# DELTA ELECTRONICS, INC.

# *VFD*-G
## User Manual

**Specific AC Motor Drives for Plastic Molding and Air Compressors Machinery**

VFD-G

**Voltage Range:**
3-phase 460V series:5.5~30kW(7.5~40HP)
3-phase 460V series:37~75kW(50~100HP)

**DELTA**
DELTA ELECTRONICS, INC.

www.delta.com.tw/industrialautomation

## ASIA

**Delta Electronics, Inc.**
Taoyuan1
31-1, Xingbang Road, Guishan Industrial Zone,
Taoyuan County 33370, Taiwan
TEL: 886-3-362-6301 / FAX: 886-3-362-7267

**Delta Electronics (Jiang Su) Ltd.**
Wujiang Plant3
1688 Jiangxing East Road,
Wujiang Economy Development Zone,
Wujiang City, Jiang Su Province,
People's Republic of China (Post code: 215200)
TEL: 86-512-6340-3008 / FAX: 86-769-6340-7290

**Delta Electronics (Japan), Inc.**
Tokyo Office
Delta Shibadaimon Building, 2-1-14 Shibadaimon,
Minato-Ku, Tokyo, 105-0012, Japan
TEL: 81-3-5733-1111 / FAX: 81-3-5733-1211

**Delta Electronics (Korea), Inc.**
Donghwa B/D 3F, 235-6, Nonhyun-dong,
Kangnam-gu, Seoul 135-010, Korea
TEL: 82-2-515-5303/5 / FAX: 82-2-515-5302

**Delta Electronics (Singapore) Pte. Ltd.**
8 Kaki Bukit Road 2, #04-18 Ruby Warehouse Complex,
Singapore 417841
TEL: 65-747-5155 / FAX: 65-744-9228

## AMERICA

**Delta Products Corporation (USA)**
Raleigh Office
P.O. Box 12173,5101 Davis Drive,
Research Triangle Park, NC 27709, U.S.A.
TEL: 1-919-767-3813 / FAX: 1-919-767-3969

## EUROPE

**Deltronics (The Netherlands) B.V.**
Eindhoven Office
De Witbogt 15, 5652 AG Eindhoven, The Netherlands
TEL: 31-40-2592850 / FAX: 31-40-2592851

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DELTA

**VFD-G**

*User Manual*

Specific AC Motor Drives for Plastic Molding and Air Compressors Machinery

# Preface

Thank you for choosing DELTA's VFD-G series for plastic molding and air compressors machinery. VFD-G Series are manufactured by adopting high-quality components, material and incorporating the latest microprocessor technology available.
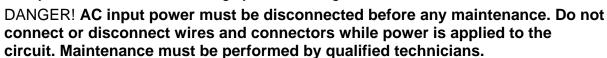
📖 Getting Started

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 drives. Keep this operating manual handy and distribute to all users for reference.

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### ⚠ WARNING

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⚠ Always read this manual thoroughly before using VFD-G 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, do not remove the cover of the AC drive until all "DISPLAY LED" lights on the digital keypad are off. Please note that there are live components exposed within the AC drive. Do not touch these live parts.

⚠ **CAUTION!** Ground the VFD-G 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.

⚠ **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.

⚠ **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 IP40). (VFD-G series corresponds with this regulation.)

⚠ **CAUTION!** Heat sink may heat up over 70°C (158°F), during the operation. Do not touch the heat sink.

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## CHAPTER 6   MAINTENANCE AND INSPECTIONS

## CHAPTER 7   TROUBLESHOOTING AND FAULT INFORMATION

## CHAPTER 8   PARAMETER SUMMARY

## APPENDIX A   SPECIFICATIONS

## APPENDIX B   ACCESSORIES

## APPENDIX C   DIMENSIONS

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# CHAPTER 1   RECEIVING AND INSPECTION

This VFD-G AC drive has gone through rigorous quality control tests at the factory before shipment. After receiving the AC drive, please check for the following:
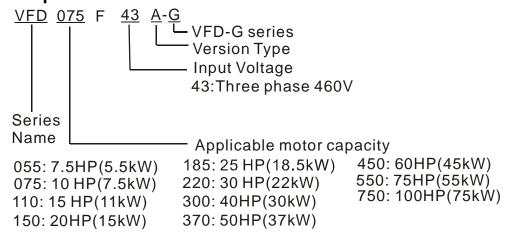
Receiving

✓ Check to make sure that the package includes an AC drive, the User Manual, dust covers 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 for 10HP/7.5kW 3-phase 460V AC drive

| | |
|---|---|
| AC Drive Model → | MODEL : VFD075F43A-G |
| Input Spec. → | INPUT : 3PH 380-480V 50/60Hz 19.0A |
| Output Spec. → | OUTPUT : 3PH 0-480V 18A 14KVA 10HP |
| Output Frequency Range → | Frequency Range : 0.1-120.00Hz |
| Enclosure type → | Enclosure: TYPE 1 |
| Serial Number & Bar Code → | 075F43A4T5200001 |
| | DELTA ELECTRONICS INC.    MADE IN XXXXX |

## 1.2 Model Explanation

VFD 075 F 43 A-G

- VFD-G series
- Version Type
- Input Voltage
  43:Three phase 460V
- Series Name
- Applicable motor capacity

055: 7.5HP(5.5kW)      185: 25 HP(18.5kW)      450: 60HP(45kW)
075: 10 HP(7.5kW)      220: 30 HP(22kW)       550: 75HP(55kW)
110: 15 HP(11kW)       300: 40HP(30kW)        750: 100HP(75kW)
150: 20HP(15kW)        370: 50HP(37kW)

## 1.3 Serial Number Explanation

075F43A4 T 5 22 0001

Production number

Production week

Production year 2005

T: Taoyuan  S:Shanghai  W: Wujuang
Production factory

460V 3-PHASE 10HP(7.5kW) — Production model

If there is any nameplate information not corresponding to your purchase order or any problem, please contact your distributor.

# 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.

**Ambient Conditions:**

Operation
Air Temperature: -10$^o$C to +40$^o$C (14$^o$F to 104$^o$F)
+50$^o$C (122$^o$F) without dust cover.
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$^o$C to +65$^o$C (-4$^o$F to 149$^o$F)
Relative Humidity: Less than 90%, no condensation allowed
Atmosphere pressure: 86 to 106 kPa

Transportation
Temperature: -20$^o$C to +60$^o$C (-4$^o$F to 140$^o$F)
Relative Humidity: Less than 90%, no condensation allowed
Atmosphere pressure: 86 to 106 kPa
Vibration: Maximum 9.86 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.

## 2.2 Installation

| ⚠ CAUTION |
|---|
| **The control, power supply and motor leads must be laid separately. They must not be fed through the same cable conduit / trunking.** |
| **High voltage insulation test equipment must not be used on cables connected to the drive.** |
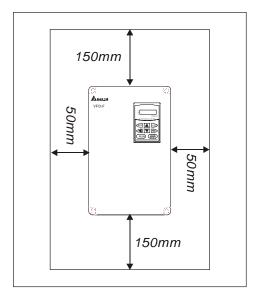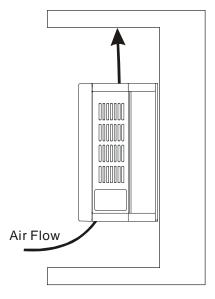
Improper installation of the AC drive will greatly reduce its life. Be sure to observe the following precautions when selecting a mounting location.

*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.

# CHAPTER 3   WIRING

**3**

*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.*
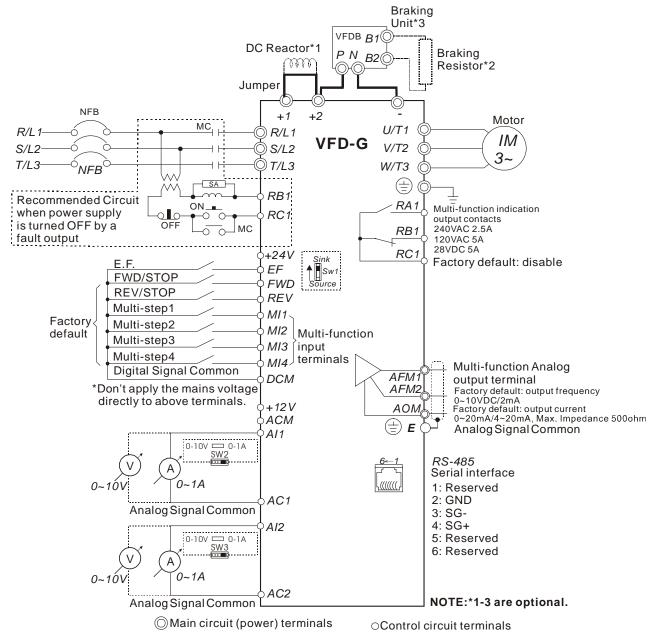
**Short Circuit Withstand:**

The rated voltage must be equal to or less than 480V and the current must be equal to or less than 5000A RMS. (the model of 51HP and above is 10000A RMS)
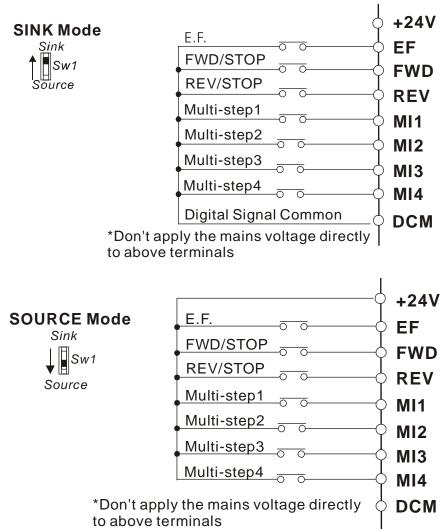
## 3.1 Basic Wiring Diagram

Users must connect wires according to the following circuit diagram shown below. Do not plug a Modem or telephone line to the RS-485 communication port, permanent damage may result. Pins 1 & 2 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

## Wiring for SINK mode and SOURCE mode

### SINK Mode

Sink
Sw1
Source

| | | |
|---|---|---|
| | | +24V |
| E.F. | | EF |
| FWD/STOP | | FWD |
| REV/STOP | | REV |
| Multi-step1 | | MI1 |
| Multi-step2 | | MI2 |
| Multi-step3 | | MI3 |
| Multi-step4 | | MI4 |
| Digital Signal Common | | DCM |

*Don't apply the mains voltage directly to above terminals

### SOURCE Mode

Sink
Sw1
Source

| | | |
|---|---|---|
| | | +24V |
| E.F. | | EF |
| FWD/STOP | | FWD |
| REV/STOP | | REV |
| Multi-step1 | | MI1 |
| Multi-step2 | | MI2 |
| Multi-step3 | | MI3 |
| Multi-step4 | | MI4 |
| | | DCM |

*Don't apply the mains voltage directly to above terminals

## 3.2 Terminal Explanations

| Terminal Symbol | Explanation of Terminal Function |
|---|---|
| R/L1, S/L2, T/L3 | AC line input terminals |
| U/T1, V/T2, W/T3 | AC drive output terminals motor connections |
| +1, +2 | Connections for DC Link Reactor (optional) |
| +2/B1~B2 | Connections for Braking Resistor (optional) |
| +2~ -, +2/B1~ - | Connections for External Braking Unit (VFDB series) |
| ⏚ | Earth Ground |

## 3.3 Control Terminal Explanations
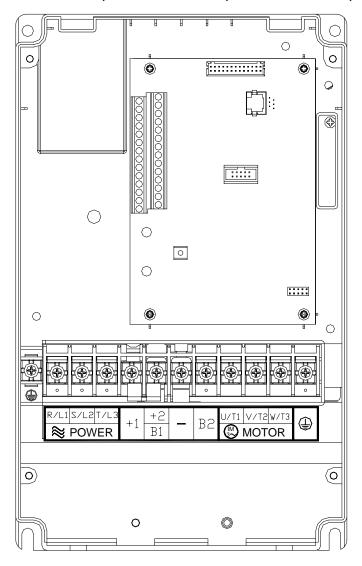
| Terminal Symbols | Terminal Functions | Factory Settings |
|---|---|---|
| FWD | Forward-Stop command | |
| REV | Reverse- Stop command | |
| EF | External fault | |
| MI1 | Multi-function Input 1 | Factory default: Multi-step speed command 1 |
| MI2 | Multi-function Input 2 | Factory default: Multi-step speed command 2 |
| MI3 | Multi-function Input 3 | Factory default: Multi-step speed command 3 |
| MI4 | Multi-function Input 4 | Factory default: Multi-step speed command 4 |
| +24V | DC Voltage Source | (+24V, 20mA), used for source mode. |
| DCM | Digital Signal Common | Used as common for digital inputs and used for sink mode. |
| AFM 1 | Analog frequency /current meter 1 | 0 to 10V correspond to Max. operation frequency |
| AFM 2 | Analog frequency /current meter 2 | 4 to 20mA correspond to 2 times of output current |
| AOM | Analog control signal (common) | |
| RA 1 | Multi-function Relay1 output (N.O.) a | 1.5A(N.O.)/1A(N.C.) 240VAC 1.5A(N.O.)/1A(N.C.) 24VDC Refer to Pr.03-00 to Pr.03-01 |
| RB 1 | Multi-function Relay1 output (N.C.) b | |
| RC 1 | Multi-function Relay1 common | |
| +12V/ACM | Potentiometer power source | +12V 20mA |
| AI1 | Analog voltage Input | 0 to +10V / 0 to 1A correspond to Max. operation frequency |
| AI2 | Analog current Input | 0 to +10V / 0 to 1A correspond to Max. operation frequency |
| AC1/AC2 | Analog control signal common | |

\* Control signal wiring size: 18 AWG (0.75 mm$^2$).

## 3.4 Main Circuit Wiring

### 7.5 HP to 20 HP (VFD055F43B-G, VFD075F43B-G, VFD110F43A-G, VFD150F43A-G)



Control Terminal

Torque: 4Kgf-cm (3 in-lbf)

Wire: 12-24 AWG

Power Terminal

Torque: 30Kgf-cm (26 in-lbf)

Wire: 12-8 AWG

Wire Type: Stranded copper only, 75° C
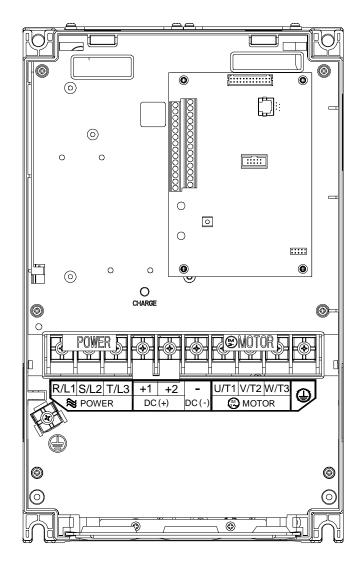
NOTE: If wiring of the terminal utilizes the wire with a 6AWG-diameter, it is thus necessary to use the Recognized Ring Terminal to conduct a proper wiring.

## 25 HP to 40 HP (VFD185F43A-G, VFD220F43A-G, VFD300F43A-G)



| R/L1 | S/L2 | T/L3 | +1 | +2 | - | U/T1 | V/T2 | W/T3 | |
|------|------|------|----|----|---|------|------|------|---|
| ≋ POWER | | | DC (+) | | DC (-) | Ⓜ MOTOR | | | ⏚ |

Control Terminal

Torque: 4Kgf-cm (3 in-lbf)

Wire: 12-24 AWG

Power Terminal

Torque: 30Kgf-cm (26 in-lbf)

Wire: 8-2 AWG

Wire Type: Stranded copper only, 75° C

NOTE: If wiring of the terminal utilizes the wire with a 1AWG-diameter, it is thus necessary to use the Recognized Ring Terminal to conduct a proper wiring.

**50 HP to 60 HP (VFD370F43A-G, VFD450F43A-G)**



Control Terminal
Torque: 4Kgf-cm (3 in-lbf)
Wire: 12-24 AWG
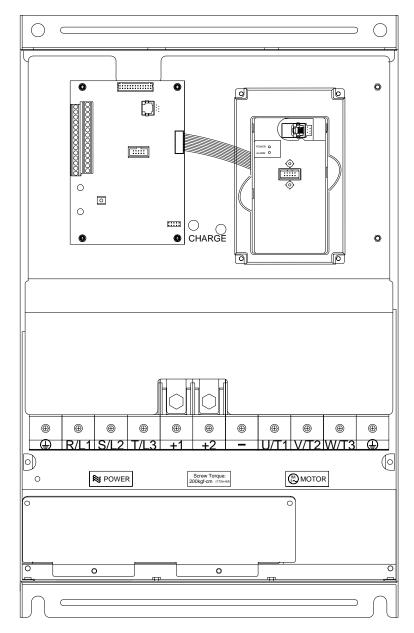
Power Terminal
Torque: 57kgf-cm (49.5 in-lbf)    min.
Wire Gauge: VFD370F43A-G: 3AWG
        VFD450F43A-G: 2AWG
Wire Type: Stranded copper only, 75° C

## 75 HP to 100 HP   (VFD550F43A-G, VFD750F43A-G)



Control Terminal

Torque: 4Kgf-cm (3 in-lbf)

Wire: 12-24 AWG

Power Terminal

Torque: 200kgf-cm (173 in-lbf)

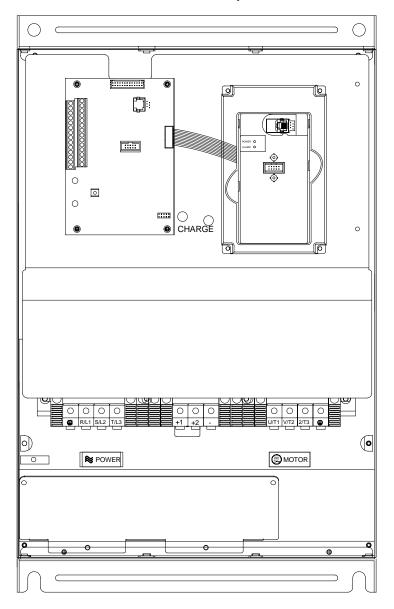Wire Gauge: VFD550F43A-G: 1/0-4/0 AWG
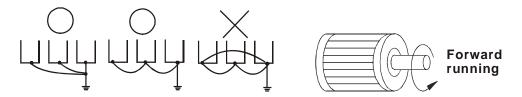
VFD750F43A-G: 3/0-4/0 AWG

Wire Type: Stranded copper only, 75°C

## 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. (Ground resistance should not exceed 0.1 Ω.)

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

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



Forward running

8. When the AC drive output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3, 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.

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°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.
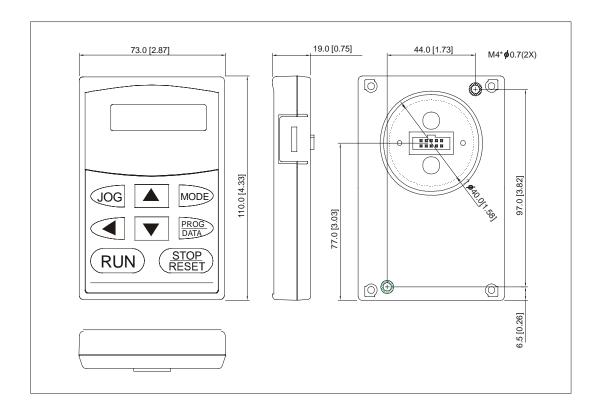
# CHAPTER 4   DIGITAL KEYPAD OPERATION

This chapter describes the various controls and indicators found on the digital keypad/display PU01. The information in this chapter should be read and understood before performing the start–up procedures described in the chapter of parameter settings.
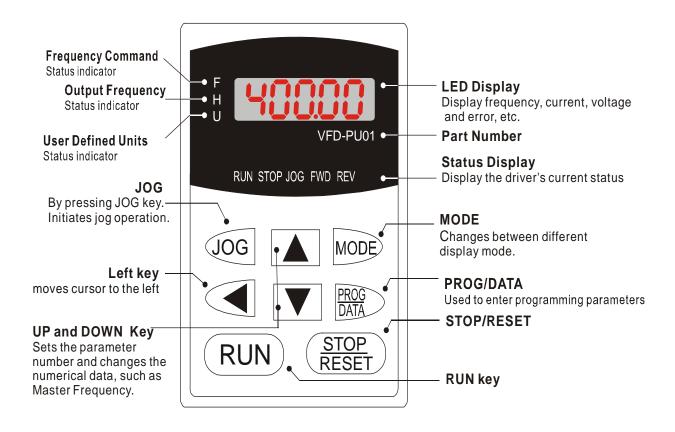
   ✧ Description of the Keypad

   ✧ Description of Display

   ✧ Keypad Operation Modes & Programming Steps

**4**

**VFD-PU01 Dimensions:   mm (inch)**

# 4.1 Description of the Digital Keypad VFD-PU01



Frequency Command
Status indicator

Output Frequency
Status indicator

User Defined Units
Status indicator

**JOG**
By pressing JOG key.
Initiates jog operation.

**Left key**
moves cursor to the left

**UP and DOWN Key**
Sets the parameter number and changes the numerical data, such as Master Frequency.

**LED Display**
Display frequency, current, voltage and error, etc.

**Part Number**

**Status Display**
Display the driver's current status

**MODE**
Changes between different display mode.

**PROG/DATA**
Used to enter programming parameters

**STOP/RESET**

**RUN key**

| Display Message | Descriptions |
|---|---|
| F 60.00 | Display the AC drive Master Frequency. |
| H 50.00 | Display the actual operation frequency present at terminals U/T1, V/T2, and W/T3. |
| U 1800.0 | Display voltage (V), Current (A), power factor and feedback signal (P) |

| Display Message | Descriptions |
|---|---|
| **A 5.0** | Display the output current present at terminals U/T1, V/T2, and W/T3. |
| **-Frd-** | Display the AC drive forward run status. |
| **-rEu-** | The AC drive reverse run status. |
| **06-00** | Display the specified parameter setting. |
| **10** | Display the actual value stored within the specified parameter. |
| **E.F.** | External Fault. |
| **-End-** | Display "End" 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 ▲ or ▼ keys. |
| **-Err-** | Display "Err", if the input is invalid. |
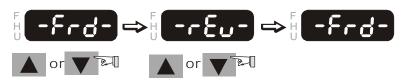
## 4.2 Operation steps of the Digital Keypad VFD-PU01

Selecting mode

**START**

F H U [60.00] $\Rightarrow$ F H U [0.00] $\Rightarrow$ F H U [60.00] $\Rightarrow$ F H U [A 0.0] $\Rightarrow$ F H U [-Frd-]

MODE  MODE  MODE  MODE  MODE

**GO START**

Note：In the selection mode, press PROG DATA to set the parameters.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Setting parameters

F H U [01-] $\Rightarrow$ F H U [01-02] $\Rightarrow$ F H U [400.0]

$\Rightarrow$ F H U [-End-]

Success to set parameter.

$\Rightarrow$ F H U [-Err-]

Input data error

PROG DATA  PROG DATA  PROG DATA

MODE  move to previous display

NOTE：In the parameter setting mode, you can press MODE to return the selecting mode.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

To shift data

**START**

F H U [60.00] $\Rightarrow$ F H U [60.00] $\Rightarrow$ F H U [60.00] $\Rightarrow$ F H U [60.00] $\Rightarrow$ F H U [60.00]

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

To modify data

**START**

F H U [60.00] $\Rightarrow$ F H U [59.99] $\Rightarrow$ F H U [60.00]

▼  ▲

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

Setting direction

F H U [-Frd-] $\Rightarrow$ F H U [-rEu-] $\Rightarrow$ F H U [-Frd-]

▲ or ▼  ▲ or ▼

# CHAPTER 5  DESCRIPTION OF PARAMETER SETTINGS

✗ : This parameter can be set during operation.

## *5.1 Group 0: AC Drive Status Parameters*

📖 Group 0 is read-only.

| **00 - 00** Software Version | Factory setting:  Read Only |

📖  This parameter displays the software version of AC drive.

| **00 - 01** AC Drive Status Indication 1 | Factory setting:  Read Only |

📖  This parameter displays the AC drive status.

| Code | AC Drive Status | Explanation |
|------|-----------------|-------------|
| 00 | No fault occurred | |
| 01 | oc | over current |
| 02 | ov | over voltage |
| 03 | oH | over temperature |
| 04 | oL | overload |
| 05 | oL1 | electronic thermal relay |
| 06 | EF (external fault) | EF-DCM is closed |
| 07 | occ (AC drive IGBT fault ) | IGBT short circuit protection |
| 08 | CF3 (CPU failure) | Abnormal A/D reading during self-check |
| 09 | HPF (hardware protection failure) | Hardware protection function activated during self-check. |
| 10 | ocA (over current during acceleration) | Output current exceeds protection level during acceleration |
| 11 | ocd (over current during deceleration) | Output current exceeds protection level during deceleration |
| 12 | Ocn (over current during steady state) | Output current exceeds protection level during steady state operation. |
| 13 | GFF (ground fault) | Ground fault protection feature activated |
| 14 | Lv (under voltage) | Low input voltage |
| 15 | CF1 | EEPROM input data is abnormal |
| 16 | CF2 | EEPROM output data is abnormal |
| 17 | bb (base block) | BB is set and activated |
| 18 | oL2 (over load 2) | Output current exceeds rated motor current |
| 19 | Reserved | |
| 20 | codE | software or password protection |
| 21 | EF1 (external emergency stop) | EF1 (a multifunction-DCM is enabled) |
| 22 | PHL (phase loss) | Input power lacks phase. 3-phase input power is unbalance and exceeds specification. |
| 23 | Lc (Low Current) | Low current detection during operation. |
| 24 | FbL(Feedback Loss) | Feedback signal is abnormal. |
| 25 | Reserved | |

**00 - 02** AC Drive Status Indication 2                    Factory setting:  Read Only

Display    Bit 0~1: 00: Run LED is off and stop led is on. (AC Drive stopping)
                   01: Run LED is blink and stop led is on. (AC Drive deceleration to stop)
                   10: Run LED is on and stop led is blink. (AC Drive standby)
                   11: Run LED is on and stop led is off. (AC Drive running)
          Bit 2: 1: Jog on.
          Bit 3~4: 00: Rev LED is off and FWD led is on. (Forward)
                   01: Rev LED is blink and FWD led is on. (Reverse to Forward)
                   10: Rev LED is on and FWD led is blink. (Forward to Reverse)
                   11: Rev LED is on and FWD led is off. (Reverse)
          Bit 5-7: Reserved
          Bit 8: Master frequency source via communication interface
          Bit 9: Master frequency source via analog
          Bit10: Running command via communication interface
          Bit11: Parameter locked
          Bit12~15: Reserved

**00 - 03** Frequency Setting (F) or Closed Loop Control Setting Point    Factory setting: Read Only

📖 This parameter displays the frequency command set by the user.

**00 - 04** Output Frequency (H)                          Factory setting: Read Only

📖 This parameter displays actual output frequency of the AC drive.

**00 - 05** Output Current (A)                            Factory setting: Read Only

📖 This parameter displays actual output current of the AC drive.

**00 - 06** DC-BUS Voltage (U)                            Factory setting: Read Only

📖 This parameter displays DC-BUS voltage of the AC drive.

**00 - 07** Output Voltage (E)                            Factory setting: Read Only

📖 This parameter displays output voltage of the AC drive.

**00 - 08** Output Power Factor (n)                       Factory setting: Read Only

📖 This parameter displays output power factor.

**00 - 09** Output Power (kW)                             Factory setting: Read Only

📖 This parameter displays output power of the AC drive.

**00 - 10** Feedback Signal Actual Value                  Factory setting: Read Only

📖 This parameter displays feedback signal value.

**00 - 11** Feedback Signal (%)                           Factory setting: Read Only

📖 This parameter displays feedback signal value(%).

| 00 - 12 | User Target Value (Low bit) uL 0-99.99 | Factory setting: Read Only |

| 00 - 13 | User Target Value (High bit) uH 0-9999 | Factory setting: Read Only |

&#x1F4D6; User Target Value = Actual output frequency (0-04) $\times$ User Defined Multiplier (02-10).

&#x1F4D6; Maximum summed display of both parameters is 999999.99.

&#x1F4D6; When User Target Value <=99.99, 00-12=0.

| 00 - 14 | PLC Time | Factory setting: Read Only |

&#x1F4D6; This parameter displays remaining time of PLC each step.

| 00 - 15 | Output Reactive Power (KVAR) | Factory setting: Read Only |

&#x1F4D6; This parameter displays reactive power of AC drives.

**5**

## 5.2 Group 1: Basic Parameters

**01 - 00** Maximum Output Frequency                       Factory Setting: 60.00

Settings        50.00~160.00Hz

📖 This parameter determines the AC drives maximum output frequency. All master frequency commands set by the keypad or analog inputs are limited by this parameter. The analog commands (ACI1 and ACI2) may be scaled to correspond to the output frequency range. (Please refer to 04-05~04-12.)

**01 - 01** Maximum Voltage Frequency (Base Frequency)        Factory Setting: 60.00

Settings        0.10~160.00 Hz

📖 This parameter sets the frequency, where the maximum output voltage (Pr. 01-02) will be reached. The output frequency may exceed this setting, but the output voltage doesn't increase beyond this point. This parameter should be set according to the rated frequency of the motor as indicated on the motor nameplate.

📖 If this parameter setting is smaller than the rated frequency of the motor, nuisance over current faults or damage to the AC drive may occur.

📖 If this parameter setting is greater than the rated frequency of the motor, the motor will encounter torque loss.

**01 - 02** Maximum Output Voltage                         Factory Setting: 440.0

Settings        0.2V ~ 510.0V

📖 This parameter determines the Maximum Output Voltage of the AC drive. This parameter setting should be set according to rated voltage of the motor as indicated on the motor nameplate. If rated voltage of the motor is 440V, this parameter must be set to 440V. If rated voltage of the motor is 380V, this parameter must be set to 380V.

📖 If this setting is greater than the rated voltage of the motor, nuisance over current faults or damage to the AC drive may occur.

**01 - 03** Mid-point Frequency                           Factory Setting: 3.00

Settings        0.10~160.00 Hz

📖 This parameter sets the Mid-point Frequency of the V/F curve.

📖 This parameter must meet the following argument. Pr.1-01 >= Pr.1-03 >= Pr.1-05.

**01 - 04** Mid-point Voltage                             Factory Setting: 11.0

Settings        0.2V~510.0V

📖 This parameter sets the Mid-point Voltage of the V/F curve.

📖 This parameter must meet the following argument.  Pr.1-02 >= Pr.1-04 >= Pr.1-06.

| 01 - 05 | Minimum Output Frequency | Factory Setting: 3.00 |

Settings        0.10~20.00 Hz

📖 This parameter sets the Minimum Output Frequency of the AC drive.  This parameter must be lower than or equal to the Mid-point frequency

| 01 - 06 | Minimum Output Voltage | Factory Setting: 11.0 |

Settings        0.2V~100.0V

📖 This parameter sets the Minimum Output Voltage of the AC Drive. The parameter must be lower than or equal to the Mid-point Voltage.

| 01 - 07 | Upper Bound Frequency | Factory Setting: 60.00 |

Settings        0.00~160.00 Hz

📖 This parameter will limit the maximum output frequency of AC drive. If slip compensation (Pr.07-02~07-05) or feedback control (Pr.10-00~10-09) are enabled, the output frequency of AC drive may exceed the Master Frequency Command, but it will continue to be limited by this parameter setting.
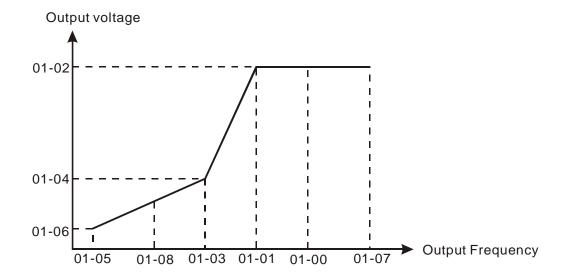
| 01 - 08 | Lower Bound Frequency | Factory Setting: 0.00 |

Settings        0.00~160.00 Hz

📖 This parameter will limit the minimum output frequency.   Any Master Frequency Command below Pr.1-08, will result in an output equal to Pr.1-08.

📖 Upon a start command, the drive will accelerate from Pr.1-05 Minimum Output Frequency to the Master Frequency Command point.

| 01 - 09 | Acceleration Time 1 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 10 | Deceleration Time 1 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 11 | Acceleration Time 2 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 12 | Deceleration Time 2 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 13 | Acceleration Time 3 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 14 | Deceleration Time 3 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 15 | Acceleration Time 4 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 16 | Deceleration Time 4 | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 17 | JOG Acceleration Time | ✏ | Factory Setting: 10.0/60.0 |
| 01 - 18 | JOG Deceleration Time | ✏ | Factory Setting: 10.0/60.0 |

Settings        0.1~3600.0 Sec                                    Unit: 0.1sec

📖 Factory setting for 30HP and higher models is 60.0 seconds.

📖 Acceleration time is the time required for the AC drive to ramp from 0 Hz to its Maximum Output Frequency (Pr.1-00). Deceleration time is the time required for the AC drive to decelerate from Maximum Output Frequency (Pr.1-00) down to 0 Hz.

📖 An Acceleration or Deceleration time that is too quickly, may cause the AC drives protection features to enable (over-current stall prevention during Accel 06-01 or over-voltage stall prevention 06-00). If this occurs, the actual Accel/Decel time will be longer than this setting.

📖 Warning:  An acceleration or deceleration that is too quickly, may cause excess loads on the AC drive and may permanently damage the drive.

📖 If you want to decelerate the AC drive in short time period, we recommend adding an external braking module and braking resistor.

📖 You can set 1st to 4th Accel/Decel time via multi-function input terminals 04-00 to 04-03.

| 01 - 19 | JOG Frequency | ✏ | Factory Setting: 6.00 |

Settings        0.0 Hz~160.00 Hz                                    Unit: 0.1sec

📖 When the JOG function is to be utilized, users need to use the multi-function input terminals (Pr. 04-00 to 04-03 set to 07) or the JOG key on keypad. Once a JOG command is initiated, the AC drive will accelerate from the Minimum Output Frequency (Pr.01-05) to the JOG frequency (Pr.01-19).

📖 The accel/decel time of the JOG operation is determined by the JOG accel/decel speed (Pr.01-17 and 01-18).

📖 When the drive is in operation, the JOG command is disabled.

| 01 - 20 | S Curve Delay Time in Accel | Factory Setting: 0.00 |
|---|---|---|
| 01 - 21 | S Curve Delay Time in Decel | |

Settings     0.00~2.50sec

&#x1F4D6; These parameters enable the S curve. The longer the S curve time period the smoother the transition between speeds.

| 01 - 22 | Modulation Index | ✗ | Factory Setting: 1.00 |
|---|---|---|---|

Settings     0.90~1.20         Unit: 0.1

&#x1F4D6; This parameter sets the ratio of the Maximum Output Voltage to the input voltage.

&#x1F4D6; The Maximum Output Voltage (Pr.01-02) is normally limited to the input voltage. With the Modulation Index parameter, the user is able to increase the output voltage beyond the incoming line voltage.

&#x1F4D6; A Modulation Index of 1, defines the Maximum Output Voltage (Pr. 1-02) is equal to the input voltage.

&#x1F4D6; A Modulation index of 1.2, defines the Maximum Output Voltage (Pr. 1-02) is 20% higher than in the input voltage. Please note, the output voltage wave form will be distorted due to harmonics and may increase torque ripple and noise in the motor.

| 01 - 23 | Accel/Decel Time Unit | Factory Setting: 01 |
|---|---|---|

Settings     00: Unit is 1 Sec
                     01: Unit is 0.1 Sec
                     02: Unit is 0.01 Sec

&#x1F4D6; This parameter sets the resolution of accel/decel time (Pr.01-09 to 01-18).

&#x1F4D6; A high resolution decreases the accel/decel time range as shown in the following chart.

| 01-23 | Accel/Decel time unit | Accel/Decel time range |
|---|---|---|
| 00 | 1 Sec | 1~36000 Sec |
| 01 | 0.1 Sec | 0.1~3600.0 Sec |
| 02 | 0.01 Sec | 0.01~360.00 Sec |

## 5.3 Group 2: Operation Method Parameters

| **02 - 00** | Source of Frequency Command | ✗ | Factory Setting: 00 |

Settings      00: via keypad
01: via analog input AI1 (10bit)
02: via analog input AI2 (10bit)
03: via RS485 serial communication (RJ-11)
04: via External Reference

Settings:

00: Frequency command source is the keypad. User may use UP/DOWN keys to adjust the frequency command.  Also if the Multi-Function Input terminals (Pr.04-00 to 04-03) are set to 13 or 14, their function will be the same as the UP/DOWN keys.

01: Frequency command source is the analog input terminal AI1.

02: Frequency command source is the analog input terminal AI2.

03: Frequency command source is the RS485 serial communication.

04: Frequency command source depends on the setting of Pr. 04-20.

| **02 - 01** | Source of Operation Command | ✗ | Factory Setting: 00 |

Settings      00: Controlled by the digital keypad
01: Controlled by the external terminals, keypad STOP enabled.
02: Controlled by the external terminals, keypad STOP disabled.
03: Controlled by the RS-485 communication interface, keypad STOP enabled.
04: Controlled by the RS-485 communication interface, keypad STOP disabled.
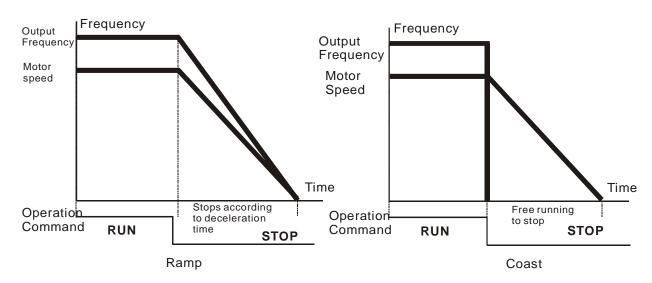
📖 This parameter sets the operation command source of the AC drive.

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

Settings      00:Stop = ramp to stop, E.F. (External Fault) = coast to stop
01:Stop = coast to stop, E.F. = coast to stop
02:Stop = ramp to stop, E.F. = ramp to stop
03:Stop = coast to stop, E.F. = ramp to stop

📖 Ramp: The AC drive decelerates the motor to minimum output frequency according to the deceleration time setting.

📖 Coast: The AC drive output instantly stops upon command and the motor free spins until it comes to a complete stop.

📖 External Fault may be enabled by the EF terminal or a Multi-Function terminal. Please refer to Pr.04-00 to 04-03.

Ramp

Coast

**5**

| **02 - 03** | PWM Carrier Frequency Selections | ✗ | Factory Setting: Depend on model type |
|---|---|---|---|

Settings     1K~6KHz

&#x1F4D6; This parameter sets the carrier frequency of PWM output. The factory setting and setting range depend on the model type.

&#x1F4D6; When the temperature of the heat sink is greater than its limit, the AC drive will automatic lower the carrier frequency to avoid over heating the AC drive.

&#x1F4D6; The Carrier frequency of the PWM output has a signification influence on the electromagnetic noise, heat dissipation of the AC drive, and the acoustic noise to the motor as shown in the following chart.

| Carrier Frequency | Acoustic Noise | Electromagnetic Noise | Leakage Current | Heat Dissipation |
|---|---|---|---|---|
| Signification ↓ Minimal | Minimal ↓ Signification | Signification ↓ Minimal | Signification ↓ Minimal | Signification ↓ Minimal |

&#x1F4D6; When the carrier frequency is low, current ripple of the AC drive is large. This may result in a current display value greater than the actual value.

| **02 - 04** | Forward/Reverse Enabled | Factory Setting: 00 |
|---|---|---|

Settings     00: Forward/Reverse enabled
                 01: Reverse disabled
                 02: Forward disabled

&#x1F4D6; This parameter enables the direction of the AC drive.

*VFD-G Series*

| **02 - 05** | 2-wire/3-wire Operation Control Modes | | Factory Setting: 00 |

Settings　　00: 2-wire (#1), FWD / STOP, REV / STOP
01: 2-wire (#2), RUN/STOP, FWD/REV
02: 3-wire operation

&#x1F4D6; This parameter sets the operation mode when operating by external terminals.

&#x1F4D6; Please refer to 02-01.

| 02-05 | External Terminal |
|---|---|
| 00  (2-wire #1)<br>FWD / STOP<br>REV / STOP | FWD/STOP ──o o── FWD:("OPEN":STOP) ("CLOSE":FWD)<br>REV/STOP ──o o── REV: ("OPEN":STOP) ("CLOSE":REV)<br>DCM　　VFD-G |
| 01 (2-wire #2)<br>REV / FWD<br>RUN / STOP | RUN/STOP ──o o── FWD:("OPEN":STOP) ("CLOSE":RUN)<br>FWD/REV ──o o── REV :("OPEN":FWD) ("CLOSE":REV)<br>DCM　　VFD-G |
| 02 3-wire | STOP ──o│o── o o──RUN FWD ("CLOSE":RUN)<br>EF  ("OPEN":STOP)<br>──o o── REV ("OPEN":FWD)<br>FWD/REV ("CLOSE":REV)<br>DCM　　VFD-G |

| **02 - 06** | Line Start Lockout | | Factory Setting: 01 |

Settings　　00: Disabled
01: Enabled

&#x1F4D6; When enabled, the AC drive will not start when powered up with a run command applied. The AC drive must see the run command transition from stop to run after power up. When Line Start Lockout is disabled (also known as Auto-Start), the AC drive will start when powered-up with run commands applied.

| **02 - 07** | Reserved |

| **02 - 08** | Start-up Display Selection | &#x2197; | Factory Setting: 00 |

Settings　　Bit0~1: 00 = F LED
01 = H LED
10 = U LED (special display)
11 = Fwd / Rev
Bit2: 0 = Fwd LED / 1 = Rev LED
Bit3~5: 000 = 1st 7-step
001 = 2nd 7-step
010 = 3rd 7-step
011 = 4th 7-step
100 = 5th 7-step
Bit6~7: Reserved

  This parameter determines the display on keypad after each power up.

  To program this parameter the user must first generate a Hex value with the information above. Then using the Hex to Decimal conversion to find the corresponding Decimal value and enter it into this parameter.

  For example, a setting of 21 (decimal 21= hex 010101) will display the "H" and "REV" LEDs and the cursor will stay at the 3rd 7-step display upon power up.

  When setting to U LED, please refer to 02-09.

| 02 - 09 | Special Display | ✔ | Factory Setting: 00 |
|---|---|---|---|

  Settings     00: A displays output current of AC drive
          01: U displays DC-Bus voltage of AC drive
          02: E displays RMS of output voltage
          03: P displays feedback signal
          04: PLC display auto procedure state

  This parameter chooses the display on the keypad immediately following the "U" user defined setting.

  "MODE" key will scroll from "F", "H", "U", (Pr. 02-09), FWD, and back to "F".

  Users may also use the "LEFT" key on the digital keypad to switch display content.

| 02 - 10 | User Defined Coefficient | ✔ | Factory Setting: 1.00 |
|---|---|---|---|

  Settings     0.01~160.00          Unit: 0.01

  When this parameter is set, the "H "display value = actual output frequency of AC drive x 02-10.

  If output frequency of AC drive is 90Hz, set 02-10 to 2.5. When H LED lights, the value on the display is 225.00.

| 02 - 11 | Flying Start | ✔ | Factory Setting: 00 |
|---|---|---|---|

  Settings    00: Disabled
        01: Enabled (DC braking disabled)

  When the AC drive starts into a running motor (Flying Start), it may cause an over current on the drive and may damage the motor. Using speed search upon start-up will allow the drive to slowly find the motor speed, smoothly take control of the motor, and bring it to command speed.

  If the Flying Start feature is enabled upon start-up, the DC braking 08-01 will be disabled.

| 02 - 12 | Flying Start Frequency | ✗ | Factory Setting: 00 |
|---------|------------------------|---|---------------------|

Settings      00: Begin search from Master Frequency Command
                      01: Begin search from Maximum Frequency (Pr.01-00)

| 02 - 13 | Master Frequency Memory Setting | ✗ | Factory Setting: 01 |
|---------|--------------------------------|---|---------------------|

Settings      00: Do not remember the last known frequency
                      01: Remember the last known frequency

📖 If this parameter is set to 00: The AC drive will not store the last known master frequency command, after power is removed.

📖 If this parameter is set to 01: The AC drive will memorize the last known master frequency command after power off. Upon power up the last known frequency is displayed.

📖 After a fault, the AC drive will always remember the last know master frequency command.

📖 This feature is only enabled when Pr. 02-00 is set for 0 or 4.

## 5.4 Group 3: Output Function Parameters

| **03 - 00** | Multi-function Output terminal 1 (Relay) | Factory Setting: 01 |

Settings      00-21

| Setting | Functions | Descriptions |
|---------|-----------|--------------|
| 00 | Disabled | |
| 01 | Indication during operation | The corresponding output will be closed during operation (including DC braking time). |
| 02 | Master frequency attained | The corresponding output will be closed when output frequency reaches master frequency command. |
| 03 | Zero Speed (including shutdown) | The corresponding output will be closed when the AC drive has no output voltage signal. |
| 04 | Over-torque | The corresponding output relay will be closed when the AC drives output current exceeds the over-torque detection level 06-04. |
| 05 | External Fault | The corresponding output will be closed when the EF is enabled.  (Pr. 04-00 to 04-03) |
| 06 | Low voltage detection | The corresponding output will be closed when the DC Bus voltage drops below our threshold. The keypad will display "Lu". |
| 07 | Operation Mode indication | The corresponding output will be closed when the AC drives "Operation Command" is controlled by the external terminals. |
| 08 | Fault Indication | The corresponding output will be closed when AC drive has experienced a fault. |
| 09 | Master Frequency Attained 1 | The corresponding output will be closed when the AC drives output frequency exceeds (Pr.03-08) Master Frequency Attained 1. |
| 10 | Master Frequency Attained 2 | The corresponding output will be closed when the AC drives output frequency exceeds (Pr.03-09) Master Frequency Attained 2. |
| 11 | Over Temperature indication | The corresponding output will be closed when the AC drive temperature exceeds its rating. |
| 12 | Drive Ready | The corresponding output will be closed the when the AC drive is ready and has no faults. |
| 13 | External Emergency Stop (EF1) | The corresponding output will be closed when multi-function input terminals (Pr.04-00 to 04-03) are set to emergency stop and then activated. |
| 14 | Software braking output | The corresponding output will be closed when the AC drives DC bus voltage exceeds (Pr.08-19) the braking level. |
| 15 | OL or OL1 overload warning | The corresponding output will be closed upon an overload (OL or OL1) fault. |

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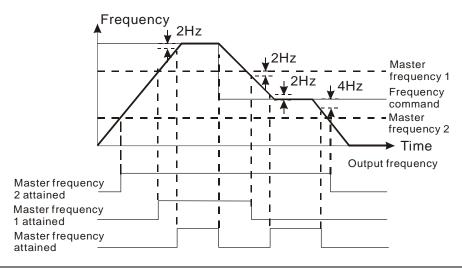
| Setting | Functions | Descriptions |
|---------|-----------|--------------|
| 16 | Low current indication | The corresponding output will be closed when the AC drives output current is lower than the Low Current setting (Pr.06-08). |
| 17 | PID feedback error indication | The corresponding output will be closed when the PID feedback signal has an error. |
| 18 | Auto Running Command | The Output will be closed when PLC Program is running. |
| 19 | 1-Step Running Completed | The Output will be closed for 0.5 sec when each multi-step speed is attained. |
| 20 | Auto Running Completed | The output will be closed for 0.5 sec when the PLC program cycle has completed |
| 21 | Auto Running Paused | The output will be closed when PLC operation is paused. |

&#x1F4D5; Standard relay specifications = 10A/250VAC or 12A/24VDC.

&#x1F4D5; Relay delay time is 5~10 msec.

**03 - 01** Reserved

**03 - 02** Master Frequency Attained 1            Factory Setting: 0.00

**03 - 03** Master Frequency Attained 2

    Settings      0.00~160.00 Hz            Unit: 0.01

&#x1F4D5; An output relay may be programmed to activate when the output frequency exceeds the desired attained frequency setting of these two parameters.

&#x1F4D5; There is a $\pm$2Hz window of operation. If the master frequency attained is 20Hz and the output frequency exceeds 20Hz, the corresponding output relay will be "closed". When the output frequency is less than 18Hz, the corresponding output relay will be "opened" as the following diagram shows.

| 03 - 04 | DC Fan Control | Factory Setting: 00 |

Settings      00: Fan runs on power up.
01: Fan begins upon a RUN command. Fan stops 1 minute after a STOP command.
02: Fan begins upon a RUN command.  Fan stops after a STOP command
03: Fan is controlled by temperature. Fan will be started at approximate 60°C.

&#x1F4D6; This parameter determines DC fan control method.

| 03 - 05 | Analog Output 1, (AFM1)  0~10Vdc | Factory Setting: 00 |
| 03 - 06 | Analog Output 2, (AFM2)  0/4~ 20mA | Factory Setting: 01 |

Settings      00: Output frequency
01: Output current
02: Output voltage
03: Frequency command
04: Power factor loading

&#x1F4D6; These parameters select the content of the analog output signals AFM1 and AFM2.

&#x1F4D6; Setting 00: 0-10V = 0 - (Pr.01-00)

&#x1F4D6; Setting 01: 0-10V = 0 - (Double rated current)

&#x1F4D6; Setting 02: 0-10V = 0 - (Pr.01-02)

&#x1F4D6; Setting 03: 0-10V = 0 - Master Freq. command

&#x1F4D6; Setting 04: 0-10V = 0.0 - output power factor 1.0

&#x1F4D6; When using 0-20mA output, please refer to Pr. 3-14.

&#x1F4D6; Maximum impedance loading of analog output 2 (AFM2) can't be greater than 500 ohms.

| 03 - 07 | Analog Output Gain 1 | &#x2717; | Factory Setting: 100 |
| 03 - 08 | Analog Output Gain 2 | | Factory Setting: 100 |

Settings      01~200%

&#x1F4D6; These parameters are to determine analog output gain.

&#x1F4D6; The analog output is limited to 10V and 20mA.  The gain is designed to offer a normally small output signal to be enlarged for easier viewing on a meter.

| 03 - 09 | Analog Output 2 Selection | Factory Setting:  01 |

Settings      00: 0~20mA
01: 4~20mA

&#x1F4D6; This parameter selects the output range of Analog Output 2 (AFM2).

## 5.5 Group 4: Input Function Parameters

| 04 - 00 | Multi-function Input terminal 1 | Factory Setting: 01 |
|---|---|---|
| 04 - 01 | Multi-function Input terminal 2 | Factory Setting: 02 |
| 04 - 02 | Multi-function Input terminal 3 | Factory Setting: 03 |
| 04 - 03 | Multi-function Input terminal 4 | Factory Setting: 04 |

Settings        00~31

| Setting | Functions | Descriptions |
|---|---|---|
| 00 | Disabled | All unused terminals should be set to 00, to assure they have no effect on drive operation. |
| 01 | Multi-Speed terminal 1 | Allows selection of the 15 multi-step speeds. Please refer to 05-00 to 05-14 to program the 15 step speeds. |
| 02 | Multi-Speed terminal 2 | |
| 03 | Multi-Speed terminal 3 | |
| 04 | Multi-Speed terminal 4 | |
| 05 | Reset (NO) | Clears (Reset) a fault and returns the AC drive to normal operation. |
| 06 | Reset (NC) | |
| 07 | Jog operation (JOG) | Enables the JOG command. Works identical to the JOG key on the digital keypad. |
| 08 | Accel/Decel disable | Stops the acceleration or deceleration of the AC drive. AC drive then maintains a constant speed. |
| 09 | 1st and 2nd Accel/Decel selection | A corresponding terminal set to value 09 and closed selects Accel/Decel time 2. A corresponding terminal set to value 10 and closed selects Accel/Decel time 3. Accel/Decel time 4 is selected when both terminals are closed. |
| 10 | 3rd and 4th Accel/Decel selection | |
| 11 | B.B. (NO) input | Enables the base block (pause) function. Please refer to Pr.08-08, for base block functions. |
| 12 | B.B. (NC) input | |
| 13 | Increase Frequency | Enables the external terminals to increase or decrease the Master Frequency command each time an input is received. Terminals are not active during a stop command. |
| 14 | Decrease Frequency | |
| 15 | Emergency stop (NO) | Generates an external fault (EF1). The function is identical to the external terminal (EF). |
| 16 | Emergency stop (NC) | |
| 17 | KEYPAD(open), EXT(close) | External selection of the Operation Command Source. (Keypad = terminal open) or (External terminals = terminal closed). This setting is valid when Pr.02-01 is set to 00. Otherwise, the Operation Command Source will follow the setting in Pr.02-01. |

| Setting | Functions | Descriptions |
|---------|-----------|--------------|
| 18 | PID disabled | Disable PID feedback control and operate via Master Frequency Command source Pr.02-00. |
| 19 | Run PLC Program | Parameter value 32 programs Multi-Function Input Terminal to enable the AC drive internal PLC program. Parameter value 33 programs an input terminal to pause the PLC program. Note: Pr.05-00 to Pr.05-16 defines the PLC program. |
| 20 | Pause PLC Program | |
| 21 | 1st Output Frequency Gain (Pr.04-30) | Output frequency multiplies a gain (Pr.04-30)，H=F*(Pr.04-30) |
| 22 | 2nd Output Frequency Gain (Pr.04-31) | Output frequency multiplies a gain (Pr.04-31)，H=F*(Pr.04-31) |
| 23 | 3rd Output Frequency Gain (Pr.04-32) | Output frequency multiplies a gain (Pr.04-32)，H=F*(Pr.04-32) |

**5**

**04 - 04** Digital Input Terminal Response Time                    Factory Setting: 01

     Settings      01~20

&#x1F4D6; This parameter selects the response time of digital input terminals MI1 to MI4, EF and FWD.

&#x1F4D6; AC drive will scan the digital input terminals once every 2msec. During each scan the drive will check the status of each terminal (open or closed).

&#x1F4D6; In noisy environments, it would be advantageous to verify the terminal status several times before executing a new command, nearly eliminating false signals.

&#x1F4D6; Example: If Pr.04-04 is set to 4, the AC drive will confirm the terminal status (4+1 = 5) 5 times before a change is made. This correlates to an 8~10msec time response from input command to execution.

&#x1F4D6; It is not recommended to set this parameter to 00, since interference may cause improper operation of the AC drive.
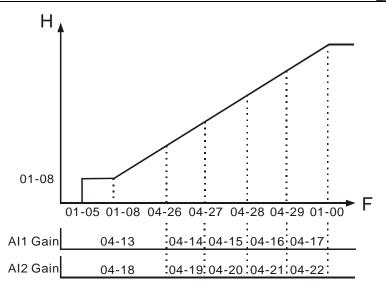
**04 - 05** Minimum AI1 Analog Input                    Factory Setting: 0

**04 - 06** Maximum AI1 Analog Input                    Factory Setting: 100

     Settings      0 ~ 100%                    Unit: 1

**04 - 07** Minimum Output that corresponds to AI1                    Factory Setting: 0.00

**04 - 08** Maximum Output that corresponds to AI1                    Factory Setting: 100.00

     Settings      0.00~100.00%                    Unit: 0.01

| 04 - 09 | Minimum AI2 Analog Input | | Factory Setting: 0 |
|---|---|---|---|
| 04 - 10 | Maximum AI2 Analog Input | | Factory Setting: 100 |
| | Settings | 0 ~ 100% | Unit: 1 |

| 04 - 11 | Minimum Output that corresponds to AI2 | | Factory Setting: 0.00 |
|---|---|---|---|
| 04 - 12 | Maximum Output that corresponds to AI2 | | Factory Setting: 100.00 |
| | Settings | 0.0~100.0% | Unit: 0.01 |

| 04 - 13 | 1st AI1 Gain | ✗ | Factory Setting: 100.0 |
|---|---|---|---|
| 04 - 14 | 2nd AI1 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 15 | 3rd AI1 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 16 | 4th AI1 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 17 | 5th AI1 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 18 | 1st AI2 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 19 | 2nd AI2 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 20 | 3rd AI2 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 21 | 4th AI2 Gain | ✗ | Factory Setting: 100.0 |
| 04 - 22 | 5th AI2 Gain | ✗ | Factory Setting: 100.0 |
| | Settings | 0.0~100.0% | Unit: 0.1 |

 These parameters set analog input value and maximum output frequency (01-00, used in open-loop control) or the corresponding function of the detection reference value (10-01, used in PID closed-loop control). They divide output frequency into several sections according to Pr.04-26 to Pr.04-29. There is an independent gain and minimum output frequency in every section. We can reduce inferior products and improve working efficiency via parameter modification. For example, we set frequency via two groups analog input terminals. When the frequency we set is 0-15Hz and the gain is 50%, the minimum output frequency will be 5Hz; when the frequency we set is 15-35Hz and the gain is 80%, the minimum output frequency will be 15Hz; when the frequency we set is 35-50Hz and the gain is 150%, the minimum output frequency will be 35Hz as the following diagram shows.

| | | | | | |
|---|---|---|---|---|---|
| AI1 Gain | 04-13 | 04-14 | 04-15 | 04-16 | 04-17 |
| AI2 Gain | 04-18 | 04-19 | 04-20 | 04-21 | 04-22 |

| **04 - 23** Analog Input Delay AI1 | Factory Setting: 0.50 |
|---|---|
| **04 - 24** Analog Input Delay AI2 | Factory Setting: 0.50 |

Settings        0.00 ~ 10.00 Sec                                    Unit: 0.01

&#x1F4D6; These parameters select the time constant for the analog input signal filter. A properly adjusted time constant may help filter noise on the analog input terminals.

&#x1F4D6; If the input delay is set too long, the system may experience oscillation. Be careful setting these parameters.

| **04 - 25** Summation of External Frequency Sources | Factory Setting: 00 |
|---|---|

Settings        00: disabled
01: AI1*(AI1 Gain)+AI2*(AI2 Gain)
02: AI1*(AI1 Gain)-AI2*(AI2 Gain)
03: AI1*(AI1 Gain)*AI2*(AI2 Gain)
04: Reserved
05: Communication master frequency +AI1*(AI1 Gain)
06: Communication master frequency +AI2*(AI2 Gain)
07: Max (AI1*(AI1 Gain), AI2*(AI2 Gain))

&#x1F4D6; This parameter selects the terminals used for summation of the External Frequency Sources.

&#x1F4D6; Setting 07 is used to compare AI1*(AI1 Gain) with AI2*(AI2 Gain). If AI1*(AI1 Gain) > AI2*(AI2 Gain), it indicates that command source is from AI1, otherwise is from AI2.

| 04 - 26 | 1st Analog Input Frequency Gain | ✗ | Factory Setting: 0.00 |
|---|---|---|---|
| 04 - 27 | 2nd Analog Input Frequency Gain | ✗ | Factory Setting: 0.00 |
| 04 - 28 | 3rd Analog Input Frequency Gain | ✗ | Factory Setting: 0.00 |
| 04 - 29 | 4th Analog Input Frequency Gain | ✗ | Factory Setting: 0.00 |

Settings      0.00~160.00Hz                              Unit: 0.01

📖 These parameters divide output frequency into several sections. (Refer to Pr.04-22).

| 04 - 30 | 1st Output Frequency Gain | ✗ | Factory Setting: 100.0 |
|---|---|---|---|
| 04 - 31 | 2nd Output Frequency Gain | ✗ | Factory Setting: 100.0 |
| 04 - 32 | 3rd Output Frequency Gain | ✗ | Factory Setting: 100.0 |

Settings      0.0~200.0%                                   Unit: 0.1

📖 These parameters set output frequency gain. We can select the functions of 21st to 23rd via multi-function terminal. When the multi-function terminal is active, output frequency multiplies a gain, i.e. output frequency H=F*(Pr.04-30/04-31/04-32).

## 5.6 Group 5: Multi-step Speed Frequency Parameters

| 05 - 00 | 1st Step Speed Frequency | ✗ | Factory Setting: 0.00 |
|---|---|---|---|
| 05 - 01 | 2nd Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 02 | 3rd Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 03 | 4th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 04 | 5th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 05 | 6th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 06 | 7th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 07 | 8th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 08 | 9th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 09 | 10th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 10 | 11th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 11 | 12th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 12 | 13th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 13 | 14th Step Speed Frequency | ✗ | Factory Setting: 0.00 |
| 05 - 14 | 15th Step Speed Frequency | ✗ | Factory Setting: 0.00 |

Settings     0.00~160.00 Hz     Unit: 0.01

&#x1F4D6; The Multi-Function Input Terminals (refer to Pr.04-00 to 04-03) are used to select one of the AC drive Multi-Step speeds. The speeds (frequencies) are determined by Pr.05-00 to 05-14 shown above.

| 05 - 15 | PLC Mode | Factory Setting: 00 |
|---|---|---|

Settings     00    Disable PLC operation

                   01    Execute one program cycle only

                   02    Continuously execute program cycles

                   03    Execute one program cycle only and step by step

                   04    Continuously execute program cycles step by step

&#x1F4D6; This parameter selects the mode of PLC operation for the AC drive. The AC drive will change speeds and directions according to the user's desired programming.

## Example 1 (Pr.05-15 = 1): Execute one cycle of the PLC program. Its relative parameter settings are:

Pr.05-00 to 05-14:      1st to 15th step speeds (sets the frequency of each step speed)

Pr.04-00 to 04-03:      Multi-Function Input Terminals (set one multi-function terminal as 32 - PLC auto-operation).
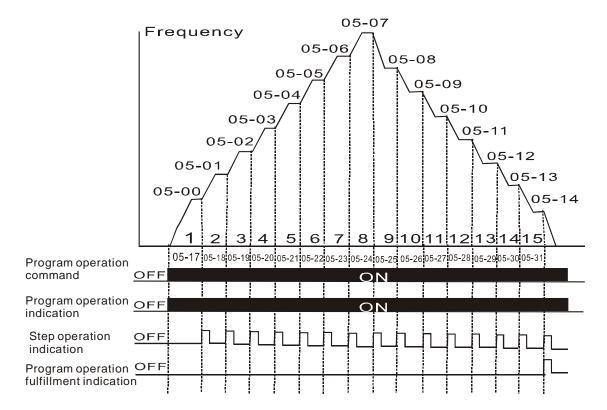
Pr.03-00:      Multi-Function Output Terminals (set a Multi-Function Terminal as 34-PLC running indication, 35-PLC step completed or 36-PLC program completed).

Pr.05-16:      Direction of the 1st to 15th step speeds.

Pr.05-17 to 05-31:      Operation time setting for each corresponding step speed.



Note: The above diagram shows one complete PLC operation cycle. To restart this cycle, turn the multi-function input terminal that designed as PLC program off and on again.
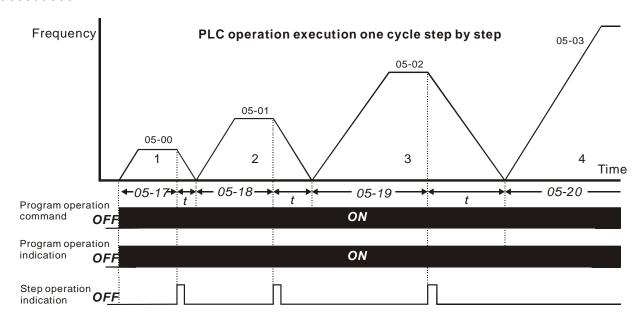
## Example 2 (Pr.05-15 = 2): Continuously executes program cycles:

The diagram above shows the PLC program stepping through each speed. Set Pr.05-15 to 2 for continuous program execution. To stop the PLC program, one must either pause the function or turn it off. (Refer to Pr.04-00 to 04-03 values 32 and 33).

### Example 3 (Pr.05-15 = 3) Execute one cycle step by step:

The example below shows how the PLC can perform one cycle at a time, within in a complete cycle. Each step will use the accel/decel times in Pr.01-09 to Pr.01-16. It should be noticed that the time each step spends at its intended frequency is diminished, due to the time spent during accel/decel.



| 05 - 16 | PLC Forward/Reverse Motion | Factory Setting: 00 |
|---|---|---|
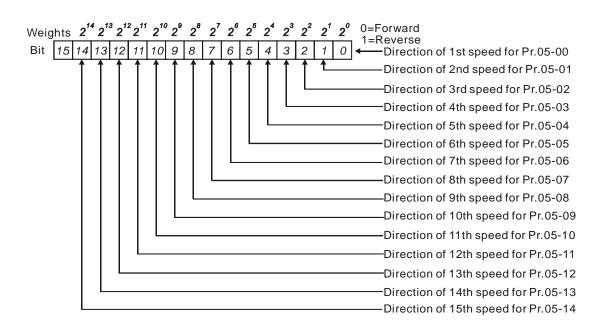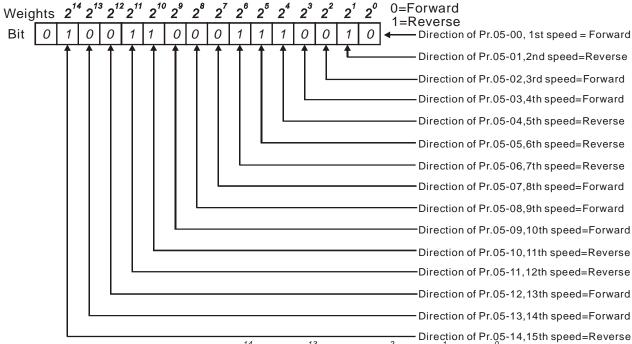
      Settings      00 to 32767 (0:Forward, 1:Reverse)

&#x1F56E; This parameter controls the direction of motion for the Multi-Step Speeds Pr.05-00 to Pr.05-14 during PLC mode. All other direction commands are invalid during the PLC mode.

Note: The equivalent 15-bit number is used to program the forward/reverse motion for each of the 15 speed steps. The binary notation for the 15-bit number must be translated into decimal notation and then entered.

Weights $2^{14}$ $2^{13}$ $2^{12}$ $2^{11}$ $2^{10}$ $2^9$ $2^8$ $2^7$ $2^6$ $2^5$ $2^4$ $2^3$ $2^2$ $2^1$ $2^0$    0=Forward
                                          1=Reverse

Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Direction of 1st speed for Pr.05-00
Direction of 2nd speed for Pr.05-01
Direction of 3rd speed for Pr.05-02
Direction of 4th speed for Pr.05-03
Direction of 5th speed for Pr.05-04
Direction of 6th speed for Pr.05-05
Direction of 7th speed for Pr.05-06
Direction of 8th speed for Pr.05-07
Direction of 9th speed for Pr.05-08
Direction of 10th speed for Pr.05-09
Direction of 11th speed for Pr.05-10
Direction of 12th speed for Pr.05-11
Direction of 13th speed for Pr.05-12
Direction of 14th speed for Pr.05-13
Direction of 15th speed for Pr.05-14

Weights $2^{14}$ $2^{13}$ $2^{12}$ $2^{11}$ $2^{10}$ $2^9$ $2^8$ $2^7$ $2^6$ $2^5$ $2^4$ $2^3$ $2^2$ $2^1$ $2^0$    0=Forward
                                          1=Reverse

Bit | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |

Direction of Pr.05-00, 1st speed = Forward
Direction of Pr.05-01,2nd speed=Reverse
Direction of Pr.05-02,3rd speed=Forward
Direction of Pr.05-03,4th speed=Forward
Direction of Pr.05-04,5th speed=Reverse
Direction of Pr.05-05,6th speed=Reverse
Direction of Pr.05-06,7th speed=Reverse
Direction of Pr.05-07,8th speed=Forward
Direction of Pr.05-08,9th speed=Forward
Direction of Pr.05-09,10th speed=Forward
Direction of Pr.05-10,11th speed=Reverse
Direction of Pr.05-11,12th speed=Reverse
Direction of Pr.05-12,13th speed=Forward
Direction of Pr.05-13,14th speed=Forward
Direction of Pr.05-14,15th speed=Reverse

The setting value $= \text{bit}14 \times 2^{14} + \text{bit}13 \times 2^{13} + \dots + \text{bit}2 \times 2^2 + \text{bit}1 \times 2^1 + \text{bit}0 \times 2^0$

$= 1 \times 2^{14} + 1 \times 2^{11} + 1 \times 2^{10} + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^1$

$= 16384 + 2048 + 1024 + 64 + 32 + 16 + 2$

$= 19570$

Setting 05-16 $= 19570$

NOTE:

| | | | | |
|---|---|---|---|---|
| $2^{14}$=16384 | $2^{13}$=8192 | $2^{12}$=4096 | $2^{11}$=2048 | $2^{10}$=1024 |
| $2^9$=512 | $2^8$=256 | $2^7$=128 | $2^6$=64 | $2^5$=32 |
| $2^4$=16 | $2^3$=8 | $2^2$=4 | $2^1$=2 | $2^0$=1 |

| 05 - 17 | Time Duration of 1st Step Speed | Factory Setting: 0.0 |
|---|---|---|
| 05 - 18 | Time Duration of 2nd Step Speed | Factory Setting: 0.0 |
| 05 - 19 | Time Duration of 3rd Step Speed | Factory Setting: 0.0 |
| 05 - 10 | Time Duration of 4th Step Speed | Factory Setting: 0.0 |
| 05 - 21 | Time Duration of 5th Step Speed | Factory Setting: 0.0 |
| 05 - 22 | Time Duration of 6th Step Speed | Factory Setting: 0.0 |
| 05 - 23 | Time Duration of 7th Step Speed | Factory Setting: 0.0 |
| 05 - 24 | Time Duration of 8th Step Speed | Factory Setting: 0.0 |
| 05 - 25 | Time Duration of 9th Step Speed | Factory Setting: 0.0 |
| 05 - 26 | Time Duration of 10th Step Speed | Factory Setting: 0.0 |
| 05 - 27 | Time Duration of 11th Step Speed | Factory Setting: 0.0 |
| 05 - 28 | Time Duration of 12th Step Speed | Factory Setting: 0.0 |
| 05 - 29 | Time Duration of 13th Step Speed | Factory Setting: 0.0 |
| 05 - 30 | Time Duration of 14th Step Speed | Factory Setting: 0.0 |
| 05 - 31 | Time Duration of 15th Step Speed | Factory Setting: 0.0 |
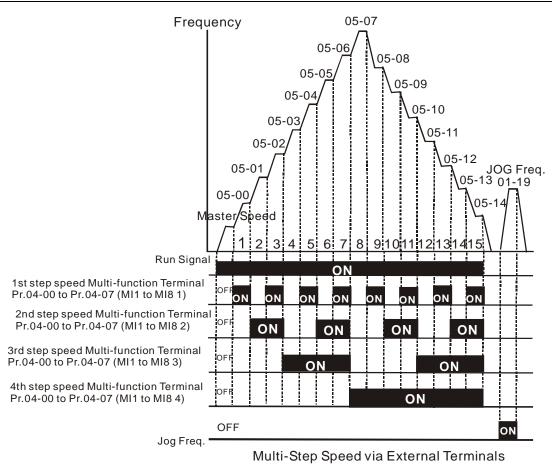
Settings        0.0 to 65500                              Unit: 1 /0.1sec

&#x1F4D6; Pr.05-17 to Pr.05-31 correspond to operation time of each step speed defined by Pr.05-00 to Pr.05-14. The maximum setting 65500 seconds will be displayed as t6550. If it is displayed t6550. that means 6550 seconds.

Note: If a parameter is set to "00" (0 sec), the corresponding step will be skipped. This is commonly used to reduce the number of program steps.

Multi-Step Speed via External Terminals

| **05 - 32** Time Unit Settings | Factory Setting: 00 |
|---|---|

Settings    00    1 Sec

              01    0.1 Sec

  This parameter determines the time unit for Pr.05-17~Pr.05-31.
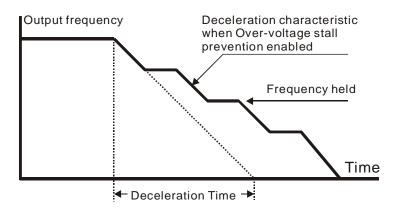
### 5.7 Group 6: Protection Function Parameters

| 06 - 00 | Over-voltage Stall Prevention | Factory Setting: 780.0 |
|---|---|---|

Settings      660.0V~820.0VDC
                 00: Disabled

&#x1F4D6; This parameter selects the voltage level for the Over-Voltage Stall Prevention function.

&#x1F4D6; During decelerations, 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. The AC drive will only resume deceleration when the voltage drops below the preset value.

&#x1F4D6; With moderate inertial loads, the over-voltage stall prevention will not occur and the deceleration time should be equal to Pr.1-10. With high inertial loads, the AC drive will automatically extend the deceleration time due to the step function shown below. If the deceleration time is critical for the application, then dynamic braking resistors should be used.
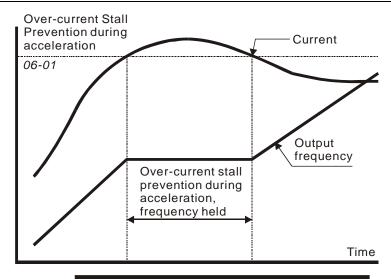


| 06 - 01 | Over-current Stall Prevention during Acceleration | Factory Setting: 150% |
|---|---|---|

Settings      20~250%                                           Unit: 1

&#x1F4D6; This parameter selects the percentage of allowable over-current during acceleration before the stall prevention is enabled.

&#x1F4D6; During acceleration, the AC drive output current may increase abruptly and exceed the value specified by Pr.06-01 due to 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. The AC drive will only resume acceleration when the current drops below the value set in Pr.06-01 (please see the graph below).

&#x1F4D6; When the over-current stall prevention is activated, the acceleration time of the AC drive will be longer than the time set in Pr. 01-09.
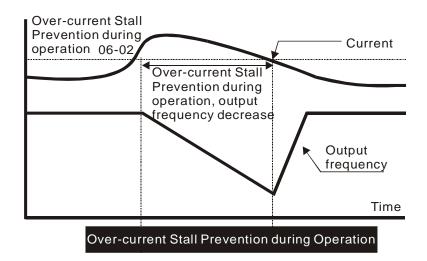
Over-current Stall Prevention during Acceleration

**06 - 02** Over-current Stall Prevention during operation      Factory Setting: 150%

         Settings        20~250%                              Unit: 1
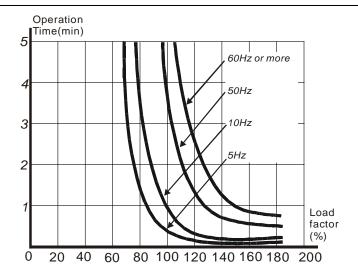
&#x1F4D5; This parameter selects the percentage of allowable over-current during operation before the stall prevention function is enabled.

&#x1F4D5; If the output current exceeds the value specified in Pr.06-02 when the drive is operating at steady state speed, the drive will decrease its output frequency to prevent the drive from faulting with an OC. Once the current falls below the value specified in Pr.06-02, the drive will then accelerate to catch up with the command frequency.



Over-current Stall Prevention during Operation

| 06 - 03 | Over-torque Detection Selection | Factory Setting: 00 |

Settings    00: Over-torque detection disabled.
                01: Over-torque detection enabled during constant speed operation (OL2), and operation continues.
                02: Over-torque detection enabled during constant speed operation (OL2), and operation halted.
                03: Over-torque detection enabled during operation (OL2), and operation continues.
                04: Over-torque detection enabled during constant speed operation (OL2), and operation halted.

&#x1F4D6; This parameter selects the Over-torque Detection operation.

&#x1F4D6; If this parameter is set to 01 or 02, over-torque detection will not occur during acceleration.

| 06 - 04 | Over-torque Detection Level | Factory Setting: 110 |

Settings    30~150%    Unit: 1

&#x1F4D6; This parameter sets the Over-torque Detection level based on the AC drive rated current.

| 06 - 05 | Over-torque Detection Time | Factory Setting: 0.1 |

Settings    0.1~60.0 Sec    Unit: 0.1

&#x1F4D6; This parameter selects the allowable time of Over-torque Detection before the AC drive faults with an OL2.

&#x1F4D6; When the output current exceeds Pr.06-04 for the time set in Pr06-05, AC drive will fault and display "OL2" on the keypad.

| 06 - 06 | Electronic Thermal Relay Selection | Factory Setting: 02 |

Settings    00: Operation disabled.
                01: Operation with a standard motor (shaft mounted fan cooled).
                02: Operation with a vector motor (non-fan cooled or self powered fan)

&#x1F4D6; This parameter provides electronic thermal protection for the motor. When the output current exceeds Pr.07-02 for the time set in Pr.06-07, the drive will fault with an OL1.

| 06 - 07 | Electronic Thermal Characteristic | Factory Setting: 60 |

Settings    30~600 Sec    Unit: 1

&#x1F4D6; This parameter selects the time required for the electronic thermal protection function to activate.

&#x1F4D6; When Pr.6-06 is set for 1 or 2 and the output current exceeds Pr.7-02 for the time set in Pr.6-07, the drive will fault with an OL1.

&#x1F4D6; The common electronic thermal reaction time (150% output current for 1 minute) is shown in the chart below. The actual reaction time will vary depending on output current.

Operation Time(min)

5
4
3
2
1

0  20  40  60  80  100  120  140  160  180  200

Load factor (%)

60Hz or more
50Hz
10Hz
5Hz

| 06 - 08 | Low Current Detection Level | Factory Setting: 00 |
|---|---|---|
| | Settings 00~100% (00 disabled) | Unit: 1 |

| 06 - 09 | Low Current Detection Time | Factory Setting: 10.0 |
|---|---|---|
| | Settings 0.1~ 3600.0 Sec | Unit: 0.1 |

| 06 - 10 | Low Current Detection Treatment | Factory Setting: 01 |
|---|---|---|
| | Settings 00: Warn and Ramp to stop | |
| | 01: Warn and Coast to stop | |
| | 02: Warn and keep operating | |

  These parameters set the low current detection mode, time, and operation.

| 06 - 11 | Present Fault Record | Factory Setting: 00 |
|---|---|---|
| 06 - 12 | 2nd Most Recent Fault Record | Factory Setting: 00 |
| 06 - 13 | 3rd Most Recent Fault Record | Factory Setting: 00 |
| 06 - 14 | 4th 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  Overload1 (oL1)

06  External fault (EF)

07  IGBT protection (occ)

08  CPU failure (CF3)

| 09 | Hardware protection failure (HPF) |
|---|---|
| 10 | Over-current during acceleration (OcA) |
| 11 | Current exceeds 2 times rated current during decel. (ocd) |
| 12 | Current exceeds 2 times rated current during steady state operation (ocn) |
| 13 | Ground fault (GFF) |
| 14 | Low voltage (Lv) |
| 15 | CPU READ failure (CF1) |
| 16 | CPU WRITE failure (CF2) |
| 17 | Base Block (bb) |
| 18 | Motor over load (oL2) |
| 19 | Reserved |
| 20 | Software/password protection (codE) |
| 21 | Emergency stop (EF1) |
| 22 | Phase-Loss (PHL) |
| 23 | Low-current (Lc) |
| 24 | Feedback Loss (FbL) |
| 25 | Reserved |

**06 - 15** Parameter Reset                                          Factory Setting: 00

Settings      00~65535
              09: Reset parameters (50Hz, 380)
              10: Reset parameters (60Hz, 440)

&#x1F4D6; This parameter resets all parameters to the factory setting.

**06 - 16** Parameter Protection Password Input                      Factory Setting: 00

Settings      00~65535

&#x1F4D6; This parameter allows the user to enter their password to unlock the Parameter Protection feature. The password entered must match the value entered into Pr.6-17. After three invalid password attempts, the drive will no longer allow any operation. The drive must then be powered off and back on again.

&#x1F4D6; After successfully entering the password, the user may change parameters as they wish. Once the drive is powered off, the drive has locked the parameters again. To clear the password, the user must enter the correct password in Pr.6-16 and then set Pr.6-17 to 00.

| 06 - 17 | Parameter Protection Password Setting | Factory Setting: 00 |
|---------|---------------------------------------|---------------------|

Settings      00~65535

                    00: No password protection

&#x1F4D6; This parameter allows the user to set a password for parameter protection. After entering a password, Pr.6-17 will display 1.

&#x1F4D6; Be sure to keep the password in a safe place. If the password is lost, please return the drive to DELTA.

## 5.8 Group 7: AC Drive and Motor Parameters

| **07 - 00** Identity Code of AC Drive | Factory Setting: ## |
|---|---|

Settings    Display by model type

  This parameter displays the AC drive model code.

  This parameter is read-only.

| **07 - 01** Rated Current of AC Drive | Factory Setting: ## |
|---|---|

Settings    Display by model type

  This parameter displays rated output current of the AC drive. The following chart may be used to look up the identity code, current, and hp of your drive.

| KW | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HP | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| Pr.07-00 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 | 29 | 31 | 33 |
| Rated Current (A) | 13 | 18 | 24 | 32 | 38 | 45 | 60 | 73 | 91 | 110 | 150 |
| Max. Carried Freq. | 6KHz | | | 6KHz | | | 6KHz | | | | |
| Min. Carried Freq. | 4KHz | | | 3KHz | | | 2KHz | | | | |
| Factory Setting | 6KHz | | | 6KHz | | | 4KHz | | | | |

  This parameter is read-only.

| **07 - 02** Full-load Current of Motor | ✗ | Factory Setting: 100% |
|---|---|---|

Settings    30~120%    Unit: 1

  This parameter selects the full load current of the motor.

  Pr7-02 = (full load motor current / drive rated current)

  Example: If the rated current of AC drive is 150A, full-load current of motor is 120A, then Pr.7-02 should be set to 80%.

  This parameter is used with slip compensation Pr.7-04 to Pr.7-05 and electronic thermal relay Pr.6-06 to Pr.6-07. An incorrect setting will cause these functions to not work incorrectly and may damage the motor and drive.

  The full-load current of the motor must be equal to or less than (but not less than 50%) the rated current of the AC drive.

| **07 - 03** No-load Current of Motor | ✗ | Factory Setting: 30% |
|---|---|---|

Settings    1~99%    Unit: 1

📖 This parameter sets the no-load current of the motor.

Pr.7-03 = (no load current / drive rated current)

Example: If the rated current of the AC drive is 150A and no-load current of the motor is 40A, then Pr.7-03 should be set to 27%.

📖 This parameter is used with slip compensation Pr.7-04 and Pr.7-05. An incorrect setting will cause the function to work incorrectly and may damage the motor and drive.

📖 If the no-load current of the motor is unavailable, it may be found by running the motor with no load and reading the current on the keypad display.

| **07 - 04** Auto Slip Compensation Gain | ✎ | Factory Setting: 0.0 |
|---|---|---|
| Settings 0.0~3.0 | | Unit: 0.1 |

📖 This parameter is set to auto slip compensation gain.

📖 Rotor speed of the motor (output frequency of AC drive) can't synchronize due to induction motor characteristic. The difference between synchronization speed and rotor speed is called slip frequency. Slip frequency is in direct proportion with output torque and output current. Therefore, slip compensation could make rotor speed and master frequency command the same according output current (Io).

📖 The equation of slip compensation is (07-05) X (07-04) X (Io-(07-03)) / ((07-02)-(07-03)). If rated current of AC drive is 150A, full-load current of the motor is 120A, no-load current is 40A, rated slip frequency is 5Hz and output current of AC drive is 100A. At this time, slip compensation is (07-04) X 5 X (100-40) / (120-40) = 3.75 X (07-04). If 07-04 is set to 1.0 and the compensation is 3.75. If master frequency command is set to 50Hz and output frequency is 53.75.

📖 Output frequency after compensation is limited by 01-07 upper bound frequency. When using slip compensation, 01-07 should be set to the suitable value.

📖 When PID feedback control, slip compensation function will be disabled.

📖 Unsuitable setting value may cause over compensation.

| **07 - 05** Rated Slip Frequency of Motor | Factory Setting: 0.00 |
|---|---|
| Settings 0.00~20.00Hz | Unit: 0.01 |

📖 This parameter is to set rated slip of loaded motor. Users need to input rated rotation speed according to nameplate of loaded motor. If rated frequency of motor is 60Hz, number of motor poles is 4 and rated rotation speed of motor is 1650rpm. The rated slip frequency of motor is 60Hz-(1650rpm X 4/120) = 5Hz.

📖 This parameter has relation with 07-04 slip compensation. To have the best slip compensation, this parameter must be set correctly. Incorrect setting may cause above functions disable and even damage the motor and AC drive.

| 07 - 06 | Auto Torque Compensation Gain | ✗ | Factory Setting: 0.0 |
|---|---|---|---|
| | Settings          0.0~10.0 | | Unit: 0.1 |

📖 This parameter is to set auto torque compensation gain.

📖 When motor loading is high, a part of output frequency of AC drive will be absorbed by impedance of stator winding to make voltage of exciting inductance of motor is not enough. Therefore, the short of gap magnet field will make a high output current but low output torque. Auto torque compensation gain could adjust output voltage automatically according to loading to maintain in a fixed gap magnet of the motor to get the best running situation.

📖 If the setting of compensation gain is too great, over-exciting magnet will cause the following situation: output current of AC drive is too great, motor is over-heating or protection function occurs.

| 07 - 07 | Torque Compensation Gain by Manual Operation | ✗ | Factory Setting: 0.0 |
|---|---|---|---|
| | Settings          0.0~10.0 | | Unit: 1.0 |

📖 This parameter determines torque compensation gain by manual operation.

📖 Torque compensation gain by manual operation won't refer to the loading situation and adds compensation voltage on the setting V/F curve. Basically, it just changes V/F curve. It could be reached by adjusting V/F curve.

| 07 - 08 | Calculate Total Running Time of the Motor (Min) | Factory Setting: 00 |
|---|---|---|
| | Settings          00 to 1439 Min | Unit: 1 |

| 07 - 09 | Calculate Total Running Time of the Motor (Day) | Factory Setting: 00 |
|---|---|---|
| | Settings          00 to 65535 Day | Unit: 1 |

📖 This parameter could display running time of the motor.

| 07 - 10 | Electric Bill for One Time | Factory Setting: Read Only |
|---|---|---|

| 07 - 11 | Accumulated Electric Bill (per currency unit) | Factory Setting: Read Only |
|---|---|---|

| 07 - 12 | Accumulated Electric Bill (per $10^4$ currency unit) | Factory Setting: Read Only |
|---|---|---|

| 07 - 13 | Electric Rate (per currency unit) | Factory Setting: 0.6 |
|---|---|---|
| | Settings          0.01 to 655.35 | Unit: 1 |

&#x1F4D6; You can get electric bill from Pr. 07-10 to Pr. 07-12 after inputting local electric rate into Pr. 07-13.

### 5.9 Group 8: Special Parameters

| 08 - 00 | DC Braking Current Level | Factory Setting: 00 |
|---|---|---|

Settings      00~100%        Unit: 1

📖 This parameter determines the level of DC braking current output.

| 08 - 01 | DC Braking Time during Start-up | Factory Setting: 0.0 |
|---|---|---|

Settings      0.0~60.0 Sec        Unit: 0.1

📖 This parameter determines the duration of time that the DC braking current will be applied to the motor during the AC drive start-up.

📖 The motor may rotate by external force or inertia itself before operating. It may damage the motor or start the AC drive protection function by an over current if the AC drive added at this time. This parameter enable the AC drive to output a direct current before running the motor that will produce a torque to forced motor stop and get a steady start-up characteristic.

| 08 - 02 | DC Braking Time during Stopping | Factory Setting: 0.0 |
|---|---|---|

Settings      0.00~60.00 Hz        Unit: 0.01

📖 This parameter determines the duration of time that the DC braking current will be applied to the motor during stopping.

📖 Motor may be in rotation status after AC drive stops output and can't in stop status accuracy when motor is running with external force or itself inertia. After AC drive stops output, this parameter could output a DC current to produce torque force motor to stop and make sure the motor has stopped accuracy.
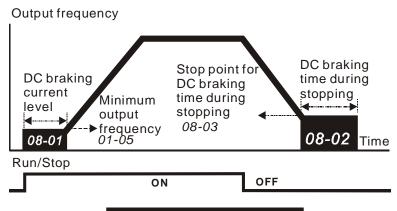
| 08 - 03 | Start-point for DC Braking | Factory Setting: 0.00 |
|---|---|---|

Settings      0.00~160.00 Hz        Unit: 0.01

📖 This parameter determines the frequency when DC braking will begin during deceleration.

📖 If this parameter is set greater than 01-05 minimum frequency setting, it won't decelerate to 01-05 and enter DC braking status when AC drive brakes. Suitable DC braking start-up frequency setting will get better braking characteristic.

Output frequency



DC Braking Time

| 08 - 04 | Momentary Power Loss Operation Selection | Factory Setting: 00 |

Settings    00: Disabled
01: Trace from top downward
02: Trace from bottom upward

&#x1F4D6; This parameter determines the start-up mode after momentary power loss operation.

&#x1F4D6; The power system connects to AC drive may occurred momentary power loss by any probably reason. This function can make AC drive output voltage continuously after power loss and AC drive won't stop by power loss.

&#x1F4D6; If this parameter is set to 01, AC drive will trace from the last frequency before power loss downward. After output frequency of AC drive and running speed of the motor is synchronization, it will accelerate to master frequency command. It is recommended to use this setting if the motor loading has the characteristics of high inertial and low resistance.

&#x1F4D6; If this parameter is set to 02, AC drive will trace from the Min. frequency upward. After output frequency of AC drive and running speed of the motor is synchronization, it will accelerate to master frequency command. It is recommended to use this setting if the motor loading has the characteristics of low inertial and high resistance.

| 08 - 05 | Maximum Allowable Power Loss Time | Factory Setting: 2.0 |

Settings    0.1~5.0 Sec        Unit: 0.1

&#x1F4D6; This parameter determines the maximum allowable power loss time. If the power loss time is less than the time defined by this parameter, the AC drive will execute 08-04 momentary power loss operation.

&#x1F4D6; The allowable power loss time is beginning to count time after AC drive displays Lu. Therefore, actual allowable power loss time will change with loading.
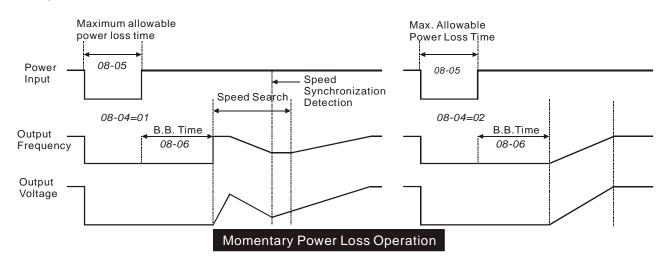
The allowable power loss time must in the condition that AC drive auxiliary power is working normally. If auxiliary power is turned off in the allowable power loss time, the actual allowable power loss time will be shorter than the parameter setting.

| 08 - 06 | Speed Search Time | Factory Setting: 0.5 |
|---|---|---|

Settings　　0.1~5.0 Sec　　　　　　　　　　　　　　　　Unit: 0.1
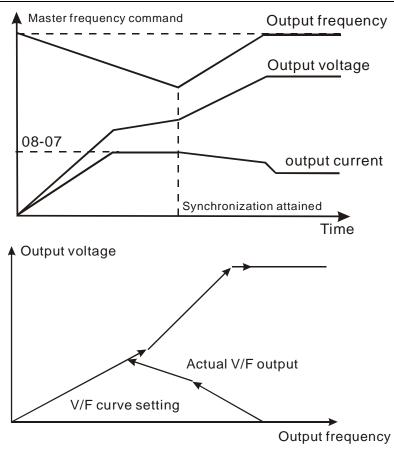
This parameter determines the delay time from fault (power loss, OV, OC or BB) recovery to start to execute the function of speed search time.

| 08 - 07 | Maximum Speed Search Current | Factory Setting: 110 |
|---|---|---|

Settings　　30~150%　　　　　　　　　　　　　　　　Unit: 1

This parameter determines maximum current of speed search.

Maximum speed search current will have influence with synchronization attained time. The greater this parameter is set, the faster it will be synchronization. But if the parameter setting value is too great, it may occur over-loaded protection.

If 08-04 is set to 01: when speed search is from top downward, output frequency is searched from master frequency command downward. Now output voltage and output current will be added from zero. When output current is equal to 08-07 setting value, AC drive output current will retain in a fixed value and output frequency will keep on searching from top downward. When output frequency and output voltage is overlapped with V/F setting frequency, AC drive will judge that is synchronization attained and accelerates from V/F curve to master frequency command.

If 08-04 is set to 02: AC drive will accelerate according to V/F curve and won't do any special treatment.



Momentary Power Loss Operation

| **08 - 08** | BB Speed Search Method | Factory Setting: 00 |

Settings      00: Trace from top downward
01: Trace from bottom upward

📖 This parameter determines BB speed search method when multi-function input terminal 04-00 to 04-03 is set to BB External interrupt (11 or 12) and activates.

📖 BB speed search method is the same with restart speed search after momentary loss power.

| **08 - 09** | Auto Restart Times After Fault | Factory Setting: 00 |

Settings      00 ~10

📖 This parameter determines the times of auto restart after fault.

📖 When AC drive occurs fault (OV, OC or OCC) and fault disappeared automatically, this parameter allows AC drive reset and runs with the parameter that is set before fault occurred.

📖 If fault occurred times exceed 08-09 setting, AC drive will reject to restart and need to reset by users to keep on running.

| 08 - 10 | Auto Restart Time after Fault | Factory Setting: 600 |

Settings          00 to 60000 sec          Unit: 1

&#9906; This parameter determines auto restart time after fault. After fault occurs and restart, there is no fault occurs during 08-10 setting time, AC drive will reset fault occurred record to zero.

| 08 - 11 | Operation Frequency Inhibition 1 UP | Factory Setting:  0.00 |
| 08 - 12 | Operation Frequency Inhibition 1 DOWN | Factory Setting:  0.00 |
| 08 - 13 | Operation Frequency Inhibition 2 UP | Factory Setting:  0.00 |
| 08 - 14 | Operation Frequency Inhibition 2 DOWN | Factory Setting:  0.00 |
| 08 - 15 | Operation Frequency Inhibition 3 UP | Factory Setting:  0.00 |
| 08 - 16 | Operation Frequency Inhibition 3 DOWN | Factory Setting:  0.00 |

Settings          0.00~160.00 Hz          Unit: 0.01

&#9906; These parameters determine the inhibition operation frequency range. This function will let AC drive not run continuous in the resonance frequency of the motor or loading system, or inhibition operation frequency.

&#9906; The settings of these parameters should follow as 08-11$\geq$08-12$\geq$08-13$\geq$08-14$\geq$08-15$\geq$ 08-16.

&#9906; Master frequency command can be set in inhibition operation frequency range. Now the output frequency will be limited in the lower bound of inhibition operation frequency.

&#9906; When AC drive accelerates or decelerates, output frequency will pass through inhibition operation frequency range.

| 08 - 17 | Automatic Energy-saving | Factory Setting: 00 |
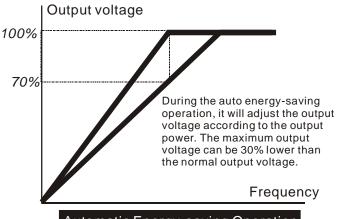
Settings          00: Energy-saving operation disabled
                       01: Energy-saving operation enabled

&#9906; This parameter determines automatic energy-saving function.



Automatic Energy-saving Operation

During the auto energy-saving operation, it will adjust the output voltage according to the output power. The maximum output voltage can be 30% lower than the normal output voltage.

| **08 - 18** Automatic Voltage Regulation (AVR) | | Factory Setting: 00 |
|---|---|---|

    Settings        00: AVR function enabled
                       01: AVR function disabled
                       02: AVR function disabled for deceleration

&#x1F4D6; This parameter determines the function of Automatic Voltage Regulation is enabled or disabled.

&#x1F4D6; This parameter is set to 01: when AVR function is disabled, AC drive will calculate input voltage by DC Bus value (620VDC). Output voltage will vary by DC Bus varying and may cause output current insufficiently, over current or oscillation.

&#x1F4D6; This parameter is set to 00: when AVR function is enabled, AC drive will calculate output voltage by actual voltage value of DC Bus. Output voltage won't vary by DC Bus varying.

&#x1F4D6; This parameter is set to 02: AC drive will disable AVR function during decelerate to stop. It can speed up braking in some degree.

| **08 - 19** Software Setting of the Braking Level (the action level of the braking resistor) | ✗ | Factory Setting: 760.0 |
|---|---|---|

    Settings       740.0V~820.0VDC                    Unit: 0.1
                     00: Disabled

&#x1F4D6; This parameter determines software setting of the braking level.

&#x1F4D6; The model VFD055~150F43A has braking chip, user could select suitable braking resistor to have the best deceleration characteristics.

&#x1F4D6; The action level of the braking resistor could be set by this parameter.

| **08 - 20** Vibration Compensation Factor | ✗ | Factory Setting: 00 |
|---|---|---|

    Settings       00~1000                               Unit: 1

&#x1F4D6; This parameter will minimize vibration at low speed during vector control. The value of the parameter is a GAIN. The higher the value, the more vibration dampening that will occur.

### 5.10 Group 9: Communication Parameters

| 09 - 00 | Communication Address | ✗ | Factory Setting: 01 |

Settings     01-254
                      00: Disabled

&#x1F4D6; If the AC drive is controlled by RS-485 serial communication, the communication address for this drive must be set via this parameter.

| 09 - 01 | Transmission Speed (Baud Rate) | ✗ | Factory Setting: 01 |

Settings     00: Baud rate 4800
                      01: Baud rate 9600
                      02: Baud rate 19200
                      03: Baud rate 38400

&#x1F4D6; This parameter determines transmission speed of AC drive communication.

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| 09 - 02 | Transmission Fault Treatment | ✗ | Factory Setting: 03 |

Settings     00: Warn and keep operating
                      01: Warn and RAMP to stop
                      02: Warn and COAST to stop
                      03: No warning and no display

&#x1F4D6; This parameter is set to detect if an error occurs and take actions.

| 09 - 03 | Time-out Detection during Transmission | Factory Setting: 00 |

Settings     00: Disabled
                      01: Enabled

&#x1F4D6; This parameter is used for ASCII mode. When this parameter is set to 01, indicates that the time-out detection is enable, the time slot between each character can't exceed 500 ms.

| 09 - 04 | Communication Format | Factory Setting: 00 |

Settings     00: 7-bit for ASCII
                      01: 8-bit for ASCII
                      02: 8-bit for RTU

| 09 - 05 | Even/Odd Parity and Stopping Parity Setting | Factory Setting: 00 |

Settings     00: None parity + 2 stop bit
                      01: Even parity + 2 stop bit
                      02: Odd parity + 2 stop bit
                      03: None parity + 1 stop bit
                      04: Even parity + 1 stop bit
                      05: Odd parity + 1 stop bit

&#x1F4D6; This parameter determines the communication format of serial communication.

| 09 - 06 | Communication Operation Command 1 | ✗ | Factory Setting: 00 |
|---|---|---|---|
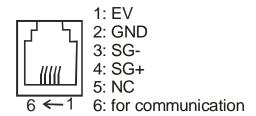
Settings     Bit0~1: 00: Disabled
                                01: Stop
                                10: Start-up
                                11: JOG start-up

                Bit2~3: Reserved

                Bit4~5: 00: Disabled
                                01: FWD command
                                10: REV command
                                11: Direction change command

                Bit6~7: 00: 1st step acce/decel speed
                           01: 2nd step acce/decel speed
                           10: 3rd step acce/decel speed
                           11: 4th step acce/decel speed

                Bit8~11: 0000: Master speed
                           0001: 1st step speed
                           0010: 2nd step speed
                           0011: 3rd step speed
                           0100: 4th step speed
                           0101: 5th step speed
                           0110: 6th step speed
                           0111: 7th step speed
                           1000: 8th step speed
                           1001: 9th step speed
                           1010: 10th step speed
                           1011: 11th step speed
                           1100: 12th step speed
                           1101: 13th step speed
                           1110: 14th step speed
                           1111: 15th step speed

                Bit12: Select Bit6~11 function

                Bit13~15: Reserved

&#128214; This parameter can be set by communication settings. It can't be set by keypad.

| 09 - 07 | Communication Frequency Setting | ✗ | Factory Setting: 60.00 |
|---|---|---|---|

Settings        0~160.00Hz                                                  Unit: 0.01

&#128214; This parameter can be set by communication settings. It can't be set by keypad.

| 09 - 08 | Communication Operation Command 2 | ✗ | Factory Setting:  00 |
|---|---|---|---|

Settings         Bit0: 1: EF ON
                       Bit1: 1: Reset
                       Bit2: 0: BB OFF, 1: BB ON
                       Bit3~15: Reserved

5

    This parameter can be set by communication settings. It can't be set by keypad.

    If you set BB action by this parameter and you also need to disable BB action by this parameter.

1. There is a built-in RS-485 serial interface, marked (RJ-11 jack) on the control terminal block. The pins are defined below:

1: EV
2: GND
3: SG-
4: SG+
5: NC
6 ← 1    6: for communication

Each AC drive has a pre-assigned communication address specified by 9-00. The computer then controls each AC drive according to its communication address.

AC drive can be setup to communicate on Modbus networks using one of the following modes: ASCII (American Standard Code for Information interchange) or RTU (Remote Terminal Unit). Users can select the desired mode along with the serial port communication protocol in 09-04 and 09-05.

Code Description:

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 |
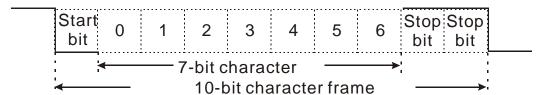
RTU mode:

Each 8-bit is the combination of two 4-bit hexadecimal characters. For example, 64 Hex.
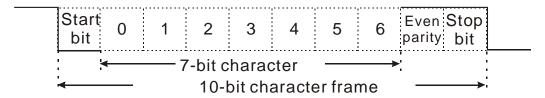
2. Data format
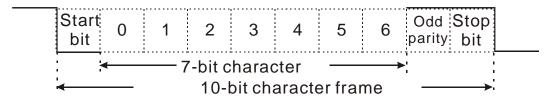
  2.1  10-bit character frame (for 7-bit):

    ❖ (7, N, 2: 9-04=0, 9-05=0)

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

7-bit character
10-bit character frame

    ❖ (7, E, 1: 9-04=0, 9-05=04)

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

7-bit character
10-bit character frame

    ❖ (7, O, 1: 9-04=0, 9-05=05)

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

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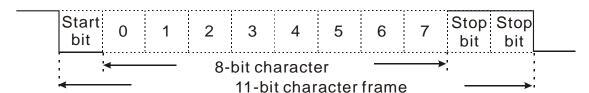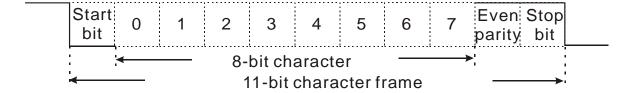
  2.2  11-bit character frame (for 8-bit):

    ❖ (8, N, 2: 9-04=1 or 2, 9-05=00)

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

8-bit character
11-bit character frame

    ❖ (8 , E , 1 : 9-04=1 or 2, 9-05=04)

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

8-bit character
11-bit character frame

❖ (8, O, 1: 9-04=1 or 2, 9-05=05)

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

8-bit character

11-bit character frame
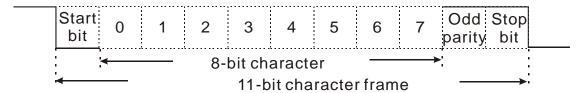
3. Communication Protocol

3.1 Communication Data Frame:

**ASCII mode:**

| STX | Start character ':' (3AH) |
|---|---|
| ADR 1 | Communication address: |
| ADR 0 | 8-bit address consists of 2 ASCII codes |
| CMD 1 | Command code: |
| CMD 0 | 8-bit command consists of 2 ASCII codes |
| DATA (n-1) | Contents of data: |
| ……. | N X 8-bit data consists of 2n ASCII codes. |
| DATA 0 | n<=25, maximum of 50 ASCII codes |
| LRC CHK 1 | LRC check sum: |
| LRC CHK 0 | 8-bit check sum consists of 2 ASCII codes |
| END 1 | End characters: |
| END 0 | END1= CR (0DH), END0= LF(0AH) |

**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 X 8-bit data, n<=25 |
| DATA 0 | |
| CRC CHK Low | CRC check sum: |
| CRC CHK High | 16-bit check sum consists of 2 8-bit characters |
| END | A silent interval of more than 10 ms |

3.2 ADR (communication address)

Valid communication addresses are in the range of 0 to 254. a communication address equal to 0, means broadcast to all AC drives (AMD). In this case, the AMD will not reply any message 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

3.3 CMD (command code) and DATA (data character)

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

● Command code: 03H, read N words. The maximum value of N is 10. for example, reading parameters 01-01 and 01-02 from address 01H.

**ASCII mode:**

Command message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '3' |
| Starting | '0' |
| data | '1' |
| address | '0' |
|  | '1' |
| Number | '0' |
| of | '0' |
| data | '0' |
| (Word) | '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 | '0' |
| data(Word) | '4' |
| Data | '1' |
| of | '7' |
| 0101H | '7' |
|  | '0' |
| Data | '0' |
| of | '8' |
| 0102H | '9' |
|  | '8' |
| LRC CHK 1 | 'D' |
| LRC CHK 0 | '1' |
| END 1 | CR |
| END 0 | LF |

Error response message

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '8' |
| CMD 0 | '3' |
| Error code | '0' |
|  | '2' |
| LRC CHK 0 | '6' |
| LRC CHK 1 | 'D' |
| END 1 | CR |
| END 0 | LF |

**RTU mode:**

Command message:

| ADR | 01H |
|---|---|
| CMD | 03H |
| Starting data | 01H |
| address | 01H |
| Number of data | 00H' |
| (Word) | 02H |
| CRC CHK Low | 94H |
| CRC CHK High | 37H |

Response message:

| ADR | 01H |
|---|---|
| CMD | 03H |
| Number of data | 04H |
| data 0101H | 17H |
| content | 70H |
| 0102H | 08H |
| content | 98H |
| CRC CHK LOW | FBH |
| CRC CHK HIGH | 36H |

Error response message

| ADR | 01H |
|---|---|
| CMD | 90H |
| Error code | 02H |
| CRC CHK LOW | CDH |
| CRC CHK HIGH | C1H |

● Command code: 06H, write a 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' |
| data | '0' |
| starting | '1' |
| address | '0' |
| | '0' |
| data | '1' |
| | '7' |
| | '7' |
| | '0' |
| LRC CHK 1 | '7' |
| LRC CHK 0 | '7' |
| END 1 | CR |
| END 0 | LF |

Response message:

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

Error response message

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '8' |
| CMD 0 | '6' |
| Error | '0' |
| code | '2' |
| LRC CHK 0 | '6' |
| LRC CHK 1 | 'D' |
| END 1 | CR |
| END 0 | LF |

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**RTU mode:**

Command message:

| ADR | 01H |
|---|---|
| CMD | 06H |
| data | 01H |
| Starting address | 00H |
| data | 17H |
| | 00H |
| CRC CHK LOW | 87H |
| CRC CHK HIGH | C6H |

Response message:

| ADR | 01H |
|---|---|
| CMD 1 | 06H |
| data | 01H |
| Starting address | 00H |
| data | 17H |
| | 70H |
| CRC CHK LOW | 87H |
| CRC CHK HIGH | C6H |

Error response message

| ADR | 01H |
|---|---|
| CMD 1 | 86H |
| Error code | 02 |
| CRC CHK LOW | C3H |
| CRC CHK HIGH | A1H |

● Command code: 08H, loop detection

This command is used to test the communication condition between master control equipment (usually is PC or PLC) and AC drive. AC drive will deliver the data that received from AC drive to master control equipment.

For example:

**ASCII mode:**

Command message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '8' |
| data | '0' |
| Starting | '0' |
| address | '0' |
| | '0' |
| data | '1' |
| | '7' |
| | '7' |
| | '0' |
| LRC CHK 1 | '7' |
| LRC CHK 0 | '0' |
| END 1 | CR |
| END 0 | LF |

Response message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '0' |
| CMD 0 | '8' |
| data | '0' |
| Starting | '0' |
| | '0' |
| | '0' |
| data | '1' |
| | '7' |
| | '7' |
| | '0' |
| LRC CHK 1 | '7' |
| LRC CHK 0 | '0' |
| END 1 | CR |
| END 0 | LF |

Error response message

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '8' |
| CMD 0 | '8' |
| Error | '0' |
| code | '2' |
| LRC CHK 0 | '6' |
| LRC CHK 1 | 'D' |
| END 1 | CR |
| END 0 | LF |

**RTU mode:**

Command message:

| ADR | 01H |
|---|---|
| CMD | 08H |
| data | 00H |
| Starting address | 00H |
| data | 17H |
| | 70H |
| CRC CHK LOW | EEH |
| CRC CHK HIGH | EFH |

Response message:

| ADR | 01H |
|---|---|
| CMD 1 | 08H |
| data | 00H |
| Starting address | 00H |
| data | 17H |
| | 70H |
| CRC CHK LOW | EEH |
| CRC CHK HIGH | EFH |

Error response message

| ADR | 01H |
|---|---|
| CMD 1 | 88H |
| Error code | 02 |
| CRC CHK LOW | E0H |
| CRC CHK HIGH | 6DH |

● Command code: 10H, write continuous words

For example, modify multi-step speed setting of AC drive (address 01H)

05-00=50.00(1388H)，05-01=40.00(0FA0H)

**ASCII mode:**

Command message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '1' |
| CMD 0 | '0' |
| Data Starting address | '0' |
| | '5' |
| | '0' |
| | '0' |
| Number Of data (Word) | '0' |
| | '0' |
| | '0' |
| | '2' |
| Number of data (Byte) | '0' |
| | '4' |
| The first data | '1' |
| | '3' |
| | '8' |
| | '8' |
| The second data | '0' |
| | 'F' |
| | 'A' |
| | '0' |

Response message:

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '1' |
| CMD 0 | '0' |
| Data address | '0' |
| | '5' |
| | '0' |
| | '0' |
| Number Of data (Word) | '0' |
| | '0' |
| | '0' |
| | '2' |
| LRC CHK 1 | 'E' |
| LRCCHK 0 | '8' |
| END 1 | CR |
| END 0 | LF |

Error response message

| STX | ':' |
|---|---|
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '9' |
| CMD 0 | '0' |
| Error code | '0' |
| | '2' |
| LRC CHK 0 | '6' |
| LRC CHK 1 | 'D' |
| END 1 | CR |
| END 0 | LF |

**5**

| LRC CHK 1 | '9' |
|-----------|-----|
| LRC CHK 0 | 'A' |
| END 1 | CR |
| END 0 | LF |

**RTU mode:**

Command message:

| ADR | 01H |
|-----|-----|
| CMD | 10H |
| Data starting | 05H |
| address | 00H |
| Number of data (Word) | 00H |
| | 02H |
| Number of data (Byte) | 04 |
| The first | 13H |
| data | 88H |
| The second | 0FH |
| data | A0H |
| CRC CHK LOW | 4DH |
| CRC CHK HIGH | D9H |

Response message:

| ADR | 01H |
|-----|-----|
| CMD 1 | 10H |
| Data starting | 05H |
| address | 00H |
| Number of data (Word) | 00H |
| | 02H |
| CRC CHK LOW | 41H |
| CRC CHK HIGH | 04H |

Error response message

| ADR | 01H |
|-----|-----|
| CMD 1 | 90H |
| Error | 02H |
| CRC CHK LOW | CDH |
| CRC CHK HIGH | C1H |

3.4 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' |
| Data starting 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, 2's complement of 0AH is **F6**H.

**RTU mode:**

RTU mode uses CRC (Cyclical Redundancy Check) detect value. CRC (Cyclical Redundancy Check) is calculated by the following steps:

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

Step 2: Excusive 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: Examine the LSB of CRC register.

Step 4: If the LSB of CRC register is 0, shift the CRC register one bit to the right with MSB zerofilling, then repeat step 3. If the LSB of CRC register is 1, shift the CRC register one bit to the right with MSB zerofilling, Exclusive OR the CRC register with the polynomial value A001H, then repeat step 3.

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 step 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 are 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.

For example, read 2 words from the to address 2102H of AMD with address 01H. The CRC register content of last byte from ADR to number of data is F76FH. The command message is as following. 6FH will transmit before F7H.

Command message:

| | |
|---|---|
| ADR | 01H |
| CMD | 03H |
| Data starting address | 02H |
| | 02H |
| Number of data (word) | 00H |
| | 02H |
| CRC CHK Low | 6FH |
| CRC CHK High | F7H |

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 values 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;
}
```

3.5 Address list:

The contents of available addresses are shown as below:

| Content | Address | Function | | |
|---------|---------|----------|---|---|
| AC drive Parameters | GGnnH | GG means parameter group, nn means parameter number, for example, the address of Pr 04-01 is 0401H. Refer to chapter 5 for the function of each parameter. When reading parameter by command code 03H, only one parameter can be read for one time. | | |
| Command Write only | 2000H | Bit 0-1 | 00B: Disabled 01B: Stop 10B: Run 11B: Jog + Run | |
| | | Bit 2-3 | Reserved | |
| | | Bit 4-5 | 00B: Disabled 01B: FWD command 10B: REV command 11B: Direction change command | |
| | | Bit 6-7 | 00B: 1st step acce/decel speed 01B: 2nd step acce/decel speed 10B: 3rd step acce/decel speed 11B: 4th step acce/decel speed | |
| | | Bit 8-11 | 0000B: Master speed 0001B: 1st step speed 0010B: 2nd step speed 0011B: 3rd step speed 0100B: 4th step speed 0101B: 5th step speed 0110B: 6th step speed 0111B: 7th step speed 1000B: 8th step speed 1001B: 9th step speed 1010B: 10th step speed 1011B: 11th step speed 1100B: 12th step speed 1101B: 13th step speed 1110B: 14th step speed 1111B: 15th step speed | |
| | | Bit 12 | Select Bit6~11 function | |
| | | Bit 13-15 | Reserved | |
| Command Write only | 2001H | Freq. command | | |
| | 2002H | Bit 0 | 1: EF (external fault) on | |
| | | Bit 1 | 1: Reset | |
| | | Bit 2 | 0: BB OFF 1: BB ON | |
| Status monitor Read only | 2100H | Fault code: | | |
| | | 00: No error occurred | | |

| Content | Address | Function | |
|---|---|---|---|
| | | 01: Over-current (oc) | |
| | | 02: Over-voltage (ov) | |
| | | 03: Overheat (oH) | |
| | | 04: Overload (oL) | |
| | | 05: Overload1 (oL1) | |
| | | 06: External fault (EF) | |
| | | 07: IGBT short circuit protection (occ) | |
| | | 08: CPU failure (cF3) | |
| | | 09: Hardware protection failure (HPF) | |
| | | 10: Current exceeds 2 times rated current during accel (ocA) | |
| | | 11: Current exceeds 2 times rated current during decel (ocd) | |
| | | 12: Current exceeds 2 times rated current during steady state operation (ocn) | |
| | | 13: Ground Fault (GFF) | |
| | | 14: Low voltage (Lv) | |
| | | 15: CPU failure 1 (cF1) | |
| | | 16: CPU failure 2 (cF2) | |
| | | 17: Base Block (bb) | |
| | | 18: Overload (oL2) | |
| | | 19: Auto accel/decel failure (cFA) | |
| | | 20: Software protection enabled (codE) | |
| | | 21: EF1 Emergency stop | |
| | | 22: PHL (Phase-Loss) | |
| | | 23: Lc (Low-current) | |
| | | 24: FbL(Feedback Loss) | |
| | | 25: Reserved | |
| | 2101H | Status of AC drive | |
| | | Bit 0-1 | 00: Run LED is off and stop led is on. (AC Drive stopping) 01: Run LED is blink and stop led is on. (AC Drive deceleration to stop) 10: Run LED is on and stop led is blink. (AC Drive standby) 11: Run LED is on and stop led is off. (AC Drive running) |
| | | Bit 2 | 1: Jog on. |
| | | Bit 3-4 | 00: Rev LED is off and FWD led is on. (Forward) 01: Rev LED is blink and FWD led is on. (Reverse to Forward) 10: Rev LED is on and FWD led is blink. (Forward to Reverse) 11: Rev LED is on and FWD led is off. (Reverse) |
| | | Bit 5-7 | Reserved |

| Content | Address | Function | |
|---------|---------|----------|---|
| | | Bit 8 | Master frequency source via communication interface |
| | | Bit 9 | Master frequency source via analog |
| | | Bit 10 | Running command via communication interface |
| | | Bit 11 | Parameter locked |
| | | Bit 12-15 | Reserved |
| | 2102H | Frequency command (F) | |
| | 2103H | Output frequency (H) | |
| | 2104H | Output current (AXXX.X) | |
| | 2105H | DC-BUS Voltage U (XXX.X) | |
| | 2106H | Output voltage E (XXX.X) | |
| | 2107H | Power Factor (n) | |
| | 2108H | Output power (XX.XXKW) | |
| | 2109H | Feedback Signal | |
| | 210AH | Feedback Signal (%) | |
| | 210BH | Estimated torque ratio | |
| | 210CH | User output (Low) uL 0-99.99 | |
| | 210DH | User output (High) uH 0-9999 | |
| | 210EH | PLC Time | |
| | 210FH | Reserved | |

3.6 Exception response:

The AC drive is expected to return a normal response after receiving command messages from the master device. The following depicts the conditions that no normal response is replied to the master device.

The AC drive does not receive the messages due to a communication error; thus, the AC drive has no response. The master device will eventually process a timeout condition.

The AC drive receives the messages without a communication error, but cannot handle it, an exception response will return to the master device and an error message "CExx" will display on the keypad of AC drive. The xx of "CExx" is a decimal code equal to the exception code that will describe below.

In the exception response, the most significant bit of the original command code is set to 1, and an exception code explains the condition that caused the exception is returned. An example of exception response of command code 06H and exception code 02H:

| **ASCII mode:** | |
|---|---|
| STX | ':' |
| ADR 1 | '0' |
| ADR 0 | '1' |
| CMD 1 | '8' |
| CMD 0 | '6' |
| Error code | '0' |
| | '2' |
| LRC CHK 1 | '7' |
| LRC CHK 0 | '7' |
| END 1 | CR |
| END 0 | LF |

| **RTU mode:** | |
|---|---|
| ADR | 01H |
| CMD | 86H |
| Exception code | 02H |
| CRC CHK Low | C3H |
| CRC CHK High | A1H |

The explanation of exception codes:

| Exception code | Explanation |
|---|---|
| 01 | Illegal command code:<br>The command code received in the command message is not available for the AC drive. |
| 02 | Illegal data address:<br>The data address received in the command message is not available for the AC drive. |
| 03 | Illegal data value:<br>The data value received in the command message is not available for the AC drive. |
| 04 | Slave device failure:<br>The AC drive is unable to perform the requested action. |
| 10 | Communication time-out: |

## 5.11 Group 10: PID Control Parameters

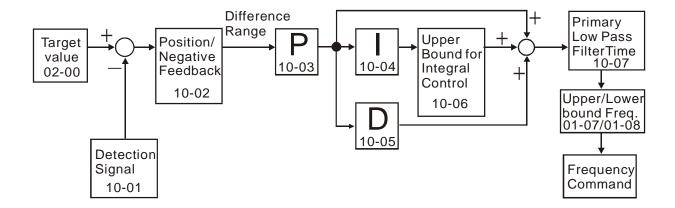| **10 - 00** | Input Terminal for PID Feedback | Factory Setting: 00 |

Settings      00: Disabled
01: Input via AI1
02: Input via AI2
03: Input via External Reference

&#x1F4D6; This parameter is to set the source of PID control feedback signal. The source could be AI1, AI2 or external reference that defined by 04-20.

&#x1F4D6; When this parameter is set to 00, PID feedback control function is disabled.

&#x1F4D6; If this parameter isn't set to 00, AC drive will automatically start-up PID feedback control. Output frequency is calculated by master frequency and PID feedback signal.

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| **10 - 01** | PID Control Detection Signal Reference | Factory Setting: 1000.0 |

Settings      1.0-6550.0            Unit: 0.1

&#x1F4D6; Please refer to 04-05 to 04-12 if this parameter is set to PID feedback control.

| **10 - 02** | PID Feedback Control Method | Factory Setting: 00 |

Settings      00: Normal (Err=SP-FB)
01: Inverse (Err=FB-SP)

&#x1F4D6; This parameter could set the calculation method of deviation signal during PID feedback control circuit.

&#x1F4D6; When this parameter is set to 00: when negative feedback control, the deviation equation is deviation = target value - detection signal. When increasing output frequency will increase detection value, this setting should be chose.

    When this parameter is set to 01: when positive control, the deviation equation is deviation = detection signal - target value. When increasing output frequency will decrease detection value, this setting should be chose.

| **10 - 03** Proportional Gain (P) | Factory Setting: 1.0 |
|---|---|
| Settings     0.0~10.0 | Unit: 0.1 |

    This parameter is to set proportional gain (P). This gain determines the response degree of P controller to feedback deviation. If gain value is large, the response is fast. But if the gain value is too great, oscillation will occur. If gain value is small, the response is slow.

| **10 - 04** Integral Time (I) | Factory Setting: 1.00 |
|---|---|
| Settings     0.00~100.00 Sec | Unit: 0.01 |

    This parameter is set to integral gain of I controller. When much integral time is to be set, the gain of I controller is small and the response is slow. The control ability to external is poor. When less integral time is to be set, the gain of I controller is large and the response is fast. The control ability to external is fast.

    If the setting of integral time is too small, output frequency and system may occur oscillation.

    If integral time is set to 0.00, I controller is closed.

| **10 - 05** Differential Time (D) | Factory Setting: 0.00 |
|---|---|
| Settings     0.00~1.00 Sec | Unit: 0.01 |

    This parameter is set to D controller gain. This gain determines D controller to the response of change of deviation. Suitable differential time could decrease overshoot of P and I controller. The oscillation will be attenuation and steady quickly. But if much differential time is to be set, it may cause system oscillation.

    Interference immunity ability is poor due to differential controller activates to change of deviation. It's not recommended to use, especially during interferences.

| **10 - 06** Upper Bound for Integral Control | Factory Setting: 100 |
|---|---|
| Settings     00~200% | Unit: 1 |

    This parameter could set the upper bound of I controller. In other words, upper bound for integral control = (01-00) X (10-04) %

| **10 - 07** Primary Low Pass Filter Time | Factory Setting: 0.0 |
|---|---|
| Settings     0.0~2.5 Sec | Unit: 0.1 |

    This parameter determines primary Low Pass filter time.

&#x2317; Output frequency of PID controller will filter by primary low pass function. This function could decrease change of output frequency. A long primary low pass time means filter degree is high and vice versa.

&#x2317; Unsuitable primary low pass filter time setting may cause system oscillation.

| **10 - 08** PID Feedback Signal Range | Factory Setting: 600.00 |
|---|---|
| Settings     0.01~160.00Hz | Unit: 0.01 |

&#x2317; This parameter setting could allow the maximum of PID deviation.

&#x2317; If PID function is normally, it should control the detective value to target value accurately in the certain time. If AC drive can't control deviation in the 10-08 setting range during 10-07 setting time, it means PID feedback control is abnormal. The treatment is set as 10-10.

| **10 - 09** PID Feedback Signal Fault Treatment Time | Factory Setting: 0.0 |
|---|---|
| Settings     0.0~3600.0 Sec | Unit: 0.1 |

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&#x2317; This parameter is to set the detection time of abnormal PID derivative. If PID deviation detection time is set to 0.0, the function is disabled.

| **10 - 10** PID Feedback Signal Fault Treatment | &#x2712; | Factory Setting: 01 |
|---|---|---|
| Settings     00: Warn and RAMP stop | | |
| 01: Warn and COAST stop | | |
| 02: Warn and keep operating | | |

&#x2317; This parameter is to set treatment of the abnormal PID deviation.

| **10 - 11** V/F Curve Selection | Factory Setting: 00 |
|---|---|
| Settings     00: Determined by group 1 | |
| 01: 1.5 power curve | |
| 02: 1.7 power curve | |
| 03: 2 power curve | |
| 04: 3 power curve | |
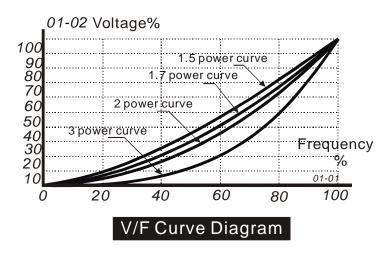
&#x2317; This parameter is to set V/F curve. If this parameter isn't set to 00, parameter 01-03 and 01-04 will disable.

&#x2317; Input current of the motor could divide into two orthogonal vectors: magnetic vector and torque vector. Gap flux, which is produced by Magnetic vector, is in direct proportion with output voltage of motor. Torque vector produces torque. Torque is in direct proportion with the result of magnetic vector multiply by torque vector. In theory, if the value of magnet vector is the same with torque vector (in unsaturated flux condition), the input current is minimum. If motor loading is unsteady torque loading (loading torque is in direct proportion with speed. For example, the loading of fan or pump), loading torque is low during low

speed, suitable lower input voltage will decrease input current of magnetic field to lower flux loss and iron loss of the motor and promote whole efficiency.

    When this parameter is set to high power V/F curve and low frequency torque is lower, it is not suitable for AC drive to accel/decel quickly. If it needs to accel/decel quickly, it is not recommended to use this parameter.



V/F Curve Diagram

# 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 10 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 multimeter set to measure DC.***

## 6.1 Periodic Inspection

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

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 the operation.
5.   Whether the motors are overheated during the operation.
6.   Always check the input voltage of the AC drive with Voltmeter.

## 6.2 Periodic Maintenance

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

1.   Tighten and reinforce the screws of the AC drive if necessary, cause it may loose due to the vibration or changing of temperatures.
2.   Whether the conductors or insulators were corroded and damaged.
3.   Check the resistance of the insulation with Meg-ohmmeter.
4.   Often check and change the capacitors and relays.
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 four most recent faults can be read on the digital keypad display.

NOTE: Faults can be cleared by a reset from the keypad or 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. |
| OCC | IGBT protection (Insulated Gate Bipolar Transistor) | 2. Check the wiring connections between the AC drive and motor for possible short circuits. 3. Increase the Acceleration time. 4. Check for possible excessive loading conditions at the motor. 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. 2. Check for possible voltage transients. 3. Bus over-voltage may also be caused by motor regeneration. Either increase the decel time or add an optional braking resistor. 4. Check whether the required braking power is within the specified limits. |

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| 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 heatsinks 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. 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.7-02.<br>3. Increase the AC drive's output capacity, i.e. bigger horsepower drive. |
| oL 1 | Internal electronic overload trip | 1. Check for possible motor overload.<br>2. Check electronic thermal overload setting.<br>3. Increase motor capacity, i.e. larger horsepower motor.<br>4. Reduce the current level so that the drive output current does not exceed the value set by the Motor Rated Current Pr.7-00. |
| oL 2 | Motor overload. Check the parameter settings (Pr.6-03 to Pr.6-05) | 1. Reduce the motor load.<br>2. Adjust the over-torque detection setting to an appropriate setting (Pr.06-03 to Pr.06-05). |
| cE - | Communication Error | 1. Check the connection between the AC drive and computer for loose wires.<br>2. Check if the communication protocol is properly set. |

| Fault Name | Fault Descriptions | Corrective Actions |
|---|---|---|
| oc$\mathcal{A}$ | 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.7-02. <br> 3. Increase the acceleration time. <br> 4. Replace with the AC drive with one that has a higher output capacity (next HP size). |
| ocd | 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). |
| ocn | 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). |
| EF | The external terminal EF-GND goes from OFF to ON. | 1. When external terminal EF-GND is closed, the output will be turned off. (Under N.O. E.F.) <br> 2. Press RESET after fault has been cleared. |
| EF 1 | Emergency stop. <br> When the multi-function input terminals (MI1 to MI6) stop, AC drive stops any output. | Press RESET after fault has been cleared. |
| codE | Software protection failure | Return to the factory. |

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| Fault Name | Fault Descriptions | Corrective Actions |
|---|---|---|
| GFF | Ground fault: 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: 1. Check whether the IGBT power module is damaged. 2. Check for possible poor insulation at the output line. |
| bb | External Base Block. AC drive output is turned off. (Refer to Pr. 08-08) | 1. When the external input terminal (B.B) is active, the AC drive output will be turned off. 2. Disable this connection and the AC drive will begin to work again. |
| Lc | Low Current | 1. Check Load current 2. Check Pr.06-08 to Pr.06-10 setting |
| PHL | Phase Loss | Check Power Source Input |
| FbL | Feedback Loss | Check Pr. 10-00 and wiring of feedback signal. |
| HPF.1 | GFF hardware error | Return to the factory |
| HPF2 | CC (current clamp) | |
| HPF3 | OC hardware error | |
| HPF4 | OV hardware error | |
| HPF5 | OH hardware error | |
| cF1 | Internal memory IC cannot be programmed. | 1. Return to the factory. 2. Check the EEPROM on the control board. |
| cF2 | Internal memory IC cannot be read. | 1. Return to the factory. 2. Reset drive to factory defaults. |
| cF3.3 | U-phase error | Return to the factory |
| cF3.4 | V-phase error | |
| cF3.5 | W-phase error | |
| cF3.6 | OV or LV | |
| cF3.7 | Isum error | |
| cF3.8 | OH error | |

# CHAPTER 8   PARAMETER SUMMARY

## Group 0 AC Drive Status Parameter

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 00-00 | Software Version | Read only | | |
| | 00-01 | AC Drive Status Indication 1 | 00: No Fault occurred<br>01: oc (over current)<br>02: ov(over voltage)<br>03: oH(over temperature)<br>04: oL(overload)<br>05: oL1(electronic thermal relay)<br>06: EF(external Fault)<br>07: occ(AC drive IGBT fault)<br>08: CF3(CPU failure)<br>09: HPF(Hardware Protection Failure)<br>10: ocA(current exceed during Acceleration)<br>11: ocd(current exceed during Deceleration)<br>12: ocn(current exceed during Steady State)<br>13: GFF(Ground Fault)<br>14: Lv(Low voltage)<br>15: CF1(abnormal input data)<br>16: CF2(abnormal output data)<br>17: bb(Base Block)<br>18: oL2(over load2)<br>19: Reserved<br>20: codE(software or password protection)<br>21: EF1(external Emergency Stop)<br>22: PHL(phase loss)<br>23: Lc (Low Current)<br>24: FbL(Feedback Loss)<br>25: Reserved | Read | |

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| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 00-02 | AC Drive Status Indication 2 | Bit 0~1: 00: Run led is off and stop led is on.<br>01: Run led is blink and stop led is on.<br>10: Run led is on and stop led is blink.<br>11: Run led is on and stop led is off.<br>Bit 2: 1: Jog on.<br>Bit 3~4: 00: Rev led is off and FWD led is on.<br>01: Rev led is blink and FWD led is on.<br>10: Rev led is on and FWD led is blink.<br>11: Rev led is on and FWD led is off.<br>Bit 5-7: Reserved<br>Bit 8: Master frequency source via communication interface<br>Bit 9: Master frequency source via analog<br>Bit10: Running command via communication interface<br>Bit11: Parameter locked<br>Bit12~15: Reserved | Read | |
| | 00-03 | Frequency Setting (F) or Closed Loop Control Setting Point | Read only | Read | |
| | 00-04 | Output Frequency (H) | Read only | Read | |
| | 00-05 | Output Current (A) | Read only | Read | |
| | 00-06 | DC-BUS Voltage (U) | Read only | Read | |
| | 00-07 | Output Voltage (E) | Read only | Read | |
| | 00-08 | Output Power Factor (n) | Read only | Read | |
| | 00-09 | Output Power (kW) | Read only | Read | |
| | 00-10 | Feedback Signal Actual Value | Read only | Read | |
| | 00-11 | Feedback Signal (%) | Read only | Read | |
| | 00-12 | User Target Value (Low bit) uL 0-99.99 | Read only | Read | |
| | 00-13 | User Target Value (High bit) uH 0-9999 | Read only | Read | |
| | 00-14 | PLC Time | Read only | Read | |
| | 00-15 | Output Reactive Power (KVAR) | Read only | Read | |

## Group 1 Basic Parameter

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 01-00 | Maximum Output Frequency | 50.00~160.00Hz | 60.00 | |
| | 01-01 | Maximum Voltage Frequency (Base Frequency) | 0.10~160.00 Hz | 60.00 | |
| | 01-02 | Maximum Output Voltage | 0.2V ~ 510.0V | 440.0 | |
| | 01-03 | Mid-point Frequency | 0.10~120 Hz | 3.00 | |
| | 01-04 | Mid-point Voltage | 0.2V~510.0V | 11.0 | |
| | 01-05 | Minimum Output Frequency | 0.10~20.00 Hz | 3.00 | |
| | 01-06 | Minimum Output Voltage | 0.2V~100.0V | 11.0 | |
| | 01-07 | Upper Bound Frequency | 0.00~160.00 Hz | 60.00 | |
| | 01-08 | Lower Bound Frequency | 0.00~160.00 Hz | 0.00 | |
| ✓ | 01-09 | Acceleration Time 1 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-10 | Deceleration Time 1 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-11 | Acceleration Time 2 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-12 | Deceleration Time 2 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-13 | Acceleration Time 3 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-14 | Deceleration Time 3 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-15 | Acceleration Time 4 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-16 | Deceleration Time 4 | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-17 | JOG Acceleration Time | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-18 | JOG Deceleration Time | 0.1~3600.0 Sec | 10.0/ 60.0 | |
| ✓ | 01-19 | JOG Frequency | 0.0 Hz~160.00 Hz | 6.00 | |
| | 01-20 | S Curve Delay Time in Accel | 0.00~2.50sec | 0.00 | |
| | 01-21 | S Curve Delay Time in Decel | 0.00~2.50sec | 0.00 | |
| ✓ | 01-22 | Modulation Index | 0.90~1.20 | 1.00 | |
| | 01-23 | Accel/Decel Time Unit | 00: Unit is 1 Sec 01: Unit is 0.1 Sec 02: Unit is 0.01 Sec | 01 | |

## Group 2 Digital Output/Input Parameter

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| ✗ | 02-00 | Source of Frequency Command | 00: via keypad<br>01: via analog input AI1<br>02: via analog input AI2<br>03: via RS485 serial communication<br>04: via External Reference | 00 | |
| ✗ | 02-01 | Source of Operation Command | 00: Controlled by the digital keypad<br>01: Controlled by the external terminals, keypad STOP enabled.<br>02: Controlled by external terminals, keypad STOP disabled.<br>03: Controlled by the RS-485 communication interface, keypad STOP enabled.<br>04: Controlled by the RS-485 communication interface, keypad STOP disabled. | 00 | |
| | 02-02 | Stop Method | 00: Stop = ramp to stop, E.F. (External Fault) = coast to stop<br>01: Stop = coast to stop, E.F. = coast to stop<br>02: Stop = ramp to stop, E.F. = ramp to stop<br>03: Stop = coast to stop, E.F. = ramp to stop | 00 | |
| ✗ | 02-03 | PWM Carrier Frequency Selections | 1K~6KHz | ## | |
| | 02-04 | Forward/Reverse Enable | 00: Forward enabled<br>01: Reverse disabled<br>02: Forward disabled | 00 | |
| | 02-05 | 2-wire/3-wire Operation Control Modes | 00: 2-wire: FWD/STOP, REV/STOP<br>01: 2-wire: FWD/REV, RUN/STOP<br>02: 3-wire operation | 00 | |
| | 02-06 | Line Start Lockout | 00: Disabled<br>01: Enabled | 01 | |
| | 02-07 | Reserved | | | |

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| ✗ | 02-08 | Start-up Display Selection | Bit0~1: 00 = F LED<br>            01 = H LED<br>            10 = U LED (special<br>                      display)<br>            11 = Fwd / Rev<br> Bit2: 0 = Fwd LED /<br>          1 = Rev LED<br>Bit3~5: 000 = 1st 7-step<br>            001 = 2nd 7-step<br>            010 = 3rd 7-step<br>            011 = 4th 7-step<br>            100 = 5th 7-step<br>Bit6~7: Reserved | 00 | |
| ✗ | 02-09 | Special Display | 00: A displays output current of<br>      AC drive<br>01: U displays DC-Bus voltage<br>      of AC drive<br>02: E displays RMS of output<br>      voltage<br>03: P displays feedback Signal<br>04: PLC display auto procedure<br>      state | 00 | |
| ✗ | 02-10 | User Defined Coefficient | 0.01~160.00 | 1.00 | |
| ✗ | 02-11 | Flying Start | 00: Disabled<br>01: Enable (Dc braking<br>      disabled) | 00 | |
| ✗ | 02-12 | Flying Start Frequency | 00: Trace from master<br>      frequency command<br>01: Trace from maximum<br>      setting frequency 01-00 | 00 | |
| ✗ | 02-13 | Master Frequency Memory Setting | 00: Do not remember the last<br>      known frequency<br>01: Remember the last known<br>      frequency | 01 | |

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## Group 3 Output Function Parameters

| Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|
| 03-00 | Multi-function Output Terminal 1 (Relay) | 00: disabled<br>01: Indication during operation<br>02: Master frequency attained<br>03: Zero Speed (including shutdown)<br>04: Over-torque<br>05: External Fault<br>06: Low voltage detection<br>07: Operation Mode indication<br>08: Fault indication<br>09: Master Frequency Attained 1<br>10: Master Frequency Attained 2<br>11: Over Temperature indication<br>12: Drive Ready<br>13: External Emergency Stop (EF1)<br>14: Software Braking Output<br>15: OL or OL1 Overload Warning<br>16: Low Current Indication<br>17: PID Feedback Error Indication<br>18: PLC Program Running<br>19: PLC Program Step Completed<br>20: PLC Program Completed<br>21: PLC Operation Paused | 01 | |
| 03-01 | Reserved | | | |
| 03-02 | Master Frequency Attained 1 | 0.00~160.00 Hz | 0.00 | |
| 03-03 | Master Frequency Attained 2 | 0.00~160.00 Hz | 0.00 | |
| 03-04 | DC Fan Control | 00: Fan runs on power up.<br>01: Fan begins upon a RUN command. Fan stops 1 minute after a STOP command.<br>02: Fan begins upon a RUN command. Fan stops after a STOP command<br>03: Fan is controlled by temperature.<br>Fan will be started at approximate 60°C. | 00 | |

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 03-05 | Analog Output Signal 1 | 00: Output frequency<br>01: Output current<br>02: Output voltage<br>03: Frequency command<br>04: Power factor loading | 00 | |
| | 03-06 | Analog Output Signal 2 | | 01 | |
| | 03-07 | Analog Output Gain 1 | 01~200% | 100 | |
| | 03-08 | Analog Output Gain 2 | 01~200% | 100 | |
| | 03-09 | Analog Output 2 Selection | 00: 0~20mA<br>01: 4~20mA | 01 | |

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## Group 4 Input Function Parameters

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 04-00 | Multi-function Input Terminal 1 | 00: disabled | 01 | |
| | 04-01 | Multi-function Input Terminal 2 | 01: Multi-Speed terminal 1 | 02 | |
| | 04-02 | Multi-function Input Terminal 3 | 02: Multi-Speed terminal 2 | 03 | |
| | 04-03 | Multi-function Input Terminal 4 | 03: Multi-Speed terminal 3<br>04: Multi-Speed terminal 4<br>05: Reset (NO)<br>06: Reset (NC)<br>07: Jog operation (JOG)<br>08: Accel/Decel disabled<br>09: 1st and 2nd Accel/Decel selection<br>10: 3rd and 4th Accel/Decel selection<br>11: B.B. (NO) input<br>12: B.B. (NC) input<br>13: Increase Frequency<br>14: Decrease Frequency<br>15: Emergency stop (NO)<br>16: Emergency stop (NC)<br>17: KEYPAD(open), EXT(close)<br>18: PID disable<br>19: Run PLC Program<br>20: Pause PLC Program<br>21: 1st Output Frequency Gain (Pr.04-30)<br>22: 2nd Output Frequency Gain (Pr.04-31)<br>23: 3rd Output Frequency Gain (Pr.04-32) | 04 | |
| | 04-04 | Digital Input Terminal Response Time | 01~20 | 01 | |
| | 04-05 | Minimum AI1 Analog Input | 0 ~ 100% | 0 | |
| | 04-06 | Maximum AI1 Analog Input | 0 ~ 100% | 100 | |
| | 04-07 | Minimum Output that corresponds to AI1 | 0.00~100.00% | 0.00 | |
| | 04-08 | Maximum Output that corresponds to AI1 | 0.00~100.00% | 100.00 | |
| | 04-09 | Minimum AI2 Analog Input | 0 ~ 100% | 0 | |
| | 04-10 | Maximum AI2 Analog Input | 0 ~ 100% | 100 | |
| | 04-11 | Minimum Output that corresponds to AI2 | 0.0~100.0% | 0.00 | |
| | 04-12 | Maximum Output that corresponds to AI2 | 0.0~100.0% | 100.00 | |
| ✎ | 04-13 | 1st AI1 Gain | 0.0~100.0% | 100.0 | |

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| ✔ | 04-14 | 2nd AI1 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-15 | 3rd AI1 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-16 | 4th AI1 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-17 | 5th AI1 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-18 | 1st AI2 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-19 | 2nd AI2 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-20 | 3rd AI2 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-21 | 4th AI2 Gain | 0.0~100.0% | 100.0 | |
| ✔ | 04-22 | 5th AI2 Gain | 0.0~100.0% | 100.0 | |
| | 04-23 | Analog Input Delay AI1 | 0.00~10.00 Sec | 0.50 | |
| | 04-24 | Analog Input Delay AI2 | 0.00~10.00 Sec | 0.50 | |
| | 04-25 | Summation of External Frequency Sources | 00: Disabled<br>01: AI1*( AI1 Gain) + AI2*( AI2 Gain)<br>02: AI1*( AI1 Gain) - AI2*( AI2 Gain)<br>03: AI1*( AI1 Gain) * AI2 *( AI2 Gain)<br>04: Reserved<br>05: Communication master frequency+AI1*( AI1 Gain)<br>06: Communication master frequency+AI2*( AI2 Gain)<br>07: Max (AI1*( AI1 Gain), AI2*( AI2 Gain)) | 00 | |
| | 04-26 | 1st AI Frequency Gain | 0.00: Disabled<br>0.01~160.00 Hz | 0.00 | |
| | 04-27 | 2nd AI Frequency Gain | 0.00: Disabled<br>0.01~160.00 Hz | 0.00 | |
| | 04-28 | 3rd AI Frequency Gain | 0.00: Disabled<br>0.01~160.00 Hz | 0.00 | |
| | 04-29 | 4th AI Frequency Gain | 0.00: Disabled<br>0.01~160.00 Hz | 0.00 | |
| | 04-30 | 1st Out Frequency Gain | 0.0 to 200.0% | 100.0 | |
| | 04-31 | 2nd Out Frequency Gain | 0.0 to 200.0% | 100.0 | |
| | 04-32 | 3rd Out Frequency Gain | 0.0 to 200.0% | 100.0 | |

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## Group 5 Multi-step Speed Frequency Parameters

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| ✗ | 05-00 | 1st Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-01 | 2nd Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-02 | 3rd Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-03 | 4th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-04 | 5th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-05 | 6th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-06 | 7th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-07 | 8th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-08 | 9th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-09 | 10th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-10 | 11th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-11 | 12th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-12 | 13th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-13 | 14th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| ✗ | 05-14 | 15th Step Speed Frequency | 0.00~160.00 Hz | 0.00 | |
| | 05-15 | PLC 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 program cycles step by step | 00 | |
| | 05-16 | PLC Forward/ Reverse Motion | 00 to 32767 (00: FWD  01: REV) | 00 | |
| | 05-17 | Time Duration Step 1 | 0.0 to 65500 sec | 0.0 | |
| | 05-18 | Time Duration Step 2 | 0.0 to 65500 sec | 0.0 | |
| | 05-19 | Time Duration Step 3 | 0.0 to 65500 sec | 0.0 | |
| | 05-20 | Time Duration Step 4 | 0.0 to 65500 sec | 0.0 | |
| | 05-21 | Time Duration Step 5 | 0.0 to 65500 sec | 0.0 | |
| | 05-22 | Time Duration Step 6 | 0.0 to 65500 sec | 0.0 | |
| | 05-23 | Time Duration Step 7 | 0.0 to 65500 sec | 0.0 | |
| | 05-24 | Time Duration Step 8 | 0.0 to 65500 Sec | 0.0 | |
| | 05-25 | Time Duration Step 9 | 0.0 to 65500 Sec | 0.0 | |
| | 05-26 | Time Duration Step 10 | 0.0 to 65500 Sec | 0.0 | |
| | 05-27 | Time Duration Step 11 | 0.0 to 65500 Sec | 0.0 | |

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 05-28 | Time Duration Step 12 | 0.0 to 65500 Sec | 0.0 | |
| | 05-29 | Time Duration Step 13 | 0.0 to 65500 Sec | 0.0 | |
| | 05-30 | Time Duration Step 14 | 0.0 to 65500 Sec | 0.0 | |
| | 05-31 | Time Duration Step 15 | 0.0 to 65500 Sec | 0.0 | |
| | 05-32 | Time Unit Settings | 00: 1 Sec<br>01: 0.1 Sec | 00 | |

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**Group 6 Protection Function Parameters**

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 06-00 | Over-voltage Stall Prevention | 660.0V~820.0VDC<br>00: Disabled | 780.0 | |
| | 06-01 | Over-current Stall Prevention during Acceleration | 20~250%<br>00: Disabled | 150% | |
| | 06-02 | Over-current Stall Prevention during operation | 20~250%<br>00: Disabled | 150% | |
| | 06-03 | Over-torque Detection Selection | 00: Over-torque detection disabled.<br>01: Over-torque detection enabled during constant speed operation (OL2), and operation continues.<br>02: Over-torque detection enabled during constant speed operation (OL2), and operation halted.<br>03: Over-torque detection enabled during operation (OL2), and operation continues.<br>04: Over-torque detection enabled during operation (OL2), and operation halted. | 00 | |
| | 06-04 | Over-torque Detection Level | 30~150% | 110 | |
| | 06-05 | Over-torque Detection Time | 0.1~60.0 Sec | 0.1 | |
| | 06-06 | Electronic Thermal Relay Selection | 00: Operate disabled.<br>01: Operate with a standard motor.<br>02: Operate with a special motor. | 02 | |
| | 06-07 | Electronic Thermal Characteristic | 30~600 Sec | 60 | |
| | 06-08 | Low Current Detection Level | 00~100% (00 disabled) | 00 | |
| | 06-09 | Low Current Detection Time | 0.1~ 3600.0 Sec | 10.0 | |
| | 06-10 | Low Current Detection Treatment | 00: Warn and Ramp to stop<br>01: Warn and Coast to stop<br>02: Warn and keep operating | 01 | |

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 06-11 | Present Fault Record | 00: No Fault | 00 | |
| | 06-12 | Second Most Recent Fault Record | 01: Oc (over-current)<br>02: Ov (over-voltage) | 00 | |
| | 06-13 | Third Most Recent Fault Record | 03: OH (over temperature)<br>04: OL (over load) | 00 | |
| | 06-14 | Fourth Recent Fault Record | 05: oL1 (over load 1)<br>06: EF (external fault)<br>07: Occ (IGBT module is abnormal)<br>08: CF3 (driver's internal circuitry is abnormal)<br>09: HPF (hardware protection failure)<br>10: OcA (over-current during acceleration)<br>11: Ocd (over-current during deceleration)<br>12: Ocn (over-current during steady state operation)<br>13: GFF(Ground Fault)<br>14: Lv (Low voltage)<br>15: CF1 (CPU READ failure)<br>16: CF2 (CPU WRITE failure)<br>17: bb (Base Block)<br>18: OL2 (over load2)<br>19: Reserved<br>20: Code (software/password protection)<br>21: EF1 (Emergency stop)<br>22: PHL (phase-loss)<br>23: Lc (Low Current)<br>24: FbL(Feedback Loss)<br>25: Reserved | 00 | |
| | 06-15 | Parameter Reset | 00~65535<br>09: Reset parameters (50Hz, 380)<br>10: Reset parameters (60Hz, 440) | 00 | |
| | 06-16 | Parameter Protection Password Input | 00~65535 | 00 | |
| | 06-17 | Parameter Protection Password Setting | 00~65535<br>00: No password protection | 00 | |

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## Group 7 AC Drive and Motor Parameters

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 07-00 | Identity Code of AC Drive | Display by model type | ## | |
| | 07-01 | Rated Current of AC Drive | Display by model type | ## | |
| ✗ | 07-02 | Full-load Current of Motor | 30~120% | 100% | |
| ✗ | 07-03 | No-load Current of Motor | 1~99% | 30% | |
| ✗ | 07-04 | Auto Slip Compensation Gain | 0.0~3.0 | 0.0 | |
| | 07-05 | Rated Slip Frequency of Motor | 0.00~20.00Hz | 0.00 | |
| ✗ | 07-06 | Auto Torque Compensation Gain | 0.0~10.0 | 0.0 | |
| ✗ | 07-07 | Torque Compensation Gain by Manually | 0.0~10.0 | 0.0 | |
| | 07-08 | Calculate Total Running Time of the Motor (Min) | 00 to 1439 Min | 00 | |
| | 07-09 | Calculate Total Running Time of the Motor (Day) | 00 to 65535 Day | 00 | |
| | 07-10 | Electric Bill for One Time | Read Only | Read | |
| | 07-11 | Accumulated Electric Bill (per currency unit) | Read Only | Read | |
| | 07-12 | Accumulated Electric Bill (per $10^4$ currency unit) | Read Only | Read | |
| | 07-13 | Electric Rate (per currency unit) | 0.01 to 655.35 | 0.6 | |

## Group 8 Special Parameters

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| | 08-00 | DC Braking Current Level | 00~100% | 00 | |
| | 08-01 | DC Braking Time during Start-up | 0.0~60.0 Sec | 0.0 | |
| | 08-02 | DC Braking Time during Stopping | 0.00~60.00 Hz | 0.0 | |
| | 08-03 | Start-point for DC Braking | 0.00~160.00 Hz | 0.00 | |
| | 08-04 | Momentary Power Loss Operation Selection | 00: Disable<br>01: Trace from top downward<br>02: Trace from bottom upward | 00 | |
| | 08-05 | Maximum Allowable Power Loss Time | 0.1~5.0 Sec | 2.0 | |
| | 08-06 | Speed Search Time | 0.1~5.0 Sec | 0.5 | |
| | 08-07 | Maximum Speed Search Current | 30~150% | 110 | |
| | 08-08 | BB speed search method | 00: Trace from top downward<br>01: Trace from bottom upward | 00 | |
| | 08-09 | Auto Restart Times after Fault | 00~10 | 00 | |
| | 08-10 | Auto Restart Time after Fault | 00 to 60000 sec | 600 | |
| | 08-11 | Operation Frequency Inhibition 1 UP | 0.00~160.00 Hz | 0.00 | |
| | 08-12 | Operation Frequency Inhibition 1 DOWN | 0.00~160.00 Hz | 0.00 | |
| | 08-13 | Operation Frequency Inhibition 2 UP | 0.00~160.00 Hz | 0.00 | |
| | 08-14 | Operation Frequency Inhibition 2 DOWN | 0.00~160.00 Hz | 0.00 | |
| | 08-15 | Operation Frequency Inhibition 3 UP | 0.00~160.00 Hz | 0.00 | |
| | 08-16 | Operation Frequency Inhibition 3 DOWN | 0.00~160.00 Hz | 0.00 | |
| | 08-17 | Automatic Energy-saving | 00: Energy-saving operation disabled<br>01: Energy-saving operation enabled | 00 | |
| | 08-18 | Automatic Voltage Regulation (AVR) | 00: AVR function enabled<br>01: AVR function disabled<br>02: AVR function disabled for deceleration | 00 | |
| ✗ | 08-19 | Software Setting of the Braking Level (the action level of the braking resistor) | 740V~820VDC<br>00:Disabled | 760 | |
| ✗ | 08-20 | Vibration Compensation Factor | 00~1000 | 00 | |

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**Group 9 Communication Parameters**

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| ✎ | 09-00 | Communication Address | 01-254<br>00:Disabled | 01 | |
| ✎ | 09-01 | Transmission Speed (Baud Rate) | 00: Baud rate 4800<br>01: Baud rate 9600<br>02: Baud rate 19200<br>03: Baud rate 38400 | 01 | |
| ✎ | 09-02 | Transmission Fault Treatment | 00: Warn and keep operating<br>01: Warn and RAMP to stop<br>02: Warn and COAST to stop<br>03: No warning and no display | 03 | |
| | 09-03 | Over Time Detection during Transmission | 00: Disabled<br>01: Enabled | 00 | |
| | 09-04 | Communication Format | 00: 7-bit for ASCII<br>01: 8-bit for ASCII<br>02: 8-bit for RTU | 00 | |
| | 09-05 | Even/Odd Parity and Stopping Parity Setting | 00: None parity + 2 stop bit<br>01: Even parity + 2 stop bit<br>02: Odd parity + 2 stop bit<br>03: None parity + 1 stop bit<br>04: Even parity + 1 stop bit<br>05: Odd parity + 1 stop bit | 00 | |
| ✎ | 09-06 | Communication Operation Command 1 | Bit0~1: 00: Disable<br>         01: Stop<br>         10: Start-up<br>         11: JOG start-up<br>Bit2~3: Reserved<br>Bit4~5: 00: No function<br>         01: FWD command<br>         10: REV command<br>         11: Change direction command<br>Bit6~7: 00: 1st step accel/decel speed<br>         01: 2nd step accel/decel speed<br>         10: 3rd step accel/decel speed<br>         11: 4th step accel/decel speed | 00 | |

| | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
| ✗ | 09-06 | Communication Operation Command 1 | Bit8~11:<br> 0000: Master speed<br> 0001: 1st step speed<br> 0010: 2nd step speed<br> 0011: 3rd step speed<br> 0100: 4th step speed<br> 0101: 5th step speed<br> 0110: 6th step speed<br> 0111: 7th step speed<br> 1000: 8th step speed<br> 1001: 9th step speed<br> 1010: 10th step speed<br> 1011: 11th step speed<br> 1100: 12th step speed<br> 1101: 13th step speed<br> 1110: 14th step speed<br> 1111: 15th step speed<br>Bit12: Select Bit6~11 function<br>Bit13~15 Reserved | 00 | |
| ✗ | 09-07 | Communication Frequency Setting | 0~160.00Hz | 60.00 | |
| ✗ | 09-08 | Communication Operation Command 2 | Bit0: 1: EF ON<br>Bit1: 1: Reset<br>Bit2: 0: BB OFF, 1: BB ON<br>Bit3~15: Reserved | 00 | |

**8**

**Group 10 PID Controls**

|  | Parameters | Functions | Settings | Factory Setting | Customer |
|---|---|---|---|---|---|
|  | 10-00 | Input Terminal for PID Feedback | 00: Disabled<br>01: Input via AI1<br>02: Input via AI2<br>03: Input via External<br>     Reference | 00 |  |
|  | 10-01 | PID Control Detection Signal Reference | 1.0-6550.0 | 1000.0 |  |
|  | 10-02 | PID Feedback Control Method | 00: Normal (Err=SP-FB)<br>01: Inverse (Err=FB-SP) | 00 |  |
|  | 10-03 | Proportional Gain (P) | 0.0~10.0 | 1.0 |  |
|  | 10-04 | Integral Time (I) | 0.00~100.00 Sec | 1.00 |  |
|  | 10-05 | Differential Time (D) | 0.00~1.00 Sec | 0.00 |  |
|  | 10-06 | Upper Bound for Integral Control | 00~200% | 100 |  |
|  | 10-07 | Primary Low Pass Filter Time | 0.0~2.5 Sec | 0.0 |  |
|  | 10-08 | PID Feedback Signal Range | 0.01 to 10-01 | 600.0 |  |
|  | 10-09 | PID Feedback Signal Fault Treatment Time | 0. 0~3600.0 Sec<br>0.0: Disabled | 0.0 |  |
| ✐ | 10-10 | PID Feedback Signal Fault Treatment | 00: Warn and RAMP stop<br>01: Warn and COAST stop<br>02: Warn and keep operating | 01 |  |
|  | 10-11 | V/F Curve Selection | 00: Determined by group 01<br>01: 1.5 power curve<br>02: 1.7 power curve<br>03: 2 power curve<br>04: 3 power curve | 00 |  |

# Specifications

| Voltage Class | | 460V Class | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model Number VFD-□□□□G43X | | 055 | 075 | 110 | 150 | 185 | 220 | 300 | 370 | 450 | 550 | 750 |
| Max. Applicable Motor Output (kW) | | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 37 | 45 | 55 | 75 |
| Max. Applicable Motor Output (HP) | | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 75 | 100 |
| Output Rating | Rated Output Capacity (KVA) | 10 | 14 | 18 | 25 | 29 | 34 | 46 | 56 | 69 | 84 | 114 |
| | Rated Output Current (A) | 13 | 18 | 24 | 32 | 38 | 45 | 60 | 73 | 91 | 110 | 150 |
| | Maximum Output Voltage (V) | Proportional to Input Voltage | | | | | | | | | | |
| | Rated Frequency (Hz) | 0.10-120.00Hz | | | | | | | | | | |
| | Carrier Frequency (kHz) | 4-6 | | 3-6 | | | | 2-6 | | | | |
| Input Rating | Rated Input Current (A) | 14 | 19 | 25 | 32 | 39 | 49 | 60 | 73 | 91 | 120 | 160 |
| | Rated Voltage | 3-phase    342-528 V | | | | | | | | | | |
| | Frequency Tolerance | 47 – 63 Hz | | | | | | | | | | |
| Control Characteristics | Control System | SPWM (Sinusoidal Pulse Width Modulation, carrier frequency 2-6kHz) | | | | | | | | | | |
| | Output Frequency Resolution | 0.01Hz | | | | | | | | | | |
| | Torque Characteristics | Including the auto-torque, auto-slip compensation; starting torque can be 150% at 1.0Hz | | | | | | | | | | |
| | Overload Endurance | 150% of rated current for 1 minute | | | | | | | | | | |
| | Accel/Decel Time | 1-36000/0.1-3600.0/0.01-360.00 seconds (3 Independent settings for Accel/Decel Time) | | | | | | | | | | |
| | V/F Pattern | Adjustable V/F pattern | | | | | | | | | | |
| | Stall Prevention Level | 20 to 150%, Setting of Rated Current | | | | | | | | | | |
| Operating Characteristics | Frequency Setting — Keypad | Setting by ▲ ▼ | | | | | | | | | | |
| | Frequency Setting — External Signal | 2 sets of analog inputs, 15 Multi-Function Inputs, RS-485 interface (MODBUS), External terminals UP/DOWN Key | | | | | | | | | | |
| | Operation Setting Signal — Keypad | Set by RUN, STOP and JOG | | | | | | | | | | |
| | Operation Setting Signal — External Signal | Operation by FWD, REV, JOG and communication operation | | | | | | | | | | |
| | Multi-Function Input Signal | Multi-step selection 0 to 15, Jog, accel/decel inhibit, first to forth accel/decel switches, counter, external Base Block (NC, NO), JOG | | | | | | | | | | |
| | Multi-Function Output Indication | AC Drive Operating, Frequency Attained, Desired Frequency Attained, Zero speed, Base Block, Fault Indication and Local/Remote indication | | | | | | | | | | |
| | Analog Output Signal | 2 sets of Analog frequency/current signal output | | | | | | | | | | |
| Other Functions | | AVR, 2 types of S-Curve, Over-Voltage, Over-Current Stall Prevention, Fault Records, Reverse inhibition, DC Braking, Momentary Power Loss restart, Auto torque and slip compensation, PID Control, Parameter Lock/Reset, Frequency Limits, Adjustable Carrier Frequency | | | | | | | | | | |
| Protection | | Self-testing, Over Voltage, Over Current, Under Voltage, Overload, Overheating, External Fault, Electronic thermal, Ground Fault, Phase-loss | | | | | | | | | | |
| Cooling Methods | | Forced Fan-cooled | | | | | | | | | | |
| Environment | Installation Location | Altitude 1,000 m or lower, keep from corrosive gasses, liquid and dust | | | | | | | | | | |
| | Pollution Degree | 2 | | | | | | | | | | |
| | Ambient Temperature | -10oC to 40oC Non-Condensing and not frozen | | | | | | | | | | |
| | Storage/ Transportation Temperature | -20oC to 60oC | | | | | | | | | | |
| | Ambient Humidity | Below 90% RH (non-condensing) | | | | | | | | | | |
| | Vibration | 9.80665m/s2 (1G) less than 20Hz, 5.88m/s2 (0.6G) at 20 to 50Hz | | | | | | | | | | |

**A**

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# ACCESSORIES

## B.1 All Braking Resistors & Braking Units Use in AC Drives

Note: Please only use DELTA resistors and recommended values. Other resistors and values will void Delta's warranty. Please contact your nearest Delta representative for use of special resistors. For instance, in 460 V series, 100 HP, AC drive has 2 braking units with total of 16 braking resistors, so each braking unit uses 8 braking resistors. There should be at least 10 cm away from AC drive to avoid possible noise. Refer to the "Braking Unit Module User Manual" for further detail.

| Voltage | Applicable Motor | | ★Full Load Torque KG-M | Equivalent Resistors Specification for Each AC Drive | Braking Unit Model VFDB No. of Unit Used | | Braking Resistors Model No. of Units Used | | Braking Torque 10%ED% | Minimum Equivalent Resistor Value for Each AC Drive |
|---|---|---|---|---|---|---|---|---|---|---|
| | HP | kW | | | | | | | | |
| 460V Series | 7.5 | 5.5 | 3.111 | 500W 100Ω | | | BR500W100 | 1 | 125 | 60Ω |
| | 10 | 7.5 | 4.148 | 1000W 75Ω | | | BR1K0W075 | 1 | 125 | 45Ω |
| | 15 | 11 | 6.186 | 1000W 50Ω | | | BR1K0W050 | 1 | 125 | 50Ω |
| | 20 | 15 | 8.248 | 1500W 40Ω | | | BR1K5W040 | 1 | 125 | 40Ω |
| | 25 | 18.5 | 10.281 | 4800W 32Ω | 4030 | 1 | BR1K2W008 | 4 | 125 | 32Ω |
| | 30 | 22 | 12.338 | 4800W 27.2Ω | 4030 | 1 | BR1K2W6P8 | 4 | 125 | 27.2Ω |
| | 40 | 30 | 16.497 | 6000W 20Ω | 4030 | 1 | BR1K5W005 | 4 | 125 | 20Ω |
| | 50 | 37 | 20.6 | 9600W 16Ω | 4045 | 1 | BR1K2W008 | 8 | 125 | 16Ω |
| | 60 | 45 | 24.745 | 9600W 13.6Ω | 4045 | 1 | BR1K2W6P8 | 8 | 125 | 13.6Ω |
| | 75 | 55 | 31.11 | 12000W 10Ω | 4030 | 2 | BR1K5W005 | 8 | 125 | 10Ω |
| | 100 | 75 | 42.7 | 19200W 6.8Ω | 4045 | 2 | BR1K2W6P8 | 16 | 125 | 6.8Ω |

Note:
1. Please select the factory default resistance value (Watt) and the frequency value (ED%)
2. If damage resulted in the drive or other equipments due to the fact that the braking resistors and the braking modules in use are not provided by Delta, the warranty will be void.
3. Take into consideration the safety of the environment when installing the braking resistors.
4. If the minimum resistance value is to be utilized, consult local dealers for the calculation of the Watt figures.
5. Please select thermal relay trip contact to prevent resistor over load.
6. When using more than 2 braking units, equivalent resistor value of parallel braking unit can't be less than the value in the column "**Minimum Equivalent Resistor Value for Each AC Drive" (the right-most column in the table)**.
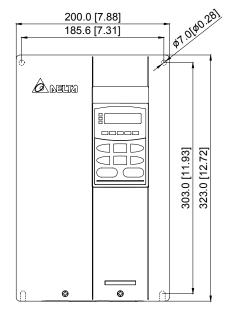
**B**
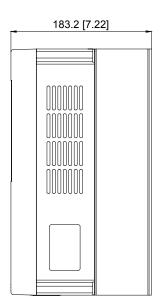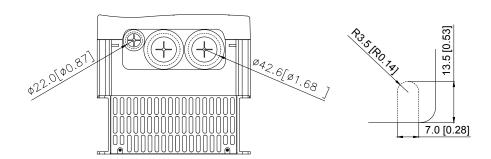
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# DIMENSIONS

**VFD055F43B-G**

**VFD075F43B-G**

**VFD110F43A-G**

**VFD150F43A-G**

**Unit: mm (inches)**

**C**

**VFD185F43A-G**

**VFD220F43A-G**

**VFD300F43A-G**

**Unit: mm (inches)**

250.0 [9.84]

226.0 [8.90]

Ø10.0 [Ø0.39]

205.4 [8.08]

384.0 [15.12]

403.8 [15.90]

Ø28.0[Ø1.10]

Ø42.0[Ø1.65](2X)

R5.0[R0.20]

13.0 [0.51]

10.0 [0.39]
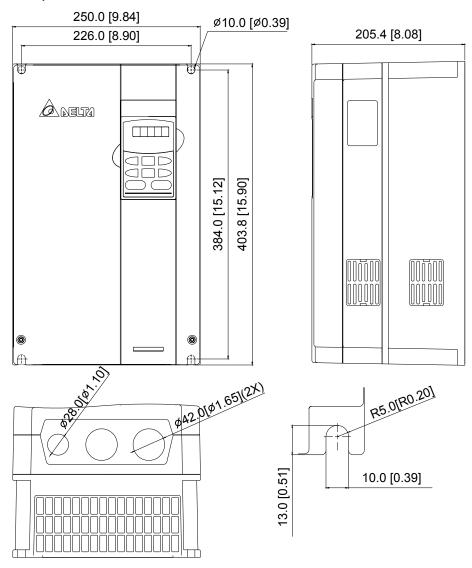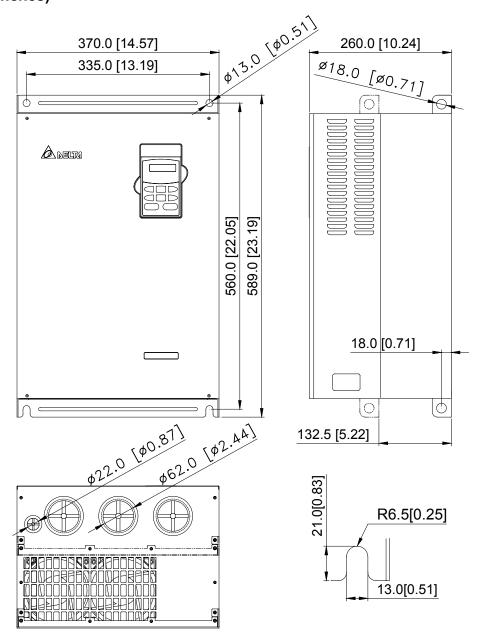
**VFD370F43A-G**

**VFD450F43A-G**

**VFD550F43A-G**

**Unit: mm (inches)**

370.0 [14.57]

335.0 [13.19]

φ13.0 [φ0.51]

560.0 [22.05]

589.0 [23.19]

260.0 [10.24]

φ18.0 [φ0.71]

18.0 [0.71]

132.5 [5.22]

φ22.0 [φ0.87]

φ62.0 [φ2.44]

21.0[0.83]

R6.5[0.25]

13.0[0.51]

**C**

## VFD750F43A-G

**Unit: mm (inches)**