TOSHIBA

Transistor Inverter

3-phase 200V class 0.4kW to 90kW
3-phase 400V class 0.75kW to 630kW

Variable torque Inverter TOSVERT™

VF-PS1

SAVE POWER AND SAVE MONEY

The VF-PS1 has arrived! Specially engineered to meet the global demand for energy saving and harmonic regulation.
"VF-PS1" is all you need for Industrial fan and pump application.

Photo is PS1 with LCD remote keypad option.

point 1 More energy saving

- Advanced energy-saving mode
  Best for exhaust fan, primary pump, boiler and feed water pump that require energy saving.

point 2 High-frequency noise reduction and harmonics reduction

- The integrated noise filter*1 and reactor*1
  Best for HVAC fan and pump.
  *1 Depends on the voltage and capacity range

point 3 Built-in special softwares for fan and pump application

- Bumpless function, Fire control, Sleep function, Multi-PID control, etc
  Best for exhaust fan, primary pump and HVAC fan.

point 4 Simple Setup by EASY Key

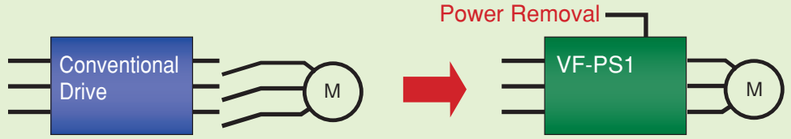
- EASY key, and 8 basic parameters
  Best for exhaust fan, dust collector, drier machine and water pump.

point 5 For more flexibility and usefulness

- Built-in RS485, My function, LONWORKS® and BAC net® fieldbus options
  Best for process pump and fan.

"Power Removal" safety function

Built-in Power Removal safety function which complies with EN954-1 category 3 and IEC/EN61508-1 SIL2.
It saves the installation of a line side or motor side contactor.



Totally enclosed box type for IP54

Variable torque Inverter TOSVERT™

VF-PS1

3-phase 200V class 0.4kW to 90kW
3-phase 400V class 0.75kW to 630kW

TOSVERT™ is a registered trademark of TOSHIBA CORPORATION

- Built-in thermal protection function which complies with NEC® 2005
- Comply with SEMI F47(Semiconductor Equipment and Materials International)

Voltage class	Applicable Motor Output (kW)
	0.4 0.75 1.5 2.2 3.7 5.5 7.5 11 15 18.5 22 30 37 45 55 75 90 110 132 160 220 250 280 315 400 500 630
3-phase 200V class (IP20/IP00)	
3-phase 400V class (IP20/IP00)	
3-phase 400V class (IP54)	

Up to 5.5kW, 3-phase 200V class can be applied to 1-phase input power supply by using 1 size-up rating.

ISO 9001 accreditation acquired
This product has been designed and manufactured at a factory accredited with ISO 9001, the international quality assurance standard.

ISO 14001 accreditation acquired
The factory that manufactures this product is registered for ISO14001, the environment management system standard.

Compatible with the World's Main Standards
CE marking, UL, CSA, C-tick

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point 1 More energy saving

In order to meet the Kyoto protocol requirements, energy efficiency is becoming one of the top priority matters for the international organization and government.

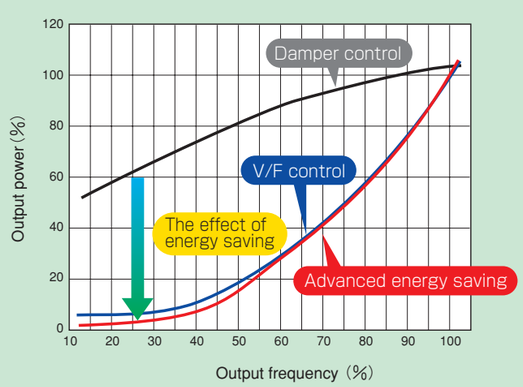
VF-PS1 can help to achieve energy saving by the advanced energy saving mode operation.

*1:Photos of machinery are illustrative purposes only.

More energy saving

The efficiency of induction motor normally fall at the light load and low speed.
The advanced energy-saving mode minimize the loss of induction motor by controlling excitation current belong to the load.
Therefore, this mode increase fan and pump efficiency even in the low speed.

Effect of advanced energy-saving mode



The Energy saved power consumption can be monitored by operation panel or through serial communication data.

Monitor

Output power	▲	H 7.5	The inverter output power (kW) is displayed.
Integral output power	▲	H 90	The integrated amount of power (KWh) supplied from the inverter is displayed.

7.5kW motor
Output power:7.5kW
Integral output power:900kWh

point 2 High-frequency noise reduction and harmonics reduction

The integrated noise filter*2 and reactor*2 drastically reduce high-frequency noise and harmonics. The power factor and energy saving are also improved.

*1:Photos of machinery are illustrative purposes only.
*2:Depends on the voltage and capacity.

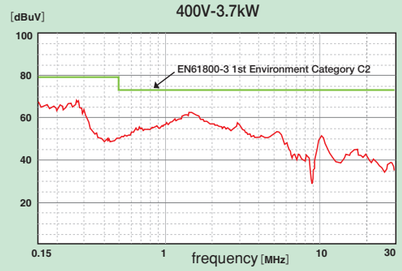
High-frequency Noise Reduction

Built-in noise filters are ideal for site such as commercial facilities and offices where attention must be paid to peripheral devices.
Compared to filter not integrated models, space and wiring can be saved by incorporating filter in the panel. Models with built-in EMC noise filter comply with the European EMC Directive as individual inverter units.

European EMC Directive : IEC/EN61800-3, 1st Environment, C2 (200V-0.4～2.2kW / 400V-0.75～3.7kW)
or
IEC/EN61800-3, 2nd Environment, C3

Effect of built-in filter

400V-3.7kW



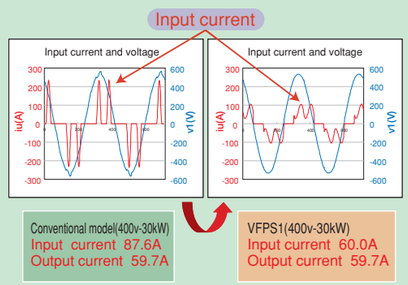
Built-in EMC filter

200V class models, 0.4 to 7.5kW : EMI noise filter (complies with the European EMC Directive) built-in standard
200V class models, 11 to 45kW : Basic noise filter (not complies with the European EMC Directive) built-in standard
400V class models, 0.75 to 75kW : EMI noise filter (complies with the European EMC Directive)built-in standard
400V class models, 90 to 630kW : EMI noise filter (complies with the European EMC Directive) built-in standard

Harmonics Reduction,Power Factor Improvement

New types of compact and space-saving DC reactor is built-in for 200 V class 11 to 45 kW and 400 V 18.5 to 75 kW models.
In addition to reducing harmonics, this reactor limits the input current to 110% of the rated output current, and it has been designed to be compatible with power supply systems containing transformers, molded-case circuit breakers, and power lines.
Optional DC reactor meets IEC harmonics standards.

Effect of built-in reactor



point 3 Built-in special softwares for fan and pump application

The following functions are available for fan and pump application.

-Bumpless function and Local/Remote mode
-Fire control
-Multi-PID control
-Sleep function
-Low torque detection

*1:Photos of machinery are illustrative purposes only.

Built-in software for fan and pump application

Local/Remote mode

You can simply switch between Local and Remote by EASY key.
By switching from Remote to Local (Bumpless function), the operating frequency and status are shifted to Local mode.
It is easier for operation and adjustment.

Fire control

Fire control keeps operation with specified speed even if light fault occurs.

Multi-PID function

The PID operation can be changed at direct and inverse proportion by pressure, flow and temperature.

Sleep function (automatic stop function)

Additional energy saving can be realized by stopping at lower limit setting

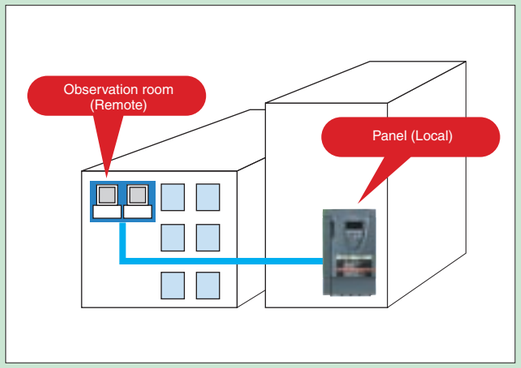
Low torque detection function

Low torque detection can notice a broken belt of AHU or low load to avoid pump trouble.

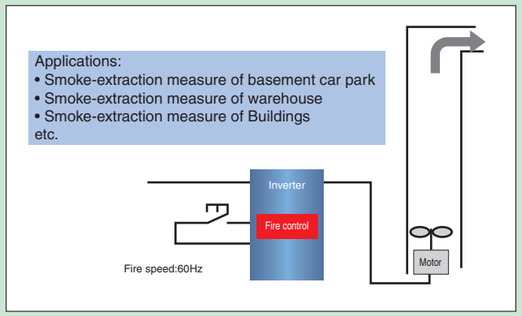
PTC thermistor input

This function is used to protect motor from overheating using the signal of PTC built-in motor.

For example:Local/Remote mode



For example:Fire control enables forced operation



VF-PS1

point 4 Simple set up by EASY key

Installation, maintenance, and parameter setting are easier by EASY key.

You can choose, customize and display maximum of 32 parameters.

*1:Photos of machinery are illustrative purposes only.

Simple setup by EASY key

In the Quick mode, pressing the EASY key on the panel allows you to operate the inverter by eight basic parameters.
When setting each functions, press the EASY key to switch to the standard mode by one-touch operation. In this mode, you can access all parameters.

You can customize the Quick mode display, maximum of 32target parameters are displayed to suit your specific setup requirements.

You can also use the EASY key as a Local/Remote key to switch between Local and Remote operation, and as a shortcut key to directly access any specific setup or display screen.

EASY key

Quick mode (EASY)

Title	Function
AU4	Parameter setting macro function
Pt	V/F control mode selection
FH	Maximum frequency
ACC	Accelertion time 1
dEC	Deceleration time 1
tHr	Motor overload protection level 1
FM	FM terminal meter selection
PSEL	Parameter display selection

Easy Installation, Easy Commissioning, Easy Maintenance

Side-by-side installation

• Side-by-side installation is possible for all VF-PS1 models. You can save and optimize space inside of control panel. Heat sink can be installed outside of the panel as an option.

Removable control terminal board

• A removable terminal board allows you to use the control wiring when replacing the inverter, which also makes maintenance easier.

ON/OFF control of cooling fan

• Temperature-based cooling fan ON/OFF control reduces sound noise, saves energy, and extends the cooling fan's life.

Monitoring of serviceable service parts/alarm output

• The expected replacement cycle of main circuit capacitors, capacitors on control board, and cooling fan is monitored. And alarm is raise when the cycle is reached to the expected replacement time

Side-by-side installation

Removable control terminal board

VF-PS1

point 5 For more flexibility and usefulness

Communications and Network

RS-485 communications

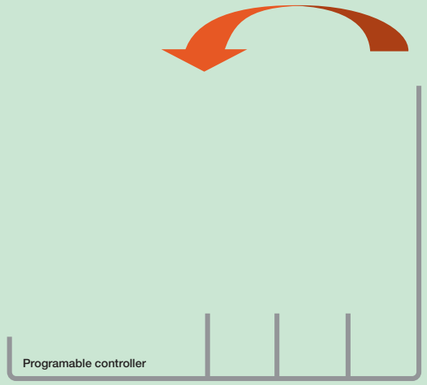
RS-485 communications is equipped as standard. Modbus-RTU protocol and TOSHIBA protocol is also supported.

Network options

DeviceNet®*1, PROFIBUS, CC-Link*1, LONWORKS®*1, BACnet®*1, Metasys®N2*1 and APOGEE®FLN*1 are also available.

Data tracing

The PCM001Z communication software allows you to edit, monitor, and trace parameter data on a PC, enabling easier data management from inverter



*1 DeviceNet is a registered trademarks of ODVA (Open DeviceNet Vendor Association). CC-Link is a registered trademarks of Mitsubishi Electric Corporation. LONWORKS is a registered trademark of Echelon Corporation. BACnet is a registered trademark of American Society of Heating, Refrigerating and Air-Conditioning Engineers, Incorporated. Metasys N2 is a registered trademark of Johnson Controls, Incorporated. APOGEE FLN is a registered trademark of Siemens Building Technologies, Incorporated.

Customizing by "My Function"

Using "My function", you can create programs up to 28 steps. This achieves logic operations and internal data operations. Parameters can also be set by analog input and minimum-peak hold of analog outputs.

For example:

(Ex.1)Inverter is automatically switched to commercial operation without external sequence when the inverter is tripped.
(Ex.2)A signal is output when torque reaches 120% and frequency is 5 Hz.
(Ex.3)"Forward rotation operation," "preset-speed operation frequency 3"and "No.2 acceleration/deceleration"are simultaneously turned ON by input on a single terminal.
(Ex.4)The acceleration/deceleration time is changed dynamically by a voltage within the range 0 to 10 V.

My function	
Number of program steps	: 28
Internal relays	: 8
Internal counters	: 2
Logic commands	: ST, STN, AND, ANDN, OR, ORN, SET, RSET, HOLD ON/OFF DELAY TIMER
Data commands	: EQ, NE, GT, GE, LT, LE, ASUB

Safety Environmental Compatibility

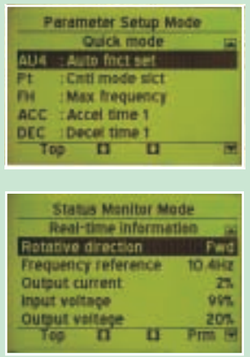
Ambient temperature 60 C	The VF-PS1 can be used at a rating up to an ambient temperature of 50 C or 45 C and in environments up to 60 C at a reduced current.
Eco Design	88% materials used on the VF-PS1 are recyclable, which was designed more than meets of the European WEEE (Waste Electrical and Electronic Equipment) Directive of 70%.
Power section IP54 all sizes	Complete isolation frame outer atmosphere. Option kit can be used to mount the power part of the drive outside the enclosure. (IP 54 degree of protection)
12-pulse input connections	The 500～630kW class can suppress the harmonic current substantially by 12-pules input connections. *12-pulse input requires a special transformer

Useful Options

LCD Remote Keypad Option

This panel indicates 8-line of 23 letters and can be used for simple setup and monitoring by selection of parameters using the jog dial.

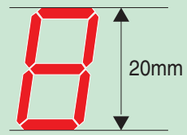
Type:RKP004Z



LED Remote Keypad Option

20 mm LEDs, ensure outstanding visibility even in the darkness. It is designed to be mounted on the panels as extension display or remote keypad. In addition, parameter copy and storing function is also available

Type:RKP002Z



Expanded Terminal Block Option Fieldbus Option

I/O terminal block can be added for more complicated operation and wide range of systems:

- Contact inputs (4) • Contact outputs (2) • Analog inputs (2)
- Analog outputs (2) • PTC input (1) • Relay output (1 circuit)
- Pulse train input (1)

For more information, refer to page23.

Type:ETB003Z, ETB004Z

Main fieldbuses as built-in option card are supported for space saving and centralized control systems.

- DeviceNet® Type:DEV002Z
- LONWORKS® Type:LIU006Z
- APOGEE®FLN Type:APG001Z
- PROFIBUS Type:PDP002Z
- BAC net® Type:BCN001Z
- CC-Link Type:CCL001Z
- Metasys®N2 Type:MTS001Z

VF-PS1

Standard specifications

Standard specifications (200 V class -55 to 75 kW, 400 V class -90 to 630 kW model)

200 V class

Item		Specification		
Applicable Motor (kW)		55	75	90
Rating	Type	VFPS1–		
	Form	2550P	2750P	2900P
	Output Capacity (kVA) Note 1)	84	109	137
	Output Current (A) Note 2)	221	285	359
	Output Voltage	3-phase, 200 to 240 V (The maximum output voltage is the same as the input voltage.)		
	Overload Current Rating	120%–1 minute 135%–2 seconds		
Electric Braking	Dynamic Braking Circuit	Built-in		
	Dynamic Breaking Resistor	External options		
Power Supply	Voltage/frequency	3-phase, 200 to 240 V – 50/60 Hz		
	Allowable Fluctuation	Voltage +10% – 15% Note 3) Frequency ±5%		
Protective method		IP20 enclosed type (JEM1030) Note 4)		
Cooling method		Forced air cooling		
Cooling fan noise (dBA)		61	61	70
Color		RAL7016		
Built-in Filter		External filter (optional)		
DC Reactor		Attached DC reactor Note 5)		

400 V class

Item		Specification										
Applicable Motor (kW)		90	110	132	160	220	250	280	315	400	500	630
Rating	Type	VFPS1–										
	Form	4900PC	4110KPC	4132KPC	4160KPC	4220KPC	4250KPC	4280KPC	4315KPC	4400KPC	4500KPC	4630KPC
	Output Capacity (kVA) Note 1)	136	164	197	239	325	367	419	469	578	717	905
	Output Current (A) Note 2)	179	215	259	314	427	481	550	616	759	941	1188
	Output Voltage	3-phase, 380 to 480 V (The maximum output voltage is the same as the input voltage.)										
	Overload Current Rating	120%–1 minute, 135%–2 seconds										
Electric Braking	Dynamic Braking Circuit	Built-in					External options					
	Dynamic Breaking Resistor	External options										
Power Supply	Voltage/frequency	Note 6)		3-phase, 380 to 440 V – 50 Hz 3-phase, 380 to 480 V – 60 Hz								
	Allowable Fluctuation	Voltage +10% – 15% Note 3) Frequency ±5%										
Protective method		IP20 enclosed type (JEM1030) Note 4)										
Cooling method		Forced air cooling										
Cooling fan noise (dBA)		61	61	72	73	73	76	76	76	76	76	78
Color		RAL7016										
Built-in Filter		EMI noise filter Note 7)										
DC Reactor		Attached DC reactor Note 5)										

Note 1) Capacity is calculated at 220V for the 200V models and at 440V for the 400V models.
Note 2) Indicates the value when the PWM carrier frequency (parameter ↗F) is 2.5 kHz or less.
When low noise (PWM carrier frequency 8 kHz) is required at 18.5 kW or more, use an inverter of capacity one rank higher than the motor capacity.
Note 3) ±10% when the inverter is used continuously (load of 100%)
Note 4) Inverters, 18.5kW or greater, do not have wiring port covers. They have large openings, but there is no space to bend the external cables inside the unit. If they are fitted external to the cabinet, please use an optional wiring port cover.
Note 5) For 200V-55kW, 400V-90kW or larger model, be sure to install DC reactor.
However, this is unnecessary for DC input specifications.
Note 6) Three-phase 380~480V-50/60Hz
Note 7) Complies with the European EMC Directive
IEC/EN61800-3, 2nd environment, category C3

Common Specifications

Item			Specification
Control specifications	Control system		Sinusoidal PWM control
	Output voltage adjustment		Main circuit voltage feedback control. (Switchable between automatic adjustment/fix/control off)
	Output frequency range		Setting between 0.01 to 500Hz. Default max. frequency is set to 0.01 to 60Hz. Maximum frequency adjustment (30 to 500Hz)
	Minimum setting steps of frequency		0.01Hz: operation panel input (60Hz base), 0.02Hz: analog input (60Hz base, 11 bit/0 to 10Vdc)
	Frequency accuracy		Within ±0.2% (25°C±10°C): analog input ±0.01% (25°C±10°C): digital input
	Voltage/frequency characteristics		V/f constant, square reduction torque control, automatic torque boost, vector calculation control, base frequency adjustment 1 and 2 (25 to 500Hz), V/F 5-point arbitrary setting, torque boost adjustment (0 to 30%), start frequency adjustment (0 to 10Hz), stop frequency adjustment (0 to 30Hz)
	Frequency setting signal		3kΩ potentiometer (possible to connect to 1 to 10kΩ-rated potentiometer) 0 to 10Vdc (input impedance Zin: 30kΩ) 0 to ±10Vdc (Zin: 22kΩ) 4 to 20mAdc (Zin:242Ω)
	Terminal board base frequency		The characteristic can be set arbitrarily by two-point setting. Compliant with 6 types of input; analog input (RR, VI/II, RX, RX2), pulse input and binary/BCD input (*RX2, binary/BCD input: optional)
	Frequency jump		3 places. Setting of jump frequency and width.
	Upper and lower limit frequencies		Upper limit frequency: 0 to max. frequency, lower limit frequency: 0 to upper limit frequency
	PWM carrier frequency		200V-45kW or less, adjustable between 1.0 to 16kHz for 400V-75kW or less200V-55kW or less, adjustable between 2.5 to 8kHz for 400V-90kW or more
	PID control		Adjustment of proportional gain, integral time, differential time and delay filter
Operation specifications	Acceleration/deceleration time		0.01 to 6000 sec. Selectable from among acceleration/deceleration. times 1 and 2. Automatic acceleration/deceleration function. S-pattern acceleration/deceleration 1 and 2 pattern adjustable.
	DC braking		Adjustment of braking start frequency (0 to 120Hz), braking (0 to 100%) and braking time (0 to 10 sec.). With emergency stop braking function and motor shaft fix control function.
	Forward run/reverse run Note 1)		With F-CC closed to forward run, with R-CC closed to reverse run, with both closed to reverse run. With ST-CC opened to coast stop. Emergency stop by panel operation or terminal board.
	Jog run Note 1)		Jog mode, if selected, allows jog operation from the operation panel Jog run operation by terminal board is possible by setting the parameters.
	Preset speed operation Note 1)		By changing the combination of open/close between S1, S2, S3, RR/S4-CC, set frequency + 15-speed operation. Selectable between acceleration/deceleration time, torque limit and V/f by set frequency.
	Retry		Capable of restarting after a check of the main circuit elements in case the protective function is activated. Max. 10 times selectable arbitrarily. Waiting time adjustment (0 to 10 sec.)
	Soft stall		Automatic load reduction control at overloading. (Default: OFF)
	Cooling fan ON/OFF		The cooling fan will be stopped automatically to assure long life when unnecessary.
	Operation panel key operation ON/OFF control		Key prohibition selectable between Stop key only, Mode key only, etc. All key operations can be prohibited.
	Regenerative power ride-through control		Possible to keep the motor running using its regenerative energy in case of a momentary power failure. (Default: OFF)
	Auto-restart operation		Possible to restart the motor in coasting in accordance with its speed and direction. (Default: OFF)
	Commercial inverter switching		Possible to switch operation by commercial power source or inverter
	Drooping function		When two or more inverters are used to operate a single load, this function prevents load from concentrating on one inverter due to unbalance.
	Override function		External input signal adjustment is possible to the operation frequency command value.
Protective function	Protective function		Stall prevention, current limit, overcurrent, overvoltage, short circuit on the load side, ground fault on the load side (Note 5), undervoltage, momentary power failure (15ms or more), non-stop control at momentary power failure, overload protection, arm overload at starting, overcurrent on the load side at starting, overcurrent and overload at dynamic braking resistance, fin overheat, emergency stop
	Electronic thermal characteristic		Switchable between standard motor/constant torque VF motor, adjustment of overload protection and stall prevention level.
	Reset		Reset by 1a contact closed (or 1b contact opened), or by operation panel. Or power source OFF/ON. This function is also used to save and clear trip records.
Display functions	4-digit and 7-segment LED	Alarms	Stall prevention during operation, overload limit, overload, undervoltage on power source side, DC circuit undervoltage, setting error, in retry, upper limit, lower limit.
		Causes of failures	Overcurrent, overvoltage, fin overheat, short circuit on the load side, ground fault on the load side, inverter overload, arm overcurrent at starting, overcurrent on the load side at starting, EEPROM error, RAM error, ROM error, transmission error, (dynamic braking resistor overcurrent/overload), (emergency stop), (undervoltage), (low current), (overtorque), (motor overload), (output phase failure) The items in the parentheses are selectable.
		Monitoring function	Operation frequency, operation frequency command, forward run/reverse run, output current, DC voltage, output voltage, compensated frequency, terminal board input/output information, CPU version, control EEPROM version, past trip history, cumulative operation time, speed feedback, torque, torque command, torque current, exiting current, PID feedback value, motor overload factor, inverter overload factor, PBR overload factor, PVBR load factor, input power, output power, peak output current, peak DC voltage, Motor counter pseudo PG, position pulse, RR input, VI/II input, RX input, RX2 input, FM output, AM output, meter adjustment fix output, flash memory version, main circuit EEPROM version, types of connection option, previous default setting, previous automatic control (AU2)
		Free unit display	Display of optional units other than output frequency (motor speed, line speed, etc), current ampere/% switch, voltage volt/% switch
		Automatic edit function	Searches automatically parameters that are different from the standard default setting parameters. Easy to find changed parameters.
		User default setting	User parameter settings can be saved as default settings. Allows to reset the parameters to the user-defined parameter settings.
	LED	Charge display	Displays main circuit capacitor charging.
Power Removal safety, function			Built-in Power Removal safety function which complies with EN954-1 category 3 and IEC/EN61508-1 SIL2.
Input/output terminal input function			Possible to select positive logic or negative logic with programmable input/output terminal function menu. Note 1: Note 2: (Default setting: positive logic)
Sink/source switching			Possible to switch between minus common (CC) and plus common (P24) for control terminal. (Default setting: minus common (CC))
Output signal	Failure detection signal		1c contact output (250Vac-2A-cosØ=1, 250Vac-1A-cosØ=0.4, 30Vdc-1A)
	Low speed/speed reach signal output Note 2)		Open collector output (24Vdc, max. 50mA, output impedance: 33Ω)
	Upper/lower limit frequency signal output Note 2)		Open collector output (24Vdc, max. 50mA, output impedance: 33Ω)
	Output for frequency meter/output for ammeter Note 3)		Analog output. 1mAdc full-scale DC ammeter or 7.7Vdc-1mA voltmeter
	Pulse train frequency output		Open collector output (24Vdc, max. 50mA)
Communication function			RS-485 standard 2-channel equipped (connector: modular 8P)
Environments	Operating environments		Indoor use. Altitude: 3000m or less (current reduction necessary if 1000m or more.) Place not exposed to direct sunlight and free of corrosive and explosive gases.
	Ambient temperature		-10 to +60°C (Remove the upper cover if 40°C or more, max. 60°C) Note 4:
	Storage temperature		-25 to +70°C
	Relative humidity		20 to 93% (free from condensation)
	Vibration		5.9m/s²{0.6G} or less (10 to 55Hz) (Compliant with JIS C0040)

Note 1: 16 contact input terminals (of which 8 are options) are programmable contact input terminals, and they make it possible to arbitrarily select from 80 types of signals.
Note 2: Programmable ON/OFF output terminals make it possible to arbitrarily select from 180 types of signals.
Note 3: Programmable analog output terminals make it possible to arbitrarily select from 50 types of signals.
Note 4: When using inverters where the ambient temperature will rise above 50°C or 45°C, remove the upper cover and operate each inverter at a current lower than the rated one.
Note 5: This function protects inverters from overcurrent due to output circuit ground fault.

VF-PS1

External dimensions

■ 200 V class -0.4 to 75 kW, 400 V class -0.75 to 110 kW model

Figure A

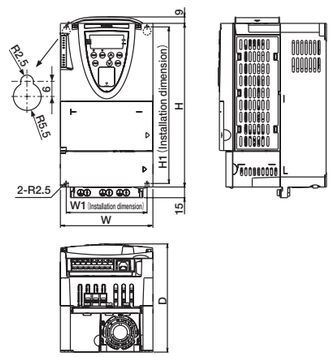


Figure B

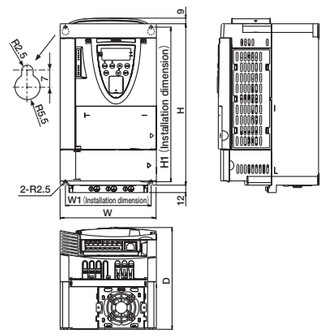


Figure C

Figure D, E

Figure F

Figure G

Figure H

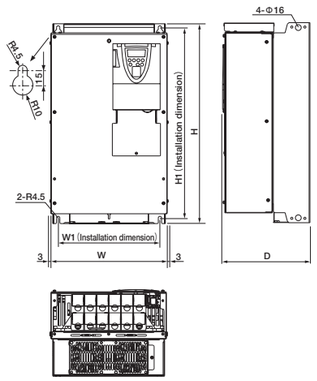


Figure I

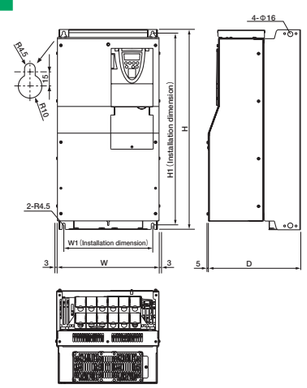
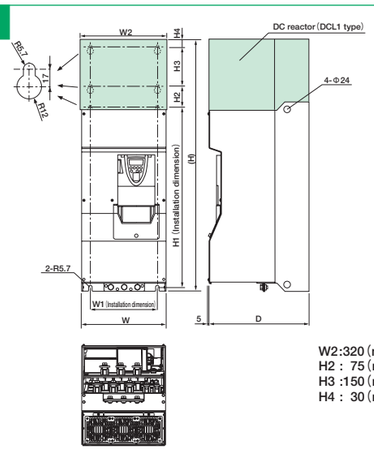


Figure J



W2:320 (mm)
H2 : 75 (mm)
H3 :150 (mm)
H4 : 30 (mm)

Input Voltage Class	Applicable Motor (kW)	Inverter Type	Dimensions (mm)					External Dimension Drawing	Approx. Weight (kg)
			W	H	D	W1	H1		
200V	0.4	VFPS1-2004PL	130	230	152	114	220	A	3
	0.75	VFPS1-2007PL							3
	1.5	VFPS1-2015PL							3
	2.2	VFPS1-2022PL	155	260	164	138	249	B	4
	3.7	VFPS1-2037PL							4
	5.5	VFPS1-2055PL	175	295	164	158	283	C	5.5
	7.5	VFPS1-2075PL	210	295	191	190	283	D	7.5
	11	VFPS1-2110PM	230	400	191	210	386	E	14
	15	VFPS1-2150PM							14
	18.5	VFPS1-2185PM	240	420	212	206	403	F	21
	22	VFPS1-2220PM							21
	30	VFPS1-2300PM	320	550	242	280	525	H	41
	37	VFPS1-2370PM							41
	45	VFPS1-2450PM							41
	55	VFPS1-2550P	310	680 (920)	370	250	650	J	59 (87)
	75	VFPS1-2750P							
400V	0.75	VFPS1-4007PL	130	230	152	114	220	A	3
	1.5	VFPS1-4015PL							3
	2.2	VFPS1-4022PL							3
	3.7	VFPS1-4037PL	155	260	164	138	249	B	4
	5.5	VFPS1-4055PL	175	295	164	158	283	C	5.5
	7.5	VFPS1-4075PL							5.5
	11	VFPS1-4110PL	210	295	191	190	283	D	8
	15	VFPS1-4150PL	230	400	191	210	386	E	13
	18.5	VFPS1-4185PL							16
	22	VFPS1-4220PL	240	420	212	206	403	F	21
	30	VFPS1-4300PL	240	550	242	206	529	G	29
	37	VFPS1-4370PL							29
	45	VFPS1-4450PL	320	630	290	280	605	I	48
	55	VFPS1-4550PL							48
	75	VFPS1-4750PL							48
	90	VFPS1-4900PC	310	680 (920)	370	250	650	J	59 (89)
	110	VFPS1-4110KPC							

Note : Value in ( ) includes attached DC reactor.

VF-PS1

External dimensions

200 V class -90 kW, 400 V class -132 to 630 kW model

Figure K

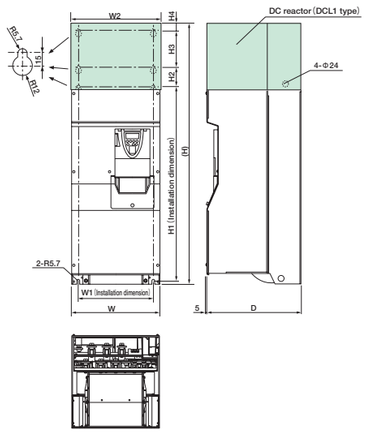


Figure L

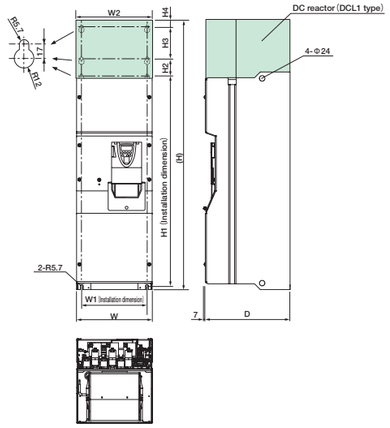


Figure M

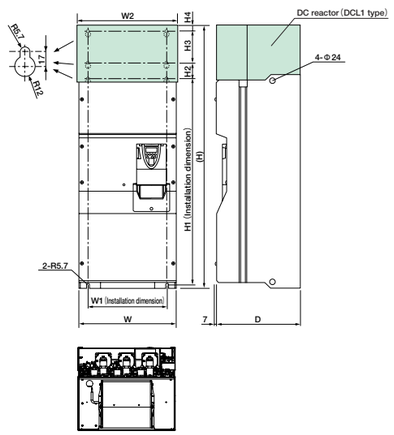


Figure N

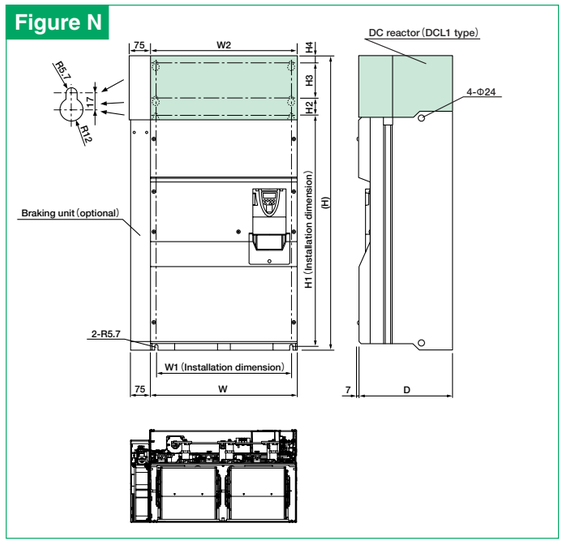


Figure O

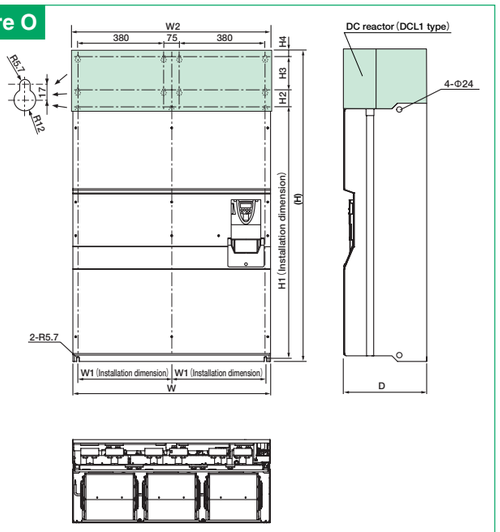
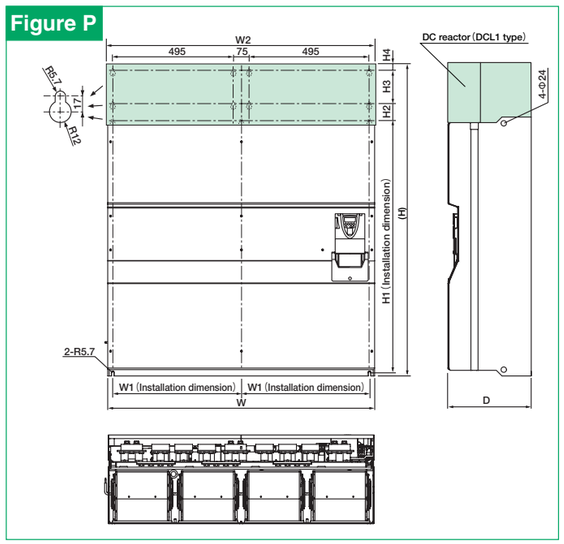


Figure P



Input Voltage Class	Applicable Motor (kW)	Inverter Type	Dimensions (mm)									External Dimension diagram	Approx. Weight (kg)
			W	H	D	W1	H1	W2	H2	H3	H4		
200V	90	VFPS1-2900P	350	782 (1022)	370	298	758	360	72	150	30	K	72 (103)
400V	132	VFPS1-4132KPC	350	782 (1022)	370	298	758	360	72	150	30	K	74 (108)
	160	VFPS1-4160KPC	330	950 (1190)	370	285	920	340	75	150	30	L	82 (118)
	220	VFPS1-4220KPC	430	950 (1190)	370	350	920	440	75	150	30	M	104 (161)
	250	VFPS1-4250KPC	585	950 (1190)	370	540	920	595	75	150	30	N	134 (194)
	280	VFPS1-4280KPC											136 (204)
	315	VFPS1-4315KPC											
	400	VFPS1-4400KPC	880	1150 (1390)	370	418	1120	890	75	150	30	O	215 (302)
	500	VFPS1-4500KPC											225 (330)
	630	VFPS1-4630KPC	1110	1150 (1390)	370	533	1120	1120	75	150	30	P	330 (462)

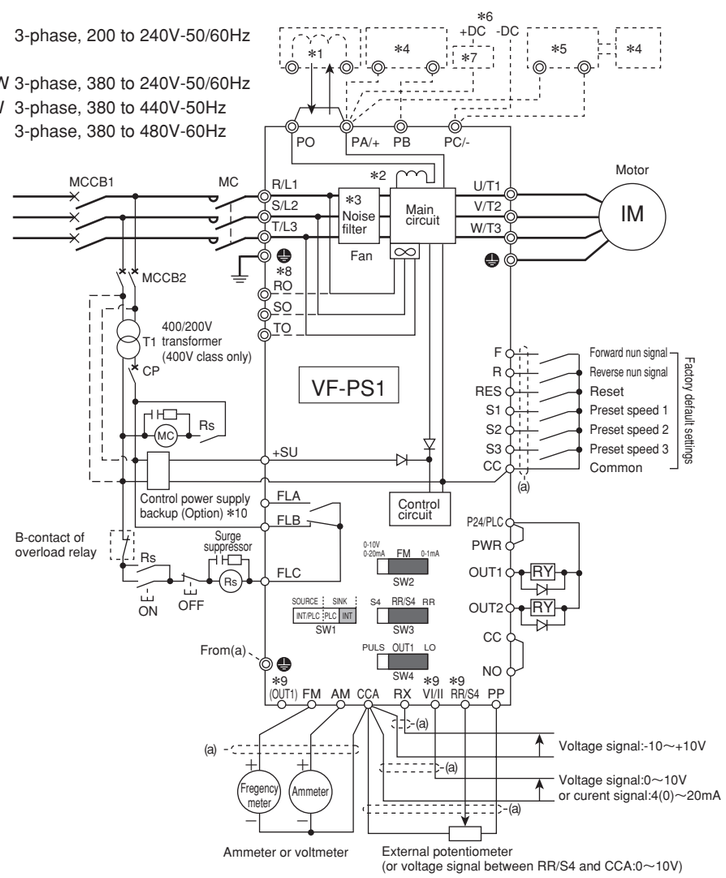
Note : The value in parentheses includes attached DC reactor.

Standard connection diagrams

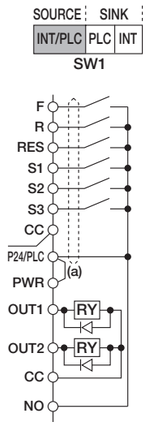
Standard connection diagram : Sink logic (common : CC)

Main circuit power supply

200V class:
0.4~90kW 3-phase, 200 to 240V-50/60Hz
400V class:
0.75 to 110kW 3-phase, 380 to 240V-50/60Hz
132 to 630kW 3-phase, 380 to 440V-50Hz
3-phase, 380 to 480V-60Hz

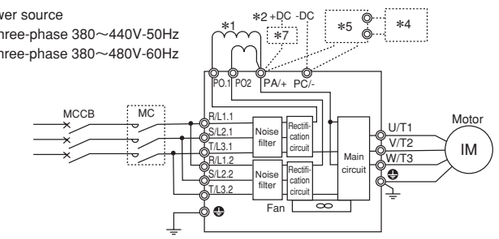


Standard connection diagram : Source logic (common : P24)



*1：The inverter is shipped with the terminals PO and PA/+ shorted with a bar (200V-45kW or amaller, 400V-75kW or smaller).
Remove this shorting bar when installing a DC reactor (DCL). For 200V-55kW or more, and 400V-90kW or more models, be sure to install the DC rector.
*2：The DC reactor is built in for models 200V-11kW~45kW and 400V-18.5kW~75kW.
*3：The noise filter is built in for models 200V-45kW or smaller and all of 400V.
*4：External braking resistor (option). Dynamic braking drive circuit built-in (GTR7)as standard for models 220kW or smaller.
*5：Power generation braking Unit (option).when the external braking resistor (optional) is used on 250kW or more models, the separate power braking unit (optional) is required.
*6：To supply a DC power, connect the cables to the PA/+ and PA/- terminals.
*7：If want to use DC power supply to operate the inverter (200V: 18.5kW or more, 400V: 22kW or more), 400V: 22kW or more), be sure to contact your supplier customer support center, because an inrush current limiting circuit is required in such a case.
*8：For models 200V-90kW and 400V-132kW or larger, three-phase power input is necessary to drive the fan if you want to use a DC power supply.
*9：The functions assigned to terminals OUT1. VI/II and RR/S4 can be swiched by changing parameter settings.
*10：To supply control power from an external power supply for backing up the control power supplied from the inverter. an optional control power backup device (CPS002Z) is required, Insuch a case , the backup device is used at the same time with the internal power supply of the inverter. The optional control power backup unit can be used with both 200V and 400V models.
*11：The rating of 400V-500 and 630kW have the double terminals of R/L1, S/L2, T/L3 for power input, and PO for DC reactor. Please refer the following figure for the wiring.

Main circuit power source
500~630kW Three-phase 380~440V-50Hz
Three-phase 380~480V-60Hz



Terminal functions

Main circuit terminal

Terminal Symbol	Terminal Function
⏚	Grounding terminal for inverter casing
R/L1, S/L2, T/L3	200V class: 0.4~90kW Three-phase 200~240V-50/60Hz 400V class: 0.75~110kW Three-phase 380~480V-50/60Hz 132~630kW Three-phase 380~440V-50Hz (500 and 630kW have the double terminals) Three-phase 380~480V-60Hz
U/T1, V/T2, W/T3	Connect to a (3-phase induction) motor.
PA/+, PB	Connect a braking resistor. (For the optional dynamic braking unit, connect it between PA/+ and PC/-.) Change the parameters Pb, Pbr and PbCP if necessary. 250kW models and smaller are not equipped with terminal PB. If your are using such a model and you wish to use a braking resistor, you will need to purchase a braking unit separately.
PC/-	This is a negative potential terminal in the internal DC main circuit. DC common power can be input across the PA/+ terminals (positive potential).
PO, PA/+	Terminals for connecting a DC reactor (DCL: optional external device). Shorted by a short bar when shipped from the factory (200V: 45kW or smaller, 400V: 75kW or smaller). Before installing DCL, remove the short bar. (500 and 630kW have the double terminals of PO)
RO, SO, TO	200V class: 90kW 400V class:132kW~630kW Inverter's cooling power input terminals. When using a DC power supply, connect three-phase power cables.

Control circuit terminal

The terminal function settings can be changed according to the application.

Terminal Symbol	Input/output	Function	Electrical Specifications
F	Input	Multifunction programmable contact input: Shorting across F-CC causes forward rotation; open causes deceleration stop. (Across ST-CC is short state.)	Voltage free contact input 24Vdc-5mA or less Lan current signal. Choose low current contacts to avoid poor attaching. * Sink/source selectable with SW1 Sink input: ON : Less than DC10V, OFF : DC16V or more Source input: ON : DC11V or more, OFF : Less than DC5V Note: Even when an external power supply is used (in sink logic mode, i.e., when SINK (PLC) is selected), connect the reference potential-side (0V side) cable from the power supply to the CC terminal.
R	Input	Multifunction programmable contact input: Shorting across R-CC causes reverse rotation; open causes deceleration stop. (Across ST-CC is short state.)	
RES	Input	Multifunction programmable contact input: Shorting and then opening RES-CC cancels the status held by an inverter protective function. When the inverter is operating normally, shorting and then opening RES-CC produces no effect.	
S1	Input	Multifunction programmable contact input: Shorting across S1-CC causes preset speed operation.	
S2	Input	Multifunction programmable contact input: Shorting across S2-CC causes preset speed operation.	
S3	Input	Multifunction programmable contact input: Shorting across S3-CC causes preset speed operation.	
RR/S4	Input	Multifunction programmable contact input: SW3: When SW4 is in the S4 position, S4 and CC are shorted and preset speed operation is selected.	
P24/PLC	Output	24Vdc power output (when SW1 is in any position other than PLC) 24V internal output terminal	24Vdc-200mA
	Input	If SW1 is turned to the PLC position, this terminal can be used as a common terminal when an external power supply is used.	—
CC*1	Common to input/output	Digital signal equipotential (0V) terminal for the control circuit and equipotential (0V) terminal for an optional control power supply backup.	—
PP	Output	Analog input setting power output	10Vdc (Permissible load current:10mAdc)
PWR*2	Input	If P24/PLC and PWR are short-circuited, the motor is put into a standby state. And if the circuit between them is opened, the motor coasts and stops. These terminals can be used for interlock. This terminal is not a multifunction programmable input terminal. It is a terminal with the power removal safety function that complies with EN954-1 category 3 and IEC/EN61508-1 SIL II.	Regardless of the setting of SW1 ON : DC17V or more OFF: Less than DC2V (OFF: Coast stop)
RR/S4	Input	SW3: Multifunction programmable analog input terminal when SW4 is in the RR position. Standard default setting:0~10Vdc input and 0~60Hz frequency.	10Vdc (Internal impedance:30 kΩ)
VI/I I	Input	Multifunction programmable analog input.Standard default setting: 0~10Vdc input and 0~60Hz frequency. This terminal can also be used as a 4-20mAdc (0-20mAdc) input terminal, if the parameter AIO8 set to 1.	10Vdc (Internal impedance:30 kΩ) 4~20mA (Internal impedance:242Ω)
RX	Input	Multifunction programmable analog input. Standard default setting:0~±10Vdc input and 0~±60Hz frequency.	10Vdc (Internal impedance:22 kΩ)
FM	Output	Multifunction programmable analog output. Standard default setting: output frequency Connect a 1mAdc full-scale ammeter or 7.5Vdc (10Vdc)-1mA full-scale voltmeter. This terminal can also be used as a 0-20mAdc (4-20mA) terminal, if the parameter FD81 set to 1 and the SW2 switch is set to OFF.	1mA full-scale DC ammeter or 7.5Vdc-1mA full-scale DC voltmeter 0-20mA (4-20mA) Full-scale DC ammeter
AM	Output	Multifunction programmable analog output. Standard default setting: output current Use this terminal to connect a 1mAdc full-scale ammeter or 7.5Vdc (10Vdc)-1mA full-scale voltmeter.	1mA full-scale DC ammeter or 7.5Vdc-1mA full-scale DC voltmeter
OUT1	Output	Multifunction programmable open collector output. The default setting is to output a signal when output low speed threshold has been reached. Depending on the SW4 setting, pulses are output with frequencies of 1.00kHz to 43.20kHz. Standard default setting:3.84kHz	Open collector output 24Vdc-50mA *Sink logic/source logic switchable
OUT2		Multifunction programmable open collector output. By default, it is set to output a signal indicating the completion of acceleration or deceleration.	
NO		Digital output signal equipotential (0V) terminal for the control circuit. It is insulated from the CC terminal.	
CCA*1	Common to input/output	Analog input/output signal equipotential (0V) terminal for the control circuit.	—
+SU	Input	DC power input terminal for operating the control circuit. Connect a control power backup device (optional) between +SU and CC.	Voltage:24Vdc±10% Use a power supply with a current rating of 1.1A or more.
FLA FLB FLC	Output	Relay contact output. Contact rating Used to detect the activation of the inverter's protective function. Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation.	250Vac-2A 30Vdc-1A :at resistance load 250Vac-1A :cosF=0.4

*1: Although the CC terminal and the CCA terminal are not insulated, they should be used separately, one for the logic circuit and the other for the analog circuit.
*2: The PWR terminal is not the same as the ST (standby signal input) terminal provided for conventional models. To use the ST function, assign it to a multifunction terminal (F, R, RES or S1 to S4) that is not currently in use.
Example: When assigning the ST function to the S3 terminal.
Set FI10 to 0, and Set FI17 to 5.
These settings put the motor into a standby state if S3 and CC are short-circuited, or coast and stop the motor if the circuit between S3 and CC is opened.

For inverter users

When studying how to use our inverters

Notes

Leakage current

This inverter uses high-speed switching devices for PWM control.
When a relatively long cable is used for power supply to an inverter, current may leak from the cable or the motor to the ground because of its capacitance, adversely affecting peripheral equipment. The intensity of such a leakage current depends on the PWM carrier frequency, the lengths of the input and output cables, etc., of the inverter. To prevent current leakage, it is recommended to take the following measures.

[Effects of leakage current]

Leakage current which increases when an inverter is used may pass through the following routes:

Route (1) ... Leakage due to the capacitance between the ground and the noise filter
Route (2) ... Leakage due to the capacitance between the ground and the inverter
Route (3) ... Leakage due to the capacitance between ground and the cable connecting the inverter and the motor
Route (4) ... Leakage due to the capacitance of the cable connecting the motor and an inverter in another power distribution line
Route (5) ... Leakage through the grounding line common to motors
Route (6) ... Leakage to another line because of the capacitance of the ground

Leakage current which passes through the above routes may cause the following trouble.

- Malfunction of a leakage circuit breaker in the same or another power distribution line
- Malfunction of a ground-relay installed in the same or another power distribution line
- Noise produced at the output of an electronic device in another power distribution line
- Activation of an external thermal relay installed between the inverter and the motor, at a current below the rate current

Leakage current flow routes

[Measures against effects of leakage current]

The measures against the effects of leakage current are as follows:

1) Measures to prevent the malfunction of leakage circuit breakers
   (1) Decrease the PWM carrier frequency of the inverter. Note)
   (2) Use radio-frequency interference-proof ELCBs (manufactured by Toshiba Schneider Inverter Corporation) as ground-fault interrupters in not only the system into which the inverter is incorporated but also other systems. When ELCBs are used, the PWM carrier frequency needs to be increased to operate the inverter.
   (3) When connecting multiple inverters to a single ELCB, use an ELCB with a high current sensitivity or reduce the number of inverters connected to the ELCB.
2) Measures against malfunction of ground-fault relay:
   (1) Decrease the PWM carrier frequency of the inverter. Note)
   (2) Install ground-fault relays with a high-frequency protective function (e.g., Toshiba CCR12 type of relays) in both the same and other lines. When ELCBs are used, the PWM carrier frequency needs to be increased to operate the inverter.
3) Measures against noise produced by other electric and electronic systems:
   (1) Separate the grounding line of the inverter from that of the affected electric and electronic systems.
   (2) Decrease the PWM carrier frequency of the inverter. Note)
4) Measures against malfunction of external thermal relays:
   (1) Remove the external thermal relay and use the electronic thermal function of the inverter instead of it. (Unapplicable to cases where a single inverter is used to drive more than one motor. Refer to the instruction manual for measures to be taken when thermal relays cannot be removed.)
   (2) Decrease the PWM carrier frequency of the inverter. Note)
5) Measures by means of wiring and grounding
   (1) Use a grounding wire as large as possible.
   (2) Separate the inverter's grounding wire from that of other systems or install the grounding wire of each system separately to the grounding point.
   (3) Ground (shield) the main circuit wires with metallic conduits.
   (4) Use the shortest possible cables to connect the inverter to the motor.
   (5) If the inverter has a high-attenuation EMI filter, turn off the grounding capacitor detachment switch to reduce the leakage current. Note that doing so leads to a reduction in the noise attenuating effect.

Note) In the case of this inverter, the PWM carrier frequency can be decreased to 1.0kHz or 2.5kHz. However, that it should not be set to less than 2.0kHz during vector control. Decreasing the carrier frequency results in an increase in electromagnetic noise from the motor.

Ground fault

Before begining operation, thoroughly check the wiring between the motor and the inverter for incorrect wiring or short circuits. Do not ground the neutral point of any star-connected motor.

Radio interference

[Noise produced by inverters]

Since this inverter performs PWM control, it produces noise and sometimes affects nearby instrumental devices, electrical and electronic systems, etc. The effects of noise greatly vary with the noise resistance of each individual device, its wiring condition, the distance between it and the inverter, etc.

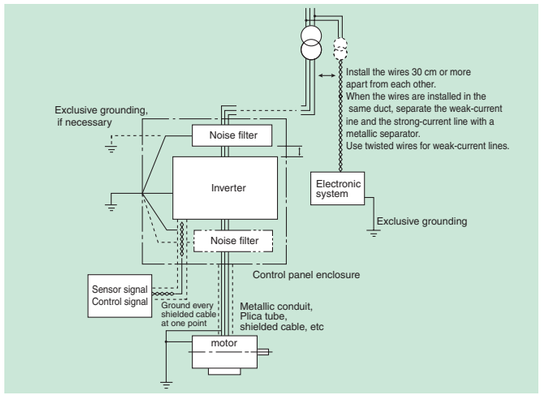
[Measures against noises]

According to the route through which noise is transmitted, the noises produced by an inverter are classified into transmission noise, induction noise and radiation noise.

[Examples of protective measures]

- Separate the power line from other lines, such as weak-current lines and signal lines, and install them apart from each other.
- Install a noise filter in each inverter. It is effective for noise prevention to install noise filters in other devices and systems, as well.
- Shield cables and wires with grounded metallic conduits, and cover electronic systems with grounded metallic cases.
- Separate the power distribution line of the inverter from that of other devices and systems.
- Install the input and output cables of the inverter apart from each other.
- Use shielded twisted pair wires for wiring of the weak-current and signal circuits, and always ground one of each pair of wires.
- Ground the inverter with grounding wires as large and short as possible, separately from other devices and systems.

On 200V 0.4 to 7.5kW and 400V 0.75 to 75kW models, noise can be greatly reduced as they have a built-in EMI noise filter on their input side.



Power factor improvement capacitors

Do not install a power factor improvement capacitors on the input or output side of the inverter.
Installing a power factor improvement capacitor on the input or output side causes current containing harmonic components to flow into the capacitor, adversely affecting the capacitor itself or causing the inverter to trip. To improve the power factor, install an input AC reactor or a DC reactor (optional) on the primary side of the inverter.

Installation of input AC rectors

These devices are used to improve the input power factor and suppress high harmonic currents and surges. Install an input AC reactor when using this inverter under the following conditions:

(1) When the power source capacity is 500kVA or more, and when it is 10 times or more greater than the inverter capacity.
(2) When the inverter is connected the same power distribution system as a thyristor-committed control equipment.
(3) When the inverter is connected to the same power distribution system as that of distorted wave-producing systems, such as arc furnaces and large-capacity inverters.

When wiring the inverter

Wiring precautions

Installing a molded-case circuit breaker [MCCB]

(1) Install a molded-case circuit breaker (MCCB) on the inverter's power supply input to protect the wiring.
(2) Avoid turning the molded-case circuit breaker on and off frequently to turn on/off the motor.
(3) To turn on/off the motor frequently, close/break the control terminals F (or R)-CC.

Installing a magnetic contactor [MC] [primary side]

(1) To prevent an automatic restart after the power interruption or overload relay has tripped, or actuation of the protective circuit, install an electro-magnetic contact in the power supply.
(2) The inverter is provided with a failure detection relay (FL), so that, if its contacts are connected to the operation circuit of the magnetic contactor on the primary side, the magnetic contactor will be opened when the protective circuit of the inverter is activated.
(3) The inverter can be used without a magnetic contactor. In this case, use an MCCB (equipped with a voltage tripping device) for opening the primary circuit when the inverter protective circuit is activated.
(4) Avoid turning the magnetic contactor on and off frequently to turn on/off the motor.
(5) To turn on/off the motor frequently, close/break the control terminals F (or R)-CC.

Installing a magnetic contactor [MC] [secondary side]

(1) As a rule, if a magnetic contactor is installed between the inverter and the motor, do not turn of ON/OFF while running. (If the secondary-side contactor is turned of ON/OFF while running, a large current may flow in the inverter, causing inverter damage and failure.)
(2) A magnetic contactor may be installed to change the motor or change to the commercial power source when the inverter is stopped. Always use an interlock with the magnetic contactor in this situation so that the commercial power supply is not applied to the inverter's output terminals.

External signal

(1) Use a relay rated for low currents. Mount a surge suppressor on the excitation coil of the relay.
(2) When wiring the control circuit, use shielded wires or twisted pair cables.
(3) Because all of the control terminals except FLA, FLB and FLC are connected to electronic circuits, insulate these terminals to prevent them from coming into contact with the main circuit.

Installing an overload relay

(1) The VF-S11 inverter has an electronic-thermal overload protective function. However, in the following cases, the thermal relay operation level must be adjusted or an overload relay matching the motor's characteristics must be installed between the inverter and the motor.
   (a) When using a motor having a rated current value different from that of the equivalent.
   (b) When driving several motors simultaneously.
(2) When using the inverter to control the operation of a constant-torque motor (VF motor), change the protective characteristic of the electronic thermal relay according to the setting of the VF motor.
(3) In order to adequately protect a motor used for low-speed operation, we recommend the use of a motor equipped with a embedded thermal relay.

When changing the motor speed

Application to standard motors

Vibration

When a motor is operated with an industrial inverter, it experiences more vibrations than when it is operated by the commercial power supply. The vibration can be reduced to a negligible level by securing the motor and machine to the base firmly. If the base is weak, however, the vibration may increase at a light load due to resonance with the mechanical system.

Reduction gear, belt, chain

Note that the lubrication capability of a reducer or a converter used as the interface of the motor and the load machine may affected at low speeds.
When operating at a frequencies exceeding 60 Hz or higher, power transmission mechanisms such as reduction gear, belts and chains, may cause problems such as production of noise, a reduction in strength, or shortening of service life.

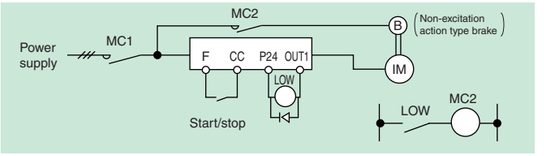
Frequency

Before setting the maximum frequency to 60 Hz or higher, confirm that this operating range is acceptable for the motor.

Application to special motors

Braking motor

When using a braking motor, if the braking circuit is directly connected to the inverters's output terminals, the brake cannot be released because of the lowered starting voltage. Therefore, when using a braking motor, connect the braking circuit to the inverter's power supply side, as shown on the below. Usually, braking motors produce larger noise in low speed ranges.



Gear motor

When using an industrial inverter to drive a gear motor, inquire of the motor manufacturer about its continuous operation range, since low-speed operation of a gear motor may cause insufficient lubrication.

Toshiba Gold Motor (High-efficiency power-saving motor)

Inverter-driven operation of Toshiba Gold Motors is the best solution for saving energy. This is because these motors have improved efficiency, power factor, and noise/vibration reduction characteristics when compared to standard motors.

Pole-changing motor

Pole-changing motors can be driven by this inverter. Before changing poles, however, be sure to let the motor come to a complete stop.

Hight-pole-count motors

Note that hight-pole count motors(8 or more poles), which may be used for fans,etc., have higher rated current than 4-pole moters.
The current ratings of multipole motors are relatively high. So, when selecting an inverter, you must pay special attention to its current rating so that the current rating of the motor is below that of the inverter.

Single-phase motor

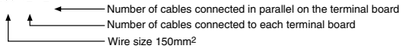
Because single-phase motors are equipped with a centrifugal switch and capacitors for starting, they cannot be driven by an inverter. If only a single-phase, power system is availabls a 3-phase motor can be driven by using a single-phase input interter to convert it into a 3-phase 200V output. (A special inverter and a 3-phase motor are required.)

For inverter users

Selecting peripheral and wiring sizes devices

Voltage Class	Applicable Motor (kW)	Inverter model	Input current (A)		Molded-case circuit breaker (MCCB) Note 1),2)		Magnetic contactor (MC) Note 1),3),4),5)		Wire size Note 6),7)										Inverter Terminal Screw Size Note 8)	
					Rated current (A)		Operational current (A) AC1		Main circuit				DC terminal		Braking resistor/ Braking unit (optional) Note 9)		Ground lead		Main Circuit Terminal	GND Terminal
									Input terminal (R, S, T)		Output terminal (U, V, W)									
			Without Reactor	With Reactor	Without Reactor	With Reactor	Without Reactor	With Reactor	AWG	mm²	AWG	mm²	AWG	mm²	AWG	mm²	AWG	mm²		
200V	0.4	VFPS1-2004PL	3.5	2.1	5	5	25	25	14	1.5	14	1.5	14	1.5	14	1.5	14	2.5	M4	M5
	0.75	VFPS1-2007PL	6.1	3.2	10	5	25	25	14	1.5	14	1.5	14	1.5	14	1.5	14	2.5		
	1.5	VFPS1-2015PL	11.5	6.4	15	10	25	25	14	1.5	14	1.5	12	1.5	14	1.5	14	2.5		
	2.2	VFPS1-2022PL	15	9.3	20	15	25	25	12	1.5	12	1.5	10	2.5	14	1.5	14	2.5		
	3.7/4.0	VFPS1-2037PL	26	15.5	30	30	32	25	10	4	10	4	8	6	14	1.5	12	4		
	5.5	VFPS1-2055PL	35	22.5	50	40	40	25	8	6	8	6	6	10	14	1.5	10	6	M5	
	7.5	VFPS1-2075PL	45	34.5	60	40	50	40	8	10	8	10	4	16	12	2.5	10	10		
	11	VFPS1-2110PM	-	53.5	-	75	-	80	4	16	4	16	3	16	10	4	10	16	M6	
	15	VFPS1-2150PM	-	72	-	100	-	80	4	25	4	25	1	25	8	6	10	16		
	18.5	VFPS1-2185PM	-	77	-	100	-	80	3	25	3	25	1/0	35	8	10	8	16	M8	
	22	VFPS1-2220PM	-	88	-	125	-	125	2	25	2	25	2/0	35	6	16	8	16		
	30	VFPS1-2300PM	-	125	-	150	-	125	2/0	50	2/0	50	4/0	70	4	25	6	25		
	37	VFPS1-2370PM	-	140	-	175	-	250	3/0	70	3/0	70	250MCM	95	3	35	6	35	M12	M8
	45	VFPS1-2450PM	-	165	-	200	-	250	4/0	70	4/0	70	300MCM	95	2	50	6	35		
	55	VFPS1-2550P	-	200	-	250	-	275	3/0×2	70×2	3/0×2	120	4/0×2	95×2	1/0	50	1/0	70		
	75	VFPS1-2750P	-	270	-	350	-	350	4/0×2	95×2	4/0×2	70×2	3/0×2	95×2	1/0	35×2	1/0	95	M10	M10
	90	VFPS1-2900P	-	336	-	500	-	500	250MCM×2	120×2	250MCM×2	95×2	300MCM×2	120×2	1/0	50×2	1/0	120		
400V	0.75	VFPS1-4007PL	3.7	2.1	5	4	25	25	14	1.5	14	1.5	14	1.5	14	1.5	14	2.5	M4	M5
	1.5	VFPS1-4015PL	5.8	3.8	10	6.3	25	25	14	1.5	14	1.5	14	1.5	14	1.5	14	2.5		
	2.2	VFPS1-4022PL	8.2	5.7	14	10	25	25	14	1.5	14	1.5	14	1.5	14	1.5	14	2.5		
	3.7/4.0	VFPS1-4037PL	14	8.7	18	14	25	25	12	1.5	12	1.5	10	2.5	14	1.5	14	2.5		
	5.5	VFPS1-4055PL	20.5	12.7	32	25	25	25	10	2.5	10	2.5	8	4	14	1.5	12	2.5		
	7.5	VFPS1-4075PL	27	16.3	32	25	32	25	10	4	10	4	8	6	14	1.5	12	4	M5	
	11	VFPS1-4110PL	36.5	21.5	50	30	40	32	8	6	8	6	6	10	14	1.5	10	6		
	15	VFPS1-4150PL	48	33.5	60	40	50	40	6	10	6	10	4	16	12	2.5	10	10	M6	
	18.5	VFPS1-4185PL	-	45.5	-	60	-	50	6	10	6	10	4	16	10	2.5	10	10		
	22	VFPS1-4220PL	-	50	-	60	-	50	6	10	6	10	4	16	10	4	10	8		
	30	VFPS1-4300PL	-	66	-	100	-	80	4	16	4	16	2	25	8	6	10	16	M8	
	37	VFPS1-4370PL	-	84	-	100	-	125	3	25	3	25	1	35	8	10	8	16		
	45	VFPS1-4450PL	-	105	-	125	-	125	1	35	1	35	2/0	50	6	16	8	16		M8
	55	VFPS1-4550PL	-	120	-	150	-	125	1/0	50	1/0	50	3/0	70	6	16	6	25	M12	
	75	VFPS1-4750PL	-	165	-	200	-	250	3/0	70	3/0	70	250MCM	95	3	35	6	35		
	90	VFPS1-4900PC	-	170	-	200	-	250	1/0×2	70×2	1/0×2	95	1/0×2	95×2	1/0	35	2	70	M10	M10
	110	VFPS1-4110KPC	-	200	-	250	-	275	2/0×2	95×2	2/0×2	120	2/0×2	95×2	1/0	35	2	95		
	132	VFPS1-4132KPC	-	240	-	300	-	315	4/0×2	95×2	4/0×2	70×2	4/0×2	120×2	1/0	50	1	95		
	160	VFPS1-4160KPC	-	290	-	350	-	350	250MCM×2	120×2	250MCM×2	95×2	4/0×2	120×2	4/0	70	1	120		
	220	VFPS1-4220KPC	-	395	-	500	-	500	350MCM×2	150×2	350MCM×2	150×2	350MCM×2	150×2	4/0	95	2/0	150		
	250	VFPS1-4250KPC	-	444	-	700	-	700	250MCM×3	150×2	250MCM×3	150×2	4/0×3	185×2	300MCM	150	2/0	150		
	280	VFPS1-4280KPC	-	495	-	700	-	700	300MCM×3	150×3	300MCM×3	120×3	300MCM×3	150×3	300MCM	150	3/0	120×2		
	315	VFPS1-4315KPC	-	555	-	700	-	1000	350MCM×3	150×3	350MCM×3	150×3	350MCM×3	150×3	300MCM	150	3/0	120×2		
	400	VFPS1-4400KPC	-	709	-	1000	-	1000	350MCM×4	150×4	350MCM×4	120×4	500MCM×3	150×4	300MCM×2	150×2	4/0	150×2		
	500	VFPS1-4500KPC	-	876	-	1200	-	1600	500MCM ×2×2 Note 12)	150×2×2 Note 12)	500MCM ×4	185×4	500MCM ×4	185×4 Note 11)	300MCM×2	150×2	250MCM	150×2	M12	M12
	630	VFPS1-4630KPC	-	1091	-	1600	-	1600	500MCM ×3×2 Note 12)	150×3×2 Note 12)	500MCM ×5	185×5	500MCM ×4	185×4 Note 11)	300MCM×2	150×2	250MCM	185×2		

Note 1) Selections for use of the Toshiba 4-pole standard motor with power supply voltage of 200V/400V-50Hz.
Note 2) Choose the MCCB according to the power supply capacity.
For comply with UL and CSA standard, use the fuse certified by UL and CSA.
Note 3) When the motor is driven by commercial power supply switching, for example, use an electromagnetic contactor that is matched to AC-3 class motor rated current.
Note 4) Attach surge killers to the magnetic contactor and exciting coil of the relay.
Note 5) In the case the magnetic contactor (MC) with 2a-type auxiliary contacts is used for the control circuit, raise the reliability of the contact by using 2a-type contacts in parallel connection.
Note 6) The recommended cable size is that of the cable (e.g. 600V class, HIV cable) with continuous maximum permissible temperature of 75°C. Ambient temperature is 40°C or less and the wiring distance is 30m or less.
Note 7) For the control circuit, use shielded wires whose size (cross-section) is 0.75 mm2 or more.
Note 8) The screw size of the control terminals is M3.
Note 9) Choose the wiring size according to the braking resistor value.
Note 10) On 200 V class 55 kW or more, and 400 V class 90 kW or more models, be sure to install the DC reactor.
Note 11) The recommended cable is 600V class HIV cable with permissible temperature of 90°C.
Note 12) The number refers to a cable composition. For example, in the case of "150×2×2": 150×2×2



Selecting the Capacity (model) of the Inverter

selection

Capacity

Refer to the applicable motor capacities listed in the standard specifications.
When driving a high-pole motor, special motor, or multiple motors in parallel, select such an inverter that the sum of the motor rated current multiplied by 1.05 to 1.1 is less than the inverter's rated output current value.

Acceleration/deceleration times

The actual acceleration and deceleration times of a motor driven by an inverter are determined by the torque and moment of inertia2 of the load, and can be calculated by the following equations.
The acceleration and deceleration times of an inverter can be set individually. In any case, however, they should be set longer than their respective values determined by the following equations.

Acceleration time	$ta = \frac{(JM+JL) \times \Delta N}{9.56 \times (TM-TL)}$ (sec.)
Deceleration time	$ta = \frac{(JM+JL) \times \Delta N}{9.56 \times (TB+TL)}$ (sec.)
Conditions	JM : Moment of inertia of motor (kg.m²) JL : Moment of inertia of load (kg.m²) (converted into value on motor shaft) ΔN : Difference in rotating speed between before and after acc. or dce. (min.⁻¹) TL : Load torque (N.m) TM : Motor rated torque x 1.1 (N.m) ... V/f control : Motor rated torque x 1.2 (N.m) ... Vector operation control TB : Motor rated torque x 0.2 (N.m) (When a braking resistor or a braking resistor unit is used: Motor rated torque x 0.8-1.0 (N.m))

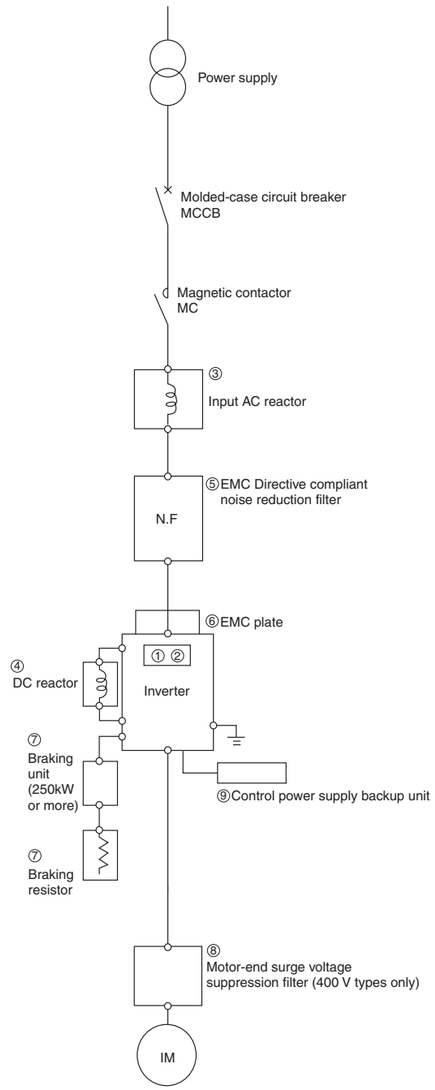
Allowable torque characteristics

When a standard motor is combined with an inverter to perform variable speed operation, the motor temperature rises slightly higher than it normally does during commercial power supply operation. This is because the inverter output voltage has a sinusoidal (approximate) PWM waveform. In addition, the cooling becomes less effective at low speed, so the torque must be reduced according to the frequency.
When constant-torque operation must be performed at low speeds, use a Toshiba VF motor designed specifically for use with inverters.

Starting characteristics

When a motor is driven by an inverter, its operation is restricted by the inverter's overload current rating, so the starting characteristic is different from those obtained from commercial power supply operation.
Although the starting torque is smaller with an inverter than with the commercial power supply, a high starting torque can be produced at low speeds by adjusting the V/f pattern torque boost amount or by employing vector control. When a larger starting torque is necessary, select an inverter with a larger capacity and examine the possibility of increasing the motor capacity.

Peripheral devices



■ Built-in options

No.	Name	Function/Purpose, etc.	Refer to
①	Expanded terminal block card	This option is convenient for adding on special functions. (Type : ETB003Z, ETB004Z)	P23
	CC-Link communications card	This option enables CC-Link communications with a host controller or other PLC. (Type : CCL001Z)	
	DeviceNet communications card	This option enables DeviceNet communications with a host controller or other PLC. (Type :DEV002Z)	
	PROFIBUS communications card	This option enables PROFIBUS communications with a host controller or other PLC. (Type : PDP002Z)	
	LONWORKS® communications card	This option enables LONWORKS® communications with a host controller or other PLC. (Type : LIU006Z)	
	BACnet® communications card	This option enables BACnet® communications with a host controller or other PLC. (Type : BCN001Z)	
	Metasys® N2 communications card	This option enables Metasys® communications with a host controller or other PLC. (Type : MT001Z)	
	APOGEE® FLN communications card	This option enables APOGEE® FLN communications with a host controller or other PLC. (Type : APG001Z)	
②	PG feedback card (complimentary output/line driver output)	Higher performance operation is possible by combining with a motor equipped with a sensor. (Type : VEC004Z, VEC005Z, VEC007Z)	

External options

No.	Name	Function/Purpose, etc.	Refer to
③	Input AC reactor	This is used to improve the input power factor of the inverter power supply, reduce harmonics or suppress external surges. Install this option when the power supply capacity is 500 kVA or more and the power supply capacity is 10 times or more than that of the inverter's capacity, or when a distortion-generating source such as a thyristor or a large-capacity inverter is connected to the same wiring leads. The effect of this option changes according to the impedance of the reactor. Consult us separately for details.	P25
④	DC reactor	Reactor / Effect: Improved Power Factor / Harmonics / External Surge Suppression Input AC Reactor: ○ / ○ / ○ DC Reactor: ○very / ○very / × ○very: very effective ○: effective ×: ineffective The DC reactor is more effective than the input reactor in improving the power factor. We recommend joint use of the input reactor, that is effective in suppressing external surges, when facilities where the inverter is to be applied require high reliability.	P26
⑤	EMC Directive compliant noise reduction filter (for European market)	This high-attenuation type EMC noise filter takes up little space, and adopts a system (foot mount or side mount) that mounting on the rear or side of the inverter (separate-standing for large-capacity class models).	P27·28
⑥	EMC plate	A steel plate used to connect shielded earth wires from inverter's power cables or to connect earth wires from external devices. Some models have it as a standard attachment or as an option.	P28
⑦	Braking resistor Braking unit	This operation is used when sudden deceleration or stops are frequently performed, or when the deceleration time must be shortened on loads having a large inertia. This resistor is for taking up energy during power generation braking. For 250kW or more inverter, it requires the braking unit.	P29·30
⑧	Motor-end surge voltage suppression filter (400 V types only)	On systems that run 400 V class general-purpose motors by voltage-type PWM system inverters using ultra high-speed switching devices (e.g. IGBT), surge voltage, that is dependent on cable length, cable laying methods, cable constants, and other factors, sometimes causes the insulation of the motor winding to deteriorate. For this reason, measures for suppressing surge voltage are performed by installing a DC reactor or surge suppression filter on the inverter output end where the insulation-reinforced motor is used.	P31
⑨	Control power supply backup unit	Control power need not be input separately as it is supplied internally on the inverter from the main circuit power supply. Use this option when backing up only by the control power supply when the main circuit is shut off. This is +24 VDC output common to both 200 and 400 V models. (Model : CPS001Z)	P32
⑩	USB communications conversion unit	This unit is connected to a PLC or a computer to enable data communications. By connecting the connector cable, parameters can be easily adjusted, and data easily saved and written. ■Monitor function ■Parameter setup function ■Command function ■Additional functions (Model : USB001Z)	P32
⑪	Communications cable	Connector cable for USB conversion unit and LED remote keypad. (Model : CAB0011, CAB0013, CAB0015)	P32
⑫	LCD remote keypad (installable on body)	LCD remote keypad is for extension or mounting on the inverter body. Its 11-character, 8-line "hiragana" and Kanji display facilitates parameter setup. The dedicated cable for the LCD remote keypad is required for connecting it to the inverter. (Model : RKP004Z)	P33
⑬	LCD cable	Connector cable for LCD remote keypad (Model : CAB0071, CAB0073, CAB0075, CAB00710)	P33
⑭	LED remote keypad (w/ parameter writer function)	LED remote keypad is for extension. It is provided with an LED display, RUN/STOP key, UP/DOWN key, monitor key, and enter key. Setup parameters for three inverters can be stored to this unit. (Model : RKP002Z)	P33
⑮	Heat sink outside protrusion option	This allows heat generated inside panels to be reduced.	P34
⑯	Operation panel	Has a built-in frequency type, frequency setter and RUN-STOP (forward run, reverse run) switch. (Model : CBVR-7B1)	P36

Harmonic current and influence to power supply

Harmonics are defined as sinusoidal waves that is multiple frequency of commercial power (base frequency: 50Hz or 60Hz). Commercial power including harmonics has a distorted waveform.
Some electrical and electronic devices produce distorted waves in their rectifying and smoothing circuits on the input side. Harmonics produced by a device influence other electrical equipment and facilities in some cases (for example, overheating of phase advancing capacitors and reactors).

Measures for suppressing higher harmonics

No	Measures	Description
1	Connecting a reactor	The leakage of a harmonic current from an inverter can be restricted by connecting an input AC reactor (ACL) on the input side of the inverter or a DC reactor (DCL) to the DC section of the inverter.
2	Connecting a higher harmonic suppressing unit (SC7)	A PWM converter that shapes the waveform of an input current into a substantially sinusoidal waveform. The leakage of a harmonic current from a power supply can be restricted by connecting a harmonic suppressing unit.
3	Connecting a higher harmonic suppressing phase advancing capacitor	A harmonic current can be absorbed by the use of a phase advancing capacitor unit composed of a phase advancing capacitor and a DC reactor.
4	Multi-pulse operation of transformation	For delta-delta connection and delta-Y connection transformers, the effect of 12 pulses can be obtained by distributing the load evenly, and thus currents containing fifth-order and seventh-order harmonics can be suppressed.
5	Other measures	Harmonic currents can also be suppressed by the use of passive (AC) and active filters.

Built-in options

Here are the internal devices optionally available. There are two types of optional devices: Add-on type and Plug-in type.

Table of optional devices

Option name		Function, purpose	Model	Type of installation
Expansion terminal function	Expansion I/O card1	Used to extend input and output terminals.	ETB003Z	Add-on
	Expansion I/O card2		ETB004Z	Add-on
Communication function	CC-Link communication card	Used to connect to a CC-Link network for control.	CCL001Z	Add-on
	DeviceNet communication card	Used to connect to a DeviceNet network for control.	DEV002Z	Add-on
	PROFIBUS-DP communication card	Used to connect to a PROFIBUS-DP network for control.	PDP002Z	Add-on
	LONWORKS communication card	Used to connect to a LONWORKS network for control.	LIU006Z	Add-on
	BAC net communication card	Used to connect to a BAC net network for control.	BCN001Z	Add-on
	Metasys N2 communication card	Used to connect to a Metasys N2 network for control.	MTS001Z	Add-on
	APOGEE FLN communication card	Used to connect to a APOGEE FLN network for control.	APG001Z	Add-on
PG feedback	Push-pull 12V	Used to issue motor pulse train rate commands or used for sensor vector control.	VEC004Z	Plug-in
	Push-pull 15V		VEC005Z	Plug-in
	RS422-5V		VEC007Z	Plug-in

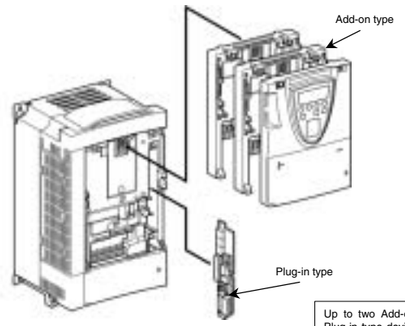
Up to two Add-on type devices and one Plug-in type device can be installed at the same time. Note, however, that two identical optional devices and two identical optional communication devices cannot be connected and used.

Function of Expansion I/O card

Model	ETB003Z	ETB004Z
Multifunction programmable contact input	Multifunction programmable contact input : 4 points No-voltage contact input (24Vdc-5mA or less) Sink logic input (at a common voltage of 24V) Source logic input ON: Less than 10Vdc ON: 11Vdc or more OFF: 16Vdc or more OFF: Less than 5Vdc	
Multifunction programmable open collector output	Multifunction programmable open collector output : 2 points Driving current: Max. 50mA when an external power source is used Max. 20mA when the internal power source is used Driving voltage: 12V (min) to 30V (max)	
Multifunction programmable relay contact output	1C contact configuration 250Vac-2A (cosϕ=1), 250Vac-1A (cosϕ=0.4), 30Vdc-1A	
Differential current input	Disable	Current input: 20mA or less Voltage input: Differential voltages 5V or less, -10V or more, +10V or less
Analog input	Disable	Current input: 20mA or less Voltage input: 0V to 10V
Monitor output	Disable	Voltage output: -10V to 10V, 0V to 10V Current output: 0mA to 20mA
Pulse train input	Disable	Input pulse specifications Voltage: Max. 5V Current: Max. 15mA Frequency: Max. 30kHz Duty: 50±10%
External thermal trip input	Resistance between TH+ and TH- Error: Approx. 70Ω or less or approx. 3kΩ or more Recovery from error: Approx. 1.6kΩ	
24V power output	24Vdc - 60mA max	
-10V power output	-10Vdc -10mA	
Contact input common terminal	Common terminals for contact input	

How to install

Add-on type devices and insertion type devices are installed in different ways.
Install them correctly, as shown in the figures below.



Up to two Add-on type devices and one Plug-in type device can be installed at the same time. Note.
however, that two identical optional devices and two identical communication devices cannot be connected and used.

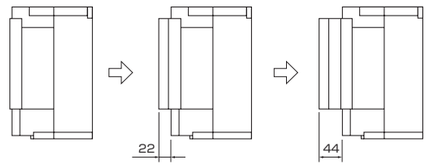
Function of PG feedback card

Model	VEC004Z, VEC005Z	VEC007Z
Sensor vector control operation	Speed control operation: Zero-speed - 120% torque Speed control range: 1:1000 (1000ppr PG)	
PG method	Complementary method, open collector method	Line drive method
PG cable length	Max. 100m (complementary method)	Max. 30m
PG supply power	VEC004Z: 12V-160mA VEC005Z: 15V-150mA	5V-160mA
Maximum pulse input frequency	300kHz or less * If a two-phase open collector is used, a study needs to be made to determine the derating factor. For details, refer to the operating manual for the optional device. Pulse duty: 50±10%	
Pulse input voltage	12Vdc~24Vdc	Line driver (LTC485 or equivalent)

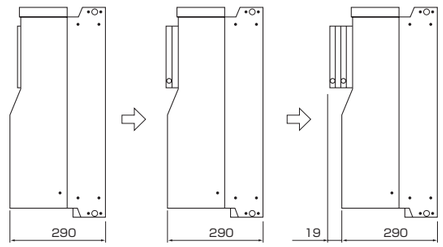
Dimension of depth that installed option

Depending on the capacity, the installation of an Add-on type device may increase the depth of the inverter.

200V 0.4 to 45kW/400V 0.75 to 37kW

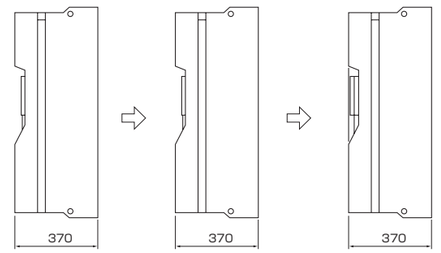


400V 45 to 75kW



200V 55 to 90kW/400V 90 to 630kW

Note: The inverters of these capacities come equipped with an Add-on type option case as standard.
When installing an optional Add-on type device, remove the case.



Standard type | **Standard type + one Add-on** | **Standard type + two Add-on**

VF-PS1

External options

Voltage class	Applicable motor (kW)	Inverter model	Input AC reactor (ACL)	DC reactor (DCL) Note 4)	EMC Directive compliant noise reduction filter	Braking resistor Note 1), 2)	Motor end surge voltage suppression filter
200V class	0.4	VFPS1-2004PL	PFL-2005S	DCL-2007	Built-in	PBR-2007	–
	0.75	VFPS1-2007PL					
	1.5	VFPS1-2015PL	PFL-2011S	DCL-2022		PBR-2022	
	2.2	VFPS1-2022PL					
	3.7	VFPS1-2037PL	PFL-2018S	DCL-2037		PBR-2037	
	5.5	VFPS1-2055PL	PFL-2025S	DCL-2055		PBR3-2055	
	7.5	VFPS1-2075PL	PFL-2050S	DCL-2110		PBR3-2075	
	11	VFPS1-2110PM		Built-in	EMF3-4072E	PBR3-2110	
	15	VFPS1-2150PM	PFL-2100S			PBR3-2150	
	18.5	VFPS1-2185PM			EMF3-4090F		
	22	VFPS1-2220PM				PBR3-2220	
	30	VFPS1-2300PM	PFL-2150S		EMF3-4180H		
	37	VFPS1-2370PM				PBR-222W002	
	45	VFPS1-2450PM	PFL-2200S				
	55	VFPS1-2550P	PFL-2300S	Attached as standard	EMF3-4300I		
	75	VFPS1-2750P	PFL-2400S			DGP600W-B1 [DGP600W-C1]	
	90	VFPS1-2900P	PFL-2600S		EMF3-4600J		
400V class	0.75	VFPS1-4007PL	PFL-4012S	DCL-2007 Note 3)	Built-in	PBR-2007	MSF-4015Z
	1.5	VFPS1-4015PL					
	2.2	VFPS1-4022PL		DCL-2022 Note 3)			MSF-4037Z
	3.7	VFPS1-4037PL				PBR-4037	
	5.5	VFPS1-4055PL		DCL-4110		PBR3-4055	MSF-4075Z
	7.5	VFPS1-4075PL	PFL-4025S			PBR3-4075	
	11	VFPS1-4110PL				PBR3-4110	MSF-4150Z
	15	VFPS1-4150PL	PFL-4050S	DCL-4220		PBR3-4150	
	18.5	VFPS1-4185PL		Built-in			MSF-4220Z
	22	VFPS1-4220PL				PBR3-4220	
	30	VFPS1-4300PL	PFL-4100S				MSF-4370Z
	37	VFPS1-4370PL				PBR-417W008	
	45	VFPS1-4450PL					MSF-4550Z
	55	VFPS1-4550PL	PFL-4150S				
	75	VFPS1-4750PL					MSF-4750Z
	90	VFPS1-4900PC	PFL-4300S	Attached as standard		DGP600W-B2 [DGP600W-C2]	MSL-4215T
	110	VFPS1-4110KPC					
	132	VFPS1-4132KPC	PFL-4400S				MSL-4314T
	160	VFPS1-4160KPC					
	220	VFPS1-4220KPC	PFL-4600S			DGP600W-B3 [DGP600W-C3]	MSL-4481T
	250	VFPS1-4250KPC	PFL-4800S			PB7-4200K Note 2) DGP600W-B4 [DGP600W-C4]	MSL-4759T
	280	VFPS1-4280KPC					
	315	VFPS1-4315KPC					
	400	VFPS1-4400KPC				PB7-4400K Note 2) DGP600W-B3 ×2 (parallel) [DGP600W-C3 ×2 (parallel)]	
	500	VFPS1-4500KPC	PFL-4450S ×2 (parallel)			PB7-4400K Note 2) DGP600W-B4 ×2 (parallel) [DGP600W-C4 ×2 (parallel)]	MSL-41188T
	630	VFPS1-4630KPC	PFL-4613S ×2 (parallel)				

Note 1) Model in square brackets is fitted with top cover.
Note 2) To use a 400V/250kW inverter or larger in combination with an external braking resistor (DGP600 series), a braking unit (PB7) is also needed.
Note 3) These reactors are usable for each of 200V class and 400V class.
Note 4) Be sure to connect DC reactor to 200V-55kW or more and 400V-90kW or more inverter. (Not necessary for DC power input.)

Input AC reactor

External dimensions diagram

Fig.A

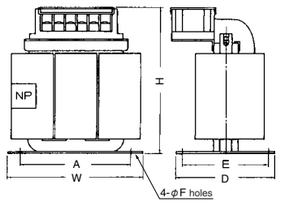


Fig.B

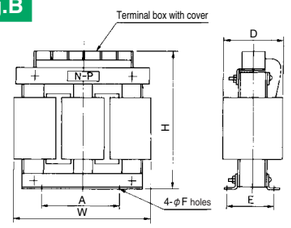


Fig.C

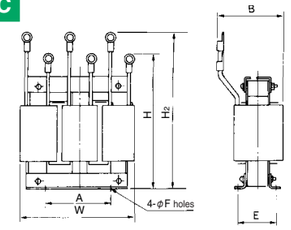


Fig.D

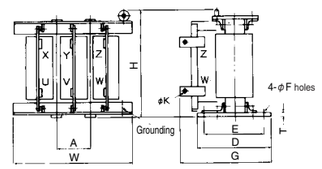


Fig.E

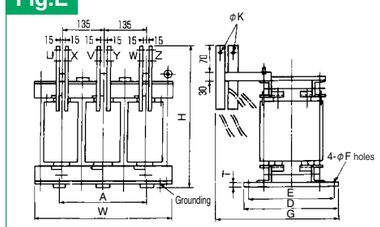
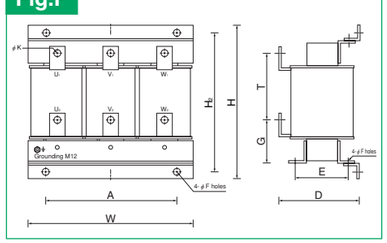
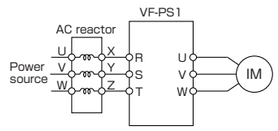
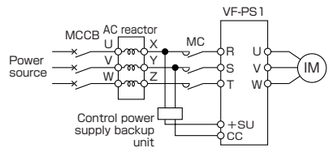


Fig.F

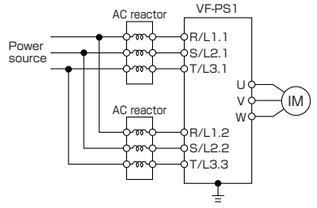


Connection diagram





In case of using control power supply backup unit (option)



For 400V class 500 to 630kW, be sure to connect the AC reactor in parallel.

Model	Rating	Inverter type	Dimensions (mm)										External dimension diagram	Terminals	Approx. weight (kg)
			W	H	D	H2	A	E	F	G	T	K			
PFL-2005S	3φ-230V-5.5A-50/60Hz	VFPS1-2004PL、2007PL	105	115	72.5	—	90	55	5	—	—	—	A	Terminal block M3.5	1.2
PFL-2011S	3φ-230V-11A-50/60Hz	VFPS1-2015PL、2022PL	130	140	85	—	115	60	5	—	—	—		Terminal block M4	2.3
PFL-2018S	3φ-230V-18A-50/60Hz	VFPS1-2037PL	130	140	85	—	115	60	5	—	—	—			2.5
PFL-2025S	3φ-230V-25A-50/60Hz	VFPS1-2055PL	125	130	100	—	50	83	7	—	—	—	B		2.6
PFL-2050S	3φ-230V-50A-50/60Hz	VFPS1-2075PL~VFPS1-2110PM	155	140	115	—	50	95	7	—	—	—		Terminal block M6	3.4
PFL-2100S	3φ-230V-100A-50/60Hz	VFPS1-2150PM、2185PM、2220PM	230	210	150	—	60	90	8	—	—	—		Terminal block M8	8.2
PFL-2150S	3φ-230V-150A-50/60Hz	VFPS1-2300PM、2370PM	175	220	160	290	60	110	8	—	—	—	C	Ring terminal 60-10	11.3
PFL-2200S	3φ-230V-200A-50/60Hz	VFPS1-2450PM	195	240	170	320	65	115	10	—	—	—		Ring terminal 80-10	15.1
PFL-2300S	3φ-230V-300A-50/60Hz	VFPS1-2550P	235	280	200	370	75	128	10	—	—	—		Ring terminal 150-10	23.1
PFL-2400S	3φ-230V-400A-50/60Hz	VFPS1-2750P	260	330	230	—	90	200	12	300	9	13	D	φ13	30
PFL-2600S	3φ-230V-600A-50/60Hz	VFPS1-2900P	440	465	290	—	280	250	15	445	12	18	E	φ18	50
PFL-4012S	3φ-460V-12.5A-50/60Hz	VFPS1-4007PL~VFPS1-4037PL	125	130	95	—	50	79	7	—	—	—		Terminal block M4	2.3
PFL-4025S	3φ-460V-25A-50/60Hz	VFPS1-4055PL~VFPS1-4110PL	155	155	110	—	50	94	7	—	—	—			4.9
PFL-4050S	3φ-460V-50A-50/60Hz	VFPS1-4150PL、4185PL、4220PL	155	165	140	—	50	112	7	—	—	—	B	Terminal block M6	6.6
PFL-4100S	3φ-460V-100A-50/60Hz	VFPS1-4300PL、4370PL、4450PL	235	250	170	—	75	105	10	—	—	—		Terminal block M8	17.6
PFL-4150S	3φ-460V-150A-50/60Hz	VFPS1-4550PL、4750PL	235	280	190	360	75	115	10	—	—	—	C	Ring Terminal 80-10	20.3
PFL-4300S	3φ-460V-300A-50/60Hz	VFPS1-4900KPC、4110KPC	260	380	230	—	90	200	12	280	9	13	D	φ13	38
PFL-4400S	3φ-460V-400A-50/60Hz	VFPS1-4132KPC、4160KPC	260	380	230	—	90	200	12	300	9	13		φ13	42
PFL-4600S	3φ-460V-600A-50/60Hz	VFPS1-4220KPC	440	465	290	—	280	250	15	445	12	18	E	φ18	75
PFL-4800S	3φ-460V-800A-50/60Hz	VFPS1-4250KPC~VFPS1-4400KPC	440	540	290	—	280	250	15	445	12	18		φ18	90
PFL-4450S	3φ-480V-450A-50/60Hz	VFPS1-4500KPC Note 1)	320	385	250	340	225	170	11	86	150	13	F	φ13	68
PFL-4613S	3φ-480V-613A-50/60Hz	VFPS1-4630KPC Note 1)	385	440	255	400	300	165	13.5	130	190	13		φ13	84.5

Note 1) Be sure to connect the AC reactor in parallel.

VF-PS1

DC reactor

For 200V class 11 to 45kW and 400V class 18.5 to 75kW, DC reactor is built-in standard. Please use these external options when requiring the further improvement of the power factor and reducing harmonics.

External dimensions diagram

Fig.A

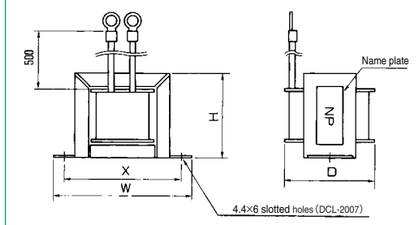


Fig.B

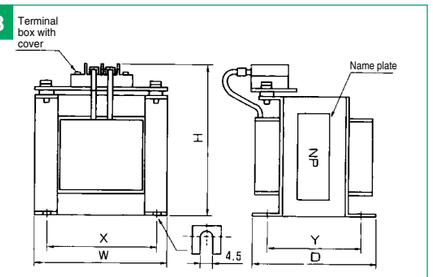


Fig.C

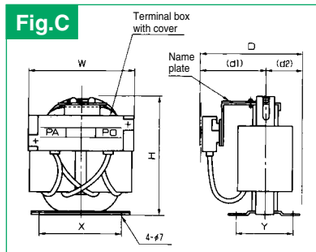
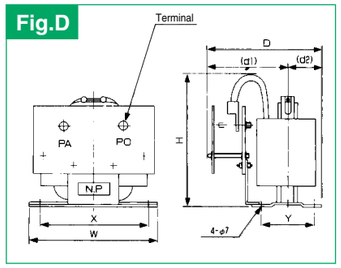
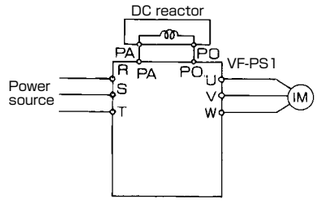


Fig.D



Connection diagram



Model	Rated current	Inverter type	Dimensions (mm)							External dimension diagram	Terminal	Approx. weight (kg)
			W	H	D	X	Y	d1	d2			
DCL-2007 Note 2)	7A	VFPS1-2004PL、2007PL	92	65	70	82	—	—	—	A	Ring terminal V2-3.5	1.2
DCL-2022	14A	VFPS1-2015PL、2022PL	86	110	80	71	64	—	—	B	M4	2.2
DCL-2037	22.5A	VFPS1-2037PL	86	110	85	71	70	—	—			2.5
DCL-2055	38A	VFPS1-2055PL	75	130	140	50	85	85	55	C	M5	1.9
DCL-2110	75A	VFPS1-2075PL~VFPS1-2110PM	100	150	150	65	85	95	55		M6	2.4
DCL-2220	150A	VFPS1-2150PM、2185PM、2220PM	117	170	190	90	90	130	60		M8	4.3
DCL-2370	225A	VFPS1-2300PM、2370PM	150	215	200	130	95	135	65	D	M8	5.9
DCL-2450	300A	VFPS1-2450PM	150	225	230	130	125	150	80		M10	7.8
DCL1-2550	316A	VFPS1-2550P、2750P Note 3)	Refer to external dimension of Inverter.									
DCL1-2750	382A	VFPS1-2900P Note 3)										
DCL-2007 Note 2)	7A	VFPS1-4007PL、4015PL Note 1)	92	65	70	82	—	—	—	A	Ring terminal V2-3.5	1.2
DCL-2022	14A	VFPS1-4022PL、4037PL Note 1)	86	110	80	71	64	—	—	B	M4	2.2
DCL-4110	38A	VFPS1-4055PL、4075PL、4110PL	95	150	165	70	90	105	60	C	M5	3.0
DCL-4220	75A	VFPS1-4150PL、4185PL、4220PL	105	160	185	80	100	120	65		M6	3.7
DCL-4450	150A	VFPS1-4300PL、4370PL、4450PL	150	180	225	120	125	145	80		M8	9.8
DCL-4750	225A	VFPS1-4550PL、4750PL	170	215	230	150	125	150	80	D	M8	11.5
DCL1-4900	243A	VFPS1-4900PC、4110KPC Note 3)	Refer to external dimension of Inverter.									
DCL1-4110K	290A	VFPS1-4132KPC Note 3)										
DCL1-4132K	351A	VFPS1-4160KPC Note 3)										
DCL1-4160K	486A	VFPS1-4220KPC Note 3)										
DCL1-4200K	575A	VFPS1-4250KPC Note 3)										
DCL1-4280K	702A	VFPS1-4280KPC、4315KPC Note 3)										

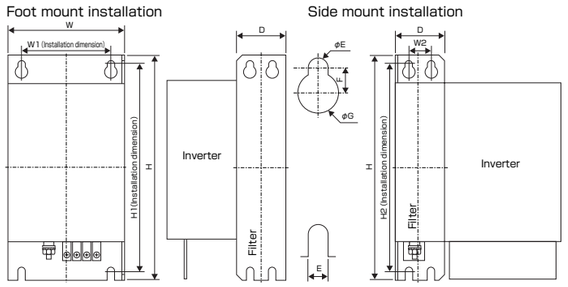
Note 1) These reactors are usable for each of 200V class and 400V class.
Note 2) Please modify the terminal according to size of inverter main terminal.
Note 3) Be sure to connect DC reactor to 200V-55kW or more and 400V-90kW or more inverter.

EMC Directive compliant noise reduction filter

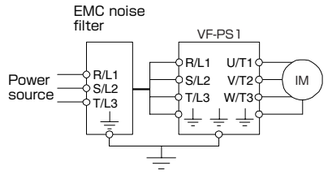
For 200V class 0.4 to 7.5kW and 400V class 0.75 to 630kW, EMC noise filter is built-in standard. Please use these external options depended on the length of the cable between inverter and motor.

Inverter type	Requirements		Conducted noise IEC61800-3 category C2 (EN55011 classA Group1)	Conducted noise IEC61800-3 category C3 (EN55011 classA Group2)
	PWM carrier frequency (kHz)	Length of motor connecting cable(m)		
VFPS1-2004PL-2022PL	4	10	Built-in filter	—
VFPS1-4007PL-4037PL	16	5		
VFPS1-2037PL-2075PL	4	10	—	Built-in filter
VFPS1-4055PL-4150PL	16	5		
VFPS1-4185PL-4750PL	2.5	25		
	16	25		
VFPS1-4900PC-4630KPC	2.5	50		

(1) Foot mount type EMC noise filter



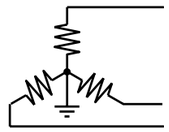
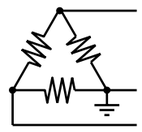
Connection diagram



EMC noise filter can be foot mounted and side mounted.

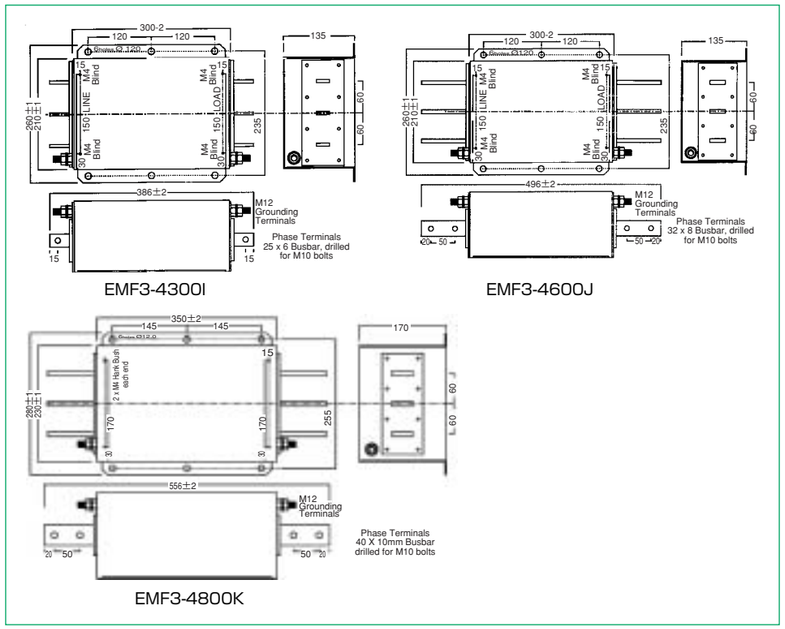
Model	Rated current (A)	Inverter type	Dimensions (mm)										Approx. leakage current (mA) Note 1)		Approx. weight (kg)
			W	H	D	W1	H1	W2	H2	E	F	G	Power source A	Power source B	
EMF3-4012A	12	VFPS1-2004PL～2015PL	130	290	39	105	275	—	275	4.5	11	10	5	35	2.5
		VFPS1-4007PL～4022PL											9	70	
EMF3-4026B	26	VFPS1-2022PL～2037PL	155	324	49	130	309	—	309	4.5	11	10	6	42	3.5
		VFPS1-4037PL											11	83	
EMF3-4035C	35	VFPS1-2055PL	175	370	59	150	355	—	355	5.5	11	11	4	25	5.0
		VFPS1-4055PL, 4075PL											6	44	
EMF3-4046D	46	VFPS1-2075PL	210	380	59	190	365	—	365	5.5	11	11	12	91	6.0
		VFPS1-4110PL											24	183	
EMF3-4072E	72	VFPS1-2110PM,2150PM	230	498.5	62	190	460	—	479.5	6.6	11	12	25	195	11
		VFPS1-4150PL, 4185PL											52	390	
EMF3-4090F	90	VFPS1-2185PM,2220PM	240	521.5	79	200	502.5	40	502.5	6.6	11	12	36	268	15
		VFPS1-4220PL											70	535	
EMF3-4092G	92	VFPS1-4300PL,4370PL	240	650	79	200	631	40	631	6.6	11	12	70	535	16
EMF3-4180H	180	VFPS1-2300PM～2450PM	320	750	119	280	725	80	725	9	18	18	70	537	40
		VFPS1-4450PL～4750PL											142	1075	

Note 1) These values are referential ones of single piece of EMC noise filter. For 200V class, 200V-60Hz power source. For 400V class, 400V-60Hz power source.

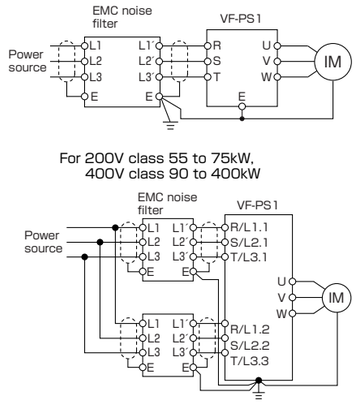
Power source A	Power source B
	

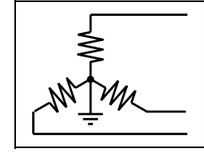
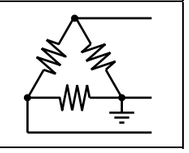
(2) EMC noise filter

External dimensions diagram



Connection diagram



Power source A	Power source B
	

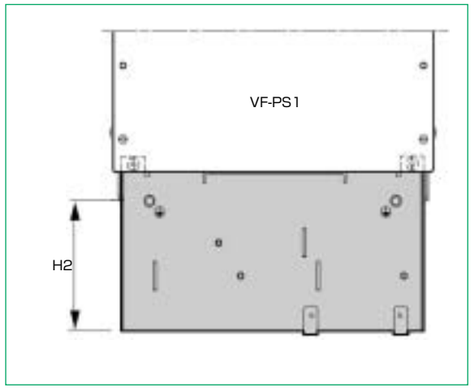
Model	Rated current (A)	Inverter type	Terminal		Approx. weight (kg)	Approx. leakage current(mA) Note 2)	
			Main circuit	Grounding		Power source A	Power source B
EMF3-4300I	300	VFPS1-2550P, 2750P	Busbar 25＊6 M10	M12	13.2	3	180
		VFPS1-4900PC～4132KPC				5	350
EMF3-4600J	580	VFPS1-2900P, 4160KPC～4280KPC, 4315KPC 4500KPC Note 1), 4630KPC Note 1)	Busbar 32＊8 M10	M12	15	5	350
EMF3-4800K	740	VFPS1-4400KPC	Busbar 40＊10 M10	M12	25	5	350

Note 1) Be sure to connect the EMC noise filter in parallel.
Note 2) These values are referential ones of single piece of EMC noise filter. For 200V class, 200V-60Hz power source. For 400V class, 400V-60Hz power source.

EMC plate

EMC plate is attached in standard for 400V class of WP type up to 18.5kW.

External dimensions



Model	Inverter type	Dimension (mm)
		H2
EMP101Z	VFPS1-2004～2015PL VFPS1-4007～4022PL	55
EMP102Z	VFPS1-2022～2037PL VFPS1-4037PL	
EMP103Z	VFPS1-2055PL, 2075PL VFPS1-4055～4110PL	65
EMP104Z	VFPS1-2110,2150PM VFPS1-4150, 4185PL	
EMP105Z	VFPS1-2185,2220PM VFPS1-4220PL	120
EMP106Z	VFPS1-4300,4370PL	
EMP107Z	VFPS1-2300～2450PM	
EMP108Z	VFPS1-4450～4750PL	

The wire clamps and screws are attached to the EMC plate for fixing the shielded cables on the EMC plate.

Braking resistor

External dimensions diagram, connection diagram

Fig.A

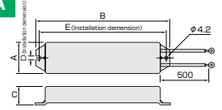


Fig.B

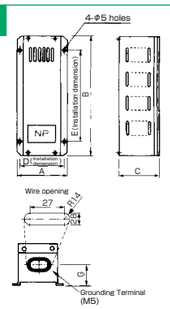


Fig.C

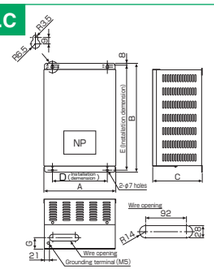


Fig.D

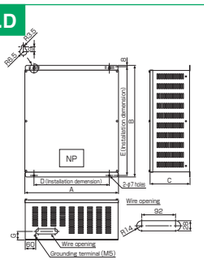


Fig.E

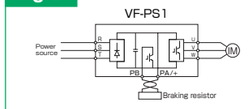
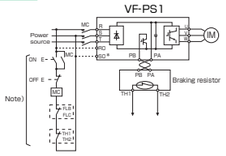


Fig.F



Note) In case of 400V class, please apply the 200V to the operation circuit by using control transformer or 200V power supply.

Braking resistor (PBR)

Voltage class	Type	Model Note 1)	Rating Note 2), 3)	Dimensions (mm) A	B	C	D	E	G	External dimension diagram	Connection diagram	Approx. weight (Kg)
200V	Standard	PBR-2007	120W-200Ω	42	182	20	4.2	172	—	A	E	0.28
		PBR-2022	120W-75Ω									
		PBR-2037	120W-40Ω									
		PBR3-2055	20Ω-240W (40Ω-120W×2P)	120	320	115	110	230	50	B	F	4
		PBR3-2075	15Ω-440W (30Ω-220W×2P)		350	190			150			4.5
		PBR3-2110	10Ω-660W (30Ω-220W×3P)									5
		PBR3-2150	7.5Ω-880W (30Ω-220W×4P)									5.5
		PBR3-2220	3.3Ω-1760W (27Ω-220W×8P)	248	430	200	190	414	47	C		13
		PBR-222W002	2Ω-2200W(20Ω-220W×10P)	297	445	200	220	429	47			13
	200W class	PBR-202W □□□	40Ω、75Ω-240W	120	320	115	110	230	50	B		3
	500W class	PBR-208W □□□	15Ω、20Ω、40Ω、75Ω-880W		350	190			150			6
	1.5kW class	PBR-217W □□□	15Ω、20Ω、40Ω、75Ω-1760W	248	430	200	190	414	47	C		13
	2.5kW class	PBR-226W □□□	2Ω、3.3Ω、7.5Ω、10Ω、15Ω、20Ω、40Ω-2640W	297	445	200	220	429	47			14
	3.5kW class	PBR-235W □□□	3.3Ω、7.5Ω、15Ω、20Ω-3520W	397	445	200	320	429	47	D		19
	5kW class	PBR-252W □□□	2Ω、3.3Ω、7.5Ω、15Ω-5280W	520	616	220	420	600	47			36
400V	Standard	PBR-2007	120W-120Ω	42	182	20	4.2	172	—	A	E	0.28
		PBR-4037	120W-160Ω									
		PBR3-4055	80Ω-240W (160Ω-120W×2P)	120	320	115	110	230	50	B	F	4
		PBR3-4075	60Ω-440W (120Ω-220W×2P)		350	190			150			4.5
		PBR3-4110	40Ω-660W (120Ω-220W×3P)									5
		PBR3-4150	30Ω-880W (120Ω-220W×4P)									5.5
		PBR3-4220	15Ω-1760W (30Ω-220W×4P2S)	248	430	200	190	414	47	C		13
		PBR-417W008	8Ω-1760W (16Ω-220W×4P2S)									13
	200W class	PBR-402W □□□	160Ω-240W	120	320	115	110	230	50	B		3
	500W class	PBR-408W □□□	40Ω、60Ω、80Ω、160Ω-880W		350	190			150			6
	1.5kW class	PBR-417W □□□	30Ω、40Ω、60Ω、80Ω-1760W	248	430	200	190	414	47	C		13
	2.5kW class	PBR-426W □□□	8Ω、15Ω、30Ω、40Ω-2640W	297	445	200	220	429	47			14
	3.5kW class	PBR-435W □□□	15Ω、30Ω、40Ω-3520W	397	445	200	320	429	47	D		19
	5kW class	PBR-452W □□□	8Ω、15Ω、30Ω、40Ω-5280W	520	616	220	420	600	47			36

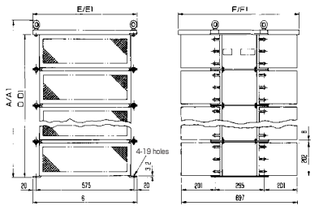
Note 1) □□□ in the type-form are numeric character. Please refer the "Selection of braking resistor" in the next page.
Note 2) The rating shows the synthetic resistor value (Ohm) and the synthetic resistor power (Wait). The word in the parentheses shows the composition of resistor elements.
Note 3) The allowable continuous regenerative power differs on the resistor value or power tolerance. Please refer the "Selection of braking resistor" in the next page.

Braking resistor (DGP600)

Model Standard	Model With cover Note 1)	Rating	Dimensions (mm) note 2) A/A1	D/D1	E/E1	F/F1	External dimension diagram	Connection diagram	Thermal relay(Th-Ry) Setting value(A)	Approx. weight (kg)
DGP600W-B1	DGP600W-C1	1.7Ω-3.4kW	283/303	207/192	620/700	725/780	G	H	46	50
DGP600W-B2	DGP600W-C2	3.7Ω-7.4kW	493/513	417/402	620/700	725/780			44	100
DGP600W-B3	DGP600W-C3	1.9Ω-8.7kW	703/723	627/612	620/700	725/780			71	150
		2.5Ω-10.5kW							65	150
		5Ω-10kW							45	150
DGP600W-B4	DGP600W-C4	1.4Ω-14kW	913/933	837/822	620/700	725/780			110	200
		1.7Ω-10kW							77	200

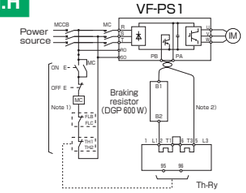
Note 1) The braking resistors are designed for indoor type. Please use them with drip cover in case of water drop. But please note it is not for water proof protection type.
Note 2) A,D,E,F are the dimensions of standard type. A1,D1,E1,F1 are the dimensions of those with drip cover type.

Fig.G



Note 1) In case of 400V class, please apply the 200V to the operation circuit by using control transformer or 200V power supply.
Note 2) Please twist the wire by 10 cm pitch. The distance between resistor power wiring and the control wiring should be over 20 cm.
Note 3) In case of TOSHIBA thermal relay, please make a short circuit with 8 mm2 wire between the 2/T1 and 6/T3 of the thermal relay.

Fig.H



For 250kW or more inverter, in requires the braking unit.

Selection of braking resistor

This is used for the quick deceleration, the frequent deceleration stop or shortening the deceleration time at the large inertia load. This resistor consumes the regenerative energy when regenerative braking operation.
In case of over 3% ED, please select the allowable continuous regenerative power (Watt) in the following table.
1) The continuous regenerative load likes an elevator
2) Deceleration stops at large inertia machine
3) Frequent deceleration stop by using braking resistors

Voltage class	Applicable motor (kW)	Inverter type Note 1)	Model: Standard type PBR Note 3)	Standard type DGP600 Note 4): Standard	Standard type DGP600 Note 4): With cover Note 5)	High frequency type Note 2) PBR: 500W class	1.5kW class	2.5kW class	3.5kW class	5kW class	DGP600: 10kW class(Note 4)
200V	0.4	VFPS1-2004PL	PBR-2007 (200Ω-90W)	–	–	PBR-208W075 (75Ω-540W)	–	–	–	–	–
	0.75	VFPS1-2007PL		–	–		PBR-217W075 (75Ω-1200W)	–	–	–	–
	1.5	VFPS1-2015PL	PBR-2022 (75Ω-90W)	–	–	PBR-208W040 (40Ω-570W)	PBR-217W040 (40Ω-1160W)	PBR-226W040 (40Ω-1630W)	–	–	–
	2.2	VFPS1-2022PL		–	–				–	–	–
	3.7	VFPS1-2037PL	PBR-2037 (40Ω-90W)	–	–				–	–	–
	5.5	VFPS1-2055PL	PBR3-2055 (20Ω-96W)	–	–	PBR-208W020 (20Ω-270W)	PBR-217W020 (20Ω-950W)	PBR-226W020 (20Ω-1580W)	PBR-235W020 (20Ω-2330W)	–	–
	7.5	VFPS1-2075PL	PBR3-2075 (15Ω-130W)	–	–	–	PBR-217W015 (15Ω-840W)	PBR-226W015 (15Ω-1350W)	PBR-235W015 (15Ω-2080W)	PBR-252W015 (15Ω-3330W)	–
	11	VFPS1-2110PM	PBR3-2110 (10Ω-200W)	–	–	–	PBR-217W010 (10Ω-470W)	PBR-226W010 (10Ω-1250W)	PBR-235W010 (10Ω-1960W)	PBR-252W010 (10Ω-3200W)	–
	15	VFPS1-2150PM	PBR3-2150 (7.5Ω-270W)	–	–	–	–	PBR-226W7R5 (7.5Ω-870W)	PBR-235W7R5 (7.5Ω-1380W)	PBR-252W7R5 (7.5Ω-3210W)	–
	18.5	VFPS1-2185PM		–	–	–	–				–
	22	VFPS1-2220PM	PBR3-2220 (3.3Ω-610W)	–	–	–	–	–	–	PBR-252W3R3 (3.3Ω-1760W)	–
	30	VFPS1-2300PM		–	–	–	–	–	–		–
	37	VFPS1-2370PM	PBR-222W002 (2Ω-1000W)	–	–	–	–	–	–	PBR-226W7R5 ×3 (parallel) (2.5Ω-2610W)	DGP600W-B4/C4 (1.7Ω-10kW)
	45	VFPS1-2450PM		–	–	–	–	–	–		
	55	VFPS1-2550P		–	–	–	–	–	–		
	75	VFPS1-2750P	–	DGP600W-B1 (1.7Ω-3.4kW)	DGP600W-C1 (1.7Ω-3.4kW)	–	–	–	–	–	
	90	VFPS1-2900P	–			–	–	–	–	–	
400V	0.75	VFPS1-4007PL	PBR-2007 (200Ω-90W)	–	–	PBR-408W160 (160Ω-570W)	–	–	–	–	–
	1.5	VFPS1-4015PL		–	–		–	–	–	–	–
	2.2	VFPS1-4022PL		–	–	PBR-408W080 (80Ω-270W)	PBR-417W080 (80Ω-1090W)	–	–	–	–
	3.7	VFPS1-4037PL	PBR-4037 (160Ω-90W)	–	–			PBR-426W040 (40Ω-1250W)	PBR-435W040 (40Ω-1900W)	PBR-452W040 (40Ω-2250W)	–
	5.5	VFPS1-4055PL	PBR3-4055 (80Ω-96W)	–	–		PBR-417W060 (60Ω-1000W)				–
	7.5	VFPS1-4075PL	PBR3-4075 (60Ω-130W)	–	–	–					–
	11	VFPS1-4110PL	PBR3-4110 (40Ω-190W)	–	–	–	PBR-417W040 (40Ω-490W)				–
	15	VFPS1-4150PL	PBR3-4150 (30Ω-270W)	–	–	–	–	PBR-426W030 (30Ω-870W)	PBR-435W030 (30Ω-1680W)	PBR-452W030 (30Ω-2700W)	–
	18.5	VFPS1-4185PL		–	–	–	–				–
	22	VFPS1-4220PL	PBR3-4220 (15Ω-540W)	–	–	–	–	–	–	PBR-452W015 (15Ω-1740W)	–
	30	VFPS1-4300PL		–	–	–	–	–	–		–
	37	VFPS1-4370PL	PBR-417W008 (8Ω-1000W)	–	–	–	–	–	–	PBR-426W030 ×3 (parallel) (10Ω-2610W)	–
	45	VFPS1-4450PL		–	–	–	–	–	–		
	55	VFPS1-4550PL		–	–	–	–	–	–		DGP600W-B3/C3 (5Ω-10kW)
	75	VFPS1-4750PL		–	–	–	–	–	–		
	90	VFPS1-4900PC	–	DGP600W-B2 (3.7Ω-7.4kW)	DGP600W-C2 (3.7Ω-7.4kW)	–	–	–	–	–	DGP600W-B3/C3 (2.5Ω-10.5kW)
	110	VFPS1-4110KPC	–			–	–	–	–	–	
	132	VFPS1-4132KPC	–			–	–	–	–	–	
	160	VFPS1-4160KPC	–			–	–	–	–	–	
	220	VFPS1-4220KPC	–	DGP600W-B3 (1.9Ω-8.7kW)	DGP600W-C3 (1.9Ω-8.7kW)	–	–	–	–	–	–
	250	VFPS1-4250KPC	–	PB7-4200K DGP600W-B4 (1.4Ω-14kW)	PB7-4200K DGP600W-C4 (1.4Ω-14kW)	–	–	–	–	–	–
	280	VFPS1-4280KPC	–			–	–	–	–	–	–
	315	VFPS1-4315KPC	–			–	–	–	–	–	–
	400	VFPS1-4400KPC	–	PB7-4400K DGP600W-B3 ×2 (parallel)	PB7-4400K DGP600W-C3 ×2 (parallel)	–	–	–	–	–	–
	500	VFPS1-4500KPC	–	PB7-4400K DGP600W-B4 ×2 (parallel)	PB7-4400K DGP600W-C4 ×2 (parallel)	–	–	–	–	–	–
	630	VFPS1-4630KPC	–			–	–	–	–	–	–

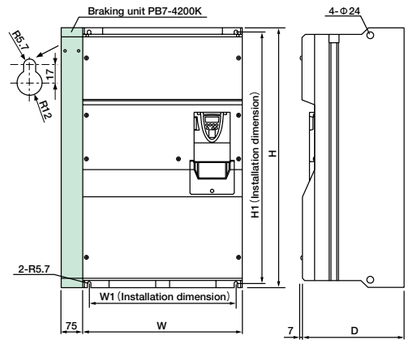
Note 1) For 250kW or more inverter, it requires the braking unit.
Note 2) The figures in the parentheses show the synthetic resistor value (Ohm) and the allowable continuous regenerative power (Wait).
Note 3) The guideline of the maximum braking at the standard type.
Note 4) The necessary power in case of deceleration from 60Hz at one time per 120 seconds periods at 30 seconds deceleration time for the 10 times of the motor inertia. please contact our agency when large inertia or quick deceleration.
Note 5) The braking resistors are designed for indoor type. Please use them with drip cover in case of water drop. But please note it is not for water proof protection type.

Applicable motor (kW)	Maximum braking power	Braking time
0.4～1.5	150%	6
2.2	100%	6
3.7～55	100%	3
75	100%	2

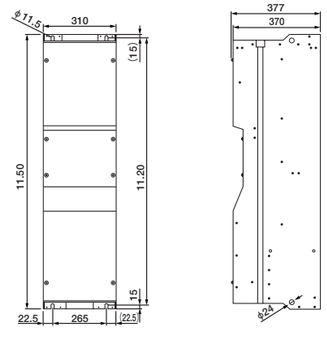
Braking unit

Model	PB7-4200K	PB7-4400K
Threshold voltage	785V ±1%	
Maximum DC voltage	850V	
Maximum braking power at 785VDC	420kW	750kW

External dimensions
PB7-4200K is mechanically mounted on the left-hand side of the inverter.
Approx. weight 30kg



PB7-4400K
Approx. weight 80kg



Motor end surge voltage suppression filter (Only 400V class)

External dimensions diagram

Fig.A

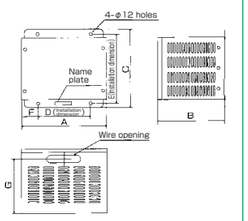


Fig.B

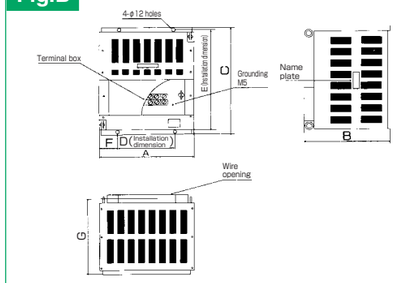
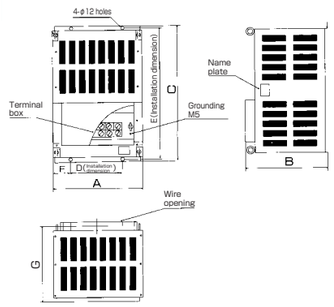
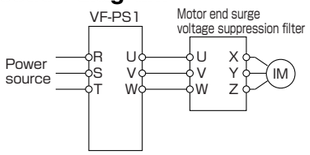


Fig.C



Connection diagram



Countermeasure of motor end surge voltage

At the system of operation of the 400V class motor by the voltage type PWM inverter with using super high-speed switching device(ex.IGBT). the degradation of insulation of motor wiring may be occurred by the length conditions of the cable, laid down of the cable and the constants of the cable.

In this case, the following countermeasures are suggested.

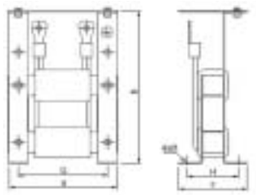
1) Use of the enhanced insulation type of motor

2) Suppress the surge voltage by AC reactors in the load side or surge suppression filter.

Model	Applicable motor (kW)	Dimensions (mm)							External dimension diagram	Terminal screw	Approx. weight (kg)
		A	B	C	D	E	F	G			
MSF-4015Z	0.4、0.75、1.5	310	255	300	200	270	55	189	A	M4	12
MSF-4037Z	2.2、3.7	310	255	300	200	270	55	209		M4	20
MSF-4075Z	5.5、7.5	310	315	350	200	320	55	249		M5	30
MSF-4150Z	11、15	330	350	400	200	370	65	289		M5	40
MSF-4220Z	18.5、22	330	400	400	200	370	65	279		M6	52
MSF-4370Z	30、37	426	375	512	260	490	83	350	B	M8	75
MSF-4550Z	45、55	450	395	632	260	610	95	365	C	M10	110
MSF-4750Z	75	450	415	700	260	678	95	385		M10	120

Fig.D

External dimension diagram



Installation

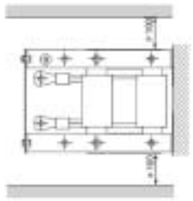
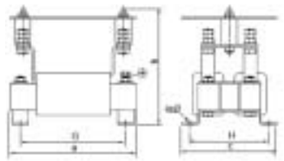


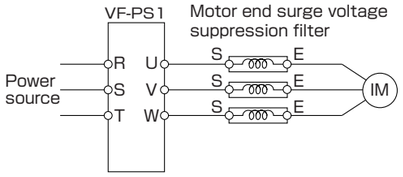
Fig.E

External dimension diagram



Installation

Connection diagram

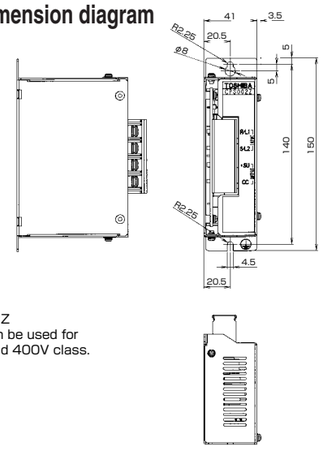


Model	Inverter type	Dimensions (mm)						External dimension diagram	Terminals	Approx. weight (kg) Note)
		a	b	c	G	H	φ			
MSL-4215T	VFPS1-4900C,4110KPC	170	235	100	140	75	R4.5-20	D	Ring Terminal 10-10	17
MSL-4314T	VFPS1-4132KPC,4160KPC	210	250	110	170	75	R4.5-13	D	Ring Terminal 10-10	30
MSL-4481T	VFPS1-4220KPC,4250KPC	245	250	200	225	175	9	E	M10	44
MSL-4759T	VFPS1-4280KPC,4315KPC, 4400KPC	305	250	220	265	200	9	E	M12	65
MSL-4118ST	VFPS1-4500KPC,4630KPC	364	250	230	325	200	9	E	M12	99

Note) The filter is used for each phase, so 3 filter for one inverter. The type-form of this filter is 3 pieces set. The approx. weight in the above table shows the total weight of 3 pieces.

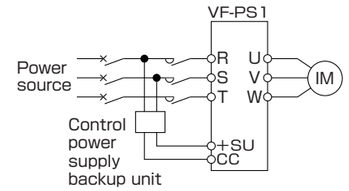
Control power supply backup unit

External dimension diagram

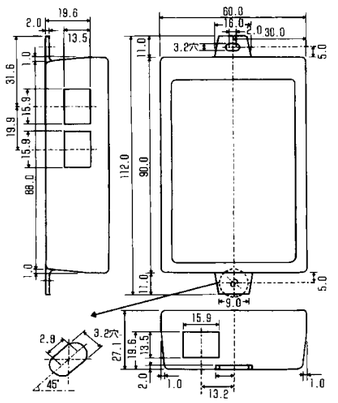


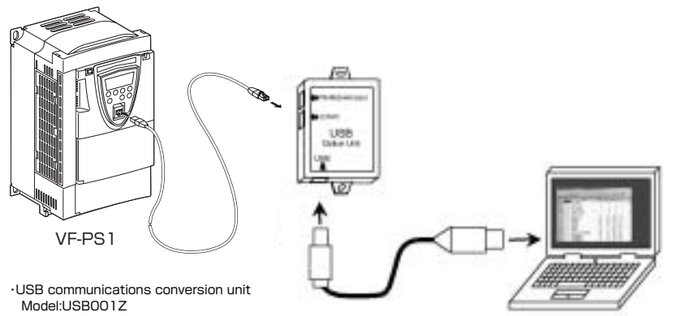
Model:CPS002Z
∗CPS002Z can be used for both 200V and 400V class.

Connection diagram



USB communications conversion unit

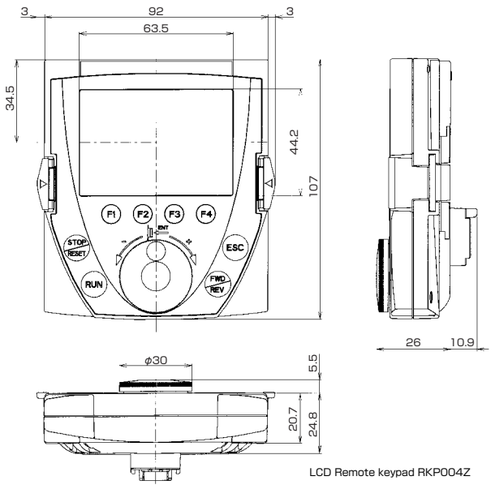




・USB communications conversion unit
Model:USB001Z
・Inverter unit connection cable
Model:CAB0011(1m)
CAB0013(3m)
CAB0015(5m)
・USB cable(A-B connection type)
Use a commercially available USB cable.
(Compliant with USB1.1/2.0)

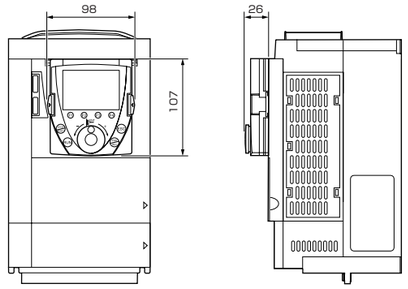
LCD Remote Keypad

External dimension diagram

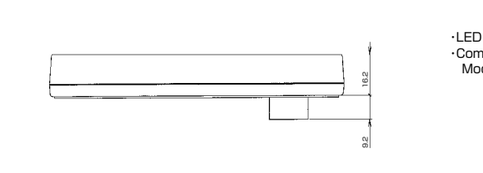


LCD Remote keypad RKP004Z

Installation on the unit



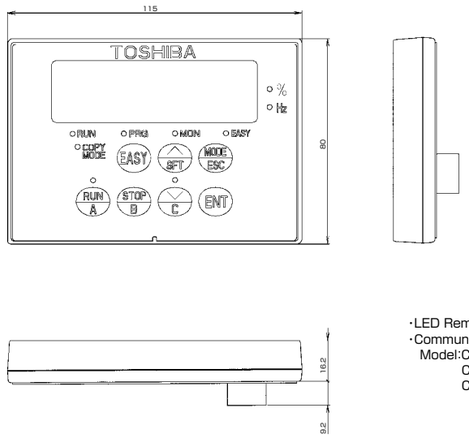
Installation on the panel



Palm top operation

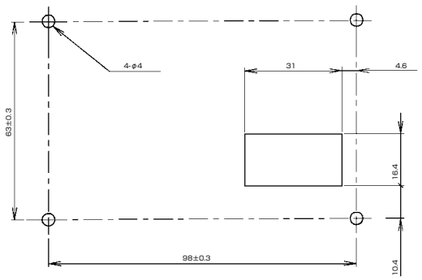
LED Remote Keypad

External dimension diagram



・LED Remote Keypad:RKP002Z
・Communication cable (option)
Model:CAB0011 (1m)
CAB0013 (3m)
CAB0015 (5m)

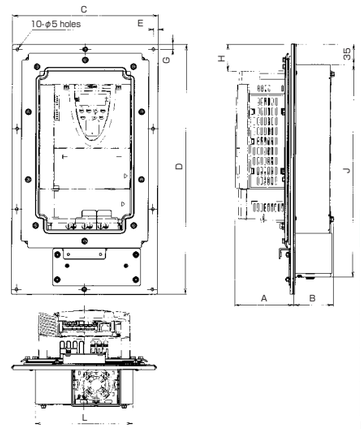
Panel cutout dimension



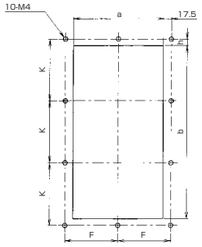
Heatsink outer option

This options enable the heatsink parts of the backside of inverter that generate much heat to be located at the outside of the panel. This is effective for the small sizing of the totally-enclosed box by reducing the heat values inside the box.

Fig.A



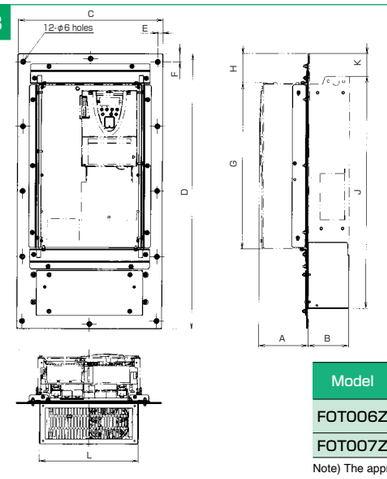
Panel cutout dimension



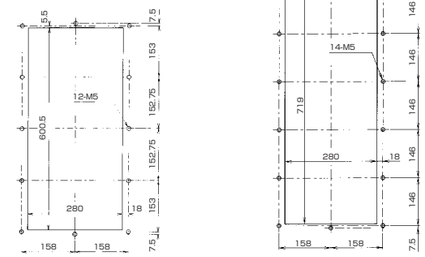
Model	Inverter type	Dimensions (mm)													Approx. weight (kg) Note)
		a	b	h	A	B	C	D	E	F	G	H	J	K	L	
FOT001Z	VFPS1-2004PL,2007PL,2015PL VFPS1-4007PL,4015PL,4022PL	170	351	15	103	54	222	397	8.5	102.5	8	47	327.5	127	138.6	2.3
FOT002Z	VFPS1-2022PL,2037PL VFPS1-4037PL	198	384.5	14	101	68	250	430	8.5	116.5	8.6	46.5	365.5	137.5	166.6	2.9
FOT003Z	VFPS1-2055PL VFPS1-4055PL,4075PL	215	419	14.5	98	73	268	465	9	125	8.5	46	400.5	149.5	183.6	3.2
FOT004Z	VFPS1-2075PL VFPS1-4110PL	250	438	13	101	95	303	482	9	142.5	8.5	45.7	419	155	220.2	4.1
FOT005Z	VFPS1-2110PM,2150PM VFPS1-4150PL,4185PL	270	537.5	15.5	98	99	325	585	10	152.5	8	45	520.5	189.5	240.2	4.8

Note) The approx. weight shows the heatsink outer option only.

Fig.B



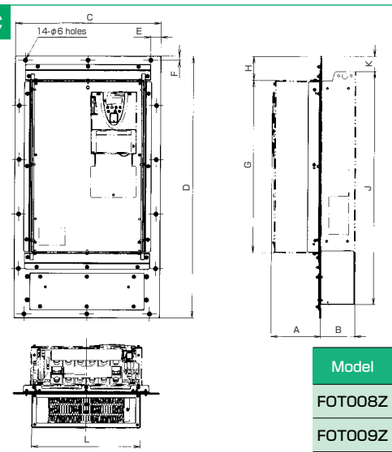
Panel cutout dimension



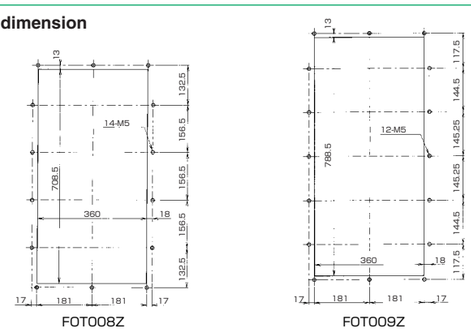
Model	Inverter type	Dimensions (mm)											Approx. weight (kg) Note)
		A	B	C	D	E	F	G	H	J	K	L	
FOT006Z	VFPS1-2185PM,2220PM VFPS1-4220PL	116.7	94.8	340	649	12	19	158	68.7	547.3	53.6	232	4.4
FOT007Z	VFPS1-4300PL,4370PL	144	97.3	340	768	12	19	158	69	677	51	232	5.1

Note) The approx. weight shows the heatsink outer option only.

Fig.C



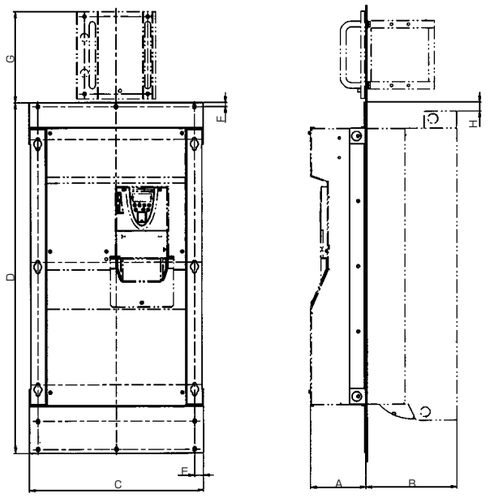
Panel cutout dimension



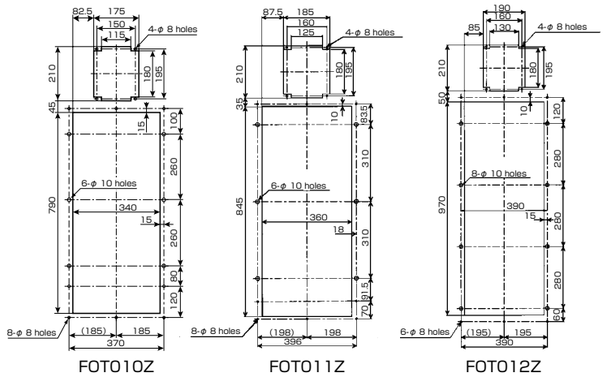
Model	Inverter type	Dimensions (mm)											Approx. weight (kg) Note)
		A	B	C	D	E	F	G	H	J	K	L	
FOT008Z	VFPS1-2300PM,2370PM,2450PM	143.5	97.8	420	757.5	29	11.5	498	69	673.5	44	313.2	5.1
FOT009Z	VFPS1-4450PL,4550PL,4750PL	178	111.8	420	837.5	29	11.5	578	69	753.5	44	313.2	5.4

Note) The approx. weight shows the heatsink outer option only.

Fig.D



Panel cutout dimension

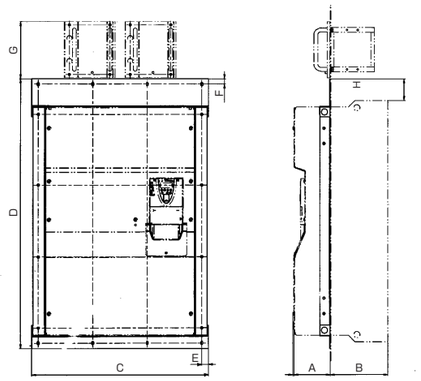


FOT010Z FOT011Z FOT012Z

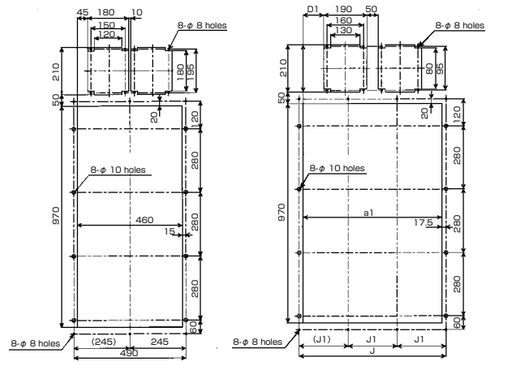
Model	Inverter type	Dimensions (mm)								Approx. weight (kg) Note)
		A	B	C	D	E	F	G	H	
FOT010Z	VFPS1-2550P,2750P VFPS1-4900PC,4110KPC	245	165	420	850	25	15	230	50	5.1
FOT011Z	VFPS1-2900P VFPS1-4132KPC	140	230	440	885	22	10	230	23	3.6
FOT012Z	VFPS1-4160KPC	143	227	442	1061	26	20.5	224.5	85.5	4.3

Note) The approx. weight shows the heatsink outer option only.

Fig.E



Panel cutout dimension



FOT013Z FOT014Z FOT015Z

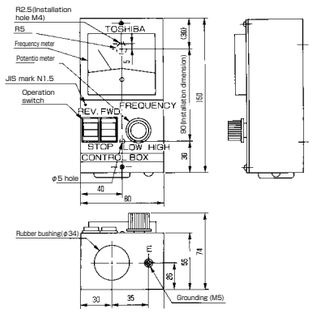
Model	Dimensions (mm)			
	D1	a1	J	J1
FOT014Z	90	610	645	215
FOT015Z	165	685	720	240

Model	Inverter type	Dimensions (mm)								Approx. weight (kg) Note)
		D	B	C	D	E	F	G	H	
FOT013Z	VFPS1-4220KPC	143	227	542	1061	26	20.5	224.5	85.5	4.4
FOT014Z	VFPS1-4250KPC,4280KPC,4315KPC	143	227	697	1061	26	20.5	224.5	85.5	4.7
FOT015Z	VFPS1-4250KPC,4280KPC,4315KPC with using PB7-4200K	143	227	772	1061	26	20.5	224.5	85.5	4.9

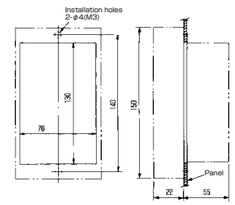
Note) The approx. weight shows the heatsink outer option only.

Operation panel (Model: CBVR-7B1)

External dimension diagram

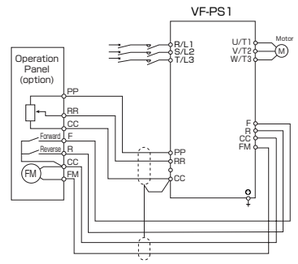


Panel cutout dimension



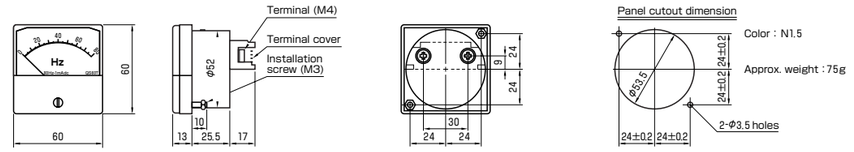
Color : JIS mark 5Y7/1
(Panel front N1.5)
Approx. weight : 0.7kg

Connection diagram



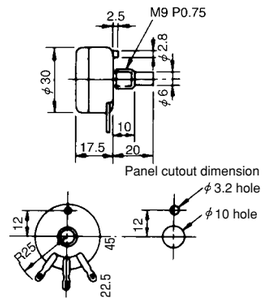
Note) The wire length should be 30m or less the inverter and the operation panel.

Frequency meter〈QS-60T (80Hz-1mAdc)〉

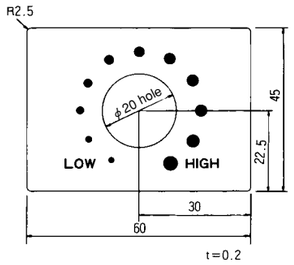


FRH-KIT

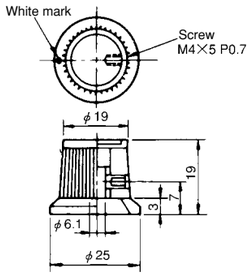
Potentiometer〈RV30YN-20S-B302〉



Potentiometer panel



Potentiometer knob〈K-3〉



Planning

Totally enclosed box type for IP54/UL type 12

Line-up

Voltage class	Applicable Motor Output (kW)															
	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
3-phase 400V class (IP54)																	

point 1 Totally enclosed box type for IP54/UL type 12

- IP54 protection for direct mounting on a wall

point 2 High-frequency noise reduction

- IP54 product with EN 55011 class A or class B (IEC/EN 61800-3) built-in EMC filters

point 3 Harmonics reduction

- New types of compact and space-saving DC reactor is built-in for all models

point 4 LCD keypad as standard

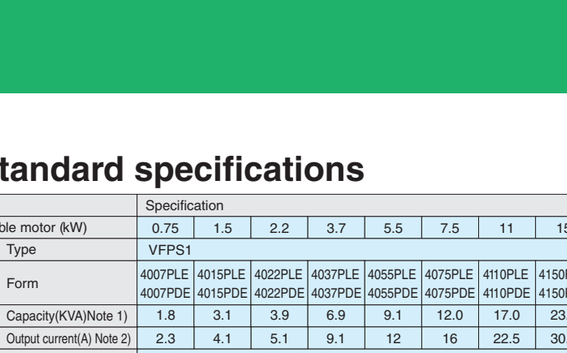
- Possible for palm top operation

Standard specifications

Item		Specification															
Applicable motor (kW)		0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
Model	Type	VFPS1															
	Form	4007PLE 4007PDE	4015PLE 4015PDE	4022PLE 4022PDE	4037PLE 4037PDE	4055PLE 4055PDE	4075PLE 4075PDE	4110PLE 4110PDE	4150PLE 4150PDE	4185PLE 4185PDE	4220PLE 4220PDE	4300PLE 4300PDE	4370PLE 4370PDE	4450PLE 4450PDE	4550PLE 4550PDE	4750PLE 4750PDE	4900PLE 4900PDE
Rating	Capacity(KVA)Note 1)	1.8	3.1	3.9	6.9	9.1	12.0	17.0	23.0	28.0	33.0	45.0	54.0	65.0	78.0	104.0	124.0
	Output current(A) Note 2)	2.3	4.1	5.1	9.1	12	16	22.5	30.5	37	43.5	58.5	71.5	85	103	137	163
Power supply	Voltage/frequency	3-phase 380 to 480V, 50/60 Hz															
	Tolerance	Voltage +10%, -15% (±10% during continuous 100% load) Frequency ±5%															
Rated output voltage		3 phase 380 to 480V : 400V class (The maximum output voltage is same as the input source voltage)															
Output frequency range		0.01 to 500 Hz (Default setting 0.01 to 80.0 Hz)															
Overload current rating		110%-60 seconds (Anti-time limit characteristic)															
Dynamic breaking circuit		Built-in dynamic breaking circuit															
Dynamic breaking resistor		External option															
Main functions		Parameter setup quick mode, Local/remote operation, Automatic energy saving mode, programmable I/O terminal block, multi-PID control, Fire control enables forced operation, My function"															
Ambient temperature /Relative humidity		-10 to 50°C (current decreases when over 40°C)/5 to 95% (no condensation or steam allowed)															
Protective method		IP54/UL type 12															
Cooling method		Forced air cooling															
Built-in filter		EN55011 class A, EN61800-3 category C2 or C3 compliant (built-in EMI noise filter) :PLE type EN55011 class B, EN61800-3 category C1 compliant (built-in EMI noise filter) :PDE type "															
Reactor		Built-in DC reactor															

Note 1) Capacity is calculated at 440V
Note 2) Rated output current when the PWM carrier frequency(parameter CF) is 8kHz or less.

External dimensions



Input voltage Class	Applicable motor (kW)	Inverter model Note 1	Dimensions (mm)							Approximate Weight(kg) Note 1
			W	H	D	W1	H1	H2	ø	
3-phase 400 V	0.75	VFPS1-4007PLE(PDE)	240	490	272	200	476	6	6	12(14)
	1.5	VFPS1-4015PLE(PDE)								
	2.2	VFPS1-4022PLE(PDE)								
	3.7	VFPS1-4037PLE(PDE)	240	490	286	200	476	6	6	13(15)
	5.5	VFPS1-4055PLE(PDE)								
	7.5	VFPS1-4075PLE(PDE)	260	525	286	220	511	6	6	16(19)
	11	VFPS1-4110PLE(PDE)								
	15	VFPS1-4150PLE(PDE)	295	560	315	250	544	8	6	21(25)
	18.5	VFPS1-4185PLE(PDE)	315	665	315	270	647	10	6	31(36)
	22	VFPS1-4220PLE(PDE)								
	30	VFPS1-4300PLE(PDE)	285	720	315	245	700	10	7	34(39)
	37	VFPS1-4370PLE(PDE)	285	880	343	245	860	10	7	43(49)
	45	VFPS1-4450PLE(PDE)								
	55	VFPS1-4550PLE(PDE)	362	1000	364	300	975	10	9	69(80)
	75	VFPS1-4750PLE(PDE)								
	90	VFPS1-4900PLE(PDE)								

Note 1) The values in parentheses refer to PDE type,
VFPS1-****PLE:Built-in class A EMC filter, VFPS1-****PDE:Built-in class B EMC filter

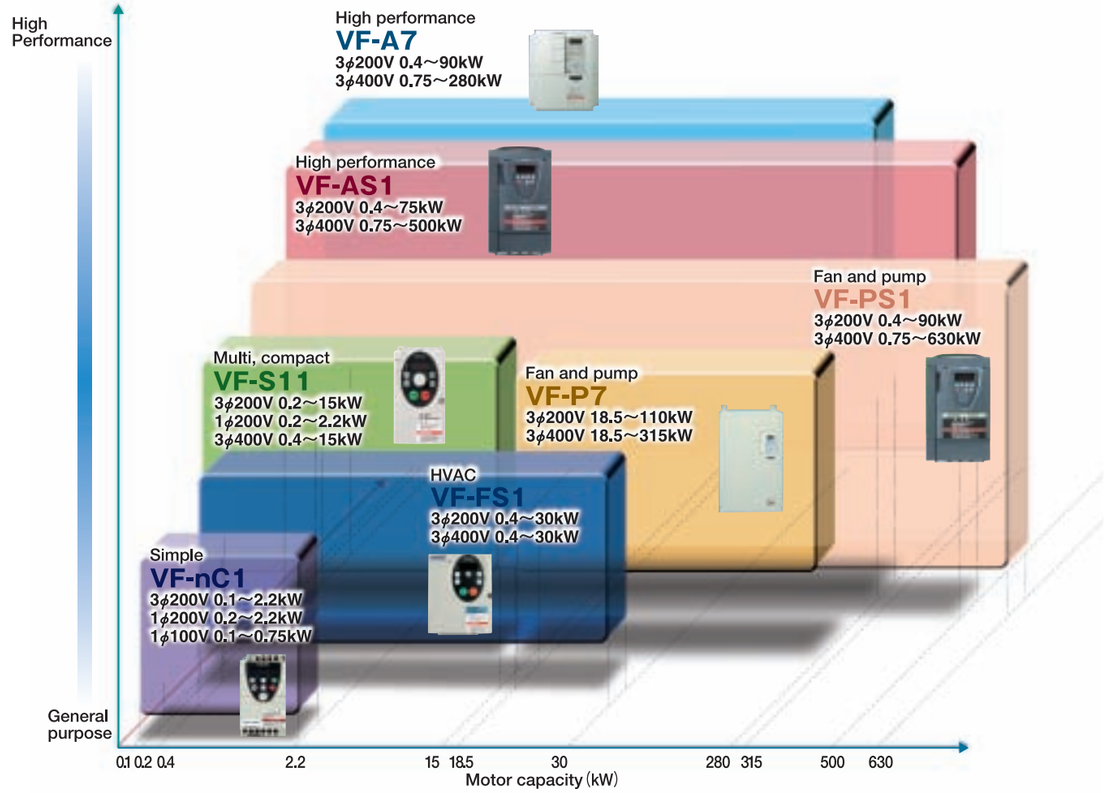
Selection peripheral and wiring sizes devices

Voltage Class	Applicable motor (kW)	Inverter model	Input current[A]	Molded-case circuit breaker (MCCB) Note 1),2) Rated current [A]	Magnetic contactor (MC) Note 1),3),4),5) Operational current(A) AC1	Wire size Note 6),7)					
						Main circuit				Ground lead	
						Input terminal (R, S, T)		Output terminal (U, V, W)			
						AWG	mm^2	AWG	mm2	AWG	mm^2
400 V class	0.75	VFPS1-4007PLE(PDE)	1.	4	25	14	1.5	14	1.5	14	2.5
	1.5	VFPS1-4015PLE(PDE)	3.5	6.3	25	14	1.5	14	1.5	14	2.5
	2.2	VFPS1-4022PLE(PDE)	5	10	25	14	1.5	14	1.5	14	2.5
	3.7	VFPS1-4037PLE(PDE)	8.8	14	25	12	1.5	12	1.5	14	2.5
	5.5	VFPS1-4055PLE(PDE)	11.4	25	25	10	2.5	10	2.5	12	2.5
	7.5	VFPS1-4075PLE(PDE)	15.8	25	25	10	4	10	4	12	4
	11	VFPS1-4110PLE(PDE)	21.9	30	32	8	6	8	6	10	6
	15	VFPS1-4150PLE(PDE)	30.5	40	40	6	10	6	10	10	10
	18.5	VFPS1-4185PLE(PDE)	37.5	60	50	6	10	6	10	10	10
	22	VFPS1-4220PLE(PDE)	43.6	60	50	6	10	6	10	10	8
	30	VFPS1-4300PLE(PDE)	56.7	100	80	4	16	4	16	10	16
	37	VFPS1-4370PLE(PDE)	69.5	100	125	3	25	3	25	8	16
	45	VFPS1-4450PLE(PDE)	85.1	125	125	1	35	1	35	8	16
	55	VFPS1-4550PLE(PDE)	104.8	150	125	1/0	50	1/0	50	6	25
	75	VFPS1-4750PLE(PDE)	140.3	200	250	3/0	70	3/0	70	6	35
	90	VFPS1-4900PLE(PDE)	171.8	200	250	250MCM	120	250MCM	120	2	70

Note 1) Selections for use of the Toshiba 4-pole standard motor with power supply voltage of 400V-50Hz.
Note 2) Choose the MCCB according to the power supply capacity.
For comply with UL and CSA standard, use the fuse certified by UL and CSA.
Note 3) When the motor is driven by commercial power supply switching, for example, use an electromagnetic contactor that is matched to AC-3 class motor rated current.
Note 4) Attach surge killers to the magnetic contactor and exciting coil of the relay.
Note 5) In the case the magnetic contactor (MC) with 2a-type auxiliary contacts is used for the control circuit, raise the reliability of the contact by using 2a-type contacts in parallel connection.
Note 6) The recommended cable size is that of the cable (e.g. 600V class, HIV cable) with continuous maximum permissible temperature of 75°C. Ambient temperature is 40°C or less and the wiring distance is 30m or less.
Note 7) For the control circuit, use shielded wires whose size (cross-section) is 0.75 mm2 or more.
Note 8) The screw size of the control terminals is M3.

TOSHIBA Inverter lineup

The abundant variations of simple variable speed to vector control



Functions of lineup

Model	Voltage class	Applicable motor	Overload current rating	Automatic functions		Control specifications					Functions					
				Automatic acceleration / deceleration	Automatic torque boost	V/F constant	Automatic torque boost control	Energy-saving	Sensorless vector control	PG feedback vector control	Torque limit	Torque control	Positioning	Local/Remote	Fire control enables forced operation	LCD keypad option
VF-nC1	3ø200V	0.1 to 2.2kW	150%-1 minute	No	No	Yes	No	No	Yes	No	No	No	No	No	No	No
	1ø200V	0.2 to 2.2kW														
	1ø100V	0.1 to 0.75kW														
VF-S11	3ø200V	0.2 to 15kW	150%-1 minute	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
	1ø200V	0.2 to 2.2kW														
	3ø400V	0.4 to 15kW														
VF-AS1	3ø200V	0.4 to 75kW	150%-1 minute	Yes	Yes	Yes	Yes	No	Yes	Yes Note 1)	Yes	Yes	No	No	No	Yes Note 1)
	3ø400V	0.75 to 500kW														
VF-A7	3ø200V	0.4 to 90kW	150%-2 minute Note 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes Note 1)	Yes	Yes	Yes Note 1)	No	No	No
	3ø400V	0.75 to 280kW														
VF-FS1	3ø200V	0.4 to 30kW	110%-1 minute	Yes	No	Yes	Yes	Yes	Yes	No	No	No	No	Yes	Yes	No
	3ø400V	0.4 to 30kW														
VF-PS1	3ø200V	0.4 to 90kW	120%-1 minute	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes Note 1)
	3ø400V	0.75 to 630kW														
VF-P7	3ø200V	0.4 to 110kW	120%-1 minute	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
	3ø400V	0.75 to 315kW														

Note 1) Option
Note 2) For 200V-75kW or more and 400V-110kW or more, 150%-1 minute overload current rating

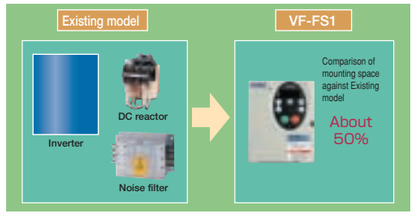
Inverter dedicated to fan and pump for HVAC

VF-FS1

Applications:
- AHUs
- Ventilation fans
- Chillers
- Water pumps

etc.

Compatible with the World's Main Standards
(CE marking, UL, CSA, C-tick)



Totally enclosed box type for IP54

POINT 1 Half installation space and less wiring
Reduce 50% of installation space, Built- in filter

POINT 2 Reactor- less harmonic reduction
Toshiba unique technologies suppress harmonics Power factor improvement

POINT 3 Long life and easy maintenance
15 years lifi designed main capacitors

POINT 4 Special softwares for fan and pump application are built-in
Local/ Remote key, Fire control enables forced operation

POINT 5 More energy saving and easier operation
The advanced energy- saving mode, Quick setting wizard

Optional filed buses for LONWORKS®, BACnet®, Metasys® N2 and APOGEE® FLN as built in option.

■Standard specifications

Item			Specification											
Applicable motor (kW)			0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30
Machine type	Input voltage class	Model	VF-FS1											
	3-phase 200V class	VFFS1-	2004PM	2007PM	2015PM	2022PM	2037PM	2055PM	2075PM	2110PM	2150PM	2185PM	2220PM	2300PM
	3-phase 400V class	VFFS1-	4004PL	4007PL	4015PL	4022PL	4037PL	4055PL	4075PL	4110PL	4150PL	4185PL	4220PL	4300PL
Rating	Capacity (kVA) 200V class/400V class		1.1	1.8/1.6	2.9/2.8	4.0/3.9	6.7/6.9	9.2/9.1	12.2	17.6/17.1	23.2	28.5/28.2	33.5/33.2	44.6
	Output current (A)	3-phase 200V class	2.8	4.6	7.5	10.6	17.5	24.2	32	46.2	61	74.8 (67.3)	88 (79.2)	117.0 (105.3)
		3-phase 400V class	1.4	2.2	3.7	5.1	9.1	12	16	22.5	30.5	37 (33.3)	43.5 (39.2)	58.5 (52.7)
Power supply	Voltage/frequency		200V class: 200V to 240V - 50/60Hz, 400V class: 3-phase 380 to 480V - 50/60Hz											
	Tolerance		Voltage +10%, −15% (±10% when the inverter is used continuously (load of 100%)											
Output voltage adjustment			Adjustable within a range of the corrected supply voltage 50 to 660V (Unadjustable to any voltage higher than the input voltage).											
Output frequency range			0.5 to 200.0Hz (default setting 0.5 to 80.0Hz)											
Voltage/frequency characteristics			V/f constant, variable torque, automatic torque boost, vector control, automatic energy conservation, PM motor control, auto-tuning function											
Overload current rating			60 seconds at 110%, 2 seconds at 180% (Anti-time limit characteristic)											
Main functions			Wizard, Local/Remote change-over, Bumpless operation, Forced fire-speed control, PTC thermal protection, Programmable I/O terminal block, Auto-restart											
Ambient temperature/Relative humidity			-10 to 60℃ (Current decrease when over 40℃) /20 to 93% free from condensation and vapor											
Protective method			0.4 to 18.5kW : IP20 enclosed type(JEM1030), 22kW and over : IP00 type(JEM1030)											
Cooling method			Forced air cooling											
Built-in filter			3-phase 200V class: basic noise filter, 400V class:EMI noise filter (IEC/EN61800-3, 1st Environment,C2 or IEC/EN61800-3, 2nd Environment,C3)											

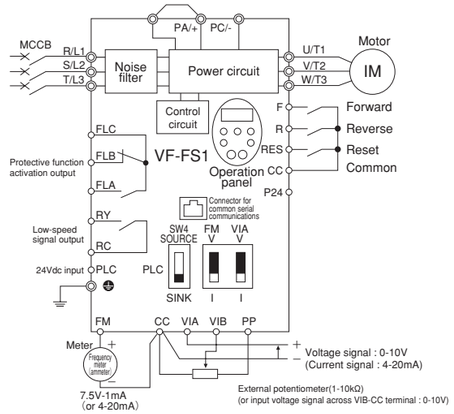
The rated output current in the parenthesis is at 12kHz of PWM carrier frequency(*F300*)setting.

■Exterior dimensions and weight

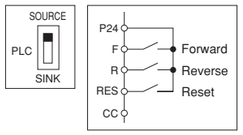
Input voltage Class	Applicable motor(kW)	Inverter model	Dimensions(mm)			Approximate weight (kg)
			Width	Height	Depth	
3-phase 200V (IP20/IP00)	0.4	VFFS1-2004PM	107	130	150	1.2
	0.75	VFFS1-2007PM	107	130	150	1.2
	1.5	VFFS1-2015PM	107	130	150	1.2
	2.2	VFFS1-2022PM	107	130	150	1.2
	3.7	VFFS1-2037PM	142	170	150	2.1
	5.5	VFFS1-2055PM	180	220	170	4.3
	7.5	VFFS1-2075PM	180	220	170	4.3
	11	VFFS1-2110PM	245	310	190	8.6
	15	VFFS1-2150PM	245	310	190	8.6
	18.5	VFFS1-2185PM	245	310	190	8.9
	22	VFFS1-2220PM	240	420	214	16.4
	30	VFFS1-2300PM	320	630	290	38
3-phase 400V (IP20/IP00)	0.4	VFFS1-4004PL	107	130	150	1.4
	0.75	VFFS1-4007PL	107	130	150	1.4
	1.5	VFFS1-4015PL	107	130	150	1.4
	2.2	VFFS1-4022PL	107	130	150	1.4
	3.7	VFFS1-4037PL	142	170	150	2.4
	5.5	VFFS1-4055PL	142	170	150	2.4
	7.5	VFFS1-4075PL	180	220	170	4.7
	11	VFFS1-4110PL	180	220	170	4.7
	15	VFFS1-4150PL	245	310	190	9
	18.5	VFFS1-4185PL	245	310	190	9
	22	VFFS1-4220PL	240	420	214	15.4
	30	VFFS1-4300PL	240	420	214	15.4

■Standard connection diagram : Sink logic(common : cc)

Main circuit power supply
200V class : three-phase 200-240V -50/60Hz
400V class : three-phase 380-480V -50/60Hz



■Standard connection diagram : Source logic(common : P24)



MEMO

To users of our inverters :

Our inverters are designed to control the speeds of three-phase induction motors for general industry.

⚠ Precautions

* Read the instruction manual before installing or operating the inverter unit and store it in a safe place for reference.
* When using our inverters for equipment such as nuclear power control, aviation and space flight control, traffic, and safety, and there is a risk that any failure or malfunction of the inverter could directly endanger human life or cause injury, please contact our headquarters, branch, or office printed on the front and back covers of this catalogue. Special precautions must be taken and such applications must be studied carefully.
* When using our inverters for critical equipment, even though the inverters are manufactured under strict quality control always fit your equipment with safety devices to prevent serious accident or loss should the inverter fail (such as issuing an inverter failure signal).
* Do not use our inverters for any load other than three-phase induction motors.
* None of Toshiba, its subsidiaries, affiliates or agents, shall be liable for any physical damages, including, without limitation, malfunction, anomaly, breakdown or any other problem that may occur to any apparatus in which the Toshiba inverter is incorporated or to any equipment that is used in combination with the Toshiba inverter. Nor shall Toshiba, its subsidiaries, affiliates or agents be liable for any compensatory damages resulting from such utilization, including compensation for special, indirect, incidental, consequential, punitive or exemplary damages, or for loss of profit, income or data, even if the user has been advised or apprised of the likelihood of the occurrence of such loss or damages.

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