



V200E SERIES



**HIGH PERFORMANCE DRIVES FOR SPEED,
TORQUE OR POSITION CONTROL OVER
A WIDE POWER RANGE (2-60HP)**

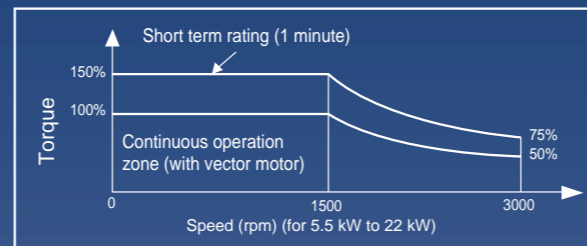


Smoother and More Precise. The V200E Vector Inverter Provides Speed, Position and Torque Control.

Mitsubishi Electric, a leader in factory automation, has channeled all its experience and technological expertise as a comprehensive electronics manufacturer into the V200E series vector inverters. This series achieves high precision and fast response that exceeds the performance of conventional general-purpose inverters. They boast all the functions of the A200E series and can be used in specialized applications such as line control and elevators. The V200E gives new levels of potential and performance.

More Precision and Better Response Than General-Purpose Inverters

We use Mitsubishi's own fully digital vector control system to achieve higher torque (150% for 60 seconds) and better response (speed loop of 200 rad/sec.). The speed control range has also been enlarged to 1:1500, while speed control mode and torque control mode are standard features. Positioning control is enabled by a built-in option unit (incremental system). On top of that, A200E series inverter peripherals such as the power supply regenerative converter (FR-RC) can also be used without special modification.



Big Product Line-up

Ultra-low noise vector control has been made standard for all ratings. The line-up runs from 1.5K (2HP) to 45K (60HP) (200 and 400V).

High Performance and Exceptionally Easy to Use

The monitor functions cover rpm, output current, output torque, motor load and many more. Setting of constants has also been greatly simplified.

Can Be Used With a Wide Variety of Encoder Equipped Motors

By adding an auto-tuning function that measures the motor constants required by the inverter, we have expanded the range of motors that can be used to include the motors listed below.

- SF-JR with encoder
- SF-JR with encoder
- SF-JRCA with encoder
- Motors with encoder made by other manufacturers (Motor with PLG)



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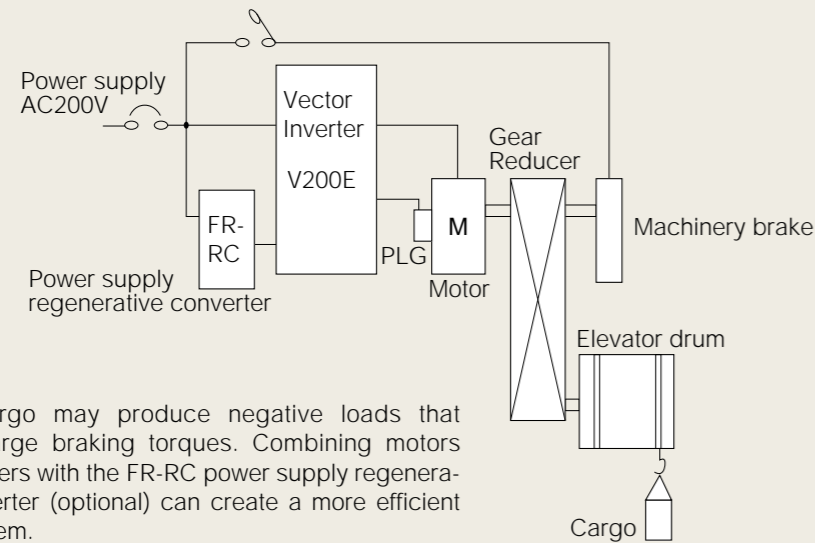
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Sample Applications

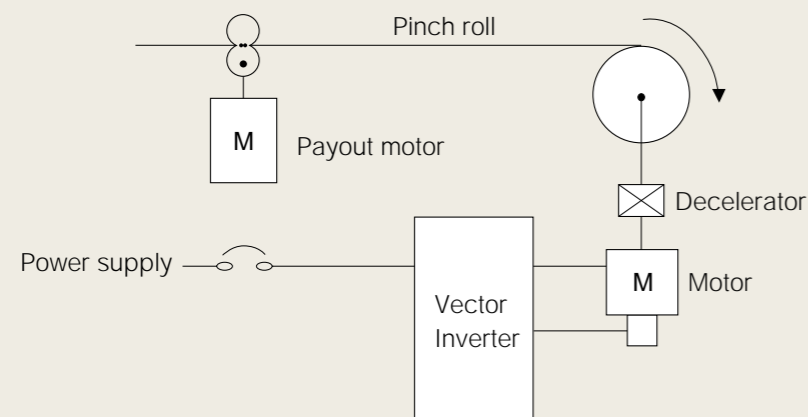
Application	Equipment	Reason for Use
Rotary presses	Paper winding line	Tensile force control
Extruders and baking machines	Extruders	High starting torque
	Baking machines	High starting torque
Iron making line	Roller drives	High starting torque
Machine tools	Main axis drives	High response, good orientation
Elevator machinery	Elevator garages	Faster drive, speed control range
	Automated warehouses	Faster drive, speed control range
	Cargo elevators	High starting torque
Winders and spoolers	Slitters	Tensile force control
	Wire makers	High starting torque
Textile machinery	Winders	Faster drive, speed control range
Conveyance machinery	Conveyors	Positioning
	Trimmers	Incremental feed

Application in an Elevator



Some cargo may produce negative loads that require large braking torques. Combining motors and inverters with the FR-RC power supply regenerative converter (optional) can create a more efficient drive system.

Sample Application in Winding and Spooling



Digital vector control allows operation with smaller speed fluctuations, enabling precise control of winding and spooling.

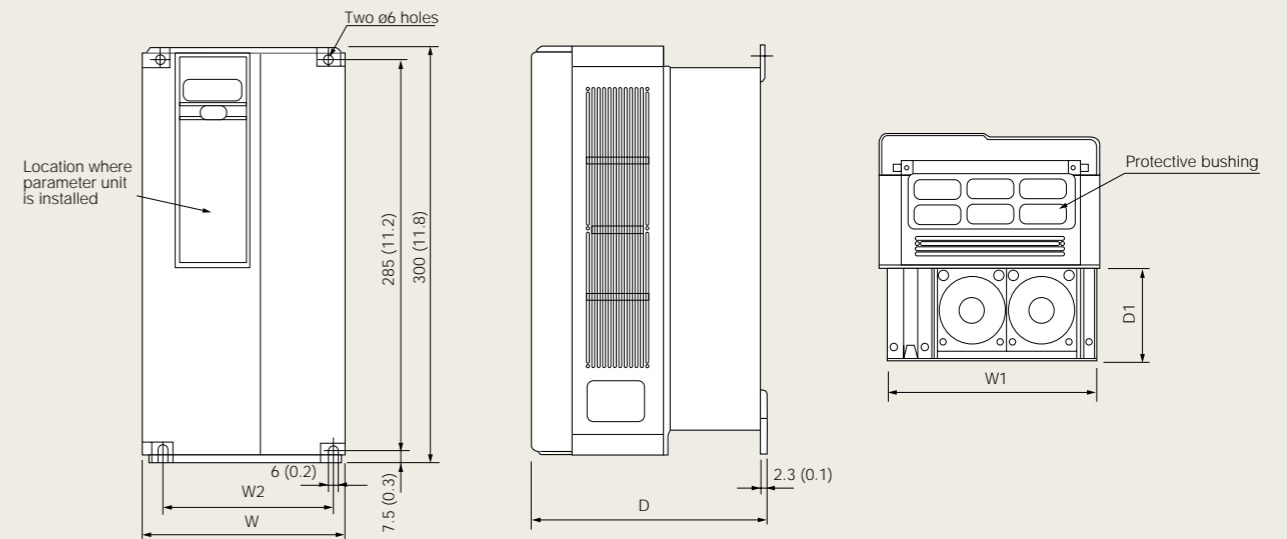
External Dimensions

Vector Inverters

FR-V220E-1.5K, 2.2K, 3.7K, 5.5K, 7.5K

Units: mm (inch)

FR-V240E-1.5K, 2.2K, 3.7K, 5.5K



200V Class

Note: The 7.5 K has no gland.

Inverter model	W	W1	D	D1	W2
FR-V220E-1.5K	150 (5.9)	142 (5.6)	170 (6.7)	71 (2.8)	125 (4.9)
FR-V220E-2.2K	150 (5.9)	142 (5.6)	170 (6.7)	71 (2.8)	125 (4.9)
FR-V220E-3.7K	220 (8.7)	210 (8.3)	190 (7.5)	67 (2.6)	195 (7.7)
FR-V220E-5.5K	220 (8.7)	210 (8.3)	190 (7.5)	67 (2.6)	195 (7.8)
FR-V220E-7.5K	220 (8.7)	210 (8.3)	190 (7.5)	67 (2.6)	195 (7.8)

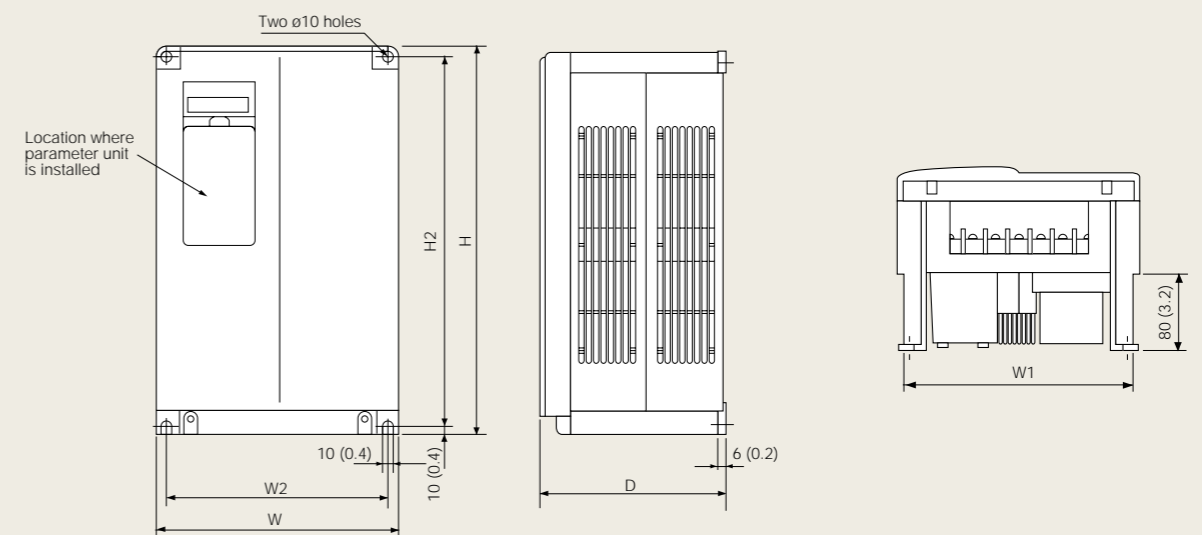
400V Class

Inverter model	W	W1	D	D1	W2
FR-V240E-1.5K	150 (5.9)	142 (5.6)	170 (6.7)	71 (2.8)	125 (4.9)
FR-V240E-2.2K	150 (5.9)	142 (5.6)	170 (6.7)	71 (2.8)	125 (4.9)
FR-V240E-3.7K	220 (8.7)	210 (8.3)	190 (7.5)	67 (2.6)	195 (7.7)
FR-V240E-5.5K	220 (8.7)	210 (8.3)	190 (7.5)	67 (2.6)	195 (7.8)

FR-V220E-11K, 15K, 18.5K

Units: mm (inch)

FR-V240E-7.5K, 11K, 15K, 18.5K



200V Class

Inverter model	W	W1	H	D	W2	H1
FR-V220E-11K	250 (9.8)	242 (9.5)	400 (15.8)	190 (7.5)	230 (9.1)	380 (15.0)
FR-V220E-15K	300 (11.8)	292 (11.5)	450 (17.7)	195 (7.7)	280 (11.0)	430 (16.9)
FR-V220E-18.5K	300 (11.8)	292 (11.5)	450 (17.7)	195 (7.7)	280 (11.0)	430 (16.9)

400V Class

Inverter model	W	W1	H	D	W2	H1
FR-V240E-7.5K	250 (9.8)	242 (9.5)	400 (15.8)	190 (7.5)	230 (9.1)	380 (15.0)
FR-V240E-11K	250 (9.8)	242 (9.5)	400 (15.8)	190 (7.5)	230 (9.1)	380 (15.0)
FR-V240E-15K	300 (11.8)	292 (11.5)	450 (17.7)	195 (7.7)	280 (11.0)	430 (16.9)
FR-V240E-18.5K	300 (11.8)	292 (11.5)	450 (17.7)	195 (7.7)	280 (11.0)	430 (16.9)

External Dimensions

Terminal Connection Diagram

Units: mm (inch)

FR-V220E-22K, 30K, 37K, 45K
FR-V240E-22K, 30K, 37K, 45K

Location where parameter unit is installed

200V Class										400V Class											
Inverter model	W	W1	H	H1	D	D1	W2	H2	H3	C	Inverter model	W	W1	H	H1	D	D1	W2	H2	H3	C
FR-V220E-22K	340 (13.4)	324 (12.8)	550 (21.7)	510 (20.1)	195 (7.8)	78 (3.1)	270 (10.1)	530 (20.9)	10 (0.4)	10 (0.4)	FR-V240E-22K	340 (13.4)	324 (12.8)	550 (21.7)	510 (20.1)	195 (7.8)	78 (3.1)	270 (10.1)	530 (20.9)	10 (0.4)	10 (0.4)
FR-V220E-30K	450 (17.7)	434 (17.1)	550 (21.7)	495 (19.5)	250 (9.8)	130 (5.1)	380 (15.0)	525 (20.7)	15 (0.6)	12 (0.5)	FR-V240E-30K	450 (17.7)	434 (17.1)	550 (21.7)	495 (19.5)	250 (9.8)	130 (5.1)	380 (15.0)	525 (20.7)	15 (0.6)	12 (0.5)
FR-V220E-37K	450 (17.7)	434 (17.1)	550 (21.7)	495 (19.5)	250 (9.8)	130 (5.1)	380 (15.0)	525 (20.7)	15 (0.6)	12 (0.5)	FR-V240E-37K	450 (17.7)	434 (17.1)	550 (21.7)	495 (19.5)	250 (9.8)	130 (5.1)	380 (15.0)	525 (20.7)	15 (0.6)	12 (0.5)
FR-V220E-45K	480 (18.9)	464 (18.3)	700 (27.6)	645 (25.4)	250 (9.8)	130 (5.1)	410 (16.1)	675 (26.6)	15 (0.6)	12 (0.5)	FR-V240E-45K	480 (18.9)	464 (18.3)	700 (27.6)	645 (25.4)	250 (9.8)	130 (5.1)	410 (16.1)	675 (26.6)	15 (0.6)	12 (0.5)

* Parameter unit is optional

The FR-PU02V Parameter Unit

Units: mm (inch)

Note: Select the screws so the length does not exceed the effective depth of the parameter unit mounting.

Note: Two M3 screws, effective depth 4.5 (0.2)

Panel cut-out dimensions for mounting the parameter unit in a panel etc. Installation dimensions drawing as seen from PU surface

3-phase AC power supply

Vector control motor

Motor with encoder

External transistor common

Analog command input

Monitor output

(No options)

Legend:
 ⊙ Main circuit terminal
 ○ Input terminal for control circuit
 ● Output terminal for control circuit

Nominal	B (mm)	F (mm)
1.25 to 3	6.4 max.	5.3 min.

(Notes) 1 : The PR and PX terminals are installed at 5.5 K or less.
 2 : When using the FR-ABR, remove this short bar.
 3 : The P1 terminal is installed in FR-V220E-3.7K to 45K and FR-V240E-3.7K to 45K.
 4 : When using the FR-BEL, remove this short bar.
 6 : Repeated inrushes of current when the power is turned on shorten the converter life, so keep the number of on / off's to a minimum.
 7 : Provide a ±10 V external power supply for terminals 1 and 3.
 8 : When using a motor that does not have a thermal protector, open the interval (make open) between inverter terminals OH and SD.
 9 : When connecting two crimps to one of the control terminals, line up the backs of round or forked crimps of the dimensions shown in the table above.

Description of Terminals

Type	Terminal No.	Terminal Name	Description	Page		
Main circuit	R, S, T (L1, L2, L3)	AC power input	Connect to a commercial power supply	11		
	U, V, W	Inverter output	Connect to vector control motor or motor with encoder.	11		
	R1, S1 (L11, L21)	Power supply for control circuit	Connect terminals R (L11) and S (L21) to a commercial power supply. To hold an error display or error output, remove the short bar of the terminal board and input a power supply to these terminals.	—		
	P(+), PR	Brake resistor connection	Remove the short bar of the PR-PX terminals and connect the optional brake resistor (FR-ABR) between the P(+) and PR terminals.	—		
	P, N(+, -)	Brake unit connection	Connects the optional brake unit and power supply regenerative converter (FR-RC).	17-20		
	P(+), P1	Power factor improvement DC reactor connection	Remove the short bar between the P(+) and P1 terminals and connect the optional reactor for improving the power factor (FR-BEL).	—		
	PR, PX*	Built-in brake circuit connection	When the PX and PR terminals are connected by a short bar (as when shipped from the factory), the built-in brake circuit is activated.	—		
	⏚	Ground	Grounds the inverter chassis. Ground to earth.	—		
Control circuit (input signals)	Contacts (start, function selection, etc.)	STF	Start forward	An ON signal between the STF and SD terminals is a forward command; an OFF is a stop command.	An ON signal between SD and both STF and STR is a stop command.	—
		STR	Start reverse	An ON signal between the STR and SD terminals is a reverse command; an OFF is a stop command.		—
		DI1	Digital input terminal 1	Selects three signals from among RH (high speed), RM (medium speed), RL (low speed), JOG (JOG operation), RT (second function selection), MRS (stop output), STOP (self hold start), LX (pre-excitation), MC (control mode switching), and TL (torque control selection). Input signals are selected with Pr.17	—	
		DI2	Digital input terminal 2		—	
		DI3	Digital input terminal 3		—	
		RES	Reset	Use when clearing hold status when the protection circuit is operating. Keep the RES-SD terminal interval on for 0.1 second, then turn it off.	—	
		OH	Thermal protector input	Terminal for connecting the thermal protector for protection against motor overheating.	—	
		SD	Contact input common	The common terminal for contact input. It is insulated from the common terminals of the control circuit.	—	
	PC1	External transistor common	When a transistor output (open collector output) such as in a programmable controller is connected, connect an external power supply common for transistor output to this terminal to prevent malfunctions caused by current leaking in.	—		
	Analog frequency setting	10E	Power supply for settings	Power supply for DC +10 V (permissible load current 10 mA) speed setting (variable resistance 1 k).	—	
		2	Speed setting	When DC 0 to +10 V is input, the maximum speed is at +10 V with proportional I/O response. Input resistance is 10 k.	—	
		1	Auxiliary terminal for speed setting	When DC 0 to ±10 V is input, this signal is added to the second terminal (No.2) setting. Input resistance is 10 k.	—	
		3	Torque setting terminal	The torque setting signal for torque control and the torque restriction signal for speed control and position control. DC 0 to ±10 V. Input resistance is 10 k.	—	
		5	Speed setting common	Common terminal for speed setting signal (terminal 1, 2 or 3). Not insulated from the common circuit of the control circuit. Do not ground to earth.	—	
	PLG signals	PA	A phase signal input terminal	Input the A-phase, B-phase, and Z-phase from the encoder built into the motor for vector control.	—	
		PAR	A phase inverted signal input terminal			
		PB	B phase signal input terminal			
		PBR	B phase inverted signal input terminal			
		PZ	Z phase signal input terminal			
		PZR	Z phase inverted signal input terminal			
5E	Encoder power supply terminal(+side)	+5V power supply for DC 5V and PLG.	—			
AG2	Power supply ground terminal	Common terminal for encoder power supply. Not insulated from the common circuit of the control circuit. Do not ground to earth.	—			
Control circuit (output signals)	Contacts	A, B, C	Error output	A contactor output that indicates that the inverter protection function has been activated and output has stopped. AC 200 V 0.3A, DC 30 V 0.3A. During errors: Non-conductive between B and C (conductive between A and C). Normally: Conductive between B and C (non-conductive between A and C).	—	
		Open collector	DO1	Digital output terminal 1	Output three signals from among ER (minor failure output), SU (speed reached), LS (low speed output), FU (speed detection), RUN (running), OL (overload), IPF/UVT (instantaneous power failure/undervoltage occurred), PU (operating from parameter unit), TU (torque detection), and RY (ready to run). Permissible load DC 24 V 0.1 A.	—
	DO2		Digital output terminal 2			
	DO3		Digital output terminal 3			
	Analog	SE1	Open collector output common	Common terminal for terminals DO1, DO2, and DO3. Insulated from the common circuit of the control circuit.	—	
		DA1	Analog signal output	Selects one of the nine monitoring items such as rpm and outputs it. Output item when shipped: Speed of rotation monitor. Output signal DC 0 to ±10 V, permissible load current 1 mA.	—	
		DA2	Analog signal output	The output signal is proportional to the size of the monitoring item. Output item when shipped: Torque monitor. Output signal DC 0 to 10 V, permissible load current 1 mA.	—	
AG1	Analog signal output common	Common terminal for DA1 and DA2. Not insulated from the common circuit of the control circuit. Do not ground to earth.	—			

(Note) *The PR and PX terminals are installed on FR-V220E-5.5 K and lower models and FR-V240E-5.5 K and lower models.

Description of Parameters

Function	Parameter No.	Name	Screen Display	Setting Range	Minimum setting unit	Factory Setting	
Basic functions	1	Maximum speed	Max. S	0-3600r/min	1r/min	1500r/min	
	2	Minimum speed	Min. S	0-3600r/min	1r/min	0r/min	
	4	3-speed setting (high)	PresetS1	0-3600r/min	1r/min	1500r/min	
	5	3-speed setting (medium)	PresetS2	0-3600r/min	1r/min	750r/min	
	6	3-speed setting (low)	PresetS3	0-3600r/min	1r/min	150r/min	
	7	Acceleration time	Acc. tl	0-3600sec	0.1sec	5sec/15sec ^{Note1}	
	8	Deceleration time	Deec. tl	0-3600sec	0.1sec	5sec/15sec ^{Note1}	
	9	Electronic thermal O/L relay		0-500A	0.01A	Motor rated current/0	
	Application functions	10	DC injection braking operation speed	DC. Br. S	0-1500r/min, 9999	1r/min	90r/min
11		DC injection braking operating time	DC. Br. t	0-10sec	0.1sec	0.5sec	
12		DC injection braking brake voltage	DC. Br. V	0-30%	0.1%	3%	
13		Starting speed	StartS	0-1500r/min	1r/min	15r/min	
14		Control mode	Ctrl Mode	0-6,11,12,16,101,102,106	Integer	0	
15		JOG speed setting	JOG S	0-1500r/min	1r/min	300r/min	
16		JOG acceleration/ deceleration time	JOG t	0-3600sec	0.1sec	0.5sec	
17		Input terminal assignments	Set Dig I	0-999	Integer	12	
18		S acceleration pattern 1		0-50%	1%	0%	
19		S deceleration pattern 1		0-50%	1%	0%	
20		Acceleration/ deceleration reference speed	Acc/DecS	0-3600r/min	1r/min	1500r/min	
21		S acceleration pattern 2		0-50%	1%	0%	
22		S deceleration pattern 2		0-50%	1%	0%	
23		Thermal protector input		0, 1	Integer	0	
24		Multi-speed setting (speeds 4)	Preset S4	0-3600r/min, 9999	1r/min	9999	
25		Multi-speed setting (speeds 5)	Preset S5	0-3600r/min, 9999	1r/min	9999	
26		Multi-speed setting (speeds 6)	Preset S6	0-3600r/min, 9999	1r/min	9999	
27		Multi-speed setting (speeds 7)	Preset S7	0-3600r/min, 9999	1r/min	9999	
28		Multi-speed compensation selection	Pre. Comp	0, 1	Integer	0	
29		Acceleration/deceleration pattern	Acc/Decp	0, 1, 2	Integer	0	
Protective functions		30	Regenerative brake selection	Br. Set	0, 1	Integer	0
		31	Speed deviation level	SDev Lvl	0-1500r/min, 9999	1r/min	9999
		32	Overspeed detection level	Ovrs Lvl	0-3600r/min	1r/min	3000r/min
Torque Restriction	33	Torque restriction mode	TL Mode	1, 2, 3, 4	Integer	3	
	34	Torque restriction level	TL Lvl.1	0-400%	0.1%	150%	
	35	Torque restriction level (Regeneration)	TL Lvl.2	0-400%, 9999	0.1%	9999	
	36	Torque restriction level (No.3 quadrant)	TL Lvl.3	0-400%, 9999	0.1%	9999	
	37	Torque restriction level (No.4 quadrant)	TL Lvl.4	0-400%, 9999	0.1%	9999	
	38	Torque restriction level 2	2nd TL	0-400%, 9999	0.1%	9999	
Torque detection	39	Torque detection	Trq. Det.	0-400%	0.1%	150%	
	40	Output terminal assignments	Set Dig O	0-999	Integer	12	
	41	Up-to-speed sensitivity	SU Range	0-100%	0.1%	10%	
	42	Speed detection	Set FU S	0-3600r/min	1r/min	300r/min	
	43	Low speed detection	LS Det.	0-1500r/min	1r/min	45/min	
Second functions	44	Second acceleration/deceleration time	Ac/DecT2	0-3600sec	0.1sec	5sec	
	45	Second deceleration time	Dec. t2	0-3600sec, 9999	0.1sec	9999	
	46	Second input terminal assignment	I	0-999, 9999	Integer	9999	
	47	Torque boost	Trq. Bst	0-30%	0.1%	3%	
	48	Base frequency	VfBase F	50-200Hz	0.01Hz	60Hz	
Display functions	49	Base frequency voltage	VfBase V	0-500V, 9999	0.1V	9999	
	51	Inverter LED display data	Set LED	1-8, 17	Integer	1	
	52	PU main display data	Set PU	0, 17, 20	Integer	0	
	53	PU level meter display data	Set Lvl.	0-3, 5-8, 17	Integer	1	
	54	DA1 terminal function selection	Set D/A1	1-3, 5-8, 17, 21	Integer	1	
	55	DA2 terminal function selection	Set D/A2	1-3, 5-8, 17, 21	Integer	7	
	56	Speed monitoring reference	CalbAM S	0-3600r/min	1r/min	1500r/min	
	57	Current monitoring reference	CalbAM I	0-500A	0.01A	Rated value	
	58	Torque monitoring reference	CalbAM T	0-400%	0.1%	100%	
	59	Language switching	PU Lang	0, 9999	Integer	9999	

Description of Parameters

Function	Parameter No.	Name	Screen Display	Setting Range	Minimum setting unit	Factory Setting	
Operation selection functions	60	Speed deviation time	SDev Time	0-100sec	0.1sec	12sec	
	61	Restart coasting time	Restrt T	0-5sec, 9999	0.1sec	9999	
	62	Pre-excitation selection	Set LX	0.1	Integer	0	
	63	Torque command selection	Set TRef	0.1	Integer	0	
	64	Motor capacity		0-55kW, 9999	0.01kW	9999	
	65	Number of motor speed		2-6, 9999	Integer	9999	
	66	Rated motor speed		0-3600r/min	1r/min	Rated motor speed ^(Notes3)	
	67	Open motor circuit detection level	1Dt. Lvl	0-50%	0.1%	5%	
	68	Open motor circuit detection time	1Dt. T	0.05-1sec, 9999	0.01%	9999	
	69	Number of PLG pulses		0-4096	1	1024/1000	
	70	Regenerative brake duty	Br. Duty	0-30%/0%	0.1%	0%	
	71	Applied motor		0.1	Integer	0	
	72	PWM frequency selection	PWM Mode	0-6	Integer	6	
	73	Speed setting signal	ExtS /IOV	0-3	Integer	0	
	74	PU stop key selection		0.1	Integer	0	
	75	Torque characteristics selection	Stop Mode	0-3	Integer	1	
	76	Alarm definition	Trbl. Def	0.1	Integer	0	
	77	Parameter write disable selection	EnableWr	0, 1, 2	Integer	0	
	78	Reverse rotation prevention selection	EnableFR	0, 1, 2	Integer	0	
	79	Operation mode selection	Ope. Mode	0, 1, 2	Integer	0	
	Control system function	80	Speed control P gain 1	S Gain1	0-1000%	1%	30%
		81	Speed control I gain 1	S ICom1	0-1000%	0.1%	3%
		82	Speed setting filter 1	SSiFil. 1	0-5sec	0.001sec	0 sec
		83	Speed detection filter 1	SDiFil. 1	0-5sec	0.001sec	0 sec
		84	Torque control P gain 1	T Gain1	0-1000%	1%	100%
		85	Torque control I gain 1	T Icomp1	0-1000%	1%	100%
		86	Torque setting filter 1	TSiFil. 2	0-5 sec	0.001sec	0 sec
		87	Torque detection filter 1	TDiFil.2	0-5 sec	0.001sec	0 sec
		88	Droop gain		0 to 100%, 9999	0.01%	9999
89		OLT level setting		0-200%	0.1%	150%	
90		Speed control P gain 2	S Gain2	0-1000%	1%	30%	
91		Speed control I gain 2	S Icomp2	0-1000%	0.1%	3%	
92		Speed setting filter 2	SSiFil. 2	0-5sec	0.001sec	0 sec	
93		Speed detection filter 2	SDiFil. 2	0-5sec	0.001sec	0 sec	
94		Torque control P gain 2	T Gain2	0-1000%	1%	100%	
95		Torque control I gain 2	T Icomp2	0-1000%	1%	100%	
96		Torque setting filter 2	TSiFil. 2	0-5 sec	0.001sec	0 sec	
97		Torque detection filter 2	TDiFil. 2	0-5 sec	0.001sec	0 sec	
98		Auto-tuning setting		0, 1	Integer	0	
99		Motor constant selection		0-2, 9999	Integer	9999	
103		Torque bias selection		0 to 3.9999	Integer	9999	
104		Torque bias 1		600 to 1400, 9999	1%	9999	
105		Torque bias 2		600 to 1400, 9999	1%	9999	
106		Torque bias 3		600 to 1400, 9999	1%	9999	
147		Torque bias filter		0 to 5sec., 9999	0.001sec.	9999	
148		Torque bias operation time		0 to 5sec., 9999	0.01sec.	9999	
149		Torque bias balance compensation		0 to 10V, 9999	0.1V	9999	
151		Secondary resistance compensation selection		0 to 200C°, 9999	Integer	9999	
152		Fall-time torque bias No.3 bias		0 to 400%, 9999	1%	9999	
153		Fall-time torque bias No.3 gain		0 to 400%, 9999	1%	9999	
154		Droop filter time constant		0 to 1 sec., 9999	0.01 sec.	9999	
155		Speed indication		11 to 9998, 9999	1	9999	
156		PLG rotation direction		0, 1	1	0	
157		Excitation ratio		0 to 100%	1%	100%	
158		Deceleration torque limit		0 to 400%, 9999	1%	9999	
159		Acceleration torque limit		0 to 400%, 9999	1%	9999	

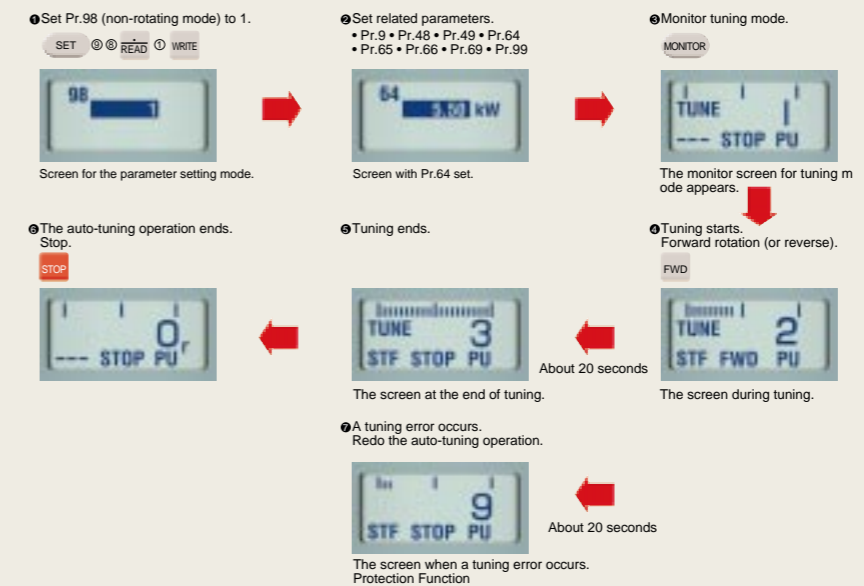
Description of Parameters

Function	Parameter No.	Name	Screen Display	Setting Range	Minimum setting unit	Factory Setting
Calibration function	900	DA1 terminal calibration	D/A1Tune	---	---	---
	901	DA2 terminal calibration	D/A2Tune	---	---	---
	902	Speed setting second bias	ExtBias2	0-10V 0-3600r/min	1r/min	(0V) 0r/min
	903	Speed setting second gain	ExtGain2	0-10V 0-3600r/min	1r/min	(10V) 1500r/min
	904	Torque command third bias	ExtBias3	0-10V 0-400%	0.1%	(0V) 0%
	905	Torque command third gain	ExtGain3	0-10V 0-400%	0.1%	(10V) 150%

(Notes)
 1. The set value depends on the inverter capacity : (5.5K or less) / (7.5K or more)
 2. The set value depends on the inverter capacity : (3.7K or less) / (5.5K or more)
 3. The set value depends on the inverter capacity : 1710r/min (1.5K to 3.7K), 1720r/min (5.5K, 11K), 1730r/min (7.5K, 15K), 1750r/min (18.5K to 30K), 1760r/min (37K, 45K)

PU Operation

Auto-tuning operation



Protection Functions

Error	Error Display	Description	Comments
Overcurrent during acceleration	E.OC1	Overcurrent occurred during acceleration	Overcurrent operation level: Twice the rated inverter current
Overcurrent during constant speed	E.OC2	Overcurrent occurred while at constant speed	
Overcurrent during deceleration	E.OC3	Overcurrent occurred during deceleration	
Overvoltage during acceleration	E.OV1	Overvoltage occurred during acceleration	Overvoltage operation level: Main DC circuit voltage above 400 V or more (200 V class) or above 800 V (400 V class)
Overvoltage during constant speed	E.OV2	Overvoltage occurred while at constant speed	
Overvoltage during deceleration	E.OV3	Overvoltage occurred during deceleration	
Insufficient voltage	E.UVT	Voltage of main DC circuit is low	Main DC circuit: 215 V min. (200 V class)
Instantaneous power failure occurred	E.IPF	An instantaneous power-failure occurred in the power supply	
Thermal operation	E.OHT	The heat-activated thermal relay connected to the OH terminal was activated	
Brake transistor error	E.BE	An error occurred in the transistor for the brake circuit	
Over-speed occurred	E.OS	The motor speed exceeded the level set for over-speed	Operates at over-speed detection level Pr.32 or greater
Large speed deviation	E.OSD	The deviation between the over setting and the motor speed exceeded the deviation level	Operates at deviation level Pr.31 or greater
Parameter data error	E.PE	An error occurred in the operation of the element that holds the parameters	
Option error	E.OPT	An error occurred in the option card	
CPU error	E.CPU	An error occurred in the operation of the CPU	
No encoder signal	E.ECT	The encoder pulse is not input	
Stall prevention	E.OLT	Stall prevention or the current restriction function have operated for a long period of time	Operates at low-speed detection level Pr.43 or less
Overload warning	E.THT	The inverter thermal relay was activated.	
	E.THM	The electronic thermal O/L relay for motor protection was activated.	
Large position error	E.OD	The deviation between the position command and the motor's angle of rotation exceeded the deviation level	
No encoder signal for orientation	E.ECA	The encoder pulse for orientation was not input	
PU leave out	E.PUE	Parameter unit is disconnected when 2 or 3 is set in Pr. 75	

Standard Specifications

Standard Specifications

200V Class

Model FR-V220E- <input type="text"/>		1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K
Applicable motor capacity [kW (HP)]		1.5 (2)	2.2 (3)	3.7 (5)	5.5 (7.5)	7.5 (10)	11 (15)	15 (20)	18.5 (25)	22 (30)	30 (40)	37 (50)	45 (60)
Output	Rated capacity (kVA)	3.1	4.5	6.9	9.6	12.6	18.3	24.6	30.1	35.8	44.0	57.8	67.5
	Rated current (A)	9.0	13.0	20.0	27.7	36.3	52.7	71.0	87.0	103.5	126.5	166.8	192.0
	Overload current rating*1	150% 60 seconds, 200% 0.5 seconds (characteristics when outside limits)											
	Voltage *2	3-phase 200-220V 50Hz, 200-230V 60Hz											
	Regenerative braking torque	Max./time	100%/5 sec	100%/5 sec	20%*3								
	Permissible usage rate	3%ED	2%ED	Continuous*3									
Power supply	Rated input AC voltage and frequency	3-phase 200-220V 50Hz, 200-230V 60Hz											
	Permissible fluctuation in AC voltage	170-242V 50Hz, 170-253V 60Hz											
	Permissible fluctuation in frequency	±5%											
	Amount of instantaneous voltage drop that can be withstood	When operated at or above 165 V continuously and voltage falls from rated voltage to under 165 V, 15 ms of continuous operation.											
	Power supply facility capacity (kVA)*4	4.5	5.5	9	12	17	20	28	34	41	52	66	80
Protective structure (JEM 1030)		Locked type (IP20)						Open type (IP00)					
Cooling system		Forced-air cooling											
Approximate mass (kg(lb))		3.5 (7.7)	3.7 (8.2)	7.5 (16.5)	7.7 (17.0)	7.7 (17.0)	14.5 (32.0)	17 (37.5)	17 (37.5)	33 (72.8)	45 (99.2)	54 (119.0)	72 (158.8)

400V Class

Model FR-V240E- <input type="text"/>		1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K
Applicable motor capacity [kW (HP)]		1.5 (2)	2.2 (3)	3.7 (5)	5.5 (7.5)	7.5 (10)	11 (15)	15 (20)	18.5 (25)	22 (30)	30 (40)	37 (50)	45 (60)
Output	Rated capacity(kVA)	3.1	4.5	6.9	9.6	12.6	18.3	24.6	30.1	35.8	44.0	57.8	67.5
	Rated current (A)	4.5	6.5	10.0	13.9	18.2	26.3	35.5	43.5	51.8	63.3	83.5	97.5
	Overload current rating*1	150% 60 seconds, 200% 0.5 seconds (characteristics when outside limits)											
	Voltage *2	3-phase 380-460V 50Hz/60Hz											
	Regenerative braking torque	Max./time	100%/5 sec						20%*3				
	Permissible usage rate	2%ED						Continuous*3					
Power supply	Rated input AC voltage and frequency	3-phase 380-460V 50 Hz/60Hz											
	Permissible fluctuation in AC voltage	170-242V 50Hz, 170-253V 60Hz											
	Permissible fluctuation in frequency	±5%											
	Amount of instantaneous voltage drop that can be withstood	When operated at or above 320V continuously and voltage falls from rated voltage to under 320V, 15ms of continuous operation.											
	Power supply facility capacity (kVA)*4	4.5	5.5	9	12	17	20	28	34	41	52	66	80
Protective structure (JEM 1030)		Locked type (IP20)						Open type (IP00)					
Cooling system		Forced-air cooling											
Approximate mass (kg(lb))		4.5 (9.9)	4.5 (9.9)	7.5 (16.5)	7.7 (17.0)	16 (35.3)	16 (35.3)	20 (44.1)	20 (44.1)	33 (72.8)	54 (119.1)	54 (119.1)	72 (158.8)

(Notes)

- The % value for overload current rating indicates the ratio to the inverter's rated output current. When using repeatedly, wait until the inverter and motor temperature fall below the temperature when at 100% load.
- The maximum output voltage cannot go above the power supply voltage.
- The maximum output voltage can be set anywhere below the power supply voltage.
Indicates the average torque when decelerating to a stop from 60Hz. Does not vary with motor loss.
- The power supply capacity varies with the value of the power supply impedance (including input reactor and power lines).
- When the power supply voltage fluctuation with a 400V class inverter is at or below 342V or at or above 484V, a built-in transformer tap switch is required. See the manual for details.

Common Specifications

Control specifications	Control system	High carrier frequency PWM control, full digital vector control			
	Speed control range	1 to 1500rpm (rated torque), 1500 to 3000/3600rpm (rated output) (with dedicated motor control)			
	Speed setting resolution	Digital input	0.03% against maximum setting (1rpm units for minimum setting)		
		Analog input	0.1% of maximum set speed		
	Acceleration/ deceleration time	0 to 3600 seconds (acceleration and deceleration can be independently set in 0.1s increments)			
	Acceleration/ deceleration pattern	Select between linear and S curve acceleration/deceleration modes			
Torque restriction level	Select torque restriction value (variable between 0 and 200%)				
Input signal	Analog setting signal	Terminal No	Setting Range	Speed Control	Torque Control
		2	0 to 10 V (resolution 0.1%)	Main speed setting	Speed restriction
	1	0 to ±10 V (resolution 0.2%)	Auxiliary speed setting	Speed restriction compensation	
	3	0 to ±10 V (resolution 0.2%)	Torque restriction (regenerative/ power running)	Torque	
	With option FR-VPA, VPB	4	0 to ±10 V (resolution 0.2%)	Torque restriction (regenerative only)	—
	With option FR-VPC	6	0 to ±10 V (resolution 0.01%)	Main speed setting (in this case, terminals 1 and 2 are invalid)	Torque command (in this case, terminal 3 is not valid)
Contact signals	4 fixed function terminals	Total 4 points (forward command, reverse command, error reset, and thermal protector)			
	3 multi-function terminals	Select between multi-stage speed setting (up to 7 speeds) and jogging operation*5 Select three parameters from among second function selection, pre-excitation, free-run terminal, hold operation signal, S-curve switching, torque restriction selection and control mode switching.			
Output signals	Contact signals	Error output, Contactor (AC 230V 0.3A, DC 30V 0.3A)			
	Open collector signals	Can output 3 from among attained speed, overload detected, insufficient voltage detected, inverter operating, minor failure, torque detected, ready to operate, low speed signal, speed detected, and parameter unit operating signals.			
	Analog output	Can output 2 from among rpm, output current, output voltage, speed setting, output frequency, output torque, DC bus voltage, and load meter.			
	Digital output (encoder output) With options FR-VPA, VPB, and VPC	A phase, B phase and Z phase (can be divided into A phase and B phase *10)			
Operation function		Upper and lower limit speed settings, external protection (thermal) input, forward/reverse prevention, and auto-tuning function			
Display	Parameter unit	PU02V and monitors (11 types: error, input, output terminal, and terminal monitors, in addition to the above analog outputs)			
	LED (7 segment)	7-segment 4-digit display (eight selectable displays)			
Protection function		Overcurrent, output short protection (acceleration, deceleration, constant speed), regenerative overvoltage, insufficient voltage, no signal, large speed deviation, overload (electronic thermal relay), brake transistor error,*6 over-speed, motor overheating, etc.			
Environment	Ambient temperature	-10°C to +50°C (no freezing)			
	Ambient humidity	90% RH max. (no condensation)			
	Storage temperature*7	-20°C to +65°C			
	Atmosphere	Indoor use (no corrosive gases, flammable gases, oil misting, or dust)			
Altitude/vibration	1000 m above sea level max., 0.6 G max. (based on JIS C 0911)				

(Notes)

- The % value for overload current rating indicates the ratio to the inverter's rated output current. When using repeatedly, wait until the inverter and motor temperature fall below the temperature when at 100% load.
- The maximum output voltage cannot go above the power supply voltage. The maximum output voltage can be set anywhere below the power supply voltage.
- Indicates the average torque when decelerating to a stop from 60Hz. Does not vary with motor loss.
- The power supply capacitance varies with the value of the power supply impedance (including input reactor and power lines).
- Jogging operation is also possible with the parameter unit.
- Not installed in the FR-V220E-7.5K to 45K and FR-V240E-7.5K to 45K, which have no built-in brake circuits.
- The temperature that can be applied for short times, such as in transit.
- When the power supply voltage fluctuation with a 400V class inverter is at or below 342V or at or above 484V, a built-in transformer tap switch is required. See the manual for details.
- The fan power supply is 200V even for 400V class inverters.
- Using the FR-VPA, VPB or VPC pulse output the direction of rotation cannot be determined. Also the FR-VPC does not have a Z-phase output.

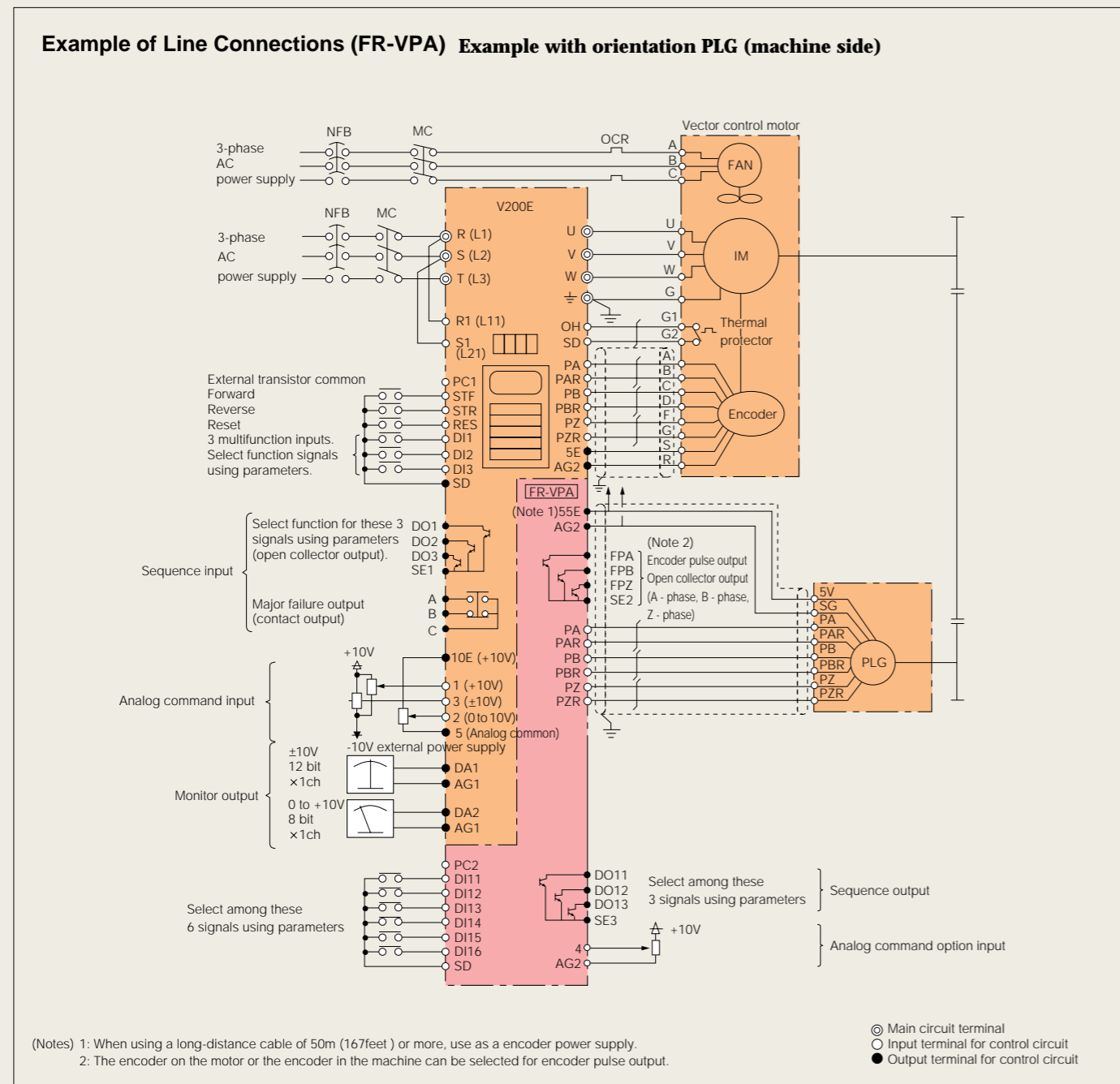
Installation of Dedicated, Built-in Options

Installation of Dedicated, Built-in Options

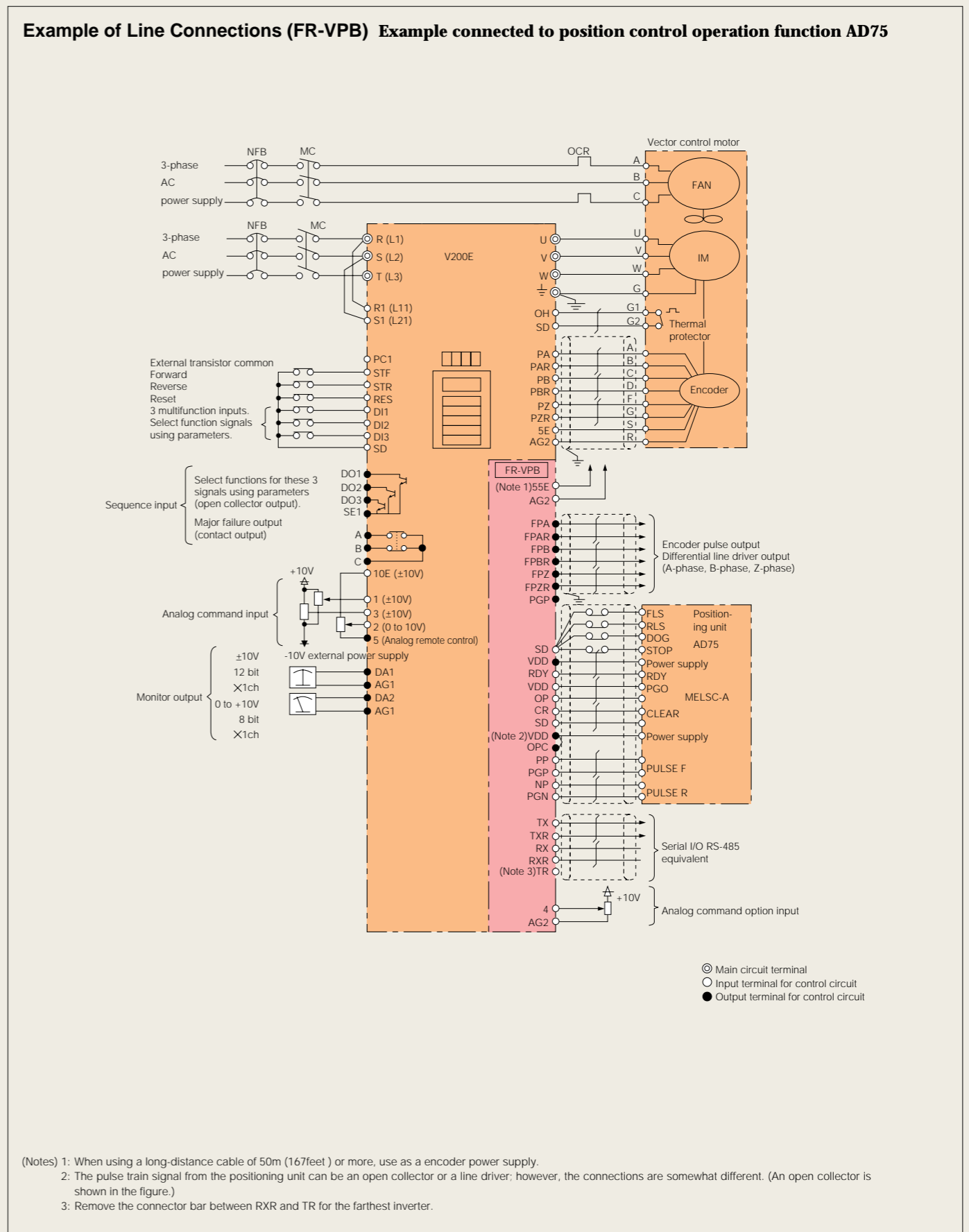
One of the optional units below can be incorporated into an inverter.
The optional units have the functions as indicated in the table.

Option	Functions Provided											
	Orientation control (orientation encoder input)	Position control (pulse train input)	Expansion input	Expansion output	Expansion analog input 0 to 10 V, 10 bit	±10 V, 14 bits	Open collector	Line driver	Power supply for long-distance cable	RS-422/RS-485 interface	Motor thermistor interface	Digital 12 bit input
FR-VPA (expansion I/O function)	●		●	●	●		●		●			
FR-VPB (position control function)		●			●		●	●	●	●		
FR-VPC (digital 12 bit input)						●	●	●			●	●

Example of Line Connections (FR-VPA) Example with orientation PLG (machine side)



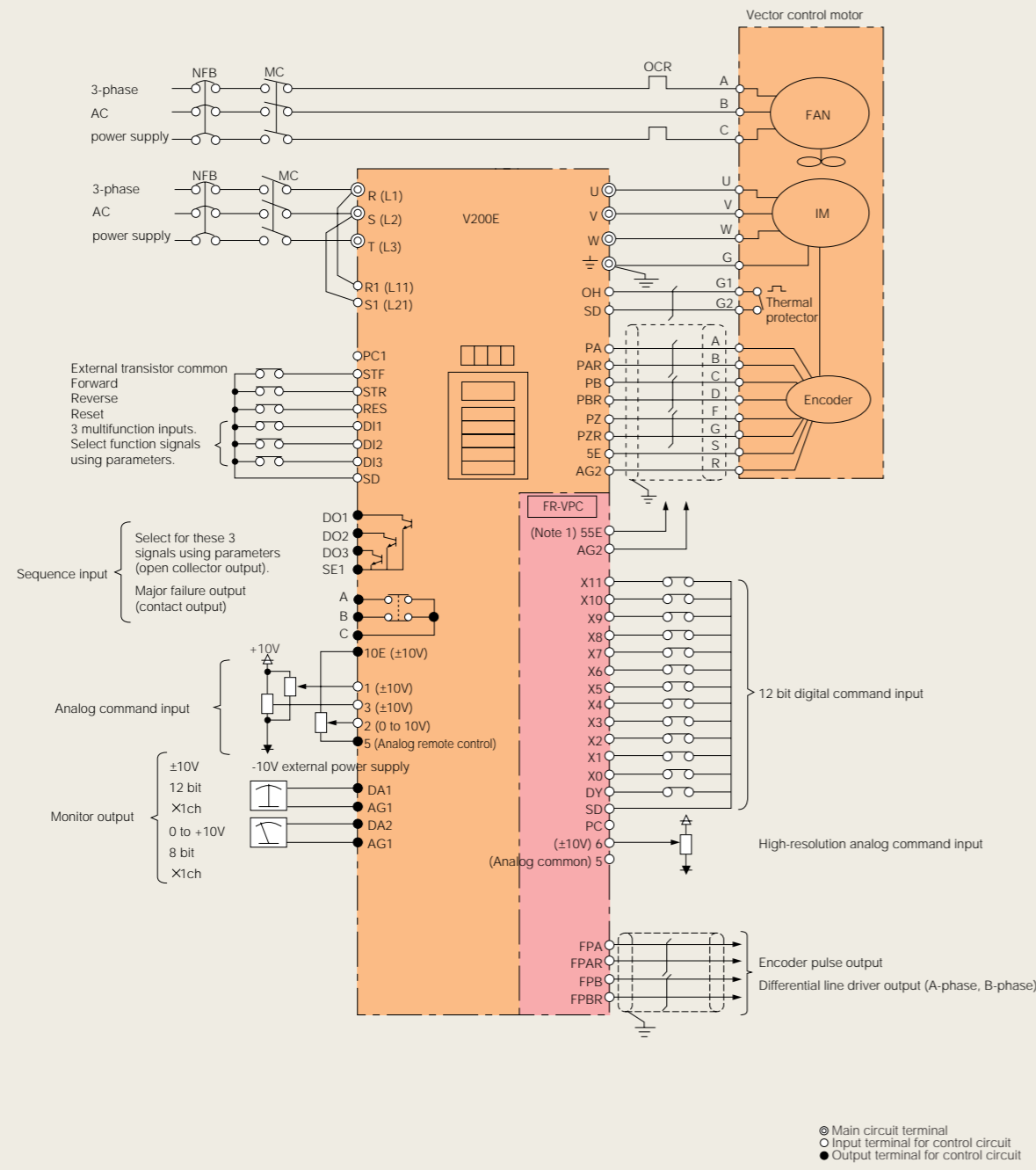
Example of Line Connections (FR-VPB) Example connected to position control operation function AD75



Installation of Dedicated, Built-in Options

List of Options

Example of Line Connections (FR-VPC)



(Note) 1: When using a long-distance cable of 50m (167feet) or more, use as an encoder power supply.

Name	Model	Application, Specification, Etc.	Inverter
Built-in (FR-V only)	Expansion I/O function	FR-VPA •6 expansion inputs •1 expansion analog input •Orientation control •3 expansion outputs •Long-distance cable (50-100m (167-334 feet)) power supply •Encoder pulse output (open collector)	For all ratings
	Position control function	FR-VPB •Position control •1 expansion analog input •RS-485 interface •Long-distance cable (50-100m(167-334 feet)) power supply •Encoder pulse output (line driver)	
	Digital 12 bit input	FR-VPC •Encoder pulse output (line driver, A and B only) •Long-distance cable (50-100m(167-334 feet)) power supply •Digital 12 bit input •Motor thermistor interface •1 expansion analog input	
External option (dedicated FR-V)	Parameter unit	FR-PU02V Interactive parameter unit using LCD display	For all ratings
	PLG cable (for vector inverter motor)	FR-VCBL □□ Cable for connection of inverter and vector inverter motor PLG	
	PLG cable (for motor with PLG)	FR-JCBL □□ Cable for connection of inverter and PLG of Mitsubishi motor with PLG	
Stand alone	Accessory cover	— Halved cover for after removing the parameter unit from the main unit	
	Serial communications unit	FR-CU01 RS-485 interface for computer link (serial communications)	
	Digital operating panel	FR-DU01 Operating panel installable on operating boards, control board doors and the like (optional connection cables are required for connection)	
	Cooling fin removal attachment	FR-ACN By using this option, the inverter's heat radiator can be extended out the back of the control board.	1.5 to 45K
	Dirt-protection structure attachment	FR-ACV By installing this option, the inverter meets the totally enclosed structure specifications (IP40)	1.5K to 18.5K
	Conduit connection attachment	FR-AFN Used to connect a conduit pipe directly to the inverter. (7.5K to 45K meet IP20 by installing this option)	1.5K to 45K
	Brake resistor for high-frequency use	FR-ABR-(H)* For increasing braking power of the brake built into the inverter	1.5 to 5.5K
	DC reactor for power factor improvement	FR-BEL-(H)* For improving the inverter's input power factor (total power factor 95%), for coordinating power supplies and for reducing harmonic attenuation	3.7 to 45K
	AC reactor for power factor improvement	FR-BAL-(H)* For improving the inverter's input power factor (total power factor 90%), for coordinating power supplies, and for reducing harmonic attenuation	1.5 to 45K
	EMC Directive-compliant noise filter	SF □□ Noise filter compliant with the EMC Directive (EN50081-2) (for 400V class only)	1.5K to 45K According to capacity
	VDE Standard-compliant noise filter	FR-ALF-(H)* Noise filter conforming to the VDE Standard (VDE0871 Class A noise terminal voltage).	
	Radio noise filter	FR-BIF-(H)* For reducing radio noise	For all ratings
	Line noise filter	FR-BLF For reducing line noise	
	Parameter unit connection cable	FR-CBL □□ Cable for connecting parameter units and parameter combination units. Straight type and L type.	For specific ratings
	BU type brake unit	BU-1500-15K, BU-H7.5K-H30K For increasing the inverter's braking power (for high inertial loads or negative loads)	
	FR-BU type brake unit	FR-BU-15K-55K, FR-BU-H15K-H5K For increasing the inverter's braking power (for high inertial loads or negative loads).	
	FR-BR type resistor unit	FR-BU-15K-55K, FR-BR-15K-H5K Use the brake unit and resistor unit in combination.	
Power supply regenerative unit	FR-RC-15K-55K, FR-RC-H15K-H5K Energy-saving high-performance brake unit that can return the energy produced in braking the motor to the power supply		

(Note) *An H is added to 400 V class models.

FR-BU Brake Units / FR-BR Resistor Units

FR-BU Brake Units / FR-BR Resistor Units

- Brake units and resistor units are optional equipment designed to make the most out of the inverters' regenerative braking force. They are always used as a set.
- There are six types of brake units, listed below. Select the appropriate one from the table from the required braking torque and deceleration time.
- Brake units come with 7-segment LEDs that display the usage factor (duty, %ED) and errors.
- Under 3.7 kW, use a combination of a BU brake unit and a discharge resistor.

Selection Table for Brake Units

•%ED with short period ratings at 100% braking torque

Motor Rating		5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW
Inverter	200V	5.5K	7.5K	11K	15K	22K	30K	37K	45K
	400V	5.5K	7.5K	11K	15K	22K	30K	37K	45K
Brake unit	200V	FR-BU-15K	80	40	15	10	—	—	—
		FR-BU-30K	—	—	—	30	15	10	—
		FR-BU-55K	—	—	—	—	60	30	20
	400V	FR-BU-H15K	80	40	15	10	—	—	—
		FR-BU-H30K	—	—	—	30	15	10	—
		FR-BU-H55K	—	—	—	—	60	30	20

•Braking torque with short period ratings at 10% ED 15 seconds (%)

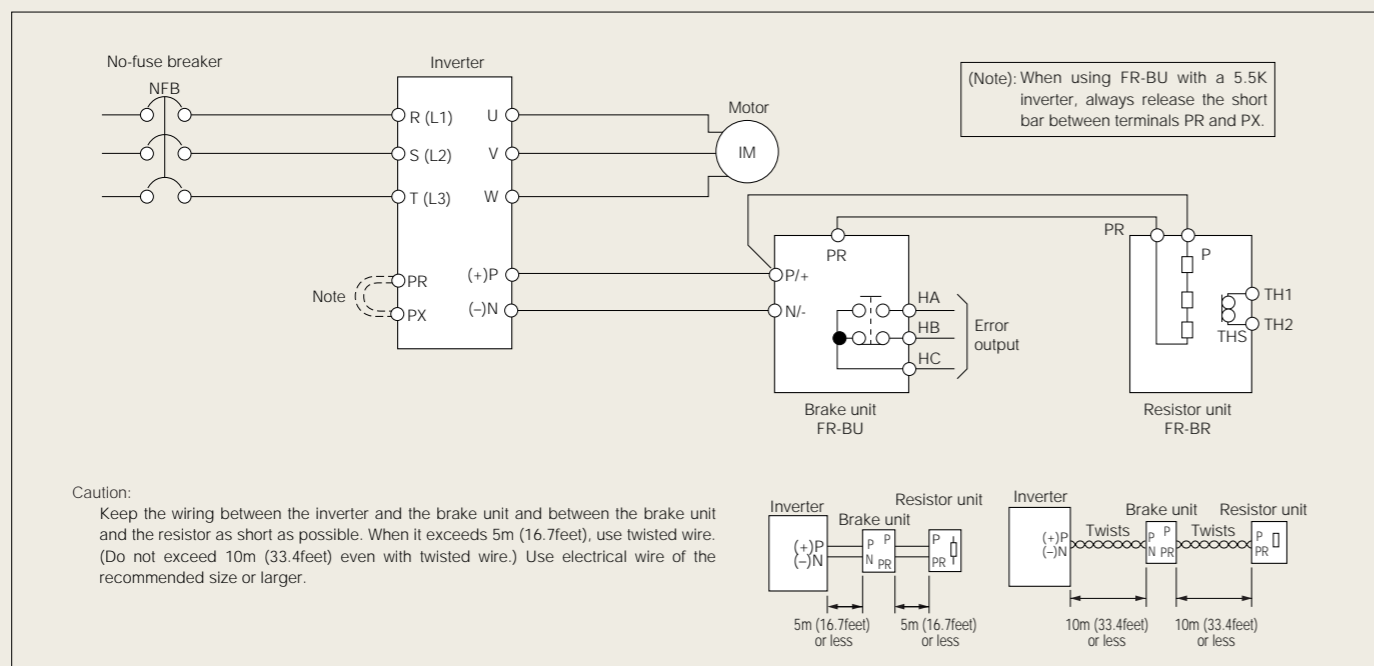
Motor Rating		5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW	
Inverter	200V	5.5K	7.5K	11K	15K	22K	30K	37K	45K	
	400V	5.5K	7.5K	11K	15K	22K	30K	37K	45K	
Brake unit	200V	FR-BU-15K	Braking torque (%)	280	200	120	100	70	—	—
		FR-BU-30K	—	—	260	180	130	100	80	70
		FR-BU-55K	—	—	—	—	250	180	150	120
	400V	FR-BU-H15K	Braking torque (%)	280	200	120	100	70	—	—
		FR-BU-H30K	—	—	260	180	130	100	80	70
		FR-BU-H55K	—	—	—	—	250	180	150	120

Selection Table for Brake Units

Brake unit model	Resistor unit model	Wiring (P-P/+, N-N/-, P/+P, PR-PR)	
200V class	FR-BU-15K	FR-BR-15K	3.5m ² (AWG12)
	FR-BU-30K	FR-BR-30K	5.5m ² (AWG10)
	FR-BU-55K	FR-BR-55K	14m ² (AWG6)
400V class	FR-BU-H15K	FR-BR-H15K	3.5m ² (AWG12)
	FR-BU-H30K	FR-BR-H30K	3.5m ² (AWG12)
	FR-BU-H55K	FR-BR-H55K	5.5m ² (AWG10)

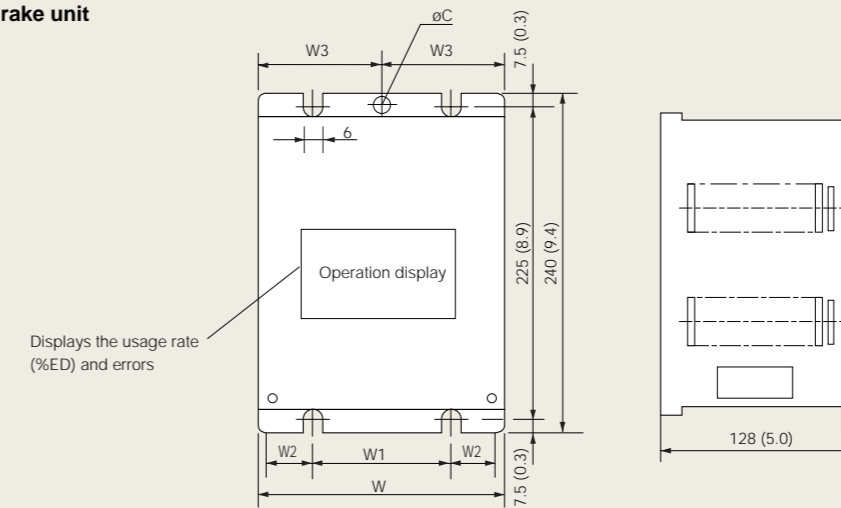
Use the size recommended above or larger for the power line.

Example of external wiring



External Dimensions

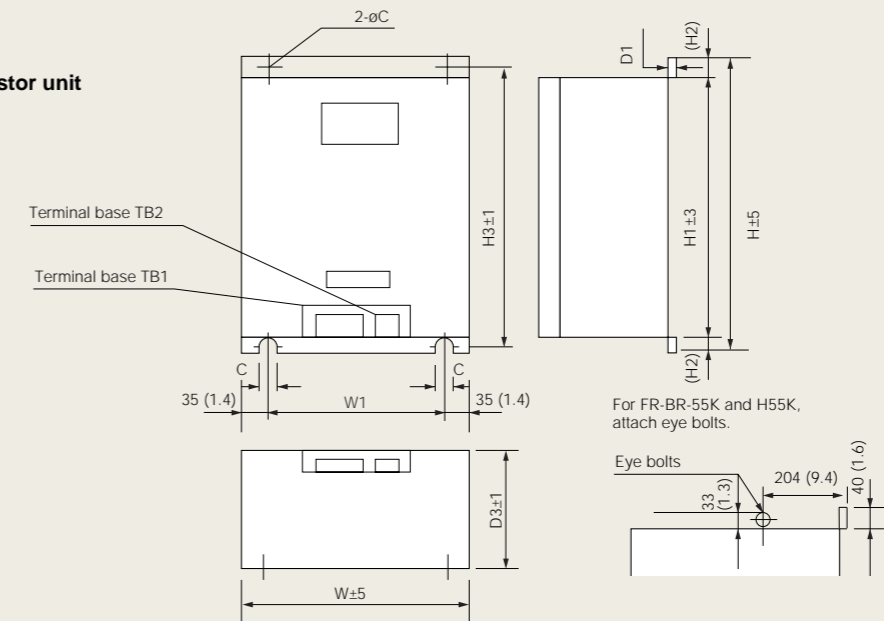
• Brake unit



Resistor unit model		W	W1	W2	W3	C	Approximate mass (kg(lb))
200V	FR-BU-15K	100 (3.9)	60 (2.4)	18.5 (0.7)	48.5 (1.9)	6 (0.2)	2.4 (5.3)
	FR-BU-30K	160 (6.3)	90 (3.5)	33.5 (1.3)	78.5 (3.1)	6 (0.2)	3.2 (7.1)
	FR-BU-55K	265 (10.4)	145 (5.7)	58.5 (2.3)	—	—	5.8 (12.8)
400V	FR-BU-H15K	160 (6.3)	90 (3.5)	33.5 (1.3)	78.5 (3.1)	6 (0.2)	3.2 (7.1)
	FR-BU-H30K	160 (6.3)	90 (3.5)	33.5 (1.3)	78.5 (3.1)	6 (0.2)	3.2 (7.1)
	FR-BU-H55K	265 (10.4)	145 (5.7)	58.5 (2.3)	—	—	5.8 (12.8)

Units: mm(inch)

• Resistor unit



Resistor unit model		W	H	H1	H2	D	W1	H3	D1	C	Approximate mass (kg(lb))
200V	FR-BR-15K	170 (6.7)	450 (17.7)	410 (16.1)	20 (0.8)	220 (8.7)	100 (3.9)	432 (17.0)	3.2 (0.1)	6 (2.4)	15 (33.1)
	FR-BR-30K	340 (13.4)	600 (23.6)	560 (22.1)	20 (0.8)	220 (8.7)	270 (10.6)	582 (22.9)	4 (0.2)	10 (3.9)	30 (66.2)
	FR-BR-55K	480 (18.9)	700 (27.6)	620 (24.4)	40 (1.6)	450 (17.7)	410 (16.1)	670 (26.4)	3.2 (0.1)	12 (4.7)	70 (154.4)
400V	FR-BR-H15K	170 (6.7)	450 (17.7)	410 (16.1)	20 (0.8)	220 (8.7)	100 (3.9)	432 (17.0)	3.2 (0.1)	6 (2.4)	15 (33.1)
	FR-BR-H30K	340 (13.4)	600 (23.6)	560 (22.1)	20 (0.8)	220 (8.7)	270 (10.6)	582 (22.9)	4 (0.2)	10 (3.9)	30 (66.2)
	FR-BR-H55K	480 (18.9)	700 (27.6)	620 (24.4)	40 (1.6)	450 (17.7)	410 (16.1)	670 (26.4)	12 (0.5)	12 (4.7)	70 (154.4)

Units: mm(inch)

FR-RC Power Supply Regenerative Converters

FR-RC Power Supply Regenerative Converters

- The energy produced during inverter braking can be returned to the AC line. This saves space and energy since the brake unit and brake resistor are not required. It also provides increased braking torque.
- Since the heat sink protrudes from the back of the enclosure to isolate heat radiation from the inverter, the enclosure can be made smaller.

Model FR-RC-	15K	30K	55K	H15K	H30K	H55K
Input voltage	3-phase 200V 50Hz 200-230V 60Hz			3-phase 400V 50Hz 400-460V 60Hz		
Permissible fluctuation in input voltage	±10%					
Inverter rating used	5.5K-45K (Select with the internal switch matched to motor capacitance)					

Note: Always install a power factor improvement reactor (FR-BAL) for coordinating the power supply.

External Dimensions

Units mm(inch)

2-∅C holes, Mounting leg (movable), Rating plate, Display panel window, Surface cover, Cooling fan, Dimensions for heat sink protrusion

Dimensions of panel cut-out for heat sink

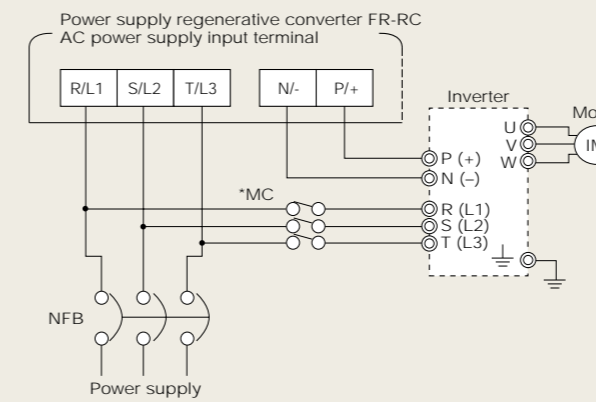
Units: mm(inch)

Model	W	H
200V FR-RC-15K	260 (10.2)	412 (16.2)
200V FR-RC-30K	330 (13.0)	562 (22.1)
200V FR-RC-55K	470 (18.5)	642 (25.3)
200V FR-RC-H15K	330 (13.0)	562 (22.1)
400V FR-RC-H30K	330 (13.0)	562 (22.1)
400V FR-RC-H55K	470 (18.5)	642 (25.3)

Model	W	H	H1	H2	D	W1	H3	D1	C	Approximate mass (kg(lb))
200V	FR-RC-15K	270 (10.6)	450 (17.7)	195 (7.7)	87 (3.4)	200 (7.9)	432 (17.0)	10 (0.4)	8 (0.3)	19 (41.9)
	FR-RC-30K	340 (13.4)	600 (23.6)	195 (7.7)	90 (3.5)	270 (10.6)	582 (22.9)	10 (0.4)	8 (0.3)	31 (68.4)
	FR-RC-55K	480 (18.9)	700 (27.6)	250 (9.8)	135 (5.3)	410 (16.1)	670 (26.4)	15 (0.6)	12 (0.5)	56 (123.5)
400V	FR-RC-H15K	340 (13.4)	600 (23.6)	195 (7.7)	90 (3.5)	270 (10.6)	582 (22.9)	10 (0.4)	8 (0.3)	31 (68.4)
	FR-RC-H30K	340 (13.4)	600 (23.6)	195 (7.7)	90 (3.5)	270 (10.6)	582 (22.9)	10 (0.4)	8 (0.3)	33 (72.8)
	FR-RC-H55K	480 (18.9)	700 (27.6)	250 (9.8)	135 (5.3)	410 (16.1)	670 (26.4)	15 (0.6)	12 (0.5)	56 (123.5)

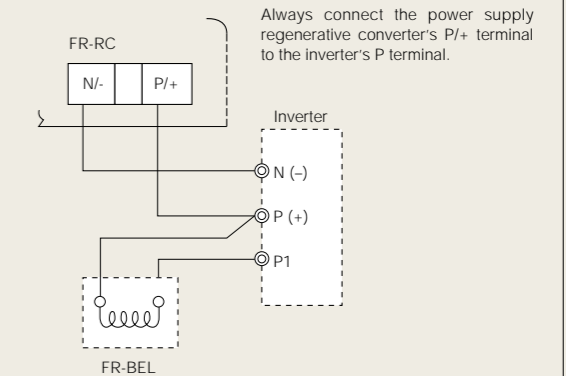
Connections

(1) Connecting the power supply and inverter

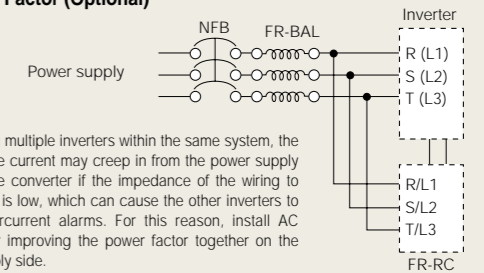


* Do not install an electromagnetic contactor on the power supply regenerative converter side.
 (When the power supply is released during regeneration, the power supply regenerative converter's overcurrent protection will engage.)
 When no voltage is being input to the inverter, the ready output signal (RDY) of the power supply regenerative converter does not go on.

(2) Connecting an FR-BEL power factor improvement DC reactor (optional)



(3) How to Connect an FR-BAL AC Reactor to improve the Power Factor (Optional)



Selection Table

(1) %ED with short period rating at 150% braking torque

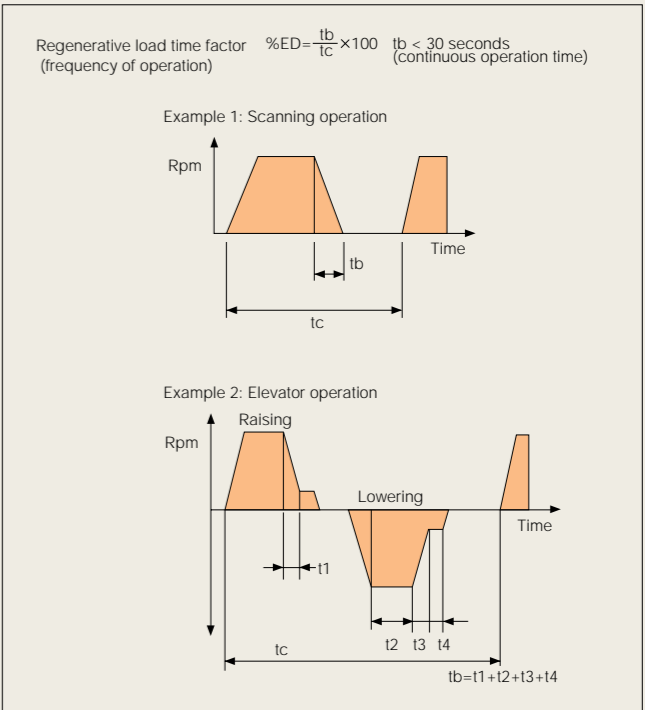
Motor Rating	3.7KW	5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW	
Inverter	200V	3.7K	5.5K	7.5K	11K	15K	22K	30K	37K	45K
	400V	3.7K	5.5K	7.5K	11K	15K	22K	30K	37K	45K
200V	FR-RC-15K	45	45	45	25	—	—	—	—	—
	FR-RC-30K	—	—	—	45	30	25	25	—	—
	FR-RC-55K	—	—	—	—	—	—	45	35	25
400V	FR-RC-H15K	45	45	45	25	—	—	—	—	—
	FR-RC-H30K	—	—	—	45	45	45	25	—	—
	FR-RC-H55K	—	—	—	—	—	—	45	45	45

(2) Braking torque with short period ratings at 50% ED 30 seconds (%)

Motor Rating	3.7KW	5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW		
Inverter	200V	3.7K	5.5K	7.5K	11K	15K	22K	30K	37K	45K	
	400V	3.7K	5.5K	7.5K	11K	15K	22K	30K	37K	45K	
200V	FR-RC-15K	Braking torque	140	140	140	100	80	70	—	—	
	FR-RC-30K	(%)	—	—	—	140	110	100	100	80	70
	FR-RC-55K	(%)	—	—	—	—	—	—	140	120	100
400V	FR-RC-H15K	Braking torque	140	140	140	100	80	70	—	—	
	FR-RC-H30K	(%)	—	—	—	140	140	100	100	80	70
	FR-RC-H55K	(%)	—	—	—	—	—	—	140	140	140

(3) Braking torque at continuous rating (%)

Motor Rating	3.7KW	5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW		
Inverter	200V	3.7K	5.5K	7.5K	11K	15K	22K	30K	37K	45K	
	400V	3.7K	5.5K	7.5K	11K	15K	22K	30K	37K	45K	
200V	FR-RC-15K	Braking torque	100	100	100	75	155	50	—	—	
	FR-RC-30K	(%)	—	—	—	100	80	75	75	55	50
	FR-RC-55K	(%)	—	—	—	—	—	—	100	85	75
400V	FR-RC-H15K	Braking torque	100	100	100	75	55	50	—	—	
	FR-RC-H30K	(%)	—	—	—	100	80	100	75	55	50
	FR-RC-H55K	(%)	—	—	—	—	—	—	100	100	100



⚠ To Ensure Safe Use

- To ensure safe use, read the manual before using the product.
- This product is not designed or manufactured to be used in machinery and systems in situations where life may depend on their operation.
- Contact your nearest Mitsubishi sales representative before using this product in special applications such as machinery or systems for automobiles, medical applications, aerospace, nuclear power, electrical power or undersea relays.
- Although this product was manufactured under strict quality control, safety devices should be installed if it is used in equipment in which its failure may cause major damage or loss.
- Do not use it with loads other than 3-phase induction motors.

■ Noise

During quiet operation, electromagnetic noise tends to increase, so countermeasures should be taken. Depending on how the inverter is installed, noise may have effects even when the carrier frequency is lowered.

Main Countermeasures

- The noise level can be reduced by lowering the carrier frequency.
- An FR-BIF(H) radio noise filter is effective at countering noise from AM radios.
- An FR-BLF line noise filter is effective at preventing sensor malfunctions.
- Separate devices by at least 30cm (11.8inches) (at the very least 10cm (3.94inches)) from inductive noise from inverter power wires. Use twisted pair shielded cable for signal lines.

■ Leakage Current

Electrostatic capacitance occurs between inverted I/O wiring and other wiring, the ground and motors. Current can leak through any of these. Its value can be affected by the carrier frequency etc., so in low noise operation leakage current increases and leakage power breakers and relays can operated at unwanted times. Adopt the following counter measure to prevent this.

Countermeasure

- Lower inverter carrier frequency Pr.72. Motor noise, however, will increase.

■ Power Supply Harmonics

A harmonic is defined as having a frequency that is an integer multiple of a basic (fundamental) frequency. Normally, up to 40-50 times (to several kHz) are defined as harmonics, while higher harmonics are treated as noise. The table below clarifies causes and responses to noise and harmonics.

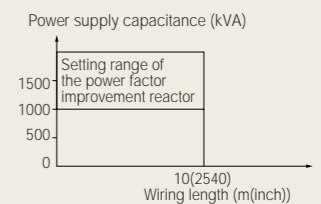
Item	Noise	Harmonic
Frequency band	Harmonic (10kHz on up)	40-50 times (to several kHz)
Main cause	Inverter area	Converter area
Transmission route	Cable runs, space, induction	Cable runs
Effect	Distance, wiring route	Line impedance
Affected item	Voltage change rate / Switching frequency	Current capacitance
Phenomenon	Misdetection of sensors, radio noise, etc. Produces heat in condensive capacitor and generators	Frequency
Remedy	Change wiring route / Install noise filter	Install reactor

■ Installation

- Install in a clean location away from oil mist, dust or other floating particles or enclose in a hermetic casing that keeps floating particles out. If using an enclosure, use a cooling system and casing that keeps the ambient temperature of the inverter to within the permissible range (see page 12 for specifications). Placing the inverter's heat sink so it protrudes from the casing is an effective method of keeping the enclosure small.
- Inverters develop hot spots, so do not install them on flammable materials such as wood.
- Install inverters on walls with the long side vertical.

■ Power Supply

- Inverters can be damaged by large peak currents in the power input circuit when connected directly after large capacitance power supply transformers (within 10m of wiring from a transformer of 1000kVA or more) and when condensive capacitors are switched. In such cases, be sure to install the optional FR-BEL or FR-BAL power factor improvement reactor.
- When a surge voltage occurs in the power supply system, the surge energy flows into the inverter. The inverter displays E.OV1, E.OV2 or E.OV3 and then does an alarm halt. In such cases, install the optional FR-BEL or FR-BAL power factor improvement reactor.



■ Selecting and Installing No-Fuse Breakers

- Install no-fuse breakers (NFB) or fuses on the electricity receiving side to protect the inverter's primary side wiring.

■ Handling of Primary Electromagnetic Contactors

- Inverters can be used without electromagnetic contactors (MCs) on the primary side. When being operated by external terminals (using the STF or STR terminals), do not perform delicate starting and stopping with MCs even when an MC is installed on the primary side. This is to prevent accidents from natural restarting when power comes back on after a power failure (such as an instant stop) and to ensure safety during maintenance work. (The open and closing service life of the inverter input circuit is about 100,000 opens and closes on - offs.)
- Motors can be stopped with the primary MC, but the stop is free-running without the inverter's special regenerative braking.

■ Handling of Secondary Electromagnetic Contactors

- In general, do not install electromagnetic contactors between inverters and motors and switch from off to on during operation. Turning them on during inverter operation produces a large surge current that can stop the device with an overcurrent break.
- When installing an MC for switching to a commercial power supply, turn the MC from on to off (inverter circuit) and off to on (commercial circuit) after stopping the inverter and motor.

■ Removal of Power Factor Improvement Capacitors (Condensive Capacitors)

- Capacitors for power factor improvement and surge killers on the inverter output side can be overheated and damaged by the harmonic component of inverter output. Since the overcurrent protection is engaged when overcurrent flows to the inverter, do not install capacitors or surge killers. Use an AC reactor for power factor improvement to improve the power factor.

■ Interchangeable Parameter Units

- The FR-PU02V is for vector inverters only. When using it on other series inverters, be aware that the displays will not be correct.

 **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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