FACTORY AUTOMATION

ENERGY-SAVING SUPPORTING DEVICES

Advanced
Energy-saving Solution

GLOBAL IMPACT OF MITSUBISHI ELECTRIC

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

Changes for the Better

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

Mitsubishi Electric is involved in many areas including the following

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

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

Home Appliance
Dependable consumer products like air conditioners and home entertainment systems.

Information and Communication Systems
Commercial and consumer-centric equipment, products and systems.

Industrial Automation Systems
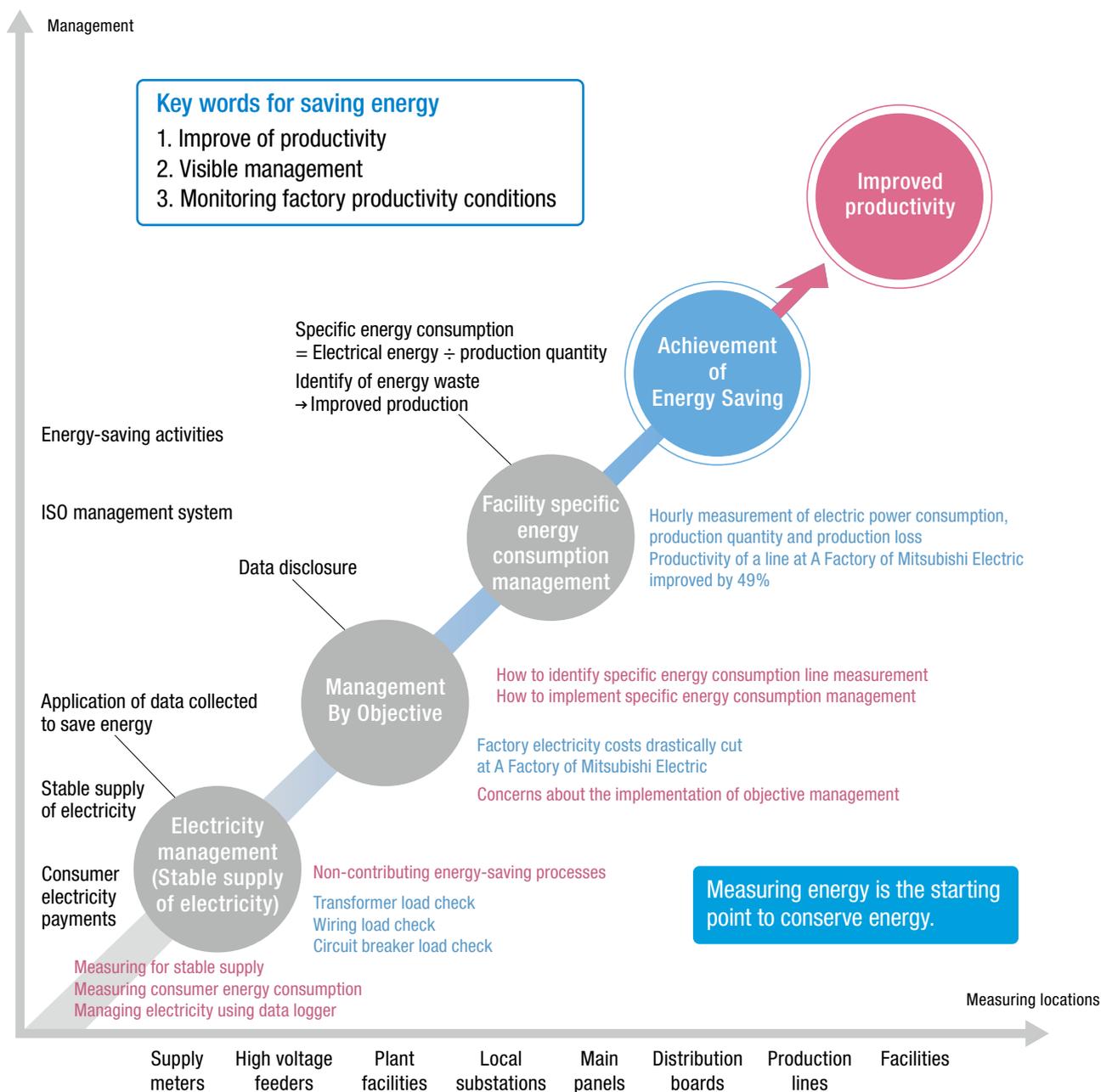Maximizing productivity and efficiency with cutting-edge automation technology.

OVERVIEW

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Energy-saving Concepts

● What do you need if you are to go on a diet? Measuring your weight and making a graph of the weight fluctuation can lead to success in a diet. The same holds for saving energy. Measuring energy and analyzing current factory conditions using Visible Management is the starting point to conserve energy.
● To save energy, measuring and managing production energy use is necessary.

➡ Measurement (understand and analyze current conditions) and improvement activities are necessary to save energy.

Steps for energy-saving activities

Energy-saving activities can ultimately lead to improved factory productivity:

Management

Key words for saving energy
1. Improve of productivity
2. Visible management
3. Monitoring factory productivity conditions

Improved productivity

Specific energy consumption
= Electrical energy ÷ production quantity

Identify of energy waste
→ Improved production

Energy-saving activities

ISO management system

Data disclosure

Achievement of Energy Saving

Facility specific energy consumption management

Hourly measurement of electric power consumption, production quantity and production loss
Productivity of a line at A Factory of Mitsubishi Electric improved by 49%

How to identify specific energy consumption line measurement
How to implement specific energy consumption management

Application of data collected to save energy

Management By Objective

Factory electricity costs drastically cut at A Factory of Mitsubishi Electric

Concerns about the implementation of objective management

Stable supply of electricity

Electricity management (Stable supply of electricity)

Non-contributing energy-saving processes
Transformer load check
Wiring load check
Circuit breaker load check

Consumer electricity payments

Measuring energy is the starting point to conserve energy.

Measuring for stable supply
Measuring consumer energy consumption
Managing electricity using data logger

Measuring locations

| Supply meters | High voltage feeders | Plant facilities | Local substations | Main panels | Distribution boards | Production lines | Facilities |

Benefit of Energy Saving

Productivity

Productivity under normal conditions can be analyzed by managing specific consumption (Electrical power/production quantity). For example, one reason of worsening specific consumption can be facility breakdown. By finding the cause, the specific consumptions can be reduced, which leads to improvement in productivity. Moreover, surveillance of upper/lower limits contributes to maintaining electrical machines and equipment.

Productivity Improved

Energy Efficiency

Effective energy saving activities start from grasping the current conditions by making energy usage amount visible. Efficiency of energy usage becomes possible by thorough energy management by department, and usage by specific consumption management by each line facility.

Visible Management

[At factories]
• Realize "visible management" by building a model factory for energy saving
• Realize "visible management" where everyone participates by disclosing data
• Finding waste by specific consumption management at each facility
• Finding waste by measuring facility management
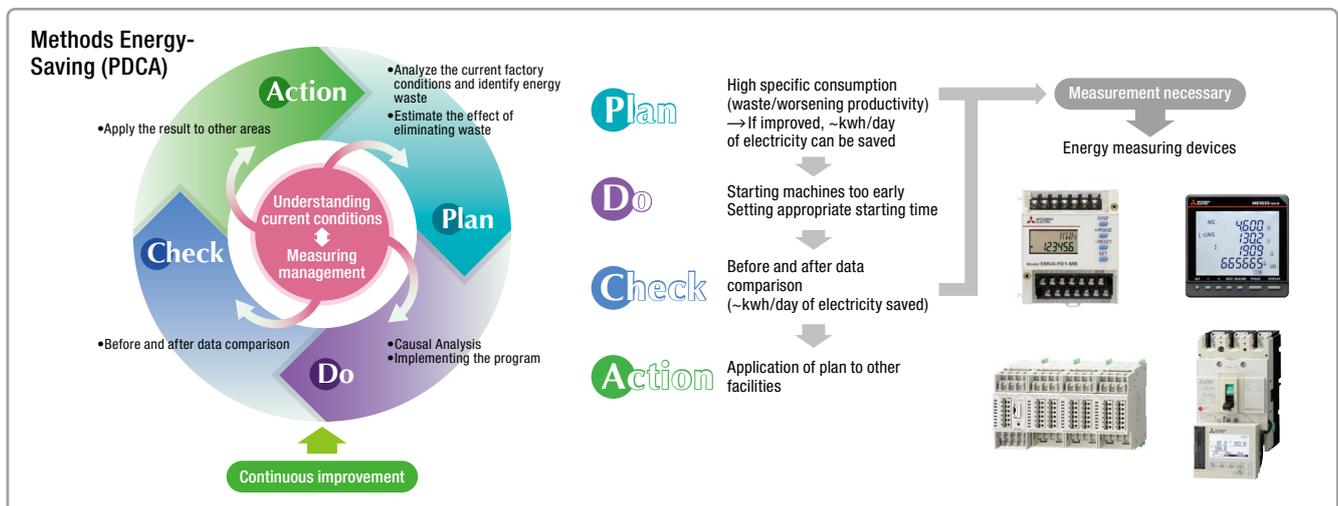• Strengthen specific consumption management by time, line and facility

[At buildings]
• Realize "visible management" where everyone participates by data disclosure
• Implement and promote energy saving activities by Management By Objective
• Strengthen each floor's time and energy usage management

Production Process Efficiency

By measuring electrical power on a short cycle (1 sec, 1 min etc), how each load changes throughout the manufacturing process can be observed. You can analyze if there is any unprofitable waiting time or unnecessary load current running during a waiting time.

Cut Waste

Example at A Factory of Mitsubishi Electric
Production specific consumption cut by
30.0%
(in 2018, compared to 2012)

Methods Energy-Saving (PDCA)

Action
• Apply the result to other areas
• Analyze the current factory conditions and identify energy waste
• Estimate the effect of eliminating waste

Plan

Check
• Before and after data comparison

Do
• Causal Analysis
• Implementing the program

Understanding current conditions
Measuring management

Continuous improvement

Plan — High specific consumption (waste/worsening productivity) → If improved, ~kwh/day of electricity can be saved

Measurement necessary

Energy measuring devices

Do — Starting machines too early Setting appropriate starting time

Check — Before and after data comparison (~kwh/day of electricity saved)

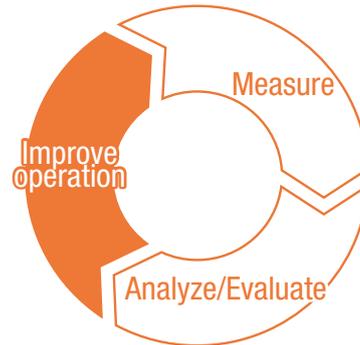**Action** — Application of plan to other facilities

Introduction of Mitsubishi Energy Saving Products

Process of Energy Saving

To maintain more efficient energy/electricity savings, it is important to repeatedly

Measure ⇒ Analyze/Evaluate ⇒ Improve operation.

Measure

Improve operation

Analyze/Evaluate

Measure ❯ Energy Saving-Supporting Device

《 Energy Measuring Unit EcoMonitorLight

》 P 9.10

Using the built-in LCD screen, the energy consumption measured per unit can be displayed and the measurement value indicated. Since the RS-485 (MUDBUS RTU) communication function is incorporated, when using the free data collection software, the present value of data being measured can be displayed on a PC and the CSV file acquired.

《 Energy Measuring unit EcoMonitorPlus

》 P 11.12

The building block system makes it possible to add circuits if necessary. Insulation-level monitoring products can be used to measure the resistance fraction of leakage current (Ior) as well as for preventive maintenance of facility equipment.

《 Programmable Logic Controller MELSEC-Q Series Energy Measuring Module/Insulation Monitoring Module

》 P 13

Directly slotted into the programmable controller, the measurement of various energy information has never been easier. Combined with an indicator (GOT), basic-unit graphs are easily displayed.

《 Programmable Controller MELSEC iQ-R Series Energy Measuring Module

》 P 14

Realize a high-speed (10ms) measurement data update cycle. This module contributes to higher productivity in production lines and machine systems.

《 Electronic Multi-Measuring Instrument

》 P 15.16

Equipped with a full lineup of features, such as multiple measuring elements, and output and transmission functions, this indicator supports the realization of measuring and monitoring systems and energy-saving monitoring that are user-friendly and have easy-to-see displays.

《 MDU Circuit Breakers

》 P 17.18

The MDU Breaker is the result of integrating a circuit breaker and measurement indicator. It realizes energy-saving management support, and save both space and labor.

Analyze/Evaluate ❯ Energy Saving-Supporting Device

《 Energy Saving Data Collecting Server EcoWebServer III

》 P 19.20.21.22

Energy-Saving Data Collection Server
With a simple setting, EcoWebServer III collects data from measurement devices connected via field networks (CC-Link or MODBUS), produces a graph and shows the present value created from the corrected data on a web browser. It easily enables the data analysis required for saving energy.

《 EcoAdviser

》 P 23.24

EcoAdviser is a support tool for energy-saving activity.
It assists monitoring and analysis of measurement data by converting data to suitable types of graphs/charts.

《 MC Works64

》 P 27.28

SCADA Software MC Works64 is a one-stop solution for configurating highly functional monitoring control systems capable of incorporating various Programmable logic controllers, PCs and FA equipments.

Improve operation ❯ Energy Saving Device Expecting energy saving-effect by just installing.
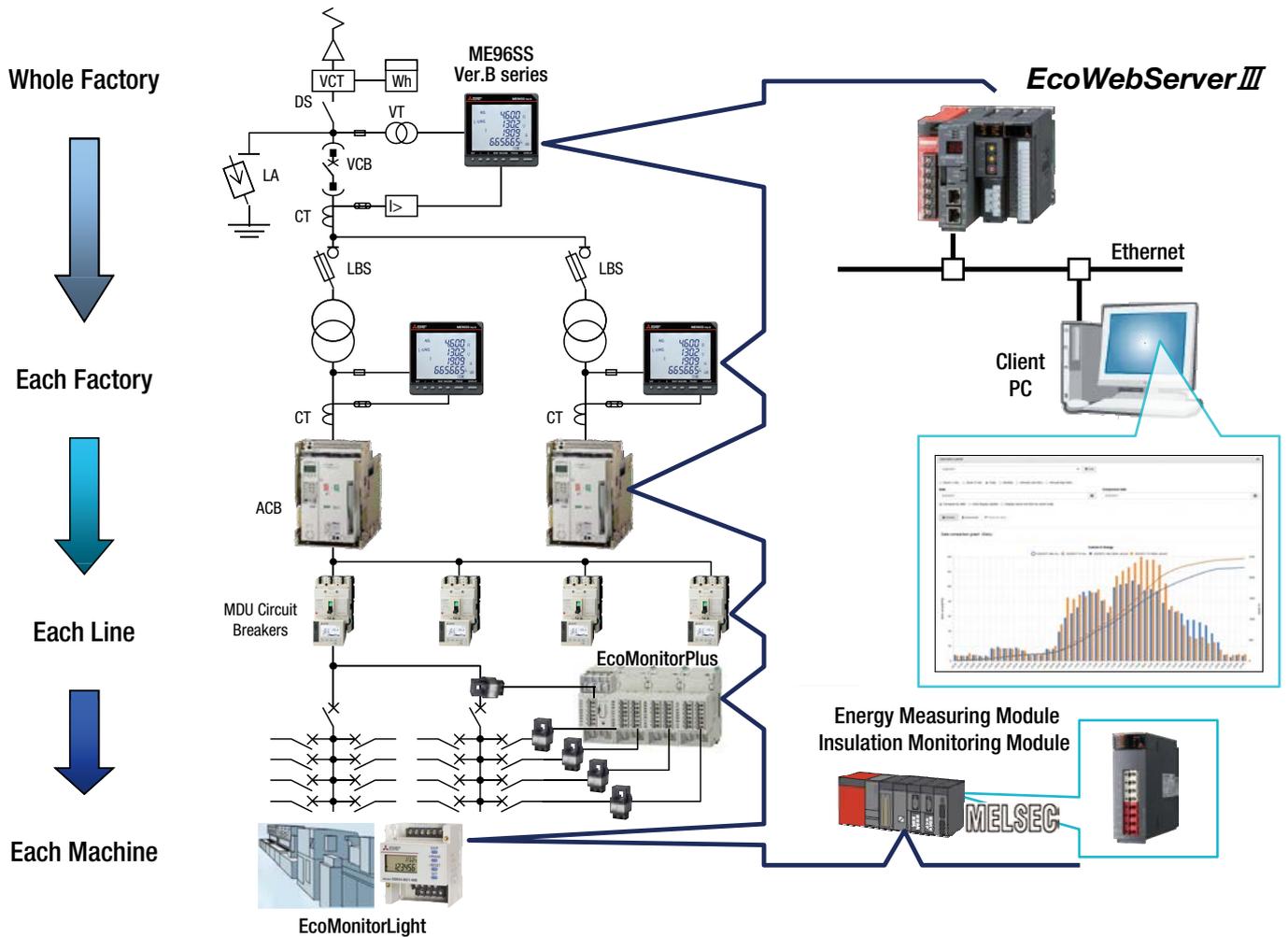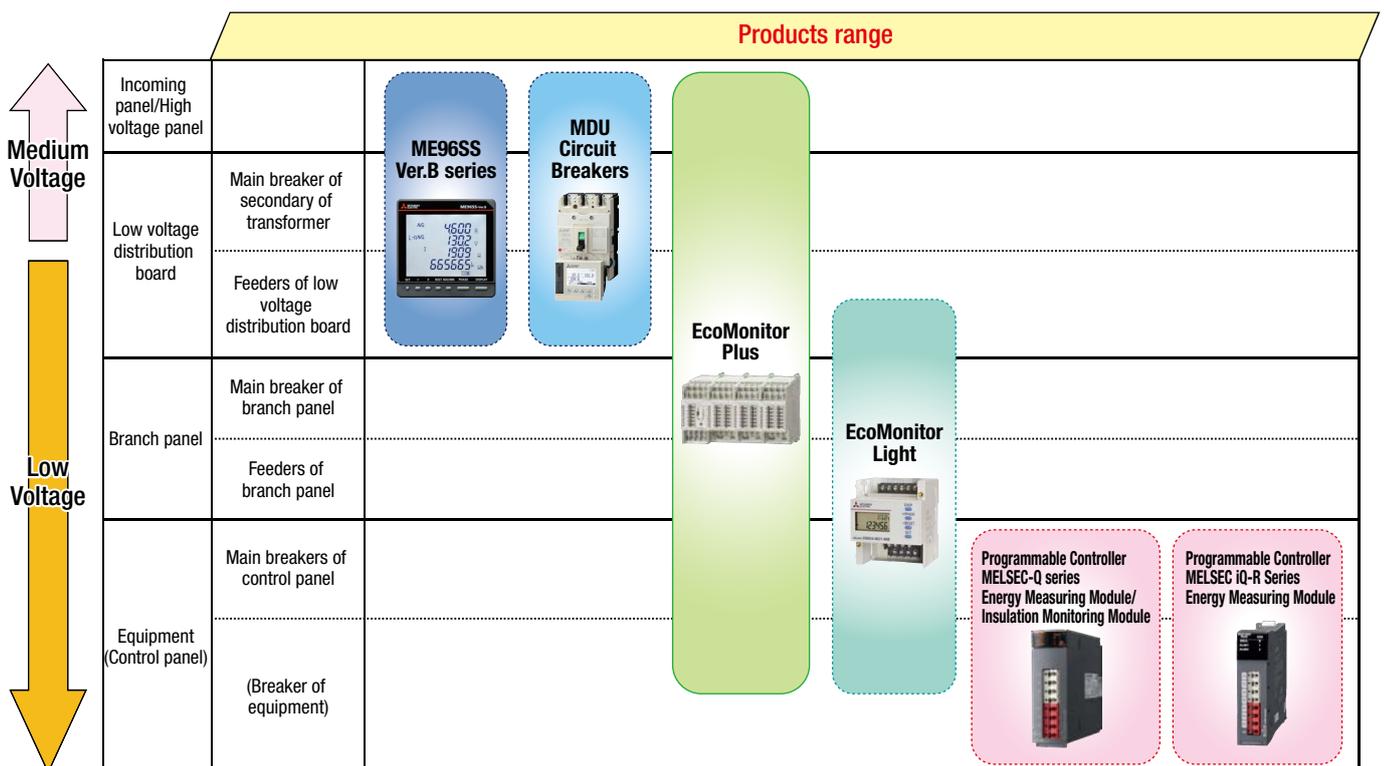
《 INVERTER FR-F800

》 P 29

In response to demands for further energy savings, FREQROL-F800 Series fan pump inverters can control general-purpose motors (three-phase induction motors).

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Mitsubishi Energy-Saving Support System

Whole Factory

Each Factory

Each Line

Each Machine

ME96SS
Ver.B series

VCT | Wh

DS

VT

LA

VCB

CT | I>

LBS   LBS

CT   CT

ACB

MDU Circuit
Breakers

EcoMonitorPlus

EcoMonitorLight

EcoWebServerⅢ

Ethernet

Client
PC

Energy Measuring Module
Insulation Monitoring Module

MELSEC

Position map of measuring devices

|			Products range				
Medium Voltage	Incoming panel/High voltage panel		**ME96SS Ver.B series**	**MDU Circuit Breakers**			
	Low voltage distribution board	Main breaker of secondary of transformer			**EcoMonitor Plus**		
		Feeders of low voltage distribution board					
Low Voltage	Branch panel	Main breaker of branch panel				**EcoMonitor Light**	
		Feeders of branch panel					
	Equipment (Control panel)	Main breakers of control panel					**Programmable Controller MELSEC-Q series Energy Measuring Module/ Insulation Monitoring Module** · **Programmable Controller MELSEC iQ-R Series Energy Measuring Module**
		(Breaker of equipment)					

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System up for Energy Measuring System

Scalable system expansion is possible depending on the number Mitsubishi Electric energy-saving support devices connected to manage functions and measurments.
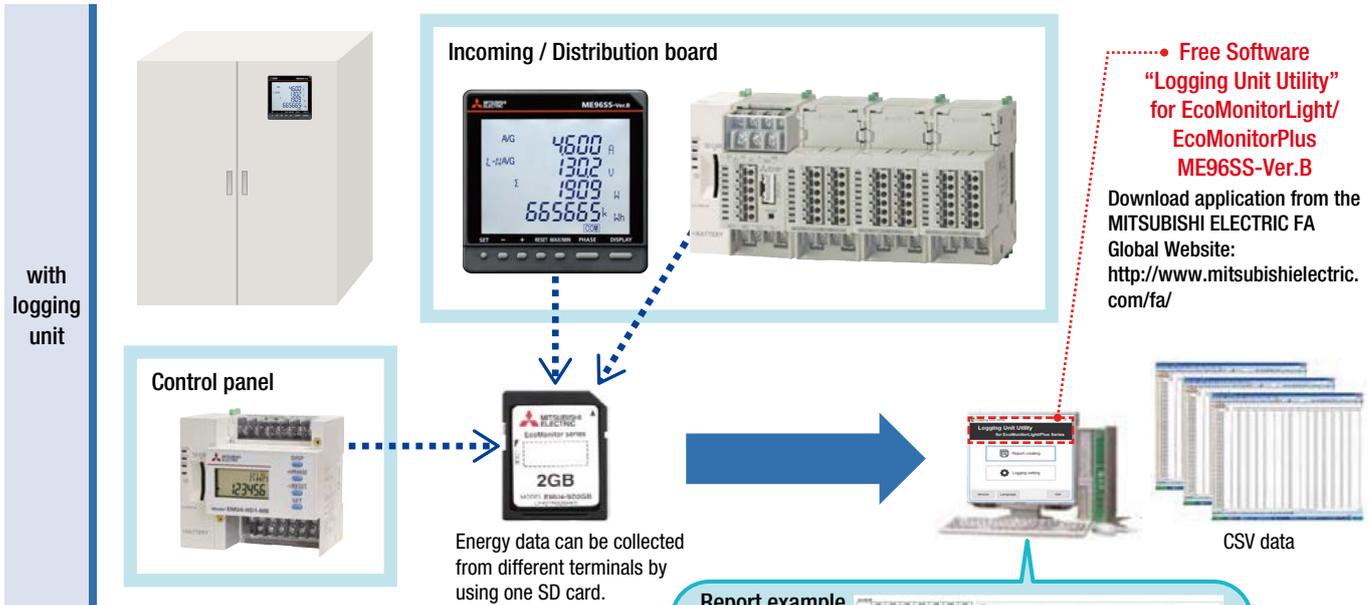
1. Visual Monitoring

● Monitor measuring devices installed in distribution boards and control panels.
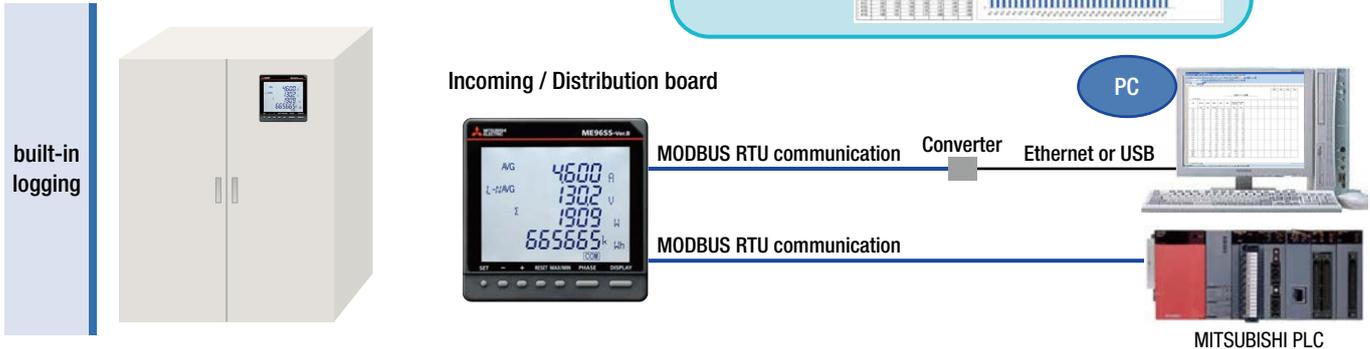● The easiest way to visualize energy consumption.

Incoming/Distribution board

Control panel
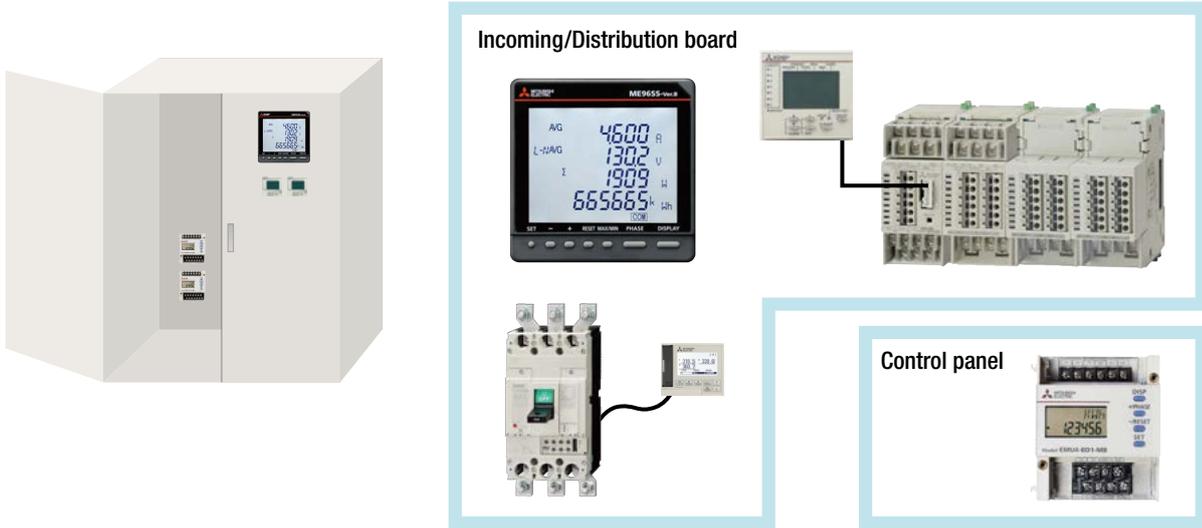
2. Data Logging (Logging unit + SD card and built-in logging)

● With logging unit to retain data.

with logging unit

Incoming / Distribution board

● Free Software
"Logging Unit Utility"
for EcoMonitorLight/
EcoMonitorPlus
ME96SS-Ver.B

Download application from the MITSUBISHI ELECTRIC FA Global Website:
http://www.mitsubishielectric.com/fa/

Control panel

Energy data can be collected from different terminals by using one SD card.

CSV data

Report example

● Use built-in logging function to retain data.

built-in logging

Incoming / Distribution board

PC

MODBUS RTU communication   Converter   Ethernet or USB

MODBUS RTU communication

MITSUBISHI PLC

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3. System networking

PC monitoring with Modbus communication
● Easily build an energy measuring system using MODBUS RTU communication.
● Collect energy data using a PC and data acquisition software.

PC

Report example

Ethernet
or
USB

converter

**Free software for
data acquisition
"EMU4-SW1"**

Download application from the
MITSUBISHI ELECTRIC FA Global Website:
http://www.mitsubishielectric.com/fa/

MODBUS RTU communication
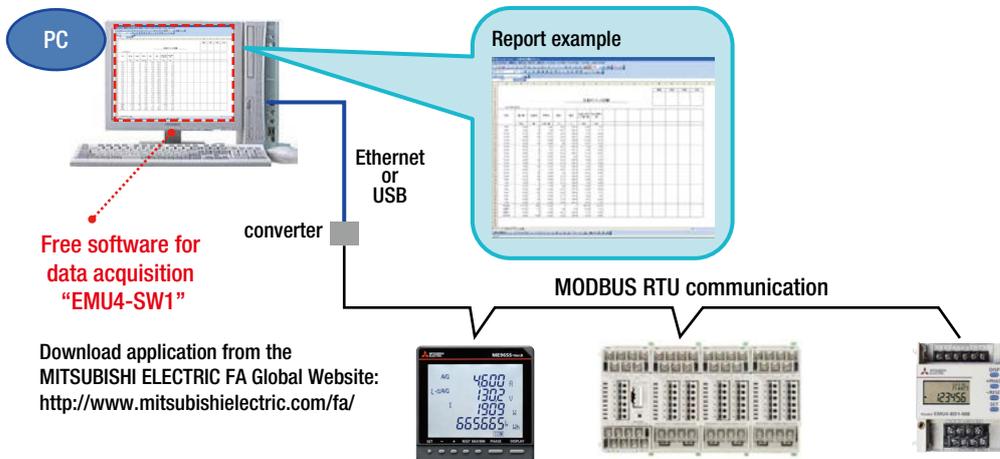
Monitoring by GOT
● Energy visualization for each facility possible using GOT
  (via MODBUS RTU communication)

Production facility

Average current graph
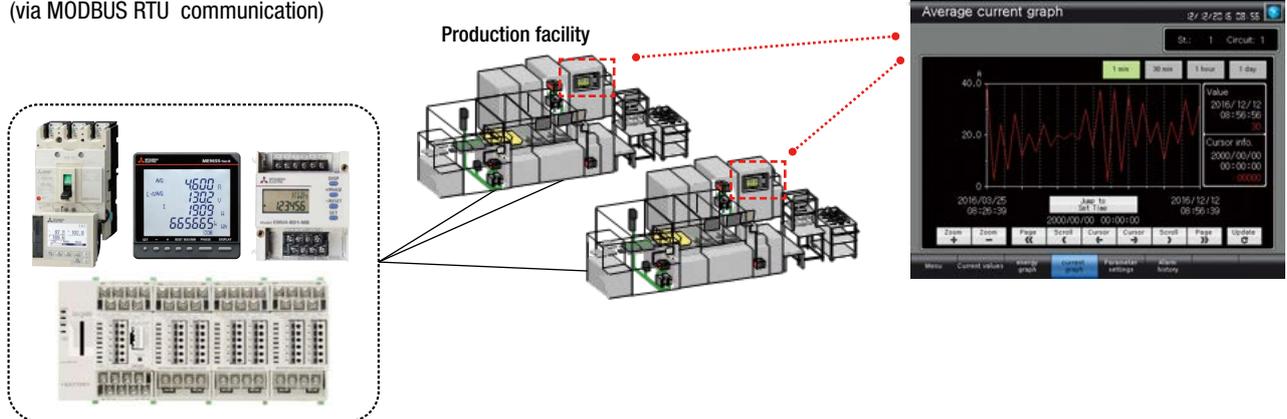
Energy Visualization System (EcoWebServerⅢ)
● Energy measurement graph can be shown through factory LAN by using EcoWebServerⅢ
● Remote monitoring of machines and line status can be shown by PC

EcoWebServerⅢ

CC-Link

converter

HUB

MODBUS TCP

MODBUS RTU
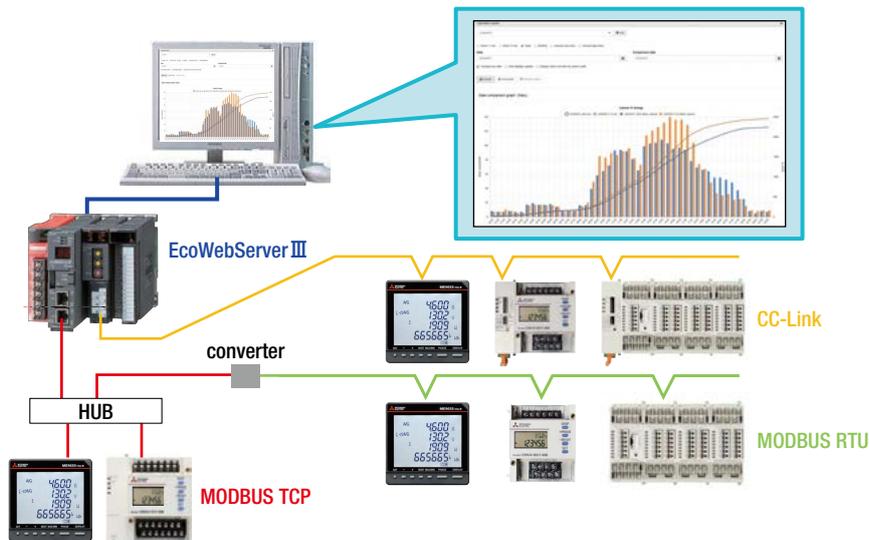
Energy Visualization System (EcoWebServerⅢ+EcoAdviser)
● Various analysis can be realized by collecting energy information such as electricity consumption and production volume accumulated by PLC.
● Collected data can be displayed in graphs/charts on customizable Dashboard. Also, if a web server is set on your PC, EcoAdviser can be used as a visualization tool at the site.
● No programming or complicated engineering work is required. All you need is just simple setting. EcoAdviser collects measured data automatically. It can be also used as an application that runs on Edgecross.

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Energy Measuring Unit "EcoMonitorLight"

With a single circuit and an integrated display, EcoMonitorLight is ideal for simple and easy measuring. This product is effective for eliminating energy waste and confirming the benefits of energy-saving countermeasures by visualizing the energy consumed by air conditioning and lighting systems, and production equipment.

EMU4-FD1-MB
General current transformer Model

EMU4-HD1-MB
High-Performance Model

EMU4-BD1-MB
Standard Model

1. EcoMonitorLight Features
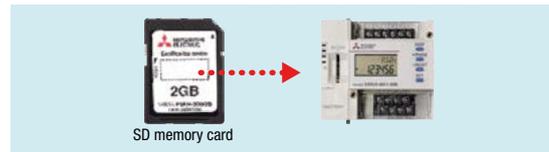
1. Measures and displays energy data on a single unit

● Easy setting/Easy management
Equipped with a setting switch and built-in LCD display, setting, measuring and displaying energy measurements are all possible using one unit.

2. MODBUS RTU communication built-in

● EMU4-SW1 data acquisition software
MODBUS RTU communication enables current value, output form, measurement device settings and other information to be displayed and set with ease on a computer. Data acquisition software can be downloaded for free from the MITSUBISHI ELECTRIC FA Global Website: http://www.mitsubishielectric.com/fa/

● Host system connectivity
With the built-in MODBUS RTU communication function, EcoMonitorLight can be easily connected with EcoWebServer III [*1] or other host system.
*1 MODBUS TCP ⇔ MODBUS RTU converter is necessary.

● Direct connection to display device (GOT)
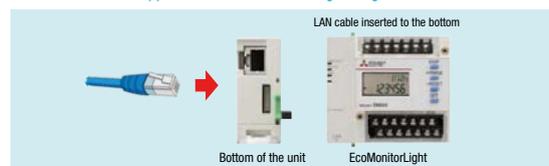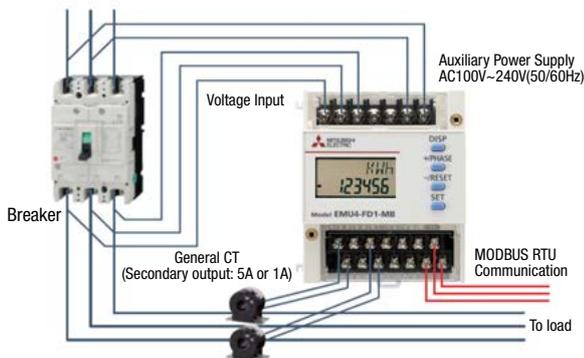MODBUS RTU communication enables direct connection with display device (GOT).

3. Expand after adding optional unit

● Logging unit
Connect a logging unit to store various logging data (such as power, current and voltage) on a SD memory card in CSV file format.

● Communication unit
Add a MODBUS TCP communication unit[*2] or CC-Link communication unit to easily expand to an EcoWebServer III visualized system or other host system.
*2 Only EMU4-FD1-MB can be connected to the MODBUS TCP communication unit (EMU4-CM-MT).

● CC-Link IEF Basic communication unit
Supports networking through Ethernet communication.

● MODBUS TCP Communication Unit
Connect to MODBUS TCP communication

EcoWeb Server III | MELSEC-Q Series | MELSEC-F Series | Display device (GOT) | Free downloadable software (EMU4-SW1)

MODBUS RTU
Connect up to 31 devices

Data stored in the logging unit (SD memory card)

SD memory card

Add communication unit (MODBUS TCP communication, CC-Link communication) to expand EcoWebServer system

EcoWebServer III

CC-Link IEF Basic supports customers networking through Ethernet communication.

LAN cable inserted to the bottom

Bottom of the unit | EcoMonitorLight

Other Features

■ **Basic Installation ①** (EMU4-FD1-MB)

Auxiliary Power Supply AC100V~240V(50/60Hz)
Voltage Input
Breaker
General CT (Secondary output: 5A or 1A)
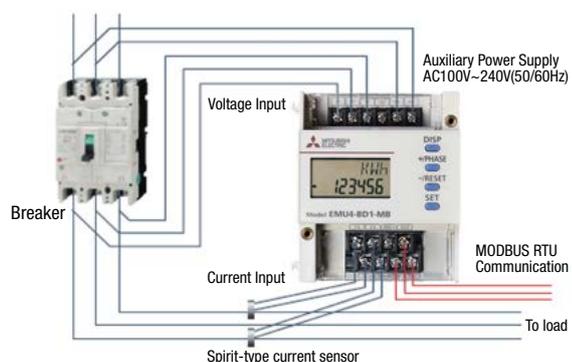MODBUS RTU Communication
To load

Since current input by general CT (secondary output : 1A or 5A) is possible, Mitsubishi spirit-type current sensor is not needed.
*1: Do not connect together more than one EMU4-FD1-MB on the secondary side of a current transformer.
*2: Do not connect together other units and EMU4-FD1-MB on the secondary side of a current transformer.

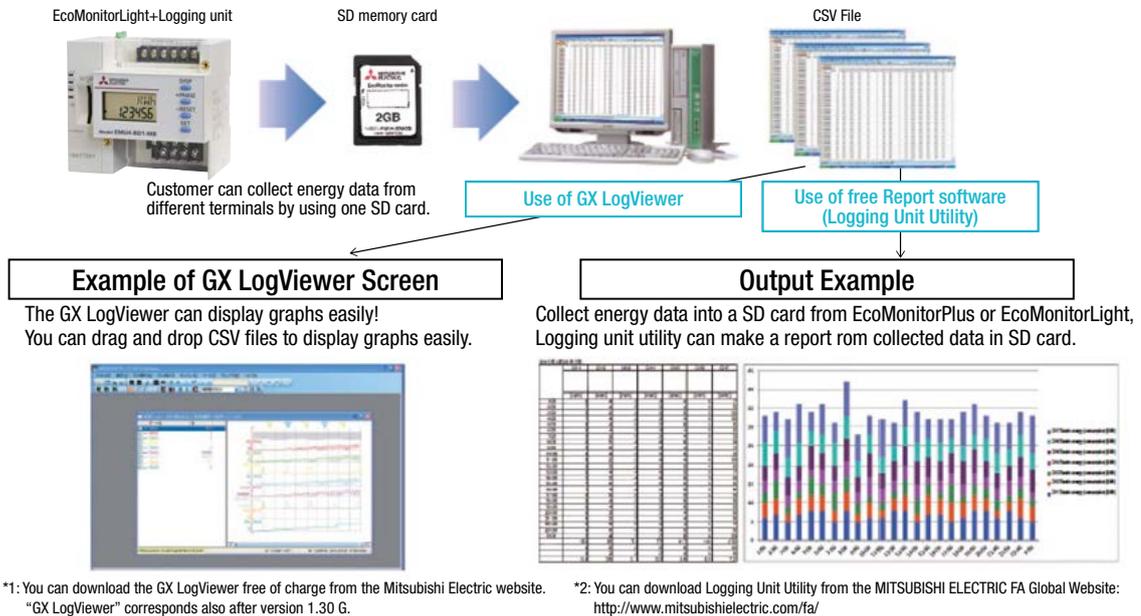■ **Basic Installation ②** (EMU4-BD1-MB/EMU4-HD1-MB)

Auxiliary Power Supply AC100V~240V(50/60Hz)
Voltage Input
Breaker
Current Input
MODBUS RTU Communication
To load
Spirit-type current sensor

Easy installation to existing circuit by Mitsubishi spirit-type current sensors.

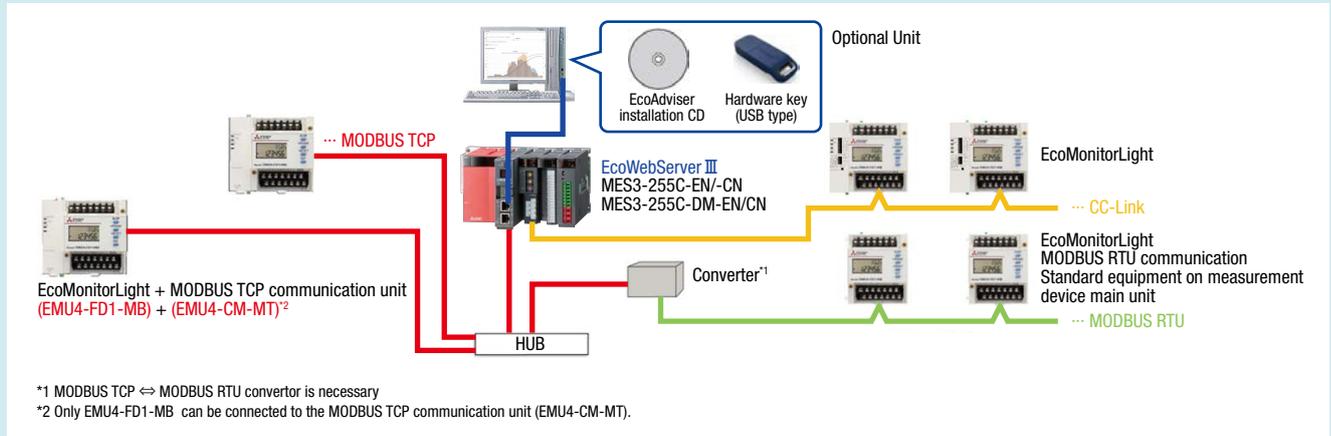## 2. Installation Steps/Application Examples

Easy Energy Logging (Logging unit + SD card)

● Add a logging unit in measuring device, and collect the data through SD card.
● To save working time on visual monitoring.

EcoMonitorLight+Logging unit   SD memory card   CSV File

Customer can collect energy data from different terminals by using one SD card.

Use of GX LogViewer

Use of free Report software (Logging Unit Utility)

Example of GX LogViewer Screen

The GX LogViewer can display graphs easily!
You can drag and drop CSV files to display graphs easily.

Output Example

Collect energy data into a SD card from EcoMonitorPlus or EcoMonitorLight, Logging unit utility can make a report rom collected data in SD card.

*1: You can download the GX LogViewer free of charge from the Mitsubishi Electric website. "GX LogViewer" corresponds also after version 1.30 G.

*2: You can download Logging Unit Utility from the MITSUBISHI ELECTRIC FA Global Website: http://www.mitsubishielectric.com/fa/

Construct a visualization system with EcoWebServer Ⅲ

By building a system with MODBUS RTU (via a converter) and MODBUS TCP communication, measurement data can be automatically collected and remotely monitored!

Optional Unit

EcoAdviser installation CD   Hardware key (USB type)

··· MODBUS TCP

EcoWebServer Ⅲ
MES3-255C-EN/-CN
MES3-255C-DM-EN/CN

EcoMonitorLight

··· CC-Link

EcoMonitorLight + MODBUS TCP communication unit
(EMU4-FD1-MB) + (EMU4-CM-MT)*2

Converter*1

HUB

EcoMonitorLight
MODBUS RTU communication
Standard equipment on measurement device main unit

··· MODBUS RTU

*1 MODBUS TCP ⇔ MODBUS RTU convertor is necessary
*2 Only EMU4-FD1-MB can be connected to the MODBUS TCP communication unit (EMU4-CM-MT).

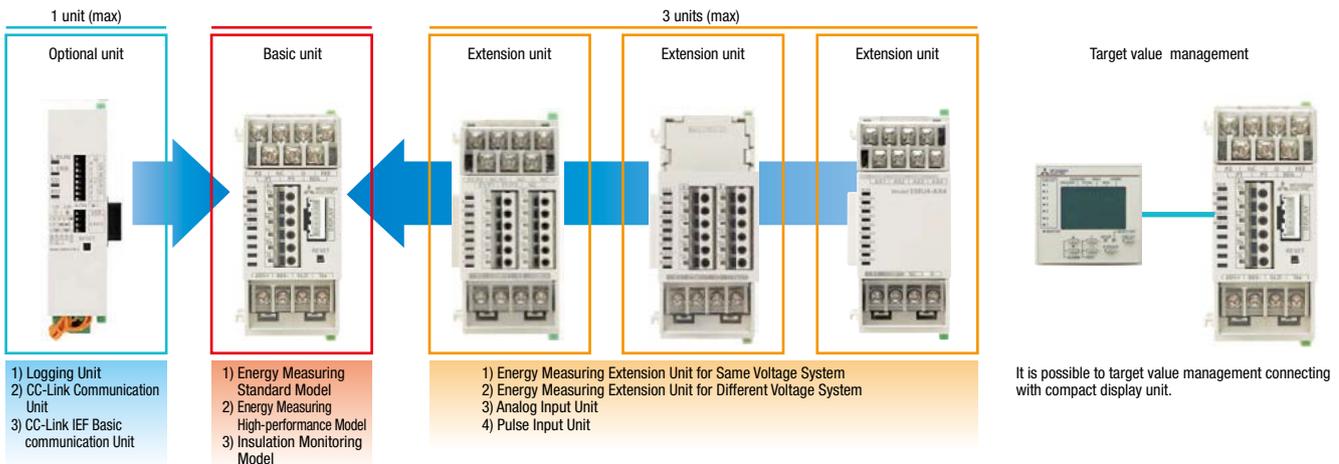| Item		Specifications		
Model		EMU4-FD1-MB	EMU4-HD1-MB	EMU4-BD1-MB
Phase-wire system		1P2W/1P3W/3P3W/3P4W common	1P2W/1P3W/3P3W/3P4W common	1P2W/1P3W/3P3W common
Rated voltage		Direct 110VAC, 220VAC, 440VAC available	Direct 110VAC, 220VAC, 440VAC available	Direct 110VAC, 220VAC available
Items measured	Energy, reactive energy	○	○	○
	Current, voltage	○	○	○
	Power, reactive power	○	○	○
	Power factor, frequency	○	○	○
	Apparent power	○	○	–
	Harmonic current, harmonic voltage	○	○	–
	Periodic energy	○	○	–
	Operating time	○	○	○
	Pulse count value	○	○	–
	CO_2 conversion value	○	○	–
External input		Pulse input/contact input × 1	Pulse input/contact input × 1	–
External output		Pulse output/alarm output × 1	Pulse output/alarm output × 1	–
Communication	MODBUS RTU	○	○	○
	MODBUS TCP*	○	–	–
	CC-Link*	○	○	○
	CC-Link IE Field Basic*	○	○	○
Data update cycle		250ms		
Standards and certifications		CE Marking, UL, KC Mark		
External dimensions		W75 × H90 × D75 (mm)		

*Optional unit is required.

Energy Measuring Unit "EcoMonitorPlus"

EcoMonitorPlus is an energy measuring unit that offers extra value depending on how it is utilized and combined to suit the application. Benefits include configuring systems to visualize energy use, supporting preventive maintenance of production equipment, and improving productivity.
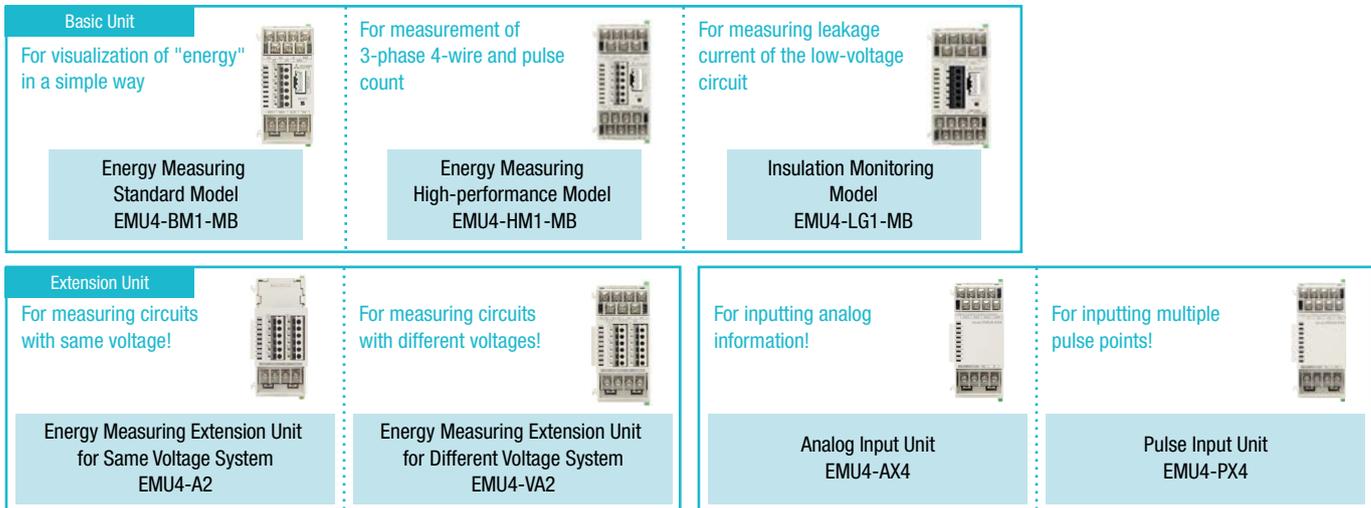
1. EcoMonitorPlus Features

Basic Configuration   Additional units can be gradually added to expand systems in "building block" style.

1 unit (max)   3 units (max)

Optional unit	Basic unit	Extension unit	Extension unit	Extension unit	Target value management

1) Logging Unit
2) CC-Link Communication Unit
3) CC-Link IEF Basic communication Unit

1) Energy Measuring Standard Model
2) Energy Measuring High-performance Model
3) Insulation Monitoring Model

1) Energy Measuring Extension Unit for Same Voltage System
2) Energy Measuring Extension Unit for Different Voltage System
3) Analog Input Unit
4) Pulse Input Unit

It is possible to target value management connecting with compact display unit.

2. Lineup

Basic Unit

For visualization of "energy" in a simple way

Energy Measuring
Standard Model
EMU4-BM1-MB

For measurement of 3-phase 4-wire and pulse count

Energy Measuring
High-performance Model
EMU4-HM1-MB

For measuring leakage current of the low-voltage circuit

Insulation Monitoring
Model
EMU4-LG1-MB

Extension Unit

For measuring circuits with same voltage!

Energy Measuring Extension Unit
for Same Voltage System
EMU4-A2

For measuring circuits with different voltages!

Energy Measuring Extension Unit
for Different Voltage System
EMU4-VA2

For inputting analog information!

Analog Input Unit
EMU4-AX4

For inputting multiple pulse points!

Pulse Input Unit
EMU4-PX4

Communication

● Since MODBUS RTU (RS-485) communication is equipped as standard, it can be connected with PLC, host system, or display device (GOT).

Optional Unit

● Logging Unit
The Logging Unit enables all of the measurement data (electric energy, voltage, current, etc.) logged to be stored in CSV file format on an SD memory card.

● CC-Link Communication Unit
By connecting a CC-Link Communication Unit, the EcoMonitorPlus can be easily expanded into an EcoWebServer III visualization system or programmable controller system.

● CC-Link IEF Basic Communication Unit
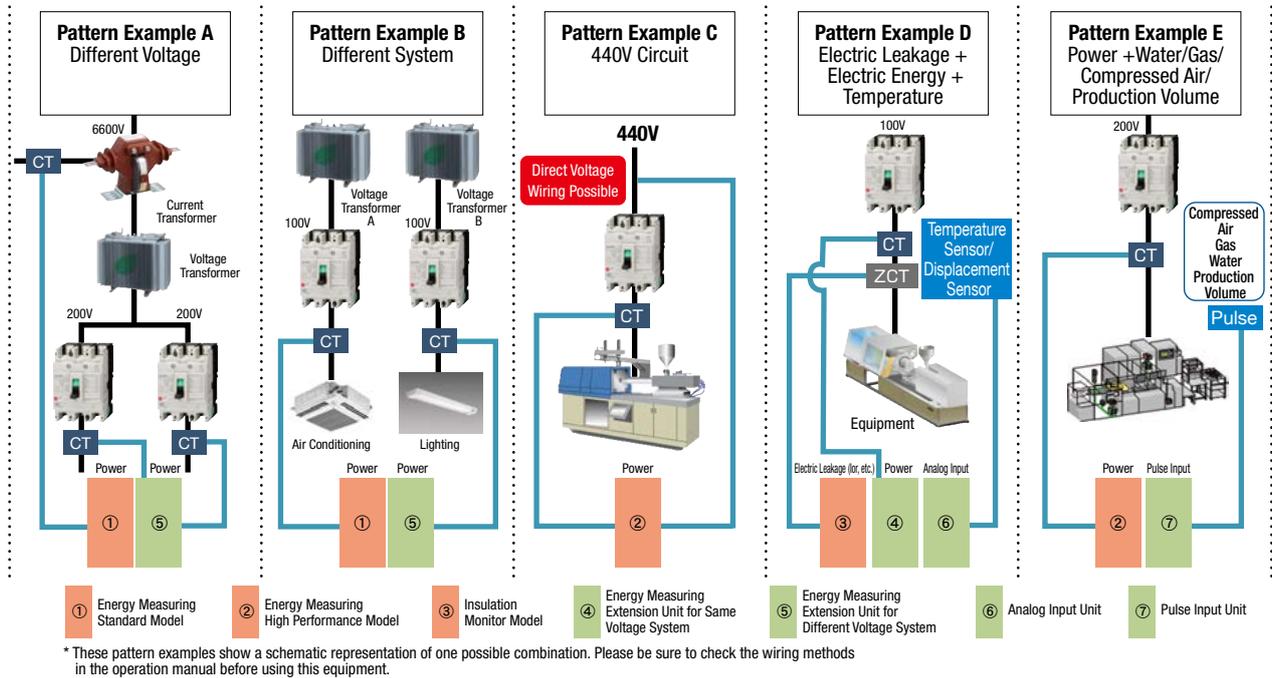CC-Link IEF Basic supports customers networking through Ethernet communication.

Logging Unit

CC-Link Communication Unit

CC-Link IEF Basic communication Unit
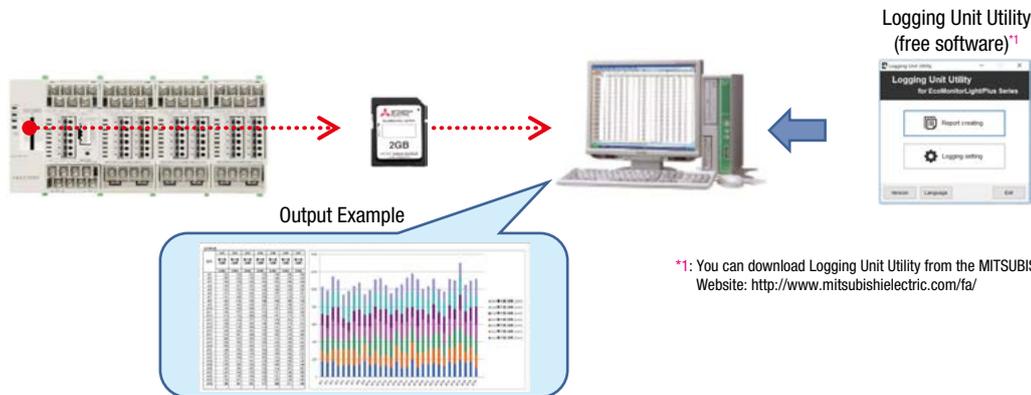
3. Application Examples

Various measuring needs answered with module combinations

Pattern Example A Different Voltage

Pattern Example B Different System

Pattern Example C 440V Circuit

Pattern Example D Electric Leakage + Electric Energy + Temperature

Pattern Example E Power +Water/Gas/ Compressed Air/ Production Volume

① Energy Measuring Standard Model
② Energy Measuring High Performance Model
③ Insulation Monitor Model
④ Energy Measuring Extension Unit for Same Voltage System
⑤ Energy Measuring Extension Unit for Different Voltage System
⑥ Analog Input Unit
⑦ Pulse Input Unit

* These pattern examples show a schematic representation of one possible combination. Please be sure to check the wiring methods in the operation manual before using this equipment.

Free software can be used to ease the burden of creating reports

Measurement data is managed using a logging unit (SD memory card)

Using a logging unit combined with a Logging Unit Utility (free software), reports can be easily created based on the measurement data logged.

Logging Unit Utility (free software)[1]

Output Example

[1]: You can download Logging Unit Utility from the MITSUBISHI ELECTRIC FA Global Website: http://www.mitsubishielectric.com/fa/

Utilize EcoWebServer III to visualize energy consumption while remote monitoring via a web browser

Utilize EcoWebServer III for centralized management when expanding measurement circuits!

System visualization with EcoWebServer III
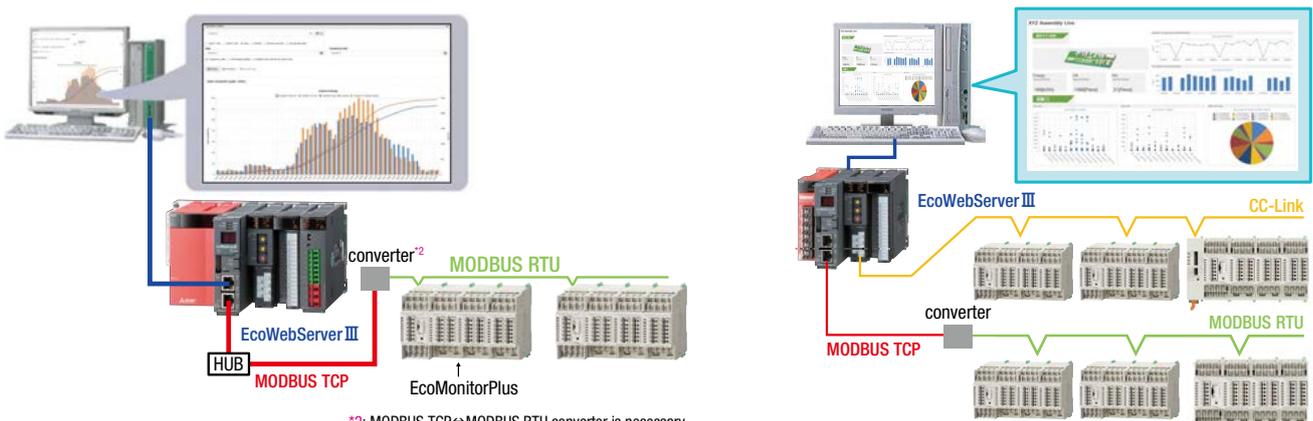
EcoAdviser

[2]: MODBUS TCP↔MODBUS RTU converter is necessary.

Programmable Logic Controller "MELSEC-Q Series" Energy Measuring Module/Insulation Monitoring Module

Slots directly into MELSEC-Q PLC and enables easy measurement of a variety of energy-related information!

A PLC-installable measurement device that enhances productivity by reducing production equipment energy consumption and realizing preventive maintenance.

■Simple Specifications Table

	Energy Measuring Module				Insulation Monitoring Module
Model name	QE81WH	QE84WH	QE81WH4W[*1]	QE83WH4W[*1]	QE82LG
Phase wire system	3-phase, 3-wire		3-phase, 4-wire		3-phase, 3-wire
Items measured	Electric energy (consumption, regenerative), reactive energy, current, voltage, power factor, frequency, etc.				Leakage current Resistive-component leakage current
No. of measured circuits	1-circuit	4-circuit	1-circuit	3-circuit	2-circuit

*1: A special-purpose voltage convertor is required for QE81WH4W and QE83WH4W

Energy Measuring Module QE81WH

Energy Measuring Module 3-phase, 4-wire QE81WH4W

Energy Measuring Module Multi-circuit model QE84WH/ QE83WH4W

Insulation Monitoring Module QE82LG

1. Energy Measuring Module Features

1. Space-saving measuring device

● An energy measuring device can be added to an empty slot in the base unit without affecting the layout of devices in the control panel.

Control panel

Control panel

Voltage
Current
Current sensor
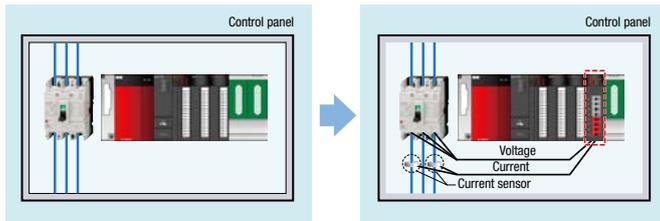
2. Reduced wiring and engineering set-up work

● Less wiring and engineering set-up work is required since the communication unit, cable and program are no longer required. As a result of the reduced workload, cost is also reduced.

Communication module

Energy Measuring Module

Communication line

CC-Link, etc.

Measuring device (with communication function)

Control power source
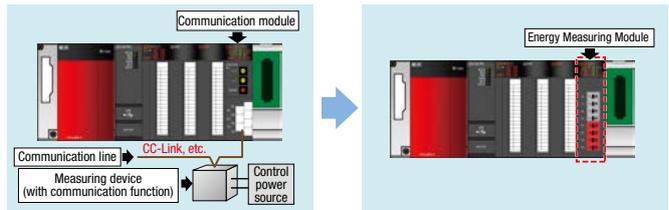
2. Features

1. Multi-Circuit Model Current Measuring Mode (QE84WH, QE83WH4W)

● In the current measuring mode, up to eight circuits can be measured for current alone.[*2]
If only current is measured, a maximum of eight currents can be measured in a 100ms cycle.
Modules with this mode are space-saving and provide the ideal solution for managing current values linked to production equipment.

Installation diagram
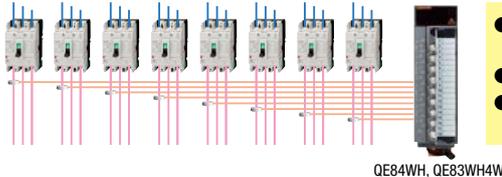
● Upper-/Lower-limit monitoring possible
● Measures up to eight circuits
● Data refreshed in 100ms cycles

QE84WH, QE83WH4W

Handy ways to use current measuring mode

1. Electrical current abnormalities can be detected in a short measurement cycle, making it possible to determine product defects.
   (e.g., manufacturing lines of semiconductors, precision devices, LCD panels, etc.)
2. Abnormal electrical current values can be detected and equipment status monitored. Equipment problems can be determined in advance.
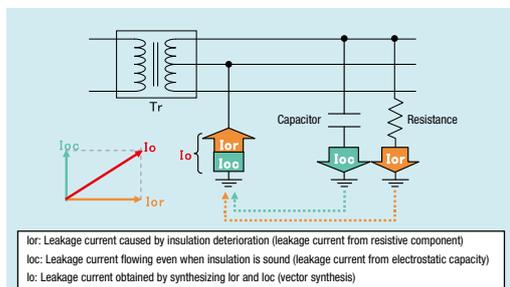
*2: Items other than the current cannot be measured in the current measuring mode.

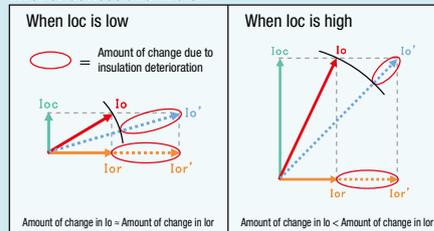## 2. Constant monitoring for insulation deterioration in equipment using the Ior method!

● The module can measure resistive-component leakage current (Ior). Even in circuits that cannot be monitored for insulation using the conventional Io method, such as inverter circuits where capacitor component leakage current (Ioc) is large, the module removes the Ioc component to accurately monitor the leakage current caused by insulation deterioration.
● The module constantly measures the resistive-component leakage current (Ior) even while equipment is running. It detects any sign of insulation deterioration without interrupting power.

Since leakage current (Io) is affected by the Ioc of the entire facility, Ior measurement is effective for insulation deterioration diagnosis!

● Method of leakage current measurement (Io and Ior measurements)

Tr

Capacitor

Resistance

Ior: Leakage current caused by insulation deterioration (leakage current from resistive component)
Ioc: Leakage current flowing even when insulation is sound (leakage current from electrostatic capacity)
Io: Leakage current obtained by synthesizing Ior and Ioc (vector synthesis)

The Ioc fluctuates in equipment with long cable length or inverter devices and filters.

When Ioc is low	When Ioc is high
= Amount of change due to insulation deterioration	
Amount of change in Io ≒ Amount of change in Ior	Amount of change in Io < Amount of change in Ior

The Ioc component interferes and it's not possible to accurately determine leakage current from the insulation resistant component.

Programmable Logic Controller "MELSEC iQ-R Series" Energy Measuring Module

Product Concept
Product name：Energy Measuring Module
Model name ：RE81WH
Specification ：1-circuit 1P2W/1P3W/3P3W

Features
1. High speed data collecting (10ms)
2. Wire saving, space saving
   Can be mounted directly into the MELSEC iQ-R slot.
3. Easy to set up
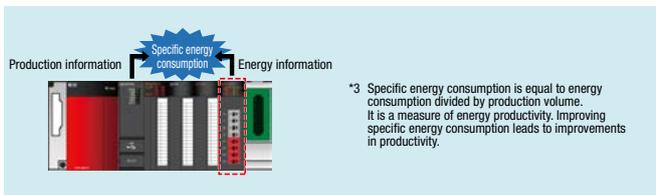   Set-up is simplified as well through use of the GX Works3 software.

Energy Measuring Module
RE81WH
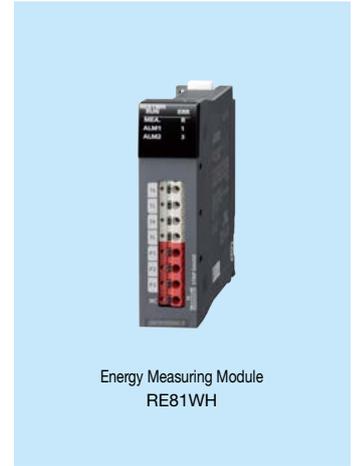
■Simple Specifications Table

	Energy Measuring Module
Model name	RE81WH
Phase wire system	1-phase, 2-wire/ 1-phase, 3-wire/ 3-phase, 3-wire
Items measured	Electric energy (consumption, regenerative), reactive energy, current, voltage, power factor, frequency, etc.
No. of measured circuits	1-circuit

3. Management based on specific energy consumption possible by measuring energy of each piece of equipment

● Specific energy consumption*3 can be easily calculated by combining the production data of the CPU module with the energy data of the Energy Measuring Module.
Measurement data is automatically collected at a speed of 250ms*4 and stored in the buffer memory, therefore enabling precise management of specific energy consumption.

Production information
Specific energy consumption
Energy information

*3 Specific energy consumption is equal to energy consumption divided by production volume.
It is a measure of energy productivity. Improving specific energy consumption leads to improvements in productivity.

*4: QE84WH and QE83WH collect data in 500ms cycles

4. System construction enables simple visualization of energy consumption

● Visualization of specific energy consumption in the form of a graph is easily achieved by installing a graphic operation terminal (GOT) on the control panel onsite at the factory. Analysis is also possible using a computer combined with a high-speed data logger unit (RD81DL96).
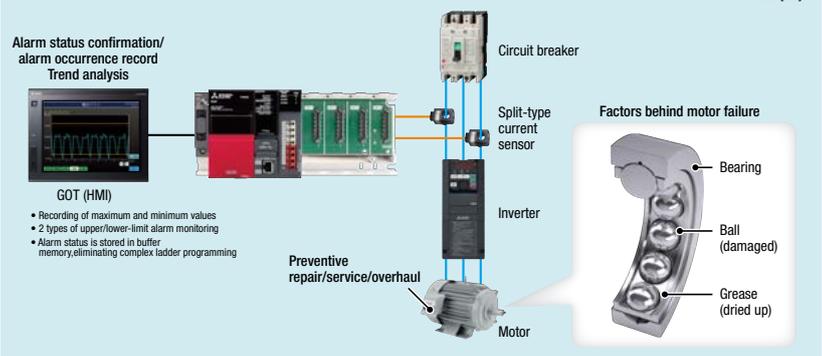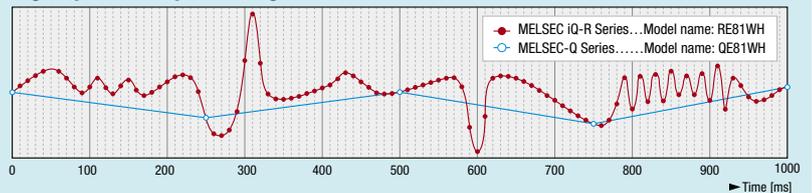
Display device (GOT)
Computer (Excel)
[Example of graphic display of specific energy consumption with GOT]
High-speed data logger unit
LAN
Energy Measuring Module
Specific energy consumption graph
Power consumption graph
Production volume graph
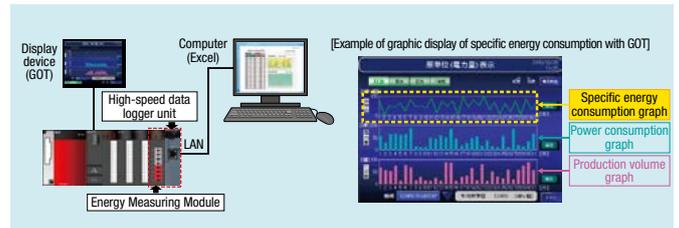
2. Features

1. 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*5, voltage*5, 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.

*5: Waveform data for current and voltage can also be obtained. For further details, please refer to the product user's manual (detailed edition).

High-speed data processing

MELSEC iQ-R Series…Model name: RE81WH
MELSEC-Q Series……Model name: QE81WH

0   100   200   300   400   500   600   700   800   900   1000
►Time [ms]

Alarm status confirmation/ alarm occurrence record
Trend analysis

Circuit breaker
Split-type current sensor
Factors behind motor failure

GOT (HMI)
• 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

Inverter
Bearing
Ball (damaged)
Grease (dried up)

Preventive repair/service/overhaul
Motor

2. Waveform data output function

Waveform data of measured voltage/current is available.
* Waveform data is sampled data of voltage/current wave (sampling terms:254µs).
Visualizing voltage/current waveform changing.

Electronic Multi-Measuring Instrument "ME96SS Ver.B Series"

Using the ME96SS Ver.B series, a single unit can replace nine devices (indicators and transducers), simplifying the system, improving performance, and reducing cost.

1. Line up

Model name	Communication/Option specifications	Main measurement items
ME96SSHB-MB (High-performance model)	MODBUS RTU communication Plug-in module (options) • Analog/Pulse/Contact output/input • CC-Link communication • Digital input/output (for MODBUS RTU communication) • Backup (on SD card) • MODBUS TCP communication	A, DA, V, Hz = ±0.1% W, var, VA, PF = ±0.2% VAh = ±2.0% Wh = class 0.5S (IEC62053-22) varh = class 1S (IEC62053-24) Harmonics = 31st-deg (max) Rolling demand = W, var, VA
ME96SSRB-MB (Standard model)	MODBUS RTU communication Plug-in module (options) • Analog/Pulse/Contact output/input • CC-Link communication • Digital input/output (for MODBUS RTU communication) • Backup (on SD card) • MODBUS TCP communication	A, DA, V = ±0.2% Hz = ±0.1% W, var, VA, PF = ±0.5% VAh = ±2.0% Wh = class 0.5S (IEC62053-22) varh = class 1S (IEC62053-24) Harmonics = 19th-deg (max) Rolling demand = W, var, VA
ME96SSEB-MB (Economy model)	MODBUS RTU communication	A, DA, V = ±0.5% Hz = ±0.2% W, var, VA, PF = ±0.5% VAh = ±2.0% Wh = class 0.5S (IEC62053-22) varh = class 1S (IEC62053-24) Harmonics = Only total

Optional Plug-in Modules

Model name	Analog output	Pulse/Alarm output	Contact input	Contact output	Communication function	Used with
ME-4210B-SS96	4	2	1	-	-	ME96SSHB-MB ME96SSRB-MB
ME-0040C-SS96	-	-	4	-	CC-Link	
ME-0052-SS96	-	-	5	2	-	
ME-0000BU-SS96	-	-	-	-	SD CARD	
ME-0000MT-SS96	-	-	-	-	MODBUS TCP	

Note: Optional Plug-in Module can not be used with ME96SSEB-MB.

2. Features

1. Clear display

● The 4 measured values can be digitally confirmed on one screen.
● Concurrent display of each phase measured values
● Cyclic display function

**Four characteristics displayed simultaneously**

2. Wide-viewing-angle (ME96SSHB-MB, ME96SSRB-MB)

As the wide-viewing-angle LCD is mounted, good visibility is obtained even when the instrument is mounted at a level lower than the eye line.

Type	Model number	When viewed from the side		When viewed from the above	
		Up	Down	Left	Right
New type	ME96SSHB-MB ME96SSRB-MB	60°	60°	60°	60°
Old type	ME96SSHA-MB ME96SSRA-MB	10°	60°	60°	60°

Note: ME96SSEB-MB has the same viewing angle as the old type.

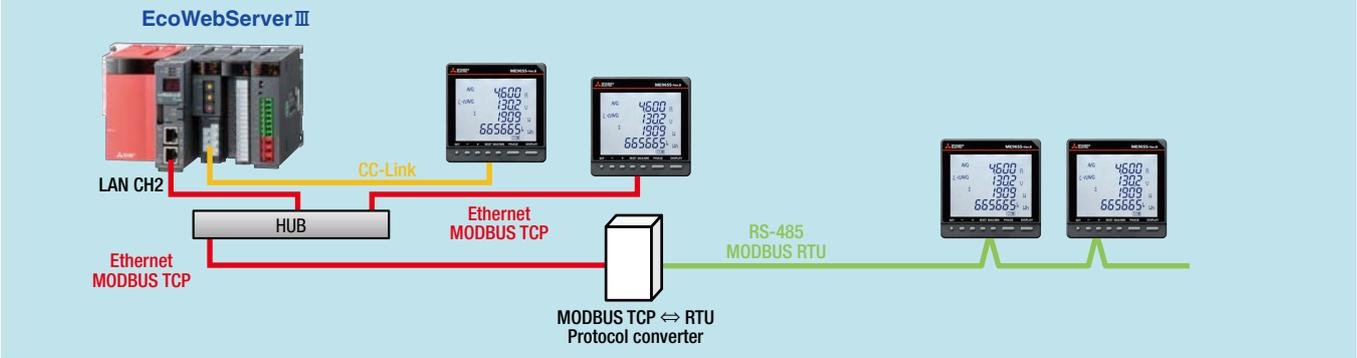(Side view)   (Overhead view)
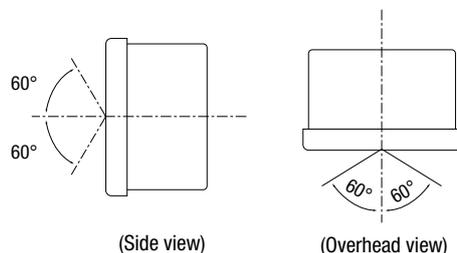
3. Additional functions

Use an optional Plug-in Module, and add Analog/Pulse/Contact output, Contact input, CC-Link communication, MODBUS TCP communication and Backup (on SD card) functions.
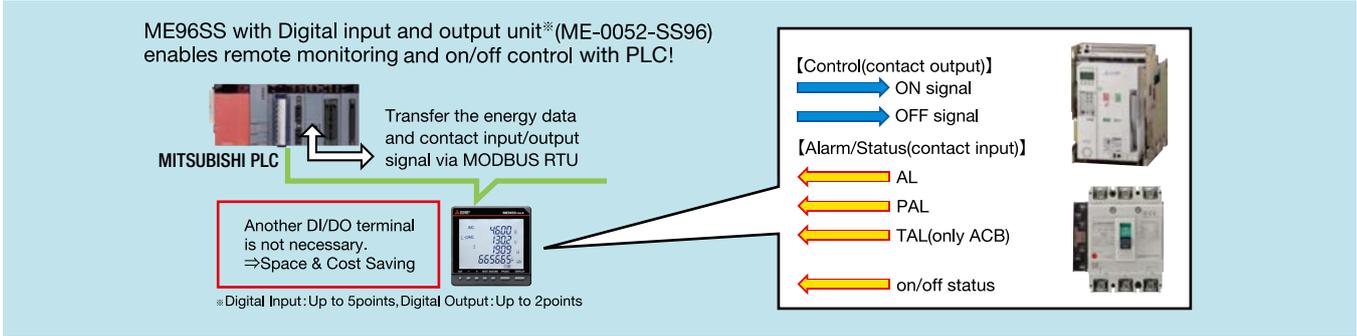
Network

● ME96SS is equipped with the RS-485 communication function as standard. Other available optional modules include CC-Link communication and MODBUS TCP communication for Ethernet network.

EcoWebServer III

LAN CH2

CC-Link

Ethernet MODBUS TCP

HUB

Ethernet MODBUS TCP

RS-485 MODBUS RTU

MODBUS TCP ⇔ RTU Protocol converter

Remote I/O

Use the ME96SS Ver.B Series (ME96SSRB-MB/ME96SSHB-MB) to remotely interface with local devices such as ACBs. This allows users advanced control without having to deploy secondary control devices.

● Attachment of ME-0052-SS96 (optional) enables remote monitoring of the contact input signal and on/off control of the contact output signal.
● Digital input signals can be latched for over 30ms, and there is no need for external latch circuits.
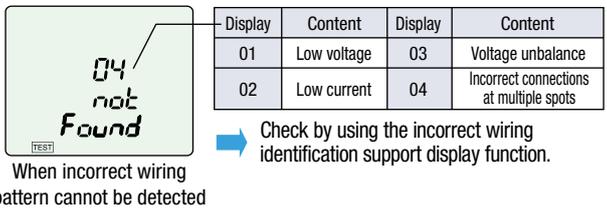
ME96SS with Digital input and output unit※(ME-0052-SS96) enables remote monitoring and on/off control with PLC!

MITSUBISHI PLC

Transfer the energy data and contact input/output signal via MODBUS RTU

Another DI/DO terminal is not necessary. ⇒Space & Cost Saving

※Digital Input：Up to 5points，Digital Output：Up to 2points

【Control(contact output)】
ON signal
OFF signal

【Alarm/Status(contact input)】
AL
PAL
TAL(only ACB)

on/off status

4. Checking Input Wiring Support Function

(1) Incorrect wiring pattern display function

● Whether the voltage/current input wirings are correct or not is displayed.
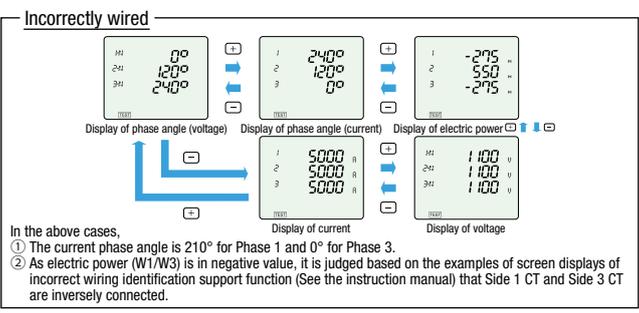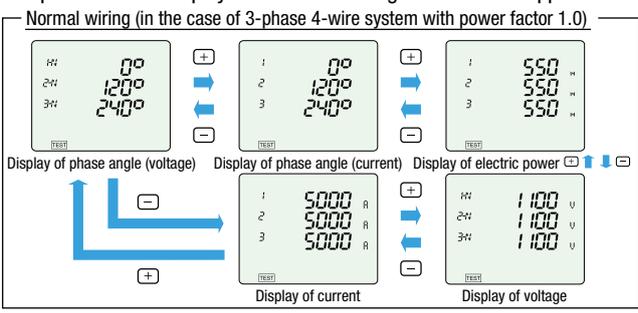As for the incorrect wiring display pattern, see the instruction manual.
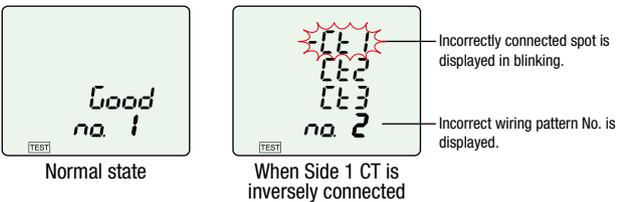
Note 1: When wiring of either one of the current/voltage terminals is not correct, the incorrectly connected spot is easily identified.
Note 2: Not all incorrect wirings can be identified. When the voltage input is incorrectly connected and the current input is also incorrectly connected, a different pattern of incorrect wiring may be displayed.

Normal state

When Side 1 CT is inversely connected

Incorrectly connected spot is displayed in blinking.

Incorrect wiring pattern No. is displayed.

When incorrect wiring pattern cannot be detected

Display	Content	Display	Content
01	Low voltage	03	Voltage unbalance
02	Low current	04	Incorrect connections at multiple spots

Check by using the incorrect wiring identification support display function.

(2) Incorrect Wiring Identification Support Display Function

● This function displays each phase angle (voltage side 1 standard) of voltage and current, power values (W1, W2, W3) of each phase, voltage value & current values to support identifying incorrect wirings. By knowing abnormality in the phase angle of voltage/current and by comparing it with the normal value, you can more easily identify an incorrectly wired spot.
● Examples of screen displays of incorrect wiring identification support function.

Normal wiring (in the case of 3-phase 4-wire system with power factor 1.0)

Display of phase angle (voltage)　Display of phase angle (current)　Display of electric power

Display of current　Display of voltage

Incorrectly wired

Display of phase angle (voltage)　Display of phase angle (current)　Display of electric power

Display of current　Display of voltage

In the above cases,
① The current phase angle is 210° for Phase 1 and 0° for Phase 3.
② As electric power (W1/W3) is in negative value, it is judged based on the examples of screen displays of incorrect wiring identification support function (See the instruction manual) that Side 1 CT and Side 3 CT are inversely connected.

16

Measuring Display Unit Circuit Breakers "MDU Circuit Breakers"

Measuring display unit (MDU) circuit breakers are a combination of circuit breaker, measuring device and display that make it possible to also measure, display and transmit information about electric circuits. They support energy savings by requiring less space, less installation work and less wiring. The MDU circuit breakers are designed even more compact, with the LCD screen for displaying circuit information embedded on the front of the main unit.

An Abundance of Functions in a Compact Body!
Energy-saving management support,
requiring less space and less installation work!

Multifunctional electronic circuit breakers equipped with a measuring unit and display that measures electric circuit information and displays it in digital form. The lineup of MDU-equipped no-fuse circuit breakers offers a rating range from 125A to 800A to support detailed energy management and our customers' energy-saving activities.

NF250-SEV with MDU

1. Space saving and construction cost saving

1. Construction cost saving

Wiring work for measuring devices is unnecessary, and the construction period and cost can be reduced.

Example of wiring for combined measuring devices (before introduction)

Modbus transmission line

After introduction of MDU breaker
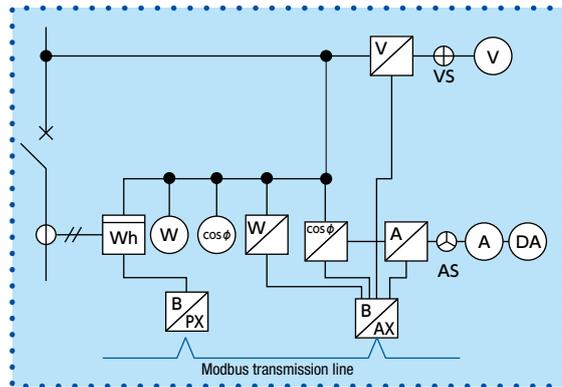
Construction		Conventional combination of devices	Introduction of MDU breaker
Wiring	CT line	Ammeter, wattmeter, power factor meter, harmonic current meter, current demand meter, electric energy meter, transducers (current, electric power, power factor, harmonic current, current demand)	Unnecessary
	Voltage line	Voltmeter, wattmeter, power factor meter, electric energy meter, transducers (voltage, electric power, power factor)	Unnecessary
	Auxiliary power supply	Transducers (current, voltage, electric power, power factor, harmonic current, current demand), transmission device	Necessary
	Measurement signal line	Transmission device input	Unnecessary
	Transmission line	Transmission device	Necessary
Devices installed		16 units	1 unit

* The MDU breakers are not designed for electric power supply and demand based on Measurement Act.
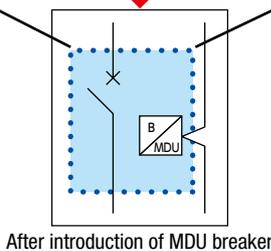
2. Space saving

The board installation area can be reduced, and the space can be effectively used.
If the MDU breaker is introduced when the board is renewed, upgrading can be expected by adding the measuring and display functions within the area of the standard circuit breaker.
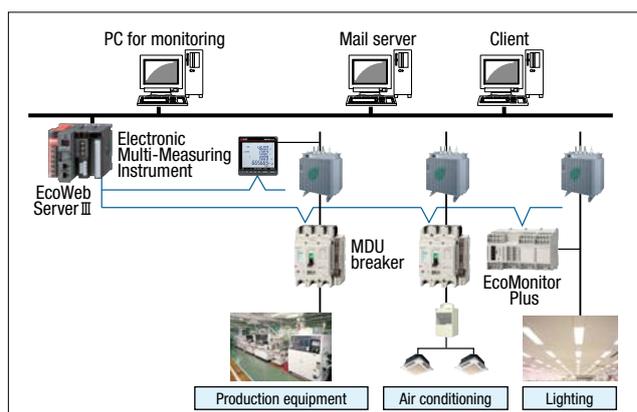
2. Sophisticated and multifunctional

1. Uses

Measurement of electric power at assembly plant
(1) The relationship between production and power usage is clarified, and the data is used, first of all, for activities for reducing the amount of wasted electricity.
(2) The breaker is used as a tool for visualized control of energy-saving activities to support planning, confirming, analyzing and evaluating the energy-saving activities.

2. Effect of introduction

(1) Automation of periodic measurement
  ● Automatic measurement by the hour
  ➤ Daily manual measurement requires to read and record the values measured at many points and enter the values into a personal computer.

(2) Automation of detailed measurement
  ● Detailed measurement of electric power in specific equipment (for example, measurement every 15 minutes for 1 week) can be automated through setting on a personal computer.

PC for monitoring　　Mail server　　Client

Electronic Multi-Measuring Instrument

EcoWeb Server Ⅲ

MDU breaker

EcoMonitor Plus

Production equipment　　Air conditioning　　Lighting

Evolving MDU Breakers

1. Downsizing

Breakers with the same outside dimensions as the standard circuit breakers are realized by using the front LCD for displaying circuit information.

MDU unit

165 mm

105 mm   68 mm

165 mm

105 mm   68 mm
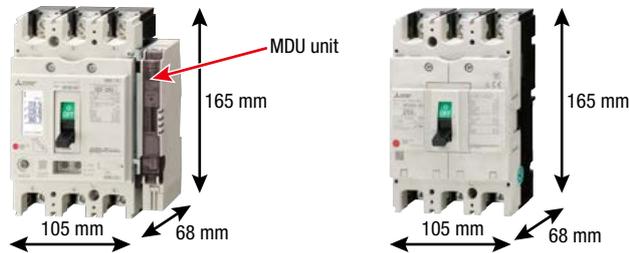
(Dimensions in the case where Breaker mounting unit of the 250 A frame is separately mounted)

2. Improved visibility

When an alarm or fault occurs, the LCD backlight changes from white to red.
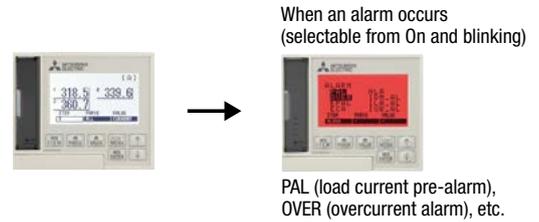
When an alarm occurs
(selectable from On and blinking)

PAL (load current pre-alarm), OVER (overcurrent alarm), etc.

The display direction can be switched.

Horizontal
(Breaker mounting unit)

Vertical

3. Improved operability

The multi-function display screen reduces the number of operations.

The measurement item to be checked can be **quickly displayed** from **the measurement item list**.

The conditions of **three phases are displayed in one window** and can be seen at a glance.

(Example)
Current value of phase 1

(Example)
Line voltage between phases 1 and 2

Since **any two elements can be constantly set in one window**, the number of repeated operations can be reduced.
(Up to 8 elements in four windows can be set.)

4. Increased breaking capacity

Type	NF250-SW with MDU	NF250-SEV with MDU
AC [V]	Rated breaking capacity [kA] Icu/Ics	
690	—	8/8
500	15/8	18/18
440	25/13	36/36
415	30/15	36/36
400	30/15	36/36
380	30/15	36/36
230	50/25	85/85
200	50/25	85/85

Type	NF400-SEP with MDU NF600-SEP with MDU NF800-SEP with MDU	NF400-SEW with MDU NF800-SEW with MDU
AC [V]	Rated breaking capacity [kA] Icu/Ics	
690	10/10	10/10
500	30/30	30/30
440	42/42	42/42
415	45/45	50/50
400	45/45	50/50
380	45/45	50/50
230	85/85	85/85
200	85/85	85/85

［Applicable standards］ JIS C 8201-2-1 Ann.1, JIS C 8201-2-1 Ann.2, IEC 60947-2

5. Various types of mounting

External mounting	Panel mounting	Breaker mounting	Breaker mounting unit separate installation

The standard MDU connecting cable for panel mounting and breaker mounting separate unit is 2 m long.
(The cable length, 0.5 m, 3 m, 5 m or 10 m, can be specified.)

	External mounting	Panel mounting	Breaker mounting	Breaker mounting unit separate installation
Pulse output	○	○	○	○
CC-Link	○	○	○	○
MODBUS	○	○	✕	✕

Energy Saving Data Collecting Server "EcoWebServer Ⅲ"
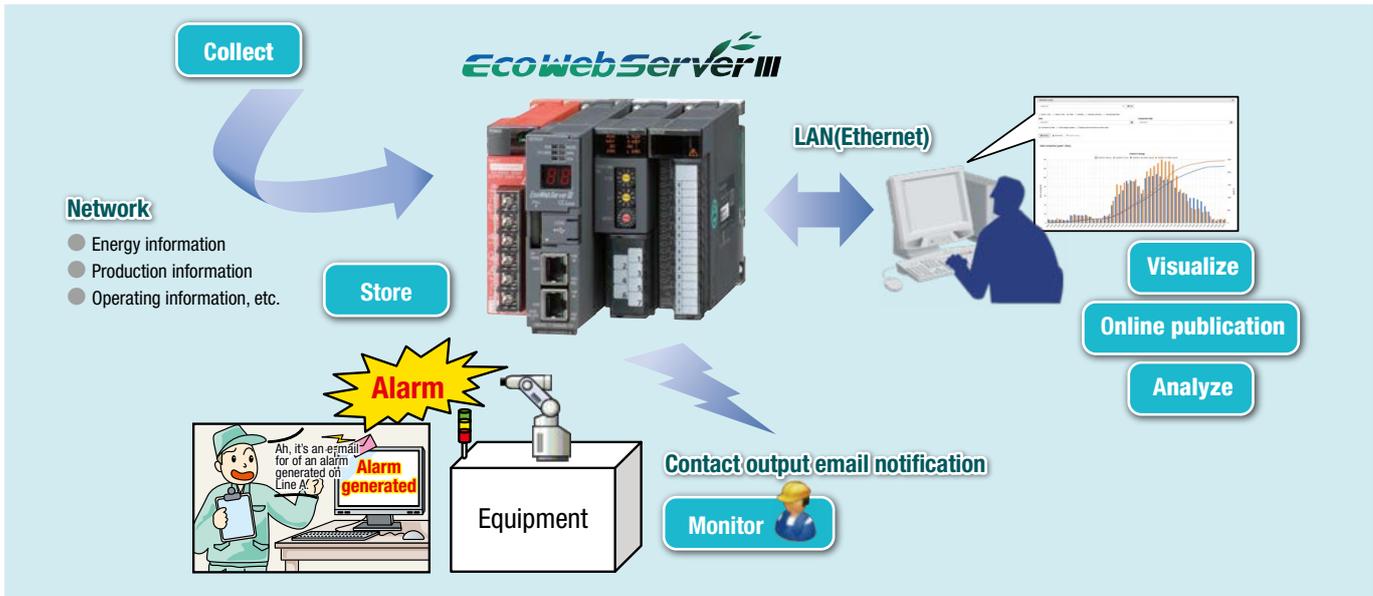
EcoWebServer Ⅲ simplifies the data analysis tasks necessary for saving energy. With simple settings, the EcoWebServer Ⅲ can collect measurement data from measurement devices connected to the field network (MODBUS or CC-Link), convert the data into graphs using a web browser and display it as current values.

| Model | MES3-255C-EN
MES3-255C-CN |

| Model | MES3-255C-DM-EN
MES3-255C-DM-CN |

Overview of EcoWebServer Ⅲ

Collect

Network
- Energy information
- Production information
- Operating information, etc.

Store

Alarm

Ah, it's an e-mail for of an alarm generated on Line A!

Alarm generated

Equipment

LAN(Ethernet)

Visualize

Online publication

Analyze

Contact output email notification

Monitor

1. No need to add programs or software

- Measurement data can be displayed as graphs on the web browser.
- Possible to confirm energy consumption status in detail, using consumption by the minute (measurement value).
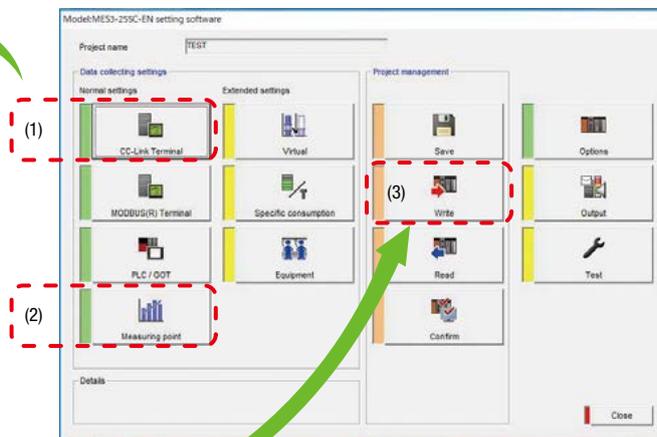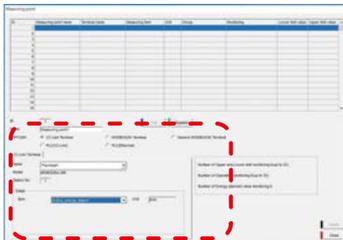
Simple settings

- Basic setting are (1) Measuring terminal registration → (2) Measuring point registration → (3) Project writing.
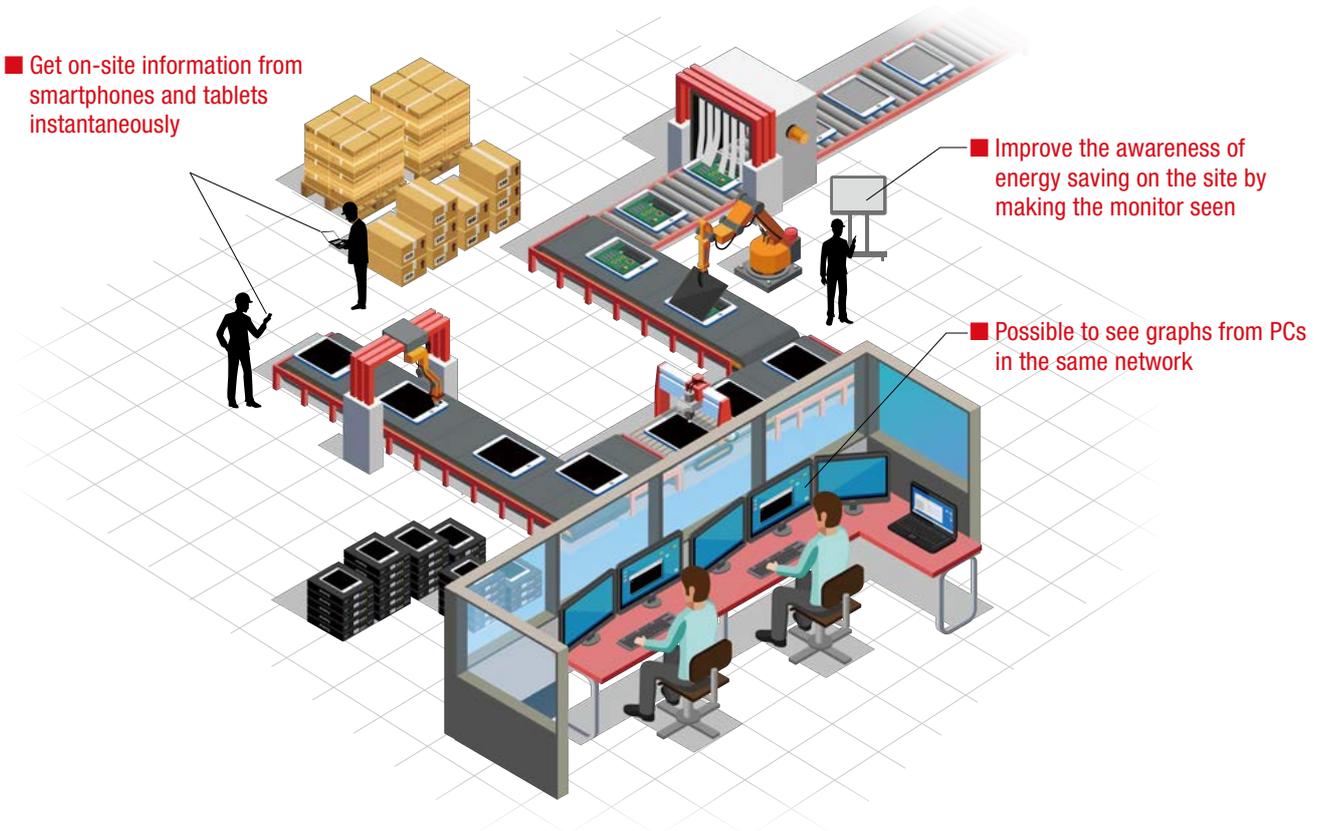
(1) Register device information
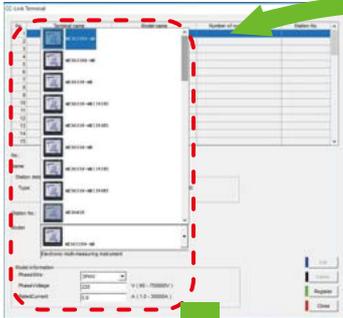
(2) Select data from list

2. Measured Data in Graphs on a Web Browser

● With built-in applications focused on energy saving (including graph functions), it is possible to contribute to energy-saving measures in plants.
● By HTTP server functions, the collected data is transmitted via Ethernet across the Intranet so that anyone in the network can check and grasp the energy usage in real-time.

■ Get on-site information from smartphones and tablets instantaneously

■ Improve the awareness of energy saving on the site by making the monitor seen

■ Possible to see graphs from PCs in the same network

3. Smartphone and Tablet Supported

● It is possible to display graphs directly on a Web browser, so you can see the graphs from mobile terminals including smartphones and tablets as well as PCs.
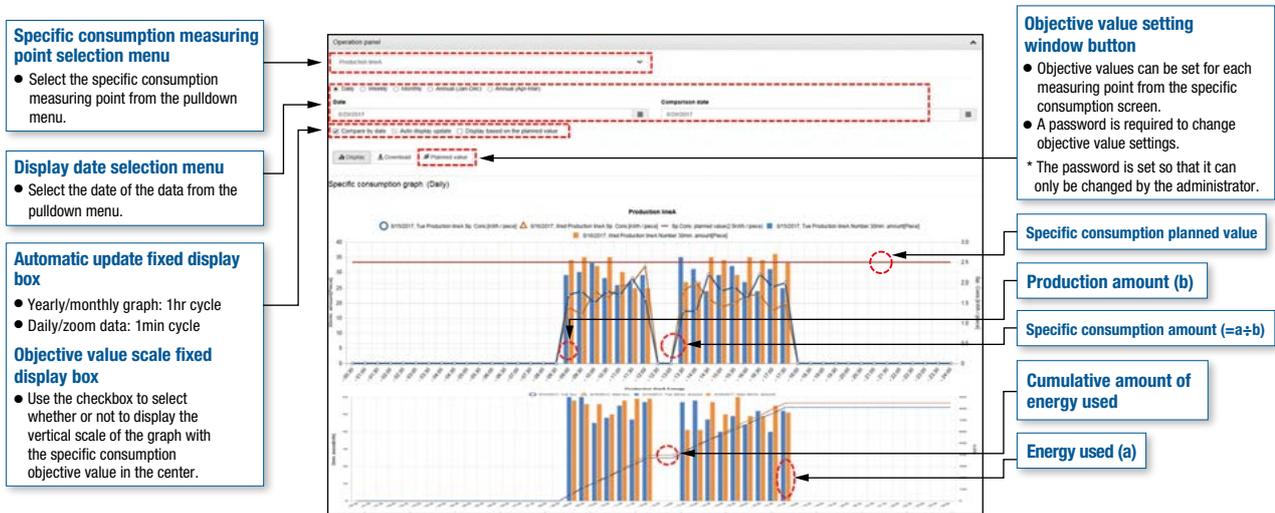
Wireless router

LAN (Ethernet)

Mobile terminals
(using a Web browser)

EcoWebServer Ⅲ
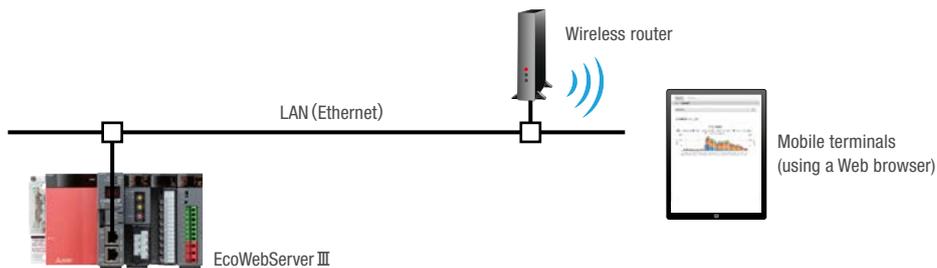
● In addition, the size and position of graphs are automatically adjusted to the window width of a Web browser and the screen size of a terminal, so now, you can see the screen adjusted to the terminal to use.
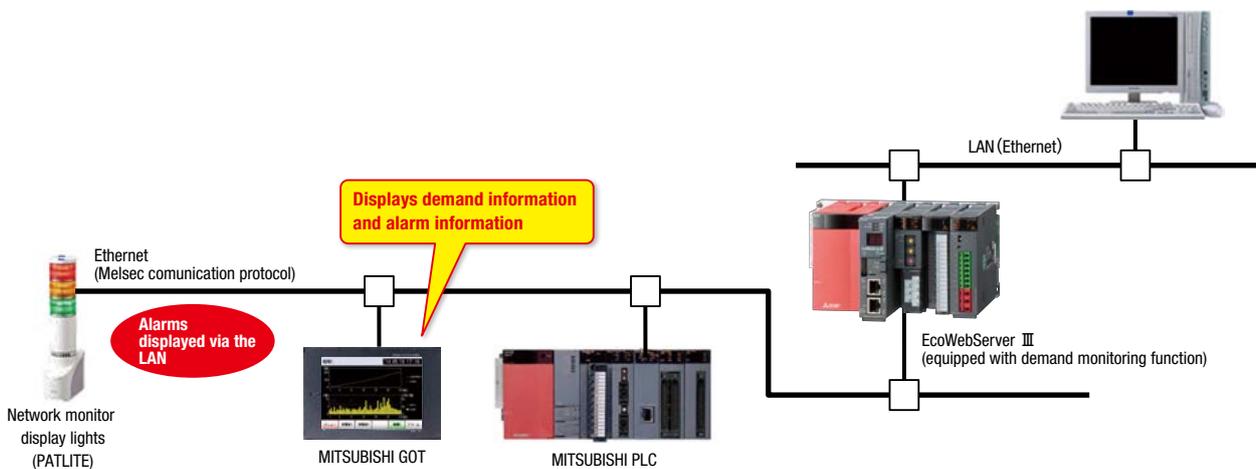
Wide monitor

Laptop PC

Tablet

Energy Saving Data Collecting Server "EcoWebServer Ⅲ"

20

Energy Saving Data Collecting Server "EcoWebServer III"

4. Easily understand productivity by confirming the specific consumption graph

● By integrating the production volumes from the measuring terminal and PLC, the specific consumption graph can be easily displayed and points related to the drop in specific consumption can be easily understood.
● Additionally, by comparing two specific consumption graphs at the same line, it is possible to confirm the benefits at the time the countermeasure was implemented.

Specific consumption measuring point selection menu
● Select the specific consumption measuring point from the pulldown menu.

Display date selection menu
● Select the date of the data from the pulldown menu.

Automatic update fixed display box
● Yearly/monthly graph: 1hr cycle
● Daily/zoom data: 1min cycle

Objective value scale fixed display box
● Use the checkbox to select whether or not to display the vertical scale of the graph with the specific consumption objective value in the center.

Objective value setting window button
● Objective values can be set for each measuring point from the specific consumption screen.
● A password is required to change objective value settings.
* The password is set so that it can only be changed by the administrator.

Specific consumption planned value

Production amount (b)

Specific consumption amount (=a÷b)

Cumulative amount of energy used

Energy used (a)

5. Connection with Mitsubishi Electric GOT display device

● Information collected on the EcoWebServer III can be displayed on the GOT.
● By displaying the alarm state/measuring value for energy information/demand, real-time monitoring at the site and urgent countermeasures are possible.
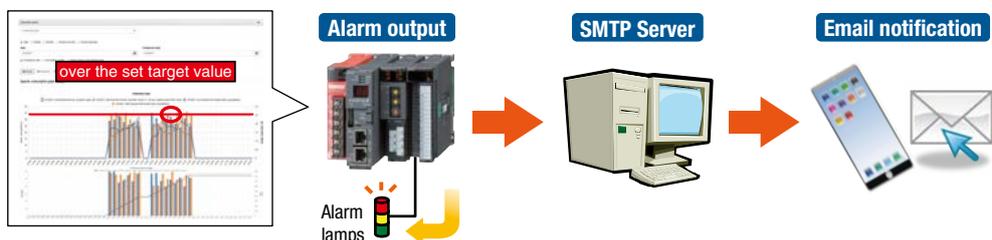
LAN (Ethernet)

Displays demand information and alarm information

Ethernet
(Melsec comunication protocol)

Alarms displayed via the LAN

EcoWebServer III
(equipped with demand monitoring function)

Network monitor display lights
(PATLITE)

MITSUBISHI GOT

MITSUBISHI PLC

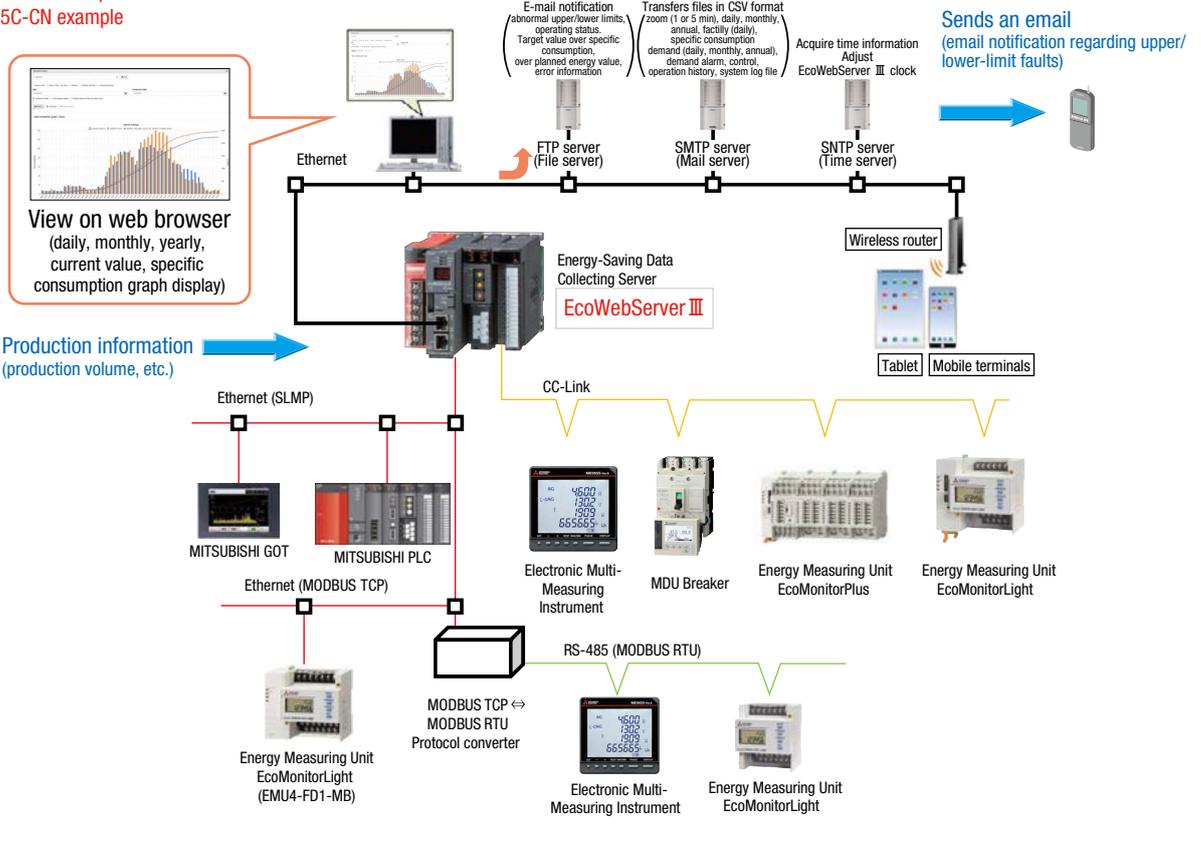## 6. Alarm output/email notification through a variety of monitoring functions

● Objective values (upper/lower) and error information can be transmitted through email notifications/alarm output, and changes in status can be recognized immediately. The result of the careful target value management and monitoring the status monitoring ensure that problems occurring at the site are not overlooked.
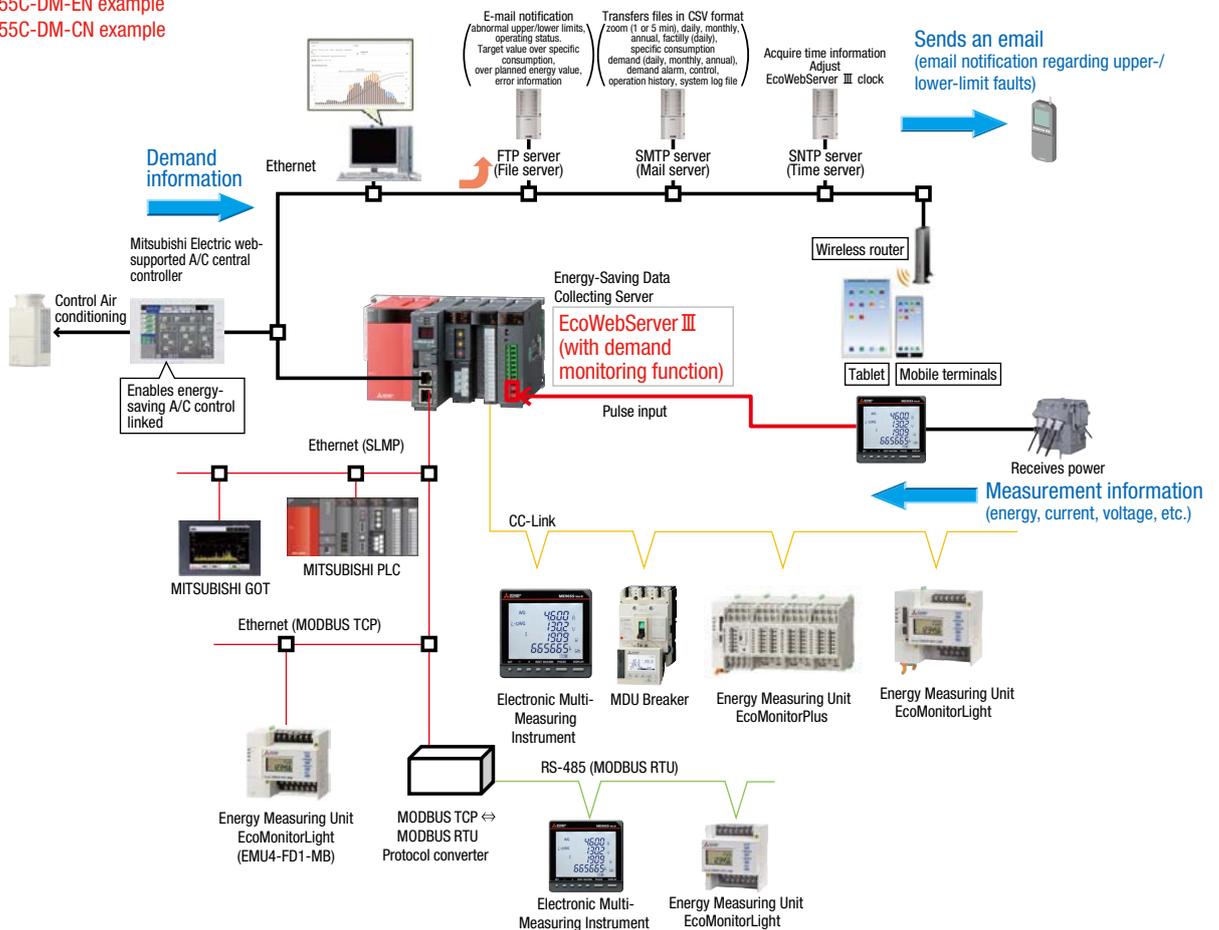
<Items monitored>
・Energy plan value
・Specific consumption objective value
・Upper/lower irregularity
・Change in operating state
・Error information
・Demand alarm

over the set target value

Alarm output

SMTP Server

Email notification

Alarm lamps

MES3-255C-EN example
MES3-255C-CN example

View on web browser
(daily, monthly, yearly,
current value, specific
consumption graph display)

E-mail notification
(abnormal upper/lower limits,
operating status.
Target value over specific
consumption,
over planned energy value,
error information)

Transfers files in CSV format
zoom (1 or 5 min), daily, monthly,
annual, factility (daily),
specific consumption
demand (daily, monthly, annual),
demand alarm, control,
operation history, system log file

Acquire time information
Adjust
EcoWebServer Ⅲ clock

Sends an email
(email notification regarding upper/
lower-limit faults)

Ethernet

FTP server
(File server)

SMTP server
(Mail server)

SNTP server
(Time server)

Wireless router

Energy-Saving Data
Collecting Server
EcoWebServer Ⅲ

Tablet | Mobile terminals

Production information
(production volume, etc.)

Ethernet (SLMP)

CC-Link

MITSUBISHI GOT

MITSUBISHI PLC

Electronic Multi-
Measuring
Instrument

MDU Breaker

Energy Measuring Unit
EcoMonitorPlus

Energy Measuring Unit
EcoMonitorLight

Ethernet (MODBUS TCP)

Energy Measuring Unit
EcoMonitorLight
(EMU4-FD1-MB)

MODBUS TCP ⇔
MODBUS RTU
Protocol converter

RS-485 (MODBUS RTU)

Electronic Multi-
Measuring Instrument

Energy Measuring Unit
EcoMonitorLight

MES3-255C-DM-EN example
MES3-255C-DM-CN example

E-mail notification
(abnormal upper/lower limits,
operating status.
Target value over specific
consumption,
over planned energy value,
error information)

Transfers files in CSV format
zoom (1 or 5 min), daily, monthly,
annual, factility (daily),
specific consumption
demand (daily, monthly, annual),
demand alarm, control,
operation history, system log file

Acquire time information
Adjust
EcoWebServer Ⅲ clock

Sends an email
(email notification regarding upper-/
lower-limit faults)

Demand
information

Ethernet

FTP server
(File server)

SMTP server
(Mail server)

SNTP server
(Time server)

Mitsubishi Electric web-
supported A/C central
controller

Control Air
conditioning

Wireless router

Energy-Saving Data
Collecting Server
EcoWebServer Ⅲ
(with demand
monitoring function)

Tablet | Mobile terminals

Enables energy-
saving A/C control
linked

Pulse input

Receives power

Ethernet (SLMP)

CC-Link

Measurement information
(energy, current, voltage, etc.)

MITSUBISHI GOT

MITSUBISHI PLC

Electronic Multi-
Measuring
Instrument

MDU Breaker

Energy Measuring Unit
EcoMonitorPlus

Energy Measuring Unit
EcoMonitorLight

Ethernet (MODBUS TCP)

Energy Measuring Unit
EcoMonitorLight
(EMU4-FD1-MB)

MODBUS TCP ⇔
MODBUS RTU
Protocol converter

RS-485 (MODBUS RTU)

Electronic Multi-
Measuring Instrument

Energy Measuring Unit
EcoMonitorLight

Energy Saving Support Software "EcoAdviser"

EcoAdviser is a support tool for energy-saving activity.
It is user-friendly, easy-setup, and helps to analyze energy usage data.

Feature 1

Analyze collected data

Various analysis can be realized by collecting energy information such as
electricity consumption and production volume accumulated by PLC.

Only 3 steps to display graphs

Step 1 — Select 'Method' → **Step 2** — Select 'View' → **Step 3** — Select 'Measuring Points'

Selectable from 7 types of graphs depending on analysis purpose

Understanding the present situation: Visualizing the energy comsumption of each production process

Rate (Pie chart)

Rank (Bar chart)

Ranking chart helps users to identify the bottleneck process.

Specific consumption management: Monitoring energy consumption in relation to production volume

analysis level

Specific consumption*1

Production volume

Deterioration point

Time series (Line, Bar, Stacked, and Other graphs)

Variation (Box plot)

EcoAdviser helps users to identify the deterioration point of production efficiency.
It assists users to find equipments or operation where KAIZEN is required.

Find out correlation

Understanding the present production efficiency by checking the correlation between production volume and energy consumption.

Correlation (Scatter diagram)

Check error records

Understanding the error content to be dealt with.

Factor (Pareto chart)

Setting threshold and target

Determine the threshold or target value by understanding the distribution of collected data.

Distribution (Histogram)

*1: Specific consumption = $\dfrac{\text{Amount of energy consumption}}{\text{Production quantity}}$

Feature 2

Customizable Dashboard

Collected data can be displayed in graphs/charts on customizable Dashboard. Also, if a web server is set on your PC, EcoAdviser can be used as a visualization tool at the site.

Dashboard

* Monitor screen update cycle is 1 hour.

• Try demo software!
Demo software can be downloaded from website.
(https://www.mitsubishielectric.com/fa/products/pmng/ems/index.html)

Feature 3

User-friendly setting and scalability

No programming or complicated engineering work is required. All you need is just simple setting.
EcoAdviser collects measured data automatically. It can be also used as an application that runs on Edgecross*.

Easy setup

The application can be launched and extended only with PC mouse operation.

Easy operation with Edgecross

*Edgecross
Open software platform for edge computing domain that enables collaboration between FA and IT.

Industrial computer: MELIPC

System Configuration

● Collecting data from EcoWebServerⅢ

Access a server PC for webpage and browse a dashboard in HTML file format. *2

Dashboard (HTML file)

The product
EcoAdviser + Hardware key

PC on the network

Measuring data *1

PC *2

Ethernet

EcoWebServerⅢ EcoWebServerⅢ

Collection source (Up to 20 units)

Measuring instrument

● Collecting data from Edgecross application

Access a server PC for webpage and browse a dashboard in HTML file format. *2

PC on the network

Dashboard (HTML file)

The product
EcoAdviser + Hardware key
+
EDGECROSS
Collection source

PC (MELIPC) *4

Peripherals

Measuring data *3

Ethernet

PLC

PLC

Measuring instrument

*1: The software collects measuring data from Zoom (1 min.) data file and Demand (daily) data file basis in EcoWebServerⅢ.
*2: To browse a dashboard in HTML file on a PC in the network, it is necessary to enable Web server functionality such as IIS on the PC.
*3: The software collects measuring data in collection source from historical data file created by Edgecross.
*4: If a PC, MELIPC, is able to communicate with EcoWebServerⅢ through Ethernet, both Edgecross and EcoWebServerⅢ can be registered as collection source.

Energy management of whole factory

Ethernet (Factory LAN)

【Factory A】

MODBUS TCP
↔MODBUS RTU
Protocol converter

MODBUS RTU

	Distribution panel
	Distribution panel
	Each Machines

【Office building】

MODBUS TCP

Air conditioner

	Air conditioner
	Lighting
	Warehouse

【Factory B】

Alarm

CC-Link

Water, Air, Gas

	Machines
	Compressor
	Chiller
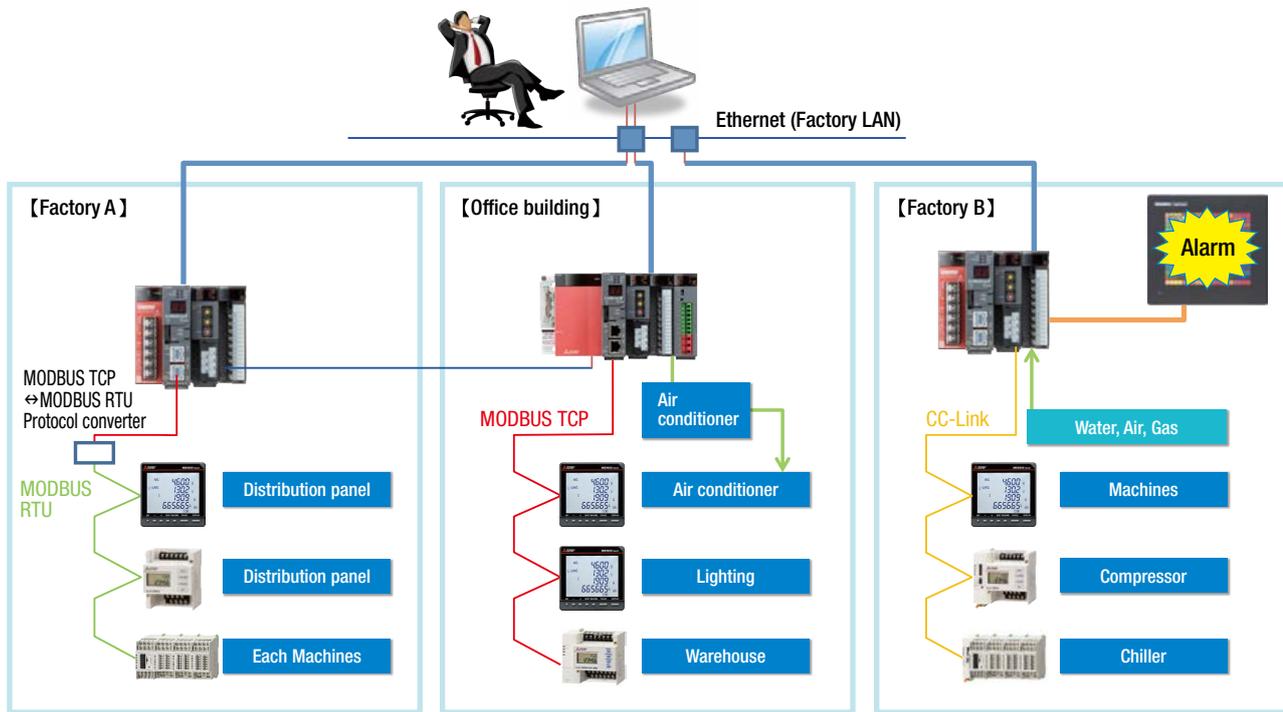
It is possible to monitor and understand energy consumption in each factory, including water, gas and air. Also, they have installed GOT in the electric room and monitored alarm status.

1. Example of office building

Lighting of General Administration Building

EcoServerⅢ

Off during lunch
↓
Automatically off
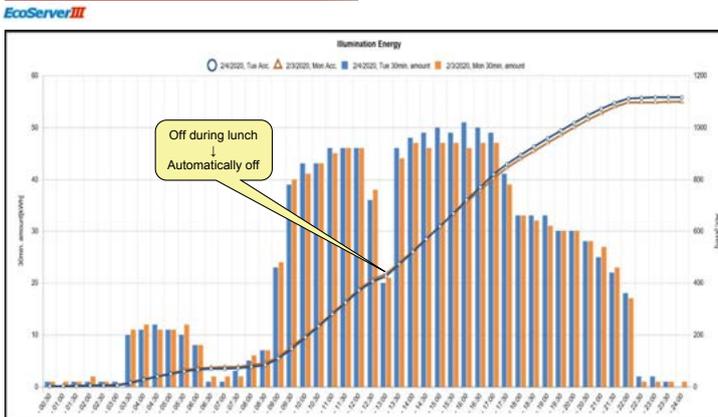
2. Example of specific consumption management

Graph and Aggravating Factor of Specific Consumption
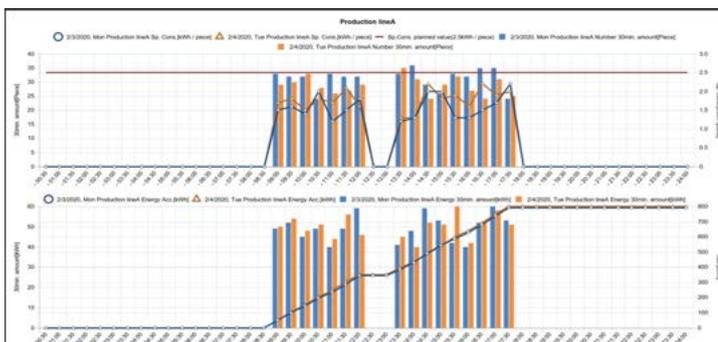
$$\frac{\text{Amount of Energy Consumed}}{\text{Production Quantity}}$$

Formula for Specific Energy Consumption

Simple energy monitoring

- I do not understand how much electricity each facility uses in factory.
- I do not understand energy-saving efficiency when replacing equipment.
- However, I cannot invest much for energy-saving initiatives.

Solution!

- **Electric energy of each device can be measured by installing one EcoMonitorLight.**

Non-ferrous metal manufacturer

- Measuring point : Facility in factory
- Customer's requests:
  I want to do simple measurement to watch the actual condition closely.
  I want to manage data by using SD card.

Cutting machine

2GB

Pressing machine

Compressor
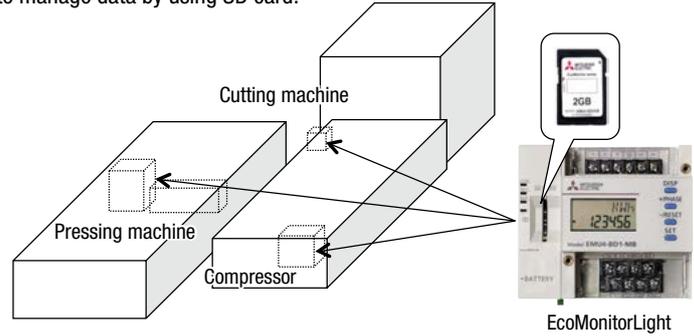
EcoMonitorLight

Introduction schedule

Status

1. **Measuring devices using one EcoMonitorLight**
Measure each facility for a certain period of time to check power consumption

↓

2. **Introduce EcoMonitorLight for each facility**
Measure at all time to implement energy-saving countermeasures for measured value

⋮
↓

3. Step up to visualization of entire factory

Introduction point

1. Enable to data collected off-line to be saved to SD card using Logging Unit.
2. Enable confirm energy-saving effect by comparing old and new performance when each device at factory is renewed. (Easy construction by segmented CT.)
3. System can be built gradually.

Preventive maintenance

Problem

- What is the best way to monitor equipment insulation using Inverter or servo motors...

Solution!

- **Insulation deterioration is constantly monitored with the Insulation Monitoring Module.**

Car/ Car parts manufacturer   ■Facility : Brazing furnaces with Inverter

- Application : Monitoring Insulation of brazing furnaces with inverter (heater)

Control Board

GOT (Display unit)

Heater
（Inverter Control）

Inverter Insulation Monitoring

Ι o — Leakage current obtained by synthesizing Ior and Ioc (vector synthesis)

Ι or — Resistive-component leakage current

Startup time

Io increase(Ioc)

Insulation Monitoring is Ior !
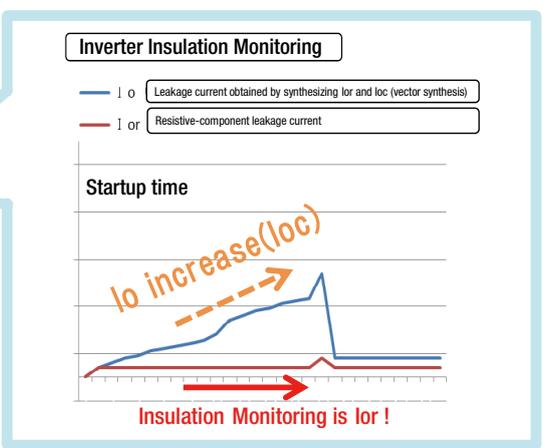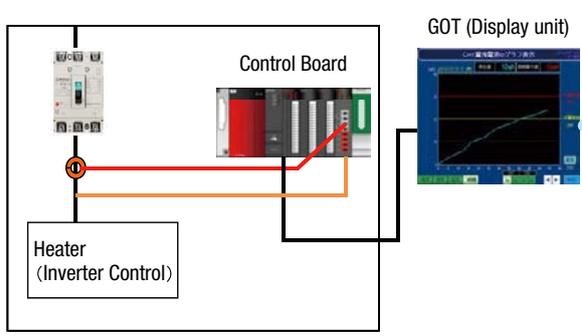
Points of introducing of QE82LG

Leakage current (Ioc) flows continuously in aluminum electrolytic capacitor used in Inverter or servo when machine is being turned on. Only with leakage current (Io) is not enough to monitor Insulation correctly.

Measurement of Insulation deterioration can prevent sudden trouble and reduce production loss due to equipment stoppage by monitoring resistive-component leakage current (Ior).

Extruder with Inverter is also enabled

[Industry applications]
Plastic products manufacturing
Rubber products manufacturing
Film products manufacturing

Example of Energy Monitoring System

26

MC Works64

SCADA Software - Create advanced integrated monitoring systems for automated equipment

MC Works64 is a one-stop solution for configurating highly functional monitoring control systems capable of incorporating Programmable Logic Controllers (PLCs), PCs and various FA equipments.

The Next Generation in Automation Software

MC Works64

Save energy and reduce cost facility-wide while improving production and operation efficiency

● By monitoring energy consumption, energy use can be reduced over time. Use Mitsubishi Electric energy measuring modules together with AX Energy—optional dedicated energy management software for MC Works64—to optimize the visualization of energy consumption.
  AX Energy offers browser independent, real-time energy monitoring and management capabilities to address any application, from single buildings to multi-site locations and entire complexes. Site managers, building engineers or maintenance personnel can quickly and intuitively navigate to find opportunities for improving energy efficiency.

Expansive wide-area monitoring

● Use various Internet mapping applications, such as Bing, to easily obtain and display geographic information related to wide-area monitoring systems; doing so at no extra cost. Monitor business offices and factories located around the world and use pins to display detailed information and alarm status all on a single map. GPS data can also be monitored.

High reliability with redundant systems

● MC Work64 can be used to configure redundant server systems and server-client systems, enhancing system reliability at the time of a malfunction or disaster. Configure two servers (control server and standby server) to the required system size, from stand-alone to large-scale. Redundant systems for PLCs that control things like pumps, lighting and air-conditioning can be configured as well.
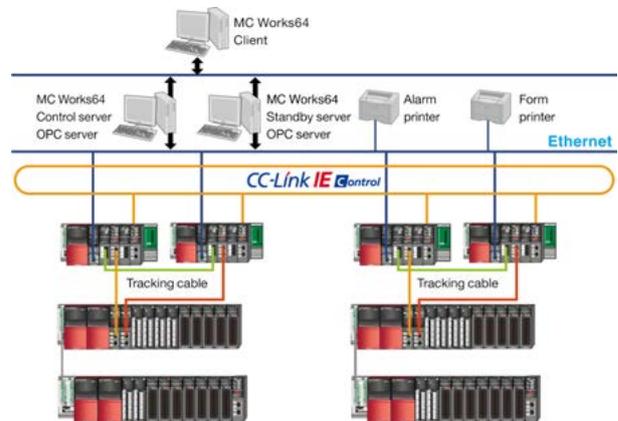
Remote monitoring from mobile devices

● MC Works64 has a mobile terminal application that enables building and factory operations to be monitored from outside the facilities. Access and monitor important data from remote terminals, even a smart phone, whenever required. Managers, engineers, operators and maintenance staff can access and monitor various data according to authority level; and view information about alarms, trends, energy use, quality and production in real time.
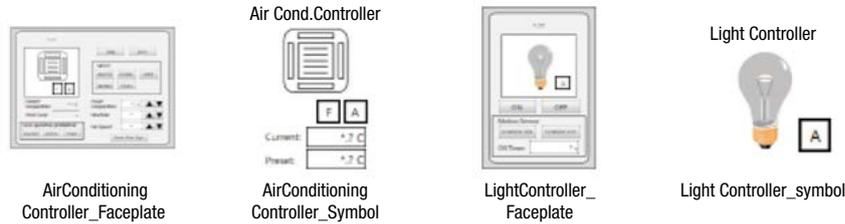
System management using operating schedule

● Use this built-in support tool to control factory operating schedules. Create and set commands to manage daily, weekly and monthly schedules as required. Intuitive setup is easy using an Outlook®-style template.
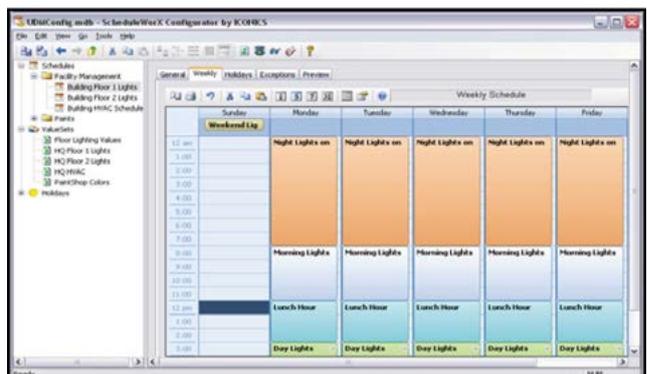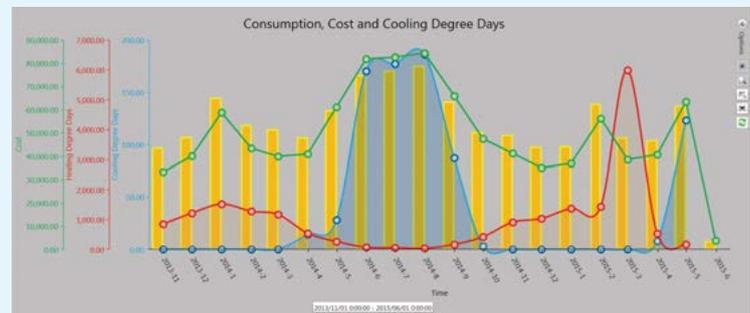
Reducing engineering cost by Customizable symbol library.

● A library with pre-made symbols comes as a standard feature, reducing the time required to create graphics. Custom symbols can also be created and imported into the library. The library comes stocked with more than 1,000 high-definition 2D and 3D symbols covering a variety of industries including water treatment, building management, food, chemicals, and more. There is also an animation function and symbols can be tagged to change colors and display numbers, thereby reducing the labor for creating script.

AirConditioning
Controller_Faceplate

AirConditioning
Controller_Symbol

LightController_
Faceplate

Light Controller_symbol

Factory Energy Management

In addition to increasing factory production line efficiency, MC Works64 and FA equipments can control the temperature and airflow via centralized air-conditioning systems, and display the temperature and humidity, which are measured by sensors in each room. It can also monitor and analyze the operations of production machinery that consume large amounts of energy, and thus optimize production cost. Simply add the AX Energy software and Mitsubishi Electric energy measuring modules to create an energy-saving solution capable of advanced energy visualization, analysis and savings. A full lineup of energy-saving devices, such as Mitsubishi Electric inverters with superior motor-drive efficiency, are available to help realize greater energy savings from factory equipment.

Building Energy Management
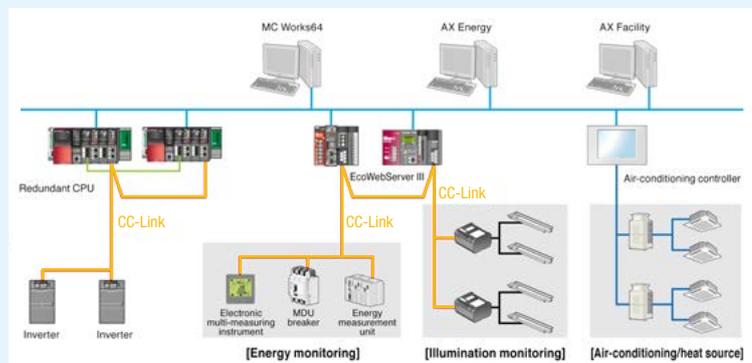
Used with EcoWebServer Ⅲ and energy measuring modules, MC Works64 visualizes the energy used by systems throughout a building such as air-conditioning, lighting and gas and water supply. Combined with the optional visualization and diagnostics software AX Energy, energy consumption can be analyzed, points of waste documented and additional energy-saving measures introduced. MC Works64 also contributes to maintaining a comfortable indoor space by automatically switching between cooling and heating according to preset temperature and air-volume settings. Since air-conditioning systems consume a lot of energy—often more than 50% of the total energy used by a building—comfort can be sacrificed when pursuing energy savings. However, MC Works64 delivers energy savings while maintaining comfort through centrally managed air-conditioning control. Lighting system control is possible as well, such as scheduling ON/OFF times and using sensors to detect when people are present.

MC Works64

INVERTER FR-F800

FREQROL
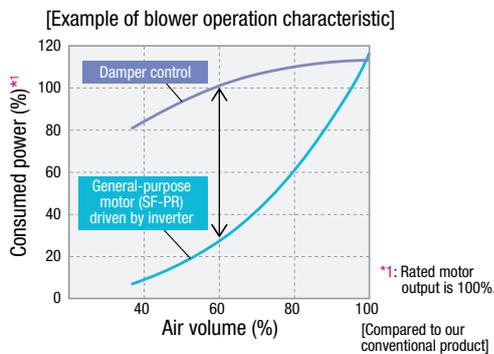
Enhanced Next-Generation Energy-Saving Inverter

F800

· Energy saving
· Functions ideal for fans and pumps
· Security & safety
· Compatibility with the environment
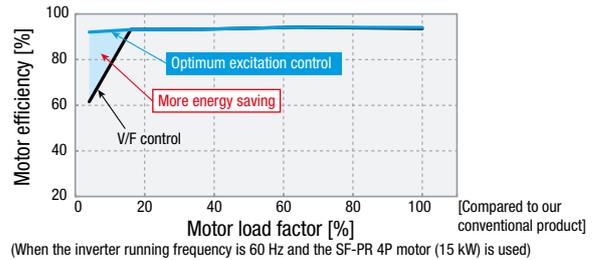· Easy setup & operation

1. Energy Saving with Inverters

The consumed power of a variable-torque load, such as fans, pumps, and blowers, is proportional to the cube of its rotation speed.
Adjusting the air volume by the inverter rotation speed control can lead to energy savings.

[Example of blower operation characteristic]

*1: Rated motor output is 100%.
[Compared to our conventional product]

Utilizing the motor capability to the full

Optimum excitation control

● Optimum excitation control continuously adjusts the excitation current to an optimum level to provide the highest motor efficiency. With a small load torque, a substantial energy saving can be achieved.
For example, at 4% motor load torque for a general-purpose motor, the motor efficiency under Optimum excitation control is about 30% higher than the motor efficiency under V/F control.


[Compared to our conventional product]
(When the inverter running frequency is 60 Hz and the SF-PR 4P motor (15 kW) is used)

2. FUNCTIONS IDEAL FOR FANS AND PUMPS

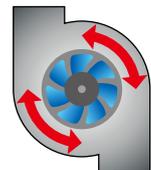### System cost reduction

PID multiple loops (two loops)
Two PID operation units are available in the inverter. The inverter can perform PID control of the motor operation and control the external equipment at the same time. The system cost can be reduced because no external PID controller is required for controlling the external equipment.
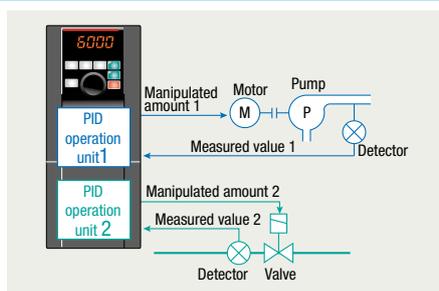
Cleaning of fans and pumps

Cleaning function
Foreign matter on the impellers or fans of pumps can be removed by repeating forward/reverse rotation and stopping of the motor. (Use this function when a back flush does not pose a problem.) This function can be also automatically started when the result of load characteristics measurement is out of range (overload).


■Model

Symbol	Voltage class
2	200 V class
4	400 V class

Symbol	Structure, functionality
0	Standard model*2
2	Separated converter type*3
6	IP55 compatible model

Symbol	Description
0.75K to 560K	Inverter LD rated capacity (kW)
00023 to 06830	Inverter SLD rated current (A)

Symbol	Type	Communication type
1	FM	RS-485
2	CA*1	
E1	FM	Ethernet
E2	CA*1	

Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
None	Without	Without
60	With	Without
06*4	With	With

Inverter model	Inverter capacity
FR-F820(-E)	0.75kW to 110kW
FR-F840(-E)	0.75kW to 315kW
FR-F842(-E)	355kW to 560kW
FR-F846(-E)	0.75kW to 160kW

*1: IP55 compatible models have LD and ND rating types only. However, the SLD rated current of standard models is used to represent the model.
*2: For the CA-type, the monitor output terminal FM/CA operates as terminal CA (analog current output 0 to 20 mADC), not as terminal FM (pulse train output).
*3: For the 75K or higher inverter, always connect a DC reactor (FR-HEL), which is available as an option. Select a DC reactor according to the applied motor capacity.
*4: Always install the converter unit (FR-CC2). (Not required when a high power factor converter (FR-HC2) is used)
*5: Available for the 7.5K or higher.
*6: Applicable to the standard structure model or the separated converter type.

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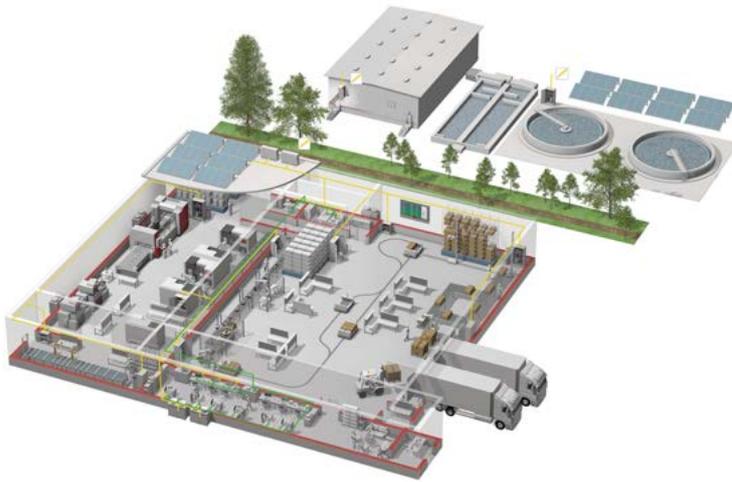
Mitsubishi Electric offers a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines.

Low voltage: MCCB, MCB, ACB

Medium voltage: VCB, VCC

Power monitoring, energy management

Compact and Modular Controllers

Inverters, Servos and Motors

Visualisation: HMIs

Numerical Control (NC)

Robots: SCARA, Articulated arm

Processing machines: EDM, Lasers, IDS

Transformers, Air conditioning, Photovoltaic systems

A NAME TO TRUST

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

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

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

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

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

* Not all products are available in all countries.

Global Partner. Local Friend.

Precautions Before Use

- Please consult with a Mitsubishi Electric representative when considering the application of products presented in this catalogue with machinery or systems designed for specialized use such as nuclear power, electrical power, aerospace/outer space, medical, or passenger transportation vehicles.
- Mitsubishi Electric Corporation shall not be liable, to the customer or equipment user, for:
  1) Any damege found not to be attributable to a Mitsubishi Electric product.
  2) The loss of opportunity or profits for the customer or user caused by any fault in a Mitsubishi Electric product.
  3) Damege, secondary damege or accident compensation resulting from special factors regardless of whether or not such factors could be predicted by Mitsubishi Electric.
  4) Damege to products of other companies and/or guarantees relating to other services.

For Safety : Please read the instruction manual carefully before using the products in this catalog. Wiring and connection must be done by the person who has specialized knowledge of electric construction and wirings.

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- Of this product, export (or service trade) permission under this law is required for exports that fall under the safety and trade control related cargo (or service) specified in the Foreign Exchange and Foreign Trade Control Law.
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eco Changes **for a greener tomorrow** Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

MITSUBISHI ELECTRIC CORPORATION HEAD OFFICE: TOKYO BLDG., 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN