

Notes :

Upon receipt of the inverter and before any operation, please carefully read this instruction manual thoroughly, also keep this manual for reference in the future. If you have any question or problem, please no hesitate to contact your local **SHANGCHIN** representative. Thanks !

PREFACE

TOP GIN TG-300 is an optimized inverter specifically designed for variable torque applications. This instruction manual describes installation, maintenance and inspection, troubleshooting, and specifications of the TG-300 Read this instruction manual thoroughly before operation.

SHANGCHIN ELECTRONICS CORP.

General Precautions

- Some drawings in this manual are shown with the protective cover or shields removed, in order to describe detail with more clarity. Make sure all covers and shields are replaced before operating this product.
- This manual may be modified when necessary because of improvement of the product, modification, or changes in specifications.
Such modifications are denoted by a revised manual
- To order a copy of this manual, if your copy has been damaged or lost, contact your **SHANGCHIN** representative.
- SHANGCHIN** is not responsible for any modification of the product made by the user, since that will void your guarantee.

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1. RECEIVING

CAUTION
●Do not install or operate any inverter which is damaged or has missing parts. Failure to observe this caution may result in personal injury or equipment damage

This chapter describes how to inspect the inverter after delivery to the user.

1.1 INSPECTION CHECKPOINTS

(1)Receiving Checkpoints

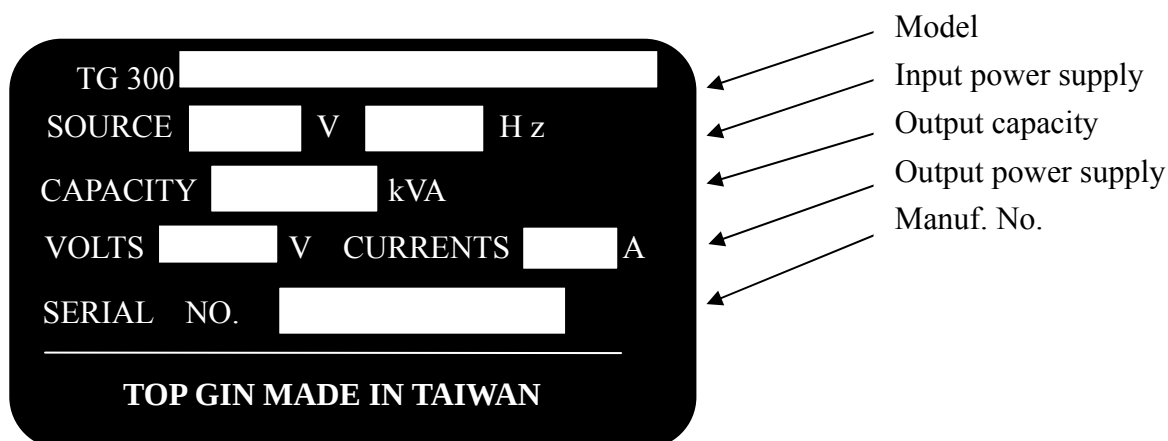
Checkpoints	Description
Does the inverter model number correspond the purchase order ?	Check the model number on the nameplate on the side of the TG-300
Are any parts damaged ?	Visually check the exterior and verify that there was no damage during transport.
Is hardware properly seated and securely tightened ?	Remover inverter front cover. Check all visible hardware with appropriate tools.
Was an instruction manual received ?	TG-300 instruction manual

If any of the above checkpoints are not satisfactory, contact your **SHANGCHIN** representative.

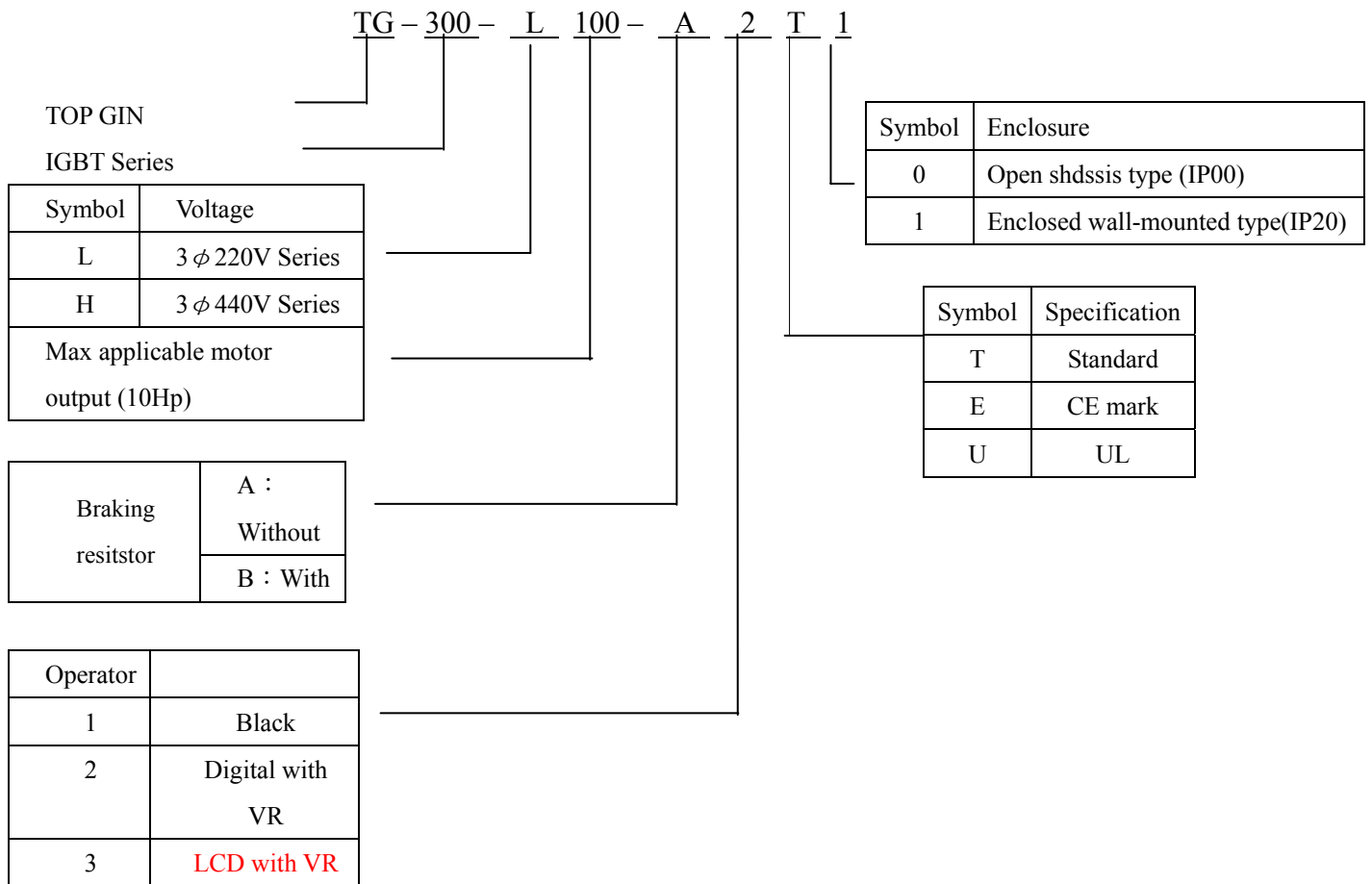
(2)Checking the Nameplate Data

(a)Nameplate Data

Example of TG-300



●Model Designation



1.2 IDENTIFYING THE PARTS

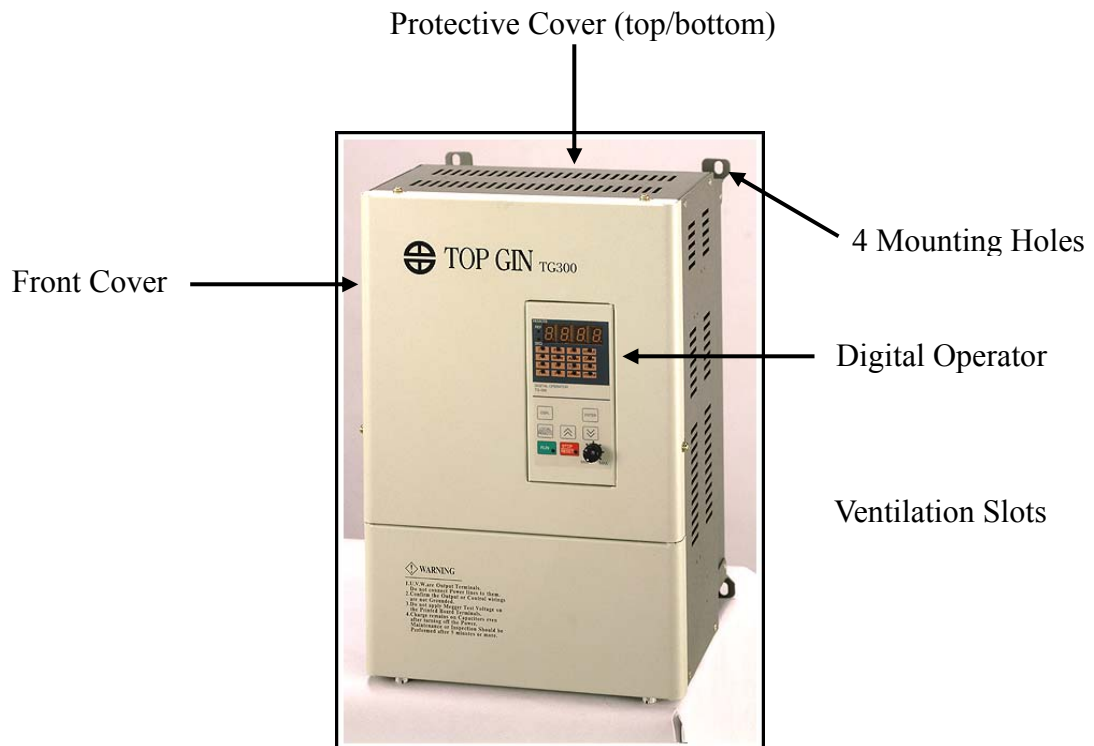


Fig. 4 Configuration of TG-300

2. INSTALLATION

CAUTION

- Lift the cabinet by the base. When moving the unit, never lift by the front cover. Otherwise, the main unit may be dropped causing damage to the unit.
- Mount the inverter on nonflammable material (i.e. metal). Failure to observe this caution can result in a fire.
- When mounting units in an enclosure, install a fan or other cooling device to keep the intake air temperature below 45°C . Overheating may cause a fire or damage to the unit.

This chapter describes configuration, location and clearances when mounting the TG-300.

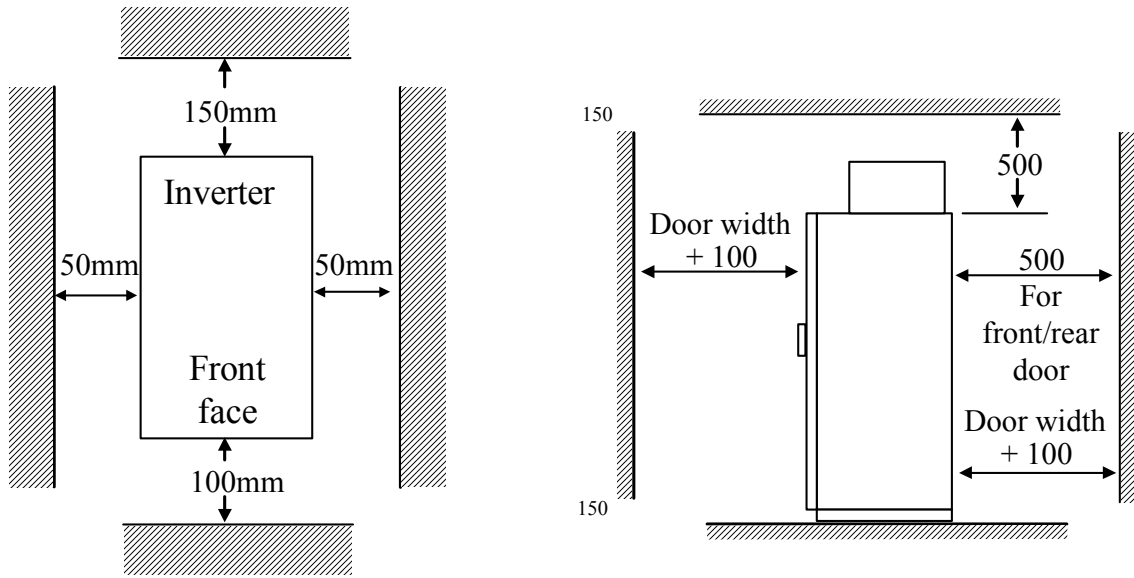
2.1 LOCATION FOR THE INVERTER

To ensure proper performance and long operating life, follow the recommendations below when choosing a location for installing the TG-300. Make sure the inverter is protected from the following conditions :

- ☐ Extreme cold and heat.
- ☐ Use only within ambient temperature range : -10°C to +40°C
- ☐ Rain, moisture. (For enclosed wall-mounted type)
- ☐ Oil sprays, splashes
- ☐ Salt spray
- ☐ Direct sunlight. (Avoid using outdoors.)
- ☐ Corrosive gases or liquids.
- ☐ Dust or metallic particles in the air.(For enclosed wall-mounted type)
- ☐ Physical shock, vibration.
- ☐ Magnetic noise. (Example: welding machines, power devices, etc.)
- ☐ High humidity.
- ☐ Radioactive materials.
- ☐ Combustibles : thinners, solvents, etc.

2.2 CLEARANCES

Install the TG-300 vertically and allow sufficient clearances for effective cooling as shown below.



Note :

1. The clearances required at top/bottom and both sides are common in open chassis type (IP00) and enclosed wall-mounted type (IP20).
2. Remove the top and bottom covers to use the open chassis type of 220V/440V 15Kw or less.
3. For the external dimensions and mounting dimensions, refer to Appendix 2 "DIMENSIONS".
4. Allowable intake air temperature to the inverter :
 - Open chassis type : -10°C to $+45^{\circ}\text{C}$
 - Enclosed wall-mounted type : -10°C to $+40^{\circ}\text{C}$
5. Ensure sufficient space for the sections at the upper and lower parts marked with * in order to permit the flow of intake/exhaust air to/from the inverter.

3. WIRING

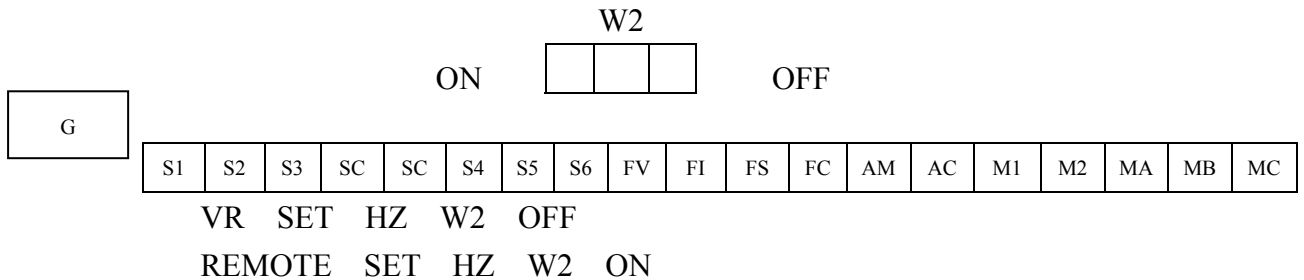
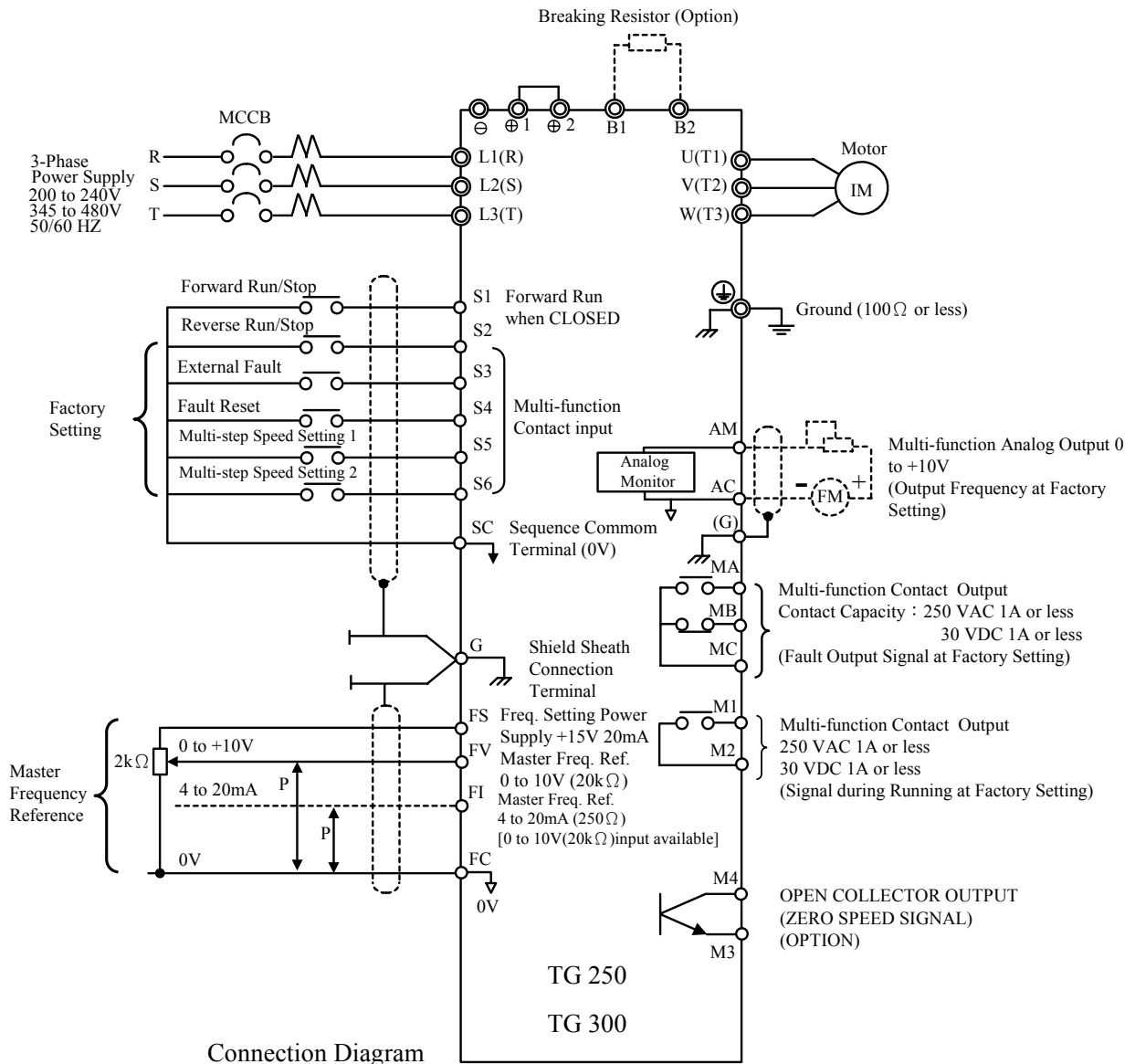
WARNING
●Only commence wiring after verifying that the power supply is turned OFF. Failure to observe this warning can result in an electrical shock or a fire. ●Wiring should be performed only by qualified personnel. Failure to observe this warning can result in an electrical shock or a fire. ●When wiring the emergency stop circuit, check the wiring thoroughly before operation. Failure to observe this warning can result in personal injury.

CAUTION
●Verify that the inverter rated voltage coincides with the AC power supply voltage. Failure to observe this warning can result in personal injury or a fire. ●Do not perform a withstand voltage test of the inverter. It may cause semi-conductor elements to be damaged. ●To connect a braking resistor, braking resistor unit or braking unit, follow the procedures described in APPENDIX 3. Improper connection may cause a fire. ●Tighten terminal screws to the specified tightening torque. Failure to observe this caution can result in a fire.

This chapter describes the main circuit wiring and the control circuit wiring of the TG-300.

3.1 CONNECTION DIAGRAM

Below is connection diagram of the main circuit and control circuit. Using the digital operator, the motor can be operated by wiring the main circuit only.



Note :

1. indicates shielded wires and indicates twisted-pair shielded wires.
2. Voltage or current input for the master frequency reference can be selected by constant H042. Voltage reference input is preset at the factory.
3. Control circuit terminal FR of +15 V has a maximum output current capacity of 20 mA.
4. Multi-function analog output should be used for monitoring meters (e.g. output frequency meter) and should not be used for feedback control system.

3.2 WIRING THE MAIN CIRCUIT

WARNING

- Make sure to ground the ground terminal
(Ground resistance 220V class : 100Ω or less. 440V class : 10Ω or less)
Failure to observe this warning can result in an electrical shock or a fire.

CAUTION

- Never connect the AC main circuit power supply to output terminals U, V and W.
The inverter will be damaged and invalidate the guarantee.

(1) Wiring Precautions for Main Circuit Input

(a) Installation of Molded-case Circuit Breaker (MCCB)

Make sure to connect MCCBs or fuses between AC main circuit power supply and TG-300 input terminals L1, L2 and L3 to protect wiring.

(b) Installation of Ground Fault Interrupter

When connecting a ground fault interrupter to input terminals L1, L2 and L3, select one that is not affected by high frequency.

(c) Installation of Magnetic Contactor

Inverters can be used without a magnetic contactor (MC) installed at the power supply side. When the main circuit power supply is shut OFF in the sequence, a magnetic contactor (MC) can be used instead of a molded-case circuit breaker (MCCB). However, when a magnetic contactor is switched OFF at the primary side, regenerative braking does not function and the motor coasts to a stop.

- The load can be operated/stopped by opening/closing the magnetic contactor at the primary side. However, frequent switching may cause the inverter to malfunction.
- When using a braking resistor unit, use a sequencer to break power supply side on overload relay trip contact. If the inverter malfunctions, the braking resistor unit may be burned out.

(d) Terminal Block Connection Sequence

Input power supply phases can be connected to any terminal regardless of the order of L1, L2 and L3 on the terminal block.

(e) Installation of AC Reactor

When connecting an inverter (220V/440V 15Kw or less) to a large capacity power supply transformer (600Kva or more), or when switching a phase advancing capacitor, excessive peak current flows in the input power supply circuit, which may damage the converter section. In such cases, install a DC reactor (optional) between inverter ⊕1 and ⊕2 terminals or an AC reactor (optional) on the input side. Installation of a reactor is effective for improvement of power factor on the power supply side.

(f) Installation of Surge Suppressor

For inductive loads (magnetic contactors, magnetic relays, magnetic valves, solenoids, magnetic brakes, etc.) connected near the inverter, use a surge suppressor simultaneously.

(g) Prohibition of Installation of Phase Advancing Capacitor

If a phase advancing capacitor or surge suppressor is connected in order to improve the power factor, it may become overheated and damaged by inverter high harmonic components. Also, the inverter may malfunction because of overcurrent.

(2) Wiring Precautions for Main Circuit Output**(a) Connection of Terminal Block and Load**

Connect output terminals U, V and W to motor lead wires U, V and W. Verify that the motor rotates in **the** forward direction (CCW : counterclockwise when viewed from the motor load side) with the forward run command. If the motor rotation is incorrect, exchange any two of output terminals U, V or W.

(b) Strict Prohibition of Connection of Input Power Supply to Output Terminals

Never connect input power supply to output terminals U, V and W.

(c) Strict Prohibition of Short Circuiting or Grounding of Output Circuit

Never touch the output circuit directly or put the output line in contact with the inverter case. Otherwise, it may cause an electrical shock or grounding. In addition, never short circuit the output line.

(d) Prohibition of Connection of Phase Advancing Capacitor or LC/RC Noise Fitter

Never connect a phase advancing capacitor or LC/RC noise, filter to the output circuit.

(e) Avoidance of Installation of Magnetic Starter

Do not connect a magnetic starter or magnetic contactor to the output, circuit. If the load is connected while the inverter is running, the inverter overcurrent protective circuit operates because of inrush current.

(f) Installation of Thermal Overload Relay

An electronic overload protective function is incorporated into the inverter. However, connect a thermal overload relay when driving several motors with one inverter or when using a multi-pole motor. When using a thermal overload relay, set inverter constant H033 to 0. Additionally, for thermal overload relay, at 50Hz set the same rated current value as that described on the motor nameplate, or at 60Hz 1.1 times larger than the rated current value described on the motor nameplate.

(g) Wiring Distance between Inverter and Motor

If the total wiring distance between inverter and motor is excessively long and the inverter carrier frequency (main transistor switching frequency) is high, harmonic leakage current from the cable will adversely affect the inverter and peripheral devices.

If the wiring distance between inverter and motor is long, reduce the inverter carrier frequency as described below. Carrier frequency can be set. by constant H050.

Wiring Distance between Inverter and Motor

Wiring Distance between Inverter and Motor	Up to 50m	Up to 100m	More than 100m
Carrier Frequency (Set value of constant H050)	15kHz or less (6)	10kHz or less (4)	5kHz or less (2)

(3)Grounding

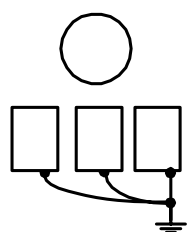
- Ground resistance

220 V class : 100Ω or less, 440 V class : 10Ω or less

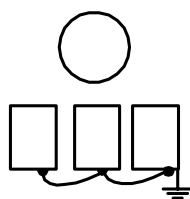
- Never ground TG-300 in common with welding machines, motors, or other large-current electrical equipment. Run all the ground wires in a conduit separate from wires for large-current electrical equipment.

- Use the ground wires described in tables below and keep the length as short as possible.

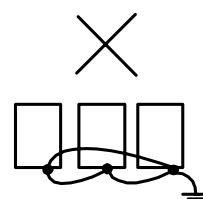
- When using several TG-300 units side by side, ground the units as shown below



(a)Acceptable



(b)Acceptable



(c)Not Acceptable

Grounding of Three TG-300 Units

3.3 WIRING THE CONTROL CIRCUIT

The following table outlines the functions of the control circuit terminals

Wire according to each terminal function.

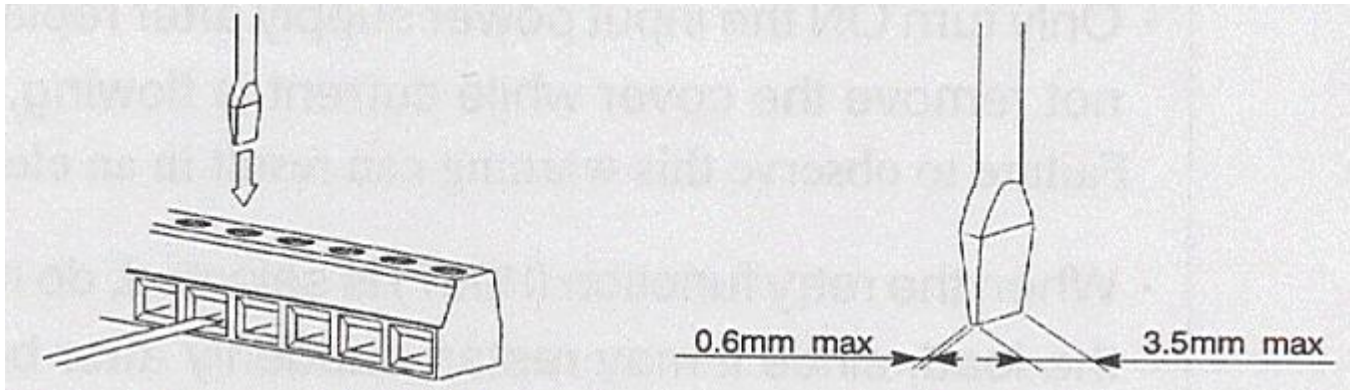
(1) Functions of Control Circuit Terminate

Control Circuit Terminals

Classification	Terminal	Signal Function	Description		Signal Level
Sequence Input Signal	S1	Forward run/stop	Forward run when closed, stop when open		Photo-coupler insulation Input : +24VD 8mA
	S2	Reverse run/stop	Reverse run when closed, stop when open	Multi-function contact inputs (H035 to H039)	
	S3	External fault input	Fault when closed, normal state when open		
	S4	Fault reset input	Reset when closed		
	S5	Multi-step speed reference 1	Effective when closed		
	S6	Multi-step speed reference 2	Effective when closed		
	SC	Sequence control input common terminal	---		
Analog Input Signal	FS	+15V Power supply output	For analog command +15V power supply		+15V (Allowable current 20mA max.)
	FV	Frequency reference input (voltage)	0 to +10V/100%	H042 = 0 : FV effective H042 = 0 : FI effective	0 to +10V (20 kΩ)
	FI	Frequency reference input (current)	4 to 20mA/100%		4 to 20mA (250 Ω)
	FC	Common terminal for control circuit	0V		---
	G	Connection to shield searh of signal lead	---		---
Sequence Output Signal	M1	During running (NO contact)	Closed when running	Multi-function contact output (H041)	Dry contact Contact capacity : 250VAC 1 A or less 30VDC 1 A or less
	M2				
	MA	Fault contact output (NO/NC contact)	Fault when closed between terminals MA and MC Fault when open between terminals MB and MC	Multi-function contact output (H040)	Dry contact Contact capacity : 250VAC 1 A or less 30VDC 1 A or less
	MB				
	MC				
Analog Output Signal	AM	Frequency meter output	0 to +10V/100% Freq.	Multi-function contact analog monitor 1 (H048)	0 to +10V 2mA or less
	AC	Common			

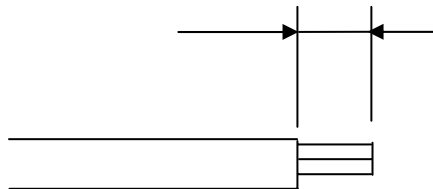
(2) Wiring the Control Circuit Terminals

Screwdriver Blade Width



Insert the wire into the lower part of the terminal block and connect it tightly with a screwdriver.
Wire sheath strip length must be 7 mm.

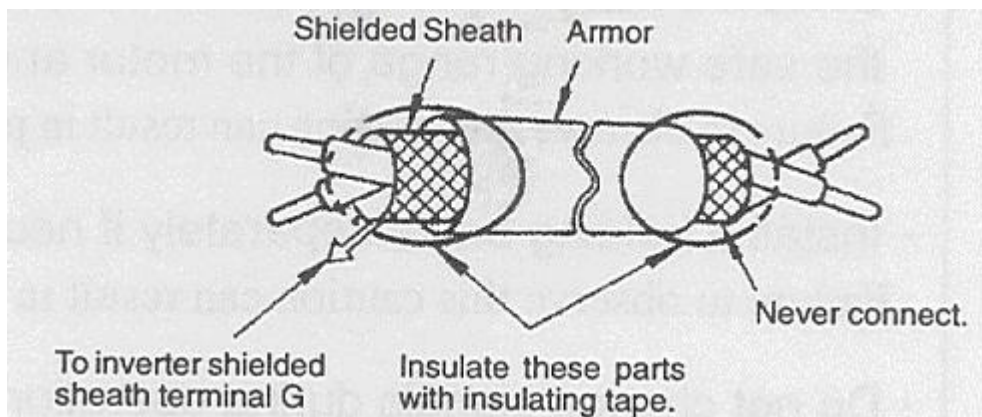
7mm



(3) Precautions on Control Circuit Wiring

- Separate control circuit wires from main circuit wires and other power cables to prevent erroneous operation caused by noise interference.
- Use twisted shielded or twisted-pair shielded wire for the control circuit line and connect the shielded sheath to the inverter terminal G.

Wiring distance should be less than 50 m.



3.4 WIRING INSPECTION

After completing of installation and wiring, check for the following items. Never use control circuit buzzer check-

- ☐ Wiring is proper.
- ☐ Wire clippings or screws are not left in the unit.
- ☐ Screws are securely tightened.
- ☐ Bare wire in the terminal does not contact other terminals

4 OPERATION

WARNING

- Only turn ON the input power supply after replacing the front cover. Do not remove the cover while current is flowing.

Failure to observe this warning can result in an electrical shock.

- When the retry function (H057) is selected, do not approach the inverter or the load, since it may restart suddenly after being stopped.

(Construct machine system, so as to assure safety for personnel, even if the inverter should restart.)

Failure to observe this warning can result in personal injury.

- Since the stop button can be disabled by a function setting, install a separate emergency stop switch.

Failure to observe this warning can result in personal injury.

CAUTION

- Never touch the heatsink or discharging resistor since the temperature is very high.

Failure to observe this caution can result in harmful burns to the body.

- Since it is easy to change operation speed from low to high speed, verify the safe working range of the motor and machine before operation.

Failure to observe this caution can result in personal injury and machine damage

- Install a holding brake separately if necessary.

Failure to observe this caution can result in personal injury

- Do not change signals during operation.

The machine or the inverter may be damaged

- All the constants of the inverter have been preset at the factory. Do not change the settings unnecessarily.

The inverter may be damaged. For supply voltage, follow Par. 4.3.

This chapter describes the basic operation procedures of the TG-300.

4.1 OPERATION MODE SELECTION

The TG-300 has two operation modes, LOCAL and REMOTE, as described below. These two modes can be selected by the digital operator "LOCAL/REMOTE" key only while the operation is stopped. The selected operation mode can be verified by observing the digital operator SEQ and REF LEDs as shown below. The operation mode is set to REMOTE (run by control circuit terminals FV and FI frequency reference and run command from a control circuit terminal) prior to shipment. Multi-function contact inputs from control circuit terminals S3 to S6 are enabled in both operation modes LOCAL/REMOTE.

- LOCAL : Both frequency reference and run command are set by the digital operator. SEQ and REF LEDs go OFF.
- REMOTE : Master frequency reference and run command can be selected as described below.

Reference Selection in REMOTE Mode (H002: Operation Method Selection)

Setting	Operation Method Selection	SEQ LED	Reference Selection	REF LED
0	Operation by run command from digital operator	OFF	Master frequency reference from digital operator	OFF
1	Operation by run command from control circuit terminal	ON	Master frequency reference from digital operator	OFF
2	Operation by run command from digital operator	OFF	Master frequency reference from control circuit terminals FV and FI	ON
3	Operation by run command from control circuit terminal	ON	Master frequency reference from control circuit terminals FV and FI	ON
4	Operation by run command from digital operator	OFF	Master frequency reference set by serial communication	ON
5	Operation by run command from control circuit terminal	ON	Master frequency reference set by serial communication	ON
6	Operation by run command from serial communication	ON	Master frequency reference set by serial communication	ON
7	Operation by run command from serial communication	ON	Master frequency reference from digital operator	OFF
8	Operation by run command from serial communication	ON	Master frequency reference from control circuit terminals FV and FI	ON

4.2 TEST RUN CHECKPOINTS

To assure safety, prior to initial operation, disconnect the machine coupling so that the motor is isolated from the machine. If initial operation must be performed while the motor is still coupled to the machine, use great care to avoid potentially hazardous conditions. Check the following items before a test run.

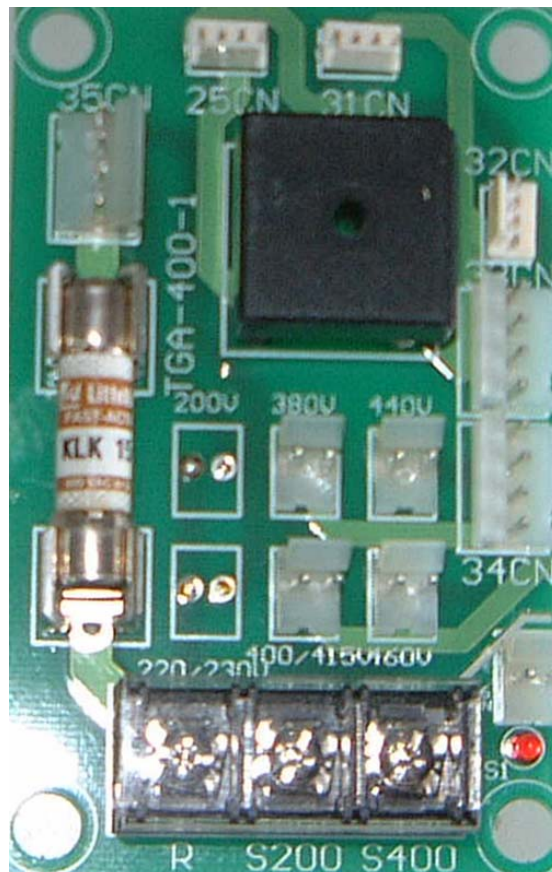
- ☐ Wiring and terminal connections are correct.
- ☐ No short circuit caused by wire clippings.
- ☐ Screw-type terminals are securely tightened.
- ☐ Motor is securely mounted.
- ☐ All items are correctly earthed(grounded).

4.3 SETTING THE LINE VOLTAGE USING JUMPER (FOR 440V CLASS 55kW AND ABOVE)

Set the line voltage jumper according to the main circuit power supply.

Insert the jumper at the appropriate location corresponding to the input line voltage

It has been preset at the factory to 440V.

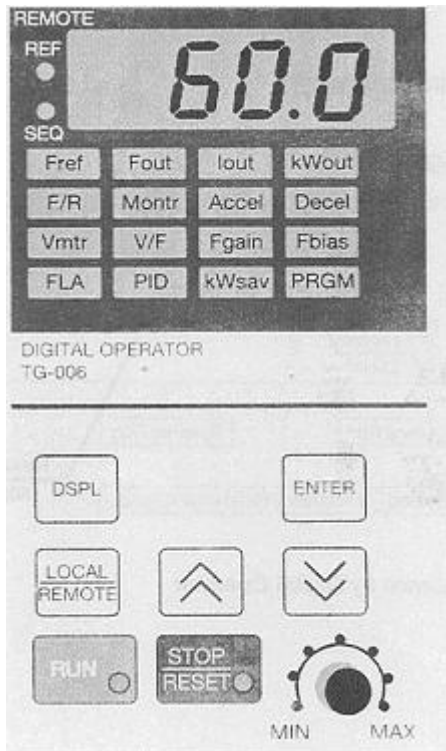


Line Voltage Jumper (For 440V Class 55W to 300kW)

4.4 TEST RUN

(1) Digital Operator Display at Power-up

When the system is ready for operation, turn ON the power supply. Verify that the inverter powers up properly. If any problems are found, turn OFF the power supply immediately. The digital operator display illuminates as shown below



Digital Operator Display
LED



Digital Operator Display
LCD

(2) Operation Check Points

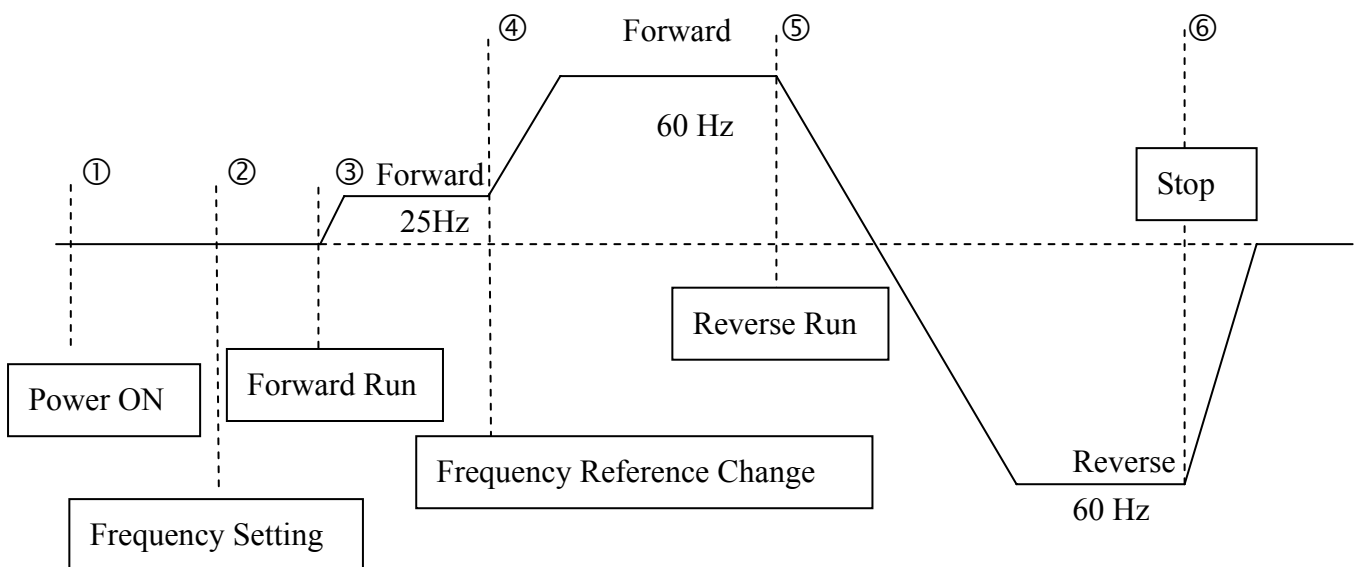
Check the following items during operation

- ☐ Motor rotates smoothly.
- ☐ Motor rotates in the correct direction.
- ☐ Motor does not have abnormal vibration or noise.
- ☐ Acceleration and deceleration are smooth.
- ☐ Current matches the load flow.
- ☐ Status indicator LEDs and digital operator display are correct

(3) Example of Basic Operation

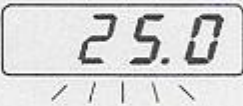
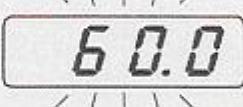
(a) Operation by Digital Operator

The diagram below shows a typical operation pattern using the digital operator

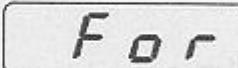
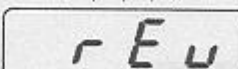
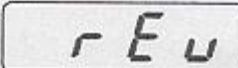


Operation Sequence by Digital Operator

Typical Operation by Digital Operator

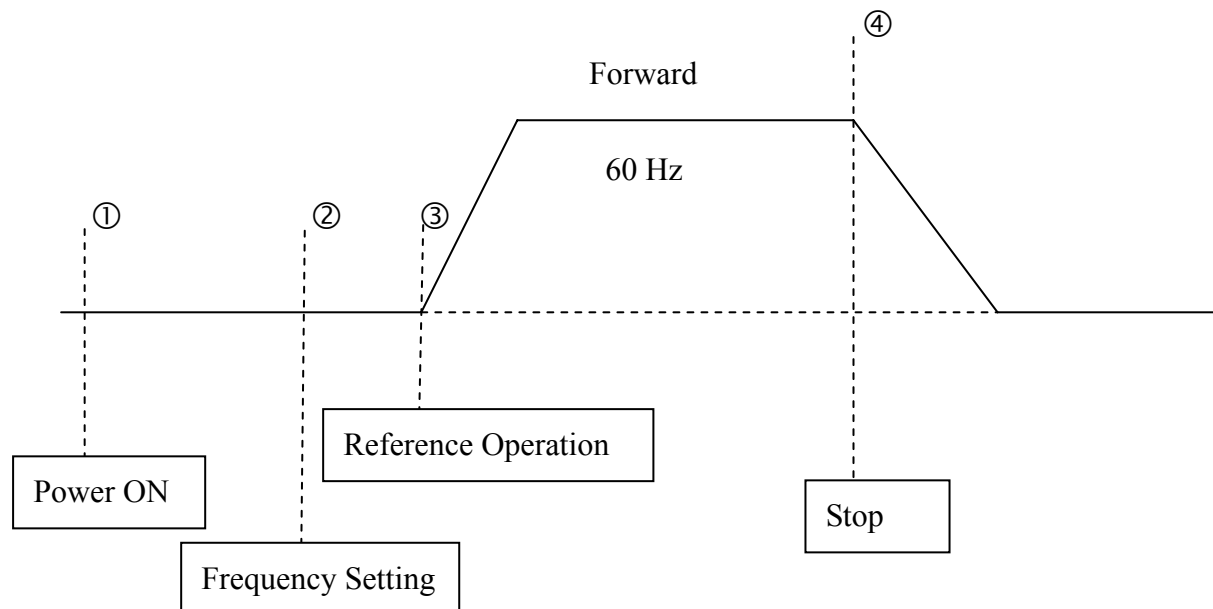
Description	Key Sequence	Digital Operator Display	LED Display
① Power ON · Displays frequency reference value.			
↓ Operation Condition Setting · Select LOCAL mode.		REMOTE LED (SEQ., REF) OFF	
② Frequency Setting · Change reference value.	Change the value by depressing  		
↓ · Write-in set value.			
↓ · Select output frequency monitor display.			
③ Forward Run · Forward run (25 Hz)			
↓ ④ Frequency Reference Value Change (25 Hz to 60 Hz) · Select frequency reference value display.			
↓ · Change set value.	Change the value by depressing  		
↓ · Write-in set value.			
↓ · Select output frequency monitor display			
↓			

Typical Operation by Digital Operator (Cont'd)

Description	Key Sequence	Digital Operator Display	LED Display
⑤ Reverse Run · Select reverse run. · Write-in set value. · Select output frequency monitor display.	DSPL Depress 3 times. Switch to "rev" by depressing   ENTER DSPL Depress 5 times. 	     RUN LED OFF STOP LED ON	    

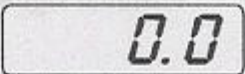
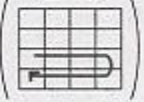
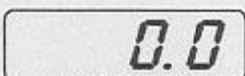
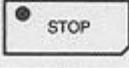
(b) Operation by Control Circuit Terminal Signal

The diagram below shows a typical operation pattern using the control circuit terminal signals.



Operation Sequence by Control Circuit Terminal Signal

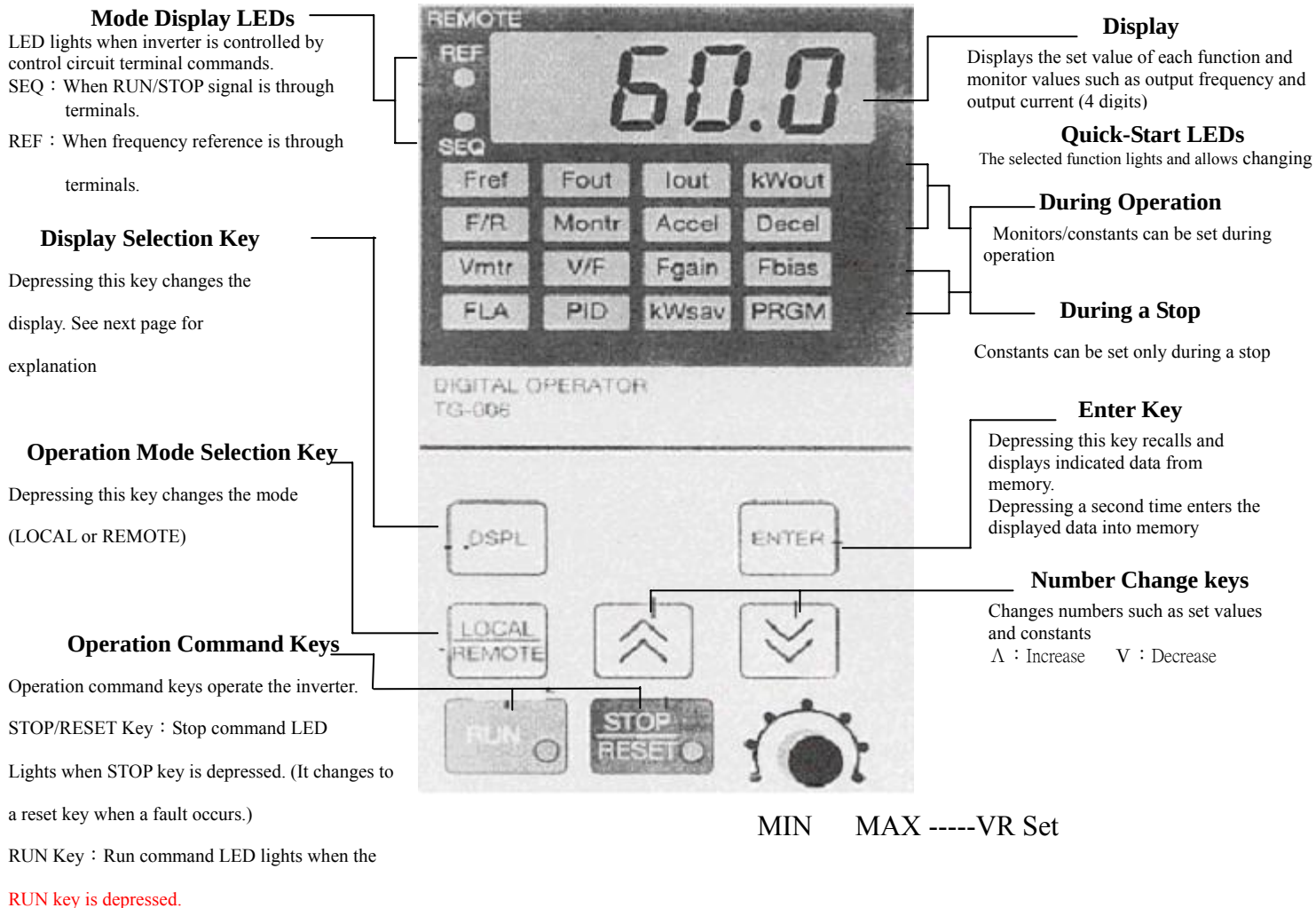
Typical Operation by Control Circuit Terminal Signal

Description	Key Sequence	Digital Operator Display	LED Display
① Power ON • Displays frequency reference value. REMOTE mode is preset at the factory.		 REMOTE LED (SEQ, REF) ON	
② Frequency Setting • Input frequency reference voltage (current) by control circuit terminal FV or FI and verify the input value by the digital operator.		 For reference voltage 10V	
Output Frequency Display • Select output frequency monitor display.			
③ Forward Run • Close between control circuit terminals S1 and SC to perform forward run.		 RUN LED ON 	 
④ Stop • Open between control circuit terminals S1 and SC to stop operation.		 STOP LED ON (RUN LED blinking during deceleration.) 	

5 SIMPLE DATA SETTING

5.1 DIGITAL OPERAT KEY DESCRIPTION

Fref Frequency Reference Setting/monitoring	Fout Output frequency monitor	Iout Output current monitor	kwout Output power monitor
F/R FWD/REV run Command Selection	Montr Monitor Selection	Accel Acceleration Time	Decel Deceleration time
Vmtr Motor rated Voltage	V/F V/f pattern selection	Fgain Frequency Reference gain	Fbias Frequency reference bias
FLA Motor rated current	P/D PID selection	Kwsalv Energy saving selection	PRGM Constant No/data



5.2 LED DESCRIPTION

By using the quick-start LEDs on the digital operator, simple operation of the inverter is possible. Each quick-start LED is selected each time [DSPL] key is depressed. Following is a flowchart describing quick-start LED selection. (Example of model TG-300-L50B2T)

LED Description

LED Display	Description	Key Sequence	Digital Operator Display	Remarks
	Power ON			
Fref	Frequency reference setting/monitoring	DSPL	0.0	
Fout	Output frequency monitor	DSPL	0.0	
Iout	Output current monitor	DSPL	0.0	
kWout	Output power monitor	DSPL	0.0	
F/R	FWD/REV run command selection	DSPL	F o r	
Montr	Monitor selection	DSPL	U - 0 1	Depress [ENTER] key to display the monitor value.
Accel	Acceleration time	DSPL	10.0	
Decel	Deceleration time	DSPL	10.0	
Vmtr	(During run) Motor rated voltage	DSPL	200.0	
V/F	V/f pattern selection	DSPL	1	
Fgain	Frequency reference gain	DSPL	100	
Fbias	Frequency reference bias	DSPL	0	Set/read is enabled only during stop.
FLA	Motor rated current	DSPL	14.0	
PID	PID selection	DSPL	0	
kWsav	Energy saving selection	DSPL	0	
PRGM	Constant No./data	DSPL	H 0 0 2	Depress [ENTER] key to display the data.

6 PROGRAMMING FEATURES

6.1 CONSTANT SET-UP AND INITIALIZATION

(1) Constant Selection/Initialization (H001)

The following table describes the data which can be set or read when H001 is selected.

Setting	Constant that can be set	Constant that can be read
0 (Constant write disable)	H001	H001 to H108
1 (Factory setting)	H001 to H034	H001 to H108
2	H001 to H049	H001 to H108
3	H001 to H108	H001 to H108
4.5	Not used (disabled)	
6	Initialize : 2-wire sequence	
7	Initialize : 3-wire sequence*	

*Refer to page 60

6.2 V/F PATTERN SETTING

V/f pattern can be set by constant H010.

Set value 0 to E : Preset V/f pattern can be selected

F : Custom V/f pattern can be set.

(1) Preset V/f Pattern

The following shows the preset V/f patterns.

(The voltages are for 220V class. For 440V class, the value is twice that of 220V class.)

Preset V/f Pattern (H010=0 to E)

Specifications				H010	V/f Pattern*1	Specifications				H010	V/f Pattern*1
General-purpose	50 Hz		0		High Starting Torque *2	50 Hz		8			
	60 Hz	60 Hz Saturation	1			High starting torque		9			
		50 Hz Saturation	2			Low starting torque		A			
	72 Hz		3			60 Hz		B			
Variable Torque Characteristics	50 Hz		4		High Speed Operation	90 Hz		C			
	Variable torque 2		5			120 Hz		D			
	60 Hz		6					180 Hz		E	
	Variable torque 4		7								

*1 Consider the following items as the conditions for selecting a V/f pattern. They must be suitable for:

- The voltage and frequency characteristics of motor
- The maximum rotation speed of motor

*2 Select high starting torque only in the following conditions. Normally, this selection is not required.

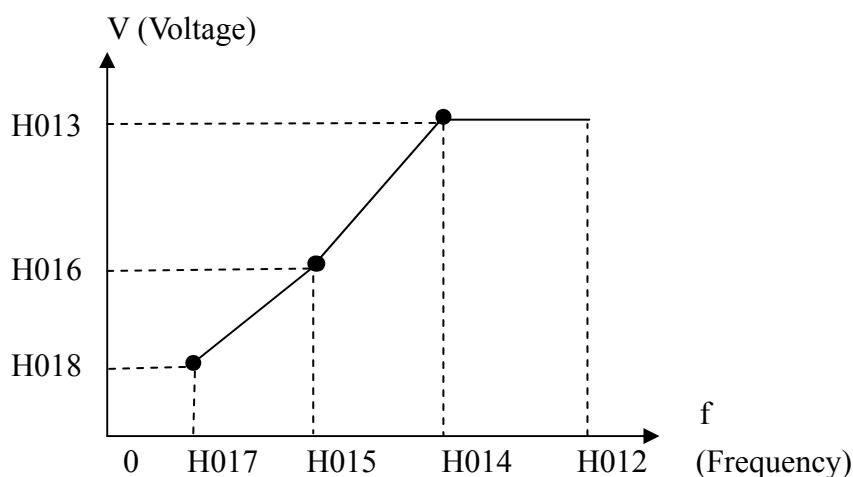
- The wiring distance is long (150 m and above).
- Voltage drop at startup is large.
- AC reactor is inserted in the input or output of the inverter.
- A motor smaller than the nominal output of the inverter is used.

(2)Custom V/f Pattern

Set each pattern when using a special motor (high-speed motor, etc.) or when requiring special torque adjustment of machine.

Make sure to satisfy the following conditions for the setting of constants H012 to H018.

$$H017 \leq H015 < H014 \leq H012$$



Constant No.	Name	Unit	Setting Range	Factory Setting
H012	Max. output frequency	0.1Hz	50.0-400.0 Hz	60.0Hz
H013	Max. voltage	0.1V	0.1-255.0V*	220.0V*
H014	Max. voltage output frequency (base frequency)	0.1Hz	50.0-400.0 Hz	60.0Hz
H015	Mid. output frequency	0.1Hz	0.1-399.9 Hz	3.0Hz
H016	Mid. output frequency voltage	0.1V	0.1-255.0V*	15.0V*
H017	Min. output frequency	0.1Hz	0.1-10.0 Hz	1.5Hz
H018	Min. output frequency voltage	0.1V	0.1-50.0V*	10.0V*

*For 440V class, the value is twice that of 220V class.

Increasing the voltage of the V/f pattern increases motor torque, but an excessive increase may cause the following :

- Inverter malfunction because of motor overexcitation
- Motor overheat or excessive vibration

Increase voltage gradually while verifying the motor current.

6.3 OPERATION CONDITIONS

(1)Reverse Run Prohibit (H006)

“Reverse run disabled” setting does not accept a reverse run command from the control circuit terminal or digital operator. This setting is used for applications where a reverse run command can cause problems.

Setting	Description
0	Reverse run enabled
1	Reverse run disabled

(2)Multi-Step Speed Selection

By combining frequency reference and input terminal function selections, up to 4 steps of speed can be set.

4-step speed change

H002 =1 (operation mode selection)

H025 =30.0 Hz

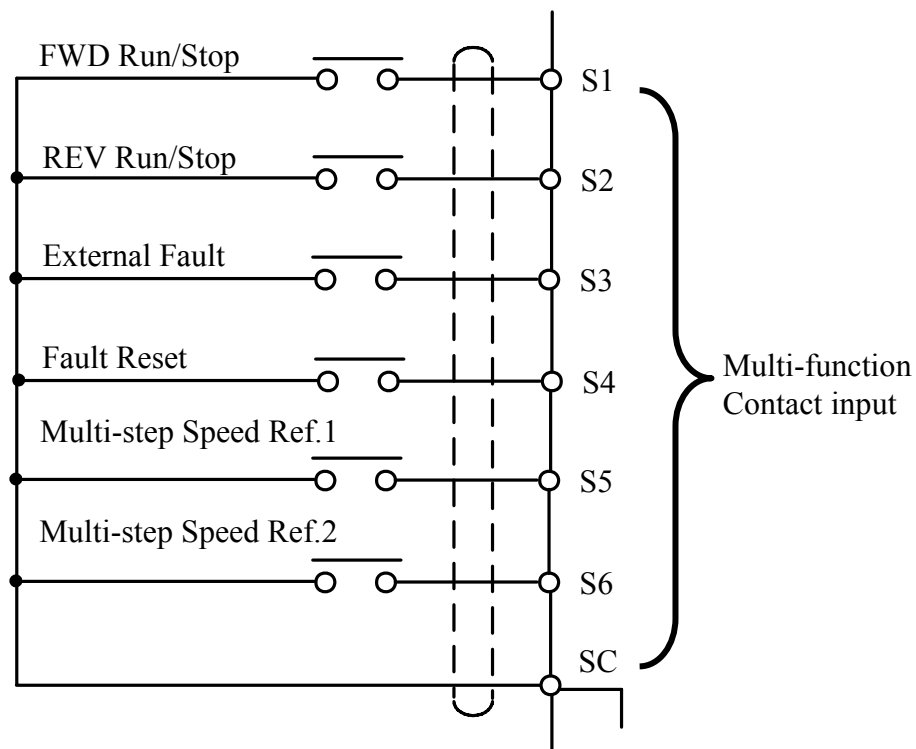
H026 =40.0 Hz

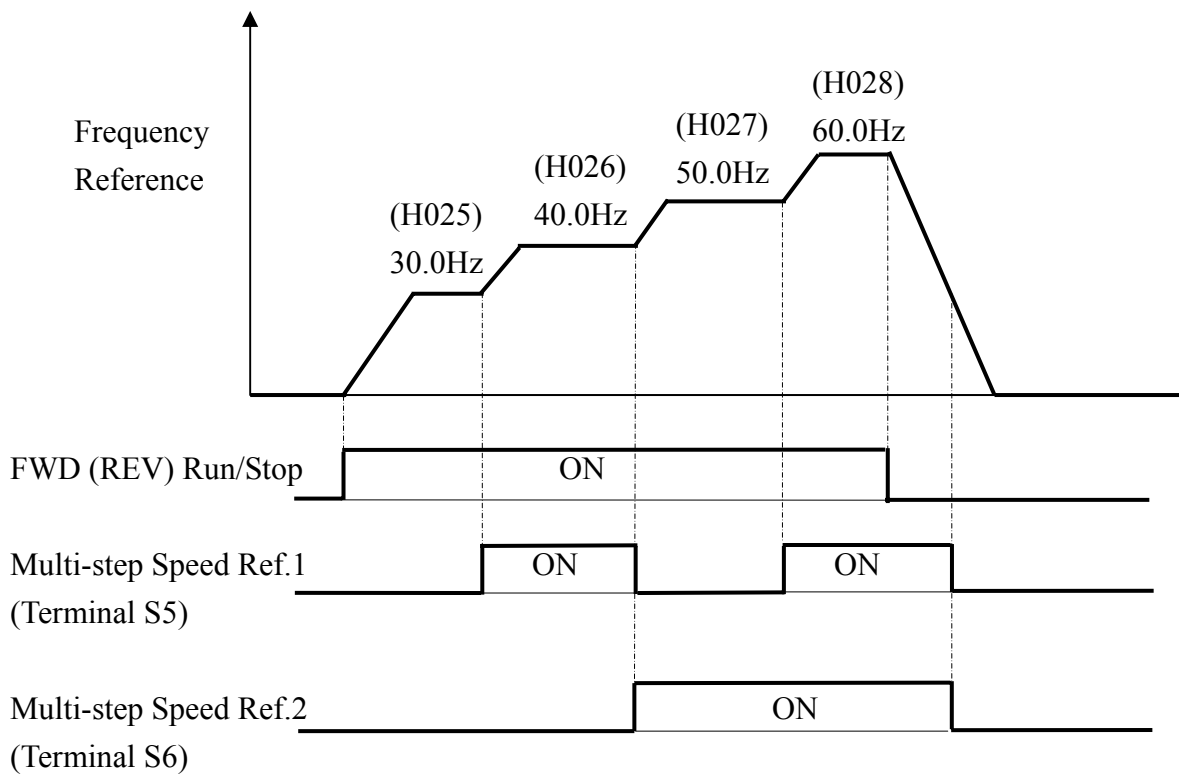
H027 =50.0 Hz

H028 =60.0 Hz

H038 =9 (Multi-function contact input terminal S5)

H039 =10 (Multi-function contact input terminal S5)





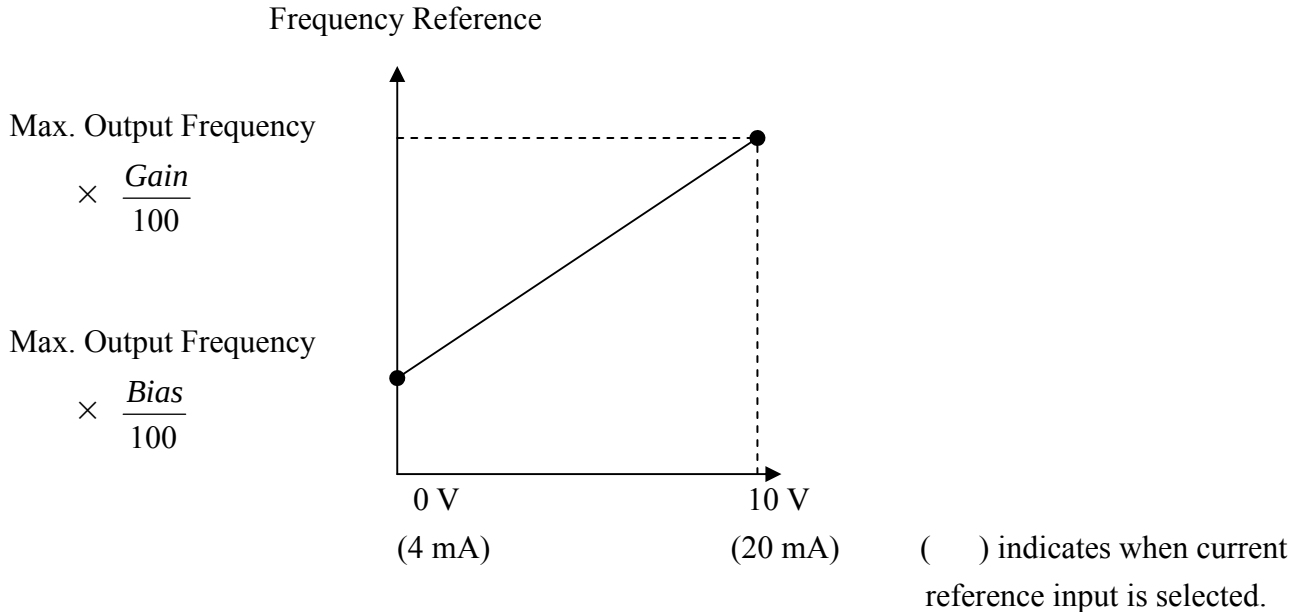
(3)Operating at Low Speed

Set jog frequency reference selection in multi-function contact input terminals (S2 to S6). Then input a forward (reverse) run command. Operation is enabled at the jog frequency set in H 029. When multi-step speed references 1 or 2 are input simultaneously with the jog frequency reference, the jog frequency reference has priority.

Name	Constant No.	Setting
Jog frequency reference	H029	(Factory setting : 6.0Hz)
Multi-function contact input selection (S2 to S6)	(H035,H036,H037,H038,H039)	Set to “11” (jog Frequency selection) for any constant.

(4) Adjusting Frequency Setting Signal

When the frequency reference is output by an analog input of control circuit terminals FV and FI, the relationship between the analog input (voltage/current) and the frequency reference can be set.



(a) Frequency Reference Gain (H046)

The frequency reference at the analog input value of 10V (20mA) can be set in units of 1%. (H012

Max. output frequency : 100%)

Factory setting : 100%

(b) Frequency Reference Bias (H047)

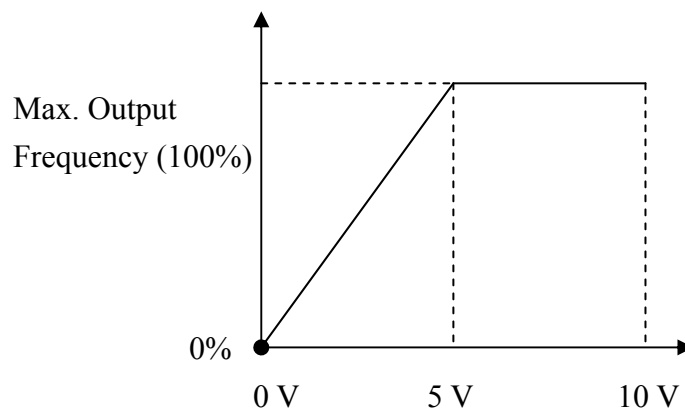
The frequency reference at the analog input value of 0V (4mA) can be set in units of 1%. (H012

Max. output frequency : 100%)

Factory setting : 0%

Typical setting

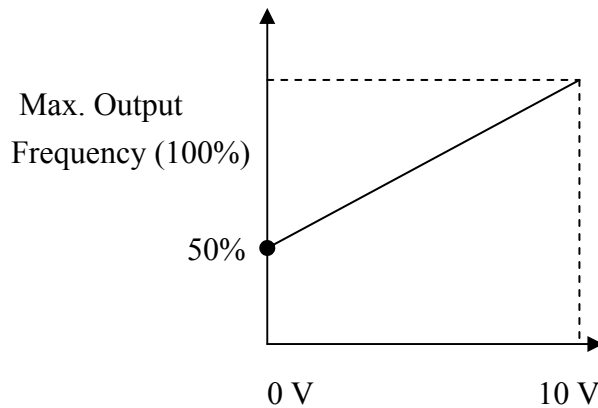
- To operate the inverter with frequency reference of 0% to 100% at 0 to 5V input



Gain : Constant H046=200

Bias : Constant H047=0

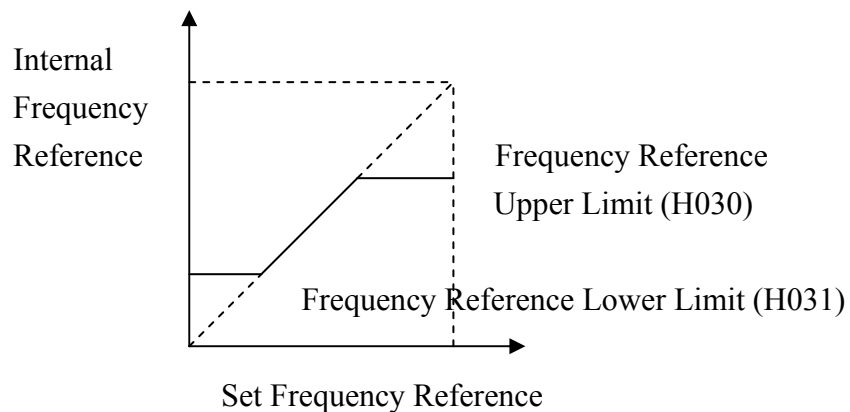
- To operate the inverter with frequency reference of 50% to 100% at 0 to 10V input



Gain : Constant H046= 100

Bias : Constant H047 = 50

(5) Adjusting Frequency Upper and Lower Limits



(a) Frequency Reference Upper Limit (H030)

Sets the upper limit of the frequency reference in units of 1%

(H012 Max. output frequency: 100%)

Factory setting: 100%

(b) Frequency Reference Lower Limit (H031)

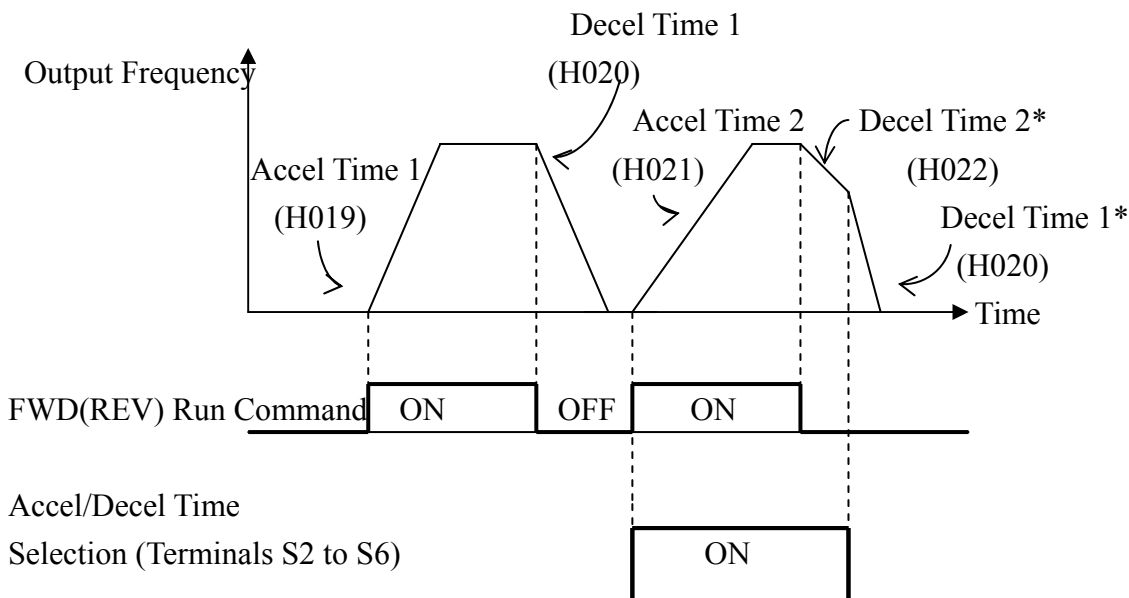
Sets the lower limit of the frequency reference in units of 1%.

(H012 Max. output frequency: 100%)

When operating at a frequency reference of 0, operation is continued at the frequency reference, lower limit. However, when the frequency lower limit is set to less than the min. output frequency (H017), operation is not performed.

Factory setting: 0%

(6) Using Two Accel/Decel Times



***When “deceleration to stop” is selected (H400=0)**

By setting multi-function contact input selection (H035, H036, H037, H038 or H039) to "12 (accel/decel time selection)", accel/decel time is selected by turning ON/OFF the accel/decel time selection (terminal S2, S3, S4, S5 or S6).

At OFF : H019 (accel time 1), H020 (decel time 1)

At ON : H021 (accel time 2), H022 (decel time 2)

Constant No.	Name	Unit	Setting Range	Factory Setting
H019	Accel time 1	0.1s (1 s for 100 s and above)	0.0 to 3600s	10.0s
H020	Decel time 1	0.1s (1 s for 100 s and above)	0.0 to 3600s	10.0s
H021	Accel time 2	0.1s (1 s for 100 s and above)	0.0 to 3600s	10.0s
H022	Decel time 2	0.1s (1 s for 100 s and above)	0.0 to 3600s	10.0s

- Accel time

Set the time needed for output frequency to reach 100% from 0%

- Decel time

Set the time needed for output frequency to reach 0% from 100%

(7)Automatic Restart after Momentary Power Loss (H051)

When momentary power loss occurs, operation restarts automatically.

Setting	Description
0	Not provided (Factory setting)
1*	Continuous operation after power recovery within 2 sec
2*	Continuous operation after power recovery within control logic time (No fault output)

*Hold the operation command to continue operation after recovery from a momentary power loss.

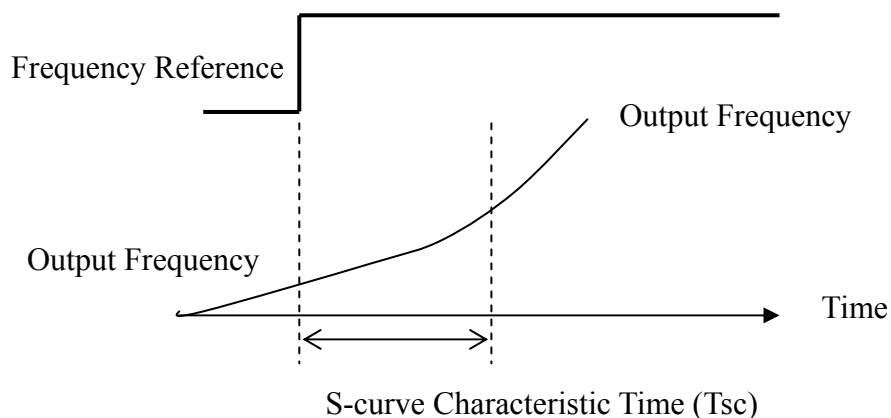
*When 2 is selected, operation restarts if power supply voltage reaches its normal level. No fault signal is output.

(8)Soft-start Characteristics (H023)

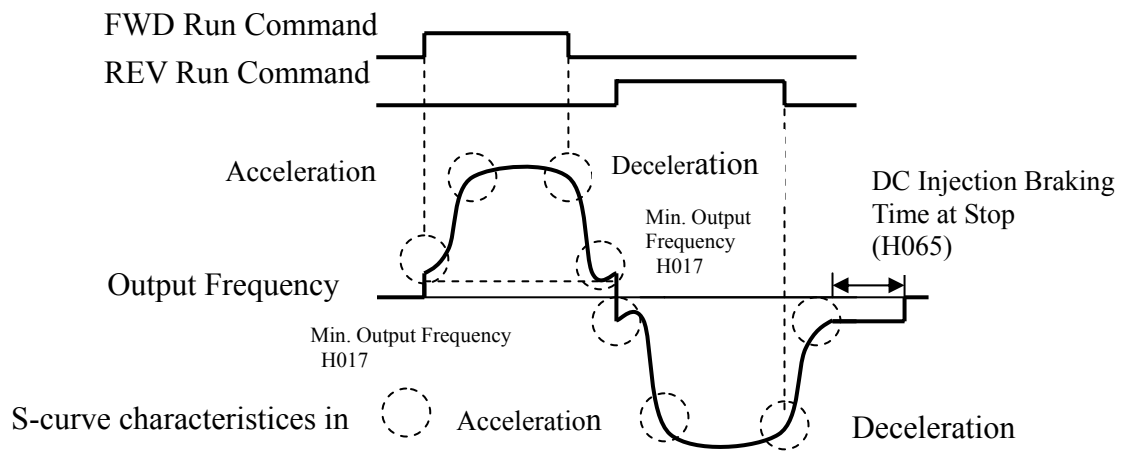
TO prevent shock during machine starting/stopping, accel/decel can be performed in S-curve pattern.

Setting	S-curve Characteristic Time
0	S-curve not provided
1	0.2 sec (Factory setting)
2	0.5 sec
3	1.0 sec

None : S-curve characteristics time is the time from accel/decel rate 0 to a regular accel/decel rate determined by the set accel/decel time.



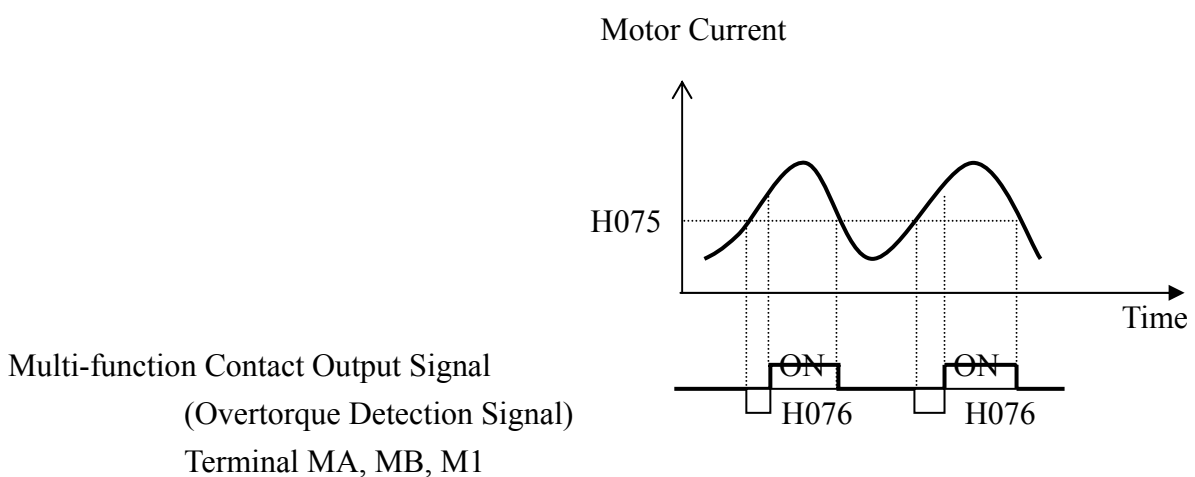
The following time chart shows FWD/REV run switching at deceleration to stop.



(9) Torque Detection

If an excessive load is applied to the machine, output current increase can be detected by output alarm signals at multi-function contact output terminals MA, MB and M1.

To output an overtorque detection signal, set multi-function contact output selection H040 or H041 to “overtorque detection” [setting : 6 (NO contact) or 7 (NC contact)] .



*Release width (hysteresis) during overtorque detection is 5% of the level of inverter rated current.

(a) Overtorque Detection Function Selection (H074)

Setting	Description
0	Detection disabled (Factory setting)
1	Detected during constant-speed running, and operation continues after detection.
2	Detected during running, and operation continues after operation.
3	Detected during constant-speed running, and inverter output is shut OFF during detection.
4	Detected during running, and inverter output is shut OFF during detection.

- 1.To detect overtorque during acceleration or deceleration, set to 2 or 4.
- 2.To continue the operation after overtorque detection, set to 1 or 2. During detection, the operator displays "OL3" alarm (blinking).
- 3.To halt the inverter by a fault at overtorque detection, set to 3 or 4. At detection, the operator displays "OL3" fault (ON).

(b) Overtorque Detection Level (H075)

Sets the overtorque detection current level in units of 1 %.

(Inverter rated current : :100%)

Factory setting: 160%

(c) Overtorque Detection Time (H076)

If the time when motor current exceeds the overtorque detection level (H075) is longer than overtorque detection time (H076), the overtorque detection function operates.

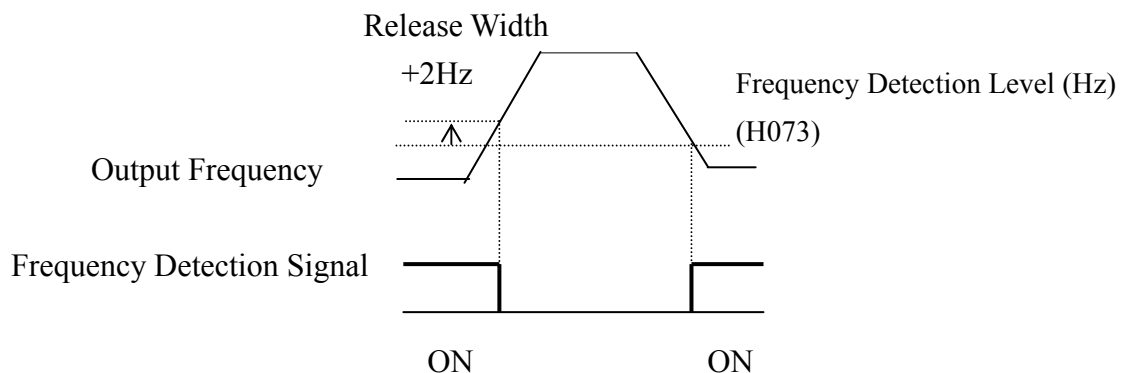
Factory setting : 0.1 s

(10) Frequency Detection (H073)

Effective when multi-function contact output selections H040 or H041 are set to “frequency detection” (setting : 4 or 5). “Frequency detection” turns ON when output frequency is higher or lower than the frequency detection level (H073)

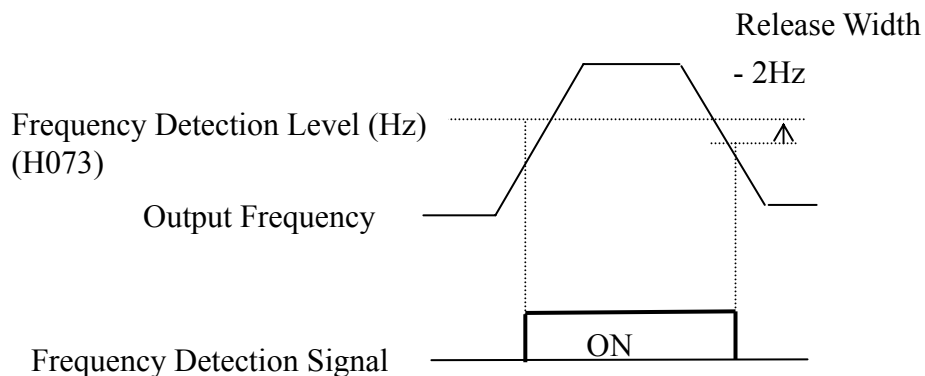
(a) Frequency Detection (Output Frequency $\leq$ Frequency Detection Level)

(Set H040 or H041 to "4".)



(b) Frequency Detection (Output Frequency $\geq$ Frequency Detection Level)

(Set H040 or H04.1 to "5".)



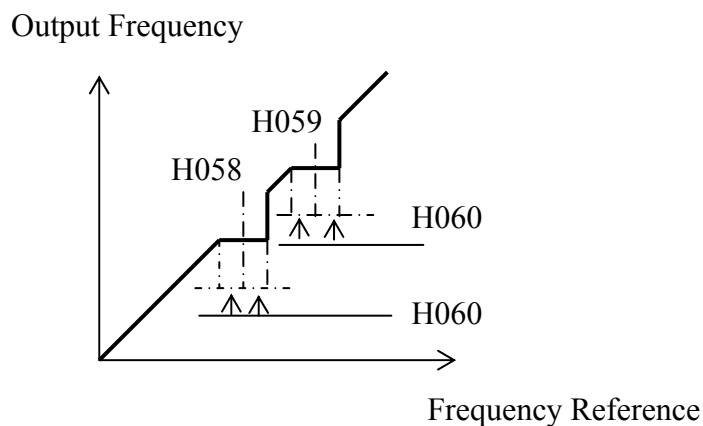
(11) Jump Frequencies (H058 to H060)

This function allows the prohibition or “jumping” of critical frequencies so that the motor can operate without resonance caused by machine systems. This function is also used for dead band control. Setting the value to 0.0Hz disables this function.

Set jump frequency 1 or 2 as follows :

$$H058 \leq H059$$

If this condition is not satisfied, the inverter displays constant setting error “OPE6”.



(12) Continuing Operation by Automatic Fault Reset (H056)

Sets the inverter to restart and reset fault detection after a fault occurs. The number of self-diagnosis and retry attempts can be set at H056 up to 10. The inverter will automatically restart after the following faults occur :

- OC (overcurrent)
- OV (overvoltage)
- UV1 (undervoltage PUV)
- GF (ground fault)
- rr (regenerative transistor fault)

The number of retry attempts are cleared to 0 in the following cases :

- If no other fault occurs within 10 minutes after retry.
- When the fault reset signal is ON after the fault is detected.
- Power supply is turned OFF.

(13) Operating Coasting Motor without Trip

To operate coasting motor without trip, use the speed search command or DC injection braking at start.

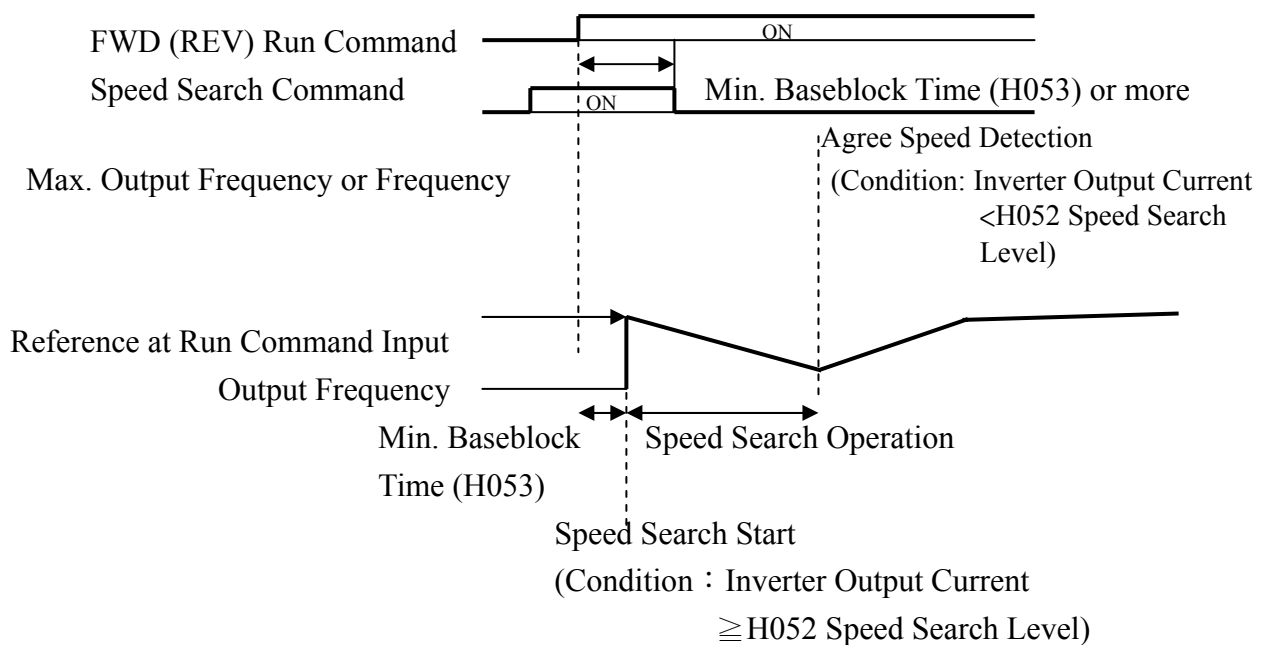
(a) Speed Search Command

Restarts a coasting motor without stopping it. This function enables smooth switching between motor commercial power supply operation and inverter operation.

Set multi-function contact input selection (constants H 035 to H039) to "15" (search command from maximum output frequency) or "16" (search command from set frequency).

Build a sequence so that FWD (REV) run command is input at the same time as the search command or after the search command. If the run command is input before the search command, the search command becomes disabled.

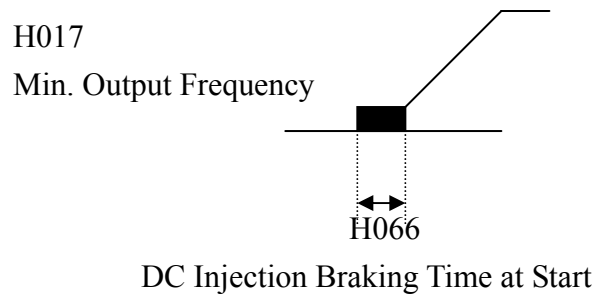
Following is a time chart at search command input.



(b) DC Injection Braking at Start (H064,H066)

Restarts a coasting motor after stopping it. Set the DC injection braking time at start in constant H066 in units of 0.1 second. When constant H066 is set to “0”, DC injection braking is not performed and acceleration starts from the minimum output frequency.

Set DC injection braking current in constant H064 in units of 1%. The inverter rated current is 100%.

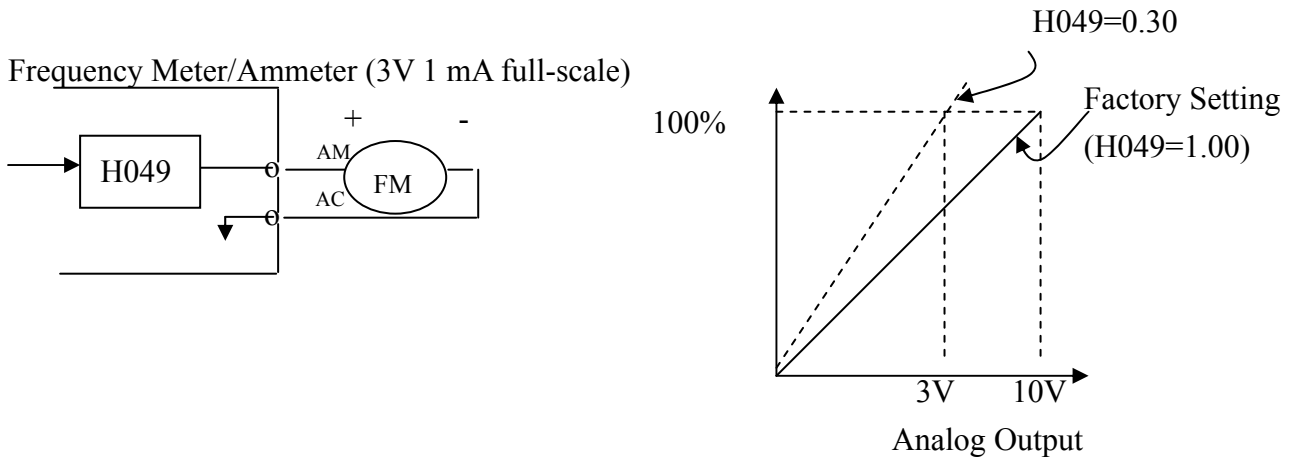
**(14) Using Frequency Meter or Ammeter (H048)**

Selects to output either output frequency or output current to analog output terminals AM-AC for monitoring.

Setting	Analog Monitor Output Item
0	Output frequency (10 V/max. frequency)
1	Output current (10V/inverter rated current)
2	Output power (10V/inverter rated voltage)
3	DC bus voltage [10V/400V (220V class), 10V/800V (440V class)]

(15)Calibrating Frequency Meter or Ammeter (H049)

Used to adjust analog output gain.



Set the analog output voltage at 100% of output frequency.

Frequency meter displays 0 to 60Hz at 0 to 3V.

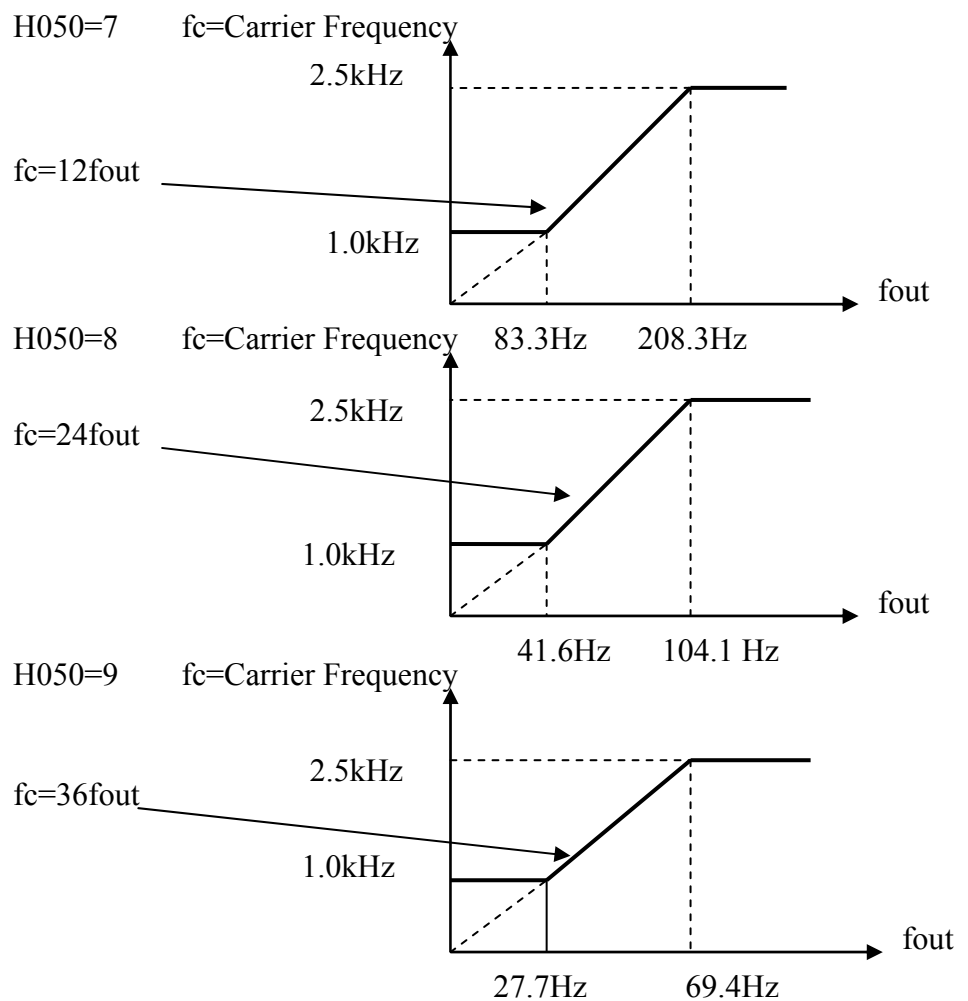
$$10V \times \begin{array}{|c|} \hline \text{H049 Setting} \\ \hline 0.30 \\ \hline \end{array} = 3V$$

Output frequency become 100% at this value.

(16) Reducing Motor Noise or Leakage Current (H050)

Sets inverter output transistor switching frequency (carrier frequency).

Setting	Carrier Frequency (kHz)	Metallic Noise from Motor	Noise and Current Leakage
1	2.5	Higher ↑ ↓ Not audible	Smaller ↑ ↓ Larger
2	5.0		
3	8.0		
4	10.0		
5	12.5		
6	15.0		



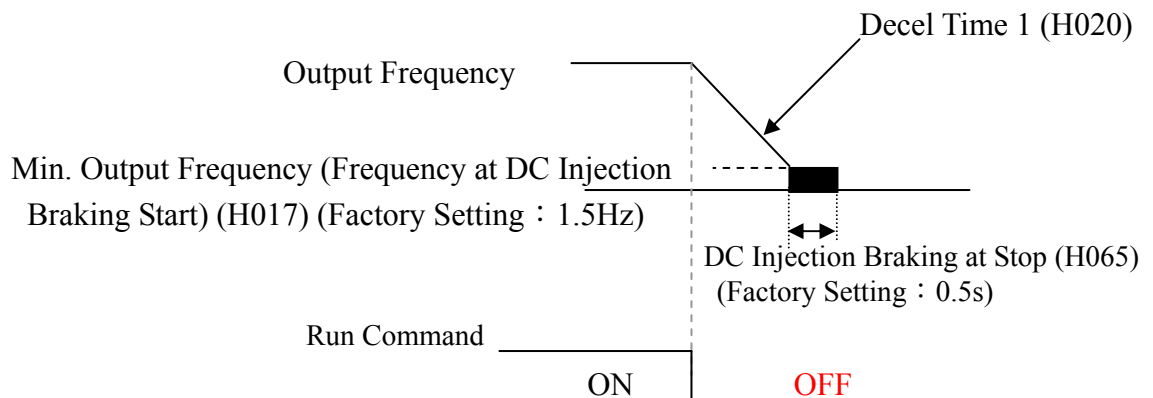
6.4 STOPPING METHOD

(1) Selecting Stopping Method (H004)

Selects the stopping method suitable for the application.

Setting	Description
0	Deceleration to stop (Factory setting)
1	Coast to stop
2	Coast to stop with timer 1
3	Coast to stop with timer 2

(a) Deceleration to Stop (H004=0)

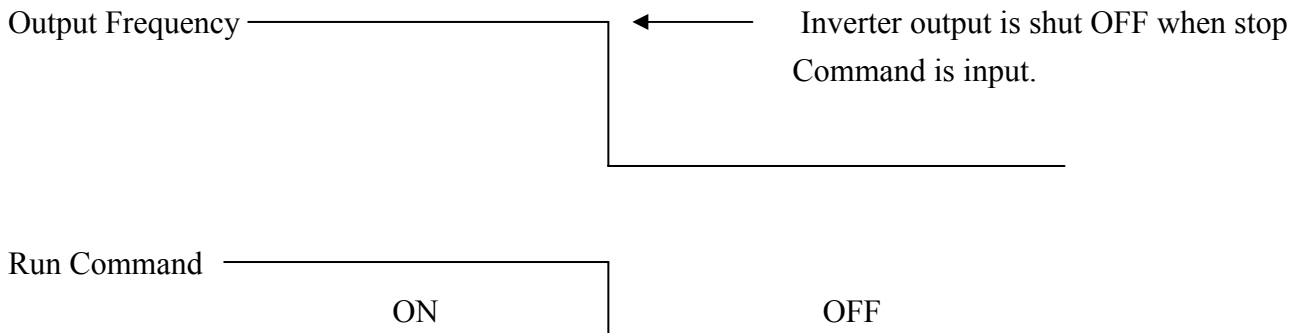


Upon removal of the FWD (REV) run command, the motor decelerates at the deceleration rate determined by the time set to decel time 1 (H020). and DC injection braking is applied immediately before stop. If the decel) time is short or the load inertia is large, an overvoltage (OV) fault may occur at deceleration.

In this case, increase the decel time or install an optional braking resistor

Braking torque : Without braking resistor : Approx. 20% torque of motor rating
With braking resistor : Approx. 150% torque of motor rating

(b) Coast to Stop (H004=1)

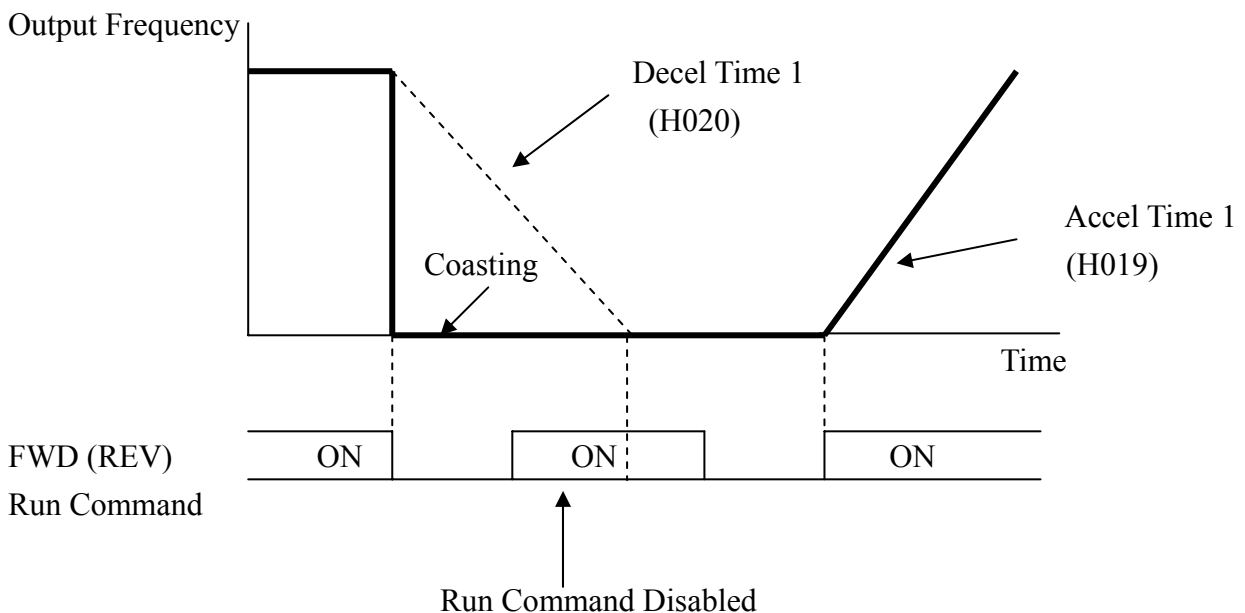


Upon removal of the FWD (REV) run command, the motor starts coasting.

(2) Coast to Stop with Timer

(a) Coast to Stop with Timer 1 (H004=2)

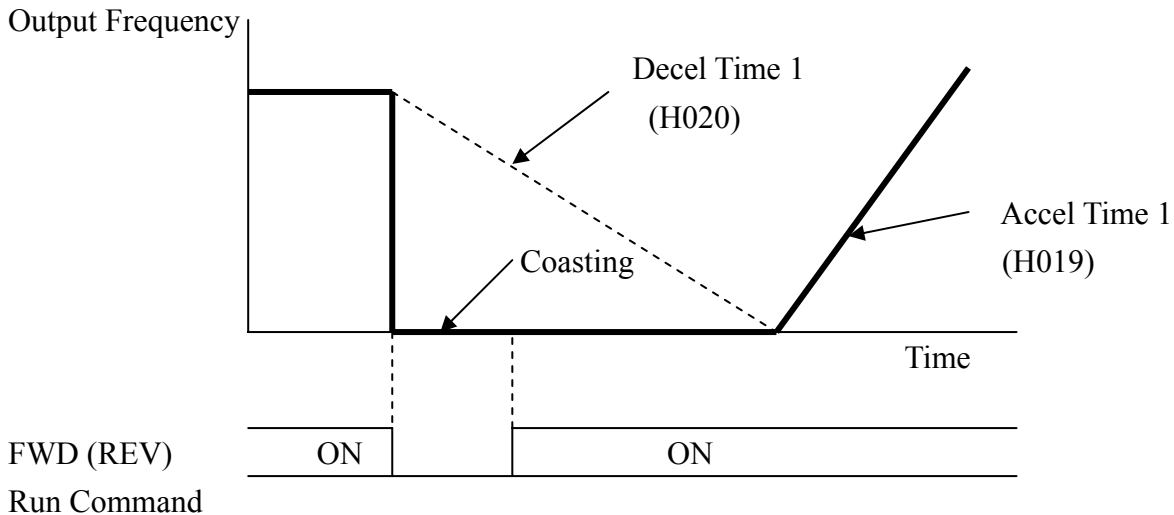
Example of accel/decel time 1 selection



A run command is not accepted while the motor decelerates after a stop command is given. However, if the time required for the motor to decelerate to a stop is shorter than the time set in constant H053 (minimum baseblock time), a run command is not accepted during the baseblock time.

(b)Coast to Stop with Timer 2 (H004=3)

Example of accel/decel time 1 selection



Operation is disabled while the motor decelerates after a stop command is given.

A run command is accepted, but operation does not start until the motor stops. However, if the deceleration time is shorter than the time set in H053 (minimum baseblock time), the inverter does not operate during the baseblock time.

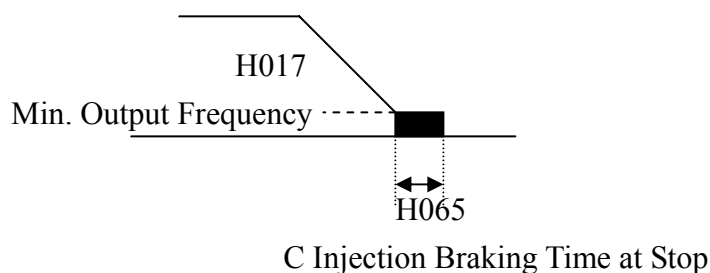
(3) Applying DC Injection Braking

(a) DC Injection Braking Current (H064)

Sets DC injection braking current in units of 1 %. (Inverter rated current: 100%)

(b) DC Injection Braking Time at Stop (H065)

Sets the DC injection braking time at stopping in units of 0.1 second. When the setting is 0, DC injection braking is not performed, but inverter output is shut OFF when DC injection braking starts.



When coast to stop is specified in stopping method selection (H004), DC injection braking at stop does not operate.

6.5 INTERFACE CIRCUITS WITH EXTERNAL DEVICES

(1) Using Sequence Input Signals (H035 to H039)

Multi-function contact input terminal S2 to S6 functions can be changed when necessary by setting constants H035 to H039, respectively. The same value cannot be set to different constant setting.

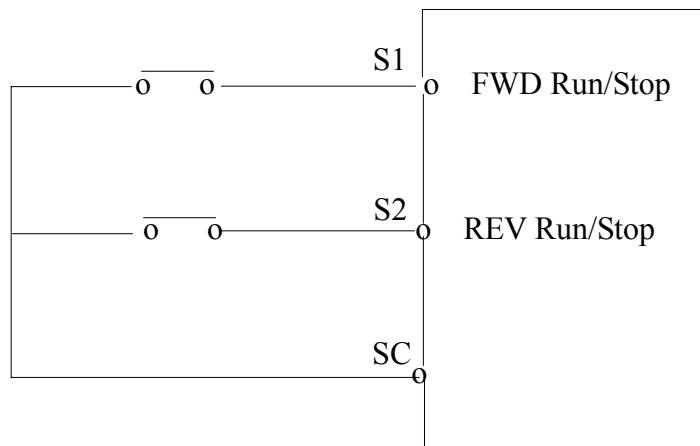
- Terminal S2 function : Set to H035
- Terminal S3 function : Set to H036
- Terminal S4 function : Set to H037
- Terminal S5 function : Set to H038
- Terminal S6 function : Set to H039

Setting	Name	Description	Ref. Page
0	REV run command(2-wire sequence)	Only constant H035 can be set	60
1	FWD/REV run command (3-wire sequence)	Only constant H035 can be set	60
2	External fault (NO contact input)	Inverter stops at fault when external fault signal is input Digital operator displays “EF□*”	---
3	External fault (NC contact input)		
4	Fault reset	Resets fault. Fault reset is disabled during run command input	---
5	LOCAL/REMOTE selection	---	60
6	Serial communication/control circuit terminal selection	---	61
7	Fast stop	Decelerates to stop by decel time 2 (H022) when fast stop is input	---
8	Master frequency reference input level selection	Master frequency reference input level (voltage input at “open”, current input at “closed”) can be selected	---
9	Multi-step speed reference 1	---	41
10	Multi-step speed reference 2		
11	Jog frequency selection	---	42
12	Accel/decel time selection	---	45
13	External baseblock (NO contact input)	Coasting signal. Motor starts coasting when the signal is input. Digital operator displays “bb” (blinking)	---
14	External baseblock (NC contact input)		
15	Search command from maximum frequency	Speed search command signals	51
16	Search command from set frequency		
17	Constant setting enable/disable	Permission or prohibition of constant setting from the digital operator or serial communication (setting disabled at “closed”, enabled at “open”) can be selected	---
18	PID integral value reset	---	72
19	PID control disable		
20	Timer function	---	61
21	OH3 (inverter overheat alarm)	When this signal is input, the digital operator displays “OH3” (blinking). Inverter continues operation	---
22	Analog reference sample/hold	Analog frequency reference is sampled at “closed and held at “open”	62
25	UP/DOWN command	Only constant H039 can be set	63
26	Loop test	Only constant H039 can be set	64

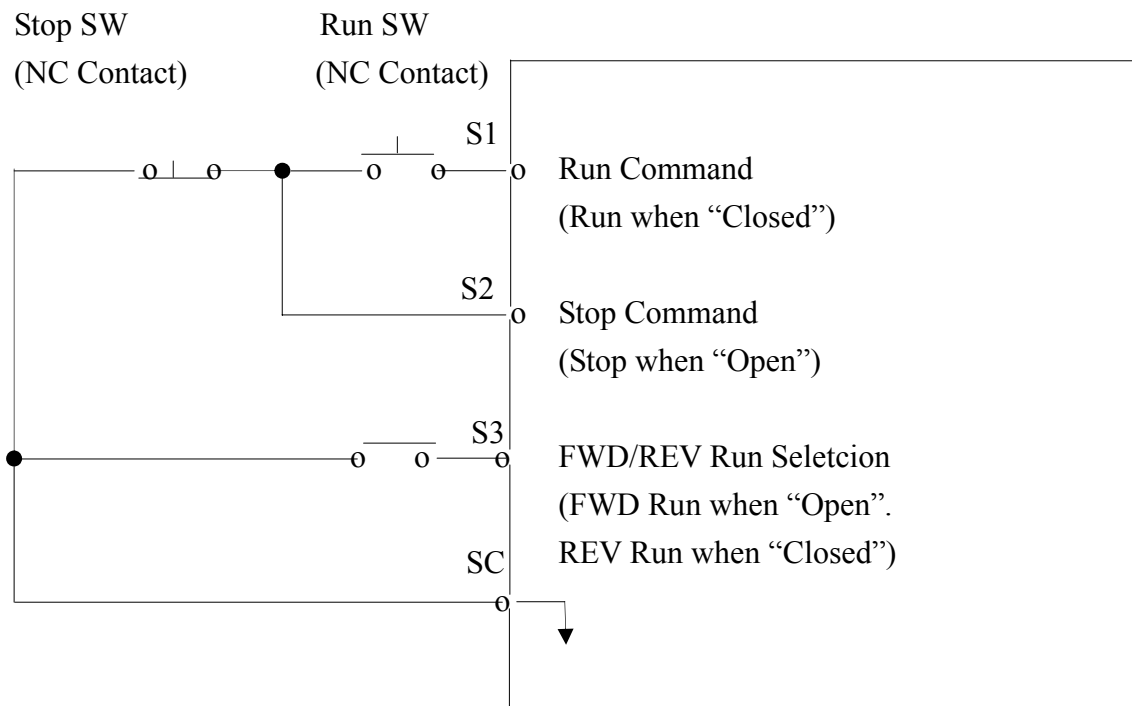
*2 to 6 are displayed in ☐ corresponding to terminals S2 to S6.

Factory setting H035 : 0 , H036 : 2 , H037 : 4 , H038 : 9 , H039 : 10

(a) Terminal Function at 2-wire Sequence Selection (Setting : 0)



(b) Terminal Function at 3-wire Sequence Selection (Setting : 1)



(c) LOCAL/REMOTE Selection (setting : 5)

Selects operation reference by the digital operator or by the control circuit terminal.

LOCAL/REMOTE selection is available only during stop.

Open : Run according to the setting of operation mode selection (H002).

Closed : Run by frequency reference and run command from the digital operator.

(Example) Set H002 to 3.

Open : Run by frequency reference from control circuit terminals FV, FI and run command from control circuit terminals S1,S2.

Closed : Run by frequency reference and run command from the digital operator.

(d) Serial Communication/Control Circuit Terminal Selection (Setting: 6)

Selects operation reference by serial communication or by the control circuit terminal. This selection is available only during stop.

Open : Run according to the setting of operation mode selection (n002).

Closed : Run by frequency reference and run command from serial communication.

(Example) Set H002 to 3.

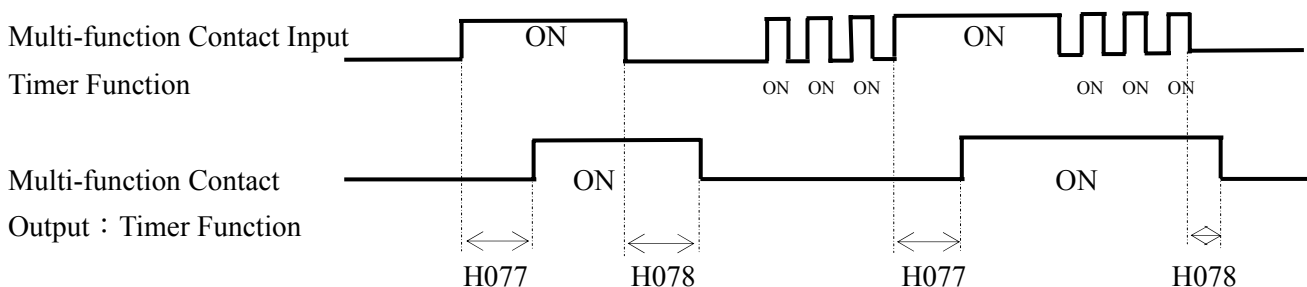
Open : Run by frequency reference from control circuit terminals FV, FI and run command from control circuit terminals S 1, S2.

Closed : Run by frequency reference and run command from serial communication.

(e) Timer Function (Setting : 20)

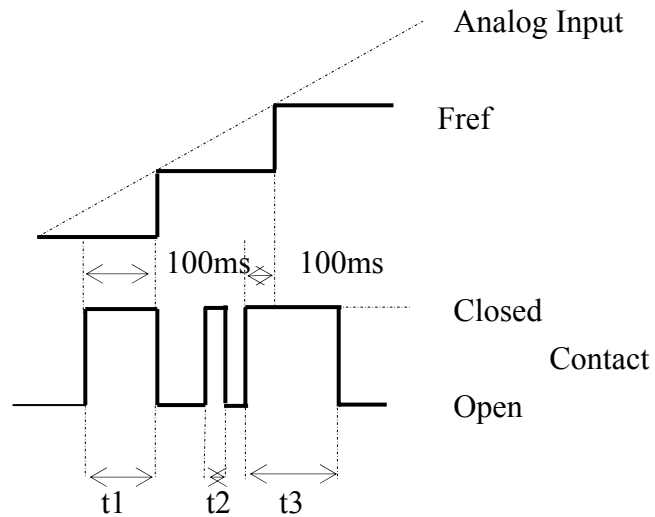
When the timer function input is longer than ON-delay timer (H077), the timer function output closes.

When the timer input is "open" for longer than OFF-delay timer (H078), the timer function output opens.



(f) Analog Reference Sample/Hold Selection (Setting: 22)

If input terminal is "closed" for 100ms or more, the analog frequency reference is sampled; when it opens, the analog frequency reference is held.



Note :

t1.t3 : Reference is held at 100ms or more.

t2 : Reference is not held at less than 100ms.

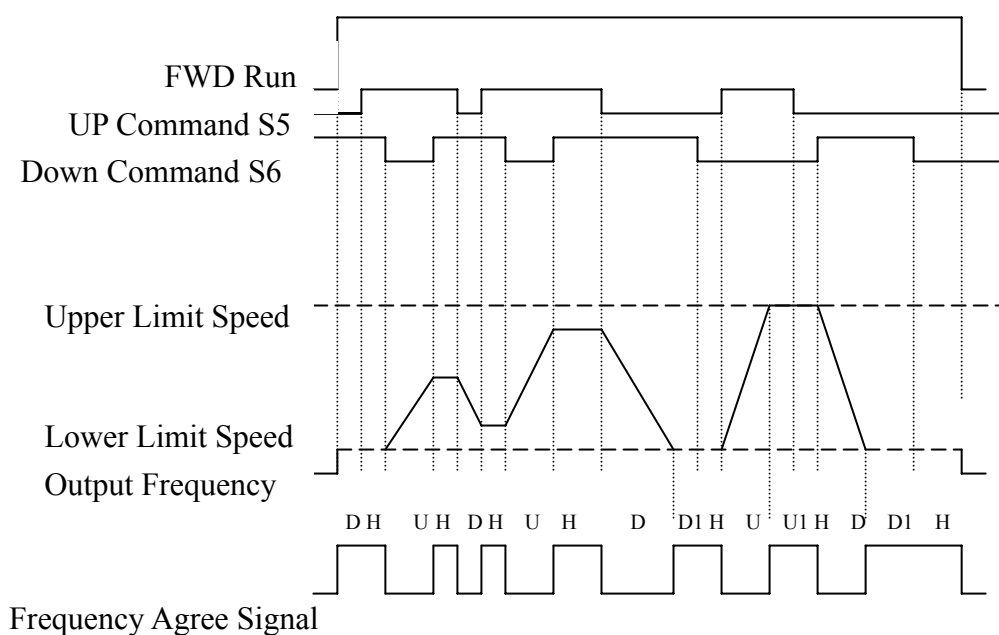
(g) UP/DOWN Command (setting : H039=25)

With the FWD (REV) run command entered, accel/decel is enabled by inputting the UP or DOWN signals to control circuit terminals S5 and S6 without changing the frequency reference, so that operation can be performed at the desired speed.

When UP/DOWN commands are specified by H039, any function set to H038 becomes disabled; terminal S5 becomes an input terminal for the UP command and terminal S6 for the DOWN command.

Control Circuit Terminal S5 (UP command)	Closed	Open	Open	Closed
Control Circuit Terminal S6 (DOWN command)	Open	Closed	Open	Closed
Operation Status	Accel	Decel	Hold	Hold

The following shows the time chart at UP/DOWN command input.



U=UP(acceleration)status

D=DOWN (decelerating) status

H= HOLD (constant speed) status

U1= UP status, clamping at upper limit speed

D1= DOWN status, clamping at lower limit speed

Note :

1. When UP / DOWN command is selected, the upper limit speed is set regardless of frequency reference.

Upper limit speed = Maximum output frequency (H012)
× Frequency reference upper limit (H030)/100

2. Lower limit value is either frequency by analog command from control circuit terminals FV, FI or frequency reference lower limit (H031) (whichever is larger).

3. When the FWD (REV) run command is input, operation starts at the lower limit speed without an UP / DOWN command.

4. If the jog frequency selection command is input while running by the UP / DOWN command, the jog command has priority.

(h) Loop Test (Setting: 26)

Checks operation in the serial I/F circuit. If a fault occurs, the digital operator displays "CE".

[Procedure]

1. Set multi-function contact input selection (n039) after turning ON the inverter power supply, and then turn OFF the inverter power supply.
2. Short circuit terminals S6 and SC. connector 2CN pins 1 and 2. (Do not short circuit when connecting communication interface card S-T/P .)
3. Loop test is started by turning ON the inverter power supply.

The digital operator displays the frequency reference after the loop test is completed satisfactorily.

(2)Using Analog Input Signals (H042 to H045)

(a)Master Analog Input Selection (H042)

To input the master frequency reference from the control circuit terminal, select voltage reference (0 to 10V) or current reference (4 to 20mA) by setting constant H042.

Setting	Master Frequency Reference Terminal	Input Level
0	FV	0 to 10 V input
1	FI	4 to 20mA input

(b) Auxiliary Analog Input Selection (H043)

To change the control circuit terminal FT input level, set constant H043

Setting	FI Terminal input Level
0	0 to 10 V input
1	4 to 20mA input

Note :

To set constant H043 to "0", cut jumper J1 on the inverter control PC board.

(c) Frequency Reference Retention (H044)

Effective when UP/DOWN or Sample/Hold commands are selected for multi-function contact inputs.

To retain the held frequency reference at power OFF, set constant H044 to "1".

Setting	Description
0	Not retained
1	Held reference retained in frequency I (constant H025)

(d) Operation Method for Frequency Reference Loss Detection (H045)

Select operation in case the frequency reference from control circuit terminal decreases rapidly.

Setting	Description
0	Not detection
1	Continue to run at 80% of Fmax

[Operation when "1" is selected]

If frequency reference decreases by 90% within 400 ms, operation is performed at 80% of the reference reached before decreasing.

(3) Using Output Signals (1H040 to H041)

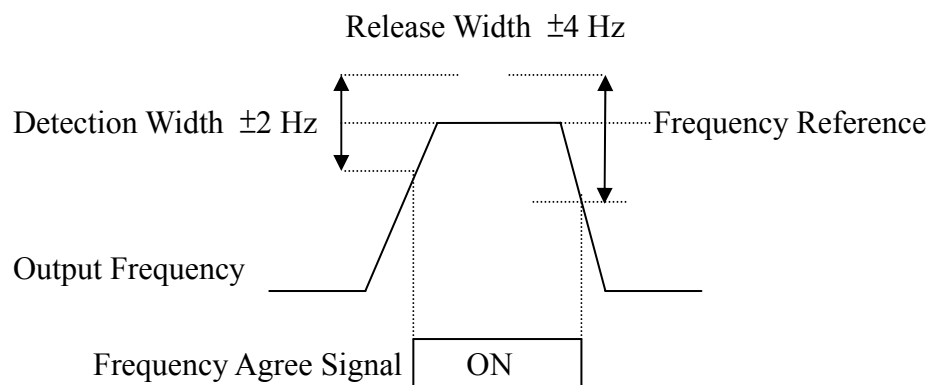
Multi-function contact output terminal MA, MB and MI functions can be changed when necessary by setting constants H040 and H041.

- Terminal MA and MB functions: Set to H040.
- Terminal MI function: Set to H041.

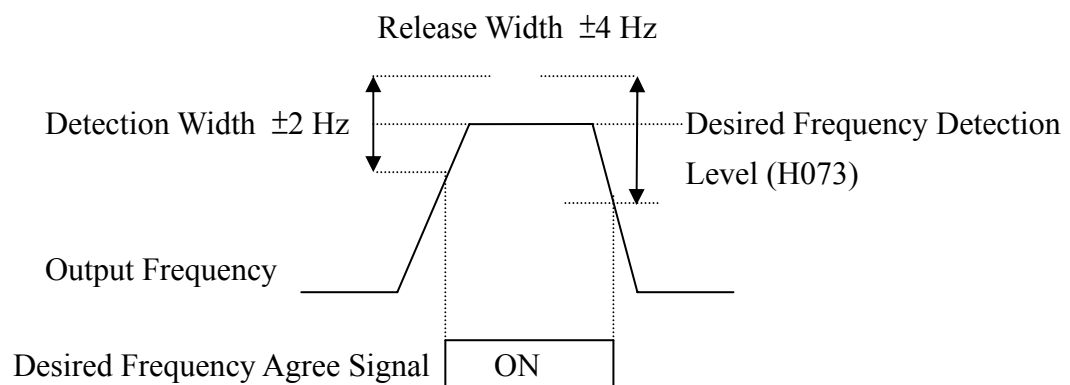
Setting	Name	Description	Ret. Page
0	Fault	“Closed” when inverter fault occurs.	---
1	During running	“Closed” when either FWD or REV run command is input or when the inverter outputs voltage.	---
2	Frequency agree	---	68
3	Desired frequency agree	---	68
4	Frequency detection	---	49
5	Frequency detection	---	49
6	Overtorque detection (NO contact)	---	47
7	Overtorque detection (NC contact)	---	47
8	During baseblock	“Closed” when inverter output shuts OFF.	---
9	Operation mode	“Closed” when run command or frequency reference from digital operator is selected.	---
10	Inverter operation ready	“Closed” when no inverter fault does not occur and the inverter can be operated.	---
11	Timer function	---	61
12	Automatic restart	“Closed” during fault retry operation.	---
13	OL pre-alarm	Outputs an alarm before inverter and motor overload protection are enabled. Pre-alarm level is 150% for 48 sec for the inverter and more than 80% of the overload protection time for the motor.	---
14	Frequency reference loss	Outputs a contact when detecting a rapid decrease in the frequency reference. The inverter continues operation at 80% of the frequency reference if the reference value is reduced more than 90% within 400 ms.	---
15	Output from serial communication	Activates contact output independently from inverter operation by a command from serial communication (MODUBS).	---
16	PID feedback- loss	Detects a rapid decrease in feedback and outputs a contact when the PID control mode is set. Detects when the feedback value decreases less than the detection level (H093) for longer than the feedback loss detection delay time (H094) ; the inverter continues operation.	---
17	OH I alarm	“Closed” during heatsink overtemperature (digital operator displays “OH1”blinking).	---

Factory settings H040 : 1 , H049 : 0

(a)Setting Example of “Frequency Agree Signal” (Setting : 2)



(b)Setting Example of “Desired Frequency Agree Signal” (Setting : 3)



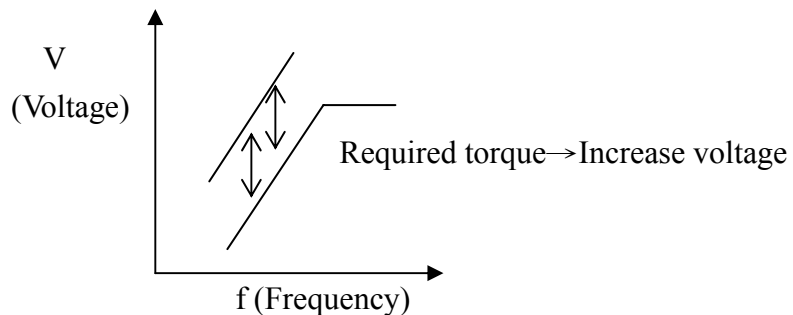
6.6 ADJUST NG MOTOR TORQUE

(1) Torque Compensation Gain (H067)

Motor torque requirement changes according to load conditions. Full-range automatic torque boost adjusts voltage of V/f pattern according to the requirement. The TG-300 automatically adjusts the voltage during constant-speed operation as well as during acceleration. The required torque is calculated by the inverter. This ensures tripless operation and energy saving effects.

Output voltage $\propto$ Torque compensation gain (H067) $\times$ Required torque

●Operation



Normally, no adjustment is necessary for torque compensation gain (H067 factory setting: 1.0).

When the wiring distance between the inverter and the motor is long, or when the motor generates vibration, change the torque compensation gain.

Increasing torque compensation gain increases motor torque, but an excessive increase may cause the followings:

- Inverter malfunctions because of motor overexcitation
- Motor overheat or excessive vibration

Increase torque compensation gain gradually while verifying the motor current.

6.7 MOTOR PROTECTION

(1) Motor Overload Detection

The inverter protects against motor overload with a built-in electronic thermal overload relay.

(a) Motor Rated Current (H032)

Set to the rated current value shown on the motor nameplate.

(b) Motor Overload Protection Selection (H033)

Setting	Electronic Thermal Characteristics
0	No protection
1	Standard motor (time constant 8 min)(Factory setting)
2	Standard motor (time constant 5 min)
3	Inverter motor (time constant 8 min)
4	Inverter motor (time constant 5 min)

The electronic thermal overload function monitors motor temperature, based on inverter output current and time, to protect the motor from overheating.

When electronic thermal overload relay is enabled, an "OL1" error occurs, shutting OFF the inverter output and preventing excessive overheating in the motor.

When operating with one inverter connected to one motor, an external thermal relay is not needed.

When operating several motors with one inverter, install a thermal relay on each motor. In this case, set constant H033 to 0.

(c) Standard Motor and Inverter Motor

Induction motors are classified as standard motors or inverter motors, based on their cooling capabilities. Therefore, the motor overload function operates differently between these two motor types.

	Cooling Effect	Torque Characteristics	Electronic Thermal Overload
Standard Motor	Effective when operated at 50/60Hz from commercial power supply	Operation Frequency (Hz) Base Frequency 60Hz (V/f for 60Hz, 220V Input Voltage) For low-speed operation, torque must be limited in order to stop motor temperature rise.	“OL1” error (motor overload protection) occurs when continuously operated at 50/60Hz or less at 100% load
Inverter Motor	Effective even when operated at low speed (approx. 6Hz)	Operation Frequency (Hz) Base Frequency 60 Hz (V/f for 60 Hz, 220V Input Voltage) Use an inverter motor for continuous operation at low speed.	Electronic thermal overload protection not enabled even when continuously operated at 50/60Hz or less at 100% load

6.8 PID CONTROL

To enable PID control, set PID selection (H084) to 1 or 2.

Setting	Description
0	PID disabled
1	PID enabled (Deviations is D-controlled.)
2	PID with feed forward (Feedback value is D-controlled.)

Then select the PID control intended value or detected value settings as follows

(1) Intended Value Setting

For setting the intended value, control circuit terminal FV voltage signal (0 to 10 V) or multi-step speed constants H025 to H029 can be used.

Control circuit terminal FV voltage signal :

Set operation mode selection (H002) to 2 or 3.

Multi-step speed constants (H025 to H029) :

Set operation mode selection (H002) to 0 or 1..

(Combination of multi-step speed reference and jog frequency reference)

(2) Detected Value Setting

For setting the detected value, control circuit terminal) FI current signal (4 to 20mA) or voltage signal

(0 to 10 V) can be used.

Control circuit terminal FI current signal :

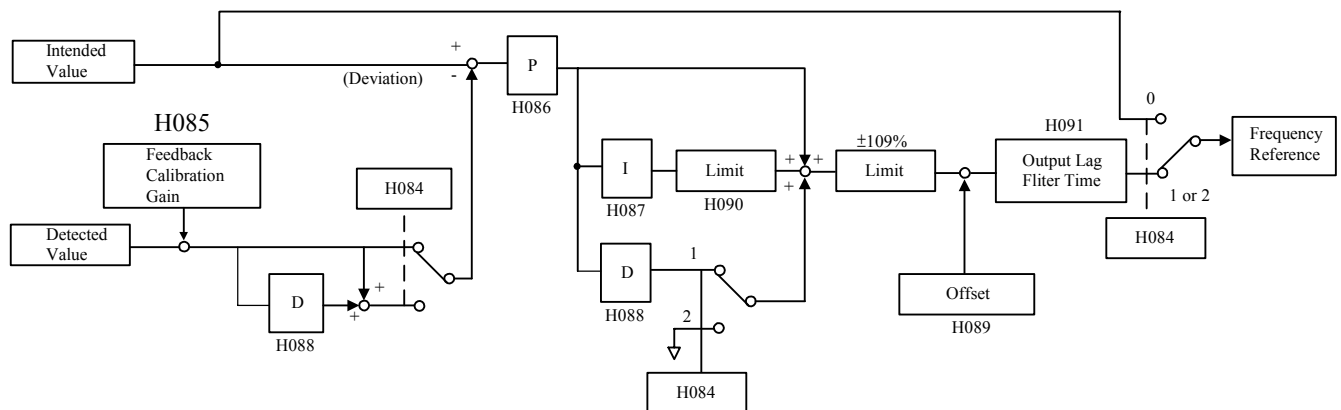
Set aux. analog input selection (H043) to 1

Control circuit terminal FI voltage signal :

Set aux. analog input selection (H.043) to 0

(Cut jumper J 1 on the control PC board.)

The following shows the block diagram of PID control



Note :

1 .Value I is reset to 0 in the following cases:

- When operation stops
- When the integral value reset signal is input by multi-function contact input selection (Any of constants H035 to H039 are set to 18.)

2 .The upper limit of value I can be set by constant H090.

Increase the value of constant H090 to upgrade control capability by integration. If the control system vibrates and it cannot be stopped by adjusting the integral time or output lag filter time, etc., decrease the setting of constant H090.

3 .PID control can be canceled by a multi-function contact input signal.

By setting any of constants H035 to H039 into 19 and by closing the contact during running, PID control is disabled and the intended value signal itself is used as a frequency reference signal.

6.9 ENERGY SAVING CONTROL

To enable energy saving control, set energy saving selection (H095) to 1

Setting	Description
0	Energy saving is disabled
1	Energy saving is enabled

Since the constants used in the energy saving control mode have been preset at the factory to the optimum values prior to shipment, it is not necessary to adjust them under normal operation. If your motor characteristics differ greatly from those of SHANGCHIN. standard motors, refer to the following description to change the constants.

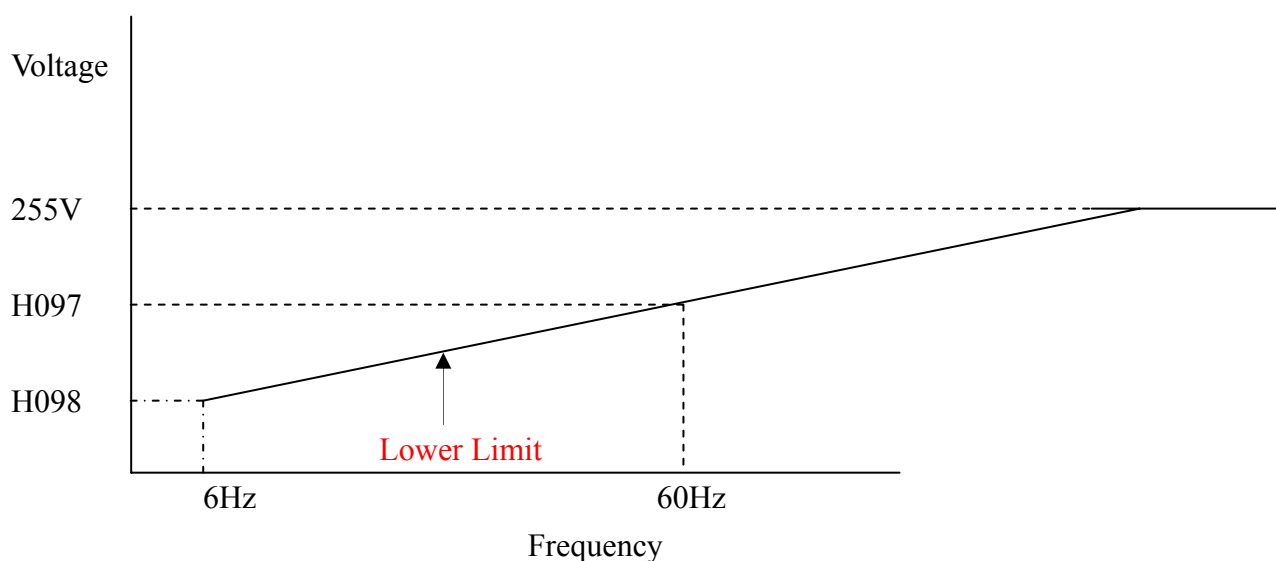
(1) Energy Saving Control Mode

(a) Energy Saving Gain K2 (H096)

Use this energy saving gain when running in the energy saving control mode to calculate the voltage at which motor efficiency will be greatest, and set it as the output voltage reference. This value is preset at the factory to the SHANGCHIN standard motor value prior to shipment. As the energy saving gain increases, output voltage increases also.

(b) Energy Saving Voltage Lower Limit (H097 , H098)

Sets the output voltage lower limit. If the voltage reference value calculated in the energy saving mode is smaller than the specified lower limit, this lower limit value is output as the voltage reference value. The lower limit value is set in order to prevent stalling at light loads. Set voltage limits at 6Hz and 60Hz ; a value obtained by linear interpolation should be set to any limit values other than at 6Hz or 60Hz. Setting is made as a percentage of motor rated voltage.



*For 440 V class, the value is twice that of 220 V class.

(2) Energy Saving Tuning

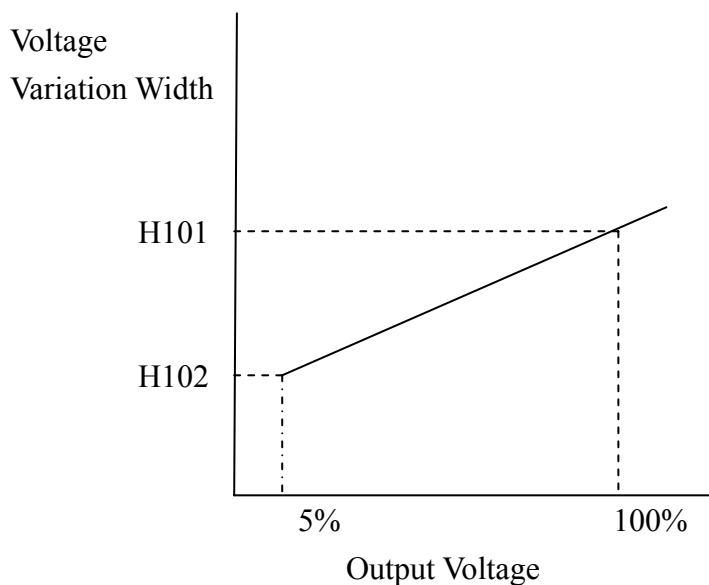
In the energy saving control mode, the optimum voltage is calculated according to load power, and the voltage is supplied to the load. However, the set constant may vary due to temperature variations or using other manufacturers' motors, therefore, the optimum voltage may not be supplied in some cases. Automatic tuning controls voltage so that highly efficient operation is maintained.

(a) Voltage Limit of Tuning (H100)

Limits the range to control voltage by tuning. Setting is made in a percentage of motor rated voltage. By setting this value to 0, tuning is disabled.

(b) Step Voltage Of Tuning (H100 , H101)

Sets voltage variation width of one tuning cycle. Setting is made in a percentage of motor rated voltage. By increasing this value, the rotating speed variation becomes larger. This voltage variation width is set when starting tuning voltage is 100% and motor rated voltage is 5%. Values obtained by linear interpolation are set to any voltage values other than these values.



6.10 MODBUS CONTROL

TG-300 can perform serial transmission by using a programmable controller (PLC) and MODBUS communication. MODBUS is composed of one master PLC and 1 to 31 (maximum) slave units (TG-300). In signal transmission (serial transmission) between the master and slaves, the master always starts transmission and the slaves respond to it.

The master performs signal transmission with one slave at one time. Therefore, address numbers are assigned to each slave in advance and the master specifies a number to perform signal transmission. The slave which receives the command from the master executes the function and returns the response to the master.

(1) Communication Specifications

- Interface : RS-485, RS-422 (Communication interface card S-T/P must be mounted.)
- Synchronization : Asynchronous
- Transmission parameter : ●Baud rate : Selectable from 2400, 4800, 9600 BPS (constant H107)
- Data length : Fixed to 8 bits
- Parity : Parity / no-parity, even / odd selectable (constant H108)
- Stop bit : Fixed to 1 bit
- Protocol : In accordance with .MODBUS
- Maximum number of units to be connected : 31 units (when RS-485 is used)

(2) Data to be Sent/Received by Communication

Data to be sent/received by communication are run commands, frequency reference, fault contents, inverter status and constant setting/reading.

(a) Operation Mode Selection (H002)

Select the run command and frequency reference input method in constant H002.

To provide a run command and frequency reference by communication, set this constant to settings 4 to 8. Also, without regard to this selection, monitoring of running status, constant setting/reading, fault reset and multi-function input command from the PLC are enabled. The multi-function input command becomes OR with the command input from control circuit terminals S2 to S6.

(b) Modbus Frequency Reference Unit (H105)

The frequency reference units from the PLC and in the frequency reference and output frequency monitors (by communication) are selected.

The output frequency resolution of the TG-300 is 0.1 Hz. Even if the frequency reference unit is changed to 0.01 Hz in constant H105, the value in the hundredth digit of 0.01 Hz of the received frequency reference is rounded off internally. When 30000/100% in units of 0.1% is selected, the value is rounded off in the same way.

(c) Modbus Slave Address (H106)

The slave address number is set. It is necessary to set the address number so that it will not overlap with the address number of another slave connected on the same transmission line.

Note :

To change the values set in constants H106 to H108 and enable new settings, it is necessary to turn OFF the power supply, and then turn it ON again.

7 MAINTENANCE AND INSPECTION

WARNING

- Never touch high-voltage terminals in the inverter.

Failure to observe- this warning can result in an electrical shock

- Replace all protective covers before powering up the inverter. To remove the cover, make sure to shut OFF the molded-case circuit breaker.

Failure to observe this warning can result in an electrical shock.

- Perform maintenance or inspection only after verifying that the CHARGE LED goes OFF, after the main circuit power supply is turned OFF.

The capacitors are still charged and can be dangerous.

- Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.

[Remove all metal objects (watches, bracelets, etc.) before operation.]

(Use tools which are insulated against electrical shock.)

Failure to observe this warning can result in an electrical shock.

CAUTION

- The control PC board employs CMOS ICs. Do not touch the CMOS elements.

They are easily damaged by static electricity.

- Do not connect or disconnect wires or connectors while power is applied to the circuit.

Failure to observe this caution can result in personal injury.

This chapter describes basic maintenance and inspection procedures for the TG-300.

7.1 PERIODIC INSPECTION

The TG-300 will function longer if it is kept clean, cool and dry, while observing the precautions listed in Par. 2.1. Check for tightness of electrical connections, discoloration or other signs of overheating or aging. Use table below as your inspection guide. Before servicing, turn OFF AC main circuit power and be sure that the CHARGE LED is OFF.

Periodic Inspection

Component	Check	Corrective Action
External Terminals, Unit Mounting Bolts, Connectors, etc.	Loose screws	Tighten.
	Loose connectors	Tighten.
Cooling Fins	Build-up of dust and dirt	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg-cm ²) pressure
Printed Circuit Board	Accumulation of conductive dust or oil.	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg-cm ²) pressure. If dust and oil cannot be removed, replace the board
Cooling Fan	For abnormal noise and vibration. Whether the cumulative operation time exceeds 20,000 hours or not	Replace the cooling fan
Power Elements	Accumulation of dust and dirt	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (4 to 6kg-cm ²) pressure
Smoothing Capacitor	Discoloration or order	Replace the capacitor or inverter unit.

7.2 PARTS REPLACEMENT SCHEDULE (GUIDELINES)

Replace the following parts periodically, for a long, safe, trouble free working life of TG-300.

Parts Replacement Schedule

Parts	Interval(Approx.)	Remarks
Cooling Fan	2 to 3years	Replace with new one
Smoothing Capacitor	5 years	Replace with new one. (Decided after inspection)
Breakers or Relays	---	Decided after inspection
Fuse	10 years	Replace with new one
Aluminum Electrolytic Capacitor on PC Board	5 years	Replace with new one. (Decided after inspection)

Note :

Operating conditions are as follows :

Ambient temperature : 30°C yearly average

Load factor : 80% or below

Operation rate : 12 hours or below /day

8 TROUBLESHOOTING

This chapter describes the inverter fault display and the fault contents caused by motor/ machine malfunctions and the corrective actions to be taken.

8.1 FAULT DIAGNOSIS AND CORRECTIVE ACTIONS

(1) When the TG-300 detects a fault, the fault is displayed on the digital operator and activates the fault contact output and the motor coasts to a stop.

Check the cause in the table below and take the corrective actions

(2) If the inspections or corrective actions described cannot solve the problem, contact your **SHANGCHIN** representative immediately.

(3) To restart, turn ON the reset input signal or depress [>RESET] key or shut OFF the main circuit power supply once, to reset the stop status.

Note :

When a forward (reverse) run command is input, the inverter does not receive a fault reset signal. Make sure to reset after turning OFF the forward (reverse) run command.

Fault Diagnosis and Corrective Actions

Fault Display	Description	Details	Corrective Action
U V 1	Main circuit undervoltage (PUV)	Undervoltage in the direct current main circuit during running. Detection level 220V class : Approx. 190V or less 440V class : Approx. 380V or less	●Check the power supply wiring. ●Correct the line voltage.
U V 2	Control circuit undervoltage (CUV)	Undervoltage in the control circuit during running	
UV3	MC fault	The pre-charge contactor opened during running	
O C	Overcurrent (OC)	The inverter output current exceeded the OC level	●Check the motor coil resistance ●Extend the accel/decel time ●Check the motor insulation ●Multi-meter check
O V	Overvoltage (OV)	The main circuit direct current voltage exceeded the OV level Detection level 220V class : Approx. 400V 440V class : Approx. 800V	Extend the deceleration time, and braking circuit
G F	Grounding (GF) (Earth fault)	Inverter output grounding current exceeded 50% of inverter rated current	●Check that motor insulation has not deteriorated ●Check that connection between inverter and motor is not damaged
P U F	Main circuit fault (PUF)	●The direct current circuit fuse is blown ●The output transistors were damaged	Check for damaged transistor, load side short circuit, grounding etc
O H 1	Heatsink overheat (OH1)	The transistor heatsink temperature exceeded the allowable value. (Fin temperature $\geq$ H130 : OH1 detection level)	Check the fan and ambient temperature
O H 2	Heatsink overheat (OH2)	The transistor heatsink temperature exceeded the allowable value (Fin temperature $\geq$ H134 : OH2 detection level)	Check the fan and ambient temperature.
O L 1	Motor overload (OL1)	Inverter output exceeded the motor overload level	Reduce the load.
O L 2	Inverter overload (OL2)	Inverter output exceeded the inverter overload level	Reduce the load, extend the acceleration time.
O L 3	Overtorque detection (OL3)	Inverter output current exceeded the overtorque detection level (H075)	Reduce the load, extend the acceleration time.
SC	Load short-circuit (SC)	Inverter output (load) is short-circuited	●Check the motor coil resistance ●Check the motor insulation
E F 0	External fault from serial communication	Fault occurred in the external control circuit	Check the external control circuit

*Stopping method selection is available.

Fault Diagnosis and Corrective Actions (Cont'd)

Fault Display	Description	Details	Corrective Action
E F 2	External fault at terminal S2	Fault occurred in the external control circuit.	Check the condition of the input terminal. If the LED lights when terminal is not connected, replace inverter.
E F 3	External fault at terminal S3		
E F 4	External fault at terminal S4		
E F 5	External fault at terminal S5		
E F 6	External fault at terminal S6		
S P 1	Excessive ripple in bus bar	● Inverter input power supply has open-phase. ● Large unbalance in input voltage.	● Check the line voltage. ● Re-tighten the input terminal screws.
S P 0	Output open-phase	Inverter output has pen-phase.	● Check the output wiring. ● Check the motor impedance ● Retighten the output terminal screws.
C E	MODBUS transmission fault	Control data cannot be received normally.	Check the transmission devices or signals.
C P F 0	Control circuit fault 1 (CPF0)(Digital operator transmission fault)	● Transmission between the inverter and digital operator cannot be established 5 seconds after supplying power. ● MPU peripheral element check fault (initial).	● Insert the digital operator connector again. ● Check the control circuit wiring. ● Replace the control card.
C P F 1	Control circuit fault 2 (CPF1)(Digital operator transmission fault)	● Transmission between the inverter and digital operator is established once after supplying power, but later transmission fault continues for more than 2 seconds. ● MPU peripheral element check fault (online).	● Insert the digital operator connector again. ● Check the control circuit wiring. ● Replace the control card.
C P F 4	EEPROM fault (CPF4)	Inverter control unit fault.	Replace the control card.
C P F 5	CPU A/D converter fault (CPF5)		

*Stopping method selection is available.

8.2 ALARM DISPLAY AND EXPLANATION

Alarms do not activate fault contact outputs and the inverter returns to its former operation status automatically when the cause is removed.

The following table explains the different types of alarms.

Alarm Display and Explanation

Alarm Display	Contents	Explanation
U V Blinking	Undervoltage detection	Undervoltage has been detected.
O V Blinking	OV during stop	Main circuit DC voltage exceeds the overvoltage detection level while the inverter output is OFF.
O H 1 Blinking	Heatsink overheating	Under condition of heatsink temperature $\geq$ H130 (OH1 detection level), continuous operation at OH1 detection selected.
O L 3 Blinking	Overtorque detection	Under condition of inverter output current $>$ H075 (overtorque detection level), continuous operation at overtorque detection is selected.
B B Blinking	External baseblock	External baseblock command is input from control circuit terminal.
E F Blinking	Simultaneous forward/reverse run commands	Both forward and reverse run commands are input simultaneously for over 500 ms.
C A L L Blinking	MODBUS transmission waiting	Under condition of H002 (operation method selection) ≥ 4 , the inverter has not received the normal data from serial communication after power ON.
O H 3 Blinking	Inverter overheat pre-alarm	Inverter overheat pre-alarm signal is input from control circuit terminal.
C E Blinking	MODBUS transmission error	Continuous operation is selected at MODBUS transmission error.
O P E 1	Inverter kVA setting fault	Inverter kVA setting error
O P E 3	Multi-function contact input setting error	One of the following setting errors occurred in the multi-function contact input selection (H035 to H039) •Two or more of the same values are set •Both 15 and 16 are set at the same time •Both 22 and 25 are set at the same time •25 or 26 is set to H035 to H038
O P E 5	V/f data setting error	Setting error of H012 to H018 (V/f data)
O P E 6	Constant setting error	One of the following setting errors occurred. •H036 (inverter rated current) $\times 0.1 >$ H032 (motor rated current), or H032 $>$ H036 $\times 2$ •H058 (jump frequency 1) $>$ H059 ((jump frequency 2) •H030 (output frequency upper limit) $<$ H031 (output frequency lower limit)

8.3 MOTOR FAULTS AND CORRECTIVE ACTIONS

(1) If any of the following faults occurs in the motor, check the cause and provide the relevant corrective action.

(2) If these inspections and corrective actions cannot solve the problem, contact your **SHANGCHIN** representative immediately.

Motor Faults and Corrective Actions

Fault	Check Point	Corrective Action
Motor does not rotate	Power supply voltage applied to power supply terminals L1, L2, L3 ? CHARGE LED is ON ?	• Turn ON power supply. • Turn OFF power supply, and then ON again. • Check power supply voltage. • Make sure terminal screws are tight.
	Use rectifier type voltmeter to test. Voltage output to output terminals U, V, W correct ?	Turn OFF power supply, then turn ON again.
	Motor locks due to excessive load ?	Reduce the load and release the lock.
	Fault displayed in operator display ?	Check troubleshooting table.
	FWD or REV run command entered ?	Check the wiring.
	Frequency setting voltage entered ?	• Correct the wiring. • Check frequency setting voltage.
	Operation mode setting correct ?	With the operator, check the operation mode selection.
Motor rotation reverses.	Wiring of terminals U, V, W correct ?	Match wiring to the phase order of the motor leads U, V, W.
	FWD and REV wiring run signals entered ?	Correct the wiring.
Motor rotates, but variable speed not available.	Wiring of frequency setting circuit correct ?	Correct the wiring.
	Operation mode setting correct ?	With the operator, check the operation mode selection.
	Load excessively large ?	Reduce the load.
Motor r/min too high or too low.	Motor ratings (number of poles, voltage) correct ?	Check motor nameplate specifications.
	Accel/decel speed change ratio for gears, etc. correct ?	Check speed changer (gears, etc.)
	Maximum frequency set value correct ?	Check the maximum frequency set value.
	Use rectifier voltmeter. Voltage between motor terminals not excessively reduced ?	Check V/f characteristics values.
Motor r/min not stable during operation	Load excessively large ?	Reduce the load.
	Load variation excessively large ?	• Reduce the load variation • Increase inverter motor capacity.
	3-phase or single-phase power supply used ? For 3-phase power supply, open phase ?	• For 3-phase power supply, check the wiring if power supply is open phase. • For single-phase power supply, connect AC reactor to the power supply.

APPENDIX 1 SPECIFICATION

Specification

220V Series :

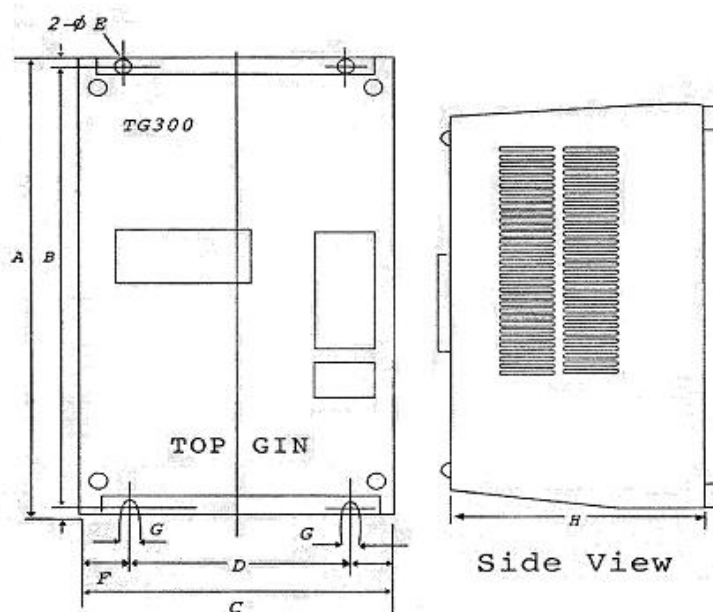
Model TG-300 TG-250	L15	L20	L30	L50	L75	L100	L150	L200	L250	L300	L400	L500	L600	L750	L1000
Motor Output KW*1	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Inverter Capacity KVA	2.3	3.0	4.3	6.8	9.9	13.5	19.5	24.5	31	37.5	51	62	70	85	110
Rated Current A	6	8	11	18	26	34	50	65	82	96	132	163	183	224	330

440V Series :

Model TG-300 TG250	H30	H50	H75	H100	H150	H200	H250	H300	H400	H500	H600	H750	H1000	H1500	H2000	H2500	H3000	H4000
Motor Output KW*1	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	110	160	185	200	300
Inverter Capacity KVA	4.7	6.7	12	16	21.5	26	32	41.5	52	62	75	98	130	170	230	260	340	460
Rated Current A	6.2	8	14.5	21	28	34	43	54	67	80	98	128	165	224	300	340	450	600

Power Sup	Item	220V Series	440V Series
	Reated Input Voltage and Frequency	3-Phase 200-240V 50/60Hz	3-Phase 345-480V 50/60Hz
	Allowable Voltage Fluctuation	+10%, -15%	
	Allowable Frequency Fluctuation	±5%	
Control characteristics	Max Output Voltage	3-Phase 200/208/220/230V (Proportional to input voltage)	3-Phase 380/400/415/440/460V (Proportional to input voltage)
	Reated Output Frequency	Up to 400Hz Available (by programming)	
	Control method	Shine wave PWM	
	Frequency control range	0.1 to 400Hz	
	Frequency precision (temperature characteristics)	Digital command : ±0.01% (-10℃ to -40℃) Analog command : ±0.1% (25℃ to ±10℃)	
	Frequency precision	Digital command : 0.1Hz Analog command : 0.06Hz/60Hz (1/1,000 or equivalent)	
	Output frequency resolution	0.01 Hz	
	Overtload capacity	TG 300 150% of rated current for one minute. TG250 120% of rated current for one minute.	
	Frequency setting signal	0 to 10 VDC(20KΩ)voltage input or 4 to 20 mA (250Ω) current input	
	Acceleration/Deceleration time	0.0 to 3,600s (acceleration and deceleration set separately)	
	Braking torque	Approx. 20% (Up to 125% possible with external braking resistor)	
	Voltage/frequency charatenistics	Select from 15 types of fixed V/f patterns or set any V/f pattern .	
Protective function	Motor protection	Protection by electronic thermal.	
	Instantaneous overcurrent protection	Stops at approx. 200% of rated output current	
	Overload protection	TG300 stops in one minute at approx. 150% of rated output current, TG250 stops in one minute at approx. 120% of rated.	
	Overvoltage	Stops when main-circuit DC voltage is approx. 410V (or 820V for 400V class.)	
	Under voltage protection	Stops when main-circuit DC voltage is approx. 190V (or 380V for 400V class)	
	Momentary power interruption compensation (selection)	Stops for 15 ms or more. Byselecting the momentary power interruption mode (H051), operation can be continued if power is restored within 2 s.	
	Cooling fin overheating	Protection by thermistor.	
	Stall Prevention	Stall prevention during accel/decel and constant steed operation	
	Grounding protection	Protection by electronic circuits.	
	Charge indicator (internal LED)	Lit when rated DC voltage is approx. 50V or more.	
Environment	Location	Indoors (no corrosive gas, oil spray, metallic dust, ect.)	
	Ambient operating temperature	-10℃ to 45℃ -10℃ to 45℃	
	Ambient operating humidity	90% RH (with no condensation)	
	Storage temperature	-20℃ to 60℃	
	Vibration withstand	Vibration open chassis type frequency less than 20Hz. 9.8m/s (0.2G) max.	
	Protective structure	Both enclosed wall-mounted type and open chassis type	
	Pf & efficiency	≥0.95	

APPENDIX 2 DIMENSIONS (mm)



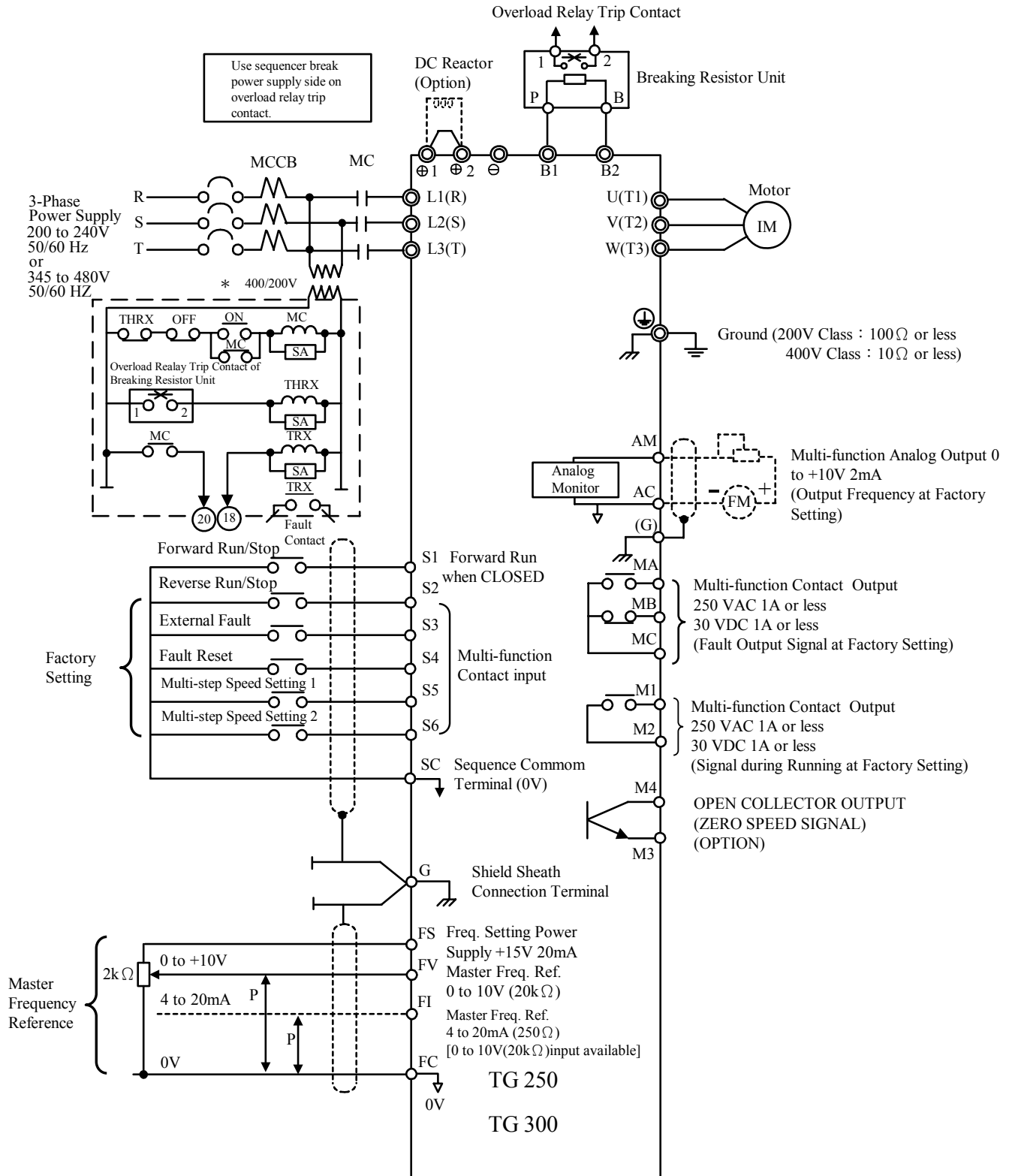
TG-300		TG-250		Dimensions(mm)								WEIGHT (KG)	
220V	380V 440V	220V	380V 440V	A	B	C	D	E	F	G	H	220V	380V 440V
L15		L15		300	289	150	126	5	12	5	195	5.5	---
L20		L20										5.8	---
L30	H30	L30	H30									5.9	5.7
L50	H50	L50	H50									6.6	6.2
L75	H75	L75	H75									7	6.8
L100	H100	L100	H100	320	308	200	185	5.5	7.5	5.5	230	10	10
L150	H150	L150	H150	390	373	257	235	7	11	7	250	16	16
L200	H200	L200	H200									17	17
L250	H250	L250	H250	476	467	301	276.5	8	12.5	8	277	23	22
L300	H300	L300	H300									25	24
---	H400	---	H400									---	25
---	H500	---	H500									---	27
L400	H600	L400	H600	685	665	420	320	8	40	8	341	57	59
L500	H750	L500	H750									60	70
L600	H1000	L600	H1000									70	72
L750	H1250	L750	H1250									75	90
	H1500		H1500	900	875	580	459	12	60	12	340	---	127
	H2000		H2000									---	142
L1000	H2500	L1000	H2500									130	145
L1500	H3000		H3000									150	160
	H4000		H4000	1100	1065	760	540	12	112	12	355	---	180

APPENDIX 3 TYPICAL CONNECTION DIAGRAM

3.1 BRAKING RESISTOR UNIT

For models L15 to L100 (220V Class 0.75 to 7.5 kW),

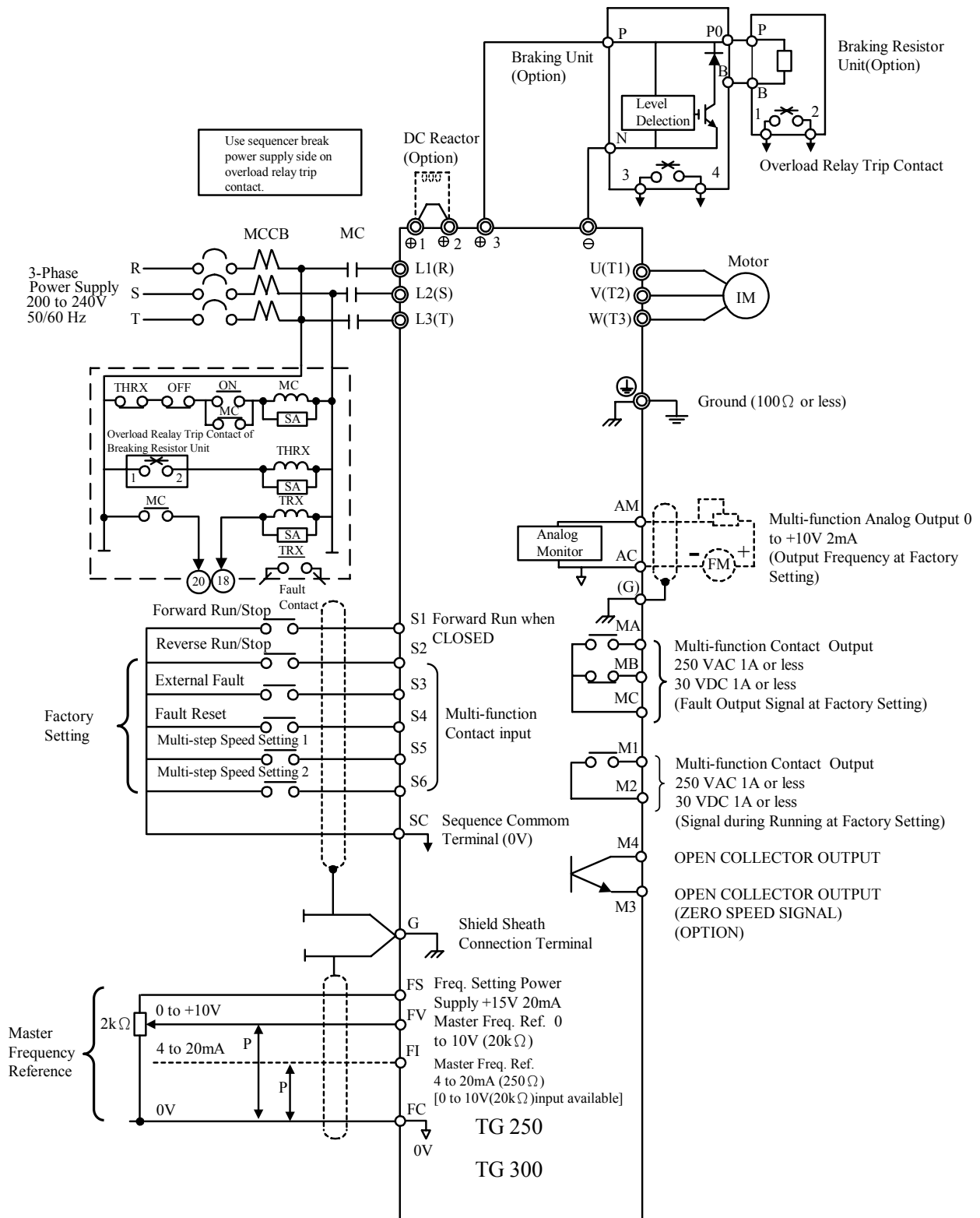
Models H30 to H200 (440V Class 2.2 to 15 kW)



* The transformer is not necessary for 220V class.

3.2 BRAKING UNIT AND BRAKING RESISTOR UNIT

For Models L150 and L200 (220V Class 11, 15 kW)



APPENDIX 4 CONSTANT LIST

No.	Function Name	Description	Initial
H 001	Password	0 : H001 read and set, H002 to H018 read only 1 : H001 to H034 read and set, H035 to H108 read only 2 : H001 to H049 read and set, H050 to H108 read only 3 : H001 to H108 read and set 4 : Not used 5 : Not used 6 : 2-wire initialization-reset 7 : 3-wire initialization-reset 8 : 2-wire initialization-reset (U.S. specifications) 9 : 3-wire initialization-reset (U.S. specifications)	1
H 002	Operation mode selection	(Setting) (Operation) (Reference) 0 : Operator Operator 1 : Terminal Operator 2 : Operator Terminal 3 : Terminal Terminal 4 : Operator Serial com 5 : Terminal Serial com 6 : Serial com Serial com 7 : Serial com Operator 8 : Serial com Terminal	3 (W2:ON)
H 003	Input voltage	Unit : 0.1V Setting range : 150.0 to 255.0V (510V for 440 units)	200.0V (400.0V)
H 004	Stopping method selection	0 : Deceleration to stop 1 : Coast to stop 2 : Coast to stop with timer (Run command cycle) 3 : Coast to stop with timer (regular)	0
H 005	Power rotation	0 : CCW 1 : CW	0
H 006	Reverse run prohibit	0 : reverse run enabled 1 : reverse run enabled	0
H 007	Local/remote key function	0 : disabled 1 : enabled	1
H 008	Stop key function	0 : stop key is effective when operated from digital operator 1 : stop key is always effective	1
H 009	Frequency reference setting method from digital operator	0 : Enter key not used 1 : Enter key used	1
H 010	V/f pattern selection (same as V/f LED)	0 to E : 15 preset V/f patterns F : Custom V/f pattern with voltage limit FF : Custom V/f pattern with voltage limit	1
H 011	Motor rated voltage (same as V _{mtr} LED)	Unit : 0.1V Setting range : 150.0 to 255.0V (510V for 440 units)	200.0V
H 012	Max. output frequency	Unit : 0.1Hz Setting range : 50.0 to 400Hz	60.0Hz
H 013	Max. voltage	Unit : 0.1V Setting range : 0.1 to 255.0V (510V for 440 units)	200.0V
H 014	Max. voltage output frequency	Unit : 0.1Hz Setting range : 0.2 to 400Hz	60.0 Hz
H 015	Mid. Output frequency	Unit : 0.1Hz Setting range : 0.1 to 399.9Hz	3.0 Hz
H 016	Mid. frequency voltage	Unit : 0.1V Setting range : 0.1 to 255.0V (510V for 440 units)	15.0V
H 017	Min. output frequency	Unit : 0.1Hz Setting range : 0.1 to 10.0Hz	1.5 Hz
H 018	Min. output frequency voltage	Unit : 0.1V Setting range : 0.1 to 50.0V	10.0V

No.	Function Name	Description	Initial
H 019	Acceleration time 1 (same as Accel LED)	Unit : 0.1sec (1 sec for 1000 sec and above) Setting range : 0.0 to 3600 sec	10.0sec
H 020	Deceleration time 1 (same as Decel LED)	Unit : 0.1sec (1 sec for 1000 sec and above) Setting range : 0.0 to 3600 sec	10.0sec
H 021	Acceleration time 2	Unit : 0.1sec (1 sec for 1000 sec and above) Setting range : 0.0 to 3600 sec	10.0sec
H 022	Deceleration time 2	Unit : 0.1sec (1 sec for 1000 sec and above) Setting range : 0.0 to 3600 sec	10.0sec
H 023	S-curve selection	(Setting) (S-curve time) 0 : S-curve not provided 1 : 0.2sec 2 : 0.5sec 3 : 1.0sec	1
H 024	Display mode	(Setting) (Unit) 0 : 0.1Hz 1 : 0.1% 2 to 39 : r/min (input # of motor poles) 40 to 3999 : custom	0
H 025	Frequency reference 1 (same as Fref LED)	Setting depends on H024 setting. Range : 0 to 9999	0.0Hz
H 026	Frequency reference 2	Setting depends on H024 setting. Range : 0 to 9999	0.0Hz
H 027	Frequency reference 3	Setting depends on H024 setting. Range : 0 to 9999	0.0Hz
H 028	Frequency reference 4	Setting depends on H024 setting. Range : 0 to 9999	0.0Hz
H 029	Jog frequency	Setting depends on H024 setting. Range : 0 to 9999	6.0 Hz
H 030	Frequency reference upper limit	Unit : 1% Setting range : 0 to 100%	100%
H 031	Frequency reference upper limit	Unit : 1% Setting range : 0 to 100%	0%
H 032	Motor rated current (same as FLA LED)	Unit 0.1A Ragne : 10 to 200% INV rated Unit is 1A when setting is more than 1000A	kVA dependent
H 033	Motor overload protection selection (OL1)	(Setting) (Characteristics) 0 : No protection 1 : Standard motor (time constant 8 min) 2 : Standard motor (time constant 5 min) 3 : Inverter motor (time constant 8 min) 4 : Inverter motor (time constant 5 min)	1
H 034	Stopping method selection (OH1)	(Setting) (Stop method) 0 : Ramp to stop-Decel 1 (fault) 1 : Coast to stop (fault) 2 : Ramp to stop-Decel 2 (fault) 3 : Continue operation (alarm)	3

No.	Function Name	Description	Initial
H 035	Multi-function contact input selection (Terminal S2)	0 : REV run command (2-wire sequence) 1 : FWD/REV run command (3-wire sequence) 2 : External fault (NO contact input) 3 : External fault (NC contact input) 4 : Fault reset 5 : LOCAL/REMOTE selection 6 : Serial communication/control circuit selection 7 : Fast stop 8 : Master freq. ref. input level selection 9 : Multi-step speed reference 1 10 : Multi-step speed reference 2 11 : Jog frequency selection 12 : Accel/decel time selection 13 : External Baseblock (NO contact input) 14 : External Baseblock (NC contact input) 15 : Search command from maximum frequency 16 : Search command from set frequency 17 : Constant setting enable/disable 18 : PID integral value reset 19 : PID control disable 20 : Timer function 21 : OH3 (inverter overheat alarm) 22 : Analog reference sample/hold	0
H 036	Multi-function contact input selection (Terminal S3)	Set items are same as H035	2
H 037	Multi-function contact input selection (Terminal S4)	Set items are same as H035	4
H 038	Multi-function contact input selection (Terminal S5)	Set items are same as H035	9
H 039	Multi-function contact input selection (Terminal S6)	Set items are same as H035 25 : UP/Down command 26 : Loop test (Modbus)	10
H 040	Multi-function contact output selection (Terminal MA-MB-MC)	0 : Fault 1 : During running 2 : Frequency agree 3 : Desired frequency agree 4 : Frequency detection 1 5 : Frequency detection 2 6 : Overtorque detection (NO contact) 7 : Overtorque detection (NC contact) 8 : During baseblock 9 : Operation mode 10 : Inverter operation ready 11 : Timer function 12 : During automatic restart 13 : OL pre-alarm 14 : Frequency reference loss 15 : Output from serial communication (DO function) 16 : PID feedback loss 17 : OH1 Alarm	0
H 041	Multi-function contact output selection (Terminal M1-M2)	Set items are as same as H040	1
H 042	Master analog input selection (FV or FI terminal)	0 : 0 to 10V input (FV) 1 : 4 to 20 mA input (FI)	0
H 043	Aux. analog input selection (FI terminal)	0 : 0 to 10V input (Jumper must be cut) 1 : 4 to 20 mA input	1
H 044	Frequency reference retention	0 : Not retained 1 : Held reference retained in frequency reference 1 (constant H025)	0

No.	Function Name	Description	Initial
H 045	Operation method for freq. ref. loss detection	0 : No detection 1 : Continue to run at 80% before ref. loss	0
H 046	Frequency reference gain (same as Fgain LED)	Unit : 1% Setting range : 0 to 200%	100%
H 047	Frequency reference bias (same as Fbias LED)	Unit : 1% Setting range : -100-100%	0%
H 048	Multi-function analog output (AM-AC)	(Setting) (Monitor) 0 : Output frequency 1 : Output current 2 : Output power 3 : DC bus voltage	0
H 049	Analog monitor gain	Unit : 0.01 Setting range : 0.01 to 2.00	1
H 050	Carrier frequency	Unit : 1 Setting range : 1 to 6 ($\times 2.5\text{kHz}$), 7 to 9 (custom pattern)	kVA dependent
H 051	Momentary power loss ridethrough method	(Setting) (Method) 0 : Not provided 1 : Continuous operation after power recovery within 2 sec 2 : Continuous operation after power recovery within control logic time (no fault output)	0
H 052	Speed search level (decel time fixed at 2 sec)	Unit : 1% Setting range : 0 to 200% 100% = INV rated current	110%
H 053	Min. baseblock time	Unit : 1% Setting range : 0.5 to 5.0 sec	kVA dependent
H 054	V/f reduction level during speed search	Unit : 1% Setting range : 0 to 100%	kVA dependent
H 055	Power loss ridethrough time	Unit : 0.1sec Setting range : 0.0 to 2.0 sec	kVA dependent
H 056	Automatic retry attempts	Unit : 1 time Setting range : 0 to 10	0
H 057	Fault contact selection during automatic retry	0 : Closed during fault retry 1 : Open during fault retry	0
H 058	Jump frequency 1	Unit : 0.1Hz Setting range : 0.0 to 400.0Hz	0.0Hz
H 059	Jump frequency 2	Unit : 0.1Hz Setting range : 0.0 to 400.0Hz	0.0Hz
H 060	Jump frequency range	Unit : 0.1Hz Setting range : 0.0 to 400.0Hz	1.0Hz
H 061	Elapsed timer selection	0 : Accumulated time during power on 1 : Accumulated time during running	1
H 062	Elapsed timer 1	Unit : 1 hour Setting range : 0 to 9999	0
H 063	Elapsed timer 2	Unit : 10,000 hours Setting range : 0 to 27	0
H 064	DC injection braking current	Unit : 1% Setting range : 0 to 100 sec	50%
H 065	DC injection braking time at stop	Unit : 0.1 sec Setting range : 0.0 to 10.0 sec	0.5sec
H 066	DC injection braking time at start	Unit : 0.1 sec Setting range : 0.0 to 10.0 sec	0.0sec

No.	Function Name	Description		Initial
H 067	Torque compensation gain	Unit : 0.1 Setting range : 0.0 to 3.0	Normally, no adjustment is necessary	1.0
H 068	Motor line to line resistance	Unit : 0.001W Setting range : 0.000 to 65.53		kVA dependent
H 069	Iron loss	Unit : 0W Setting range : 0 to 9999W		kVA dependent
H 070	Stall prevention during deceleration	0 : Disabled 1 : Enabled		1
H 071	Stall prevention level during acceleration	Unit : 1% Setting range : 30 to 200% When level is set to 200%, stall prevention during acceleration is disabled.		170%
H 072	Stall prevention level during running	Unit : 1% Setting range : 30 to 200% When level is set to 200%, stall prevention during running is disabled		160%
H 073	Frequency detection (multi-function contact output)	Unit : 0.1Hz Setting range : 0.0 to 400.0Hz		0.0Hz
H 074	Overtorque detection function selection (OL3)	(Setting) (Function) 0 : Detection disabled 1 : Detected during constant-speed running, and operation continues after detection. 2 : Detected during running, and operation continues after operation. 3 : Detected during constant-speed running, and inverter output is shut OFF during detection. 4 : Detected during running, and inverter output is shut OFF during detection.		0
H 075	Overtorque detection level (OL3)	Unit : 1% Setting range : 30 to 200% 100% = INV rated current		160%
H 076	Overtorque detection time (OL3)	Unit : 0.1 sec Setting range : 0.0 to 10.0 sec		0.1 sec
H 077	ON-delay timer	Unit : 0.1 sec Setting range : 0.0 to 25.5 sec		0.0 sec
H 078	OFF-delay timer	Unit : 0.1 sec Setting range : 0.0 to 25.5 sec		0.0 sec
H 079	dB resistor overheat function (rH)	0 : No dB protection calculated or provided 1 : Protection provided for installed Yaskawa resistor only		0
H 080	Input phase loss detection level (SPI)	Unit : 1% ec Setting range : 1 to 100 When setting is 100%, this function is disabled.		7%
H 081	Input phase loss detection delay time (SP1)	Unit : 1 (1.28sec) Setting range : 2 to 255 (2.56 to 326.4 sec)		(10.24sec)
H 082	Output phase loss detection level (SPO)	Unit : 1% Setting range : 0 to 100		0%
H 083	Output phase loss detection delay time (SPO)	Unit : 0.1 sec Setting range : 0.0 to 2.0 sec		0.2sec
H 084	PID selection (same as PID LED)	0 : PID disabled 1 : PID enabled (Deviation is D-controlled.) 2 : PID with feed forward (Feedback value is D-controlled.)		0
H 085	Feedback calibration gain (PID)	Unit : 0.01 Setting range : 0.00 to 10.00		1.00
H 086	Proportional gain (PID)	Unit : 0.1 Setting range : 0.0 to 10.0		1.0

No.	Function Name	Description	Initial
H 087	Integral time (PID)	Unit : 0.1 sec Setting range : 0.0 to 100.0 sec	10.0sec
H 088	Derivative time (PID)	Unit : 0.01 sec Setting range : 0.00 to 1.00 sec	0.00sec
H 089	Offset (PID)	Unit : 1% Setting range : -109 to 109%	0%
H 090	Limit of integral value (PID)	Unit : 1% Setting range : 0 to 109%	100%
H 091	Output lag filter time (PID)	Unit : 0.1 sec Setting range : 0.0 to 2.5 sec	0.0sec
H 092	Feedback loss detection (PID)	0 : Detection is disabled 1 : Detection is enabled	0
H 093	Feedback loss detection level (PID)	Unit : 1% Setting range : 0 to 100%	0%
H 094	Feedback loss detection delay time (PID)	Unit : 0.1 sec Setting range : 0.0 to 25.5 sec	1.0sec
H 095	Energy saving selection (same as kWsav LED)	0 : Energy saving is disabled. 1 : Energy saving enabled.	0
H 096	Energy saving gain K2	Unit : 0.01 Setting range : 0.00 to 655.0	kVA dependent
H 097	Energy saving voltage lower limit at 60Hz	Unit : 1% Setting range : 0 to 120%	50%
H 098	Energy saving power limit at 60Hz	Unit : 1% Setting range : 0 to 25%	12%
H 099	Time of average kW (Energy saving)	Unit : 1 = 25ms Setting range : 1 to 200	1
H 100	Voltage limit of tuning (Energy saving)	Unit : 1% Setting range : 0 to 100%	0%
H 101	Step voltage of tuning at 100% output voltage (Energy saving)	Unit : 0.1% Setting range : 0.1 to 10.0%	0.5%
H 102	Step voltage of tuning at 5% output voltage (Energy saving)	Unit : 0.1% Setting range : 0.1 to 10.0%	0.2%
H 103	Modbus time over detection	0 : Time over detection is disabled 1 : Time over detection is enabled	1
H 104	Modbus stop method at communication error (CE)	(Setting) (Stop method) 0 : Ramp to stop-Decel 1 (fault) 1 : Coast to stop (fault) 2 : Ramp to stop-Decel 2 (fault) 3 : Continue operation (alarm)	1
H 105	Modbus frequency reference unit	(Setting) (Frequency unit) 0 : 0.1Hz / 1 1 : 0.01Hz / 1 2 : 100% / 30000 3 : 0.1% / 1	0
H 106	Modbus slave address	Unit : 1 Setting range : 0 to 31	0
H 107	Modbus BPS selection	(Setting) (BPS rate) 0 : 2400 BPS 1 : 4800 BPS 2 : 9600 BPS	2
H 108	Modbus parity selection	(Setting) (BPS rate) 0 : No parity 1 : Even parity 2 : Odd parity	1

APPENDIX 5 DIGITAL OPERATOR MONITOR DISPLAY

The following table shows the contents of the digital operator monitor display

LED	Name	Description	
Fref	Frequency reference	●Frequency reference can be monitored/set. ●Setting/display unit depends on display mode (H024).	
Fout	Output frequency	●Output frequency can be monitored. ●Display unit depends on display mode (H024).	
Iout	Output current	Output current can be monitored in units of 0.1A (1A for 1000A and above).	
kWout	Output voltage	Output voltage can be monitored in units of 0.1kW (1 kW for 1000 kW and above).	
F/R	FWD/REVrun command	●FWD/REV run command can be set /monitored. ●Setting enabled during run command from digital operator. ●FWD run displays “For”, REV run “ruv”.	
Motor	Monitor	The following contents can be monitored.	
		No.	Contents
		U-01	Frequency reference (same as Fref)
		U-02	Output frequency (same as Fout)
		U-03	Output current (same as Iout)
		U-04	Output voltage reference can be monitored in units of 1V.
		U-05	DC voltage can be monitored in units of 1 V.
		U-06	Output power (same as kWout)
		U-07	Input terminal status can be monitored (terminals S1 to S6).
			1111 1 : S1 closed 1 : S2 closed 1 : S3 closed 1 : S4 closed 1 : S5 closed 1 : S6 closed Always “0” Always “0”

		U-08	Inverter status can be monitored 11 11 11 11 ↑ ↑ ↑ ↑ 1 : During run 1 : Reverse run command 1 : Inverter ready 1 : Fault 1 : Constant write error from MODBUS Always "0" 1 : MA-MC output OFF 1 : M1-M2 output OFF
LED	Name	Description	
Montr	Monitor	No.	Contents
		U-09	Max. 4 faults can be monitored.
		U-10	Lower 4 digits of PRGM No. can be monitored.
		U-11 U-12	Elapsed time can be monitored as follows. × × × × × ← Elapsed time (in units of hour) U-10 (lower 4 digits) U-11 (upper 2 digits) Max. 279,620 hours
		U-13	PID feedback can be monitored in units of 0.1 Hz.
Accel	Acceleration time 1	Acceleration time 1 (H019) can be set/read in units of 0.1 sec (1 sec for 1000 sec and above)	
Decel	Deceleration time 1	Deceleration time 1 (H020) can be set/read in units of 0.1 sec (1 sec for 1000 sec and above).	
Vmtr	Montr rated voltage	Motor rated voltage (H011) can be set during stop.	
V/F	V/f pattern selection	V/f pattern selection gain (H010) can be set during stop.	
Fgain	Frequency reference gain	Frequency reference gain (H046) can be set during stop.	
Fbias	Frequency reference bias	Frequency reference bias (H047) can be set during stop.	
FLA	Motor rated current	Motor rated current (H032) can be set during stop.	
PID	PID selection	PID selection (H084) can be set during stop.	
kWsa v	Energy saving selection	Energy saving selection (H095) can be set during stop.	
PRG M	PRGM mode	Constants can be set/read.	

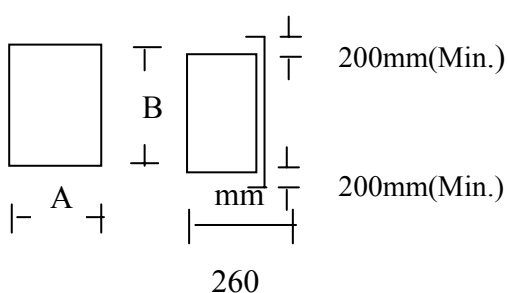
BRAKING UNIT APPLICATION LIST

INVERTER		INVERTER - MOUNTED TYPE				SEPARATELY - INSTALLED TYPE							
VOL-TAGE	MAX. Applicable Motor (HP)	Resistor			Braking Torque (3%ED)%	Braking Unit		Resistor			Max. Connectable table Q'TY	Min. Resistance Ω	Braking Torque (10%ED)%
		Resistance (150W)	CODE No.	Q'TY		MODEL No.	Q'TY	CODE No.	Resistance (per unit)	Q'TY			
220V Class	0.5	200 Ω	TG24	1	220	—	—	TG1	70W 200 Ω	1	4	48	220
	1	200 Ω	TG25	1	125	—	—	TG1	70W 200 Ω	1	4	48	125
	2	100 Ω	TG26	1	125	—	—	TG2	260W 100 Ω	1	5	16	125
	3	70 Ω	TG27	1	120	—	—	TG3	260W 70 Ω	1	4	16	120
	5	62 Ω	TG28	1	100	—	—	TG4	390W 40 Ω	1	2	16	125
	7.5	—	—	—	—	—	—	TG5	520W 30 Ω	1	3	9.6	115
	10	—	—	—	—	—	—	TG6	780W 20 Ω	1	2	9.6	125
	15	—	—	—	—	TGL-400	1	TG7	2400W 13.6 Ω	1	1	9.6	125
	20	—	—	—	—	TGL-400	1	TG8	3000W 10 Ω	1	1	9.6	125
	25	—	—	—	—	TGL-600	1	TG9	4800W 8 Ω	1	1	6.4	125
	30	—	—	—	—	TGL-600	1	TG10	4800W 6.8 Ω	1	1	6.4	125
	40	—	—	—	—	TGL-400	2	TG8	3000W 10 Ω	2	1	9.6	125
	50	—	—	—	—	TGL-400	2	TG8	3000W 10 Ω	2	1	9.6	100
	60	—	—	—	—	TGL-600	2	TG9	4800W 6.8 Ω	2	1	6.4	120
	75	—	—	—	—	TGL-600	2	TG9	4800W 6.8 Ω	2	1	6.4	100
	100	—	—	—	—	TGL-600	3	TG10	4800W 6.8 Ω	3	1	1.6	110
440V Class	0.5	750 Ω	TG29	1	230	—	—	TG11	75W 750 Ω	1	7	64	230
	1	750 Ω	TG30	1	130	—	—	TG11	75W 750 Ω	1	7	64	130
	2	400 Ω	TG31	1	125	—	—	TG12	260W 400 Ω	1	6	64	125
	3	300 Ω	TG32	1	115	—	—	TG13	260W 250 Ω	1	3	32	135
	5	—	—	—	—	—	—	TG14	390W 150 Ω	1	4	32	135
	7.5	—	—	—	—	—	—	TG15	520W 100 Ω	1	3	32	135
	10	—	—	—	—	—	—	TG16	780W 75 Ω	1	2	32	130
	15	—	—	—	—	TGH-400	1	TG17	1040W 50 Ω	1	2	20	135
	20	—	—	—	—	TGH-400	1	TG18	1560W 40 Ω	1	2	20	125
	25	—	—	—	—	TGH-400	1	TG19	4800W 32 Ω	1	1	19.2	125
	30	—	—	—	—	TGH-400	1	TG20	4800W 27.2 Ω	1	1	19.2	125
	40	—	—	—	—	TGH-400	1	TG21	6000W 20 Ω	1	1	19.2	125
	50	—	—	—	—	TGH-600	1	TG22	9600W 16 Ω	1	1	12.8	125
	60	—	—	—	—	TGH-600	1	TG23	9600W 13.6 Ω	1	1	12.8	125
	75	—	—	—	—	TGH-400	2	TG21	6000W 20 Ω	2	1	19.2	135
	100	—	—	—	—	TGH-600	2	TG23	9600W 13.6 Ω	2	1	12.8	145
	150	—	—	—	—	TGH-400	3	TG21	6000W 20 Ω	3	1	3.2	100
	200	—	—	—	—	TGH-600	4	TG23	9600W 13.6 Ω	4	1	3.2	140
	250	—	—	—	—	TGH-400	4	TG23	9600W 13.6 Ω	4	1	3.2	120
	300	—	—	—	—	TGH-600	5	TG23	9600W 13.6 Ω	5	1	3.2	125
	400	—	—	—	—	TGH-600	6	TG23	9600W 13.6 Ω	6	1	3.2	110

SEPARATELY - INSTALLED TYPE BRAKING RESISTOR

Applicable Voltage	Code no.	Size(mm)			Resistor Spec (per unit)	Resistor no. (per unit)	Wiring diagram	Applicable HP
		A	B	Screw				
220V Class	TG1	120	180	M5*2	70W 200Ω	1	—	1
	TG2	120	260	M5*4	260W 100Ω	2	1	2
	TG3	120	260	M5*4	260W 70Ω	2	1	3
	TG4	120	320	M5*4	390W 40Ω	2	1	5
	TG5	155	340	M9*4	520W 30Ω	2	1	7.5
	TG6	155	415	M9*4	780W 20Ω	2	1	10
	TG7	340	425	M9*8	2400W 13.6Ω	4	2	15
	TG8	380	425	M9*8	3000W 10Ω	4	2	20
	TG9	380	485	M9*8	4800W 8Ω	4	2	25
	TG10	380	485	M9*8	4800W 6.8Ω	4	2	30
440V Class	TG11	80	140	M5*4	70W 750Ω	2	1	1
	TG12	120	260	M5*4	260W 400Ω	2	1	2
	TG13	120	260	M5*4	260W 250Ω	2	1	3
	TG14	120	320	M5*4	390W 150Ω	2	1	5
	TG15	150	340	M9*4	520W 100Ω	2	1	7.5
	TG16	150	415	M9*4	780W 75Ω	2	1	10
	TG17	150	425	M9*4	1040W 50Ω	2	1	15
	TG18	170	425	M9*4	1560W 40Ω	2	1	20
	TG19	380	485	M9*8	4800W 32Ω	4	3	25
	TG20	380	485	M9*8	4800W 27.2Ω	4	3	30
	TG21	440	640	M9*8	6000W 20Ω	4	2	40
	TG22	440	790	M9*8	9600W 16Ω	4	2	50
	TG23	440	790	M9*8	9600W 13.6Ω	4	2	60

MOUNTING SPACE



Note :

A and B are the approximate length for the resistor unit

Wiring Diagram

