VFD-S

Variable Speed AC Motor Drive

230V/460V 0.25 HP - 3.0HP

0.2KW-2.2KW

High-performance / Low Noise / Mini-Type AC Drive

User Manual

April 24, 1999





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Preface

Thank you for choosing DELTA's high-performance VFD-S Series. VFD-S 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 motor drives. Keep this operating manual handy and distribute to all users for reference.





Always read this manual thoroughly before using VFD-S 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-S 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 (CH 3-1).



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, V, and W directly to the AC main circuit power supply.



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

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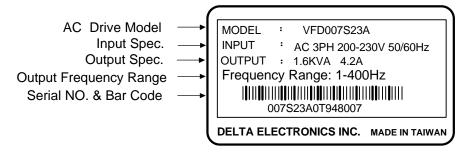
Chapter 1 Receiving and Inspection

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

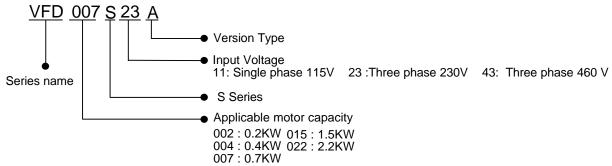
Receiving

- ✓ Check to make sure that the package includes an AC drive, the User Manual, and rubber bushings.
- ✓ Inspect the unit to insure it was not damaged during shipment.
- Make sure that the part number indicated on the nameplate corresponds with the part number of your order.

CH 1-1 Nameplate Information: ► Example for 1HP 230V AC drive



CH 1-2 Model Explanation:

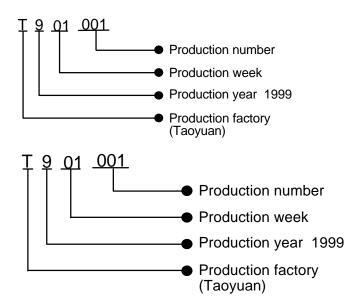


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CH 1-3 Series Number Explanation:

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

Chapter 1 Receiving and Inspection



Chapter 2 Storage and Installations

CH 2-1 Storage

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

CH 2-2 Ambient Conditions:

• Operation Air Temperature: -10° C to +40° C (14° F to 122° F)

Atmosphere pressure: 86 to 106 kPa **Installation Site Altitude:** below 1000m

Vibration: Maximum 9.86 m/s² (1G) at less than 20Hz Maximum 5.88 m/s² (1G) at 20Hz to 50Hz

• Storage Temperature: -20° C to $+60^{\circ}$ C (-4° F to 140° F)

Relative Humidity: Less than 90%, no condensation allowed

Atmosphere pressure: 86 to 106 kPa

• Transportation Temperature: -20° C to +60° C (-4° F to 140° F)

Relative Humidity: Less than 90%, no condensation allowed

Atmosphere pressure: 86 to 106 kPa

Vibration: Maximum 9.86 m/s² (1G) at less than 20Hz

Maximum 5.88 m/s² (1G) at 20Hz to 50Hz

CH 2-3 Installation:

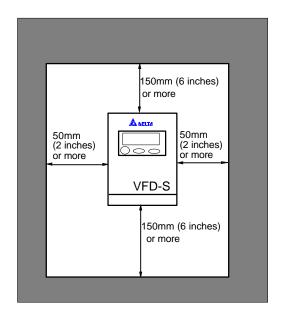
A CAUTION

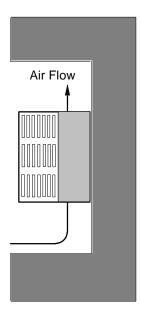
The control, power supply and motor leads must be laid separately. They must not be fed through the same cable conduit / trunking.

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 as shown in the figure shown next page:





Minimum Clearances and Air Flow

CH 2-4 Connections:

A DANGER

Hazardous Voltage

Before servicing the electrical system:

- Disconnect all power.
- Wait one minute until DC bus capacitors discharge.

Failure to observe this instruction will result in death or serious injury.

General Wiring Information Applicable Codes

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

Installations intended to meet UL and cUL requirements must follow the instructions provided in "CH 3-5 Wiring Notes" section below as a minimum standard. Where local codes exceed these requirements, they must also be followed. Refer to the technical data label affixed to the AC drive and the motor nameplate for electrical data.

CH 2-5 Environment

Avoid rain and moisture;

Avoid direct sunlight;

Avoid corrosive gases or liquids;

Free from airborne dust or metallic particles;

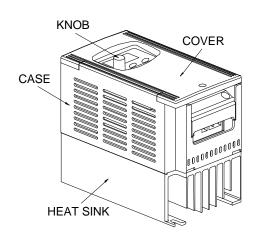
Free from vibration

Free from magnetic interference

Environment temperature: -10 to 50 Environment humidity: below 90% RH

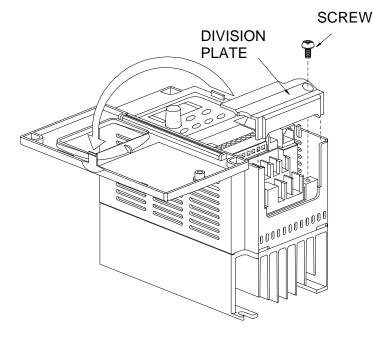
Environment air pressure: 86 kpa to 106 kpa

CH 2-6 Installation Steps



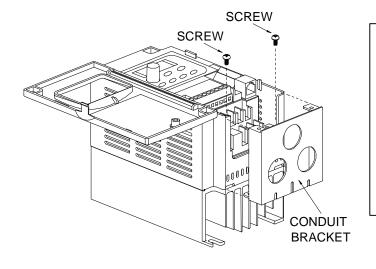
Component Explanation

- 1 Plastic Cover
- 2 Knob
- 3 Case
- 4 Aluminum Heat Sink



Installation Steps

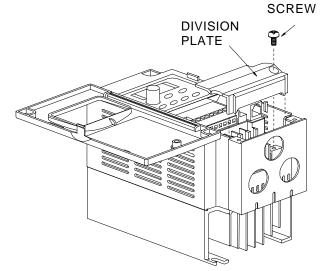
- 1. Remove front cover screw and open.
- Remove Division Plate.If using optional conduit bracket, please refer to next page.
- Connect AC Input Power and motor leads. Never connect the AC drive output terminals U, V, W to main AC Input power.
- 4. Reinstall Division Plate.



For Optional Conduit Bracket:

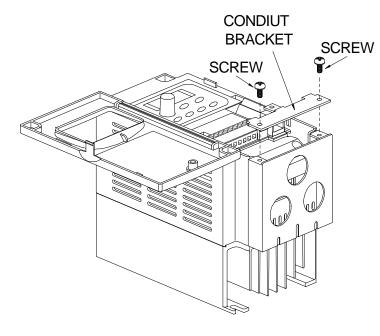
Make sure to fasten both screws on conduit bracket as shown in the drawing for safety grounding purpose. Bring all the wires out through the conduit bracket.

Screw Torque: 5 to 6 kgf.cm



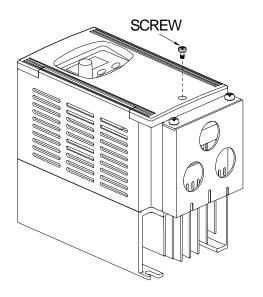
Reinstall Division Plate.

Screw Torque: 5 to 6 kgf.cm

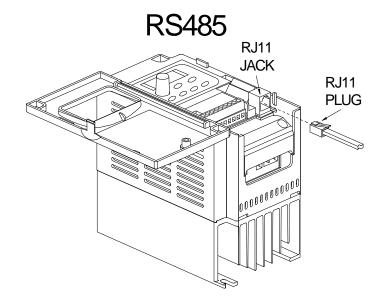


Install Conduit Bracket cover and tighten screws.

UL ENCLOSED TYPE



Close the cover and tighten screw as shown. Screw torque: 5 to 6 kgf-cm



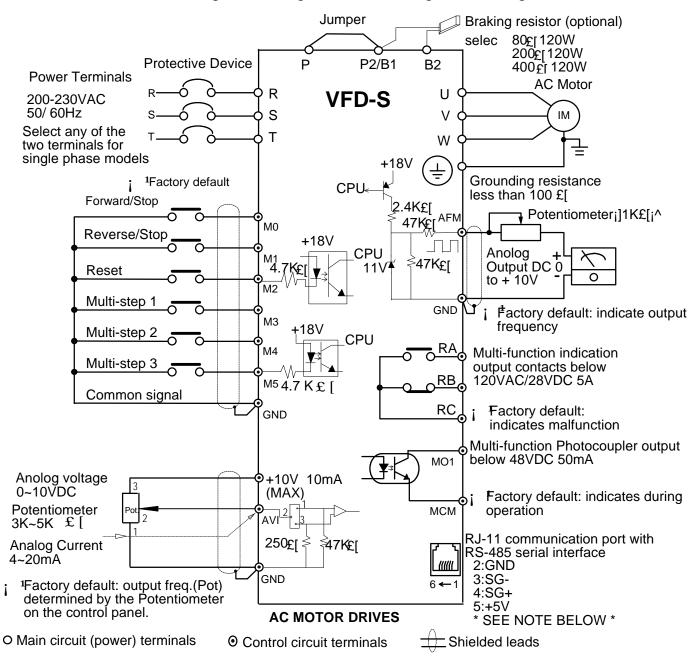
For additional communication:

Plug the communication device into the RJ11 jack for serial communication.

Chapter 3 Wiring

CH 3-1 Basic Wiring Diagram

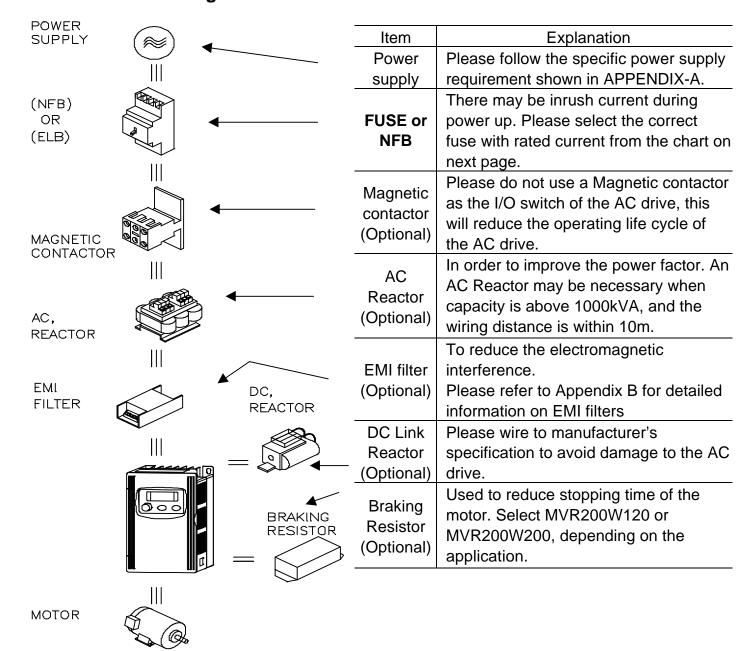
Users must connect wiring according to the following circuit diagram shown below.



NOTE: Do not plug in a Modem or telephone line to the RS-485 communication port.

Terminals 2 & 5 are the power sources for the optional copy keypad. Do not connect to these terminals while using RS-485 communication port.

CH 3-2 External Wiring



Fuse and No Fuse Breaker (NFB) Specifications

	No Fuse	Fuse for Branch circuit and short circuit protection				
Models	Breaker			Voltage	Ampere	
	Specifications	Manufacturer	P/N	rating	rating	Class
				(VAC)	(A)	
VFD002S21A	10A	Bussmann	JJN-10	300	10	Т
VFD004S21A	20A	Bussmann	JJN-20	300	20	Т
VFD007S43A	5A	Bussmann	JJS-10	600	10	Т
VFD015S21A	30A	Bussmann	JJN-25	300	25	Т
VFD015S43A	10A	Bussmann	JJS-15	600	15	Т
VFD022S23A	20A	Bussmann	JJN-40	300	40	Т
VFD022S43A	15A	Bussmann	JJS-20	600	20	Т
VFD004S21A	10A	Bussmann	JJN-10	300	10	Т
VFD004S23A	5A	Bussmann	JJN-10	300	10	Т
VFD007S21A	20A	Bussmann	JJN-20	300	20	Т
VFD007S23A	10A	Bussmann	JJN-20	300	20	Т
VFD015S21A	30A	Bussmann	JJN-25	300	25	Т
VFD015M23A	15A	Bussmann	JJN-25	300	25	Т

CH 3-3 Main Circuit Wiring

1. Main Circuit Terminals

Power Terminal

AC Input Line Motor Connection

R S T U V W

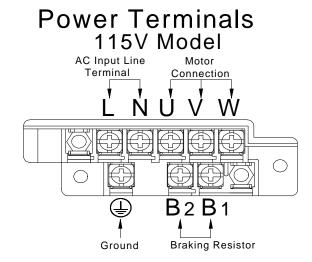
B 2 B P P P P 1

Ground Braking DC Reactor Resistor

Wire Gauge: 12-18

AWG

Wire Type: Copper Only



2. Terminal Explanations

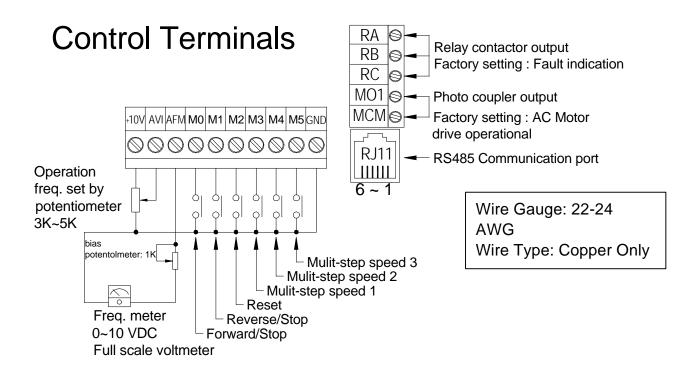
Terminal Symbol	Explanation of Terminal Function	
R, S, T	AC line input terminals	
L, N	AC line input terminals (115 VAC)	
U, V, W	Motor connections	
B1 / P2, B2	Connections for Braking Resistor(optional)	
B1 / P2, P1	Connections for DC Link Reactor (optional)	
(Earth Ground	

3. Terminal Dimensions

Model VFD-	002S11A, 002S21A, 002S23A, 004S11A, 004S21A, 004S23A 007S23A, 007S23A	015S21A, 022S23A, 007S11A 015S33A, 022S43A 007S43A 015S43A, 004S43A,
Terminal Specification (Terminal φ)	M3.5	M4

CH 3-4 Control Terminal Wiring (Factory Setting)

1. Terminal Explanations:

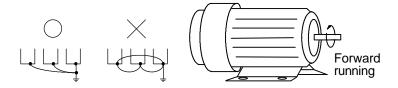


Terminal symbols	Terminal name	Remarks
RA - RC	Multi-Function Indication Output Contact	Refer to Pr.3-06 Relay output contact
RB – RC	Multi-Function Indication Output Contact	RA-RC (N.O. Contact) RB-RC (N.C. Contact)
MO1 -MCM	Multi-function PHC output	Refer to Pr.3-05
RJ - 11	Serial communication port	RS-485 serial communication interface
+10V - GND		Power Supply (+10 V)
AVI - GND	Analog voltage/current freq. command	0 to +10 V (Max. Output Frequency) Input or 4 to 20mA (Max. Output Frequency) Input
AFM - GND	Analog frequency/current meter	0 to +10 V (Max. output Frequency) Output
M0 - GND	Multi-function auxiliary input	
M1 - GND	Multi-function input 1	
M2 - GND	Multi-function input 2	D (D . 4.04 . D . 4.00
M3 - GND Multi-function input 3 M4 - GND Multi-function input 4		Refer to Pr.4-04 to Pr.4-08
M5 - GND	Multi-function input 5	

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

CH 3-5 Wiring Notes:

- 1. **CAUTION:** Do not connect the AC input to any of the U, V, W terminals, as it will damage the AC drive.
- 2. A 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 100 . For 460V-class AC drive, the ground resistance should not exceed 10 .)
- 6. Use ground leads that comply with AWG/MCM standards and keep them as short as possible.
- 7. Multiple VFD-S units can be installed in one location. All the units should be grounded directly to a common ground terminal. The VFD-S ground terminals may also be connected in parallel, as shown in the figure below. **Ensure there are no ground loops.**



- 8. When the AC drive output terminals U, V, and W are connected to the motor terminals U, V, and W, respectively, the motor will rotate counterclockwise (as viewed from the shaft ends of the motor) when a forward operation command is received. To reverse the direction of motor rotation, switch over any of the two motor leads.
- 9. Make sure that the power source is capable of supplying the correct voltage and required current to the AC drive.

- 10. Do not attach or remove wiring when power is applied to the AC drive.
- 11. Do not monitor the signals on the circuit board while the AC drive is in operation.
- 12. For the single-phase applications, the AC input line can be connected to any two of the three input terminals R, S, T. **Note: This drive is not intended for the use with single-phase motors.**
- 13. Route the wires of Power Terminals and Control Terminals separately, or 90° angle to each other.
- 14. 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.
- 15. If the AC drive is installed in the place where load reactor is needed, install the filter close to U.V.W. side of AC drive. Do not use a Capacitor or L-C Filter (Inductance-Capacitance) or R-C Filter (Resistance-Capacitance).
- 16. When using a GFCI (Ground Fault Circuit Interrupt), select current sensor with not less than 200mA, with not less than 0.1-second detection to avoid nuisance tripping

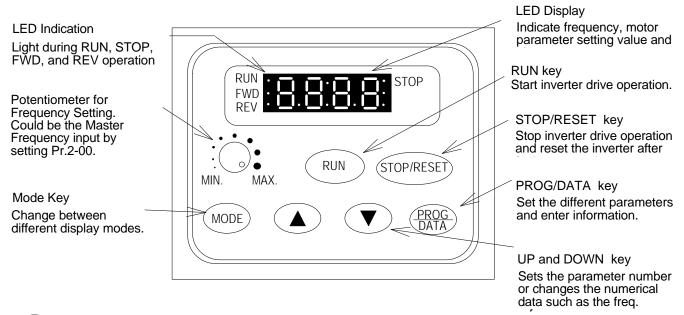
CH 3-6 Motor Operation Precautions

- 1. When using the AC drive to operate a standard 3-phase induction motor, notice that the energy loss is greater than an inverter duty motor.
- 2. While using the standard induction motor at low speed, the temperature of the motor may rise, so do not operate the motor at low speed for a long period of time.
- 3. When the standard motor operates at low speed, the motor output torque will decrease, please decrease the load during the operation.
- 4. If 100% output torque were desired at low speed operation, it may be necessary to use a special motor that can handle this load (inverter duty).

Chapter 4 Digital Keypad Operation

CH 4-1 Description of Digital Keypad

This digital keypad includes two parts: Display panel and keypad. Display panel provides the parameter display and shows operation status of the AC drive. Keypad provides programming interface between users and AC drives.





Mode

By pressing the "mode" key repetitively, the display will show status at the AC drive such as the reference frequency, output frequency, and output current.



PROG/DATA

Pressing the "PROG/DATA" key will store entered data or can show factory stored data.



Run

Start the AC drive operation. This key has no function when the drive is controlled by the External Control Terminals.



Stop / Reset

Stop AC drive operation. If the drive stops due to a fault, correct the fault first, then press this key to reset the drive.



Up / Down

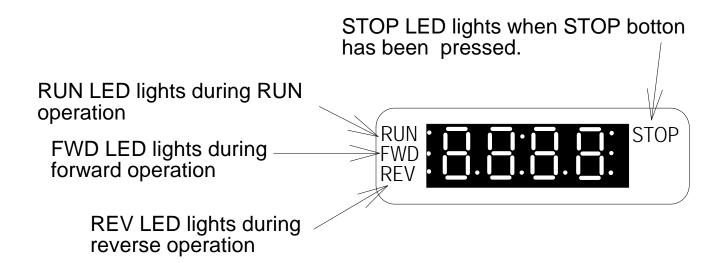
Press the "Up" or "Down" keys momentarily to change parameter settings. These keys may also be used to scroll through different operating values or parameters. Pressing the "Up" or "Down" key momentarily, will change the parameter settings in single-unit increments. To quickly run through the range of settings, press down and hold the key.

CH 4-2 Explanations of Display Messages

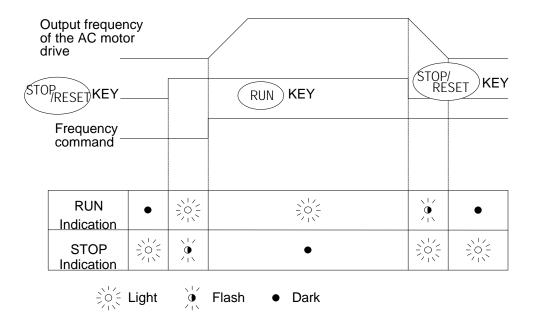
Display Message	Descriptions		
F60.0	Displays the AC drive Master Frequency.		
H60.0	Displays the Actual Operation Frequency present at terminals U, V, and W.		
<u>8 42</u>	Displays the output current present at terminals U, V, and W		
□600 .	Displays the custom unit (u), where u = H x Pr 0-05.		
[888]	Displays the counter value (C).		
1=5.0	Displays the internal PLC process step currently being performed.		
U3 10	Indicates the DC–BUS voltage		
E250	Indicates the output voltage		
<u>[]-</u>	Displays the specified parameter group		

	Chapter 4 Digital Keypad Operation
0-00	Displays the specified parameter.
d C	Displays the actual value stored within the specified parameter.
Frd	Displays AC drive forward run status.
rEu	Displays AC drive reverse run status.
	Displays "End" for approximately 0.5 second if input has been accepted. After a parameter value has been set, the new value is automatically stored in memory. To modify an entry, use the and keys.
Err	Displays "Err", if the input is invalid.

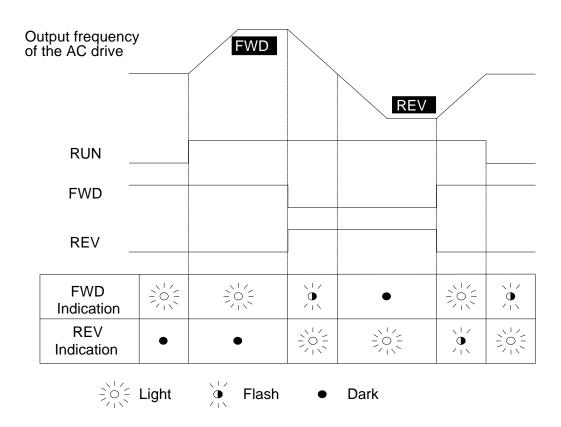
CH 4-3 Explanation of LED Indicators



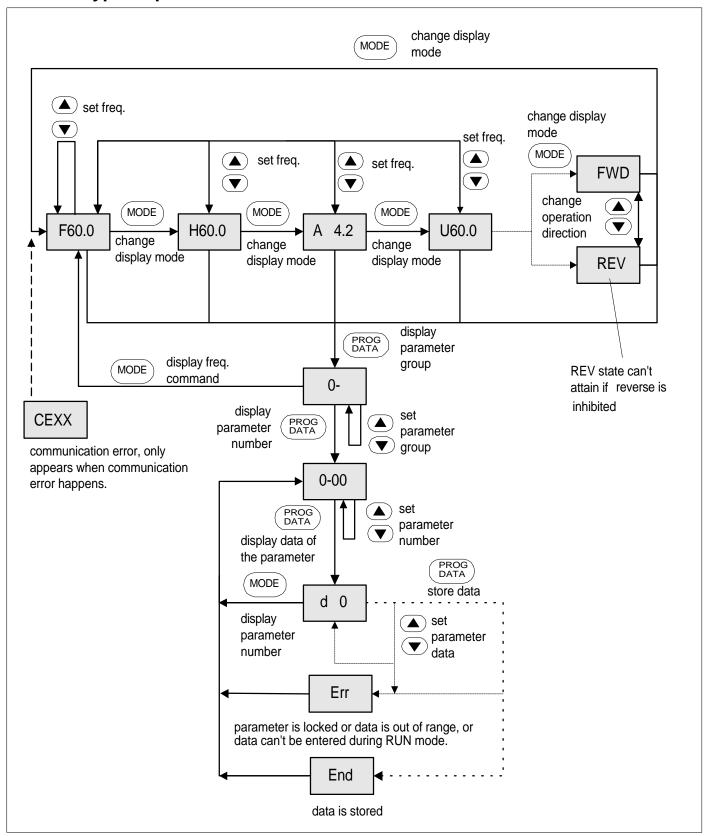
1. Description of LED functions of RUN and STOP



2. Description of LED functions of FWD and REV.



CH 4-4 Keypad Operation



Chapter 5 Description of Parameter Settings

This chapter will explain all parameters in detail. They are divided into ten parameter groups to categorize parameter settings more clearly and effectively.

The ten-parameter groups are described as below:

Group 0: User Parameters

Group 1: Basic Parameters

Group 2: Operating Method Parameters

Group 3: Output Function Parameters

Group 4: Input Function Parameters

Group 5: Multi-step Speed and PLC (Process Logic Control) Parameters

Group 6: Protection Parameters

Group 7: Motor Parameters

Group 8: Special Parameters

Group 9: Communication Parameters

CH 5-1 Group 0: User Parameters

0 - 00 Identity Code of AC Motor Drive Factory setting: d

Settings None

V \ HP	1/4	1/2	1	2	3
115V/230V	d 0	d 2	d 4	d 6	d 8
460V		d 3	d 5	d 7	d 9

This parameter shows the capacity of the AC drive. Users can read Pr.0-01 to check if it is the rated current of the AC drive corresponds to the identity code shown above and the current shown below.

V \ HP	1/4	1/2	1	2	3
115V/230V	1.6A	2.5A	4.2A	7.5A	11.0A
460V		1.5 A	2.5 A	4.2 A	5.5 A

0 - 01 Rated Current Display of the AC drive Factory Setting: d ##.#

Settings None

Unit: 0.1A

This parameter displays the rated current of the AC drive. It will display based on Pr.0-00, and is read-only.

0 - 02 Parameter Reset

Factory Setting: d 0

Settings d 0 to d 9 Not used

d 10 All parameters are reset to be factory settings

This setting allows the user to return all parameters to the factory default settings.

0 - 03 Start-up Display Selection

Factory Setting: d 0

Settings d 0

Display the Master Frequency (F)

- d 1 Display the actual operation frequency (H)
- d 2 Display the content of users-defined unit
- d 3 Display the output current (A

This parameter can be set during operation.

0 - 04 Content of User Defined Unit

Factory Setting: d 0

Settings d 0 Display the user-defined unit (u)

- d 1 Display the counter value (C)
- d 2 Display the content of PLC time (1 tt)
- d 3 Display the DC BUS voltage (U)
- d 4 Display the output voltage (E)

This parameter can be set during operation.

Note: Display the user-defined unit, where unit = H **♦**



0 - 05 User Defined Coefficient K

Factory Setting: d 1.0

Settings d 0.1 to d 160

Unit: 0.1

This parameter can be set during operation.

- The coefficient K determines the multiplying factor for the user-defined unit.
 - The display value is calculated as follows:
 - Display value =(output frequency*K)
- The display window is only capable of showing three digits, yet you could use Pr.0-05 to create larger numbers. The display windows uses decimal points to signify numbers up to five digits as illustrated in the next page:

Display	Number Represented
999	The absence of a decimal point indicates a three –digit integer.
99.9	A signal decimal point between the middle and the right-most numbers is a true decimal point; it separates ones and tenths as in "30.5" (thirty and one-half).
999.	A single decimal point after the fight-most numbers is not a true decimal point; instead it indicates that a zero follows the right-most number. For example, the number 1230 would be display as "123."
99.9.	Two decimal points (one between the middle and the right-most numbers, and one after the right-most number) are not true decimal points; instead they indicate that two zeros follow the right-most number. For example, the number 34500 would be display as "34.5.".

0 - 06	Software Version	Factory Setting: d #.#
Se	etting None	

The software version is read-only that stores the version number of VFD-S series software.

0 - 07	Passw	ord Input		Factory Setting: d 0
Se	ettings	d 0 to d 999	Unit: 1	

Pr.0-07 and Pr.0-08 work together to provide data security for the AC drive. When Pr.0-08 is set to a value other than 0, a password must be entered to alter the values of parameters. The password is the number set in Pr.0-08, which ranges from 1 to 999. Pr.0-07 is where the password is entered to allow parameter values to be altered.

Display states:

d 0: no password / correct password has been input.

d 1: parameters are locked.

0 - 08 Password Configuration Factory Setting: d 0
Settings d 0 to d 999 Unit: 1

For a password to be configured, the non-zero value assigned to Pr.0-08 must be entered **twice.** In other words, set the value of Pr.0-08 to the desired value and press the Prog/Data key. Then, press the Prog/Data key again to display the value of Pr.0-08. Finally, press the Prog/Data key again to store the displayed value, which then becomes the password.

For example, say that pr.0-08 is set to 111. When the AC drive is powered-up, all the parameters will be locked and their values cannot be changed. To permit the values of parameters to be altered, navigate to Pr.0-07 and change its value to 111 (the password configured in Pr.0-08). Then press the Prog/Data key, and you may alter the parameter values.

Display states:

d 0: no password

d 1: password has been set

CH 5-2 Group 1: Basic Parameters

1 – 00 Maximum Output Frequency (Fo. max) Factory Setting: d 60.0

Settings d 50.0 to d 400 Hz Unit: 0.1Hz

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

1 - 01 Maximum Voltage Frequency Factory Setting: d 60.0
Settings d 10.0 to d 400Hz Unit: 0.1Hz

This value should be set according to rated frequency of the motor as indicated on the motor nameplate. Maximum Voltage Frequency determines the volts per hertz ratio. For example, if the drive is rated for 460 VAC output and the Maximum Voltage Frequency is set to 60Hz, the drive will maintain a constant ratio of 7.66 v/Hz. The setting value must be greater than or equal to the middle freq. setting (Pr.1-03).

1 - 02 Max. Output Voltage (Vmax) Factory Setting: d 220*

Settings d 2.0 to d 255V* Unit: 0.1V*

*Twice value for 460V class

This parameter determines the Maximum Output Voltage of the AC drive. The Maximum Output Voltage setting must be smaller than or equal to the rated voltage of the motor as indicated on the motor nameplate. The setting value must be greater than or equal to the Mid-Point Voltage (Pr.1-04).

Chapter 5 Description of Parameter Settings

Unit: 0.1Hz

1 - 03 Mid-Point Frequency (Fmid) Factory Setting: d 1.0

Settings d 1.0 to d 400Hz

This parameter sets the Mid-Point Frequency of V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point frequency can be determined. This parameter must be greater than or equal to Minimum Output Frequency (Pr.1-05) and equal to or less than Maximum Voltage Frequency (Pr.1-01).

1 - 04 Mid-Point Voltage (Vmid) Factory Setting: d12.0*

Settings d 2.0 to d 255V* Unit: 0.1V*

*Twice value for 460V class

The parameter sets the Mid-Point Voltage of any V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point Frequency can be determined. This parameter must be equal to or greater than Minimum Output Voltage (Pr.1-06) and equal to or less than Maximum Output Voltage (Pr.1-02).

1 - 05 Minim	num Output Frequency (Fmin)	Factory Setting: d 1.0	
Settings	d 1.0 to d 60.0Hz	Unit: 0.1Hz	

This parameter sets the Minimum Output Frequency of the AC drive. This parameter must be equal to or less than Mid-Point Frequency (Pr.1-03).

Chapter 5 Desci	iption of	Parameter	Settings
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1 - 06	Minimum Output Voltage (Vmin)	Factory Setting: d12.0*
S	ettings d 2.0 to d 255V*	Unit: 0.1V*
*Twice value for 460V class		

This parameter sets Minimum Output Voltage of the AC drive. This parameter must be equal to or less than Mid-Point Voltage (Pr.1-04).

1 - 07 Upper Bound of Output Frequency Factory Setting: d 100
Settings d 1 to d110% Unit: 1%

This parameter must be equal to or greater than the Lower Bound of Output Frequency (Pr.1-08). The Maximum Output Frequency (Pr.1-00) is regarded as 100%.

Chapter 5 Description of Parameter Settings

1 - 08	Lower	Bound of Output Frequency		Factory Setting: d 0
Set	ttings	d 0 to d100%	Unit: 1%	

- The Upper/Lower Bound is to prevent operation error and machine damage.
- If the Upper Bound of Output Frequency is 50Hz and the Maximum Output Frequency is 60Hz, the Maximum Output Frequency will be limited to 50Hz.
- If the Lower Bound of Output Frequency is 10Hz, and the Minimum Output Frequency Pr.1-05 is set at 1.0Hz, then any Command Frequency between 1-10Hz will generate a 10Hz output from the drive.
- This parameter must be equal to or less than the Upper Bound of Output Frequency (Pr.1-07).

1 - 09 Acceleration Time 1 (Taccel 1)	Factory Setting : d10.0
1 - 10 Deceleration Time 1 (Tdecel 1)	Factory Setting : d10.0
1 - 11 Acceleration Time 2 (Taccel 2)	Factory Setting : d10.0
1 - 12 Deceleration Time 2 (Tdecel 2)	Factory Setting : d10.0

Settings d 0.1 to d 600Sec Unit: 0.1Sec

These parameters can be set during operation.

- Pr.1-09. This parameter is used to determine the time required for the AC drive to ramp from 0 Hz to its Maximum Output Frequency (Pr.1-00). The rate is linear unless S-Curve is "Enabled."
- Pr.1-10. This parameter is used to determine the time required for the AC drive to decelerate from the Maximum Output Frequency (Pr.1-00) down to 0 Hz. The rate is linear unless S-Curve is "Enabled."

- The accel/decel time 2 determines the time for the AC drive to accel/decel from 0Hz to Maximum Output Frequency (Pr.1-00) (accel/decel time 1 is the default). A Multi-Function Input terminals must be programmed to select accel/decel time 2 and the terminals must be closed to select accel/decel time 2. See Pr.4-04 to Pr.4-08.
- In the diagram shown below, the accel/decel time of the AC drive is the time between 0 Hz to Maximum Output Frequency (Pr.1-00). Suppose the Maximum Output Frequency is 60 Hz, start-up frequency (1-05) is 1.0 Hz, and accel/decel time is 10 seconds. The actual time for the AC drive to accelerate from start-up to 60 Hz is 9.83 seconds and the deceleration time is also 9.83 seconds.

1 - 13 Jog Accel/Decel Time

Factory Setting: d 10.0

Unit: 0.1Sec

Settings d 0.1 to d 600Sec

This parameter can be set during operation.

Chapter 5 Description of Parameter Settings

1 - 14 Jog Frequency

Factory Setting : d 6.0

Settings d 1.0 to d 400Hz

Unit: 0.1Hz

This parameter can be set during operation.

The JOG function can be selected using Multi-function Input terminals (Pr.4-04 to Pr.4-08) if programmed for Jog (d10). When the Jog terminal is "closed". the AC drive will accelerate from Minimum Output Pr.1-14 . When the Jog Frequency Pr.1-05 to Jog Frequency terminal "open", the AC drive will decelerate from Jog Frequency to zero. The accel/decel time is decided by the Jog accel/decel time During operation, the AC drive can not perform Jog command. And during Jog operation, other operation commands can not be accepted, except command of FORWARD, REVERSE and STOP keys on the digital keypad.

1 - 15 Auto-Acceleration / Deceleration

Factory Setting: d0

Settings d 0 Linear acceleration / deceleration.

- d 1 Auto acceleration, linear Deceleration.
- d 2 Linear acceleration, auto Deceleration.
- d 3 Auto acceleration / deceleration
- d 4 Linear acceleration/deceleration, and stall prevention during deceleration.
- d 5 Auto acceleration, linear deceleration, and stall prevention during deceleration
- If the auto accel/decel is selected, the AC drive will accel/ decel in the fastest and smoothest means possible by automatically adjusting the time of accel/decel.

1 - 16 Acceleration S-Curve

Factory Setting: d 0

Settings d 0 to d 7

1 - 17 Deceleration S-Curve

Factory Setting: d 0

Settings d 0 to d 7

- These two parameters allow you to configure whether the acceleration and/or deceleration ramps are linear or S-shaped. The S-curve is enabled when set at d1-d7. Setting d1 offers the quickest S-curve and d7 offers the longest and smoothest S-curve. The AC drive will not follow the accel/decel time in Pr.1-09 to Pr.1-12. To Disable the S-curve, set Pr.1-16 and Pr.1-17 to d0.
- From the diagram shown below, the original setting accel/decel time will be for reference when the function of the S-curve is enabled. The actual accel/decel time will be determined based on the S-curve selected (d1 to d7).

Chapter 5 Description of Parameter Settings

CH 5-3 Group 2: Operation Method Parameters

2 – 00 Source of Frequency Command

Factory Setting: d 0

Settings d 0 Master Frequency input determined by digital keypad.

- d 1 Master Frequency determined by analog signal DC 0V-10V (external terminal AVI).
- d 2 Master Frequency determined by analog signal DC
 4mA 20mA (external terminal AVI).
- d 3 Master Frequency determined by Potentiometer on the digital keypad.
- d 4 Master Frequency operated by RS-485 serial communication interface.
- This parameter sets the Frequency Command Source of the AC drive.

 If the Frequency Command Source is external (DC 0 to +10V or 4 to 20mA),
 please make sure the AVI terminal jumper is in the proper position as shown below.
- Position of jumper: Please open the top cover. It is at the lower-left corner of the panel. The jumper J1 determines the type of external analog input, either DC voltage signal or current signal.

2 - 01 Source	ce of Op	peration	Command	Factory Setting: d 0
Settings	d 0		Controlled by the keypad	
		d 1	Controlled by the external enabled.	terminals, keypad STOP
		d 2	Controlled by the external disabled.	terminals, keypad STOP
		d 3	Controlled by the RS-485 keypad STOP enabled.	communication interface,
		d 4	Controlled by the RS-485 keypad STOP disabled.	communication interface,

When the AC drive is controlled by an external source, please refer to parameter group 4 for detailed explanations on related parameter settings.

2 - 02 Stop	Method	j	Factory Setting: d 0
Settings	d 0	Ramp stop	
		d 1 Coast stop	

- The parameter determines how the motor is stopped when the AC drive receives a valid stop command.
- 1. Ramp: the AC drive decelerates the motor to Minimum Output Frequency (Pr.1-05) and then stops according to the deceleration time set in Pr.1-10 or Pr.1-12.
- 2. Coast: the AC drive stops output instantly upon command, and the motor free runs until it comes to a complete stop.

Note: The motor stop method is usually determined by the characteristics of the motor load and frequency of stops.

2 - 03 PWM Carrier Frequency Selections Factory Setting: d 10

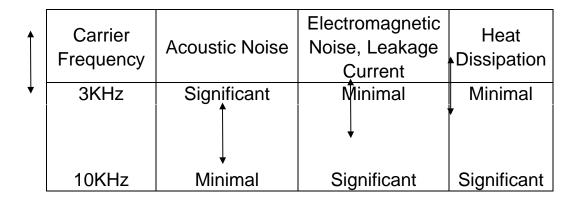
Settings d 03 fc= 3KHz Unit: 1KHz

d 04 fc= 4KHz d 05 fc= 5KHz

to

d 10 fc= 10KHz

This parameter can set the carrier frequency of PWM output.



Chapter 5 Description of Parameter Settings

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

2 - 04 Reverse Operation Inhibit

Factory Setting: d 0

Settings d 0 enable REV operation

d 1 disable REV operation

The parameter determines whether the AC drive can operate in the reverse direction.

ACI Input Loss Detection Factory Setting: d 0 Settings d 0 Upon the loss of ACI, the drive will default to an output frequency of 0 Hz. d 1 Upon the loss of ACI, the drive will stop and display error message "EF". d 2 Upon the loss of ACI, the drive will continue to run at the last known ACI input.

This parameter is only effective when the Source of Frequency is commanded by a 4 to 20 mA signal. The ACI input is considered lost when the ACI signal falls below 2 mA.

CH 5-4 Group 3: Output Function Parameters

3 - 00 Analog Output Signal

Factory Setting: d 0

Settings d 0

Analog frequency meter (0 to Maximum Output

Frequency).

d 1 Analog current meter (0 to 250% of the rated AC

drive current).

This parameter selects either Output Frequency or current to be displayed using the 0 to 10 V AFM output.

3 - 01 Analog Output Gain

Factory Setting: d100

Settings d 1 to d 200%

Unit: 1%

The parameter can be set during operation.

The parameter sets the voltage range of analog output signal (frequency or current), on output terminal AFM.

The analog output voltage is directly proportional to the output frequency of the AC drive. With the factory setting of 100%, the Maximum Output Frequency (Pr.1-00) of the AC drive corresponds to +10VDC analog voltage output. (The actual voltage is about +10VDC, and can be adjusted by Pr.3-01)

The analog output voltage is directly proportional to the output current of the AC drive. With the factory setting of 100%, the 2.5 times rated current of the AC drive corresponds to +10VDC analog voltage output. (The actual voltage is about +10VDC, and can be adjusted by Pr. 3-01)

Note: Any type of voltmeter can be used. If the meter reads full scale at a voltage less than 10 volts, then Pr.3-01 should be set by the following formula:

$$Pr.3-01 = ((meter full scale voltage)/10) \times 100\%$$

For Example: When using the meter with full scale of 5 volts, adjust Pr.3-01 to 50%

3 - 02	Desire	d Frequency Attained	Factory Setting: d 1.0
Se	ettings	d 1.0 to d 400 Hz	Unit: 0.1Hz

If a Multi-function output terminal is set to function as Desired Frequency Attained (Pr.3-05 or 3-06=d9), then the output will be activated when the programmed frequency is attained.

Chapter 5 Description of Parameter Settings

3 - 03 Terminal Count Value Factory Setting: d 0

Settings d 0 to d 999

The parameter determines the value of the internal counter. The internal counter can be triggered by the external terminal (Pr.4-4 to Pr.4-8, d19). Upon completion of counting, the specified output terminal will be activated. (Pr.3-05, Pr.3-06, d14).

3 - 04 Preliminary Count Value Factory Setting: d 0

Settings d 0 to d 999

When the counter value is counted up from "1" to the setting value of this parameter, the corresponding multi-function output terminal will be closed, when sets d15 as desired value attained setting. The application can be that closing the multi-function output terminal makes the AC drive operate at low speed until stop before the counting value is going to be attained.

The timing diagram is shown in the next page:

3 - 05	Multi-function Output Terminal 1 (Photocoupler output)	Factory Setting: d 1
3 - 06	Multi-function Output Terminal 2 (relay output)	Factory Setting: d 8
Se	ettings d 0 to d 15	

Function Table List:

Setting	Function	Setting	Function
d 0	Not used	d 9	Desired Frequency Attained
d 1	AC Drive Operational	d 10	PLC Program Running
d 2	Maximum Output Frequency	d 11	PLC Program Step Completed
u z	Attained	d 12	PLC Program Completed
d 3	Zero speed	d 13	PLC Operation Paused
d 4	Over-Torque detection	d 14	Terminal Count Value Attained
d 5	Base-Block (B.B.) Indication	d 15	Preliminary Counter Value Attained
d 6	Low-Voltage Indication	d 16	All Functions Normal
d 7	AC Drive Operation Mode		
d 8	Fault Indication		

- Function Explanations
- d 0 Not Used.
- **d 1 AC drive operational:** the output of output terminal will be activated when there is an output from the drive.
- **d 2** Maximum Output Frequency Attained: the output will be activated when the AC drive attains Maximum Output Frequency.
- **d 3 Zero speed:** the output will be activated when Command Frequency is lower than the Minimum Output Frequency.
- **d 4 Over-Torque Detection:** the output will be activated as long as the overtorque is detected. Pr.6-04 determines the Over-Torque detection level.
- **d 5** Base-Block (B.B.) Indication: the output will be activated when the output of the AC drive is shut off by external Baseblock.
- **d 6** Low Voltage Indication: the output will be activated when low voltage is detected.
- **d 7 AC Drive Operation Mode:** the output will be activated when the operation of the AC drive is controlled by External Control Terminals.
- **d 8 Fault Indication:** the output will be activated when faults occur (oc, ov, oH, oL, oL1, EF, cF3, HPF, ocA, ocd, ocn, GF).
- **d 9 Desired Frequency Attained:** the output will be activated when the desired frequency (Pr.3-02)is attained.
- **d10 PLC Program Running:** the output will be activated when the PLC program is running.
- **d11 PLC Program Step Completed:** the output will be activated for 0.5 sec. when each multi-step speed is attained.
- **d12 PLC Program completed:** the output will be activated for 0.5 sec. when the PLC program cycle has completed.
- **d13 PLC Program Operation Paused:** the output will be activated when PLC operation is paused.
- d14 Terminal Count Value Attained: counter reaches Terminal Count Value.
- **d15 Preliminary Count Value Attained:** counter reaches Preliminary Count Value.
- **d16 All Functions Normal:** a When the AC Drive is in a normal state, the contact will be closed. If there is a fault or the AC drive is not functioning normally, the contact will be open.

CH 5-5 Group 4: Input Function Parameters

4 - 00 Potentiometer Bias Frequency

Factory Setting:

d0.0

Settings d 0.0 to d 350Hz

Unit: 0.1Hz

This parameter can be set during the operation.

4 - 01 Potentiometer Bias Polarity

Factory Setting: d 0

Settings d 0 Positive bias

d 1 Negative bias

This parameter can be set during the operation.

4 - 02 Potentiometer Frequency Gain

Factory Setting: d 100

Settings d 1 to d 200%

Unit: 1%

This parameter can be set during the operation.

4 - 03 Potentiometer Reverse Motion Enable

Factory Setting: d 0

Settings d 0

Forward motion only

d 1 Reverse motion enable (must be negative bias)

Pr.4-00 to Pr.4-03 are used when the source of frequency command is the analog signal (0 to +10V DC or 4 to 20 mA DC). Refer to the following examples.

Example 1:

The following is the most common method. Set parameter 2-00 to d1 (0 to +10V signal), d2 (4 to 20mA current signal), or d3 (keypad potentiometer).

Example 2:

In this example with the potentiometer set to 0V the Output Frequency is 10 Hz. The mid-point of the potentiometer becomes 40 Hz. Once the Maximum Output Frequency is reached any further increase of the potentiometer will not increase output frequency.

Example 3:

The example also shows the popular method. The whole scale of the potentiometer can be used as desired. In addition to signals of 0 to 10V and 4 to 20mA, the popular voltage signals also include signals of 0 to 5V, 20 to 4mA or that under 10V. Regarding the setting, please refer to the following examples.

Chapter 5	Descri	ption of	Parameter	Settings
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This example shows a potentiometer range of 0 to 5 Volts.

Example 5:

In this example a 1 volt negative bias is used. In a noise environment, it is advantageous to use negative bias to provide a noise margin (1V in this example).

Example 6:

In this example, a negative bias is used to provide a noise margin. Also a potentiometer frequency gain is used to allow the Maximum Output Frequency to be reached.

Example 7:

In this example, the potentiometer is programmed to run a motor is both forward and reverse direction. A motor will be idle when the potentiometer position is at mid-point of its scale. Using Pr.4-03 will disable the external FWD and REV controls.

Example 8:

In this example, the option of anti-slope is shown. Anti-slope is used in an application where control of pressure, temperature, or flow is needed. Under a high pressure or flow situation, a sensor will generate a large signal such as 20 mA or 10V. With anti-slope enable, the large signal will slow or stop the AC drive

4 - 04	Multi-function Input Terminal (M0, M1)	Factory Setting: d 1
Se	ettings d 0 to d 20	
4 - 05	Multi-function Input Terminal (M2)	Factory Setting: d 6
4 – 06	Multi-function Input Terminal (M3)	Factory Setting: d 7
4 - 07	Multi-function Input Terminal (M4)	Factory Setting: d 8
4 – 08	Multi-function Input Terminal (M5)	Factory Setting: d 9

Settings d0, d4 to d20

Parameters & Functions table:

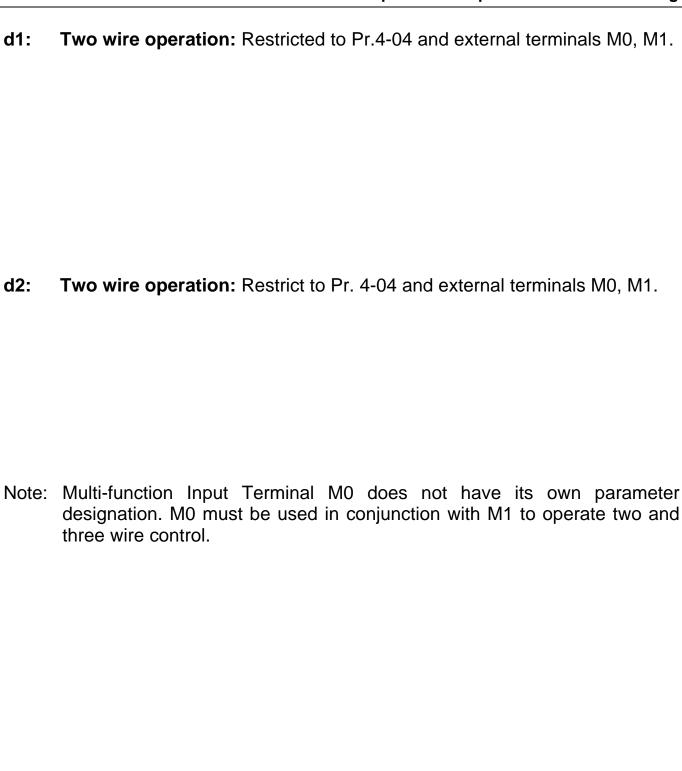
Value	Function	Value	Function
d 0	Parameter Disable	d11	Accel/Decel Speed Inhibit
d 1	M0: FWD / STOP M1: REV / STOP	d12	First or Second Accel/Decel Time Selection
d 2	M0: RUN / STOP M1: FWD / REV	d13	External Base Block (N.O.) (Normally Open Contact Input)
d 3	3-Wire Operation Control mode (M0,M1,M2)	d14	External Base Block (N.C.) (Normally Close Contact Input)
d 4	External Fault (Normally Open)	d15	Increase Master Frequency
d 5	External Fault (Normally Closed)	d16	Decrease Master Frequency
d 6	External Reset	d17	Run PLC Program
d 7	Multi-Step Speed Command 1	d18	Pause PLC Program
d 8	Multi-Step Speed Command 2	d19	Counter Trigger Signal
d 9	Multi-Step Speed Command 3	d20	Counter Reset
d10	Jog operation	d21	ACI / AVI Selection

Explanations:

d0 Parameter Disable:

Enter value (d0) to disable any Multi-Function Input Terminal: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08)

Note: The purpose of this function is to provide isolation for unused Multi-Function Input Terminals. Any unused terminals should be programmed to d0 to insure they have no effect on drive operation.



d3: Three Wire Control: Restricted to Pr.4-04 control terminals M0, M1, M	2.
Note: When value d3 is selected for Pr. 4-04, this will over ride any value entered in Pr.4-05, since Pr.4-05 must be used for three wire control as showe.	
d4, d5 External Faults: Parameter values d4, d5 programs Multi-Function Input Terminals: M1 (F 04), M2 (Pr. 4-05), M3 (Pr. 4-06), M4 (Pr. 4-07) or M5 (Pr. 4-08) to be External (E.F.) inputs.	
When an External Fault input signal is received, the AC drive will stop all or and display "E.F." on Digital Keypad, the motor will free run. Normal oper can resume after the External Fault is cleared and the AC drive is reset.	-

d6 External Reset:

Parameter value d6 programs a Multi-Function Input Terminal: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) to be an External Reset.

Note: the External Reset has the same function as the Reset key on the Digital keypad. After external fault such as O.H., O.C. and O.V. are clear, this input can be used to reset the drive.

d7, d8, d9 Multi-Step Speed Command:

Parameter values d7, d8, d9 programs any three of the following Multi-Function Input Terminals: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) for multi-step speed command function.

These three inputs select the multi-step speeds defined by Pr.5-00 to Pr.5-06 as shown in the following diagram. Pr.5-07 to Pr.5-16 can also control output speed by programming the AC drive's internal PLC function.

C	Chapter 5 Description of Parameter Settings
d10 Jog Operation Control: Parameter value d10 programs Multi-F M2 (Pr.4- 05), M3 (Pr.4-06), M4 (Pr.4-	
Note: Jog operation programmed by d10 ca	an only be initiated while the motor is
stopped. (Refer to Pr.1-13, Pr.1-14.)	

d11 Accel/Decel Speed Inhibit:

Parameter value d11 programs Multi-Function Input Terminal: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) for Accel/Decel Inhibit. When the command is received, acceleration and deceleration is stopped and the AC drive maintains a constant speed.

d12 First or Second Accel./Decel. Time Selection:

Parameter value d12 programs a Multi-Function Input Terminal: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) to control selection of First or Second Accel/Decel time. (Refer to Pr.1-09 to Pr.1-12.)

Para 04), Bloc	M14 External Base Block: ameter values d13, d14 program Multi-Function Input Terminals: M1 (Pr.4-M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) for external Base ck control. Value d13 is for normally open (N.O.) input, and value d14 is for ormally closed (N.C.) input.
Note:	When a Base-Block signal is received, the AC drive will stop all output and the motor will free run. When base block control is deactivated, the AC drive will start its speed search function and synchronize with the motor speed, and then accelerate to Master Frequency.

Chapter 5 Description of Parameter Settings

Chapter 5 Description of Parameter Settings
d15, d16 Increase/Decrease Master Frequency: Parameter values d15, d16 program the Multi-Function Input Terminals: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) to incrementally increase/ decrease the Master Frequency each time an input is received.

d17, d18 PLC Function Control:

Parameter value d17 programs Multi-Function Input Terminal: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) to enable the AC drive internal PLC program. Parameter value d18 programs an input terminal to pause the PLC program.

Note: Pr.5-00 to Pr.5-16 define the PLC program.

d19 Counter Trigger:

Parameter value d19 programs Multi-Function Input Terminal: M1 (Pr.4-04), M2 (Pr.4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) to increase the AC drive's internal counter. When an input is received, the counter is increased by 1.

Note:

The Counter Trigger input can be connected to an external Pulse Signal Generator to count a processing step or unit of material. See the diagram below.

d20 Counter Reset:

Parameter value d20 programs Multi-Function Input Terminal: M1 (Pr.4-04), M2 (Pr. 4-05), M3 (Pr.4-06), M4 (Pr.4-07) or M5 (Pr.4-08) to reset the counter.

d21 ACI / AVI Selection:

Parameter value d21 allows the user to select the input type ACI or AVI via an external switch. AVI is selected when the contact is open and ACI is selected when the contact is closed. Please note: The use of this feature will override Pr. 2-00 programming and the jumper on the front of the drive must be moved to the correct location either across the AVI or ACI pin heads.

4- 09 Line Start Lockout

Factory Setting: d 0

Settings: d0 Disable

d1 Enable

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

CH 5-6 Group 5: Multi-step Speed and PLC (Process Logic Control) Parameters

Factory Setting: d
0.0
Factory Setting: d
0.0

Settings d 0.0 to d 400 Hz

Unit: 0.1Hz

This parameter can be set during operation.

The Multi-Function Input Terminals (refer to Pr.4-04 to 4-08) are used to select one of the AC drive Multi-Step speeds. The speeds (frequencies) are determined by Pr.5-00 to 5-06 shown above.

5 – 07 PLC Mode	Factory Setting: d 0

Settings d 0 Disable PLC operation

- d 1 Execute one program cycle
- d 2 Continuously execute program cycles
- d 3 Execute one program cycle step by step
- d 4 Continuously execute program cycles step by step
- This parameter selects the mode of PLC operation for the AC drive. The PLC program can be used in lieu of any External Controls, Relays or Switches. The

			Chapter	5 Description	on of	Para	meter	Settings
AC drive will programming	speeds	and	directions	according	to th	ne u	ıser's	desired

Example 1 (Pr.5-07 = d1): Execute one cycle of the PLC program. Its relative parameter settings are:

- 1. Pr.5-00 to 5-06: 1st to 7th step speed (sets the frequency of each step speed
- 2. Pr.4-04 to 4-08: Multi-Function Input Terminals (set one multi-function terminal as d17- PLC auto-operation .
- 3. Pr.3-05 to 3-06: Multi-Function Output Terminals (set a Multi-Function Terminal as d10-PLC operation indication, d11-one cycle in PLC auto mode or d12-PLC operation fulfillment attainment).
- 4. Pr.5-07: PLC mode.
- 5. Pr.5-08: Direction of operation for Master Frequency and 1st to 7th step speed.
- 6. Pr.5-09 to 5-16: operation time setting of Master Frequency and 1st to 7th step speed.

Note: The above diagram shows one complete PLC cycle. To restart the cycle, turn the PLC program off and then back on.

Example 2 (Pr.5-07 = d2): Continuously executes program cycles

The diagram below shows the PLC program stepping through each speed and the automatically starting again. To stop the PLC program, one must either pause the program or turn it off (Refer to Pr.4-05 to 4-08 value d17 and d18).

Example 3 (Pr. 5-07 = d3) Execute one cycle step by step:

The example shows how the PLC can perform one cycle at a time, within a complete cycle. Each step will use the accel/decel times in Pr.1-09 to Pr.1-12. It should be noticed that the time each step spends at its intended frequency is diminished, due to the time spent during accel/decel.

Example 4 (Pr. 5-07 =d 4) Continuously execute PLC cycles step by step:

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

Example 5 (Pr. 5-07 = d1 Execute one cycle of the PLC program):

In this example, the PLC program runs continuously. It should be noted that the times of reserve motion may be shorter than expected, due to the accel/decel times.

5 - 08 PLC Forward/Reverse Motion

Factory Setting: d 0

Settings d 0 to d 255

This parameter controls the direction of motion for the Multi-Step Speed Pr.5-00 to Pr.5-06 and the Master Frequency. The original direction of Master Frequency will become invalid.

Note:

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

The setting value = bit7 x
$$2^7$$
+bit6 x 2^6 +bit5 x 2^5 +bit4 x 2^4 +bit3 x 2^3 +bit2 x 2^2 +bit1 x 2^1 +bit0 x 2^0
= 0 x 2^7 +1 x 2^6 +0 x 2^5 +0 x 2^4 +0 x 2^3 +1 x 2^2 +0 x 2^1 +0 x 2^0
= 0+64+0+0+0+4+0+0
= 68

Setting Pr.5-08 as d68.

Chapter 5 Description of Parameter Settings

5 - 09	Time Duration of Master Frequency	Factory Setting: d 0
5 - 10	Time Duration of 1st Step Speed	Factory Setting: d 0
5 - 11	Time Duration of 2nd Step Speed	Factory Setting: d 0
5 - 12	Time Duration of 3rd Step Speed	Factory Setting: d 0
5 - 13	Time Duration of 4th Step Speed	Factory Setting: d 0
5 - 14	Time Duration of 5th Step Speed	Factory Setting: d 0
5 - 15	Time Duration of 6th Step Speed	Factory Setting: d 0
5 - 16	Time Duration of 7th Step Speed	Factory Setting: d 0

Settings d 0 to d 65500 Unit: 1 Sec

Pr.5-10 to Pr.5-16 correspond to operation time of each multi-step speed defined by parameters 5-00 to 5-06. The maximum value of these parameters is 65500 sec, and it's displayed as d 65.5.

Note: If a parameter is set to "d0" (0 Sec), the corresponding step will be skipped. This is commonly used to reduce number of program steps

CH 5-7 Group 6: Protection Parameters

6 - 00	Over-Voltage Stall Prevention			I Prevention	Factory Setting: d 1
Se	ttings	d 0		Disable Over-Voltage Stall Preven	
			d 1	Enable Over-Voltage Stall Preve	ention

During deceleration, the motor DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled, the AC drive will stop decelerating. Maintaining a constant output frequency when it happens. The AC drive will only resume deceleration when the voltage drops below preset value.

Note:

With a moderate inertial load, the over-voltage during deceleration won't happen, and the drive will stop in programmed time. The AC drive will automatically extend the deceleration time with high inertial loads. If deceleration time is critical for the application, then dynamic braking resistors should be used.

- Over-Current Stall Prevention during Acceleration Factory Setting: d170
 Settings d 20 to d 250%
 Unit: 1%
- A setting of 100% is equal to the Rated Output Current of the drive.
- During acceleration, the AC drive output current may increase abruptly to exceed the value specified by Pr.6-01 due to rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and maintaining a constant output frequency. The AC drive will only resume acceleration when the current drops below the maximum value.
- Over-current Stall Prevention during Operation Factory Setting: d 170
 Settings d 20 to d 250% Unit: 1%
- During the steady-state operation with motor load rapidly increasing, the AC drive output current may exceed the limit specified in Pr.6-02. When this occurred, the output frequency will decrease to maintain a constant motor speed. The drive will accelerate to the steady-state output frequency only when the output current drops below the level specified by Pr.6-02.

6 - 03 Over-Torque Detection Mode

Factory Setting: d 0

Settings d 0

Over-Torque detection disabled.

- d 1 Over-Torque detection enabled during constant speed operation (OL2), and operation continues until the continuous operation limit (Pr.6-05) is reached.
- d 2 Over-Torque detection enabled during constant speed operation, and operation halted after over-torque detection.
- d 3 Over-Torque detection enabled during acceleration, and operation continues before the Continuous Output Time Limit (Pr.6-05) is reached.
- d 4 Over-Torque detection enabled during acceleration, and operation halted after over-torque detection

Chapter 5 Description of Parameter Settings

6 - 04 Over-Torque Detection Level Factory Setting: d 150
Settings d 30 to d 200% Unit: 1%

A setting of proportional to the Rated Output Current of the drive.

6 - 05 Continuous Output Time Limit Factory Setting: d 0.1

Settings d 0.1 to d 10.0Sec Unit: 0.1Sec

This parameter determines the time that AC drive will run after over-torque is detected. Over-torque detection is based on the following:

If a Multi-Function Output Terminal is set as Over-Torque Detection Indication and the output current exceeds the Over-Torque Detection Level (Pr.6-04, Factory Setting: 150%), the output will be activated.

6 - 06 Electronic Thermal Overload Relay Selection Factory Setting: d 2 Settings d 0 Reduce Torque Motor d 1 Constant Torque Motor d 2 Inactive

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

6 - 07 Electronic Thermal Characteristic Factory Setting: d 60

Settings d 30 to d 600Sec Unit: 1 Sec

This parameter can be set during operation.

The parameter determines the time required activating the I²t electronic thermal protection function. The graph below shows I²t curves for 150% output power for 1 minute.

	-		
6 - 08	Present F	ault Re	ecord Factory Setting: d 0
6 - 09	Second M	lost Re	cent Fault Record Factory Setting: d 0
6 - 10	Third Mos	t Rece	nt Fault Record Factory Setting: d 0
	Settings d 0 No fau		No fault occurred
	J	d 1	Over-current (oc)
		d 2	Over-voltage (ov)
	5 (/		Overheat (oH)
		d 4	Overload (oL)
		d 5	Overload1 (oL1)
		d 6	External fault (EF)
		d 7	CPU failure (cF3)
		d 8	Hardware protection failure (HPF)
		d 9	Current exceeds 2 times rated current during acce. (ocA)
		d 10	Current exceeds 2 times rated current during dece. (ocd)
	d 11 Current exceeds		Current exceeds 2 times rated current during steady state operation (ocn)
		d 12	Ground fault (GF)

Pr.6-08 to 6-10 store records of the three most recent faults that had occurred. Use the reset key to reset the drive when the fault no longer exits.

CH 5-8 Group 7: Motor Parameters

7 - 00 Motor Rated Current

Factory Setting: d 85

Settings d 30 to d 120

Unit: 1%

This parameter can be set during operation.

This parameter will limit the AC drive output current in order to prevent the motor from overheating. Use the following method to calculate the percentage entered in this parameter.

7 - 01 Motor No-load Current

Factory Setting: d 50

Settings d 0 to d 90%

Unit: 1%

This parameter can be set during operation.

The rated current of the AC drive is regarded as 100%. Motor setting of noload current will effect the slip compensation. The setting value must be less than motor rated current setting Pr.7-00.

7 - 02 Torque Compensation

Factory Setting: d 3

Settings d 0 to d 10

Unit: 1

This parameter can be set during operation.

This parameter may be set so that the AC drive will increase its voltage output during start-up to obtain a higher initial starting torque.

Chapter 5 Description of Parameter Settings

7 - 03 Slip Compensation Factory Setting: d 0.0

Settings d 0.0 to d 10.0

Unit: 0.1

This parameter can be set during operation.

While driving an asynchronous motor, load on the AC drive will increase, causing an increase in slip. This parameter may be used to compensate the nominal slip within a range of 0 to 10. When the output current of the AC drive is greater than the motor no-load current (Pr.7-01), the AC drive will adjust its output frequency according to this parameter.

CH 5-9 Group 8: Special Parameters

8 - 00 DC Bra	aking Voltage Level		Factory Setting: d 0
Settings	d 0 ⇔ d30%	Unit: 1%	

This parameter determines the level of DC Braking Voltage Level output to the motor during start-up and stopping. When setting DC Braking Voltage, the Maximum Output Voltage (Pr.1-02) is regarded as 100%. It is recommended to start with a low DC Braking Voltage Level and then increase until proper holding torque has been attained.

8 - 01	DC Braking Time during Start-up	Factory Setting: d 0.0
S	ettings d 0.0 to d 60.0Sec	Unit: 0.1Sec

This parameter determines the duration of time that the DC Braking Current will be applied to the motor during the AC drive start-up. DC Braking will be applied for the time set in this parameter until the Minimum Frequency is reached during acceleration.

8 - 02	DC Braking Time during Stopping	Factory Setting: d 0.0
Se	ettings d 0.0 to d 60.0Sec	Unit: 0.1Sec

This parameter determines the duration of time that the DC braking voltage will be applied to the motor during stopping. If stopping with DC Braking is desired, then Pr.2-02 must be set to RAMP stop (d 0).

8 - 03 Start-Point for DC Braking	Factory Setting: d 0.0
Settings d 0.0 to d 400Hz	Unit: 0.1Hz

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

- NOTE: 1. DC Braking during Start-up is used for loads that may move before AC drive starts, such as fans and pumps. These loads may also be moving in the wrong direction. Under such circumstances, DC Braking can be executed to hold the load in position before applying a forward motion.
 - 2. DC Braking during stopping is used to decrease stopping time and also to hold a stopped load in position. For high inertial loads, a dynamic braking resistor may be needed for quick decelerations.

8 - 04	Momentary F	Power	Loss Operation Selection	Factory Setting: d 0
Settings d 0			Operation stop after momentary power loss	
		d 1	Operation continue after moments Speed search start with the Marreference value	• •
		d 2	Operation continue after momen Speed search start with the min	• •

Chapter 5 Description of Parameter Settings

8 - 05	Maxim	um Allowable Power Loss Tim	е	Factory Setting: d 2.0
S	ettings	d 0.3 to d 5.0Sec	Unit: 0.1	Sec

During a power loss, if the power loss time is less than the time defined by this parameter, the AC drive will resume operation. If the Maximum Allowable Power Loss Time is exceeded, the AC drive output is then turned off.

8 - 06	Base-	Block Time for Speed Search	Factory Setting: d 0.5
Se	ettings	d 0.3 to d 5.0Sec	Unit: 0.1Sec

- When a momentary power loss is detected, the AC drive turns off for a specified time interval determined by Pr.8-06 before resuming operation. This time interval is called Base-Block. This parameter should be set to a value where the residual output voltage is nearly zero, before the drive resumes operation.
- This parameter also determines the searching time when performing external Base-Block and Fault Reset (Pr.8-14).

8 - 07 Maximum Speed Search Current Level Factory Setting: d 150 Settings d 30 to d 200 Unit: 1%

Following a power failure, the AC drive will start its speed search operation, only if the output current is greater than the value determined by Pr.8-07. When the output current is less than that of Pr.8-07, the AC drive output frequency is at a "speed synchronization point". The drive will start to accelerate or decelerate back to the operating frequency at which it was running prior to the power failure.

Chapter 5 Description of Parameter Settings

Chapter 5 Description of Parameter Settings

8 - 08	Skip Frequency 1 Upper Bound	Factory Setting: d 0.0
8 - 09	Skip Frequency 1 Lower Bound	Factory Setting: d 0.0
8 - 10	Skip Frequency 2 Upper Bound	Factory Setting: d 0.0
8 - 11	Skip Frequency 2 Lower Bound	Factory Setting: d 0.0
8 - 12	Skip Frequency 3 Upper Bound	Factory Setting: d 0.0
8 - 13	Skip Frequency 3 Lower Bound	Factory Setting: d 0.0

Settings d $0.0 \Leftrightarrow d 400Hz$ Unit: 0.1Hz

- These parameters determine Skip frequency. It will cause the AC drive to skip operation at these frequency ranges with continuous frequency output.
- Pr.8-9, Pr.8-11, Pr.8-13 are for Lower Bound setting, and the settings should follow as Pr.8-9 Pr.8-11 Pr.8-13.

8 - 14 Auto Restart After Fault

Factory Setting: d 0

Settings d 0 to d 10

After fault occurs (allowable faults: over-current OC, over-voltage OV), the AC drive can be reset/restarted automatically up to 10 times. Setting this parameter to 0 will disable the reset/restart operation after any fault has occurred. When enabled, the AC drive will restart with speed search, which starts at the Master Frequency. To set the fault recovery time after a fault, please see (Pr.8-06) Baseblock Time for speed search.

8 - 15 Automatic Voltage Regulation (AVR)

Factory Setting: d 2

Settings d 0 AVR function enabled

- d 1 AVR function disabled
- d 2 AVR function disabled for deceleration

Ch	apter 5	Description	of Parameter	Settings

- AVR function automatically regulates the AC drive output voltage to the Maximum Output Voltage (Pr.1-02). For instance, if Pr.1-02 is set at 200 VAC and the input voltage is at 200V to 264VAC, then the Maximum Output Voltage will automatically be regarded to 200 VAC.
- Without AVR function, the Maximum Output Voltage may vary between 180V to 264VAC, due to the input voltage varying between 180V to 264 VAC.
- Selecting program value d2 enables the AVR function and also disables the AVR function during deceleration. This offers a quicker deceleration.

8 - 16 Dynamic Braking Voltage

Factory Setting: d 380*

Settings d 350 to d 450V*

*Twice value for 460V class

Unit: 1Volt*

During deceleration, the DC-bus voltage will increase due to motor regeneration. When DC bus voltage level exceeds the Dynamic Braking Voltage, the DC brake output pins (B1, B2) will be activated.

8 - 17 DC Braking Inhibit Frequency

Factory Setting: d 0

Settings d 0 to d 400 Unit: 0.1 Hz

This parameter determines the frequency range (from Pr.8-17 to 0 Hz) where DC injection braking will be inhibited. If the output frequency during stopping is at or below Pr.8-03, but above Pr.8-17 then DC braking is applied. 0DC braking will always be inhibited if Pr.8-17 is equal to or greater than Pr.8-03.

Chapter 6 Maintenance and Inspections

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

CH 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.

CH 6-2 Periodic Maintenance

It is necessary to stop the motor operation during the check up.

- 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 Megaohmeter.
- 4. 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.
- 5. 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 adherence of dust and dirt can cause unforeseen failures.

The AC motor 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 to shut down the AC drive output. Below are the fault descriptions, for a fault shown on the AC drive digital keypad display. The three most recent faults can be read on the digital keypad display by viewing Pr.6-08 to Pr.6-10

NOTE: After faults occurred, press RESET to begin using the drive again.

Common Problems and Solutions:

Fault Name	Fault Descriptions	Corrective Actions
		Check whether the motors horsepower corresponds to the AC drive output power.
		2. Check the wiring connections between the AC drive and motor for possible short circuits.
	The AC drive detects an abnormal increase in	3. Increase the Acceleration time (Pr.1-09, Pr.1-11).
oc	current.	4. Check for possible excessive loading conditions at the motor.
		 If there are any abnormal conditions when operating the AC drive after short-circuit being removed, it should be sent back to manufacturer.
	The AC drive detects that the DC bus voltage has exceeded its maximum allowable value.	 Check whether the input voltage falls within the rated AC drive input voltage.
		2. Check for possible voltage transients.
ου		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.
		 Ensure that the ambient temperature falls within the specified temperature range.
	The AC drive temperature sensor detects excessive heat.	2. Make sure that the ventilation holes are not obstructed.
oH		Remove any foreign objects on the heatsinks and check for possible dirty heat sink fins.
		4. Provide enough spacing for adequate ventilation.

Fault Name	Fault Descriptions	Corrective Actions
Lo	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.
οL	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.	 Check whether the motor is overloaded. Reduce torque compensation setting as set in Pr.7-02. Increase the AC drive's output capacity.
oLI	Internal electronic overload trip	 Check for possible motor overload. Check electronic thermal overload setting. Increase motor capacity. Reduce the current level so that the drive output current does not exceed the value set by the Motor Rated Current Pr.7-00.
aL2	Motor overload. Check the parameter settings (Pr.6-03 to Pr.6-05)	 Reduce the motor load. Adjust the over-torque detection setting to an appropriate setting.
ocЯ	Over-current during acceleration: 1. Short-circuit at motor output. 2. Torque boost too high. 3. Acceleration time too short. 4. AC drive output capacity is too small.	 Check for possible poor insulation at the output line. Decrease the torque boost setting in Pr.7-02. Increase the acceleration time. Replace with the AC drive with one that has a higher output capacity (next HP size).

Fault Name	Fault Descriptions	Corrective Actions
	Over-current during deceleration:	
ocd	 Short-circuit at motor output. Deceleration time too short. AC drive output capacity is too small. 	 Check for possible poor insulation at the output line. Increase the deceleration time. Replace with the AC drive with one that has a higher output capacity (next HP size).
ocn	Over-current during steady state operation: 1. Short-circuit at motor output. 2. Sudden increase in motor loading. 3. AC drive output capacity is too small.	 Check for possible poor insulation at the output line. Check for possible motor stall. 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.	When external terminal EF-GND is closed, the output will be turned off. (under N.O. E.F.)
cFl	Internal memory IC can not be programmed.	 Switch off power supply. Check whether the input voltage falls within the rated AC drive input voltage. Switch the AC drive back on.
cF2	Internal memory IC can not be read.	 Check the connections between the main control board and the power board. Reset drive to factory defaults.
cF3	Drive's internal circuitry abnormal.	 Switch off power supply. Check whether the input voltage falls within the rated AC drive input voltage. Switch on the AC drive.
HPF	Hardware protection failure	Return to the factory.
codE	Software protection failure	Return to the factory.

Fault Name	Fault Descriptions	Corrective Actions
cFR	Auto accel/decel failure	Don't use the function of auto acceleration /deceleration.
	Ground fault :	
GF	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.
EEI	Communication Error	Check the connection between the AC drive and computer for loose wires.
		2. Check if the communication protocol is properly set.
	External Base Block.	1. When the external input terminal (B.B) is active, the AC
55	AC drive output is turned	drive output will be turned off.
_	off.	Disable this connection and the AC drive will begin to work again.

★: The parameter can be set during operation. *: Twice the value for 460V class

Group 0: User Parameters

Parameters	Explanation	Settings	Factory Setting
0-00	Identity Code of Drive	Read-only	#
0-01	Rated Current Display	Read-only	##.#
0-02	Parameter Reset	d10: Reset Parameter to Factory Setting	0
		d0: F (setting frequency)	
0-03	Start-up Display of AC	d1: H (actual frequency	0
0-03	Drive ★	d2: (user-defined unit)	J
		d3: A (output current	
		d0: Display User-Defined Unit (u)	
		d1: Display Counter Value (C)	
0-04	User-Defined Unit ★	d2: Display Process Operation (1= tt)	0
		d3: Display DC-BUS Voltage (U)	
		d4: display output voltage (E)	
0-05	User-Defined Coefficient K ★	0.1 to 160	1.0
0-06	Software Version	Read-only	1.8
0-07	Password Input	0 to 999	0
0-08	Password Configuration	0 to 999	0

Group 1 Basic Parameters

Parameters	Explanation	Settings	Factory Setting
1-00	Maximum Output Freq. (Fo,max)	50.0 to 400 Hz	60.0
1-01	Maximum Voltage Frequency (Base Freq) (Fmax)	10.0 to 400 Hz	60.0
1-02	Maximum Output Voltage (Vmax)	2.0V to 255V*	220*
1-03	Mid-Point Frequency (Fmid)	1.0 to 400 Hz	1.0
1-04	Mid-Point Voltage (Vmid)	2.0V to 255V*	12*
1-05	Minimum Output Frequency (Fmin)	1.0 to 60.0 Hz	1.0
1-06	Minimum Output Voltage (Vmin)	2.0V to 255V*	12*
1-07	Upper bound of freq.	1 to 110%	100
1-08	Lower bound of freq.	0 to100 %	0
1-09	Accel Time 1 (Tacc1) ★	0.1 to 600 Sec	10.0
1-10	Decel Time 1 (Tdec1)★	0.1 to 600 Sec	10.0
1-11	Accel Time 2 ★	0.1 to 600 Sec	10.0
1-12	Decel Time 2 ★	0.1 to 600 Sec	10.0
1-13	Jog accel/decel Time ★	0.1 to 600 Sec	10.0
1-14	Jog Frequency ★	1.0 Hz to 400 Hz	6.0
		d0: Linear Accel/Decel	
		d1: Auto Accel, Linear Decel	
		d2: Linear Accel, Auto Decel	
		d3: Auto Accel/Decel	_
1-15	Auto-Accel/Decel	d4: Linear Accel/Decel Stall Prevention	0
		during Deceleration	
		d5: Auto Accel, Linear Decel Stall Prevention during Deceleration	
1-16	S-Curve setting in Acceleration	0 to 7	0
1-17	S-Curve setting in Deceleration	0 to 7	0

Group 2 Operation Method Parameters

Parameters	Explanation	Settings	Factory Setting
2-00		d0: Digital Keypad	
		d1: 0 to 10V from AVI	
	Source of Frequency	d2: 4 to 20mA from ACI	0
	Command	d3: Potentiometer Control	
		d4: RS-485 communication Interface	
		d0: by Digital Keypad	
		d1: by external terminals, keypad STOP enabled	
2-01	Source of Operation	d2: by external terminals, keypad STOP disabled	0
	Command	d3: by RS-485 communication interface, keypad STOP enabled	
		d4: by RS-485 communication interface, keypad STOP disabled	
0.00	Oton Motherd	d0: Ramp Stop	0
2-02	Stop Method	d1: Coast Stop	0
		d3: 3KHz	
		d4: 4KHz	
		d5: 5KHz	
2-03	PWM Carrier Frequency	d6: 6KHz	10
2-03		d7: 7KHz	
		d8: 8KHz	
		d9: 9KHz	
		d10:10KHz	
2-04	Reverse Operation	d0: enable REV	0
∠ -∪ 1	Inhibition	d1: disable REV	U
		d0: 0 Hz, continue running	
2-05	ACI Input Loss Detection	d1: Stop the frequency output	0
		d2: Last ACI input command	

Group 3 Output Function Parameters

			Factor
Parameters	Explanation	Settings	У
			Setting
3-00	Analog Output Signal	d0: analog frequency	0
3-00	3-00 Analog Output Signal 3-01 Analog Output Gain ★ 3-02 Desired Freq. Attained 3-03 Terminal Count Value 3-04 Preliminary Count Value Multi-Function Output1	d1: analog current	
3-01	Analog Output Gain ★	1 to 200%	100
3-02	Desired Freq. Attained	1.0 to 400 Hz	1.0
3-03	Terminal Count Value	0 to 999	0
3-04	Preliminary Count Value	0 to 999	0
3-05	•	d0: Not Used	1
		d1: AC Drive Operational	
		d2: Max. Output Freq. Attained	
		d3: Zero Speed	
		d4: Over Torque	
		d5: Base-Block (B.B.)	
		d6: Low Voltage Detection	
		d7: AC Drive Operation Mode	
2.00	Multi-Function Output2	d8: Fault Indication	
3-06	(Relay Output)	d9: Desired Freq. Attained	8
		d10: PLC Program Running	
		d11: PLC Program Step Complete	
		d12: PLC Program Complete	
		d13: PLC Program Operation Pause	
		d14: Terminal Count Value Attained	
		d15: Preliminary count Value Attained	
		d16: All Functions Normal	

Group 4 Input Function Parameters

Parameters	Explanation	Settings	Factory Setting
4-00	Potentiometer Bias Frequency ★	0.0 to 350 Hz	0.0
4.04	Potentiometer Bias	d0: Positive Bias	
4-01	Polarity ★	d1: Negative Bias	0
4-02	Potentiometer Frequency Gain ★	1 to 200 %	100
4-03	Potentiometer Reverse	d0: Forward Motion Only	0
4-03	Motion Enable	d1: Reverse Motion enabled	U
4-04	Multi-Function Input Terminal 1 (M0, M1)	d0: Parameter Disable	1
4-05	Multi-Function Input Terminal 2 (M2)	d1: FWD/STOP, REV/STOP	6
4-06	Multi-Function Input Terminal 3 (M3)	d2: FWD/REV, RUN/STOP	7
4-07	Multi-Function Input Terminal 4 (M4)	d3: 3-wire Operation Control Mode	8
		d4: E.F. External Fault Input (N.O)	
		d5: E.F. External Fault Input (N.C)	
		d6: Reset	
		d7: Multi-Step Speed Command 1	
		d8: Multi-Step Speed Command 2	
		d9: Multi-Step Speed Command 3	
		d10: Jog Operation	
		d11: Accel/Decel Speed Inhibit	
	Multi-Function Input	d12: First or Second Accel/Decel Time	
4-08	Terminal 5 (M5)	Selection	9
	Terrinia 5 (IVIS)	d13: Base-Block (B.B.) (N.O.)	
		d14: Base-Block (B.B.) (N.C.)	
		d15: Increase Master Frequency	
		d16: Decrease Master Frequency	
		d17: Run PLC Program	
		d18: Pause PLC	
		d19: Counter Trigger Signal	
		d20: Counter Reset	
		d21: ACI / AVI Selection	

Group 4 Input Function Parameters

Parameters	Explanation	Settings	Factory Setting
4-09	Line Start Lockout	d0: Disable d1: Enable	0

Group 5 Multi-Step Speed and PLC Parameters

Parameters	Explanation	Settings	Factory Setting	
5-00	1 st Step Speed Freq.	0.0 to 400 Hz	0.0	
5-01	2 nd Step Speed Freq.	0.0 to 400 Hz	0.0	
5-02	3 rd Step Speed Freq.	0.0 to 400 Hz	0.0	
5-03	4 th Step Speed Freq.	0.0 to 400 Hz	0.0	
5-04	5 th Step Speed Freq.	0.0 to 400 Hz	0.0	
5-05	6 th Step Speed Freq.	0.0 to 400 Hz	0.0	
5-06	7 th Step Speed Freq.	0.0 to 400 Hz	0.0	
		d0: Disable PLC Operation		
	PLC Mode	d1: Execute one program cycle		
5-07		d2: Continuously execute program cycles	0	
5-07		d3: Execute one program cycle step by step	_	
		d4: Continuously execute one program cycle		
		step by step		
5-08	PLC Forward/ Reverse Motion	0 to 255 (0:FWD 1:REV)		
5-09	Time Duration Step 0	0 to 65500 sec	0	
5-10	Time Duration Step 1	0 to 65500 Sec	0	
5-11	Time Duration Step 2	0 to 65500 Sec	0	
5-12	Time Duration Step 3	0 to 65500 Sec	0	
5-13	Time Duration Step 4	0 to 65500 Sec	0	
5-14	Time Duration Step 5	0 to 65500 Sec	0	
5-15	Time Duration Step 6	0 to 65500 Sec	0	
5-16	Time Duration Step 7	0 to 65500 Sec	0	

Group 6 Protection Parameters

Parameters	Explanation	Settings	Factory Setting	
6-00	Over-Voltage Stall Prevention	d0: Disable d1: Enable	1	
6-01	Over-Current Stall Prevention during Accel	20 to 250%	170	
6-02	Over-Current Stall Prevention during Operation	20 to 250%	170	
		d0: Disabled d1: Enabled during constant speed operation and continues until the continuous limit (Pr.6-05) is reached.	0	
6-03	Over-Torque Detection Mode	d2: Enabled during Constant Speed Operation and halted after detection d3: Enabled during Accel and continues before Continuous Output Time Limit (Pr.6-05) is reached		
		d4: Enabled during Accel and halted after Over-Torque detection		
6-04	Over-Torque Detection Level	30 to 200%		
6-05	Continuous Output Time Limit	0.1 to 10.0 Sec	0.1	
6-06	Electronic Thermal Overload Relay	0 to 2	2	
6-07	Electronic Thermal characteristic ★	30 to 600 Sec		
6-08	Present Fault Record	d0: No Fault occurred		
6-09	Second Most Recent Fault Record	d1: Over Current (oc)		
6-10	Third Most Recent Fault Record	d2: Over Voltage (ov) d3: Over Heat (oH) d4: Over Load (oL) d5: Over Load (oL1) d6: External Fault (EF)	0	

Group 6 Protection Parameters

Parameters	Explanation	Settings	Factory Setting
6-10	Third Most Recent Fault Record	d7: CPU Fault (cF3) d8: Hardware Protection failure (HPF) d9: Current exceed during Acceleration (ocA) d10: Current exceed during Deceleration (ocd)	0
		d11: Current exceed during Steady State (ocn) d12: Ground Fault (GF)	

Group 7 Motor Parameters

Parameters	Explanation	Settings	Factory Setting
7-00	Motor Rated Current ★	30 to 120%	85
7-01	Motor No-Load Current ★	0 to 90%	50
7-02	Torque Compensation ★	0 to 10	3
7-03	Slip Compensation ★	0.0 to 10.0	0.0

Group 8 Special Parameters

Parameters	Explanation	Settings	Factory Setting
8-00	DC Braking Voltage Level	0 to 30%	0
8-01	DC Braking Time during Start-Up	0.0 to 60.0 Sec	0.0
8-02	DC Braking time during Stopping	0.0 to 60.0 Sec	0.0
8-03	Start-Point for DC Braking	0.0 to 400 Hz	0.0
8-04	Momentary Power Loss	d0: Stop Operation after Momentary Power Loss	0

Group 8 Special Parameters

Parameters	Explanation	Settings	Factory Setting
8-04	Momentary Power Loss	d1: Continues after Momentary Power Loss, speed search starts with Master Frequency d2: Continues after Momentary Power Loss, speed search starts with Minimum Output Frequency	0
8-05	Maximum Allowable Power Loss Time	0.3 to 5.0 Sec	2.0
8-06	B.B. Time for Speed Search	0.3 to 5.0 Sec	0.5
8-07	Maximum Speed Search Current Level	30 to 200%	150
8-08	Skip Frequency 1 Upper Bound	0.0 to 400 Hz	0.0
8-09	Skip Frequency 1 Lower Bound	0.0 to 400 Hz	0.0
8-10	Skip Frequency 2 Upper Bound	0.0 to 400 Hz	0.0
8-11	Skip Frequency 2 Lower bound	0.0 to 400 Hz	0.0
8-12	Skip Frequency 3 Upper bound	0.0 to 400 Hz	0.0
8-13	Skip Frequency 3 Lower Bound	0.0 to 400 Hz	0.0
8-14	Auto Restart After Fault	0 to 10	0
8-15	AVR Function	d0: AVR Function Enable d1: AVR Function Disable d2: AVR Function Disable for Decel	2
8-16	Dynamic Braking Voltage	350 to 450V*	380*
8-17	DC Braking Inhibit Freq	0.0 to 400 Hz	0.0

Group 9 Communication Parameters

Parameters	Explanation	Settings	Factory Setting
9-00	Communication Address ★	1 to 254	1
		d0: Baud Rate 4800 bps	
9-01	Transmission	d1: Baud Rate 9600 bps	1
9-01	Speed ★	d2: Baud Rate 19200 bps	
		d3: Baud Rate 38400 bps	
	Transmission Fault	d0: Warn and Continue Running	
9-02	Transmission Fault Treatment ★	d1: Warn and Ramp to Stop	
	rrealment *	d2: Warn and Coasting Stop	
	Modbus	d0: Disable	
9-03	Communication Watchdog Timer ★	d1 to d20: time setting (1 sec increment)	0
		d0: 7,N,2 (Modbus, ASCII)	
		d1: 7,E,1 (Modbus, ASCII)	
		d2: 7,O,1 (Modbus, ASCII)	
	Communication	d3: 8,N,2 (Modbus, ASCII)	
9-04	Protocol *	d4: 8,E,1 (Modbus, ASCII)	0
	FIOLOGOI X	d5: 8,O,1 (Modbus, ASCII)	
		d6: 8,N,2 (Modbus, RTU)	
		d7: 8,E,1 (Modbus, RTU)	
		d8: 8,O,1 (Modbus, RTU)	

Standard Specifications

Voltage Class		115V Class		230V Class			460V Class							
Model Number VFD-□ □ 및		002	004	007*	002	004	007	015*	022*	004*	007*	015*	022*	
Max. A	Applicable Motor	Output (kW)	0.2	0.2 0.4 0.75 0.2 0.4 0.75 1.5 2.2 0.4 0.75				0.75	1.5	2.2				
	Rated Output (0.6	1.0	1.6	0.6	1.0	1.6	2.9	4.4	1.1	1.9	3.2	4.1
Output	Rated Output (\ /	1.6	2.5	4.2	1.6	2.5	4.2	7.5	11.0	1.5	2.5	4.2	5.5
Rating	Maximum Outp	out Voltage (V)	1	lote	1			Prop	ortion	al to In	put Vo	oltage		
	Rated Frequer	ncy (Hz)						1.0 to	400 H	Z				
Input Rating	Rated Voltag	ge/Frequency	Single phase 100/110/120 VAC 50/60 Hz			20	Single/3-phase 3-phase 200/208/220/240 VAC 380/400/415/480 VA 50/60Hz 50/60Hz			VAC				
	Voltage/Freq.	Tolerance				Vol	tage: :	± 10%	, Freq	uency:	± 5%			
	Control System	n	SP	WM (S	Sinusoi	dal Pu	lse W	dth Mo	odulatio	on, car	rier fre	equenc	y 3k-10	OkHz)
	Output Freque	ncy Resolution						0	.1Hz					
Control Characteristics	Torque Charac	cteristics		iding t % at 5		o-torqı	ue, au	to-slip	compe	nsatio	n; star	ting tor	que ca	an be
eris	Overload Endu	ırance				150)% of	rated c	current	for 1 r	ninute			
act	Accel/Decel Ti	me		0.1to	600 s	econd	(2 Ind	epend	ent set	tings f	or Acc	el/Dece	el Time	e)
ont	V/F Pattern								rn adju					
ÖÖ	Stall Preventio	n Level							ing of					
		Keypad	Setting by or Potentiometer											
Operating Characteristics	Frequency Setting	External Signal	Potentiometer-5K Ω /0.5W, DC 0 to +10V or 0 to +5V (Input impedance 47K Ω); RS-485 interface; 4 to 20 mA (Input impedance 250 Ω); Multi-Function Inputs 1 to 5 (7 steps, Jog, up/down)											
ıcte	Operation	Keypad	Setting by RUN, STOP											
Chara		External Signal	M0 to M5 can be combined to offer various modes of operation, RS-485 serial interface (MODBUS).											
ating (Multi-Function	Input Signal	Multi-step selection 0 to7, Jog, accel/decel inhibit, first/second accel/decel switch, counter, PLC operation, external Base Block (NC, NO)											
Opera	Multi-Function Indication	Output	AC Drive Operating, Frequency Attained, Non-zero, Base Block, Fault Indication, Local/Remote indication, PLC Operation indication.											
	Analog Output	Signal	Ana	Analog frequency/current signal output.										
Other Function			AVR, S-Curve, Over-Voltage, Over-Current Stall Prevention, Fault Records, Adjustable Carrier Frequency, DC Braking, Momentary Power Loss restart, Frequency Limits, Parameter Lock/Reset, Reverse Inhibition, etc.											
Protection			Self-testing, Over Voltage, Over Current, Under Voltage, Overload, Overheating, External Fault, Electronic thermal, Ground Fault.											
	Cooling				N	atural	air-cod	oling				orced a		
+=	Installation L	ocation	Al	titude	1,000	m or lo	ower, I	ceep fr	om coi	rosive	gasse	es, liqui	d and	dust
Enviroment	Ambient Ten	nperature			-10	to 4	N) 04	lon-Co	ndens	ing and	d not fi	rozen)		
ron	Storage Tem	perature	-20 to 60											
N N	Ambient Hur	midity	Below 90% RH(non-condensing)											
ш Vibration		9.80665m/s ² (1G) less than 20Hz, 5.88m/s ² (0.6G)at 20 to 50Hz												

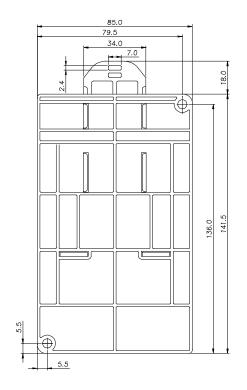
^{*} Under Development

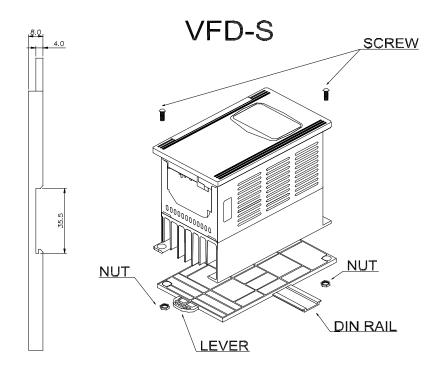
Note 1: 3-phase, voltage proportional to 2 times input.

Accessories List

Name	Model	Remarks		
Din Rail	DR01 & DR02	Refer to B-1 on next page		
Remote Control Box	RC-01	Use twisted shielded or twisted-pair shielded wire.		
Conduit Bracket	BK-S	Optional		
Braking Resistor	Refer to P 121 for detailed specifications			
EMI Filter Refer to P 12		3 for detailed specifications		
EMI Core (22*14*8)	CTC221408A	Selected by the wire diameter and # of turns		
EMI Core (31*19*13)	CTC311913A	Selected by the wire diameter and # of turns		
EMI Core (51*31*13)	CTC513113A Selected by the wire diameter and # of			
EMI Core (68*44*13.5)	CTC684413B	Selected by the wire diameter and # of turns		

B-1 Din Rail-DR01 Units: mm

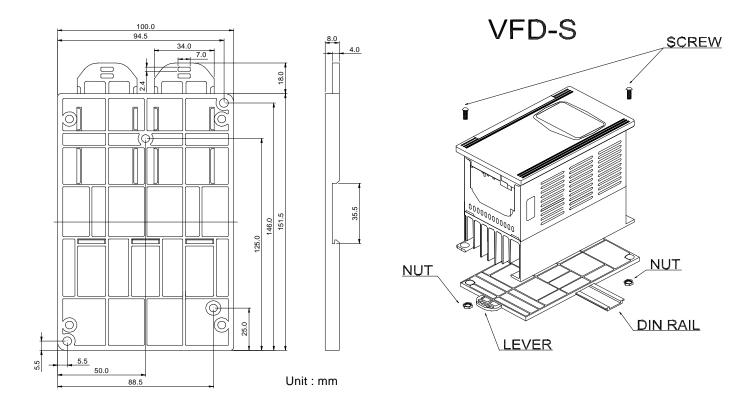




Models:	Screw Size:
VFD002S11A	M4*22
VFD002S21A	M4*22
VFD002S23A	M4*22
VFD004S11A	M4*12
VFD004S21A	M4*12
VFD004S23A	M4*12
VFD004S43A	M4*12
VFD007S21A	M4*12
VFD007S23A	M4*12
VFD007S43A	M4*12
VFD007S43B	M4*12

- To install the Din Rail Adapter use the specified screws for different models. Refer to the above chart.
- To mount the drive on a Din Rail, place the drive on the rail and push the lever toward the rail.

B-1 Din Rail-DR02 Units: mm

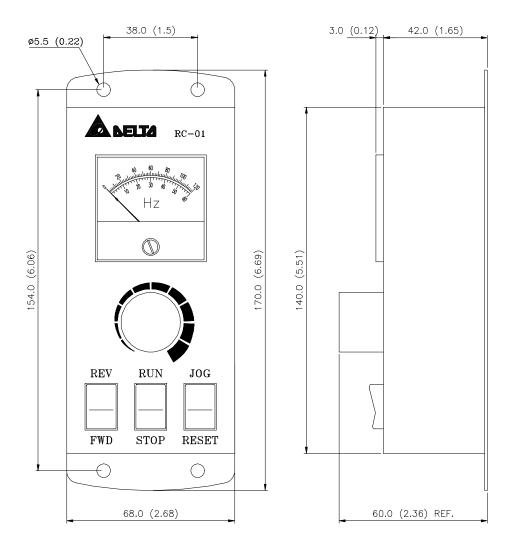


Models:	Screw Size:
VFD007S11A	M4*12
VFD015S21A	M4*12
VFD015S21B	M4*12
VFD015S23A	M4*12
VFD015S23A	M4*12
VFD015S43A	M4*12
VFD015S43B	M4*12
VFD022S23A	M4*12
VFD022S43A	M4*12

- ☐ To install the Din Rail Adapter use the specified screws for different models. Refer to the above chart.
- To mount the drive on a Din Rail, place the drive on the rail and push the lever toward the rail.

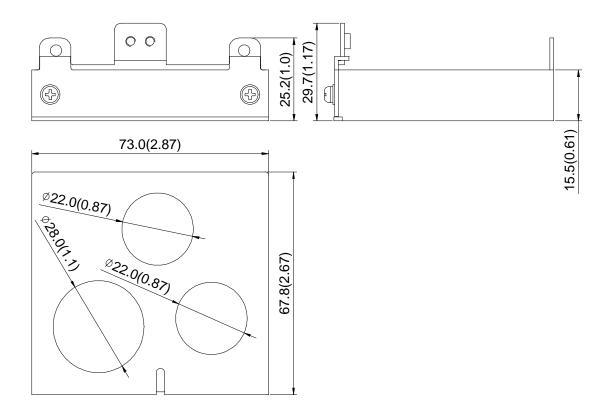
B-2 Remote Controller RC-01

Unit: mm (inch)



B-3 Conduit Bracket (BK-S)

Unit: mm (inch)



All Braking Resistors & Braking Units Use in AC Drives

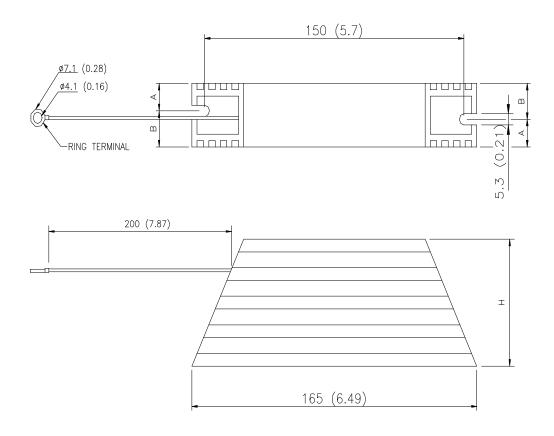
Voltage	Мо	cable tor	Full Load	Specification f	Braking Unit Model VFDB No. of Unit Used		Braking Resisto Model No of Ur		Braking Torque	Minimum Resistance
Volt	HP 4P	kW	Torque KG-M	Resistors			Used		10%ED %	rates
	1/4	0.2	0.110	80W 200			BR080W200	1	400	
	1/2	0.4	0.216	80W 200			BR080W200	1	220	
	1	0.75	0.427	80W 200			BR080W200	1	125	80
	2	1.5	0.849	300W 100			BR300W100	1	125	55
	3	2.2	1.262	300W 70			BR300W070	1	125	35
	5	3.7	2.080	400W 40			BR400W040	1	125	25
တ္သ	7.5	5.5	3.111	500W 30			BR500W030	1	125	16
Series	10	7.5	4.148	1000W 20			BR1K0W020	1	125	12
	15	11	6.186	2400W 13.6	2015	1	BR1K2W6P8	2	125	
230V	20	15	8.248	3000W 10	2015	1	BR1K5W005	2	125	
23	25	18.5	10.281	4800W 8	2022	1	BR1K2W008	4	125	
	30	22	12.338	4800W 6.8	2022	1	BR1K2W6P8	4	125	
	40	30	16.497	6000W 5	2015	2	BR1K5W005	4	125	
	50	37	20.6	9600W 4	2015	2	BR1K2W008	8	125	
	60	45	24.745	9600W 3.4	2022	2	BR1K2W6P8	8	125	
	75	55	31.11	9600W 3.4	2022	2	BR1K2W6P8	8	100	
	100	75	42.7	14400W 2.3	2022	3	BR1K2W6P8	12	110	
	1/4	0.2	0.110	80W 750			BR080W750	1	300	
	1/2	0.4	0.216	80W 750			BR080W750	1	230	
	1	0.75	0.427	80W 750			BR080W750	1	125	260
	2	1.5	0.849	300W 400			BR300W400	1	125	190
	3	2.2	1.262	300W 250			BR300W250	1	125	145
	5	3.7	2.080	400W 150			BR400W150	1	125	95
es	7.5	5.5	3.111	500W 100			BR500W100	1	125	60
Serie	10	7.5	4.148	1000W 75			BR1K0W075	1	125	45
	15	11	6.186	1000W 50	4030	1	BR1K0W050	1	125	
460V	20	15	8.248	1500W 40	4030	1	BR1K5W040	1	125	
4	25	18.5	10.281	4800W 32	4030	1	BR1K2W008	4	125	
	30	22	12.338	4800W 27.2	4030	1	BR1K2W6P8	4	125	
	40	30	16.497	6000W 20	4030	1	BR1K5W005	4	125	
	50	37	20.6	9600W 16	4045	1	BR1K2W008	8	125	
	60	45	24.745	9600W 13.6	4045	1	BR1K2W6P8	8	125	
	75	55	31.11	12000W 10	4030	2	BR1K5W005	8	125	
	100	75	42.7	19200W 6.8	4045	2	BR1K2W6P8	16	125	

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. AC drive has 3 braking units with total of 12 braking

	_	_	_		_		_
^	_	_	_	NI		·	_

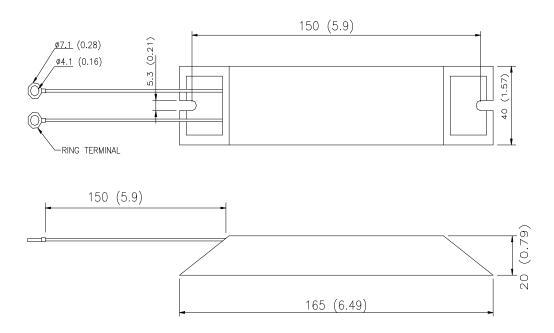
resistors, so each braking unit uses 4 braking resistors.

B-4 Braking Resistors Unit: mm (inch)



Type	Н	Α	В	MAX. WEIGHT (g)
MVR080W120	40 (1.57)	8 (0.31)	12 (0.47)	240
MVR200W120	40(1.57)	8 (0.31)	12 (0.47)	240
MVR080W200	60 (2.36)	15 (0.59)	15 (0.59)	460
MVR200W200	60 (2.36)	15 (0.59)	15 (0.59)	460

B-4 Braking Resistors Unit: mm (inch)

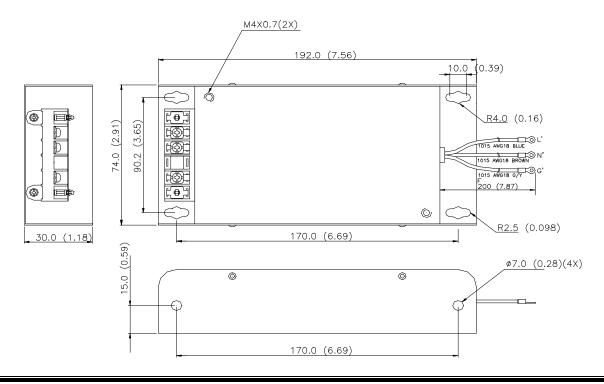


B-5 EMI Filters

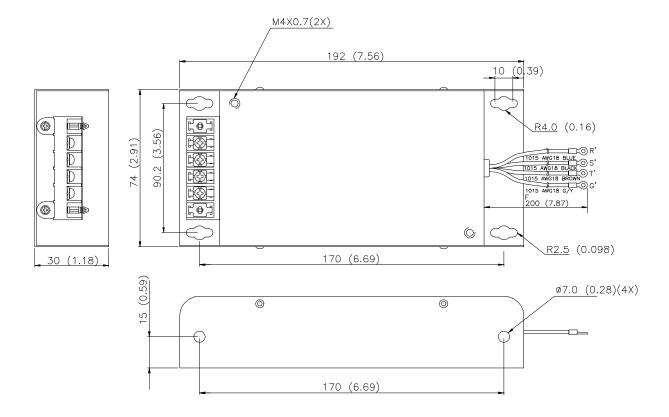
The DELTA VFD-S Series 0.25-3HP, 115V / 230V, 1 /3 AC drive uses DELTA EMI Filter. Use the table below to find the appropriate filter for your DELTA VFD-S drive.

Model of			Output choke			
AC Motor Drive	Models of EMI Filter	Specifications	Part Numbers	PC	Turns	
VFD002S11A						
VFD004S11A						
VFD002S21A	10DKT1W3S	250V, 1 , 10A	CTC513113B	2	10	
VFD004S21A						
VFD007S21A						
VFD002S23A						
VFD004S23A	06TDT1W4S	250V,3 , 6A	CTC513113B	2	10	
VFD007S23A						
VFD007S11A	20DKT1W3S	250\/ 1 20 4	CTC513113B	2	8	
VFD015S21A	ZUDKT 1993	250V,1 , 20A	CICSISTISE	2	O	
VFD015S23A	16TDT1W4S	250\/2 464	CTC513113B	2	8	
VFD022S23A	1010110045	250V,3 , 16A	CICCICIO	2	0	

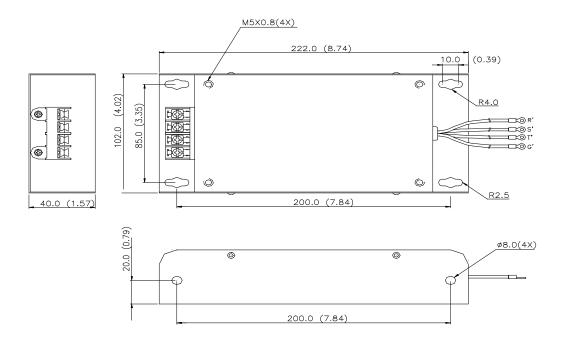
1. EMI Filter (10DKT1W3S) Use on 0.25-1 HP, 115V/230V, Single Phase Models



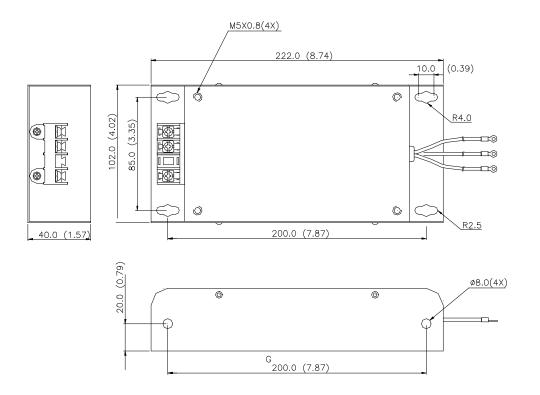
EMI Filter (06TDT1W4S) Use on 0.25-1 HP, 230V, Three Phase Models



EMI Filter (16TDT1W3S): for VFD015S23A, VFD022S23A



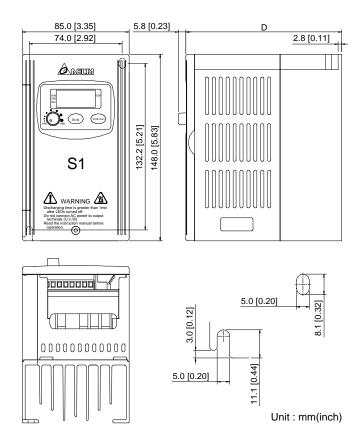
EMI Filter (20DKT1W3S): for VFD007S11A, VFD015S21A



VFD-S Dimensions (Use DR-01)

Unit: mm (inch)

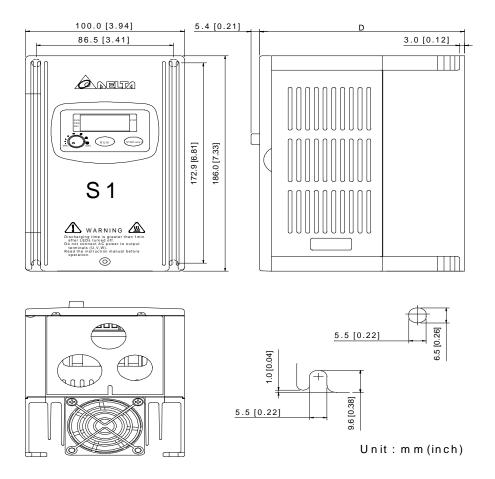
Model	HP	Voltage	Phase	Depth: mm (inch)	Weight (Kg)	Fan
VFD002S11A	0.2 HP	115 V	1 Phase	88 (3.49)	0.71	No
VFD002S21A	0.2 HP	230 V	1 Phase	88 (3.49)	0.67	No
VFD002S23A	0.2 HP	230 V	3 Phase	88 (3.49)	0.64	No
VFD004S11A	0.5 HP	115 V	1 Phase	102 (4.01)	0.81	No
VFD004S21A	0.5 HP	230 V	1 Phase	102 (4.01)	0.76	No
VFD004S23A	0.5 HP	230 V	3 Phase	102 (4.01)	0.71	No
VFD004S43A	0.5 HP	430 V	3 Phase	102 (4.01)		No
VFD007S21A	1 HP	230 V	1 Phase	125 (4.92)	0.93	No
VFD007S23A	1 HP	230 V	3 Phase	125 (4.92)	0.88	No
VFD007S43A	1 HP	430 V	3 Phase	125 (4.92)		No
VFD007S43B	1 HP	430 V	3 Phase	125 (4.92)		Yes



VFD-S DIMENSIONS (Use DR-02)

Unit: mm (inch)

Model	HP	Voltage	Phase	Depth: mm (inch)	Weight (Kg)	Fan
VFD007S11A	1 HP	115 V	1 Phase	129 (5.08)	1.35	NO
VFD015S21A	1 HP	230 V	1 Phase	143 (5.63)	1.52	NO
VFD015S21B	1 HP	230 V	1 Phase	129 (5.08)	1.42	YES
VFD015S23A	2 HP	230 V	3 Phase	143 (5.63)	1.43	NO
VFD015S23B	2 HP	115 V	3 Phase	129 (5.08)	1.33	YES
VFD015S43A	2 HP	430 V	3 Phase	143 (5.63)		NO
VFD015S43B	2 HP	430 V	3 Phase	129 (5.08)		YES
VFD022S23A	3 HP	230 V	3 Phase	129 (5.08)	1.42	YES
VFD022S43A	3 HP	430 V	3 Phase	129 (5.08)		YES



EC Declaration of Conformity



EC Declaration of Conformity According to the Low Voltage Directive 73/23/EEC and the Amendment Directive 93/68/EEC

For the following equipment:

AC Motor Drive

(Product Name)

VFD002S11A, VFD004S11A, VFD002S21A, VFD002S23A, VFD004S21A, VFD004S23A, VFD007S21A, VFD007S23A

(Model Name)

is herewith confirmed to comply with the requirements set out in the Council Directive 73/23/EEC for electrical equipment used within certain voltage limits and the Amendment Directive 93/68/EEC. For the evaluation of the compliance with this Directive, the following standard was applied:

EN 50178

The following manufacturer/importer is responsible for this declaration:

Del	lta	ΕI	ect	roi	nic	s. l	ln	C.

(Company Name)

31-1,Shien Pan Road, Kuei San Industrial Zone, Taoyuan Shien, Taiwan, R.O.(\mathbb{C}
---	--------------

(Company Address)

Person responsible for making this declaration:

H.L. Pan	_(Name)
Electromechanical Business Unit / Deputy Manager	
(Position/Title)	

(Place) (Date) (legal Signature)



EC Declaration of Conformity According to the Electromagnetic Compatibility 89/336/EEC and the Amendment Directive 93/68/EEC

For the following equipment:

AC Motor Drive

(Product Name)

VFD002S11A, VFD004S11A, VFD002S21A, VFD002S23A, VFD004S21A, VFD004S23A, VFD007S21A, VFD007S23A

(Model Designation)

is herewith confirmed to comply with the requirements set out in the Council Directive 89/336/EEC for electromagnetic compatibility and the Amendment Directive 93/68/EEC. For the evaluation of the compliance with this Directive, the following standard was applied:

EN61800-3, EN50081-2, EN50082-2, EN55011, IEC1000-4-2, IEC-1000-4-3, IEC-1000-4-4, IEC-1000-4-5, IEC-1000-4-6, IEC-1000-4-8

The following manufacturer/importer is responsible for this declaration:

Delta Electronics, Inc.

(Company Name)

31-1, Shien Pan Road, Kuei San Industrial Zone, Taoyuan Shien, Taiwan, R.O.C.

(Company Address)

Person responsible for marking this declaration:

H.L. Pan

(Name)

Electromechanical Business Unit / Deputy Manager

(Position/Title)

(Place) (Date) (legal Signature)

Warranty

DELTA warrants the product delivered in the DELTA ship package to be free from defects in material and workmanship, under normal use and service, for twenty four (24) months from date of manufacturing. Products that fail during this period will be repaired or replaced at DELTA's discretion, with the same or a functionally equivalent product, provided the original purchaser (A) returns the failed product, and (B) provides proof of original date of purchase. This warranty does not apply, in the judgement of Delta, to damage caused during shipment, handling, storage, or accidental misuse. The original purchaser of the product must obtain a Return Material Authorization (RMA) number from Delta prior to returning any defective product. (When purchased through an Authorized Distributor, the Distributor should supply an RMA number to their customer.)

The maximum liability of this warranty is limited to the purchase price of the product. In no event, regardless of cause, shall delta be liable (a) for penalties or penalty clauses of any description, or (b) for certification not otherwise specifically provided herein and/or indemnification of purchaser or others for costs, damages or expenses, each arising out of or related to the product or services of any order or (c) for any damages resulting from loss of profits, use of products or for any incidental indirect or consequential damages, even if advised of the possibility of such damages.

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