TOSHIBA

Instruction Manual

High Performance Inverter

TOSVERT VF-A3

200V class 0.4～55kW

400V class 0.75～75kW

Introduction

Congratulaitons for your selection of the "TOSVERT VF-A3", a high performance version of Toshiba's line of solid-state inverters.

The VF-A3 is a high performance inverter equipped with a number of specific functions that are designed for a wide variety of applications. You will find the VF-A3 very easy to operate by inputting its easy-to-remember commands from the inverter's keyboard type operating panel. This user-friendly interface allows you to change basic inverter settings and operations without having to halt operation fo look up this complicated instructions in the user's manual. The inverter's operational reliability has been made highly resilient and hard to trip by using the latest technology. Specifically, the VF-A3 has current limiting, retry, soft-stall, and non-stop control functions (protection against instantaneous power failure) all built into its compact, sturdy body.

To help you take full advantage of the VF-A3's unsurpassed capabilities. we strongly advise that you read this manual carefully before operating the inverter.

Toshiba recommends that this document be preserved in the custody of an actual user of the VF-A3 so that it is always available for immediate reference,and for future maintenance and inspection requirements.

Check Your Equipment

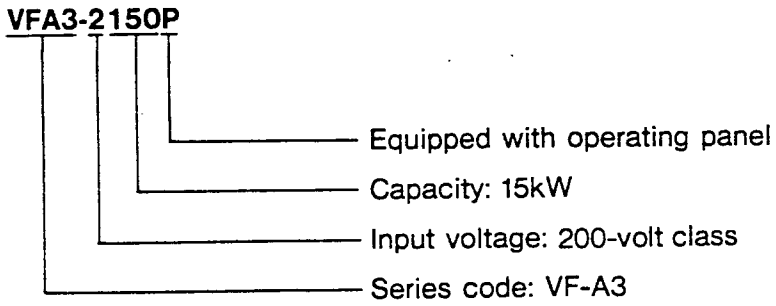
When unpacking and installing the VF-A3, exercise caution that you don't damage its sensitive circuitry by jolting of vibrating the unit in excess of its tolerances.

After unpacking the VF-A3, check the following points:

1) That the VF-A3 has not been damaged during shipment,
2) Confirm that the unit you received has the exact ratings and specifications that you ordered. Look at the unit's model code number, which is stamped on the unit's name plate (see illustration below), to determine if the unit you received matches your order specifications.

Our utmost efforts have been applied to assure maximum quality control in the manufacture, packaging, and shipment of this inverter. However, if by any change a problem with the inverter should arise, promptly contact your Toshiba representative.

Inverter Model Code



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Remarks:

① Notations such as [WRT], [NEXT] and [1] given in the table for operating procedure as well as elsewhere in the text of this manual refer to the respective keys of the operating panel.

② The notation " <--> " that appears in the table for operating procedure signifies that the each of the indications shown on both sides of the " <--> " appear alternately on the inverter's monitoring display.

③ In the operating procedure table, the indications appended with a colon (:) refer to the title or data display that appears in the inverter's monitoring display. Those without the colon refer to operating frequency or cause of a fault.

④ An asterisk "*" indicates that a complimentary explanation or reference matter is provided for the subject bearing the mark.

⑤ A description marked with a frame ☐ indicates a precaution or an interdiction.

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CHAPTER 1 INSTALLATION AND OPERATION

This chapter describes the installation and wiring connections of the VF-A3 inverter. It also explains a simplified operation using the inverter's standard functions.

CHAPTER 1

Installation and Operation

1.1 Installation

The TOSVERT-VFA3 inverter has been designed for mounting on a vertical wall that receives adequate ventilation. See Figure 1.1 for an illustration of clearances required for proper installation of the inverter to ensure adequate ventilation and access for maintenance. If you attempt to insstall this unit in any position other than the recommended vertical position, please consult with your Toshiba representative beforehand.

Avoid installation sites wherer the atmosphere is hot, humid, or contaminated with dust or metallic particles. If you must install the inverter in such environments, please consult with your Toshiba representative before you install the inverter.

CAUTION: Models with a capacity of 3.7 kW or smaller are equipped with a regenerative discharge resistor on the rear side of the inverter. Because an operation involving frequent starting and sopping will result in higher exhaust air temperatures (up to 150°C) due to the heating of the inverter's regenerative discharge resistor, select the installation site carefully (e.g., mounting on a metallic surface may be a good choice).

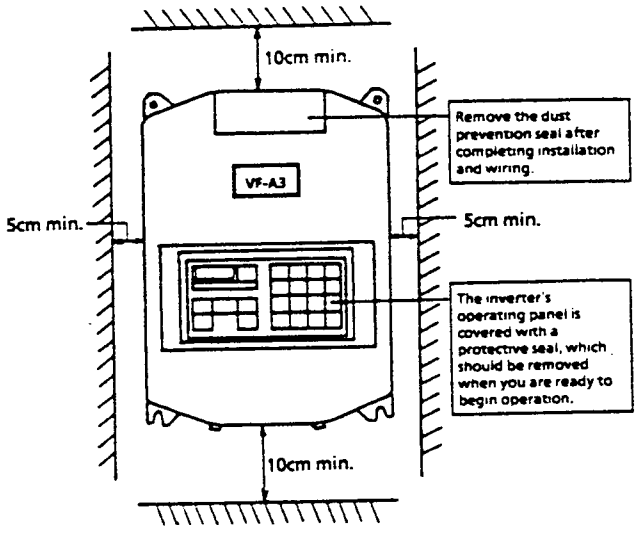


Figure 1.1 Installation clearances for the VF-A3

1.2 Wiring connections

You can operate your VF-A3 inverter with its standard functions by connecting the unit to a power supply and a drive motor. See Figures 1.2 and 1.3 and perform the connection work following the procedure specified below.

1) Open the VF-A3'a front cover.
2) Connect an input power supply (power lines from a distribution panel) to Control power supply terminals as well as L1/R, L2/S, and L3/T on the left side of the inverter's main circuit terminal block.
3) Connect the inverter's motor drive terminals T1/U, T2/V, and T3/W to your motor's U, V, and W terminals.
4) Connect the inverter's E/G terminal, located to the left of the main circuit terminal block, to your system's ground wire.
5) After completing the installation and wiring connections, remove the dust prevention seal that is pasted on the upper part of the unit (for models of 200V, 3.7kW and smaller).

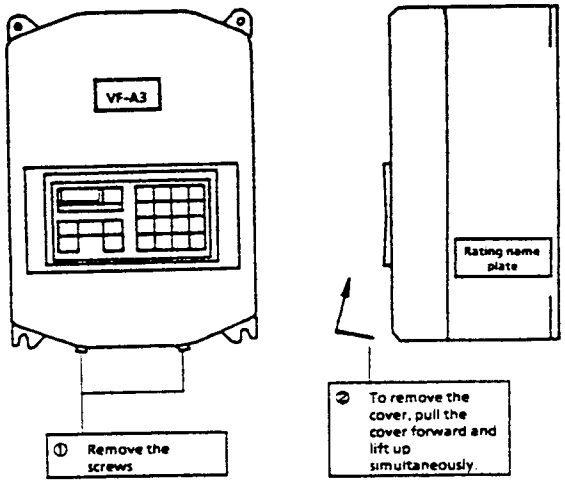


Figure 1.2 How to open the front cover

* Mount the cover to the original place. You will find the rating nameplate on the right side of the unit.
* Before you begin connecting wires, be sure to turn the distribution panel's main switch OFF.

Before you start wiring, ensure that the inverter's "CHARGE" lamp in no longer lit.

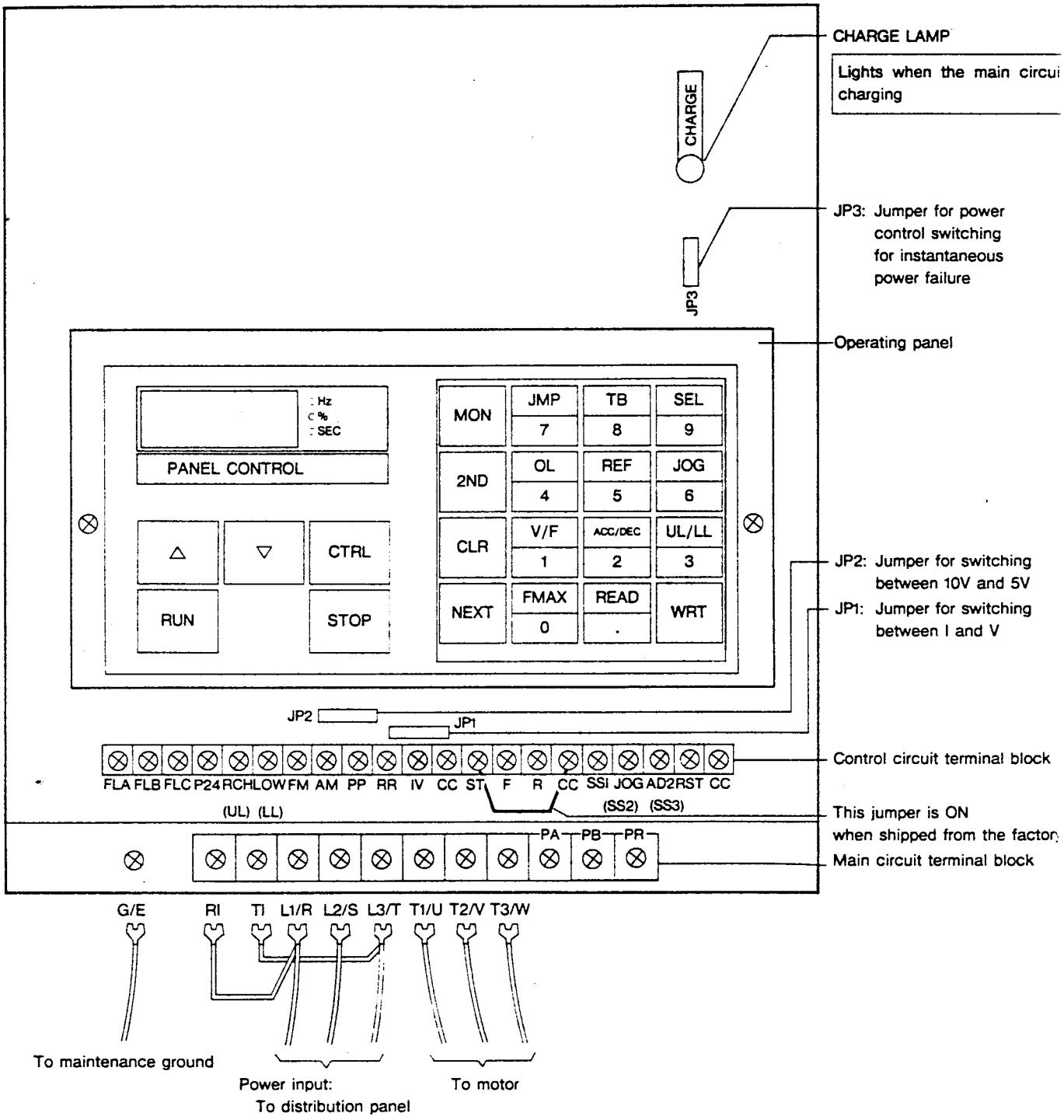
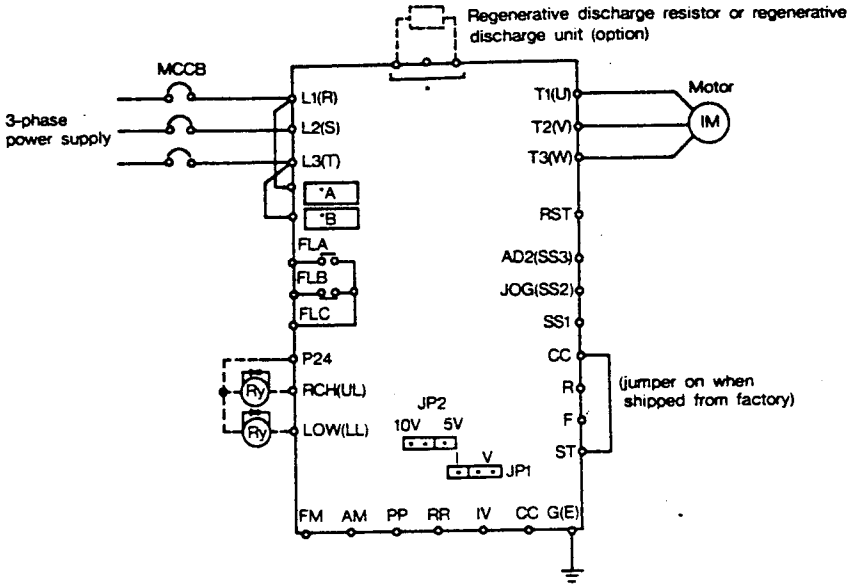
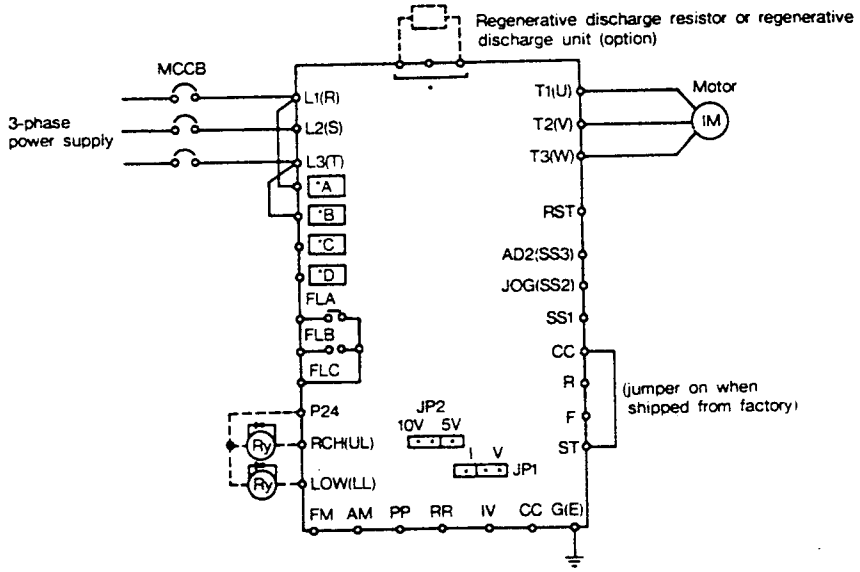


Figure 1.3 Terminals for connecting the VF-A3 to the power supply and to a motor.



TYPE	MARK AND VOLTAGE	
	*A	*B
1	R1	T1
	200V - 50Hz 200V to 230V - 60Hz	
2	R20	T20
	200V to 220V - 50Hz	

(a) 200V CLASS

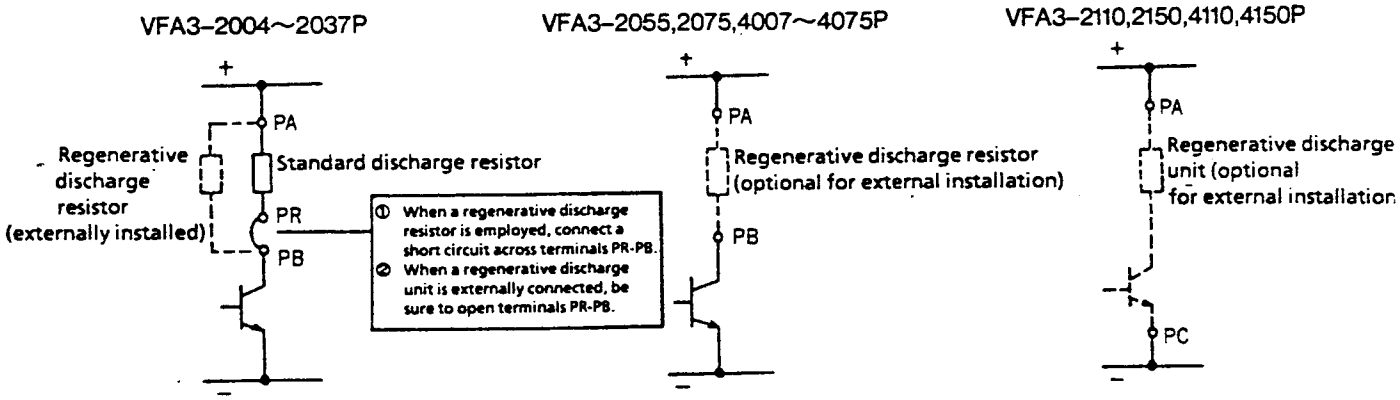


TYPE	MARK AND VOLTAGE			
	*A	*B	*C	*D
1	R1	T1	R20	T20
	400V to 440V - 50Hz 400V to 460V - 60Hz		200V to 220V - 50Hz 200V to 230V - 60Hz	
2	R38/R41	T38/T41	R22/R24	T22/T24
	380V to 415V - 50/60Hz		220V to 240V - 50/60Hz	
3	R41/R44	T41/T44	R22/R24	T22/T24
	415V to 440V - 50/60Hz		220V to 240V - 50/60Hz	

(b) 400V CLASS

Because all the inverter's control terminals (except FLA, FLB, and FLC) are designed for electronic circuits, be sure to insulate these signal circuits from the main circuit.

*) Note: Regenerative discharge circuit and terminals



When yor use a regenerative discharge resistor/regenerative discharge unit, refer to section 8.2. 3(page 114).

Figure 1.4 Standard connection

CAUTION: Do not connect a power-factor improvement capacitor either to the power supply side or the motor end of the VF-A3 inverter system.
An accidental connection of cables from a power supply(L1(R), L2(S), L3(T)) to terminals T1(U),T2(V), and T3(W) of the inverter could damage the inverter.
To protect the VF-A3's circuits, mount a molded case circuit breaker (MCCB) on the power input side.(For fuse sizes, see Table 8.1.)

CHAPTER 2 SIMPLIFIED OPERATION

This chapter will explain the VF-A3 inverter's operating panel and simplified operation by using its standard functions.

CHAPTER2

Simplified Operation

2.1 Operating panel

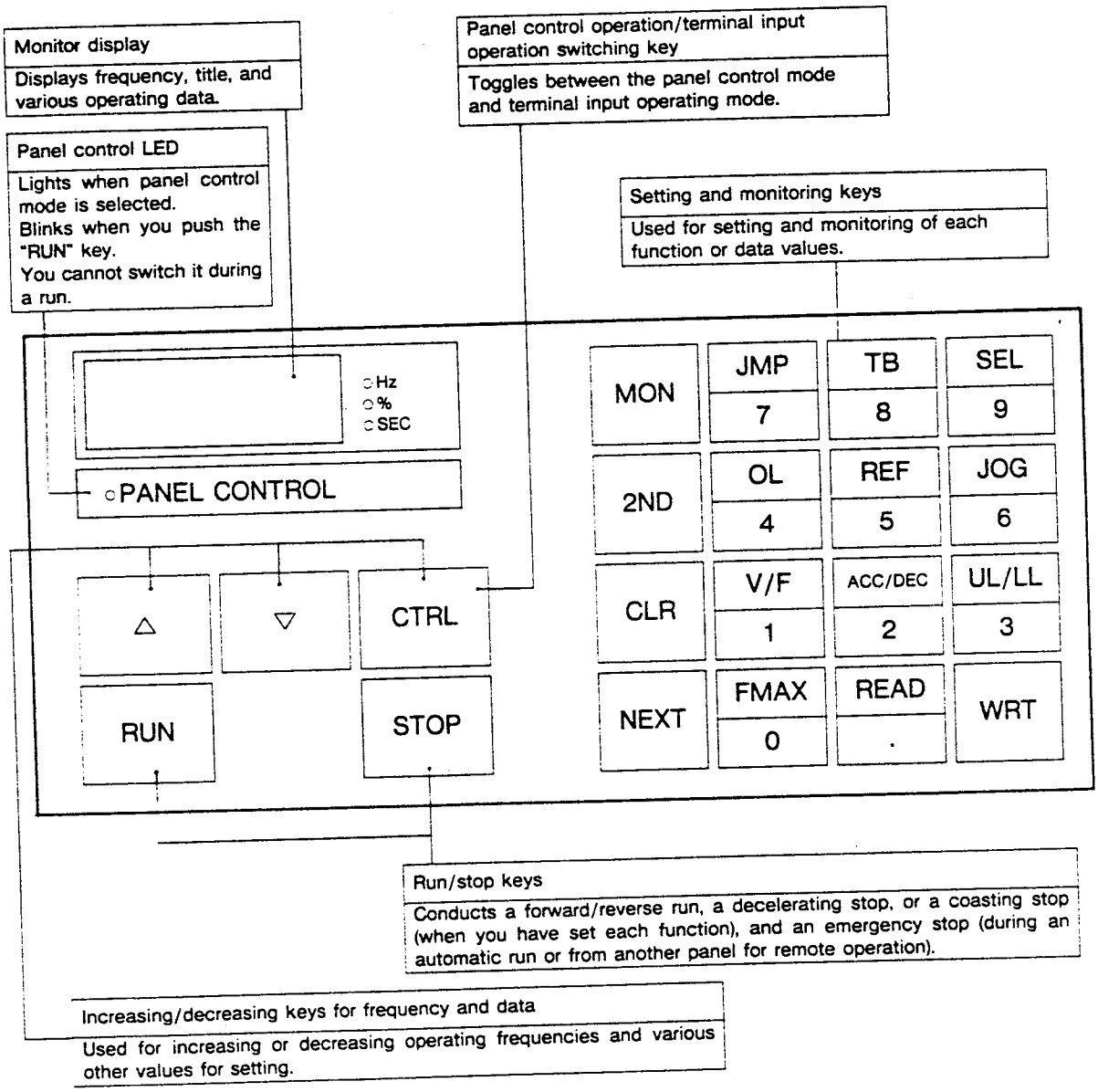


Figure 2.1 Operating panel

Keys for operating the inverter as well as setting adjustments and monitoring are shown below:

1) Operating keys

Table 2.1 Operating keys

Key	Function
CTRL	Switches the modes of panel control operation, terminal input operation and host command operation (disabled during a run).
△	Increases a frequency setting value and various other data values, and also sets to forward rotation during a special run (either jogging or multispeed run).
▽	Decreases a frequency setting value and various other data values, and also sets to reverse rotation duing a special run (either jogging or multispeed run).
RUN	Issues a command for starting a normalu run, mulitspeed run, jogging run, or patterned run. Also activates the calibration of the analog frequency meter or an ammeter (FM or AM).
STOP	Issues a command for stopping a normal run and patterned run, and for allowing coasting stop.

2) Setting and monitoring keys

Table 2.2 Setting and monitoring keys

Key	Function
MON	Toggles between to and from the monitoring and setting modes.
2ND	Switches to the second function mode.
NEXT	Displays the next item in the same function number.
CLR	Clears the current display, and also clears the data after a trip. *Note: The data clear must be preceded by pushing WRT key.
WRT	Writes each piece of data. *Note: Writes to the inverter memory.
READ ·	"." is a decimal point. "READ" reads out the data.
FMAX 0	"0" is the numerical zero. In the first function mode, "FMAX" selects the standard setting mode and sets the maximum frequency (disabled during a run). In the second function mode, it sets the start-up frequency and the operation starting frequency .
V/F 1	"1" is a number. In the first function mode, "V/F" sets the torque boost, automatic torque boost, base frequency, and V/f pattern. In the second function mode, it sets the DC injection braking start-up frequency, braking voltage, and braking time.
ACC/DEC 2	"2" is a number. "ACC/DEC" sets the acc./dec. time 1 or 2, and the pattern of acc./dec. 1 or 2, and also selects acc./dec. 1 or 2. In the second function mode, sets the universal (or arbitrary) unit desplay function.
UL/LL 3	"3" is a number. In the first function mode, "UL/LL" sets the upper and lower limit frequencies. In the second function mode, "UL/LL" selects the low speed signal output frequency and speed reach function, and also sets the speed reach detection range and speed reach specificaftion frequency.
OL 4	"4" is a number. In the first funciton, "OL" sets the overload protection level and stall activation level, and also selects the overload protection characteristics.

Table 2.2 Setting and monitoring keys (continued)

Key	Function
REF / 5	"5" is a number. In the first function mode, "REF" sets the output frequency at IV Terminal input signal point 1 or 2 and also sets the output frequency at points 1 and 2,and the priority of RR terminal input. In the second function mode, it sets the function TG,PG, or PI control.
JOG / 6	"6" is a number. In the first funciton mode, "JOG" sets the jogging run frequency, jogging stop pattern, and 1st ~7th speed run frequencies. In the second function mode, it switches the PWM carrier frequecy.
JMP / 7	"7" is a number. In the first function mode, "JMP" sets the jump frequencies 1, 2, and 3, and also sets the jump widths 1, 2, and 3. In the second function mode, it sets the terminal selection for optional function, the memory function the memory function, baud rate, the communicational bit and parity, the stop bit and the output for line/inverter chengeover option.
TB / 8	"8" is a number. In the first function mode, "TB" selects the I/O terminals. In the second function mode, it sets the mode for the patterned run, the selection of the patterned time, the number of the patterned repetition times, and the operation time of the patterned run 1 through 7 and selects forward or reverse run, and also selects acceleration or deceleration.
SEL / 9	"9" is a number. In the first function mode, "SEL" selects forward/reverse run, trip retention, automatic restart, or restart after momentary interrupt, and in the second function mode, it selects the commandmode, frequency setting mode, or parameter setting mode.

2.2 Simplified operation

After checking to assure that the VF-A3's terminals have been properly connected to the power supply and to a motor, you are ready to operate the inverter with the standard settings, which are described in Table 3.1 (page 17). For a trial test operation, it is best to start with a low operating frequency. Use the following procedure.

[Operaiton procedure]

Operation	Action
1) Power ON.	Turn on the power supply molded case circuit breaker (MCCB). A string of characters *OFF* flashes and then numerics 0.0 appear on the monitor display. *0.0*
2) [CTRL]	The LED "PANEL CONTROL" lights and the inverter unit phases in the panel operating mode. (Another push of "PANEL CONTROL" puts off the LED.
3) a) [1] [0] [WRT]	Either procedure a) or b) sets the operating frequency. Numerical setting (to set at 10Hz, for example): The "10" and "FC" appear alternately indicating that setting has been completed. : *10* → *FC* ↔ : *10*
b) [△] ..... [WRT]	Setting with [△] or [▽] key (to set at 5.5Hz for example): Keep pushing the [△] key for increasing the value on the display, and as soon as it reaches 5.5, push the [WRT] key: then the "5.5" and "FC" appear alternately indicating that setting has been completed. : *5.5* → : *FC* ↔ : *5.5*
[▽]	To decrease the value, keep pusing the [▽] key.
4) [RUN]	Raises the frequency to start the forward rotation of your motor. (Then the normal run follows.)
5) [STOP]	Lowers the frequency to cause the motor to decelerate and comes to a complete stop.

Operation	Action
1) a) [5] [0] [WRT]	While a motor is running at 60.0Hz, to set a new frequency (50Hz) by pushing the numerical keys: Push the keys "5", "0", and [WRT] then the monitor displays "50" and "FC" alternately and the frequency is decreased for the deceleration. 60.0 ↓ : 50 → : FC ↔ : 50
b) [△] ..... [▽]	to set a new frequency by pushing either [△] key or [▽] key: keep pushing the [△] key for raising the frequency. keep pushing the [▽] key for lowering the frequency.
2) [RUN]	Returns to the original display of run frequency. 50.0

In this b) way, you should push the WRT key before you power the inverter off if you want to retain the current settings.

6) This concludes the simplified operation.

* When you have a motor that is rated at 50Hz, set the base frequency at 50Hz (see page 38).

* When the power is turned off, the message " POFF " will flashes on, then disappear.

7) If an error message indicating an abnormal operation appears, turn the inverter off, then check the input and output cable connections and ensure that they are in order.

8) Also check the power voltage for abnormal values.

9) Refer to Chapter 9,"Fault Messages,(page 119) for explanations of the inverter's fault messages and recommended remedial action.

Although you can allow you motor to come to a coasting stop by switching power to the inverter OFF while it is in RUN mode as described under 4) above, you should use this method only for an emergency stop. Avoid turning the power switch ON or OFF for frequent starting or stopping.

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* When an abnormal value is set, an error message and the data will appear alternately twice on the inverter's monitor display. (For example, if the set frequency is higher than the maximum frequency, the error message FH and the input setting value will display in turn.)
Check the current input values and set the correct values again. In this case, the set value will not be written.

CHAPTER 3 VARIOUS OPERATING FUNCITONS

This chapter will describe how to use the VF-A3's monitor display, a wide variety of settings, and a sample operational procedure.

CHAPTER 3

Various Operating Functions

3.1 Functions and adjustments

The VF-A3 inverter is designed with a wide variety of functions to meet the requirements of a broad range of applications.

Operation as well as adjustment functions comprise the inverter's first and second functions. The ranges of adjustment for these functions are listed in Table 3.1.

The methods for making settings and monitoring will be explained in Sections 3.1.1 (page 22) and 3.1.2 (page 23), and the role, selection and setting of each function will be explained in the respective explanatory items.

* During a run, you cannot adjust the "standard setting mode(tYP) (page 34)" and the "maximum frequency (FH) (page 36). Before you can adjust these values, you must stop the inverter.
* When the inverter's "CHARGE" lamp is lit, the voltage level in the inverter's live circuits is sufficient to cause bodily injury or damage equipment. Therefore, do not touch the inverter's PWB, terminal block, or main circuit with your bare hands when the "CHARGE" lamp is lit.

Table 3.1 First and second functions

Function No.		Function	Title	Adjustment		Standard setting			Error message	Ref. page
				Adjustment range	Unit	ex-factory	50Hz	60Hz		
First function	—	Frequency setting	FC	0.0~400	0.1Hz	0	—	—	LL.UL.FH	24
	0	Standard setting mode selection	tYP	1: Setting to general purpose 50Hz 2: Setting to general purpose 60Hz 3: Standard shipment setting (Note: Monitor always displays zero.)	—	3	1	2	Err.0 (Displayed "0" is not error message in monitoring)	34
		Maximum frequency	FH	30~400	1Hz	80	50	60	Err.U.Err.0	36
	1	Torque boost	ub	0~30	1%	3	—	—	Err.0	37
		Automatic torque boost	Aub	0: Without automatic torque boost 1: With automatic torque boost	—	0	—	—	Err.0	38
		Base frequency	UL	25~400	1Hz	60 (50*)	50	60	Err.U.FH	39
		V/f pattern	Pt.	0: Constant torque 1: Variable torque	—	0	—	—	Err.0	40
	2	Acceleration time 1	AC1	0.1~6000	0.1sec	10	—	—	Err.U.Err.0	41
		Deceleration time 1	dEC1	0.1~6000	0.1sec	10	—	—	Err.U.Err.0	
		Pattern of acc./dec. 1	Pt.1	0: Linear 1: S-shaped 1 2: S-shaped 2	—	0	—	—	Err.0	
		Acceleration time 2	AC2	0.1~6000	0.1sec	10	—	—	Err.U.Err.0	
		Deceleration time 2	dEC2	0.1~6000	0.1sec	10	—	—	Err.U.Err.0	
		Pattern of acc./dec. 2	Pt.2	0: Linear 1: S-shaped 1 2: S-shaped 2	—	1	—	—	Err.0	
		Selection of acc./dec. 1 or 2	SEL2	0: Acc./dec. 1 1: Acc./dec. 2	—	0	—	—	Err.0	
	3	Upper limit frequency	UL	0~ Maximum frequency	0.1Hz	80	50	60	FH	56
		Lower limit frequency	LL	0~ Upper limit frequency	0.1Hz	0	—	—	UL	
	4	Electronic thermal protection level	tHr	10~100	1%	100	—	—	Err.U.Err.0	93
		Stall prevention activation level	StL	10~150	1%	150	—	—	Err.U.Err.0	
		Electronic thermal protection characteristic selection	SEL4	0: Standard motor, without soft stall 1: Standard motor, with soft stall 2: VF motor, without soft stall 3: VF motor, with soft stall	—	0	—	—	Err.0	94
	5	Terminal IV point 1 setting signal	PI	0~100	1%	20	—	—	Err.0	54
		Point 1 output frequency	F-PI	0~Maximum frequency	0.1Hz	0	—	—	FH	
		Terminal IV point 2 setting signal	P2	0~100	1%	100	—	—	Err.0	
		Point 2 output frequency	F-P2	0~Maximum frequency	0.1Hz	80	50	60	FH	
		Priority of RR terminal input	rr.CC	0: Normal 1: Priority of RR	—	0	—	—	Err.0	54

*for C1 (EUROPE) and D1 (AUSTRALIA) type.

Table 3.1 First and second functions (continued)

Function No.		Function	Title	Adjustment		Standard setting			Error message	Ref. page
				Adjustment range	Unit	ex-factory	50Hz	60Hz		
First function-	6	Jogging run frequency	JOG	0.0~20	0.1Hz	5	—	—	Err.0	56
		Jogging stop pattern	J.StP	0: Decelerating stop 1: Coasting stop 2: DC dynamic braking stop	—	0	—	—	Err.0	
		1st speed run frequency	Sr 1	Lower limit frequency~Upper limit frequency	0.1Hz	0	—	—	LL.UL.FH	59
		2nd speed run frequency	Sr2	Lower limit frequency~Upper limit frequency	0.1Hz	0	—	—	LL.UL.FH	
		3rd speed run frequency	Sr3	Lower limit frequency~Upper limit frequency	0.1Hz	0	—	—	LL.UL.FH	
		4th speed run frequency	Sr4	Lower limit frequency~Upper limit frequency	0.1Hz	0	—	—	LL.UL.FH	
		5th speed run frequency	Sr5	Lower limit frequency~Upper limit frequency	0.1Hz	0	—	—	LL.UL.FH	
		6th speed run frequency	Sr6	Lower limit frequency~Upper limit frequency	0.1Hz	0	—	—	LL.UL.FH	
		7th speed run frequency	Sr7	Lower limit frequency~Upper limit frequency	0.1Hz	0	—	—	LL.UL.FH	
	7	Jump frequency 1	FJ1	0~Maximum frequency	0.1Hz	0	—	—	FH	62
		Jump width 1	bFJ1	0~Maximum frequency	0.1Hz	0	—	—	FH	
		Jump frequency 2	FJ2	0~Maximum frequency	0.1Hz	0	—	—	FH	
		Jump width 2	bFJ2	0~Maximum frequency	0.1Hz	0	—	—	FH	
		Jump frequency 3	FJ3	0~Maximum frequency	0.1Hz	0	—	—	FH	
		Jump width 3	bFJ3	0~Maximum frequency	0.1Hz	0	—	—	FH	
	8	Input terminal selection	I.tb	0: SS2,SS3 1: JOG,SS3 2: SS2,AD2 3: JOG,AD2	—	2	—	—	Err.0	79
		Output terminal selection	O.tb	0: LL,UL 1: LOW,UL 2: LL,RCH 3: LOW,RCH	—	3	—	—	Err.0	81
	9	Forward/reverse run selection	F.r	0: Reverse run 1: Forward run	—	1	—	—	Err.0	49
		Trip retention selection	tr.CL	0: Cleared when powered OFF. 1: Retained even when powered OFF.	—	0	—	—	Err.0	95
		Automatic restart selection	rtry	0: OFF 1: ON	—	0	—	—	Err.0	96
		Automatic restart after instantaneous power failure selection	ArSt	0: OFF 1: ON	—	0	—	—	Err.0	97
		Power control function for instantaneous power failure	Uu.C	0: OFF 1: ON	—	0	—	—	Err.0	98

Table 3.1 First and second functions (continued)

Function No.		Function	Title	Adjustment		Standard setting			Error message	Ref. page
				Adjustment range	Unit	ex-factory	50Hz	60Hz		
Second functions	0	Start-up frequency setting	F-St	0~10	0.1Hz	0	—	—	Err.0	62
		Operation starting frequency	F.run	0~Maximum frequency	0.1Hz	0	—	—	FH	63
		Operation starting frequency hysteresis	F.HYS	0~Maximum frequency	0.1Hz	0	—	—	FH	
	1	DC injection braking start-up frequency	dbF	0~10	0.1Hz	0	—	—	Err.0	64
		DC injection braking voltage	dbu	0~20	1%	0	—	—	Err.0	
		DC injection braking time	dbt	0~5	0.1sec	0	—	—	Err.0	
	2	Multiplication factor of universal unit system	dSP.2	0(OFF) 0.01~200	0.01	0	—	—	Err.0	67
	3	Low speed signal output frequency	LF	0~Maximum frequency	0.1Hz	0.5	—	—	FH	83
		Speed reach selection	rCH	0: Acceleration completion output 1: Specified frequency reach output	—	0	—	—	Err.0	
		Speed reach detection range	rrCH	0~Maximum frequency	0.1Hz	2.5	—	—	Err.U,Err.O	
		Speed reach specification frequency	FrCH	0~Maximum frequency	0.1Hz	0	—	—	FH	
	4	Output voltage regulation	P.OUt	0~100(Standard) (0~120(Option))	1%	100	—	—	Err.0	68
		Regenerative braking selection	Pb	0: Without regenerative braking 1: With regenerative braking but without overload detection 2: With regenerative braking and with overload detection	—	0	—	—	Err.0	65
		Selection of over-voltage stall operation	OPS.S	0: ON 1: OFF	—	0	—	—	Err.0	
	5	Selection of FB or PI control	Fb.PI	0: OFF 1: FB(TG.PG) 2: PI	—	0	—	—	Err.0	74
		Proportional gain	GP	0~9999	1	0	—	—		
		Integral gain	GI	0~9999	1	0	—	—		
		Antihunting gain	GR	0~255	1	0	—	—	Err.0	
		Temporary delay filter constant	GFS	0~255	1	0	—	—	Err.0	
		PG feedback selection	PG	0: TG feedback 1: 500ppr 2: 100ppr	—	0	—	—	Err.0	*
		Coefficient for PG	COnu	0~9999	1	0	—	—		
	6	PWM carrier frequency	CF	0.5~3	0.1kHz	1.5	—	—	Err.0	72

Table 3.1 First and second functions (countinued)

Function No.		Function	Title	Adjustment		Standard setting			Error message	Ref. page
				Adjustment range	Unit	ex-factory	50Hz	60Hz		
Second functions	7	Terminal selection for optional function	OPt	0~12(Note1)	–	0	–	–	Err.0	*
		Memory function (inverter No.)	I.no.	0~31	–	0	–	–	Err.0	
		Baud rate (RS-232C)	b.rAt	0: 150 1: 300 2: 600 3: 1200 4: 2400	–	0	–	–	Err.0	*
		Communication bit	SMod	0: 7bit 1: 8bit	–	0	–	–	Err.0	
		Communication parity and stop bit	SSEr	0~5(Note2)	–	0	–	–	Err.0	
		Output for line/inverter changeover option	C.CHG	0: Without output 1: with output	–	0	–	–	Err.0	
	8	Mode for the patterned run	P.SEL	0: OFF 1: Mode for terminal block command 2: Control panel mode 3: Host command mode	–	0	–	–	Err.0	69
		Selection of patterned time	Pt.t	0: Second 1: Minute	–	0	–	–	Err.0	
		Number of patterned repetition times	Pt.n	0~255 (255:infinite repetition)	–	0	–	–	Err.0	
		Patterned run 1~7 changeover time	Pt.1t~ Pt.7t	0~8000 9999(continuation)	1min or 1sec	0	–	–	Err.0	
		Forward/reverse and acc./dec. selection of patterned runs 1~7	Pt.1~ Pt.7	0: Forward run, acc./dec. 1 1: Forward run, acc./dec. 2 2: Reverse run, acc./dec. 1 3: Reverse run, acc./dec. 2	–	0	–	–	Err.0	
	9	Command mode selection	C.Mod	0: Disables all inputs 1: Valid for terminal input only 2: Valid for panel input only 3: Switching between terminal and panel inputs is allowed 4: Valid for host command input only.(note3) 5: Switching between terminal and host command inputs is allowed. 6: Switching between panel and host command inputs is allowed 7: Switching to any of terminal, panel and host command inputs is allowed.	–	7	–	–	Err.0	73
		Frequency setting mode selection	F.Mod	equal to command mode selection	–	7	–	–	Err.0	73
		Parameter setting mode selection	P.Mod	0: Disables all inputs. 1: Valid for terminal input only 2: Valid for host command input only 3: Switching between panel and host command inputs is allowed.	–	3	–	–	Err.0	74

* IF you want to adjust the standard setting mode (tYP) and maximum frequency (FH) at First function, stop the inverter before you adjust them.

* The "*" marked functions can be used when installing the Multioptional printed wiring board. Refer to the instruction Manual of the Multioptional printed wiring board in detail.

Note 1) Terminal seleciton for optional function [OPt] (optional)

OPt setting	Functions
0	OFF
1	12 bit binary absolute value input
2	12 bit binary relative value input
3	3 dig it BCD code unit input by 0.1Hz step
4	3 dig it BCD code unit input by 1Hz step
5	pulse input
6	multi-speed input
7	OPt setting "1" signal with read-in
8	OPt setting "2" signal with read-in
9	OPt setting "3" signal with read-in
10	OPt setting "4" signal with read-in
11	OPt setting "5" signal with read-in
12	OPt setting "6" signal with read-in

Note 2) Communicational parity and stop bit [SSCr] (optional)

SSCr setting	Functions
0	An even number parity · 1 STOP bit
1	An even number parity · 2 STOP bit
2	Without parity · 1 STOP bit
3	Without parity · 2 STOP bit
4	An odd number parity · 1 STOP bit
5	An odd number parity · 2 STOP bit

Note 3) The Host command is the command by the Multioptional printed wiring board or the computer interface.

3.1.1 First functions

To set and monitor the first functions, use the following procedure. Additionally, those functions which are frequently used are illustrated with examples in the respective sections. For the sections which are not exemplified, make use of the following examples for your setting:

[Operating procedure]

Operation	Action	
1) MON		no.0 → : typ
2) FUNC.NO. (2 for example)	ACC 1 appears.	no.2 → : ACC1
3) READ	DATA appears.	: 10.0
4) 5 . 6 or △ ▽	You can change the displayed value by inputting a new value by keying in the number or by increasing or decreasing it by pushing the △ key or ▽ key, respectively.	: 5.6
5) WRT	Sets the new value that you have input.	: 5.6 → : ACC1 ↔ : 5.6
6) NEXT	The next parameter dEC 1 appears.	: dEC1
7) NEXT	The next parameter Pt. 1 appears.	: Pt.1
8) MON	Returns to the original display.	(OFF,0.0 and frequency)

* [NEXT]···
  When you keep pushing the NEXT key, the display sequence ACC1,dEC1,Pt.1,ACC2,dEC2,Pt.2, SEL2 revolves and returns to the original ACC1.
  If you want to set or monitor other functions, just input the appropriate function number.
* When an erroneous input value is attempted to be set, at the time of read or write, the inverter will prompt you with an error message and the input value in turn for your correction. If so, check the value and set the right value again. (When the error message appears, the inverter disables the write.)
* When you want to start a run, first perform the procedure No.8 (push the "MON" key) to bring back the display to operation frequency or OFF, and then push the "RUN" key.
* If you have made an erroneous operation, push "MON" or "MON" "MON" (push the "MON" key twice), in order to get back to the original status.

3.1.2 Second functions

To set and monitor the second fuctions, use the following procedure. Additionally, those functions which are frequently used are illustrated with examples in the respective sections.

For the sections which are not exemplified, make use of the following examples for your setting:

[Operating procedure]

Operation	Action	
1) MON		no.0 → : tYP
2) SECOND FUNC.		: 2nd
3) FUNC.NO. (0 for instance	F-St appears.	: no.10 → : F-St

* The monitoring and setting methods are the same as those for the first functions.
* When an erroneous input value is attempted to be set, at the time of read or write, the inverter will prompt you with an error message and the input value in turn for your correction. If so, check the value and set the rigth value again. (When the error message appears, the inverter disables the write.)
* When you want to start a run, first perform the procedure No.8 (push the "MON" key) to bring back the display to the operation frequency or OFF, and then push the "RUN" key.
* If you have made an erroneous operation, push "MON" or "MON" "MON" (push the "MON" key twice), in order to get back to the original status.

3.2 Frequency setting [FC]

You can use both the inverter's operating panel and an external signal for setting the operation frequency (FC).

(1) Setting by a command from the operating panel

[Operating procedure]

It's your choice to use either the numerical keys or the "△" and "▽" keys for setting an operaiton frequency through the panel.

When the inverter is standing still, use the following procedure to set the frequency:

Operation	Action
1) a) [6] [0] [.] [0] [WRT]	Setting with the numerical keys: Sets to 60.0Hz. : 60.0 → : FC ↔ : 60.0
b) [△] ··· or [▽] ··· [WRT]	Setting with the [△] or [▽] key: When you keep pushing either key, the frequency continues to increase or decrease. Sets to the value. :[Value] → : FC ↔ :[VALUE]

* After setting a frequency, push the "RUN" key. Then, your inverter accelerates you motor until the set frequency is reached.

  When you first push the numerical keys "6", "0", ".", or the "△" or "▽" key to set the frequency, and then you push the "RUN" key, the inverter accelerates the motor unitil the set frequency is reached. (WRT key has not been pushed.)

  In this case, the set frequency value will evaporate when you power off. So, push the "WRT" key before you power off.

* As you keep pushing the "△" or "▽" key, the speed of increasing or decreasing frequency will gradually pick up.

Operation	Action
1) a) [5] [0] [.] [0] [WRT]	Setting with the numerical keys: Sets to 50.0Hz : 50.0 → : FC ↔ : 50.0
b) [△] ... or [▽] ...	When you keep pushing either key, the output frequency continues to increase or decrease, according to the monitored frequency. * Note: At this time the monitor shows setting frequency. When you push [RUN], the monitor shows operating frequency.

* When you push the "READ" key, the frequency value that has been set through the panel appears.

  Pushing "MON" + "MON" brings you back to the original status.

(2) Setting with external signals

You can perform the frequency setting with a 1k ~ 10kΩ rheostat, 0-10Vdc, 0-5Vdc, 4-20mAdc signals. The terminal input can be selected by using the "frequency setting mode selection" function of the second functions. (For details, refer to Section 3.9 (page 49)

3.3 Status monitoring

You can monitor the inverter's status both when it is running and when it is halted.
When the inverter trips, you can also monitor the status and settings that were in effect when it tripped.

3.3.1 Monitoring during a run or when halted

When the inverter's monitor displays OFF or an operating frequency, push the NEXT key to monitor the inverter status as listed below:

Table 3.2 Monitoring during a run or a satndstill

Display	Status
OFF	Not ready for run (with ST-CC opened)
0.0	0Hz (ready to run with ST-CC shorted)
60.0	60.0Hz (running at 60.0Hz)
200	200Hz (runnig at 200Hz)
C50.0	Stall prevention activated
P50.0	Overvoltage limitation activated
L50.0	Overload detection activated * Displays C, P ,and L blink.
POFF	Power supply end undervoltage (The voltage supplied to the inverter is low.)
nOFF	DC main circuit undervoltage (The DC main circuit voltage within the inverters is low.)

⇩

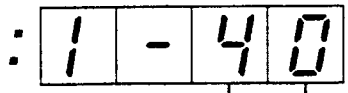
Operation	Display example	Status
NEXT	:F. or :r.	F for forward run and r for reverse run. During a standstill, indicates either command value forward or reverse. When no command value is input during a standstill, indicates the status immediately before a standstill.
NEXT	: 60.0	The set frequency is 60.0Hz.
NEXT	:C 90	The output current is 90%. (90% of the inverter's rated output current) (Note)
NEXT	:P 90	The set value of output voltage is 90% (90% of the inverter's rated output voltage)
NEXT	:I-40	Input contact information code
NEXT	:O-33	Inverter status code
NEXT	:U 2.2	Inverter's software type
NEXT	:UP2.0	Panel's software type
NEXT	original display	Returns to the original display.

* When you keep pushing the "NEXT" key, the display revolves with an interval of 0.5 second and finally returns to the original display.
* When you push the "READ" key, the frequency value that has been set through the panel appears.

  Pushing "MON" + "MON" brings you back to the original status.

  Note: Even if the motor is standing sill, a few percent of value which indicates a measuring error may be displayed.

* Display of input contact point information: Displays the state of an input contact point.



Display	RR/IV	ST/$\overline{ST}$	F/$\overline{F}$	R/$\overline{R}$
0	IV	$\overline{ST}$	$\overline{F}$	$\overline{R}$
1	IV	$\overline{ST}$	$\overline{F}$	R
2	IV	$\overline{ST}$	F	$\overline{R}$
3	IV	$\overline{ST}$	F	R
4	IV	ST	$\overline{F}$	$\overline{R}$
5	IV	ST	$\overline{F}$	R
6	IV	ST	F	$\overline{R}$
7	IV	ST	F	R
8	RR	$\overline{ST}$	$\overline{F}$	$\overline{R}$
9	RR	$\overline{ST}$	$\overline{F}$	R
A	RR	$\overline{ST}$	F	$\overline{R}$
b	RR	$\overline{ST}$	F	R
C	RR	ST	$\overline{F}$	$\overline{R}$
d	RR	ST	$\overline{F}$	R
E	RR	ST	F	$\overline{R}$
F	RR	ST	F	R

Display	SSI/$\overline{SSI}$	JOG(SS2)/$\overline{JOG(SS2)}$	AD2(SS3)/$\overline{AD2(SS3)}$	RST/$\overline{RST}$
0	$\overline{SSI}$	$\overline{JOG(SS2)}$	$\overline{AD2(SS3)}$	$\overline{RST}$
1	$\overline{SSI}$	$\overline{JOG(SS2)}$	$\overline{AD2(SS3)}$	RST
2	$\overline{SSI}$	$\overline{JOG(SS2)}$	AD2(SS3)	$\overline{RST}$
3	$\overline{SSI}$	$\overline{JOG(SS2)}$	AD2(SS3)	RST
4	$\overline{SSI}$	JOG(SS2)	$\overline{AD2(SS3)}$	$\overline{RST}$
5	$\overline{SSI}$	JOG(SS2)	$\overline{AD2(SS3)}$	RST
6	$\overline{SSI}$	JOG(SS2)	AD2(SS3)	$\overline{RST}$
7	$\overline{SSI}$	JOG(SS2)	AD2(SS3)	RST
8	SSI	$\overline{JOG(SS2)}$	$\overline{AD2(SS3)}$	$\overline{RST}$
9	SSI	$\overline{JOG(SS2)}$	$\overline{AD2(SS3)}$	RST
A	SSI	$\overline{JOG(SS2)}$	AD2(SS3)	$\overline{RST}$
b	SSI	$\overline{JOG(SS2)}$	AD2(SS3)	RST
C	SSI	JOG(SS2)	$\overline{AD2(SS3)}$	$\overline{RST}$
d	SSI	JOG(SS2)	$\overline{AD2(SS3)}$	RST
E	SSI	JOG(SS2)	AD2(SS3)	$\overline{RST}$
F	SSI	JOG(SS2)	AD2(SS3)	RST

RR: A rheostat is connected across PP-CC.

IV: No rheostat is connected across PP-CC.

ST: Run preparations underway

$\overline{ST}$: No run preparations underway

F: Forward run in progress

$\overline{F}$: No forward run in progress

R: Reverse run in progress

$\overline{R}$: No reverse run in progress

SS1: Multispeed run in progress

$\overline{SS1}$: No multispeed run in progress

JOG(SS2): Jogging run in progress (multispeed run in progress)

$\overline{JOG(SS2)}$: No jogging run in progress (no multispeed run in progress)

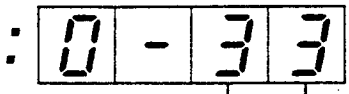
AD2(SS3): In acc./dec. 2 mode (in multispeed run mode)

$\overline{AD2(SS3)}$: Not in acc./dec. 2 mode (not in multispeed run mode)

RST: In reset mode

$\overline{RST}$: Not in reset mode

* Inverter status indication: Displays the output conditions.



Display	RCH/$\overline{\text{RCH}}$	UL/$\overline{\text{UL}}$
0	$\overline{\text{RCH}}$	$\overline{\text{UL}}$
1	$\overline{\text{RCH}}$	UL
2	RCH	$\overline{\text{UL}}$
3	RCH	UL

Display	LOW/$\overline{\text{LOW}}$	LL/$\overline{\text{LL}}$
0	$\overline{\text{LOW}}$	$\overline{\text{LL}}$
1	$\overline{\text{LOW}}$	LL
2	LOW	$\overline{\text{LL}}$
3	LOW	LL

RCH: Output frequency reaches the set frequency.

$\overline{\text{RCH}}$: Not in the "RCH" state.

UL: UL frequency has been reached.

$\overline{\text{UL}}$: Not at the UL frequency.

LOW: Output frequency is above the low speed.

$\overline{\text{LOW}}$: Not at the LOW speed.

LL: Above the LL frequency

$\overline{\text{LL}}$: Not at the LL frequency.

3.3.2 Monitoring trip status

When the inverter trips, you can monitor the inverter's status of the moment it tripped by pushing the NEXT key.

Table 3.3 Monitoring tripped status

Display example	Status
OC1	Overcurrent durnig accleration (An overcurrent occurred during an acceleration.)
OC2	Overcurrent during deceleration(An over current occurred during an deceleration.)
OC3	Overcurren during run (An overcurrent occurred during a run.)
OCA	Overcurrent (An overcurrent flew in the armature during start-up.)
OCL	Overcurrent (An overcurrent flew in the load machine during start-up.)
OCr	Overcurrent in regenerative discharge resistor (An overcurrent flew in the regenerative discharge resistor.)
OP2	Overvoltage during deceleration (An overvoltage was generated during deceleration.)
OP	Overvoltage (An overvoltage was generated.)
OL	Overload (The motor was overloaded.)
OLr	Overload of regenerative discharge resistor (The regenerative resistor was overloaded.)
OH	Overheat (The inverter body was overheated.)
EF	Ground fault (A ground fault overcurrent flew in the load machine.)
E	Emergency stop (An emergency stop was executed by a command from the panel during an automatic run or a remote control operation.)
Err.1 (Note)	frequency setting signal setting abnormality (An abnormality occurred in the setting of frequency setting signal point 1 and 2.)
Err.2	Main RAM abnormality (An abnomality was found in the main CPU's RAM)
Err.3	Main ROM abnormality (An abnomality was found in the main CPU's ROM)
Err.4 (Note)	Panel's RAM abnormality (An abnomality was found in the Operating Panel's RAM)
Err.5 (Note)	Panel's ROM abnormality (An abnomality was found in the Operting Panel's ROM)
Err.6 (Note)	Panel's key abnormality (An abnomality was found in the Operting Panel's key)
EEP	EEPROM abnormality (Various abnormal data were detected.)
EEP2	EEPROM abnormality (Some abnormalities were found in the past trip cause data.)
EEP3	EEPROM abnormality (An abnormality was found in a set value.)
Err.t (Note)	Transmission abnormality (An abnormality was found in transmission.)

Table 3.3 Monitoring tripped status (continued)

Operation	Display example	Status
NEXT	:20.0	Operating frequency at trip was 20.0Hz
NEXT	:F.	Rotating direction at trip
NEXT	:50.0	The set value of operating frequency at trip was 50.0Hz
NEXT	:C150	The output current at trip was 150% (150% of the inverter's rated output current).
NEXT	:P100	The output voltage at trip was 100% (100% of the inverter's rated output voltage).
NEXT	:I-60	The input contact point information code at trip
NEXT	:O-33	The output status code at trip
NEXT	:U 2.2	The inverter's software type
NEXT	:UP2.0	The panel's software type
NEXT	Original display	Returns to the original display.

Note: The Err.1, Err.4, Err.5, Err.6 and Err.E are the displays only without involving a trip.

* When you keep pushing the "NEXT" key, the display revoles with an interval of 0.5 second and finally returns to the original display.
* When you push "CLR" + "WRT" keys, the tripped status is reset.
  [Refer to Section 4.5 (page 86).

You can also monitor the cause of trip (retrospectively up to the fourth event)

Table 3.4 Monitoring details of faults

Display example	Status
Frequency or fault indication	Displays current operating frequency or the cause for the fault.

Operation	Display example	Status
2nd function	2nd	Selects the second functions.
9	:1 ↔ OC1	Displays the previous fault (for example, OC1 and OP)
NEXT	:2 ↔ OP	The retrospective second fault
NEXT	:3 ↔ OH	The retrospective third fault
NEXT	:4 ↔ OP	The retrospective fourth fault
NEXT	Original display	Returns to the original display.

* When no past fault was recorded, the message : :n.Err (no error) appears.
* When you set as tYP = 3 in the standard setting mode, all the past fault data will be erased.

3.4 Standard setting mode [tYP]

The VF-A3 inverter is provided with three types of standard settings (tYP)

Any of the inverter's three basic types of standard settings can be selected with a single keystroke, as listed in the table below. Voltage/frequency characteristics of the tree patterns are shown in Figure 3.1.

Setting No. in typ mode	Function
1	Setting for general purpose 50Hz (set to 50Hz of base frequency)
2	Setting for general purpose 60Hz (set to 60Hz of base frequency)
3	Standard setting when shipped from factory

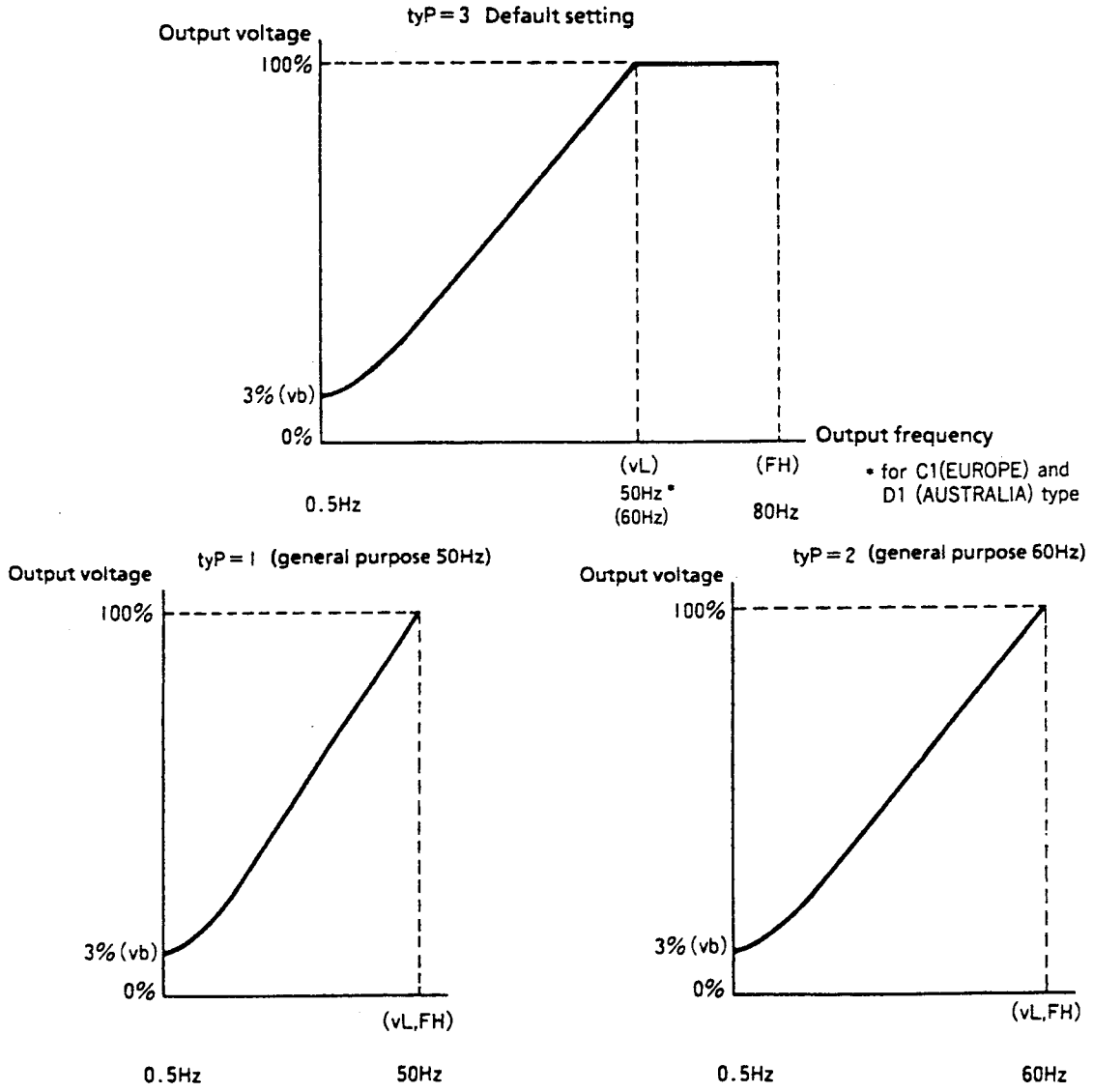


Figure 3.1 Standard setting patterns

* When the number 1 or 2 is selected, maximum frequency [FH] base frequency [uL] upper frequency [UL] and the output frequency of point 2 [F-P2] (page 54) are modified. Other data will remain unchanged.

[Operation procedure]

Example operation	Action
1) Check whether the inverter has stopped	Ensure that the inverter has come to a complete stop before you set the tYP number. You cannot change the setting while the motor is running.
2) MON	:no.0 → :tYP
3) READ	A zero (0) is displayed. : 0
4) 1 ~ 3 or △ ▽	Use either a numerical key or the increase/decrease key △ ▽ to change the displayed setting.
5) WRT	A new data value is set. : 2 → :tYP ↔ : 2
6) MON	Returns to the original display. (OFF and 0.0)

* When the number 3 is set by pushing the WRT key, the message InIt appears briefly, and is then replaced with the original display (OFF or 0.0) and the past fault data will be erased.
* tYP unmber cannot be set while the motor is running. If a value is input while the motor is running, the value will be displayed twice, but will not be written to memory. In sych a case, you should stop the inverter and set the value again.
* Standard setting mode is for a command, not for a parameter.
  Therefore, when tYP number is read out after counting, the 0 is always displayed, but the erroneous number is not set.

3.5 Setting voltage/Frequency characteristics

Output voltage characteristics against output frequencies are set in the following manners:
Standard setting patterns are shown in Figure 3.1.
In the following cases, the "voltage/frequency characteristics" should be adjusted:

* When you want to run your motor at a frequency above 80Hz
* When you want to increase the start-up torque of your motor
* When you want to set the base frequency other than 50Hz or 60Hz.

3.5.1 Maximum frequency [FH]

Use this function to set the range of output frequencies.

The inverter's maximum frequency (FH) can be set anywhere within a range of from 30Hz to 400Hz.

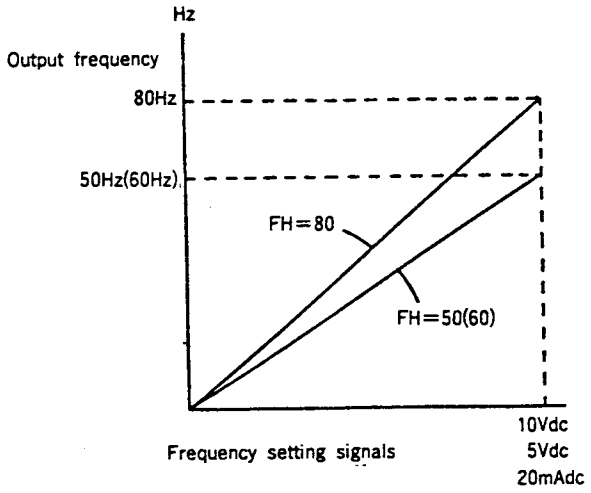


Figure 3.2 Setting maximum freqency

[Operation procedure]

Example operation	Action
1) Check whether the inverter has stopped	Before you set the FH number, ensure that the inverter has come to a complete stop. You cannot change the setting while the motor is running.
2) MON	:no.0 → :typ
3) NEXT	:FH
3) READ	DATA value is displayed. : 80
4) 0 ~ 9 or △ ▽	Use either a numerical key or the increase/decrease key △ ▽ to change the displayed setting.
5) WRT	Sets a new data value. :50 → :FH ↔ :50
6) MON	Returns to the original display. (OFF, 0.0 and frequency)

* The maximum frequency value is determined in compliance with the ratings of the motor being used.
* The output frequency ranges from 0.1 to the maximum frequency.
* The maximum frequency setting cannot be changed while the motor is running. Instead, you should stop the inverter and then set the value again.

3.5.2 Torque boost [ub]

When you want to increase the start-up torque of your motor, adjust the torque boost setting. The torque boost value (ub) can be set within a range of 0% to 30% of the rated output voltage.

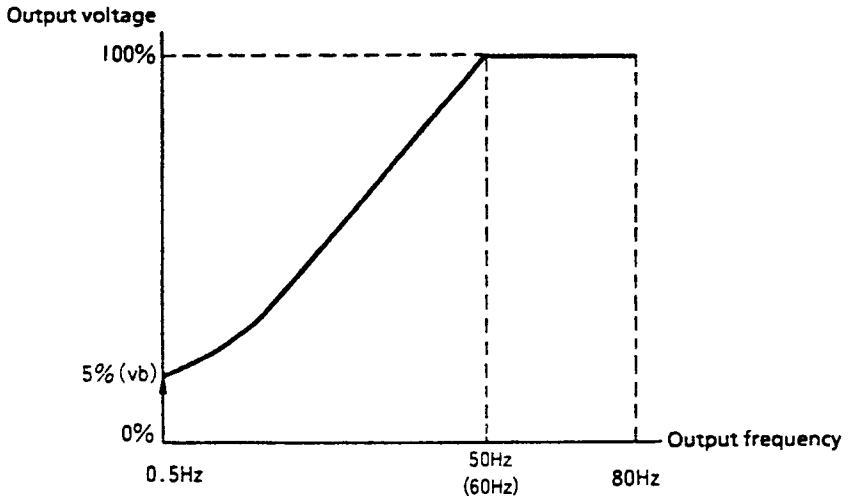


Figure 3.3 Setting to increase start-up torque

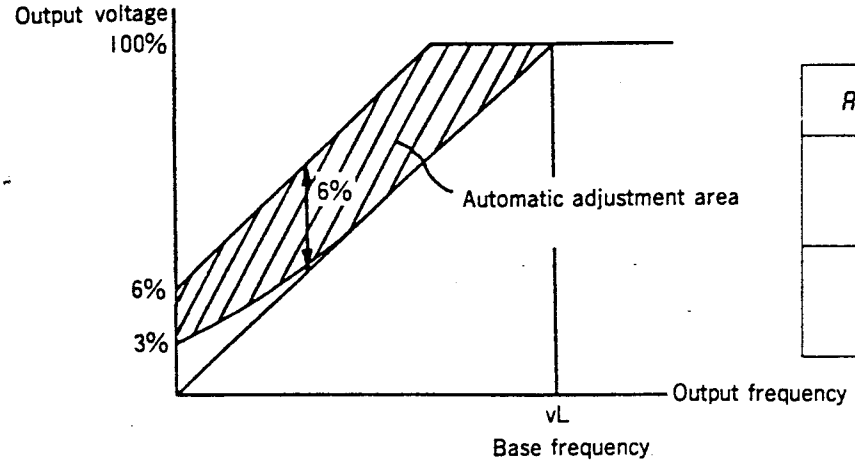
* An excessive torque boost setting may cause an overcurrent trip at a start-up.

[Operating procedure]

Example operation	Action	
2) MON		:no.0 → :typ
3) 1		:no.1 → :ub
3) READ	DATA value is displayed.	: 3
4) 0 ~ 9 or △ ▽	The displayed value can be changed either with the numerical keys or the increase/decrease keys. Adjustment can be made while observing the load coditions during a run.	
5) WRT	The renewed data value can be set.	: 5 → :ub ↔ : 5
6) MON	Returns to the original display.	(OFF, 0.0 and frequencies)

3.5.3 Automatic torque boost [A.ub]

The output voltage can be adjusting within the oblique line's part (refer to figure 3.4) by the Automatic torque boost, detecting the load current.



A.ub setting	Function
0	Without Automatic torque boost
1	With Automatic torque boost

Figure 3.4 Automatic torque boost

Example operation	Action	
1) MON		:no.0 → :typ
2) 1		:typ → :ub
3) NEXT		:ub → :A.ub
4) READ	Data displayed	:0
5) 0 or 1		:1
6) WRT	The renewed data value can be set	:1 → :A.ub ↔ :1
7) MON	Returns to the original display.	(OFF,0.0 and frequencies)

3.5.4 Base frequency [uL]

When you run a 50Hz-rated motor, set the base frequency at 50Hz by selecting the standard setting mode number 1.

The base frequency (uL) can be set within a range from 25Hz to 400Hz.

When you want to set frequencies other than 50Hz 60Hz, use the following procedure:

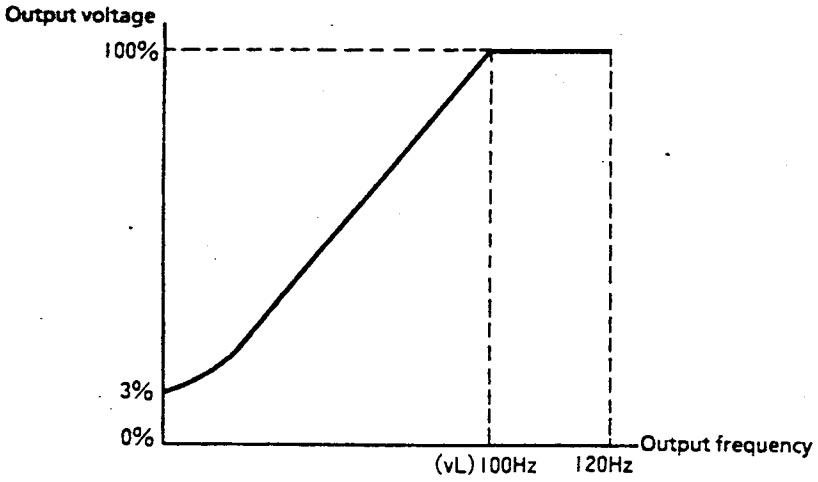


Figure 3.5 Setting base frequency

[Operating procedure]

Example operation	Action	
1) MON		:no.0 → :tYP
2) 1		:nb.1 → :ub
3) NEXT		:Rub
4) NEXT		:uL
5) READ	DATA value is displayed.	: 60
6) 0 ~ 9 or △ ▽	The displayed value can be changed either with the numerical keys or the increase/decrease keys.	
7) WRT	The renewed data value can be set.	:100 → :ub ↔ : 100
8) MON	Returns to the original display.	(OFF,0.0 or frequencies)

3.5.5 V/f patterns [Pt.]

Two V/f patterns are provided for your selection. One is the constant torque characteristic, which is suited for machines like conveyers, and the other is the variable torque characteristic, which is suited for energy-saving operaitons of fans and pumps.

Pt setting No.	Function
0	For constant torque characteristic
1	For variable torque characteristic (for energy-saving operations)

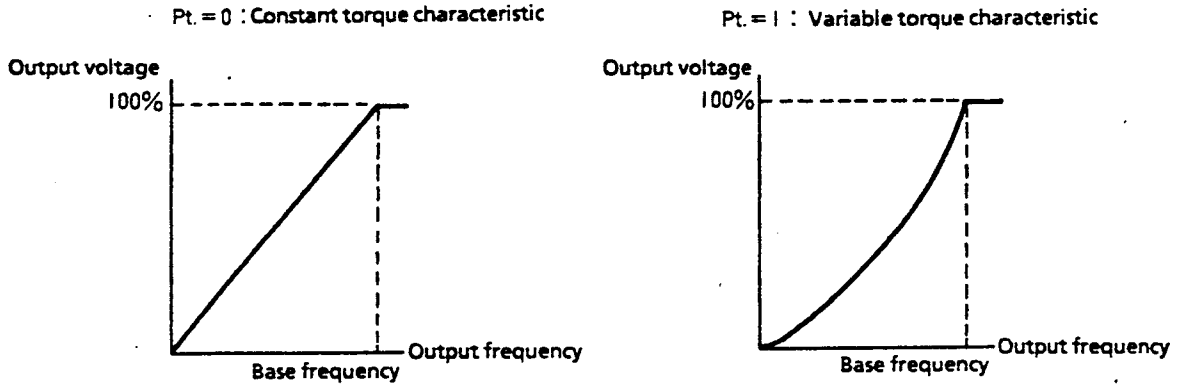


Figure 3.6 Setting V/f patterns

[Operating procedure]

Example operation	Action
1) MON	: no.0 → : typ
2) 1	: no.1 → : ub
3) NEXT	: Rub
4) NEXT	: uL
5) NEXT	: Pt.
6) READ	DATA value is displayed. : 0
7) 0 , 1 or △ ▽	The displayed value can be changed by using either the numerical keys or the increase/decrease keys.
8) WRT	Use to set the renewed data value. : 1 → : Pt. ↔ : 1
9) MON	Returns to the original display. (OFF 0.0 or frequencies)

3.6 Acceleration/Deceleration time

[ACC1, dEC1, Pt.1, ACC2, dEC2, Pt.2, SEL2]

This combined setting covers the acceleration time (ACC) required for the VF-A3's output frequency to rise from 0 to its maximum frequency and the deceleration time (DEC) from the maximum frequency to 0.

(1) Acc./dec. time

The acc./dec. time 1 and 2 (ACC1, dEC1, ACC2 and dEC2) can be set within a range of from 0.1 to 6000 seconds.

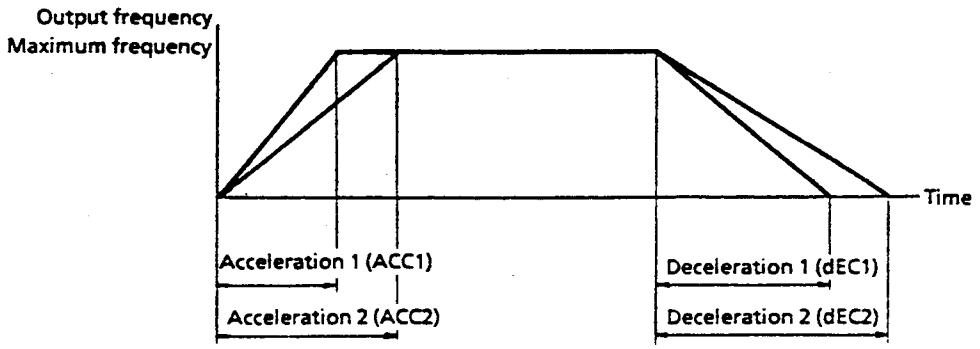


Figure 3.7 Acceleration/deceleration time

(2) Acc./dec. patterns

You can select the acc./dec. patterns of the acc./dec. time 1 and 2 (Pt.1 and Pt.2)

Setting of Pt.1 and Pt.2	Function
0	Linear pattern
1	Non-linear pattern 1 (Accelerates a motor gradually at speeds where the accelerating torque is small; suitable for mateirals handling machinery)
2	Non-linear pattern 2 (Accelerates a motor gradually at speeds where the accelerating torque is small; suitable for high speed runs.)

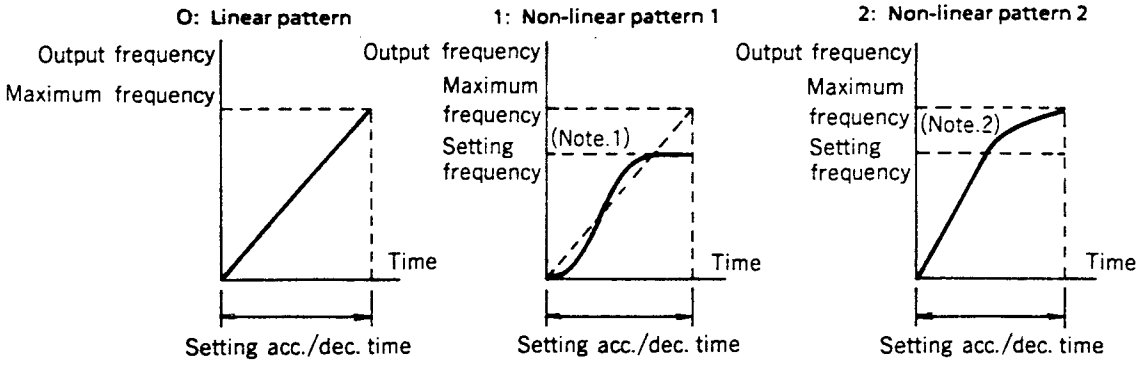
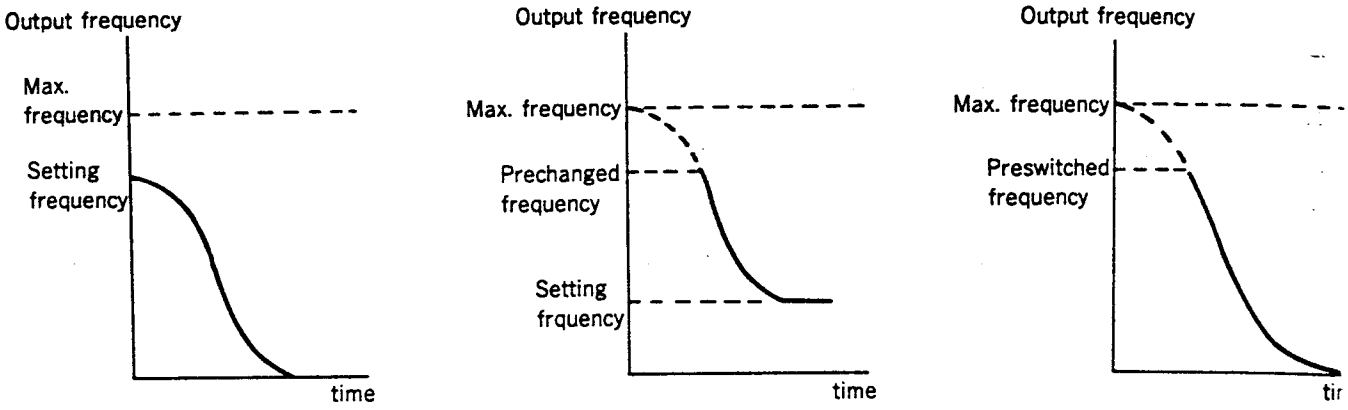


Figure 3.8 Acc./dec. patterns

Note 1) Figure 3.9 shows the deceleration pattern when non-liner pattern 1 is set.



a) At operating command OFF

b) At changing operating frequency

c) At swiching forward/reverse operating frequency

Figure 3.9 Deceleration patterns

Note 2) Non-liner pattern 2 is based on the maximum frquency.

(3) Selection of acc./dec. 1 or 2 (during a panel-controlled run)

1) While you are operating the inverter via the operating panel, you can select either acceleration time 1 or acceleration time 2 [SEL2].

Setting of SEL2	Function
0	Selects acc. dec.time 1.
1	Selects acc. dec.time 2.

2) Selection of acc./dec. 1 or 2 (during an External signal operated run)

You can also select either acceleration time 1 or 2 through the terminal input, AD2.

For details, refer to Section 4.2.1 (page 79).

AD2-CC Terminals	Function
AD2-CC opened	Selects acc. dec.time 1.
AD2-CC shorted	Selects acc. dec.time 2.

(4) Settings and adjustments

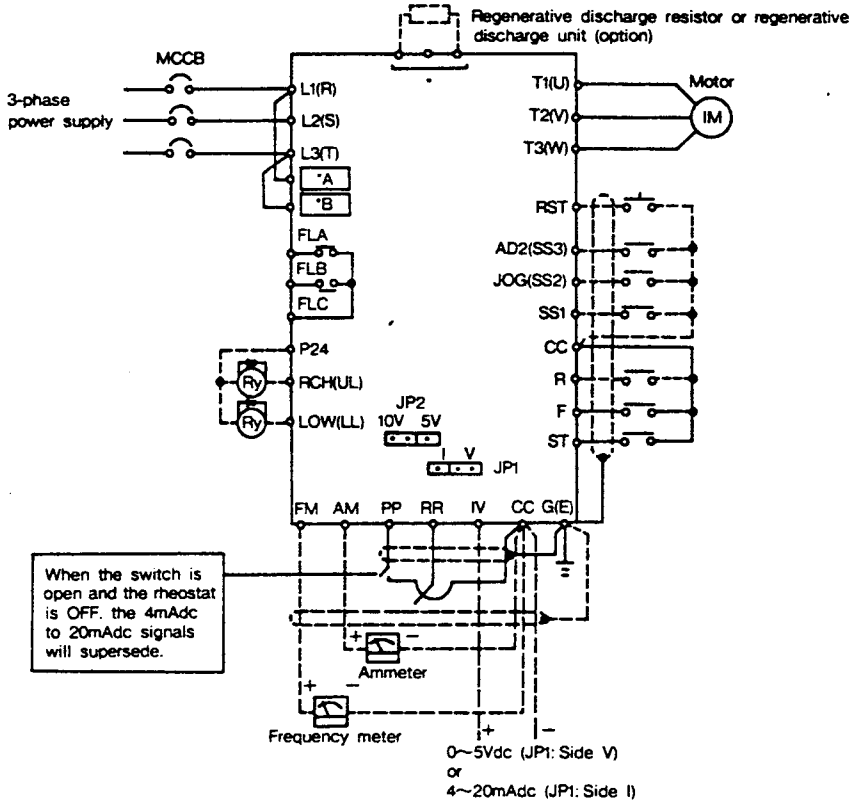
Use the following procedure for the adjusting settings:

[Operating procedure]

Example operation	Action	
1) MON		:no.0 → :tYP
2) 2		:no.2 → :ACC1
3) READ	DATA value is displayed.	: 10.0
4) 0 ~ 9 or △ ▽	The displayed value can be changed by using either the numerical keys or the increase/decrease keys.	
5) WRT	The renewed data value can be set.	:20.0 → ACC1 ↔ :20.0
6) NEXT		:dEC1
7) READ	DATA value is displayed.	: 10.0
8) NEXT		:Pt.1
9) NEXT		:ACC2
10) NEXT		:dEC2
11) NEXT		:Pt.2
12) NEXT		:SEL2
13) MON	Returns to the original display. (OFF, 0.0 and frequencies)	

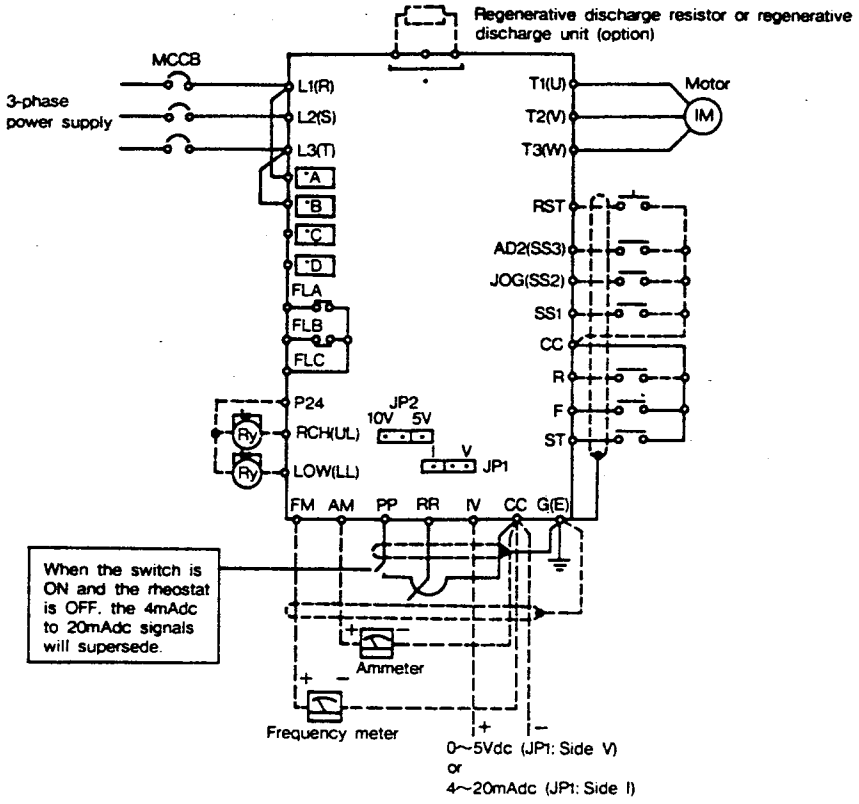
3-7. Connections for operating the inverter by external signals.

3.7.1. External signal connections.



TYPE	MARK AND VOLTAGE	
	*A	*B
1	R1	T1
	200V - 50Hz 200V to 230V - 60Hz	
2	R20	T20
	200V to 220V - 50Hz	

(a) 200V CLASS



TYPE	MARK AND VOLTAGE			
	*A	*B	*C	*D
1	R1	T1	R20	T20
	400V to 440V - 50Hz 400V to 460V - 60Hz		200V to 220V - 50Hz 200V to 230V - 60Hz	
2	R38/R41	T38/T41	R22/R24	T22/T24
	380V to 415V - 50/60Hz		220V to 240V - 50/60Hz	
3	R41/R44	T41/T44	R22/R24	T22/T24
	415V to 440V - 50/60Hz		220V to 240V - 50/60Hz	

(b) 400V CLASS

Because all the inverter's control terminals (except FLA, FLB, and FLC) are designed for electronic circuits, be sure to insulate these signal circuits from the main circuit.

*) Note: Regenerative discharge circuit and terminals

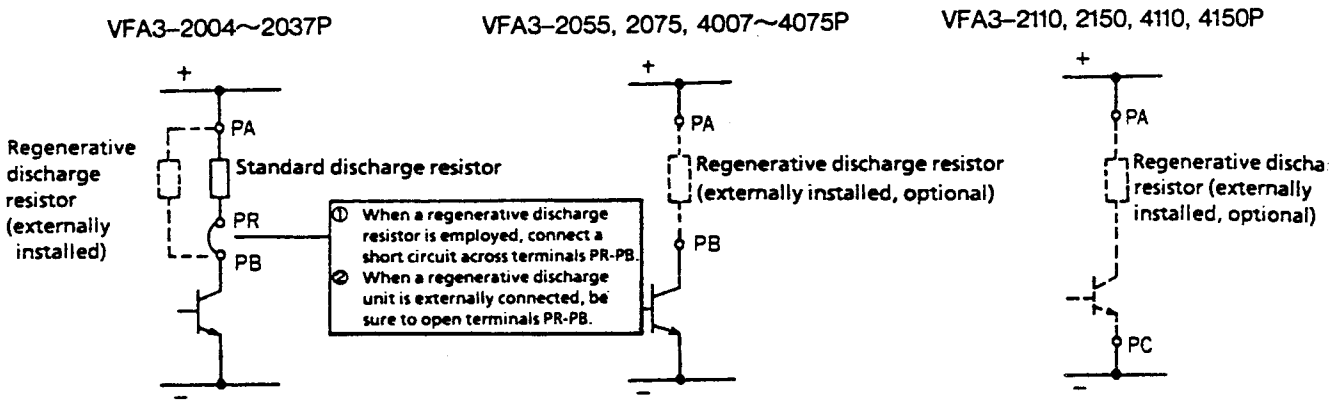


Figure 3.10 External signal connections

3.7.2 Terminal connections

* Terminal connections and functions are described as follows:

Terminal name	Terminal functions	Terminal block type
L1.L2.L3 (R.S.T)	Connect these terminals to a 3-phase power supply.	Main circuit terminal block
T1.T2.T3 (U.V.W)	Connect these terminals to a 3-phase induction motor.	
R1.T1 (R20,T20) (R38/R41,T38/T41)	Connect these terminals to a single phase power supply, which are used for the inverter's control circuit.	
PA.PB.PC.PR	Connect these terminals to either a regenerative discharge resistor, or to a regenerative discharge unit (optional).	
R20.T20 (R22/R24, T22/T24)	This teminal provide an output of the power supply for the inverter's operating circuit (400V class only). Provide a power supply when you use another relay, be cause this output controls only one MC (equal to C12A)	
FLA.FLB.FLC	Each activates when it detects that its corresponding inverter protective funciton has been activated (250Vac-2A)	Control circuit terminal block
P24	Connect this terminal to an external relay or its equivalent (24Vdc, 100mA maximum)	
RCH(UL)	Detects when the speed reaches its set value or detects when the designated upper limit frequency is reached, and output the signals. This terminal provides an open collector output (50mAdc max.)	
LOW(LL)	Detects when the designated low speed is reached, or detects when the disignated lower limit frequency is reached. This terminal provides an open collector output (50mAdc max.)	
FM	Connect this terminal to an external frequency meter. Use either an ammeter rated at 1mAdc at full scale or a voltmeter rated at 7.5Vdc-1mA at full scale.	
AM	Connect and external ammeter. Use either an ammerter rated at 1mAdc at full scale or a voltmeter rated at 7.5Vdc-1mA at full scale.	

Terminal name	Terminal functions	Terminal block type
PP	This terminal provides an output of the reference signal for frequency setting (10Vdc).	
RR	Input a frequency setting signal to this terminal. A 3kΩ potentiometer (one rated at 1K to 10kΩ may also be connected), 0 to 10Vdc (with JP2 set at 10V), or 0 to 5Vdc (with JP2 set at 5V).	
IV	Input a frequency setting signal to this terminal. 0 to 5Vdc (with JP1 set at V), or 4(0) to 20mAdc (with JP1 set at I).	
CC	This is the common end of the FM, PP, RR, and IV terminals.	Control circuit terminal block
ST	With ST-CC shorted, the inverter is ready to run. With the ST-CC opened, a coasting stop phases in. Can be used for an interlocked operation. (Preparation to run / terminal for coast to stop)	
F	With F-CC shorted, a forward run is engaged: With F-CC opened, deceleration phases in for a complete stop. (ST-CC is shorted.)	
R	With R-CC shorted, a reverse run is engaged, and with R-CC opened, deceleration phases in for a complete stop. (ST-CC is shorted.) (If both F-CC and R-CC are shorted simultaneously, a reverse run will result.)	
CC	This is the common end of the ST, F, and R terminals.	
SSI	With SS1-CC shorted, a multispeed run is engaged.	
JOG (SS2)	With JOG-CC shorted, a jogging run is engaged: with SS2-CC shorted, a multispeed run is effected.	
AD2(SS3)	With AD2-CC shorted an acc./dec. time2 run is engaged; or with SS3-CC shorted, a multispeed run will result.	
RST	With RST-CC shorted, the inverter's protective function resets.	
CC	This is the common end of the SS1, JOG(SS2), AD2(SS3), and RST terminals.	
G(E)	The inverter housing's ground terminal.	Terminal block or frame screw

3.8 Forward/Reverse run, coasting stop, and emergency stop operations

You can run your motor in forward or reverse direction or bring it to either a coasitng stop or an emergency stop by using either the inverter's operating panel or via external signals connected to the inverter's terminal block. You can also make an emergency stop by issuing a command from the operating panel while the motor is being operated automatically or from a remote location.

3.8.1 Operation via the inverter's panel control [F.r.]

(1) Forward or reverse run (F.r.)

1) Select either a forward run or a reverse run.

Setting of F.r.	Function
0	Reverse run
1	Forward run

* For the setting procedure, refer to Section 3.1.1 (Page 22). Its function number is 9.

2) Push the RUN key to start the motor. (Panel control LED blinks)
Push the STOP key to halt the motor.

* Before you degin operating the inverter, make sure that the "PANEL CONTROL" LED is lit.

(2) Coasting stop

1) Push the 2nd and STOP keys to bring the motor to a coasting stop.

2) 0.0 will then appear on the inverter's monitor display.

(3) Emergency stop

During automatic or remote-controlled operation of your motor, you can make an emergency stop by inputting the following command from the inverter's operating panel:

[Operating procedure]

Example operation	Action	
1) STOP	EOFF blinks.	EOFF
2) STOP	Causes an emergency stop. Output power becomes 0, and the motor comes to a coasting stop. As soon as the emergency stop is completed, a fault detect signal is output.	E
3) CLR / WRT	Resets the emergency stop state. Turn the fault detect signal is clear.	0.0

* When in the panel operation mode, the command for an emergency stop is disabled and the motor comes to a decelerating stop. The emergency stop is effective in an automatic or remote-controlled operation mode (when the "PANEL CONTROL" LED is turned off).
* To reset the emergency stop state, short-circuit terminals RST-CC.
* You should short-circuit terminals ST-CC. When they are opened, the output becomes 0 and the motor phases in a coasting stop. OFF is displayed on the monitor display.
* When you want to cancel an emergency stop command [after you have completed step "(3) 1)" in the preceding table] push the MON key twice.

3.8.2 External signal operation

Make the wiring connecions by using the following procedure:

[Wiring procedure]

1) Remove the wire that connects terminals ST-CC.
   * Both forward and reverse runs may be operated with ST-CC shorted, but a coasting stop cannot be used.
2) Set switches on the control circuit terminal block as shown in Figure 3.11.
3) Frequency setting signals must be input to the terminals specified in Fig. 3.14. (Section 3.9. page 52).
   When the operation frequency is setting via the oprating panel, and the operation signals are input to the terminals from an external, set as follows.

   Command mode seleciton : C.MOd=1 (the terminal input is only accepted)
   Frequency setting mode selection : F.MOd=2 (the panel input is only accepted)

4) Fig. 3.12 shows a timing chart for an example forward/reverse run operation.

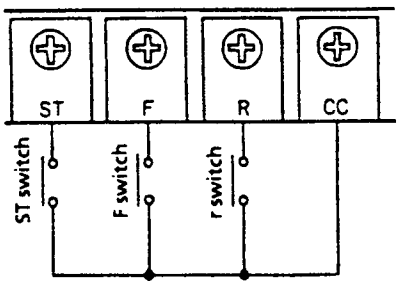


Figure 3.11 Forward and reverse runs switches

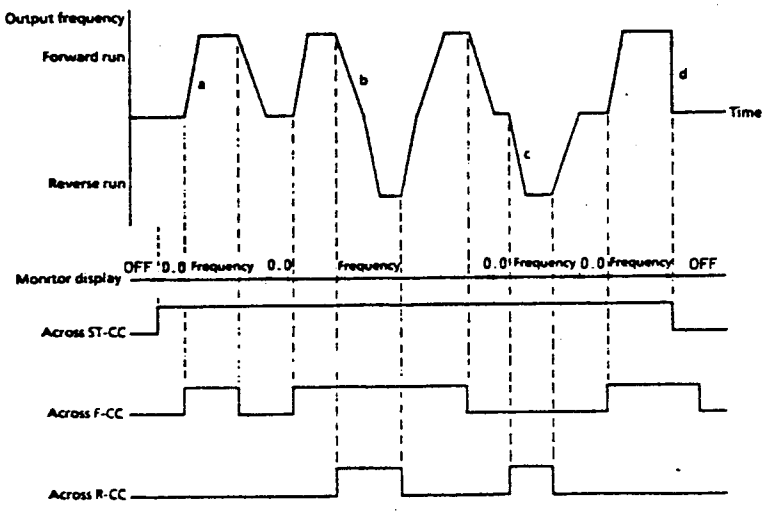


Figure 3.12 Timing chart for forward/reverse run operation

Operate the VF-A3 inverter by using the following procedure:

[Operating procedure]

1) Ensure that the "PANEL CONTROL" LED is turned off. If it is lit, push the CTRL key to turn off the "PANEL CONTROL" LED.
2) Throw the ST switch ON.
3) The monitor display will alternate between "OFF" to "0.0".
4) Throw the F switch ON.
5) A forward run operation will begin, as shown by "a" in Figure 3.12.
6) At "b," the motor run is reversed when both the F and R switches are on.
7) At "c," a reverse run is engaged.
8) When the ST switch is thrown off, a coasting stop of the motor will result, as shown by "d."
9) If the power input is switched off (with MCCB) while the ST and F switches remain on, a coasting stop will result.

Use step "9)" above only for an emergency stop. Avoid using power input switch MCCB to start and stop the inverter/motor while the ST and F switches are on.

---

* These steps apply when operating in the "acceleration 1" pattern. When you want to conduct the acceleration 2 pattern operation, install a short-circuit across terminals AD2-CC.

Table 3.6 Terminal inputs and actions

Terminal			Action
ST	F	R	
OFF	ON/OFF	ON/OFF	Output OFF, coasting stop
ON	OFF	OFF	Stop
ON	OFF	ON	Reverse run
ON	ON	OFF	Forward run
ON	ON	ON	Reverse run

3.9 Frequency setting signals (setting with external signals)

The VF-A3 inverter's output frequency can be controlled from an external device by using the PP, PR,IV, and CC terminals of the inverter's control circuitterminal block, which are shown in Figure 3. 13.

For wiring details, refer to Section 8.3 (page 117)

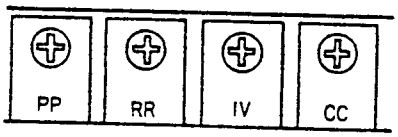


Figure 3.13 Terminals for setting output frequency from an external device

3.9.1 Types of frequency setting signals

The inverter's frequency setting signal can be changed by setting jumpers JP1 and JP2, which are located in the inverter's control board. Their combinations and the functions achieved thereby are described in Figure 3.14. The jumper locations are indicated in Figure 1.3 (page 17).

Setting of J.StP	Function
0	Deceleration stop (The motor follows the deceleration pattern.)
1	Coasting stop
2	DC injection braking stop (The motor is forced to stop in the DC injection braking stop pattern set earlier by dbF, dbu. and dbt .)

* For details of the setting procedure, refer to Section 3.1.1 (page 22). Its function number is 6.

3.11.1 Operaiton via the VF-A3's control panel

Use the following procedure to operate your VF-A3 inverter by inputting commands from its operating panel.

[Operating procedure]

Example operation	Action
1) CTRL	Selects the panel operation mode. "PANEL CONTROL" LED lights.
2) SECOND	2nd
3) 0	JOG
4) △	△ key for a forward run. JOG
·▽	▽ key for reverse run. JOG-
5) RUN	The inverter will engage in a jogging run as long as the RUN key is pushed. When the RUN key is released, the motor comes to a halt. JOG 5.0
6) CLR or STOP	Returns to the original display.

* A jogging run cannot be engaged during a regular run. Conduct the above-mentioned procedure after allowing the inverter to come to a complete stop.

3.11.2 Operation the inverter via external signals

Wire and operate the inverter by using the following procedure.

[Operating procedure]

1) Connect a jogging switch across JOG-CC of the inverter's control circuit terminal block, as shown in Figure 3.20.
2) Ensure that the selection of input terminal (Function number's 8 of First function) is set $tb =$ 1 or 3 via the operating panel (Setted $1.tb = 2$ at shipment).
   For setting of $1.tb$, refer to Section 4.2.1 (page 79)
3) Ensure that the "PANEL CONTROL" LED is turned off. If it is lit, push the CTRL key to turn it off.
4) Turn the JOG switch on. While the F switch or R switch is turned on, the motor will operate at the jogging frequency.

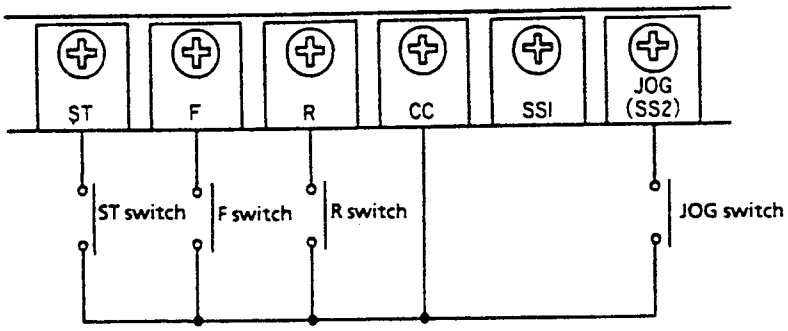
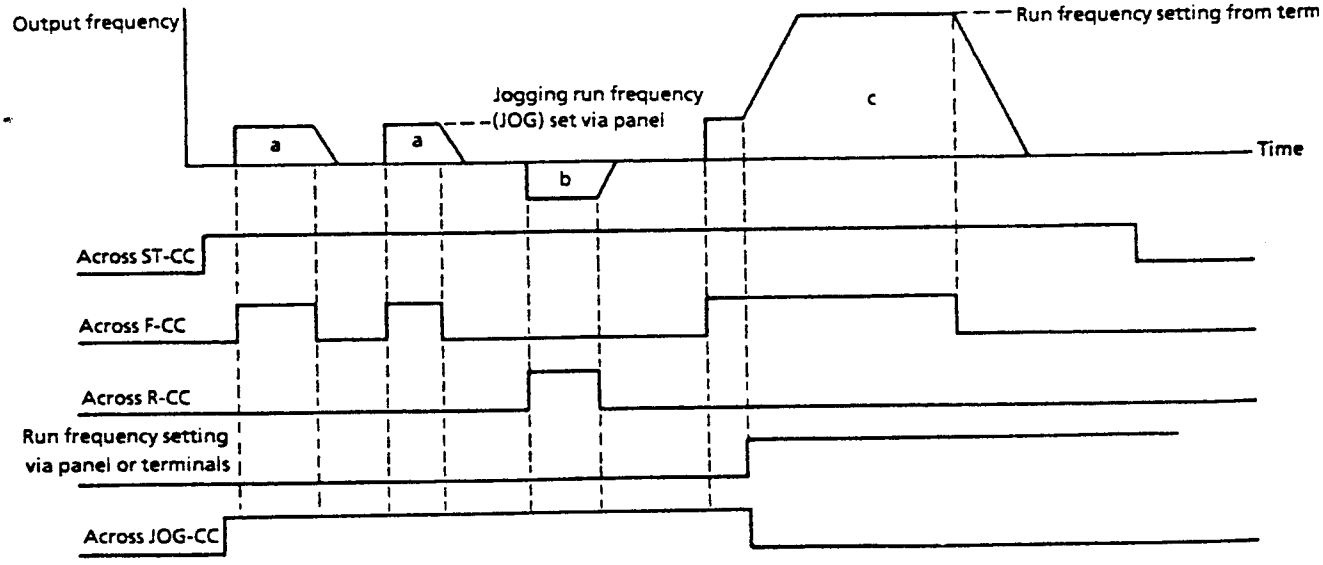


Figure 3.20 Connecting a JOG switch and associated switches

5) Figure 3.21 shows the timing chart for an example run operation using a "JOG switch."



a: Forward jogging run
b: Reverse jogging run
c: If during a jogging run, a run frequency change is made via the inverter's terminals and terminals across JOG-CC are opened, the motor's run frequency will conform with the new setting.

* A jogging run cannot be engaged by closing the JOG switch during a normal run.

Figre 3.21 Example of a jogging run using a JOG switch

Table 3.7 Terminal inputs and actions

Terminal				Action
ST	JOG	F	R	
ON	ON	OFF	OFF	Jogging stop
ON	ON	OFF	ON	Reverse jogging run
ON	ON	ON	OFF	Forward jogging run
ON	ON	ON	ON	Reverse jogging run

3.12 Multispeed runs [Sr1-Sr7]

This function allows the inverter to run at seven different speeds (an 8-speed run can be used if you include the operating frequency).

Each speed (any of the speeds Sr1-Sr7) can be set within the range from a lower limit frequency (LL) to an upper limit frequency (UL).

* For details of the setting, refer to Section 3.1.1 (page 22).
  Its function number is 6.

3.12.1 Panel controlled operation

Use the following procedure to perform a multispeed run.

[Operating procedure]

Example operation	Action
1) CTRL	Selects the panel control mode "PANEL CONTROL" LED lights.
2) SECOND	2nd
3) 1 to 7	Run speeds are selected by pushing the appropriate numerical keys 1 through 7. When the key 5 is selected, the alphanumerics shown at right appear on the monitor display. Sr5
4) △ or ▽	Push the △ key to set a forwar run; ▽ for a reverse run.
5) RUN	The motor operates at the run frequency set to Sr5 in step "3". 30.0
6) STOP	The motor phases to a decelerating stop. 0.0

3.12.2 External signal operation

Use the following procedure for wiring and operating.

[Operating procedure]

1) Connect switches SS1, SS2, and SS3 across terminals SS1-CC, SS2-CC, and SS3-CC of the inverter's control circuit terminal block, as shown in Figure 3.23.
2) Ensure that the selecation of input terminal (Function number's 8 of First function) is set tb = 0 via the operating panel (Set I.tb = 2 at shipment). For setting of I.tb ,refer to Section 4.2.1 (page 79).
3) Ensure that the "PANEL CONTROL " LED is turned off. If it is lit, push the CTRL key to turn it off.

SS3-CC	SS2-CC	SS1-CC	Selected run frequency
OFF	OFF	OFF	Run frequency set via terminals
OFF	OFF	ON	1st run frequency
OFF	ON	OFF	2st run frequency
OFF	ON	ON	3rd run frequency
ON	OFF	OFF	4th run frequency
ON	OFF	ON	5th run frequency
ON	ON	OFF	6th run frequency
ON	ON	ON	7th run frequency

4) A multispeed run schedule can be set by turning switces SS1, SS2, and SS3 on or off, according to the following combinations:
5) Figure 3.22 shows an example timing chart for a multispeed run operation.

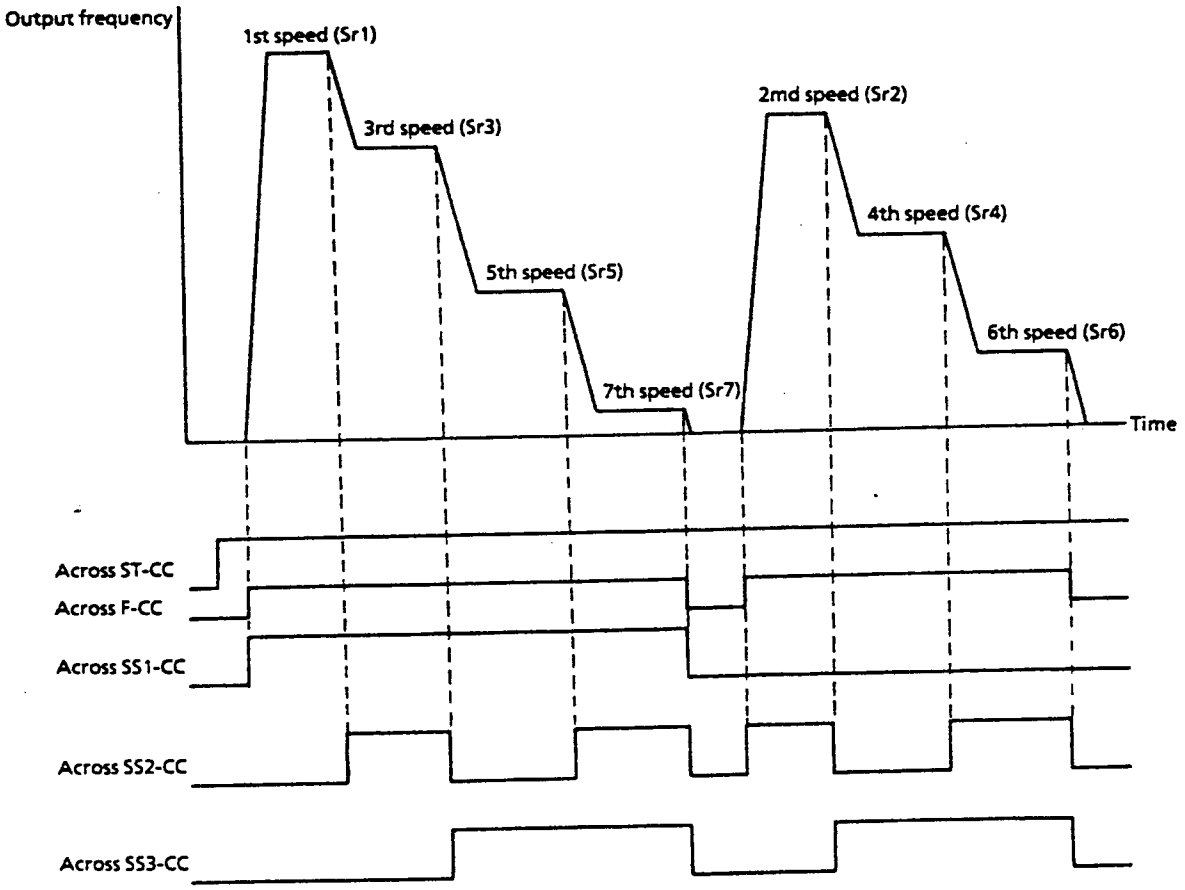


Figure 3.22 Timing chart showing multispeed run

Seven different speeds can be set via the contact signals of the switches. When every contact signal is OFF, the run frequency set via the inverter's terminals will be selected.

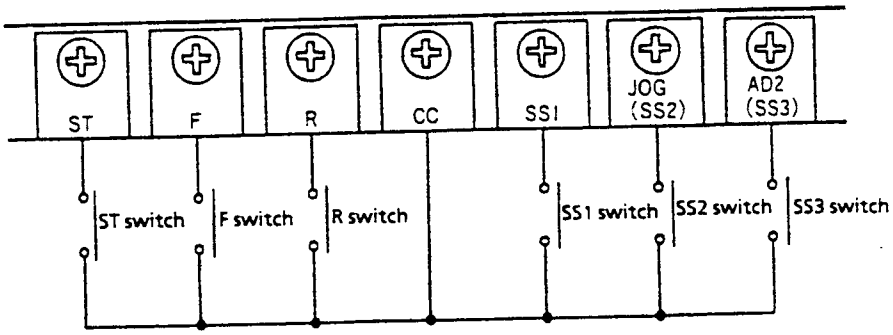


Figure 3.23 Terminal connections with switches for multispeed controls

* When the SS2 terminal is employed for a jogging run, or the SS3 terminal is used for the selection of acc./dec. 1 or 2, the 3rd speed run will be performed.
  Refer to section 4.2.1 (page 79)
  An optional setup is available when a combined operation of a jogging run, or acc./dec. 1 or 2, with a 7-speed run operation is required.

3.13 Frequency jump [FJ1, bFJ1~FJ3, bFJ3]

The inverter's frequency jump function is used when the resonance of load machine system must be avoided during a run, to prevent noise and vibration.

Three jump points can be set.

Jump points 1, 2, and 3 [FJ1, FJ2, and FJ3] can be set within a range from 0 to the maximum frequency (Hz).

Jump widths 1, 2, and 3 [bFJ1, bFJ2, and bFJ3] can be set within a range from 0 to the maximum frequency (Hz).

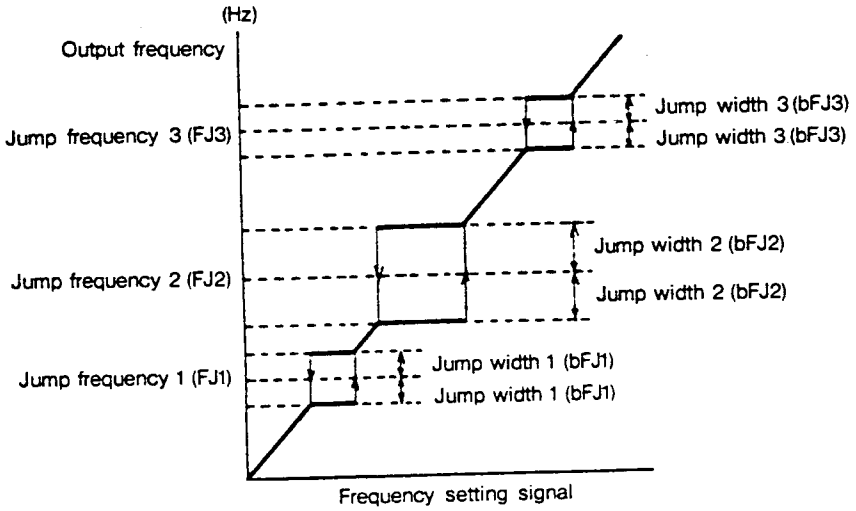


Figure 3.24 Frequency jump settings

* For details of the setting procedure, refer to Section 3.1.1 (page 22). Its function Number is 7.
* A frequency jump cannot be engaged during an acceleration or deceleration period.

3.14 Start-up frequency [F-St]

A motor's start-up torque characteristic can be optimized through the combined use of the invertr s torque boost function and the start-up frequency, which can be set within a range from 0Hz to 10Hz.

A start-up frequency can be output immediately after being set. The term "acceleration time" refers to the time required for accelerating the motor from 0 to the maximum frequency.

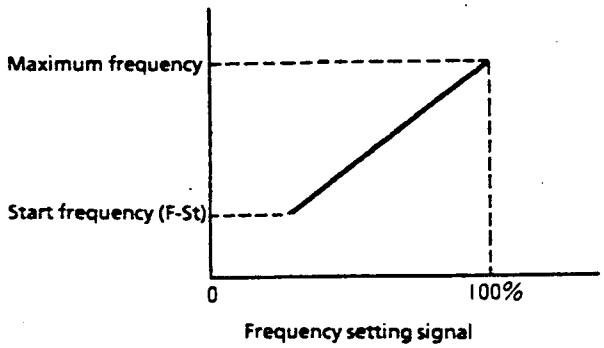


Figure 3.25 Start frequency

3.15 Operation starting frequency [F.run, F.HYS]

The only frequency setting signals enable to command for starting or stopping the inverter's run.

According to setting the operation stating frequency and the Hysteresis' width, the inverter runs when the frequency setting signal is above B.point, and stops when below A. point indicated by Figure 3.26.

* When the inverter which is used by the air-conditioning fan and so on is auto-operated via a signal of room's temperature, for example, the frequency setting signal going down below 30Hz can cause to stop the inverter's run.

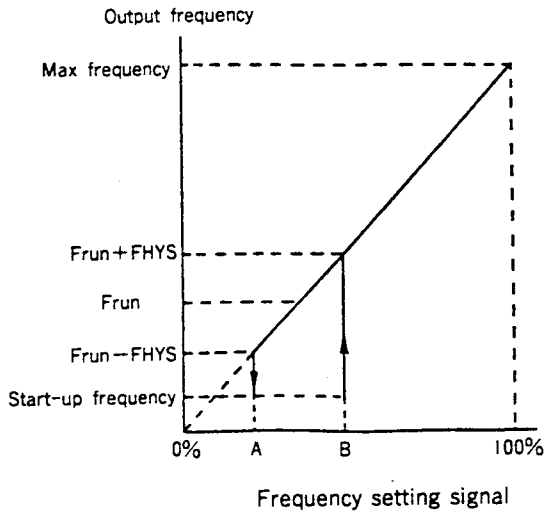


Figure 3.26 Operation starting frequency.

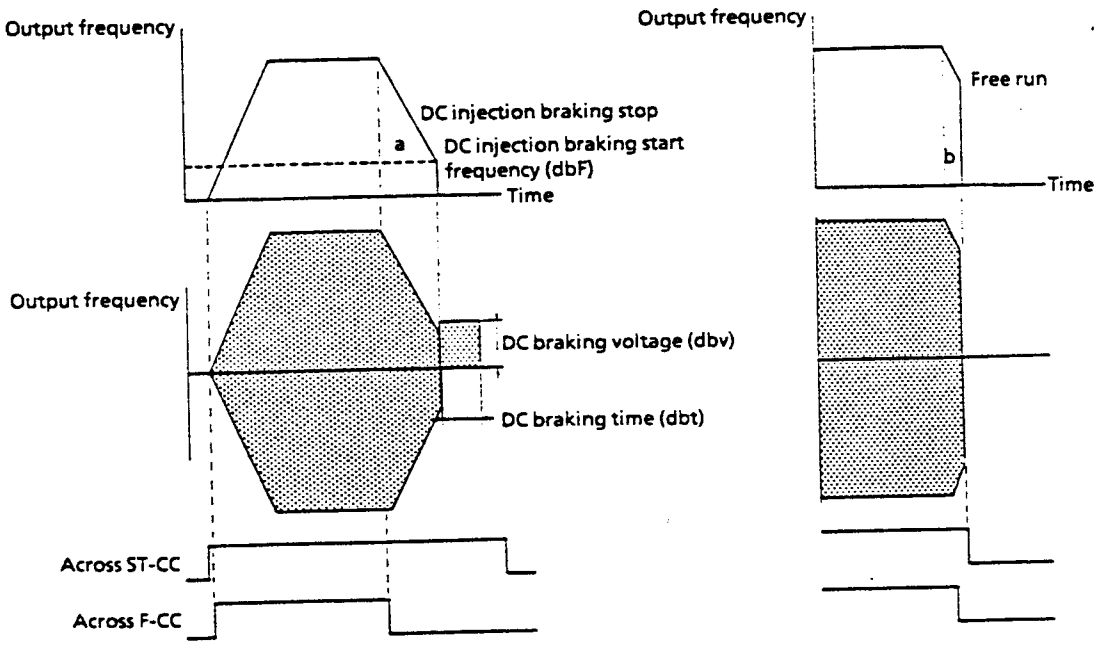
* For setting procedure, refer to section 3.1.2 (page 23). Its function number is "0".

3.16 DC Injection braking [dbF. dbu. dbt]

While a motor is undergoing a decelerating stop, a dynamic injection braking may be engaged. When the DC injection braking function is activated, the message " db " appears on the inverter' s monitor display. This DC injection braking function may used for precise positioning ("inching") of the motor-driven equipment.

The DC injection braking start frequency [dbF] can be set within a range of from 0Hz to 10Hz. The DC injection braking voltage [dbu] can be set within a range of from 0% to 20%. The DC injection braking time [dbt] can be set within a range from 0 seconds to 5 seconds.

Figure 3.27 shows an example operation of DC injection braking.
When the inverter's F switch is thrown off, deceleraiton will begin by regenerative braking in accordance with a deceleration time setting made at rheostat dEC, and DC injection braking is activated according to the DC injection braking start frequency preset at rheostat dBF.



a) DC braked stop
When the dbu has been set at 0, a coasting stop will be activated if the inverter's output frequency below dbF.

b) If the ST switch is thrown off before the start of DC braking, a coasting stop will result.

Figure 3.27 Timing chart showing an example of a DC injection braking operation

* Because DC injection braking forces the motor to stop running, do not set excessive braking voltage (dbu) or braking times (dbt). This is necessary to avoid straining the motor.

If the panel control setting or an external frequency signal has been set below the start-up frequency for decelerating stop, the DC injection braking function will be mobilized at frequencies below values set for the DC injection braking start frequency. When the frequency setting signals is gradually decreased, the DC injection braking will also be activated below the start-up frequency.

3.17 Regenerative braking [Pb.0PS.S]

When a rapid deceleration or an overvoltage trip during a decelerating stop is required, a regenerative braking operation can be selected.

Setting of Pb	Function
0	Without regenerative braking(or using a regenerative discharge unit)
1	With regenerative braking, without a regenerative discharge resistor overload deteciton
2	With a ragenerative braking, with regenerative discharge resistor overload detection

Setting of 0PS.S	Function
Ó	With an overvoltage stall operation
1	Without an overvoltage stall operation

* For details of the setting procedure, refer to Section 3.1.2 (page 23). Its function number is 4.

According to Table 3.8, connect and set the regenerative braking and the selection of the overvoltage stall operation.

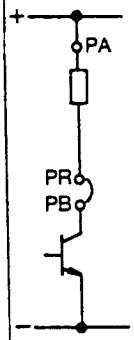
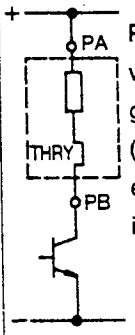
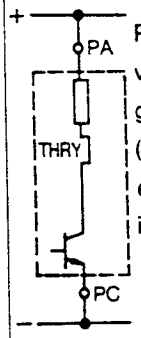
Method of regenerative braking (Applicable model)	Connection	Pb Setting	OPS.5 setting	Remark
Regenerative braking, using a built-in regenerative discharge resistor (VFA3-2004~2037P)	 Discharge resistor (built-in) Short terminals PR-PB	Pb=2	OPS.5=0 or 1 (Without an overvoltage stall operation in either settings)	Note)
Regenerative braking, connecting an optional regenerative discharge resistor across terminals PA-PB. (external installation) (VFA3-2004~2075P / VFA3-4007~4075P)	 Regenerative discharge resistor (an optional external installation)	Pb=1	OPS.5=0 or 1 (Without an overvoltage stall operation in either settings)	Use an overload relay to protect overloading the regenerative discharge resistor
Regenerative braking, connecting an optional regenerative discharge unit across terminals PA-PC. (external installation) (VFA3-2110~2550P / VFA3-4110~4750P)	 Regenerative discharge unit (an optional external installation)	Pb=0	OPS.5=1	Use an overload relay to protect overloading the regenerative discharge resistor

Table 3.8 Connection and setting of Regenerative braking

* Use a built-in discharge resistor in the following conditions:

  Regeneration time per cycle: less than 5 seconds

  Service rate: 3% ED maximum

  If you need to use your inverter under conditions exceeding those specified above, connect a regenerative resistor having the necessary heat capacity.

* When the inverter is subjected to frequent run and stop operation, the temperature of the built-in regenerative discharge resistor will rise to 150°C due to heat build up. Thus you should pay adequate attention to the safety precautions for selecting an installation site. (Refer to Section 1.1 (page 2)
* When you use a regenerative discharge resistor or a regenerative discharge unit, install a magnetic contactor (MC) or a molded case circuit breaker (MCCB) with trip coil on the inverter' s power supply side. This will allow the power supply circuit to open when the inverter's built-in fault detection relay (FL) and the externally mounted overload relay are activated.

3.18 Universal unit setting and display [dSP.2]

This function not only permits use of the inverter's monitor display for indicating a motor's revolution speed, line speed, and frequency, but to set them via the inverter's operating panel.

The VF-A3 inverter's universal unit multiplication factor [dSP.2] determines the multiplication factor of a frequncy indication within a range of 0.01 to 200,as well as 0 (OFF).

Indication on the monitor display
= universal unit multiplication factor x frequency value

Indicated values on the monitor display range from 0.00 to 9999. When the value exceeds 9999, the most significant 4 digits from the 5th place through the 2nd place to the left of the decimal point will blink on and off on the display monitor.

[Example settings]

1) Revolution speed setting and indication

   For a 4-pole motor, if you set the universal unit multiplication factor [dSP.2] at 30, the monitor display will show revolutions within a range of from 0 to 1800 rpm at a run frequency of from 0Hz to 60 Hz. The frequency via the inverter's operating panel must be set by revolutions (9 ~1800rpm).

2) Line speed setting and indication

   If you set the universal unit multiplication factor [dSP.2] at 0.1, the monitor display will show a linear speed of 5m/sec at 50Hz. The frequency via the inverter's operating panel must be set by a line speed (5).

* Input the frequency setting by the universal unit multiplication factor.
  Each data value (such as frequency set value, maximum frequency, etc.) is shown as a frequency indication.
* For details of the setting procedure, refer to Section 3.1.2 (page 23). Its function number is 2.

3.19 Data storage function [*I.no.*]

The VF-A3 inverter can memorize numbers from 0 through 31, which can then be used for administrative tasks such a sorting inverter unit numbers and set values.

* For details of the setting procedure, refer to Section 3.1.2 (page 23). Its function number is 7.

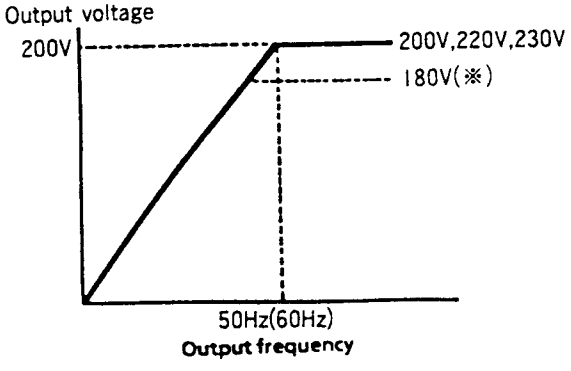
3.20 Output voltage reduciton and output voltage regulation [*P.OUt*]

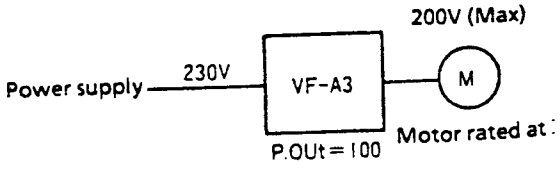
A standard VF-A3 inverter is equipped with an output voltage reduction function,while an output voltage regulation function is available as an option.

(1) Output voltage reduction function (standard equipment)
The VF-A3 inverter's output voltage can be reduced in proportion to its input voltage. The output voltage can be set within a range of from 0% to 100%. (When the input voltage fluctuates, the output voltage will vary in proportion to the input voltage fluctuations.)

* For details of the setting procedure, refer to Section 3.1.2 (page 23). Its function number is 4.

(2) Output voltage regulation (optional)
This optional function maintains the output voltage of the VF-A3 inverter at a preset absolute value, which can be set within a range of from 0% to 120%. Thus, even if a fluctuating peak voltage exceeds the rated voltage, this function automatically compensates for the voltage deviation and maintains the preset output voltage.





(*) To put out the higher voltage than input voltage is impossible

3.21 Simplified patterned run operation [P.SEL, Pt.t, Pt.n, Pt.1t, Pt.1~Pt.7t, Pt.7]

Seven types of automatic operation can be done via the inverter's operating panel by setting run frequencies, run times, and acceleration and/or deceleration patterns to form a combined timing schedule.

1) Patterned run frequencies [Sr1~Sr7]

Patterned run frequencies can be set by using the inverter's multispeed run frequency setting techniques, which are described in Section 3.12 (page 23).

2) Patterned run mode [P.SEL]

The method of a command to start and stop the patterned run can be set.

Setting of P.SEL	Function
0	Patterned run off
1	Valid for Terminal command only
2	Valid for Panel command only
3	Valid for Host command only

3) Patterned times selection [Pt.t]

The patterned run operation "1 ~ 7" are permitted to select the minute or the second of unit for running times.

Setting of Pt.t	Function
0	Second unit
1	Minute unit

4) Number of patterned run repetition times [Pt.n]

The number of patterned run repetition times can be set within a range of from 0 to 254 times and 255 times (255: infinite repetition). When you set 1 time repetition, the invertr operate twice. Setting 255 times repetition cause the continuous run operation.

5) Patterned run times [Pt.1t~Pt.7t]

Patterned run times "1~7" can be set within a range of from 0 to 8000 minutes or seconds and at 9999 (continuous). Setting 9999 (continuous) cause the patterned run operation continuously.

6) Selection of patterned run states [Pt.1~Pt.7]

You can select forward/reverse run and acc./dcc. patterns of patterned run "1 ~7" (page 41).

Setting of Pt.1-Pt.7	Function
0	Forward run; acc./dec. 1
1	Forward run; acc./dec. 2
2	Reverse run; acc./dec. 1
3	Reverse run; acc./dec. 2

* For details of the setting procedure, refer to Section 3.1.2 (page 23). Its function number is 8.

7) Command modes [C.Mod]

When the patterned run operation is done, set that the command mode is 2 (valid for operting panel input) in any patterned run modes "1 ~ 3" (terminal command, panel command, host command).

[Refer to Section 3.23 (page 72)]

8) Change of patterned run modes

Make the change patterned run modes by using the following procedure.

Example operation	Action	
1) MON	After setting palarameter 1) ~ 7), change the state of displaying frequency	0.0
2) CLR		CLr
3) WRT	Change the modes of patterned run	0.0

9) Operation via the terminal input

Connect switches to the inverter's control circuit terminal block, as shown in Figure 3.29.

After setting as the above mentioning 1) ~ 8), ON-OFF of ST,F and R switches enables to operate the patterned run.

* When either F or R switch is ON and the other swich turns ON, the patterned run operation is continued.

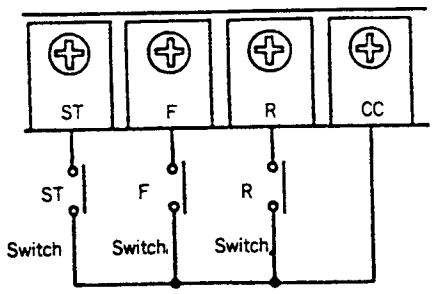


Figure 3.29 Connection of the patterned run switches

ST switch	F switch	R switch	Action
OFF	OFF	OFF	Output off, coast to stop
ON	OFF	OFF	Stops
ON	OFF	ON	Resumes the run from where it was interrupted
ON	ON	OFF	Operates from pattern 1
ON	ON	ON	Priority of R switch at simultaneous turning ON

Note) When the power supply is shut off in the patterned run operation, the inverter operate from pattern 1 after restored.

10) Operation via the inverter's operating panel

Press the [Run] key to allow the inverter to start the patterned run

[Interruption of a patterned run]

[STOP] : Deceleration stop

[2ND], [STOP] : Coast to stop

After an interruption of a run,

① Press the [RUN] key to allow the inverter to resume the run from where it was interrupted.

② Pushing [2ND], [RUN] keys causes the inverter to operate from pattern 1

Note) When the power supply is shut off in the patterned run operation, push the RUN key causes the inverter to operate from pattern 1.

11) Example of the simplified patterned run

Figure 3.30 shows an example timing chart for the simplified patterned run operation.

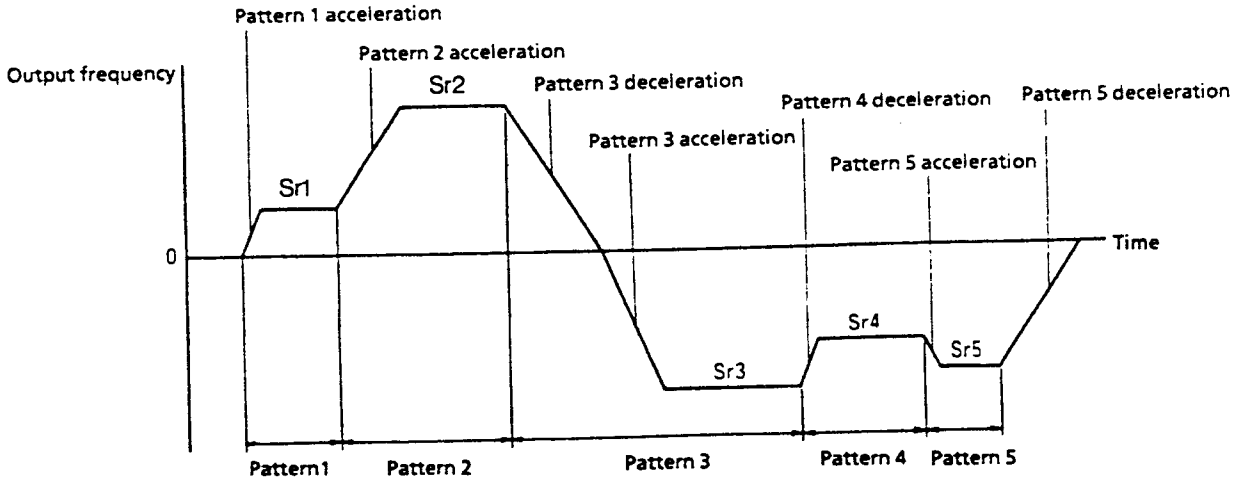


Figure 3.30 Timing chart showing a example of a simplified patterned run operation

12) Monitoring during a patterned run

Use the following procedure to monitor a patterned run.

[Operating procedure]

Example operation	Action
	A run frequency is displayed 10.0
1) NEXT	Displays the current pattern number :Pt.1
2) NEXT	Displays the balance of current run pattern : 12.3
3) NEXT	Displays current forward/reverse status. :F or :r Repeated pressing of the NEXT key allows you to monitor all items of the inverter's status information. The items appear in the sequence listed in Table 3.2 of Section 3.3.1.

3.22 PWM carrier frequency switching [CF]

The level or tone of acoustic motor noise can be modified by adjusting the inverter's PWM carrier frequency. When the noise level caused by resonance between teh motor and a load machine or a motor's fan cover, adjusting the PWM carrier frequency often will lower the level of acoustic noise.

The PWM carrier frequency (in a low speed region) [CF] can be set within a range of from 0.5Hz to 3kHz.

* For details of the setting procedure, refer to section 3.1.2 (page 23). Its function number is 6.

3.23 Command modes [C.Mod]

Select the desired run mode by inputting an appropriate number from these listed in the following table.

Selection of C.Mod	Function
0	Disables all inputs. (Run prohibited)
1	Valid for terminal input only
2	Valid for panel input only
3	Switching between terminal and panel inputs is allowed.
4	Valid for host command input only
5	Switching between terminal and host command inputs is allowed.
6	Switching between panel and host command inputs is allowed.
7	Switching to any of terminal, panel and host command inputs is allowed.

* For details of setitng methods, refer to Section 3.1.2 (page 23). Its function number is 9.
* When you set [C.Mod] = 3,6,7, if you want to switch to panel input, press the CTRL key.
* Panel input of the command mode is set "PANEL CONTROL" LED lights on the inverter's operating panel.

3.24 Frequency setting mode [F.Mod]

Select the desired frequency setting method by inputting an appropriate number from those listed in the following table.

Selection of F.Mod	Function
0	Disables all inputs. (Run prohibited)
1	Valid for terminal input only
2	Valid for panel input only
3	Switching between terminal and panel inputs is allowed.
4	Valid for host command input only
5	Switching between terminal and host command inputs is allowed.
6	Switching between panel and host command inputs is allowed.
7	Switching to any of terminal, panel and host command inputs is allowed.

* For details of setitng procedures, refer to Section 3.1.2 (page 23). Its function number is 9.
* When you set [C.Mod] = 3,6,7, if you want to switch to panel input, press the CTRL key.

3.25 Parameter setting mode [P.nOd]

Select the desired data setting mode by inputting an appropriate number from the list given in the following table.

Selection of P.nOd	Function
0	Disables all inputs except data input, change disabling command, and frequency setting.
1	Valid for panel input only
2	Valid for host command input only
3	Switcing between panel and host command inputs is allowed. (Latest data input overwrites previous entries).

* For details of setting procedure, refer to Section 3.1.2 (page 23). Its function number is 9.

3.26 PI control [Fb. PI. GP. GI. GR. GFS]

By using a 4 to 20mAdc signal from a process transducer, you can perform a PI control with the inverter.

(1) Wiring and operation procedure.

1) Feedback signals form the process transducer must be input to the IV-CC terminals. Switch to I-side as regards jumpers JP 1.

2) The output frequency must be set within a range from 0 to maximum frequency against terminal frequency setting signal with a 4mA to 20mA input indicating Section 3.9.3 (page 54).

3) A frequency must be set by control panel. Set a frequency for the process rate. Switch in the frequency setting mode to the panel mode, refer to Section 3.24 (page 73). (Switch to the terminal mode enable to connect the process rate set pointer externally)

4) Set to 2 (PI control) in the FB.PI selection.

Setting of Fb.PI	Function
0	Feedback control OFF
1	Feedback control (TG, PG) (optional)
2	PI control

5) Set to the following data, refer to a block diagram Figure 3.31

Parameter	Calculation	Adjustment range	Data and setting range	Standard value	
				Parameter value	Setting data
Proportional gain GP	$\frac{GP}{256}$	0 ~ 39	GP : 0 ~ 9999	GP=1	GP=256
Integral gain GI	$\frac{GI}{255}$	0 ~ 39	GI : 0 ~ 9999	GI=0.18	GI=46
Antihunting gain GA	$\frac{GR}{256}$	0 ~ 1	GR : 0 ~ 255	GA=0	GR=0
Temporary delay filter constant GFS	GFS	0 ~ 255	GFS : 0~ 255	GFS=15	GFS=15

* Set the data as follows.

[Example] When you set the proportional gain Gp to 1, set the data GP as follows.

$$GP = Gp \times 256 = 256$$

* For details of setting procedure, refer to Section 3.1.2 (page 23). Its function number is 5.

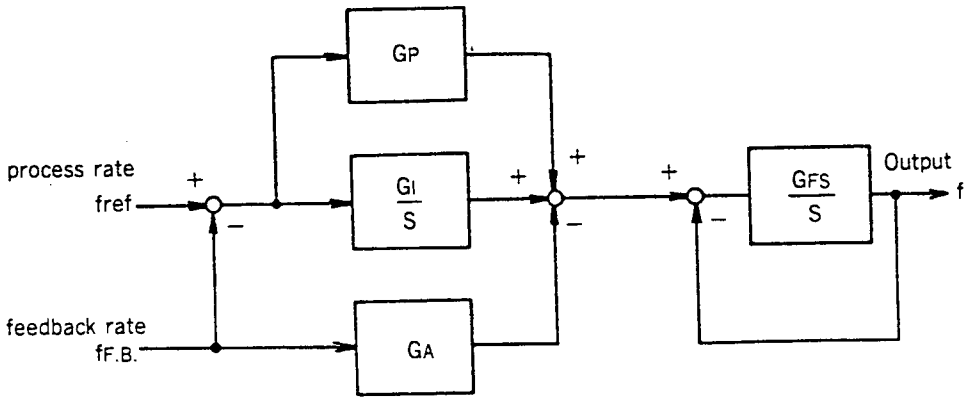


Figure 3.31 Block diagram

6) An acceleration and deceleration time must be set as short as possible.

7) When you want to limit an output, set upper and lower limit frequency (refer to page 82).

8) Start or Stop a run via the inverter's operating panel or by switching ON or OFF between F and CC terminals. Check the command mode, refer to Section 3.23 (page 73). To reset the integral value by pushing the STOP key on the inverter's operating panel or by switching OFF between F and CC terminals.

9) Figure 3.32 shows the pressure constant control as an example.

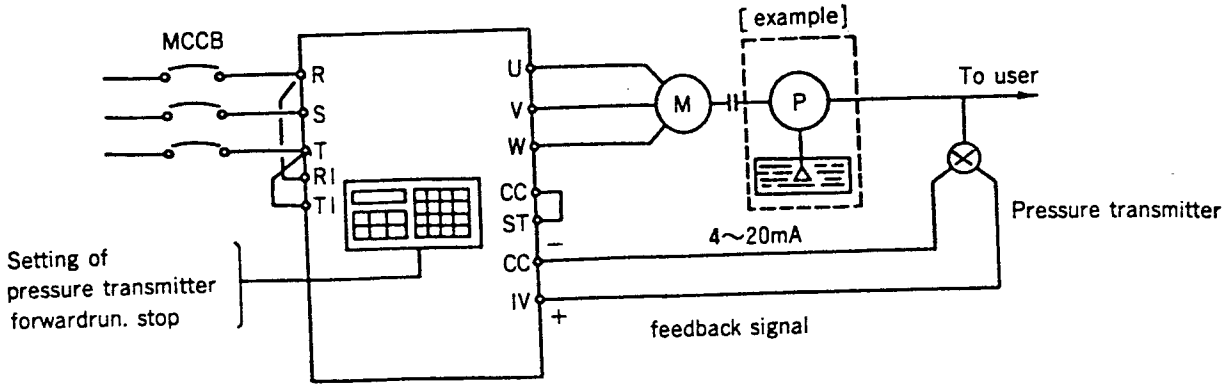


Figure 3.32 Example of pressure constant control

CHAPTER 4 SIGNALS AND CONNECTIONS FOR AUTOMATIC OPERATION

This chapter will describe the following:

Connection on instruments for automatic control

Signals for automatic operation

Connection of a frequency meter and an ammeter and their signals

Connection of resetting signal circuits

CHAPTER 4

Signals and Connections for Automatic Operation

4.1 Connection of signals

Chapter 2 discussed individual run functions of the Toshiba VF-A3 inverter. Operating the inverter in conjunction with other Toshiba control equipment (for example, a motion controller and a programmable controller) will allow you to make reliable, automated runs of your equipment that will save your time, maintenance and personnel costs.

The VF-A3 inverter provides a variety of signals for automated operation of all your equipment for optimum operation. These signals and their functions are discussed in this capter.

For automatic operations, Toshiba's EX series programmable controllers are best suited for use with the VF-A3 inverter.

4.1.1 Operation signals

Example connections were described in Chapter 3 to conncet discrete switches to individual control signals on the inverter. In addition to these, such signals as ST, F, R, SS1, JOG (SS2) and AD2 (SS3) may also be controlled with a programmable controller or any other transistorized output equipment (for example, non-contact switches). For this purpose, use transistors that can operate under 24Vdc ,5mA.

Figure 4.1 shows a typical configuration for transistor-to-terminal output connections.

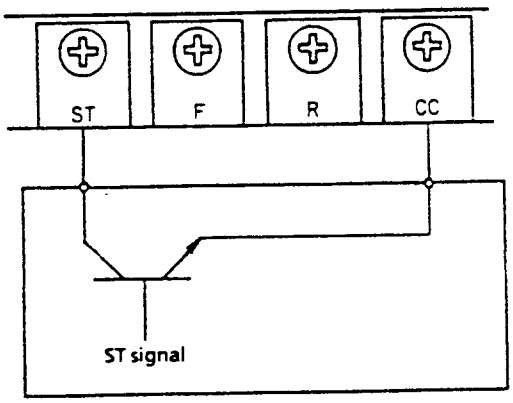


Figure 4.1 Example of ltransistorized output connected to the VF-A3 inverter's output terminals

4.2 Terminal Selection

Functions associated with the input and output terminals on the inverter's control circuit board can be selected via the operating panel by using the procedures described in this section.

4.2.1 Selection of input terminals [I.tb]

1) Seleciton of control terminals SS1, JOG/SS2, and AD2/SS3

Setting on I.tb	Function
0	SS2 and SS3 (for a 7-speed run)
1	JOG and SS3 (for jogging and 3-speed runs)
2	SS2 and AD2 (for acc./dec. 1,2 runs coupled with 3-speed runs)
3	JOG and AD2 (for jogging and acc./dec. 1,2 runs)

* For details of the procedure for selecting input terminals via the operating panel, refer to Section 3.1.1 (page 22). Select function number 8 for the terminal selection operation.

2) Table 4.1 below specifies the ON or OFF positions of control terminals SS1, JOG/SS2, and AD2/SS3, and shows their respective operating frequencies.

Table 4.1 Input terminal setting and corresponding operating frequency

Input terminal selection	Terminal			Selected operating frequency
	AD2/SS3	JOG/SS2	SS1	
0: SS2 SS3	OFF	OFF	OFF	Operating frequency set via terminals
	OFF	OFF	ON	1st speed operating frequency
	OFF	ON	OFF	2nd speed operating frequency
	OFF	ON	ON	3rd speed operating frequency
	ON	OFF	OFF	4th speed operating frequency
	ON	OFF	ON	5th speed operating frequency
	ON	ON	OFF	6th speed operating frequency
	ON	ON	ON	7th speed operating frequency
1: JOG SS3	OFF	OFF	OFF	Operating frequency set via terminals
	OFF	ON	OFF	Jogging run operating frequency
	OFF	OFF	ON	1st speed operating frequency
	ON	OFF	OFF	2nd speed operating frequency
	ON	OFF	ON	3rd speed operating frequency
2: SS2 AD2	ON/OFF	OFF	OFF	Operating frequency set via terminals
	ON/OFF	OFF	ON	1st speed operating frequency
	ON/OFF	ON	OFF	2nd speed operating frequency
	ON/OFF	ON	ON	3rd speed operating frequency
3: JOG AD2	ON/OFF	OFF	OFF	Operating frequency set via terminals
	ON/OFF	ON	OFF	Jogging run operating frequency
	ON/OFF	OFF	ON	1st speed operating frequency

4.2.2 Selection of output terminals [0.Eb]

1) Selection of output terminals RCH(UL) and LOW (LL)

Setting on 0.Eb	Function
0	LL and UL (for lower limit and uppper limit frequency signals)
1	LOW and UL (for low speed and upper limit frequency signals)
2	LL and RCH (for low frequency and speed reach signals)
3	LOW and RCH (for low speed and speed reach signals)

* For details of the setting procedure for selecting output terminals RCH and LOW via the operating panel, refer to Section 3.1.1 (page 22). Select function number 8 for the terminal selection operation.

2) When a pre-designated frequency has been reached during a run, signals are output at terminals RCH (UL) and LOW (LL) of the inverter's control circuit terminal block to indicate that the frequency has been reached. These signals are provided as open-collector outputs (at a maximum of 24Vdc and 50mAdc each).

The control end of the inverter uses these signals as 24Vdc input, either to a relay or to a programmable controller.

Example inverter terminal-to-relay connections for a speed reach signal are shown in Figure 4. 2, while Figure 4.3 shows reach signal's connections fro an inverter-to- programmable controller arrangement.

[Recommended relay:]

Mode MY1 manufactured by OMROM Co., with an operating coil rated at 24Vdc.

To protect your equipment, mount a surge suppresser (200V-1A) across each relay coil.

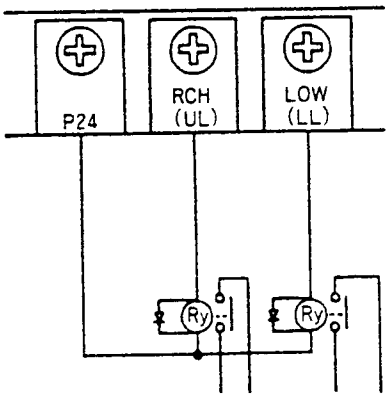
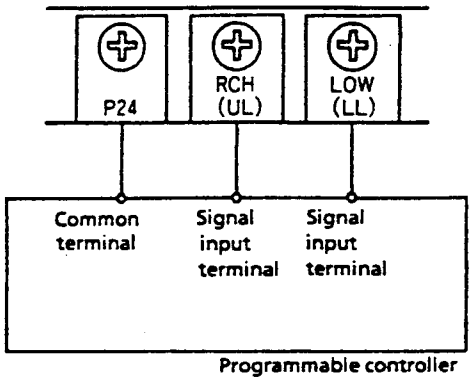


Figure 4.2 Example inverter-to-relay connections for reach signal detection



Figre 4.3 Example inverter-to-programmable controller connections for reach signal detection

* When an output frequency fluctuates in the vicinity of a frequency to be reached, the reach signal may alternately turn on and off because of the lack of hysteresis in the reach signal.

4.2.3 Upper and lower limit frequency signal outputs [UL, LL]

A reach signal is output when a pre-designated upper frequency or lower frequency is reached during a run. (For details of upper and lower frequency setting, refer to Section 3.10 on page 56).

Figre 4.4 shows the timing chart and output signals of an example operation.

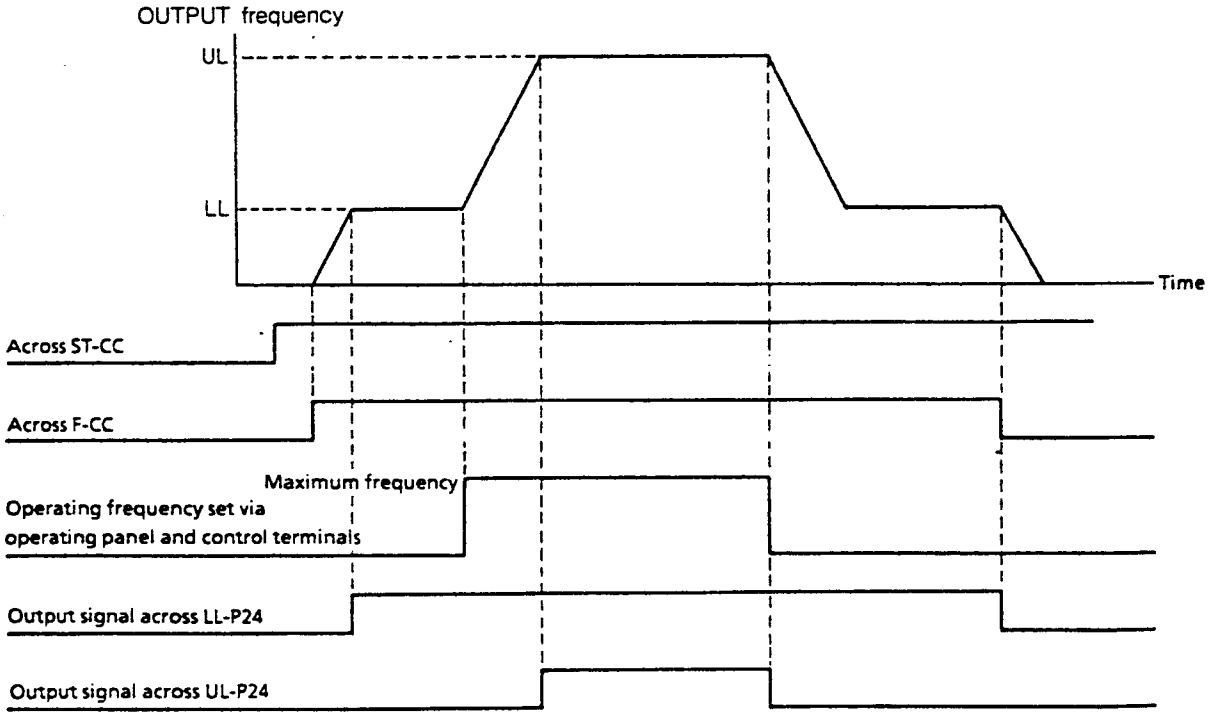


Figure 4.4 Example operation with upper and lower limit frequency signal outputs

* When the upper frequency (UL) or lower frequency (LL) is reached during a run , the reach signal may alternately turn on and off.

4.2.4 Low-speed and speed-reach signal outputs [LF, rCH, rrCH, FrCH]

When an output frequency reaches either a pre-designated low speed or a pre-designated frequency, a reach signal is output.

1) Low-speed signal output

   A low-speed signal output frequency [LF] can be set within a range of from 0 to maximum frequency (Hz).

2) Speed-reach signal output

   The speed-reach condition [rCH] can be set as follows:

Setting on rCH	Function
0	Outputs when acceleration or deceleration is completed
1	Outputs when a specified frequency is reached [FrCH].

The range of speed-reach detection can be set within a range of from 0Hz to maximum frequency.

The frequency for speed-reach specification [FrCH] can be set within a range of from 0 to maximum frequency (Hz).

* For details of the procedure for setting speed-reach detection via the operating panel, refer to Section 3.1.2 (page 23). Select function number 3 for the selection of limits.

3) Example operation with low-speed and speed-reach signals (Figure 4.5).

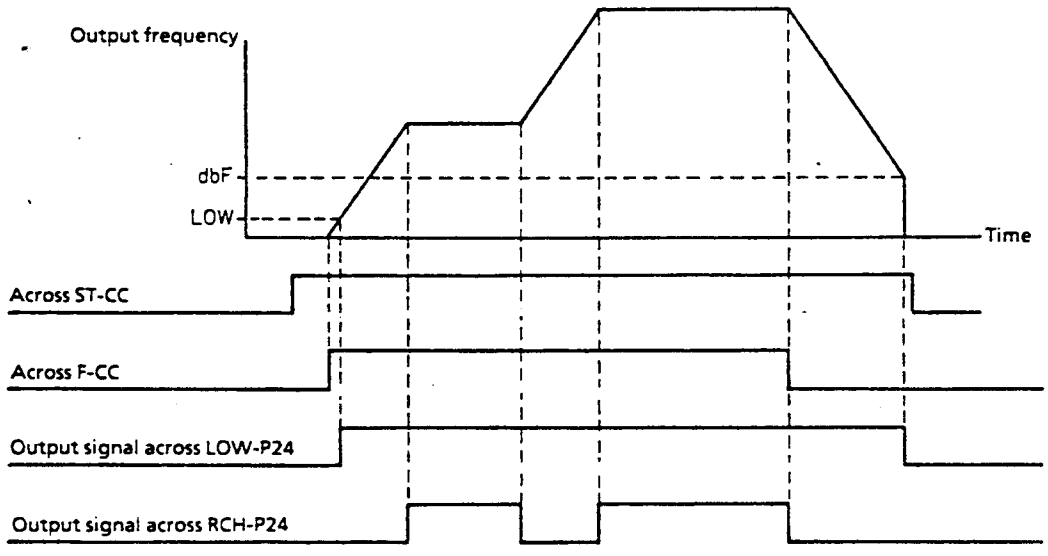


Figure 4.5 Example operation with low-speed and speed-reach signals

* The speed-reach signal is output when one of the speeds of a multispeed-run operation.
* When DC dissipation braking is applied during a decelerating stop period, the low-speed signal is turned off.

4.3 Meter Connection

You can connect a frequency meter and an ammeter.
Use either an ammeter rated at 1 mAdc (full scale), or a DC voltmeter rated at 7.5 Vdc-1 mA (full scale), or a rectifying AC voltmeter. For wiring connection see section 8.3 page 117).
Zero-adjust the frequency meter by turning its adjustment screw. Calibrate its scale with the FM control provided in the control area (see Fig. 3.7, 3.8).

* The FM terminal outputs PWM waveforms. When your system requires an analog output, please contact your Toshiba representative.

4.3.1 Connecting a frequency meter [FM]

You can connect a frequency meter across the inverter's FM-CC terminals (see Figure 3.8 for the locations of these terminals).

Calibrate the frequency meter's scale by using the following procedure:

[Operating procedure]

Example operation	Action
1) —	Adjustments should be made during a run. When a calibration is conducted with a power supply of 60Hz, the inverter should be run with 60Hz rating. 60.0
2) 2ND	2nd
3) MON	:FM
4) RUN	Monitor display indicates the output frequency.: 60.0
5) △ or ▽	Adust the frequency by pushing either the △ or ▽ key so that the frequency mater indicates 60Hz. The output frequency indication on the monitor display remains unchanged.
6) WRT	:60.0 ↔ :FM
7) MON	Returns to original frequency. 60.0

* You can interrupt your adjustment operation at any time by pushing the STOP key.

Figure 4.6 shows terminals to use for connecting a frequency meter to the inverter.

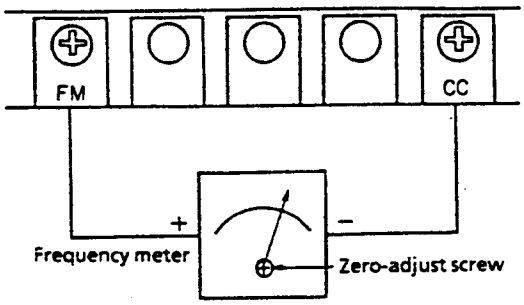


Figure 4.6 Terminals for connecting a frequency meter to the inverter

4.3.2 Ammeter connections [AM]

An ammeter can be connected across terminals AM-CC on teh control terminal block.
Calibrate the frequency meter's scale by using the following procedure:
[Operating procedure]

Example operation	Action
1) —	Adjustments should be done figure 4.7 shows terminals to use for connecting an ammeter to the inverter during a run. For a trial, you can run your inverter at 50Hz. 50.0
2) 2ND	2nd
3) MON	:FM
4) SHIFT	:AM
5) RUN	Monitor display indicates the output current value (%). :C 60
6) △ or ▽	Adjust the frequency by pushing either the △ or ▽ keys so that the ammeter indicates 60% of the activation level of electronic thermal. The output current indication on the monitor display remains unchanged.
7) WRT	:C 60 ↔ :AM
8) MON	Returns to original frequency. 50.0

* You can interrupt your adjustment operation at any time by pushing the STOP key.

Figure 4.7 shows terminals to use for connecting an ammeter to the inverter.

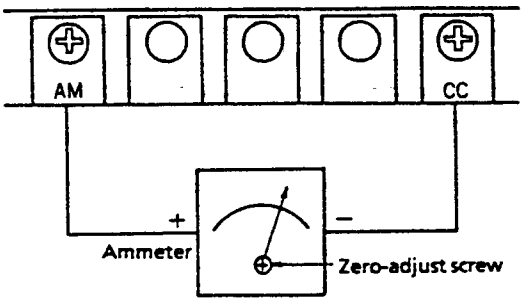


Figure 4.7 Terminals to use for connecting an ammeter to the niverter

* When a voltmeter of 7.5Vdc rating is used, set the upper limit of its scale to a maximum of 2.5 times the inverter's rating.
* Calibrate the ammeter's scale by using a frequency above 40Hz, preventing from occuring an incorrect value about the AM output voltage at low-frequency.

4.4 Fault-detection signal terminals

When any of the inverter's system protection features are activated and the inverter trips(see list of probable causes in Section 3.3.2 (page 31), the coded cause of the problem will be displayed on the monitor display and a fault-detected signal will be output. The VF-A3 inverter's three fault-detection terminals 8FLA, FLB, and FLC (see Figure 4.8 for their locations) are provided as a relay contact output (250Vac, 2A).

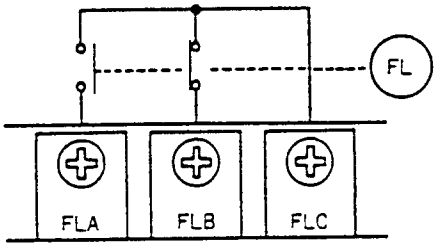


Figure 4.8 Fault-detection signal terminals.

4.5 Reset signal terminals

When the inverter trips due to an emergency stop or the activation of one or more of its protective functions (refer to the list of status monitor codes given in Table 3.3 of Section 3.3.2 (page 31)), you must first correct the cause of the fault, and then reset the inverter.

You can reset either via the inverter's operating panel or via an external signal.

* When the trip retention function is set at zero (0), you can reset the inverter after switching power off for at least 10 seconds (see Section 5.3.4 (page 95)) for details on the trip retention function).
* The inverter can not be reset till correcting the cause of the fault.

Correct the cause of the fault before attempting to reset the inverter for a restart. A forced restart without prior fault-correction measures could damage the inverter and connected devices.

4.5.1 Resetting the inverter via the operating panel

Use the following procedure to reset the tripped inverter:

[Operating procedure]

Example operation	Action	
1) —	Indicates the cause of the trip.	OP
2) CLR		Clr
3) WRT	Resets the trip retention state.	0.0

* After the write process has been completed, the display goes blank for an instant, then the original display (0.0) reappears.

4.5.2 Resetting with an external signal

Connect a resetting switch across terminals RST-CC, as shown in Figure 4.9. The monitor display indicates the sign [Clr] while the reset switch is turned on.

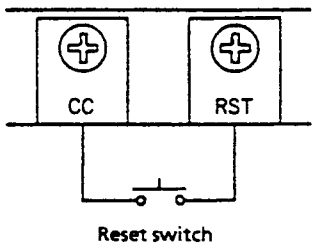


Figure 4.9 Connections for the inverter's reset switch

* After the write process has been completed, the display goes blank for an instant, then the original display (0.0) reappears.

CHAPTER 5 VF-A3 SPECIFICATIONS

This chapter will describe the following:

Standard specifications
Inverter models and their external dimensions
Protective functions
Electronic thermal function
Soft stall function
Retry function
Automatic restart function
Power control function for momeotary power failure

Specifications

5.1 Standard specifications

ITEM			STANDARD SPECIFICATIONS													
Voltage class			200 volts													
Applicable motor output (kW)			0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Rating	Model		VFA3–														
			2004P	2007P	2015P	2022P	2037P	2055P	2075P	2110P	2150P	2185P	2220P	2300P	2370P	2450P	2550P
	Rated capacity (kVA)		1.0	2.0	3.0	4.0	6.5	9.5	13	19	25	28	34	46	55	69	84
	Rated output current (A)		3.0	5.0	7.5	10.0	16.5	25	33	49	66	73	88	120	144	180	220
Input power	Voltage/ frequency	Main circuit	3-phase 200V/50Hz, 200 to 230V/60Hz, 200 to 220V −50Hz														
		Control circuit	Single phase 200V/50Hz, 200 to 230V/60Hz, 200 to 220V −50Hz														
	Permissible variations		Voltage ±10%, frequency ±5%														
Control	control method		Sinusoidal PWM control														
	Rated output voltage		3-phase, 200V to 230V (maximum voltage under no load)														
	Output voltage regulation		Voltage normally reduced 0% to 100%; for options setting to 0% to 120% of absolute regulating value														
	Output frequency		0.1Hz to 400Hz (0.1Hz to 80Hz setting when shipped); maximum frequency set to 30Hz to 400Hz														
	Frequency setting resolution		0.1Hz: Operating panel input; 0.03Hz: Analog input; 0.01Hz: Input through computer interface (against 60Hz)														
	Frequency accuracy		±0.5% (at 25°C ±10°C) against the maximum frequency														
	Volt./freq. characteristics		Either constant V/f or second-order nonlinearity mode (for variable torque) Base frequency adjustment (25Hz to 400Hz), torque boost adjustment (0% to 30%), start-up frequency adjustment (0Hz to 10Hz), selection of automatic torque boost														
	Overload current rating		150% for 2 minutes														
	Frequency setting signals		3k potentiometer (a 1kΩ to 10kΩ-rated potentiometer can be connected) 0Vdc to 10Vdc (input impedance: 30kΩ), 0Vdc to 5Vdc (15kΩ), 4mAdc to 20mAdc (250Ω)														
	Output frequency characteristics of IV terminal input signal		Can be set to an orbitary characteristic by setting 2 points.														
	Frequency jump		3-point setting; setting jump frequency and width														
	Upper/lower limit frequencies		Upper limit frequency: 0 to maximum frequency; lower limit frequency: 0 to upper limit frequency														
	PWM carrier frequency switching		Adjusted in the range of 500Hz to 3kHz														
	PI control		Proportional gain, integral gain, antihunting gain, temporary delay filter constant adjustment														
Operating functon	Acceleration/deceleration time		0.1 to 6000 seconds, switching of acceleration time 1 or 2, selection of S-shaped 1 or 2, selection of acceleration/deceleration patterns														
	Electric braking	Regeneration/ discharge braking	Built-in regenerative discharge circuit and resistor are provided.														
			Externally mounted regenerative discharge resistor (optional)														
		DC injection braking	Starting frequency adjustment (0Hz to 10Hz), braking voltage adjustment (0% to 20%), braking time adjustment (0 seconds to 5 seconds)														
	Forward or reverse run		Forward run when F-CC closed; reverse run when R-CC closed; reverse run when both F-CC and R-CC closed; coasting stop when ST-CC open; emergency stop by a command from operating panel.														
	Jogging run		Jogging run with 1a contact signal (retention) closed (adjustment range 0Hz to 20Hz)														
	Multispeed run		With the combinations of the close or open of circuits CC with any of the SS1, SS2, or SS3, set speed plus 7 speed levels can be selected.														
	Restart		When a prevetive function is activated, the system checks main circuit devices, and makes five attempts to restart (set at OFF when shipped).														
	Soft stall		Sustains a run in overload mode (set at OFF when shipped)														
	Automatic restart		Smoothly recovers a normal run of a coast-stopping motor.														
	Simplified patterns of operation		Allows setting of seven different patterns of automatic operation.														
Protection	Protective functions		Stall prevention, current limit, overcurrent, regenerative overvoltage, short-circuit at load, load-end ground fault, undervoltage, momentary power interrupt, power control for momentary power failure (about 100msec), electronic themal overload, armature overcurrent at start-up, load-end overcurrent at start-up, regenerative discharge resistor overcurrent or overload, fin overheat, and emergency stop														
	Electronic thermal characteristics		Standard motor/constant torque, VF motor switching, and electronic thermal stall prevention activating level adjustment														
	Reset		Resets when contact 1a is closed or through a command from the operating panel. Retention of tripped state and clear setting.														
Display	4-digit, 7-segment LEDs	Output frequency/ OFF	Frequency range 0.0Hz to 400Hz and OFF state														
		Warning indications	Mid-run warning, overvoltage limit warning, overload warning, power-end undervoltage warning, DC main circuit undervoltage warning, and setting error, EEPROM abnormality, RAM abnormality, ROM abnormality panel's key abnormality, and data transfer abnormality warnings														
		Fault indications	Overcurrent, overvoltage, load-end ground fault, overload, armature overcurrent at start-up, load-end overcurrent at start-up, regenerative discharge resistor overcurrent or overload, and fin overheat														
		Date and status	Inverter status (forward/reverse run, frequency set value, output current, etc.) and each set value														
		Free unit indication	An orbitary unit (revolution speed, linear velocity or the like) as well as output frequency can be displayed.														
		Number storage	A number is assigned to each inverter (for 0 to 31 inverters).														
	LED	Charging indicator	Main circuit capacitors charging indicator														
Output signals	Fault detection signal		Output of contact point 1c (250Vdc, 2A)														
	Low speed/reach signals		Open collector output (24Vdc, 50mA maximum)														
	Upper limit/lower limit frequency signals		Open collector output (24Vdc, 50mA maximum)														
	Frequncy meter output and ammeter output		Ammeter rated at 1mAdc at full scale, or voltmeter rated at 7.5Vdc, 1mA														
Enclosure			Closed type														
Cooling method			Self-cooled														
			Air-cooled														
Color			Munsell 5Y7/1														
Service conditions	Service environment		Indoor, altitude 1000m (3,300ft) maximum. Must not be exposed to direct sunlight, or subjected to corrosive or flammable or fluids.														
	Ambient temperature		From −10 to +40 C (up to 50 C when not enclosed in cabinet)														
	Relative humidity		90% maximum (no condensation allowed)														
	Vibration		Acceleration at 0.5G maximum (20Hz to 50Hz), amplitude at 0.1mm maximum (50Hz to 100Hz)														

Table 5.1 Standard specification (continued)

ITEM			STANDARD SPECIFICATIONS														
Voltage class			400 volts														
Applicable motor output (kW)			0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Rating	Model		VFA3-														
			4007P	4015P	4022P	4037P	4055P	4075P	4110P	4150P	4185P	4220P	4300P	4370P	4450P	4550P	4750P
	Rated capacity (kVA)		2.0	3.0	4.0	6.5	9.5	13	19	25	28	34	46	55	69	84	115
	Rated output current (A)		2.5	4.0	5(5.5)	8.5	13	17	25	33	37	44	60	72	90	110	144
Input power	Voltage/frequency	Main circuit	3-phase 380 to 440V/50Hz, 400 to 460V/60Hz														
		Control circuit	Single phase 380 to 440V/50Hz, 400 to 460V/60Hz														
	Permissible variations		Voltage ±10%, frequency ±5%														
Control	control method		Sinusoidal PWM control														
	Rated output voltage		3-phase, 380V to 460V (maximum voltage under no load)														
	Output voltage regulation		Voltage normally reduced 0% to 100%; for options setting to 0% to 120% of absolute regulating value														
	Output frequency		0.1Hz to 400Hz (0.1Hz to 80Hz setting when shipped); maximum frequency set to 30Hz to 400Hz														
	Frequency setting resolution		0.1Hz: Operating panel input; 0.03Hz: Analog input; 0.01Hz: Input through computer interface (against 60Hz														
	Frequency accuracy		±0.5% (at 25°C ±10°C) against the maximum frequency														
	Volt./freq. characteristics		Either constant V/f or second-order nonlinearity mode (for variable torque) Base frequency adjustment (25Hz to 400Hz), torque boost adjustment (0% to 30%), start-up frequenc adjustment (0Hz to 10Hz), selection of automatic torque boost														
	Overload current rating		150% for 2 minutes														
	Frequency setting signals		3k potentiometer (a 1kΩ to 10kΩ-rated potentiometer can be connected) 0Vdc to 10Vdc (input impedance: 30kΩ), 0Vdc to 5Vdc (15kΩ), 4mAdc to 20mAdc (250Ω)														
	Output frequency characteristics of IV terminal input signal		Can be set to an orbitary characteristic by setting 2 points.														
	Frequency jump		3-point setting; setting jump frequency and width														
	Upper/lower limit frequencies		Upper limit frequency: 0 to maximum frequency; lower limit frequency: 0 to upper limit frequency														
	PWM carrier frequency switching		Adjusted in the range of 500Hz to 3kHz														
	PI control		Proportional gain, integral gain, antihunting gain, temporary delay filter constant adjustment														
Operating functon	Acceleration/deceleration time		0.1 to 6000 seconds, switching of acceleration time 1 or 2, selection of S-shaped 1 or 2, selection c acceleration/deceleration patterns														
	Electric braking	Regeneration/discharge braking	Externally mounted regenerative discharge resistor (optional)									Externally mounted discharge unit (optional)					
		DC injection braking	Starting frequency adjustment (0Hz to 10Hz), braking voltage adjustment (0% to 20%), braking time adjustmer (0 seconds to 5 seconds)														
	Forward or reverse run		Forward run when F-CC closed; reverse run when R-CC closed; reverse run when both F-CC and R-CC closec coasting stop when ST-CC open; emergency stop by a command from operating panel.														
	Jogging run		Jogging run with 1a contact signal (retention) closed (adjustment range 0Hz to 20Hz)														
	Multispeed run		With the combinations of the close or open of circuits CC with any of the SS1, SS2, or SS3, set speed plu 7 speed levels can be selected.														
	Restart		When a prevetive function is activated, the system checks main circuit devices, and makes five attempts t restart (set at OFF when shipped).														
	Soft stall		Sustains a run in overload mode (set at OFF when shipped)														
	Automatic restart		Smoothly recovers a normal run of a coast-stopping motor.														
	Simplified patterns of operation		Allows setting of seven different patterns of automatic operation.														
Protection	Protective functions		Stall prevention, current limit, overcurrent, regenerative overvoltage, load-end ground fault (detectior undervoltage, momentary power interrupt, power control for momentary power failure (about 100msec electronic thermal overload, armature overcurrent at start-up, load-end overcurrent at start-up, regenerati discharge resistor overcurrent or overload, fin overheat, and emergency stop														
	Electronic thermal characteristics		Standard motor/constant torque, VF motor switching, and electronic thermal stall prevention activating lev adjustment														
	Reset		Resets when contact 1a is closed or through a command from the operating panel. Retention of tripped sta and clear setting.														
Display	4-digit, 7-segment LEDs	Output frequency/OFF	Frequency range 0.0Hz to 400Hz and OFF state														
		Warning indications	Mid-run warning, overvoltage limit warning, overload warning, power-end undervoltage warning, DC ma circuit undervoltage warning, and setting error, EEPROM abnormality, RAM abnormality, ROM abnormali panel's key abnormality, and data transfer abnormality warnings														
		Fault indications	Overcurrent, overvoltage, load-end ground fault, overload, armature overcurrent at start-up, load-end overcu rent at start-up, regenerative discharge resistor overcurrent or overload, and fin overheat														
		Date and status	Inverter status (forward/reverse run, frequency set value, output current, etc.) and each set value														
		Free unit indication	An orbitary unit (revolution speed, linear velocity or the like) as well as output frequency can be displaye														
		Number storage	A number is assigned to each inverter (for 0 to 31 inverters).														
	LED	Charging indicator	Main circuit capacitors charging indicator														
Output signals	Fault detection signal		Output of contact point 1c (250Vdc, 2A)														
	Low speed/reach signals		Open collector output (24Vdc, 50mA maximum)														
	Upper limit/lower limit frequency signals		Open collector output (24Vdc, 50mA maximum)														
	Frequncy meter output and ammeter output		Ammeter rated at 1mAdc at full scale, or voltmeter rated at 7.5Vdc, 1mA														
Enclosure			Closed type														
Cooling method			Self-cooled									Air-cooled					
Color			Munsell 5Y7/1														
Service conditions	Service environment		Indoor, altitude 1000m (3,300ft) maximum. Must not be exposed to direct sunlight, or subjected to corrosi or flammable or fluids.														
	Ambient temperature		From −10° to +40°C (up to 50°C when not enclosed in cabinet)														
	Relative humidity		90% maximum (no condensation allowed)														

5.2 External dimensions

Toshiba's VF-A3 transistor inverter is available in 17 models, depending on the motor output required for your system's requirements.

17 models ranging from motor output capacities of 0.4kW to 15kW are listed in Table 5.2.

Procedures for equipment installation therefore involve different dimensions and weights, and calls for due attention to these differences.

Table 5.2 External dimensions of nine models of the VF-A3

Voltage class	Applicable motor output (kW)	Inverter model	Dimensions(mm)					Outline Drawing	Approximate weight (kg)
			W	H	D	A	B		
200V	0.4	VFA3-2004P	220	300	125	200	280	A	5
	0.75	VFA3-2007P	220	300	125	200	280		5
	1.5	VFA3-2015P	220	300	165	200	280		6
	2.2	VFA3-2022P	220	300	165	200	280		7
	3.7	VFA3-2037P	220	300	165	200	280		7
	5.5	VFA3-2055P	253	400	204	230	380	B	12
	7.5	VFA3-2075P	253	400	204	230	380		12
	11	VFA3-2110P	253	460	269	230	440		19
	15	VFA3-2150P	253	460	269	230	440		20
	18.5	VFA3-2185P	322	570	240	230	550	C	25
	22	VFA3-2220P	322	570	240	230	550		25
	30	VFA3-2300P	375	570	240	230	550		32
	37	VFA3-2370P	375	680	240	230	660		36
	45	VFA3-2450P	390	870	260	250	850		64
	55	VFA3-2550P	390	870	260	250	850		65
400V	0.75	VFA3-4007P	253	350	190	230	330	B	11
	1.5	VFA3-4015P	253	350	190	230	330		11
	2.2	VFA3-4022P	253	350	190	230	330		11
	3.7	VFA3-4037P	253	350	190	230	330		11
	5.5	VFA3-4055P	253	400	204	230	380		13
	7.5	VFA3-4075P	253	400	204	230	380		13
	11	VFA3-4110P	253	460	269	230	440		19
	15	VFA3-4150P	253	460	269	230	440		20
	18.5	VFA3-4185P	322	570	240	230	550	C	27
	22	VFA3-4220P	322	570	240	230	550		27
	30	VFA3-4300P	375	570	240	230	550		34
	37	VFA3-4370P	375	680	240	230	660		38
	45	VFA3-4450P	375	680	240	230	660		39
	55	VFA3-4550P	375	680	260	230	660		40
	75	VFA3-4750P	390	870	260	250	850		65

* By using an special mounting attachment, the cooling fins of the VF-A3 inverter can be exposed, thus making it readily installable in a fully enclosed cabinet.

Screw sizes of the main circuit and control circuit are as follows:

Applicable motor output	Main circuit screws size						Control circuit screws size
	200V class			400V class			
	Control circuit power supply terminal	Granding terminal	Other terminal	Control power Output for operation terminal	Granding terminal	Other terminal	
0.4~3.7kW	M4	M4	M4	M4	M5	M4	M3
5.5kW	M4	M5	M4	M4	M5	M4	M3
7.5/11kW	M4	M5	M5	M4	M5	M4	M3
15kW	M4	M5	M6	M4	M5	M5	M3
18.5/22kW	M4	M5	M8	M4	M5	M6	M3
30kW	M4	M5	M8	M4	M5	M8	M3
37kW	M4	M5	M10	M4	M5	M8	M3
45kW	M4	M5	M10	M4	M5	M8	M3
55kW	M4	M5	M10	M4	M5	M8	M3
75kW				M4	M5	M10	M3

Figure 5.1~5.3 show outline drawings of the VF-A3 inverter.

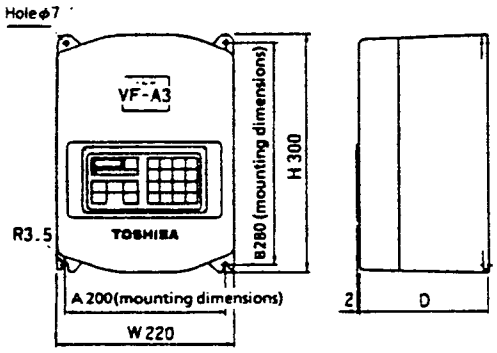


Figure 5.1 Outline drawing (A)

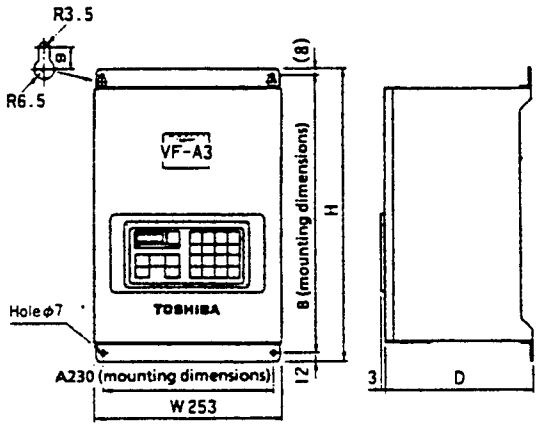


Figure 5.2 Outline drawing (B)

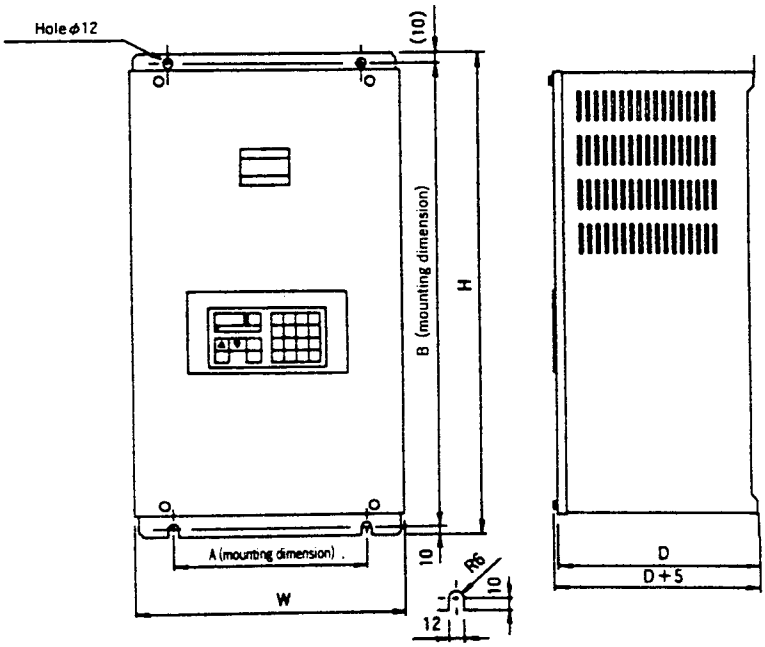


Fig5.3 Outline drawing (C)

5.3 Protective functions

The VF-A3 inverter incorporates a wide range of protective functions that can be set to match the specifications of any motor, load machine, or system characteristics.

5.3.1 Electronic thermal function [tHr]

This function of the VF-A3 inverter allows the operator to adjust the activationleve [tHr] of the electronic thermal function to the rating and characteristics of the connected motor. The activation level [tHr] can be set within a range of from 10% to 100% of the rated output current.

* For details on the setting procedure, refer to Section 3.1.1 (page 22). The function number is 4.

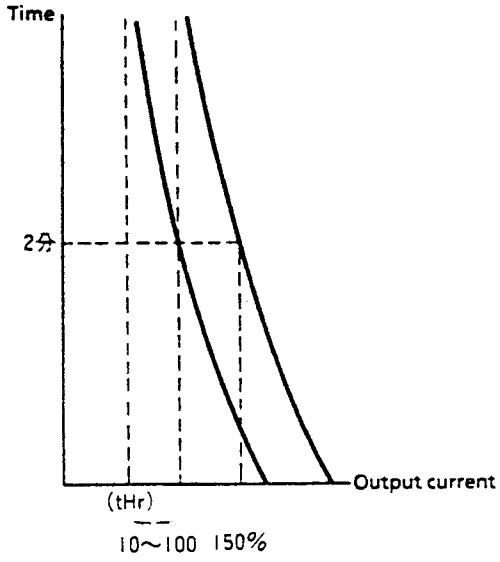


Figure 5.3 Electronic thermal function activation characteristics

* The monitor display indicates the value of output current to match with the set activation level of the electoric thermal function.
  The value is displayed on the basis that 100% correspond to

$$\text{Ratted output current} \times \frac{\text{tHr setting value}}{100}$$

5.3.2 Stall prevention function [StL]

The activation level of the stall prevention function can be adjusted wihin a range of from 10% to 150% of the rated output current.

* For details on the setting procedure, refer to Section 3.1.1 (page 22). The function number is 4.

5.3.3 Selection of electronic thermal characteristics [SEL4]

The optimum electronic thermal characteristics can be selected by switching either to those for standard motors or variable frequency (VF) motors, and also by adding the soft stall function.

Setting of SEL4	Function
0	For standard motors, without soft stall function
1	For standard motors, with soft stall function
2	For VF motors, without soft stall function
3	For VF motors, with soft stall function

* For details on the setting procedure, refer to Section 3.1.1 (page 22). This function number is 4.

Soft stall function:

When an inverter overload is detected, the program will continue to run without an inverter-halt. This is made possible by having the inverter's output frequency decreased automatically to a frequency that balances the load current, before the phase-in of an overload trip mode. This process can be applied to a fan, blower, or any load device whose speed exhibits variable torque characteristics when the load current diminishes against any dropping run speed.

Do not use the inverter's soft stall function for any constant-torque characteristic load (where the load current remains fixed regardless of motor speed).

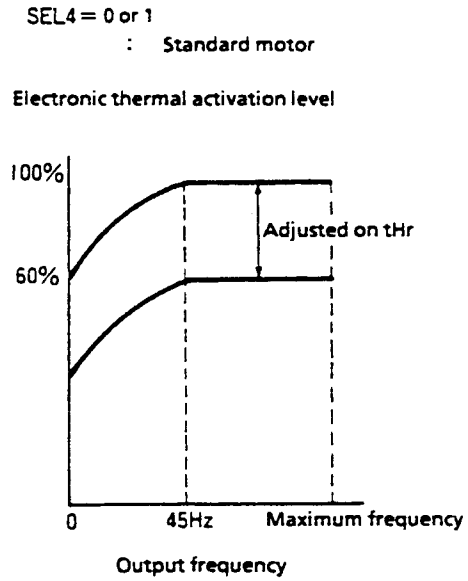


Figure 5.4 Electronic thermal activation characteristic for standard motors

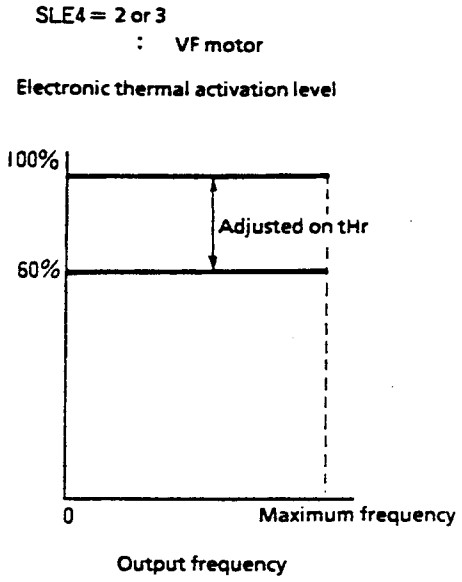


Figure 5.5 Electronic thermal activation characteristic for VF motors

* The electronic thermal activation is adjusted to the invertr's rated output current.

5.3.4 Retention of system status [tr.CL]

When the inverter's system protection features have been activated and the inverter has tripped, the system data that was in effect when the trip occurred will be stored in the inverter's memory area even if the power switch has been turned off.

Setting on tr.CL	Function
0	When power is turned off, retained system data is cleared (standard) (Subsequent power on releases the tripped state. Consequently, the input of an operation signal re-activates the system.)
1	Stores the cause of faults when the trip occurred after power off (The cause of faults is displayed after power is reconnected to reset enables the operator to restart)

* For the setting procedure, refer to Section 3.1.1 (page 22). This function number is 9.
* For datails to reset at trip, refer to Section 4.5 (page 86).
* To store the cause of fault is allowed and to store the triped conditions is not allowed by setting the retention of system status (tr.CL = 1).

5.3.5 Restart try function [rtry]

When any of the inverter's protective functions are activated and the inverter has tripped, the inverter's restart try function can be activated.

Setting on rtry	Function
0	OFF (When the inverter has tripped, the system retains the tripped conditions and does not try to restart automatically.)
1	ON (If the inverter as tripped under the following conditions, it will try to restart itself automatically.)

* For the setting procedure of this funciton, refer to Section 3.1.1 (page 22). This function number is 9.

When you have selected the retry function, the inverter automatically will try to restart after power restoration in case of an instantaneous power interrupt, or following any failure caused by an overcurrent, overvoltage, or overload.

Table 5.3 shows the causes of inverter faults and the retry processes.

Table 5.3 Causes of faults and retry processes

Cause of fault	Retry process	Restart failure conditions
Instantaneous power interupt Overcurrent Overvoltage Overload	Tries to restart 5 times in succession. 1st restart: 1 second after problem occurs 2nd restart: 2 seconds after initial restart try 3rd restart: 4 seconds after 2nd restart try 4th restart: 8 seconds after 3rd restarty try 5th restart: 16 seconds after 4th restart try	In case failure is caused by any condition other than an instantaneous power interrupt, overcurrent, overvoltge, or overload occurs in a retry process.

* No restart is tried when any of the following messages is displayed on the inverter's monitor display:
  - OCA : Overcurrent (armature short-circuit at start-up)
  - OCL : Overcurrent (load end short-circuit at start-up)
  - OCr : Overcurent (overcurrent through the regenerative discharge resistor)
  - EF : Ground fault
  - E : Emergency stop
  - EEP : EEPROM abnormally
  - Err.2 : Main RAM abnormally
  - Err.3 : Main ROM abnormally
* While opeparing for a restart, this function causes the faul code and "0.0" to be displayed alternately on the monitor display.
* Fault-detection signals are not output during the inverter's restart process.
* If the cause of the failure has not been corrected, the intervals before each restart try indicated above will be prolonged.
* No restart is tired during the retention of system staturs (tr.CL = 1) is selected.

Before using the inverter's restart try function, check to be certaing that the auto-restart procedure will not damege or otherwise cause problems for the load machine or system when the inverter's automatic retry operations are being executed.
If the load exhibits an extremely large moment of inertia (GD^2), automatic restart using the procedure described above may not work.

5.3.6 Automatic restart funciton (after instantaneous power interruption [Ar-St]

When power to theinverter has been restored following an instantaneous power interruption while the inverter was being operated by an external signal, or when system operation is switched from a commercial bypass run to the inverter run, activation of the inverter's automatic restart function will cause the inverter to ouput a frequency corresponding to the motor's free-run speed. This process assures a smooth restart of a free-running motor.

Setting on Ar-St	Function
0	OFF (Does not activate the automatic restart function).
1	ON (Activates the automatic restart function.)

* For the setting procedure for this function, refer to Seciton 3.1.1 (page 22). This function number is 9.

* Automatic restart procedure, while the inverter was being operated by the panel, depends on the status of panel control LED as follows:

"PANEL CONTROL" LED blinks ··· Pushing the RUN key causes the inverter to restart after power to inverter has been restored. When main power (L1(R), L2(S), L3(T), is interrupted, it is not until main power is restored that the inverter is restarted.

"PANEL CONTROL" LED is turned off ····· After a restoration of power, changing to turned panele operation mode, and pushig the RUN key causes the inverter to start.

Note) In the external signal operation, if you want to operate forward/reverse run via switching of F or R terminal, avoid using the automatic restart function. The inverter may trip because of over current of overvoltage when the instantaneous power interruption occures during the operation of forward/reverse run.

* An automatic restart function is adjusted below 80Hz in the maximum frequency. If you want to use this function above 80Hz, contact your Toshiba representive for readjustment.

5.3.7 Power control function for momentary power failure. [Uu.C]

When the instantaneous power interruption occures, this function is that the motor continues to run using the regenerative energy that the motor have run.

Use this function with the automatic restart function can prevent the motor from being interrupted by an inverter and loads.

- If you want to work this function, after setting jumper JP3 which are located in the inverter's control board, set the parameter Uu.C.

	JP3	Parameter Uu.C	Function
1		0	Without power control function for momentary power failure
2		1	With power control funciton for momentary power

* Jumper JP3 must be switched while charge lamp is turned off.
* This function activates within approxmate 100 msec.

CHAPTER 6 SUMMARY OF SETTINGS AND ADJUSTMENTS

This chapter describes the following:

Settings and adjustments for each inverter funciton Displayed messages adn data

CHAPTER 6

Summary of Settings and Adjustments

This chapter gives a brief summary of the functions and displays explained in the preceding chapters.

(1) First functions and second functions

TABLE 3.1 (page 17) lists the allowable ranges of adjustment data of the inverter's first functions and the second functions as well as the settings made when the inverter was shipped from the factory.

* The inverter's standard setting mode (tYP) allows you to adjust the basic pattern (general purpose 50Hz, general purpose 60Hz, and standard settings when See Section 3.4 (page 34).
* You must bring the inverter to a complete halt before you attempt to adjust the standard setting mode (tYP) and maximum frequency (FH)
* All of the inverter's other functions can be adjusted while the inverter is being operated.

(2) Meter calibration

You can adjust the scales of any frequency meter or ammeter that have been connected to the inverter. See Section 4.3 (page 84).

There is no need to connect any external rheostats when making meter calibrations.

(3) Jumpers

The functions of inverter jumpers JP1 and JP2 are as follows:

Table 6.1 (1) Functions of jumpers JP1 and JP2

Jumper	Symbol	Function	Left side	Right side	Setting when shipped
JP1	I/V	Switching the types of frequency setting signals input to terminal IV	0 to 20mAdc or 4 to 20mAdc; Internal impedance 250Ω	0 to 5Vdc; internal impedance 15kΩ	V end (right side)
JP2	10V/5V	Switching of the types of frequency setting signals to be input to terminal RR	0 to 5Vdc across terminals RR; internal impedance 15kΩ	0 to 10Vdc across terminals RR; internal impedance 30kΩ	10V end (left side)

* JP1 and JP2 jumpers can be switched with the control power on.

→See Sections 3.9.1 (page 52)

The function of jumper JP3 are as follows:

Table 6.1 (2) Function of jumper JP3

Jumper	Symbol	Function	Down side	Up side	Setting when shipped
JP3	ON/OFF	Swithing the power control function for momentary power failure (To alter the paramer-ter is required)	Without the power control function for momentary power failure (UU.C = 0)	With the power control fuction for momentary power failure (UU.C = 1)	OFF side (downside)

* Jumper JP3 must be switched while charge lamp is turned off. →See Sections 5.3.6

(4) Terminal inputs and actions

The actions about operating signals can be summarized as follows:

The inverter's 7-speed run functions is modified to a 3-speed run when it is incorporated with a jogging run or with acceleration/deceleration 1 and 2 runs. In such a case, if you want to use a combined 7-speed run, employ an optional system.

→See Sections 3.8.2 (page 47),
3.11.2 (page 54),
and 3.12 (page 56)

Table 6.2(1) Terminal inputs and actions (1)

Terminal				Action
ST	JOG	F	R	
OFF	ON/OFF	ON/OFF	ON/OFF	Output off; coasting stop
ON	OFF	OFF	OFF	Stop
ON	OFF	OFF	ON	Reverse rotation
ON	OFF	ON	OFF	Forward rotation
ON	OFF	ON	ON	Reverse rotation
ON	ON	OFF	OFF	Jogging run
ON	ON	OFF	ON	Reverse jogging run
ON	ON	ON	OFF	Forward jogging run
ON	ON	ON	ON	Reverse jogging run

Table 6.2(1) Terminal inputs and actions (2)

Input Terminal selection	Terminal			Selected operating frequency
	AD2/SS3	JOG/SS2	SS1	
0: SS2 SS3	OFF	OFF	OFF	Operating frequency set via terminals
	OFF	OFF	ON	1st speed operating frequency
	OFF	ON	OFF	2nd speed operating frequency
	OFF	ON	ON	3rd speed operating frequency
	ON	OFF	OFF	4th speed operating frequency
	ON	OFF	ON	5th speed operating frequency
	ON	ON	OFF	6th speed operating frequency
	ON	ON	ON	7th speed operating frequency
1: JOG SS3	OFF	OFF	OFF	Operating frequency set via terminals
	OFF	ON	OFF	Jogging run operating frequency
	OFF	OFF	ON	1st speed operating frequency
	ON	OFF	OFF	2nd speed operating frequency
	ON	OFF	ON	3rd speed operating frequency
2: SS2 AD2	ON/OFF	OFF	OFF	Operating frequency set via terminals
	ON/OFF	OFF	ON	1st speed operating frequency
	ON/OFF	ON	OFF	2nd speed operating frequency
	ON/OFF	ON	ON	3rd speed operating frequency
3: JOG AD2	ON/OFF	OFF	OFF	Operating frequency set via terminals
	ON/OFF	ON	OFF	Jogging run operating frequency
	ON/OFF	OFF	ON	1st speed operating frequency

(5) LED display

The LED display funciton of the inverter's monitor display can be summarized as follows:

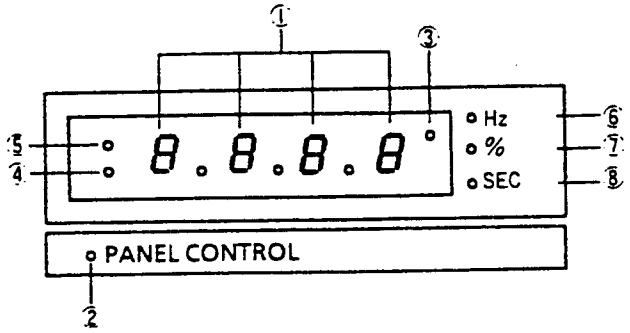


Figure 6.1 LEDs used for the inverter's monitor display

Table 6.3 LEDs used for the inverter's monitor display

Item	Name	Function
①	Monitor display	7-segment, 4-column LED Displays frequency,title, data, etc.
②	Panel control LED	When panel control is selected by pushing the MODE key, the LED lights.
③	Superior mode display LED	When teh command mode is set to the host command input, or when the patterned mode is set to the host command imput, the LED lights
④ ⑤	Monitor display LED	(i) When an operating frequency (or universal unit display) is displayed, ○ ○ (turned off): Normally turned off. ● ○ (⑤ is lit): this LED lights during a patternedrun. (ii) Displays other than operating frequency display: ● (④ and ⑤ are lit): Lit when making settings via the ● inverter's operating panel. ● (⑤ is lit): Lit when the change-settings function is ○ disabled. (turned off): Normally turned off.
⑥	Hz display	Displays the unit of the number currently shown on the monitor display. When the monitor displays any unit other than Hz and %, no LED will be lit.
⑦	% display	
⑧	Time display in seconds	

* When settings are disabled, LEDs ② and ③ in addition to ④ and ⑤ will be lit.

(6) Alphanumerical display

The alphanumerics used for the inverter's monitor display can be summarized as follows:

Table 6.4 Alphanumerics used for the monitor display

Numeric	LED display
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Character	LED display
A	A
b	b
c	c
d	d
E	E
F	F
G	G
H	H
I	I
J	J
L	L
M	M
n	n
O	0 or o
P	P
r	r
s	S
t	t
u	U or u
v	u
y	y
-	-

CHAPTER 7 OPTIONAL UNITS

This chapter describes the following units.

Externally installed options:

Input reactor

Radio noise reduction filter

Motor noise reduction reactor

Regenerative discharge resistor

Regenerative discharge unit

Operating board

External operating panel

Programming I/F kit

Applied control unit

Built-in options:

Multi-option printed wiring board

Output voltage regulator

Cooling fin structure

CHAPTER 7

Optional Units

The selection on the VF-A3 inverter's optional units include those that are mounted externally and those that can be built in, as per your request.

7.1 Options for exernal installation

The VF-A3 inverter can be connected with the following externally installed options: input reactor, radio noise reduction filter, motor noise reduction reactor, regenerative discharge resistor/regenerative discharge unit, operating board, external operating panel, stand-alone programmer, and applied control units. These external options are listed in Table 7.1.

Table 7.1 Optional units for external installation

Classification	Item		
External installation type	Input reactor	Model	PFL 2012 to 2100,4012 to 4050
	Motor noise reduction filter	Model	NRL 2005 to 2083, 4005 to 4033
	Radio noise reduction filter	Model	HF 3005A-Z to 3080A-Z, 3010C-Z to 3040C-Z
	Regenerative discharge resistor	Model	PBR3-2055, 2075,4037 to 4075
	Regenerative discharge unit	Model	PBR3-2110,2150,4110,4150
	Operating board	Model	CBV-7B2 or CBV-CE
	External operating panel	Model	PANEL-KIT * 1M/3M/5M
	Programming I/F kit	Model	(Future option)
	Applied control units	Model	EX series and AP series

These options are usually used for the following reaseons:

1) Input reacators

These devices improve the power supply power factor and suppress line surges. They are also used when the inverter is connected directly to a large capacity power supply (above 1000kVA), or when thyristor equipment, an arc furnace, any other powerful distorition-generating source and/or a large capacity inverter are connected to the same power distribution system.

2) Radio noise reduction filters

Used when there is interference caused by a radio or equivalent device being installed near the inverter.

3) Motor noise reduction reactor

Used to reduce noise when a motor is operated with the inverter. This device reduces the acoustic noise of the motor by approximately 2 to several dB(A).
(Note that this reactor itself generates a small extent of electromagnetic noise.)

4) Regenerative discharge resistor/regenerative discharge unit

Use either of these devices when you want to perform a sudden deceleration of the motor or stop it, or when you want to boost the braking torque during deceleration of a large-inertia load (models of 200V,3.7kW and smaller are equipped with this unit buil-in).

5) Operating board

Used when the inverter is operated from a remote location. This unit is equipped with built-in frequency meter, frequency setter and on/off push button (model CBV-7B2). It also includes an operating board equipped with a run/stop switch for remote operation of the inverter (model CBV-CE)

6) External operating panel

Used when the inverter's operating panel is detached and used as an external operating panel (1 meter, 3 meters and 5 meters cables of this panel are provided).

7) Programming I/F kit (future option)

Connecting the lap top computer (ex. T-3100) to the inverter with RS232C, setting and monitoring all parameters or past events of faults, run-stop operating control can be done.

8) Applied control units

Toshiba's EX series general purpose programmable controllers, as well its AP series of applied control units are especially designed to use the VF-A3 inverter's wide range of options.

7.2 Built-in options

Multi-option printed wiring board, output voltage regulator, and heat-fin attachment are provided as built-in options for the VF-A3 inverter.
Table 7.2 lists the built-in options for the VF-A3 inverter.

Table 7.2 Built-in type options

Classification	Item			
Built-in type	Multi-option printed wiring board	Computer interface	Model	VF3X-0887B
		BCD code input/12 bit binary input function		
		Speed feedback controller		
		Output for line/inverter switching		
		Overload warning output		
		Analog output		
		Pulse input		
		7-speed run and acc./dec. 1 and 2 runs simultaneous operation		
		96 times frequency signal output		
	Output voltage regulator		Model	Order
	Cooling fin structure		Model	Order

1) Multi-option printed wiring board.

A optional printed wiring board is equipped with built-in following functions.

a) Computer interface

A link with a host computer can be established by using the RS-232C interface, enabling operation and adjustments to be made from the host computer, as well as monitoring of inverter status.

b) BCD code input/12 bit binary input

Operating frequencies can be set with a 3-column BCD code or a 12-bit binary input.

c) Speed feedback control

Enables speed feedback control by use of the feedback signals from TG (generator for Speedmeter) and PG (pulse generator). Its control pricision is approximately 0.5% at the maximum.

d) Output for line/inverter switching

ON and OFF control signals (open collector) of contactor which are used for switching between the commercial run and the inverter's run are output.

e) Overload warning output

A digital frequency meter displays "L" (overload warning) to inform the inverter's output overloading. To combine with the putout signals (open collector) externally.

f) Analog output

Analog signals of current and frequencies can be output.

g) Pulse input

The pulse input 16 times as many as the inverter's set frequency enable you to set frequency.

h) 7-speed run and acc./dec. 1 and 2 runs simultaneouts operaiton

The inverter's 7-speed run function (8-speed run including the set frequency via the inverter' s operating panel) can be incorporated with a jogging run or with acceletion./deceleration. 1 and 2 runs.

i) 96 times frequency signal output

The pulse 96 times as many as the inverter's output frequency can be output. You can use it in order to check the inverter's output frequency.

2) Cooling fin structure

By mounting an optional attachement, the inverter's fin can be exposed to air flow for improved cooling. As a result, the inverter can be housed in a fully enclosed cabinet.

3) Output voltage regulator

An absolute value of output voltage can be set. When the inverter is moved to other district where a different input voltage from before is used, to readjust V/f characteristic and to change the motor's rated voltage is unnecessary.

CHAPTER 8 WRITING PRECAUTIONS

This chapter describes the following:

Installing the inverter and its operating environment:

Main circuit connections
Wiring supplies
Control signal circuit witing

CHAPTER 8

Wiring Precautions

8.1 Installation site and operating environment

Operating environment: Indoors

Do not install the inverter in locations subject to high temperatures or humidity, or where the air contains high levels of dust or metallic particles. Select a well ventilated location for installing the inverter to ensure that it receives sufficient amounts of cooling air.

Operating temperature:

From −10°C to +40°C (50°C without cover)

Relative humidity:

90% maximum; no condensation

Altitude:

1,000 meters (3,300 ft) maximum

Vibration:

Acceleration at 0.5G max. (20 to 50Hz)

Amplitude at 0.1mm max. (50 to 100Hz)

* See Figure 1.1. (page2) for a diagram showing minimal access and ventilation clearances necessary around the inverter when choosing an installation site.

8.2 Main circuit connections

8.2.1 Power supply to the inverter

Mount a molded-case circuit breaker (MCCB), an electromagnetic contactor, an input reactor, and a radio noise reduction filter between the input power supply and the inverter.

1) Molded-case circuit breaker

Install a molded-case circuit breaker at the power supply end to protect the invertere's circuits.

2) Magnetic contactor

① Connect a magnetic contactor (MC) at the inverter's power supply end. To prevent unwanted restarts after a power supply interruption, a trip of the overload relay(Th-Ry), or the activation of the inverter's protective circuit, connect the control power supply to the primary end of the magnetic contactor (MC).

② To cause an MC trip when the inverter's protective circuit, connect the contact points of the inverter's built-in fault detection FL to the operating circuit of the primary end of the magnetic contactor (MC).

③ The inverter can be operated without installing an electromagnetic contactor. In such a case, configure the system so that the primary circuit is opened via the MCCB (with a trip coil) any of the inverter's protective circuits are activated.

* When you use a regenerative discharge resistor/regenerative discharge unit, install a magnetic contactor (MC) or a molded-case circuit breaker (MCCB) equipped with a trip coil on the inverter's power supply end. This is neccessary to allow the power supply circuit to open when the built-in fault detection relay (FL) or an externally istalled overload relay (THRY) are opened.

④ When you perform an operation that has frequent starts and stops, avoid using the magnetic contactor to start and stop the inverter. Instead, use the terminals F (or R) and CC for the switching the inverter on and off.

⑤ Connect a surge suppressor to the excitation coil of the magnetic contactor (MC).

* When a power factor improvement capacitor is attached to the power supply, either disconnect it or apply necessary means to reduce harmonic distortions.

3) Input reactors (optional for external installation)

Used when improving the input power supply factor, and for suppressing harmonic currents or line surges. Input reactors are also used when the inverter is connected directly to a large capacity power supply (above 500kVA), or when thyristor equipment, an arc furnace, any other powerful distortion-generating source, and/or a large capacity inverter are connected to the same power distribution system. Select reactors that match your inverter's ratings.

4) Radio noise-reduction filter(optional for external installation)

Use this device when a radio or a similar electronic device located nearby is affected by signal interference from the inverter.

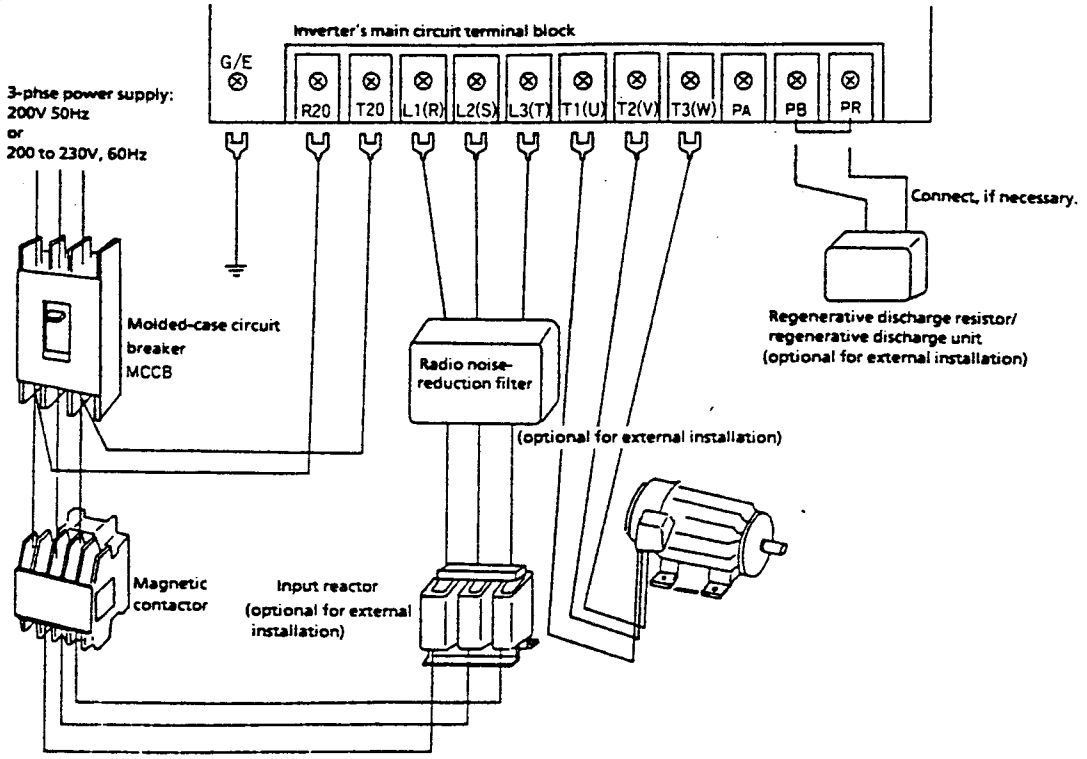


Figure 8.1 Terminal connections for the main circuit components (200V class)

Figure 8.1 shows the wiring connections for the inverter's main circuit.

8.2.2 Motor to the inverter to a ground terminal

To connect a motor and the inverter plus link them to a ground terminal, use the following procedure.

1) Connect terminals T1(U), T2(V) and T3(W) of the inverter's main circuit terminal block to terminals T1(U), T2(V), and T3(W) of the motor.
2) Connect a ground line to terminal G/E or the inverter. The ground line should meet the class specifications required of your system's configurations.
3) When using a motor with a rating smaller than the range of electronic thermal activation level, or when multiple motors are simultaneously run, install an overload relay that matches the motor, between the inverter and the motor, as shown in Table 8.1.

* The grounding connection should conform to class 3 specifications.
Before you connect any wiring, be sure to turn the power supply switch on the distribution board OFF.

Before attempting to connect or disconnect any wiring, ensure that the inverter's CHARGE lamp is not lit.

Do not install power factor improvement capacitors in the VF-A3's output circuits.

As a rule, install a magnetic contactor between the inverter and the motor.
However, do not use the contactor to switch power to the inverter off or on during a run. This is because any opening or closing of the secondary circuit during a run will cause a large in-rush current to the inverter, which could damage it and other equipment.

While the inverter's output is shut off completely, you can connect a magnetic contactor in the circuit between the inverter and the motor when the mtor is switched to an another motor, or when switching to a commercial power supply. Additionally, establish an interlock so as to prevent the erroneous application of commercial power to the inverter's output terminals.

Exercise maximum caution when connecting power input lines to the inverter's L1(R),L2(S) and L3(T) terminals. Miswiring of power input lines could damage the inverter's circuits and components.

8.2.3 Between the inverter and the regenerative discharge resistor/regenerative discharge unit

Install wiring so that the connections between the inverter and the regenerative discharge resistor/ regenerative discharge unit use the shortest possible wires. Use twisted-pair wires for these connections. Further, to improve the cooling, the regenerative discharge resistor/regenerative discharge unit should not be directly attached to the inverter, but installed nearby.

If you use a regenerative discharge resistor/regenerative discharge unit, install a magnetic contactor (MC) or a molded-case circuit breaker (MCCB) equipped with a trip coil on the inverter' s power supply end. This is necessary to allow the power supply circuit to open at the activation of the built-in fault detection relay (FL) or an externally installed overload relay (THRY).

8.2.4 Wiring specifications

Table 8.1 lists example selections, recommended models and ratings of wiring supplies. Table 8.2 lists wire sizes and ratings for connecting the inverter's main circuit components.

Table 8.1 Models and ratings of the inverter's main circuit parts

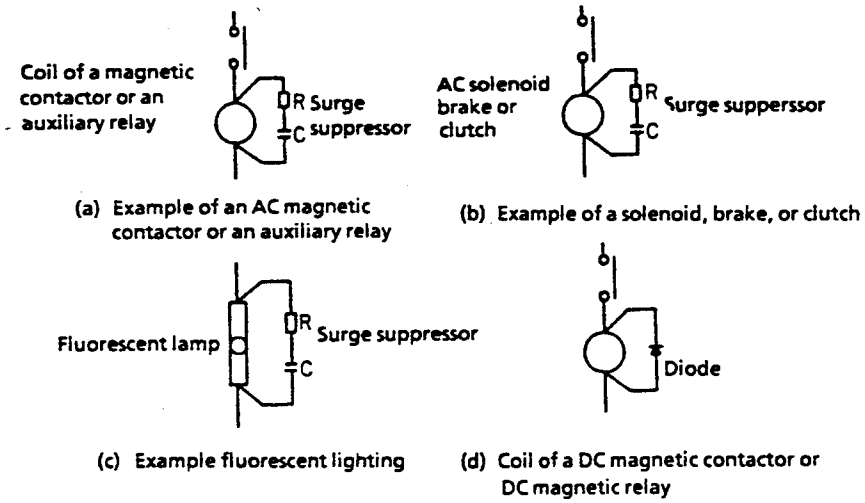
Voltage class	Inverter	Applicable motor (kW)	Molded-case circuit breaker (MCCB)		Magnetic contactor (MC) (Note)		Overload relay (ThRy)	
	Model		Rated current (Ampere frame)	Toshiba model	Capacitance (A)	Toshiba model	Adjusted current(A) [Reference value]	Toshiba Model
200V	VFA3-2004P	0.4	5	SS30	12	C12A	2.3	T11A
	VFA3-2007P	0.75	10	SS30	12	C12A	4.2	T11A
	VFA3-2015P	1.5	15	SS30	12	C12A	6.6	T11A
	VFA3-2022P	2.2	20	SS30	12	C12A	9.3	T11A
	VFA3-2037P	3.7	30	SS30	18	C20A	15	T20A
	VFA3-2055P	5.5	50	ES50	35	C35A	22	T35A
	VFA3-2075P	7.5	60	EH100	50	C50A	28	T35A
	VFA3-2110P	11	100	EH100	65	C65A	43	T65A
	VFA3-2150P	15	125	EH225	80	C80A	57	T65A
	VFA3-2185P	18.5	125	EH225	93	C100A	70	T80A
	VFA3-2220P	22	150	EH225	93	C100A	85	T125A
	VFA3-2300P	30	200	EH225	180	C180A	108	T125A
	VFA3-2370P	37	225	EH225	180	C180A	138	T150A
	VFA3-2450P	45	300	EH400	220	C220A	162	T180A
	VFA3-2550P	55	350	EH400	220	C220A	198	T220A
400V	VFA3-4007P	0.75	5	SS30	9	C12A	2.3	T125A
	VFA3-4015P	1.5	10	SS30	9	C12A	3.6	T125A
	VFA3-4022P	2.2	10	SS30	9	C12A	5.0	T150A
	VFA3-4037P	3.7	15	SS30	9	C12A	8	T11A
	VFA3-4055P	5.5	30	SS30	17	C20A	11	T20A
	VFA3-4075P	7.5	30	SS30	17	C25A	15	T20A
	VFA3-4110P	11	50	ES50	33	C35A	22	T35A
	VFA3-4110P	15	60	EH100	48	50A	28	T35A
	VFA3-4185P	18.5	75	EH100	50	C50A	35	T35A
	VFA3-4220P	22	100	EH100	50	C50A	43	T65A
	VFA3-4300P	30	125	EH225	80	C80A	57	T65A
	VFA3-4370P	37	125	EH225	93	C100A	70	T80A
	VFA3-4450P	45	150	EH225	180	C180A	85	T125A
	VFA3-4550P	55	175	EH225	180	C180A	108	T125A
	VFA3-4550P	75	225	EH225	220	C220A	138	T150A

NOTE: For the auxilliarty contacts of magnetic contactor C12A, use the 2a contact.

A large surge current is generated in the magnetic contactor of the inverter's primary circuit, and the magnetic contactor and auxiliary contactor when current through the coil is cut. This could damage electronic circuits.

Noises generated from solenoids, brakes and clutches located outside the control board, and use of fluoresent lamps may likewise cause the erroneous effects in the inverter's circuits.

To prevent these problems, ① for AC operation circuits, mount a surge suppressor to both ends of the coils of magnetic contactor and auxiliary relays; ② for DC operation circuits, install a diode.



(a) Example of an AC magnetic contactor or an auxiliary relay

(b) Example of a solenoid, brake, or clutch

(c) Example fluorescent lighting

(d) Coil of a DC magnetic contactor or DC magnetic relay

Table 8.2 Example selection of wires for inverter connecitons

Voltage class	Inverter Model	Applicable motor (kW)	Wires for main circuit: Wire size (mm^2)	Wires for main circuit: Conductor resistance at 20°C (mΩ/m)	Wires for control circuit (mm^2)	Wires for grounding the inverter (mm^2)	Wires for regenerative discharge resistor/regenerative discharge unit (optional) (mm^2)
200V	VFA3-2004P	0.4	2.0	9.24	0.75 minimum	3.5 minimum	—
	VFA3-2007P	0.75					
	VFA3-2015P	1.5					
	VFA3-2022P	2.2					
	VFA3-2037P	3.7	3.5	5.20			5.5
	VFA3-2055P	5.5	8	2.31			8
	VFA3-2075P	7.5	14	1.30			22
	VFA3-2110P	11					
	VFA3-2150P	15	22	0.824			60
	VFA3-2185P	18.5	38(30)	0.487(0.624)			
	VFA3-2220P	22	38	0.487			
	VFA3-2300P	30	60	0.303			
	VFA3-2370P	37	100(80)	0.180(0.229)			
	VFA3-2450P	45	100	0.180			
	VFA3-2550P	55					
400V	VFA3-4007P	0.75	20	9.24			2
	VFA3-4015P	1.5					
	VFA3-4022P	2.2					
	VFA3-4037P	3.7					
	VFA3-4055P	5.5	3.5	5.20			3.5
	VFA3-4075P	7.5	5.5	3.33			
	VFA3-4110P	11	8	2.31			8
	VFA3-4110P	15					
	VFA3-4185P	18.5	14	1.30			22
	VFA3-4220P	22	22	0.824			
	VFA3-4300P	30	38(30)	0.487(0.624)			38(30)
	VFA3-4370P	37					
	VFA3-4450P	45	38	0.487			
	VFA3-4550P	55	60	0.303			
	VFA3-4750P	75	100(80)	0.180(0.229)			

NOTE: 1. For stranded wires (mild copper)

2. For the inverter's main circuit, minimum size for wiring lenghs up to 30 meters. For longer wiring, use a large wire size.

8.3 Control signal circuit wiring

To prevent signal interference from other circuits, use shielded wires or twisted-pair cable.

To connect frequency setting signal lines to inverter terminals PP, RR, IV, and CC, and frequency meter lines to terminals FM and CC, use wires sizes of 0.3mm2 (minium).

For all the inverter's other signal circuits, use wires with a cross sectional area of at least $0.75mm^2$.

Separate all lines mentioned above from the inverter's main circuit wiring. To minimize interference, do not lay these terminal cables in a common duct with the inverter's power cables.

Wire sizes:
Frequency setting signal inputs: shielded wires, each $0.3mm^2$ minimum

Other signals: Vinyl-coated wires, $0.75mm^2$ minimum

To protect the electronic circuits connected to the control terminals (all the control terminals other than FLA, FLB, and FLC), insulate the circuits of the input signals fed to these terminals from the main circiut

CHAPTER 9 FAULT MESSAGES

This chapter enumerates the primary causes of an inverter-trip and explains how to correct each cause.

Fault messages

9.1 Fault Messages

The following table lists 28 fault messages that the inverter will display as causes of faults, as well as recommended countermeasures you should take to correct the problem.

Table 9.1 Fault messages and their corrective measures

Message	Explanation	Countermeasure
OC1	Mid-acceleration overcurrent	1. Increase the acceleration time (ACC setting). 2. Lower the torque boost voltage (vb setting).
OC2	Mid-deceleration overcurrent	1. Increase the deceleration time (dEC).
OC3	Mid-run overcurrent	1. The load underwent a sudden change. 2. Reduce fluctuations in the load.
OCA	Overcurrent (armature overcurrent at start-up)	1. One or more main circuit devices must be replaced.
OCL	Overcurrent (load end overcurrent at start-up)	1. Insulaitng properties of the main output circuit or motor wiring have deteriorated. 2. Recheck the wiring and insulation.
OCr	Overcurrent in regenerative discharge resistor	1. Check the main circuit device of the regenerative discharge circuit. One or more devices must be replaced. 2. Check the main circuit fuse (motor's output 5.5 kW, 7.5kW)
OP2	Mid-deceleration overvoltage	1. Increase the deceleration time (dEC setting). 2. Install an optional regenrative discharge resistor/regenerative discharge unit.
OP	Overvoltage	1. Check the power supply voltage.
POFF	Undervoltage (Note)	1. The power input voltage has dropped. 2. Recheck the power supply status and wiring at the input end.
nOFF	Undervoltage in DC main circuit (Note)	1. The power input voltage has dropped. 2. Recheck the power supply status and wiring at the input end. When the control power is turned on, while the main circuit power supply is off, this message appears. Push the STOP key, when the panel control LED is blinking. Then by switching power on, the display massage will disappear and the inverter is ready for operation. 3. Check the main circuit fuse. (motor's output above 5.5kW)

Message	Explanation	Countermeasure
OL	Overload	1. Reduce the load. 2. V/f characteristics are inadequate. Check to see if a 50Hz-rated motor has been operated at a 60Hz base frequency. 3. Use an inverter with a higher rating.
OLr	Overload in regenerative discharge resistor	1. Stop the motor less frequency. 2. Increase the deceleration time (dEC setting). 3. Raise the capacity-rating of the regenerative discharge resistor.
OH	Overheating	1. Check to see if the cooling fan is working properly. 2. Check the ambient temperature to see if it is excessively high.
EF	Ground fault at load end	1. Check to see if a ground faul has occurred at load end.
E	Emergency stop	1. The inverter has been stopped by a command from the operating panel during an automatic run or remote-controlled run.
EOFF	Confirmation of an emergency stop	1. The inverter has been stopped by a command from the operating panel during an automatic run or remote-controlled run. Press the STOP key to effect an emergency stop. To cancel the emergency stop, press the CLR + WRT keys.
Err.1	Emergency setting signal error (Note)	1. Points 1 and 2 of a frequency setting signal are too close together. Correct the setting of points 1 and 2 by providing an adequate distance between them.
Err.2	Main RAM abnormality	1. The main RAM in the main CPU are abnormal. The main RAM must be repaired or replaced.
Err.3	Main ROM abnormality	1. The main ROM in the main CPU are abnormal. The main ROM must be reqaired or replaced.
Err.4	Panel's RAM abnormality	1. The RAM in the operating panel's CPU are abnormal. The RAM must be repaired or replaced.
Err.5	Panel's ROM abnormality	1. The ROM in the operating panel's CPU are abnormal. The ROM must be repaired or replaced.
Err.6	Panel's key abnormality	1. The key in the operating panel are abnormal. The key must be repaired or replaced.
EEP	EEPROM abnormality	1. The data stored in the EEPROM are abnormal. The EEPROM must be repaired or replaced.

Message	Explanation	Countermeasure
EEP2	EEPROM abnormality	1. The EEPROM data for the causes of the previous trip(s) are abnormal. Cycle the power switch off,then on. If the message "EEP3" appears again, the EEPROM must be repaired.
EEP3	EEPROM abnormality	1. Setting are abnormal Renew the settings correctly.
Err.t	Transmission error (Note)	1. A transmission error between the panel and the inverter has been detected. Check the connections between the panel and the inverter.
C	Stall prevention warning	1. Increase the acceleraion time (ACC setting).
P	Overvoltage restriction warning	1. Increase the acceleration time (dEC setting). 2. Install an optional regenerative discharge resistor/ regenerative discharge unit.
L	Overload warning	1. Reduce the load. 2. Use an inverter with a higher rating.
Err.U Err.0 UL.LL FH	Set value abnormality warning (the fault message and the related data are displayed alternately twice.)	1. An abnormality in a set value has been detected during read and write of the data. Check the set value and correct the setting.

NOTE: The inverter will not trip when the fault messages "POFF" or "MOFF" or "Err. 1" or "Err. 4" or "Err. 5" or "Err. 6" or any one of the warning messages appears.

9.2 Symptoms of common motor problems

Table 9.2 lists common motor problems you may encounter when using the VF-A3 inverter with a motor. Causes and/or countermeasures for these problems are listed in the table's right-side column.

Table 9.2 Symptoms of common motor problems and recommended countermeasures

Problem	Cause or Countermeasures
Motor will not run.	1. Miswiring, open phase, or power failure in the input, output, or power input lines. Check whether the CHARGE lamp is lit. 2. For an operation via the inverter's operating panel, check whether the PANEL CONTROL LED is lit Push the MODE key. For an operation using an external signal, check whether the PANEL CONTROL LED is turned off. Push the MODE key. 3. Confirm that an operating frequency has been set. 4. Check to see if inverter terminals ST and CC have been shorted together. If not, short ST-CC together. 5. Check to see if the inverter has tripped or is preparing for a restart try. If it has tripped, eliminate the cause, then reset. When the inverter is in the process of a restart try, it may automatically restart, so monitor it for a while. 6. Load exceeds the motor's rating. Reduce the load.
Motor runs in reverse direction.	1. Try altering the phase sequence of inverter output terminals T1(U)/T2(V)/T3(W). If that doesn't work, short R-CC together.
Motor runs but will not change speed.	1. Load exceeds the motor's rating. Reduce the load. 2. Soft stall function is activated. Disengage the soft stall function. 3. Inverter's upper limit frequency (UL) is too low. Set the upper limit frequency (UL) at a higher value. 4. Frequency setting signals are too low. Recheck circiuts and signal levels. 5. Check the setting characteristics of the frequency setting signal.
The motor's accelerations and decelerations are not smooth.	1. Acceleration (ACC) and deceleration (DEC) setting times are too brief. Increase as necessary
Motor runs too fast or too low.	1. Motor's voltage ratings are inadequate. Use a motor with proper voltage ratins. 2. Motor's terminal voltage is too low. Check the set values for output a voltage reduction and output voltage regulation. Also, use heavier gauge cables. 3. Step-up or reduction gear ratio is incorrect. Recheck the step-up or reduction ratio of gearss. 4. Output frequency settings are improper. Check the set values for the range of output frequencies. 5. Re-adjust tne base frequency
Mid-run speed fluctuations	1. Load fluctuations cause run-speed fluctuations. Minimize the load fluctuation. 2. The inverter and motor ratings do not meet requirements. Use a higher rated inverter and motor.

CHAPTER 10 INSPECTIONS AND MAINTENANCE

This chapter will describe the methods for carrying out preventative maintenance and periodical inspections.

CHAPTER 10

Inspections and Maintenance

10.1 Preventive Maintanance and Periodic Inspection

To assure long, dependable service from your VF-A3 transistor inverter, you should conduct brief daily and periodic inspections of it and related equipment.
Conduct periodic inspections of the inverter once very 3 to 6 months, depending on its oerational status.

CAUTION: Before beginning an inspection, be sure to first use the inverter's MCCB switch to disconnect power, then wait until the inverter's CHARGE lamp stops glowing before connecting wires from testing meters. See Figures 2.1 and 2.9 for the locations of the inverter's MCCB switch and CHARGE lamp.

Items to check:

1. Are all terminal screws tight? Use a screwdriver to tighten any loose terminal screws.
2. Check for improper crimping at ends of wires. Visually check for overheated crimpings, which are usually identifiable by discoloration.
3. Check for scars or abrasions on wires and connections.
4. Use a vacuum cleaner to remove dust from the inverter. Pay particular attention to ventilation slots and printed wiring boards. Accumulations of dust and dirt in these areas can cause overheating of sensitive circuit parts.
5. If, for some reason, the VF-A3 inverter is to be stored for prolonged periods, you should schedule regular sessions for energizing the inverter to assure that it will remain operational. Stored inverters should be energized at least once every two years. After removing an inverter from a prolonged storage, energize it with electricity for at least five hours before attempting to run a motor with the inverter.
6. Run insulation tests with a 500V megohmmeter exclusively on the main circuit terminal block.

CAUTION: When you want to conduct insulation tests on a motor, you must disconnect the motor from inverter terminals T1(U), T2(V), and T3(W) before beginning the tests.

7. Voltage and temperature checks - Regular checks of your inverter's input and output voltage levels is an effective way to detect problems before they become major. Depending on the type of circuit tester or voltmeter used, the inverter's output voltage may vary. It is for this reason that a record should be kept of your invertr's daily or weekly output voltages, in order

to identify deviations unique to your meters. On the inverter's input side, measure voltages across terminals R-S, S-T, and R-T. At the inverter's output terminal block, measure voltage across terminals U-V, V-W, and W-U. See Figure 2.9 for the locations of these terminals on the inverter's main chassis.

Recommended voltmeters:

For the inverter's input end: moving-iron voltmeter (⫲)

For the inverter's output end: rectifying voltmeter (-▷|-)

Taking periodic temperature readings of the inverter at start-up, run, and shutdown mode is also an effective way to detect early signs of trouble before it develops into a major problem, thus reducing system downtime.

CHAPTER 11 STORING THE INVERTER AND TERMS OF WARRANTY

This chapter discusses precautions to take when storing the VF-A3 inverter to ensure that it will remain in good operating condition while in storage.

CHAPTER 11

Storing the Inverter and Terms of Warranty

11.1 Storing the Inverter

If you plan to store the VF-A3 inverter temporarily of for a prolonged period for any reason, observe the following precautions.

1. Do not store the inverter in locations subject to higt temperature or humidity levels, or environments where the air contains high concentrations of dust or metallic particles. Select a well ventilated location for storing the inverter.
2. If the inverter is to be stored for prolonged periods, you should schedule regular sessions for energizing the inverter's circuits. This is necessary to assure that inverters circuitry will remain operaitonal. Stored inverters should be energized and tested at least once every two years, to ensure that its large electrolytic capacitors are recharged. These capacitors will becom degraded if they are stored for too long with no regular energization of the inverter. After removing an inverter from prolonged storage, energize it with electricity for at least five hours before attempting to run a motor with the inverter.

11.2 Terms of Warranty

This chapter discusses the limitations and liabilities of the VF-A3 transistor inverter's product warranty.

Toshiba will repair the VF-A3 transistor inverter at no cost to the user to correct any malfunctions or damage sustained during the period of the inverter's warranty.

The warranty period of the VF-A3 inverter is 12 months after delivery. However, the occurence of one or more of the following conditions will void the warranty so that repairs resulting from these conditions will be charged to the user.

- Misoperation of the inverter by the user, as well as damage or malfunctions caused as a result of unauthorized repairs or modifications of the inverter and/or its components.
- Malfunctions of the inverter that result from damage incurred during shipment from the factory to the user, or damage to the inverter caused by unnecessary jolting, vibrations or other user-controlled environmental factors at the installation site.

- Damage to the inverter caused by fire, flooding, wind, lightning, irregular voltage levels at the installation site, earthequakes, or other natural disasters.

- Any damages sustained by the inverter that are the result of the user having used the inverter for purposes (applications) other than its intended applications as an industrial inverter.

  Where a set of separately defined warranty condition have been established between the user and the manufacturer, they shall prevail over the terms of this warranty.

* The user is urged to inspect the inverter and its related components carefully after unpacking to assure that the model you received matches all the specifications of the one that you ordered, that all parts listed have been received, and that the inverter was not damaged during shipment.