MITSUBISHI ELECTRIC

INVERTER

Model

# FR-D700

*Changes for the Better*

700 series

## GLOBAL STANDARD

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

MELSOFT

ISO 14001 JACO EC97J1113 — UKAS ENVIRONMENTAL MANAGEMENT 051

ISO 9001 BUREAU VERITAS Certification — UKAS QUALITY MANAGEMENT 008

# GLOBAL STANDARD

## 1 New standard of inverter

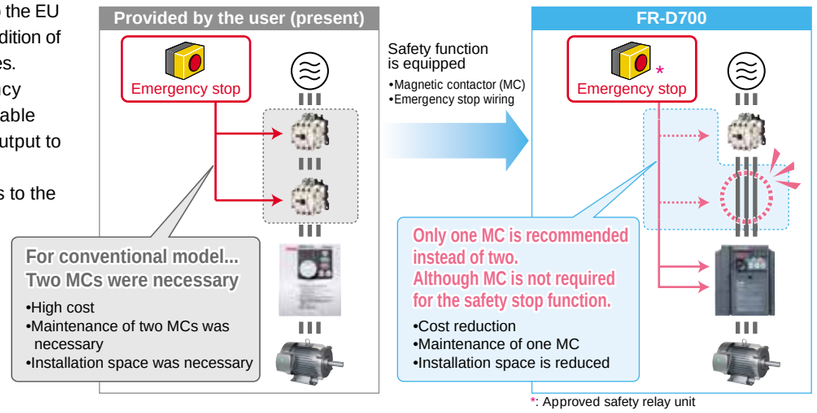
**Highly reliable inverter!**

### (1) Safety stop function

The FR-D700 series is compliant to the EU Machinery Directive without the addition of previously required external devices.
Operation of an external Emergency Stop device results in a highly reliable immediate shutoff of the D700's output to the motor.
This safety stop function conforms to the following standards.

EN ISO 13849-1 Category 3 / PLd

EN62061 / IEC61508 SIL2

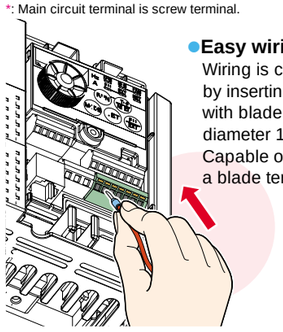



*: Approved safety relay unit

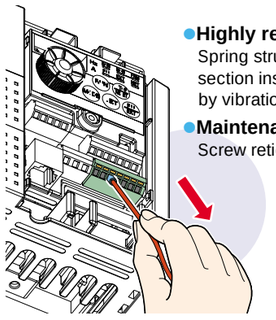
### (2) Spring clamp terminal (control circuit terminal)

With spring clamp terminals, the wiring became easier and more secure.

*: Main circuit terminal is screw terminal.

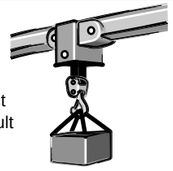


●**Easy wiring**
Wiring is completed only by inserting wires treated with blade terminal (max. diameter 1.5mm)
Capable of wiring without a blade terminal.

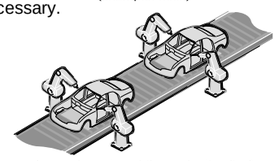


●**Highly reliable**
Spring structure in terminal contact section inside prevents contact fault by vibration.

●**Maintenance is unnecessary**
Screw retightening is unnecessary.



(example: hoist)



(example: automobile production line)

### (3) Long-life design

- The design life of the cooling fan has been extended to 10 years*1. The life of the fan can be further extended utilizing the it's ON/OFF control.
- The design life of the capacitors has been extended to 10 years by the adoption of a capacitor endures 5000 hours at 105˚C surrounding air temperature*1,*2.

*1: Surrounding air 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 critical components

| Components | Guideline of the FR-D700 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 Manufacture's Association)

### (4) Leading life check function

- 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: If any one of main circuit capacitor, control circuit capacitor, inrush current restriction 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 alarm to be output.
The cooling fan outputs alarm by using fan speed detection.

### (5) Password function

Registering a 4-digit password can limit parameter read/write.
It is effective for parameter setting protection.

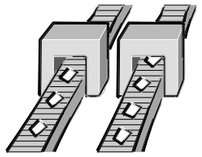
## 2 Mitsubishi's new standard (As of April 2008)

**Compact yet equipped with highest level of function/performance!!**

### (1) 150%/1Hz high starting torque by General-purpose magnetic flux vector control

General-purpose magnetic flux vector control and auto tuning function are available.
It ensures operation that requires high starting torque, such as transfer machine including conveyer, hoist, lift, etc., washing machine, and agitators.

- High torque of 150%/1Hz and 200%/3Hz (3.7K or less) is realized (when the slip compensation function is valid).
- Auto tuning
  Many kinds of motors can be optimally controlled with Mitsubishi original "non-rotation" auto tuning function. (R1 constants tuning)

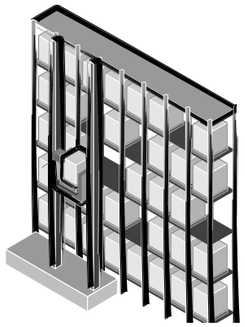


(example: conveyer)

(example: industrial washing machine)

### (2) Brake resistor can be connected

A brake transistor is built-in to the 0.4K or more.
Connecting an optional brake resistor increases regeneration capability.
It is useful for deceleration time reduction of a machine with a large inertia, such as fan, and operation of lift, etc.

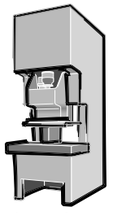


(example: automated storage)

### (3) Enhanced function

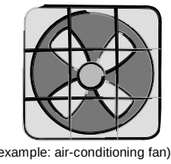
New functions and useful functions from superior models support all sorts of applications.

●**Regeneration avoidance function**
For a pressing machine and fan rotated faster than the set speed due to the effect of another fan, a trip is less likely to occur by automatically increasing frequency at regeneration.

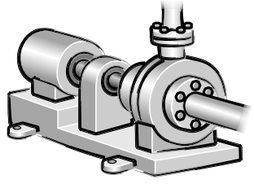


(example: pressing machine)

●**Optimum excitation control**
This control enables the motor efficiency to its optimum. More energy saving is possible in applications with variable load torque characteristic such as fan and pump.

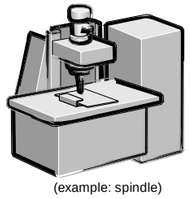


(example: air-conditioning fan)



(example: pump)

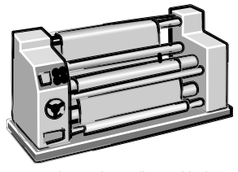
●**Power failure-time deceleration-to-stop function**
The motor can be decelerated to a stop when a power failure or undervoltage occur to prevent the motor from coasting.
For fail-safe of machine tool, etc., it is effective to stop the motor when a power failure occurs.



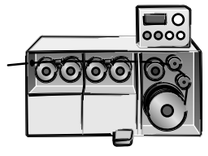
(example: spindle)

●**Dancer control**
Entering position detection signal of dancer roll to use PID control enables tension control by dancer roll.

●**Traverse function**
Traverse function for wind-up drum of spinning machine and wiredrawing machine prevents unevenness and deformation at thread winding.



(example: textile machine)



(example: wiredrawing machine)


- Features 1
- Standard specifications 5
- Outline dimension drawings 7
- Terminal connection diagram / Terminal specification explanation 11
- Operation panel / Parameter unit 13
- Parameter list 16
- Protective functions 23
- Option and peripheral devices 24
- Precautions for operation/selection / Precautions for peripheral device selection 27
- FR-D700 Series Specification Difference List 32
- Warranty / International FA Center 33

# 3 Easy use and time saving built-in as standard

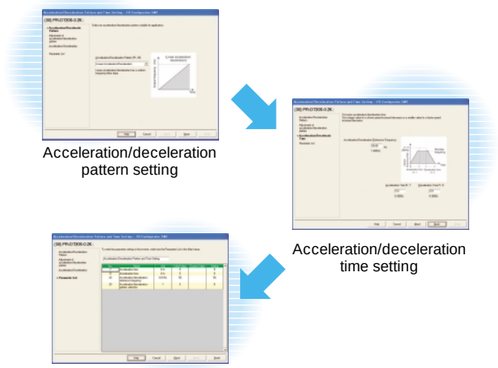
## (1) Quick setup with the setting dial

Setting dial is the feature of Mitsubishi inverters.
- Displayed numbers can be jumped by turning the setting dial quickly, and numbers can be changed one by one by turning it slowly, enabling speedy parameter setting.
- The nonslip setting dial is easier to turn.

## (2) Easy setting from a personal computer using the FR Configurator (option)

Connecting a personal computer and the inverter via RS-485 communication enables setting with wizard (interactive) function of the FR Configurator (inverter setup software).
In addition, a parameter setting can be converted from the FR-S500 series to the FR-D700 series by "Convert" function.
"Graph" function displays monitor data in waveform.

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




## (3) Enclosure surface operation panel FR-PA07 (option)

Optional enclosure surface operation panel (FR-PA07) can be connected. In addition, an operation panel for the FR-E500 series can be connected.

The operation panel of the inverter can not be removed.
A parameter unit connection cable (FR-CB20☐) is separately necessary.

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

An optional parameter unit (FR-PU07) can be connected as well.

A parameter unit connection cable (FR-CB20☐) is separately necessary.

- Setting such as direct input method with a numeric keypad, operation status indication, and help function are usable.
  Eight languages can be displayed.
- Parameter setting values of maximum of three inverters can be stored.
- A battery pack type (FR-PU07BB(-L)) allows parameter setting and parameter copy without powering on the inverter. (available soon)

To use a parameter unit with battery pack (FR-PU07BB) outside Japan, order a "FR-PU07BB-L" (parameter unit type indicated on the package has L at the end).

## (5) Enhanced communication function

- **Mitsubishi inverter protocol and Modbus-RTU**
  Communication speed of RS-485 has been improved (communication at 38.4kbps is available)
  "Multi command mode" has been added to Mitsubishi inverter protocol (data processing time of the inverter has been reduced to 1/4)
  Supports Modbus-RTU

# 4 Compact and space saving

## (1) Easily replaceable compact body

Installation size is the same as that of the FR-S500 series which is the smallest model of the Mitsubishi inverter.

FR-D740-0.4K FR-S540E-0.4K

## (2) Side by side installation saves space

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

*: Use the inverter at the surrounding air temperature of 40°C or less.

# 5 Easy maintenance

## (1) Easy replacement of cooling fan

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

## (2) Combed shaped wiring cover

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

# 6 Environment consciousness in global standard

## (1) RoHS Directive compliant

Human and environment-friendly inverter in compliant with RoHS Directive.

RoHS Directive requires member nations to guarantee that new electrical and electronic equipment sold in the market after July 1, 2006 do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants.
<G> mark indicating RoHS Directive compliance is printed on the package.

## (2) Filterpack FR-BFP2 (option)

Power factor improving DC reactor, zero phase reactor, and capacitative filter (radio noise filter), are frequently-used units for an air conditioning application. The filterpack combines those three units are available as an option.

## (3) EMC Directive compliant noise filter

Compliance to the EMC Directive of European Norm is easier.
- EMC filter integrated type will be added to the line (to be released).
- Noise filter option which is compatible with EMC Directive (EN61800-3 2nd Environment Category C3) is available.

## (4) Complies with UL, cUL, EC Directives (CE marking) as a standard model.

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CE

# 7 Lineup

The lineup of three phase 200V/400V class goes to 15K.
- For a use in harsh environment, special unit with board coating is also available. Please contact our sales representative.
- For the FR-D700 series, North American (NA), EU (EC), and Chinese (CHT) specifications also are supported.

*: This catalog explains based on the Japanese specifications.
Consult our sales office for specifications of each country.

**FR-D740☐-0.4K-☐**

| 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 | Indicate capacity "kW". |

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

| Power Supply | Inverter Model | Inverter Capacity | 0.1 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Three phase 200V | FR-D720-☐K | Enclosed structure (IP20) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | Totally-enclosed structure (IP40) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Three phase 400V | FR-D740-☐K | Enclosed structure (IP20) | — | — | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | Totally-enclosed structure (IP40) | — | — | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Single phase 200V * | FR-D720S-☐K | Enclosed structure (IP20) | ● | ● | ● | ● | ● | ● | — | — | — | — | — |
| Single phase 100V * | FR-D710W-☐K | Enclosed structure (IP20) | ● | ● | ● | ● | — | — | — | — | — | — | — |

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

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

## Rating

### ● Three-phase 200V power supply

| Model FR-D720-□K | | 0.1 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model FR-D720-□-NA | | 008 | 014 | 025 | 042 | 070 | 100 | 165 | 238 | 318 | — | — |
| 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 | 1.0 | 1.7 | 2.8 | 4.0 | 6.6 | 9.5 | 12.7 | 17.9 | 23.1 |
| | Rated current (A) | 0.8 | 1.4 | 2.5 | 4.2 | 7.0 | 10.0 | 16.5 | 23.8 | 31.8 | 45.0 | 58.0 |
| | Overload current rating*3 | 150% 60s, 200% 0.5s (inverse-time characteristics) | | | | | | | | | | |
| | Voltage*4 | Three-phase 200 to 240V | | | | | | | | | | |
| | Regenerative braking torque*5 | 150% | | 100% | | 50% | 20% | | | | | |
| Power supply | Rated input AC voltage/frequency | Three-phase 200 to 240V 50Hz/60Hz | | | | | | | | | | |
| | Permissible AC voltage fluctuation | 170 to 264V 50Hz/60Hz | | | | | | | | | | |
| | Permissible frequency fluctuation | ±5% | | | | | | | | | | |
| | Power supply capacity (kVA)*6 | 0.4 | 0.7 | 1.2 | 2.1 | 4.0 | 5.5 | 9.0 | 12.0 | 17.0 | 20.0 | 27.0 |
| Protective structure (JEM1030) | | Enclosed type (IP20). | | | | | | | | | | |
| Cooling system | | Self-cooling | | | | Forced air cooling | | | | | | |
| Approximate mass (kg) | | 0.5 | 0.5 | 0.8 | 1.0 | 1.4 | 1.4 | 1.8 | 3.6 | 3.6 | 6.5 | 6.5 |

### ● Three-phase 400V power supply

| Model FR-D740-□K | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|
| Model FR-D740-□-NA | | 012 | 022 | 036 | 050 | 080 | 120 | 160 | — | — |
| Model FR-D740-□-EC | | 012 | 022 | 036 | 050 | 080 | 120 | 160 | — | — |
| Model FR-D740-□K-CHT | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | — | — |
| Applicable motor capacity (kW)*1 | | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 |
| Output | Rated capacity (kVA)*2 | 0.9 | 1.7 | 2.7 | 3.8 | 6.1 | 9.1 | 12.2 | 17.5 | 22.5 |
| | Rated current (A) | 1.2 | 2.2 | 3.6 | 5.0 | 8.0 | 12.0 | 16.0 | 23.0 | 29.5 |
| | Overload current rating*3 | 150% 60s, 200% 0.5s (inverse-time characteristics) | | | | | | | | |
| | Voltage*4 | Three-phase 380 to 480V | | | | | | | | |
| | Regenerative braking torque*5 | 100% | | 50% | 20% | | | | | |
| Power supply | Rated input AC voltage/frequency | Three-phase 380 to 480V 50Hz/60Hz | | | | | | | | |
| | Permissible AC voltage fluctuation | 325 to 528V 50Hz/60Hz | | | | | | | | |
| | Permissible frequency fluctuation | ±5% | | | | | | | | |
| | Power supply capacity (kVA)*6 | 1.5 | 2.5 | 4.5 | 5.5 | 9.5 | 12.0 | 17.0 | 20.0 | 28.0 |
| Protective structure (JEM1030) | | Enclosed type (IP20). | | | | | | | | |
| Cooling system | | Self-cooling | | Forced air cooling | | | | | | |
| Approximate mass (kg) | | 1.3 | 1.3 | 1.4 | 1.5 | 1.5 | 3.3 | 3.3 | 6.0 | 6.0 |

*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 for three-phase 200V class and 440V for three-phase 400V class.

*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 braking torque indicated is a short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 60Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor when regenerative energy is large. A brake unit (FR-BU2) may also be used.

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

## ● Single-phase 200V power supply

| Model FR-D720S-□K | | 0.1 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
|---|---|---|---|---|---|---|---|
| Model FR-D720S-□-NA | | 008 | 014 | 025 | 042 | 070 | 100 |
| Model FR-D720S-□-EC | | 008 | 014 | 025 | 042 | 070 | 100 |
| Model FR-D720S-□K-CHT | | 0.1 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| Applicable motor capacity (kW)*1 | | 0.1 | 0.2 | 0.4 | 0.75 | 1.5 | 2.2 |
| Output | Rated capacity (kVA)*2 | 0.3 | 0.6 | 1.0 | 1.7 | 2.8 | 4.0 |
| | Rated current (A) | 0.8 | 1.4 | 2.5 | 4.2 | 7.0 | 10.0 |
| | Overload current rating*3 | 150% 60s, 200% 0.5s (inverse-time characteristics) | | | | | |
| | Voltage*4 | Three-phase 200 to 240V | | | | | |
| | Regenerative braking torque*5 | 150% | | 100% | | 50% | 20% |
| Power supply | Rated input AC voltage/frequency | Single-phase 200 to 240V 50Hz/60Hz | | | | | |
| | Permissible AC voltage fluctuation | 170 to 264V 50Hz/60Hz | | | | | |
| | Permissible frequency fluctuation | ±5% | | | | | |
| | Power supply capacity (kVA)*6 | 0.5 | 0.9 | 1.5 | 2.3 | 4.0 | 5.2 |
| Protective structure (JEM1030) | | Enclosed type (IP20). | | | | | |
| Cooling system | | Self-cooling | | | | Forced air cooling | |
| Approximate mass (kg) | | 0.5 | 0.5 | 0.9 | 1.1 | 1.5 | 2.0 |

## ● Single-phase 100V power supply

| Model FR-D710W-□K | | 0.1 | 0.2 | 0.4 | 0.75 |
|---|---|---|---|---|---|
| Model FR-D710W-□-NA | | 008 | 014 | 025 | 042 |
| Applicable motor capacity (kW)*1 | | 0.1 | 0.2 | 0.4 | 0.75 |
| Output | Rated capacity (kVA)*2 | 0.3 | 0.6 | 1.0 | 1.7 |
| | Rated current (A) | 0.8 | 1.4 | 2.5 | 4.2 |
| | Overload current rating*3 | 150% 60s, 200% 0.5s (inverse-time characteristics) | | | |
| | Voltage | Three-phase 200 to 230V*7, *8 | | | |
| | Regenerative braking torque*5 | 150% | | 100% | |
| Power supply | Rated input AC voltage/frequency | Single-phase 100 to 115V 50Hz/60Hz | | | |
| | Permissible AC voltage fluctuation | 90 to 132V 50Hz/60Hz | | | |
| | Permissible frequency fluctuation | ±5% | | | |
| | Power supply capacity (kVA)*6 | 0.5 | 0.9 | 1.5 | 2.5 |
| Protective structure (JEM1030) | | Enclosed type (IP20). | | | |
| Cooling system | | Self-cooling | | | |
| Approximate mass (kg) | | 0.6 | 0.7 | 0.9 | 1.4 |

*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. If the automatic restart after instantaneous power failure function *(Pr. 57)* or power failure stop function *(Pr. 261)* is set and power supply voltage is low while load becomes bigger, the bus voltage decreases to power failure detection level and load of 100% or more may not be available.

*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 braking torque indicated is a short-duration average torque (which varies with motor loss) when the motor alone is decelerated from 60Hz in the shortest time and is not a continuous regenerative torque. When the motor is decelerated from the frequency higher than the base frequency, the average deceleration torque will reduce. Since the inverter does not contain a brake resistor, use the optional brake resistor when regenerative energy is large. A brake unit (FR-BU2) may also be used.

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

*7 For single-phase 100V power input model, the maximum output voltage is twice the amount of the power supply voltage and cannot be exceeded.

*8 In a single-phase 100V power input model, the output voltage may fall down when the load is heavy, and larger output current may flow compared to a three-phase input model. Use the motor with less load so that the output current is within the rated motor current range.

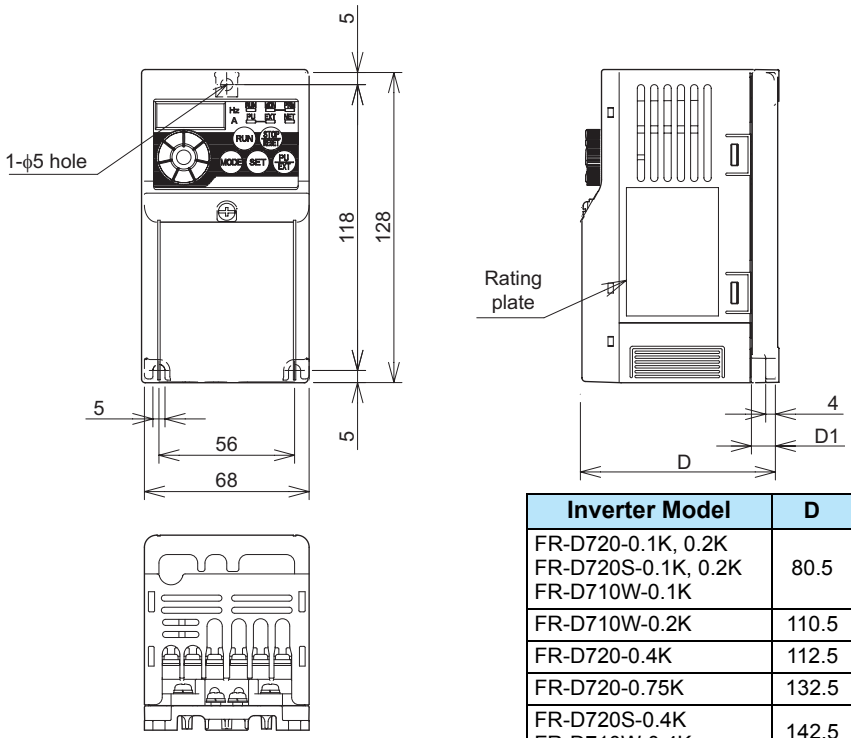
## Common specifications

| | | | |
|---|---|---|---|
| Control specifications | Control method | | Soft-PWM control/high carrier frequency PWM control (V/F control, General-purpose magnetic flux vector control, and Optimum excitation control are available) |
| | 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: 0 to 20mA/10bit) |
| | | Digital input | 0.01Hz |
| | Frequency accuracy | Analog input | Within ±1% 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. Constant-torque/variable torque pattern can be selected |
| | Starting torque | | 150% or more (at 1Hz)...when General-purpose magnetic flux vector control and slip compensation is set |
| | Torque boost | | Manual torque boost |
| | Acceleration/deceleration time setting | | 0.1 to 3600s (acceleration and deceleration can be set individually),<br>Linear and S-pattern acceleration/deceleration modes are available. |
| | DC injection brake | | Operation frequency (0 to 120Hz), operation time (0 to 10s), and operation voltage (0 to 30%) can be changed |
| | Stall prevention operation level | | Operation current level (0 to 200%), and whether to use the function or not can be selected |
| Operation specifications | Frequency setting signal | Analog input | Two terminals<br>Terminal 2: 0 to 10V and 0 to 5V are available<br>Terminal 4: 0 to 10V, 0 to 5V, and 4 to 20mA are available |
| | | Digital input | The signal is entered from the operation panel or parameter unit.<br>Frequency setting increment can be set. |
| | Start signal | | Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected. |
| | Input signal (five terminals) | | The following signals can be assigned to *Pr. 178 to Pr.182 (input terminal function selection)*: multi-speed selection, remote setting, second function selection, terminal 4 input selection, JOG operation selection, PID control valid terminal, 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, second function, multi-speed operation, regeneration avoidance, slip compensation, operation mode selection, offline auto tuning function, PID control, computer link operation (RS-485), Optimum excitation control, power failure stop, speed smoothing control, Modbus-RTU |
| | Output signal<br>Open collector output (two terminals)<br>Relay output (one terminal) | Operating status | The following signals can be assigned to *Pr.190, Pr.192 and Pr.197 (output terminal function selection)*: 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, fan alarm*1, heatsink overheat pre-alarm, deceleration at an instantaneous power failure, PID control activated, PID output interruption, safety monitor output, safety monitor output 2, during retry, life alarm, current average value monitor, remote output, alarm output, fault output, fault output 3, and maintenance timer alarm. |
| | | For meter<br>Pulse train output<br>(MAX 2.4kHz: one terminal) | The following signals can be assigned to *Pr.54 FM terminal function selection*: output frequency, output current (steady), output voltage, frequency setting, 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, PID deviation, motor thermal load factor, and inverter thermal load factor.<br>Pulse train output (1440 pulses/s/full scale) |
| Indication | Operation panel<br>Parameter unit (FR-PU07) | Operating status | The following operating status can be displayed: output frequency, output current (steady), output voltage, frequency setting, cumulative energization time, actual operation time, 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, output power, cumulative power, motor thermal load factor, inverter thermal load factor, and PTC thermistor resistance. |
| | | Fault record | Fault definition is displayed when a fault occurs. Past 8 fault records (output voltage/current/frequency/cumulative energization time right before the fault occurs) are stored. |
| | | Interactive guidance | Function (help) for operation guide *2 |
| Protective/warning function | | Protective function | 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 loss *3 *4, output side earth (ground) fault overcurrent at start*3, output phase loss, external thermal relay operation *3, PTC thermistor operation*3, parameter error, PU disconnection, retry count excess *3, CPU fault, brake transistor alarm, inrush resistance overheat, analog input error, stall prevention operation, output current detection value exceeded *3, safety circuit fault |
| | | Warning function | Fan alarm*1, overcurrent stall prevention, overvoltage stall prevention, PU stop, parameter write error, regenerative brake prealarm *3, electronic thermal relay function prealarm, maintenance output *3, undervoltage, operation panel lock, password locked, inverter reset, safety stop |
| Environment | Surrounding air temperature | | -10°C to +50°C maximum (non-freezing) (-10°C to +40°C for totally-enclosed structure feature) *5 |
| | Ambient humidity | | 90%RH or less (non-condensing) |
| | Storage temperature*6 | | -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/s $^2$ or less at 10 to 55Hz (directions of X, Y, Z axes) |

*1 As the 0.75K or less are not provided with the cooling fan, this alarm does not function.
*2 This operation guide is only available with option parameter unit (FR-PU07).
*3 This protective function does not function in the initial status.
*4 This protective function is available with the three-phase power input specification model only.
*5 When using the inverters at the surrounding air temperature of 40°C or less, the inverters can be installed closely attached (0cm clearance).
*6 Temperatures applicable for a short time, e.g. in transit.

# Outline Dimension Drawings

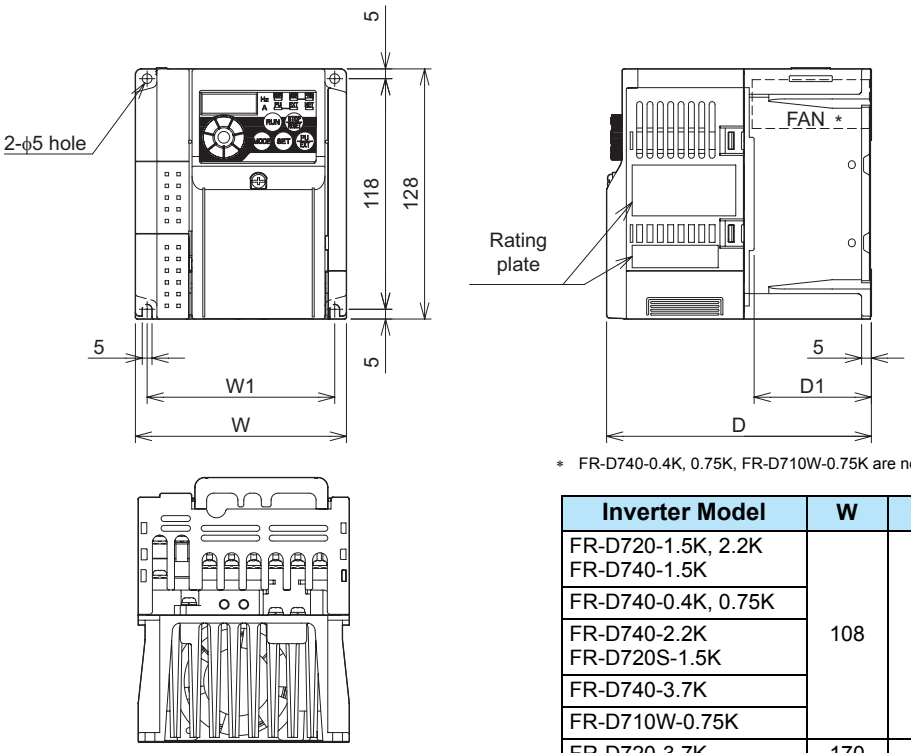
- FR-D720-0.1K to 0.75K
- FR-D720S-0.1K to 0.75K
- FR-D710W-0.1K to 0.4K




| Inverter Model | D | D1 |
|---|---|---|
| FR-D720-0.1K, 0.2K<br>FR-D720S-0.1K, 0.2K<br>FR-D710W-0.1K | 80.5 | 10 |
| FR-D710W-0.2K | 110.5 | 10 |
| FR-D720-0.4K | 112.5 | 42 |
| FR-D720-0.75K | 132.5 | 62 |
| FR-D720S-0.4K<br>FR-D710W-0.4K | 142.5 | 42 |
| FR-D720S-0.75K | 162.5 | 62 |

(Unit: mm)

- FR-D720-1.5K to 3.7K
- FR-D740-0.4K to 3.7K
- FR-D720S-1.5K
- FR-D710W-0.75K

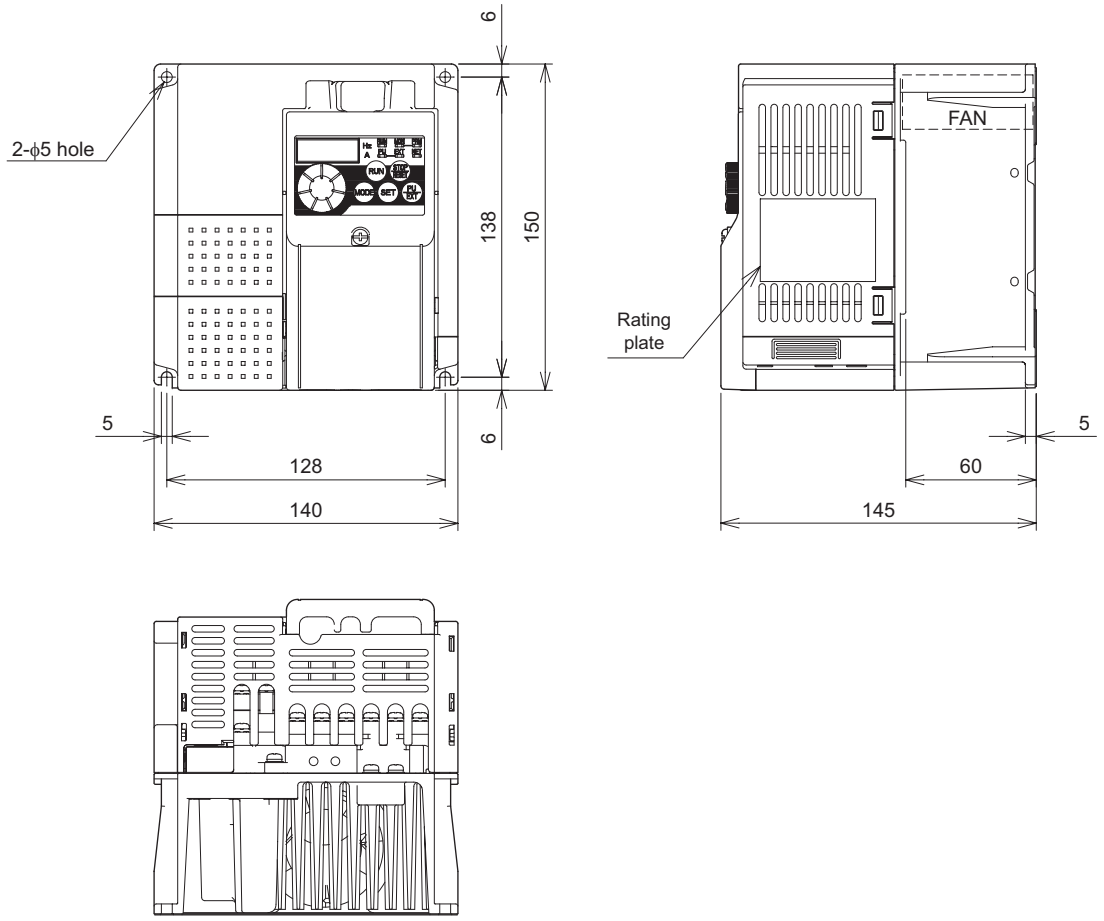



* FR-D740-0.4K, 0.75K, FR-D710W-0.75K are not provided with the cooling fan.

| Inverter Model | W | W1 | D | D1 |
|---|---|---|---|---|
| FR-D720-1.5K, 2.2K<br>FR-D740-1.5K | 108 | 96 | 135.5 | 60 |
| FR-D740-0.4K, 0.75K | | | 129.5 | 54 |
| FR-D740-2.2K<br>FR-D720S-1.5K | | | 155.5 | 60 |
| FR-D740-3.7K | | | 165.5 | |
| FR-D710W-0.75K | | | 149.5 | 54 |
| FR-D720-3.7K | 170 | 158 | 142.5 | 66.5 |

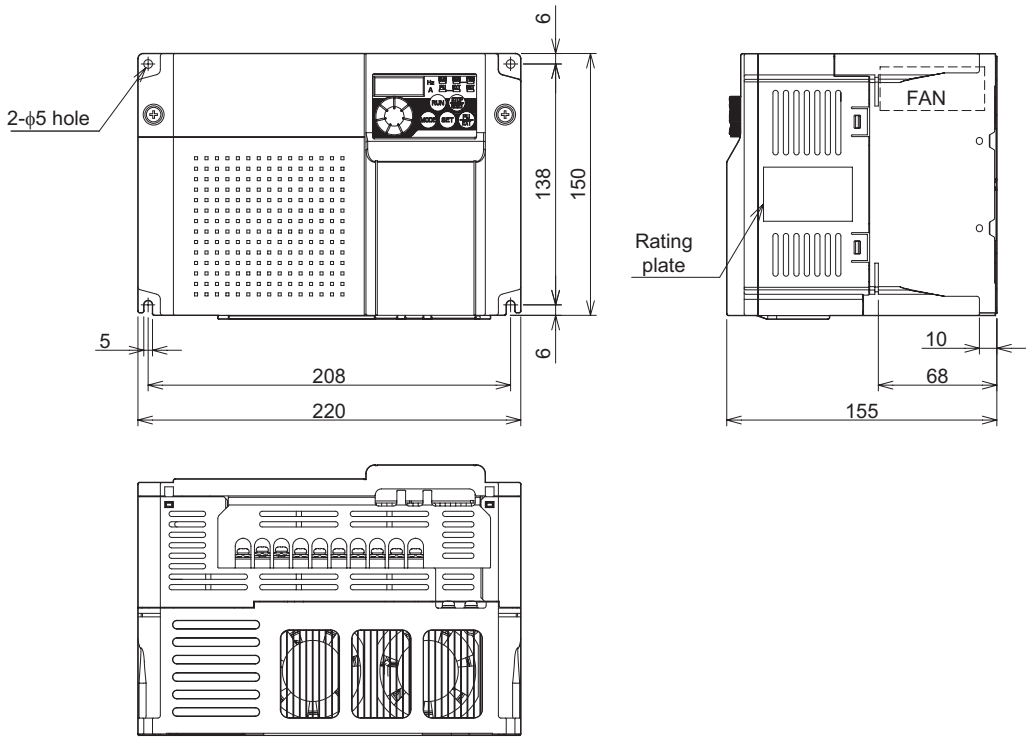
(Unit: mm)

●FR-D720S-2.2K



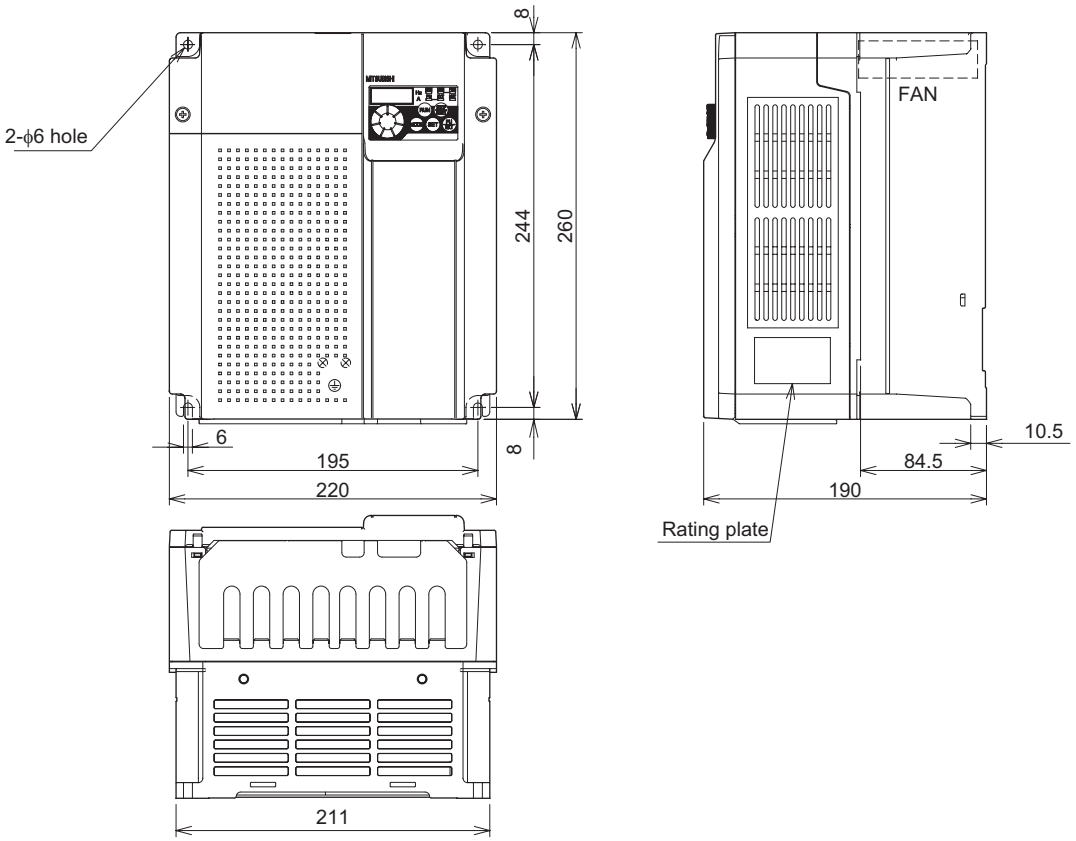

(Unit: mm)

●FR-D720-5.5K, 7.5K
●FR-D740-5.5K, 7.5K



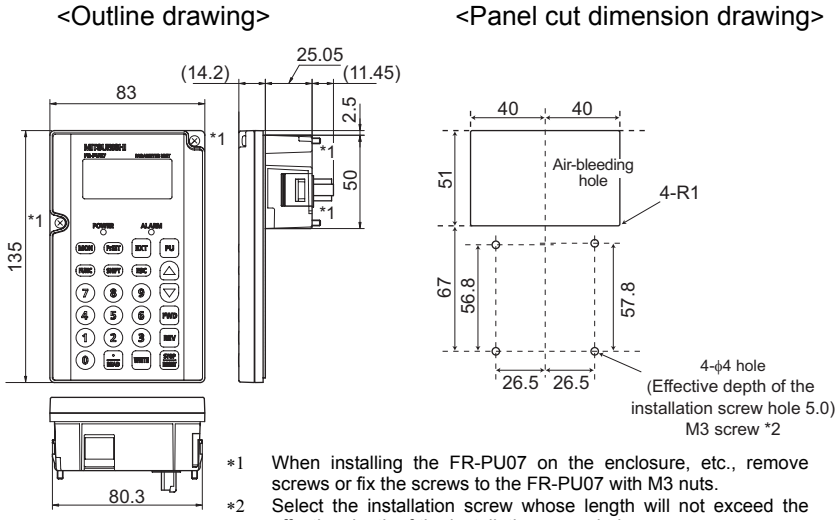

(Unit: mm)

●FR-D720-11K, 15K
●FR-D740-11K, 15K




(Unit: mm)

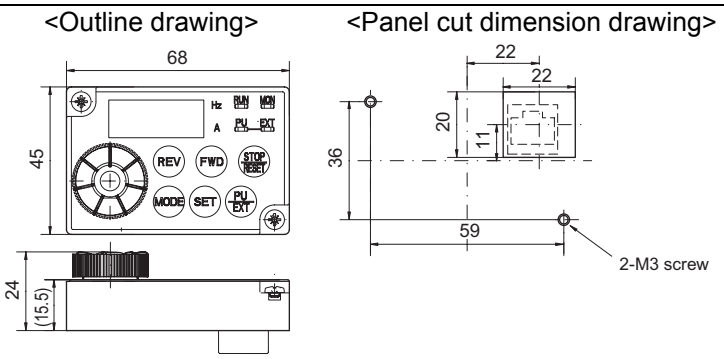
●Parameter unit (option) (FR-PU07)




*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.

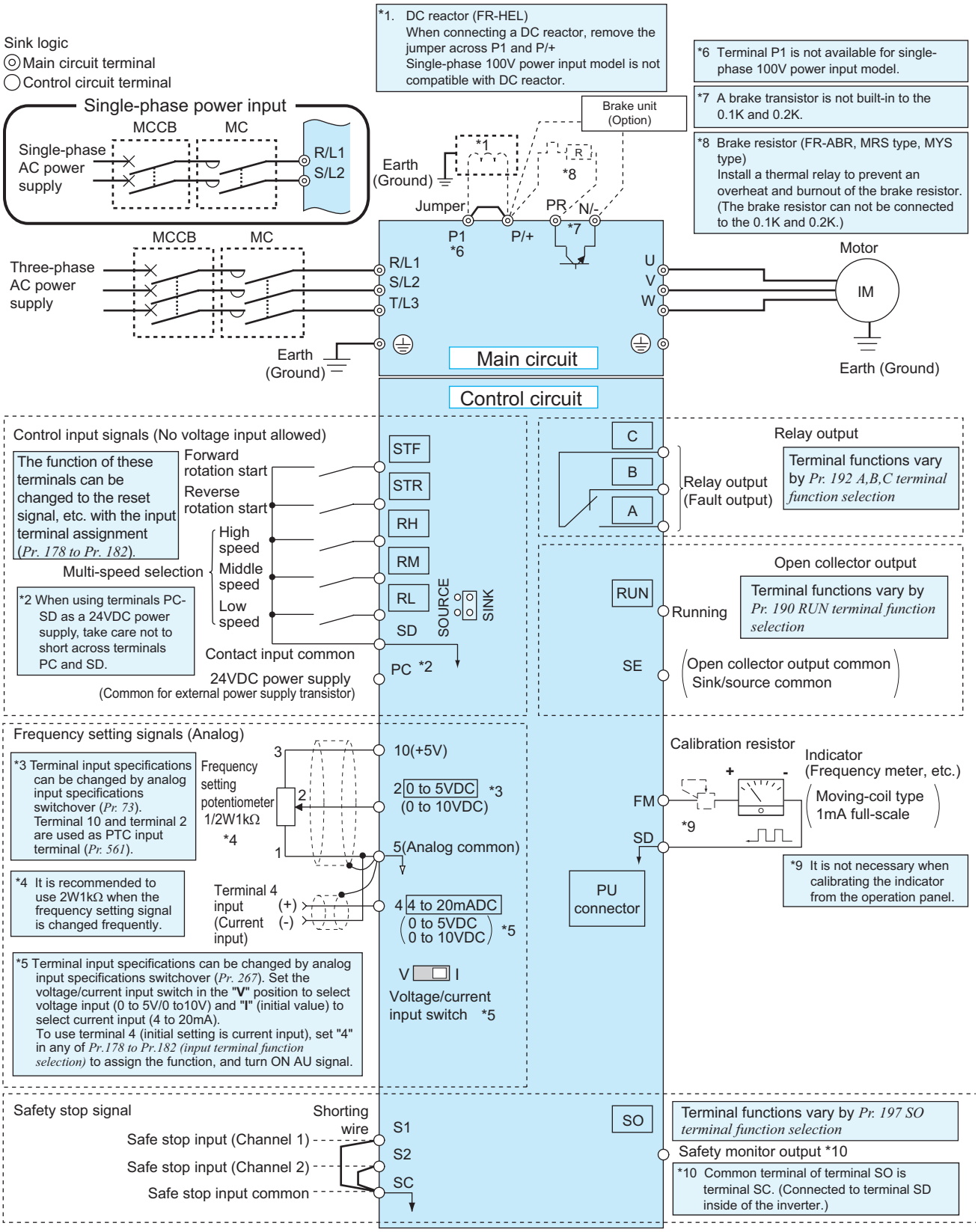
(Unit: mm)

●Enclosure surface operation panel (option) (FR-PA07)




(Unit: mm)

# Terminal Connection Diagram




## Note

- **To prevent a malfunction caused by noise, separate the signal cables more than 10cm from the power cables. Also separate the main circuit wire of the input side and the output side.**
- **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.**
- **The output of the single-phase power input specification is three-phase 200V.**

# 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).<br>* When using single-phase power input, terminals are R/L1 and S/L2. | |
| | | U, V, W | Inverter output | Connect a three-phase squirrel-cage motor. | |
| | | P/+, PR | Brake resistor connection | Connect a brake resistor (FR-ABR, MRS type, MYS type) across terminals P/+ and PR.<br>(The brake resistor can not be connected to the 0.1K and 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.<br>Single-phase 100V power input model is not compatible with DC reactor.<br>* Terminal P1 is not available for single-phase 100V power input model. | |
| | | ⏚ | 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. | |
| | | SD | Contact input common (sink) (initial setting) | Common terminal for contact input terminal (sink logic) and terminal FM. | |
| | | | External transistor common (source) | When connecting the transistor output (open collector output), such as a programmable controller, when source logic is selected, connect the external power supply common for transistor output to this terminal to prevent a malfunction caused by undesirable currents. | |
| | | | 24VDC power supply common | Common output terminal for 24VDC 0.1A power supply (PC terminal).<br>Isolated from terminals 5 and SE. | |
| | | PC | External transistor common (sink) (initial setting) | When connecting the transistor output (open collector output), such as a programmable controller, 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. | |
| | | | Contact input common (source) | Common terminal for contact input terminal (source logic). | |
| | | | 24VDC power supply | Can be used as 24VDC 0.1A power supply. | |
| | Frequency setting | 10 | Frequency setting power supply | Used as power supply when connecting potentiometer for frequency setting (speed setting) from outside of the inverter. | 5VDC 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<br>Permissible maximum voltage 20VDC |
| | | 4 | Frequency setting (current) | Inputting 4 to 20mADC (or 0 to 5V, 0 to 10V) provides the maximum output frequency at 20mA and makes input and output proportional. This input signal is valid only when the AU signal is ON (terminal 2 input is invalid). To use terminal 4 (initial setting is current input), set "4" in any of *Pr.178 to Pr.182 (input terminal function selection)* to assign the function, and turn ON AU signal. 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:<br>Input resistance 10kΩ ± 1kΩ<br>Permissible maximum voltage 20VDC<br>Current input:<br>Input resistance 233Ω ± 5Ω<br>Maximum permissible current 30mA. |
| | | 5 | Frequency setting common | Common terminal for the frequency setting signals (terminals 2 or 4). Do not earth (ground). | |
| PTC thermistor | | 10<br>2 | PTC thermistor input | For connecting PTC thermistor output.<br>When PTC thermistor protection is valid (*Pr. 561* ≠ "9999"), terminal 2 is not available for frequency setting. | Adaptive PTC thermistor specification<br>Heat detection resistance : 500Ω to 30kΩ (Set by *Pr. 561*) |
| Control circuit/output signal | Relay | A, B, C | Relay output (fault output) | 1 changeover contact output indicates that the inverter fault occurs.<br>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.<br>(Low is when the open collector output transistor is ON (conducts). High is when the transistor is OFF (does not conduct).) | Permissible load 24VDC (Maximum 27VDC) 0.1A<br>(a voltage drop is 3.4V maximum when the signal is on) |
| | | 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. (Not output during inverter reset.) The output signal is proportional to the magnitude of the corresponding monitoring item. | Permissible load current 1mA<br>1440 pulses/s at 60Hz |
| Communication | | — | PU connector | With the PU connector, RS-485 communication can be made.<br>· Conforming standard: EIA-485 (RS-485)<br>· Transmission format: Multi-drop link<br>· Communication speed: 4800 to 38400bps<br>· Overall extension: 500m | |
| Safety stop signal | | S1 | Safety stop input (Channel 1) | Terminals S1 and S2 are for safety stop input signals used with the safety relay module. Terminals S1 and S2 are used simultaneously (dual channel). Inverter output is shut off by shortening/opening across terminals S1 and SC and across S2 and SC. In the initial status, terminals S1 and S2 are shorted with terminal SC by shortening wire.<br>Remove the shortening wire and connect the safety relay module when using the safety stop function. | Input resistance: 4.7kΩ<br>Current: 4 to 6 mA<br>(In case of shorted to SC)<br>Voltage: 21 to 26 V<br>(In case of open from SC) |
| | | S2 | Safety stop input (Channel 2) | | |
| | | SO | Safety monitor output (open collector output) | The signal indicates the status of safety stop input. Low indicates safe state, and High indicates drive enabled or fault detected. (Low is when the open collector output transistor is ON (conducts). High is when the transistor is OFF (does not conduct).) | Load: 24VDC/0.1A max.<br>Voltage drop: 3.4V max.<br>(In case of 'ON' state) |
| | | SC | Safety stop input terminal common | Common terminal for terminals S1, S2 and SO. Connected to terminal SD inside of the inverter. | |

**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. 182, Pr. 190, Pr. 192, Pr. 197 (I/O terminal function selection)*.**
- **Terminal names and terminal functions are those of the factory set.**

# Explanation of the Operation Panel

**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. (Lit at power-ON at initial setting.)
NET: Lit to indicate Network operation mode.
PU, EXT: Lit to indicate External/PU combined operation mode 1, 2.
These turn OFF when command source is not on operation panel.

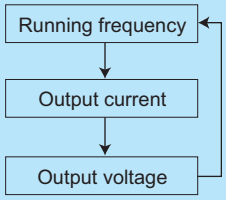
**Unit indication**
Hz: Lit to indicate frequency. (Flickers when the set frequency monitor is displayed.)
A: Lit to indicate current.
(Both "Hz" and "A" turn OFF when other than the above is displayed.)

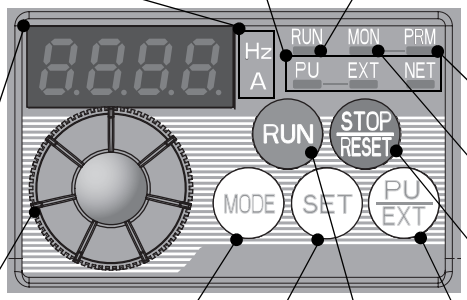
**Monitor (4-digit LED)**
Shows the frequency, parameter number, etc.

**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
- Present set value is displayed during calibration
- Displays the order in the faults 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;




**Operating status indication**
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): When (RUN) was pressed or the start command was given, but the operation can not be made.
- When the frequency command is less than the starting frequency.
- When the MRS signal is input.

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

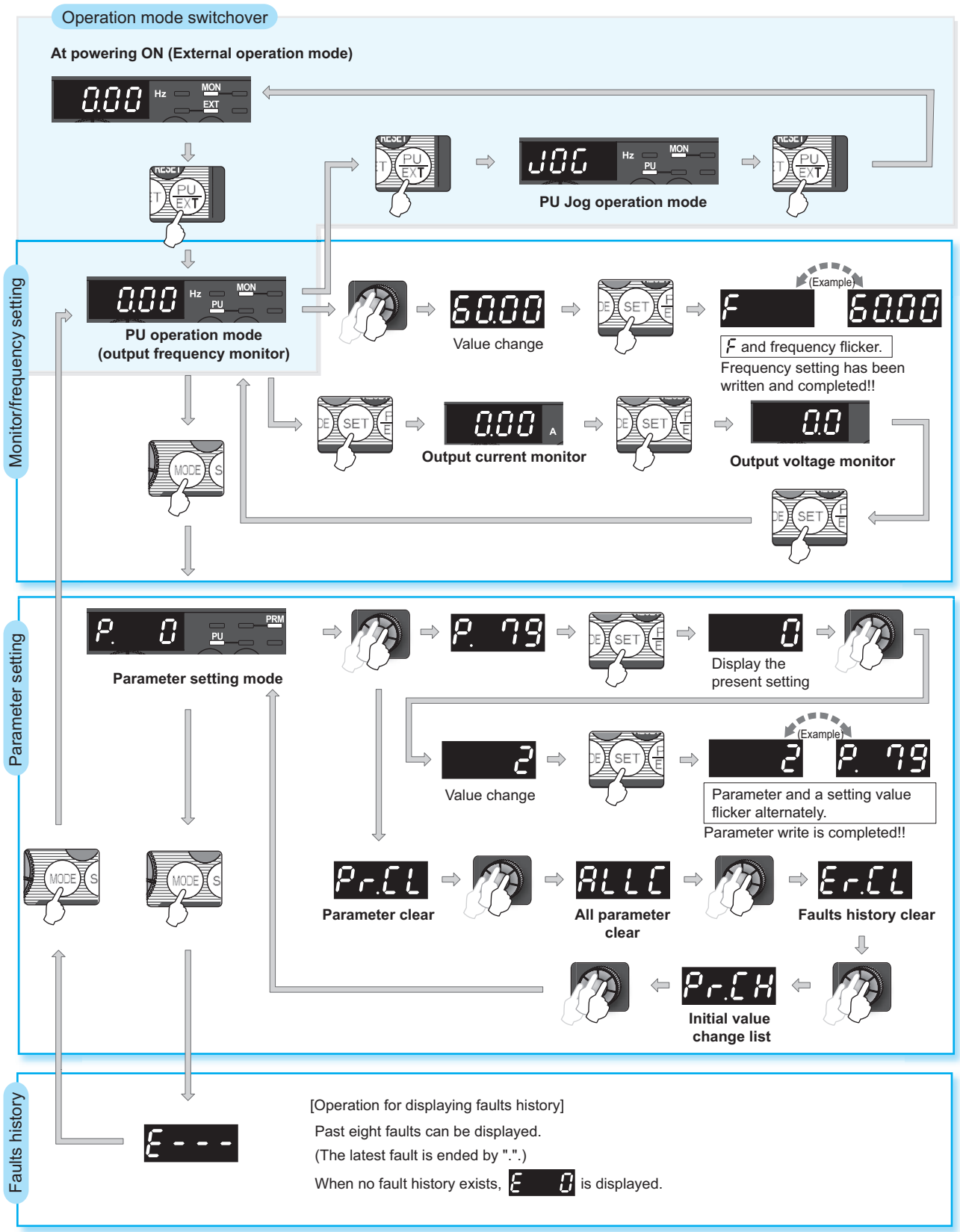
**Monitor indication**
Lit to indicate monitoring mode.

**Stop operation**
Used to stop Run command.
Fault can be reset when protective function is activated (fault).

**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) simultaneously (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



## Parameter unit (FR-PU07)

- The parameter unit is a convenient tool for inverter setting such as direct input method with a numeric keypad, operation status indication, and help function.
- Eight languages can be displayed.
- Parameter setting values of maximum of three inverters can be stored.

∗ The parameter unit connection cable FR-CB20☐ is required for connecting to the inverter.

FR-PU07

| 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. |
| 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>• The monitor screen selected by the cursor appears. |

● Main functions

| Function | Description |
|---|---|
| Monitor | 6 types of monitors appear by simply pressing SHIFT . |
| Frequency setting | For PU operation mode and External/PU combined operation mode (*Pr.79* = "3"), frequency setting is available. Settings is performed by the direct setting, which sets frequency directly by 0 to 9, and the step setting, which sets frequency continuously by ▲ ▼. |
| Parameter Setting | Reading parameter and changing setting values are easily done. To change the setting value of an parameter, specify the parameter number, or select a parameter from the functional parameter list. |
| Batch copy | FR-PU07 reads parameter settings of an inverter, and stores three different parameter settings.<br>FR-PU07 can also copy the stored parameter setting to another inverter of the same series, or verify its stored parameter setting against the parameter setting stored in an inverter. |
| Operation | Switching between External operation mode [EXT] and PU operation mode [PU] is easy.<br>Start/stop is enabled during PU operation mode and External/PU operation mode (*Pr.79* = "3"). |

∗ Available function differs by the inverter. Please refer to the instruction manual of the inverter and the parameter unit.

# 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.
This catalog explains based on the Japanese specifications.

**POINT**

Only simple mode parameters are displayed by the initial setting of *Pr. 160 Extended function display selection*. Set *Pr. 160 Extended function display selection* as required.

| *Pr. 160* | Description |
|---|---|
| 9999 (initial value) | Parameters classified as simple mode can be displayed. |
| 0 | Both the parameters classified as simple mode and the parameters classified as extended mode can be displayed. |

| Parameter Number | Name | Unit | Initial Value | Range | Application |
|---|---|---|---|---|---|
| 0 | Torque boost | 0.1% | 6%/4%/3/ 2%* | 0 to 30% | Set when you want to increase a starting torque under V/F control, or when the motor with a load will not rotate, resulting in an alarm [OL] and a trip [OC1].<br>* Initial values differ according to the inverter capacity. (0.75K or less/ 1.5K to 3.7K/5.5K, 7.5K/11K, 15K) |
| 1 | Maximum frequency | 0.01Hz | 120Hz | 0 to 120Hz | Set when the maximum output frequency need to be limited. |
| 2 | Minimum frequency | 0.01Hz | 0Hz | 0 to 120Hz | Set when the minimum output frequency need to be limited. |
| 3 | Base frequency | 0.01Hz | 60Hz | 0 to 400Hz | Set when the rated motor frequency is 50Hz.<br>Check the motor rating plate. |
| 4 | Multi-speed setting (high speed) | 0.01Hz | 60Hz | 0 to 400Hz | Set when changing the preset speed in the parameter with a terminal. |
| 5 | Multi-speed setting (middle speed) | 0.01Hz | 30Hz | 0 to 400Hz | |
| 6 | Multi-speed setting (low speed) | 0.01Hz | 10Hz | 0 to 400Hz | |
| 7 | Acceleration time | 0.1s | 5s/10s/15s* | 0 to 3600s | Acceleration/deceleration time can be set.<br>* Initial values differ according to the inverter capacity. (3.7K or less/ 5.5K, 7.5K/11K, 15K) |
| 8 | Deceleration time | 0.1s | 5s/10s/15s* | 0 to 3600s | |
| 9 | Electronic thermal O/L relay | 0.01A | Rated inverter current | 0 to 500A | The inverter protects the motor from overheat.<br>Set the rated motor current. |
| 79 | Operation mode selection | 1 | 0 | 0, 1, 2, 3, 4, 6, 7 | Select the start command location and frequency setting location. |
| 125 | Terminal 2 frequency setting gain frequency | 0.01Hz | 60Hz | 0 to 400Hz | Frequency for the maximum value of the potentiometer (5V initial value) can be changed. |
| 126 | Terminal 4 frequency setting gain frequency | 0.01Hz | 60Hz | 0 to 400Hz | Frequency for the maximum current input (20mA initial value) can be changed. |
| 160 | Extended function display selection | 1 | 9999 | 0, 9999 | Parameter which can be read from the operation panel and parameter unit can be restricted. |

## ● Extended mode parameter

**REMARKS**

- ◎ indicates simple mode parameters.
- 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 | Customer Setting |
|---|---|---|---|---|---|---|
| Basic functions | ◎ 0 | Torque boost | 0 to 30% | 0.1% | 6/4/3/2% *1 | |
| | ◎ 1 | Maximum frequency | 0 to 120Hz | 0.01Hz | 120Hz | |
| | ◎ 2 | Minimum frequency | 0 to 120Hz | 0.01Hz | 0Hz | |
| | ◎ 3 | Base frequency | 0 to 400Hz | 0.01Hz | 60Hz | |
| | ◎ 4 | Multi-speed setting (high speed) | 0 to 400Hz | 0.01Hz | 60Hz | |
| | ◎ 5 | Multi-speed setting (middle speed) | 0 to 400Hz | 0.01Hz | 30Hz | |
| | ◎ 6 | Multi-speed setting (low speed) | 0 to 400Hz | 0.01Hz | 10Hz | |
| | ◎ 7 | Acceleration time | 0 to 3600s | 0.1s | 5/10/15s *2 | |
| | ◎ 8 | Deceleration time | 0 to 3600s | 0.1s | 5/10/15s *2 | |
| | ◎ 9 | Electronic thermal O/L relay | 0 to 500A | 0.01A | Rated inverter current | |
| DC injection brake | 10 | DC injection brake operation frequency | 0 to 120Hz | 0.01Hz | 3Hz | |
| | 11 | DC injection brake operation time | 0 to 10s | 0.1s | 0.5s | |
| | 12 | DC injection brake operation voltage | 0 to 30% | 0.1% | 6/4/2% *3 | |
| — | 13 | Starting frequency | 0 to 60Hz | 0.01Hz | 0.5Hz | |
| — | 14 | Load pattern selection | 0 to 3 | 1 | 0 | |
| JOG operation | 15 | Jog frequency | 0 to 400Hz | 0.01Hz | 5Hz | |
| | 16 | Jog acceleration/deceleration time | 0 to 3600s | 0.1s | 0.5s | |
| — | 17 | MRS input selection | 0, 2, 4 | 1 | 0 | |
| — | 18 | High speed maximum frequency | 120 to 400Hz | 0.01Hz | 120Hz | |
| — | 19 | Base frequency voltage | 0 to 1000V, 8888, 9999 | 0.1V | 9999 | |
| Acceleration/deceleration time | 20 | Acceleration/deceleration reference frequency | 1 to 400Hz | 0.01Hz | 60Hz | |
| Stall prevention | 22 | Stall prevention operation level | 0 to 200% | 0.1% | 150% | |
| | 23 | Stall prevention operation level compensation factor at double speed | 0 to 200%, 9999 | 0.1% | 9999 | |
| Multi-speed setting | 24 | Multi-speed setting (speed 4) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 25 | Multi-speed setting (speed 5) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 26 | Multi-speed setting (speed 6) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 27 | Multi-speed setting (speed 7) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| — | 29 | Acceleration/deceleration pattern selection | 0, 1, 2 | 1 | 0 | |
| — | 30 | Regenerative function selection | 0, 1, 2 | 1 | 0 | |
| Frequency jump | 31 | Frequency jump 1A | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 32 | Frequency jump 1B | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 33 | Frequency jump 2A | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 34 | Frequency jump 2B | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 35 | Frequency jump 3A | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 36 | Frequency jump 3B | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| — | 37 | Speed display | 0, 0.01 to 9998 | 0.001 | 0 | |
| — | 40 | RUN key rotation direction selection | 0, 1 | 1 | 0 | |
| Frequency detection | 41 | Up-to-frequency sensitivity | 0 to 100% | 0.1% | 10% | |
| | 42 | Output frequency detection | 0 to 400Hz | 0.01Hz | 6Hz | |
| | 43 | Output frequency detection for reverse rotation | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Customer Setting |
|---|---|---|---|---|---|---|
| Second functions | 44 | Second acceleration/deceleration time | 0 to 3600s | 0.1s | 5/10/15s *2 | |
| | 45 | Second deceleration time | 0 to 3600s, 9999 | 0.1s | 9999 | |
| | 46 | Second torque boost | 0 to 30%, 9999 | 0.1% | 9999 | |
| | 47 | Second V/F (base frequency) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 48 | Second stall prevention operation current | 0 to 200%, 9999 | 0.1% | 9999 | |
| | 51 | Second electronic thermal O/L relay | 0 to 500A, 9999 | 0.01A | 9999 | |
| Monitor functions | 52 | DU/PU main display data selection | 0, 5, 8 to 12, 14, 20, 23 to 25, 52 to 55, 61, 62, 64, 100 | 1 | 0 | |
| | 54 | FM terminal function selection | 1 to 3, 5, 8 to 12, 14, 21, 24, 52, 53, 61, 62 | 1 | 1 | |
| | 55 | Frequency monitoring reference | 0 to 400Hz | 0.01Hz | 60Hz | |
| | 56 | Current monitoring reference | 0 to 500A | 0.01A | Rated inverter current | |
| Automatic restart functions | 57 | Restart coasting time | 0, 0.1 to 5s, 9999 | 0.1s | 9999 | |
| | 58 | Restart cushion time | 0 to 60s | 0.1s | 1s | |
| — | 59 | Remote function selection | 0, 1, 2, 3 | 1 | 0 | |
| — | 60 | Energy saving control selection | 0, 9 | 1 | 0 | |
| — | 65 | Retry selection | 0 to 5 | 1 | 0 | |
| — | 66 | Stall prevention operation reduction starting frequency | 0 to 400Hz | 0.01Hz | 60Hz | |
| Retry | 67 | Number of retries at fault occurrence | 0 to 10, 101 to 110 | 1 | 0 | |
| | 68 | Retry waiting time | 0.1 to 600s | 0.1s | 1s | |
| | 69 | Retry count display erase | 0 | 1 | 0 | |
| — | 70 | Special regenerative brake duty | 0 to 30% | 0.1% | 0% | |
| — | 71 | Applied motor | 0, 1, 3, 13, 23, 40, 43, 50, 53 | 1 | 0 | |
| — | 72 | PWM frequency selection | 0 to 15 | 1 | 1 | |
| — | 73 | Analog input selection | 0, 1, 10, 11 | 1 | 1 | |
| — | 74 | Input filter time constant | 0 to 8 | 1 | 1 | |
| — | 75 | Reset selection/disconnected PU detection/PU stop selection | 0 to 3, 14 to 17 | 1 | 14 | |
| — | 77 | Parameter write selection | 0, 1, 2 | 1 | 0 | |
| — | 78 | Reverse rotation prevention selection | 0, 1, 2 | 1 | 0 | |
| — | ◎ 79 | Operation mode selection | 0, 1, 2, 3, 4, 6, 7 | 1 | 0 | |
| Motor constants | 80 | Motor capacity | 0.1 to 15kW, 9999 | 0.01kW | 9999 | |
| | 82 | Motor excitation current | 0 to 500A, 9999 | 0.01A | 9999 | |
| | 83 | Rated motor voltage | 0 to 1000V | 0.1V | 200V/400V *4 | |
| | 84 | Rated motor frequency | 10 to 120Hz | 0.01Hz | 60Hz | |
| | 90 | Motor constant (R1) | 0 to 50Ω , 9999 | 0.001Ω | 9999 | |
| | 96 | Auto tuning setting/status | 0, 11, 21 | 1 | 0 | |
| PU connector communication | 117 | PU communication station number | 0 to 31 (0 to 247) | 1 | 0 | |
| | 118 | PU communication speed | 48, 96, 192, 384 | 1 | 192 | |
| | 119 | PU communication stop bit length | 0, 1, 10, 11 | 1 | 1 | |
| | 120 | PU communication parity check | 0, 1, 2 | 1 | 2 | |
| | 121 | Number of PU communication retries | 0 to 10, 9999 | 1 | 1 | |
| | 122 | PU communication check time interval | 0, 0.1 to 999.8s, 9999 | 0.1s | 0 | |
| | 123 | PU communication waiting time setting | 0 to 150ms, 9999 | 1 | 9999 | |
| | 124 | PU communication CR/LF selection | 0, 1, 2 | 1 | 1 | |
| — | ◎ 125 | Terminal 2 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | |
| — | ◎126 | Terminal 4 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Customer Setting |
|---|---|---|---|---|---|---|
| PID operation | 127 | PID control automatic switchover frequency | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 128 | PID action selection | 0, 20, 21, 40 to 43 | 1 | 0 | |
| | 129 | PID proportional band | 0.1 to 1000%, 9999 | 0.1% | 100% | |
| | 130 | PID integral time | 0.1 to 3600s, 9999 | 0.1s | 1s | |
| | 131 | PID upper limit | 0 to 100%, 9999 | 0.1% | 9999 | |
| | 132 | PID lower limit | 0 to 100%, 9999 | 0.1% | 9999 | |
| | 133 | PID action set point | 0 to 100%, 9999 | 0.01% | 9999 | |
| | 134 | PID differential time | 0.01 to 10s, 9999 | 0.01s | 9999 | |
| PU | 145 | PU display language selection | 0 to 7 | 1 | 0 | |
| — | 146 *5 | Built-in potentiometer switching | 0, 1 | 1 | 1 | |
| Current detection | 150 | Output current detection level | 0 to 200% | 0.1% | 150% | |
| | 151 | Output current detection signal delay time | 0 to 10s | 0.1s | 0s | |
| | 152 | Zero current detection level | 0 to 200% | 0.1% | 5% | |
| | 153 | Zero current detection time | 0 to 1s | 0.01s | 0.5s | |
| — | 156 | Stall prevention operation selection | 0 to 31, 100, 101 | 1 | 0 | |
| — | 157 | OL signal output timer | 0 to 25s, 9999 | 0.1s | 0s | |
| — | ◎ 160 | Extended function display selection | 0, 9999 | 1 | 9999 | |
| — | 161 | Frequency setting/key lock operation selection | 0, 1, 10, 11 | 1 | 0 | |
| Automatic restart functions | 162 | Automatic restart after instantaneous power failure selection | 0, 1, 10, 11 | 1 | 1 | |
| | 165 | Stall prevention operation level for restart | 0 to 200% | 0.1% | 150% | |
| Current detection | 166 | Output current detection signal retention time | 0 to 10s, 9999 | 0.1s | 0.1s | |
| | 167 | Output current detection operation selection | 0, 1 | 1 | 0 | |
| — | 168 | Parameter for manufacturer setting. Do not set. | | | | |
| — | 169 | | | | | |
| Cumulative monitor clear | 170 | Watt-hour meter clear | 0, 10, 9999 | 1 | 9999 | |
| | 171 | Operation hour meter clear | 0, 9999 | 1 | 9999 | |
| Input terminal function assignment | 178 | STF terminal function selection | 0 to 5, 7, 8, 10, 12, 14, 16, 18, 24, 25, 60, 62, 65 to 67, 9999 | 1 | 60 | |
| | 179 | STR terminal function selection | 0 to 5, 7, 8, 10, 12, 14, 16, 18, 24, 25, 61, 62, 65 to 67, 9999 | 1 | 61 | |
| | 180 | RL terminal function selection | 0 to 5, 7, 8, 10, 12, 14, 16, 18, 24, 25, 62, 65 to 67, 9999 | 1 | 0 | |
| | 181 | RM terminal function selection | | 1 | 1 | |
| | 182 | RH terminal function selection | | 1 | 2 | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Customer Setting |
|---|---|---|---|---|---|---|
| Output terminal function assignment | 190 | RUN terminal function selection | 0, 1, 3, 4, 7, 8, 11 to 16, 25, 26, 46, 47, 64, 70, 80, 81, 90, 91, 93, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 125, 126, 146, 147, 164, 170, 180, 181, 190, 191, 193, 195, 196, 198, 199, 9999 | 1 | 0 | |
| | 192 | A,B,C terminal function selection | 0, 1, 3, 4, 7, 8, 11 to 16, 25, 26, 46, 47, 64, 70, 80, 81, 90, 91, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 125, 126, 146, 147, 164, 170, 180, 181, 190, 191, 195, 196, 198, 199, 9999 | 1 | 99 | |
| | 197 | SO terminal function selection | 0, 1, 3, 4, 7, 8, 11 to 16, 25, 26, 46, 47, 64, 70, 80, 81, 90, 91, 93, 95, 96, 98, 99, 100, 101, 103, 104, 107, 108, 111 to 116, 125, 126, 146, 147, 164, 170, 180, 181, 190, 191, 193, 195, 196, 198, 199 | 1 | 80 | |
| Multi-speed setting | 232 | Multi-speed setting (speed 8) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 233 | Multi-speed setting (speed 9) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 234 | Multi-speed setting (speed 10) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 235 | Multi-speed setting (speed 11) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 236 | Multi-speed setting (speed 12) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 237 | Multi-speed setting (speed 13) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 238 | Multi-speed setting (speed 14) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| | 239 | Multi-speed setting (speed 15) | 0 to 400Hz, 9999 | 0.01Hz | 9999 | |
| — | 240 | Soft-PWM operation selection | 0, 1 | 1 | 1 | |
| — | 241 | Analog input display unit switchover | 0, 1 | 1 | 0 | |
| — | 244 | Cooling fan operation selection | 0, 1 | 1 | 1 | |
| Slip compensation | 245 | Rated slip | 0 to 50%, 9999 | 0.01% | 9999 | |
| | 246 | Slip compensation time constant | 0.01 to 10s | 0.01s | 0.5s | |
| | 247 | Constant-power range slip compensation selection | 0, 9999 | 1 | 9999 | |
| — | 249 | Earth (ground) fault detection at start | 0, 1 | 1 | 0 | |
| — | 250 | Stop selection | 0 to 100s, 1000 to 1100s, 8888, 9999 | 0.1s | 9999 | |
| — | 251 | Output phase loss protection selection | 0, 1 | 1 | 1 | |
| Life diagnosis | 255 | Life alarm status display | (0 to 15) | 1 | 0 | |
| | 256 | Inrush current limit circuit life display | (0 to 100%) | 1% | 100% | |
| | 257 | Control circuit capacitor life display | (0 to 100%) | 1% | 100% | |
| | 258 | Main circuit capacitor life display | (0 to 100%) | 1% | 100% | |
| | 259 | Main circuit capacitor life measuring | 0, 1 (2, 3, 8, 9) | 1 | 0 | |
| — | 260 | PWM frequency automatic switchover | 0, 1 | 1 | 0 | |
| Power failure stop | 261 | Power failure stop selection | 0, 1, 2 | 1 | 0 | |
| — | 267 | Terminal 4 input selection | 0, 1, 2 | 1 | 0 | |
| — | 268 | Monitor decimal digits selection | 0, 1, 9999 | 1 | 9999 | |
| — | 269 | Parameter for manufacturer setting. Do not set. | | | | |
| — | 295 | Magnitude of frequency change setting | 0, 0.01, 0.10, 1.00, 10.00 | 0.01 | 0 | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Customer Setting |
|---|---|---|---|---|---|---|
| Password function | 296 | Password lock level | 1 to 6, 101 to 106, 9999 | 1 | 9999 | |
| | 297 | Password lock/unlock | 1000 to 9998 (0 to 5, 9999) | 1 | 9999 | |
| — | 298 | Frequency search gain | 0 to 32767, 9999 | 1 | 9999 | |
| — | 299 | Rotation direction detection selection at restarting | 0, 1, 9999 | 1 | 0 | |
| RS-485 communication | 338 | Communication operation command source | 0, 1 | 1 | 0 | |
| | 339 | Communication speed command source | 0, 1, 2 | 1 | 0 | |
| | 340 | Communication startup mode selection | 0, 1, 10 | 1 | 0 | |
| | 342 | Communication EEPROM write selection | 0, 1 | 1 | 0 | |
| | 343 | Communication error count | — | 1 | 0 | |
| Second motor constant | 450 | Second applied motor | 0, 1, 9999 | 1 | 9999 | |
| Remote Output | 495 | Remote output selection | 0, 1, 10, 11 | 1 | 0 | |
| | 496 | Remote output data 1 | 0 to 4095 | 1 | 0 | |
| — | 502 | Stop mode selection at communication error | 0, 1, 2 | 1 | 0 | |
| Maintenance | 503 | Maintenance timer | 0 (1 to 9998) | 1 | 0 | |
| | 504 | Maintenance timer alarm output set time | 0 to 9998, 9999 | 1 | 9999 | |
| Communication | 549 | Protocol selection | 0, 1 | 1 | 0 | |
| | 551 | PU mode operation command source selection | 2, 4, 9999 | 1 | 9999 | |
| Current average time monitor | 555 | Current average time | 0.1 to 1s | 0.1s | 1s | |
| | 556 | Data output mask time | 0 to 20s | 0.1s | 0s | |
| | 557 | Current average value monitor signal output reference current | 0 to 500A | 0.01A | Rated inverter current | |
| — | 561 | PTC thermistor protection level | 0.5 to 30kΩ , 9999 | 0.01kΩ | 9999 | |
| — | 563 | Energization time carrying-over times | (0 to 65535) | 1 | 0 | |
| — | 564 | Operating time carrying-over times | (0 to 65535) | 1 | 0 | |
| — | 571 | Holding time at a start | 0 to 10s, 9999 | 0.1s | 9999 | |
| PID operati | 575 | Output interruption detection time | 0 to 3600s, 9999 | 0.1s | 1s | |
| | 576 | Output interruption detection level | 0 to 400Hz | 0.01Hz | 0Hz | |
| | 577 | Output interruption cancel level | 900 to 1100% | 0.1% | 1000% | |
| — | 611 | Acceleration time at a restart | 0 to 3600s, 9999 | 0.1s | 9999 | |
| — | 653 | Speed smoothing control | 0 to 200% | 0.1% | 0 | |
| — | 665 | Regeneration avoidance frequency gain | 0 to 200% | 0.1% | 100 | |
| Protective functions | 872 *7 | Input phase loss protection selection | 0, 1 | 1 | 0 | |

| Func-tion | Parameter | Name | Setting Range | Minimum Setting Increments | Initial Value | Customer Setting |
|---|---|---|---|---|---|---|
| Regeneration avoidance function | 882 | Regeneration avoidance operation selection | 0, 1, 2 | 1 | 0 | |
| | 883 | Regeneration avoidance operation level | 300 to 800V | 0.1V | 400VDC/ 780VDC *4 | |
| | 885 | Regeneration avoidance compensation frequency limit value | 0 to 10Hz, 9999 | 0.01Hz | 6Hz | |
| | 886 | Regeneration avoidance voltage gain | 0 to 200% | 0.1% | 100% | |
| Free parameter | 888 | Free parameter 1 | 0 to 9999 | 1 | 9999 | |
| | 889 | Free parameter 2 | 0 to 9999 | 1 | 9999 | |
| — | 891 | Cumulative power monitor digit shifted times | 0 to 4, 9999 | 1 | 9999 | |
| Calibration parameters | C0 (900) *6 | FM terminal calibration | — | — | — | |
| | C2 (902) *6 | Terminal 2 frequency setting bias frequency | 0 to 400Hz | 0.01Hz | 0Hz | |
| | C3 (902) *6 | Terminal 2 frequency setting bias | 0 to 300% | 0.1% | 0% | |
| | 125 (903) *6 | Terminal 2 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | |
| | C4 (903) *6 | Terminal 2 frequency setting gain | 0 to 300% | 0.1% | 100% | |
| | C5 (904) *6 | Terminal 4 frequency setting bias frequency | 0 to 400Hz | 0.01Hz | 0Hz | |
| | C6 (904) *6 | Terminal 4 frequency setting bias | 0 to 300% | 0.1% | 20% | |
| | 126 (905) *6 | Terminal 4 frequency setting gain frequency | 0 to 400Hz | 0.01Hz | 60Hz | |
| | C7 (905) *6 | Terminal 4 frequency setting gain | 0 to 300% | 0.1% | 100% | |
| | C22 (922) *5*6 | Frequency setting voltage bias frequency (built-in potentiometer) | 0 to 400Hz | 0.01Hz | 0 | |
| | C23 (922) *5*6 | Frequency setting voltage bias (built-in potentiometer) | 0 to 300% | 0.1% | 0 | |
| | C24 (923) *5*6 | Frequency setting voltage gain frequency (built-in potentiometer) | 0 to 400Hz | 0.01Hz | 60Hz | |
| | C25 (923) *5*6 | Frequency setting voltage gain (built-in potentiometer) | 0 to 300% | 0.1% | 100% | |
| PU | 990 | PU buzzer control | 0, 1 | 1 | 1 | |
| | 991 | PU contrast adjustment | 0 to 63 | 1 | 58 | |
| Clear parameters Initial value change list | Pr.CL | Parameter clear | 0, 1 | 1 | 0 | |
| | ALLC | All parameter clear | 0, 1 | 1 | 0 | |
| | Er.CL | Faults history clear | 0, 1 | 1 | 0 | |
| | Pr.CH | Initial value change list | — | — | — | |

*1 Differ according to capacities.
6%: 0.75K or less
4%: 1.5K to 3.7K
3%: 5.5K, 7.5K
2%: 11K, 15K

*2 Differ according to capacities.
5s: 3.7K or less
10s: 5.5K, 7.5K
15s: 11K, 15K

*3 Differ according to capacities.
6%: 0.1K, 0.2K
4%: 0.4K to 7.5K
2%: 11K, 15K

*4 The initial value differs according to the voltage class. (100V class, 200V class / 400V class)

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

*6 The parameter number in parentheses is the one for use with the operation panel (PA02) for the FR-E500 series or parameter unit (FR-PU04/FR-PU07).

*7 Available only for the three-phase power input model.

# 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 |
| | **Password locked** | Appears when a password restricted parameter is read/written. | LOCd |
| | **Parameter write error** | Appears when an error occurred during parameter writing. | Er1 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** *7 | 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** *7 | Appears when the cumulative energization time has exceeded the maintenance output timer set value. | MT |
| | **Undervoltage** | Appears when the main circuit power became low voltage. | UV |
| | **Safety stop** | Appears when safety stop function is activated (during output shutoff). | SA |
| Alarms *4 | **Fan alarm** | Appears when the cooling fan remains stopped when operation is required or when the speed has decreased. | FN |
| Fault *5 | **Overcurrent trip during acceleration** | Appears when an overcurrent occurred during acceleration. | E.OC1 |
| | **Overcurrent trip during constant speed** | Appears when an overcurrent occurred during constant speed operation. | E.OC2 |
| | **Overcurrent trip during deceleration or stop** | Appears when an overcurrent occurred during deceleration and at a stop. | E.OC3 |
| | **Regenerative overvoltage trip during acceleration** | Appears when an overvoltage occurred during acceleration. | E.OV1 |
| | **Regenerative overvoltage trip during constant speed** | Appears when an overvoltage occurred during constant speed operation. | E.OV2 |
| | **Regenerative overvoltage trip during deceleration or stop** | Appears when an overvoltage occurred during deceleration and at a stop. | E.OV3 |
| | **Inverter overload trip (electronic thermal relay function)** | Appears when the electronic thermal relay function for inverter element protection was activated. | E.THT |
| | **Motor overload trip (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** *7 *8*9 | Appears if one of the three phases on the inverter input side opened. It may function if phase-to-phase voltage of the three-phase power input becomes largely unbalanced. | E.ILF |
| | **Stall prevention stop** | 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 at start** *7 | Appears when an earth (ground) fault occurred on the inverter's output side. (detects only at a start) | E. GF |
| | **Output phase loss** | If one of the three phases (U, V, W) on the inverter's output side (load side) is lost during inverter operation (except during DC injection brake operation and when output frequency is under 1Hz), inverter stops the output. | E. LF |
| | **External thermal relay operation** *6 *7 | Appears when the external thermal relay connected to the OH signal was activated. | E.OHT |
| | **PTC thermistor operation** *7 | Appears when resistance of PTC thermistor connected between terminal 2 and terminal 10 is more than the value set in *Pr. 561 PTC thermistor protection level*. | E.PTC |
| | **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** *7 | Appears when the operation was not restarted within the set number of retries. | E.rET |
| | **CPU fault** | Appears during the CPU and peripheral circuit errors occurred. | E. 5/ E.CPU |
| | **Output current detection value exceeded** *7 | Appears when output current exceeded the output current detection level set by the parameter. | E.CDO |
| | **Inrush current limit circuit fault** | Appears when the resistor of the inrush current limit circuit overheated. | E.IOH |
| | **Analog input fault** | Appears if voltage(current) is input to terminal 4 when the setting in *Pr.267 Terminal 4 input selection* and the setting of voltage/current input switch are different. | E.AIE |
| | **Safety circuit fault** | Appears when safety circuit is malfunctioning. | E.SAF |

*1 Resetting the inverter initializes the internal cumulative heat value 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. 182 (input terminal function selection)*.
*7 This protective function does not function in the initial status.
*8 Protective function activates when *Pr.872 Input phase loss protection selection* = "1".
*9 This protective function is available with the three-phase power input specification model only.

## Option list

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

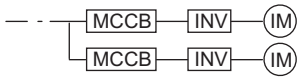
| | Name | Model | Applications, Specifications, etc. | Applicable Inverter |
|---|---|---|---|---|
| Stand-alone shared | Parameter unit (8 languages) | FR-PU07<br>FR-PU04 | Interactive parameter unit with LCD display | Shared among all models |
| | Enclosure surface operation panel | FR-PA07 | This operation panel enables inverter operation and monitoring of frequency, etc. from the enclosure surface | 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) | |
| | DIN rail attachment | FR-UDA01 to 03 | Attachment for installation on DIN rail | Compatible with the 3.7K or less |
| | AC reactor | FR-HAL | For harmonic current reduction and inverter input power factor improvement | According to capacities |
| | DC reactor | FR-HEL | | |
| | EMC Directive compliant noise filter | SF<br>FR-E5NF<br>FR-S5NFSA | EMC Directive (EN61800-3 C3) compliant noise filter | According to capacities |
| | EMC compliant EMC filter installation attachment | FR-A5AT03<br>FR-AAT02<br>FR-E5T | For installation of the inverter to the EMC Directive compliant EMC filter (SF). | 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<br>FR- BLF | For line noise reduction | |
| | Filterpack | FR-BFP2 | Combination of power factor improving DC reactor, zero phase reactor, and capacitative filter | Three-phase power input model: compatible with 0.4K or bigger capacity |
| | Brake resistor | MRS type,<br>MYS type | For increasing the regenerative braking capability (permissible duty 3%/6%ED) | 200V: For the 0.4K or more |
| | High-duty brake resistor | FR-ABR | For increasing the regenerative braking capability (permissible duty 10%/6%ED) | For the 0.4K or more |
| | Brake unit<br>Resistor unit<br>Discharging resistor | FR-BU2<br>FR-BR<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 | |
| | Power regeneration common converter<br>Stand-alone reactor dedicated for the FR-CV | FR-CV<br>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.) | |
| | Surge voltage suppression filter | FR-ASF | Filter for suppressing surge voltage on motor | 400V: According to capacities |
| | | FR-BMF | | 400V: For the 5.5K or more |
| 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 (1VA) 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 SW3(VFD setup software) | FR-SW3-SETUP-WE | Supports an inverter startup to maintenance. | Shared among all models |

* 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.

## Peripheral devices/cable size list

| Inverter type | | Motor Output (kW) | Moulded Case Circuit Breaker (MCCB)*1 or Earth Leakage Current Breaker (ELB)*2 | | Magnetic Contactor (MC)*3 | | HIV Cables, etc. ($mm^2$)*5 | | Reactor | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Reactor connection | | Reactor connection | | | | | |
| | | | Without | With | Without | With | R/L1, S/L2, T/L3*4 | U, V, W | FR-HAL | FR-HEL |
| Three-Phase 200V | FR-D720-0.1K | 0.1 | 30AF 5A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | 0.4K *7 | 0.4K *7 |
| | FR-D720-0.2K | 0.2 | 30AF 5A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | 0.4K *7 | 0.4K *7 |
| | FR-D720-0.4K | 0.4 | 30AF 5A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | 0.4K | 0.4K |
| | FR-D720-0.75K | 0.75 | 30AF 10A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | 0.75K | 0.75K |
| | FR-D720-1.5K | 1.5 | 30AF 15A | 30AF 10A | S-N10 | S-N10 | 2 | 2 | 1.5K | 1.5K |
| | FR-D720-2.2K | 2.2 | 30AF 20A | 30AF 15A | S-N10 | S-N10 | 2 | 2 | 2.2K | 2.2K |
| | FR-D720-3.7K | 3.7 | 30AF 30A | 30AF 30A | S-N20, S-N21 | S-N10 | 3.5 | 3.5 | 3.7K | 3.7K |
| | FR-D720-5.5K | 5.5 | 50AF 50A | 50AF 40A | S-N20, S-N21 | S-N20, S-N21 | 5.5 | 5.5 | 5.5K | 5.5K |
| | FR-D720-7.5K | 7.5 | 100AF 60A | 50AF 50A | S-N25 | S-N20, S-N21 | 14 | 8 | 7.5K | 7.5K |
| | FR-D720-11K | 11 | 100AF 75A | 100AF 75A | S-N35 | S-N35 | 14 | 14 | 11K | 11K |
| | FR-D720-15K | 15 | 225AF 125A | 100AF 100A | S-N50 | S-N50 | 22 | 22 | 15K | 15K |
| Three-phase 400V | FR-D740-0.4K | 0.4 | 30AF 5A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | H0.4K | H0.4K |
| | FR-D740-0.75K | 0.75 | 30AF 5A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | H0.75K | H0.75K |
| | FR-D740-1.5K | 1.5 | 30AF 10A | 30AF 10A | S-N10 | S-N10 | 2 | 2 | H1.5K | H1.5K |
| | FR-D740-2.2K | 2.2 | 30AF 15A | 30AF 10A | S-N10 | S-N10 | 2 | 2 | H2.2K | H2.2K |
| | FR-D740-3.7K | 3.7 | 30AF 20A | 30AF 15A | S-N10 | S-N10 | 2 | 2 | H3.7K | H3.7K |
| | FR-D740-5.5K | 5.5 | 30AF 30A | 30AF 20A | S-N20, S-N21 | S-N11, S-N12 | 3.5 | 2 | H5.5K | H5.5K |
| | FR-D740-7.5K | 7.5 | 30AF 30A | 30AF 30A | S-N20, S-N21 | S-N20, S-N21 | 3.5 | 3.5 | H7.5K | H7.5K |
| | FR-D740-11K | 11 | 50AF 50A | 50AF 40A | S-N20, S-N21 | S-N20, S-N21 | 5.5 | 5.5 | H11K | H11K |
| | FR-D740-15K | 15 | 100AF 60A | 50AF 50A | S-N25 | S-N20, S-N21 | 8 | 8 | H15K | H15K |
| Single-phase 200V | FR-D720S-0.1K | 0.1 | 30AF 5A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | 0.4K *7 | 0.4K *7 |
| | FR-D720S-0.2K | 0.2 | 30AF 5A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | 0.4K *7 | 0.4K *7 |
| | FR-D720S-0.4K | 0.4 | 30AF 10A | 30AF 10A | S-N10 | S-N10 | 2 | 2 | 0.75K *7 | 0.75K *7 |
| | FR-D720S-0.75K | 0.75 | 30AF 15A | 30AF 10A | S-N10 | S-N10 | 2 | 2 | 1.5K *7 | 1.5K *7 |
| | FR-D720S-1.5K | 1.5 | 30AF 20A | 30AF 20A | S-N10 | S-N10 | 2 | 2 | 2.2K *7 | 2.2K *7 |
| | FR-D720S-2.2K | 2.2 | 30AF 40A | 30AF 30A | S-N20, S-N21 | S-N10 | 3.5 | 2 | 3.7K *7 | 3.7K *7 |
| Single-Phase 100V | FR-D710W-0.1K | 0.1 | 30AF 10A | 30AF 5A | S-N10 | S-N10 | 2 | 2 | 0.75K *6, *7 | — *8 |
| | FR-D710W-0.2K | 0.2 | 30AF 10A | 30AF 10A | S-N10 | S-N10 | 2 | 2 | 1.5K *6, *7 | — *8 |
| | FR-D710W-0.4K | 0.4 | 30AF 15A | 30AF 15A | S-N10 | S-N10 | 2 | 2 | 2.2K *6, *7 | — *8 |
| | FR-D710W-0.75K | 0.75 | 30AF 30A | 30AF 20A | S-N10 | S-N10 | 3.5 | 2 | 3.7K *6, *7 | — *8 |

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




*2 For the use in the United States or Canada, select a UL and cUL certified fuse with Class T fuse equivalent cut-off speed or faster with the appropriate rating for branch circuit protection. Alternatively, select a UL489 molded case circuit breaker (MCCB).

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

*4 When using single-phase power input, terminals are R/L1 and S/L2.

*5 The cable size is that of the cable (HIV cable (600V class 2 vinyl-insulated cable) etc.) with continuous maximum permissible temperature of 75°C. Assumes that the surrounding air temperature is 50°C or less and the wiring distance is 20m or less.

*6 When connecting a single-phase 100V power input model to a power transformer (50kVA or more), install an AC reactor (FR-HAL) so that the performance is more reliable.

*7 The power factor may be slightly lower.

*8 Single-phase 100V power input model is not compatible with DC reactor.

### Note

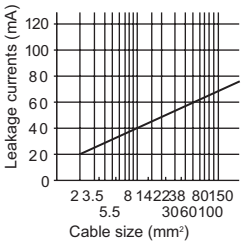
- **When the inverter capacity is larger than the motor capacity, select an MCCB and a magnetic contactor according to the inverter model and cable and reactor according to the motor output.**
- **When the breaker on the inverter primary side trips, check for the wiring fault (short circuit), damage to internal parts of the inverter, etc. Identify the cause of the trip, then remove the cause and power on the breaker.**

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

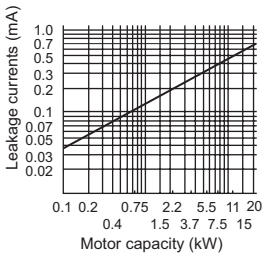
When using the earth leakage current breaker with the inverter circuit, select its rated sensitivity current as follows, independently of the PWM carrier frequency.

- Breaker designed for harmonic and surge suppression
  Rated sensitivity current IΔn≥10×(Ig1+Ign+Igi+Ig2+Igm)
- Standard breaker
  Rated sensitivity current IΔn≥10×{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

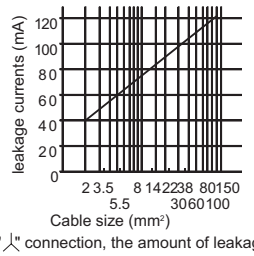
Example of leakage current of cable path per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (200V 60Hz)



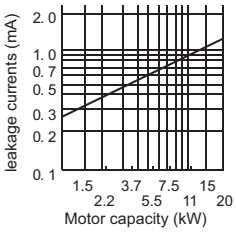

Example of leakage current of three-phase induction motor during the commercial power supply operation (200V 60Hz)




Example of leakage current per 1km during the commercial power supply operation when the CV cable is routed in metal conduit (Three-phase three-wire delta connection 400V60Hz)

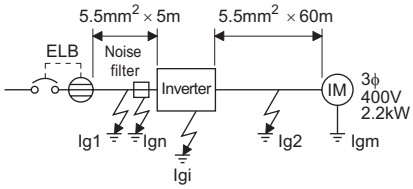



Example of leakage current of three-phase induction motor during the commercial power supply operation (Totally-enclosed fan-cooled type motor 400V60Hz)




For "⅄" connection, the amount of leakage current is appox.1/3 of the above value.

Example




(Note) 1 Install the earth leakage breaker (ELB) on the input side of the inverter.
2 In the ⅄ 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 (400V class ⅄ connection))

| | Breaker Designed for Harmonic and Surge Suppression | Standard Breaker |
|---|---|---|
| Leakage current Ig1 (mA) | $\frac{1}{3} \times 66 \times \frac{5m}{1000m} = 0.11$ | |
| Leakage current Ign (mA) | 0 (without noise filter) | |
| Leakage current Igi (mA) | 1 | |
| Leakage current Ig2 (mA) | $\frac{1}{3} \times 66 \times \frac{60m}{1000m} = 1.32$ | |
| Motor leakage current Igm (mA) | 0.36 | |
| Total leakage current (mA) | 2.79 | 6.15 |
| Rated sensitivity current (mA) (≥ Ig × 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

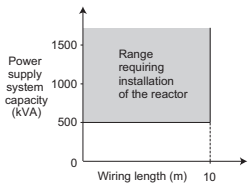
- A magnetic contactor (MC) provided on the input side should not be used to make frequent starts and stops. It could cause the inverter to fail.
- However, at this time, the motor cannot be brought to a sudden stop. Hence, provide a mechanical stopping/holding mechanism for the machine/equipment which 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-HAL). When connecting a single-phase 100V power input model to a power transformer (50kVA or more), install an AC reactor (FR-HAL) so that the performance is more reliable.
- 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 enclosure dimensions so that the surrounding air temperature of the inverter is within the permissible value. (*refer to page 7* 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.

### 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 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 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 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 type, MYS type, 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.

# Precautions for Peripheral Device Selection

## 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 25* 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 26)*

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 an 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 at the input side is recommended. A magnetic contactor avoids overheat or burnout of a brake resistor when heat capacity of the resistor is insufficient or a brake regenerative transistor is damaged with short while connecting an optional brake resistor. 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 30)* 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, especially in the 400V class, small-capacity models, 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.

## 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 25*)

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 | 100V 200V | 200m | 200m | 300m | 500m | 500m | 500m | 500m |
| | 400V | — | — | 200m | 200m | 300m | 500m | 500m |
| 2 to 15 | 100V 200V | 30m | 100m | 200m | 300m | 500m | 500m | 500m |
| | 400V | — | — | 30m | 100m | 200m | 300m | 500m |

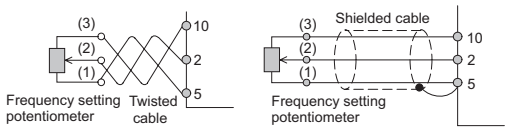
When using the automatic restart after instantaneous power failure function with wiring length exceeding below, select "without frequency search" (*Pr.162* = "1, 11").

| Motor Capacity | 0.1K | 0.2K | 0.4K or more |
|---|---|---|---|
| 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)

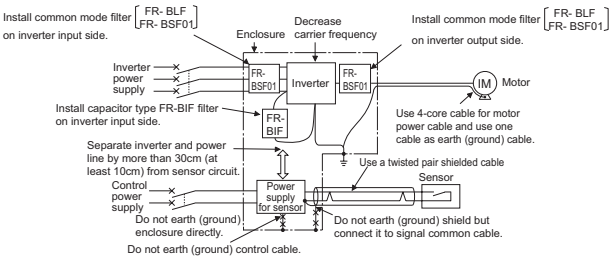
When the inverter is run in the low acoustic noise mode, more leakage currents occur than in the non-low acoustic noise mode due to high-speed switching operation. Be sure to earth (ground) the inverter and motor before use. In addition, always use the earth (ground) terminal of the inverter to earth (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.

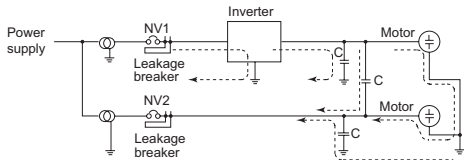
Noise reduction examples



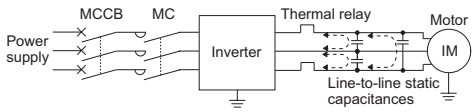

## Leakage currents

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 26)*

### 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. When the wiring length is long (50m or more) for the 400V class model, the external thermal relay is likely to operate unnecessarily because the ratio of the leakage current to the rated motor current increases.<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** |

## ●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, single-phase 200V input specifications 2.2kW or less, single-phase 100V input specifications 0.75kW 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 |
|---|---|---|
| Single-phase 100V<br>Single-phase 200V<br>Three-phase 200V<br>Three-phase 400V | 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 |
|---|---|---|
| Single-phase 100V | 0.75kW 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 |
| Single-phase 200V | 2.2kW or less | |
| Three-phase 200V | 3.7kW or less | |

●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 |
|---|---|---|---|---|---|---|---|---|---|
| Three-phase bridge (Capacitor smoothing) | 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 |
| Single-phase bridge (Capacitor smoothing) | Not used | 50 | 24 | 5.1 | 4.0 | 1.5 | 1.4 | — | — |
| | Used (AC side)* | 6.0 | 3.9 | 1.6 | 1.2 | 0.6 | 0.1 | — | — |

* The harmonic contents for "single-phase bridge/with reactor" in the table 1 are values when the reactor value is 20%. Since a 20% reactor is large and considered to be not practical, harmonic contents when a 5% reactor is used is written in the technical data JEM-TR201 of The Japan Electrical Manufacturers'
Association and this value is recommended for calculation for the actual practice.

Table 2: Rated Capacities and Outgoing Harmonic Currents for Three-phase 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) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 200V | 400V | | | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| **0.4** | 1.61 | 0.81 | 49 | 0.57 | 31.85 | 20.09 | 4.165 | 3.773 | 2.107 | 1.519 | 1.274 | 0.882 |
| **0.75** | 2.74 | 1.37 | 83 | 0.97 | 53.95 | 34.03 | 7.055 | 6.391 | 3.569 | 2.573 | 2.158 | 1.494 |
| **1.5** | 5.50 | 2.75 | 167 | 1.95 | 108.6 | 68.47 | 14.20 | 12.86 | 7.181 | 5.177 | 4.342 | 3.006 |
| **2.2** | 7.93 | 3.96 | 240 | 2.81 | 156.0 | 98.40 | 20.40 | 18.48 | 10.32 | 7.440 | 6.240 | 4.320 |
| **3.7** | 13.0 | 6.50 | 394 | 4.61 | 257.1 | 161.5 | 33.49 | 30.34 | 16.94 | 12.21 | 10.24 | 7.092 |
| **5.5** | 19.1 | 9.55 | 579 | 6.77 | 376.1 | 237.4 | 49.22 | 44.58 | 24.90 | 17.95 | 15.05 | 10.42 |
| **7.5** | 25.6 | 12.8 | 776 | 9.07 | 504.4 | 318.2 | 65.96 | 59.75 | 33.37 | 24.06 | 20.18 | 13.97 |
| **11** | 36.9 | 18.5 | 1121 | 13.1 | 728.7 | 459.6 | 95.29 | 86.32 | 48.20 | 34.75 | 29.15 | 20.18 |
| **15** | 49.8 | 24.9 | 1509 | 17.6 | 980.9 | 618.7 | 128.3 | 116.2 | 64.89 | 46.78 | 39.24 | 27.16 |

# FR-D700 Series Specification Difference List

| Item | Japanese Specification | NA Specification | EC Specification | CHT Specification |
|---|---|---|---|---|
| **Applicable Capacity Type** | FR-D720-0.1K to 15K<br>FR-D740-0.4K to 15K<br>FR-D720S-0.1K to 2.2K<br>FR-D710W-0.1K to 0.75K<br>Type : Rated capacity (kW) | FR-D720-008 to 318-NA<br>FR-D740-012 to 160-NA<br>FR-D720S-008 to 100-NA<br>FR-D710W-008 to 042-NA<br>Type : Rated current value | FR-D740-012 to 160-EC<br>FR-D720S-008 to 100-EC<br>Type : Rated current value | FR-D740-0.4K to 7.5K-CHT<br>FR-D720S-0.1K to 2.2K-CHT<br>Type : Rated capacity (kW) |
| **Main Circuit Terminal Name**<br>**AC Power Input**<br>**Three-phase Input** | R, S, T | | L1, L2, L3 | |
| **Single-phase Input** | R, S | | L1, N | |
| **Brake Unit Connection** | P, N | | +, - | |
| **Control Terminal Logic Initial Setting** | Sink logic | Sink logic | Source logic | Sink logic |
| **Control Terminal Contact Input Common Terminal Initial Setting** | SD | SD | PC | SD |
| **Monitor Output Terminal For Indicator** | FM (Digital output) | AM (Analog output) | AM (Analog output) | AM (Analog output) |
| **Parameter**<br>***Pr.3, Pr.4, Pr.20, Pr.55, Pr.66, Pr.84, Pr.125, Pr.126, Pr.903, Pr.905, Pr.923*** **Initial Value** | 60Hz | 60Hz | 50Hz | 50Hz |
| ***Pr.19*** **Initial Value** | 9999 | 9999 | 8888 | 9999 |
| ***Pr.122*** **Initial Value** | 0 | 9999 | 9999 | 0 |
| ***Pr.145*** **Initial Value** | 0 | 1 | 1 | 1 |
| ***Pr.160*** **Initial Value** | 9999 | 0 | 0 | 9999 |
| ***Pr.249*** **Initial Value** | 0 | 0 | 1 | 1 |
| **Indicator Output Terminal Function** | *Pr.54 FM terminal function selection, Pr.900 FM terminal calibration* | *Pr.158 AM terminal function selection, Pr.901 AM terminal calibration* | *Pr.158 AM terminal function selection, Pr.901 AM terminal calibration* | *Pr.158 AM terminal function selection, Pr.901 AM terminal calibration* |
| **Traverse Function** ***Pr.592 to Pr.597*** | Without | Without | With | With |

# Warranty

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 even in gratis warranty period, otherwise there will be no 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.

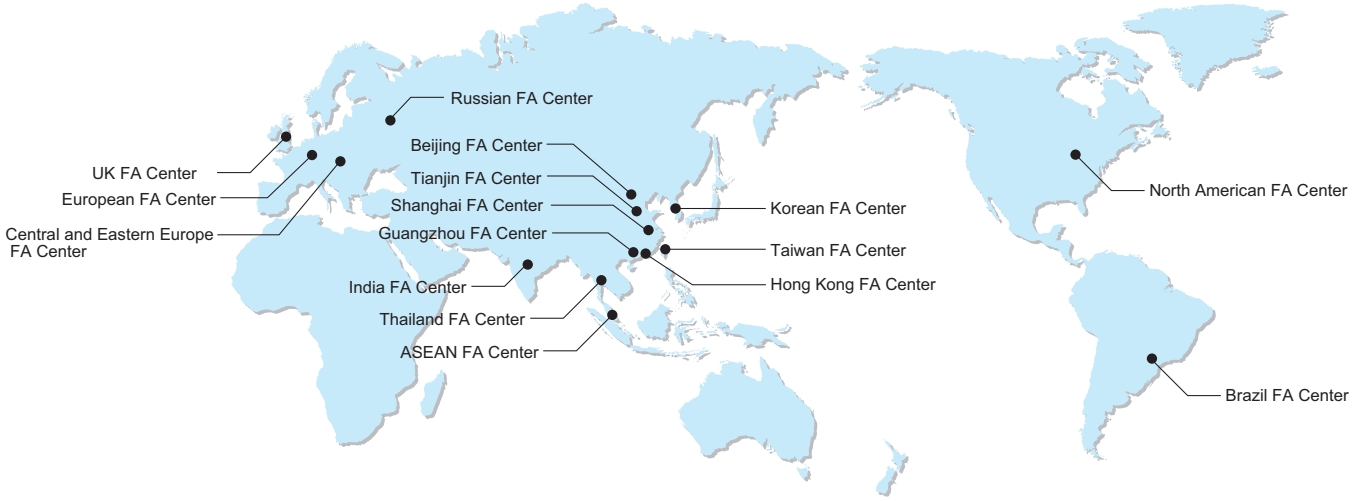
3. Repair period after production is discontinued

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

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## ⚠ Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

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