



# 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.

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# 800/700 Series INVERTER



## 800/700 Series

### Superior driving performance backed by the highest quality!

#### Main features of the 800/700 series

##### Environmentally friendly

- The EMC filter reduces electromagnetic noise generated by the inverter. (Embedded in the FR-A800 and F800 series inverters.)
- AC and DC reactors can be connected to suppress the harmonic current to the power supply and to improve the power factor.
- The inverters are compliant with the restriction of hazardous substances (RoHS) directive of EU and friendly to people and to the environment.

##### Drive performance

- The inverters provide powerful and consistent driving.
- The inverters can drive more highly efficient IPM motors (magnet motors) as well as induction motors. The inverters provide the solution to your further energy saving needs. (FR-A800, F800, and F700PJ series) The highly accurate PM sensorless vector control of the FR-A800 series achieves productivity improvement and energy saving at the same time.

##### Long-life and easy maintenance

- Long-life cooling fan\*<sup>1</sup> and long-life capacitor\*<sup>1\*2</sup> are incorporated (design life: 10 years)
  - \*<sup>1</sup>: Surrounding air temperature: 40°C on yearly average (free from corrosive gas, flammable gas, oil mist, dust and dirt).  
The design life is a calculated value and is not a guaranteed product life.
  - \*<sup>2</sup>: Output current: 80% of the inverter rated current.
- Degradation degrees of the main circuit capacitor, control circuit capacitor, and inrush current limit resistor can be monitored. The inverter self diagnoses the degradation degree and outputs a warning, allowing trouble to be prevented.
- Upgrading to the succeeding models is easy with the adoption of a removable control circuit terminal block. (FR-A800, F800, and E700 series)
- Cooling fan replacement is performed in simple steps. Maintenance of the inverter is easy.

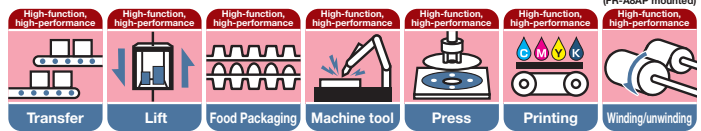
##### Easy-to-use

- An operation panel is mounted as standard on all models.
- The Mitsubishi's setting dial is used.
- Use FR Configurator or FR Configurator2 to facilitate operations from start-up to maintenance.



Advanced functionality and high-performance inverter

## FR-A800 Series



### Features

#### Leading drive performance

- The enhanced Real sensorless vector control and vector control achieves improved speed response and high-speed operation.
- The PM motor auto tuning function enables operation of other manufacturers' permanent magnet (PM) motors.

#### Security & safety

- Controls with safety functions can be easily performed. (Safety stop function)
- 24 VDC control power input is equipped as standard. The parameter setting and communication operation can be done without turning ON the main power.
- The operating status immediately before the protective function is activated can be stored with the trace function, facilitating the trouble analysis at a separate location by using a USB memory device and the inverter setup software (FR Configurator2).

#### Easy setup & easy to use

- A USB host connector (A type) is equipped. Parameters can be copied to commercial USB memory devices.
- Highly reliable and easily wired spring clamp terminals have been adopted for control circuit terminals.
- Parameter setting mode can be changed to the group parameter mode, which provides intuitive and simple parameter settings. (The conventional parameter setting mode is selected by default.)

#### Eco-friendly factories

- With Optimum excitation control, the excitation current is constantly adjusted to drive the motor in the most efficient method which leads to energy saving.
- The 315K or higher models are inverter-converter separated types, which are suitable for power regeneration. Select the FR-CC2 converter unit according to the connected motor capacity (refer to page 14).



#### System support

- Rated current and four different overload capacity ratings (SLD rating, LD rating, ND rating, and HD rating) can be selected with parameters. (Multiple rating)
- Parameters and setting frequency can be changed at the program, and the inverter control based on the machine specifications is possible by the PLC function.

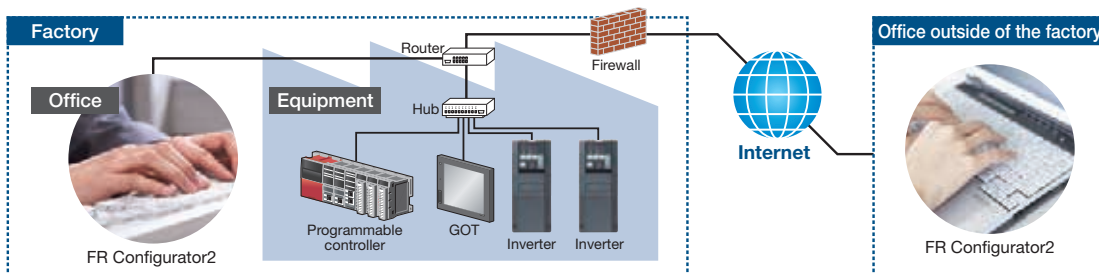
#### Environmental adaptability

- A built-in noise filter (EMC filter), the newly developed drive technology, and the power supply technology minimize the EMI emitted from inverters.
- For the 400 V class, compliance with various countries ship classifications allows use on ship equipment.  
(For details of the certified models, refer to Mitsubishi Electric FA Global Website ([www.MitsubishiElectric.co.jp/fa](http://www.MitsubishiElectric.co.jp/fa)).

### Supporting Ethernet communication Integrated communication function

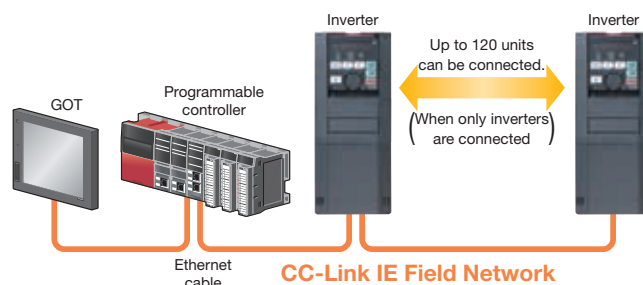
#### FR-A800-E CC-Link IE Field Basic

The CC-Link IE Field Network Basic enables easy development of network communication using the general-purpose Ethernet-based technology. The integrated Ethernet communication function enables monitoring of the inverter's status or setting of parameters via Internet.



#### FR-A800-GF CC-Link IE Field

The FR-A800-GF inverter, supporting CC-Link IE Field Network communication, is available. The CC-Link IE Field Network communication is ready for immediate operation.



## ■ Direct installation near the machine IP55 compatible

### ● FR-A846

As the FR-A846 (IP55 compatible model) inverter offers waterproof and dustproof performance with a highly protective structure, it can be installed near the machine.

- Compatibility with hostile environments such as high humidity and dusty environments widens the range of locations for installation.
- With a DC reactor inside the inverter, less wiring and smaller space are required.



**IP 55**

• **First digit** (protection rating against solid objects)

IP rating	Description
Class 5	Protection against dust. No ingress of dust that may inhibit normal operation.

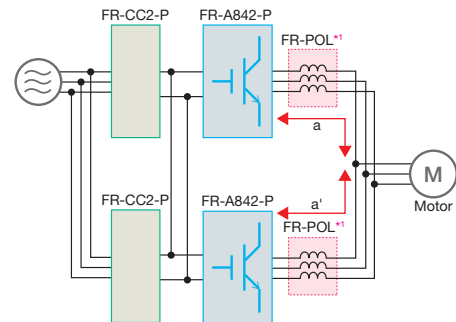
• **Second digit** (protection rating against water)

IP rating	Description
Class 5	Protection against water jets from all directions.

## ■ Enlarged range of applicable motor capacity Parallel operation

### ● FR-A842-P, FR-CC2-P

Motors up to 1350 kW can be driven by operating the inverters (FR-A842-P) and converter units (FR-CC2-P) in parallel, enhancing the application to larger scale systems. Parallel operation of up to three inverters and three converter units is possible without increasing the size of the inverter or converter unit, facilitating installation into the enclosure.



\*1: When the cable length from an inverter to each node point (a or a') is less than 10 m, install the FR-POL.

## Model

FR - A 8 2 0 - 0.4K - 1 - [ ] - [ ]

Symbol	Voltage class	Symbol	Structure, functionality	Symbol <sup>90</sup>	Description	Symbol	Type	Communication type	Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor	Symbol	Function
2	200 V class	0	Standard model <sup>*3</sup>	0.4K to 500K	Inverter ND rated capacity (kW)	1	FM	RS-485	None <sup>*5</sup>	Without	Without	None	Standard type
4	400 V class	2	Separated converter type <sup>*4</sup>	00023 to 12120	Inverter SLD rated current (A)	2	CA <sup>*2</sup>	RS-485	60	With	Without	GF	With built-in CC-Link IE Field Network function
		6	IP55 compatible model			E1	FM	Ethernet	06 <sup>*5</sup>	With	With	P	Parallel operation
						E2	CA <sup>*2</sup>	Ethernet					

Inverter model	Inverter capacity
FR-A820(-E)(-GF)	0.4 kW to 90 kW
FR-A840(-E)(-GF)	0.4 kW to 280 kW
FR-A842(-E)(-GF)	315 kW to 500 kW
FR-A842-P	400 kW to 500 kW
FR-A846(-E)	0.4 kW to 132 kW

\*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 mA DC), not as terminal FM (pulse train output).

\*3: For the 75K or higher inverter and a 75 kW or higher motor, 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-P). (Not required when a high power factor converter (FR-HC2) is used)  
 \*5: Available for the 5.5K or higher.  
 \*6: Applicable to the standard structure model or the separated converter type.

## Specifications (standard type)

Control method	Soft-PWM control, high carrier frequency PWM control (selectable among V/F control, Advanced magnetic flux vector control, Real sensorless vector control), Optimum excitation control, vector control <sup>*1</sup> , and PM sensorless vector control
Starting torque	SLD rating: 120% 0.3 Hz, LD rating: 150% 0.3 Hz, ND rating: 200% <sup>*2</sup> 0.3 Hz, HD rating: 250% <sup>*2</sup> 0.3 Hz (with Real sensorless vector control or vector control <sup>*1</sup> )
Output frequency range	0.2 to 590 Hz (Up to 400 Hz with Advanced magnetic flux vector control, Real sensorless vector control, vector control <sup>*1</sup> or PM sensorless vector control)
Regenerative braking torque <sup>*3</sup> (ND rating)	200 V class <sup>*4</sup> : 0.4K to 1.5K..... 150%3%ED 11K to 55K..... 20% continuous 400 V class <sup>*5</sup> : 0.4K to 7.5K..... 100%2%ED 2.2K/3.7K..... 100%3%ED 75K or higher..... 10% continuous 11K to 55K..... 20% continuous 75K or higher..... 10% continuous
Acceleration/deceleration time setting	0 to 3600 s (up to three types of accelerations and decelerations can be set individually.)
Multi-speed	15 speeds
Speed command	0 to 5 VDC, 0 to 10 VDC, 0 to ±5 VDC, 0 to ±10 VDC, 4 to 20 mA, digitally set with pulse train input, operation panel or parameter unit, 4-digit BCD or 16-bit binary (when using optional FR-A8AX)
Alarm output	1 changeover contact (230 VAC, 0.3 A, 30 VDC, 0.3 A), open collector output, alarm code (4-bit) output
Output signal	Five types of open collector outputs and two types of contact output (1 changeover contact) can be selected from inverter running, up to frequency, frequency detection, operation ready, overload warning, error output and alarm, etc.
Monitor function	One type can be selected from output frequency, motor current (steady or peak value), output voltage, operation speed, motor torque, converter output voltage, regenerative brake duty, input power, output power and load meter, etc. Pulse train output (1440 pulses/s, 2 mA) and analog output (-10 to 10 VDC)
Restart after instantaneous power failure	Available (reduced voltage method <sup>1</sup> (frequency search selectable))
Removable terminal block	Used for control circuit terminals
Communication function	Communication supported as standard: RS-485 (Mitsubishi inverter protocol, MODBUS <sup>®</sup> RTU <sup>®</sup> ) or Ethernet <sup>*6</sup> . Communication supported when the compatible option is used: CC-Link, CC-Link IE Field Network, PROFIBUS-DP, DeviceNet <sup>™</sup> , SSCNET III(H), or FL remote communication.

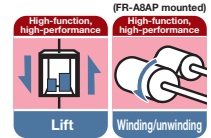
\*1: Vector control is available when a Vector control compatible option is installed.  
 \*2: In the initial setting for the FR-A820-00340(5.5K) or higher and the FR-A840-00170(5.5K) or higher, the starting torque is limited to 150% by the torque limit level.

\*3: The regenerative braking torque indicates the average short-time torque (which varies by the motor loss) that is generated when a motor decelerates in the shortest time by itself from the rated speed. When a motor decelerates from a speed higher than the rated speed, the average deceleration torque decreases. When the regenerative power is large, use an option brake unit.

\*4: The following performance can be attained when FR-ABR (option) is connected: 150% torque and 10%ED for 0.4K and 0.75K, 100% torque and 10%ED for 1.5K to 7.5K, 100% torque and 6%ED for 11K to 22K.  
 \*5: The following performance can be attained when FR-ABR-H (option) is connected: 100% torque and 10%ED for 0.4K and 0.75K, 100% torque and 6%ED for 11K to 22K.  
 \*6: Availability depends on the communication type of the inverter specifications.

Dedicated inverter for specialized field

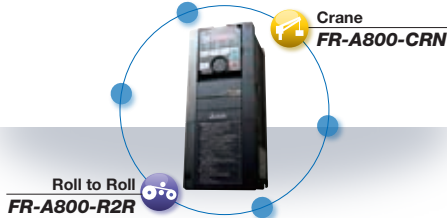
## FR-A800 Plus Series



### Features

#### Pursuing optimum functions to meet our customers' needs

A lineup of dedicated inverters for specialized fields are offered. Plus! The optimum functions for each dedicated field are added to the already high performance and high functionality FR-A800 series inverter.

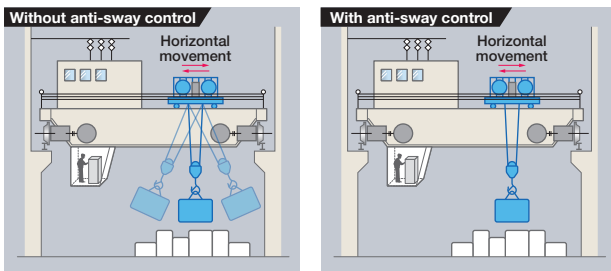


#### Optimum functions for cranes FR-A800-CRN



##### Reduction in tact time

By using the Mitsubishi's original anti-sway control technology, the swinging of an object moved by a crane is suppressed at the time of stopping, even without operator's input adjustment. This control cuts down the tact time and facilitates efficient operation.



##### Load slippage prevention

- The highly scalable brake sequence function enables the output of a brake opening signal for the optimum brake operation calculated from the load torque or the speed.
- Slippage during the start of a lift can be checked. (A speed detector such as an encoder is required.)

##### Dedicated monitoring functions

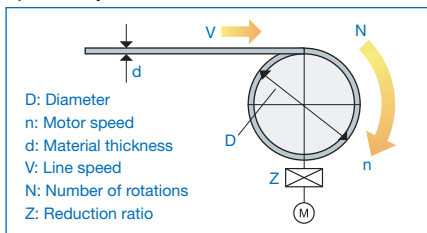
- A signal can be output when too much load is applied.
- The inverter starting times can be counted to determine the timing of the maintenance.

#### Optimum functions for roll to roll applications FR-A800-R2R



##### System simplification

The FR-A800-R2R inverter has various dedicated functions such as winding diameter calculation, providing stable winding/unwinding control independently.



##### Easy startup and adjustment

Mechanical adjustment according to applications can be achieved just by setting parameters, which enables the startup and adjustment work of the system by the inverter alone.

##### Wide range of applications

The inverter offers four types of control functions which enables the use in various system applications such as winding/unwinding in the wire drawing machines and printers.

- Dancer feedback speed control
- Tension sensor feedback speed control
- Tension sensorless torque control
- Tension sensor feedback torque control

### Model

FR - A 8 2 0 - 0.4K - 1 - R2R

Symbol	Voltage class	Symbol	Structure, functionality	Symbol	Description	Symbol	Type	Symbol	Circuit board coating (IEC60721-3-3/C2/S2 compatible)	Plated conductor	Enhanced vibration resistance	Symbol	Dedicated function
2	200 V class	0	Standard model <sup>*3</sup>	0.4K to 500K	Inverter ND rated capacity (kW)	1	FM	None <sup>*4</sup>	Without	Without	Without	R2R	Roll to roll dedicated model
4	400 V class	2	Separated converter type	00023 to 12120	Inverter SLD rated current (A)	2	CA <sup>*1</sup>	60	With	Without	Without	CRN	Crane dedicated model
								06 <sup>*2</sup>	With	With	Without		
								61 <sup>*5</sup>	With	Without	With		
								16 <sup>*2+5</sup>	With	With	With		

Inverter model	Inverter capacity
FR-A820	0.4kW to 90kW
FR-A840	0.4kW to 280kW
FR-A842	315kW to 500kW

<sup>\*1</sup>: For the CA type, the monitor output terminal FM/CA operates as terminal CA (analog current output 0 to 20 mA/DC), not as terminal FM (pulse train output).

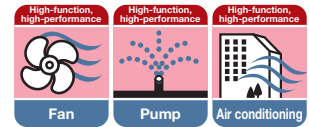
<sup>\*2</sup>: Available for the 5.5K or higher.

<sup>\*3</sup>: For the 75K or higher inverter and a 75 kW or higher motor, always connect a DC reactor (FR-HEL), which is available as an option.

<sup>\*4</sup>: Applicable to the roll to roll dedicated model.

<sup>\*5</sup>: Applicable to the crane dedicated model.





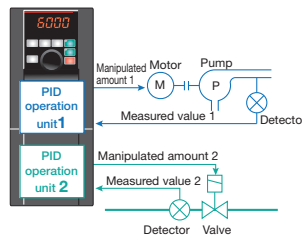
## Features

### Energy saving

- Advanced optimum excitation control, which has been newly developed, provides a large starting torque while maintaining the motor efficiency under the conventional Optimum excitation control.
- The tuning function enables operation of other manufacturers' induction motors and PM motors, which increases the use in the energy saving applications.

### Functions ideal for fans and pumps

- 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 (multiple rating).
- The inverter can perform PID control of the motor operation and control the external equipment at the same time (PID multiple loops). The system cost can be reduced.
- By controlling the pumps connected in parallel (up to four pumps) by the PID control, water volume, etc. can be adjusted by one inverter (multi-pump function).
- The integrated Ethernet communication function of the FR-F800-E inverter enables monitoring of the inverter's status or setting of parameters via Internet.



### Security & safety

- The inverter is equipped with a temperature sensor, which outputs a signal when the internal temperature is high.

### Compatibility with the environment

- A built-in noise filter (EMC filter) minimizes the EMI emitted from inverters.
- By installing a DC reactor (FR-HEL), which is available as an option, they can conform to the Architectural Standard Specifications (2013 revision) supervised by the Ministry of Land, Infrastructure, Transport and Tourism of Japan.

## Model

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

Symbol	Voltage class	Symbol	Structure, functionality	Symbol	Description	Symbol	Type	Communication type	Symbol	Circuit board coating (IEC60721-3-3 3C2/3S2 compatible)	Plated conductor
2	200 V class	0	Standard model*2	0.75K	Inverter LD rated capacity (kW)	1	FM	RS-485	None	Without	Without
4	400 V class	2	Separated converter type*3	00023	Inverter SLD rated current (A)	2	CA*1		60	With	Without
						E1	FM	Ethernet	06*4	With	With
						E2	CA*1				

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

- \*1: For the CA-type, the monitor output terminal FM/CA operates as terminal CA (analog current output 0 to 20 mA DC), not as terminal FM (pulse train output).
- \*2: 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.
- \*3: Always install the converter unit (FR-CC2). (Not required when a high power factor converter (FR-HC2) is used)
- \*4: Available for the 7.5K or higher.

## Specifications

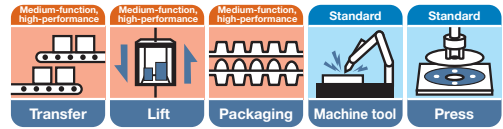
Control method	Soft-PWM control, high carrier frequency PWM control (selectable among V/F control (Optimum excitation control), Advanced magnetic flux vector control (Advanced optimum excitation control), and PM motor control)	
Starting torque	Induction motor	120% 0.5 Hz (Advanced magnetic flux vector control)
	IPM motor	50%
Output frequency range	0.2 to 590 Hz (Up to 400 Hz with Advanced magnetic flux vector control, and PM motor control.)	
Regenerative braking torque (Maximum value/permissible duty)	Induction motor	0.75K to 55K...15% continuous, 75K or higher...10% continuous
	IPM motor	Approximately 5% (1.5K or lower...Approximately 10%)*1
Acceleration/deceleration time setting	0 to 3600 s (up to three types of accelerations and decelerations can be set individually.)	
Multi-speed	15 speeds	
Speed command	0 to 5 VDC, 0 to 10 VDC, 0 to ±5 VDC, 0 to ±10 VDC, 4 to 20 mA, pulse train input digitally set with operation panel or parameter unit, 4-digit BCD or 16-bit binary (when using optional FR-A8AX)	
Alarm output	1 changeover contact (230 VAC, 0.3 A, 30 VDC, 0.3 A), open collector output, alarm code (4-bit) output	
Output signal	Five types of open collector outputs and two types of contact outputs (1 changeover contact) can be selected from inverter running, up to frequency, frequency detection, operation ready, overload warning, error output and alarm, etc.	
Monitor function	One monitored item can be selected from output frequency, motor current (steady or peak value), output voltage, operation speed, converter output voltage, input power, output power and load meter, etc. Pulse train output (1440 pulses/s, 2 mA) and analog output (0 to 10 VDC)	
Restart after instantaneous power failure	Available (reduced voltage method (frequency search selectable))	
Removable terminal block	Used for control circuit terminals	
Communication function	Communication supported as standard: RS-485 (Mitsubishi inverter protocol, MODBUS®RTU*, BACnet®MS/TP) or Ethernet*. Communication supported when the compatible option is used: CC-Link, CC-Link IE Field Network, PROFIBUS-DP, DeviceNet™, LonWorks®, or FL remote communication.	

\*1: Regenerative braking torque is the average short-time torque when a motor decelerates to a stop from the rated speed in the shortest time. (It varies with the motor loss.) It is not a continuous regenerative torque. The average deceleration torque decreases when a motor decelerates from a speed higher than the rated speed. When the regenerative power is large, use a braking option.

\*2: Availability depends on the communication type of the inverter specifications.

Simple, powerful, and compact inverter

## FR-E700 Series



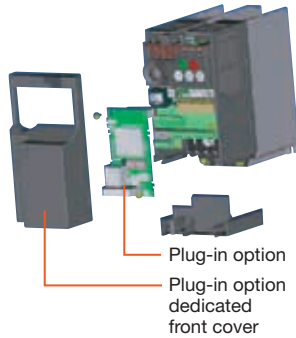
### Features

#### Pursuing the best performance—top level of driving performance in a compact body

- Advanced magnetic flux vector control enables accurate start-ups for general-purpose industrial machines. (200% 0.5 Hz (3.7K or lower))
- Improved short-time permissible overload (200% for 3s) provides powerful and consistent driving.
- Torque limit and current limit functions are available.

#### Easy-to-use (Outstanding operability and diverse expandability)

- Plug-in options are available to add digital inputs/analog outputs and to support different communication networks.
- For the customers who need more than the standard terminals, the option terminal blocks, such as the 2-port RS-485 terminal block, are available.
- The inverters with 0.4K or higher capacity have plug-in regenerative brake transistors, which enable use for lift applications.
- An enclosure surface operation panel can be attached on an enclosure surface and is available as an option.



#### Compact and space-saving

- The mounting dimensions are the same as the conventional FR-E500 model to keep backwards compatibility.
- Space can be saved with the side-by-side installation.



#### Improved reliability and easy maintenance

- Spring clamp terminals provide high reliability and easy wiring. (FR-E700-SC/NF/NC)
- Shutoff circuit (hardware) securely provides emergency output shutoffs. The inverter with the safety stop function can comply with the safety standards without incurring too much cost. (FR-E700-SC/NF/NC)
- Using the self-diagnosis function, the part life warning can be output and the degree of deterioration can be monitored to prevent malfunction.
- The removable control circuit terminal block simplifies replacement work.

#### Environmentally friendly

- Filter options reduce the electromagnetic noise generated at the inverter and enables compliance with the harmonic suppression guidelines of Japan.

### Model

FR - E 7 **2** 0 **3.7K**

Symbol	Voltage class
2	200 V class
4	400 V class
1	100 V class

Symbol	Number of phases
None	Three-phase input
S	Single-phase input
W	Single-phase input (double-voltage output)

Symbol	Applicable motor capacity
0.1K to 15K	Represents the capacity (kW)

Symbol	Control circuit terminal specification
None	Standard control circuit terminal (screw type)
SC	Safety stop function model
NF	FL remote communication model
NC	CC-Link communication model

Inverter model	Inverter capacity
FR-E720(SC)(NF)(NC)	0.1 kW to 15 kW
FR-E740(SC)(NF)(NC)	0.4 kW to 15 kW
FR-E720S(SC)*	0.1 kW to 2.2 kW
FR-E710W*	0.1 kW to 0.75 kW

### Specifications

Control method	Soft-PWM control, high carrier frequency PWM control (V/F control, General-purpose magnetic flux vector control, Advanced magnetic flux vector control or Optimum excitation control can be selected)
Starting torque	200%0.5 Hz (3.7K or lower) 150% 0.5 Hz (5.5K or higher) with Advanced magnetic flux vector control
Output frequency range	0.2 to 400 Hz
Regenerative braking torque*1	0.1K/0.2K.....150%, 0.4K/0.75K.....100%, 1.5K.....50%, 2.2K or higher.....20%
Acceleration/deceleration time setting	0 to 3600 s (up to two types of accelerations and decelerations can be set individually.)
Multi-speed	15 speeds
Speed command*2	0 to 5 VDC, 0 to 10 VDC, 4 to 20 mA, digital setting with setting dial, digital setting with operation panel or parameter unit
Safety stop*3	Output shutoff S1 and S2
Alarm output*4	1 changeover contact (230 VAC 0.3 A, 30 VDC 0.3 A), open collector output
Output signal*4	Two types of open collector outputs and one type of contact output (1 changeover contact) can be selected from inverter running, up to frequency, frequency detection, output current detection, operation ready, overload warning, fault output, and alarm, etc.
Monitor function	One monitored item can be selected from output frequency, motor current (steady or peak value), output voltage, frequency setting value, motor torque, converter output voltage, regenerative brake duty, and output power, etc. Pulse train output (1440 pulse/s, 1 mA)*5, analog output 0 to 10 VDC (when using optional analog terminal block), pulse output (when using optional pulse train terminal block)
Restart after instantaneous power failure	Available (reduced voltage method (frequency search selectable))
Removable terminal block	Used for control circuit terminals
Communication function	RS-485 supported (Mitsubishi inverter protocol and MODBUS®RTU) as standard. CC-Link, PROFIBUS-DP, DeviceNet™, LonWorks® options available. The FL remote communication model and the CC-Link communication model are available.

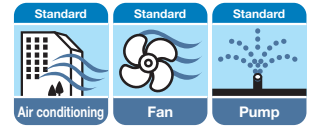
\*1: Braking torque is the average short-time torque when a motor decelerates to a stop from 60 Hz in the shortest time. (It varies with the motor loss.) It is not a continuous regenerative torque. The average deceleration torque becomes lower when a motor decelerates from a frequency higher than the base frequency. The inverter is not equipped with a built-in brake resistor. Use an optional brake resistor for an operation with large regenerative power. (Not available for 0.1K and 0.2K.) Brake unit (FR-BU2) can be also used.

\*2: For the FL remote communication model, commands can be input from the operation panel or through FL remote communication. For the CC-Link communication model, commands can be input from the operation panel or through CC-Link communication.

\*3: Not available for the standard model.

\*4: The FL remote communication model and the CC-Link communication model have only one open collector output terminal. (For the FL remote communication model, the terminal is fixed to output the safety monitor output signal (not selectable).)

\*5: Not available for the FL remote communication model and the CC-Link communication model.



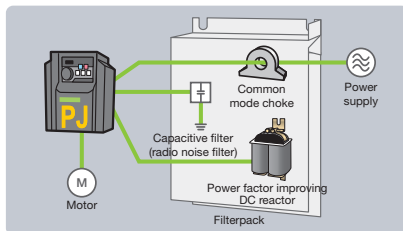
## Features

### ■ Suitable for both the general-purpose motor and the IPM motor

- This series can drive both a general-purpose motor and an IPM motor. Switching between the two motor controls is simple—just a single parameter setting. Initially, a general purpose motor could be used, then upgraded to an IPM motor without switching this inverter, leading to lower cost of equipment.

### ■ Environmentally friendly

- Power factor improving DC reactor, common mode choke (line noise filter), capacitive filter (radio noise filter) are all essential for air conditioning applications, and all of these are included in the Filterpack. The inverter with Filterpack (FR-F700PJ-□F) is also available.



The inverter with Filterpack

- Less wiring and smaller space is required when Filterpack is used. Filterpack also enables compliance with the harmonic suppression guideline, the Architectural Standard Specifications (electrical installation), and the architectural standard specifications (machinery installation) (2013 revisions) in Japan.

### ■ Easy-to-use

- The following functions provide the ideal operation for fans and pumps (PID control, Optimum excitation control, regeneration avoidance, and automatic restart after instantaneous power failure).

### ■ Improved reliability and easy maintenance

- Spring clamp terminals provide high reliability and easy wiring.

## Model

FR - F 7 **4** O P J - **3.7K** □

Symbol	Voltage class
2	200 V class
4	400 V class

Symbol	Inverter capacity
0.4K to 15K	Represents the capacity (kW)

Symbol	Filterpack
None	Without
F	With*

Inverter model	Inverter capacity
FR-F720PJ	0.4 kW to 15 kW
FR-F740PJ	0.4 kW to 15 kW

#### <Precautions>

- Never drive an IPM motor in the IM drive setting.
- Use the same IPM motor capacity as the inverter capacity.
- For IPM motor, use an MM-EFS or MM-EF series motor. Please contact us regarding a combination with other manufacturer's IPM motor.

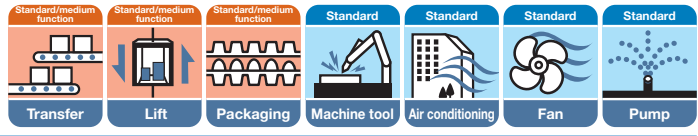
\*The inverter with Filterpack consists of an inverter and a Filterpack. The inverter carries the rating plate, "FR-F700PJ-□K," and the Filterpack carries the rating plate "FR-BFP2-□K."

## Specifications

Control method	Soft-PWM control, high carrier frequency PWM control (V/F control, General-purpose magnetic flux vector control, Optimum excitation control, and IPM motor control can be selected)	
Starting torque	General-purpose motor control	120% (at 1 Hz) with General-purpose magnetic flux vector control and slip compensation
	IPM motor control	50%
Output frequency range	0.2 to 400 Hz	
Regenerative braking torque	General-purpose motor control	15%*1
	IPM motor control	5% (10% for 1.5 kW or lower)*1
Acceleration/deceleration time setting	0.1 to 3600 s (up to two types of accelerations and decelerations can be set individually.)	
Multi-speed	15 speeds	
Speed command	0 to 5 VDC, 0 to 10 VDC, 4 to 20 mA, digital input with setting dial, digital setting with operation panel or parameter unit	
Alarm output	1 changeover contact (230 VAC 0.3 A, 30 VDC 0.3 A), open collector output	
Output signal	One type of open collector output and one type of contact output (1 changeover contact) can be selected from inverter running, up to frequency, frequency detection, output current detection, operation ready, overload warning, fault output, and alarm, etc.	
Monitor function	One monitored item can be selected from output frequency, motor current (steady or peak value), output voltage, frequency setting value, converter output voltage, regenerative brake duty, and output power, etc. Pulse train output (1440 pulses/s, 1 mA)	
Restart after instantaneous power failure	Available (reduced voltage method (frequency search selectable))	
Communication function	RS-485 supported (Mitsubishi inverter protocol and MODBUS®RTU) as standard	

\*1: Regenerative braking torque is the average short-time torque when a motor decelerates to a stop from the rated speed in the shortest time. (It varies with the motor loss.) It is not a continuous regenerative torque. The average deceleration torque becomes lower when a motor decelerates from a speed higher than the rated speed. When the regenerative power is large, use a braking option.

## Simple and compact inverter FR-D700 Series



### Features

#### Improved reliability and easy maintenance

- Spring clamp terminals provide high reliability and easy wiring.
- Shutoff circuit (hardware) securely provides emergency output shutoffs.  
The inverter with the safety stop function can comply with the safety standards without incurring too much cost.
- Parameter writing/reading can be restricted with a 4-digit password.



#### Pursuing the best performance

- The General-purpose magnetic flux vector control and the auto tuning function enable reliable operation in applications that require large starting torque. (150% 1 Hz, 200% 3 Hz (3.7K or lower with the slip compensation))



#### Easy-to-use (pursuing the easy operation)

- The non-slip, adaptable scroll speed setting dial allows for quick jumps or precise increments based on turning speed.
- An enclosure surface operation panel, which can be attached on an enclosure surface, is available as an option.
- The inverters with 0.4K or higher capacity have built-in regenerative brake transistors, and their usage can be extended to a lift application.

#### Environmentally friendly

- Filter options reduce the electromagnetic noise generated at the inverter and enables the compliance with the harmonic suppression guidelines of Japan.

### Model

FR - D 7 4 0 - 0.4K

Symbol	Voltage class
1	100 V class
2	200 V class
4	400 V class

Symbol	Number of phases
None	Three-phase input
S	Single-phase input
W	Single-phase input (double-voltage output)

Symbol	Applicable motor capacity
0.1K to 15K	Represents the capacity (kW)

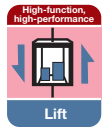
Inverter model	Inverter capacity
FR-D720	0.1 kW to 15 kW
FR-D740	0.4 kW to 15 kW
FR-D720S*	0.1 kW to 2.2 kW
FR-D710W*	0.1 kW to 0.75 kW

\*The output of the single-phase 200 V and single-phase 100 V input models is three-phase 200 V.

### Specifications

Control method	Soft-PWM control, high carrier frequency PWM control (V/F control, General-purpose magnetic flux vector control, Optimum excitation control can be selected)
Starting torque	150% 1 Hz, 200% 3 Hz (3.7K or lower) with General-purpose magnetic flux vector control and slip compensation
Output frequency range	0.2 to 400 Hz
Regenerative braking torque <sup>*1</sup>	0.1K/0.2K.....150%, 0.4K/0.75K.....100%, 1.5K.....50%, 2.2K or higher.....20%
Acceleration/deceleration time setting	0 to 3600 s (up to two types of accelerations and decelerations can be set individually.)
Multi-speed	15 speeds
Speed command	0 to 5 VDC, 0 to 10 VDC, 4 to 20 mA, digital input with setting dial, digital setting with operation panel or parameter unit
safety stop	Monitor output S0, output shutoff S1 and S2
Alarm output	1 changeover contact (230 VAC 0.3 A, 30 VDC 0.3 A), open collector output
Output signal	One type of open collector output and one type of contact output (1 changeover contact) can be selected from inverter running, up to frequency, frequency detection, output current detection, operation ready, overload warning, fault output, and alarm, etc.
Monitor function	One monitored item can be selected from output frequency, motor current (steady or peak value), output voltage, frequency setting value, converter output voltage, regenerative brake duty, and output power, etc. Pulse train output (1440 pulses/s, 1 mA)
Restart after instantaneous power failure	Available (reduced voltage method (frequency search method selectable))
Communication function	RS-485 (Mitsubishi inverter protocol and MODBUS <sup>®</sup> RTU) supported as standard

<sup>\*1</sup>: Braking torque is the average short-time torque when a motor decelerates to a stop from 60 Hz in the shortest time. (It varies with the motor loss.) It is not a continuous regenerative torque. The average deceleration torque becomes lower when a motor decelerates from a frequency higher than the base frequency. The inverter is not equipped with a built-in brake resistor. Use an option brake resistor for an operation with large regenerative power. Brake unit (FR-BU2) can be also used.



## Features

### Easy-to-use

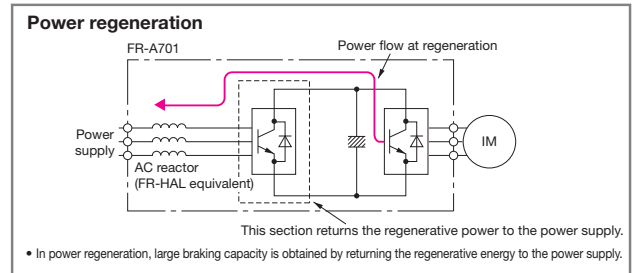
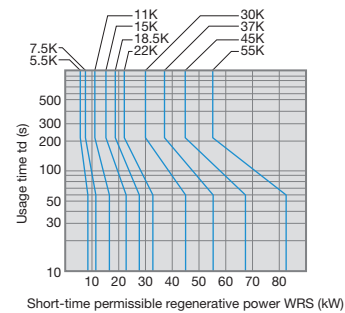
- The number of wires in the main circuit has been reduced to approx. 40% and the installation area has been reduced to approx. 60% (for 7.5K) compared to the conventional configuration with stand-alone common converters. Use this model to save the wiring and the space.
- For easy replacement, the installation size is the same as the conventional model (FR-A201).
- The braking circuit is built-in for this inverter, so the selection procedure for a braking option is no longer required.
- The total cost is reduced compared to the conventional system (inverter + power regenerative converter + AC reactor). Less heat is generated in this inverter because the regenerative power is returned to the power supply, leading to energy savings.

### Pursuing the best performance

- The power regeneration function enables excellent braking capacity (regenerative braking torque: 100% for continuous operation, 150% for 60 seconds).



FR-A701



## Model

FR - **A721** - **5.5K**

Symbol	Voltage class	Symbol	Applicable motor capacity
A721	200 V class	5.5K to 55K	Represents the capacity (kW).
A741	400 V class		

Applicable motor (kW)	5.5	7.5	11	15	18.5	22	30	37	45	55
Three-phase 200 V class FR-A721-□□	●	●	●	●	●	●	●	●	●	●
Three-phase 400 V class FR-A741-□□	●	●	●	●	●	●	●	●	●	●

● : Available

## Specifications

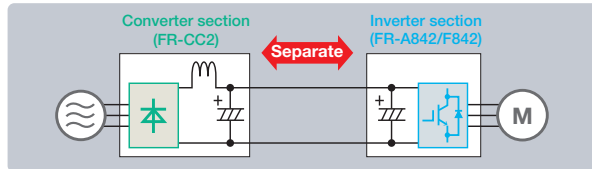
Control method	Soft-PWM control, high carrier frequency PWM control (V/F control, Advanced magnetic flux vector control or Real sensorless vector control can be selected) Vector control*1
Starting torque	150% 0.3 Hz with Real sensorless vector control or vector control*1
Output frequency range	0.2 to 400 Hz (Up to 120 Hz with Real sensorless vector control or vector control*1)
Regenerative braking torque	100% continuous 150% 60 s
Acceleration/deceleration time setting	0 to 3600 s (up to three types of accelerations and decelerations can be set individually.)
Multi-speed	15 speeds
Speed command	0 to 5 VDC, 0 to 10 VDC, 0 to ±5 VDC, 0 to ±10 VDC, 4 to 20 mA, digitally set with pulse train input, operation panel or parameter unit, 4-digit BCD or 16-bit binary (when using optional FR-A7AX)
Alarm output	1 changeover contact (230 VAC, 0.3 A, 30 VDC, 0.3 A), open collector output, alarm code (4-bit) output
Output signal	Five types of open collector outputs and two types of contact output (1 changeover contact) can be selected from inverter running, up to frequency, instantaneous power failure (undervoltage), frequency detection, operation ready, overload warning, error output and alarm, etc.
Monitor function	One type can be selected from output frequency, motor current, output voltage, operation speed, motor torque, converter output voltage (steady or peak value), input power, output power and load meter, etc. Pulse train output (1440 pulses/s, 2 mA) and analog output (0 to 10 VDC)
Restart after instantaneous power failure	Available (reduced voltage method (frequency search selectable))
Removable terminal block	Used for control circuit terminals
Communication function	Communication supported as standard: RS-485 (Mitsubishi inverter protocol, MODBUS®RTU). Communication supported when the compatible option is used: CC-Link, CC-Link IE Field Network, PROFIBUS-DP, DeviceNet™, LonWorks®, or SSCNET III communication.

\*1: Available when an option (FR-A7AP/FR-A7AL) is mounted.

## Converter unit FR-CC2 Series

### Features

- For the 800 series large-capacity inverters (FR-A800: 315K or higher, FR-F800: 355K or higher), converter section (FR-CC2) and the inverter section are separated. This can contribute to space and cost savings of large capacity systems (except when one converter unit is connected to one inverter).  
The converter unit can be run with 12-phase rectifier power supply.



### Model

- Select the capacity of the converter unit according to the motor capacity.
- The converter unit has a built-in DC reactor.

FR-CC2 - **H** 355K - **60** **P**

Model	315K	355K	400K	450K	500K	560K	630K
FR-CC2-H□	●	●	●	●	●	●	●
FR-CC2-H□-P	—	—	●	●	●	●	—

● : Available — : Not available

Symbol	Voltage class	Symbol	Description	Symbol	Circuit board coating (IEC60721-3-3:3C2/3S2 compatible)	Plated conductor	Symbol	Function
H	400 V class	315K to 630K	Applicable motor capacity (kW)	60	With	Without	None	Standard type
				06	With	With	P	Parallel operation

### Inverter for pressure-resistant explosion-proof type motor

## FR-B, B3 Series

\*As the inverter does not have an explosion proof structure, install it in a non-hazardous place.



- This inverter for pressure-resistant explosion-proof type motor, in combination with the Mitsubishi Electric pressure-resistant explosion-proof type motor, has passed the explosion-proof test by the Japanese Ministry of Health, Labour and Welfare.
- Always install the inverter away from the explosive environment.

Variable torque type		
Applicable motor output [kW]	200 V class	400 V class
0.2		
0.4		
0.75		
1.5	FR-B-1500	FR-B-1500
2.2	FR-B-2200	FR-B-2200
3.7	FR-B-3700	FR-B-3700
5.5	FR-B-5.5K	
7.5	FR-B-7.5K	FR-B-7.5K
11	FR-B-11K	
15	FR-B-15K	FR-B-15K
22	FR-B-22K	FR-B-22K
30	FR-B-30K	
37	FR-B-37K	FR-B-37K
45	FR-B-45K	
55	FR-B-55K	FR-B-55K
75	FR-B-75K	FR-B-75K
90	—	FR-B-90K
110	—	FR-B-110K

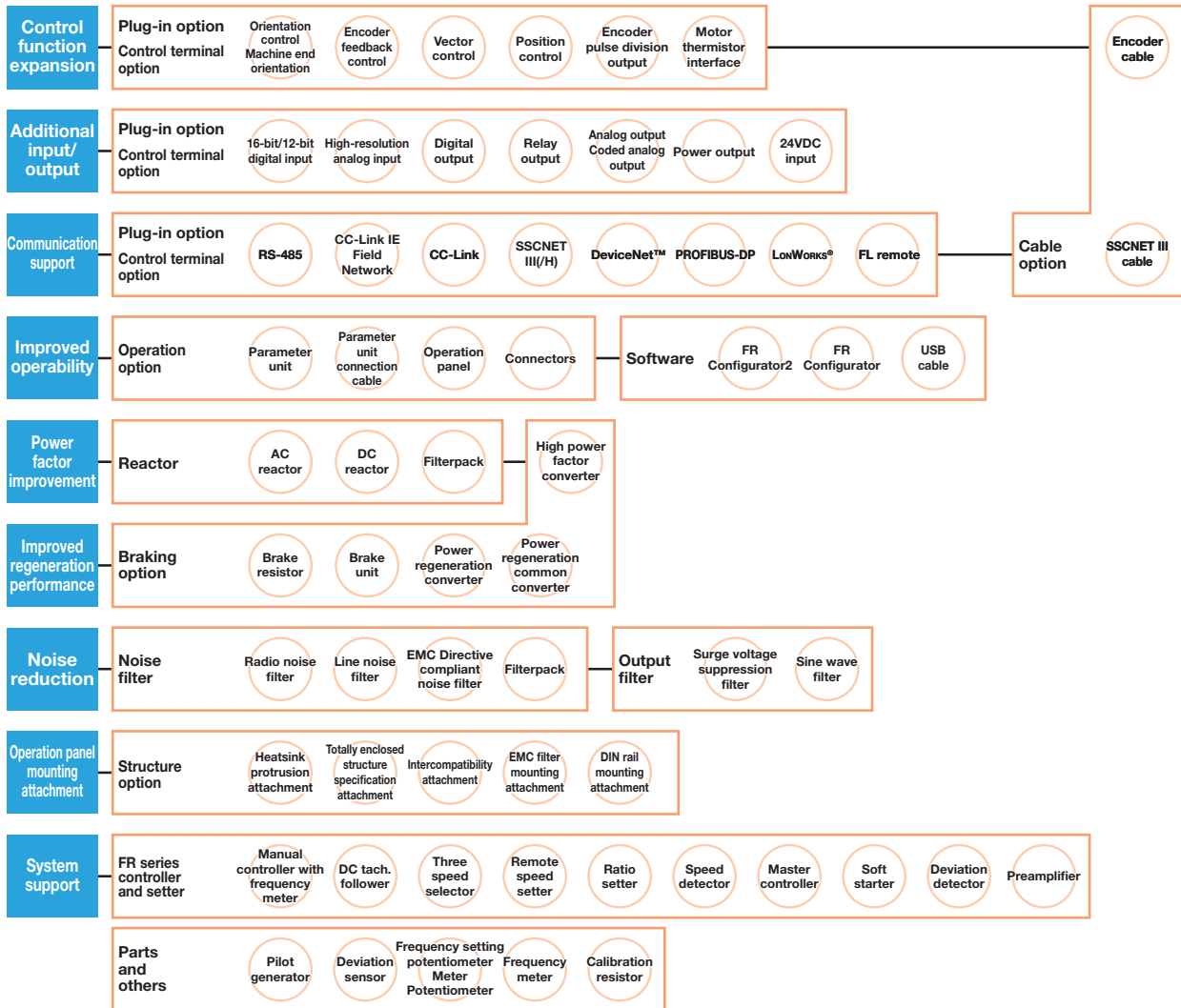
Constant torque type		
Applicable motor output [kW]	200 V class	400 V class
0.4	FR-B3-400	FR-B3-H400
0.75	FR-B3-750	FR-B3-H750
1.5	FR-B3-1500	FR-B3-H1500
2.2	FR-B3-2200	FR-B3-H2200
3.7	FR-B3-3700	FR-B3-H3700
5.5	FR-B3-5.5K	FR-B3-H5.5K
7.5	FR-B3-7.5K	FR-B3-H7.5K
11	FR-B3-11K	FR-B3-H11K
15	FR-B3-15K	FR-B3-H15K
18.5	FR-B3-18.5K	FR-B3-H18.5K
22	FR-B3-22K	FR-B3-H22K
30	FR-B3-30K	FR-B3-H30K
37	FR-B3-37K	FR-B3-H37K



# Option Series

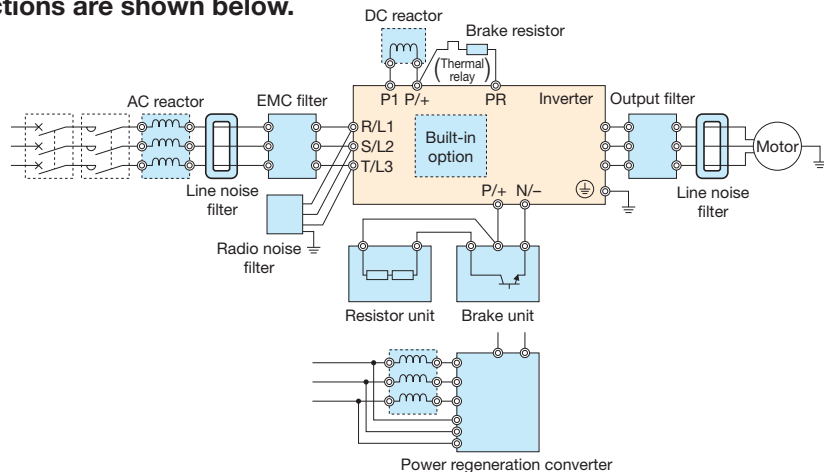
## Option lineup

A wide variety of options which improve function and performance, such as installation attachments, are available for the FR series lineup.



## Option connections

The main option connections are shown below.



# List of options

○: Available x: Not available

Name	Model	Applicable inverter						
		FR-A800	FR-A800 Plus	FR-F800	FR-E700	FR-F700PJ	FR-D700	FR-A701
<b>Plug-in option (control function expansion, additional input/output)</b>								
Orientation control	FR-A8AP	○	○	x	x	x	x	x
Encoder feedback control	FR-A8APR	○	○	x	x	x	x	x
Vector control	FR-A7AP	x	x	x	x	x	x	○
Orientation control	FR-A8AL	○	○	x	x	x	x	x
Encoder feedback control	FR-A7AL	x	x	x	x	x	x	○
Vector control/position control								
Encoder pulse dividing output								
16-bit digital input	FR-A8AX	○	○	○	x	x	x	x
	FR-A7AX	x	x	x	○ (E kit type)	x	x	○
Analog output (2 terminals)	FR-A8AY	○	○	○	x	x	x	x
	FR-A7AY	x	x	x	○ (E kit type)	x	x	○
Digital output (7 terminals)	FR-A8AR	○	○	○	x	x	x	x
	FR-A7AR	x	x	x	○ (E kit type)	x	x	○
Relay output (3 terminals)								
Coded analog output	FR-A8AZ	○	○	x	x	x	x	x
High-resolution analog input	FR-A7AZ	x	x	x	x	x	x	○
Motor thermistor interface								
24 VDC input	FR-E7DS	x	x	x	○ (for the FR-E700-SC only)	x	x	x
<b>Plug-in option (communication support)</b>								
RS-485	PU connector (inverter)	Equipped as standard	Equipped as standard	Equipped as standard	Equipped as standard	Equipped as standard	Equipped as standard	Equipped as standard
	Dedicated terminal (inverter)	Equipped as standard	Equipped as standard	Equipped as standard	FR-E7TR	x	x	Equipped as standard
USB	USB host	A connector	Equipped as standard	Equipped as standard	Equipped as standard	x	x	x
	USB device	B connector	x	x	x	x	x	Equipped as standard
Mini B connector	FR-A8NCE	○ <sup>2</sup>	○	○	x	x	x	x
	FR-A7NCE	x	x	x	x	x	x	○
Dedicated inverter	FR-A800-GF	x	x	x	x	x	x	x
	FR-A8NC	○ <sup>2</sup>	○	○	x	x	x	x
Dedicated inverter	FR-A7NC	x	x	x	○ (E kit type)	x	x	○
	FR-E700-NC	x	x	x	x	x	x	x
SSCNET III(H)	FR-A8NS	○ <sup>2</sup>	○ <sup>3</sup>	x	x	x	x	x
SSCNET III	FR-A7NS	x	x	x	x	x	x	○
DeviceNet™	FR-A8ND	○ <sup>2</sup>	○	○	x	x	x	x
	FR-A7ND	x	x	x	○ (E kit type)	x	x	○
PROFIBUS-DP	FR-A8NP	○ <sup>2</sup>	○	○	x	x	x	x
	FR-A7NP	x	x	x	○ (E kit type)	x	x	○
LonWorks®	FR-A8NL	x	x	○	x	x	x	x
	FR-A7NL	x	x	x	○ (E kit type)	x	x	○
FL remote	FR-A8NF	○ <sup>2</sup>	○ <sup>3</sup>	○	x	x	x	x
	FR-A7NF	x	x	x	x	x	x	○
Dedicated inverter		x	x	x	FR-E700-NF	x	x	x
<b>Control terminal option</b>								
Vector control terminal block	FR-A8TP	○	○	x	x	x	x	x
Screw terminal block	FR-A8TR	○ <sup>4</sup>	○	○ <sup>4</sup>	x	x	x	x
12V control circuit terminal block with encoder power supply	FR-A7PS	x	x	x	x	x	x	○
RS-485 2-port terminal block	FR-E7TR	x	x	x	○ (for models with the standard control circuit terminal specification only)	x	x	x
<b>Dedicated cable option</b>								
Encoder cable	FR-V7CBL□□	○	○	x	x	x	x	○
	FR-JCBL□□	○	○	x	x	x	x	○
SSCNET III cable	MR-J3BUS□M-□	x	x	x	x	x	x	○
<b>Operation option</b>								
LCD operation panel	FR-LU08(-01)	○	○	○	x	x	x	x
Parameter unit	FR-PU07	○	○	○	○ <sup>1</sup>	○	○	○
	FR-PU07BB	○	○	○	○ <sup>1</sup>	x	x	x
Enclosure surface operation panel	FR-PA07	x	x	x	○	○	○	x
Parameter unit connection cable	FR-CB20□	○	○	○	○	○	○	○
Operation panel connection connector	FR-ADP	○	○	○	x	x	x	○
<b>Software</b>								
FR Configurator2	SW1DND-FRC2	○	○	○	x	x	x	x
FR Configurator	FR-SW3-SETUP-WE	x	x	x	○ <sup>5</sup>	○	○	○
USB cable	MR-JUSBCBL3M	○	○	○	○	x	x	x
<b>Reactor</b>								
AC reactor	FR-HAL	○	○	○	○	○	○	x
DC reactor	FR-HEL	○	○	○	○	○	○	x
Balance reactor	FR-POL	For the FR-A842-P only	x	x	x	x	x	x
<b>Braking option</b>								
Brake resistor	MRS, MYS	x	x	x	○ <sup>6</sup>	○ <sup>6</sup>	○ <sup>6</sup>	x
High-duty brake resistor	FR-ABR	○ <sup>6</sup>	○ <sup>6</sup>	x	○ <sup>6</sup>	○ <sup>6</sup>	○ <sup>6</sup>	x
Brake unit	FR-BU2	○ <sup>7</sup>	○ <sup>7</sup>	○ <sup>7</sup>	○ <sup>7</sup>	○ <sup>7</sup>	○ <sup>7</sup>	x
	Resistor	GR2G	○	○	○	○	○	x
Resistor unit	FR-BR	○	○	○	○	○	○	x
	MT-BR5	○	○	○	x	x	x	x
Power regeneration common converter	FR-CV	○	○	○	○	○	○	x
Dedicated standalone reactor	FR-CVL	○	○	○	○	○	○	x
Power regeneration converter	MT-RC	○	○	○	x	x	x	x
High power factor converter	FR-HC2	○	○	○	○	○	○	x



○: Available ×: Not available

Name	Model	Applicable inverter						
		FR-A800	FR-A800 Plus	FR-F800	FR-E700	FR-F700PJ	FR-D700	FR-A701
<b>Noise filter</b>								
Line noise filter	FR-BSF01	○ <sup>*6</sup>	○ <sup>*8</sup>	○ <sup>*6</sup>	○	○	○	○
	FR-BLF	○ <sup>*6</sup>	○ <sup>*8</sup>	○ <sup>*6</sup>	○	○	○	○
Radio noise filter	FR-BIF	Corresponding filter is built-in	Corresponding filter is built-in	Corresponding filter is built-in	○	○	○	○
	Built-in filter	Equipped as standard			×	×	×	×
EMC Directive compliant EMC filter	SF□□	×	×	×	○	×	○	○
	FR-ESNF	×	×	×	○	○	○	×
	FR-S5NFSA	×	×	×	○	×	○	×
Filterpack (DC reactor / noise filter)	FR-BFP2	×	×	×	○	○ <sup>*9</sup>	○	×
<b>Output filter</b>								
Surge voltage suppression filter	FR-ASF	○ <sup>*10</sup>	○ <sup>*10</sup>	○ <sup>*10</sup>	○	○ <sup>*11</sup>	○	○ <sup>*10</sup>
	FR-BMF	○ <sup>*10</sup>	○ <sup>*10</sup>	○ <sup>*10</sup>	○	○ <sup>*11</sup>	○	○ <sup>*10</sup>
Sine wave filter	Reactor	MT-BSL(-HC)	○ <sup>*12</sup>	○ <sup>*12</sup>	○ <sup>*12</sup>	×	×	×
	Capacitor	MT-BSC	○ <sup>*12</sup>	○ <sup>*12</sup>	○ <sup>*12</sup>	×	×	×
<b>Structure option</b>								
Panel through attachment	FR-A8CN	○	○	○	×	×	×	×
	FR-E7CN	×	×	×	○	○	○	×
Totally enclosed structure specification attachment	FR-E7CV	×	×	×	○ <sup>*13</sup>	×	×	×
Control circuit terminal block intercompatibility attachment	FR-A8TAT	○	○	○	×	×	×	×
Intercompatibility attachment	FR-AAT	○	○	○	○	○	○	×
	FR-A5AT	○	○	○	○	○	○	×
	FR-E7AT	×	×	×	○	×	×	×
	FR-F8AT	×	×	○	×	×	×	×
EMC filter mounting attachment	FR-E5T	×	×	×	○	○	○	×
DIN rail mounting attachment	FR-UDA	×	×	×	○ <sup>*14</sup>	○ <sup>*14</sup>	○ <sup>*14</sup>	×
<b>FR Series controller and setter</b>								
Preamplifier	FR-FA	○	○	○	○	○	○	○
Soft starter	FR-FC	○	○	○	○	○	○	○
Deviation detector	FR-FD	○	○	○	○	○	○	○
Master controller	FR-FG	○	○	○	○	○	○	○
Ratio setter	FR-FH	○	○	○	○	○	○	○
Remote speed setter	FR-FK	○	○	○	○	○	○	○
Speed detector	FR-FP	○	○	○	○	○	○	○
DC tach. follower	FR-AL	○	○	○	○	○	○	○
Three speed selector	FR-AT	○	○	○	○	○	○	○
Manual controller with frequency meter	FR-AX	○	○	○	○	○	○	○
<b>Parts and others</b>								
Pilot generator	QVAH-10	○	○	○	○	○	○	○
Deviation sensor	YVGC-500W-NS	○	○	○	○	○	○	○
Analog frequency meter	YM206NRI 1mA	○	○	○	○	○	○	○
Calibration resistor	RV24YN 10kΩ	○	○	○	○	○	○	○
Frequency setting potentiometer	WA2W 1kΩ	○	○	○	○	○	○	○

\*1: PU connector is disabled for the FL remote communication model and the CC-Link communication model.  
\*2: The option is not compatible with the FR-A800-GF.  
\*3: The option is not compatible with the FR-A800-R2R.  
\*4: The option is not available for the FR-A800-E or FR-F800-E inverter.  
\*5: FR Configurator is not compatible with FL remote communication models.  
\*6: Only models with a built-in brake transistor can be used.  
\*7: For the 200 V class 0.2K or lower, 400 V class 1.5K or lower, they cannot be used in combination with a brake unit.  
\*8: For the 55K or lower, a corresponding appliance is built-in on the input side.  
\*9: Filterpack (FR-BFP2) is enclosed for the FR-F7[0]PJ-[JKF] inverters.  
\*10: The filter can be used under V/F control or Advanced magnetic flux vector control.  
\*11: The filter cannot be used during IPM motor control.  
\*12: The filter can be used under V/F control.  
\*13: The option is compatible with the FR-E720-0.1K to 7.5K only.  
\*14: The option is compatible with the models with the 3.7 kW or lower capacity.

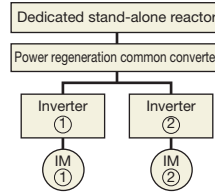
## Power regeneration common converter

### FR-CV

- Continuous regenerative operation at 100 % torque is possible with this converter. It is useful for lift operation and line control. (Regeneration at a max. 150% torque for 60 s is possible.)
- This converter is a common converter. Each inverter does not need a brake unit when this converter is used. Use this converter to cut down the total space and the cost.

Voltage	Applicable inverter capacity	Main body	Dedicated stand-alone reactor	Voltage	Applicable inverter capacity	Main body	Dedicated stand-alone reactor
200 V	7.5K	FR-CV-7.5K(-AT)	FR-CVL-7.5K	400 V	7.5K	FR-CV-H7.5K(-AT)	FR-CVL-H7.5K
	11K	FR-CV-11K(-AT)	FR-CVL-11K		11K	FR-CV-H11K(-AT)	FR-CVL-H11K
	15K	FR-CV-15K(-AT)	FR-CVL-15K		15K	FR-CV-H15K(-AT)	FR-CVL-H15K
	22K	FR-CV-22K(-AT)	FR-CVL-22K		22K	FR-CV-H22K(-AT)	FR-CVL-H22K
	30K	FR-CV-30K(-AT)	FR-CVL-30K		30K	FR-CV-H30K(-AT)	FR-CVL-H30K
	37K	FR-CV-37K	FR-CVL-37K		37K	FR-CV-H37K	FR-CVL-H37K
	55K	FR-CV-55K	FR-CVL-55K		55K	FR-CV-H55K	FR-CVL-H55K

\* Dedicated stand-alone reactor is an option.



## High power factor converter

### FR-HC2

- Harmonic current is greatly suppressed, and the equivalent capacity conversion coefficient  $K5=0$  in the "Japanese specific consumer higher harmonics suppression guidelines" is achieved.
- Input current waveforms are improved to be sine waves.
- Power regeneration function is provided as standard.

Voltage class	High power factor converter	Voltage class	High power factor converter	Standard accessories
200 V class	FR-HC2-7.5K	400 V class	FR-HC2-H7.5K	Reactor 1, reactor 2, external box* (Use in combination with the above accessories. The wires for connecting the standard accessories are not included.)
	FR-HC2-15K		FR-HC2-H15K	
	FR-HC2-30K		FR-HC2-H30K	
	FR-HC2-55K		FR-HC2-H55K	
	FR-HC2-75K		FR-HC2-H75K	
			FR-HC2-H400K	
			FR-HC2-H110K	
			FR-HC2-H560K	

\* Peripheral devices are separately provided for FR-HC2-H280K to H560K (not provided in a box).



## Brake unit

### FR-BU2

- The regenerative power from the motor is consumed as heat to improve the braking capacity of the motor.
- Connect this unit to the DC bus voltage directly to use with the conventional inverter.
- This unit can replace conventional models, BU, FR-BU, and MT-BU5.
- The units can be connected in parallel to handle large capacity.

Voltage class	Brake unit model	Voltage class	Brake unit model
200 V class*	FR-BU2-1.5K	400 V class*	FR-BU2-H7.5K
	FR-BU2-3.7K		FR-BU2-H15K
	FR-BU2-7.5K		FR-BU2-H30K
	FR-BU2-15K		FR-BU2-H55K
	FR-BU2-30K		FR-BU2-H75K
	FR-BU2-55K		FR-BU2-H220K
			FR-BU2-H280K

\* Resistors and resistor units are required. Refer to the Instruction Manual for the combination patterns.

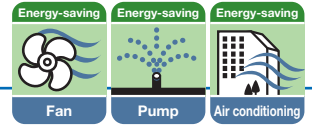


# Mitsubishi Electric Product Guide

Premium high-efficiency IPM motor

## MM-EFS/MM-THE4 Series

Compatible inverter  
FR-F800  
FR-F700PJ

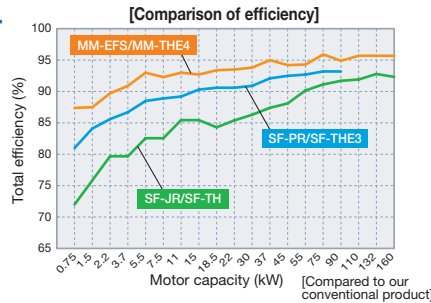


### Features

#### Energy savings with IPM motor

##### High efficiency achieved with IPM motors

- The IPM motors that have permanent magnets embedded in their rotors are even more efficient than the high-performance energy-saving motors.



#### IE4-equivalent efficiency level

- A premium high-efficiency IPM motor "MM-EFS series/MM-THE4 series" provides even better efficiency that is equivalent to IE4 (super premium efficiency), the highest efficiency class\*.

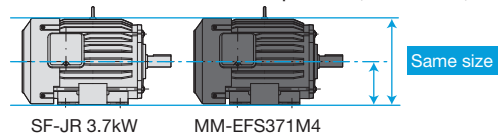
\*As of June 2016

IEC 60034-30 Efficiency class	Efficiency of Mitsubishi Electric motors	
	General-purpose motor	IPM motor
IE4 (super premium efficiency)**	—	Premium high-efficiency IPM (MM-EFS/MM-THE4)
IE3 (premium efficiency)	Super line premium series (SF-PR, SF-THE3)	—
IE2 (high efficiency)	High-performance energy-saving motor (SF-HR)	—
IE1 (standard efficiency)	Standard three-phase motor (SF-JR)	—
Below the class	—	—

\*\*1: The details of IE4 can be found in IEC 60034-31.

#### Smooth replacement from a general-purpose motor (with the same installation size)

- The frame number is the same (same size) as the Mitsubishi general-purpose motors (4-pole SF-JR/SF-HR series). Replacement is easy as the installation sizes are compatible. (55kW or lower)



#### Improved lifespan and reliability

- Bearing grease lasts longer than that of general-purpose motors. Design life: Approx. 7 years (60000 hours)
- The motor is equipped with anti-creep bearings as standard. Slip does not occur with synchronous motor, and precise operation is achievable.
- Magnetic pole positions are detected automatically. The motor does not use a magnetic position sensor consisting of electric devices, and that ensures high reliability.

### Model

[ 55 kW or lower ]

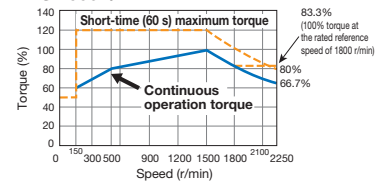
MM - EFS 7 1M 4 -S10

Symbol	Output	Symbol	Voltage class	Symbol	Specifications <sup>②</sup>	Symbol	Specifications <sup>②</sup>
See motor models in table below	See rated output in table below	None	200 V	None	Standard model	None	Standard model
		4	400 V	Q	Class B	P1	Outdoor type
		Symbol	Rated speed <sup>①</sup>	Symbol	Dedicated specification		
		1M	1500 r/min	None	Standard model		
		3	3000 r/min	-S10	Belt drive model		

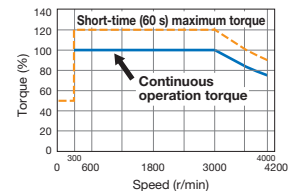
\*1: It can be also used for an application with the rated speed 1800 r/min.

\*2: The outdoor type and class B are semi-standard models.

MM-EFS 1500 r/min



MM-EFS 3000 r/min



[ 75 kW or higher ]

MM - T H E 4

- The motor can be used for applications which required the rated speed of 1500 r/min and 1800 r/min.
- For dedicated motors such as the outdoor type, the long-axis type, the flange type, the waterproof outdoor type, and the corrosion proof type, contact your sales representative.

Rated output (kW)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160
Motor model name	7	15	22	37	55	75	11K	15K	18K	22K	30K	37K	45K	55K	—	—	—	—	—
200 V class	MM-EFS□1M	●	●	●	●	●	●	●	●	●	●	●	●	●	—	—	—	—	—
	MM-EFS□1M-S10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	MM-EFS□3	●	●	●	●	●	●	●	●	●	—	—	—	—	—	—	—	—	—
400 V class	MM-EFS□1M4	●	●	●	●	●	●	●	●	●	●	●	●	●	—	—	—	—	—
	MM-EFS□1M4-S10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	MM-EFS□34	●	●	●	●	●	●	●	●	●	—	—	—	—	—	—	—	—	—
200 V class	MM-THE4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
400 V class	—	—	—	—	—	—	—	—	—	—	—	—	—	—	●	●	●	●	●

#### Caution

- The IPM motor MM-EFS/MM-THE4 series cannot be driven by the commercial power supply.
- The total wiring length for an IPM motor should be 100 m or less.
- Only one IPM motor can be connected to each inverter.
- For belt drive application of the 11 kW or higher MM-EFS series IPM motor with the 1500 r/min specification, use a dedicated belt drive motor. The 11 kW or higher motors with 3000 r/min specification are designed for a direct connection only.

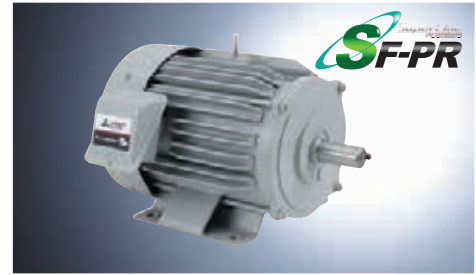
● : Available — : Not available

## High-performance energy-saving motor

### SF-PR

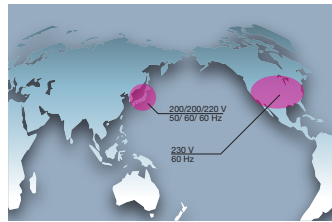
We have released the superline premium series SF-PR models compatible with the Top Runner Standard in Japan, which is equivalent with IE3 premium efficiency for three-phase motors, and with the Energy Independence and Security Act (EISA) in the United States. The SF-PR has achieved the efficiency class IE3 with the same dimensions as those of conventional models using our unique technology of the steel plate frame and new core materials.

It maintains interchangeability with our standard efficiency motor SF-JR and easy replacement becomes possible. By adopting a high-efficiency motor, energy savings in plant facilities and reduction of electricity consumption are expected, as well as the effects of recovering the investment cost.



### One motor conforms to the power supply in Japan and the United States.

- The SF-PR series conform to the Top Runner Standard of the "Act on the Rational Use of Energy (energy saving law)" started on April 1, 2015.
- The 230 V 60 Hz motors of the series also conform to the Energy Independence and Security Act (EISA).



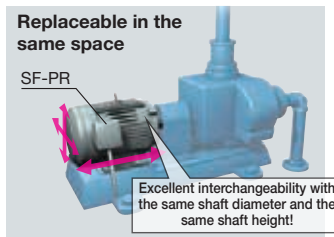
200	200	220	230	V
50	60	60	60	Hz

In Japan In the United States

\*For the 200 V class

### Interchangeable installation size

- Replacement can be smoothly performed because the installation size (frame number) is compatible with our standard motor SF-JR series.
- It is possible to use a power distribution control equipment (thermal relay and breaker), which is the same as a conventional one.



Replaceable in the same space

Excellent interchangeability with the same shaft diameter and the same shaft height!

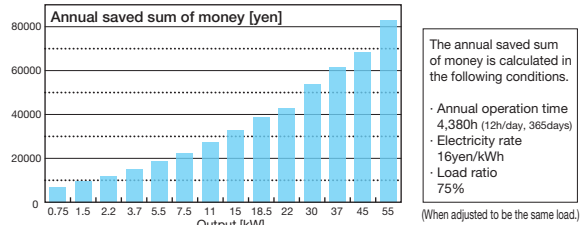
- \*1 For the frame number 180 LD or higher and some models of the 6-pole product, the total length or diametrical dimension is greatly different.
- \*2 The frame number is different from 1.5 kW6P (112M), 2.2 kW6P(132S) of the SF-JR models.
- \*3 When replacing the SF-JR to the SF-PR, it is required to consider upgrading the contactor to secure the same electric durability as using the SF-JR because the electric durability of the contactor may reduce by about 30%. Besides, when replacing the SF-JR to the SF-PR, the existing thermal relay may trip depending on the operating conditions (long starting time). As a countermeasure, consider "Adjusting the heater set value of the thermal" or "Adopting the thermal with a saturated reactor", etc.
- \*4 If the breaker NF400-SW manufactured by Mitsubishi Electric is used with the 55 kW motor (Y-Δ starting), change the breaker. (Change the rated current of the breaker NF400-SW from 300 A to 350 A.)

### Introduction effects of the superline premium series SF-PR

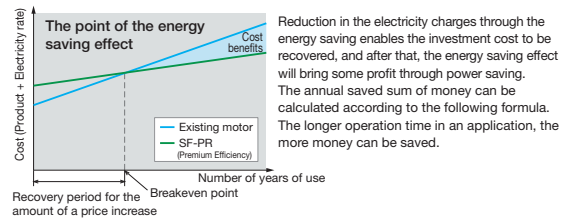
The SF-PR motor conforms to the Top Runner Standard (IE3 equivalent), which remarkably reduces its operation cost (electricity charges) and greatly contributes minimization of TCO (Total Cost Ownership).

- Trial calculation example of an annual saved sum of money (at upgrading the motor from energy-efficiency class IE1 to IE3)

Motor with 4-poles 200 V 50 Hz



- Economic efficiency on an energy saving effect



<Calculation formula>

$$\text{Output (kW)} \times \left( \frac{100}{\text{Efficiency of current motor (\%)}} - \frac{100}{\text{Efficiency of SF-PR model (\%)}} \right) \times \text{Number of motors} \times \text{Number of hours of use (h/day)} \times \text{Number of days of operation (day/year)} \times \text{Electricity rate (yen/kWh)}$$

When replacing our standard motor SF-JR with the SF-PR on the ventilation fan in plant

<Condition>  
 Type : 11 kW 4P 200 V 50 Hz 75% load  
 Units : 10units  
 Operation time : 12h/day 365day/year  
 Electricity rate : 16yen/kWh

**Reduced cost of about 350,000 yen per year**

Trial calculation results in replacing the SF-JR with the SF-PR with improved efficiency by 5% under the same conditions of the load factor, operation time, and electricity charges, etc.

## Lineup

S F - P R V O B - K R

Symbol	Structure	Symbol	Enclosure type	Symbol	Series	Symbol	Installation	Symbol	Classification	Symbol	With or without brake	Symbol	Country code
S	Superline series	F	Totally enclosed fan-cooled	PR	Premium series Steel plate frame	None	Foot mounting type	None	Indoor type (IP44)	None	Without brake	None	Japan and the U.S.A.
						V	Vertical type	O	Outdoor type (IP44)			UL	US UL standard
						F	Flange type	P	Dust-proof and waterproof type (IP55)	B	With brake	KR	Korea
												EU	Europe
												CN	China

### Available range

Type	Totally enclosed fan-cooled													
	Foot mounting type			Vertical type			Flange type			Outdoor type		Dust-proof and waterproof type		
	SF-PR			SF-PRV			SF-PRF			SF-PRO		SF-PRP		
Model	SF-PR			SF-PRV			SF-PRF			SF-PRO		SF-PRP		
Number of poles	2P	4P	6P	2P	4P	6P	2P	4P	6P	2P	4P	2P	4P	6P
Output [kW]	0.75	●	●	●	●	●	●	●	●	●	●	●	●	●
	1.5	●	●	●	●	●	●	●	●	●	●	●	●	●
	2.2	●	●	●	●	●	●	●	●	●	●	●	●	●
	3.7	●	●	●	●	●	●	●	●	●	●	●	●	●
	5.5	●	●	●	●	●	●	●	●	●	●	●	●	●
	7.5	●	●	●	●	●	●	●	●	●	●	●	●	●
	11	●	●	●	●	●	●	●	●	●	●	●	●	●
	15	●	●	●	●	●	●	●	●	●	●	●	●	●
	18.5	●	●	●	●	●	●	●	●	●	●	●	●	●
	22	●	●	●	●	●	●	●	●	●	●	●	●	●
	30	●	●	●	●	●	●	●	●	●	●	●	●	●
	37	●	●	●	●	●	●	●	●	●	●	●	●	●
45	●	●	●	●	●	●	●	●	●	●	●	●	●	
55	●	●	●	●	●	●	●	●	●	●	●	●	●	

- The vertical type and the flange type are also available for the outdoor type and the dustproof/waterproof type.
- SF-THE3 is used for the frame number of 250 or higher.

●: Available range

High-performance energy-saving motor with encoder

# SF-PR-SC

## Fast-response / high-accuracy vector control

Fast-response and high-accuracy vector control can be performed by the use in combination with the general-purpose FR-A800 inverter, plug-in option (FR-A8AP/A8AL), and control terminal option (FR-A8TP).

## Wide range of constant-torque characteristics

By selecting vector control, constant-torque continuous operation can be performed in the range from 0 Hz to 60 Hz (zero speed control and servo lock are available).

## Energy saving / CO<sub>2</sub> emission reduction

The premium efficiency motor with encoder (compatible with IE3) meets the Top Runner Standard in Japan and the Energy Independence and Security Act (EISA) in the United States.

## Compatibility with the inverter

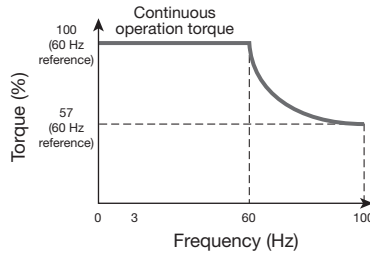
The motor is used in combination with an inverter of the same capacity.

## Improved environmental resistance

- Environmental resistance was improved due to the change from the fan cooled type to the blower cooled type. The IP55 compatible motor with an encoder is now also available.
- With the wire-saving design, improved reliability can be obtained.

## Motor torque

- Excellent speed accuracy  
Speed fluctuation ratio:  $\pm 0.01\%$  (for power driving)
- Wide range of speed control  
Speed control range: 1:1800 (for power driving)



The reference torque differs from that of the SF-V5RU series motor.

## Lineup

S F - P R F O B - S C 7K 4 P H A

Symbol	Installation method
None	Foot mounting type
F	Flange type

Symbol	Classification
None	Indoor type (IP44)
O	Outdoor type (IP44)
P	Dustproof/waterproof type (IP55)

Symbol	With or without brake
None	Without brake
B	With brake

Symbol	Output	Symbol	Output
1K	1.5 kW	18K	18.5 kW
2K	2.2 kW	22K	22 kW
3K	3.7 kW	30K	30 kW
5K	5.5 kW	37K	37 kW
7K	7.5 kW	45K	45 kW
11K	11 kW	55K	55 kW
15K	15 kW		

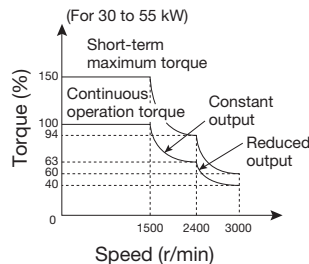
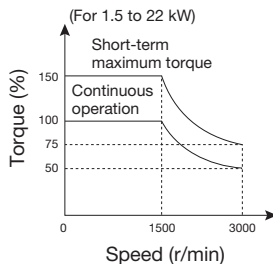
Symbol	Classification
None	200 V class
H	400 V class

Symbol	Protective equipment
None	Without
T	Thermostat
A	Thermistor

## Vector control motor Dedicated motor

# SF-V5RU

- When the motor is driven by the FR-A800 or FR-A701 inverter, continuous operation at 100% torque is enabled over the speed range from 1500 r/min to as low as 0 r/min.
- An encoder and cooling fan are built-in.
- In addition to the standard type with legs, the flange type and type with brakes can be manufactured.
- It is suitable for winder and unwinder applications. Motors with speed ratio of 1000/2000 r/min, 1000/3000 r/min and 500/2000 r/min specifications are available and they can support applications whose winding diameter greatly changes.



\*The maximum speed for the 55 kW is 2400 r/min.

## Mitsubishi Electric Molded Case Circuit Breakers and Earth Leakage Circuit Breakers

### WS-V Series

"WS-V Series" is the new circuit breakers that have a lot of superior aspects such as higher breaking capacity, design for easy use, standardization of accessory parts, and compliance to the global standards.

### Features

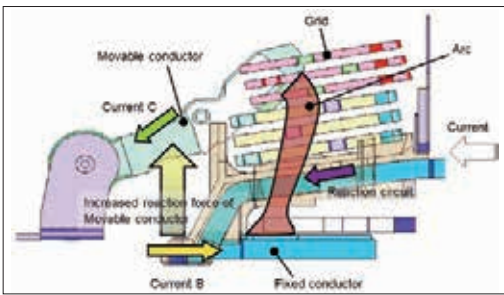
#### Technologies based on long years of experience are brought together to achieve improved performance

The new circuit breaking technology "Expanded ISTAC" has improved the current limiting performance and upgraded the overall breaking capacity.

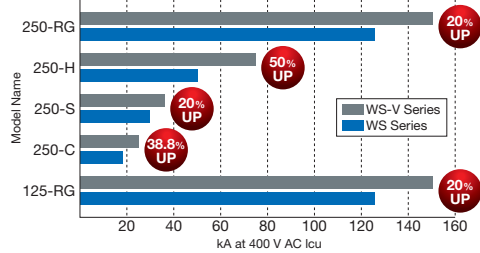
Expansion of the conductor under the stator shortens the contact parting time of the mover as compared to the conventional ISTAC structure.

The current-limiting performance has been improved remarkably. (The maximum peak current value has been reduced by approx. 10%.)

#### New circuit breaking technology (Expanded ISTAC)

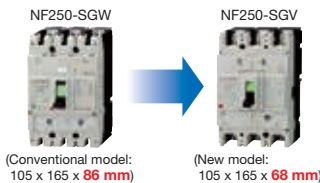


#### Breaking capacity comparison with a conventional model



#### Compact design for ease of use

The thermal adjustable circuit breakers and electronic circuit breakers are smaller.

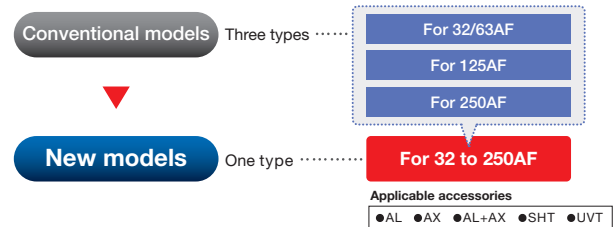


**Volume ratio 79%**  
(Compared with our conventional models)



#### Types of internal accessories are reduced from 3 types to 1 type

Standardization of internal accessories contributes to a reduction of stock and delivery time.



#### Lineup of UL 489 listed circuit breakers with 54 mm width "Small Fit" F Style

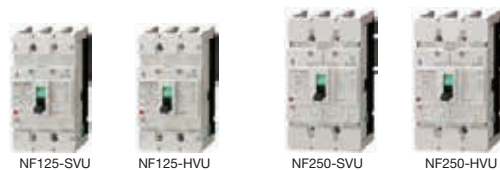
The compact breakers contribute to a size reduction of machines, and IEC 35 mm rail mounting is standard.



For security and standard compliance of machines, F-type and V-type operating handles are available for breakers with 54 mm width.

#### Lineup of UL 489 listed circuit breakers for 480 V AC "High Performance"

The breaking capacity has been improved to satisfy the request for SCCR upgrading.



Breaking capacity of UL 489 listed circuit breakers for 480 V AC (UL 489)

NF125-SVU/NV125-SVU	30 kA
NF125-HVU/NV125-HVU	50 kA
NF250-SVU/NV250-SVU	35 kA
NF250-HVU/NV250-HVU	50 kA

# MS-T Series

MS-T series is newly released! The MS-T series is smaller than ever, enabling more compact control panel. The MS-T series is suitable for other Mitsubishi Electric FA equipment. In addition, the MS-T conforms to a variety of global standards, supporting the global use. DC operated SD-T magnetic contactors (13 A frame to 32 A frame) are now available.

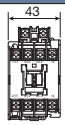




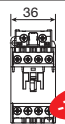
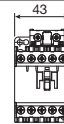

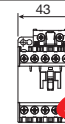
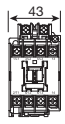
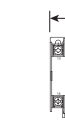
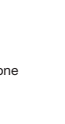






## Features

### Compact

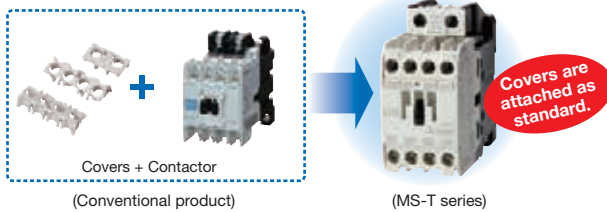
The width of the 10 A-frame model is as small as 36 mm. General-purpose magnetic contactor with smallest width\*1 in the industry. The width of MS-T series is reduced by 32% as compared to the prior MS-N series, enabling a more compact panel. To select the model, refer to the catalog of each inverter.

\*1: Based on Mitsubishi Electric research as of February 2015 in the general-purpose magnetic contactor industry for 10 A-frame class.

Frame size	11A	13A		20A	25A
MS-N series	 S-N10	 S-N11 (Auxiliary 1-pole)	 S-N12 (Auxiliary 2-pole)	 S-N20	 S-N25
New MS-T series	 S-T10	 S-T12 (Auxiliary 2-pole)		 S-T20	 S-T25
Frame size	13A		18A	20A	32A
SD-N	 SD-N11	 SD-N12	None	 SD-N21	None
SD-T (New model)	 SD-T12		 SD-T20	 SD-T21	 SD-T32

### Standardization

- Covers provided as standard equipment  
Safety improvement is achieved by the standard terminal cover. It is not necessary for the new MS-T series to order a dedicated terminal cover (S-N□CX) or a retrofit cover (UN-CW, etc.), which is required for the former MS-N series. (Prevention of failure to order)  
The number of items in stock can be reduced.
- The standard integrated terminal cover eliminates the need for additional ordering.



- Widened range of operation coil ratings (AC operated model)  
The widened range reduces the number of operation coil rating types from 14 (MS-N series) to 7.  
The reduced number of the operation coil types enables more simplified customers' ordering process and the faster delivery.
- Customers can select the operation coil more easily.






Coil designation	Rated voltage [V]	
	50 Hz	60 Hz
AC12V	12	12
AC24V	24	24
AC48V	48 to 50	48 to 50
AC100V	100	100 to 110
AC120V	110 to 120	115 to 120
AC127V	125 to 127	127
AC200V	200	200 to 220
AC220V	208 to 220	220
AC230V	220 to 240	230 to 240
AC260V	240 to 260	260 to 280
AC380V	346 to 380	380
AC400V	380 to 415	400 to 440
AC440V	415 to 440	460 to 480
AC500V	500	500 to 550

Integrated coil ratings facilitate selection!

### Global Standard

- Conforms to various global standards  
Not only major global standards such as IEC, JIS, UL, CE, and CCC but also ship standards and other country standards are planned to be certified.

- Conforms to various global standards

Standard	Applicable Standard				Safety Standard
	International	Japan	Europe	China	U.S.A. and Canada
	IEC <sup>*2</sup>	JIS	EN EC Directive	Certification Body GB	UL <sup>®</sup> US
					

\*2: The MS-T series also provide safe isolation (mirror contact) specified in the IEC standard.

\*3: The motor starters are certified under each type name of the magnetic contactors and the thermal overload relays on the condition that the magnetic contactors and the thermal overload relays are used in combination.

Mitsubishi Electric Magnetic Motor Starters and Magnetic Contactors

# MS-N Series

Environment-friendly Mitsubishi MS-N series ensures safety and conforms to various global standards. Its compact size contributes to space-saving in a machine. The MS-N series is suitable for other Mitsubishi Electric FA equipment and can be used globally.

## Features

### ■ Bifurcated contact adopted to achieve high contact reliability

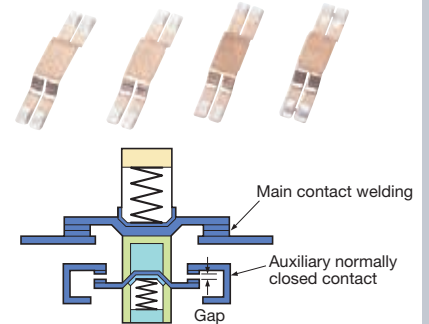
Contact reliability is greatly improved by combining bifurcated moving contact and stationary contact. This series responds to the various needs such as the application to safety circuit. (The MS-T series also has bifurcated contacts.)

### ■ Mirror contact (auxiliary contact off at main contact welding)

The MS-N series meets requirements of "Control functions in the event of failure" described in EN 60204-1 "Electrical equipment of machines", being suitable as interlock circuit contact. The MS-N series is applicable for category 4 safety circuit. We ensure safety for our customers. (The MS-T series also has mirror contacts.)

### ■ Various option unit

Various options including surge absorbers and additional auxiliary contact blocks are available.



Motor Circuit Breaker

# MMP-T Series

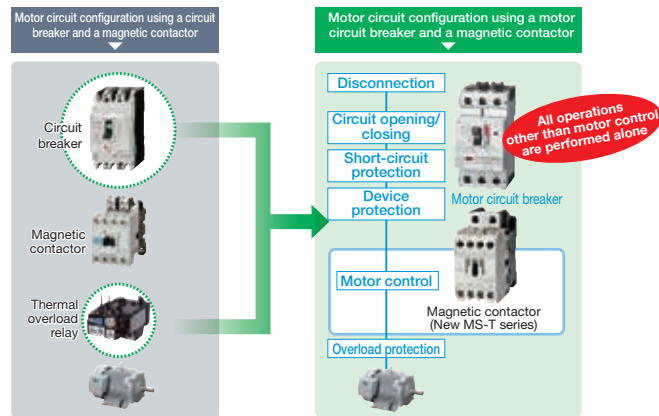
Motor circuit protection (against overload / phase loss / short-circuit) is achievable the MMP-T series alone. The wire-saving, space-saving design enables downsizing of the enclosure. The MMP-T series can be used in combination with the MS-T series (DC operated model).\*1

\*1: The connection conductor unit for the DC operated compact model (SD-T) is to be released soon.

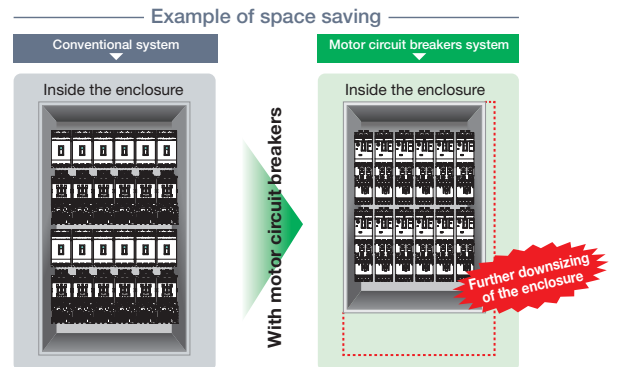
## Features

### ■ What is the motor circuit breaker?

The motor circuit breaker, applicable to the motor circuit, has the functions of a circuit breaker and a thermal overload relay in one unit. The motor circuit breaker provides protection against overload, phase loss, and short circuit.



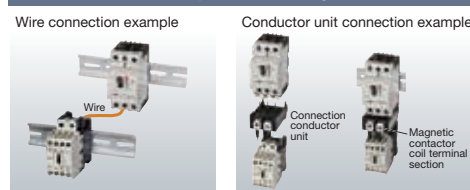
### ■ Space-saving design for downsizing of the enclosure



### ■ Wire saving

Using a connection conductor unit (option) for connecting a motor circuit breaker and a contactor reduces work hours required for wiring. A connection conductor unit for the high sensitivity contactor (SD-Q) is also available. (Model: UT-MQ12)

### Example of wire saving



### ■ Compliance to major standards support customers' overseas business

- Compliance with major global standards  
Not only major international standards such as IEC, JIS, UL, CE, and CCC but also other national standards are certified. This will help our customers expand their business in foreign countries.
- UL60947-4-1A Type E/F is also covered.  
Compliance of the device to UL's Type E/F combination can surely support export to the United States.

Standard	Applicable standard					Safety Standard U.S.A./Canada
	International	Japan	Europe	China		
IEC	JIS	EN EC Directive	Certification body CE	CCC	GB	cULus



## EcoMonitorLight

The handy, low cost energy measuring module with an integrated display visualizes energy consumption.

### Features

#### ■ Measurement and display of the energy consumption in a single module

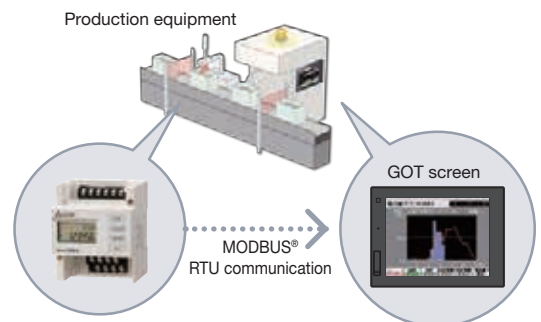
With the built-in LCD display, the single module enables measurement and display of the energy consumption. The module can be used for simple measurement of the production equipment (motors, compressors, etc.) and verification of the energy saving effect by measuring the energy consumption before and after introduction of high-efficiency equipment (inverters, etc.).

#### ■ System coordination facilitated by the standard MODBUS® RTU communication function

The MODBUS® RTU communication is supported as standard, facilitating coordination with the host system (programmable controller, GOT, etc.).

For example, by using GOT to visualize the energy consumption at work sites, you can raise the awareness of energy saving, and achieve the energy management in response to the actual operation of the production equipment.

\* The GOT sample screen data can be downloaded free of charge from the Mitsubishi Electric FA Global Website.



Energy measuring module in the enclosure  
Energy information is transmitted to GOT using MODBUS® RTU communication.

Molded case circuit breaker, magnetic contactor, cable gauge (FR-A800)

•280K or lower

Voltage	Motor output (kW) <sup>1)</sup>	Applicable inverter model (ND rating)	Molded case circuit breaker (MCCB) <sup>2)</sup> or earth leakage circuit breaker (ELB) (NF, NV type)		Input side magnetic contactor <sup>3)</sup>		Recommended Cable gauge (mm <sup>2</sup> ) <sup>4)</sup>		
			Power factor improving (AC or DC) reactor connection		Power factor improving (AC or DC) reactor connection		R/L1, S/L2, T/L3		U, V, W
			Without	With	Without	With	Without	With	
200 V class	0.4	FR-A820-0.4K (00046)	5 A	5 A	S-T10	S-T10	2	2	2
	0.75	FR-A820-0.75K (00077)	10 A	10 A	S-T10	S-T10	2	2	2
	1.5	FR-A820-1.5K (00105)	15 A	15 A	S-T10	S-T10	2	2	2
	2.2	FR-A820-2.2K (00167)	20 A	15 A	S-T10	S-T10	2	2	2
	3.7	FR-A820-3.7K (00250)	30 A	30 A	S-T21	S-T10	3.5	3.5	3.5
	5.5	FR-A820-5.5K (00340)	50 A	40 A	S-T35	S-T21	5.5	5.5	5.5
	7.5	FR-A820-7.5K (00490)	60 A	50 A	S-T35	S-T35	14	14	8
	11	FR-A820-11K (00630)	75 A	75 A	S-T35	S-T35	14	14	14
	15	FR-A820-15K (00770)	125 A	100 A	S-T50	S-T50	22	22	22
	18.5	FR-A820-18.5K (00930)	150 A	125 A	S-T65	S-T50	38	22	22
	22	FR-A820-22K (01250)	175 A	125 A	S-T100	S-T65	38	38	38
	30	FR-A820-30K (01540)	225 A	150 A	S-T100	S-T100	60	60	60
	37	FR-A820-37K (01870)	250 A	200 A	S-N150	S-N125	80	60	60
	45	FR-A820-45K (02330)	300 A	225 A	S-N180	S-N150	100	100	100
	55	FR-A820-55K (03160)	400 A	300 A	S-N220	S-N180	100	100	100
	75	FR-A820-75K (03800)	—	400 A	—	S-N300	—	125	125
90	FR-A820-90K (04750)	—	400 A	—	S-N300	—	150	150	
400 V class	0.4	FR-A840-0.4K (00023)	5 A	5 A	S-T10	S-T10	2	2	2
	0.75	FR-A840-0.75K (00038)	5 A	5 A	S-T10	S-T10	2	2	2
	1.5	FR-A840-1.5K (00052)	10 A	10 A	S-T10	S-T10	2	2	2
	2.2	FR-A840-2.2K (00083)	10 A	10 A	S-T10	S-T10	2	2	2
	3.7	FR-A840-3.7K (00126)	20 A	15 A	S-T10	S-T10	2	2	2
	5.5	FR-A840-5.5K (00170)	30 A	20 A	S-T21	S-T12	2	2	2
	7.5	FR-A840-7.5K (00250)	30 A	30 A	S-T21	S-T21	3.5	3.5	3.5
	11	FR-A840-11K (00310)	50 A	40 A	S-T21	S-T21	5.5	5.5	5.5
	15	FR-A840-15K (00380)	60 A	50 A	S-T35	S-T21	8	5.5	5.5
	18.5	FR-A840-18.5K (00470)	75 A	60 A	S-T35	S-T35	14	8	8
	22	FR-A840-22K (00620)	100 A	75 A	S-T35	S-T35	14	14	14
	30	FR-A840-30K (00770)	125 A	100 A	S-T50	S-T50	22	22	22
	37	FR-A840-37K (00930)	150 A	100 A	S-T65	S-T50	22	22	22
	45	FR-A840-45K (01160)	175 A	125 A	S-T100	S-T65	38	38	38
	55	FR-A840-55K (01800)	200 A	150 A	S-T100	S-T100	60	60	60
	75	FR-A840-75K (02160)	—	200 A	—	S-T100	—	60	60
	90	FR-A840-90K (02600)	—	225 A	—	S-N150	—	60	60
	110	FR-A840-110K (03250)	—	225 A	—	S-N180	—	80	80
132	FR-A840-132K (03610)	—	350 A	—	S-N220	—	100	100	
150	FR-A840-160K (04320)	—	400 A	—	S-N300	—	125	125	
160	FR-A840-160K (04320)	—	400 A	—	S-N300	—	125	125	
185	FR-A840-185K (04810)	—	400 A	—	S-N300	—	150	150	
220	FR-A840-220K (05470)	—	500 A	—	S-N400	—	2×100	2×100	
250	FR-A840-250K (06100)	—	600 A	—	S-N600	—	2×100	2×100	
280	FR-A840-280K (06830)	—	600 A	—	S-N600	—	2×125	2×125	

\*1: Assumes the use of a Mitsubishi Electric 4-pole standard motor with the power supply of 200/400 VAC 50 Hz.

\*2: Select an MCCB according to the power supply capacity. Install one MCCB per inverter.

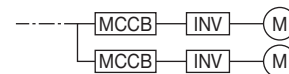
For the use in the United States or Canada, provide the appropriate UL and cUL listed fuse or UL489 molded case circuit breaker (MCCB) that is suitable for branch circuit protection. (Refer to the Instruction Manual (Detailed).)

\*3: The magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stops during motor driving, the electrical durability is 25 times. If using an MC for emergency stop during motor driving or using it on the motor side during commercial power supply operation, select an MC with the class AC-3 rated current for the rated motor current.

\*4: Cables

For FR-A820-03160(55K) or lower and FR-A840-01800(55K) or lower, it is the gauge of a cable with the continuous maximum permissible temperature of 75°C. (HIV cable (600 V grade heat-resistant PVC insulated wire), etc.) It assumes a surrounding air temperature of 50°C or lower and the wiring distance of 20 m or shorter.

For FR-A820-03800(75K) or higher and FR-A840-02160(75K) or higher, it is the gauge of the cable with the continuous maximum permissible temperature of 90°C or higher. (LMFC (heat resistant flexible cross-linked polyethylene insulated cable), etc.) It assumes a surrounding air temperature of 50°C or lower and in-enclosure wiring.



NOTE

- When the inverter capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the inverter model, and select cables and reactors according to the motor output.
- When the breaker on the inverter's input side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.

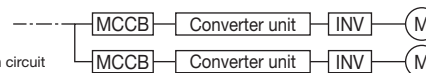
### •315K or higher

Voltage	Motor output (kW) <sup>2)</sup>	Applicable inverter model (ND rating)	Applicable converter model	Molded case circuit breaker (MCCB) <sup>2)</sup> or earth leakage circuit breaker (ELB) (NF, NV type)	Input-side magnetic contactor <sup>3)</sup>	HIV cables, etc. (mm <sup>2</sup> ) <sup>4)</sup>		
						R/L1, S/L2, T/L3	P/+, N/-	U, V, W
400 V class	315	FR-A842-315K (07700)	FR-CC2-H315K-60	700 A	S-N600	2 x 150	2 x 150	2 x 150
	355	FR-A842-355K (08660)	FR-CC2-H355K-60	800 A	S-N600	2 x 200	2 x 200	2 x 200
	400	FR-A842-400K (09620)	FR-CC2-H400K-60	900 A	S-N800	2 x 200	2 x 200	2 x 200
	450	FR-A842-450K (10940)	FR-CC2-H450K-60	1000 A	1000 A rated product	2 x 250	2 x 250	2 x 250
	500	FR-A842-500K (12120)	FR-CC2-H500K-60	1200 A	1000 A rated product	3 x 200	3 x 200	2 x 250

\*1: Assumes the use of a Mitsubishi Electric 4-pole standard motor with the motor capacity of 400 VAC 50 Hz.

\*2: Select an MCCB according to the power supply capacity.  
Install one MCCB per converter.

For the use in the United States or Canada, provide the appropriate UL and cUL listed fuse that is suitable for branch circuit protection. (Refer to the Instruction Manual (Detailed) of the inverter.)



\*3: The magnetic contactor is selected based on the AC-1 class. The electrical durability of magnetic contactor is 500,000 times. When the magnetic contactor is used for emergency stops during motor driving, the electrical durability is 25 times.

If using an MC for emergency stop during driving the motor, select an MC regarding the converter unit input side current as JEM1038-AC-3 class rated current. When using an MC on the inverter output side for commercial-power supply operation switching using a general-purpose motor, select an MC regarding the rated motor current as JEM1038-AC-3 class rated current.

\*4: The gauge of the cable with the continuous maximum permissible temperature of 90°C or higher. (LMFC (heat resistant flexible cross-linked polyethylene insulated cable), etc.). It assumes a surrounding air temperature of 40°C or lower and in-enclosure wiring.

#### NOTE

- When the converter unit capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the converter unit model, and select cables and reactors according to the motor output.
- When the breaker on the converter unit's input side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter and the converter unit, etc. The cause of the trip must be identified and removed before turning ON the power of the breaker.

For the other series, refer to the catalog of each series.

## List of Alternative Models for the Conventional Series

Conventional series name	Production termination schedule	Repair components supply termination	Alternative model
FR-F2	December 1986	November 1993	FR-F800 FR-A800*1
FR-K	December 1986	November 1993	FR-A800
FR-K400	July 1989	June 1996	FR-A800
FR-F300	July 1989	June 1996	FR-F800 FR-A800*1
FR-K3	July 1989	June 1996	FR-A800
FR-E	September 1993	August 2000	FR-A800
FR-Z020	March 1994	March 2001	FR-E700 FR-D700
FR-Z300	June 1994	June 2001	FR-A800
FR-Z100	December 1994	December 2001	FR-A800
FR-Z123	March 1995	March 2002	FR-E700 FR-D700
FR-F400	June 1995	June 2002	FR-F800 FR-A800*1
FR-A200	October 1995	October 2002	FR-A800
FR-Z024	October 1995	October 2002	FR-E700 FR-D700
FR-V200	April 1996	April 2003	FR-A800 + FR-A8AP/FR-A8AL/FR-A8TP
FR-A100	April 1996	April 2003	FR-F800
FR-Z200	June 1996	April 2003	FR-A800
FR-A200E	April 2000	April 2007	FR-A800
MT-A100E	April 2000	April 2007	FR-F800
FR-A100E	September 2000	September 2007	FR-F800
MT-A200E	September 2000	September 2007	FR-A800
FR-U100	September 2001	September 2008	FR-D700
FR-S500 (3-phase 200 V)	June 2004	June 2011	FR-D700
FR-V200E	October 2004	October 2011	FR-A800 + FR-A8AP/FR-A8AL/FR-A8TP
FR-S500 (3 phase 400 V/1-phase 200 V/1-phase 100 V)	May 2006	May 2013	FR-D700
FR-F500 (L)	May 2006	May 2013	FR-F800
FR-A500 (L)	April 2007	April 2014	FR-A800
FR-A024/A044	December 2008	December 2015	FR-E700 FR-D700
FR-A201E	September 2009	September 2016	FR-A701
FR-S500E	August 2010	August 2017	FR-D700
FR-E500	April 2011	April 2018	FR-E700
FR-F700	August 2011	August 2018	FR-F800
FR-FP700	August 2011	August 2018	FR-F800
FR-HC (200 V)	October 2011	October 2018	FR-HC2 (200 V)
MT-HC (200 V)	October 2011	October 2018	FR-HC2 (200 V)
MT-B	November 2011	November 2018	FR-B
FR-F500J	April 2012	April 2019	FR-F700PJ
FR-FP500J	April 2012	April 2019	FR-F700PJ
FR-C500	April 2012	April 2019	FR-E700 (Use the FR-E700-NC or the CC-Link option.)
FR-HC (400 V)	October 2012	October 2019	FR-HC2 (400 V)
MT-HC (400 V)	October 2012	October 2019	FR-HC2 (400 V)
SC-A	April 2015	April 2022	FR-D700
MD-AX520	September 2015	September 2022	FR-A800
FR-A700	December 2015	December 2022	FR-A800
FR-F700P	September 2016	September 2023	FR-F800
FR-V500	January 2017	January 2024	FR-A800 + FR-A8TP

\*1: For the operation where the inverter output current exceeds 120% of its rated current, select the FR-A800 series.



# Warranty

When using this product, make sure to understand the warranty described below.

## Warranty period and coverage

We will repair any failure or defect (hereinafter referred to as "failure") in our FA equipment (hereinafter referred to as the "Product") arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit are repaired or replaced.

### [Term]

The term of warranty for Product is twelve months after your purchase or delivery of the Product to a place designated by you or eighteen months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

### [Limitations]

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged.  
However, it will not be charged if we are responsible for the cause of the failure.
- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.
- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases;
  - 1) a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
  - 2) a failure caused by any alteration, etc. to the Product made on your side without our approval
  - 3) a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
  - 4) a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
  - 5) any replacement of consumable parts (condenser, cooling fan, etc.)
  - 6) a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
  - 7) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
  - 8) any other failures which we are not responsible for or which you acknowledge we are not responsible for

## Term of warranty after the stop of production

- (1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.
- (2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

## Service in overseas

Our regional FA Center in overseas countries will accept the repair work of the Product; however, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA center for details.

## Exclusion of responsibility for compensation against loss of opportunity, secondary loss, etc.

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

## Change of Product specifications

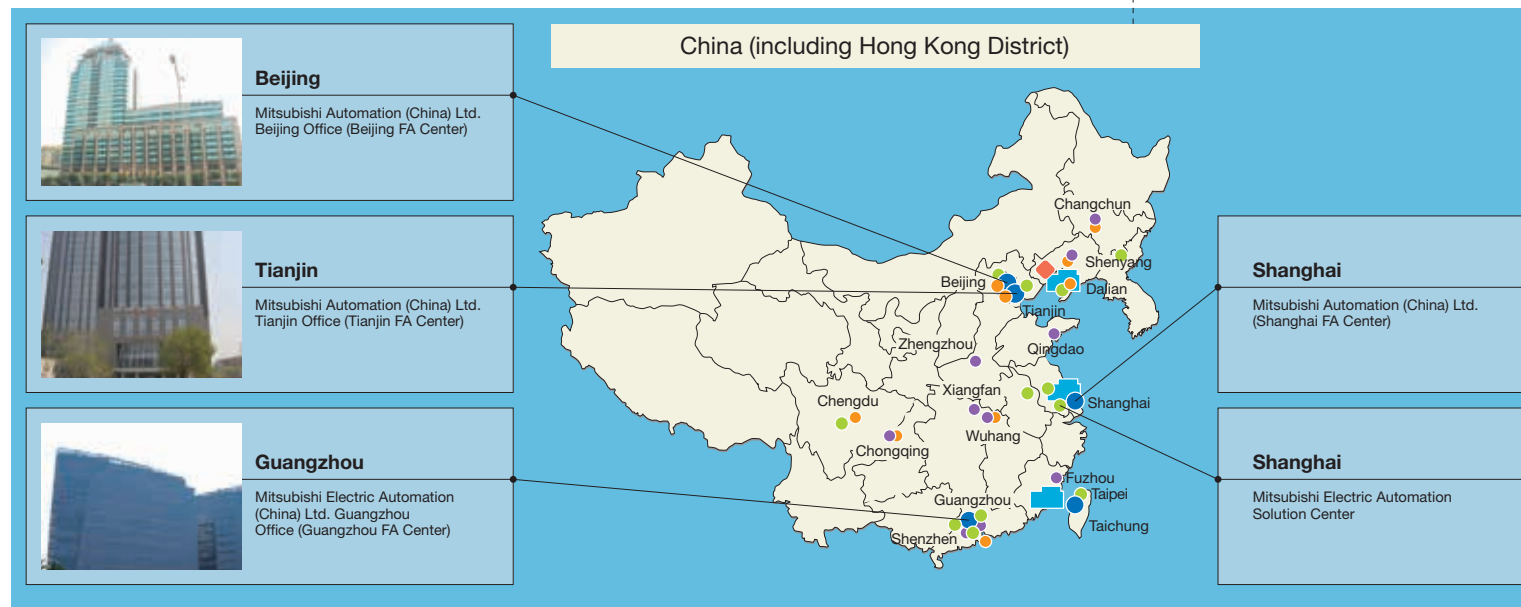
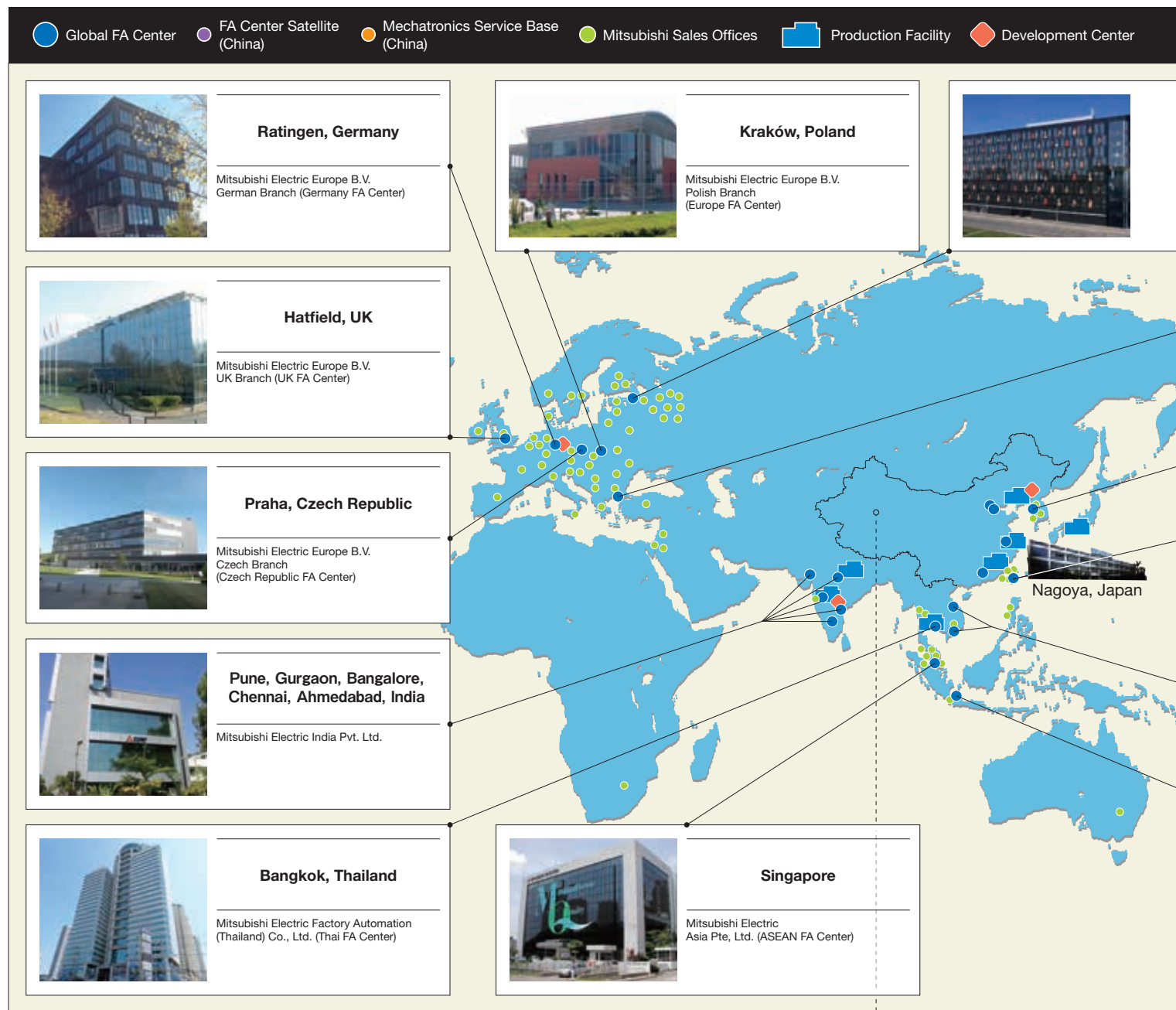
Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

## Application and use of the Product

- (1) For the use of our product, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in product, and a backup or fail-safe function should operate on an external system to product when any failure or malfunction occurs.
- (2) Our product is designed and manufactured as a general purpose product for use at general industries.  
Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.  
In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.  
We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.



# Global network for comprehensive support of





# customers' manufacturing.



Service bases are established around the world to globally provide the same services as in Japan.

**Overseas bases are opened one after another to support business expansion of our customers.**

Overseas bases | As of July 2014 \* Some includes distributors

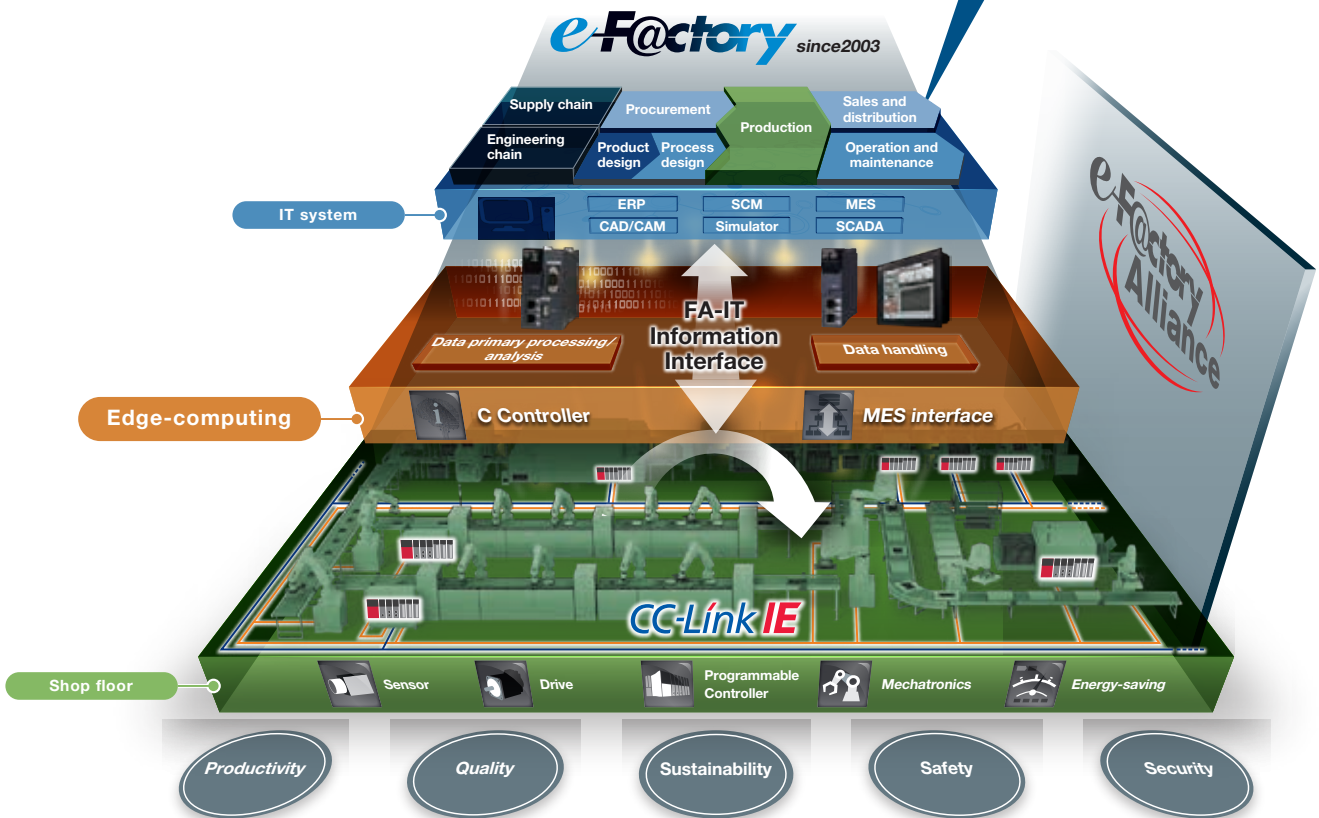
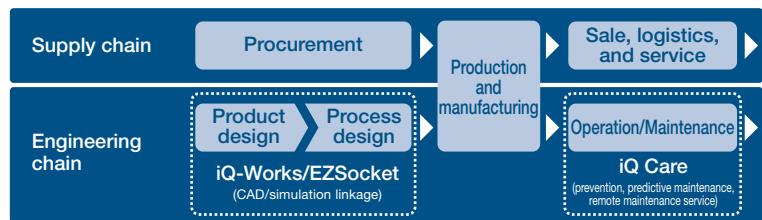
Area	Our overseas offices		Bases providing our products	Countries (Regions)
		FA Center (Satellite)		
EMEA	11	6 (2)	146	54
China	13	4 (10)	171	1
Asia	21	13	79	10
America	14	4 (0)	130	16
Others	1	0	3	2
<b>Total</b>	<b>60</b>	<b>27 (12)</b>	<b>529</b>	<b>83</b>

# This solution solves customers' issues and concerns by enabling visualization and analysis that lead to improvements and increase availability at production sites.

Utilizing our FA and IT technologies and collaborating with e-F@ctory Alliance partners, we reduce the total cost across the entire supply chain and engineering chain, and support the improvement initiatives and one-step-ahead manufacturing of our customers.



**FA integrated solutions reduce total cost**

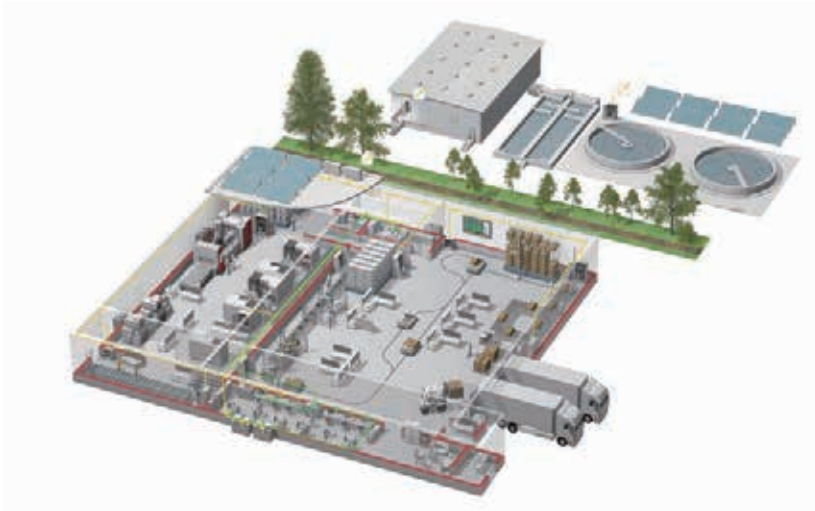


Overall production information is captured in addition to energy information, enabling the realization of efficient production and energy use (energy savings).

**•Trademarks**

BACnet is a registered trademark of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), LonWorks is a registered trademark of Echelon Corporation, DeviceNet is a trademark of the ODVA, PROFIBUS is a trademark of the PROFIBUS User Organization, and MODBUS is a registered trademark of Schneider Automation Incorporated is a registered trademark of the United States. Ethernet is a registered trademark of Fuji Xerox Corporation in Japan. Other company and product names herein are the trademarks and registered trademarks of their respective owners.

# YOUR SOLUTION PARTNER



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

## A NAME TO TRUST

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

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

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

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

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



Low voltage: MCCB, MCB, ACB



Medium voltage: VCB, VCC



Power monitoring, energy management



Compact and Modular Controllers



Inverters, Servos and Motors



Visualization: HMIs



Numerical Control (NC)



Robots: SCARA, Articulated arm



Processing machines: EDM, Lasers, IDS



Transformers, Air conditioning, Photovoltaic systems

\* Not all products are available in all countries.

Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO14001 (standards for environmental management systems) and ISO9001 (standards for quality assurance management systems)



# MITSUBISHI ELECTRIC CORPORATION

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