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 equipment, aviation and space flight control equipment, traffic equipment, and safety equipment, 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. 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 failure to issue an inverter trouble 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.
The information in this brochure is subject to change without notice.

TOSHIBA

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TOSHIBA

VF-S9

Compact Inverter TOSVERT

1-phase 200V 0.2kW to 2.2kW
3-phase 200V 0.2kW to 15kW
3-phase 400V 0.75kW to 15kW

Environment-friendly, Handy Inverter — All Models, EMI Noise Filter Inside

Introducing the New-Generation Compact Inverter! Easy to Use, Powerful Performance, and Wide Applications

Major World Standard

CE c UL us N1971

Complies with major world standards (CE marking, UL, cUL, C-tick)

ISO 9001:
VF-S9 series is manufactured at the works, which has received the international quality assurance standard ISO 9001 certification.

UKAS QUALITY MANAGEMENT 001

JAB QS Accreditation R 016

The works producing the VF-S9 series is registered as an environment management system factory specified by ISO 14001.

ISO 14001 JACO

JAB EMS Accreditation RECOS

1

For System Designers ...

Flexible Selections

Excellent basic performance and diverse functions allow operations as needed.

- Sensorless vector control provides the startup torque of 150% or more.
  The "Auto-tuning function" allows setting motor constants without rotating the motor.
- Wide capacity range (0.2 to 15 kW) is provided even for this compact class.
- Compatible with various power voltages.
  The single-phase input model inputs 200V to 240V, the three-phase 400V model inputs 380V to 500V.
- The control circuit I/O logic (Sink/Source) is switched by one-touch operation. Many types of programmable controllers are easily connected.

■ **Capacity Range**

Voltage Class (Input/Rated Output)	Applicable Motor Capacity (kW)									
	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
1ø200V/3ø200V										
3ø200V/3ø200V										
3ø400V/3ø400V										

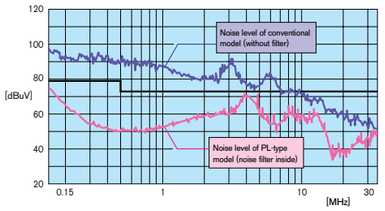
2

For Manufacturers ...

Easy Installation

EMI noise, audible noise, and installation space problems are solved.

- All models have EMI noise filter inside, significantly reducing noise emissions.
- EMC plate (attached as standard) shields the wiring to further suppress radiated EMI noise.
- Side-by-side installation saves space. Multiple units can be installed without side clearance.
  For example, installing five units of VFS9-2007PM side by side requires only 60% of the area for conventional inverters.
- Optional DIN rail kit allows one-touch installation (models of 200V class 0.75kW or less).
- Availability of high carrier frequency setting reduces audible motor noise.
  Even if the carrier frequency is set to a low level to suppress the EMI noise influence, the newly developed "Random Mode Carrier Frequency" can soften audible noise.
- Foot-mount type filter for space-saving is provided as option to comply with the EN standard.



■ **Side-by-side installation**

Installation of VF-S9 | Conventional models

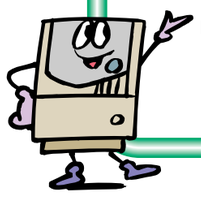
3

For Users ...

Easy Setting

Users can easily make settings and operate reliably.

- Switches and potentiometer dial on the front panel allow immediate and easy operation.
- The enhanced "Automatic Setting Functions" enable easy and convenient set up.
  Automatic acceleration/deceleration, Automatic torque boost, Automatic environment setting, Automatic function setting, reduce start up time.
- Diverse functions are conveniently enhanced.
  - Relay contact output:
    1 c-contact + 1 a-contact (+ 1 open collector output) is provided.
  - Programmable I/O terminals:
    6 input terminals and 3 output terminals can be selected from 51 input types and 30 output types of menus.
  - Meter analog output:
    Analog output signal can be selected from 6 types of menus. 0-10V and 4-20mA signal can also be switched by one-touch operation.
- Enhanced protective functions assure reliable operation.
  - I/O phase failure detecting, earth fault detecting function.
  - Dependable operation in case of power voltage drop.
  - Reliable continuous operation secured by auto-restart control function and regenerative power ride-through control function.



Contents

Panel and Operation Method

Standard Setting (ｲﾆｼｮｾｯﾃｲ=3)

Displays 60 when the standard setting (ｲﾆｼｮｾｯﾃｲ=3) is entered.

Select the base motor frequency. (60 or 50)

ENT

Displays 0.0 during frequency setting, and in it upon completion.

Power ON

Displays 0.0 when the power is ON.

Setting

Pressing the MON (monitor) key ... MON

❶ Displays "AU 1"

Pressing key until "ACC" is displayed ...

❷ Displays "ACC"

Press the ENTER key ... ENT

❸ Displays the setting.

Press the ENTER key after setting a value with the UP/DOWN key ... ENT

❹ Displays "ACC" and the setting value alternately, and then the setting is complete.

Operating

Pressing the RUN key and turning the potentiometer dial ... RUN

❶ Operates TOSVERT at the frequency set with the potentiometer.

Turning the potentiometer dial ...

❷ Changes the frequency.

Pressing the STOP key ... STOP

❸ Decelerates and stops the motor.

Monitoring

❶ Displays operation frequency.

Pressing the MON (monitor) key twice ... MON MON

❷ Displays the motor rotating direction.

Press the UP key ...

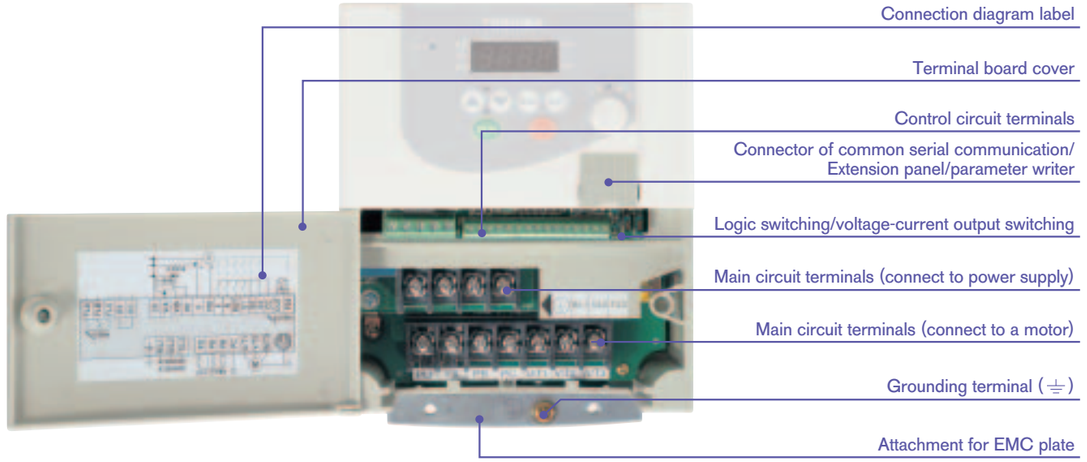
❸ Displays operation frequency command value.

Press the UP key ...

❹ Displays load current in (%/ampere)

Pressing the UP key displays various data such as input voltage, output voltage, input/output terminal status.
Pressing the MON (monitor) key ... MON

❺ Displays operation frequency (returns to the beginning).



Monitoring — Status monitor mode

In this mode, you can monitor the operational status of the inverter. To display the operation status during normal operation:
Press the (MON) key twice.

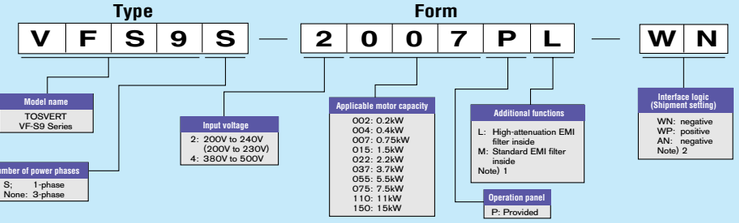
Setting procedure (eg. operation at 60Hz)

Item displayed	Key operated	LED display	Description
		60.0	The operation frequency is displayed (during operation). (When the standard monitor display selection parameter F710 is setat 0 [operation frequency])
Parameter setting mode	MON	AU 1	The first basic parameter "Automatic acceleration/ deceleration (AU 1)" is displayed.
Operation frequency	MON	F60.0	The operation frequency is displayed (during operation).
Direction of rotation	▲	Fr-F	The direction of rotation is displayed. (F: forward run, r : reverse run)
Operation frequency command	▲	F60.0	The operation frequency command value is displayed.
Load current	▲	C80	The inverter output current (load current) is displayed.
Input voltage	▲	V 100	The inverter input voltage is displayed. (Default setting: unit %)
Output voltage	▲	P 100	The inverter output voltage is displayed. (Default setting: unit %)
Input terminal	▲	A1111111	The ON/OFF status of each of the control signal input terminals (F, R, RST, S1, S2 and S3) is displayed in bits. ON: 1 OFF: 0 — S3, S2, S1, F, R, RST
Output terminal	▲	0111	The ON/OFF status of each of the control signal output terminals (RY, OUT and FL) is displayed in bits. ON: 1 OFF: 0 — FL, RY, OUT

Item displayed	Key operated	LED display	Description
CPU version	▲	U101	The version of the CPU is displayed.
Memory version	▲	VE100	The version of the memory mounted is displayed.
Past trip 1	▲	OC3 ⇔1	Past trip 1 (displayed alternately at 0.5-sec. intervals)
Past trip 2	▲	OH ⇔2	Past trip 2 (displayed alternately at 0.5-sec. intervals)
Past trip 3	▲	OP3 ⇔3	Past trip 3 (displayed alternately at 0.5-sec. intervals)
Past trip 4	▲	nErr⇔4	Past trip 4 (displayed alternately at 0.5-sec. intervals)
Cumulative operation time	▲	t 0.10	The cumulative operation time is displayed. (0.01 corresponds to 1 hours.)
Torque current	▲	t88	The torque current is displayed in %.
PI feedback	▲	d50	The PI feedback value is displayed. (Unit: processed amount)
Inverter load factor	▲	L 80	The inverter load factor is displayed in %.
PBR overload factor	▲	r 80	The overload factor of the braking resistor is displayed in %.
Output power	▲	H 3.7	The inverter output power is displayed in %.
Default display mode	MON	60.0	The operation frequency is displayed (during operation).

Note) 1. With the current unit selection parameter or voltage unit selection parameter, you can choose between percentage and ampere (A) for current or between percentage and volt (V) for voltage, respectively.

Contents of the product code



Note) 1. L:Standard model without optional filter conform to "EN55011 Group 1 Class A"
With Foot-mounted noise filter conform to "EN55011 Group 1 Class B"
M:With Foot-mounted noise filter conform to "EN55011 Group 1 Class A"

Note) 2. Interface logic can be switched easily.

Standard Specifications and External Dimensions

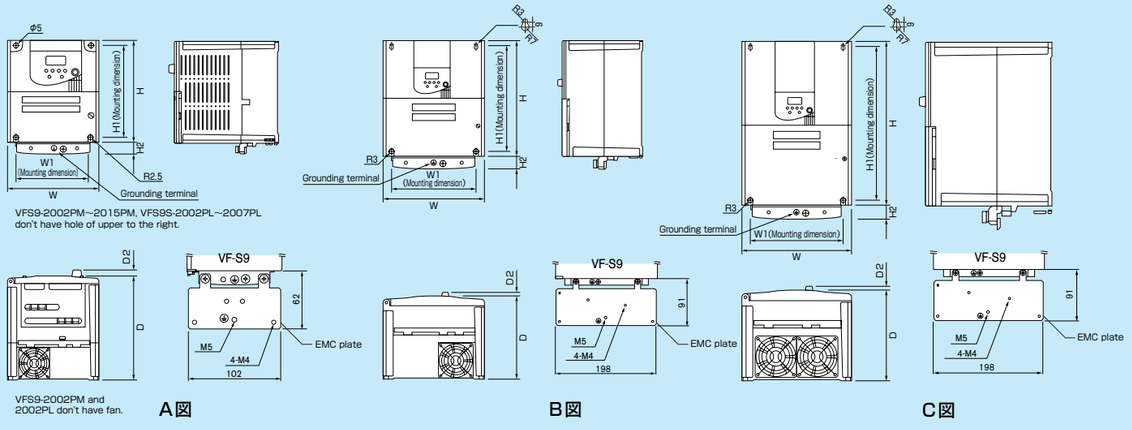
■Model and standard specifications

Item		Specification									
Input voltage		3-phase 200V									
Applicable motor (kW)		0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
Rating	Type	VFS9 –									
	Form	2002PM	2004PM	2007PM	2015PM	2022PM	2037PM	2055PL	2075PL	2110PM	2150PM
	Capacity (kVA) Note 1)	0.6	1.3	1.8	3.0	4.2	6.7	10	13	21	25
	Rated output current (A) Note 2)	1.5 (1.5)	3.3 (3.3)	4.8 (4.4)	7.8 (7.5)	11.0 (10.0)	17.5 (16.5)	27.5 (25.0)	33 (33)	54 (49)	66 (60)
	Rated output voltage Note 3)	3-phase 200V to 230V									
	Overload current rating	60 seconds at 150%, 0.5 seconds at 200%									
Power supply	Voltage-frequency	3-phase 200V to 230V – 50/60Hz									
	Allowable fluctuation	Voltage +10%, -15% Note 4), frequency ±5%									
Protective method		IP20 Enclosed type (JEM1030)									
Cooling method		Self cooling	Forced air-cooled								
Color		Munsel 5Y-8/0.5									
Built-in filter		Standard EMI filter						High-attenuation EMI filter		Standard EMI filter	

Item		Specification												
Input voltage		1-phase 200V					3-phase 400V							
Applicable motor (kW)		0.2	0.4	0.75	1.5	2.2	0.75	1.5	2.2	3.7	5.5	7.5	11	15
Rating	Type	VFS9S –					VFS9 –							
	Form	2002PL	2004PL	2007PL	2015PL	2022PL	4007PL	4015PL	4022PL	4037PL	4055PL	4075PL	4110PL	4150PL
	Capacity (kVA) Note 1)	0.6	1.3	1.8	3.0	4.2	1.8	3.1	4.2	7.2	11	13	21	25
	Rated output current (A) Note 2)	1.5 (1.5)	3.3 (3.3)	4.8 (4.4)	7.8 (7.5)	11.0 (10.0)	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)
	Rated output voltage Note 3)	3-phase 200V to 240V					3-phase 380V to 500V							
	Overload current rating	60 seconds at 150%, 0.5 seconds at 200%					60 seconds at 150%, 0.5 seconds at 200%							
Power supply	Voltage-frequency	3-phase 200V to 240V – 50/60Hz					3-phase 380V to 500V – 50/60Hz							
	Allowable fluctuation	Voltage +10%, -15% Note 4), frequency ±5%					Voltage +10%, -15% Note 4), frequency ±5%							
Protective method		IP20 Enclosed type (JEM1030)					IP20 Enclosed type (JEM1030)							
Cooling method		Self cooling	Forced air-cooled				Forced air-cooled							
Color		Munsel 5Y-8/0.5					Munsel 5Y-8/0.5							
Built-in filter		High-attenuation EMI filter					High-attenuation EMI filter							

Note) 1. Capacity is calculated at 220V for the 200V models and at 440V for the 400V models.
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 400V class model exceeds 480V, it is necessary to further reduce the setting. The default setting of the PWM carrier frequency is 12kHz.
3. Maximum output voltage is the same as the input voltage.
4. ±10% when the inverter is used continuously (load of 100%).

■Outline drawing



■Standard Specifications

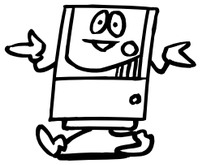
Item		Specification
Principal control functions	Control system	Sinusoidal PWM control
	Rated output voltage	Adjustable within a range of 100 to 120% of the corrected supply voltage (200/400V) (Unadjustable to any voltage higher than the input voltage).
	Output frequency range	0.5 to 400Hz, default setting: 0.5 to 60Hz, maximum frequency: 30 to 400Hz.
	Minimum setting steps of frequency	0.1Hz: operation panel setting, 0.2Hz: analog input (when the max. frequency is 100Hz).
	Frequency accuracy	Digital setting: within ±0.01% of the max. frequency (-10 to +50°C). Analog setting: within ±0.5% of the max. frequency (25°C±10°C).
	Voltage/frequency characteristics	V/f constant, variable torque, vector control, automatic torque boost, Base frequency and torque boost amount adjustable.
	Frequency setting signal	Front potentiometer and external potentiometer (rated impedance of connectable potentiometer: 1 to 10kΩ), 0 to 10Vdc (input impedance: VIA=30.55 kΩ, VB=30 kΩ), 4 to 20mAdc (input impedance: 400Ω), The characteristic can be set arbitrarily by two-point setting.
Operation specifications	Start-up frequency/frequency jump	Adjustable within a range of 0 to 10Hz / Up to 3 frequencies can be adjusted together with their widths.
	PWM carrier frequency (Note 1)	Adjustable within a range of 2.0 to 16.5Hz (default: 12kHz).
	Acceleration/deceleration time	0.1 to 3600 seconds, switchable between acceleration/deceleration time 1 and 2, selectable between S-pattern acceleration/deceleration 1 and 2.
	Retry operation	Restart after a check of the main circuit elements in case the protective function is activated: 10 times (Max.) (adjustable with a parameter).
	Dynamic braking	With a built-in dynamic braking circuit, external braking resistor available (optional).
	DC braking	Braking start-up frequency: 0 to maximum frequency, braking rate: 0 to 100%, braking time: 0 to 20 seconds.
	Input terminal functions (selectable)	Forward/reverse run input signal, jog run input signal, standby signal, preset-speed operation input signal, reset input signal, etc. / Switching between sink/source.
	Output terminal functions (selectable)	Frequency lower limit output signal, frequency upper limit output signal, low-speed detection output signal, specified speed attainment output signal, etc. Open collector, RY output.
	Failure detection signal	1c-contact output: 250Vac/2A, cosø = 0.1, 250Vac/1A, cosø = 0.4, 3Vdc/1A.
	Output for frequency meter/output for ammeter	Analog output: (1mAdc full-scale DC ammeter or 7.5Vdc full-scale DC ammeter / Rectifier-type AC voltmeter, 225% current Max. 1mAdc, 7.5Vdc full-scale), 4 to 20mA/0 to 20mA output.
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-load at start-up (5.5kW or larger), load-side over-torque at start, pre-alarm, overheat.
	Protection against momentary power failure	Auto-restart/non-stop control after momentary power failure.
	Electronic thermal characteristic	Switching between standard motor/constant-torque VF motor, overload trip, overload stall selection.
Display function	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, VEC lamp, ECN 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 or vibration (less than 5.9m/s^2) (10 to 55Hz).
	Ambient temperature	-10 to +60°C Note)1.2.3
	Storage temperature	-20 to +65°C
	Relative humidity	20 to 93% (free from condensation and vapor).

Note) 1. Above 40°C : Remove the protective seal from the top of VF-S9.
2. Above 50°C : Remove the protective seal from the top of VF-S9, and derate the rated output current by 3% for every °C above 50°C
3. Side-by-side installation
・Model of 3.7kW or less : from −10°C to 40°C (Remove the protective seal from the top of VF-S9.)
・Model of 5.5kW or more : from −10°C to 50°C

■External dimensions/weights

Input voltage	Applicable motor (kW)	Type	Dimensions (mm)							Drawing	Approx. weight (kg)
			W	H	D	W1	H1	H2	D2		
1-phase 200V	0.2	VFS9S-2002PL	105	130	140	93	118	14	8.5	A	1.2
	0.4	VFS9S-2004PL									1.3
	0.75	VFS9S-2007PL									1.3
	1.5	VFS9S-2015PL	130	150	150	118	138				1.8
	2.2	VFS9S-2022PL	140	195	163	126	182				2.8
3-phase 200V	0.2	VFS9-2002PM	105	130	130	93	118	14	8.5	A	1.1
	0.4	VFS9-2004PM									1.2
	0.75	VFS9-2007PM									1.2
	1.5	VFS9-2015PM		150			138				1.4
	2.2	VFS9-2022PM	140	195	147	126	182				2.3
	3.7	VFS9-2037PM									2.5
	5.5	VFS9-2055PL	200	270	170	180	255	12		B	6.2
	7.5	VFS9-2075PL									6.3
	11	VFS9-2110PM	245	330	195	225	315			C	9.8
	15	VFS9-2150PM									9.9
3-phase 400V	0.75	VFS9-4007PL	130	150	150	118	138	14	8.5	A	1.8
	1.5	VFS9-4015PL									1.9
	2.2	VFS9-4022PL	140	195	163	126	182				2.7
	3.7	VFS9-4037PL									2.9
	5.5	VFS9-4055PL	200	270	170	180	255	12		B	6.3
	7.5	VFS9-4075PL									6.3
	11	VFS9-4110PL	245	330	195	225	315			C	9.8
	15	VFS9-4150PL									9.8

Function Description



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

● Four automatic functions

Title	Function	Unit	Adjustment range	Default setting	MEMO
AU1	Automatic acceleration/ deceleration	–	0: Disabled (manual) 1: Optimum rate 2: Minimum rate	0	
AU2	Automatic torque boost		0: Disabled 1: Sensorless Vector control + auto-tuning	0	
AU3	Automatic environment setting		0: Disabled 1: Automatic setting	0	
AU4	Automatic function seting		0: Disabled 1: Coast stop 2: 3-wire operation 3: External input UP/ DOWN setting 4: 4-20mA current input operation	0	

Note) 1. In case of the model of Type-form “–WN”, default setting of parameter UL, uL, F170, F204, and F213 are 60 (Hz).
In case of “–WP”, these parameter are 50 (Hz).
2. The setting varies with the inverter capacity.
3. Display units are changed by the setting of parameter F701 (unit selection).
4. If 3 or 4 is set for parameter F200 (frequency priority selection), the parameter function at the lower stage is active for F210 to F213.

Setup parameters

● When the standard setting (tYP=3) is entered, the following parameter is displayed. Be sure to make that setting.

Title	Function	Unit	Adjustment range	Default setting	MEMO
—	Applicable motor base frequency	Hz	60 50	*1	

Note) Make settings suitable for the applicable motor base frequency (reference frequency at rated torque of motor).

● Other basic parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
CMOD	Command mode selection	–	0: Terminal board 1: Operation panel	1	
FMOD	Frequency setting mode selection	–	0: Terminal board 1: Operation panel 2: Internal potentiometer 3: Serial communication	2	
FMSL	Meter selection	–	0: Output frequency 1: Output current 2: Set frequency 3: For adjustment (current fixed at 100%) 4: Inverter load factor 5: Output power 6: Torque current 7: PBr load factor 8: PN voltage 9: Output voltage command 10: Frequency of VIA 11: Frequency command after PI	0	
FM	Meter adjustment	–	—	–	
tYP	Standard setting mode selection		0: -(invalid) 1: 50 Hz setting 2: 60 Hz setting 3: Default setting 4: Trip clear 5: Cumulative operation time clear 6: Initialization of type information	0	
Fr	Forward/reverse run selection (Operation panel)	–	0: Forward run 1: Reverse run	0	
ACC	Acceleration time 1	s	0.1 - 3600	10.0	
dEC	Deceleration time 1	s	0.1 - 3600	10.0	
FH	Maximum frequency	Hz	30.0 - 400	80.0	
UL	Upper limit frequency	Hz	0.5 - FH	*1	
LL	Lower limit frequency	Hz	0.5 - UL	0.0	
uL	Base frequency 1	Hz	25 - 400	*1	
Pt	V/F control mode selection	–	0: V/F constant 1: Variable torque 2: Automatic torque boost 3: Sensorless vector control 4: Automatic energy-saving 5: Sensorless vector control (VFS7 mode)	0	
ub	Torque boost	%/(V)	0.0 - 30.0 *3	*2	
tHr	Motor electronic-thermal protection level 1	%/(A)	10 - 100 *3	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 / VF motor (special motor) / invalid / valid	0	
Sr1 to Sr7	Preset-speed operation frequencies 1 to 7	Hz	LL – UL	0.0	
F---	Extended parameter	–	—	–	
Gr.U	Automatic edit function	–	—	–	

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	Cc	Dd	Ee	Ff	Gg	Hh	Ii	Jj	Kk	Ll	Mm
A	b	C	d	E	F	G	H	I			L	M

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

Extended parameters

● Input/output parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
F100	Low-speed signal output frequency	Hz	0.0 - FH	0.0	
F101	Speed reach setting frequency	Hz	0.0 - FH	0.0	
F102	Speed reach detection band	Hz	0.0 - FH	2.5	
F103	ST signal selection	–	0: Stand by on when ST is on 1: Stand by always on 2: Interlocked with F/R 3: Stand by on when ST is off	1	
F104	RST signal selection	–	0: Default 1: Activated by turning RST off	0	
F105	Movement of F/R input at same time	–	0: Reverse run 1: Stop	0	
F110	Always-active function selection	–	0 - 53	0	
F111	Input terminal selection 1 (F)	–	0 - 53 (F)	2	
F112	Input terminal selection 2 (R)	–	0 - 53 (R)	3	
F113	Input terminal selection 3 (RST)	–	0 - 53 (RST)	10	
F114	Input terminal selection 4 (S1)	–	0 - 53 (SS1)	6	
F115	Input terminal selection 5 (S2)	–	0 - 53 (SS2)	7	
F116	Input terminal selection 6 (S3)	–	0 - 53 (SS3)	8	
F130	Output terminal selection 1 (RY-RC)	–	0 - 41 (LOW)	4	
F131	Output terminal selection 2 (OUT)	–	0 - 41 (RCH)	6	
F132	Output terminal selection 3 (FL)	–	0 - 41 (FL)	10	
F170	Base frequency 2	Hz	25 - 400	*1	
F172	Torque boost 2	% (V)	0.0 - 30.0 *3	*2	
F173	Motor electronic-thermal protection level 2	% (A)	0.0 - 30.0 *3	100	
F200	Frequency priority selection	–	0: VIA/II, VIB, 1: VIB, VIA/II 2: External switching (FCHG enabled) 3: External contact UP/DOWN *4 4: External contact UP/DOWN *4 (Setting retained even if the power is turned off) 5: VIAI/II+VIB	0	
F201	VIA/II input point 1 setting	%	0 - 100	0	
F202	VIA/II input point 1 frequency	Hz	0.0 - 400.0	0.0	
F203	VIA/II input point 2 setting	%	0 - 100	100	
F204	VIA/II input point 2 frequency	Hz	0.0 - 400.0	*1	
F210	VIB input point 1 setting	%	0 - 100	0	
	Frequency UP response time *4	(0.1s)	0 - 100	0	
F211	VIB input point 1 frequency	Hz	0.0 - 400.0	0	
	Frequency UP step width *4		0.0 - 400.0	0	
F212	VIB input point 2 setting	%	0 - 100	100	
	Frequency DOWN response time *4	(0.1s)	0.0 - 400.0	100	
F213	VIB input point 2 frequency	Hz	0 - 400	*1	
	Frequency DOWN step width *4		0.0 - 400.0	60.0	
F240	Starting frequency setting	Hz	0.5 - 10.0	0.5	
F241	Operation starting frequency	Hz	0.0 - FH	0.0	
F242	Operation starting frequency hysterisis	Hz	0.0 - FH	0.0	
F250	DC braking starting frequency	Hz	0.0 - 20.0	0.0	
F251	DC braking current	% (A)	0 - 100	30	
F252	DC braking time	s	0.0 - 20.0	1.0	
F254	Motor shaft fixing control	–	0: Disabled, 1: Enabled	0	
F256	Auto stop of continuous running at LL	–	0.0:Disabled, 0.1-25.5	0	
F260	Jog run frequency	Hz	0.0 - 20.0	0.0	
F261	Jog run stopping pattern	–	0: Slowdown stop, 1: Coast stop 2: DC braking 3: Slowdown stop (panel jog mode) 4: Coast stop (panel jog mode) 5: DC braking (panel jog mode)	0	
F270	Jumping frequency 1	Hz	LL - UL	0.0	
F271	Jumping width 1	Hz	0.0 - 30.0	0.0	
F272	Jumping frequency 2	Hz	LL - UL	0.0	
F273	Jumping width 2	Hz	0.0 - 30.0	0.0	
F274	Jumping frequency 3	Hz	LL - UL	0.0	
F275	Jumping width 3	Hz	0.0 - 30.0	0.0	
F280 to F294	Preset-speed operation frequencies 1 to 15	Hz	LL - UL	0.0	

● Operation mode parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
F300	PWM carrier frequency	kHz	2.0 - 16.5	12.0	
F301	Auto-restart control selection	–	0: Disabled 1: At auto-restart after momentary stop 2: When turning ST-CC on or off 3: At auto-restart or when turning ST-CC on or off 4: Motion of DC braking at start-up (at auto-restart after momentary stop) 5: Motion of DC braking at start-up (when turning ST-CC on or ff) 6: Motion of DC braking at start-up (at auto-restart or when turning ST-CC on or off) 7-13: See the instruction manual	0	
F302	Regenerative power ride-through control	–	0: Disabled, 1:Enabled 2: Enabled(deceleration stop)	0	
F303	Retry selection (number of times)	Times	0 - 10	0	
F304	Dynamic braking selection	–	0: Dynamic braking disabled 1: Dynamic braking enabled, overload protection disabled 2: Dynamic braking enabled, overload protection enabled	0	
F305	Overvoltage stall operation	–	0: Enabled, 1: Disabled 2: Enabled(quick deceleration with overexcitation)	0	
F306	Output voltage adjustment (Base frequency voltage)	V	0 - 300 / 0 - 600	200/400	
F307	Supply voltage compensation	–	0: Supply voltage uncorrected, output voltage limited 1: Suply voltage corrected, output voltage limited 2: Supply voltage corrected (off during deceleration), output voltage limited 3: Supply voltage uncorrected, output voltage unlimited 4: Supply voltage corrected, output voltage limited 5: Supply voltage corrected (off during deceleration), output voltage unlimited	3	
F308	Braking resistor operation rate	%ED	1 - 100	3	
F312	Random mode	–	0: Disabled, 1: Enabled	0	
F319	Voltage gain of overexcitation	–	0-255	*1	
F320	Drooping gain	%	0-25.0	0.0	
F323	Drooping insensitive torque band	%	0-100	100	
F360	PI control	–	0: Disabled, 1: Enabled	0	
F362	Proportional gain	–	0.01 - 100.0	0.30	
F363	Integral gain	–	0.01 - 100.0	0.20	

● Torque boost parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
F400	Auto-tuning	–	0: Auto-tuning disabled (use of internal parameters) 1: Application of individual settings of F40 1 to F405 2: Auto-tuning enabled (returns to 1 after auto-tuning)	0	
F401	Slip frequency	Hz	0.0 - 10.0	*2	
F402	Motor primary constant	–	0 - 255	*2	
F403	Motor secondary constant	–	0 - 255	*2	
F404	Motor excitation constant	–	0 - 255	*2	
F405	Magnification of load inertial moment	Times	0 - 200	0	
F408	Rated capacity ratio of motor to inverter	–	0: Same capacity as interver 1: One-size smaller than inverter	0	
F409	Torque current filter	–	0 - 8	2	

● Acceleration/deceleration time parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
F500	Acceleration time 2	s	0.1 - 3600	10.0	
F501	Deceleration time 2	s	0.1 - 3600	10.0	
F502	Acceleraion/deceleration 1 pattern	–	0: Linear 1: S-pattern 1 2: S-pattern 2	0	
F503	Acceleraion/deceleration 2 pattern			0	
F504	Acceleration/deceleration pattern selection (1 or 2)	–	0: Acceleration/deceleration 1 1: Acceleration/deceleration 2	0	
F505	Acceleration/deceleration 1 and 2 switching frequency	Hz	0 - UL	0.0	

● Protection parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
F600	Motor electronic-thermal protection level 1	% (A)	10 - 100 *3	100	
F601	Stall prevention level	% (A)	10 - 199, 200 (disabled) *3	150	
F602	Inverter trip retention selection	–	0: Not retained, 1: Retained	0	
F603	External input trip stop mode selection	–	0: Coast stop, 1: Slowdown stop 2: Emergency DC braking	0	
F604	Emergency DC braking time	s	0.0 - 20.0	1.0	
F605	Output phase failure detection mode selection	–	0: Disabled, 1: Enabled	0	
F608	Input phase failure detection mode selection	–	0: Disabled, 1: Enabled	1	
F610	Small current trip selection	–	0: Disabled, 1: Enabled	0	
F611	Small current (trip/alarm) detectin current	%	0 - 100	0	
F612	Small current (trip/alarm) detectin time	s	0 - 255	0	
F613	Selection of output short-circuit detection pulse during start-up	–	0: 60usec, every start to run 1: 60usec, only at power on or reset 2: 30usec, every start to run 3: 30usec, only at power on or reset	0	
F615	Over-torque trip selection	–	0: Disabled, 1: Enabled	0	
F616	Over-torque (trip/alarm) level	%	0 - 250	150	
F618	Over-torque detection time	s	0 - 10	0.5	
F619	Over-torque (trip/alarm) level hysterisis	%	0 - 100	10	
F626	Overvoltage limit operation level	%	50 - 150	*1	
F627	Undervoltage trip selection	–	0: Disabled 1:Enabled (at 70% or les) 2: Disabled (at 50% or less, optional soon to be relreased)	0	
F633	VIA analog input line break detection	%	0: Disabled, 1-100%	0	
F632	Meter bias	%	0: - 50	0	

● Operation panel parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
F700	Prohibition of change of parameter settings	–	setting / RUN/STOP/ Key / Parameter setting / CHG/FMOD Change / Panel Parameter setting 0 / effective / Permit / impossible / — 1 / effective / Prohibit / — / Prohibit 2 / effective / Permit / possible / — 3 / effective / Prohibit / — / Permit 4 / Prohibit / Permit / impossible / — 5 / Prohibit / Prohibit / — / Prohibit 6 / Prohibit / Permit / possible / — 7 / Prohibit / Prohibit / — / Permit	0	
F701	Unit selection	–	0: No change 1: % → A (ampere)/V (volt) 2: Free unit selection enabled (F702) 3: % → A (ampere)/V (volt) Free unit selection enabled (F702)	0	
F702	Free unit selection	–	0.01 - 200.0	1.00	
F710	Standard monitor display selection	–	0: Operation frequency (Hz/free unit) 1: Output current (%/A) 2: Frequency command (Hz/free unit) 3: Inverter rate current (A) 4: Inverter over load factor (%) 5: Output power (%) 6: After compensation frequency (Hz/free unit)	0	

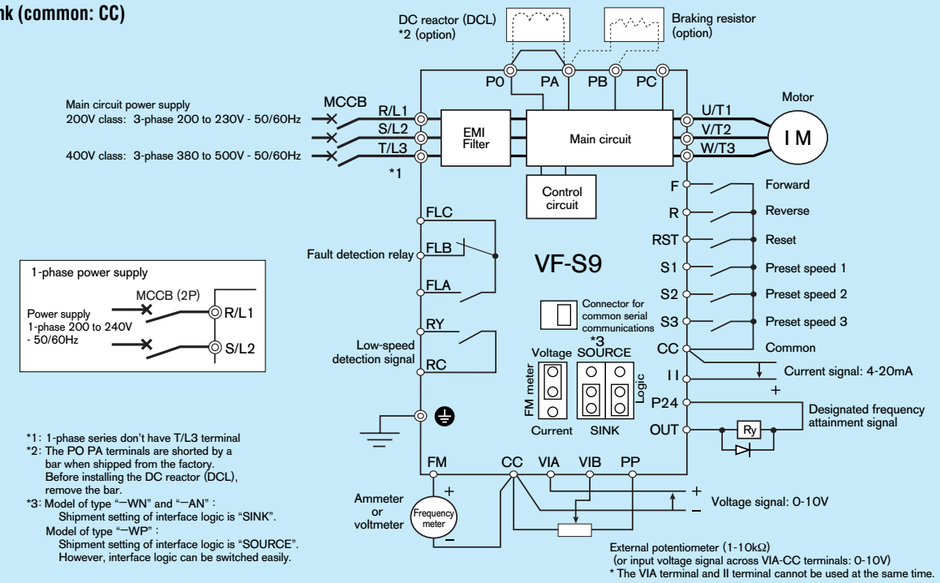
● Communication parameters

Title	Function	Unit	Adjustment range	Default setting	MEMO
F800	Communication band speed	–	0: 1200bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200bps	3	
F801	Parity	–	0: NON 1:EVEN 2: ODD	1	
F802	Inverter number	–	0 - 255	0	
F803	Communication error trip time	s	0 (Disabled), 1 - 100	0	
F805	Communication internal	s	0.00 - 2.00	0.00	
F806	Inter-drive communication	–	0: Normal 1:Frequency reference 2: Output frequency	0	
F880	Free internal	–	0 - 65535	0	

Connection Diagram and Selection of Wiring Devices

Standard connection diagram

Sink (common: CC)



*1: 1-phase series don't have T/L3 terminal
*2: The PO PA terminals are shorted by a bar when shipped from the factory. Before installing the DC reactor (DCL), remove the bar.
*3: Model of type "—WN" and "—AN" : Shipment setting of interface logic is "SINK". Model of type "—WP" : Shipment setting of interface logic is "SOURCE". However, interface logic can be switched easily.

Selection of wiring devices

Voltage class	Capacity applicable motor (kW)	Interver model	Molded-case circuit breaker (MCCB)		Magnetic contactor (MC)		Overload relay (Th-Ry)		Earth leakage breaker		Wire size (mm²)			
			Rated current (A)	Type Note 1)	Rated current (A)	Type Note 1)	Adjusted current (A) (For reference)	Type Note 1)	Rated current (A)	Type Note 1)	Main circuit (mm²) Note 4)	DC reactor (optional) (mm²)	Braking resistor/ Braking unit (optional) (mm²)	Grounding cable (mm²) Note 6)
1-phase 200V class	0.2	VFS9S-2002PL	10	NJ30N	11	C11J	1.3	T13J	10	NJV50E	2.0	1.25	1.25	3.5
	0.4	VFS9S-2004PL	15	NJ30N	11	C11J	2.3	T13J	15	NJV50E	2.0	1.25	1.25	3.5
	0.75	VFS9S-2007PL	20	NJ30N	11	C11J	3.6	T13J	20	NJV50E	2.0	2.0	1.25	3.5
	1.5	VFS9S-2015PL	30	NJ30N	18	C20J	6.8	T13J	30	NJV50E	3.5	2.0	1.25	3.5
	2.2	VFS9S-2022PL	40	NJ50E	35	C35J	9.3	T13J	40	NJV50E	5.5	2.0	2.0	5.5
3-phase 200V class	0.2	VFS9-2002PM	5	NJ30N	11	C11J	1.3	T13J	5	NJV50E	2.0	1.25	1.25	3.5
	0.4	VFS9-2004PM	5	NJ30N	11	C11J	2.3	T13J	5	NJV50E	2.0	1.25	1.25	3.5
	0.75	VFS9-2007PM	10	NJ30N	11	C11J	3.6	T13J	10	NJV50E	2.0	2.0	1.25	3.5
	1.5	VFS9-2015PM	15	NJ30N	11	C11J	6.8	T13J	15	NJV50E	2.0	2.0	1.25	3.5
	2.2	VFS9-2022PM	20	NJ30N	13	C13J	9.3	T13J	20	NJV50E	2.0	2.0	2.0	3.5
	3.7	VFS9-2037PM	30	NJ30N	26	C25J	15	T20J	30	NJV50E	3.5	5.5	5.5	3.5
	5.5	VFS9-2055PL	50	NJ50E	35	C35J	22	T35J	50	NJV50E	8.0	5.5	5.5	8.0
	7.5	VFS9-2075PL	60	NJ100F	50	C50J	28	T35J	60	NJV60F	14	14	5.5	14
	11	VFS9-2110PM	100	NJ100F	65	C65J	44	T65J	100	NJV100F	14	14	5.5	14
	15	VFS9-2150PM	125	NJ225F	80	C80J	57	T65J	125	NJV225F	22	22	5.5	22
3-phase 400V class	0.75	VFS9-4007PL	5	NJ30N	9	C11J	1.6	T13J	5	NJV50E	2.0	1.25	1.25	3.5
	1.5	VFS9-4015PL	10	NJ30N	9	C11J	3.6	T13J	10	NJV50E	2.0	1.25	1.25	3.5
	2.2	VFS9-4022PL	15	NJ30N	9	C11J	5.0	T13J	15	NJV50E	2.0	2.0	1.25	3.5
	3.7	VFS9-4037PL	20	NJ30N	13	C13J	6.8	T13J	20	NJV50E	2.0	2.0	1.25	3.5
	5.5	VFS9-4055PL	30	NJ30N	17	C20J	11	T13J	30	NJV50E	3.5	2.0	2.0	3.5
	7.5	VFS9-4075PL	30	NJ30N	25	C25J	15	T20J	30	NJV50E	3.5	3.5	2.0	3.5
	11	VFS9-4110PL	50	NJ50E	33	C35J	22	T35J	50	NJV50E	5.5	5.5	3.5	5.5
	15	VFS9-4150PL	60	NJ100F	48	C50J	28	T35J	60	NJV100F	8.0	8.0	3.5	8.0

Note) 1. Produced by Schneider Toshiba electric corporation.
2. Be sure to attach surge killer to the exciting coil of the relay and the magnetic contactor.
Selection of surge killers for Toshiba magnetic contactors
200V class: Surge absorbing units are optionally available for Toshiba C11J to C65J, or Model SS-2 for C50J and C65J
400V class: For the operation and control circuit, regulate the voltage at 200V 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.

Terminal Functions

Main circuit teminal functions

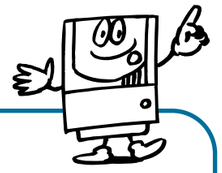
Terminals symbol	Terminal function
⏚	Grounding terminal for connecting inverter case. 2 grounding terminals.
R/L1, S/L2, T/L3	200V class: 1-phase 200 to 240V - 50/60Hz 3-phase 200 to 230V - 50/60Hz 400V class: 3-phase 380 to 500V - 50/60Hz * 1-phase series have R/L1 and S/L2 terminal.
U/T1, V/T2, W/T3	Connect to a (3-phase induction) motor.
PA, PB	Connect to braking resistors. Change parameters F304, F305 and F308 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 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 switchable	Solid wire : 0.3 to 1.5 (mm²) Stranded wire : 0.3 to 1.25 (mm²) (AWG22 to 16) Sheath strip length : 5 (mm)
R		Shorting across R-CC causes reverce rotation; open causes slowdown and stop.		
RST		Shorting across RST-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 RST-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.		
CC	Control circuit's equipotential terminal (sink logic). 2 common terminals for input/output.			
PP	Power output for analog input setting.		10Vdc (permissible load current: 10mAdc)	
I I *	Multifunction programmable analog input. Standard default setting: 4 (0) to 20mAdc input and 0-50Hz (50Hz setting) or 0-60Hz (60Hz setting) frequency.		4 to 20mA (internal impedance: 400Ω)	
VIA *	Multifunction programmable analog input. Standard default setting: 0-10Vdc input and 0-80Hz frequency.		10Vdc (internal impedance: 30kΩ)	
VIB	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 current. Connect a 1mAdc full-scale ammeter or 7.5Vdc (10Vdc)-1mA full-scale voltmeter. Can change to 0-20mA (4-20mA) by jumper switching.		1mA full-scale DC ammeter or 7.5Vdc 1mA full-scale DC voltmeter *Switchable for jumpper 0 to 20mA (4 to 20mA) DC ammeter	
P24	24Vdc power output/common at source logic.		24Vdc - 100mA	
OUT	Multifunction programmable open collector output. Standard default settings detect and output speed reach signal output frequencies.		Open collector output: 24Vdc - 50mA *Sink-source selectable	
RC RY	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 - 2A: at resistance load 30Vdc - 1A, 250Vac - 1A (cosø = 0.4)	Solid wire : 0.3 to 1.5 (mm²) Stranded wire : 0.3 to 1.5 (mm²) (AWG22 to 16) Sheath strip length : 6 (mm)
FLA FLB FLC	Multifunction programmable relay contact output. Contact ratings: 250Vac-2A (cosø = 1), 30Vdc-1A, 250Vac-1A (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 - 2A: at resistance load 30Vdc - 1A, 250Vac - 1A (cosø = 0.4)	

* The VIA terminal and I I terminal cannot be used at the same time.

Inverter Q & A



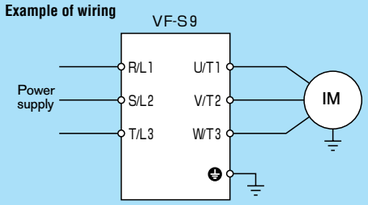
Q1 How can I use the inverter immediately?

A1 Just connect the power supply and the motor, and you can use the VF-S9 series inverter immediately.

You can use the RUN and STOP keys and the frequency setting potentiometer to easily operate the inverter. You can also make adjustments easily using the automatic setting functions.

- **Automatic acceleration/deceleration:** Automatically adjusts the acceleration or deceleration time according to the load.
- **Automatic torque increase:** Automatically improves the motor torque according to the load.
- **Automatic environment setting:** Automatically makes all the settings related to the inverter environment protection at one time.
- **Automatic function setting:** Selects the inverter operation method.

Example of wiring



Q2 What can I do if I forget what I have programmed?

A2 You can use the change setting retrieval function. You can also use the following operation to restore all the parameters to the default values immediately.

1) Change setting retrieval (**CrU**): Automatically retrieves and displays only the parameters differing from the default setting. You can confirm the changed parameters.

Pressing the MON (monitor) key, and pressing the DOWN key ...

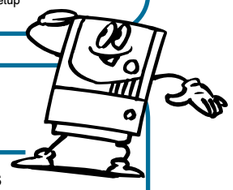
Pressing the ENTER key and then the DOWN key ...

2) Standard setting mode selection (**tYP**): Restores all the parameters to the default values.

Parameter	Setting
tYP (standard setting mode selection)	3 (default value)

Note) When the defaurt setting is entered, the system enters the setup parameter mode.

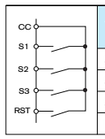
Q3 How can I change the frequency by contact input in combination with a PC (programmable controller)?



A3 Incorporating a standard 15-step speed function, the VF-S9 series allows you to change the frequency by setting parameters and using contact input.

Multi-step contact input signal samples

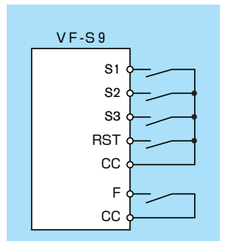
○ : ON — : OFF (Speed command other than a preset-speed becomes effective when all contacts are OFF.)



Terminal	Preset-speed														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S1-CC	○	—	○	—	○	—	○	—	○	—	○	—	○	—	○
S2-CC	—	○	○	—	—	○	○	—	—	○	○	—	—	○	○
S3-CC	—	—	—	○	○	○	○	—	—	—	—	○	○	○	○
RST-CC	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○

You can change the frequency using contact input.

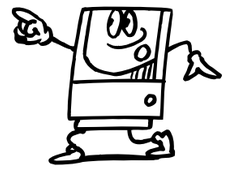
Parameter	Setting
Sr 1 (**F280**) (Preset-speed operation frequencies1)	Lower limit frequency-Upper limit frequency
:	:
Sr 7 (**F286**) (Preset-speed operation frequencies7)	Lower limit frequency-Upper limit frequency
:	:
F294 (Preset-speed operation frequencies15)	Lower limit frequency-Upper limit frequency
F 114 (Input teminal Selection4)	**6** (Preset-speed command 1)
F 115 (Input teminal Selection5)	**7** (Preset-speed command 2)
F 116 (Input teminal Selection6)	**8** (Preset-speed command 3)
F 113 (Input teminal Selection3)	**9** (Preset-speed command 4)



Q4 What is the input/output programmable terminal block?

A4 The VF-S9 series allows you to set the terminal functions as you wish from a broad menu selection.

Parameter	Setting
F 111 Input terminal selection 1(F)	**2** (Forward run)
F 112 Input terminal selection 2(R)	**3** (Reverse run)
F 113 Input terminal selection 3(RST)	**10** (Reset)
F 114 Input terminal selection 4(S1)	**6** (Preset-speed 1)
F 115 Input terminal selection 5(S2)	**7** (Preset-speed 2)
F 116 Input terminal selection 6(S3)	**8** (Preset-speed 3)
F 130 Output terminal selection 1(RY-RC)	**4** (Low-speed detection signal)
F 131 Output terminal selection 2(OUT)	**6** (Designated frequency reach)
F 132 Output terminal selection 3(FL)	**10** (Failure FL)



■ Table of input terminal functions

Function No.	Code	Function
0	–	No function is assigned
1	ST	Standby terminal
2	F	Forward-run command
3	R	Reverse-run command
4	JOG	Jog run command
5	AD2	Acceleration/deceleration 2 pattern selection
6	SS1	Preset-speed command 1
7	SS2	Preset-speed command 2
8	SS3	Preset-speed command 3
9	SS4	Preset-speed command 4
10	RST	Reset command
11	EXT	Trip stop command from external input device
12	PNL/TB	Operation panel/terminal board switching
13	DB	DC braking command
14	PI	Prohibition of PI control
15	PWENE	Permission of parameter editing
16	ST+RST	Combination of standby and reset commands
17	ST+PNL/TB	Combination of standby and operation panel/terminal board switching
18	F+JOG	Combination of forward run and jog run
19	R+JOG	Combination of reverse run and jog run
20	F+AD2	Combination of forward run and acceleration/deceleration 2
21	R+AD2	Combination of reverse run and acceleration/deceleration 2
22	F+SS1	Combination of forward run and preset-speed command 1
23	R+SS1	Combination of reverse run and preset-speed command 1
24	F+SS2	Combination of forward run and preset-speed command 2
25	R+SS2	Combination of reverse run and preset-speed command 2
26	F+SS3	Combination of forward run and preset-speed command 3
27	R+SS3	Combination of reverse run and preset-speed command 3
28	F+SS4	Combination of forward run and preset-speed command 4
29	R+SS4	Combination of reverse run and preset-speed command 4
30	F+SS1+AD2	Combination of forward run, preset-speed command 1 and acceleration/deceleration 2
31	R+SS1+AD2	Combination of reverse run, preset-speed command 1 and acceleration/deceleration 2
32	F+SS2+AD2	Combination of forward run, preset-speed command 2 and acceleration/deceleration 2
33	R+SS2+AD2	Combination of reverse run, preset-speed command 2 and acceleration/deceleration 2
34	F+SS3+AD2	Combination of forward run, preset-speed command 3 and acceleration/deceleration 2
35	R+SS3+AD2	Combination of reverse run, preset-speed command 3 and acceleration/deceleration 2
36	F+SS4+AD2	Combination of forward run, preset-speed command 4 and acceleration/deceleration 2
37	R+SS4+AD2	Combination of reverse run, preset-speed command 4 and acceleration/deceleration 2
38	FCHG	Frequency command forced switching
39	THR2	No. 2 thermal switching
40	MCHG	No. 2 motor switching
41	UP	Frequency UP signal input from external contacts
42	DOWN	Frequency DOWN signal input from external contacts
43	CLR	Frequency UP/DOWN clear signal input from external contacts
44	CLR+RST	Combination of frequency UP/DOWN clear and reset by means of external contacts
45	EXTN	Inversion of trip stop command from external device
46	OH	Thermal trip stop signal input from external device
47	OHN	Inversion of thermal trip stop command from external device
48	SC/LC	Remote/local control forced switching
49	HD	Operation holding (stop of 3-wire operation)
49	HD	Operation holding (stop of 3-wire operation)
50	SDBF	Forward run after DC braking
51	SDBR	Reverse run after DC braking
52	FCR	Forced operation (factory setting needed)
53	FIRES	Fire speed control

■ Table of output terminal functions

Function No.	Code	Function
0	LL	Frequency lower limit
1	LLN	Inversion of frequency lower limit
2	UL	Frequency upper limit
3	ULN	Inversion of frequency upper limit
4	LOW	Low-speed detection signal
5	LOWN	Inversion of low-speed detection signal
6	RCH	Designated frequency reach signal (completion of acceleration/deceleration)
7	RCHN	Inversion of designated frequency reach signal (inversion of completion of acceleration/deceleration)
8	RCHF	Set frequency reach signal
9	RCHFN	Inversion of set frequency reach signal
10	FL	Failure FL (trip output)
11	FLN	Inversion of failure FL (inversion of trip output)
12	OT	Over-torque detection
13	OTN	Inversion of over-torque detection
14	RUN	RUN/STOP
15	RUNN	Inversion of RUN/STOP
16	POL	OL pre-alarm
17	POLN	Inversion of OL pre-alarm
18	POHR	Braking resistor overload pre-alarm
19	POHRN	Inversion of braking resistor overload pre-alarm
20	POT	Over-torque detection pre-alarm
21	POTN	Inversion of over-torque detection pre-alarm
22	PAL	Pre-alarm
23	PALN	Inversion of pre-alarm
24	UC	Low-current detection
25	UCN	Inversion of low-current detection
26	HFL	Hard fault
27	HFLN	Inversion of hard fault
28	LFL	Soft fault
29	LFLN	Inversion of soft fault
30	RDY1	Ready for operation(including ST, RUN)
31	RDY1N	Inversion of ready for operation(including ST, RUN)
32	RDY2	Ready for operation
33	RDY2N	Inversion of ready for operation
34	FCVIA	Selection of freqency reference for VIA
35	FCVIAN	Selection of freqency reference for VIA(inverted)
36	TBVIA	Selection of terminal for VIA
37	TBVIAN	Selection of terminal for VIA(inverted)
38	OUTO	Communication data output1
39	OUTON	Communication data output1(inverted)
40	OUT1	Communication data output2
41	OUT1N	Communication data output2(inverted)

Q5 How can I get a large torque?

A5 The VF-S9 series ensures a torque of 150% or more from low speeds by utilizing Toshiba's sensorless vector control.

Enable the sensorless vector control for a load that requires high starting or low speed torque.

To use sensorless vector control

1) When automatic torque increase **AU2** = **1** is set, all the sensorless vector controls and motor constants are set at one time.
2) Set V/F control mode selection **Pt** = **3** (sensorless vector control). Set the motor constant.
(1) For the same capacity as the inverter with the 4P Toshiba standard motor, it is not necessary to set the motor constants.
(2) The motor constants can be automatically set using the auto-tuning function **F400** = **2** (Auto tuning).
(3) The motor constants can be set individually.
F401: Slip frequency
F402: Motor primary constant
F403: Motor secondary constant
F404: Motor excitation constant
F405: Magnification of load inertial moment
F408: Rated capacity ratio of motor to inverter

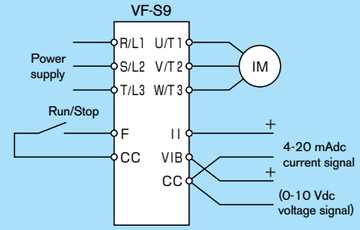
Q6 How do I start/stop a motor by external contacts, and control the frequency by a current signal of 4-20 mA (or a voltage signal of 0-10 Vdc.)

A6 To allow start/stop of the motor by external contacts, and to control the frequency by a current (voltage) signal, you need to set the following parameters:

■ **Parameters to be changed**

Parameter		Setting
CMOd	(Command mode selection)	0 (Terminal board)
FMOd	(Frecuency setting mode selection)	0 (Terminal board)

Example of wiring



■ **CMOd (Command mode selection) is a parameter to determine the source of the operation signal.**

For performing run/stop through a terminal
→ set to 0 (terminal board).
For performing run/stop with RUN/STOP key on the panel → set to 1 (panel).

■ **FMOd (Frequency setting mode selection) is a parameter to determine the place for providing frequency command.**

For providing frequency by current (voltage) signal through a terminal
→ set to 0 (terminal board).
For setting with UP/DOWN key on the panel
→ To be set on 1 (operation panel).
For setting with potentiometer
→ To be set to 2 (internal potentiometer).

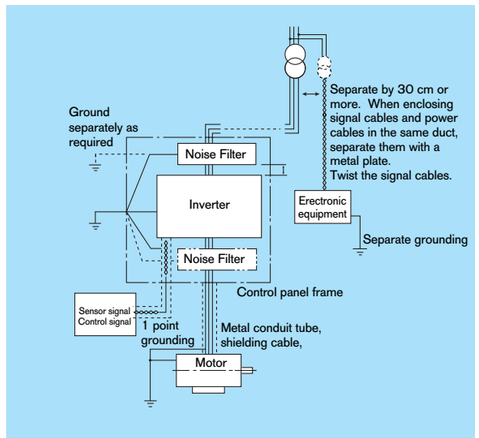
Note) Because they are connected to each other in the inverter, the VIA and II terminals cannot be used jointly. Use terminal VIB for joint use with terminal II.

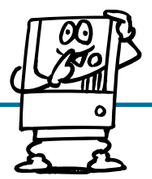
Q7 Why do other devices malfunction due to noise?

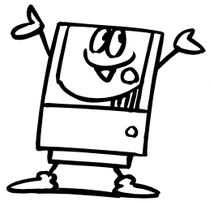
A7 Using PWM control, the VF-S9 series generates noise that may affect nearby instrumentation and electronic equipment.

Noise is classified by propagation route into transmission noise, and radiation noise.
Take the following counter measures for noise which affects other equipment:

- Separate the signal cables from the power cables with sufficient distance.
- Install noise filters.
  *VF-S9 series have a built-in noise filter (primary of inverter).
- Use twisted-pair shielding cables for weak electric circuits and signal circuits, and be sure to ground one end of the shielding.
- Install the inverters separately from other equipment.
- Cover the inverters and their cables with metal conduit tubes and metal control panels, and ground these covers.
- EMC plate is attached for measures of radiation noise.







To users of our 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) Because the VF-S9 inverter has a built-in fault detection relay [FL], the primary end magnetic contactor (MC) can be configured to trip on activation of the inverter's protective functions by connecting the contact points of the FL to the operation circuit of the MC.
(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.
(6) Install a surge suppressor on the excitation coil of the magnetic contactor (MC).

Installing a magnetic contactor [MC] [secondary side]

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

External signal

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

Installing an overload relay

(1) The VF-S9 inverter has a built-in overload protection function by means of a thermal relay. 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 you want to use a constant-torque Toshiba VF motor together with the VF-S9 inverter, change the inverter's electronic thermal protection characteristics to match those of the VF motor.
(3) In order to adequately protect a motor used for low-speed operation, we recommend the use of a motor equipped with a embedded thermal relay.

When changing the motor speed

Application to standard motors

Vibration

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

Reduction gear, belt, chain

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

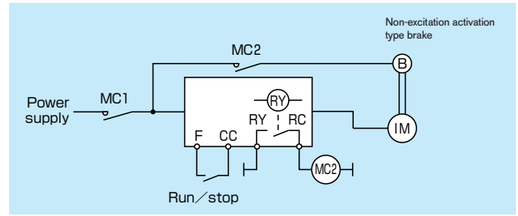
Frequency

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

Application to special motors

Braking motor

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



Gear motor

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

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

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

Pole-changing motor

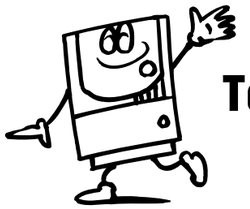
Pole-changing motors can be driven by the VF-S9 inverter. Before changing poles, however, be sure to let the motor come to a complete stop.

Hight-pole-count motors

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

Single-phase motor

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



To users of our inverters

When studying how to use our inverters

Notes

Leakage current

The VF-S9 series of inverters uses high-speed switching deuices 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.

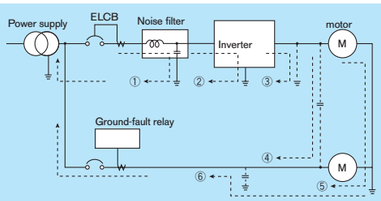
【Effects of leakage current】

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. In the case of the VF-S9, the frequency can be decreased to 2.0kHz. (*)
   (2) Install leakage circuit breakers (ELCB) with a high-frequency protective function (e.g., Toshiba Mighty series of breakers) in both the same and the other power distribution lines. This makes it possible to operate the VF-S9 with its PWM carrier frequency set high.
2) Measures against malfunction of ground-fault relay:
   (1) Decrease the PWM carrier frequency of the inverter. In the case of the VF-S9, the frequency can be decreased to 2.0kHz. (*)
   (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. This makes it possible to operate the VF-S9 with its PWM carrier frequency set high.
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. In the case of the VF-S9, the frequency can be decreased to 2.0kHz. (*)
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. In the case of the VF-S9, the frequency can be decreased to 2.0kHz.

Note) If the carrier frequency reduce, the magnetic noise caused by the motor increase.

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.

(*): The PWM carried frequency should not be decreased below 2.2kHz in the vector control mode.

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

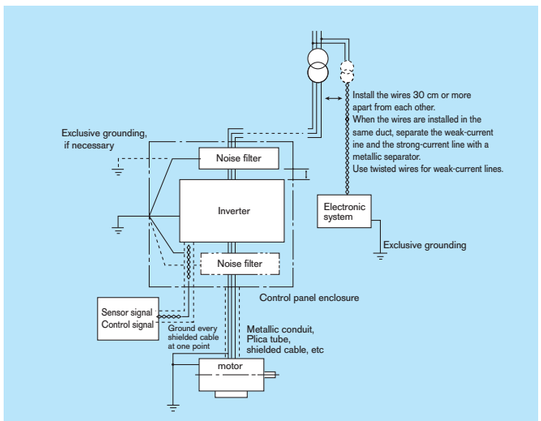
[Noise produced by inverters]
Since the VF-S9 series of inverters performs PWM control, it produces noise and sometimes affects nearby instrumental devices, electrical and electronic systems, etc. The effects of noise greatly vary with the noise resistance of each individual device, its wiring condition, 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.

All 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 rectors

These devices are used to improve the input power factor and suppress high harmonic currents and surges. Install an input AC reactor when using a VF-S9 inverter under the following conditions:

(1) When the power source capacity is 200kVA 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.

Standard replacement intervals of main parts

The table below lists standard component replacement intervals under normal operating conditions (i.e., average year round ambient temperature of 30∞C, load ratio of 80% or less, average operation time of 12 hours/day). The replacement intervals do not indicates the service life of each component, but the number of years beyond which the failure rate of a component used without being replaced increases shapely because of deterioration and wear.

Component name	Standard replacement intervals	Replacement method, etc.
Cooling fan	2 to 3 years	Replaced with a new one
Smoothing capacitor	5 years	Replaced with a new one (upon examination)
Circuit breaker, relay	———	Decided upon examination
Timer	———	Decided upon examination of the cumulative operation time
Fuse	10 years	Replaced with a new one
Aluminum capacitors on the printed circuit board	5 years	Replaced with a new circuit board (upon examination)

Extract from "Periodic Inspection of General-purpose Inverters" published by the Japan Electrical Ma nufacturers' Association
Note: The service life of each component greatly varies with its usage environment.

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 inertia^2 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.

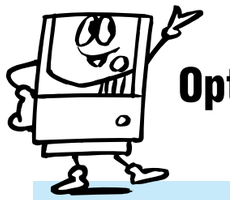
Acceleration time	$ta = \dfrac{(J_M + J_L) \times \triangle N}{9.56 \times (T_M - T_L)}$ (sec.)
Deceleration time	$ta = \dfrac{(J_M + J_L) \times \triangle N}{9.56 \times (T_B + T_L)}$ (sec.)
Conditions	J_M : Moment of inertia of motor (kge.m^2) J_L : Moment of inertia of load (kge.m^2) (converted into value on motor shaft) $\triangle N$: Difference in rotating speed between before and after acc. or dce. (min.$^{-1}$) T_L : Load torque (Ne.m) T_M : Motor rated torque x 1.2-1.3 (Ne.m) ... V/f control : Motor rated torque x 1.5 (Ne.m) ... Vector operation control T_B : 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.

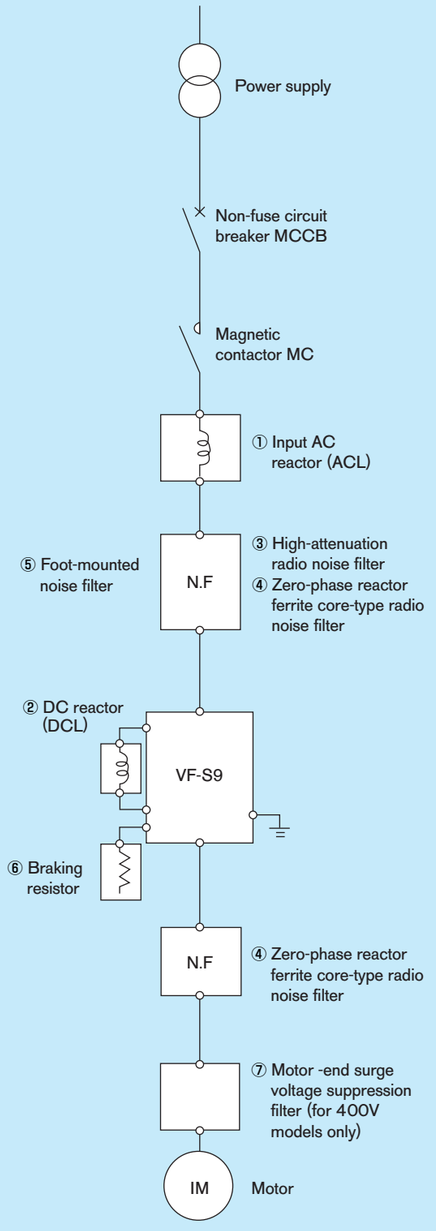
Starting characteristics

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.



Optional external devices

The following external devices are optionally available for the VF-S9 series of inverters.



No.	Device	Function, Purpose, etc.	Refer to
①	Input AC reactor	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.	P. 18
②	DC reactor	Improves the power factor more than the input reactor. When the facility applying the inverter requires high reliability, it is recommended to use the DC reactor with an input reactor effective for external surge suppression. * An inverter unit of 200V-3.7kW or less is connected to a reactor selected on P. 18 to conform "Guides of limits for harmonics current emissions on general purpose inverter having an input current up to and including 20A per phase" by the Japan Electrical Manufacturers' Association.	
③	Radio noise reduction filter — High-attenuation filter (LC filter) NF type manufactured by Soshin Electric Co.	These types of filters are not necessary because all single-phase 200 V or 3-phase 400 V models and 3-phase 200 V, 5.5 kW or 7.5 kW models have a built-in EMI noise filter, conforming to Class A, as standard But install these filters if necessavly of noise reduction more and more. • Effective to prevent interference with 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 10 MHz. • Use when equipment readily affected by noise is installed in the peripheral area.	P. 19
④	Radio noise reduction filter — Zero-phase reactor (inductive filter) Ferrite core type manufactured by Soshin Electric Co.	• Effective to prevent interference with 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 10 MHz. • For noise countermeasures, insert on the secondary side of the inverter.	P. 19
⑤	Radio noise reduction filter — Foot-mounted type noise reduction filter	High-attenuation EMI noise filter requiring only small space; mounted on the rear side of the inverter. This filter can be installed to conform to the following classes of EMC standard EN5501 Group 1. 3-phase 200 V models excluding those of 5.5/7.5 kW : Conform to Class A. All models other than above : Conform to Class B.	P. 19
⑥	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. 20
⑦	Motor-end surge voltage suppression filter (400 V 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 400 V class motor driven with an inverter.	Contact your Toshiba representative.
⑧	Conduit pipe kit	Attachment kit used for conformance to NEMA TYPE1.	
⑨	IP43 enclosure kit	Attachment kit for making a panel conform to the IP43 structure.	
⑩	DIN rail kit	Available for the 200 V class models of 0.75 kW or less. (Model: DIN001Z)	
⑪	Parameter writer	Use this unit for batch read, batch copy, and batch writing of setting parameters. (Model: PWU001Z)	P. 20
⑫	Extension panel	Extended operation panel kit provided with LED indication section, RUN/STOP key, UP/DOWN key, Monitor key, and Enter key. (Model: RKP001Z)	
⑬	RS485 communication converter unit	Use to connect a personal computer for data communication with up to 64 or 256 units. (Model: RS4001Z, RS4002Z)	
⑭	RS232C communication converter unit	Use to connect a personal computer for data communication. (Model: RS2001Z)	
⑮	Remote panel	Provided with built-in frequency indicator, frequency setting device, and RUN-STOP (forward/reverse) switch. (Model: CBVR-7B1)	P. 21
⑯	Application control unit	AP Series is available to enable various types of application control functions when combined with an inverter. Contact your Toshiba representative for further information.	—

Device: Input AC reactor (ACL)

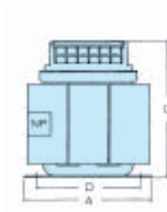


Fig.A

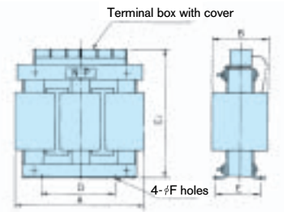
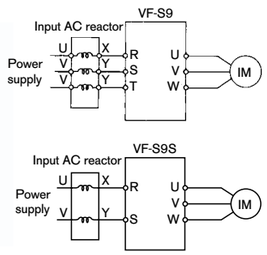


Fig.B



Type	Rating	Inverter type	Dimensions (mm) A	B	C	D	E	F	G	Drawing	Terminals	Approx.weight. (kg)
PFLS2002S	1ϕ-230V-2.0A-50/60Hz	VFS9S-2002PL	80	55	115	63	45	5	45	A	M3.5	0.85
PFL2001S	3ϕ-230V-1.7A-50/60Hz	VFS9-2002PM	105	65	115	90	55	5	40		M3.5	1.0
PFL2005S	3ϕ-230V-5.5A-50/60Hz	VFS9-2004PM,2007PM VFS9S-2004PL,2007PL	105	65	115	90	55	5	40		M3.5	1.2
PFL2011S	3ϕ-230V-11A-50/60Hz	VFS9-2015PM、2022PM	130	70	140	115	60	5	50		M4	2.3
PFL2018S	3ϕ-230V-18A-50/60Hz	VFS9-2037PM, VFS9S-2015PL,VFS9S-2022PL	130	70	140	115	60	5	50		M4	2.5
PFL2025S	3ϕ-230V-25A-50/60Hz	VFS9-2055PL	125	100	130	50	83	7	—		M4	2.6
PFL2050S	3ϕ-230V-50A-50/60Hz	VFS9-2075PL,VFS9-2110PM	155	115	140	50	95	7	—	B	M6	3.4
PFL2100S	3ϕ-230V-100A-50/60Hz	VFS9-2150PM	230	150	210	60	90	8	—		M8	8.2
PFL4012S	3ϕ-460V-12.5A-50/60Hz	VFS9-4007PL～VFS9-4037PL	125	95	130	50	79	7	—		M4	2.3
PFL4025S	3ϕ-460V-25A-50/60Hz	VFS9-4055PL～VFS9-4110PL	155	110	155	50	94	7	—			4.9
PFL4050S	3ϕ-460V-50A-50/60Hz	VFS9-4150PL	155	140	165	50	112	7	—		M6	6.6

Note) PFL2002S has 4 terminals.

Device: DC reactor (DCL)

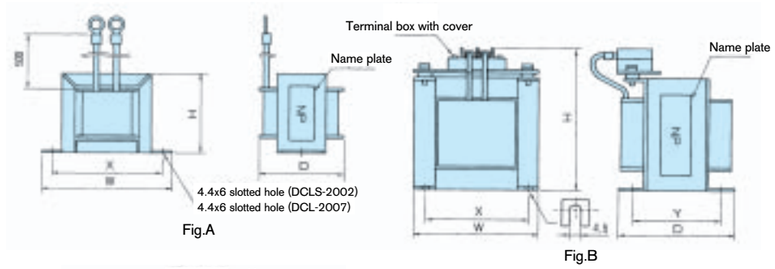


Fig.A

Fig.B

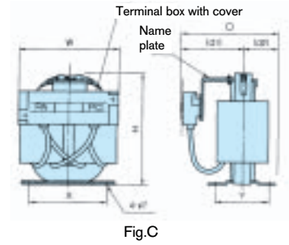
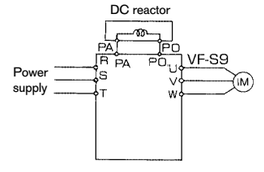


Fig.C



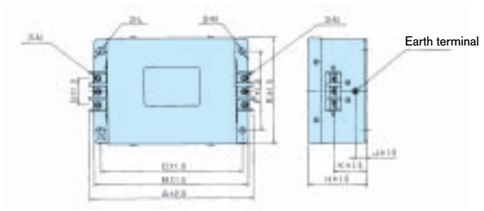
Type	Rated current (A)	Inverter type	Dimensions (mm) W	H	D	X	Y	d1	d2	Drawing	Terminals	Approx. weight. (kg)
DCL-2002		VFS9-2002PM	59	37	35	51	—	—	—	A	V1.25-3.5	0.2
DCLS-2002	2.5	VFS9S-2002PL	79	50	44	66	—	—	—		V1.25-3.5	0.6
DCL-2007	7	VFS9-2004PM,2007PM VFS9S-2004PL VFS9-4007PL,4015PL Note)	92	65	70	82	—	—	—		V2-3.5	1.2
DCL-2022	14	VFS9-2015PM,2022PM VFS9S-2007PL VFS9-4022PL,4037PL Note)	86	110	80	71	64	—	—	B	M4	2.2
DCL-2037	22.5	VFS9-2037PM VFS9S-2015PL,2022PL	86	110	85	71	70	—	55		M4	2.5
DCL-2055	38	VFS9-2055PL	75	130	140	50	85	85	55	C	M5	1.9
DCL-2110	75	VFS9-2075PL~VFS9-2110PM	100	150	150	65	85	95	60		M6	2.4
DCL-2220	150	VFS9-2150PM	117	170	190	90	90	130	—		M8	4.3
DCL-4110	38	VFS9-4055PL~4110PL	95	150	165	70	90	105	60	C	M5	3.0
DCL-4220	75	VFS9-4150PL	105	160	185	80	100	130	65		M8	3.7

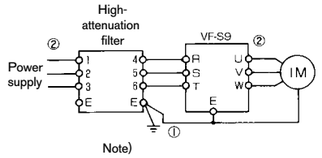
Note) VFS9-4007PL~4037PL are used DC reactor for 200V class.

Device

External dimensions and connections

High-attenuation radio noise reduction filter



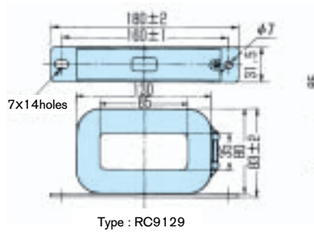


Note)
① Noise filter should be connected to the primary-side of inveter.
② Out put cable should be kept away from input cable.

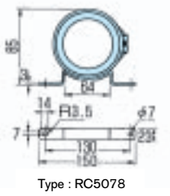
Type	Rated current (A)	Inverter type	Dimensions (mm)												Approx.weight. (kg)
			A	B	C	E	F	G	H	J	K	M	N	P	
NF3005A-MJ	5	VFS9-2002PM~VFS9-2007PM	174.5	160	145	110	80	32	70	20	45	ø5.5	M4	M4	1.0
NF3015A-MJ	15	VFS9-2015PM, VFS9-2022PM													1.6
NF3020A-MJ	20	VFS9-2037PM													
NF3050A-MJ	50	VFS9-2110PM	267.5	250	235	170	140	44	90	30	60	ø6.5	M6	M6	4.6
NF3080A-MJ	80	VFS9-2150PM	294.5	280	260	170	150	37	100		65			M6	7.0

Note) End of type of Inverter : -PL has a built-in the high-attenuation radio noise reduction filter

Zero-phase ferrite core type radio noise reduction filter

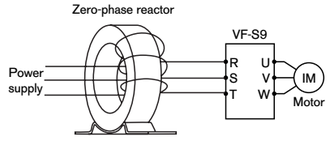


Type : RC9129



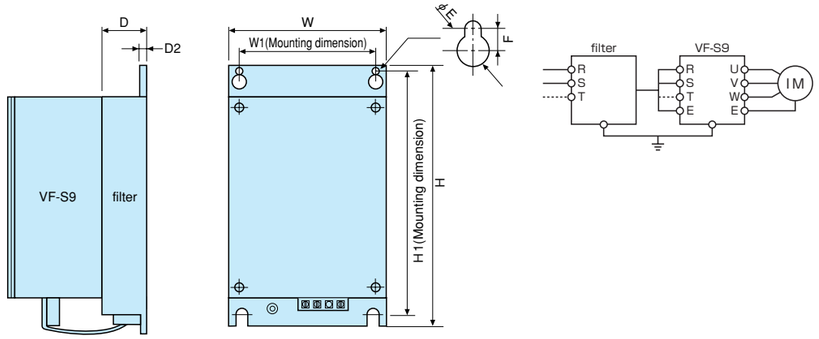
Type : RC5078

Unit : mm



Input or output cable should be coiled over 4-times.

Foot-mounted noise filter



Type	Rated current (A)	Inverter type	Dimensions (mm)									Leakage current(mA) note)
			W	H	D	W1	H1	D2	E	F	G	
EMFS2010AZ	10	VFS9S-2002PL~2007PL	105	185	50	85	170	2	10	8.5	4.5	76
EMF2011BZ	11	VFS9-2002PM~2015PM										84
EMFS2016CZ	16	VFS9S-2015PL	130	205	60	110	190					70
EMF4006CZ	6	VFS9-4007PL, 4015PL										200
EMFS2025DZ	25	VFS9S-2022PL	140	250		120	230					78
EMF4022DZ	22	VFS9-2022PM, 2037PM										170
		VFS9-4022PL, 4037PL										400
EMF4045EZ	45	VFS9-2055PL, 2075PL, 4055PL, 4075PL	200	351		160	330		11	9.5	5.5	180
EMF4045FZ	45	VFS9-4110PL, 4150PL	245	372		250	360					400
EMF2080GZ*	80	VFS9-2110PM, 2150PM										110

*Install grounding cable between the filter and EMC plate to conform to "EN55011 Group 1 class A".(EMF2080GZ)
wire size : 6mm^2 or more (AWG9 or more)
wire length : 0.29m or less
note) In case of the delta connection.(Primary side of the inverter)

Device

External dimensions and connections

Braking resistor

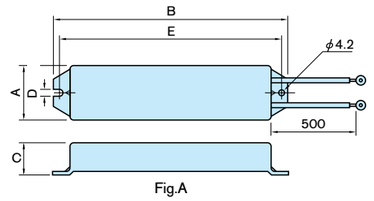


Fig.A

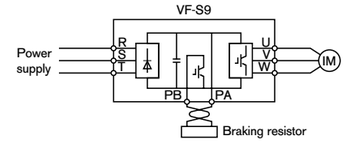


Fig.C

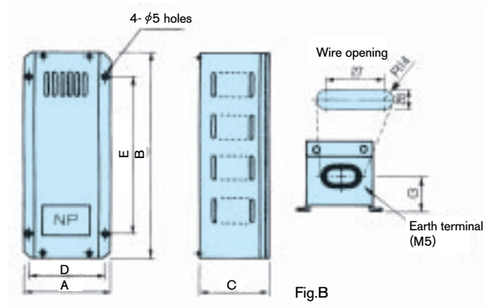


Fig.B

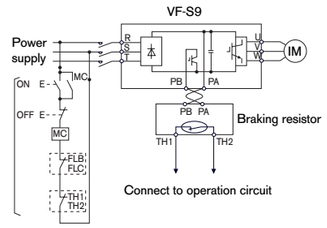


Fig.D

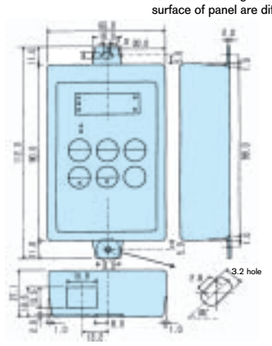
Type	Rating	Inverter type	Dimensions (mm)						Drawing	Approx.weight. (kg)
			A	B	C	D	E	G		
PBR-2007	120W-200Ω	VFS9-2002PM~VFS9-2007PM VFS9S-2002PL~VFS9S-2007PL VFS9-4007PL~VFS9-4022PL Note)	42	182	20	4.2	172	—	A & C	0.28
PBR-2022	120W-75Ω	VFS9-2015PM~VFS9-2022PM VFS9S-2015PL, 2022PL								
PBR-2037	120W-40Ω	VFS9-2037PM								
PBR3-2055	120W-40Ω×2P (240W-20Ω)	VFS9-2055PL	120	320	115	110	230	50	B & D	4
PBR3-2075	220W-30Ω×2P (440W-15Ω)	VFS9-2075PL		350	190			150		4.5
PBR3-2110	220W-30Ω×3P (660W-10Ω)	VFS9-2110PM								5
PBR3-2150	220W-30Ω×4P (880W-7.5Ω)	VFS9-2150PM								5.5
PBR-4037	120W-160Ω	VFS9-4037PL	42	182	20	4.2	172	—	A & C	0.28
PBR3-4055	120W-160Ω×2P (240W-80Ω)	VFS9-4055PL	120	320	115	110	230	50	B & D	4
PBR3-4075	220W-120Ω×2P (440W-60Ω)	VFS9-4075PL		350	190			150		4.5
PBR3-4110	220W-120Ω×3P (660W-40Ω)	VFS9-4110PL								5
PBR3-4150	120W-120Ω×4P (880W-30Ω)	VFS9-4150PL								5.5

Note) VFS9-4007PL~4022PL are used breaking resister for 200V class.

Parameter writer Extention panel Communication Converter unit (RS485/RS232C)

Parameter writer **Extention panel** **Communication Converter Unit** **RS485/RS232C**

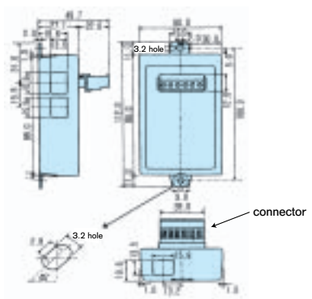
Note) Dimentions of extention panel are same as following drawing, but tha surface of panel are different.



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

Extension panel type:
PKP001Z
Extension panel cable type:
CAB0011(1m)
CAB0013(3m)
CAB0015(5m)

Note) Following is RS485 unit. Dimentions of RS232C unit are same as following,but RS232C doesn't have a connector.

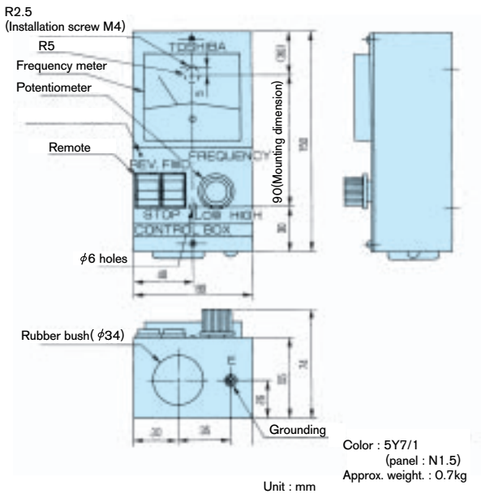


RS485 communication converter type: RS4001Z
RS485 cable type: CAB0011(1m) CAB0013(3m) CAB0015(5m)

RS232C communication converter type: RS2001Z
Computer cable type: CAB0025
RS232C cable type: CAB0011(1m) CAB0013(3m) CAB0015(5m)

Device	External dimensions and connections

Remote panel CBVR-7B1

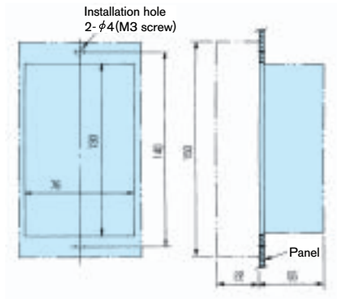


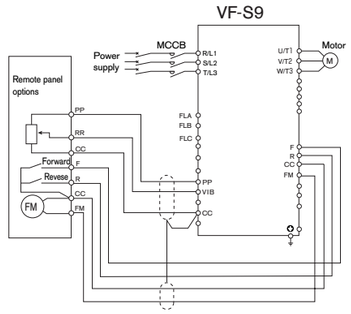
Color : 5Y7/1
(panel : N1.5)
Approx. weight. : 0.7kg

Unit : mm

Note) Mounting dimension of CBVR-7B(old type)is same as CBVR-7B1.

Panel hole

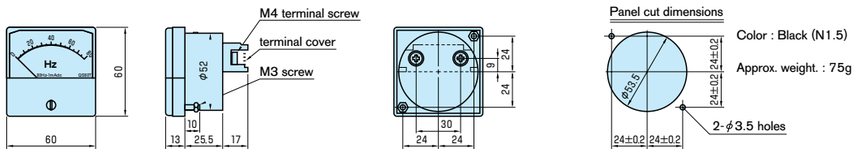




Note) The length of wire between inverter and remote panel less than 30m.

Frequency meter QS60T

Frequency meter <QS60T(80Hz-1mAdc)>



(Front) (Side) (Rear)

Color : Black (N1.5)

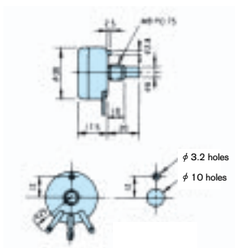
Approx. weight. : 75g

Unit : mm

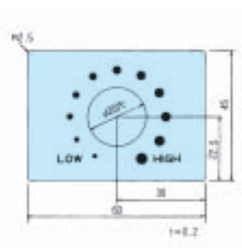
Note) Dimension of QS60T is diffrent from old type : QY-11.

FRH kit

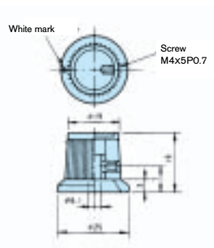
Frequency setting resistor <RV30YN-20S-B302>



Frequency setting panel



Frequency setting



Unit : mm

Trip display / Alarm display

■ Trip information

Error code	Problem	Remedies
OC 1	Overcurrent during acceleration	・Increase the acceleration time ACC . ・Check the V/F parameter. ・Use F301 (Auto-restart) and F302 (ride-through control). ・Increase the carrier frequency F300 .
OC2	Overcurrent during deceleration	・Increase the deceleration time dEC.
OC3	Overcurrent during operation	・Reduce the load fluctuation. ・Check the load (operated machine).
OCA	Arm overcurrent at start-up	・A main circuit element is defective. Make a service call.
OCL	Overcurrent (An overcurrent on the lood side at start-up)	・Check the cables and wires for defective insulation.
OP 1	Overvoltage during acceleration	・Insert a suitable input reactor. ・Use F301 (Auto-restart) and F302 (ride-through control).
OP2	Overvoltage during deceleration	・Increase the deceleration time dEC. ・Install a suitable dynamic braking resistor. ・Enable F304 (dynamic braking selection). ・Enable F305 (overvoltage limit operation). ・Inset a suitable input reactor.
OP3	Overvoltage during constant-speed operation	・Insert a suitable input reactor. ・Install a dynamic braking resistor.
OL 1	Inverter overload	・Increase the acceleration time ACC. ・Reduce the DC braking amount F251 and the DC braking time F252 . ・Check the V/F parameter setting. ・Use F301 (Auto-restart) and F302 (ride-through control). ・Use an inverter with a larger rating.
OL2	Motor overload	・Check the V/F parameter setting. ・Check the load (operated machine). ・Adjust OLN to the overload that the motor can withstand during operation in a low speed range.
*EPHO	Output phase failure	・Check the main circuit output line, motor, etc., for phase failure. ・Enable F605 (Output phase failure detection).
*EPH 1	Input phase failure	・Check the main circuit input line for phase failure. ・Enable F608 (Input phase failure detection).
OH2	External thermal trip	・Check the external input device.
*Ot	Over-torque trip	・Check whether the system is in a normal condition.
OLr	Dynamic braking resistor overload trip	・Increase the deceleration time dEC. ・Use a dynamic resistor with a larger capacity (W) and adjust F308 (PBR capacity parameter) accordingly.
OH	Overheat	・Restart the operation by resetting the inverter after it has cooled down enough. ・The fan requires replacement if it does not rotate during operation. ・Secure sufficient space around the inverter. ・Do not place any heat-generating device near the inverter. ・The thermistor in the unit is broken. Make a service call.
*UP 1	Undervoltage trip (main circuit)	・Check the input voltage. ・Enable F627 (undervoltage trip selection). ・To cope with a momentary stop due to undervoltage, enable F302 (ride-through control) and (Auto-restart) F301.

■ Trip information

Error code	Problem	Remedies
*UC	Small-current operation trip	・Enable F610 (Low-current detection parameter). ・Check whether the detection level is set properly to the system. (F611 and F612) ・If no error is found in the setting, make a service call.
EF2	Ground fault trip	・Check the cable and the motor for ground faults.
E	Emergency stop	・Reset the inverter.
E-18	VIA analog input line break detected	・Check F633 setting value or VIA input value
Err2	Main unit RAM fault	・Make a service call.
Err3	Main unit ROM fault	・Make a service call.
Err4	CPU fault trip	・Make a service call.
Err5	Remote control error	・Check the remote control device, cables, etc.
EtyP	Inverter type error	・Make a service call.
EEP 1	EEPROM fault	・Turn off the inverter, then turn it on again. If it does not recover from the error, make a service call.
Etn	Auto-tuning error	・Check the settings of the motor parameters F401 to F408 . ・Check that the motor is not two or more sizes smaller in capacity than the inverter. ・Check that the inverter output cable is not too thin. ・Check that the motor is not running. ・Check that the motor is a three-phase inductive motor.

Note) With a parameter, you can choose between trip-on and -off.

■ Alarm information

Each message in the table is displayed to give a warning but does not cause the inverter to trip.

Error code	Problem	Remedies
OFF	ST terminal OFF	・Close the ST-CC circuit.
nOFF	Undervoltage in main circuit	・Measure the main circuit supply voltage. If the voltage is at a normal level, the inverter requires repairing.
rtry	Retry in process	・The inverter is normal if it restarts after several tens of seconds. The inverter restarts automatically. Be careful of the machine because it may suddenly restart.
Err 1	Frequency point setting error	・Set the frequency setting signals at points 1 and 2 apart from each other.
CLr	Clear command acceptable	・Press the STOP key again to clear the trip.
EOFF	Emergency stop command acceptable	・Press the STOP key for an emergency stop. To cancel the emergency stop, press any other key.
H 1/LO	Setting error alarm / An error code and data are displayed alternately twice each.	・Check whether the setting is made correctly.
db	DC braking	・Normal if the message disappears after several tens of seconds. (See Note.)
In it	Parameters in the process of initialization	・Normal if the message disappears after a while (several seconds to several tens of seconds).
	Setup parameters in the process of being set	・Normal if the message disappears after a while (several seconds to several tens of seconds).
Atn	Auto-tuning in process	・Normal if the message disappears after several seconds.

Note) When the ON/OFF function is selected for DC braking (DB), using the input terminal selection parameter, you can judge the inverter to be normal if "db" disappears when opening the circuit between the terminal and CC.