

VARIABLE FREQUENCY DRIVES

V200E SERIES

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

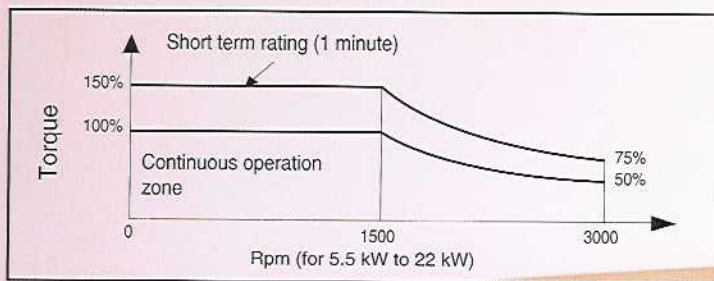


Smoother and The V Vector Inverter Provides Full Fledged

Mitsubishi Electric, a leader in factory automation, has channeled all its experience and technological expertise as a comprehensive electronics manufacturer into the V200E series of full fledged 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 packs a new dimension of potential into a body that breathes high performance.

More Precision and Better Response Than General-Purpose Motors

We use Mitsubishi's own fully digital vector control system to achieve higher torque (150% at 60 seconds) and better response (speed loop of 200 rad/sec). The speed control range has also been enlarged to 1:1500, while a speed control mode has been added and torque control made standard equipment. 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 1.5 K to 45 K (200 and 400V).

High Performance and Exceptionally Easy to Use

The monitor functions now cover the rpm, output current, output torque, motor load and 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 constant required by the inverter, we have expanded the range of motors that it can work with to include the motors listed below.

- o SF-JR with encoder (p. 4)
- o SF-JR with encoder (p. 6)
- o SF-JRCA with encoder (p. 4)
- o Motors with encoder made by other manufacturers (pp. 4 and 12. Motor with PLG)



More Precise. 200E Speed, Position and Torque Control.



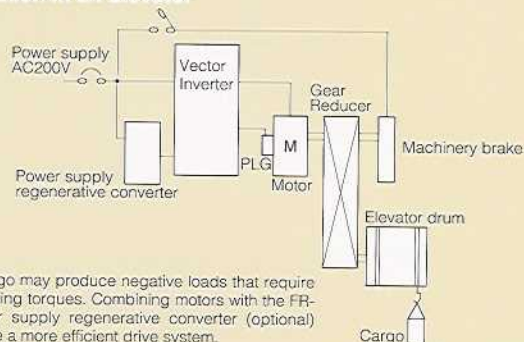
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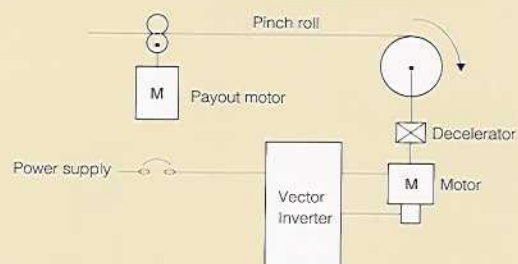
Sample Applications

Application	Equipment	Reason for Use
Rotary presses	Paper winding line	Tensile force control
Extruders and making 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



Sample Application in Winding and Spooling



Equipment Configurations

Vector Inverters

200V Class	400V Class
FR-V220E-1.5K-UL	FR-V240E-1.5K-UL
FR-V220E-2.2K-UL	FR-V240E-2.2K-UL
FR-V220E-3.7K-UL	FR-V240E-3.7K-UL
FR-V220E-5.5K-UL	FR-V240E-5.5K-UL
FR-V220E-7.5K-UL	FR-V240E-7.5K-UL
FR-V220E-11K-UL	FR-V240E-11K-UL
FR-V220E-15K-UL	FR-V240E-15K-UL
FR-V220E-18.5K-UL	FR-V240E-18.5K-UL
FR-V220E-22K-UL	FR-V240E-22K-UL
FR-V220E-30K-UL	FR-V240E-30K-UL
FR-V220E-37K-UL	FR-V240E-37K-UL
FR-V220E-45K-UL	FR-V240E-45K-UL

FR-V220E-5.5K-UL

Symbol	Description
UL	UL, cUL listed

Symbol	Voltage Class
220	200V class
240	400V class

Symbol	Applicable Motor Ratings
1.5K to 45K	Indicates the capacitance in kW

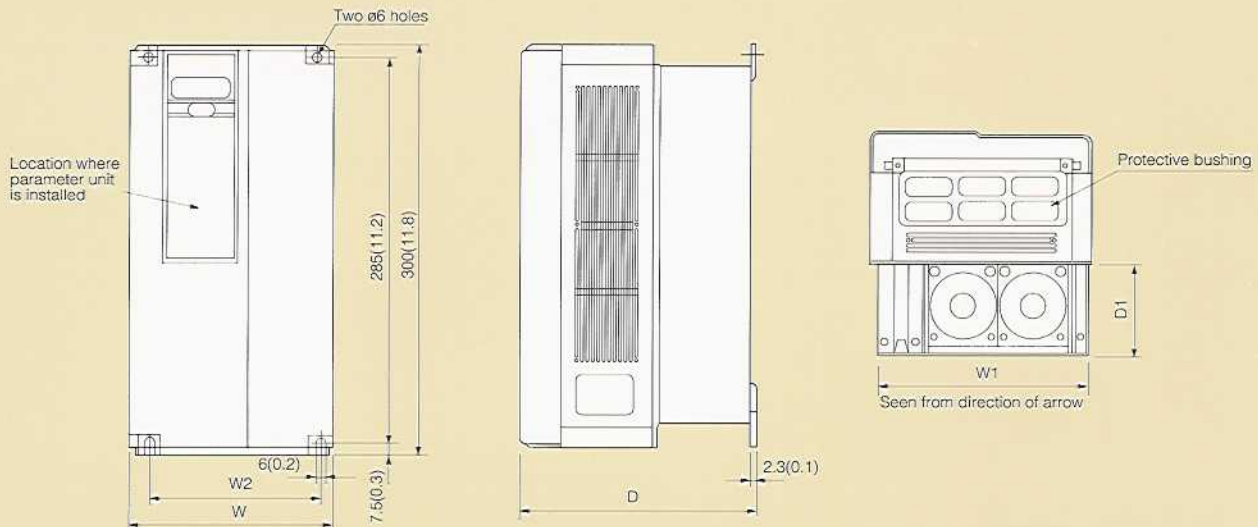
External Dimensions

Vector Inverters

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

Units: mm(inch)

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



200V Class

Note: The 7.5 K has no bushing.

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)

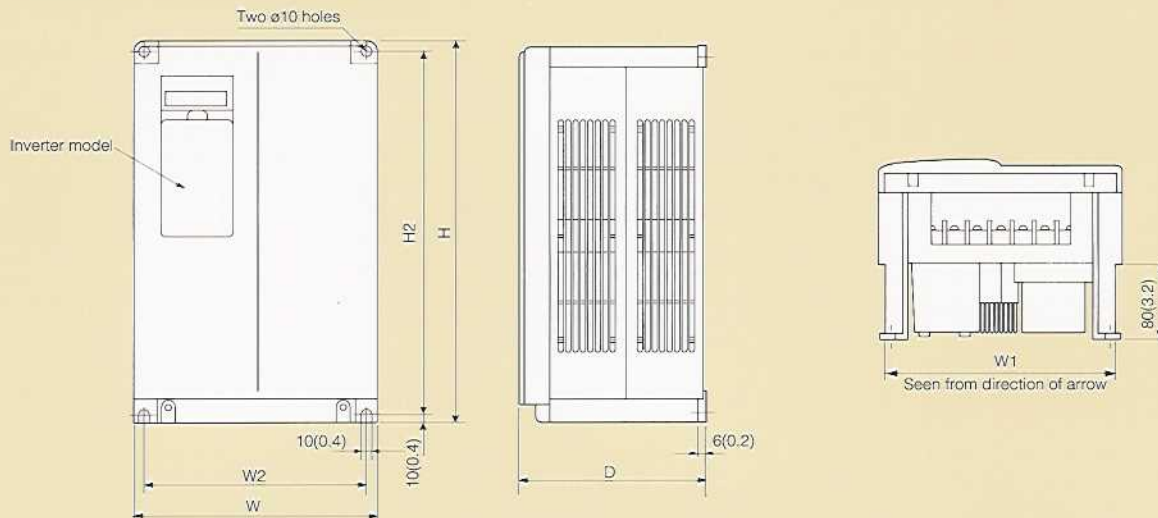
400V Class

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-7.5K	220 (8.7)	210 (8.3)	190 (7.5)	67 (2.6)	195 (7.8)

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

Units: mm(inch)

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



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)

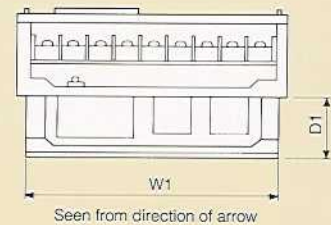
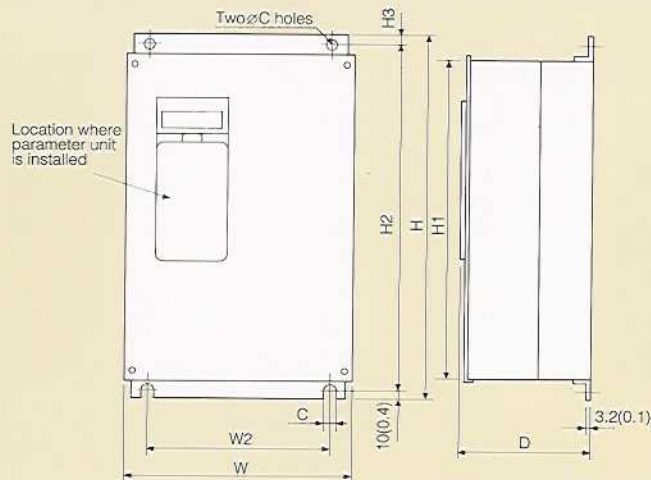
400V Class

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)

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

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

Units: mm(inch)



200V Class

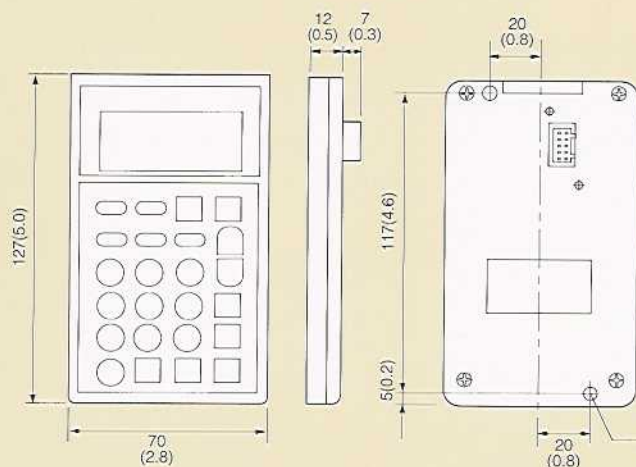
Inverter model	W	W1	H	H1	D	D1	W2	H2	H3	C
FR-V220E-22K	340 (13.4)	324 (12.8)	550 (21.7)	510 (20.1)	195 (7.8)	78 (3.1)	270 (10.1)	530 (20.9)	10 (0.4)	10 (0.4)
FR-V220E-30K	450 (17.7)	434 (17.1)	550 (21.7)	495 (19.5)	250 (9.8)	130 (5.1)	380 (15.0)	525 (20.7)	15 (0.6)	12 (0.5)
FR-V220E-37K	450 (17.7)	434 (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-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)

400V Class

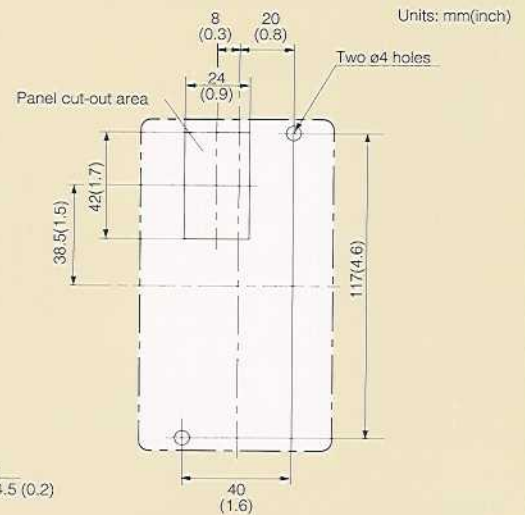
Inverter model	W	W1	H	H1	D	D1	W2	H2	H3	C
FR-V240E-22K	340 (13.4)	324 (12.8)	550 (21.7)	510 (20.1)	195 (7.8)	78 (3.1)	270 (10.1)	530 (20.9)	10 (0.4)	10 (0.4)
FR-V240E-30K	450 (17.7)	434 (17.1)	550 (21.7)	495 (19.5)	250 (9.8)	130 (5.1)	380 (15.0)	525 (20.7)	15 (0.6)	12 (0.5)
FR-V240E-37K	450 (17.7)	434 (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-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

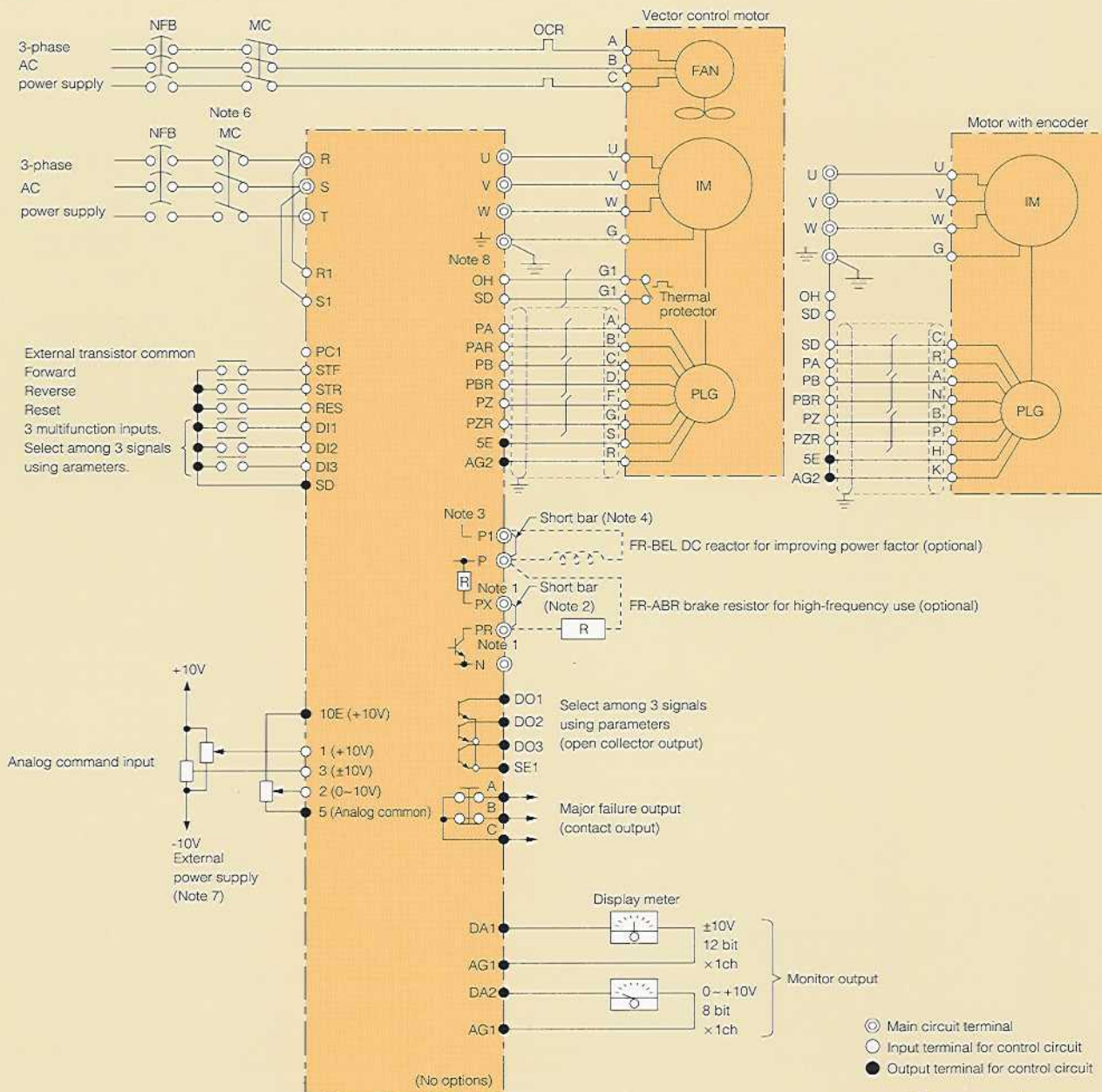


Note: Select the screws so the length does not exceed the effective depth of the parameter unit mounting.



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

Terminal Connection Diagram



(Note) 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 influxes of current when the power is turned on shorten the converter life, so keep on and offs to a minimum.

7: Provide a ±10 V outside power supply for terminals 1 and 3.

8: When using a motor that does not have a thermal protector, open the interval between inverter terminals OH and SD.

9: When connecting two amps to one of the control terminals, line up the backs of round or forked amps of the dimensions shown in the table below.

Description of Terminal Specifications

Type		Terminal No.	Terminal Name	Description		Page	
Main circuit		R, S, T	AC power input	Connects to commercial power supply		16	
		U, V, W	Inverter output	Connects to vector control motor or motor with encoder.		16	
		R1, S1	Power supply for control circuit	Connects to AC power supply terminals R and S. To hold an error display or error output, remove the short bar of the terminal board and input a power supply externally 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).		24, 25	
		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).		25	
		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.		—	
		\perp	Ground	Grounds the inverter chassis. Ground to earth.		—	
Control circuit (input signals)	Contacts (start, function selection, etc.)	STF	Start forward	An ON between the STF and SD terminals is a forward command; an OFF is a stop command.	ON between SD and both STF and STR is a stop command.	—	
		STR	Start reverse	An ON 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 of start), LX (preparatory excitation), MC (control mode switching), and TL (torque control selection). Input signals are selected with Pr.17			12
		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 seconds, 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 setter (variable resistance 1 k Ω).			—
		2	Speed setting	When DC 0 to +10 V is input, becomes the maximum speed at +10 V with proportional I/Os. Input resistance is 10 k Ω .			—
		1	Auxiliary terminal for speed setting	When DC 0 to ± 10 V is input, this signal is added to the second terminal setting. Input resistance is 10 k Ω .			—
		3	Torque setting terminal	The torque setting signal for torque control and torque restriction signal for speed control and position control. DC 0 to ± 10 V. Input resistance is 10 k Ω .			—
		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	1c contact 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: Nonconductive between B and C (conductive between A and C). Normally: Conductive between B and C (nonconductive between A and C).		—	
	Open collectors	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 (instant stop/undervoltage occurred), PU (operating under parameters), TU (torque detection), and RV (ready to run). Permissible load DC 24 V 0.1 A.			—
		DO2	Digital output terminal 2				
		DO3	Digital output terminal 3				
		SE1	Open collector output common				
	Analog	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.	13	
		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.	13	
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.			—	

(Notes) *The PR and PX terminals are installed at FR-V220E-5.5 K or lower and FR-V240E-5.5 K or lower.

Description of Parameters

Function	Para-meter No.	Name	Screen Display	Setting Range	Minimum setting unit	Shipment Setting
Basic function	1	Upper limit setting	Max. S	0-3600r/min	1r/min	1500r/min
	2	Lower limit setting	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
	8	Deceleration time	Deec. tl	0-3600sec	0.1sec	5sec/15sec
	9	Electronic thermal		0-500A	0.01A	Motor rated current/0
Application functions	10	DC braking operating speed	DC. Br. S	0-1500r/min, 9999	1r/min	90r/min
	11	DC braking operating time	DC. Br. t	0-10sec	0.1sec	0.5sec
	12	DC braking operating 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	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	Acceleration time S curve 1		0-50%	1%	0%
	19	Deceleration time S curve 1		0-50%	1%	0%
	20	Acceleration/ deceleration reference speed	Acc/DecS	0-3600r/min	1r/min	1500r/min
	21	Acceleration time S curve 2		0-50%	1%	0%
	22	Deceleration time S curve 2		0-50%	1%	0%
	23	Thermal protector input		0, 1	Integer	0
	24	Multi-stage speed setting (4 speeds)	Preset S4	0-3600r/min, 9999	1r/min	9999
	25	Multi-stage speed setting (5 speeds)	Preset S5	0-3600r/min, 9999	1r/min	9999
	26	Multi-stage speed setting (6 speeds)	Preset S6	0-3600r/min, 9999	1r/min	9999
	27	Multi-stage speed setting (7 speeds)	Preset S7	0-3600r/min, 9999	1r/min	9999
	28	Multi-stage speed compensation selection	Pre. Comp	0, 1	Integer	0
	29	Acceleration/ deceleration pattern	Acc/Decp	0, 1, 2	Integer	0
Protection function	30	Regenerative brake selection	Br. Set	0, 1	Integer	0
	31	Speed deviation level	SDev Lvl	0-1500r/min, 9999	1r/min	9999
	32	Over-speed 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	0-200%	0.1%	150%
	35	Torque restriction level (regenerative)	TL Lvl.2	0-200%, 9999	0.1%	9999
	36	Torque restriction level (3 quadrant)	TL Lvl.3	0-200%, 9999	0.1%	9999
	37	Torque restriction level (4 quadrant)	TL Lvl.4	0-200%, 9999	0.1%	9999
	38	Torque restriction level 2	2nd TL	0-200%, 9999	0.1%	9999
Output terminal function	39	Torque detection	Trq. Det.	0-200%	0.1%	150%
	40	Output terminal assignments	Set Dig O	0-999	Integer	12
	41	Speed arrival operation width	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 function	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 1		0-999, 9999	Integer	9999
	47	Torque boost	Trq. Bst	0-30%	0.1%	3%
	48	Bottom frequency	VFBASE F	50-200Hz	0.01Hz	60Hz
	49	Bottom frequency voltage	VFBASE V	0-500V, 9999	0.1V	9999
Display function	51	Main unit 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 monitor reference	CalbAM S	0-3600r/min	1r/min	1500r/min
	57	Current monitor reference	CalbAM I	0-500A	0.01A	Rated value
	58	Torque monitor reference	CalbAM T	0-200%	0.1%	100%
	59	Language switching	PU Lang	0, 9999	Integer	9999

Function	Para-meter No.	Name	Screen Display	Setting Range	Minimum setting unit	Shipment Setting
Operation selection function	60	Speed deviation time	SDev Time	0-100sec	0.1sec	12sec
	61	Restart free-run time	Restrt T	0-5sec, 9999	0.1sec	9999
	62	Preparatory excitation selection	Set LX	0.1	Integer	0
	63	Torque command selection	Set TRef	0.1	Integer	0
	64	Motor capacitance		0-55kW, 9999	0.01kW	9999
	65	Number of motor poles		2-6, 9999	Integer	9999
	66	Rated motor rpm		0-3600r/min	1r/min	1800r/min
	67	Zero current detection	1Dt. Lvl	0-50%	0.1%	5%
	68	Zero current detection time	1Dt. T	0.05-1sec, 9999	0.01%	9999
	69	Number of PLG pulses		0-4096	1	1024
	70	Regenerative brake usage rate	Br. Duty	0-30%/0%	0.1%	0%
	71	Applicable 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	0.1	Integer	1
	76	Failure definition	Trbl. Def	0.1	Integer	0
	77	Parameter write disable selection	EnableWr	0, 1, 2	Integer	0
	78	Reverse disable selection	EnableFR	0, 1, 2	Integer	0
	79	Operating mode selection	Ope. Mode	0, 1, 2	Integer	0
Control system function	80	Speed control P gain 1	S Gaim1	0-1000%	1%	30%
	81	Speed control I gain 1	S ICom1	0-1000%	0.1%	3%
	82	Speed setting filter 1	SSFil. 1	0-5sec	0.001sec	0 sec
	83	Speed detection filter 1	SDtFil. 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	TStFil. 2	0-5 sec	0.001sec	0 sec
	87	Torque detection filter 1	TDtFil.2	0-5 sec	0.001sec	0 sec
	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	SSFil. 2	0-5sec	0.001sec	0 sec
	93	Speed detection filter 2	SDtFil. 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	TStFil. 2	0-5 sec	0.001sec	0 sec
	97	Torque detection filter 2	TDtFil. 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
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) 1800r/min
	904	Torque command third bias	ExtBias3	0-10V 0-200%	0.1%	(0V) 0%
	905	Torque command third gain	ExtGain3	0-10V 0-200%	0.1%	(10V) 150%

(Note) Settings for parameters in yellow can be changed during operation.

■ PU Operation

Auto-tuning operation

- ① Set Pr.98 (non-rotating mode) to 1.

SET ⑨ ⑧ READ ① WRITE



Screen for the parameter setting mode.

- ② Set related parameters.

• Pr.9 • Pr.48 • Pr.49 • Pr.64
• Pr.65 • Pr.66 • Pr.69 • Pr.99



Screen with Pr.64 set.

- ③ Monitor tuning mode.

MONITOR



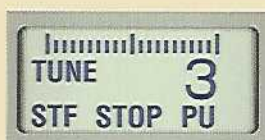
The monitor screen for tuning mode appears.

- ④ The auto-tuning operation ends. Stop.

STOP



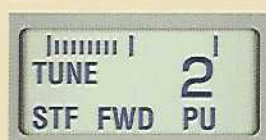
- ⑤ Tuning ends.



The screen at the end of tuning.

- ⑥ Tuning starts. Forward rotation (or reverse).

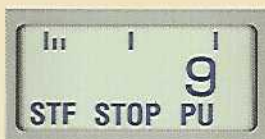
FWD



The screen during tuning.

About 20 seconds

- ⑦ A tuning error occurs. Redo the auto-tuning operation.



The screen when a tuning error occurs. Protection Functions

About 20 seconds

■ 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-out occurred	E.IPF	An instantaneous power-outage occurred in the power supply being input	
Thermal operation	E.OHT	The heat-activated thermal connected to the OH terminal was activated	
Brake transistor error	E.EB	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.EP	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 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	

Standard Specifications

■ 200V Class

Model FR-V220E- [] -UL		1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	
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 sec, 200% 0.5 sec (characteristics when outside limits)											
	Voltage *2		3phase 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		3phase 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 (1.4)	3.7 (1.5)	7.5 (3.0)	7.7 (3.0)	7.7 (3.0)	14.5 (5.7)	17 (6.7)	17 (6.7)	33 (13.0)	45 (17.7)	54 (21.3)	72 (28.3)

■ 400V Class

Model FR-V240E- [] -UL			1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K
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% 60sec, 200% 0.5sec (characteristics when outside limits)											
	Voltage *2		3phase 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		3phase 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 (1.8)	4.5 (1.8)	7.5 (3.0)	7.7 (3.0)	16 (6.3)	16 (6.3)	20 (7.9)	20 (7.9)	33 (13.0)	54 (21.3)	54 (21.3)	72 (28.3)

(Notes) *1. 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.

*2. The maximum output voltage cannot go above the power supply voltage.

*3. 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.

*4. The power supply capacity varies with the value of the power supply impedance (including input reactor and power lines).

*5. 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, fully 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 settings (1rpm units for minimum setting)			
		Analog input	0.1% of maximum set speed			
	Acceleration/ deceleration time		0 to 3600 seconds (acceleration and deceleration independently settable in 0.1sec increments)			
	Acceleration/ deceleration pattern		Select between linear and S curve acceleration/deceleration modes			
Torque restriction level			Settable torque restriction value (variable between 0 and 200%)			
Input signal	Analog setting signal	Terminal No	Setting Range	Speed Control	Torque Control	
		2	0-10 V (resolution 0.1%)	Main speed setting	Speed restriction	
		1	0±10 V (resolution 0.2%)	Auxiliary speed setting	Speed restriction compensation	
		3	0±10 V (resolution 0.2%)	Torque restriction (regenerative/ power running)	Torque	
	With option FR-VPA-VPB	4	0±10 V (resolution 0.2%)	Torque restriction (regenerative only)	—	
		6	0±10 V (resolution 0.01%)	Main speed setting (in this case, terminals 1and 2are invalid)	Torque command (in this case, terminal 3is not valid)	
	Contact signals	4fixed function terminals	Total 4 points (forward command, reverse command, error reset, and thermal protector)			
		3multi-function terminals	Select between multi-stage speed setting (up to 7 speeds) and jogging operation*5 Select three parameters from among second function selection, preparatory excitation, free-run terminal, hold operation signal, S curve switching, torque restriction selection, and control mode switching.			
Output signals	Contact signals		Error output, 1c contact (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)			
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), brake transistor error,*6 over-speed, motor overheating, etc.			
Environment	Ambient temperature		-10°Cto +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) 1. 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.

2. The maximum output voltage cannot go above the power supply voltage. The maximum output voltage can be set anywhere below the power supply voltage.

3. Indicates the average torque when decelerating to a stop from 60Hz. Does not vary with motor loss.

4. The power supply capacitance varies with the value of the power supply impedance (including input reactor and power lines).

5. Jogging operation is also possible with the parameter unit.

6. Not installed in the FR-V220E-7.5K-45K-UL and FR-V240E-7.5K-45K-UL, which have no built-in brake circuits.

7. The temperature that can be applied for short times, such as in transit.

8. 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.

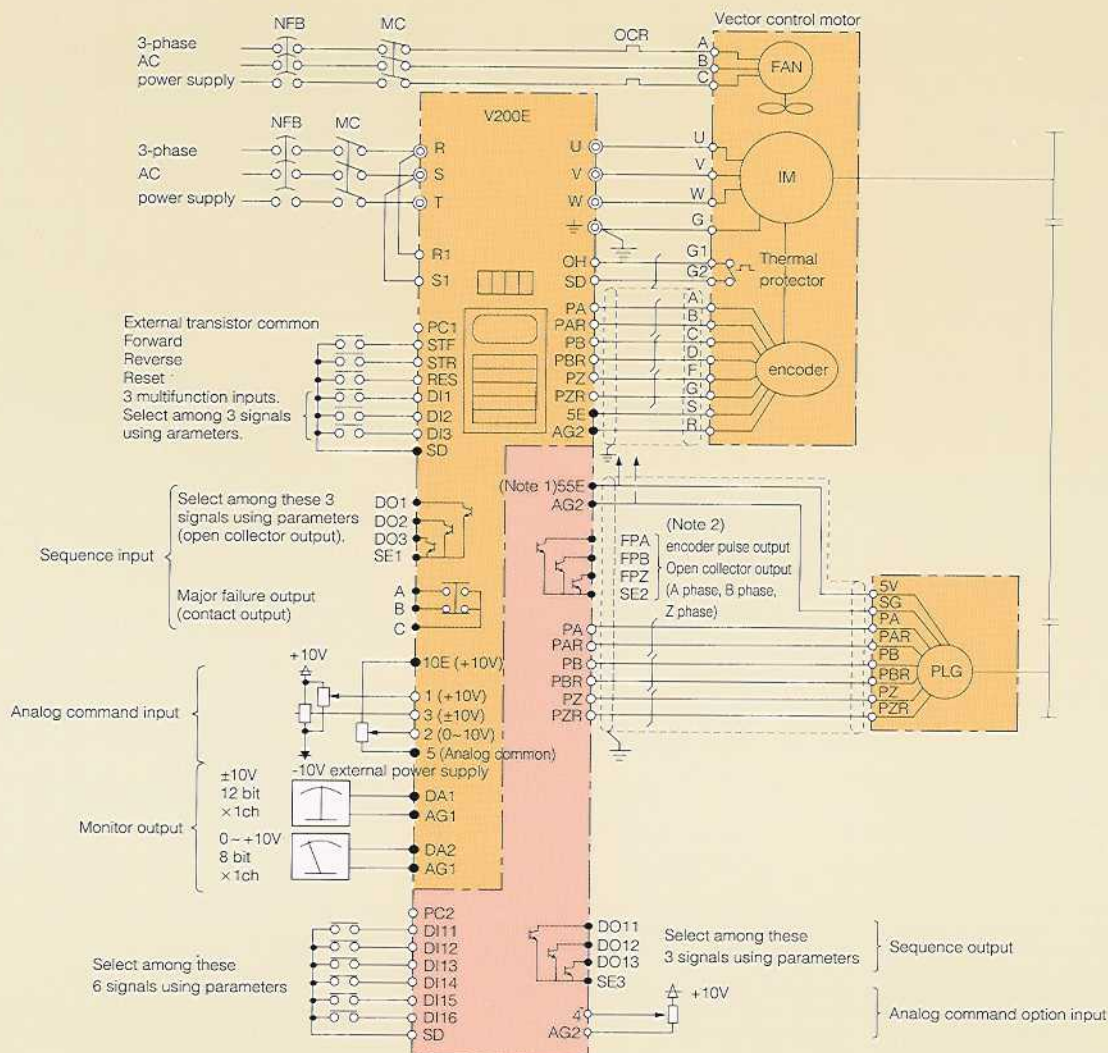
9. The fan power supply is 200V even for 400V class inverters.

Installation of Dedicated, Built-in Options

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

Option	Functions Provided											
	Orientation control (orientation encoder input)	Position control (pulse string input)	Expansion input	Expansion output	Expansion analog input		PLG pulse output		Power supply for long-distance cable	RS422/RS485 interface	Motor thermistor interface	Digital 12 bit input
					0-10 V, 10 bits	±10 V, 14 bits	Open collector	Line driver				
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)

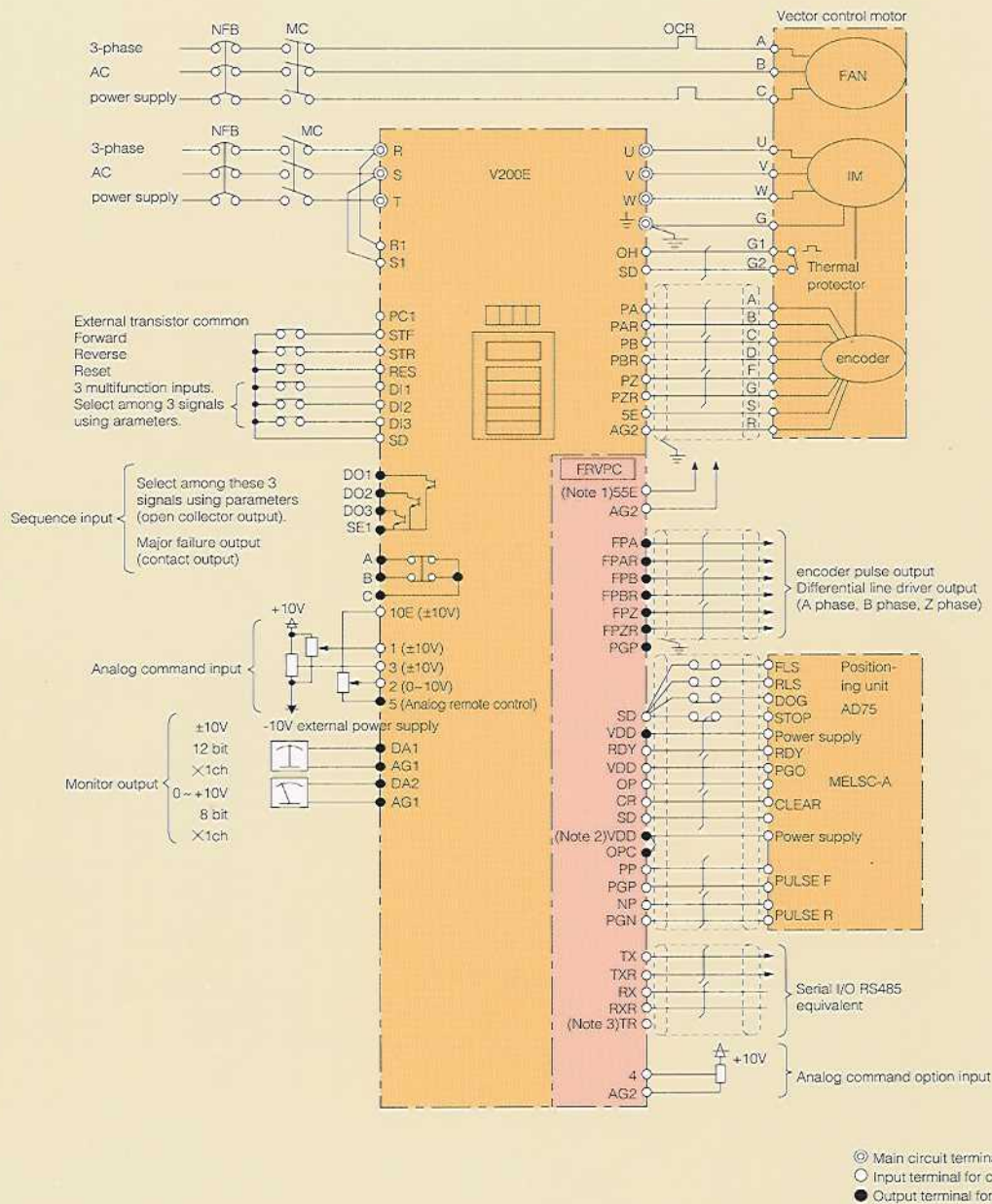


(Note) 1: When using a long-distance cable of 50m (167feet) or more, use as an encoder power supply.

2: The encoder on the motor or the encoder in the machine can be selected for encoder pulse output.

◎ Main circuit terminal
○ Input terminal for control circuit
● Output terminal for control circuit

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

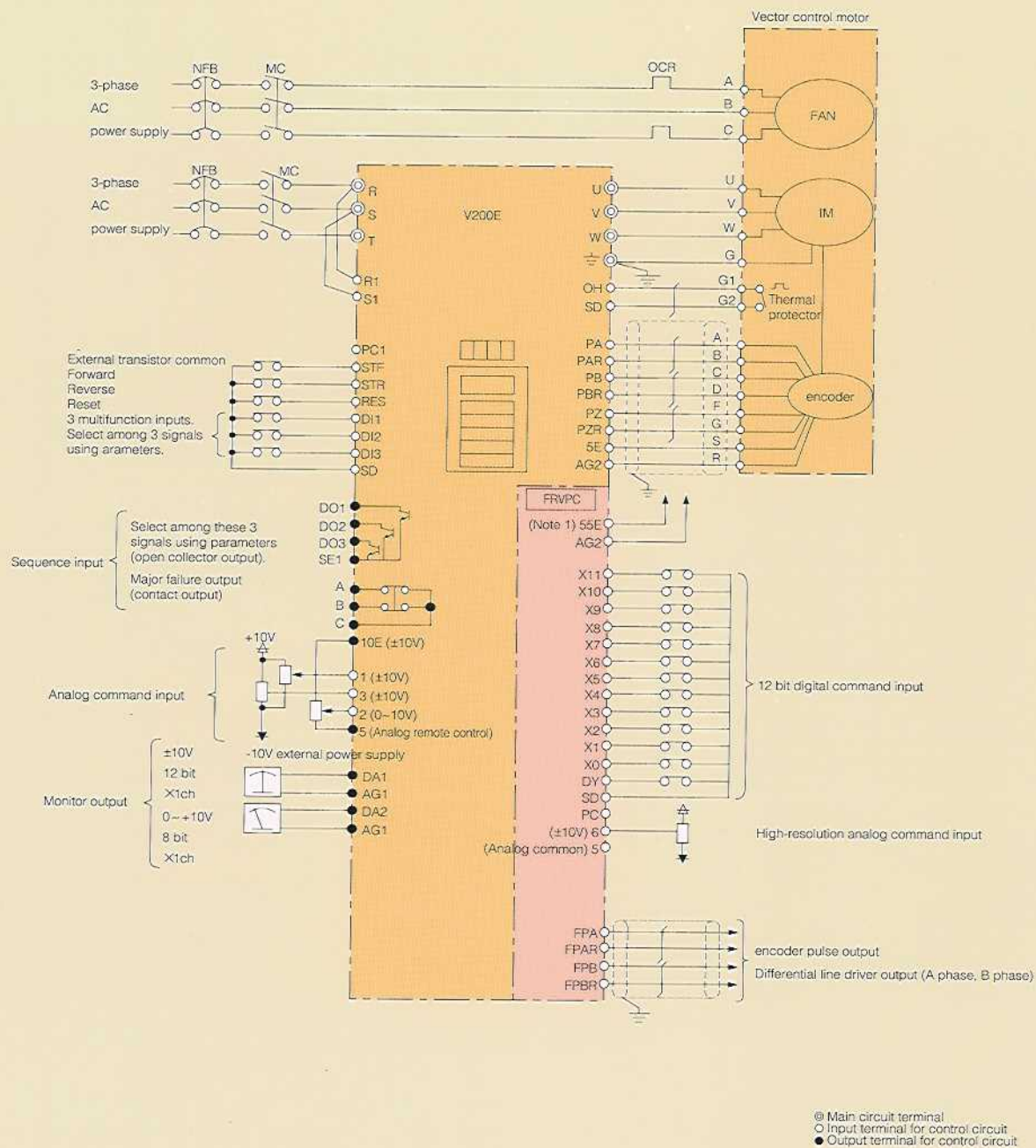


(Note) 1: When using a long-distance cable of 50m (167feet) or more, use as a encoder power supply.

2: The pulse string signal from the positioning unit can be an open collector or a line driver; however, the connections are somewhat different. (An open collector is shown in the figure.)

3: Remove the connector bar between RXR and TR for the farthest inverter.

Example of Line Connections (FR-VPC)



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

List of Options

	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 •RS485 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	
Stand alone	Accessory cover	—	Halved cover for after removing the parameter unit from the main unit	For all ratings
	Serial communications unit	FR-CU01	RS485 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.	1.5-45K
	Brake resistor for high-frequency use	FR-ABR-(H)*	For increasing braking power of the brake built into the inverter	1.5-5.5K
	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	3.7-45K
	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	1.5-45K
	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 <input type="checkbox"/>	Cable for connecting parameter units and parameter combination units. Straight type and L type.	
	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)	For specific ratings
	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	

(Notes) *An H is added to 400 V class models. **Rated power consumption.

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 (%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	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	%ED	80	40	15	10	—	—	—
		FR-BU-30K		—	—	30	15	10	—	—
		FR-BU-55K		—	—	—	60	30	20	15
	400V	FR-BU-H15K	%ED	80	40	15	10	—	—	—
		FR-BU-H30K		—	—	30	15	10	—	—
		FR-BU-H55K		—	—	—	60	30	20	15

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

Motor Rating			5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW
Inverter	200V	5.5K	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	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	100	80	70
		FR-BU-H55K		—	—	—	250	180	150	120

■ Selection Table for Brake Units

Brake unit model	Resistor unit model	Power (P-P/+, N-N/-, line P/+P, PR-PR)	
200V class	FR-BU-15K	FR-BR-15K	3.5m ² (11.7ft ²)
	FR-BU-30K	FR-BR-30K	5.5m ² (18.4ft ²)
	FR-BU-55K	FR-BR-55K	14m ² (46.7ft ²)
400V class	FR-BU-H15K	FR-BR-H15K	3.5m ² (11.7ft ²)
	FR-BU-H30K	FR-BR-H30K	3.5m ² (11.7ft ²)
	FR-BU-H55K	FR-BR-H55K	5.5m ² (18.4ft ²)

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



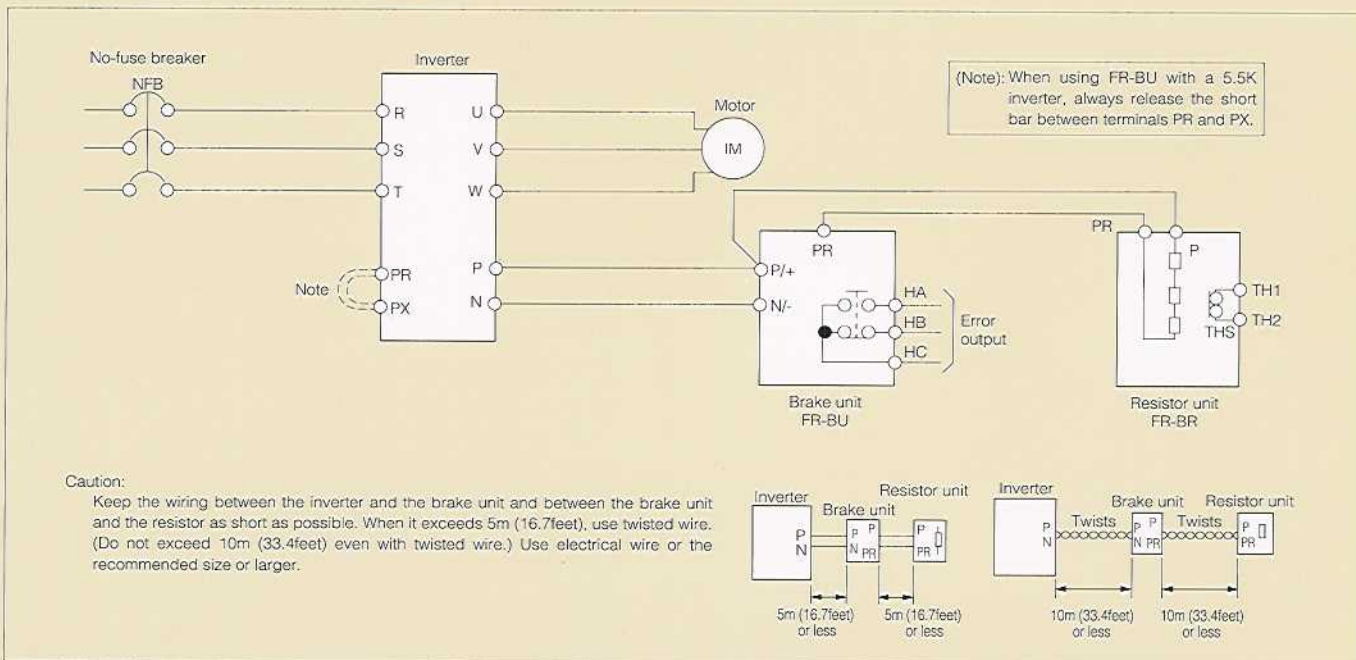
Resistor unit

Brake unit

Note 1: The maximum temperature rise of the resistor unit is 100 degrees. Either use heat-resistant electrical wire (fiber-glass braided wire or the like) or cover the wire in silicon tubing.

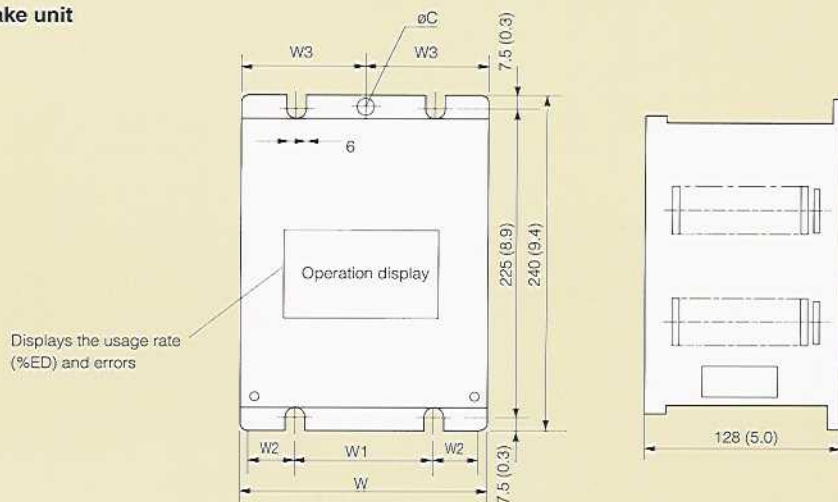
Note 2: Correctly wire the P/+ and N/- terminals to the inverter's P and N terminals. Mistakes in wiring will prevent the brake unit from operating correctly.

■ Example of external wiring



External Dimensions

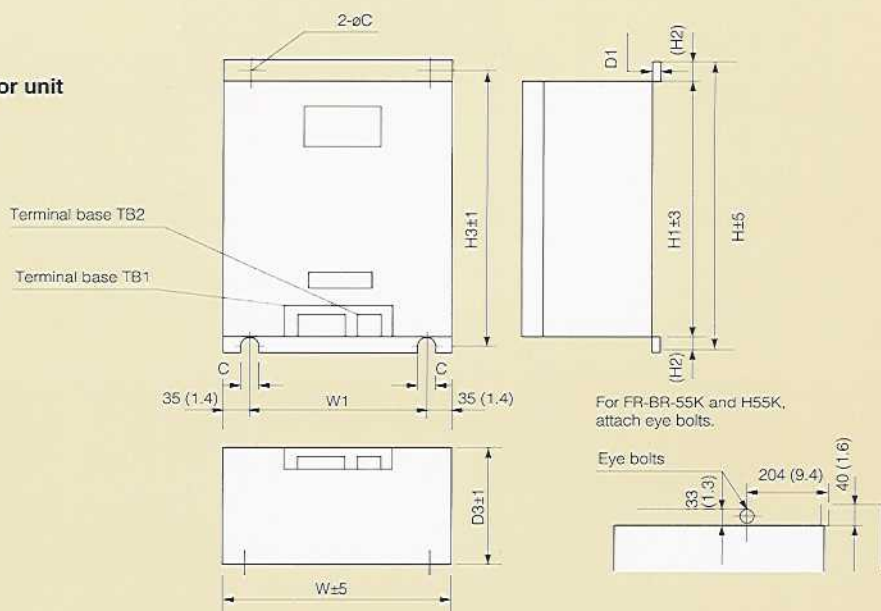
• Brake unit



Units: mm(inch)

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 (0.9)
	FR-BU-30K	160 (6.3)	90 (3.5)	33.5 (1.3)	78.5 (3.1)	6 (0.2)	3.2 (1.3)
	FR-BU-55K	265 (10.4)	145 (5.7)	58.5 (2.3)	—	—	5.8 (2.3)
400V	FR-BU-H15K	160 (6.3)	90 (3.5)	33.5 (1.3)	78.5 (3.1)	6 (0.2)	3.2 (1.3)
	FR-BU-H30K	160 (6.3)	90 (3.5)	33.5 (1.3)	78.5 (3.1)	6 (0.2)	3.2 (1.3)
	FR-BU-H55K	265 (10.4)	145 (5.7)	58.5 (2.3)	—	—	5.8 (2.3)

• Resistor unit



Units: mm(inch)

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 (5.9)
	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 (11.8)
	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 (27.6)
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 (5.9)
	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 (11.8)
	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 (27.6)

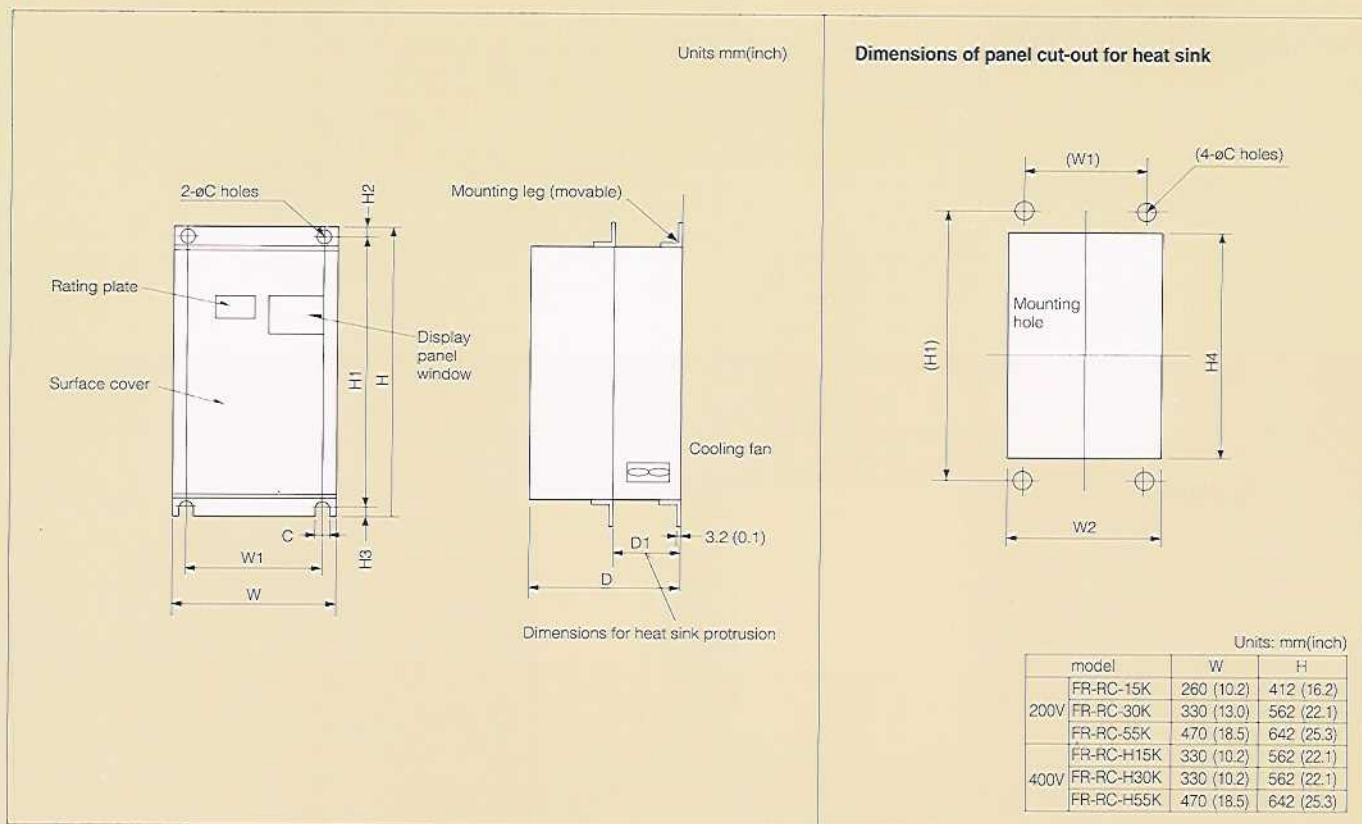
FR-RC Power Supply Regenerative Converters

- 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- <input type="checkbox"/>	15K	30K	55K	H15K	H30K	H55K
Input voltage	3phase 200V 50Hz 200-230V 60Hz			3phase 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.

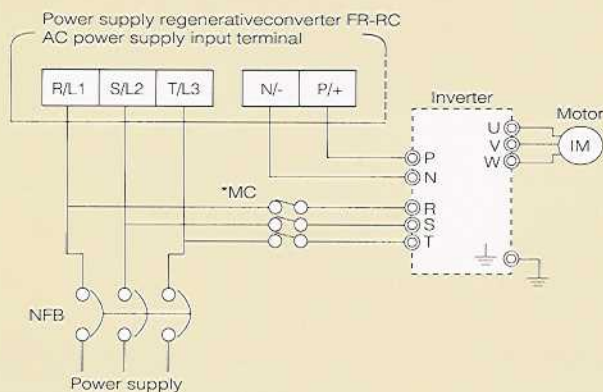
External Dimensions



Units: mm(inch)											
	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)	10 (0.4)	19 (7.5)
	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)	10 (0.4)	31 (12.2)
	FR-RC-55K	480 (18.9)	700 (27.6)	250 (9.8)	135 (5.3)	410 (16.1)	670 (26.4)	15 (0.6)	15 (0.6)	12 (0.5)	56 (22.0)
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)	10 (0.4)	31 (12.2)
	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)	10 (0.4)	33 (13.0)
	FR-RC-H55K	480 (18.9)	700 (27.6)	250 (9.8)	135 (5.3)	410 (16.1)	670 (26.4)	15 (0.6)	15 (0.6)	12 (0.5)	56 (22.0)

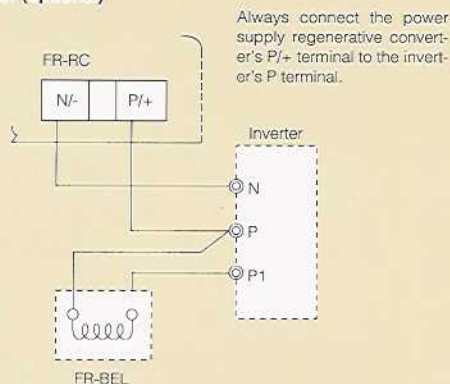
Connections

(1) Connecting the power supply and inverter



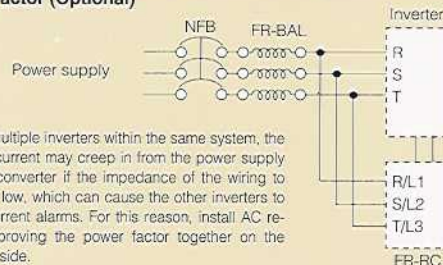
* Do not install an electromagnetic contactor on the power supply regenerative converter side.
(When the power supply is released during regeneration, the power supply regenerative converter's overcurrent protection will engage.)
When no voltage is being input to the inverter, the ready output signal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

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



Always connect the power supply regenerative converter's P/+ terminal to the inverter's P terminal.

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



When using multiple inverters within the same system, the regenerative current may creep in from the power supply regenerative converter if the impedance of the wiring to the inverter is low, which can cause the other inverters to trigger overcurrent alarms. For this reason, install AC reactors for improving the power factor together on the power supply side.

Selection Table

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

Motor Rating	5.5KW	5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW
Inverter	200V	5.5K	5.5K	7.5K	11K	15K	22K	30K	45K
	400V	5.5K	5.5K	7.5K	11K	15K	22K	30K	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 sec (%)

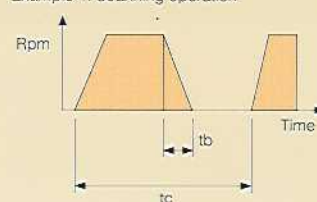
Motor Rating	5.5KW	5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW
Inverter	200V	5.5K	5.5K	7.5K	11K	15K	22K	30K	45K
	400V	5.5K	5.5K	7.5K	11K	15K	22K	30K	45K
200V	FR-RC-15K	140	140	140	100	80	70	—	—
	FR-RC-30K	—	—	—	140	110	100	80	70
	FR-RC-55K	—	—	—	—	—	140	120	100
400V	FR-RC-H15K	140	140	140	100	80	70	—	—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

(3) Braking torque at continuous rating (%)

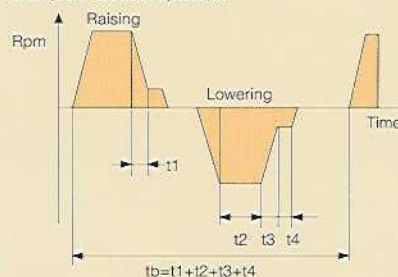
Motor Rating	5.5KW	5.5KW	7.5KW	11KW	15KW	22KW	30KW	37KW	45KW
Inverter	200V	5.5K	5.5K	7.5K	11K	15K	22K	30K	45K
	400V	5.5K	5.5K	7.5K	11K	15K	22K	30K	45K
200V	FR-RC-15K	100	100	100	75	155	50	—	—
	FR-RC-30K	—	—	—	100	80	75	55	50
	FR-RC-55K	—	—	—	—	—	100	85	75
400V	FR-RC-H15K	100	100	100	75	55	50	—	—
	FR-RC-H30K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

Regenerative load time factor (frequency of operation) $\%ED = \frac{t_b}{t_c} \times 100$ $t_b < 30 \text{ sec}$ (continuous operation time)

Example 1: Scanning operation



Example 2: Elevator operation



⚠ 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 the Mitsubishi customer liaison office 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 conductive 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 it 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 and the like, so in low noise operation leaking current increases and leaking 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 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	Frequency band	Frequency band
Frequency band	Harmonic (10kHz on up)	40-50times (to several kHz)
Main cause	Inverter area	Converter area
Transmission route	Cable runs, space, induction	Cable runs
Effect	Distance, wiring route	Line impedance
Amount produced	Voltage change rate / Switching frequency	Current capacitance
Phenomenon	Misdetction of sensors, radio noise, etc. Produces heat in condensive capacitors and generators	Frequency band
Remedy	Change wiring route / Install noise filter	Install reactor

■ Installation

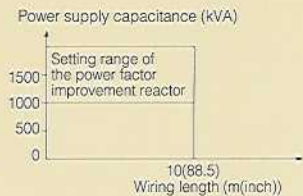
- Install in a clean location away from oil mist, dust or other floating particles, or enclose in a hermetic casing that keeps floating particles out. If using an enclosure, use a cooling system and casing that keeps the ambient temperature of the inverter to within the permissible range (see page 17 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 FRBAL 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 (MC) on the electromagnet 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 end. This is to prevent accidents from natural restarting when power comes back on after a power outage (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.)
- 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 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.

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