TOSHIBA

6F3K0269

Toshiba inverter tosvert 130-G1 instructions manual

INSTRUCTIONS MANUAL

INVERTER TOSVERT-130G1 OPERATION GUIDE

(380~460V 150~200kVA)

WALL MOUNT TYPE

CODE VT130G1

TOSVERT-130G1 GENERAL PURPOSE INVERTER

HANDLING PRECAUTIONS

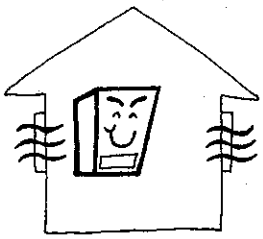
Before using these inverters, read their operation manuals carefully. Since mishandling them may cause them to break down or even be completely destroyed, carefully follow the suggestions listed below.

DANGER HIGH VOLTAGE

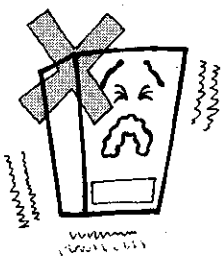
Do not touch any internal parts while main power is connected and the red CHARGE lamp is lit!

1 ENVIRONMENTAL FACTORS

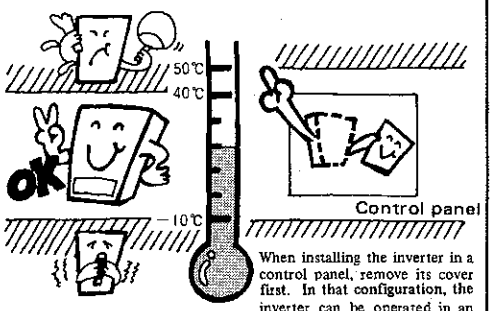
- Avoid installing the inverter where there is high temperature and/or humidity, or where there is dust or metallic powder. Be sure to install it in a well ventilated indoor space.



- Do not install the inverter where there is a high level of vibration.



- Keep the ambient temperature within a range of −10° to +40°C.



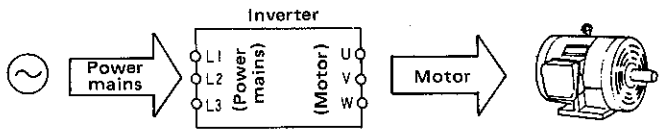
When installing the inverter in a control panel, remove its cover first. In that configuration, the inverter can be operated in an ambient temperature range of −10° to +50°C.

2 POWER INPUT

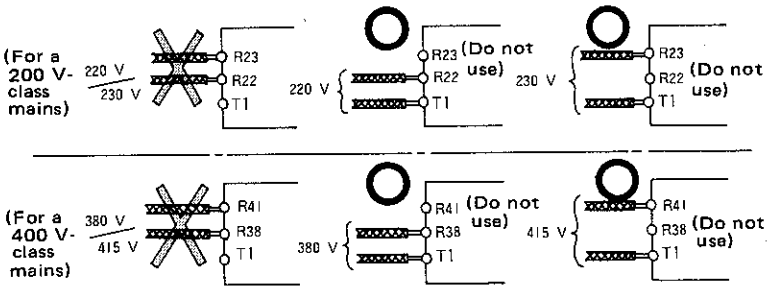
- Assure that the input power mains voltage is within ±10% of the voltage rating. If the voltage is above or below that range, a protective device may trip, or in the worst case, the inverter may be destroyed.

3 CONNECTION

- Connect input terminals L1, L2, and L3 to a power mains, and connect output terminals U, V, and W to a motor.

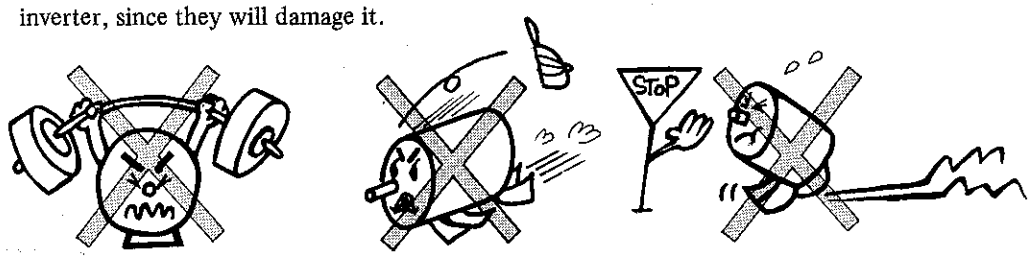


- Make the control power supply connections in accordance with the power mains voltage used.



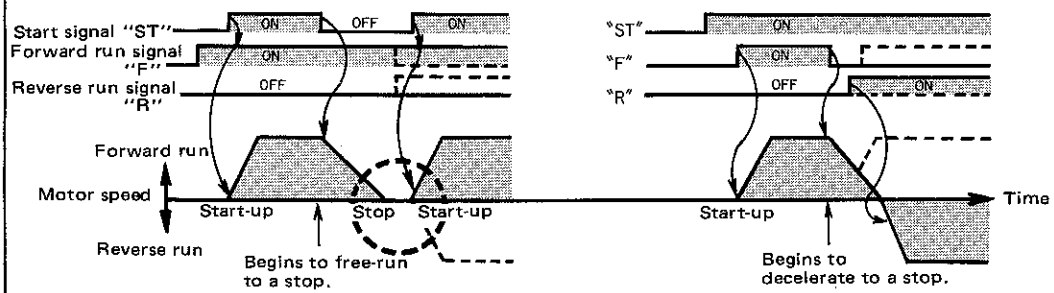
4 RUNNING THE INVERTER

• Avoid overloads, sudden accelerations or decelerations, or other irregular operations of the inverter, since they will damage it.



Overload **Sudden acceleration** **Sudden deceleration**

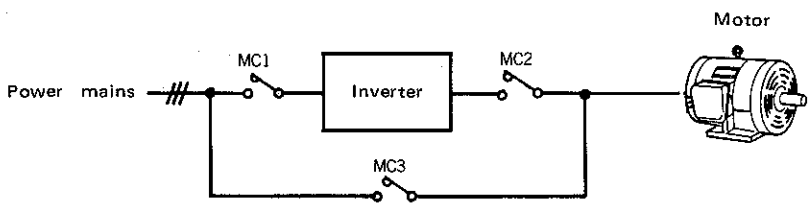
• Inverter running pattern (For further details, see the operating instructions.)

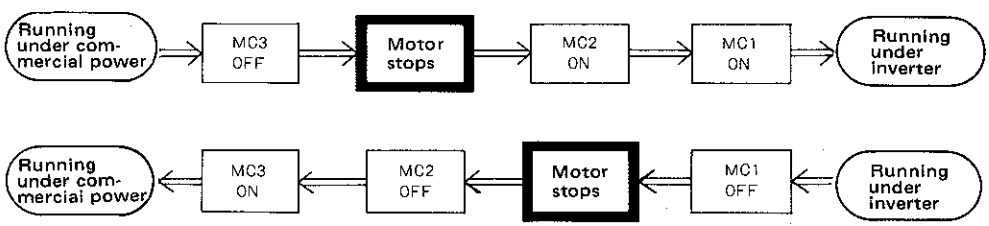


o When the "ST" signal disappears, the motor will free-run to a stop.
o Do not re-start the motor while it is still free-running to a stop.
Only after the motor comes to a complete stop should it be re-started.

o When the "ST" signal is on, and the "F" or "R" signal disappears, the motor will decelerate to a stop.
o If the deceleration time is too short, the overvoltage protective circuit sometimes trips.
In that case, either set a longer deceleration time, or use a regenerated power discharging resistor unit.

• When switching to commercial power, follow the steps described below.





PREFACE

Thank you for purchasing the Toshiba general purpose inverter. This guide describes the operation and maintenance procedures.

It could be read carefully before using the inverter for the best use.

This instructions could be attached with the inverter unit to final users.

CONTENTS

SECTION 1

INITIAL INSPECTION/STORAGE

1-1 Inspection Upon Purchase

If there are any problems, please contact your dealer.

(1) Check for damages during transportation.

(2) Check for the rated kVA capacity inscribed on the name plate and ordered kVA.

1-2 Storage

Following remarks are required to storage the inverter unit for long term.

(1) The inverter unit should be kept in clean dry location free from temperature extremes, humidity corrosive gas, dust and metal particles.

(2) The test working once a half year should be recommended to reconfirm the inverter operation and maintain the filter capacitors quality, because the characteristic of electrolytic capacitors used as main circuit DC bus filter becomes worse without electricity for long term.

(3) Some unit's PWB are protected from electrostatic stress by the conductive cover sheet. Please don't take it away in storaging. Please remove it at working only.

＊＊＊ Be sure charge light is out before touching any component.

SECTION 2

STANDARD SPECIFICATION

The standard specifications are shown in Table.

If there are any special specifications with your order, they will be described separately.

2-1 Rated Type-Form

Type-form	Rated Capacity (kVA)	Rated output current (A)	Maximum Motor *1	
			kW	HP
VT130G1-4150KU2	150	206	110	150
VT130G1-4200KU2	200	275	150	200

Note *1 Examples of applicable motors of max. capacity (4-pole)

2-2 Input Power Supply

There are three types of rated voltages in 400 volt inverter series.

Please confirm the voltage rating or your inverter unit and then refer to this instructions.

Item	Contents		
	Type 1	Type 2	Type 3
Voltage Frequency	3φ-400V-50Hz 3φ-400/440V-60Hz	3φ-460V-60Hz	3φ-380/415V-50Hz
Allowable variation	Voltage ±10% Frequency ±2Hz		

2-3 Control Specification

Item	Contents
Control system	Sinusoidal wave PWM control
Output voltage	Output voltage is in proportion to input voltage
Output Frequency	0.5 to 80Hz (1 to 160Hz)
Frequency acturacy	±0.5% of maximum frequency (at 25°C ±10°C)
Voltage / Frequency ratio	0.5 to 60Hz : V/F constant 60 to 80Hz : V constant
Overload capacity	120% for 60 seconds 100% continuous
Speed Reference	DC 0 to 12V / 4 to 20mA (Changeable)

2-4 Operating Functions

Item	Contents
Acceleration/Deceleration Time	1 to 20 seconds (acceleration and deceleration individually adjustable) SERECT "X6" by J13 6 to 120 seconds
Braking	By capacitor charge
Starting	By dry contact (hold)
Forward , Reverse	Reversing can be added using limits are adjustable
Upper and Lower speed limits	Upper and lower speed setting limits are adjustable

2-5 Protecting Functions

Item	Contents
Protedtion	Stall prevention, overcurrent protection, overvoltage protection, undervoltage protection, momentary power failure protection (about 15ms), and fuse protection, overheat protection
Fault detection	Fault relay form-C contacts (250 VAC 3A resistive). The relay will engage when overcurrent, overheat, overvoltage, or undervoltage is detected. (Reset manually or remote via a 1A contact)

Note) When automatic restart option is provided, undervoltage doesn't work.

2-6 Display

Item	Contents
LED display	Frequency display ····· 3 digit 7 Segment LED Fault display ····· Same LED as frequency display Over current ····· "OC" Over voltage ····· "OP" Unstable (under) voltage ····· "UP" DBR over heat ····· "OH" Main circuit condencer charge display ····· LED

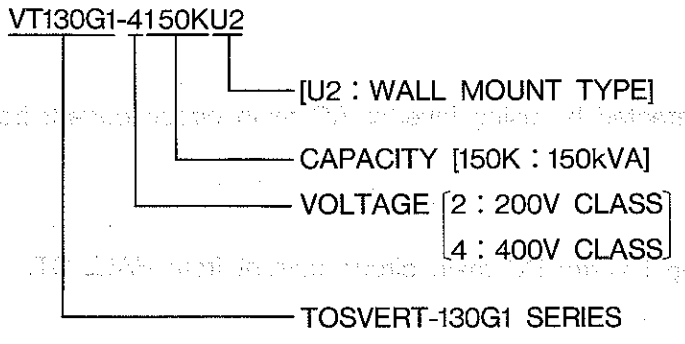
2-7 Instrument Signals

Item	Contents
Frequency meter output	DC 1mA full scale
Current meter output	DC 1mA full scale

2-8 Ambient Conditions

Item	Contents
Location	Indoor
Ambient Temperature	–10°C~50°C
Relative Humidity	Less than 90% non condensing
Vibration	Less than 0.5G

2-9 Explained type-form



SECTION 3

OPTIONS

3-1 Built-in Option

3-1-1 Speed Feedback Control

For applications requiring extremely accurate speed regulation which take into account motor ship, motor speed is regulated by a speed feedback signal from a tachometer.

Tachometer is not furnished in this option and should be a single phase, 24P, 1800RPM, 25 Volt type.

3-1-2 SF Control

SF control circuit is designed to achieve torque correction. =Speed response is improved.

3-1-3 PI Control

For applications requiring flow rate control or head pressure control for pump, fan and blower, optimum control is done in accordance with process signal (1~5V DC or 4~20mA DC) from process value detector.

3-1-4 Automatic Restart Circuit

Automatic restart circuit is available for switching system between inverter and commercial power. Motor is restarted automatically.

3-1-5 Low Speed Detection and Accelerating Condition Output Signal

Output signal of low speed is obtained.

Output signal of accelerating condition and low speed condition is obtained.

3-1-6 Jogging/Inching Control

To meet the requirement for jogging/inching control, this circuit is available.

3-1-7 Overload Detection

Overload condition of motor is detected by using inverter AC main circuit current from CT.

3-1-8 Speed Regulation Circuit

Motor speed is regulated by using inverter DC main circuit current from HALL CT.

3-2 External Option

3-2-1 Remote Operation Box

Standard remote operation box contains an analog frequency meter, frequency setting variable resistor and run/stop switch.

3-2-2 Power Factor Improvement, Harmonics Reduction and External Surge Reduction Reactor

To meet the requirement for power factor improvement, harmonics reduction and external surge reduction, this reactor is available.

3-2-3 Operation Parts

Analog frequency meter	Analog frequency meter is available for monitoring the output frequency
Frquency setting variable resistor	Frequency setting variable resistor is available for remote control of output frequency
Knob for frequency setting variable resistor	For frequency setting variable resistor

3-3 External Options required some arrangement of the Inverter Unit.

3-3-1 Ground Fault Detection

Earth leakage current is detected by using ZCT.

3-3-2 Output Voltage Control

Output voltage control is available for output voltage correction. Motor terminal voltage is regulated by voltage reference and inverter output voltage.

SECTION 4

PRINCIPLES OF OPERATION / APPLICATIONS

4-1 Principles of Operation

Most A. C. induction motors in the past have been limited to fixed speeds. The Toshiba motor drive provides a simulated (P.W.M.) A.C. that varies the speed of the motor. Toshiba's giant transistor (G-TR) is used with a microprocessor controlled regulator to accomplish the conversion.

Motor speed ratings usually show the motor base speed at 60Hz operation. Slower speeds (below base speed) are produced by reducing both the voltage and the frequency of the output.

Figure 4-1 shows the voltage varying with the frequency until base speed (60Hz) is reached. Above base speed, the voltage remains constant.

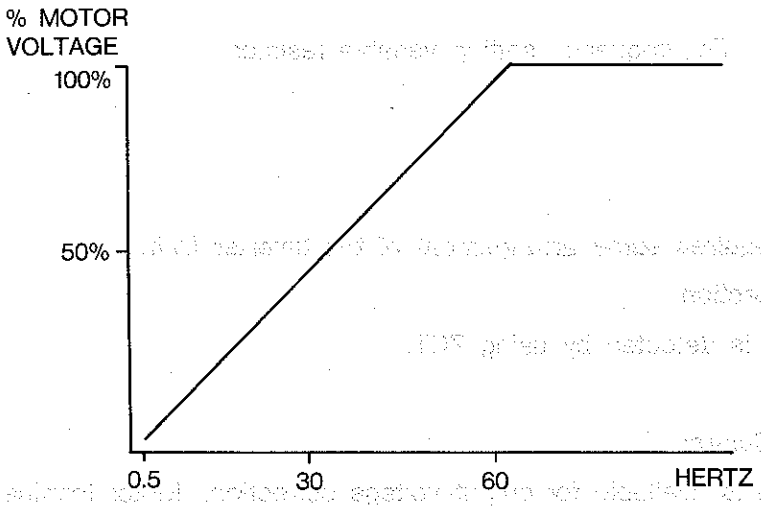


Fig. 4-1

P.W.M. (Pulse Width Modulated) inverters change the incoming power to D.C. and then pulse the D.C. into the motor leads to simulate A.C. Figure 4-2 shows a representation of the Toshiba output voltage waveform.

An A.C. waveform is super-imposed on the pulse wave for illustration.

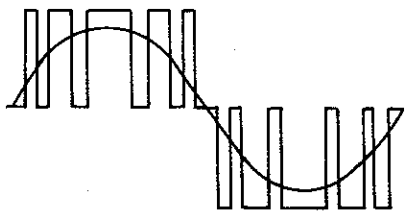


Fig. 4-2

Figure 4-3 is divided into two parts; the MAIN CIRCUIT which handles the input and output power, the REGULATOR BOARD which senses input information to direct the power transistor (GTR).

Figure 4-3 shows a block diagram of the VT130GI representative schematic.

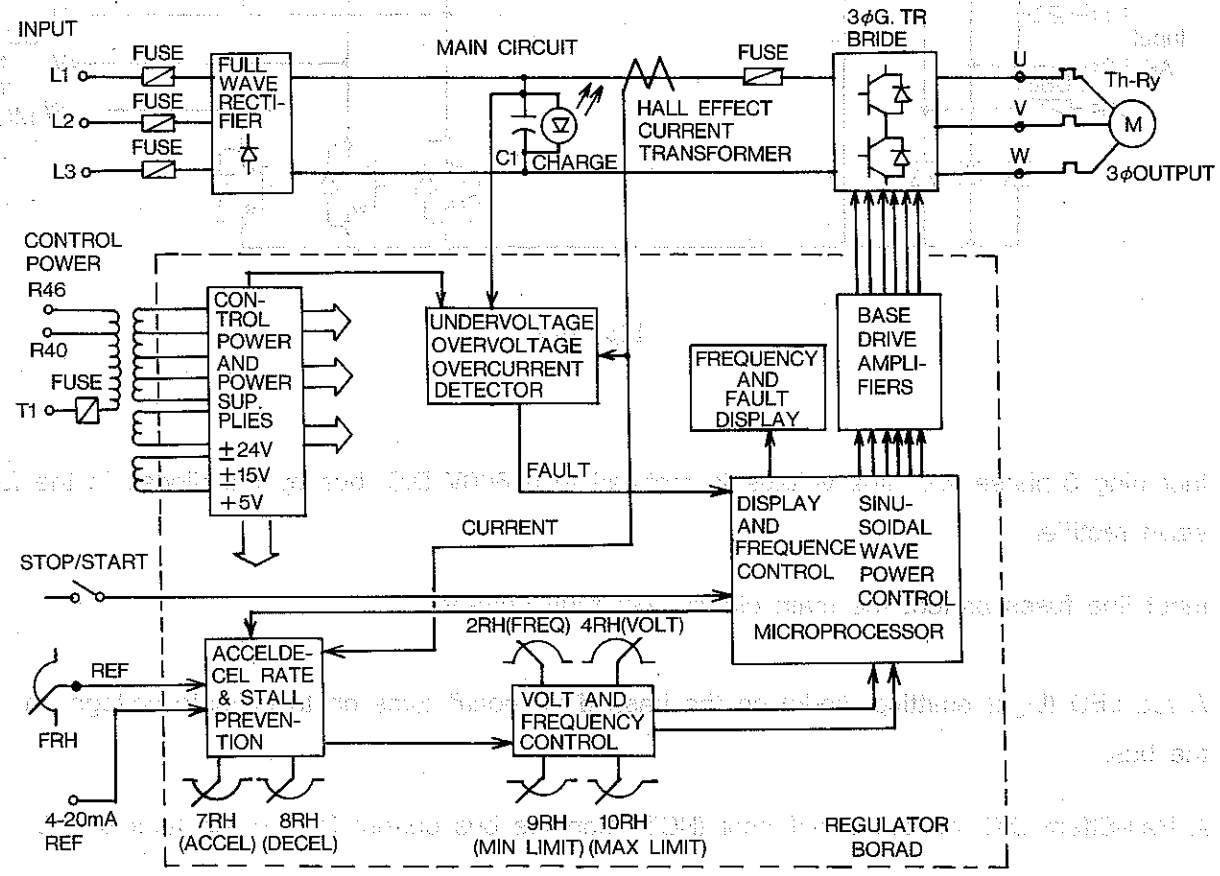


Fig. 4-3

A. Main Circuit

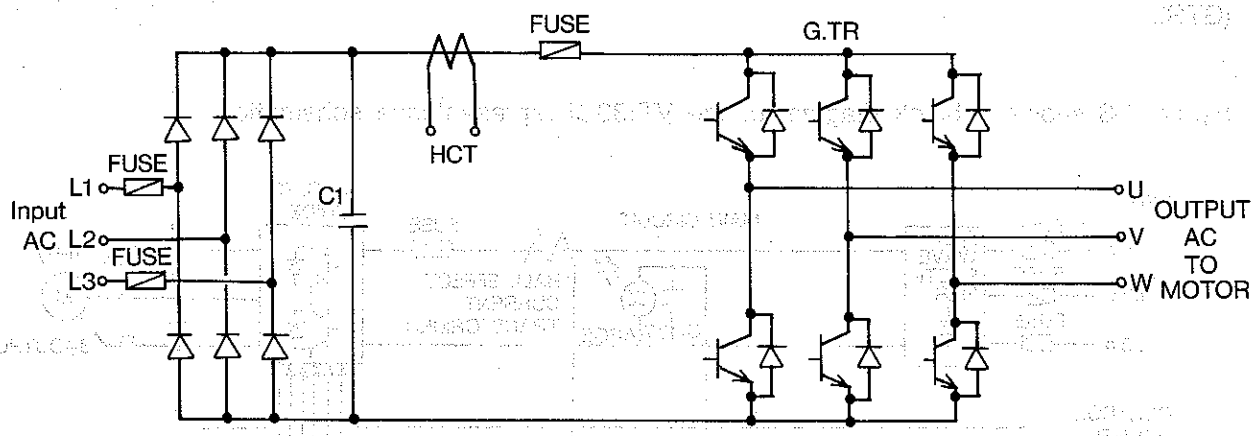


Fig. 4-4

Incoming 3 phase A.C. line voltage is rectified to a 600V D.C. bus by the diodes in the full wave rectifier.

Input line fuses protect the main circuit from fault currents.

A red LED (Light emitting diode) on the base drive board turns on to indicate voltage on the bus.

A Hall-Effect D.C. current transformer (HCT) monitors bus current for the regulator board.

Output to the motor is obtained by switching the D.C. bus with the transistor (GTR) inverter. G-TR control comes from the regulator board through the base amplifiers.

Switching of the transistors is controlled by the regulator board.

Output waveforms are illustrated in Figure 4-5.

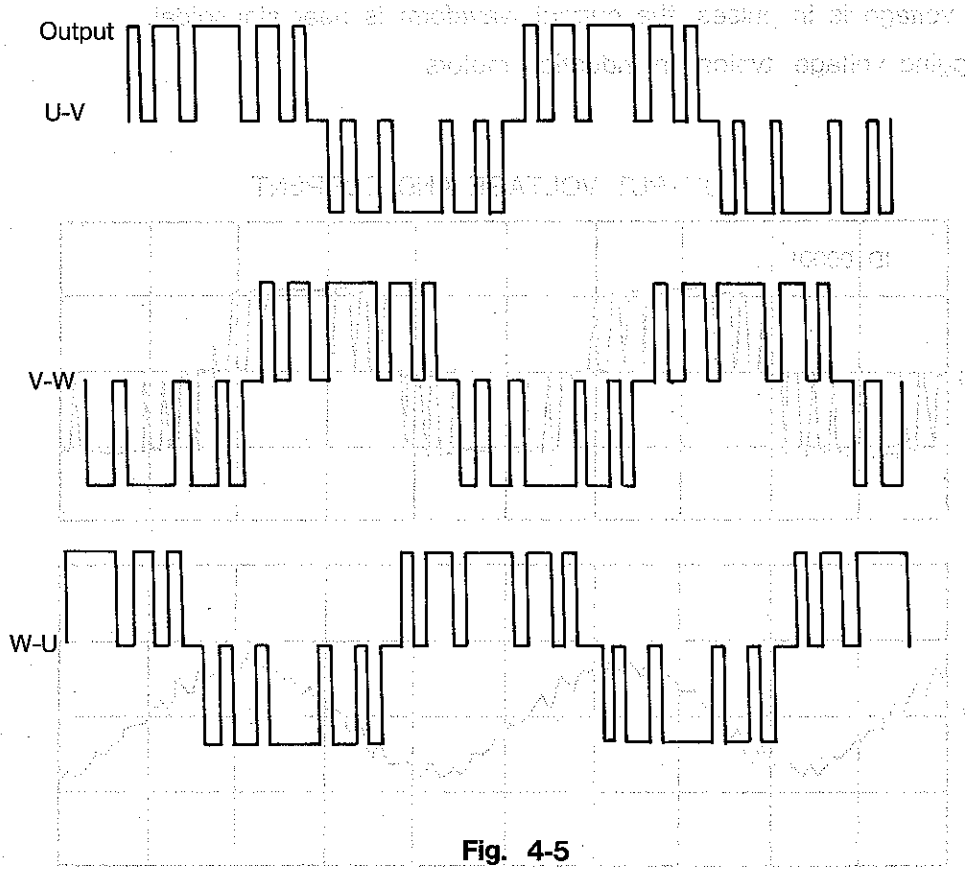


Fig. 4-5

Proper 120°phase shift between output leads stays constant over the entire frequency range. Typical motor voltage and current at 60hertz (full load) is shown on Figure 4-6. Note that although the voltage is in pulses, the current waveform is near sinusoidal. Current is lagging voltage, typical in induction motors.

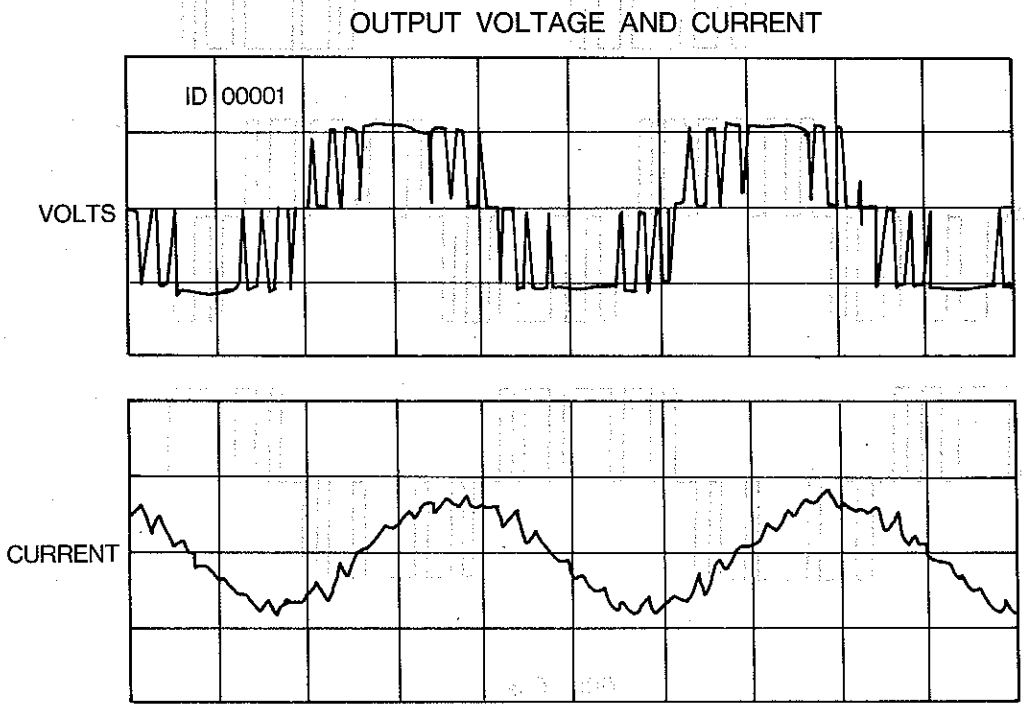


Fig. 4-6

B.Regulator Board

The regulator board accepts operator information and outputs base signals to control the G-TR's. Refer to the wiring diagrams pages 20 for the following descriptions.

The operator speed pot. (frequency setting signal) is connected to CRF, REF, and OV, 0 to 12V DC at REF controls full range output of the inverter.

A 4 to 20mA signal can be connected at IRF and OV. A contact opening the CRF wire of the speed pot. will automatically switch to this current reference.

ST (start), F (forward), and R (reverse) connected to COM controls the start/stop function and direction of inverter output.

Fault relay (contats at FLA, FLB, and FLC) latches on if a fault occurs. Pressing the reset button or remotely resetting will reset the relay. (Remote reset use term. RST to COM)

A low speed relay may be used to detect inverter speed below 0.5 Hz. (option)

Factory adjustment provides 0.5 to 80Hz operation. Moving jumper J3 from the 60Hz to the 50Hz position automatically changes maximum output to 67Hz. Frequency range is adjustable from 0.5Hz to 80Hz with 1F jumpere at J2.

Jumping 2F at J2 raises output frequency to 160Hz. Note that adjustments or changes in output frequency may require readjustment of remote frequency meter and V/Hz.

The current detector monitors bus current from the HCT.If bus current rises to 120%, stall prevention circuitry phases. 150% current shuts the G-TR base drive off until current decreases. 180% current turns base drive off and latches the fault relay and OC overcurrent display.

Bus voltage is monitored on the base drive board. Fast deceleration rates can cause the bus voltage to rise when absorbing energy from the motor. At 800V, the inverter shuts down to protect filter capacitors C1 and G-TRs from damage and latches fault relay and OV display.

The microprocessor (CPU) develops base signals which are isolated and amplified by the base driver circuit. Transformer T1 provides isolated low voltage A.C. which is rectified and filtered for the base driver amplifiers.

4-2 Applications

VT 130GI provides a high quality output voltage and current, but it is not a perfect sine wave. Therefore some increase in motor temperature, noise, and vibration may be noticed.

Special considerations must be taken when applying an inverter to an existing motor. At slower speeds, cooling is not effective due to reduced fan RPM. FULLLOAD torque at slow speeds may damage the motor due to overheating. In situations where the load requires high torque at slow speeds, the motor may require replacement with a large frame size for heat dissipation.

Figure 4-7 shows a curve plotting acceptable torque vs. speed.

Note that for a safety margin, the curve shows no more than 90% motor rated torque at any speed. If torque requirements at slow speeds continuously exceed levels shown in Figure 4-7, a larger motor can be substituted.

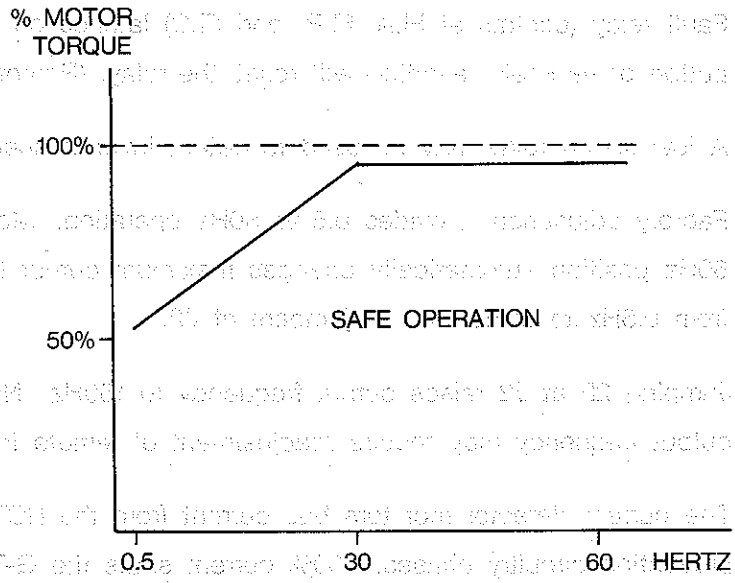


Fig. 4-7

Fixed speed machinery may not run properly at available speed ranges. Operation above 60 Hz may damage bearings or rotating parts. Slow speeds may provide insufficient lubrication on oil filled gear boxes or speed reducers. Manufacturer specifications may need to be consulted.

The above precautions should be looked at carefully to prevent any problems. It is most often the case, however, that the motor or motors on a variable speed application can be directly applied to the VT130GI.

SECTION 5

INSTALLATION

The following instructions show the installation method. This inverter unit requires vertical installation.

1. The ambient temperature must be between –10°C and 50°C (18 to 122 degrees Farenheit). If the inverter is installed inside a self-contained panel or a large control panel, there must be proper ventilation to keep the temperature between –10°C and 50°C. (–10°C and 40°C when equipped with cover)
2. It is necessary for proper inverter operation to avoid high temperatures, humidity, dust, or metal particles.
3. Corrosive gas and/or liquids must be avoided.
4. Install in an area where there is no vibration or noise from other electrical equipment and where maintenance can be performed easily.
5. On magnetic contactors, cooling fans and flourescent lamps turn off or turn on, large voltage surge occurs.
   Then sometimes the electronic circuits are failed and the large voltage surge prevents normal operation for inverter. So please attach the surge suppressor at above equipment.
   Recommended surge suppressor : MARCON ELECTRONICS CO., LTD.
   Type-Form : DCR2-22A25
   Rating : 200Ω, 0.22uF

   When the inverter is installed near the circuits which generate large electromagnetic noise such as the direct on line starting circuits, the failure of the electronic circuits on the printed circuit boards sometime prevents normal operation for inverter.
   In this case please attach the surge suppressor at the motor driven by line power to reduce the generated noise.
   Recommended surge suppressor : OKAYA ELECTRIC IND. CO., LTD.
   Type-Form : 3CRE-50500
   Rating : 50Ω, 0.5uF

SECTION 6

WIRING

6-1 Wiring Cautions

Refer to Page 20, Standard Connection Diagram, Page 21, Standard Wire Size and Main Circuit Equipments Selection Table and use the following instructions.

1. Be careful not to apply commercial voltage to output terminals (U, V, or W). This will damage the unit.
2. A surge suppressor must be connected across the excitation coil of the electromagnetic contactor (MC) when used. Recommended surge suppressor : MARCON Electronics DCR2-22A25 (or RC type, 0.22uf-250V, 220Ω-1/2W).
3. Grounding wire size at terminal E must be 3.5mm^2 or greater (#10 AWG).
4. Match the power supply voltage to the control power input terminals.
5. Use shielded, twisted wires for external connections of speed reference signals (CRF, REF, IRF, OV) and also remote meter signals (FM, CM, OV).
6. Use a DC 1 mA meter for frequency and current meter. A 20 k ohms variable resistor is needed for the ammeter scale calibration.
7. Connect either F(forward) or R(reverse) terminal to ST terminal through the START/STOP switch. If there are two input signals from both F and R, F (forward) command will override the reverse. The DRIVE-SW (START-STOP) on the operation panel is connected to F (forward), therefore to perform reverse operation without switching, two of the output terminal connections (U, V, and W) must be interchanged. If F (forward) or R (reverse) is to be controlled externally, switch the DRIVE-SW lead on the operation panel between F (forwarde) and R (reverse).
8. The 4 to 20mA current input signal is not isolated in the inverter control circuit. Toshiba recommends that signal common not be grounded since noise problems may result.

Requirements

Unless supplied in a special optional enclosure, the VT-130G1 should be installed in an area where :

1. Cabinet mounting is upright leaving room for door clearance.
2. Ambient atmosphere is free of dust, corrosive gases, high moisture content and temperature extremes.

3. Vibration is kept to a minimum.

4. Unit should be easily accessible for maintenance and troubleshooting.

Procedures

Each VT130G1 is shipped with wiring diagrams that show necessary inter-connections. page 21 shows diagram that would be received with the standard unit.

Terminal numbers in the standard units are shown clearly in wiring diagrams. Terminal strips are mounted at a convenient angle for easy access.

Read the following precautions before installing the inverter :

1. Signal wires, (speed pots, meters, 4 to 20 mA) should be twisted conductors and run in separate conduit.

2. The inverter enclosure should be grounded to conform with electrical codes.

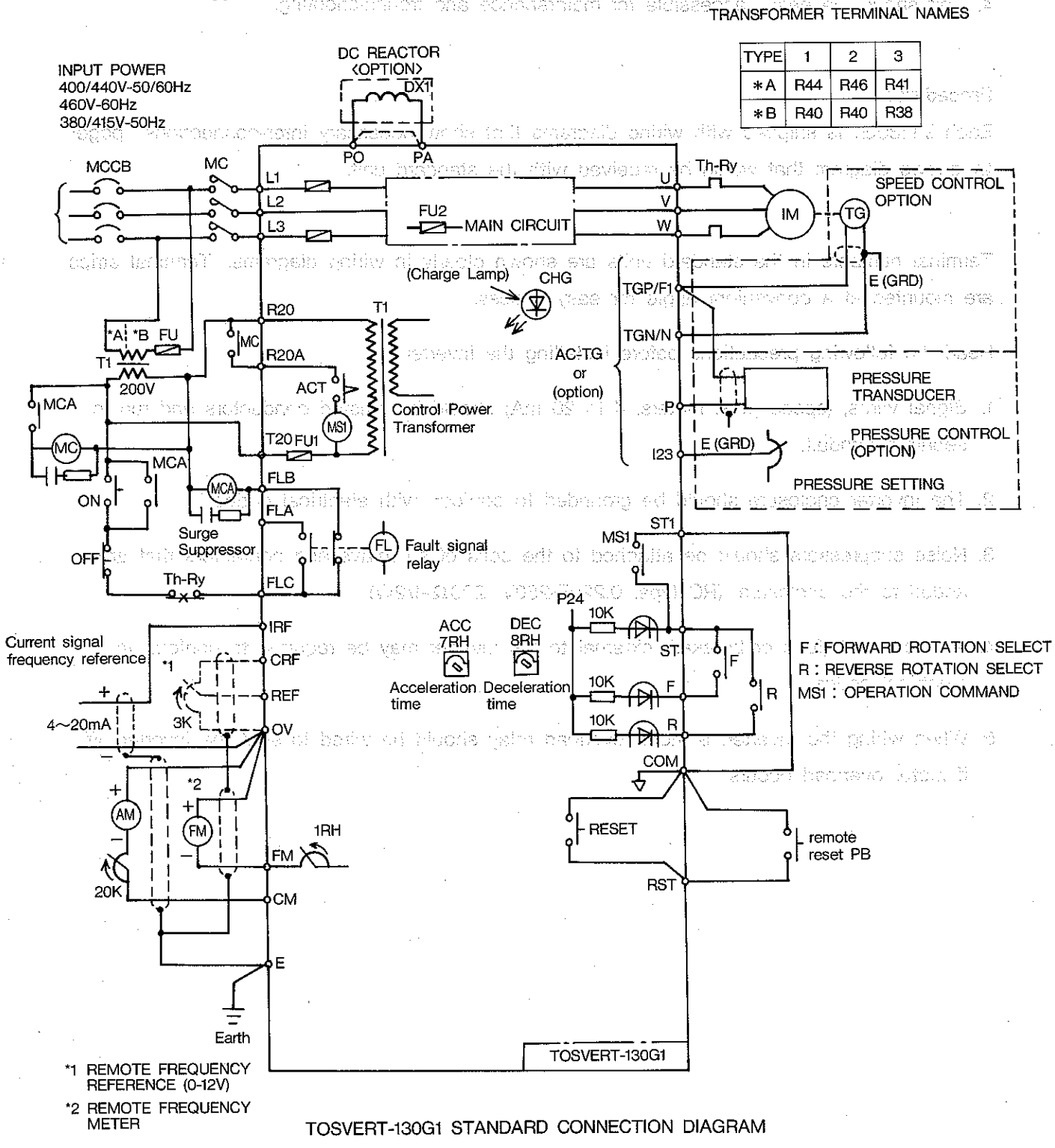
3. Noise suppressors should be attached to the coils of all relays and contactors that are added to the enclosure. (RC type, 0.22uF-250V, 220Ω-1/2W)

4. A disconnect (fuse or breaker), external to the inverter may be required to conform to electrical codes.

5. When wiring the inverter, a motor overload relay should be wired to shut the inverter off if motor overload occurs.

6-2 Standard Connection Diagram

6-2-1 Frame Type



TOSVERT-130G1 STANDARD CONNECTION DIAGRAM

*CONTACT CAPACITY OF FL RELAY IS AC250V-3A.

Magnetic Contactor must be connected with MCA contact. If R20-R20A terminal shorten, the main circuit fuse might be blown at initial charge.

6-3 Standard Wire Size and Main Circuit Equipments Selection Table

6-3-1 Standard Wire Size Unit (mm^2)

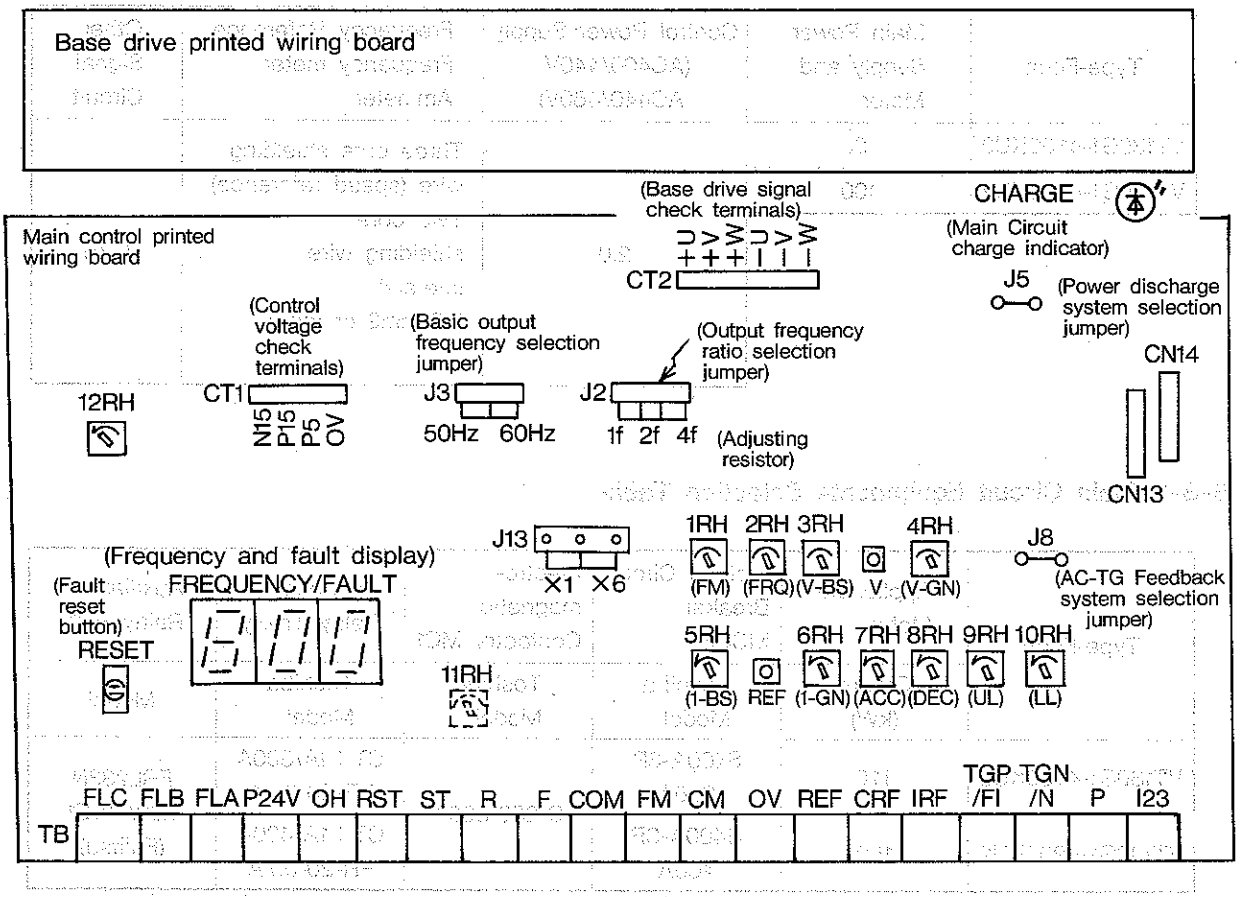
Unit (mm^2)

Type-Form	Main Power Supply and Motor	Control Power Supply (AC400/440V AC440/460V)	Frequency Reference Frequency meter Ammeter	Other Signal Circuit
VT130G1-4150KU2	80	2.0	Three core shielding wire (speed reference) Two core shielding wire (meters) 0.3 mm2 or more	0.75
VT130G1-4200KU2	100			

6-3-2 Main Circuit Equipments Selection Table

Type-Form	Applicable Motor	Molded Circuit Breaker MCCB	Electro-magnetic Contactor MC1	Overload Relay Th-Ry	Auxiliary Relay RUN
	Output (kW)	Toshiba Model	Toshiba Model	Toshiba Model	Model
VT130G1-4150KU2	110	S400A-3P 300A	C-250-300A	CT : 1A/300A +R-20-0.7A	FRL233N 200/4WE1 (Fujitsu)
VT130G1-4200KU2	150	S400A-3P 400A		CT : 1A/400A +R-20-0.7A	

6-4 Location of Terminals, Adjusting Resister and Display on the Printed Wiring Boards



6-4-2 Terminal Function

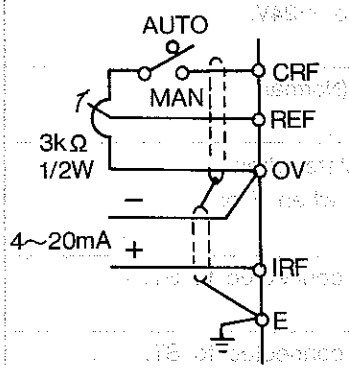
Terminal Symbol	Terminal Function
FLB	"Open" output is obtained between FLC during inverter fault.
FLA	"Close" output is obtained between FLC during inverter fault.
OH	Overheat contact input. OH operation when connected to +24V. (Norinal "open" contact)
RST	Fault reset input. Fault reset when connected to COM. (Normal "open" contact.)
ST	Start preparation command input. Start preparation complete when ST is connected to COM, then start command complete when F or R is selected.
F	Forward operation signal input. Forward operation when connected to ST.
R	Reverse operation signal input. Reverse operation when connected to ST.
COM	Control circuit OV.
FM	Remote frequency meter terminal. Connect DC 1 mA meter between FM and OV.
CM	Remote ammeter terminal. Connect DC 1 mA meter between CM and OV through the calibration resistor (20kΩ)
OV	Control circuit OV.
REF	Remote frequency reference (0-12V) input.
CRF	Power supply terminal to remote frequency setting device.
IRF	Current input (4 to 20mA) terminal. Connect 4 to 20mA signal between IRF and OV.
TGP/FI	Terminal for optional signal input.
TGN/N	
P	
I23	

SECTION 7

OPERATION AND CONNECTION EXAMPLES

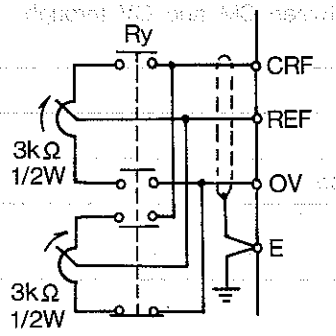
7-1 Connection of Frequency Reference Signal

7-1-1 Switching between Variable Resistor and Current Input



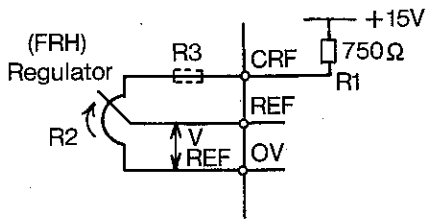
SW-MAN : Variable resistor is selected
SW-AUTO : 4 to 20mA current is selected

7-1-2 Switching between Two or More Variable Resistors



Two or more setting devices are adjusted to different frequencies and switched over.
Use small current rating relay for switching.

7-1-4 Selection of the variable resistor other than 3kΩ for frequency setting device.



A 750Ω fixed resistor is used as R1 in the inverter unit so that the REF value (V_{REF}) is between 0 and 12V when regulator R2 is 3kΩ and the voltage (V_{REF}) is divided by R1 and R2. If the resistance value of the regulator is to be changed, a compensation resistor R3 is required. Obtain the compensation resistance R3 by substituting the value of the generator (R2) in the following equation.

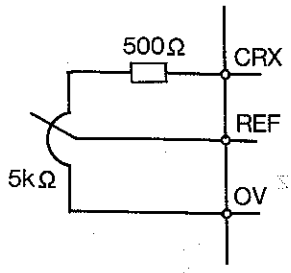
$$V_{REF} = \frac{15V \times R2}{750\Omega + R2 + R3} = 12V$$

$$R_3 = \frac{3 \times R2 - 9000}{12} (\Omega) \quad \text{where } 5k\Omega > R2 > 3k\Omega$$

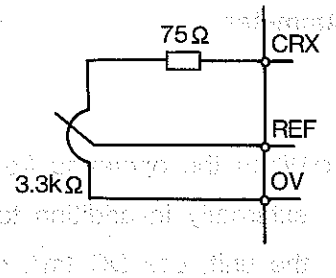
If a fixed resistor cannot be selected because R3 is not a round number, change R2 or use a variable resistor for R3.

Selection example

<f-1> When using a 5kΩ variable resistor

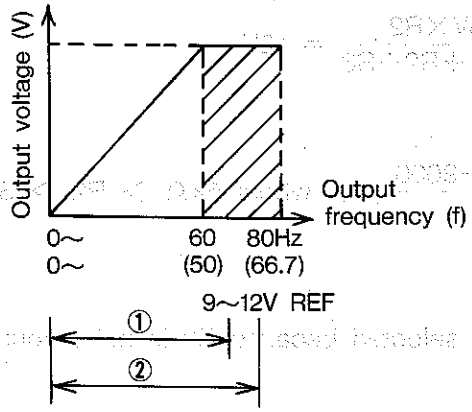


<f-2> When using a 3.3kΩ variable resistor



Note : If the regulator is less than 3kΩ, REF voltage becomes less than 0 to 12V and the maximum output frequency decreases. Therefore R3 must be greater than 3kΩ.

However, if V/F characteristic between 9 and 12V (shaded area) is not required, a regulator between 1.2 and 3kΩ can be used.



Example

1 When 1.5kΩ

V_{REF} : 0 to 10V variable

Output frequency : 0 to 66.7 (55.6) Hz

2 When 2.5kΩ

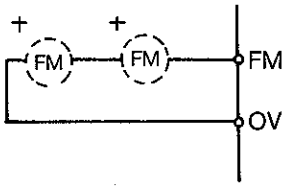
V_{REF} : 0 to 11.5 variable

Output frequency : 0 to 76.7(63.9) Hz

Note) ( ) : When 50Hz is selected by jumper J3 for the basic output frequency, thes values are available

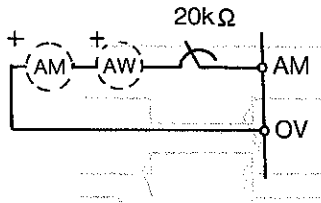
7-2 Connection of Frequency Meter and Ammeter

7-2-1 Connection of frequency meter FM



- When the operating frequency is to be displayed externally in addition to the digital display on the unit, use DC 1mA meter.
- When using multiple meters, connect meters with the same rating in series.

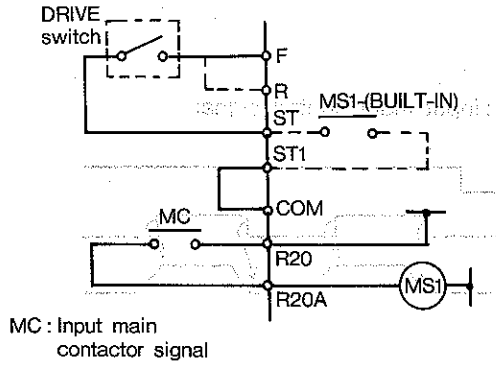
7-2-2 Connection of ammeter AM



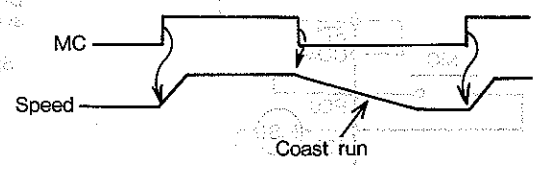
- Use DC 1mA meter
- Use a 20k ohms variable resistor for the scale calibration.
- When using multiple meters, connect meters with the same rating in series.

7-3 Connection of Operation Signals (Forward, Reverse)

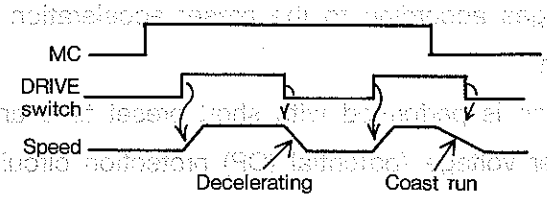
7-3-1 When operating in one direction



- Connect ST terminal directly to either F(Forwsrd) or R(reverse) terminal with wire and between ST1 and COM terminal

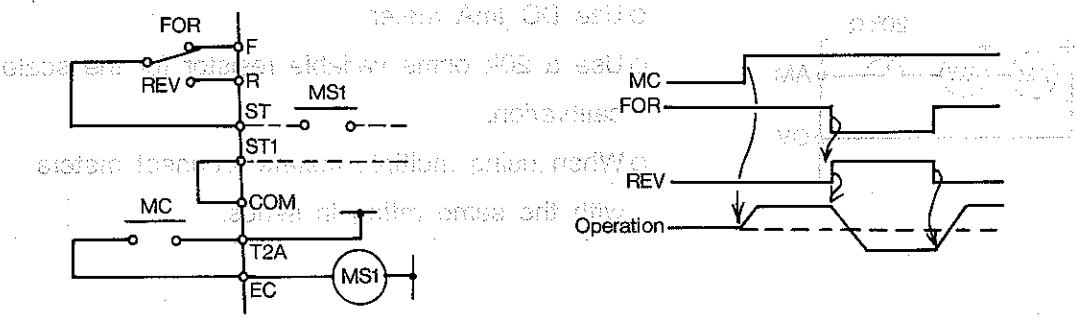


- Connect a DRIVE switch for stop operation in controled deceleration.



7-3-2 When operating in both directions

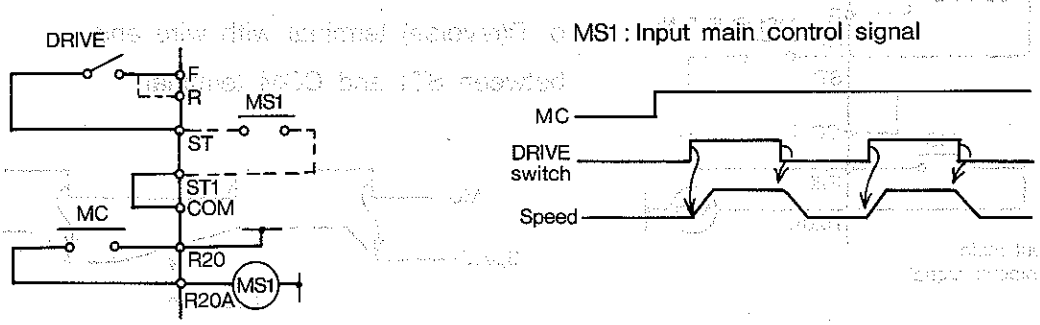
o Use FOR-REV switch as below.



Note : If both F(forward) and R(reverse) operating signals are connected at same time, F(forward) command is in advantage.

7-3-3 Acceleration and Deceleration

o Connect DRIVE switch and MS1 signal as below

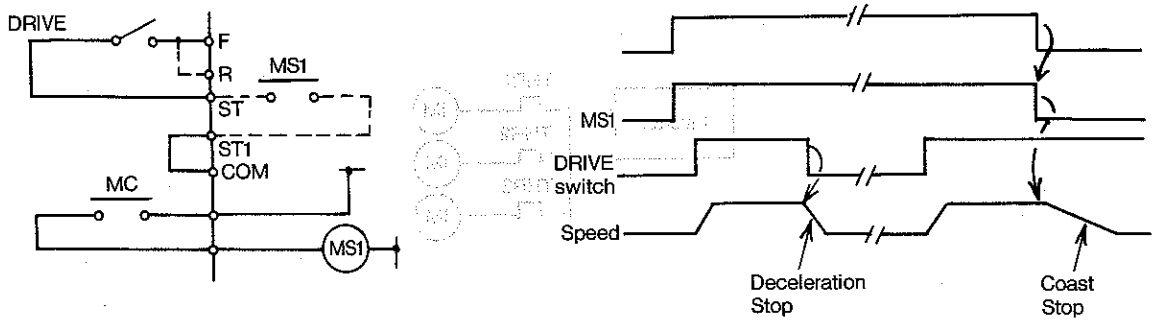


Inverter output frequency changes according to the preset acceleration and deceleration time by switching the DRIVE switch.

Note : If acceleration/deceleration is performed with short preset time and overload inertia, OC (over current), or over voltage /potential (OP) protection circuit may be activated. If the fault signal relay is activated, check the cause and take necessary action such as increasing the preset time.

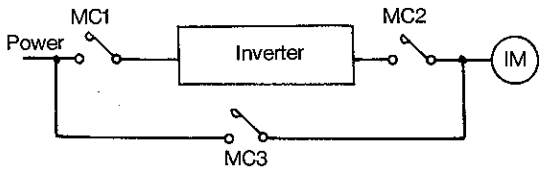
7-3-4 Motor coast stop and deceleration stop

Coast stop or deceleration stop is determined by the input signal to ST terminal.

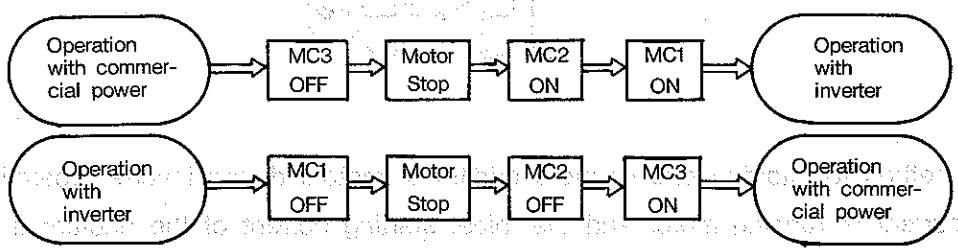


7-4 Switching between Commercial Power Source and Inverter Output

- MC2 must be provided in order to prevent the transistors in the inverter unit from damages.
- MC2 and MC3 must be equipped with mechanical interlocking.
- Rrotection circuit may be activated when switching from commerical power to inverter while the motor is running.

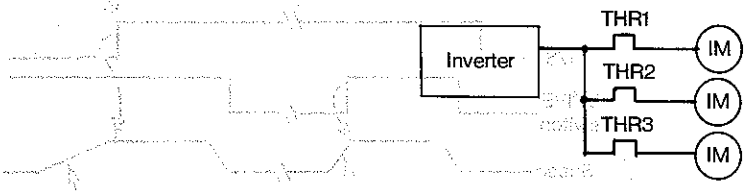


Switching sequence



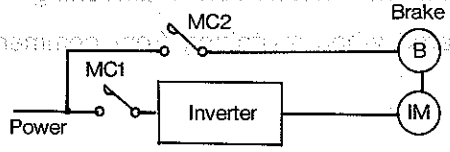
7-5 Parallel Motor Operation

- The total current of the motors (including transient current at start and stop) must not exceed the rated current of the inverter.
- Add a thermal relay for each motor for over load protection.

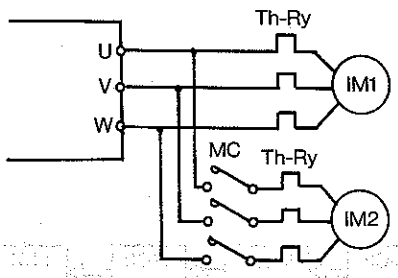


7-6 Using Brake with Motor

- Connect brake power from the inverter input line.
- Use brake with mechanical interlocking so that operation sequence is MC1 OFF first then MC2 ON second.

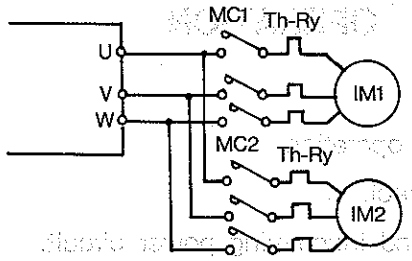


7-7 Additional Motor Operation



- This is a method for starting one or more additional motors during inverter operation.
- Both the current of running motor and the initial starting current of the additional motor flow in the inverter. Inverter rating current must be greater than these total current.
  The over current protection circuit may be activated if the capacity of the inverter is not sufficient.
- Please contact your dealer when you want this operation.

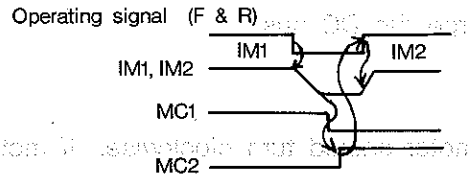
7-8 Switching Method between Motors



○ This is the method for switching from an operating motor to a non-operating motor.

○ Switching procedure

Turn off the operating signal (F or R) and after the motor stops, turn off MC1, turn on MC2, and then turn on the operation signal.



○ If the switching is made before the motor stops, an overcurrent protection circuit may be activated.

SECTION 8

OPERATION

8-1 Pre-operation Check Off

Check the followings before starting operation.

1) Check that all wirings are correct.
2) Check power supply voltage and incomming power circuit.
3) Check that control power transformer terminals are connected to the correct voltages.
4) Check that there is no short-circuit.
5) Check that terminal screws and connectors are tight.

Initial Operation

1. Initial conditions before power up:
   a) Frequency pot. (speed adjustment) should be at minimum setting.
   b) Forward/Reverse switch (if used) in forward position.

2. Energize the input terminals and charge the DC bus.
   The charge LED comes on.

3. Adjust the speed pot. slightly. The motor should turn clockwise. If motor runs backwards: stop inverter, turn off power, and reverse any two output leads U, V, W to correct direction.

4. Forward/Reverse (if used) should be checked while motor is running. Forward command sw switchs to reverse, motor should stop, and turn to reverse direction. The final speed in reverse direction should be same as in forward.

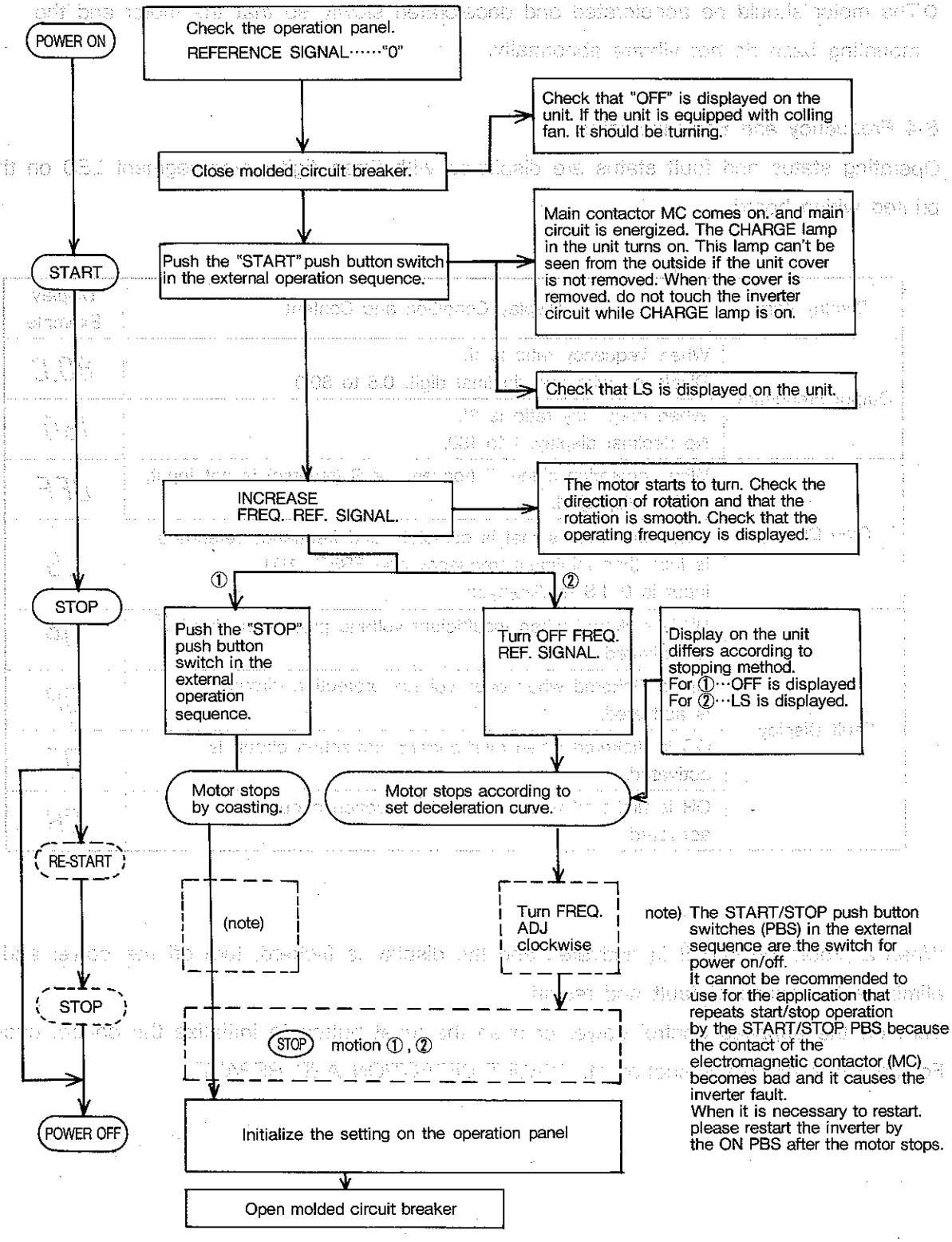
5. Increase speed to maximum slowly, and check motor condition. Leave setting at maximum. Push the stop button. Motor should decelerate or coast without tripping inverter off. Push RUN button, motor should accelerate smoothly to maximum without tripping inverter. Motor current should be checked at several different speed.

8-2 Pre-operation Adjustments

This inverter can be adjusted according to usage and load. Refer to section 9 "ADJUSTMENTS" and make the proper adjustments.

8-3 Operation Procedure

Refer to the standard Connection Diagram (Page 20) and Perform the followings.



note) The START/STOP push button switches (PBS) in the external sequence are the switch for power on/off.
It cannot be recommended to use for the application that repeats start/stop operation by the START/STOP PBS because the contact of the electromagnetic contactor (MC) becomes bad and it causes the inverter fault.
When it is necessary to restart. please restart the inverter by the ON PBS after the motor stops.

- Operating frequency (inverter output frequency) changes according to the preset acceleration time and deceleration time. The motor also accelerates and decelerates according to the operating frequency.
- The motor should be accelerated and decelerated slowly so that the motor and the mounting base do not vibrate abnormally.

8-4 Frequency and Fault Indicator

Operating status and fault status are displayed with three-digit seven-segment LED on the printed wiring board.

Display Item	Display Condition and Content	Display Example
Output Frequency	When frequency ratio is 1f. Displayed with one decimal digit. 0.5 to 80.0	80.0
	When frequency ratio is 2f. No decimal display. 1 to 160.	160
Stop Display	When operation signal F (forward) or R (reverse) is not input, OFF is displayed.	OFF
	When operation signal is complete and frequency reference is less than minimum frequency and FREQ. ADJ. input is 0, LS is displayed.	LS
Fault Display	UP is flickered when insufficient voltage protection circuit is activated.	UP
	OP is flickered when over voltage protection circuit is activated.	OP
	OC is flickered when over current protection circuit is activated.	OC
	OH is flickered when overheat protection circuit is activated.	OH

When a protection circuit is activated and the display is flickerd, turn off the power and eliminate the cause of fault and restart.

Turn off the supplied control power or push the reset button to initialize the control circuit.

For details, refer to the section 11. "FAULT DETECTION AND REPAIR".

SECTION 9

ADJUSTMENTS

9-1 Variable Resistors

The variable resistors are adjusted to specification at the factory and should not be touched unless necessary.

(Caution when adjusting)

1. Small-scale precision type variable resistors are used. Use a well insulated thin type minus screwdriver.

2. When the power is on. a high voltage is applied to the parts on the printed circuit board. Also after the power is turned off, the large capacitor is charged for about three (3) minutes. Do not touch any circuit while the CHARGE lamp is on.

3. A digital counter and an oscilloscope are necessary for readjustment. Do not ground the instruments when connecting and keep the input impedance of the instruments over 1M-ohm.

4. When monitoring the waveform with an oscilloscope, turn off the power before connecting or disconnecting the probe.

Description of Variable Resistor (RH)

RH No.	Symbol	Adjustment Function	When the RH is Turned Clockwise	Adjustment at Shipment	Remarks
1RH	FM	Remote frequency meter calibration	Sweep of the frequency meter increases	—	
2RH	FRQ	Output frequency adjustment	Output frequency decreases	80Hz	
3RH	V-BS	Output voltage bias (Voltage boost)	Minimum output voltage increases	—	
4RH	V-GN	Output voltage gain	V/F ratio decreases	100%	
5RH	I-BS	Current input bias	Output V and F increase	0%	4mA input
6RH	I-GN	Current input gain	Output gain decreases	100%	20mA input
7RH	ACC	Acceleration time adjustment	Acceleration time decreases	about 120 sec (×6)	×1 : 1～about 20 sec ×6 : 6～about 120 sec
8RH	DEC	Deceleration time adjustment	Deceleration time decreases	about 120 sec (×6)	×1 : 1～about 20 sec ×6 : 6～about 120 sec
9RH	UL	REF input upper limit	Limit value increases	80Hz	
10RH	LL	REF input lower limit	Limit value increases	0Hz	

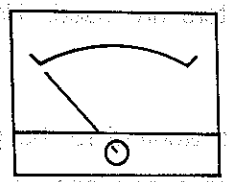
Note : Do not touch variable resistors which are not described above

9-1-2 Adjustment of each variable resistors

9-1-2-1 1RH ····· frequency meter Adjustment

If a remote frequency meter is used, it can be caribrated according to following procedure.

1) Make zero adjustment before turning on the power.
2) The meter will swing a little in the negative direction when the power is turned on.
3) Adjust the meter to the frequency shown on the digital display (Frequency/Fault) on the printed wiring board.

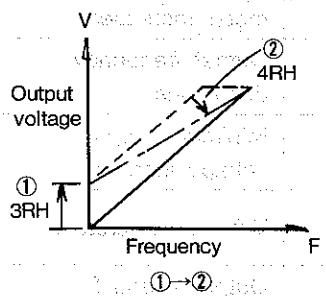


Zero adjustment

9-1-2 3RH, 4RH ····· V/F Ratio Adjustment

Adjustment is required if there is insufficient torque to start the motor.

1) Use 3RH to increase the minimum output voltage at start time. (Turn clockwise.)
2) Use 4RH to change the V/F slope and adjust so that maximum output voltage is obtained at 50Hz or 60Hz. (Turn clockwise.)
   The activation frequency (0.5Hz) of the motor is set between 35 mV and 75mV of frequency setting value (REF value).



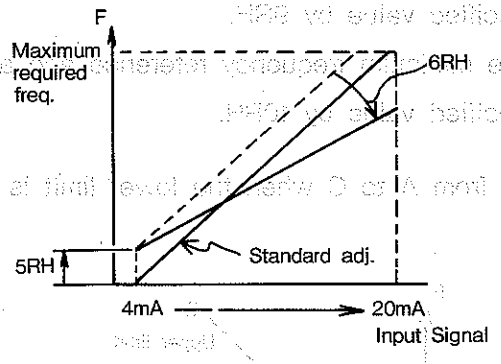
9-1-2-3 5RH, 6RH ····· Adjustment of 4 to 20mA reference

Re-adjustment is necessary when the relation between 4-20mA and output frequency must be changed.

1) Switch off or disconnect the CRX terminal from the resistor for the frequency reference. Give 4mA between the terminal IRF-COM.
   The frequency indication on the digital display is adjusted to required basic value by 5RH.
2) Give 20mA instead of 4mA. The frequency indication is adjusted to required top value by 6RH.

3) Above 4mA and 20mA adjustment should be done few times for accurate adjustment.

The resistor reference mode has no changing with above re-adjustment when CRF terminal is connected to reference resistor.



9-1-2-4 7RH, 8RH ····· Acceleration Time and Deceleration Time Adjustments

Adjust the time t1 to accelerate from 0 to maximum frequency by 7RH and time t2 to decelerate from maximum frequency to 0 by 8RH. Both can be adjusted from 1 to 20 seconds.

○ Readjustment of acceleration time (7RH)

If the load torque or load GD^2 is great and acceleration time is short, stall prevention circuit dan be activated. The acceleration time is automatically increased to accelerate the motor without stalling. However, if the load condition is beyond the capacity of the stall prevention circuit, the motor may stall or the inverter may trip due to over current. In such case, the acceleration time must be increased. (Turn counter clock-wise.)

○ Readjustment of deceleration time (3RH)

If the deceleration time is short when the load torque or load GD^2 is large, the regenerative energy of the motor becomes large and capacitor voltage goes up. The over voltage protection circuit can be activated and the inverter may trip. In such case, increase the deceleration time. (Turn counter clockwise.)

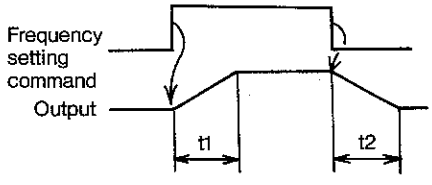
○ If the acceleration or deceleration time must be adjusted greater than 20 seconds, change J13 from one-time mode (×1) to six-times mode (×6).

The adjustable range is shown as below.

×1 ····· 1 to 20 seconds

×6 ····· 6 to 120 seconds

When you select either mode, ACC/DEC times are fixed to the selected mode.



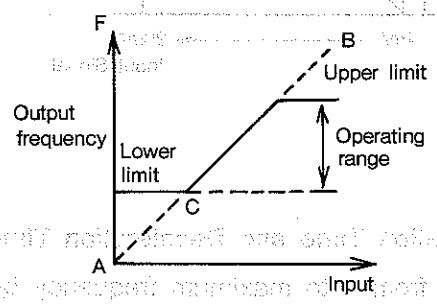
9-1-2-5 9RH, 10RH ····· Upper and Lower Limits Adjustments.

○ Adjust with 9RH and 10RH when the upper and lower frequencies are to be limited regardless of the external frequency reference signal.

9RH upper limit ····· Set the maximum frequency reference and adjust the output frequency to specified value by 9RH.

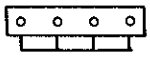
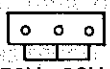
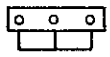
10RH lower limit ····· Set the minimum frequency reference and adjust the output frequency to specified value by 10RH.

○ The motor accelerates linearly from A to C when the lower limit is changed.



9-2 Jumper Connection

Jumpers are connected to specification at factory shipment and should not be changed if not necessary. The locations of jumpers are shown on page 22. The function of each jumper is as following.

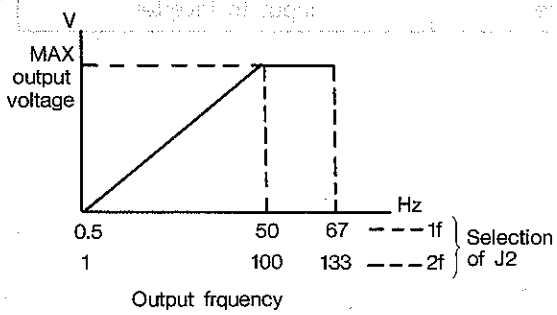
No.	Symbol on Circuit Board	Function	Connection at Shipment
J2	 1f 2f	Ratio of output frequency can be changed. 2f ··· Output frequency is doubled.	1f
J3	 50Hz 60Hz	Output frequency can be switch between 50Hz and 60Hz according to jumper selection.	60Hz
J13	 ×1 ×6	Acceleration/Deceleration time can be extended approx. 1～ 20sec. approx. 6～120sec.	×6

Note 1 : Do not touch jumpers that are not described above.

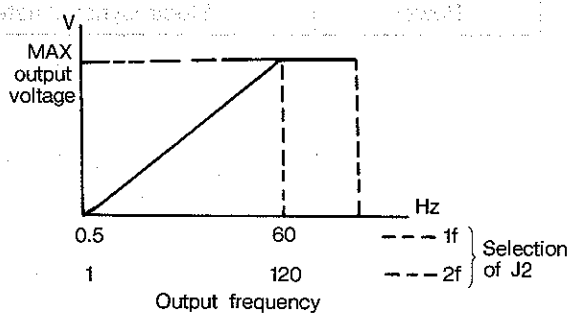
Note 2 : J2 and J3 jumpers

The V/F characteristic is as follows when J2 and J3 jumpers are switched.

a) When J3 is set to 50Hz



b) When J3 is set to 60Hz



SECTION 10

MAINTENANCE

Check the following items monthly

Before performing inspection, be sure to open the input circuit breaker (MCCB). Wait for at least 5 minutes, and check that the "CHARGE" lamp is "OFF" and then start inspection. The "CHARGE" lamp being "ON" indicates that the inverter unit is still energized by the main capacitor.

1. Check for loose wiring at terminals and damaged wires.
2. Check that the vents are not clogged by dust or debris.
3. Check that there is no dust on the printed wiring board and inside the unit.
4. If the inverter unit has been unused for a long period, turn on the power at least once every six months to check its operation. The protection against dust, corrosive gas, high temperature, and excessive humidity must be continued during any unused period. Periodic inspection is required.
5. Do not allow excessive vibration of the unit since damage may occur.
6. If necessary, perform megger test only for main circuit terminals with a DC 500V megger.

Note : Perform megger test with the terminals shorted. Do not test the terminals on the printed circuit board with a megger.

7. Measuring instruments

   Instruments may not show the correct measurements because of the PWM output wave forms. Use the following instruments at the specified locations.

Measurement	Instrument type	Location
Output voltage	Rectifier type analog voltmeter	Output terminals U, V, W
Current	Moving-iron type + CT	Each phase of motor and inverter
Power	Electrodynamometer type	Input to inverter

SECTION 11

FAULT DETECTION AND REPAIR

11-1 Fault Detection

The followings are the fault displays and corrective actions. Check the cause before taking corrective action. If the same fault occurs again after taking the corrective action, do not try to restart since inverter damage may result. Make sure the CHARGE lamp is off when inspecting.

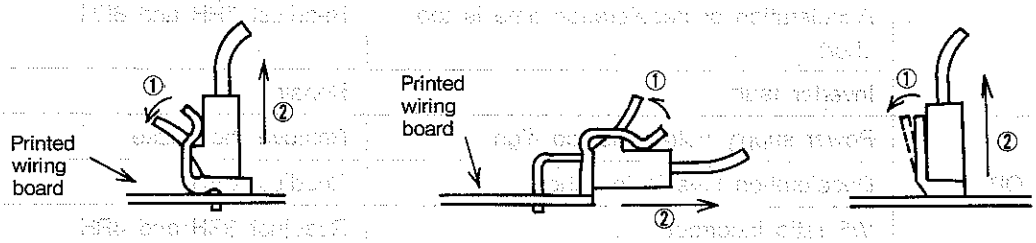
Fault Display	Probable Cause	Action
OC	Inverter capacity does not match the motor rating	Increase inverter capacity
	Short-circuit or ground fault of motor circuit. Note 1	Remove the cause and repair
	Overload or sudden change in load	Decrease load
	Acceleration or deceleration time is too short	Readjust 7RH and 8RH
	Inverter fault	Repair
OP	Power supply voltage is too high	Remove the cause
	Deceleration time is too short	Readjust 8RH
	V/F ratio incorrect	Readjust 3RH and 4RH
UP	Power supply voltage is too low	Remove the cause
OH	Regenerative discharge resistor overheat	Decrease load, readjust 8RH
	Interior temperature of too high	Decrease ambient temperature
Main circuit fuse blown out	Fault in inverter. Main rectifier diode or GTR may be damaged	Repair
Control circuit fuse blown out	Power supply fault in the inverter control circuit	Repair

Note 1 : In case of ground fault of the load, it may not be detected by the inverter and GTR may be damaged. "OC" is displayed upon retray.

Note 2 : If the power supply voltage changes suddenly, the main circuit fuse may blow out. In this case, additional impedance can be added at the input power side to restrict the large charge current into the main circuit capacitor.

11-2 Parts Replacement and Precautions

1. Before replacing parts, check that power is no supplied to the inverter and the main circuit capacitor is not charged (CHARGE lamp is not illuminated).
2. Replacement of parts on the printed wiring board must be performed by trained personnel. Please contact your dealer.
3. Removing the printed wiring board
   The printed wiring board is fastened with locking supports at four corners. Remove the connectors on the circuit board, remove the locking support and then remove the wiring board.
4. Removing connectors on the wiring circuit board
   Connectors are held with stoppers. Release the stopper and pull the connector out carefully. Do not pull on the wire.

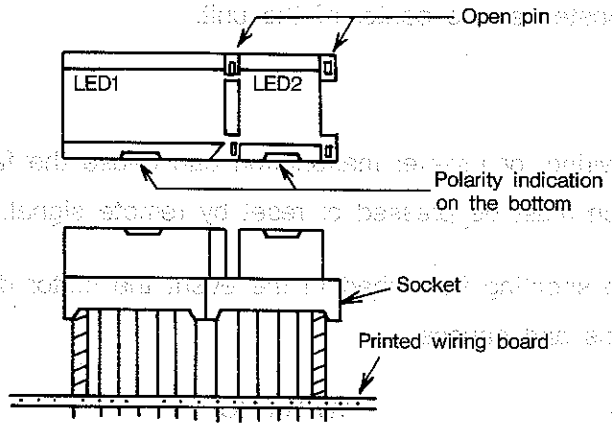


   To plug the connector back in, push it in place to lock with the stopper.

   Excessive force may cause damage. Hold the print board and push gently. Also check the connector numbers and match the pins correctly.
   In some models the connector on the base drive circuit board is difficult to get at. In such case, remove the locking support and lift the circuit board so that the connector can be grasped easily before removing.

5. Replacing LED (7 segment indicator)
   The LED indicator is plugged in a socket and can be easily replaced, but it should not be removed unless necessary.

If it must be replaced, refer to the following figure. The location and direction must be checked carefully.

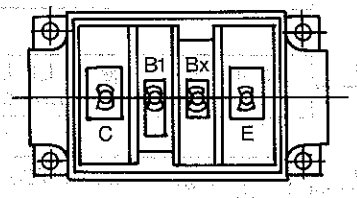
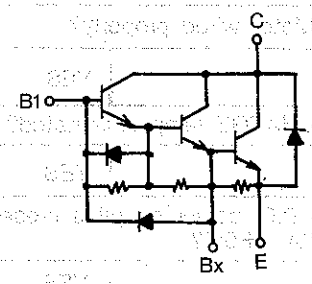


6. Replacing main circuit. G-TR (Transistor)

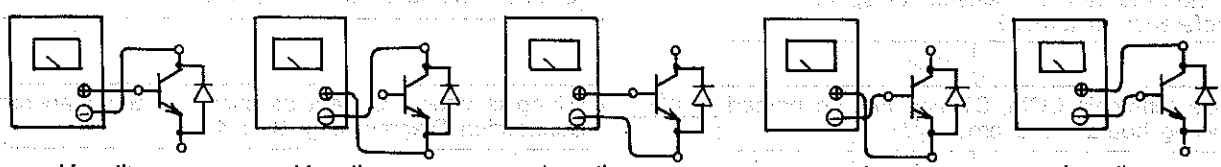
The connecting wires are not numbered. Therefore, when replacing, numbering the wires is suggested to prevent mis-connection.

Apply a silicone compound on the contact surface of G-TR cooling fins.

Typical types of silicone compound are as follows. Alcan by Alcan, Jointal S-200 by Nikkei Kako. The method of GTR checkout is shown below.

Type Form	Outline	Equivalent Circuit
MG300N1FK2		

Ohm meter (Tester)



More than 50 kilo-ohms	More than 50 kilo-ohms	Less than 500ohms, more than 250 ohms	Less than 500 ohms, more than 250 ohms	Less than 500 ohms, more than 250 ohms

Note : Check the polarity of the meter internal battery at the ohmmeter terminals, with polarity as shown. It is necessary to apply a thin coat of a heat-conductive silicone compound to the surface of the heat sink before attaching new G-TR.

7. Replacing fuse

Refer to section 12-OUTLINE VIEW and check the location of fuses FU1 and FU2. In some models, they are located at the center of the unit.

11-3 Troubleshooting

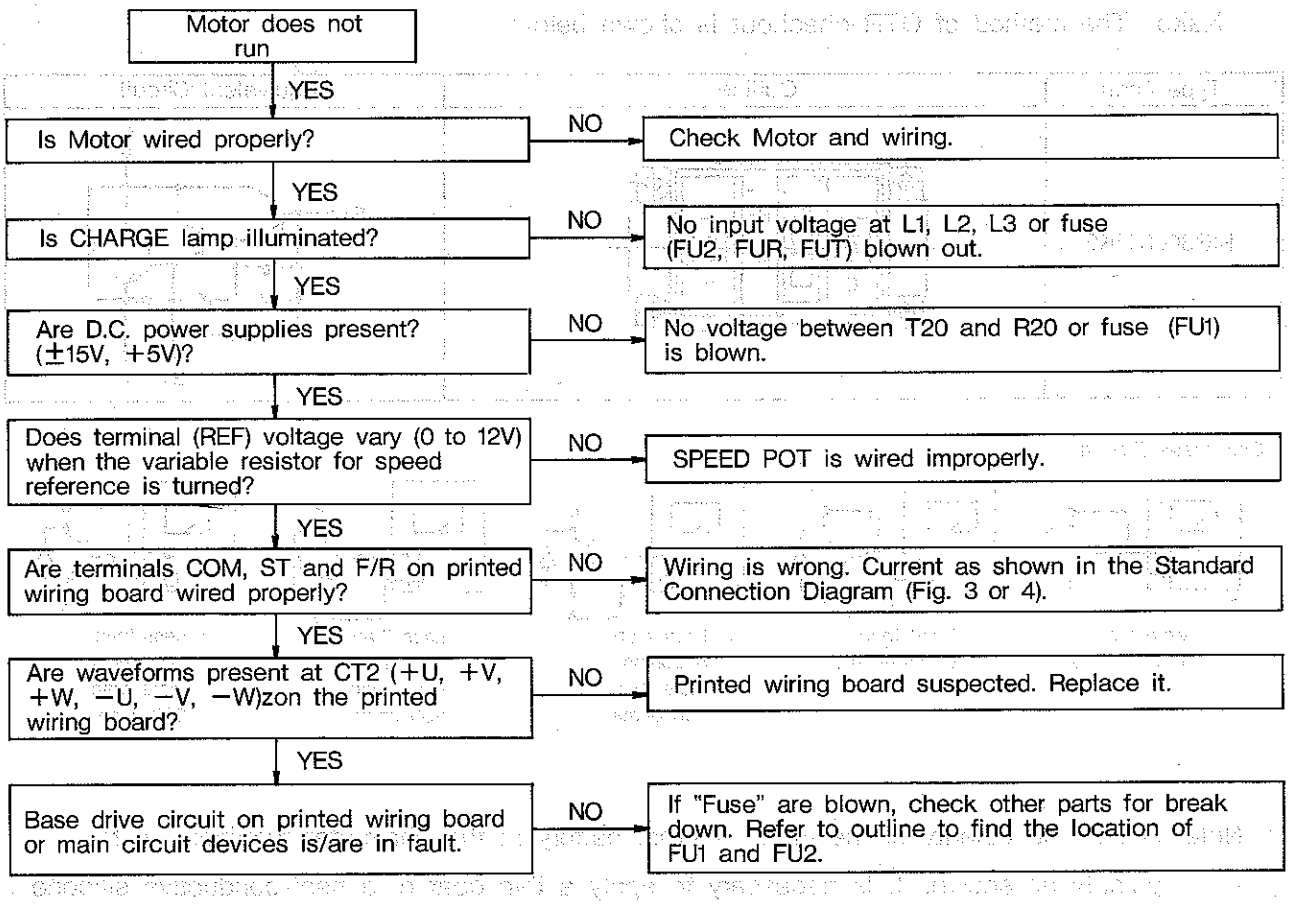
Improper adjustment, wiring, or inverter malfunction can cause the fault relay to latch. To reset a fault, the reset button must be pressed or reset by remote signal.

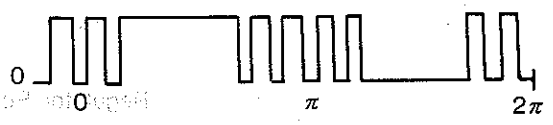
Figure 11-1 is a trouble shooting flow chart in the event the motor does not run. page 41 shows some trouble indications and causes.

WARNING

When troubleshooting with power on, care must be taken to avoid electric shock. Grounded test equipment may damage inverter. D. C. BUS voltage remains charged for several minutes after power is removed.

Fig. 11-1 Troubleshooting Flow Chart When Motor Does Not Run

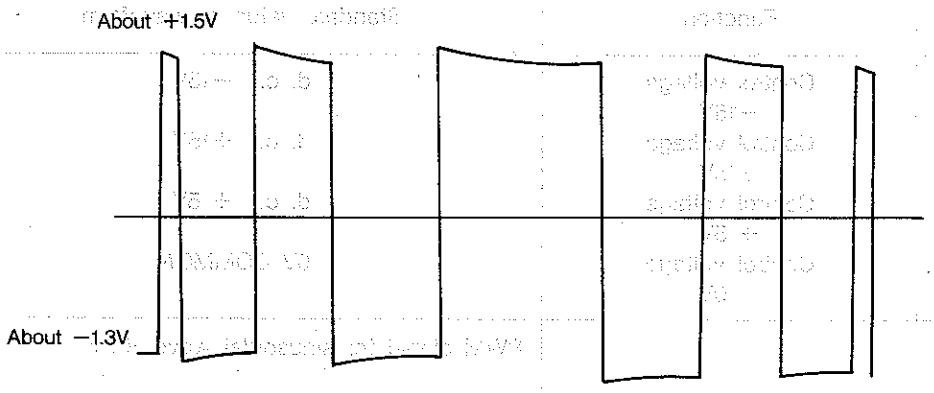


Test point Symbol	Function	Standard value or waveform
CT1-N15 CT1-P15 CT1-P5 CT1-0V	Control voltage −15V Control voltage +15V Control voltage + 5V Control voltage 0V	d. c. −15V d. c. +15V d. c. + 5V 0V COMMON
CT2 +U +V +W −U −V −W	Base drive circuit input signals	PWM signal for sinusoidal wave +5V 
REF	The output signal of acceleration/deceleration circuit (Actual frequency reference)	The signal voltage varies from 0 to −12V when SPEED setting resistor is turned from 0 to maximum.
V	The output signal of voltage control circuit	The signal voltage reaches +5V when the freq./volt. referenct (REF) goes up to the equivalent value of maximum motor voltage.

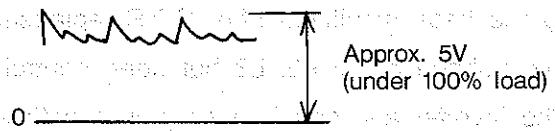
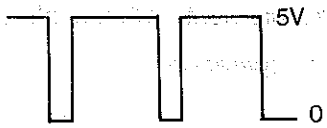
Checking the base amplifiers after G-TR replacement is a good practice:

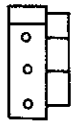
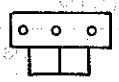
1. Remove voltage at L1, L2, L3 but keep control voltage.
2. Run the inverter and check base pulses with an oscilloscope. The ground lead of the scope should be connected to the emitter and the probe on the base. Connectors (CN41-4 to -6, CN61-1 to -2, CN21-6 to -8, CN11-1 to -2, CN31-1 to -2, CN51-1 to -2) on the driver Board provide access for measurement. Check all six base amplifier voltages. Figure 11-2 shows normal levels for proper operation.

FIGUREE 11-2 Base Pulse



Regulator Board Functions

Test point symbol	Function	Waveform example
CT2 +U +V +W −U −V −W	Base drive circuit input signal	PWM signal of sinusoidal wave distribution  PWM signal
CM to COM	Current feedback rate	Waveform repeated every 60° 
OF	Voltage / frequency converter circuit output pulse	Pulse having a frequency 1152 times the inverter output frequency 
V	Voltage control circuit amplifier output voltage	Varies from 0 to 5V with speed setting resistor varied from 0 to maximum
CT1 P15	Control voltage +15V	d. c. voltage of +15V
CT1 N15	Control voltage −15V	d. c. voltage of −15V
CT1 P5	Control voltage +5V	d. c. voltage of +5V
CT1 0V	Control voltage 0V	0V Common

No.	BC Board Symbol	Function	Factory Connection	Remarks
J2	 1f 2f	1f : Output frequency 1 2f : Output frequency 2	1f	Note 1
J3	 50 60 Hz Hz	60Hz : Maximum output frequency 80Hz 50Hz : Maximum output frequency 67Hz	60Hz	Voltage increases up to maximum at 60Hz constant voltage from 60 to 80Hz
J5	J5	BUS discharge control ON DECEL	Connected	Cut when Dynamic Brake Option used

Note : Other Jumper connections are for factory use. Removing or changing may cause improper operation.

Note 1 : If extended frequency ranges are required : A jumper at 2F will raise the maximum to 160Hz (or double the original frequency).

11-4 Spare Parts

It is recommended that the following parts be ordered with the inverter unit in order to reduce system downtime. Rank A signifies parts of relatively high necessity. Rank B signifies parts of relatively low necessity.

A Rank

Inverter Type Form	Fuses		G-TR	
	Type Form	Used Q'ty	Type Form	Used Q'ty
VT130G1-4150KU2	URB31TTC400 URB31TTC500 PC1-5A	2 1 1	MG300N1FK2	12
VT130G1-4200KU2	URB31TTC500 URB31TTC630 PC1-5A	2 1 1	MG300N1FK2	18

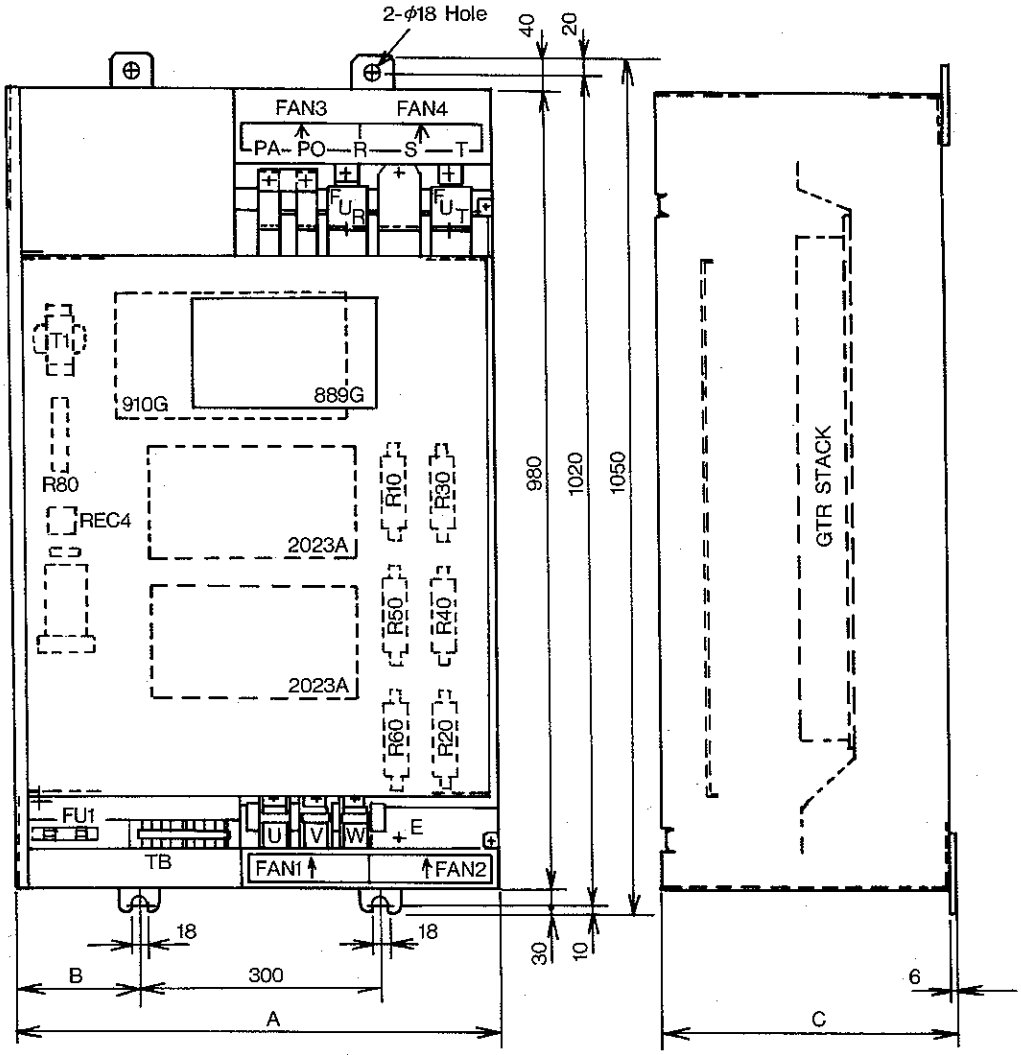
B Rank

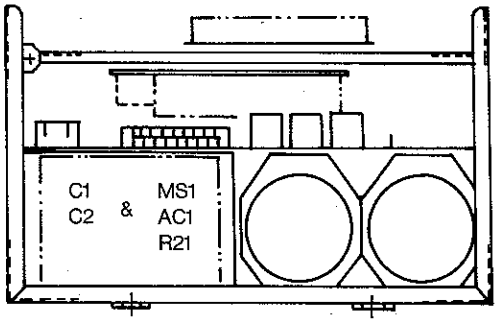
Inverter Type Form	Condenser (Main Circuit)		Printed Wiring Board	
	Ratings	Used Q'ty	Type Form	Used Q'ty
VT130G1-4150KU2	400V-2700μF	18	ARNI-889G	1
			ARNI-910G	1
VT130G1-4200KU2		26	VT3D-2023A	2

SECTION 12

UNIT OUTLINE

12-1 150kVA, 200kVA INVERTER UNIT (WALL-MOUNT TYPE)





kVA	A	B	C	W
150	600	150	370	86
200	660	180	370	92

APPROX, WEIGHT; W kg

COLOR ; MUNSELL 5Y 7/1