

# Addition of New Models for the FR-A800 and FR-F800 Series Inverters

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



FR-A800-00250-SYN



FR-F800-00250-SYN

## ■ Driving the new Mitsubishi Electric synchronous reluctance motors (SynRM\*)

- Our unique inverter control technology, ideal for synchronous reluctance motors, enables energy saving operation and high-speed operation (5400 min<sup>-1</sup> maximum).
- As the inverter stores the motor constants, the settings required to drive the synchronous reluctance motors can be configured easily by using parameters.

\* SynRM stands for the synchronous reluctance motor.



Mitsubishi Electric Sustainable Motor MELSUMO RF-SR

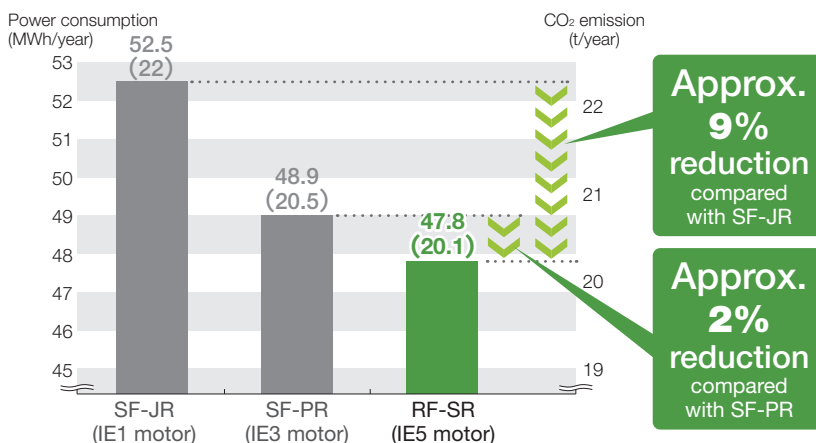
## Features

### •Energy saving operation using the IE5 efficiency class motor

Power consumption can be reduced by approx. 9% compared with our SF-JR (IE1 efficiency class) motor and approx. 2% compared with our SF-PR (IE3 efficiency class) motor.

Power consumption and CO<sub>2</sub> emission can be reduced compared to using the conventional motors.

#### ■Comparison of power consumption (MWh/year) and CO<sub>2</sub> emission (t/year)



#### Calculation condition

- Load condition: 7.5 kW, 3,600 min<sup>-1</sup>
- Operating hours: 17 hours per day, 335 days
- Inverter efficiency: 96.2%
- CO<sub>2</sub> emission factor: 0.42 kg/kWh

## Inverter rating

The LD rating is recommended for driving the synchronous reluctance motor RF-SR.

### •FR-A800-SYN

|                   |                                            |                      | Model FR-A820-[]-SYN                                                                      |                          |       |       |       |       | Model FR-A840-[]-SYN               |                          |       |       |       |       |
|-------------------|--------------------------------------------|----------------------|-------------------------------------------------------------------------------------------|--------------------------|-------|-------|-------|-------|------------------------------------|--------------------------|-------|-------|-------|-------|
|                   |                                            |                      | 00250                                                                                     | 00340                    | 00490 | 00630 | 00770 | 00930 | 00126                              | 00170                    | 00250 | 00310 | 00380 | 00470 |
|                   |                                            |                      | 3.7K                                                                                      | 5.5K                     | 7.5K  | 11K   | 15K   | 18.5K | 3.7K                               | 5.5K                     | 7.5K  | 11K   | 15K   | 18.5K |
| Output            | Rated capacity<br>(kVA)                    | SLD                  | 10                                                                                        | 13                       | 19    | 24    | 29    | 35    | 10                                 | 13                       | 19    | 24    | 29    | 36    |
|                   |                                            | LD                   | 8.8                                                                                       | 12                       | 17    | 22    | 27    | 32    | 8.8                                | 12                       | 18    | 22    | 27    | 33    |
|                   |                                            | ND (initial setting) | 6.7                                                                                       | 9.1                      | 13    | 18    | 23    | 29    | 6.9                                | 9.1                      | 13    | 18    | 24    | 29    |
|                   |                                            | HD                   | 4.2                                                                                       | 6.7                      | 9.1   | 13    | 18    | 23    | 4.6                                | 6.9                      | 9.1   | 13    | 18    | 24    |
|                   | Rated current<br>(A)                       | SLD                  | 25                                                                                        | 34                       | 49    | 63    | 77    | 93    | 12.6                               | 17                       | 25    | 31    | 38    | 47    |
|                   |                                            | LD                   | 23                                                                                        | 31                       | 45    | 58    | 70.5  | 85    | 11.5                               | 16                       | 23    | 29    | 35    | 43    |
|                   |                                            | ND (initial setting) | 17.5                                                                                      | 24                       | 33    | 46    | 61    | 76    | 9                                  | 12                       | 17    | 23    | 31    | 38    |
|                   |                                            | HD                   | 11                                                                                        | 17.5                     | 24    | 33    | 46    | 61    | 6                                  | 9                        | 12    | 17    | 23    | 31    |
|                   | Overload<br>current rating                 | SLD                  | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature of 40°C |                          |       |       |       |       |                                    |                          |       |       |       |       |
|                   |                                            | LD                   | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C |                          |       |       |       |       |                                    |                          |       |       |       |       |
|                   |                                            | ND (initial setting) | 150% 60 s, 200% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C |                          |       |       |       |       |                                    |                          |       |       |       |       |
|                   |                                            | HD                   | 200% 60 s, 250% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C |                          |       |       |       |       |                                    |                          |       |       |       |       |
|                   | Rated voltage                              |                      |                                                                                           | Three-phase 200 to 240 V |       |       |       |       |                                    | Three-phase 380 to 500 V |       |       |       |       |
| Power<br>supply   | Rated input AC voltage/frequency           |                      | Three-phase 200 to 240 V, 50/60 Hz                                                        |                          |       |       |       |       | Three-phase 380 to 500 V, 50/60 Hz |                          |       |       |       |       |
|                   | Permissible AC voltage fluctuation         |                      | 170 to 264 V, 50/60 Hz                                                                    |                          |       |       |       |       | 323 to 550 V, 50/60 Hz             |                          |       |       |       |       |
|                   | Permissible frequency fluctuation          |                      | ±5%                                                                                       |                          |       |       |       |       |                                    |                          |       |       |       |       |
|                   | Protection rating of structure (IEC 60529) |                      |                                                                                           | Enclosed type (IP20)     |       |       |       |       |                                    |                          |       |       |       |       |
| Cooling system    |                                            |                      | Forced air                                                                                |                          |       |       |       |       |                                    |                          |       |       |       |       |
| Approx. mass (kg) |                                            |                      | 3.4                                                                                       | 6.7                      | 6.7   | 8.3   | 15.5  | 15.5  | 3.4                                | 6.7                      | 6.7   | 8.3   | 8.3   | 15    |

### •FR-F800-SYN

|                                            |                                    |     | Model FR-F820-[]-SYN                                                                      |       |       |       |       | Model FR-F840-[]-SYN               |       |       |       |       |
|--------------------------------------------|------------------------------------|-----|-------------------------------------------------------------------------------------------|-------|-------|-------|-------|------------------------------------|-------|-------|-------|-------|
|                                            |                                    |     | 00250                                                                                     | 00340 | 00490 | 00630 | 00770 | 00126                              | 00170 | 00250 | 00310 | 00380 |
|                                            |                                    |     | 5.5K                                                                                      | 7.5K  | 11K   | 15K   | 18.5K | 5.5K                               | 7.5K  | 11K   | 15K   | 18.5K |
| Output                                     | Rated capacity (kVA)               | SLD | 10                                                                                        | 13    | 19    | 24    | 29    | 10                                 | 13    | 19    | 24    | 29    |
|                                            |                                    | LD  | 8.8                                                                                       | 12    | 17    | 22    | 27    | 8.8                                | 12    | 18    | 22    | 27    |
|                                            | Rated current (A)                  | SLD | 25                                                                                        | 34    | 49    | 63    | 77    | 12.6                               | 17    | 25    | 31    | 38    |
|                                            |                                    | LD  | 23                                                                                        | 31    | 45    | 58    | 70.5  | 11.5                               | 16    | 23    | 29    | 35    |
|                                            | Overload current rating            | SLD | 110% 60 s, 120% 3 s (inverse-time characteristics) at surrounding air temperature of 40°C |       |       |       |       |                                    |       |       |       |       |
|                                            |                                    | LD  | 120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C |       |       |       |       |                                    |       |       |       |       |
| Power supply                               | Rated voltage                      |     | Three-phase 200 to 240 V                                                                  |       |       |       |       | Three-phase 380 to 500 V           |       |       |       |       |
|                                            | Rated input AC voltage/frequency   |     | Three-phase 200 to 240 V, 50/60 Hz                                                        |       |       |       |       | Three-phase 380 to 500 V, 50/60 Hz |       |       |       |       |
|                                            | Permissible AC voltage fluctuation |     | 170 to 264 V, 50/60 Hz                                                                    |       |       |       |       | 323 to 550 V, 50/60 Hz             |       |       |       |       |
|                                            | Permissible frequency fluctuation  |     | ±5%                                                                                       |       |       |       |       |                                    |       |       |       |       |
| Protection rating of structure (IEC 60529) |                                    |     | Enclosed type (IP20)                                                                      |       |       |       |       |                                    |       |       |       |       |
| Cooling system                             |                                    |     | Forced air                                                                                |       |       |       |       |                                    |       |       |       |       |
| Approx. mass (kg)                          |                                    |     | 3.1                                                                                       | 6.3   | 6.3   | 8.3   | 15.5  | 3.1                                | 6.3   | 6.3   | 8.3   | 8.3   |

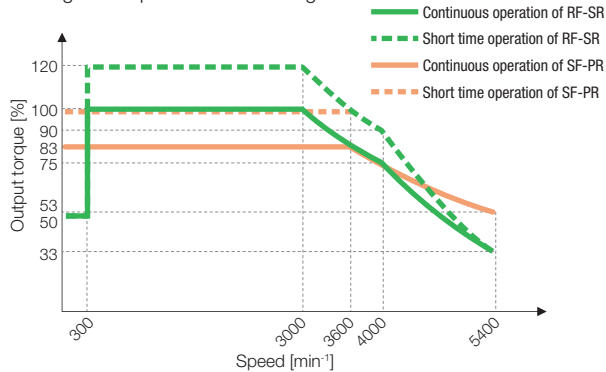
## Torque characteristics of the synchronous reluctance motor RF-SR

High-speed operation up to 5400 min<sup>-1</sup> 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).

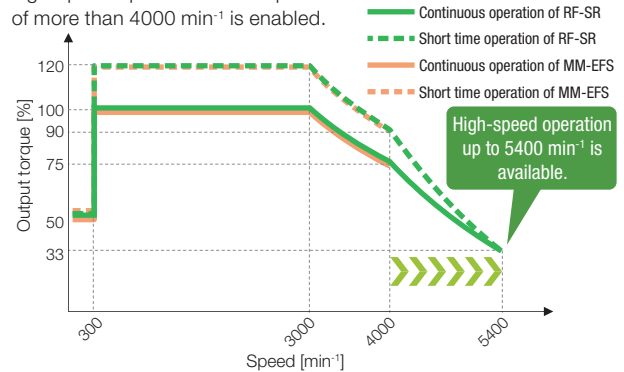
### ■ Comparison with SF-PR (LD rating)

In the range from 300 to 3600 min<sup>-1</sup>, 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<sup>-1</sup> 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 model    | RF-SR[]30S     | 5K           | 7K           | 11K         | 15K           |
|----------------|----------------|--------------|--------------|-------------|---------------|
| Inverter model | FR-A820-[]-SYN | 00340 (5.5K) | 00490 (7.5K) | 00630 (11K) | 00770 (15K)   |
|                | FR-F820-[]-SYN | 00340 (7.5K) | 00490 (11K)  | 00630 (15K) | 00770 (18.5K) |

### ● 400 V class

| Motor model    | RF-SR[]30HS    | 5K           | 7K           | 11K         | 15K           |
|----------------|----------------|--------------|--------------|-------------|---------------|
| Inverter model | FR-A840-[]-SYN | 00170 (5.5K) | 00250 (7.5K) | 00310 (11K) | 00380 (15K)   |
|                | FR-F840-[]-SYN | 00170 (7.5K) | 00250 (11K)  | 00310 (15K) | 00380 (18.5K) |

\* 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 <sup>*1</sup> | 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 <sup>*2</sup> communication |
| FR-A800-SYN    | ×                        | ×                  | ×                  | ×                   | ×                 | ×                          | ×                                     |
| FR-F800-SYN    | ○                        | ○                  | ○                  | ○                   | ○                 | ○                          | ○                                     |

Supported: ○  
Not supported: ×

\*1: The LD rating is recommended for driving the synchronous reluctance motor RF-SR.

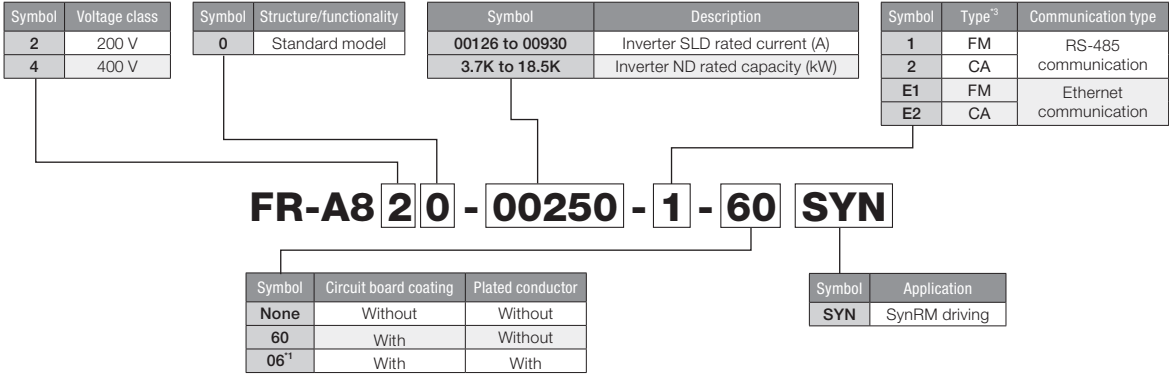
\*2: BACnet/IP communication is available only for the Ethernet model. For details, refer to the FR-A800-E/F800-E Ethernet Function Manual (IB-0600628ENG).

Outline dimensions

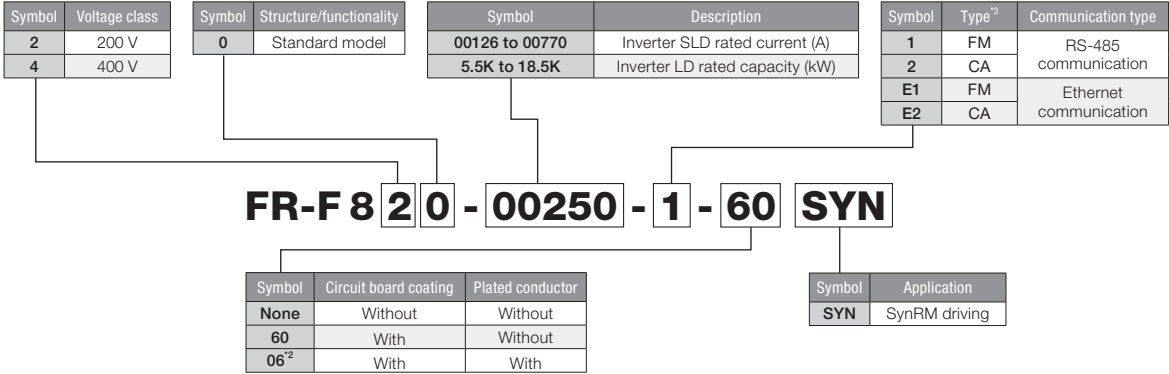
Outline dimensions are the same as those of FR-A800 and FR-F800 inverters.

Product line

FR-A800 series



FR-F800 series



\*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. Major differences are shown in the following table.

| Type                               | Monitor output                                                                                           | Initial setting     |               |                 |                                            |
|------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------|---------------|-----------------|--------------------------------------------|
|                                    |                                                                                                          | Built-in EMC filter | Control logic | Rated frequency | Pr.19 Base frequency voltage               |
| FM<br>(terminal FM equipped model) | Terminal FM (pulse train output)<br>Terminal AM (analog voltage output (0 to ±10 VDC))                   | OFF                 | Sink logic    | 60 Hz           | 9999<br>(same as the power supply voltage) |
| CA<br>(terminal CA equipped model) | Terminal CA (analog current output (0 to 20 mADC))<br>Terminal AM (analog voltage output (0 to ±10 VDC)) | ON                  | Source logic  | 50 Hz           | 8888<br>(95% of the power supply voltage)  |

|                                            |       |       |       |       |       |       |
|--------------------------------------------|-------|-------|-------|-------|-------|-------|
| Three-phase 200 V class<br>FR-A820-[-]-SYN | 00250 | 00340 | 00490 | 00630 | 00770 | 00930 |
|                                            | 3.7K  | 5.5K  | 7.5K  | 11K   | 15K   | 18.5K |
|                                            | ●     | ●     | ●     | ●     | ●     | ●     |
| Three-phase 400 V class<br>FR-A840-[-]-SYN | 00126 | 00170 | 00250 | 00310 | 00380 | 00470 |
|                                            | 3.7K  | 5.5K  | 7.5K  | 11K   | 15K   | 18.5K |
|                                            | ●     | ●     | ●     | ●     | ●     | ●     |
| Three-phase 200 V class<br>FR-F820-[-]-SYN | 00250 | 00340 | 00490 | 00630 | 00770 |       |
|                                            | 5.5K  | 7.5K  | 11K   | 15K   | 18.5K |       |
|                                            | ●     | ●     | ●     | ●     | ●     |       |
| Three-phase 400 V class<br>FR-F840-[-]-SYN | 00126 | 00170 | 00250 | 00310 | 00380 |       |
|                                            | 5.5K  | 7.5K  | 11K   | 15K   | 18.5K |       |
|                                            | ●     | ●     | ●     | ●     | ●     |       |

● : Model to be released in May 2023