Boston Gear®

ACE15 SERIES

Adjustable Frequency AC Motor Controllers

P-1577-BG **Users Guide**

ACE15 Series

Boston Gear

www.bostongear.com

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Quick Start Guide

This guide is to assist in installing and running the drive to verify that the drive and motor are working properly. Initially, the motor will be started and stopped using the Run/Stop key on the digital operator.

Using ⌄ and ⌃ keys will set the Speed Reference. Operation from remote start/stop inputs or contact closures is described later.

Step 1 - Before Starting The Drive

Please review Preface and Safety Precautions (pages 10 through 13). Verify drive was installed in accordance with the procedures as described in Ambient Environment and Installation on pages 14 and 15. If you feel this was abnormal, do not start the drive until qualified personnel have corrected the situation. (Failure to do so could result in serious injury.)

Check Drive and motor nameplates to determine that they have the same HP and voltage ratings. (Ensure that full load motor amps do not exceed that of the controller.)

- Record the following information from the motor nameplate:

  Motor Rated Voltage

  Motor Rated Speed (RPM)

  Motor Rated Frequency (Hz)

  Motor Rated Full Load Current (Amps)

  Motor Rated Horsepower

- Remove the terminal cover to expose the motor and power terminals.

  a. Connect AC power to L1, L2, and L3 terminals.

  b. Connect AC Motor leads to T1 (U), T2 (V), and T3 (W).

Do not connect AC power supply to T1 (U), T2 (V), and T3 (W) terminals of the drive or serious damage to the drive will result.

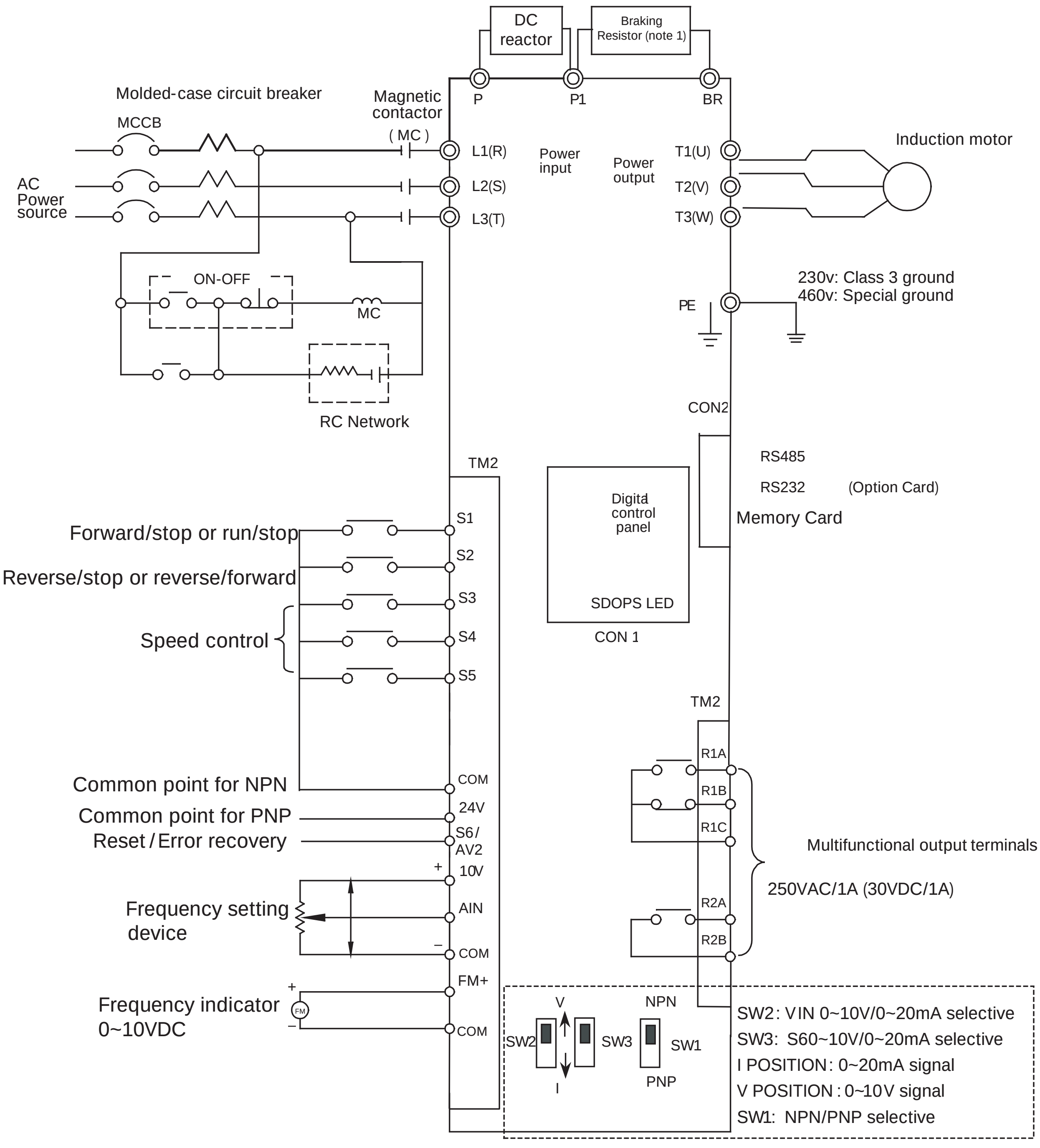
Descriptions of ACE15 Main Circuit Terminals

Terminal	Description
L1 (L)	Main power input: Single-phase: L/N Three-phase: L1/L2/L3
L2	
L3 (N)	
P1	Braking resistor or connecting terminal: Used in cases where the drive frequently trips due to large load inertia or short deceleration time (refer to specifications of braking resistor)
BR	
P1 and P	DC reactor connecting terminals
T1	Drive output
T2	
T3	

Description of ACE15 Control Circuit Terminals

Terminal	Description		
R2A	Multifunctional output terminal - Normally open		Contact rated capacity: (250VAC/1A or 30VDC/1A) Contact using description: (refer to 8-02, 8-03)
R2B			
R1C	Common contact	Multifunctional terminals - Normally open	
R1B	Normally close contact		
R1A	Normally open contact		
10V	Speed Potentiometer (VR) power source terminal (referenced to COM)		
AIN	Analog frequency signal input terminal (refer to 5-06 description)		
24V	Common contact for S1-S5 in PNP (source) input. (refer to wiring diagram) of SW1 when PNP input is used.		
COM	Common contact for S1-S5 in NPN (sink) input. (refer to wiring diagram) of SW1 when NPN input is used.		
FM+	The positive analog output for multifunction (refer to 8-00 description), the signal for output terminal is 0-10VDC		
S1	Multifunction input terminals (refer to 5-00 -5-04 description)		
S2			
S3			
S4			
S5			
S6/AV2	PID input terminal (refer to 5-05 description)		

Wiring Diagram ACE15 Series Drive



Note 1: Please refer to description of main circuit terminals (P1, BR) and specification of braking resistor for value selection. (Table 6.2 Dynamic Braking Resistor)

Keypad and Display Description

1. **Hz/RPM LED** – Indicates Speed Reference (Frequency) when stopped and Output Frequency when running. To display RPM, or Engineering units it must be selected in the program. See parameters 4-04 and 4-05 on page 36.

2. **VOLTS LED** – Indicates Output Voltage when running and also DC Bus Voltage.

3. **AMPS LED** – Indicates Output Current.

4. **FUNC** – Indicates Drive is in Program Mode.

5. **SEQ Remote** – Start/Stop when lit, Local Start/Stop (Run/Stop Key) when off.

6. **FRQ LED** – Remote Speed Reference when lit, Local Speed Ref. when off.

7. **FWD LED** – Indicates Forward Direction when lit (Flashes if stopped, Stays Lit while operating).

8. **REV LED** – Indicates Reverse Direction when lit (Flashes if stopped, Stays Lit while operating).

9. **DSP/FUNC** – Access program mode. Scroll thru monitoring functions.

10. **LOCAL/REMOTE** – Switches between Local (Keypad Operation) and Remote Control (Terminal Control).

11. **LCD** – Keypad does not have FUNC, Hz/RPM, VOLT, and AMP LEDs.

12. **RESET** – Moves digit to be changed from right to left. Resets drive fault.

13. **READ/ENTER** – Saves Edited Parameter Data into Memory.

14. **UP/DOWN** – Changes speed up or down when in local. Also Parameter values.

Step 2 - Apply Power To The Drive

Apply AC power to the drive and observe the keypad. The four digit 7-segment display should read the AC Input Voltage for 3-5 seconds and then it will display flashing 05.00 Speed Reference (Hz/RPM LED lit). The FWD LED should be flashing all the time. If this condition is not observed, then the drive parameters need to be reset to Factory Settings. Parameter 15-6 must be set accordingly (see page 64). Also see "To Change Parameter Data".

ACE15 Parameter Groups

Each parameter group branches off into individual parameters. See pages 35 through 43 for more detailed information about each parameter number.

Parameter Group No.	Description
0-	Drive Operation Mode
1-	Start/Stop and Frequency Control Modes
2-	Manual/Automatic Restart Modes
3-	Operating Parameters
4-	Digital Display Operation Mode
5-	Multifunction Input Terminals (MFIT)
6-	Jog, and Preset (MFIT) Speed Setting on Keypad
7-	Analog Input Signal Operation
8-	Multifunction Output Relays and Output signal Operation
9-	Drive and Load Protection Modes
10-	Volts/Hz Pattern Operation Mode
11-	PID Operation Mode
12-	PID "Limits" and "Out of Range" Mode
13-	Communication Mode
14-	Motor Auto-Tuning Parameters
15-	Drive Status and Function Reset

To Change Parameter Data:

1. Press the DSP FUNC key until the display reads “X - YY” (parameter group, Y parameter number). The initial value will be “0-00”.
2. Press the ▲ or ▼ keys to change the parameter number. The first digit to be changed will always be the farthest to the right “X-Y**Y**” and it will be flashing.
3. Press < RESET the key to move to the next flashing digit to be changed “X-**Y**Y”.

   Edit by using the ▲ or ▼ keys.
4. Press the READ ENTER key to edit the parameter value.
5. Press the ▲ or ▼ keys to change the parameter value. The digit to be edited will be flashing.
6. Press the < RESET key to move to the next digit to be changed with the ▲ or ▼ keys.
7. Press the READ ENTER key to save the edited parameter value to memory. Display will read “END” indicating it saved the information then the parameter edited will be displayed in the keypad.

Step 3 - Enter Setup Data

Use the flowchart on page 8 as a guide when entering setup data. There are two different procedures for entering setup data, one for the Vector Control modes and the other for the Volts/Hz mode of operation. Use the motor nameplate data recorded earlier to enter setup data parameter values.

Selecting Drive Operating Mode:

A. Vector (General Purpose): Use for General Purpose applications when a single motor is connected to the drive.

B. Vector (Variable Torque): Use for applications where the motor load varies as the speed of the motor varies and fast response of the drive to motor speed command changes is not required. Can only be used when a single motor is connected to the drive. (Fans and pumps)

C. Volts/Hz: Use for multiple motor applications where more than one motor is connected to the drive. Also use the Volts / Hertz mode if the motor horsepower rating and the drive horsepower rating differ by more than 1 horsepower size.

Step-by-Step Procedure for Step 3

A. Enter the drive Operating Mode in parameter 0-00.

   0-00 = 0000 Vector (General Purpose)
   “Default Setting”

   0-00 = 0001 Vector (Variable Torque)

   0-00 = 0002 Volts / Hz

B. If a value of 0002 (Volts/Hz) was entered for parameter 0-00, then skip to step K.

C. Enter Motor Rated Voltage from motor nameplate in parameter 0-01.

D. Enter Motor Rated Current from motor nameplate in parameter 0-02.

E. Enter Motor Rated Kilowatts (kW=HP x .746) from motor nameplate in parameter 0-03.

F. Enter Motor Rated Speed (RPM) from motor nameplate in parameter 0-04.

G. Enter Motor Rated Frequency from motor nameplate in parameter 0-05.

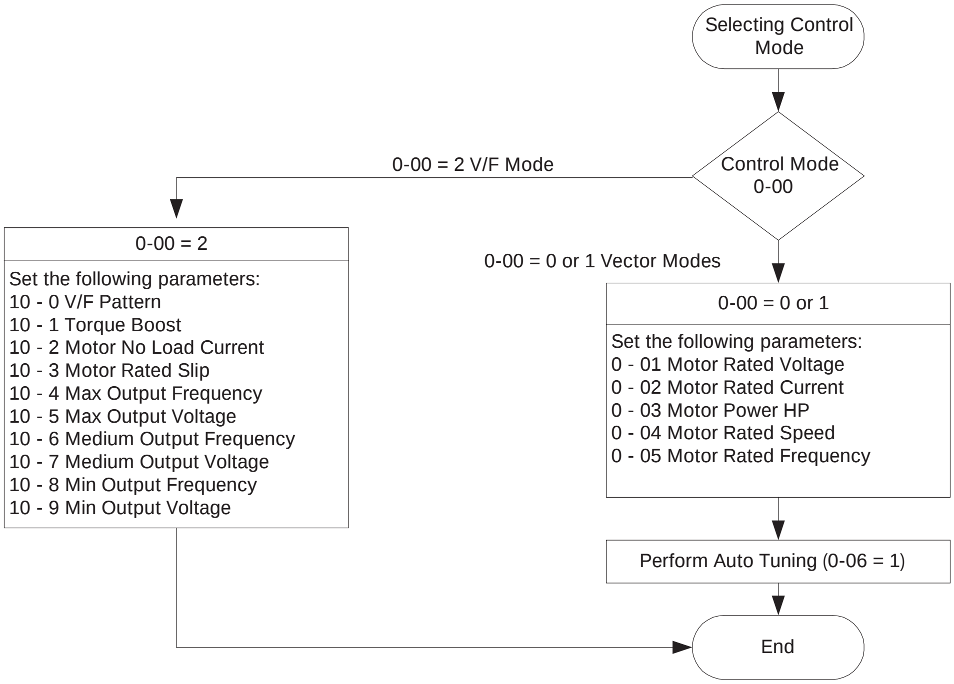
H. Set parameter 0-06 equal to 0001 (enable auto tuning). Press the key and the auto tuning function will start and the display will read “- At -”.

I. The motor will not rotate during the auto tuning process but voltage will be applied to the motor.

J. When the auto tuning is successful, the display will read parameter 0-06. Otherwise an auto tuning error will be displayed. Press the DSP FUNC key until the display reads “5.00” (frequency reference). Setup is completed. Skip the remaining steps K through O).

K. For Volts/Hz Operation, select a pattern in parameter 10-0 = 0-18 (See page 62 for more detailed information) each pattern selects default values for parameters 10-1 through 10-9. These values may require tuning to meet your application speed and torque requirements.

L. Parameter 10-0 = 18, allows for a custom Volts/Hz pattern to be entered in parameters 10-4 to 10-9 to meet specific applications. Refer to page 62.



Note: Auto Tuning cannot be carried out in V/F Mode. “Err2” will be displayed.

M. If the motor rated frequency is not 50 or 60 Hz, adjust parameter 10-4 to the desired motor rated frequency.

N. If you wish to operate the motor at a frequency higher than the motor rated frequency, adjust parameter 3-00 to the maximum frequency desired.

O. Press the DSP/FUNC key until the display reads “5.00” (frequency reference). Setup is now completed.

Step 4 - Check Motor Rotation

- Press RUN key (FWD LED should light), motor should start running, and the digital operator should display a value increasing from 00.00 to 05.00.
- Check motor rotation.

  If the motor does not rotate in the correct direction:

  Press STOP key. Remove AC power.

  Wait for LED “charge” lamp to extinguish.

  Reverse motor leads T1 and T2. Restart the drive and check the rotation.
- Press STOP key to stop the drive.

Step 5 - Check Full Speed at 50Hz/60Hz

- Frequency/Speed can be changed by pressing the ▲ or ▼ keys. To move left for next digit, press ◄/RESET key. Press the READ/ENTER key to set the speed.
- Set frequency to 50Hz/60Hz as applicable.
- Press RUN key and check drive acceleration to full speed.
- Press STOP key to stop drive and check deceleration.
- Display should now read the last set frequency.

Step 6 - Other Operations

The drive is now setup for basic Run/Stop operation in both forward and reverse directions from the keypad. For other motor control options see below.

A. Disable Reverse Operation: Set parameter 1-02 equal to 0001 to disable reverse operation. When set the FWD/REV button on the keypad will no longer function and any external reverse commands will stop the motor. Refer to page 44.

B. Change Acceleration Time: Parameter 3-02 sets the acceleration time in seconds. Acceleration Time is defined as the length of time to accelerate the motor from zero speed to Motor Rated Speed. Refer to page 48.

C. Change Deceleration Time: Parameter 3-03 sets the deceleration time in seconds. Deceleration Time is defined as the length of time to decelerate the motor from Motor Rated Speed to zero speed. Refer to page 48.

D. Set Maximum Speed: Parameter 3-00 sets the maximum output frequency to the motor. If Parameter 3-00 is set greater than the Motor Rated Frequency (parameter 0-05 for vector modes, parameter 10-4 for Volts/Hz mode), the motor will operate in the constant horsepower mode when motor rated frequency is exceeded. Refer to pages 43, 48 and 62.

E. Set Minimum speed: Parameter 3-01 sets the minimum output frequency to the motor. Refer to page 48.

F. Local / Remote Selection: By default, the drive is configured to use the UP/DOWN keys on the keypad (Local Control) to set the Frequency Reference (motor speed command) for the drive and the RUN/STOP key to control the starting and stopping of the motor (Local Control). Once parameters 1-00 and 1-06 are set to any value other than 0000, the drive recognizes it as REMOTE CONTROL. By pressing the RESET and FWD/REV keys simultaneously the drive switches between LOCAL CONTROL and REMOTE CONTROL or vice versa.

Note: Parameter 1-00 and 1-06 must be set to remote in order for this function to take effect.

G. Set Frequency Reference Source: Set Frequency Reference Source: change parameter 1-06 to change the frequency reference source as shown below. After setting parameter 1-06, remove AC input power, wait for the “Charged” LED to extinguish, and connect any devices to the drive as shown in Figure 1.

1. Parameter 1-06 = 000: The Up/Down Arrow Keys on the keypad set the Frequency Reference Command, Default Setting.

2. Parameter 1-06 = 0001: The Potentiometer Mounted on the Keypad Sets the Frequency Reference Command.

3. Parameter 1-06 = 0002: The Analog Voltage/Current connected to Terminal AIN sets the Frequency Reference Command.

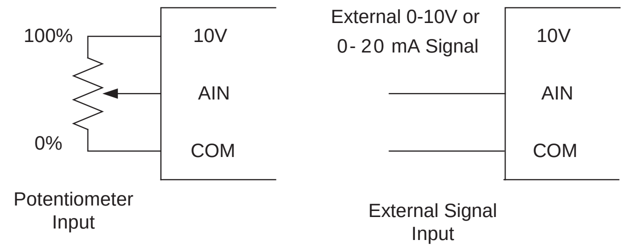


Figure 1

Set SW2 switch per Table 1 based on the type of analog signal connected to the drive (use 0 - 10 VDC position for potentiometer input).

	Type of external signal	Remarks
V I	0-10VDC analog signal	External control is 1-06 = 0002
V I	0-20mA analog signal	

Table 1

4. Parameter 1-06 = 0003: The Up/Down Digital Inputs (Digital Input Function Codes 14 and 15) set the Frequency Command. Set Parameters 5-03 to 0014 and 5-04 to 0015 and connect Up/Down pushbuttons to the drive as shown below in Figure 2.

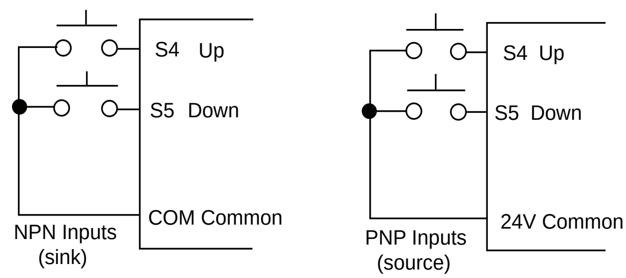


Figure 2

5. Parameter 1-06 = 0004: Serial Communications set the Frequency Command. Refer to the serial communications document for more detailed information.

H. Set for External Start / Stop Control: By default, the drive is configured to use the keypad pushbuttons to start and stop the drive. To enable starting and stopping the drive using external switches or pushbuttons, set parameter 1-00 equal to 0001 (External Terminal Control) and set parameter 1-01 to the desired value as described below. After setting parameters 1-00 and 1-01, remove AC input power, wait for the “Charged” LED to extinguish, and connect the switches or pushbuttons as shown in Figures 3-A, 3-B, and 3-C.

Set Switch SW1 according to the desired type of digital input used:

SW1	Type of external signal	Remarks
NPN	NPN input (sink) (Zero volts on the input terminal is ON)	Active Low
PNP	PNP input (source) (24 VDC on the input terminal is ON)	Active High Factory Default

1. Parameter 1-01 = 0000:
   Forward/Stop -Reverse/Stop

   a. Input signal is NPN (Active Low)
   b. Input signal is PNP (Active High)

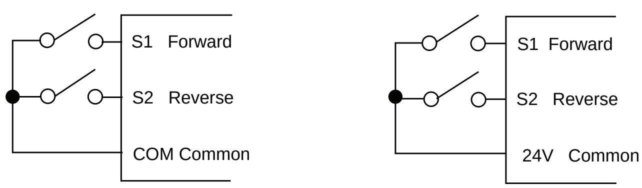


Figure 3-A

If both forward and reverse commands are applied at the same time, the drive will stop. Functions of Digital Inputs S1 and S2 are overridden by this command.

2. Parameter 1-01 = 0001:
   Run/Stop - Forward/Reverse

   a. Input signal is NPN (Active Low)
   b. Input Signal is PNP (Active High)

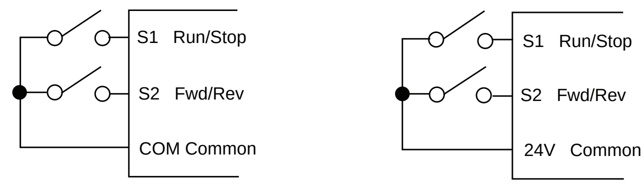


Figure 3-B

Functions of Digital Inputs S1 and S2 are overridden by this command.

3. Parameter 1-01 = 0002:
   3 Wire Control Mode, Run/Stop - Forward/Reverse

   a. Input signal is NPN (Active Low)
   b. Input signal is PNP (Active High)

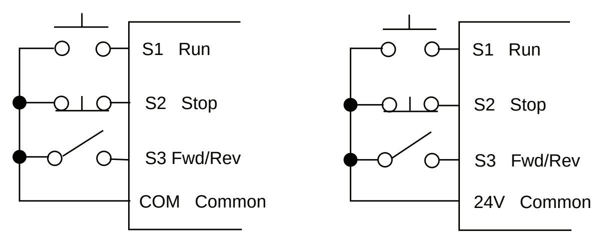


Figure 3-C

Functions of Digital Inputs S1, S2, and S3 are overridden by this command.

Note: If parameter 1-02 = 0001, then the reverse commands in all of above figures will act like a stop command.

Chapter 0 Preface

0.1 Preface

To extend the performance of the product and ensure your safety, please read this manual thoroughly before using the drive. Should there be any problem in using the product that cannot be solved with the information provided in this manual, contact your nearest Boston Gear distributor or our sales representatives who will be willing to help you.

- Precautions

Drive is an electrical electronic product. For your safety, there are symbols such as "Danger", "Caution" in this manual to remind you to pay attention to safety instructions on handling, installing, operating, and checking the drive. Be sure to follow the instructions for highest level of safety.

⚠DANGER Indicates a potential hazard could cause death or serious personal injury if misused.

⚠CAUTION Indicates that the drive or the mechanical system might be damaged if misused.

⚠DANGER
• Do not touch any circuit board or components if the charging indicator is still lit after the power is turned off. • Do not wire when the drive is electrified. Do not check parts and signals on circuit boards during the drive operation. • Do not disassemble the drive and modify internal wires, circuits and parts. Ground the ground terminal of the drive properly. As for 200V class ground to 10Ω or below, 400V class ground to 10Ωor below.

⚠CAUTION
• Do not perform a voltage test on parts inside the drive. High voltage will easily destroy semi-conductor parts. • Do not connect T1(U), T2 (V), and T3 (W) terminals of the drive to AC power supply. • CMOS IC's on the drive's main board are susceptible to static electricity. Do not touch the main circuit board.

0.2 Product Inspection

Boston Gear drives have passed all the function tests before delivery. Please check the following when you receive and unpack the drive:

- The model and capacity of the drive are the same as those specified in your purchase order.
- Check for any damages caused by transportation. If so, please do not apply the power, and contact Boston Gear sales representatives if any of the above problems occur.

Chapter 1 Safety Precautions

1.1 Operation Precaution

⚠CAUTION
The line voltage applied must comply with the drives specified input voltage.

⚠DANGER
Make sure the main circuit connections are correct. L1 (L), L2 and L3 (N) are power-input terminals and must not be mistaken for T1, T2 and T3. Otherwise, the drive might be damaged.

⚠CAUTION

- To prevent the front cover from disengaging, do not hold by the cover during handling or the heat sink may fall off. If the inverter is dropped it may be damaged or cause personal injury.
- To avoid the risk of fire, do not install the inverter on a flammable surface. Install it on nonflammable object such as metal.
- If several drives are placed in the same control panel, add extra cooling to keep the temperature below 50°C to avoid overheat or fire.
- When removing or installing the operator, turn OFF the power first, and manipulate the operator following the instruction diagram to avoid operator error or no display caused by bad contact.

⚠WARNING

This is a product of the restricted sales distribution class according to IEC 61800-3. In a domestic environment this product may cause radio interference in which case the user may be required to take appropriate measures.

1.1.2 During Power ON

⚠DANGER

- Do not plug or unplug the connectors on the drive when electrified to avoid the control panel damage resulting from erratic transition voltage surge.
- When momentary power loss is longer than 2 seconds (the larger the horsepower, the longer the time); the drive does not have enough storage power to control the circuit. Therefore, when power is restored, the operation of the drive is based on the setup of 1-00 / 2-05 and the condition of external switches, this is considered to be restart in the following paragraphs.
- When the momentary power loss is short, the drive still has enough storage power to control the circuit. Therefore, when power is restored, the inverter will automatically restart depending on the setup of 2-00/2-01.

⚠DANGER

- When restarting the drive, the operation of the drive is based on the setup of 1-00 and 2-05 and the condition of external switch (FWD/REV button). Attention: the start operation is irrelevant with 2-00/2-01/2-02/2-03.

  1. When 1-00=0000, the drive will not automatically run after restart.
  2. When 1-00=0001 and the external switch (FWD/REV button) is OFF, the drive will not run after restart.
  3. When 1-00=0001, the external switch (FWD/REV button) is ON, and 2-05=0000, the inverter will run automatically after restart.

     Attention: For safety, please turn off the external switch (FWD/REV button) after power loss to avoid consequential damage to the machine and the personnel after sudden restoration of power.

- To ensure the safety of people and machine, please refer to the description and suggestion of 2-05.

1.1.3 Before Operation

⚠DANGER

Make sure the model and capacity are the same as those set by 15-0.

⚠CAUTION

The drive will flash the power voltage set by 0-07 for 5 seconds when applying power.

1.1.4 During Operation

⚠DANGER

Do not engage or disengage the motor during operation. The resulting over current may cause the inverter to trip or power components to fail.

⚠DANGER

- To avoid electric shock, do not take the front cover off while energized.
- The motor will restart automatically after stop when auto-restart function is on. In this case, stay clear of the machine.
- **Note:** The stop switch is different from the emergency stop switch. It must be set first to be effective.

⚠CAUTION
• Do not touch heat-generating components such as heat sink and braking resistor. • The drive can run the motor from low speed to high speed. Verify the allowable capacities range of the motor and the mechanism. • Note the settings related to the braking resistor. • Do not check signals on circuit boards while the drive is running.

⚠CAUTION
Wait 5 minutes before disassembling or checking the components after power supply OFF and the LED indicator turned off.

1.1.5 During Maintenance

⚠CAUTION
The drive should be used in an environment with temperature from -10°C to +40°C and relative humidity of 95% non-condensing.

⚠CAUTION
When the drive top cover has been removed, it can be used in an environment with temperature from -10°C to +50°C and relative humidity of 95%, but the environment should be free from water and metal dust.

Chapter 2 Definition Of Models

Drive Model
Input Phase
Input Voltage
Input Current
Output Specification
Output Voltage
Output Current

CAUTION

Do not inspect components unless the lamp is off. See manual for proper installation and operation.

PART NUMBER

INPUT
VOLTAGE
Amps

OUTPUT AC 3 phases 0-650Hz
VOLTAGE
Amps

IP20 / UL Open-Type with shielding cover removed (rated -10°C to 50°C Ambient).
NEMA 1/UL Type 1 with shielding cover and optional conduit box kit installed (rated -10°C to 40°C Ambient).

LISTED 16KJ
POWER CONV.EQ.
E177007

Made In Taiwan

Part Number

ACE15 2V 3P 0020 C

- ACE15: ACE15 Series
- 2V: 2V-230 VAC, 4V-460 VAC
- 3P: 1P-Single Phase, 3P-Three Phase
- 0020: 0005-.5 HP, 0010-1 HP, 0020-2 HP, 0030-3 HP, 0050-5 HP, 0075-7.5 HP, 0100-10 HP, 0150-15 HP
- C: C-Chassis

Chapter 3 Ambient Environment and Installation

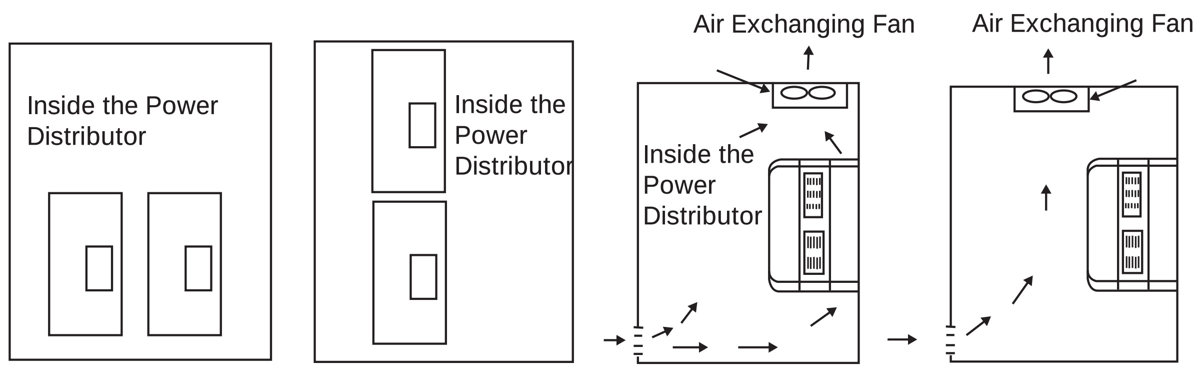
3.1 Environment

The environment will directly affect the proper operation and the life span of the drive, so install the drive in an environment complying with the following conditions:

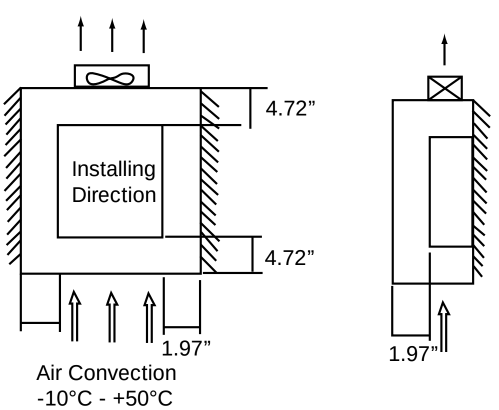
Place the front side of the drive forward and top upward to insure proper airflow over the Heat sink.

Install the drive according to the following figures: (Take the dustproof cover off for cooling if it is installed in a box or the environment allows)

• Ambient temperature: -10°C - +40°C; without cover: -10°C - +50°C	
• Avoid exposure to rain or moisture.	• Avoid direct sunlight
• Avoid oil mist and salinity.	• Avoid corrosive liquid and gas.
• Avoid dust, washdown and small metal pieces.	• Keep away from radioactive and flammable materials.
• Avoid electromagnetic interference (soldering machine, power machine).	
• Avoid vibration (punching machine). Add a vibration-proof pad if the situation cannot be avoided.	
• If several drives are placed in the same control panel, add extra cooling to keep the temperature below 50°C.	



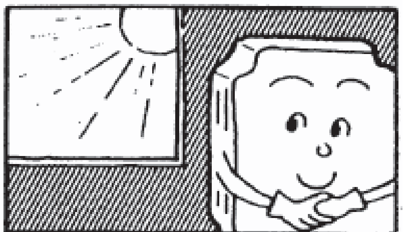
(Correct Configuration) (Incorrect Configuration) (Correct Configuration) (Incorrect Configuration)



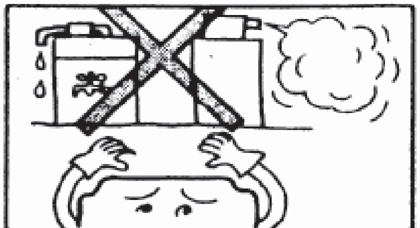
a. Front View b. Side View

3.2 Environmental Precautions

Do not use the drive in an environment with the following conditions:

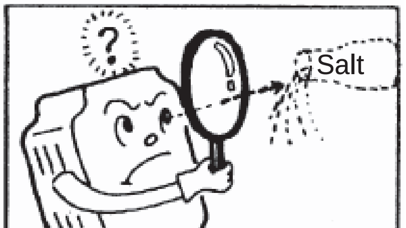


Direct sunlight



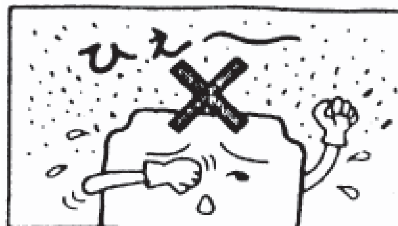
Corrosive gas and liquid

Oil Mist

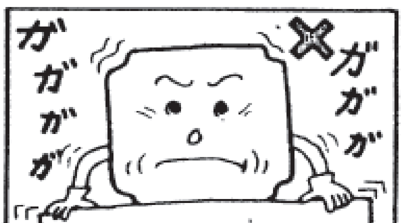


Salt

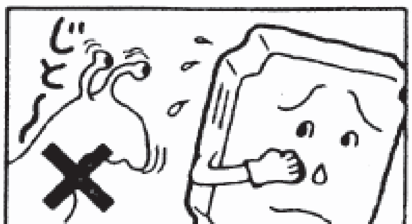
Wind, rain, and water drops



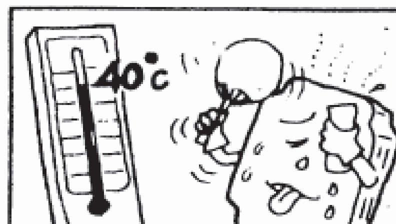
Iron filings, dust



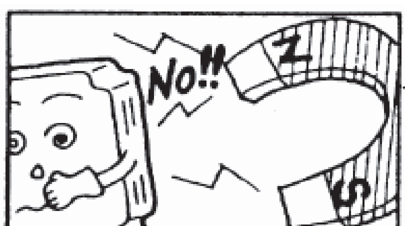
Strong vibration



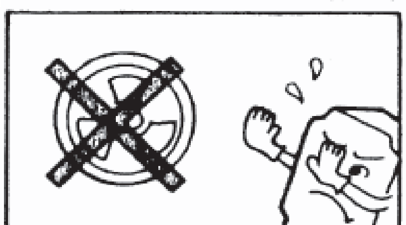
Extreme low temperature



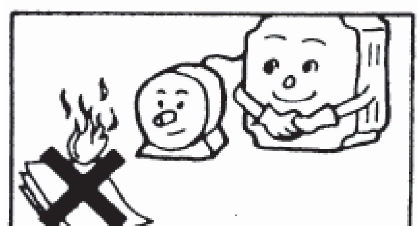
Excessive high temperature



Electromagnetic wave and ultra high wave
(Near an electric welding machine)



Radioactive materials



Inflammable materials

3.3 Wiring Practices

3.3.1 Notice for Wiring

A. Screwdriver torque:

Wiring with a screwdriver or other tools, follow the torque values listed below:

Securing Torque			
Horsepower	Power Source	Nominal torque for TM1 Terminal	
0.5/1	200-240V	0.59/0.08 (lbs.-ft./KG-M)	7.10/8.20 (lbs.-in./KG-CM)
1/2	380-480V		
2/3/5/7.5/10	200-240V	1.5/0.21 (lbs.-ft./KG-M)	18.00/20.28 (lbs.-in./KG-CM)
3/5/7.5/10/15	380-480V		

B. Power wires:

Power wires are connecting to L1, L2, L3, T1, T2, T3, P, BR and P1. Choose wires in accordance with the following criteria:

1 Deciding diameters of wires should be based on rating working at 105°C.

2. For rating voltage of wires, the minimum voltage of 230VAC type is 300V, and 460VAC type is 600V.

C. Control wires:

Control wires are wires connecting to TM2 control terminal. Choose the wire in accordance with the following criteria:

1. Deciding diameters of wires should be based on rating working at 105°C.

2. For rating voltage of wires, the minimum voltage of 230VAC type is 300V, and 460VAC type is 600V.

3. To avoid noise interference, do not route the control wires in the same conduit with power wires and motor wires.

D. Nominal electrical specifications of the terminals Block:

The following list is nominal values of TM1:

Horsepower	Power Source	Volts	Amps
0.5/1/2	200-240V	600	15
1/2	380-480V		
5/7.5/10	200/240V	600	40
3/5/7.5/10	380-480V		
15	380/480V	600	40

Note: Nominal values of input and output signals (TM2) - follow the specifications of class 2 wiring.

E. Fuse types

To protect the drive most effectively, use fuses with current-limit function.

Horsepower	Power Source	Rated Fuse Specifications
7.5/10	200~240V	50A, 660VAC, 100KA I.R.
7.5	380~480V	32A, 660VAC, 100KA I.R.
10		40A, 660VAC, 100KA I.R.
15		50A, 660VAC, 100KA I.R.

Notes:

- To avoid shock hazards, do not touch any electrical component when the power is applied or after five minutes from when the plug is power unplugged. Other actions could be performed after the charge indicator goes off.
- Do not perform wiring on the drive while it is still electrified. Disregarding this notice could cause serious injury or death. This product is designed to use in Pollution Degree 2 environments or equivalent environments.

3.3.2 Applicable Specifications of Magnetic Contactor and Wires

Molded-case circuit breaker/magnetic contactor

Boston Gear bears no responsibility to service for failures caused by the following conditions:

1. A molded-case circuit breaker is not installed, or an improper or overrated breaker is used, between the power source and the drive.

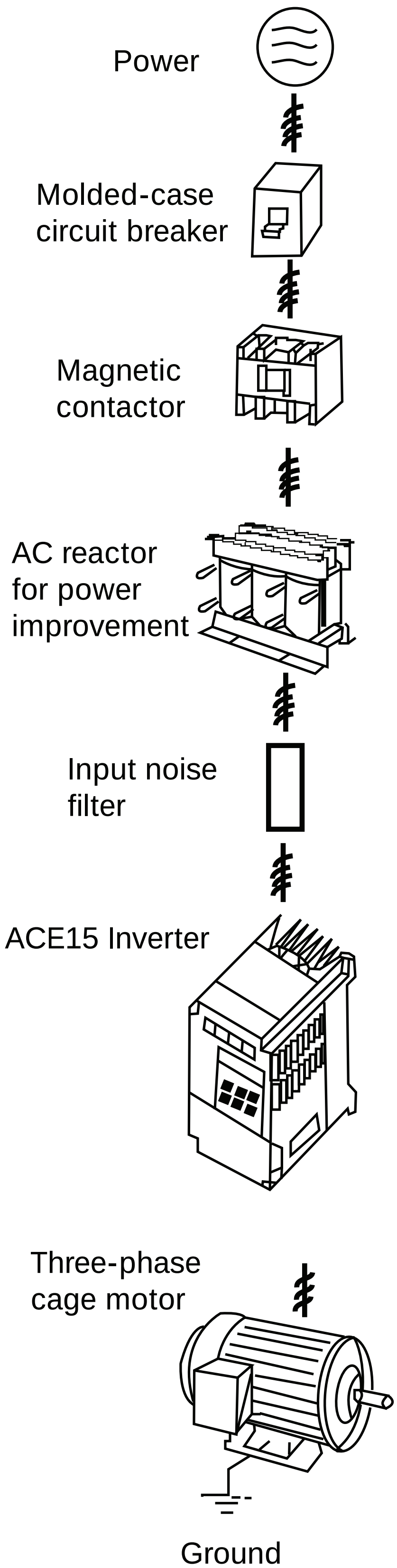
2. A magnetic contactor, a phase capacitor, or a surge absorber is connected between the drive and the motor.

ACE15 Series 230VAC-3 Phase	ACE152V3P						
	0005C	**0010C**	**0020C**	**0030C**	**0050C**	**0075C**	**0100C**
Molded-case circuit breaker	10A	20A	30A	30A	30A	50A	60A
Main circuit terminals (TM1) L1 / L2 / L3 T1 / T2 / T3 P / P1 / BR	Wire gauge 14AWG Terminal screw M4	Wire gauge 12AWG Terminal screw M4	Wire gauge 12AWG Terminal screw M4	Wire gauge 8AWG Terminal screw M4	Wire gauge 8AWG Terminal screw M4	Wire gauge 4AWG Terminal screw M6	Wire gauge 4AWG Terminal screw M6
Signal terminals (TM2) 1 - 16	Wire gauge (# 18 AWG, terminal screw M3)						

ACE15 Series 460VAC-3 Phase	ACE154V3P			
	0010C, 0020C, 0030C, 0050C	**0075C**	**0100C**	**0150C**
Molded-case circuit breaker	15A	20A	30A	50A
Main circuit terminals (TM1) L1 / L2 / L3 T1 / T2 / T3 / P / P1 / BR	Wire gauge 12AWG Terminal screw M4	Wire gauge 12AWG Terminal screw M4		Wire gauge 4AWG Terminal screw M6
Signal terminals (TM2) 1 - 16	Wire gauge (#18 AWG, Terminal Screw M3)			

- Use three-phase induction motor with capacity suitable for the drive.
- One drive is driving several motors, the total current of all motors running simultaneously must be less than the capacity of the drive, and each motor has to be equipped with a proper overload relay.
- Do not add capacitive component, such as a phase capacitor, LC or RC, between the drive and the motor.

3.3.3 Precautions for Peripheral Applications



Power supply:

- Make sure the voltage applied is correct to avoid damaging the drive.
- A molded-case circuit breaker must be installed between the AC source and the drive.

Molded-case circuit breaker:

- Use a molded-case circuit breaker that conforms to the rated voltage and current of the drive to control the power ON/OFF and protect the drive.
- Do not use the drive as the switch for run/stop switch.

Leakage breaker:

- Install a leakage breaker to prevent error operation caused by electric leakage and to protect operators.

Magnetic contactor:

- Normal operations do not need a magnetic contactor. But a contactor has to be installed in primary side when performing functions such as external control and auto restart after power failure, or when using brake controller.
- Do not use the magnetic contactor as the run/stop switch of the drive.

AC reactor for power improvement:

- When drives below 200V/400V 20HP are supplied with high capacity (above 600KVA) power source, an AC reactor can be connected to improve the power system performance.

Input noise filter:

- A filter must be installed when there is inductive load around the drive.

Drive:

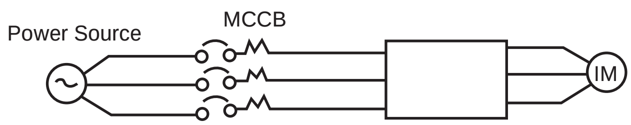
- Input power terminals L1, L2, and L3 can be used in any sequence regardless of phases.
- Output terminals T1, T2 and T3 are connected to U, V, and W terminals of the motor. If the motor is reversed while the drive is forward, just swap any to terminals or T1, T2, and T3.
- To avoid damaging the drive, do not connect the terminals T1, T2, and T3 to AC power.
- Connect the ground terminal properly. 200 V series: class 3 grounding, <100Ω; 400 V series: <10Ω.

Make external connections according to the following instructions. Check connections after wiring to make sure all connections are correct. (Do not use the control circuit buzzer to check connections.)

A. Main circuit's wiring must separate from other high voltage or high current power line to avoid noise interference. Refer to the figures below.

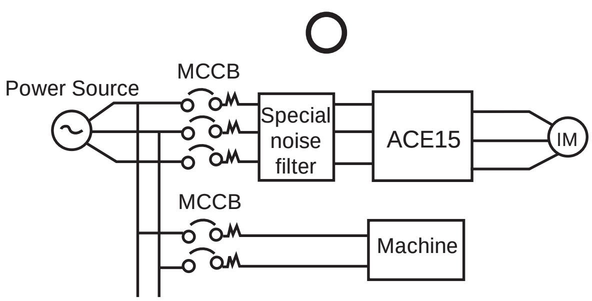
- A noise filter in the output of the main circuit can suppress conductive noise. To prevent radiated noise, the wires should be put in a metal pipe and distance from signal lines of other control machines for more than 30 cm.

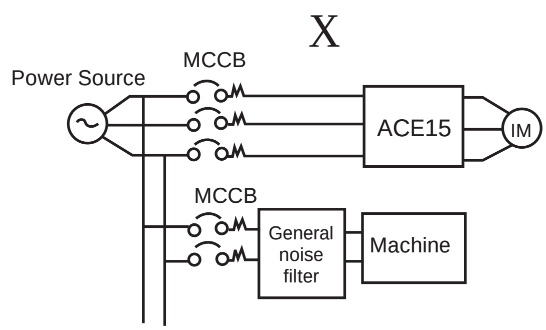
- The drive uses dedicated power line. A general noise filter may not provide desired results.

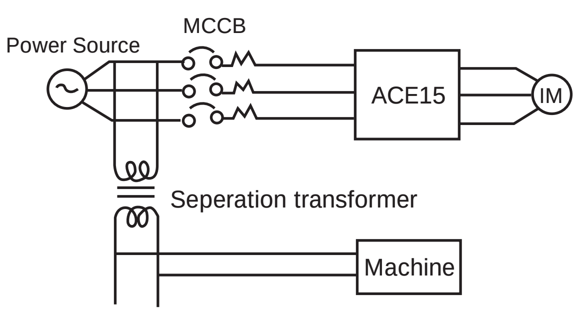


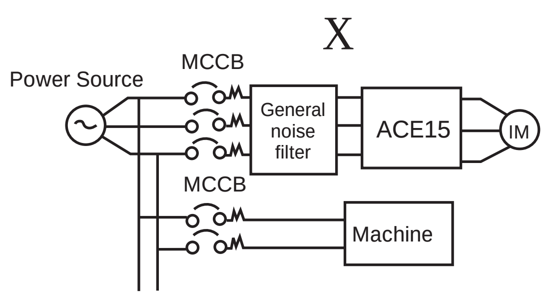
- Add a noise filter or separation transformer when missing.

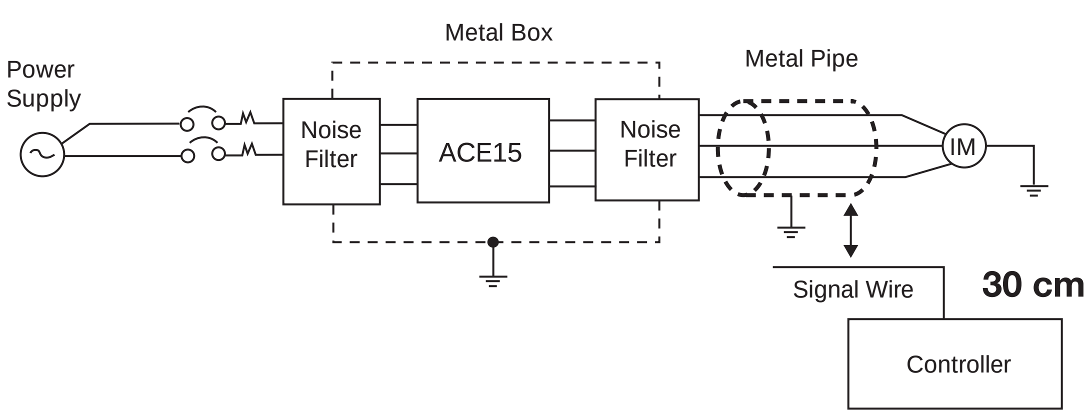
- The Drive shares the power line with other machines.











- When the connection between the drive and the motor is long, consider the voltage drop of the circuit. Phase-to-phase voltage drop (V) = $\sqrt{3}$ x resistance (Ω/km)e x length of line (m) x currentx 10^{-3}. And the number of conductors must be adjusted based on the length of the line.

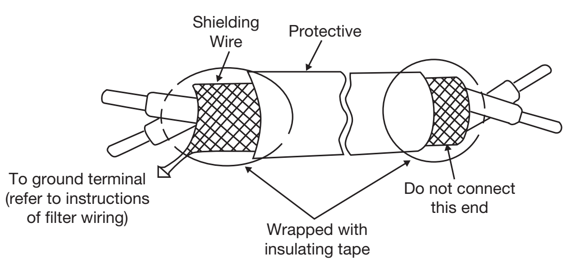
The length of the cabling between the drive and motor	Less Than 82 ft. (25m)	Less Than 164 ft. (50M)	Less Than 328 ft. (100m)	More Than 328 ft. (100m)
Number of carriers allowed	16kHz and below	12kHz and below	8kHz and below	5kHz and below
Settings of Parameter 3-22	16	12	8	5

B. The wiring of the control circuit must be separated and routed away from the main circuit wiring and other high voltage or current power lines to avoid noise interference.

To avoid problems caused by noise interference, shield the control circuit wiring with a twisted wire, and connect the shielded wire to a ground terminal. Refer to the figure below.

The wiring distance should not exceed 165 ft.

C. Ground the ground terminal of the drive properly.



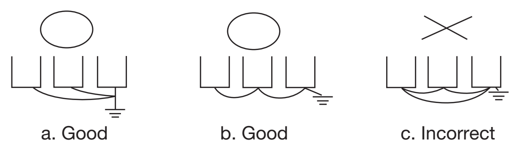
For 230V class ground 100Ω or less; for 480V class ground 10Ω or less.

- Ground wiring is based on the electrical equipment technical basis (AWG). The shorter the distance the better.

- Do not share the ground of the drive with other high current loads (welding machine, high power motor). Connect the terminals to ground respectively.

- Do not make a loop when several drives share a common ground point.

D. To ensure maximum safety, use proper wire gauges (AWG) for the main power circuit and control circuit according to relative regulations.



E. After wiring, check that the wiring is correct, wires are intact, and terminal screws are secured.

3.4 Specifications

3.4.1 Product Specifications

Single phase, 200-240VAC Model

ACE152V1P_ _ _ _ _	0005C	0010C	0020C	0030C
Horsepower (HP)	0.5	1	2	3
Suitable Motor Capacity (kW)	0.4	0.75	1.5	2.2
Rated Output Current (A)	3.1	4.5	7.5	10.5
Rated Capacity (KVA)	1.2	1.7	2.9	4.0
Max. Input Voltage	Single Phase: 200~240V + 10%-15%, 50/60Hz ±5%			
Max. Output Voltage	Three Phases: 0~240V			
Input Current (A)	8.5	12	19	27
Net Weight (kg)	1.2 (1.3)	1.2 (1.3)	1.5 (1.8)	1.9 (2.3)
Allowable momentary power loss time (second)	1.0	1.0	2.0	2.0

Three phase, 200-240 Volt Models

ACE152V3P_ _ _ _ _	0005C	0010C	0020C	0030C	0050C	0075C	0100C
Horsepower (HP)	0.5	1	2	3	5	7.5	10
Suitable Motor Capacity (kW)	0.4	0.75	1.5	2.2	3.7	5.5	7.5
Rated Output Current (A)	3.1	4.5	7.5	10.5	17.5	26	35
Rated Capacity (KVA)	1.2	1.7	2.9	4.0	6.7	9.9	13.3
Max. Input Voltage	Three Phase voltage: 200~240V + 10% - 15%, 50/60Hz ± 5%						
Max. Output Voltage	Three Phase voltage: 0~240V						
Input Current (A)	4.5	6.5	11	15.4	20	29	40
Net Weight (kg)	1.2	1.2	1.2	1.75	1.9	5.6	5.6
Allowable momentary power loss time (second)	1.0	1.0	2.0	2.0	2.0	2.0	2.0

Three phase, 380-480 Volt Models

ACE154V3P_ _ _ _ _	0010C	0020C	0030C	0050C	0075C	0100C	0150C
Horsepower (HP)	1	2	3	5	7.5	10	15
Suitable Motor Capacity (kW)	0.75	1.5	2.2	3.7	5.5	7.5	11
Rated Output Current (A)	2.3	3.8	5.2	8.8	13.0	17.5	25
Rated Capacity (KVA)	1.7	2.9	4.0	6.7	9.9	13.3	19.1
Max. Input Voltage	Three Phase voltage: 380~480V + 10% - 15%, 50/60Hz ± 5%						
Max. Output Voltage	Three Phase voltage: 0~480V						
Input Current (A)	4.2	5.6	6	10.2	15	20.5	30.2
Net Weight (kg)	1.2 (1.3)	1.2 (1.3)	1.8 (2.2)	1.8 (2.2)	5.6 (6.6)	5.6 (6.6)	5.6 (6.6)
Allowable momentary power loss time (second)	1.0	1.0	2.0	2.0	2.0	2.0	2.0

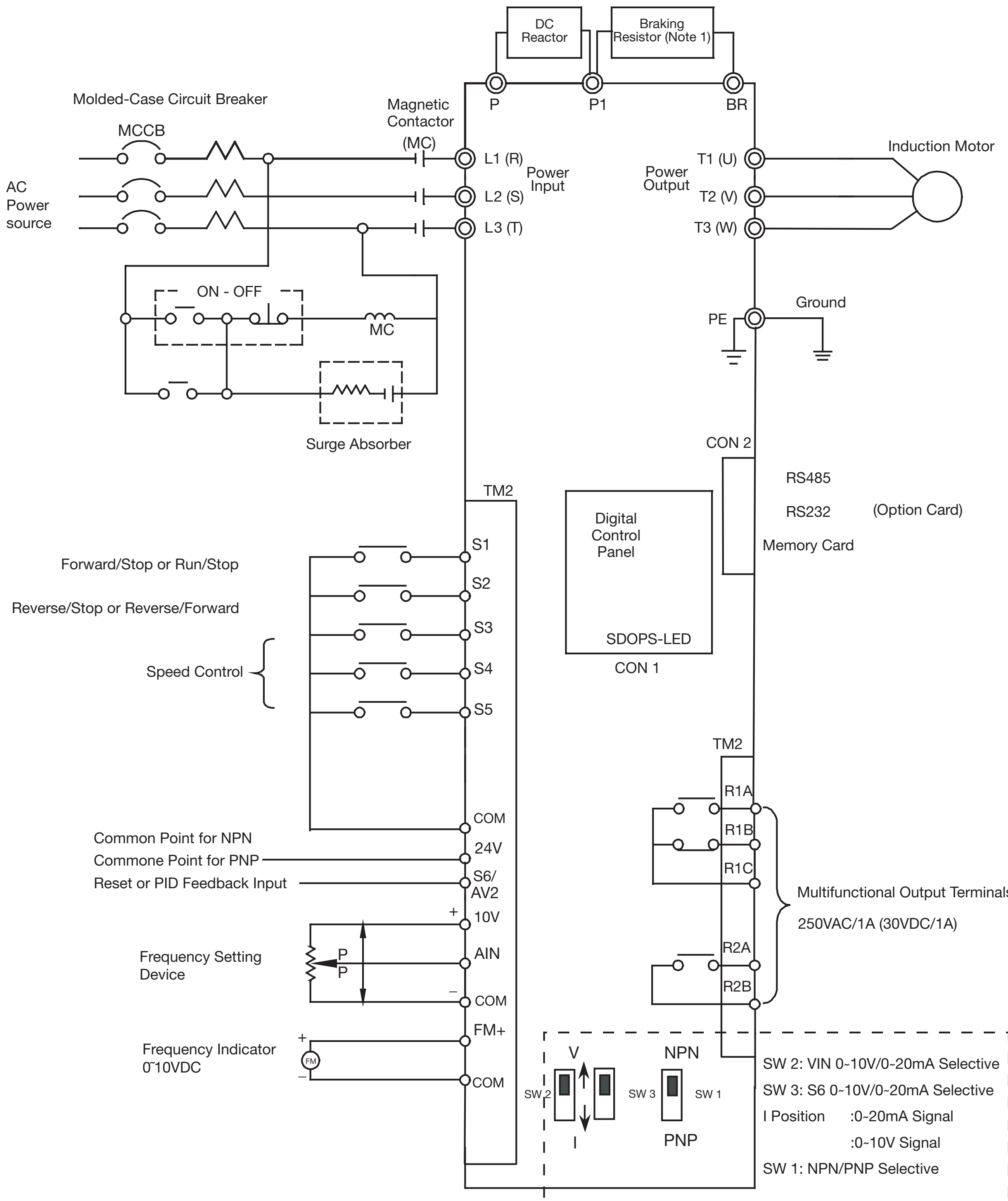
3.4.2 General Specifications

Item		ACE15 Compact Vector Drive
Control Mode		V/F or Current Vector Control
Frequency Control	Frequency Range	0.1~650.0 Hz
	Start Control Torque	150% x 1 Hz (Current Vector)
	Speed Control Range	1:50 (Current Vector)
	Speed Control Precision	±0.5% (Current Vector)
	Setting Resolution	Digital: 0.01 Hz (Note 1); Analog: 0.06 Hz/60 Hz (10 bits)
	Keypad Setting	Set directly with up or down keys or the VR on the keypad
	Display Function	Four digital LED (or 2x16 LCD) and status indicator; display frequency/speed/line speed/DC voltage/output voltage/current/rotation direction/drive parameter/trouble log/program version
	External Signal Setting	1. External variable resistor / 0-5V/0-10V/4-20mA/5-0V/10-0V/20-4mA 2. Performs up/down controls, speed control or automatic procedure control with multifunctional contacts on the terminal block (TM2)
	Frequency Limit Function	Respectively setting upper/lower frequency limits and three-stage prohibited frequencies
Carrier Frequency		2 ~ 16 kHz
V/F Pattern		18 fixable patters, 1 programmable pattern
Acc/Dec Control		Two-stage Acc/Dec time (0.1 - 3,600 seconds) and two-stage S curves (refer to descriptions on 3-05)
Multifunctional Analog Output		6 functions (refer to descriptions on 8-00/8-01)
Multifunctional Input		30 functions (refer to description on 5-00~5-06
Multifunctional Output		16 functions (refer to description on 8-02~8-03
Digital Input Signal		NPN (sink)/PNP (source) toggle
Other Function		Momentary Power Loss Restart, Speed Search, Overload Detection, 8 preset speeds. Acc/Dec Switch (2 Stages), S Curves, 3-wire Control, PID Control, Torque Boost, Slip Compensation, Frequency Upper/Lower Limit, Auto energy saving, Modbus slave and PC/PDA Link, Auto Restart, Built-in Simple PLC Function.
Communication Control		1. Control by RS232 or RS485 2. One to one or One to more (RS485 ONLY) control 3. BAUD RATE/STOP BIT/PARITY/ bit can be set
Braking Torque		About 20% stand alone, with the built-in braking transistor and connected braking resistor is 100%
Operation Temperature		-10 ~ 50°C (Note 2)
Storage Temperature		-20 ~ 60°C
Humidity		0 - 95% Relative Humidity (Non-condense)
Vibration Sustention		1G (9.8m/s 2)
EMC		Comply with requirement EN 61800-3 with optional Filter
LVD		Comply with requirement EN 50178
Enclosure		IP20 (NEMA 1 by external box attached)
Safety Level		UL 508C
Protective Functions	Overload Protection	The relay to protect the motor (the curve can be set) and the drive is rated at 150% / 1 min
	FUSE Protection	The motor stops after FUSE is damaged
	Over Voltage	200V class: DC Voltage: 410V 460V class: DC Voltage: 820V
	Under Voltage	200V class: DC Voltage: 190V 460V class: DC Voltage: 380V
	Momentary Power Loss Restart	Stop for more than 15ms-power-loss can be restarted with spin start after momentary power loss in Max 2 sec. 15ms
	Stall Prevention	Stall prevention for Acceleration/Deceleration/Operation
	Short-circuit Output Terminal	Electronic Circuit Protection
	Grounding Fault	Electronic Circuit Protection
	Other Function	Protection for overheating of heat sink, over torque detection, error contact control, reverse restriction, restrictions for direct start after power up and error recovery, parameter lock up

Note 1: The setting resolution of above 100Hz is 0.1Hz when controlled with operation keypad, and 0.01 Hz when controlled using computer (PC) or programmable logic controller (PLC)

Note 2: -10 ~ 50°C in distributor (without dust-proof cover). -10 ~ 40°C outside distributor (with dust-proof cover).

3.5 Wiring Diagram ACE15 Series Drive



Note 1: Please refer to description of main circuit terminals (P1, BR) and specification of braking resistor for value selection. (Table 6.2 Dynamic Braking Resistor)

3.6 Description of Terminals

Description of main circuit terminals

Terminal	Description
L1 (L)	Main power input: Single-phase: L/N Three-phase: L1/L2/L3
L2	
L3 (N)	
P1	Braking resistor or connecting terminal: Used in cases where the drive frequently trips due to large load inertia or short deceleration time (refer to specifications of braking resistor) (also see Table 6.2)
BR	
P1 and P	DC reactor connecting terminals
T1	Drive output
T2	
T3	

Description of ACE15 control circuit terminals

Terminal	Description		
R2A	Multifunctional terminal - Normally open		Contact rated capacity: (250VAC/1A or 30VDC/1A) Contact using description: (refer to page 59)
R2B			
R1C	Common contact	Multifunctional terminals- Normally open	
R1B	Normally close contact		
R1A	Normally open contact		
10V	Speed Potentiometer (VR) power source terminal (referenced to COM) terminal		
AIN	Analog frequency signal input terminal (refer to page 54 for description)		
24V	Common contact for S1~S5 in PNP (sink) input. Short-circuit pin 2 and pin 3 (refer to ACE15 wiring diagram) of SW1 when used PNP (sink) input		
COM	Common contact for S1~S5 in NPN (source) input. Short-circuit pin 2 and pin 3 (refer to ACE15 wiring diagram) of SW1 when used NPN (source) input		
FM+	The positive analog output for multifunction (refer to page 59 for description) the signal for output terminal is 0-10VDC		

Terminal	Terminal Description
S1	Multifunction input terminals (refer to page 54 for description)
S2	
S3	
S4	
S5	
S6/AV2	PID input terminal (refer to page 54 for description)

Description of SW function

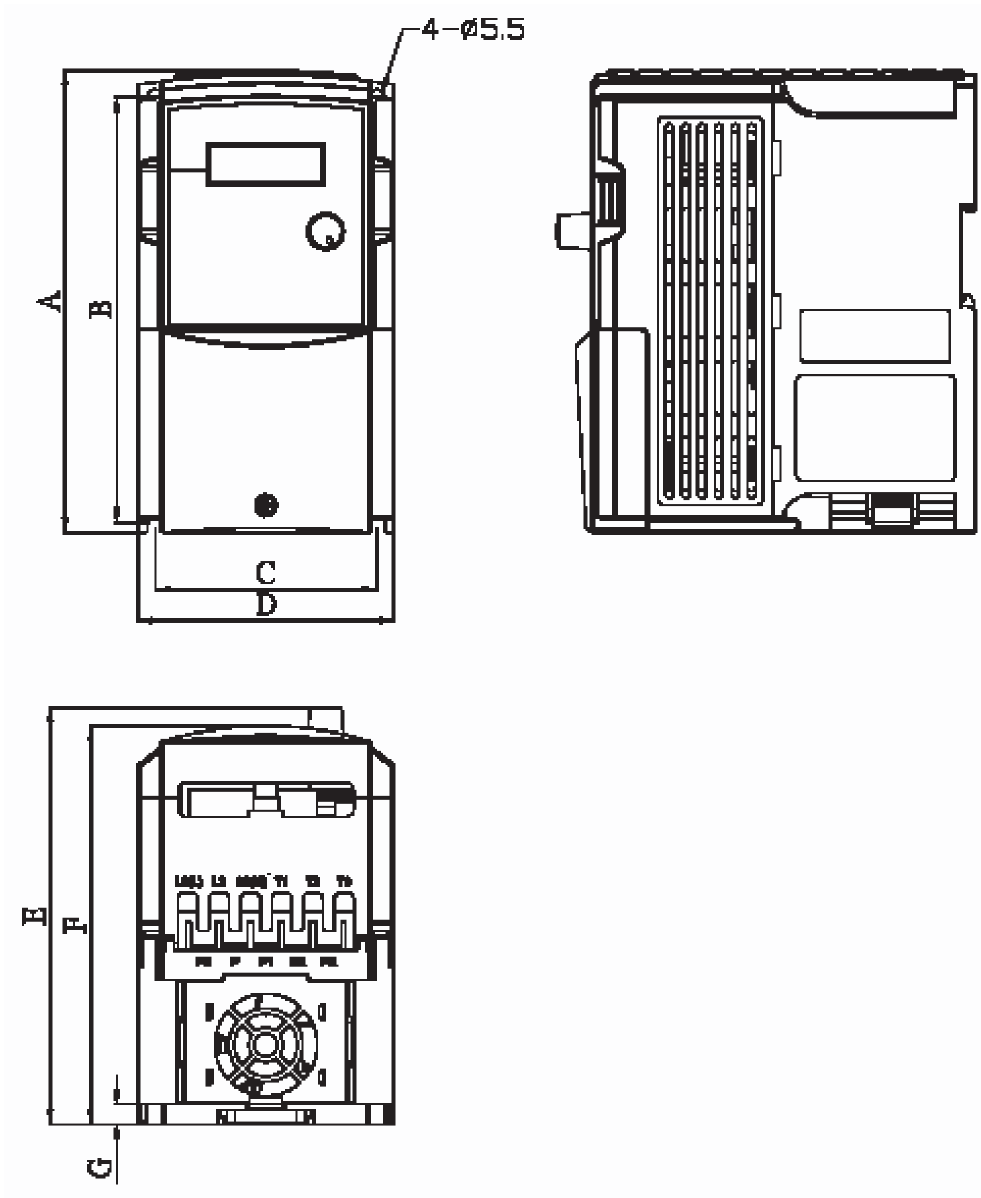
SW2/SW3	Type of external signal	Remarks
 V I	0-10VDC analog signal (Factory Default)	External control is 1-06 = 0002 SW2 determines for AIN signal SW3 determines for S6/AV2 signal
 V I	0-20mA analog signal	

SW1	Type of external signal	Remarks
 NPN	NPN input (sink)	Active Low
 PNP	PNP input (source) (Factory Default)	Active High

3.7 Outline Dimensions

1. Frame 1: ACE152V1P0005C, ACE152V1P0010C, ACE152V3P0005C, ACE152V3P0010C, ACE152V3P0020C, ACE154V3P0010C, ACE154V3P0020C

2. Frame 2: ACE152V1P0020C, ACE152V1P0030C, ACE152V3P0030C, ACE152V3P0050C, ACE154V3P0030C, ACE154V3P0050C

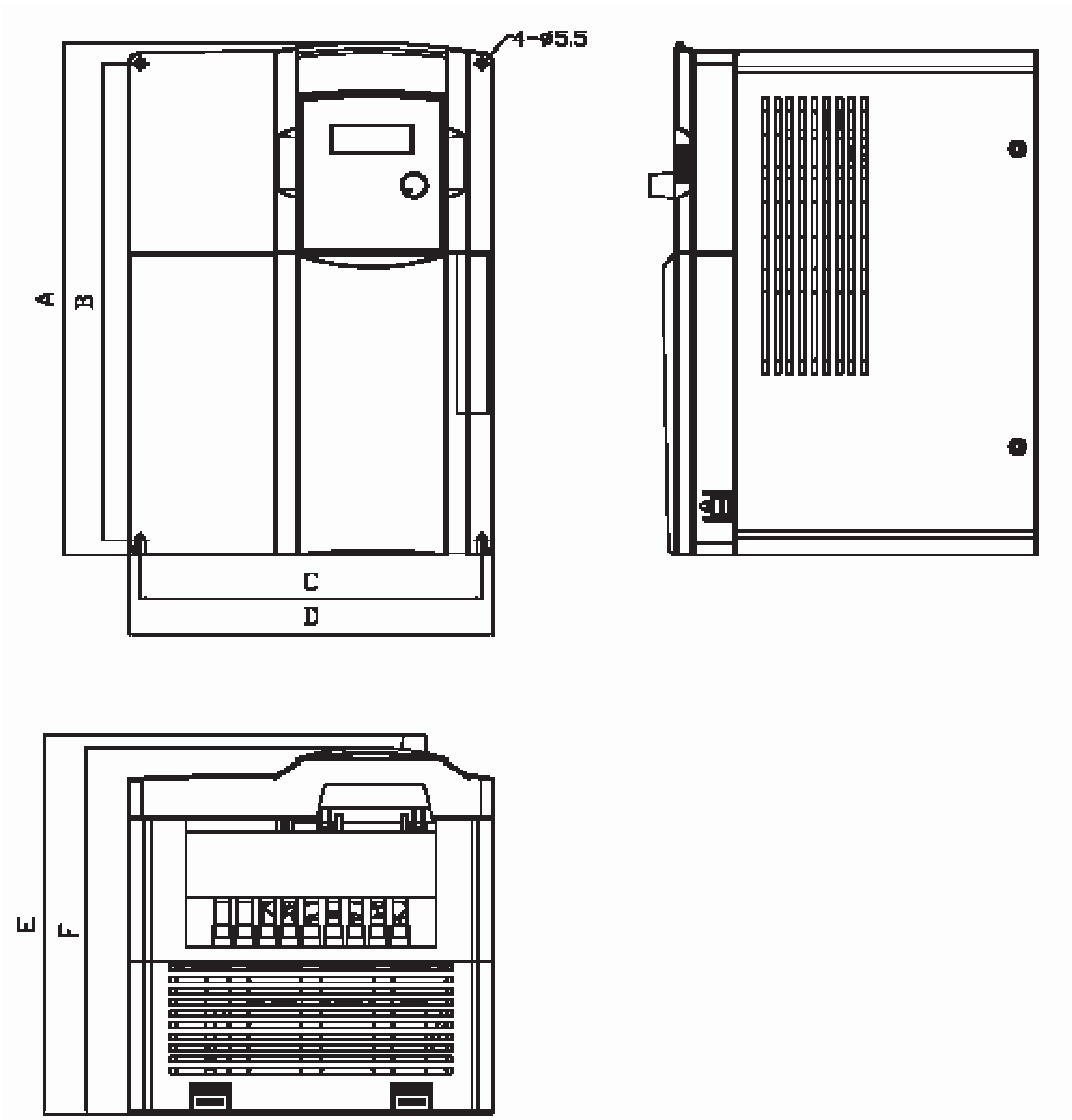


Unit - inch/mm

MODEL	A	B	C	D
Frame 1	6.42/163	5.9/150	3.07/78	3.54/90
Frame 2	7.36/187	6.71/170	4.51/114	5.04/128
MODEL	**E**	**F**	**G**	
Frame 1	5.79/147	5.55/141	0.28/7	
Frame 2	5.83/148	5.59/142	0.28/7	

3.7 Outline Dimensions (cont'd)

3. Frame 3: ACE152V3P0075C, ACE152V3P0100C, ACE154V3P0075C, ACE154V3P0100C, ACE154V3P0150C



Unit: inch/mm

Model	A	B	C	D	E	F
Frame 3	10.24/260	9.61/244	6.81/173	7.32/186	7.68/195	7.4/188

Chapter 4 Software Index

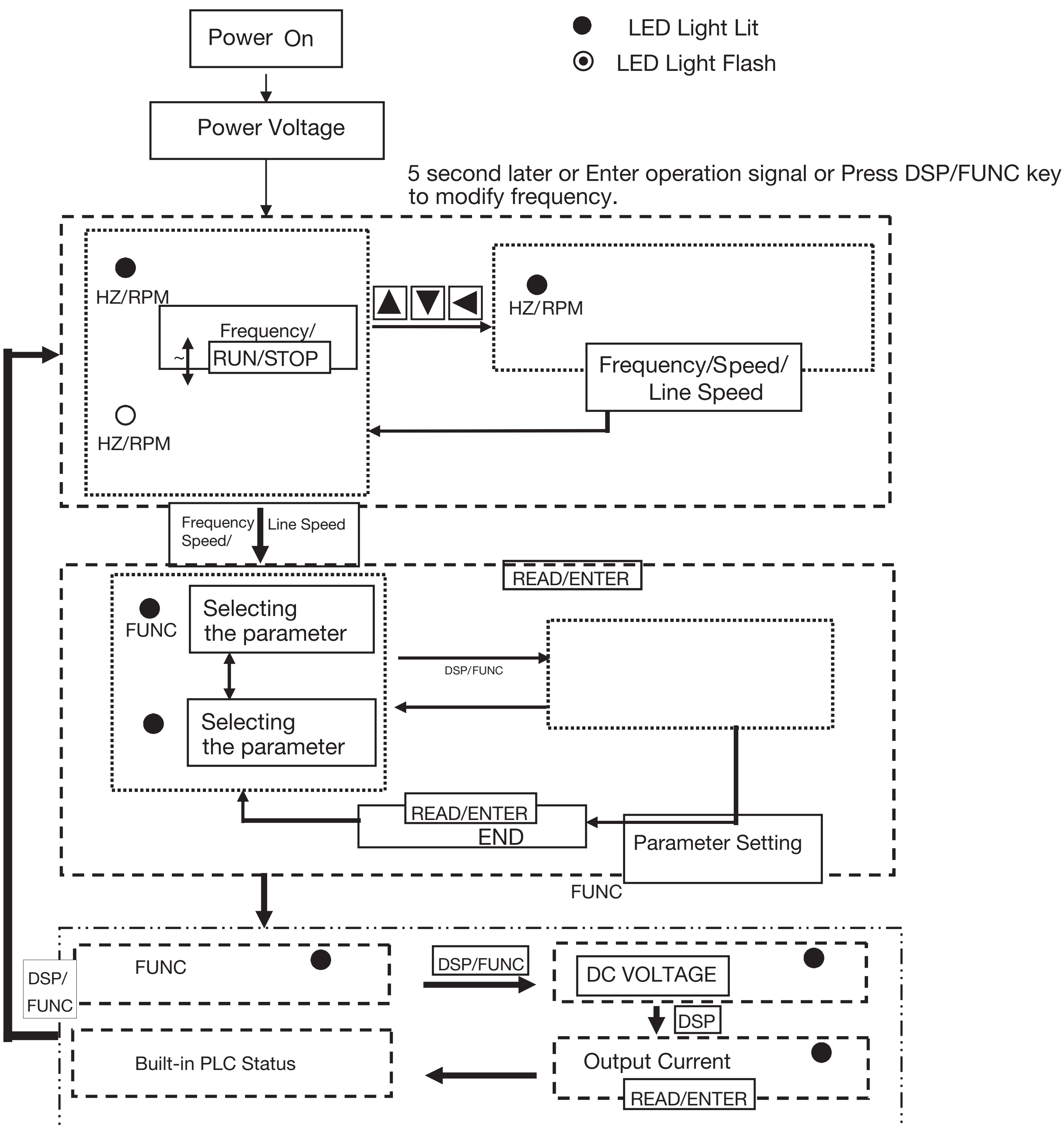
4.1 Keypad Description

4.1.1 Keypad Display and Operation Instructions

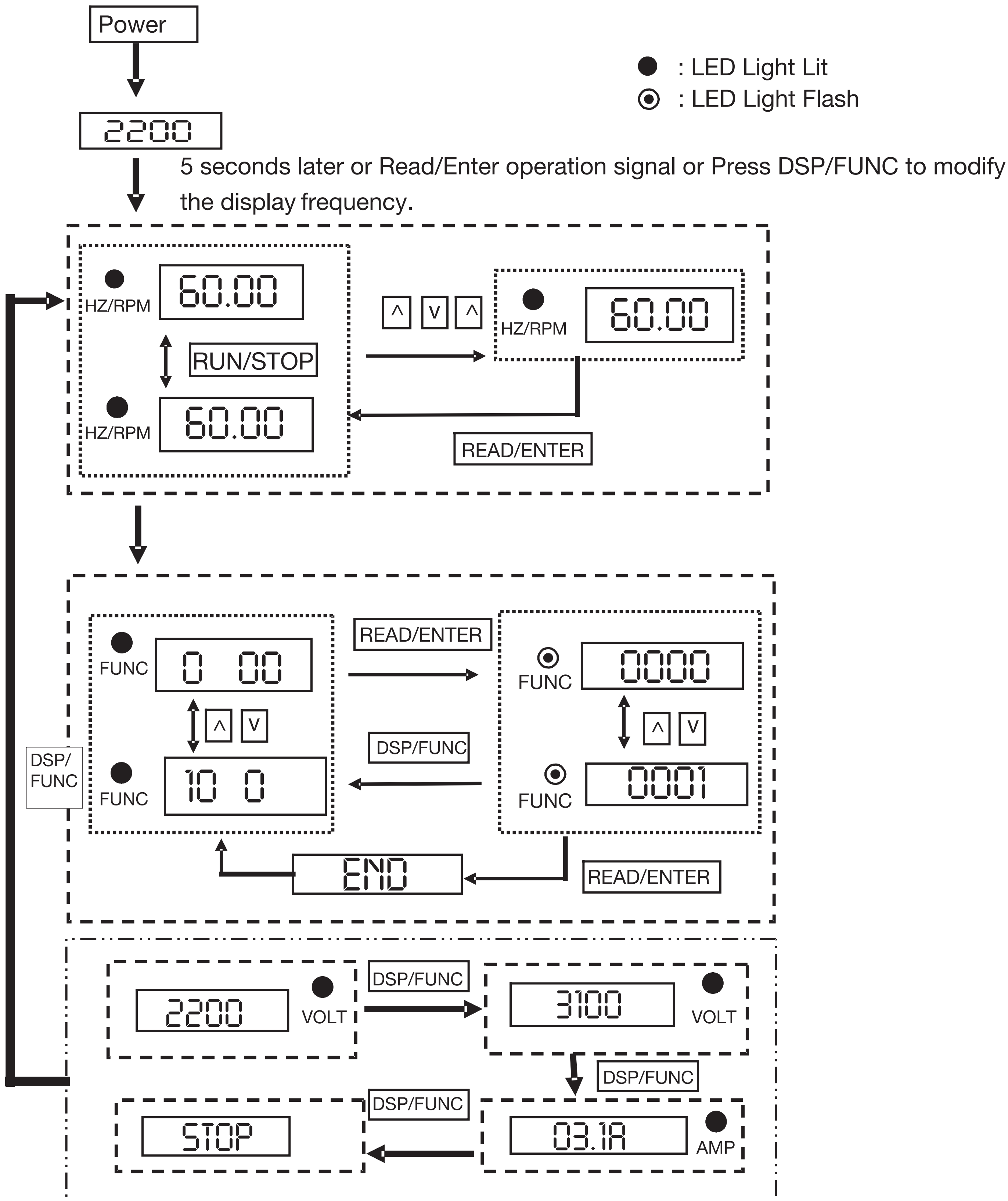
1. **SEQ LED** Parameter 1-00 = 1, LED Lit
2. **FRQ LED** Parameter 1-01 = 1/2/3/4, LED Lit
3. **FWD LED** Forward Direction, LED action (Flashes in stop. Stays Lit while running.)
4. **REV LED** Reverse Direction, LED action (Flashes in stop. Stays Lit while running.)
5. Action of DSP/FUNC key Hz/RPM, FUNC, VOLT, AMP, LEDs and display of four 7- segment LED display, refer to operation description of the keypad.
6. LCD keypad without FUNC, Hz/RPM, VOLT, AMP, LEDs
7. Local/Remote switch, switch from local control to remote control

⚠CAUTION
To avoid damaging the keypad, do not operate it with screwdriver or sharp and hard tool.

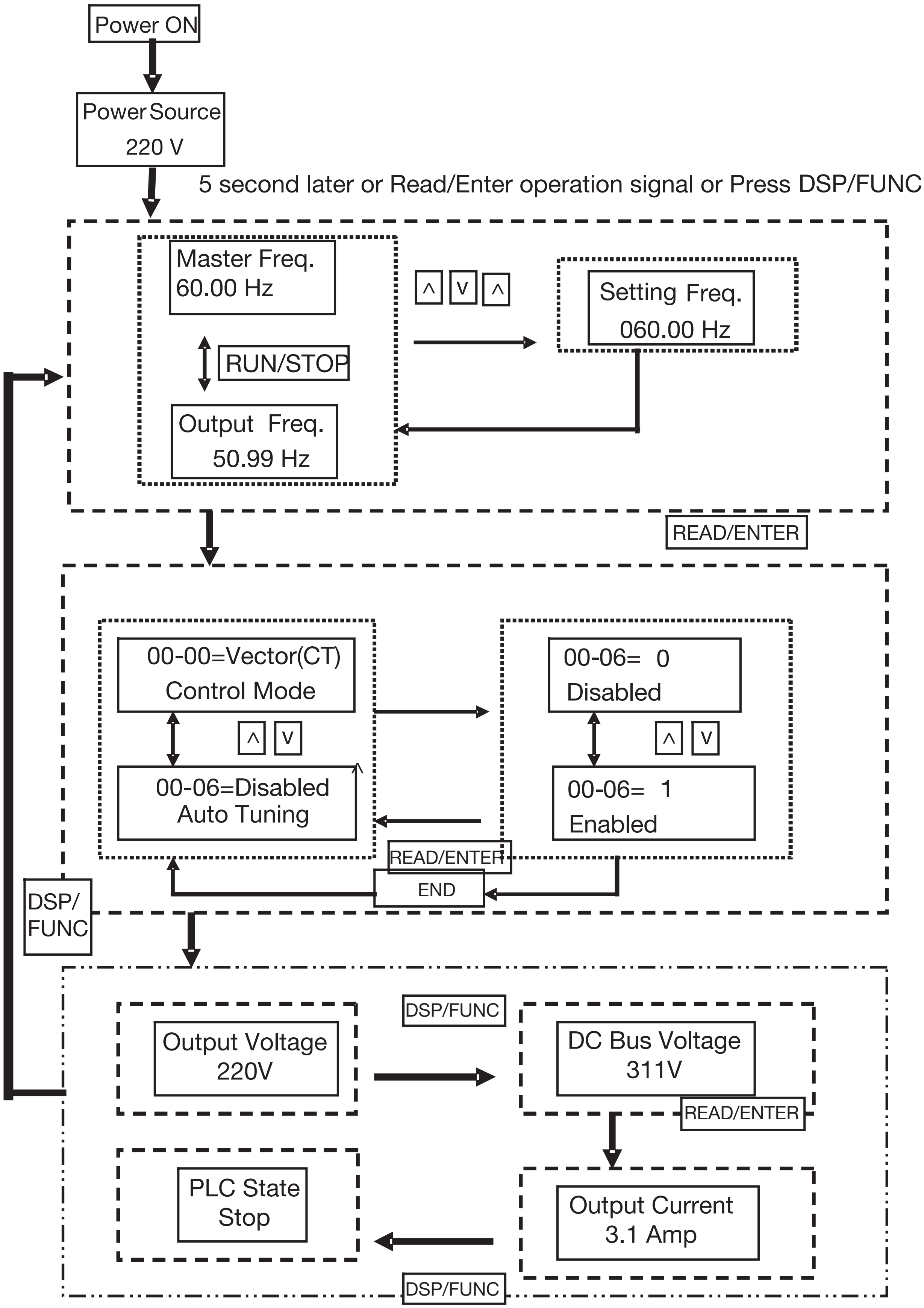
4.1.2 Operation Instructions of the Keypad



4.1.3 Operation Instructions of the LED Keypad

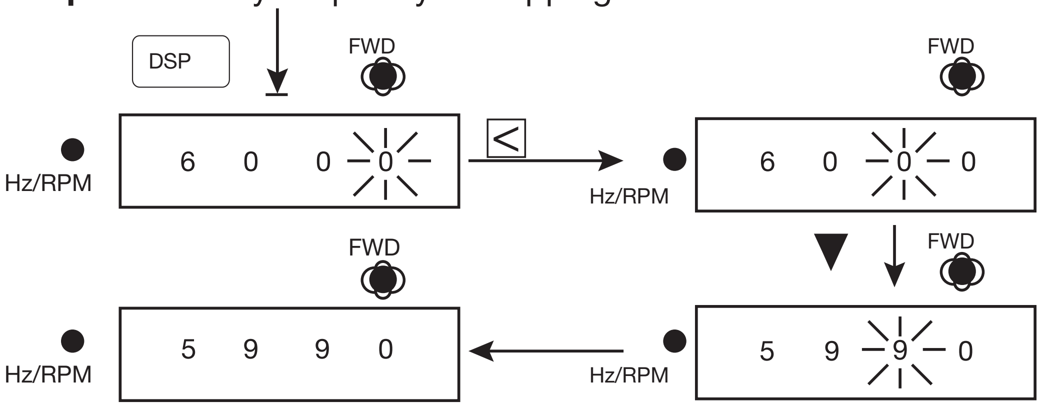


4.1.4 Operation Instructions of the LCD Keypad

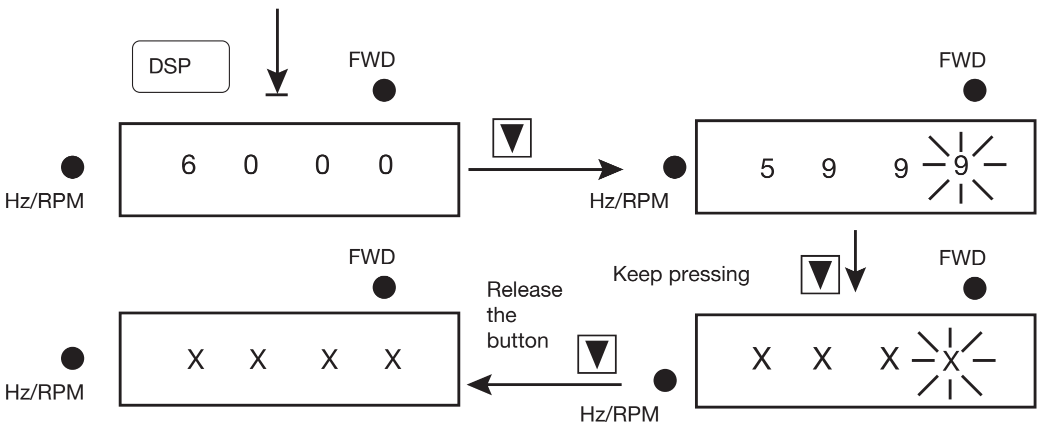


4.1.5 Keypad Operating Example

Example 1. Modify frequency in stopping

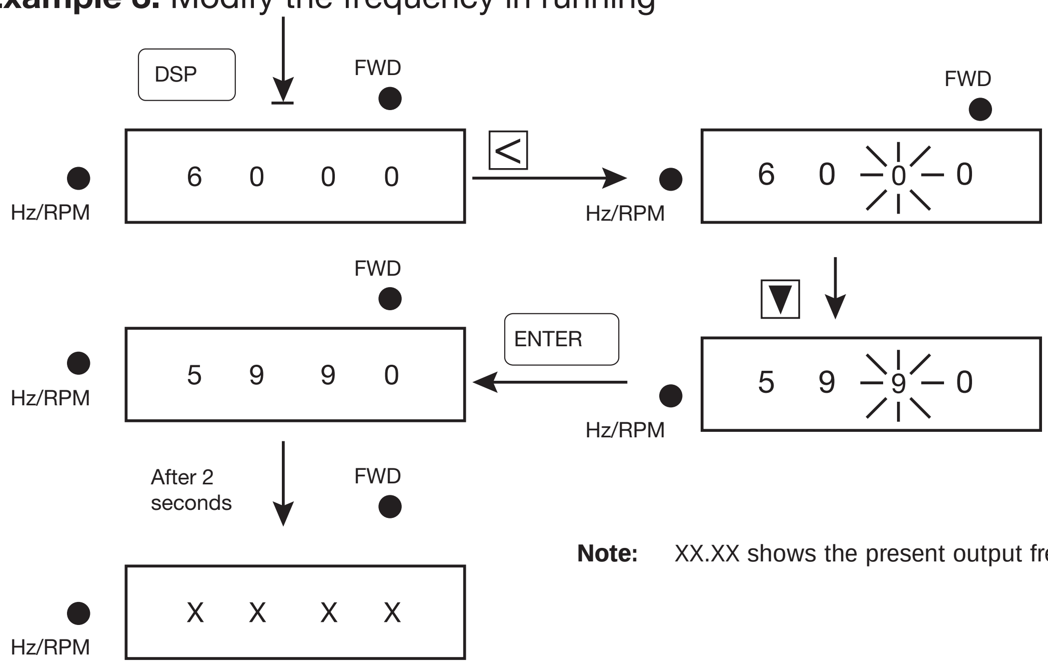


Example 2. Modify frequency in operating



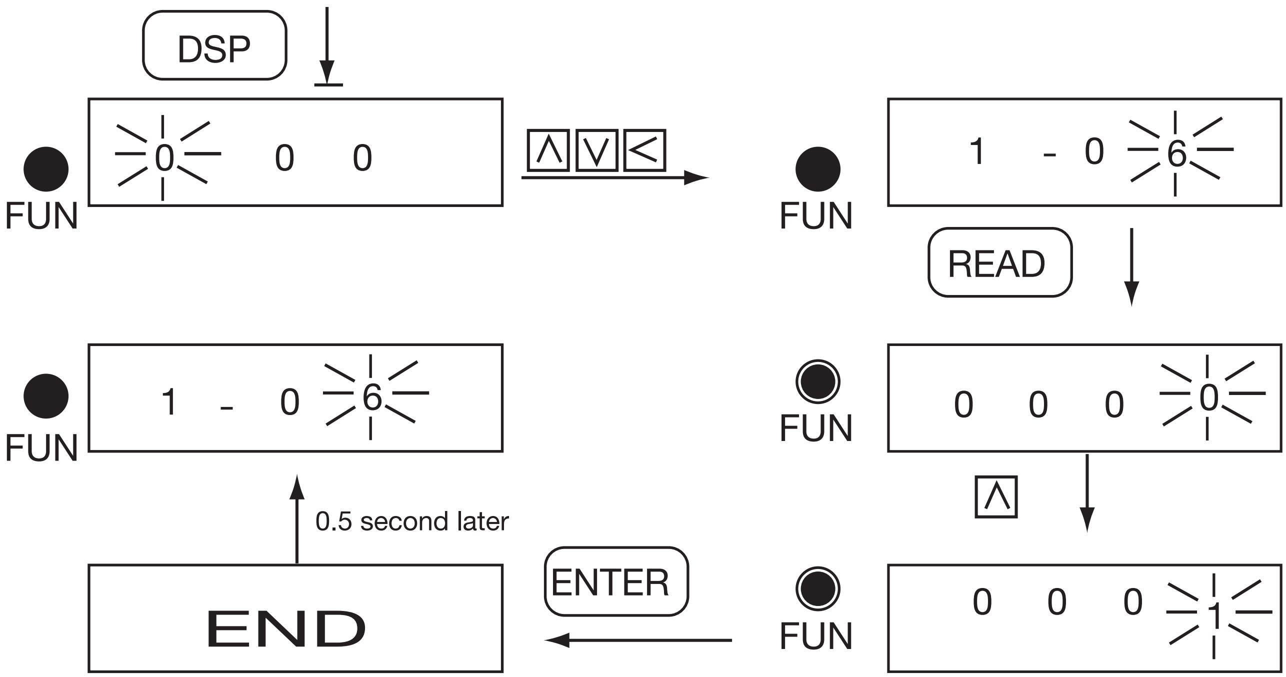
Note: XX . XX shows the present output frequency. The value ranges from 59 58 to 0 Hz, depending on the length of time the ▼ key is pressed.

Example 3. Modify the frequency in running

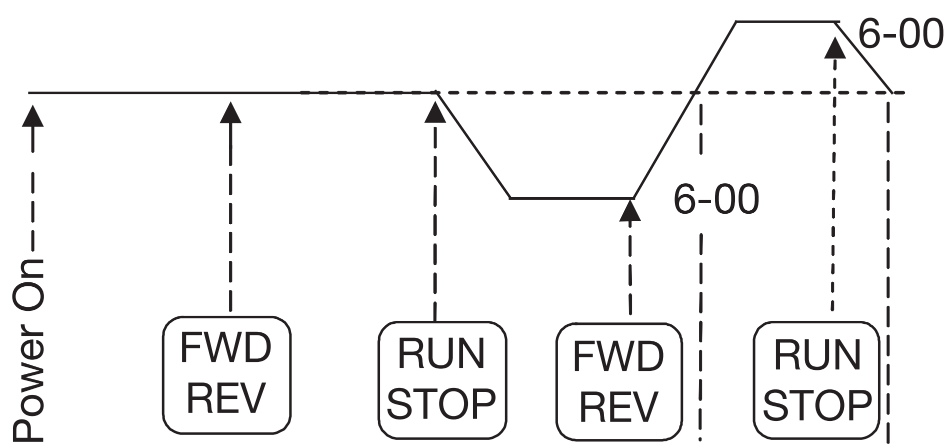


Note: XX.XX shows the present output frequency

Example 4. Modify the Value of the Parameter



Example 5. Operation Control



FWD LED	⊙	○	○	●	⊙
REV LED	○	⊙	●	○	○

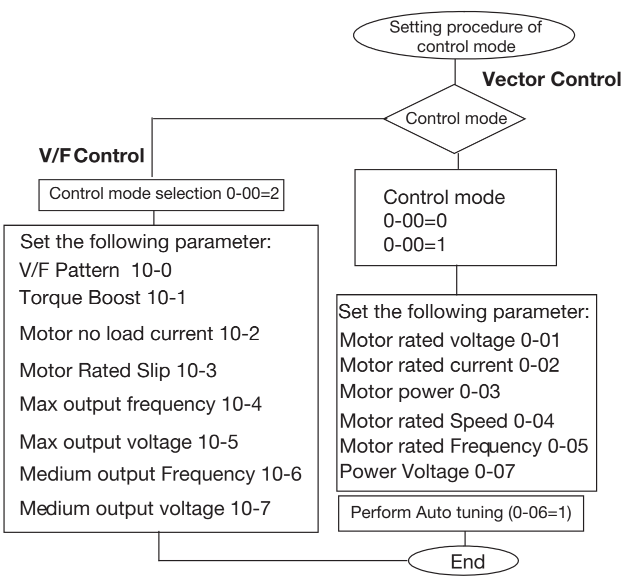
●: LED Lit ⊙: LED Flash ○: LED Out

4.2 Control Mode Selection

ACE15 Controller has three control modes:

1. General Vector Control Mode
2. Variable Torque (ND) Vector Control Mode (for Blowers and pumps)
3. V/F Control Mode

The user can choose these modes with the digital keypad according to the application characteristics. The factory setting is general vector control mode. Before operation, please set the control mode and the relative parameters of the motor in accordance with the following flow chart. (The Vector control mode only suits the drive with the same capacity comparing to the motor, or one size smaller.)



Note:

1. Use V/F Control Mode:
   a. Use one drive to drive several motors simultaneously.
   b. Motor's nameplate is unknown.
   c. Specification of drive and motor differ more than 1 size.
2. One drive runs several motors (only V/F mode available), set the motor parameter complying with the following rules:
   a. Choose the highest rated frequency among those of motors.
   b. Choose the lowest rated voltage among those of motors.
   c. Choose the lowest rated speed among those of motors.
   d. As for the current, sum the rated current of all motors.
   e. As for the power, sum the rated power of all motors.
3. When the nameplate of the motor is unknown, the drive will set the internal parameter according to the standard motor.
4. When parameter 0-00 is set to 2, the keypad will display "Err2" in performing Auto tuning.

4.3 Programmable Parameter List

Parameter Group No.	Description
0-	Drive Operation Mode
1-	Start/Stop and Frequency Control Modes
2-	Manual/Automatic Restart Modes
3-	Operating Parameters
4-	Digital Display Operation Mode
5-	Multifunction Input Terminals (MFIT)
6-	Jog, and Preset (MFIT) speed Setting on Keypad
7-	Analog Input Signal Operation
8-	Multifunction Output Relays and Output Signal Operation
9-	Drive and Load Protection Modes
10-	Volts/Hz Pattern Operation Mode
11-	PID Operation Mode
12-	PID "Limits" and "Out of Range" Mode
13-	Communication Mode
14-	Motor Auto-Tuning Parameters
15-	Drive Status and Function Reset

0 - Drive Operation Mode

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
0-00	(Control Mode)	Control Mode	0000: Vector (General Purpose) 0001: Vector (Variable Torque ND) 0002: Volts/Hz (Refer to Parameter Group 10- Volts/Hz Mode	0000	*3
0-01	(Motor Rated Volt)	Motor Rated Voltage (VAC)	----		*3, *5
0-02	(Motor Rated Amp)	Motor Rated Current (Amp)	----		*3, *5
0-03	(Motor Rated kW)	Motor Rated Power (kW)	----		*3, *5
0-04	(Motor Rated RPM)	Motor Rated Speed (RPM)	----		*3, *5
0-05	(Motor Rated Hz)	Motor Rated Frequency (Hz)	----		*3, *5
0-06	(Auto Tuning)	Motor Auto Tuning	0000: Disabled 0001: Enabled	0000	
0-07	(AC Input Volt)	AC Line Input Voltage (VAC)	230V Series: 170.0~264.0 460V Series: 323.0~528.0		*3
0-08	(Select Language)	Language Selection	0000: English 0001: German 0002: French 0003: Italian 0004: Spanish	0000	LCD Keypad Only

1 - Start/Stop and Frequency Control Modes

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
1-00	(Run Source)	Run Command Source Selection	0000: Keypad 0001: External Run/Stop Control (See page 44) 0002: Communication 0003: Built-in PLC	0000	
1-01	(MFIT Run Mode)	Run/Stop-Forward/Reverse Operation Mode with External Terminals	0000: Forward/Stop-Reverse/Stop 0001: Run/Stop-Forward/Reverse 0002: 3-Wire Control Mode-Run/Stop	0000	
1-02	(Reverse Oper)	Prohibit of Reverse operation	0000: Enable Reverse Command 0001: Disable Reverse Command	0000	
1-03	(Keypad Stop)	Keypad Stop Button	0000: Stop Button Enabled 0001: Stop Button Disabled	0000	
1-04	(Starting Method)	Starting Method Selection	0000: Normal Start 0001: Enable Speed Search	0000	
1-05	(Stopping Method)	Stopping Method Selection	0000: Deceleration-to- Stop with DC Injection Braking (Rapid Stop) 0001: Coast to a Stop	0000	
1-06	(Frequency Source)	Frequency Command Source Selection	0000: Keypad 0001: Potentiometer on Keypad 0002: External Analog Signal Input or Remote Potentiometer 0003: Up/Down Frequency Control Using MFIT (S1 - S6) 0004: Communication setting frequency 0005: Pulse Follower	0000	
1-07	(Keypad Up/Down)	Keypad Operation with Up/Down Keys in Run Mode	0000: 'Enter' must be pressed after frequency change with Up/Down Keys on keypad 0001: Frequency will be changed directly when Up/Down Keys are Pressed	0000	

2 - Manual/Automatic Restart Modes

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
2-00	(PwrL Selection)	Momentary Power Loss and Restart	0000: Momentary power loss and restart disable 0001: Momentary power loss and restart enable 0002: Momentary power loss and restart enable while CPU is operating.	0000	
2-01	(PwrL Ridethru T)	Momentary Power Loss Ride-Thru Time (Seconds)	0.0 - 2.0	0.5	
2-02	(Delay of Restart)	Auto Restart Delay Time (Seconds)	0.0 - 800.0	0	
2-03	(Num of Restart)	Number of Auto Restart Attempts	0 - 10	0	
2-04	(Auto Restart)	Auto Restart Method	0000: Enable Speed Search 0001: Normal Start	0000	
2-05	(Direct Start Sel)	Direct Running After Power Up	0000: Enable direct running after power up 0001: Disable direct running after power up	0000	
2-06	(Delay-on Timer)	Delay-ON Timer (Seconds)	0.0 - 300.0	0	
2-07	(Reset Mode Sel)	Reset Mode Setting	0000: Enable Reset Only when Run Command is Off 0001: Enable Reset when Run Command is On or Off	0000	
2-08	(KEB_Decel_Time)	Kinetic Energy Back-up Deceleration Time	0.0:Disable 0.1~25.0: KEB Deceleration Time	0	

3 - Operating Parameters

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
3-00	(Freq Upper Limit)	Frequency Upper Limit (Hz)	0.01 – 650.00	50.00/ 60.00	*4
3-01	(Freq Lower Limit)	Frequency Lower Limit (Hz)	0.00 – 650.00	0	
3-02	(Accel Time 1)	Acceleration Time # 1 (Seconds)	0.1 – 3600.0	10	*1
3-03	(Decel Time 1)	Deceleration Time # 1 (Seconds)	0.1 – 3600.0	10	*1
3-04	(S-Curve 1)	S-Curve Acc/Dec # 1 (Seconds)	0.0 – 4.0	0.2	
3-05	(S-Curve 2)	S-Curve Acc/Dec # 2(Seconds)	0.0 – 4.0	0.2	
3-06	(Accel Time 2)	Acceleration Time # 2 (MFIT) (Seconds)	0.1 – 3600.0	10	*1
3-07	(Decel Time 2)	Deceleration Time # 2 (MFIT) (Seconds)	0.1 – 3600.0	10	*1
3-08	(Jog Acc Time)	Jog Acceleration Time (MFIT) (Seconds)	0.1 – 25.5	0.5	*1
3-09	(Jog Dec Time)	Jog Deceleration Time (MFIT) (Seconds)	0.1 – 25.5	0.5	*1
3-10	(DCInj Start Freq)	DC Injection Brake Start Frequency (Hz)	0.1 – 10.0	1	
3-11	(DCInj Level)	DC Injection Brake Level (%)	0.0 – 20%	5%	
3-12	(DCInj Time)	DC Injection Brake Time (Seconds)	0.0 – 25.5	0.5	
3-13	(Skip Freq 1)	Skip Frequency # 1 (Hz)	0.00 – 650.00	0.0	*1
3-14	(Skip Freq 2)	Skip Frequency # 2 (Hz)	0.00 – 650.00	0.0	*1
3-15	(Skip Freq 3)	Skip Frequency # 3 (Hz)	0.00 – 650.00	0.0	*1
3-16	(Skip Bandwidth)	Skip Frequency Bandwidth (± Hz)	0.00 – 30.00	0.0	*1
3-17	(Parameter Lock)	Parameter Lock	0000: Enable all Functions 0001: 6-00 – 6-08 cannot be changed 0002: All Functions Except 6-00 - 6-08 cannot be changed 0003: Disable All Function	0000	
3-18	(ROM Pack Operate)	Copy Unit	0000: Disable 0001: Drive to Copy Unit 0002: Copy Unit to Drive 0003: Verify	0000	

3 - Operating Parameters (Con't)

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
3-19	(Fan Control)	Fan Control	0000: Auto (Depend on temp.) 0001: Operate while in RUN mode 0002: Always Run 0003: Always Stop	0000	
3-20	(Energy Save Model)	Energy Saving Mode *1	0000: Disabled 0001: Controlled by MFIT at Set Frequency	0000	*6
3-21	(Energy Save Gain)	Energy Saving Gain (%)* 1	0-100	80	*6
3-22	(Carrier Freq)	Carrier Frequency (kHz)	2 - 16	10	
3-23	(Center F of Trav)	Center Frequency (CF) of Traverse Run (%)	5.00 - 100.00	20.00	
3-24	(Amplit of Trav)	Amplitude (A) of Traverse Run (%)	0.1 - 20.0	10.0	
3-25	(Drop of Trav)	Drop (D) of Traverse Run (%)	0.0 - 50.0	0.0	
3-26	(Acc T of Trav)	Acc Time (AT) of Traverse Run (Seconds)	0.5 - 60.0	10.0	
3-27	(Dec T of Trav)	Dec Time (DT) of Traverse Run (Seconds)	0.5 - 60.0	10.0	
3-28	(Rise Deviated)	Rise (X) Deviated Traverse (%)	0.0 - 20.0	10.0	
3-29	(Lower Deviated)	Lower (Y) Deviated Traverse (%)	0.0 - 20.0	10.0	

*Note: 1. Energy Saving Mode is availiable only under Volts/Hz Mode (0-00 = 0002).

4 - Digital Display Operation Mode

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
4-00	(Motor Curr Disp)	Motor Current Display Selection	0000: Disable Motor Current Display 0001: Enable Motor Current Display	0000	*1
4-01	(Motor Volt Disp)	Motor Voltage Display Selection	0000: Disable Motor Voltage Display 0001: Enable Motor Voltage Display	0000	*1
4-02	(Bus Volt Disp)	DC Bus Voltage Display Selection	0000: Disable Bus Voltage Display 0001: Enable Bus Voltage Display	0000	*1
4-03	(PLC Status Disp)	PLC Status Display Selection	0000: Disable PLC Status Display 0001: Enable PLC Status Display	0000	*1
4-04	(Display Scaling)	Custom Units (Line Speed) Value	0 - 9999	1800	*1
4-05	(Display Units)	Custom Units (Line Speed) Display Mode	0000: Drive Output Frequency is Displayed 0001: Line Speed is Displayed in Integer (xxxx) 0002: Line Speed is Displayed with One Decimal Place (xxx.x) 0003: Line Speed is Displayed with Two Decimal Places (xx.xx) 0004: Line Speed is Displayed with Three Decimal Places (x.xxx)	0000	*1
4-06	(PID Feed Disp)	PID Feedback Display Selection	0000: Disable PID Feedback Display 0001: Enable PID Feedback Display	0000	*1; *7

5 - Multifunction Input Terminals (MFIT)

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
5-00	(MFIT S1 Sel)	Multifunction Input Term. S1	000: Forward/Stop Command 0001: Reverse/Stop Command 0002: Preset Speed # 1 (6-02) 0003: Preset Speed # 2 (6-03) 0004: Preset Speed # 3 (6-05) 0005: Jog 0006: Acc/Dec # 2 0007: Emergency Stop A Contact 0008: Base Block 0009: Speed Search 0010: Energy Saving 0011: Control Signal Selection 0012: Communication Selection 0013: Acc/Dec Disabled 0014: Up Command 0015: Down Command 0016: Master/Auxiliary Speed 0017: PID Function Disabled 0018: Reset 0019: Encoder input terminal (terminal S5) 0020: PID feedback signal A12 (terminal S6) 0021: AI2 Bias signal 1 input (terminal S6) 0022: AI2 Bias signal 2 input (terminal S6) 0023: Analog input (terminal AIN) 0024: PLC Application 0025: Traverse Run 0026: Traverse run upper deviation 0027: Traverse run lower deviation 0028: Power Source Detect for KEB Function 0029: Emergency Stop B Contact	0000	*1 *2 *3
5-01	(MFIT S2 Sel)	Multifunction Input Term. S2		0001	
5-02	(MFIT S3 Sel)	Multifunction Input Term. S3		0002	
5-03	(MFIT S4 Sel)	Multifunction Input Term. S4		0003	
5-04	(MFIT S5 Sel)	Multifunction Input Term. S5		0004	
5-05	(MFIT S6 Sel)	Multifunction Input Term. S6		0018	
5-06	(MFIT AIN Sel)	Multifunction Input Term. AIN		0023	*7
5-07	(MFIT Scan Time)	Multifunction Input Term. S1 - S6 Signal Verification Scan Time (mSec X 4)	1 – 100	5	
5-08	(Stop Sel by MFIT)	Stop Mode Using MFIT	0000: When the MFITs are Programmed for Up/Down Frequency Control, the Set Frequency will remain when the Drive stops. And when the Drive stops, Up/Down Function Disabled. 0001: Up/Down is used. The preset frequency is reset to 0Hz as the Drive stops. 0002: When the MFITs are Programmed for Up/Down Frequency Control, the Set Frequency will remain when the Drive stops. And when the Drive stops, Up/Down Function Enabled.	0000	*7

5 - Multifunction Input Terminals (MFIT) (cont'd)

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
5-09	(Step Up/Down Fun)	Step of Up/Down Function (Hz)	0.00 – 5.00	0.00	
5-10	Pulse Inp. Mult.	Pulse Follower Multiplier	0-999	1	
5-11	Ref.Source2	Reference Source 2	0000: Keypad 0001: Potentiometer on Keypad 0002: External Analog Signal Input or Remote Potentiometer 0003: Up/Down Frequency Control Using MFIT (S1 - S6) 0004: Communication setting frequency	0.00	

△Notes:

1. To switch to Run/Stop with Function 1-01 = 0001.
2. To switch to Forward/Reverse with Function 1-01 = 0001.
3. Preset Speed # 3 is obtained by activating Terms. S3 and S4 simultaneously.

6 - Jog, and Preset (MFIT) Frequency Setting on Keyboard

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
6-00	(Keypad Freq)	Keypad Frequency (Hz)	0.00 - 650.00	5.00	*1
6-01	(Jog Freq)	Jog Frequency (Hz)	0.00 - 650.00	2.00	*1
6-02	(Preset Speed #1)	Preset Speed # 1 (Hz)	0.00 - 650.00	5.00	*1
6-03	(Preset Speed #2)	Preset Speed # 2 (Hz)	0.00 - 650.00	10.00	*1
6-04	(Preset Speed #3)	Preset Speed # 3 (Hz)	0.00 - 650.00	20.00	*1
6-05	(Preset Speed #4)	Preset Speed # 4 (Hz)	0.00 - 650.00	30.00	*1
6-06	(Preset Speed #5)	Preset Speed # 5 (Hz)	0.00 - 650.00	40.00	*1
6-07	(Preset Speed #6)	Preset Speed # 6 (Hz)	0.00 - 650.00	50.00	*1
6-08	(Preset Speed #7)	Preset Speed # 7 (Hz)	0.00 - 650.00	60.00	*1

7 - Analog Input Signal Operation

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
7-00	(AIN Gain)	AIN Gain (%)	0-200	100	*1
7-01	(AIN Offset)	AIN Bias (%)	0-100	0	*1
7-02	(AIN Bias)	AIN Bias Selection	0000: Positive 0001: Negative	0000	*1
7-03	(AIN Slope)	AIN Slope	0000: Positive 0001: Negative	0000	*1
7-04	(AIN Scan Time)	AIN Signal Verification Scan Time (AIN, AI2) (mSec x 2)	1-100	50	
7-05	(AI2 Gain)	AI2 Gain (%)(S6)	0-200	100	*1

△Notes: Group 7 is available when 5-06=0023 (AIN term. = Analog input)

8 - Multifunciton Output Relays and Output Signal Operation

<table>
<tr><th>Parameter</th><th>LCD Display</th><th>Description</th><th>Range/Code</th><th>Factory Default</th><th>Remarks</th></tr>
<tr><td>8-00</td><td>(AO Mode Sel)</td><td>Analog Output Voltage Mode
(0 - 10 VDC, Term. FM+)</td><td>0000: Output Frequency
0001: Frequency Setting
0002: Output Voltage
0003: DC Voltage
0004: Output Current
0005: PID Feedback</td><td>0000</td><td>*1
*7</td></tr>
<tr><td>8-01</td><td>(AO Gain)</td><td>Analog Output Gain (%)</td><td>0 - 200</td><td>100</td><td>*1</td></tr>
<tr><td>8-02</td><td>(Relay R1 Sel)</td><td>Output Relay R1 Operation Mode</td><td rowspan="2">0000: Run
0001: Frequency Reached
(Target Frequency)
(Set Frequency ± 8-05)
0002: Set Frequency
(8-04 ± 8-05)
0003: Frequency Threshold Level (> 8-04) - Frequency Reached
0004: Frequency Threshold Level (< 8-04) - Frequency Reached
0005: Over torque Threshold Level
0006: Fault
0007: Auto Restart
0008: Momentary AC Power Loss
0009: Rapid Stop Mode
0010: Coast-to-Stop Mode
0011: Motor Overload Protection
0012: Drive Overload Protection
0013: PID Feedback Signal Loss
0014: PLC Operation
0015: Power On</td><td>0006</td><td></td></tr>
<tr><td>8-03</td><td>(Relay R2 Sel)</td><td>Output Relay R2 Operation Mode</td><td>0000</td><td>*7</td></tr>
<tr><td>8-04</td><td>(Freq Agree)</td><td>Frequency Reached (Hz)
(Refer to 8-02: 0001)</td><td>0.00 - 650.00</td><td>0.00</td><td>*1</td></tr>
<tr><td>8-05</td><td>(Freq Agree width)</td><td>Frequency Reached Bandwidth
(± Hz)</td><td>0.00 - 30.00</td><td>0.00</td><td>*1</td></tr>
</table>

9 - Drive and Load Protection Modes

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
9-00	(Trip ACC Sel)	Trip Prevention Selection During Acceleration	0000: Enable Trip Prevention During Acceleration 0001: Disable Trip Prevention During Acceleration	0000	
9-01	(Trip ACC Level)	Trip Prevention Level During Acceleration (%)	50-300	200	
9-02	(Trip DEC Sel)	Trip Prevention Selection During Deceleration	0000: Enable Trip Prevention During Deceleration 0001: Disable Trip Prevention During Deceleration	0000	
9-03	(Trip DEC Level)	Trip Prevention Level During Deceleration (%)	50-300	200	
9-04	(Trip RUN Sel)	Trip Prevention Selection in Run Mode	0000: Enable Trip Prevention in Run Mode 0001: Disable Trip Prevention in Run Mode	0000	
9-05	(Trip Run Level)	Trip Prevention Level In Run Mode (%)	50 - 300	200	
9-06	(Dec Sel Trip RUN)	Trip Prevention Deceleration Time Selection in Run Mode	0000: Trip Prevention Deceleration Time Set by 3-03 0001: Trip Prevention Deceleration Time Set by 9-07	0000	
9-07	(Dec Time Trip RUN)	Deceleration Time In Trip Prevention Mode (Seconds)	0.1 – 3600.0	3.0	
9-08	(Motor OL1 Sel)	Electronic Motor Overload Protection Operation Mode	0000: Enable Electronic Motor Overload Protection 0001: Disable Electronic Motor Overload Protection	0000	
9-09	(Motor Type)	Motor Type Selection	0000: Electronic Motor Overload Protection Set for Non-Drive Duty Motor 0001: Electronic Motor Overload Protection Set for Drive Duty Motor	0000	
9-10	(Motor OL1 Curve)	Motor Overload Protection Curve Selection	0000: Constant Torque (OL=103) (150 % for 1 Minute) 0001: Variable Torque (OL=113) (123 % for 1 Minute)	0000	
9-11	(Motor OL1 Operat)	Operation After Overload Protection is Activated	0000: Coast-to-Stop After Overload Protection is Activated 0001: Drive Will Not Trip when Overload Protection is Activated (OL1)	0000	
9-12	(Torq Det Sel)	Over Torque Detection Selection	0000: Disable Over Torque Operation 0001: Enable Over Torque Operation Only if at Set Frequency 0002: Enable Over Torque Operation while the drive is in Run Mode	0000	
9-13	(Torq Det Operat)	Operation After Over Torque Detection is Activated	0000: Drive will Continue to Operate After Over Torque is Activated 0001: Coast-to-Stop After Over Torque is Activated	0000	
9-14	(Torq Det Level)	Over Torque Threshold Level (%)	30 - 200	160	
9-15	(Torq Det Delay)	Over Torque Activation Delay Time (Seconds)	0.0 - 25.0	0.1	

10 - Volts/Hz Operation Mode

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
10-0	(V/F Selection)	Volts/Hz Patterns	0-18	0/9	*4; *6
10-1	(Torque Boost)	Volts/Hz Curve Modification (Torque Boost) (%)	0-30.0	0.0	*1; *6
10-2	(Motor noLoad Amp)	Motor No Load Current (Amps AC)	----		*5; *6
10-3	(Motor rated Slip)	Motor Slip Compensation (%)	0.0-100.0	0.0	*1; *6
10-4	(Max frequency)	Maximum Frequency (Hz)	50.00-650.00	50.00/ 60.00	*4; *6
10-5	(Max Voltage)	Maximum Frequency Voltage Ratio (%)	0.0-100.0	100	*6
10-6	(Mid frequency)	Mid Frequency (Hz)	0.10-650.00	30Hz	*4; *6
10-7	(Mid Voltage)	Mid Frequency Voltage Ratio (%)	0.0-100.0	50%	*6
10-8	(Min frequency)	Minimum Frequency (Hz)	0.10-650.00	0.6	*6
10-9	(Min Voltage)	Minimum Frequency Voltage Ratio (%)	0.0-100.0	1%	*6

11 - PID Operation Mode

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
11-0	(PID Mode Sel)	Mode Selection	0000: Disabled 0001: Bias D Control 0002: Feedback D Control 0003: Bias D Reversed Characteristics Control 0004: Feedback D Reversed Characteristics Control 0005: Frequency Command + Bias D Control 0006: Frequency Command + Feedback D Control 0007: Frequency Command + Bias D Reversed Characteristics Control 0008: Frequency Command + Feed-back D Reversed Characteristics	0000	
11-01	(Feedback Gain)	Feedback Gain (%)	0.00 - 10.00	1.00	*1
11-02	(PID Gain)	Proportional Gain (%)	0.0 - 10.0	1.00	*1
11-03	(PID I Time)	Integration Time (Seconds)	0.0 - 100.0	10.00	*1
11-04	(PID D Time)	Differentiation Time (Seconds)	0.00 - 10.00	0.00	*1
11-05	(PID Offset)	PID Offset	0000: Positive 0001: Negative	0000	*1
11-06	(PID Offset Adj)	PID Offset Adjust (%)	0 - 109	0	*1
11-07	(Output Filter T)	Output Lag Filter Time (Seconds)	0.0 - 2.5	0.0	*1

12 - PID “Limits” and “Out of Range” Mode

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
12-0	(Fb Los Det Sel)	Feedback Loss Detection Mode	0000: Disabled 0001: Enabled - Drive Continues to Operate After Feedback Loss 0002: Enabled - Drive "STOPS" After Feedback Loss	. 0000	
12-1	(Fb Los Det Lvl)	Feedback Loss Detection Level (%)	0-100	0	
12-2	(Fb Los Det Time)	Feedback Loss Detection Delay Time (Seconds)	0.0-25.5	1.0	
12-3	(PID I Limit)	Integration Limit Value (%)	0-109	100	*1
12-4	(I Time value Sel)	Integration Value Resets to Zero when Feedback Signal Equals the Intended Value	0000: Disabled 0001: 1 Second 0030: 30 Seconds	. 0000	
12-5	(I Error Margin)	Allowable Integration Error Margin (Units)(1 Unit = 1/8192)	0-100	0	
12-6	(PID Comm. Source)	PID Feedback signal	0000: 0~10V 0001: 4~20mA	. 0000	
12-7	(Sleep Level)	Sleep Function Operation Level	0.00-650.00	0.0	*7
12-8	(Sleep Delay Time)	Sleep Function Delay Time	0.0-25.5	0.0	*7

13 - Communication Mode

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
13-0	(Serial Comm Adr)	Assigned-Communication Station Number	1 - 254	1	*2*3
13-1	(Serial Baud Rate)	Baud Rate Setting (bps)	0000: 4800 0001: 9600 0002: 19200 0003: 38400	0003	*2*3
13-2	(Comm Stop Bit)	Stop Bit Selection	0000: 1 Stop Bit 0001: 2 Stop Bits	0000	*2*3
13-3	(Comm Parity Sel)	Parity Selection	0000: Without Parity 0001: With Even Parity 0002: With Odd Parity	0000	*2*3
13-4	(Comm Data Format)	Data Format Selection	0000: 8-Bits Data 0001: 7-Bits Data	0000	*2*3

14 - Motor Auto-Tune Parameters

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
14-0	(Stator Resistor)	Stator Resistance (Ohms)	see Appendix 1		*3*5
14-1	(Rotor Resistor)	Rotor Resistance (Ohms)	see Appendix 1		*3*5
14-2	(Equi Inductance)	Equivalent Inductance (mH)	see Appendix 1		*3*5
14-3	(Magnet Current)	Magnetizing Current (Amps AC)	see Appendix 1		*3*5
14-4	(Ferrite Loss)	Ferrite Loss Conductance (gm)	see Appendix 1		*3*5

15 - Drive Status and Function Reset

Parameter	LCD Display	Description	Range/Code	Factory Default	Remarks
15-0	(Drive Model)	Drive Horsepower Code	(See page 64)		*3
15-1	(Software Version)	Software Version	----	----	*3
15-2	(Fault Log)	Fault Jog (Last 3 Faults)	(See page 64)	----	*3
15-3	(Elapsed Hours)	Accumulated Operation Time (Hours)	0 - 9999	----	*3
15-4	(Elapsed Hr*10000)	Accumulated Operation Time (Hours X 10000)	0 - 27	----	*3
15-5	(Elapsed Time Sel)	Accumulated Operation Time Mode	0000: Time Under Power 0001: Run Time	0000	*3
15-6	(Reset Parameter)	Reset drive to Factory Settings	1110: Reset for 50Hz Motor Operation 1111: Reset for 60Hz Motor Operation 1112: Reset PLC Program	0000	*4

Notes:
*1 can be modified during operation
*2 cannot be modified during communication
*3 does not change while making factory setting
*4 as parameter related to factory setting
*5 the parameter will be changed by replacing model
(see descriptions of the POSTSCRIPT 1)
*6 only available in V/F mode
*7 only for version 1.6 and above

4.4 Parameter Function Description

Parameter Group 0: Drive

0-00: Control Mode
0000: Vector Mode (General Mode) - Default Setting
0001: Vector Mode (Variable Torque Mode ND)
0002: V/F Mode

To select the most suitable vector control mode or V/F mode according to the load characteristics.

1. Vector (general mode) is intended to control the general load or rapidly-changing torque load.

2. Vector (VT or ND mode) is suitable for Blower/Pump and HVAC load. The magnetic current of motor will be variable with the torque, which will reduce the current to save the energy.

3. V/F mode is selected, please set the parameter group 10 to comply with the load features.

0-01: Motor Rated Voltage (VAC)
0-02: Motor Rated Current (A)
0-03: Motor Rated Power (kW)
0-04: Motor Rated Speed (RPM)
0-05: Motor Rated Frequency (Hz)
0-06: Motor Parameter Auto Tuning
0000: Disabled - Default Setting
0001: Enabled

It is necessary to input the motor data from the nameplate and perform the auto tuning when using either Vector Mode. (0-01 Control Mode)

Auto tuning: First input the motor data to parameters 0-01_0-05 according to the motor's nameplate, then set 0-06=0001 and perform auto tuning; the motor may rotate. When auto tune is completed, the display will stop showing "AT". The detected internal motor data will be written to parameter group 14.

⚠PRECAUTION

1. The motor auto tuning parameter is for a stationary auto tune. During motor auto tuning, the motor does not rotate, and the keypad displays ”AT”.

2. During motor parameter auto tuning, the input signal in control circuit is inalid. (Keypad Only)

3. Before motor parameter auto tuning, please confirm the stop state of the motor.

4. The motor parameter auto tuning is only available for vector control mode (0-00=0000 or 0-00=0001).

0-07: AC Line Input Voltage (Volts AC)
230V Series: 170.0~264.0
460V Series: 323.0~528.0

To make sure of the voltage level of the drive, please input the actual on-site voltage value.

0-08: Language Selection
0000: English - Default Setting
0001: German
0002: French
0003: Italian
0004: Spanish

The function is only avilable for the products with LCD operation keypad. The operation is not available with LED keypad.

Parameter Group 1 - Start/Stop and Frequency Control Modes

1-00: Run Command Source Selection
0000: Keypad - Default Setting
0001: External Terminal Control
0002: Communication Control
0003: Built-in PLC

1. 1-00=0000 Start/Stop is controlled by the keypad.

2. 1-00=0000 Start/Stop is controlled by the external terminals, and the Stop key on the keypad is active for emergency stop. (Refer to parameter 1-03 for detail description.)

3. 1-00=0002 Start/Stop is communication controlled.

4. 1-00=0003 Start/Stop is built-in PLC controlled.

Note: 1-00=0001, please refer to parameter groups 2-00, 2-01, 2-02 and 2-03 for detail descriptions. Drive may restart automatically.

1-01: Operation modes for external terminals
0000: Forward/Stop-Reverse/Stop - Default Setting
0001: Run/Stop-Forward/Reverse
0002: 3-wire Control Mode - Run/Stop

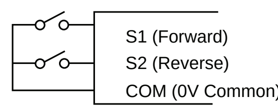
1. When operation command 1-00 = 0001 (external terminal), 1-01 is valid.

2. When operation command 1-00 = 0001 (external terminal control), the Stop key on the keypad does work for emergency stop. (Refer to 1-03 for detail description.)

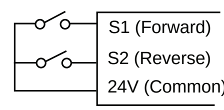
3. When both forward and reverse commands are ON, the drive will treat as a STOP.

1-01 = 0000, Control mode is as below:

1. Input signal is NPN (sink)

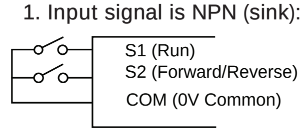


2. Input signal is PNP (source)

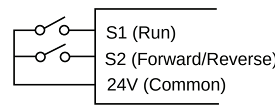


1-01 = 0001, Control mode is as below:

1. Input signal is NPN (sink):



2. Input signal is PNP (source)



Note: When 3-wire control (parameter 1-02=0002) mode is selected, the terminal S3 is not controlled by 5-02.

1-02: Prohibit of Reverse Operation 0000: Enable Reverse Command -
0000: Enable Reverse Command - Default Seting
0001: Disable Reverse Command

Note: 1-02=0001, the reverse command is unavailable.

1-03: Keypad Stop Button
0000: Stop Button Enable -Default Setting
0001: Stop Button Disable

This parameter has 2 functions:

Run/Stop set to External Control:
Parameter 1-00: 1, 2, and 3 (Terminals, Serial Communication, PLC)

When 1-03 is set to enable (0) the keypad STOP button is active. When STOP is pressed in any of the run source control modes the drive will coast to a stop and display a STP2 fault. When parameter 1-03 is set to disabled (1) the STOP button will be inactive.

Run/Stop set to Keypad Control:
Parameter 1-00: 0 (Keypad) or LOCAL Mode Control

When 1-03 is set to enable (0) and run source (1-00) is set to 1 (keypad) and the keypad is removed during operation, the drive will coast to a stop and display a STP2 fault. When parameter 1-03 is set to disabled (1) the STOP button will be inactive and the user can remove the keypad during operation. In case the drive's Frequency Source (1-06) is programmed for "potentiometer on keypad" it will use the last known reference before the keypad was removed.

Note: The drive's automatic reset function will not reset STP2 faults.

1-04: Starting Method Selection
0000: Normal Start - Default Setting
0001: Enable Speed Search

1. 1-04=0000: When starting, the drive accelerates from 0 to target frequency in the set time.
2. 1-04=0001: When starting, the drive accelerates to target frequency from the detected speed of motor.

1-05: Stopping Method
0000: Controlled Deceleration-to-Stop with DC Injection Braking (Rapid Stop) - Default Setting
0001: Coast to a stop

1. 1-05=0000: Drive will decelerate to 0Hz in programmed deceleration time after receiving the stop command.
2. 1-05=0001: Drive will stop output after receiving the stop command. The motor will coast to a stop.

1-06: Frequency Command Source Selection
0000: Set the Frequency with Keypad - Default Setting
0001: Potentiometer on Keypad
0002: External Analog Signal Input or Remote Potentiometer
0003: Up/Down Frequency Control Using MFIT (S1 - S6)
0004: Communication Setting Frequency
0005: Pulse Follower

1. 1-06=0001: As one of the parameters in the group 5-00~5-06 is set to 16 and multifunction terminal is OFF, the frequency is set by the speed pot on the keypad. While the multifunction terminal is ON, the frequency is set by analog signal (auxiliary speed) on terminal block (TM2).
2. 1-06=0002: As one of the parameter in group 5-00~5-06 is set to 16 and the multifunction terminal is OFF, the frequency is set by analog signal on terminal block (TM2). While the multifunction terminal is ON, the frequency is set by the speed pot on the keypad.
3. Please refer to description of parameter group 5-00~5-06 (multifunction input terminals) for the function Up/Down terminal.
4. The priority in reading frequency is PLC frequency control > traverse run>jog> preset speed>up or down keys on keypad or Up/Down or communication control.

Follow pulse train input, using Terminal S5. The parameter in group 5-04 has to be set to 19 and the multifunction terminal S5 is dedicated to pulse follower train input. Use 5-10 to adjust the ratio multiplier and 7-00 to adjust the gain, 7-01 to adjust the offset.

1-07: Keypad Operation with Up/Down Keys in Run Mode
- 0000: "Enter" Must be Pressed After Frequency Change with Up/Down Keys on keypad. - Default Setting
- 0001: Frequency Will be Changed Directly When Up/Down Keys are Pressed.

Parameter Group 2 - Manual/Automatic Restart Modes

2-00: Momentary Power Loss and Restart
- 0000: Momentary Power Loss and Restart Disable - Default Setting
- 0001: Momentary Power Loss and Restart is Enable
- 0002: Momentary Power Loss and Restart Enable While CPU is Operating

2-01: Momentary Power Loss Ride - Through Time (sec): 0.0 - 2.0 seconds - Default setting 0.5

1. When starting of other loads may cause lowering the voltage below the under-voltage level, the drive will stop outputting at once. If the power supply recovers in the 2-01 preset time, it will speed search beginning from the trip frequency, or the drive will trip with "LV-C" displayed.

2. The allowable power loss time differs with each model. The range is from 1 to 2 seconds.

3. 2-00=0000: After power lost, the drive will not start.

4. 2-00=0001: If the loss time is less than the value of parameter 2-01, the drive will speed search in 0.5 second after the power supply is restored.

5. 2-00=0002: When power is lost for a long time, before the drive loses the control power for the CPU, the drive will restart according to the parameter 1-00 and 2-04 setting and status of external switch as the power is supplied.

Note: 1-00=0001, 2-04=0000, 2-00=0001 or 0002 after power loss for a long time, please turn OFF the power and power switches in case of injury to person and machine by the reconnecting of the power source.

2-02: Auto restart Delay time: 0 ~ 800.0 seconds - Default setting 0.5

2-03: Number of Auto Restart Attempts: 0 ~ 10 times - Default setting 00

1. 2-03=0 Drive will not auto restart after drive tripped.

2. 2-03>0, 2-02=0:
The drive will conduct SPEED SEARCH in 0.5 seconds after the drive tripped. The motor will decelerate after the trip and then accelerate or decelerate to the target frequency.

3. 2-03>0, 2-02>0:
The output will be stopped for a period which is determined by parameter 2-02 after the trip. Then, the drive speed search to target frequency.

4. If the drive is decelerating or DC braking at the time of the trip, it will not perform restarter after a trip.

2-04: Start Method:
- 0000: Enable Speed Search - Default Setting
- 0001: Normal Start

1. 2-04=0000: Drive will detect motor speed and accelerate to set frequency.

2. 2-04=0001: Drive will accelerate the motor speed from stop (zero speed) to the set frequency.

2-05: Direct running after power up:
- 0000: Enable Direct Running After Power Up - Default setting
- 0001: Disable Direct Running After Power Up

⚠ DANGER

1. 2-05=0000: The drive is set to external terminal control (1-00=0001), if the run switch is ON as power is supplied, the drive will auto start. It is recommended to cut off the power switch and run switch in case of injury to persons or machine as power is supplied.

2. 2-05=0001: The drive is set to external terminal control (1-00=0001), if the run switch is ON as power is supplied, the drive will not auto start and flash STP1. It is necessary to cycle the Run switch to perform a start.

2-06: Delay-ON Timer (seconds):
0 ~ 300.0 seconds - Default Setting 0.0

As power on and 2-05=0000, the drive will perform auto restart in the setting time of delay.

2-07: Reset mode setting:
- 0000: Enable Reset Only when Run Command is OFF - Default Setting
- 0001: Enable Reset when Run Command is On or Off

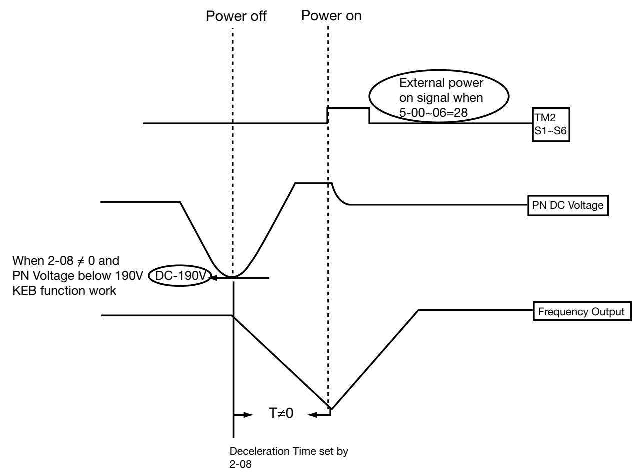
2-07=0000 As the drive detected the trip, please remove the Run signal and perform the reset, or restarting will not work.

2-08: Kinetic Energy Back-up Deceleration Time: 0.00~25.00 seconds (Inertia Ride-thru)

2-08 = 0 Kinetic Energy Back-up (KEB) Function Disable

2-08 = 0 Kinetic Energy Back-up (KEB) Function Enable

Example: 230V system



Note:
1. When 2-08 ≠ 0: Momentary power loss and Restart is disabled, the drive will do Kinetic Energy Back-up (KEB) Function.

2. When power off: CPU detects the DC Voltage. KEB function enables when DC Voltage is below 190V (230V system) or 380V (460V system).

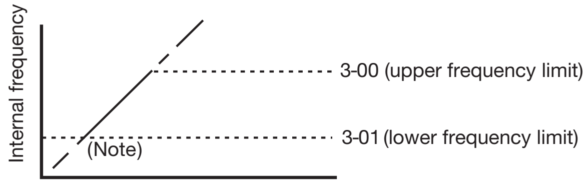
3. When KEB function is enabled, the drive decelerates to zero by parameter 2-08, and the drive stops.

4. If the power is turned on during the KEB function, the drive accelerates to original frequency.

Parameter Group 3 - Manual/Automatic Restart Modes

3-00: Frequency Upper limit (Hz):
0.01 - 650.00 - Default Setting 60Hz

3-01: Frequency Lower limit (Hz):
0.01 - 650.00 - Default Setting 0Hz



***Note:** When 3-01 = 0Hz and frequency command is 0Hz, the drive will stop at zero speed. When 3-01 > 0Hz and frequency command ≥3-01, the drive will output parameter 3-01 value.

3-02: Acceleration Time #1 (second):
0.1 - 3600.0 - Default Setting 10

3-03: Deceleration Time #1 (second):
0.1 - 3600.0 - Default Setting 10

3-04: S Curve of First Acceleration Stage (second):
0.0 - 4.0 - Default Setting 0

3-05: S Curve of Second Acceleration Stage (second):
0.0 - 4.0 - Default Setting 0

3-06: Acceleration Time #2 (second):
0.1 - 3600.0 - Default Setting 10

3-07: Deceleration Time #2 (second):
0.1 - 3600.0 - Default Setting 10

3-08: Jog Acceleration Time (second):
0.1 - 25.5 - Default Setting 0.5

3-09: Jog Deceleration Time (second):
0.1 - 25.5 - Default Setting 0.5

1. Formula for calculating acceleration and deceleration time: The denominator is the base frequency of the motor.

Acceleration time =

$$\text{3-02 (or 3-06) X } \frac{\text{Preset frequency}}{\text{0-05}}$$

Deceleration time =

$$\text{3-03 (or 3-07) X } \frac{\text{Preset frequency}}{\text{0-05}}$$

2. When parameter 5-00 to 5-06 is set to 06 (the acceleration and deceleration time), the first acceleration/deceleration/S-curve or the second acceleration/deceleration/S curve will be set when the MFIT is ON.

3. When parameter 5-00 to 5-06 is set to 05 (Jog), external terminals control the Jog run. The acceleration and deceleration action will be at Jog acceleration and deceleration time.

4. When parameter 5-00 to 5-06 is set as 05 (Jog) and 06 (acceleration and deceleration time toggle), the acceleration and deceleration time will be selected as shown in the table below.

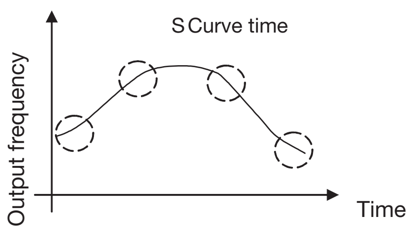
	Acc/Dec Time 1 (3-02/3-03)	**Acc/Dec Time 2 (3-06/3-07)**	**Jog Acc/Dec Time (3-08/3-09)**
Funcition = Preset Value	**Parameter 1-06 Determines the Output Frequency**	**Parameter 1-06 Determines the Output Frequency**	**Run at Parameter 6-01 Jog Frequency**
5-00 ~ 5-05 JOG command	Off	Off	On
5-00 ~ 5-04 Toggle Acc/Dec Time	Off	On	Off

5. When S curve time (3-04/3-05) is set to 0, the S curve is turned off. Acceleration and deceleration rates are linear.

6. When S curve time (3-04/3-5) is larger than 0, the acceleration and deceleration action will follow the diagram below.

7. Regardless of the stall prevention period, actual acceleration and deceleration time = preset acceleration/deceleration time + S curve time.

8. During acceleration and deceleration process, there might be residual error in acceleration and deceleration toggling. Please set the S curve time as 0 (3-04/3-05), if you need to toggle acceleration and deceleration time in acceleration / deceleration process.



3-10 DC Injection Brake Start Frequency (Hz):
0.1 - 10.0 - Default setting 1Hz

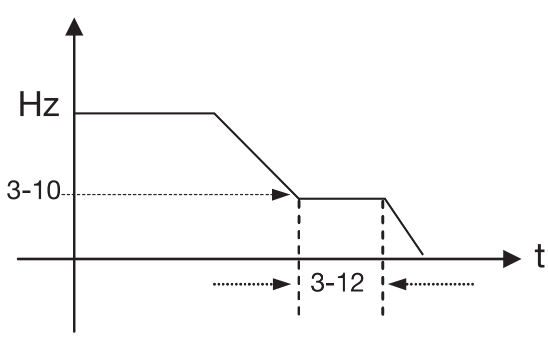
3-11: DC Injection Brake Level (%):
0.0 - 20.00% - Default setting 5%

3-12: DC Injection Brake Time (second):
0.0 - 25.5 - Default setting 0.5 sec.

1. 3-10=Frequency at which the drive will start injecting DC into the motor

2. 3-11=Percentage of current being injected into the motor (based on max output voltage)

3. 3-12=Duration of the DC injection. See graph below.



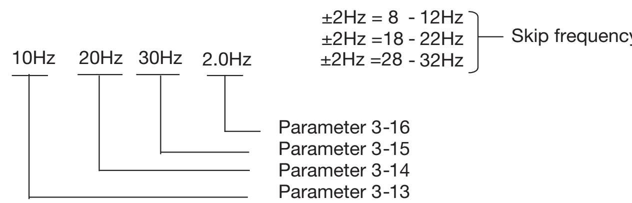
3-13: Skip Frequency #1 (Hz):
0.00 - 650.00 - Default Setting 0

3-14: Skip Frequency #2 (Hz):
0.00 - 650.00 - Default Setting 0

3-15: Skip Frequency #3 (Hz);
0.00 - 650.00 - Default Setting 0

3-16: Skip Frequency Bandwidth (±Hz):
0.00 - 30.00 - Default Setting 0

Example: Parameter 3-13 is set to 10.0Hz/13-14 to 20.0Hz/13-5 to 30.0Hz/13-6 to 2.0Hz



3-17: Parameter lock function
- 0000: Enable all Functions - Default Setting
- 0001: Parameter 6-00 to 6-08 Cannot be Changed
- 0002: All Functions Except 6-00 to 6-08 Cannot be Changed
- 0003: Disable All Functions

3-18: Copy Unit
- 0000: Disable - Default Setting
- 0001: Drive to Copy Unit
- 0002: Copy Unit to Drive
- 0003: Verify

1. 3-18=0000: Drive cannot copy parameters.

2. 3-18=0001: Copy the drive parameters to module.

3. 3-18=0002: Copy the module parameters to drive.

4. 3-18=0003: Copy the parameters to drive or module to mutually verify the parameters.

Note: The copy function is available for the models with same capacity. An optional copy module is required. (P/N SIF S-MP)

3-19: Cooling Fan Control
0000: Auto (Depends on temp.) - Default Setting
0001: Operate while in RUN Mode
0002: Always Run
0003: Always Stop

1. 3-19=0000: The fan will run when the drive senses a temperature rise, thereby extending the life of the cooling fans.

2. 3-19=0001: The fan runs while the drive is running.

3. 3-19=0002: The fan is continuously running regardless of the drive's run status.

4. 3-19=0003: The fan is always stopped regardless of the drive's run status.

3-20: Energy Saving Mode Operation
0000: Disabled - Default Setting
0001: Controlled by MFIT at Set Frequency

3-21: Energy Saving Operation Gain (%)
0-100 - Default setting 80

1. For fan and pump applications or other heavy inertia loads that need greater torque for starting than is required for operation. This parameter is only active when operating in Volts/Hz mode (parameter 0-00=0002) and when parameter 3-20=0001.

2. Parameter 5-00 to 5-06 (Multifunction input terminal) set to 10 for energy saving.

3. 3-20=0001: If the multifunction terminal is set as 10 (energy saving control terminal), the output voltage will gradually decrease to "original voltage" x "3-21 preset value as the terminal" is ON. The output voltage will rise to original voltage as the terminal is OFF.

Note

1. The decreasing and rising rates of voltage for energy saving is the same as the ones for SPEED SEARCH.

2. Energy saving mode is only available under V/F mode. (0-00 = 0002)

3. If energy saving is desired when operating in the vector mode, set 0-00=0001. Parameter 3-21 will have no effect, but energy savings will be realized.

3-22 Carrier Frequency (kHz):
2-16 - Default Setting 10.

	Carrier Frequency		Carrier Frequency		Carrier Frequency		Carrier Frequency
2	2kHz	6	6kHz	10	10kHz	14	14kHz
3	3kHz	7	7kHz	11	11kHz	15	15kHz
4	4kHz	8	8kHz	12	12kHz	16	16kHz
5	5kHz	9	9kHz	13	13kHz		

3-23: Center Frequency (CF) of Traverse Run (%):
5-100 - Default Setting 20

3-24: Amplitude (%):
0.1-20.0 - Default Setting 0

3-25: Amplitude Drop (%):
0.0-50.0 - Default Setting 0

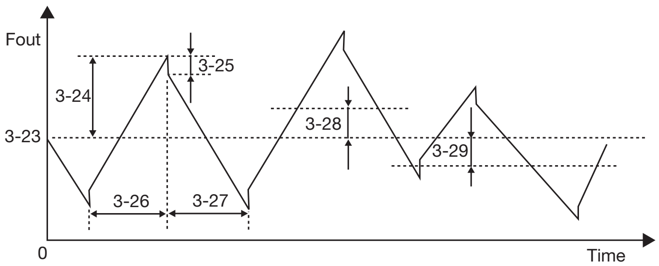
3-26: Acceleration Time of Traverse Run(s):
0.5-60.0 - Default Setting 10

3-27: Deceleration Time of Traverse Run(s):
0.5-60.0 - Default Setting 10

3-28: Deviated traverse (X upper deviation) (%):
0.0-20.0 - Default Setting 10

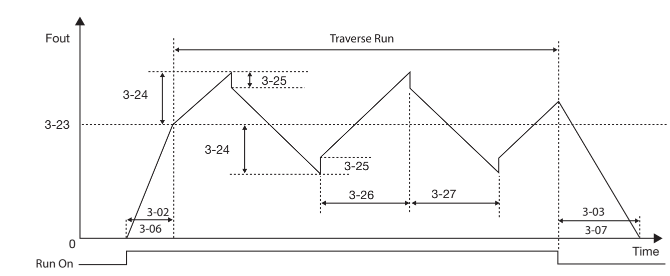
3-29: Deviated traverse (Y lower deviation) (%): 0.0-20.0 - Default setting 10

Traverse Run is defined as adding a triangle wave to the basic operation frequency of drive output frequency at the preset acceleration and deceleration time. The action is as the graph shows below:

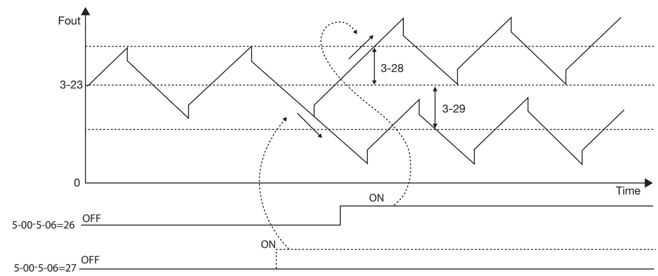


3-23 = Traverse Run Center frequency (%)
3-24 = Amplitude (%)
3-25 = Amplitude Drop (%)
3-26 = Acceleration Time(s)
3-27 = Deceleration Time(s)
3-28 = Deviated traverse (X upper deviation)
3-29 = Deviated traverse (Y lower deviation)

1. The traverse run is available when the terminal (5-00 to 5-05=0025) and operation is ON. Drive operation, in traverse run is ready when the drive output frequency reaches center frequency parameter (3-23). During acceleration to center frequency, the acceleration time is at the originally preset value parameter (3-02/3-06). When the traverse run is OFF or the drive is OFF, the deceleration time is also at original preset value parameter (3-03/3-07). However, in traverse running, the drive is at traverse run acceleration time parameter (3-26) and deceleration time parameter (3-27). The action is shown in the following diagram:



2. During traverse run, the center frequency could be controlled by the multifunction input terminals. However, the X upper deviation and Y lower deviation cannot be input at the same time. If they are inputted at the same time, the drive will maintain the original center frequency. The motion is as the graph below:



3. The stall prevention is idle during the acceleration and deceleration time of traverse run. Whereas, it is valid during first acceleration to center frequency process when the Function of traverse run is OFF or the drive is in deceleration time after the STOP command is received.

4. The frequency range of traverse run is restricted by the drive upper and lower frequency limit. That is if the (center frequency + Amplitude) is larger than Upper Limit, it will operate at upper frequency limit. And if (center frequency - Amplitude) is less than Lower Limit, it will operate at lower frequency limit.

5. During traverse run, all the preset values can be modified such as (center frequency, amplitude, amplitude drop, acceleration time, deceleration time, traverse run upper deviation and lower deviation). The motion is as graph above.

6. The stall prevention protection is unavailable during traverse run acceleration and deceleration time. Therefore, one must take into consideration the actual system capacity with the proper drive capacity when designing equipment with the traverse run active.

Parameter Group 4 - Digital Display Operation Mode

4-00: Motor Current Display Selection:
- 0000: Disable Motor Current Display - Default Setting
- 0001: Enable Motor Current Display

4-01: Motor Voltage Display Selection:
- 0000: Disable Motor Voltage Display - Default Setting
- 0001: Enable Motor Voltage Display

4-02: DC Bus Voltage Display Selection:
- 0000: Disable Bus Voltage Display - Default Setting
- 0001: Enable Bus Voltage Display

4-03: PLC Staus Display Selection:
- 0000: Disable PLC Status Display - Default Setting
- 0001: Enable PLC Status Display

This function is available for LCD keypad only.

4-04: Custom Units (Line Speed) Value:
0 - 9999 - Default setting 1800

The maximum custom units value of 4-04 is equal to the rated frequency (0-05) of the motor. For instance, given line speed 1800 is equal to display 900 when output is 30Hz while the operation frequency is 60Hz.

4-05: Custom Units (Line Speed) Display Mode
- 0000: Drive Output Frequency is Displayed - Default Setting
- 0001: Line Speed is Displayed in Integer (xxxx)
- 0002: Line Speed is Displayed with One Decimal Place (xxx.x)
- 0003: Line Speed is Displayed with Two Decimal Places (xx.xx)
- 0004: Line Speed is Displayed with Three Decimal Places (x.xxx)

The frequency reference is displayed as the drive stops, while in operation line speed is displayed.

4-06: PID Feedback Display
- 0000: Disabled - Default Setting
- 0001: Enable

Keypad displays PID feedback value:

Parameter 5-05=20 (S6 is set as the PID feedback analog terminal, refer to PID), parameter 11-0=1 (PID is enabled), and 4-06=1 (Display S6 as PID analog feedback value 0-100, the formula as follows):

If feedback signal is 0~10V, (12-6=0000), keypad display value = (S6/10V)*100

If feedback Signal is 4~20mA, (12-6=0001), keypad display value = (S6/20mA)*100

Note: Press DSP Key to switch between the output frequency and PID feedback value.

Note: The drive displays XXXF as Running, while XXXr at Stop.

Parameter Group 5 - Multifunction Input Terminals (MFIT)

5-00 to 5-06 Multifunction Input-Terminals (S1-S6/AIN):

0000: Forward/Stop Command
0001: Reverse/Stop Command
0002: Preset Speed #1 (6-02)
0003: Preset Speed #2 (6-03)
0004: Preset Speed #3 (6-05)
0005: Jog
0006: Acc/Dec time #2
0007: Emergency Stop Contact A
0008: Base Block
0009: Speed Search Stop
0010: Energy Saving
0011: Control Signal Selection
0012: Communication Control Signal Selection
0013: ACC/DEC Disabled
0014: Up Command
0015: Down Command
0016: Principal/Auxiliary Speed
0017: PID Function Disabled
0018: Reset
0019: Encoder Input Terminal (Terminal S5)
0020: PID Feedback Signal A12 (Terminal S6)
0021: AI2 Bias Signal 1 Input (Terminal S6)
0022: AI2 Bias Signal 2 Input (Terminal S6)
0023: Analog Input (Terminal AIN)
0024: PLC Application
0025: Traverse Run
0026: Traverse Run Upper Deviation
0027: Traverse Run Lower Deviation
0028: Power Source Detect for KEB Function
0029: Emergency Stop Contact B

A. Terminals S1-AIN on terminal block (TM2) are multifunction-input terminals. The above 30 functions can be set to those terminals.

B. Function Descriptions for parameters 5-00 to 5-06:

1. 5-00~06=0/1 (Forward/Reverse/Stop)
When forward command is ON, the drive runs and stops at OFF. The 5-00 factory set is forward. When reverse command is ON, the drive runs and stops at OFF. The 5-01 factory set is reverse.

2. 5-00~06=2-4 (Preset speed 1~3)
When the external multifunction input terminals are ON, the drive is in operation at the preset speed, and the duration is determined by the time of the terminal ON. The corresponding frequency parameter is illustrated below:

3. 5-00~06=5 (Jog)
When the MFIT programmed to the Jog function is ON, the drive operates at jog Frequency (parameter 6-01). Now, the drive operates at the Jog acceleration and deceleration time. The corresponding action for both preset speed and jog is illustrated below:

Multifunction Terminal 3 Preset Value = 04	Multifunction Terminal 2 Preset Value = 03	Multifunction Terminal 1 Preset Value = 02	Multifunction Terminal Preset Value = 05	Output Frequency Preset Value
0	0	0	0	6-01
X	X	X	1	6-01
0	0	1	0	6-02
0	1	0	0	6-03
0	1	1	0	6-04
1	0	0	0	6-05
1	0	1	0	6-06
1	1	0	0	6-07
1	1	1	0	6-08

The priority order of frequency command: Jog Speed - Preset Speed - Keypad frequency or external frequency signal

4. 5-00~06=6 (Toggle acceleration and deceleration time)
When the external input terminal is OFF, the acceleration 1/deceleration 1/S-curve 1 is selected. When the external input terminal is ON acceleration 2/ deceleration 2/S-curve 2 is selected.

5. 5-00~06=7/29 (External Emergency Stop Contact A or B)
   Drive will decelerate to stop and Flash E.S as the emergency stop signal received regardless of parameter 1-05 setting. After such signal is released, turn OFF the operation switch then ON or Press Operation Key, the drive will restart from the start frequency. If the emergency signal was released before the drive stopped completely, the drive still carries out emergency stop. The parameters 8-02/03 determine the action of the error terminal. As 8-02/0=0: the error terminal does not act when the external emergency signal input. While 8-02/03=9, the error terminal does act when emergency signal input.

6. 5-00~06=8 (Base Block)
   Drive stops the output voltage when receiving STOP command, and the motor coasts to a stop and the display shows ”-bb-”.

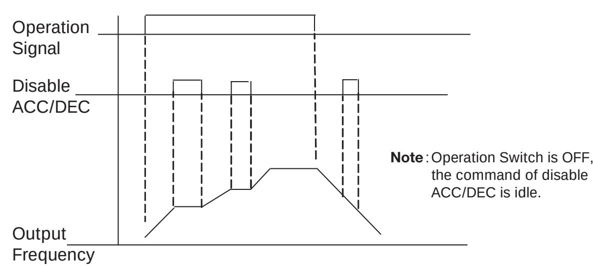
7. 5-00~06=9 (Speed Search)
   When starting, the drive detects the current speed of the motor first, then, the drive accelerates from the current speed to preset speed.

8. 5-00~06=10 (Energy-saving operation)
   The multifunction input enables the energy savings operation when ON. (See parameters 3-20 and 3-21 for further information.)

9. 5-00~06=11 (Switch of the control signal) External switch terminal is OFF: 1-00 or 1-01 determines the operation signal and frequency signal. External switch terminal is ON: Keypad controls the operation signal and frequency signal by parameter 1-00 or 1-01.

10. 5-00~06=12 (Switch of the Drive control to communication)
    External switch terminal is OFF: communication, the master (PC or PLC) can control the drive operation and frequency signal and modify the parameters, and the operation signals from Keypad and TM2 are idle. Furthermore, the keypad can only display the voltage, current and frequency, the parameters are readable and not writable, and Emergency Stop is available. Exernal switch terminal is ON: The drive is controlled by the keypad regardless of the setting of the parameter 1-00/1-06 and master. The master still can read and write the drive parameters.

11. 5-00~06=13 (Disable acceleration and deceleration) Acceleration and deceleration is unavailable until the disable acceleration and deceleration signal released. The action is illustrated in the graph below:



12. 5-00~06=14, 15 (UP/DOWN Function) (Actual ACC/DEC time is based on the setting.)

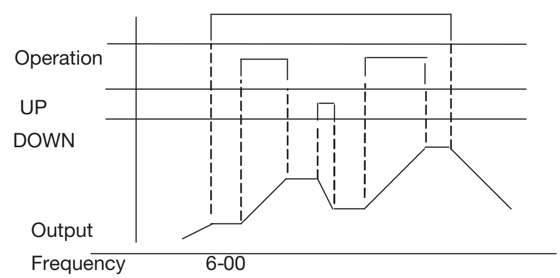
    A. Please set parameter 1-06=3 if you want to use the UP/DOWN Function, and the other frequency signals are ineffective.

    B. Set parameter 5-08=0 and 5-09=0, the drive accelerates to the preset value of parameter 6-00 when the terminal is ON, then maintains speed. As the drive receives the UP/DOWN command, it will accelerate/ decelerate until the command is released, the drive runs at that speed. The drive will ramp to a stop or coast to a stop which is determined by the parameter 1-05 when the drive receives the STOP command and the frequency of stopping will be stored in parameter 6-00 The UP/DOWN KEY is invalid as the drive stops. It is necessary to use the Keypad to modify the preset parameter.

    C. Set 5-08=1, the drive will operate from 0Hz when the operation terminal is ON. The action of UP/DOWN is as above description. The drive will ramp to a stop or coast to a stop which determined by parameter 1-05 setting when it receives the Stop Command and Return to 0Hz. The next operation will start at 0Hz.

    D. Supplying UP/DOWN signals simultaneously is invalid.

    E. 5-09≠0, Drive will accelerate to the setting of parameter 6-00 and maintain that speed. When the UP/DOWN terminal is On, Frequency is present value of the parameter. 6-00 ± 5-09, and the drive will accelerate/decelerate to frequency set in parameter 6-00. The upper frequency limit and lower frequency limit also restrict the operation. If the signal of UP/DOWN is maintained for over 2 seconds, the drive will begin to accelerate/decelerate. If parameter 5-09=0, the operation is the same, until the UP/DOWN signal stops.Please refer to the time diagram of parameter 5-09.



13. 5-00~06=16 (Principal/Auxiliary speed toggle) Multifunction terminal = OFF, the frequency is set by the VR (Master Speed) on the Keypad. While, Multifunction terminal = ON, the frequency is set by the analog signal terminal (Auxiliary Speed) on the TM2 on terminal Block.

14. 5-00~06=17 (PID Function Disable) The PID function Disable is ON. PID is not controlled by parameter 11-0, while OFF, it is controlled by parameter 11-0.

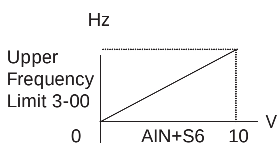
15. 5-00~06=18 (Reset Command) The Reset command is same as Reset Key on the keypad. The command is OFF, and the drive does not respond. The factory setting of parameter 5-05 is Reset command.

16. 5-04=19 (Encoder Input Terminal) The multifunction terminal S5 is set to 19 means it is the input terminal for PLC program Encoder Input Terminal.

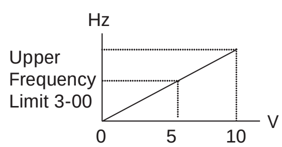
17. 5-05=20 (PID Feedback Input Terminal) The multifunction terminal S6 is set to 20 means the PID feedback input terminal is controlled by the setting of parameter 11-0.

18. 5-05=21/22 (Bias Signal 1/2 Input) To regulate the Offset of the Keypad VR or AIN analog inputs (signal of 0 ~ 10V or 0 ~ 20mA).

5-05 = 21 Function



5-05 = 22 Function



19. 5-00~06=23 (Analog Input AIN) The multifunction terminal AIN=23. The action is provided for setting the frequency.

20. 5-00~06=24 (PLC Application) The multifunction terminal S1-AIN=24, which means the terminal is for PLC application. The terminal is provided for the PLC program input.

21. 5-00~06=25 (Traverse Run)

22. 5-00~06=26 (Upper Deviation Traverse)

23. 5-00~06=27 (Lower Deviation Traverse)
The motion description refers to parameters 3-23~3-29 for detail description.

24. 5-00~06=28 (Power Source Detect for KEB Function) Please refer to the description of parameter 2-08.

Digital/Analog Input Signal Scan Times:

5-07: Multifunction terminal S1 to S6 and AIN signal scan times (mSec X 4):
1~100 times - Default Setting 5

A. TM2 terminal are sampled every 4 milliseconds. Parameter 5-07 determines how many consecutive scans of the input terminal are required without an input signal changing states before the inputs are considered valid. If the input signal changes states during scan time, the inputs will be considered invalid and will be ignored.

B. Each scan period is 4ms.

C. The user can specify the scan times interval duration according to the noise environment. If the noise is serious, modify the value of parameter 5-0, but the response speed will be slowed down.

D. **Note:** If the terminals S6 and AIN are for digital signals, the voltage level for digital signal above 8V is treated as ON, below 2V is OFF.

5-08: Stop Mode Using MFIT:
0000: When Up/Down is used, the preset frequency is held as the drive stops, and the UP/DOWN is idle. - Default Setting 0000.
0001: When Up/Down is used, the preset frequency is reset to 0Hz as the drive stops.
0002: When Up/Down is used, the preset frequency is held as the drive stops, and the UP/DOWN is available.

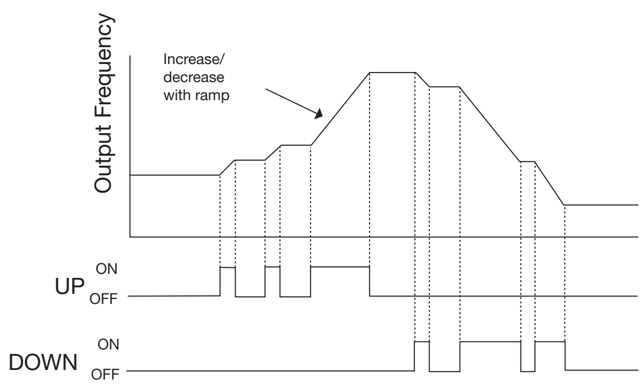
1. Set parameter 5-08=0, the drive will accelerate to the speed of parameter 6-00 after receiving the Run command and run at that speed. The drive begins to accelerate (decelerate) as the UP (Down) terminals are energized. The drive will hold the speed as the UP/DOWN command is released. When the Run Signal releases, the drive will ramp to a stop or stop output voltage (determined by parameter 1-05). It will store the frequency when the operation signal disappears. UP/DOWN keys are idle when the drive is stopped. The keypad is available for you to modify the preset frequency (6-00). If 5-08=0002, the UP/DOWN is available as the drive stops.

2. Set parameter 5-08=1, as the Run terminal is energized, the drive operates from 0Hz, the Function of UP/DOWN is same as the above description. When the Run Signal release, the drive will ramp stop or stop output (determined by parameter 1-05). And return to 0Hz. The following operation will always begin from 0Hz.

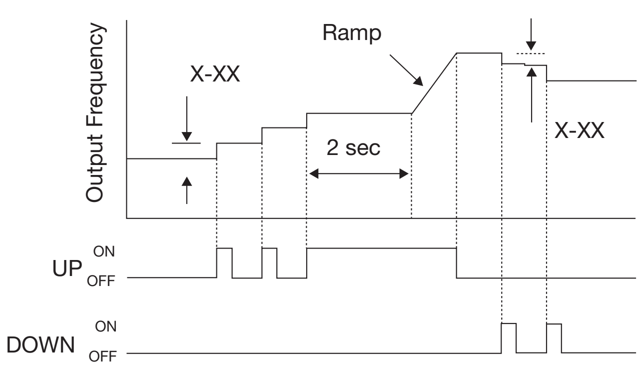
5-09: Step of Up/Down Function (Hz): Up/Down (Hz) 0.00 - 5.00 - Default Setting 0.00

There are two modes covered below:

1. 5-09=0.00, the function is disable. The operation is just the same as original one. While UP terminal is ON, the frequency increases while the DOWN terminal is ON, the frequency decreases. (Refer to the following graph.)



2. 5-09=0.01 t0 5.00, UP/DOWN terminal ON, that equivalent to increase/decrease the frequency of parameter 5-09. If the pressing is over 2 seconds, renew the original UP/DOWN mode. (Please refer to the following diagram.)



5-10: Pulse Follower Multiplier: Up/Down (Hz) 0.000 To 9.999 - Default Setting 1.000

Pulse input multiplier used to set the pulse follower ratio, when 1-06 is set to a value 5 and 5-04 = 19, the drive will follow a pulse train input on terminal S5.

Example: 1kHz pulse input train reference to terminal S5, set parameter 5-10 = 0.500. Frequency Reference = 1kHz x 0.500 = 5.00Hz Output Frequency

1kHz pulse input train reference to terminal S5, set parameter 5-10 = 1.000. Frequency Reference = 1kHz x 1.000 = 10.00Hz Output Frequency.

5-11: Reference Source 2: (Hz) 0-4-0 Default setting

Set Multifunction input to a value of 16, which allows the switching of the input reference signals from Frequency command source (1-06) to Reference Source (5-11).

Reference Source Selection

0000:	Set the Frequency with Keypad - Default Setting
0001:	Potentiometer on Keypad
0002:	External Analog Signal Input or Remote Potentiometer
0003:	Up/Down Frequency Control Using MFIT (S1 - S6)
0004:	Communication Setting Frequency

Note: Parameter 1-06 has to be set to a value of 5 (Pulse Follower).

Parameter Group 6 - Jog and Preset (MFIT) Speed Setting

6-00~08 Jog and Preset (MFIT) Speed Setting

A. 5-00~06=2 (Preset Speed 1-3)
The external multifunction terminal = ON, the drive operates at preset speed. The operation time of the 8 stages is based on the ON time of the terminal. Please refer to the corresponding parameter list:

B. 5-00~05=5 (Jog Terminal)
The external multifunction terminal = ON, the drive operates in Jog acceleration time/Jog decelerate time/ON.

Parameter No.	LCD Display	Description	Range/Code
6-00	(Keypad Freq.)	Keypad Frequency (Hz)	0.00 - 650.00
6-01	(Jog Freq.)	Jog Frequency (Hz)	0.00 - 650.00
6-02	(Preset Speed #1)	Preset Speed #1 (Hz)	0.00 - 650.00
6-03	(Preset Speed #2)	Preset Speed #2 (Hz)	0.00 - 650.00
6-04	(Preset Speed #3)	Preset Speed #3 (Hz)	0.00 - 650.00
6-05	(Preset Speed #4)	Preset Speed #4 (Hz)	0.00 - 650.00
6-06	(Preset Speed #5)	Preset Speed #5 (Hz)	0.00 - 650.00
6-07	(Preset Speed #6)	Preset Speed #6 (Hz)	0.00 - 650.00
6-08	(Preset Speed #7)	Preset Speed #7 (Hz)	0.00 - 650.00

Priotity in reading the frequency: Jog > Preset speed > Keypad frequency or external frequency signal

Multifunction Terminal 3 Preset Value = 04	Multifunction Terminal 2 Preset Value = 03	Multifunction Terminal 1 Preset Value = 02	Jog Command Terminal Preset Value = 05	Output Frequency Preset Value Parameter
0	0	0	0	6-00
X	X	X	1	6-01
0	0	1	0	6-02
0	1	0	0	6-03
0	1	1	0	6-04
1	0	0	0	6-05
1	0	1	0	6-06
1	1	0	0	6-07
1	1	1	0	6-08

Parameter Group 7 - Analog Input Signal Operation Mode

Analog Input Signal Operation Mode:

7-00: AIN Gain(%):
0-200 - Default Setting100

7-01: AIN Bias(%):
0-100 - Default Setting 0

7-02: AIN B ias Selection:
0000: Positive
0001: Negative - Default Setting 0000

7-03: AIN Slope:
0000: Positive
0001: Negative - Default Setting 0000

7-04: AIN signal verification Scan Time (AIN, AI2) (mSec x 4):
1 -100 - Default Setting 50

7-05: AI2 Gain (%) (S6):
0-200 - Default Setting 100

1. 7-02=0: 0V (0mA) corresponding to Lower Frequency Limit, 10V (20mA) corresponding to Upper Frequency Limit.

2. 7-02 = 1: 10V (20mA) corresponding to Lower Frequency Limit, 0V (0mA) corresponding to Upper Frequency Limit.

The setting of Figure 1:

Parameter	7-00	7-01	7-02	7-03	7-05
A	100%	50%	0	0	100%
B	100%	0%	0	0	100%

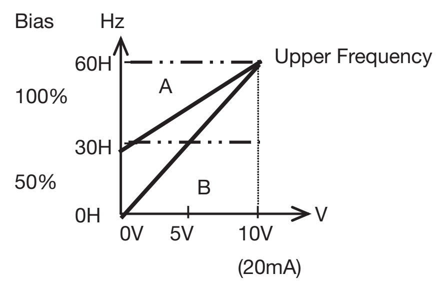


Figure 1

The setting of Figure 2:

Parameter	7-00	7-01	7-02	7-03	7-05
C	100%	50%	0	1	100%
D	100%	0%	0	1	100%

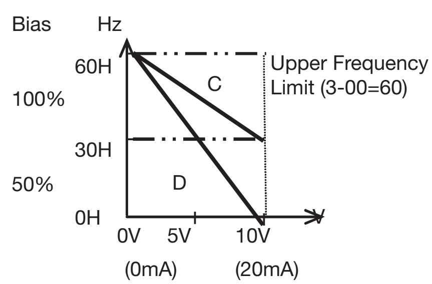


Figure 2

The setting of Figure 3:

Parameter	7-00	7-01	7-02	7-03	7-05
E	100%	20%	1	0	100%

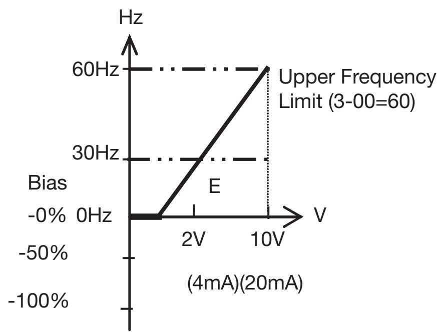


Figure 3

The setting of Figure 4:

Parameter	7-00	7-01	7-02	7-03	7-05
F	100%	50%	1	1	100%

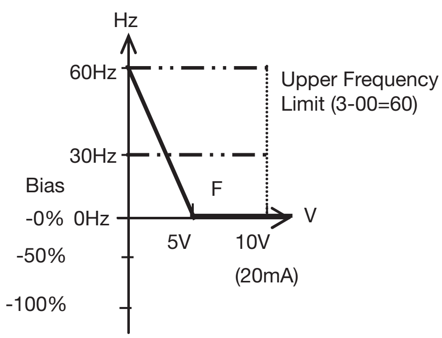


Figure 4

3. Drive reads the average value of A/D signals once per (7-04x4ms). Users can determine scan intervals according to noise in the environment. Increase 7-04 in noisy environment, but the response time will increase accordingly.

Parameter Groups 8 - Multifunction Analog Output and Output Signal Operation

Multifunction analog output control:

8-00: Analog Output Voltage Mode:
- 0000: Output frequency - Default Setting 0000
- 0001: Frequency Setting
- 0002: Output Voltage
- 0003: DC Bus Voltage
- 0004: Motor Current
- 0005: FEEDBACK Signal of PID

8-01: Analog Output Gain = 0~200% - Default Setting 100

The multifunction analog output terminal of the terminal block (TM2), is 0-10Vdc analog output. The output type is determined by the parameter 8-00. Parameter 8-01 allows the scaling of the analog output to be changed to match the tolerance of the external voltage meter and peripheral equipment. The FEEDBACK of PID (that is the input voltage and current of S6) outputs analog value on FM+ terminal. This value corresponds to the input signal 0~10V or 4~20mA.

Note: The max output voltage is 10V due to the hardware of the circuit.

Multifunction output terminals control:

8-02: RELAY 1 (R1C, R1B, R1A terminal on TM2): - Default Setting 0000

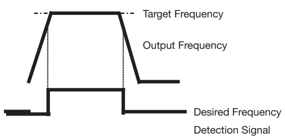
8-03: RELAY 2 (R2C, R2A terminal on TM2):
- 0000: Run - Default Setting 0000
- 0001: Frequency Reached (Target Frequency) (Set Frequency ± 8-05)
- 0002: Set Frequency (8-04± 8-05)
- 0003: Frequency Threshold Level (>8-04) - Frequency Reached
- 0004: Frequency Threshold Level (<8-04) - Frequency Reached
- 0005: Over torque Threshold Level
- 0006: Fault
- 0007: Auto-restart
- 0008: Momentary AC Power Loss
- 0009: Rapid Stop Mode
- 0010: Coast-to-Stop Mode
- 0011: Motor Overload Protection
- 0012: Drive Overload Protection
- 0013: PID Feedback Signal Break
- 0014: PLC Operation
- 0015: Power On

8-04: Frequency Reached Output
Setting = 0-650Hz - Default Setting 0.0

8-05: Frequency Output Detection
Range = 0-30Hz - Default setting 0.0

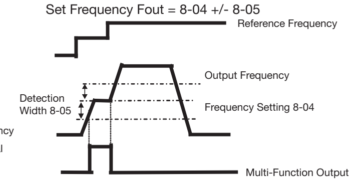
8-02/03=01:

Preset Frequency is Reached (+/- 8-05)



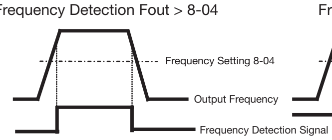
8-02/03=02:

Set Frequency Fout = 8-04 +/- 8-05



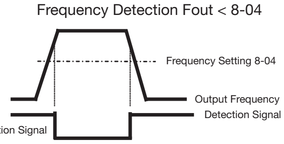
8-02/03=03:

Frequency Detection Fout > 8-04



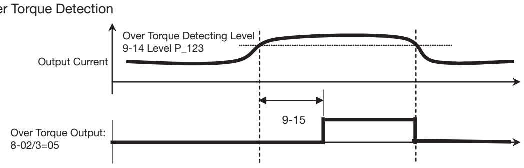
8-02/03=04:

Frequency Detection Fout < 8-04



8-02/03=05:

Over Torque Detection



Parameter Group 9 - Drive and Load Protection Modes

9-00: Trip Prevention Selection During Acceleration:
- 0000: Enable Trip Prevention During Acceleration - Default Setting 0000
- 0001: Disable Trip Prevention during Acceleration

9-01: Trip Prevention Level During Acceleration:
50%~ 300% - Default Setting 200

9-02: Trip Prevention Selection During Deceleration:
- 0000: Enable Trip Prevention During Deceleration - Default Setting 0000
- 0001: Disable Trip Prevention During Deceleration

9-03: Trip Prevention Level During Deceleration:
50% ~ 300% - Default Setting 200

9-04: Trip Prevention selection in Run Mode:
- 0000: Enable Trip Prevention in Run Mode - Default Setting 0000
- 0001: Disable Trip Prevention in Run Mode

9-05: Trip Prevention Level in Run Mode:
50% ~ 300% - Default etting 200

9-06: Trip Prevention Deceleration Time Selection in Run Mode:
- 0000: Trip Prevention Deceleration Time Set by 3-03 - Default Setting 0000
- 0001: Trip Prevention Deceleration Time Set by 9-07

9-07: Deceleration Time in Trip Prevention Mode (sec):
0.1 ~ 3600.0 - Default Setting 3.0

Note:

1. When accelerating, the drive will delay the acceleration time if the time is too short resulting in an over current in order to prevent the drive from tripping.

2. When decelerating, the drive will delay the deceleration time if the time is too short resulting in the over voltage trip of DC BUS in order to prevent the drive trips with “OV” displayed.

3. Some mechanical characteristics (such as a punch press) or unusual breakdown (seize due to insufficient lubrication, uneven operation, impurities of precessed materials, etc.) will cause the drive to trip. When the operating torque of the drive exceeds the setting of parameter 9-05, the drive will lower the output frequency following the deceleration time set by parameter 9-05, and return to the normal operation frequency after the torque is stable.

9-08: Electronic Motor Overload Protection Operation Mode:
- 0000: Enable Electronic Motor Overload Protection - Default Setting 0000
- 0001: Disable Electronic Motor Overload Protection

9-09: Motor Type Selection:
- 0000: Electronic Motor Overload Protection Set for TEFC type motors - Default Setting 0000
- 0001: Electronic Motor Overload Protection Set for TEBC, TENV Type Motors.

9-10: Motor Overload Protection Curve Selection:
- 0000: Constant Torque (OL=103%) (150%, 1 minute) - Default Setting 0000
- 0001: Variable Torque (OL=113%) (123%, 1 minute)

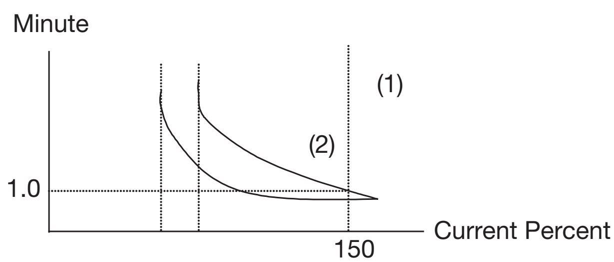
9-11: Operation After Overload Protection is Activated:
- 0000: Coast-to-Stop After Overload Protection is Activated - Default Setting 0000
- 0001: Drive will not trip when Overload Protection is Activated (OL1)

Description of the overload relay function:

1. 9-10=0000: Protect the general mechanical load, the load is less than 103% rated current, the motor will continue to run. The load is larger than 150% rated current, the motor will run for 1 minute. (Refer to curve 1 below)
   9-10=0001: Protect HVAC load (FAN, PUMP...so on): the load is less than 113% rated current, the motor will continue to run. The load is larger than 123% rated current, the motor will run for 1 minute.

2. The cooling function of the motor will decrease when the motor is run at slow speeds. So the overload relay action level will decrease at the same time. (The curve 1 will change to curve 2)

3. 9-09=0000: Set 0-05 as the rated frequency of the serve motor.
   9-11=0000: Drive coasts-to-stop as the overload relay activates and flashes OL1. Press the reset or the external reset terminal to continue to run.
   9-11=0001: Drive continues to run as the overload relay activates and flashes OL1. Until the current decreases below 103% or 113% (determined by 9-10), OL1 will disappear.



9-12: Over-Torque Detection Selection:
- 0000: Disable Over Torque Operation - Default Setting 0000
- 0001: Enable Over Torque Operation Only if at Set Frequency
- 0002: Enable Over Torque Operation While the Drive is in Run Mode

9-13: Operation After Over Torque Detection is Activated:
- 0000: Drive will Continue to Operate After Over Torque is Activated - Default Setting 0000
- 0001: Coast-to-Stop After Over Torque is Activated

9-14: Over-Torque Threshold Level (%):
30-200% - Default Setting 160

9-15: Over-Torque Activation Delay Time(s):
0.0-25.0 - Default Setting 0

The over-torque is defined as: The output torque is inside parameter 9-15, the voltage level (the drive rated torque is 100%) is over parameter 9-14.

1. 9-13=0000: If there is over torque, the drive can continue to run and flashes OL3 until the output torque is less than the 9-14 setting value.

2. 9-13=0001: If there is over torque, the drive coasts-to-stop and flashes OL3. It is necessary to press “RESET” or external terminal to continue to run.

Parameter 8-02, 03 (Multifunction output terminal) = 05, the output terminal is output over torque signal.

Note: Over-torque output signal will be output as the parameter 9-12=0001 or 0002 and over the level and time.

Parameter Group 10 - Volts/Hz Pattern Operation Mode

1. V/F PATTERN Selection

10-0: V/F PATTERN Selection
0-18 Default 9

10-1: Torque boost gain (V/F pattern modulation)
0.0-30 Default 0%

10-2: Motor no load current (Amps AC)
Motor Dependent

10-3: Motor rated slip compensation (%)
0.0-100.0 Default 0.0%

10-4: Max output frequency (Hz)
50.0-650.0 Default 60Hz

10-5: Max output frequency voltage ratio (%)
0.0-100.0 Default 100%

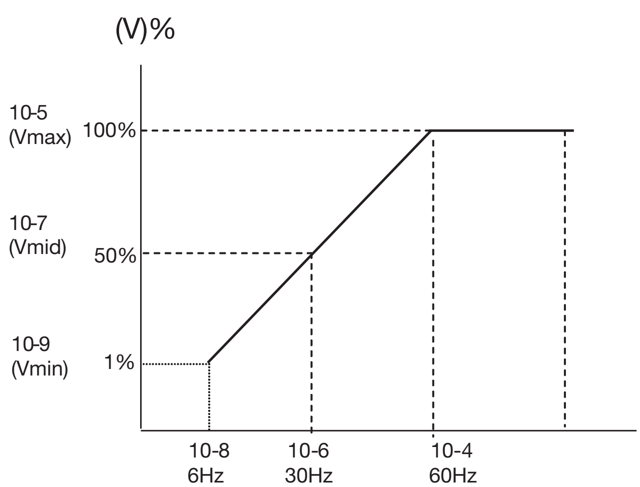
10-6: Mid frequency (Hz)
0.1-650.0 Default 30Hz

10-7: Mid output frequency voltage ratio (%)
0.0-100.0 Default 50%

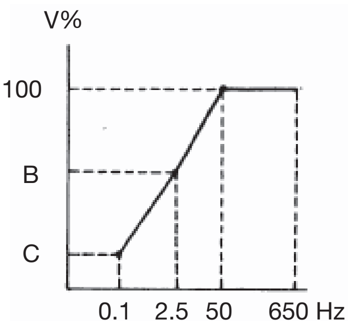
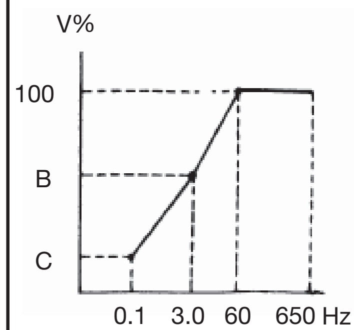
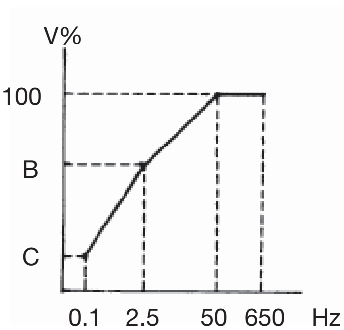
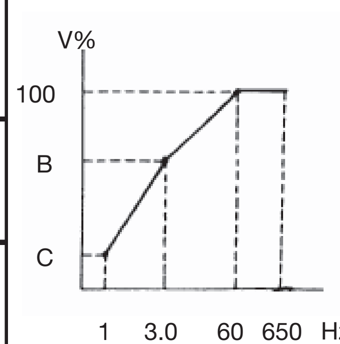
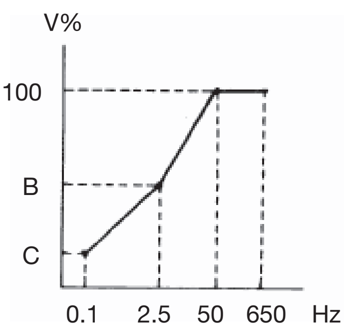
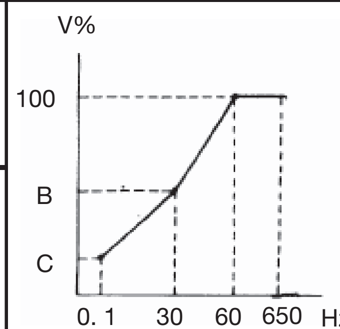
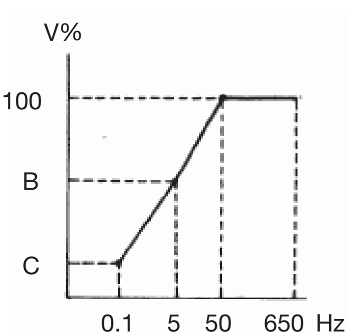
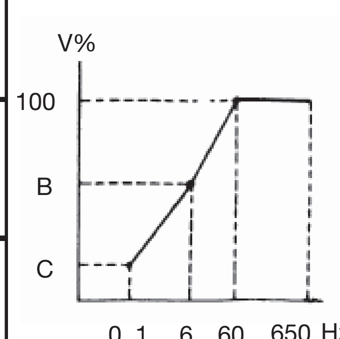
10-8: Min output frequency (Hz)
0.1-650.0 Default 0.6Hz

10-9: Min output frequency voltage ratio (%)
0.1-10.10 Default 1%

The following diagram shows the factory default settings for parameter 10-4 thru 10-9 when 0-00=0002 (V/Hz).



2. Parameter 10-0 = 0-17 V/F Pattern (Refer to the following list)

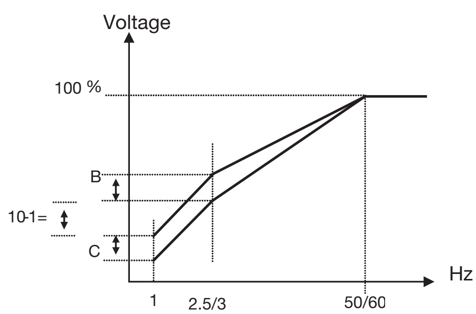
<table>
<tr><th></th><th>Parameter</th><th>10-0</th><th>V/F Pattern</th><th></th><th>Parameter</th><th>10-0</th><th>V/F Pattern</th></tr>
<tr><td rowspan="8">50Hz</td><td>General Use</td><td>0</td><td>
</td><td rowspan="8">60Hz</td><td>General Use</td><td>9</td><td>
</td></tr>
<tr><td rowspan="3">High Start Torque</td><td>1</td><td rowspan="3">
</td><td rowspan="3">High Start Torque</td><td>10</td><td rowspan="3">
</td></tr>
<tr><td>2</td><td>11</td></tr>
<tr><td>3</td><td>12</td></tr>
<tr><td rowspan="2">Normal Duty (VT)</td><td>4</td><td rowspan="2">
</td><td rowspan="2">Normal Duty (VT)</td><td>13</td><td rowspan="2">
</td></tr>
<tr><td>5</td><td>14</td></tr>
<tr><td rowspan="3">Heavy Duty (CT)</td><td>6</td><td rowspan="3">
</td><td rowspan="3">Heavy Duty (CT)</td><td>15</td><td rowspan="3">
</td></tr>
<tr><td>7</td><td>16</td></tr>
<tr><td>8</td><td>17</td></tr>
</table>

(1/2 to 15HP)

Parameter 10-0	V/F Pattern Description	B	C
0/9	General Purpose 50/60Hz	50.00%	1.00%
1/10	Increased Starting Torque 50/60Hz	10.00%	7.50%
2/11	High Starting Torque 50/60Hz	15.00%	7.50%
3/12	Maximum Torque 50/60Hz	20.00%	7.50%
4/13	Fan/Pump Starting Torque 50/60Hz	17.50%	7.50%
5/14	Fan/Pump High Starting Torque 50/60Hz	25.00%	7.50%
6/15	High Slip Starting Torque 50/60Hz	15.00%	7.50%
7/16	High Slip Normal Starting Torque 50/60Hz	20.00%	7.50%
8/17	High Slip Normal High Starting Torque 50/60Hz	25.00%	7.50%

3. The drive will output the value that B, C voltage (refer to parameter 10-0) plus 10-1 V/F pattern setting. And the starting torque will be increased.

Note: Parameter 10-1=0, Torque boost function is invalid.



4. When the induction motor is running, there must be slip due to the load. It is necessary to boost the slip frequency to improve the regulation of the speed.

$$\text{Slip frequency boost} = \frac{\text{Output Current-(10-2)}}{\text{(0-02)-(10-2)}} \times \text{(10-3)}$$

Note: 0-02=motor rated current, 10-2=motor no load current

10-3 rough value = (Motor synchronization speed - Ratedspeed)/ Motor synchronization speed

Marked on the motor nameplate

$$\text{Motor synchronization speed (RPM)} = \frac{120}{\text{Motor Poles}} \times \text{Motor rated frequency (50Hz or 60Hz)}$$

$$\text{eg: 4 Poles, 60Hz induction motor synchronization speed} = \frac{120}{4} \times 60 = 1800 \text{ RPM}$$

Note: Motor no load current (parameter 10-2) differs with the drive capacities (15-0) (Refer to 0-02 note). It should be regulated according to the actual condition.

Parameter Group 11 - PID Operation Mode

11-0: PID Operation Selection
- 0000: PID Disable - Default Setting
- 0001: PID Enable (Deviation is D-Controlled) Normal Operation
- 0002: PID Feedback D-controlled
- 0003: PID D Reverse Characteristic Controlled (Inverse Operation)
- 0004: PID Feedback D Characteristic Controlled
- 0005: PID, Frequency Command + D Controlled
- 0006: PID, Frequency command + Feedback D Controlled
- 0007: PID, Frequency Command + D Reverse Characteristic Controlled
- 0008: PID, Frequency Command + Feedback D Reverse Characteristic Controlled

11-0=1 D is the deviation of (target value - detected value) in the unit time (Parameter 11-4).

11-0=2 D is the deviation of the detected values in unit time (parameter 11-4).

11-0=3 D is the deviation of target value - detected value in the unit time (parameter 11-4). If the deviation is positive, the output frequency decreases, vice versa.

11-0=4 D is the deviation of detected value in unit time (Parameter 11-4). When the deviation is positive, the frequency decreases, vice versa.

11-0=5 D is equal to the deviation of (target value - detected value) in unit time (Parameter 11-4) + Frequency command.

11-0=6 D is equal to the deviation of detected values in unit time + Frequency command.

11-0=7 D is equal to the deviation of (target value - detected value) in unit time + Frequency command. If the deviation is positive, the output frequency decreases, vice versa.

11-0=8 D is equal to the deviation of detected values in unit time + Frequency command. When the deviation is positive, the frequency decreases, vice versa.

11-1: Feedback Calibration Gain (%):
0.00 - 10.00 - Default Setting 1.0

11-1 - is the calibration gain. Deviation = (target value - detected value) x 11-1.

11-2: Proportion Gain (%):
0.0 - 10.0 - Default Setting 1

11-2 - Proportion gain for P control

11-3: Integrate Time(s):
0.0 - 100.0 - Default Setting 10

11-3 - Integrate time for I control

11-4: Differential Time(s):
0.0 - 10.00 - Default Setting 0

11-4 - Differential time for D control

11-5: PID Offset:
0000: Positive Direction - Default Setting
0001: Negative Direction

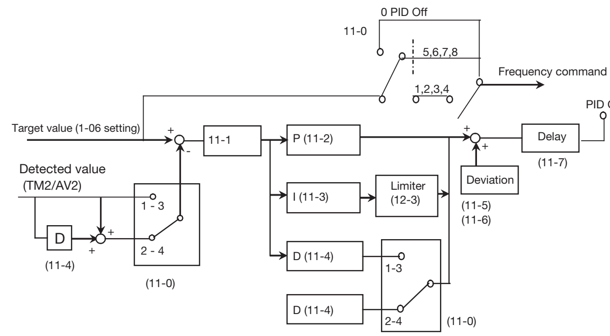
11-6: PID Offset Adjust (%):
-109% – +109% - Default Setting 0

11-5/11-6 - PID the calulated result plus 11-6 (the sign of 11-6 is determined by 11-5)

11-7: Output Lag Filter Time(s):
0.0 - 2.5 - Default Setting 0.0

11-7 - Update time for the output frequency

Note: PID Function is available for controlling the output flow, external fan flow and temperature. The control flow is as follow:



1. Performing PID control, set parameter 5-05=23, AV2 to TM2 as PID feedback signal.

2. The target value of above diagram is the Parameter 1-06 input frequency.

Parameter Group 12 - PID Mode

12-0: Feedback Loss Detection Mode:
0000: Disable - Default Setting
0001: Enable - Drive Continues to Operate After Feedback Loss
0002: Enable - Drive “STOPS” After Feedback Loss

1. 12-0=0: Disable

2. 12-0=1: Detect to run and display PDER

3. 12-0=2: Detect to stop and display PDER

12-1: Feedback Loss Detection Mode (%):
0-100 - Default Setting 0

12-1- Is the level for signal loss. Deviation = Command value - Feedback value. When the deviation is larger than the loss level, the feedback signal is lost.

12-2: Feedback Loss Detection Delay Time (s):
0.0-25.5 - Default Setting 1.0

12-2 - Action delay time when the feedback signal lost.

12-3: Integrate Limit Value (%):
0-109 - Default Setting 100

12-3 - Limit value to prevent PID saturating

12-4: Integrator Reset to 0 when Feedback Signal Equals the Intended Value:
0000: Disable - Default Setting
0001: 1 second
0030: 30 seconds

1. 12-4=0: When the PID feedback value reaches the command value, the integrator will not be reset to 0.

2. 12-4=1-30: When the PID feedback value reaches the target value, reset to 0 in 1-30 seconds and drive stops out putting. The drive will output again as the feedback value differs from the target value.

12-5: Allowable Integration Error Margin (Unit Value) (1 Unit = 1/8192): 0 ~ 100 - Default Setting 0

1. 12-5=0~100% Unit Value: restart the tolerance after the integrator reset to 0.

12-6: PID Feedback Signal:
0000: 0~10V - Default Setting
0001: 4~20mA

Feedback signal selection
0000: 0~10V
0001: 4~20mA

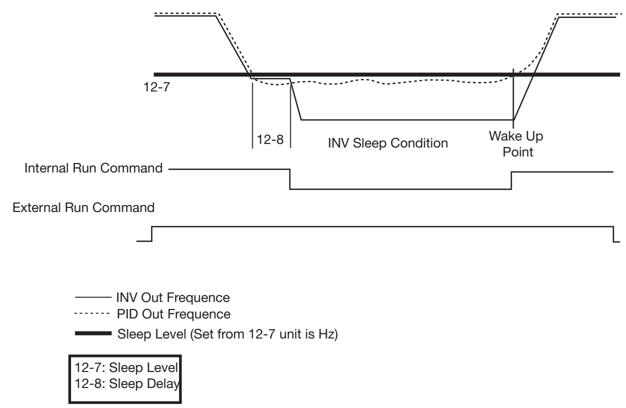
12-7: PID Sleep Start Level (Hz):
00 to 650Hz - Default Setting 0.0

12-7 - Set the frequency for sleep mode to start, Unit: HZ

12-8: PID Sleep Delay Time(s):
0.0-25.5 - Default Setting 0.0

12-8 - Set the Time for sleep delay, Unit: sec

When PID output frequency is less than the frequency for sleep start and reaches the end of sleep delay time, the drive will decelerate to 0 and enter PID sleep mode. When PID output frequency is higher than the frequency for sleep start the drive will be awoken and enter PID mode. The time diagram is as follows:



Parameter Group 13 - Communication Mode

13-0: Assigned Communication Station Number:
1 ~ 254 - Default Setting 1

13-0-Sets the communication station codes when more than one drive is used.

13-1: Baud Rate setting (bps):
0000: 4800
0001: 9600
0002: 19200
0003: 38400 - Default Setting

13-2: Stop Bit Selection:
0000: 1 Stop Bit - Default Setting
0001: 2 Stop Bit

13-3: Parity Selection:
0000: No Parity - Default Setting
0001: Even Parity
0002: Odd Parity

13-4: Data Format Selection:
0000: 8 Bit Data - Default Setting
0001: 7 Bit Data

1. RS-485 Communication:

   a. 1 vs. 1 Controlling: To control one drive by a PC, PLC or controller. (Set 13-0 =1~254)

   b. 1 vs. more controlling: To control more than one drive by PC, PLC or controller (the max number of drives could be 254. Set 13-0=~254), when the drive receives the communication station code = 0, the communication control is accepted regardless of the setting value of 13-0.

2. RS-232 communication: (RS232 interface is required) 1 vs. 1 controlling: to control one drive by a PC, PLC or controller. (Set 13-0 = 1~254)

Notes:

a. The BAUD RATE (13-1) of PC (or PLC or controller) and the one of the drives should be set the same. Communicaiton format (13-2/13-3/13-4) should be set the same.

b. Drive will confirm the parameter is accepted PC modifies the parameter of the drive.

c. Please refer to the ACE15 Communication PROTOCOL.

Parameter Group 14 - Auto Tuning

14-0: Stator Resistance (Ohms) - Default Setting, see Appendix 1.

14-1: Rotator Resistance (Ohms) - Default Setting, see Appendix 1.

14-2: Equivalent Inductance (mH) - Default Setting, see Appendix 1.

14-3: Magnetized Current (Amps AC) - Default Setting, see Appendix 1.

14-4: Ferrit Loss Conduction (gm) - Default Setting, see Appendix 1.

1. If parameter 0-00=0 or 1 (vector mode) is selected, with power ON, set 0-06=1, the motor may run as the drive performs auto tuning. As the motor stops, it means that auto tuning is finished. The drive will write the internal parameter from the motor to 14-0~14-4, and auto reset the 0-06 as 0.

2. Auto tuning must be carried out when the motor changes. If the internal parameters are known already, they can be input to 14-0~14-4 directly.

3. 0-06=1 to perform auto tuning, when finished, 0-06 auto resets to 0, the Keypad displays END.

Parameter Group 15 - Operation Status and Function Reset

15-0: Drive Horsepower Code - Default Setting Horsepower Dependent

15-0	Drive Model	
0005C	ACE152V1P/3P	F50
0010C		1
0020C		2
0030C		3
0050C		5
0075C		7
0100C		10

15-0	Drive Model	
0010C	ACE154V3P	1
0020C		2
0030C		3
0050C		5
0075C		7
0100C		10
0150C		15

15-1: Software Version

15-2: Fault Log (Last 3 faults)

1. When the drive fails to work normally, the former fault stored in 2.xxxx will be transferred to 3.xxxx, then, the one in 1.xxxx to 2.xxxx. The current fault will be stored in the blank 1.xxxx. Therefore, the fault stored in 3.xxxx is the oldest one of the three, while the one 1.xxxx are the last.

2. Enter 15-2, the fault 1.xxxx will be displayed first, press up arrow, you can read 2.xxx-3.xxx-1.xxx, where as down arrow, order is 3.xxx-2.xxx-1.xxx-3.xxx.

3. Enter parameter 15-2, the three fault log will be cleared as the reset key is pressed. The log content will change to 1.—,2.—,3—.

4. E.g. If the fault log content is “1.OCC” this indicates the latest fault is OC-C, and so on.

15-3: Accumulated Operation Time 1 (Hours):
0 - 9999

15-4: Accumulated Operation Time 2 (Hours X 10000):
0 - 27

15-5: Accumulated Operation Time Mode:
0000: Power on Time - Default Setting
0001: Operation Time

1. When the operation time is set to 9999 and the operation duration is set to 1. The next hour will be carried to operation duration 2. Meanwhile, the recorded value will be cleared to 0000, and the record value of operation duration 2 will be 01.

2. Description of operation time selection:

Preset Value	Description
0	Power on counts the accumulated time
1	Drive operation, count the accumulated operation time

15-6: Reset the factory setting:
0000: Default Setting
1110: Reset to 50Hz Factory Setting
1111: Reset to 60Hz Factory Setting
1112: Reset PLC Program

As parameter 15-6 is set as 1111, the parameter will be reset to factory setting. The max output voltage will comply with the voltage and frequency (0-01/0-05) on the nameplate of the motor. The output frequency is 60Hz if the upper frequency limit is not set.

Note:
Motor parameters (parameters 14-0~14-4) will be modified under V/F control mode when reset to factory setting.

Motor parameters (parameters 14-0~14-4) will not be modified under vector control mode when reset to factory setting.

4.5 Specification Description on Built-In PLC Function

ACE15 has a built-in simple PLC function, users can download Ladder Diagram from their PC (Windows base software) or PDA (Win CE base software).

4.5.1 Basic Instructions

				P			No/NC
Input Instruction							I1~I7 / i1~i7
Output Instruction	Q	Q	Q	Q	Q	q	Q1~Q2 / q1~82
Auxiliary Instruction	M	M	M	M	M	m	M1~MF / m1~mF
Special Register							V1~V7
Counter Instruction	C				C	c	C1~C4 / c1~c4
Timer Instruction	T				T	t	T1~T8 / t1~t8
Analog Comparing Instruction	G				G	g	G1~G4 / g1~g4
Encoder Comparing Instruction	J				H	h	H1~H4 / h1~h4
Operation Instruction	F				F	f	F1~F8 / f1~f8

Description for Special Registers:
V1: Setting Frequency Range: 0.1~650.0Hz
V2: Operation Frequency Range: 0.1~650.0Hz
V3: AIN Input Value Range: 0~1000
V4: S6 Input Value (Analog) Range: 0~1000
V5: Keypad VR Input Value Range: 0~1000
V6: Operation Current Range: 0.1~999,9A
V7: Torque Value Range: 0.1~200.0%

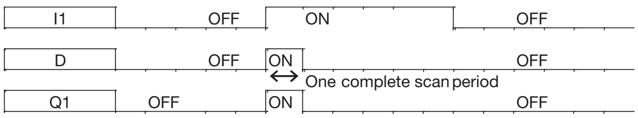
	Upper Differential	Lower Differential	Other Instruction Symbol
Differential Instruction	D	d	
SET Instruction			
RESET Instruction			
P Instruction			P

Open Circuit (On Status)	“ “	
Short Circuit (Off Status)	“--”	

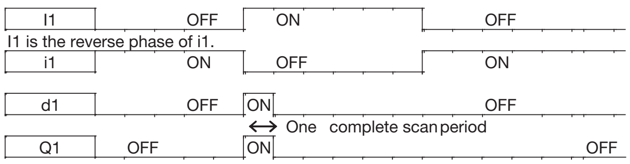
Connection Symbol	Description
─	Connecting left and right Components
┴	Connecting left, right, and upper Components
┼	Connecting left, right, upper, and lower Components
┬	Connecting left, right and lower Components

4.5.2 Function of Basic Instructions
Function D (d) Command

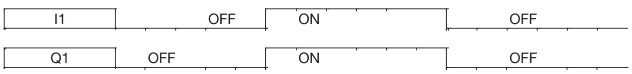
Function D (d) Command
Sample 1: I1-d-[Q1



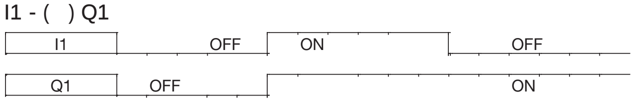
Sample 2: i1-d-[Q1



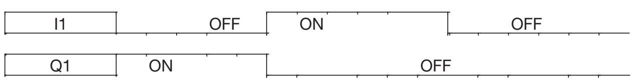
NORMAL (-[ ) Output
I1 - [Q1



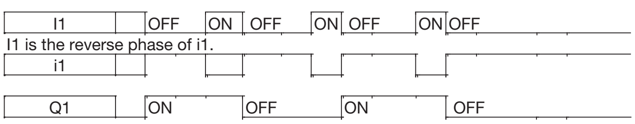
SET ( ) OUTPUT
I1 - ( ) Q1



RESET (V) Output
I1 - (V) Q1

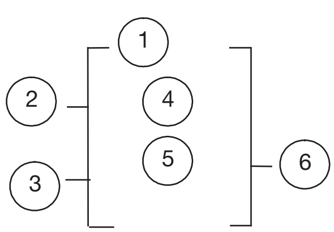


P Output
i1 - PQ1



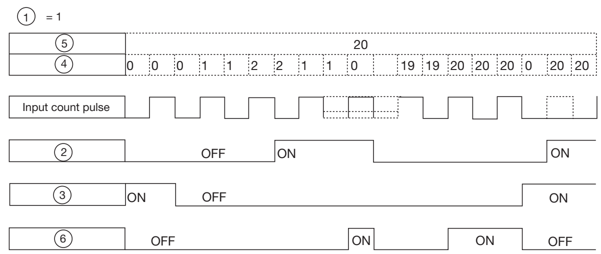
4.5.3 Application Instructions

1. Counter Mode 1

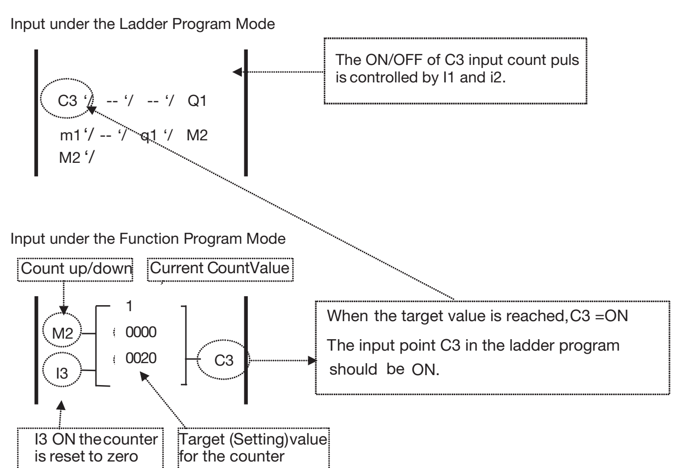


Symbol	Description
1	Counting Mode (1-4)
2	Use (I1 ~ f8) to set counting up or counting down OFF: counting up (0,1,2,3,4 ...) ON: Counting down (...3,2,1,0)
3	Use (I1 ~ f8) to RESET the counting value ON: the counter is initialized to zero and 6 OFF OFF: the counter continues to count
4	Preset Counting Value
5	Target (Setting) Value
6	Code of the counter (C1~C4 total: 4 groups)

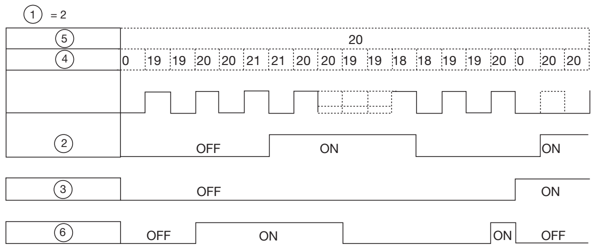
Sample



Sample



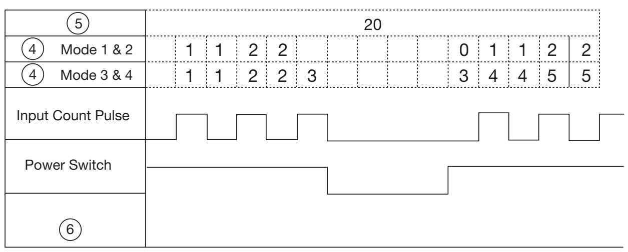
2. Counter Mode 2



Note: Under this Mode, the counting preset value appeared will be greater than 20, unlike the Mode 1 in which the value is locked at 20.

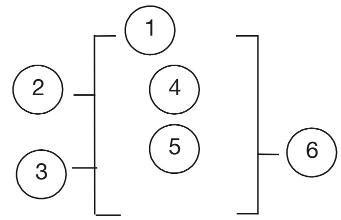
3. The counter Mode 3 is similar to the counter Mode 1 except that the former can retain the recorded value after the power is cut off and continued counting when the power is turned on at the next time.

4. The counter Mode 4 is similar to the counter Mode 2 except that the former can retain the recorded value after the power is cut off and continued counting when the power is turned on at the next time.

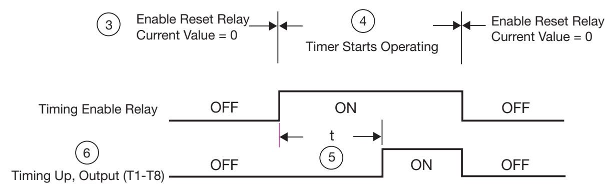


Timer

1. Timer Mode 1 (ON Delay A Mode)

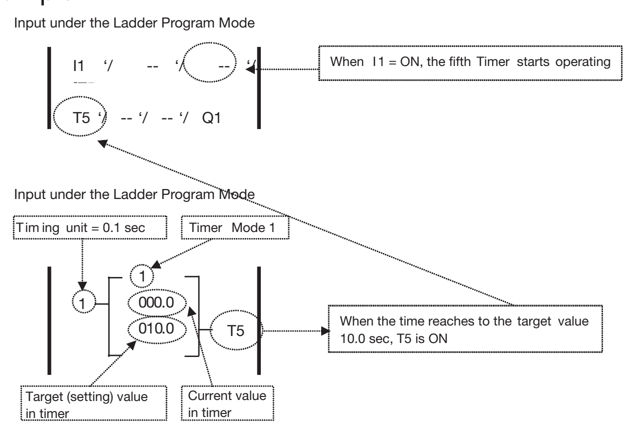


Symbol	Description
1	Timing Mode (1-7)
2	Timing unit 1: 0.0 - 999.9 sec. 2: 0 - 9999 sec. 3: 0 - 9999 min.
3	Use (I1 ~ f8) to RESET the timing value. ON: The counter is reset to zero and ⑥ OFF OFF: The counter continues to count
4	Preset Timing Value
5	Target (setting) Timing Values
6	The code of the Timer (T1 ~ T8 total: 8 groups).

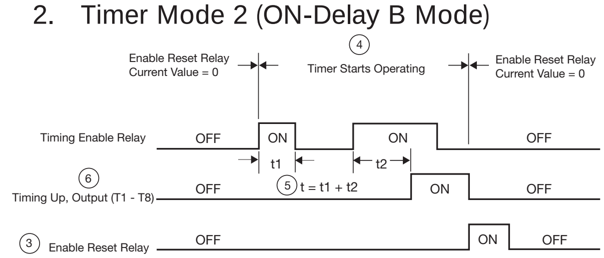


t = a Time Period Set in the Counter

Sample

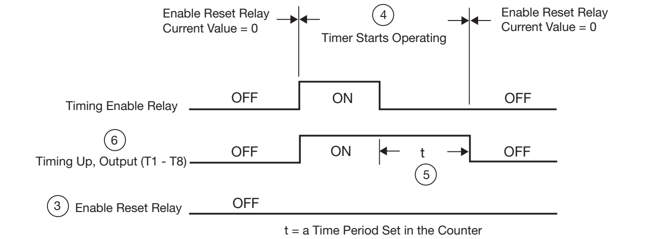


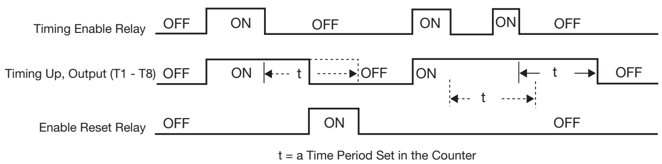
2. Timer Mode 2 (ON-Delay B Mode)



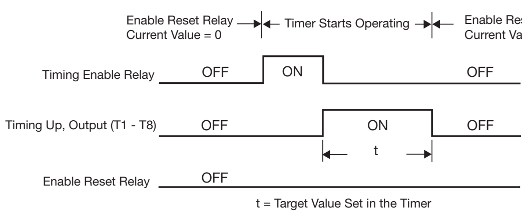
t = a Time Period Set in the Counter

3. Timer Mode 3 (OFF-Delay A Mode)

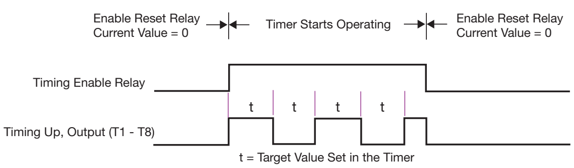




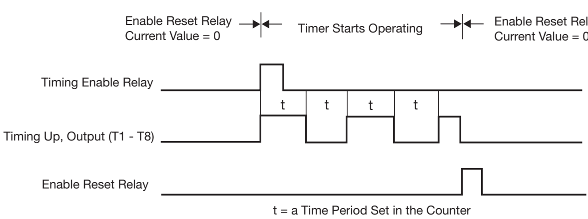
4. Timer Mode (4) OFF-Delay B Mode)



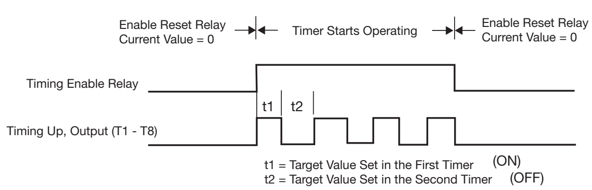
5. Timer Mode 5 (Flash A Mode)



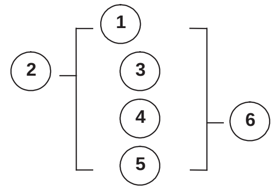
6. Timer Mode 6 (Flash B Mode)



7. Timer Mode 7 (Flash C Mode)



Analog Comparator



Symbol	Description
1	Analog comparison mode (1-3)
2	Selection of the input comparison value
3	Analog input value
4	Setting reference comparison value (upper limit)
5	Setting reference comparison value (lower limit)
6	Output terminals of analog comparator (G1-G4)

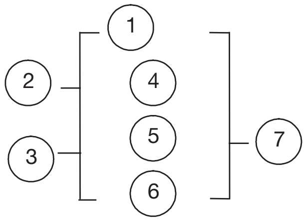
Analog Comparison Mode (1-3)

1. Analog comparator mode 1 - (② ≤ ④, ⑤ ON)
2. Analog comparator mode 2 - (② ≥ ③, ⑤ ON)
3. Analog comparator mode 3 - (④ ≤ ② ≤ ③, ⑤ ON)

Selection of the input comparison value (V1-V7)

1. The input comparison value = V1: Setting Frequency
2. The input comparison value = V2: Operation Frequency
3. The input comparison value = V3: AIN Input Value
4. The input comparison value = V4: AI2 Input Value
5. The input comparison value = V5: Keypad VR Input Value
6. The input comparison value = V6: Operation Current
7. The Input comparison value = V7: Torque Value

Encoder Input Comparing Instruction

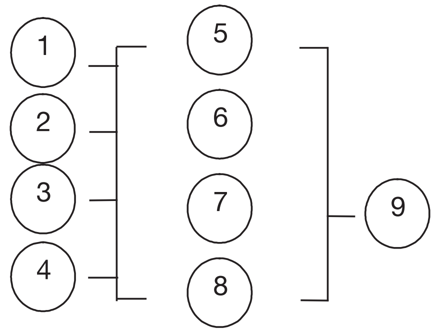


Symbol	Description
1	Encoder control mode (1-2)
2	Use (I1-f8) to Set Counting up or Counting Down OFF: Counting up (0,1,2,3,4...) ON: Counting down (...3, 2, 1, 0)
3	Use (I1-f8) to Reset Counting Value
4	A1, Encoder Input Value/Encoder Dividing Ratio (6)
5	A2, Setting Comparing Value
6	C, Encoder Dividing Ratio
7	Encoder Comparing Output Terminal, H1-H4

1. Control Mode 1
   Encoder Comparing Function:
   A1?A2 Comparing Output

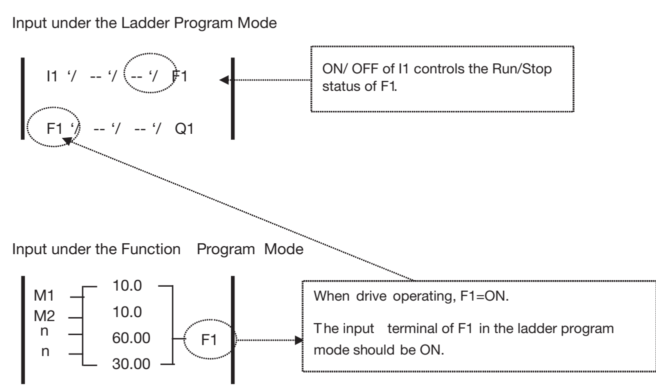
2. Control Mode 2
   Encoder Comparing Function:
   A1?A2 Comparing Output

Comparison Enable/Disable of the Encoder input value is determined by the Ladder Program ON/OFF.



Symbol	Description
1	Running Mode could be set via I1~f8 OFF: (FWD) ON: (REV)
2	Preset Speed could be set via I1~f8 OFF: Operating at the frequency set on 7 ON: Operating at the frequency set on 8
3	Select constant or V3, V5 for Setting Frequency
4	Select constant or V3, V5 for Preset Speed
5	Acceleration Time
6	Deceleration Time
7	Setting Frequency (could be a constant or V3, V5)
8	Preset Speed (could be a constant or V3, V5)
9	Instruction code of operation (F1~F8, Total: 8 Groups)

Sample:



Chapter 5 Troubleshooting and Maintenance

5.1 Error Display and Corrective Action

5.1.1 Errors which can not be recovered manually

	Display	Error	Probable Cause	Corrective Action
	CPF	Noise Problem	External noise interference	Connect a parallel surge absorber across the magnetizing coil of the magnetic contactor that may cause interference.
	EPR	EEPROM problem	Faulty EEPROM	1. Cycling the input power to the drive 2. Replace EEPROM
@	**-OV-**	Voltage too high during stopping	Heavy Regenerative energy from the driven load. Input Voltage is too high.	1. Set a longer deceleration time 2. Add a brake resistor or brake module
@	**-LV-**	Voltage too low during stop	1. Power voltage too low 2. Soft Charge resistor or fuse burnt out 3. Detection circuit malfunction	1. Check if the power voltage was correct or not 2. Replace the restraining resistor or the fuse 3. Send the drive back for repair
@	**-OH-**	Drive is overheated during stop	1. Ambient temperature too high or bad ventilation 2. Detection circuit malfunction 3. Cooling fan failure	1. Improve ventilation conditions 2. Send the drive back for repair 3. Replace cooling fan
	CTER	Current Sensor detecting error	Current transformer (CT) error or circuit malfunction	Send the drive back to Boston Gear

Note: "@" the Failure contact does not function.

Errors which can be recovered manually and automatically:

Display	Error	Probable Cause	Corrective Action
OC-S	Over-current at start-up	1. Short circuit in the motor windings or connections 2. The motor contacts with a short circuit 3. Output transistor damaged	1. Inspect the motor connections 2. Inspect the motor wiring 3. Replace damaged transistor module
OC-D	Over-current during deceleration	1. Deceleration time too short 2. Output transistor damaged	1. Set a longer deceleration time 2. Replace damaged transistor module
OC-A	Over-current at acceleration	1. Acceleration time too short 2. The capacity of the motor higher than the capacity of the drive 3. Short circuit in the motor windings or connections 4. Short circuit between motor wiring and earth 5. Output transistor damaged	1. Set a longer acceleration time 2. Replace drive with the same capacity as that of the motor 3. Check the motor connections 4. Check the motor wiring 5. Replace damaged transistor module
OC-C	Over-current at set speed	1. Transient load change 2. Transient power change	1. Increase capacity of the drive 2. Rerun auto tuning(O06=1) 3. Reduce stator resistance (14-0) if above remedies are not affective
OV-C	Voltage too high during operation/ deceleration	1. Deceleration time too short or large inertia load 2. Input voltage is too high	1. Set a longer deceleration time 2. Add a brake resistor 3. Add a line reactor on the input side
OH-C	Heatsink temperature too high during operation	1. Heavy load 2. Ambient temperature too high or bad ventilation 3. Cooling fan failure	1. Check if there are any problems with load. 2. Improve ventilation conditions 3. Replace cooling fan
Err4	Illegal interrupt of CPU	Outside noise interference	Inspect surrounding equipment for proper operation and grounding. If fault reoccurs frequently, send drive back to Boston Gear.

Errors which can be recoverd manually

	Display	Error	Probable Cause	Corrective Action
@	OC	Over - current during stop	1. Short circuit in the motor windings or connections 2. The motor contacts with a short circuit 3. Output transistor damaged	1. Inspect the motor connections 2. Inspect the motor wiring 3. Replace damaged transistor module
	OL1	Motor overload	1. Heavy load on motor 2. Incorrect setting of Parameters O - 02 or 9-08~11	1. Decrease the motor load or Increase the motor capacity 2. Set 0-02 (Motor FLA) and 9-08~11 properly
	OL2	Drive overload	Heavy load on motor	Increase the drive capacity or decrease the load on the motor
	OL 3	Over torque	1. Heavy load on motor 2. Insufficient settings of 9 -14, 9-15	1. Increase the drive capacity 2. Set 9 - 14, 9-15 properly
	L V -C	Voltage too low during operation	1. Power supply voltage too low 2. Power supply voltage varies widely	1. Improve power quality or increase the value of 2 -01 2. Set a longer acceleration time 3. Add a reactor to the input side

Note: “@” the Failure contact does not function.

5.1.2 Special Conditions

Display	Error	Description
STP0	Zero speed stop	Occurs when preset frequency < 0.1Hz
STP1	Fail to start directly	1. Drive is set as external terminal control mode (1-00=1) and direct start is disabled (2-04=0001), the drive cannot be started amd will flash STP1 when start switch turned to ON after applying power (refer to descriptions of 2-04). 2. Direct start is possible when2-04=0001.
STP2	Keypad emergency stop	1. Drive is set to external control mode (1-00=0001) and Stop key is enabled (1-03=0000), the drive will stop according to the setting of 1-05 when Stop key is pressed. S TP2 flashes after stop. Turn the start switch to OFF and then ON again to restart the drive. 2. Drive is in communication mode and Stop key is enabled (1-03=0000), the drive will stop in the way set by 1-05 when Stop key is pressed during operation and then flashes STP2. The PC has to send a Stop command then a Run command to the drive for it to be restarted. 3. Stop key cannot perform emergency stop when 1-03=0001
E.S.	External emergency stop	Drive will ramp to a stop and then flash E.S., when an external emergency stop signal is input via the multifunctional input terminals (refer to descriptions of5-00~5-06).
b.b.	External base block	The drive stops immediately and then flashes bb. when external base block is input through the multifunctional input terminals (refer to descriptions of5-00~5-06).
ATER	Auto-tuning faults	1. Motor data error resulting in for Auto-tuning failure 2. Stopping the drive during Auto-tuning
PDER	PID feedback loss	PID feedback loss detection

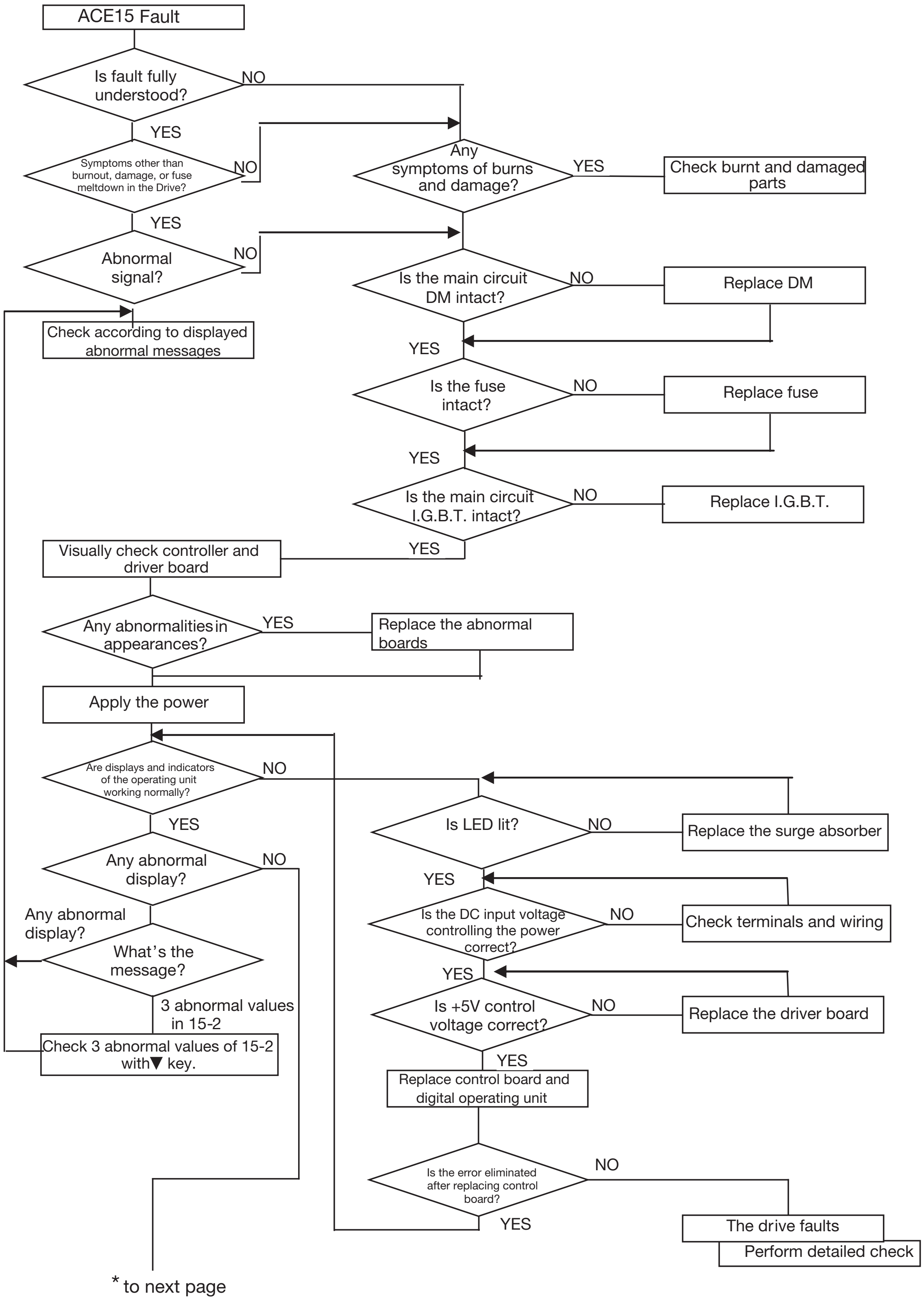
5.1.3 Operation Errors

Display	Error	Probable Cause	Corrective Action
LOC	Parameter and frequency reverse already locked	1. Attempt to modify frequency parameter while 3-17>0000 2. Attempt to reverse while 1-02=0001	1. Set 3-17=0000 2. Set 1-02=0000
Err1	Key operation error	1. Press up or down keys while 1-06>0 or running at preset speed. 2. Attempt to modify the parameters that cannot be modified during operation (refer to the parameter list).	1.The up or down keys are available for modifying the parameter only when 1-06=0 2.Modify the parameter while STOP
Err2	Parameter setting error	1. 3-01 in the range of 3-13 ± 3-16 or 3-14 ± 3-16 or 3-15 ± 3-16 2. 3-00 ⩽ 3-01 3. The setting error when performing Auto tuning(e.g. 1-00 ≠ 0, 1-06 ≠ 0)	1. Modify 3-13~3-15 or 3-16 2. 3-00>3-01 Set 1-00=0, 1-06=0 during Auto tuning
Err5	Modification of parameter is not available in communication	1. Issue a control command during communication disabled 2. Modify the function 13 -1~13 - 4 during communication	1.Issue enable command before communication 2.Set the parameter of the function before communication
Err6	Communication failed	1. Wiring error 2. Communication parameter setting error 3. Sum-check error 4. Incorrect communication protocol	1.Check hardware and wiring 2.Check Function 13-1~13-4
Err7	Parameter conflict	1. Attempt to modify the function 15-0 or 15-6 2. Voltage and current detection circuit abnormal 3. Attempt to RUN PLC when not enabled 4. Attempt to program PLC while a program is running.	If reset drive (15-6) is not available, please send the drive back to Boston Gear.
Err8	Factory setting error	When PLC is Running, Perform factory setting	Please perform factory setting before PLC stops.
EPr1	Parameter setting error copy unit failed	1. Set 3-18=1.2 without connecting copy unit 2. Copy module failed	1. Modify 3-18 2. Replace copy module
EPr2	Parameter does not match	Copy the parameter to drive to verify the parameter is not matched.	Replace copy module

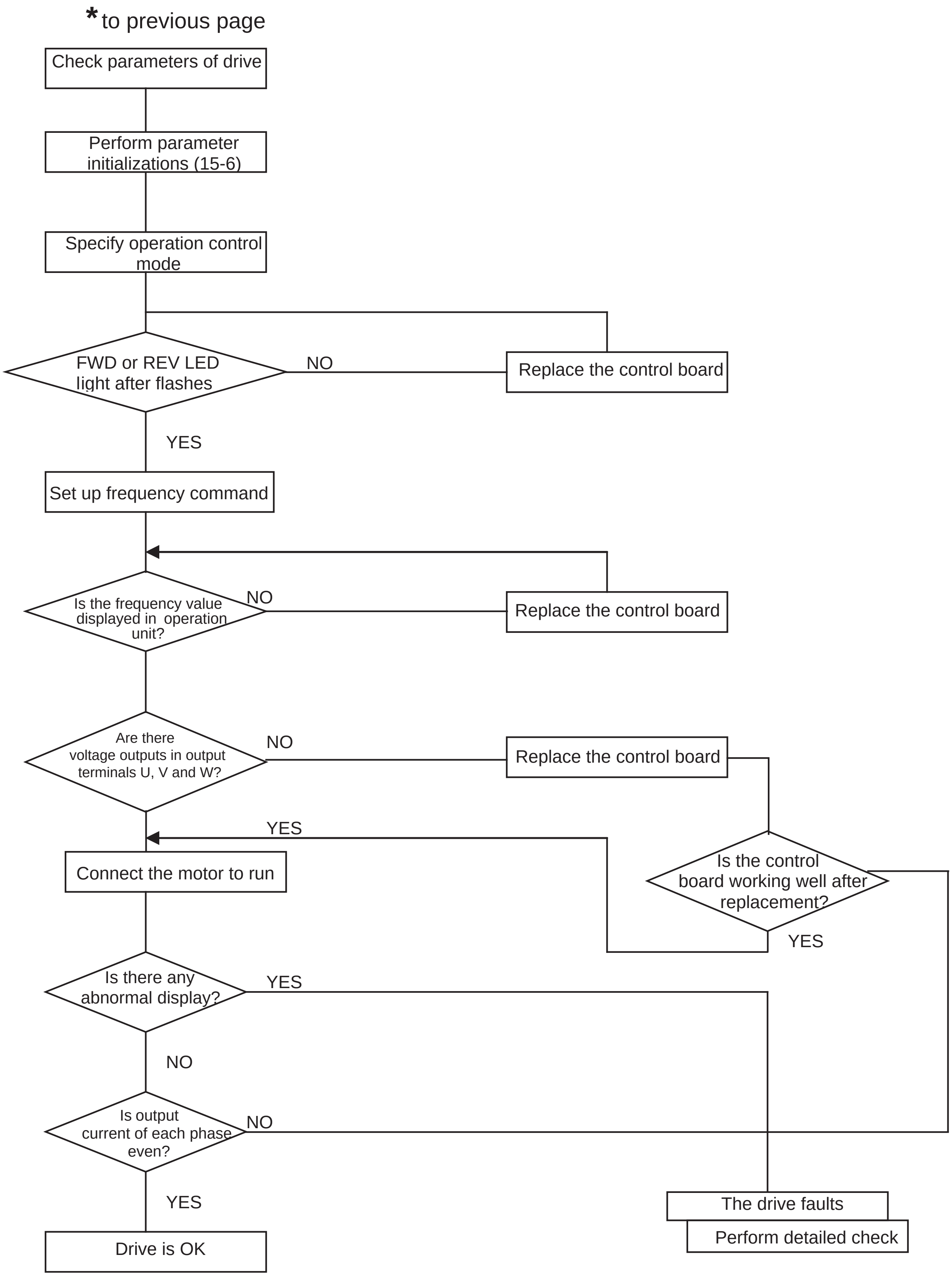
5.2 General Troubleshooting

Status	Checking point	Corrective Action
Motor does not rotate	Is power applied to L1 (L), L2, and L3 (N) terminals (is the charging indicator lit)?	• Is the power applied? • Turn the power OFF and ON again. • Make sure the power supply voltage is correct. • Make sure screws are secured firmly.
	Is there voltage across the output terminal T1, T2, and T3?	• Turn the power OFF and ON again.
	Is the motor blocked?	• Reduce the load to let the motor run.
	Are there any abnormalities in the drive?	• See error descriptions to check wiring and correct if necessary.
	Is forward or reverse running command issued?	
	Has analog frequency signal been input?	• Is analog frequency input signal wiring correct? • Is voltage of frequency input correct?
	Is operation mode setting correct?	• Check operations through the keypad.
Motor runs incorrect rotation	Is Wiring for output terminals T1, T2, and T3 correct?	• Wiring must match U, V, and W terminals of the motor.
	Is wiring for forward and reverse signals correct?	• Check wiring, correct if necessary.
Motor speed cannot be regulated.	Is wiring for analog frequency inputs correct?	• Check wiring, correct if necessary.
	Is the setting of operation mode correct?	• Check the operation mode of the drive.
	Is the load too heavy?	• Reduce the load.
Motor speed too high or too low	Are specifications of the motor (poles, voltage...) correct?	• Confirm the motorís specifications.
	Is the gear ratio correct?	• Confirm the gear ratio.
	Is the setting of the highest output frequency correct?	• Confirm the highest output frequency.
Motor speed varies unusually	Is the load too heavy?	• Reduce the load.
	Does the load vary largely?	• Minimize the variation of the load. • Increase capacities of the drive and the motor. • Add an AC reactor at the power-input side if using single-phase power. • Check wiring if using three-phase power.
	Is the input power lack of phase?	

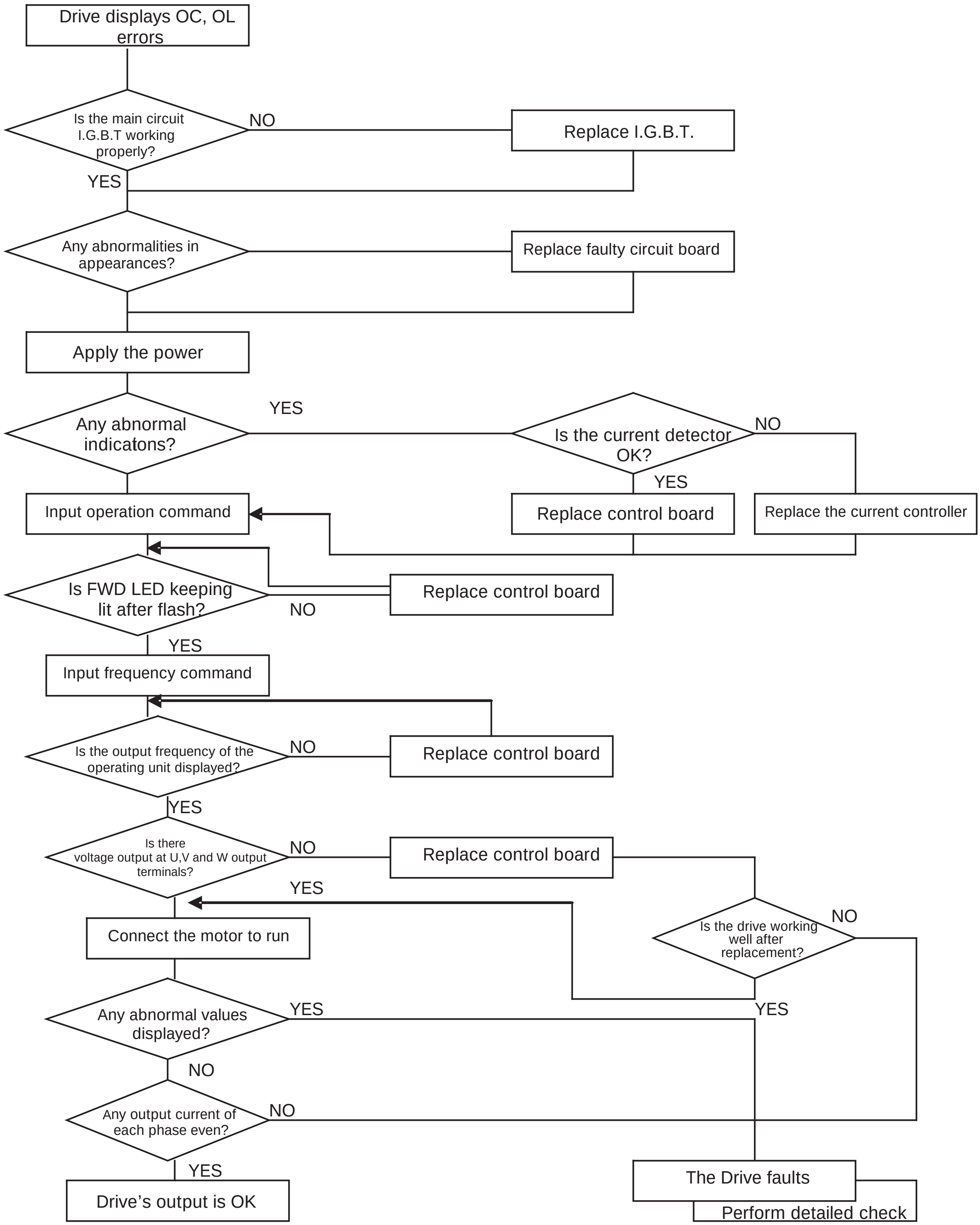
5.3 Quick Troubleshooting of ACE15



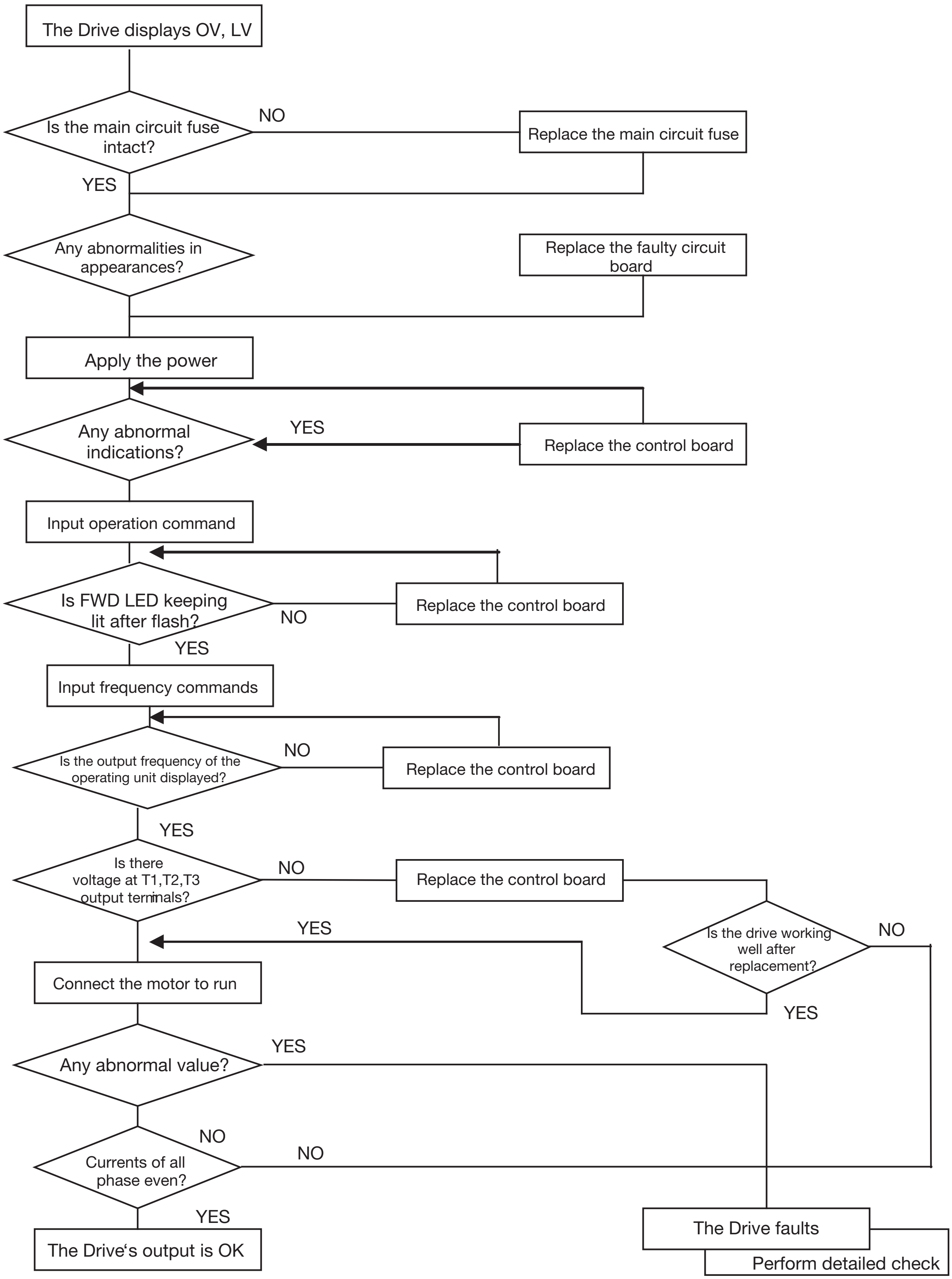
5.3 Quick Troubleshooting of ACE15 (cont'd)



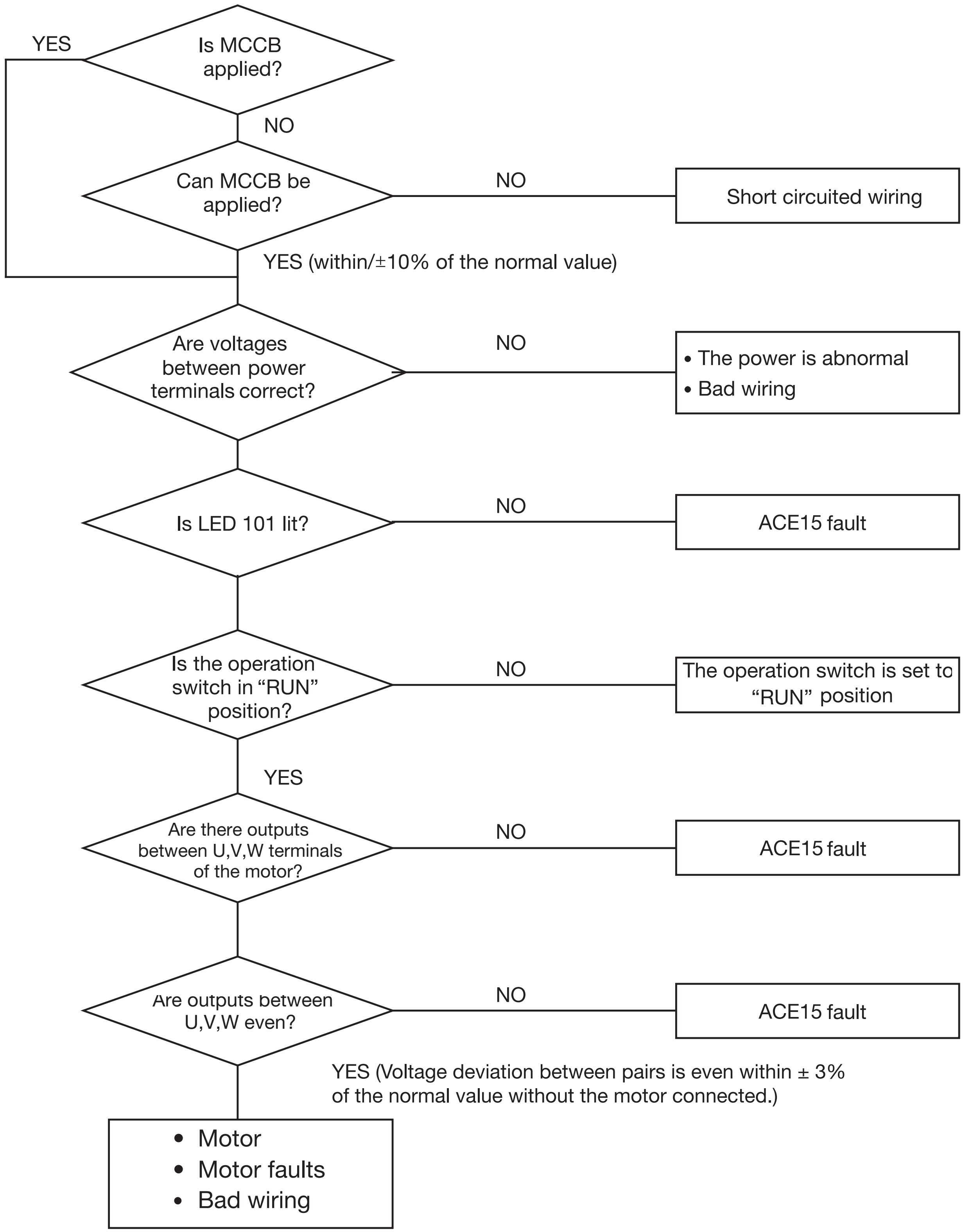
Troubleshooting for OC, OL Error Displays



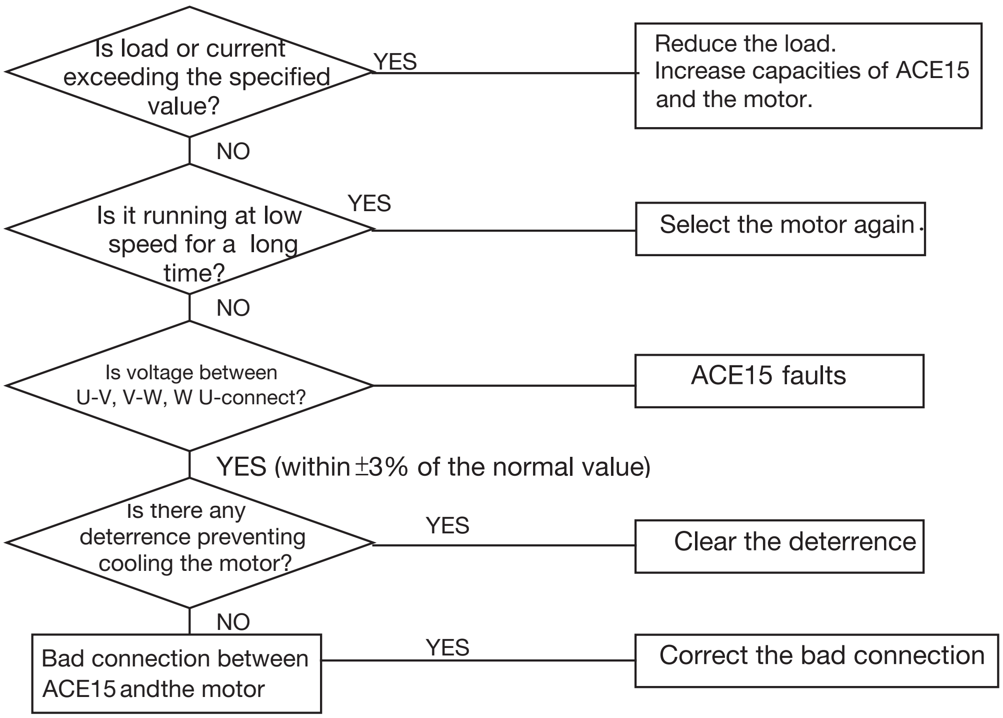
Troubleshooting for OV, LV Error



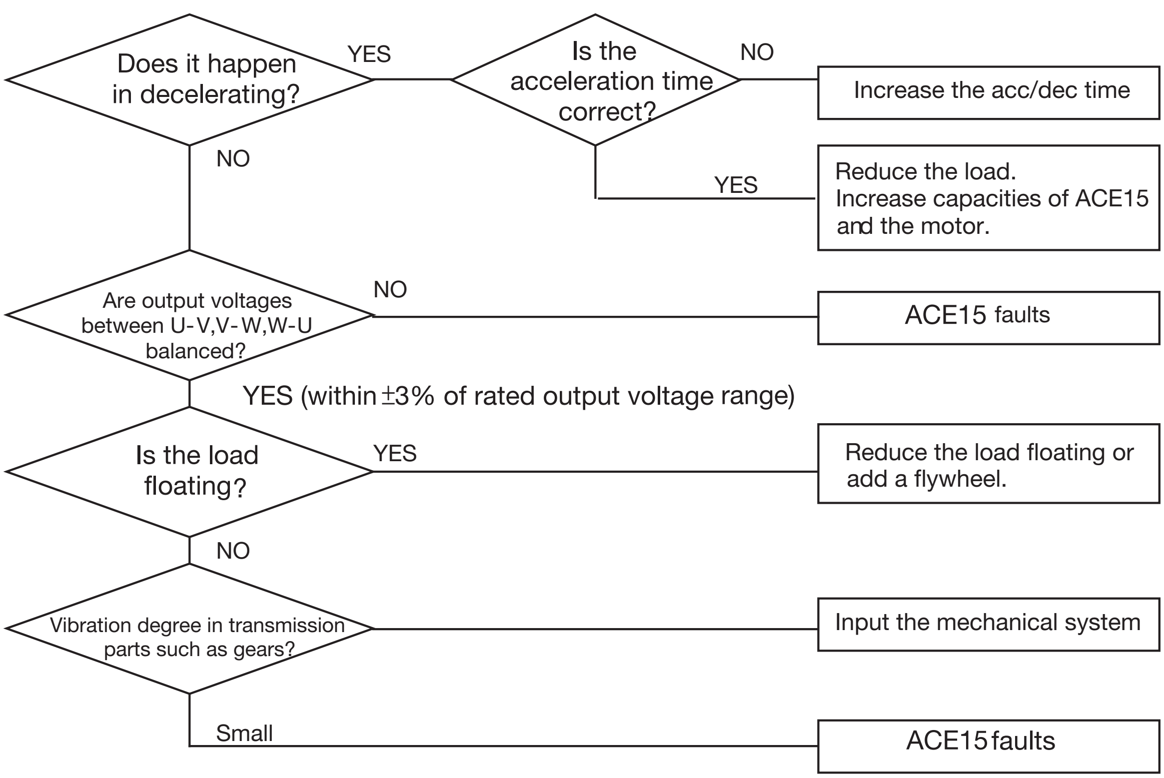
The motor will not run



The Motor Is Overheated



Motor runs unevenly



5.4 Routine Inspection and Period Inspection

The table below lists the items to be checked to ensure stable and safe operations. Check these items 5 minutes after the “Charge” indicator goes out to prevent service persons from being hurt by residual electric power.

Items	Details	Checking Period		Methods	Criteria	Remedies
		Daily	1 Year			
Circumstances around the machine	Confirm the temperature and humidity around the machine	❑		Measure with thermometer and Hygrometer according to installation notices.	Temperature: -10 ñ 40°C Humidity: Below 95% RH	Improve the circumstances
	Are their inflammables piled up around?	❑		Visual check	No foreign matters	
Installation and grounding of the drive	Any unusual vibration from the machine?	❑		Visual, hearing	No foreign matters	Secure screws
	Is the grounding resistance correct?		❑	Measure the resistance with a multi-tester	200V series: below 100Ω 400V series: below 10Ω	Improve the grounding
Input power voltage	Is the voltage of the main circuit correct?	❑		Measure the voltage with a multi-tester	Voltage must conform with the specifications	Resolve input voltage
External terminals and internal mounting screws of the drive	Are secure parts loose?		❑	Visual check Check with a screwdriver	No abnormalities	Secure or send back to authorized dealer
	Is the terminal base damaged?		❑			
	Obvious rust stains		❑			
Internal wiring of the drive	Deformed or crooked		❑	Visual check	No abnormalities	Replace or send back to authorized dealer
	Any damage of the wrapping of the conducting wire		❑			
Heat sink	Full of dust or debris	❑		Visual check	No abnormalities	Clean up heat sink
Printed circuit board	Heap of conductive metal or oil sludge		❑	Visual check	No abnormalities	Clean up or replace the circuit board
	Discolored, Overheated, or Burned parts		❑			
Cooling fan	Unusual vibration and noise		❑	Visual or hearing check	No abnormalities	Replace the cooling fan
	Full of dust or debris	❑		Visual check		Clean up
Power component	Full of dust or debris		❑	Visual check	No abnormalities	Clean up
	Check resistance between each terminal		❑	Measure with a multi-tester	No short circuit or broken circuit in three-phase output	Replace power component or drive
Capacitor	Any unusual odor or leakage	❑		Visual check	No abnormalities	Replace capacitor or drive
	Any inflation or protrusion	❑				

5.5 Maintenance and Inspection

Drive doesn't need daily inspection and maintenance. To ensure long-term reliability, follow the instructons below to perform regular inspection. Turn the power off and wait for the charge indicator (LED101) to go out before inspection to avoid potential shock hazard caused by charges in high-capacity capacitors.

1. Clean up the accumulation of debris inside the drive.

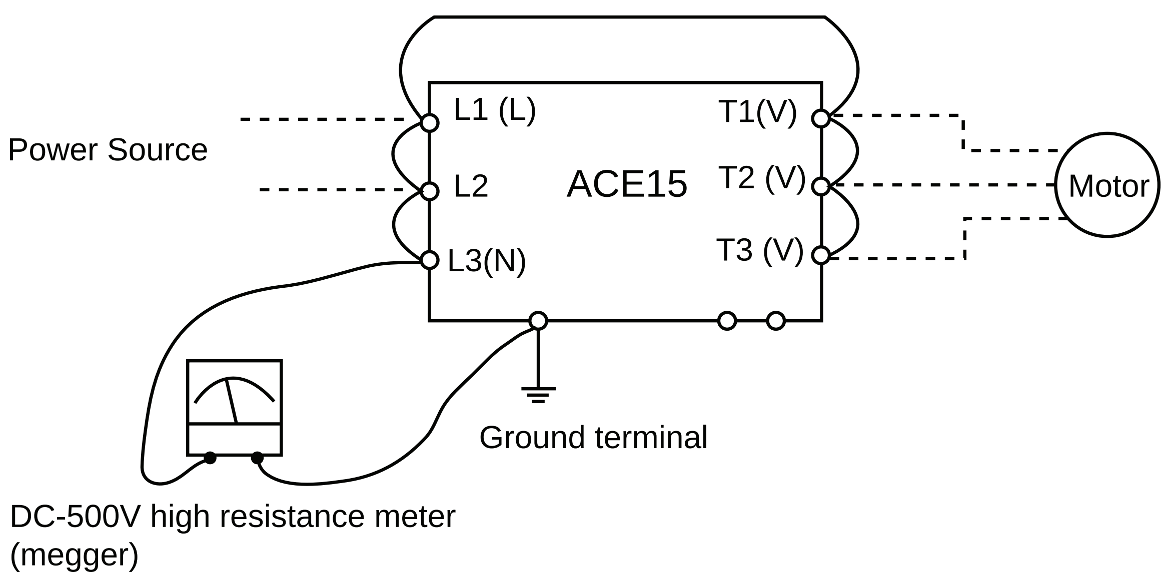
2. Check if there are any loose terminal screws and securing screws. Tighten all loose screws.

3. Insulation tests

   a. Disconnect all leads connecting ACE15 drive with external circuit when performing insulation tests on the external circuit.

   b. Internal insulation test should be performed to the main circuit of the ACE15 body only. Use a high DC 500V meter with insulating resistance higher than 5MΩ.

⚠CAUTION Do not perform this test to the control circuit.



Chapter 6 Peripheral Components

6.1 Reactor Specification At Input Side

Model	AC Inductance At Input Side	
	Current (A)	Inductance (mH)
ACE152V3P0005C	5.0	2.1
ACE152V3P0010C	5.0	2.1
ACE152V3P0020C	19.0	1.1
ACE152V3P0030C	25.0	0.71
ACE152V3P0050C	20.0	0.53
ACE152V3P0075C	30.0	0.35
ACE152V3P0100C	40.0	0.265
ACE154V3P0010C	2.5	8.4
ACE154V3P0020C	5.0	4.2
ACE154V3P0030C	7.5	3.6
ACE154V3P0050C	10.0	2.2
ACE154V3P0075C	16.0	1.42
ACE154V3P0100C	20.0	1.06
ACE154V3P0150C	30.0	0.7

6.2 Dynamic Braking Resistor

Dynamic Braking Current Calculation

Model	Brake Resistor Part No.	Suitable Motor Capacity (HP)	Brake Resistor Specification		Brake Resistor ED(%)	Brake Torque %	Resistor Dimension (HxWxD) in	Allowable Min Brake Resistor			Brake Torque %
			(W)	()				()	(W)	ED(%)	
ACE152V3P0005C	005-4278	0.5	200	200	8	214	14x4x5	100	150	10	407
ACE152V3P0010C	005-4278	1	200	200	8	117	14x4x5	100	150	10	214
ACE152V3P0020C	005-4280	2	400	130	10	117	14x4x5	55	270	10	196
ACE152V3P0030C	005-4281	3	500	80	9	112	12x13x5	35	420	10	204
ACE152V3P0050C	005-4282	5	900	60	8	117	12x13x5	20	730	10	214
ACE152V3P0075C	005-4276	7.5	800	26	8	123	12x7x5	15	1000	10	192
ACE152V3P0100C	005-4277	10	900	15	8	117	12x7x5	10	1500	10	214
ACE154V3P0010C	005-4237	1	300	300	8	123	14x4x5	300	200	10	278
ACE154V3P0020C	005-4279	2	400	160	10	117	14x4x5	150	390	10	278
ACE154V3P0030C	005-4279	3	400	160	8	123	14x4x5	125	470	10	226
ACE154V3P0050C	005-4281	5	800	80	8	123	12x13x5	80	730	10	214
ACE154V3P0075C	005-4282	7.5	900	60	8	123	12x13x5	55	1100	10	208
ACE154V3P0100C	005-4318	10	1000	45	8	117	12x7x5	40	1500	10	214
ACE154V3P0150C	005-4206C*	15	1200	22	8	149	14x5x13	25	1350	10	226

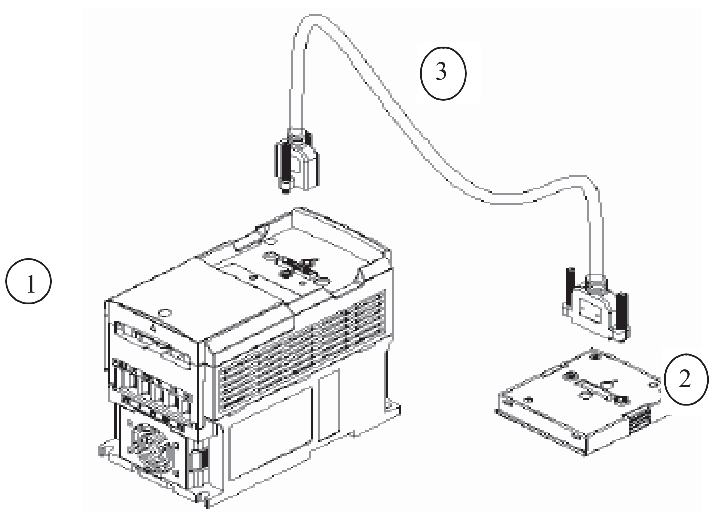
* Requires 2 resistors in series.

Notes:
Formula for brake resistor:

W= (Vpnb * Vpnb)*ED% / Rmin

1. W: Brake resistor consumption power
2. Vpnb: Brake voltage (220V=380VDC, 440V=760VDC)
3. ED%: Braking effective period
4. Rmin: Allowable minimum brake resistor

6.3 Digital Operators and Extension Cable



1. Remote Cable
2. Content
   a. Drive
   b. LED (SDOP-LED) or LCD (SDOP-LCD) Keypad
   c. REMOTE Cable for Keypad
3. Operation Procedure

   ⚠WARNING Turn OFF the power supply. The following procedure should be performed after there is no display on the keypad.

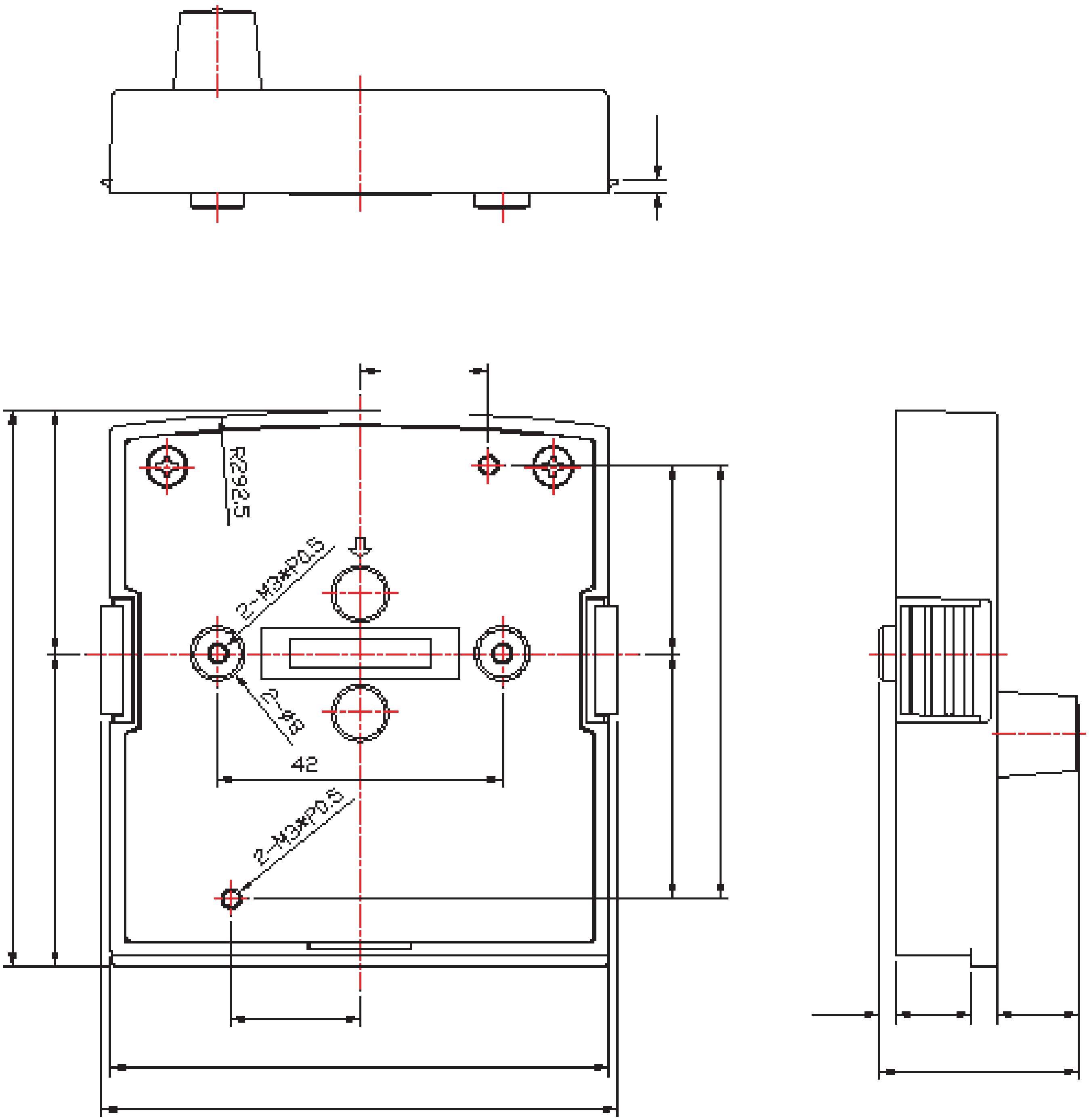
   a. Remove the keypad from the drive.

   b. Please refer to diagram before mounting the keypad to your machine or panel.

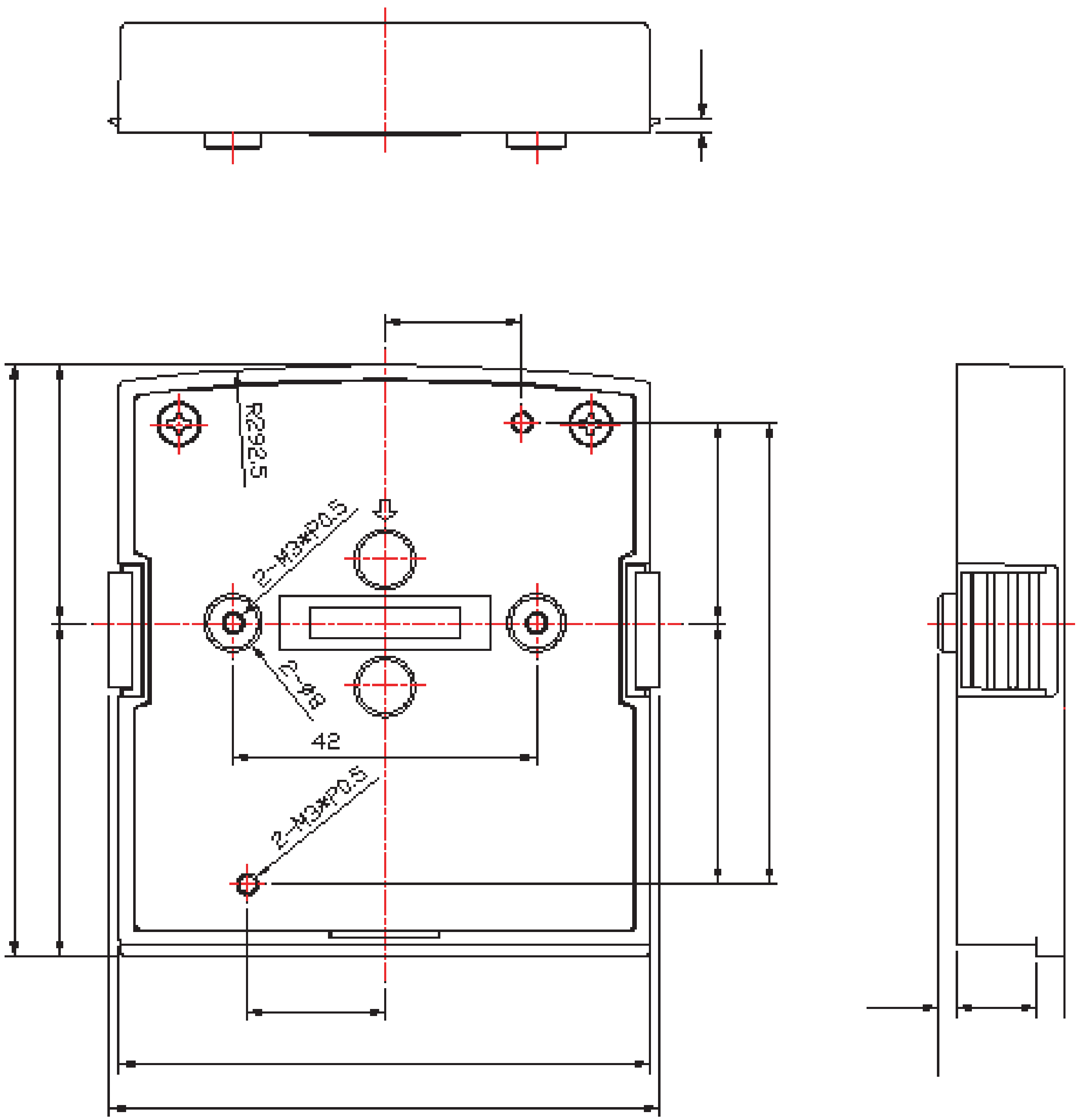
   c. Connect the drive and the keypad with the remote cable in accordance with the above diagram

   Supply the power to operate ONLY after all elements are securely fixed.

LED Keypad (SDOP-LED) Mounting

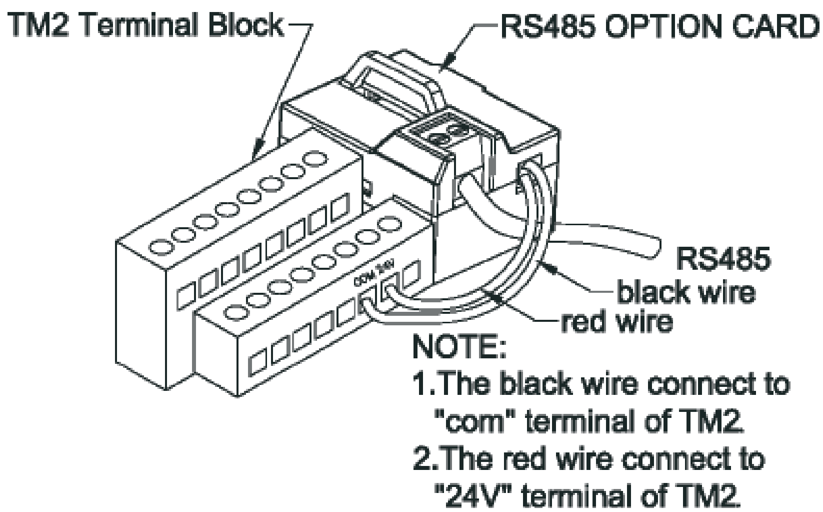


LCD Keypad (SDOP-LCD) Mounting

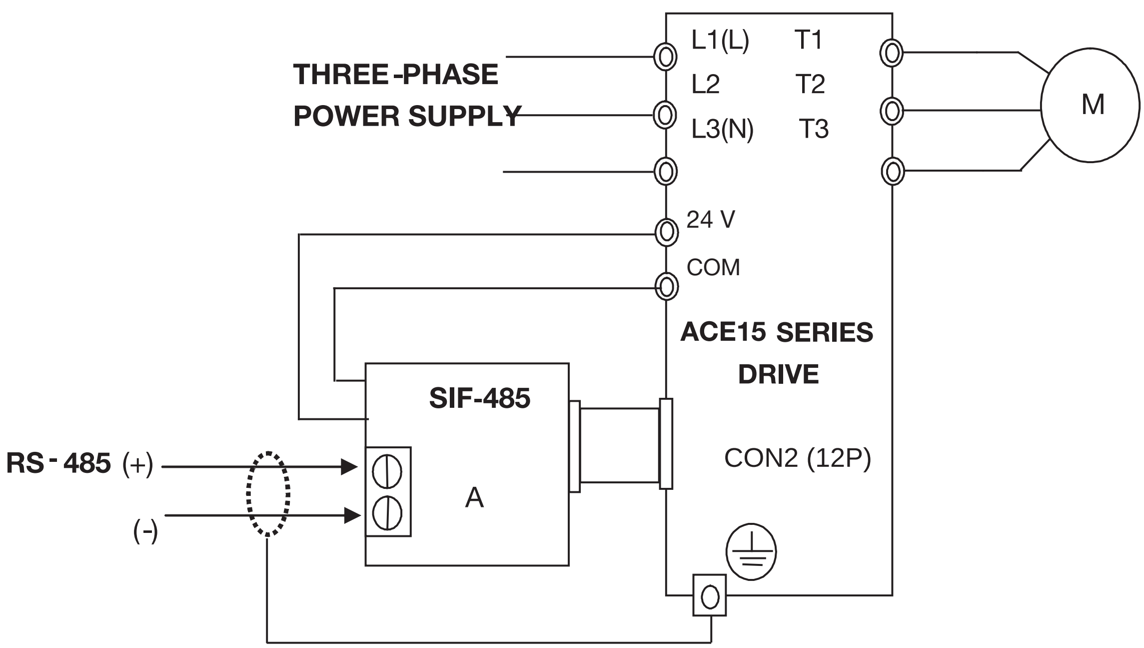


6.4 Interface Card

6.4.1 RS-485 Interface Card (Model: SIF-485)

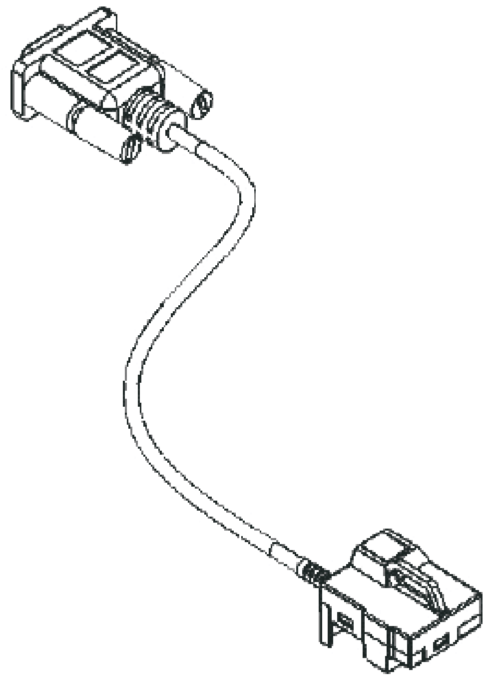


SIF-485 Wiring Diagram

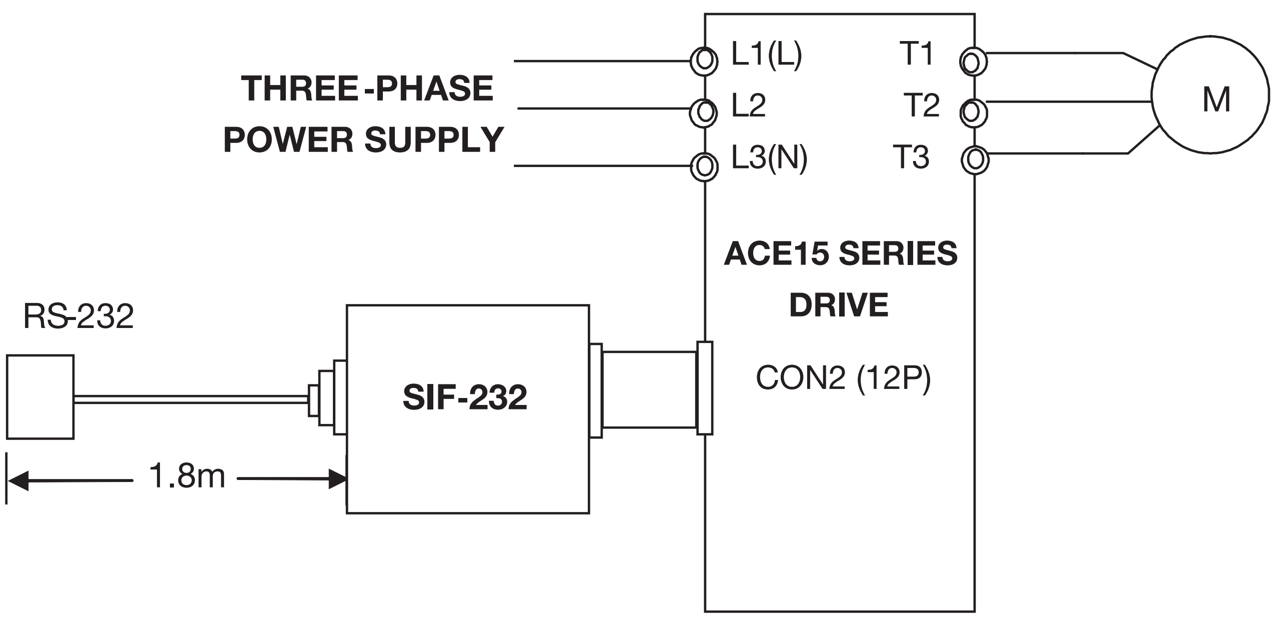


Note: Please put on the cover of drive to avoid the Interface Card distrubed by outside static electricity.
Please use isolated RE232/RS485 converter to link PC and interface card to avoid damaging equipment.

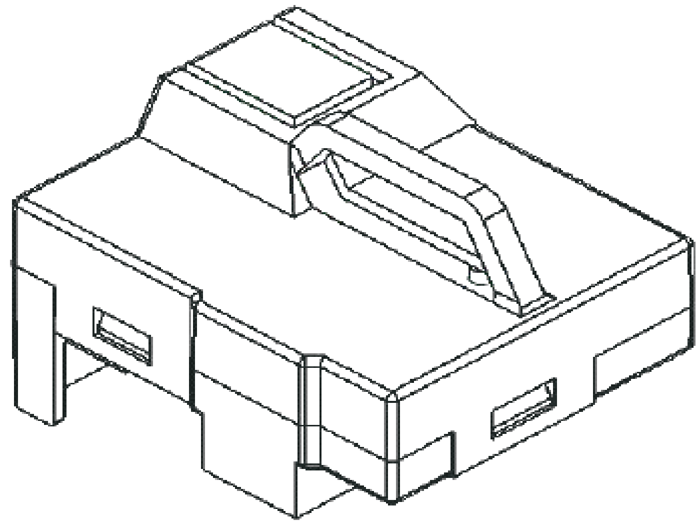
6.4.2 RS-232 Interface Card (Model: SIF-232)



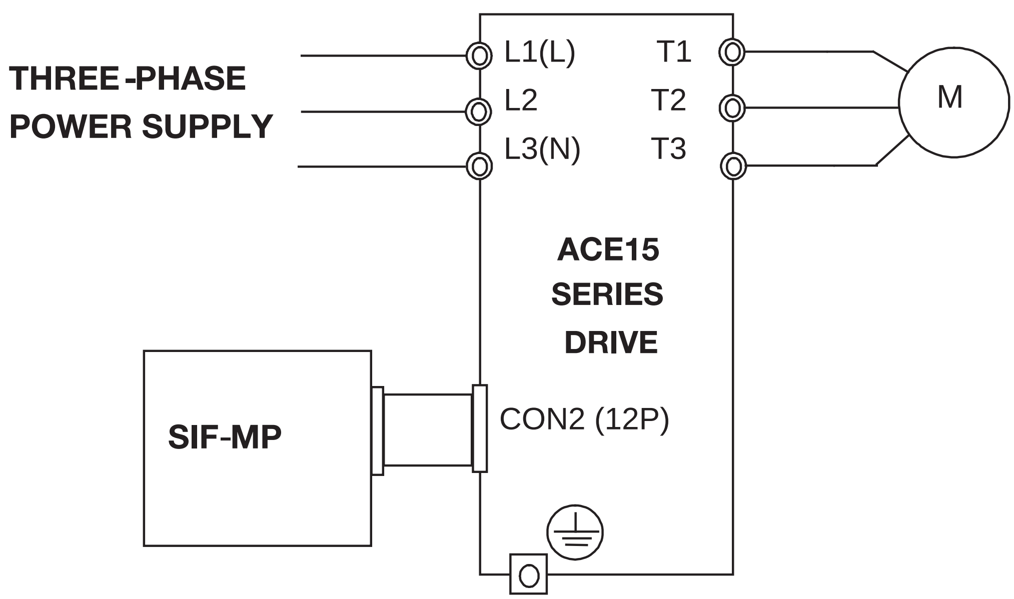
SIF-232 Wiring Diagram



6.4.3 Program Copy Module (Model: SIF-MP)



SIF-MP wiring Diagram



Chapter 7 Appendix

Appendix 1: ACE15 Motor Internal Parameter List

Factory Setting of the Motor Internal Parameters:

<table>
<tr><th>Model</th><th>14-0 (Stator Resistance)</th><th>14-1 (Rotor Resistance)</th><th>14-2 (Equivalent Inductance)</th><th>14-3 (Magnetization Current)</th><th>14-4 (Iron Loss Conductance)</th></tr>
<tr><td>ACE152V3OP0005C</td><td>200</td><td>200</td><td>800</td><td>7200</td><td>0</td></tr>
<tr><td>ACE152V3OP0010C</td><td rowspan="2">380</td><td rowspan="2">300</td><td rowspan="2">800</td><td rowspan="2">7200</td><td rowspan="2">0</td></tr>
<tr><td>ACE154V3OP0010C</td></tr>
<tr><td>ACE152V3OP0020C</td><td rowspan="2">300</td><td rowspan="2">280</td><td rowspan="2">800</td><td rowspan="2">7200</td><td rowspan="2">0</td></tr>
<tr><td>ACE154V3OP0020C</td></tr>
<tr><td>ACE152V3OP0030C</td><td rowspan="2">280</td><td rowspan="2">240</td><td rowspan="2">800</td><td rowspan="2">7200</td><td rowspan="2">0</td></tr>
<tr><td>ACE154V3OP0030C</td></tr>
<tr><td>ACE152V3OP0050C</td><td rowspan="2">260</td><td rowspan="2">200</td><td rowspan="2">800</td><td rowspan="2">7200</td><td rowspan="2">0</td></tr>
<tr><td>ACE154V3OP0050C</td></tr>
<tr><td>ACE152V3OP0075C</td><td rowspan="2">240</td><td rowspan="2">160</td><td rowspan="2">800</td><td rowspan="2">7200</td><td rowspan="2">0</td></tr>
<tr><td>ACE154V3OP0075C</td></tr>
<tr><td>ACE152V3OP0100C</td><td rowspan="2">220</td><td rowspan="2">150</td><td rowspan="2">800</td><td rowspan="2">7200</td><td rowspan="2">0</td></tr>
<tr><td>ACE154V3OP0100C</td></tr>
<tr><td>ACE154V3OP0150C</td><td>200</td><td>140</td><td>800</td><td>7200</td><td>0</td></tr>
</table>

Note:

1. The above motor internal parameters are idle under V/F control mode. These parameters are usable under vector control mode.
2. The motor parameters (14-0~14-4) are not modified when factory setting under vector mode. The internal parameters will be maintained at the ones after auto tuning (refer to Auto Tuning and Description on motor Internal Parameter).
3. The motor parameters (14-0~14-4) will be modified to factory setting completely under whatever operation mode.

Appendix 2: ACE15 Parameter Setting List

Customer	Drive Model						
Using Site	Contact Phone						
Address							
Parameter Code	Setting Content	Parameter Code	Setting Content	Parameter Code	Setting Content	Parameter Code	Setting Content
0-00		3-14		6-06		10-7	
0-01		3-15		6-07		10-8	
0-02		3-16		6-08		10-9	
0-03		3-17		7-00		11-0	
0-04		3-18		7-01		11-1	
0-05		3-19		7-02		11-2	
0-06		3-20		7-03		11-3	
0-07		3-21		7-04		11-4	
0-08		3-22		7-05		11-5	
1-00		3-23		8-00		11-6	
1-01		3-24		8-01		11-7	
1-02		3-25		8-02		12-0	
1-03		3-26		8-03		12-1	
1-04		3-27		8-04		12-2	
1-05		3-28		8-05		12-3	
1-06		3-29		9-00		12-4	
1-07		4-00		9-01		12-5	
2-00		4-01		9-02		12-6	
2-01		4-02		9-03		13-0	
2-02		4-03		9-04		13-1	
2-03		4-04		9-05		13-2	
2-04		4-05		9-06		13-3	
2-05		5-00		9-07		13-4	
2-06		5-01		9-08		14-0	
3-00		5-02		9-09		14-1	
3-01		5-03		9-10		14-2	
3-02		5-04		9-11		14-3	
3-03		5-05		9-12		14-4	
3-04		5-06		9-13		15-0	
3-05		5-07		9-14		15-1	
3-06		5-08		9-15		15-2	
3-07		5-09		10-0		15-3	
3-08		6-00		10-1		15-4	
3-09		6-01		10-2		15-5	
3-10		6-02		10-3		15-6	
3-11		6-03		10-4			
3-12		6-04		10-5			
3-13		6-05		10-6			

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P-1577-BG 5/06

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