# MITSUBISHI ELECTRIC

*Changes for the Better*

**700 series**

INVERTER

**Model**

# FR-E700

**Remarkable usability**  **Top level driving performance!**

**Compact body**

# *All-rounder*

Easy for anybody and high performance

Easy & High performance

MITSUBISHI

6000 Hz

3Φ 200V

E700

MELSOFT

# Evolution in all functions

## ① Top level driving performance in compact body
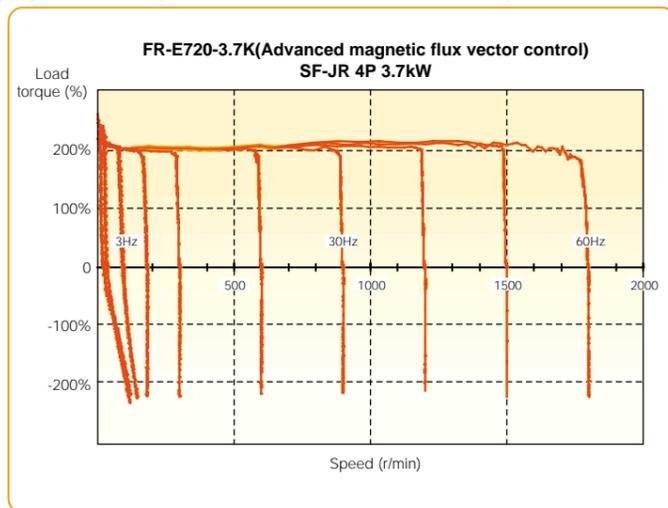### The inverter became more powerful.

### (1) High torque 200%/0.5Hz is realized by advanced magnetic flux vector control (3.7K or less)

Advancement from general-purpose magnetic flux vector control to advanced magnetic flux vector control ! Class top-level driving performance is realized.
Since V/F control and general-purpose magnetic flux vector control operations are available, operation after replacement of the conventional model (FR-E500 series) is ensured.

For the 5.5K to 15K, 150%/0.5Hz torque is realized.

#### Speed/torque characteristics example



**FR-E720-3.7K(Advanced magnetic flux vector control)
SF-JR 4P 3.7kW**

Load torque (%)

200%
100%
0
-100%
-200%

3Hz          30Hz          60Hz
500    1000    1500    2000

Speed (r/min)

#### Advanced auto tuning

Many kinds of 3 phase induction motors can be optimally controlled with Mitsubishi original "non-rotation" auto tuning function.  High precision tuning is enabled even when a test operation of a machine can not be performed at parameter adjustment.
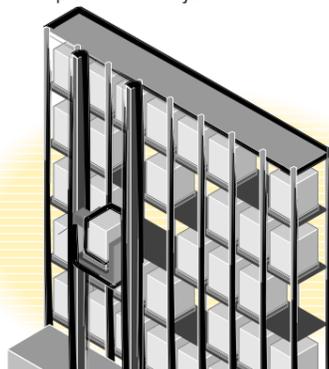


Advanced magnetic flux vector control is optimum for lift for the automated-storage requiring high torque at low speed.

### (2) Short time overload capacity is increased (200% 3s)

Short time overload capacity is increased to 200% 3s (conventional model 200% 0.5s). Overcurrent trip is less likely to occur.
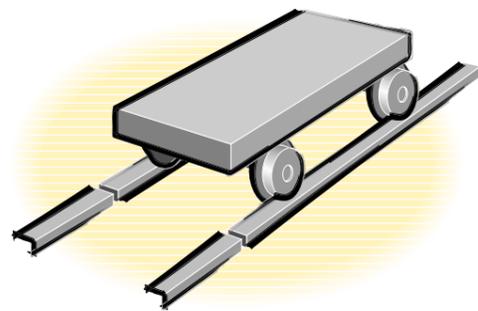


An impact load placed when a running bogie steps over the bump does not affect operation.

### (3) Torque limit/current limit function

Improved torque limit/current limit function provides a machine protection, load limit, and stop-on-contact operation.
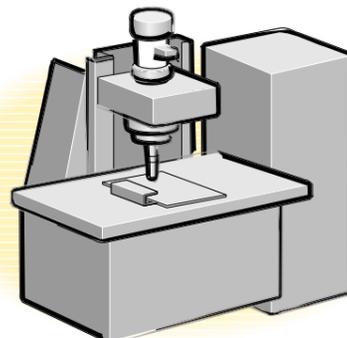


Torque limit ensures mechanical protection such as prevention of tool blade breakage.

# Easy/powerful compact inverter

## ② Overriding operability
### Usability was thoroughly pursued.
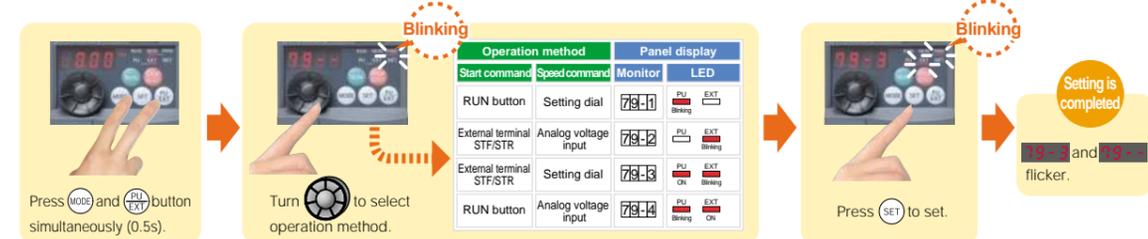
### (1) Improved setting dial

Mitsubishi inverter has a setting dial of course.
• The scrolling speed of the dial was made to variable for more improved operability.
• The nonslip setting dial is easier to turn.
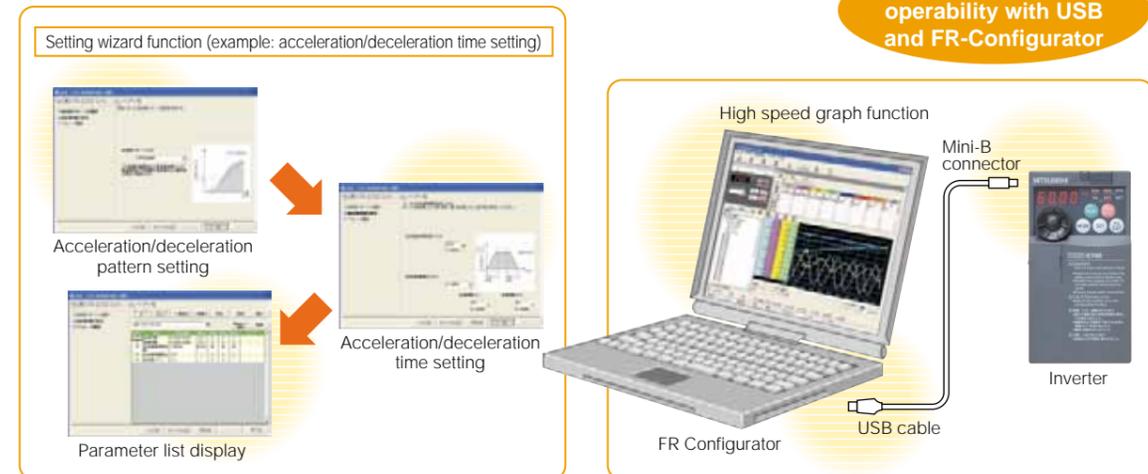
### (2) Easy setting mode

Setting of Pr.79 Operation mode selection which select the combination of the start command and speed command can be easily made.



Blinking          Blinking

| Operation method | | Panel display | |
| Start command | Speed command | Monitor | LED |
| RUN button | Setting dial | 79-1 | PU Blinking / EXT |
| External terminal STF/STR | Analog voltage input | 79-2 | PU / EXT Blinking |
| External terminal STF/STR | Setting dial | 79-3 | PU ON / EXT Blinking |
| RUN button | Analog voltage input | 79-4 | PU Blinking / EXT ON |

Press (MODE) and (PU EXT) button simultaneously (0.5s).

Turn to select operation method.

Press (SET) to set.

Setting is completed

79-2 and 79-3 flicker.

### (3) With a provided USB connector, setting is easily done from a personal computer using the FR Configurator (to be released)

An USB connector (mini-B connector) is provided as standard. The inverter can be easily connected without a USB-RS-485 converter.
Wizard (interactive) function of the FR Configurator (inverter setup software) realizes setting support.
In addition, a high-speed graph function with USB enables high speed sampling display.

**Expanded advanced operability with USB and FR-Configurator**



Setting wizard function (example: acceleration/deceleration time setting)

Acceleration/deceleration pattern setting

Acceleration/deceleration time setting

Parameter list display

High speed graph function

Mini-B connector

FR Configurator          USB cable          Inverter

### (4) Operation panel for enclosure surface mounting is supported (to be released)

An optional operation panel for an enclosure surface mounting can be connected.
In addition, an operation panel for conventional model (FR-E500 series) can be connected.
The operation panel of the inverter cannot be removed.

### (5) Parameter unit FR-PU07 (option)

The FR-PU07, an optional parameter unit, can be connected as well.
• Setting such as direct input method with a numeric keypad, operation status indication, and help function are usable.
  The display language can be selected from 8 languages.
• Parameter setting values of maximum of three inverters can be stored.
• A battery pack type (available soon) allows parameter setting and parameter copy without powering on the inverter.

## ③ Enhanced expandability

**Expandability catching up with the FR-A700 series is realized.**

### (1) A plug-in option is mountable

Plug-in options supporting digital input, analog output extension, and variety of communication provide scalability which is almost equivalent to the FR-A700 series. (One type of plug-in option can be mounted. An option comes with a dedicated front cover as a package.)
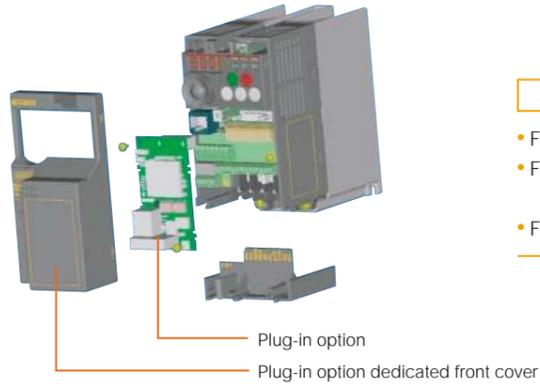
| Compatible Plug-in Options |
|---|
| • FR-A7AX E kit ...16-bit digital input • FR-A7NC E kit ...CC-Link |
| • FR-A7AY E kit ...Digital output • FR-A7ND E kit* ...DeviceNet |
| Extension analog output • FR-A7NP E kit* ...PROFIBUS-DP |
| • FR-A7AR E kit ...Relay output • FR-A7NL E kit* ...LONWORKS |

\* : to be released soon

Plug-in option
Plug-in option dedicated front cover

### (2) Control terminals are selectable according to applications

Terminal cards other than standard terminal such as analog, pulse train, two port RS-485 terminal are available as options. (to be released soon)
A crimp ring terminal type is also available. (to be released)
A terminal card is removable and can be easily replaced from a standard terminal card.

Terminal card

### (3) Support various kinds of network

EIA-485 (RS-485), ModbusRTU (equipped as standard), CC-Link, PROFIBUS-DP*, DeviceNet®*, LONWORKS®* (option)

*: to be released soon

LONWORKS® is a registered trademark of Echelon Corporation and DeviceNet® is of ODVA. Other company and product names herein are the trademarks of their respective owners.

### (4) Break resistor can be connected to the 0.4K to 15K

A brake transistor is built-in to the 0.4K to 15K.
Connecting an optional brake resistor increases regeneration capability.

## ④ Compact and space saving

**Compact design expands flexibility of enclosure design.**

### (1) Compact body with high performance function

Installation size is the same as the conventional mode (FR-E500 series) in consideration of intercompatibility.
(200V class 0.1K to 7.5K)

128mm

FR-E720-0.2K    FR-E520-0.2K

### (2) Side by side installation saves space

Space can be saved by side by side no clearance installation*.

*: Use the inverter at the ambient temperature of 40˚C or less.

### (3) Heatsink protrusion attachment option (1.5K or more) (to be released soon)

A heatsink portion of the inverter can be protruded outside the enclosure by fitting an optional heatsink protrusion attachment FR-E7CN.
Protruding a hot section outside the enclosure allows selection of downsized enclosure, reducing cost for enclosure cooling equipments.

## ⑤ Ensured maintenance

**700 series are the pioneer of long life and high reliability.**

### (1) Long-life design

• The life of cooling fan has been extended to 10 years[1] of design life. The life of the cooling fan is further extended with ON/OFF control of the cooling fan.
• Longevity of capacitor was achieved with the adoption of a design life of 10 years[1],[2]. (A capacitor with specification of 5000 hours at 105˚C ambient temperature is adapted.)

[1]: Ambient temperature : annual average 40˚C (free from corrosive gas, flammable gas, oil mist, dust and dirt) Since the design life is a calculated value, it is not a guaranteed value.
[2]: Output current : 80% of the inverter rated current

• Life indication of life components

| Components | Guideline of the FR-E700 Life | Guideline of JEMA[3] |
|---|---|---|
| Cooling fan | 10 years | 2 to 3 years |
| Main circuit smoothing capacitor | 10 years | 5 years |
| Printed board smoothing capacitor | 10 years | 5 years |

[3]: Excerpts from "Periodic check of the transistorized inverter" of JEMA (Japan Electrical Manufacturer's Association)

### (2) Most advanced life check

• Degrees of deterioration of main circuit capacitor, control circuit capacitor, and inrush current limit circuit can be monitored.
• Trouble can be avoided with the self-diagnostic alarm[4] that is output when the life span is near.

[4]: Any one of main circuit capacitor, control circuit capacitor, inrush current limit circuit or cooling fan reaches the output level, an alarm is output.
Capacity of the main circuit capacitor can be measured by setting parameter at a stop and turning the power from off to on. Measuring the capacity enables an alarm to be output.

### (3) Easy replacement of cooling fan

A cooling fan is provided on top of the inverter of all capacities requiring a cooling fan (1.5K to 15K).
A cooling fan can be easily replaced without disconnecting main circuit wires.

### (4) Combed shaped wiring cover

Since a wiring cover can be fitted after wiring, wiring work is easily done.

### (5) Removable control terminal block

Wiring of the control circuit when replacing the same series inverter can be done by changing the terminal card.

## ⑥ Environment-friendly

**Human and environment-friendly inverter**

### (1) EU restriction of the use of certain hazardous substances (RoHS) directive compliance

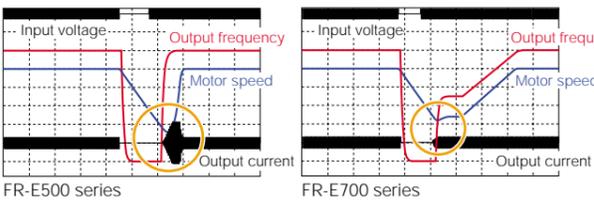Human and environment-friendly inverter in compliant with RoHS Directive

### (2) Filter option (to be released soon)

• The inverter with filter pack (a package of power factor improving DC reactor, common mode core and capacitive filter) conforms to the Japanese harmonic suppression guideline.
• The inverter itself can comply with the EMC Directive (2nd Environment) with the newly developed noise filter (EMC filter).

## ⑦ Full of useful functions

**Enhanced functions for all sorts of applications**

• Automatic restart after instantaneous power failure function with frequency search

Input voltage ··· Output frequency ··· Motor speed ··· Output current
FR-E500 series

Input voltage ··· Output frequency ··· Motor speed ··· Output current
FR-E700 series

Detection of coasting speed (frequency search function) prevents the motor speed from decreasing at a restart, starting the motor smoothly with less output current.

• Power-failure deceleration stop function/operation continuation at instantaneous power failure function
The motor can be decelerated to a stop when a power failure or undervoltage occurred to prevent the motor from coasting. For fail-safe of machine tool, etc., it is effective to stop the motor when a power failure has occurred.
With the newly adapted operation continuation at instantaneous power failure function, the motor continues running without coasting even if an instantaneous power failure occurs during operation.

*: The inverter may trip and the motor may coast depending on the load condition.

• Brake sequence mode·························· For mechanical brake control of the lift
• Regeneration avoidance function ············· Regenerative overvoltage is less likely to occur in the pressing machine.
• Optimum excitation control····················· More energy saving is possible with the maximum motor efficiency control.
• Main circuit power supply DC input·········· DC power supply can be connected.
• Enhanced I/O terminal function················ Analog input (voltage/current) can be switched.
and so on

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Peripheral Devices
Standard Specifications
Outline Dimension Drawings
Terminal Connection Diagram Terminal Specification Explanation
Operation panel Parameter unit FR Configurator
Parameter List
Explanations of Parameters
Protective Functions
Options
Instructions
Motor
Compatibility
Warranty
Inquiry

## Lineup

**FR-E720☐☐-0.1K-☐**

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

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

| Symbol | Inverter Capacity |
|---|---|
| 0.1K to 15K | Represents the inverter capacity "kW". |

| Symbol | Protective Structure |
|---|---|
| None | Enclosed-type structure IP20 |
| C | Totally enclosed structure IP40 |

| Inverter Type | Inverter Capacity | 0.1K | 0.2K | 0.4K | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | 11K | 15K |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Three-phase 200V FR-E720-☐☐ | Enclosed-type structure (IP20) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Totally enclosed structure (IP40) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Three-phase 400V FR-E740-☐☐ | Enclosed-type structure (IP20) | — | — | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | Totally enclosed structure (IP40) | — | — | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Single-phase 200V FR-E720S-☐☐* | Enclosed-type structure (IP20) | ○ | ○ | ○ | ○ | ○ | ○ | — | — | — | — | — |
| Single-phase 100V FR-E710W-☐☐* | Enclosed-type structure (IP20) | ○ | ○ | ○ | ○ | — | — | — | — | — | — | — |

*:Output of the single-phase 200V and single-phase 100V input specifications is three-phase 200V.

●:Available models　○:Models to be released　—:Not available

c ®UL US LISTED　CE

Complies with UL, cUL, EN (LVD) standards

## Connection with Peripheral Devices

**Three-phase AC power supply**
Use within the permissible power supply specifications of the inverter.

**Moulded case circuit breaker (MCCB) or earth leakage current breaker (ELB), fuse**
The breaker must be selected carefully since an in-rush current flows in the inverter at power on.

**Magnetic contactor (MC)**
Install the magnetic contactor to ensure safety. Do not use this magnetic contactor to start and stop the inverter. Doing so will cause the inverter life to be shorten.

**Reactor (FR-HAL, FR-HEL option)**
Reactors (option) must be used when power harmonics measures are taken, the power factor is to be improved or the inverter is installed near a large power supply system (500kVA or more). The inverter may be damaged if you do not use reactors. Select the reactor according to the model. Remove the jumpers across terminals P/+ - P1 to connect the DC reactor.

**Parameter unit (FR-PU07)**
By connecting the connection cable (FR-CB2) to the PU connector, operation can be performed from FR-PU07.

**USB connector**
A personal computer and an inverter can be connected with a USB (Ver1.1) cable.

**AC reactor (FR-HAL)**

**DC reactor (FR-HEL)**

**Brake resistor (FR-ABR, MRS, MYS)**
Braking capability can be improved. (0.4K or more)

P/+
PR

P/+ P1　R/L1 S/L2 T/L3　P/+ N/-　Earth (Ground)　U V W

**Noise filter (FR-BSF01, FR-BLF)**
Install a noise filter to reduce the electromagnetic noise generated from the inverter. Effective in the range from about 1MHz to 10MHz. When more wires are passed through, a more effective result can be obtained. A wire should be wound four turns or more.

**Radio noise filter (FR-BIF)**
Reduces the radio noise.

**Noise filter (FR-BSF01, FR-BLF)**
Install a noise filter to reduce the electromagnetic noise generated from the inverter. Effective in the range from about 1MHz to 10MHz. A wire should be wound four turns at a maximum.

**Motor**

**Earth (Ground)**

**Brake unit (FR-BU2)**

P/+ PR
P/+
PR

**High power factor converter (FR-HC)**
Power supply harmonics can be greatly suppressed. Install this as required.

**Power regeneration common converter (FR-CV)**
Great braking capability is obtained. Install this as required.

**Register unit (FR-BR) Discharging register (GZG, GRZG)**
The regenerative braking capability of the inverter can be exhibited fully. Install this as required.

**Devices connected to the output**
Do not install a power factor correction capacitor, surge suppressor or radio noise filter on the output side of the inverter. When installing a moulded case circuit breaker on the output side of the inverter, contact each manufacturer for selection of the moulded case circuit breaker.

**Earth (Ground)**
To prevent an electric shock, always earth (ground) the motor and inverter. For reduction of induction noise from the power line of the inverter, it is recommended to wire the earth (ground) cable by returning it to the earth (ground) terminal of the inverter.

## Rating

● **Three-phase 200V power supply**

| Type FR-E720-□K(-C) *7 | 0.1 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Applicable motor capacity (kW) *1 | 0.1 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
| Output / Rated capacity (kVA) *2 | 0.3 | 0.6 | 1.2 | 2.0 | 3.2 | 4.4 | 7.0 | 9.5 | 13.1 | 18.7 | 23.9 |
| Output / Rated current (A) *6 | 0.8 (0.8) | 1.5 (1.4) | 3 (2.5) | 5 (4.1) | 8 (7) | 11 (10) | 17.5 (16.5) | 24 (23) | 33 (31) | 47 (44) | 60 (57) |
| Output / Overload current rating *3 | 150% 60s, 200% 3s (inverse time characteristics) | | | | | | | | | | |
| Output / Voltage *4 | Three-phase 200 to 240V | | | | | | | | | | |
| Power supply / Rated input AC voltage/frequency | Three-phase 200 to 240V 50Hz/60Hz | | | | | | | | | | |
| Power supply / Permissible AC voltage fluctuation | 170 to 264V 50Hz/60Hz | | | | | | | | | | |
| Power supply / Permissible frequency fluctuation | ±5% | | | | | | | | | | |
| Power supply / Power supply capacity (kVA) *5 | 0.4 | 0.8 | 1.5 | 2.5 | 4.5 | 5.5 | 9 | 12 | 17 | 20 | 28 |
| Protective structure (JEM1030) | Enclosed type (IP20). IP40 for totally enclosed structure series. | | | | | | | | | | |
| Cooling system | Self-cooling | | | | Forced air cooling | | | | | | |
| Approximate mass (kg) | 0.5 | 0.5 | 0.7 | 1.0 | 1.4 | 1.4 | 1.7 | 4.3 | 4.3 | 9.0 | 9.0 |

*1    The applicable motor capacity indicated is the maximum capacity applicable for use of the Mitsubishi 4-pole standard motor.

*2    The rated output capacity indicated assumes that the output voltage is 230V.

*3    The % value of the overload current rating indicated is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the temperatures under 100% load.

*4    The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. However, the pulse voltage value of the inverter output side voltage remains unchanged at about $\sqrt{2}$ that of the power supply.

*5    The power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).

*6    Setting 2kHz or more in *Pr. 72 PWM frequency selection* to perform low acoustic noise operation in the ambient temperature exceeding 40°C (totally-enclosed structure is 30°C), the rated output current is the value in parenthesis.

*7    Totally enclosed structure series ends with -C.

## Common specifications

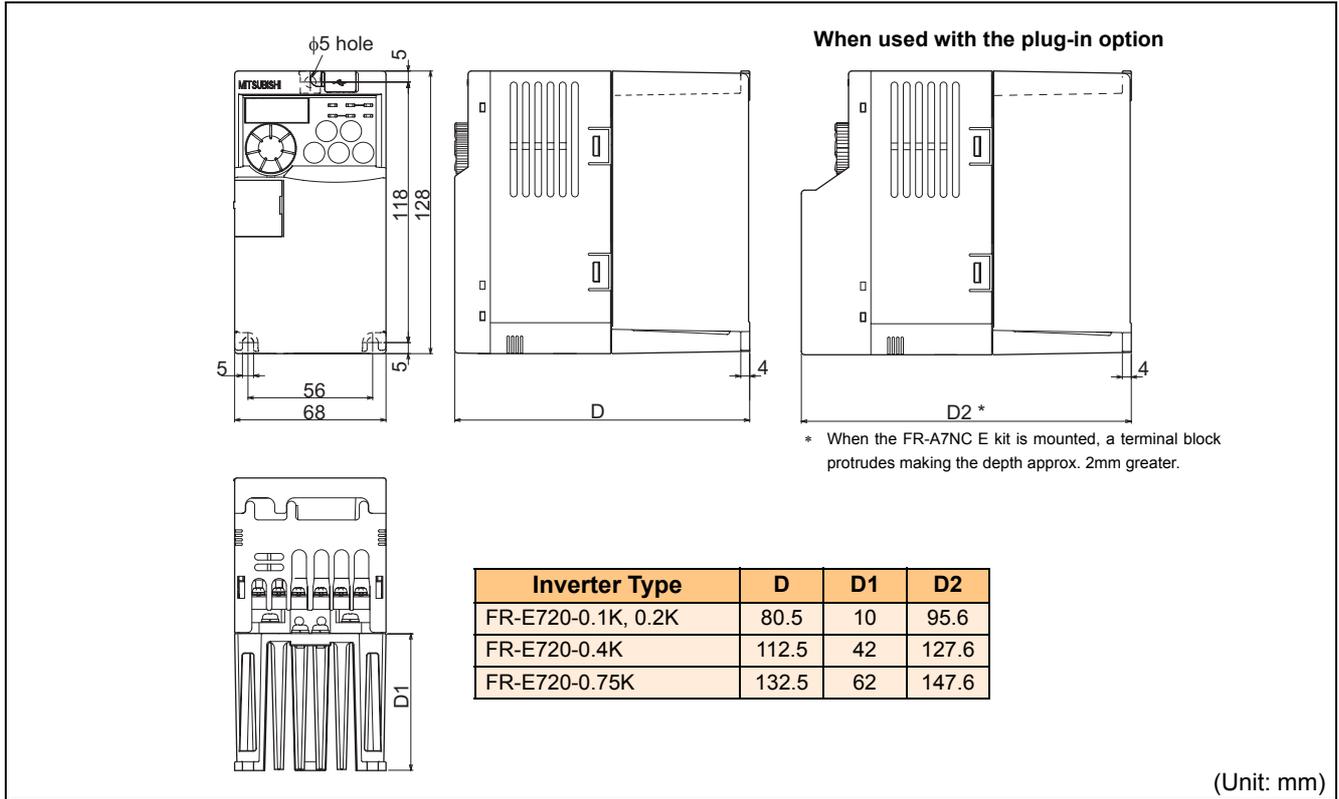| | | | |
|---|---|---|---|
| **Control specifications** | **Control method** | | Soft-PWM control/high carrier frequency PWM control (V/F control, advanced magnetic flux vector control, general-purpose magnetic flux vector control, optimum excitation control can be selected) |
| | **Output frequency range** | | 0.2 to 400Hz |
| | **Frequency setting resolution** | **Analog input** | 0.06Hz/60Hz (terminal2, 4: 0 to 10V/10bit)<br>0.12Hz/60Hz (terminal2, 4: 0 to 5V/9bit)<br>0.06Hz/60Hz (terminal4: 4 to 20mA/10bit) |
| | | **Digital input** | 0.01Hz |
| | **Frequency accuracy** | **Analog input** | Within ±0.5% of the max. output frequency (25°C ±10°C) |
| | | **Digital input** | Within 0.01% of the set output frequency |
| | **Voltage/frequency characteristics** | | Base frequency can be set from 0 to 400Hz<br>Constant torque/variable torque pattern can be selected |
| | **Starting torque** | | 200% or more (at 0.5Hz)...when advanced magnetic flux vector control is set (3.7K or less) |
| | **Torque boost** | | Manual torque boost |
| | **Acceleration/deceleration time setting** | | 0.01 to 360s, 0.1 to 3600s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode can be selected. |
| | **DC injection brake** | | Operation frequency (0 to 120Hz), operation time (0 to 10s), operation voltage (0 to 30%) variable |
| | **Stall prevention operation level** | | Operation current level can be set (0 to 200% adjustable), whether to use the function or not can be selected |
| **Operation specifications** | **Frequency setting signal** | **Analog input** | Two points<br>Terminal 2: 0 to 10V, 0 to 5V can be selected<br>Terminal 4: 0 to 10V, 0 to 5V, 4 to 20mA can be selected |
| | | **Digital input** | Entered from operation panel and parameter unit |
| | **Start signal** | | Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected. |
| | **Input signal** | | Seven points<br>You can select from among multi-speed selection, remote setting, stop-on contact selection, second function selection, terminal 4 input selection, JOG operation selection, PID control valid terminal, brake opening completion signal, external thermal input, PU-external operation switchover, V/F switchover, output stop, start self-holding selection, forward rotation, reverse rotation command, inverter reset, PU-NET operation switchover, external-NET operation switchover, command source switchover, inverter operation enable signal, and PU operation external interlock |
| | **Operational functions** | | Maximum/minimum frequency setting, frequency jump operation, external thermal relay input selection, automatic restart after instantaneous power failure operation, forward/reverse rotation prevention, remote setting, brake sequence, second function, multi-speed operation, stop-on contact control, droop control, regeneration avoidance, slip compensation, operation mode selection, offline auto tuning function, PID control, computer link operation (RS-485) |
| | **Output signal** **Output signal points** | **Open collector output** | Two points |
| | | **Relay output** | One point |
| | | **Operating status** | You can select from among inverter operation, up-to-frequency, overload alarm, output frequency detection, regenerative brake prealarm, electronic thermal relay function prealarm, inverter operation ready, output current detection, zero current detection, PID lower limit, PID upper limit, PID forward/reverse rotation output, brake opening request, fan alarm, heatsink overheat pre-alarm, deceleration at an instantaneous power failure, PID control activated, during retry, life alarm, current average value monitor, remote output, minor failure output, alarm output, alarm output 3, and maintenance timer alarm |
| | **For meter Output points** | **Pulse output** | MAX 2.4kHz: one point |
| | | **For meter** | You can select from among output frequency, motor current (steady), output voltage, frequency setting, motor torque, converter output voltage, regenerative brake duty, electronic thermal relay function load factor, output current peak value, converter output voltage peak value, reference voltage output, motor load factor, PID set point, PID measured value, output power<br>Pulse train output (1440 pulses/s/full scale) |
| **Indication** | **Operation panel Parameter unit (FR-PU07)** | **Operating status** | You can select from among output frequency, motor current (steady), output voltage, frequency setting, cumulative energization time, actual operation time, motor torque, converter output voltage, regenerative brake duty, electronic thermal relay function load factor, output current peak value, converter output voltage peak value, motor load factor, PID set point, PID measured value, PID deviation, inverter I/O terminal monitor, I/O terminal option monitor, output power, and cumulative power |
| | | **Alarm definition** | Alarm definition is displayed when the protective function is activated and the past 8 alarm definitions (output voltage/current/frequency/cumulative energization time right before the protective function was activated) are stored |
| | **Additional display by the parameter unit (FR-PU04/FR-PU07) only** | **Operating status** | Not used |
| | | **Alarm definition** | Output voltage/current/frequency/cumulative energization time immediately before protective function is activated |
| | | **Interactive guidance** | Function (help) for operation guide |
| | **Protective/warning function** | | <Protective functions><br>Overcurrent during acceleration, overcurrent during constant speed, overcurrent during deceleration, overvoltage during acceleration, overvoltage during constant speed, overvoltage during deceleration, inverter protection thermal operation, motor protection thermal operation, heatsink overheat, input phase failure, output side earth (ground) fault overcurrent, output phase failure, external thermal relay operation, option alarm, parameter error, PU disconnection, retry count excess, CPU alarm, brake transistor alarm, inrush resistance overheat, communication error, analog input error, USB communication error, brake sequence error 4 to 7<br><Warning functions><br>Fan alarm∗2, overcurrent stall prevention, overvoltage stall prevention, PU stop, parameter write error, regenerative brake prealarm, electronic thermal relay function prealarm, maintenance output, undervoltage |
| **Environment** | **Ambient temperature** | | -10°C to +50°C (non-freezing) (-10°C to +40°C for totally-enclosed structure feature) ∗3 |
| | **Ambient humidity** | | 90%RH maximum (non-condensing) |
| | **Storage temperature**∗1 | | -20°C to +65°C |
| | **Atmosphere** | | Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt etc.) |
| | **Altitude/vibration** | | Maximum 1000m above sea level, 5.9m/s² or less |

∗1　Temperatures applicable for a short time, e.g. in transit.

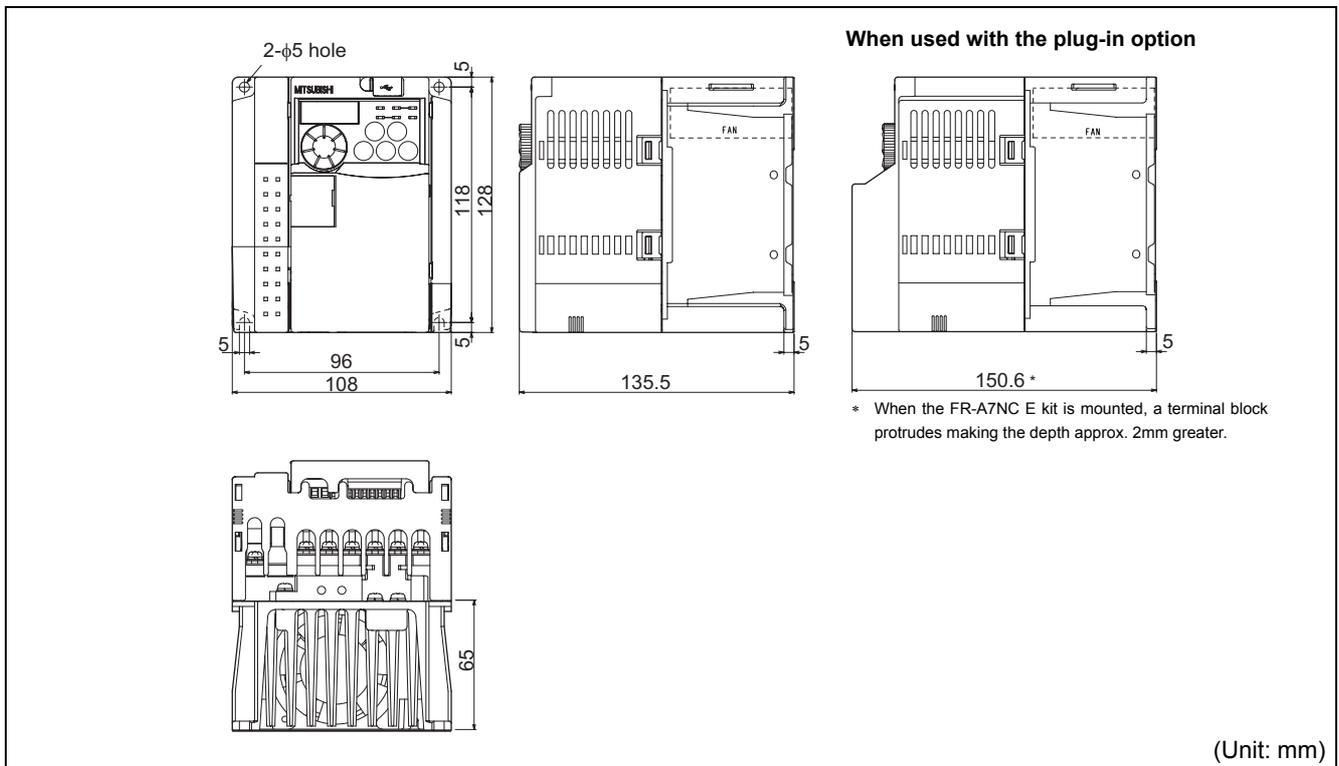∗2　As the FR-E720-0.75K or less is not provided with the cooling fan, this alarm does not function.

∗3　When using the inverters at the ambient temperature of 40°C or less, the inverters can be installed closely attached (0cm clearance).
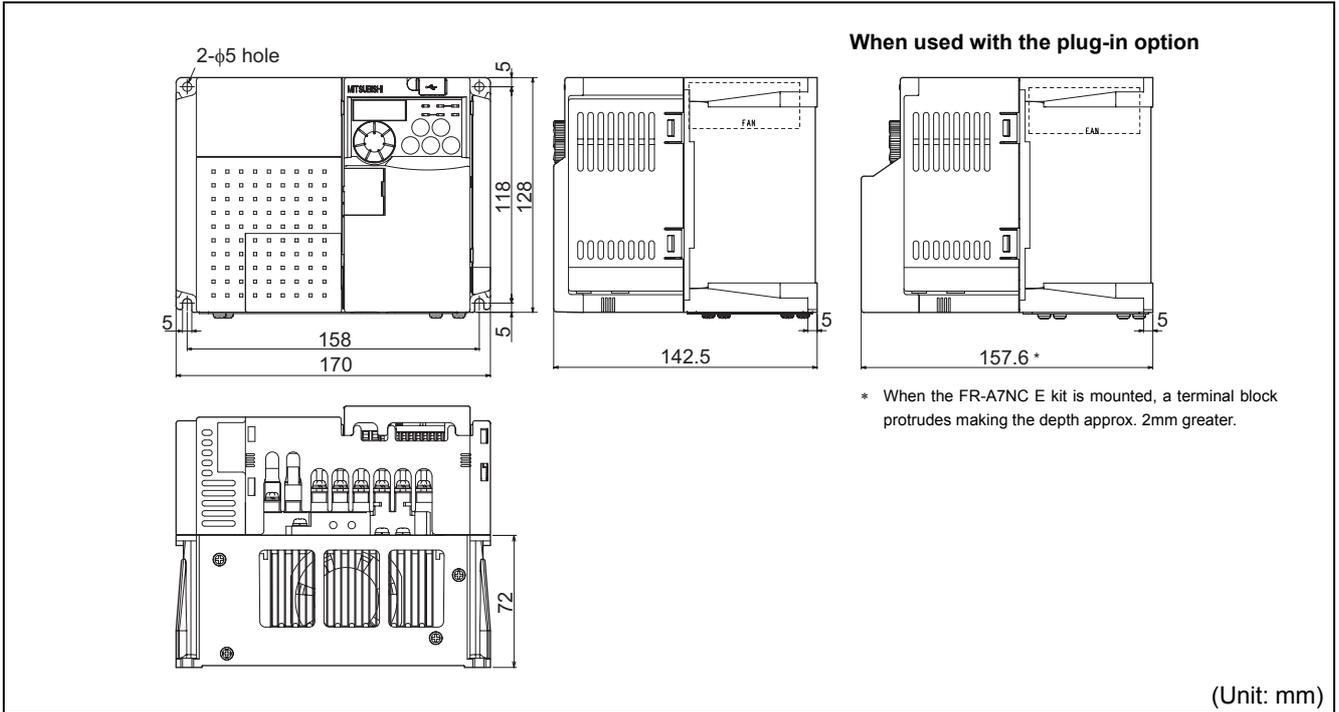
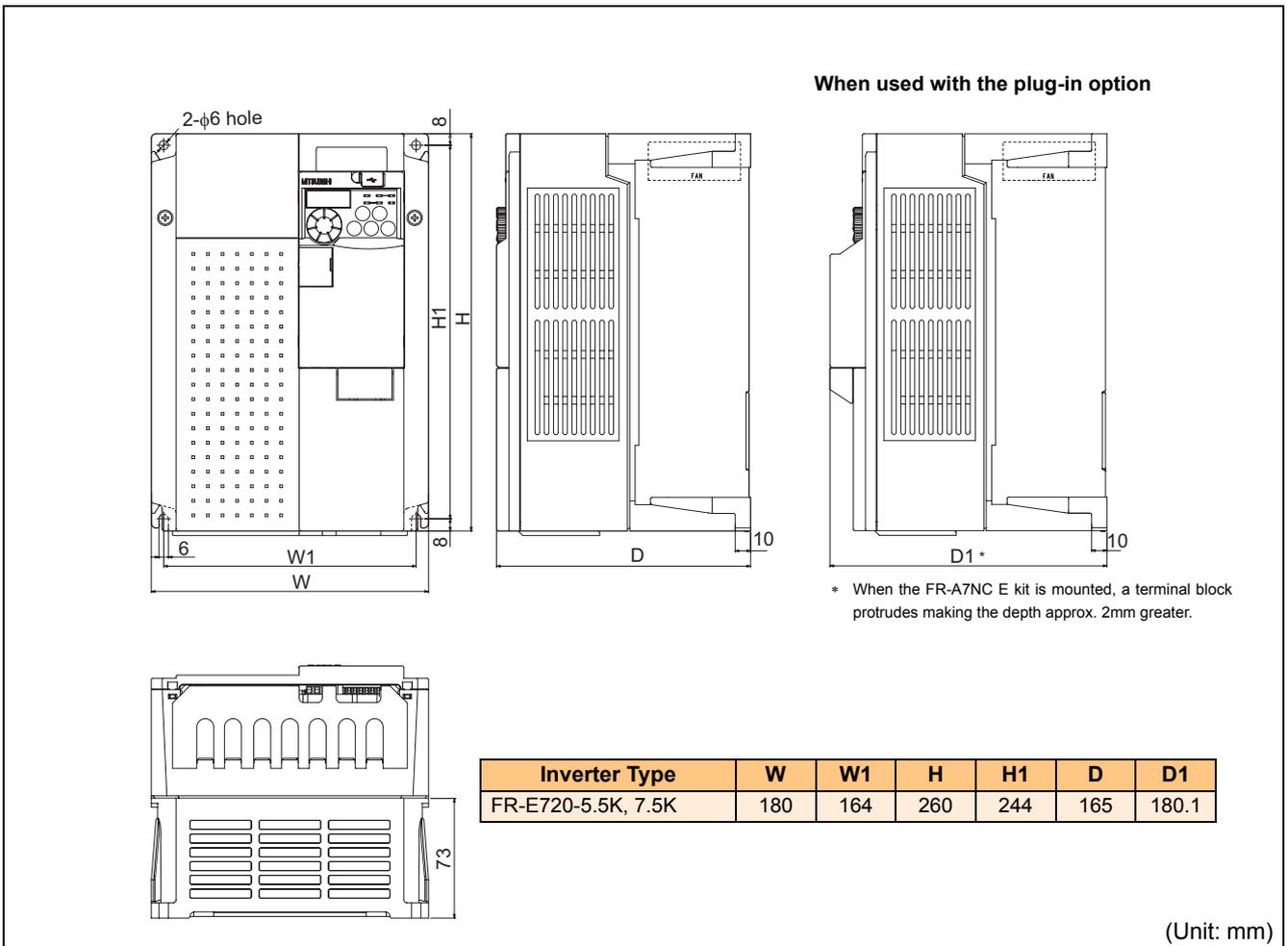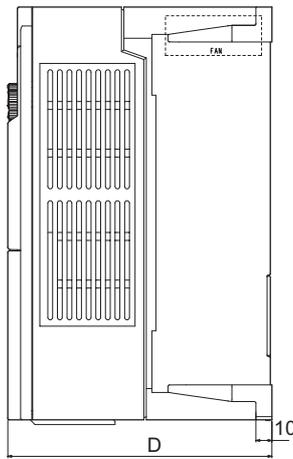# Outline Dimension Drawings

● FR-E720-0.1K, 0.2K, 0.4K, 0.75K

φ5 hole

5

118

128

5

5

56

68

D

4

**When used with the plug-in option**

D2 *

4
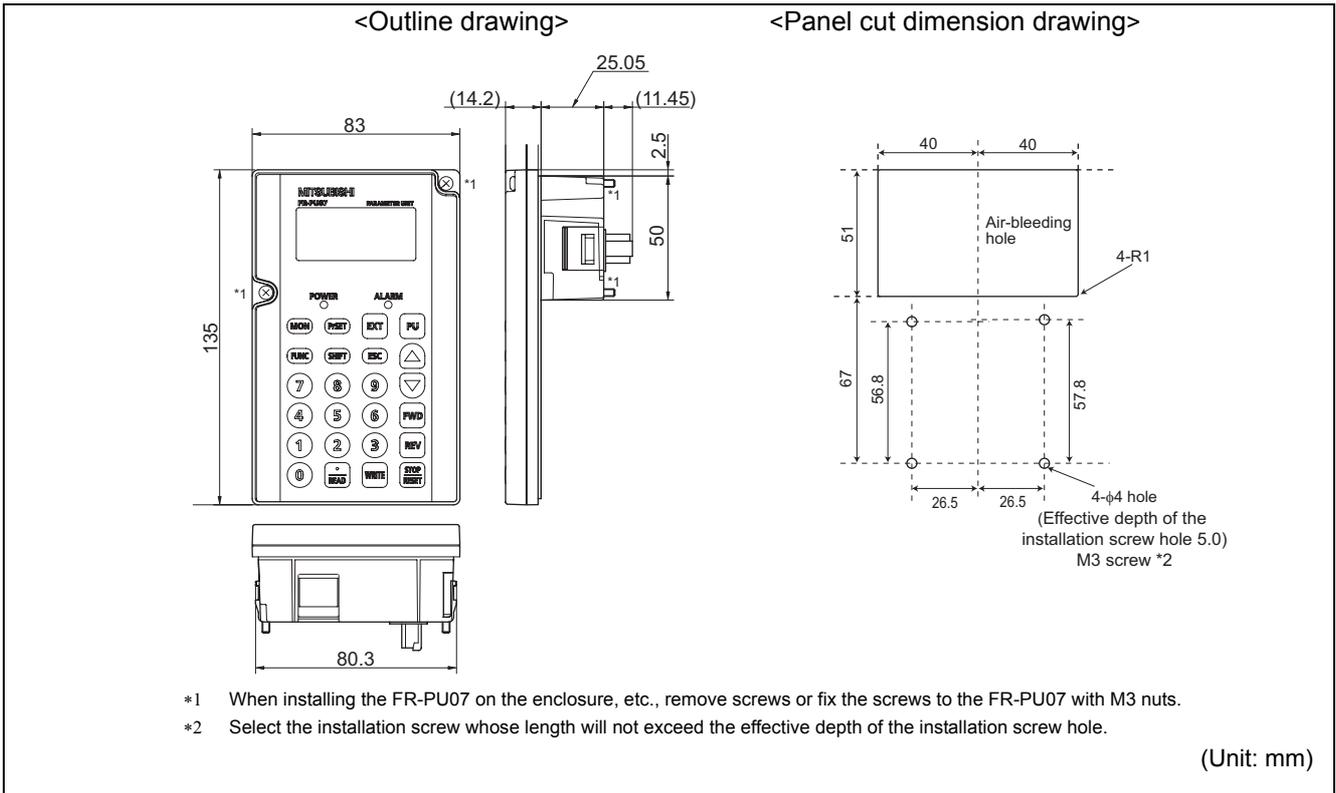
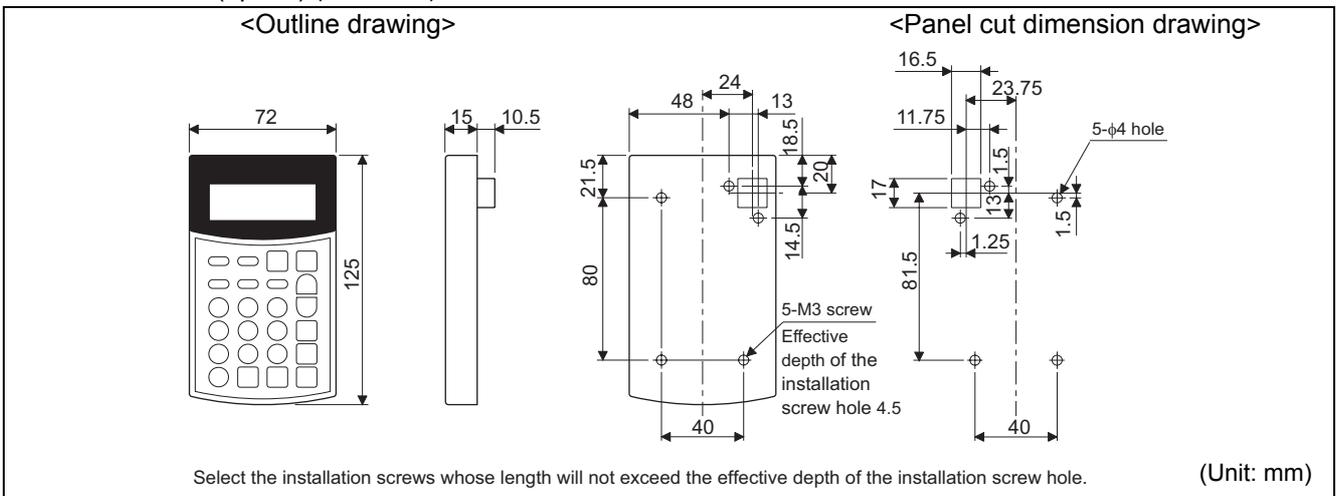∗ When the FR-A7NC E kit is mounted, a terminal block protrudes making the depth approx. 2mm greater.

D1

| Inverter Type | D | D1 | D2 |
|---|---|---|---|
| FR-E720-0.1K, 0.2K | 80.5 | 10 | 95.6 |
| FR-E720-0.4K | 112.5 | 42 | 127.6 |
| FR-E720-0.75K | 132.5 | 62 | 147.6 |

(Unit: mm)

● FR-E720-1.5K, 2.2K

2-φ5 hole

5

118

128

5

5

96

108

135.5

5

**When used with the plug-in option**

FAN

FAN

150.6 *

5

∗ When the FR-A7NC E kit is mounted, a terminal block protrudes making the depth approx. 2mm greater.

65

(Unit: mm)

● FR-E720-3.7K



2-φ5 hole

**When used with the plug-in option**

118
128
5
5
158
170
142.5
157.6 *
5
72

∗ When the FR-A7NC E kit is mounted, a terminal block protrudes making the depth approx. 2mm greater.

(Unit: mm)

● FR-E720-5.5K, 7.5K



2-φ6 hole

**When used with the plug-in option**

8
H1
H
6
W1
8
W
D
10
D1 *
10
73

∗ When the FR-A7NC E kit is mounted, a terminal block protrudes making the depth approx. 2mm greater.

| Inverter Type | W | W1 | H | H1 | D | D1 |
|---|---|---|---|---|---|---|
| FR-E720-5.5K, 7.5K | 180 | 164 | 260 | 244 | 165 | 180.1 |

(Unit: mm)

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●FR-E720-11K, 15K
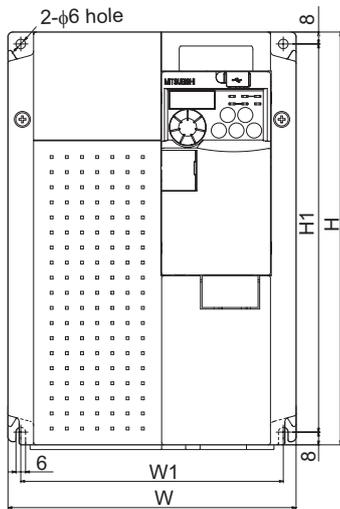
**When used with the plug-in option**
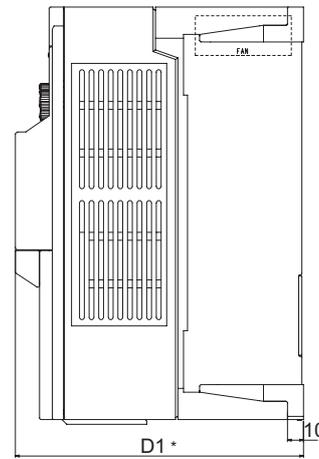
2-φ6 hole

∗ When the FR-A7NC E kit is mounted, a terminal block protrudes making the depth approx. 2mm greater.
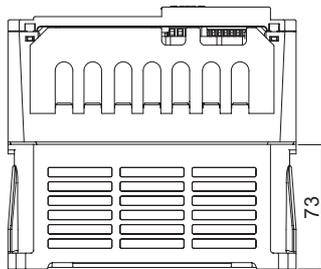
| Inverter Type | W | W1 | H | H1 | D | D1 |
|---|---|---|---|---|---|---|
| FR-E720-11K, 15K | 220 | 195 | 260 | 244 | 190 | 205.1 |

(Unit: mm)

● Parameter unit (option) (FR-PU07)

<Outline drawing>       <Panel cut dimension drawing>



∗1   When installing the FR-PU07 on the enclosure, etc., remove screws or fix the screws to the FR-PU07 with M3 nuts.

∗2   Select the installation screw whose length will not exceed the effective depth of the installation screw hole.

(Unit: mm)

● Parameter unit (option) (FR-PU04)

<Outline drawing>       <Panel cut dimension drawing>



Select the installation screws whose length will not exceed the effective depth of the installation screw hole.

(Unit: mm)

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Sink logic
◎ Main circuit terminal
○ Control circuit terminal

*1. DC reactor (FR-HEL)
When connecting a DC reactor, remove the jumper across P1-P/+

Brake unit (Option)

*6 A brake transistor is not built-in to the 0.1K and 0.2K.

*7 Brake resistor (FR-ABR, MRS, MYS type) Install a thermal relay to prevent an overheat and burnout of the brake resistor. (The brake resistor can not be connected to the 0.1K and 0.2K.)

Earth (Ground)

Jumper   P1   P/+   PR   N/-   *6

Three-phase AC power supply   MCCB   MC

R/L1
S/L2
T/L3

Earth (Ground)

Motor

U
V
W

IM

Earth (Ground)

**Main circuit**

**Control circuit**

**Standard control terminal block**

Control input signals (No voltage input allowed)

Terminal functions vary with the input terminal assignment (*Pr. 178 to Pr. 184*)

Forward rotation start
Reverse rotation start

STF
STR
RH
RM
RL
MRS
RES
SD

High speed
Middle speed
Low speed

Multi-speed selection

*2 When using terminals PC-SD as a 24VDC power supply, take care not to short across terminals PC-SD.

Output stop
Reset

Contact input common

24VDC power supply (Common for external power supply transistor)

PC *2

SOURCE  SINK

C
B
A

Relay output (Alarm output)

Relay output

Terminal functions vary by *Pr. 192* A,B,C terminal function selection

RUN
FU
SE

Running

Frequency detection

Terminal functions vary with the output terminal assignment (*Pr. 190 and Pr. 191*)

Open collector output

Open collector output common
Sink/source common

Frequency setting signals (Analog)

*3 Terminal input specifications can be changed by analog input specifications switchover (*Pr. 73*).

*4 Terminal input specifications can be changed by analog input specifications switchover (*Pr. 267*). Set the voltage/current input switch in the "**V**" position to select voltage input (0 to 5V/0 to10V) and "**I**" (initial value) to select current input (4 to 20mA).

*5 It is recommended to use 2W1kΩ when the frequency setting signal is changed frequently.

Frequency setting potentiometer 1/2W1kΩ *5

Terminal 4 input (Current input)

3
2
1
(+)
(-)

10(+5V)

2  0 to 5VDC  *3
(0 to 10VDC)

5(Analog common)

4  4 to 20mADC
( 0 to 5VDC
0 to 10VDC )  *4

I ▭ V
Voltage/current input switch  *4

Calibration resistor

FM
SD

*8

Indicator (Frequency meter, etc.)

Moving-coil type 1mA full-scale

*8 It is not necessary when calibrate the indicator from the operation panel.

PU connector

USB connector

Connector for plug-in option connection

Option connector

**Note**
- To prevent a malfunction caused by noise, separate the signal cables more than 10cm from the power cables.
- After wiring, wire offcuts must not be left in the inverter.
  Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take care not to allow chips and other foreign matter to enter the inverter.

# Terminal Specification Explanation

| Type | Terminal Symbol | Terminal Name | Description | |
|---|---|---|---|---|
| **Main circuit** | R/L1, S/L2, T/L3 | AC power input | Connect to the commercial power supply. Keep these terminals open when using the high power factor converter (FR-HC) or power regeneration common converter (FR-CV). | |
| | U, V, W | Inverter output | Connect a three-phase squirrel-cage motor. | |
| | P/+, PR | Brake resistor connection | Connect a brake transistor (MRS, MYS, FR-ABR) across terminals P/+-PR. (The brake resistor can not be connected to the 0.1K or 0.2K) | |
| | P/+, N/- | Brake unit connection | Connect the brake unit (FR-BU2), power regeneration common converter (FR-CV) or high power factor converter (FR-HC). | |
| | P/+, P1 | DC reactor connection | Remove the jumper across terminals P/+-P1 and connect a DC reactor. | |
| | ⏚ | Earth (Ground) | For earthing (grounding) the inverter chassis. Must be earthed (grounded). | |
| **Control circuit/input signal** — Contact input | STF | Forward rotation start | Turn on the STF signal to start forward rotation and turn it off to stop. | When the STF and STR signals are turned on simultaneously, the stop command is given. |
| | STR | Reverse rotation start | Turn on the STR signal to start reverse rotation and turn it off to stop. | |
| | RH, RM, RL | Multi-speed selection | Multi-speed can be selected according to the combination of RH, RM and RL signals. | |
| | MRS | Output stop | Turn on the MRS signal (20ms or more) to stop the inverter output. Use to shut off the inverter output when stopping the motor by electromagnetic brake. | |
| | RES | Reset | Used to reset alarm output provided when protective circuit is activated. Turn on the RES signal for more than 0.1s, then turn it off. Initial setting is for reset always. By setting *Pr. 75*, reset can be set to enabled only at an inverter alarm occurrence. Recover about 1s after reset is cancelled. | |
| | SD | Contact input common (Sink) | Common terminal for contact input terminal (sink logic) and terminal FM. Common output terminal for 24VDC 0.1A power supply (PC terminal). Isolated from terminals 5 and SE. | |
| | PC | External transistor common, 24VDC power supply, contact input common (source) | When connecting the transistor output (open collector output), such as a programmable controller (PLC), when sink logic is selected, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents. Can be used as 24VDC 0.1A power supply. When source logic has been selected, this terminal serves as a contact input common. | |
| Frequency setting | 10 | Frequency setting power supply | Used as power supply when connecting potentiometer for frequency setting (speed setting) from outside of the inverter. | 5.2VDC ± 0.2V permissible load current 10mA |
| | 2 | Frequency setting (voltage) | Inputting 0 to 5VDC (or 0 to 10V) provides the maximum output frequency at 5V (10V) and makes input and output proportional. Use *Pr. 73* to switch between input 0 to 5VDC (initial setting) and 0 to 10VDC input. | Input resistance 10kΩ ± 1kΩ Permissible maximum voltage 20VDC |
| | 4 | Frequency setting (current) | Inputting 0 to 20mADC (or 0 to 5V / 0 to 10V) provides the maximum output frequency at 20mA makes input and output proportional. This input signal is valid only when the AU signal is on (terminal 2 input is invalid). Use *Pr. 267* to switch from among input 4 to 20mA (initial setting), 0 to 5VDC and 0 to 10VDC. Set the voltage/current input switch in the "V" position to select voltage input (0 to 5V/0 to 10V). | Voltage input: Input resistance 10kΩ ± 1kΩ Permissible maximum voltage 20VDC Current input: Input resistance 233Ω ± 5Ω Maximum permissible current 30mA. |
| | 5 | Frequency setting common | Common terminal for the frequency setting signals (terminals 2 or 4). Do not earth (ground). | |
| **Control circuit/output signal** — Relay | A, B, C | Relay output (fault output) | 1 changeover contact output indicates that the inverter fault occurs. Fault: discontinuity across B-C (continuity across A-C), Normal: continuity across B-C (discontinuity across A-C) Contact capacity 230VAC 0.3A (power factor = 0.4) 30VDC 0.3A | |
| Open collector | RUN | Inverter running | Switched low when the inverter output frequency is equal to or higher than the starting frequency (initial value 0.5Hz). Switched high during stop or DC injection brake operation.*1 | Permissible load 24VDC (Maximum 27VDC) 0.1A (a voltage drop is 3.4V maximum when the signal is on) |
| | FU | Frequency detection | Switched low when the inverter output frequency is equal to or higher than the preset detected frequency and high when less than the preset detected frequency.*1 | |
| | SE | Open collector output common | Common terminal of terminal RUN and FU. | |
| Pulse | FM | For meter | Select one e.g. output frequency from monitor items.*2 The output signal is proportional to the magnitude of the corresponding monitoring item. | Permissible load current 1mA 1440 pulses/s at 60Hz |
| **Communication** | — | PU connector | With the PU connector, RS-485 communication can be made. · Conforming standard: EIA-485 (RS-485) · Transmission format: Multi-drop link · Communication speed: 4800 to 38400bps · Overall extension: 500m | |
| | — | USB connector | The FR Configurator can be operated by connecting the inverter to the personal computer through USB. · Interface: conforms to USB1.1 · Transmission Speed: 12Mbps · Connector: USB connector (Mini-B receptacle) | |

*1 Low indicates that the open collector output transistor is on (conducts).
   High indicates that the transistor is off (does not conduct).
*2 Not output during inverter reset.

**Note**
- Set *Pr. 267* and a voltage/current input switch correctly, then input an analog signal in accordance with the setting. Applying a voltage with voltage/current input switch in "I" position (current input is selected) or a current with switch in "V" position (voltage input is selected) could cause component damage of the inverter or analog circuit of output devices.
- The inverter will be damaged if power is applied to the inverter output terminals (U, V, W). Never perform such wiring.
- ▯ indicates that terminal functions can be selected using *Pr. 178* to *Pr. 192 (I/O terminal function selection)*.
- Terminal names and terminal functions are those of the factory set.

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**The operation panel cannot be removed from the inverter.**

**Operation mode indication**
PU: Lit to indicate PU operation mode.
EXT: Lit to indicate external operation mode.
NET: Lit to indicate network operation mode.

**Unit indication**
Hz: Lit to indicate frequency.
A Lit to indicate current.
(Off to indicate voltage and flicker to indicate set frequency monitor.)

**Monitor (4-digit LED)**
Shows the frequency, parameter number, etc.

**Setting dial**
(Setting dial: Mitsubishi inverter dial)
Used to change the frequency setting and parameter values.
Press to display the following.
• Displays the set frequency in the monitor mode
• Currently set value is displayed during calibration
• Displays the order in the error history mode

**Mode switchover**
Used to change each setting mode.

Pressing (PU/EXT) simultaneously changes the operation mode.
Pressing for a while (2s) can lock operation.

**Determination of each setting**
If pressed during operation, monitor changes as below;

Running frequency
↓
Output current
↓
Output voltage
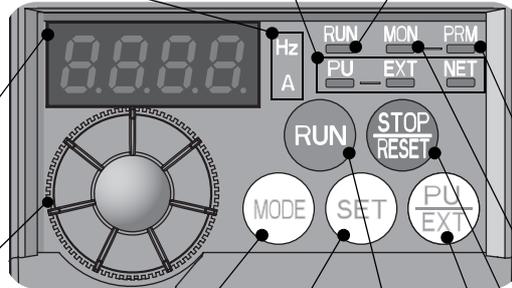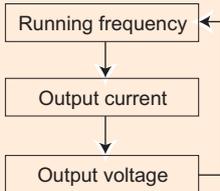
**Operating status display**
Lit or flicker during inverter operation. *
* On: Indicates that forward rotation operation is being performed.
Slow flickering (1.4s cycle): Reverse rotation operation
Fast flickering (0.2s cycle): Indicates that operation is not being performed but the (RUN) was pressed or the start command was given.
When the start command is given and the frequency command is less than the starting frequency.

**Parameter setting mode**
Lit to indicate parameter setting mode.

**Monitor indication**
Lit to indicate monitoring mode.

**Stop operation**
Alarms can be reset

**Operation mode switchover**
Used to switch between the PU and external operation mode.
When using the external operation mode (operation using a separately connected frequency setting potentiometer and start signal), press this key to light up the EXT indication.

(Press (MODE) simultanesouly (0.5s) or change *Pr. 79* setting to change to combined mode .)
PU: PU operation mode
EXT: External operation mode
Cancels PU stop also.

**Start command**
The rotation direction can be selected by setting *Pr. 40*.

# Basic operation of the operation panel

## Operation mode switchover

**At powering on (external operation mode)**



`0.00` Hz MON EXT

PU/EXT

**PU Jog operation mode**

`JOG` Hz MON PU

### Monitor/frequency setting

`0.00` Hz MON PU

**PU operation mode
(output frequency monitor)**

MODE/SET

Value change `60.00`

SET

(Example)
`F      60.00`

$F$ and frequency flicker.
Frequency setting has been
written and completed!!

SET `0.00` A

**Output current monitor**

SET `0.0`

**Output voltage monitor**

SET

### Parameter setting

`P. 0` PRM PU

**Parameter setting mode**

`P. 79`

SET `0`

Display the
current setting

`2`

Value change

SET

(Example)
`2    P. 79`

Parameter and a setting value
flicker alternately.
Parameter write is completed!!

MODE/SET

MODE/SET

`Pr.CL`

**Parameter clear**

`ALLC`

**All parameter
clear**

`Er.CL`

**Faults history clear**

`Pr.CH`

**Initial value
change list**

### Alarm history

`E - - -`

[Operation for displaying faults history]

Past eight faults can be displayed.

(The latest fault is ended by ".".)

When no fault history exists, `E    0` is displayed.

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## Parameter unit (FR-PU07)

**POWER lamp**
Lit when the power turns on.

**Monitor**
- Liquid crystal display (16 characters x 4 lines with backlight)
- Interactive parameter setting
- Trouble shooting guidance
- Monitor (frequency, current, power, etc.)

**ALARM lamp**
Lit to indicate an inverter alarm occurrence.

**Operation keys**
(Refer to the table on the right)

| Key | Description |
|---|---|
| PrSET | Use for parameter setting<br>Press to choose the parameter setting mode. |
| MON | First priority monitor is displayed.<br>In the initial setting, the output frequency is displayed. |
| ESC | Operation cancel key |
| FUNC | Used to display the function menu.<br>A variety of functions can be used on the function menu. |
| SHIFT | Used to shift to the next item in the setting or monitoring mode. |
| 0 to 9 | Used to enter a frequency, parameter number or set value. |
| EXT | Inverter operates in the external operation mode. |
| PU | Used to select the PU operation mode to display the frequency setting screen. |
| ▲ / ▼ | • Used to keep on increasing or decreasing the running frequency. Hold down to vary the frequency.<br>• Press either of these keys on the parameter setting mode screen to change the parameter setting value sequentially.<br>• On the selecting screen, these keys are used to move the cursor.<br>• Hold down SHIFT and press either of these keys to advance or return the display screen one page. |
| FWD | Forward rotation command key. |
| REV | Reverse rotation command key. |
| STOP RESET | • Stop command key.<br>• Used to reset the inverter when an alarm occurs. |
| WRITE | • Used to write a set value in the setting mode.<br>• Used as a clear key in the all parameter clear or alarm history clear mode. |
| • READ | • Used as a decimal point when entering numerical value.<br>• Used as a parameter number read key in the setting mode.<br>• Used as an item select key on the menu screen such as parameter list or monitoring list.<br>• Used as an alarm definition display key in the alarm history display mode.<br>• Used as a command voltage read key in the calibration mode. |

●Monitor: Merely pressing SHIFT calls 6 different monitor screens in sequence.
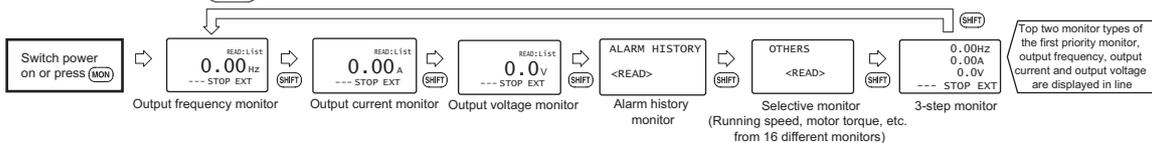


●Parameter setting: When changing 5s to 180s as the *Pr. 8 Deceleration time* setting



●Pr. List: Displays the parameters list.
You can select the parameter from the list to read and write the parameter setting.
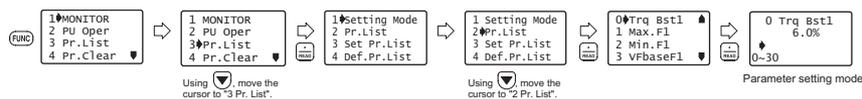


●Multiple copies: You can read the parameter settings of the inverter into the FR-PU07 and store the settings of maximum three inverters. You can also copy the stored parameter settings to another inverter of the same series.
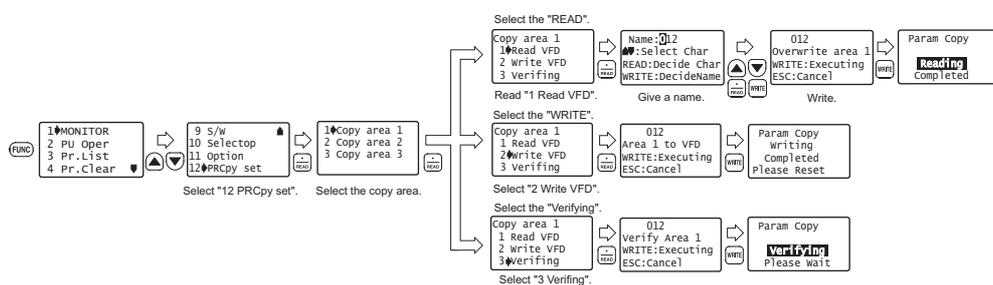
# FR Configurator (VFD SETUP SOFTWARE)

## FR-SW3-SETUP-WJ (Windows*2000 Professional, XP Home Edition, XP Professional supported)

FR Configurator is a software offers an easy operating environment.

Can be utilized effectively from inverter setting up to maintenance.

Parameter setting, monitoring, etc. can be performed on a display of Windows * personal computer.

A personal computer and an inverter can be easily connected with a USB cable.

(RS-485 communication using PU connector is also available.)

∗ Windows is a registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.

USB cable    USB connector

<How to open the USB connector cover>

**Pull the cover in the direction of arrow.**    **Then turn it upward.**

MITSUBISHI
Integrated FA Software    MELSOFT

**FR Configurator**

MELSOFT
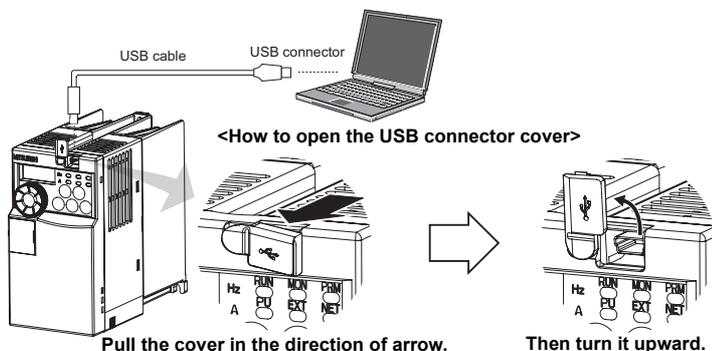
### Startup

Desired function can be performed just after a start-up of the software.

(1) Open the recent used System File

(2) Perform Easy Setup

(3) Perform each functions

(4) Help

### Easy Setup

From station number to parameter setting, setting with wizard style dialog (interactive) is available.

Procedure for Easy Setup

(1) System File setting

(2) Communication setting

(3) Inverter recognition

(4) Control method selection

(5) Motor setting

(6) Start command, frequency command setting

(7) Parameter setting

### Navigation area

In Navigation area, switching ONLINE/OFFLINE and changing operation mode can be performed.

(1) Frequency setting and forward/reverse rotation [Test operation]

(2) Display the connected inverter in tree view [System List]

(3) Function setting without regard to parameter number [Basic setting]

### Monitor area

In Monitor area, inverter status can be monitored.

(1) Display monitor data in waveform

(2) Display current waveform with High Speed graph function [Graph]
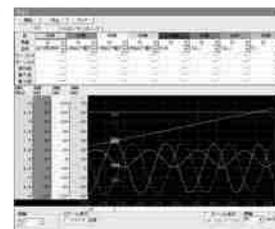
### System area

In System area, parameter setting, Diagnosis, Troubleshooting, etc. can be performed.

(1) Parameter reading, writing, verification, Functional List and Individual List display are available. [Parameter List]

(2) Convert parameter setting from conventional models [Convert]

### Setting wizard

Setting wizard can set parameters with wizard style dialog (interactive). Inputting or selecting required items for each function, parameter setting can be made, without regard to parameter number.

### Help

Displays operating instructions and details of each parameters.

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# Parameter List

For simple variable-speed operation of the inverter, the initial setting of the parameters may be used as they are. Set the necessary parameters to meet the load and operational specifications. Parameter setting, change and check can be made from the operation panel. For details of parameters, refer to the instruction manual.

**REMARKS**
- ◎ indicates simple mode parameters. (initially set to extended mode)
- ▨ The shaded parameters in the table allow its setting to be changed during operation even if "0" (initial value) is set in *Pr. 77 Parameter write selection*.

| Function | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Refer to Page | Customer Setting |
|---|---|---|---|---|---|---|---|
| Basic functions | ◎ 0 | Torque boost | 0 to 30% | 0.1% | 6/4/3/2% *1 | *26* | |
| | ◎ 1 | Maximum frequency | 0 to 120Hz | 0.01Hz | 120Hz | *26* | |
| | ◎ 2 | Minimum frequency | 0 to 120Hz | 0.01Hz | 0Hz | *26* | |
| | ◎ 3 | Base frequency | 0 to 400Hz | 0.01Hz | 60Hz | *26* | |
| | ◎ 4 | Multi-speed setting (high speed) | 0 to 400Hz | 0.01Hz | 60Hz | *26* | |
| | ◎ 5 | Multi-speed setting (middle speed) | 0 to 400Hz | 0.01Hz | 30Hz | *26* | |
| | ◎ 6 | Multi-speed setting (low speed) | 0 to 400Hz | 0.01Hz | 10Hz | *26, 43* | |
| | ◎ 7 | Acceleration time | 0 to 3600/360s | 0.1/0.01s | 5/10s *2 | *27* | |
| | ◎ 8 | Deceleration time | 0 to 3600/360s | 0.1/0.01s | 5/10s *2 | *27* | |
| | ◎ 9 | Electronic thermal O/L relay | 0 to 500A | 0.01A | Rated inverter current | *27* | |
| DC injection brake | 10 | DC injection brake operation frequency | 0 to 120Hz | 0.01Hz | 3Hz | *27* | |
| | 11 | DC injection brake operation time | 0 to 10s | 0.1s | 0.5s | *27* | |
| | 12 | DC injection brake operation voltage | 0 to 30% | 0.1% | 6/4/2% *3 | *27* | |
| — | 13 | Starting frequency | 0 to 60Hz | 0.01Hz | 0.5Hz | *27* | |
| — | 14 | Load pattern selection | 0 to 3 | 1 | 0 | *28* | |
| JOG operation | 15 | Jog frequency | 0 to 400Hz | 0.01Hz | 5Hz | *28* | |
| | 16 | Jog acceleration/deceleration time | 0 to 3600/360s | 0.1/0.01s | 0.5s | *28* | |
| — | 17 | MRS input selection | 0, 2, 4 | 1 | 0 | *28* | |
| — | 18 | High speed maximum frequency | 120 to 400Hz | 0.01Hz | 120Hz | *26* | |
| — | 19 | Base frequency voltage | 0 to 1000V, 8888, 9999 | 0.1V | 9999 | *26* | |
| Acceleration/ deceleration time | 20 | Acceleration/deceleration reference frequency | 1 to 400Hz | 0.01Hz | 60Hz | *27* | |
| | 21 | Acceleration/deceleration time increments | 0, 1 | 1 | 0 | *27* | |
| Stall prevention | 22 | Stall prevention operation level | 0 to 200% | 0.1% | 150% | *29* | |
| | 23 | Stall prevention operation level compensation factor at double speed | 0 to 200%, 9999 | 0.1% | 9999 | *29* | |
| Multi-speed setting | 24 | Multi-speed setting (speed 4) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 25 | Multi-speed setting (speed 5) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 26 | Multi-speed setting (speed 6) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 27 | Multi-speed setting (speed 7) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| — | 29 | Acceleration/deceleration pattern selection | 0, 1, 2 | 1 | 0 | *29* | |
| — | 30 | Regenerative function selection | 0, 1, 2 | 1 | 0 | *29, 32* | |
| Frequency jump | 31 | Frequency jump 1A | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *30* | |
| | 32 | Frequency jump 1B | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *30* | |
| | 33 | Frequency jump 2A | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *30* | |
| | 34 | Frequency jump 2B | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *30* | |
| | 35 | Frequency jump 3A | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *30* | |
| | 36 | Frequency jump 3B | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *30* | |
| — | 37 | Speed display | 0, 0.01 to 9998 | 0.001 | 0 | *30* | |
| — | 40 | RUN key rotation direction selection | 0, 1 | 1 | 0 | *30* | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Refer to Page | Customer Setting |
|---|---|---|---|---|---|---|---|
| Frequency detection | 41 | Up-to-frequency sensitivity | 0 to 100% | 0.1% | 10% | *30* | |
| | 42 | Output frequency detection | 0 to 400Hz | 0.01Hz | 6Hz | *30* | |
| | 43 | Output frequency detection for reverse rotation | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *30* | |
| Second functions | 44 | Second acceleration/deceleration time | 0 to 3600/360s | 0.1/0.01s | 5/10s *2 | *27* | |
| | 45 | Second deceleration time | 0 to 3600/360s, 9999 | 0.1/0.01s | 9999 | *27* | |
| | 46 | Second torque boost | 0 to 30%, 9999 | 0.1% | 9999 | *26* | |
| | 47 | Second V/F (base frequency) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 48 | Second stall prevention operation current | 0 to 200%, 9999 | 0.1% | 9999 | *29, 43* | |
| | 51 | Second electronic thermal O/L relay | 0 to 500A, 9999 | 0.01A | 9999 | *27* | |
| Monitor functions | 52 | DU/PU main display data selection | 0, 5, 7 to 12, 14, 20, 23 to 25, 52 to 57, 100 | 1 | 0 | *31* | |
| | 54 | FM terminal function selection | 1 to 3, 5, 7 to 12, 14, 21, 24, 52, 53 | 1 | 1 | *31* | |
| | 55 | Frequency monitoring reference | 0 to 400Hz | 0.01Hz | 60Hz | *31* | |
| | 56 | Current monitoring reference | 0 to 500A | 0.01A | Rated inverter current | *31* | |
| Automatic restart functions | 57 | Restart coasting time | 0, 0.1 to 5s, 9999 | 0.1s | 9999 | *32* | |
| | 58 | Restart cushion time | 0 to 60s | 0.1s | 1s | *32* | |
| — | 59 | Remote function selection | 0, 1, 2, 3 | 1 | 0 | *33* | |
| — | 60 | Energy saving control selection | 0, 9 | 1 | 0 | *33* | |
| Automatic acceleration /deceleration | 61 | Reference current | 0 to 500A, 9999 | 0.01A | 9999 | *33* | |
| | 62 | Reference value at acceleration | 0 to 200%, 9999 | 1% | 9999 | *33* | |
| | 63 | Reference value at deceleration | 0 to 200%, 9999 | 1% | 9999 | *33* | |
| — | 65 | Retry selection | 0 to 5 | 1 | 0 | *34* | |
| — | 66 | Stall prevention operation reduction starting frequency | 0 to 400Hz | 0.01Hz | 60Hz | *29* | |
| Retry | 67 | Number of retries at alarm occurrence | 0 to 10, 101 to 110 | 1 | 0 | *34* | |
| | 68 | Retry waiting time | 0.1 to 360s | 0.1s | 1s | *34* | |
| | 69 | Retry count display erase | 0 | 1 | 0 | *34* | |
| — | 70 | Special regenerative brake duty | 0 to 30% | 0.1% | 0% | *29* | |
| — | 71 | Applied motor | 0, 1, 3 to 6, 13 to 16, 23, 24, 40, 43, 44, 50, 53, 54 | 1 | 0 | *34* | |
| — | 72 | PWM frequency selection | 0 to 15 | 1 | 1 | *34* | |
| — | 73 | Analog input selection | 0, 1, 10, 11 | 1 | 1 | *35* | |
| — | 74 | Input filter time constant | 0 to 8 | 1 | 1 | *35* | |
| — | 75 | Reset selection/disconnected PU detection/PU stop selection | 0 to 3, 14 to 17 | 1 | 14 | *35* | |
| — | 77 | Parameter write selection | 0, 1, 2 | 1 | 0 | *35* | |
| — | 78 | Reverse rotation prevention selection | 0, 1, 2 | 1 | 0 | *35* | |
| — | ◎ 79 | Operation mode selection | 0, 1, 2, 3, 4, 6, 7 | 1 | 0 | *36* | |

Features

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| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Refer to Page | Customer Setting |
|---|---|---|---|---|---|---|---|
| Motor constants | 80 | Motor capacity | 0.1 to 15kW, 9999 | 0.01kW | 9999 | 37 | |
| | 81 | Number of motor poles | 2, 4, 6, 8, 10, 9999 | 1 | 9999 | 37 | |
| | 82 | Motor excitation current | 0 to 500A (0 to ****), 9999 *4 | 0.01A (1) *4 | 9999 | 37 | |
| | 83 | Motor rated voltage | 0 to 1000V | 0.1V | 200V | 37 | |
| | 84 | Rated motor frequency | 10 to 120Hz | 0.01Hz | 60Hz | 37 | |
| | 89 | Speed control gain (advanced magnetic flux vector) | 0 to 200%, 9999 | 0.1% | 9999 | 37 | |
| | 90 | Motor constant (R1) | 0 to 50Ω (0 to ****), 9999 *4 | 0.001Ω (1) *4 | 9999 | 37 | |
| | 91 | Motor constant (R2) | 0 to 50Ω (0 to ****), 9999 *4 | 0.001Ω (1) *4 | 9999 | 37 | |
| | 92 | Motor constant (L1) | 0 to 1000mH (0 to 50Ω, 0 to ****), 9999 *4 | 0.1mH (0.001Ω, 1) *4 | 9999 | 37 | |
| | 93 | Motor constant (L2) | 0 to 1000mH (0 to 50Ω, 0 to ****), 9999 *4 | 0.1mH (0.001Ω, 1) *4 | 9999 | 37 | |
| | 94 | Motor constant (X) | 0 to 100% (0 to 500Ω, 0 to ****), 9999 *4 | 0.1% (0.01Ω, 1) *4 | 9999 | 37 | |
| | 96 | Auto tuning setting/status | 0, 1, 11, 21 | 1 | 0 | 37 | |
| PU connector communication | 117 | PU communication station number | 0 to 31 (0 to 247) | 1 | 0 | 38 | |
| | 118 | PU communication speed | 48, 96, 192, 384 | 1 | 192 | 38 | |
| | 119 | PU communication stop bit length | 0, 1, 10, 11 | 1 | 1 | 38 | |
| | 120 | PU communication parity check | 0, 1, 2 | 1 | 2 | 38 | |
| | 121 | Number of PU communication retries | 0 to 10, 9999 | 1 | 1 | 38 | |
| | 122 | PU communication check time interval | 0, 0.1 to 999.8s, 9999 | 0.1s | 0 | 38 | |
| | 123 | PU communication waiting time setting | 0 to 150ms, 9999 | 1 | 9999 | 38 | |
| | 124 | PU communication CR/LF presence/absence selection | 0, 1, 2 | 1 | 1 | 38 | |
| — | ◎ 125 | Terminal 2 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | 39 | |
| — | ◎126 | Terminal 4 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | 39 | |
| PID operation | 127 | PID control automatic switchover frequency | 0 to 400Hz, 9999 | 0.01Hz | 9999 | 39 | |
| | 128 | PID action selection | 0, 20, 21, 40 to 43, 50, 51, 60, 61 | 1 | 0 | 39 | |
| | 129 | PID proportional band | 0.1 to 1000%, 9999 | 0.1% | 100% | 39 | |
| | 130 | PID integral time | 0.1 to 3600s, 9999 | 0.1s | 1s | 39 | |
| | 131 | PID upper limit | 0 to 100%, 9999 | 0.1% | 9999 | 39 | |
| | 132 | PID lower limit | 0 to 100%, 9999 | 0.1% | 9999 | 39 | |
| | 133 | PID action set point | 0 to 100%, 9999 | 0.01% | 9999 | 39 | |
| | 134 | PID differential time | 0.01 to 10.00s, 9999 | 0.01s | 9999 | 39 | |
| PU | 145 | PU display language selection | 0 to 7 | 1 | 0 | 39 | |
| — | 146 *5 | Built-in potentiometer switching | 0, 1 | 1 | 1 | 39 | |
| Current detection | 150 | Output current detection level | 0 to 200% | 0.1% | 150% | 40 | |
| | 151 | Output current detection signal delay time | 0 to 10s | 0.1s | 0s | 40 | |
| | 152 | Zero current detection level | 0 to 200% | 0.1% | 5% | 40 | |
| | 153 | Zero current detection time | 0 to 1s | 0.01s | 0.5s | 40 | |
| — | 156 | Stall prevention operation selection | 0 to 31, 100, 101 | 1 | 0 | 29 | |
| — | 157 | OL signal output timer | 0 to 25s, 9999 | 0.1s | 0s | 29 | |
| — | ◎ 160 | User group read selection | 0, 1, 9999 | 1 | 0 | 40 | |
| — | 161 | Frequency setting/key lock operation selection | 0, 1, 10, 11 | 1 | 0 | 40 | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Refer to Page | Customer Setting |
|---|---|---|---|---|---|---|---|
| Automatic restart functions | 162 | Automatic restart after instantaneous power failure selection | 0, 1, 10, 11 | 1 | 1 | *32* | |
| | 165 | Stall prevention operation level for restart | 0 to 200% | 0.1% | 150% | *32* | |
| — | 168 | Parameter for manufacturer setting. Do not set. | | | | | |
| — | 169 | | | | | | |
| Cumulative monitor clear | 170 | Watt-hour meter clear | 0, 10, 9999 | 1 | 9999 | *31* | |
| | 171 | Operation hour meter clear | 0, 9999 | 1 | 9999 | *31* | |
| User group | 172 | User group registered display/batch clear | 9999,  (0 to 16) | 1 | 0 | *40* | |
| | 173 | User group registration | 0 to 999, 9999 | 1 | 9999 | *40* | |
| | 174 | User group clear | 0 to 999, 9999 | 1 | 9999 | *40* | |
| Input terminal function assignment | 178 | STF terminal function selection | 0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25, 60, 62, 65 to 67, 9999 | 1 | 60 | *41* | |
| | 179 | STR terminal function selection | 0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25, 61, 62, 65 to 67, 9999 | 1 | 61 | *41* | |
| | 180 | RL terminal function selection | 0 to 5, 7, 8, 10, 12, 14 to 16, 18, 24, 25, 62, 65 to 67, 9999 | 1 | 0 | *41* | |
| | 181 | RM terminal function selection | | 1 | 1 | *41* | |
| | 182 | RH terminal function selection | | 1 | 2 | *41* | |
| | 183 | MRS terminal function selection | | 1 | 24 | *41* | |
| | 184 | RES terminal function selection | | 1 | 62 | *41* | |
| Output terminal function assignment | 190 | RUN terminal function selection | 0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 90, 91, 93, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 120, 125, 126, 146, 147, 164, 190, 191, 193, 195, 196, 198, 199, 9999 | 1 | 0 | *41* | |
| | 191 | FU terminal function selection | | 1 | 4 | *41* | |
| | 192 | A,B,C terminal function selection | 0, 1, 3, 4, 7, 8, 11 to 16, 20, 25, 26, 46, 47, 64, 90, 91, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 120, 125, 126, 146, 147, 164, 190, 191, 195, 196, 198, 199, 9999 | 1 | 99 | *41* | |
| Multi-speed setting | 232 | Multi-speed setting (speed 8) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 233 | Multi-speed setting (speed 9) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 234 | Multi-speed setting (speed 10) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 235 | Multi-speed setting (speed 11) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 236 | Multi-speed setting (speed 12) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 237 | Multi-speed setting (speed 13) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 238 | Multi-speed setting (speed 14) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| | 239 | Multi-speed setting (speed 15) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | *26* | |
| — | 240 | Soft-PWM operation selection | 0, 1 | 1 | 1 | *34* | |
| — | 241 | Analog input display unit switchover | 0, 1 | 1 | 0 | *39* | |
| — | 244 | Cooling fan operation selection | 0, 1 | 1 | 1 | *41* | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Refer to Page | Customer Setting |
|---|---|---|---|---|---|---|---|
| Slip compensation | 245 | Rated slip | 0 to 50%, 9999 | 0.01% | 9999 | *41* | |
| | 246 | Slip compensation time constant | 0.01 to 10s | 0.01s | 0.5s | *41* | |
| | 247 | Constant-power range slip compensation selection | 0, 9999 | 1 | 9999 | *41* | |
| — | 249 | Earth (ground) fault detection at start | 0, 1 | 1 | 0 | *42* | |
| — | 250 | Stop selection | 0 to 100s, 1000 to 1100s, 8888, 9999 | 0.1s | 9999 | *42* | |
| — | 251 | Output phase loss protection selection | 0, 1 | 1 | 1 | *42* | |
| Life diagnosis | 255 | Life alarm status display | (0 to 15) | 1 | 0 | *42* | |
| | 256 | Inrush current limit circuit life display | (0 to 100%) | 1% | 100% | *42* | |
| | 257 | Control circuit capacitor life display | (0 to 100%) | 1% | 100% | *42* | |
| | 258 | Main circuit capacitor life display | (0 to 100%) | 1% | 100% | *42* | |
| | 259 | Main circuit capacitor life measuring | 0, 1 (2, 3, 8, 9) | 1 | 0 | *42* | |
| Power failure stop | 261 | Power failure stop selection | 0, 1, 2 | 1 | 0 | *43* | |
| — | 267 | Terminal 4 input selection | 0, 1, 2 | 1 | 0 | *35* | |
| — | 268 | Monitor decimal digits selection | 0, 1, 9999 | 1 | 9999 | *31* | |
| — | 269 | Parameter for manufacturer setting. Do not set. | | | | | |
| — | 270 | Stop-on contact control selection | 0, 1 | 1 | 0 | *43* | |
| Stop-on contact control | 275 | Stop-on contact excitation current low-speed multiplying factor | 0 to 300%, 9999 | 0.1% | 9999 | *43* | |
| | 276 | PWM carrier frequency at stop-on contact | 0 to 9, 9999 | 1 | 9999 | *43* | |
| — | 277 | Stall prevention operation current switchover | 0, 1 | 1 | 0 | *29* | |
| Brake sequence function | 278 | Brake opening frequency | 0 to 30Hz | 0.01Hz | 3Hz | *44* | |
| | 279 | Brake opening current | 0 to 200% | 0.1% | 130% | *44* | |
| | 280 | Brake opening current detection time | 0 to 2s | 0.1s | 0.3s | *44* | |
| | 281 | Brake operation time at start | 0 to 5s | 0.1s | 0.3s | *44* | |
| | 282 | Brake operation frequency | 0 to 30Hz | 0.01Hz | 6Hz | *44* | |
| | 283 | Brake operation time at stop | 0 to 5s | 0.1s | 0.3s | *44* | |
| Droop control | 286 | Droop gain | 0 to 100% | 0.1% | 0% | *44* | |
| | 287 | Droop filter time constant | 0 to 1s | 0.01s | 0.3s | *44* | |
| — | 292 | Automatic acceleration/deceleration | 0, 1, 7, 8, 11 | 1 | 0 | *33, 44* | |
| — | 293 | Acceleration/deceleration separate selection | 0 to 2 | 1 | 0 | *33* | |
| — | 295 | Magnitude of frequency change setting | 0, 0.01, 0.10, 1.00, 10.00 | 0.01 | 0 | *40* | |
| — | 298 | Frequency search gain | 0 to 32767, 9999 | 1 | 9999 | *37* | |
| — | 299 | Rotation direction detection selection at restarting | 0, 1, 9999 | 1 | 0 | *32* | |
| RS-485 communication | 338 | Communication operation command source | 0, 1 | 1 | 0 | *45* | |
| | 339 | Communication speed command source | 0, 1, 2 | 1 | 0 | *45* | |
| | 340 | Communication startup mode selection | 0, 1, 10 | 1 | 0 | *36* | |
| | 342 | Communication EEPROM write selection | 0, 1 | 1 | 0 | *38* | |
| | 343 | Communication error count | — | 1 | 0 | *38* | |

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| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Refer to Page | Customer Setting |
|---|---|---|---|---|---|---|---|
| Second motor constant | 450 | Second applied motor | 0, 1, 9999 | 1 | 9999 | *34* | |
| Output | 495 | Remote output selection | 0, 1, 10, 11 | 1 | 0 | *45* | |
| | 496 | Remote output data 1 | 0 to 4095 | 1 | 0 | *45* | |
| | 497 | Remote output data 2 | 0 to 4095 | 1 | 0 | *45* | |
| — | 502 | Stop mode selection at communication error | 0, 1, 2, 3 | 1 | 0 | *38* | |
| Maintenance | 503 | Maintenance timer | 0 (1 to 9998) | 1 | 0 | *46* | |
| | 504 | Maintenance timer alarm output set time | 0 to 9998, 9999 | 1 | 9999 | *46* | |
| USB | 547 | USB communication station number | 0 to 31 | 1 | 0 | *46* | |
| | 548 | USB communication check time interval | 0 to 999.8s, 9999 | 0.1s | 9999 | *46* | |
| Communication | 549 | Protocol selection | 0, 1 | 1 | 0 | *38* | |
| | 550 | NET mode operation command source selection | 0, 2, 9999 | 1 | 9999 | *45* | |
| | 551 | PU mode operation command source selection | 2 to 4, 9999 | 1 | 9999 | *45* | |
| Current average time monitor | 555 | Current average time | 0.1 to 1.0s | 0.1s | 1s | *46* | |
| | 556 | Data output mask time | 0.0 to 20.0s | 0.1s | 0s | *46* | |
| | 557 | Current average value monitor signal output reference current | 0 to 500A | 0.01A | Rated inverter current | *46* | |
| — | 563 | Energization time carrying-over times | (0 to 65535) | 1 | 0 | *31* | |
| — | 564 | Operating time carrying-over times | (0 to 65535) | 1 | 0 | *31* | |
| — | 571 | Holding time at a start | 0.0 to 10.0s, 9999 | 0.1s | 9999 | *27* | |
| — | 611 | Acceleration time at a restart | 0 to 3600s, 9999 | 0.1s | 9999 | *32* | |
| — | 653 | Speed smoothing control | 0 to 200% | 0.1% | 0 | *47* | |
| — | 665 | Regeneration avoidance frequency gain | 0 to 200% | 0.1% | 100 | *47* | |
| — | 800 | Control method selection | 20, 30 | 1 | 20 | *37* | |
| — | 859 | Torque current | 0 to 500A (0 to ****) , 9999 *4 | 0.01A (1) *4 | 9999 | *37* | |
| Protective Functions | 872 | Input phase loss protection selection | 0, 1 | 1 | 1 | *42* | |
| Regeneration avoidance function | 882 | Regeneration avoidance operation selection | 0, 1, 2 | 1 | 0 | *47* | |
| | 883 | Regeneration avoidance operation level | 300 to 800V | 0.1V | 400VDC | *47* | |
| | 885 | Regeneration avoidance compensation frequency limit value | 0 to 10Hz, 9999 | 0.01Hz | 6Hz | *47* | |
| | 886 | Regeneration avoidance voltage gain | 0 to 200% | 0.1% | 100% | *47* | |
| Free parameter | 888 | Free parameter 1 | 0 to 9999 | 1 | 9999 | *47* | |
| | 889 | Free parameter 2 | 0 to 9999 | 1 | 9999 | *47* | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Refer to Page | Customer Setting |
|---|---|---|---|---|---|---|---|
| Calibration parameters | C0 (900) | FM terminal calibration | — | — | — | 47 | |
| | C2 (902) | Terminal 2 frequency setting bias frequency | 0 to 400Hz | 0.01Hz | 0Hz | 39 | |
| | C3 (902) | Terminal 2 frequency setting bias | 0 to 300% | 0.1% | 0% | 39 | |
| | 125 (903) | Terminal 2 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | 39 | |
| | C4 (903) | Terminal 2 frequency setting gain | 0 to 300% | 0.1% | 100% | 39 | |
| | C5 (904) | Terminal 4 frequency setting bias frequency | 0 to 400Hz | 0.01Hz | 0Hz | 39 | |
| | C6 (904) | Terminal 4 frequency setting bias | 0 to 300% | 0.1% | 20% | 39 | |
| | 126 (905) | Terminal 4 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | 39 | |
| | C7 (905) | Terminal 4 frequency setting gain | 0 to 300% | 0.1% | 100% | 39 | |
| | C22 *5 (922) | Frequency setting voltage bias frequency (built-in potentiometer) | 0 to 400Hz | 0.01Hz | 0 | 39 | |
| | C23 *5 (922) | Frequency setting voltage bias (built-in potentiometer) | 0 to 300% | 0.1% | 0 | 39 | |
| | C24 *5 (923) | Frequency setting voltage gain frequency (built-in potentiometer) | 0 to 400Hz | 0.01Hz | 60Hz | 39 | |
| | C25 *5 (923) | Frequency setting voltage gain (built-in potentiometer) | 0 to 300% | 0.1% | 100% | 39 | |
| PU | 990 | PU buzzer control | 0, 1 | 1 | 1 | 48 | |
| | 991 | PU contrast adjustment | 0 to 63 | 1 | 58 | 48 | |
| Clear parameters / Initial value change list | Pr.CL | Parameter clear | 0, 1 | 1 | 0 | 48 | |
| | ALLC | All parameter clear | 0, 1 | 1 | 0 | 48 | |
| | Er.CL | Alarm history clear | 0, 1 | 1 | 0 | 48 | |
| | Pr.CH | Initial value change list | — | — | — | 48 | |

*1   Differ according to capacities. (0.1K to 0.75K/1.5K to 3.7K/5.5K, 7.5K/11K, 15K)

*2   Differ according to capacities. (3.7K or less/5.5K or more)

*3   Differ according to capacities. (0.1K, 0.2K/0.4K to 7.5K/11K, 15K)

*4   The range differs according to the *Pr. 71* setting.

*5   Set this parameter when calibrating the operation panel built-in potentiometer of the FR-E500 series operation panel (PA02) connected with cable.

# Explanations of Parameters

The abbreviations in the explanations below indicate [V/F] ...V/F control, [AD MFVC] ...advanced magnetic flux vector control, [GP MFVC] ...general-purpose magnetic flux vector control. (Parameters without any indication are valid for all control)

## Pr. 0, 46

### Manual torque boost [V/F]

| Pr. 0 Torque boost | Pr. 46 Second torque boost |
|---|---|

You can compensate for a voltage drop in the low-frequency region to improve motor torque reduction in the low-speed region.

- Motor torque in the low-frequency range can be adjusted to the load to increase the starting motor torque.
- Two kinds of starting torque boost can be switched by using RT signal.
- This function is valid for V/F control only.
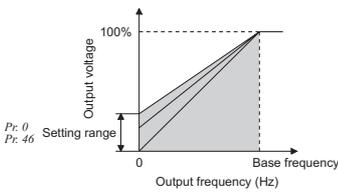


| Pr. 0 Initial Value | | When Using the Mitsubishi Constant Torque Motor |
|---|---|---|
| 0.1K to 0.75K | 6% | ← |
| 1.5K to 3.7K | 4% | ← |
| 5.5K, 7.5K | 3% | 2%* |
| 11K, 15K | 2% | ← |

* If the *Pr. 71* initial value is changed to the setting for use with a constant-torque motor, the *Pr. 0* setting changes to the corresponding value in the above table.

## Pr. 1, 2, 18

### Maximum/minimum frequency

| Pr. 1 Maximum frequency | Pr. 2 Minimum frequency |
|---|---|
| Pr. 18 High speed maximum frequency | |

Motor speed can be limited.

- Clamp the upper and lower limits of the output frequency.
- To perform operation above 120Hz, set the maximum output frequency in *Pr. 18*.
  (When *Pr. 18* is set, *Pr. 1* is automatically changed to the frequency set in *Pr. 18*. Also, when *Pr. 1* is set, *Pr. 18* is automatically changed to the frequency set in *Pr. 1*.)



## Pr. 3, 19, 47

### Base frequency, voltage [V/F]

| Pr. 3 Base frequency | Pr. 19 Base frequency voltage |
|---|---|
| Pr. 47 Second V/F (base frequency) | |

- Used to adjust the inverter outputs (voltage, frequency) to the motor rating.
- When running the standard motor, generally set the rated frequency of the motor in *Pr. 3 Base frequency*. When running the motor using commercial power supply-inverter switch-over operation, set *Pr. 3* to the same value as the power supply frequency.
- When you want to change the base frequency when switching multiple motors with one inverter, use the *Pr. 47 Second V/F (base frequency)*.

- Use *Pr. 19 Base frequency voltage* to set the base voltage (e.g. rated motor voltage).
- This function is valid for V/F control only.
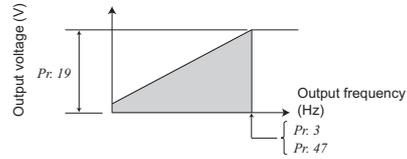


## Pr. 4 to 6, 24 to 27, 232 to 239

### Multi-speed setting operation

| Pr. 4 Multi-speed setting (high speed) | Pr. 5 Multi-speed setting (middle speed) |
|---|---|
| Pr. 6 Multi-speed setting (low speed) | Pr. 24 Multi-speed setting (speed 4) |
| Pr. 25 Multi-speed setting (speed 5) | Pr. 26 Multi-speed setting (speed 6) |
| Pr. 27 Multi-speed setting (speed 7) | Pr. 232 Multi-speed setting (speed 8) |
| Pr. 233 Multi-speed setting (speed 9) | Pr. 234 Multi-speed setting (speed 10) |
| Pr. 235 Multi-speed setting (speed 11) | Pr. 236 Multi-speed setting (speed 12) |
| Pr. 237 Multi-speed setting (speed 13) | Pr. 238 Multi-speed setting (speed 14) |
| Pr. 239 Multi-speed setting (speed 15) | |

Can be used to change the preset speed in the parameter with the contact signals.

Any speed can be selected by merely turning on-off the contact signals (RH, RM, RL, REX signals).

- Operation is performed at the frequency set in *Pr. 4* when the RH signal turns on, *Pr. 5* when the RM signal turns on, and *Pr. 6* when the RL signal turns on.
- Frequency from 4 speed to 15 speed can be set according to the combination of the RH, RM, RL and REX signals. Set the running frequencies in *Pr. 24* to *Pr. 27, Pr. 232* to *Pr. 239* (In the initial value setting, speed 4 to speed 15 are unavailable)





*1 When "9999" is set in *Pr. 232 Multi-speed setting (speed 8)*, operation is performed at 0Hz when RH, RM and RL are turned off and REX is turned on.

When setting parameters, refer to the instruction manual (applied) and understand instructions.

*26*

## Pr. 7, 8, 20, 21, 44, 45
## Acceleration/deceleration time setting

| Pr. 7 Acceleration time | Pr. 8 Deceleration time |
| --- | --- |
| Pr. 20 Acceleration/deceleration reference frequency | Pr. 21 Acceleration/deceleration time increments |
| Pr. 44 Second acceleration/deceleration time | Pr. 45 Second deceleration time |

Used to set motor acceleration/deceleration time.

Set a larger value for a slower speed increase/decrease or a smaller value for a faster speed increase/decrease.

- Use *Pr. 7 Acceleration time* to set the acceleration time to reach *Pr. 20 Acceleration/deceleration reference frequency* from 0Hz

- Use *Pr. 8 Deceleration time* to set the deceleration time taken to reach 0Hz from *Pr. 20 Acceleration/deceleration reference frequency*.
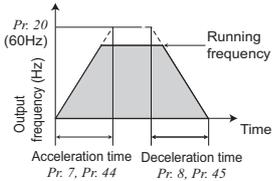


| *Pr. 21* Setting | Definition | |
| --- | --- | --- |
| 0 (initial value) | Increments: 0.1s Range: 0 to 3600s | Increments and setting range of acceleration/ deceleration time setting can be changed. |
| 1 | Increments: 0.01s Range: 0 to 360s | |

## Pr. 9, 51
## Motor protection from overheat (electronic thermal relay function)

| Pr. 9 Electronic thermal O/L relay | Pr. 51 Second electronic thermal O/L relay |
| --- | --- |

Set the current of the electronic thermal relay function to protect the motor from overheat. This feature provides the optimum protective characteristics, including reduced motor cooling capability, at low speed.

- This function detects the overload (overheat) of the motor, stops the operation of the inverter's output transistor, and stops the output.

- Set the rated current [A] of the motor in *Pr. 9*.
  (When the power supply specification is 200V/220V 60Hz, set the 1.1 times the rated motor current.)

- Set "0" in *Pr. 9* to make the electronic thermal relay function invalid when using a motor with an external thermal relay, etc. (Note that the output transistor protection of the inverter functions (E.THT).)

- When using a Mitsubishi constant-torque motor
  1) Set any of "1, 13 to 16, 50, 53, 54" in *Pr. 71*. (This provides a 100% continuous torque characteristic in the low-speed range.)
  2) Set the rated current of the motor in *Pr. 9*.

- When the RT signal is on, thermal protection is provided based on the *Pr. 51* setting.
  Use this function when running two motors of different rated currents individually by a single inverter. (When running two motors together, use external thermal relays.)

## Pr. 10 to 12
## DC injection brake

| Pr. 10 DC injection brake operation frequency | Pr. 11 DC injection brake operation time |
| --- | --- |
| Pr. 12 DC injection brake operation voltage | |

The DC injection brake can be operated at a motor stop to adjust the stop timing and braking torque.

When 0 is set in *Pr. 11* or *Pr. 12*, DC injection brake is not performed.
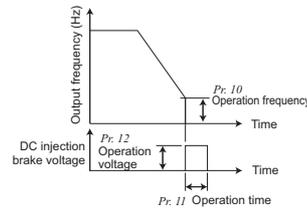


| *Pr. 12* Initial Value | | When Using the Mitsubishi Constant Torque Motor |
| --- | --- | --- |
| 0.1K, 0.2K | 6% | ← |
| 0.4K to 3.7K | 4% | ← |
| 5.5K to 7.5K | 4% | 2%∗ |
| 11K to 15K | 2% | ← |

∗ If the *Pr. 71* initial value is changed to the setting for use with a constant-torque motor, the *Pr. 12* setting changes to the corresponding value in the above table.

## Pr. 13, 571
## Starting frequency

| Pr. 13 Starting frequency | Pr. 571 Holding time at a start |
| --- | --- |

You can set the starting frequency and hold the set starting frequency for a certain period of time.

Set these functions when you need the staring torque or want smooth motor drive at a start.

When setting parameters, refer to the instruction manual (applied) and understand instructions.
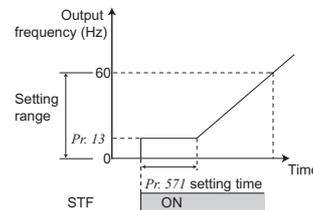
## Pr. 14

# V/F pattern matching applications

V/F

*Pr. 14 Load pattern selection*

You can select the optimum output characteristic (V/F characteristic) for the application and load characteristics.
This function is valid for V/F control only.

**For constant torque load (initial value)**



*Pr. 14 = 0*
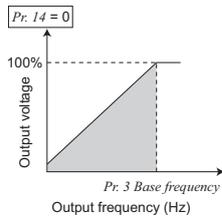
**For variable torque load**



*Pr. 14 = 1*

**For constant torque elevator load**

*Pr. 14 = 2*

For vertical lift loads
At forward rotation boost...*Pr. 0 (Pr. 46)* setting
At reverse rotation boost...0%



**For constant torque elevator load**

*Pr. 14 = 3*

For vertical lift loads
At forward rotation boost...0%
At reverse rotation boost...*Pr. 0 (Pr. 46)* setting
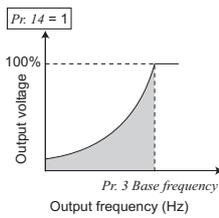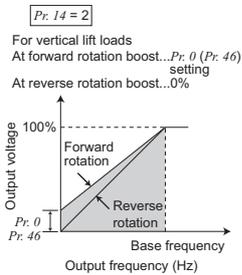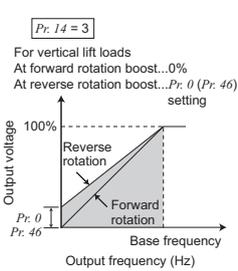


## Pr. 15, 16

# Jog operation

*Pr. 15 Jog frequency*          *Pr. 16 Jog acceleration/deceleration time*

You can set the frequency and acceleration/deceleration time for jog operation. Jog operation can be performed from either of the external or the PU operation mode.
Can be used for conveyor positioning, test operation, etc.
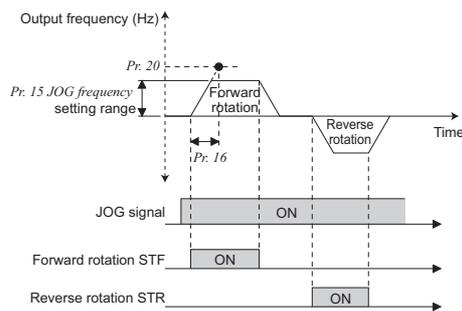


## Pr. 17

# Logic selection of output stop signal (MRS)

*Pr. 17 MRS input selection*

The inverter output can be shut off by the MRS signal. Also, logic for the MRS signal can be selected.
When *Pr. 17* is set to "4", the MRS signal from external terminal (output stop) can be changed to the normally closed (NC contact) input, and the MRS signal from communication can be changed to the normally open (NO contact) input.
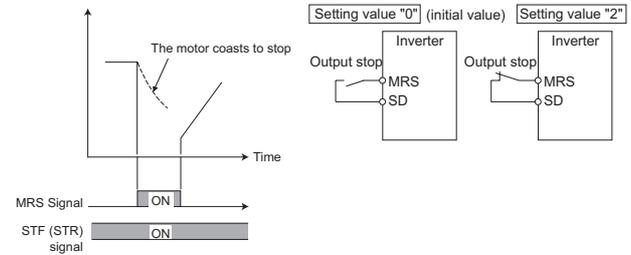


## Pr. 18 ⇒ **Refer to the section about** *Pr. 1*.

## Pr. 19 ⇒ **Refer to the section about** *Pr. 3*.

## Pr. 20, 21 ⇒ **Refer to the section about** *Pr. 7*.

---

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## **Pr.** 22, 23, 48, 66, 156, 157, 277

# Stall prevention operation

| | |
|---|---|
| *Pr. 22 Stall prevention operation level* | *Pr. 23 Stall prevention operation level compensation factor at double speed* |
| *Pr. 48 Second stall prevention operation current* | *Pr. 66 Stall prevention operation reduction starting frequency* |
| *Pr. 156 Stall prevention operation selection* | *Pr. 157 OL signal output timer* |
| *Pr. 277 Stall prevention operation current switchover* | |

This function monitors the output current and automatically changes the output frequency to prevent the inverter from coming to an alarm stop due to overcurrent, overvoltage, etc. It can also limit stall prevention and fast-response current limit operation during acceleration/deceleration, driving or regeneration.

In addition, torque limit which limits the output torque to the predetermined value can be selected.

- Stall prevention

  If the output current exceeds the stall prevention operation level, the output frequency of the inverter is automatically varied to reduce the output current.

- Fast-response current limit

  If the current exceeds the limit value, the output of the inverter isshut off to prevent an overcurrent.

- Set in *Pr. 22* the percentage of the output current to the rated inverter current at which stall prevention operation will be performed. Normally set this parameter to 150% (initial value).

- During high-speed operation above the rated motor frequency, acceleration may not be made because the motor current does not increase. If operation is performed in a high frequency range, the current at motor lockup becomes smaller than the rated output current of the inverter, and the protective function (OL) is not executed even if the motor is at a stop.

  To improve the operating characteristics of the motor in this case, the stall prevention level can be reduced in the high frequency range. This function is effective for performing operation up to the high-speed range on a centrifugal separator etc. Normally, set 60Hz in *Pr. 66* and 100% in *Pr. 23*.

- By setting "9999" (initial value) in *Pr. 23 Stall prevention operation level compensation factor at double speed*, the stall prevention operation level is constant at the *Pr. 22* setting up to 400Hz.
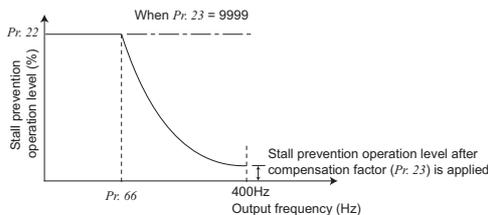


- Stall prevention operation and fast response current limit function can be restricted according to the operation condition using *Pr. 156*.

- When *Pr. 277* = "1" , torque limit can be set. Torque limit level can be set using *Pr. 22* .

## **Pr.** 24 to 27    ⇨ Refer to the section about *Pr. 4*.

## **Pr.** 29

# Acceleration/deceleration pattern

*Pr. 29 Acceleration/deceleration pattern selection*

You can set the acceleration/deceleration pattern suitable for application.
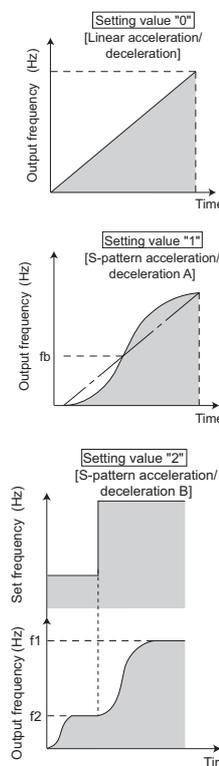


- Linear acceleration/deceleration (setting "0", initial value)

  For the inverter operation, the output frequency is made to change linearly (linear acceleration/deceleration) to prevent the motor and inverter from excessive stress to reach the set frequency during acceleration, deceleration, etc. when frequency changes.

- S-pattern acceleration/deceleration A (setting "1")

  For machine tool spindle applications, etc. Used when acceleration/deceleration must be made in a short time to a high-speed range of not lower than *Pr. 3 Base frequency* (fb).

- S-pattern acceleration/deceleration B (setting "2")

  For prevention of load shifting in conveyor and other applications.

  Since acceleration/deceleration is always made in an S shape from current frequency (f2) to target frequency (f1), this function eases shock produced at acceleration/deceleration and is effective for load collapse prevention, etc.

## **Pr.** 30, 70

# Selection of regeneration unit

| | |
|---|---|
| *Pr. 30 Regenerative function selection* | *Pr. 70 Special regenerative brake duty* |

- When making frequent starts/stops, use the optional brake resistor to increase the regeneration capability. (0.4K or more)

- Use a power regeneration common converter (FR-CV) for continuous operation in regeneration status.

  Use a high efficiency converter (FR-HC) for harmonic suppression and power factor improvement.

| Pr. 30 Set Value | Pr. 70 Set Value | Regeneration Unit |
|---|---|---|
| 0 (initial value) | *1 | Brake resistor (MRS, MYS) Brake unit (FR-BU2) Power regeneration common converter (FR-CV) High power factor converter (FR-HC) |
| 1 | 10/6% *2 | High-duty brake resistor (FR-ABR) |
| 2 | — | High power factor converter (FR-HC) (when an automatic restart after instantaneous power failure is selected) |

*1 The brake duty varies according to the inverter capacity.
*2 7.5K or less/11K or more

## Pr. 31 to 36

# Avoid mechanical resonance points (frequency jump)

*Pr. 31 Frequency jump 1A*  |  *Pr. 32 Frequency jump 1B*
*Pr. 33 Frequency jump 2A*  |  *Pr. 34 Frequency jump 2B*
*Pr. 35 Frequency jump 3A*  |  *Pr. 36 Frequency jump 3B*

When it is desired to avoid resonance attributable to the natural frequency of a mechanical system, these parameters allow resonant frequencies to be jumped.
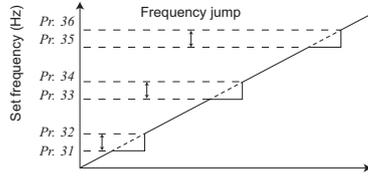


- Up to three areas may be set, with the jump frequencies set to either the top or bottom point of each area.
- The settings of frequency jumps 1A, 2A, 3A are jump points, and operation is performed at these frequencies in the jump areas.
- Frequency jump is not performed if the initial value is set to "9999".
- During acceleration/deceleration, the running frequency within the set area is valid.

## Pr. 37

# Speed display

*Pr. 37 Speed display*

The monitor display and frequency setting of the PU (FR-PU04/FR-PU07) can be changed to the machine speed.

- To display the machine speed, set in *Pr. 37* the machine speed for 60Hz operation.

| *Pr. 37* Setting | Output Frequency Monitor | Set Frequency Monitor | Frequency Setting Parameter Setting |
|---|---|---|---|
| 0 (initial value) | Hz | Hz | Hz |
| 0.01 to 9998 | Machine speed *1 | Machine speed *1 | |

∗1 Machine speed conversion formula..........*Pr.37* x frequency/60Hz
∗2 Hz is displayed in 0.01Hz increments and machine speed is in 0.001.

## Pr. 40

# RUN key rotation direction selection

*Pr. 40 RUN key rotation direction selection*

- Used to choose the direction of rotation by operating the RUN key of the operation panel.

| *Pr. 40* Setting | Description |
|---|---|
| 0 | Forward rotation |
| 1 | Reverse rotation |

## Pr. 41 to 43

# Detection of output frequency (SU, FU signal)

*Pr. 41 Up-to-frequency sensitivity*  |  *Pr. 42 Output frequency detection*
*Pr. 43 Output frequency detection for reverse rotation*

The inverter output frequency is detected and output at the output signals.

- The *Pr. 41* value can be adjusted within the range 0% ±100% on the assumption that the set frequency is 100%.
- This parameter can be used to ensure that the running frequency has been reached to provide the operation start signal etc. for related equipment.
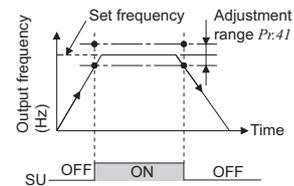


- When the output freqency rises to or above the *Pr. 42* setting, the output frequency detection signal (FU) is output. This function can be used for electromagnetic brake operation, open signal, etc.
- When the detection frequency is set to *Pr. 43*, frequency detection for reverse operation use only can also be set. This function is effective for switching the timing of electromagnetic brake operation between forward rotation (rise) and reverse rotation (fall) during vertical lift operation, etc.
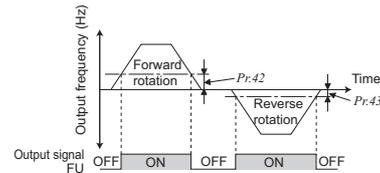


**Pr. 44, 45** ⇒ Refer to the section about *Pr. 7*.

**Pr. 46** ⇒ Refer to the section about *Pr. 0*.

**Pr. 47** ⇒ Refer to the section about *Pr. 3*.

**Pr. 48** ⇒ Refer to the section about *Pr. 22*.

**Pr. 51** ⇒ Refer to the section about *Pr. 9*.

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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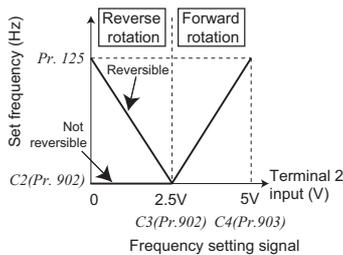Instructions
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## Pr. 52, 54, 170, 171, 268, 563, 564

# Change of DU/PU monitor descriptions Cumulative monitor clear

*Pr. 52 DU/PU main display data selection*  
*Pr. 170 Watt-hour meter clear*  
*Pr. 268 Monitor decimal digits selection*  
*Pr. 564 Operating time carrying-over times*  
*Pr. 54 FM terminal function selection*  
*Pr. 171 Operation hour meter clear*  
*Pr. 563 Energization time carrying-over times*

The monitor to be displayed on the main screen of the control panel and parameter unit (FR-PU04/FR-PU07) can be selected.

| Types of Monitor | Unit | Pr. 52 Setting | | Pr. 54 (FM) Set Value | Full-scale Value |
|---|---|---|---|---|---|
| | | Operation Panel LED | PU Main Monitor | | |
| Output frequency | 0.01Hz | 0/100 | | 1 | *Pr. 55* |
| Output current | 0.01A | 0/100 | | 2 | *Pr. 56* |
| Output Voltage | 0.1V | 0/100 | | 3 | 400V |
| Fault or alarm indication | — | 0/100 | | — | — |
| Frequency setting value | 0.01Hz | 5 | *1 | 5 | *Pr. 55* |
| Motor torque *2 | 0.1% | 7 | *1 | 7 | Rated torque of the applied motor × 2 |
| Converter output voltage | 0.1V | 8 | *1 | 8 | 400V |
| Regenerative brake duty | 0.1% | 9 | *1 | 9 | Brake duty set in *Pr. 30* and *Pr. 70* |
| Electronic thermal O/L relay load factor | 0.1% | 10 | *1 | 10 | Electronic thermal relay function operation level |
| Output current peak value | 0.01A | 11 | *1 | 11 | *Pr. 56* |
| Converter output voltage peak value | 0.1V | 12 | *1 | 12 | 400V |
| Output power | 0.01kW | 14 | *1 | 14 | Rated inverter power × 2 |
| Input terminal status | — | — | *1 | — | — |
| Output terminal status | — | — | *1 | — | — |
| Cumulative energization time *3 | 1h | 20 | | — | — |
| Reference voltage output | — | — | | 21 | — |
| Actual operation time *3, *4 | 1h | 23 | | — | — |
| Motor load factor | 0.1% | 24 | | 24 | 200% |
| Cumulative power | 0.01kWh *5 | 25 | | — | — |
| PID set point | 0.1% | 52 | | 52 | 100% |
| PID measured value | 0.1% | 53 | | 53 | 100% |
| PID deviation | 0.1% | 54 | | — | — |
| Inverter I/O terminal monitor | — | 55 | | — | — |
| Option input terminal status | — | 56 | | — | — |
| Option output terminal status | — | 57 | | — | — |

*1 Selected by the parameter unit (FR-PU04/FR-PU07)  
*2 The motor torque display remains "0" under V/F control.  
*3 The cumulative energization time and actual operation time are accumulated from 0 to 65535 hours, then cleared, and accumulated again from 0. When the operation panel is used, the time is displayed up to 65.53 (65530h) on the assumption that 1h = 0.001, and thereafter, it is added up from 0.  
*4 The actual operation time is not added up if the cumulative operation time before power supply-off is less than 1h.  
*5 When using the parameter unit (FR-PU04/FR-PU07), "kW" is displayed.

- Writing "0" in *Pr. 170* clears the cumulative power monitor.
- You can check the numbers of cumulative energization time monitor exceeded 65535h with *Pr. 563* and the numbers of actual operation time monitor exceeded 65535h with *Pr. 564*.
- Writing "0" in *Pr. 171* clears the actual operation time monitor.

| Pr. 268 Setting | Definition |
|---|---|
| 9999 (initial value) | No function |
| 0 | For the first or second decimal places (0.1 increments or 0.01 increments) of the monitor, numbers in the first decimal place and smaller are rounded to display an integral value (1 increments). The monitor value smaller than 0.99 is displayed as 0. |
| 1 | When 2 decimal places (0.01 increments) are monitored, the 0.01 decimal place is dropped and the monitor displays the first decimal place (0.1 increments). When the monitor display digit is originally in 1 increments, it is displayed unchanged in 1 increments. |

- When *Pr. 52* is set to "100", the set frequency monitor is displayed during a stop and the output frequency monitor is displayed during operation. (LED of Hz flickers during stop and is lit during operation.)

| | Pr. 52 | | |
|---|---|---|---|
| | 0 | 100 | |
| | During running/stop | During stop | During running |
| Output frequency | Output frequency | Set frequency * | Output frequency |
| Output current | Output current | | |
| Output voltage | Output voltage | | |
| Fault or alarm indication | Fault or alarm indication | | |

* The set frequency displayed indicates the frequency to be output when the start command is on.
Different from the frequency setting displayed when *Pr. 52* = "5", the value based on maximum/minimum frequency and frequency jump is displayed.

## Pr. 55, 56

# Reference of the monitor output from terminal FM

*Pr. 55 Frequency monitoring reference*  
*Pr. 56 Current monitoring reference*

Set the full-scale value of the monitor value output from terminal FM.

| Monitor* | Reference Parameter | Initial Value |
|---|---|---|
| Frequency | Pr. 55 | 60Hz |
| Current | Pr. 56 | Rated inverter current |

* Refer to the section about *Pr. 52* for monitor names.

Pulse speed(terminal FM)

2400 pulse/s  
1440 pulse/s

Output frequency reference  *Pr.55*  400Hz  
Output current reference  *Pr.56*  500A

When setting parameters, refer to the instruction manual (applied) and understand instructions.
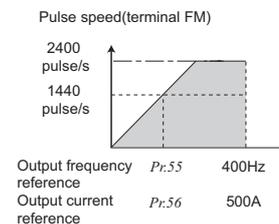
## Pr. 30, 57, 58, 162, 165, 299, 611

## Automatic restart operation after instantaneous power failure/flying start

*Pr. 30 Regenerative function selection*

*Pr. 57 Restart coasting time*

*Pr. 58 Restart cushion time*

*Pr. 162 Automatic restart after instantaneous power failure selection*

*Pr. 165 Stall prevention operation level for restart*

*Pr. 299 Rotation direction detection selection at restarting*

*Pr. 611 Acceleration time at a restart*

You can restart the inverter without stopping the motor in the following cases:

- When power comes back on after an instantaneous power failure
- When motor is coasting at start

| Pr. Number | Setting Range | Description |
|---|---|---|
| 30 | 0 (initial value), 1 | When MRS (X10) turns ON then OFF The motor starts at the starting frequency |
| | 2 | When MRS (X10) turns ON then OFF Automatic restart operation |
| 57 | 0 | 1.5K or less ......... 1s, 2.2K to 7.5K ........ 2s, 11K or more ........ 3s The above times are coasting time. |
| | 0.1 to 5s | Set the waiting time for inverter-triggered restart after an instantaneous power failure. |
| | 9999 (initial value) | No restart |
| 58 | 0 to 60s | Set a voltage starting time at restart. |
| 162 | 0 | With frequency search |
| | 1 (initial value) | Without frequency search (reduced voltage system) |
| | 10 | Frequency search at every start |
| | 11 | Reduced voltage system at every start |
| 165 | 0 to 200% | Considers the rated inverter current as 100% and sets the stall prevention operation level during restart operation. |
| 299 | 0 (initial value) | Without rotation direction detection |
| | 1 | With rotation direction detection |
| | 9999 | When *Pr. 78* = 0, the rotation direction is detected. When *Pr. 78* = 1, 2, the rotation direction is not detected. |
| 611 | 0 to 3600s | Set the acceleration time to reach the set frequency at a restart. |
| | 9999 (initial value) | Acceleration time for restart is the normal acceleration time (e.g. *Pr. 7*). |

- When *Pr. 162* = "1" (initial value) or "11", automatic restart operation is performed in a reduced voltage system, where the voltage is gradually risen with the output frequency unchanged from prior to an instantaneous power failure independently of the coasting speed of the motor.



Power supply (R/L1, S/L2, T/L3)

Motor speed N (r/min)

Inverter output frequency f (Hz)

Inverter output voltage E (V)

Instantaneous (power failure) time

Coasting time *Pr. 57* setting

Restart cushion time (*Pr. 58* setting)
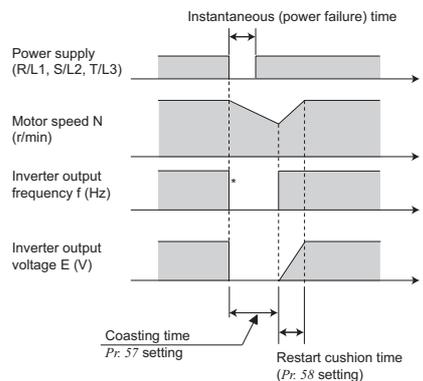
* The output shut off timing differs according to the load condition.

- When "0" or "10" is set in *Pr. 162*, the inverter smoothly starts after detecting the motor speed upon power restoration. (The motor capacity should be equal to or one rank lower than the inverter capacity)

  When using the frequency search, perform offline auto tuning.

  Also be noted that there is a wiring length limit. *(Refer to page 61)*

- Even when the motor is rotating in the opposite direction, the inverter can be restarted smoothly as the direction of rotation is detected. (You can select whether to make rotation direction detection or not with *Pr. 299 Rotation direction detection selection at restarting*.)



Power supply (R/L1, S/L2, T/L3)

Motor speed N (r/min)

Inverter output frequency f (Hz)

Inverter output voltage E (V)

Instantaneous (power failure) time

Coasting time (*Pr. 57*) + Speed detection time

Restart cushion time (*Pr. 58* setting)

Acceleration time at a restart (*Pr. 611* setting)
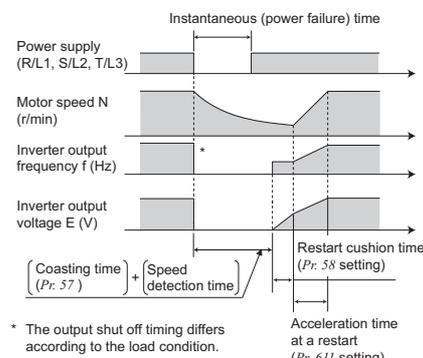
* The output shut off timing differs according to the load condition.

- Restart operation after turning MRS (X10) signal ON then OFF can be selected using *Pr. 30*. Set when restart operation after instantaneous power failure is selected while using the high power factor converter (FR-HC).

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## Pr. 59

# Remote setting function

*Pr. 59 Remote function selection*

- If the operation panel is located away from the enclosure, you can use contact signals to perform continuous variable-speed operation, without using analog signals.
- By merely setting this parameter, you can use the acceleration, deceleration and setting clear functions of the motorized speed setter (FR-FK).

| *Pr. 59* Setting | Description | |
| --- | --- | --- |
| | RH, RM, RL signal function | Frequency setting storage function |
| 0 (initial value) | Multi-speed setting | — |
| 1 | Remote setting | With |
| 2 | Remote setting | Not used |
| 3 | Remote setting | Not used (Turning off STF/STR clears remotely set frequency) |
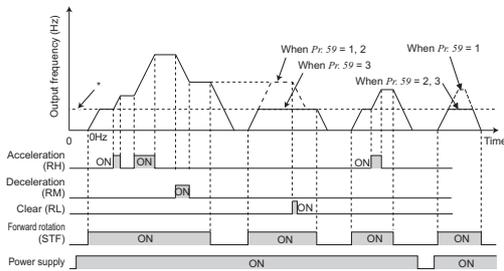


∗ External running frequency (other than multi-speed) or PU running frequency

## Pr. 60

# Energy saving control selection  V/F

*Pr. 60 Energy saving control selection*

Without a fine parameter setting, the inverter automatically performs energy saving operation.
This function is optimum for fan and pump applications
This function is valid for V/F control only.

| *Pr. 60* Setting | Description |
| --- | --- |
| 0 (initial value) | Normal operation mode |
| 9 | Optimum excitation control mode The optimum excitation control mode is a control system which controls excitation current to improve the motor efficiency to maximum and determines output voltage as an energy saving system. ∗ |

∗ Output current may slightly increase, since output voltage is controlled.

## Pr. 61 to 63, 292, 293

# Automatic acceleration/deceleration

*Pr. 61 Reference current*  *Pr. 62 Reference value at acceleration*
*Pr. 63 Reference value at deceleration*  *Pr. 292 Automatic acceleration/deceleration*
*Pr. 293 Acceleration/deceleration separate selection*

The inverter automatically sets appropriate parameters for operation.

- The inverter operates in the same conditions as when appropriate values are set in each parameter even if acceleration/deceleration time and V/F pattern are not set. This operation mode is useful when you just want to operate, etc. without fine parameter setting.
- If the automatic acceleration/deceleration has been selected, inputting the jog or RT (second function selection) signal during an inverter stop will switch to the normal operation and give priority to JOG operation or second function selection.
  After automatic acceleration/deceleration operation has been started, none of JOG signal and RT signal are accepted.

| *Pr. 292* Setting | Operation | | Automatic Setting Parameter |
| --- | --- | --- | --- |
| 0 (initial value normal mode) | — | | — |
| 1 (shortest acceleration/ deceleration mode) | Without brake resistor and brake unit | Set when you want to accelerate/ decelerate the motor for the shortest time. (stall prevention operation level 150%) | Pr. 7, Pr. 8 |
| 11 (shortest acceleration/ deceleration mode) | With brake resistor and brake unit | | |
| 7 (brake sequence mode 1) | With mechanical brake opening completion signal input | Operation mode in which a mechanical brake operation timing signal for vertical lift applications is output. | — |
| 8 (brake sequence mode 2) | Without mechanical brake opening completion signal input | | |

- Use *Pr. 61* to *Pr. 63* to change the reference current for the shortest acceleraiton/deceleration mode and optimum acceleration/deceleration mode.
- Calculation of acceleration/deceleration can be performed individually.
  This function is made valid in the shortest acceleration/deceleraion mode.

| *Pr. 293* Setting | Description |
| --- | --- |
| 0 (initial value) | Both acceleration/deceleration time is calculated. |
| 1 | Only acceleration time is calculated. |
| 2 | Only deceleration time is calculated. |

When setting parameters, refer to the instruction manual (applied) and understand instructions.

## Pr. 65, 67 to 69

## Retry function at fault occurrence

*Pr. 65 Retry selection*                    *Pr. 67 Number of retries at alarm occurrence*
*Pr. 68 Retry waiting time*                  *Pr. 69 Retry count display erase*

If a fault occurs, the inverter resets itself automatically to restart. You can also select the fault description for a retry.

When you have selected automatic restart after instantaneous power failure (*Pr. 57 Restart coasting time* ≠ 9999), restart operation is performed at the retry operation time which is the same of that of a power failure.

● Use *Pr. 65* to select the fault to be activated for retries.

"●" indicates the alarms selected for retry.

| Fault Display for Retry | Pr. 65 Setting | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 |
| E.OC1 | ● | ● | | ● | ● | ● |
| E.OC2 | ● | ● | | ● | ● | |
| E.OC3 | ● | ● | | ● | ● | ● |
| E.OV1 | ● | | ● | ● | ● | |
| E.OV2 | ● | | ● | ● | ● | |
| E.OV3 | ● | | ● | ● | ● | |
| E.THM | ● | | | | | |
| E.THT | ● | | | | | |
| E. BE | ● | | | | ● | |
| E. GF | ● | | | | ● | |
| E.OHT | ● | | | | | |
| E.OLT | ● | | | | ● | |
| E.OP1 | ● | | | | ● | |
| E. PE | ● | | | | ● | |
| E.MB4 | ● | | | | ● | |
| E.MB5 | ● | | | | ● | |
| E.MB6 | ● | | | | ● | |
| E.MB7 | ● | | | | ● | |
| E.USB | ● | | | | ● | |
| E.ILF | ● | | | | ● | |

● Set the number of retries at fault occurrence in *Pr. 67*.

| Pr. 67 Setting | Description |
|---|---|
| 0 (initial value) | No retry function |
| 1 to 10 | Set the number of retries at fault occurrence. A fault output is not provided during retry operation. |
| 101 to 110 | Set the number of retries at fault occurrence. (The setting value of minus 100 is the number of retries.) A fault output is provided during retry operation. |

● Use *Pr. 68* to set the waiting time from when an inverter fault occurs until a retry is made in the range 0 to 10s. (Setting value "0" equals to 0.1s.)

● Reading the *Pr. 69* value provides the cumulative number of successful restart times made by retry. (Use setting value "0" to clear.)

## Pr. 66 ⇨ Refer to the section about *Pr. 22*.

## Pr. 67 to 69 ⇨ Refer to the section about *Pr. 65*.

## Pr. 70 ⇨ Refer to the section about *Pr. 30*.

## Pr. 71, 450

## Motor selection (applied motor)

*Pr. 71 Applied motor*                       *Pr. 450 Second applied motor*

Setting of the used motor selects the thermal characteristic appropriate for the motor.

Setting is required to use a constant-torque motor. Thermal characteristic of the electronic thermal relay function suitable for the motor is set.

| Pr. 71, Pr. 450 Setting | Thermal Characteristic of the Electronic Thermal Relay Function | | Motor (○: Motor used) | |
|---|---|---|---|---|
| | | | Standard (SF-JR, etc.) | Constant-torque (SF-JRCA, etc.) |
| 0 | Thermal characteristics of a standard motor (*Pr. 71* initial value) | | ○ | |
| 1 | Thermal characteristics of the Mitsubishi constant-torque motor | | | ○ |
| 40 | Thermal characteristic of Mitsubishi high efficiency motor SF-HR | | ○ *1 | |
| 50 | Thermal characteristic of Mitsubishi constant torque motor SF-HRCA | | | ○ *2 |
| 3 | Standard | Select "Offline auto tuning setting" | ○ | |
| 13 | Constant-torque | | | ○ |
| 23 | Mitsubishi standard motor SF-JR4P (1.5kW or less) | | ○ | |
| 43 | Mitsubishi high efficiency SF-HR | | ○ *1 | |
| 53 | Mitsubishi constant-torque SF-HRCA | | | ○ *2 |
| 4 | Standard | Auto tuning data can be read, changed, and set. | ○ | |
| 14 | Constant-torque | | | ○ |
| 24 | Mitsubishi standard motor SF-JR4P (1.5kW or less) | | ○ | |
| 44 | Mitsubishi high efficiency SF-HR | | ○ *1 | |
| 54 | Mitsubishi constant-torque SF-HRCA | | | ○ *2 |
| 5 | Standard*3 | Direct input of motor constants is enabled | ○ | |
| 15 | Constant-torque *3 | | | ○ |
| 6 | Standard *4 | | ○ | |
| 16 | Constant-torque *4 | | | ○ |
| 9999 | Function invalid (only *Pr. 450* can be set, initial value) | | | |

*1 Motor constants of Mitsubishi high efficiency motor SF-HR
*2 Motor constants of Mitsubishi constant-torque motor SF-HRCA.
*3 Star connection
*4 Delta connection

● For the 5.5K and 7.5K, the *Pr. 0 Torque boost* and *Pr. 12 DC injection brake operation voltage* settings are automatically changed according to the *Pr. 71* and *Pr. 450* settings as follows.

| Automatic Change Parameter | Standard Motor Setting *1 | Constant-torque Motor Setting *2 |
|---|---|---|
| *Pr. 0* | 3% | 2% |
| *Pr. 12* | 4% | 2% |

*1 *Pr. 71, Pr. 450* setting: 0, 3 to 6, 23, 24, 40, 43, 44
*2 *Pr. 71, Pr. 450* setting: 1, 13 to 16, 50, 53, 54

## Pr. 72, 240

## Carrier frequency and Soft-PWM selection

*Pr. 72 PWM frequency selection*            *Pr. 240 Soft-PWM operation selection*

You can change the motor sound.

| Pr. Number | Setting Range | Description |
|---|---|---|
| 72 | 0 to 15 | PWM carrier frequency can be changed. The setting is in [kHz]. Note that 0 indicates 0.7kHz and 15 indicates 14.5kHz. |
| 240 | 0 | Soft-PWM is invalid |
| | 1 | When *Pr. 72* = "0 to 5", Soft-PWM is valid. |

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## Pr. 73, 267

## Analog input selection

*Pr. 73 Analog input selection*        *Pr. 267 Terminal 4 input selection*

● You can select the function that switches between forward rotation and reverse rotation according to the analog input terminal specifications and analog input level.

● Either voltage input (0 to 5V, 0 to 10V) or current input (4 to 20mA) can be selected for terminals 4 used for analog input.

Set the voltage/current input switch in the "V" position to select voltage input (0 to 5V/0 to10V) and "I" position to select current input (4 to 20mA), and change the parameter setting *(Pr. 267)*.

( ▭ indicates main speed setting)

| *Pr. 73* Setting | Terminal 2 Input | Terminal 4 Input | Reversible Operation |
|---|---|---|---|
| 0 | 0 to 10V | When the AU signal is off × | Not function |
| 1 (initial value) | 0 to 5V | | |
| 10 | 0 to 10V | | Yes |
| 11 | 0 to 5V | | |
| 0 | × | When the AU signal is on According to *Pr. 267* setting 0:4 to 20mA (initial value) 1:0 to 5V 2:0 to 10V | Not function |
| 1 (initial value) | | | |
| 10 | × | | Yes |
| 11 | | | |



Frequency setting signal

## Pr. 74

## Response level of analog input and noise elimination

*Pr. 74 Input filter time constant*

● The time constant of the primary delay filter can be set for the external frequency command (analog input (terminal 2, 4) signal).

• Effective for filtering noise in the frequency setting circuit.

• Increase the filter time constant if steady operation cannot be performed due to noise.

A larger setting results in slower response. (The time constant can be set between approximately 10ms to 1s with the setting of 0 to 8.)

## Pr. 75

## Reset selection, disconnected PU detection

*Pr. 75 Reset selection/disconnected PU detection/PU stop selection*

You can select the reset input acceptance, disconnected PU (FR-PU04/FR-PU07) connector detection function and PU stop function.

| *Pr. 75* Setting | Reset Selection | Disconnected PU Detection | PU Stop Selection |
|---|---|---|---|
| 0 | Reset input normally enabled | If the PU is disconnected, operation will be continued. | Pressing ⊙ decelerates the motor to a stop only in the PU operation mode. |
| 1 | Reset input is enabled only when a fault occurs. | | |
| 2 | Reset input normally enabled | When the PU is disconnected, the inverter output is shut off. | |
| 3 | Reset input is enabled only when a fault occurs. | | |
| 14 (initial value) | Reset input normally enabled | If the PU is disconnected, operation will be continued. | Pressing ⊙ decelerates the motor to a stop in any of the PU, external and communication operation modes. |
| 15 | Reset input is enabled only when a fault occurs. | | |
| 16 | Reset input normally enabled | When the PU is disconnected, the inverter output is shut off. | |
| 17 | Reset input is enabled only when a fault occurs. | | |

● Reset selection

You can select the operation timing of reset function (RES signal, reset command through communication) input.

● Disconnected PU detection

This function detects that the PU (FR-PU04/FR-PU07) has been disconnected from the inverter for longer than 1s and causes the inverter to provide a fault output (E.PUE) and come to an inverter trip.

● PU stop selection

In any of the PU operation, external operation and network operation modes, the motor can be stopped by pressing ⊙ of the PU.

## Pr. 77

## Prevention of parameter rewrite

*Pr. 77 Parameter write selection*

You can select whether write to various parameters can be performed or not. Use this function to prevent parameter values from being rewritten by misoperation.

| *Pr. 77* Setting | Description |
|---|---|
| 0 (initial value) | Write is enabled only during a stop. |
| 1 | Parameter can not be written. |
| 2 | Parameter write is enabled in any operation mode regardless of operating status. |

## Pr. 78

## Prevention of reverse rotation of the motor

*Pr. 78 Reverse rotation prevention selection*

This function can prevent reverse rotation fault resulting from the incorrect input of the start signal.

| *Pr. 78* Setting | Description |
|---|---|
| 0 (initial value) | Both forward and reverse rotations allowed |
| 1 | Reverse rotation disabled |
| 2 | Forward rotation disallowed |

When setting parameters, refer to the instruction manual (applied) and understand instructions.

## Pr. 79, 340

# Operation mode selection

*Pr. 79 Operation mode selection*     *Pr. 340 Communication startup mode selection*

● Used to select the operation mode of the inverter.

Mode can be changed as desired between operation using external signals (external operation), operation from the PU (FR-PU04/FR-PU07), combined operation of PU operation and external operation (external/PU combined operation, and network operation (when RS-485 communication or a communication option is used)

| Pr. 79 Setting | Description | LED Indication <br> ▭ : OFF <br> ▭ : ON |
|---|---|---|
| 0 (initial value) | Use external/PU switchover mode <br> (press PU/EXT to switch between the PU and external operation mode. <br> At power on, the inverter is placed in the external operation mode. | External operation mode <br> EXT <br> PU operation mode <br> PU |
| 1 | Fixed to PU operation mode | PU |
| 2 | Fixed to external operation mode <br> Operation can be performed by switching between the external and Net operation mode. | External operation mode <br> EXT <br> NET operation mode <br> NET |
| 3 | External/PU combined operation mode 1 <br><br> **Running frequency:** Operation panel and PU (FR-PU04/FR-PU07) setting or external signal input (multi-speed setting, across terminals 4-5 (valid when AU signal turns on)). <br> **Start signal:** External signal input (terminal STF, STR) | PU EXT |
| 4 | External/PU combined operation mode 2 <br><br> **Running frequency:** External signal input (terminal 2, 4, JOG, multi-speed selection, etc.) <br> **Start signal:** Input from the operation panel and the PU (FR-PU04/FR-PU07) (RUN) | PU EXT |
| 6 | Switchover mode <br> Switch among PU operation, external operation, and NET operation while keeping the same operating status. | PU operation mode <br> PU <br> External operation mode <br> EXT <br> NET operation mode <br> NET |
| 7 | External operation mode (PU operation interlock) <br> X12 signal ON <br>   Operation mode can be switched to the PU operation mode. <br>   (output stop during external operation) <br> X12 signal OFF <br>   Operation mode can not be switched to the PU operation mode. | PU operation mode <br> PU <br> External operation mode <br> EXT |

● Specify the operation mode at power on *(Pr. 340)*

• When power is switched on or when power comes back on after instantaneous power failure, the inverter can be started up in the network operation mode.
After the inverter has started up in the network operation mode, parameter write and operation can be performed from a program. Set this mode for communication operation using the inverter RS-485 communication or communication option.

• You can set the operation mode at power on (reset) according to the *Pr. 79* and *Pr. 340* settings.

| Pr. 340 Setting | Pr. 79 Setting | Operation Mode at Power-on, Power Restoration, Reset | Operation Mode Switching |
|---|---|---|---|
| 0 (initial value) | | As set in *Pr. 79*. | |
| 1 | 0 | NET operation mode | Can be switched to external, PU or NET operation mode∗1 |
| | 1 | PU operation mode | Fixed to PU operation mode |
| | 2 | NET operation mode | Switching between the external and NET operation mode is enabled <br> Switching to PU operation mode disabled |
| | 3, 4 | External/PU combined operation mode | Operation mode switching disabled |
| | 6 | NET operation mode | Switching among the external, PU, and NET operation mode is enabled while running. |
| | 7 | X12 (MRS) signal ON ..NET operation mode | Can be switched to external, PU or NET operation mode∗1 |
| | | X12 (MRS) signal ON ..External operation mode | Fixed to external operation mode (forcibly switched to external operation mode) |
| 10 | 0 | NET operation mode | Switching between the PU and Net operation mode is enabled∗2 |
| | 1 | PU operation mode | Fixed to PU operation mode |
| | 2 | NET operation mode | Fixed to NET operation mode |
| | 3, 4 | External/PU combined operation mode | Operation mode switching disabled |
| | 6 | NET operation mode | Switching between the PU and NET operation mode is enabled while running∗2 |
| | 7 | External operation mode | Fixed to external operation mode (forcibly switched to external operation mode) |

∗1 Operation mode can not be directly changed between the PU operation mode and network operation mode

∗2 Operation mode can be changed between the PU operation mode and network operation mode with PU/EXT key of the operation panel and X65 signal.

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## **Pr.** 80, 81, 89, 800

## Selection of control method and control mode  AD MFVC   GP MFVC

| | |
|---|---|
| *Pr. 80 Motor capacity* | *Pr. 81 Number of motor poles* |
| *Pr. 89 Speed control gain (advanced magnetic flux vector)* | *Pr. 800 Control method selection* |

Advanced magnetic flux vector control and general-purpose magnetic flux vector control can be selected by setting the motor capacity, number of poles in *Pr. 80 and Pr. 81*. Selection of advanced magnetic flux vector control or general-purpose magnetic flux vector control can be made by *Pr. 800*.

| Parameter Number | Setting Range | Description |
|---|---|---|
| 80 | 0.1 to 15kW | Set the applied motor capacity. |
| | 9999 (initial value) | V/F Control |
| 81 | 2, 4, 6, 8, 10 | Set the number of motor poles. |
| | 9999 (initial value) | V/F Control |
| 800 | 20 (initial value) | Advanced magnetic flux vector control * |
| | 30 | General-purpose magnetic flux vector control * |

∗ Set a value other than "9999" in *Pr. 80* and *Pr. 81*.

● The motor speed fluctuation at load fluctuation can be adjusted using *Pr. 89*.

## **Pr.** 82 to 84, 90 to 94, 96, 298, 859

## Offline auto tuning

| | |
|---|---|
| *Pr. 82 Motor excitation current* | *Pr. 83 Motor rated voltage* |
| *Pr. 84 Rated motor frequency* | *Pr. 90 Motor constant (R1)* |
| *Pr. 91 Motor constants (R2)* | *Pr. 92 Motor constant (L1)* |
| *Pr. 93 Motor constant (L2)* | *Pr. 94 Motor constant (X)* |
| *Pr. 96 Auto tuning setting/status* | *Pr. 298 Frequency search gain* |
| *Pr. 859 Torque current* | |

Offline auto tuning operation for automatic calculation of motor constants can be executed when using advanced magnetic flux vector control and general-purpose magnetic flux vector control.

When offline auto tuning is performed under V/F control, *Pr. 298 Frequency search gain* necessary for frequency search for automatic restart after instantaneous power failure is set as well as the motor constants (R1).

| Parameter Number | Setting Range | Description |
|---|---|---|
| 96 | 0 (initial value) | Without offline auto tuning |
| | 1 | Offline auto tuning for advanced magnetic flux vector control |
| | 11 | Offline auto tuning for general-purpose magnetic flux vector control (compatible with FR-E500 series) |
| | 21 | Offline auto tuning for V/F control (automatic restart after instantaneous power failure (with frequency search)) |

● You can copy the offline auto tuning data (motor constants) to another inverter with the PU (FR-PU07).
● Even when motors (other manufacturer's motor, SF-JRC, etc.) other than Mitsubishi standard motor (SF-JR SF-HR 0.2kW or more) and Mitsubishi constant-torque motor (SF-JRCA SF-HRCA four-pole 0.4kW to 15kW) are used or the wiring length is long, using the offline auto tuning function runs the motor with the optimum operating characteristics.
● Offline auto tuning conditions
  • A motor should be connected.
  • The motor capacity is equall to or one rank lower than the inverter capacity.
    (note that the capacity should be 0.1kW or more)
  • The maximum frequency is 120Hz.
  • A high-slip motor, high-speed motor and special motor cannot be tuned.
● As the motor may run slightly, fix the motor securely with a mechanical brake or make sure that there will be no problem in safety if the motor runs.
  * This instruction must be followed especially in elevator.
  Note that if the motor runs slightly, tuning performance is unaffected.

## **Pr.** 89  ⇨ Refer to the section about *Pr. 80*.

When setting parameters, refer to the instruction manual (applied) and understand instructions.

**Pr.** 117 to 124, 342, 343, 502, 549

## Communication initial setting

| | |
|---|---|
| *Pr. 117 PU communication station number* | *Pr. 118 PU communication speed* |
| *Pr. 119 PU communication stop bit length* | *Pr. 120 PU communication parity check* |
| *Pr. 121 Number of PU communication retries* | *Pr. 122 PU communication check time interval* |
| *Pr. 123 PU communication waiting time setting* | *Pr. 124 PU communication CR/LF selection* |
| *Pr. 342 Communication EEPROM write selection* | *Pr. 343 Communication error count* |
| *Pr. 502 Stop mode selection at communication error* | *Pr. 549 Protocol selection* |

**(1) Initial settings and specifications of RS-485 communication** *(Pr. 117 to Pr. 124)*

Used to perform required settings for RS-485 communication between the inverter and personal computer.

- Use PU connector of the inverter for communication.
- You can perform parameter setting, monitoring, etc. using the Mitsubishi inverter protocol or Modbus-RTU protocol.
- To make communication between the personal computer and inverter, initialization of the communication specifications must be made to the inverter.

Data communication cannot be made if the initial settings are not made or there is any setting error.

| Pr. Number | Setting Range | Description |
|---|---|---|
| 117 | 0 to 31 (0 to 247) *1 | Specify the inverter station number. Set the inverter station numbers when two or more inverters are connected to one personal computer. |
| 118 | 48, 96, 192, 384 | Set the communication speed. The setting value × 100 equals the communication speed. For example, the communication speed is 19200bps when the setting value is 192. |

| 119 | | Stop bit length | Data length |
|---|---|---|---|
| | 0 | 1bit | 8bit |
| | 1 (initial value) | 2bit | |
| | 10 | 1bit | 7bit |
| | 11 | 2bit | |

| 120 | 0 | Without parity check |
|---|---|---|
| | 1 | With odd parity check |
| | 2 (initial value) | With even parity check |

| 121 | 0 to 10 | Set the permissible number of retries at occurrence of a data receive error. If the number of consecutive errors exceeds the permissible value, the inverter will come to an alarm stop. |
|---|---|---|
| | 9999 | If a communication error occurs, the inverter will not come to an alarm stop. |

| 122 | 0 (initial value) | RS-485 communication can be made Note that a communication error (E.PUE) occurs as soon as the inverter is switched to the operation mode with control source. |
|---|---|---|
| | 0.1 to 999.8s | Sets the interval of communication check time. If a no-communication state persists for longer than the permissible time, the inverter will come to an alarm stop. |
| | 9999 | No communication check |

| 123 | 0 to 150ms | Set the waiting time between data transmission to the inverter and response. |
|---|---|---|
| | 9999 (initial value) | Set with communication data. |

| 124 | 0 | Without CR/LF |
|---|---|---|
| | 1 (initial value) | With CR |
| | 2 | With CR/LF |

| Pr. Number | Setting Range | Description | | | |
|---|---|---|---|---|---|
| | | At alarm occurrence | Indication | Error output | At error removal |
| 502 | 0 (initial value) 3 | Coasts to stop. | E.PUE | Output | Stop (E.PUE) |
| | 1 | Decelerates to stop | After stop E.PUE | Output after stop | Stop (E.PUE) |
| | 2 | Decelerates to stop | After stop E.PUE | Without output | Automatic restart functions |

*1 When making communication through Modbus-RTU protocol (*Pr. 549* = "1"), the setting range within parenthesis is applied.

**(2) Communication EEPROM write selection** *(Pr. 342)*

Parameters written via the inverter's PU connector or from the communication option can be written to the RAM. When performing parameter change frequently, set "1" in *Pr. 342*.

**(3) Modbus-RTU communication specifications** *(Pr. 343, Pr. 549)*

| Pr. Number | Setting Range | Description |
|---|---|---|
| 343 | — | Displays the number of communication errors during Modbus-RTU communication. (Reading only) |
| 549 | 0 (initial value) | Mitsubishi inverter (computer link operation) protocol |
| | 1 | Modbus-RTU protocol |

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## Pr. 125, 126, 241, C2 (902) to C7 (905), C22 (922) to C25 (923)

### Analog input frequency change and adjustment (calibration)

| | |
|---|---|
| Pr. 125 Terminal 2 frequency setting gain frequency | Pr. 126 Terminal 4 frequency setting gain frequency |
| Pr. 241 Analog input display unit switchover | C2 (Pr. 902) Terminal 2 frequency setting bias frequency |
| C3 (Pr. 902) Terminal 2 frequency setting bias | C4 (Pr. 903) Terminal 2 frequency setting gain |
| C5(Pr. 904) Terminal 4 frequency setting bias frequency | C6 (Pr. 904) Terminal 4 frequency setting bias |
| C7 (Pr. 905) Terminal 4 frequency setting gain | C22 (Pr. 922) Frequency setting voltage bias frequency (built-in potentiometer) |
| C23 (Pr. 922) Frequency setting voltage bias (built-in potentiometer) | C24 (Pr. 923) Frequency setting voltage gain frequency (built-in potentiometer) |
| C25 (Pr. 923) Frequency setting voltage gain (built-in potentiometer) | |

You can set the magnitude (slope) of the output frequency as desired in relation to the frequency setting signal (0 to 5VDC, 0 to 10V or 4 to 20mA).

C22 (Pr. 922) to C25 (Pr. 923) is available when the operation panel (PA02) for the FR-E500 series is connected with cable. You can calibrate the operation panel built-in potentiometer.

**(1) Change the frequency at maximum analog input. (Pr. 125, Pr. 126)**

Set Pr. 125 (Pr. 126) when changing only frequency setting (gain) of the maximum analog input voltage (current). (Other calibration parameter settings need not be changed.)

**(2) Analog input bias/gain calibration (C2 (Pr. 902) to C7 (Pr. 905))**

- The "bias" and "gain" functions are designed to adjust the relationships between the output frequency and the setting input signal, e.g. 0 to 5VDC/0 to 10VDC or 4 to 20mADC entered from outside the inverter.
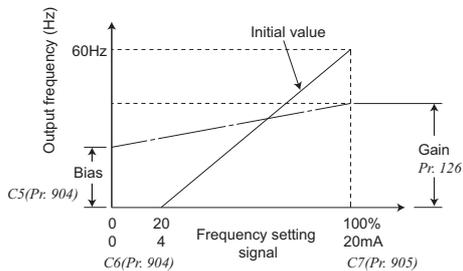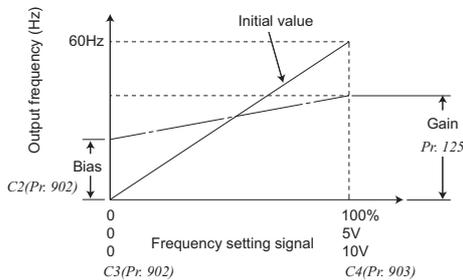




**(3) Analog input display unit changing (Pr. 241)**

- You can change the analog input display unit (%/V/mA) for analog input bias/gain calibration.

## Pr. 127 to 134

### PID control, Dancer control

| | |
|---|---|
| Pr. 127 PID control automatic switchover frequency | Pr. 128 PID action selection |
| Pr. 129 PID proportional band | Pr. 130 PID integral time |
| Pr. 131 PID upper limit | Pr. 132 PID lower limit |
| Pr. 133 PID action set point | Pr. 134 PID differential time |

- The inverter can be used to exercise process control, e.g. flow rate, air volume or pressure.
  The terminal 2 input signal or parameter setting is used as a set point and the terminal 4 input signal used as a feedback value to constitute a feedback system for PID control.

- Pr. 128 = "20, 21" (measured value input)
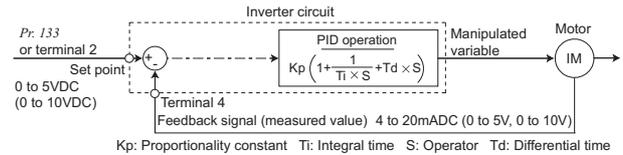


- Performs PID control by feedbacking the position signal of the dancer roller, controlling the dancer roller is in the specified position. Performs dancer control by setting 40 to 43 in Pr. 128 PID action selection. The main speed command is the speed command of each operation mode (external, PU, communication). Performs PID control by the position detection signal of the dancer roller, then the result is added to the main speed command.

## Pr. 145

### Parameter unit display language selection

Pr. 145 PU display language selection

You can switch the display language of the parameter unit (FR-PU04/FR-PU07) to another.

| Pr. 145 Setting | Description |
|---|---|
| 0 (initial value) | Japanese |
| 1 | English |
| 2 | German |
| 3 | French |
| 4 | Spanish |
| 5 | Italian |
| 6 | Swedish |
| 7 | Finnish |

## Pr. 146

### Built-in potentiometer switching

Pr. 146 Built-in potentiometer switching

When connecting the operation panel (PA02) of the FR-E500 series with a cable, use Pr. 146 Built-in potentiometer switching for selecting the operation using the built-in frequency setting potentiometer, or using [UP/DOWN] key.

| Pr. 146 Setting | Description |
|---|---|
| 0 | Built-in frequency setting potentiometer gain |
| 1 (initial value) | Digital frequency setting by the [UP/DOWN] key. |
| 9999 | Frequency setting with the built-in frequency setting potentiometer is available when the frequency set by [UP/DOWN] key is "0Hz". |

When setting parameters, refer to the instruction manual (applied) and understand instructions.

## Pr. 150 to 153

## Detection of output current (Y12 signal)
## Detection of zero current (Y13 signal)

| | |
|---|---|
| *Pr. 150 Output current detection level* | *Pr. 151 Output current detection signal delay time* |
| *Pr. 152 Zero current detection level* | *Pr. 153 Zero current detection time* |

The output power during inverter running can be detected and output to the output terminal.

**(1) Output current detection**
  **(Y12 signal, *Pr. 150*, *Pr. 151*)**
  - The output current detection function can be used for excessive torque detection, etc.
  - If the output current remains higher than the *Pr. 150* setting during inverter operation for longer than the time set in *Pr. 151*, the output current detection signal (Y12) is output from the inverter's open collector or relay output terminal.
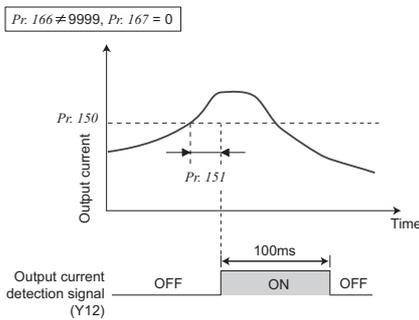


**(2) Zero current detection (Y13 signal, *Pr. 152*, *Pr. 153*)**
  - If the output current remains lower than the *Pr. 152* setting during inverter operation for longer than the time set in *Pr. 153*, the zero current detection (Y13) signal is output from the inverter's open collector or relay output terminal.
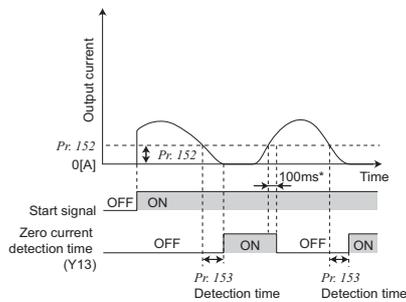


## Pr. 156, 157  ⇨ Refer to the section about *Pr. 22*.

## Pr. 160, 172 to 174

## User group function

| | |
|---|---|
| *Pr. 160 User group read selection* | *Pr. 172 User group registered display/batch clear* |
| *Pr. 173 User group registration* | *Pr. 174 User group clear* |

● Parameter which can be read from the operation panel and parameter unit can be restricted.
  The inverter is set to display all parameters with initial setting.

| Pr. 160 Setting | Description |
|---|---|
| 0 (initial value) | All parameters are displayed. |
| 1 | Only the parameters registered in the user group can be displayed. |
| 9999 | Only the simple mode parameters can be displayed. |

● User group function *(Pr. 160, Pr. 172* to *Pr. 174)*
  - The user group function is designed to display only the parameters necessary for setting.
  - From among all parameters, a maximum of 16 parameters can be registered in the user group. When "1" is set in *Pr. 160*, only parameters registered in the user group can be accessed for reading and writing. (The parameters not registered in the user group can not be read.)
  - Set parameter numbers in *Pr. 173* to register parameters in the user group.
  - To delete a parameter from the user group, set its parameter number in *Pr. 174*. To batch-delete the registered parameters, set *Pr. 172* to "9999".

## Pr. 161, 295

## Operation selection of the operation panel

| | |
|---|---|
| *Pr. 161 Frequency setting/key lock operation selection* | *Pr. 295 Magnitude of frequency change setting* |

● The setting dial of the operation panel can be used for setting like a potentiometer.
● The key operation of the operation panel can be disabled.

| *Pr. 161* Setting | Description | |
|---|---|---|
| 0 (initial value) | Setting dial frequency setting mode | Key lock mode invalid |
| 1 | Setting dial potentiometer mode | |
| 10 | Setting dial frequency setting mode | Key lock mode valid |
| 11 | Setting dial potentiometer mode | |

● When setting the set frequency with the setting dial, the frequency setting increments of the setting dial can be changed, in proportion as the rotated amount of the setting dial (speed).

## Pr. 162, 165  ⇨ Refer to the section about *Pr. 57*.

## Pr. 168, 169  Parameter for manufacturer setting. Do not set.

## Pr. 170, 171  ⇨ Refer to the section about *Pr. 52*.

## Pr. 172 to 174  ⇨ Refer to the section about *Pr. 160*.

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When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## Pr.178 to 184

## Function assignment of input terminal

*Pr. 178 STF terminal function selection*　*Pr. 179 STR terminal function selection*
*Pr. 180 RL terminal function selection*　*Pr. 181 RM terminal function selection*
*Pr. 182 RH terminal function selection*　*Pr. 183 MRS terminal function selection*
*Pr. 184 RES terminal function selection*

Use these parameters to select/change the input terminal functions.

| Pr. 178 to Pr. 184 Setting | Signal | Functions | |
|---|---|---|---|
| 0 | RL | *Pr. 59* = 0 (initial value) | Low-speed operation command |
| | | *Pr. 59* = 1, 2 *1 | Remote setting (setting clear) |
| | | *Pr. 270* = 1 *2 | Stop-on contact selection 0 |
| 1 | RM | *Pr. 59* = 0 (initial value) | Middle-speed operation command |
| | | *Pr. 59* = 1, 2 *1 | Remote setting (deceleration) |
| 2 | RH | *Pr. 59* = 0 (initial value) | High-speed operation command |
| | | *Pr. 59* = 1, 2 *1 | Remote setting (acceleration) |
| 3 | RT | Second function selection | |
| | | *Pr. 270* = 1 *2 | Stop-on contact selection 1 |
| 4 | AU | Terminal 4 input selection | |
| 5 | JOG | Jog operation selection | |
| 7 | OH | External thermal relay input*3 | |
| 8 | REX | 15-speed selection (combination with three speeds RL, RM, RH) | |
| 10 | X10 | Inverter operation enable signal (FR-HC/FR-CV connection) | |
| 12 | X12 | PU operation external interlock | |
| 14 | X14 | PID control valid terminal | |
| 15 | BRI | Brake opening completion signal | |
| 16 | X16 | PU-external operation switchover | |
| 18 | X18 | V/F switchover (V/F control is exercised when X18 is on) | |
| 24 | MRS | Output stop | |
| 25 | STOP | Start self-holding selection | |
| 60 | STF | Forward rotation command (assigned to STF terminal *(Pr. 178)* only) | |
| 61 | STR | Reverse rotation command (assigned to STR terminal *(Pr. 179)* only) | |
| 62 | RES | Inverter reset | |
| 65 | X65 | PU/NET operation switchover | |
| 66 | X66 | External/NET operation switchover | |
| 67 | X67 | Command source switchover | |
| 9999 | — | No function | |

∗1 When *Pr. 59 Remote function selection* = "1 or 2", the functions of the RL, RM and RH signals change as listed above.
∗2 When *Pr. 270* = "1", the functions of the RL and RT signals change as listed above.
∗3 The OH signal turns on when the relay contact "opens".

## Pr.190 to 192

## Terminal assignment of output terminal

*Pr. 190 RUN terminal function selection*　*Pr. 191 FU terminal function selection*
*Pr. 192 A,B,C terminal function selection*

You can change the functions of the open collector output terminal and relay output terminal.

| Pr. 190 to Pr. 196 Setting | | Signal | Functions |
|---|---|---|---|
| Positive logic | Negative logic | | |
| 0 | 100 | RUN | Inverter running |
| 1 | 101 | SU | Up to frequency |
| 3 | 103 | OL | Overload alarm |
| 4 | 104 | FU | Output frequency detection |
| 7 | 107 | RBP | Regenerative brake prealarm |
| 8 | 108 | THP | Electronic thermal relay function prealarm |
| 11 | 111 | RY | Inverter operation ready |
| 12 | 112 | Y12 | Output current detection |
| 13 | 113 | Y13 | Zero current detection |
| 14 | 114 | FDN | PID lower limit |
| 15 | 115 | FUP | PID upper limit |
| 16 | 116 | RL | PID forward/reverse rotation output |
| 20 | 120 | BOF | Brake opening request |
| 25 | 125 | FAN | Fan fault output |
| 26 | 126 | FIN | Heatsink overheat pre-alarm |
| 46 | 146 | Y46 | During deceleration due to instantaneous power failure (retained until release) |
| 47 | 147 | PID | During PID control activated |
| 64 | 164 | Y64 | During retry |
| 90 | 190 | Y90 | Life alarm |
| 91 | 191 | Y91 | Fault output 3 (power-off signal) |
| 93 | 193 | Y93 | Current average value monitor signal |
| 95 | 195 | Y95 | Maintenance timer signal |
| 96 | 196 | REM | Remote output |
| 98 | 198 | LF | Alarm output |
| 99 | 199 | ALM | Fault output |
| 9999 | | — | No function |

## Pr.232 to 239 ⟹ Refer to the section about *Pr. 4*.

## Pr.240 ⟹ Refer to the section about *Pr. 72*.

## Pr.241 ⟹ Refer to the section about *Pr. 125*.

## Pr.244

## Increase cooling fan life

*Pr. 244 Cooling fan operation selection*

You can control the operation of the cooling fan (200V class 1.5K or more) built in the inverter.

| Pr. 244 Setting | Description |
|---|---|
| 0 | Operates in power-on status. Cooling fan on/off control invalid (the cooling fan is always on at power on) |
| 1 (initial value) | Cooling fan on/off control valid The fan is always on while the inverter is running. During a stop, the inverter status is monitored and the fan switches on-off according to the temperature. |

## Pr.245 to 247

## Slip compensation ⟨V/F⟩ ⟨GP MFVC⟩

*Pr. 245 Rated slip*　*Pr. 246 Slip compensation time constant*
*Pr. 247 Constant-power range slip compensation selection*

The inverter output current may be used to assume motor slip to keep the motor speed constant.

When setting parameters, refer to the instruction manual (applied) and understand instructions.

## Pr. 249

# Earth (ground) fault detection at start

*Pr. 249 Earth (ground) fault detection at start*

You can choose whether to make earth (ground) fault detection at start valid or invalid. Earth (ground) fault detection is executed only right after the start signal is input to the inverter.

| Pr. 249 Setting | Description |
|---|---|
| 0 (initial value) | Without earth (ground) fault detection |
| 1 | With earth (ground) fault detection* |

∗ As detection is executed at starting, output is delayed for approx. 20ms every starting.
• If an earth (ground) fault is detected with "1" set in *Pr. 249*, fault output (E.GF) is displayed and the output is shut off.
• Protective function will not activate if an earth (ground) fault occurs during operation.
• If the motor capacity is smaller than the inverter capacity for the 5.5K or more, earth (ground) fault detection may not be provided.

## Pr. 250

# Selection of motor stopping method and start signal

*Pr. 250 Stop selection*

Used to select the stopping method (deceleration to a stop or coasting) when the start signal turns off.

Used to stop the motor with a mechanical brake, etc. together with switching off of the start signal.

You can also select the operations of the start signals (STF/STR).

| Pr. 250 Setting | Description | |
|---|---|---|
| | Start signal (STF/STR) | Stop operation |
| 0 to 100s | STF signal: Forward rotation start STR signal: Reverse rotation start | The motor is coasted to a stop when the preset time elapses after the start signal is turned off. |
| 1000s to 1100s | STF signal: Start signal STR signal: Forward/reverse signal | The motor is coasted to a stop (*Pr. 250* - 1000)s after the start signal is turned off. |
| 9999 | STF signal: Forward rotation start STR signal: Reverse rotation start | When the start signal is turned off, the motor decelerates to stop. |
| 8888 | STF signal: Start signal STR signal: Forward/reverse signal | |

When "9999 (initial value) or 8888" is set in *Pr. 250*

Output frequency (Hz)
Deceleration starts when start signal turns off
Deceleration time (Time set in *Pr. 8*, etc.)
DC brake
Time
Start signal    ON    OFF
RUN signal    ON    OFF
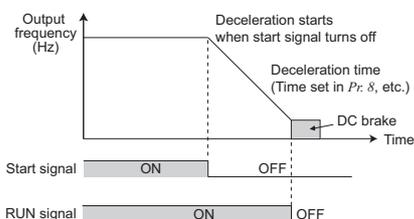
When a value other than "9999" (initial value) or "8888" is set in *Pr. 250*

Output frequency (Hz)
Output is shut off when set time elapses after start signal turned off
*Pr. 250*
The motor coasts to stop
Time
Start signal    ON    OFF
RUN signal    ON    OFF
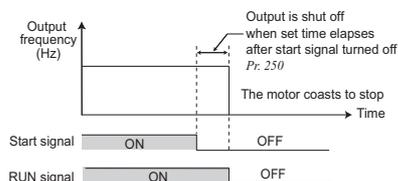
## Pr. 251, 872

# Input/output phase failure protection selection

*Pr. 251 Output phase loss protection selection*    *Pr. 872 Input phase loss protection selection*

You can disable the output phase failure protection function that stops the inverter output if one of the inverter output side (load side) three phases (U, V, W) opens.

The input phase failure protection function of the inverter input side (R, S, T) can be made valid.

| Pr. Number | Setting Range | Description |
|---|---|---|
| 251 | 0 | Without output phase failure protection |
| | 1 (initial value) | With output phase failure protection |
| 872 | 0 | Without input phase failure protection |
| | 1 (initial value) | With input phase failure protection |

## Pr. 255 to 259

# Display of the life of the inverter parts

*Pr. 255 Life alarm status display*    *Pr. 256 Inrush current limit circuit life display*
*Pr. 257 Control circuit capacitor life display*    *Pr. 258 Main circuit capacitor life display*
*Pr. 259 Main circuit capacitor life measuring*

Degrees of deterioration of main circuit capacitor, control circuit capacitor or inrush current limit circuit and cooling fan can be diagnosed by monitor.

When any part has approached the end of its life, an alarm can be output by self diagnosis to prevent a fault.

(Use the life check of this function as a guideline since the life except the main circuit capacitor is calculated theoretically.)

| Pr. Number | Setting Range | Description |
|---|---|---|
| 255 | (0 to 15) | Displays whether the control circuit capacitor, main circuit capacitor, cooling fan, and each parts of the inrush current limit circuit has reached the life alarm output level or not. (Reading only) |
| 256 | (0 to 100%) | Displays the deterioration degree of the inrush current limit circuit. (Reading only) |
| 257 | (0 to 100%) | Displays the deterioration degree of the control circuit capacitor. (Reading only) |
| 258 | (0 to 100%) | Displays the deterioration degree of the main circuit capacitor. (Reading only) The value measured by *Pr. 259* is displayed. |
| 259 | 0, 1 | Setting "1" and turning the power supply off starts the measurement of the main circuit capacitor life. When the *Pr. 259* value is "3" after powering on again, the measuring is completed. Displays the deterioration degree in *Pr. 258*. |

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## Pr. 261

### Operation at instantaneous power failure

*Pr. 261 Power failure stop selection*

When a power failure or undervoltage occurs, the inverter can be decelerated to a stop or can be decelerated and re-accelerated to the set frequency.

| Pr. Number | Setting Range | Description |
|---|---|---|
| 261 | 0 (initial value) | Coasts to stop. When undervoltage or power failure occurs, the inverter output is shut off. |
| | 1 | When undervoltage or a power failure occurs, the inverter can be decelerated to a stop. |
| | 2 | When undervoltage or a power failure occurs, the inverter can be decelerated to a stop. If power is restored during a power failure, the inverter accelerates again. |

**(1) Power failure stop mode (*Pr. 261* = "1")**

- If power is restored during power failure deceleration, deceleration to a stop is continued and the inverter remains stopped. To restart, turn off the start signal once, then turn it on again.
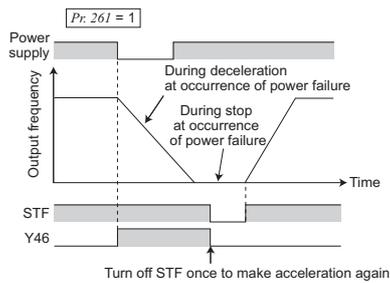


**(2) Original operation continuation at instantaneous power failure function (*Pr. 261* = "2")**

- When power is restored during deceleration after a power failure, acceleration is made again up to the set frequency.
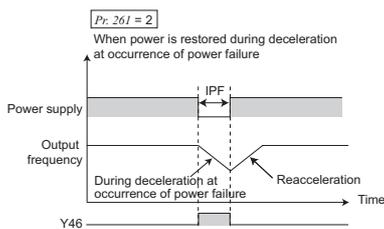


## Pr. 267 ⇨ Refer to the section about *Pr. 73*.

## Pr. 268 ⇨ Refer to the section about *Pr. 52*.

## Pr. 269 Parameter for manufacturer setting. Do not set.

## Pr. 270, 275, 276, 6, 48

### Stop-on-contact control [AD MFVC] [GP MFVC]

*Pr. 270 Stop-on contact control selection*
*Pr. 276 PWM carrier frequency at stop-on contact*
*Pr. 275 Stop-on contact excitation current low-speed multiplying factor*
*Pr. 6 Multi-speed setting (low speed)*
*Pr. 48 Second stall prevention operation current*

To ensure accurate positioning at the upper limit etc. of a lift, stop-on-contact control causes a mechanical brake to be closed while the motor is developing a holding torque to keep the load in contact with a mechanical stopper etc.

This function suppresses vibration which is liable to occur when the load is stopped upon contact in vertical motion applications, ensuring steady precise positioning.

| *Pr. 270* Setting | Description |
|---|---|
| 0 (initial value) | Without stop-on-contact control |
| 1 | Stop-on-contact control |

● Select advanced magnetic flux vector control or general-purpose magnetic flux vector control.

When both the RT and RL signals are switched on, the inverter enters the stop-on contact mode, in which operation is performed at the frequency set in *Pr. 6 "Multi-speed setting (low speed)"* independently of the preceding speed.
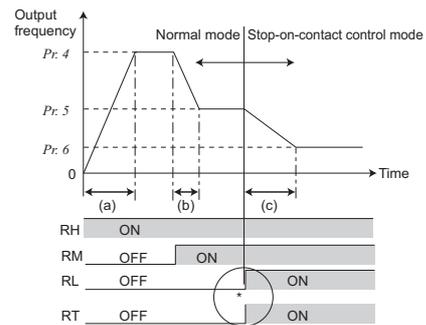


\* Goes into stop-on-contact control when both RL and RT switch on.
  RL and RT may be switched on in any order with any time difference.
  (a) Acceleration time (*Pr. 7* )   (b) Deceleration time (*Pr. 8* )
  (c) Second deceleration time (*Pr. 44/Pr. 45* )

| Pr. Number | Setting Range | Description |
|---|---|---|
| 6 | 0 to 400Hz | Sets the output frequency for stop-on-contact control The frequency should be as low as possible (about 2Hz). If it is set to more than 30Hz, the operating frequency will be 30Hz. |
| 48 | 0 to 200% | Sets the stall prevention operation level for stall prevention operation level. (*Pr. 22* when *Pr. 48* = "9999") |
| 275 | 0 to 300% | Usually set a value between 130% and 180%. Set the force (holding torque) for stop-on-contact control. |
| | 9999 | Without compensation. |
| 276 | 0 to 9 | Sets a PWM carrier frequency for stop-on-contact control. |
| | 9999 | As set in *Pr. 72 PWM frequency selection*. |

When setting parameters, refer to the instruction manual (applied) and understand instructions.

## Pr. 278 to 283, 292

## Brake sequence function [AD MFVC] [GP MFVC]

| Pr. 278 Brake opening frequency | Pr. 279 Brake opening current |
| Pr. 280 Brake opening current detection time | Pr. 281 Brake operation time at start |
| Pr. 282 Brake operation frequency | Pr. 283 Brake operation time at stop |
| Pr. 292 Automatic acceleration/deceleration | |

This function is used to output from the inverter the mechanical brake opening completion signal timing signal in vertical lift and other applications.

This function prevents the load from dropping with gravity at a start due to the operation timing error of the mechanical brake or an overcurrent alarm from occurring at a stop, ensuring secure operation.

<Operation example>

● At start: When the start signal is input to the inverter, the inverter starts running. When the internal speed command reaches the value set in *Pr. 278* and the output current is not less than the value set in *Pr. 279*, the inverter outputs the brake opening request signal (BOF) after the time set in *Pr. 280* has elapsed.

When the time set in *Pr. 281* elapses after the brake opening completion signal (BRI) was activated, the inverter increases the output frequency to the set speed.

● At stop: When the speed has decreased to the frequency set in *Pr. 282*, the brake opening request signal (BOF) is turned off. When the time set in *Pr. 283* elapses after the brake operation confirmation signal (BRI) was activated, the inverter output is switched off.

* If *Pr. 292* = "8" (mechanical brake opening completion signal not input), this time is the time after the brake opening request signal is output.

1) *Pr. 292* = "7" (brake opening completion signal input)
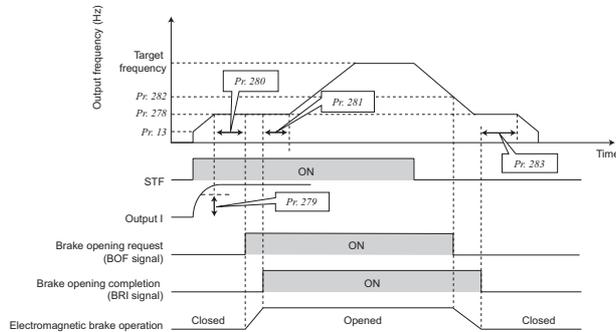


2) *Pr. 292* = "8" (brake opening completion signal not input)
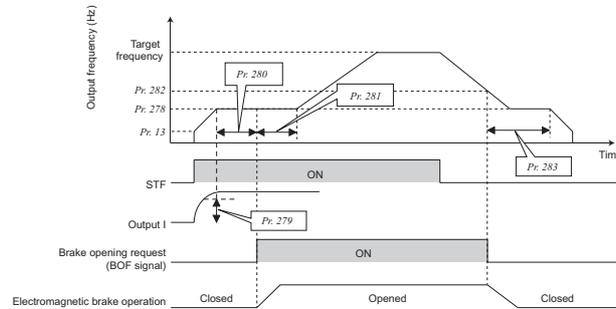


| Pr. Number | Setting Range | Description |
|---|---|---|
| 278 | 0 to 30Hz | Set to the rated slip frequency of the motor + about 1.0Hz. This parameter may be set only if *Pr. 278 ≤ Pr. 282*. |
| 279 | 0 to 200% | Generally, set this parameter to about 50 to 90%. If the setting is too low, the load is liable to drop due to gravity at start. Suppose that the rated inverter current is 100%. |
| 280 | 0 to 2s | Generally, set this parameter to about 0.1 to 0.3s. |
| 281 | 0 to 5s | *Pr. 292* = 7: Set the mechanical delay time until the brake is loosened. *Pr. 292* = 8: Set the mechanical delay time until the brake is loosened + about 0.1 to 0.2s. |
| 282 | 0 to 30Hz | At this frequency, the brake opening request signal (BOF) is switched off. Generally, set this parameter to the *Pr. 278* setting + 3 to 4Hz. This parameter may be only set if *Pr. 282 ≥ Pr. 278*. |
| 283 | 0 to 5s | *Pr. 292* =7: Set the mechanical delay time until the brake is closed + 0.1s. *Pr. 292* =8: Set the mechanical delay time until the brake is closed + 0.2 to 0.3s. |
| 292 | 0, 1, 7, 8, 11 | Brake sequence function is made valid when a setting is "7" or "8". |

## Pr. 286, 287

## Droop control [AD MFVC]

| Pr. 286 Droop gain | Pr. 287 Droop filter time constant |

This function is designed to balance the load in proportion to the load torque to provide the speed drooping characteristic.

This function is effective for balancing the load when using multiple inverters

| Pr. Number | Setting Range | Description |
|---|---|---|
| 286 | 0 (initial value) | Droop control is invalid |
| | 0.1 to 100% | Set the drooping amount at the rated torque as a percentage with respect to the rated motor frequency. |
| 287 | 0.00 to 1.00s | Set the time constant of the filter applied on the torque amount current. |

● Droop control

This control is valid when a value other than "0" is set in *Pr. 286* under advanced magnetic flux vector control.

The maximum droop compensation frequency is 120Hz.
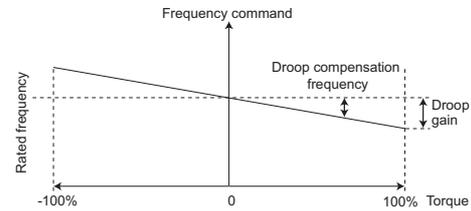


## Pr. 292, 293 ⇒ Refer to the section about *Pr. 61*.

## Pr. 295 ⇒ Refer to the section about *Pr. 161*.

## Pr. 298 ⇒ Refer to the section about *Pr. 82*.

## Pr. 299 ⇒ Refer to the section about *Pr. 57*.

When setting parameters, refer to the instruction manual (applied) and understand instructions.

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**Pr.** 338, 339, 550, 551

## Operation command source and speed command source during communication operation

*Pr. 338 Communication operation command source*  *Pr. 339 Communication speed command source*
*Pr. 550 NET mode operation command source selection*  *Pr. 551 PU mode control source selection*

When the RS-485 communication with the PU connector or communication option is used, the external operation command and speed command can be made valid. Operation command in the PU operation mode can be selected.

| Pr. Number | Setting Range | Description |
|---|---|---|
| 338 | 0 (initial value) | Operation command source communication |
| | 1 | Operation command source external |
| 339 | 0 (initial value) | Speed command source communication |
| | 1 | Speed command source external (Frequency setting from communication is invalid, terminal 2 setting from external is valid) |
| | 2 | Speed command source external (Frequency setting from communication is valid, terminal 2 setting from external is invalid) |
| 550∗ | 0 | Selects the communication option as NET operation mode command source. |
| | 2 | Selects the PU connector as the NET operation mode control source |
| | 9999 (initial value) | Automatic communication option recognition Normally, PU connector is valid. When a communication option is mounted, the communication option is valid. |
| 551∗ | 2 | Selects the PU connector as the PU operation mode control source |
| | 3 | Select the USB connector as the PU operation mode control source |
| | 4 | Selects the operation panel as the PU operation mode control source. |
| | 9999 (initial value) | USB automatic recognition Normally, operation panel is valid. When the parameter unit is connected to the PU connector, PU is valid. When USB is connected, USB is valid. |

∗ *Pr. 550 and Pr. 551* are always write-enabled.

**Pr.** 340  ⇨  **Refer to the section about** *Pr. 79*.

**Pr.** 342, 343  ⇨  **Refer to the section about** *Pr. 117*.

**Pr.** 450  ⇨  **Refer to the section about** *Pr. 71*.

**Pr.** 495 to 497

## Remote output function (REM signal)

*Pr. 495 Remote output selection*  *Pr. 496 Remote output data 1*
*Pr. 497 Remote output data 2*

You can utilize the on/off of the inverter's output signals instead of the remote output terminal of the PLC.

| Pr. Number | Setting Range | Description | |
|---|---|---|---|
| 495 | 0 (initial value) | Remote output data clear at powering off | Remote output data clear at inverter reset |
| | 1 | Remote output data retention at powering off | |
| | 10 | Remote output data clear at powering off | Remote output data retention at inverter reset |
| | 11 | Remote output data retention at powering off | |
| 496∗ | 0 to 4095 | Refer to the following diagram. | |
| 497∗ | 0 to 4095 | | |

∗ The above parameters allow its setting to be changed during operation in any operation mode even if "0" (initial value) is set in *Pr. 77 Parameter write selection*.

**\<Remote output data\>**

*Pr. 496*

| b11 | | | | | | | | | | | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ∗1 | ∗1 | ∗1 | ∗1 | ∗1 | ∗1 | ABC | FU | ∗1 | ∗1 | ∗1 | RUN |

*Pr. 497*

| b11 | | | | | | | | | | | b0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ∗1 | ∗1 | RA3 ∗2 | RA2 ∗2 | RA1 ∗2 | Y6 ∗2 | Y5 ∗2 | Y4 ∗2 | Y3 ∗2 | Y2 ∗2 | Y1 ∗2 | Y0 ∗2 |

∗1 As desired (always 0 when read)
∗2 Y0 to Y6 are available only when the extension output option (FR-A7AY E kit) is fitted
∗3 RA1 to RA3 are available only when the relay output option (FR-A7AR E kit) is fitted

**Pr.** 502  ⇨  **Refer to the section about** *Pr. 117*.

## Pr. 503, 504
## Maintenance of parts

*Pr. 503 Maintenance timer*  *Pr. 504 Maintenance timer alarm output set time*

When the cumulative energization time of the inverter reaches the parameter set time, the maintenance timer output signal (Y95) is output. $\sqcap\sqcap\sqcap$ (MT) is displayed on the operation panel.

This can be used as a guideline for the maintenance time of peripheral devices.
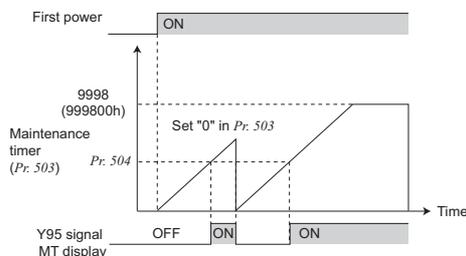


- The cumulative energization time of the inverter is stored into the E2PROM every hour and indicated in *Pr. 503 Maintenance timer* in 100h increments. *Pr. 503* is clamped at 9998 (999800h).

## Pr. 547, 548
## Inverter setup using USB communication

*Pr. 547 USB communication station number*  *Pr. 548 USB communication check time interval*

Inverter setup with setup software (FR Configurator) can be easily performed by USB communication.

| Pr. Number | Setting Range | Description |
|---|---|---|
| 547 | 0 (initial value) | Set the station number of USB device (inverter) within the range "0 to 31". |
| | 1 to 31 | |
| 548 | 0 to 999.8 | Set the communication check time interval of USB communication. If data is not received within the time set in *Pr. 548*, $\mathcal{E}.\mathit{U5b}$ (E.USB) is displayed. |
| | 9999 (initial value) | Communication time interval is not checked. |

## Pr. 549  ⇨ Refer to the section about *Pr. 117*.

## Pr. 550, 551  ⇨ Refer to the section about *Pr. 338*.

## Pr. 555 to 557
## Current average value monitor signal

*Pr. 555 Current average time*  *Pr. 556 Data output mask time*
*Pr. 557 Current average value monitor signal output reference current*

The average value of the output current during constant speed operation and the maintenance timer value are output as a pulse to the current average value monitor signal (Y93).

The pulse width output to the I/O module of the PLC or the like can be used as a guideline due to abrasion of machines and elongation of belt and for aged deterioration of devices to know the maintenance time.

The current average value monitor signal (Y93) is output as pulse for 20s as 1 cycle and repeatedly output during constant speed operation.
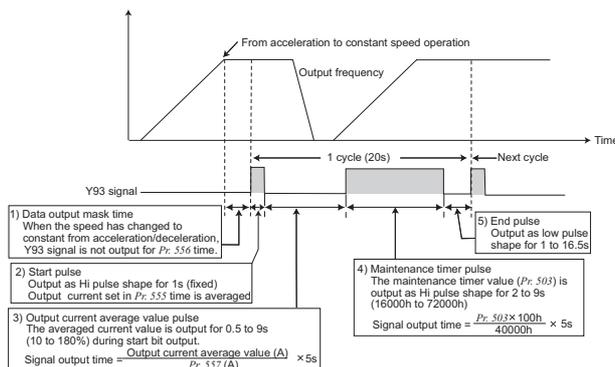


## Pr. 563, 564  ⇨ Refer to the section about *Pr. 52*.

## Pr. 571  ⇨ Refer to the section about *Pr. 13*.

## Pr. 611  ⇨ Refer to the section about *Pr. 57*.

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When setting parameters, refer to the instruction manual (applied) and understand instructions.

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## Pr. 653

## Reduce mechanical resonance

*Pr. 653 Speed smoothing control*

Mechanical vibration produced while motor is driving (resonance) can be reduced.

Set 100% in *Pr. 653* and check if the vibration will be reduced. Make adjustment gradually increasing the setting, until the vibration become the smallest.

## Pr. 665, 882, 883, 885, 886

## Regeneration avoidance function

*Pr. 665 Regeneration avoidance frequency gain*　　*Pr. 882 Regeneration avoidance operation selection*

*Pr. 883 Regeneration avoidance operation level*　　*Pr. 885 Regeneration avoidance compensation frequency limit value*

*Pr. 886 Regeneration avoidance voltage gain*

This function detects a regeneration status and increases the frequency to avoid the regenerative status.

● Possible to avoid regeneration by automatically increasing the frequency and continue operation if the fan happens to rotate faster than the set speed due to the effect of another fan in the same duct.

| Pr. Number | Setting Range | Description |
|---|---|---|
| 882 | 0 (initial value) | Regeneration avoidance function invalid |
| | 1 | Regeneration avoidance function is always valid |
| | 2 | Regeneration avoidance function is valid only during a constant speed operation |
| 883 | 300 to 800V | Set the bus voltage level at which regeneration avoidance operates. When the bus voltage level is set to low, overvoltage error will be less apt to occur. However, the actual deceleration time increases.The set value must be higher than the "power supply voltage $\times \sqrt{2}$". |
| 885 | 0 to 10Hz | Set the limit value of frequency which rises at activation of regeneration avoidance function. |
| | 9999 | Frequency limit invalid |
| 886 | 0 to 200% | Adjusts responsiveness at activation of regeneration avoidance. A larger setting will improve responsiveness to the bus voltage change. However, the output frequency could become unstable. When the load inertia of the motor is large, decrease the *Pr. 886* setting. When vibration is not suppressed by decreasing the *Pr. 886* setting, set a smaller value in *Pr. 665*. |
| 665 | | |



Regeneration avoidance operation example for deceleration
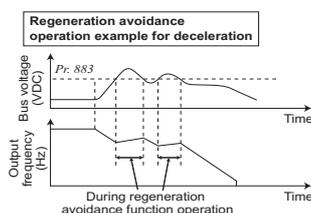
## Pr. 800　⇒　**Refer to the section about** *Pr. 80*.

## Pr. 859　⇒　**Refer to the section about** *Pr. 82*.

## Pr. 872　⇒　**Refer to the section about** *Pr. 251*.

## Pr. 888, 889

## Free parameter

*Pr. 889 Free parameter 1*　　*Pr. 889 Free parameter 2*

Parameters you can use for your own purposes.

You can input any number within the setting range 0 to 9999.

For example, the number can be used:

● As a unit number when multiple units are used.

● As a pattern number for each operation application when multiple units are used.

● As the year and month of introduction or inspection.

## Pr. C0(900)

## Adjustment of terminal FM output (calibration)

*C0 (Pr. 900)FM terminal calibration*

By using the operation panel or parameter unit, you can calibrate terminal FM to full scale deflection.

### FM terminal calibration (*C0 (Pr. 900)*)

● The terminal FM is preset to output pulses. By setting the *calibration parameter C0 (Pr. 900)*, the meter connected to the inverter can be calibrated by parameter setting without use of a calibration resistor.

● Using the pulse train output of the terminal FM, a digital display can be provided by a digital counter. The monitor value is 1440 pulses/s output at the full-scale value of *Pr. 54 FM terminal function selection*.



Pulse width T1: Adjust using calibration parameter C0
Pulse cycle T2: Set with *Pr. 55* (frequency monitor)
Set with *Pr. 56* (current monitor)
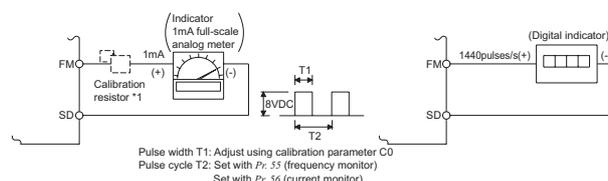
∗1 Not needed when the operation panel or parameter unit (FR-PU04/FR-PU07) is used for calibration.

Used when calibration must be made near the frequency meter for such a reason as a remote frequency meter.

However, the frequency meter needle may not deflect to full-scale if the calibration resistor is connected. In this case, use this resistor and operation panel or parameter unit together.

## Pr. C2(902) to C7(905), C22(922) to C25(923)

⇒　**Refer to the section about** *Pr. 125*.

When setting parameters, refer to the instruction manual (applied) and understand instructions.

## **Pr.**990

### Buzzer control of the operation panel

*Pr. 990 PU buzzer control*

You can make the buzzer "beep" when you press key of the operation panel and parameter unit (FR-PU04/FR-PU07)

| *Pr. 990* Setting | Description |
|---|---|
| 0 | Without buzzer |
| 1 (initial value) | With buzzer |

## **Pr.**991

### PU contrast adjustment

*Pr. 991 PU contrast adjustment*

Contrast adjustment of the LCD of the parameter unit (FR-PU04/FR-PU07) can be performed.
Decreasing the setting value makes contrast light.

| *Pr. 991* Setting | Description |
|---|---|
| 0 to 63 | 0: Light ↓ 63: Dark |

## **Pr.**CL, ALLC, Er.CL, CH

### Clear parameter, initial value change list

*Pr.CL Parameter clear*        *ALLC All parameter clear*
*Er.CL Alarm history clear*      *Pr.CH Initial value change list*

- Set "1" in *Pr.CL parameter clear*  to initialize all parameters. (Calibration parameters are not cleared.) *
- Set "1" in *ALLC  All parameter clear*  to initialize all parameters.*
- Set "1" in *Er.CL Faults history clear* to clear faults history.*
- Using *Pr.CH Initial value change list*, only the parameters changed from the initial value can be displayed.
* Parameters are not cleared when "1" is set in *Pr. 77 Parameter write selection*.

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When setting parameters, refer to the instruction manual (applied) and understand instructions.

# Protective Functions

When a fault occurs, the inverter trips and the PU display automatically changes to any of the following fault or alarm indications.

| | Function Name | Description | Display |
|---|---|---|---|
| **Error message** *2 | **Operation panel lock** | Appears when operation was tried during operation panel lock. | *HOLd* |
| | **Parameter write error** | Appears when an error occurred during parameter writing. | *Er 1* to *Er4* |
| | **Inverter reset** | Appears when the RES signal is on. | *Err.* |
| **Warnings** *3 | **Stall prevention (overcurrent)** | Appears during overcurrent stall prevention. | *OL* |
| | **Stall prevention (overvoltage)** | Appears during overvoltage stall prevention. Appears while the regeneration avoidance function is activated. | *oL* |
| | **Regenerative brake prealarm** | Appears if the regenerative brake duty reaches or exceeds 85% of the *Pr. 70 Special regenerative brake duty* value. If the regenerative brake duty reaches 100%, a regenerative overvoltage (E. OV_) occurs. | *rb* |
| | **Electronic thermal relay function prealarm** | Appears when the electronic thermal O/L relay has reached 85% of the specified value. | *TH* |
| | **PU stop** | Appears when (STOP/RESET) on the operation panel was pressed during external operation. | *PS* |
| | **Maintenance signal output** | Appears when the cumulative energization time has exceeded the maintenance output timer set value. | *nr* |
| **Alarms** *4 | **Undervoltage** | Appears when the main circuit power became low voltage. | *Uv* |
| | **Fan alarm** | Appears when the cooling fan remains stopped when operation is required or when the speed has decreased. | *Fn* |
| **Fault** *5 | **Overcurrent shut-off during acceleration** | Appears when an overcurrent occurred during acceleration. | *E.OC 1* |
| | **Overcurrent shut-off during constant speed** | Appears when an overcurrent occurred during constant speed operation. | *E.OC2* |
| | **Overcurrent shut-off during deceleration or stop** | Appears when an overcurrent occurred during deceleration and at a stop. | *E.OC3* |
| | **Regenerative overvoltage shut-off during acceleration** | Appears when an overvoltage occurred during acceleration. | *E.Ov 1* |
| | **Regenerative overvoltage shut-off during constant speed** | Appears when an overvoltage occurred during constant speed operation. | *E.Ov2* |
| | **Regenerative overvoltage shut-off during deceleration or stop** | Appears when an overvoltage occurred during deceleration and at a stop. | *E.Ov3* |
| | **Inverter overload shut-off (electronic thermal relay function)** *1 | Appears when the electronic thermal relay function for inverter element protection was activated. | *E.THT* |
| | **Motor overload shut-off (electronic thermal relay function)** *1 | Appears when the electronic thermal relay function for motor protection was activated. | *E.THM* |
| | **Fin overheat** | Appears when the heatsink overheated. | *E.FIn* |
| | **Input phase loss** | Appears if one of the three phases on the inverter input side opened. | *E.ILF* |
| | **Stall prevention** | Appears when the output frequency drops to 1Hz as a result of deceleration due to the excess motor load. | *E.OLT* |
| | **Brake transistor alarm detection** | This function stops the inverter output if an alarm occurs in the brake circuit, e.g. damaged brake transistors. In this case, the inverter must be powered off immediately. | *E. bE* |
| | **Output side earth (ground) fault overcurrent** | Appears when an earth (ground) fault occurred on the inverter's output side. (detects only at a start) | *E. GF* |
| | **Output phase loss** | Appears if one of the three phases on the inverter output side opened. | *E. LF* |
| | **External thermal relay operation** *6 | Appears when the external thermal relay connected to the OH signal was activated. | *E.OHT* |
| | **Communication option fault** | Appears when a communication error occurred in the communication option. | *E.OP 1* |
| | **Option fault** | Appears when a contact fault or the like of the connector between the inverter and communication option occurs. | *E.  1* |
| | **Parameter storage device fault** | Appears when operation of the element where parameters stored became abnormal. (control board) | *E. PE* |
| | **PU disconnection** | Appears when a communication error between the PU and inverter occurred, the communication interval exceeded the permissible time during the RS-485 communication with the PU connector, or communication errors exceeded the number of retries during the RS-485 communication. | *E.PUE* |
| | **Retry count excess** | Appears when the operation was not restarted within the set number of retries. | *E.rET* |
| | **CPU error** | Appears during the CPU and peripheral circuit errors occurred. | *E. 6/* *E. 7/* *E.CPU* |
| | **Inrush current limit circuit fault** | Appears when the resistor of the inrush current limit circuit overheated. | *E.IOH* |
| | **Analog input fault** | Appears when voltage is input (7.3V or more for 5s or more) with the terminal 4 set to current input. | *E.AIE* |
| | **Brake sequence error** | The inverter output is stopped when a sequence error occurs during use of the brake sequence function *(Pr. 278 to Pr. 285)*. | *E.Mb4* to *E.Mb7* |
| | **USB communication fault** | Appears when USB communication error occurred. | *E.USb* |
| | **Internal circuit fault** | Appears when an internal circuit error occurred. | *E. 13* |

*1 Resetting the inverter initializes the internal thermal integrated data of the electronic thermal relay function.
*2 The error message shows an operational error. The inverter output is not shut off.
*3 Warnings are messages given before fault occur. The inverter output is not shut off.
*4 Alarms warn the operator of failures with output signals. The inverter output is not shut off.
*5 When faults occur, the protective functions are activated to inverter trip and output the fault signals.
*6 The external thermal operates only when the OH signal is set in *Pr. 178* to *Pr. 184 (input terminal function selection)*.

# Option and Peripheral Devices

## Option list

By fitting the following options to the inverter, the inverter is provided with more functions.

One type of plug-in option can be mounted.

| Name | | Type | Applications, Specifications, etc. | Applicable Inverter |
|---|---|---|---|---|
| Plug-in type | 16-bit digital input | FR-A7AX E kit | • This input interface sets the high frequency accuracy of the inverter using an external BCD or binary digital signal.<br>• BCD code 3 digits (maximum 999) •BCD code 4 digits (maximum 9999)<br>• Binary 12 bits (maximum FFFH) •Binary 16 bits (maximum FFFFH) | Shared among all models |
| | Digital output Extension analog output | FR-A7AY E kit | • This option provides the inverter with open collector outputs selected from among the standard output signals.<br>• This option adds two different signals that can be monitored at the terminals AM0 and AM1, such as the output frequency, output voltage and output current.<br>• 20mADC or 10VDC meter can be connected. | |
| | Relay output | FR-A7AR E kit | • This option provides the inverter with three different relay contact outputs selected from among the standard output signals. | |
| | Communication | CC-Link communication | FR-A7NC E kit | • This option allows the inverter to be operated or monitored or the parameter setting to be changed from PLC, etc. | Shared among all models (To be released) |
| | | LONWORKS communication | FR-A7NL E kit | | |
| | | DeviceNet communication | FR-A7ND E kit | | |
| | | PROFIBUS-DP communication | FR-A7NP E kit | | |
| Stand-alone shared | Parameter unit (8 languages) | FR-PU07 FR-PU04 | Interactive parameter unit with LCD display | Shared among all models |
| | Parameter unit connection cable | FR-CB20□ | Cable for connection of operation panel or parameter unit<br>□ indicates a cable length. (1m, 3m, 5m) | |
| | USB cable | MR-J3USBCBL3M Cable length 3m | Connector for amplifier mini-B connector (5 pin)    Connector for personal computer A connector | Shared among all models |
| | AC reactor | FR-HAL | For harmonic current reduction and inverter input power factor improvement (total power factor approx. 88%) | According to capacities |
| | DC reactor | FR-HEL | For harmonic current reduction and inverter input power factor improvement (total power factor approx. 93%) | According to capacities |
| | Radio noise filter | FR-BIF(H) | For radio noise reduction (connect to the input side) | Shared among all models |
| | Line noise filter | FR-BSF01 FR-BLF | For line noise reduction | Shared among all models |
| | Brake resistor | MRS type, MYS type | For increasing the regenerative braking capability (permissible duty 3%ED) | For the 0.4K or more |
| | High-duty brake resistor | FR-ABR | For improvement of braking capability of the built-in brake of the inverter | For the 0.4K or more |
| | Brake unit Resistor unit Discharging resistor | FR-BU2 FR-BR GZG, GRZG type | For increasing the braking capability of the inverter (for high-inertia load or negative load)<br>Brake unit, electrical-discharge resistor and resistor unit are used in combination | For the 0.4K or more |
| | Power regeneration common converter Stand-alone reactor dedicated for the FR-CV | FR-CV FR-CVL | Unit which can return motor-generated braking energy back to the power supply in common converter system | According to capacities |
| | High power factor converter | FR-HC | The high power factor converter switches the converter section on/off to reshape an input current waveform into a sine wave, greatly suppressing harmonics. (Used in combination with the standard accessory.) | According to capacities |
| | DIN rail attachment | FR-UDA01 to 03 | Attachment for installation on DIN rail | Compatible with the 3.7K or less |
| FR series manual controller/speed controller | Manual controller | FR-AX | For independent operation. With frequency meter, frequency potentiometer and start switch. | Shared among all models |
| | DC tach. follower | FR-AL | For synchronous operation (1.5VA) by external signal (0 to 5V, 0 to 10V DC)∗ | |
| | Three speed selector | FR-AT | For three speed switching, among high, middle and low speed operation (1.5VA)∗ | |
| | Motorized speed setter | FR-FK | For remote operation. Allows operation to be controlled from several places (5VA)∗ | |
| | Ratio setter | FR-FH | For ratio operation. The ratios of five inverters can be set (3VA)∗ | |
| | Speed detector | FR-FP | For tracking operation by a pilot generator (PG) signal (3VA)∗ | |
| | Master controller | FR-FG | Master controller (5VA) for parallel operation of multiple (maximum 35) inverters.∗ | |
| | Soft starter | FR-FC | For soft start and stop. Enables acceleration/deceleration in parallel operation (3VA)∗ | |
| | Deviation detector | FR-FD | For continuous speed control operation. Used in combination with a deviation sensor or synchro (5VA)∗ | |
| | Preamplifier | FR-FA | Used as an A/V converter or arithmetic amplifier (3VA)∗ | |
| Others | Pilot generator | QVAH-10 | For tracking operation. 70V/35VAC 500Hz (at 2500r/min) | |
| | Deviation sensor | YVGC-500W-NS | For continuous speed control operation (mechanical deviation detection) Output 90VAC/90ºC | |
| | Frequency setting potentiometer | WA2W 1kΩ | For frequency setting. Wire-wound 2W 1kΩ type B characteristic | |
| | Analog frequency meter (64mm × 60mm) | YM206NRI 1mA | Dedicated frequency meter (graduated to 120Hz). Moving-coil type DC ammeter | |
| | Calibration resistor | RV24YN 10kΩ | For frequency meter calibration. Carbon film type B characteristic | |
| | FR Configurator (VFD setup software) | FR-SW3-SETUP-WJ | Supports an inverter startup to maintenance. | Shared among all models (To be released) |

∗ Rated power consumption. The power supply specifications of the FR series manual controllers and speed controllers are 200VAC 50Hz, 220V/220VAC 60Hz, and 115VAC 60Hz.

**50**

## Stand-alone option

| Name (type) | Specifications, Structure, etc. |
|---|---|

### AC reactor (for power coordination) FR-HAL-(H)□□K

● Outline dimension

(Unit: mm)

| Inverter Type | | W | D | H | Mass (kg) | Inverter Type | W | D | H | Mass (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 200V | 0.4K | 104 | 72 | 99 | 0.6 | H0.4K | 135 | 59.6 | 115 | 1.5 |
| | 0.75K | 104 | 74 | 99 | 0.8 | H0.75K | 135 | 59.6 | 115 | 1.5 |
| | 1.5K | 104 | 77 | 99 | 1.1 | H1.5K | 135 | 59.6 | 115 | 1.5 |
| | 2.2K | 115 | 77 | 115 | 1.5 | H2.2K | 135 | 59.6 | 115 | 1.5 |
| | 3.7K | 115 | 83 | 115 | 2.2 | H3.7K | 135 | 70.6 | 115 | 2.5 |
| | 5.5K | 115 | 83 | 115 | 2.3 | H5.5K | 160 | 72 | 142 | 3.5 |
| | 7.5K | 130 | 100 | 135 | 4.2 | H7.5K | 160 | 91 | 142 | 5.0 |
| | 11K | 160 | 111 | 164 | 5.2 | H11K | 160 | 91 | 146 | 6.0 |
| | 15K | 160 | 126 | 167 | 7.0 | H15K | 220 | 105 | 195 | 9.0 |

Less than D

H

W
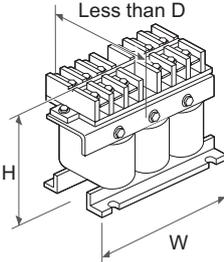
(Note) 1. Make selection according to the applied motor capacity. (When the inverter capacity is larger than the motor capacity, make selection according to the motor capacity)
2. Power factor improving reactor (FR-BAL) can be used.
   Power factor improving effect
   FR-BAL approx. 90%
   FR-HAL approx. 88%
3. Outline dimension drawing shown is a one of a typical model.
   The shape differs according to each models.
4. Install the AC reactor (FR-HAL) on horizontal or vertical plane.

### DC reactor (for power coordination) FR-HEL-(H)□□K

● Outline dimension

(Unit: mm)

| Inverter Type | | W | D | H | Mass (kg) | Inverter Type | W | D | H | Mass (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 200V | 0.4K | 70 | 61 | 71 | 0.4 | H0.4K | 90 | 60 | 78 | 0.6 |
| | 0.75K | 85 | 61 | 81 | 0.5 | H0.75K | 66 | 70 | 100 | 0.8 |
| | 1.5K | 85 | 70 | 81 | 0.8 | H1.5K | 66 | 80 | 100 | 1 |
| | 2.2K | 85 | 70 | 81 | 0.9 | H2.2K | 76 | 80 | 110 | 1.3 |
| | 3.7K | 77 | 82 | 92 | 1.5 | H3.7K | 86 | 95 | 120 | 2.3 |
| | 5.5K | 77 | 92 | 92 | 1.9 | H5.5K | 96 | 100 | 128 | 3 |
| | 7.5K | 86 | 98 | 113 | 2.5 | H7.5K | 96 | 105 | 128 | 3.5 |
| | 11K | 105 | 112 | 133 | 3.3 | H11K | 105 | 110 | 137 | 4.5 |
| | 15K | 105 | 115 | 133 | 4.1 | H15K | 105 | 125 | 152 | 5 |

Less than D

H   W
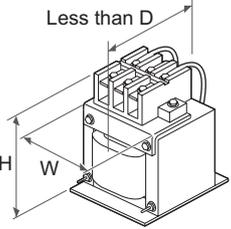
(Note) 1. Be sure to remove the jumper across the inverter terminals P/+-P1. (A failure to do so will produce no power factor improving effect))
2. The wiring length between the reactor and inverter should be within 5m.
3. The size of the cables used should be equal to or larger than that of the power supply cables (R/L1, S/L2, T/L3).
4. Make selection according to the motor capacity.
   (When the inverter capacity is larger than the motor capacity, make selection according to the motor capacity)
5. Power factor improving reactor (FR-BEL) can be used.
   Power factor improving effect
   FR-BEL approx.95%
   FR-HEL approx.93%
6. Outline dimension drawing shown is a one of a typical model.
   The shape differs according to each models.
7. Install the DC reactor (FR-HEL) on horizontal or vertical plane.

### Radio noise filter FR-BIF (200V class) FR-BIF-H (400V class)

● Outline dimension

R S T
Red White Blue   Green

300

Leakage currents: 4mA

29

58

41

φ4.3 hole

29  7

44

4

(Unit: mm)

MCCB    Inverter

Power supply   R/L1
               S/L2
               T/L3

Earth (Ground)

Radio noise filter FR-BIF(-H)

(Note) 1. Can not be connected to the inverter output side.
2. Wire should be cut as short as possible, and connect to the inverter terminal block.

| Name (type) | Specifications, Structure, etc. |
|---|---|

### Line noise filter FR-BSF01
...for small capacities FR- BLF

● Outline dimension

**FR-BSF01**

110
95
2-φ5
22.5
65
33
65
4.5

**FR-BLF**

31.5
φ7
130
85
80
35
7
2.3
160
180

MCCB → Inverter
Power supply → R/L1, S/L2, T/L3
Line noise filter
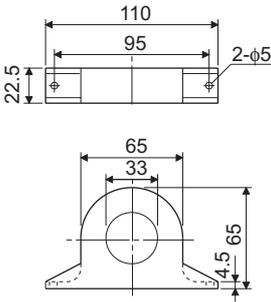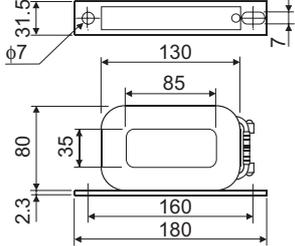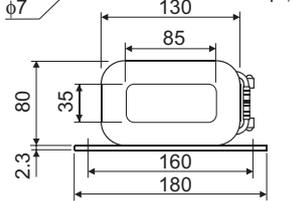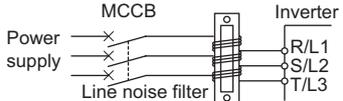
(Note) 1. Each phase should be wound at least 3 times (4T, 4 turns) in the same direction. (The greater the unmber of turns, the more effevtive result is obtained.)
2. When the thickness of the wire prevents winding, use at least 4 in series and ensure that the current passes through each phase in the same direction.
3. Can be used on the output side in the same way as the input side.
4. Please use FR-BSF01 for inverters with small capacities of 3.7K or less. Thick wires (38mm$^2$ or more) can not be used. In such cases, use the FR-BLF.

### Brake Resistor MRS type, MYS type

● Outline dimension

**MRS type** (Unit: mm)

500
182
Round crimping terminals 1.25-4
42
20
(Unit : mm)

**MYS type**
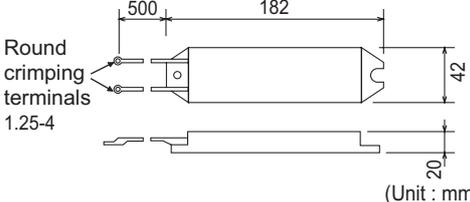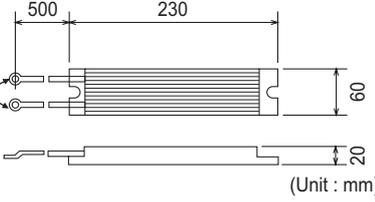
500
230
Round crimping terminals 1.25-4
60
20
(Unit : mm)

| | Resistor Type | Permissible Duty | Resistance Value (Ω) | Permissible Power (W) | Applicable Motor Capacity (kW) |
|---|---|---|---|---|---|
| 200V output, MRS type | MRS120W200 | 3% | 200 | 15 | 0.4 |
| | MRS120W100 | | 100 | 30 | 0.75 |
| | MRS120W60 | | 60 | 55 | 1.5, 2.2 |
| | MRS120W40 | | 40 | 80 | 2.2, 3.7 |
| MYS type | MYS220W50 * | 6% | 50/2 | 2×80 | 3.7 |

＊ Two unit in parallel

(Note) 1. The temperature of the brake resistor becomes 200ºC or more depending on the operation frequency, care must be taken for installation and heat dissipation.
2. The brake resistor can not be used with the 0.1K and 0.2K.

### High-duty brake resistor FR-ABR-(H)□□

● Outline dimension

(Unit: mm)

| Brake Resistor Type | Permissible Brake Duty | Outline Dimension | | | | Resistance Value (Ω) | Approx. Mass (kg) | Brake Resistor Type | Permissible Brake Duty | Outline Dimension | | | | Resistance Value (Ω) | Approx. Mass (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | W | W1 | D | H | | | | | W | W1 | D | H | | |
| FR-ABR-0.4K | 10% | 140 | 500 | 40 | 21 | 200 | 0.2 | FR-ABR-H0.4K | 10% | 115 | 500 | 40 | 21 | 1200 | 0.2 |
| FR-ABR-0.75K | 10% | 215 | 500 | 40 | 21 | 100 | 0.4 | FR-ABR-H0.75K | 10% | 140 | 500 | 40 | 21 | 700 | 0.2 |
| FR-ABR-2.2K*1 | 10% | 240 | 500 | 50 | 26 | 60 | 0.5 | FR-ABR-H1.5K | 10% | 215 | 500 | 40 | 21 | 350 | 0.4 |
| | | | | | | | | FR-ABR-H2.2K | 10% | 240 | 500 | 50 | 26 | 250 | 0.5 |
| FR-ABR-3.7K | 10% | 215 | 500 | 61 | 33 | 40 | 0.8 | FR-ABR-H3.7K | 10% | 215 | 500 | 61 | 33 | 150 | 0.8 |
| FR-ABR-5.5K | 10% | 335 | 500 | 61 | 33 | 25 | 1.3 | FR-ABR-H5.5K | 10% | 335 | 500 | 61 | 33 | 110 | 1.3 |
| FR-ABR-7.5K | 10% | 400 | 500 | 80 | 40 | 20 | 2.2 | FR-ABR-H7.5K | 10% | 400 | 500 | 80 | 40 | 75 | 2.2 |
| FR-ABR-11K | 6% | 400 | 700 | 100 | 50 | 13 | 3.5 | FR-ABR-H11K | 6% | 400 | 700 | 100 | 50 | 52 | 3.2 |
| FR-ABR-15K*2 | 6% | 300 | 700 | 100 | 50 | 18 (×1/2) | 2.4 (×2) | FR-ABR-H15K*3 | 6% | 300 | 700 | 100 | 50 | 18 (×2) | 2.4 (×2) |

(200V / 400V)

＊1 For the 1.5K and 2.2K inverter.
＊2 For the 15K brake resistor, configure so that two 18Ω resistors are connected in parallel.
＊3 For the 15K brake resistor, configure so that two 18Ω resistors are connected in series. FR-ABR-15K is indicated on the resistor. (same resistor as the 200V class 15K)

D
H
W1+20
0
W
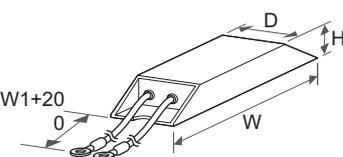
(Note) 1. The regenerative brake duty setting should be less than permissible brake duty in the table above.
2. The temperature of the brake resistor becomes 300°C or more depending on the operation frequency, care must be taken for installation and heat dissipation.
3. MYS type resistor can be also used. Note that the permissible brake duty.
4. The brake resistor can not be used with the 0.1K and 0.2K.
5. Do not remove a jumper across terminal P/+ and P1 except when connecting a DC reactor.

| Name (type) | Specifications, Structure, etc. |
|---|---|

● A brake unit is an option that fully enhances the regenerative braking capability of the inverter, and should be used with an electrical-discharge resistor. Select from three discharging resistor according to the required braking torque.

● **Specification**

**<Brake Unit>**

| Type FR-BU2-□ | 200V | | | | | 400V | | |
|---|---|---|---|---|---|---|---|---|
| | **1.5K** | **3.7K** | **7.5K** | **15K** | **30K** | **H7.5K** | **H15K** | **H30K** |
| Applicable motor capacity | Capacity of the motor to be used with differs according to the braking torque and duty (%ED) | | | | | | | |
| Connected brake resistor | GRZG type, FR-BR, MT-BR5 (refer to the table below for combinations) | | | | | | | |
| Multiple (parallel) operation | Up to 10 units (note that torque generated is not more than the tolerable overcurrent amount of connected inverter) | | | | | | | |
| Approximate mass (kg) | 0.9 | 0.9 | 0.9 | 0.9 | 1.4 | 0.9 | 0.9 | 1.4 |

**<Resistor unit>**

| Type GRZG | 200V | | | | 400V | |
|---|---|---|---|---|---|---|
| | **GZG300W-50Ω** | **GRZG200-10Ω** | **GRZG300-5Ω** | **GRZG400-2Ω** | **GRZG200-10Ω** | **GRZG300-5Ω** |
| Number of connectable devices | One | Three in series | Four in series | Six in series | Six in series | 8 in series |
| Brake resistor total resistance value (Ω) | 50 | 30 | 20 | 12 | 60 | 40 |
| Continuous permissible power (W) | 100 | 300 | 600 | 1200 | 600 | 1200 |

| Type FR-BR-□ | 200V | 400V |
|---|---|---|
| | **15K** | **H15K** |
| Brake resistor total resistance value (Ω) | 8 | 32 |
| Continuous permissible power (W) | 990 | 990 |
| Approximate mass (kg) | 15 | 15 |

● **Combinations of brake unit and resistor unit**

| Brake Unit | | Discharging Resistor/Resistor Unit Type | |
|---|---|---|---|
| | | **GRZG type** | **FR-BR** |
| **200V class** | FR-BU2-1.5K | GZG 300W-50Ω (1) | — |
| | FR-BU2-3.7K | GRZG 200-10Ω (3 in series) | — |
| | FR-BU2-7.5K | GRZG 300-5Ω (4 in series) | — |
| | FR-BU2-15K | GRZG 400-2Ω (6 in series) | FR-BR-15K |
| | FR-BU2-30K | — | FR-BR-30K |
| **400V class** | FR-BU2-H7.5K | GRZG 200-10Ω (6 in series) | — |
| | FR-BU2-H15K | GRZG 300-5Ω (8 in series) | FR-BR-H15K |
| | FR-BU2-H30K | GRZG 400-2Ω (12 in series) | FR-BR-H30K |

**Brake unit**
**FR-BU2-(H)□□K**

**Resistor unit**
**FR-BR-(H)□□K**

**Discharging resistor**
**GZG type**
**GRZG type**

● **Selection**

**<When GRZG type is connected>**

• The maximum temperature rise of the discharging resistors is approximately 100°C. Use heat-resistant wires and wire to avoid contact with resistors.

| Power Supply Voltage | Motor (kW) Braking torque | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|
| **200V class** | 50% 30s | FR-BU2-1.5K | | | FR-BU2-3.7K | | FR-BU2-7.5K | | FR-BU2-15K | |
| | 100% 30s | FR-BU2-1.5K | | FR-BU2-3.7K | FR-BU2-7.5K | | FR-BU2-15K | | 2 × FR-BU2-15K*1 | |
| **400V class** | 50% 30s | —*1 | | | FR-BU2-H7.5K | | | | FR-BU2-H15K | |
| | 100% 30s | —*2 | | | FR-BU2-H7.5K | | FR-BU2-H15K | | FR-BU2-H30K | |

∗1 The number before the model name explains the number of connectable units in parallel.
∗2 The inverter for 400V class 1.5K or less can not be used in combination with a brake unit. To use in combination with a brake unit, use the inverter of 2.2K or more.

**<When FR-BR is connected>**

• The temperature rise of the resistor unit is about a maximum of 100°C. Therefore, use heat-resistant wires (such as glass wires).

**%ED at short-time rating when braking torque is 100%**

| Motor Capacity | | | 5.5kW | 7.5kW | 11kW | 15kW |
|---|---|---|---|---|---|---|
| **200V class** | FR-BU2-15K | %ED | 80 | 40 | 15 | 10 |
| | FR-BU2-30K | | — | — | 65 | 30 |
| **400V class** | FR-BU2-H15K | %ED | 80 | 40 | 15 | 10 |
| | FR-BU2-H30K | | — | — | 65 | 30 |

**Braking torque (%) at short-time rating when 10%ED is 15s**

| Motor Capacity | | | 5.5kW | 7.5kW | 11kW | 15kW |
|---|---|---|---|---|---|---|
| **200V class** | FR-BU2-15K | Injection brake torque (%) | 280 | 200 | 120 | 100 |
| | FR-BU2-30K | | — | — | 260 | 180 |
| **400V class** | FR-BU2-H15K | Injection brake torque (%) | 280 | 200 | 120 | 100 |
| | FR-BU2-H30K | | — | — | 260 | 180 |

Regeneration duty factor (operation frequency)%ED $= \dfrac{tb}{tc} \times 100$   tb<15s (continuous operation time)

Example 1  Travel operation

Example 2  Lift operation

tb=t1+t2+t3+t4

| Name (type) | Specifications, Structure, etc. |
|---|---|

**Brake unit
FR-BU2-(H)□□K**

**Resistor unit
FR-BR-(H)□□K**

**Discharging resistor
GZG type
GRZG type**

● Connection diagram
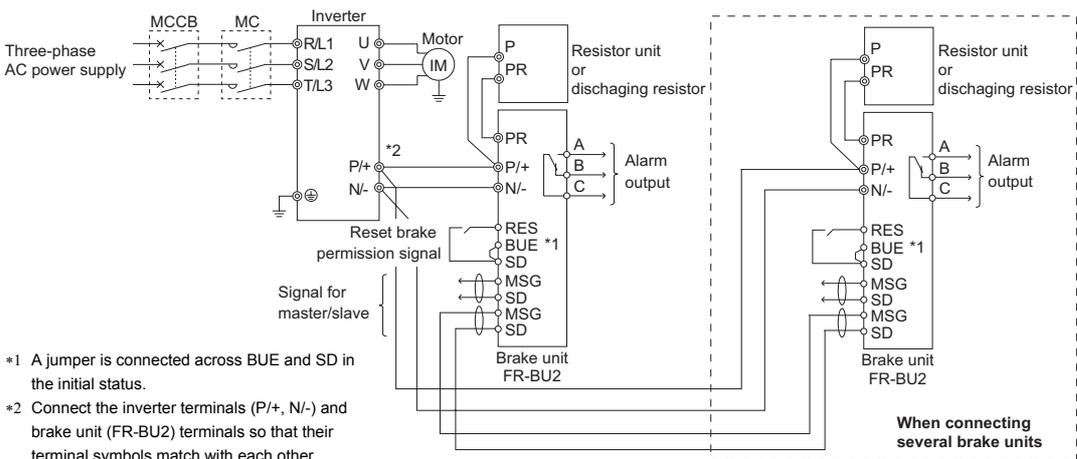


∗1 A jumper is connected across BUE and SD in the initial status.

∗2 Connect the inverter terminals (P/+, N/-) and brake unit (FR-BU2) terminals so that their terminal symbols match with each other. Incorrect connection will damage the inverter. Do not remove a jumper across terminal P/+ and P1 except when connecting a DC reactor.

● Outline dimension drawings
**\<FR-BU2\>**
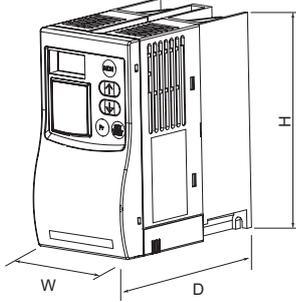


(Unit: mm)

| Model | W | H | D |
|---|---|---|---|
| FR-BU2-1.5K to 15K | 68 | 128 | 132.5 |
| FR-BU2-30K | 108 | 128 | 129.5 |
| FR-BU2-H7.5K, H15K | 68 | 128 | 132.5 |
| FR-BU2-H30K | 108 | 128 | 129.5 |

**\<GZG,GRZG\>**



(Unit: mm)
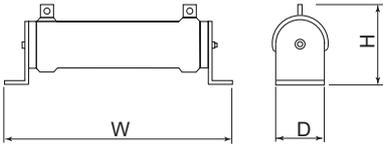
| Type | W | D | H |
|---|---|---|---|
| GZG300W | 335 | 40 | 78 |
| GRZG200 | 306 | 26 | 55 |
| GRZG300 | 334 | 40 | 79 |
| GRZG400 | 411 | 40 | 79 |

**\<FR-BR\>**



(Unit: mm)
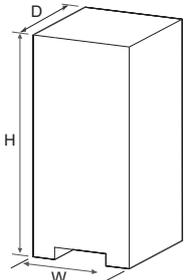
| Model | W | H | D |
|---|---|---|---|
| FR-BR-15K | 170 | 450 | 220 |
| FR-BR-30K | 340 | 600 | 220 |
| FR-BR-H15K | 170 | 450 | 220 |
| FR-BR-H30K | 340 | 600 | 220 |

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| Name (type) | Specifications, Structure, etc. |
|---|---|

**Power regeneration common converter FR-CV-(H)□□K**

- Enables 100%-torque continuous regeneration to support continuous regenerative operation for line control, etc. (Maximum torque 150% 60s)
- Eliminates the need to use a brake unit with each inverter, reducing total space and total cost.
- Saves energy since regeneration energy is used for the other inverters and excess energy is returned to the power supply.
- Heatsink protrusion type has the heat generating section outside of the enclosure, and exhaust the converter generated heat to the outside of enclosure.

● **Connection diagram**
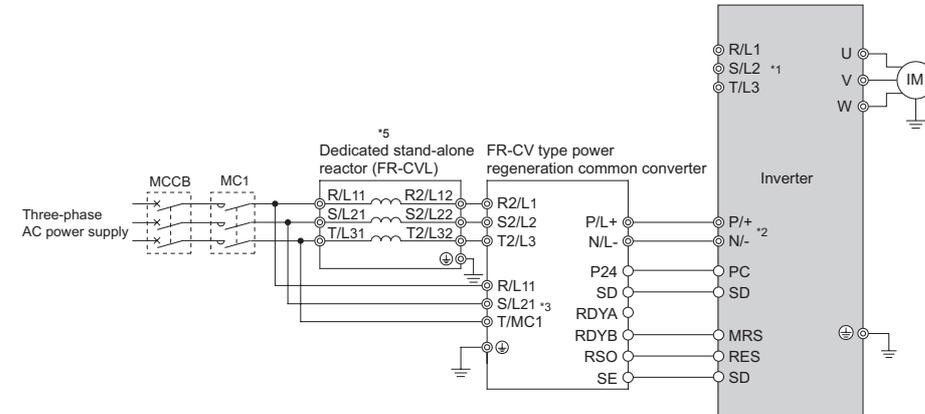


*1 Always keep the power input terminals R/L1, S/L2, T/L3 open. Incorrect connection will damage the inverter. Opposite polarity of terminals N/-, P/+ will damage the inverter.

*2 Do not insert an MCCB between the terminals P/+-N/- (between P/L+-P/+, between N/L--N/-). Connect the inverter terminals (P/+, N/-) and power regeneration common converter terminals so that their terminal symbols match with each other. Incorrect connection will damage the inverter.
Do not remove a jumper across terminal P/+ and P1 except when connecting a DC reactor.

*3 Assign the terminal for X10 signal using any of *Pr. 178* to *Pr. 184 (input terminal function selection)*.

*4 Always connect the power supply and terminals R/L11, S/L21, T/MC1. If the inverter is operated without connection, the power regeneration common converter will be damaged.

*5 Install the dedicated stand-alone reactor (FR-CVL) on horizontal plane.

● **Outline dimension drawings**
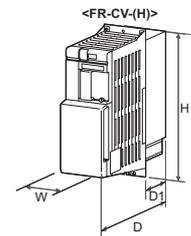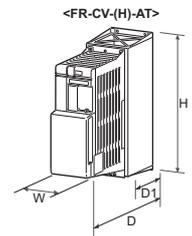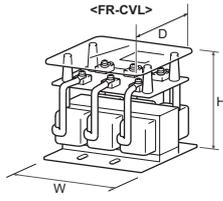


FR-CV-(H) (Unit mm)

| Voltage/Capacity | | W | H | D | D1 | Voltage/Capacity | | W | H | D | D1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200V | 7.5K/11K | 90 | 300 | 303 | 103 | 400V | 7.5K/11K/15K | 120 | 300 | 305 | 105 |
| | 15K | 120 | 300 | 305 | 105 | | | | | | |
| | 22K/30K | 150 | 380 | 322 | 122 | | 22K/30K | 150 | 380 | 305 | 105 |
| | 37K/55K | 400 | 620 | 250 | 135 | | 37K/55K | 400 | 620 | 250 | 135 |

FR-CV-(H)-AT (Unit mm)

| Voltage/Capacity | | W | H | D | D1 | Voltage/Capacity | | W | H | D | D1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200V | 7.5K/11K | 110 | 330 | 315 | 115 | 400V | 7.5K/11K/15K | 130 | 330 | 320 | 120 |
| | 15K | 130 | 330 | 320 | 120 | | | | | | |
| | 22K/30K | 160 | 410 | 350 | 150 | | 22K/30K | 160 | 410 | 350 | 150 |

FR-CVL (Unit mm)

| Voltage/Capacity | | W | H | D | Voltage/Capacity | | W | H | D |
|---|---|---|---|---|---|---|---|---|---|
| 200V | 7.5K/11K/15K | 165 | 130 | 155 | 400V | 7.5K/11K | 220 | 135 | 200 |
| | 22K | 165 | 140 | 155 | | 15K | 220 | 135 | 205 |
| | 30K | 215 | 160 | 175 | | 22K | 220 | 150 | 215 |
| | 37K | 220 | 320 | 200 | | 30K | 245 | 185 | 220 |
| | 55K | 250 | 335 | 225 | | 37K | 245 | 230 | 265 |
| | | | | | | 55K | 290 | 230 | 280 |

| Name (type) | Specifications, Structure, etc. |
|---|---|

## High power factor converter FR-HC- (H)☐☐K

● Substantially suppresses power harmonics to realize the equivalent capacity conversion coefficient K5=0 in the "Harmonic suppression guideline for consumers who receive high voltage or special high voltage".

● Has the power regeneration function as standard.
● Connects multiple inverters to enable common converter system operation.

### ● Specifications

| Type FR-HC☐☐ | 200V | | | | 400V | | | |
|---|---|---|---|---|---|---|---|---|
| | 7.5K | 15K | 30K | 55K | H7.5K | H15K | H30K | H55K |
| Applicable inverter capacity (*1) | 3.7K to 7.5K | 7.5K to 15K | 15K to 30K | 30K to 55K | 3.7K to 7.5K | 7.5K to 15K | 15 to 30K | 30K to 55K |
| Rated input voltage/ frequency | Three-phase 200V to 220V 50Hz 200V to 230V 60Hz | | | | Three-phase 380V to 460V 50/60Hz | | | |
| Rated input current (A) | 33 | 61 | 115 | 215 | 17 | 31 | 57 | 110 |
| Rated output voltage (V) (*2) | 293V to 335VDC | | | | 558V to 670VDC | | | |

*1 The applicable capacity to the high power factor converter is the total capacity of the inverters.
*2 The output voltage varies with the input voltage value.
*3 Reactor 1 FR-HCL01, Reactor 2 FR-HCL02 and Outside box FR-HCB are supplied with a order of the high power factor converter (FR-HC)

### ● Outline dimension

(Unit: mm)

| Voltage | Capacity | High Power Factor Converter FR-HC | | | Reactor 1 FR-HCL01 | | | Reactor 2 FR-HCL02 | | | Outside Box FR-HCB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | W | H | D | W | H | D | W | H | D | W | H | D |
| 200V | 7.5K | 220 | 300 | 190 | 160 | 155 | 100 | 240 | 230 | 160 | 190 | 320 | 165 |
| | 15K | 250 | 400 | 190 | 190 | 205 | 130 | 260 | 270 | 170 | | | |
| | 30K | 340 | 550 | 195 | 220 | 230 | 170 | 340 | 320 | 180 | 270 | 450 | 203 |
| | 55K | 480 | 700 | 250 | 210 | 260 | 225 | 430 | 470 | 360 | | | |
| 400V | H7.5K | 220 | 300 | 190 | 160 | 150 | 100 | 240 | 220 | 160 | 190 | 320 | 165 |
| | H15K | 250 | 400 | 190 | 190 | 195 | 130 | 260 | 260 | 170 | | | |
| | H30K | 340 | 550 | 195 | 220 | 215 | 140 | 340 | 310 | 180 | 270 | 450 | 203 |
| | H55K | 480 | 700 | 250 | 280 | 255 | 190 | 400 | 380 | 285 | | | |

High power factor converter       Outside box       Reactor 1, Reactor 2
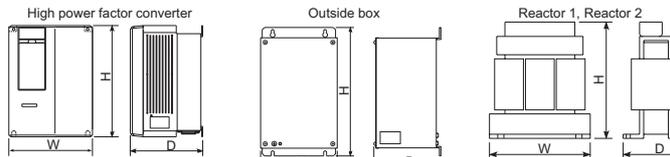
\* Install the reactor (FR-HCL01, 02) on horizontal plane.

## DIN rail mounting attachments FR-UDA☐☐

● Attachment to enable insataltion of FR-E700 series on DIN rail.

### Selection table

| Model | Inverter Capacity (kW) | | |
|---|---|---|---|
| | FR-UDA01 | FR-UDA02 | FR-UDA03 |
| FR-E720 | 0.1K, 0.2K, 0.4K, 0.75K | 1.5K, 2.2K | 3.7K |

### ● Approximate dimension

<FR-UDA01>       <FR-UDA02>       <FR-UDA03>

68
67
15
128
8.7
Hook       3-M4×0.7 screw

108
67
15
10
128
8.7
Hook       4-M4×0.7 screw

170
67
14.4
128
8.7
Hook       4-M4×0.7 screw       (Unit: mm)

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## Peripheral devices/cable size list

| Inverter type | | Motor Output (kW) | Moulded Case Circuit Breaker (MCCB)∗1 or Earth Leakage Current Breaker (ELB)∗4 | | Magnetic Contactor (MC) | HIV Cables, etc. (mm²) | | Reactor | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Standard | With power factor improving reactor | | R/L1, S/L2, T/L3 | U, V, W | FR-HAL | FR-HEL |
| Three-phase 200V | FR-E720-0.1K | 0.1 | 30AF 5A | 30AF 5A | S-N10 | 2 | 2 | 0.4K | 0.4K |
| | FR-E720-0.2K | 0.2 | 30AF 5A | 30AF 5A | S-N10 | 2 | 2 | 0.4K | 0.4K |
| | FR-E720-0.4K | 0.4 | 30AF 5A | 30AF 5A | S-N10 | 2 | 2 | 0.4K | 0.4K |
| | FR-E720-0.75K | 0.75 | 30AF 10A | 30AF 10A | S-N10 | 2 | 2 | 0.75K | 0.75K |
| | FR-E720-1.5K | 1.5 | 30AF 15A | 30AF 15A | S-N10 | 2 | 2 | 1.5K | 1.5K |
| | FR-E720-2.2K | 2.2 | 30AF 20A | 30AF 15A | S-N10 | 2 | 2 | 2.2K | 2.2K |
| | FR-E720-3.7K | 3.7 | 30AF 30A | 30AF 30A | S-N20, S-N21 | 3.5 | 3.5 | 3.7K | 3.7K |
| | FR-E720-5.5K | 5.5 | 50AF 50A | 50AF 40A | S-N25 | 5.5 | 5.5 | 5.5K | 5.5K |
| | FR-E720-7.5K | 7.5 | 100AF 60A | 50AF 50A | S-N35 | 14 | 8 | 7.5K | 7.5K |
| | FR-E720-11K | 11 | 100AF 75A | 100AF 75A | S-N35 | 14 | 14 | 11K | 11K |
| | FR-E720-15K | 15 | 225AF 125A | 100AF 100A | S-N50 | 22 | 22 | 15K | 15K |

∗1 Select the MCCB according to the inverter power supply capacity.
Install one MCCB per inverter.

— - ─┬─ MCCB ─ INV ─ (IM)
    └─ MCCB ─ INV ─ (IM)
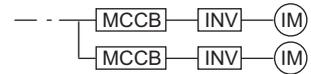
∗2 When the inverter capacity is larger than the motor capacity, select a brake and a magnetic contactor according to the inverter type and cable and reactor according to the motor output.

∗3 When the breaker on the inverter primary side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter, etc. Identify the cause of the trip, then remove the cause and power on the breaker.

∗4 For installations in the United States or Canada, use the class T type fuse certified by the UL and cUL.

# Selecting the rated sensitivity current for the earth leakage current breaker

When using the earth leakage current breaker with the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency.

- Breaker designed for harmonic and surge suppression
  Rated sensitivity current $I\Delta n \geq 10 \times (Ig1+Ign+Igi+Ig2+Igm)$
- Standard breaker
  Rated sensitivity current $I\Delta n \geq 10 \times \{Ig1+Ign+Igi+3X(Ig2+Igm)\}$

Ig1, Ig2: Leakage currents in wire path during commercial power supply operation

Ign  : Leakage current of inverter input side noise filter

Igm  : Leakage current of motor during commercial power supply operation

Igi  : Leakage current of inverter unit

Example of leakage current of cable path per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (200V 60Hz)



Cable size (mm²)
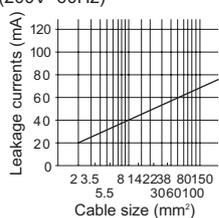
Leakage current example of three-phase induction motor during the commercial power supply operation (200V 60Hz)



Motor capacity (kW)
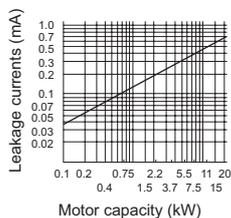
## example
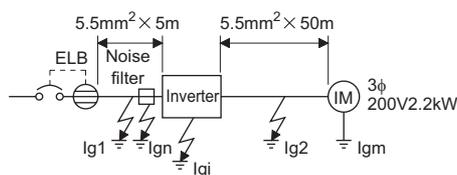


(Note) 1  Install the earth leakage breaker (ELB) on the input side of the inverter.

2  In the 人 connection earthed-neutral system, the sensitivity current is blunt against an earth (ground) fault in the inverter output side. Earthing (Grounding) must conform to the requirements of national and local safety regulations and electrical codes. (NEC section 250, IEC 536 class 1 and other applicable standards)

● Selection example (in the case of the above figure)

| | Breaker Designed for Harmonic and Surge Suppression | Standard Breaker |
|---|---|---|
| Leakage current Ig1 (mA) | $33 \times \dfrac{5m}{1,000m} = 0.17$ | |
| Leakage current Ign (mA) | 0 (without noise filter) | |
| Leakage current Igi (mA) | 1 | |
| Leakage current Ig2 (mA) | $33 \times \dfrac{50m}{1,000m} = 1.65$ | |
| Motor leakage current Igm (mA) | 0.18 | |
| Total leakage current (mA) | 3.00 | 6.66 |
| Rated sensitivity current (mA) ($\geq Ig \times 10$) | 30 | 100 |

## Precautions for use of the inverter

⚠ Safety Precautions
- To operate the inverter correctly and safely, be sure to read the "instruction manual" before starting operation.
- This product has not been designed or manufactured for use with any equipment or system operated under life-threatening conditions.
- Please contact our sales office when you are considering using this product in special applications such as passenger mobile, medical, aerospace, nuclear, power or undersea relay equipment or system.
- Although this product is manufactured under strict quality control, safety devices should be installed when a serious accident or loss is expected by a failure of this product.
- The load used should be a three-phase induction motor only.

## Operation

- A magnetic contactor (MC) provided on the input side should not be used to make frequent starts and stops. It could cause the inverter to fail.
- However, at this time, the motor cannot be brought to a sudden stop. Hence, provide a mechanical stopping/holding mechanism for the machine/equipment which requires an emergency stop.
- It will take time for the capacitor to discharge after shutoff of the inverter power supply. When accessing the inverter for inspection, wait for at least 10 minutes after the power supply has been switched off, and check to make sure that there are no residual voltage using a tester or the like.

## Wiring

- Application of power to the output terminals (U, V, W) of the inverter will damage the inverter. Therefore, fully check the wiring and sequence to ensure that wiring is correct, etc. before powering on.
- The terminals P/+, PR, P1, N/- are provided for connection of a dedicated option. Connect only a dedicated option. Do not short the frequency setting power supply terminal 10 and common terminal 5 or the terminal PC and terminal SD.

## Power supply

- When the inverter is connected under a large-capacity power transformer (500kVA or more transformer) or when a power capacitor is to be switched over, an excessive peak current may flow in the power input circuit, damaging the inverter.
  To prevent this, always install an optional AC reactor (FR-HEL).
- If a surge voltage occurs in the power supply system, this surge energy may flow into the inverter, causing the inverter to display overvoltage protection (E.OV□) and come to an inverter trip. To prevent this, always install an optional AC reactor (FR-HAL).
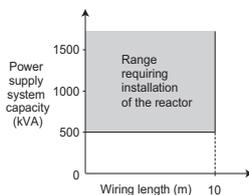
## Installation

- Avoid hostile environment where oil mist, fluff, dust particles, etc. are suspended in the air, and install the inverter in a clean place or put it in an ingress-protected "enclosed" enclosure. When placing the inverter in an enclosure, determine the cooling system and panel dimensions so that the ambient temperature of the inverter is within the permissble value. (*refer to page 8* for the specified value)
- Do not install the inverter on wood or other combustible material as it will be hot partly.
- Install the inverter in the vertical orientation.

## Setting

- The inverter can be operated as fast as a maximum of 400Hz by parameter setting. Therefore, incorrect setting can cause a danger. Set the upper limit using the maximum frequency limit setting function.
- A setting higher than the initial value of DC injection brake operation voltage or operation time can cause motor overheat (electronic thermal relay error).
- Do not set *Pr. 70 Special regenerative brake duty* except for using the optional brake resistor. This function is used to protect the brake resistor from overheating. Do not set the value exceeding permissible duty of the brake resistor.

## Precautions for selection

### Inverter capacity selection

- When operating a special motor or more than one motor in parallel with a single inverter, select the inverter capacity so that 1.1 times the total rated motor current is less than the rated output current of the inverter.
- Setting 2kHz or more in *Pr. 72 PWM frequency selection* to perform low acoustic noise operation with the ambient temperature exceeding 40°C (totally-enclosed structure is 30°C), decrease the output current according to the rating table on *page 7* . (Also change the *Pr. 9 Electronic thermal O/L relay* setting.)

### Starting torque of the motor

- The start and acceleration characteristics of the motor driven by the inverter are restricted by the overload current rating of that inverter. Generally the torque characteristic is less than when the motor is started by a commercial power supply. If torque boost adjustment, advanced magnetic flux vector control, or general-purpose magnetic flux vector control cannot provide enough torque when a large starting torque is necessary, select the inverter of one rank higher capacity or increase the capacities of both the motor and inverter.

### Acceleration/deceleration times

- The acceleration/deceleration time of the motor depends on the motor-generated torque, load torque and moment of inertia of the load (J).
- When the torque limit function or stall prevention function is activated during acceleration/deceleration, increase the acceleration/deceleration time as the actual time may become longer.
- To decrease the acceleration/deceleration time, increase the torque boost value (setting of a too large value may activate the stall prevention function at a start, longer the acceleration time), use the advanced magnetic flux vector control or general-purpose magnetic flux vector control or increase the inverter and motor capacities. To decrease the deceleration time, it is necessary to add optional brake resistor MRS or FR-ABR (for the 0.4K or more), the brake unit (FR-BU2), power regeneration common converter (FR-CV), or a similar device to absorb braking energy.

### Power transfer mechanism (reduction gear, belt, chain, etc.)

- When an oil-lubricated gear box, speed change/reduction gear or similar device is used in the power transfer system, note that continuous operation at low speed only may deteriorate oil lubrication, causing seizure. When performing fast operation at higher than 60Hz, fully note that such operation will cause strength shortage due to the noise, life or centrifugal force of the power transfer mechanism.

### Instructions for overload operation

- When performing operation of frequent start/stop of the inverter, rise/fall in the temperature of the transistor element of the inverter will repeat due to a repeated flow of large current, shortening the life from thermal fatigue. Since thermal fatigue is related to the amount of current, the life can be increased by reducing current at locked condition, starting current, etc. Decreasing current may increase the life. However, decreasing current will result in insufficient torque and the inverter may not start. Therefore, choose the inverter which has enough allowance for current.

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## Installation and selection of moulded case circuit breaker

Install a moulded case circuit breaker (MCCB) on the power receiving side to protect the wiring of the inverter input side. For MCCB selection, refer to *page 57* since it depends on the inverter power supply side power factor (which changes depending on the power supply voltage, output frequency and load). Especially for a completely electromagnetic MCCB, one of a slightly large capacity must be selected since its operation characteristic varies with harmonic currents. (Check it in the data of the corresponding breaker.) As an earth leakage current breaker, use the Mitsubishi earth leakage current breaker designed for harmonics and surge suppression. *(Refer to page 58)*

When installing a moulded case circuit breaker on the output side of the inverter, contact each manufacturer for selection of the moulded case circuit breaker.

## Handling of the inverter input side magnetic contactor

● For operation via external terminal (terminal STF or STR used), provide a input side MC to prevent an accident caused by a natural restart at power recovery after a power failure, such as an instantaneous power failure, and to ensure safety for maintenance work. Do not use this magnetic contactor to make frequent starts and stops. (The switching life of the inverter input circuit is about 1,000,000 times.) For parameter unit operation, an automatic restart after power failure is not made and the MC cannot be used to make a start. Note that the primary side MC may be used to make a stop but the regenerative brake specific to the inverter does not operate and the motor is coasted to a stop.

● Installation of a magnetic contactor on the primary side is recommended. Since when cycle operation or heavy-duty operation is performed with an optional brake resistor connected, overheat and burnout of the electrical-discharge resistor can be prevented if a regenerative brake transistor is damaged due to insufficient heat capacity of the electrical-discharge resistor and excess regenerative brake duty. In this case, shut-off the magnetic contactor when fault occurs and inverter trips.

## Handling of the inverter output side magnetic contactor

Switch the magnetic contactor between the inverter and motor only when both the inverter and motor are at a stop. When the magnetic contactor is turned on while the inverter is operating, overcurrent protection of the inverter and such will activate. When an MC is provided for switching to the commercial power supply, for example, switch it on/off after the inverter and motor have stopped.

## Thermal relay installation

The inverter has an electronic thermal relay function to protect the motor from overheating. However, when running multiple motors with one inverter or operating a multi-pole motor, provide a thermal relay (OCR) between the inverter and motor. In this case, set the electronic thermal relay function of the inverter to 0A. And for the setting of the thermal relay, add the line-to line leakage current *(refer to page 62)* to the current value on the motor rating plate.

For low-speed operation where the cooling capability of the motor reduces, it is recommended to use a thermal relay protector incorporated motor.

## Measuring instrument on the output side

When the inverter-to-motor wiring length is large, the meters and CTs may generate heat due to line-to-line leakage current. Therefore, choose the equipment which has enough allowance for the current rating.

## Disuse of power factor improving capacitor (power capacitor)

The power factor improving capacitor and surge suppressor on the inverter output side may be overheated or damaged by the harmonic components of the inverter output. Also, since an excessive current flows in the inverter to activate overcurrent protection, do not install a capacitor or surge suppressor. For power factor improvement, use a DC reactor *(refer to page 51)*.

## Wire thickness and wiring distance

When the wiring length between the inverter and motor is long, use thick wires so that the voltage drop of the main circuit cable is 2% or less especially at low frequency output. (A selection example for the wiring distance of 20m is shown on *page 57*)

Especially at a long wiring distance, the maximum wiring length should be within the length in the table below since the overcurrent protection function may be misactivated by the influence of a charging current due to the stray capacitances of the wiring. (The overall wiring length for connection of multiple motors should be within the value in the table below.)

| *Pr. 72* **Setting** (carrier frequency) | | 0.1K | 0.2K | 0.4K | 0.75K | 1.5K | 2.2K | 3.7K or more |
|---|---|---|---|---|---|---|---|---|
| 1 or less | 200V | 200m | 200m | 300m | 500m | 500m | 500m | 500m |
| 2 to 15 | 200V | 30m | 100m | 200m | 300m | 500m | 500m | 500m |

When using the automatic restart after instantaneous power failure function with wiring length exceeding below, select "without frequency search".

| Motor Capacity | 0.1K | 0.2K | 0.4K to 15K |
|---|---|---|---|
| Wiring Length | 20m | 50m | 100m |

Use the recommended connection cable when connecting the parameter unit.

For remote operation via analog signal, wire the control cable between the operation box or operation signal and inverter within 30m and away from the power circuits (main circuit and relay sequence circuit) to prevent induction from other devices.

When using the external potentiometer instead of the parameter unit to set the frequency, use a shielded or twisted cable, and do not earth (ground) the shield, but connect it to terminal 5 as shown below.
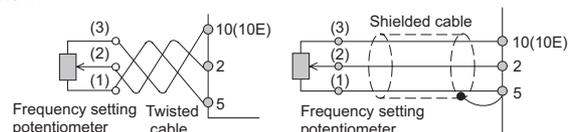
## Earth (Ground)

When the inverter is run in the low acoustic noise mode, more leakage currents occur than in the non-low acoustic noise mode due to high-speed switching operation. Be sure to earth (ground) the inverter and motor before use. In addition, always use the earth (ground) terminal of the inverter to earth (ground) the inverter. (Do not use the case and chassis)

## Noise

When performing low-noise operation at higher carrier frequency, electromagnetic noise tends to increase. Therefore, refer to the following measure example and consider taking the measures. Depending on the installation condition, the inverter may be affected by noise in a non-low noise (initial) status.

- The noise level can be reduced by decreasing the carrier frequency *(Pr. 72)*.
- As measures against AM radio broadcasting noise, radio noise filter FR-BIF produces an effect.
- As measures against sensor malfunction, line noise filter FR-BSF01, FR-BLF produces an effect.
- As measures against induction noise from the power cable of the inverter, an effect is produced by putting a distance of 30cm (at least 10cm) or more and using a twisted pair shielded cable as a signal cable. Do not earth (ground) shield but connect it to signal common cable.

Noise reduction examples
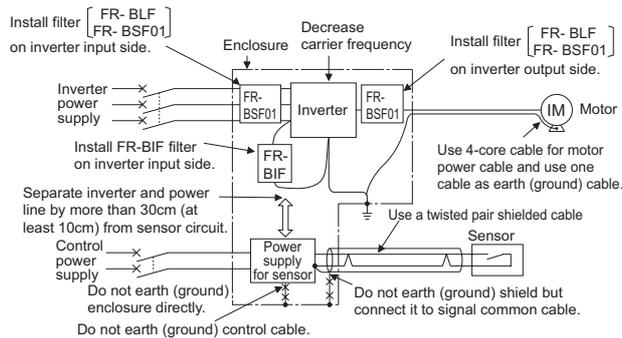


## Leakage currents

Capacitances exist between the inverter I/O cables, other cables and earth and in the motor, through which a leakage current flows. Since its value depends on the static capacitances, carrier frequency, etc., low acoustic noise operation at the increased carrier frequency of the inverter will increase the leakage current. Therefore, take the following measures. Select the earth leakage current breaker according to its rated sensitivity current, independently of the carrier frequency setting. *(Refer to page 58)*

### To-earth (ground) leakage currents

| Type | Influence and Measures |
|---|---|
| Influence and measures | • Leakage currents may flow not only into the inverter's own line but also into the other line through the earth (ground) cable, etc. These leakage currents may operate earth (ground) leakage circuit breakers and earth leakage relays unnecessarily.<br>● Countermeasures<br>• If the carrier frequency setting is high, decrease the *Pr. 72 PWM frequency selection* setting.<br>Note that motor noise increases. Select *Pr. 240 Soft-PWM operation selection* to make the sound inoffensive.<br>• By using earth leakage circuit breakers designed for harmonic and surge suppression in the inverter's own line and other line, operation can be performed with the carrier frequency kept high (with low noise). |
| Undesirable current path |  |

### Line leakage current

| Type | Influence and Measures |
|---|---|
| Influence and measures | • This leakage current flows via a static capacitance between the inverter output cables.<br>• The external thermal relay may be operated unnecessarily by the harmonics of the leakage current.<br>● Countermeasures<br>• Use *Pr.9 Electronic thermal O/L relay*.<br>• If the carrier frequency setting is high, decrease the *Pr. 72 PWM frequency selection* setting.<br>Note that motor noise increases. Select *Pr. 240 Soft-PWM operation selection* to make the sound inoffensive.<br>To ensure that the motor is protected against line-to-line leakage currents, it is recommended to use a temperature sensor to directly detect motor temperature. |
| Undesirable current path | <br>**Line-to-line leakage currents path** |

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## ● Harmonic suppression guideline

Harmonic currents flow from the inverter to a power receiving point via a power transformer. The harmonic suppression guideline was established to protect other consumers from these outgoing harmonic currents.

The three-phase 200V input specifications 3.7kW or less are previously covered by "Harmonic suppression guideline for household appliances and general-purpose products" and other models are covered by "Harmonic suppression guideline for consumers who receive high voltage or special high voltage". However, the transistorized inverter has been excluded from the target products covered by "Harmonic suppression guideline for household appliances and general-purpose products" in January 2004 and "Harmonic suppression guideline for household appliances and general-purpose products" was repealed on September 6, 2004.

All capacity and all models of general-purpose inverter used by specific consumers are covered by "Harmonic suppression guideline for consumers who receive high voltage or special high voltage".

• "Harmonic suppression guideline for consumers who receive high voltage or special high voltage"
This guideline sets forth the maximum values of harmonic currents outgoing from a high-voltage or especially high-voltage consumer who will install, add or renew harmonic generating equipment. If any of the maximum values is exceeded, this guideline requires that consumer to take certain suppression measures.
Users who use models other than the target models are not covered by the guideline. However, we ask to connect an AC reactor or a DC reactor as before to the users who are not covered by the guideline.
For compliance to the harmonic suppression guideline for consumers who receive high voltage or special high voltage

| Input Power Supply | Target Capacity | Countermeasures |
|---|---|---|
| Three-phase 200V | All capacities | Make a judgment based on "Harmonic suppression guideline for consumers who receive high voltage or special high voltage" issued by the Japanese Ministry of Economy, Trade and Industry (formerly Ministry of International Trade and Industry) in September 1994 and take measures if necessary. For calculation method of power supply harmonics, refer to materials below.<br>Reference materials<br>• "Harmonic suppression measures of the inverter"<br>Jan. 2004 Japan Electrical Manufacturer's Association<br>• "Calculation method of harmonic current of the general-purpose inverter used by specific consumers"<br>JEM-TR201 (revised in Dec. 2003): Japan Electrical Manufacturer's Association<br>Japan Electrical Manufacturer's Association |

For compliance to "Harmonic suppression guideline of the transistorized inverter (input current of 20A or less) for consumers other than specific consumers" published by JEMA.

| Input power supply | Target capacity | Countermeasures |
|---|---|---|
| Three-phase 200V | 3.7kW or less | Connect the AC reactor or DC reactor recommended in a catalog or an instruction manual.<br>Reference materials<br>• "Harmonic suppression guideline of the general-purpose inverter (input current of 20A or less)"<br>JEM-TR226 (revised in Dec. 2003): Japan Electrical Manufacturer's Association |

## ● Calculation of outgoing harmonic current

Outgoing harmonic current = fundamental wave current (value converted from received power voltage) × operation ratio × harmonic content

• Operation ratio: Operation ratio = actual load factor operation time ratio during 30 minutes
• Harmonic content: Found in Table.

Table 1: Harmonic Contents (Values at the fundamental current of 100%)

| Reactor | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
|---|---|---|---|---|---|---|---|---|
| Not used | 65 | 41 | 8.5 | 7.7 | 4.3 | 3.1 | 2.6 | 1.8 |
| Used (AC side) | 38 | 14.5 | 7.4 | 3.4 | 3.2 | 1.9 | 1.7 | 1.3 |
| Used (DC side) | 30 | 13 | 8.4 | 5.0 | 4.7 | 3.2 | 3.0 | 2.2 |
| Used (AC, DC sides) | 28 | 9.1 | 7.2 | 4.1 | 3.2 | 2.4 | 1.6 | 1.4 |

Table 2: Rated Capacities and Outgoing Harmonic Currents for Inverter Drive

| Applied Motor kW | Rated Current [A] | Fundamental Wave Current Converted from 6.6kV (mA) | Rated Capacity (kVA) | Outgoing Harmonic Current Converted from 6.6kV (mA) (No reactor, 100% operation ratio) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| 0.4 | 1.61 | 49 | 0.57 | 31.85 | 20.09 | 4.165 | 3.773 | 2.107 | 1.519 | 1.274 | 0.882 |
| 0.75 | 2.74 | 83 | 0.97 | 53.95 | 34.03 | 7.055 | 6.391 | 3.569 | 2.573 | 2.158 | 1.494 |
| 1.5 | 5.50 | 167 | 1.95 | 108.6 | 68.47 | 14.20 | 12.86 | 7.181 | 5.177 | 4.342 | 3.006 |
| 2.2 | 7.93 | 240 | 2.81 | 156.0 | 98.40 | 20.40 | 18.48 | 10.32 | 7.440 | 6.240 | 4.320 |
| 3.7 | 13.0 | 394 | 4.61 | 257.1 | 161.5 | 33.49 | 30.34 | 16.94 | 12.21 | 10.24 | 7.092 |
| 5.5 | 19.1 | 579 | 6.77 | 376.1 | 237.4 | 49.22 | 44.58 | 24.90 | 17.95 | 15.05 | 10.42 |
| 7.5 | 25.6 | 776 | 9.07 | 504.4 | 318.2 | 65.96 | 59.75 | 33.37 | 24.06 | 20.18 | 13.97 |
| 11 | 36.9 | 1121 | 13.1 | 728.7 | 459.6 | 95.29 | 86.32 | 48.20 | 34.75 | 29.15 | 20.18 |
| 15 | 49.8 | 1509 | 17.6 | 980.9 | 618.7 | 128.3 | 116.2 | 64.89 | 46.78 | 39.24 | 27.16 |

# Application to Motor

## Application to standard motors
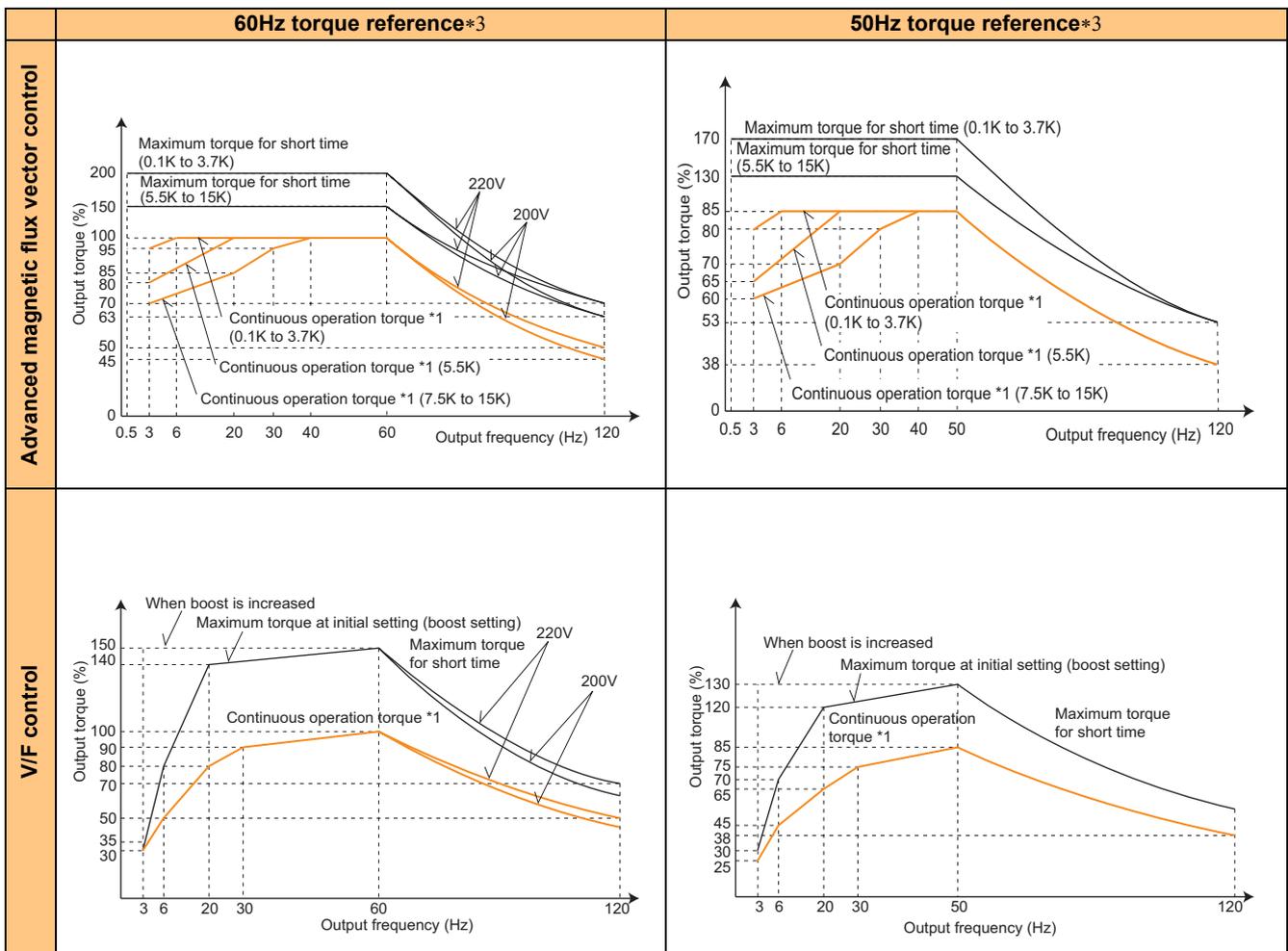
### Motor loss and temperature rise

The motor operated by the inverter has a limit on the continuous operating torque since it is slightly higher in temperature rise than the one operated by a commercial power supply. At a low speed, reduce the output torque of the motor since the cooling effect decreases. When 100% torque is needed continuously at low speed, consider using a constant-torque motor. *(Refer to page 65)*

### Torque characteristic

The motor operated by the inverter may be less in motor torque (especially starting torque) than the one driven by the commercial power supply. It is necessary to fully check the load torque characteristic of the machine.

### Vibration

The machine-installed motor operated by the inverter may be slightly greater in vibration than the one driven by the commercial power supply. The possible causes of vibration are as follows.

1. Vibration due to imbalance of the rotator itself including the machine
2. Resonance due to the natural oscillation of the mechanical system. Caution is required especially when the machine used at constant speed is operated at variable speed. The frequency jump function allows resonance points to be avoided during operation.(During acceleration/deceleration, the frequency within the set area is passed through.) An effect is also produced if *Pr. 72 PWM frequency selection* is changed. When a two-pole motor is operated at higher than 60Hz, caution should be taken since such operation may cause abnormal vibration.

### Motor torque

When the Mitsubishi standard squirrel-cage motor (SF-JR, 4-pole) and inverter of the same capacity are used, the torque characteristics are as shown below.

| 60Hz torque reference∗3 | 50Hz torque reference∗3 |
|---|---|

**Advanced magnetic flux vector control**



**V/F control**



∗1 Continuous operation torque is for checking the limit of permissible load torque when using the motor within the permissible ambient temperature, and is not the motor output torque itself. Maximum torque for short time is the amount of torque a motor can output.

∗2 Depending on the motor capacity or the number of motor poles, the operation at 60Hz or more may not be performed. Make sure to check the permissible maximum operating frequency of the motor.

∗3 A 60Hz torque reference indicates that the rated torque of the motor run at 60Hz is 100%, and a 50Hz torque reference indicates that the rated torque of the motor run at 50Hz is 100%.

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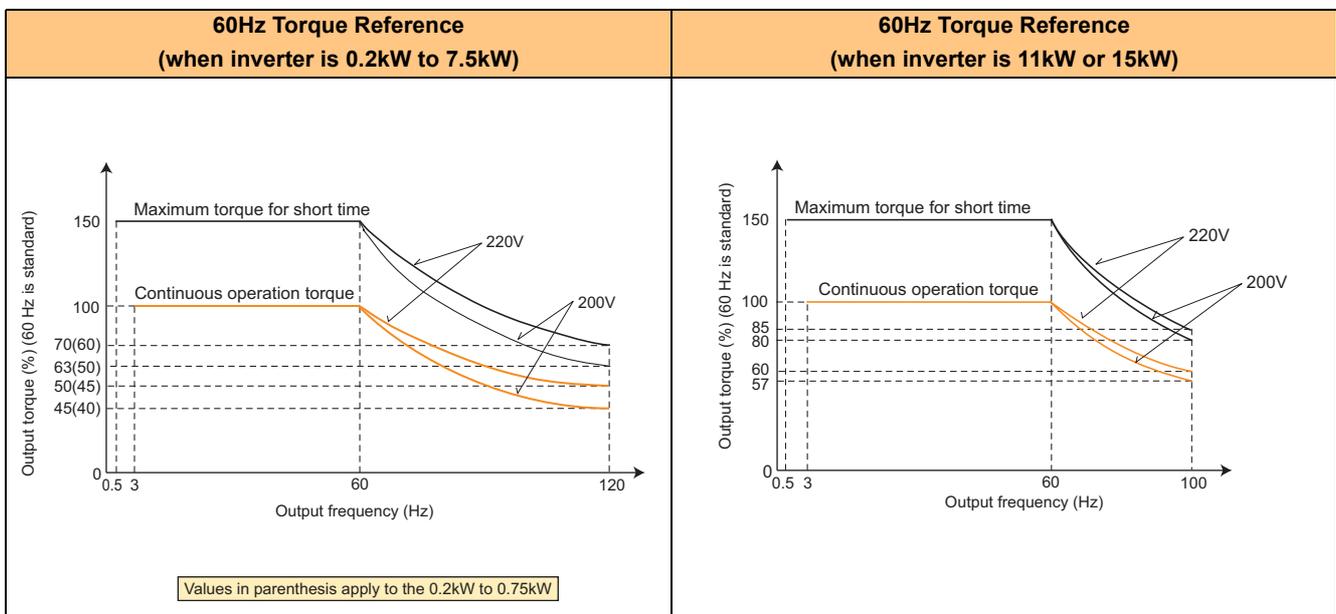Inquiry

## Application to constant-torque motors

### SF-HRCA type (Advanced magnetic flux vector control)

- Continuous operation with 100% torque even at low speed of 3Hz is possible

  Load torque is not need to be reduced even at a low speed and constant torque (100% torque) continuous operation is possible within the range of speed ratio 1/20 (3 to 60Hz). (The characteristic of motor running at 60Hz or more is that output torque is constant.)
- Installation size is the same as that of the standard motor
- ★ Note that operation characteristic in the chart below can not be obtained if V/F control is employed.

### Standard specifications (indoor type)

| Output (kW) | Number of Poles | Frequency Range | Common Specifications |
|---|---|---|---|
| 0.2 | | | Standard frequency 60Hz |
| 0.4 | | | ● rotation direction (CCW) is |
| 0.75 | | | counterclockwise when |
| 1.5 | | 3 to 120Hz | viewed from the motor end |
| 2.2 | | | ●Lead wire |
| 3.7 | 4 | | 3.7kW or less .....3 wires |
| 5.5 | | | 5.5kW or more ...6 or 12 |
| 7.5 | | | wires |
| 11 | | | ●Ambient temperature: 40°C |
| 15 | | 3 to 100Hz | maximum |
| | | | Protective structure is IP44 |

- Torque characteristic (during advanced magnetic flux vector control, and initial value for other parameters)

| 60Hz Torque Reference (when inverter is 0.2kW to 7.5kW) | 60Hz Torque Reference (when inverter is 11kW or 15kW) |
|---|---|



Values in parenthesis apply to the 0.2kW to 0.75kW

* Please contact us separately when 150% or more of maximum torque for short time is necessary.
- When rapid acceleration/deceleration is needed, the inverter capacity may need to be one rank higher.
- When two or more motors are operated in parallel, torque imbalance is likely to occur as motor slip is smaller than that of the standard motor.

## Application to geared motor

### GM-S, GM-D, GM-SY, GM-HY2 series

- Wide constant torque range even with the standard type(when using advanced magnetic flux vector control)

  Load torque is not need to be reduced even at a low speed and constant torque (100% torque) continuous operation is possible within the range of speed ratio 1/20 (3 to 60Hz). (0.1K to 0.75K)
- Wide speed control range

  The motor can be used in the wide speed deviation range of 3 to 120Hz

  The characteristic of motor running at 60Hz or more is that output torque is constant. (0.1K to 0.75K)
  ★ Note that operation characteristic in the chart below can not be obtained if V/F control is employed.

### Standard specifications

| Inverter Type | Output (kW) | Number of Poles | Available Frequency Range (base frequency 60Hz) | | Constant Torque Range When Using Advanced Magnetic Flux Vector Control |
|---|---|---|---|---|---|
| | | | Grease Lubrication | Oil Lubrication | |
| GM-S GM-SY GM-HY2 | 0.1 to 2.2 | 4 | 3 to 120Hz | | 3 to 60Hz (0.1kW to 0.75kW) 6 to 60Hz (1.5kW, 2.2kW) |
| GM-D | 0.4 to 2.2 | | 3 to 120Hz | 25 to 120Hz | 3 to 60Hz (0.4kW, 0.75kW) 6 to 60Hz (1.5kW, 7.5kW) |
| | 3.7 | | | | |
| | 5.5 | | | | |
| | 7.5 | | | 25 to 115Hz | |

● Torque characteristic (range during advanced magnetic flux vector control)
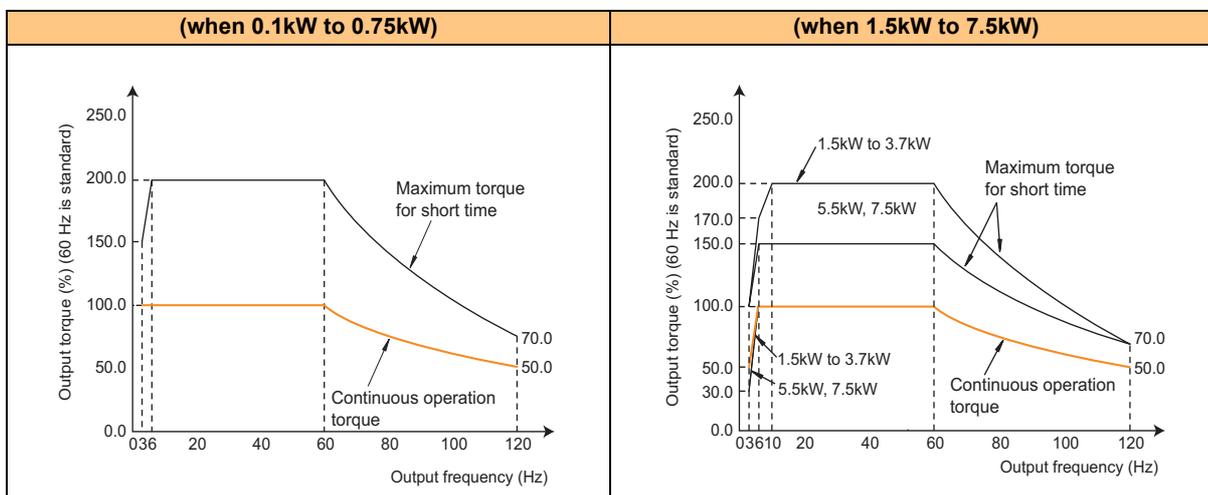
| (when 0.1kW to 0.75kW) | (when 1.5kW to 7.5kW) |
|---|---|

## Application to special motors

### Motor with brake

Use the motor with brake having independent power supply for the brake, connect the brake power supply to the inverter input side power and make the inverter output off using the output stop terminal (MRS) when the brake is applied (motor stop). Rattle may be heard according to the type of the brake in the low speed region but it is not a fault.

### Pole changing motor

As this motor differs in rated current from the standard motor, confirm the maximum current of the motor and select the inverter. Be sure to change the number of poles after the motor has stopped. If the number of poles is changed during rotation, the regenerative overvoltage protecion circuit may be activated to cause an inverter alarm, coasting the motor to a stop.

### Submersible motor

Since the motor rated current is larger than that of the standard motor, make selection of the inverter capacity carefully. In addition, the wiring distance between the motor and inverter may become longer, *refer to page 57* to perform wiring with a cable thick enough. Leakage current may flow more than the land motor, take care when selecting the earth leakage current breaker.

### Explosion-proof motor

To drive an explosion-proof type motor in Japan, an explosion-proof test of the motor and inverter together is necessary. The test is also necessary when driving an existing explosion-proof motor. Please contact us for the FR-B, B3 series, which has passed an explosion-proof test. The inverter is an non-explosion proof structure, install it in a safety location.

### Geared motor

The continuous operating rotation range of this motor changes depending on the lubrication system and maker. Especially in the case of oil lubrication, continuous operation in the low-speed range only can cause gear seizure. For fast operation at higher than 60Hz, please consult the motor maker.

### Synchronous motor

This motor is not suitable for applications of large load variation or impact, where out-of-sync is likely to occur. Please contact us when using this motor because its starting current and rated current are greater than those of the standard motor and will not rotate stably at low speed.

### Single phase motor

The single phase motor is not suitable for variable operation by the inverter.

For the capacitor starting system, the capacitor may be damaged due to harmonic current flowing to the capacitor. For the deviation phase starting system and repulsion starting system, not only output torque is not generated at low speed but it will result in starting coil burnout due to failure of centrifugal force switch inside. Replace with a three-phase motor for use.

# Main Differences and Compatibilities with the FR-E500 series

| Item | FR-E500 | FR-E700 |
|---|---|---|
| Control method | V/F control<br>General-purpose magnetic flux vector control | V/F control<br>General-purpose magnetic flux vector control<br>Advanced magnetic flux vector control<br>Optimum excitation control |
| Changed/cleared functions | Torque boost *(Pr. 0)* initial value<br>FR-E520-1.5K to 7.5K: 6% | FR-E720-1.5K to 3.7K: 4%<br>FR-E720-5.5K to 7.5K: 3% |
| | DC injection brake operation voltage *(Pr.12)* initial value<br>FR-E520-0.4K to 7.5K: 6% | FR-E720-0.4K to 7.5K: 4% |
| | Frequency at 5V (10V) input (*Pr. 38* )<br>Frequency at 20mA input frequency (*Pr. 39* )<br>Second electronic thermal O/L relay (*Pr. 48* )<br>Shortest acceleration/deceleration mode (*Pr. 60* ) | Parameter number change<br>*(Pr. 125 Terminal 2 frequency setting gain frequency)*<br>*(Pr. 126 Terminal 4 frequency setting gain frequency*)<br>*(Pr. 51 Second electronic thermal O/L relay)*<br>*(Pr. 60 Energy saving control selection)*<br>*(Pr. 292 Automatic acceleration/deceleration)* |
| | Reverse rotation from the inverter operation panel<br>Press REV . | After setting "1" in *Pr. 40 RUN key rotation direction*<br>*selection* , press RUN . |
| | FM terminal function selection (*Pr. 54* ) setting<br>0: Output frequency (initial value),<br>1: Output current,<br>2: Output voltage | 1: Output frequency (initial value),<br>2: Output current,<br>3: Output voltage |
| | Second applied motor<br>*Pr. 71 =* 100 to 123 | *Pr. 450 Second applied motor* |
| | Terminal 2 0 to 5V, 0 to 10V selection (*Pr. 73* ) setting<br>0: 0 to 5V (initial value),<br>1: 0 to 10V | *Pr. 73 Analog input selection*<br>0: 0 to 10V<br>1: 0 to 5V (initial value) |
| | Operation mode selection (*Pr. 79* )<br>Initial value  1: PU operation mode<br><br>Setting  8: Operation mode switching by external signal | Initial value 0: External operation mode is selected at power on<br>Setting  8: deleted (X16 signal is used instead) |
| | Setting general-purpose magnetic flux vector<br>*Pr. 80 ≠* 9999 | *Pr. 80 ≠* 9999, *Pr. 81 ≠* 9999, *Pr. 800 =* 30 |
| | User group 1 (16), user group 2 (16)<br>*(Pr. 160, Pr. 173 to Pr. 175* ) | User group (16) only, setting methods were partially changed<br>*(Pr. 160, Pr. 172, Pr. 173* ) |
| | Input terminal function selection (*Pr. 180 to Pr. 183* ) setting<br>5: MRS signal (output stop)<br>6: STOP signal (start self-holding selection) | *Pr. 178 to Pr. 184 Input terminal function selection* setting<br>5: JOG signal (jog operation selection)<br>6: None<br>24: MRS signal (output stop)<br>25: STOP signal (start self-holding selection) |
| | Cooling fan operation selection (*Pr. 244* ) initial setting<br>0: Cooling fan operates in power-on status. | 1: Cooling fan on/off control valid |
| | Stop selection (*Pr. 250* )  setting increments<br>1s | 0.1s |
| | RS-485 communication control source from the PU connector<br>PU operation mode | Network operation mode (use *Pr. 551* to change) |
| Inrush current limit circuit | Provided for the 200V class 2.2K or more and 400V class | Provided for the all capacity |
| Control terminal block | Fixed terminal block (can not be removed)<br>(+ screw M2.5) | Removable terminal block<br>(- screw M2 (M3 for terminal A, B, and C only) |
| Operation panel | Removable operation panel (PA02) | Integrated operation panel (can not be removed) |
| PU | FR-PU04 | FR-PU07<br>FR-PU04 (some functions, such as parameter copy, are unavailable.) |
| Plug-in option | Dedicated plug-in option (installation is incompatible) | |
| | for 400V class only<br>FR-E5NC : CC-Link communication<br>FR-E5ND : DeviceNet communication<br>FR-E5NL : LONWORKS communication | FR-A7AX E kit :  16bit digital input<br>FR-A7AY E kit:   Digital output, Extension analog output<br>FR-A7AR E kit:   Relay output<br>FR-A7NC E kit : CC-Link communication<br>FR-A7ND E kit : DeviceNet communication ∗<br>FR-A7NP E kit : PROFIBUS-DP communication ∗<br>FR-A7NL E kit :  LONWORKS communication ∗<br>∗  : to be released soon |
| Installation size | 0.1 to 7.5K are compatible in mounting dimensions | |

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1. Gratis warranty period and coverage

[Gratis warranty period]
   Note that an installation period of less than one year after installation in your company or your customer's premises or a period of less than18 months (counted from the date of production) after shipment from our company, whichever is shorter, is selected.

[Coverage]
(1)   Diagnosis of failure
      As a general rule, diagnosis of failure is done on site by the customer.
      However, Mitsubishi or Mitsubishi service network can perform this service for an agreed upon fee upon the customer's request.
      There will be no charges if the cause of the breakdown is found to be the fault of Mitsubishi.
(2)   Breakdown repairs
      There will be a charge for breakdown repairs, exchange replacements and on site visits for the following four conditions, otherwise there will be a charge.
      1)Breakdowns due to improper storage, handling, careless accident, software or hardware design by the customer.
      2)Breakdowns due to modifications of the product without the consent of the manufacturer.
      3)Breakdowns resulting from using the product outside the specified specifications of the product.
      4)Breakdowns that are outside the terms of warranty.

      Since the above services are limited to Japan, diagnosis of failures, etc. are not performed abroad.
      If you desire the after service abroad, please register with Mitsubishi. For details, consult us in advance.

2. Exclusion of opportunity loss from warranty liability
   Regardless of the gratis warranty term, compensation to opportunity losses incurred to your company or your customers by failures of Mitsubishi products and compensation for damages to products other than Mitsubishi products and other services are not covered under warranty.

3. Repair period after production is discontinued
   Mitsubishi shall accept product repairs for seven years after production of the product is discontinued.

4. Terms of delivery
   In regard to the standard product, Mitsubishi shall deliver the standard product without application settings or adjustments to the customer and Mitsubishi is not liable for on site adjustment or test run of the product.

# International FA Center



Map markers:
- FA Center in England
- FA Center in Europe
- FA Center in North America
- FA Center in Beijing
- FA Center in Tianjin
- FA Center in Shanghai
- FA Center in Hong Kong
- FA Center in Korea
- FA Center in Taiwan
- FA Center in Thailand
- FA Center in ASEAN

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Side tabs: Features, Peripheral Devices, Standard Specifications, Outline Dimension Drawings, Terminal Connection Diagram Terminal Specification Explanation, Operation panel Parameter unit FR Configurator, Parameter List, Explanations of Parameters, Protective Functions, Options, Instructions, Motor, Compatibility, Warranty, Inquiry