TOSHIBA

Transistor Inverter

Built-in EMI noise filter
Introducing the world's top class compact inverter

1-phase 240V 0.2kW to 2.2kW
3-phase 240V 0.4kW to 15kW
3-phase 500V 0.4kW to 15kW
3-phase 600V 0.75kW to 15kW

New Global Standard Inverter **TOSVERT™**

VF-S11

They look the same,
but if you crack the shell you can see the difference.
The VF-S11 reveals the potential and future of inverters.

ISO-9001 certification
This product is designed and manufactured at plants that have acquired ISO-9001 certification, the worldwide quality assurance benchmark.

ISO-14001 certification
The plants that manufacture this product are registered as compliant with ISO-14001, the environmental management system.

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

New Global Standard Inverter **TOSVERT™**

VF-S11

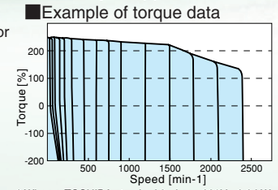
VF-S11 - The easy-to-use inverter for a variety of machines and facilities

For users who need large starting torque

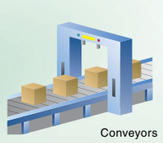
Conveyors, hoists, stairway elevators, and other conveyance machinery often need a large torque at startup. The VF-S11 incorporates a TOSHIBA proprietary control system -- current vector calculation control -- to generate starting torque of 1Hz - 200% or more*. This provides sufficient leeway in applications that require large starting torque.

*When a TOSHIBA standard 4-pole motor is the drive source(Torque may differ according to voltage and model.)

■Example of torque data



* When a TOSHIBA standard 3-phase 220V - 2.2 kW motor is driven by the VFS11-2022PM after parameters are set

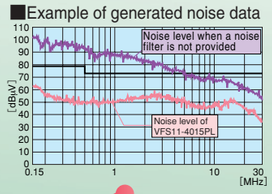

Conveyors


Stairway elevators

For users troubled by electromagnetic noise

Equipment such as commercial ironing boards, car washers and indoor running machines, that are used in the fields of health, medicine and welfare care, the environment and in our daily lives, cause a great deal of trouble to the surrounding area if they generate electromagnetic noise. The VF-S11 incorporates a noise filter in its compact body to drastically reduce any generated electromagnetic noise. The VF-S11 also complies with the EU EMC Directive. (See page 4.)

■Example of generated noise data




Commercial ironing boards

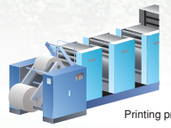

Car washing machines


Treadmills

For users with limited installation space

The VF-S11 has been downsized considerably in comparison with conventional models. In addition, side-by-side installation means that you can further save space as two or more units can be installed in close proximity next to each other.


Band tighteners


Printing presses


Control panels

■Side-by-side installation

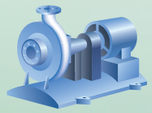
For users who place importance on maintenance

Fans, pumps, blowers, and air-conditioning equipment must be maintained on a regular basis. The VF-S11 monitors the expected replacement period of spare parts and outputs an alarm to serve as a rough guideline for when to perform maintenance. Capacitors on the main circuit have been designed to have a life of 10 years*. In addition, the VF-S11 can be used in an ambient temperature of up to 60°C and demonstrates excellent environmental resistance.

* Ambient temperature: annual average 40°C, output current: 80% of rated current, 24-hour operation 365 days per year


Fans/blowers


Fans in air-conditioning systems

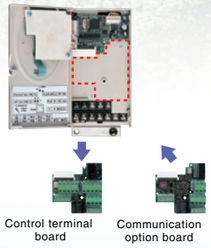

Pumps

For users who need expandability

You often need to control and monitor systems by communications, for example, in building air-conditioning systems and plant line control systems.
As well as being highly expandable, the VF-S11 uses a detachable type of control terminal board, which allows you to easily mount optionally available communication boards (RS-485, DeviceNet* and LonWorks®*).

* DeviceNet is a registered trademarks of ODVA(Open DeviceNet Vendor Association)
* LonWorks® is a registered trademarks of Echelon Corporation

■Detachable terminal board




Buildings

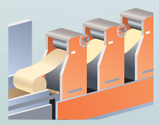
For users who need a wide capacity and range of models

For obtaining spare parts and easy maintenance for the same machinery and facilities, wouldn't you like a lineup of the same kind of inverters?
For an inverter in its class, the VF-S11 boasts a broad capacity range extending up to 15 kW. The VF-S11 also comes in a lineup of totally enclosed box types that can be used in severe installation environments subject to lots of water and dust.

■Line-up

Input Voltage Class	Applicable motor (kW) 0.2	0.4	0.55	0.75	1.5	2.2	4.0	5.5	7.5	11	15
1-phase 240V	IP20										
	IP54*2										
3-phase 240V	IP20										
	IP54*2										
3-phase 500V	IP20										
	IP54*2							IP00			
3-phase 600V	IP20										

* 1: 0.55kW model is 3-phase 240V class IP20 type only.
* 2: IP54 type is possible to bring into compliance with IP55 specification.


Food machines

Applicable specification by each segment

The VF-S11 is provided with a wide range of useful functions for machinery and facilities in various industrial sectors and applications.

Fan & Pumps — Air-conditioning systems, various fans, blowers, pumps, plumbing/sewerage systems, clean rooms, driers

Noise filter · Replacement alarm · Life 10 years · 60C° · Capacity range · Totally enclosed · Energy savings · Deceleration · Restart · Non-stop · One-touch · PID control · Ground capacitor · Standards

Conveyance machinery — Conveyors, automatic vertical storage units, hoists, lifts, dumbwaiters

High torque · Compact · Side-by-side · Capacity range · Totally enclosed · Braking resistance · 8 inputs · 2 output functions · Step width · Free unit · Speed control · Standards

Food processing machinery — Bread, confectionery, tea, and noodle making machines, rice, wheat and powder milling machines, mixers, slivers, and fruit selection machines

High torque · Noise filter · Compact · Side-by-side · 60C° · Capacity range · Totally enclosed box type · Deceleration · Braking resistance · 8 inputs

Packaging machinery — Trimming machines, packing machines, wrapping machines, band tighteners

High torque · Noise filter · Compact · Side-by-side · Detachable · Communications · Capacity range · Totally enclosed · Deceleration · Braking resistance

Medical equipment — Stairway elevators, nursing beds, Jacuzzis, health equipment (treadmills), medical equipment (X-ray machines)

High torque · Noise filter · Compact · Side-by-side · Detachable · Braking resistance · Free unit · Ground capacitor

Commercial facility equipment — Commercial ironing boards, car washing machines, raw garbage disposal, dust collectors

High torque · Noise filter · Compact · Side-by-side · Communications · Capacity range · Braking resistance · Ground capacitor

Amusement machinery — Batting machines, pinball feeders, game machines

High torque · Noise filter · Compact · Side-by-side · 60C° · Totally enclosed · Braking resistance · Ground capacitor

Semiconductor production equipment — Semiconductor production equipment, LCD production equipment, electronic component production and assembly machinery

High torque · Noise filter · Compact · Side-by-side · Life 10 years · Capacity range · Speed control · Ground capacitor

Printing machinery — Platemakers, binding machines, printing presses

High torque · Compact · Side-by-side · Capacity range · Step width · Free unit

Woodworking machinery — Lumber machinery, woodworking machinery, plywood making machinery

High torque · Compact · Capacity range · Totally enclosed · 500 Hz · Power voltage

Agricultural machinery — Rice and wheat milling machines, fruit selection machines

High torque · Noise filter · Compact · Side-by-side · 60C° · Totally enclosed · Braking resistance · Ground capacitor

Chemical machinery — Mixers, extruding machines, centrifugal separators, painting machines, pulverizers

High torque · Compact · Capacity range · Restart · Non-stop · Pulse train

Machine tools — Lathes, drilling machines, hobbing machines, grinding machines, boring machines

High torque · Compact · Capacity range · 500 Hz

Metal processing machinery — Various rolling and shearing machinery, mechanical pressing, winding and take-up machines

High torque · Compact · Capacity range · Braking resistance

Textile machinery — Weaving machines, knitting machines, dyeing/finishing machines, sewing machine

Compact · Detachable · Communications · 500 Hz

Panel manufacturer — Control panels, special control panels

Compact · Side-by-side · 60C° · Detachable · Capacity range · Ground capacitor

General — General related items, common items, other

History · Log details · 28 monitors · Storage

Explanation of symbols

:Described pages 1 and 2. :Described page 4. :Functions enabled on all models

High torque	High torque (1 Hz - 200% or more)	Capacity range	Wide capacity range up to 15 kW.	8 inputs	8 logic inputs	Standards	Compatible with main standards (CE, UL, CSA)
Noise filter	Built-in noise filter	Totally enclosed	Totally enclosed box type (IP54, IP55 compatible)	2 output functions	2 output terminal functions are assigned.	Sink/source	Sink/source logic switching
Compact	Small-sized, compact	Energy savings	Dynamic energy saving function	Step width	Variable step width setting	History	History function
Side-by-side	Side-by-side installation	Deceleration	Dynamic deceleration time reduction	Free unit	Free unit multiplication factor, bias setting	Log details	Detailed information of past tripping
Replacement alarm	Expected replacement period alarm for spare parts	Restart	Instantaneous power interruption restart (frequency scan system)	500 Hz	Max. frequency 500 Hz	28 monitors	28 monitor functions (power, watt-hour power)
Life 10 years	Main circuit capacitor designed to have a life of 10 years	Non-stop	Instantaneous power interruption non-stop control function	Pulse train	Pulse train output	Storage	Storage of user parameter settings
60°C	Possible installed in an ambient temperature 60°C	One-touch	One-touch fan replacement	Speed control	Speed control accuracy		
Detachable	Detachable terminal block	PID control	PID control with wait time	Power voltage	Wide power supply voltage range (240 V, 500 V)		
Communications	Built-in communications options	Braking resistance	Built-in braking resistor drive circuit	Ground capacitor	Ground capacitor disconnection switch		

Dynamic Automatic Energy Savings

Energy savings Dynamic automatic energy savings: A new function exclusively for fans and pumps in addition to the conventional energy savings mode. With this function, you can expect considerable energy savings.

Deceleration Dynamic deceleration time reduction control: Conventional deceleration time reduction control has been further modified. With this function, you can expect a certain amount of reduction in deceleration time even without the aid of a braking resistor.

28 monitors Energy saving effect monitor: Besides monitoring of input/output power (momentary values), the effect of energy savings can be easily checked as the input/output watt-hour power (electric energy) can be monitored.

Instantaneous power interruption restart function: The inverter can be restarted smoothly without any shock as it employs a frequency scan system.

Restart Instantaneous power interruption restart function: The inverter can be restarted smoothly without any shock as it employs a frequency scan system.

Non-stop Instantaneous power interruption non-stop control: This function uses the regenerative energy from the motor to continue inverter operation when a power interruption occurs during operation. In the same way, regenerative energy can be used to decelerate the motor to a stop without the inverter running free and then stopping.

PID control PID control: Conventional PID control functions have been enhanced for even easier use. New functions are a wait time for applying a time period in which PID control is disabled at startup and a function for resetting integrated amounts.

Full Lineup of Monitor and Display Functions

28 monitors Extensive monitor menus: 28 monitor values including load current and torque current can be viewed in real time.

Log details Monitor at trip: 28 momentary monitor values for when a trip occurs can be viewed. Ten monitor values are stored in memory for the last four inverter operations, which is effective in pin-pointing the cause of a trip.

Storage Storage of user parameter settings: All parameter settings made by the user can be stored in memory. Stored parameters can be immediately called even they have been changed.

History History function: This function is for displaying the latest five changes made to parameter settings. This is displayed in the top menu (AUH), which is handy when parameters are frequently changed or repeatedly adjusted.

Free unit Free unit display: Bias can also be set in addition to the multiplication factor in the free unit display. This display shows speed of rotation, line speed and other units in addition to frequency.

Step width Variable step width setting: The change increment of the frequency when an arrow key on the panel is pressed can be set as desired. For example, this is convenient when you want to change the frequency in 10 Hz increments each time that a key is pressed.

Various Input Terminals

8 inputs 8 contact input terminals: Analog input terminals can be selected as contact inputs. This means that up to eight contact inputs can be set to support more complex settings.

8 inputs 76 menus: A variety of operation specifications are supported as functions selected from 66 menus can be individually assigned to contact input terminals.

8 inputs Use of external power supply possible: A PLC terminal is provided for input of an external +24 V power supply. This is convenient when the inverter is connected to a programmable controller. A +24 V power supply is also integrated into the inverter which can also be used for contact input.

Safe Maintenance

One-touch One-touch fan replacement: The cooling fan, one of the service parts, can be easily removed for replacement. The fan, of course, is designed to last a long time as it has a temperature-based ON/OFF control function.

Ground capacitor Ground capacitor disconnection switch: Even when current leakage is a problem, it is possible to reduce current leakage easily with a ground condenser cutoff switch. (Only on single-phase 240 V models and 3-phase 500 V models)

Various Output Terminals

2 output functions 3 contact output terminals: Various outputs are provided on three terminals, relay contact (1c) output, relay contact (1a) output, and open collector output.

Pulse train Pulse train output: Open collector output is insulated from other circuits so that it can also be used as pulse train output.

2 output functions 58 menus: Functions selected from 58 menus can be individually assigned to contact output terminals. Moreover, two menus can be simultaneously assigned to a single terminal. A hold function for holding the state of an input once it turns ON is also provided. This enables inverter compatibility with various operation specifications.

2 output functions Analog output terminal: Any of 0 to 10 V, 0 to 1 mA and 4 to 20 mA can be selected. Also, data can be selected from 20 menus.

Extensive Communication Functions

Detachable Built-in communications option board: The detachable terminal block board can be detached and swapped with various internal option boards. Communications option boards including RS-485, DeviceNET and LonWorks are available.

Communications Communications protocol: TOSHIBA inverter protocol and Modbus-RTU protocol are supported. The inverter can also be connected directly by communications to touch panels made by Digital Electronics Corporation.

Communications Block communications: Block read/write functions have been added on as communications methods to simplify high-speed transmission of instructions and monitoring. Inverter-to-inverter communications is also supported, which enables master/slave control on just inverters without the aid of a host controller.

Compatibility with World's Main Standards

Standards Compatibility with main standards: All models are compatible with the World's Main Standards (EC Directive (CE marking), UL, and CSA. Some of C-tick complied models are also available.

Sink/source Sink/source logic switching: Sink or source (i.e. positive - negative) on input terminals can be easily switched by the bit switch on the circuit board.

Noise filter Built-in noise filter: A noise filter is built into all models.

Model	Built-in Filter	European EMC Directive
Single-phase models, 500 V models	High-attenuation EMI filter	Compatible on standard products
3-phase 240 V models	Standard filter	Optionally* compatible

*1. A noise reduction filter (EU-compatible) compatible with the EMC Directive is available. See page 20.

Other Features

Power voltage Wide power supply voltage range: 200 to 240 V range on 200 V class models, and 380 to 500 V range on 400 V class models are supported.

Speed control Speed control accuracy: Speed control accuracy is improved by high startup torque and current vector calculation control, a TOSHIBA proprietary control system.

500 Hz Output frequency: The VF-S11 can be used in a wide range of applications as its maximum output frequency is 500 Hz.

Braking resistance Built-in braking resistor drive circuit: A drive circuit for an external braking resistor is integrated into all models to enable large regenerative energy loads to be stopped in a short time.

Standard specifications

■3-phase 240V

Item		Specification									
Input voltage class		3-phase 240V									
Applicable motor (kW)		0.4	0.55	0.75	1.5	2.2	4.0	5.5	7.5	11	15
Rating	Type	VFS11									
	Form	2004PM	2005PM	2007PM	2015PM	2022PM	2037PM	2055PM	2075PM	2110PM	2150PM
	Capacity (kVA) Note 1)	1.3	1.4	1.8	3.0	4.2	6.7	10	13	21	25
	Rated output current (A) Note 2)	3.3 (3.3)	3.7 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)	17.5 (16.4)	27.5 (25.0)	33 (33)	54 (49)	66 (60)
	Output voltage Note 3)	3-phase 200V to 240V									
	Overload current rating	150%-60 seconds, 200%-0.5 second Note 4)									
Power supply	Voltage-frequency	3-phase 200V to 240V - 50/60Hz									
	Allowable fluctuation	Voltage + 10%, -15% Note 5), frequency ±5%									
Protective method		IP20 Enclosed type (JEM1030)									
Cooling method		Self-cooling				Forced air-cooled					
Color		Munsel 5Y-8/0.5									
Built-in filter		Basic filter Note 7)									

■3-phase 500V

Item		Specification								
Input voltage class		3-phase 500V								
Applicable motor (kW)		0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15
Rating	Type	VFS11								
	Form	4004PL	4007PL	4015PL	4022PL	4037PL	4055PL	4075PL	4110PL	4150PL
	Capacity (kVA) Note 1)	1.1	1.8	3.1	4.2	7.2	11	13	21	25
	Rated output current (A) Note 2)	1.5 (1.5)	2.3 (2.1)	4.1 (3.7)	5.5 (5.0)	9.5 (8.6)	14.3 (13.0)	17.0 (17.0)	27.7 (25.0)	33 (30)
	Output voltage Note 3)	3-phase 380V to 500V								
	Overload current rating	150%-60 seconds, 200% -0.5 second Note 4)								
Power supply	Voltage-frequency	3-phase 380V to 500V - 50/60Hz								
	Allowable fluctuation	Voltage + 10%, -15% Note 5), frequency ±5%								
Protective method		IP20 Enclosed type (JEM1030)								
Cooling method		Forced air-cooled								
Color		Munsel 5Y-8/0.5								
Built-in filter		High-attenuation EMI filter Note 8)								

■1-phase 240V

Item		Specification				
Input voltage class		1-phase 240V				
Applicable motor (kW)		0.2	0.4	0.75	1.5	2.2
Rating	Type	VFS11S				
	Form	2002PL	2004PL	2007PL	2015PL	2022PL
	Capacity (kVA) Note 1)	0.6	1.3	1.8	3.0	4.2
	Rated output current (A) Note 2)	1.5 (1.5)	3.3 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)
	Output voltage Note 3)	3-phase 200V to 240V				
	Overload current rating	150%-60 seconds, 200%-0.5 second Note 4)				
Power supply	Voltage-frequency	1-phase 200V to 240V – 50/60Hz				
	Allowable fluctuation	Voltage + 10%, -15% Note 5), frequency±5%				
Protective method		IP20 Enclosed type (JEM1030)				
Cooling method		Self-cooling			Forced air-cooled	
Color		Munsel 5Y-8/0.5				
Built-in filter		High-attenuation EMI filter Note 8)				

■3-phase 600V

Item		Specification											
Input voltage class		3-phase 600V Note 6)											
Applicable motor (kW)		0.75	1.5	2.2	4.0	5.5	7.5	11	15				
Rating	Type	VFS11											
	Form	6007P	6015P	6022P	6037P	6055P	6075P	6110P	6150P				
	Capacity (kVA) Note 1)	1.7	2.7	3.9	6.1	9.0	11	17	22				
	Rated output current (A) Note 2)	1.7 (1.5)	2.7 (2.4)	3.9 (3.5)	6.1 (5.5)	9.0 (8.1)	11.0 (9.9)	17.0 (15.3)	22.0 (19.8)				
	Output voltage Note 3)	3-phase 525V to 600V											
	Overload current rating	150%-60 seconds, 200%-0.5 second Note 4)											
Power supply	Voltage-frequency	3-phase 525V to 600V – 50/60Hz											
	Allowable fluctuation	Voltage + 10%, -15% Note 5), frequency±5%											
Protective method		IP20 Enclosed type (JEM1030)											
Cooling method		Forced air-cooled											
Color		Munsel 5Y-8/0.5											
Built-in filter		No filter											

Note 1. Capacity is calculated at 220V for the 240V class, at 440V for the 500V class and at 575V for the 600V models.

Note 2. Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4kHz or less.
When exceeding 4kHz, the rated output current setting is indicated in the parenthesis. When the input power voltage of the 500V class model exceeds 480V, it is necessary to further reduce the setting. The default setting of the PWM carrier Frequency is 12kHz.

Note 3. Maximum output voltage is the same as the input voltage.

Note 4. May differ according to voltage and model.

Note 5. ±10% when the inverter is used continuously (load of 100%).

Note 6. If you are using 600V model, be sure to connect an input reactor (ACL).

Note 7. Built-in standard filter: Core and capacitors, with RFI noise filter option: Complies IEC61800-3 categoly C2 (Max.5m*) and IEC61800-3 categoly C1 (Max.1m*)
* Length of motor connecting cable.

Note 8. Built-in high-attenuation EMI filter: Complies IEC61800-3 categoly C2 for 240V class 0.2-1.5kW and 500V class 0.4-4.0kW, IEC61800-3 categoly C3 for 240V class 2.2kW and 500V class 5.5-15kW (Max.5m*)
With RFI noise filter option : Complies IEC61800-3 categoly CI (Max.20m*) and IEC61800-3 categoly C2 (Max.50m*)* Length of motor connecting cable.

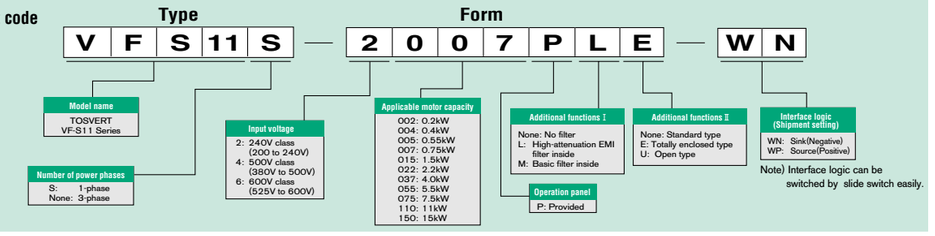
Note 9. Above 40°C : Remove the protective seal from the top of the inverter. Above 50°C: Remove the seal from the top of the inverter and use the inverter with the rated output current reduced.

Note10. If inverters are installed side by side (with no sufficient space left between them) installation: Remove the seal from the top of each inverter.
When installing the inverter where the ambient temperature will rise above 40°C, remove the seal from the top of the inverter and use the inverter with the rated output current reduced.

■Common specification

Item		Specification
Principal control functions	Control system	Sinusoidal PWM control
	Rated output voltage	Adjustable within the range of 50 to 600V by correcting the supply voltage (not adjustable above the input voltage)
	Output frequency range	0.5 to 500.0Hz, default setting: 0.5 to 80Hz, maximum frequency: 30 to 500Hz
	Minimum setting steps of frequency	0.01Hz: operation panel setting, 0.1Hz: analog input (when the max. frequency is 100Hz).
	Frequency accuracy	Digital setting: within ±0.01% of the max. frequency (-10 to +60°C) Analog setting: within ±0.5% of the max. frequency (25°C ±10°C)
	Voltage/frequency characteristics	V/f constant, variable torque, automatic torque boost, vector control, automatic energy-saving, dynamic automatic energy-saving control. Auto-tuning. Base frequency (25 - 500Hz) adjusting to 1 or 2, torque boost (0 - 30%) adjusting to 1 or 2, adjusting frequency at start (0.5 - 10Hz)
	Frequency setting signal	Potentiometer on the front panel, external frequency potentiometer (connectable to a potentiometer with a rated impedance of 1 - 10kΩ), 0 - 10Vdc (input impedance: VIA/VIB=30kΩ), 4 - 20mAdc (Input impedance: 250Ω).
	Terminal board base frequency	The characteristic can be set arbitrarily by two-point setting. Possible to set individually for three functions: analog input (VIA and VIB) and communication command.
	Frequency jump	Three frequencies can be set. Setting of the jump frequency and the range.
	Upper- and lower-limit frequencies	Upper-limit frequency: 0 to maximum frequency, lower-limit frequency: 0 to upper-limit frequency
	PWM carrier frequency	Adjustable within a range of 2.0 to 16.0Hz (default: 12kHz).
	PID control	Setting of proportional gain, integral gain, differential gain and control wait time. Checking whether the amount of processing amount and the amount of feedback agree.
Operation specifications	Acceleration/deceleration time	Selectable from among acceleration/deceleration times 1, 2 or 3 (0.0 to 3200 sec.). Automatic acceleration/deceleration function. S-pattern 1 or 2, and S-pattern value adjustable. Forced rapid deceleration and dynamic rapid deceleration function.
	DC braking	Braking start-up frequency: 0 to maximum frequency, braking rate: 0 to 100%, braking time: 0 to 20 seconds, emergency DC braking, motor shaft fixing control
	Dynamic braking	Control and drive circuit is built in the inverter with the braking resistor outside (optional).
	Input terminal function (programmable)	Possible to select from 76 functions, such as forward/reverse run signal input, jog run signal input, operation base signal input and reset signal input, to assign to 8 input terminals. Logic selectable between sink and source.
	Output terminal functions (programmable)	Possible to select from 58 functions, such as upper/lower limit frequency signal output, low speed detection signal output, specified speed reach signal output and failure signal output, to assign to FL relay output, open collector output and RY output terminals.
	Forward/reverse run	The RUN and STOP keys on the operation panel are used to start and stop operation. The switching between forward run and reverse run can be done from one of the three control units: operation panel, terminal board and external control unit.
	Jog run	Jog mode, if selected, allows jog operation from the operation panel or the terminal board.
	Preset speed operation	Base frequency + 15-speed operation possible by changing the combination of 4 contacts on the terminal board.
	Retry operation	Capable of restarting automatically after a check of the main circuit elements in case the protective function is activated. 10 times (Max.) (selectable with a parameter)
	Various prohibition settings	Possible to write-protect parameters and to prohibit the change of panel frequency settings and the use of operation panel for operation, emergency stop or resetting.
	Regenerative power ride-through control	Possible to keep the motor running using its regenerative energy in case of a momentary power failure.
	Auto-restart operation	In the event of a momentary power failure, the inverter reads the rotational speed of the coasting motor and outputs a frequency appropriate to the rotational speed in order to restart the motor smoothly. This function can also be used when switching to commercial power.
	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	The sum of two analog signals (VIA/VIB) can be used as a frequency command value.
	Failure detection signal	1c-contact output: (250Vac-0.5A-cos ϕ =0.4)
Protective function	Protective function	Stall prevention, current limitation, over-current, output short circuit, over-voltage, over-voltage limitation, undervoltage, ground fault, power supply phase failure, output phase failure, overload protection by electronic thermal function, armature over-current at start-up, load side over-current at start-up, over-torque, undercurrent, overheating, cumulative operation time, life alarm, emergency stop, braking resistor over-current/overload, various pre-alarms
	Electronic thermal characteristic	Switching between standard motor and constant-torque VF motor, switching between motors 1 and 2, setting of overload trip time, adjustment of stall prevention levels 1 and 2, selection of overload stall
	Reset function	Function of resetting by closing contact 1a or by turning off power or the operation panel. This function is also used to save and clear trip records.
Display function	Alarms	Stall prevention, overvoltage, overload, under-voltage, setting error, retry in process, upper/lower limits
	Causes of failures	Over-current, overvoltage, overheating, short-circuit in load, ground fault, overload on inverter, over-current through arm at start-up, over-current through load at start-up, CPU fault, EEPROM fault, RAM fault, ROM fault, communication error. (Selectable: Over-current through braking resistor/overload, emergency stop, under-voltage, low voltage, over-torque, motor overload, output open-phase)
	Monitoring function	Operation frequency, operation frequency command, forward/reverse run, output current, voltage in DC section, output voltage, torque, torque current, load factor of inverter, integral load factor of PBR, input power, output power, information on input terminals, information on output terminals, version of CPU1, version of CPU2, version of memory, PID feedback amount, frequency command (after PID), integral input power, integral output power, rated current, causes of past trips 1 through 4, information on life alarm, cumulative operation time
	Past trip monitoring function	Stores data on the past four trips: number of trips that occurred in succession, operation frequency, direction of rotation, load current, input voltage, output voltage, information on input terminals, information on output terminals, and cumulative operation time when each trip occurred.
	Output for frequency meter	Analog output (1mAdc full-scale DC ammeter or 7.5Vdc full-scale DC voltmeter/rectifier type AC voltmeter, 4 to 20mA/0 to 20mA output)
	4-digit 7-segments LED	Frequency: inverter output frequency. Alarm: stall alarm “C”, overvoltage alarm “P”, overload alarm “L”, overheat alarm “H”. Status: inverter status (frequency, cause of activation of protective function, input/output voltage, output current, etc.) and parameter settings. Free-unit display: arbitrary unit (e.g. rotating speed) corresponding to output frequency.
	Indicator	Lamps indicating the inverter status by lighting, such as RUN lamp, MON lamp, PRG lamp, % lamp, Hz lamp, frequency setting potentiometer lamp, UP/DOWN key lamp and RUN key lamp. The charge lamp indicates that the main circuit capacitors are electrically charged.
Environments	Use environments	Indoor, altitude: 1000m (Max.), not exposed to direct sunlight, corrosive gas, explosive gas / vibration (less than 5.9m/s²) (10 to 55Hz)
	Ambient temperature	-10 to +60°C Note 9,10)
	Storage temperature	-25 to +70°C
	Relative humidity	20 to 93% (free from condensation and vapor).

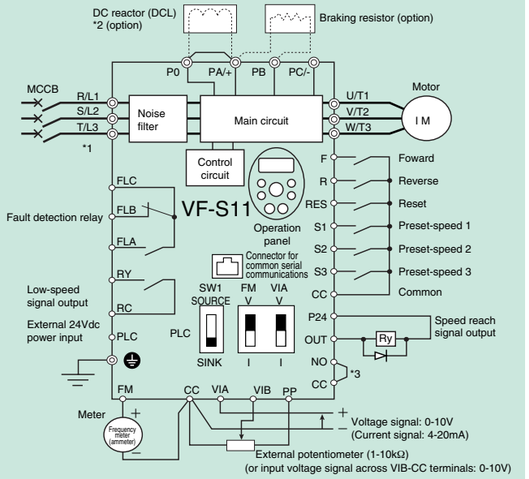
Contents of the product code



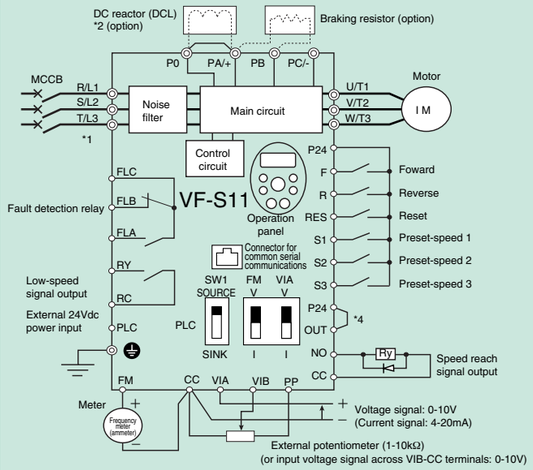
Connection diagram and selection of wiring devices

Standard connection diagram

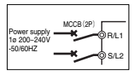
Sink (Negative) logic : common = CC



Source (Positive) logic : common = P24



Main circuit power supply
240V class: three-phase 200-240V -50/60Hz
500V class: three-phase 380-500V -50/60Hz
600V class: three-phase 525-600V -50/60Hz



*1: The T/L3 terminal not provided for signal-phase models. Use the R/L1 and S/L2 terminal as input terminals.
*2: The inverter came with the PO and the PA/+ terminals shorted by means of a shoeting bar.
Before installing the DC reactor (DCL), remove the bar.
*3: When using the OUT output terminal in sink logic mode, short-circuit the NO and CC terminals.
*4: When using the NO output terminal in source logic mode, short-circuit the P24 and OUT terminals.

wiring devices

Voltage class	Capacity applicable motor (kW)	Interver model	Molded-case circuit breaker (MCCB) Earth leakage circuite breaker(ELCB)	Magnetic contactor (MC)	Overload relay (Th-Ry)	Wire size (mm²)			
			Rated current(A) Note 8)	Rated current(A) Note 8)	Adjusted current (A) (For reference)	Main circuit (mm²) Note 4,8)	DC reactor (optional)(mm²)	Braking resistor (optional)(mm²)	Grounding cable (mm²)Note 6)
3-phase 240V class	0.4	VFS11-2004PM	5(5)	9(9)	2.3	2.0(2.0)	1.25	2.0	3.5
	0.55	VFS11-2005PM	10(5)	9(9)	2.7	2.0(2.0)	2.0	2.0	3.5
	0.75	VFS11-2007PM	10(5)	9(9)	3.6	2.0(2.0)	2.0	2.0	3.5
	1.5	VFS11-2015PM	15(10)	9(9)	6.8	2.0(2.0)	2.0	2.0	3.5
	2.2	VFS11-2022PM	20(15)	12(12)	9.3	2.0(2.0)	2.0	2.0	3.5
	4.0	VFS11-2037PM	30(30)	25(18)	15	3.5(2.0)	3.5	2.0	3.5
	5.5	VFS11-2055PM	50(40)	32(25)	22	5.5(2.0)	8.0	2.0	5.5
	7.5	VFS11-2075PM	60(50)	38(38)	28	8.0(5.5)	14	3.5	5.5
	11	VFS11-2110PM	100(75)	65(50)	44	14(8.0)	14	5.5	8.0
	15	VFS11-2150PM	125(100)	80(65)	57	22(14)	22	14	8.0
3-phase 500V class	0.4	VFS11-4004PL	5(5)	9(9)	1.0	2.0(2.0)	2.0	2.0	3.5
	0.75	VFS11-4007PL	5(5)	9(9)	1.6	2.0(2.0)	2.0	2.0	3.5
	1.5	VFS11-4015PL	10(10)	9(9)	3.6	2.0(2.0)	2.0	2.0	3.5
	2.2	VFS11-4022PL	15(10)	9(9)	5.0	2.0(2.0)	2.0	2.0	3.5
	4.0	VFS11-4037PL	20(15)	12(9)	6.8	2.0(2.0)	2.0	2.0	3.5
	5.5	VFS11-4055PL	30(20)	18(18)	11	2.0(2.0)	3.5	2.0	3.5
	7.5	VFS11-4075PL	30(30)	25(18)	15	3.5(2.0)	5.5	2.0	3.5
	11	VFS11-4110PL	50(40)	32(25)	22	5.5(2.0)	8.0	2.0	5.5
	15	VFS11-4150PL	60(50)	38(38)	28	8.0(5.5)	14	3.5	5.5
1-phase 240V class	0.2	VFS11S-2002PL	5(5)	9(9)	1.3	2.0(2.0)	2.0	2.0	3.5
	0.4	VFS11S-2004PL	10(5)	9(9)	2.3	2.0(2.0)	2.0	2.0	3.5
	0.75	VFS11S-2007PL	15(10)	9(9)	3.6	2.0(2.0)	2.0	2.0	3.5
	1.5	VFS11S-2015PL	20(15)	18(12)	6.8	2.0(2.0)	2.0	2.0	3.5
	2.2	VFS11S-2022PL	30(30)	25(18)	9.3	2.0(2.0)	3.5	2.0	3.5
3-phase 600V class	0.75	VFS11-6007P	5(5)	9(9)	1.0	2.0(2.0)	2.0	2.0	3.5
	1.5	VFS11-6015P	10(10)	9(9)	1.6	2.0(2.0)	2.0	2.0	3.5
	2.2	VFS11-6022P	10(10)	9(9)	3.6	2.0(2.0)	2.0	2.0	3.5
	4.0	VFS11-6037P	15(15)	12(12)	5.0	2.0(2.0)	2.0	2.0	3.5
	5.5	VFS11-6055P	20(20)	18(18)	6.8	2.0(2.0)	2.0	2.0	3.5
	7.5	VFS11-6075P	30(30)	25(25)	11	2.0(2.0)	2.0	2.0	3.5
	11	VFS11-6110P	30(30)	25(25)	15	3.5(3.5)	3.5	2.0	3.5
	15	VFS11-6150P	40(40)	33(33)	22	5.5(5.5)	5.5	2.0	5.5

Note) 1. Be sure to attach surge killer to the exciting coil of the relay and the magnetic contactor.
2. 500V and 600V class: For the operation and control circuit, regulate the voltage at 240V or less with a step-down transformer.
3. When using the auxiliary contacts 2a of the magnetic contactor MC for the control circuit, connect the contacts 2a in parallel to increase reliability.
4. Size of the wires conected to the input terminals R, S and T and the output terminals U, V and W when the length of each wire does not exceed 30m.
5. For the control circuit, use shielded wires 0.75 mm² or more in diameter.
6. For grounding, use a cable with a size equal to or larger than the above.
7. The wire sizes specified in the above table apply to HIV wires (cupper wires shielded with an insulator with a maximum allowable temperature of 75°C) used at an ambient temperature of 50°C or less.
8. The numeric values in parentheses refer to the sizes of wires to be used when a DC reactor is connected.

Terminal functions

Main circuit teminal functions

Terminals symbol	Terminal function
⏚	Grounding terminal for connecting inverter. There are 3 terminals in total. 2 terminals in the terminal board, 1 terminal in the cooling fin.
R/L1, S/L2, T/L3	240V class: single-phase 200~240V-50/60Hz three-phase 200~240V-50/60Hz 500V class: three-phase 380~500V-50/60Hz 600V class: three-phase 525~600V-50/60Hz * Single-phase input: R/L1 and S/L2 terminals
U/T1, V/T2, W/T3	Connect to a (three-phase induction) motor.
PA/+, PB	Connect to braking resistors. Change parameters F304, F305, F308, F309 if necessary.
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. Before installing DCL, remove the short bar.

Control circuit terminal functions

Terminal symbol		Function	Electrical specifications	Wire size
F	Multifunction programmable contact input	Shorting across F-CC causes forward rotation; open causes slowdown and stop.	Dry contact input 24Vdc - 5mA or less *Sink/Source/ PLC selectable using SW	Solid wire : 0.3 to 1.5 (mm²) Stranded wire : 0.3 to 1.5 (mm²) (AWG22 to 16) Sheath strip length : 6 (mm) Screwdriver: Small-sized flat-blade screwdriver Blade thickness: 0.4 mm or less Blade width: 2.5 mm or less
R		Shorting across R-CC causes reverce rotation; open causes slowdown and stop.		
RES		Shorting across RES-CC causes a held reset when the inverter protector function is operating. Note that when the inverter is operating normally, it will not operate even if there is a short across RES-CC.		
S1		Shorting across S1-CC causes preset speed operation.		
S2		Shorting across S2-CC causes preset speed operation.		
S3		Shorting across S3-CC causes preset speed operation.		
PLC		External 24Vdc power input	(Insulation resistance: 50Vdc)	
CC		Control circuit's equipotential terminal (sink logic).3 common terminals for input/output.		
PP		Power output for analog input setting.	10Vdc (permissible load current: 10mAdc)	
VIA Note 1)		Multifunction programmable analog input. Standard default setting: 0-10Vdc input and 0-60Hz frequency. The function can be changed to 4-20 mAdc (0-20 mA) current input by flipping the VIA slide switch to the I position.	10Vdc (internal impedance: 30kΩ) 4~20mA (Internal impedance: 250Ω)	
VIB Note 1)		Multifunction programmable analog input. Standard default setting: 0-10Vdc input and 0-50Hz (50Hz setting) or 0-60Hz (60Hz setting) frequency.	10Vdc (internal impedance: 30kΩ)	
FM		Multifunction programmable analog output. Standard default setting: output freguency. Connect a 1mAdc full-scale ammeter or 7.5Vdc (10Vdc)-1mA full-scale voltmeter. The function can be changed to 0-20mAdc (4-20mA) current output by flipping the FM slide switch to the I position.	1mA full-scale DC ammeter or 7.5Vdc 1mA full-scale DC voltmeter 0-20mA (4-20mA) full-scale DC ammeter	
P24		When the source logic is used, a common terminal 24Vdc is connected.	24Vdc - 100mA	
OUT NO Note 2)		Multifunction programmable open collector output. Standard default settings detect and output speed reach signal output frequencies. The NO terminal is an isoelectric output terminal. It is insulated from the CC terminal. These terminals can also be used as multifunction programmable pulse train output terminals.	Open collector output: 24Vdc - 50mA Pulse train output 10mA or more	
RC RY Note 2)		Multifunction programmable relay contact output. Contact ratings: 250Vac - 2A (cosø = 1), 30Vdc - 1A, 250Vac - 1A (cosø = 0.4). Standard default settings detect and output low-speed signal output frequencies.	250Vac - 1A: at resistance load 30Vdc - 0.5A, 250Vac - 0.5A (cosø = 0.4)	
FLA FLB FLC		Multifunction programmable relay contact output. Contact ratings: 250Vac-1A (cosø = 1), 30Vdc-0.5A, 250Vac-0.5A (cosø = 0.4). Detects the opertion of the inverter's protection function. Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation.	250Vac - 1A: at resistance load 30Vdc - 0.5A, 250Vac - 0.5A (cosø = 0.4)	

Note 1: By changing parameter setting, this terminal can also be used as a multifunction programmable contact input terminal.
When the inverter is used in a sink logic configuration, a resistor (4.7kΩ at 0.5W) should be inserted between the P24 and VIA/VIB terminals.
Also, the slide switch for the VIA terminal needs to be turned to the V position.
Note 2: Multifunction output terminals to which two different functions can be assigned.

External dimensions

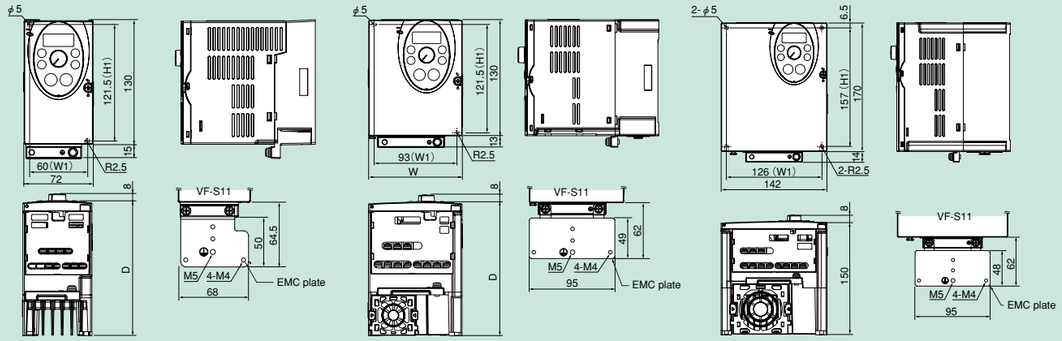


Fig. A　　Fig. B　　Fig. C

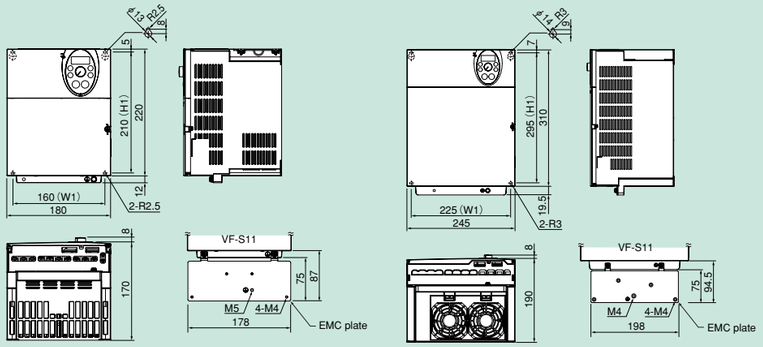


Fig. D　　Fig. E

Note 1. To make it easier to grasp the dimensions of each inverter, dimensions common to all inverters in these figures are shown with numeric values but not with symbols.
Here are the meanings of the symbols used.

W: Width
H: Height
D: Depth
W1: Mounting dimension (horizontal)
H1: Mounting dimension (vertical)
H2: Height of EMC plate mounting area
D2: Depth of frequency setting knob

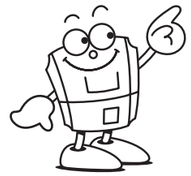
Note 2. Here are the available EMC plate
Fig. A　　: EMP003Z (Approx. weight : 0.1kg)
Fig. B, Fig. C: EMP004Z (Approx. weight : 0.1kg)
Fig. D　　: EMP005Z (Approx. weight : 0.3kg)
Fig. E　　: EMP006Z (Approx. weight : 0.3kg)

Note 3. The models shown in Fig. A and Fig. B are fixed at two points : in the upper left and lower right corners.

Note 4. The model shown in Fig. A is not equipped with a cooling fan.

Input voltage	Applicable motor (kW)	Type	Dimensions (mm) W	H	D	W1	H1	H2	D2	Drawing	Approx. weight (kg)
3-phase 240V	0.4	VFS11-2004PM	72	130	120	60	121.5	15	8	A	0.9
	0.55	VFS11-2005PM			130						1.1
	0.75	VFS11-2007PM									1.1
	1.5	VFS11-2015PM	105	130	130	93	121.5	13		B	1.2
	2.2	VFS11-2022PM	107		150						1.3
	4.0	VFS11-2037PM	142	170	150	126	157	14		C	2.2
	5.5	VFS11-2055PM	180	220	170	160	210	12		D	4.8
	7.5	VFS11-2075PM									4.9
	11	VFS11-2110PM	245	310	190	225	295	19.5		E	9.3
	15	VFS11-2150PM									9.6
3-phase 500V	0.4	VFS11-4004PL	107	130	150	93	121.5	13	8	B	1.4
	0.75	VFS11-4007PL									1.5
	1.5	VFS11-4015PL									1.5
	2.2	VFS11-4022PL	142	170	150	126	157	14		C	2.3
	4.0	VFS11-4037PL									2.5
	5.5	VFS11-4055PL	180	220	170	160	210	12		D	5.0
	7.5	VFS11-4075PL									5.1
	11	VFS11-4110PL	245	310	190	225	295	19.5		E	9.6
	15	VFS11-4150PL									9.6
1-phase 240V	0.2	VFS11S-2002PL	72	130	130	60	121.5	15	8	A	1.0
	0.4	VFS11S-2004PL									1.0
	0.75	VFS11S-2007PL			140						1.2
	1.5	VFS11S-2015PL	107	130	150	93	121.5	13		B	1.4
	2.2	VFS11S-2022PL	142	170	150	126	157	14		C	2.2
3-phase 600V	0.75	VFS11-6007P	107	130	150	93	121.5	13	8	B	1.3
	1.5	VFS11-6015P									1.3
	2.2	VFS11-6022P	142	170	150	126	157	14		C	2.1
	4.0	VFS11-6037P									2.2
	5.5	VFS11-6055P	180	220	170	160	210	12		D	4.7
	7.5	VFS11-6075P									4.7
	11	VFS11-6110P	245	310	190	225	295	19.5		E	8.8
	15	VFS11-6150P									8.8

List of parameters



What are parameters?

Each “setting item” that determines the control (operation) of an inverter is called a parameter.
For example, the connection meter selection parameter (title FMSL) is adjusted to set the connection meter, the acceleration time parameter (title ACC) is adjusted to change the acceleration time, and the maximum frequency parameter (title FH) is adjusted to modify the maximum frequency.
For the function you want to use, check the necessary parameter(s).

Basic parameters

2005 Ver.112/113

●Operation frequency parameter

Title	Function	Adjustment range	Default setting	Remarks
FC	Operation frequency of operation panel	LL – UL	0.0	

●Four automatic functions

Title	Function	Adjustment range	Default setting	Remarks
AUH	History function	Displays parameters in groups of five in the reverse order to that in which their settings were changed. * (Possible to edit)	——	
AU1	Automatic acceleration/ deceleration	0: Invalid (manual) 1: Automatic 2: Automatic (only at acceleration)	0	
AU2	Torque boost setting macro function	0: Invalid 1: Automatic torque boost + auto-tuning 2: Vector control + auto-tuning 3: Energy saving + auto-tuning	0	
AU4	Parameter setting macro function	0: Invalid 1: Coast stop 2: 3-wire operation 3: External input UP/DOWN setting 4: 4-20 mA current input operation	0	

●Other basic parameters

Title	Function	Adjustment range	Default setting	Remarks
CMOD	Command mode selection	0: Terminal board 1: Operation panel (Extention panel)	1	
FMOD	Frequency setting mode selection 1	0: Built-in potentiometer 1: VIA 2: VIB 3: Operation panel (Extention panel) 4: Serial communication 5: UP/DOWN from external contact 6: VIA + VIB (Override)	0	
FMSL	Meter selection	0: Output frequency 1: Output current 2: Set frequency 3: DC voltage 4: Output voltage command value 5: Input power 6: Output power 7: Torque 8: Torque current 9: Motor cumulative load factor 10: Inverter cumulative load factor 11: PBR (braking reactor) cumulative load factor 12: Frequency setting value (after PID) 13: VIA Input value 14: VIB Input value 15: Fixed output 1 (Output current: 100%) 16: Fixed output 2 (Output current: 50%) 17: Fixed output 3 (Other than the output current: 100%) 18: Serial communication data 19: For adjustments (FM set value is displayed.)	0	
FM	Meter adjustment	——	——	

Title	Function	Adjustment range	Default setting	Remarks
TYP	Default setting	0: - 1: 50Hz default setting 2: 60Hz default setting 3: Default setting (Initialization) 4: Trip record clear 5: Cumulative operation time clear 6: Initialization of type information 7: Save user-defined parameters 8. Call user-defined parameters 9. Cumulative fan operation time re-cord clears	0	
FR	Forward/reverse run selection (Operation panel)	0: Forward run 1: Reverse run 2: Forward run (F/R switching possible) 3: Reverse run (F/R switching possible)	0	
ACC	Acceleration time 1	0.0–3200(s)	10.0	
DEC	Deceleration time 1	0.0–3200(s)	10.0	
FH	Maximum frequency	30.0–500.0(Hz)	80.0	
UL	Upper limit frequency	0.5– FH (Hz)	50(WP) 60(WN)	
LL	Lower limit frequency	0.0– UL (Hz)	0.0	
UL	Base frequency 1	25–500.0(Hz)	50(WP) 60(WN)	
ULV	Base frequency voltage 1	50-330(V) (240V class) 50-660(V) (500V/600V class)	230/ 460/ 575	
PT	V/F control mode selection	0: V/F constant 1: Variable torque 2: Automatic torque boost control 3: Vector control 4: Automatic energy-saving 5: Dynamic automatic energy-saving (for fans and pumps) 6: PM motor control	0(WP) 2(WN)	
UB	Torque boost value 1	0.0–30.0(%)	Depends on the capacity	
THR	Motor electronic-thermal protection level 1	10–100(%/A)	100	
OLN	Electronic-thermal protection characteristic selection	Setting / Type / Overload protection / OL stall 0 / Standard motor / Valid / Invalid 1 / Standard motor / Valid / Valid 2 / Standard motor / Invalid / Invalid 3 / Standard motor / Invalid / Valid 4 / VF motor (Special motor) / Valid / Invalid 5 / VF motor (Special motor) / Valid / Valid 6 / VF motor (Special motor) / Invalid / Invalid 7 / (Hz) / Invalid / Valid	0	
SR1 to SR7	Preset-speed operation frequency 1~7	LL – UL (Hz)	0.0	
F---	Extended parameters	——	——	
GR.U	Automatic edit function	——	——	

To **Extended parameters** Nearly 200 parameters

How to read the monitor display?

Monitor display

The LEDs on the operation panel display the following symbols to indicate operations and parameters.

LED (number)

0	1	2	3	4	5	6	7	8	9	–
0	1	2	3	4	5	6	7	8	9	–

LED (alphabet)

Aa	Bb	C	c	Dd	Ee	Ff	Gg	H	h	I	i	Jj	Kk	Ll
A	b	C	c	d	E	F	G	H	h	I	i	J	/	L

Mm	Nn	O	o	Pp	Qq	Rr	Ss	Tt	Uu	Vv	Ww	Xx	Yy	Zz
n	n	O	o	P	q	r	S	t	U	u	/	/	y	/

Extended parameters Ⅰ

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Parameters for setting functions that cannot be fulfilled by basic parameters.

Input terminal functions assignment parameters

A variety of functions can be given to various compatible input terminals by assigning the function numbers for the parameter in the table below.

Title	Function	Adjustment range	Default setting
F108	Always active function selection 1	0-75 (No function)	0
F110	Always-active function selection 2	0-75 (ST)	1
F111	Input terminal selection 1 (F)	0-75 (F)	2
F112	Input terminal selection 2 (R)	0-75 (R)	3
F113	Input terminal selection 3 (RES)	0-75 (RES)	10
F114	Input terminal selection 4 (S1)	0-75 (SS1)	6
F115	Input terminal selection 5 (S2)	0-75 (SS2)	7
F116	Input terminal selection 6 (S3)	0-75 (SS3)	8
F117	Input terminal selection 7 (VIB)	5-17 (SS4)	9
F118	Input terminal selection 8 (VIA)	5-17 (AD2)	5

■ input terminal functions list

Function No.	Function	Function No.	Function
0	No function	38	Frequency command forced switching
1	Standby	39	No.2 Switching of V/F setting
2	Forward run command	40	Combination of No. 5, 39 and 61
3	Reverse run command	41	Frequency UP signal input from external contacts
4	Jog run mode	42	Frequency DOWN signal input from external contacts
5	Acceleration/deceleration 2 pattern selection	43	Frequency UP/DOWN cancellation signal input from external contacts
6	Preset-speed command 1	44	Combination of No. 10 and 43
7	Preset-speed command 2	45	Inversion of No. 11
8	Preset-speed command 3	46	Thermal trip stop signal input from external device
9	Preset-speed command 4	47	Inversion of No. 46
10	Reset command	48	Forced switching from remote to local control
11	Trip stop command from external input device	49	Operation holding (stop of 3-wire operation)
12	Switching of command mode and frequency setting mode	50	Forced switching of command mode and terminal board command
13	DC braking command	51	Display cancellation of the cumulative power amount (kWh)
14	PID control prohibited	52	Forced operation (factory configuration required)
15	Permission of parameter editing	53	Fire-speed control
16	Combination of No. 1 and 10	54	Coast stop (gate off)
17	Combination of No. 1 and 12	55	Inversion of No. 10
18	Combination of No. 2 and 4	56	Combination of No. 1 and 2
19	Combination of No. 3 and 4	57	Combination of No. 1 and 3
20	Combination of No. 2 and 5	58	Acceleration/deceleration 3 selection
21	Combination of No. 3 and 5	59	Combination of No. 2 and 58
22	Combination of No. 2 and 6	60	Combination of No. 3 and 58
23	Combination of No. 3 and 6	61	Forced switching of stall prevention level 2
24	Combination of No. 2 and 7	62	Holding of RY-RC terminal output
25	Combination of No. 3 and 7	63	Holding of OUT-NO terminal output
26	Combination of No. 2 and 8	64	Cancellation (clearing) of operation command from panel
27	Combination of No. 3 and 8	65	PID control integral value clear
28	Combination of No. 2 and 9	66	Combination of No. 1, 2 and 6
29	Combination of No. 3 and 9	67	Combination of No. 1, 3 and 6
30	Combination of No. 2, 5 and 6	68	Combination of No. 1, 2 and 7
31	Combination of No. 3, 5 and 6	69	Combination of No. 1, 3 and 7
32	Combination of No. 2, 5 and 7	70	Combination of No. 1, 2 and 8
33	Combination of No. 3, 5 and 7	71	Combination of No. 1, 3 and 8
34	Combination of No. 2, 5 and 8	72	Combination of No. 1, 2 and 9
35	Combination of No. 3, 5 and 8	73	Combination of No. 1, 3 and 9
36	Combination of No. 2, 5 and 9	74	Combination of No. 1, 2 and 4
37	Combination of No. 3, 5 and 9	75	Combination of No. 1, 3 and 4

Output terminal functions assignment parameters

A variety of functions can be given to various compatible output terminals by assigning the function numbers for the parameter in the table below.

Title	Function	Adjustment range	Default setting
F130	Output terminal selection 1A (RY-RC)	0-255 (LOW)	4
F131	Output terminal selection 2A (OUT-NO)	0-255 (RCH)	6
F132	Output terminal selection 3 (FL)	0-255 (FL)	10
F137	Output terminal selection 1B (RY-RC)	0-255 (always ON)	255
F138	Output terminal selection 2B (OUT-NO)	0-255 (always ON)	255
F139	Output terminal logic selection (RY-RC, OUT-NO)	0, 1, 2, 3	0

■Output terminal functions list

Function No.	Function	Function No.	Function
0/1	Frequency lower limit	30/31	Ready for operation (including ST/RUN)
2/3	Frequency upper limit	32/33	Ready for operation (excluding ST/RUN)
4/5	Low-speed detection signal	34/35	Frequency VIB selection
6/7	completion of acceleration/deceleration signal	36/37	Fault signal (put out also at the time of a retry)
8/9	Designated frequency attainment signal	38/39	Specified data output
10/11	Failure signal (trip output)	40/41	Specified data output 2
12/13	Over-torque detection	42/43	Cumulative operation time alarm
14/15	Start/Stop	44/45	Parts replacement alarm
16/17	OL pre-alarm	46/47	Braking sequence output
18/19	Braking resistor overload pre-alarm	48/49	F terminal input signal
20/21	Over-torque detection pre-alarm	50/51	Inversion of R terminal input signal
22/23	pre-alarm	52/53	Signal in accordance of frequency command
24/25	Small-current detection	54/55	Undervoltage detection
26/27	Significant failure	56-253	Invalid settings, always OFF (ignored)
28/29	Insignificant failure	254	Always OFF
		255	Always ON

Note) For functions 0 to 55, even numbers are true logic and odd numbers are false logic.

Carrier frequency parameters

Set parameters related to deep carrier frequency motor noise.

Title	Function	Adjustment range	Default setting
F300	PWM carrier frequency	2.0-16.0 (kHz)	12.0
F312	Random mode	0: Invalid, 1: Automatic setting	0
F316	Carrier frequency control mode selection	0, 1, 2, 3	1

Frequency command (terminal block) specialized parameters

Set characteristics if input frequency instruction is input from terminal block.

Title	Function	Adjustment range	Default setting
F200	Frequency priority selection	0, 1	0
F201	VIA input point 1 setting	0-100 (%)	0
F202	VIA input point 1 frequency	0-500 (Hz)	0.0
F203	VIA input point 2 setting	0-100 (%)	100
F204	VIA input point 2 frequency	0-500 (Hz)	50 (WP) 60 (WN)
F207	Frequency setting mode selection 2	0-6 (same as F100)	1
F210	VIB input point 1 setting	0-100 (%)	0
F211	VIB input point 1 frequency	0-500 (Hz)	0.0
F212	VIB input point 2 setting	0-100 (%)	100
F213	VIB input point 2 frequency	0-500 (Hz)	50 (WP) 60 (WN)
F470	VIA input bias	—	—
F471	VIA input gain	—	—
F472	VIB input bias	—	—
F473	VIB input gain	—	—

Input/output terminal function parameters

Set specific values for functions such as low-speed/signal output and speed arrival signal output.

Title	Function	Adjustment range	Default setting
F100	Low-speed signal output frequency	0-FH (Hz)	0.0
F101	Speed reach setting frequency	0-FH (Hz)	0.0
F102	Speed reach detection band	0-FH (Hz)	2.5
F109	Analog/logic input function selection (VIA/VIB terminal)	0-4	0
F167	Frequency command agreement detection range	0-FH (Hz)	2.5

Protection parameters

Set protection operations, trip output and alarm output settings etc.

Title	Function	Adjustment range	Default setting
F301	Auto-restart control selection	0, 1, 2, 3, 4	0
F302	Regenerative power ride-through control (Deceleration stop)	0,1, 2	0
F303	Retry selection (number of times)	0: Invalid, 1-10 (times)	0
F305	Overvoltage limit operation (Slowdown stop mode selection)	0, 1, 2, 3	2
F307	Supply voltage correction (limitation of output voltage)	0, 1, 2, 3	3
F601	Stall prevention level 1	10-199 (%/A), 200 (Invalid)	150
F602	Inverter trip retention selection	0, 1	0
F603	Emergency stop selection	0, 1, 2	0
F604	Emergency DC braking time	0-20 (s)	1.0
F605	Output phase failure detection mode selection	0, 1, 2, 3, 4, 5	0
F607	Motor 150%-overload time limit	10-2400 (s)	300
F608	Input phase failure detection mode selection	0: Invalid, 1: Valid	1

Torque up parameters

Set to generate high torque to match load or motor.

Title	Function	Adjustment range	Default setting
F400	Auto-tuning	0, 1, 2	0
F401	Slip frequency gain	0-150 (%)	50
F402	Automatic torque boost value	0-30 (%)	* 1
F415	Motor rated current	0.1-100.0 (A)	* 1
F416	Motor no-load current	10-90 (%)	* 1
F417	Motor rated speed	100-32000 (min-1)	1710
F418	Speed control response coefficient	1-150	40
F419	Speed control stability coefficient	1-100	20

Panel display parameters

Set if changing units displayed or various display methods.

Title	Function	Adjustment range	Default setting
F701	Unit selection	0: %, 1: A (ampere)/V (volt)	0
F702	Free unit selection	0.00: Invalid, 0.01-200.0	0.00
F705	Inclination characteristic of free unit display	0: Negative inclination, 1: Positive inclination	1
F706	Free unit display bias	0-FH (Hz)	0.00
F707	Free step 1 (pressing a panel key once)	0.00: Invalid, 0.01-FH (Hz)	0.00
F708	Free step 2 (panel display)	0: Invalid, 1-255	0
F710	Standard monitor display selection	0,1,2,3,4,5,6,7	0
F719	Canceling of operation command when standby terminal (ST) is turned off	0: Operation command canceled (cleared), 1: Operation command retained	1
F721	Panel stop pattern	0: Slowdown stop, 1: Coast stop	0

* 1: Default values vary depending on the capacity.

Extended parameters Ⅱ

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Parameters for setting higher functions.

DC Braking parameters

Title	Function	Adjustment range	Default setting
F250	DC braking starting frequency	0.0-FH (Hz)	0.0
F251	DC braking current	0-100 (%/A)	50
F252	DC braking time	0.0-20.0 (s)	1.0
F254	Motor shaft fixing control	0: Invalid, 1: Valid (after DC braking)	0

Multi-stage speed run parameters

Title	Function	Adjustment range	Default setting
F287	Preset-speed operation frequency 8	LL-UL (Hz)	0.0
F288	Preset-speed operation frequency 9	LL-UL (Hz)	0.0
F289	Preset-speed operation frequency 10	LL-UL (Hz)	0.0
F290	Preset-speed operation frequency 11	LL-UL (Hz)	0.0
F291	Preset-speed operation frequency 12	LL-UL (Hz)	0.0
F292	Preset-speed operation frequency 13	LL-UL (Hz)	0.0
F293	Preset-speed operation frequency 14	LL-UL (Hz)	0.0
F294	Preset-speed operation frequency 15 (Fire-speed)	LL-UL (Hz)	0.0

Power generation braking parameters

Title	Function	Adjustment range	Default setting
F304	Dynamic braking selection	0: Invalid, 1: Valid	0
F308	Dynamic braking resistance	1.0-1000 (Ω)	* 1
F309	Dynamic braking resistor capacity	0.01-30.00 (kW)	* 1

No. 2 motor parameters

Title	Function	Adjustment range	Default setting
F170	Base frequency 2	25-500 (Hz)	50/60
F171	Base frequency voltage 2	50-330 (V)/50-660 (V)	230/460/575
F172	Torque boost value 2	0-30 (%)	* 1
F173	Motor electronic-thermal protection level 2	10-100 (%/A)	100
F185	Stall prevention level 2	10-199 (%/A), 200: Invalid	150

No. 2 and no. 3 acceleration/deceleration time setting parameters

Title	Function	Adjustment range	Default setting
F500	Acceleration time 2	0.0-3200 (s)	10.0
F501	Deceleration time 2	0.0-3200 (s)	10.0
F502	Acceleration/deceleration 1 pattern	0: Linear, 1: S-pattern 1, 2: S-pattern 2	0
F503	Acceleration/deceleration 2 pattern	0: Linear, 1: S-pattern 1, 2: S-pattern 2	0
F504	Acceleration/deceleration 1, 2, 3 selection	1: Acc/dec 1, 2: Acc/dec 2, 3: Acc/dec 3	1
F505	Acc/dec 1 and 2 switching frequency	0.0-UL (Hz)	0.0
F506	S-pattern lower-limit adjustment amount	0-50 (%)	10
F507	S-pattern upper-limit adjustment amount	0-50 (%)	10
F510	Acceleration time 3	0.0-3200 (s)	10.0
F511	Deceleration time 3	0.0-3200 (s)	10.0
F512	Acceleration/deceleration 3 pattern	0: Linear, 1: S-pattern 1, 2: S-pattern 2	0
F513	Acc/dec 2 and 3 switching frequency	0.0-UL (Hz)	0.0

Jog run parameters

Title	Function	Adjustment range	Default setting
F260	Jog run frequency	F240 - 20.0 (Hz)	5.0
F261	Jog run stopping pattern	0, 1, 2	0
F262	Panel jog run operation mode	0: Invalid, 1: Valid	0

Jump frequency parameters

Title	Function	Adjustment range	Default setting
F270	Jump frequency 1	**0-FH (Hz)**	0.0
F271	Jumping width 1	**0-30 (Hz)**	0.0
F272	Jump frequency 2	**0-FH (Hz)**	0.0
F273	Jumping width 2	**0-30 (Hz)**	0.0
F274	Jump frequency 3	**0-FH (Hz)**	0.0
F275	Jumping width 3	**0-30 (Hz)**	0.0

Forward/reverse/start frequency parameters

Title	Function	Adjustment range	Default setting
F105	Priority selection (Both F-CC and R-CC are ON)	0: Reverse, 1: Slowdown Stop	1
F240	Starting frequency setting	0.5-10 (Hz)	0.5
F241	Operation starting frequency	0-FH (Hz)	0.0
F242	Operation starting frequency hysteresis	0-FH (Hz)	0.0
F256	Time limit for lower-limit frequency operation	0: Invalid, 0.1-600 (s)	0.1
F311	Reverse-run prohibition	0, 1, 2	0

Analog/pulse train output setting parameters

Title	Function	Adjustment range	Default setting
F669	Logic output/pulse train output selection (OUT-NO)	0: Logic output, 1: Pulse train output	0
F676	Pulse train output function selection (OUT-NO)	0-17 (Same as FM5L)	0
F677	Maximum numbers of pulse train	500-1600(PPS)	800
F691	Inclination characteristic of analog output	0: Negative inclination, 1: Positive inclination	1
F692	Meter bias	0-100 (%)	0

PID control setting parameters

Title	Function	Adjustment range	Default setting
F359	PID control waiting time	0-2400 (s)	0
F360	PID control	0: Invalid, 1: Valid	0
F362	Proportional gain	0.01-100.0	0.30
F363	Integral gain	0.01-100.0	0.20
F366	Differential gain	0.00-2.55	0

Communications functions parameters

Title	Function	Adjustment range	Default setting
F800	Communication rate	0, 1, 2, 3, 4	3
F801	Parity	0, 1, 2	1
F802	Inverter number	0-255	0
F803	Communication error trip time	0: Invalid, 1-100 (s)	0
F805	Communication waiting time	0-2 (s)	0.00
F806	Setting of master and slave for communication between inverters	0, 1, 2, 3, 4	0
F811	Communication command point 1 setting	0-100 (%)	0
F812	Communication command point 1 frequency	0.0-500.0 (Hz)	0.0
F813	Communication command point 2 setting	0-100 (%)	100
F814	Communication command point 2 frequency	0.0-500.0 (Hz)	60.0
F829	Selection of communication protocol	0, 1	0
F870	Block write data 1	0-5	0
F871	Block write data 2	0-5	0
F875	Block read data 1	0-10	0
F876	Block read data 2	0-10	0
F877	Block read data 3	0-10	0
F878	Block read data 4	0-10	0
F879	Block read data 5	0-10	0

Detailed protection settings parameters

Title	Function	Adjustment range	Default setting
F396	Stall prevention release mode	0, 1	0
F609	Small current detection current hysteresis	1-20	10
F610	Small current trip/alarm selection	0: Alarm only, 1: Tripping	0
F611	Small current detection current	0-100 (%)	0
F612	Small current detection time	0-255 (s)	0
F613	Detection of output short-circuit during start-up	0, 1, 2, 3	0
F615	Over-torque trip/alarm selection	0: Alarm only, 1: Tripping	0
F616	Over-torque detection level	0-250 (%)	150
F618	Over-torque detection time	0-10 (s)	0.5
F619	Over-torque detection level hysteresis	0-100 (%)	10
F621	Cumulative operation time alarm setting	0-999.9	610
F626	Over-voltage stall protection level	100-150 (%)	*1
F627	Undervoltage trip/alarm selection	0, 1, 2	0
F633	Trip at VIA low level input mode	0: Invalid, 1-100 (%)	0
F634	Annual average ambient temperature (parts replacement alarms)	1, 2, 3, 4, 5, 6	3

Panel settings parameters

Title	Function	Adjustment range	Default setting
F700	Prohibition of parameter change	0: Permitted, 1: Prohibited	0
F730	Prohibition of frequency setting on the operation panel (FC)	0: Permitted, 1: Prohibited	0
F733	Panel operation prohibition (RUN/STOP keys)	0: Permitted, 1: Prohibited	0
F734	Prohibition of panel emergency stop operation	0: Permitted, 1: Prohibited	0
F735	Prohibition of panel reset operation	0: Permitted, 1: Prohibited	0
F736	Prohibition of CN0d / FN0d change during operation	0: Permitted, 1: Prohibited	1

External connection input up/down setting parameters

Title	Function	Adjustment range	Default setting
F264	Input from external contacts- UP response time	0.0-10.0 (s)	0.1
F265	Input from external contacts- UP frequency step width	0.0-FH (Hz)	0.1
F266	Input from external contacts- DOWN response time	0.0-10.0 (s)	0.1
F267	Input from external contacts- DOWN frequency step width	0.0-FH (Hz)	0.1
F268	Initial value of UP/DOWN frequency	LL-UL (Hz)	0.0
F269	Saving of changed value of UP/DOWN frequency	0, 1	1

Torque up detailed setting parameter

Title	Function	Adjustment range	Default setting
F480	Exciting current coefficient	100-130 (%)	100
F485	Stall prevention control coefficient 1	10-250	100
F492	Stall prevention control coefficient 2	50-150	100
F494	Motor adjustment coefficient	0-200	* 1
F495	Maximum voltage adjustment coefficient	90-120 (%)	104
F496	Waveform switching adjustment coefficient	0.1-14.0 (kHz)	0.2
F497	Starting current suppression function	0: Invalid, 1: Valid	0

Others/option settings parameters

Title	Function	Adjustment range	Default setting
F320	Droop gain	0-100 (%)	0
F323	Droop insensitive torque band	0-100 (%)	10
F342	Braking mode selection	0, 1, 2, 3	0
F343	Release frequency	F240 -20.0 (Hz)	3.0
F344	Release time	0.00-2.50 (s)	0.05
F345	Creeping frequency	F240 -20.0 (Hz)	3.0
F346	Creeping time	0.00-2.50 (s)	0.10
F880	Free notes	0-65535	0
F890	Parameter for option 1	0-65535	0
F891	Parameter for option 2	0-65535	0
F892	Parameter for option 3	0-65535	0
F893	Parameter for option 4	0-65535	0
F894	Parameter for option 5	0-65535	0
F910	Step-out detection current level	10-150 (%/A)	100
F911	Step-out detection time	0.0: Invalid, 0.1-25.0 (s)	0.0
F912	High-speed torque adjustment coefficient	0.00-650.0	0.00

* 1: Default values vary depending on the capacity.

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.

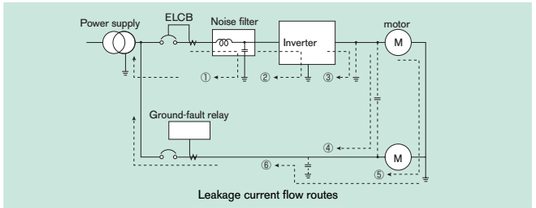
[Effects of leakage current]

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 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) This inverter allows you to decrease the frequency up to 2.0kHz.
If the carrier frequency reduce, the acoustic noise caused by the motor increase.

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

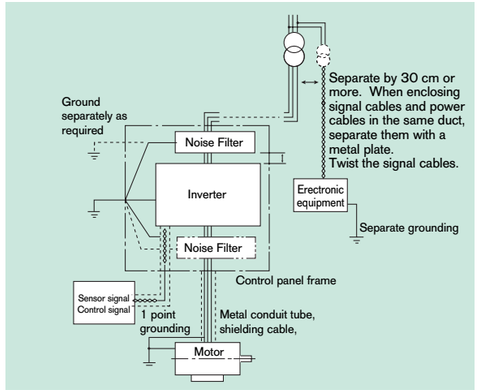
[Noise produced by inverters]
Since this inverter performs PWM control, it produces noise and sometimes affects nearby instrumental devices, electrical and electronic systems, etc. The effects of noise greatly vary with the noise resistance of each individual device, its wiring condition, the distance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

The single-phase 240V and three-phase 500V models have built-in noise filters which significantly reduce noise.



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 reactors

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]

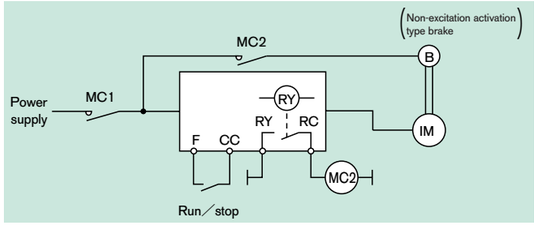
(1) As a rule, if a magnetic contactor is installed between the inverter and the motor, do not turn ON/OFF while running. (If the secondary-side contactor is turned ON/OFF while running, a large current may flow in the inverter, causing inverter damage and failure.)
(2) A magnetic contactor may be installed 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) All control terminals, except FLA, FLB and FLC are electronic circuits. Therefore, input signal must insulate with power 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

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

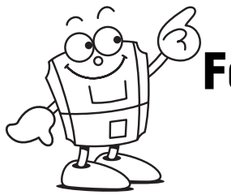
Because single-phase motors are equipped with a centrifugal switch and capacitors for starting, they cannot be driven by an inverter. If only a single-phase, power system is availabls a 3-phase motor can be driven by using a single-phase input interter to convert it into a 3-phase 240V output. (A special inverter and a 3-phase motor are required.)

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 left. Usually, braking motors produce larger noise in low speed ranges.

Note: In the case of the circuit shown on the left, assign the function of detecting low-speed signals to the RY and RC terminals. Make sure the parameter F130 is set to 4 (factory default setting).

For inverter users



For inverter users

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

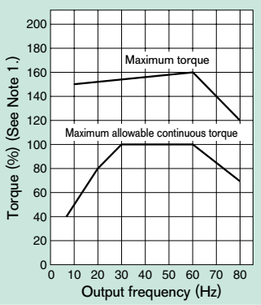
The actual acceleration and deceleration times of a motor driven by an inverter are determined by the torque and moment of inertia2 of the load, and can be calculated by the following equations.
The acceleration and deceleration times of an inverter can be set individually. In any case, however, they 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 (kge.m^2) JL : Moment of inertia of load (kge.m^2) (converted into value on motor shaft) △N : Difference in rotating speed between before and after acc. or dce. (min.$^{-1}$) TL : Load torque (Ne.m) TM : Motor rated torque x 1.2-1.3 (Ne.m) ... V/f control : Motor rated torque x 1.5 (Ne.m) ... Vector operation control TB : Motor rated torque x 0.2 (Ne.m) (When a braking resistor or a braking resistor unit is used: Motor rated torque x 0.8-1.0 (Ne.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.

[An example of V/f control at a base frequency of 60 Hz]



Note 1. 100% of torque refers to the amount of torque that the motor produces when it is running at a 60Hz-synchronized speed. The starting torque is smaller in this case than that required when power is supplied from a commercial power line. So, the characteristics of the machine to be operated need to be taken into consideration.
Note 2. The maximum allowable torque at 50Hz can be calculated approximately by multiplying the maximum allowable torque at a base frequency of 60Hz by 0.8.

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. (200% in sensorless control mode, though this rate varies with the motor characteristics.)
When a larger starting torque is necessary, select an inverter with a larger capacity and examine the possibility of increasing the motor capacity.

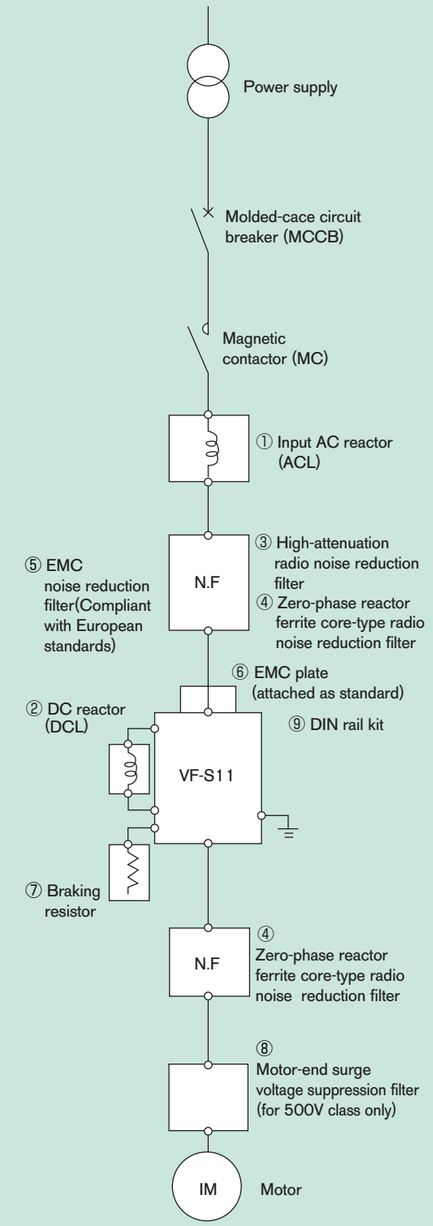
Harmonic current and influence to power supply

Harmonics are defined as sinusoidal waves that is multiple freguency 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 (SC7).
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.

Peripheral devices



No.	Device		Function and purpose	Refer to
①	Input AC reactor (ACL)		Used to improve the input power factor, reduce the harmonics, and suppress external surge on the inverter power source side. Install when the power capacity is 500 kVA or more and 10 times or more than the inverter capacity or when a distorted wave generation source such as a thyristor unit or a large-capacity inverter is connected in the same distribution system. Reactor type / Effect: Improvement of power factor; Suppression of harmonic (240V-4.0kW or less; Other model); Suppression of external surge Input AC reactor: ○ ○ ○ ○ DC reactor: ○ Large ○ ○ Large × ○Large : Large effective. ○: effective. ×: ineffective	P.17
②	DC reactor (DCL)		Generally, a DC reactor improves the power factor more than a DC reactor. When the inverter is used along with equipment for which a high degree of reliability is required, an input AC reactor capable of suppressing external surges should be used along with a DC reactor.	
③	Radio noise reduction filter	High-attenuation radio noise filter (NF type)	These types of filters are not necessary because all single-phase 240V or 3-phase 500V models have a built-in EMI noise filter, conforming to Class A, as standard. But install these filters if necessarily of noise reduction move and more. • Effective to prevent interference in audio equipment used near the inverter. • Install on the input side of the inverter. • Provided with wide-range attenuation characteristics from AM radio bands to near 10MHz. • Use when equipment readily affected by noise is installed in the peripheral area.	P.18
④		Zero-phase reactor ferrite core-type	• Effective to prevent interference in audio equipment used near the inverter. • Effective in noise reduction on both input and output sides of the inverter. • Provided with attenuation characteristics of several dB in frequencies from AM radio bands to 10MHz. • For noise countermeasures, insert on the secondary side of the inverter.	P.18
⑤		EMC noise filter (Compliant with European standards)	A high-attenuation compact EMI noise filter that can be Foot-mounted and Side-mounted. With this filter on, the inverter complies with the following standards. Three-phase 240V model: EN55011: Class A, Group 1 (Motor connecting cable length: 5 m or less) And EN55011: Class B, Group 1 (Motor connecting cable length: 1 m or less) Single-phase 240V, three-phase 500V models: EN55011: Class B, Group 1 (Motor connecting cable length: 20 m or less) And EN55011: Class A, Group 1 (Motor connecting cable length: 50 m or less)	P.20
⑥	EMC plate (attached as standard)		A steel plate used to connect shielded earth wires from inverter's power cables or to connect earth wires from external devices.	P.9
⑦	Braking resistor		Use when rapid deceleration or stop is frequently required or when it is desired to reduce the deceleration time with large load. This resistor consumes regenerative energy during power generation braking. • Braking resistor - With (resistor + protective thermal relay) built in.	P.18
⑧	Motor-end surge voltage suppression filter (for 500V class only)		Use an insulation-reinforced motor or install the surge voltage restraint filter to prevent degrading motor insulation caused by surge voltage generation depending on cable length and wiring method, or use of a 400V class motor driven with an inverter.	P.19
⑨	DIN rail kit		Available for the 2.2kW (or 1.5kW) or less. (Model: DIN003Z, DIN005Z)	P.20
⑩	Parameter writer		Use this unit for batch read, batch copy, and batch writing of setting parameters. (Model: PWU001Z)	P.19
⑪	Extension panel		Extended operation panel kit provided with LED indication section, RUN/STOP key, UP/DOWN key, Monitor key, and Enter key. (Model: RKP001Z, RKP002Z)	
⑫	RS232C communication conversion cable		This unit allows you to connect a personal computer to inverters for data communications. (Model: RS20035)	
⑬	RS485 communication conversion unit		This unit allows you to connect a personal computer to multiple inverters for data transfer. (Models: RS4001Z, RS4002Z)	P.19
⑭	USB communication 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. (Type: USB 001Z)	-
⑮	Internal communication card		These boards allow you to connect a upper controller to multiple inverters for data transfer. Removable terminal board is replaced by these boards. RS485, DeviceNet and LonWorks are prepared. (Models: RS4003Z, DEV001Z, LIU005Z)	P.20
⑯	Remote panel		This panel includes a frequency meter, a frequency regulator and RUN/STOP (forward/reverse run)switches. (Model: CBVR-7B1)	P.19
⑰	Conduit pipe attachment kit		Attachment kit used for conformance to NEMA TYPE1.	-
⑱	Communication cable for totally enclosed box type		This cable allows you to connect a personal computer for the totally enclosed box type while retaining the protective construction of the IP54 (or IP55). (Type: CAB 0031)	-

Devices

External dimensions and connections

Input AC reactor (ACL)

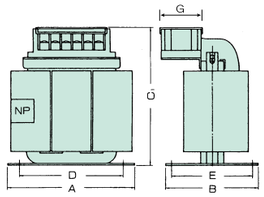


Fig. A

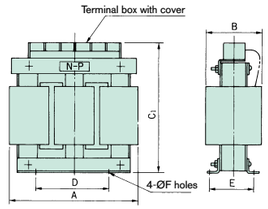
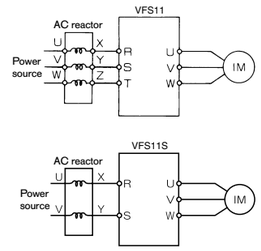


Fig. B



Model	Rating	Inverter type	Dimensions (mm)							Diagram	Terminals	Approx. weight (kg)
			A	B	C	D	E	F	G			
PFLS2002S	1-phase 240V -2.0A-50/60Hz	VFS11S-2002PL (Note)	80	55	115	63	45	5	45	A	Harmonica terminal M3.5	0.85
PFL2005S	3-phase 240V -5.5A-50/60Hz	VFS11-2004～2007PM VFS11S-2004PL	105	65	115	90	55	5	40		Harmonica terminal M3.5	1.2
PFL2011S	3-phase 240V -11A-50/60Hz	VFS11-2015、2022PM VFS11S-2007PL	130	70	140	115	60	5	50		Harmonica terminal M4	2.3
PFL2018S	3-phase 240V -18A-50/60Hz	VFS11-2037PM VFS11S-2015、2022PL	130	70	140	115	60	5	50		Harmonica terminal M4	2.5
PFL2025S	3-phase 240V -25A-50/60Hz	VFS11-2055PM	125	100	130	50	83	7	—		Harmonica terminal M4	2.6
PFL2050S	3-phase 240V -50A-50/60Hz	VFS11-2075、2110PM	155	115	140	50	95	7	—	B	Harmonica terminal M6	3.4
PFL2100S	3-phase 240V -100A-50/60Hz	VFS11-2150PM	230	150	210	60	90	8	—		Harmonica terminal M8	8.2
PFL4012S	3-phase 500V -12.5A-50/60Hz	VFS11-4004～4037PL	125	95	130	50	79	7	—		Harmonica terminal M4	2.3
PFL4025S	3-phase 500V -25A-50/60Hz	VFS11-4055～4110PL	155	110	155	50	94	7	—	B		4.9
PFL4050S	3-phase 500V -50A-50/60Hz	VFS11-4150PL	155	140	165	50	112	7	—		Harmonica terminal M6	6.6

Note: PFLS2002S has 4 terminals.

DC reactor (DCL)

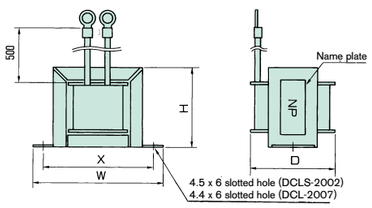


Fig. A

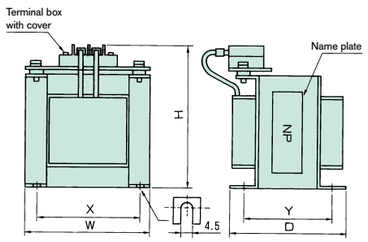


Fig. B

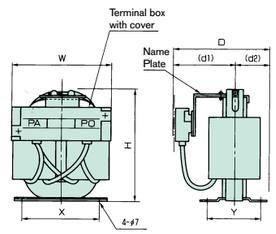
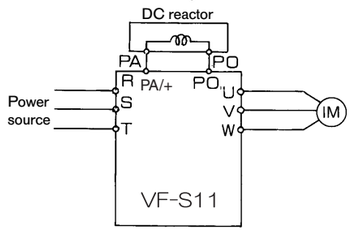


Fig. C



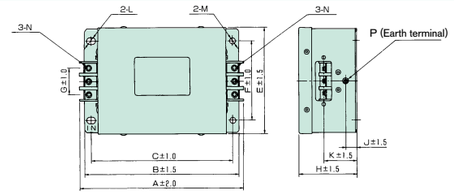
Model	Rated current (A)	Inverter type	Dimensions (mm)							Diagram	Terminals	Approx. weight (kg)
			W	H	D	X	Y	d1	d2			
DCLS-2002	2.5	VFS11S-2002PL	79	50	44	66	—	—	—	A	V1.25-3.5	0.6
DCL-2007	7	VFS11-2004～2007PM VFS11S-2004PL	92	65	70	82	—	—	—		V2-3.5	1.2
DCL-2022	14	VFS11-2015、2022PM VFS11S-2007PL	86	110	80	71	64	—	—	B	M4	2.2
DCL-2037	22.5	VFS11-2037PM VFS11S-2015、2022PL	86	110	85	71	70	—	—		M4	2.5
DCL-2055	38	VFS11-2055PM	75	130	140	50	85	85	55		M5	1.9
DCL-2110	75	VFS11-2075～2110PM	100	150	150	65	85	95	55	C	M6	2.4
DCL-2220	150	VFS11-2150PM	117	160	190	90	90	130	60		M8	4.3
DCL-2007	7	VFS11-4004～4015PL (Note)	92	65	70	82	—	—	—	A	V2-3.5	1.2
DCL-2022	14	VFS11-4022、4037PL (Note)	86	110	80	71	64	—	—	B	M4	2.2
DCL-4110	38	VFS11-4055～4110PL	95	150	165	70	90	105	60	C	M5	3.0
DCL-4220	75	VFS11-4150PL	105	160	185	80	100	130	65		M8	3.7

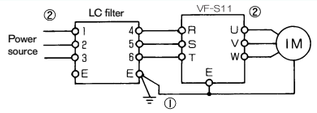
Note: VFS11-4004PL-4037PL are used DC reactor for 240V class.

Devices

External dimensions and connections

High-attenuation radio noise filter (NF type)



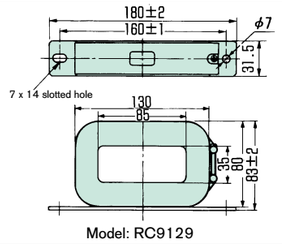


Note:(1) Noise filter should be connected to the inverter main circuit primaryside.
(2) Output cable should be kept away from the input cable.

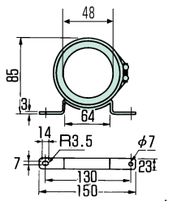
Reactor model	Rated current (A)	Inverter type	Dimensions (mm)											Approx. weight (kg)
			A	B	C	E	F	G	H	J	K	M	N	P	
NF3005A-MJ	5	VFS11-2004PM～VFS11-2007PM	174.5	160	145	110	80	32	70	20	45	Ø5.5	M4	M4	1.0
NF3015A-MJ	15	VFS11-2015PM, VFS11-2022PM													1.6
NF3020A-MJ	20	VFS11-2037PM													
NF3030A-MJ	30	VFS11-2055PM													
NF3040A-MJ	40	VFS11-2075PM	217.5	200	185	120	90	44	90	30	43	Ø6.5	M5	M4	2.7
NF3050A-MJ	50	VFS11-2110PM	267.5	250	235	170	140				60		M6		4.6
NF3080A-MJ	80	VFS11-2150PM	294.5	280	260	170	150	37	100		65			M6	7.0
NF3010C-MJ	10	VFS11-4004～4037PL	174.5	160	145	110	80	32	70	20	45	Ø5.5	M4	M4	1.4
NF3015C-MJ	15	VFS11-4055PL													1.6
NF3020C-MJ	20	VFS11-4075PL													
NF3030C-MJ	30	VFS11-4110PL	177.5	200	185	120	90	44			43		M5		2.7
NF3040C-MJ	40	VFS11-4150PL	217.5												

Note: Every inverter with a model number ending in-PL comes standard with a built-in noise filter almost equal in size and performance to this filter.

Zero-phase reactor ferrite core-type radio noise filter

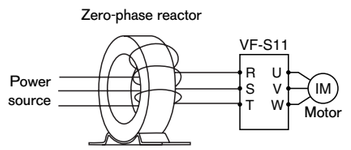


Model: RC9129



Model: RC5078

Unit: mm



Input or output cable sould be coiled over 4-times. RC5078 is recommended for the models 4.0kW or less.

Braking resistor

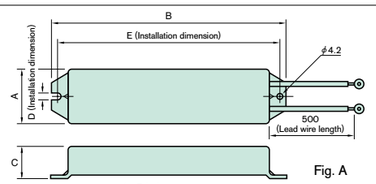


Fig. A

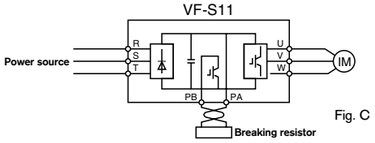


Fig. C

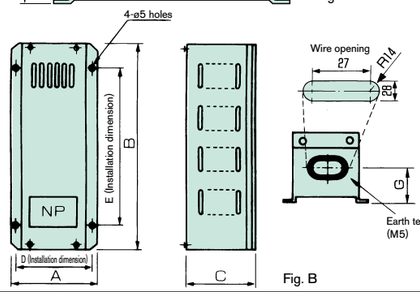


Fig. B

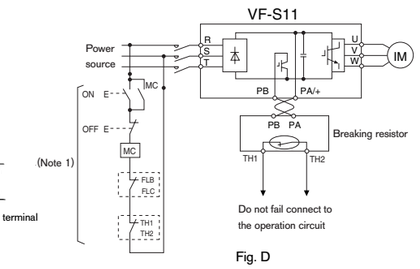


Fig. D

Model	Rating	Inverter type	Dimensions (mm)						External dimensions and connections	Approx. weight (kg)
			A	B	C	D	E	G		
PBR-2007	120W-200Ω	VFS11-2004～2007PM VFS11S-2002～2007PL	42	182	20	4.2	172	—	A and C	0.28
PBR-2022	120W-75Ω	VFS11-2015, 2022PM VFS11S-2015, 2022PL								
PBR-2037	120W-40Ω	VFS11-2037PM								
PBR3-2055	240W-20Ω(40Ω×2P)	VFS11-2055PM	120	320	115	110	230	50	B and D	4
PBR3-2075	440W-15Ω(30Ω×2P)	VFS11-2075PM		350	190			150		4.5
PBR3-2110	660W-10Ω(30Ω×3P)	VFS11-2110PM								5
PBR3-2150	880W-7.5Ω(30Ω×4P)	VFS11-2150PM								5.5
PBR-2007	120W-200Ω	VFS11-4004～4022PL	42	182	20	4.2	172	—	A and C	0.28
PBR-4037	120W-160Ω	VFS11-4037PL								
PBR3-4055	240W-80Ω(160Ω×2P)	VFS11-4055PL	120	320	115	110	230	50	B and D	4
PBR3-4075	440W-60Ω(120Ω×2P)	VFS11-4075PL		350	190			150		4.5
PBR3-4110	660W-40Ω(120Ω×3P)	VFS11-4110PL								5
PBR3-4150	880W-30Ω(120Ω×4P)	VFS11-4150PL								5.5

Note1: Use the same type of braking resistor of VFS11-2002 ~ 2007PM for those of VFS11-4004 ~ 4022PL.
Note2: The data in Rating above refer to the resultant resistance capacities (watts) and resultant re-sistance values (_).
The numeric values inside parentheses refer to the internal compositions of resistors.

Devices

External dimensions and connections

Motor-end surge voltage suppression filter (for 500V class only)

Motor-end surge voltage suppression filter I	Invertor type	Dimensions (mm)			Terminal screw	Grounding screw	Approx. weight (kg)
		Width	Hight	Depth			
MSF-4015Z	VFS11-4004~4015PL	310	300	255	M4	M4	12
MSF-4037Z	VFS11-4022, 4037PL	310	300	255	M4	M4	20
MSF-4075Z	VFS11-4055, 4075PL	310	350	315	M5	M5	30
MSF-4150Z	VFS11-4110, 4150PL	330	400	350	M5	M5	40

Parameter writer

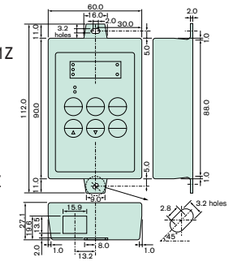
Extension panel

Parameter writer

Parameter writer type: PWU001Z
Cable type (1m): CAB0011
(3m): CAB0013
(5m): CAB0015

Extension panel

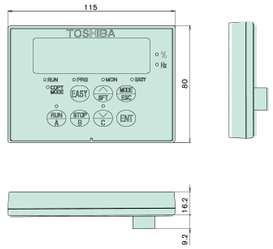
Extension panel type: RKP001Z
Cable type (1m): CAB0011
(3m): CAB0013
(5m): CAB0015



Extension panel

Extension panel type: RKP002Z
Cable type (1m): CAB0011
(3m): CAB0013
(5m): CAB0015

Note: This panel has the parameter copy function.

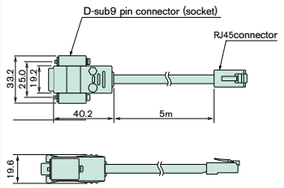


RS232C communication conversion cable

RS485 communication conversion unit

RS232C communication converter cable

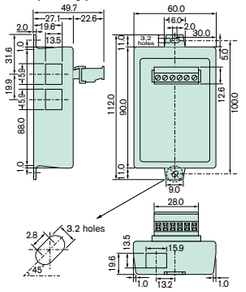
Type: RS20035



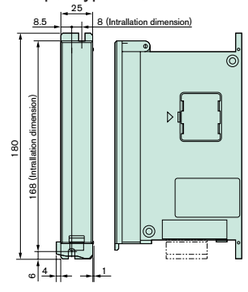
Note: For information about the software program that enables you to set parameters using a personal computer.

RS485 communication converter unit

·2-port type : RS4001Z

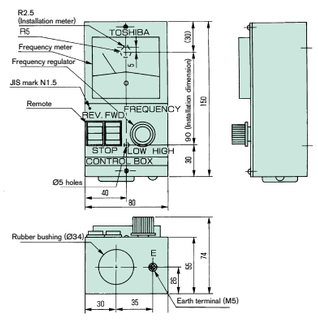


·8-port type : RS4002Z

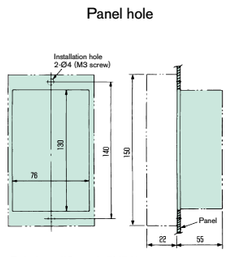


Cable type(1m): CAB0011, (3m): CAB0013, (5m): CAB0015

Remote panel CBVR-7B1

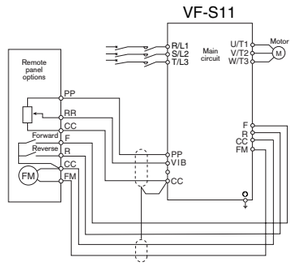


Panel hole



Painting: JIS mark 5Y7/1
(Panel front N1.5)
Weight: 0.7kg

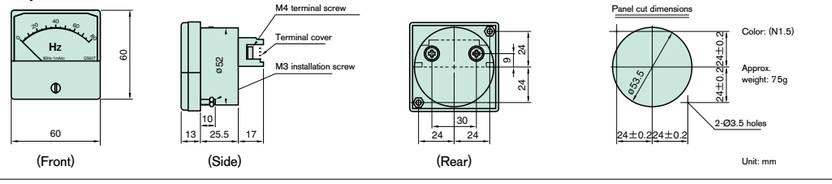
VF-S11



Note: The wire length should be 30m or less the inverter and the remote panel.

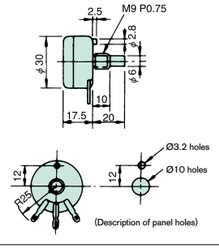
Frequency meter QS60T

Frequency meter <QS-60T (80Hz-1mAdc)>

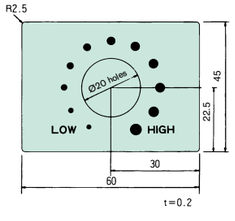


FRH kit

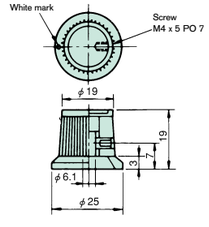
Frequency setting resistor <RV30YN-20S-B302>



Frequency setting panel



Frequency setting knob <K-3>



Devices

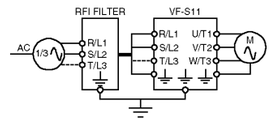
External dimensions and connections

EMC noise reduction filter (Compliant with European standards)

Foot mount installation

Side mount installation

How to wire



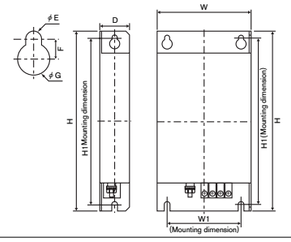
A high-attenuation compact EMI noise filter that can be Foot-mounted and Side-mounted. With this filter on, the inverter complies with the folllwing standards.

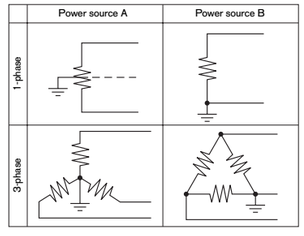
Three-phase 240V model:
IEC61800-3:Categoly C2(Motor connecting cable length: 5 m or less)
And IEC61800-3:Categoly C1(Motor connecting cable length: 1 m or less)

Single-phase 240V, three-phase 500V models:
IEC61800-3:Categoly C2(Motor connecting cable length: 20 m or less)
And IEC61800-3:Categoly C1(Motor connecting cable length: 50 m or less)

Type	Rated current	Inverter type	Dimensions (mm)								Approx. weight (kg)	Approx.leakage current(mA) Note 1)	
			W	H	D	W1	H1	E	F	G		Power source A	Power source B
EMFS11S-2009AZ	9	VFS11S-2002～2007PL	72	195	37	52	180	5	8.5	10	0.5	3	47
EMFS11-2007AZ	7	VFS11-2004～2007PM	72	195	37	52	180	5	8.5	10	0.6	7	45
EMFS11S-2016BZ	16	VFS11S-2015PL	105	195	35	85	180	5	8.5	10		3	47
EMFS11-4015BZ	15	VFS11-2015、2022PM	105	195	42	85	180	5	8.5	10	0.9	8	48
		VFS11-4004～4015PL										15	96
EMFS11S-2022CZ	22	VFS11S-2022PL	140	235	35	120	215	5	8.5	10	0.8	6	103
EMFS11-4025CZ	25	VFS11-2037PM	140	235	50	120	215	5	8.5	10	1.3	20	125
		VFS11-4022、4037PL										40	249
EMFS11-4047DZ	47	VFS11-2055、2075PM	180	305	60	140	285	5.5	9.5	11	2.6	23	147
		VFS11-4055、4075PL										47	293
EMFS11-2083EZ	83	VFS11-2110、2150PM	245	395	80	205	375	5.5	9.5	11	5.0	17	104
EMFS11-4049EZ	49	VFS11-4110、4150PL	245	395	60	205	375	5.5	9.5	11	3.8	47	293

Note 1. These values are referential ones of single piece of RFI filter. For 240V class, 60Hz/200V power source. For 500V class, 60Hz/400V power source. For power system A and B, refer to table below.
Select an earth leakage breaker with consideration of leakage current above and leakage current from the inverter unit.





Internal communication card

RS485

Type:RS4003Z

DeviceNet

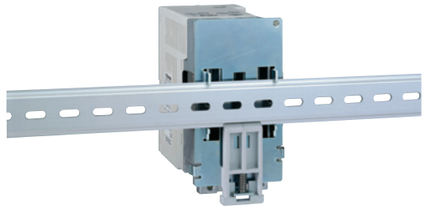
Type:DEV001Z

LonWorks

Type:LIU005Z

DIN rail kit

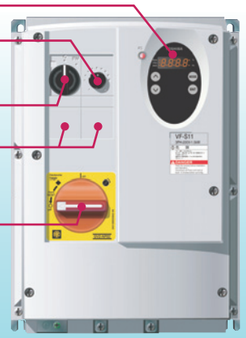
Type	Inverter type	Approx. weight (kg)
DIN003Z	VFS11S-2002PL～2007PL VFS11-2004PM～2007PM	0.2
DIN005Z	VFS11S-2015PL VFS11-2015PM、2022PM VFS11-4004PL～4015PL VFS11-6007P、6015P	0.3



Totally enclosed box type

Possible to bring into compliance with IP55 specifications!

- Operation panel
- Frequency setting potentiometer
- Operation switch
- Slots for additional switches (Two)
- Power switch for motor circuit breaker



<UL compliant type>

■Line-up

Input voltage class	Applicable motor (kW)									
	0.2	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15
1-phase 240V	IP54									
3-phase 240V		IP54								
3-phase 500V			IP54				IP00			

- **Totally enclosed structure compliant with IP54**
- **Built-in noise filter**
- **Equipped with all control devices as standard (Control devices compliant with IP55 specifications / All-in-one)**
- **Built-in motor circuit breaker**
- **Minimum wiring**
- **Cooling structure: Self-cooling type**

■External dimensions

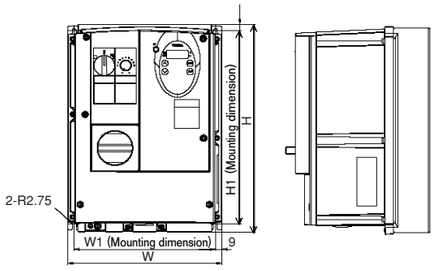


Fig.F

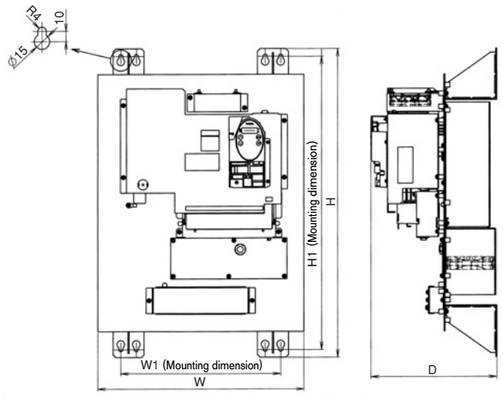


Fig.G

■External dimensions

Input voltage class	Aplicable motor (kW)	Inverter type	Dimensions (mm) W	H	D	W1	H1	D2	Cabling hole	Drawing	Approx.weight (kg)
3ph-240V	0.4	VFS11-2004PME	210	240	163.3	192	218	13.7	ϕ19x3 ϕ21x1	F	3.9
	0.75	VFS11-2007PME									
	1.5	VFS11-2015PME	215	297	192.3	197	277	13.7	ϕ19x1 ϕ23x3	F	5.9
	2.2	VFS11-2022PME									
	4.0	VFS11-2037PME	230	340	208.3	212	320	13.7			7.6
3ph-500V	0.75	VFS11-4007PLE	215	297	192.3	197	277	13.7	ϕ19x1 ϕ23x3	F	6.1
	1.5	VFS11-4015PLE									
	2.2	VFS11-4022PLE	230	340	208.3	212	320	13.7			8.0
	4.0	VFS11-4037PLE									
	5.5	VFS11-4055PLU	400	600	243	310	570	—	—	G	11.8
	7.5	VFS11-4075PLU									
	11	VFS11-4110PLU	450	700	267	340	670	—	—	G	17.0
	15	VFS11-4150PLU									
1ph-240V	0.2	VFS11S-2002PLE	210	240	163.3	192	218	13.7	ϕ19x3 ϕ21x1	F	4.0
	0.4	VFS11S-2004PLE									
	0.75	VFS11S-2007PLE									
	1.5	VFS11S-2015PLE	215	297	192.3	197	277	13.7	ϕ19x1 ϕ23x3	F	6.0
	2.2	VFS11S-2022PLE	230	340	208.3	212	320	13.7			7.6

■Standard specifications

* Other specifications are the same as those of the standard type. See common specification on page 6.

Item			Specification									
Input voltage class			1ph-240V input class / 3ph-240V input class / 3ph-500V input class						3ph-500V input class			
Applicable motor (kW)			0.2	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15
Model	Input voltage class	Type	Form						Form			
	1ph-240V class	VFS11S-	2002PLE	2004PLE	2007PLE	2015PLE	2022PLE	–	–	–	–	–
	3ph-240V class	VFS11-	–	2004PME	2007PME	2015PLME	2022PME	2037PME	–	–	–	–
	3ph-500V class	VFS11-	–	–	4007PLE	4015PLE	4022PLE	4037PLE	4055PLU	4075PLU	4110PLU	4150PLU
Rating	Capacity(kVA) Note 1)		0.6	1.3	1.8	3.0/3.0/3.1	4.2	6.7/7.2	11	13	21	25
	Rated output current (A) Note 2)	1ph-240V class	1.5 (1.5)	3.3 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)	–	–	–	–	–
		3ph-240V class	–	3.3 (3.3)	4.8 (4.4)	8.0 (7.9)	11.0 (10.0)	17.5 (16.4)	–	–	–	–
		3ph-500V class	–	–	2.3 (2.1)	4.1 (3.7)	5.5 (5.0)	9.5 (8.6)	14.3 (13.0)	17.0 (17.0)	27.7 (25.0)	33 (30)
	Output voltage Note 3)		240V class : 3ph-200V to 240V, 500V class : 3ph-380V to 500V						3ph -380V to 500V			
	Overload current rating		150% -60 seconds, 200% -0.5 second						150% -60 seconds, 200% -0.5 second			
Power supply	Voltage-frequency		240V class : 1ph/3ph-200V to 240V -50/60Hz, 500V class : 3ph-380V to 500V -50/60Hz						3ph-380V to 500V -50/60Hz			
	Allowable fluctuation		Voltage +10%, -15% Note4), frequency ±5%						Voltage +10%, -15% Note4), frequency ±5%			
	Protective method		IP54 Totally enclosed type (JEM1030) / Possible to bring into compliance with IP55						IP00 Open type (JEM1030) / Cooling fin mountable out side			
	Cooling method		Self-cooling						Forced air-cooling			
	Color		Munsel 5Y-8/0.5						Not painted			
	Built-in filter		1ph and 500V class : High-attenuation EMI filter, 3ph-240V class : Basic filter						High-attenuation EMI filter			
Environments	Service environments Note 6)		Indoor, altitude 1000m or less. Place not exposed to direct sunlight and free from of corrosive and explosive gases.									
	Ambient temperature		-10 to +40°C						-10 to +40°C			
	Storage temperature		-25 to +70°C						-25 to +70°C			
	Relative humidity		20 to 93%						20 to 93%			
	Vibration		5.9 m/s² or less (10 to 55Hz)						5.9 m/s² or less (10 to 55Hz)			

Note 1: Capacity is calculated at 220V for the 240V class and at 440V for the 500V class.
Note 2: Indicates rated output current setting when the PWM carrier frequency (Parameter F300) is 4kHz or less. When exceeding 4kHz , the rated output current setting is indicated in the parenthesis.
Note 3: The maximum output voltage is equal to the input supply voltage.
Note 4: ±10% when the inverter is operated continuously (under a load of 100%).
Note 5: The factory default settings of the following parameters are different from those of the standard type.
The factory default settings of all other parameters are the same as those of the standard type.
For parameter settings, see the tables of parameters on page 10. periodically.

Title	Function	VF-S11 Standard type	VF-S11 totally enclosed type
CMOd	Command mode selection	1	0
FMOd	Frequency setting mode selection	0	2

Note 6: Installation environment
· Install the inverter in a well-ventilated place and mount it on a flat metal plate in portrait orientation. Install the inverter so that it is not inclined more than ±10° from the vertical.
· Leave a space of 10 cm or more on the upper and lower sides of the inverter, and a space of 5 cm or more on each side.
· The inverter has a cooling fan to circulate air in it. The cooling fan has a useful life of approximately 30,000 hours (2 to 3 years when operated continuously), so it needs to be replaced periodically.

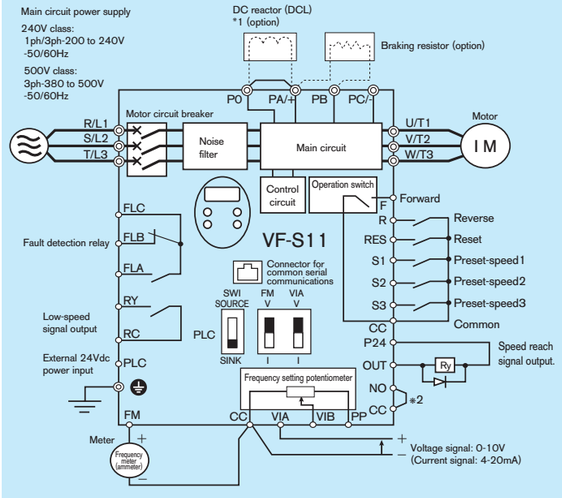
■Compliance with IP55

IP54-compliant structures refer to structures that protect the contents from dust and harmful effects of water that drops from every direction. The inverter can be brought into compliance with IP55 specifications by making the wiring port watertight. (IP55-compliant structures refer to structures that protect the contents from dust and harmful effects of water that comes in a jet from every direction.)

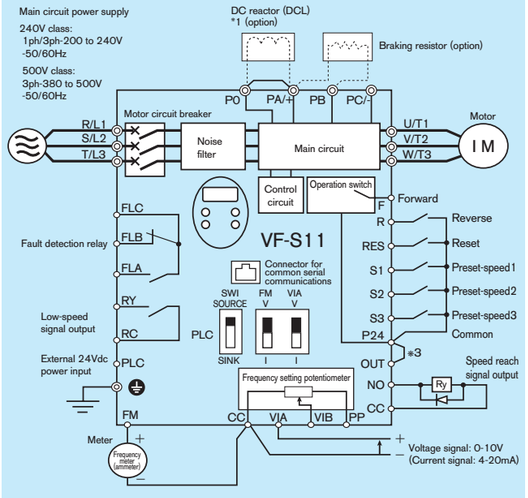
Note) 500V class 5.5 to 15kW range are IP00 type.

■Standard connection diagram

Sink (Negative) logic : Common = CC



Source (Positive) logic : Common = P24



*1: The inverter comes with the PO and PA (positive) terminals short-circuited with a shorting bar. When connecting a DC reactor (DCL), detach the shorting bar.
*2: When using the OUT output terminal in a sink logic configuration, do not short-circuit the NO and CC terminals.
*3: When using the OUT output terminal in a sink logic configuration, do not short-circuit the P24 and OUT terminals.

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.

For further information, please contact your nearest Toshiba Representative or International Operations-Producer Goods.
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