TOSHIBA

E6582386

■ Additional sheet

■ VF-nC3M : UL standard and CSA standard

UL / CSA 規格に適合する VF-nC3M には、定格銘板に UL / CSA マークが記載されています。
この追加取扱説明書は、UL61800-5-1 に適合するための訂正と追加情報です。
形式には、末尾に Y-Axx（xx は特定のコード）や、文字と数字の組み合わせが追加される場合があります。

UL61800-5-1 に適合するために、本追加取扱説明書の記載内容を適用してください。

インバータ本体取扱説明書 E6581694 に記載の安全上のご注意、表示、および図記号なども合わせてご確認ください。

VF-nC3M that comply to UL/CSA Standard have the UL/CSA mark on the nameplate.
This additional manual is the correction and additional information to comply UL61800-5-1.
Type-from may have additional suffix Y-Axx (xx is the specific code) or the combination of several characters and numbers.

To comply to UL61800-5-1, please apply them in accordance with this additional manual description.

Confirm the safety precautions, the symbols and the indications described in the instruction manual E6581694 together.

E6582386-000

1. General

⚠ WARNING / AVERTISSEMENT

- RISK OF ELECTRIC SHOCK -
DANGEROUS VOLTAGE MAY EXIST FOR _15_MINUTES AFTER REMOVING POWER

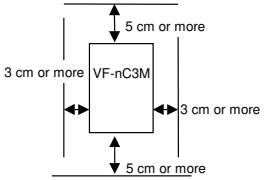
- RISQUE DU CHOC ÉLECTRIQUE -
UNE TENSIONDANGEREUSE PEUT ÊTRE PRÉSENTÉE JUSQU'À _15_ MINUTES APRÈS AVOIR COUPÉL'ALIMENTATION

The following steps must be performed before wiring and servicing.
(1)Turn off all input power.
(2)Wait at least fifteen minutes and check to make sure that the charge lamp is no longer lit.
(3)Use a tester that can measure DC voltage (400VDC or more), and check to make sure that the voltage to the DC main circuits (across PA/+ and PC/-) is 45V or less.
If these steps are not properly performed, the wiring will cause electric shock.

2. Compliance with Installation

A UL certificate was granted on the assumption that the inverter would be installed in an enclosure. Therefore, install the inverter in an enclosure and if necessary, take measures to maintain the inverter ambient temperature (temperature in the enclosure) within the specified temperature range.
Be sure to apply the minimum enclosure size shown in Table 3

■Standard installation



■Environments

Location of use	Indoors; not exposed to direct sunlight, corrosive gas, explosive gas, flammable gas, oil mist, or dust; and vibration of less than 5.9m/s^2 (10 to 55Hz).
Elevation	1000 m or less
Ambient temperature	-10 to +50°C Maximum Surrounding Air Temperature : 50 °C 40 °C (with the protective label on the top of the inverter) 50 °C (without the protective label on the top of the inverter)
Storage temperature	-25 to +70°C (Temperature applicable for a short term.)
Relative humidity	5 to 95% (free from condensation and vapor).
Pollution degree	2

■Current reduction

According to the carrier frequency F300 setting, you may need to reduce the inverter's continuous output current. Reduction rates vary depending on the capacity of the inverter.

Inverter model	Ambient temperature	Input voltage three-phase 200V to 240V	
		PWM Carrier frequency	
		2.0 to 4.0 kHz	4.1 to 12.0 kHz
VFNC3M-2002P	40°C or less *1	1.4 A	1.4 A
	Above 40 to 50°C *2	1.2 A	1.2 A
VFNC3M-2004P	40°C or less *1	2.4 A	2.4 A
	Above 40 to 50°C *2	2.1 A	2.1 A
VFNC3M-2007P	40°C or less *1	4.2 A	3.6 A
	Above 40 to 50°C *2		3.2 A
VFNC3M-2015P	40°C or less *1	7.5 A	7.5 A
	Above 40 to 50°C *2		7.1 A
VFNC3M-2022P	40°C or less *1	10.0 A	8.5 A
	Above 40 to 50°C *2		7.5 A

*1: Maintain the ambient temperature of 40°C or less for the compliance with UL standard.

*2: Remove the protective label on the top of the inverter for the compliance with UL standard for the ambient temperature above 40°C to 50°C.

3. Compliance with Connection

⚠WARNING / AVERTISSEMENT

The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the controller should be examined and replaced if damaged.
If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.

(LE DÉCLENCHEMENT DU DISPOSITIF DE PROTECTION DU CIRCUIT DE DÉRIVATION PEUT ÊTRE DÛ À UNE COUPURE QUI RÉSULTE D'UN COURANT DE DÉFAUT. POUR LIMITER LE RISQUE D'INCENDIE OU DE CHOC ÉLECTRIQUE, EXAMINER LES PIÈCES PORTEUSES DE COURANT ET LES AUTRES ÉLÉMENTS DU CONTRÔLEUR ET LES REMPLACER S'ILS SONT ENDOMMAGÉS. EN CAS DE GRILLAGE DE L'ÉLÉMENT TRAVERSÉ PAR LE COURANT DANS UN RELAIS DE SURCHARGE, LE RELAIS TOUT ENTIER DOIT ÊTRE REMPLACÉ)

Use the UL conformed cables (Rating 75 °C or more, Use the copper conductors only.) to the main circuit terminals (R/L1, S/L2, T/L3, U/T1, V/T2, W/T3).

-> For recommended tightening torque for the main terminal, see Table 1.
-> Use the ring terminal for the earth cables, see Table 2.
-> For recommended wire size for the main terminal, see Table 3.
-> Use the electric wire of Class 1 for the control wire. (For wire size and tightening torque, see the label on unit)

For instruction in the United States, Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

For instruction in the Canada, Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, Part1.

(LA PROTECTION INTÉGRÉE CONTRE LES COURTSCIRCUITS N'ASSURE PAS LA PROTECTION DE LA DÉRIVATION. LA PROTECTION DE LA DÉRIVATION DOIT ÊTRE EXÉCUTÉE CONFORMÉMENT AU CODE CANADIEN DE L'ÉLECTRICITÉ, PREMIÈRE PARTIE.)

Table 1 Tighten the screws to specified torque

Screw size	tightening torque	
M3.5	1.0 N·m	8.9 lb·in
M4	1.4 N·m	12.4 lb·in
M5	3.0 N·m	26.6 lb·in

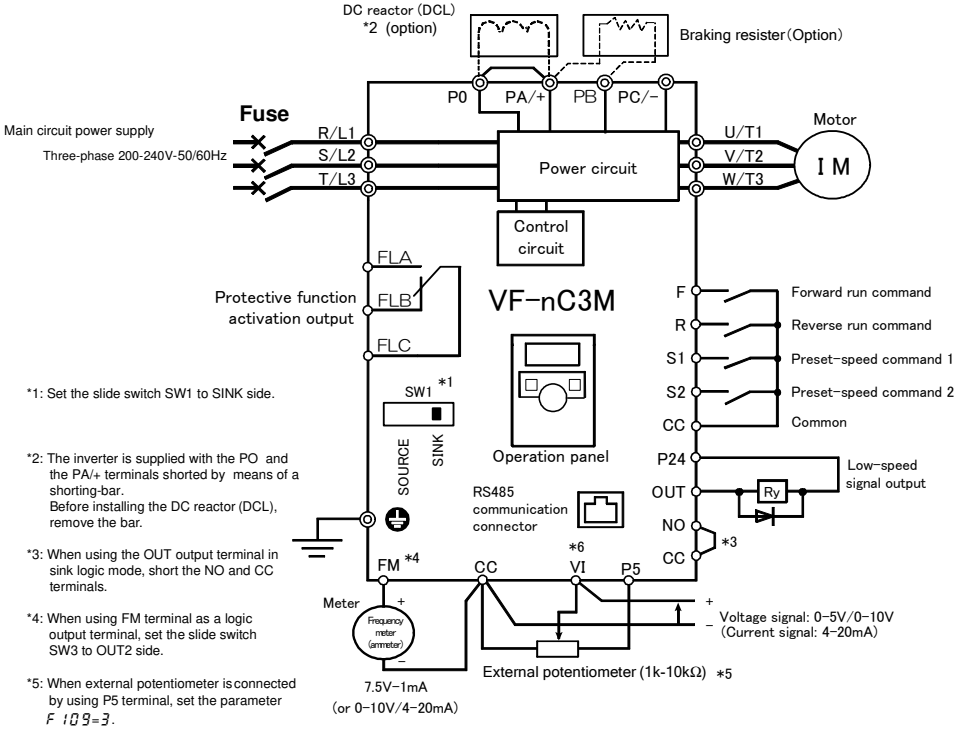
Table 2 Ring terminal size for earth cables

Earth Cable Sizes	M4 (grounding terminal)	M5 (grounding terminal)
AWG14	R2-4 [JIS standard]	R2-5 [JIS standard]

■Main and control circuit terminals

This diagram shows an example of wiring of the main and control circuit (in case of sink logic).

Standard connection diagram – SINK (Negative) (common:CC)



*1: Set the slide switch SW1 to SINK side.

*2: The inverter is supplied with the PO and the PA/+ terminals shorted by means of a shorting-bar.
Before installing the DC reactor (DCL), remove the bar.

*3: When using the OUT output terminal in sink logic mode, short the NO and CC terminals.

*4: When using FM terminal as a logic output terminal, set the slide switch SW3 to OUT2 side.

*5: When external potentiometer is connected by using P5 terminal, set the parameter F109=3.

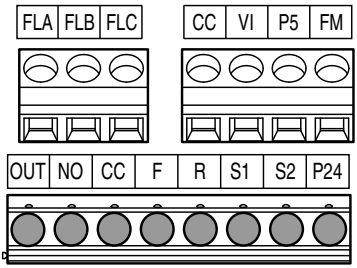
*6: When VI terminal is used as a logic input terminal, refer to section 7.2.1.

For sections and page, refer to instruction manual E6581694.

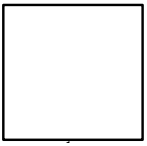
■Power circuit

Terminal symbol	Terminal function
⏚	Grounding terminal for connecting inverter. There are 3 terminals in total.
R/L1,S/L2,T/L3	200V/240V class: three-phase 200 to 240V-50/60Hz
U/T1,V/T2,W/T3	Connect to a (three-phase induction) motor.
PA/+, PB	Connect to braking resistors. Change parameters F304, F305, F308, F309 if necessary.
PC/-	This is a negative potential terminal in the internal DC main circuit. DC common power can be input across the PA terminals (positive potential).
PO, PA/+	Terminals for connecting a DC reactor (DCL: optional external device). Shorted by a shorting-bar when shipped from the factory. Before installing DCL, remove the shorting-bar.

■Control circuit terminals

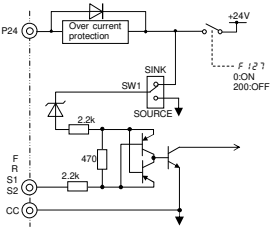


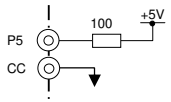
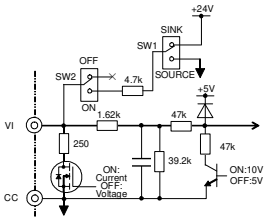
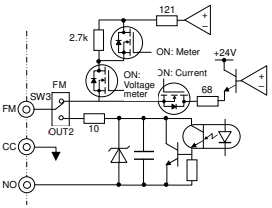
RS485 connector



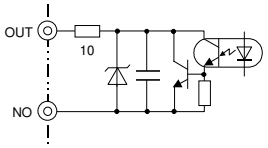
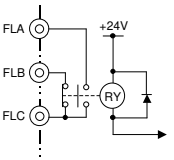
Screw size	Recommended tightening torque
M2.5 screw	0.5 N·m
	4.4 lb·in

Stripping length: 6 (mm)
Screwdriver: Small-sized flat-blade screwdriver
(Blade thickness: 0.5 mm, blade width: 3.5 mm)

Terminal symbol	Input / output	Function	Electrical specifications	Inverter internal circuits
F	Input	Multifunction programmable logic input: Shorting across F-CC causes forward rotation; open causes slow-down and stop. (When Standby ST is always ON) 3 different functions can be assigned.	No voltage logic input 24Vdc-5mA or less *Sink/Source selectable using slide switch SW1 (Default setting is SINK side)	
R	Input	Multifunction programmable logic input: Shorting across R-CC causes reverse rotation; open causes slow-down and stop. (When Standby ST is always ON) 3 different functions can be assigned.		
S1	Input	Multifunction programmable logic input: Shorting across S1-CC causes preset speed operation. 2 different functions can be assigned.		
S2	Input	Multifunction programmable logic input: Shorting across S2-CC causes preset speed operation. 2 different functions can be assigned.		
P24	Output	24Vdc power output (When F127=0)	24Vdc-100mA	
	Input	This terminal can be used as an external 24Vdc input for logic input terminal by changing parameter F127=200.	-	
CC	Common to Input / output	Control circuit's equipotential terminal (2 terminals)	-	

Terminal symbol	Input / output	Function	Electrical specifications	Inverter internal circuits
P5	Output	Analog power supply output	5Vdc (permissible load current: 10mA)	
V I	Input	Multifunction programmable analog input. Factory default setting: 0-10Vdc (1/1000 resolution) and 0-60Hz (0-50Hz) frequency input. The function can be changed to 0-20mAdc (4-20mA) current input by parameter F 109 = 1 setting. 0-5Vdc (1/1000 resolution) voltage input by parameter F 109 =3 setting. Switch to this setting when external potentiometer is connected by using P5 terminal. By changing parameter F 109=2 setting, this terminal can also be used as a multifunction programmable logic input terminal. Sink/source logic is switched by slide switch SW1 and parameter F 127. In that case, set the slide switch SW2 to ON side.	5V/10Vdc (internal impedance: 40kΩ) 4-20mA (internal impedance: 250Ω) Note 1)	
FM	Output	Multifunction programmable analog output. Standard default setting: output frequency. The function can be changed to 0-10Vdc voltage by parameter F 681 =2 setting or 0-20mAdc (4-20mA) current output by parameter F 681 = 1 setting. By setting the slide switch SW3 to OUT2 side, these terminals can also be used as multifunction programmable open collector output terminals. (only sink logic)	1mAdc full-scale ammeter or QS6T(option) 0-20mA (4-20mA) DC ammeter Permissible load resistance: 750Ω or less 0-10V DC volt meter Permissible load resistance: 1kΩ or more Open collector output 25Vdc-50mA	

Note 1) Be careful, if 4-20mA is selected, when the inverter's power is ON, the internal impedance is 250Ω, but when the power is OFF, the internal impedance increases very much to approximately 40kΩ.

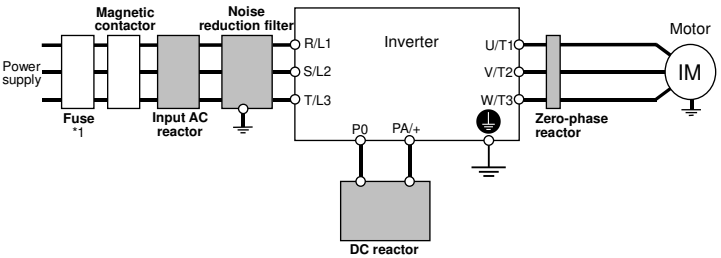
Terminal symbol	Input / output	Function	Electrical specifications	Inverter internal circuits
OUT NO Note 3)	Output	Multifunction programmable open collector output. Standard default setting detect and output low speed signal. Multifunction output terminals to which two different functions can be assigned. The NO terminal is an isoelectric output terminal. It is insulated from the CC terminal. By changing parameter settings, these terminals can also be used as multifunction programmable pulse train output terminals.	Open collector output 24Vdc-100mA To output pulse trains, a current of 10mA or more needs to be passed. Pulse frequency range: 25～1600pps	
FLA FLB FLC Note 2) Note 3)	Output	Multifunction programmable relay contact output. Detects the operation of the inverter's protection function. Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation.	Max. switching capacity 250Vac-2A 30Vdc-2A (cosϕ=1) : at resistive load 250Vac-1A (cosϕ=0.4) 30Vdc-1A (L/R=7ms) Min. permissible load 5Vdc-100mA 24Vdc-5mA	

Note 2) A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measures when connecting it directly with input unit terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected.

Note 3) OVC II: Overvoltage category II

4. Compliance with Peripheral devices

■ Connections with peripheral equipment



*1: Use the UL listed fuses at connecting to power supply.
Short circuit test is performed under the condition of the power supply short-circuit currents.
These interrupting capacities and fuse rating currents depend on the applicable motor capacities.
For input withstand rating, fuse rating currents and wire size, see Table 3.

Table 3 SCCR, Fuse and Wire sizes, with Enclosure

Inverter model	Voltage (V)	SCCR (kA)	Fuse Class (1)	Fuse current (A) (2)	Minimum Enclosure Volume (L:liter) (3)	Wire sizes of power circuit	Earth Cable
	<Y>	<X>	<Z1>	<Z2>			
VFNC3M-2002P	240	5	Class CC	5	15.7	AWG 14	AWG 14
VFNC3M-2004P	240	5	Class CC	7	15.7	AWG 14	AWG 14
VFNC3M-2007P	240	5	Class J	15	15.7	AWG 14	AWG 14
VFNC3M-2015P	240	5	Class J	25	15.7	AWG 14	AWG 14
VFNC3M-2022P	240	5	Class J	25	15.7	AWG 12	AWG 14

Suitable for use on a circuit capable of delivering not more than___X___rms symmetrical kilo Amperes, ___Y___Volts maximum, when protected by___Z1___with a maximum rating of___Z2___.
(CONVIENT AUX CIRCUITS NON SUSCEPTIBLES DE DÉLIVRER PLUS DE___X___AMPÉRES SYMÉTRIQUES EFFICACES, MAX. ___Y___V, AVEC PROTECTION PAR ___Z1___DE CALIBRE NOMINAL DE ___Z2___.)

(1) Use Class CC or J fast acting or time delay with any manufacturer.
(2) The ampere rating of the short circuit protection devices in the table are maximum values. Smaller ampere sizes can be used.
(3) The enclosure mounting an inverter are a Type 1, 4(X) or 12 rated enclosure, only for the indoor usage.
Minimum enclosure volume allows for specified SCCR. Thermal requirements may require a larger enclosure.

5. Overload protection

VF-nC3M has overload protection.
Over current rating: 150%-1min. , 200%-0.5sec.
Refer to the nameplate for the rated current.

6. Motor thermal protection

⚠CAUTION

- Risk to damage the motor -
Motor thermal protection will not be provided by the drive if the motor's nominal current is 20% lower than that output of the drive.
In this case, find an alternative source of thermal protection.
Failure to follow these instruction can result in equipment damage.

The devices VF-nC3M are provided with integral overload and over-speed protection for the motor after activation of this function by setting.
Protection at 100% of the full load motor current. The motor thermal protection current (ELHr) must be set to the rated current indicated on the motor nameplate.
The devices VF-nC3M are provided motor overload protection at 115% of rated current.

VF-nC3M has the motor thermal protection.
Select the electronic thermal protection characteristics that fit with the ratings and characteristics of the motor.
In case of multi motor operation with one inverter, thermal relay should be connected to each motor.

Setting the electronic thermal

- Function
  This parameter allows selection of the appropriate electronic thermal protection characteristics according to the particular rating and characteristics of the motor.

[Parameter setting]

Title	Function	Adjustment range				Default setting
tHr	Motor electronic-thermal protection level 1	10 – 100 (%) / (A)				100
OLn	Electronic-thermal protection characteristic selection	Setting value		Overload protection	Overload stall	0
		0	Standard motor	valid	invalid	
		1		valid	valid	
		2		invalid	invalid	
		3		invalid	valid	
		4	VF motor (special motor)	valid	invalid	
		5		valid	valid	
		6		invalid	invalid	
		7		invalid	valid	
F173	Motor electronic-thermal protection level 2	10 – 100 (%) / (A)				100
F607	Motor 150% overload detection time	10 – 2400 (s)				300
F632	Electronic-thermal memory	0: Disabled 1: Enabled				0

1) Setting the electronic thermal protection characteristics selection OLn and motor electronic thermal protection level 1 tHr, 2 F173

The electronic thermal protection characteristics selection OLn is used to enable or disable the motor overload trip function (OL2) and the overload stall function.
While the inverter overload trip (OL1) will be in constant detect operation, the motor overload trip (OL2) can be selected using the parameter OLn.

[Using standard motors (other than motors intended for use with inverters)]

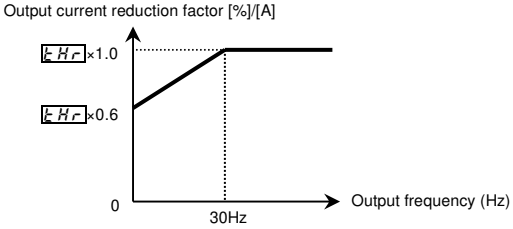
When a motor is used in the lower frequency range than the rated frequency, that will decrease the cooling effects for the motor. This speeds up the start of overload detection operations when a standard motor is used in order to prevent overheating.

■Setting of electronic thermal protection characteristics selection OLn

Setting value	Overload protection	Overload stall
0	valid	invalid
1	valid	valid
2	invalid	invalid
3	invalid	valid

■Setting of motor electronic thermal protection level 1 tHr (Same as F173)

When the capacity of the motor in use is smaller than the capacity of the inverter, or the rated current of the motor is smaller than the rated current of the inverter, adjust thermal protection level 1 tHr for the motor in accordance with the motor's rated current.



Note: The motor overload protection start level is fixed at 30Hz.

[Using a VF motor (motor for use with inverter)]

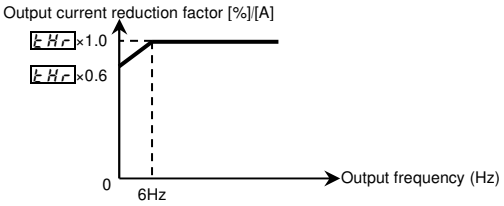
■Setting of electronic thermal protection characteristics selection OLn

Setting value	Overload protection	Overload stall
4	valid	invalid
5	valid	valid
6	invalid	invalid
7	invalid	valid

VF motors (motors designed for use with inverters) can be used in frequency ranges lower than those for standard motors, but their cooling efficiency decreases at frequencies below 6Hz.

■Setting of motor electronic thermal protection level 1 tHr (Same as F173)

If the capacity of the motor is smaller than the capacity of the inverter, or the rated current of the motor is smaller than the rated current of the inverter, adjust the electronic thermal protection level 1 tHr so that it fits the motor's rated current.



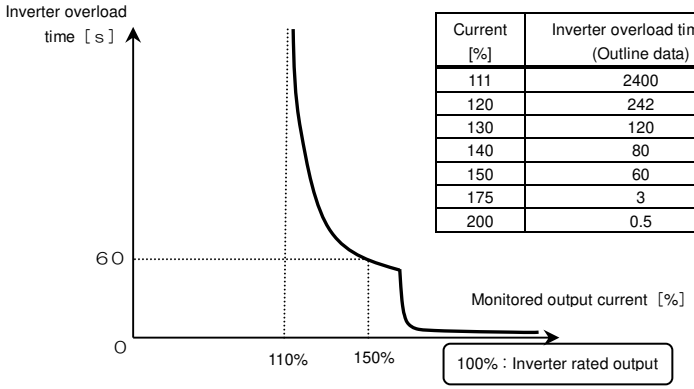
Note) The start level for motor overload reduction is fixed at 6 Hz.

2) Motor 150%-overload time F607

Parameter F607 is used to set the time elapsed before the motor trips under a load of 150% (overload trip OL2) within a range of 10 to 2400 seconds.

3) Inverter overload characteristics

Set to protect the inverter itself. The setting of this parameter cannot be turned to off.
When an inverter overload trip (OL 1) operates, operation can be improved by lowering stall operating level F601, or increasing acceleration time ACC and deceleration time dEC.



Current [%]	Inverter overload time [s] (Outline data)
111	2400
120	242
130	120
140	80
150	60
175	3
200	0.5

Inverter overload protection characteristic

Note 1: At extremely low speeds of lower than 1 Hz, an overload trip (OL 3) occurs in a short period of time to protect the inverter.
Note 2: At over 150%, an overload trip (OL 1) occurs in a short period of time to protect the inverter.

4) Electronic thermal memory F632

When the power is OFF, it is possible to reset or maintain the overload totaling level.
This parameter's settings are applied both to the motor's electronic thermal memory and the electronic thermal memory for inverter protection.

[Parameters settings]

Title	Function	Adjustment range	Default setting
F632	Electronic thermal memory	0: Disabled 1: Enabled	0

*F632= 1 is a function for complying with the U.S. NEC standards.

7. Other

⚠ WARNING
Operation of this equipment requires detailed installation and operation instructions provided in the hardware manual intended for use with this product. This information is provided included in the container this device was packaged in. This information should be retained with this device at all times.

Please contact where you purchase the inverter, your Toshiba sales representative, if you need the hard copy (paper).