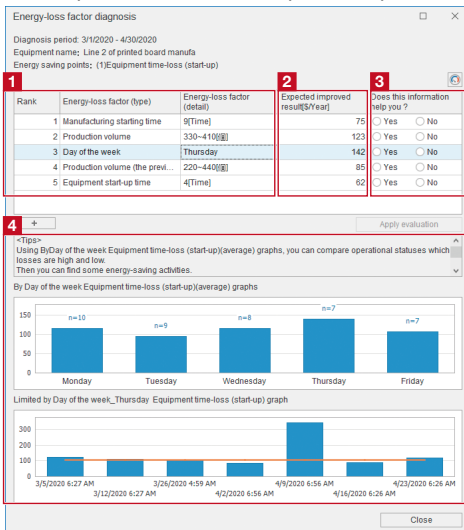
[Excessive consumption] Identify excessive energy consumption with our unique knowledge and AI technology

With the knowledge cultivated at Mitsubishi Electric over many years, EcoAdviser automatically identifies excessive energy consumption through AI analysis that focuses on five energy-saving perspectives.



[Factor diagnosis] Diagnose factors for excessive energy consumption through AI

AI ranks factors such as time and production information that are highly correlated with excessive energy consumption and evaluates expected improvement effects.



Point 1

- Ranked in order of factors that are likely to cause excessive energy consumption
- Default factors: equipment startup time, production starting time, day of the week, production volume, etc.
 - Add more collected data such as product types, temperature, and humidity as factors

Point 2

Estimated amount of cost that can be saved under suitable measures

Point 3

Options to allow AI to learn the results and apply them on hereafter diagnoses or not

Point 4

- Displays information for improving the shop floor by each selected factor
- Advice
 - Excessive energy consumption by factor
 - Excessive energy consumption of a specific factor

[Verification] Visualize the improvement effects of energy-saving measures

Users can easily check the effects on power usage, costs, and excessive energy consumption by selecting the periods before and after the energy-saving measures.

NC Machine Tool Optimizer

NC Machine Tool Optimizer is software that analyzes and diagnoses operation status collected data from machine tools and peripheral equipment.

This software can also perform analysis and diagnosis on operation status of various equipment including machine tools equipped with not only Mitsubishi Electric computerized numerical controllers (CNCs), but also other vendor's CNCs, improving efficiency at the shop floor.



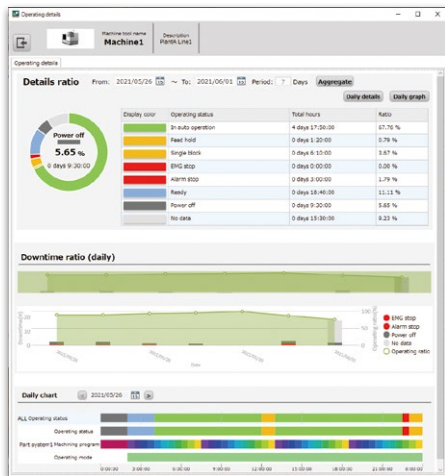
Contribution to efficient product planning with visualization of operation status

The operation status of each machine is visualized, and the operational analysis, stopping factor, etc. can be obtained in real time. This software also helps making production plans by reflecting the operation status of the machines.

● Easy downtime diagnostics and trend analysis!

• Operation details window

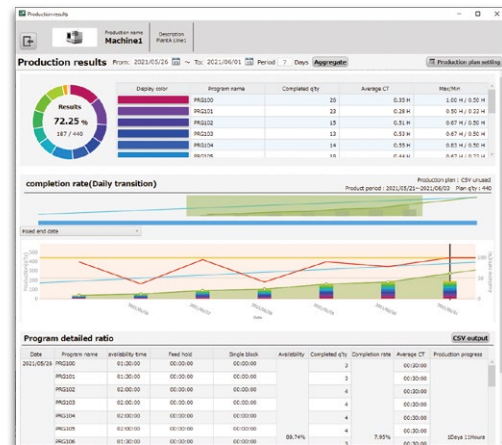
The occurrences of alarm stops and other events are presented in various charts, helping you to analyze the trends of the factors contributing to machine stops



● Easy comparison and analysis of planned vs. actual production!

• Production results window

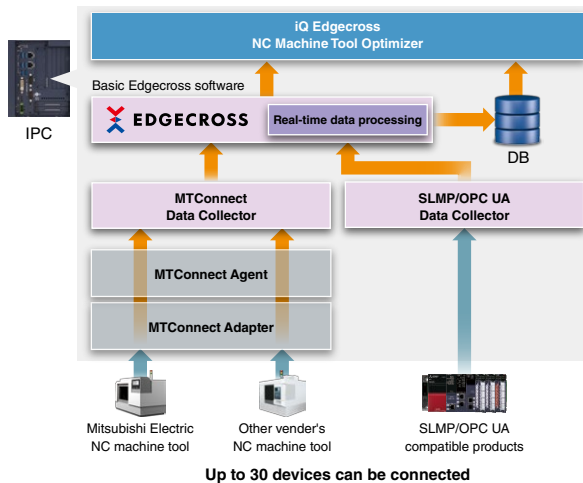
The variance between the planned and actual production output (the number of finished goods and the percentage of completion for each machine) provides insights into productivity trends, enabling you to optimize your planning.



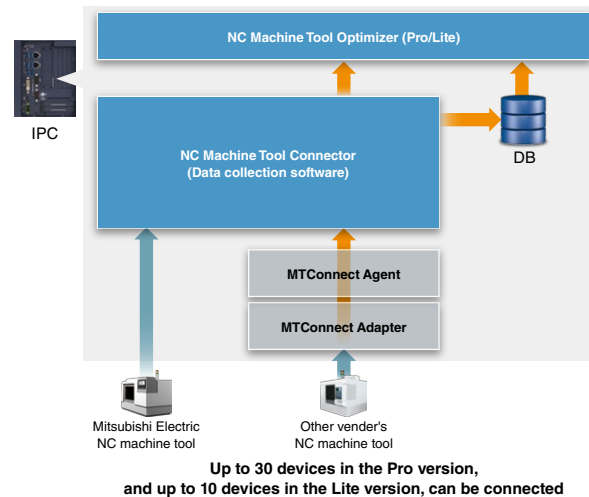
Configuration example of connectable devices

The following two editions are available depending on connections, etc.

• iQ Edgecross NC Machine Tool Optimizer



• NC Machine Tool Optimizer (Pro/Lite)



MELSOFT MaiLab

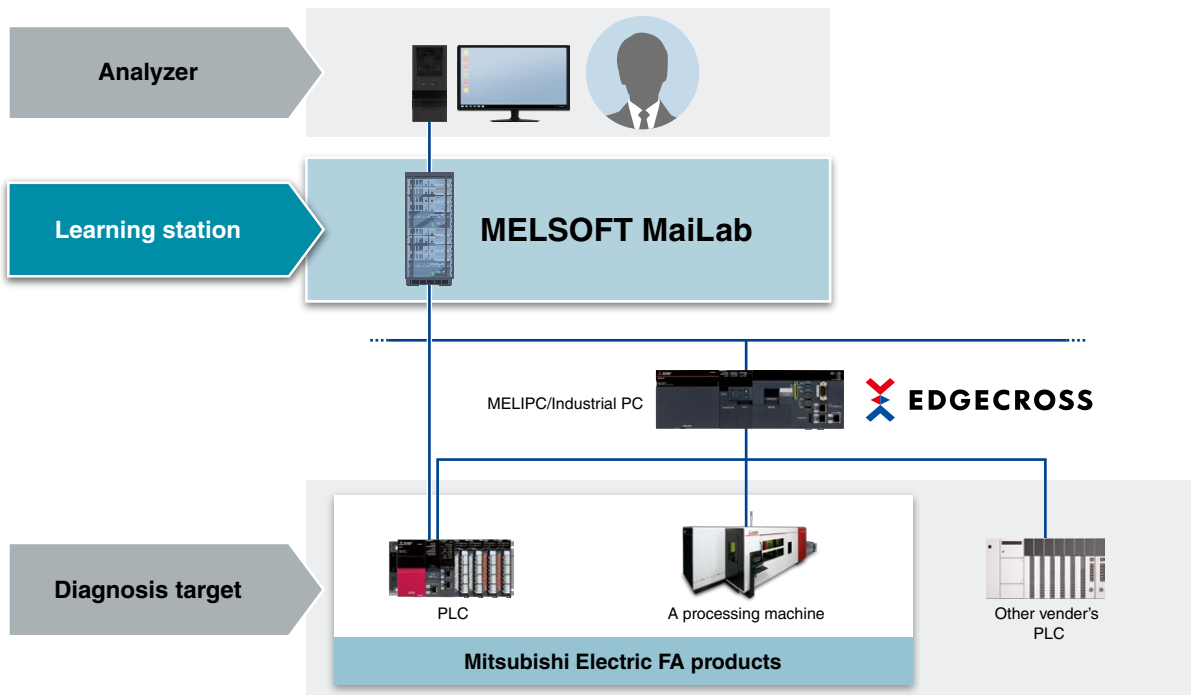
MELSOFT MaiLab

MELSOFT MaiLab is a data-science tool that replaces human experience and expertise with digital technologies and easily incorporates them in a control system, accelerating improvement in manufacturing.



Connectivity with various devices including other vender's PLC and manufacturing equipment

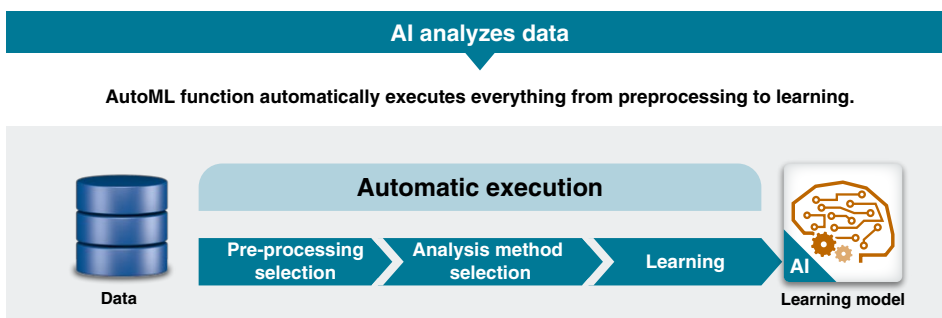
MELSOFT MaiLab can directly connect to Mitsubishi Electric PLC. Using Edgexcross, it can also connect to other various devices including other vender's PLC and manufacturing equipment.



Analysis and diagnosis of shop floor data without expertise

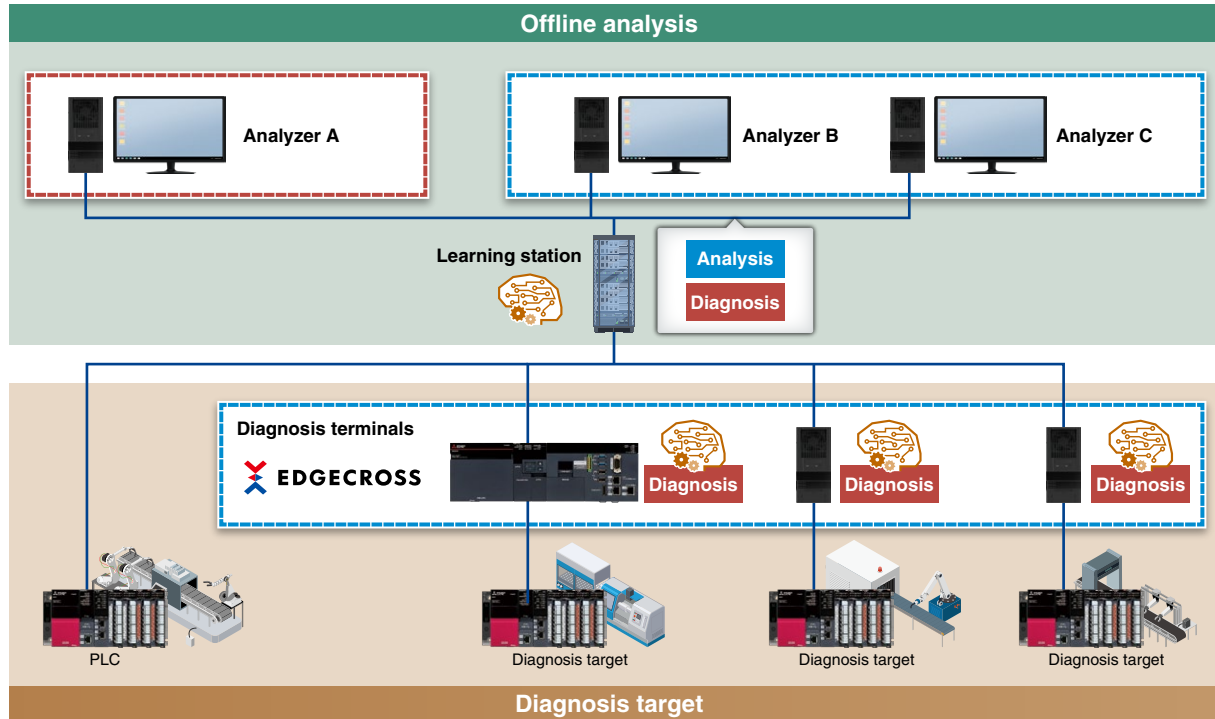
AutoML function, an AI automated-learning function, is provided and allows workers to analyze and diagnose data without expertise, helping to increase productivity at shop floor.

In addition, for those who have knowledge of AI, customizing the learning model in Python® is also possible.



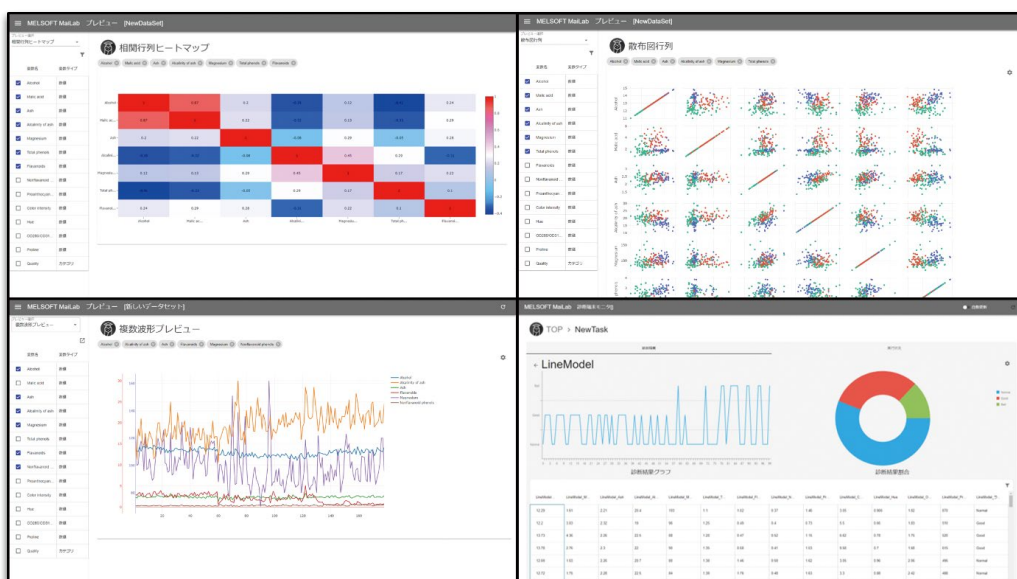
Flexible system configuration perfect for data analysis and diagnosis

In addition to the standard license, separate licenses are available for analysis and diagnosis, allowing customers to flexibly purchase licenses according to the system.



Intuitive operation with graphical displays

Shop floor data can be displayed in various graphs, enabling users to analyze and diagnose data with an intuitive operation. In addition, users can remotely monitor the production status of the shop floor using a tablet device together.



e-F@ctory Starter Package

The e-F@ctory Starter Package includes sample projects for the MELSEC iQ-R/iQ-F Series programmable controller and the GOT2000 Series human-machine interface. Designing advanced analysis algorithms and graphs is unnecessary, enabling an analysis/diagnosis system at a lower cost.



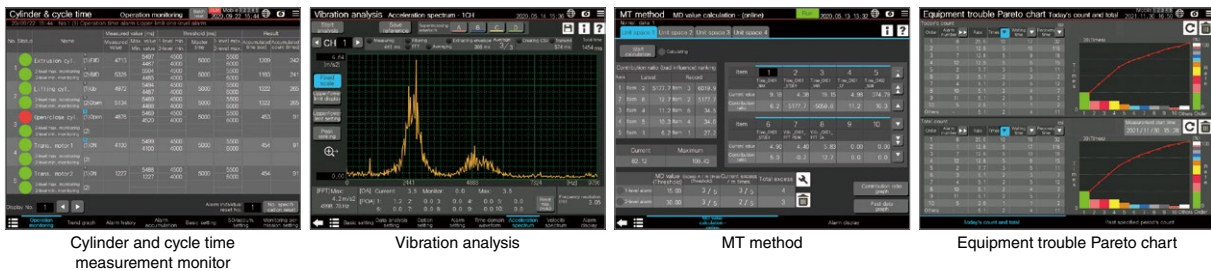
GOT2000

MELSEC iQ-F

MELSEC iQ-R

*1. The screen examples are those of MELSEC iQ-R series. The screen image is subject to change without notice.

Screen examples for the GOT2000 series*1



Cylinder and cycle time measurement monitor

Vibration analysis

MT method

Equipment trouble Pareto chart

Product lines

MELSEC iQ-R **MELSEC iQ-F**

Name	Outline	Supported series
Equipment operation monitor solution	A package of functions useful for visualization of equipment operational status	iQ-R iQ-F
MT method simple diagnosis solution	A package of functions from data collection to Mahalanobis distance monitoring necessary for abnormal detection by the MT method	iQ-R iQ-F
Vibration analysis	Monitors OA (overall value) by analyzing vibration waveforms using frequency analysis (FFT)	iQ-R iQ-F
Wave guard band monitoring	Monitors analog input waveform data	iQ-R iQ-F
Change point monitoring log	Detects and saves change point of equipment from perspectives of 4M and 5M + 1E	iQ-R iQ-F
Equipment inspection	Makes daily inspection of equipment paperless and improves quality maintenance by using the inspection results for interlock	iQ-R iQ-F
Equipment overall efficiency monitor	Comprehensively displays production and operational status of equipment, including overall equipment efficiency and production outputs	iQ-R iQ-F
Cylinder and cycle time measurement monitor*1	Measures and monitors the operational status of cylinders and equipment operation cycles for error signs	iQ-R iQ-F
MT method*2	Quantifies deviation degrees between normal and input data to detect and estimate an error from the abnormality	iQ-R iQ-F
Equipment trouble Pareto chart*1	Displays alarm status of factors that cause a drop in operation rate by using a Pareto chart	iQ-R iQ-F

*1. This function is also available in the equipment operation monitor solution of the MELSEC iQ-R series.

*2. This function is equivalent to the unit space generation and Mahalanobis distance calculation functions included in the MT method simple diagnosis solution of the MELSEC iQ-R series.

Equipment operation monitor solution functions

MELSEC iQ-R **MELSEC iQ-F**

Function name	Outline
Dashboard	Comprehensively displays production and operational status of equipment, including overall equipment efficiency and production outputs
Production counting	Displays production status by product type and time zone according to the set type and zone
Process capability index (histogram)	Displays collected data from equipment in a histogram and calculates the process capability index
Operational status monitor	Displays equipment operational status in a time series graph
Specific energy consumption management	Calculates specific energy consumption from energy amount and production volume to identify areas for improvement, such as wasted power usage of equipment
Cylinder and cycle time measurement monitor	Measures and monitors the operational status of cylinders and equipment operation cycles for error signs
Error action and inspection	Monitors alarm signals and displays corrective actions registered in advance when an alarm occurs
Sensor value monitor	Monitors sensor values for exceeding set threshold
Equipment trouble Pareto chart	Displays alarm status of factors that cause a drop in operation rate by using a Pareto chart
Control chart (Xbar-R/S)	Displays collected data from equipment on X-R control chart or X-S control chart in real time
Loss time analysis	Measures equipment non-operation time for each factor and displays the rate by date/total/time zone

* Multiple functions are provided as a package. The required functions can be selected from the package for use.

MT method simple diagnosis solution functions

MELSEC iQ-R **MELSEC iQ-F**

Function name	Outline
Time series data collection	Calculates feature quantities (mean value, standard deviation, etc.) from time series data and monitors the threshold
Vibration analysis*3	Calculates feature quantities (OA*4, CF*5, etc.) by analyzing vibration waveforms using frequency analysis (FFT) and monitors alarms
MT method*6	Quantifies deviation degrees between normal and input data to detect and estimate an error from the abnormality

*3. This function is the same as the vibration analysis function described in the "Product lines" list.

*4. An abbreviation for overall value, which is the sum of the power spectrum for each frequency after FFT analysis. This is one of the indicators of vibration intensity.

*5. Waveform rate (crest factor)

*6. MT stands for Mahalanobis-Taguchi.

iQ Monozukuri Rotary Machine Vibration Diagnosis

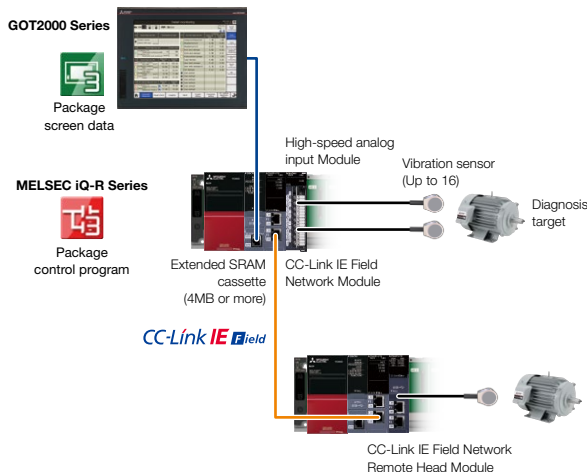
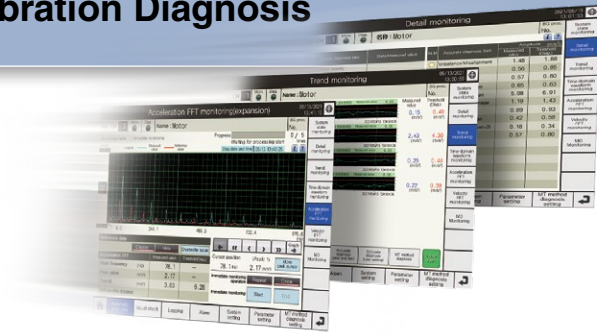
iQ Monozukuri Rotary Machine Vibration Diagnosis is an application package that collects/analyzes/diagnoses vibration data of equipment with rotating mechanisms to visualize the equipment condition and assess the faulty area.

Package Contents



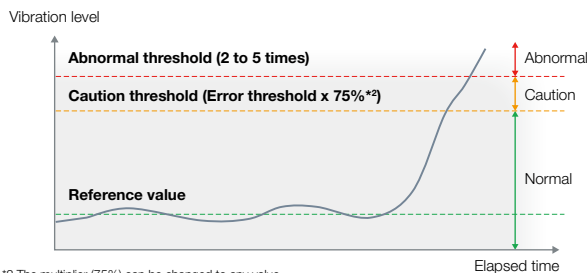
- GX Works3 control program for MELSEC iQ-R Series
- GT Works3 screen data for GOT2000 Series
- Instruction manual (PDF)

* This product includes software and documents. Purchase hardware and engineering software separately. For details, refer to the individual product catalog (L(NA)16057(ENG)).



Fault detection by simple diagnosis (Relative value judgment)

Measure the vibration at the same location multiple times (10 times if possible) to obtain a value at the normal condition (reference value). Compare the measured value with a threshold which is specified as 2 to 5 times the reference value to determine if it is normal.



*2 The multiplier (75%) can be changed to any value.

Fault detection by simple diagnosis (Absolute value judgment)

exceeds the judgment reference value specified in ISO 10816-1, it is judged as abnormal.

Vibration severity

An endurance reference for the vibration of rotary machines which is specified by the ISO. The judgment standard differs depending on the size and type of equipment.

- Class I : Small machine (such as motor with power of 15 kW or less)
- Class II : Medium machine (such as motor with power between 15 to 75 kW or machine with power of 300 kW)
- Class III : Large machine (when mounted on stiff and heave foundation)
- Class IV** : Large machine (when mounted on a soft foundation)

Velocity RMS value (effective value) (mm/s)	ISO 10816-1			
	Class I	Class II	Class III	Class IV**
0.28	A	A	A	A
0.45	A	A	A	A
0.71	A	A	A	A
1.12	B	B	B	B
1.8	B	B	B	B
2.8	C	C	C	C
4.5	C	C	C	C
7.1	D	D	D	D
11.2	D	D	D	D
18	D	D	D	D
28	D	D	D	D
45	D	D	D	D

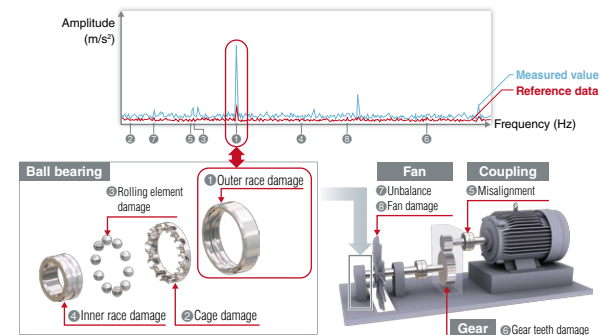
* Conditions to apply the vibration severity
Number of rotations: 600 to 12000 r/min
Vibration measuring range: 10 to 1000 Hz

** In iQ Monozukuri Rotary Machine Vibration Diagnosis, Class IV under ISO 10816-1 is not supported because the class is determined according to the motor capacity.

Note: The measured value may exceed the judgment reference value due to the installation status of the equipment or the influence of noise.

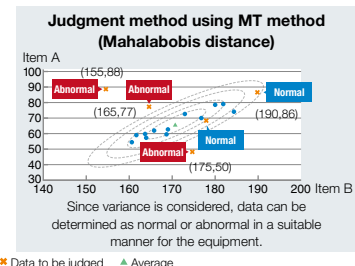
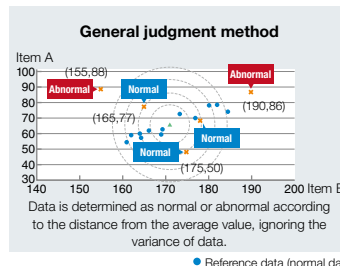
Presume the faulty area according to the accurate diagnosis

By monitoring the amplitude of the characteristic frequency calculated from the rotary speed and the specification values of components, the faulty area can be presumed and a fault can be found at an early stage. The threshold value should be set between 2 and 5 times of the reference value which is the value at the normal condition obtained by measuring the vibration from equipment multiple times (10 times if possible). This threshold value is compared with the measured value to perform pass / fail judgment.



Easy to detect anomalies by using the MT method

By applying the MT method (quality engineering method) to vibration analysis, anomalies can be easily detected even without knowledge about vibration analysis or specification value information of the components. Moreover, compositive diagnosis is possible by combining vibration data with data other than vibration such as temperature and current. It is used as an equivalent to simple diagnosis.



● Reference data (normal data) ✖ Data to be judged ▲ Average

iQ Monozukuri Tool Wear Diagnosis for Machine Tools



iQ Monozukuri is part of the manufacturing reform that is occurring in the digital transformation (DX) era utilizing the information of things (IoT) data from gathered from machine tools. IoT data is collected and analyzed using Mitsubishi Electric proprietary technologies. This application package optimizes tool management in the metalworking process of machine tools and enables automatic detection of machining defects.

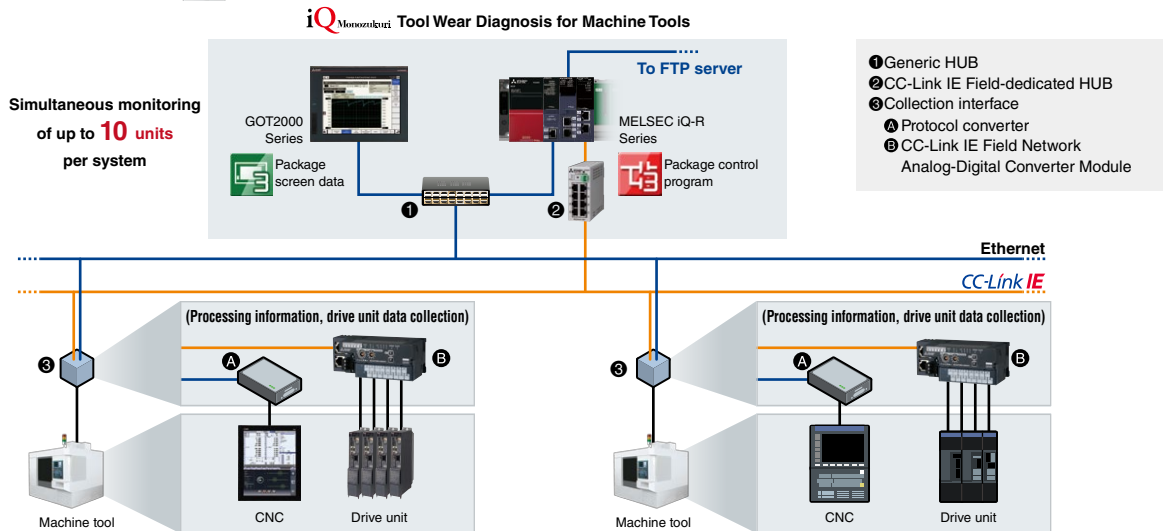


Items included in package



- MELSEC iQ-R Series GX Works3 control program
- GOT2000 Series GT Works3 screen data
- Instruction Manual (PDF)

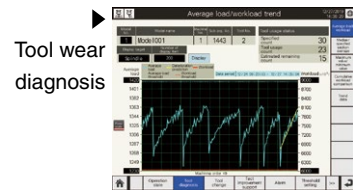
* This product is equipped with software application and documentation. Hardware and engineering software are required separately. For details, please refer to each catalog [L(NA)16092].



Determine the “sharpness” of tools and reduce tool costs through appropriate tool exchange



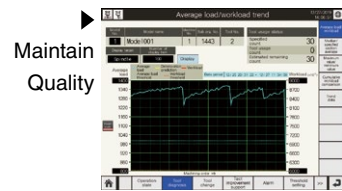
Predicts tool wear by identifying appropriate service life in accordance with spindle/feed shaft torque through IoT diagnostic technology for each processing condition. Tool exchange cost can be reduced by fully utilizing tools up until the end of service life.



Automatically detect machining defects immediately after processing (before inspection) and perform machine maintenance according to changes in machining variation



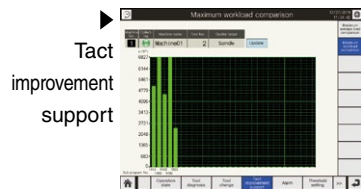
This product assists the calculation of abnormality determination thresholds based on past good product processing data and air-cut data. It detects machining defects such as tool breakage/damage, material defects, and upstream processing defects, and retains the number of defects to a maximum of one. In addition, by monitoring changes in deviation value of the feature quantity of the same machining data at predetermined workpiece interval (several hundred), it can identify signs of deterioration by individual axis.



Utilize machining data to improve takt time



IoT collected data during machining is utilized to detect tool damage without requiring sensors. Maintenance time is reduced as there is no need to check damage detection sensors. User can easily compare maximum average load and maximum workload data per individual program or tool. By comparing the torques between machining programs using identical tools, it is possible to adjust optimum cut volume, spindle rotation speed, and feed rate, thus shortening the machining cycle time.



Advanced Data Science Tool*1

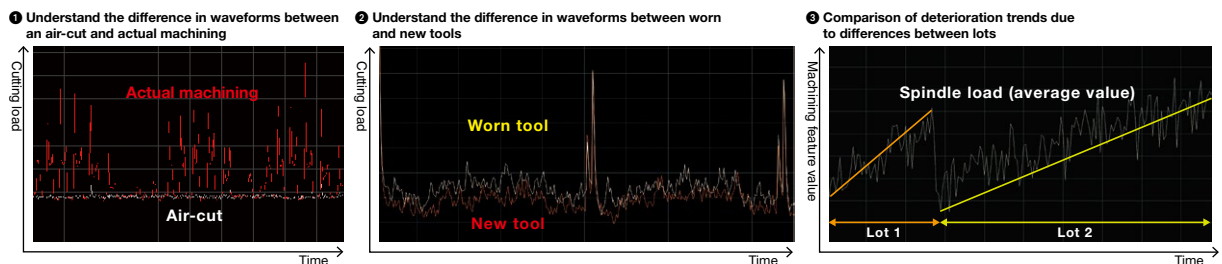
(Engineering environment that promotes digital transformation)

The Advanced Data Science Tool is a software that links to iQ Monozukuri Tool Wear Diagnosis for Machine Tools to utilize IoT data for the support of tool diagnosis, equipment maintenance, and statistical analysis.

*1. Advanced Data Science Tool is sold separately.

Confirm changes in status when machining abnormalities occurs

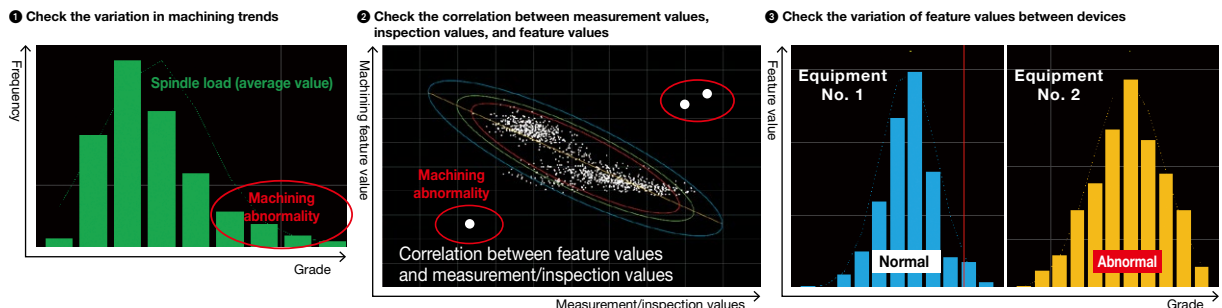
- By comparing the waveforms of air-cut data and actual machining data, it is possible to determine differences in cutting load. This information can then be used to diagnose tool abnormalities.
 - Comparing the waveforms allows you to better understand the difference between worn and new tools, as well as normal and abnormal machining.
 - It is possible to check any tool deterioration trends and confirm any differences between molding (lots).
- **By utilizing IoT data and comparing waveforms, it is possible to better understand various states during machining.**



Detect machining and equipment anomalies from big data

- By plotting the same machining feature value on a histogram, it is possible to check for any variations in tool wear and better grasp any trends in machining abnormality data.
- It is possible to check the correlation between feature values and machining quality (measurement/inspection values) by plotting them on a scatter diagram. This can help you to detect any machining abnormalities by easily identifying outliers.
- By comparing the feature value histograms of the same machining process between different equipment, it is possible to identify equipment differences and deterioration trends and easily detect equipment abnormalities.

● **Statistical analysis utilizing big data allows you to easily identify machining and equipment abnormalities**

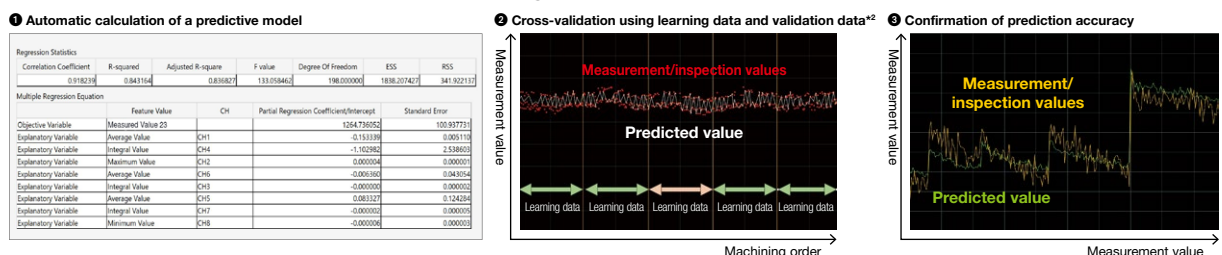


Predict machining finish with greater accuracy from IoT data

- Machine learning is applied to the relationship between IoT data and machining quality (measurement/inspection values) and a predictive model is automatically calculated.
- Through cross-validation of learning and validation data that has been divided into blocks, it is possible to confirm the validity from the predictive model's regression analysis results. This improves overall calculation accuracy.
- It is possible to check the prediction accuracy by comparing the calculated predicted values of the model with the actual measurement values.



● **The combination of machine learning and IoT data can be used to create a highly accurate quality predictive model which minimizes machining abnormalities and defects.**



*2. All data of processes mass-produced under identical processing conditions are divided into five data groups; four of which are used to automatically generate prediction models as learning data groups. Using these prediction models, finished quality is predicted from the remaining data group, and the deviation between the actual measurement and prediction is verified.

Smart Plus

MELFA

Smart Plus

MELFA Smart Plus is an option that brings next-generation intelligence to MELFA FR series robots. Inserting a MELFA Smart Plus card into a robot controller enables a multitude of intelligent functions. MELFA Smart Plus card supports different functions depending on its type.



Intelligent function
MELFA Smart Plus card: A type



AI function
MELFA Smart Plus card: B type



A brand encompassing Mitsubishi Electric's proprietary AI technology, including "compact AI" and AI basic and applied technologies.

CR800 controller



MELFA Smart Plus card

Preventive maintenance function

● Maintenance simulation

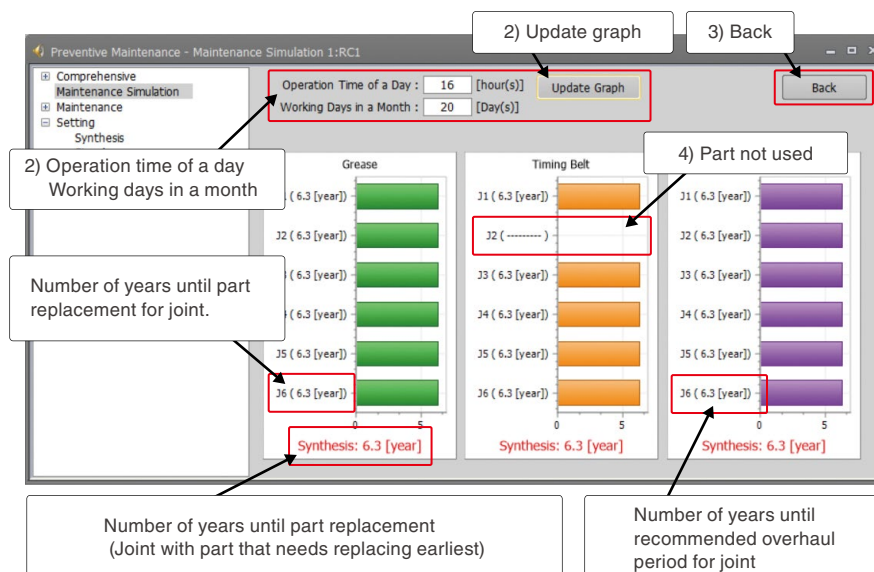
The preventive maintenance function estimates the recommended maintenance period and when to replace consumable parts. This is done by observing repeat patterns in actual program used by the robot or executed in the simulator in RT ToolBox3.*1

● Output data:

Grease replenishment period (per axis)/Timing belt replacement period (per axis)/Recommended maintenance period for overhaulable parts (per axis)*2

*1. This function is supported by the RH-3CRH, RH-6CH, and RV-8CRL with RT ToolBox3 Ver. 1.90U or later.

*2. For overhaulable parts such as reduction gears, bearings, ball screws, the internals of ball splines, the part which needs to be overhauled the earliest will be displayed.



* For details, refer to "MITSUBISHI INDUSTRIAL ROBOT MELFA Smart Plus Catalog (L(NA)-09100ENG)";

GOT2000 Drive Control Interactive Solutions

GOT Drive

GOT2000 provides some functions of the setting tool of servo systems, inverters, and robots.
The GOT Drive enhanced functionality is designed to eliminate need for additional hardware, software and suits customers' applications to speed up system startup, improve maintenance and troubleshooting.



Servo interaction

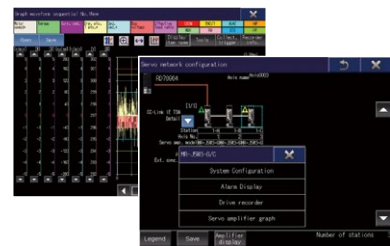
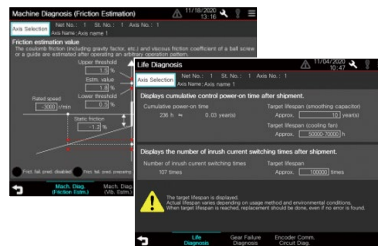
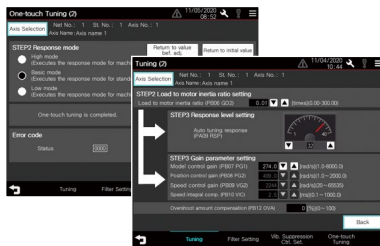


GOT2000 provides some functions of MR Configurator2.
GOT2000 supports the startup and adjustment of servo systems and predictive maintenance with various diagnosis functions without a personal computer. It also monitors drive recorders and servo network configuration.

- Support system startup and adjustment
One-touch tuning/tuning*1

- Support preventive maintenance
Machine diagnosis/servo amplifier life diagnosis*1

- Support maintenance
Drive recorder/system launcher (servo network)*2



Inverter interaction*1



GOT2000 provides some functions of FR Configurator2.
GOT2000 monitors multiple inverters and supports monitoring and setting parameters, predictive maintenance with a machine diagnosis function, and effective maintenance.

Robot interaction*1



GOT2000 monitors the current positions and error contents of robots and displays maintenance information. It supports easy startup, adjustment, and maintenance without a personal computer.



*1. Sample screens are available.
*2. A dedicated screen is provided as a function of GOT.

e-Factory Alliance

PARTNERS

Partners



Broad knowledge and skill
as a comprehensive
FA manufacturer



Know-how of all fields
relating to monozukuri



Co-creation

Customer



Giving customers
back the values born
from co-creation



e-F@ctory Ecosystem – Co-creation with over 1000 Partners*

As a solutions provider, we collaborate with many partners across all monozukuri fields. This ecosystem provides optimal solutions in various regions and fields in response to the issues experienced by our customers.

*As of September 2021



Producing entire production systems
Achieving advanced systems integration



IT



Production shop floor



Robots



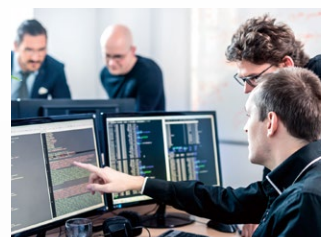
Development of application software strengthening connection affinity with Mitsubishi Electric FA devices



ERP/MES/SCADA



CAD/CAM/3D simulator



Data analysis



Provide device compatibility with Mitsubishi Electric FA equipment
Achieve improved system builds and maintainability



Sensors



RFID



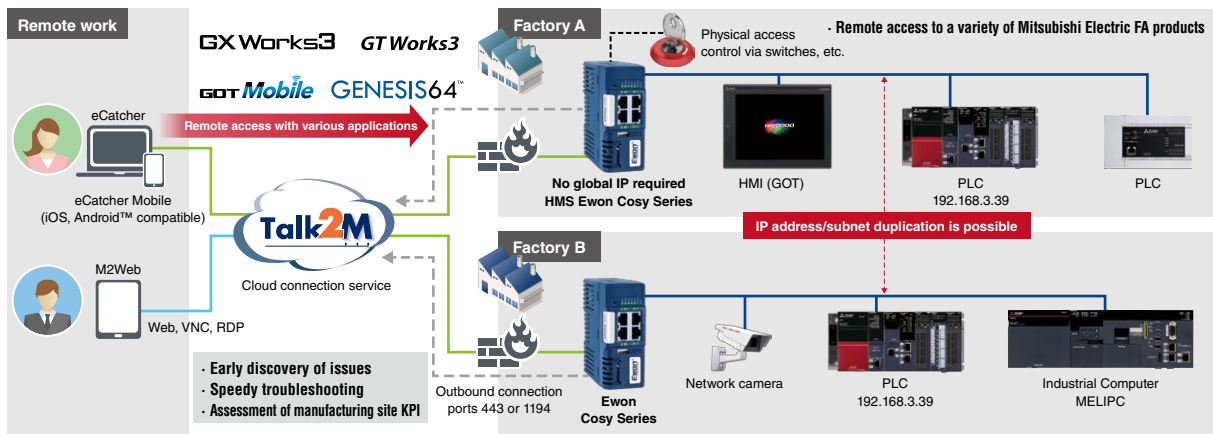
Related network devices

HMS Industrial Networks

HMS Ewon Cosy Series

With the Cosy Series (remote access gateway) and Talk2M (cloud connection service), users can access Mitsubishi Electric FA devices from anywhere in the world and safely perform troubleshooting of equipment and devices, thus reducing support cost and downtime. A secure connection is achieved through measures such as exclusive outbound connection, two-layer authentication, connection audit tracing, and access control using physical external key switches. Additionally, HMS Ewon Cosy Series has obtained ISO27001 security certification and has NVISO*1 perform external invasion tests regularly.

Access is possible not only from a computer using eCache (client software), but also remotely from an iOS or Android™ device installed with eCatcher Mobile on a browser of MELSEC or GOT. Moreover, assuming installation on a control panel, Ewon Cosy has been designed with specifications suited to industrial use, such as 24 VDC input, industrial EMC support, wide operating temperature range, and DIN rail mounting.



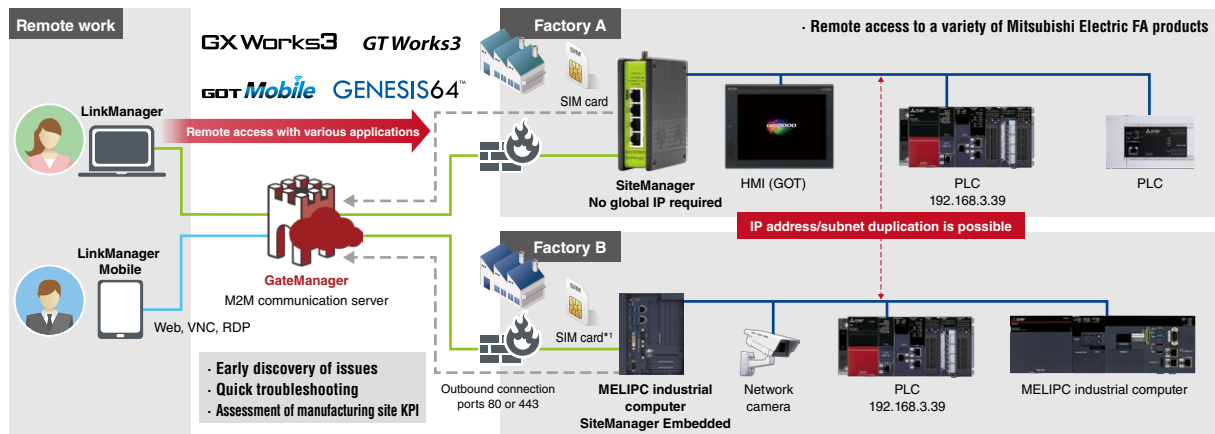
*1. NVISO is a cybersecurity consulting firm with a proven track record of providing cybersecurity-related services for all Belgian banks.

Secomea SiteManager Series

With SiteManager (remote access gateway), GateManager (relay M2M communication server), and LinkManager (client software), it is possible to access Mitsubishi Electric FA devices to monitor and perform maintenance on machinery and equipment at a manufacturing site, thus reducing business trip/ transportation costs, and enabling quicker response. A secure connection is achieved through measures such as exclusive outbound connection, encryption using SSL/TSL, multi-factor authentication using certificates, SMS, etc., access authority using an individual device, audit log, etc. The Secomea solution has obtained security certification from ProtectEM GmbH (a German thirdparty organization) and conforms to Industry 4.0. In addition to SiteManager's main unit being designed with a robust aluminum housing, SiteManager Embedded (embedded software) can be used to make industrial computers such as MELIPC, etc. function as a gateway.



secomea
SiteManager



*1. SIM card can be inserted by adding a separate communication module.

Sampling comparison

Data sampling performance

Product name	Sampling interval	Maximum number of sampling points*1	Maximum data storage capacity
MELSEC IQ-R			
CPU module (built-in logging function)	1 ms to	128 points × 10 settings	32 GB
CPU module (simple CPU communication function)	10 ms to	512 words × 64 settings	-
High-speed data logger module	0.1 ms to	4096 points × 64 settings	16 GB
MES interface module	1 ms to*2	1024 points × 64 settings	2048 MB*3
OPC UA server module	200 ms to	12000 points	-
Ethernet interface module (simple CPU communication function)	1 ms to	1024 words × 512 settings	-
C intelligent function module	0.5 ms to	32768 points	16 GB
MELSEC IQ-F			
CPU module (built-in logging function)	10 ms to	128 points × 4 settings	16 GB
CPU module (simple CPU communication function)	10 ms to	512 words × 32 settings*4	-
OPC UA module	100 ms to	500 points × 8 subscriptions	-
GOT/SCADA			
GOT2000	100 ms to	256 points × 60 settings*5	32 GB*6
GT SoftGOT2000	100 ms to	256 points × 60 settings	Depends on the operating personal computer.*7
SCADA GENESIS64™	10 ms to*8	75 points to 1,000,000 points*9	Depends on the operating personal computer.*7
Data Collector			
CC-Link IE TSN Data Collector	0.5 ms to	256 points × 12 settings*10	Depends on the operating personal computer.*9
CC-Link IE Field Network Data Collector	5 ms to	256 points × 12 settings*10	Depends on the operating personal computer.*9
CC-Link IE Controller Network Data Collector	50 ms to	256 points × 12 settings*10	Depends on the operating personal computer.*9
SLMP Data Collector	100 ms to	256 points × 12 settings*10	Depends on the operating personal computer.*9
OPC UA Data Collector	500 ms to	256 points × 12 settings*10	Depends on the operating personal computer.*9
MTConnect Data Collector	500 ms to	256 points × 12 settings*10	Depends on the operating personal computer.*9
MELSOFT			
MX Sheet	100 ms to	256 points	Depends on the operating personal computer.*9

*1. The maximum number of sampling points varies depending on the data.

*2. Indicates the trigger monitoring cycle.

*3. DB buffering function temporarily stores SQL text that failed to be sent due to a communication error.

*4. The total points of all settings are up to 8192 words.

*5. For GT27 and GT25. For GT21, up to 4 settings.

*6. When specifying an SD memory card as a save destination. When specifying a local disk of the personal computer as a save destination, the storage capacity depends on the specification of Microsoft® Excel® and the maximum memory capacity of the personal computer.

*7. The storage capacity depends on the specification of Microsoft® Excel® and the maximum memory capacity of the personal computer.

*8. When OPC sever included with SCADA GENESIS64™ is used.

*9. Depends on the purchased license. Saving 250,000 tags or more is possible with an optional function.

*10. The number of settings depends on the specification of Edgecross Basic Software.

Accessed device

Product name	Accessed CPU						Other vender's PLC	Other devices
	MELSEC iQ-R	MELSEC iQ-F	MELSEC-Q	MELSEC-L	MELSEC-F			
MELSEC iQ-R								
CPU module (built-in logging function)	●	-	-	-	-	-	-	-
CPU module (simple CPU communication function)	●	●	●	●	-	-	-	-
High-speed data logger module	●	-	●	●	-	-	-	-
MES interface module	●	●	●	●	●	-	-	-
OPC UA server module	●	-	●	●	-	-	-	-
Ethernet interface module (simple CPU communication function)	●	●	●	●	●	●	-	-
C intelligent function module	●	-	●	●	-	-	-	-
MELSEC iQ-F								
CPU module (built-in logging function)	-	●	-	-	-	-	-	-
CPU module (simple CPU communication function)	-	●	-	-	-	-	-	-
OPC UA module	-	●	-	-	-	-	-	-
GOT/SCADA								
GOT2000	●	●	●	●	●	●	●	●*1
GT SoftGOT2000	●	●	●	●	●	●	●	●*1
SCADA GENESIS64™	●	●	●	●	●	●	-	●*2
Data Collector								
CC-Link IE TSN Data Collector	●	●	●	●	-	-	-	-
CC-Link IE Field Network Data Collector	●	●	●	●	-	-	-	-
CC-Link IE Controller Network Data Collector	●	●	●	●	●	-	-	-
SLMP Data Collector	●	●	●	●	-	-	-	-
OPC UA Data Collector	-	-	-	-	-	-	-	●*3
MTConnect Data Collector	-	-	-	-	-	-	-	●*4
MELSOFT								
MX Sheet	●	●	●	●	●	-	-	-

*1. Data can be collected from temperature controllers and other devices. For details on the devices that data can be collected from, refer to "Connectable model list" of the GOT2000 series catalog (L(NA)08270ENG).

*2. For details on the connectable modules, refer to the Mitsubishi Electric SCADA software GENESIS64™ product catalog (L(NA)08785ENG).

*3. Enables data collection from OPC UA server devices.

*4. Enables data collection from MTConnect supported devices.

Data storage/distribution destination

Product name	Data storage		Data distribution method				
	Device that stores data	File format	FTP	SQL	OPC UA	MQTT	E-mail
MELSEC iQ-R							
CPU module	SD memory card	CSV/Unicode® text/ binary	●	-	-	-	-
High-speed data logger module	SD memory card	CSV/Unicode® text/ binary/Microsoft® Excel®	●	-	-	-	●
MES interface module	-	-	-	●	-	-	-
OPC UA server module	-	-	-	-	●	-	-
Ethernet interface module	-	-	-	-	-	-	-
C intelligent function module	SD memory card	Depends on the user application.*1	-	-	-	-	-
MELSEC iQ-F							
CPU module	SD memory card	CSV*2/binary	●	-	-	-	-
OPC UA module	-	-	-	-	●	-	-
GOT/SCADA							
GOT2000	SD memory card/ USB memory	CSV/Unicode® text/ binary	●	●	-	-	●
GT SoftGOT2000	Operating personal computer	CSV/Unicode® text/ binary	●	●	-	-	●
SCADA GENESIS64™	Operating personal computer	Binary/CSV/ Microsoft® Excel®	●*3	●*3	●	●*3	●*3
Data Collector							
CC-Link IE Field Network Data Collector	Operating personal computer	CSV*4	-	●*4	●*4	●*4	-
CC-Link IE Controller Network Data Collector	Operating personal computer	CSV*4	-	●*4	●*4	●*4	-
SLMP Data Collector	Operating personal computer	CSV*4	-	●*4	●*4	●*4	-
OPC UA Data Collector	Operating personal computer	CSV*4	-	●*4	●*4	●*4	-
MTConnect Data Collector	Operating personal computer	CSV*4	-	●*4	●*4	●*4	-
MELSOFT							
MX Sheet	Operating personal computer	CSV/Microsoft® Excel®/HTML	-	-	-	-	-

*1. Customers can use a file format according to the user application to be used.

*2. Supported by FX5U/FX5UC CPU module only.

*3. This method is available using an optional function. For details on the optional function, refer to Mitsubishi Electric SCADA software GENESIS64™ product catalog (L(NA)08785ENG).

*4. Available by using a function of Edgecross Basic Software.

Visualization comparison

Features

Product name	Features	Display environment
MELSOFT		
MX Sheet	Monitors, logs, collects alarm data, and changes setting values of PLC and Motion controllers using Microsoft® Excel®.	Personal computer
GX LogViewer*1	Displays and analyzes large-volume collected data by various modules having a data collection function with a simple operation. Allows users to set the connected devices easily in the same method as using configuration tools and engineering tools.	Personal computer
e-F@ctory Starter Package*2		
Equipment operation monitoring solution	Software for analyzing equipment information collected in a programmable controller and displaying the result on the GOT	HMI GOT, personal computer
iQ Monozukuri		
iQ Monozukuri ANDON	Enables visualization by displaying information obtained from the production equipment on the monitor for ANDON via GOT2000, and sharing information of the shop floor	HMI GOT, personal computer
iQ Monozukuri Process Remote Monitoring	Supports productivity improvement and process improvement throughout the shop floor by displaying the operation status of the shop floor, operation logs and alarm information for each equipment, etc. on GT SoftGOT2000 via shop floor GOT, and analyzing the data	HMI GOT, GT SoftGOT2000, personal computer
GOT/SCADA		
GOT2000	Supports a wide variety of industrial devices and connection types. A multi-channel function and device data transfer function enables the monitoring of multiple types of industrial devices of different manufacturers.	HMI GOT
GT SoftGOT2000	Monitors and manages information collected from FA equipment connected to personal computers and panel computers via a network. Interacts with Edgexcross and Windows® applications and connects to OPC UA servers.	Personal computer, MELIPC
SCADA GENESIS64™	Enables high-precision graphic display, mobile monitoring, email notification, wide area monitoring, and cloud connection	Personal computer, MELIPC*3
MELSEC Series		
MELSEC iQ-R/iQ-F CPU (Web server function)	Reads and writes device data of a CPU module and checks error codes via a web browser using a tablet device, etc.	Personal computer
Energy saving products		
EcoWebServerIII	Enables an energy measuring system to be configured simply with settings (without programming)	HMI GOT, personal computer
EcoAdviser	Helps analyze collected energy data, visualizes the data for workers with the dashboard function, and builds a visualization system without programming	Personal computer, MELIPC
Computerized numerical controllers (CNC) IoT-related products		
NC Machine Tool Optimizer	An application for supporting productivity improvement and efficiency improvement of the shop floor by operation analysis/diagnosis of various machine tools and peripheral equipment equipped with not only Mitsubishi Electric computerized numerical controllers (CNCs), but also other vendor's CNCs	Personal computer, MELIPC

*1. This is software provided free of charge. For the information on how to obtain GX LogViewer, please contact your local Mitsubishi Electric sales office or representative.

*2. This is a sample program provided free of charge. If needed, please contact your local sales office.

*3. Edge Computing Edition, iQ Edgexcross-compatible software, needs to be installed on an MELIPC. A normal version can be installed on a personal computer.

Handled data

Features

Product name	Read data format	Written data format	Maximum number of monitoring points
MELSOFT			
MX Sheet	Programmable controller device data	CSV/Microsoft® Excel®/HTML	2000 points
GX LogViewer	CSV/Unicode® text/ binary/JSON	CSV/Unicode® text	16 points*1
e-F@ctory Starter Package			
Equipment operation monitoring solution	Varies by the available functions of each product.*2	Varies by the available functions of each product.*2	Varies by the available functions of each product.*2
iQ Monozukuri			
iQ Monozukuri ANDON	Binary	CSV*3/Microsoft® Excel®	15000 points
iQ Monozukuri Process Remote Monitoring	Binary	CSV/PDF	15000 points
GOT/SCADA			
GOT2000	CSV/Unicode® text/binary	CSV*3	15000 points
GT SoftGOT2000	CSV/Unicode® text/binary	CSV*3	15000 points
SCADA GENESIS64™	CSV/binary/SQL DB	Binary/CSV/Microsoft® Excel®	15000 points
MELSEC Series			
MELSEC iQ-R/iQ-F CPU (Web server function)	Programmable controller device data	-	32 points*4
Energy saving products			
EcoWebServerIII	*5	CSV	255 points
EcoAdviser	CSV	CSV/Microsoft® Excel®/HTML	5680 points
Computerized numerical controllers (CNC) IoT-related products			
NC Machine Tool Optimizer	CSV/JSON/SQL DB	CSV	180 to 250*6

*1. This value is applicable for real-time monitor. For other functions such as the historical trend display, refer to the manual.

*2. For details, refer to each manual.

*3. CSV data can be outputted using GOT standard functions such as the logging function and the recipe function.

*4. The recommended maximum number of device points specified for one user WEB page.

*5. Data is collected and displayed through communication from energy measuring modules and PLC.

*6. Varies by the communication protocol for data collection.

Analysis/diagnosis comparison

Features

Product name	Features	Display environment
MELSOFT		
MELSOFT MaiLab	Replaces human experience and expertise with digital technologies and easily incorporates them in a control system. This data-science tool accelerates improvement in manufacturing.	Windows® PC
iQ Monozukuri		
iQ Monozukuri Rotary Machine Vibration Diagnosis	Enables simple diagnosis (absolute value judgment, relative value judgment), acceleration FFT guard band monitoring, accurate diagnosis, and MT method diagnosis for equipment with rotating mechanisms.	MELSEC iQ-R + GOT2000
iQ Monozukuri Tool Wear Diagnosis for Machine Tools	Extracts (cleanses) cutting work section data based on the cutting/grinding work conditions of various materials and creates a statistical database from the collected time-series waveform by combining primary processing (6 types) and feature value operations (11 types). The created statistics enable outlier deviation monitoring and statistical trend monitoring, and outlier deviation monitoring and trend monitoring by AI (machine learning) prediction.	MELSEC iQ-R + GOT2000
e-F@ctory Starter Package*1		
MT method simple diagnosis	Enables functions required for monitoring abnormality with MELSEC iQ-R and GOT2000, such as calculation of feature quantities for temperature, current, vibration, etc. and generation of unit space	MELSEC iQ-R + GOT2000
Wave guard band monitoring	Creates a guard band waveform based on the reference waveform and enables guard band monitoring of the input waveforms	MELSEC iQ-R + GOT2000
Vibration analysis	Enables generic vibration analysis such as FFT of vibration waveforms and calculation of OA	MELSEC iQ-R + GOT2000

Analysis/diagnosis methods

Product name	Data analysis/diagnosis methods						
	MT method	Multiple regression analysis	SPC	Guard band	AI waveform diagnosis	Vibration analysis	Deep learning
MELSOFT							
MELSOFT MaiLab*2	●	●	●	●	●	-	●
iQ Monozukuri							
iQ Monozukuri Rotary Machine Vibration Diagnosis	●	-	-	●	-	Simple/accurate diagnoses	-
iQ Monozukuri Tool Wear Diagnosis for Machine Tools	-	●	△ (σ deviation)	-	-	-	-
e-F@ctory Starter Package*1							
MT method simple diagnosis	●	-	-	●*3	-	Simple diagnoses	-
Wave guard band monitoring	-	-	-	●	-	-	-
Vibration analysis	-	-	-	●*3	-	Simple diagnoses	-

*1. This is a sample program provided free of charge. If needed, please contact your local sales office.

*2. MELSOFT MaiLab offers a variety of other analysis methods. For details, refer to the product manuals.

*3. Wave guard band monitoring can be performed on acceleration and velocity spectrum waveforms.

Offline analysis

Data pre-processing function

Product name	Waveform extraction	Missing data/outlier processing	Calculation of statistics
MELSOFT			
MELSOFT MaiLab	●	●	●
iQ Monozukuri			
iQ Monozukuri Rotary Machine Vibration Diagnosis	-	-	_* ¹
iQ Monozukuri Tool Wear Diagnosis for Machine Tools	●	●	●
e-F@ctory Starter Package			
MT method simple diagnosis	●	-	_* ¹
Wave guard band monitoring	-	-	_* ¹
Vibration analysis	-	-	_* ¹

Data display function

Product name	Data display function
MELSOFT	
MELSOFT MaiLab	Line chart, histogram, box plot, pie chart, scatter plot matrix, correlation matrix heat map, waveform overlaid display
iQ Monozukuri	
iQ Monozukuri Rotary Machine Vibration Diagnosis	Waveform overlaid display/trend graph
iQ Monozukuri Tool Wear Diagnosis for Machine Tools	Normal/abnormal machining waveform comparisons, machining trend/wear condition trend display, inspection correlation analysis, evaluation of learning results, prediction accuracy confirmation graph, predicted value trend graph
e-F@ctory Starter Package	
MT method simple diagnosis	Waveform overlaid display ^{*2} /waveform parallel display ^{*2} /trend graph
Wave guard band monitoring	Waveform data parallel display
Vibration analysis	Waveform overlaid display/waveform parallel display

Real-time diagnosis

Product name	Diagnosis results notification method	Number of diagnosis points and settings
MELSOFT		
MELSOFT MaiLab	Outputting to the programmable controller, Outputting to a CSV file ^{*3}	256 × 64 points ^{*4}
iQ Monozukuri		
iQ Monozukuri Rotary Machine Vibration Diagnosis	Notified on a GOT screen. ^{*5}	Vibration sensor: 16 channels/ MT method unit space: 20 types ^{*6}
iQ Monozukuri Tool Wear Diagnosis for Machine Tools	Alarm display on a GOT screen, alarm output to machine tools	(CNC machining conditions: 6 points, spindle/X/Y/Z/C axes: analog 8 points) × 10 machines
e-F@ctory Starter Package		
MT method simple diagnosis	Notified on a GOT screen. ^{*5}	Vibration sensors: 4 channels/sensors: 48 channels/ MT method unit space: 4 types ^{*7}
Wave guard band monitoring	Notified on a GOT screen. ^{*5}	Sensors: 48 channels
Vibration analysis	Notified on a GOT screen. ^{*5}	Sensors: 48 channels

*1. The feature values required for real-time diagnosis can be calculated.

*2. Only vibration waveform data can be displayed.

*3. By interacting with Edgexross Basic Software, MaiLab can send feedback to other vender's PLC and execute any program on industrial computers.

*4. The number of diagnosis settings can be increased by adding diagnosis terminals. In addition, the maximum number of diagnosis settings varies depending on the diagnosis methods and the contents.

*5. External output is also possible via network and an I/O module.

*6. The unit space of the MT method can be saved in and read from an SD memory card, and therefore it is possible to use more than 20 types.

*7. The unit space of the MT method can be saved in and read from an SD memory card, and therefore it is possible to use more than four types.

Open integrated network

CC-Link IE TSN

CC-Link IE TSN supports TCP/IP communications and applies it to industrial architectures through its support of TSN enabling real-time communications. With its flexible system architecture and extensive setup and troubleshooting features make CC-Link IE TSN ideal for building an IIoT infrastructure across the entire manufacturing enterprise.

• **What is Time-Sensitive Networking (TSN)?**

TSN is the IEEE-defined standard technology that enables deterministic messaging on standard Ethernet. The technology ensures deterministic communications by utilizing the time synchronization method (IEEE 802.1AS) and time-sharing method (IEEE 802.1Qbv). With the addition of these standards to Ethernet technology, real-time control communication and non-real time information communication can be mixed, which is not possible with conventional Ethernet communications.

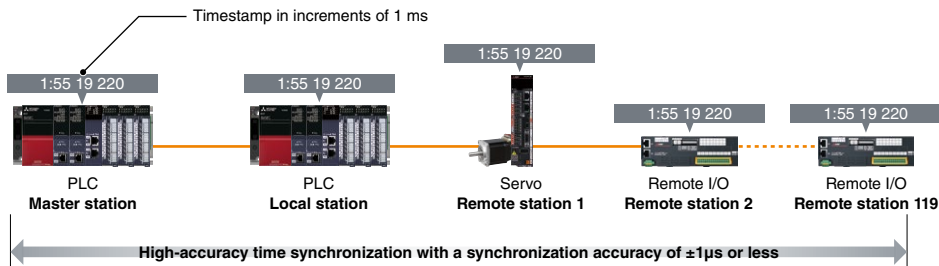


TSN technology enables the transfer of deterministic communication even when delivering the information communication data of IT systems on the same network. By increasing network bandwidth and giving priority to CC-Link IE TSN communications and TCP/IP communications, devices that use general Ethernet communications can be connected to the same network without affecting real-time control communication performance.



Time series analysis using high-accuracy time synchronization

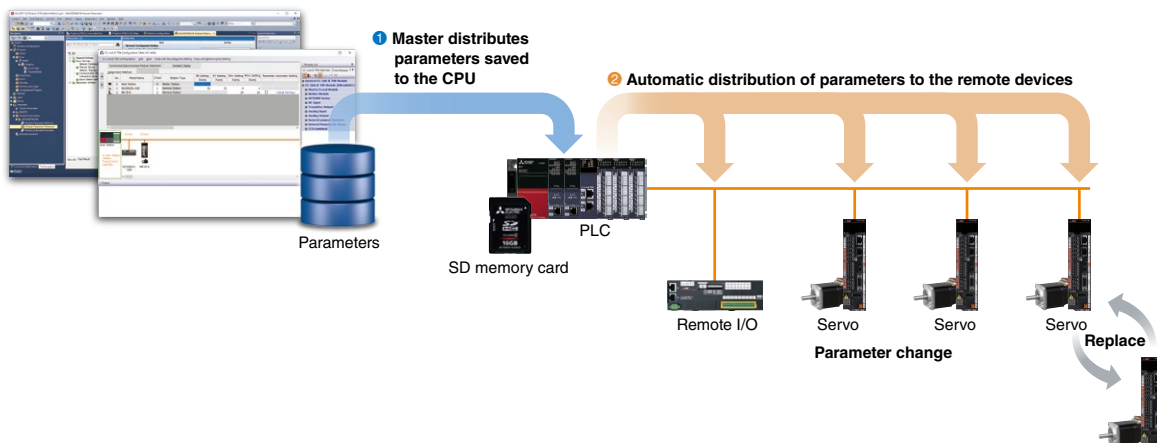
Achieves high-accuracy time synchronization with a synchronization accuracy of $\pm 1\mu\text{s}$ or less and retains timestamp information in each connected station at increments of 1 ms. Error history can be displayed in time series, therefore enabling users to accurately analyze what happened and the cause of the problem from the exact time an error occurs.



Easy replacement of remote devices through automatic parameter distribution [Reducing start-up time]

When power is turned on or there is contingency, the master device automatically distributes parameters saved on the CPU unit to remote devices.

As such, even when a remote device is replaced, there's no need to separately write parameters to it; making for smooth replacement.



Open software platform

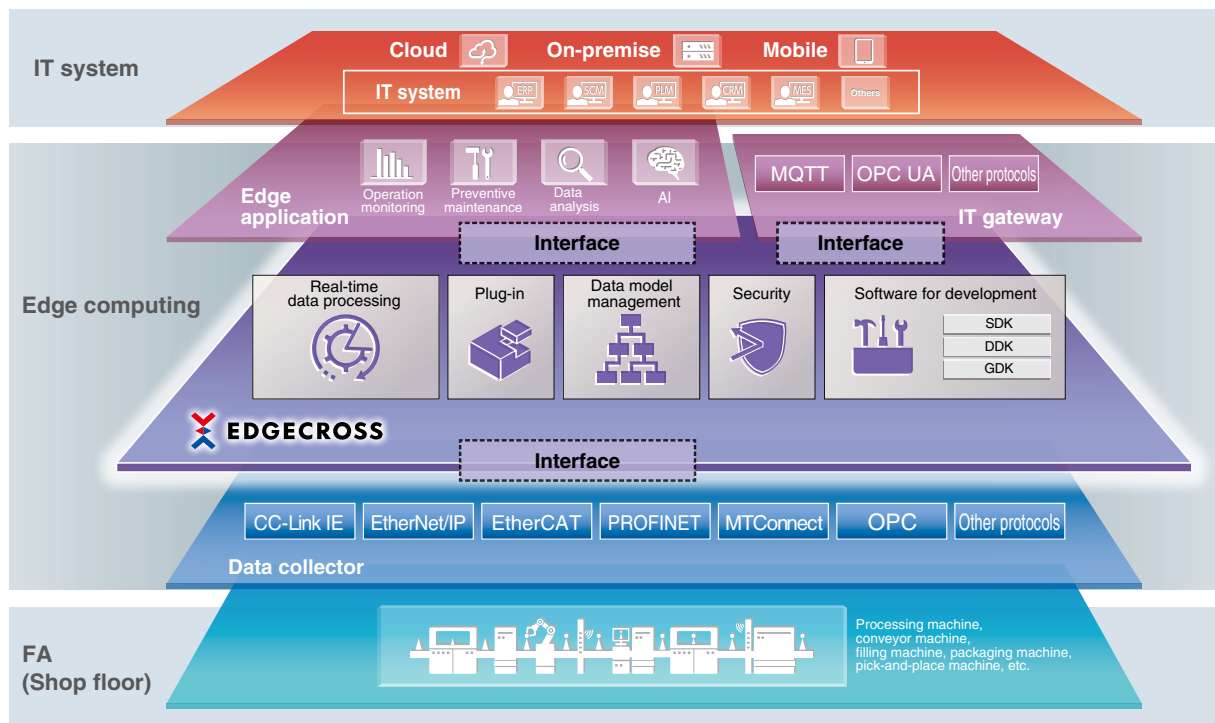
Edgecross



In the manufacturing industry, IoT adaptation is accelerated to enhance competitiveness and create new value. Following the trend, Edgecross Consortium aims to create new added value based on the edge computing layer beyond the borders of companies and industries, contributing to IoT adoption in the manufacturing industry.



Creating new value with a focus on the edge computing domain



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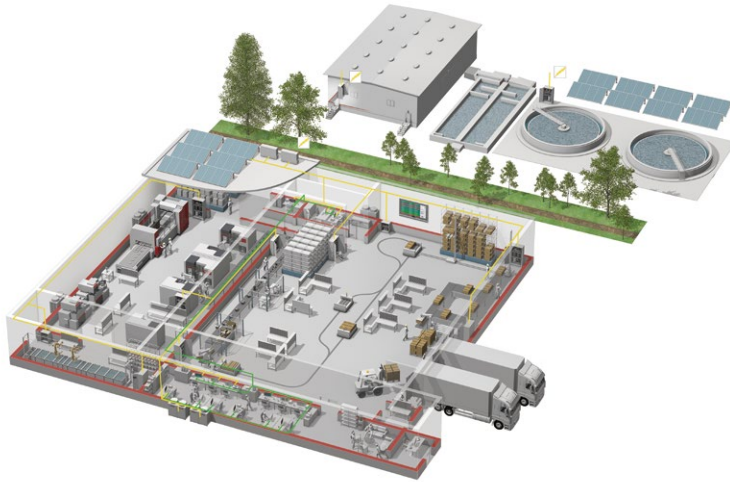
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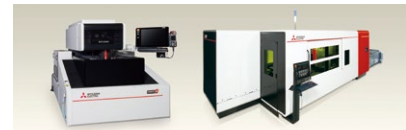
Edge Computing Products



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Processing machines: EDM, Lasers

* Not all products are available in all countries.

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