

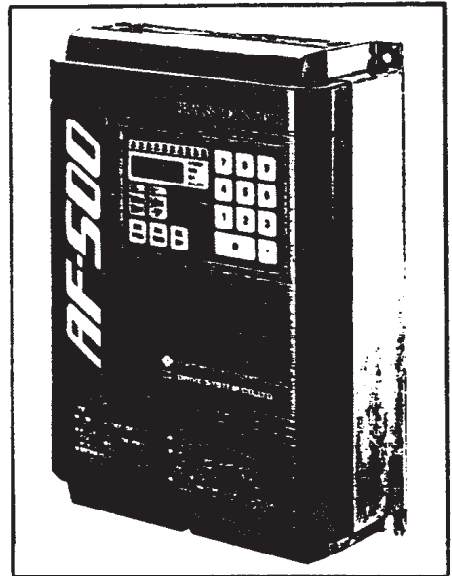
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Technical Sheet  
MH-382  
April, 1988

# AF-500 Series

## General-Purpose Transistor Inverter

### Operating Instructions



 **Regeltechnik**  
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## 4. WIRING

### 4-1 Wiring Items

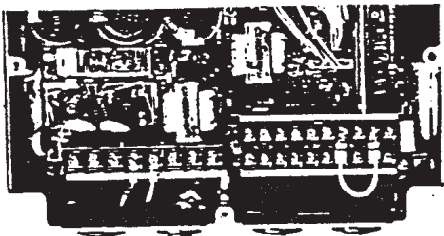
- (1) **Main circuit wiring and control circuit wiring**  
Wire according to the standard connection diagram. In the case of special applications, refer to the AF-500 for the method of connection.  
The relays used with the control circuit terminal should be either be twin-contact relays or micro-signal relays that prevent improper contact.
- (2) **Signal circuit handling**  
The signal circuit uses either shield lines or twisted lines, and should be wired either using a wiring duct separate from that for the drive circuit, or with the wiring conduit at as large a distance as possible.
- (3) **Connecting the power supply and the AC motor**  
Connecting the main circuit, is by wiring according to the main circuit connection terminal. Care is required to not connect the input and output terminals since damage to the unit will result.  
The inverter model, the breaker (MCB) current ratings, and the wire diameters of the main circuit are as shown in the following table.

Inverter model	AF 502-A 40	AF502-A 75	AF 502-1 A 5	AF 502-2 A 2	AF 502-3 A 7
MCB	5 A	10 A	15 A	20 A	30 A
Wire diameter of main circuit	1.25 mm	1.25 mm	2 mm	2 mm	3.5 mm

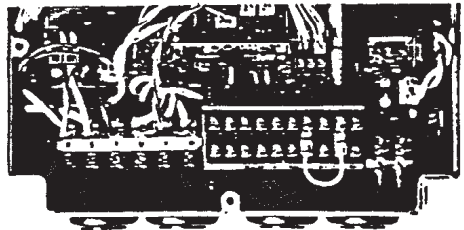
- (4) **Grounding**  
Grounding is performed in accordance with the Electrical Facility Technical Standards and using the ground terminal at the lower left of the main circuit terminal plate of the AF-500 control unit.

### 4-2 Terminals

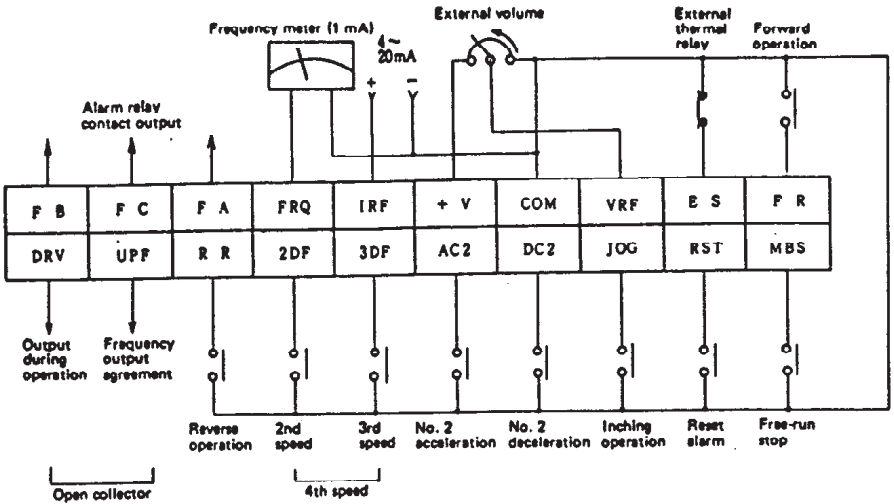
Photograph 1 (0.4 to 0.75 kW)



Photograph 2 (1.5 to 3.7 kW)



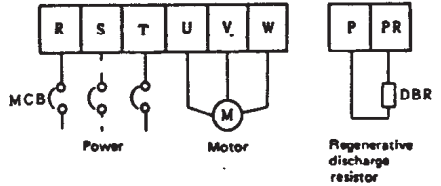
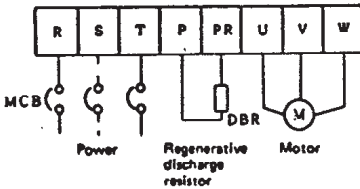
(1) Control circuit terminal diagram



(2) Main circuit terminal diagram

AF 502 - A40 . A75  
(200 V. 0.4 kW / 0.75 kW)


AF 502 - 1A5 ~ 3A7  
(200 V. 1.5 kW ~ 3.7 kW)

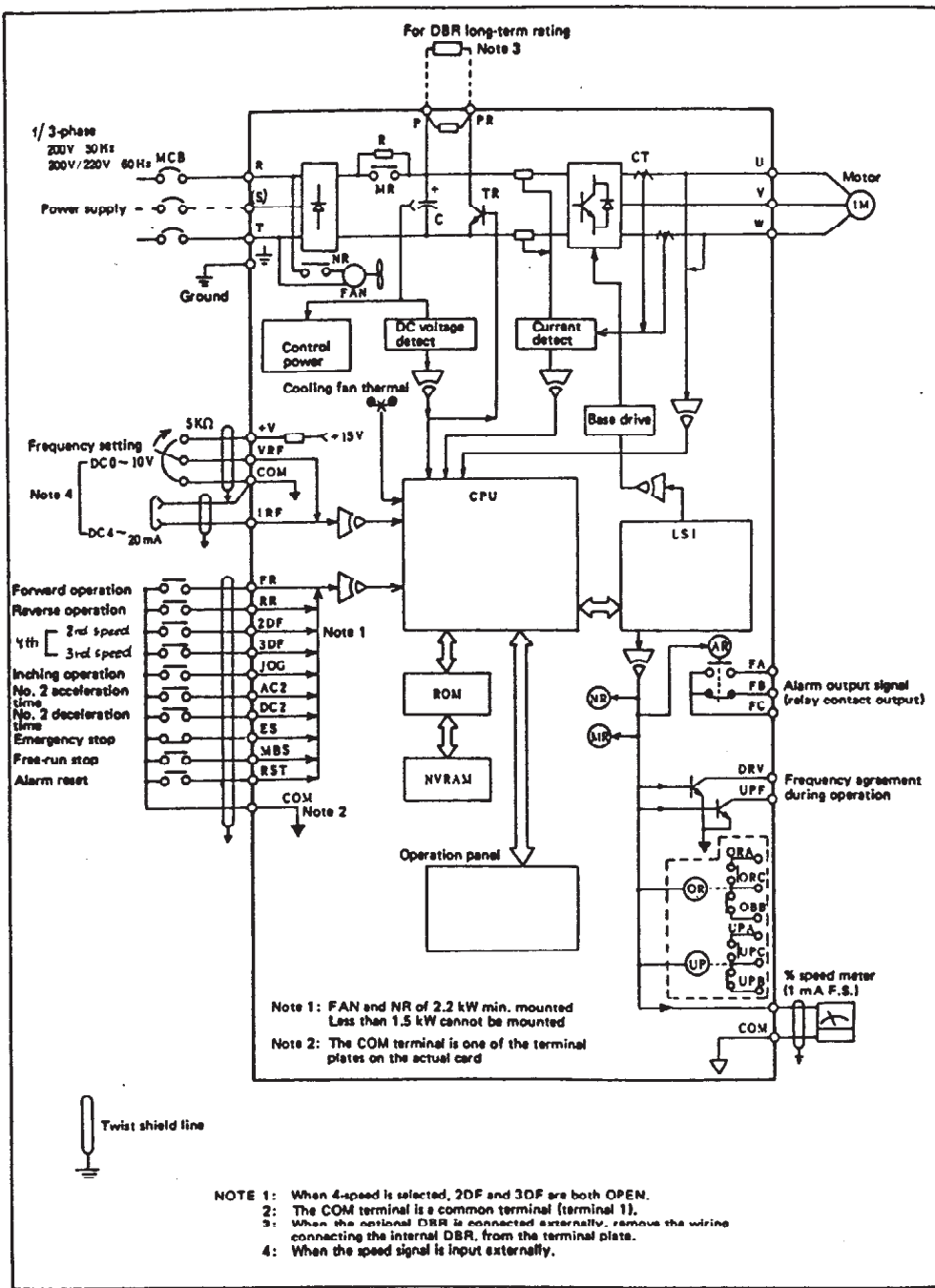


**CAUTION:**

Terminals P and PR are connected to the internal regenerative discharge resistor (DBR). When start-stop operation is performed often and for special uses such as fast control of large inertia loads will tax the thermal performance of the internal resistor. In these cases, disconnect the internal resistor from the terminal and then connect to a special external resistor (optional).

Terminal specifications

Main circuit	R(S)T.	AC power input terminal	Connected to commercial power AC 200V/50 Hz, 200 – 300 V/60 Hz
	U,V,W.	Inverter output terminal	Connected to 3-phase induction motor
	E	Ground terminal	Ground terminal of inverter chassis
	PR P	Brake resistor connector terminal	The resistor for the short-term rated brake provided as standard equipment, is connected when shipped from the factory. When connecting the optional long-term rated resistor, remove the wiring for the resistor mounted as standard, perform the necessary processing for the insulation, and then connect to this terminal plate.
Control circuit input terminal	+V	Power output terminal for frequency setting	DC 10 V for volume setting only
	VRF	Signal input terminal for frequency setting	DC +0 to 10 V, with the maximum frequency at 10 V, with proportional output. The input impedance is 10 K-ohms, with a DC 5 V max., internally switchable.
	IRF	Signal input terminal for frequency setting by 4 – 20 mA current signal	Maximum frequency at 04 – 20 mA, with proportional output. Input impedance: 320 ohms
	COM	COM terminal	Common terminals for control signals
	FR	Forward rotation start input signal terminal	Stop command when forward operation freed by FR-COM short
	RR	Reverse operation start input signal terminal	Stop command when reverse operation freed by RR-COM short
	2DF	No. 2 frequency setting selector input terminal	Selects the Inverter's internal No. 2 frequency setting by 2DF-COM
	3DF	No. 3 frequency setting selector input terminal	Selects the Inverter's internal No. 3 frequency setting by 3DF-COM
	AC2	No. 2 acceleration time mode selector input terminal	Selects the No. 2 acceleration time mode by AC2-COM short
	DC2	No. 2 deceleration time mode selector input terminal	Selects the No. 2 deceleration time mode by DC2-COM short
	JOG	Jogging operation selector input terminal	Selects jog operation by JOG-COM short
	RST	Reset signal input terminal	Reset terminal for when Inverter detects abnormality. Shorted for when there is RST-COM for 0.1 sec. min.
	ES	External emergency stop input terminal	Terminal incorporating an abnormality condition external to the inverter
	MBS	Free-run stop terminal	Interrupts the transistor base and brings the motor to a free-run stop
	Control circuit output terminal	DRV	Inverter operation display output terminal
UPF		Frequency obtain display output terminal	Open collector output 50 V 50 mA max.
FRQ		Frequency meter output terminal	DC 0 – 1 mA F.S. maximum frequency at 1 mA
FC FB FA		Abnormality detect signal output terminal 	Indicates that the inverter has detected an abnormality, and that the base has been interrupted by the protector function - Relay output specification - For forward FA-FC open IC contact, contact capacity AC 250 V 0.3 A For reverse FA-FC closed



- NOTE 1: When 4-speed is selected, 2DF and 3DF are both OPEN.
- 2: The COM terminal is a common terminal (terminal 1).
- 3: When the optional DBR is connected externally, remove the wiring connecting the internal DBR, from the terminal plate.
- 4: When the speed signal is input externally,

## 5. TEST OPERATION

### 5-1 Inspection before testing

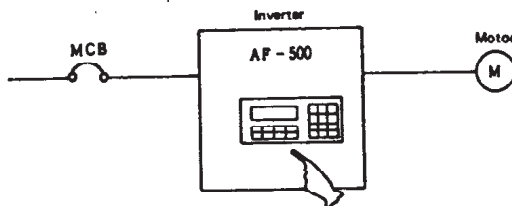
Once the installation wiring has been completed, perform the following tests before applying current.

- (1) Is there any miswiring? In particular, check that power is connected to the U, V and W terminals.
- (2) Are power scraps creating shorts or unwanted grounding?
- (3) Are there any loose screws or terminals?
- (4) Check the external sequence circuit?
- (5) Check the power voltage.

### 5-2 Operation method

The AF-500 series has the two types of operation of operation by panel, and operation by external signal.

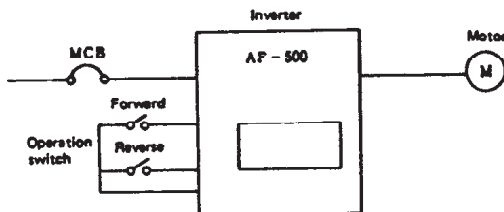
#### (1) Operation by panel



Operation by panel is when key operation is used to operate the motor.

The mode is set to Operation by Panel when the unit is shipped from the factory. Refer to "Explanation of Panel Operation" (page 7) for how to use the panel keys to operate the motor.

#### (2) Operation by external signal



This is the method whereby an external operation switch is used for operation. This operation mode is set by the "External Signal" switch on the keyboard.

The functions of the control terminals FR, RR, 2DF, 30DF, AC2, DC2 and JOG are effective only for the "Operation by External Signal" mode. In the "Panel Key" mode, these functions do not operate even if signals are input to the terminals.

### 5-3 Test Operation

- (1) Operate the breaker (MCB) and apply power to the inverter. The mode is switched to the "Panel Key" mode when shipped from the factory and so the inverter will not operate even if the external signal is "ON."

(2) Perform test operation for the following items and confirm the status of operation.

1. Apply the power.
2. There will be a flashing display for the objective frequency.
3. Operate by pressing either (FWD) or (REV).
4. If (STOP) is pressed, then there will be flashing display for the set frequency.

The "READY" and "STOP" LED light and "Hz" flashes.

1	0.	0	0
1	0.	0	0
1	0.	0	0

Flashes

Lights

Flashes

(3) The output frequency is set by pressing either (  $\Delta$  ) or (  $\nabla$  ), or by direct setting using the PROG setting method. Setting can also be made by pressing (FWD, REV) and by using (  $\Delta$  ) and (  $\nabla$  ) to adjust.

**Direct setting**

- Press the number keys to set the desired frequency of operation, and then press the SET key.

**Step setting**

- Set using the (  $\Delta$  ) and (  $\nabla$  ) keys for the frequency of operation.

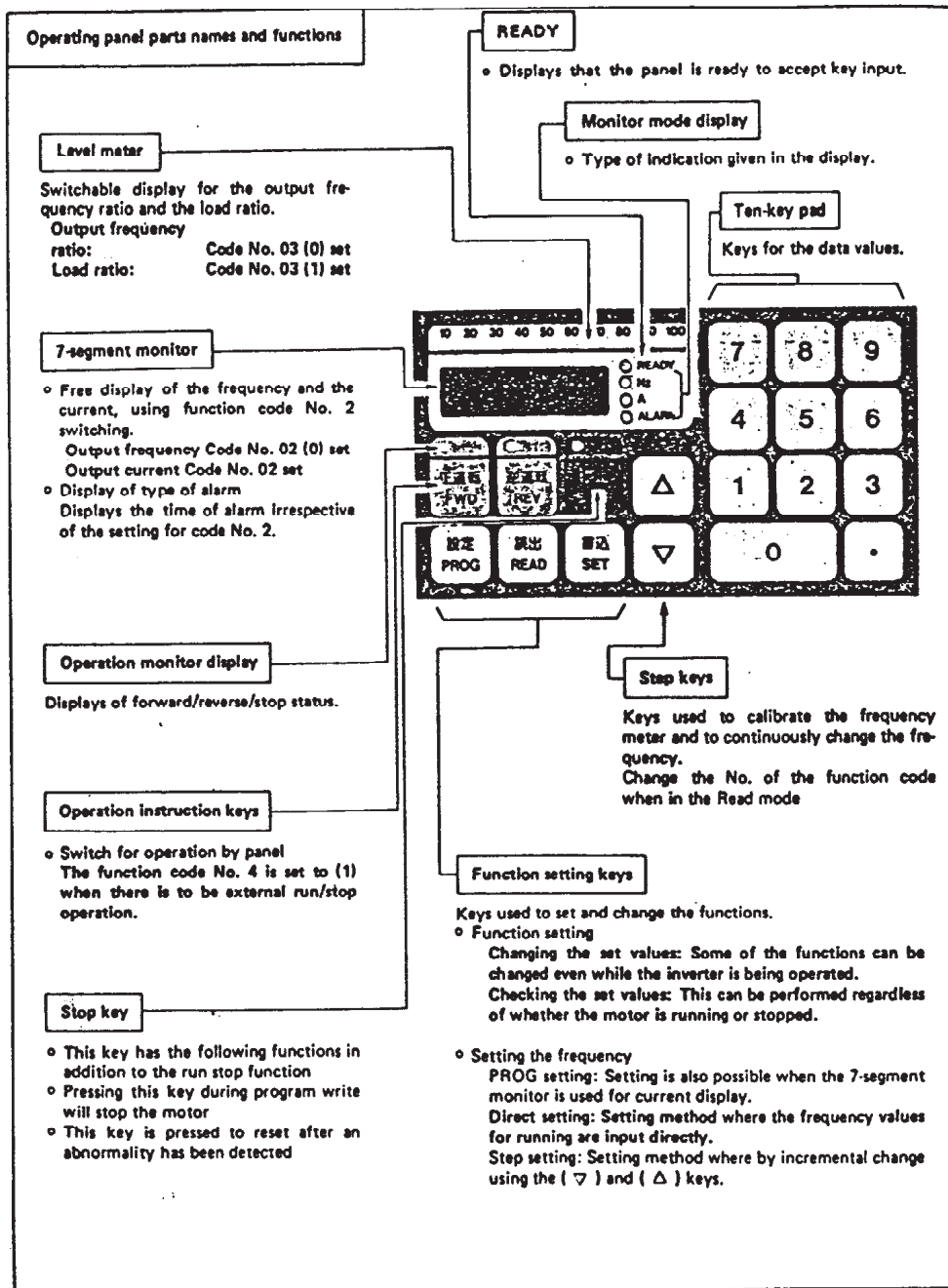
(4) Checkpoints

- Is the direction of rotation normal?
- Is there any abnormal motor noise or vibration?
- Is there smooth acceleration and deceleration?
- If the protector circuit operates, and the inverter trips, then take the appropriate measures outlined in "Troubleshooting." (page 8)

**CAUTION:**

If operating by external signal, then the simultaneous input of both the FR (forward) and RR (reverse) signals will cause the inverter to continue operation in the direction of the signal initially input.

## 6. ADJUSTMENTS





## Description of Indications

### Alarm Indications

These indications are cleared by the reset signal issued upon restart.

Error indication	Description of abnormal operation	Item for inspection	Processing
Err	Misoperation due to operation error	Was the unit operated as indicated in the manual?	Use the correct procedure.
ErO	Misoperation of internal ROM or RAM	Switch off the power and then apply again when the CHARGE lamp lights.	Exchange the unit.
ErC	Misoperation of internal CPU.	Is there a large amount of external noise?	Check the contact absorber. Install a noise filter.
OCPa	Overcurrent detected during acceleration (180% of the rated current for the unit is detected)	Was there rapid acceleration?	Lengthen the acceleration time
OCPd	Overcurrent detected during deceleration (180% of the rated current for the unit is detected)	Was there rapid deceleration?	Lengthen the deceleration time
OCPn	Overcurrent detected during normal operation (180% of the rated current for the unit is detected)	Was there any variation in the load?	Lengthen the time for the load variations
OCS	Output short circuit or ground detected	Is there a short circuit for the output or grounding for the motor?	Inspect the terminals and perform a megger check for the motor.
OU	DC link voltage overcurrent (DC link voltage of 400V is detected)	Was there fast acceleration? Was there operation with a large negative load.	Lengthen the deceleration time. Investigate the use of the optional DBR.
LU	Insufficient voltage detected due to power failure, or instantaneous power loss. (DC link voltage of 200V is detected)	Are the power and voltage conditions good? Is there a low voltage?	Restore the power. Improve the voltage conditions.
OH	Overheating of the cooling fan detected	Has the cooling fan stopped (for the 2.2 and 3.7kW units)? Is the peripheral temperature too hot? Is the motor being overloaded?	Exchange the cooling fan Lower the peripheral temperature Check the load conditions
OLE	Motor overheat detected (thermal relay for the motor)	Is the motor being overloaded?	Reduce the load. Increase the capacity of the inverter and motor.
OL	Inverter overload detected (150% of the value for the electronic thermal setting detected for more than one minute)		
buOH	DBR overheat detected (flashes for 10 seconds)	Is the frequency of control appropriate.	Reduce the value for the load GD*

### Mode indications

READY	This is made ineffective by Code No. 35 when there is remote panel key operation.
Hz	The "Hz" indication will flash when the stall prevent function has operated during frequency display.
A	The "A" indication will be given when the stall prevent function has operated during motor display.

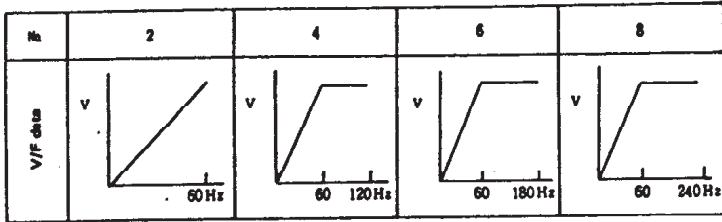
### Level meter display

Frequency ratio mode	Displays the output frequency in 10% steps with the maximum frequency set using the V/F pattern as 100%.
Load ratio mode	Displays the current ratio of load with the value for load capacity 50% x 60sec. = 3000% sec. as 100.

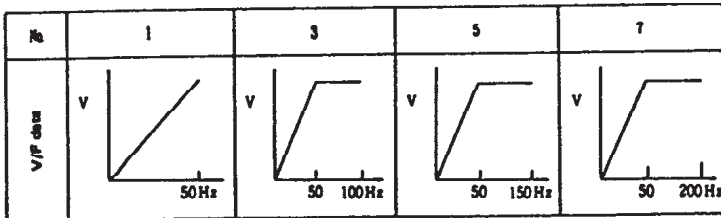
- NOTE 1:** External operation and panel key operation cannot be performed at the same time. Either one or the other must be selected.
- 2:** Operate while making certain that the panel keys are being properly pressed.
- 3:** Input programs will be stored even if the power is turned off.
- 4:** There will be free-run stop when the motor output is turned off after the inverter has detected an abnormality.  
(The inverter will continue operating only for when buOH and OL are flashing.)
- 5:** The "LU" indication will be given when the power is applied but this is not an abnormality.

V/F output adjustment	Code No.
	05

o When using in areas with 200 V/50 Hz power, or 200 V, 220 V/60 Hz power

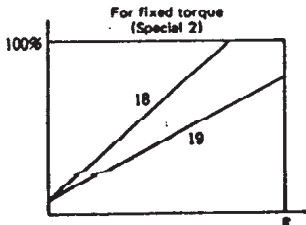
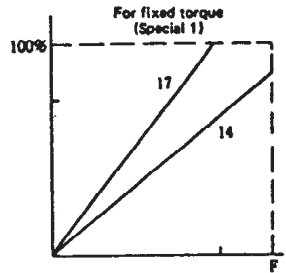
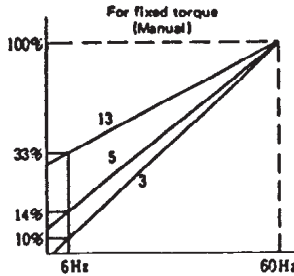
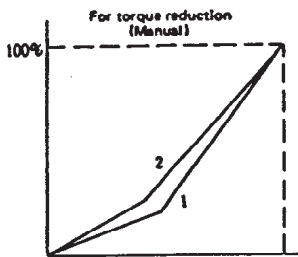


o When using in areas with 200 V/50 Hz power



NOTE: Contact us for information on areas with other patterns

Torque boost	Code No.
	06



NOTE: If vibration occurs for operation at light load for frequencies intermediate between Special Mode 1 and 2, the vibration can be lessened by setting this mode and performing adjustments. In this case, it is general practise to select the objective voltage from voltages with the standard V/f pattern (200 V/50 Hz or 200 V/60 Hz).

V/F adjustment	Code No.
	05

PROG setting

PROG	C	d		
5	C	d		5
READ				2
4				4
SET	C	d	0	5
				4

Example: Fixed torque operation when the output specification is from 200 V/60 Hz max. to 60 Hz, and for fixed output operation between 60 Hz and 200 Hz.

However, the setting for the maximum frequency is performed by the Code No. 17 frequency upper limit.

Alternating display

Torque boost	Code No.
	06

PROG setting

PROG	C	d		
6	C	d		6
READ				5
1				1
2			1	2
SET	C	d	0	6
			1	2

Example: When the standard "5" is to be changed to "12" to raise the starting torque.

The guide for the setting of this boost involves switching the monitor to the current mode, and setting so that the value for the current is minimum.

NOTE: In general, when there is to be torque boost, there are occasions when raising the starting torque causes a drop in the voltage because of the long wiring.

Alternating display

Frequency setting	Code No.
	00

Setting possible while either stopped or running

There are four methods available to set the frequency.

1. Direct setting (normal setting method)
2. PROG setting (by Code No. 00)
3. Step setting (using the (  $\Delta$  ) and (  $\nabla$  ) keys. This is used for fine adjustment of the frequencies set in the direct setting mode and the PROG setting mode.
4. Setting by external volume
5. Setting by external current signal

NOTE 1: Step setting cannot be performed if the monitor is not in the frequency mode.

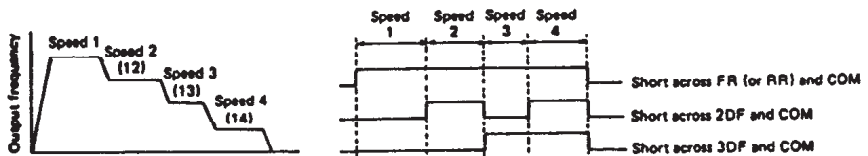
2: When setting is performed in the direct setting mode or the PROG setting mode, the frequency starts to change as soon as the SET button is pressed.

3: The acceleration and deceleration times for direct setting, PROG setting, step setting and external volume setting are the No. 1 acceleration time and the No. 2 acceleration time when there is normal operation.

4: When there is operation by external volume using current signals, the function is switched to Code No. 1. In this case, setting the volume to maximum will make the frequency rise unto the value set by the frequency upper limiter.

4-speed setting	Code No.
	12, 13, 14

- Operation for up to four speeds can be performed by switching of the external contact signals.
- The No. 2 and No. 4 frequencies are set by the PROG key, using the same method as for function setting.
- The frequencies for speeds 1 to 4 can be set from 0 to 100%.



NOTE 1: The speed 2 - 4 function is valid only when the operation instruction is the External Signal Mode (Code No. 4-1).

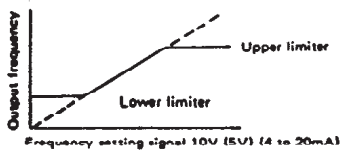
2: This function is not available for external analog setting.

3: When there is speed 2/3/4 operation, the displayed frequency can be changed by either direct setting or step setting.

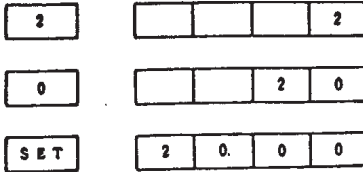
Frequency upper limiter	Code No.
	17

Frequency lower limiter	Code No.
	18

- The upper and lower limits for the output frequency are clamped.
- The limiter operates either when the frequency setting function is by panel setting or by external operation setting.
- This is used to guarantee the minimum rotation for reasons of preventing overspeed due to misoperation of the panel keys, misoperation of the external frequency setting signals, and for mechanical reasons.

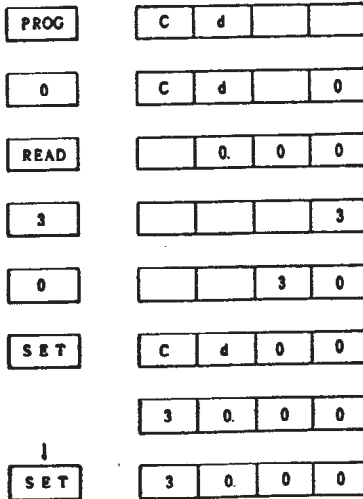


**1. Direct setting**



Example: Changing the currently set operating frequency to 20 Hz.

**2. PROG setting**



Example: Changing the currently set operating frequency to 30 Hz.

NOTE: It is possible to set the frequency for up to the frequency of the frequency upper limiter.

Alternating display

Flashing

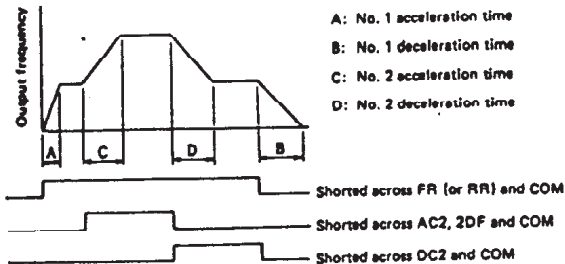
**3. Step setting**

Pressing the ( Δ ) key will increase the set frequency.

Pressing the ( ▽ ) key will decrease the set frequency.

Acceleration/ deceleration time	Code No.
	08, 09, 10, 11

- Setting the time required so that the acceleration time and the deceleration time are both at 50 Hz.
- The setting range is from 0.1 to 9999 secs.
- The setting time is double when there is acceleration to 100 Hz.
- Independent setting in two modes is possible for acceleration and deceleration.



- A: No. 1 acceleration time
- B: No. 1 deceleration time
- C: No. 2 acceleration time
- D: No. 2 deceleration time

NOTE 1: The No. 2 deceleration time is valid only for when the operating instruction is the External Signal Mode (Code No. 04 = 1).  
 2: The diagram illustrates an example when the speed 2 setting is used.

Example: When the No. 1 acceleration has been set to 10 sec./50 Hz and the No. 2 acceleration has been set to 100 sec./50 Hz.

No. 1 acceleration

PROG setting

PROG    C    d         

B        C    d       8

READ             S. 0

1                 1

0              1 0

SET     C    d    0 8

          1 0 0

Alternating display

No. 2 acceleration

PROG setting

PROG    C    d         

1        C    d       1

0        C    d    1 0

READ             5

1                 1

0              1 0

0           1 0 0

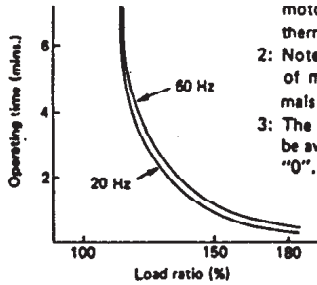
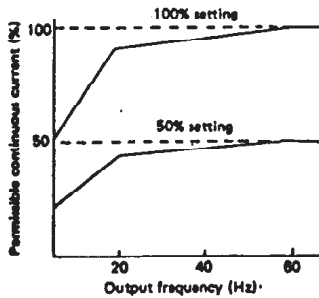
SET     C    d    0 0

1 0 0 0

Alternating display

Electronic thermal	Code No.
	07

- The thermal will operate to prevent overheating, and the inverter will stop.
- The setting is input as a percentage, with the rated current of the inverter as 100%.



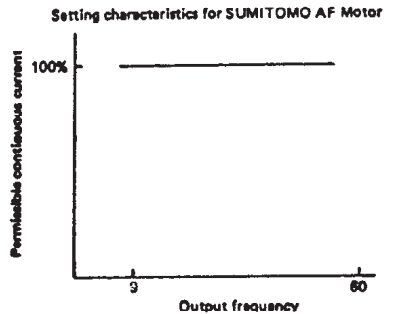
- NOTE 1: Use an external thermal when several motors are being used. (Input the thermal signals to control terminal ES.)
- 2: Note that there is a high incidence of misoperation with electronic thermals of 5Hz or less.
- 3: The function of the thermal will not be available when Code No. 07 is set to "0".

- The continuous permissible current for the motor decreases by the output frequency.

Use with electronic thermal motors	Code No.
	37

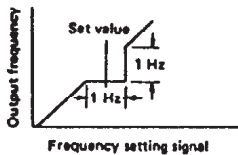
This switches the characteristics of the electronic thermal from those for general purpose motors to those for special motors.

- Code No. 37 "0" setting for general purpose motors
- "1" setting for special motors



Frequency jump	Code No.
	20, 21, 22, 23, 24

- There is no output for frequencies with a set value of  $\pm 0.5$ Hz.
- Setting is possible for up to five places.
- The acceleration time and the frequencies for the set places are also output.
- This is used to prevent resonance with the mechanical system.



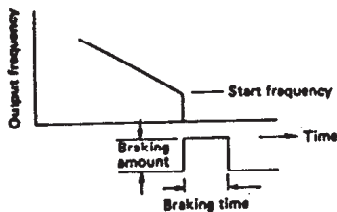
NOTE: The values set for the upper and lower limiters take priority when they occur within this range of the jump frequency.

High frequency limiter	Code No.
	27

- For safety reasons, the output limiter will operate for 120Hz.
- Use function Code No. 27 = 0 when a V/F pattern of 120Hz or more is selected.

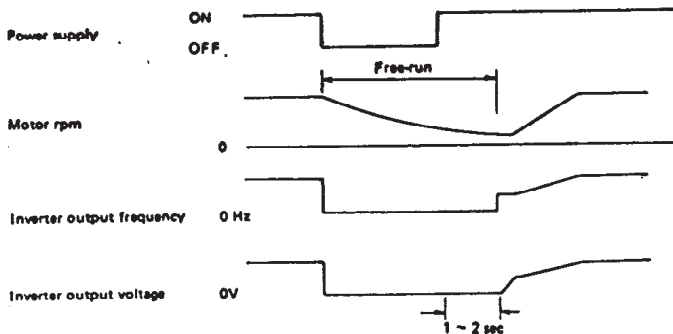
DC brake	Code No.
	25 - 26

- Adjustment can be made for whether or not the DC brake is to operate to stop, and also for the amount of braking and the braking time.
- The DC brake operates for the following start frequencies.



Free-run restart time	Code No.
	30

- The inverter can be restarted while the motor is still rotating for free-run.
- This function operates when the function Code No. 30 = 1.
- Restoration after an instantaneous power failure occurs automatically when the inverter outputs a frequency corresponding to the motor which is still rotating one to two seconds after restoration of power.



NOTE 1: If this function is set, then the inverter will start with a 1-2 sec. lag after the run signal has been input for normal start.

Use Code No. 30 = 1 if this lag becomes a problem.

2: Use Code No. 30 = 0 for when the motor inertia is small and for free-run status stops after one to two seconds.



Mode switching for overcurrent stall prevention	Code No.
	28

- During acceleration, the acceleration time changes if the motor current exceeds 150%.
- During steady running, the frequency will drop if the motor current exceeds 100%.
- During acceleration, it is possible to change the settings for the frequency lowering ratio and the amount of change.

Data value	During acceleration	During steady running
0	No stall prevention function	
	Changes according to the acceleration time	Outputs the set frequency
1	Doubles the acceleration time $\Delta F / \Delta T = 1/2$	Lowers the frequency by four times the deceleration time
2	Quadruples the acceleration time $\Delta F / \Delta T = 1/4$	Lowers the frequency by twice the deceleration time
3	Stops frequency change $\Delta F / \Delta T = 0$	Lowers the frequency by the deceleration time

Stall prevention selector function	Code No.
	29

- Function to select the overcurrent stall prevention function for acceleration and steady running.
- Operates only for acceleration for function Code No. 29 = 0.
- Operates only for steady running for function Code No. 29 = 1.
- Operates for both acceleration and for steady running when function Code No. 29 = 2.

Automatic boost	Code No.
	06

- Automatically raises the voltage and the starting torque during acceleration, to give smooth acceleration.
- Operates only during acceleration, and not for steady running or deceleration.
- Operates when function Code No. 06 = 0.

Frequency meter sway calibration	Code No.
	31

- Adjustment can be performed by the  $\Delta$  and  $\nabla$  keys without having to use a variable resistor for sway adjustment.
- Function Code No. 31 = 1 for when meter correction is performed.



After correction, press the SET key to return to function Code No. 31 = 0. If this is not done, then it will not be possible to change the frequency using the  $\Delta$  and  $\nabla$  keys.

NOTE: If the initialization function is used, then the sway will return to the setting upon shipment from the factory (No. 36 = 1).

Automatic alarm return	Code No.
	32

- This allows automatic recovery if the protector function operates to trip the inverter when there is either overcurrent or overvoltage.
- This minimizes the device down time due to accidental shorts across the motor terminals, and due to excessive external noise.
- Restart is performed by the Free-run restart function.
- The inverter will stop if restart is tripped three times within ten seconds.
- This function is activated by function Code No. 32 = 1.
- This function is preset to "0" when shipped from the factory.

Alarm signal output for power failure	Code No.
	33

- If a power failure occurs when function Code No. 33 = 1, then the alarm relay signal will be output if the inverter stops. (Several seconds later, the alarm relay will go OFF when the residual charge in the inverter has decreased.)
- The operation will occur at the same time as the input circuit breaker goes OFF.
- There is automatic reset for recovery after instantaneous power failures.
- This is set to "0" upon shipment from the factory.

Remote switching for panel key input function	Code No.
	35

- This function makes the unit panel keys inoperative when there is a remote panel. (The remote panel is optional.)
  - If function Code No. 35 = 0, then control will shift to the remote panel. There will be no display.
- NOTE: Do not operate the normal code No. 35.

Function code data initialization	Code No.
	36

- This is the function to return the settings for the codes to those set upon shipment from the factory.
- If function Code No. 36 = 1, then the data for all of the function codes will become that shown on page 22.
- If "1" is input and the SET key pressed, then "PASS" will light after three or four seconds.

Brake resistor selection	Code No.
	38

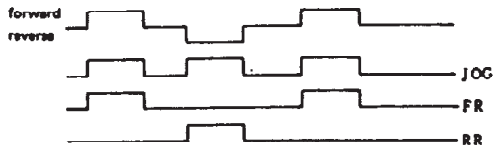
- No. 38 = 0 is normally used. Use No. 38 = 1 when there is the optional external resistor.

Fixing direction of motor rotation	Code No.
	39

- The direction of rotation of the motor can be fixed for either forward operation or reverse operation. This function is used to prevent misoperation.
- If No. 39 = 1, then the motor will not rotate even if the reverse signal is input. In the same way, if No. 39 = 2, then the motor will not rotate if the forward signal is input.
- This function is set to either No. 39 = 0 upon shipment from the factory (the reverse setting is also possible).

Inching operation	Code No.
	15

- The acceleration and deceleration times are fixed to 0.1 sec./50Hz.
- Inching operation is achieved by shorting across the JOG terminal and COM, and by the input of either the forward (FR) or reverse (RR) signals.



**NOTE 1:** If either the FR or RR signals is input first, then there will not be inching operation even if the JOG signal is input afterwards.

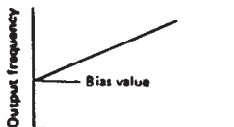
The JOG signal must be either input first, or the FR and RR signals input at the same time.

However, it is possible to have inching operation even when the set frequency is less than the start frequency.

**2:** Inching operation is only possible when the run instruction is an external signal.

Frequency bias	Code No.
	19

- It is possible to set the output frequency when the frequency set signal is 0, for cases when the external analog method is used for frequency setting.

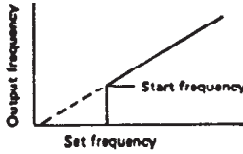


**NOTE 1:** Start will be from the value set for the start frequency.

**2:** Even if the input signal is 0V, the motor will start when the bias value exceeds the start frequency.

Start frequency	Code No.
	16

- The start frequency can be set between 0.5 and 50Hz, in 0.01Hz steps.



NOTE: Note that setting to 10Hz or more may cause overcurrent, and consequent damage.

NOTE: The motor will not operate if the frequency for operation is less than the start frequency (set frequency). However, once operating, it is possible to have operation as low as 0.5Hz by lowering the set frequency to less than the start frequency. (This is when the lower limiter is 0.5Hz or less.)

Function code data lock function	Code No.
	40

- Setting No. 40 = 1 will prevent the function code data from being changed. This is used to prevent misoperation.
- Read is still possible even while the data is locked. Moreover, it is still possible to change the frequency by either direct setting or step setting.

AF-500 Series Function Code List

Code No.	Function	Data content	Data set upon shipment	Code No.	Function	Data content	Data set upon shipment
00	Frequency setting	Frequency (Hz)	10	24	Jump frequency setting 4		0
01	Frequency setting method selection	0: Panel key setting 1: External analog setting	1	25	DC brake voltage	0: No braking 1-7: Braking amount	0
02	Panel display content switching (7-segment LED)	0: Frequency (Hz) 1: Current (A)	0	26	DC braking time	1 ~ 60 sec.	1
03	Level meter display content switching	0: Output frequency (%) 1: Load ratio (%)	0	27	Maximum frequency limiter	0: No limiter 1: 120 Hz limit	1
04	Operation instruction selection	0: Panel key 1: External signal	1	28	Overcurrent stall mode switching	0: No stall 1: ΔFct to one half 2: ΔFct to one quarter 3: ΔFct to zero	0
05	V/F parameter selection	1 ~ 28	3	29	Stall prevent selector function	0: Acceleration only 1: Steady running only 2: Acceleration and steady running	0
06	Torque boost select	0: Automatic boost 1-25: Manual boost	5	30	Restart during free-run function	0: Deactivated 1: Activated	0
07	Electronic thermal	25 ~ 100 (%) 0: Deactivated	100	31	Frequency meter away correction	0: Normal mode 1: Correction mode	0
08	No. 1 acceleration time	0.1 ~ 9999 sec./50 Hz	0.5	32	Automatic alarm return function	0: Deactivated 1: Activated	1
09	No. 1 deceleration time	0.1 ~ 9999 sec./50 Hz	1.5	33	Alarm signal output for power failure	0: Alarm relay deactivated 1: Alarm relay activated	0
10	No. 2 acceleration time	0.1 ~ 9999 sec./50 Hz	10	34	Acceleration/deceleration mode switching	0: Linear change	0
11	No. 2 deceleration time	0.1 ~ 9999 sec./50 Hz	10	35	Remote/main-unit switching for panel keys input functions	0: Shift to remote	1
12	No. 2 frequency setting	Frequency (Hz)	20	36	Function code data initialize	0: Steady running 1: Data set upon shipment	-
13	No. 3 frequency setting	Frequency (Hz)	30	37	Electronic thermal motor function	0: General purpose motor 1: Special inverter motor	1
14	No. 4 frequency setting	Frequency (Hz)	40	38	Brake resistor select	0: Built-in resistor used 1: Optional resistor used	0
15	Inching frequency setting	Frequency (Hz)	5	39	Motor rotation direction fixing function	0: Both forward and reverse rotation possible 1: Forward rotation only 2: Reverse rotation only	1
16	Start frequency	0.5 ~ 10 Hz	0.5				
17	Frequency upper limiter	Frequency (Hz)	60				
18	Frequency lower limiter	Frequency (Hz)	5				
19	Frequency bias limiter	Frequency (Hz)	0				
20	Jump frequency setting 1	Frequency (Hz)	0				
21	Jump frequency setting 2	Frequency (Hz)	0				
22	Jump frequency setting 3	Frequency (Hz)	0				
23	Jump frequency setting 4	Frequency (Hz)	0				

◆ The following are the functions for which it is not possible to change the data while the inverter is running.

Code No.	Function
01	Selection of frequency setting method
04	Selection of operating instruction
05	Selection of V/F pattern
06	Selection of torque boost
27	High frequency limiter
34	Acceleration/deceleration mode switching
35	Panel key input function remote/main-unit switching
36	Function code data initialization
39	Motor rotation direction fixing function

## 7. TROUBLESHOOTING

### 7-1 No rotation

Description of trouble	Suspected cause	Necessary processing
The motor does not rotate at all.	(1) Miswiring	Check the wiring against that of the standard wiring chart. <ul style="list-style-type: none"> <li>• Check the power input wiring</li> <li>• Check the CHARGE lamp</li> <li>• Is there a voltage for U,V,W output</li> </ul>
	(2) Wrong settings on operating panel	The function code No. 04 operation instruction is as follows. 0: Panel key operation 1: External analog signals
	(3) Confirmation of inverter protect function operation	Inspect as for 5 "Protect Function"
	(4) Is the motor locked? (Is the load heavy?)	

### 7-2 Tripping when motor is started

Description of trouble	Suspected cause	Necessary processing
"DCPR" is indicated as soon as the motor is started. (Overcurrent protect operation during acceleration.)	(1) Insufficient starting torque for the load	<ul style="list-style-type: none"> <li>• Change the torque boost Standard setting: B</li> <li>• Raise the value one step at a time to 6 or more. (Function Code No. 06)</li> </ul>
	(2) Is the acceleration time short when compared to load $GD^2$ ?	Lengthen the acceleration time (Function Code No. 08, Code No. 10)
	(3) Is the start frequency too low?	Set the optimum start frequency (Function Code No. 18)
	(4) The inverter is starting during motor free-run	Change function Code No. 30 from 0 to 1

### 7-3 Tripping during motor deceleration

Description of trouble	Suspected cause	Necessary processing
"OU" is indicated during deceleration (Overvoltage protector operation.)	(1) $GD^2$ for load is large during deceleration and so the regeneration energy cannot be absorbed. NOTE: If the DC link voltage is approximately 400V or more, then the overvoltage protector circuit will operate.	Use the optional DBR. Lengthen the deceleration time. (Function Code No. 09, Code No. 11)
	(2) The deceleration time is short when compared to the load $GD^2$ .	Lengthen the deceleration time. (Function Code No. 09, Code No. 11)

## 7-4 Unexpected stopping during operation

Description of trouble	Suspected cause	Necessary processing
"LU" is indicated in the display during operation and the inverter stops.	Drop in power voltage (The power voltage has dropped to less than approximately 170V, and the instantaneous protector function has operated.)	Check the capacity of the power facilities.
Unexpected stopping during operation. The display for the out-put frequency changes to zero, and there is no abnormality indication.	Power failure. With the standard specifications, the inverter stops for power failures and there is no automatic recovery upon restoration. External operation signals are not stored.	<ul style="list-style-type: none"> <li>o It is necessary to restart using the operation switch.</li> <li>o Make so that the operation signals are stored for external operation.</li> </ul>
"OU" is displayed while the motor is operating, and the motor stops. (Over-voltage protector operation.)	The motor is rotating because of the load. The input voltage waveform is greatly distorted. The peak value for the voltage is high.	In the case of continuous regenerative loads, it is necessary to use the optional DBR (regenerative discharge resistor) in accordance with the amount of the regenerative load.
"CCFn" is displayed during operation and the motor stops.	(1) Check that large load variations are not occurring, and that there is not the possibility of impact loads being applied.	If impact loads are being applied, then it is necessary to raise the capacity of the inverter one or two ranks.
	(2) When there is excessive external noise in the inverter signal input lines, due to the AC input power.	Use a twist wire or a shield wire for the inverter signal input line, and separate the drive power lines as far as possible.

## 8. MAINTENANCE AND INSPECTION

Maintenance and inspections are necessary in order to ensure that the device can exhibit its full performance for a long period of time. These inspections should be performed at regular intervals.

### 8-1 Maintenance and inspection cautions

- (1) Turning the power on and off should be performed by the person who is performing the inspection, so as to prevent the misoperation of the motor.
- (2) A high voltage will remain in the condenser for a short while after the power has been turned off. When performing work, do so only after the charge lamp on the PCB has gone out.

### 8-2 Inspection items

- (1) Check that there are no abnormalities for any of the following.
  - o Is the motor operating as expected?
  - o Are there any abnormalities in the installation environment.
  - o Are there any abnormalities in the cooling system?
  - o Are there any abnormal vibration or sounds?
  - o Is there any abnormal overheating or discoloration?

Check the input and output voltage of the inverter using a normal tester for during operation.

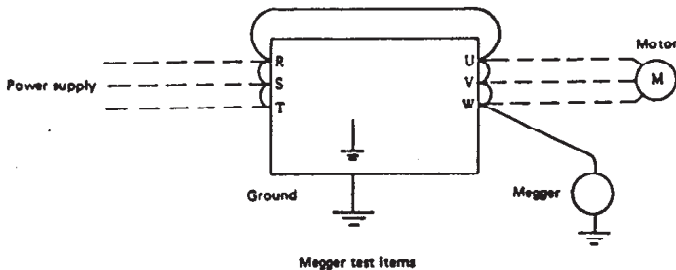
#### (2) Periodic inspection

The following items should be inspected periodically.

Inspection interval	Inspection item
every 6 months	<ol style="list-style-type: none"> <li>1. Terminal plates and mounting bolts.</li> <li>2. Condition for the connector fixing.</li> <li>3. Corrosion and breaks in the terminal clips for the wiring.</li> <li>4. Loose contacts for the external relay connectors.</li> </ol>
once a year	<ol style="list-style-type: none"> <li>1. Use clean, dry air to remove dust buildup from the guards, the case and the swelling fins.</li> <li>2. Check for parts burns or damage and make any exchanges necessary.</li> </ol>

(3) Megger test

- (a) When performing a megger test for the motor and the sequence circuit, this should be done so that the test voltage is not applied to the inverter.
- (b) The megger test for the inverter itself is implemented only for the main circuit for the parts shown in the following diagram. A megger test is not performed for the control circuit.



**NOTE:** A tester (high-resistance range) is used for the conductivity test for the control circuit. Do not use meggers or buzzers.

**8-3 Parts exchange**

With the exception of the cooling fan (when one is used), parts exchange is performed at the factory after an inspection has been performed.

The cooling fan is used to cool heat generating parts such as the semiconductor elements in the main circuit. The bearing life is approximately 10,000 to 35,000 hours. Therefore, it is necessary to replace the entire cooling fan once every two or three years in the case of normal operation of the device. When the fan is replaced, a check should also be conducted for any abnormal vibration or sound that occurs, and any necessary replacement performed.



## 9. LIST OF STANDARD SPECIFICATIONS

Suitable motor output (kW)	0.4	0.75	1.5	2.2	3.7
Model name	AF502-A40	AF502-A75	AF502-1A5	AF502-2A2	AF502-3A7
Rated output current (A)	3.2	4.8	8.0	11.1	17.4
Rated capacity (kVA)	1.3	1.9	3.2	4.4	6.9
Rated input voltage	3-phase 200V $\pm$ 10%, 50Hz $\pm$ 5%, 200 ~ 230V $\pm$ 10%, 60Hz $\pm$ 5%				
Protector structure	Self cooled			Forced air cooling	
	Completely sealed				
Control method	Magnetic flux control method PWM				
Frequency accuracy (with the rated frequency as standard)	For digital setting: $\pm$ 0.01% For analog setting: $\pm$ 0.5% (25°C $\pm$ 10°C)				
Frequency setting resolution	For digital setting 0.5 ~ 100Hz $\rightarrow$ 0.01Hz    For analog setting, 1/2000Hz of the rated frequency. 10.0 ~ 400Hz $\rightarrow$ 0.1Hz				
Frequency control range	0.5 to 400Hz (including special patterns) (Start frequency 0.5Hz ~ 50Hz freely settable)				
Rated output voltage	3-phase 200V, 220V, 230V				
Voltage/frequency ratio setting	Settable in 28 ways (including special patterns)				
Torque boost	Manual boost (switchable in 24 ways), automatic boost				
Acceleration/deceleration time setting	0.1 sec. ~ 9999 sec. (linear acceleration, 2 types of modes settable)				
Standard accessories	Motor free-run restart function, jogging operation, variable upper/lower limiters, frequency jump, 4-speed internal setting, others				
Braking torque	More than 150% of the regenerative brake (short-term rating)		More than 100% of regenerative brake (short-term rating)		
	DC dynamic brake (freely settable torque)				
Frequency setting signal	Digital setting by panel keys, external setting (DC0 to +10V or DC4 to 20mA)				
Protector function	Overcurrent stall, overcurrent limit, ground protect, electronic thermal, overvoltage stall, overvoltage protect, insufficient input voltage protect, instantaneous power failure protect				
Display functions	7-segment LED character display Frequency mode, current mode, setting mode, abnormality mode, operation mode				
Overcurrent resistance	Approx. 150% for 1 minute				
Altitude	Indoors up to 1000m (with no corrosive gases or dust)				
Peripheral temperature	-10°C ~ 40°C (0V, -10°C to 50°C when the upper and lower covers are removed)				
Peripheral humidity	90% or less (no condensation)				
Weight (kg)	3.0	3.0	5.4	6.0	6.2