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.

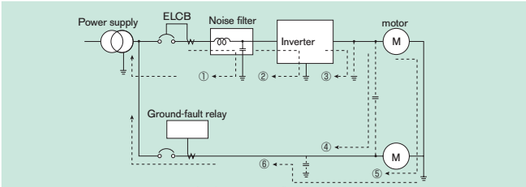
【Effects of leakage current】

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

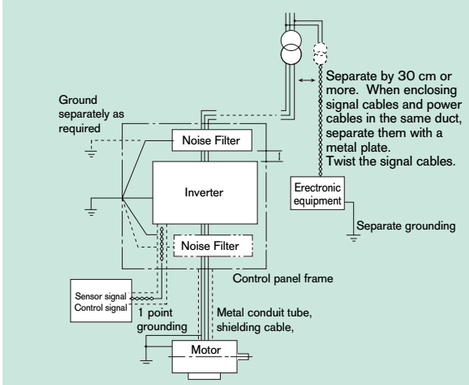
[Noise produced by inverters]
Since this inverter performs PWM control, it produces noise and sometimes affects nearby instrumental devices, electrical and electronic systems, etc. The effects of noise greatly vary with the noise resistance of each individual device, its wiring condition, the distance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

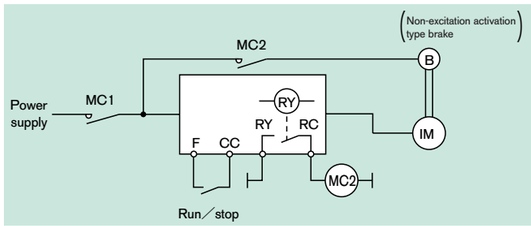
(1) As a rule, if a magnetic contactor is installed between the inverter and the motor, do not turn ON/OFF while running. (If the secondary-side contactor is turned ON/OFF while running, a large current may flow in the inverter, causing inverter damage and failure.)
(2) A magnetic contactor may be installed 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

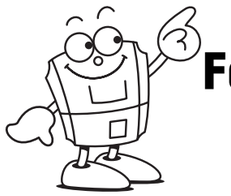
Because single-phase motors are equipped with a centrifugal switch and capacitors for starting, they cannot be driven by an inverter. If only a single-phase, power system is availabls a 3-phase motor can be driven by using a single-phase input interter to convert it into a 3-phase 240V output. (A special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

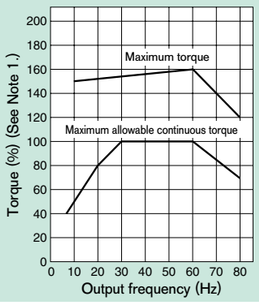
The actual acceleration and deceleration times of a motor driven by an inverter are determined by the torque and moment of inertia2 of the load, and can be calculated by the following equations.
The acceleration and deceleration times of an inverter can be set individually. In any case, however, they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

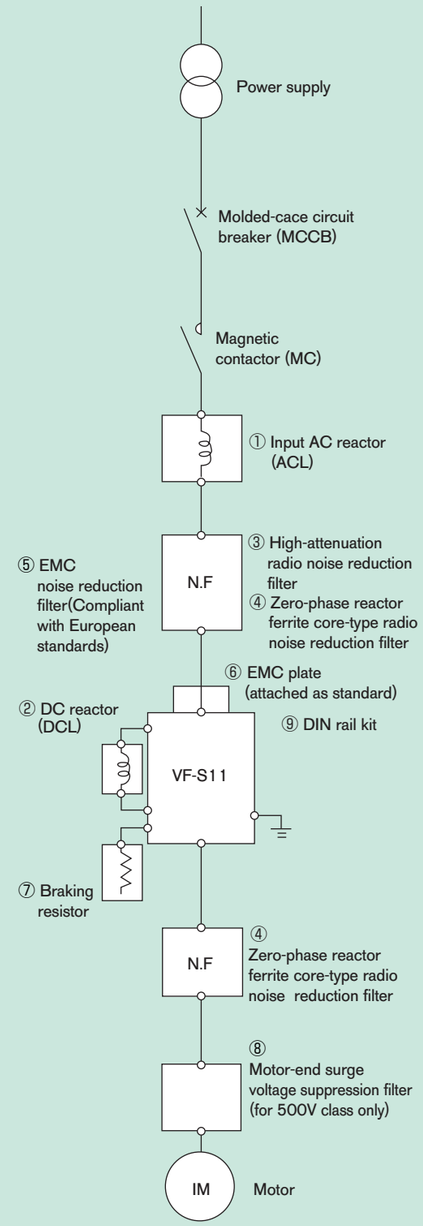
Harmonic current and influence to power supply

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. Effect: Reactor type / 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	Radio noise reduction filter: 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	Radio noise reduction filter: 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)

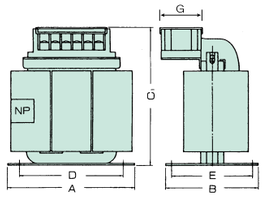


Fig. A

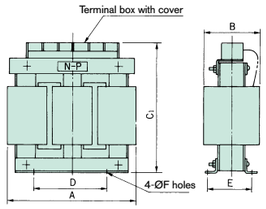
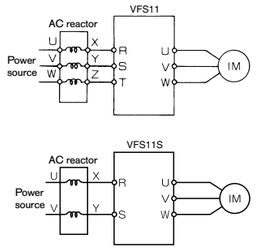


Fig. B



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	—	B	Harmonica terminal M4	2.3
PFL4025S	3-phase 500V -25A-50/60Hz	VFS11-4055～4110PL	155	110	155	50	94	7	—			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)

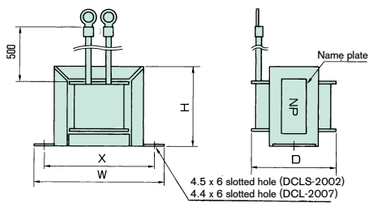


Fig. A

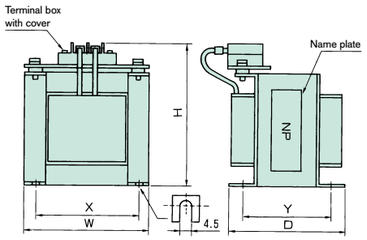


Fig. B

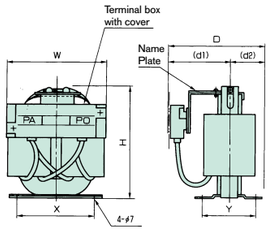
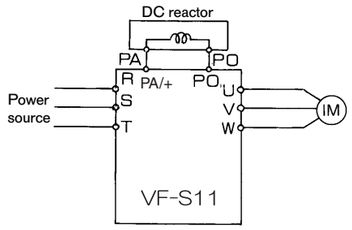


Fig. C

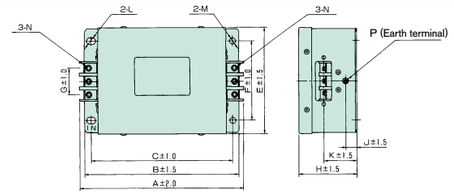


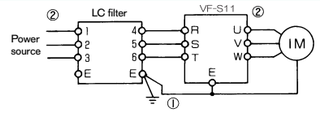
Model	Rated current (A)	Inverter type	Dimensions (mm)							Diagram	Terminals	Approx. weight (kg)
			W	H	D	X	Y	d1	d2			
DCLS-2002	2.5	VFS11S-2002PL	79	50	44	66	—	—	—	A	V1.25-3.5	0.6
DCL-2007	7	VFS11-2004～2007PM VFS11S-2004PL	92	65	70	82	—	—	—		V2-3.5	1.2
DCL-2022	14	VFS11-2015、2022PM VFS11S-2007PL	86	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	C	M5	1.9
DCL-2110	75	VFS11-2075～2110PM	100	150	150	65	85	95	55		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)



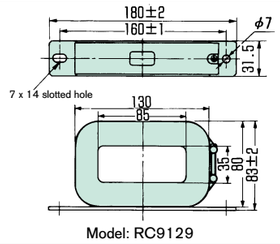


Note:(1) Noise filter should be connected to the inverter main circuit primaryside.
(2) Output cable should be kept away from the input cable.

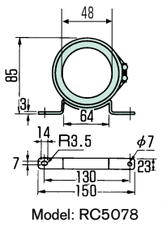
Reactor model	Rated current (A)	Inverter type	Dimensions (mm)												Approx. weight (kg)
			A	B	C	E	F	G	H	J	K	M	N	P	
NF3005A-MJ	5	VFS11-2004PM～VFS11-2007PM	174.5	160	145	110	80	32	70	20	45	Ø5.5	M4	M4	1.0
NF3015A-MJ	15	VFS11-2015PM, VFS11-2022PM													1.6
NF3020A-MJ	20	VFS11-2037PM													
NF3030A-MJ	30	VFS11-2055PM													
NF3040A-MJ	40	VFS11-2075PM	217.5	200	185	120	90	44			43		M5		2.7
NF3050A-MJ	50	VFS11-2110PM	267.5	250	235	170	140		90	30	60	Ø6.5	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				
NF3040C-MJ	40	VFS11-4150PL	217.5										M5		2.7

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

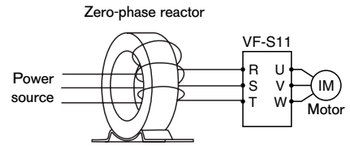


Model: RC9129



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

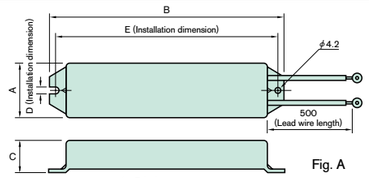


Fig. A

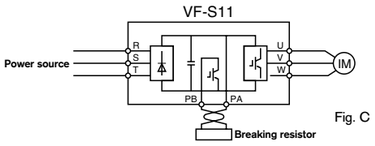


Fig. C

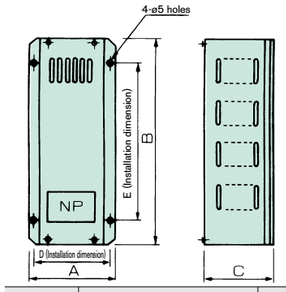
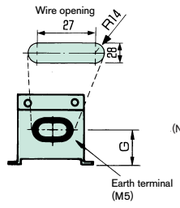


Fig. B



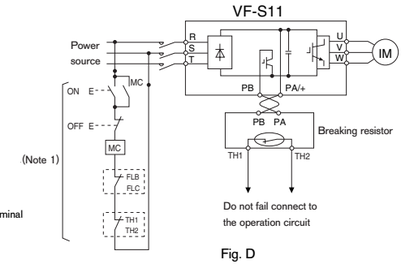


Fig. D

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 (Ω).
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) Width	Hight	Depth	Terminal screw	Grounding screw	Approx. weight (kg)
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

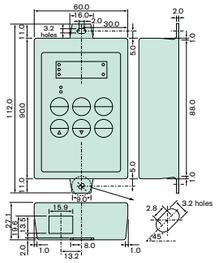
Parameter writer / Extension panel

Parameter writer

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

Extension panel

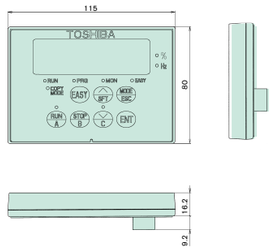
Extension panel type: RKP001Z
Cable type (1m): CAB0011
(3m): CAB0013
(5m): CAB0015



Extension panel

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

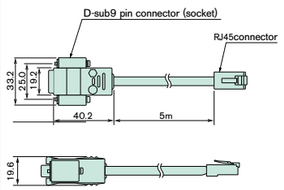
Note: This panel has the parameter copy function.



RS232C communication conversion cable / RS485 communication conversion unit

RS232C communication converter cable

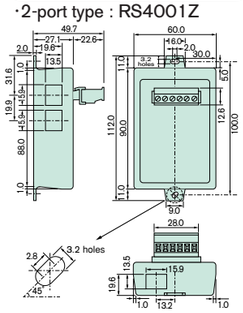
Type: RS20035



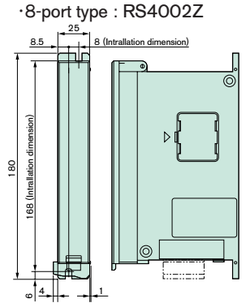
Note: For information about the software program that enables you to set parameters using a personal computer.

RS485 communication converter unit

·2-port type : RS4001Z

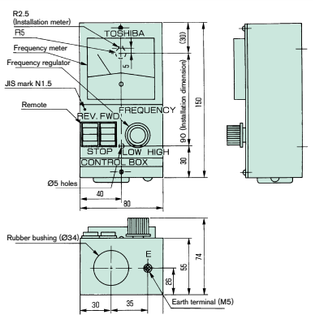


·8-port type : RS4002Z

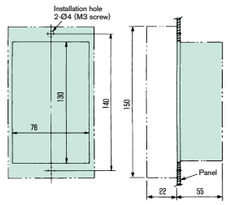


Cable type(1m): CAB0011, (3m): CAB0013, (5m): CAB0015

Remote panel CBVR-7B1

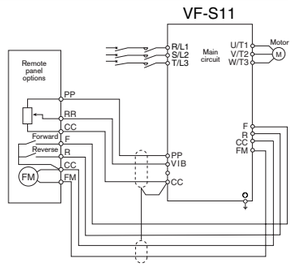


Panel hole



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

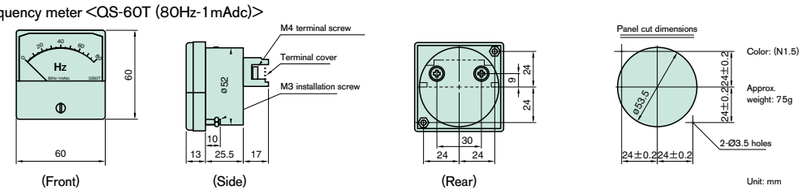
VF-S11



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

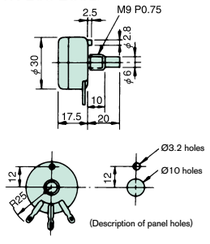
Frequency meter QS60T

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

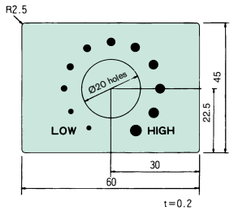


FRH kit

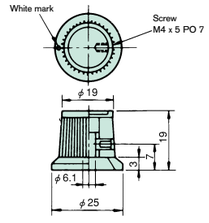
Frequency setting resistor <RV30YN-20S-B302>



Frequency setting panel



Frequency setting knob <K-3>



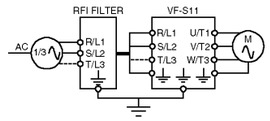
Devices	External dimensions and connections

EMC noise reduction filter (Compliant with European standards)

Foot mount installation

Side mount installation

How to wire



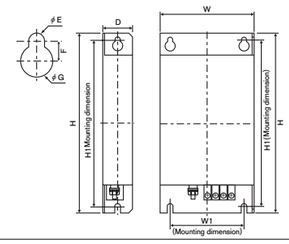
A high-attenuation compact EMI noise filter that can be Foot-mounted and Side-mounted. With this filter on, the inverter complies with the folllwing standards.

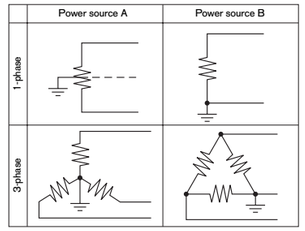
Three-phase 240V model:
IEC61800-3:Categoly C2(Motor connecting cable length: 5 m or less)
And IEC61800-3:Categoly C1(Motor connecting cable length: 1 m or less)

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) W	H	D	W1	H1	E	F	G	Approx. weight (kg)	Approx.leakage current(mA) Note 1) 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