BEDFORD ®

AC MOTOR SPEED CONTROLLER



**B550 Series
Sensorless Vector Frequency Drive
Installation & Quick-Start Manual**

# Preface

Thank you for choosing B550 series sensorless vector frequency Drive. B550 series are manufactured by adopting high-quality components, material and incorporating the latest microprocessor technology available.

&#x1F4D6; Getting Started

This manual will be helpful in the installation, parameter setting, troubleshooting, and daily maintenance of the AC motor drives. To guarantee safe operation of the equipment, read the following safety guidelines before connecting power to the AC motor drives.  Keep this operating manual handy and distribute to all users for reference.

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## ⚠ WARNING

⚠  Always read this manual thoroughly before using B550 series AC Motor Drives.

⚠  **DANGER!** AC input power must be disconnected before any maintenance. Do not connect or disconnect wires and connectors while power is applied to the circuit. Maintenance must be performed by qualified technicians.

⚠  **CAUTION!** There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity.  To avoid damage to these components, do not touch these components or the circuit boards with metal objects or your bare hands.

⚠  **DANGER!** A charge may still remain in the DC-link capacitor with hazardous voltages even if the power has been turned off.  To avoid personal injury, please ensure that power has turned off before operating AC drive and wait ten minutes for capacitors to discharge to safe voltage levels.

⚠  **CAUTION!** Ground the B550 series using the ground terminal.  The grounding method must comply with the laws of the country where the AC drive is to be installed. refer to Basic Wiring Diagram.

⚠  **CAUTION!** The final enclosures of the AC drive must comply with EN50178. (Live parts shall be arranged in enclosures or located behind barriers that meet at least the requirements of the Protective Type IP20. The top surface of the enclosures or barrier that is easily accessible shall meet at least the requirements of the Protective Type IP20). (Users must provide this environment for B550 series.)

⚠  **DANGER!** The AC drive may be destroyed beyond repair if incorrect cables are connected to the input/output terminals.  Never connect the AC drive output terminals U/T1, V/T2, and W/T3 directly to the AC main circuit power supply.

# TABLE OF CONTENTS

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# CHAPTER 1   RECEIVING AND INSPECTION

This B550 series AC drive has gone through rigorous quality control tests at the factory before shipment. After receiving the AC motor drive, please check for the following:

Receiving

✓ Check to make sure that the package includes an AC drive, the User Manual, and rubber bushings.

✓ Inspect the unit to insure it was not damaged during shipment.

✓ Make sure that the part number indicated on the nameplate corresponds with the part number of your order.

♦ **1.1 Nameplate Information:**  Example of 1HP 230V AC drive

AC Drive Model ⟶
Input Spec. ⟶
Output Spec. ⟶
Output Frequency Range ⟶
Bar Code ⟶
Serial Number ⟶
Software Version ⟶

```
MODE     : B 5 5 0 - 2001
INPUT    :3PH 200-240V 50/60Hz 6.0A
OUTPUT   :3PH 0-240V 5.0A 1.9kVA 1HP
Freq. Range :0.1~400Hz

‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖‖
   007M23A0T0011230
Manufacturer:
```

♦ **1.2 Model Explanation**

# B550 — 2 001

0R5: 0.5hp (0.4kw)    001: 1hp (0.75kw)
002: 2hp (1.5kw)      003: 3hp (2.2kw)
005: 5hp (3.7kw)      007: 7hp (5.5kw)
010: 10hp (7.5kw)

2: single phase 230V
2T: three phase 230V
4: three phase 460V

**Series number**

## 1.4 External Parts and Labels



① :Mounting Screw Holes
② :Nameplate Label
③ :Bottom Cover
④ :Digital Keypad
⑤ :Upper Cover
⑥ :Ventilation Hole
⑦ :Input Terminals
⑧ :Control Input/Output
   Terminals
⑨ :External Braking Resistor
⑩ :Output Terminals
⑪ :Grounding
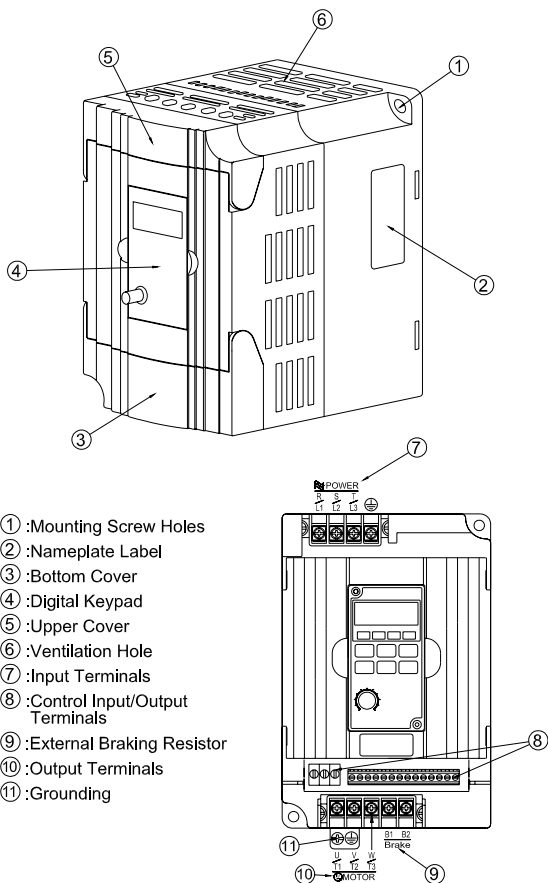
# CHAPTER 2   STORAGE AND INSTALLATION

## 2.1 Storage

The AC drive should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC drive should be stored properly when it is not to be used for an extended period of time. Some storage suggestions are:

Store in a clean and dry location free from direct sunlight or corrosive fumes.

Store within an ambient temperature range of -20 °C to +60 °C.

Store within a relative humidity range of 0% to 90% and non-condensing environment.

Store within an air pressure range of 86 kPA to 106kPA.

## 2.2 Ambient Conditions

| | |
|---|---|
| Operation | Air Temperature: -10°C to +50°C (14°F to 122°F), for 5.5 kW models and above: -10°C to +40°C (14°F to 104°F) Relative Humidity: 0% to 90%, no condensation allowed Atmosphere pressure: 86 to 106 kPa Installation Site Altitude: below 1000m Vibration: Maximum 9.80 m/s$^2$ (1G) at less than 20Hz Maximum 5.88 m/s$^2$ (0.6G) at 20Hz to 50Hz |
| Storage | Temperature: -20°C to +60°C (-4°F to 140°F) Relative Humidity: Less than 90%, no condensation allowed Atmosphere pressure: 86 to 106 kPa |
| Transportation | Temperature: -20°C to +60°C (-4°F to 140°F) Relative Humidity: Less than 90%, no condensation allowed Atmosphere pressure: 86 to 106 kPa Vibration: Maximum 9.80 m/s$^2$ (1G) at less than 20Hz, Maximum 5.88 m/s$^2$ (0.6G) at 20Hz to 50Hz |
| Pollution Degree | 2: good for a factory type environment. |

## 2.3 Installation:

Improper installation of the AC drive will greatly reduce its life. Be sure to observe the following precautions when selecting a mounting location. **Failure to observe these precautions may void the warranty!**

- ◆ Do not mount the AC drive near heat-radiating elements or in direct sunlight.

- ◆ Do not install the AC drive in a place subjected to high temperature, high humidity, excessive vibration, corrosive gases or liquids, or airborne dust or metallic particles.

- ◆ Mount the AC drive vertically and do not restrict the air flow to the heat sink fins.

- ◆ The AC drive generates heat. Allow sufficient space around the unit for heat dissipation as shown in the figure below:
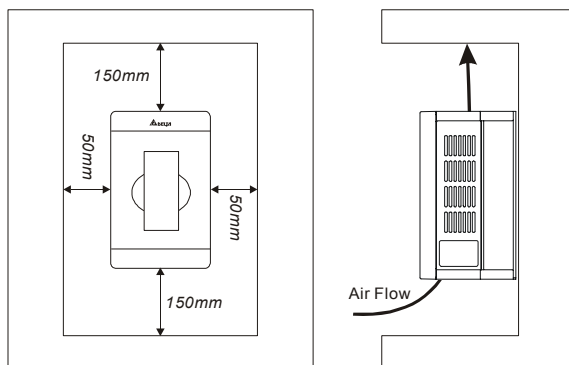
# CHAPTER 3   WIRING

⚠ **DANGER**

**Hazardous Voltage**

Before accessing the AC drive:

- ◆ Disconnect all power to the AC drive.
- ◆ Wait five minutes for DC bus capacitors discharge.

*Any Electrical or mechanical modification to this equipment without prior written consent of Delta Electronics, Inc. will void all warranties and may result in a safety hazard in addition to voiding the UL listing.*

Short Circuit Withstand:
Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, for all 460V Models, the maximum is 480 Volts, 230V Models, the maximum is 240 Volts.

📖 **General Wiring Information**

## Applicable Codes

All B550 AC drives are Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL) listed, and therefore comply with the requirements of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

Installation intended to meet the UL and cUL requirements must follow the instructions provided in "Wiring Notes" as a minimum standard. Follow all local codes that exceed UL and cUL requirements. Refer to the technical data label affixed to the AC drive and the motor nameplate for electrical data.

The "Line Fuse Specification" in Appendix B, lists the recommended fuse part number for each M-Series part number. These fuses (or equivalent) must be used on all installations where compliance with U.L. standards is a required.

## 3.1 Basic Wiring Diagram

Users must connect wiring according to the following circuit diagram shown below.

Braking resistor (optional)

Main Circuit Power

NFB
R/L1
S/L2
T/L3

Recommended Circuit when power supply is turned OFF by a fault output

SA
MC
OFF    ON
MC
RC

R/L1    B1        B2
S/L2
T/L3
RB
RB

AC Motor
U/T1
V/T2
W/T3
E
IM 3~
Grounding

The spec. of main circuit terminal is M3.0

Factory default
Forward/Stop                M0
Reverse/Stop                M1
Reset                       M2
Multi-step 1                M3
Multi-step 2                M4
Multi-step 3                M5
Common signal               GND
E

Master Frequency setting factory default is VR which is on the digital keypad

Power for speed setting +10V 10mA(MAX)

Analog voltage
0~10VDC
VR：3K~5KΩ
VR    2
3
1

Analog current
4~20mA

AVI

ACI
GND
E

RA    Multi-function indication output contact
RB    120VAC/250VAC  5A
RC    24VDC  less than 2.5A
Factory default: indicates malfunction

MO1    Multi-function Photocoupler output contact 48VDC 50mA
MCM    Factory default: Indicates during operation

AFM    VR(1KΩ)
For adjustment
+    Analog output
–    DC 0~10V
GND
E    Factory default: output frequency

RS-485 series interface
RJ-11
6←1
1:15V
2:GND
3:SG-
4:SG+
5:Reserved
6:Reserved

Main circuit (power) terminals
Control circuit terminals
Shielded leads
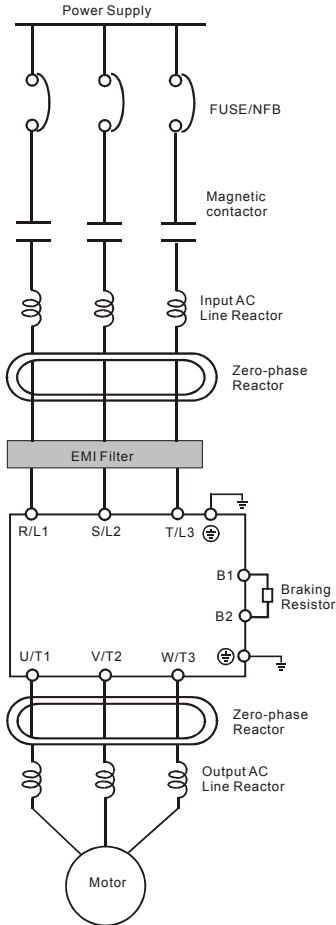
NOTE: Do not plug a Modem or telephone line to the RS-485 communication port, permanent damage may result. Terminal 1& 2 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.
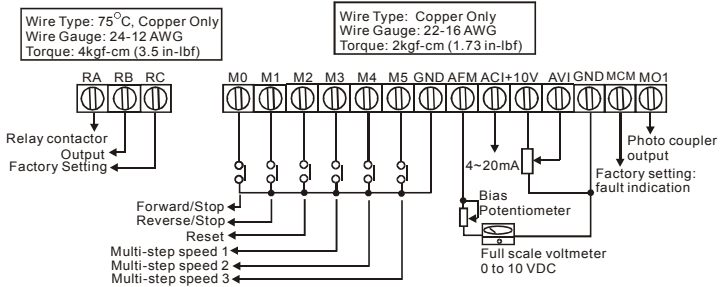* If it is single phase model, please select any of the two input power terminals in main circuit power.
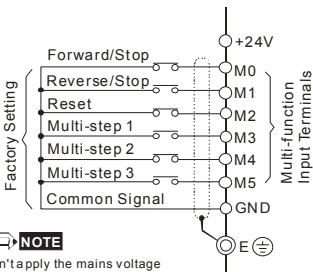* Single phase model can be input 3-phase power.

## 3.2 External Wiring



**3**

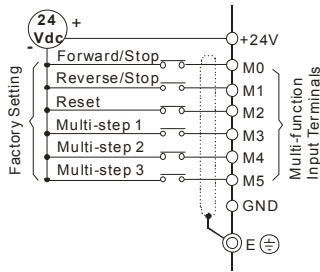| Items | Explanations |
|---|---|
| Power supply | Please follow the specific power supply requirement shown in APPENDIX A. |
| Fuse/NFB (Optional) | There may be inrush current during power up. Please check the chart of APPENDIX B and select the correct fuse with rated current. NFB is optional. |
| Magnetic contactor (Optional) | Please do not use a Magnetic contactor as the I/O switch of the AC drive, this will reduce the operating life cycle of the AC drive. |
| Input AC Line Reactor (Optional) | Used to improve the input power factor, to reduce harmonics and provide protection from AC line disturbances. (Surge, switching spike, power flick, etc.). AC line reactor should be installed when the power supply capacity is $\geqq$500kVA or phase lead reactor will be switched. And the wiring distance should not exceed 10m. Please refer to Appendix B for detail. |
| Zero-phase Reactor (Ferrite Core Common Choke) (Optional) | Zero phase reactors are used to reduce radio noise especially when audio equipment installed near the inverter. Effective for noise reduction on both the input and output sides. Attenuation quality is good for a wide range from AM band to 10Mhz. Appendix B specifies zero phase reactors. (RF220X00A) |
| EMI filter (Optional) | To reduce electromagnetic interference. Please refer to Appendix B for detail. |
| Braking Resistor (Optional) | Used to reduce stopping time of the motor. Please refer to the chart on Appendix B for specific Braking Resistors. |
| Output AC Line Reactor (Optional) | Motor surge voltage amplitudes depending on motor cable length. For long motor cable applications (>10m), it is necessary to install on the inverter output side. |

## 3.3 Control Terminal Wiring (Factory Settings)

Wire Type: 75°C, Copper Only
Wire Gauge: 24-12 AWG
Torque: 4kgf-cm (3.5 in-lbf)

Wire Type: Copper Only
Wire Gauge: 22-16 AWG
Torque: 2kgf-cm (1.73 in-lbf)

RA RB RC    M0 M1 M2 M3 M4 M5 GND AFM ACI+10V AVI GND MCM MO1

Relay contactor
Output
Factory Setting

Forward/Stop
Reverse/Stop
Reset
Multi-step speed 1
Multi-step speed 2
Multi-step speed 3

4~20mA

Bias
Potentiometer

Full scale voltmeter
0 to 10 VDC

Photo coupler
output
Factory setting:
fault indication

**NPN Mode**

NPN mode without external power

Forward/Stop
Reverse/Stop
Reset
Multi-step 1
Multi-step 2
Multi-step 3
Common Signal

Factory Setting

+24V
M0
M1
M2
M3
M4
M5
GND
E

Multi-function Input Terminals

📖 **NOTE**

Don't apply the mains voltage
directly to above terminals.
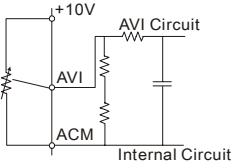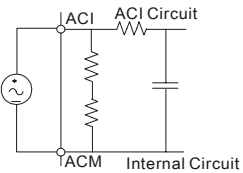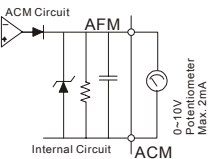
NPN mode with external power

24 Vdc  +  −

Forward/Stop
Reverse/Stop
Reset
Multi-step 1
Multi-step 2
Multi-step 3

Factory Setting

+24V
M0
M1
M2
M3
M4
M5
GND
E

Multi-function Input Terminals

| Terminal Symbol | Terminal Function | Factory Settings (NPN mode) |
|---|---|---|
| RA | Multi-Function Relay Output (N.O.) a | RA-RC<br>Resistive Load<br>5A(N.O.)/3A(N.C.) 277Vac;<br>5A(N.O.)/3A(N.C.) 30Vdc<br>Refer to P45 for programming. |
| RB | Multi-Function Relay Output (N.C.) b | RB-RC<br>Resistive Load<br>5A(N.O.)/3A(N.C.) 277Vac;<br>5A(N.O.)/3A(N.C.) 30Vdc |

| Terminal Symbol | Terminal Function | Factory Settings (NPN mode) |
|---|---|---|
| RC | Multi-function Relay Common | 5A(N.O.)/3A(N.C.) 277Vac; 5A(N.O.)/3A(N.C.) 30Vdc |
| M0 | Multi-function auxiliary input | M0~M5-GND |
| M1 | Multi-function input 1 | Refer to P38~P42 for programming the |
| M2 | Multi-function input 2 | multi-function inputs. |
| M3 | Multi-function input 3 | ON: the activation current is 10 mA. |
| M4 | Multi-function input 4 | OFF: leakage current tolerance is 10$\mu$A. |
| M5 | Multi-function input 5 | |
| GND | Common Signal | |
| +10V | +10 Vdc Output | +10V-GND It can supply +10 VDC power. |
| AVI | Analog Voltage Input  | Impedance: 20k$\Omega$ Resolution: 10 bits Range: 0~10Vdc = 0~Max.Output Frequency |
| ACI | Analog Current Input  | Impedance: 250$\Omega$ Resolution: 10 bits Range: 4~20mA = 0~Max.Output Frequency |
| AFM | Analog Output Meter  | 0 to 10V, 2mA Impedance: 100k$\Omega$ Output Current: 2mA max Resolution: 8 bits Range: 0 ~ 10Vdc |

**3**

| Terminal Symbol | Terminal Function | Factory Settings (NPN mode) |
|---|---|---|
| MO1 | Multi-function Output Terminal (Photocoupler) | Maximum: 48Vdc, 50mA<br>Refer to P45 for programming.<br><br>MO1-DCM       Max: 48Vdc/50mA<br>      MO1<br>Internal Circuit   MCM |
| MCM | Multi-function Output Common (Photocoupler) | Common for Multi-function Outputs |

**Note:** Use twisted-shielded, twisted-pair or shielded-lead wires for the control signal wiring. It is recommended to run all signal wiring in a separate steel conduit. The shield wire should only be connected at the drive. Do not connect shield wire on both ends.

## 3.4 Main Circuit Wiring

Wire Type: 75 $^o$C Copper Only



**3**
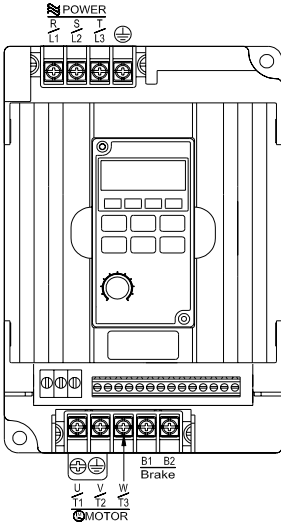
| Model name | Max. Current (Input/ output) | Wire Gauge AWG (mm2) | Torque kgf-cm (in -lbf) |
|---|---|---|---|
| B550-200R5 | 6.3A/2.5A | 12-14 (3.3-2.1) | 14(12) |
| B550-2001 | 11.5A/5.0A | | |
| B550-2002 | 15.7A/7.0A | 12(3.3) | |
| B550-2003 | 27A/10A | 8(8.4) | 15(13) |
| B550-2T0R5 | 3.2A/2.5A | 12-14 (3.3-2.1) | 14(12) |
| B550-2T001 | 6.3A/5.0A | | |
| B550-2T002 | 9.0A/7.0A | | |
| B550-2T003 | 12.5A/10A | 8-12 (8.4-3.3) | 15(13) |
| B550-2T005 | 19.6A/17A | 8(8.4) | |
| B550-2T007 | 28A/25A | 8(8.4) | |
| B550-4001 | 4.2A/3.0A | 12-14 (3.3-2.1) | 14(12) |
| B550-4002 | 5.7A/4.0A | | |
| B550-4003 | 6.0A/5.0A | | |
| B550-4005 | 8.5A/8.2A | 8-14 (8.4-2.1) | 15(13) |
| B550-4007 | 14A/13A | 8-12 (8.4-3.3) | 15(13) |

**Note: It needs to use the Recognized Ring Terminal to conduct a proper wiring.**

**Terminal Explanations**

| Terminal Symbol | Explanation of Terminal Function |
|---|---|
| R/L1, S/L2, T/L3 | AC line input terminals (three phase) |
| U/T1, V/T2, W/T3 | Motor connections |
| B1 – B2 | Connections for Braking Resistor (optional) |
| ⏚ | Earth Ground |

## 3.5 Wiring Notes: PLEASE READ PRIOR TO INSTALLATION.

1. ⚠ **CAUTION:** Do not connect the AC power to the U/T1, V/T2, W/T3 terminals, as it will damage the AC drive.

2. ⚠ **WARNING:** Ensure all screws are tightened to the proper torque rating.

3. During installation, follow all local electrical, construction, and safety codes for the country the drive is to be installed in.

4. Ensure that the appropriate protective devices (circuit breaker or fuses) are connected between the power supply and AC drive.

5. Make sure that the leads are connected correctly and the AC drive is properly grounded.

6. Use ground leads that comply with AWG/MCM standards and keep them as short as possible.

7. Multiple B550 units can be installed in one location. All the units should be grounded directly to a common ground terminal. The B550 ground terminals may also be connected in parallel, as shown in the figure below. **Ensure there are no ground loops.**
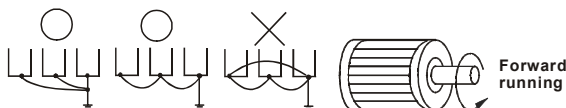


8. When the AC drive output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U, V, and W, respectively, the motor will rotate counterclockwise (as viewed from the shaft ends of the motor) when a forward operation command is received. To reverse the direction of motor rotation, switch over any of the two motor leads.

9.  Make sure that the power source is capable of supplying the correct voltage and required current to the AC drive.

10. Do not attach or remove wiring when power is applied to the AC drive.

11. Do not inspect components unless inside "CHARGE" lamp is turned off.

12. Do not monitor the signals on the circuit board while the AC drive is in operation.

**3**

13. For the single-phase rated AC drives, the AC power can be connected to any two of the three input terminals R/L1, S/L2, T/L3.  **Note: This drive is not intended for the use with single-phase motors.**

14. Route the power and control wires separately, or at 90 degree angle to each other.

15. If a filter is required for reducing EMI (Electro Magnetic Interference), install it as close as possible to AC drive.   EMI can also be reduced by lowering the Carrier Frequency.

16. If the AC drive is installed in the place where a load reactor is needed, install the filter close to U/T1, V/T2, W/T3 side of AC drive. Do not use a Capacitor or L-C Filter (Inductance-Capacitance) or R-C Filter (Resistance-Capacitance), unless approved by Delta.

17. When using a GFCI (Ground Fault Circuit Interrupt), select current sensor with sensitivity of 200mA, and not less than 0.1-second detection to avoid nuisance tripping.

## 3.6 Motor Operation Precautions

1.  When using the AC drive to operate a standard 3-phase induction motor, notice that the energy loss is greater than for an inverter duty motor.

2.  Avoid running a standard induction motor at low speed. Under these conditions, the motor temperature may rise above the motor rating due to limited airflow produced by the motor's fan.

3.  When the standard motor operates at low speed, the output load must be decreased.

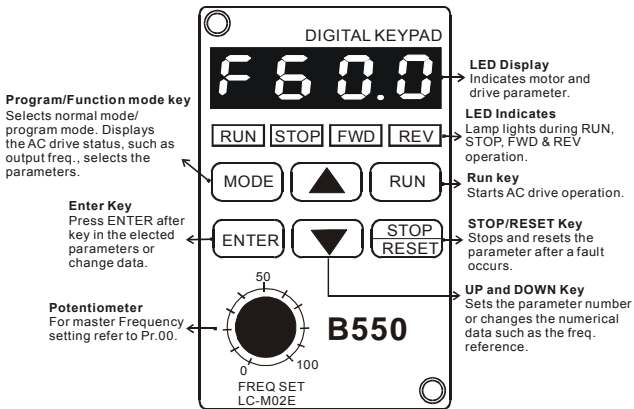4.  If 100% output torque is desired at low speed, it may be necessary to use a special "inverter-duty" rated motor.

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# CHAPTER 4   DIGITAL KEYPAD OPERATION

## 4.1 Description of Digital Keypad

The digital keypad includes two parts: Display panel and keypad. The display panel provides the parameter display and shows the operation status of the AC drive and the keypad provides programming and control interface.



**Program/Function mode key**
Selects normal mode/
program mode. Displays
the AC drive status, such as
output freq., selects the
parameters.

**Enter Key**
Press ENTER after
key in the elected
parameters or
change data.

**Potentiometer**
For master Frequency
setting refer to Pr.00.

DIGITAL KEYPAD

RUN   STOP   FWD   REV

MODE   ▲   RUN

ENTER   ▼   STOP RESET

50

0      100

FREQ SET
LC-M02E

**B550**

**LED Display**
Indicates motor and
drive parameter.

**LED Indicates**
Lamp lights during RUN,
STOP, FWD & REV
operation.

**Run key**
Starts AC drive operation.

**STOP/RESET Key**
Stops and resets the
parameter after a fault
occurs.

**UP and DOWN Key**
Sets the parameter number
or changes the numerical
data such as the freq.
reference.

| | |
|---|---|
| MODE | **Function / Program**<br>Pressing the "mode" key repetitively displays the AC drive status such as the reference frequency, output frequency, and output current. |
| ENTER | **Enter**<br>Pressing the "ENTER" key will store or display parameter settings. |
| RUN | **Run**<br>Starts AC drive operation.　This key has no effect when the drive is controlled by the External Control Terminals. |
| STOP RESET | **Stop / Reset**<br>Used to stop AC drive operation. If the drive has stopped due to a fault, clear the fault first, then press this key to reset the drive. |
| ▲ ▼ | **Up / Down**<br>Press the "Up" or "Down" keys momentarily to change parameter settings. These keys may also be used to scroll through different operating values or parameters. Pressing the "Up" or "Down" key momentarily, will change the parameter settings in single-unit increments.　To quickly run through the range of settings, press and hold the "DOWN" key. |

## 4.2 Explanation of the LED Indicators

LED Displays

RUN  STOP  FWD  REV

Green lamp lights during REV operation.
Green lamp lights during FWD operation.
Red lamp lights by pressing STOP.
Green lamp lights by pressing RUN.
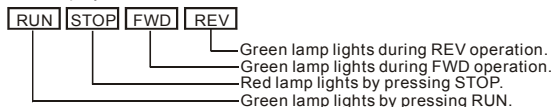
## 4.3 Explanations of Display Messages

| Displayed Message | Descriptions |
|---|---|
| **F60.0** | The AC drives Master Frequency. |
| **H60.0** | The Actual Operation Frequency present at terminals U, V, and W. |
| **u600.** | The custom unit (v), where v = H x Pr.-65. |
| **c 999** | The counter value (c). |
| **A 5.0** | The output current present at terminals U, V, and W |
| **i 50** | The internal PLC process step currently being performed. |
| **P 01** | The specified parameter. |
| **01** | The actual value stored within the specified parameter. |
| **Frd** | The AC drive forward run status. |
| **rEu** | The AC drive reverse run status. |
| **End** | "End" displays for approximately 1 second if input has been accepted.  After a parameter value has been set, the new value is automatically stored in memory.  To modify an entry, use the ⏶ and ⏷ keys. |
| **Err** | "Err" displays, if the input is invalid. |

**4**

## 4.4 Explanation of Digital Keypad LC-M02E Operation

### To view parameters:

| Indication after power on | Parameter values setting monitor | Output frequency | Output current | FWD/REV monitor |
|---|---|---|---|---|



Press **MODE** Key



Press **MODE** Key



Press **MODE** Key



Press **MODE** Key



Press **MODE** key
Display the freq. setting monitor.
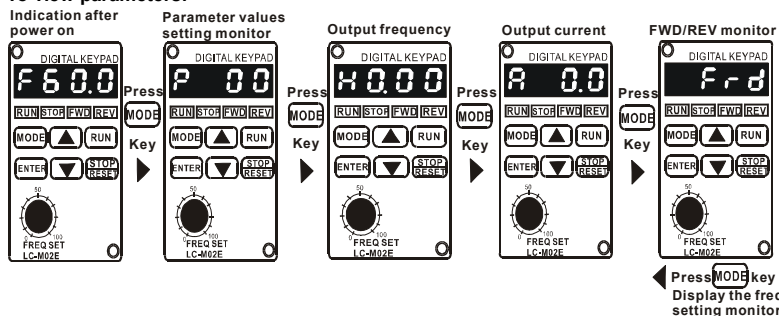
### Parameter value setting:

| Indication after power on | Parameter values setting monitor | Parameter value is 01 | The setting is completed | Parameter setting monitor |
|---|---|---|---|---|



Press **MODE** Key



Press **MODE** Key



Press **MODE** Key



Press **MODE** Key



Press ▲ ▼ key to select the parameter number

Press ▲ ▼ key to select the parameter number

"End":The new has been automatically stored in the internal memory.
"Err": Enter value is illegal.

Display the parameter number automatically.

### To correct the fault messages:

| Display fault message o.H.. | Display frequency setting after fault is corrected |
|---|---|



Press **STOP RESET** Key
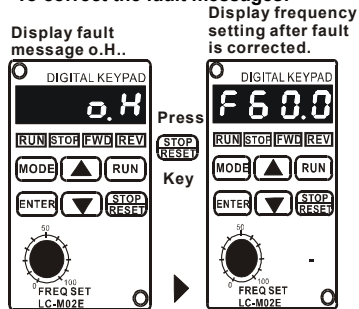
## To change frequency, proceed as follows:

**Note:** The Pr.00 has to be set to d00 in order to operate via digital keypad.

| Freq. value setting monitor | Freq. set at 59.9 Hz. | Decreasing freq. value to 0.0 Hz. | Increasing freq. value to 60.0 Hz. | Frequency setting monitor. |
|---|---|---|---|---|
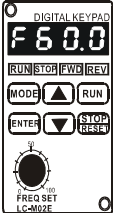


**Press** key to select the monitor operating frequency.
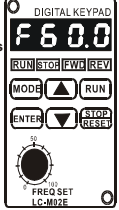
The value will be decreased with 3.5 Hz/sec, if press key still.

The value will be increased with 3.5 Hz/sec, if press key still.

The freq. value can be entered in stop or operating mode.

## To change the different indication mode as follows:

| Indication after power on | Parameter values setting monitor | Parameter value is 01 | The setting is completed | Parameter setting monitor |
|---|---|---|---|---|



**Press** key to select the parameter number

**Press** key to select the parameter number

"End":The new has been automatically stored in the internal memory.

"Err": Enter value is illegal.
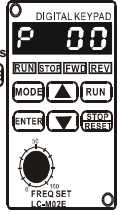
Display the parameter number automatically.



| Change FWD or REV operation | Change to reserve operation. | Frequency setting. | AC driver decelerates the motor according to the time set. | Stop mode |
|---|---|---|---|---|
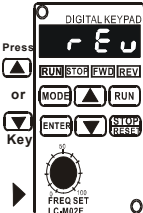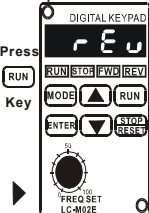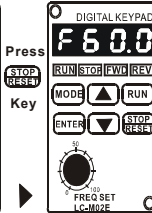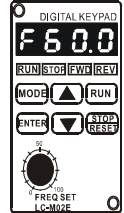
lighten
glisten

lighten
glisten

lighten

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# CHAPTER 5   DESCRIPTION OF PARAMETER SETTINGS

✗ : The parameter can be set during operation.

| **Pr.00** Source of Frequency Command | ✗ | Factory Setting: 00 |
| --- | --- | --- |

Settings    00    Master Frequency determined by digital keypad. (LC-M02E)

01    Master frequency determined by 0 to +10 V input

02    Master frequency determined by 4 to 20mA input

03    Master frequency determined by RS-485 Communication port

04    Master frequency determined by potentiometer on digital keypad. (LC-M02E)

**5**

| **Pr.01** Source of Operation Command | ✗ | Factory Setting: 00 |
| --- | --- | --- |

Settings    00    Operation instructions determined by the Digital Keypad.

01    Operation instructions determined by the External Control Terminals. Keypad STOP key is effective.

02    Operation instructions determined by the External Control Terminals. Keypad STOP key is not effective.

03    Operation instructions determined by the RS-485 communication port. Keypad STOP key is effective.

04    Operation instructions determined by the RS-485 communication port. Keypad STOP key is not effective.

📖   Refer to Pr.38 to Pr.42 for more details.

| **Pr.02** Stop Method | Factory Setting: 00 |
| --- | --- |

Settings    00    Ramp to stop

01    Coast to stop

📖   This parameter determines how the motor is stopped when the AC drive receives a valid stop command.

1.    Ramp:  The AC drive decelerates the motor to Minimum Output Frequency (Pr.08) and then stops according to the deceleration time set in Pr.11 or Pr.13.

2. Coast: The AC drive will stop the output instantly, and the motor will coast to stop.
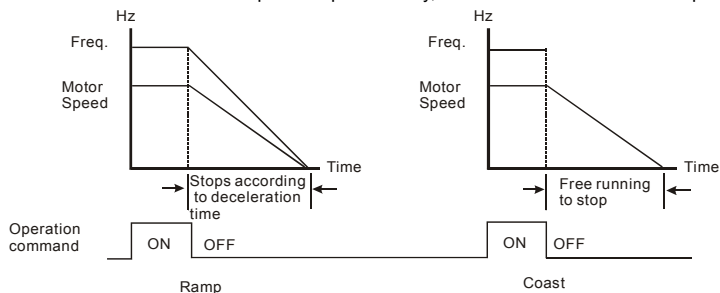


Note: The motor stop method is usually determined by the application or system requirements.

| Pr.03 Maximum Output Frequency | Factory Setting: 60.00 |
|---|---|
| Settings   50.00 to 400.0 Hz | Unit: 0.1Hz |

&#x1F4D6; This parameter determines the AC drive's Maximum Output Frequency. All the AC drive analog inputs (0 to +10V, 4 to 20mA) are scaled to correspond to the output frequency range.

| Pr.04 Maximum Voltage Frequency (Base Frequency) | Factory Setting: 60.00 |
|---|---|
| Settings   10.00 to 400.0Hz | Unit: 0.1Hz |

&#x1F4D6; This parameter should be set according to the rated frequency as indicated in the motor nameplate. Pr.04 and Pr.03 determine the volts per hertz ratio.

For example: if the drive is rated for 460 VAC output and the Maximum Voltage Frequency is set to 60Hz, the drive will maintain a constant ratio of 7.66 v/Hz. *Setting of Pr.04 must be equal to or greater than setting of Mid-Point Frequency (Pr.06).*

| Pr.05 Maximum Output Voltage (Vmax) | | |
|---|---|---|
| Settings | 230V series | 0.1 to 255.0V | Factory Setting: 220.0 |
| | 460V series | 0.1 to 510.0V | Factory Setting: 440.0 |

📖 This parameter determines the Maximum Output Voltage of the AC drive. The Maximum Output Voltage setting must be smaller than or equal to the rated voltage of the motor as indicated on the motor nameplate. ***Setting of Pr.05 must be equal to or greater than setting of Mid-Point Voltage (Pr.07).***

| **Pr.06** Mid-Point Frequency | Factory Setting: 1.50 |
|---|---|
| Settings  0.10 to 400.0Hz | Unit: 0.1Hz |

📖 The parameter sets the Mid-Point Frequency of V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point frequency can be determined. ***Setting of this parameter must be equal to or greater than Minimum Output Frequency (Pr.08) and equal to or less than Maximum Voltage Frequency (Pr.04).***

**5**

| **Pr.07** Mid-Point Voltage | | |
|---|---|---|
| Settings   230V series | 0.1 to 255.0V | Factory Setting: 10.0 |
| 460V series | 0.1 to 510.0V | Factory Setting: 20.0 |

📖 The parameter sets the Mid-Point Voltage of any V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point Frequency can be determined. ***Setting of this parameter must be equal to or greater than Minimum Output Voltage (Pr.09) and equal to or less than Maximum Output Voltage (Pr.05).***

| **Pr.08** Minimum Output Frequency | Factory Setting: 1.50 |
|---|---|
| Settings  0.10 to 20.00Hz | Unit: 0.1Hz |

📖 The parameter sets the Minimum Output Frequency of the AC drive. ***Setting of this parameter must be equal to or less than Mid-Point Frequency (Pr.06).***

| **Pr.09** Minimum Output Voltage | | |
|---|---|---|
| Settings   230V series | 0.1 to 255.0V | Factory Setting: 10.0 |
| 460V series | 0.1 to 510.0V | Factory Setting: 20.0 |

📖 This parameter sets the Minimum Output Voltage of the AC drive.  ***Setting of this parameter must be equal to or less than Mid-Point Voltage (Pr.07).***

Voltage

Pr.05

Pr.07
Pr.09

0    Frequency

Pr.06      Pr.03
Pr.08      Pr.04

**Standard V/F Curve**

Voltage

Pr.05

Pr.07

Pr.09

Frequency

Pr.08   Pr.06    Pr.04   Pr.03

**Custom V/F Curve**

Voltage

Pr.05

Pr.07

Pr.09

Frequency

Pr.08    Pr.06    Pr.04   Pr.03

**Fan/Pump V/F Curve**
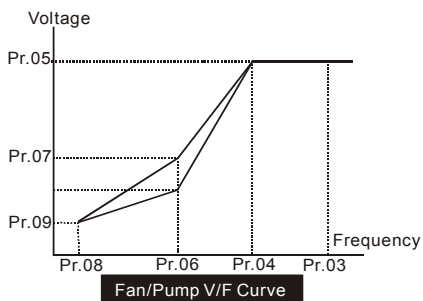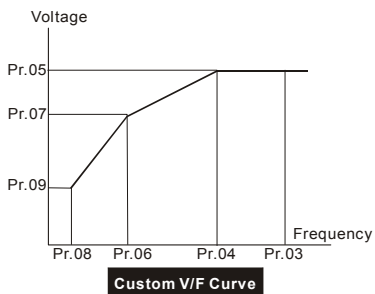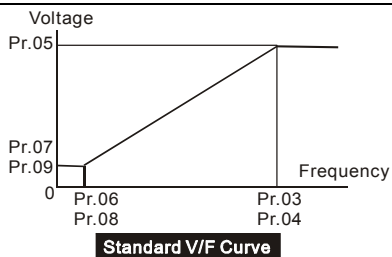
Commonly used V/F Setting

(1) General Purpose
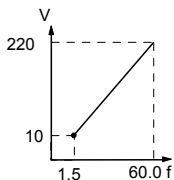
Factory Settings

Motor Spec. 60Hz



| No. | Set value |
|------|-----------|
| Pr.03 | 60.0 |
| Pr.04 | 60.0 |
| Pr.05 | 220.0 |
| Pr.06 | 1.5 |
| Pr.07 | 10.0 |
| Pr.08 | 1.5 |
| Pr.09 | 10.0 |
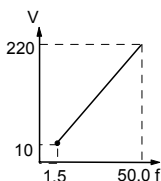
Motor Spec. 50Hz



| No. | Set value |
|------|-----------|
| Pr.03 | 50.0 |
| Pr.04 | 50.0 |
| Pr.05 | 220.0 |
| Pr.06 | 1.3 |
| Pr.07 | 12.0 |
| Pr.08 | 1.3 |
| Pr.09 | 12.0 |

(2) Fans and Pumps

Motor Spec. 60Hz  Factory Settings
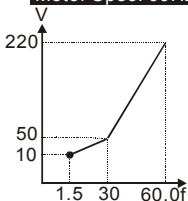


| No. | Set value |
|------|-----------|
| Pr.03 | 60.0 |
| Pr.04 | 60.0 |
| Pr.05 | 220.0 |
| Pr.06 | 30 |
| Pr.07 | 50.0 |
| Pr.08 | 1.5 |
| Pr.09 | 10.0 |
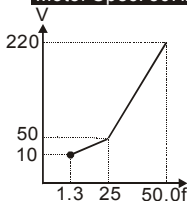
Motor Spec. 50Hz



| No. | Set value |
|------|-----------|
| Pr.03 | 50.0 |
| Pr.04 | 50.0 |
| Pr.05 | 220.0 |
| Pr.06 | 25 |
| Pr.07 | 50.0 |
| Pr.08 | 1.3 |
| Pr.09 | 10.0 |

(3) High Starting Torque

Motor Spec. 60Hz  Factory Settings
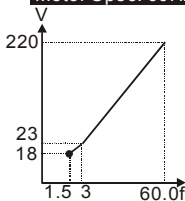


| No. | Set value |
|------|-----------|
| Pr.03 | 60.0 |
| Pr.04 | 60.0 |
| Pr.05 | 220.0 |
| Pr.06 | 3 |
| Pr.07 | 23.0 |
| Pr.08 | 1.5 |
| Pr.09 | 18.0 |

Motor Spec. 50Hz
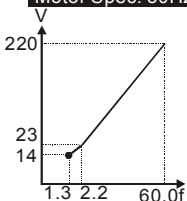


| No. | Set value |
|------|-----------|
| Pr.03 | 50.0 |
| Pr.04 | 50.0 |
| Pr.05 | 220.0 |
| Pr.06 | 2.2 |
| Pr.07 | 23.0 |
| Pr.08 | 1.3 |
| Pr.09 | 14.0 |

| Pr.10 | Acceleration Time 1 | ↗ | Factory Setting: 10.0 |
|-------|---------------------|---|------------------------|
| Pr.11 | Deceleration Time 1 | ↗ | Factory Setting: 10.0 |
| Pr.12 | Acceleration Time 2 | ↗ | Factory Setting: 10.0 |
| Pr.13 | Deceleration Time 2 | ↗ | Factory Setting: 10.0 |

Settings  0.1 to 600.0 sec or 0.01 to 600.0 sec        Unit:  0.1 or 0.01 sec

&#x1F56E; Pr.10. This parameter is used to determine the time required for the AC drive to ramp from 0 Hz to its Maximum Output Frequency (Pr.03). The rate is linear unless the S-Curve (Pr.14) is "Enabled".

&#x1F56E; Pr.11. This parameter is used to determine the time required for the AC drive to decelerate from the Maximum Output Frequency (Pr.03) down to 0 Hz. The rate is linear unless the S-Curve (Pr.14) is "Enabled".

&#x1F56E; Pr.12 and Pr.13: Provide an additional Accel/Decel time although Time 1 is the default. A Multi-Function input terminal must be programmed to select Accel/ or Decel/ Time 2 and the terminal must be closed to select Accel/Decel Time 2 (See Pr.38 to Pr.42).

&#x1F56E; In the below diagram, suppose the Maximum Output Frequency is 60 Hz (Master Freq), Minimum Output Frequency (start-up) is 1.0 Hz, and accel/decel time 1 is 10 seconds. The actual time for the AC drive to accelerate from start-up to 60 Hz is 9.83 seconds (deceleration time is also 9.83 seconds), can be determined by the formula.



$$\text{Actual Acceleration/Deceleration Time} = \frac{\text{Acceleration/Deceleration Time} \times (\text{Master Freq.} - \text{Min.Output Freq.})}{\text{Max. Output Freq.}}$$
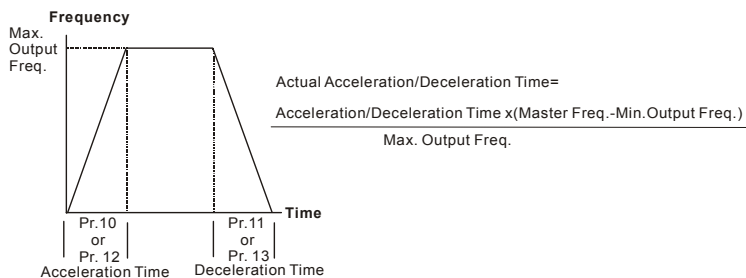
| **Pr.14** | Acceleration S-Curve | Factory Setting: 00 |
|---|---|---|

Settings  00 to 07

&#x1F56E; This parameter is used whenever the motor load needs to be accelerated or decelerated smoothly. The desired accel/decel effect is selectable from 0 to 7, in which the larger the number, the greater the effect achieved. If the default value of Pr.111 Deceleration S Curve is unchanged ("0"), then Pr.14 sets both acceleration and deceleration S-Curves. If Pr.111 is set to any value other than "0", then Pr.14 will set the acceleration S-Curve and Pr.111 will set the deceleration S-Curve.
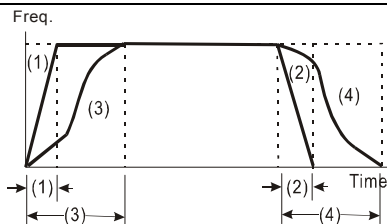
Acceleration/Deceleration characteristics
(1), (2) Disabling S curve
(3), (4) Enabling S curve

5

| Pr.15 | Jog Accel / Decel Time | ↗ | Factory Setting: 1.0 sec |
|---|---|---|---|
| | Settings  0.1 to 600.0 sec or 0.01 to 600.0 sec | | Unit: 0.1 or 0.01 sec |

📖 This parameter sets the acceleration or deceleration time for Jog operation.

| Pr.16 | Jog Frequency | ↗ | Factory Setting: 6.00 Hz |
|---|---|---|---|
| | Settings  0.00 to 400.0 Hz | | Unit: 0.1 Hz |

📖 When the JOG function is activated, the AC drive will accelerate from Minimum Output Frequency  (Pr.08) to Jog Frequency (Pr.16). Drive must be in "stop" status for the operator to activate the JOG function. Likewise, during Jog operation, other commands cannot be accepted through the keypad but FORWARD, REVERSE and STOP. The JOG function can be remotely activated when the Jog terminal is closed, and if the Jog terminal opens, the AC drive will decelerate from Jog Frequency to zero. The accel / decel time is entered as Jog Accel / Decel Time (Pr.15). Multi-function Input terminals (M1-M5) can also be used to initiate the JOG operation if so programmed.
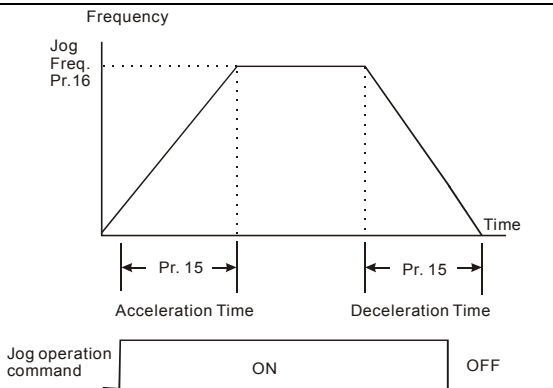
Frequency



| **Pr.17** | 1st Step Speed Frequency | ↗ | Factory Setting: 0.00 Hz |
|---|---|---|---|
| **Pr.18** | 2nd Step Speed Frequency | ↗ | Factory Setting: 0.00 Hz |
| **Pr.19** | 3rd Step Speed Frequency | ↗ | Factory Setting: 0.00 Hz |
| **Pr.20** | 4th Step Speed Frequency | ↗ | Factory Setting: 0.00 Hz |
| **Pr.21** | 5th Step Speed Frequency | ↗ | Factory Setting: 0.00 Hz |
| **Pr.22** | 6th Step Speed Frequency | ↗ | Factory Setting: 0.00 Hz |
| **Pr.23** | 7th Step Speed Frequency | ↗ | Factory Setting: 0.00 Hz |

Settings     0.00 to 400.0Hz                      Unit: 0.1 Hz

📖 Multi-Function Input Terminals (refer to Pr.38 to Pr.42) are used to select Multi-Step speeds. The desired speed frequencies are entered in Pr.17 to Pr.23. When the associated multi-function input terminal is closed, drive will run at one of these specific frequencies.

📖 Multi-step speeds (Pr.17 to Pr.23), Pr.78, Pr.79, and Pr.81 to Pr.87; are used for multi-step motion control, which is executed in an orderly manner, similar to a PLC program.

| **Pr.24** | Reverse Operation Inhibition | Factory Setting: 00 |
|---|---|---|

Settings     00     Enable REV operation

00     01     Disable REV operation

📖 This parameter is used to disable motor rotation in reverse.

**Pr.25** Over–Voltage Stall Prevention

| Settings | 115V/230V series | 330-450Vdc | Factory Setting: 390 |
| --- | --- | --- | --- |
| | 460V series | 660-900Vdc | Factory Setting: 780 |
| | 575V series | 825-1025Vdc | Factory Setting: 975 |
| | 00 disable | | |

&#x1F4D6; During deceleration, the DC bus voltage may exceed its maximum allowable value due to motor regeneration. When this function is enabled, the AC drive will stop decelerating, and maintain a constant output frequency to prevent from over-voltage tripping. Drive will resume deceleration when the voltage drops below the setting for Pr.25.

Note: In applications where inertia is low, over-voltage during deceleration would not occur. When inertia is high, the AC drive will automatically extend the deceleration period. If a faster stop is needed, then a dynamic braking resistor should be used.

**5**



Over-voltage Stall Prevention
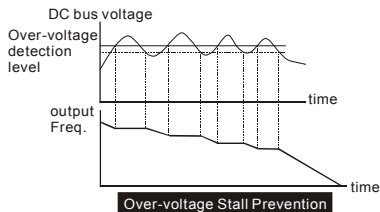
**Pr.26** Over-Current Stall Prevention during Acceleration     Factory Setting: 150%

| Settings | 20 to 200% | Unit: 1% |
| --- | --- | --- |
| | 00 disable | |

&#x1F4D6; A setting of 100% is equal to the Rated Output Current of the drive.

&#x1F4D6; Under certain conditions, the AC drive output current may increase abruptly, and exceed the value specified by Pr.26. This is commonly caused by rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and maintain a constant output frequency.  Drive will resume accelerating only after the current drops below the setting for Pr.26.

**Pr.27** Over-Current Stall Prevention during Operation     Factory Setting: 150%

| Settings | 20 to 200% | Unit: 1% |
| --- | --- | --- |
| | 00: disable | |

   &#8520; During a steady-state operation with the motor load rapidly increasing, the AC drive output current may exceed the limit specified in Pr.27. When this occurs, the output frequency will decrease to maintain a constant motor speed. The drive will accelerate to the steady-state output frequency only when the output current drops below the setting for Pr.27.



over-current Stall Prevention during Acceleration

Over-current Stall Prevention during Operation
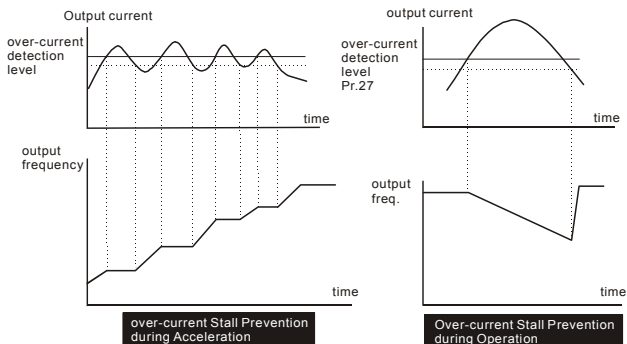
| **Pr.28** DC Braking Current Level | Factory Setting: 00 |
|---|---|
| Settings   00 to 100% | Unit: 1% |

   &#8520; This parameter determines the amount of DC Braking Current applied to the motor during starting and stopping. When setting the DC Braking Current, please note that 100% corresponds to the rated current of the AC drive. It is recommended to start with a low DC Braking Current level and then increase it until proper holding torque has been attained.

| **Pr.29** DC Braking Time during Start-up | Factory Setting: 0.0 |
|---|---|
| Settings   0.0 to 5.0 sec | Unit: 0.1sec |

   &#8520; This parameter determines the duration for the DC Braking Current applied during starting. DC Braking is applied until the Minimum Frequency is reached.

| **Pr.30** DC Braking Time during Stopping | Factory Setting: 0.0 |
|---|---|
| Settings   0.0 to 25.0 sec | Unit: 0.1sec |

   &#8520; This parameter determines the duration for the DC Braking voltage to be applied during stopping.   If stopping with DC Braking is desired, then Pr.02 must be set to Ramp to Stop (0.0).

| **Pr.31** | Start-Point for DC Braking | Factory Setting: 0.00 |

    Settings   0.00 to 60.00Hz              Unit: 0.1sec

📖  This parameter sets the frequency at which the DC Braking will begin during deceleration.
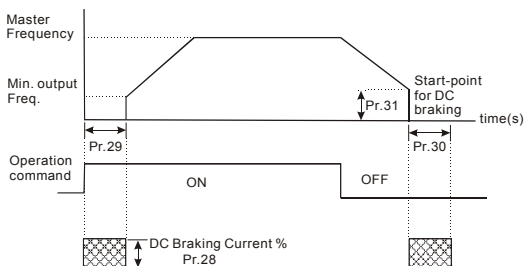


Notes:

1. DC Braking during starting is used for loads that may move before the AC drive starts, such as hoists and cranes. These loads may also be moving in the wrong direction. Under such circumstances, the DC Braking can be used to hold the load in position before applying a forward motion.

2. DC Braking during stopping is used to stop faster than the ramp-to-stop or to hold a stopped load in position. A dynamic braking resistor may be needed in order to stop loads of high inertia.

| **Pr.32** | Momentary Power Loss Operation Selection | Factory Setting: 00 |

| Settings | 00 | Operation stops after momentary power loss |
|---|---|---|
| | 01 | Operation continues after momentary power loss Speed search starts with the Master Frequency reference value |
| | 02 | Operation continues after momentary power loss Speed search starts with the min frequency |

| **Pr.33** | Maximum Allowable Power Loss Time | Factory Setting: 2.0 sec |

    Settings   0.3 to 5.0 sec              Unit: 0.1sec

📖  After a power loss, the AC drive will resume operation only if the power loss duration is shorter than the time defined by Pr.33. If the Maximum Allowable Power Loss Time is exceeded, the AC drive output is then turned off.

| **Pr.34** Base-Block Time for Speed Search | Factory Setting: 0.5 sec |
|---|---|
| Settings   0.3 to 5.0 sec | Unit: 0.1sec |

&#128214;  When a momentary power loss is detected, the AC drive will stop its output and will wait during a specified time interval called Base Block (entered in Pr.34) before resuming operation. Setting of this parameter should make the residual output voltage due to regeneration almost zero, before the drive resumes operation.

&#128214;  This parameter also determines the search time when performing external Base-Block and Fault Reset (Pr.72).

| **Pr.35** Maximum Current Level for Speed Search | Factory Setting: 150 |
|---|---|
| Settings   30 to 200% | Unit: 1% |

&#128214;  Following a power failure, the AC drive will start its speed search operation only if the output current is greater than the value determined by Pr.35. When the output current is less than that of Pr.35, the AC drive output frequency is at a "speed synchronization point" and will accelerate or decelerate back to the operating frequency at which it was running prior to the power failure.
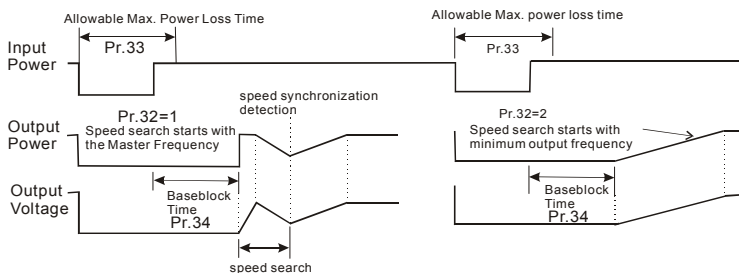


| **Pr.36** Upper Bound of Output Frequency | Factory Setting: 400 |
|---|---|
| Settings   0.10 Hz to 400.0 Hz | Unit: 0.1Hz |

&#128214;  The Upper/Lower Bounds help prevent operation error and machine damage.

&#128214;  If the Upper Bound of Output Frequency is 50Hz and the Maximum Output Frequency is 60Hz, the Maximum Output Frequency will be limited to 50Hz.

&#128214;  Setting of this parameter must be equal to or greater than the Lower Bound of Output Frequency (Pr.37).

---

**Pr.37** Lower Bound of Output Frequency                    Factory Setting: 0 Hz

    Settings   0.00 Hz to 400.0 Hz                    Unit: 0.1Hz

📖 Setting of this parameter must be equal to or less than the Upper Bound of Output Frequency

📖 If the Lower Bound of Output Frequency is 10Hz, and the Minimum Output Frequency (Pr.08) is set at 1.0Hz, then any command frequency between 1-10Hz will generate a 10Hz output from the drive.

output frequency

Pr.36

Pr.37

Input Freq.

---
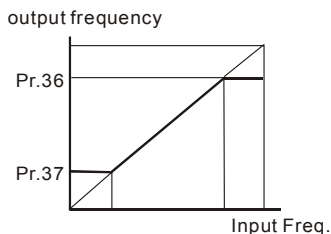
**Pr.38** Multi-function Input Terminal (M0, M1)                    Factory Setting: 00

    Settings   00   M0: FWD/STOP, M1: REV/STOP

              01   M0: RUN/STOP, M1: REV/FWD

              02   M0, M1, M2: 3-wire operation control mode

**Explanations:**

**00: Two wire operation:** Only Pr.38 can be set to "0".

FWD/STOP ──o o── M0 "Open": Stop, "Close": FWD Run

REV/STOP ──o o── M1 "Open": Stop, "Close":REV Run

GND

**01: Two wire operation:** Only Pr.38 can be set to "1".

RUN/STOP

M0 "Open": Stop, "Close": Run

M1 "Open": FWD, "Close":REV

REV/FWD

GND
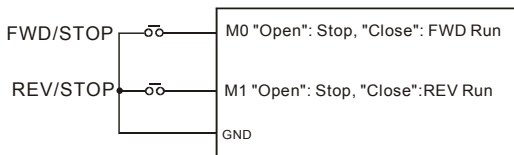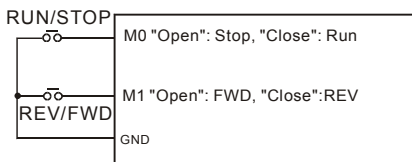
Note: Multi-function Input Terminal M0 does not have its own parameter designation. M0 must be used in conjunction with M1 to operate two and three wire control.

**02 Three Wire Control:** Only Pr.38 can be set to "2".

STOP    RUN

M0 Run command, Runs when "close"
M2 Stop command, stops when "Open"

M1 REV/FWD Run selection
"Open": FWD Run
"Close": REV Run

RUN/FWD

GND
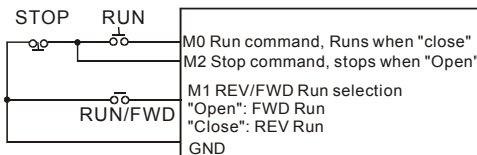
Note: When the "2" setting is selected for Pr.38, the value in Pr.39 will be ignored.

| | | |
|---|---|---|
| **Pr.39** | Multi-function Input Terminal (M2) | Factory Setting: 05 |
| **Pr.40** | Multi-function Input Terminal (M3) | Factory Setting: 06 |
| **Pr.41** | Multi-function Input Terminal (M4) | Factory Setting: 07 |
| **Pr.42** | Multi-function Input Terminal (M5) | Factory Setting: 08 |

Settings   00 to 32

Parameters & Functions table:

| Value | Function | Value | Function |
|---|---|---|---|
| 00 | No Function | 01 | Output OFF (N.O.) (enabled when running) |
| 02 | Output OFF (N.C.) (enabled when running) | 03 | External Fault (N.O.) |
| 04 | External Fault (N.C.) | 05 | External Reset |
| 06 | Multi-Step Speed Command 1 | 07 | Multi-Step Speed Command 2 |

| Value | Function | Value | Function |
|---|---|---|---|
| 08 | Multi-Step Speed Command 3 | 09 | Jog Operation |
| 10 | Accel/Decel Speed Inhibit | 11 | First or Second Accel/Decel Time Selection |
| 12 | External Base Block (N.O.) (Normally Open Contact Input) | 13 | External Base Block (N.C.) (Normally Close Contact Input) |
| 14 | Increase Master Frequency | 15 | Decrease Master Frequency |
| 16 | Run PLC Program | 17 | Pause PLC Program |
| 18 | Counter Trigger Signal | 19 | Counter Reset |
| 20 | No Function | 21 | RESET Command (N.C) |
| 22 | Control source: External Terminal | 23 | Control source: Keypad |
| 24 | Control source: Communication | 25 | Parameter Lock (Write disable, Read is always 0) |
| 26 | PID Disable (N.O.) | 27 | PID Disable (N.C.) |
| 28 | Second Source for Frequency Command | 29 | Forward (contact is open) / Reverse (contact is close) |
| 30 | One-Shot PLC Run | 31 | Index Input Signal |
| 32 | Virtual Timer Input | | |

**5**

**Explanations:**

**00: no function.**

**01, 02:** when it is set to 01 or 02, AC drive output will stop immediately. If there is start signal after stopping, the output will start from the minimum frequency.

**03, 04 External Faults:** Parameter values 3 and 4 program Multi-Function Input Terminals: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) to be External Fault (E.F.) inputs.
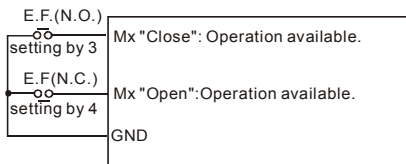


Note: When an External Fault input signal is received, the AC drive output will turn off, drive will display " E.F." on Digital Keypad, and the motor will coast. Normal operation can resume after the External Fault is cleared and the AC drive is reset.

**05 External Reset:**

Parameter value 5 programs Multi-Function Input Terminals: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) to be an External Reset.



Note: the External Reset has the same function as the Reset key on the Digital keypad. It will reset the drive after a fault.

**06, 07, 08 Multi-Step Speed Command:**

Parameter values 06, 07,and 08 program any three of the following Multi-Function Input Terminals: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) for Multi-step Speed Command function.



Note: These three inputs select up to seven multi-step speeds defined by Pr.17 to Pr.23 as shown in the following diagram. Pr.78 to Pr.87 can also control output speed by programming the AC drive's internal PLC function.

**09 Jog Operation Control:**

Parameter value 09 programs Multi-Function Input Terminal: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) for Jog control.

9 jog operation command

Mx "Close": Operation available

GND
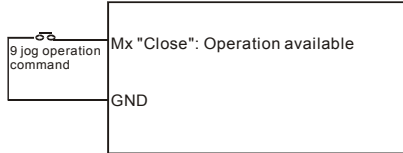
Note: Jog operation programmed by 9 can only be initiated while the motor is stop. (Refer to Pr.15, Pr.16.)

**10 Accel/Decel Speed Inhibit:**

Parameter value 10 programs Multi-Function Input Terminal: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) for Accel/Decel Inhibit. After receiving this command, the AC Drive stops accelerating or decelerating and maintains a constant speed.

Frequency

Master Frequency

Accel inhibit

Decel inhibit

Decel inhibit

Accel inhibit

Actual operation frequency

Time

Mx-GND    ON    ON    ON    ON

Operation command    ON    OFF
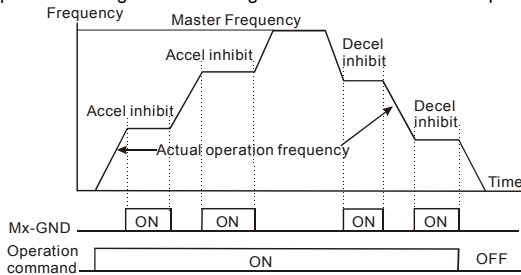
**11 First or Second Accel/Decel Time Selection:**

Parameter value 11 programs a Multi-Function Input Terminal: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) for selecting the First or Second Accel/Decel time. (Refer to Pr.10 to Pr.13.)

Mx set 11

Mx "Close": 2nd Accel/Decel
  "Open": 1st Accel/Decel

GND
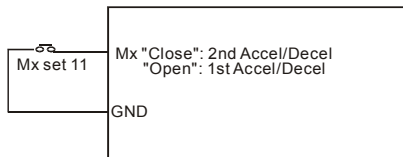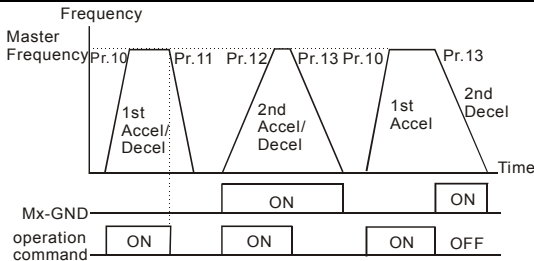
**12, 13 External Base Block:**

Parameter values 12, 13 program Multi-Function Input Terminals: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) for external Base Block control. Value 12 is for normally open (N.O.) input, and value 13 is for a N.C. input.
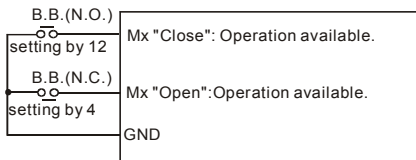


Note: When a Base-Block signal is received, the AC drive will stop all output and the motor will coast. When base block control is deactivated, the AC drive will start its speed search function and synchronize with the motor speed, and then accelerate to the Master Frequency.
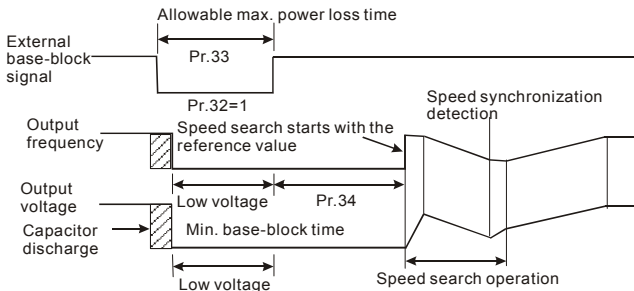
**14, 15 Increase/Decrease Master Frequency:**

Parameter values 14, 15 program the Multi-Function Input Terminals: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) to incrementally increase/ decrease the Master Frequency each time an input is received.

```
        UP
       ─o o─         ┌─────────────────────────────────────┐
setting by 14        │  Mx "Close": Freq. will increase     │
                     │              by one unit.            │
       DOWN          │                                      │
    ●──o o─          │  Mx "Open":Freq. will decrease       │
setting by 15        │              by one unit.            │
                     │  GND                                 │
                     └─────────────────────────────────────┘
```
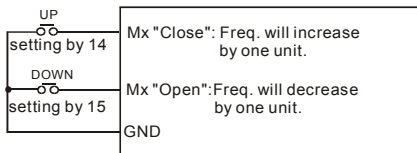
**16, 17 PLC Function Control:**

Parameter value 16 programs Multi-Function Input Terminal: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) to enable the AC drive internal PLC program.    Parameter value 17 programs an input terminal to pause the PLC program.

```
    PLC operation    ┌─────────────────────────────────────┐
       ─o o─         │  Mx "Close": Run PLC.                │
setting by 16        │                                      │
                     │                                      │
    ●──o o─          │  Mx "Open":Pause PLC.                │
setting by 17        │                                      │
                     │  GND                                 │
                     └─────────────────────────────────────┘
```
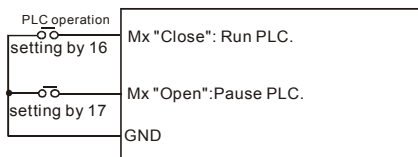
Note: Pr.17 to Pr.23, Pr.78, Pr. 79, Pr.81 to Pr.87 define the PLC program. Another related function is "30 One-Shot PLC Run". It can be set to use a not-latched contact as the run signal.

**18 Counter Trigger:**
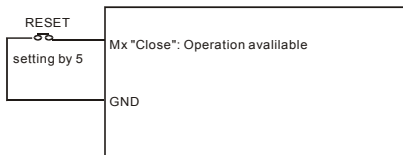
Parameter value 18 programs Multi-Function Input Terminal: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) to increase the AC drive's internal counter. When an input is received, the counter is increased by 1.

```
       Trigger       ┌─────────────────────────────────────┐
    ┌──o o──┐        │  Mx counter value increase by        │
    │               │  1 when closed.                      │
 18 counter          │                                      │
 trigger signal      │                                      │
 input.              │                                      │
                     │  GND                                 │
                     └─────────────────────────────────────┘
```
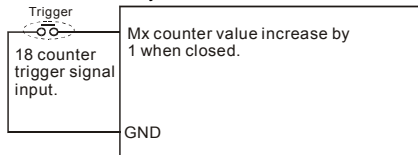
Note: The Counter Trigger input can be connected to an external Pulse Signal Generator when counting a process step or unit of material.   See the diagram below.
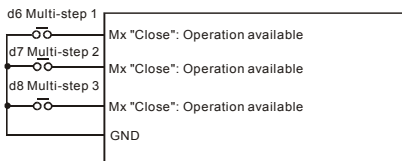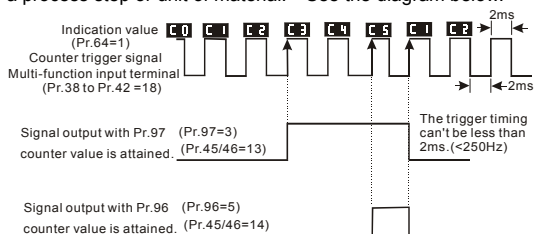


### 19 Counter Reset:

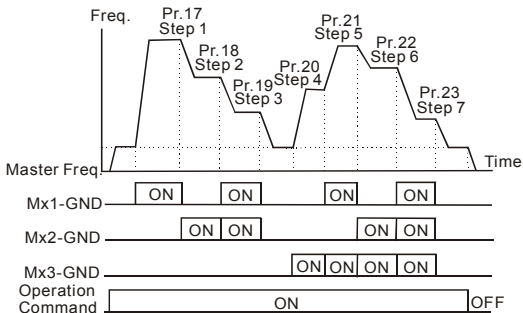Parameter value 19 programs Multi-Function Input Terminal: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) to reset the counter.
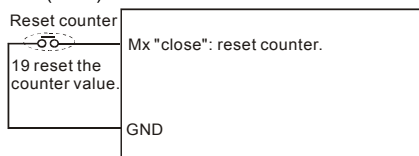


### 20 Parameter Disable:

Enter value (20) to disable any Multi-Function Input Terminal: M1 (Pr.38), M2 (Pr.39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42)

Note: Purpose of this function is to isolate unused Multi-Function Input Terminals. Any unused terminals should be programmed to 20 to insure they have no effect on drive operation.

### 22 Control Source: External Terminal / 23 Control Source: Keypad / 24 Control Source: Communication:

Enter values 22, 23, or 24 to set the control source to be the external terminals, keypad or communication respectively. This setting is used to create functions for manual/auto, and remote/near-end control. When these three functions are used at the same time, the priority is 22-I/O > 23-Keypad > 24-Communication.

**25 Parameter Lock (Write disable, Read is always 0)**

This function will disable the write function and all the content of read are 0. The application is for customer having a key to control the operator to modify parameters or modify the parameter by improper use.

**26 PID Disable (N.O.) / 27 PID Disable (N.C.)**

This function pause the PID control. It is commonly used for manual operation or function testing, and to recover the PID function when the system is normal.

**28 Second Source of Frequency Command**

This function is used with Pr. 142 to select a different frequency source for control.

**29 Forward (contact is open) / Reverse (contact is close)**

This function has top priority to set the direction for running (If "Pr. 24 inhibit REV function" is not set). No mater what the present direction of run is, the contact N.O. is forward and the contact N.C. is reverse, once this function is set.

The requirement for setting direction is Pr. 24 > setting 29 of Pr. 39-Pr. 42 > Pr. 38.

**31 Index Input Signal**

This function is used with parameters 149 to 151. The position where AC drive stops will be regarded as the zero position and it will move to the angle that Pr. 150 sets.

**32 Counter Incremented by Drive Output Frequency**

This function is for counting at the speed of the output frequency.

Note: The settings 00~32 in Pr. 39 to Pr.42 can be used to set multi-function terminals (M2-M5) but the settings cannot be used repeatedly at the same time (besides settings 20).

| **Pr.43** Analog Output Signal | ↗ | Factory Setting: 00 |
|---|---|---|

Settings   00   Analog Frequency Meter (0 to Maximum Output Frequency)

            01   Analog Current Meter (0 to 250% of the rated AC drive current)

            02   Feedback Signal (0 - 100%)

            03   Output Power (0 - 100%)

&#x2610; This parameter selects if the Output Frequency, Current, PID feedback or Output Power will be the output signal on the AFM terminal (0 to 10V).

| **Pr.44** Analog Output Gain | ✔ | Factory Setting: 100 |
|---|---|---|

      Settings   00 to 200%               Unit: 1%

&#x2610; This parameter sets the voltage range of the analog output signal on output terminal AFM.



Analog Frequency Meter                Analog Current Meter
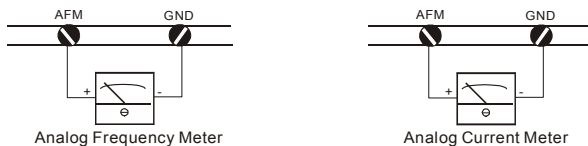
The analog output voltage is directly proportional to the output frequency of the AC drive. A setting of 100% on Pr.44 makes the Maximum Output Frequency (Pr.03) of the AC drive to correspond to the +10VDC analog voltage output. (The actual voltage is about +10VDC, and can be adjusted by Pr.44)

The analog output voltage is also directly proportional to the output current of the AC drive. A setting of 100% on Pr.44 makes the 2.5 times rated current of the AC drive to correspond to the +10 VDC analog voltage output. (The actual voltage is about +10 VDC, and can be adjusted by Pr.44)

Note: Any type of voltmeter can be used. If the meter reads full scale at a voltage less than 10 volts, then Pr.44 should be set by the following formula:

    Pr.44 = ((meter full scale voltage)/10)×100%
  For Example: When using a meter with a full scale of 5 volts, adjust Pr.44 to 50%

| **Pr.45** Multi-function Output Terminal 1 (Photocoupler output) | Factory Setting: 00 |
|---|---|
| **Pr.46** Multi-function Output Terminal 2 (Relay output) | Factory Setting: 07 |

      Settings   00 to 24

**Function Table List:**

| Setting | Functions | Setting | Functions |
|---------|-----------|---------|-----------|
| 00 | AC Drive Operational | 13 | Top Count Value Attained |
| 01 | Maximum Output Frequency Attained | 14 | Preliminary Counter Value Attained |
| 02 | Zero speed | 15 | Warning (PID feedback loss, communication error) |
| 03 | Over-Torque detection | 16 | Below the Desired Frequency |
| 04 | Base-Block (B.B.) Indication | 17 | PID supervision |
| 05 | Low-Voltage Indication | 18 | Over Voltage supervision |
| 06 | AC Drive Operation Mode | 19 | Over Heat supervision |
| 07 | Fault Indication | 20 | Over Current stall supervision |
| 08 | Desired Frequency attained | 21 | Over Voltage stall supervision |
| 09 | PLC Program Running | 22 | Forward command |
| 10 | PLC Program Step Completed | 23 | Reverse command |
| 11 | PLC Program Completed | 24 | Zero Speed (Includes Drive Stop) |
| 12 | PLC Operation Paused | | |

**5**

&#9906; **Function Explanations:**

**00**    **AC Drive operational:** terminal output is activated when there is power output from drive.

**01**    **Maximum Output Frequency Attained:** terminal output is activated when the AC drive attains Maximum Output Frequency.

**02**    **Zero speed:** terminal output is activated when Command Frequency is lower than the Minimum Output Frequency.

**03**    **Over-Torque Detection:** terminal output is activated when over-torque is detected. Parameter Pr.61 determines the Over-Torque detection level.

**04**    **Base-Block (B.B.) Indication:** terminal output is activated when the AC drive output is shut-off by the external Base-Block.

**05**    **Low Voltage Indication:** terminal output is activated when low voltage is detected.

**06**    **AC Drive Operation Mode:** terminal output is activated when the operation of AC Drive is controlled by External Control Terminals.

**07**    **Fault Indication:** terminal output is activated when certain faults occur (oc, ov, oH, oL, oL1, EF, cF3, HPF, ocA, ocd, ocn, GF).

**08**    **Desired Frequency Attained:** terminal output is activated when the desired frequency (Pr.47) is attained.

**09**  **PLC Program Running:** terminal output is activated when the PLC program is running.

**10**  **PLC Program Step Completed:** terminal output is activated for 0.5 sec. when each multi-step speed is attained.

**11**  **PLC Program completed:** terminal output is activated for 0.5 sec. when the PLC program cycle has completed.

**12**  **PLC Program Operation Paused:** terminal output is activated when PLC operation is paused.

**13**  **Top Count Value Attained:** terminal output is activated when counter reaches the Top Count Value. See diagram for Pr.38 to Pr.42=18.

**14**  **Preliminary Count Value Attained:** terminal output is activated when counter reaches the Preliminary Count Value. See diagram for Pr.38 to Pr.42=18.

**15**  **Warning (PID feedback loss, communication error):** the contact will be "close" when PID feedback loss or communication is error.

**16**  **Below the Desired Frequency:** the contact will be "close" when output frequency is less than desired frequency.

**17**  **PID supervision:** the contact will be "close" when PID offset exceeds the setting of P126 and P127.

**18**  **Over voltage supervision:** the contact will be "close" before over voltage. It will be activated at 370Vdc in 230V series and at 740Vdc in 460 series.

**19**  **Over Heat supervision:** the contact will be "close" before 90°C.

**20**  **Over Current stall supervision:** the contact will be "close" before exceeding the setting of P26/P27.

**21**  **Over voltage stall supervision:** the contact will be "close" before exceeding the setting of P25.

**22**  **Forward command:** the contact will be "close" with forward command.

**23**  **Reverse command:** the contact will be "close" with reverse command.

**24**  **Zero Speed (Includes Drive Stop):** the contact will be "close" when the setting frequency is less than min. frequency or drive stop.

Multi-function indication output terminals.

RA  Faults indication.

AC 250V 2A
DC 30V 2A

RB  Power indication.

RC

AC/DC  Power source

BZ

LT

Multi-function PHC output terminals.

MO1

PHC
480VDC 50mA

MCM

Pre-set freq. attained

LT

Plus terminals
Power 48VDC
50mA

Minus terminal
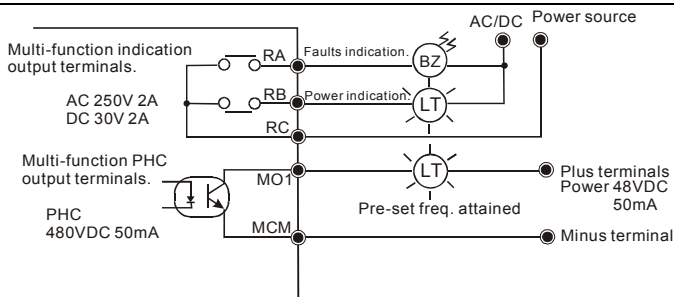
**Multi-function Terminals Wiring Example**

| **Pr.47** | Desired Frequency Attained | ✎ | Factory Setting: 0.00 |
|---|---|---|---|

Settings   0.00 to 400.0 Hz                    Unit: 0.1Hz

📖 This parameter allows monitoring a certain frequency and then activates one of the Multi-function output terminals (Pr.45 or Pr.46 set to 8) when that frequency is achieved.



Freq.

Max. Output
Freq.

Detection range

Detection range +4Hz

+2Hz

Desired Freq.
Pr.47

Detection range -2Hz

Time

Preset Freq.
Attained
Indication
Pr.45 to
Pr.46

OFF

ON

OFF

Desired Freq.
Attained
Indication
Pr.45 & Pr.46

OFF

ON

OFF
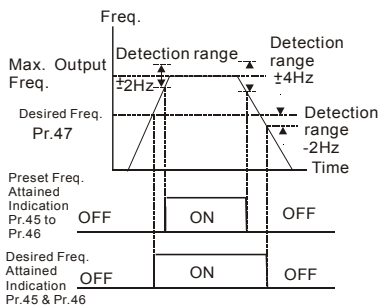
Desired Freq. Attained & Preset Freq. Attained

| **Pr.48** | Adjust Bias of External Input Frequency | ✎ | Factory Setting: 0.00 Hz |
|---|---|---|---|

Settings   0.00 to 200.0%                      Unit: 0.1Hz

📖 This parameter provides a frequency offset when the source of frequency command is the analog input.

| **Pr.49** Potentiometer Bias Polarity | ✎ | Factory Setting: 00 |
|---|---|---|

    Settings    00    Positive Bias

                 01    Negative Bias

&#128366; This parameter sets the potentiometer Bias Frequency to be positive or negative.

| **Pr.50** Potentiometer Frequency Gain | ✎ | Factory Setting: 100.0 |
|---|---|---|

    Settings   0.10 to 200.0%                            Unit: 1%

&#128366; This parameter sets the ratio of analog input vs frequency output.

| **Pr.51** Potentiometer Reverse Motion Enable | Factory Setting: 00 |
|---|---|

    Settings    00    Reverse Motion Disabled in negative bias

                 01    Reverse Motion Enabled in negative bias

&#128366; Pr.48 to Pr.51 are used when the source of frequency command is the analog signal (0 to +10V DC or 4 to 20mA DC). Refer to the following examples.

**Example 1:**

Set Pr.00=1 to command frequency with the potentiometer on keypad or Pr.00=2 (4 to 20mA current signal) potentiometer/current signal of external terminal.
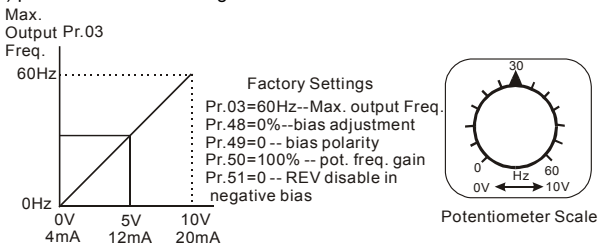


**Example 2:**

A Bias Adjustment (16.7% of 60Hz) determines the Output Frequency to be 10 Hz with the potentiometer set at 0V as shown. Notice that the entire V/F is transposed accordingly. An analog input voltage 0-8.33V (or current 4-13.33mA) would set frequency as 0-60Hz.Once the Maximum Output Frequency is reached any further increase on the potentiometer will not increase output frequency (If you want to use the range of 60Hz, please refer to the example 3).

Max.
Output Freq.  Pr.03

60Hz

Bias Adjustment  10Hz

0Hz  0V      5V      10V
     4mA    12mA    20mA
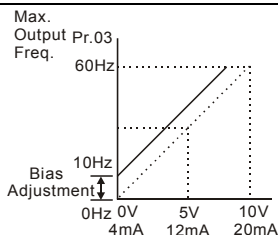
Factory Settings
Pr.03=60Hz--Max. output Freq.
Pr.48=16.7%-- bias adjustment
Pr.49=0 -- bias polarity
Pr.50=100% -- pot. freq. gain
Pr.51=0 -- REV motion disable in negative bias

40

10      60

0V  Hz  10V

It is 60Hz in this range.

Potentiometer Scale
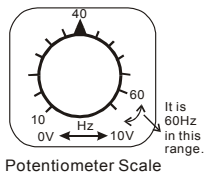
## Example 3:

The whole scale of the potentiometer may be used as desired. In addition to the signals 0 to 10V and 4 to 20mA, other popular voltage signals include 0 to 5V, 20 to 4mA or that under 10V.

Max.
Output Freq.  Pr.03

60Hz

Bias Adjustment  10Hz

-2V  0Hz  0V              10V
XV        4mA             20mA
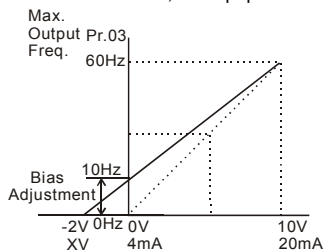
Factory Settings
Pr. 03 = 60Hz--Max. output Freq.
Pr. 48 = 20.0%-- bias adjustment
Pr. 49 = 0-- bias polarity
Pr. 50 = 83.3%-- pot. Freq. gain
Pr. 51 = 0-- REV motion disable in negative bias

Pr. 50 = $\dfrac{10V}{12V}$ X 100% = 83.3%

Negative bias:

$\dfrac{60\text{-}10Hz}{10V} = \dfrac{10\text{-}0Hz}{XV}$

$XV = \dfrac{100}{50} = 2V$

∴Pr.48 = $\dfrac{2}{10}$ X 100%

35

0      60

0V  Hz  10V

Potentiometer Scale
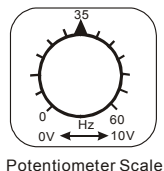
## Example 4:

This example shows how to use Gain to set a potentiometer range of 0 to 5 Volts for 0-60 Hz. As an option, you also could set Pr. 03 =120Hz

Max.
Output Freq.  Pr.03

60Hz

Gain adjustment

30Hz

0Hz  0V          5V
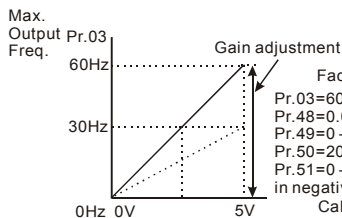
Factory Settings
Pr.03=60Hz--Max. output Freq.
Pr.48=0.0% bias adjustment
Pr.49=0 -- bias polarity
Pr.50=200% -- pot. freq. gain
Pr.51=0 -- REV motion disable in negative bias

Calculation of gain
Pr.50= ( $\dfrac{10V}{5V}$ )X100% = 200%

30

0      60

0V  Hz  5V

Potentiometer Scale

5
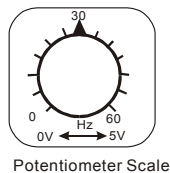
**Example 5:**

In this example, a 6 Hz (10% of 60 Hz) negative bias is used. This setting is used to provide a noise margin (1V in this example) in noisy environments. Note that the top frequency is reduced to 54 Hz.

Max.
Output Freq. Pr.03

60Hz
54Hz

Factory Settings
Pr.03=60Hz--Max. output Freq.
Pr.48=10.0% -- bias adjustment
Pr.49=1 -- bias polarity
Pr.50=100% -- pot. freq. gain
Pr.51=0 -- Rev. motion disable
in negative bias

Negative
bias 6Hz    0Hz
0V  1V      10V

It's 0Hz within this range.

24

Hz   54
0V ← → 10V

Potentiometer Scale
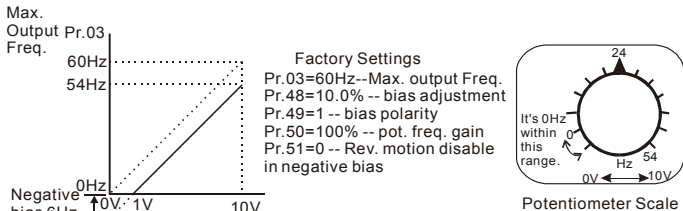
**Example 6:**

This example also uses negative bias and includes a potentiometer frequency gain to allow the AC drive to reach the Maximum Output Frequency.

Max.
Output Freq. Pr.03

60Hz

Bias adjustment
Factory Settings
Pr.03=60Hz--Max. output Freq.
Pr.48=10%--bias adjustment
Pr.49=1 -- bias polarity
Pr.50=111% -- pot. freq. gain
Pr.51=0 -- REV. motion disable
in negative bias
Calculation of gain
Pr.50=($\frac{10V}{9V}$)X100%=111%

Negative    0Hz
bias 6.6Hz  0V  1V      10V

It's 0Hz within this range.

27

Hz   60
0V ← → 10V

Potentiometer Scale
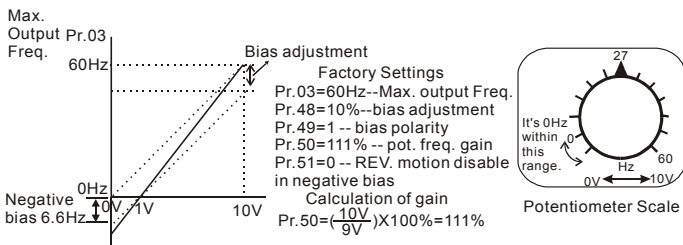
**Example 7:**

In this example, the potentiometer is programmed to run a motor in forward or reverse direction. The motor will idle when the potentiometer is set at the scale mid-point. Please note that this adjustment will disable the external FWD and REV controls.

Pr.03  Max.Output Freq.
60Hz
30Hz   FWD
0V   0Hz
5V   10V
30Hz
REV
60Hz

Factory Settings
Pr.03=60Hz--Max. output Freq.
Pr.48=50%--bias adjustment
Pr.49=1 -- bias polarity
Pr.50=200% -- pot. freq. gain
Pr.51=1 -- REV motion disable
in negative bias

0
REV.      FWD.

60   Hz   60
0V ← → 10V

Potentiometer Scale
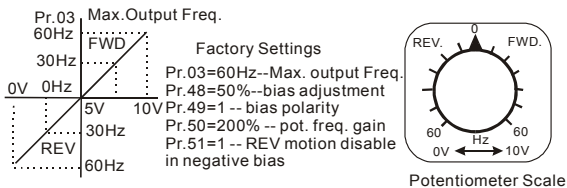
**Example 8:**

This example shows how to set up the "anti-slope", which is an inversely proportional variation of frequency to the input analog signal, required for some applications in process control.   A sensor will generate a large signal (such as 20mA or 10V) and the AC Drive will slow or stop.



Factory Settings
Pr.03=60Hz--Max. output Freq.
Pr.48=100%--bias adjustment
Pr.49=1 -- bias polarity
Pr.50=100% -- pot. freq. gain
Pr.51=1 -- REV. motion enable in negative bias

Potentiometer Scale
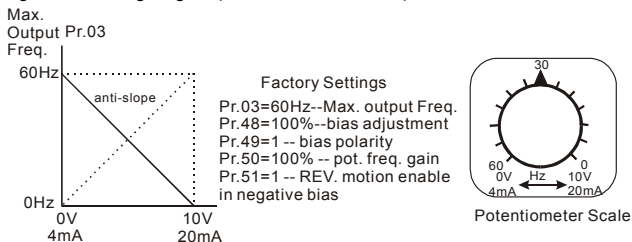
| **Pr.52** Motor Rated Current | ✐ | Factory Setting: FLA |
|---|---|---|

Settings   30.0% FLA to 120.0% FLA          Unit: 0.1A

&#9633; Factory setting is the AC drive rated current. When setting this parameter, just input the motor rated current value without any calculation.

&#9633; Use the following criteria to determine the setting of this parameter: no-load current < rated current of motor < rated current of AC drive. You can use this parameter to limit the output current to the motor as to prevent overheat.

| **Pr.53** Motor No-Load Current | ✐ | Factory Setting: 0.4*FLA |
|---|---|---|

Settings   00%FLA to 99%FLA          Unit: 0.1A

&#9633; The rated current of the AC drive means 100%. Setting of this parameter affects the slip compensation. The setting value must be smaller than the motor rated current setting in Pr.52. (this parameter displays the value of actual current.)

| **Pr.54** Torque Compensation | ✐ | Factory Setting: 00 |
|---|---|---|

Settings  00 to 10

&#9633; This parameter forces the AC drive to increase its voltage output during start-up in order to obtain a higher initial starting torque.

| **Pr.55** Slip Compensation | ✐ | Factory Setting: 0.00 |
|---|---|---|

Settings  0.00 to 10.00

  This parameter can be used to compensate motor slip. Although no linear, it typically adds 6 Hz for a setting of 10 if Pr.03=60 Hz. When the output current of the AC drive is greater than the motor no-load current (Pr.53), the AC drive will adjust its output frequency according to this parameter.

**Pr.56** Reserved

**Pr.57** Rated Current Display of the AC motor drive     Factory Setting: ##.#

  Settings  Read Only

  Pr.57 displays the rated current of the AC motor drive. By reading this parameter the user can check if the AC motor drive is correct. See Pr.80 for details.

**Pr.58** Electronic Thermal Overload Relay Selection    Factory Setting: 02

  Settings   00   Standard Motor (self cool motor)

      01   Inverter Motor (auxiliary cool fan on motor)

      02   Inactive

  This function is used to limit the output power of the AC drive when powering a "self-cooled motor" at low speed.

**Pr.59** Electronic Thermal Motor Overload     Factory Setting: 60

  Settings   30 to 300sec       Unit: 1 second

  The parameter determines the time required to activate the $I^2t$ electronic thermal motor overload protection. The graph below shows $I^2t$ curves at 150% output power for 1 minute.

Operation time(min)

60Hz or more
50Hz
10Hz
5Hz

Load factor (%)

0  20  40  60  80  100 120 140 160 180 200
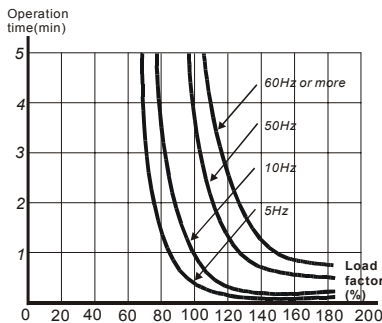
| **Pr.60** Over-Torque Detection Mode | Factory Setting: 00 |
|---|---|

Settings 00 Over-Torque detection disabled.

01 Enabled during constant speed operation until the allowable time for detection (Pr.62) elapses.

02 Enabled during constant speed operation and halted after detection.

03 Enabled during acceleration until the allowable time for detection (Pr.62) elapses.

04 Enabled during acceleration and halted after detection.

| **Pr.61** Over-Torque Detection Level | Factory Setting: 150 |
|---|---|

Settings 30 to 200% Unit: 1%

📖 A setting of 100% is proportional to the Rated Output Current of the drive.

📖 This parameter sets the Over-Torque Detection level in 1% increments. (The AC drive rated current is equal to 100%.)

| **Pr.62** Over-Torque Detection Time | Factory Setting: 0.1sec |
|---|---|

Settings 0.0 to 10.0sec Unit: 0.1 sec

📖 This is the duration for over-torque detection. When the output current is larger than the over-torque detection level (Pr.61), an over-torque condition exists and the detection time (Pr.62) is timed-out. Any of the multi-function output terminals set to indicate over-torque, will then close. (Please refer to Pr. 45 and Pr.46)

| **Pr.63** Loss of ACI (4-20mA) | Factory Setting: 00 |
|---|---|

Settings 00 Decelerate to 0 Hz

01 Stop immediately and display "EF"

02 Continue operation by last frequency command

| **Pr.64** User Defined Function for Display | Factory Setting: 06 |
|---|---|

Settings 00 Displays AC drive output frequency (Hz)

01 Display User-defined output Frequency (H*Pr.65)

02 Output Voltage (E)

03 DC Bus Voltage (u)

| 04 | PV (i) |
| 05 | Displays the value of the internal counter (c) |
| 06 | Displays the setting Frequency (F) |
| 07 | Displays the parameter setting (P) |
| 08 | Reserved |
| 09 | Output Current (A) |
| 10 | Display program operation (0. xxx), Fwd, or Rev |

  The parameter can be set to display the user-defined value. (where v = H x  **Pr.65** )

| **Pr.65** Coefficient K | ✗ | Factory Setting: 1.00 |
|---|---|---|

  Settings   0.01 to 160.0        Unit: 0.01

  The coefficient K determines the multiplying factor for the user-defined unit.

  The display value is calculated as follows:

  Display value = output frequency x K

  The display window is only capable of showing four digits, yet you could use Pr.65 to create larger numbers.   The display windows uses decimal points to signify numbers up to three digits as illustrated in next page:

| Display | Number Represented |
|---|---|
| 9999 | The absence of a decimal point indicates a four-digit integer. |
| 999.9 | A signal decimal point between the middle and the right-most numbers is a true decimal point. For example, the number 123.4 would be displayed as "123.4". |
| 9999. | A single decimal point after the right-most number is not a true decimal point; instead it indicates that a zero follows the right-most number.   For example, the number 12340 would be displayed as "1234." |
| 999.9. | Two decimal points (one between the middle and the right-most numbers, and one after the right-most number) are not true decimal points; instead they indicate that two zeros follow the right-most number.   For example, the number 345600 would be displayed as "345.6.". |

| **Pr.66** Communication Frequency | Factory Setting: 0.00 |
|---|---|

  Settings   0.00 to 400.0 Hz        Unit: 0.1 Hz

&#x2751; This parameter defines the Master Frequency when the AC drive is controlled by the communication interface.

| **Pr.67** Skip Frequency 1 | Factory Setting: 0.00 |
|---|---|
| **Pr.68** Skip Frequency 2 | Factory Setting: 0.00 |
| **Pr.69** Skip Frequency 3 | Factory Setting: 0.00 |
| Settings    0.00 to 400.0 Hz | Unit: 0.1 Hz |

&#x2751; These three parameters determine the three Skip Frequencies that in conjunction with Pr.70, Skip Frequency Band, will cause the AC drive to skip operating in each frequency band.   Note: Pr.67 > Pr.68 > Pr.69.

| **Pr.70** Skip Frequency Band | Factory Setting: 0.00 |
|---|---|
| Settings    0.00 to 20.00 Hz | Unit: 0.1 Hz |

**5**

&#x2751; This parameter determines the frequency band for a given Skip Frequency. Half of the Skip Frequency Band is above the Skip Frequency and the other half is below. Programming this parameter to 0.1 disables all skip frequencies.

output
freq.

Pr.67

Pr.68                    Adjustable
                         range

Pr.69

0
                    Speed command
                    freqency

Decelerating
skip freq.                  Pr.70
set point                   Freq. to
                            be jumped
           Accelerating
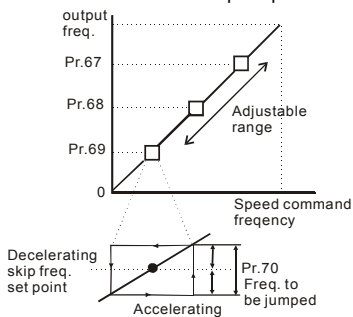
**Pr.71** PWM Carrier Frequency

| Settings | 230V series    01 to 15 (1KHz to 15KHz) | Factory Setting: 15 |
|---|---|---|
| | 460V series | B550-4010 is 10 |

Note: 1-9kHz in sensorless vector control mode

📖 The parameter defines the carrier frequency of the PWM (Pulse-Width Modulated) output.

| Carrier Frequency | Acoustic Noise | Electromagnetic Noise, Leakage Current | Heat Dissipation |
|---|---|---|---|
| 1KHz ↕ 15KHz | Significant ↕ Minimal | Minimal ↕ Significant | Minimal ↕ Significant |

📖 From the above table, we see that the carrier frequency of PWM output has a significant influence on the electromagnetic noise, heat dissipation of the AC drive, and the acoustic noise to the motor.

| **Pr.72** Auto Restart Attempts After Fault | Factory Setting: 00 |
|---|---|

Settings        00 to 10

📖 When this parameter is enabled (set different to zero), the AC Drive will restart/reset automatically up to 10 times after the occurrence of certain type of faults (over-current OC, over-voltage OV). If enabled, the AC drive will restart on "speed search", which begins at Master Frequency. Setting this parameter to 0 will disable this operation. To set the fault recovery time after a fault, please see base-block time for speed search (Pr.34).

| **Pr.73** Present Fault Record | Factory Setting: 00 |
|---|---|
| **Pr.74** Second Most Recent Fault Record | Factory Setting: 00 |
| **Pr.75** Third Most Recent Fault Record | Factory Setting: 00 |

Settings        00     (no fault occurred )

01     Over-current (oc)

02     Over-voltage (ov)

03     Overheat (oH)

04     Overload (oL)

05     Overload 1 (oL1)

06     External Fault (EF)

07     CPU failure 1 (CF1)

08     CPU failure 3 (CF3)

09     Hardware Protection Failure (HPF)

| 10 | Over-current during acceleration (OCA) |
| 11 | Over-current during deceleration (OCd) |
| 12 | Over-current during steady state operation (OCn) |
| 13 | Ground fault or fuse failure (GFF) |
| 14 | Low voltage (not record) |
| 15 | 3 Phase Input Power Loss |
| 16 | CPU Failure (CF2) |
| 17 | External Base-Block (bb) |
| 18 | Overload 2 (oL2) |
| 19 | Auto Adjustable accel/decel failure (cFA) |
| 20 | Software protection code (codE) |

**5**

**Pr.76** Parameter Lock and Configuration                              Factory Setting: 00

Settings   00   All parameters can be set/read

01   All parameters are read-only

02-08   Reserved

09   Resets all parameters to 50Hz factory defaults

10   Resets all parameters to 60Hz factory defaults

📖   This parameter allows the user to reset the drive to factory settings.

**Pr.77** Time for Auto Reset the Restart Times after Fault              Factory Setting: 60.0

Settings   0.1 to 6000.0 sec                              Unit: 0.1 second

📖   If there is no fault in the period of this setting, it will reset the rest restart times that used after fault to the setting of restart times.

**Pr.78** PLC Operation Mode                                          Factory Setting: 00

Settings   00   Disable PLC operation

01   Execute one program cycle

02   Continuously execute program cycles

03   Execute one program cycle step by step (separated by "STOP")

| 04 | Continuously execute program cycles step by step (separated by "STOP") |

📖 This M drive can be programmed to execute a sequence of operations named "PLC mode". The PLC program can be used in lieu of any external controls, relays or switches. The AC drive will change speeds and directions according to the user's desired programming. This parameter selects the PLC operation mode for the drive. Please review the following examples:

**Example 1 (Pr.78 =01):** Execute one cycle of the PLC program. Its relative parameter settings are:

**1  Pr.17 to Pr.23:** 1st to 7th step speed (sets the frequency for each step speed)

**2  Pr.38 to Pr.42:** Multi-Function Input Terminals (program one multi-function terminal for PLC auto-operation (16)).

**3  Pr.45 to Pr.46:** Multi-Function Output Terminals : program a Multi-Function Output Terminal for PLC operation indication (09), one cycle in PLC auto mode (10) or PLC operation fulfillment attainment (11).

**4  Pr.78:** PLC mode.

**5  Pr.79:** Direction of operation for Master Frequency and 1st to 7th step speeds.

**6  Pr.81 to Pr.87:** operation time setting of Master Frequency and 1st to 7th step speeds.

**Example 1 (Pr.78 = 01) Execute one cycle through the PLC program:**
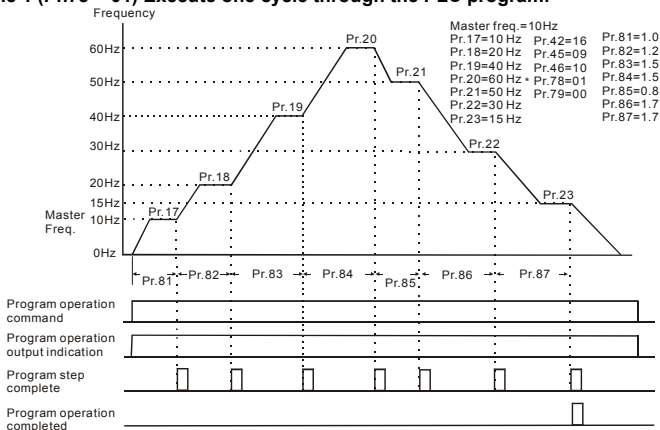
Note: The above diagram shows one complete PLC cycle.   To restart the cycle, turn the PLC
Program input off and then back on.

**Example 2 (Pr.78 = 02) Continuously executes program cycles:**

The diagram below shows the PLC program stepping through each speed and then
automatically starting again.   To stop the PLC program, either pause or stop the program.
(Refer to Pr.38 to Pr.42 value 17 and 18)
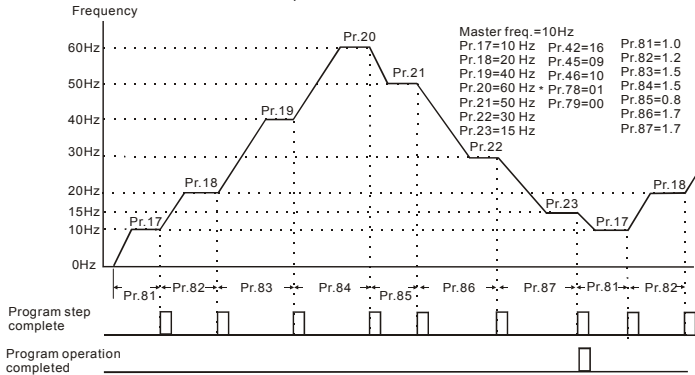


**Example 3 (Pr.78 = 03) Execute one cycle step by step:**

This example shows how the PLC function can perform one cycle at a time, within a complete
cycle. Each step will use the accel/decel times in Pr.10 to Pr.13. It should be noted that the
time interval for each step may be shorter than expected due to the time required for
acceleration and deceleration.
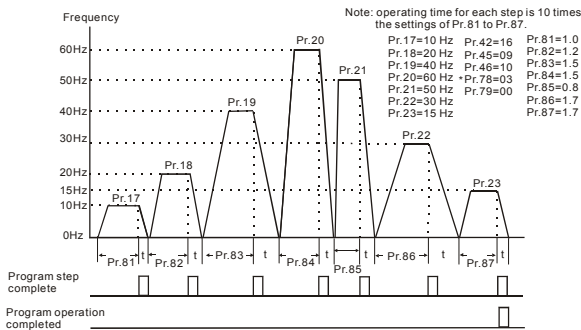
**Example 4 (Pr.78 = 04) Continuously executes program cycles step by step:**

In this explanation, the PLC program runs continuously step by step.   Also shown are examples of steps in the reserve direction.
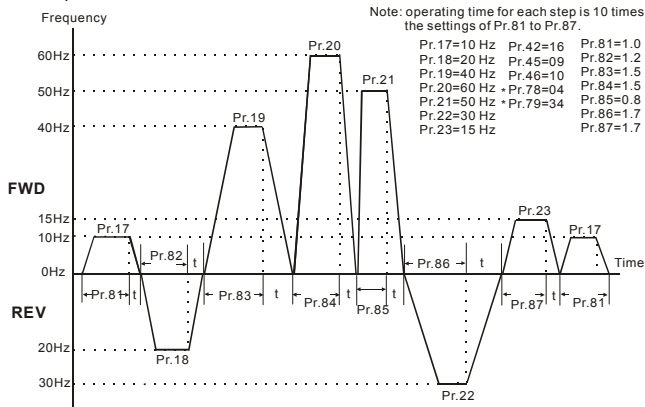


**Example 5 (Pr.78 = 01) Execute one cycle through the PLC program:**

In this example, the PLC program runs continuously.   It should be noted that the time interval for each step may be shorter than expected due to the time required for acceleration and deceleration.
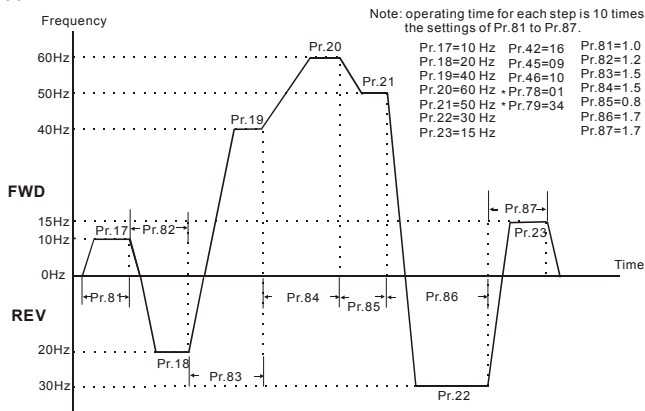
**Application Note:**

PLC program execution will be interrupted when values for JOG parameters 15 and 16 are changed.

---

**Pr.79** PLC Forward/Reverse Motion                                    Factory Setting: 00

Settings   00 to 127

📖 This parameter determines the direction of motion for the multi-speed Pr.17 to Pr.23 and Master Frequency. The original direction of Master Frequency will become invalid.

Note: A 7-bit binary number is used to program the forward/reverse motion for each of the 8 speed steps (including Master Frequency). The binary notation for the 7-bit number must be translated into decimal notation and then entered in Pr.79.

```
Weights   2⁶ 2⁵ 2⁴ 2³ 2² 2¹ 2⁰     0=Forward
Bit       | 7 | 6 | 5 | 4 | 3 | 2 | 1 |   1=Reverse
                                  └─── Direction of 1st speed for Pr.17
                              └─────── Direction of 2nd speed for Pr.18
                          └─────────── Direction of 3rd speed for Pr.19
                      └─────────────── Direction of 4th speed for Pr.20
                  └─────────────────── Direction of 5th speed for Pr.21
              └─────────────────────── Direction of 6th speed for Pr.22
          └─────────────────────────── Direction of 7th speed for Pr.23
```

Example:

```
Weights   2⁶ 2⁵ 2⁴ 2³ 2² 2¹ 2⁰     0=Forward
Bit       | 7 | 6 | 5 | 4 | 3 | 2 | 1 |   1=Reverse
Direction | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
                                  └─── Forward motion of Pr.17 multi-speed1
                              └─────── Reverse motion of Pr.18 multi-speed2
                          └─────────── Forward motion of Pr.19 multi-speed3
                      └─────────────── Forward motion of Pr.20 multi-speed4
                  └─────────────────── Forward motion of Pr.21 multi-speed5
              └─────────────────────── Reverse motion of Pr.22 multi-speed6
          └─────────────────────────── Forward motion of Pr.23 multi-speed7
```

The setting value=bit7 x $2^6$+bit6 x $2^5$+bit5 x $2^4$+bit4 x $2^3$+bit3 x $2^2$+bit2 x $2^1$+bit1 x $2^0$

= 0 x $2^6$+1 x $2^5$+0 x $2^4$+0 x $2^3$+0 x $2^2$+1 x $2^1$+0 x $2^0$

= 0+32+0+0+0+2+0+0

= 34

---

**Pr.80** Identity Code of the AC Motor Drive                          Factory Setting: ##

Settings   Read Only

📖 This parameter displays the identity code of the AC motor drive. The capacity, rated current, rated voltage and the max. carrier frequency relate to the identity code. Users can use the following table to check how the rated current, rated voltage and max. carrier frequency of the AC motor drive correspond to the identity code.

| | 115V series | | | 230V series | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| kW | 0.2 | 0.4 | 0.75 | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 |
| HP | 0.25 | 0.5 | 1.0 | 0.5 | 1 | 2 | 3 | 5 | 7.5 |
| Model Number (Pr.80) | 20 | 22 | 24 | 00 | 02 | 04 | 06 | 08 | 10 |
| Rated Output Current (A) | 1.6 | 2.5 | 4.2 | 2.5 | 5.0 | 7.0 | 10 | 17 | 25 |
| Max. Carrier Frequency (kHz) | 15kHz | | | | | | | | |

| | 460V series | | | | | | 575V series | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| kW | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 |
| HP | 1 | 2 | 3 | 5 | 7.5 | 10 | 1 | 2 | 3 | 5 | 7.5 | 10 |
| Model Number (Pr.80) | 03 | 05 | 07 | 09 | 11 | 13 | 50 | 51 | 52 | 53 | 54 | 55 |
| Rated Output Current (A) | 3.0 | 4.0 | 5.0 | 8.2 | 13 | 18 | 1.7 | 3.0 | 4.2 | 6.6 | 9.9 | 12.2 |
| Max. Carrier Frequency (kHz) | 15kHz | | | | | | 10kHz | | | | | |

| | | |
|---|---|---|
| **Pr.81** | Time Duration of 1st Step Speed (correspond to Pr.17) | Factory Setting: 00 |
| **Pr.82** | Time Duration of 2nd Step Speed (correspond to Pr.18) | Factory Setting: 00 |
| **Pr.83** | Time Duration of 3rd Step Speed (correspond to Pr.19) | Factory Setting: 00 |
| **Pr.84** | Time Duration of 4th Step Speed (correspond to Pr.20) | Factory Setting: 00 |
| **Pr.85** | Time Duration of 5th Step Speed (correspond to Pr.21) | Factory Setting: 00 |
| **Pr.86** | Time Duration of 6th Step Speed (correspond to Pr.22) | Factory Setting: 00 |
| **Pr.87** | Time Duration of 7th Step Speed (correspond to Pr.23) | Factory Setting: 00 |

Settings   00 to 9999 second                    Unit: 1 sec

&#x1F4D6; Pr.81 to Pr.87 input the duration of each Multi-step speed operation defined by Pr.17 to Pr.23.

Note: If any duration is set to "0" (sec), the corresponding step operation will be skipped.   This is commonly used to reduce the number of program steps.

| | | |
|---|---|---|
| **Pr.88** | Communication Address | Factory Setting: 01 |

Settings   01 to 254

&#x1F4D6; This parameter sets the Ac drive address identification when using the RS-485 serial port for communication.

| **Pr.89** | Transmission Speed (Baud rate) | | Factory Setting: 01 |
|---|---|---|---|

Settings    00    4800 bps

            01    9600 bps

            02    19200 bps

            03    38400 bps

📖 This parameter sets the transmission speed for communication on the RS-485 serial port

| **Pr.90** | Transmission Fault Treatment | | Factory Setting: 03 |
|---|---|---|---|

Settings    00    Warn and Continue Operating

            01    Warn and RAMP to Stop

            02    Warn and COAST to Stop

            03    Keep Operation without Warning

| **Pr.91** | Time Out Detection | Factory Setting: 0.0 |
|---|---|---|

Settings    0.1 to 120.0 sec

           0.0 disable

📖 This parameter is used for ASCII mode. When the over-time detection is enabled, the separation between characters cannot exceed 500 ms.

| **Pr.92** | Communication Protocol | | Factory Setting: 00 |
|---|---|---|---|

Settings    00    Modbus ASCII mode, <7,N,2>

            01    Modbus ASCII mode, <7,E,1>

            02    Modbus ASCII mode, <7,O,1>

            03    Modbus RTU mode, <8,N,2>

            04    Modbus RTU mode, <8,E,1>

            05    Modbus RTU mode, <8,O,1>

📖 **1. Computer Control**

★ Each drive has a built-in RS-485 serial interface, marked (RJ-11 Jack) on the control terminal block, whose pins are defined as shown:

1: +15V
2: GND
3: SG-
4: SG+
5: NC
6 ← 1    6: for communication
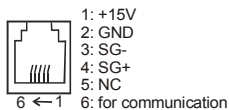
★ Either ASCII or RTU Modbus protocols are used for communication.   Users can select the desired mode along through parameters Pr.92 and Pr.113.

★ Each B550 AC drive has a pre-assigned communication address specified by Pr.88. The master controller communicates with each AC drive according to its particular address.

★ Code Meaning:

ASCII mode:

Each 8-bit data is the combination of two ASCII characters. For example, a 1-byte data: 64 Hex, shown as '64' in ASCII, consists of '6' (36Hex) and '4' (34Hex).

| Character | '0' | '1' | '2' | '3' | '4' | '5' | '6' | '7' |
|---|---|---|---|---|---|---|---|---|
| ASCII code | 30H | 31H | 32H | 33H | 34H | 35H | 36H | 37H |

| Character | '8' | '9' | 'A' | 'B' | 'C' | 'D' | 'E' | 'F' |
|---|---|---|---|---|---|---|---|---|
| ASCII code | 38H | 39H | 41H | 42H | 43H | 44H | 45H | 46H |

RTU mode:

Each 8-bit data is the combination of two 4-bit hexadecimal characters. For example, 64 Hex.

📖 **2. Data Format**

    2.1  10-bit character frame (For 7-bit character):
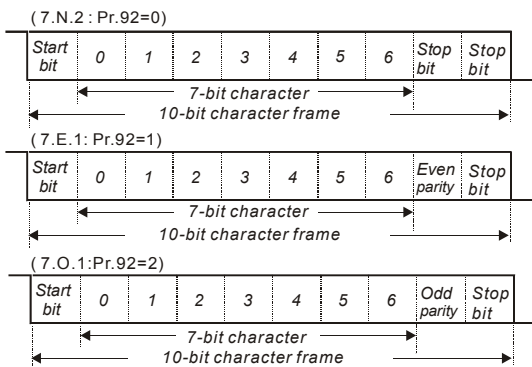
2.2  11-bit character frame (For 8-bit character):

( 8.N.2:Pr.92=3)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Stop bit | Stop bit |
|---|---|---|---|---|---|---|---|---|---|---|

← 8-data bits →
← 11-bits character frame →

( 8.E.1:Pr.92=4)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Even parity | Stop bit |
|---|---|---|---|---|---|---|---|---|---|---|

← 8-data bits →
← 11-bits character frame →

( 8.O.1:Pr.92=5)

| Start bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Odd parity | Stop bit |
|---|---|---|---|---|---|---|---|---|---|---|

← 8-data bits →
← 11-bits character frame →
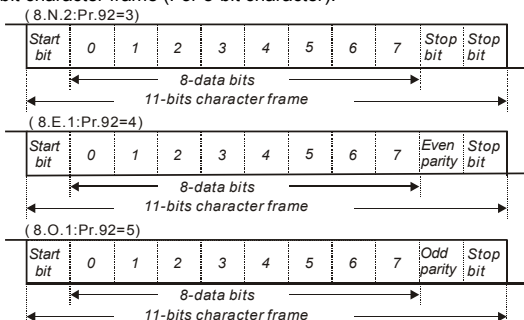
**3. Communication Protocol**

3.1  Communication Data Frame:

| STX | ADR1 | ADR0 | CMD1 | CMD0 | 0 | 1 | ...... | N-1 | N | ETX | CHK1 | CHK0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02H | Address | | CMD | | Data characters | | | | | 03H | Check Sum | |

3.2  **ASCII mode:**

| STX | Start character: (3AH) |
|---|---|
| ADR 1 | Communication address: 8-bit address consists of 2 ASCII codes |
| ADR 0 | |
| CMD 1 | |
| CMD 0 | |
| DATA (n-1) | Contents of data: n x 8-bit data consist of 2n ASCII codes. n≦25 maximum of 50 ASCII codes |
| ...... | |
| DATA 0 | |
| LRC CHK 1 | LRC check sum: 8-bit check sum consists of 2 ASCII codes |
| LRC CHK 0 | |
| END 1 | END characters: END 1 = CR (0DH), END 0 = LF (0AH) |
| END 0 | |

**RTU mode:**

| START | A silent interval of more than 10 ms |
|---|---|
| ADR | Communication address: 8-bit address |
| CMD | Command code: 8-bit command |
| DATA (n-1) | Contents of data: n×8-bit data, n<=25 |
| ....... | |
| DATA 0 | |
| CRC CHK Low | CRC check sum: 16-bit check sum consists of 2 8-bit characters |
| CRC CHK High | |
| END | A silent interval of more than 10 ms |

5

3.3   ADR (Communication Address)

Valid communication addresses are in the range of 0 to 254. An address equals to 0 means a broadcast to all AC drives (AMD) in the network.   In this case, the AMD will not reply to the master device.

For example, communication to AMD with address 16 decimal:

ASCII mode: (ADR 1, ADR 0)='1','0'   => '1'=31H, '0'=30H

RTU mode: (ADR)=10H

3.4   Function (Function code) and DATA (data characters)

The format of data characters depends on the function code. The available function codes are described as follows:

03H: read data from register

06H: write single data to register

10H: write multiple data to registers

Command code: 03H, read N words. The maximum value of N is 12. For example, reading continuous 2 words from starting address 2102H of AMD with address 01H.

**ASCII mode:**

Command message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '3' |
| Starting data address | '2' |
| | '1' |
| | '0' |
| | '2' |
| Number of data (count by word) | '0' |
| | '0' |
| | '0' |
| | '2' |
| LRC CHK 1 | 'D' |
| LRC CHK 0 | '7' |
| END 1 | CR |
| END 0 | LF |

Response message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '3' |
| Number of data (count by byte) | '0' |
| | '4' |
| Content of starting data address 2102H | '1' |
| | '7' |
| | '7' |
| | '0' |
| Content of data address 2103H | '0' |
| | '0' |
| | '0' |
| | '0' |
| LRC CHK 1 | '7' |
| LRC CHK 0 | '1' |
| END 1 | CR |
| END 0 | LF |

**RTU mode:**

Command message:

| ADR | 01H |
|---|---|
| CMD | 03H |
| Starting data address | 21H |
| | 02H |
| Number of data (count by word) | 00H |
| | 02H |
| CRC CHK Low | 6FH |
| CRC CHK High | F7H |

Response message:

| ADR | 01H |
|---|---|
| CMD | 03H |
| Number of data (count by byte) | 04H |
| Content of data address 2102H | 17H |
| | 70H |
| Content of data address 2103H | 00H |
| | 00H |
| CRC CHK Low | FEH |
| CRC CHK High | 5CH |

Command code: 06H, write 1 word

For example, writing 6000(1770H) to address 0100H of AMD with address 01H.

**ASCII mode:**

Command message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '6' |
| | '0' |
| Data address | '1' |
| | '0' |
| | '0' |
| Data content | '1' |
| | '7' |
| | '7' |
| | '0' |
| LRC CHK 1 | '7' |
| LRC CHK 0 | '1' |
| END 1 | CR |
| END 0 | LF |

Response message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '6' |
| | '0' |
| Data address | '1' |
| | '0' |
| | '0' |
| | '1' |
| Data content | '7' |
| | '7' |
| | '0' |
| LRC CHK 1 | '7' |
| LRC CHK 0 | '1' |
| END 1 | CR |
| END 0 | LF |

**RTU mode:**

Command message:

| ADR | 01H |
|---|---|
| CMD | 06H |
| Data address | 01H |
| | 00H |
| Data content | 17H |
| | 70H |
| CRC CHK Low | 86H |
| CRC CHK High | 22H |

Response message:

| ADR | 01H |
|---|---|
| CMD | 06H |
| Data address | 01H |
| | 00H |
| Data content | 17H |
| | 70H |
| CRC CHK Low | 86H |
| CRC CHK High | 22H |

Command code: 10H, write multiple data to registers

For example, set the multi-step speed,

Pr.17=50.00 (1388H), Pr.18=40.00 (0FA0H). AC drive address is 01H.

**ASCII Mode:**

Command message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '1' |
| CMD 0 | '0' |
| Starting data address | '0' |
| | '0' |
| | '1' |
| | '1' |
| Number of data (count by word) | '0' |
| | '0' |
| | '0' |
| | '2' |
| Number of data （count by byte） | '0' |
| | '4' |
| The first data content | '1' |
| | '3' |
| | '8' |
| | '8' |
| The second data content | '0' |
| | 'F' |
| | 'A' |
| | '0' |
| LRC Check | '8' |
| | 'E' |
| END | CR |
| | LF |

Response message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '1' |
| CMD 0 | '0' |
| Starting data address | '0' |
| | '0' |
| | '1' |
| | '1' |
| Number of data (count by word) | '0' |
| | '0' |
| | '0' |
| | '2' |
| LRC Check | 'D' |
| | 'C' |
| END | CR |
| | LF |

**RTU Mode:**

Command message:

| ADR | 01H |
|---|---|
| CMD | 10H |
| Starting data address | 00H |
| | 11H |
| Number of data (count by word) | 00H |
| | 02H |
| Number of data (count by byte) | 04H |
| The first data content | 13H |
| | 88H |
| The second data content | 0FH |
| | A0H |

Response message:

| ADR | 01H |
|---|---|
| CMD | 10H |
| Starting data address | 00H |
| | 11H |
| Number of data (count by word) | 00H |
| | 02H |
| CRC Check Low | 11H |
| CRC Check High | CDH |

| CRC Check Low | B2H |
|---|---|
| CRC Check High | 49H |

### 3.5   CHK (check sum)

**ASCII mode:**

LRC (Longitudinal Redundancy Check) is calculated by summing up, module 256, the values of the bytes from ADR1 to last data character then calculating the hexadecimal representation of the 2's-complement negation of the sum.

For example, reading 1 word from address 0401H of the AC drive with address 01H

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '3' |
| Starting data address | '0' |
| | '4' |
| | '0' |
| | '1' |
| Number of data | '0' |
| | '0' |
| | '0' |
| | '1' |
| LRC CHK 1 | 'F' |
| LRC CHK 0 | '6' |
| END 1 | CR |
| END 0 | LF |

01H+03H+04H+01H+00H+01H=0AH, the 2's-complement negation of 0AH is **F6**H.

**RTU mode:**

| ADR | 01H |
|---|---|
| CMD | 03H |
| Starting address | 21H |
| | 02H |
| Number of data (count by word) | 00H |
| | 02H |
| CRC CHK Low | 6FH |
| CRC CHK High | F7H |

CRC (Cyclical Redundancy Check) is calculated by the following steps:

Step 1:   Load a 16-bit register (called CRC register) with FFFFH.

Step 2:   Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3:   Shift the CRC register one bit to the right with MSB zero filling. Extract and examine the LSB.

Step 4:   If the LSB of CRC register is 0, repeat step 3, else Exclusive or the CRC register with the polynomial value A001H.

Step 5: Repeat step 3 and 4 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

Step 6: Repeat steps 2 to 5 for the next 8-bit byte of the command message.

Continue doing this until all bytes have been processed. The final contents of the CRC register is the CRC value. **When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte will be transmitted first.**

The following is an example of CRC generation using C language. The function takes two arguments:

Unsigned char* data ← a pointer to the message buffer
Unsigned char length ← the quantity of bytes in the message buffer

```
The function returns the CRC value as a type of unsigned integer.
    Unsigned int crc_chk(unsigned char* data, unsigned char length){
        int j;
        unsigned int reg_crc=0xFFFF;
        while(length--){
          reg_crc ^= *data++;
          for(j=0;j<8;j++){
            if(reg_crc & 0x01){   /* LSB(b0)=1 */
              reg_crc=(reg_crc>>1) ^ 0xA001;
            }else{
              reg_crc=reg_crc >>1;
            }
          }
        }
      return reg_crc;
    }
```

3.6 Address list:

The contents of available addresses are shown as below:

| Content | Address | Functions |
|---|---|---|
| AC drive Parameters | 00nnH | 00 means parameter group, nn means parameter number, for example, the address of Pr.100 is 0064H. Referencing to chapter 5 for the function of each parameter. When reading parameter by command code 03H, only one parameter can be read at one time. |

| Content | Address | Functions | | |
|---|---|---|---|---|
| Command Read/Write | 2000H | Bit 0-1 | 00: No function<br>01: Stop<br>10: Run<br>11: Jog + Run | |
| | | Bit 2-3 | Reserved | |
| | | Bit 4-5 | 00: No function<br>01: FWD<br>10: REV<br>11: Change direction | |
| | | Bit 6-15 | Reserved | |
| | 2001H | Freq. command | | |
| | 2002H | Bit 0 | 1: EF (external fault) on | |
| | | Bit 1 | 1: Reset | |
| | | Bit 2-15 | Reserved | |
| Status monitor Read only | 2100H | Error code:<br>00: No errors occurred<br>01: Over-current (oc)<br>03: Overheat (oH)<br>04: Drive overload (oL)<br>05: Motor overload1 (oL1)<br>06: External fault (EF)<br>07: CPU failure (cF1)<br>08: CPU or analog circuit failure (cF3)<br>09: Hardware protection failure (HPF)<br>10: Current exceeds 2 times rated current during accel (ocA)<br>11: Current exceeds 2 times rated current during decel (ocd)<br>12: Current exceeds 2 times rated current during steady state<br>    operation (ocn)<br>13: Ground Fault (GF)<br>14: Low voltage (Lv)<br>15: Reserved<br>16: CPU failure 1 (cF2)<br>17: Base block<br>18: Overload (oL2)<br>19: Auto accel/decel failure (cFA)<br>20: Software protection enable (codE) | | |
| | 2101H | Status of AC Drive | | |
| | | Bit 0-1 | 00: RUN LED light off, STOP LED light up | |
| | | | 01: RUN LED blink, STOP LED light up | |
| | | | 10: RUN LED light up, STOP LED blink | |
| | | | 11: RUN LED light up, STOP LED light off | |
| | | Bit 2 | 01: Jog active | |
| | | Bit 3-4 | 00: REV LED light off, FWD LED light up | |
| | | | 01: REV LED blink, FWD LED light up | |
| | | | 10: REV LED light up, FWD LED blink | |
| | | | 11: REV LED light up, FWD LED light off | |

**5**

| Content | Address | Functions | |
|---------|---------|-----------|---|
| | | Bit 5-7 | Reserved |
| | | Bit 8 | 1: Main freq. Controlled by communication |
| | | Bit 9 | 1: Main freq. Controlled by external terminal |
| | | Bit 10 | 1: Operation command controlled by communication |
| | | Bit 11 | 1: Parameters have been locked |
| | | Bit 12 | 0: Stop      1: Run |
| | | Bit 13 | 1: Jog command |
| | | Bit 14-15 | Reserved |
| | 2102H | Frequency command F (XXX.XX) | |
| | 2103H | Output Frequency H (XXX.XX) | |
| | 2104H | Output Current A (XXX.X) | |
| | 2105H | DC-BUS Voltage U (XXX.X) | |
| | 2106H | Output Voltage E (XXX.X) | |
| | 2107H | Step number of Multi-Step Speed Operation (step) | |
| | 2108H | Time of PLC Operation (sec) | |
| | 2109H | Value of External Trigger (count) | |
| | 210AH | The Correspondent Value of Power Factor (XXX.X) | |
| | 210BH | Pr.65 X Low word of H (XXX.XX) | |
| | 210CH | Pr.65 X High word of H (XXX.XX) | |
| | 210DH | AC Drive Temperature (XXX.X) | |
| | 210EH | PID Feedback Signal (XXX.XX) | |
| | 210FH | PID Target Value (XXX.XX) | |
| | 2110H | AC Drive Mode Type Information | |

3.7    Communication program of PC:

The following is a simple example of how to write a communication program for Modbus ASCII mode on a PC by C language.

```
#include<stdio.h>
#include<dos.h>
#include<conio.h>
#include<process.h>
#define PORT 0x03F8   /* the address of COM1 */
/* the address offset value relative to COM1 */
#define THR   0x0000
```

```
#define RDR   0x0000
#define BRDL 0x0000
#define IER   0x0001
#define BRDH 0x0001
#define LCR   0x0003
#define MCR   0x0004
#define LSR   0x0005
#define MSR   0x0006
unsigned char rdat[60];
/* read 2 data from address 2102H of AC drive with address 1 */
 unsigned char tdat[60]={':','0','1','0','3','2','1','0','2', '0','0','0','2','D','7','\r','\n'};
 void main(){
  int i;
  outportb(PORT+MCR,0x08);            /* interrupt enable */
  outportb(PORT+IER,0x01);            /* interrupt as data in */
  outportb(PORT+LCR,(inportb(PORT+LCR) | 0x80));
    /* the BRDL/BRDH can be access as LCR.b7==1 */
  outportb(PORT+BRDL,12);             /* set baudrate=9600,
12=115200/9600*/
  outportb(PORT+BRDH,0x00);
  outportb(PORT+LCR,0x06);            /* set protocol, <7,N,2>=06H
<7,E,1>=1AH,   <7,O,1>=0AH
<8,N,2>=07H,   <8,E,1>=1BH
<8,O,1>=0BH */
  for(i=0;i<=16;i++){
    while(!(inportb(PORT+LSR) & 0x20)); /* wait until THR empty */
    outportb(PORT+THR,tdat[i]);      /* send data to THR */
  }
  i=0;
  while(!kbhit()){
    if(inportb(PORT+LSR) & 0x01){ /* b0==1, read data ready */
      rdat[i++]=inportb(PORT+RDR); /* read data form RDR */
    }    }     }
```

| **Pr.93** Accel 1 to Accel 2 Frequency Transition | Factory Setting: 0.00 |
|---|---|
| **Pr.94** Decel 1 to Decel 2 Frequency Transition | Factory Setting: 0.00 |

Settings   0.01 to 400.0 Hz               Unit: 0.10 Hz

             0.00 disable

&#x1F4D6; These functions are used to change acceleration or deceleration depending on attained frequency and not by closing contacts on the external terminals. The priority of this parameter is higher than the time of Accel/Decel 1 and Accel/Decel 2.

| **Pr.95** Auto energy-saving | Factory Setting: 00 |
|---|---|

Settings     00   Disable auto energy-saving operation

            01   Enable auto energy-saving operation

&#x1F4D6; When this function is enabled, the AC drive operates at full voltage during speed changes. At the constant speed periods, drive calculates the optimal output voltage value for the load and may get it reduced up to 30% below the Maximum Output Voltage.



With energy-saving enabled, the drive automatically adjust the output voltage based on the output power level. The maximum output voltage reduction is 30%.
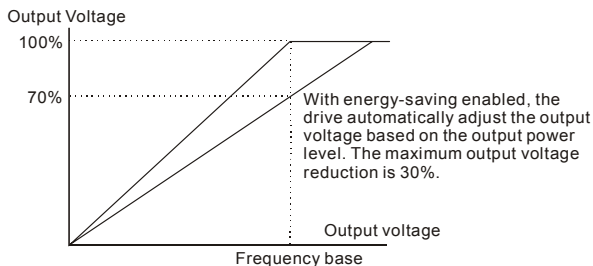
| **Pr.96** Count Down Completion | Factory Setting: 00 |
|---|---|

Settings   00 to 9999

&#x1F4D6; This parameter defines the top count value for the B550 internal counter.   Please also see Pr.45 and Pr.46 (setting 13). Counting is incremented when the Multi-Function Input Terminal M1 or M2, makes a low-to-high transition. Upon completion of the count, either Multi-Function Output Terminal (MO1) or the Multi-Function Relay Contact (RA, RB) will close.

**Pr.97** Preset Count Down Completion                    Factory Setting: 00

    Settings    00 to 9999

&#x1F4D6; This parameter sets a preliminary count value for the internal counter. Counter is incremented by a low-to-high transition on one of the programmed Multi-Function Input Terminals: M1 or M2 (see Pr.44 or Pr.45, setting 14).   Count starts at 01. Upon completion the selected Multi-Function Output Terminal will close.   Preliminary Count could be used to initiate an external event before the "terminal count" is reached.   (See Pr.38, 39, 40, 41, 42, 45, and 46 for further details.)

**Pr.98** Total Time Count from Power On (Days)              Read Only

    Settings    00 to 65535 days

**Pr.99** Total Time Count from Power On (Minutes)          Read Only

    Settings    00 to 1440 minutes

**5**

**Pr.100** Software Version                              Read Only

&#x1F4D6; This parameter shows the software version for the AC motor drive.

**Pr.101** Auto Acceleration/Deceleration                 Factory Setting: 00

    Settings    00    Linear acceleration/deceleration

             01    Auto acceleration, linear deceleration

             02    Linear acceleration, auto deceleration

             03    Auto acceleration/deceleration

             04    Linear Accel/Decel Stall Prevention during Deceleration

               (Please refer to Accel/Decel time setting at parameter Pr.10-Pr.13)

&#x1F4D6; When this parameter is set to 03, the AC drive will accel/decel in the fastest and smoothest possible way by automatically adjusting the accel /decel time.

&#x1F4D6; This parameter provides five modes to choose:
    00    Linear acceleration and deceleration (operation by Pr.10, Pr.11, or Pr.12, Pr.13 acceleration/deceleration time)
    01    Automatic acceleration, linear deceleration (Operation by automatic acceleration, Pr.11 or Pr.13 deceleration time).
    02    Linear acceleration and automatic deceleration (Operation by automatic deceleration time, Pr.10 or Pr.12 acceleration time).
    03    Automatic acceleration, deceleration (Operation by AC drive auto adjustable control)

| 04 | If this parameter is set to 04, Accel/Decel time will be equal to or more than parameter Pr.10 ~Pr.13. |

&#x1F4D5; This parameter should not be used when a braking unit is installed.

---

**Pr.102** Auto Voltage Regulation (AVR)                    Factory Setting: 00

Settings   00   AVR function enabled

01   AVR function disabled

02   AVR function disabled when stop

03   AVR function disabled for deceleration

&#x1F4D5; AVR function automatically regulates the AC drive output voltage to the Maximum Output Voltage (Pr.03).   For instance, if Pr.03 is set at 200 VAC and the input voltage varies from 200V to 264VAC, then the Maximum Output Voltage will automatically be regulated to 200 VAC.

&#x1F4D5; When the AVR function is disabled, the Maximum Output Voltage follows the variations of the input voltage (180V to 264 VAC).

&#x1F4D5; Selecting program value 2 enables the AVR function and also disables the AVR function during deceleration.   This offers a quicker deceleration.

---

**Pr.103** Auto Tune Motor parameters                    Factory Setting: 00

Settings   00   Disable

01   Auto tune for R1

02   Auto tune for R1 + No Load testing

&#x1F4D5; For Auto Tune, set Pr.103 to 01 or 02 and press the RUN key. When it is set to 02, motor should have no load.

---

**Pr.104** R1 Value                                       Factory Setting: 00

Settings   00 to 65535m$\Omega$

&#x1F4D5; As an option to Auto Tune, this parameter inputs the motor resistance.

---

**Pr.105** Control Mode                                   Factory Setting: 00

Settings   00   V/F Control

01   Sensor-less Control

**Pr.106** Rated Slip                                    Factory Setting: 3.0

   Settings   0.00 to 10.00 Hz                          Unit: 0.01Hz

📖 Example of Slip calculation: The rated speed of 4 poles/3 φ/ 60Hz/ 220V on the nameplate is 1710RPM. The rated slip is then: 60-(1710/(120/P))=3Hz. (being P the number of poles)

**Pr.107** Vector Voltage Filter                         Factory Setting: 10

   Settings   5 to 9999                                 Unit: 2ms

**Pr.108** Vector Slip Compensation Filter               Factory Setting: 50

   Settings   25 to 9999                                Unit: 2ms

📖 This parameter sets the low-pass filter in vector control.
📖 Example: Pr. 107 = 10 X 2ms =20ms, Pr. 108 = 50 X 2 ms =100ms.

**Pr.109** Selection for Zero Speed Control              Factory Setting: 00

   Settings   00   No output
             01   Control by DC voltage

📖 This parameter is used to select the control method at zero speed. If set to 01, the voltage in Pr.110 is used for holding torque.

**Pr.110** Voltage of Zero Speed Control                 Factory Setting: 5.0

   Settings   0.0 to 20.0 % of Max. output voltage (Pr.05)   Unit: 0.1%

📖 This parameter should be used in conjunction with Pr.109.
📖 Example: if Pr.05 = 100 and this parameter is set to 20.0, the level of output voltage is 100 X 20.0% = 20.

**Pr.111** Deceleration S Curve                          Factory Setting: 00

   Settings   00 to 07

📖 When this parameter is set differently to zero, it selects a deceleration S-curve and overrides Pr.14. Otherwise, Pr.14 sets the deceleration S-curve.

Note: From the diagram shown below, the original setting accel/decel time will be for reference when the function of the S-curve is enabled. The actual accel/decel time will be determined based on the S-curve selected (1 to 7).

---

**Pr.112** External Terminal Scanning Time                     Factory Setting: 01

---

Settings   01 to 20                                            Unit: 2msec

📖 This function screens the signal on I/O terminals for CPU malfunctions due to external transients.   A setting of 02, makes the scanning time to be 2 x 2 = 4 msec.

📖 Set Pr.77 to 02 before changing settings in Pr.112.

---

**Pr.113** Restart Method after Fault (oc, ov, BB)              Factory Setting: 01

---

Settings   00   None speed search

           01   Continue operation after fault speed search from speed reference

           02   Continue operation after fault speed search from Minimum speed

📖 This parameter is used to select the restart method after certain faults.

---

**Pr. 114** Cooling Fan Control                                Factory Setting: 02

---

Settings   00   Fan Off when the drive stop after 1 Min

           01   AC Drive Runs and Fan On, AC Drive Stops and Fan Off

           02   Always Run

           03   Reserved

---

**Pr. 115** PID Set Point Selection                            Factory Setting: 00

---

Settings   00   Disable

           01   Keypad (based on Pr.00 setting)

           02   AVI (external 0-10V)

           03   ACI (external 4-20mA)

           04   PID set point (Pr.125)

---
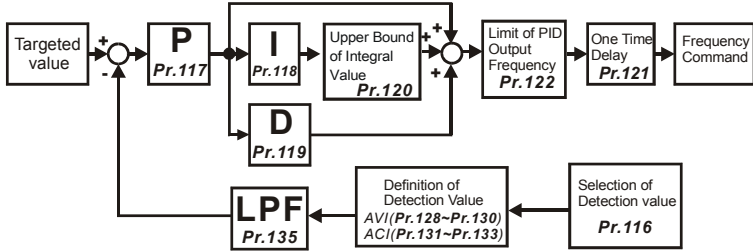
**Pr. 116** PID Feedback Terminal Selection                    Factory Setting: 00

    Settings   00   Input positive PID feedback, PV from AVI (0 to 10V)

               01   Input negative PID feedback, PV from AVI (0 to 10V)

               02   Input positive PID feedback, PV from ACI (4 to 20mA)

               03   Input negative PID feedback, PV from ACI (4 to 20mA)

&#x1F56E;  Select an input terminal to be the PID feedback.   Please verify the PID feedback position is different from the Frequency Set Point position.

&#x1F56E;  Negative feedback = positive targeted value – detective value. Positive feedback = negative targeted value + detective value.

---

**Pr. 117** Proportional Gain (P)                    Factory Setting: 1.0

    Settings  0.0 to 10.0

&#x1F56E;  This parameter determines the feedback loop Gain.   If the gain is large, the response will be strong and immediate (If the gain is too large, vibration may occur).   If the gain is small, the response will be weak and slow.

&#x1F56E;  When I=0.0 and D=0.0, it is only used for proportional control.

---

**Pr. 118** Integral Time (I)                    Factory Setting: 1.00

    Settings  0.01 to 100.00 sec          Unit: 0.01sec

              0.00 disable

&#x1F56E;  This parameter determines the speed of response for the PID feedback loop.   If the integral time is long, the response will be slow. If the integral time is short, the response will be quick.   Be careful not to set (I) too small, since a rapid response may cause oscillation in the PID loop.

| **Pr. 119** Differential Time (D) | Factory Setting: 0.00 |
|---|---|

  Settings   0.00 to 1.00 sec                                    Unit: 0.01sec

📖  This parameter determines the damping effect for the PID feedback loop.   If the differential time is long, any oscillation will quickly subside.   If the differential time is short, the oscillation will subside slowly.

| **Pr. 120** Integration's Upper Bound Frequency | Factory Setting: 100 % |
|---|---|

  Settings   00 to 100 %

📖  This parameter determines the integration's upper frequency limit while operating in the PID feedback loop. (Limit = Pr.03×Pr.120).   During a fast Integration response, it is possible for the frequency to surpass a reasonable point.   This parameter will help limit this frequency spike.

| **Pr. 121** One-Time Delay | Factory Setting: 0.0 |
|---|---|

  Settings   0.0 to 2.5 sec                                      Unit: 0.1sec

           0.0 disable

📖  PI Control: When controlled by P action only, deviations cannot be eliminated entirely. To eliminate residual deviations, the P + I control is generally utilized.   If PI is used, it could eliminate the deviation caused by set-point changes and external interferences. However, if the I-action is excessively powerful, it will delay the response to the variation. The P-action could solely be used on a loading system that possesses integral components.

📖  PD Control: when a deviation occurs, the system immediately generates some operational load that is greater than the single load generated by the D-action in order to restrain the increment of the deviation.   If the deviation is small, the effectiveness of the P-action decreases as well.   In some cases, control systems include integral component loads, which are controlled by the P action only, and sometimes, if the integral component is functioning, the whole system will be vibrating.   In such cases, a PD control could be used to lower the P-action's vibration and to stabilize the system.   In other words, this control is good for use if the loads have no braking functions over the process.

📖  PID Control: Uses the I-action to eliminate the deviation and the D-action to restrain the vibration, and combine with the P action to construct the PID control.   The PID control method normally determines a control process with no deviations, high accuracy and very stable.

**Pr. 122** PID Frequency Output Command limit                    Factory Setting: 00

   Settings   00 to 110 %

📖   This parameter sets a limit of the PID Command frequency.   If this parameter is set to
20%, then the maximum output frequency for the PID operation will be (20% x Pr.01-00).

**Pr. 123** Feedback Signal Detection Time                    Factory Setting: 60.0

   Settings   0.1 to 3600 sec                    Unit: 0.1sec

               0.0 disable

📖   This parameter defines the detection time for the loss of a feedback analog signal. The
drive will follow the operating procedure programmed in Pr.124 if the feedback signal is
lost for more than the time set in Pr.123.

**Pr. 124** Feedback Signal Fault Treatment                    Factory Setting: 00

   Settings     00    Warning and RAMP to stop

               01    Warning and keep operating

📖   This parameter selects the operation of the drive upon a loss of the PID feedback signal.

**Pr. 125** Source of PID Set point                    Factory Setting: 0.00

   Settings   0.00 to 400.0Hz

📖   This parameter is used in conjunction with Pr.115 (04) to input a set point in Hz.

**Pr. 126** PID Offset Level                    Factory Setting: 10.0

   Settings   1.0 to 50.0 %

📖   This parameter is used to set the offset between set point and feedback.

**Pr. 127** Detection Time of PID Offset                    Factory Setting: 5.0

   Settings   0.1 to 300.0 sec

📖   This parameter is used to set the detection time of PID offset.

**Pr. 128** Minimum Reference Value                    Factory Setting: 0.0

   Settings   0.0 to 10.0 V                    Unit: 0.1V

📖 This parameter is used to set the AVI input voltage that corresponds to minimum frequency.

---

**Pr. 129** Maximum Reference Value            Factory Setting: 10.0

     Settings    0.0 to 10.0 V

📖 This parameter is used to set the AVI input voltage that corresponds to maximum frequency.

---

**Pr. 130** Invert Reference Signal AVI (0-10V)        Factory Setting: 00

     Settings     00    Not Inverted

                  01    Inverted

📖 If this parameter is set to 01, the reference signal is inverted: 0V corresponds to 60Hz in Pr.128 and 10V corresponds to 0Hz in Pr.129.

---

**Pr. 131** Minimum Reference Value (0-20mA)       Factory Setting: 4.0

     Settings    0.0 to 20.0mA                Unit: 0.1mA

📖 This parameter is used to set the ACI input frequency that corresponds to minimum frequency.

---

**Pr. 132** Maximum Reference Value (0-20mA)      Factory Setting: 20.0

     Settings    0.0 to 20.0mA                Unit: 0.1mA

📖 This parameter is used to set the ACI input frequency that corresponds to maximum frequency.

---

**Pr. 133** Inverts Reference Signal (0-20mA)        Factory Setting: 00

     Settings     00    Not Inverted

                  01    Inverted

📖 If this parameter is set to 01, 4mA corresponds to 0Hz in Pr.132, and 0mA corresponds to 60Hz in Pr.131.

📖 The main purpose for Pr.128-Pr.133 is to allow changes in the output frequency when setting the analog frequency or PID feedback control per the feedback sensor. For example, if the feedback sensor inputs 4mA-20mA but the output frequency from drive that user needs is 5mA-18mA, then user could set Pr.131 to 5mA and Pr.132 to 18mA.

| **Pr. 134** Analog Input Delay Filter for Set Point | Factory Setting: 50 |
|---|---|
| Settings   00 to 9999 | Unit: 2ms |

| **Pr. 135** Analog Input Delay Filter for Feedback Signal | Factory Setting: 5 |
|---|---|
| Settings   00 to 9999 | Unit: 2ms |

&#x1F4D6; These two parameters are used to set the analog input delay filter in set point or feedback signal.

| **Pr. 136** Sleep Period | Factory Setting: 0.0 |
|---|---|
| Settings   0.0 to 6550.0 sec | Unit: 0.1sec |

| **Pr. 137** Sleep Frequency | Factory Setting: 0.0 |
|---|---|
| Settings   0.00 to 400.0 Hz | Unit: 0.10Hz |

| **Pr. 138** Wake Up Frequency | Factory Setting: 0.0 |
|---|---|
| Settings   0.00 to 400.0 Hz | Unit: 0.10Hz |

&#x1F4D6; These parameters determine the sleep functions of the AC drive.  If the command frequency falls below the sleep frequency, for the specified time in Pr.136, then drive output is turned off until the command frequency rises above Pr.138.  Please see the below diagram.
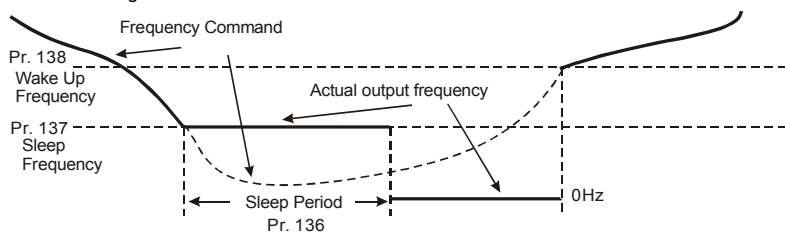


| **Pr. 139** Treatment for Counter Attained | Factory Setting: 00 |
|---|---|
| Settings     00    Continue Operation | |
|            01    Stop Immediately and display E.F. | |

&#x1F4D6; This parameter sets the procedure for the AC drive to follow once the internal counter attains the setting value in Pr.96.

| **Pr. 140** External Up/Down Selection | Factory Setting: 00 |
| --- | --- |

Settings　　00　Fixed Mode (keypad)

　　　　　　01　By Accel or Decel Time

　　　　　　02　Reserved

📖　This parameter is used to change the Master Frequency externally with the Multifuction Input Terminals. If any two parameters in the group Pr.39-Pr.42 are set to 14 and 15, and Pr.140 is set to 01, the up/down frequency operation is initiated as the contact closes and according to the time of acceleration/deceleration.

| **Pr. 141** Save Frequency Set Point | Factory Setting: 01 |
| --- | --- |

Settings　　00　Not Save

　　　　　　01　Save

📖　This parameter is used to save the frequency setting before powering off.

| **Pr. 142** Second Source of Frequency Command | Factory Setting: 00 |
| --- | --- |

Settings　　00　Keypad Up/Down

　　　　　　01　AVI (0-10V)

　　　　　　02　ACI (4-20mA)

　　　　　　03　RS485

　　　　　　04　Keypad Potentiometer

📖　This parameter changes the source for frequency command by using any Multifunction Input (Pr.39-Pr.42, setting= 28).

| **Pr. 143** Software Braking Level | | Unit: 0.1V |
| --- | --- | --- |
| Settings　115V/230V series | 370 to 450 Vdc | Factory setting: 380.0 |
| 460V series | 740 to 900 Vdc | Factory setting: 760.0 |
| 575V series | 925 to 1075 Vdc | Factory setting: 950.0 |

📖　This parameter sets the level for the dynamic braking to operate. The setting value must be higher than the steady-state DC BUS Voltage to prevent the braking transistor from having a 100%-duty.　At 100% duty the transistor and resistor will most likely fail.

| **Pr. 144** Accumulative Motor Operation Day | Read Only |
|---|---|

Settings   00-65535 Days

| **Pr. 145** Accumulative Motor Operation Time (Min.) | Read Only |
|---|---|

Settings   00-1440 Minutes

📖 These parameters display accumulative time of motor operation. They will not reset to zero due to parameter reset to factory and will not re-calculate if the 65535 days limit is exceeded.

| **Pr. 146** Line Start Lockout | Factory Setting: 00 |
|---|---|

Settings     00     Disable

01     Enable

📖 When Line Start Lockout is disabled (also known as Auto-Start), the drive will start when powered-up with run commands applied. To start in Line Start Lockout mode, the AC drive must see the run command go from stop to run after power up. When enabled, the AC drive will not start when powered up if run commands were applied.

| **Pr. 147** Decimal Number of Accel / Decel Time | Factory Setting: 00 |
|---|---|

Settings     00     One Decimal

01     Two Decimals

📖 It sets the number of decimals in the accel/decel time. It can be used for Acceleration / Deceleration Time 1, Acceleration / Deceleration Time 2 and JOG Acceleration / Deceleration Time.

| **Pr. 148** Number of Motor Poles | Factory Setting: 04 |
|---|---|

Settings   02 to 20

| **Pr. 149** Gear Ratio for Simple Index Function | Factory Setting: 200 |
|---|---|

Settings   4 to 1000

| **Pr. 150** Index Angle for Simple Index Function | Factory Setting: 180.0 |
|---|---|

Settings   00.0 to 360.0

| **Pr. 151** Deceleration Time for Simple Index Function | Factory Setting: 0.00 |
|---|---|

Settings   0.00 to 100.00 sec                          0.00 Disable

📖 This parameter should be used with Pr. 39-Pr.42 (setting 31).

Example:



Frequency

← Proximity Sensor Actives

← Stop Command Actives

Time

$t_f$          $\triangle t$

Signal of Zero
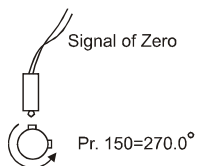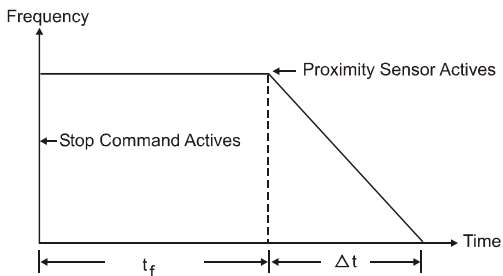
$t_f$ is uncertainty, it is the time from the stop command ON to the proximity sensor trigged.
$\triangle t$ =Pr. 151

Pr. 150=270.0°

| Pr. 152 | Skip Frequency Width | Factory Setting: 0.00 |
|---|---|---|

 Settings   0.00 to 400.00Hz

| Pr. 153 | Bias Frequency Width | Factory Setting: 0.00 |
|---|---|---|

 Settings   0.00 to 400.00Hz

 Frequency of $\triangle$ top point $F_{up}$= master frequency F + Pr.152 + Pr.153.

 Frequency of $\triangle$ down point $F_{down}$= master frequency F – Pr.152 – Pr.153.



Fup

Double Pr. 153

Pr.152

Master
Frequency
(F)    Pr.10, 12

Pr.11, 13

Fdown
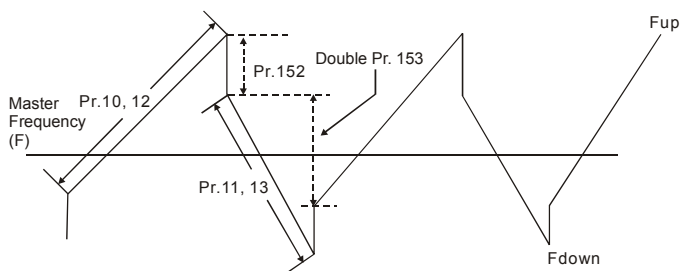
**Pr. 154** Reserved

| **Pr.155** Compensation Coefficient for Motor Instability | ✎ | Factory Setting: 0.0 |
|---|---|---|

Settings   0.1 to 5.0 (recommended setting 2.0)

0.0 Disable

📖 This parameter is used to improve a condition of unstable current in any specific area. For higher frequencies, you can adjust this parameter to 0.0, and increase the setting value in Pr.155 for 30HP and above (a setting of 2.0 is recommended).

| **Pr.156** Communication Response Delay Time | ✎ | Factory Setting: 0 |
|---|---|---|

Settings   0 to 200 (x500μs)

📖 This parameter is used to set communication response delay time. If you set Pr. 156 to 1 the communication response delay time will be 1 X 500μs=500μs, set Pr. 156 to 2 the communication response delay time will be 2 X 500μs=1000μs.

| **Pr.157** Communication Mode Selection | ✎ | Factory Setting: 1 |
|---|---|---|

Settings   0: Delta ASCII

1: MODBUS

📖 This parameter is to select the communication mode, 0 is the existed Delta ASCII communication mode, whereas 1 is to select MODBUS mode.

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# CHAPTER 6   MAINTENANCE AND INSPECTIONS

Modern AC drives are based on solid state electronics technology. Preventive maintenance is required to operate this AC drive in its optimal condition, and to ensure a long life. It is recommended to perform a monthly check-up of the AC drive by a qualified technician. Before the check-up, always turn off the AC Input Power to the unit. ***Wait at least 2 minutes after all display lamps have gone out, and then confirm that the capacitors have fully discharged by measuring the voltage between B1 and Ground using a multi meter set to measure DC.***

**Periodic Inspection:**

Basic check-up items to detect if there were any abnormality during operation are:

1.  Whether the motors are operating as expected.
2.  Whether the installation environment is abnormal.
3.  Whether the cooling system is operating as expected.
4.  Whether any irregular vibration or sound occurred during operation.
5.  Whether the motors are overheating during operation.
6.  Always check the input voltage of the AC drive with Voltmeter.

**Periodic Maintenance**

⚠ **WARNING!** Disconnect AC power before processing!

1.  Tighten and reinforce any screws of the AC drive if necessary because they might loose due to vibration or temperature changes.

2.  Check the conductors or insulators for corrosion and any physical damages.

3.  Check the resistance of the insulation with Mega-ohm meters.

4.  Frequently or regularly check the capacitors, relays and change if necessary.

5.  If use of the AC drive is discontinued for a long period of time, turn the power on at least once every two years and confirm that it still functions properly. To confirm functionality, disconnect the motor and energize the AC drive for 5 hours or more before attempting to run a motor with it.

6.  Clean off any dust and dirt with a vacuum cleaner.   Place special emphasis on cleaning the ventilation ports and PCBs.   Always keep these areas clean, as accumulation of dust and dirt can cause unforeseen failures.

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# CHAPTER 7   TROUBLESHOOTING AND FAULT INFORMATION

The AC drive has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The following faults are displayed as shown on the AC drive digital keypad display. The three most recent faults can be read on the digital keypad display by viewing Pr.73 to Pr.75

NOTE: faults can be cleared by resetting at the keypad or with Input Terminal.

## Common Problems and Solutions:

| Fault Name | Fault Descriptions | Corrective Actions |
|---|---|---|
| OC | The AC drive detects an abnormal increase in current. | 1. Check whether the motors horsepower corresponds to the AC drive output power.<br>2. Check the wiring connections between the AC drive and motor for possible short circuits.<br>3. Increase the Acceleration time (Pr.10, Pr.12).<br>4. Check for possible excessive loading conditions at the motor.<br>5. If there are any abnormal conditions when operating the AC drive after short-circuit being removed, it should be sent back to manufacturer. |
| OU | The AC drive detects that the DC bus voltage has exceeded its maximum allowable value. | 1. Check whether the input voltage falls within the rated AC drive input voltage.<br>2. Check for possible voltage transients.<br>3. Bus over-voltage may also be caused by motor regeneration. Either increase the decel time or add an optional braking resistor.<br>4. Check whether the required braking power is within the specified limits. |

| Fault Name | Fault Descriptions | Corrective Actions |
|---|---|---|
| oH | The AC drive temperature sensor detects excessive heat. | 1. Ensure that the ambient temperature falls within the specified temperature range.<br>2. Make sure that the ventilation holes are not obstructed.<br>3. Remove any foreign objects on the heat sinks and check for possible dirty heat sink fins.<br>4. Provide enough spacing for adequate ventilation. |
| Lu | The AC drive detects that the DC bus voltage has fallen below its minimum value. | Check whether the input voltage falls within the rated AC drive's input voltage. |
| oL | The AC drive detects excessive drive output current.<br>Note: The AC drive can withstand up to 150% of the rated current for a maximum of 60 seconds. | 1. Check whether the motor is overloaded.<br>2. Reduce torque compensation setting as set in Pr.54.<br>3. Increase the AC drive's output capacity. |
| oL 1 | Internal electronic overload trip | 1. Check for possible motor overload.<br>2. Check electronic thermal overload setting.<br>3. Increase motor capacity.<br>4. Reduce the current level so that the drive output current does not exceed the value set by the Motor Rated Current Pr.52. |
| oL 2 | Motor overload. Check the parameter settings (Pr.60 to Pr.62) | 1. Reduce the motor load.<br>2. Adjust the over-torque detection setting to an appropriate setting. |

| Fault Name | Fault Descriptions | Corrective Actions |
|---|---|---|
| oc A | Over-current during acceleration:<br>1. Short-circuit at motor output.<br>2. Torque boost too high.<br>3. Acceleration time too short.<br>4. AC drive output capacity is too small. | 1. Check for possible poor insulation at the output line.<br>2. Decrease the torque boost setting in Pr.54.<br>3. Increase the acceleration time.<br>4. Replace with the AC drive with one that has a higher output capacity (next HP size). |
| oc d | Over-current during deceleration:<br>1. Short-circuit at motor output.<br>2. Deceleration time too short.<br>3. AC drive output capacity is too small. | 1. Check for possible poor insulation at the output line.<br>2. Increase the deceleration time.<br>3. Replace with the AC drive with one that has a higher output capacity (next HP size). |
| oc n | Over-current during steady state operation:<br>1. Short-circuit at motor output.<br>2. Sudden increase in motor loading.<br>3. AC drive output capacity is too small. | 1. Check for possible poor insulation at the output line.<br>2. Check for possible motor stall.<br>3. Replace with the AC drive with one that has a higher output capacity (next HP size). |
| cF 1 | Internal memory IC can not be programmed. | 1. Switch off power supply.<br>2. Check whether the input voltage falls within the rated AC drive input voltage.<br>3. Switch the AC drive back on. |
| cF 2 | Internal memory IC can not be read. | 1. Check the connections between the main control board and the power board.<br>2. Reset drive to factory defaults. |
| EF | The external terminal EF-GND goes from OFF to ON. | When external terminal EF-GND is closed, the output will be turned off (under N.O. E.F.). |
| cF A | Auto accel/decel failure | Don't use the function of auto acceleration/deceleration. |

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| Fault Name | Fault Descriptions | Corrective Actions |
|---|---|---|
| $GFF$ | Ground fault : <br><br> The AC drive output is abnormal. When the output terminal is grounded (short circuit current is 50% more than the AC drive rated current), the AC drive power module may be damaged. The short circuit protection is provided for AC drive protection, not user protection. | Ground fault : <br> 1. Check whether the IGBT power module is damaged. <br> 2. Check for possible poor insulation at the output line. |
| $cE1$ | Communication Error <br> Please refer to Pr.92. | 1. Check the connection between the AC drive and computer for loose wires. <br> 2. Check if the communication protocol is properly set. |
| $bb$ | External Base Block. <br> AC drive output is turned off. | 1. When the external input terminal (base-block) is active, the AC drive output will be turned off. <br> 2. Disable this connection and the AC drive will begin to work again. |
| $HPF$ | OC hardware error | |
| $HPF.$ | CC (current clamp) | |
| $HPF.$ | OV hardware error | Return to the factory. |
| $HPF.$ | GFF hardware error | |
| $cF3$ | OV or LV | |
| $cF3.$ | Current sensor error | |

| Fault Name | Fault Descriptions | Corrective Actions |
|---|---|---|
| c̄F.Ǝ | U-phase error | Return to the factory. |
| c̄.FƎ | W-phase error | |
| PHL | Phase Loss | Check input phase wiring for loose contacts. |
| codE | Software protection failure | Return to the factory. |
| FbE | PID feedback signal error | 1. Check parameter settings (Pr.116) and AVI/ACI wiring.<br>2. Check for possible fault between system response time and the PID feedback signal detection time (Pr.123) |

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# CHAPTER 8 SUMMARY OF PARAMETER SETTINGS

✔ : The parameter can be set during operation

| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| ✔ | Pr.00 | Source of Frequency Command | 00: Master frequency determined by digital keypad (LC-M02E)<br>01: Master frequency determined by 0 to +10 V input on AVI terminal with jumpers<br>02: Master frequency determined by 4 to 20mA input on ACI terminal with jumpers<br>03: Master frequency determined by RS-485 Communication port<br>04: Master frequency determined by potentiometer on digital keypad | 00 | |
| ✔ | Pr.01 | Source of Operation command | 00: Operation determined by digital keypad<br>01: Operation determined by external control terminals, keypad STOP is effective<br>02: Operation determined by external control terminals, keypad STOP is ineffective<br>03: Operation determined by RS-485 communication port, keypad STOP is effective<br>04: Operation determined by RS-485 communication port, keypad STOP is ineffective | 00 | |
| | Pr.02 | Stop Method | 00: Ramp stop<br>01: Coast Stop | 00 | |
| | Pr.03 | Maximum Output Frequency | 50.00 to 400.0 Hz | 60.00 | |
| | Pr.04 | Maximum Voltage Frequency (Base Frequency) | 10.00 to 400.0Hz | 60.00 | |
| | Pr.05 | Maximum Output Voltage (Vmax) | 115V/230V: 0.1 to 255.0V<br>460V: 0.1 to 510.0V<br>575V: 0.1 to 637.0V | 220.0<br>440.0<br>575.0 | |
| | Pr.06 | Mid-point Frequency | 0.10 to 400.0Hz | 1.50 | |
| | Pr.07 | Mid-point Voltage | 115V/230V: 0.1 to 255.0V<br>460V: 0.1 to 510.0V<br>575V: 0.1 to 637.0V | 10.0<br>20.0<br>26.1 | |
| | Pr.08 | Minimum Output Freq | 0.10 to 20.00Hz | 1.50 | |

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| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | Pr.09 | Minimum Output Voltage | 115V/230V: 0.1 to 255.0V<br>460V: 0.1 to 510.0V<br>575V: 0.1 to 637.0V | 10.0<br>20.0<br>26.1 | |
| ✔ | Pr.10 | Acceleration Time 1 | 0.1 to 600.0 sec or 0.01 to 600.0 sec | 10.0 | |
| ✔ | Pr.11 | Deceleration Time 1 | 0.1 to 600.0 sec or 0.01 to 600.0 sec | 10.0 | |
| ✔ | Pr.12 | Acceleration Time 2 | 0.1 to 600.0 sec or 0.01 to 600.0 sec | 10.0 | |
| ✔ | Pr.13 | Deceleration Time 2 | 0.1 to 600.0 sec or 0.01 to 600.0 sec | 10.0 | |
| | Pr.14 | Accel S-curve | 00 to 07 | 00 | |
| ✔ | Pr.15 | Jog Accel/Decel Time | 0.1 to 600.0 sec or 0.01 to 600.0 sec | 1.0 | |
| ✔ | Pr.16 | Jog Frequency | 0.00 to 400.0 Hz | 6.00 | |
| ✔ | Pr.17 | 1st Step Speed Freq. | 0.00 to 400.0Hz | 0.00 | |
| ✔ | Pr.18 | 2nd Step Speed Freq. | 0.00 to 400.0Hz | 0.00 | |
| ✔ | Pr.19 | 3rd Step Speed Freq. | 0.00 to 400.0Hz | 0.00 | |
| ✔ | Pr.20 | 4th Step Speed Freq. | 0.00 to 400.0Hz | 0.00 | |
| ✔ | Pr.21 | 5th Step Speed Freq. | 0.00 to 400.0Hz | 0.00 | |
| ✔ | Pr.22 | 6th Step Speed Freq. | 0.00 to 400.0Hz | 0.00 | |
| ✔ | Pr.23 | 7th Step Speed Freq. | 0.00 to 400.0Hz | 0.00 | |
| | Pr.24 | Reserve Operation Inhibition | 00: Enable REV operation<br>01: Disable REV operation | 00 | |
| | Pr.25 | Over-Voltage Stall Prevention | 00: Disable<br>115V/230V: 330 to 450 Vdc<br>460V: 660 to 900 Vdc<br>575V: 825 to 1025 Vdc | 390<br>780<br>975 | |
| | Pr.26 | Over-current Stall Prevention during Acceleration | 00: Disable<br>20% to 200% | 150 | |
| | Pr.27 | Over-current Stall Prevention during Operation | 00: Disable<br>20% to 200% | 150 | |
| | Pr.28 | DC Braking Current Level | 00 to 100 % | 00 | |
| | Pr.29 | DC Braking during Start-up | 0.0 to 5.0 sec | 0.0 | |
| | Pr.30 | DC Braking during Stopping | 0.0 to 25.0 sec | 0.0 | |
| | Pr.31 | Start-point for DC Braking | 0.00 to 60.00 Hz | 0.00 | |

| Parameter | Explanation | Settings | Factory Setting | Customer |
|-----------|-------------|----------|-----------------|----------|
| Pr.32 | Momentary Power Loss Operation Selection | 00: Stop operation after momentary power loss<br>01: Continues after momentary power loss, speed search starts with Master Frequency<br>02: Continues after momentary power loss, speed search starts with Minimum output Frequency | 00 | |
| Pr.33 | Maximum Allowable Power Loss Time | 0.3 to 5.0 sec | 2.0 | |
| Pr.34 | Base-Block Time for Speed Search | 0.3 to 5.0 sec | 0.5 | |
| Pr.35 | Maximum Current Level for Speed Search | 30 to 200 % | 150 | |
| Pr.36 | Upper Bound of Output Frequency | 0.10 Hz to 400.0 Hz | 400.0 | |
| Pr.37 | Lower Bound of Output Frequency | 0.00 Hz to 400.0 Hz | 0.00 | |
| Pr.38 | Multi-function Input Terminal (M0,M1) | 00: M0: FWD/STOP, M1: REV/STOP<br>01: M0: RUN/STOP, M1: REV/FWD<br>02: M0, M1, M2: 3-wire operation control mode | 00 | |
| Pr.39<br><br>Pr.40<br><br>Pr.41<br><br>Pr.42 | Multi-function Input Terminal (M2)<br><br>Multi-function Input Terminal (M3)<br><br>Multi-function Input Terminal (M4)<br><br>Multi-function Input Terminal (M5) | 00: No Function<br>01: Output OFF (N.O.) (enabled when running)<br>02: Output OFF (N.C.) (enabled when running)<br>03: External Fault (normally open) N.O.<br>04: External Fault (normally close) N.C<br>05: RESET<br>06: Multi-Step Speed Command 1<br>07: Multi-Step Speed Command 2<br>08: Multi-Step Speed Command 3<br>09: Jog Operation<br>10: Accel/Decel Speed Inhibit<br>11: First or Second Accel/Decel Time<br>12: Base-block (B.B.) (N.O)<br>13: Base-block (B.B.) (N.C)<br>14: Increase Master Frequency<br>15: Decrease Master Frequency<br>16: Run PLC Program<br>17: Pause PLC<br>18: Counter Trigger Signal<br>19: Counter Reset | 05<br><br>06<br><br>07<br><br>08 | |

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| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | | | 20: No function<br>21: RESET command (N.C)<br>22: Control source: External Terminal<br>23: Control source: Keypad<br>24: Control source: Communication<br>25: Parameter Lock (Write disable, Read is always 0)<br>26: PID Disable (N.O.)<br>27: PID Disable (N.C.)<br>28: Second Source for Frequency Command<br>29: Forward (contact is open) / Reverse (contact is close)<br>30: One-Shot PLC Run<br>31: Index input signal<br>32: Counter Incremented by Drive Output Frequency | | |
| ✗ | Pr.43 | Analog Output Signal | 00: Analog Frequency Meter (0 to Maximum Output Frequency)<br>01: Analog Current Meter (0 to 250% of the rated AC drive current)<br>02: Feedback signal (0 - 100%)<br>03: Output power (0 - 100%) | 00 | |
| ✗ | Pr.44 | Analog Output Gain | 00 to 200 % | 100 | |
| ✗ | Pr.45<br><br><br><br>Pr.46 | Multi-Function Output Terminal 1 (Photocoupler output)<br><br>Multi-function Output Terminal 2 (Relay Output) | 00: AC Drive Operational<br>01: Maximum Output Frequency Attained<br>02: Zero Speed<br>03: Over-Torque Detection<br>04: Base-Block (B.B) Indication<br>05: Low Voltage Indication<br>06: AC Drive Operation Mode<br>07: Fault Indication<br>08: Desired Frequency Attained<br>09: PLC Program Running<br>10: PLC Program Step Completed<br>11: PLC Program Completed<br>12: PLC Operation Paused<br>13: Top Count Value Attained<br>14: Preliminary Counter Value Attained<br>15: Warning (PID feedback loss, communication error)<br>16: Below the Desired Frequency<br>17: PID supervision<br>18: Over Voltage supervision<br>19: Over Heat supervision<br>20: Over Current stall supervision | 00 | |

| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | | | 21: Over Voltage stall supervision<br>22: Forward command<br>23: Reverse command<br>24: Zero Speed (Includes Drive Stop) | 00 | |
| ✔ | Pr.47 | Desired Frequency Attained | 0.00 to 400.0 Hz | 0.00 | |
| ✔ | Pr.48 | Adjust Bias of External Input Frequency | 0.00 to 200.0% | 0.00 | |
| ✔ | Pr.49 | Potentiometer Bias Polarity | 00: Positive Bias<br>01: Negative Bias | 00 | |
| ✔ | Pr.50 | Potentiometer Frequency Gain | 0.10 to 200.0% | 100.0 | |
| | Pr.51 | Potentiometer Reverse Motion Enable | 00: Reverse Motion Disabled in negative bias<br>01: Reverse Motion Enabled in negative bias | 00 | |
| ✔ | Pr.52 | Motor Rated Current | 30.0% FLA to 120.0% FLA | FLA | |
| ✔ | Pr.53 | Motor No-Load Current | 00%FLA to 99%FLA | 0.4*FLA | |
| ✔ | Pr.54 | Torque Compensation | 00 to 10 | 00 | |
| ✔ | Pr.55 | Slip Compensation | 0.00 to 10.00 | 0.00 | |
| | Pr.56 | Reserved | | | |
| | Pr.57 | AC Drive Rated Current Display (unit: 0.1A) | | ##.# | |
| | Pr.58 | Electronic Thermal Overload Relay | 00: Standard Motor (self cool motor)<br>01: Inverter Motor (auxiliary cool fan on motor)<br>02: Inactive | 02 | |
| ✔ | Pr.59 | Electronic Thermal Motor Overload | 30 to 300 sec | 60 | |
| | Pr.60 | Over-Torque Detection Mode | 00: Over-Torque Detection Disable<br>01: Enabled during constant speed operation until the allowable time for detection (Pr.62) elapses.<br>02: Enabled during constant speed operation and halted after detection.<br>03: Enabled during acceleration until the allowable time for detection (Pr.62) elapses.<br>04: Enabled during acceleration and halted after detection. | 00 | |

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| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | Pr.61 | Over-Torque Detection Level | 30 to 200 % | 150 | |
| | Pr.62 | Over-Torque Detection Time | 0.0 to 10.0 seconds | 0.1 | |
| | Pr.63 | Loss of ACI (4-20mA) | 00: Decelerate to 0 Hz<br>01: Stop immediately and display "EF"<br>02: Continue operation by last frequency command | 00 | |
| ✎ | Pr.64 | User Defined Function for Display | 00: Display AC drive output Frequency (Hz)<br>01: Display User-defined output Frequency (H*Pr.65)<br>02: Output Voltage (E)<br>03: DC Bus Voltage (u_)<br>04: PV (i)<br>05: Display the value of internal counter (c)<br>06: Display the setting frequency (F or o=%)<br>07: Display the parameter setting (Pr.00)<br>08: Reserved<br>09: Output Current (A)<br>10: Display program operation (0.xxx), Fwd, or Rev | 06 | |
| ✎ | Pr.65 | Coefficient K | 0.01 to 160.0 | 1.00 | |
| ✎ | Pr.66 | Communication Frequency | 0.00 to 400.0 Hz | 0.00 | |
| | Pr.67 | Skip Frequency 1 | 0.00 to 400.0 Hz | 0.00 | |
| | Pr.68 | Skip Frequency 2 | 0.00 to 400.0 Hz | 0.00 | |
| | Pr.69 | Skip Frequency 3 | 0.00 to 400.0 Hz | 0.00 | |
| | Pr.70 | Skip Frequency Band | 0.00 to 20.00 Hz | 0.00 | |
| | Pr.71 | PWM Carrier Frequency | 230V/460V series: 01 to 15 | 15 | |
| | Pr.72 | Auto Restart Attempts after Fault | 00 to 10 | 00 | |

| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | Pr.73 | Present Fault Record | 00: No fault occurred<br>01: Over-current (oc)<br>02: Over-voltage (ov)<br>03: Overheat (oH)<br>04: Overload (oL)<br>05: Overload 1 (oL1) | 00 | |
| | Pr.74 | Second Most Recent Fault Record | 06: External Fault (EF)<br>07: CPU failure 1 (CF1)<br>08: CPU failure 3 (CF3)<br>09: Hardware Protection Failure (HPF)<br>10: Over-current during acceleration (oca)<br>11: Over-current during deceleration (ocd)<br>12: Over-current during steady state | 00 | |
| | Pr.75 | Third Most Recent Fault Record | operation (ocn)<br>13: Ground fault or fuse failure(GFF)<br>14: Low Voltage (not record)<br>15: 3 Phase Input Power Loss<br>16: EPROM failure (CF2)<br>17: External interrupt allowance(bb)<br>18: Overload (oL2)<br>19: Auto Adjustable accel/decel failure (CFA)<br>20: CPU self detection failure (codE) | 00 | |
| | Pr.76 | Parameter Lock and Configuration | 00: All parameters can be set/read<br>01: All parameters are read-only<br>02-08: Reserved<br>09: Resets all parameters to 50Hz factory defaults<br>10: Resets all parameters to 60Hz factory defaults | 00 | |
| | Pr.77 | Time for Auto Reset the Restart Times in Abnormality | 0.1 to 6000.0 sec | 60.0 | |
| | Pr.78 | PLC Operation Mode | 00: Disable PLC operation<br>01: Execute one program cycle<br>02: Continuously execute program cycles<br>03: Execute one program cycle step by step<br>04: Continuously execute one program cycle step by step | 00 | |
| | Pr.79 | PLC FWD/REV Motion | 00 to 127 | 00 | |
| | Pr.80 | Identity Code of the AC Motor Drive | Read only | ## | |
| | Pr.81 | Time Duration of 1st Step Speed | 00 to 9999 sec | 00 | |

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| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | Pr.82 | Time Duration of 2nd Step Speed | 00 to 9999 sec | 00 | |
| | Pr.83 | Time Duration of 3rd Step Speed | 00 to 9999 sec | 00 | |
| | Pr.84 | Time Duration of 4th Step Speed | 00 to 9999 sec | 00 | |
| | Pr.85 | Time Duration of 5th Step Speed | 00 to 9999 sec | 00 | |
| | Pr.86 | Time Duration of 6th Step Speed | 00 to 9999 sec | 00 | |
| | Pr.87 | Time Duration of 7th Step Speed | 00 to 9999 sec | 00 | |
| | Pr.88 | Communication Address | 01 to 254 | 01 | |
| | Pr.89 | Transmission Speed | 00: 4800 bps<br>01: 9600 bps<br>02: 19200 bps<br>03: 38400 bps | 01 | |
| | Pr.90 | Transmission Fault Treatment | 00: Warn and Continue Operating<br>01: Warn and RAMP to Stop<br>02: Warn and COAST to Stop<br>03: Keep Operation without Warning | 03 | |
| | Pr.91 | Time Out Detection | 0.0: Disable<br>0.1 to 120.0 sec | 0.0 | |
| | Pr.92 | Communication Protocol | 00: MODBUS ASCII mode, <7,N,2><br>01: MODBUS ASCII mode, <7,E,1><br>02: MODBUS ASCII mode, <7,O,1><br>03: MODBUS RTU mode, <8,N,2><br>04: MODBUS RTU mode, <8,E,1><br>05: MODBUS RTU mode, <8,O,1> | 00 | |
| | Pr.93 | Accel 1 to Accel 2 Frequency Transition | 0.01 to 400.0<br>0.00: Disable | 0.00 | |
| | Pr.94 | Decel 1 to Decel 2 Frequency Transition | 0.01 to 400.0<br>0.00: Disable | 0.00 | |
| | Pr.95 | Auto Energy Saving | 00: Disable auto energy saving<br>01: Enable auto energy saving | 00 | |
| | Pr.96 | Counter Countdown Complete | 00 to 9999 | 00 | |
| | Pr.97 | Preset counter countdown | 00 to 9999 | 00 | |

| Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|
| Pr.98 | Total Time Count from Power On (Days) | 00 to 65535 days | Read Only | |
| Pr.99 | Total Time Count from Power On (Minutes) | 00 to 1440 minutes | Read Only | |
| Pr.100 | Software Version | | ## | |
| Pr.101 | Auto Adjustable Accel/Decel | 00: Linear Accel/Decel<br>01: Auto Accel, Linear Decel<br>02: Linear Accel, Auto Decel<br>03: Auto Accel/Decel<br>04: Linear Accel/Decel Stall Prevention during Deceleration | 00 | |
| Pr.102 | Auto Voltage Regulation (AVR) | 00: AVR function enabled<br>01: AVR function disabled<br>02: AVR function disabled when stops<br>03: AVR function disabled when decel | 00 | |
| Pr.103 | Auto tune Motor Parameters | 00: Disable<br>01: Auto tune for R1<br>02: Auto tune for R1 + No Load testing | 00 | |
| Pr.104 | R1 value | 00 to 65535 mΩ | 00 | |
| Pr.105 | Control Mode | 00: V/F Control<br>01: Sensor-less Control | 00 | |
| Pr.106 | Rated Slip | 0.00 to 10.00 Hz | 3.00 | |
| Pr.107 | Vector Voltage Filter | 5 to 9999 (per 2ms) | 10 | |
| Pr.108 | Vector Slip Compensation Filter | 25 to 9999 (per 2ms) | 50 | |
| Pr.109 | Selection for Zero Speed Control | 00: No output<br>01: Control by DC voltage | 00 | |
| Pr.110 | Voltage of Zero Speed Control | 0.0 to 20.0 % of Max. output voltage (Pr.05) | 5.0 | |
| Pr.111 | Decel S-curve | 00 to 07 | 00 | |
| Pr.112 | External Terminal Scanning Time | 01 to 20 | 01 | |
| Pr.113 | Restart Method after Fault (oc, ov, BB) | 00: None speed search<br>01: Continue operation after fault speed search from speed reference<br>02: Continue operation after fault speed search from Minimum speed | 01 | |

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| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | Pr.114 | Cooling Fan Control | 00: Fan Off when the drive stop after 1 Min.<br>01: AC Drive Runs and Fan On, AC Drive Stops and Fan Off<br>02: Always Run<br>03: Reserved | 02 | |
| | Pr.115 | PID Set Point Selection | 00: Disable<br>01: Keypad (based on Pr.00 setting)<br>02: AVI (external 0-10V)<br>03: ACI (external 4-20mA)<br>04: PID set point (Pr.125) | 00 | |
| | Pr.116 | PID Feedback Terminal Selection | 00: Input positive PID feedback, PV from AVI (0 to 10V)<br>01: Input negative PID feedback, PV from AVI (0 to 10V)<br>02: Input positive PID feedback, PV from ACI (4 to 20mA)<br>03: Input negative PID feedback, PV from ACI (4 to 20mA) | 00 | |
| | Pr.117 | Proportional Gain (P) | 0.0 to 10.0 | 1.0 | |
| | Pr.118 | Integral Time (I) | 0.00: Disable<br>0.01 to 100.0 sec | 1.00 | |
| | Pr.119 | Differential Time (D) | 0.00 to 1.00 sec | 0.00 | |
| | Pr.120 | Integration's Upper Bound Frequency | 00 to 100 % | 100 % | |
| | Pr.121 | One-Time Delay | 0.0 to 2.5 sec | 0.0 | |
| | Pr.122 | PID Frequency Output Command Limit | 00 to 110 % | 100 | |
| | Pr.123 | Feedback Signal Detection Time | 0.0: Disable<br>0.1 to 3600 sec | 60.0 | |
| | Pr.124 | Feedback Signal Fault Treatment | 00: Warning and RAMP to stop<br>01: Warning and keep operating | 00 | |
| | Pr.125 | Source of PID Set Point | 0.00 to 400.0Hz | 0.00 | |
| | Pr.126 | PID Offset Level | 1.0 to 50.0 % | 10.0 | |
| | Pr.127 | Detection Time of PID Offset | 0.1 to 300.0 sec | 5.0 | |
| | Pr.128 | Minimum Reference Value | 0.0 to 10.0 V | 0.0 | |
| | Pr.129 | Maximum Reference Value | 0.0 to 10.0 V | 10.0 | |

| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | Pr.130 | Invert Reference Signal AVI (0-10V) | 00: Not inverted<br>01: Inverted | 00 | |
| | Pr.131 | Minimum Reference Value (4-20mA) | 0.0 to 20.0mA | 4.0 | |
| | Pr.132 | Maximum Reference Value (4-20mA) | 0.0 to 20.0mA | 20.0 | |
| | Pr.133 | Invert Reference Signal (4-20mA) | 00: Not inverted<br>01: Inverted | 00 | |
| | Pr.134 | Analog Input Delay Filter for Set Point | 00 to 9999 (per 2ms) | 50 | |
| | Pr.135 | Analog Input Delay Filter for Feedback Signal | 00 to 9999 (per 2ms) | 5 | |
| | Pr.136 | Sleep Period | 0.0 to 6550.0 sec | 0.0 | |
| | Pr.137 | Sleep Frequency | 0.00 to 400.0 Hz | 0.00 | |
| | Pr.138 | Wake Up Frequency | 0.00 to 400.0 Hz | 0.00 | |
| | Pr.139 | Treatment for Counter Attained | 00: Continue operation<br>01: Stop Immediately and display E.F. | 00 | |
| | Pr.140 | External Up/Down Selection | 00: Fixed Mode (keypad)<br>01: By Accel or Decel Time<br>02: Reserved | 00 | |
| | Pr.141 | Save Frequency Set Point | 00: Not Save<br>01: Save | 01 | |
| | Pr.142 | Second Source of Frequency Command | 00: Keypad Up/Down<br>01: AVI (0-10V)<br>02: ACI (4-20mA)<br>03: Communication<br>04: Keypad potentiometer | 00 | |
| | Pr.143 | Software Braking Level | 115V/230V | 370-450 Vdc | 380.0 | |
| | | | 460V | 740-900 Vdc | 760.0 | |
| | | | 575V | 925-1075 Vdc | 950.0 | |
| | Pr.144 | Total operation time (Day) | Read Only | | |
| | Pr.145 | Total operation time (Minutes) | Read Only | | |
| | Pr.146 | Line start Lockout | 00: Disable<br>01: Enable | 00 | |
| | Pr.147 | Decimal Number of Accel / Decel Time | 00: One decimal<br>01: Two decimals | 00 | |
| | Pr.148 | Number of Motor Poles | 02 to 20 | 04 | |

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| | Parameter | Explanation | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | Pr.149 | Gear Ratio for Simple Index Function | 4 to 1000 | 200 | |
| | Pr.150 | Index Angle for Simple Index Function | 00.0 to 360.0 | 180.0 | |
| | Pr.151 | Deceleration Time for Simple Index Function | 0.00 to 100.00 sec | 0.00 | |
| | Pr.152 | Skip Frequency Width | 0.00 to 400.0Hz | 0.00 | |
| | Pr.153 | Bias Frequency Width | 0.00 to 400.0Hz | 0.00 | |
| | Pr.154 | Reserved | | | |
| ✗ | Pr.155 | Compensation Coefficient for Motor Instability | 0.0: Disable<br>0.1 to 5.0 (recommended setting d2.0) | 0.0 | |
| ✗ | Pr.156 | Communication Response Delay Time | 0 to 200 (x500us) | 0 | |
| ✗ | Pr.157 | Communication Mode Selection | 0: Delta ASCII<br>1: Modbus | 1 | |

# STANDARD SPECIFICATIONS

| Voltage Class | 115V Class | | |
|---|---|---|---|
| Model Number B550-XXXX | 002 | 004 | 007 |
| Max. Applicable Motor Output (kW) | 0.2 | 0.4 | 0.75 |
| Max. Applicable Motor Output (hp) | 0.25 | 0.5 | 1.0 |
| Output Rating — Rated Output Capacity (kVA) | 0.6 | 1.0 | 1.6 |
| Rated Output Current (A) | 1.6 | 2.5 | 4.2 |
| Maximum Output Voltage (V) | 3-Phase proportion to twice the input voltage | | |
| Output Frequency (Hz) | 0.1~400 Hz | | |
| Carrier Frequency (kHz) | 1-15 | | |
| Input Rating — Rated Input Current (A) | Single phase | | |
| | 6 | 9 | 16 |
| Rated Voltage, Frequency | Single phase, 100-120 VAC, 50/60Hz | | |
| Voltage Tolerance | ± 10% (90-132VAC) | | |
| Frequency Tolerance | ± 5% (47~63Hz) | | |
| Cooling Method | Fan Cooled | | |
| Weight (kg) | 1.5 | 1.5 | 1.5 |

| Voltage Class | 230V Class | | | | | |
|---|---|---|---|---|---|---|
| Model Number.B550-2XXX | 004 | 007 | 015 | 022 | 037 | 055 |
| Max. Applicable Motor Output (kW) | 0.4 | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 |
| Max. Applicable Motor Output (hp) | 0.5 | 1.0 | 2.0 | 3.0 | 5.0 | 7.5 |
| Output Rating — Rated Output Capacity (kVA) | 1.0 | 1.9 | 2.7 | 3.8 | 6.5 | 9.5 |
| Rated Output Current (A) | 2.5 | 5.0 | 7.0 | 10 | 17 | 25 |
| Maximum Output Voltage (V) | 3-Phase proportional to input voltage | | | | | |
| Output Frequency (Hz) | 0.1~400 Hz | | | | | |
| Carrier Frequency (kHz) | 1-15 | | | | | |
| Input Rating — Rated Input Current (A) | Single/3-phase | | | | 3-phase | |
| | 6.3/2.9 | 11.5/7.6 | 15.7/8.8 | 27/12.5 | 19.6 | 28 |
| Input Current for 1-phase Models when Using 3-phase Power | 3.2 | 6.3 | 9.0 | 12.5 | -- | -- |
| Rated Voltage, Frequency | Single/3-phase 200-240 VAC, 50/60Hz | | | | 3-phase 200-240VAC, 50/60Hz | |
| Voltage Tolerance | ± 10% (180~264 VAC) | | | | | |
| Frequency Tolerance | ± 5% (47~63 Hz) | | | | | |
| Cooling Method | Fan Cooled | | | | | |
| Weight (kg) | 2.2/1.5 | 2.2/1.5 | 2.2/1.5 | 3.2/2.2 | 3.2 | 3.2 |

| Voltage Class | 460V Class | | | | | |
|---|---|---|---|---|---|---|
| Model Number B550-4XXX | 007 | 015 | 022 | 037 | 055 | 075 |
| Max. Applicable Motor Output (kW) | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 |
| Max. Applicable Motor Output (hp) | 1.0 | 2.0 | 3.0 | 5.0 | 7.5 | 10 |
| Output Rating — Rated Output Capacity (kVA) | 2.3 | 3.1 | 3.8 | 6.2 | 9.9 | 13.7 |
| Rated Output Current (A) | 3.0 | 4.0 | 5.0 | 8.2 | 13 | 18 |
| Maximum Output Voltage (V) | 3-phase Proportional to Input Voltage | | | | | |
| Output Frequency (Hz) | 0.1~400 Hz | | | | | |
| Carrier Frequency (kHz) | 1-15 | | | | | |

| Voltage Class | | 460V Class | | | | | |
|---|---|---|---|---|---|---|---|
| Input Rating | Rated Input Current (A) | 3-phase | | | | | |
| | | 4.2 | 5.7 | 6.0 | 8.5 | 14 | 23 |
| | Rated Voltage, Frequency | 3-phase 380-480 VAC, 50/60Hz | | | | | |
| | Voltage Tolerance | $\pm$ 10% (342~528 VAC) | | | | | |
| | Frequency Tolerance | $\pm$ 5% (47~63 Hz) | | | | | |
| Cooling Method | | Fan Cooled | | | | | |
| Weight (kg) | | 1.5 | 1.5 | 2.0 | 3.2 | 3.2 | 3.3 |

| Voltage Class | | 575V Class | | | | | |
|---|---|---|---|---|---|---|---|
| Model Number B550-6XXX | | 007 | 015 | 022 | 037 | 055 | 075 |
| Max. Applicable Motor Output (kW) | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 |
| Max. Applicable Motor Output (hp) | | 1.0 | 2.0 | 3.0 | 5.0 | 7.5 | 10 |
| Output Rating | Rated Output Capacity (kVA) | 1.7 | 3.0 | 4.2 | 6.6 | 9.9 | 12.2 |
| | Rated Output Current (A) | 1.7 | 3.0 | 4.2 | 6.6 | 9.9 | 12.2 |
| | Maximum Output Voltage (V) | 3-phase Proportional to Input Voltage | | | | | |
| | Output Frequency (Hz) | 0.1~400 Hz | | | | | |
| | Carrier Frequency (kHz) | 1-10 | | | | | |
| Input Rating | Rated Input Current (A) | 3-phase | | | | | |
| | | 2.4 | 4.2 | 5.9 | 7.0 | 10.5 | 12.9 |
| | Rated Voltage, Frequency | 3-phase 500-600 VAC, 50/60Hz | | | | | |
| | Voltage Tolerance | -15% ~ +10% (425~660 V) | | | | | |
| | Frequency Tolerance | $\pm$ 5% (47~63 Hz) | | | | | |
| Cooling Method | | Fan Cooled | | | | | |
| Weight (kg) | | 1.5 | 1.5 | 2.0 | 3.2 | 3.2 | 3.3 |

| General Specifications | | |
|---|---|---|
| Control Characteristics | Control System | SPWM (Sinusoidal Pulse Width Modulation) control (V/F or sensorless vector control) |
| | Freq. Setting Resolution | 0.1Hz |
| | Output Frequency Resolution | 0.1Hz |
| | Torque Characteristics | Including the auto-torque, auto-slip compensation; starting torque can be 150% at 5.0Hz |
| | Overload Endurance | 150% of rated current for 1 minute |
| | Skip Frequency | Three zones, settings range 0.1-400Hz |
| | Accel/Decel Time | 0.1 to 600 seconds (4 Independent settings for Accel/Decel Time) |
| | Stall Prevention Level Frequency Setting | 20 to 200%, Setting of Rated Current |
| | DC Injection Braking | Operation frequency 0-60Hz, output 0-100% rated current Start time 0-5 seconds, stop time 0-25 seconds |
| | Braking Torque | Approx. 20% (up to 125% possible with option braking resistor or braking unit externally mounted, 1-15HP braking transistor built-in) |
| | V/F Pattern | Adjustable V/F pattern |

| | | Keypad | Setting by △ ▽ |
|---|---|---|---|
| Operating Characteristics | Frequency Setting | External Signal | Potentiometer-5KΩ/0.5W, 0 to +10VDC, 4 to 20mA RS-485 interface; Multi-Function Inputs 0 to 5 (7 steps, Jog, up/down) |
| | Operation Setting Signal | Keypad | Set by RUN, STOP |
| | | External Signal | M0 to M5 can be combined to offer various modes of operation, RS-485 serial interface (MODBUS). |
| | Multi-Function Input Signal | | Multi-step selection 0 to 7, Jog, accel/decel inhibit, first to forth accel/decel switches, counter, PLC operation, external Base Block (NC, NO), auxiliary motor control is invalid, selections, driver reset, UP/DOWN key settings, sink/source selection |
| | Multi-Function Output Indication | | AC drive operating, frequency attained, non-zero, base block, fault indication, local/remote indication, PLC operation indication, auxiliary motor output, driver is ready, overheat alarm, emergency stop |
| | Analog Output Signal | | Analog frequency/current signal output. |
| Alarm Output Contact | | | 1 Form C contact or open collector output |
| Operation Functions | | | AVR, S-Curve, over-voltage, over-current stall prevention, fault records, adjustable carrier frequency, DC braking, momentary power loss restart, auto tuning, frequency limits, parameter Lock/Reset, vector control, counter, PID Control, PLC, MODBUS communication, reverse Inhibition, abnormal reset, abnormal re-start, digital frequency output, sleep/revival function, 1st/2nd frequency source selections |
| Protection Functions | | | Self-testing, over voltage, over current, under voltage, overload, overheating, external fault, electronic thermal, ground fault. |
| Display Keypads | | | 6-key, 4-digit, 7-segment LED, 4 status LEDs, master frequency, output frequency, output current, custom units, parameter values for setup, review and faults, RUN, STOP, RESET, FWD/REV |
| Built-in Braking Chip | | | Built-in for all models |
| Environmental Conditions | Protection Level | | IP20 |
| | Pollution Degree | | 2 |
| | Installation Location | | Altitude 1,000 m or lower, keep from corrosive gasses, liquid and dust |
| | Ambient Temperature | | -10$^o$C to 40$^o$C (-10$^o$C to 50$^o$C without blind plate) Non-Condensing and not frozen |
| | Storage/ Transportation Temperature | | -20$^o$C to 60$^o$C |
| | Ambient Humidity | | Below 90% RH (non-condensing) |
| | Vibration | | 9.80665m/s$^2$ (1G) less than 20Hz, 5.88m/s$^2$ (0.6G) at 20 to 50Hz |
| Approvals | | | C E |

**A**

**Note:** Do not attempt to connect a single-phase power source to a three-phase models drive. However it is acceptable to connect two wires of a three-phase power source to a single-phase drive.

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