MITSUBISHI ELECTRIC
Changes for the Better

Automating the World

INVERTER

FACTORY AUTOMATION

New Product RELEASE No.24-2E

Release of the FR-A800-SYN and FR-F800-SYN Series Inverters

Synchronous reluctance motor (SynRM) driving inverters FR-A800-SYN and FR-F800-SYN are now available.

FR-A820-00046-SYN　　FR-F820-00046-SYN

▪ Driving the new Mitsubishi Electric synchronous reluctance motors (SynRM*1)

- Our unique inverter control technology, ideal for synchronous reluctance motors, enables energy saving operation and high-speed operation (5400 min^{-1} maximum).
- As the inverter stores the motor constants, the settings required to drive the Mitsubishi Electric synchronous reluctance motors*2 can be configured easily by using parameters.

*1: SynRM stands for the synchronous reluctance motor.
*2: Non-Mitsubishi Electric synchronous reluctance motors can be driven by performing tuning.
*3: For the Mitsubishi Electric sustainable motor MELSUSMO RF-SR, only the released capacities are supported. (As of May 2024)

Mitsubishi Electric Sustainable Motor MELSUSMO RF-SR *3

Release schedule	July 2024

Features

• Energy saving operation using the IE5 efficiency class motor

Power consumption can be reduced by approx. 11% compared with our IE1 efficiency class motor and approx. 6% compared with our IE3 efficiency class motor.
Power consumption and CO_2 emission can be reduced compared to using the conventional motors.

■Comparison of energy saving effects
(dollars/year, euro/year)

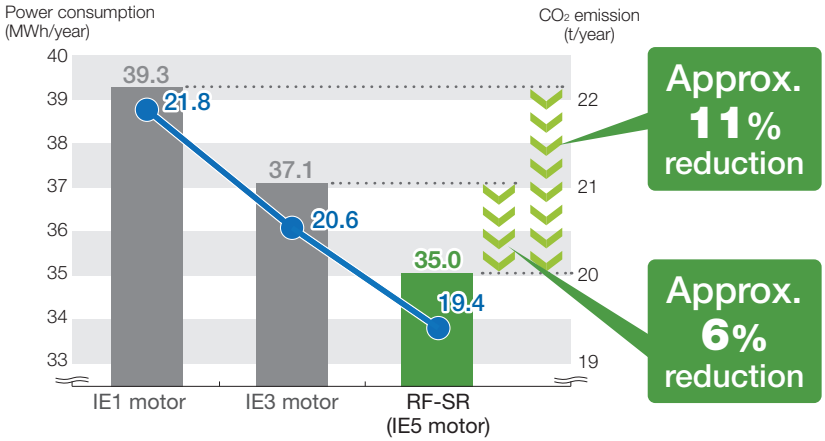
Motor replacement	Energy saving effect (dollars/year, euro/year)
From IE1 to IE5	$860 , €258
From IE3 to IE5	$420 , €126

* The calculation condition is as follows. The energy saving effect (dollars/year, euro/year) depends on conditions such as quantity and capacity.

Calculation condition

- Load condition: 5.5 kW, 3,000 min^{-1}
- Operating hours: 17 hours per day, 335 days
- Inverter efficiency: 96.2%
- CO_2 emission factor: 0.555 kg/kWh
- Electricity charge factor: $0.2/kWh, €0.06/kWh

■Comparison of power consumption (MWh/year) and CO_2 emission (t/year)

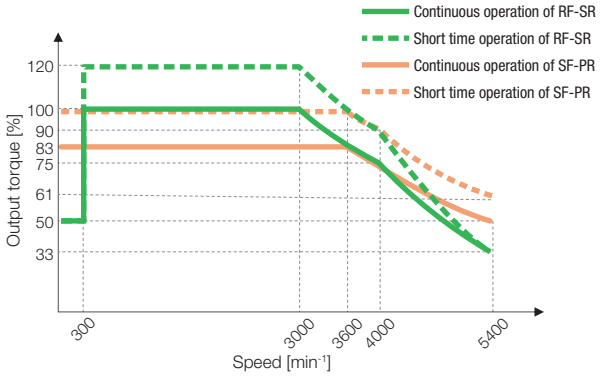


Torque characteristics of the synchronous reluctance motor RF-SR

High-speed operation up to 5400 min^{-1} is enabled by our unique inverter control technology ideal for the permanent magnet-less synchronous reluctance motor.
The following figures show the comparisons of torque characteristics with those of the existing SF-PR series (IE3 motor) and MM-EFS series (IPM motor).

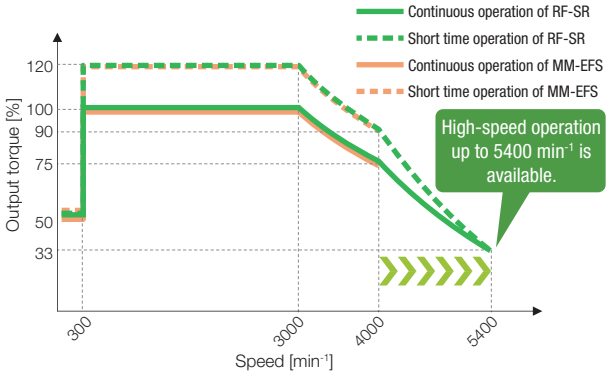
■Comparison with SF-PR (LD rating)

In the range from 300 to 3600 min^{-1}, operation can be performed with higher torque than when using SF-PR.



■Comparison with MM-EFS

Operation can be performed with the equivalent torque. In addition, high-speed operation with a speed of more than 4000 min^{-1} is enabled.



* The characteristics above assume that the wiring length between the inverter and the motor is 5 m or less and the DC bus voltage inside the inverter is equal to or higher than the specified value (282 V or higher for the 200 V class or 565 V or higher for the 400 V class).

Recommended combinations of inverters and motors

● 200 V class

Motor output		5.5kW	7.5kW	11kW	15kW
Motor model	RF-SR[]30S	5K	7K	11K	15K
Inverter model	FR-A820-[]-SYN Same as motor capacity	5.5K	7.5K	11K	15K
		00340	00490	00630	00770
	FR-F820-[]-SYN One rank higher than motor capacity	7.5K	11K	15K	18.5K
		00340	00490	00630	00770

● 400 V class

Motor output		5.5kW	7.5kW	11kW	15kW
Motor model	RF-SR[]30HS	5K	7K	11K	15K
Inverter model	FR-A840-[]-SYN Same as motor capacity	5.5K	7.5K	11K	15K
		00170	00250	00310	00380
	FR-F840-[]-SYN One rank higher than motor capacity	7.5K	11K	15K	18.5K
		00170	00250	00310	00380

* The LD rating (Pr.570 = "1") is recommended for driving the synchronous reluctance motor RF-SR.
* For how to set inverter parameters, refer to the FR-A800-SYN and FR-F800-SYN SynRM Driving Function Manual (IB-0601007ENG).

Major comparison of control methods

Inverter model	Item	SynRM magnetic flux vector control (synchronous reluctance motor RF-SR)	PM sensorless vector control (IPM motor MM-CF)	Real sensorless vector control (induction motor control)
FR-A800-SYN	Starting torque	50%	High frequency superposition control: 150%, current synchronization operation: 50%	200% (FR-A820-00250(3.7K) or lower and FR-A840-00126(3.7K) or lower), or 150% (FR-A820-00340(5.5K) or higher and FR-A840-00170(5.5K) or higher)
	Control mode	Speed control	Speed control, position control	Speed control, torque control

Inverter model	Item	SynRM magnetic flux vector control (synchronous reluctance motor RF-SR)	PM sensorless vector control (IPM motor MM-EFS)	Advanced magnetic flux vector control (induction motor control)
FR-F800-SYN	Starting torque	50%	50%	120%
	Control mode	Speed control	Speed control	Speed control

* Other information is described in the Function Manual. For detailed specifications, refer to the FR-A800-SYN and FR-F800-SYN SynRM Driving Function Manual (IB-0601007ENG).

Specification differences between FR-A800-SYN and FR-F800-SYN

To use any of the functions in the following tables, select the model with which the desired function is provided.
The described specifications are for driving the synchronous reluctance motor RF-SR.
For details on the functions, refer to the FR-A800 Instruction Manual (Detailed) (IB-0600503ENG) or the FR-F800 Instruction Manual (Detailed) (IB-0600547ENG).

Inverter model	Item							
	Acceleration/ deceleration pattern (S-curve)	Multiple rating*1	Third function selection	Load torque high-speed frequency control	Droop control	Anti-sway control	Easy dancer control	Special regenerative brake duty
FR-A800-SYN	4	3	○	○	○	○	○	○
FR-F800-SYN	2	2	×	×	×	×	×	×

Inverter model	Item						
	PID gain tuning function	PID direct setting	PID multiple loops	Multi-pump function	Cleaning function	BACnet MS/TP communication	BACnet/IP*2 communication
FR-A800-SYN	×	×	×	×	×	×	×
FR-F800-SYN	○	○	○	○	○	○	○

Supported: ○
Not supported: ×

*1: The LD rating is recommended for driving the synchronous reluctance motor RF-SR.
*2: BACnet/IP communication is available only for the Ethernet model. For details, refer to the FR-A800-E/F800-E Ethernet Function Manual (IB-0600628ENG).

Outline dimensions

Outline dimensions are the same as those of FR-A800 and FR-F800 inverters.

Product line

● FR-A800 series

Symbol	Voltage class
2	200 V
4	400 V

Symbol	Structure/functionality
0	Standard model
2	Separated converter type

Symbol	Description
0.4K to 500K	Applicable motor capacity (ND) (kW)
00023 to 12120	Inverter rated current (SLD) (A)

Symbol	Type*3	Communication type
1	FM	RS-485 communication
2	CA	
E1	FM	Ethernet communication
E2	CA	

FR-A8 2 0 - 00340 - 1 - 60 SYN

Symbol	Circuit board coating (Conforming to IEC 60721-3-3:1994 3C2/3S2)	Plated conductor
None	Without	Without
60	With	Without
06*1	With	With

Symbol	Application
SYN	SynRM driving

●: Newly released model

Three-phase 200 V class FR-A820-[]-SYN*4	0.4 K	0.75 K	1.5 K	2.2 K	3.7 K	5.5 K	7.5 K	11 K	15 K	18.5 K	22 K	30 K	37 K	45 K	55 K	75 K	90 K
	00046	00077	00105	00167	00250	00340	00490	00630	00770	00930	01250	01540	01870	02330	03160	03800	04750
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Three-phase 400 V class FR-A840-[]-SYN*4	0.4 K	0.75 K	1.5 K	2.2 K	3.7 K	5.5 K	7.5 K	11 K	15 K	18.5 K	22 K	30 K	37 K	45 K	55 K	75 K	90 K
	00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160	01800	02160	02600
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	110 K	132 K	160 K	185 K	220 K	250 K	280 K										
	03250	03610	04320	04810	05470	06100	06830										
	●	●	●	●	●	●	●										
Three-phase 400 V class FR-A842-[]-SYN*5	315 K	355 K	400 K	450 K	500 K												
	07700	08660	09620	10940	12120												
	●	●	●	●	●												

● FR-F800 series

Symbol	Voltage class
2	200 V
4	400 V

Symbol	Structure/functionality
0	Standard model
2	Separated converter type

Symbol	Description
0.75K to 560K	Applicable motor capacity (LD) (kW)
00023 to 12120	Inverter rated current (SLD) (A)

Symbol	Type*3	Communication type
1	FM	RS-485 communication
2	CA	
E1	FM	Ethernet communication
E2	CA	

FR-F 8 2 0 - 00340 - 1 - 60 SYN

Symbol	Circuit board coating (Conforming to IEC 60721-3-3:1994 3C2/3S2)	Plated conductor
None	Without	Without
60	With	Without
06*2	With	With

Symbol	Application
SYN	SynRM driving

●: Newly released model

Three-phase 200 V class FR-F820-[]-SYN*4	0.75 K	1.5 K	2.2 K	3.7 K	5.5 K	7.5 K	11 K	15 K	18.5 K	22 K	30 K	37 K	45 K	55 K	75 K	90 K	110 K
	00046	00077	00105	00167	00250	00340	00490	00630	00770	00930	01250	01540	01870	02330	03160	03800	04750
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Three-phase 400 V class FR-F840-[]-SYN*4	0.75 K	1.5 K	2.2 K	3.7 K	5.5 K	7.5 K	11 K	15 K	18.5 K	22 K	30 K	37 K	45 K	55 K	75 K	90 K	110 K
	00023	00038	00052	00083	00126	00170	00250	00310	00380	00470	00620	00770	00930	01160	01800	02160	02600
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	132 K	160 K	185 K	220 K	250 K	280 K	315 K										
	03250	03610	04320	04810	05470	06100	06830										
	●	●	●	●	●	●	●										
Three-phase 400 V class FR-F842-[]-SYN*5	355 K	400 K	450 K	500 K	560 K												
	07700	08660	09620	10940	12120												
	●	●	●	●	●												

*1: Plated conductors can be provided for the FR-A820-00340(5.5K) or higher and the FR-A840-00170(5.5K) or higher.
*2: Plated conductors can be provided for the FR-F820-00340(7.5K) or higher and the FR-F840-00170(7.5K) or higher.
*3: Specification differs by the type. For the specification differences, refer to the Instruction Manual.
*4: For the 75K or higher inverter, or whenever a 75 kW or higher motor is used, always connect a DC reactor (FR-HEL), which is available as an option.
*5: Always install the converter unit (FR-CC2). (Not required when a high power factor converter (FR-HC2) is used.)

MITSUBISHI ELECTRIC CORPORATION

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

(2407) MEE

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