TOSHIBA

Compact, Simple Inverter TOSVERT

VF-S7e

New User-Friendly, Compact Inverters

Actual size

VF-S7e Series Inverters— Easy to Use Right from the Start

Operation

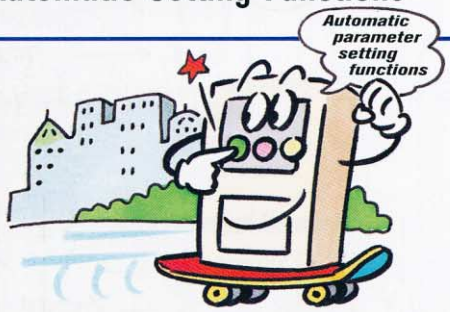
Easy-to-operate with large dials and switches

Ideal for beginners with the Potentiometer for frequency setting and two keys —RUN, STOP—located at the center

Setting

Quick setting by Automatic Setting Functions

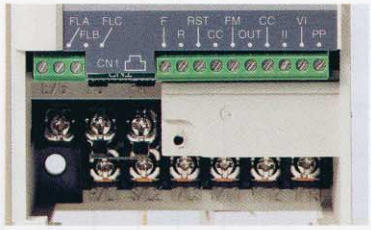
Saves time and labor. Just wire the motor and power supply, and press the RUN switch. Your TOSVERT will start working at once. The "Automatic Setting Functions" take care of tedious parameter setting.



Wiring

Easy-to-wire screw type terminal block

Using screw type terminal blocks, both the main and control circuits are easy to wire securely.



Complies with ISO-9001

Designed and produced by the Toshiba Mie Plant, which obtained the international quality assurance standard ISO9001 certification in March 1995.

■ Capacity

Input voltage class	Applicable motor capacity (kW)			
	0.1	0.2	0.4	0.75
3ø200V				
1ø200V				
1ø100V				

Table of Contents

Simple to Operate & Easy to Set

MON lamp
ON during monitoring

PRG lamp
ON during setting

RUN lamp
ON while TOSVERT is running

Display
Indicates operation frequency, parameters, and probable cause of trouble.

RUN key lamp
ON when TOSVERT is ready to operate with the RUN key.

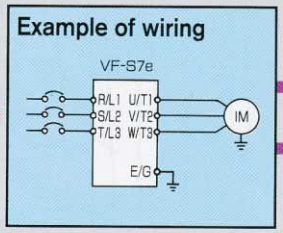
RUN key
Press the RUN key to start TOSVERT while the RUN key lamp is ON.

STOP key
Press the STOP key to stop TOSVERT while the RUN key lamp is ON.

Potentiometer lamp
ON when the potentiometer built in TOSVERT is effective.

Potentiometer
Used to set the operation frequency while its lamp is ON.

Panel operation



Operating

❶ Displays 0.0 when the power is ON.

Pressing the RUN key and turning the potentiometer...

Monitoring

❶ Displays the operation frequency.

Pressing the monitor key twice...

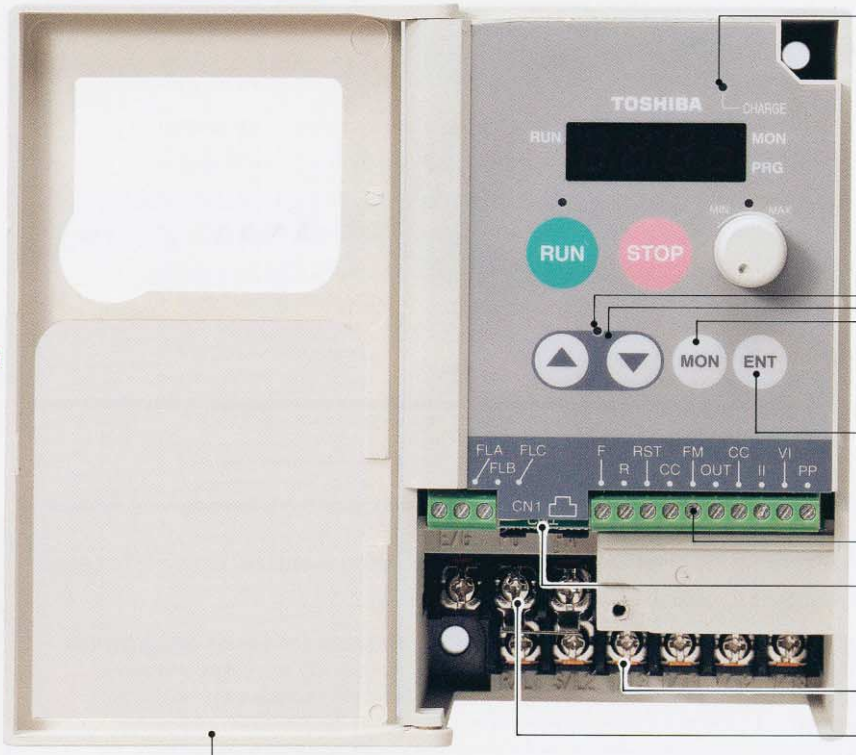
Setting

❶ Displays 0.0 when the power is ON.

Pressing the MONITOR key...

(changing the acceleration time)

Inside the front cover



CHARGE lamp
Indicates that a high voltage remains in TOSVERT. While this is ON, do not touch the terminal block.

UP/DOWN key lamp
While this is ON, you can set the operation frequency with the UP/DOWN key.

UP/DOWN key

MONITOR key
Used to select the operation mode, parameter setting mode, or status monitor mode.

ENTER key
Reads or writes a frequency and parameters.

Control terminal block

Connector for remote keypad
This connector is used to connect to the extension panel (optional) and the parameter writer (optional).

Main circuit terminal block

DC-link reactor terminal block

Front cover

*Terminal block cover: Be sure to attach the accompanying terminal block cover before operating TOSVERT, in order to prevent you from accidentally touching the main circuit terminal block.

❷ Operates TOSVERT at the frequency set with the potentiometer.

Turning the potentiometer use ellipses...

❸ Changes the frequency.

Pressing the STOP key use ellipses...

❹ Decelerates and stops the motor.

❷ Displays the motor rotating direction.

Pressing the UP key...

❸ Displays the operation frequency command value.

Pressing the UP key...

❹ Displays the load current in (%/ampere).

Pressing the UP key displays various information such as input voltage, output voltage, and input/output terminal status. Pressing the MONITOR key...

❺ Displays the operation frequency (returns to the start).

❷ Displays "AU 1."

Pressing the key until "ACC" is displayed...

❸ Displays "ACC"

Pressing the ENTER key...

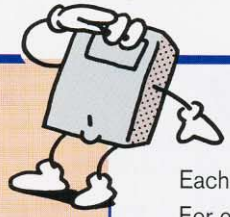
❹ Displays the setting.

Pressing the ENTER key after setting a value you desire with the UP/DOWN key...

❺ Displays "ACC" and the setting alternately, completing the setting.

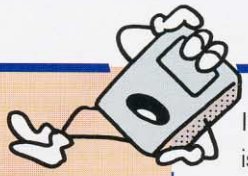
*Pressing the ENTER key without changing the setting displays the next parameter ("DEC").

Leave the setting to TOSVERT.



What are parameters?

Each of the setting items that control the inverter is called a "parameter." For example, to set a meter to be connected, set the meter selection parameter (FMSL); to change an acceleration time, change the acceleration time parameter (ACC); to change the maximum frequency, change the maximum frequency parameter (FH). Use the parameters as required to achieve the functions you need.



What are the three "Automatic Parameter Setting Functions"?

Incorporating the three Automatic Parameter Setting Functions, the VF-S7e series is designed to minimize tedious parameter setting.

Automatic acceleration & deceleration time adjusting function

Automatically adjusts the acceleration and deceleration time according to the load conditions.

When you have set the Automatic acceleration & deceleration time adjusting function, the acceleration & deceleration times are continuously changed according to the load conditions.

Parameter	Setting
AU1	1 (Automatic acceleration & deceleration)

Automatic torque up adjusting function

Adjusts the inverter output voltage correspond to the load conditions, thereby increasing the motor torque.

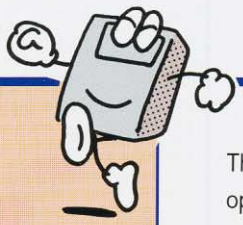
Parameter	Setting
AU2	1 (Automatic torque boost)

Automatic environment setting function

Automatically sets various environment functions incorporated in the inverter to ensure that the inverter runs reliably.

Setting the Automatic environment setting function to 1 or 2 sets the following parameters automatically. For details, see the Operation Manual.

- Maximum frequency
- Upper limit frequency
- Base frequency
- Acceleration/deceleration pattern
- VI/II reference point frequency
- Auto-restart
- Regeneration power ride-through control
- Overvoltage stall protection
- Power voltage compensation



How to read the monitor display

The LEDs on the operator 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 (character)

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	v			y	

Basic parameters

• Before using the 3 automatic setting functions

Title	Function	Adjustment range	Default value
AU1	Automatic acceleration & deceleration	0: No 1: Yes	0
AU2	Automatic torque boost	0: No 1: Automatic torque boost	0
AU3	Automatic environment setting	0: No 1: Automatic 50 Hz motor 2: Automatic 60 Hz motor	0

• Before using the basic functions of VF-S7e

Title	Function	Adjustment range	Default value
CMOd	Command mode selection	0: Terminal block, 1: Panel	1
FMOd	Frequency setting mode selection	0: Terminal block, 1: Panel, 2: Built-in on potentiometer	2
FMSL	FM terminal function selection	0: Output frequency , 1: Output current	0
FM	Connected meter adjustment	*To adjust the external frequency meter/ammeter	—
tYP	Standard setting mode selection	0: No action 1: 50 Hz standard 2: 60 Hz standard 3: Default setting 4: Clearing error logs 5: Clearing accumulated operation time	0
Fr	Forward/reverse selection (panel)	0: Forward 1: Reverse	0
ACC	Acceleration time #1 (sec.)	0.1—3600	10.0
dEC	Deceleration time #2 (sec.)	0.1—3600	10.0
FH	Maximum frequency (Hz)	30.0—320.0	80.0
UL	Upper limit frequency (Hz)	0.5— FH	80.0
LL	Lower limit frequency (Hz)	0.0— UL	0.0
uL	Base frequency (Hz)	25.0—320.0	60.0
Pt	V/F pattern	0: Constant V/f 1: Square reduction 2: Automatic torque boost	0
ub	Voltage boost (%)	0—30.0	6
OLM	Selection of electronic thermal protection characteristics	0: OL trip/standard motor 1: OL trip, stall/standard motor 2: Standard motor 3: OL stall/standard motor 4: OL trip/VF motor 5: OL trip, stall/VF motor 6: VF motor 7: OL stall/VF motor	0
Sr1 to Sr7	Preset speed 1 to 7 (Hz)	LL— UL	0.0
F---	Extended parameter	—	—
Gr.U	Automatic edit function	Displays parameters different from their default values	—

Extended parameters

• For even better performance

Input/output parameters

Title	Function
F100	Low speed signal output frequency
F101	Speed reached frequency
F102	Speed reached detection band
F103	ST signal selection
F104	RST signal selection
F110	Always active function selection
F111	Input terminal selection #1
F112	Input terminal selection #2
F113	Input terminal selection #3
F130	Output terminal selection #1

Frequency parameters

Title	Function
F201	VI/II reference point #1
F202	VI/II point #1 frequency
F203	VI/II reference point #2
F204	VI/II point #2 frequency
F240	Start-up frequency
F241	Run frequency
F242	Run frequency hysteresis
F250	DC injection starting frequency
F251	DC injection current
F252	DC injection time
F260	Jog run frequency
F261	Jog stop control
F270	Jump frequency #1
F271	Jump frequency band #1

Frequency parameters

Title	Function
F272	Jump frequency #2
F273	Jump frequency band #2
F274	Jump frequency #3
F275	Jump frequency band #3
F280	Preset speed #1
F281	Preset speed #2
F282	Preset speed #3
F283	Preset speed #4
F284	Preset speed #5
F285	Preset speed #6
F286	Preset speed #7

Operation mode parameters

Title	Function
F300	PWM carrier frequency
F301	Auto-restart
F302	Regeneration power ride-though control
F303	Retry selection
F305	Overvoltage stall protection
F306	Output voltage adjustment
F307	Power voltage compensation

Torque increase mode parameters

Title	Function
F406	Automatic torque boost no-load current
F407	Maximum automatic torque boost level

Acceleration/deceleration time parameters

Title	Function
F500	Acceleration time #2
F501	Deceleration time #2
F502	Acc./dec. pattern #1
F503	Acc./dec. pattern #2
F504	Acc./dec. #1 & #2 selection
F505	Acc./dec. #1/#2 switching frequency

Protection parameters

Title	Function
F600	Motor overload protection level
F601	Stall prevention level
F602	Fault trip saving
F603	Emergency stop selection
F604	Emergency DC inject time

Panel parameters

Title	Function
F700	Parameter setting disable selection
F701	Unit selection
F702	Frequency units multiplication factor

Communication parameters

Title	Function
F800	Communication speed
F801	Parity
F803	Communication error trip time

Standard Specification

	Input voltage class	3-phase 200 V input				1-phase 200 V input			1-phase 100 V input		
	Applicable motor capacity (kW)	0.1	0.2	0.4	0.75	0.1	0.2	0.4	0.1	0.2	0.4
Type	Model	VFS7E-				VFS7ES-					
		2001P	2002P	2004P	2007P	2001P	2002P	2004P	1001P	1002P	1004P
Rating	Capacity (kVA)	0.3	0.6	1.0	1.6	0.3	0.6	1.0	0.3	0.6	1.0
	Rated output current (A)	0.7	1.4	2.4	4.0	0.7	1.4	2.4	0.7	1.4	2.4
Power supply	Voltage & frequency	3-phase 200—230V-50/60Hz				1-phase 200—230V-50/60Hz			1-phase 100—115V-50/60Hz		
	Tolerance	Voltage: ±10%, Frequency: ±5%									
Main control functions	Control method	Sinusoidal PWM control									
	Rated output voltage	The voltage is controlled to within 100—120 % of the rated voltage (100/200V) by the power supply voltage compensating function (output voltage cannot exceed input voltage).									
	Output frequency range	0.5—320 Hz, set to 0.5—60 Hz by default, maximum frequency adjustment(30—320 Hz)									
	Frequency setting resolution	0.1 Hz: input from the operation panel, 0.2 Hz: Analog input (at the maximum frequency of 100 Hz)									
	Frequency accuracy	Digital setting: ±0.01% of the maximum output frequency or less(at -10—+50°C) Analog setting: ±0.5% of the maximum output frequency or less(at 25±10°C)									
	Voltage/frequency characteristics	V/f constant mode/Automatic torque boost Base frequency (25—320 Hz) adjustment, Torque boost (0—30%) adjustment									
	Overload current rating	60 seconds at 150%									
	Frequency setting signal	Built-in potentiometer External potentiometer(1—10 kΩ potentiometer connection also possible) 0—10 Vdc (input impedance: 15.5 kΩ) 4—20 mAdc (input impedance: 500 Ω) Arbitrary characteristics (gain, bias) can be set by 2-point setting.									
Operation specifications	Start-up frequency, frequency jump	Adjustable from 0.5—10 Hz, jump frequency and band setting can be set in three places.									
	PWM carrier frequency	Adjustable between 2.2 and 12 kHz.									
	Acceleration/deceleration time	0.1—3600 sec., acceleration/deceleration time #1 and #2 selection, acceleration/deceleration pattern selection.									
	Retry	When a protective function activates, after main circuit device are checked, running restarts. Settable to a max of 10 times.									
	Dynamic braking	Braking by capacitor charge (cannot be connected to dynamic braking resistor)									
	DC injection braking	Braking starting frequency adjustment (0—maximum frequency), braking current adjustment (0—100%), braking time adjustment (0—20 seconds)									
	Input terminal function (selection)	Forward/reverse rotation input signal, jog operation input signal, operation preparation input signal, preset speeds operation input (up to 7 preset speed operation), emergency stop input signal, reset input signal, etc.									
	Output terminal function (selection)	Lower limit frequency output signal, upper limit frequency output signal, low speed output signal, speed reached output signal, specified speed attained output signal, etc.									
	Failure detection signal	1c contact output (230 Vac-0.3 A- cosø=0.4)									
	Frequency meter/ammeter outputs.	PWM output (1 mAdc full scale DC ammeter or 7.5 Vdc full scale voltmeter).									
Protective function	Protective specifications	Stall prevention, current limit, overcurrent, load-side short circuit, overvoltage, overvoltage restriction, undervoltage, electronic thermal overload, armature overcurrent during start up, load-side overcurrent during start-up, emergency stop (optional)									
	Counter measures against instantaneous power failure	Auto-restart and regeneration power ride-through control									
	Electronic thermal protection characteristics	Switching between standard motor and constant-torque VF motor, and selecting overload trip, or overload stall									
Display specifications	4-digit, 7-segment LED	Frequency display: Inverter output frequency Alarm display: In-operation stall alarm "C", overvoltage limit alarm "P", overload alarm "L" Status display: Inverter status (setting frequency, cause of trip actuation, input/output voltage, output current, etc.), and setting parameters Free unit display: Arbitrary-unit display for against output frequency									
	Discrete LEDs	Displays inverter status with RUN lamp, MON lamp, PRG lamp, POTENTIOMETER lamp, up/down key lamps, RUN key lamp. Charging of the main circuit capacitor by a charge LED.									
Service conditions	Service environment	Indoor, altitude 1000 m or less; not subject to direct sunlight or corrosive/explosive gases; vibration: 5.9 m/S² {0.6 G} or less, (20—50 Hz)									
	Ambient temperature/relative humidity	-10—50°C/85% (no condensation allowed)									
	Protective structure/cooling structure	Sealed structure/Self-cooled									

External dimensions and standard connections

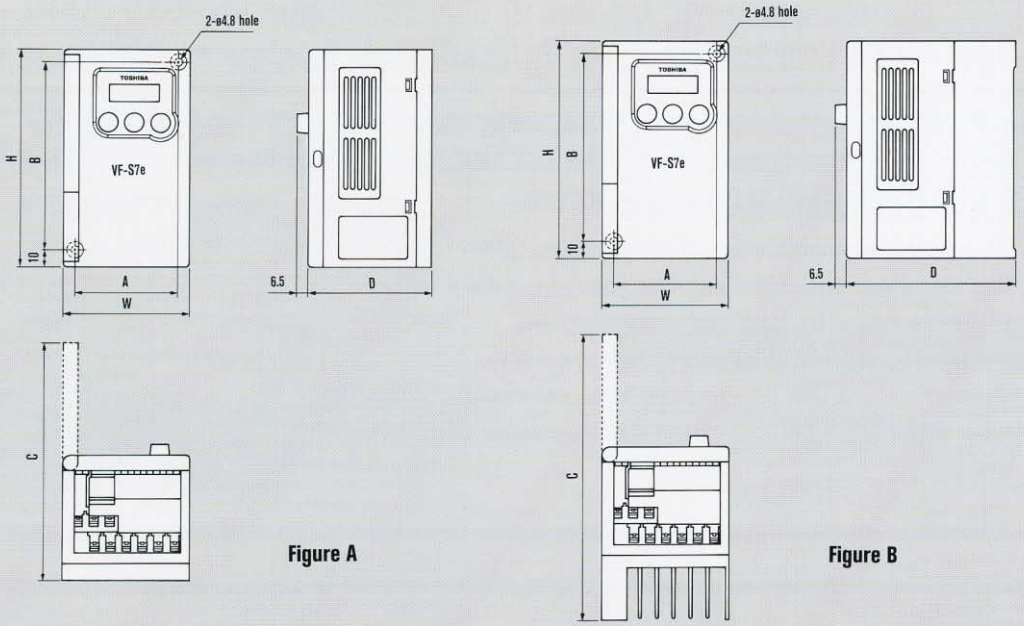
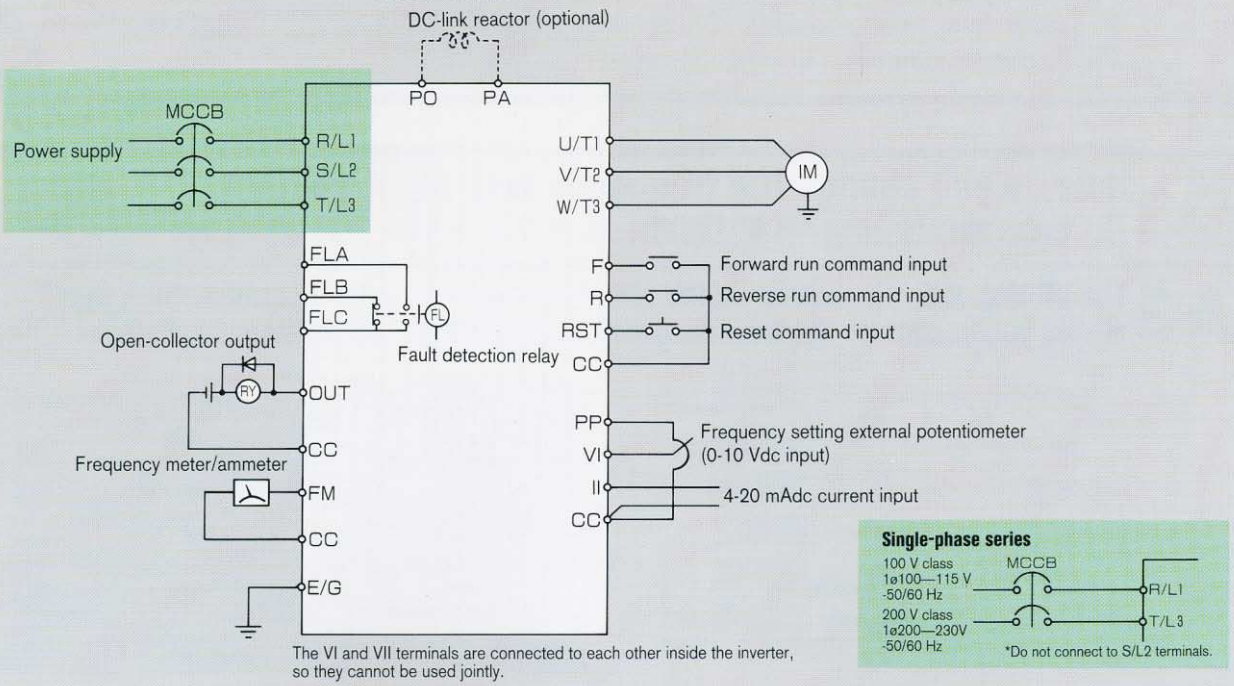


Figure A

Figure B

Input voltage class	Applicable motor capacity (kW)	Inverter model	Dimensions (mm)						External dimensions diagram	Approximate weight (kg)
			W	H	D	A	B	C		
3-phase 200 V	0.1	VFS7E-2001P	75	125	72	61	108	138	A	0.6
	0.2	VFS7E-2002P	75	125	72	61	108	138	A	0.6
	0.4	VFS7E-2004P	75	125	100	61	108	166	B	0.8
	0.75	VFS7E-2007P	75	125	130	61	108	196	B	1.0
1-phase 200 V	0.1	VFS7ES-2001P	75	125	72	61	108	138	A	0.6
	0.2	VFS7ES-2002P	75	125	72	61	108	138	A	0.7
	0.4	VFS7ES-2004P	75	125	120	61	108	186	B	0.9
1-phase 100 V	0.1	VFS7ES-1001P	75	125	72	61	108	138	A	0.7
	0.2	VFS7ES-1002P	75	125	92	61	108	158	A	0.7
	0.4	VFS7ES-1004P	75	125	120	61	108	186	B	0.9



The VI and VII terminals are connected to each other inside the inverter, so they cannot be used jointly.

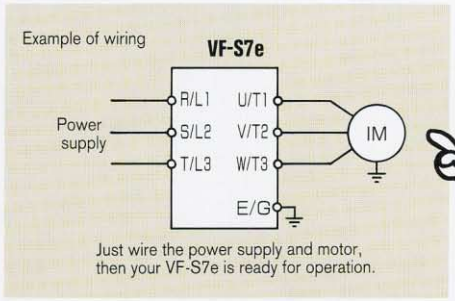
Inverters Q & A

Q1 How can I use the inverter immediately?

A1 Just wire the power supply and motor to make the VF-S7e series ready for operation. No parameters need be set, so it can be used very easily even if you have not used an inverter before.

The potentiometer for frequency-setting and ON/OFF keys are located on the front panel, so you can use the VF-S7e series just like an ordinary operator panel.

You can also make adjustments easily by using the "Automatic acc. & dec. time adjusting functions" that automatically adjust the acceleration and deceleration time.

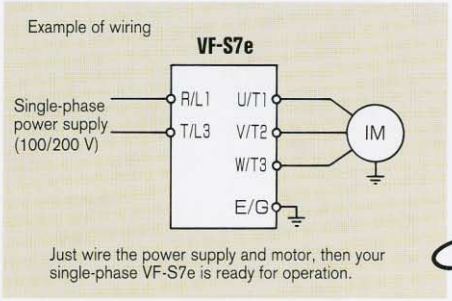


Q2 Can we control a 3-phase motor by a single-phase power supply?

A2 Yes. The VF series is available as a single-phase type to meet the need to control 200 V class three-phase motors from a single-phase power supply (100V/200 V).

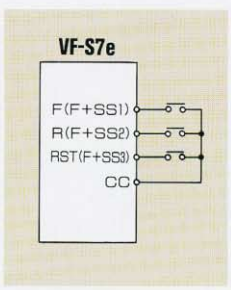
The single-phase VF-S7e series allows you to operate three-phase motors easily from a single-phase power supply (100 V/200 V). It has the same motor control capacity as the three-phase VF-S7e, ensuring the same motor output as developed from a three-phase power supply.

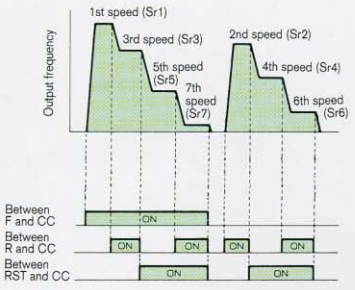
Incorporating the same standard functions as the three-phase series, the single-phase VF-S7e can easily adapt to changes in the power supply specifications.



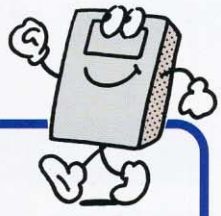
Q3 How do you change the frequency with input contact (in combination with PLCs)?

A3 The VF-S7e series incorporates the standard 7-preset speed operation. This function allows you to change the frequency with input contacts by setting parameters.





Parameter	Setting
Sr1 (1st speed)	Lower limit frequency–upper limit frequency
Sr2 (2nd speed)	Lower limit frequency–upper limit frequency
Sr3 (3rd speed)	Lower limit frequency–upper limit frequency
Sr4 (4th speed)	Lower limit frequency–upper limit frequency
Sr5 (5th speed)	Lower limit frequency–upper limit frequency
Sr6 (6th speed)	Lower limit frequency–upper limit frequency
Sr7 (7th speed)	Lower limit frequency–upper limit frequency
F111 (input terminal selection 1)	22 (F+SS1)
F112 (input terminal selection 2)	24 (F+SS2)
F113 (input terminal selection 3)	26 (F+SS3)



Q4 What countermeasures are provided against instantaneous power failure?

A4 The VF-S7e series incorporates a regeneration power ride-through control and auto-restart function, so that it does not trip in case of an instantaneous power failure.

■ Auto-restart function

Smoothly restarts the freely running motor when recovering from instantaneous power failure or when switching from a commercial by-pass operation to the inverter.

Parameter	Setting
F301 (Auto-restart)	0: Inhibit 1: Operation

■ Regeneration power ride-through control

Continues operation during instantaneous power failure using regenerative energy.

Parameter	Setting
F302 (Regeneration power ride-through control)	0: Inhibit 1: Operation

You can keep operating the motor without tripping in case of an instantaneous power failure by taking advantage of these two functions.

Q5 How are higher harmonics reduced?

A5 The VF-S7e series has an optional DC-link reactor.

'Higher harmonics' refers to current or voltage with integer multiples of the power supply waveform (50 or 60 Hz). A waveform of the fundamental frequency that does not contain higher harmonics is a normal sine-wave, while a waveform containing higher harmonics is distorted.

The input AC reactor and DC-link reactor are effective for improving the input power factor of the inverter power supply, and for decreasing the higher harmonics.

An input AC reactor can be used for any type of inverter, while the DC-link reactor is applicable only for models provided with DC-link reactor terminal block. (All the VF-S7e series are provided with DC-link terminal block.)

Contact your Toshiba representative for the appropriate impedance for the reactor.

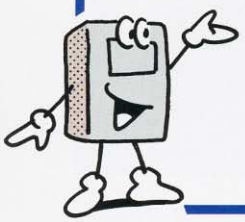
Q6 What happens when there is inverter or motor trouble?

A6 In case of inverter or motor trouble, the VF-S7e series actuates the protective functions to protect the inverter or motor from damage.

"Trip" refers to the inverter protective function cutting off the output.

When the trip is triggered, the display indicates the cause of the trip.

Typical trip causes are displayed on the right, but various other indications may reveal the cause of trouble.



OC1	Overcurrent during acceleration
OC2	Overcurrent during deceleration
OC3	Overcurrent during constant speed run
OCL	Armature short circuit
OCA	Short circuit trip during starting
OP1	Overvoltage

To users of our inverter

When studying how to use our inverters

Notes

Leakage currents

Leakage currents may increase slightly depending on the connection method of grounding.

(1) Use an ELCB with higher harmonic suppression.

(2) When two or more inverters are connected to one ELCB, increase the ELCB current sensitivity value.

(3) Keep the wiring length between the inverter and motor as short as possible.

Ground faults

Before beginning operation, thoroughly check for erroneous wiring or short circuits in the motor or in the wiring between the motor and inverter. Do not ground the neutral point of a star-connected motor.

Radio interference

Use of the inverter may affect nearby audio equipment with radiowave interference.

If this happens, install a noise filter (optional) on the inverter's power supply end, or shield the cable for the motor in an enclosed conduit. Contact your Toshiba representative for details.

Power factor improvement capacitors

Do not install power factor improvement capacitors at the inverter's input or output end. Output capacitors can generate high currents containing high frequency components, resulting in the inverter tripping because of overcurrent. This can also have adverse effects on the capacitors. To improve the power factor, insert an input AC reactor (optional) on the inverter's input side.

Installation of input AC reactors

These devices are used to improve the input power factor and suppress the high harmonic currents and surges. Install an input AC reactor when using a VF-S7e inverter with the following conditions:

(1) When the power source capacity is 200 kVA or more, and when power source capacity is greater than the inverter capacity by a factor of 10 times or more.

(2) When the inverter is connected to the same power distribution system as thyristor-committed control equipment.

(3) When the inverter is connected to the same power distribution system as that of an arc furnace, any other powerful distortion-generating source, such as a large capacity inverter.

Standard replacement intervals of main parts

The table below lists standard component replacement intervals under normal operating conditions (i.e., yearly average ambient temperature 30°C, load ratio 80% or less, operation of 12 hours/day).

The replacement interval does not indicate the service life of each component. Instead, it indicates the number of years beyond which the failure rate of a component used without replacement increases sharply due to deterioration and wear.

Component name	Standard replacement interval	Replacement method, etc.
Smoothing capacitors	5 years	Replace with new ones.
Breaker, relay	——	Decide by examination. Replace it inspection requires.
Timers	——	Decide by checking the cumulative operation time.
Fuses	10 years	Replace with new ones.
Aluminum capacitors on the printed circuit board	5 years	Replace with a new board (it inspection requires).

(except from "Periodic Inspection of General-purpose Inverters" published by the Japan Electrical Manufacturers' Association)

(Note: The service, life of components vary greatly with the usage environment.)

Selecting the capacity (model) of the inverter

Selection

Capacity

Refer to the applicable motor capacity listed in the standard specifications.

When driving a high-pole-count motor, special motor, or multiple motors in parallel, select an inverter such that the sum of the motor rated currents 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 GD^2 of the load, and can be obtained by the following equations:

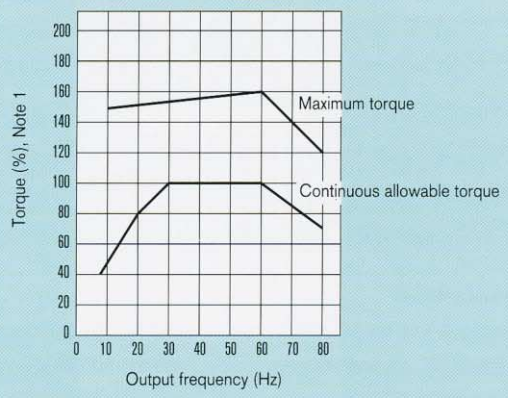
	SI unit system	Conventional unit system (reference)
Acceleration time	$ta=\frac{(J_M+J_L)\times\Delta N}{9.56\times(T_M-T_L)}$ (sec.)	$ta=\frac{(GD^2_M+GD^2_L)\times\Delta N}{375\times(T_M-T_L)}$ (sec.)
Deceleration time	$ta=\frac{(J_M+J_L)\times\Delta N}{9.56\times(T_B+T_L)}$ (sec.)	$ta=\frac{(GD^2_M+GD^2_L)\times\Delta N}{375\times(T_M+T_L)}$ (sec.)
Conditions	J_M : Motor moment of inertia (kg·m²) J_L : Load moment of inertia (motor axis conversion value) (kg·m²) ΔN: Difference between rotational speeds before and after acc./dec. (min⁻¹) T_L : Load torque (N·m) T_M : 1.2—1.3 × motor rated torque (N·m) T_B : 0.2 × motor rated torque (N·m)	GD^2_M : Motor GD^2 (kg·m²) GD^2_L : Load GD^2 (motor axis conversion value) (kg·m²) ΔN: Difference between rotational speeds before and after acc./dec. (rpm) T_L : Load torque (kg·m) T_M : 1.2—1.3 × motor rated torque (kg·m) T_B : 0.2 × motor rated torque (kg·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 is a sinusoidal (approximate) PWM waveform. In addition cooling becomes less effective at lower speeds, so the torque must be reduced in accordance with the frequency.

When constant-torque operation must be performed at low speeds, use a Toshiba VF motor specifically designed for use with inverters.

Base frequency 60 Hz , V/f control



(Note 1): The 100% torque: value obtained using the synchronous rotational speed at 60 Hz as the reference. The starting torque is smaller with an inverter than with the commercial power supply. Be aware of the characteristics of the load machine.

(Note 2): To obtain allowable torque at 50 Hz base frequency, multiply 60 Hz base frequency data by 0.8.

Starting characteristics

When a motor is driven by an inverter, its operation is restricted by the inverter's overload current rating, so the starting characteristic is different than the characteristics 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 voltage boost amount. (A maximum torque of about 150% can be generated with 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.

When wiring the inverter

Notes on wiring

Installing a no-fuse 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 no-fuse breaker on and off frequently to turn on/off the motor.

(3) To turn on/off the motor frequently, make/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-S7e inverter has a built-in fault detection rely (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 voltage tripping device) for opening the primary circuit when the inverter protection 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, make/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 motor, do not turn of ON/OFF while running. (If the secondary-side contactor is turned ON and 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 to 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 relay's excitation coil.
(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 (thermal relay)

(1) The VF-S7e inverter is equipped with 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 matting the motor's characteristics must be installed between the inverter and the motor.
- When using a motor having a rated current value different from that of the equivalent Toshiba general purpose motor.
- When using a single motor whose output is less than the applicable standard motor, or when driving several motors simultaneously. (Install an overload relay.)

(2) When you want to use a constant-torque Toshiba VF motor together with the VF-S7e 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 an embedded-type 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 fixing 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 in the interface of the motor and the load machine may be affected at low speeds.

When operating at frequencies exceeding 60 Hz, power transmission mechanism such as reducers, belts and chains, may exhibit problems such as noise generation, insufficient strength, or a reduced service life.

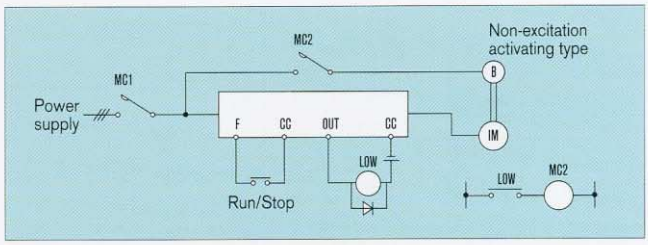
Frequency

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

Application to special motors

Brake motor

When using a braking motor, if the braking circuit is directly connected to the inverter'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. Some braking motors commercially available motors can generate considerable noise at low speeds.



Gear motor

Because low speed operation of geared motors can cause insufficient lubrication, confirm the permissible continuous operation range with the respective manufacturers. Whenever possible, avoid operating geared motors at high speeds (over 80 Hz), as this can cause high noise and significant temperature rise.

Toshiba Gold Motor

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

Pole-changing motor

Pole-changing motors can be driven by the VF-S7e inverter. Before changing poles, however, be sure to let the motor come to a complete stop.

High-pole-count motors

Note that high-pole-count motors (8 or more poles), which may be used for fans, etc., have higher rated current than 4-pole motors.

Single-phase motor

Because signal-phase motors are equipped with a centrifugal switch and capacitors for starting, they cannot be driven by an inverter. If only a signal-phase, 100 V power supply is available, a 3-phase motor can be driven by using a single-phase input inverter to convert it to a 3-phase 200 V output.
(A special inverter and a 3-phase motor are required.)

Stand-alone Options

Input AC reactance/DC reactance

Used to improve the input power factor, reduce higher harmonics or suppress external surges on the power supply side of the inverter. Install these reactors when the power supply capacity is 200 kVA or above and, at the same time, 10 times as much as the inverter capacity, or when a distortion-producing thyristor drive or large-capacity inverter is connected to the same distribution line.

Radio noise reduction filter

Effective for preventing radio interference with audio equipment used near the inverter.

(1) High attenuation type (LC filter), NF type
- Install on the input side of the inverter.
- Attenuation characteristic is available only in a wide range from the AM radio band to 10 kHz.
- Use this type when equipment vulnerable to noise is installed in the vicinity of the inverter.

(2) Simplified type (capacitive filter), capacitor type
- Install on the input side of the inverter.
- Attenuation characteristic is available only in a specific frequency band. Effective in suppressing noise in a AM radio station (e.g., when radio signal strength is weak in mountainous areas).
- The capacitive-type filter increases leakage current. Do not use many filters when an ELCB is installed on the power supply side.

(3) Zero-phase reactor (inductive filter), ferrite core type
- Effective in reducing noise on the input and output ends of the inverter.
- Attenuation characteristic of several dB is available in frequency bands ranging from the AM radio band to 10 MHz.

Parameter writer

Unit for reading, copying, and writing parameters in batch processing.

Remote keypad

Used when the inverter is installed inside a control cabinet, and only the panel is installed outside the control cabinet.

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

PRECAUTIONS

- Careful investigation should be made if the inverter is used for equipment which could cause death or bodily injury if the inverter malfunctions (such as a nuclear control system, aerospace system, traffic system, and safety devices and instruments). In such cases, please consult us.
- This product is manufactured under strict quality control. If using it for critical equipment, install safety devices on the equipment to prevent serious accidents or losses in case of an inverter failure, e.g., failure to output an error signal.
- Use the inverter only for general, industrial three-phase induction motors.

In Touch with Tomorrow

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96-7 (AB) 6480

Printed in Japan