V500 Series

VARIABLE FREQUENCY DRIVES

1 – 400 HP

The Reliable "V" Combining High Performance with Ease-of-Use!

MITSUBISHI ELECTRIC

Loaded with New Technology!

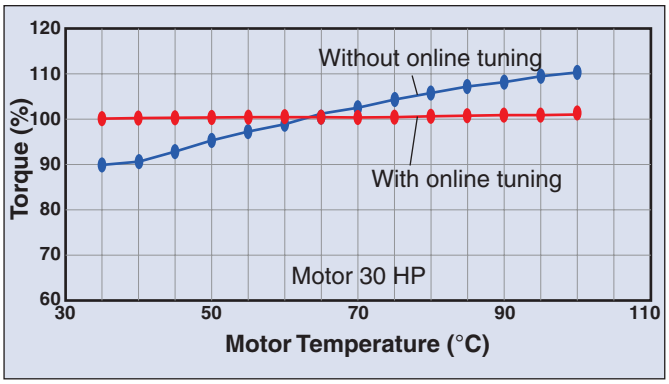
Adaptive Flux Observer

Motor flux is continuously updated using the motor current and the inverter output voltage.

The motor flux is calculated at high precision, improving torque accuracy.

Torque fluctuation caused by changes in the motor temperature is reduced by using online tuning with the adaptive flux observer, high torque accuracy is realized regardless of changes in the motor temperature (Vector control with encoder).

Motor Temperature – Torque Characteristics



Improved torque accuracy makes this product suitable for torque controlled applications such as winding machines, printing machines (tension control) and steel lines (helper control using speed-torque).

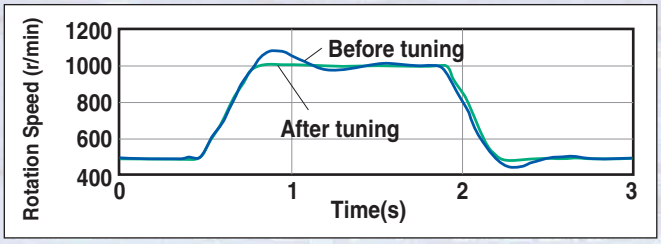
Simple Gain Tuning

The motor's load inertia is estimated online, and the speed control gain and position loop gain are adjusted automatically.

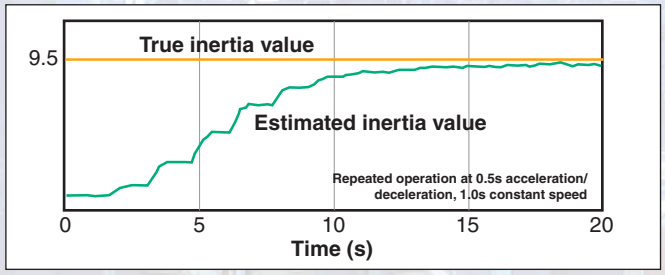
Speed control gain and position loop gain adjustments are no longer necessary!

The motor's load inertia, estimated automatically online from the output torque during acceleration/deceleration, provides the optimum speed control gain and position loop gain. The software can set the optimum response automatically with the 15-step responsiveness settings.

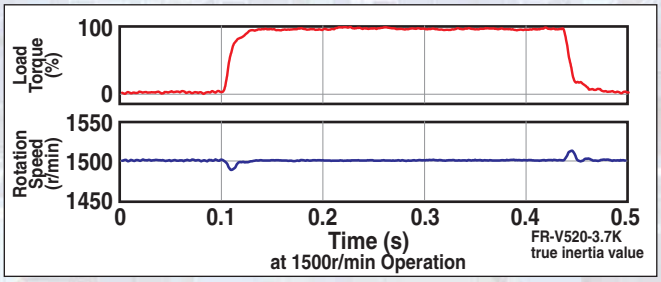
Comparison of Speed Accuracy Before and After Tuning



Automatic Load Inertia Estimation Characteristics



Tracking Ability at Impact Load



The speed control gain, position loop gain and load inertia are estimated automatically, eliminating bothersome adjustments of the gains by manual inputs. This function is suitable for cycle-operation applications in speed control and position control.

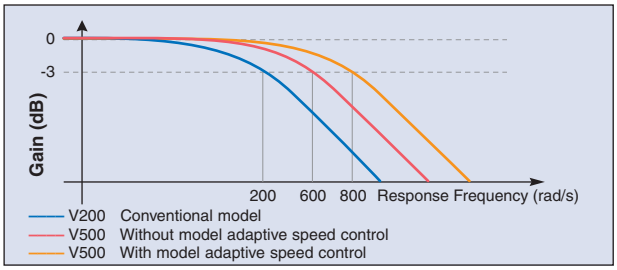
Ideal Model Adaptive Speed Control

High responsiveness with respect to the target speed value is achieved by providing an ideal model adaptive speed control section in the control system. Vibrations are suppressed by reducing the error between the ideal model speed and actual speed with a disturbance suppression section.

Improve responsiveness of speed command by using in combination with simple gain tuning!

(Inverter internal speed response is 800rad/s, speed control range is 1:1500) The response can be set independently for the ideal model's speed control section and the disturbance control section.

Speed Response Characteristics



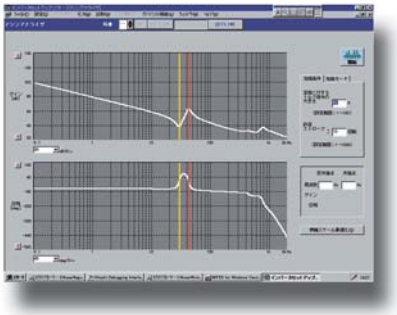
Suitable when there are noises in the analog command. In addition, by adjusting the speed responsiveness and the motor's disturbance torque individually, it is suitable for speed-controlled lifters or machines with a large load fluctuation.

Machine Analyzer

Avoid resonance by measuring the machine's resonance point.

The motor is automatically accelerated and the resonance frequency in the machine system is analyzed by the setup software. Machine resonance can be avoided easily by combining the analysis results and notch filter function.
(Used with the trace card (built-in option))

Machine Analyzer Screen



Vector Control Without an Encoder

By controlling the motor excitation and torque currents separately, speed control and torque control are possible. (To be released soon)

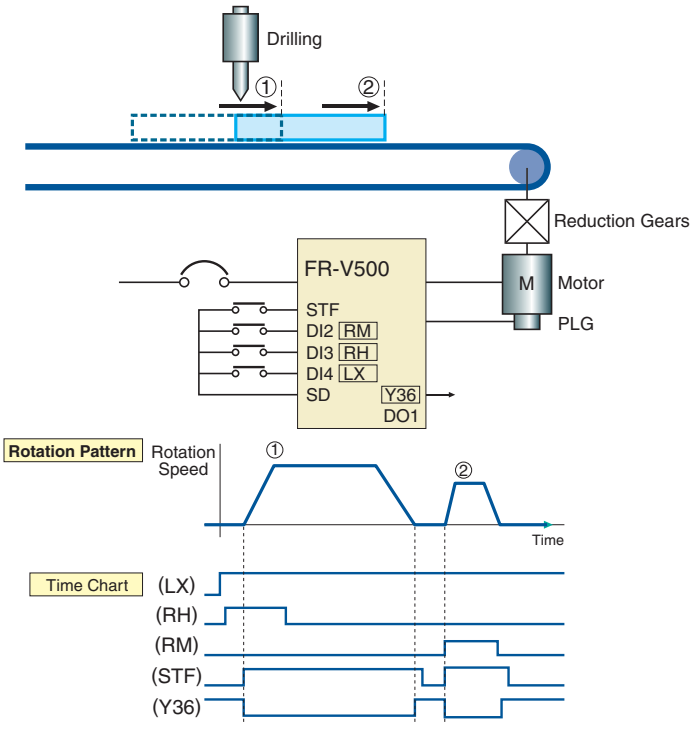
Compatible with a Wide Range of Motors

Encoder expandability.

The Encoder power supply voltage can be set to 5.5V, 12V or 24V. (Differential line driver or complimentary).

New Functions

- **Position control by contact inputs**
  By setting the feed pulse rate in advance, position control is possible using input signals. Options are not required and up to 15 positions can be set.
- **Feed Forward Control**
  The motor responsiveness to changes in the speed command is improved. This is suitable for improving responsiveness to acceleration and deceleration.
- **Compatible with 16-bit high resolution analog input (FR-V5AX) and 16-bit digital input (FR-V5AH) built-in options**
  Operation at higher accuracies is possible.
- **Minimum setting resolution for speed command is 0.1r/min**
- **Brake transistor built-in for 15kW and smaller capacities**
- **Brake resistor also built-in for 5.5kW and smaller capacities**
- **Remote output function**
  The output signal can be turned ON/OFF like a PLC's remote output. Example: ON/OFF of the pilot lamp, etc.
- **Master-slave function (analog type)**
  Synchronous speed operation is possible by inputting the information from the master inverter to the slave inverter.
- **Compatible with power regeneration common converter (FR-CV)**



Pr.183=23 (LX: Pre-excitation/servo ON), Assign 36 (Y36: in-position) to Pr. 190

Complete Network Compliance

- **Compatible with SSCNET**
  Up to eight axes can be connected and controlled in a batch using SSCNET, a highly reliable system with reduced wiring. SSCNET uses the high-speed synchronous serial communication method, and is optimal for synchronous operation.
- **Compatible with CC-Link using optional FR-A5NC**
- **Compatible with Ethernet using optional FR-V5NE**
  To support the setup of the inverter, monitoring from the office is possible over LAN.
- **Compatible with other open networks using communication option**
  (RS-485, DeviceNet™, Profibus-DP, Modbus Plus)

* DeviceNet™, Profibus-DP, Modbus Plus, Ethernet and CC-Link are trademarks or registered trademarks of the respective corporations or groups.

Improved Operability and Maintainability

- **Removable control terminal**
- **Easy replacement of the cooling fan**
  (Fan's life is further extended with ON/OFF control)
- **FR-DU04-1 operation panel standard on all models**
- **Optional setup software available to support all operations from inverter setup to maintenance with RS-485.**
- **Data, such as output current, can be saved on the optional trace card when an inverter error occurs.**
  This data can be read out and analyzed with the setup software.
- **Maintenance output function**
  This signal output function notifies when the inverter's cumulative power ON time has passed a set time.
- **Extended main circuit capacitor life**
  Design life is 10 years (87,600 hours) at an average ambient temperature of 40°C.

Environmental Conformance

- **Soft-PWM control reduces the motor's metallic sound at low carrier frequency. RFI noise is lower compared to high carrier frequency.**
- **The compact and lightweight DC reactor (DCL) can be connected to all capacities.**
- **European EMC Directives are easily met with the optional EMC filter.**

Global Compliance

- **Compatible with 240V/480V or 575V power supply as standard**
- **Input/output terminal logic (sink/source) selectable**
- **Optional parameter unit (FR-PU04V) compatible with eight languages**
  Compatible languages: English, Japanese, German, French, Spanish, Italian, Swedish, Finnish

Standard Specifications

Model FR-V520-□□-NA			1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Output	Horsepower Rating		2	3	5	7.5	10	15	20	25	30	40	50	60	75
	Rated Current (A)		9.0	13.0	20.0	28.5	37.5	54.0	72.8	88.0	103.5	126.5	168.0	198.0	264.0
	Overload Current Rating (Note 1)		150% for 60 sec., 200% for 0.5 sec. (inverse time characteristics)												
	Regenerative Braking Torque	Max./Time	100% 5 sec.				20% (Note 4)								
		Tolerable Work Rate	3%ED (Note 4)		2% ED (Note 4)		Continuous (Note 4)								
Power Supply	Rated Input, AC Voltage and Frequency		3-phase 200-240V 60Hz							3-phase 200-230V 60Hz					
	Tolerable AC Voltage Fluctuation		170-242V 50Hz, 170-264V 60Hz							170-242V 50Hz, 170-253V 60Hz					
	Tolerable Frequency Fluctuation		+/- 5%												
	Supply (kVA) (Note 2)		5.0	6.5	10	14	19	23	33	39	48	57	77	90	123
Protective Structure			Fully enclosed type (IP20, NEMA 1) (Note 3)							Open type (IP00)					
Cooling Method			Forced air cooling												
Approximate Weight (lbs.)			7.7	7.7	13.2	13.2	13.2	30.8	30.8	46.2	66	88	88	121	128

Model FR-V540-□□-NA			1.5K	2.2K	3.7K	5.5K	7.5K	11K	15K	18.5K	22K	30K	37K	45K	55K
Output	Horsepower Rating		2	3	5	7.5	10	15	20	25	30	40	50	60	75
	Rated Current (A)		4.5	6.5	10.0	14.5	18.5	27.5	35.5	44.0	51.8	67.0	86.0	99.0	132.0
	Overload Current Rating (Note 1)		150% for 60 sec., 200% for 0.5 sec. (inverse time characteristics)												
	Regenerative Braking Torque	Max./Time	100% 5 sec.				20% (Note 4)								
		Tolerable Work Rate	2% ED (Note 4)				Continuous (Note 4)								
Power Supply	Rated Input, AC Voltage and Frequency		3-phase 380-480V 50Hz / 60Hz												
	Tolerable AC Voltage Fluctuation		323-528V 50Hz / 60Hz												
	Tolerable Frequency Fluctuation		+/- 5%												
	Supply (kVA) (Note 2)		5.0	6.5	10.2	14	19	23	33	39	48	57	77	90	123
Protective Structure			Fully enclosed type (IP20, NEMA 1) (Note 3)							Open type (IP00)					
Cooling Method			Forced air cooling												
Approximate Weight (lbs.)			7.7	7.7	13.2	13.2	30.8	30.8	30.8	30.8	66	77	77	79	143

Model FR-V540L-□□-NA			75K	90K	110K	132K	160K	200K	250K
Output	Horsepower Rating		100-125	125-150	150-200	200	250	300-350	400
	Rated Current (A)		165	195	240	270	330	415	505
	Rated Capacity (kVA)		114	135	166	187	229	288	350
	Overload Current Rating (Note 1)		150% for 60 sec., 200% for 0.5 sec. (inverse time characteristics)						
	Regenerative Braking Torque	Max./Time	20%						
		Tolerable Work Rate	Continuous						
Power Supply	Rated Input, AC Voltage and Frequency		3-phase 380-480V 50Hz / 60Hz						
	Tolerable AC Voltage Fluctuation		323-528V 50Hz / 60Hz						
	Tolerable Frequency Fluctuation		+/- 5%						
Protective Structure (JEM1030)			Open type (IP00)						
Cooling Method			Forced air cooling						
Approximate Inverter Weight (lbs.)			165	165	265	265	485	518	518
Approximate DC Reactor Weight (lbs.)			49	49	79	79	106	126	126

Model FR-V560-□□-NA			2.2K	3.7K	7.5K	15K	22K	37K	55K
Output	Horsepower Rating		1 to 3	5	7, 5 & 10	15 & 20	25 & 30	40 & 50	60 & 75
	Rated Current (A)		4	6.1	12	22	33	55	84
	Overload Current Rating (Note 1)		150% for 60 sec., 200% for 0.5 sec. (inverse time characteristics)						
	Regenerative Braking Torque	Max./Time	100% 5 sec.			20%			
		Tolerable Work Rate	2% ED			Continuous			
Power Supply	Rated Input, AC Voltage and Frequency		3-phase 575V 60Hz						
	Tolerable AC Voltage Fluctuation		490 to 632V 60Hz						
	Tolerable Frequency Fluctuation		+/- 5%						
	Supply (kVA) (Note 2)		5.5	9	17	28	41	66	100
Protective Structure			Enclosed type (IP20) (Note 3)			Open type (IP00)			
Cooling Method			Forced air cooling						
Approximate Weight (lbs.)			13.2	13.2	13.2	30.9	30.9	77	77

Model FR-V560L-□□-NA			75K	110K	160K	220K
Output	Horsepower Rating		1 to 3	5	7, 5 & 10	15 & 20
	Rated Current (A)		4	6.1	12	22
	Overload Current Rating (Note 1)		150% for 60 sec., 200% for 0.5 sec. (inverse time characteristics)			
	Regenerative Braking Torque	Max./Time	20%			
		Tolerable Work Rate	Continuous			
Power Supply	Rated Input, AC Voltage and Frequency		3-phase 575V 60Hz			
	Tolerable AC Voltage Fluctuation		488 to 632V 60Hz			
	Tolerable Frequency Fluctuation		+/- 5%			
Protective Structure			Open type (IP00)			
Cooling Method			Forced air cooling			
Approximate Weight (lbs.)			218	342	586	639
Approximate DC Reactor Weight (lbs.)			53	77	101	121

Notes:

1. The overload current rating percentage indicates the percentage with respect to the inverter's rated output current. When used repeatedly, it is necessary to wait for the inverter and motor to return to less than the temperature at 100% load.
2. The power capacity will change according to the power supply side impedance (including the input reactor and power) value.
3. When the wiring cover for options is removed and built-in options are mounted, the protective structure will be open chassis (IP00).
4. With the 1.5kW to 15kW capacities, 100% torque 10% ED can be achieved by connecting the dedicated external brake resistor (FR-ABR) option.

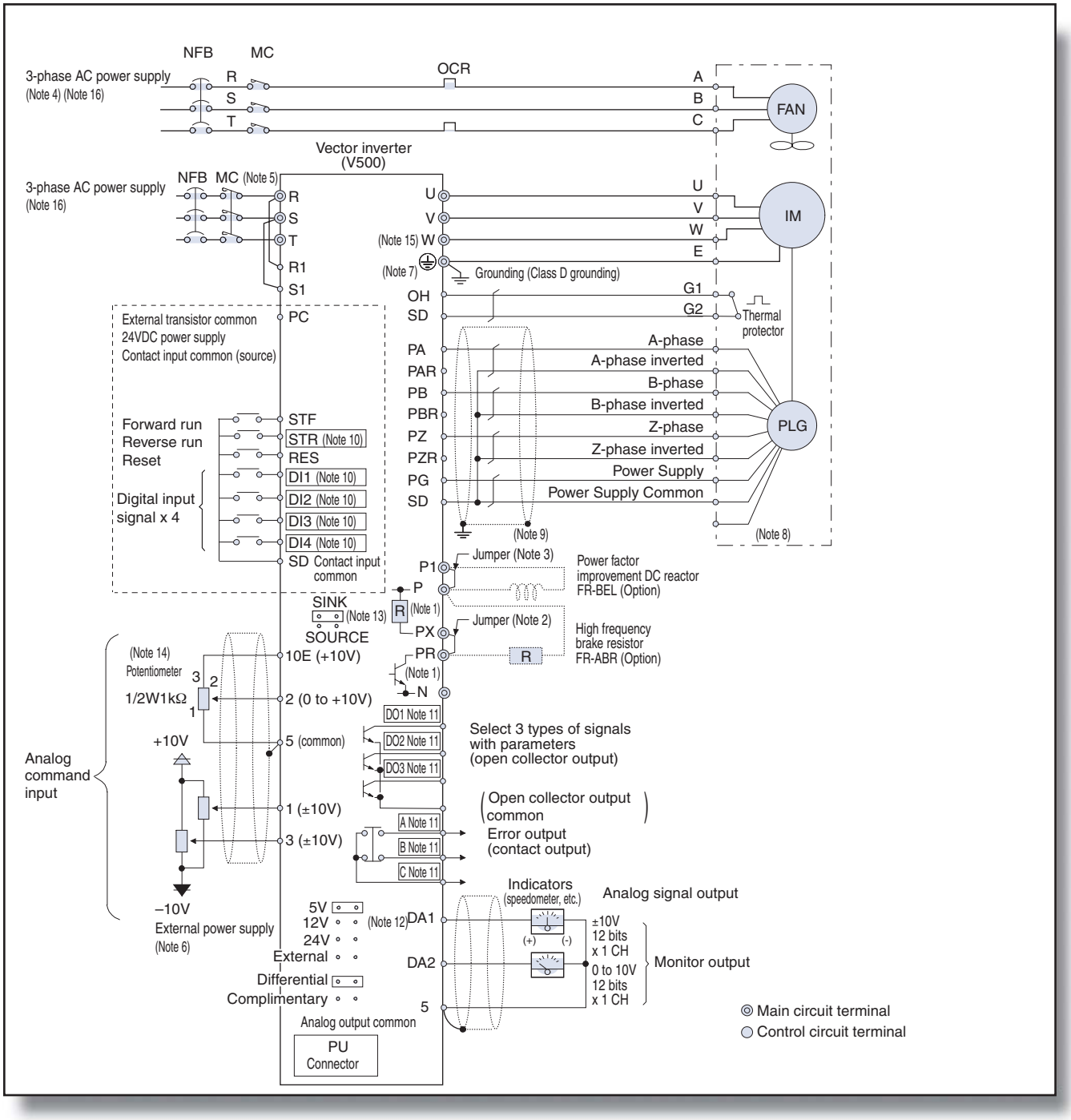
Common Specifications

Dedicated Motor	Control Specifications	Control Method		Select from Soft-PWM control or high carrier frequency sine wave PWM control; Select from vector control or V/F control		
		Control Mode		Speed control, torque control, position control		
		Speed Setting Resolution	Analog Input	0.03% of maximum speed setting		
			Digital Input	0.003% with respect to maximum setting (minimum setting 0.1r/min)		
		Acceleration/Deceleration Time		0 to 3600 sec. (0.1sec. pitch)		
		Acceleration/Deceleration Pattern		Select from linear, S-pattern (three types) or backlash compensation acceleration/deceleration		
		Torque Limit Value		Torque limit value can be set (between 0 and 400%)		
		Speed Response		800rad/s (model adaptive speed control provided) (300rad/s at analog input) (Note 6)		
		Speed Control Range		1:1500		
		Speed Accuracy		Within ±0.01% of maximum rotation speed/during digital input		
		Repeatable Torque Accuracy		±5% (adaptive flux observer provided)		
	Input Signals	Analog Setting Signal		Terminal No.	Setting Range	Speed Control / Torque Control
				2	0 to 10V Resolution (0.03%)	Main Speed Setting / Speed Limit
				1	0 to ±10V Resolution (0.05%)	Auxiliary speed setting/flux command/regenerative torque limit / Speed limit compensation/Flux command/power factor side speed limit
				3	0 to ±10V Resolution (0.05%	Torque limit/torque bias / Torque command
			Option (FR-V5AX)	6	0 to ±10V Resolution (0.003%)	Main speed setting (terminal 2 is invalid)/Torque limit / Speed limit (terminal 2 is invalid)/) Torque command (terminal 3 is invalid)
		Digital Input Signal Option (FR-V5AH)		16-bit digital input (speed can be set with BCD or binary codes)		
		Contact Signals		Fixed function terminals: 3 points		Forward run command, error reset, external thermal
				Function terminals: 5 points		Select from reverse run command, multi-speed setting (max. 15 speeds), remote setting, JOG operation (Note 1) 2nd function selection, 3rd function selection, output stop, start signal self-hold, pre-excitation, control mode changeover, torque limit selection, S-pattern changeover, PID control terminal, orientation command, brake release complete signal, PU operation/external operation changeover, torque bias selection 1, 2, P control selection, servo ON, HC connection, PU/internal interlock, external DC braking start
			Option (FR-V5AX)	Multi-function terminal: 6 points		
	Output Signals	Contact Signals		Form C contact (AC230V 0.3A,DC30V 0.3A)		Select from inverter running, speed reached, instantaneous power failure (undervoltage) speed detection 2nd speed detection, 3rd speed detection, PU operation mode, overload warning, regenerative brake (Note 2) pre-alarm, electronic thermal pre-alarm, output current detection, zero current detection PID lower limit, PID upper limit, PID forward/reverse run output, READY, READY2, brake release request, fan fault output, fin overheat pre-alarm, orientation complete, output during forward run, output during reverse run, low-speed output, torque detection, regeneration status output, minor fault output, error output, maintenance timer output, remote output, speed detection, in-position, trace state
		Open Collector Signal		Multi-function terminal: 3 points		
			Option (FR-V5AY)	Multi-function terminal: 3 points		
			Option (FR-V5AM)	Multi-function terminal: 1 points		
			Option (FR-A5AY)	Multi-function terminal: 7 points		
		Analog Output		0 to ±10V 12 bits x 1 CH 0 to 10V 12 bits x 1 CH		Select from rotation speed, output current output voltage, set speed, output frequency, motor torque, converter output voltage, regenerative brake duty, electronic thermal load rate, output current peak value, converter output voltage peak value, load meter, motor exciting current, motor output, reference voltage output, torque command, torque current command, torque motor
			Option (FR-A5AY)	0 to 10V 10 bits x 1 CH 0 to 20mA 10 bits x 1 CH		
		PLG Output Option (FR-V5AY)		A phase, B phase, Z phase (A phase and B phase can be divided) (Note 3) Select open collector or differential line driver		
		Operation Functions		Upper/lower limit speed setting, speed jump, external thermal input selection, polarity reversed operation, override function, restart after instantaneous power failure, forward/reverse run prevention, operation mode selection, offline automatic tuning function online automatic tuning function, simple gain tuning, computer link operation, remote setting, brake sequence, 2nd function, 3rd function, multi-speed operation, coast to stop, power failure stop, PID control, speed feed forward, model adaptive speed control, master, slave, torque bias, 12-bit digital command (option FR-A5AX), 16-bit digital command (option FR-V5AH), pulse train input (option FR-A5AP), motor thermistor interface (option FR-V5AX)		
	Display	Parameter Unit (FR-DU04-1/FR-PU04V)		Select from rotation speed, output current output voltage, set speed, output frequency, motor torque, converter output voltage, regenerative brake duty, electronic thermal load, output current peak value, converter output voltage peak value, input terminal state (Note 5), output terminal state (Note 5), load meter, motor exciting current, position pulse, cumulative power ON time, actual operation time, motor load rate, torque command, torque current command, feedback pulse, motor output, trace state		
		Error Details		The details of the error appear when the protection function operates, and up to eight past errors are saved. (Only four errors are displayed on operation.)		
		Protective Functions		Overcurrent shut-off (during acceleration, deceleration, and constant speed), regenerative overvoltage shut-off (during acceleration, deceleration, and constant speed), overvoltage, instantaneous power failure, overload shut-off (electronic thermal), brake transistor error (Note 2), ground fault overcurrent power output short-circuit (12VDC/24VDC/operation panel), stall prevention, external thermal, fin overheating, fan fault, option error, parameter error, PU disconnection, encoder no signal, excessive speed detection, excessive position error, CPU error, output phase failure, No. of retries exceeded, brake sequence error, encoder phase error		
	Environment	Ambient Temperature		–10 to +50°C (non-freezing)		
		Ambient Humidity		90%RH or less (with no dew condensation)		
		Storage Temperature (Note 4)		–20 to +65°C		
		Atmosphere		Indoors (with no corrosive gases, flammable gases, oil mist or dust)		
		Altitude and Vibration		1000m or less above sea level, 5.9m/s2 or less (JIS C 0040 compliant)		

Notes:

1. JOG operation is also possible with the operation panel or parameter unit (FR-PU04V).
2. This is not mounted on the V500-18.5K to 250K capacities which do not have a built-in brake circuit.
3. The FR-V5AY cannot identify the rotation direction during division.
4. This is the temperature to which units can be exposed for a short time, such as during transportation.
5. This is not provided with the operation panel (FR-DU04-1).
6. 800 rad/s valid for 55K and below, 300 rad/s for 75K and larger.

Terminal Connection Diagram



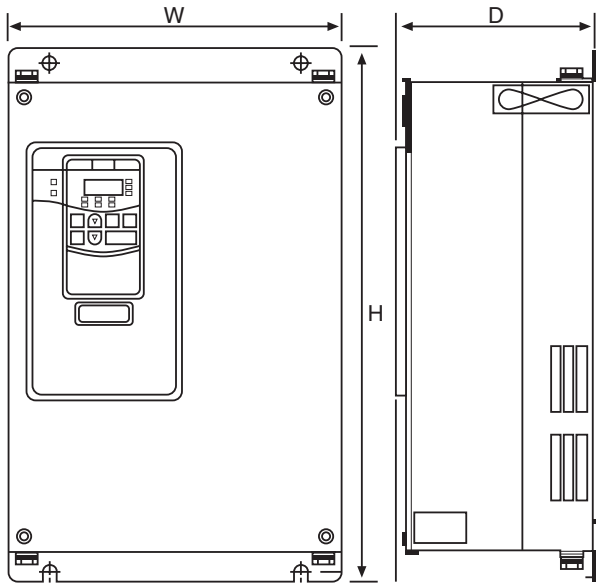
Notes:

1. Terminal PR is mounted on the 15K and smaller capacities, and terminal PX is mounted on the 5.5K and smaller capacities.
2. When using FR-ABR with the 5.5kW or smaller capacity, remove this Jumper.
3. Remove this Jumper when using FR-BEL.
4. The fan power is a single-phase power for the 7.5kW or smaller dedicated motors.
5. The inverter's life will shortened by repeated in-rush currents when the power is turned ON, so do not turn the power ON and OFF frequently.
6. Prepare a ±10V external power for terminals 1 and 3.
7. When using a motor that is not provided with a thermal protector, set Pr. 876, thermal protector input to 0, and set Pr. 9 (Pr. 452) electronic thermal (2nd electronic thermal).
8. The encoder's pin numbers may differ.
9. The motor's encoder's case should be grounded.
10. The terminal functions can be changed with the input terminal function selection (Pr. 180 to Pr. 183, Pr. 187).
11. The terminal functions can be changed with the output terminal function selection (Pr. 190 to Pr. 192, Pr. 195).
12. Change the connector according to the encoder's power supply specifications.
13. The sink logic and source logic will change when the connector is changed.
14. Use of the 2W 1kΩ is recommended when the settings are changed frequently.
15. Always ground the inverter and motor.
16. Refer to the standard specifications on page 5 for details on the input power specifications.

Terminal Specifications

Type			Terminal Symbol	Terminal name	Description	
Main Circuit			R,S,T	AC Power Supply Input	Connect these to the commercial power supply. Do not connect anything when using the high-power factor converter (FR-HC) or power regeneration common converter (FR-CV).	
			U,V,W	Inverter Output	Connect these to the dedicated motor or 3-phase squirrel cage motor.	
			R1,S1	Control Circuit Power Supply	These are connected with the AC power terminals R and S. When displaying the errors or holding the error output, or when using the high-power factor converter (FR-HC) or power regeneration common converter (FR-CV), remove the jumpers from across terminals R-R1 and S-S1, and input the power to this terminal from an external source.	
			P, PR	Brake Resistor Connection	Remove the jumper from across terminals PR-PX, and connect the optional brake resistor (FR-ABR) across terminals P-PR. A regenerative braking force can be attained when the resistor is connected to the 15k and smaller capacities.	
			P,N	Brake Unit Connection	Connect the optional FR-BU type brake unit, high-power factor converter (FR-HC) and power regeneration common converter (FR-CV).	
			P, P1	Power Factory Improvement	Remove the jumper from across terminals P-P1, and connect the optional power factor improvement DC reactor (FR-BEL).	
			PR, PX	Built-in Brake Circuit Connection	The built-in brake circuit will be valid when the terminals PX-PR are connected with the jumper. (Mounted on the 5.5k and smaller capacities.)	
			⏚	Grounding	This terminal is used to ground the inverter chassis. Ground this terminal.	
Control Circuit	Input Signal	Contact Input	STF	Forward Rotation Start	This functions as the forward run command when the STF signal is ON, and the stop command when the signal is OFF	If the STF and STR signals turn ON simultaneously, these will function as the stop command.
			STR	Reverse Rotation Start	This functions as the reverse run command when the STR signal is ON, and the stop command when the signal is OFF.	
			DI1 to DI4	Digital Input Terminals 1 to 4	The terminal function will change according to the input terminal function selection (Pr. 180 to 183). Refer to the "common specifications" on page 6 for details on the terminal functions that can be changed.	
			OH	Thermal Protector Input	This is the temperature detector terminal input for motor overheating protection.	
			RES	Reset	This is used when resetting the holding state when the protection circuit has functioned. Turn the RES signal ON for 0.1s or more, and then turn OFF.	
			SD	Contact Input Common (Sink) Power Ground Terminal	This is the contact input common terminal or PLG power common terminal. This common is insulated from terminals 5 and SE. Do not ground this common.	
			PC	24VDC Power Supply External Transistor Common Contact Input Common (Source)	When connecting a transistor output (open collector output) such as a programmable controller (PLC), malfunctioning caused by the leakage current can be prevented by connecting the external power supply common for the transistor output to this terminal. This can be used as the 24VDC 0.1A power source between terminals PC and DS. When the source logic is selected, this will be the contact input common.	
		Speed Setting	10E	Speed Setting Power Supply	10VDC, tolerable load current 10mA	
			2	Speed Setting (Voltage)	When 0 to 10VDC is input, the maximum output frequency will be reached at 10V, and the input/output will be proportional. The input resistance is 10kW, and the maximum permissible input voltage is 20V.	
			3	Torque Setting Terminal	This is the torque setting signal during torque control, and the torque limit signal during speed control and position control. This can be used as the input terminal during the torque bias function by using the external analog. The input is 0 to ±10VDC, the input resistance is 10kW, and the maximum permissible input voltage is ±20V.	
			1	Multi-Function Setting Terminal	This is the multi-function terminal that has various function when the No. 1 terminal is set. Refer to the instruction manual for details on the functions. The input is 0 to ±10VDC, the input resistance is 10kW, and the maximum permissible input voltage is ±20V	
			5	Speed Setting Common Analog Signal Output Common	This is the common terminal for the speed setting (terminals 2, 1 or 3), and the common terminal for DA1 and DA2. This terminal is insulated from terminals SD and SE. Do not ground this common.	
		Contact	PA	A Phase Signal Input Terminal	The A phase, B phase and Z phase signals are input from encoder.	
			PAR	A Phase Reverse Signal Input Terminal		
			PB	B Phase Signal Input Terminal		
			PBR	B Phase Reverse Signal Input Terminal		
			PZ	Z Phase Signal Input Terminal		
			PZR	Z Phase Reverse Signal Input Terminal		
			PG	PLG Power Terminal (+ Side)	This is the encoder power supply. The power supply can be selected from 5V, 12V or 24VC. An external power supply can also be used.	
			SD	Contact Input Common (Sink) Power Ground Terminal	This is the contact input common terminal or encoder power common terminal. This common is insulated from terminals 5 and SE. Do not ground this common.	
	Output Signal	Contact	A,B,C	Error Output	This is the 1c contact output which indicates that the inverter protection function has activated and the output has stopped. 200VAC 0.3A 30VDC 0.3A. When there is an error, there is discontinuity between B-C (continuity between A-C), and during normal operation, there is continuity between B-C (discontinuity between A-C). The terminal function will change according to the output terminal function selection (Pr. 195).	
		Open Collector	DO1	Digital Output 1 Terminal	Permissible load 24VDC 0.1A. The terminal function will change according to the output terminal function section (Pr. 190 to Pr. 192.) Refer to the “common specifications” on page 6 for details on the terminal functions that can be changed.	
			DO2	Digital Output 2 Terminal		
			DO3	Digital Output 3 Terminal		
			SE	Open Collector Output Common	This is the common terminal for terminals DO1, DO2 and DO3. This common is insulated from terminals SD and 5.	
		Analog	DA1	Analog Signal Output	One of 18 monitor items, such as rotation speed, is selected and output. The output signal is proportional to the size of each monitor item.	
			DA2	Analog Signal Output		
			5	Speed Setting Common	This is the speed setting (terminal 2, 1 or 3) common terminal or DA1 and DA2 common terminal. This common is insulated from terminals SD and SE. Do not ground this common.	Default output item: Rotation speed monitor Output signal 0 to ±10VDC permissible load current 1mA
						Default output item: Torque monitor Output signal 0 to 10VDC permissible load current 1mA
	Communication	RS-485	–	PU Connector	Communication using RS-485 is possible by using the PU connector. • Compliant standard: EIA Standards RS-485 • Transmission format: Multi-drop link method • Communication speed: 19200bps max. • Total length: 500m	

Outline Dimensions



Note: Supplied dimensions are for reference purposes only. Refer to instruction manual for detailed dimensions.

mm (inches)

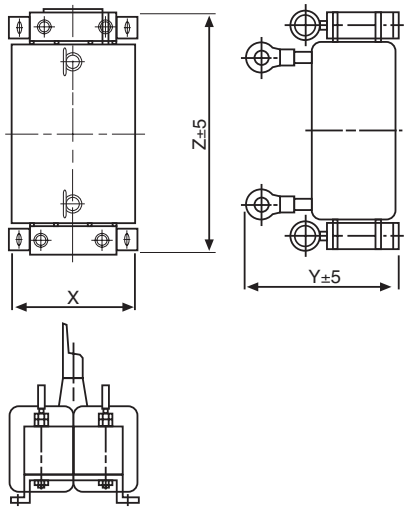
Inverter Model	W	H	D
FR-V520-1.5K	150 (5.9)	260 (10.2)	163 (6.4)
FR-V520-2.2K			
FR-V520-3.7K	220 (8.7)	260 (10.2)	193 (7.6)
FR-V520-5.5K			
FR-V520-7.5K			
FR-V520-11K	250 (9.9)	400 (15.8)	218 (8.6)
FR-V520-15K			
FR-V520-18.5K	300 (11.8)	450 (17.8)	195 (7.7)
FR-V520-22K	340 (13.4)	550 (21.7)	195 (7.7)
FR-V520-30K	450 (17.8)	550 (21.7)	250 (9.9)
FR-V520-37K			
FR-V520-45K	480 (18.9)	700 (27.6)	250 (9.9)
FR-V520-55K			270 (10.7)

Inverter Model	W	H	D
FR-V540-1.5K	150 (5.9)	260 (10.2)	163 (6.4)
FR-V540-2.2K			
FR-V540-3.7K	220 (8.7)	260 (10.2)	193 (7.6)
FR-V540-5.5K			
FR-V540-7.5K	250 (9.9)	400 (15.8)	218 (8.6)
FR-V540-11K			
FR-V540-15K			
FR-V540-18.5K			
FR-V540-22K	340 (13.4)	550 (21.7)	195 (7.7)
FR-V540-30K	450 (17.8)	550 (21.7)	250 (9.9)
FR-V540-37K			
FR-V540-45K	480 (18.9)	700 (27.6)	250 (9.9)
FR-V540-55K			270 (10.7)

Inverter Model	W	H	D
FR-V560-2.2K	220 (8.7)	260 (10.2)	193 (7.6)
FR-V560-3.7K			
FR-V560-7.5K			
FR-V560-15K	250 (9.9)	400 (15.8)	218 (8.6)
FR-V560-22K			
FR-V560-37K	450 (17.8)	550 (21.7)	250 (9.9)
FR-V560-55K			

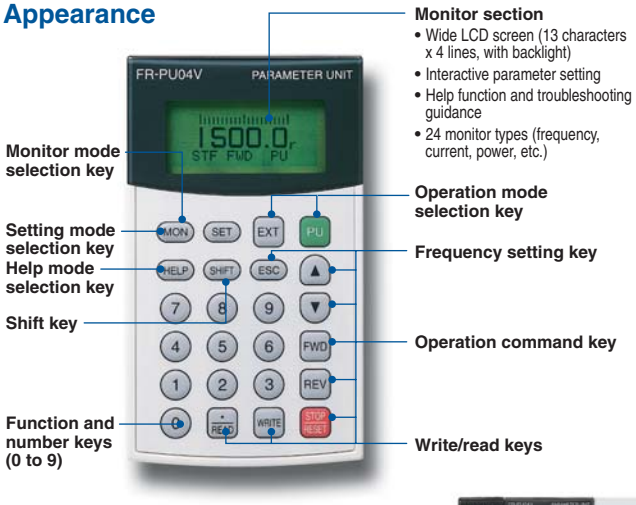
Inverter Model	W	H	D	DC Link Reactor (included)		
				X	Y	Z
FR-V540L-75K FR-V540L-90K	480 (18.9)	740 (29.2)	360 (14.2)	175 (6.9)	190 (7.5)	400 (15.8)
FR-V540L-110K FR-V540L-132K	498 (19.6)	1010 (39.8)	380 (15.0)	190 (7.5)	225 (8.9)	438 (17.3)
FR-V540L-160K	680 (26.8)	1010 (39.8)	380 (15.0)	210 (8.3)	235 (9.3)	495 (19.5)
FR-V540L-200K FR-V540L-250K	790 (31.1)	1330 (52.4)	440 (17.4)	220 (8.7)	250 (9.9)	495 (19.5)

Inverter Model	W	H	D	DC Link Reactor (included)		
				X	Y	Z
FR-V560L-75K	480 (18.9)	740 (29.2)	360 (14.2)	175 (6.9)	200 (7.8)	400 (15.8)
FR-V560L-110K	498 (19.6)	1010 (39.8)	380 (15.0)	190 (7.5)	220 (8.7)	438 (17.3)
FR-V560L-160K	680 (26.8)	1010 (39.8)	380 (15.0)	210 (8.3)	235 (9.3)	495 (19.5)
FR-V560L-220K	790 (31.1)	1330 (52.4)	440 (17.4)	220 (8.7)	265 (10.4)	495 (19.5)



Parameter Unit FR-PU04V (Option)

Appearance

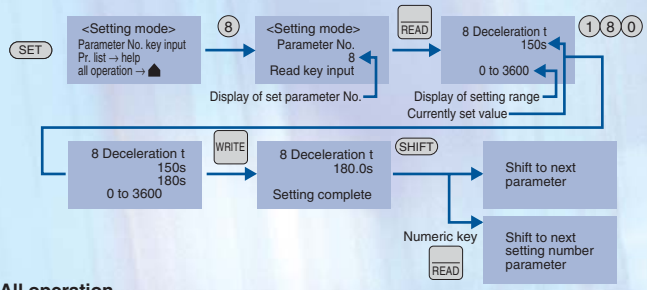


FR-PU04V installed in inverter unit

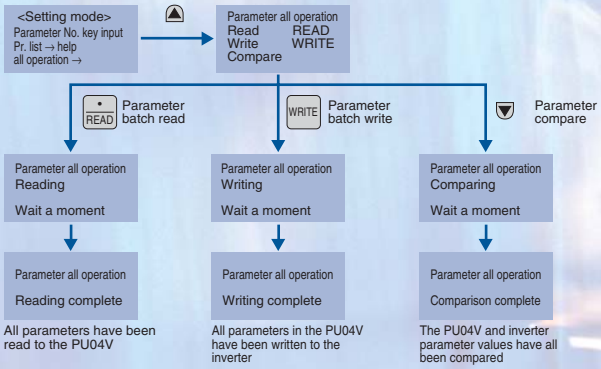
Notes:
1. The parameter unit operations are basically the same as the conventional FR-PU02V.
2. The parameter unit is an option.

Parameter Unit Operation

Parameter setting
Select the mode with the (SET) key. Enter the setting value into the parameter.
(Example) To set 180 seconds for parameter 8 (deceleration time setting)



All operation
All parameters can be read, written and compared when selected with the (SET) key.

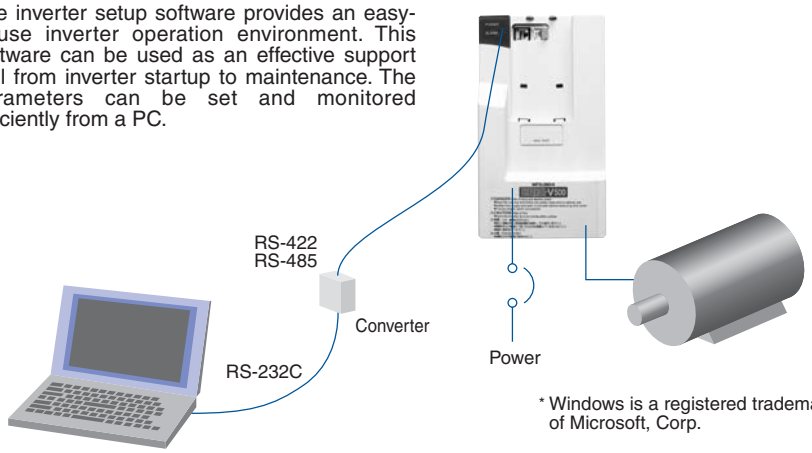


Changed value list
The changed value list can be read with the following operation.
(HELP) → Parameter (Read) → Change List (Read)

Inverter Setup Software

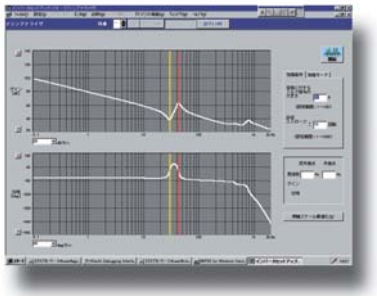
FR-SW1-SETUP-WE (Windows* 95, 98, 2000 Compatible) (Option)

The inverter setup software provides an easy-to-use inverter operation environment. This software can be used as an effective support tool from inverter startup to maintenance. The parameters can be set and monitored efficiently from a PC.



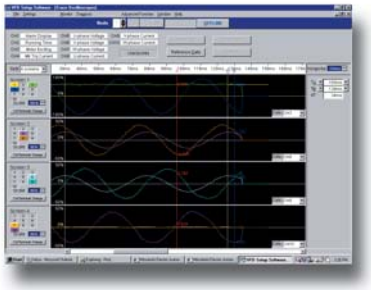
* Windows is a registered trademark of Microsoft, Corp.

Machine Analyzer Screen



Note: This is a reference screen, and may differ slightly from the actual screen.

Trace Function Oscilloscope Screen



Note: This is a reference screen, and may differ slightly from the actual screen.

Functions

■ New Function

1. Machine analyzer function
   The motor is automatically accelerated and the machine system's resonance frequency analyzed.
2. Trace function
   When used in combination with the trace code operation, the software can be used as a high-coder. Data can be measured, and movements can be analyzed.

■ Standard function

1. Parameter setting and editing
2. Monitor
3. Test operation
4. Diagnosis
5. System setting
6. File
7. Window
8. Help

Options

	Name	Type	Details	Applicable Inverter
Built-in Dedicated Options (Notes 3, 4)	Expanded Input Thermistor Interface	FR-V5AX	• Any six out of 25 types of input signals can be selected and contact input. • Highly accurate operation is possible by using the high resolution analog input (16-bit). • When using the motor with thermistor, the motor temperature can be detected by the thermistor, and the generated torque's temperature fluctuation reduced.	Common for all models
	Expanded Output Pulse Division Output	FR-V5AY	• Three out of 37 types of output signals are selected and open collector output to the inverter. • The pulse train input by the inverter can be divided and output.	
	Position Control	FR-V5AP	• By inputting a pulse train from an external source, positioning can be controlled. The Mitsubishi PLC (positioning unit) can also be connected.	
	Machine Orientation	FR-V5AM	• By using in combination with the position detector (PLG) installed on the machine's spindle, the spindle can be stopped at a set position (orientation function).	
	Trace Card	T-TRC50	• By mounting this card on the inverter, the various data (output current, etc.) sampled can be saved in the memory.	
	16-bit Digital Input	FR-V5AH	• This is an input interface used to set the inverter speed with a high accuracy using a 4-digit BCD or 16-bit binary code signal from an external source.	
	SSCNET	FR-V5NS	• The inverter can be controlled via the Q Series Motion Control CPU or QD-75M.	
	Ethernet	FR-V5NE	• All operations from inverter startup to maintenance are supported.	
	12-bit Digital Input	FR-A5AX	• This is an input interface used to set the inverter speed with a high accuracy using a 3-digit BCD or 12-bit binary code signal from an external source. • The gain and offset can also be adjusted.	
	Digital Output	FR-A5AY	• Seven out of 37 types of output signals provided as a standard in the inverter can be randomly selected and output from the open collector. • 18 types of signals, such as rotation speed, output voltage and output current, which can be monitored with terminals DA1 and DA2 are expanded and output. • A 20mADC or 5VDC (10V) meter can be connected.	
	Expanded Analog Output			
	Relay Output	FR-A5AR	• Three out of 37 types of output signals provided as a standard in the inverter can be randomly selected and output from the relay contact.	
	Orientation	FR-A5AP	• By using in combination with the position detector (PLG) installed on the machine's spindle, the spindle can be stopped at a set position (orientation function).	
	Pulse Train Input		• The speed command to the inverter can be input as pulse train signals.	
	Computer Link	FR-A5NR	• When connected with a computer such as a personal computer or FA controller by a communication cable, the inverter can be operated and monitored and the parameters can be changed with user programs in the computer.	
	Relay Output		• One of the output signals provided as a standard in the inverter can be randomly selected and output as a relay contact.	
	Profibus DP	FR-A5NPA	• The inverter can be operated and monitored and the parameters can be changed from a computer or PLC.	
	DeviceNet ™	FR-A5ND		
	CC-Link	FR-A5NC		
	Modbus Plus	FR-A5NM		
Standalone Type Options	Parameter Unit (8-language)	FR-PU04V	Interactive parameter unit with LCD display (Compatible with English, Japanese, German, French, Spanish, Italian, Swedish and Finnish)	Common for all models
	Parameter Unit Connection Cable	FR-CB2 □□ (Note 2)	Cable for connecting operation panel and parameter unit	
	Heat Sink Protrusion Attachment	FR-A5CN □□ (Note 2)	The inverter heat sink section can be protruded from the back of the control panel.	Compatible with 1.5 to 55k capacities
	Totally Enclosed Structure Attachment	FR-A5CV □□ (Note 2)	This enables compliance with the totally enclosed structure specifications (IP40).	Compatible with 1.5 to 15k capacities
	Wire Conduit Connection Attachment	FR-A5FN □□ (Note 2)	The wire conduit can be directly connected. This enables compliance to IP20.	Compatible with 18.5 to 55k capacities
	Installation Adaptor	FR-A5AT □□ (Note 2)	Attachment for installing on the V500 Series using the V200 installation holes.	Compatible with 1.5 to 7.5k, 15k capacities
	EMC Directive Compatible Noise Filter	SF □□ (Note 2)	Noise filter compatible with EMC Directives (EN50071-2)	Compatible with 1.5 to 55k capacities
	High-frequency Braking Resistor	FR-ABR □□ (Note 1)	Used for improving braking performance of brakes built into inverter	Compatible with 1.5 to 15k capacities
	Power Factor Improving DC Reactor	FR-BEL□□ (Note 1)	Used for improving inverter input power factor (total power factor approx. 95%) and for balancing power supply	Compatible with 1.5 to 55k capacities
	Power Factor Improving AC Reactor	FR-BAL □□ (Note 1)	Used for improving inverter input power factor (total power factor approx. 95%) and for balancing power supply	Compatible with 1.5 to 55k capacities
	Radio Noise Filter	FR-BIF □□ (Note 1)	Used to reduce radio noise	Common for all models
	Line Noise Filter	FR-BSF01	Used to reduce line noise (applicable for 3.7kW or smaller capacities)	
		FR-BLF	Used to reduce line noise	
	BU Type Brake Unit	BU-1500~15K	Used for improving inverter braking performance (for high inertia loads or negative loads)	Common for all models
	Brake Unit	FR-BU-15K to 55K	Use the brake unit and resistor unit as a set	
	Resistor Unit	FR-BR-15K to 55K	Used for improving inverter braking performance (for high inertia loads or negative loads)	
	Regenerative Common Converter	FR-CV-7.5K(-AT) to 55K (Note 5)	High-function unit that regenerates the braking energy generated at the motor into power with a common converter method.	
	Standalone Reactor Dedicated for FR-CV	FR-CVL-7.5K to 55K	Power balancing reactor for FR-CV	
	High-power Factor Converter	FR-HC-7.5K to 55K	The high-power factor converter allows the converter section to alter the input current waveform into a sine wave and greatly reduce the higher harmonics. (used in combination with the standard accessories.)	

Notes:

1. □□ indicates the capacity.
2. □□ indicates the value.
3. Up to three built-in options can be mounted simultaneously. (Only one of the same options can be mounted. Only one communication option can be mounted.)
4. When the option wiring cover is removed and the built-in option is mounted, the structure will be the open type (IP00).
5. -AT indicates the inner panel installation dimensions. When not indicated, this is the heat sink protrusion type. The 37k and larger capacity can be installed in any orientation by changing the position of the installation legs. There is no -AT.

V500 Series

VARIABLE FREQUENCY DRIVES

1 – 400 HP

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