ADVANCED AND EVER ADVANCING MITSUBISHI ELECTRIC

MITSUBISHI
VARIABLE FREQUENCY DRIVES

ACP&D Limited

F500 SERIES

Refined Control. Superior Results. An Advanced Inverter Series For Fans and Pumps.

MITSUBISHI'S NEW SERIES OF FAN/PUMP INVERTERS

Economical

Industry-leading energy savings achieved through newly introduced optimum excitation control.

- By adjusting the magnetic flux to be at its optimum continuously, the motor operates at the highest efficiency thus enabling maximum energy savings.
- Optimum excitation control for highly efficient motor operation and improved economy (For example, when a motor is operating at a load torque of 10%).
- Motor efficiency is improved by approximately 15% over the previous variable-frequency control system when using new optimum excitation control technology.
- Optimum excitation control minimizes motor loss and reduces electricity consumption to provide greater economy and energy savings.
- For example, when an inverter is operating at a frequency of 20Hz:
  1. Using optimum excitation control, the electricity consumption ratio is reduced approximately 45% as compared to using the previous variable-frequency control system.
  2. A reduction of approximately 5% is attained as compared to using the energy-saving mode.

Connection with the high-performance* FR-BEL DC reactor reduces the initial costs for power-supply and peripheral equipment as well.

*At 100% load, input power ratio is improved to approximately 95% (For example: 400V/15kW).

- Compact, lightweight, high-performance FR-BEL DC reactor connection to all capacities.
- Minimizes power-supply harmonic response current.

Easy to Use

Easy to use for Fan/Pump applications.

- Easy to use air-conditioning control is possible using standard equipment with PID control.
- Commercial switching sequence provides automatic back-up should any problem occur.

Simple Operation

The simple FR-DU04 control panel is provided as standard on all models.

- An optional extension cable can be used with the control panel. Operational and alarm signals can also be shown with this unit.

Parameter setting made easier with simple mode parameters.

- Parameter setting and management has been simplified through the use of read and write only basic parameters. Switching to Standard Mode Parameters quickly changes to high performance parameters.
- High-performance parameter examples: PID control, Commercial power supply switching, 2nd functions, multiple speeds, communication function, etc.

Contents

Setup preparation easier with setup software.

- Using RS-485 communication, the optional Setup Software can be used for the setup and maintenance of inverters when used in connection with a personnel computer.
- Communications is a standard feature. The control panel can be disconnected to allow the unit to be controlled by a personal computer via an RS-485 interface.

  Note: A converter is necessary if an RS-232C interface is to be used.

Easy Maintenance

- The life of the cooling fan has been extended by the use of intelligent ON/OFF control, and replacement is easier.
- Simple installation and removal of the control terminal block makes maintenance easier.
- Parameters can be saved using the control panel which is fitted as standard.

  When an inverter is replaced, parameters can be set up simply by writing previously saved parameters from the control panel.

  Note: It is necessary to batch-read the parameters using the control panel beforehand.

Environment Friendly

Soft-PMW control

- Mitsubishi's Soft-PWM switching system keeps noise to a minimum.

Low-noise operation

- A higher carrier frequency can be used to reduce operating noise.

EMC filter (400V-class)

- Use the optional EMC filter to help to comply with EMC standards.

Power-supply harmonics regulations compliant.

- It is also possible to connect a high-power factor regenerative converter (FR-HC) that conforms to Japanese harmonic guidelines (conversion coefficient: K5=0).

Exceptional Performance

Expandability

- Various I/Os are available, including analog signals, digital signals, and network connections.
- Up to three option cards can be mounted internally.
- Direct communications with a PLC is possible, e.g. Control & Communication Link (CC-Link).

  Accommodates PLC X/Y instructions for easy programming.

  Note: The TO and FROM commands are necessary for part of the PLC programming.

Compliance with 240V power supplies (maximum 22K) and 480V power supplies as standard.

Sink/Source Logic is selectable.

(Using jumper on terminal block).

The FR-PU04 LCD parameter unit with long-life backlight display is available as an option.

- The unit features Mitsubishi's original direct input method which uses the ten-key pad. Eight different languages are available on one unit.

Compliance with major international standards.

- All units comply with UL, CSA* and EN standards (low-voltage directive) as standard.

  * In order to obtain CSA standards approval at UL, the cUL mark is applied.
- NEMA1 compliance is standard up to 22K.
- The optional FR-PU04 parameter unit can handle eight languages: Japanese, English, German, French, Spanish, Italian, Swedish and Finnish

Compliance with major international communications standards.

- North America - DeviceNet™, Modbus plus
- Europe - Profibus DP

Model Configuration

Model

FR - F540 - 3.7K

Model	Voltage Class
F520	200V class 55K or less
F540	400V class 55K or less
F520L	200V class 75K or more
F540L	400V class 75K or more

Model	Applicable Motor Capacity
0.75K–375K	Indicates capacity in kW

Model Configuration

Applicable Motor Capacity (kW)	Power Supply Voltage	
	200V class	400V class
0.75	FR-F520-0.75K	FR-F540-0.75K
1.5	FR-F520-1.5K	FR-F540-1.5K
2.2	FR-F520-2.2K	FR-F540-2.2K
3.7	FR-F520-3.7K	FR-F540-3.7K
5.5	FR-F520-5.5K	FR-F540-5.5K
7.5	FR-F520-7.5K	FR-F540-7.5K
11	FR-F520-11K	FR-F540-11K
15	FR-F520-15K	FR-F540-15K
18.5	FR-F520-18.5K	FR-F540-18.5K
22	FR-F520-22K	FR-F540-22K
30	FR-F520-30K	FR-F540-30K
37	FR-F520-37K	FR-F540-37K
45	FR-F520-45K	FR-F540-45K
55	FR-F520-55K	FR-F540-55K
75	FR-F520L-75K	FR-F540L-75K
90	FR-F520L-90K	FR-F540L-90K
110	FR-F520L-110K	FR-F540L-110K
132	–	FR-F540L-132K
160	–	FR-F540L-160K
185	–	FR-F540L-185K
220	–	FR-F540L-220K
280	–	FR-F540L-280K
375	–	FR-F540L-375K

Units with applicable motors with capacities of 75kW and over are not covered in this catalog.

Standard Specifications

Ratings

200V class

Model FR-F520-□□			0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor capacity (kW) (Note 1)			0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) (Note 2)		1.5	2.7	3.7	5.7	8.8	11.8	17.1	22.1	26.7	32.4	43.4	53.3	64.8	80.8
	Rated current (A)		4.1	7	9.6	15	23	31	45	58	70	85	114	140	170	212
	Overload current rating (Note 3)		120% for 60 sec., 150% for 0.5 sec.													
	Voltage (Note 4)		3-phase 200–220V 50Hz, 200–240V 60Hz										3-phase 200–220V 50Hz, 200–230V 60Hz			
	Regenerative braking torque	Max. value/time	15% (Note 5)													
		Tolerable working rate	Continuous (Note 5)													
Power supply	Rated input, AC voltage, frequency		3-phase 200–220V 50Hz, 200–240V 60Hz										3-phase 200–220V 50Hz, 200–230V 60Hz			
	Tolerable AC voltage fluctuation		170–242V 50Hz, 170–264V 60Hz										170–242V 50Hz, 170–253V 60Hz			
	Tolerable frequency fluctuation		±5%													
	Power facility capacity (kVA) (Note 6)	No DC reactor	2.1	4.0	4.8	8.0	11.5	16	20	27	32	41	52	65	79	99
		DC reactor present	1.2	2.6	3.3	5.0	8.1	10	16	19	24	31	41	50	61	74
Protective structure (JEM1030)			Fully enclosed type (IP20, NEMA1)										Open type (IP00)			
Cooling method			Self cooling	Forced cooling												
Approx. weight kg (lb)			2.5 (5.5)	3.5 (7.7)	3.5 (7.7)	3.5 (7.7)	6.0 (13.2)	6.0 (13.2)	8.0 (17.6)	13.0 (28.7)	13.0 (28.7)	13.0 (28.7)	21.0 (46.3)	30.0 (66.1)	40.0 (88.2)	55.0 (121.3)

400V class

Model FR-F540-□□			0.75K	1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Applicable motor capacity (kW) (Note 1)			0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated capacity (kVA) (Note 2)		1.5	2.7	3.7	5.7	8.8	12.2	17.5	22.1	26.7	32.8	43.4	53.3	64.8	80.8
	Rated current (A)		2.0	3.5	4.8	7.5	11.5	16	23	29	35	43	57	70	85	106
	Overload current rating (Note 3)		120% for 60 sec., 150% for 0.5 sec. (Inverse time characteristics)													
	Voltage (Note 4)		3-phase 380–480V 50Hz/60Hz													
	Regenerative braking torque	Max. value/time	15% (Note 5)													
		Tolerable working rate	Continuous (Note 5)													
Power supply	Rated input, AC voltage, frequency		3-phase 380–480V 50Hz/60Hz													
	Tolerable AC voltage fluctuation		323–528V 50Hz/60Hz													
	Tolerable frequency fluctuation		± 5%													
	Power facility capacity (kVA) (Note 6)	No DC reactor	2.1	4.0	4.8	8.0	11.5	16	20	27	32	41	52	65	79	99
		DC reactor present	1.2	2.6	3.3	5.0	8.1	10	16	19	24	31	41	50	61	74
Protective structure (JEM1030)			Fully enclosed type (IP20, NEMA1)										Open type (IP00)			
Cooling method			Self cooling		Forced cooling											
Approx. weight kg (lb)			3.0 (6.6)	3.0 (6.6)	3.0 (6.6)	3.0 (6.6)	5.5 (12.1)	6.0 (13.2)	7.0 (15.4)	13.0 (28.7)	13.0 (28.7)	13.0 (28.7)	24.0 (52.9)	24.0 (52.9)	35.0 (77.2)	36.0 (79.4)

Notes:
1. "Applicable motor capacity" refers to the maximum applicable capacity when using a 4-pole standard Mitsubishi motor.
2. The rated output capacity is 220V for the 200V class, and 440V for the 400V class.
3. The percentage given for the overload current rating indicates the ratio with respect to the inverter's rated output current. In the case of repeated use, it is essential to wait until the inverter and the motor have cooled to below the temperature for 100% load.
4. The maximum output voltage may not exceed the power supply voltage, and can be set at any value below the power supply voltage.
5. Indicates the average torque for decelerating to a stop from 60Hz. Changes according to motor loss.
6. Power capacity differs according to the power supply impedance value (including the input reactor or wire values).

Standard Specifications

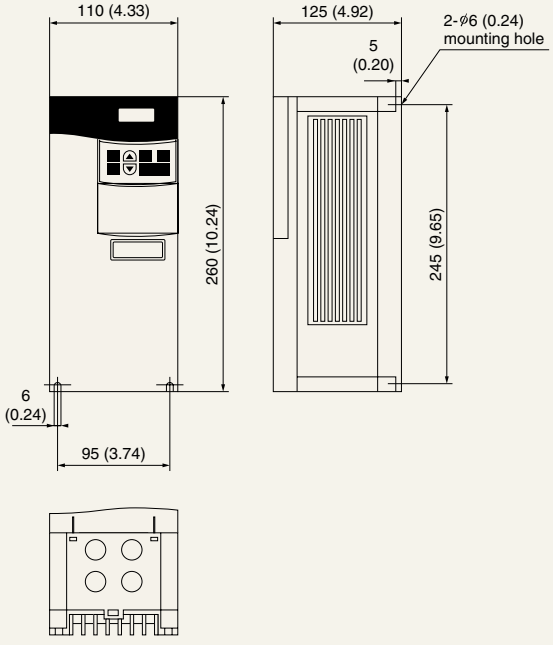
Common Specifications

Control Specifications	Control Method		Soft-PWM control, high-carrier frequency PWM control (V/F control)/optimum excitation control.	
	Output frequency range		0.5 to 120Hz	
	Frequency control resolution	Analog input	0.015Hz/60Hz (Terminal No. 2 input: 12 bit/0 to 10V, 11 bit/0 to 5V; Terminal No. 1 input: 12 bit/−10 to +10V, 11 bit/−5 to +5V)	
		Digital input	0.01Hz	
	Frequency accuracy		Within ±0.2% of max. output frequency (25°C (53°F)±10°C (±21.2°F))/during analog input: within 0.01% of set output frequency during digital input	
	Voltage/frequency characteristics		Any base frequency setting possible between 0 and 120Hz; constant torque or variable torque pattern selection possible.	
	Torque boost		Manual or automatic torque boost	
	Acceleration/deceleration time setting		0 to 3600 sec. (individual setting for acceleration/deceleration possible), linear or S-curve mode	
	DC braking		Operation frequency (0 to 120Hz), operation time (0 to 10 sec.), operation voltage (0 to 30%) variable	
	Stall prevention operation level		Operation current level setting possible (0 to 150% variable), enable/disable selection	
Operation Specifications	Frequency setting signal	Analog input	DC0 to 5V, 0 to 10V, 0 to ±10V, 4 to 20mA	
		Digital input	Input from control panel, parameter unit; BCD 3-digit or 12-digit binary (using option FR-A5AX)	
	Starting signal		Individual selection of forward run, reverse run; starting signal self-hold input (3-wire input) selective	
	Input signal	Multi-speed selection	Up to 7 set speeds (each speed can be set between 0 and 120Hz; speed can be changed via control panel or parameter unit during operation)	Select using Pr.180 to Pr.186
		2nd accel/decel time	0 to 3600 sec. (max. of two individual accelerations/decelerations can be set)	
		JOG operation selection	JOG operation mode selection terminal provided (Note 1)	
		Current input selection	Select input of frequency setting signal 4 to 20 mA DC (terminal No. 4)	
		Instantaneous power failure restart selection	Restarts operation after halt in operation due to power failure.	
		External thermal input	Thermal contact input to when stopping inverter an externally mounted thermal relay.	
		FR-HC connection	Enables input of inverter operations and instantaneous power failure interruption detection.	
		External braking start signal	External input of DC braking start.	
		PID control selection	Select PID control execution.	
		PU external operation switching	Enables external switching between PU and external operation.	
		PU operation external interlock	Enables external interlock switching between PU and operation.	
		Output stop	Instant cutoff of inverter output (frequency, voltage)	
		Error reset	Reset of protection operation hold state	
	Operation functions		Upper/lower limit frequency setting, frequency jump operation, external thermal input selection, reverse polarity operation, instantaneous power failure restart operation, commercial power supply inverter switch-over function, forward run/reverse run prevention, operation mode selection, PID control, computer link operation (RS-485)	
	Output signal	Operation status	Five types can be selected from: inverter running, frequency reached, instantaneous power failure (undervoltage), frequency detection, 2nd frequency detection, in PU operation, overload warning, regenerative brake pre-alarm, electronic thermal relay pre-alarm, zero current detection, PID lower limit, PID upper limit, PID forward run, PID reverse run, commercial power supply-inverter switchover MC 1, 2, 3, operation ready, fan trouble, and fin overheat re-alarm. Open collector output.	
		Error (inverter trip)	Relay output - contactor (AC 230V 0.3A, DC 30V 0.3A); open collector - alarm code (4-bit) output	
		For meter	One type can be selected from: output frequency, motor current (constant or peak value), output voltage, frequency setting value, operation speed, converter output voltage (constant or peak value), electronic thermal relay load rate, input power, output power and load meter. Pulse train output (1440 pulse/sec./full scale) or analog output (0 to 10 VDC).	
Display	Displayed on FR-DU04 control panel or FR-PU04 parameter unit	Operation status	Select from output frequency, motor current (constant or peak value), output voltage, frequency setting value, operation speed, overload, converter output voltage (constant or peak value), electronic thermal relay load rate, input power, output power, load meter, cumulative power ON time, actual operation time, cumulative power and motor load rate.	
		Error details	Details of errors are displayed when the protective function activates. Details of up to eight errors are saved. (Only four errors are displayed on the control panel.)	
	Additional displays only on FR-PU04 parameter unit	Operation status	Input terminal signal status, output terminal signal status, option mounting status, terminal assignment status.	
		Error details	Output voltage, current, frequency and cumulative power ON time before protective function activates	
		Interactive	Operation guide and troubleshooting with help function	
Protective and warning functions			Overcurrent cut-off (during acceleration, deceleration, constant speed), regenerative overvoltage cut-off, undervoltage, instantaneous power failure, overload cut-off (electronic thermal relay), ground fault overcurrent, output short circuit, stall prevention, overload warning, fin overheating, fan trouble, option error, parameter error, PU disconnected number of retries exceeded, output phase loss, CPU error, DC 24V power output short circuit, control panel power short circuit.	
Environment	Ambient temperature		−10°C (−21.2°F) to +50°C (+106°F) (no freezing) (−10°C (−21.2°F) to +40°C (+84.8°F) using fully enclosed structure specifications attachment (FR-A5CV))	
	Ambient humidity		90%RH or less (no condensation)	
	Storage temperature (Note 2)		−20°C (+42.4°F) to +65°C (+137.8°F)	
	Atmosphere		Indoors (no corrosive gases, flammable gases, oil mist or dust)	
	Altitude and vibration		Max. 1000 m (3280.8 ft) above sea level, max. 5.9 m (19.03 ft)/s² {0.6G} (JIS C 0911 compliance)	

Notes:
1. JOG operation is possible with the control panel and parameter unit.
2. Temperatures to which the units can be exposed for a short time, such as during transportation.

External Dimension Diagrams

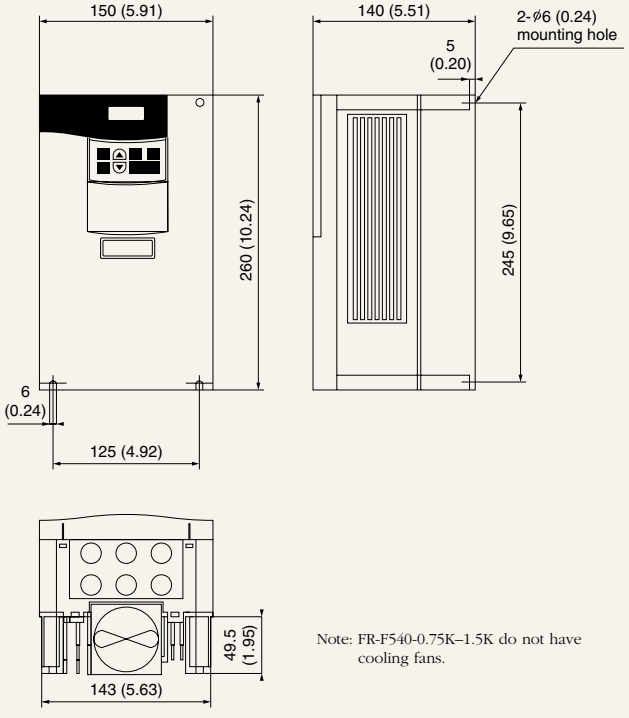
FR-F520-0.75K



FR-F520-1.5K, 2.2K, 3.7K

FR-F540-0.75K, 1.5K, 2.2K, 3.7K

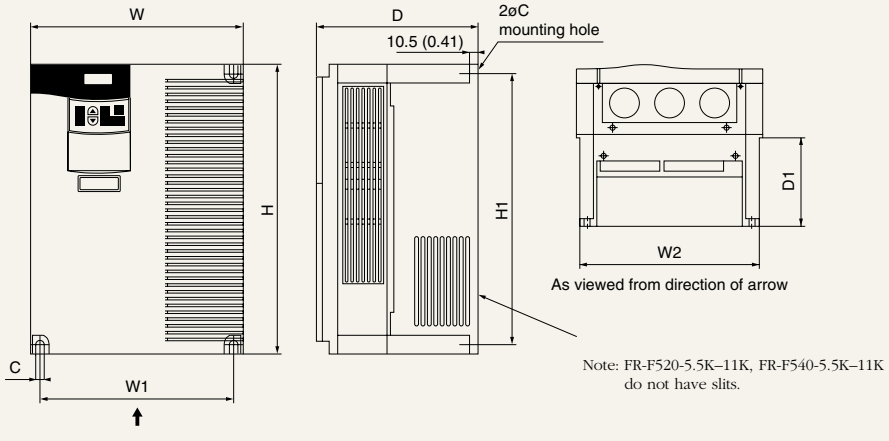
Units: mm (inch)



Note: FR-F540-0.75K–1.5K do not have cooling fans.

FR-F520-5.5K, 7.5K, 11K, 15K, 18.5K, 22K

FR-F540-5.5K, 7.5K, 11K, 15K, 18.5K, 22K



Note: FR-F520-5.5K–11K, FR-F540-5.5K–11K do not have slits.

● 200V class

Inverter type	W	W1	W2	H	H1	D	D1	C
FR-F520-5.5K/7.5K	220 (8.66)	195 (7.68)	211 (8.31)	260 (10.24)	245 (9.65)	170 (6.69)	86.5 (3.41)	6 (0.24)
FR-F520-11K	220 (8.66)	195 (7.68)	211 (8.31)	300 (11.81)	285 (11.22)	190 (7.48)	101.5 (4.00)	6 (0.24)
FR-F520-15K/18.5K/22K	250 (9.84)	230 (9.06)	242 (9.53)	400 (15.75)	380 (14.96)	190 (7.48)	101.5 (4.00)	10 (0.39)

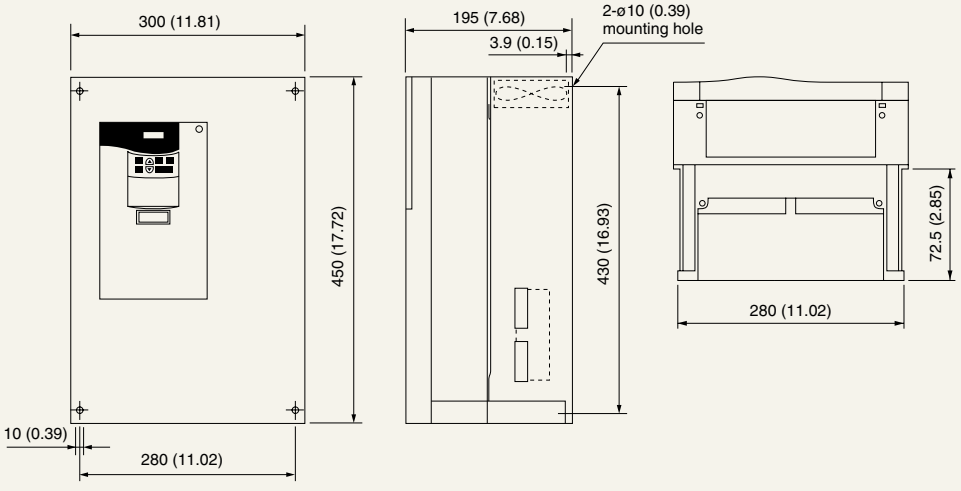
● 400V class

Inverter type	W	W1	W2	H	H1	D	D1	C
FR-F540-5.5K/7.5K	220 (8.66)	195 (7.68)	211 (8.31)	260 (10.24)	245 (9.65)	170 (6.69)	86.5 (3.41)	6 (0.24)
FR-F540-11K	220 (8.66)	195 (7.68)	211 (8.31)	260 (10.24)	245 (9.65)	190 (7.48)	106.5 (4.19)	6 (0.24)
FR-F540-15K/18.5K/22K	250 (9.84)	230 (9.06)	242 (9.53)	400 (15.75)	380 (14.96)	190 (7.48)	101.5 (4.00)	10 (0.39)

External Dimension Diagrams

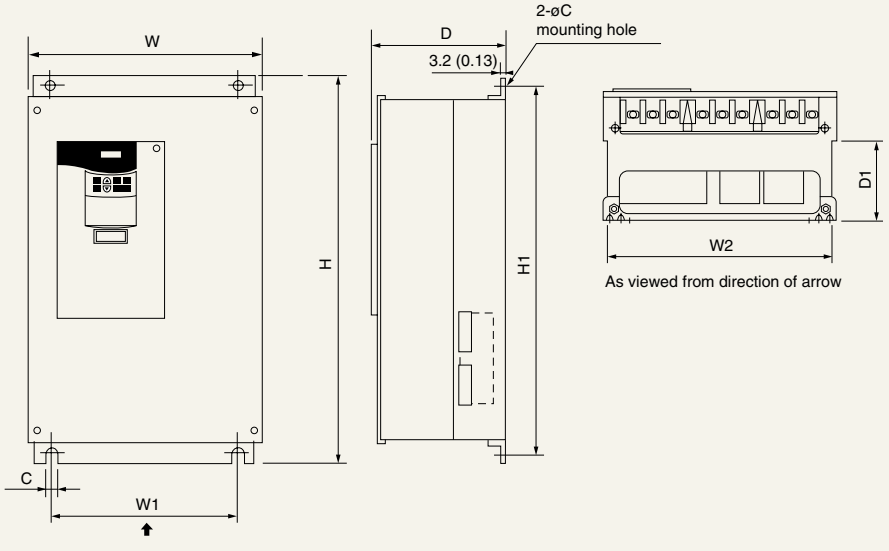
FR-F520-30K

Units: mm (inch)



FR-F520-37K, 45K, 55K

FR-F540-30K, 37K, 45K, 55K



● 200V class

Inverter type	W	W1	W2	H	H1	D	D1	C
FR-F520-37K	340 (13.39)	270 (10.63)	320 (12.60)	550 (21.65)	530 (20.87)	195 (7.68)	71.5 (2.81)	10 (0.39)
FR-F520-45K	450 (17.72)	380 (14.96)	430 (16.93)	550 (21.65)	525 (20.67)	250 (9.84)	154 (6.06)	12 (0.47)
FR-F520-55K	480 (18.90)	410 (16.14)	460 (18.11)	700 (27.56)	675 (26.57)	250 (9.84)	154 (6.06)	12 (0.47)

● 400V class

Inverter type	W	W1	W2	H	H1	D	D1	C
FR-F540-30K/37K	340 (13.39)	270 (10.63)	320 (12.60)	550 (21.65)	530 (20.87)	195 (7.68)	71.5 (2.81)	10 (0.39)
FR-F540-45K/55K	450 (17.72)	380 (14.96)	430 (16.93)	550 (21.65)	525 (20.67)	250 (9.84)	154 (6.06)	12 (0.47)

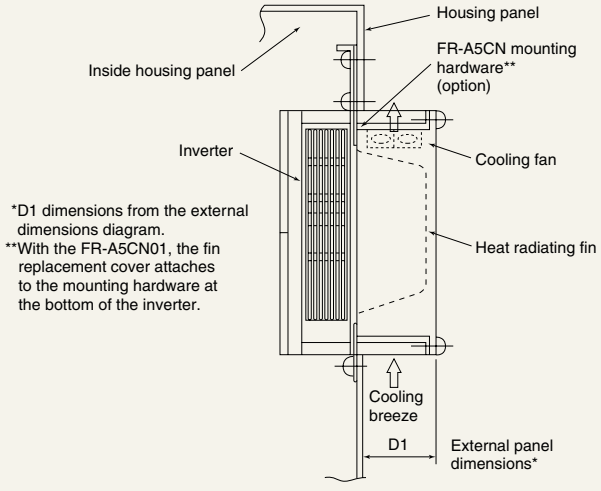
Note: The main circuit terminal size for the FR-540-37K has been reduced to one rank smaller than the FR-A140E-37K. (M8, M6)

Making the Housing Panel More Compact

When the inverter is being used inside a housing panel, the heat generated inside the panel can be greatly reduced by projecting the inverter's heat radiating fin outside of the panel. This mounting method is recommended when trying to reduce the size of a completely sealed housing panel.

Notes:
1. When mounting, use mounting attachment FR-A5CN (sold separately) (for models 1.5K–55K).
2. The fin height is greater than the fin height of the FR-A100 series.

Inverter		Attachment	
200V class	400V class	Model	Drawing No.
FR-F520-1.5–3.7K	FR-F540-0.75K–3.7K	FR-A5CN01	1
FR-F520-5.5K/7.5K	FR-F540-5.5K/7.5K	FR-A5CN02	2
FR-F520-11K	—	FR-A5CN03	3
—	FR-F540-11K		2
FR-F520-15K–22K	FR-F540-15K–22K	FR-A5CN04	4
FR-F520-30K	—	FR-A5CN08	8
FR-F520-37K	FR-F540-30K/37K	FR-A5CN05	5
FR-F520-45K	FR-F540-45K/55K	FR-A5CN06	6
FR-F520-55K	—	FR-A5CN07	7

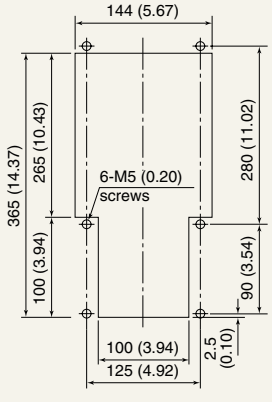


*D1 dimensions from the external dimensions diagram.
**With the FR-A5CN01, the fin replacement cover attaches to the mounting hardware at the bottom of the inverter.

Panel Cut-out Dimensions (When Using FR-A5CN)

Units: mm (inch)

●No.1



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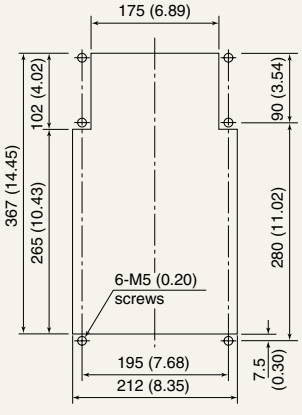

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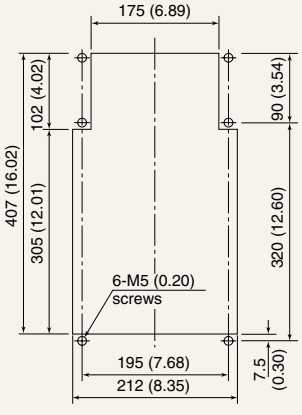
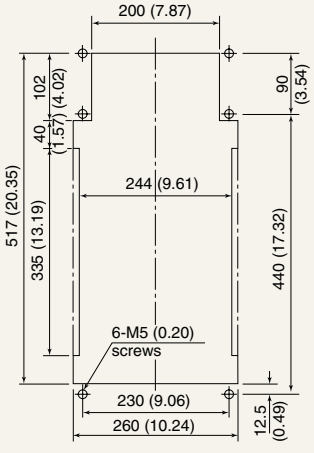
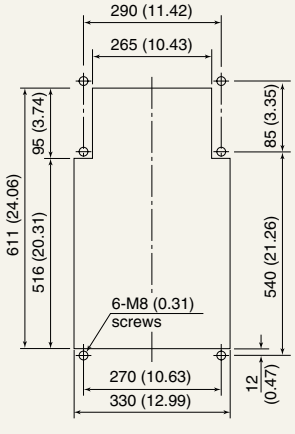


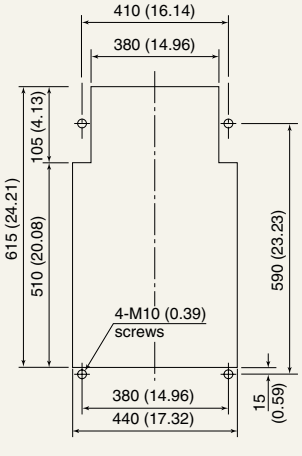
●No.4



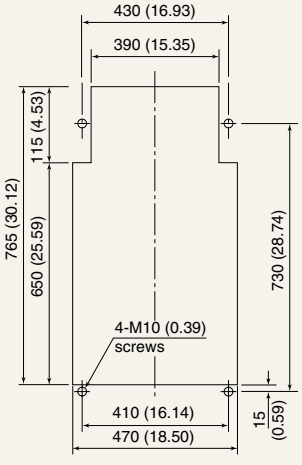
●No.5



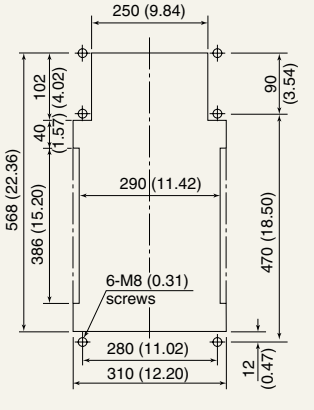
●No.6



●No.7



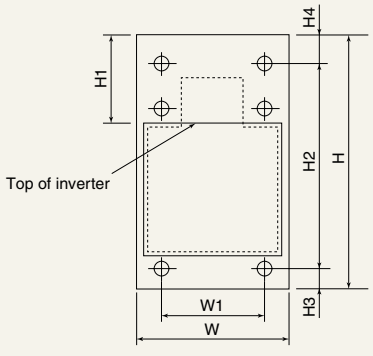
●No.8



External Dimension Diagrams

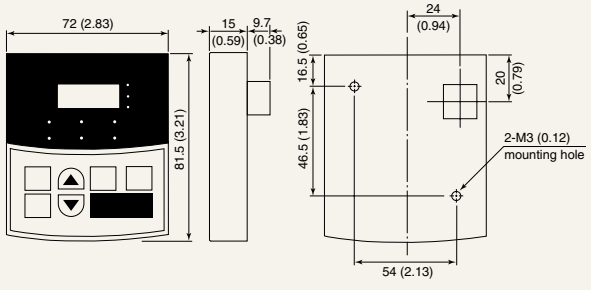
Dimensions After Mounting of Attachment (When Using FR-A5CN)

Units: mm (inch)



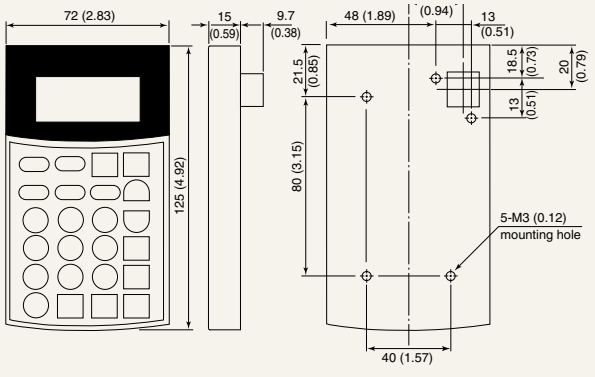
Model	W	H	H1	W1	H2	H3	H4
FR-A5CN01	150 (5.91)	389.5 (15.33)	18 (0.71)	125 (4.92)	370 (14.57)	11.5 (0.45)	8 (0.31)
FR-A5CN02	245 (9.65)	408.5 (16.08)	116.5 (4.59)	195 (7.68)	370 (14.57)	22 (0.87)	16.5 (0.65)
FR-A5CN03	245 (9.65)	448.5 (17.66)	116.5 (4.59)	195 (7.68)	410 (16.14)	22 (0.87)	16.5 (0.65)
FR-A5CN04	280 (11.02)	554 (21.81)	122 (4.80)	230 (9.06)	530 (20.87)	12.5 (0.49)	11.5 (0.45)
FR-A5CN05	340 (13.39)	645 (25.39)	130 (5.12)	270 (10.63)	540 (21.26)	10 (0.39)	10 (0.39)
FR-A5CN06	460 (18.11)	650 (25.59)	145 (5.71)	380 (14.96)	590 (23.23)	10 (0.39)	50 (1.97)
FR-A5CN07	490 (19.29)	800 (31.50)	145 (5.71)	410 (16.14)	730 (28.74)	10 (0.39)	60 (2.36)
FR-A5CN08	330 (12.99)	604 (23.78)	122 (4.80)	280 (11.02)	580 (22.83)	12 (0.47)	12 (0.47)

Control Panel
FR-DU04



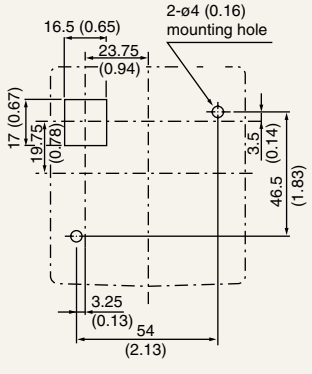
Please use an attachment screw length that does not exceed the effective depth of the attachment screw mount.

Parameter Unit (option)
FR-PU04

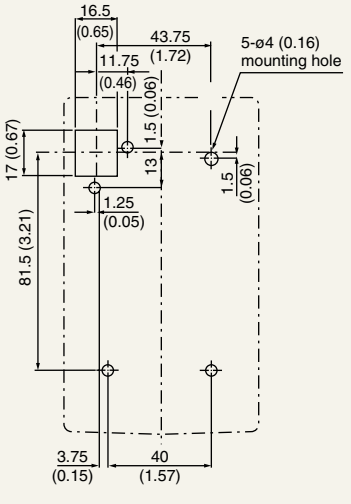


Please use an attachment screw length that does not exceed the effective depth of the attachment screw mount.

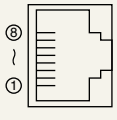
Panel cut-out dimensions



Panel cut-out dimensions



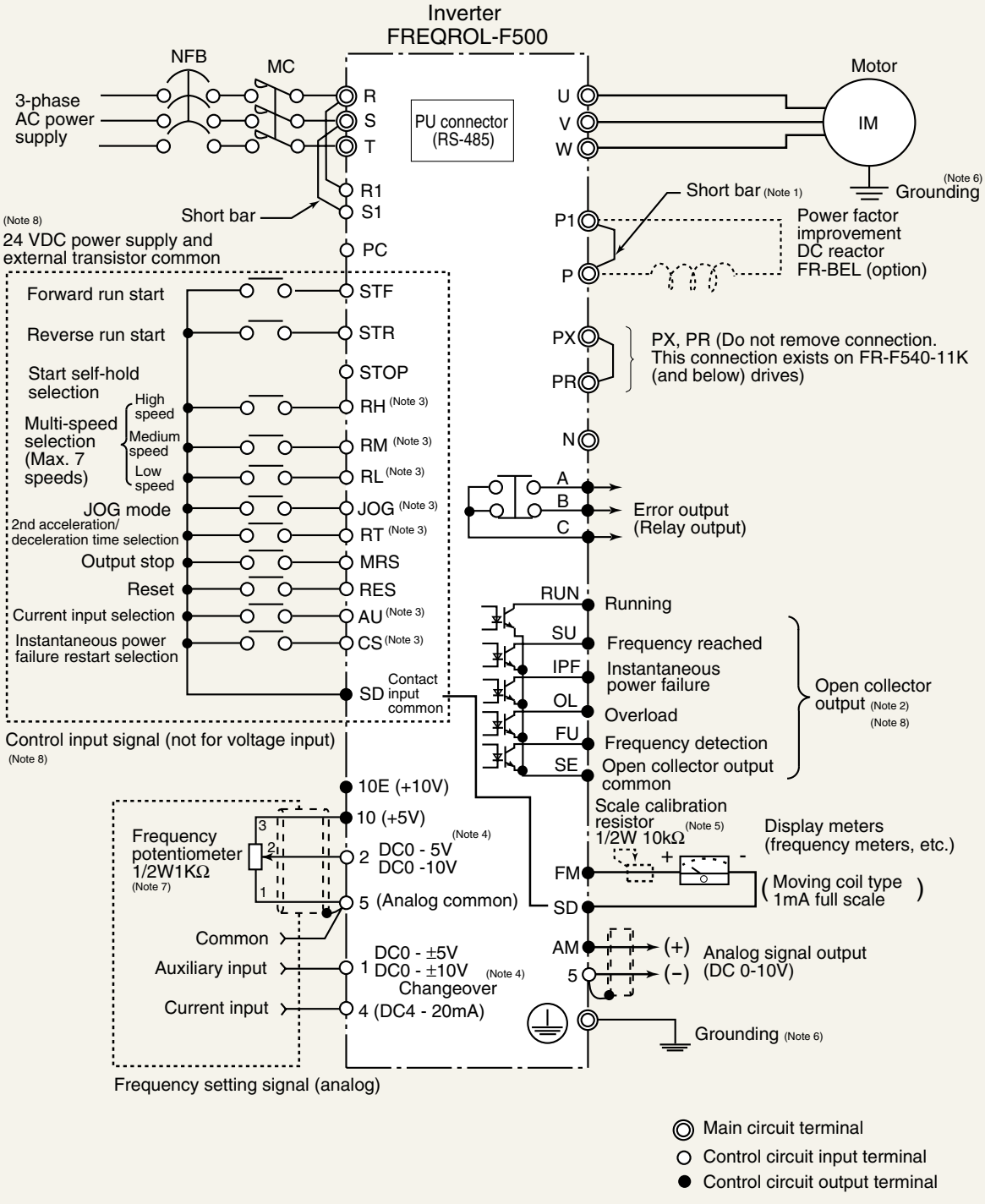
PU connector pin arrangement
[Main inverter unit (receptacle side), as seen from the front]



① SG ⑤ SDA
② P5S ⑥ RDB
③ RDA ⑦ SG
④ SDB ⑧ P5S

Notes:
1. Please do not make connections between the PU connector and computer LAN boards, fax modem sockets, or modular connectors for telephones. Since their electrical specifications are different, doing so may damage the unit.
2. Pins ② and ⑧ (P5S) are the power supplies for the control panel and the parameter unit. Please do not use them during communications via the RS-485 interface.

Terminal Connection Diagram



Notes:

(1) Remove this short bar when using the FR-BEL.
(2) These output terminals can output error alarm codes, or 19 types of function can be individually assigned with Pr.190 through to Pr.195.
(3) This input terminal can be individually assigned 14 types of function with Pr.180 through to Pr.186.
(4) The input signal can be changed with Pr.73.
(5) Not required when the meter is calibrated with the control panel.
(6) Always ground the inverter and motor.
(7) 2W1kΩ is recommended when the frequency setting is changed frequently.
(8) This connection diagram is for when the control circuit uses sink logic.

Explanation of Terminal Specification

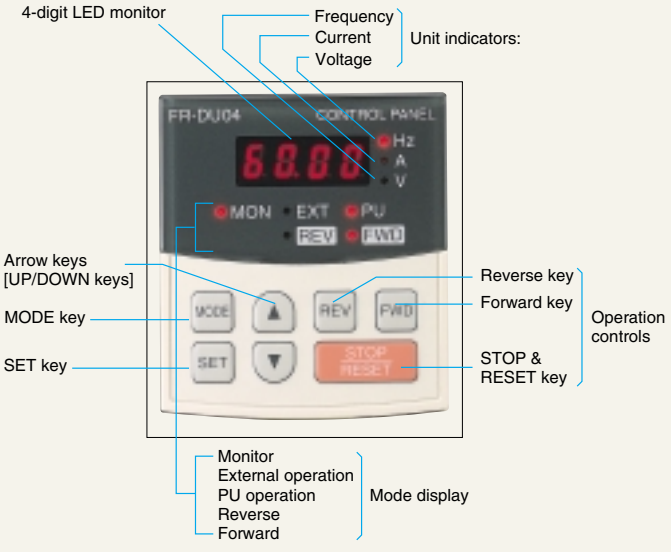
Type		Terminal symbol	Terminal name	Explanation	
Main Circuit		R, S, T	AC power supply input	Connected to the commercial power supply.	
		U, V, W	Inverter output	Connects the 3-phase squirrel cage motor.	
		R1, S1	Control circuit power supply	Connected to the AC power supply terminals R and S. To hold the error display or error output, remove the short bar on the terminal block, and input a power supply to this terminal from an external source.	
		P, N	Brake unit connection	Connect the optional FR-BU type brake unit or high-power factor converter (FR-HC).	
		P, P1	Power factor improvement DC reactor connection	Remove the short bar between terminals P and P1, and connect the optional power factor improvement DC reactor (FR-BEL).	
		PR, PX	Built-in brake circuit connection	The built-in brake circuit is enabled when the short bar is connected between terminals PX and PR. (Default setting)	
		⏚	Grounding	This is for grounding the inverter chassis. Always ground the inverter.	
Control Circuit, Input Signals	Contact	STF	Forward run start	Serves as the forward run command when terminals STF-SD (Note 2) are ON. In the programmed operation mode, serves as programmed operations start signal. (Start at ON, stop at OFF)	If terminals STF and STR-SD (Note 2) are ON simultaneously, they serve as the stop command.
		STR	Reverse run start	Serves as the reverse run command when terminals STR-SD (Note 2) are ON.	
		STOP	Start self-hold selection	The self-hold of the start signal is selected when terminals STOP-SD (Note 2) are ON.	
		RH, RM, RL	Multi-speed selection	The multi-speed can be selected with a combination of ON/OFF commands between the terminals RH, RM and RL-SD (Note 2) .	The terminal function changes according to the input terminal function selection (Pr.180 through Pr.186). Other signal names: OH, X10, X11, X12, X13, X14, X16 (Please refer to page 21.)
		JOG	JOG mode selection	JOG operation is selected when terminals JOG-SD (Note 2) are ON, and JOG operation can be started with the start signal (STF or STR), or control panel.	
		RT	2nd acceleration/ deceleration time selection	The 2nd acceleration/deceleration time is selected when terminals RT-SD (Note 2) are ON. If other 2nd functions such as "2nd torque boost" or "2nd V/F (base frequency)" are set, these functions will be selected when terminals RT-SD are ON.	
		AU	Current input selection	Operation is possible with the frequency setting signal 4 to 20 mA DC only when terminals AU-SD (Note 2) are ON.	
		CS	Instantaneous power failure restart selection	If terminals CS-SD (Note 2) are ON, the motor will restart automatically when the power is restored. However, to use this operation, restart must be enabled. (Restart is disabled as the default setting.)	
		MRS	Output stop	Inverter output stops when terminals MRS-SD (Note 2) are ON (for 20 ms or more). This is used to cut off the inverter output when stopping the motor with a magnetic brake.	
		RES	Reset	This is used to cancel the hold state when the protection circuit activates. Turn ON terminals RES-SD (Note 2) for 0.1 sec., or more, and then turn OFF.	
		SD	Contact input common (sink)	This is the common terminal for the terminal FM and for the contact input terminal during sink logic. It is insulated from the control circuit's common terminals.	
		PC	DC 24V power supply, external transistor common and contact input common (source)	When connecting a transistor output (open collector output) such as a programmable logic controller (PLC), malfunctions caused by supplied current can be prevented by connecting the external power common for the transistor output to this terminal. It is possible to use DC 24V 0.1A as the power supply. When source logic is selected, this is the common terminal for the contact input terminal.	
Analog	Frequency setting	10E	Frequency setting power supply	DC 10V tolerable load current 10 mA	When connecting a potentiometer at the default setting, connect to terminal 10. To connect to terminal 10E, change the input specifications for terminal 2.
		10		DC 5V tolerable load current 10 mA	
		2	Frequency setting (voltage)	When 0 to DC 5V (or 0 to 10V) is input, the max. output frequency is reached at 5 V (10 V). The input and output are proportional. The inputs 0 to DC 5V (default setting) and 0 to 10 VDC are changed using Pr. 73. Input resistance 10 Ω max., tolerable voltage 20V.	
		4	Frequency setting (current signal)	When 4 to 20 mA DC is input, the max. output frequency is reached at 20 mA. The input and output are proportional. This input signal is enabled only when terminals AU-SD (Note 2) are ON. The input resistance 250 Ω max., tolerable current 30 mA.	
		1	Auxiliary frequency setting	When 0 to DC ±5V or 0 to ±10V is input, this signal is added to the terminal 2 or 4 frequency setting signal. The inputs 0 to DC ±5V or 0 to ±10 V (default setting) are changed using Pr.73. Input resistance 10 Ω max., tolerable voltage ±20V	
		5	Frequency setting common	This is the common terminal for the frequency setting signal (terminal 2, 1 or 4) and analog output terminal AM. This terminal is not insulated from the control circuit's common terminals. Do not ground this common.	
Control Circuit Output Signal	Cont-act	A,B,C	Error output	This is a relay output that indicates that the inverter's protection circuit has functioned and the output has stopped. AC 200V 0.3 A, DC 30V 0.3A. When an error occurs, there is non-continuity between B-C (continuity between A-C); in normal operations, there is continuity between B-C (non-continuity between A-C).	The terminal function changes according to the output terminal function selection (Pr.190 to Pr.195). Other signal names: FU2, THP, PU, RY, Y13, FDN, FUP, RL, MC1–3, FAN, FIN, LF (Please refer to page 21.)
	Open collector	RUN	Inverter running	L level is output when the inverter output frequency is higher than the starting frequency (default: 0.5 Hz, changeable), and the H level is set when stopped or during DC braking (Note 1). Tolerable load: DC 24V 0.1 A	
		SU	Frequency reached	The L level is set when the output frequency is within ±10% (default, changeable) of the set frequency, and the H level is set during acceleration/deceleration and when stopped (Note 1). Tolerable load: 24V DC 0.1A	
		OL	Overload warning	The L level is output when stall prevention is activated by the stall prevention function, and the H level is set when stall prevention is canceled (Note 1). Tolerable load: DC 24V 0.1A	
		IPF	Instantaneous power failure	The L level is output when the instantaneous power failure or undervoltage protection has functioned (Note 1). Tolerable load: 24 VDC 0.1 A	
		FU	Frequency detection	The L level is output when the output frequency is higher than the set detection frequency, and the H level is output when it is lower (Note 1). Tolerable load: DC 24V 0.1A	
		SE	Open collector output common	This is the common terminal for the terminals RUN, SU, OL, IPF and FU. It is insulated from the control circuit's common terminals.	
	Pulse	FM	For display meter	One of 13 monitor items, such as output frequency, is selected and output. The output signal is proportional to the size of each monitor item.	Default output item: frequency; tolerable load current 1 mA 1440 pulse/sec. at 60 Hz
	Analog	AM	Analog signal output		Default output item: frequency; output signal 0 to DC 10V, tolerable load current 1mA
Commu-nications	RS-485	–	PU connector	RS-485 communications can be carried out using the control panel connector. Compliance standards: EIA Standard RS-485. Transmission format: multidrop link method. Communication rate: max. 19200 baud. Total length: 500 m (1640.4 ft).	

Notes:
1. The L level indicates when the open connector output transistor turns ON (continuity state). The H level indicates when it is in the OFF state (non-continuity state).
2. When using source logic, the terminal PC will be the common terminal, not SD.

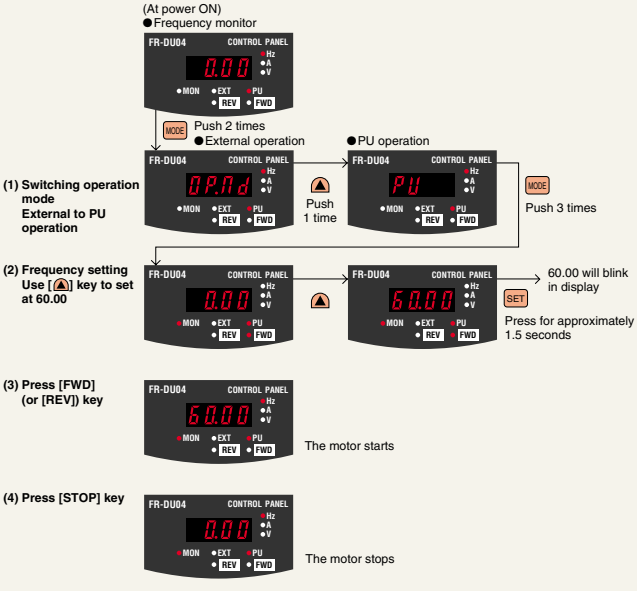
Explanation of Control Panel

Control Panel FR-DU04

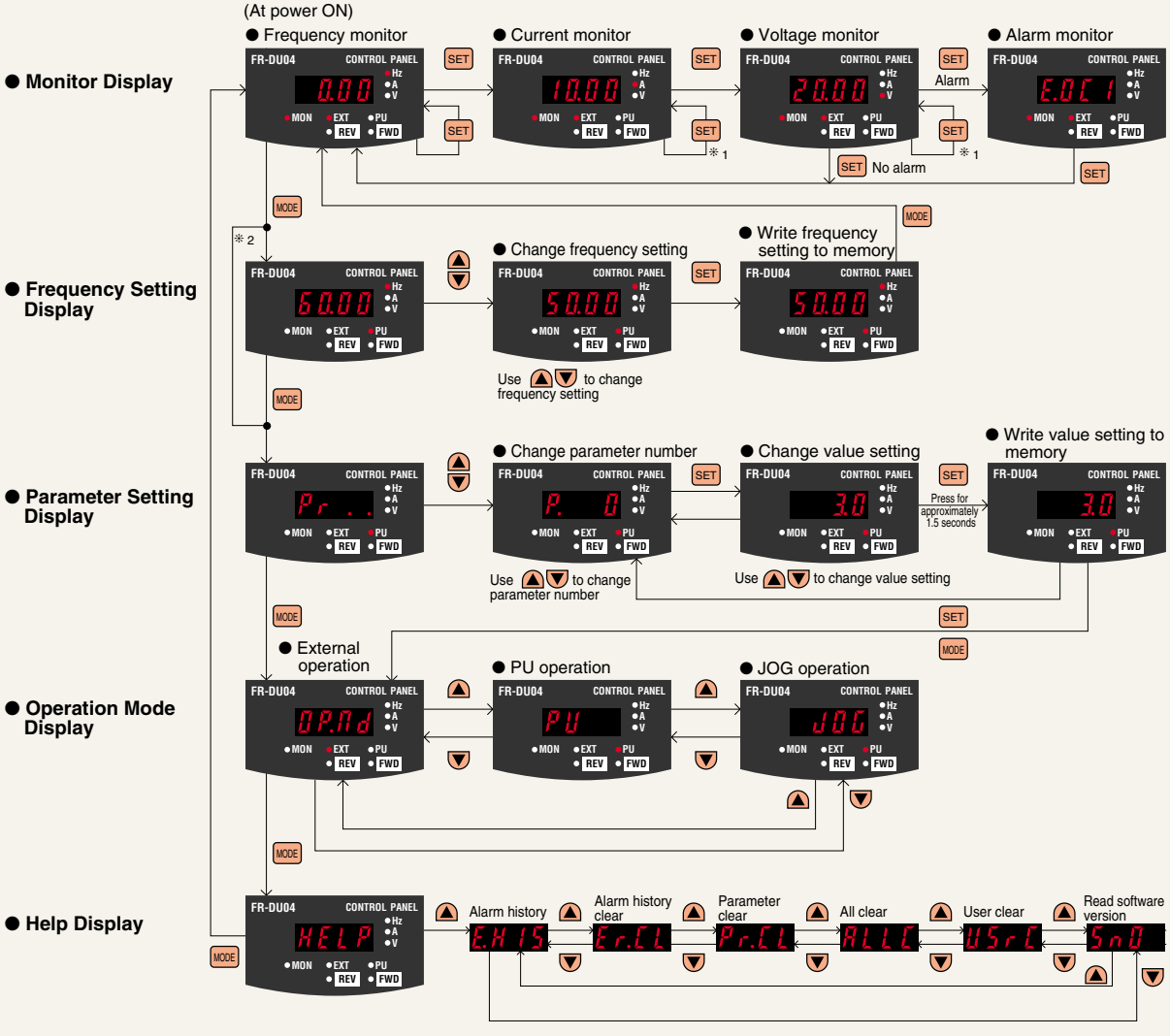
External View



PU Operation (Example: 60Hz operation)



Key Operations



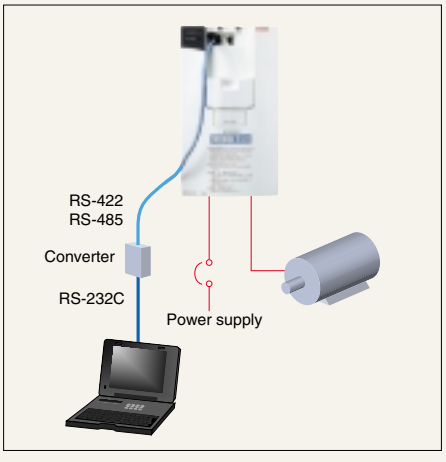
※1 If SET is pressed continuously for approximately 1.5 seconds, the current display switches to the initial power ON display.
※2 During external operations, the frequency setting display does not appear.

Inverter Setup Software and Networks

FR-SW0-SETUP-WE

(Windows 3.1*, Windows 95* compatible)

Inverter setup software provides an amenable inverter operating environment. Use it as a support tool for everything from inverter startup to maintenance. It allows you to efficiently set parameters and monitor operation in Windows*.



*"Windows" is a registered trademark of Microsoft Corporation.

Functions

1. Set and edit parameters
Four systems provided: Overall list system, function list system, individual system, simplified setup system.

2. Monitor
Four systems provided: data display system, meter display system, waveform display system and alarm history system.

3. Test operation
Test operation function incorporated.

4. Diagnosis
Interior self-diagnosis and failure diagnosis systems incorporated.

5. System settings
System setup incorporated.

6. Files
Saving to hard-disk/floppy disk, readout and printout functions incorporated.

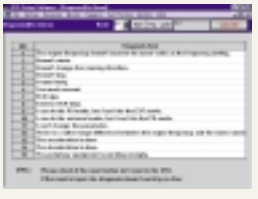
7. Windows
Multi-display screen function incorporated.

8. Help
Operation procedures displayed on-screen.


Sample screen showing simple parameter setting

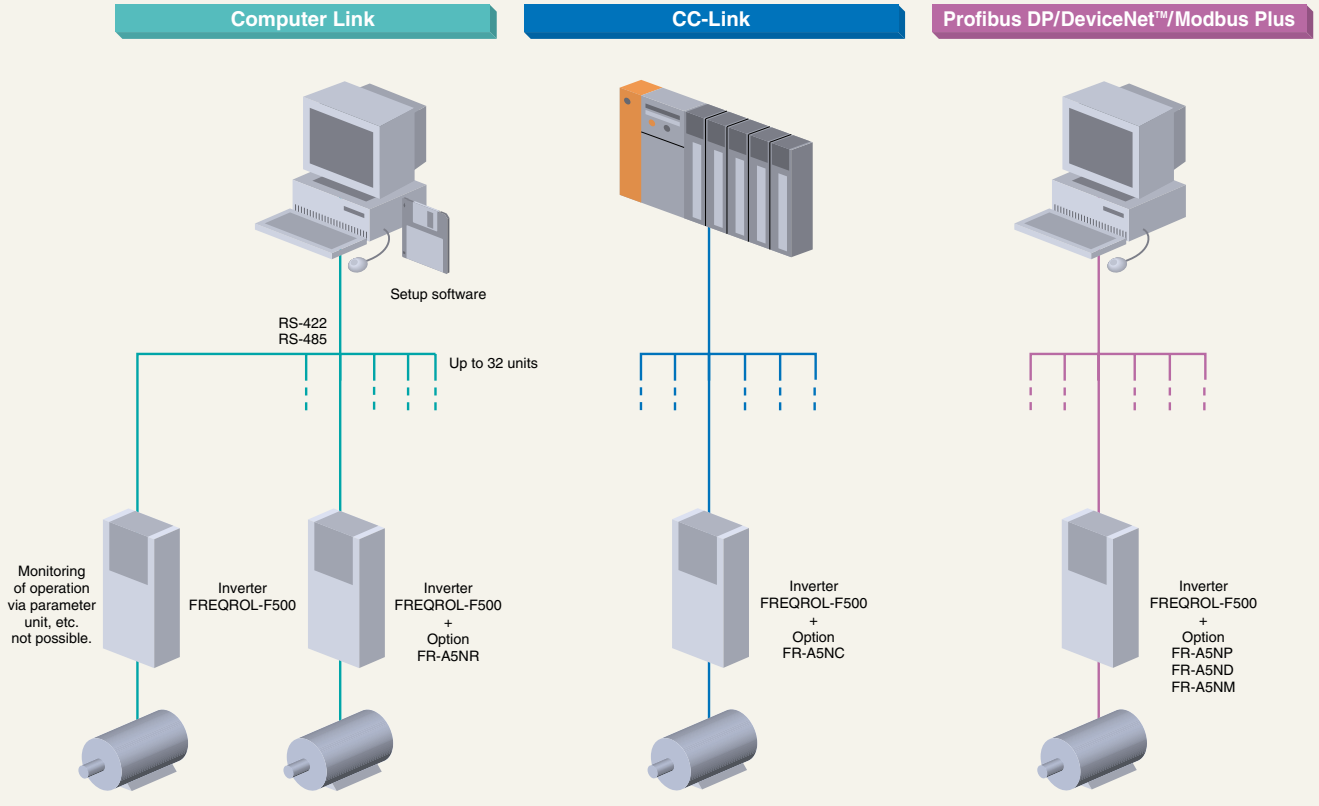

Sample screen showing monitoring and meter displays


Sample screen showing test operation


Sample screen showing diagnostic display

Networks

Compatible with networks used throughout the world.



List of Parameters

Simple Mode Parameters (Modes are for setting parameters for high frequency use only; default setting at time of shipment.)

Function	Pr. No.	Name	Setting range	Minimum setting	Default setting
Basic functions	0	Torque boost	0–30%	0.1%	6%/4%/3%/2% (Note 1)
	1	Maximum frequency	0–120Hz	0.01Hz	120Hz
	2	Minimum frequency	0–120Hz	0.01Hz	0Hz
	3	Base frequency	0–120Hz	0.01Hz	60Hz
	4	Multi-speed setting (high speed)	0–120Hz	0.01Hz	60Hz
	5	Multi-speed setting (middle speed)	0–120Hz	0.01Hz	30Hz
	6	Multi-speed setting (low speed)	0–120Hz	0.01Hz	10Hz
	7	Acceleration time	0–3600 sec./0–360 sec.	0.1 sec./0.01 sec.	5 sec./15 sec. (Note 2)
	8	Deceleration time	0–3600 sec./0–360 sec.	0.1 sec./0.01 sec.	10 sec./30 sec. (Note 2)
	9	Electronic thermal O/L relay	0–500A	0.01A	Rated output current
Standard operation functions	10	DC injection brake operation frequency	0–120Hz, 9999	0.01Hz	3Hz
	11	DC injection brake operation time	0–10 sec., 8888	0.1 sec.	0.5 sec.
	12	DC injection brake voltage	0–30%	0.1%	4%/2% (Note 2)
	13	Starting frequency	0–60Hz	0.01Hz	0.5Hz
	14	Load pattern selection	0, 1	1	1
	19	Base frequency voltage	0–1000V, 8888, 9999	0.1V	9999
Display functions	52	DU/PU main display data selection	0, 5, 6, 8, 10–14, 17, 20, 23–25, 100	1	0
	53	Parameter for FR-PU04	Refer the instruction manual for full details.		
	54	FM terminal function selection	1–3, 5, 6, 8, 10–14, 17, 21	1	1
	55	Frequency monitor reference	0–120Hz	0.01Hz	60Hz
	56	Current monitor reference	0–500A	0.01A	Rated output current
Restart	57	Restart coasting time	0, 0.1–5 sec., 9999	0.1 sec.	9999
	58	Restart cushion time	0–60 sec.	0.1 sec.	1.0 sec.
Operation selection functions	60	Intelligent mode selection (Note 5)	0, 3, 4, 9	1	0
	65	Retry selection	0–5	1	0
	66	Stall prevention operation reduction starting frequency (Note 5)	0–120Hz	0.01Hz	60Hz
	67	Number of retries at alarm occurrence	0–10, 101–110	1	0
	68	Retry waiting time	0–10 sec.	0.1 sec.	1 sec.
	69	Retry count display erasure	0	—	0
	71	Applied motor (Note 5)	0, 1, 2	1	0
	72	PWM frequency selection	0–15	1	2
	73	0 - 5V, 0 - 10V selection	0–5, 10–15	1	1
	74	Filter time constant selection	0–8	1	1
	75	Reset selection/PU disconnected/PU stop selection	0–3, 14–17	1	14
	76	Alarm code output selection	0, 1, 2	1	0
	77	Parameter write disable selection	0, 1, 2	1	0
	78	Reverse rotation prevention selection	0, 1, 2	1	0
	79	Operation mode selection (Note 5)	0–4, 6–8	1	0
Supplementary functions	160	User group read selection	0, 1, 10, 11, 9999	1	9999
Terminal function selection	180	RL terminal function selection (Note 5)	0–99, 9999	1	0
	181	RM terminal function selection (Note 5)	0–99, 9999	1	1
	182	RH terminal function selection (Note 5)	0–99, 9999	1	2
	183	RT terminal function selection (Note 5)	0–99, 9999	1	3
	184	AU terminal function selection (Note 5)	0–99, 9999	1	4
	185	JOG terminal function selection (Note 5)	0–99, 9999	1	5
	186	CS terminal function selection (Note 5)	0–99, 9999	1	6
	190	RUN terminal function selection (Note 5)	0–199, 9999	1	0
	191	SU terminal function selection (Note 5)	0–199, 9999	1	1
	192	IPF terminal function selection (Note 5)	0–199, 9999	1	2
	193	OL terminal function selection (Note 5)	0–199, 9999	1	3
	194	FU terminal function selection (Note 5)	0–199, 9999	1	4
	195	A.B.C terminal function selection (Note 5)	0–199, 9999	1	99
Auxiliary functions	240	Soft-PWM setting	0, 1	1	1
	244	Cooling fan operation selection	0, 1	1	0
Calibration functions	900	FM terminal calibration	—	—	
	901	AM terminal calibration	Refer the instruction manual for full details.		
	902	Frequency setting voltage bias	0–10V / 0–60Hz	0.01Hz	0V / 0Hz
	903	Frequency setting voltage gain	0–10V / 1–120Hz	0.01Hz	5V / 60Hz
	904	Frequency setting current bias	0–20mA / 0–60Hz	0.01Hz	4mA / 0Hz
	905	Frequency setting current gain	0–20mA / 1–120Hz	0.01Hz	20mA / 60Hz
Supplementary functions	990	Buzzer control	0, 1	1	1
	991	LCD contrast	0–63	1	53

Notes:
1. Setting values differ according to inverter capacity. The setting values are: (0.75K)/(1.5K–3.7K)/(5.5K, 7.5K)/(11K and over).
2. Setting values differ according to inverter capacity. The setting values are: (7.5K and below)/(11K and over).
3. The set values for the parameters in the shaded areas can be altered during operations even if Pr.77 (Parameter write disable) is set to 0 (default setting).
4. Reading and writing are possible when Pr.29=3.
5. Even if Pr.77 (Parameter write disable) is set to 2, the set value cannot be changed during operations.

List of Parameters

Standard Mode Parameters

(When modes other than Simple mode parameters are required, the standard mode parameters can also be used by changing the user group readout selection (Pr.160) to "0".)

Function	Pr. No.	Name
Standard operation functions	15	JOG frequency
	16	JOG acceleration/deceleration time
	17	MRS input selection
	20	Acceleration/deceleration reference frequency
	21	Acceleration/deceleration time increments
	22	Stall prevention operation level
	23	Stall prevention operation at double speed (Note 5)
	24	Multi-speed setting (4 speed)
	25	Multi-speed setting (5 speed)
	26	Multi-speed setting (6 speed)
	27	Multi-speed setting (7 speed)
	28	Multi-speed input compensation
	29	Acceleration/deceleration pattern
	30	Regenerative function selection
	31	Frequency jump 1A
	32	Frequency jump 1B
	33	Frequency jump 2A
	34	Frequency jump 2B
	35	Frequency jump 3A
	36	Frequency jump 3B
	37	Speed display
	38	Automatic torque boost
	39	Automatic torque boost operation start current
Output terminal functions	41	Up to frequency sensitivity
	42	Output frequency defection
	43	Output frequency defection during reverse rotation
2nd functions	44	2nd acceleration/deceleration time
	45	2nd deceleration time
	46	2nd torque boost
	47	2nd V/F (base frequency)
	48	2nd stall prevention operation current (Note 5)
	49	2nd stall prevention operation frequency (Note 5)
	50	2nd output frequency detection
Supplementary functions	59	Remote setting function selection
	61	Standard current
	62	Standard value of current at time of acceleration
	63	Standard value of current at time of deceleration
5-point flexible V/F characteristics	100	V/F1 (1st frequency) (Note 5)
	101	V/F1 (1st frequency voltage) (Note 5)
	102	V/F2 (2nd frequency) (Note 5)
	103	V/F2 (2nd frequency voltage) (Note 5)
	104	V/F3 (3rd frequency) (Note 5)
	105	V/F3 (3rd frequency voltage) (Note 5)
	106	V/F4 (4th frequency) (Note 5)
	107	V/F4 (4th frequency voltage) (Note 5)
	108	V/F5 (5th frequency) (Note 5)
	109	V/F5 (5th frequency voltage) (Note 5)
Communications functions	117	Station number
	118	Communication speed

Function	Pr. No.	Name
Communications functions	119	Stop bit length/data length
	120	Parity check presence/absence
	121	Number of communication retries
	122	Communication check time interval
	123	Wait time setting
	124	CR/LF absence/presence selection
PID control	128	PID action selection
	129	PID proportional band
	130	PID integral time
	131	Upper limit
	132	Lower limit
	133	PID action set point for PU operation
	134	PID differential time
Commercial power supply switchover	135	Commercial power supply switchover sequence output terminal selection (Note 5)
	136	MC switchover interlock time (Note 5)
	137	Start waiting time (Note 5)
	138	Commercial power supply-inverter switchover selection at alarm occurrence (Note 5)
	139	Automatic inverter-commercial power supply switch-over selection at alarm occurrence
Backlash	140	Backlash acceleration stopping frequency (Note 4)
	141	Backlash acceleration stopping time (Note 4)
	142	Backlash deceleration stopping frequency (Note 4)
	143	Backlash deceleration stopping time (Note 4)
Display	144	Speed setting switchover
	145	Switch parameter unit language
Supplementary functions	148	Stall prevention level at 0 V input
	149	Stall prevention level at 10 V input
Current detection	152	Zero current detection level
	153	Zero current detection period
Auxiliary functions	154	Voltage reduction selection during stall prevention operation
	155	RT activated condition
	156	Stall prevention operation selection
	157	OL signal waiting time
	158	AM terminal function selection
Restart	162	Automatic restart after instantaneous failure selection
	163	First cushion time for restart
	164	First cushion voltage for restart
	165	Restart stall prevention operation level
Initial monitor	170	Watt-hour meter clear
	171	Actual operation hour meter clear
User functions	173	User group 1 registration
	174	User group 1 deletion
	175	User group 2 registration
	176	User group 2 deletion
Supplementary functions	199	User initial value setting
	251	Select output phase interruption protection
	252	Override bias
	253	Override gain
Integrated option	300	Parameters for inboard options

Note: Please refer to the product instruction manual for details of standard mode parameters.

Parameter Use List

Use	Parameter number required for setup	Use	Parameter number required for setup
Adjust acceleration/deceleration time and pattern	Pr.7, 8, 20, 21, 160	Operation timing of electromagnetic brake	Pr.42, 160, 190–195
Motor overheat protection	Pr.9, 71	Display revolution speed, etc.	Pr.37, 52, 53, 160
Select optimum output characteristic for load characteristic	Pr.3, 14, 19, 60	Prevent re-writing of function	Pr.77
For operation over 60Hz	Pr.903, 905	Prevent reverse operation	Pr.78
Adjust frequency setup signal and output	Pr.73, 74, 902–905	Switch to optimum excitation control operation	Pr.60
Correct scale of frequency indicator	Pr.54–56, 158, 160, 900, 901	Automatic restart after stoppage at time of an alarm	Pr.65, 67–69
Adjust digital frequency indicator	Pr.54–56, 900	Adjust motor output torque	Pr.0, 13, 38, 39, 160
For multi-speed operations	Pr.1, 2, 4–6, 15, 24–27, 160	Operation of communications with PC	Pr.117–124, 160
Instantaneous power failure restart operation	Pr.57, 58, 180–186	Operation of PID control	Pr.73, 79, 128–134, 160, 180–186, 190–195
Adjust braking operation	Pr.10–12	Commercial power supply and inverter switching operation	Pr.135–139, 160, 180–186, 190–195
Reduce noise output	Pr.72, 240	To extend cooling fan lifetime	Pr.244
Select inverter reset	Pr.75	Select alarm code output	Pr.76

Description of Parameters

Note: "Parameter" is sometimes abbreviated "Pr."

Pr. 0 Setting Torque Boost

- The motor torque can be adjusted at low frequencies to match the load.

Notes: 1. The Default Setting (Torque Boost)
0.75K: 6%; 1.5–3.7K: 4%; 5.5K, 7.5K: 3%; more than 11K: 2%
2. When using a motor that is dedicated for inverters (a constant torque motor), change the settings as follows.
0.75K: 6%; 1.5–3.7K: 4%; more than 5.5K: 2%
If Pr.71 is changed to the settings for using constant torque motors, but the default settings are not changed, the Pr.0 setting will switch to the above values.

Pr. 1 Pr. 2 Setting Maximum and Minimum Frequencies

Pr. 1 Maximum frequency **Pr. 2** Minimum frequency

- The output frequency can be clamped by maximum and minimum frequencies.

Pr. 3 Pr. 19 Setting the Base Frequency

Pr. 3 Base frequency

Pr. 19 Base frequency voltage

- Any base frequency (the reference frequency at the motor's rated torque) can be set in the range of 0–120Hz to match the motor rating.
- Motors rated at below the inverter's power supply voltage are best used by setting Pr.19 (base frequency voltage). This is convenient when using, for example, a 400V rated motor with a 460V power supply.

Note: When Pr.19 is set to 8888, the maximum output voltage is 95% of the power supply voltage. When Pr.19 is set to 9999 (the default setting), the maximum output voltage is the same as the power supply voltage.

Pr. 4–6 Setting Multi-Speeds

Pr. 4 Three-speed setting (high speed)

Pr. 5 Three-speed setting (middle speed)

Pr. 6 Three-speed setting (low speed)

- Speeds can be selected by simply switching the external contact signals (RH, RM and RL signals).
- All speeds (frequencies) can be set in the range 0–120Hz while the inverter is running. Change the settings by using the ▽△ keys while a multi-speed parameter is displayed. (Press the write key to record the frequency setting in memory once you have released the ▽△ keys.)
- Combining maximum frequency (Pr.1) and minimum frequency (Pr.2), JOG frequency (Pr.15) can be set to a maximum speed of 10.

Notes: 1. Multi-speed settings have priority over analog input commands (between terminals 2 and 5 or 4 and 5).
2. Multi-speed settings can be done during PU operation or external operation.
3. Please refer to the product instruction manual for details regarding Pr.15.

Pr. 7 Pr. 8 Setting Acceleration/ Deceleration Time

Pr. 7 Acceleration time

Pr. 8 Deceleration time

- Pr.7 (acceleration time) is the time required from reach the reference frequency of Pr.20 from 0Hz; Pr.8 (deceleration time) is the time required to reach 0Hz from the setting of Pr.20.

Notes: 1. Set the gain (Pr.903 or Pr.905) for the output frequency of the frequency setup signal (analog).
2. Please refer to the product instruction manual regarding the details of Pr.20.

Pr. 9 Electronic Thermal O/L Relay

- The setting for motor overheating protection can be set as the current value (A). Normally, the rated motor current for 50Hz is set. This provides the optimum protection characteristics for low speed operations, including when motor cooling power drops during low-speed operation.
- When 0A is set, the motor protection function does not engage. (The inverter's output transistor protection function does.)
- When using a Mitsubishi fixed torque motor, set Pr.71 (applied motor) to 1, select the 100% continuous torque characteristics at low speed, and set the motor's rated current in Pr.9 (electronic thermal O/L relay).
- The factory default setting is the inverter's rated output current, except for 0.75K inverters, for which it is 85% of the inverter's rated current.
- When several motors are operated simultaneously, install an external thermal relay on each motor.

Pr. 10 Pr. 11 Pr. 12 DC Injection Brake Adjustment

Pr. 10 DC injection brake operation frequency

Pr. 11 DC injection brake operation time

Pr. 12 DC injection brake voltage

- The stopping precision for positioning or similar operations can be adjusted to the load by setting the time for which the DC brake torque (voltage) is activated during stopping and the frequency at which the operation is started.

Notes: 1. If the setting is Pr.10=9999 for the same frequency as that set by Pr.13 (Starting frequency), DC braking is operating.
2. If the setting is Pr.11=8888, DC braking is controlled by the external DC braking start signal (X13 signal). The terminal for X13 signal input is allocated by Pr.180–Pr.186 (Input Terminal Function Selection).
3. Default Settings at Time of Shipment <DC braking voltage>
Less than 7.5K: 4%; more than 11K: 2%.
In the case of special inverter motor (constant torque motor), please change the parameter settings as follows: Less than 3.7K: 4%; more than 5.5K: 2%. Using the value set by the factory at the time of shipment, Pr.71 is set to that at the time of using a constant torque motor and the setup value of Pr.12 is switched to the above-mentioned value.

Pr. 13 Setting the Starting Frequency

● The frequency at startup can be set in the range 0–60Hz.

Pr. 14 Load Pattern Selection

● This allows you to select the optimum output characteristics (V/F characteristics) for your application and load characteristics.

Pr. 14 setting	Output characteristics
0	Constant torque load
1	Variable torque load (the default setting)

Pr. 19 See the description of Pr. 3

Pr. 52 Pr. 53 Pr. 54 Selecting Monitor Output Signal

Pr. 52 DU/PU main display data

Pr. 54 FM terminal function selection

● Using the setup numbers listed in the following table, 20 various signals can be selected for the monitor and output signals.
● Pr. 54 is the pulse line output FM terminal and Pr. 158 is the analog AM terminal.
● Default settings at the time of shipment: Pr.52, 0; Pr.54, 1; Pr.158, 1.
● Please refer to the product instruction manual for details regarding Pr. 158.

Signal types	Display unit	Parameter setting			Full-scale value of FM, Level meter
		Pr. 52	Pr. 54	Pr. 158	
		DU LED	FM terminal	AM terminal	
No display	–	×	×	×	–
Output frequency	Hz	0/100	1	1	Pr. 55
Output current	A	0/100	2	2	Pr. 56
Output voltage	V	0/100	3	3	400V or 800V
Error display	–	0/100	×	×	–
Frequency setting	Hz	5	5	5	Pr. 55
Operating speed	r	6	6	6	Value of Pr.55 changed by Pr.37 value
Converter output voltage	V	8	8	8	400V or 800V
Electronic thermal load ratio	%	10	10	10	Thermal operation level
Output current peak value	A	11	11	11	Pr. 56
Converter output voltage peak value	V	12	12	12	400V or 800V
Electric power input	kW	13	13	13	Rated power of inverter ×2
Electric power output	kW	14	14	14	Rated power of inverter ×2
Input terminal status	–	×	×	×	–
Output terminal status	–	×	×	×	–
Load meter	%	17	17	17	Pr. 56
Cumulative operation time	hr	20	×	×	–
Standard output voltage	–	×	21	21	FM terminal output of 1440pulses/sec, full-scale voltage output to AM terminal
Actual operating time	hr	23	×	×	–
Motor load ratio	%	24	×	×	Rated current of inverter ×2
Cumulative power	–	25	×	×	–

Notes: 1. Monitor selection of sections marked by "×" is not possible.
2. If Pr. 52 "DU/PU Main Display Data" is set to "0", output frequency–error display can be selected with the monitor using the sequence setup key. (Factory setting at time of shipment)
3. Load meter is the current value set by Pr. 56, 100% displayed in %.
4. If Pr. 54 is set to "1, 2, 5, 6, 11 and 17", Pr. 55 and Pr. 56 can be set to full-scale value.
5. Addition of circulation time and actual operating time is possible from 0–65,535hr. After this the value is cleared and addition starts from 0 again.
6. The actual running time is counted in terms of time the inverter operates. Time is not counted when the inverter is stopped.

● When Pr. 52 is set to 100, the output frequency value monitored will differ when it is stopped and when it is running. (While stopped, the Hz LED blinks; while running, it stays lit.)

	Pr. 52		
	0	100	
	Running/stopped	Stopped	Running
Output frequency	Output frequency	Set frequency	Output frequency
Output current	Output current		
Output voltage	Output voltage		
Error display	Error display		

Notes: 1. During an alarm, the frequency when the alarm occurred is displayed.
2. While output is stopped (MRS), everything is handled the same as when the inverter is stopped.

Pr. 53 Selecting PU level display data

● Select the signal displayed in the level meter of the parameter unit (FR-PU04).
Please refer to the product instruction manual for further details.

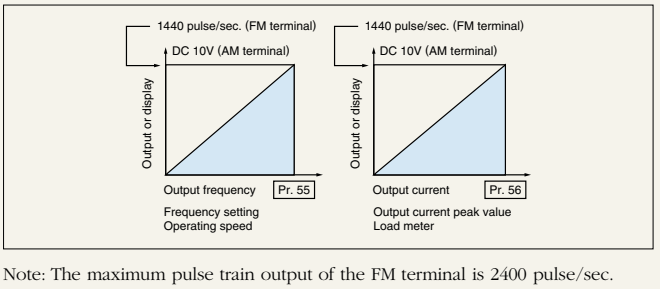
Pr. 55 Pr. 56 Setting the Monitor Reference

Pr. 55 Frequency monitor reference

Pr. 56 Current monitor reference

● For the FM and AM terminals, set the frequency and current values to the display standards.

Monitor standard setting parameter	Monitor content selection ( ) depicts setting unit	FM terminal function selection (Pr.54) setting	AM terminal function selection (Pr.158) setting
Frequency monitor standard Pr.55	Output frequency (Hz)	1	1
	Frequency setting (Hz)	5	5
	Operating speed (Pr.37)	6	6
Current monitor standard Pr.56	Output current (A)	2	2
	Output current peak value (A)	11	11
	Load meter (A)	17	17
Pr.55 and Pr.56 setup		Output pulse line of FM terminal should be set to 1400pulses/sec.	Output voltage of AM terminal should be set to 10V.



Note: The maximum pulse train output of the FM terminal is 2400 pulse/sec.

Pr. 57 Pr. 58 Restart Operation after Instantaneous Power Failure or Commercial Power Supply Switch-over Operation

Pr. 57 Restart coasting time Pr. 58 Restart cushion time

- When switching from commercial operation to inverter operation or following an instantaneous power failure, the motor does not have to stop (free-running condition) and the inverter can be restarted.
- Pr. 57 "Restart, Coasting Time"

Pr. 57 setting	Restarting possible
9999 (default)	No
0 or 0.1–5*	Yes

The coasting time is the time spent waiting for control to start, which is used for restarting after recovery.

* When Pr. 57 is set to 0, the standard coasting time described below is set. You can generally operate at this setting, but you can also adjust the time in the range of 0.1–5 seconds to better suit the inertial moment (GD^2) of the load and the size of the torque.
0.75–1.5K: 0.5 seconds; 2.2–7.5K: 1.0 seconds; more than 11K: 3.0 seconds

- Pr. 58 can usually be used with the default setting. The output voltage rise at the time of restart can be adjusted to suit load specifications (moment of inertia, torque).

Notes: 1. If the inverter capacity is more than two ranks higher than the motor capacity, the over-current (OCT) alarm may sound and an instance in which operation cannot restart may occur.
2. In the case of the setting of Pr.57≠9999, and it is used under the condition of the CS signal being OFF, the inverter will not operate.
3. Please refer to the product instruction manual for further information.

Pr. 60 Selecting Intelligent Mode

Pr. 60 Selecting intelligent mode

- Selection of this parameter is convenient if you want to begin use immediately and precise parameter settings are not required. Using this parameter, there is no need to set adjustable acceleration/deceleration speed times or variable-frequency pattern, and the inverter will operate under normal conditions with adequate values set for each parameter. (Note 1)

Pr. 60 setting	Function set	Description of operation	Parameter automatically set
0 (default)	Normal operating mode	–	–
3	Optimum adjustable speed mode	Using the Intelligent mode, an automated learning function set the average current of the adjustment speed to the rated current of the inverter and then automatically sets the boost value and adjustable speed times. Operating the inverter under the continuous rated limitations attains optimum operation.(Note2) This mode is suitable for uses in which the load changes very little.	Pr. 0 Pr. 7 Pr. 8
4	Energy-saving mode	This operation mode conducts on-line tuning of the output voltage to minimize the inverter output current during constant speed operation. It is best suited for energy-saving uses such as for fans and pumps.	Output voltage
9	Optimum excitation control mode	This mode optimizes the flux vector to control energy saving while providing maximum motor efficiency. It is most suitable for energy-saving use in machinery in which GD^2 is large and adjustment speed time is long.	Output voltage

Notes: 1. Set individual parameters when you need control suited to the application as well.
2. The inverter selects the adequate parameters automatically and then begins operation.

Pr. 66 Setting the Stall Prevention Operation Level

Pr. 66 Stall prevention operation level reduction starting frequency

- When operated faster than 60Hz, the motor current does not increase, so acceleration is not always available. To improve the motor operating characteristics, the stall prevention operation level can be decreased in the high frequency zone.

Pr. 65 Pr. 67 Pr. 68 Pr. 69 Retry Selection

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

- Retry is a function in which the inverter automatically resets the alarm when an inverter alarm occurs and then restarts and continues operation.
- Use Pr. 65 to select the alarms for which a retry is done.

Pr. 65 setting	Retry type
0	Retry for all alarms except fin overheating (FIN), PU disconnected (PUE), and CPU error (CPU).
1	Retry when an overcurrent cut-off (OC1–3) occurs.
2	Retry when a regenerative overvoltage cut-off (OV1–3) occurs.
3	Retry when a regenerative overvoltage cut-off (OV1–3) or overcurrent cut-off (OC1–3) occurs.
4	Over-current shutdown (OC1–3) Regenerative over-voltage shutdown (OV1–3) Instantaneous power failure (IPF), under-voltage protection (UVT) Ground fault over-current protection (GF) Parameter error (PE) Stall operation shutdown (OLT) Optional equipment error (OPT)
5	Over-current shutdown during acceleration (OC1) Over-current shutdown during deceleration (OC3)

- You can also set the number of retries when an alarm occurs with Pr. 67.

Pr. 67 setting	Number of retries	Alarm error signal output
0 (default)	No retries	–
1–10	1–10	Not output
101–110	1–10	Output

- You can set the length of time to wait after an inverter alarm before restarting (0–10 sec.) using Pr. 68.
- You can find out how many retires were needed to successfully restart by reading Pr. 69. When set to 0, the count is erased.

Notes: 1. When using this function, be sure to take precautions so that the operator or machinery is not injured when the inverter automatically starts running after the retry wait time set with Pr. 68.
2. A reset when restarting using the retry function does not clear accumulated data, such as for the electronic thermal O/L relay (which is not the case for a power supply reset).

Pr. 71 Selecting Applied Motor

- When using a Mitsubishi constant torque motor, set Pr. 71 to 1. The electronic thermal characteristic is set to the constant torque motor thermal characteristics.
- If Pr. 0 and Pr. 12 are the default settings at the time of shipment, the values for 5.5K and 7.5K of Pr. 71 should be set to the values listed in the table below.

Pr. 71 setting	0, 2	1
Pr. 0 setting	3%	2%
Pr. 12 setting	4%	2%

Pr. 71 setting	Electronic thermal characteristics	Motor	
		Standard	Constant torque
0	Thermal characteristics to match general-purpose motors (default)	●	
1	Thermal characteristics for Mitsubishi constant torque motor		●
2 (Note 1, 2)	Thermal characteristics suitable for standard motor when using 5-point adjustable variable frequency	●	

Notes: 1. These are the settings in the case of using Pr. 100–Pr. 109 (5-point adjustable variable frequency).
2. If Pr. 19 = 9999, it is not possible to set Pr. 71 = 2; therefore if you select Pr. 71 = 2, please set a value other than 9999 for Pr. 19.
3. Please refer to the product instruction manual for details regarding Pr. 100–Pr. 109.

Pr. 72 Pr. 240 Changing Motor Noise

Pr. 72 Select PWM frequency Pr. 240 Set Soft-PWM

- When the PWM carrier frequency is lowered, motor noise increases, but the noise generated from the inverter and the leakage current decrease.
- Pr. 72 can be set between 0 and 15; however, for 0, the value is 0.7 kHz, for 15 the value is 14.5 kHz, and all other settings are the set value in kHz.
- You can use Pr. 240 to set whether to have Soft-PWM control, which changes the motor noise quality. Soft-PMW Control is a noise management system that filters motor mechanical noise into multiplex sound, which is more pleasant to the human ear.

Pr. 240 setting	Description
0	Soft-PWM control disabled
1	Soft-PWM control enabled

Note: This is only valid when Pr. 72 (Set PWM frequency) is 0–5.

Pr. 73 Selecting the Frequency Command Voltage Range

- Setting input specifications of terminals 1, 2 and 4 and override function.

Pr. 73 setting	AU signal	Terminal 2 input voltage	Terminal 1 input voltage*1	Terminal 4 input, 4–20 mA	Override function*2	Reversible poles
0	OFF (none)	DC 0–10V	DC 0–±10V	×	×	*3
1		DC 0–5V	DC 0–±10V			
2		DC 0–10V	DC 0–±5V			
3		DC 0–5V	DC 0–±5V			
4		DC 0–10V	DC 0–±10V		○	
5		DC 0–5V	DC 0–±5V			
10		DC 0–10V	DC 0–±10V		×	○
11		DC 0–5V	DC 0–±10V			
12		DC 0–10V	DC 0–±5V			
13		DC 0–5V	DC 0–±5V			
14		DC 0–10V	DC 0–±10V		○	
15		DC 0–5V	DC 0–±5V			
0	ON (present)	×	DC 0–±10V	○	×	*3
1			DC 0–±10V			
2			DC 0–±5V			
3			DC 0–±5V			
4		DC 0–10V	×		○	
5		DC 0–5V				
10		×	DC 0–±10V		×	○
11			DC 0–±10V			
12			DC 0–±5V			
13			DC 0–±5V			
14		DC 0–10V	×		○	
15		DC 0–5V				

*1. Terminal 1 (frequency setup auxiliary input) is added to the main setting signal of terminals 2 and 4.
*2. When override has been selected, terminals 1 or 4 become the main speed setting and terminal 2 is part of the override signal (0–5V or 0~10V at 50–150%).
*3. A negative polar frequency command signal indicates an unacceptable condition.
Notes: 1. A mark of "×" indicates a condition that does not accept a signal.
2. If the maximum output frequency is changed when the maximum frequency command voltage (current) is input, set the frequency setting voltage (current) gain using Pr. 903 (Pr. 905). Input of the command voltage is not required at this time. Additionally, as the adjustable speed time is a gradient of the adjustable standard frequency, it is not influenced by a change in the setting of Pr. 73.
3. ▭ is the default setting.
4. If the setting is Pr. 22 = 9999, terminal 1 (frequency setup auxiliary input) becomes the terminal for setting the start prevention operation level. Please refer to the product instruction manual for details.

Pr. 74 Input Filter Time Constant

- You can set the built-in input filter constant of the frequency setting signal for the external voltage or current. This aids in removing noise from the frequency setting circuit.
- When noise prevents stable operation, increase the filter time constant. Increasing the setting will lower responsiveness.

Pr. 75 Reset Selection/Disconnected PU Detection/PU Stop Selection

- This function monitors the PU (control panel, parameter unit) connector and sounds an alarm if connection to the main body of the inverter is broken. Selection of the function can be made using the reset terminal. If Pr. 75 is set for 14–17, for any of the PU external or communication modes, the deceleration stop function can be selected by input using the PU stop key.
- Operation Description (PU disconnect detection)
  The function setting "Yes or No" for detecting PU disconnection is set using the PU. When "Yes" is set, the unit will detect if the PU connector becomes disconnected from the main body of the inverter and execute a stop alarm.

Pr. 75 setting	Reset signal	PU disconnected	PU stop selection
0	Normal reset input possible	Keeps operating even when PU disconnected	Decelerates to a stop only when PU stop key is entered in PU operating mode
1	Reset input available only during operation of protective function		
2	Normal reset input available	Inverter output cuts off when PU disconnected	
3	Reset input available only during operation of protective function		
14 (default)	Normal reset input available	Keeps operating even when PU disconnected	Stops when PU stop key is entered in all operating modes (PU, external, communications, etc.).
15	Reset input available only during operation of protective function		
16	Normal reset input available	Inverter output cuts off when PU disconnected	
17	Reset input available only during operation of protective function		

Notes: 1. When the RES signal goes ON during operation, the inverter cuts off the output while the signal remains ON; the electronic overcurrent protection are reset, and the motor coasts to a stop.
2. When something other than a PU is connected (such as when doing RS-485 serial communications with a computer), no PU disconnections are detected.
3. Input from the PU reset key is only accepted when protective functions are engaged, regardless of the Pr. 75 settings.

Pr. 76 Selecting Alarm Code Output

- If an error happens, the content can be output in a 4-bit digital signal using an open collector output terminal.

Pr. 76 setting	Output terminal			
	SU	IPF	OL	FU1
0 (default)	Depends on Pr. 190–Pr. 195 (output terminal function selection)			
1	Alarm code bit 3	Alarm code bit 2	Alarm code bit 1	Alarm code bit 0
2	Normal operation time: operating condition signal (same as setup value, 0) At time of error: Alarm code signal			

Note: Please refer to page 23 regarding the alarm codes.

Pr. 77 Parameter Write Disable Selection

- This parameter disables writing in control panel and parameter unit functions.

Pr. 77 setting	Write disable function
0	Parameter write enabled. (Only while stopped during PU mode. Default.) (Note 1)
1	Parameter write disabled. (Note 2)
2	Parameter write also enabled during operation. (Note 3)

Notes: 1. Monitor-related Pr.52–Pr.56 can be set at any time.
2. Pr. 77, Pr. 75 and Pr. 79 (operating mode selection) are write-enabled.
3. Some parameters cannot be written during operation. Please refer to Note 5 in the Parameters List.

Pr. 78 Reverse Rotation Prevention Selection

- Set this parameter to prevent problems caused by reverse rotation caused by mistaken start signal input.

Pr. 78 setting	Rotation direction
0	Forward or reverse both allowed. (Default.)
1	Reverse disabled.
2	Forward disabled.

Note: These settings are valid for both PU and external operation.

Pr. 79 Operation Mode Selection

- The inverters have two operating modes: operation by external signal and operation by PU (control panel and parameter unit). You can set this parameter to use either or both. The setting for this parameter can be changed even when in external mode.

Setting	Description	
0 (default)	Operation can be switched between PU and external operation	
1	Only PU operation is possible	
2	Only external operation is possible	
3	Operating frequency	Start signal
	PU • Direct setup and ▼▲ key setup Terminal signal • Multi-speed selection (Pr. 4–6, 24–27)	Terminal signal • STF • STR
4	Terminal signal • 2–5 DC 0–5V • 2–5 DC 0–10V • 4–5 DC 4–20mA • 1–5 DC 0–±5V 0–±10V • Multi-speed selection (Pr. 4–6, 24–27) • JOG frequency (Pr. 15)	PU • Forward rotation key • Reverse rotation key
6	Switchover mode	
7	PU operation interlock	
8	Switch operating mode external signal (can't switch during operation) • PU operation is selected when X16 signal is OFF • External operation is selected when X16 signal is ON	

Note: Use Pr. 180–Pr. 186 (input terminal function selection) to assign the terminal that the X16 signal will use.
Please refer to the product instruction manual for details.

Pr. 160 User Group Selection

Pr. 160 User group read selection

- Up to 32 of the parameters can be registered in two user groups. The registered parameters can be read and written. When a user group is selected with Pr. 160 (user group selection), unregistered parameters cannot be read.

Pr. 160=0001
- 1 User group 1 (0: Disabled, 1: Enabled)
- 2 User group 2 (0: Disabled, 1: Enabled)

9999 is simple mode.

Please refer to the product instruction manual for details.

Pr. 180–186 Input Terminal Function Selection

Pr. 180 RL terminal function selection

Pr. 181 RM terminal function selection

Pr. 182 RH terminal function selection

Pr. 183 RT terminal function selection

Pr. 184 AU terminal function selection

Pr. 185 JOG terminal function selection

Pr. 186 CS terminal function selection

● Functions can be freely assigned to input terminals by setting 0–16 for Pr. 180–Pr. 186.

Pr. number	Name	Terminal
180	RL terminal function selection	RL
181	RM terminal function selection	RM
182	RH terminal function selection	RH
183	RT terminal function selection	RT
184	AU terminal function selection	AU
185	JOG terminal function selection	JOG
186	CS terminal function selection	CS

Setting	Terminal	Terminal function			
0	RL	Pr. 59=0	Low speed	Pr. 59=1, 2	Remote setting (clear settings)
1	RM		Middle speed		Remote setting (deceleration)
2	RH		High speed		Remote setting (acceleration)
3	RT	Second function selection			
4	AU	Current input selection			
5	JOG	JOG operation			
6	CS	Instantaneous power failure restart selection			
7	OH	External thermal input			
10	X10	FR-HC connection (inverter operation enable)			
11	X11	FR-HC connection (instantaneous power failure detection)			
12	X12	PU external operation interlock signal			
13	X13	External DC braking start signal			
14	X14	PID control efficiency signal			
16	X16	Switch between PU operation to external operation			
9999		No function			

Note: Please refer to the product instruction manual regarding Pr. 59.
The functions of the STF, STR, MRS, STOP, and RES terminals cannot be changed.

Pr. 190 Pr. 191 Pr. 192 Pr. 193 Pr. 194 Pr. 195 Output Terminal Function Selection

Pr. 190 RUN terminal function selection

Pr. 191 SU terminal function selection

Pr. 192 IPF terminal function selection

Pr. 193 OL terminal function selection

Pr. 194 FU terminal function selection

Pr. 195 A, B, C terminal function selection

● Set Pr. 190–Pr. 195 to 0–99 or 9999 to freely assign functions to the output terminals (including relays)

Pr. number	Name	Terminal
190	RUN terminal function selection	RUN
191	SU terminal function selection	SU
192	IPF terminal function selection	IPF
193	OL terminal function selection	OL
194	FU terminal function selection	FU
195	A, B, C terminal function selection	Error output

Setting		Signal	Terminal function
Positive logic	Negative logic		
0	100	RUN	Inverter running
1	101	SU	Frequency reached
2	102	IPF	Instantaneous power failure or under-voltage
3	103	OL	Overloading warning
4	104	FU	Frequency detection
5	105	FU2	Second frequency detection
8	108	THP	Electronic overcurrent protection pre-alarm
10	110	PU	PU operation mode
11	111	RY	Inverter ready to run
13	113	Y13	Zero current detection
14	114	FDN	PID minimum
15	115	FUP	PID maximum
16	116	RL	PID forward reverse output
17	–	MC1	MC1 commercial-use switch
18	–	MC2	MC2 commercial-use switch
19	–	MC3	MC3 commercial-use switch
25	125	FAN	Fan failure output
26	126	FIN	Fin overheat pre-alarm
98	198	LF	Minor breakdown output
99	199	ABC	Error output
9999		–	No function

0–99: Positive logic 100–199: Negative logic

Note: In the case of Pr. 76=1, the output signal for SU, IPF, OL and FU terminals follows Pr. 76. Output allocation for RUN terminal and error output relay follow the setup mentioned above, and does not relate to Pr. 76.

Pr. 240 See the description of Pr. 72

Pr. 244 Cooling Fan Operation Selection

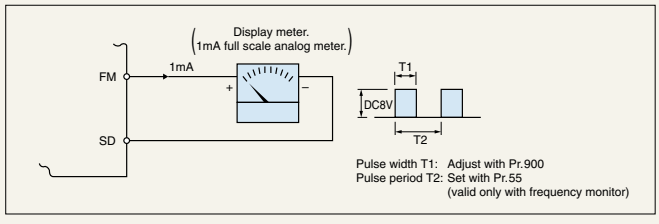
● Controls the cooling fan.

Pr. 244 setting	Fan operation
0	No ON-OFF control (Factory setting)
1	ON-OFF control (Always ON during inverter operation; while the inverter is stopped, goes ON-OFF according to temperature control.)

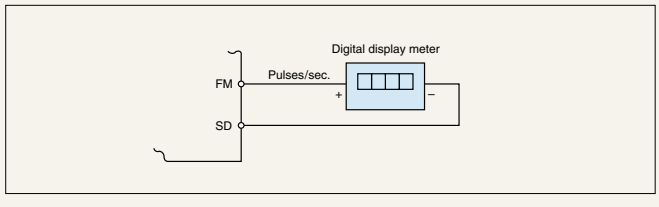
Pr. 900 FM Terminal Output Calibration

● You can use the control panel to calibrate meters connected to the FM terminal. This calibration function is shared by all monitor functions selected with Pr. 54.

● The FM terminal output is pulse output like that shown in the diagram below. You can set Pr. 900 so you can use the control panel for scale calibration of meters connected to the inverter without having to install a scale calibrating resistor.
(See the manual for more information about calibration.)



● Monitoring Using Digital Display Meter
You can display data digitally using a digital counter by employing the pulse train output of the FM terminal. Output is 1440 pulse/sec. at the full scale value described in the section on Pr. 54. When operating frequency is selected for monitoring, you can set the FM output frequency for this terminal using Pr. 55.



Note: Set before shipment so that 1mA provides full scale and a FM output frequency of 1440Hz at 60Hz.

Pr. 901 AM Terminal Output Calibration

● The AM terminal is used for calibration when the monitor signal is set by Pr. 158 to execute analog output.
Please refer to the product instruction manual regarding the calibration method.

Pr. 902 Pr. 903 Pr. 904 Pr. 905
Frequency Setting Signal Gain and Bias Adjustment

Pr. 902 Frequency setting voltage bias

Pr. 903 Frequency setting voltage gain

Pr. 904 Frequency setting current bias

Pr. 905 Frequency setting current gain

● The size (gradient) of the output frequency for the frequency setting signal (DC 0–5V, DC 0–10V and 4–20mA) can be set optionally. It has the characteristic of a straight line which is defined by two points Pr. 902 (Pr. 904) and Pr. 903 (Pr. 905).

Pr. 990 Buzzer Sound Control

● You can turn the buzzer sound used when parameter unit keys are pressed either on or off.

Pr. 990 setting	Description
0	No buzzer
1	Buzzer

Pr. 991 LCD Contrast

● You can adjust the contrast of the LCD on the optional FR-PU04 parameter unit.

Pr. 991 setting	Description
0 to 63	Bright
	53 (default)
	Dark

Note: The LCD contrast setting will not be recorded unless you press the [WRITE] key.

Protective Functions

Except for the motor's electronic thermal relay, the following functions are provided for the protection of the inverter itself, but they may also function when the inverter breaks down.

Function name		Description		Display	Type (Note 3)	
					Major fault	Minor fault
Over-current cut-off		When the inverter output current exceeds the rated current by more than approximately 150% during acceleration/deceleration or at constant speed, the protective circuit activates, halting inverter output.	Accelerating	E.OC1 (OC1)	●	
			Constant speed	E.OC2 (OC2)		
			Decelerating	E.OC3 (OC3)		
Regenerative overvoltage cut-off		If the DC voltage in the inverter's internal main circuit exceeds the rated value as a result of regenerative energy generated through motor braking during acceleration/deceleration or at constant speed, the protective circuit activates, halting inverter output. There are also cases where it is activated by surge voltage generated in the power supply system.	Accelerating	E.OV1 (OV1)	●	
			Constant speed	E.OV2 (OV2)		
			Decelerating	E.OV3 (OV3)		
Overload cut-off (electronic thermal relay)	Motor	The electronic thermal relay inside the inverter detects motor overheating resulting from overloading or a decline in cooling capacity at constant speed, activating the protective circuit and halting inverter output. The electronic thermal relay cannot protect multipolar and other special motors, or several motors working together, so a thermal relay should be installed on the inverter's output side. (120% of overload capacity, 60 seconds.)		E.THM (THM)	●	
	Inverter	In the case where a current flows that is at least 120% of the rated output current but does not exceed the overcurrent cut-off (OC) level (150% max.), the electronic thermal relay activates according to reverse time characteristics to protect the main circuit transistors, and halts inverter output.		E.THT (THT)	●	
Instantaneous power failure protection		When the power fails for more than 15ms and is restored within approximately 100ms, the instantaneous power failure protection function activates to prevent erroneous operation of the control circuit, and halts inverter output. At this time, error warning output contacts open (between terminals A and C) and close (between terminals B and C) (Note 4). If the power failure continues for 100ms or more, the error warning output does not activate, and if the start signal is ON when power is restored, the inverter restarts. (If the instantaneous power failure lasts for less than 15ms, the control circuit functions normally.)		E.IPF (IPF)	●	
Undervoltage protection		(1) If the inverter's supply voltage drops, the control circuit can no longer fulfill its normal functions. Also, the motor suffers from insufficient torque and overheating. For this reason, inverter output halts when the supply voltage falls to 150V or below (300V or below in the case of 400V class units). (2) The undervoltage protection function operates if there is no short bar between P and P1.		E.UVT (UVT)	●	
Fin overheat		If the cooling fin overheats, the fin overheat sensor activates and halts inverter output.		E.FIN (FIN)	●	
Fan trouble		In the case of inverters with built-in cooling fans, "FN" is displayed at the control panel if the cooling fan stops operation because of trouble, or operates differently from the setting for Pr.244 (Cooling fan operation selection). Inverter output does not halt.		FN (FN)		●
Output side ground fault overcurrent protection		Inverter output halts when a ground fault occurs on the inverter's output side (load side) and a ground fault overcurrent is generated.		E.GF (GF)	●	
External thermal relay operation (Note 1)		When an externally installed motor overheating protective thermal relay or temperature relay within the motor, etc., activates (relay contact open), the inverter can be stopped if the contact is input to the inverter. Even if the relay contact resets automatically, the inverter will not restart unless it is reset also.		E.OHT (OHT)	●	
Option error		(1) When a dedicated built-in type option is installed within the inverter, inverter output halts if there is a setting error or the connection is faulty. (2) When a high-power factor converter connection is set, the display indicates that an AC power supply is connected to R, S, T.		E.OPT (OPT)	●	
Parameter error		Generated when an error occurs in a stored parameter (e.g. E²ROM breakdown).		E.PE (PE)	●	
PU disconnected		Inverter output halts when communication between the main unit and the PU are interrupted by disconnection of the PU, etc., when Pr. 75 is set to 2, 3, 16, 17.		E.PUE (PUE)	●	
No. of retries exceeded		When operation cannot be restarted normally within the set number of retries, inverter output is halted.		E.RET (RET)	●	
Output phase loss detection		Detects when the inverter looses an output phase (U, V or W).		E.LF (LF)	●	
CPU error		If the built-in CPU does not complete operation within the prescribed time, it self-diagnoses a fault and halts inverter output.		E.CPU (CPU)	●	
Current limit/ Stall prevention	During acceleration	When a current of 120% (Note 2) or more of the inverter's rated current flows in the motor, the rise in frequency is stopped until the load current declines, preventing the inverter from executing an over-current shut-off. The frequency is increased again once the current falls below 120% of the rated value.		(OL)	●	
	At constant speed	When a current of 120% (Note 2) or more of the inverter's rated current flows in the motor, the frequency is lowered until the load current declines, preventing the inverter from executing an over-current shut-off. The frequency is restored to the set level once the current falls below 120% of the rated value.		E.OLT (OLT) (When inverter output is halted)		
	During deceleration	If the motor's regenerative energy is excessive and surpasses its braking capacity, the decline in frequency is halted, preventing the inverter from executing an over-current shut-off. Once the regenerative energy has declined, deceleration continues. When a current of 120% (Note 2) or more of the inverter's rated current flows in the motor, the decline in frequency is halted until the load current declines, preventing the inverter from executing an over-current shut-off. The frequency is lowered once again once the current falls below 120% of the rated value.				
24VDC power supply output short circuit		When the DC 24V power output from the PC terminal is short circuited, power output is shut off. At such times, all external contact inputs are switched OFF. Resetting cannot be performed by an RES signal input. To reset, either use the control panel or shut off the power, then turn it on again.		E.P24 (P24)	●	
Operating panel power supply short circuit		When the control panel power supply (P5S of the PU connector) is short circuited, power output is shut off. At such times, it is not possible to use the control panel (parameter unit) or perform RS-485 communications from the PU connector. To reset, either input an RES signal or shut off the power, then turn it on again.		E.CTE (CTE)	●	

Notes: 1. External thermal relay operations are only performed when Pr.180–Pr.186 (input terminal function selection) is set to OH.
2. Indicated when the stall prevention operation current level is set to 120% (default setting). When this value is altered, stall prevention is performed at the altered set value.
3. Major faults: The protective function activates, inverter output is shut off, and an error output is executed. Minor faults: Output is not shut off even when the protective function activates. It is possible to output minor fault signals by setting parameters.
4. In the case where Pr.190–Pr.195 (output terminal function selection) are set to the default values.
5. When setting Pr.76 (alarm code output selection), error contents can be output in 4 bit digital signal. The signal is output from the open collector output terminal, which is a standard inverter component.
0: Output transistor OFF 1: Output transistor ON (common SE terminal)

	Alarm Code (Note 5)					Check Point	Procedure
	Output Terminal Operation (Note 5)				Alarm Code		
	SU	IPF	OL	FU			
	0	0	0	1	1	Was the acceleration very quick? Was there an output short-circuit or ground fault? Is the torque boost setting high?	Increase acceleration time.
	0	0	1	0	2	Was there a rapid change in load? Was there an output short-circuit of ground fault?	Resolve the problem of quick load change.
	0	0	1	1	3	Was the deceleration very quick? Was there an output short-circuit or ground fault? Is the motors brake operation too fast?	Increase length of deceleration time. Check braking operation.
	0	1	0	0	4	Was the acceleration very quick? Was there a rapid change in load? Was the deceleration very quick? Was there an excessively large surge voltage form the power supply?	Increase acceleration time. Resolve the problem of quick load change. Increase length of deceleration time. Reduce the frequency of using the brake.
	0	1	0	1	5	Is the load too large for the motor? Is there a high torque boost when the load is light?	Reduce the load. Increase the capacity of the motor and inverter.
	0	1	1	0	6	Is the load too large for the motor?	Reduce the load. Increase the capacity of the motor and inverter.
	0	1	1	1	7	Check the cause of the power interruption.	Recover the power.
	1	0	0	0	8	Is the fluctuation in power supply large? Were any large capacity motors started? Are there any short-circuited boards or DC reactors connected between terminal P and P1?	Investigate power-supply distribution and devices. Connect short-circuit bar or DC reactor between terminals P and P1.
	1	0	0	1	9	Is the surrounding temperature too high?	Temperature of surrounding should be within operating specifications.
	—	—	—	—	—	Is there any problem with the cooling fan?	Replace the fan.
	1	0	1	1	B	Is there grounding for the motor and connecting line.	Reconnect the grounding wires.
	1	1	0	0	C	Did the motor overheat? Is the Pr.180–Pr.186 setting correct?	Reduce the load and operating frequency.
	1	1	1	0	E	Has the connector come loose?	Confirm all connections are satisfactory.
	1	1	1	1	F	Is the number of parameters written too many?	Please contact your local Mitsubishi dealer.
	1	1	1	1	F	Are any of the DU or PU mounts loose? Is the Pr.75 setting correct?	Confirm that DU and PU are mounted.
	1	1	1	1	F	Check the cause of error.	After confirming the cause and making repair, reset the inverter.
	1	1	1	1	F	Was there any output phase interruption?	Are there any phase interruptions?
	1	1	1	1	F	Has the connector come loose?	Confirm all connections are correct.
	1	1	0	1	D	Is the load too large for the motor? Was there a rapid acceleration operation?	Reduce the load. Increase the capacity of the motor and inverter.
						Is the load too large for the motor?	Reduce the load. Reduce the frequency of using the brake.
	—	—	—	—	—	Did the PC terminal output short-circuit?	Repair the short-circuit.
	—	—	—	—	—	Did the PU connector connection line short-circuit?	Check the PU and cable.

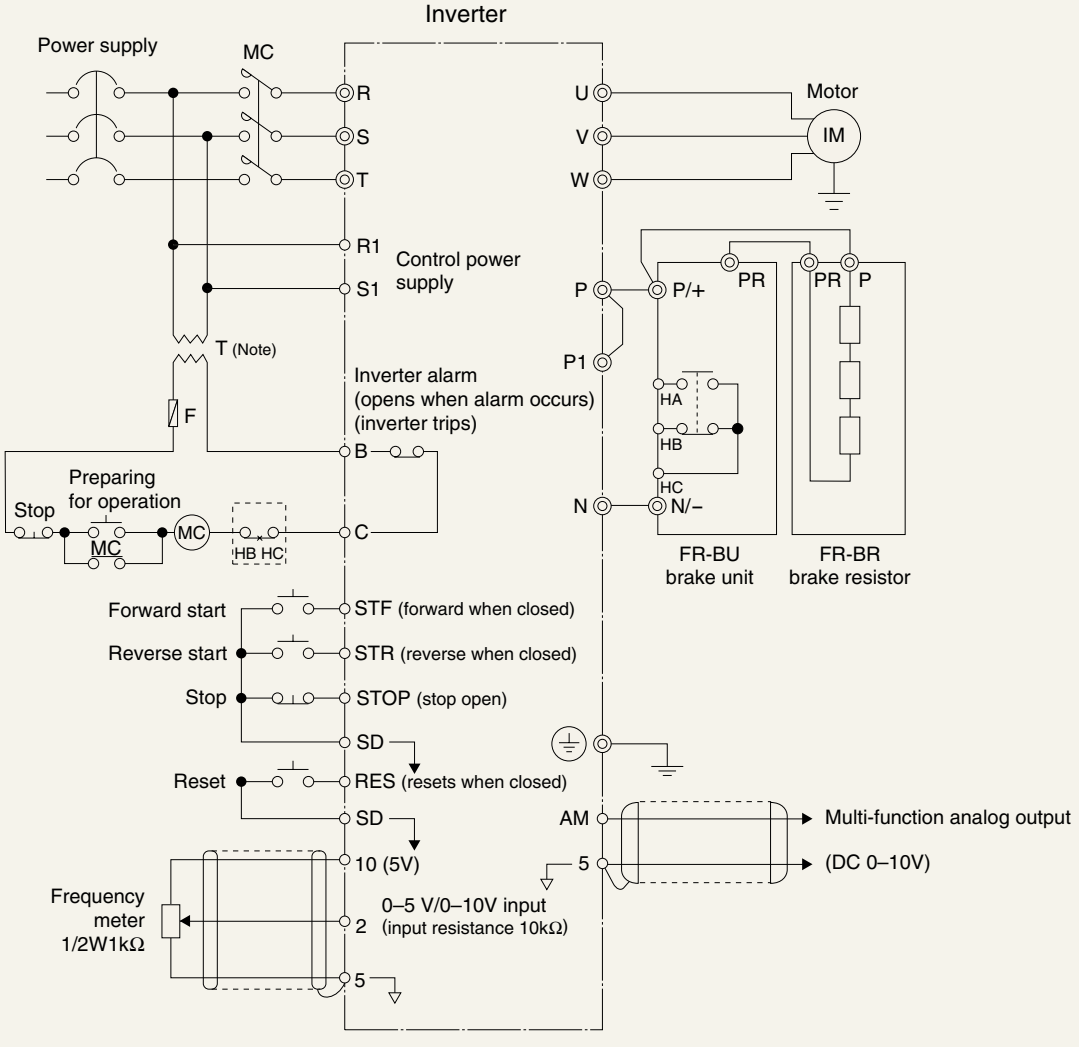
Connection Examples

Basic Wiring Diagram

(Main Circuit Input Cut-Off by Alarm)

- This circuit shuts down the main circuit input of the inverter using an electromagnetic contactor when an inverter shutdown alarm occurs. Also using STOP connection provides self protection of the inverter.
- Using the power-supply terminals R1 and S1 for the control circuit, even if an inverter shutdown alarm occurs, the control circuit and PU can be operated without resetting the main circuit of the inverter power-supply. Please refer to the product instruction manual regarding other connecting methods for the control circuits of other power sources.
  An error signal can be held, and the error contents conveniently read out using the PU, thus aiding in the executing of trouble-shooting.
  If you use the FR-BIF radio noise filter, please connect it to the primary side of the MC. If you connect it to the secondary side, an under-voltage alarm (E.UVT) will occur when the MC is switched from ON to OFF. Additionally, when you disconnect the control terminal at the time of maintenance, please be sure to turn off the primary side breaker and confirm no power with the charge lamp before beginning maintenance work.
- When the FR-BU brake unit (option) is needed, such as when machinery with large inertial moment (GD^2) causes system shutdown or shutdown in a short period of time, please connect it between the P and N terminals.
- The terminal FM-SD (or AM-5 as in example) output can be either a frequency or a motor current signal. (See the description of Pr. 54.)
- For the reset input, you can also select a function (error reset) that accepts signals only when the inverter alarm stops. (See the description of Pr. 75.)

Note: Use a step-down transformer for 400V power supply.



Automatic Operation Using DC 4–20mA Current Signals

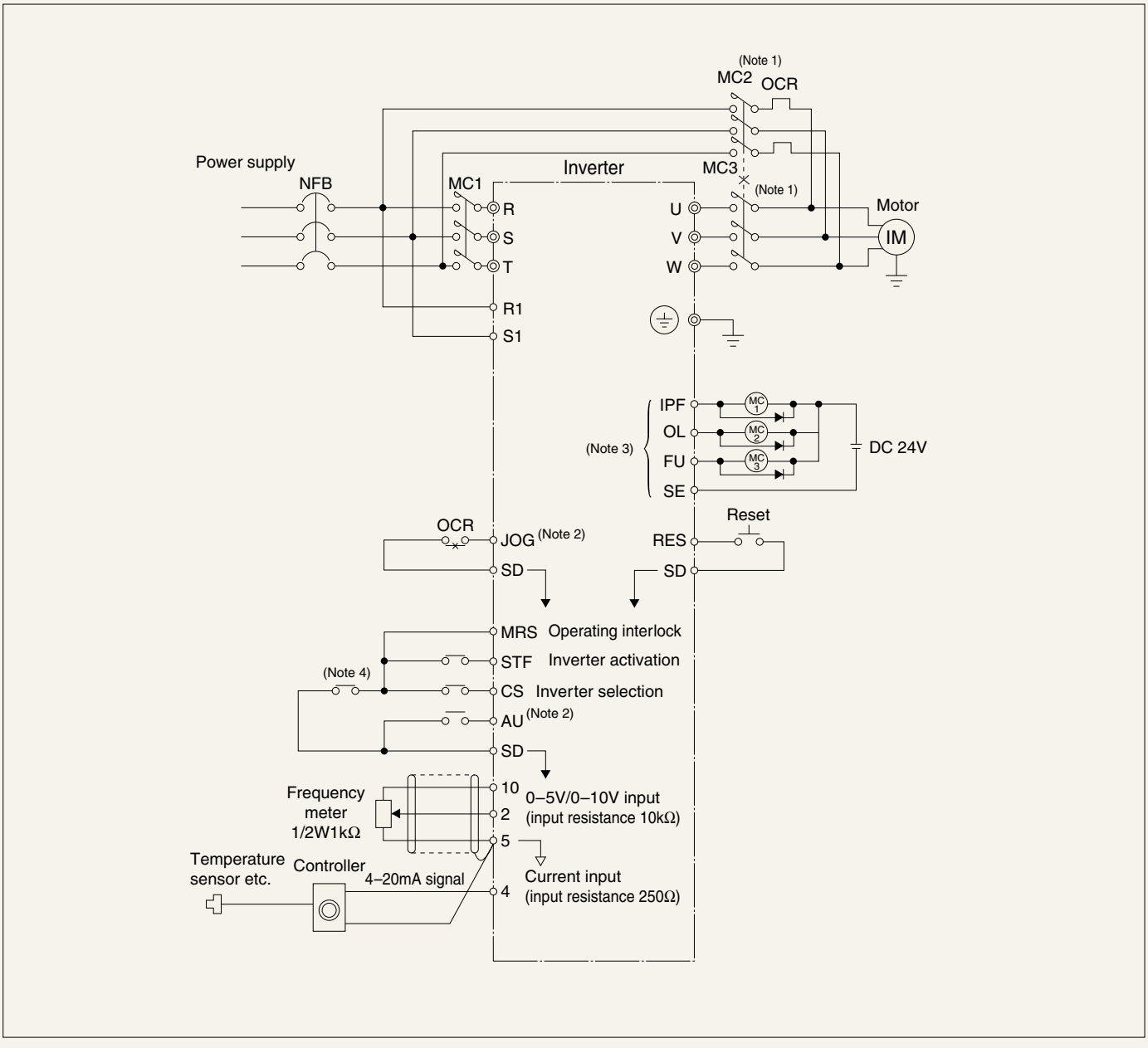
(Building Air-Conditioners)

- This is a sample circuit for automatic operation when used in combination with controllers such as temperature control for building air-conditioners.
- Switching back and forth between inverter operation and commercial operation is possible. The operation timing of MC1–3 is best controlled by the commercial switch sequence function, which is integrated into the inverter. External switching of sequence circuits is also easy.
- Operation automatically switches to commercial power supply operation when an alarm stop occurs in the inverter.
- Using the AU signal, it is possible to use the 4–20mA signal from the sensor controller and the manual signal (voltage) from the speed setting.
- Set Pr.75 to change the reset input signal to an error reset that is only accepted when an inverter alarm stop occurs.
- For safety, install a magnetic contactor on the input side.

Related parameters

Commercial power supply switch-over Pr.135–139
Reset section Pr.75 Terminal function selection Pr.180–195

Notes: 1. Use mechanically interlocked magnetic contactors for MC2 and MC3.
2. Uses the terminal in the case of Pr.185=7 and Pr.186=6.
3. Uses the terminal in the case of Pr.192=17, Pr.193=18 and Pr.194=19.
4. Depends upon control circuit system/wiring.



Connection Examples

■ PID Control

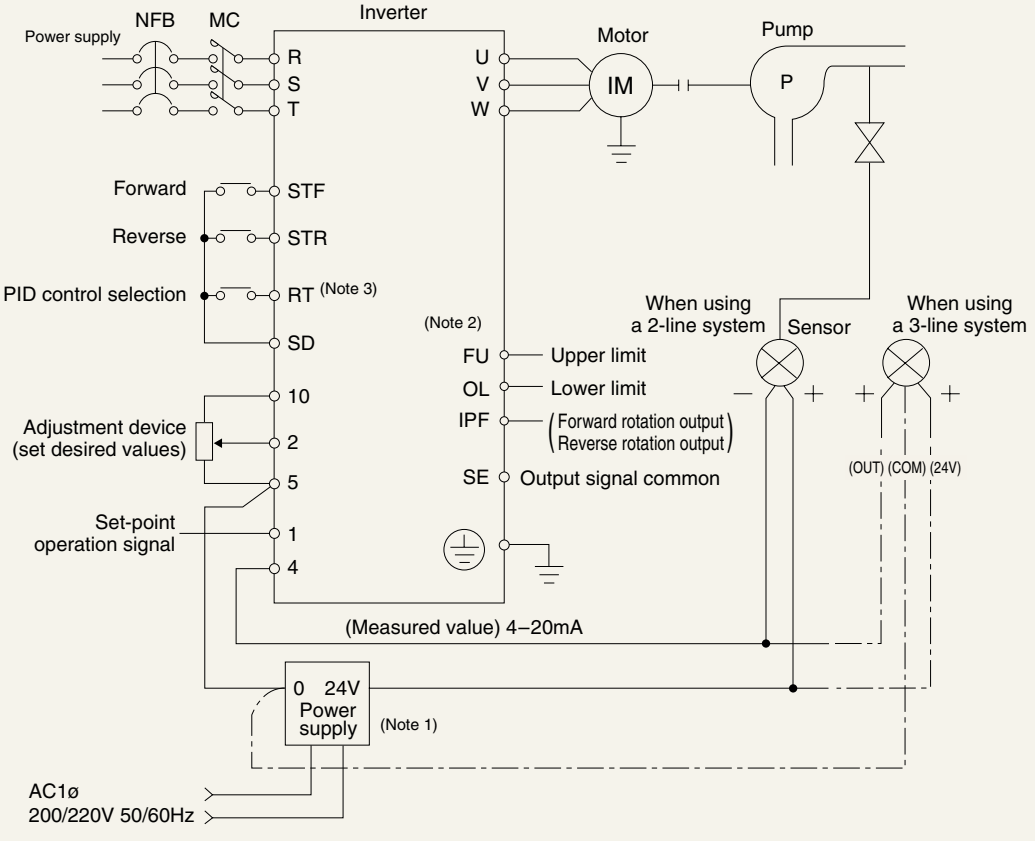
(Process control of flow rate, wind capacity, pressure, etc.)

- PID control operation can be executed in the main body of the inverter by selection of Pr.128.
- For safety purposes, please install a electromagnetic contactor.

Related parameters

PID operation selection Pr.128	Upper/lower limits Pr.131/132
PID proportional band Pr.129	Target value of PID control during PU operation Pr.133
PID integral time Pr.130	PID differential time Pr.134
Input terminal function selection Pr.180–186	Output terminal function selection Pr.190–195

Notes: 1. Please use a power-supply that suits the power use requirements of the detector.
2. The function output from the output signal terminals depends on the values set for Pr.190–Pr.195 (output terminal selection). The example terminals used are in the case of Pr.192=16. Pr.193=14 and Pr.194=15.
3. The input signal terminal changes function depending the values set for Pr.180–Pr.186 (input terminal function selection). The example terminal is used in the case of Pr.183=14.



CC-Link Operation

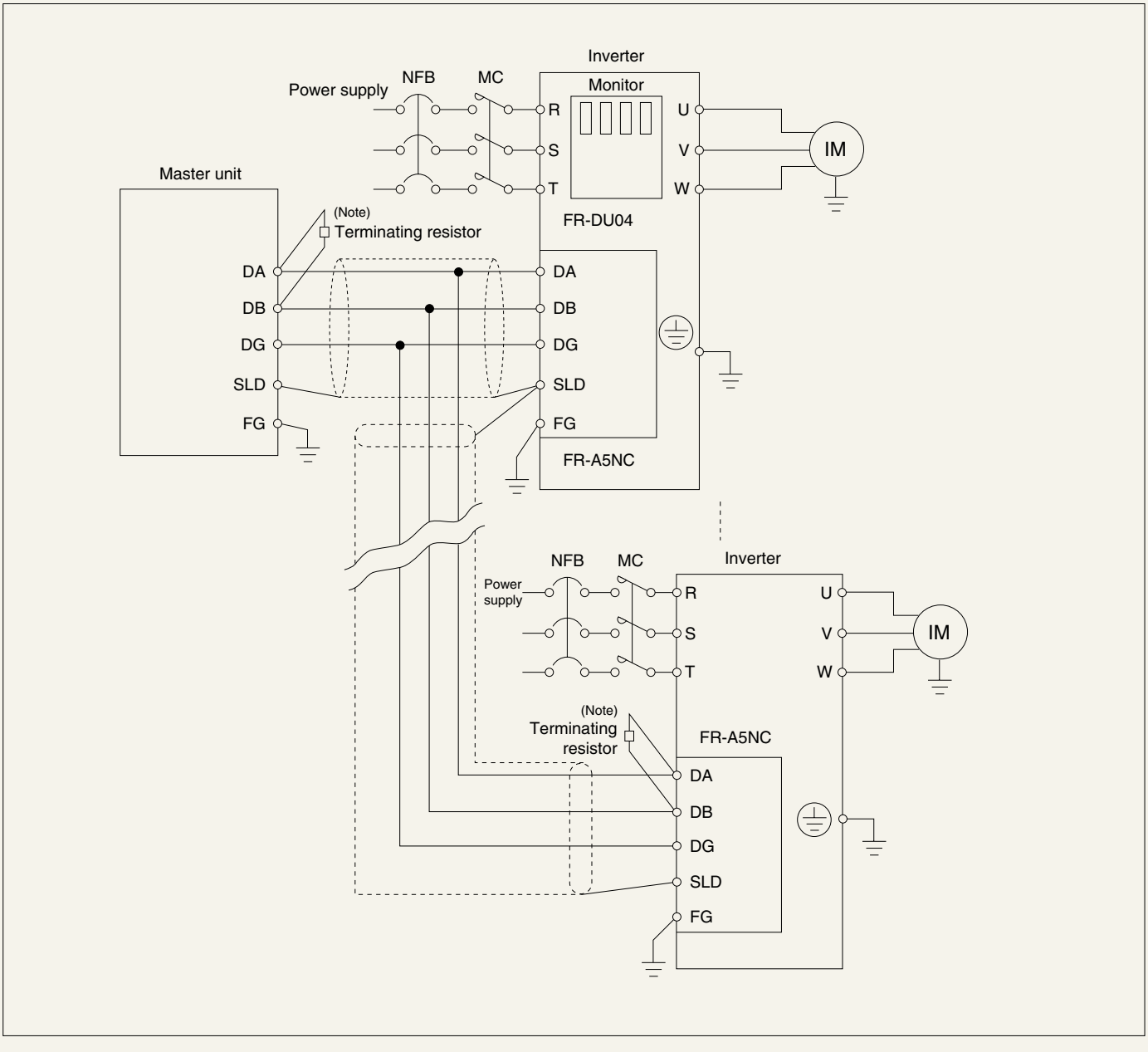
(When linked to a programmable controller)

- CC-Link operation can be executed with the FR-A5NC (optional).
- With one inverter occupying one station, the maximum number of possible connected inverters is 42.
- For safety purposes, please install a electromagnetic contactor for each inverter.

Related parameters

Operation mode selection Pr.79
Link start mode selection Pr.340
Operation command write Pr.338
Speed command write Pr.339

Note: Please use a terminating resistor at the Master controller (Master unit) and the furthest inverter unit.



Peripherals

Selecting Peripherals

Voltage	Motor output (kW)	Applicable inverters	No-fuse breaker (NF) or leakage breaker (NV)		Magnetic contactors (MC)	Lead (mm^2)	
			Standard models	With power factor improvement rector		R, S, T	U, V, W
200V class	0.75	FR-F520-0.75K	Models NF30 and NV30 10A	Models NF30 and NV30 10A	S-N10	2	2
	1.5	FR-F520-1.5K	Models NF30 and NV30 15A	Models NF30 and NV30 15A	S-N10	2	2
	2.2	FR-F520-2.2K	Models NF30 and NV30 20A	Models NF30 and NV30 15A	S-N11, S-N12	2	2
	3.7	FR-F520-3.7K	Models NF30 and NV30 30A	Models NF30 and NV30 30A	S-N20	3.5	3.5
	5.5	FR-F520-5.5K	Models NF50 and NV50 50A	Models NF50 and NV50 40A	S-N25	5.5	5.5
	7.5	FR-F520-7.5K	Models NF100 and NV100 60A	Models NF50 and NV50 50A	S-N30	14	8
	11	FR-F520-11K	Models NF100 and NV100 75A	Models NF100 and NV100 75A	S-N50	14	14
	15	FR-F520-15K	Models NF225 and NV225 125A	Models NF100 and NV100 100A	S-N65	22	22
	18.5	FR-F520-18.5K	Models NF225 and NV225 150A	Models NF225 and NV225 125A	S-N80	30	30
	22	FR-F520-22K	Models NF225 and NV225 175A	Models NF225 and NV225 150A	S-N95	38	30
	30	FR-F520-30K	Models NF225 and NV225 225A	Models NF225 and NV225 175A	S-N125	60	50
	37	FR-F520-37K	Models NF400 and NV400 250A	Models NF225 and NV225 225A	S-N150	80	80
	45	FR-F520-45K	Models NF400 and NV400 300A	Models NF400 and NV400 300A	S-N180	100	80
	55	FR-F520-55K	Models NF400 and NV400 400A	Models NF400 and NV400 350A	S-N220	150	125
400V class	0.75	FR-F540-0.75K	Models NF30 and NV30 5A	Models NF30 and NV30 5A	S-N10	2	2
	1.5	FR-F540-1.5K	Models NF30 and NV30 10A	Models NF30 and NV30 10A	S-N10	2	2
	2.2	FR-F540-2.2K	Models NF30 and NV30 15A	Models NF30 and NV30 10A	S-N20	2	2
	3.7	FR-F540-3.7K	Models NF30 and NV30 20A	Models NF30 and NV30 15A	S-N20	2	2
	5.5	FR-F540-5.5K	Models NF30 and NV30 30A	Models NF30 and NV30 20A	S-N20	3.5	2
	7.5	FR-F540-7.5K	Models NF30 and NV30 30A	Models NF30 and NV30 30A	S-N20	3.5	3.5
	11	FR-F540-11K	Models NF50 and NV50 50A	Models NF50 and NV50 40A	S-N20	5.5	5.5
	15	FR-F540-15K	Models NF100 and NV100 60A	Models NF50 and NV50 50A	S-N25	14	8
	18.5	FR-F540-18.5K	Models NF100 and NV100 75A	Models NF100 and NV100 60A	S-N35	14	8
	22	FR-F540-22K	Models NF100 and NV100 100A	Models NF100 and NV100 75A	S-N50	22	14
	30	FR-F540-30K	Models NF225 and NV225 125A	Models NF100 and NV100 100A	S-N65	22	22
	37	FR-F540-37K	Models NF225 and NV225 150A	Models NF225 and NV225 125A	S-N80	38	22
	45	FR-F540-45K	Models NF225 and NV225 175A	Models NF225 and NV225 150A	S-N80	38	38
	55	FR-F540-55K	Models NF225 and NV225 200A	Models NF225 and NV225 175A	S-N125	60	60

Notes: 1. The lead size shown is for a wiring length of 20m.
2. When the inverter capacity exceeds the motor capacity, select the breaker and magnetic contactor appropriate for the inverter model and select the lead and reactor for improving the power factor appropriate for the motor model.

Low-Voltage Standards

(1) General-purpose inverters can be used for low-voltage standards.
(2) Caution: When using DIN VDE0160, some specifications and cautions differ from the standard, as described in the table below.

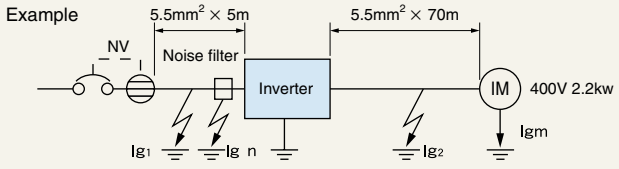
Specification	Changes and cautions	Comments
Error output	Contactor (DC 30V, 0.3A)	–
Ground	Securely ground equipment and use single wires for ground terminals.	–
Magnetic contactor, no-fuse breaker	Use products that conform to EN or IEC standards.	The magnetic contactors and no-fuse breakers on the peripherals list conform to IEC standards.
Input insulation transformer surge absorber	Use products that conform to EN or IEC standards for the inverter inputs.	Standard IEC664
Line type and lead size	The inverter connection lead should conform to EN60204.	Standard EN60204, appendix C
Power voltage (400V class)	3-phase 380–415V 50/60Hz	–

Selecting the Rated Sensitivity Current of the Leakage Breaker

If you are using a leakage breaker in the inverter circuit, use the following criteria to select a rated sensitivity current.

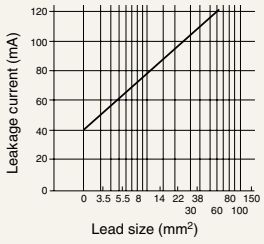
- For the Progressive Super NV Series (models SP, CF, SF and CP):
  Rated sensitivity current I $\Delta n \geqq 10 \times (Ig_2+Ign+Ig_2+Igm)$
- For the conventional NV series (models CA, CS, and SS):
  Rated sensitivity current I $\Delta n \geqq 10\{Ig_1+Ign+3\times(Ig_2+Igm)\}$

Ig_1, Ig_2: Leakage current when operating with a cable run off a commercial power supply.
Ign*: Leakage current of noise filter on inverter input side.
Igm: Leakage current when operating a motor off a with commercial power supply.

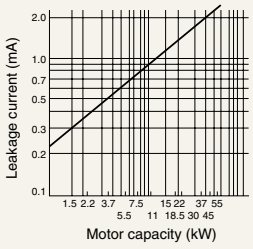


Notes: 1. Install the NV on the primary side of the inverter the (power supply side).
2. If you are using the Y connection neutral point grounding method, the sensitivity current of the grounding at the inverter's secondary side will increase, so use a class D ground (10Ω or less) for the protection ground of the equipment under load.
* Consult the filter manufacturer for the leakage current value of the noise filter installed at the inverter input side. (See pages 33, 34 for the Mitsubishi inverter filters.)

● If the CV cable is metallic wire, the example is of current leakage per 1km when operating with a commercial power-supply. (3-phase, 3-line system, 400V/60Hz Δ connection)



● Example of leakage currents for operating a 3-phase induction motor off a commercial power supply (Fully enclosed 400V/60Hz fan-cooled motor).



In the case of ⅄ connection, approximately 1/3 of the above.

● Examples of Selections
(In the case of a 3-phase, 3-line system ⅄ connection like that shown in the figure to the left.)

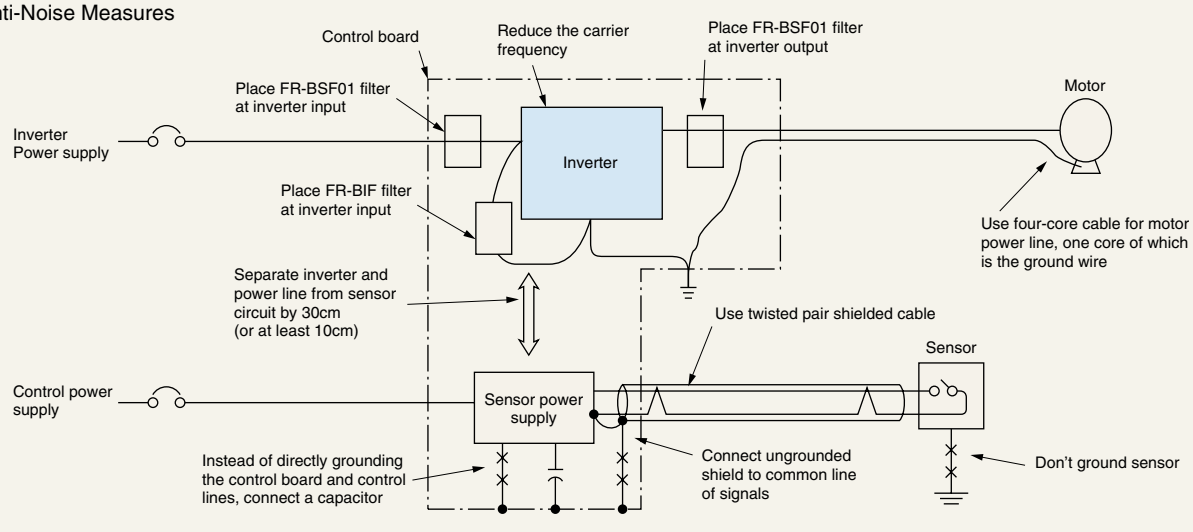
		Progressive Super NV Series	Conventional NV
Leakage current	(Ig_1)	$\frac{1}{3}\times 66\times\frac{5m}{1000m}=0.11$	
Leakage current	(Ign)	0 (without noise filter)	
Leakage current	(Ig_2)	$\frac{1}{3}\times 66\times\frac{70m}{1000m}=0.54$	
Motor leakage current	(Igm)	0.36	
Total leakage current		2.01	5.81
Rated sensitivity current	(≧Ig×10)	30	100

Noise

When making operation quieter by raising the carrier frequency, electromagnetic noise tends to increase, so measures should be taken to reduce it along the lines outlined below. Note that in some installations, noise can be a factor even without the low noise settings (i.e., at default settings).

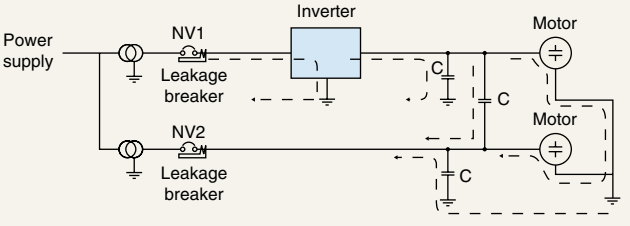
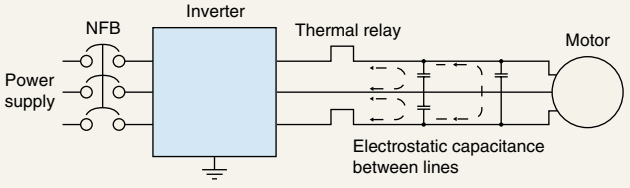
- Noise levels can be reduced by decreasing the Pr.72 setting for the carrier frequency.
- An FR-BIF radio noise filter can be effective against AM radio broadcast noise.
- The FR-BSF01 and FR-BLF line noise filter can be effective against malfunctioning of sensors.
- Inductive noise in the inverter's cable runs can be reduced by separating them 30cm (or at least 10cm) and using twisted pair shielded cable. The shielded cable should not be grounded; instead, connect them to one point on the common side of the signals.

Anti-Noise Measures



Leakage Current

There are electrostatic capacitances between the inverter's input/output wiring and other wires and the earth and in the motor. Leakage current flows through these. Since their values are affected by the static caapcitances and carrier frequencies, leakage current increases when operation is made quieter by increasing the inverter's carrier frequency. This can be improved by the following measures. Also, when selecting a leakage breaker, follow the advice on page 30, regardless of the carrier frequency.

Type	Effect and Response	Leakage current paths
Leakage current to earth	● The leakage current between the inverter input and output lines and the earth flows not just to the inverter system but also to other systems through the ground wires. ● Leakage breakers and relays may trip unnecessarily. **Response** ● Lower the inverter's carrier frequency (Pr. 72). Motor noise will increase, but the noise can be made more pleasant by selecting Soft-PWM control (Pr. 240). ● Use of anti-harmonic and anti-surge components (such as Mitsubishi's New Super NV Series) in the leakage breakers of the inverter system and other systems can allow use of the low noise configuration (with the raised carrier frequency).	
Leakage current between wires	● Leakage current flows through the electrostatic capacitance between inverter output lines. ● Externally connected thermal relays can be tripped unnecessarily by harmonics of leakage currents. **Response** ● Use the built-in electronic thermal protection in the inverter. ● Lower the inverter's carrier frequency (Pr.72). Motor noise will increase, but the noise can be made more pleasant by selecting Soft-PWM control (Pr. 240).	

List of Options

General Options

Name		Type	Application, specifications, etc.	Applicable inverter
Built-in options (Note 4)	12-bit digital input	FR-A5AX	A digital signal of BCD or binary code can be used for setting the inverter's frequency.	Common to all units
	Digital output	FR-A5AY	Outputs the inverter main unit's standard output signal at the open collector.	
	Expansion analog output		Outputs signals such as output frequency, output voltage, output current in analog form.	
	Relay output	FR-A5AR	Outputs the inverter main unit's standard output signal at the relay contact.	
	Computer link	FR-A5NR	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	Common to all units (Available soon)
	Profibus DP	FR-A5NP	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	
	DeviceNet™	FR-A5ND	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	
	CC-Link	FR-A5NC	Allows changes in inverter operations, monitoring and parameters to be executed from a PLC.	
	Modbus Plus	FR-A5NM	Allows changes in inverter operations, monitoring and parameters to be executed from a computer or PLC.	
Standalone, common	Parameter unit (8 languages)	FR-PU04	Interactive parameter unit with LCD.	Common to all units
	Parameter unit connector cable	FR-CB2□□ (Note 2)	Cable for connecting control panel or parameter unit.	
	Cooling fan external installation attachment	FR-A5CN□□ (Note 2)	Allows inverter's heat generating parts to be installed externally at the back of the unit.	For inverter capacities 1.5K–55K
	IP40 attachment	FR-A5CV□□ (Note 2)	Allows inverter's to meet IP40 specifications.	For inverter capacities 0.75K–22K
	Conduit connection attachment	FR-A5FN□□ (Note 2)	Allows direct connection of conduits. IP20 compliance possible.	For inverter capacities 30K–55K
	Mounting adaptor attachment	FR-A5AT□□ (Note 2)	Plate to allow mounting using same dimensions as FR-A200E models.	For inverter capacities 0.75K–22K, 55K
	Noise filter (compliant with EMC directive)	SF□□ (Note 2)	Noise filter (compliant with EMC directives) (EN50081-2)	For inverter capacities 0.75K–55K (Note 5)
	Surge voltage suppression filter	FR-ASF-H□□ (Note 3)	Filter for suppressing micro-surge voltage at inverter's output side.	For inverter capacities 0.75K–55K
	Power factor improvement DC reactor	FR-BEL(H)□□ (Note 1, 3)	For inverter input power factor improvement (overall power factor approx. 95%) and power supply balancing.	For inverter capacities 0.75K–55K
	Power factor improvement AC reactor	FR-BAL-(H)□□ (Note 1, 3)	For inverter input power factor improvement (overall power factor approx. 90%) and power supply balancing.	For inverter capacities 0.75K–55K
	Radio noise filter	FR-BIF-(H)□□ (Note 1, 3)	For suppressing radio noise.	Common to all units
	Line noise filter	FR-BSF01	For suppressing line noise (for small capacities of 3.7kW or less).	
		FR-BLF	For suppressing line noise.	
	FR-BU type brake unit	BU-1500–15K, H7.5K–H30K	For use in boosting inverter's braking capacity. (For high inertial loads or negative loads.)	Depends on capacity
	Brake unit	FR-BU-15K–55K, H15K–55K	For use in boosting inverter's braking capacity. (For high inertial loads or negative loads.) Used in combination with resistor units.	
	Resistor unit	FR-BR-15K–55K, H15K–55K		
	Power regeneration converter	FR-RC-15K–55K, H15K–H55K	High performance brake unit capable of regenerating braking energy generated by motor.	
	High-power factor converter	FR-HC7.5K–55K, H7.5K–H55K	Greatly suppresses high frequencies by improving input current waveforms into sine waves by switching converter. (Used in conjunction with standard accessories) Power regeneration also possible.	

Notes:
1. Units in the 400V class are designed by an "H" in the model name.
2. □□ indicates number value.
3. □□ indicates capacity.
4. A total of 3 built-in options can be mounted at the same. (Only one unit of each option type and only one communication option.)
5. 400V class only.

List of Options

Standalone Options

Units: mm (inch)

FR-A5CN □□
Attachment for external mounting of cooling fin

- Use of this attachment increases the mounting space by the size of the attachment. Therefore, when using this attachment, refer to the dimensions (page 9) that include the attachment.
- Refer to page 8 for the dimensions of the panel cut.

Model	Applicable inverter		Model	Applicable inverter	
	200V class	400V class		200V class	400V class
FR-A5CN01	FR-F520-1.5K–3.7K	FR-F540-1.5K–3.7K	FR-A5CN05	FR-F520-37K	FR-F540-30K–37K
FR-A5CN02	FR-F520-5.5K/7.5K	FR-F540-5.5K/7.5K	FR-A5CN06	FR-F520-45K	FR-F540-45K–55K
FR-A5CN03	FR-F520-11K	FR-F540-11K	FR-A5CN07	FR-F520-55K	—
FR-A5CN04	FR-F520-15K–22K	FR-F540-15K–22K	FR-A5CN08	FR-F520-30K	—

FR-A5CV □□
Attachment for IP40

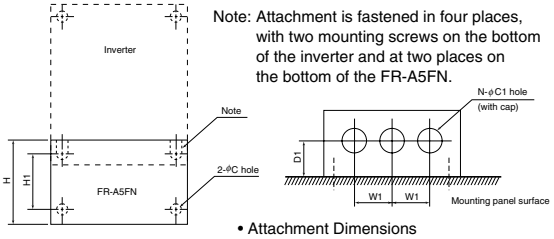
- The inverter can be converted to IP40 specification by mounting this attachment on the inverter's top/bottom or left/right slits.
- This attachment is suited for wall mounting. (The IP40 [JEM1030]: The attachment is constructed so that wires larger than 1 mm in diameter or drive belts thicker than 1 mm do not project into the inverter.)

Notes
1: This attachment is not constructed to be impervious to water or other liquids, and therefore is not suited to environments with lots of dripping water, soot etc.
2: When using this attachment, the inverter's allowable ambient temperature is –10° to 40°C.

Model	Applicable inverter	
	200V class	400V class
FR-A5CV01	FR-F520-0.75K–7.5K	FR-F540-0.75K–11K
FR-A5CV02	FR-F520-11K–22K	FR-F540-15K–22K

FR-A5FN □□
Attachment for conduit connection

- This attachment is for connecting a conduit directly to the inverter. It is mounted on the bottom of the inverter.
- 30K–55K (200V–400V) inverters can be brought up to IP20 specifications by mounting this attachment. (Standard is IP00)



Note: Attachment is fastened in four places, with two mounting screws on the bottom of the inverter and at two places on the bottom of the FR-A5FN.

Model	Applicable inverter	
	200V class	400V class
FR-A5FN01	FR-F520-37K	FR-F540-30K–3.7K
FR-A5FN02	FR-F520-45K	FR-F540-45K–55K
FR-A5FN03	FR-F520-55K	—
FR-A5FN04	FR-F520-30K	—

• Attachment Dimensions

Units: mm (inch)

Model	H	W1	H1	D1	N	C	C1
FR-A5FN01	157.5 (6.20)	95 (3.74)	102.5 (4.04)	125 (4.92)	3	10 (0.39)	76 (2.99)
FR-A5FN02	297.5 (11.71)	113 (4.45)	227.5 (8.96)	120 (4.72)	3	12 (0.40)	91 (3.58)
FR-A5FN03	297.5 (11.71)	113 (4.45)	227.5 (8.96)	120 (4.72)	4	12 (0.40)	91 (3.58)
FR-A5FN04	190 (7.48)	95 (3.74)	165 (6.50)	128 (5.04)	3	10 (0.39)	76 (2.30)

FR-A5AT □□
FR-AAT □□
FREQROL-A100 <EXCELLENT>/ FREQROL-F400 Series mount transportation attachment

- With this attachment, using the mounting points for the pervious machine, the FREQROL-A100<EXCELLENT>/FREQROL-F400 Series can be mounted as is. Since the 15K–18.5K, 30K and 45K, 400V class models of the FREQROL-A100 <EXCELLENT> have the same mounting configuration, there is no need for exchanging attachments. When an attachment is used, the longitudinal is 6mm larger against the 37K, 400V class FREQROL-A100 <EXCELLENT>.

Notes
1: When the attachment is used, the overall depth of the inverter when mounted is approximately 12–15mm higher.
2: The FR-AAT09 attachment is 6mm larger longitudinally against the 37K, 400V class FREQROL-A100 <EXCELLENT>.

FREQROL-A100 <EXCELLENT>

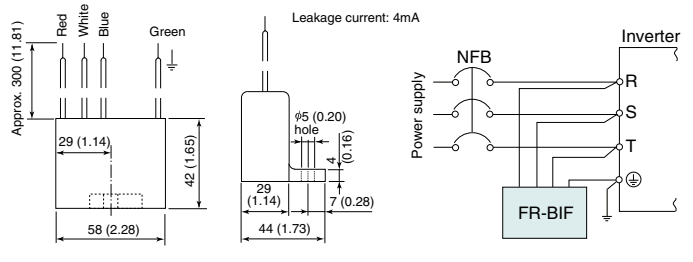
Model	Applicable inverter	
	200V class	400V class
FR-A5AT01	FR-F520-0.75K	—
FR-A5AT02	FR-F520-1.5K–3.7K	FR-F540-0.75K–3.7K
FR-A5AT03	FR-F520-5.5K–7.5K	FR-F540-5.5K–11K
FR-A5AT04	FR-F520-22K	FR-F540-22K
FR-A5AT05	—	FR-F540-55K
FR-AAT09	—	FR-F540-37K

FREQROL-F400

Model	Applicable inverter	
	200V class	400V class
FR-AAT01	FR-F520-2.2K–3.7K	FR-F540-2.2K–3.7K/7.5K
FR-AAT02	FR-F520-5.5K–11K	FR-F540-0.75K–3.7K
FR-AAT03	FR-F520-15K	—
FR-AAT04	FR-F520-22K	FR-F540-15K/22K
FR-AAT05	FR-F520-30K	—
FR-AAT06	FR-F520-37K	FR-F540-37K
FR-AAT07	FR-F520-45K–55K	FR-F540-55K

Radio noise filter
FR-BIF····· 200V class
FR-BIF-H····· 400V class

Units: mm (inch)



Notes:
1. Cannot be connected to inverter's output side.
2. Cut wiring as short as possible and connect with inverter's terminal block.

Units: mm (inch)

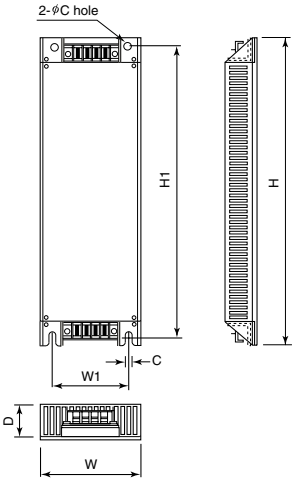
Name (Type)	Specifications, configurations, etc.

Noise filter (compliant with EMC Directives) SF☐☐

Compliant with European EMC Directives

External dimensions

	Noise filter model	Applicable inverter model	Noise filter external dimensions W	H	D	W1	H1	C	Approximate weight kg (lb)	Loss (W)	Leakage current reference value (mA)
400V	SF1197	FR-F540-0.75K–3.7K	114 (4.49)	360 (14.17)	47.5 (1.87)	117 (4.61)	340 (13.39)	6 (0.24)	1.5 (3.3)	10	57
	SF1147B	FR-F540-5.5K/7.5K	213 (8.39)	360 (14.17)	38 (1.50)	180 (7.09)	340 (13.39)	6 (0.24)	1.8 (3.97)	51	51
	SF1175	FR-F540-11K/15K	253 (9.96)	530 (20.87)	60 (2.36)	220 (8.66)	505 (19.88)	10 (0.39)	4.7 (10.4)	56	76
	SF1176	FR-F540-18.5K/22K	303 (11.93)	600 (23.62)	60 (2.36)	260 (10.24)	575 (22.64)	10 (0.39)	5.9 (13.0)	71	108
	SF1177	FR-F540-30K	327 (12.87)	700 (27.56)	80 (3.15)	280 (11.02)	675 (26.57)	10 (0.39)	9.4 (20.7)	65	156
	SF1178	FR-F540-37K/45K	450 (17.72)	770 (30.31)	80 (3.15)	384 (15.12)	735 (28.94)	12 (0.47)	16 (35.3)	74	156
	SF1179	FR-F540-55K	467 (18.39)	920 (36.22)	80 (3.15)	410 (16.14)	895 (35.24)	12 (0.47)	19 (41.9)	125	156



Note:
With some exceptions, the mounting adapter attachment (FR-A5AT ☐☐) is necessary.
When the adapter is used, the installation dimensions change as a result of an increase in depth.

Measures to deal with leakage current

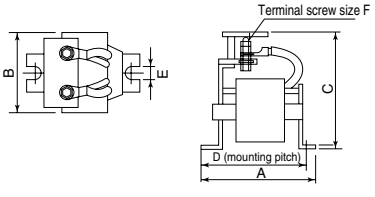
Please take the following steps to prevent erroneous operation of peripherals and electric shocks caused by leakage current:

1. Ground the noise filter before connecting to the power supply. In this case, please confirm that it is properly grounded to earth via the panel's ground.
2. Please note, the noise filter's leakage current when selecting earth leakage breakers or earth leakage relays. Also, in cases where earth leakage breakers or earth leakage relays cannot be used because the leakage current of a large-capacity noise filter is too large, ensure that the grounding measures referred to in 1. are properly taken.

Power factor improvement DC reactor (for power supply balancing) FR-BEL(H) ☐☐K

Model	FR-BEL A	B	C	D	E	F	Weight kg (lb)	FR-BEL-H A	B	C	D	E	F	Weight kg (lb)
0.75K	120 (4.72)	53 (2.09)	102 (4.02)	105 (4.13)	6 (0.24)	M4	0.7 (1.5)	110 (4.33)	54 (2.13)	85 (3.35)	95 (3.74)	6 (0.24)	M3.5	0.7 (1.54)
1.5K	130 (5.12)	65 (2.56)	110 (4.33)	115 (4.53)	6 (0.24)	M4	1.1 (2.4)	130 (5.12)	63 (2.48)	89 (3.50)	115 (4.53)	6 (0.24)	M3.5	0.9 (2.0)
2.2K	130 (5.12)	65 (2.56)	110 (4.33)	115 (4.53)	6 (0.24)	M4	1.2 (2.6)	130 (5.12)	63 (2.48)	101 (3.98)	115 (4.53)	6 (0.24)	M3.5	1.1 (2.4)
3.7K	150 (5.91)	75 (2.95)	102 (4.02)	135 (5.31)	6 (0.24)	M4	1.7 (3.7)	150 (5.91)	75 (2.95)	102 (4.02)	135 (5.31)	6 (0.24)	M4	1.7 (3.7)
5.5K	150 (5.91)	75 (2.95)	126 (4.96)	135 (5.31)	6 (0.24)	M5	2.2 (4.9)	150 (5.91)	75 (2.95)	124 (4.88)	135 (5.31)	6 (0.24)	M4	2.2 (4.9)
7.5K	150 (5.91)	75 (2.95)	126 (4.96)	135 (5.31)	6 (0.24)	M5	2.3 (5.1)	150 (5.91)	75 (2.95)	124 (4.88)	135 (5.31)	6 (0.24)	M4	2.3 (5.1)
11K	170 (6.70)	93 (3.66)	132 (5.20)	155 (6.10)	6 (0.24)	M5	3.1 (6.8)	170 (6.69)	93 (3.66)	132 (5.20)	155 (6.10)	6 (0.24)	M5	3.1 (6.8)
15K	170 (6.70)	93 (3.66)	170 (6.69)	155 (6.10)	6 (0.24)	M8	3.8 (8.4)	170 (6.69)	93 (3.66)	160 (6.30)	155 (6.10)	6 (0.24)	M6	3.7 (8.2)
18.5K	185 (7.28)	94 (3.70)	184 (7.24)	165 (6.50)	7 (0.28)	M8	5.1 (11.2)	185 (7.28)	94 (3.70)	173 (6.81)	165 (6.50)	7 (0.28)	M6	4.8 (10.6)
22K	185 (7.28)	119 (4.69)	182 (7.17)	165 (6.50)	7 (0.28)	M8	5.4 (11.9)	185 (7.28)	119 (4.69)	171 (6.73)	165 (6.50)	7 (0.28)	M6	5.0 (11.0)
30K	185 (7.28)	119 (4.69)	201 (7.91)	165 (6.50)	7 (0.28)	M8	6.7 (14.8)	185 (7.28)	119 (4.69)	189 (7.44)	165 (6.50)	7 (0.28)	M6	6.7 (14.8)
37K	195 (7.68)	136 (5.35)	215 (8.46)	175 (6.89)	7 (0.28)	M10	7.4 (16.3)	195 (7.68)	136 (5.35)	199 (7.83)	175 (6.89)	7 (0.28)	M8	7.0 (15.4)
45K	195 (7.68)	136 (5.35)	215 (8.46)	175 (6.89)	7 (0.28)	M10	8.0 (17.6)	195 (7.68)	138 (5.43)	219 (8.62)	175 (6.89)	9 (0.35)	M8	8.6 (19.0)
55K	195 (7.68)	136 (5.35)	146 (5.75)	175 (6.89)	9 (0.35)	M12	9.8 (21.6)	195 (7.68)	138 (5.43)	219 (8.62)	175 (6.89)	9 (0.35)	M8	9.0 (19.8)

Notes:
1. Be sure to remove the short bar between inverter terminals P and P1 (unless the short bar is removed, there is no power factor improvement).
2. The wiring distance between the inverter and the reactor should be less than 5m.
3. The size of the wire used should be the same or greater than the power supply wire (R,S,T).
4. Select according to motor capacity. (Where the capacity of the inverter is greater than that of the motor, match the capacity with that of the motor.)

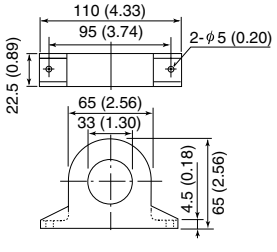


Power factor improvement AC reactor (for power supply balancing) FR-BAL(H) ☐☐K

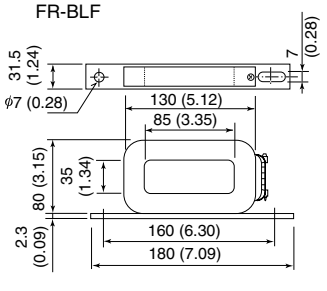
All models of the FREQROL-F500 Series can be mounted with a FR-BEL DC reactor by connecting to terminals (P, P1). Compared to the AC reactor, the FR-BEL DC reactor has an improved, higher power ratio while being more compact, weighing less and having fewer wiring points (6 lines for the AC reactor, 2 lines for the DC reactor). Accordingly, we recommend using the FR-BEL DC reactor. Please contact your Mitsubishi Electric inverter distributor if you require the FR-BAL AC reactor.

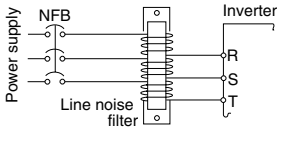
Line noise filter FR-BSF01 (for small capacities) FR-BLF

FR-BSF01



FR-BLF





Notes:
1. Each phase should be wound at least 3 times (4T, 4 turns) in the same direction. (The greater the number of turns, the more efficient.)
2. When the thickness of the wire prevents winding, use at least 4 in series and ensure that the current passes through each phase in the same direction.
3. Can be used on the output side in the same way as the input side. On the output side, the number of turns should be less than 3 (4T, 4 turns).
4. Please use FR-BSF01 for inverters with small capacities of 3.7kW or less. Thick wires (38mm² or more) cannot be used. In such cases, use FR-BLF.

List of Options

FR-HC High-power Factor Converters

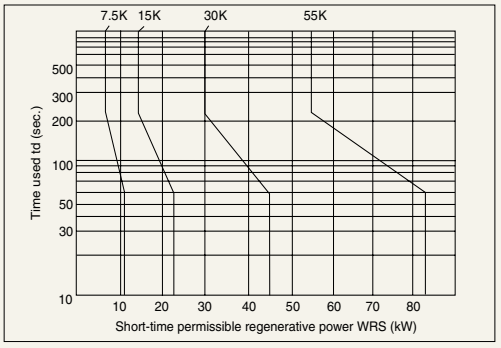
- Used for suppressing the high frequencies of the inverter's power supply, it achieves an equivalent capacity conversion coefficient of K5=0 under the "Japanese Harmonics Suppression Countermeasure Guidelines for Specific Customers."
- Improves input current waves into sine waves.
- Reduces input capacity by improving input power factor.
- Power source regenerative functions included as standard.
- Integrated converter operation with multiple connection to inverters possible.

Specifications

Model FR-HC-□□		200V				400V			
		7.5K	15K	30K	55K	H7.5K	H15K	H30K	H55K
Applicable inverter capacity (Note 1)		3.7K–7.5K	7.5K–15K	15K–30K	30K–55K	3.7K–7.5K	7.5K–15K	15K–30K	30K–55K
Rated input voltage/frequency		3-phase 200V–220V 50Hz 200V–230V 60Hz				3-phase 380V–460V 50/60Hz			
Rated input current		33	61	115	215	17	31	57	110
Rated output voltage (V) (Note 2)		DC 293V–335V				DC 558V–670V			
Approximate weight kg (lb)	Unit kg (lb)	8 (17.6)	15 (33.1)	29 (63.9)	70 (154.3)	9 (19.8)	16 (35.3)	35 (77.2)	72 (158.7)
	Accessory components (reactors 1, 2, external box) total kg (lb)	21 (46.3)	31 (68.3)	67 (147.7)	97 (213.8)	23 (50.7)	32 (70.5)	52 (114.6)	94 (207.2)

Notes:
1. With regard to the applicable inverter for the high-power factor converter, the applicable capacity is the total capacity.
2. The output voltage changes according to the input voltage value.

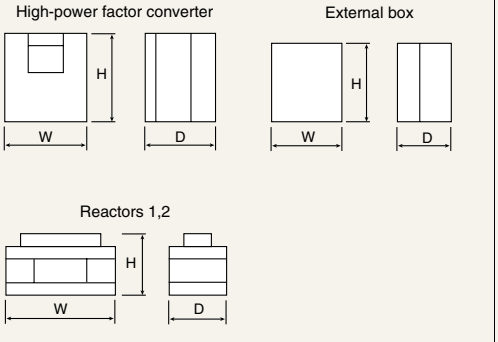
Regenerative Power Capacity



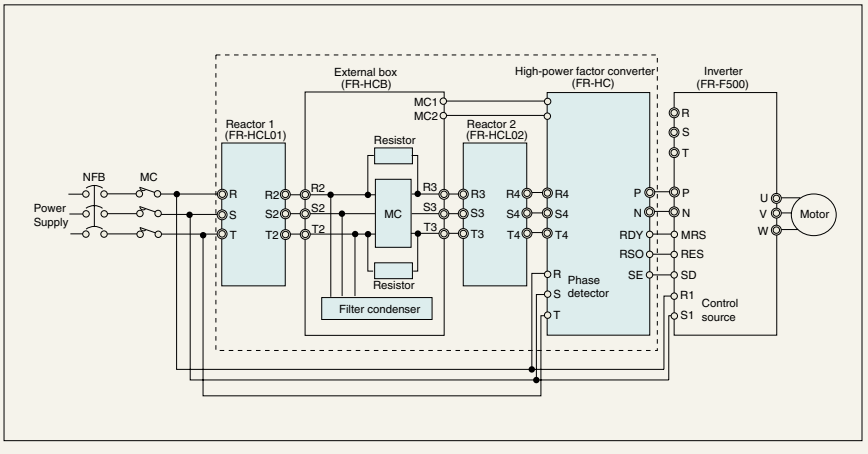
External Dimensions

Units: mm (inch)

Voltage	Capacity	FR-HC converter			Reactor 1 FR-HCL01			Reactor 2 FR-HCL02			External box FR-HCB		
		W	H	D	W	H	D	W	H	D	W	H	D
200V	7.5K	220 (8.66)	300 (11.81)	190 (7.48)	160 (6.30)	155 (6.10)	100 (3.94)	240 (9.45)	230 (9.06)	160 (6.30)	190 (7.48)	320 (12.60)	165 (6.50)
	15K	250 (9.84)	400 (15.75)	190 (7.48)	190 (7.48)	205 (8.07)	130 (5.12)	260 (10.24)	270 (10.63)	170 (6.69)			
	30K	340 (13.39)	550 (21.66)	195 (7.68)	200 (7.87)	230 (9.05)	170 (6.69)	340 (13.39)	320 (12.60)	180 (7.09)	270 (10.63)	450 (17.72)	203 (7.99)
	55K	480 (18.90)	700 (27.56)	250 (9.84)	210 (8.27)	260 (10.24)	210 (8.27)	430 (16.93)	370 (14.57)	360 (14.17)			
400V	H7.5K	220 (8.66)	300 (11.81)	190 (7.48)	160 (6.30)	150 (5.91)	100 (3.94)	240 (9.45)	220 (8.66)	160 (6.30)	190 (7.48)	320 (12.60)	165 (6.50)
	H15K	250 (9.84)	400 (15.75)	190 (7.48)	190 (7.48)	195 (7.68)	130 (5.12)	260 (10.24)	260 (10.24)	170 (6.69)			
	H30K	340 (13.39)	550 (21.65)	195 (7.68)	220 (8.66)	215 (8.46)	140 (5.51)	340 (13.39)	310 (12.20)	180 (7.09)			
	H55K	480 (18.90)	700 (27.56)	250 (9.84)	280 (11.02)	255 (10.04)	190 (7.48)	400 (15.75)	380 (14.96)	285 (11.22)	270 (10.63)	450 (17.72)	203 (7.99)



External Dimensions



Notes:
1. Be sure to open inverter power input terminals R, S and T. If they are incorrectly connected, the inverter will be damaged. Also, if the polarity of terminals P and N are mistaken, the high-power factor converter and the inverter will be damaged.
2. The wiring of terminals R4, S4, T4 and terminals R, S and T must match the power supply phase shift.
3. Be sure to confirm the order in which reactor 1 and reactor 2 are connected. The reactors will overheat if connection mistakes are made.

Motor Applications

Standard Motor Application

Motor Loss and Temperature Rise

The temperature of a motor will run a little hotter with an inverter than when operating with a commercial power supply; therefore, there is a limitation for continuous operating torque. Additionally, as the cooling effect is reduced at low-speed, please reduce the motor output torque accordingly. If 100% torque is required during low-speed operation, please consider the use of a constant torque motor.

Torque Characteristics

There may be an occasion when motor torque is lacking (especially starting torque) when operating a motor with an inverter as compared to operation when using a commercial power supply. Please be sure to check the load torque characteristics of the machinery being used.

Vibration

Compared to the drive vibration when using a commercial power supply, the vibration of the motor mounted on the machine may be slightly larger. The occurrence of vibration, if present, could be caused by one of the following.

1. Vibration due to unbalanced rotational body of the entire machine.
2. Natural frequency resonance of the machinery, especially in the case of a constant-speed machine being operated at variable speeds. Using the frequency jump function operation, bypassing the resonance frequency is possible. Additionally, abnormal vibration may occur if operating a bipolar motor at speeds more than 60Hz. Please check operation specifications closely.

400V Class Motor Inverter Drive

When driving a 400V class motor with an inverter, surge voltage originating from the wiring constant may affect the motor terminal and degrade motor insulation. If this should happen, please consider the following countermeasures.

(1) Strengthen motor insulation

1. Please use a motor with reinforced insulation for 400V class inverter operation.
   Note: Mitsubishi standard 4-pole motors (SF-JR, SB-JR) reinforced insulation specifications match 400V class inverter drive requirements. (0.75–55kW produced and available since August 1997)
2. For special motors such as constant-torque motors and low-vibration motors, please specify special motor which is designed for inverter use.

(2) Confine surge voltage to inverter side

Please connect a filter to the secondary side of the inverter so as to restrain motor terminal voltage to less than 850V. If the motor is driven using a Mitsubishi inverter, connect an optional surge voltage suppression filter (FR-ASF-H) to the secondary side of the inverter.

Application of Special Motors

Motors with a Variable Numbers of Poles

When the number of motor poles is convertible, the rated current will differ from a standard motor, so check the motor's maximum current when selecting an inverter. Be sure to stop the motor before switching the number of poles. Switching on the fly will engage the regenerative overvoltage protection circuit, trigger the inverter alarm, and send the motor into a coasting stop.

Geared Motors

The ranges for continuous operation vary with both the lubrication system used and the manufacturer. Oil lubricated motors are particularly prone to burning of gears when operated exclusively at low speeds. Consult the manufacturer before operating motors at speeds in excess of 60Hz.

Low-Voltage Motors

Please set the inverter torque boost (Pr.0) to approximately 1–2%.

Synchronous Motors

Applications that involve load fluctuations and high impacts can easily put a motor out of synchronization, so these are not suitable applications. They have higher starting currents and rated currents than standard motors and do not maintain stable speeds at low speeds, please take these factors into consideration.

Constant-Torque Motor Application

- As the current is higher than a standard motor, the inverter type should be raised one rank.
- Please set the torque boost at a small figure.
  Recommended values:
  0.75kW, 6%; 1.5–3.7kW, 4%; more than 5.5kW, 2%
- If more than two machines are operating simultaneously, synchronized operation as the motor slip is smaller when compared to standard motors; thus, unbalanced torque can occur easily.

Points to Note when Using and Selecting Units

For Maximum Safety

⚠ Please use to ensure safety

- In order to use the equipment properly and safely, please be sure to read the manual before use.
- This product was not designed or manufactured as equipment or a system to be used in situations that can affect or endanger human life.
- When considering this equipment for operations in special machinery or systems used in passenger-moving applications, medical applications, aerospace applications, atomic power applications, electric power applications, or submarine repeating applications, please contact Mitsubishi Electric Corporation's sales department.
- Although this product was manufactured under conditions of strict quality control, you are strongly advised to install safety devices when it is used in facilities where a breakdown in the product is likely to cause a serious accident or loss.
- Please do not use loads other than 3-phase induction motors.

Operation

- To avoid damage to the inverter when an electromagnetic contactor (MC) is installed on the primary side, please do not subject the MC to repeated start/stop operations.
- When a fault occurs in the inverter, the protective function activates and halts inverter output, but does not suddenly stop the motor itself. For this reason, please install the mechanical stopping and holding mechanisms necessary as mechanical equipment for emergency stops.
- Even if the inverter's power supply is cut off, it takes time for the capacitor to discharge. When carrying out inspections, wait for at least 10 minutes after the power supply has been cut off, then use a meter, etc., to confirm the voltage.

Wiring

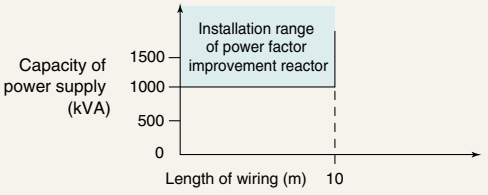
- The inverter will be damaged if electric power is applied to the inverter's output terminals (U, V, W). Before switching on the power, please check wiring and sequence very carefully to ensure there are no wiring connection errors.
- Terminals P, P1 and N are designed for use in connecting specially designed, dedicated options. Do not connect equipment other than dedicated options to these terminals. Also, please do not create a short circuit between power terminal 10, which is used for setting frequency, and common terminal 5.
- The PR and PX terminals are special manufacturer terminals, please do not connect any wiring to them.

Installation

- Please install the unit in a clean location, avoiding adverse environments such as oil mist, fluff, dust, etc., or use it within a sealed enclosure which will not allow the entry of floating particles. In the latter case, please ensure that the cooling system and dimensions allow the inverter's ambient temperature to remain within the permissible values (see page 4 for specification values). The enclosure can be made more compact if the FR-A5CN option is used for isolating the inverter's heat generating parts outside the enclosure is used.
- Since certain parts of the inverter can get extremely hot, do not attach it to combustible material.
- The unit should be attached to the wall, vertically.

Power Supply

- In cases where the unit is installed directly below a large-capacity power supply (1000 kVA or over, length of wiring 10 meters or less), or where switching of a phase advance capacitor occurs, an excessive peak current may flow in the power input circuit, damaging the inverter. In such cases, be sure to install an optional FR-BEL or FR-BAL power factor improvement reactor.



- If a surge voltage occurs in the power system, the surge energy may flow into the inverter, causing the inverter to execute an over-voltage alarm stop. In such cases, be sure to install an optional FR-BEL or FR-BAL power factor improvement reactor.

Settings

- Using the control panel or the parameter unit for setting makes it possible to set the inverter for high-speed operations up to 120Hz, so a mistake when setting can be very dangerous. Use the upper frequency setting function to set an upper limit.
- Setting the DC braking voltage and operation time at a higher value than the default setting can cause motor overheating (electronic thermal relay trip).

Points to Note

Selecting Inverter Capacity

- In the cases where special motors or several motors are operated in parallel using a single inverter, select an inverter whose capacity is such that the total rated current of the motors is equal to or less than the inverter's rated output current.

Motor Starting Torque

- The starting and accelerating characteristics of motors driven by inverters are constrained by the overload current rating of the inverters used in combination. Torque characteristic values are smaller than when general commercial power supplies are used. If larger starting torque is required and torque boost adjustment is insufficient, select an inverter with a capacity rank one level higher or increase the rank of both the motor and inverter capacity.

Acceleration/Deceleration Time

- The motor's acceleration/deceleration time is determined by the torque and load torque generated by the motor, and by the moment of inertia (GD^2) of the load.
- In the case where the current limit function or stall prevention function activates during acceleration/deceleration, the time sometimes increases, so please make the acceleration/deceleration time greater.
- When you wish to shorten the acceleration/deceleration time, make the torque boost value larger. (Making the torque boost value too large may activate the stall prevention function, otherwise, try lengthening the acceleration time.) If this is still not enough, increase the capacity of both the inverter and the motor. To shorten the deceleration time, it is necessary to add the optional FR-BU brake unit or the optional FR-RC power regenerating converter, etc., necessary for absorbing braking energy.

Power Transfer Devices (Reduction gears, belt, chain, etc.)

- Oil circulation systems are used for gearboxes or changing/reduction gears of power transfer systems, and if continuous operation is only in the low-speed range, there is a possibility of gear seizure due to poor oil circulation. Please watch for this problem carefully. On the other hand, if a motor is operated at high speeds of more than 60Hz, careful attention should be given to watch for problems with the noise, lifetime and centrifugal force of the power transfer devices due to reduced strength, etc.

Points to Note when Selecting Peripherals

Selecting and Installing No-fuse Breakers

Please install a no-fuse breaker (NFB) on the incoming side to protect the wiring on the inverter's primary side. The selection of the NFB depends on the power factor on the inverter's power supply side (changes in supply voltage, output frequency, load); In particular, since the operating characteristics of fully electro-magnetic type NFBs change according to high frequency current, it is necessary to select larger capacities. (Use the materials on the appropriate breakers for confirmation.) Also, for leakage breakers, please use models that have been designed to cope with high frequencies and surges, such as Mitsubishi's Progressive Super NV.

Handling Primary Side Electromagnetic Contactors

Inverters may be used without electromagnetic contactors (MC) on the power supply side. In the case of operations using external terminals (using terminals STF or STR), even if a primary-side MC is installed to prevent accidents caused by natural restarts when power is restored following instantaneous power failures, etc., or to ensure safety during maintenance operations, please do not use the MC to execute frequent start/stop operations (the switching life of an inverter input circuit is approximately 100000 operations). In PU operation mode, inverters do not restart automatically after power is restored, so they cannot be restarted by the MC. It is possible to halt operations using a primary side MC, but the inverter's special regenerative brake does not function and the motor coasts to a stop.

Handling Secondary Side Electromagnetic Contactors

Please note carefully that when an electromagnetic contactor is installed between the inverter and the motor, and an OFF/ON procedure is performed during operations, a large inrush current occurs and may affect the motor. When an MC is installed for switching to commercial power supplies, etc., we recommend that you use commercial power supply switchover functions Pr.135–Pr.139.

Installing Thermal Relays

The inverter is provided with a protection function that employs an electronic thermal relay to protect the motor from overheating. However, in cases where several motors or multi-polar motors are operated using a single inverter, please install a heat-activated type thermal relay (OCR) between the inverter and the motor(s). In such cases, set the inverter's electronic thermal relay to 0 A, and the OCR setting to 1.1 times the current value on the motor's rating plate taking inter-wire leakage current into account.

Secondary-side Measuring Instruments

When the wiring between the inverter and the motor is long, the effects of inter-wire leakage current, especially with small-capacity, 400V class units, may cause heating in instruments or Current Transformers. For this reason, please select instruments that have an adequate current rating.
When the inverter's output voltage and output current are measured and displayed, we recommend that you make use of the inverter's AM-5 terminal output function.

Removal of Power Factor Improvement Condenser (Phase Advance Capacitor)

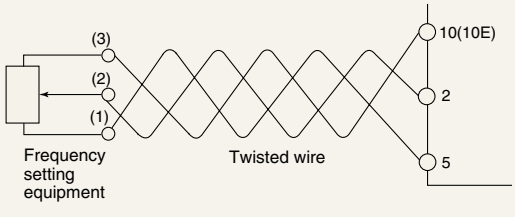
There is a danger that the high frequency components of the inverter's output will cause overheating and damage any power factor improvement capacitor and surge killer installed on the inverter's output side. Furthermore, neither capacitor nor surge killers should be inserted because current flows in the inverter causing the overcurrent protection function to activate. Use the power factor improvement DC reactor (page 32) for power improvement.

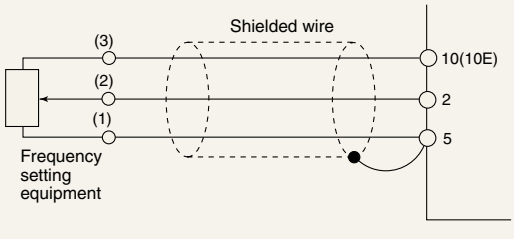
Regarding Noise, Leakage Current, High-Frequency Power-Supply

Characteristics of inverters include noise, leakage current and high-frequency power-supplies. As the countermeasures for each are different, please refer to pages 30 and 31 for further details on the steps for correct countermeasures.

Wiring Thickness and Distances

When the wiring distance between the inverter and the motor is long, use a thick wire that will keep the drop in voltage in the main circuit cable to 2% or less, especially during low frequency output. In cases of long distance cabling, the effects of charging current arising from floating capacity in the wiring may cause the overcurrent protection function to activate erroneously, so the maximum length of the wiring should not exceed 500 meters.
Please use the recommended connecting cable when installing the control panel (parameter unit) separately from the main body.
When performing remote operations using analog signals, the control wire between the control signal and the inverter should be a maximum of 30 meters long, and should be isolated from power circuits (main circuit and relay sequence circuits) so as not to be affected by induction from other equipment.
When the frequency is set using an external volume control (potentiometer) rather than the control panel (parameter unit), please use shielded or twisted wire as shown in the drawing, and connect the shield to terminal 5, not to earth.





Grounding

Always ground the inverter and the motor. Furthermore, when grounding the inverter, it is essential to use the inverter's grounding terminal, not its case or chassis.

⚠ 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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