TOSHIBA

VF-nC1

Ultra-Compact, Easy-To-Use Inverter TOSVERT™

Single-phase 100V class 0.1 to 0.75kW
Single-phase 200V class 0.2 to 2.2kW
Three-phase 200V class 0.1 to 2.2kW

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.
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Compact, Easy-to-Use, Inverter for Small-Sized Machines!

The wide range of functions of the VF-nC1 meets various users' needs, from simple speed control to steady torque at low speed. The vertical contact-type main circuit terminal board and captive screws also ensure easy wiring.

＊ This is a composite photograph.

POINT 1 Easy to Wire and Install

Like most internal power distribution and control devices, the VF-nC1 has a vertical main circuit terminal board for smoother installation in switchboards. Wiring set-up is further improved by the use of captive screws on the main circuit terminal board. The VF-nC1 may also be installed side by side to save space.

POINT 2 Easy to Select

General-purpose Toshiba inverters have been developed for "Compliance with Global Standards." The three main series: the three-phase 200V, single-phase 200V and single-phase 100V series, comply with major international standards in addition, several series of European models with a built-in EMI noise filter are also available. All of them have a wide range of functions.

ISO 9001:
VF-nC1 series is manufactured at the works, which has received the international quality assurance standard ISO 9001 certification.

ISO 14001:
The works producing the VF-nC1 series is registered as an environment management system factory specified by ISO 14001.

Type Form

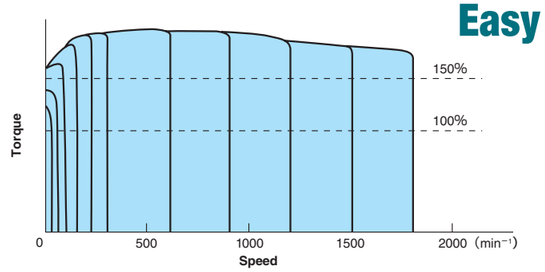
V	F	N	C	1	S	–	2	0	0	7	P	L	–	W

- **Model name**: TOSVERT VF-nC1 Series
- **Input voltage**: 1:100V～115V, 2:200V～240V
- **Applicable motor capacity**: 001: 0.1kW, 002: 0.2kW, 004: 0.4kW, 007: 0.75kW, 015: 1.5kW, 022: 2.2kW
- **Operation panel**: P: Provided
- **Additional functions**: L: EMI filter inside
- **Destination**: W: World wide, - : Japan
- **Number of power phases**: S: 1-phase, None: 3-phase

■Models and applicable motors

Voltage (Input/Rated Output)	Applicable Motor Capacity (kW)					
	0.1	0.2	0.4	0.75	1.5	2.2
1φ100V/3φ200V	■	■	■	■		
1φ200V/3φ200V		■	■	■	■	■
3φ200V/3φ200V		■	■	■	■	■
1φ200V/3φ200V (built-in EMI noise filter)		■	■	■	■	■

POINT 3 Easy to Set Up and Operate



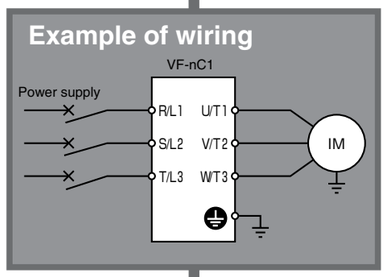
Ex.Sensorless Vector control (3φ200V-0.4kW)

Even novice inverter users can operate the VF-nC1 without difficulty by using the RUN and STOP keys and the frequency adjusting knob on the operation panel. The design also allows most functions be controlled from the input terminals. A wizard function helps users with complicated settings. Other functions, which allow easy operation of the VF-nC1, include a vector control function (which improves the torque characteristic), a PI control function (useful for fans and pumps), and a 15-speed preset function.

Contents

Panel and operation procedure

Example of wiring



The following configuration is available for VFNC1(S)-□□□□P□-W type.

Power ON (Set-up parameter)

①Displays "n50"
When the power is ON at initialization...

②Select the logic and base motor frequency.
n50
or
P50
or
n60

ENT

③Displays "0.0" during frequency setting, and Fin it upon completion.

Operation

①Turn on the power.
0.0 is displayed.

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

②Operates VF-nC1 at the frequency set with the potentiometer.

Turning the potentiometer dial ...

③Changes the frequency.

Pressing the STOP key ... STOP

④Decelerates and stops the motor.

Monitoring

①Displays operation frequency.

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

②Displays the motor rotating direction.

Press the UP key ...

③Displays operation frequency command value.

Press the UP key ...

④Displays load current (%/ampere)

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

⑤Displays operation frequency (returns to the beginning).

Setting

①Turn on the power.
0.0 is displayed.

Pressing the MON (monitor) key ... MON

②Displays "RUN".

Pressing key until "ACC" is displayed ...

③Displays "ACC".

Pressing the ENTER key ... ENT

④Displays the setting.

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

⑤Displays "ACC" and the setting value alternately, and then the setting is complete.

※If you press the Enter key without changing the setting, the next parameter ("dEC") is displayed.

Monitor display

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

LED (number)

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

LED (alphabet)

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

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

Set-up parameter

Title	n50	P50	n60
F127	0	100	0
F409 / F171	220(V)	220(V)	230(V)
F417	1410(min^{-1})	1410(min^{-1})	1710(min^{-1})
FH, UL, LL, F170, F204	50.0(Hz)	50.0(Hz)	60.0(Hz)

Item displayed	Key operation	LED display	Description
		60.0	The operation frequency is displayed (during operation). (When the standard monitor display selection parameter F710 = 0 is set at 0 [operation frequency].)
Parameter setting mode	MON	RUN	The first basic parameter "History function (RUN)" is displayed.
Direction of rotation	MON	F--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	▲	C 80	The inverter output current is displayed. (Default setting: unit %)
Input voltage	▲	U 100	The inverter input voltage is displayed. (Default setting: unit %)
Output voltage	▲	P 100	The inverter output voltage is displayed. (Default setting: unit %)
Torque current	▲	t 88	The torque current is displayed in %.
PI feedback	▲	d 50	The PI feedback value is displayed. (Unit: Hz)
Inverter load factor	▲	L 80	The inverter load factor is displayed in %.
Output power	▲	H 80	The inverter output power is displayed in %.
Operation frequency	▲	o60.0	The operation frequency is displayed (during operation).

Item displayed	Key operation	LED display	Description
Input terminal	▲	A IIII	The ON/OFF status of each of the control signal input terminals (F, R, S1, S2, VI/S3) is displayed in bits. ON: 1 OFF: 0 — VI/S3, S2, F, R, S1
Output terminal	▲	O 11	The ON/OFF status of each of the control signal output terminals (FM/OUT, FL) is displayed in bits. ON: 1 OFF: 0 — FL, FM/OUT
CPU1 version	▲	U 1.1	The version of the CPU1 is displayed.
CPU2 version	▲	uC01	The version of the CPU2 is displayed.
Memory version	▲	uE01	The version of the memory mounted is displayed.
Past trip 1	▲	OC3 ⇔1	The past trip 1 (displayed alternately at 0.5-sec. intervals)
Past trip 2	▲	OH ⇔2	The past trip 2 (displayed alternately at 0.5-sec. intervals)
Past trip 3	▲	OP3 ⇔3	The past trip 3 (displayed alternately at 0.5-sec. intervals)
Past trip 4	▲	nEr ⇔4	The 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 hour.)

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.

Model and standard specifications

■Three-phase 200V

Item		Specification					
Input voltage		3-phase 200V					
Applicable motor (kW)		0.1	0.2	0.4	0.75	1.5	2.2
Rating	Type	VFNC1					
	Form	2001P	2002P	2004P	2007P	2015P	2022P
	Capacity (kVA) Note 1)	0.3	0.6	1.0	1.6	2.9	3.9
	Rated output current (A) Note 2)	0.7	1.4	2.4	4	7.5	10.0
	Rated output voltage Note 3)	3-phase 200V to 240V					
	Overload current rating	60 seconds at 150%					
Power supply	Voltage-frequency	3-phase 200V to 240V - 50/60Hz					
	Allowable fluctuation	Voltage +10%, -15% Note 4), frequency±5%					
Protective method		IP20 Enclosed type (JEM 1030)					
Cooling method		Self-cooling				Forced air-cooled	
Color		Munsel 5Y8/0.5					
Charge lamp		LED indicating the charge status of the capacitor in the main circuit					

■1-phase 200V

Item		Specification					
Input voltage		1-phase 200V					
Applicable motor (kW)		0.1	0.2	0.4	0.75	1.5	2.2
Rating	Type	VFNC1S					
	Form	—	2002P	2004P	2007P	2015P	2022P
	Capacity (kVA) Note 1)	—	0.6	1.0	1.6	2.9	3.9
	Rated output current (A) Note 2)	—	1.4	2.4	4	7.5	10.0
	Rated output voltage Note 3)	3-phase 200V to 240V					
	Overload current rating	60 seconds at 150%					
Power supply	Voltage-frequency	1-phase 200V to 240V - 50/60Hz					
	Allowable fluctuation	Voltage +10%, -15% Note 4), frequency ±5%					
Protective method		IP20 Enclosed type (JEM 1030)					
Cooling method		—	Self-cooling			Forced air-cooled	
Color		Munsel 5Y8/0.5					
Charge lamp		LED indicating the charge status of the capacitor in the main circuit					

■1-phase 100V

Item		Specification					
Input voltage		1-phase 100V					
Applicable motor (kW)		0.1	0.2	0.4	0.75	1.5	2.2
Rating	Type	VFNC1S					
	Form	1001P	1002P	1004P	1007P	—	—
	Capacity (kVA) Note 1)	0.3	0.6	1.0	1.6	—	—
	Rated output current (A) Note 2)	0.7	1.4	2.4	4	—	—
	Rated output voltage Note 3)	3-phase 200V to 230V					
	Overload current rating	60 seconds at 150%					
Power supply	Voltage-frequency	1-phase 100V to 115V - 50/60Hz					
	Allowable fluctuation	Voltage +10%, -15% Note 4), frequency ±5%					
Protective method		IP20 Enclosed type (JEM 1030)					
Cooling method		Self-cooling		Forced air-cooled		—	—
Color		Munsel 5Y8/0.5					
Charge lamp		LED indicating the charge status of the capacitor in the main circuit					

■1-phase 200V (built-in EMI noise filter)

Item		Specification					
Input voltage		1-phase 200V (built-in EMI noise filter)					
Applicable motor (kW)		0.1	0.2	0.4	0.75	1.5	2.2
Rating	Type	VFNC1S					
	Form	—	2002PL	2004PL	2007PL	2015PL	2022PL
	Capacity (kVA) Note 1)	—	0.5	0.9	1.6	2.9	4.1
	Rated output current (A) Note 2)	—	1.2	2.3	4	7.5	10.7
	Rated output voltage Note 3)	3-phase 200V to 240V					
	Overload current rating	60 seconds at 150%					
Power supply	Voltage-frequency	1-phase 200V to 240V - 50/60Hz					
	Allowable fluctuation	Voltage +10%, -15% Note 4), frequency ±5%					
Protective method		IP20 Enclosed type (JEM 1030)					
Cooling method		—	Self-cooling			Forced air-cooled	
Color		Munsel 5Y8/0.5					
Charge lamp		None					
Built-in filter		EMI noise filter (EN55011 Group1 ClassB)					

Note) 1. Capacity is calculated at 220V for the 200V models.
Note) 2. Indicates rated output current setting when the PWM carrier frequency (parameter F300) is 4kHz or less.
If the PWM carrier frequency setting is fixed above 4kHz, the rated current needs to be reduced. If the PWM carrier frequency is set above 4kHz, it could fall automatically if an over-current flaws during acceleration or for any other reason, depending on the amount of current that flows.
The default setting of the PWN carrier frequency is 12kHz.
Note) 3. Maximum output voltage is the same as the input voltage. The maximum output voltage of a single-phase 100V model is proportional to the supply voltage.
With regard to 100V models, the output voltage may decrease about 10 to 20% if motor load is applied.
When operating VF-nC1 in conjunction with general purpose motor (200V), it is necessary to reduce the motor load.
Note) 4. ±10% when the inverter is used continuously (load of 100%).

Standard specifications/outline drawing

Item		Specification
Principal control functions	Control system	Sinusoidal PWM control
	Related output voltage	Adjustable of output voltage in base freguency setting by the correcting supply voltage (200V) (Unadjustable to any voltage higher than the input voltage).
	Output frequency range	0.5 to 200Hz, default setting: 0.5 to 80Hz, maximum frequency: 30 to 200Hz.
	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 ±0.5% of the max. frequency (-10 to +50˚C) Analog setting: within ±1.0% of the max. frequency (25 ˚C ± 10˚C)
	Voltage/frequency characteristics	V/f, sensorless vector control, base frequency, base frequency voltage and torque boost amount adjustable
	Frequency setting signal	Volume on the front panel, external frequency volume (connectable to a volume with a rated impedance of 3-10kΩ), VI terminal (input impedance: 42kΩ(voltage: 0-10Vdc) or 250Ω (current: 4-20mAdc)). The characteristic can be set arbitrarily by two-point setting.
Operation specifications	Start-up frequency/frequency jump	Adjustable within a range of 0.5 to 10Hz/Up to 1 frequency can be adjusted together with their widths.
	PWM carrier frequency	Selectable from among 2, 4, 8, 12 and 16kHz (Standard default setting: 12kHz)
	Acceleration/deceleration time	0.1 to 3000 seconds, switchable between acceleration/deceleration time 1 and 2.
	Retry operation	Number of times of retry selectable (Max. 10 times). If the protection function is activated, the retry function restarts on completion of a check of the main circuit.
	Electric control	Charging of capacitor (Deceleration time can be shortened by activating Forced Shortened Deceleration mode.)
	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, cosΦ = 0.4
	Output for frequency meter/ output for ammeter	PWM 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)
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, load-side over-torque at start, overheating prevention, detection of analog signal break.
	Protection against momentary power failure	Auto-restart/non-stop control after momentary power failure.
	Electronic thermal characteristics	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 and PRG lamp.
Environments	Use environments	Indoor, altitude: 1000m (Max.), not exposed to direct sunlight, corrosive gas, explosive gas or vibration (less than 5.9m/s2) (10 to 55Hz).
	Ambient temperature	-10 to 50˚C Note)1.2
	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-nC1.
Note) 2. Side-by-side installation : 40˚C or less (Remove the protective seal from the top of VF-nC1).

■External dimensions/weights

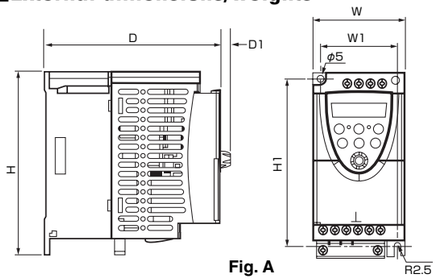


Fig. A

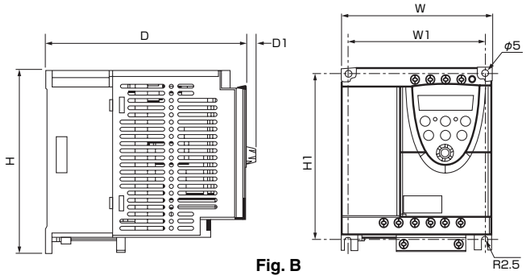


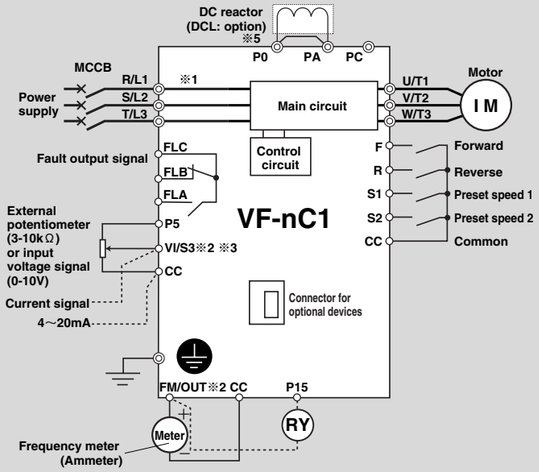
Fig. B

Input voltage	Applicable motor (kW)	Type	Dimensions (mm) W	H	D	W1	H1	D1	Drawing	Approx. weight (kg)
1-phase 200V	0.2	VFNC1S-2002P	72	142	100	60	131	8.5	A	1.0
	0.4	VFNC1S-2004P			124					1.0
	0.75	VFNC1S-2007P			137					1.0
	1.5	VFNC1S-2015P	117		155	106			B	1.5
	2.2	VFNC1S-2022P								1.5
3-phase 200V	0.1	VFNC1-2001P	72		100	60			A	1.0
	0.2	VFNC1-2002P								1.0
	0.4	VFNC1-2004P			124					1.0
	0.75	VFNC1-2007P			137					1.0
	1.5	VFNC1-2015P	117		155	106			B	1.5
	2.2	VFNC1-2022P								1.5
1-phase 100V	0.1	VFNC1S-1001P	72		100	60			A	1.0
	0.2	VFNC1S-1002P								1.0
	0.4	VFNC1S-1004P			124					1.0
	0.75	VFNC1S-1007P	117		155	106			B	1.5
1-phase 200V (built-in EMI noise filter)	0.2	VFNC1S-2002PL	72		100	60			A	1.0
	0.4	VFNC1S-2004PL			124					1.0
	0.75	VFNC1S-2007PL			137					1.0
	1.5	VFNC1S-2015PL	117		155	106			B	1.5
	2.2	VFNC1S-2022PL								1.5

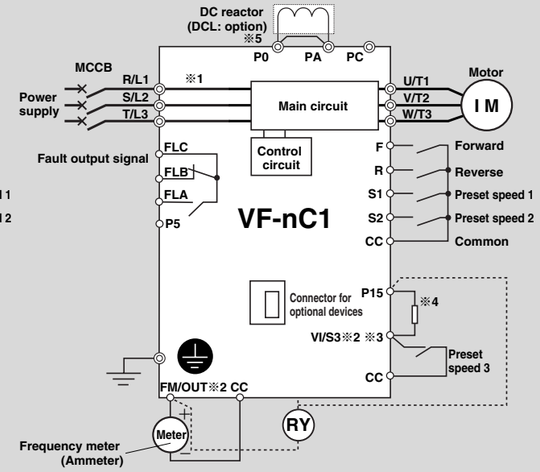
Standard connection

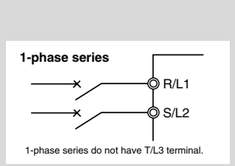
Standard connection Sink (common = CC)

■When using VI/S3 terminal as an analog input terminal (F109: 0 or 1)



■When using VI/S3 terminal as a logic input terminal (F109: 2)

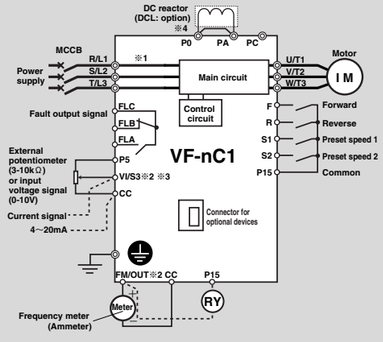




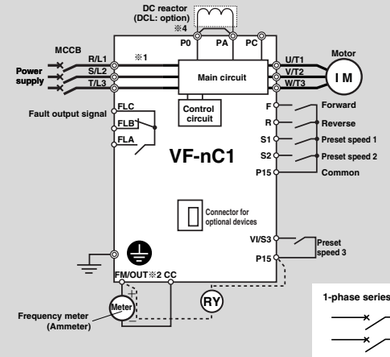
※1：Only VFNC1S-□□□□PL has a built-in noise filter.
※2：The terminal can be switched between FM/OUT and VI/S3 by changing a parameter.
※3：The terminal can also be used as an input terminal by changing a parameter.
※4：To use VI/S3 terminal as an input terminal, P15 and VI/S3 must be short-circuited with a resistor (recommended resistance: 4.7kΩ-1/4W).
※5：1-phase100V models cannot be used with DCL. 1-phase 200V models (with a built-in EMI noise filter) are not provided with PO terminal.

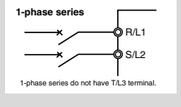
Source (common = P15)

■When using VI/S3 terminal as an analog input terminal (F109: 0 or 1)



■When using VI/S3 terminal as a logic input terminal (F109: 2)





※1：Only VFNC1S-□□□□PL has a built-in noise filter.
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■Main circuit

Terminal symbol	Terminal function
⏚	Grounding terminal for connecting inverter case. 2 grounding terminals.
R/L1, S/L2, T/L3	100V class: 1-phase 100V to 115V - 50/60Hz 200V class: 1-phase 200V to 240V - 50/60Hz, 3-phase 200V to 240V - 50/60Hz ※1-phase series have R/L1 and S/L2 terminals.
U/T1, V/T2, W/T3	Connect to a (3-phase induction) motor.
PC	This is a negative potential terminal in the internal DC main circuit.
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. 1-phase 100V models cannot be used with DC reactors. 1-phase 200V models with a built-in EMI noise filter are not provided with PO terminal.

■Control circuit terminal (Sink (common: CC))

Terminal symbol	Input/output	Function		Specifications	Wire size
F	Input	Multifunction programmable contact input	Shorting across F-CC causes forward rotation; open causes slowdown and stop. (ST and CC are short-circuited.)	Dry contact input 15Vdc - 5mA or less Sink/source selectable by changing a parameter	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	Input		Shorting across R-CC causes reverse rotation; open causes slowdown and stop. (ST and CC are short-circuited.) ✻ Shorting across R-CC/F-CC causes reverse rotation.		
S1	Input		Shorting across S1-CC causes preset speed operation.		
S2	Input		Shorting across S2-CC causes preset speed operation.		
CC	Common to input/output	Control circuit's equipotential terminal.			
P5	Output	Power output for analog input setting.		5Vdc (permissible load current: 10mAdc)	
VI/S3	Input	Multifunction programmable analog input. Standard default setting: Analog input 0-10Vdc and frequency 0-80Hz. Possible to use as analog input (4 (0)-20mAdc) or contact input (programmable contact input) by changing a parameter.		10Vdc: (internal impedance: 42kΩ) 4-20mA: (internal impedance: 250Ω)	
FM/OUT	Output	Multifunction programmable meter output. Standard default setting: output frequency. Meters connectable to FM/OUT: 1mAdc full-scale ammeter or 7.5Vdc (10Vdc) full-scale voltmeter (PWM output). Possible to switch to programmable open collector output by changing a parameter.		1mA full-scale DC ammeter or 7.5Vdc (10Vdc) full-scale DC voltmeter Open collector output: 24Vdc-50mA	
P15	Output	15Vdc power output.		15Vdc-100mA	
FLA FLB FLC	Output	Multifunction programmable relay contact output. Contact ratings: 250Vac - 2A (cosΦ=1), 30Vdc - 1A, 250Vac - 1A (cosΦ=0.4). Standard default setting: Monitoring of status of inverter's protection function. Activation of the protection function causes circuit FLA-FLC to close and circuit FLB-FLC to open.		250Vac-2A (cosΦ=1): at resistance load 30Vdc-1A 250Vac-1A (cosΦ=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)

■Selection of wiring devices

Voltage class	Capacity applicable motor (kW)	Inverter model	Molded case circuit breaker (MCCB)	Magnetic contactor (MC) Note 1)	Wire size		
			Rated current (A)	Rated current (A)	Main circuit Note 2)	DCL	Grounding cable Note 4)
1-phase 100V class	0.1	VFNC1S-1001P	5	11	AWG14/2.0mm²	—	AWG12/3.5mm²
	0.2	VFNC1S-1002P	10	11	AWG14/2.0mm²	—	AWG12/3.5mm²
	0.4	VFNC1S-1004P	15	11	AWG14/2.0mm²	—	AWG12/3.5mm²
	0.75	VFNC1S-1007P	30	18	AWG14/3.5mm²	—	AWG12/3.5mm²
1-phase 200V class	0.2	VFNC1S-2002P（L）	10	11	AWG14/2.0mm²	AWG16/1.25mm²	AWG12/3.5mm²
	0.4	VFNC1S-2004P（L）	15	11	AWG14/2.0mm²	AWG16/1.25mm²	AWG12/3.5mm²
	0.75	VFNC1S-2007P（L）	20	11	AWG14/2.0mm²	AWG14/2.0mm²	AWG12/3.5mm²
	1.5	VFNC1S-2015P（L）	30	18	AWG10/3.5mm²	AWG14/2.0mm²	AWG12/3.5mm²
	2.2	VFNC1S-2022P（L）	40	35	AWG10/5.5mm²	AWG14/2.0mm²	AWG10/5.5mm²
3-phase 200V class	0.1	VFNC1-2001P	5	11	AWG14/2.0mm²	AWG16/1.25mm²	AWG12/3.5mm²
	0.2	VFNC1-2002P	5	11	AWG14/2.0mm²	AWG16/1.25mm²	AWG12/3.5mm²
	0.4	VFNC1-2004P	5	11	AWG14/2.0mm²	AWG16/1.25mm²	AWG12/3.5mm²
	0.75	VFNC1-2007P	10	11	AWG14/2.0mm²	AWG14/2.0mm²	AWG12/3.5mm²
	1.5	VFNC1-2015P	15	11	AWG10/2.0mm²	AWG14/2.0mm²	AWG12/3.5mm²
	2.2	VFNC1-2022P	20	13	AWG10/2.0mm²	AWG14/2.0mm²	AWG12/3.5mm²

Note) 1. Be sure to attach surge killer to the exciting coil of the relay and the magnetic contactor.
Note) 2. Size of the wires connected 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.
Note) 3. For the control circuit, use shielded wires.
Note) 4. For grounding, use a cable with a size equal to or larger than the above.

Basic and extended parameters

Basic parameters

Title	Function	Adjustment range	Default setting
AUH	History function	Function of displaying 5 parameters grouped into one in the order of change ＊Parameters can be edited within a group, too.	
AUF	Wizard function	0:— 1: Basic setting wizard 2: Preset speed operation wizard 3: Analog signal operation wizard 4: Motor 1/2 switching operation wizard 5: Torque up wizard ＊1	0
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 4: Terminal board/internal volume switching	2
FMSL	FM/OUT terminal functions selection	-1: Open collector output 0: Output frequency 1: Output current 2: Set frequency 3: For adjustment (current fixed at 100%) 4: For adjustment (current fixed at 50%) 5: For adjustment (output of max. frequency) 6: For adjustment (display of gain)	0
FM	Meter adjustment	—	—
tYP	Standard setting mode selection	0: — 1: Set at 50Hz 2: Set at 60Hz 3: Default setting 4: Trip clear 5: Cumulative operation time clear	0
Fr	Forward/reverse selection (Operation panel)	0: Forward run 1: Reverse run	0
ACC	Acceleration time 1 (s)	0.1—3000 (s)	10.0
dEC	Deceleration time 1 (s)	0.1—3000 (s)	10.0
FH	Maximum frequency (Hz)	30.0—200 (Hz)	＊2
UL	Upper limit frequency (Hz)	0.5— FH(Hz)	＊2
LL	Lower limit frequency (Hz)	0.0— UL(Hz)	0.0
uL	Base frequency 1 (Hz)	25—200 (Hz)	＊2
Pt	V/f control mode selection	0 (1.2): V/f 3: Sensorless vector control	0
ub	Torque boost 1 (%)	0.0—30.0 (%)	＊3
tHr	Motor thermal protection level 1 (%)	30—100 (%)	100
OLn	Electric thermal protection characteristics ＊4	Setting / Overload protection / Overload stall: 0 (Standard motor): ○ × 1 (Standard motor): ○ ○ 2 (Standard motor): × × 3 (Standard motor): × ○ 4 (VF motor): ○ × 5 (VF motor): ○ ○ 6 (VF motor): × × 7 (VF motor): × ○	0
Sr1	Preset speed operation frequencies 1 (Hz)	LL — UL (Hz)	0.0
Sr2	Preset speed operation frequencies 2 (Hz)	LL — UL (Hz)	0.0
Sr3	Preset speed operation frequencies 3 (Hz)	LL — UL (Hz)	0.0
Sr4	Preset speed operation frequencies 4 (Hz)	LL — UL (Hz)	0.0
Sr5	Preset speed operation frequencies 5 (Hz)	LL — UL (Hz)	0.0
Sr6	Preset speed operation frequencies 6 (Hz)	LL — UL (Hz)	0.0
Sr7	Preset speed operation frequencies 7 (Hz)	LL — UL (Hz)	0.0
F---	Extended parameter	—	—
GrU	Search for changed settings	—	—

＊1: This parameter is valid only for VFNC1(S)-□□□□P□-W type.
＊2: The value is changed according to the set-up parameter condition. (refer to page 3)
＊3: Parameter values vary depending on the capacity.
＊4: ○:Applicable, ×:Inapplicable

Extended parameters

●Input parameters

Title	Function	Adjustment range	Default setting
F100	Low speed signal output frequency (Hz)	0.6—FH (Hz)	0.6
F101	Speed-reach setting frequency (Hz)	0.0—FH (Hz)	0.0
F109	Analog input/logic input function selection (VI/S3)	0:Voltage signal input (0-5or10V) 1:Current signal input (4-20mA) 2:Contact input	0
F110	Always active function selection	0-40, 49, 54-57	1 (ST)
F111	Input terminal selection 1 (F)	0-40, 49, 54-57	2 (F)
F112	Input terminal selection 2 (R)	0-40, 49, 54-57	3 (R)
F113	Input terminal selection 3 (S1)	0-40, 49, 54-57	6 (SS1)
F114	Input terminal selection 4 (S2)	0-40, 49, 54-57	7 (SS2)
F115	Input terminal selection 5 (VI/S3) ＊5	5～17	8 (SS3)
F127	Sink/Source selection	0:Sink, 100:Source, 1-99, 101-200:Disabled	＊2
F130	Output terminal selection 1 (FM/OUT) ＊6	0—13	4 (LOW)
F132	Output terminal selection 3 (FL)	0—13	10 (FL)
F170	Base frequency 2 (Hz)	25—200 (Hz)	＊2
F171	Base frequency voltage 2 (V)	50—500 (V)	＊2
F172	Torque boost 2 (%)	0.0—30.0 (%)	＊1
F173	Motor thermal protection level 2 (%)	30—100 (%)	100

＊5: This function is enabled if F109 is set at 2 (logic input).
＊6: This function is enabled if FMSL (open collector output) is set at -1.

●Frequency parameters

Title	Function	Adjustment range	Default setting
F201	VI/S3 reference point 1 setting (%)	0—100 (%)	0
F202	VI/S3 point 1 frequency (Hz)	0—200 (Hz)	0.0
F203	VI/S3 reference point 2 setting (%)	0—100 (%)	100
F204	VI/S3 point 2 frequency (Hz)	0—200 (Hz)	＊2
F240	Starting frequency setting (Hz)	0.5—10.0 (Hz)	0.5
F241	Operation starting frequency (Hz)	0.0—FH (Hz)	0.0
F242	Operation starting frequency hysteresis (Hz)	0.0—FH (Hz)	0.0
F250	DC braking starting frequency (Hz)	0.0 (OFF), 0.1—FH (Hz)	0.0
F251	DC braking current (%)	0.0, 1—100 (%)	50
F252	DC braking time (s)	0.0 (OFF), 0.1—20 (s)	1.0
F270	Jump frequency (Hz)	LL — UL (Hz)	0.0
F271	Jumping width (Hz)	0.0—30.0 (Hz)	0.0
F287	Preset speed operation frequencies 8 (Hz)	LL — UL (Hz)	0.0
F288	Preset speed operation frequencies 9 (Hz)	LL — UL (Hz)	0.0
F289	Preset speed operation frequencies 10 (Hz)	LL — UL (Hz)	0.0
F290	Preset speed operation frequencies 11 (Hz)	LL — UL (Hz)	0.0
F291	Preset speed operation frequencies 12 (Hz)	LL — UL (Hz)	0.0
F292	Preset speed operation frequencies 13 (Hz)	LL — UL (Hz)	0.0
F293	Preset speed operation frequencies 14(Hz)	LL — UL (Hz)	0.0
F294	Preset speed operation frequencies 15 (Hz)	LL — UL (Hz)	0.0

●Operation mode parameters

Title	Function	Adjustment range	Default setting
F300	PWM carrier frequency	0: 2kHz 1: 2kHz (Random mode) 2: 4kHz 3: 4kHz (Random mode) 4: 8kHz (auto-reduction mode) 5: 12kHz (auto-reduction mode) 6: 16kHz (auto-reduction mode)	5
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 after momentary stop or when turning ST-CC on or off	0
F302	Regenerative power ride-though control	0: Disabled 1: Enabled 2: Deceleration stop	0
F303	Retry selection (Number of times)	0 (OFF), 1 - 10	0
F305	Over voltage limit opertion	0: Disabled 1: Enabled 2: Enabled (forced shortened deceleration)	0
F360	PI control	0: Disabled, 1: Enabled	0
F362	Proportional (P) gain	0.01—100.0	0.30
F363	Integral (I) gain	0.01—100.0	0.20

●Torque boost parameters

Title	Function	Adjustment range	Default setting
F401	Slip frequency gain	0—150 (%)	50
F409	Base frequency voltage 1 (V)	50—500 (V)	＊2
F415	Motor rated current	0.1—50.0 (A)	＊3
F416	Motor no-load current	30—80 (%)	＊3
F417	Motor rated speed	100—12000 (min^{-1})	＊2
F418	Speed control gain	0—100 (%)	40
F419	Speed control stable coefficient	0—100 (%)	20

●Acceleration/deceleration time parameters

Title	Function	Adjustment range	Default setting
F500	Acceleration time 2 (s)	0.1—3000 (s)	10.0
F501	Deceleration time 2 (s)	0.1—3000 (s)	10.0
F505	Acceleration/deceleration 1 and 2 switching frequency	0— UL (Hz)	0.0

●Protection parameters

Title	Function	Adjustment range	Default setting
F601	Stall prevention level	30—199 (%) 200 (disabled)	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
F605	Output phase failure detection mode selection	0: Disabled 1: Selected (Output open-phase is checked when operation is started for the first time after power is turned on.) 2: Selected (Output open-phase is checked each time operation is started.)	0
F607	Motor 150%-overload time limit	10—800 (s)	300
F608	Input phase failure detection mode selection	0: Disabled, 1: Enabled	1
F616	Over-torque alarm level	0—200 (%)	150
F618	Over-torque detection time	0.0—10 (s)	0.5
F627	Under voltage trip selection	0: Disabled 1: Enabled (64% or less: Trip, FL relay activated) 2: Disabled (50% or less: Trip, FL relay not activated)	0
F633	Analog input disconnection detection	0 (Disabled), 1—100 (%)	0

●Operation panel parameters

Title	Function	Adjustment range	Default setting
F700	Prohibition of change parameter setting	0: Permitted (CMOd , FMOd cannot be changed during operation.) 1: Prohibited 2: Permitted (CMOd , FMOd also can be changed during operation) 3: Prohibited (except for panel frequency setting.) 4: 0 & panel emergency stop prohibited 5: 1 & panel emergency stop prohibited 6: 2 & panel emergency stop prohibited 7: 3 & panel emergency stop prohibited	0
F701	Unit selection	0: %, H z 1: %→A/V 2: Free unit selection enabled (F702) 3: %→A/V, Free unit selection enabled (F702)	0
F702	Frequency units selection	0.01—200.0	1.00
F710	Monitor display selection	0: Operation frequency (Hz/free unit) 1: Frequency command (Hz/free unit) 2: Output current (%/A)	0

●Communication parameters

Title	Function	Adjustment range	Default setting
F800	Communication baud rate	0:1200bps 1:2400bps 2:4800bps 3:9600bps 4:19200bps	3
F801	Parity	0:NON (non-parity) 1:EVEN (even parity) 2:ODD (odd parity)	1
F802	Inverter number	0—99	0
F803	Communication error trip time	0 (Disabled), 1—100 (s)	0
F880	Free notes	0—65535	0

●Factory setting

Title	Function	Adjustment range	Default setting
F990	For factory setting	—	—

Input terminal functions

Function No.	Code	Function	Action
0	—	No function is assigned	No action
1	ST	Standby terminal	ON: Standby, OFF: Free run
2	F	Forward-run command	ON: Forward run, OFF: Deceleration stop
3	R	Reverse-run command	ON: Reverse run, OFF: Deceleration stop (priority to reverse run)
4	JOG	Jog run command	ON: Jog run, OFF: Canceled
5	AD2	Acceleration/deceleration 2 pattern selection	ON: Acceleration/deceleration 2, OFF: Acceleration/deceleration 1
6	SS1	Preset speed command 1	Selection of preset speeds (up to 15 speeds) using 4 bits: SS1 to SS4
7	SS2	Preset speed command 2	
8	SS3	Preset speed command 3	
9	SS4	Preset speed command 4	
10	RST	Reset command	ON→ OFF: Trip reset
11	EXT	Trip stop command from external input device	ON: E Trip stop
12	PNL/TB	Operation panel/terminal board switching	ON: Forced switching from operation panel/ internal volume to terminal board control
13	DB	DC braking command	ON: DC braking
14	PI	Prohibition of PI control	ON: PI control prohibited, OFF: PI control permitted
15	PWENE	Permission of parameter editing	ON: Edition of parameters permitted, OFF: Edition of parameter prohibited
16	ST+RST	Combination of standby and reset commands	ON: Simultaneous input of ST and RST commands
17	ST+PNL/TB	Combination of standby and operation panel/terminal board switching	ON: Simultaneous input of ST and PNL/TB commands
18	F+JOG	Combination of forward run and jog run	ON: Simultaneous input of F and JOG commands
19	R+JOG	Combination of reverse run and jog run	ON: Simultaneous input of R and JOG commands
20	F+AD 2	Combination of forward run and acceleration/deceleration 2	ON: Simultaneous input of F and AD2 commands
21	R+AD 2	Combination of reverse run and acceleration/deceleration 2	ON: Simultaneous input of R and AD2 commands
22	F+SS 1	Combination of forward run and preset-speed command 1	ON: Simultaneous input of F and SS1 commands
23	R+SS 1	Combination of reverse run and preset-speed command 1	ON: Simultaneous input of R and SS1 commands
24	F+SS 2	Combination of forward run and preset-speed command 2	ON: Simultaneous input of F and SS2 commands
25	R+SS 2	Combination of reverse run and preset-speed command 2	ON: Simultaneous input of R and SS2 commands
26	F+SS 3	Combination of forward run and preset-speed command 3	ON: Simultaneous input of F and SS3 commands
27	R+SS 3	Combination of reverse run and preset-speed command 3	ON: Simultaneous input of R and SS3 commands
28	F+SS 4	Combination of forward run and preset-speed command 4	ON: Simultaneous input of F and SS4 commands
29	R+SS 4	Combination of reverse run and preset-speed command 4	ON: Simultaneous input of R and SS4 commands
30	F+SS1+AD 2	Combination of forward run, preset-speed command 1 and acceleration/deceleration 2	ON: Simultaneous input of F, SS1 and AD2 commands
31	R+SS1+AD 2	Combination of reverse run, preset-speed command 1 and acceleration/deceleration 2	ON: Simultaneous input of R, SS1 and AD2 commands
32	F+SS 2 +AD 2	Combination of forward run, preset-speed command 2 and acceleration/deceleration 2	ON: Simultaneous input of F, SS2 and AD2 commands
33	R+SS 2 +AD 2	Combination of reverse run, preset-speed command 2 and acceleration/deceleration 2	ON: Simultaneous input of R, SS2 and AD2 commands
34	F+SS 3 +AD 2	Combination of forward run, preset-speed command 3 and acceleration/deceleration 2	ON: Simultaneous input of F, SS3 and AD2 commands
35	R+SS 3 +AD 2	Combination of reverse run, preset-speed command 3 and acceleration/deceleration 2	ON: Simultaneous input of R, SS3 and AD2 commands
36	F+SS 4 +AD 2	Combination of forward run, preset-speed command 4 and acceleration/deceleration 2	ON: Simultaneous input of F, SS4 and AD2 commands
37	R+SS 4 +AD 2	Combination of reverse run, preset-speed command 4 and acceleration/deceleration 2	ON: Simultaneous input of R, SS4 and AD2 commands
38	FCHG	Frequency command forced switching	Enabled if FMOd = 4 (selectable between terminal board and operation panel/internal volume) ON: VI terminal, OFF: Internal volume
39	THR 2	No.2 thermal switching	ON: No.2 thermal (Pt:0, F170, F171, F172, F173) OFF: No.1 thermal (Pt:Setting, uL, F409, ub, tHr)
40	MCHG	No.2 motor switching	ON: No.2 motor (Pt:0, F170, F171, F172, F173, F500, F501) OFF: No.1 motor (Pt:Setting, uL, F409, ub, tHr, ACC dEC)
49	HD	Operation holding (stop of 3-wire operation)	ON: F(forward run) / R(reverse run) hold.3-wire operation OFF: Slowdown stop
54	FreeRun	Standby (inversion)	ON: Free run, OFF: Standby
55	RSTN	Reset signal (inversion)	OFF→ON: Trip reset
56	F+ST	Combination of forward run and standby commands	ON: Simultaneous input of F and ST commands
57	R+ST	Combination of reverse run and standby commands	ON: Simultaneous input of R and ST commands

Output terminal functions

Function No.	Code	Function	Action
0	LL	Frequency lower limit	ON: Output frequency higher than LL setting OFF: Output frequency equal to or lower than LL setting
1	LLN	Inversion of frequency lower limit	Inverse output of LL
2	UL	Frequency upper limit	ON: Output frequency equal to or higher than UL setting OFF: Output frequency lower than UL setting
3	ULN	Inversion of frequency upper limit	Inverse output of UL
4	LOW	Low-speed detection signal	ON: Output frequency equal to or higher than F100 setting OFF: Output frequency lower than F100 setting
5	LOWN	Inversion of low-speed detection signal	Inverse output of LOW
6	RCH	Designated frequency reach signal (completion of acceleration/deceleration)	ON: Output frequency within command frequency ±2.5Hz OFF: Output frequency exceeding command frequency ±2.5Hz
7	RCHN	Inversion of designated frequency reach signal (inversion of completion of acceleration/deceleration)	Inverse output of RCH
8	RCHF	Set frequency reach signal	ON: Output frequency within F101 setting ±2.5Hz OFF: Output frequency exceeding F101 setting ±2.5Hz
9	RCHFN	Inversion of set frequency reach signal	Inverse output of RCHF
10	FL	Failure FL (trip output)	ON: Inverter trips
11	FLN	Inversion of failure FL (inversion of trip output)	Inverse output of FL
12	OT	Over-torque detection	ON: Torque current is held above the torque set with F616 for a period of time longer than that set with F618.
13	OTN	Inversion of over-torque detection	Inverse output of OT

To users of our inverters

When studying how to use our inverters

Notes

Leakage current

The amount of leakage current could increase to some extent, depending on the way the inverter is grounded. To prevent current leakage:

(1) Use an ELCB free of higher harmonic waves.

(2) When connecting multiple inverters to the same ELCB, use an ELCB with high current sensitivity.

(3) Connect the inverter to a motor, using a cable as short as possible.

(4) Leakage current could increase by installing noise filter.
VFNC1S-□□□□PL has a built-in noise filter.

Radio interference

This inverter could cause interference with nearby audio systems. If interference occurs, its influence can be reduced by installing a noise filter (optional) on the primary side of the inverter or by shielding the cable connecting the inverter to a motor with a conduit, etc.
For further information, please contact your nearest Toshiba dealer.

Power factor improvement capacitors

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

Installation of input AC reactors

These devices are used to improve the input power factor and suppress high harmonic currents and surges. Install an input AC reactor when using a VF-nC1 inverter under the following conditions:

(1) When the power source capacity is 200kVA or more, and when it is 10 times or more great than the inverter capacity.

(2) When the inverter is connected to 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	———	Decides upon examination
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)

Extracted from "Periodic Inspection of General-purpose Inverters" published by the Japan Electrical Manufacturers' 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

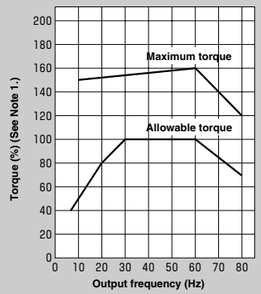
The actual acceleration and deceleration times of a motor driven by an inverter are determined by the torque and moment of inertia of the load, and can be calculated by the following equations.
The acceleration and deceleration times of an inverter can be set individually. In any case, however, they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

Acceleration time	$ta = \frac{(J_M + J_L) \times \Delta N}{9.56 \times (T_M - T_L)}$ (sec.)
Deceleration time	$ta = \frac{(J_M + J_L) \times \Delta N}{9.56 \times (T_B + T_L)}$ (sec.)
Conditions	J_M : Moment of inertia of motor (kg·m²) J_L : Moment of inertia of load (converted into value on motor shaft) (kg·m²) ΔN : Difference in rotating speed between before and after acc. or dce. (min^{-1}) T_L : Load torque (N·m) T_M : Motor rated torque × 1.2-1.3 (N·m) ···V/f control : Motor rated torque × 1.5 (N·m) ···Vector operation control T_B : Motor rated torque × 0.2 (N·m) When a braking resistor or a braking resistor unit is used: Motor rated torque × 0.8-1.0 (N·m)

Allowable torque characteristics

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

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

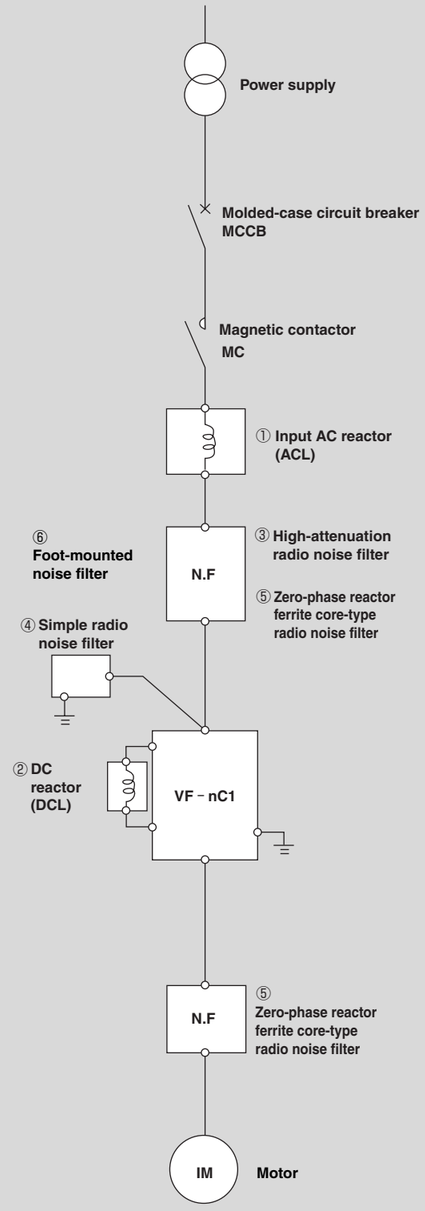


Note 1. 100% torque is based on the rotating speed of a motor operated at 60Hz. Starting torque lowers to some extent if the motor runs on commercial power. So, check the characteristic of the machine to drive.
Note 2. The allowable torque at a base frequency of 50Hz can be calculated approximately by multiplying the allowable torque at 60Hz by 0.8.

Starting characteristics

When a motor is driven by an inverter, its operation is restricted by the inverter's overload current rating, so the starting characteristic is different from those obtained from commercial power supply operation. Although the starting torque is smaller with an inverter than with the commercial power supply, a high starting torque can be produced at low speeds by adjusting the V/f pattern toque boost amount. (150% max., 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



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 200kVA or more and 10 times or more than the inverter capacity or when a distorted wave generation source such as a thyristor unit or a large-capacity inverter is connected in the same distribution system. Reactor type / Effect: Power factor improvement / Harmonics suppression / External surge suppression Input AC reactor: ○ / ○ / ○ DC reactor: ○Large / ○ / × ○:Effective ○Large:Highly effective ×:Ineffective	P.13
②	**DC reactor**	Improves the power factor more than the inverter 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.	
③	**High-attenuation filter (LC filter) NF type manufactured by Soshin Denki Co., Ltd.**	These type of filters are not necessary for single-phase 200V (built-in EMI noise filter) model. The built-in filter meets EN55011 Group1 Class B. ● 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 10MHz. ● Use when equipment readily affected by noise is installed in the peripheral area.	P.13
④	**Simple filter (capacitive filter) Capacitor type, manufactured by Malcon Electronics, Co., Ltd.**	● Effective to prevent interference with audio equipment used near the inverter. ● Install on the input side of the inverter. ● Attenuation characteristic is available only in a specific frequency and. Effective in suppressing noise in a specific AM radio station (e.g., weak radio waves in mountainous regions). ● Increases leakage current because this is a capacitor-based filter. When the power supply is equipped with an ELCB, avoid using too many filters of this type.	—
⑤	**Zero-phase reactor (inductive filter) Ferrite core type manufactured by Soshin Denki Co., Ltd.**	● 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 10MHz. ● For noise countermeasures, insert on the secondary side of the inverter.	—
⑥	**Compliant with EMC directives Foot-mounted type noise reduction filter**	This noise filter complies with European EMC Directive. 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 EMC standard EN55011 Group1, class A. (These type of filters are not necessary for single-phase 200V (built-in EMI noise filter) model. The built-in filter meets EN55011 Group1 Class B.)	—
	Radio noise reduction filter		
⑦	**Remote panel**	Provided with built-in frequency indicator, frequency setting device, and RUN-STOP (forward/reverse) switch. (Model: CBVR-7B1)	P.14
⑧	**DIN rail kit**	Use to mount the inverter on DIN rails.	—
⑨	**Parameter writer**	Use this unit for batch read, batch copy, and batch writing of setting parameters. (Model: PWU001Z)	P.14
⑩	**Extension panel**	Extended operation panel kit provided with LED indication section, RUN/STOP key, UP/DOWN key, Monitor key and Enter key. (Model: RKP001Z)	
⑪	**RS485 communication converter unit**	Use to connect a personal computer for data communication with up to 64 units. (Model: RS4001Z)	
⑫	**RS232C communication converter unit**	Use to connect a personal computer for data communication. (Model: RS2001Z)	
⑬	**Cable with a built-in RS232C communication converter**	Optional cable with a built-in RS232C communication converter (Model: RS20035)	

Device	External dimensions and connections

Input AC reactor (ACL)

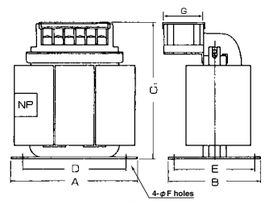
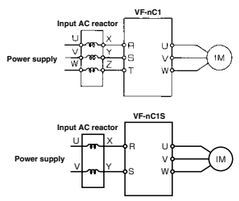


Fig. A



Type	Rating	Inverter type	Dimensions (mm)							Drawing	Terminals	Approx. weight (kg)
			A	B	C	D	E	F	G			
PFLS2002S	1-phase 200V 2.0A-50/60Hz	VFNC1S-2002P、VFNC1S-2002PL	80	55	115	63	45	5	45	A	Harmonica terminal M3.5	0.85
PFL2001S	3-phase 200V 1.7A-50/60Hz	VFNC1-2001P、VFNC1-2002P	105	65	115	90	55	5	40		Harmonica terminal M3.5	1.0
PFL2005S	3-phase 200V 5.5A-50/60Hz	VFNC1-2004P, VFNC1-2007P, VFNC1S-2004P, VFNC1S-2004PL, VFNC1S-1001P, VFNC1S-1002P	105	65	115	90	55	5	40		Harmonica terminal M3.5	1.2
PFL2011S	3-phase 200V 11A-50/60Hz	VFNC1-2015P, VFNC1-2022P, VFNC1S-2007P, VFNC1S-2007PL	130	70	140	115	60	5	50		Harmonica terminal M4	2.3
PFL2018S	3-phase 200V 18A-50/60Hz	VFNC1S-2015P, VFNC1S-2022P, VFNC1S-2015PL, VFNC1S-2022PL, VFNC1S-1004P, VFNC1S-1007P	130	70	140	115	60	5	50		Harmonica terminal M4	2.5

※PFL 2002S has 4 terminals.

DC reactor (DCL)

DC reactors cannot be used with any single-phase 100V or single-phase 200V model (built-in EMI noise filter). Use an input reactor.

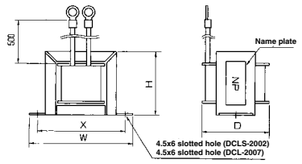


Fig. A

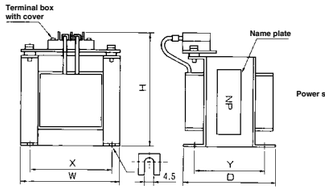


Fig. B

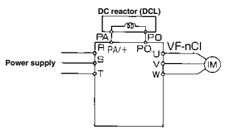
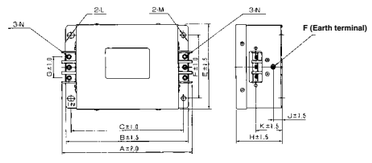
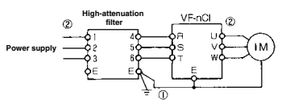


Fig. C

Type	Rating (A)	Inverter type	Dimensions (mm)							Drawing	Terminals	Approx. weight (kg)
			W	H	D	X	Y	d1	d2			
DCL-2002	2	VFNC1-2001P VFNC1-2002P	59	37	35	51	——	——	——	A	Crimp terminal V1.25 - 3.5	0.2
DCLS-2002	2.5	VFNC1S-2002P	79	50	44	66	——	——	——		Crimp terminal V1.25 - 3.5	0.6
DCL-2007	7	VFNC1-2004P VFNC1-2007P VFNC1S-2004P	92	65	70	82	——	——	——		Crimp terminal V2 - 3.5	1.2
DCL-2022	14	VFNC1-2015P VFNC1-2022P VFNC1S-2007P	86	110	80	71	64	——	——	B	M4	2.2
DCL-2037	22.5	VFNC1S-2015P VFNC1S-2022P	86	110	85	71	70	——	——		M4	2.5

High-attenuation radio noise reduction filter



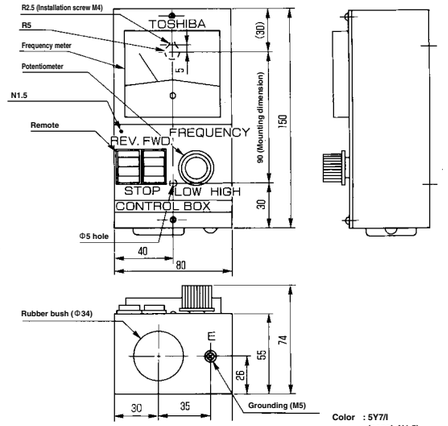


Note) ①Noise filter should be connected to the primary-side of inverter.
②Output cable should be kept away from input cable.

Radio noise filter type	Rating (A)	Inverter type	Dimensions (mm)												Approx. weight (kg)
			A	B	C	E	F	G	E	J	K	M	N	P	
NF3005A-MJ	5	VFNC1-2001P～2007P VFNC1S-2002P VFNC1S-1001P	174.5	160	145	110	80	32	70	20	45	φ5.5	M4	M4	1.0
NF3015A-MJ	15	VFNC1-2015P、2022P VFNC1S-2004P～2015P VFNC1S-1002P、1004P													1.6
NF3020A-MJ	20	VFNC1S-1007P													
NF3030A-MJ	30	VFNC1S-2022P													

Device	External dimensions and connections

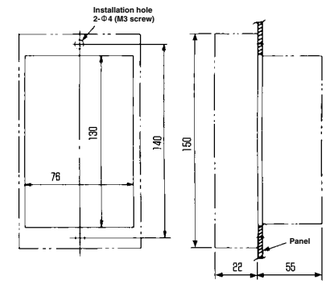
Remote panel CBVR-7B1

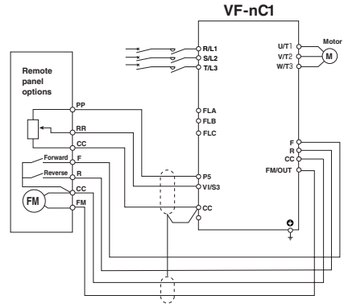


Color : 5Y7/1
(panel: N1.5)
Weight : 0.7kg

Note) The outside dimensions and installation dimensions are the same as those of the former model CBVR-7B, though the meter is different from that on the CBVR-7B.

Panel hole



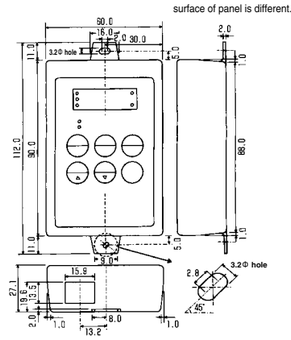


Note) The length of wire between inverter and remote panel less than 30m.

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

Parameter writer **Extention panel**

Note) Dimensions of extension panel are same as following drawing, but the surface of panel is different.

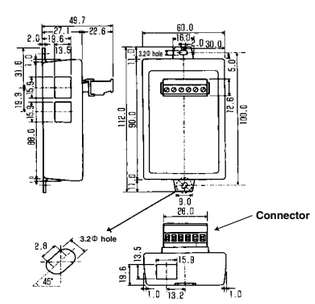


Parameter writer type: PWU001Z
Parameter writer cable type:
CAB0011 (1m)
CAB0013 (3m)
CAB0015 (5m)

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

Communication converter unit **RS485/RS232C**

Note) Following is RS485 unit. Dimensions of RS232C unit are same as following, but RS232C does not have a connector.

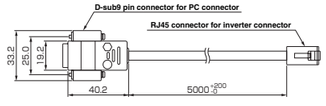


RS485 communication converter type: RS4001Z
RS4002Z*
RS485 cable type:
CAB0011 (1m)
CAB0013 (3m)
CAB0015 (5m)
*Supports up to 8 units. RS4001Z and RS4002Z are different in outside shape.

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

Cable with a built-in RS232C communication converter

Cable with a built-in RS232C communication converter **Type:RS20035**



Side view