MEIDEN

MEIDEN
AC SPEED CONTROL EQUIPMENT

THYFREC-VT110S

200V System 1.0 to 3.5kVA
400V System 1.5 to 3.5kVA

INSTRUCTION MANUAL

NOTICE

1. Read this manual thoroughly before using the VT110S, and store in a safe place for reference.
2. Make sure that this manual is delivered to the final user.
3. When using this inverter in the EU region, compliance with the EMC Directive (89/336/EEC) is required. Thus, in this case, refer to the separate "EMC Application Manual" (ST-3038), and install and wire accordingly.

MEIDENSHA CORPORATION

ST-2946D Jul. 1998

Contents

Preface

Thank you for purchasing the Meiden general-purpose inverter THYFREC-VT110S.
THYFREC-VT110S is a highly functional inverter that is easy to use.
Please read this manual thoroughly before use, and keep the manual at hand for later reference. Also make sure that this manual is delivered to the final users.

⚠ WARNING

ALWAYS READ THIS MANUAL THOROUGHLY BEFORE USING THE VT110S.

THIS INVERTER CONTAINS HIGH VOLTAGE CIRCUITS THAT MAY BE FATAL TO HUMANS. USE EXTREME CAUTION DURING INSTALLATION. MAINTENANCE MUST BE PERFORMED BY QUALIFIED TECHNICIANS, AND ALL POWER SOURCES MUST BE DISCONNECTED BEFORE ANY MAINTENANCE. SUFFICIENT NOTICE MUST BE GIVEN TO THE GENERAL OPERATORS AND WORKERS BEFORE STARTING.

- ELECTRIC SHOCK MAY OCCUR IF THE FOLLOWING POINTS ARE NOT OBSERVED.
  1) DO NOT OPEN THE COVER WHILE THE POWER IS ON.
  2) A CHARGE STILL REMAINS IN THE INVERTER WHILE THE INDICATOR IS LIT EVEN IF THE POWER HAS BEEN TURNED OFF. DO NOT OPEN THE COVER IN THIS CASE. WAIT AT LEAST 10 MINUTES AFTER THE INDICATOR GOES OUT.
  3) DO NOT CONTACT THE ELECTRICAL CIRCUIT WHILE THE CHARGE LAMP ON THE PCB IS LIT. PERFORM SERVICING, ETC., AFTER WAITING AT LEAST 10 MINUTES AFTER THE LAMP GOES OUT.
  4) ALWAYS GROUND THE INVERTER CASE. THE GROUNDING METHOD MUST COMPLY WITH THE LAWS OF THE COUNTRY WHERE THE INVERTER IS BEING INSTALLED.
- THE INVERTER MAY BE DESTROYED BEYOND REPAIR IF THE FOLLOWING POINTS ARE NOT OBSERVED.
  1) OBSERVE THE INVERTER SPECIFICATIONS.
  2) CONNECT ADEQUATE CABLES TO THE INPUT/OUTPUT TERMINALS.
  3) ALWAYS KEEP THE INVERTER INTAKE/OUTTAKE PORTS CLEAN, AND PROVIDE ENOUGH VENTILATION.
  4) ALWAYS OBSERVE THE CAUTIONS LISTED IN THIS INSTRUCTION MANUAL.
- THERE MAY BE SOURCES OF NOISE AROUND THIS INVERTER. CONSIDER THE POWER SUPPLY SYSTEM, INSTALLATION PLACE AND WIRING METHOD BEFORE INSTALLATION.

Chapter 1 Delivery Inspection and Storage

1-1 Delivery Inspection and Storage

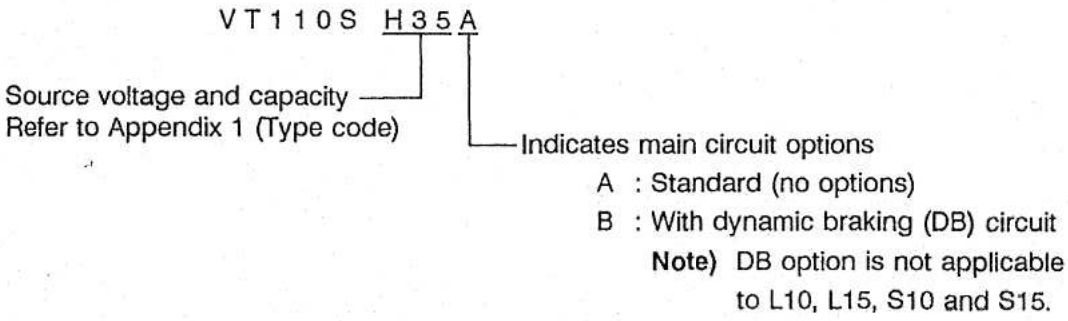
1) Remove the inverter from the packaging, and check the details on the rating nameplate to confirm that the inverter is as ordered. The rating name plate is on left side of the cover.
2) Confirm that the product has not been damaged.
3) If the inverter is not to be used for a while after purchasing, store it in a place with no humidity or vibration in the packaged state.
4) Always inspect the inverter before using after storing for a long period. (Refer to 8-1.)

1-2 Details of Rating Nameplate and Type Display Method

1) The following details are listed on the rating nameplate.

VT110S	H35B
SOURCE	
OUTPUT CURRENTS	
SERIAL NO.	

2) Using the above type as an example, the type is displayed as follows:



Chapter 2 Installation and Wiring

2-1 Installation Environment

Observe the following points when installing the inverter.

1) Install the inverter vertically so that the cable lead-in holes face downward.
2) Make sure that the ambient temperature is 0°C to 50°C.
3) Avoid installation in the following environment.
   - Places subject to direct sunlight
   - Places with oil mist, dust or cotton lint, or subject to salty winds
   - Places with corrosive gas, explosive gas or high humidity levels
   - Places near vibration sources such as dollies or press machines
   - Places made of flammable materials such as wood, or places that are not heat resistant
4) Ensure ventilation space around the inverter. (Refer to Fig. 2.1.)

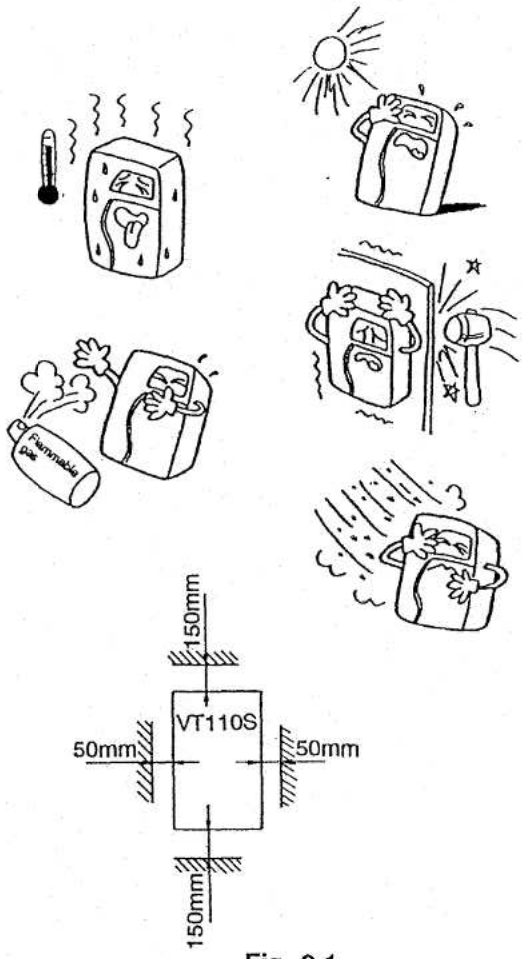


Fig. 2.1

2-2 Installation

> **⚠ WARNING**
> Install this inverter on a perpendicular wall. If laid on the floor and used, the cooling capacity will drop, and the unit may overheat.

Loosen the fixing screw on the two corners of the VT110S cover, and remove the cover. Fix the VT110S on the two corners.
Pass the wiring through the slot on the bottom side.

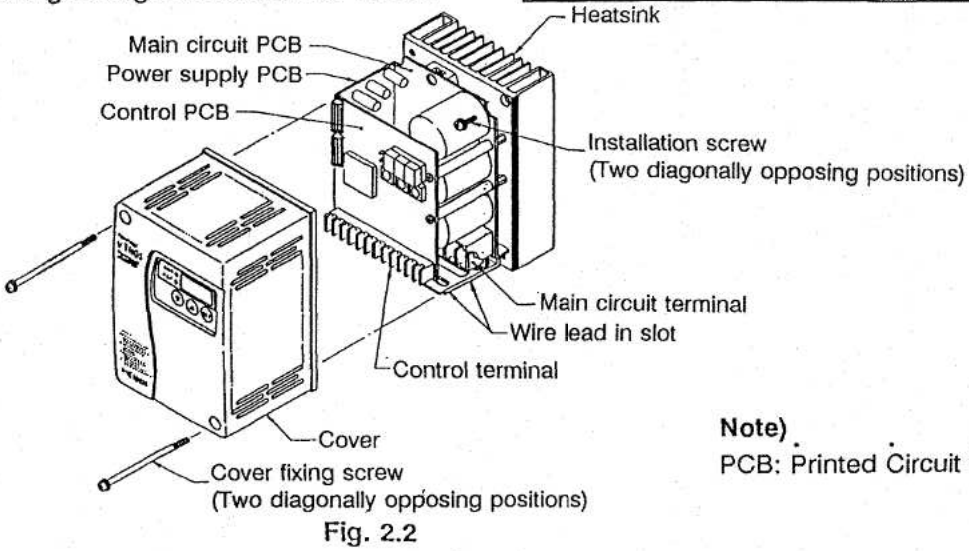


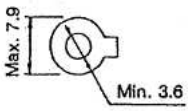
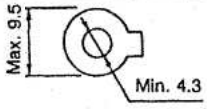
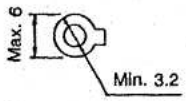
Fig. 2.2

Note)
PCB: Printed Circuit Board

2-3 Precautions for Power Supply and Motor Wiring

1) When using the VT110S at the rating, the wire size should be higher than the values shown in Table 2.1. The applicable wire size range and tightening torque of the terminal block are shown in Table 2.1.

Table 2.1 Wire size and tightening torque

	Main circuit terminal		Control terminal
VT110S type (Capacity)	S10, S15 L10, L15	S25, S35 L25, L35 H15, H25, H35 <U15, U25, U35>	All
Rated wire [mm²]	2	3.5 <12 AWG>	0.75 <20 AWG>
Applicable wire range [mm²]	2	0.52 ~ 5.2 <10 ~ 20 AWG>	0.6 ~ 1.3 <16 ~ 20 AWG>
Ring terminal dimension [mm]		 <Not regulated>	 <Not regulated>
Tightening torque [N·m]	1.0	1.2	0.8

Note) The details in < > apply to the types U15, U25 and U35 (UL approved parts).

2) Always connect the power supply line to L1, L2 and L3. The inverter will be damaged if connected to U, V and W.
3) The capacity of the transformer that is the power supply must be within the range of 1.3 to 10 times even when using one with a 4% impedance. If not, the inverter may overheat and will be destroyed. If the capacity exceeds 10 times, install an AC reactor on the power supply side.
4) Install an MCCB on the power supply, and install near the inverter.
5) If wiring is parallel to the control wire explained in section 2.4, the VT110S may malfunction due to noise.
6) The motor terminal voltage will rise causing the motor to burn if the output wiring is too long.
7) Always ground the VT110S.

<Cautions for satisfying UL approval>

The VT110S has received UL approval under the following conditions.
Thus, when actually using the VT110S-Uxx, observe the following.

1. The VT110S is an open-type equipment. Thus store the unit in a case of which the height, width and depth is 1.5 times or more that of the VT110S outer dimensions.

VT110S type	Equipment dimensions WxHxD [mm]	Min. case dimensions WxHxD [mm]
U15, U25, U35	135x200x165	202.5x300x247.5

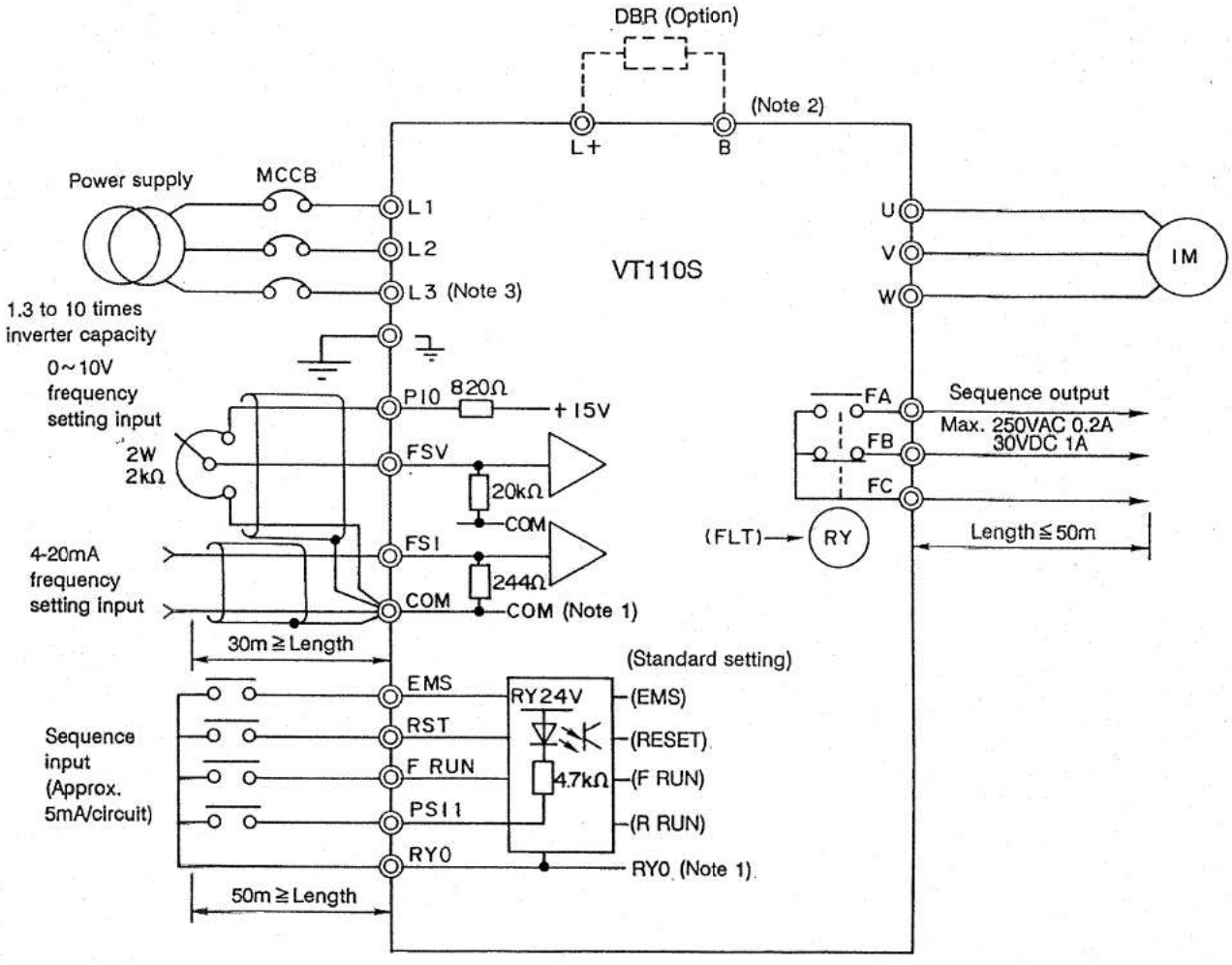
2. Use 75 deg C copper and class 1 wires only for main terminal.
3. Use class 1 wires only for control terminal.
4. Refer to table 2.1 for wire range and tightening torque ranges.
5. Suitable for use on a circuit capable of delivering not more than 5,000 rms amperes, 460 volts maximum.
6. Following distribution fuse required
   Non-time-delay type, not exceed 300 percent but not less than 225 percent of motor and UL listed.
7. Motor over load protection required separately from this equipment.

2-4 Precautions for Wiring to the Control Signal

1) When connecting to the control terminal block, refer to Table 2.1 (control terminal) and confirm the wire size and tightening torque.
2) Use shielded wires for wiring to the setting inputs. (analog signal circuit).
   Connect the shield to the VT110S COM terminal. The wire length must be 30m or less.
3) The length of the contact input/output wire must be 50m or less.
4) Follow the precautions listed in "Table 5.4 Control input/output circuit".

< Caution >

When using this inverter in the EU region, compliance with the EMC Directive (89/336/EEC) is required. Thus, in this case, refer to the separate "EMC Application Manual" (ST-3038), and install and wire accordingly.



(Notes)
1. No connection shall be made between RY0 and COM since this section is insulated.
2. DBR option is not applicable to L10, L15, S10 and S15.
3. In case of single phase type unit (S10, S15, S25, S35), connect the power supply lines to L1 and L2.

Fig. 2.3

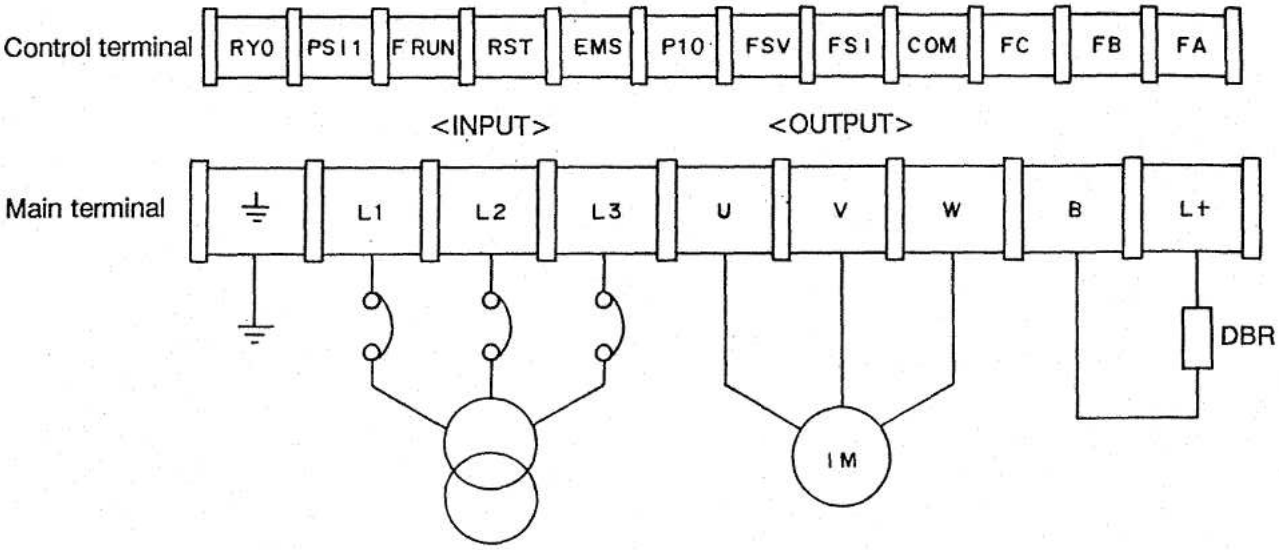

Control terminal
RY0
PSI1
F RUN
RST
EMS
P10
FSV
FSI
COM
FC
FB
FA
<INPUT>
<OUTPUT>
Main terminal
L1
L2
L3
U
V
W
B
L+
DBR
IM

Fig. 2.4

Chapter 3 Test Operation and Adjustment

Various parameters can be set on the THYFREC-VT110S, some of which must be set before actual operation. The operation of a 220V/60Hz standard motor with the default setting adjusted (200V/50Hz) is explained in this chapter.

3-1 Flow of Test Operation

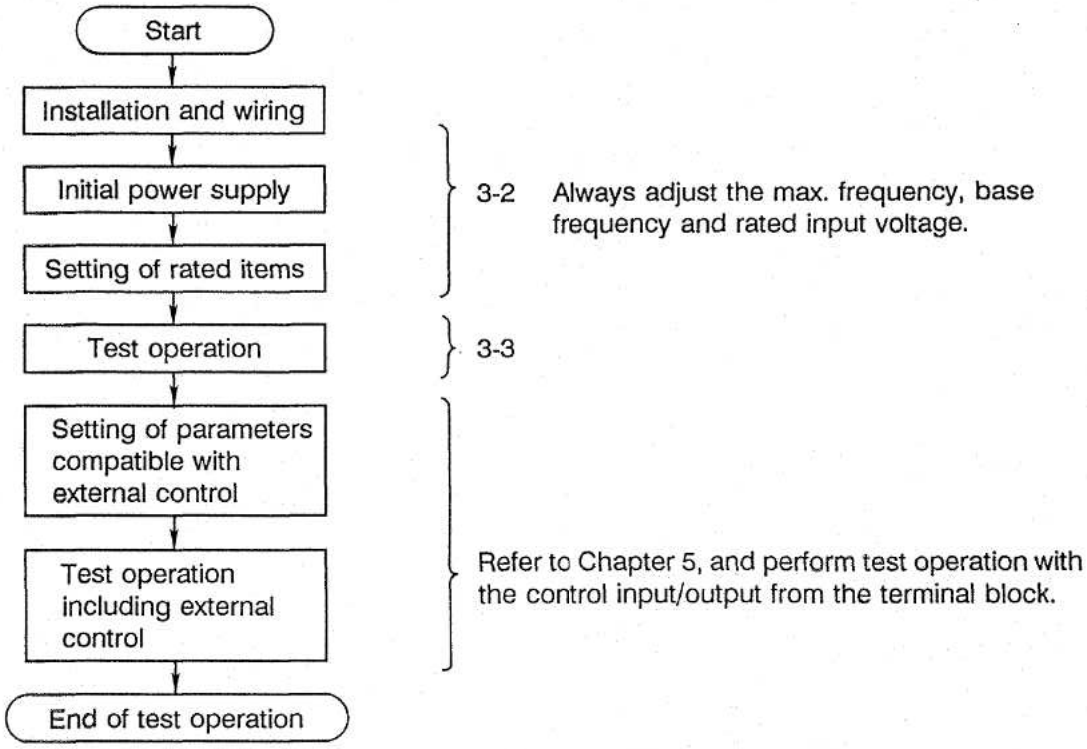


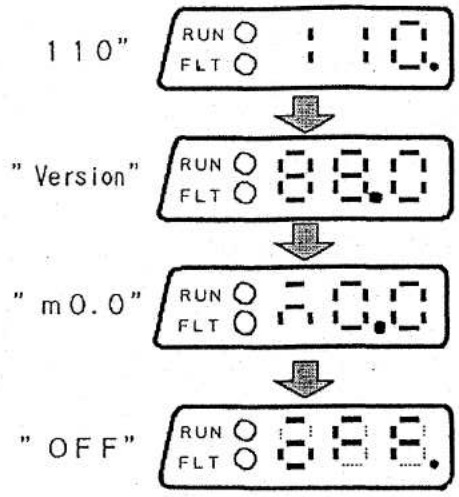
Fig. 3.1 Test operation procedure

⚠ WARNING

1. Check that the wiring is correct.
2. The power supply must always be kept in the tolerable range.
3. Always check that the inverter rating and motor rating match.
4. Always correctly install the cover before turning the power on.
5. Assign one worker to operate the switches, etc.
6. Refer to the Chapter 6 and observe the precautions when changing the set values such as torque boost A2.0.

3-2 Settings of Parameter before Operation

(1) Turn ON the MCCB, and then turn ON the inverter power.
" 110", "version", and " A0.0 " will display momentarily on the 7-segment display, and then " OFF. " will display.



(2) Refer to section 4-4, and change the rating parameters according to the power supply and motor.

3-3 Test Operation

The test operation is performed with the following procedure.

<Caution>

1. Make sure that all control signals on the control terminal are not activated yet.
2. The motor will run. Confirm the safety around the motor.

(1) Turn ON the power supply.
" 110", "version", and " A0.0 " will display momentarily on the 7-segment display, and then " OFF. " will display.

(2) Try to run in forward.
Turn ON the F RUN command.
"RUN" lamp will light and the 7-segment display will change from " OFF " to numerical display (output frequency monitor). After several seconds, the display value will reach " 10.0 " [Hz]. This is because the local setting frequency (A0.0) is set to 10.0Hz as the default setting.
Confirm the following.
a) Does the motor run?
b) Is the rotate direction correct? Check the wiring to the motor if it is abnormal.

(3) Try to run in reverse.
Turn OFF the F RUN command and turn ON the PSI1 (R RUN).
Confirm that the motor speed decelerates and reverse its rotation direction. The end speed will reach 10Hz in reverse.
Turn OFF PSI1 (R RUN) and turn ON F RUN command in order to run in forward again.

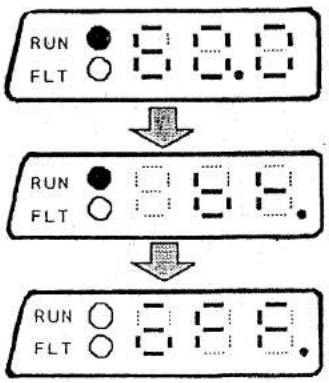
(4) Try to change frequency setting.
a) Press the ▲ key 9 times. The display will alternate between " A0.0 " and " 10. " [Hz].
b) Press the SET key once.
The display will stop at " 10. " and decimal position will flicker.

c) Press the ▲ key. Display value will increase every ▲ key operation, at the same time, motor speed will increase.
The output frequency can be incremented/decremented with the ▲ / ▼ keys.

d) Hold down ▲ key until the display reaches at " 60. " [Hz], and then press SET key.
Confirm that the motor is running stably.

e) Press the ▼ key 9 times in order to change the display to the output frequency monitor (" A0.0 ") mode.

Note) A 10-second acceleration and 20-second deceleration ramp time are set as defaults. The motor will slowly increase its speed to the set value. Increase the speed by approx. 10Hz at a time with the ▲ / ▼ keys.



(5) Try to stop.
Turn OFF the F RUN command. The motor speed will decelerate and stop with DC-brake. At this time, the display will drop to 0 and display " bk " for two seconds, and then change to "OFF ", and RUN lamp will off.
" bk " shows that DC-brake is in active.

Chapter 4 Operation Panel

4-1 Details of Operation Panel

The configuration of the operation panel is shown in Fig. 4.1.

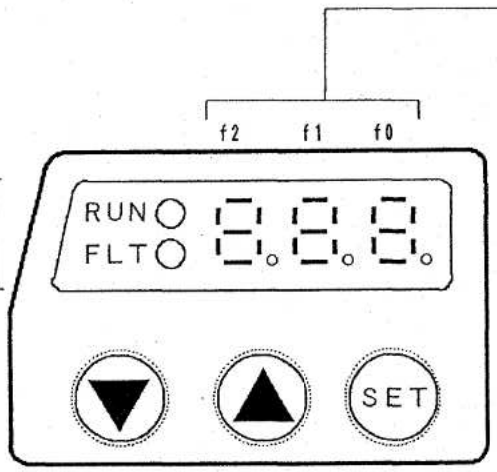
Status lamps

RUN: Lights during the inverter running or DC-braking.

FLT: Lights when the inverter has detected a fault and has stalled.
It can be reset with the following operation.

a) Input RST command from control terminal.

b) Set a value into parameter b4.00.



Display

The section is configured of a 7-segment LED with 3 digits from f0 to f2.

SET key

a) In parameter scan mode:
Select parameter and enter into the state of parameter value change mode.

b) In parameter value change mode:
Input displayed value to the internal function block.

▲ / ▼ key

These are parameter operation keys.

a) In parameter scan mode:
The parameter number will increment/decrement.
When held down, the parameter number will increment/decrement continuously.
When held down and SET key is pressed, then the parameter block number will be skipped.

b) In parameter value change mode:
The parameter value will increment/decrement.

Fig. 4.1 Operation panel

4-2 Parameter Arrangement and Operation

The VT110S Parameters are classified as shown in Fig. 4.2. These parameters are grouped into blocks according to their functions and frequency of usage. The details are shown in Table 6.1.

A parameter scan operation is done with ▲/▼ key from A0.00 to b9.07 when the first or last parameter is reached, the scan will automatically return to the first or last parameter (A0.00←→b9.07). A fast scan can be done by holding down ▲/▼ key for one second or more. The fastest scan can be done with block skip operation by holding down ▲/▼ key and pressing the SET key.

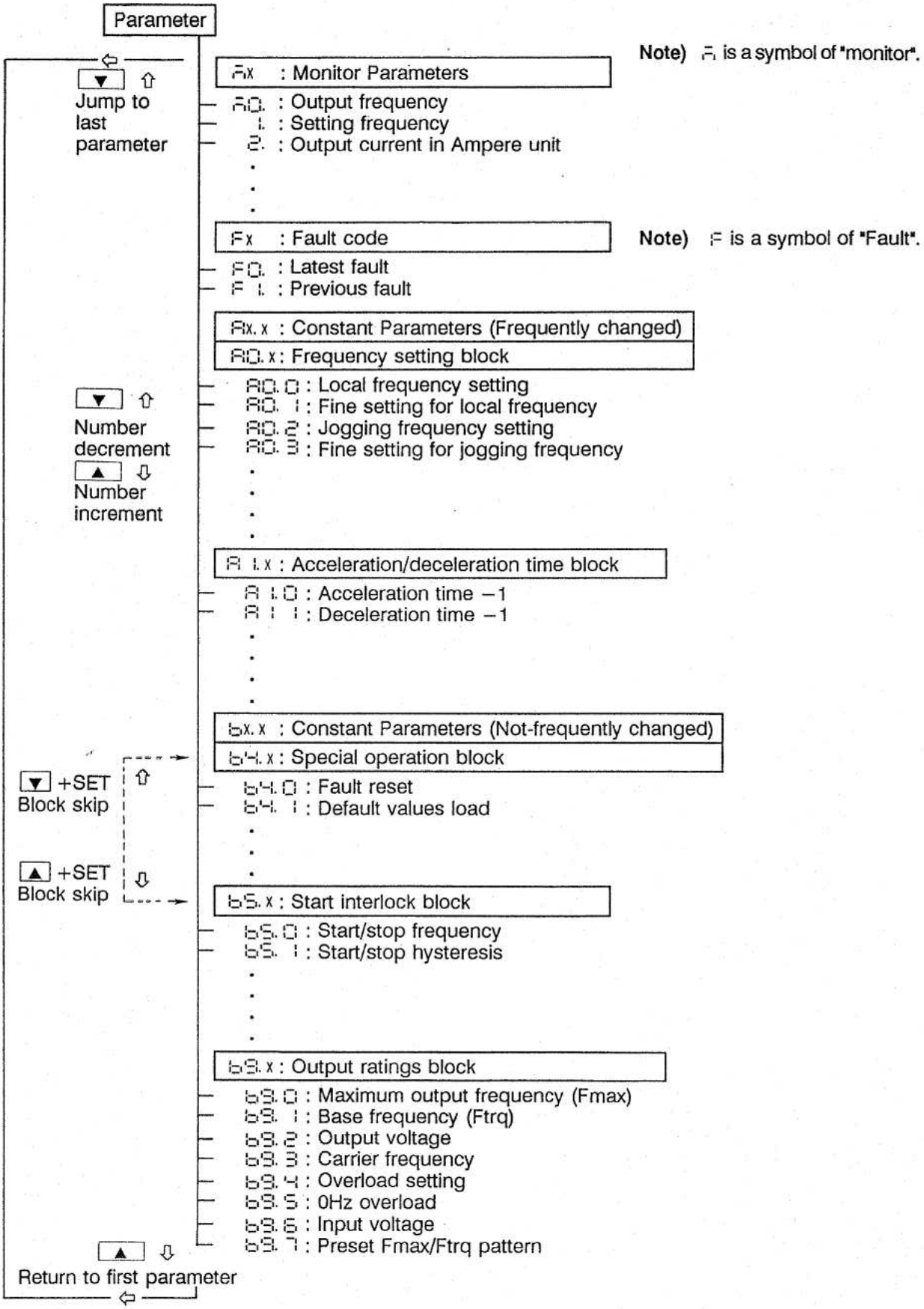


Fig. 4.2 Parameter arrangement and scan operation

4-3 Reading Monitor Parameters

(1) Refer to Chapter 6 "Monitor parameters" section.

(2) The following is an example for reading the output current as a percentage and then showing the output frequency as Hz.

Table 4.1 Example of reading monitor parameter

Key operation	Display	Explanation
① Change parameter from A0 to A3 .		
(In the condition of that the inverter is running.)		
	60.0 [Hz]	A0 : Output frequency monitor
▲		Parameter number increments.
▲	A1	Next parameter number displays.
▲	A2	
	A3	Parameter: A3 displays.
		This is the parameter number of the output current monitor in a % unit.
	⇩	
	65.4 [%]	After one second, the display will show the output current value as a percentage against rated current of the inverter.
② Change parameter from A3 to A0 .		
▼		Parameter number decrements.
▼	A2	Next parameter number displays.
▼	A1	
	A0	Parameter: A0 displays.
		This is the parameter number of the output frequency monitor in Hz.
	⇩	
	60.0 [Hz]	After one second, the display will show the output frequency value.

4-4 Reading and Adjusting Constant Parameters

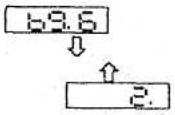
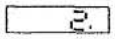
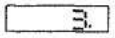
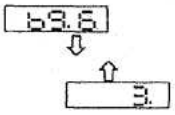
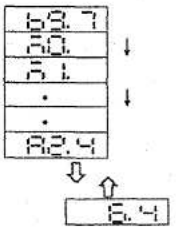
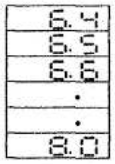
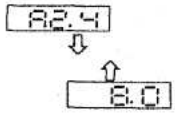
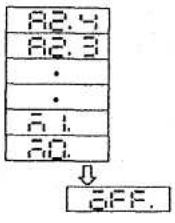
(1) Refer to Chapter 6 for the details on the Constant parameters.
(2) The following is an example for changing "Preset Fmax/Ftrq patterns" and rated input voltage setting, and then changing "DC-Brake time".

Table 4.2 (1/2) Example of adjusting constant parameter

Key operation	Display	Explanation
① Change V/F Pattern from Fmax/Ftrq=50/50Hz to 60/60Hz with using Preset Fmax/Ftrq Pattern		
(Turned on the power)	AO. ⇩ OFF.	The display shows "output is OFF" state in output frequency monitor mode (AO).
[▼]		Parameter number changes from AO to b9.7.
		Remark) In this case, ▼ key operation is better than ▲ key, because b9.7 is nearest in backward scan.
	b9.7 ⇩⇧ 1.	The display will alternate between Parameter number b9.7 and the present value " 1 ".
		b9.7 : Parameter number of Preset Fmax/Ftrq Pattern
		1 : Code of Fmax=50Hz, Ftrq=50Hz
[SET]		Enter Parameter value change mode.
	1.	Alternate display will stop and parameter value will display.
[▲]		Increment the value
	2.	2 : Code of Fmax=60Hz, Ftrq=60Hz
[SET]		Enter the new value.
	b9.7 ⇩⇧ 2.	Display alternates again.
		<Continue on next page>

Note) b9.7, b9.6 are parameters that can only be changed while the inverter is stopped. If "rUn" (RUN) is displayed while the parameter is being set, then stop the inverter first and press the SET key again.

Table 4.2 (2/2) Example of adjusting constant parameter

Key operation	Display	Explanation
② Change Rated Input Voltage from 200V to 220V		
▼		Parameter number decrements. The display will alternate between Parameter number b9.6 and the present value " 2 ". b9.6 : Parameter number of Rated Input Voltage 2 : Code of input voltage = 200V
SET		Enter the Parameter value change mode. Alternate display will stop and parameter value will display.
▲		Increment the value 3 : Code of input voltage = 220V
SET		Enter the new value. Display alternates again.
③ Change Brake Voltage from 6.4% to 8.0%		
▲ ・・・ ▲		Hold down ▲ key until A2.4 displays. (Automatically increment parameter number.)
		The display will alternate between Parameter number A2.4 and the present value " 6.4 ".
SET		Enter the Parameter value change mode.
▲ ・・・ ▲		Alternate display will stop and parameter value will be displayed. Hold down ▲ key until near 8.0 is reached and then adjust to 8.0 with ▲/▼ key.
SET		Enter the new value. Display alternates again.
▲ ・・・ ▲		Hold down ▼ key until A0 is displayed. (Automatically decrement parameter number.)
		Return to the output frequency monitor mode. The inverter is ready to run a motor, at a rating of 220V/60Hz.

4-5 Reading Fault Codes

Parameters FO and F1 are fault codes. FO is the latest fault and F1 is the previous fault code. These parameters can be read like a monitor parameter.
Refer to Table 4.4 for the fault codes and the details.

Table 4.3 Reading fault code

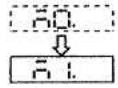
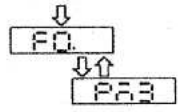
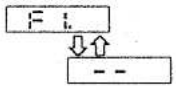
Key operation	Display	Explanation
▲ 7 times		Change parameter number from A0 to F0.
		Fault number and its fault code will display alternately. F0 : Fault number (Latest fault) Pm3 : Fault code (Pm3: Power module fault during acceleration)
▲		Previous fault will display. F1 : Fault number (Previous) -- : No fault is registered.

Table 4.4 Fault code list

Display code	Name	Causes
EMS. (EmS) Pm.n (Pm. n)	Emergency stop Power module	EMS command input has been activated. The protection circuit of the power module has been activated.
OC.n (OC. n) OV.n (OV. n) UV.n (UV. n)	Overcurrent Overvoltage Undervoltage	Short circuit or overload has been detected. DC-link voltage is over 400V (200V system)/800V (400V system). DC-link voltage is lower than 65%V of rated input voltage. **Note)** "n" is code for following inverter states when the fault was detected. n=1: during stop n=2: during constant speed operation n=3: during acceleration n=4: during deceleration n=5: during DC-brake
OH.	Overheat	Power module temperature has risen.
EA.m (EA. m) Eb.m (Eb. m)	Parameter-A Error Parameter-B Error	Error in Group-A parameter setting. Error in Group-B parameter setting. **Note)** "m" is parameter block number of error parameter.
OL. (OL)	Overload	Load has exceeded 150% for one minute.
IO.k (IO. k) CP.k (CP. k)	I/O error CPU error	Control circuit is abnormal. CPU or memory is abnormal. **Note)** "k" is code for details.

Chapter 5 Control Input/Output

5-1 Input/Output Terminal Functions

The terminal block and input/output functions related to control are as shown in Tables 5.1, 5.2 and 5.3.

Table 5.1 Terminal block functions

Symbol		Meaning	Features
Relay input	RY0	Relay input common	This is a common terminal for relay input signals specified below.
	EMS (Note 1)	Emergency stop	While the VT110S is stopped, all operational commands are inhibited. If it is ON during operation, the VT110S is led into a stopping sequence. As for stopping method, either ramp down stop or coast-to-stop is available. It is also possible to output this signal as a fault (FLT).
	RST (Note 1)	Fault reset	A faulty condition is reset. With this signal, a fault mode (FLT LED, FAULT relay) is turned off and operation is made possible again.
	F RUN (Note 1)	Forward run	This is a command for forward run. A command for run/reverse mode or a selfhold mode can be selected.
	PSI1	Programmable input	This command can be arbitrarily led to the input signal circuit in the control PCB through relay input selective setting.
Analog input	FSV	Voltage/ frequency setting	This is a frequency setting input with a voltage range from 0 to 10V. A maximum frequency setting is available at a 10V input. This setting is valid when VFS of the internal relay signal is ON.
	FSI	Current/ frequency setting	This is a frequency setting input with a current range from 4 to 20mA. A maximum frequency setting is available at a 20mA input. This setting is valid when IFS of the internal relay signal is ON. The load resistance is 244Ω.
	COM	Analog input common	This is a common terminal for FSV and FSI signals.
Relay output	P10	FSV source	This is a 10V source used when a frequency setter is connected to the FSV input circuit. The frequency setter to be used should be a variable resistor of 2W and 2kΩ.
	FC, FA, FB (Note 1)	Fault	These contacts function when a fault occurs (when the FLT lamp is lighted). When a fault occurs, the section FA-FC is closed and the section FB-FC is open.

(Note 1) The signal names are default functions and can be arbitrarily changed to other functions with parameter No.B7.x or B8.x.

Table 5.2 Relay input signals in control section

Symbol	Meaning	Features	
F RUN	Forward run	(See Table 5.1)	
R RUN	Reverse run	This is a command for reverse run. A command of reverse run mode is available in the run/reverse mode.	
F JOG	Forward inching	These are inching commands. If this signal is ON while F RUN or R RUN is OFF, operation then conforms to the setting of inching (A0.2) made within the control circuit. For stoppage, either ramp down stop or coast-stop is available.	
R JOG	Reverse inching		
HOLD	Hold	This is a stop signal generated when the setting is to be the self-hold mode during the operating mode. The VT110S stops with this signal turned off. Input of RUN or R RUN can be held with this signal turned on.	
RST	Reset	(See Table 5.1)	
EMS	Emergency stop	(See Table 5.1)	
VFS	Voltage setting	Frequency setting is made with an input from FSV.	When inputs are entered simultaneously, setting is selected in accordance with following preference order. PROG>IFS>VFS
IFS	Current setting	Frequency setting is made with an input from FSI.	
PROG	Program setting	Used for multiple setting. Selection of 4 steps (PROG0~PROG3) is made with S0 and S1.	
S0, S1	Program setting selection	When PROG is ON, Program frequency 0~3 are selected. Prog.0 Prog.1 Prog.2 Prog.3 S0 0 1 0 1 S1 0 0 1 1 In this case [0] denotes OFF and [1] denotes ON.	
C SEL	Ramp selection	Accel./decel. ramp performance is switched over. Accel./decel. time 2 is available with ON, and accel./decel. time 1 is available with OFF.	
FUP	Frequency increment	To raise the internal frequency setting.	
FDW	Frequency decrement	To lower the internal frequency setting.	

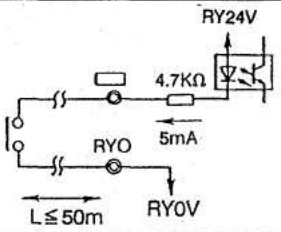
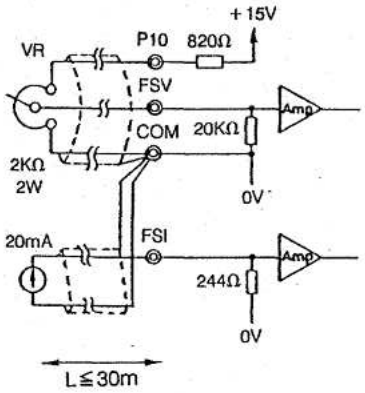
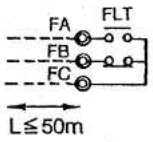
Table 5.3 Relay output signals in control section

Symbol	Meaning	Features
RUN	Run	This signal is ON during operation or DC braking.
FLT	Fault	ON when a fault occurs. (The same signal as that of the standard Fault relay output.)
RDY	Ready	Operation is possible while this signal is ON.
REV	Reverse	ON when reverse run or reverse inching command is received. This signal is held even during the operation stopping.
I DET	Current detection	ON when the current exceeds the level set by parameter No. A5.1.
ATN	Frequency attained	ON when the output frequency has reached the setting input level.
SPD	Speed detection	ON when the frequency exceeds the level set by parameter No. A5.2.

5-2 Control Input/Output Circuit

Examples of the control input/output circuit wiring are shown in table 5.4. The precautions must be observed during wiring.

Table 5.4 Control input/output circuit

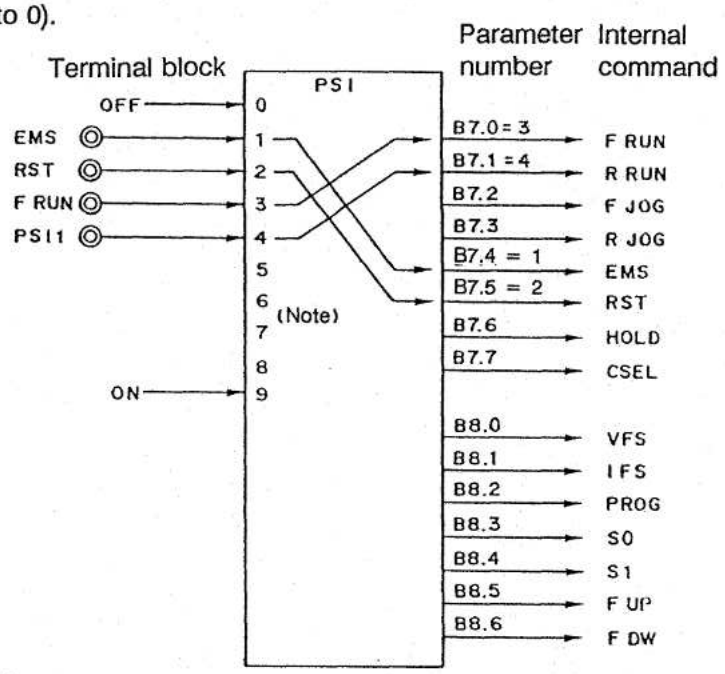
Function	Example of wirings	Precautions
Relay input		1. Wiring must not be longer than 50m. 2. The allowable leakage current is 0.5mA. 3. Use a minute current contact. 4. Do not connect to the analog input/output.
Analog input and P10 output		1. Use 2kΩ/2W rating setter for the external variable resistor. 2. The maximum input rating of FSV is −0.0 to +10.5V. 3. Use a shielded wire shorter than 30m for the wiring. 4. For shield connections, open the mate side, and connect to COM terminal on the VT110S side. 5. The maximum input rating for FSI is 0 to +21mA or 0 to +5.25V. 6. Do not connect to the relay input.
Relay output		1. Use within the rated range as shown below. 2. The wire must be shorter than 50m. Rated capacity (resistance load): 250VAC 0.2A, 125VAC 0.6A, 30VDC 1A Max. voltage: AC250V DC220V Max. current: 1A Switching capacity: 50VA 60W

5-3 Changing of Terminal Functions

The programmable input terminals (EMS, RST, F RUN, PSI 1) can be connected to random internal commands. The internal state can be connected to the fault relay terminal, to lead in the ON/OFF signal.

(1) Relay input terminal assignment (PSI Function)

The parameters can be assigned to the terminal block as shown in Fig. 5.1 according to the parameter Nos. B7.0 to 7 and B8.0 to 6. Each parameter can be fixed to ON (set value to 9) or OFF (set value to 0).



Note) These values are reserved for future use.
Currently, these are set to 0.

Fig. 5.1 Assignment of relay input

(2) Relay output terminal assignment

The ON/OFF of the internal signals can be output to the FA-FC-FB terminal as shown in Fig. 5.2 with the parameter No. B8.8.

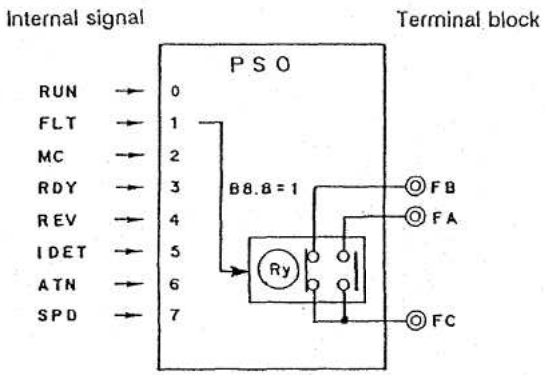


Fig. 5.2 Assignment of relay output

Chapter 6 Control Functions and Parameter Settings

6-1 Parameter Summary

Table 6.1 Parameter summary

dX : Monitor Parameters	bX.X : Constant Parameters (Not-frequently changed)
d0 : Output frequency d1 : Setting frequency d2 : Output current in Ampere unit d3 : Output current in % unit d4 : OLT monitor d5 : DC-link voltage d6 : Output voltage	b3.x : Overcurrent limit block b3.0 : Drive current limit b3.1 : Regenerative torque limit
FX : Fault code read	b4.x : Special operation block b4.0 : Fault reset b4.1 : Default values load (Note 4) b4.3 : Parameter lock
F0 : Latest fault F1 : Previous fault	b5.x : Start interlock block b5.0 : Start/stop frequency b5.1 : Start/stop hysteresis b5.3 : Interlock frequency
AX.X : Constant Parameters (Frequently changed)	b6.x : Control method block b6.0 : RUN command method b6.1 : F RUN, R RUN stop method b6.2 : F JOG, R JOG stop method b6.3 : Auto start b6.4 : EMS command input logic b6.5 : EMS stop method
A0.x : Frequency setting block (Note 1, Note 2) A0.0 : Local frequency setting A0.1 : Fine setting for local frequency (Note 2) A0.2 : Jogging frequency setting A0.3 : Fine setting for jogging frequency A0.4 : Program frequency -0 A0.5 : Fine setting for program frequency -0 A0.6 : Program frequency -1 A0.7 : Fine setting for program frequency -1 A0.8 : Program frequency -2 A0.9 : Fine setting for program frequency -2 A0.A : Program frequency -3 A0.b : Fine setting for program frequency -3	b7.x : Programmable Input configuration block -1 (Operating commands) b7.0 : F•RUN b7.1 : R•RUN b7.2 : F•JOG b7.3 : R•JOG b7.4 : EMS b7.5 : RESET b7.6 : HOLD b7.7 : CSEL
A1.x : Acceleration/deceleration time block A1.0 : Acceleration time -1 A1.1 : Deceleration time -1 A1.2 : Acceleration time -2 A1.3 : Deceleration time -2 A1.4 : Acceleration time for jog A1.5 : Deceleration time for jog A1.6 : Acceleration/Deceleration time unit	b8.x : Programmable Input configuration block -2 (Select commands) b8.0 : VFS b8.1 : IFS b8.2 : PROG b8.3 : S0 b8.4 : S1 b8.5 : FUP b8.6 : FDW b8.7 : FUP/FDW Step b8.8 : Relay output terminal parameter b8.9 : Operation panel initial monitor parameter
A2.x : Torque boost and DC-Brake setting block A2.0 : Torque boost voltage A2.1 : Reduced voltage for square-low torque A2.2 : Auto torque boost gain A2.3 : Slip compensation gain A2.4 : DC-Brake voltage A2.5 : DC-Brake time A2.6 : Start frequency A2.7 : Stop frequency	b9.x : Output ratings block (Note 3) b9.0 : Maximum output frequency (Fmax) b9.1 : Base frequency (Ftrq) b9.2 : Output voltage b9.3 : Carrier frequency b9.4 : Overload setting b9.5 : 0Hz overload b9.6 : Input voltage b9.7 : Preset Fmax/Ftrq pattern
A3.x : Frequency skip function setting block A3.0 : Skip frequency -0 A3.1 : Skip band -0 A3.2 : Skip frequency -1 A3.3 : Skip band -1 A3.4 : Skip frequency -2 A3.5 : Skip band -2	
A4.x : Ratio interlock function setting block A4.0 : Polarity of coefficient (A) A4.1 : Polarity of Bias (B) A4.2 : Coefficient (A) A4.3 : Bias (B) A4.4 : Upper limit A4.5 : Lower limit	
A5.x : Detect level block A5.0 : ATN detect band A5.1 : IDET Current detect level A5.2 : SPD Speed detect level	

The notes are listed on the next page.

Note 1) The parameter can be reflected immediately to the operation by ▲ or ▼ key. The SET key operation is not always required.

Note 2) "Frequency setting" (A0.0, A0.2, A0.4, etc.) changes a value of decimal point or above digits, and "Fine setting" (A0.1, A0.3, A0.5, etc.) changes a value below a decimal point.

Note 3) Parameters in b9.X cannot be changed when the inverter is running. (Except for b9.3)

Note 4) The parameter cannot be changed when the inverter is running.

6.2 Monitor Parameters and Fault Code Read

The monitor parameters sequentially display the frequency, power supply, etc., and are parameters recognized by the VT110S.

A list of parameters and their details that can be monitored are shown in Table 6.2.

Table 6.2 Monitor and fault code read

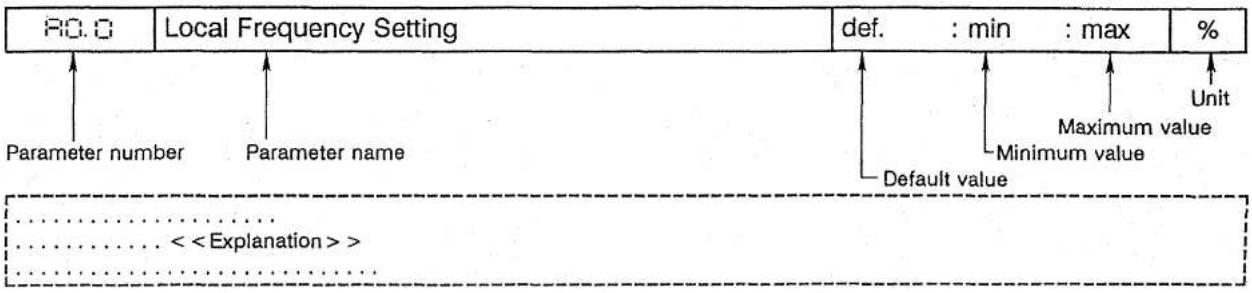
No.	Parameter	Unit	Remark	
A0	Output frequency	Hz	OFF (OFF) will display when the inverter output is shut off. br (Br) displays while the DC-Brake is in action.	
A1	Setting frequency	Hz	The currently selected frequency setting value is displayed.	
A2	Output current in Ampere unit	A	Detected output current is displayed.	
A3	Output current in % unit	%	Detected output current is displayed in percentage unit of the inverter rated output current. br (Br) displays while the DC-Brake is in action.	
A4	OLT monitor	%	OLT (Overload Trip) will occur when this value reaches 100%.	
A5	DC-link voltage	V	Displays the voltage of DC-link circuit in the main circuit.	
A6	Output voltage	V	Displays output voltage command. The display may differ from the actual output voltage. It depends on the DC-link voltage. OFF (OFF) will display when the inverter output is shut off.	
F0	Latest fault read		The latest detected fault is displayed.	Refer to Table 4.4 for a fault code.
F1	Previous fault read		The previous detected fault is displayed.	

6-3 Group-A Parameters

The parameters used frequently have been grouped in Group-A.

By setting the Group-B parameters B9.7, B9.6 and the Group-A parameters, the VT110S can be operated easily.

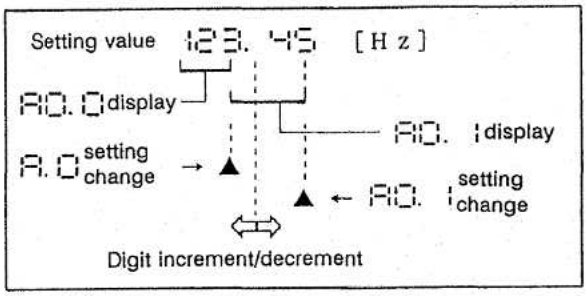
In this section, each parameter is explained in the following format.



A0. 0	Local frequency setting	10.00	: 0.10	: Fmax	Hz
A0. 1	Fine setting for local frequency				
A0. 2	Jogging frequency setting	5.00	: 0.10	: Fmax	
A0. 3	Fine setting for jogging frequency				
A0. 4	Program frequency -0	10.0	: 0.10	: Fmax	
A0. 5	Fine setting for Program frequency -0				
A0. 6	Program frequency -1	10.0	: 0.10	: Fmax	
A0. 7	Fine setting for Program frequency -1				
A0. 8	Program frequency -2	10.0	: 0.10	: Fmax	
A0. 9	Fine setting for Program frequency -2				
A0. A	Program frequency -3	10.0	: 0.10	: Fmax	
A0. b	Fine setting for Program frequency -3				

Each frequency is set in the A0 .x blocks.

The frequency is set in 1Hz increments in the Frequency Setting (A0. 0, A0. 2 etc.). For the fine setting, the frequency is set in 0.01Hz increments. The operation will be as shown on the right.
With these parameters, the output frequency will immediately change when the ▲ , ▼ keys are operated even when the SET key is not pressed.



The frequency setting having the highest priority according to the following table will be selected with the sequence command.

Table 6.3

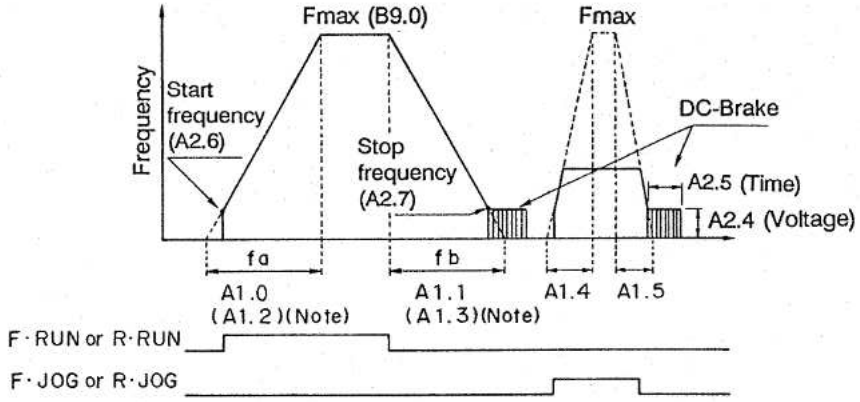
Priority	Sequence commands					Frequency setting
	VFS	IFS	PROG	S0	S1	
Lowest	OFF	OFF	OFF	X	X	Local frequency setting (A0.0)
	ON	OFF	OFF	X	X	PSV terminal input (1-10V Voltage)
	X	ON	OFF	X	X	FSI terminal input (4-20mA Current)
	X	X	ON	OFF	OFF	Program frequency -0 (A0.4)
	X	X	ON	OFF	ON	Program frequency -1 (A0.6)
	X	X	ON	ON	OFF	Program frequency -2 (A0.8)
Highest	X	X	ON	ON	ON	Program frequency -3 (A0.A)
Note 2	X	X	X	X	X	Jog frequency (A0.2)

Note 1) "X" is an insignificant bit.

Note 2) The jog frequency is selected by the F·JOG and R·JOG commands input while the motor is stopped.

A1.0	Acceleration time -1	10.0	: 0.1	: 99.9	sec
A1.1	Deceleration time -1	20.0	: 0.1	: 99.9	
A1.2	Acceleration time -2	10.0	: 0.1	: 99.9	
A1.3	Deceleration time -2	20.0	: 0.1	: 99.9	
A1.4	Acceleration time for jog	5.0	: 0.1	: 99.9	
A1.5	Deceleration time for jog	5.0	: 0.1	: 99.9	
A0.6	Acceleration/Deceleration time unit	1.	: 1.	: 100	

The acceleration/deceleration times are set in the A1.x blocks
Obtain the optimum acceleration/deceleration time with the calculation equation provided in Appendix 3.
Each parameter sets the section shown below.



Note 2) A1.2 and A1.3 will be selected when the sequence command CSEL is ON.

Fig. 6.1

A1.6 sets the coefficient of the acceleration/deceleration time. This coefficient is multiplied with all setting values in A1.0 to A1.5 .
If 3600 sec. are exceeded because of multiplication, the time will be limited internally to 3600 sec., and then will be loaded.

A2.0	Torque boost voltage	3.0 (Note)	: 0.0	: 25.0	%
A2.1	Reduced voltage for square-low torque	0	: 0.0	: 25.0	%

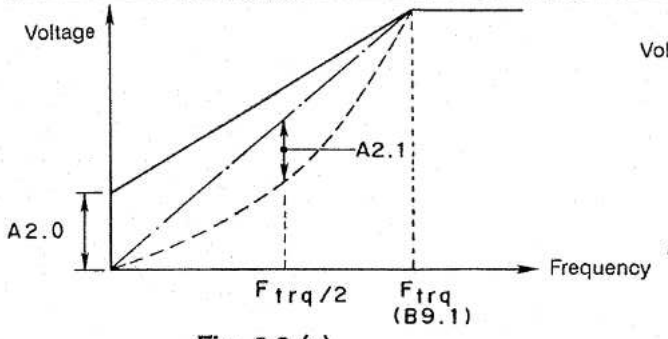


Fig. 6.2 (a)

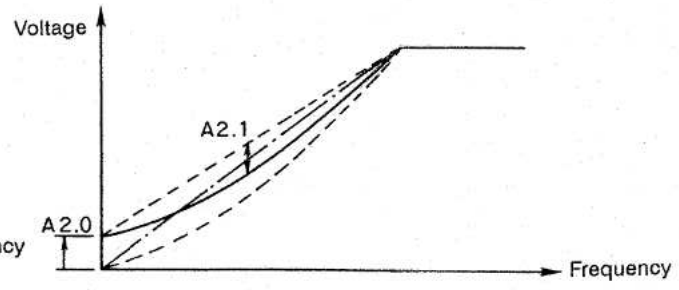


Fig. 6.2 (b)

The torque boost is set with the boost voltage at 0Hz.
The reduced voltage for square-law torque is set with the reduced voltage at $F_{trq}/2$.
If both A2.0 and A2.1 are set, the voltage will be an added voltage as shown Fig. 6.2 (b).
Note) The default value for the torque boost voltage will differ according to the inverter capacity.

A2.2	Auto Torque Boost	0.0	: 0.0	: 20.0	%

The auto torque boost controls the output voltage according to the magnitude of the load. Set the boost voltage (normally 3 to 5%) of when the rated output current is being output. When this parameter is set, A2.0 and 1 (boost and reduced voltage for square-law torque functions) will not work.
Set 0 when not using auto torque boost.
When auto torque boost is used, the output voltage will drop with light loads.
The rotation may become unstable or the inverter may trip if the setting is too high.

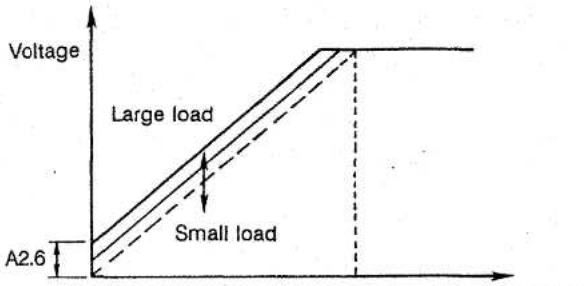


Fig. 6.3

A2.3	Slip Compensation	0.0	: 0.0	: 20.00	%

Set the slip [%] during the motor rated load.
The output frequency is controlled according to the motor load torque as shown on the right.
The motor rotation may become unstable if the setting is too high.

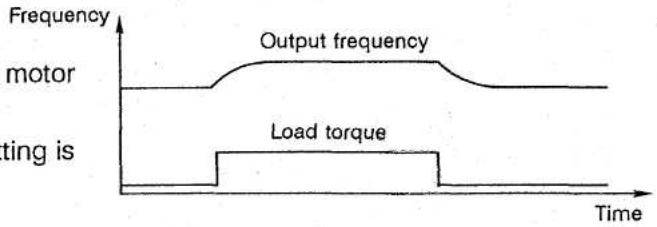


Fig. 6.4

A2.4	DC-Brake voltage	5.0 (Note)	: 0.0	: 20.0	%
A2.5	DC-Brake time	2.0	: 0.0	: 20.0	sec

The DC-Brake will function during the deceleration stop mode. Refer to Fig. 6.1.
Increase the DC braking voltage in units of 1% or less at a time while monitoring the output current. The inverter may trip if the setting is too high.
If DC-Brake is not necessary, set A2.5 = 0.

Note) The default value for the DC-Brake voltage will differ according to the inverter capacity.

A2.6	Start Frequency	1.0	: 0.1	: 60.0	Hz
A2.7	Stop Frequency	1.0	: 0.1	: 60.0	Hz

The initial output frequency when starting running is set in start frequency. The frequency to start DC-Brake application during the decelerations stop mode is set in stop frequency. Refer to Fig. 6.1.

A3. 0	Skip frequency -0	0	: 0	: 440	Hz
A3. 1	Skip band -0	0.0	: 0.0	: 10.0	
A3. 2	Skip frequency -1	0	: 0	: 440	
A3. 3	Skip band -1	0.0	: 0.0	: 10.0	
A3. 4	Skip frequency -2	0	: 0	: 440	
A3. 5	Skip band -2	0.0	: 0.0	: 10.0	

The frequency skip function is set in the A3. x blocks.

By setting this parameter, the motor's mechanical resonance point at a specific frequency can be skipped. This function controls the frequency setting, so the above skip frequency area will be passed with a ramp function.

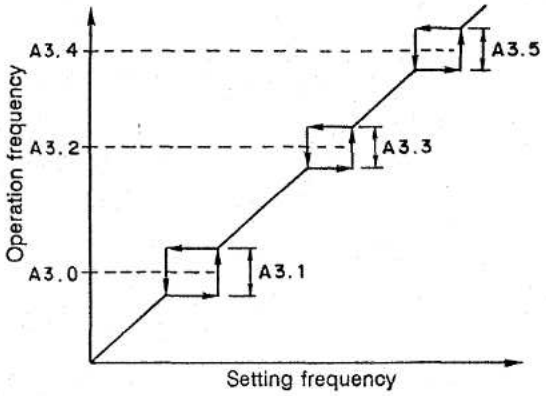


Fig. 6.5

A4. 0	Polarity of Coefficient (A)	1	: 1	: 2	
A4. 1	Polarity of Bias (B)	1	: 1	: 2	
A4. 2	Coefficient (A)	1.00	: 0.01	: 9.99	
A4. 3	Bias (B)	0	: 0	: 440	Hz
A4. 4	Upper limit (Note)	440	: 0	: 440	Hz
A4. 5	Lower limit (Note)	0	: 0	: 440	Hz

The ratio interlock function is set in the A4. x blocks.
Use the following formula to calculate the ratio interlock, and set according to each setting signal characteristics.

$Y = AX + B$ X: Frequency setting
Y: Frequency command (calculation results)
A: Coefficient (B4.2)
B: Bias (B4.3)

Note) Set so that the relation of upper limit ≧ lower limit is maintained.

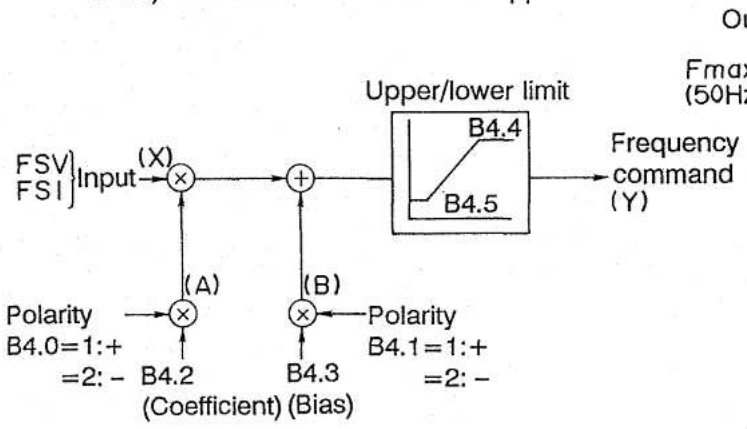


Fig. 6.6

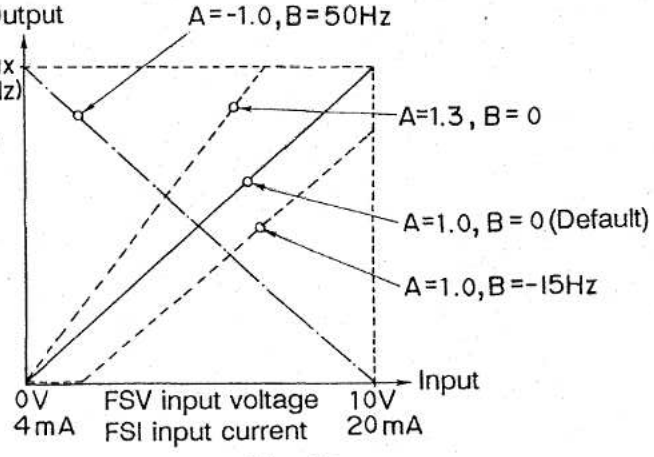


Fig. 6.7

A5. 0	ATN detect band	1.0	: 0.0	: 20.0	%

The attained output ATN operation band is set.

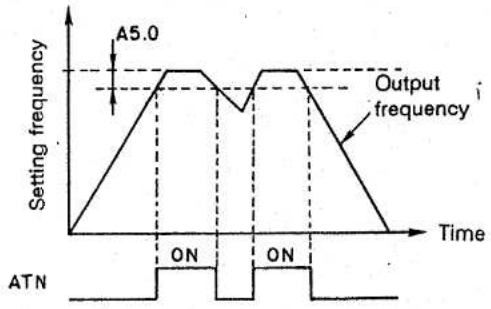


Fig. 6.8

A5. 1	IDET Current detect level	100	: 5	: 300	%

The current detection (IDET) operation level is set. Set with a percentage of the rated current.
A 5% hysteresis will occur with the IDET operation.

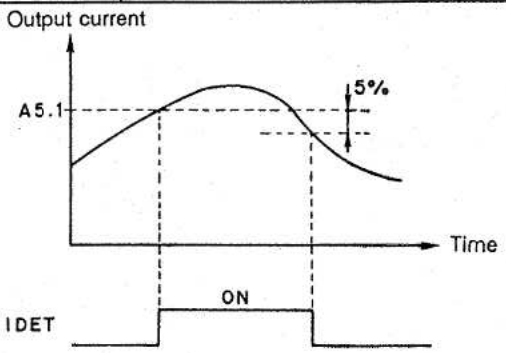


Fig. 6.9

A5. 2	SPD Speed detect level	95	: 1	: 105	%

The speed detection SPD operation level is set.
Set with a percentage to the max. frequency. Normally, the output frequency will be the comparison target.
A 1% hysteresis will occur with SPD operation.

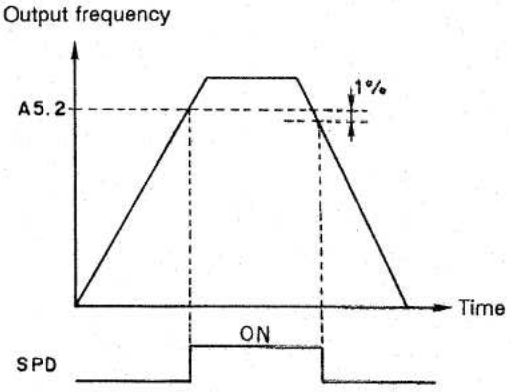


Fig. 6.10

b3.0	Drive current limit	150	: 50	: 300	%

The output current is limited by lowering the output frequency so that the output current does not exceed the value set with this parameter during starting or constant running.
The setting uses the inverter rated current as 100%.

<Caution>
Set a value larger than the motor no-load current.

b3.1	Regenerative torque limit	20	: 10	: 300	%

The regenerative torque to deceleration or the regenerative load during or constant running is limited. When not using DBR, set the value shown below. When using DBR, calculate the formula shown below, and then set a value within the range shown below.

$$B3.1 = \left[\left(\frac{V2}{\text{DBR resistance value}} \right) / \text{Motor capacity [kW]} \right] \times 100\ [\%]$$

where V2=148.2 for the 200V system and V2=593 for the 400V system.

Fmax (b9.0)	Regenerative torque limit (b3.1)		Remarks
	Without DBR	With DBR	
100Hz or less	20%	30 – 100%	
100 ~ 199Hz	25%	35 – 105%	Changes are required
200 ~ 299Hz	30%	40 – 110%	
300 ~ 440Hz	35%	45 – 115%	

b4.0	Fault reset	0	: 0	: 255	

b4.0 ≠ 9: Fault reset
= 9: Fault reset and fault code in F0, F1 clear
The setting value of this parameter is not registered.

b4.1	Default values load	0	: 0	: 255	%

b4.1 = 9 : Parameter group-A default value load (A x. x)
= 19: All parameter default value load (A x. x and b x. x)
The setting value of this parameter is not registered.

b4.2	Parameter lock	0	: 0	: 255	%

b4.2 = 37: Only A0.x can be changed. The other parameters cannot be changed.
= 54: All parameters (A, B) can be changed.
= Setting values other than the above: Changing of all parameters is inhibited.

b5. 0	Start/stop frequency	0.0	: 0.0	: 20.0	Hz
b5. 1	Start/stop hysteresis	0.0	: 0.0	: 20.0	
b5. 2	Interlock frequency	0.0	: 0.0	: 20.0	

The following types of interlock can be obtained for the F·RUN and R·RUN commands.

① Setting start/stop function

The motor will run when the frequency setting is higher than the B5.0 setting value, and will stop when lower. (Normally when the frequency setting is 0, the motor will not stop completely because the output frequency will be limited at 0.1Hz.)

Starting and stopping with the setter is possible with this function.

② Start interlock

If the frequency setting value is larger than B5.2 when the run command (RUN X) is ON, the motor will not start.

Use this function when the frequency setting is to be lowered when starting for safety purposes.

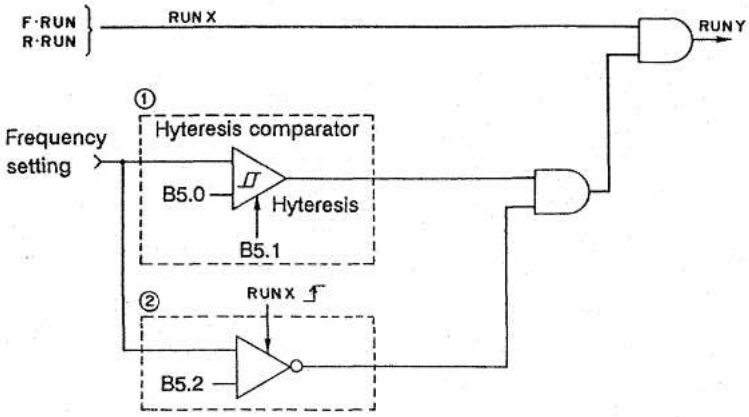


Fig. 6.11

Note 1) The setting start/stop and start interlock functions cannot be used simultaneously. Thus, set B5.0 or B5.2 to 0.

Note 2) Set the parameter setting values to 0 when not using ①, ②.

Note 3) The ①, ② functions will not function during jogging run.

Note 4) When interlock is applied on ①, ② the RUN lamp will flicker.

b6. 0	RUN command method	1	: 1	: 3	

b6. 0 = 1 : F·RUN, R·RUN

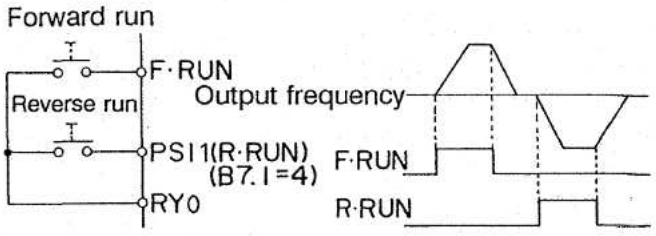


Fig. 6.12

b6. 0 = 2 : RUN, REV

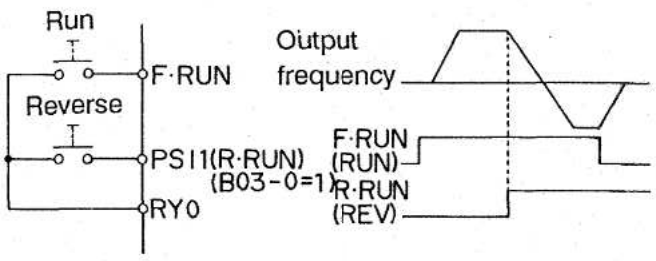


Fig. 6.13

= 3 : Self-hold (F·RUN, R·RUN pulse input)

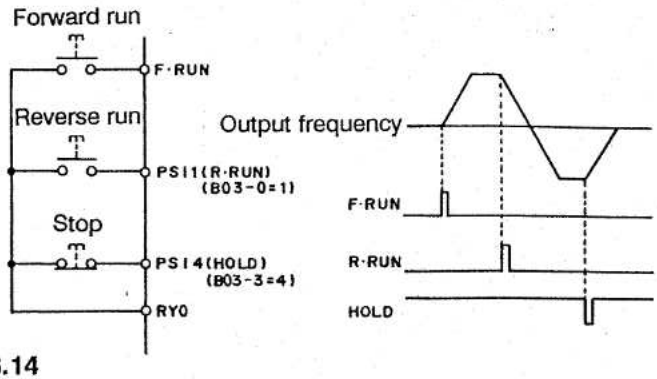


Fig. 6.14

b6. 1	F RUN, R RUN stop method	2	: 1	: 2	
b6. 2	F JOG, R JOG stop method	2	: 1	: 2	

= 1: Coast to stop
= 2: Deceleration stop

Coast to stop refers to stopping by turning the output OFF simultaneously with the stop command (F·RUN and R·RUN OFF).
Deceleration stop refers to stopping by decelerating to the stopping by decelerating to the stopping frequency with the ramp down after the stop command, and then applying the DC-brake to stop.

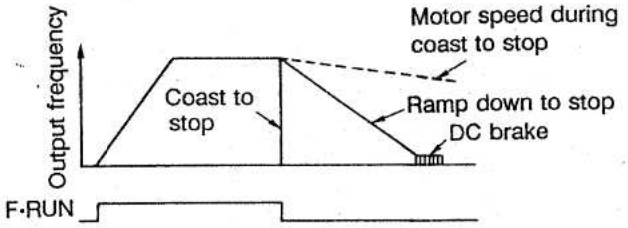


Fig. 6.15

b6. 3	Auto Start	1	: 1	: 3	

= 1: OFF (runs with the run command ON after pre-charging)
= 2: ON
If the run command is ON when the pre-charging is completed after the power is turned on, run will start after the inverter is charged.

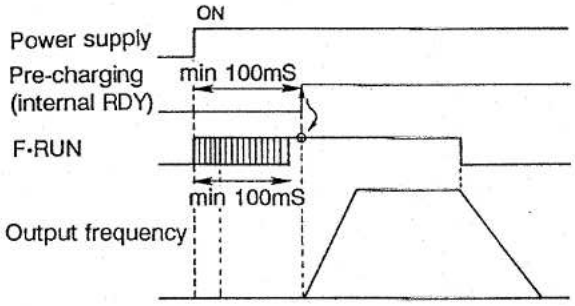


Fig. 6.16

= 3: ON with momentary interruption mode
This is used to continue operation even when a momentary power failure occurs while the inverter is running.
If the RUN command is ON when the power is turned ON again and the pre-charge is completed, normal running will start after the initial operation (restart operation) is executed.

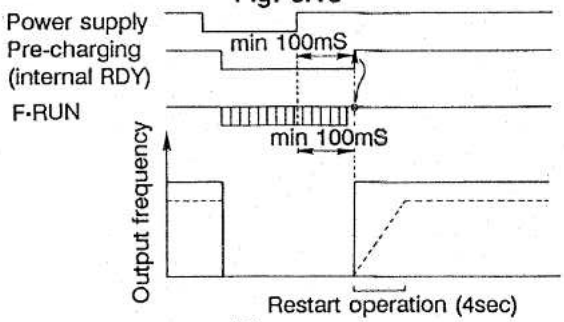


Fig. 6.17

Note) Short circuit the run command (F-RUN or R-RUN) and RY0 or turn on within 100ms when using the auto start function.

b6. 4	EMS command input logic	1 : 1 : 2	

= 1: Close to stop
(when a contact is connected)
= 2: Open to stop
(when b contact is connected)

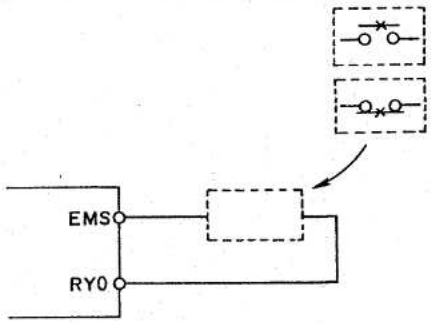


Fig. 6.18

Note) Set B7.4 to 1 when using the emergency stop command. This will allow use of the EMS terminal. This setting value is the default value.

b6. 4	EMS stop method	1 : 1 : 3	

= 1: Coast to stop, without fault output
= 2: Coast to stop, with fault output
When the EMS signal turns ON, the output will be shut off, and FLT will be output.
= 3: Ramp down to stop (without fault output)

Note) Refer to Fig. 6. 14 for the stopping operation.

b7. 0~7	Programmable input configuration block -1 (Operating commands)	(Table 6.4) : 0 : 9	
b8. 0~5	Programmable input configuration block -2 (Selection commands)	(Table 6.4) : 0 : 9	

The input terminal of each signal or the ON/OFF statues is selected by setting these parameters. Refer to Table 5.2 for the functions of the sequence command. Refer to section 5-3 for details on this PSI (Programmable Sequence Input) function.

Table 6.4

Parameter	Sequence command	Default value	Setting value and input terminal
b7.0	F-RUN	3	
b7. 1	R-RUN	4	
b7.2	F-JOG	0	
b7.3	R-JOG	0	
b7.4	EMS	1	
b7.5	RESET	2	
b7.6	HOLD	0	
b7.7	CSEL	0	
b8.0	VFS	0	
b8. 1	IFS	0	
b8.2	PROG	0	
b8.3	S0	0	
b8.4	S1	0	
b8.5	FUP	0	
b8.6	FDW	0	

Setting value	Control terminal symbol
0	Keep OFF State
1	EMS
2	RST
3	F RUN
4	PSI1
5 6 7 8	**Note)** For future use Do not set these values.
9	Keep ON state

b8. 7	FUP/FDW Step	0.10 : 0.01 : 2.00	Hz

This is used to increment or decrement the setting value when the sequence command is set to FUP and local frequency or program frequency is selected for FDW.
This parameter sets the increment/decrement frequency for one FUP/FDW operation.
The changed frequency setting will be registered in the non-volatile memory in 20 sec. after the FUP/FDW operation.

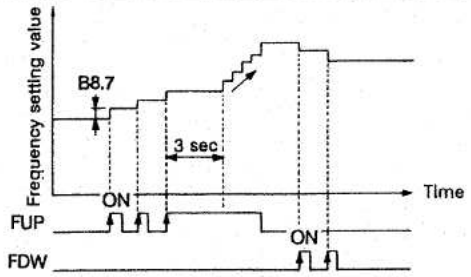


Fig. 6.19

Thus, do not turn off the inverter power for 20 sec. after the FUP/FDW operation.
The frequency setting will continuously increment or decrement when FUP/FDW is turned on for 3 seconds or more.

b8. 8	FLT terminal output parameter	1 : 0 : 7	

The internal status signals shown on the right can be output to the relay output FA-FB-FC. Refer to Table 5.3 for details on the status signal functions.

Table 6.5

Setting value	Output signal	Setting value	Output signal
0	RUN	4	REV
1	FLT	5	IDET
2	MC	6	ATN
3	RDY	7	SPD

b8. 9	Operation panel initial monitor parameter	0 : 0 : 6	

Set the No. of the monitor parameter to be displayed when the power is turned on.

b9. 0	Maximum output frequency (Fmax)	50	: 3 : 440	Hz
b9. 1	Base frequency (Ftrq)	50	: 0 : 440	Hz
b9. 2	Output voltage	200	: 0 : 460	V

Set these parameters to the motor ratings.
Ftrq and Fmax can be set easily with b9. 7. If the compatible Ftrq or Fmax is not available in the b9. 7 table, set these randomly with b9. 0 and b9. 1.

<Caution>

When setting the B9.0 (max. frequency), make sure that the motor and machine rating is not exceeded.

Note 1) Set the B9.2 rated output voltage setting value 0 to turn OFF the DC-AVR function. The output voltage will be the same as the input voltage with this setting.
(DC-AVR: function that compensates the fluctuation in the power voltage to keep the output voltage constant.)

Note 2) A value that exceeds the input voltage selected with b9. 6 cannot be set for b9. 2 (output voltage).

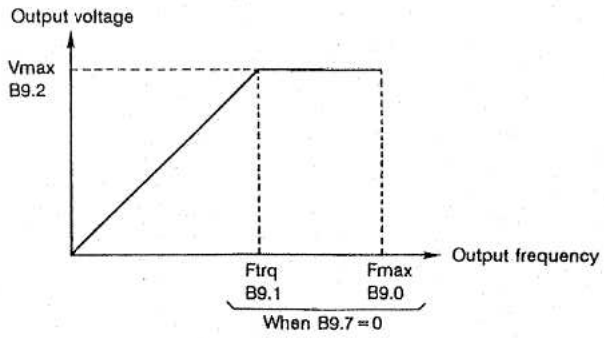


Fig. 6.20

b9. 3	Carrier frequency	12	: 3	: 12	kHz

Set the inverter's PWM carrier frequency with this parameter.

< Caution >

When the carrier frequency is increased, the noise may increase and the equipment around the inverter may malfunction. In this case, lower the carrier frequency.

b9. 4	Overload setting	100	: 20	: 105	%
b9. 5	0Hz overload	100	: 10	: 105	%

The operation reference for overload (OLT) is set. The reverse time interval characteristics will change with the B9.4 setting as shown on the right.

The setting uses the inverter rated current as 100%.

< Caution >

Do not set a value that exceeds the inverter rated current.

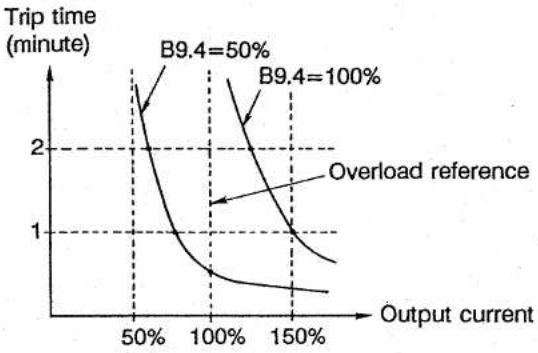


Fig. 6.21

When running a self-cooling type motor at a low speed, set B9.5 according to the motor characteristics. The characteristics will be as shown on the right.

< Caution >

At 0.5Hz or less, the inverter will trip at 75% of the rated current in one minute. If the inverter output current exceeds 155%, the inverter will trip at 170% of the rated current in 2.5 seconds.

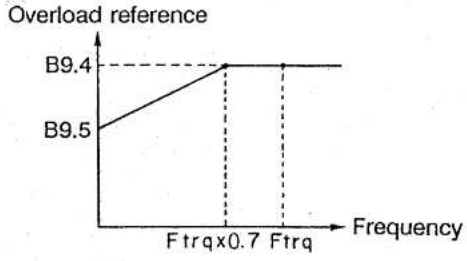


Fig. 6.22

b9. 6	Input voltage	2	: 1	: 5	

Select the rated voltage of the inverter power supply.

Table 6.6

Setting value	200V system	400V system
1	190V	380V
2	200V	400V
3	220V	415V
4	230V	440V
5	240V	460V

When this parameter is changed, the value of b9. 2 (output voltage) will also automatically change to the same value selected with this parameter.

b9. 7	Preset Fmax/Ftrq pattern	1 : 0 : 9	

Select the output Fmax and Ftrq from the table on the right. When this parameter is changed, the value of b9. 0 and b9. 1 will also automatically change to the same value selected with this parameter.

If the compatible combination is not available in the table, set these randomly with b9. 0 (Fmax) and b9. 1 (Ftrq).

<Caution>

When setting the parameter, make sure that the motor and machine rating is not exceeded.

Table 6.7

Setting value	Ftrq [Hz]	Fmax [Hz]
0	Random setting with B9.1	Random setting with B9.0
1	50	50
2	60	60
3	50	60
4	50	75
5	50	100
6	60	70
7	60	80
8	60	90
9	60	120

Chapter 7 Options

The following options are available for the VT110S.

(1) DBR for Dynamic Braking
(2) ACL for input current harmonics reduction
(3) Noise filter for electromagnetic interference reduction

7-1 Using External DBR

(1) A VT110S with DB (Dynamic Braking) option is available. Designate this when ordering (VT110S-xxxB).
When using the dynamic brakes with this type of inverter, connect an external resistor (DBR) as shown in Fig. 2.3. Prepare a separate external resistor.
Note that the DB option type is not available for L10, L15, S10 or S15.
(2) When using the dynamic brake, set the setting value for parameter b3. ; (regenerative torque limit) to 30% or more.
(3) Select the resistor according to Table 7.1.

Table 7.1

VT110S Type	Minimum resistance value [Ω]	Maximum brake time per 10minutes	100% torque 10%ED (60sec/10min) Resistor	100% torque 5%ED (30sec/10min) Resistor	100% torque 2.5%ED (15sec/10min) Resistor
L25, S25	100 Ω	25sec at 100%torque	400W 100 Ω 1P	300W 100 Ω 1P	300W 100 Ω 1P
L35, S35	75 Ω	15sec at 100%torque 25sec at 50%torque	300W 150 Ω 2P	300W 150 Ω 2P	200W 150 Ω 2P
H10, U10	200 Ω	60sec at 100%torque	300W 1k Ω 1P	200W 1k Ω 1P	200W 1k Ω 1P
H15, U15	200 Ω	60sec at 100%torque	300W 680 Ω 1P	200W 680 Ω 1P	200W 680 Ω 1P
H25, U25	200 Ω	60sec at 100%torque	300W 680 Ω 2P	200W 680 Ω 2P	300W 330 Ω 1P
H35, U35	200 Ω	60sec at 100%torque	300W 470 Ω 2P	300W 470 Ω 2P	200W 470 Ω 2P

Note 1) "P" refers to parallel connection.
Note 2) The applicable wire size for DBR is 2.0mm^2 (AWG14).

<Caution>

A maximum voltage of 400V (200V system) or 800V (400V system) is applied on the DBR resistor, so take special care to the withstand voltage of the DBR resistor.
Select the resistor and wiring withstand voltage to be higher than the above values.

7-2 Using ACL and Noise Filter

Select an ACL or noise filter according to Table 7.2 and Table 7.3 when the input current high harmonics or static noise terminal voltage is to be suppressed. Install the selected device between the power supply and inverter as shown in Fig. 7.1.
Keep the wiring of each device as short as possible.

<Caution>

The noise filters listed in Table 7.3 are standard Meidensha products, and do not comply with the EMC Directive. To comply with the EMC Directive, refer to the separate "EMC Application Manual" (ST-3038), and use the noise filters described within. Furthermore, follow the said manual for the installation and wiring methods.

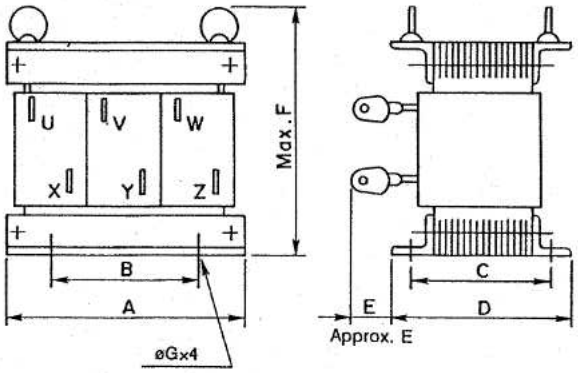
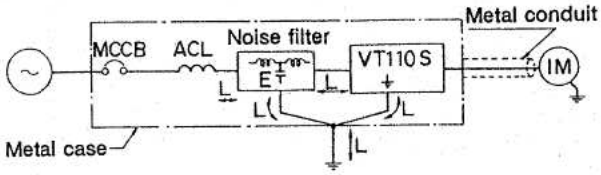


Fig. 7.1 ACL



<Caution>

The wire indicated as L must be kept as short as possible.

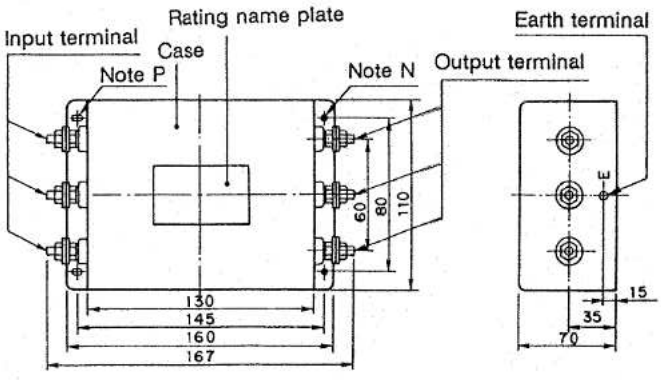
Fig.7.2 Installation of ACL and noise filler

Table 7.2 ACL (3%Z)

VT110S type	ACL type	Dimensions [mm]							Approx. weight [kg]
		A	B	C	D	E	F	G	
L10, S10	N71P44639#4	170	100	70	85	45	100	8	4
L15, S15	N71P44639#4	170	100	70	85	45	100	8	4
L25, S25	N71P44639#8	170	100	70	85	45	100	8	4
L35, S35	N71P44639#12	170	100	70	85	45	110	8	5
H10, U10	N71P44497#3	170	100	70	85	45	100	8	4
H15, U15	N71P44497#3	170	100	70	85	45	100	8	4
H25, U25	N71P44497#4	170	100	70	85	45	100	8	4
H35, U35	N71P44497#6	170	100	70	85	45	100	8	4

Table 7.3 Noise filter

VT110S type	Noise filter type	Installation hole [mm]	
		N	P
L10, S10	NF3005A-MA	ø4.5	R2.75 Length 7
L15, S15	NF3005A-MA	ø4.5	R2.75 Length 7
L25, S25	NF3010A-MA	ø5.5	R2.75 Length 7
L35, S35	NF3015A-MA	ø5.5	R2.75 Length 7
H10, U10	NF3005C-MA	ø4.5	R2.75 Length 7
H15, U15	NF3005C-MA	ø5.5	R2.75 Length 7
H25, U25	NF3005C-MA	ø5.5	R2.75 Length 7
H35, U35	NF3010C-MA	ø5.5	R2.75 Length 7



Note) Refer to Table 7.3 for details on P and N.

Fig. 7.3 Noise filter

Chapter 8 Maintenance and Inspection

Periodic inspections are necessary to prevent abnormalities caused by the working environment and parts life and to use the VT110S for a long period.
Take caution to the following points during maintenance and inspection.

⚠ WARNING

(1) A designated person must carry out the maintenance and inspection with the specified methods.
(2) The inspections shown in Table 8.2 must be performed with the power supply turned off.
(3) The inspector must confirm whether the power supply is turned on/off, and make sure that no one other than that person operates the equipment.
(4) Do not open the cover for at least 10 minutes after turning the power supply off. Confirm that all lamps are out.
(5) After inspections, confirm that no tools are left lying around, and that all screws have been tightened.

8-1 Inspection Items

The inspections must be carried out periodically according to the working environment and frequency of use. If there are any abnormalities, the cause must be inspected immediately and countermeasures taken.

(1) Daily inspections

Table 8.1

Inspection item	Inspection details and work
Temperature/humidity	Confirm that the ambient temperature is 0 to 50°C, and that the humidity is 90% or less with no dew condensation.
Oil mist and dust	Confirm that there is no oil mist or dust in the VT110S.
Abnormal noise and vibration	Confirm that there is no abnormal noise or vibration from the installation site or VT110S.
Input power source	Confirm that the input voltage and frequency are within the specifications range.
Cooling fan	Confirm that the cooling fan rotates normally and that no lint, etc. is stuck on it.
Indicator	Confirm that all lamps on the operation panel light properly.

(2) Periodic inspections

Table 8.2

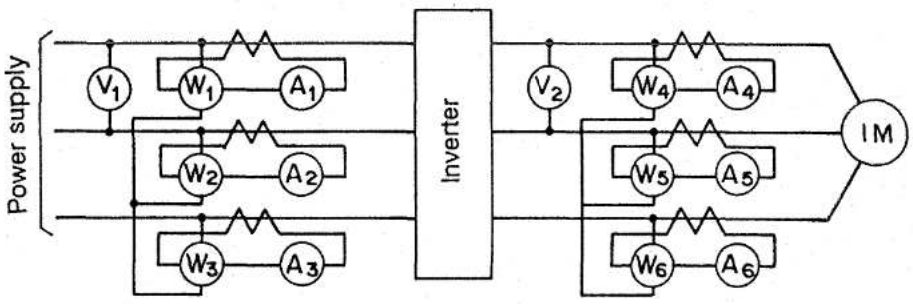
Inspection item	Inspection details and work
VT110S appearance	Check the state of dirt and dust on the vent or heatsink, and clean if necessary.
VT110S interior	Check the state of dirt and dust on the PCB and inside the equipment, and clean if necessary.
Terminal block	Tighten the terminal block screws if loose.
Cooling fan	Replace the fan every three years.
Electrolytic capacitor	Confirm that there is no liquid leaking or sheath discoloration.
Insulation resistance	Do not perform a megger test on the VT110S. When doing a megger test on the external circuit, disconnect all wires connected to the VT110S.

(3) Inspection of spare VT110S

The inspection shown in Table 8.2 must also be performed for spare VT110S that are left connected but are not used in normal operation. The operation of the VT110S must be checked every six months by turning the power on.

8-2 Measuring Devices

As the voltage and current on the input and output sides include high harmonics, the measured value will differ according to the measuring device. When measuring with a device for commercial frequencies, measure with the following circuits and noted measuring devices.



(V1) : Moving iron type voltmeter (⧓)
(V2) : Rectifying voltmeter (⊣▷⊢)
(W1)~(W6) : Electrodynamometer type power meter (⧆)
(A1)~(A6) : Moving iron type ammeter (⧓)

Fig. 8.1

8-3 Troubleshooting with Fault Display

The countermeasures for when the inverter stops with a fault code display are shown in Table 8.3.

Table 8.3 Troubleshooting (1)

Display symbol	Name	Causes and countermeasures
EMS.	Emergency stop	1. The sequence input EMS has been activated. Check the signal wiring. 2. This fault occurs when B6.5=2
PM. 1~5	Power module	1. The protection circuit (overcurrent, short circuit or control power voltage drop) of the power module has activated. 2. The sub-codes and causes and countermeasures are the same as for OC-1~5. 3. A ground fault may have occurred in the output line or motor. Restore the grounded point.
OC. 1	Overcurrent during stop	1. The power module in the main circuit may be broken.
OC. 2	Overcurrent during constant speed operation	1. A sudden change in the load or short circuit may have occurred. 2. Reduce the load fluctuation.
OC. 3	Overcurrent during acceleration	1. Increase the acceleration time setting (A1.x). 2. Reduce the torque boost voltage (A2.0, A2.2). 3. An excess GD^2, short circuit or rapid fluctuation of the load may have occurred.
OC. 4	Overcurrent during deceleration	1. Increase the deceleration time setting (A1.x) 2. A short circuit or rapid fluctuation of the load may have occurred.
OC. 5	Overcurrent during braking	1. Reduce the brake voltage setting (A2.4). 2. A short circuit in the load may have occurred.
OV. 1	Overvoltage during stop	1. The power supply voltage may have risen. Reduce the voltage to within the specified range. 2. A surge voltage may have entered from the power supply.
OV. 2	Overvoltage during constant speed operation	1. The power supply voltage may have risen. Reduce the voltage to within the specified range. 2. Most likely surge voltage has come in from the power supply.
OV. 3	Overvoltage during acceleration	

Display symbol	Name	Causes and countermeasures
OV. 4	Overvoltage during deceleration	1. The load GD^2 may be too large. Set the deceleration time (A1.x) according to the load GD^2. 2. The power supply voltage may have risen. Reduce the voltage to within the specified range.
OV. 5	Overvoltage during braking	1. The power supply voltage may have risen. Reduce the voltage to within the specified range.
UV. 1~5	Undervoltage	1. A drop in voltage, phase dropout or power supply failure may have occurred. Check the power supply system and correct if necessary.
OH	Overheat	1. A trouble may have occurred in the cooling fan. Replace if necessary. 2. The ambient temperature may have risen. Lower the ambient temperature. (50°C or less) 3. The vent or heatsink may be clogged. Clean the dirt and dust accumulated in the vent, etc.
OL.	Overload	1. The motor may have overloaded. Reduce the load or increase the motor and inverter capacity.
IO. 1	I/O error (gate turn-off circuit error)	1. The VT110S may be malfunctioning due to external noise, etc. Look for the noise source and remove the cause. 2. The control circuit may be faulty.
IO. 2	I/O error (A/D converter error)	
CP. 1~9	CPU error	1. The unit may be malfunctioning due to external noise, etc. Look for the noise source and remove the cause. 2. The control circuit may be faulty. 3. For all sub-codes other than 8, turn the power off and on once.
EA. n	Parameter error in Group-A	1. The parameter setting value is incorrect. 2. "n" indicates the parameter group A or B block No. Example) If there is an error at A2. 3 , " EA. 2 " will be displayed. 3. Search the errored parameter and correct the parameter setting value. The data display for the parameter where an error has occurred will be "--".
EB. n	Parameter error in Group-B	

8-4 Troubleshooting with No Fault Display

The causes and countermeasures for errors with no fault display are shown Table 8.4.

Table 8.4 Troubleshooting (2)

Phenomenon	Causes and countermeasures
Motor does not run	1. The input/output wiring may be improper, or phase or power failure may have occurred. Inspect and correct the wiring. 2. The motor may be locked or the load excessively heavy. Reduce the load. 3. The voltage may not be output to the VT110S output terminal. Measure the output voltage, and confirm that the three phases are balanced.
Motor runs in opposite direction	1. The output terminals U, V, and W sequence may be incorrect. Interchange the phase sequence. 2. The sequence input wires for forward/reverse run may not be connected to the specified terminals. Connect the wires as follows: Forward run: Short-circuit terminals F RUN - RY0 Reverse run: Short-circuit terminals PSI1 - RY0 (When input terminal function setting is B7.1=4 (default value))
Motor runs but the speed does not vary	1. The load may be too heavy. Reduce the load. 2. The frequency setting signal level may be too low. Check the signal level, circuit and parameter . 3. The overcurrent limit function has functioned. Reduce the load or lower the boost setting value (A2.0, A2.2).
Motor acceleration/ deceleration is not smooth	1. The motor acceleration/deceleration time setting (A01-0, 1) may be too low. Increase the acceleration/deceleration time.
Motor speed varies during constant speed operation	1. The load may be fluctuating excessively or the load is too heavy. Reduce the load or fluctuation. 2. The inverter-motor ratings may not match the load. Select an inverter-motor set that matches the load. 3. The phenomena of instability that generally occurs in an inverter drive are as follows: Try the following measures. a) Lower the carrier frequency (B9.3) b) Increase the boost (A2.0) c) Increase the load torque d) Increase GD^2
Motor speed is too high or low	1. The number of poles or voltage may be incorrect. Check the motor specifications. 2. The maximum frequency or base frequency (B9.0, 1) may be incorrect. 3. The motor terminal voltage may be low. Use a thicker output cable.

Appendix 1 VT110S Specifications

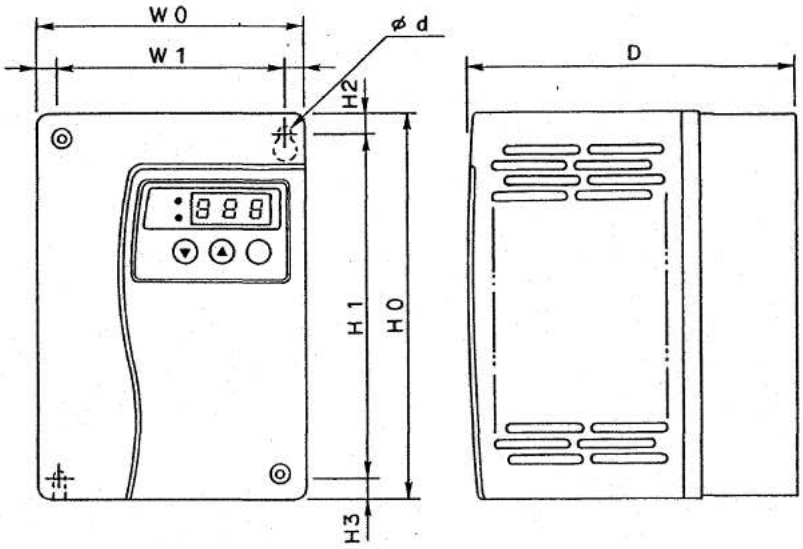
Inverter rating												
	System	200V-S system				200V system				400V system		
	Type code	S10	S15	S25	S35	L10	L15	L25	L35	H15 U15	H25 U25	H35 U35
	Capacity [kVA] (Note 1)	1.0	1.5	2.7	3.8	1.0	1.5	2.7	3.8	1.7	2.7	3.8
	Output current [A] (Note 2)	3	4.2	8	11	3	4.2	8	11	2.5	3.6	5.5
	Applicable motor [kW] (Note 3)	0.4	0.75	1.5	2.2	0.4	0.75	1.5	2.2	0.75	1.5	2.2
Power supply												
	Phase	Single phase				3 phase				3 phase		
	Rated voltage [V]	200~240V±10%				200~240V±10%				380~460V±10%		
	Rated frequency [Hz]	50/60Hz±5%				50/60Hz±5%				50/60Hz±5%		
Rated output												
	Voltage	200~240V (Max.)								380~460V (Max.)		
	Frequency	0.1~440Hz								0.1~440Hz		
Construction												
	Enclosure	IP20										
	Structure	Wall-mounted type										
	Dimensions (W/H/D) [mm]	105x150x130		135x200x167		105x150x130		135x200x167		135x200x167		
	Mass [kg]	1.2		2.4		1.2		2.4		2.4		
	Cooling method	Natural			Forced	Natural			Forced	Natural		Forced
Frequency Control												
	Switching device	IGBT										
	Carrier frequency	3~12kHz (Arbitrarily selectable in steps of 1kHz)										
	Control system	All-digital sinusoidal PWM										
	Voltage/frequency characteristics	Constant torque (V/F=constant)/Constant power/Reduced torque selectable Base frequency range: 3~440Hz										
	Output resolution	0.01Hz										
	Accuracy	Digital setting : 0.01% (25±10°C) Analog setting: 0.5% (25±10°C)										
	Setting resolution	Digital (internal) : 0.01Hz or 1Hz Analog (external): 0.1% of max. frequency										
Control specifications												
	Torque boost	Auto/manual selectable Setting range boost: 0~25.0%, square low: 0~25.0%										
	Start/stop frequency	0.1~60.0Hz (set separately)										
	Accel./decel. time	0.1~3600sec (set separately) 2 sets of accel./decel. times can be selected.										
	Ratio interlock function	F=AX+B F: Frequency, X: External frequency setting input A: Coefficient (0.01~±9.99) B: Bias (0~±440Hz)										
	Frequency limit	Upper/lower limits programmable of F (above)										
	Frequency jump	3 positions										
	Multistep frequency setting	4 steps										
	Slip compensation	Enable/disable selectable										
Operation specifications												
	Operation system	3 modes selectable 1) Forward-run/reverse-run 2) Run /direction (reverse) 3) Forward-run (pulse)/reverse-run (pulse)/stop Jogging operation available										
	Stopping system	Ramp-down-stop/coast-to-stop selectable with each command for run, jog, emergency stop.										
	DC-brake	Braking voltage: 0.1~25.0%, Brake time: 0.0~20.0sec										

Appendix 1 VT110S Specifications

External I/O		
	Operation panel	3-digit 7-segment LEDs, RUN, FLT lamps 3 keys for parameter programming
	Sequence input	4 programmable inputs for the following commands F•RUN, R•RUN, FJOG, RJOG, HOLD, VFS, IFS, CSEL, S0, S1, FUP, FDW, RESET, EMS
	Sequence output	1 programmable relay (1c) output for the following status FLT, RUN, RDY, MC, REV, ATN, IDET, SPD
	Analog input	FSV: 0-10V frequency reference input FSI : 4-20mA frequency reference input
	Serial communication	Option (RS485) [In development stage]
Protective function		Over voltage, IPM fault (Overcurrent, overheat, IPM fault), overload, undervoltage grounding
Operating environment		Indoor, ambient temperature: 0~50°C. Relative humidity: 90% or lower (no dew condensation), altitude 1000m or less. Free of corrosive or explosive gases, dust, steam or oil mist. Vibration: 3.0m/S^2 or less.

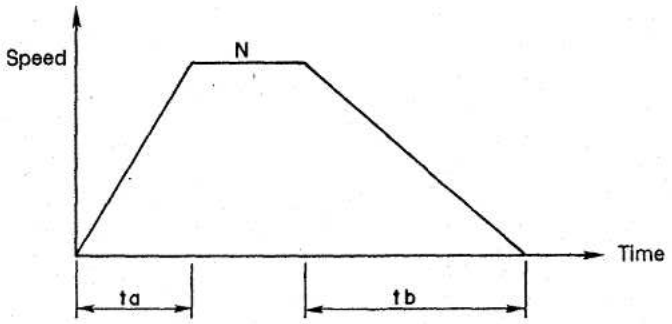
Note 1: The unit capacity (kVA) is applicable where the output voltage is 200V (200V system) or 400 (400V system).
Note 2: The rated output current includes the harmonic current.
Note 3: The maximum applicable motor mentioned here is a standard induction motor made by Meidensha Corporation.
Note 4: An output voltage higher than power supply voltage is not obtainable.
Note 5: Type U15, U25, U35 are recognized by UL.

Appendix 2 External Dimensions



Type	Dimensions [mm]							
	W0	W1	H0	H1	H2	H3	D	ød
L10 S10 L15 S15	105	90	150	134	8	8	130	4.8
H15 U15 L25 S25 H25 U25	135	118	200	150	9	41	167	5.8
L35 S35 H35 U35 (With cooling fan)								

Appendix 3 Acceleration/Deceleration Time Setting



$$\text{Acceleration time ta} = \frac{J \cdot N}{9.56\,(T_{MA} - T_L)} \quad \text{..... Formula 1}$$

$$\text{Deceleration time tb} = \frac{J \cdot N}{9.56\,(T_{MB} + T_L)} \quad \text{..... Formula 2}$$

$$J = J_M + J_L \quad [kg \cdot m^2]$$

Where: J_M: Motor inertia

J_L: Load inertia (Converted to motor shaft.)

N : Rated speed [rpm]

Where: Speed at Ftrq

T_{MA} : Motor drive torque [N·m]

$\left(T_{MA} = \frac{P}{0.1047 \cdot N}\right.$ Where: P is motor capacity [kW])

T_L : Load torque [N·m]

T_{MB} : Motor braking torque [N·m]

$T_{MB} = T_{MA} \cdot$(dynamic braking capacity[kW]/ motor capacity[kW]) $\cdot \frac{1}{0.8}$

MEIDENSHA CORPORATION

Riverside Building, 36-2, Nihonbashi Hakozakicho, Chuo-ku, Tokyo 103 Japan
Phone: Tokyo 3-5641-7211 Telex: 246-6036 (MEIDEN J) Cable Address: "Meiden Tokyo"
Facsimile: 3-5641-7249

Overseas Offices

Hong Kong
MEIDENSHA CORPORATION
9 Floor, Jardine Engineering House
260 King's Road, North Point, Hong Kong
Phone: 2807-4250
Facsimile: 2887-8046

Indonesia
MEIDENSHA CORPORATION
Summitmas Tower 19th Floor,
Jl. Jenderal Sudirman kaveling 61-62
P.O. BOX 20/KBY/Summitmas Tower
Jakarta Selatan 12068, Indonesia
Phone: 21-520-1239/2108
Facsimile: 21-5251305
Telex: 45235 MEIDEN IA

Iraq
MEIDENSHA CORPORATION
2nd Floor, Flat No. 1,
No. 2 Zukak-12, Mahallah-929, Hay Babil,
P.O. Box 20319 Baghdad, Iraq
Phone: 1-718-2374
Telex: 213672 MEIDEN IK

Korea
MEIDENSHA CORPORATION
Royal Bldg. No. 410
Dangju-Dong, Chongro-ku, Seoul, Korea
Phone: 2-736-0232/0233
Facsimile: 2-736-0234

Malaysia
MEIDENSHA CORPORATION
22nd Floor, Menara Boustead, 69
Jalan Raja Chulan, 50200 Kuala Lumpur, Malaysia
Phone: 3-248-3776/3669/3896
Facsimile: 3-241-2881
Telex: 30191 MEIDEN MA

Singapore
MEIDENSHA CORPORATION
5, Jalan Pesawat,
Jurong Industrial Estate,
Singapore 2261
Phone: 268-8222
Facsimile: 264-4292

Taiwan
MEIDENSHA CORPORATION
Room 1103, 11th Floor, No. 142
Chung Hsiao East Roat, Sec. 4
Taipei, Taiwan, R.O.C.
Phone: 2-775-3337/3338
Facsimile: 2-775-3339

Thailand
MEIDENSHA CORPORATION
Floor 11, TST Tower Building,
No. 21, Vibhavadi-Rangsit Road,
Chatuchak, Bangkok 10900, Thailand
Phone: 2-273-8954~61
Facsimile: 2-273-8966
Telex: 84228 THAIMEW TH

The United Kingdom
MEIDENSHA CORPORATION
Chancery House, 53/64 Chancery Lane,
London WC2A 1QS, England
Phone: 171-405-6474/6396
Facsimile: 171-404-0447
Telex: 266608 MEIDEN G

The United States
MEIDENSHA CORPORATION
Detroit
The American Center Building, Suite 1110
27777 Franklin Road, Southfield
Michigan 48034, U.S.A.
Phone: 313-353-2540
Facsimile: 313-353-3150