



for a greener tomorrow



# HVAC

Global Heating, Ventilation and Air Conditioning  
Building Management & Control Systems



# 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 portfolio 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**

Maximization productivity and efficiency with cutting-edge automation technology.

# CONTROLLING CLIMATE



Buildings serve a fundamental purpose – to protect their occupants, along with the activities that go on inside them. However, the microclimate within their walls can sometimes be less than desirable – due to a number of factors, both intrinsic and external – and end up creating problems instead. Fortunately, modern technology has the means to manage these issues effectively with the use of Heating, Ventilation and Air-Conditioning (HVAC) systems, allowing the buildings' objectives to be achieved.

Temperature and ventilation control is a skill – one that strikes a fine balance between performance, efficiency and reliability. It defines the ability to maintain a consistent environment by adjusting to different variables, ranging from seasonal changes to exception occurrences.

This ability is richly encapsulated in Mitsubishi Electric's HVAC solutions, refined through decades of research and continuous improvement efforts. Our systems have stood the test of time and the rigours of countless deployments worldwide. Through the deployment of intelligent hardware such as Programmable Logic Controllers (PLC) and Direct Digital Controllers (DDC), fluctuating environmental variables can be managed with pinpoint accuracy. This technology is controlled by our MC Works<sup>64</sup> automation and control software; and where human intervention is required, easy-to-use Graphic Operation Terminals (GOT) allow operators to make changes manually.

System safety and integrity is ensured with our eco-friendly circuit breakers and earth-leakage circuit breakers, while redundant PLCs guarantee that undesired interruptions are effectively prevented.

At Mitsubishi Electric, we take pride in what we develop for the market. Our HVAC technologies serve clients far and wide, helping to enhance their operations and maximise productivity.



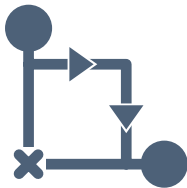
# WHY MITSUBISHI ELECTRIC?

Mitsubishi Electric's HVAC systems offer unparalleled benefits. These advantages bring to our customers the comfort and ease-of-use, while ensuring the smooth operation of their business.



## Monitoring On-The-Move

Keeping an eye on the HVAC does not have to be confined to the control room. Mitsubishi Electric understands the demands for mobility by today's workforce; our systems can be watched by maintenance staff both onsite or off. Secure remote monitoring is performed from a browser, tablet or smartphone, keeping operators in-the-know in real-time.



## Catering for Redundancy

In hospitals, a non-performing HVAC system could result in a swift deterioration in patient health. This is especially true in operating theatres, where every second lost could mean life or death. In such critical environments, HVAC systems must continue to function optimally, even when certain faults occur. Redundancy is therefore a key requirement in these setups, buying ample time for Mitsubishi Electric's engineers to respond and address problems – without interrupting vital life-saving operations.

Time is money in industrial operations and downtime is an undesired scenario that manufacturers want to avoid. It is especially vital on work shifts where machines are left running without human supervision, and HVAC problems could go unnoticed for many hours. This could cause machinery to overheat and malfunction, resulting in undesired costs and production loss. Having built-in redundancy serves to prevent such situations, putting plant managers' minds at ease when they go off for the weekend or a holiday.



## Seasonal Changes

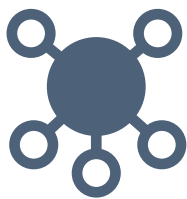
In temperate climates, the changing seasons mean that temperatures fluctuate greatly throughout the year. The building's HVAC will also have to adjust to meet these demands, from cooling in hot summers to heating in freezing winter months. Mitsubishi Electric's HVAC systems are designed with the ability to maintain a consistent indoor temperature, regardless of the climate outside.



## Quiet Operation

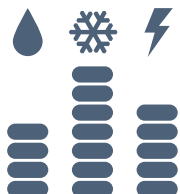
Noise is often an overlooked issue in the choice of a HVAC system. Yet, this factor can often be a distraction to the occupants of the building, affecting productivity and causing undesired interruptions to work. Mitsubishi Electric's HVAC systems are designed to run silently in the background, allowing the freedom for work to be carried out effectively and efficiently.





### **Simplified, Unified Management**

In many factories, the production line, HVAC, lighting and utilities are monitored via separate systems. With Mitsubishi Electric's e&eco-F@ctory solution, a single system is all that is needed to monitor all these functions. Productivity, quality and energy efficiency can easily be managed, vastly reducing overheads and staff costs.



### **Visualising Energy Use**

The heart of every successful system is still the human element. Operators have to ensure that operations run smoothly and be able to quickly detect exceptions events.

Whether it is for hospitals, commercial buildings or factories, visual representations of energy consumption are needed to inform operators if the system is functioning correctly. Mitsubishi Electric's SCADA MC Works64 serves this purpose and presents clear, graphical onscreen illustrations that are easy to understand.



### **Simplified Setup**

Mechanical ventilation fans are a common and essential feature across HVAC systems. Yet the conventional method of hardwiring this equipment takes many hours and requires the deployment of large cable trunking and conduits. This means a number of inherent disadvantages: commissioning time is increased; a higher risk of human error; difficulties in detecting cable breaks; and little flexibility for system changes.

Understanding these limitations, Mitsubishi Electric has revolutionised and perfected the art of fan control in buildings. Using Multi-protocol (CC-link, Ethernet, BACnet & Modbus) as the communications backbone, the only necessary field wiring is the communications cable between each panel. The advantages of this method are:

1. Allowing the flexibility for changes to be made to the HVAC system
2. Vastly reduced timeframe for commissioning
3. A neatly wired system that is immune to electromagnetic interferences
4. Wire breaks are detected quickly, and facilities management staff are immediately alerted for troubleshooting

Proactively proposing building systems leading to energy savings while pursuing eco-friendly systems providing secure, comfortable, and efficient solutions by making the most of the Mitsubishi Electric Group's advanced and environmental technologies and building management systems. We always prioritize customer safety and security in the installation and maintenance of our products, and our mission is to achieve a comfortable, environment-friendly society.





**Mitsubishi Electric has been dedicated to producing energy efficient technology for over ninety years. Controls are an essential part of that. Mitsubishi Electric has long heritage in factory automation where the company leads the field in providing controls that enhance productivity, efficiency and energy use.**

Monitor and control building systems such as heating, ventilation, and air conditioning (HVAC), lighting, power, fire, access control, and security to optimize the occupant's comfort, productivity safety, security, and building energy performance.

The right controls take building performance to the next level. With them, building systems become more responsive, easier to automate, monitor and maintain and less costly to operate in the long-term. The right controls can deliver a cost-effective solution that helps manage, monitor and report on the performance of all building services systems. Control technology is now widely available for buildings of all sizes, so it is possible to access the benefits whatever the scale or scope of your project.



### **Environment Friendly Building**

As a result of the increased worldwide interest in green building concepts and practices, several organizations have developed standards, norms and rating systems that allow government regulators, building professionals and consumers to embrace green building with confidence. Green building rating systems such as BREEAM (United Kingdom), LEED (United States and Canada), DGNB (Germany) and Green Mark (Singapore) help consumers determine a structure's level of environmental performance

They award credits for optional building features that support green design in categories such as:

- Location and maintenance of the building site
- Conservation of water, energy, building materials, and heating and cooling

Mitsubishi Electric can contribute by providing key products for HVAC solutions in green buildings. Wasted energy can be visualized. through hierarchical management of the facilities to be monitored. Functions can then be used to display energy consumed over defined time periods for each area and even converted into equivalent CO2 emissions, all helping to support energy-saving operations.



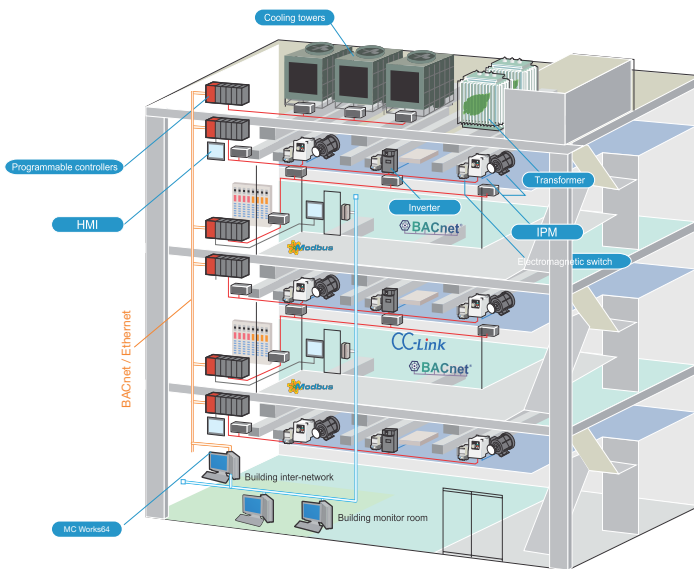
## **REVOLUTIONIZED SOCIAL INFRASTRUCTURE SOLUTIONS**



# TYPICAL SYSTEM CONFIGURATION

The Integrated Building Management System framework brings together separate applications such as security, access, building monitoring and management and HVAC systems.

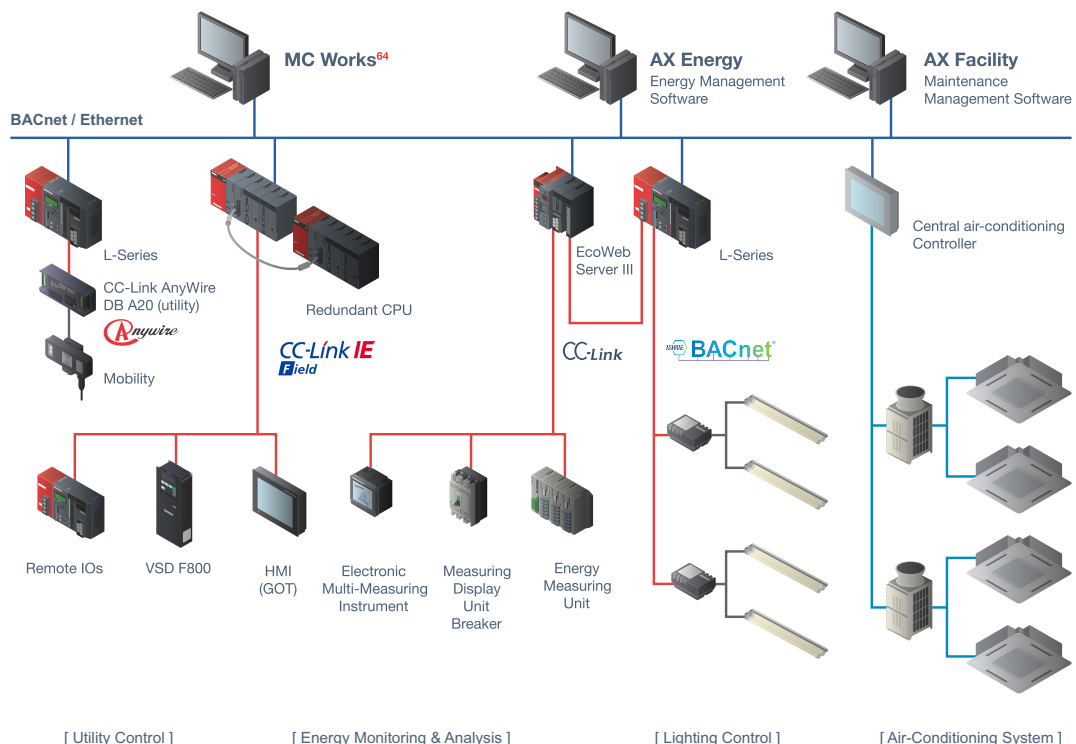
Property managers of industrial plants and facilities are under constant pressure to improve comfort, efficiency and sustainability and to reduce overall energy costs. Smart energy solutions turn data and information into building intelligence by integrating with BMS, SCADA and control systems.



We recommend MC Works64 for the monitoring control of building and plant air-conditioning and facilities. This provides a variety of solutions:

Monitoring control linked to an air-conditioning controller, The visualization of energy with Eco Web Server-III and energy measurement equipment. It provides an energy-saving solution linked to a high efficiency inverter and a building's wire-saving network.

Information is collected, aggregated and normalized from a wide variety of protocols and interfaces, including: BACnet, OPC, SNMP, MODBUS, Web-services, Databases.



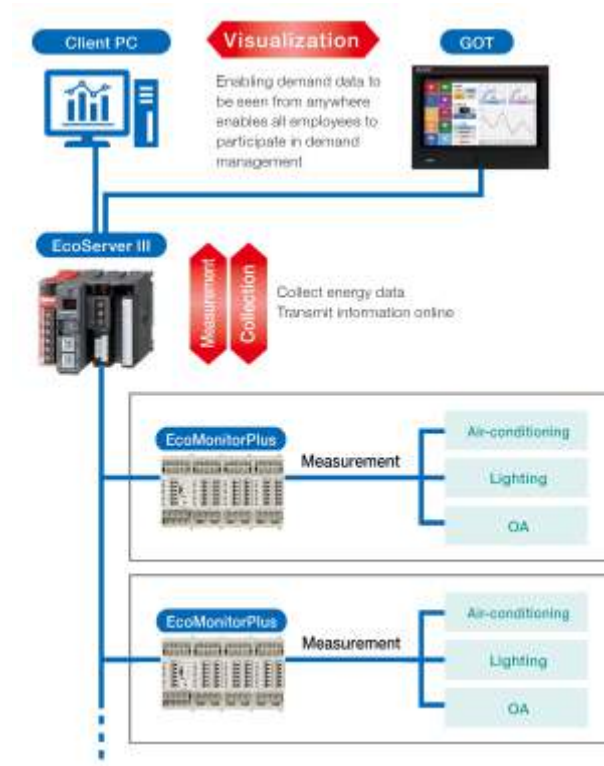
### Energy Management and Sustainability

Demands for energy-saving and power monitoring directly retrieves the measured energy rate, current and voltage, etc., from EcoWebServer III to MC Works<sup>64</sup> and clearly displays the energy consumption rate.

In addition, by connecting EcoWebServer III to the advanced energy visualization and analytic software **AX Energy** to improve productivity and energy optimisation.

### High-Efficiency Energy-savings Based on Production Status and Power Demand Forecasts

- Ongoing energy savings in smart meter production buildings overall Effective demand peak shift with power demand, weather information, etc. managed online
- Measure load current for each piece of production equipment and control air-conditioning and lighting while detecting the presence/absence of operators.



### Preliminary prediction of equipment faults

The advanced fault prediction and equipment diagnosis software **AX Facility**. This allows the device operation status data to be automatically collected, and for equipment to be managed with operation rate control, preventive maintenance and device fault prediction, etc. Use this system to prevent the effect of faults onto production and reduce maintenance costs.

### Key Benefits-

- Future-proof Your Investments in Building Automation
- Integrate with HVAC, Lighting, Security and More
- Provide Unified Operations Centre Monitoring and Control
- Reduce Engineering, Start-up, Deployment and Costs
- Instantly Deliver Alerts to Mobile and Smart Devices
- Coordinate Multiple Buildings with a Single Schedule
- Scale from Hundreds of BACnet Devices

### Building Applications -

- |                       |                 |                |                        |
|-----------------------|-----------------|----------------|------------------------|
| • Commercial          | • Retail        | • Healthcare   | • Government           |
| • Pharmaceutical, F&B | • Laboratories  | • Data Centres | • Residential township |
| • Stadiums            | • Manufacturing | • Airports     | • Transportation       |

## **Mitsubishi Electric's HVAC systems enhance control and maximise productivity, while delivering the ideal climate within buildings.**

We continuously improve our intelligent hardware such as Direct Digital Controllers (DDCs) and Programmable Logic Controllers (PLCs), managed by MC Works64 automation and control software, and supplemented by easy-to-use HMI interfaces for operators to make changes manually.

Our range of circuit breaker technologies ensure system safety and integrity, while redundant PLCs prevent unexpected interruptions. Mitsubishi Electric's HVAC solutions deliver the right balance of performance, efficiency and reliability to maintain a consistent environment in all types of buildings in all seasons.

### **Air Conditioning Systems for Buildings**

Robust air conditioning systems are an essential part of life in today's modern buildings. Our solutions ensure that chillers and boilers for cooling and heating, Air Handling Units (AHU), and ventilation equipment all work together to create the ideal environment for the building.

#### **Major Applications of Our Products :**

- Chiller plant optimization
- Cooling tower optimization
- Boiler control
- Airflow control
- Energy-saving control
- Energy monitoring



### **Ventilation Systems for Tunnels**

Tunnel ventilation systems deliver clearer visibility and reductions in harmful exhaust gas levels. Our solutions contribute through control of jet fans, dust separators and other equipment.

#### **Major Applications of Our Products:**

- Exhaust fan control
- Emergency fan control
- Operating unit number control
- Separator airflow control





## Air Conditioning Systems for Train Stations

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High-traffic train station environments are affected by wind, outside weather, and the heat from railcars, lighting systems, and other train-related equipment. In large station buildings, large-scale fans and air conditioning equipment are always in operation. We have solutions to help.

### Major Applications of Our Products:

- Energy-saving control
- Remote monitoring control
- Energy monitoring



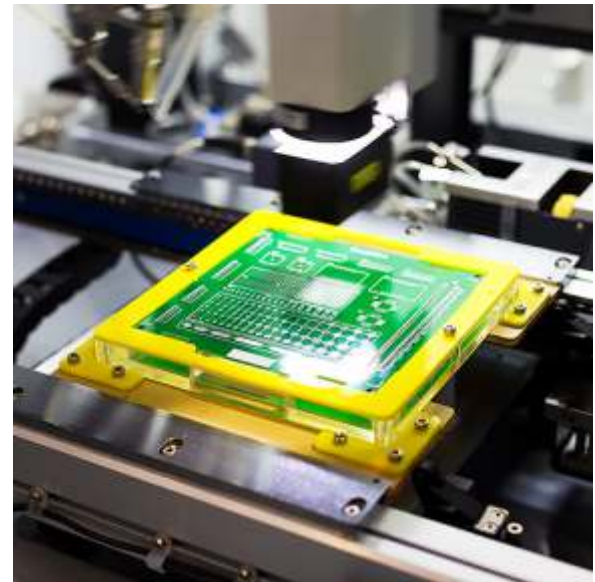
## Clean Room Systems

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Clean rooms require pure air and a consistent temperature and humidity to ensure the quality of the products being made therein. Our control solutions for filtering and circulation can help maintain the ideal environment.

### Major Applications of Our Products:

- Circulation fan control
- Room pressure control
- Monitoring compliant with 21 CFR Part 11
- Remote monitoring control
- Energy-saving & monitoring



# PRODUCT LINEUP

## CONTROLLERS

The MELSEC Series takes control to the next level. Increase security and ensure effective use of energy management capabilities by supporting various building automation protocols, resulting in a reduced carbon footprint



The compact **MELSEC iQ-F Series** controller embeds functions such as analogue and digital I/O, security features, data logging along with serial and Ethernet communication. This makes it a compact and affordable design option for standalone or networked configuration.

Ideal for large-scale building automation, **MELSEC iQ-R Series** BACnet module enables up to 4000 I/O object instances to be registered. It can monitor up to 10,000 points (RDMONB function), realizing large-scale automated building control systems capable of simultaneously managing many different devices such as sensors and drive equipment. It can be used in two modes, either controlling automated building devices as a BACnet® controller or managing/ monitoring multiple controllers as a workstation.

The new **MELSEC iQ-R Series Redundancy** range provides Dual Redundancy, ensuring 100 percent uptime even during process interruptions that arise from power or system failures.



## DIRECT DIGITAL CONTROLLER (DDC)

The L-Series DDC comes in a compact, cost effective and easy-to-expand rack-free design. Its CPU includes built-in Ethernet and Mini-USB interfaces. It also features a SD/SDHC memory card slot for program storage and data logging. All I/O and communications options can be added-on where needed.

Easily communicate with target devices by selecting a predefined protocol. The communication protocol library supports the SLMP, MODBUS®TCP and BACnet®client functions.



## ALL IN ONE COMPACT CONTROLLER- GOC

The Graphic Operation Controller (GOC) is a compact, cost effective and easy-to-expand panel door mountable design. Controller with option of MODBUS-RTU, MODBUS TCP and CC-Link IE Field Basic interface. It also features a SD memory card slot for data logging. All I/O and communications options can be added-on where needed.

The compact Controller + HMI combo allows for customisation of the product based on the requirement and HMI supports multiple local languages along with basic graphic symbols.



## MODULAR I/O

Modular I/O series is ideal for application requiring compatibility with various network and flexibility in connecting digital, analog and serial IO devices makes it simpler and flexible in configuring system as per application need.

Utilizing Ethernet based communication CC-Link IE Field Basic, MODBUS TCP and Ethernet/IP network functions with main controller fulfils easy connection of field devices and communication interface remotely.



## HUMAN-MACHINE INTERFACE (HMI)-GOT

Graphic Operation Terminal (GOT) platforms provide a clear visualisation of system information and schematics, making it easy for manual troubleshooting and system configuration. A wide variety of line-up meets the needs of production sites. The GOT boasts advanced functionality, acts as a seamless gateway to other devices, all while increasing productivity and efficiency

Simply connect to various controllers using built-in interfaces of GOT. Monitor your worksite from a remote location by GOT Mobile function

The GOT Drive enhanced functionality is designed to eliminate need for additional hardware, software and suits customer's applications to realize central monitoring, speed up system start-up, improve predictive maintenance and troubleshooting.



## BUILDING AUTOMATION SOFTWARE- MCWORKS<sup>64</sup>

MC Works<sup>64</sup> is a 64-bit advanced modular & integral software providing a variety of functions and refined user interfaces suitable for social infrastructure fields that makes it an ideal solution for HVAC applications. It serves as a quick deployment platform that integrates plant and business data into a high-performance, real-time, distributed platform.

Advanced add-ons such as AX Energy, AX Quality, are available to further improve productivity & control.

MC Works<sup>64</sup> supports various communications such as OPC DA/AE/HDA/UA, BACnet®(compliant with ANSI/ASHRAE Standard 135-2008), and databases. Different systems in multiple sites and different types of devices can be easily connected. MC Works64 Web Services can obtain weather data utilizing Web Services supporting SOAP or REST on the Internet.





## VARIABLE FREQUENCY DRIVE (VFD)

The FREQROL F800-Series VFD has been designed to optimise 3-phase IM & PM motor control, helping to reduce energy consumption for HVAC applications while offering power regeneration functions.

It supports BACnet®MS/TP as standard, as well as Mitsubishi inverter protocol and MODBUS®RTU protocol. Options are also available for major network protocols such as BACnet/IP, MODBUS/TCP, Ethernet/IP, LONWORKS® integrate seamlessly with the BMS System.



## LOW-VOLTAGE POWER DISTRIBUTION PRODUCTS

A broad line-up of low voltage circuit breakers. Compact, safe, and easy-to-use motor starters.

Mitsubishi low voltage circuit breakers have advanced breaking technologies and are available to use the several applications and used as the main circuit breakers of power distribution systems for commercial buildings, factories and freight ships which will provide a high-level of circuit monitoring and friendly networking.

Heavy duty Contactor and Motor Starters feature specifications that are environmentally friendly, internationally usable, compact, easy to use and safe. They comply with many international standards and cover a wide range of applications from switchboards to machines by high reliability.

## POWER MONITORING PRODUCTS

The reliable power management, monitoring and control equipment has many energy-saving functions and network capability.

Energy saving supporting devices facilitates measuring, collecting and analysing energy consumption, achieving "Visualizing" solution. Support your energy saving activities for productivity enhancement and cost reduction.

Insulation Monitoring Module measure leakage currents in equipment units and constantly monitor insulation deterioration to prevent problems.

Power management meters equipped with a full function of measuring, output and transmission. It supports the realization of measuring, displaying and monitoring energy consumption and power quality in buildings.



Electronic multi measuring device  
ME96SSA series



Energy Saving Data Collecting servers  
EcoWebServerIII



Energy Measuring Units  
EcoMonitorLight



Energy Measuring Units  
EcoMonitorPlus



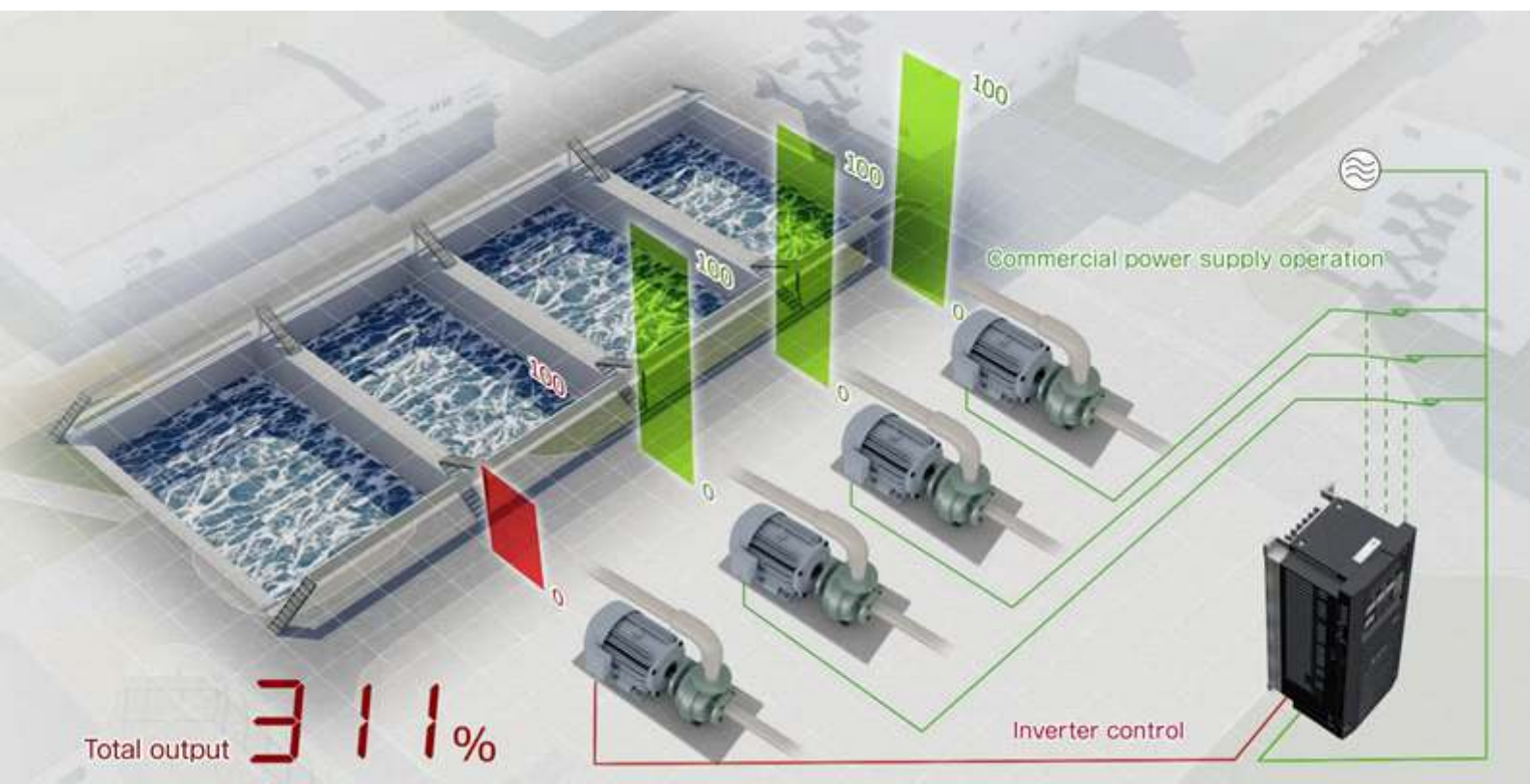
Energy Measuring Module /  
Insulation monitoring module  
MELSEC-Q series



# HVAC Systems

Network enabled Inverters (VFDs) offer an efficient and effective alternative to traditional mechanical damper systems. Since building systems are sized for peak load conditions, pump and fan motors use more energy than necessary during most of their operating hours. Inverters allow the use of energy as demand increases, and only in the amounts necessary.

Additionally, using inverters in air handlers, pumps, chillers, ventilation and tower fans not only saves energy, but reduces motor starting current, thermal and mechanical stresses on motors and belts during starts. This means less maintenance, a higher power factor, and lower kVA.



# INVERTER FOR HVAC APPLICATIONS

The frequency inverters in the **FR-F800 (-E)** range have been especially designed for pump and fan applications as well as heating, ventilation and air-conditioning installations (HVAC) that combines performance, accuracy and reliability with IM and PM (IPM) motors, in building automation and industrial plants.

Besides their protection rating IP00/IP20, the outstanding features of these power saving frequency inverters include their simple but safe operation and start-up, perfect control management and optional network-capability.

The **FR-F846 (-E)** frequency inverter with a protective structure of IP55 is suitable for use under harsh environmental conditions.

The **FR-F842 (-E)** is separated into control and power unit. FR-CC2 (converter unit) and FR-F842 (frequency inverter). This concept enables simple installation and commissioning of cost-effective DC bus systems.

The **FR-F800-E/ FR-F846-E** is with embedded Ethernet based communications to enhance overall system flexibility. With 100Mbps Ethernet TCP/IP and BACnet/IP connectivity as the standard, the FR-F800-E/ FR-F846-E provides an increased ability for remote system monitoring, parameter adjustments and easy integration into existing network environments.

Built-in functions, such as the pre-charge function or the PLC functionality, help to reduce the costs and the complexity of many applications, because additional components are eliminated.



## FR-F800 Specifications

**POWER RANGE :** 0.75 - 630 kW

**INPUT :** 200/415 V AC 3 - ph (50/60 Hz)

**OUTPUT FREQUENCY :** 0 - 590 Hz

### PROTECTION:

FR-F820/F840: up to 30kW IP20

FR-F820/F840: from 37kW IP00

FR-F842: from 355kW IP00

FR-F846: up to 160kW IP55

**SAFETY:** Integrated STO function (SIL3 PLe)

**CONTROL:** V/f, AOEC, SMFV, Built-in PLC

### NETWORK INTERFACES:

BACnet® MS/TP, MODBUS-RTU, MODBUS/TCP, BACnet/IP CC-Link, CC-Link IE, LONWORKS, FL-remote, PROFIBUS-DP and DeviceNet™, EtherNet IP, ProfiNet, SLMP, EtherCat, CAN-Bus, RS485, USB.

**CONTROL OPTIONS:** Analog + digital IO

**EMC PROTECTION:** Integrated





## FR-F846 (-E) Inverter for Field Use (IP55 Model)

The FR-F846 (-E) inverter has a highly protective structure with the IP55 rating, UL Type-12 Enclosure-Suitable for Installation in a Compartment Handling Conditioned Air (Plenum).

Since the inverter is compatible with hostile environments such as high humidity and dusty environments, you can easily install the inverter near the machine or in available spaces. By installing the inverter outside of the enclosure, the enclosure design becomes easier in terms of countermeasures against heat, and the enclosure is downsized as well.



### A Operation panel (FR-DU08-01)

The FR-DU08-01 is compatible with the IP55 rating and detachable from the inverter. An optional LCD operation panel (FR-DU08-01) is available for replacement.

### B Circuit board coating

The coating conforms to IEC 60721-3-3 3C2/3S2 for improved environmental resistance.

### C Gasket

Reliable gasket sealing is provided.

### D Cable connection

To ensure compliance with the IP55 rating of the cable section, cable glands are available.

### E EMC filter

The inverter has a built-in filter for industrial environments. (EN 61800-3 C3). A filter for residential environments (EN 61800-3 C2) is also available.

### F Waterproof fan

The cooling fan is compatible with the IP55 rating. It is detachable from the inverter without disconnecting the main circuit wiring. (The cooling fan is provided for the -00250 or higher).

### G DC reactor

The inverter has a built-in DC reactor compatible with the EN 61000-3-2/12 standard.

### H Internal air circulation fan

The internal cooling fan (detachable) circulates air inside the inverter.

## IP55 Inverter Lineup: (0.75 – 160 kW)

**F R - F 8 4 6 - 00250 - 1 - 60 C3**

Symbol	Voltage class	Symbol	Voltage class	Symbol	Type <sup>1)</sup>	Communication type <sup>2)</sup>	Symbol	Circuit board coating (IEC60721-3-3) 3C2/3S2 compatible	Plated conductor	Symbol	EMC filter	Operation panel
4	400 V class	00023	Inverter rated current to 03610 (SLD rated current of the F800 standard model) (A)	1	FM	RS-485	60	With	Without	C2	Built-in C2 filter Residential environments (EN 61800-3 C2)	FR-DU08-01
		0.75K to 160K	Inverter LD rated capacity (kW)	2	CA	Ethernet	60	With	With	C3	Built-in C3 filter Industrial environments (EN 61800-3 C3)	
				E1	FM					L2	Built-in C2 filter Residential environments (EN 61800-3 C2)	FR-LU08-01
				E2	CA							
Symbol	Structure, functionality											
6	IP55 compatible model											

## FR-F800 (-E) Inverter (Standard Model)

FR-F800 (-E) is a dedicated energy-saving inverter with protection rating IP00/IP20, the outstanding features of these power saving frequency inverters include their simple but safe operation and start-up, perfect control management and optional network-capability.



### Standard Inverter Lineup:

**FR - F 8 2 0 - 0.75 K - 1 -**

Symbol	Voltage class	Symbol	Structure, functionality	Symbol	Description	Symbol	Type <sup>*1</sup>	Communication type	Symbol	Circuit board coating (IEC60721-3-3) 3C2/3X2 compatible	Plated conductor
2	200 V class	0	Standard model <sup>*2</sup>	0.75 to 560K	Inverter LD rated capacity (kW)	1	FM	RS-485	None	Without	Without
4	400 V class	2	Separated converter type <sup>*3</sup>	00023 to 06830	Inverter SLD rated current (A)	2	CA <sup>*1</sup>		60	With	Without
						E1	FM	Ethernet	60	With	With
						E2	CA <sup>*1</sup>				

<sup>\*1</sup>. 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).

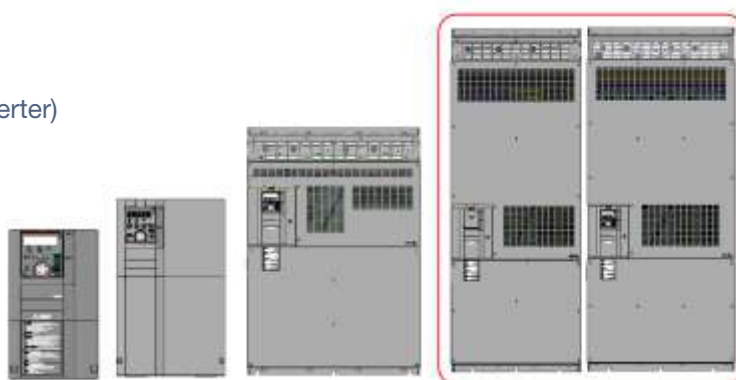
<sup>\*2</sup>. For the 75K or higher inverter, always connect a DC reactor (FR-HEL), which is available as an option. Select a DC reactor according to the applied motor capacity.

<sup>\*3</sup>. Always install the converter unit (FR-CC2) - Not required when a higher power factor converter (FR-HC2) is used.

IP20: 0.75 to 30 kW (Single Module)

IP00: 37 to 355 kW (Single Module)

IP00: 355 to 630 kW (with Separated Converter)

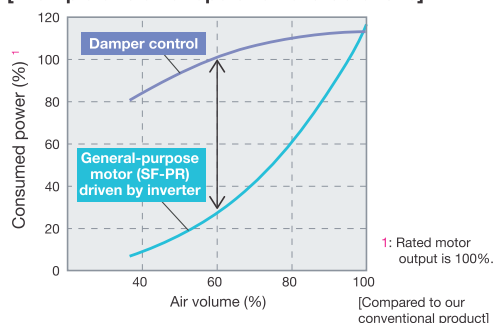


## Effective energy savings

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.

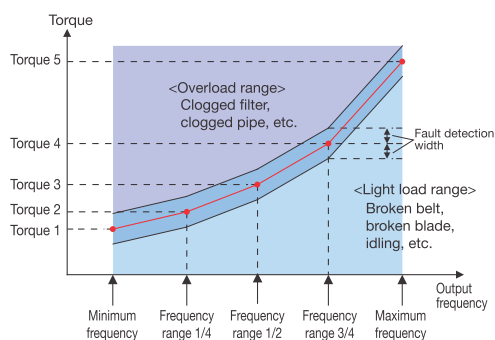
Pumps and fans are particularly good targets for great reductions in energy consumption. Energy costs can be slashed by up to 60 %, notably in the lower speed or light load range of such applications.

[Example of blower operation characteristic]



## Load characteristics measurement function (Detection of mechanical faults)

The speed/torque relationship is stored while no fault occurs. By comparing the present load status with the stored load characteristics, out-of-range warnings can be output if applicable. Mechanical faults such as clogging of the filter or breakage of the belt can be easily detected, and maintenance is facilitated.



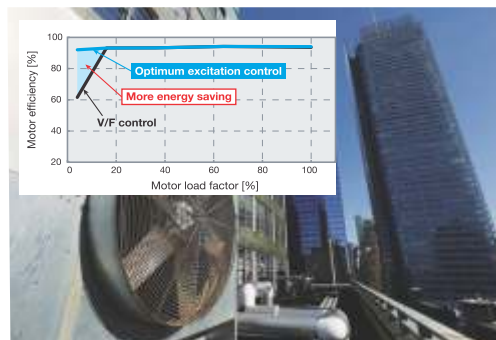
## Optimum Inverter Capacity Selection (Multiple rating)

The rating can be selected between the two types (LD (light duty) or SLD (superlight duty)) depending on the load of the fan/pump to be used. The optimum inverter capacity can be selected suitable for motor to be used.

Load	Rating	Overload current rating
Superlight duty	SLD rating	110% 60s, 120% 3s (Inverse-time characteristics) at surrounding air temperature of 40°C
Light duty	LD rating	120% 60s, 150% 3s (Inverse-time characteristics) at surrounding air temperature of 50°C

## Utilizing the motor capability to full

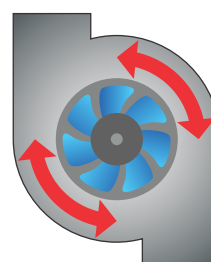
Additional energy savings are realized by the cutting-edge “Advanced Optimum Excitation Control (AOEC) algorithm” developed by Mitsubishi Electric. It supplies the motor with the optimum magnetic flux at any given time, thereby reducing losses. The result is maximum motor performance teamed with supreme efficiency.



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.

## Cleaning function (Cleaning of fans and pumps)

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)

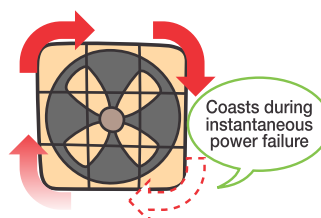


This function can be also automatically started when the result of load characteristics measurement is out of range (overload).

## Smooth Restart (flying start function)

After an instantaneous power failure, the operation is restarting from the coasting motor speed.

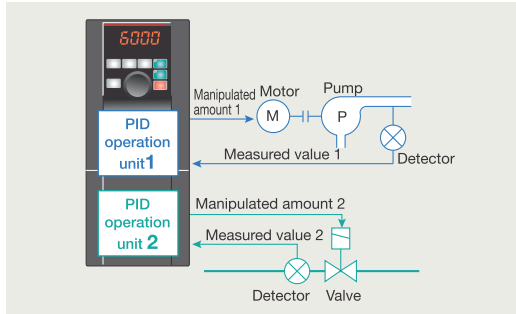
- Advanced flying start function
- Regeneration avoidance function





## Enhanced PID Control

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.

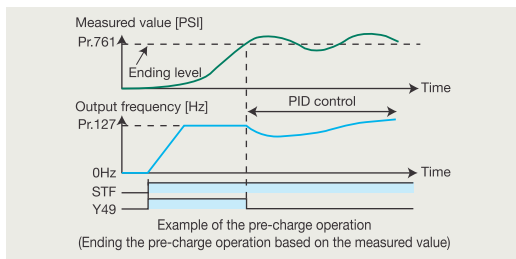


## Direct setting of the PID set point

The PID set point can be set directly from the operation panel. Setting can be easily changed.

## PID pre-charge function

Before PID action, the water flow to the pipe is controlled by operating the motor at a constant speed until the measured value (pressure, etc.) reaches the set level.

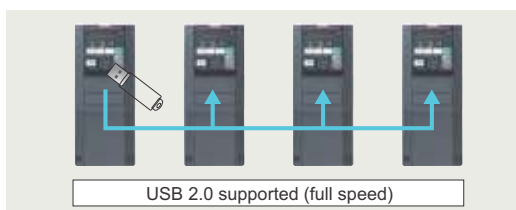


This function is used to avoid rapid acceleration/deceleration caused by starting the PID action while the pipe is empty, and prevent a water hammer action, etc.

## USB memory device Function

A USB host connector (A type), which allows to commercial USB memory devices.

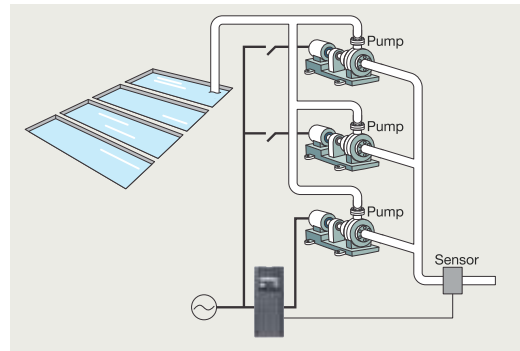
- Parameter copy Function
- Trace Function
- PLC function data copy



## Multi-pump function

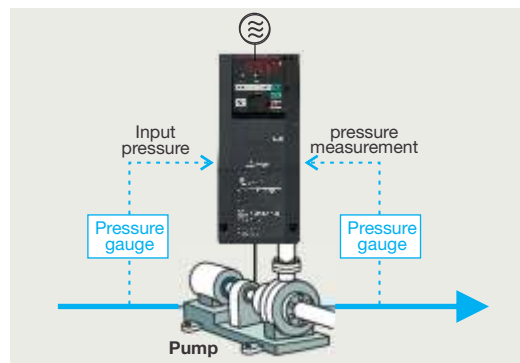
By controlling the pumps connected in parallel (up to four pumps) by the PID control by one inverter, water volume, etc. can be adjusted.

One of the connected pumps is driven by the inverter. Other pumps are driven by commercial power supply. The number of pumps to be driven by commercial power supply is automatically adjusted according to the water volume



## Pump water volume control

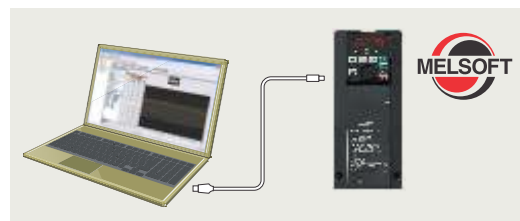
In order to prevent air intake and cavitation inside the pump, the pump inlet pressure can be controlled so that there is no water shortage



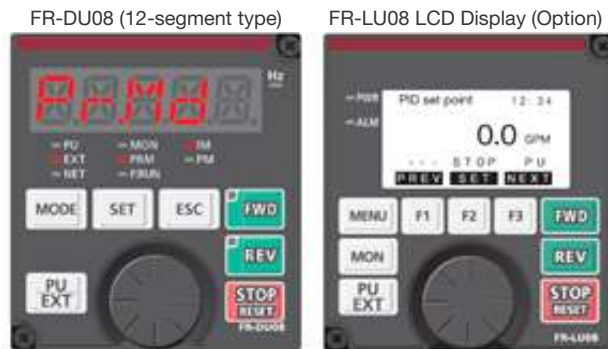
## Easy setup with FR Configurator2

With the sense of unity with other Mitsubishi Electric FA products with common MELSOFT design and operability, the software is easy to use.

Easy plug-and-play connection is available to the USB terminal equipped as standard.



## Easy-to-read operation panel



The operation panel with the one touch Digital Dial allows direct access.

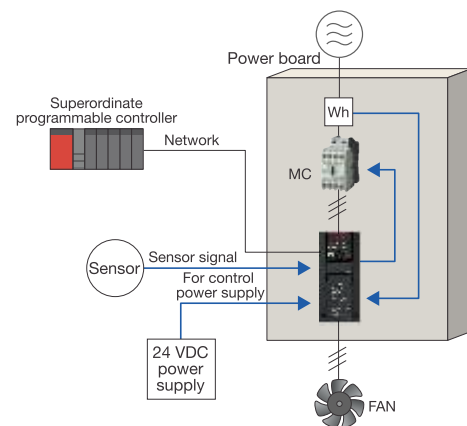
FR-LU08 optional operation panel with an LCD screen offering enhanced display functionality and a clock function – Allows time-based control and time stamping of trip messages.

With FR-LU08-01 the unit can be changed from "%" to other easy-to-see units.

Maintenance and adjustment are facilitated by using a familiar unit of air volume, temperature, etc. for indication and direct setting of the PID set point. Or a more economical FR-DU08 operation panel with a 5-digit, 12-segment display.

## Built in PLC Function

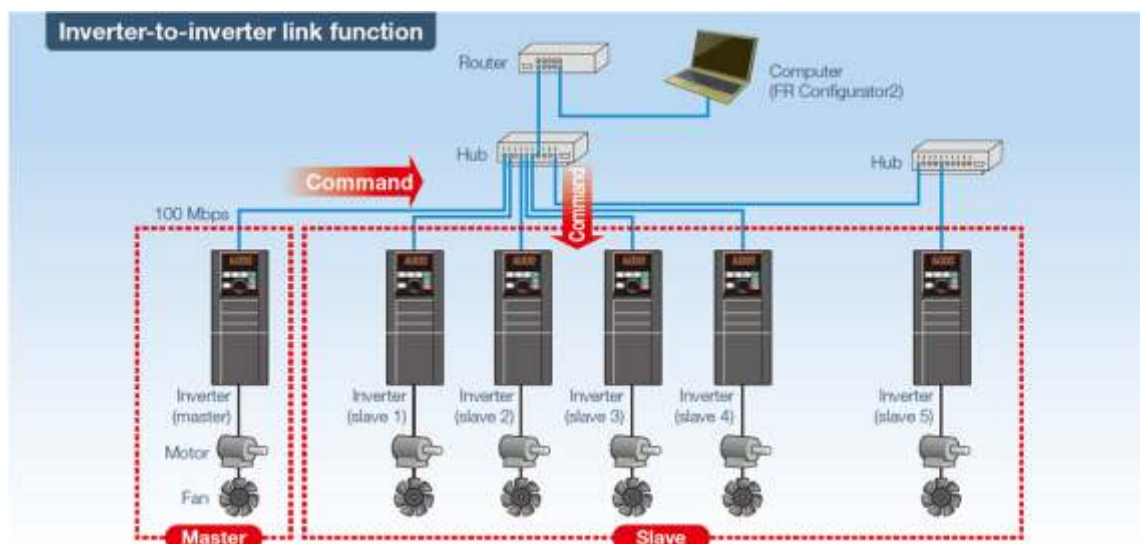
- The integrated PLC function can be utilized to control whole system by the inverter alone, and control.
- Control programs can be created in sequence ladders using the inverter setup software (FR Configurator2). Parameters and setting frequency can be changed at the program.
- 24 VDC control power input as standard. The parameter setting and communication operation can be done without turning ON the main power.
- The PLC function device monitor can be displayed at the HMI. Batch control of multiple inverter device monitors is possible with a single HMI unit.
- Time-based operation by using in combination with the real-time clock function on optional LCD operation panel (FR-LU08).



## FR-F800-E/ FR-F846-E: Drive to Drive Communications

### Enabling construction of a small-scale system of inverters

Utilize the internal PLC to communicate without a master PLC controller allowing the master inverter to send commands to control multiple slave inverters connected to Ethernet Communication between multiple inverters is carried out through the I/O device and special register transmission of the PLC function.



## Long Life Components and Life Check Function

- The service life of the cooling fans is now 10 years. The life can be further extended by control of cooling fan.
- Capacitors with a design life of 10 years are adapted.
- Life indication of life components
- Prevention of trouble with temperature monitoring. Use this function as a guide for the life diagnosis.
- Maintenance timers are available for up to three peripheral devices, such as a motor and bearings.

## Protected in Hazardous Environments

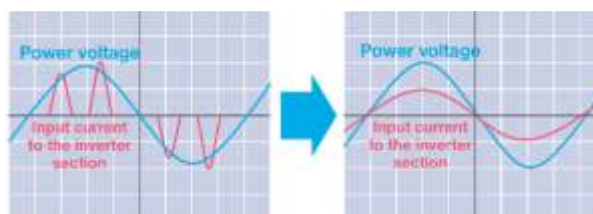
Inverters with circuit board coating (IEC60721-3-3 3C2/3S2) and plated conductors are available for improved environmental resistance. ("-60" or "-06" is affixed to the end of the inverter model name).

## Structure option: Protruding the heatsink through panel for compact enclosures

When encasing the FR-F800 (-E) standard model inverter in compact enclosure, the heat generated in the enclosure can be greatly reduced by protruding the heat sink of the inverter.

## Suppression of Harmonic Current and EMI

**Power supply harmonics of inverters** can be suppressed, minimizing the effects on other equipment. The total harmonic distortion of the input current (THDi) is 5% or less, which facilitates compliance with the overseas standards related to harmonic suppression.



Harmonic current may adversely affect the power supply.

To suppress such harmonic current, mains disturbances can be reduced by passive or active devices. Mitsubishi Electric offers frequency inverters with integrated chokes or external chokes, harmonic filters or AFE converters. Harmonic distortion can be significantly decreased below 5% by active filters and AFE converters (FR-XC, FR-HC2).

**The built-in EMC filter** can be set enabled/disabled \*1\*2 by attaching the EMC filter connector to the ON/OFF position. When it is enabled, the inverter conforms to the EMC Directive (EN61800-3/2nd Environment Category C3 \*3) by itself.

	Capacitive filter	Common mode choke	DC reactor
55 kW or lower	Standard (built-in)	Standard (built-in)	Optional (sold separately)
75 kW or higher	Standard (built-in)	Optional (sold separately)	Optional (sold separately)

\* 1: Enabling the EMC filter increases leakage current.

\* 2: The input side common mode choke, which is built in the 55 kW or lower inverter, is always enabled regardless of the EMC filter ON/OFF connector setting.

\* 3: Refer to the EMC Installation Guidelines for the required specifications.

## Safety standards compliance

Controls with safety functions can be easily performed. The Safe Torque Off (STO) safety function is supported by the inverter. The FR-F800 inverter with the safety function complies with safety standards while incurring little expense.

### Safety Integrity Level (SIL) 3

ISO 13849-1:2015 Category 3 / PL<sub>e</sub>

IEC 61508:2010 SIL 3

IEC 61800-5-2:2016 Stop category 0

IEC 62061:2015 / IEC 61800-5-2:2016 /

IEC 60204-1:2016 /

## Global Compatibility

Complies with UL, cUL, and EC Directives (CE marking), and the Radio Waves Act (South Korea) (KC marking). It is also certified as compliant with the Eurasian Conformity (EAC).


The inverters are compliant with the EU RoHS Directive (Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), friendly to people and to the environment.





## Exhaustive range of Inverters from Mitsubishi Electric -

In addition to FR-F800 inverter series, the variety of the Mitsubishi Electric frequency inverter models makes it easy for the user to choose the optimum inverter for different applications

	<b>FR-CS80: Compact &amp; Smart Inverter</b> <b>200V:</b> FR-CS82S (up to 2.2 kW), <b>400V:</b> FR-CS84 (up to 15 kW) <ul style="list-style-type: none"> <li>Variety of Functions to Support Various Applications - Fan &amp; Pump, Conveyor, Fountain, Packaging, Spinning, Food machinery, Machine tools.</li> <li>World's smallest class compact body. Space saving by the side-by-side installation.</li> <li>MODBUS/RS485 network interface. Easy maintenance.</li> </ul>
	<b>FR-D700: Easy and Compact Inverter</b> <b>200V:</b> FR-D720S (up to 2.2 kW), <b>400V:</b> FR-D740 (up to 7.5 kW) <ul style="list-style-type: none"> <li>Ideal for AHU, small pump and fan control in HVAC applications.</li> <li>High reliability, Compact and easy maintenance.</li> <li>Magnetic Flux Vector Control with auto-tuning, Safety stop function.</li> <li>MODBUS/RS485 network interface</li> <li>The model FR-D700-E12 dedicated inverter for Solar-pump applications.</li> </ul>
	<b>FR-E700/ FR-E740-NE: Simple and Powerful Inverter</b> <b>400V:</b> FR-E740 (up to 15 kW) <ul style="list-style-type: none"> <li>Achieving the top level of driving performance in compact body, the inverter became more powerful. Expansion options for variety of network interface &amp; IO.</li> <li>Advanced magnetic flux vector control enables accurate start-ups operation.</li> <li>FR-E700-NE is equipped with an Ethernet interface which supports CC-Link IE Field Basic and Modbus TCP.</li> <li>The model FR-E700-E12 dedicated inverter for Solar-pump applications.</li> </ul>
	<b>FR-A701: Inverter with Power regeneration function</b> <b>200V:</b> FR-A721 (up to 55 kW), <b>400V:</b> FR-A741 (up to 55 kW) <ul style="list-style-type: none"> <li>Inverter with built-in power regeneration, achieving great braking capability is now available.</li> <li>This compact body inverter with variety of advanced technology attained high performance suitable for lift operation, line control, etc.</li> <li>It contributes to high performance of machine equipment which generate regeneration torque such as elevator, centrifugal separator, various testing machine, winding machine.</li> </ul>
	<b>FR-A800/ FR-A800-E: High Performance and High Functionality Inverter</b> <b>200V:</b> FR-A820 (up to 110 kW), <b>400V:</b> FR-A840 (up to 1350 kW), <b>690V:</b> (From 160 kW) <ul style="list-style-type: none"> <li>Extensive range of high-value next-generation advanced inverter available in IP00/20 &amp; IP55.</li> <li>Delivering outstanding drive performance with IP &amp; PM motors. Support to Soft-PWM, V/F, optimum excitation control, AMFVC, real sensorless vector, vector control and PM control.</li> <li>Fully equipped with a variety of functions for security &amp; safety and easy to use.</li> <li>Save energy and Numerous functions and the extensive lineup of models are ready to support various systems.</li> </ul>
	<b>FR-A800 Plus: Dedicated Inverter for Specialized Field</b> <ul style="list-style-type: none"> <li>The optimum functions for each dedicated field special applications are added to the already high performance and high functionality of FR-A800 series inverter.</li> <li>FR-A800-R2R for Roll to Roll (winding un-winding)</li> <li>FR-A800-CRN for Crane</li> <li>FR-A800-ELV for Elevator</li> <li>FR-A800-AWH for Automated Warehouse Stacker Crane</li> <li>FR-A800-LC Liquid Cooled product.</li> </ul>
	<b>Regenerative Function, High Power Factor &amp; Power Harmonics Reduction</b> <ul style="list-style-type: none"> <li>The harmonic converters can supply the DC-bus of the inverter or several inverters in case of regenerative energy and equipped with a powerful filter for reducing main disturbances by suppressing the power supply harmonics.</li> <li>FR-XC: Multifunction Power Regeneration Converter (7.5 kW - 55 kW)</li> <li>FR-HC2: High Power Factor Converter (7.5 kW - 560 kW)</li> <li>FR-CC2: 12-pulse/ Back-to-Back converter (315 kW - 630 kW)</li> </ul>

# LOW-VOLTAGE CIRCUIT BREAKER

## WS-V, W&WS, AE-SW Series

Various low-voltage circuit breakers are prepared for ships.

- Creating the next level of high-performance
- Extensive lineup of products catering to rapidly expanding globalization
- User-friendly products



### Features

#### Extensive lineup of products compliant with various ship classifications

The products are approved for the ship classification standards by NK, LR, ABS, DNV GL, BV and CCS.

#### AE-SW generator protection relay

The generator protection relay with the rated value specified by customers provides the most optimal protection.

#### Plug-in type

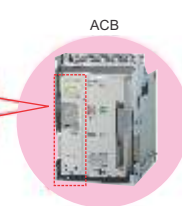
The molded case circuit breaker (MCCB) is used as a circuit breaker for switchboards or distribution boards. The plug-in type allows installation or suitable for replacing and updating work in a short time.



Generator protection relay



ACB



### Product Lineup

#### Molded Case Circuit Breaker/ Earth Leakage Circuit Breaker

WS-V series

W&WS series



#### Air Circuit Breaker

AE-SW series



Some models have not been approved by all classification societies. For details of the models compliant with ship classification standards and precautions, please contact your local sales office.

## Magnetic Starter

# MS-T Series

All your expectations packed into one small device

- Down-sized width
- Expansion of the standard range of operation coil ratings
- Terminal cover with finger protection
- Variety of terminals for smart wiring
- Compliant with main International Standards



## Features

### Down-sizing

With a Magnetic Contactor that boasts the smallest width dimension\* in the industry, customers can easily downsize their boards more than ever before.

\*For AC-operated 10 A frame class general-purpose Magnetic Contactor (based on survey conducted by Mitsubishi Electric dated January 2019)



Downsized  
by 7mm!

### Expansion of operation coil rating range

The applicable voltage ranges have been extended in some operation coils, which reduces the number of operation coil rating types from 13 (previous series) to 7. Users can reduce their inventory by global standardization.

Conventional Product		
Coil	Rated voltage [V]	
Designation	50 Hz	60 Hz
24 VAC	24	24
48 VAC	48-50	48-50
100 VAC	100	100-110
120 VAC	110-120	115-120
127 VAC	125-127	127
200 VAC	200	200-220
220 VAC	208-220	220
230 VAC	220-240	230-240
260 VAC	240-260	260-280
380 VAC	346-380	380
400 VAC	380-415	400-440
440 VAC	415-440	460-480
500 VAC	500	500-550

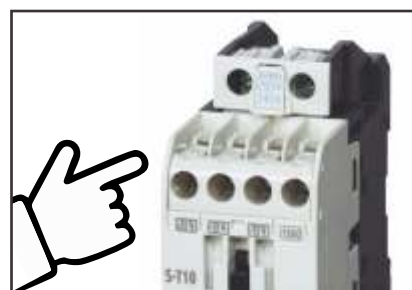


MS-T series		
Coil	Rated voltage [V]	
Designation	50/60 Hz	
24 VAC	24	
48 VAC	48-50	
100 VAC	100-127	
200 VAC	200-240	
300 VAC	260-300	
400 VAC	380-440	
500 VAC	460-550	

The conventional seven types are Available for the 50A and larger frames

### Terminal cover with finger protection is provided as standard

In addition to the Magnetic Contactor, a terminal cover is also provided as standard for the terminal relay, electromagnetic relay and auxiliary contact unit options. This prevents electric shocks and increases safety during maintenance and inspections.



## Product Lineup

### Magnetic Contactor

S-T□



### Thermal Overload Relay

TH-T□KP



### Magnetic Starter

MSO-T□KP



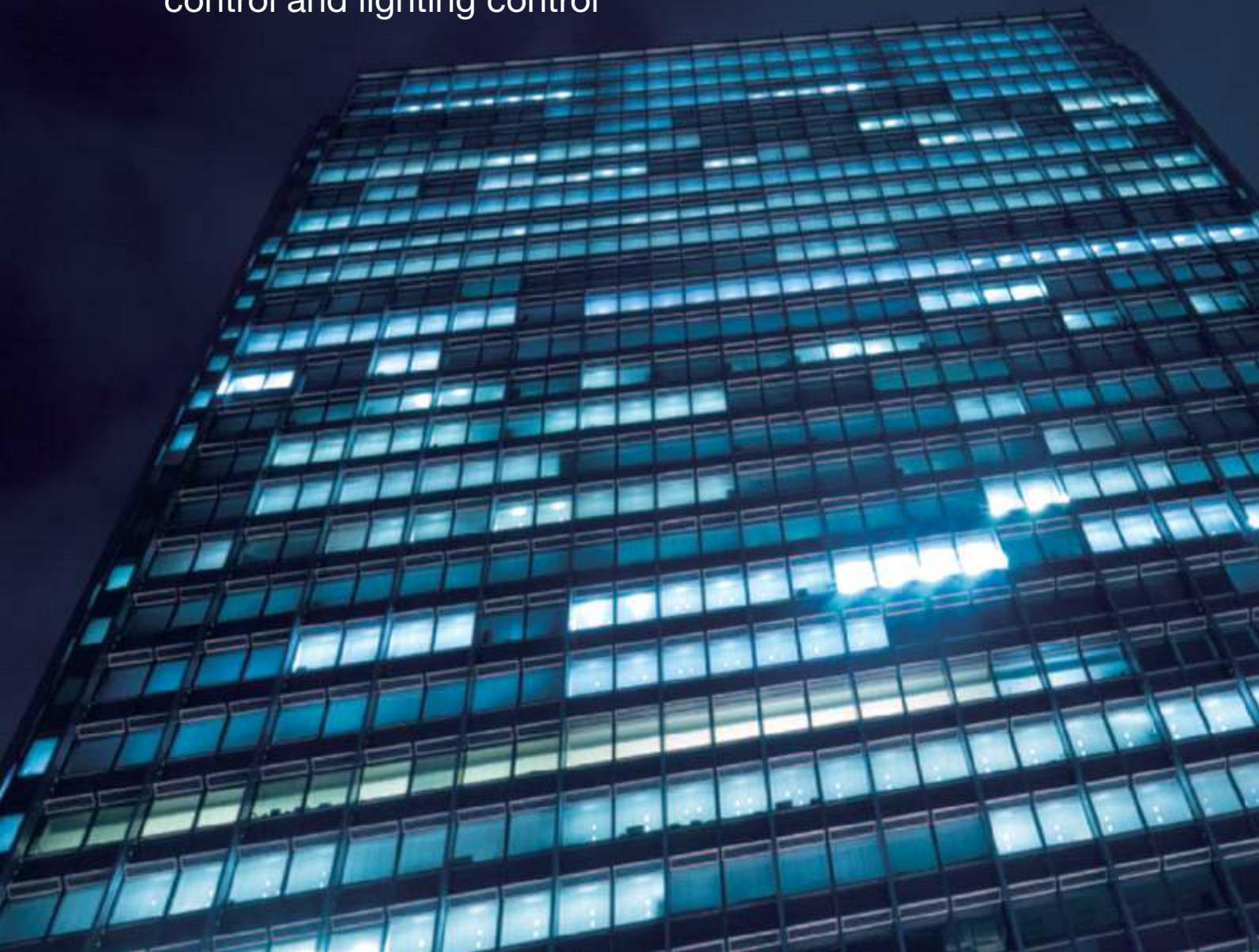
Some models have not been approved by all classification societies. For details of the models compliant with ship classification standards and precautions, please contact your local sales office.





# Building Automation

- Managing the entire building's energy
- Collectively monitoring multiple buildings
- Monitor each system's operation status and alarms
- Providing comfort and energy-saving with air-conditioning control and lighting control



## Realizing advanced integrated monitoring systems.



Redundant Controllers in duty- standby configuration are used to control the operation of critical equipment such as chillers, pumps and cooling towers. This ensures a constant and reliable supply of chilled water to the air-side equipment. Precise temperature control is possible due to the high resolution of the controllers.



HVAC series variable speed drives are used to regulate the motors of Air Handling Units (AHUs) for energy savings when load demand is low. Advance Optimum Excitation Control (AOEC) technology ensures optimum flux applied to the motors at all load conditions to achieve the highest efficiency level. High level interfacing with all drives provide necessary information for performance and preventive maintenance.

MC Works64 provides graphic displays allowing the state of all M&E equipment to be grasped at a glance.

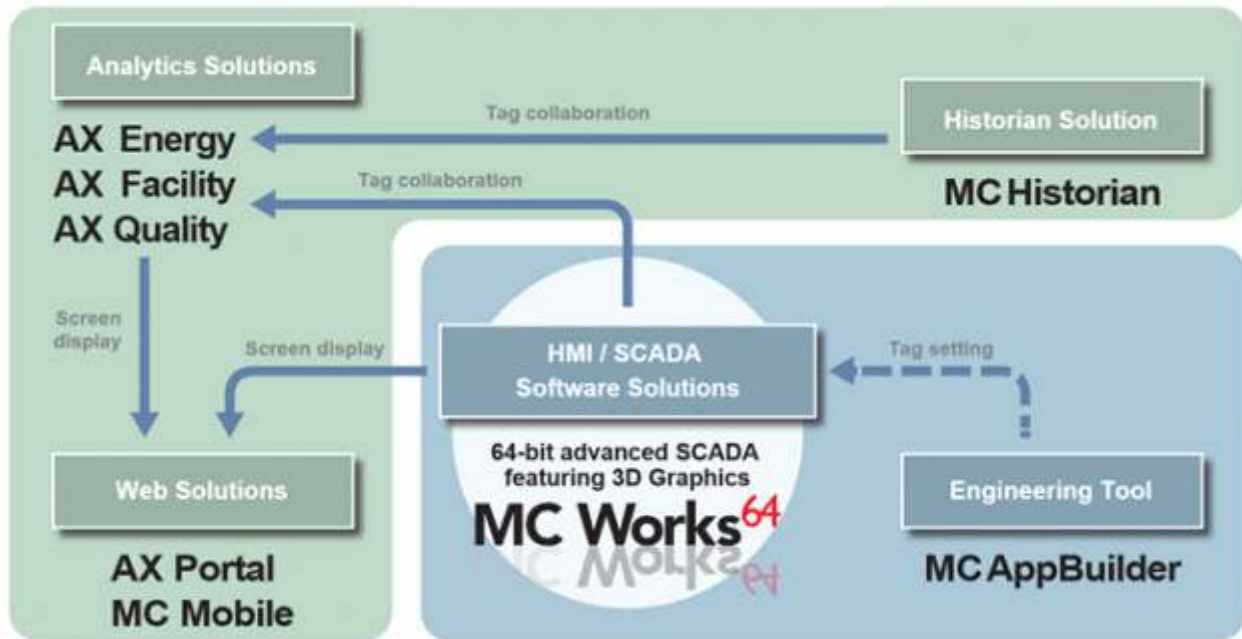


The optimization program works to achieve the overall efficiency of the chiller plant room complying to design standards. Chronological changes in the measured values, cumulative values and device operation time are displayed on trend graphs and bar graphs, allowing changes in the alarms and system state to be monitored in real time and historically.

Advanced AX Facility software enables system management by collecting data on the device operation state, controlling the operation rate, providing preventive maintenance and predicting device failure.

MC Works64, is an advanced 64- bit OS compatible SCADA equipped with 3D graphics screen. Software features the MC AppBuilder engineering tool to realize easy collaboration between the SCADA and programmable controller.

Implement MC Works64 for monitoring and control including functions such as HMI screens, trends and alarms, and for engineering to support aspects from monitoring to control. Functions for various markets can be realized by adding the optional package to the basic package MC Works64. For example, add AX Energy to control energy such as power, water and gas in buildings.



## MC Works packages

<b>MC Works</b>	Software are including monitor control with HMI screens, trend and alarm functions, supporting operations from monitoring to control Mc AppBuilder - Software to support MC Works /MC Graph/ MC Alarm/ settings
<b>AX Energy</b>	Software to monitor energy including factory and plant energy, water and gas
<b>AX Facility</b>	Software for factory or plan equipment control and preventive maintenance
<b>AX Quality</b>	Software for powerful Statistical Control Analysis
<b>MC Historian</b>	Software for high-speed data collection, redundancy and automatic archiving of data
<b>AX Portal</b>	Software to display and analyse MC Works 64 / AX Energy / AX Facility / AX Quality screens on web browser
<b>MC Mobile</b>	Software to allow access to operational information from anywhere and at any time with mobile devices such as tablets
<b>MC Graph</b>	Software specialised for the MC Works 64 HM screen creation and display application



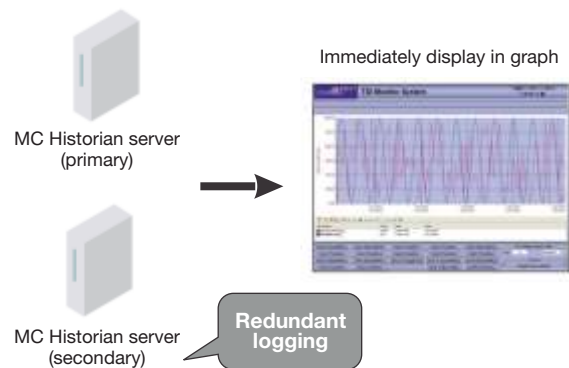
## Use with options to increase usage possibilities

### Effective logging to increase data reliability

#### MC Historian

This high performance and high reliability data logger can collect 100,000 points per second\* and is capable of logging the operation results using formulas. The high compression logging function enables long-term logging. A highly reliable system can be constructed during a redundant server and distributed processing.

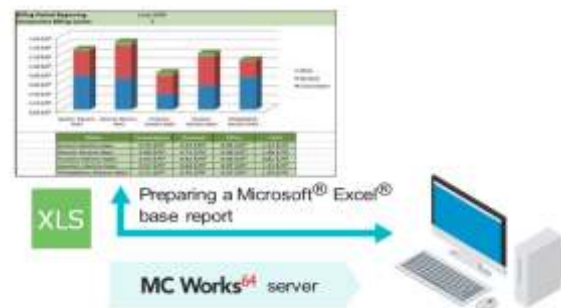
\* Depends on system configuration.



### Simplify report preparation

#### ReportWorX Lite

A variety of reports, including daily, weekly, monthly, and yearly reports can be created from the database. Reports are created with Microsoft®Excel® and can be saved with HTML or PDF formats. Templates for several report formats can also be registered.



### Smart monitoring from mobile application

#### MC Mobile

MC Mobile software monitors important applications for buildings and factories. Important data can be accessed and monitored from a variety of mobile terminals when needed. Microsoft®(Windows Phone® Surface®, Apple® (iPhone® iPad®, Android®(Phone, Tablet) and HTML5 compatible mobile terminals are supported



### Efficiently conserve energy

#### AX Energy

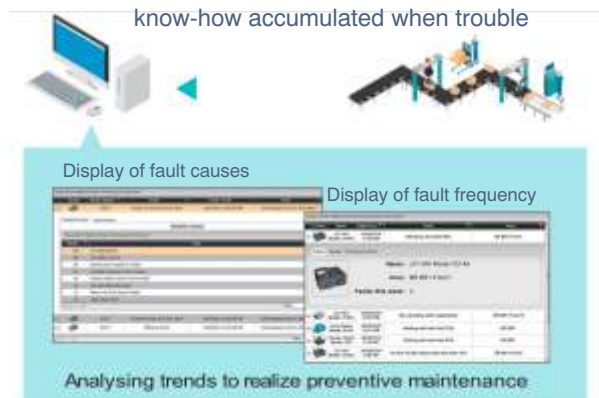
With AX Energy, you can visualize and analyse the building and equipment energy consumption rates (electricity, gas, etc.) and the CO2 emissions, and can reduce costs by suppressing needless energy consumption. Daily and monthly energy consumption rates can be displayed in graphs.



## Preventive maintenance and fault analysis

### AX Facility

Your accumulated troubleshooting know-how can be set and used to support early recovery from trouble. The causes of equipment faults and the frequency of occurrence are analysed to identify trends and realize preventive maintenance.



## Statistical process control (SQC/SPC)

### AX Quality

AX Quality creates management charts for the analysis of quality control and process capacity, reducing the labour of onsite operators and managers. In addition to analysing SQC/APC data, AX Quality provides SQC charts and reports.

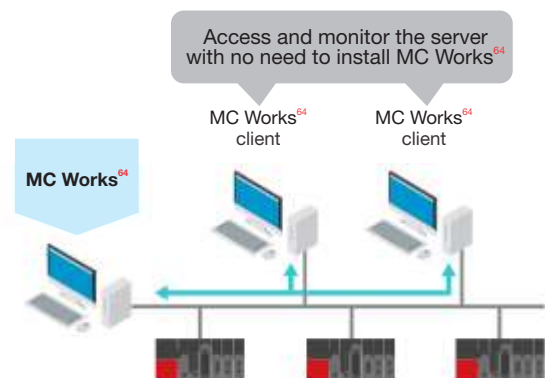


Variation in production line data is displayed. If the variation is high, an alarm is issued to notify the operator that the quality may be affected.

## Simultaneous monitoring with two or more personal computers

### Web-HMI

Web-HMI uses your MC Works64 server as a web server. This allows operators to access and monitor important data in the web server from a random web client on the web. Most of the MC Works64 functions can be used without installing MC Works64 in the client.



## Performing detailed monitoring with graphical screens

**Issue 1:** How can I visually understand the state of equipment without visiting the worksite?

**Issue 2:** How can I change the screen display according to the viewer?

**Issue 3:** How can I easily create a professional and easy to read monitoring screen?



### **Solution 1** Reproduce the system with 3D monitoring screens

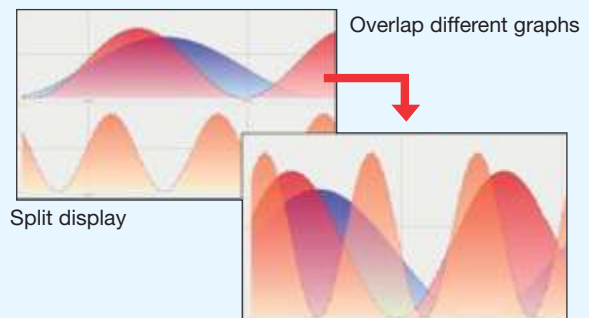
3D graphics allow you to visually and easily monitor the equipment and line without going to the worksite. 3D graphics can be created easily just by importing the CAD



Image of imported CAD data

### **Solution 2** Set the best display method for each operator

With the graph displays, each operator can set whether to display multiple graphs independently, to partially overlap the graphs, or to overlap the entire graph. When the settings are registered, the same display method can be used when starting up the next time. Display methods customized for each operator will improve the monitoring and analysis work efficiency.



### **Solution 3** Create professional, easy to view screens

A library with more than 3000 types of parts is available. The parts library includes animations that can be used to create an animated screen that shows changes in devices just by assigning the actual device data.



## Increasing operation rate

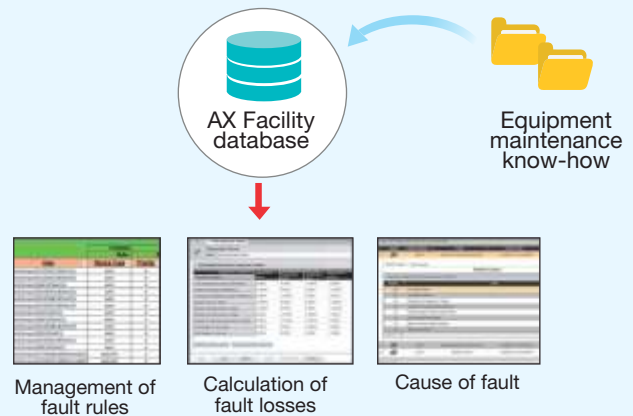
### Have you ever faced the following issues?

- Issue 1:** How can I reduce down-time?
- Issue 2:** How can I prevent equipment fault before it occurs?
- Issue 3:** How can I confirm required information when I need it?



### Solution 1 Use equipment maintenance know-how to reduce down time

When the maintenance know-how for your equipment is registered in the database, the AX facility will analyse and present the causes when an alarm or trouble occurs. Early discovery of causes and application of counter measures will contribute to a shorter down-time.



### Solution 2 Analyze alarms to prevent problems that can cause equipment stoppage and improve operation rates

In addition to the list format, the number of alarms can be displayed in bar graphs by sorting them by importance of alarms, by equipment, etc. Equipment with a high rate of alarms can be identified quickly and actions can be taken to prevent problems that could cause equipment stoppage.



### Solution 3 Easily monitor information on important alarms etc.

Create instant monitoring screens by pasting display parts into the screen and assigning information (tags) to be confirmed. In addition to using personal computers by downloading the KPIWorX mobile app on a smartphone etc. required data can be easily checked without going to the worksite.





## Collectively monitoring multiple Buildings

Have you ever faced the following

**Issue 1 :** How can I collectively confirm the state of multiple buildings?

**Issue 2 :** How can I provide effective security for monitoring when using the cloud?

**Issue 3 :** How can I connect multiple systems without bothersome work?



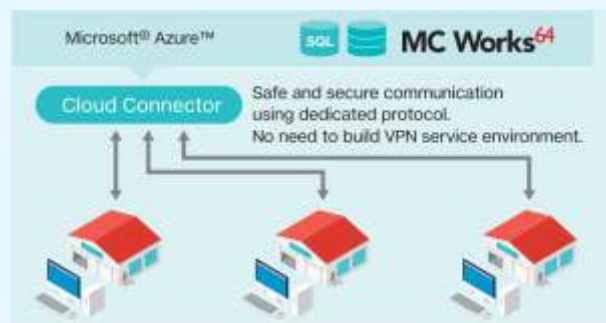
### **Solution 1** Easily realize visual monitoring using maps

What is happening at each factory can be checked quickly through linkage with general mapping tools such as Google Maps and Microsoft Bing Maps.



### **Solution 2** MC Works64 in the cloud allows all data to be monitored securely

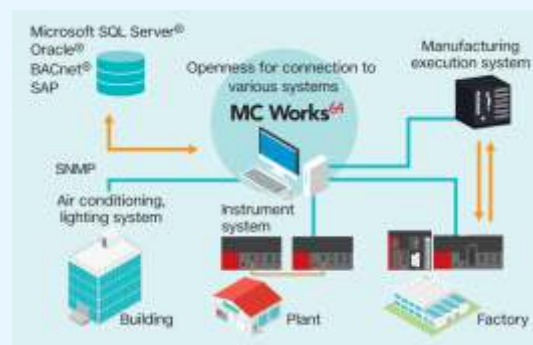
Through linkage with the Microsoft Azure cloud, data is communicated over a dedicated connection tool (Cloud Connector). This eliminates the need to create a VPN service environment and builds a secure system. The customer's important data is protected even during



MC Works<sup>64</sup> MC Works<sup>64</sup> MC Works<sup>64</sup>

### **Solution 3** Use open connectability to easily connect to different types of devices

A variety of connection types, including OPC UA, OPC classic (DA, HDA, A/E) BACnet and Data Base, are supported so that devices can be easily connected to existing systems and monitoring of several factories can be started right away.



## PERFECT VISION - Human Machine Interface (HMI)

The GOT2000 boasts advanced functionality, acts as a seamless gateway to other automation devices, all while increasing productivity and efficiency.

All GOT2000 HMIs provide Ethernet, RS232 and RS422/485 communications. SD card and front and rear USB ports deliver increased flexibility. Options include a wireless LAN interface for communication with PCs and tablets, enabling users to download/upload screen data and use the FA Transparent function.

### Innovative handling

Mitsubishi Electric sets high standards with its technologies in human machine communication. Multi-Touch/Gesture Control, as nowadays known from tablets, simplify handling and maintenance significantly.



### Remote control

High performance, market leading, operator terminals are the result of intelligent yet carefully planned design. Therefore, the data access is possible e.g. via the front panel USB interface or via VNC Remote Access.



### Database communication

Direct connection to an Oracle-, SQL- or Access-database through the MES functionality gives users greater access to operational data from across their entire plant – down to the shop floor.



### Data logging

Data of controllers or devices for temperature registration can be stored with the data logging function. These data can be displayed as a diagram or a list. Data can also be exported to a computer for further analysis.



### Multimedia function

With the multimedia function it is for example possible to connect a camera for observing the production line. In case of a fault 2 minutes before and after the event can be analysed to eliminate the cause and prevent re-occurrence.



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