User Manual

MC8000 Series

General Sensorless Vector

Contorl Micro Drives

Preface

Thank you for choosing DFL's high-performance MC8000 Series. The MC8000 Series is manufactured with high-quality components and materials and incorporate the latest microprocessor technology available.

This manual is to be used for the installation, parameter setting, troubleshooting, and daily maintenance of the AC motor drive. To guarantee safe operation of the equipment, read the following safety guidelines before connecting power to the AC motor drive. Keep this operating manual at hand and distribute to all users for reference.

To ensure the safety of operators and equipment, only qualified personnel familiar with AC motor drive are to do installation, start-up and maintenance. Always read this manual thoroughly before using MC8000 series AC Motor Drive, especially the WARNING, DANGER and CAUTION notes. Failure to comply may result in personal injury and equipment damage. If you have any questions, please contact your dealer.

PLEASE READ PRIOR TO INSTALLATION FOR SAFETY.

DANGER!

1. AC input power must be disconnected before any wiring to the AC motor drive is made.
2. A charge may still remain in the DC-link capacitors with hazardous voltages, even if the power has been turned off. To prevent personal injury, please ensure that power has turned off before opening the AC motor drive and wait ten minutes for the capacitors to discharge to safe voltage levels.
3. Never reassemble internal components or wiring.
4. The AC motor drive may be destroyed beyond repair if incorrect cables are connected to the input/output terminals. Never connect the AC motor drive output terminals U/T1, V/T2, and W/T3 directly to the AC mains circuit power supply.
5. Ground the MC8000 using the ground terminal.The grounding method must comply with the laws of the country where the AC motor drive is to be installed. Refer to the Basic Wiring Diagram.
6. MC8000 series is used only to control variable speed of 3-phase induction motors, NOT for 1-phase motors or other purpose.
7. MC8000 series shall NOT be used for lifesupport equipment or any life safety situation.

WARNING!

1. DO NOT use Hi-pot test for internal components. The semi-conductor used in AC motor drive easily damage by high-voltage.
2. There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. To prevent damage to these components, do not touch these components or the circuit boards with metal objects or your bare hands.
3. Only qualified persons are allowed to install, wire and maintain AC motor drives.

CAUTION!

1. Some parameters settings can cause the motor to run immediately after applying power.
2. DO NOT install the AC motor drive in a place subjected to high temperature, direct sunlight, high humidity, excessive vibration, corrosive gases or liquids, or airborne dust or metallic particles.
3. Only use AC motor drives within specification. Failure to comply may result in fire, explosion or electric shock.
4. To prevent personal injury, please keep children and unqualified people away from the equipment.
5. When the motor cable between AC motor drive and motor is too long, the layer insulation of the motor may be damaged. Please use a frequency inverter duty motor or add an AC output reactor to prevent damage to the motor. Refer to appendix B Reactor for details.
6. The rated voltage for AC motor drive must be ≤ 240V for 230V models (≤ 120V for 115V models; ≤ 480V for 460V models; ≤ 600V for 575V models) and the mains supply current capacity must be ≤ 5000A RMS.

Table of Contents

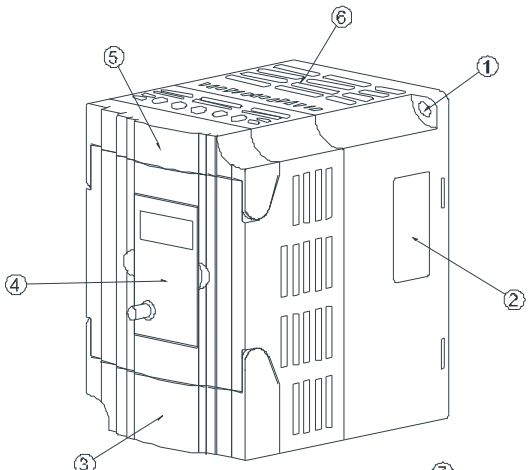
Chapter 1 Introduction

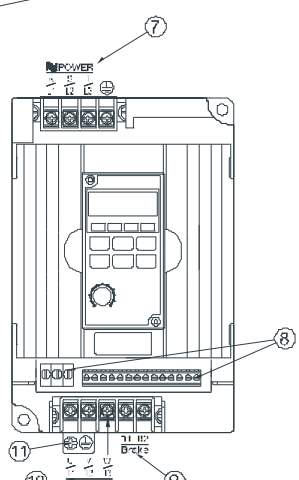
The AC motor drive should be kept in the shipping carton or crate before installation. In order to retain the warranty coverage, the AC motor drive should be stored properly when it is not to be used for an extended period of time. Storage conditions are:

CAUTION!

1. Store in a clean and dry location free from direct sunlight or corrosive fumes.
2. Store within an ambient temperature range of -20 °C to +60 °C.
3. Store within a relative humidity range of 0% to 90% and non-condensing environment.
4. Store within an air pressure range of 86 kPA to 106kPA.
5. DO NOT place on the ground directly. It should be stored properly. Moreover, if the surrounding environment is humid, you should put exsiccator in the package.
6. DO NOT store in an area with rapid changes in temperature. It may cause condensation and frost.
7. If the AC motor drive is stored for more than 3 months, the temperature should not be higher than 30 °C. Storage longer than one year is not recommended, it could result in the degradation of the electrolytic capacitors.
8. When the AC motor drive is not used for longer time after installation on building sites or places with humidity and dust, it's best to move the AC motor drive to an environment as stated above.

1.1.4 External Parts and Labels





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

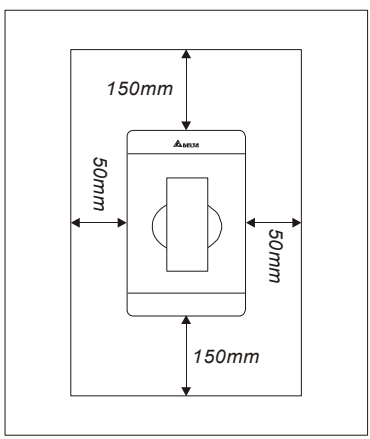
1.2 Preparation for Installation and Wiring

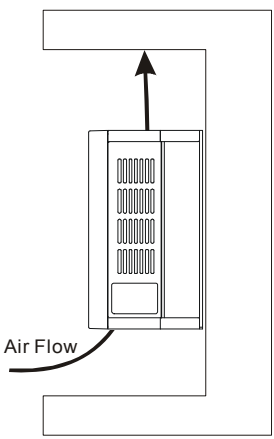
1.2.1 Ambient Conditions

Install the AC motor drive in an environment with the following conditions:

Operation	Air Temperature:	-10 ~ +50°C (14 ~ 122°F) for UL & cUL -10 ~ +40°C (14 ~ 104°F) for 5.5kw models and above
	Relative Humidity:	<90%, no condensation allowed
	Atmosphere pressure:	86 ~ 106 kPa
	Installation Site Altitude:	<1000m
	Vibration:	<20Hz: 9.80 m/s^2 (1G) max 20 ~ 50Hz: 5.88 m/s^2 (0.6G) max
Storage Transportation	Temperature:	-20°C ~ +60°C (-4°F ~ 140°F)
	Relative Humidity:	<90%, no condensation allowed
	Atmosphere pressure:	86 ~ 106 kPa
	Vibration:	<20Hz: 9.80 m/s^2 (1G) max 20 ~ 50Hz: 5.88 m/s^2 (0.6G) max
Pollution Degree	2: good for a factory type environment.	

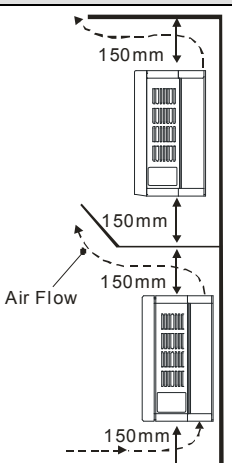
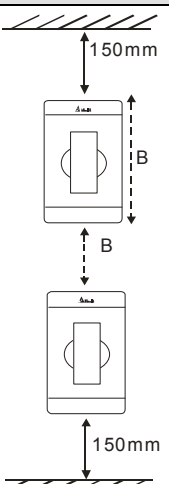
1.2.2 Minimum Mounting Clearances



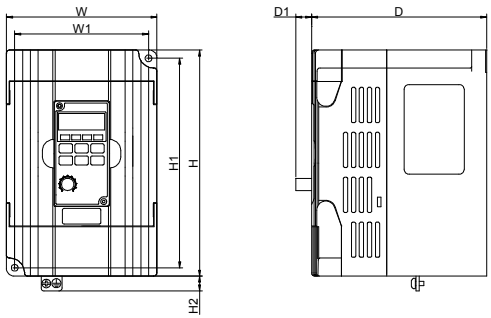


CAUTION!

1. Operating, storing or transporting the AC motor drive outside these conditions may cause damage to the AC motor drive.
2. Failure to observe these precautions may void the warranty!
3. Mount the AC motor drive vertically on a flat vertical surface object by screws. Other directions are not allowed.
4. The AC motor drive will generate heat during operation. Allow sufficient space around the unit for heat dissipation.
5. The heat sink temperature may rise to 90°C when running. The material on which the AC motor drive is mounted must be noncombustible and be able to withstand this high temperature.
6. When AC motor drive is installed in a confined space (e.g. cabinet), the surrounding temperature must be within 10 ~ 40°C with good ventilation. DO NOT install the AC motor drive in a space with bad ventilation.
7. Prevent fiber particles, scraps of paper, saw dust, metal particles, etc. from adhering to the heatsink.
8. When installing multiple AC more drives in the same cabinet, they should be adjacent in a row with enough space in-between. When installing one AC motor drive below another one, use a metal separation between the AC motor drives to prevent mutual heating.

Installation with Metal Separation	Installation without Metal Separation
	

1.3 Dimensions



Unit: mm [inch]

Model Name	W	W1	H	H1	H2	D	D1
MC8000	125.0 [4.92]	110.0 [4.33]	220.0 [8.66]	205.0 [8.07]	15.0 [0.59]	166.3 [6.55]	8.2 [0.32]

Chapter 2 Installation and Wiring

After removing the front cover, check if the power and control terminals are clear. Be sure to observe the following precautions when wiring.

- General Wiring Information

  Applicable Codes

  All MC8000 series are Underwriters Laborator ies, Inc. (UL) and Canadian Underwriters Laboratories (cUL) listed, and therefore comply with the requirements of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

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

  The "Line Fuse Specification" in Appendix B, lists the recommended fuse part number for each MC8000 Series part number. These fuses (or equivalent) must be used on all installations where compliance with U.L. standards is a required.

CAUTION!

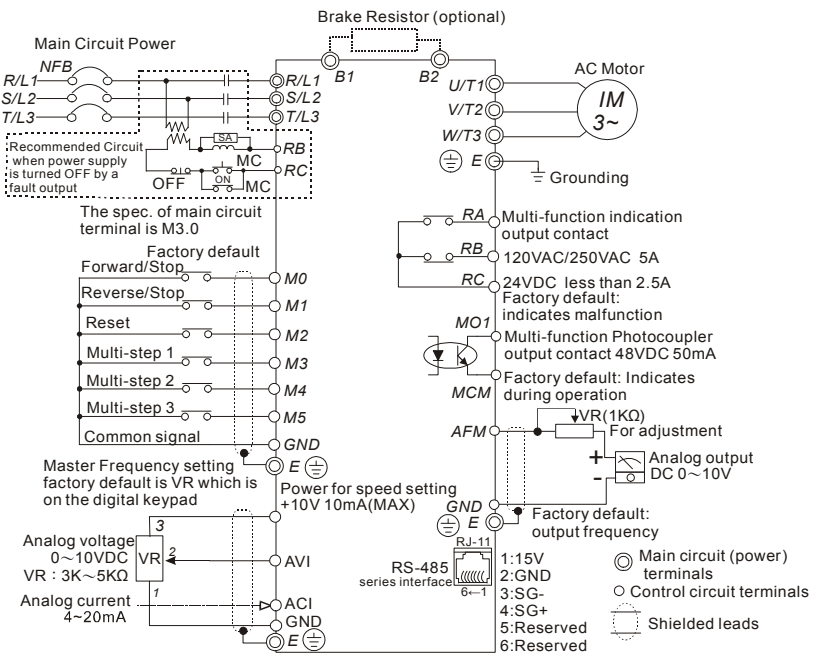
1. Make sure that power is only applied to the R/L1, S/L2, T/L3 terminals. Failure to comply may result in damage to the equipment. The voltage and current should lie within the range as indicated on the nameplate.
2. All the units must be grounded directly to a common ground terminal to prevent lightning strike or electric shock.
3. Please make sure to fasten the screw of the main circuit terminals to prevent sparks which is made by the loose screws due to vibration.
4. Check following items after finishing the wiring:
   A. Are all connections correct?
   B. No loose wires?
   C. No short-circuits between terminals or to ground?

DANGER!

1. A charge may still remain in the DC bus capacitors with hazardous voltages even if the power has been turned off. To prevent personal injury, please ensure that the power is turned off and wait ten minutes for the capacitors to discharge to safe voltage levels before opening the AC motor drive.
2. Only qualified personnel familiar with AC motor drives is allowed to perform installation, wiring and commissioning.
3. Make sure that the power is off before doing any wiring to prevent electric shock.

2.1 Basic Wiring Diagram

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



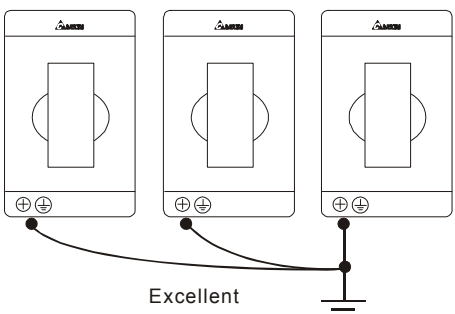
NOTE: Do not plug a Modem or telephone line to the RS-485 communication port, permanent damage may result. Terminal 1& 2 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

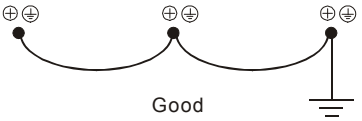
* If it is single phase model, please select any of the two input power terminals in main circuit power.

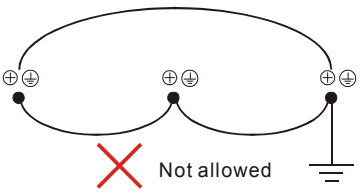
* Single phase model can be input 3-phase power.

CAUTION!

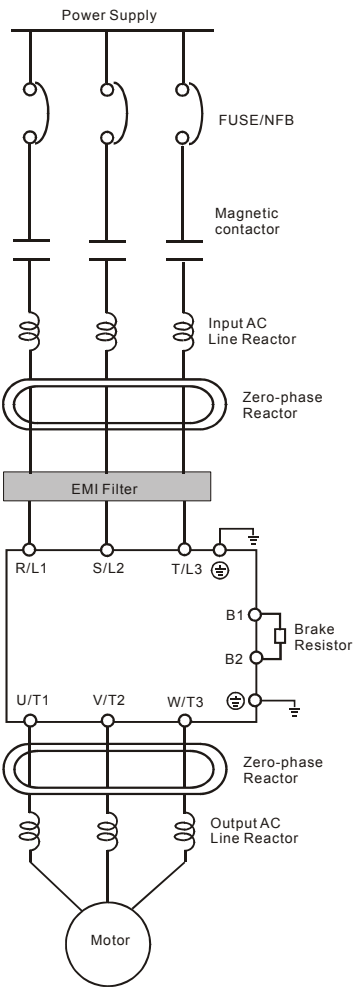
1. The wiring of main circuit and control circuit should be separated to prevent erroneous actions.
2. Please use shield wire for the control wiring and not to expose the peeled-off net in front of the terminal.
3. Please use the shield wire or tube for the power wiring and ground the two ends of the shield wire or tube.
4. Damaged insulation of wiring may cause personal injury or damage to circuits/equipment if it comes in contact with high voltage.
5. The AC motor drive, motor and wiring may cause interference. To prevent the equipment damage, please take care of the erroneous actions of the surrounding sensors and the equipment.
6. When the AC drive output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3, respectively. To permanently reverse the direction of motor rotation, switch over any of the two motor leads.
7. With long motor cables, high capacitive switching current peaks can cause over-current, high leakage current or lower current readout accuracy. To prevent this, the motor cable should be less than 20m for 3.7kW models and below. And the cable should be less than 50m for 5.5kW models and above. For longer motor cables use an AC output reactor.
8. The AC motor drive, electric welding machine and the greater horsepower motor should be grounded separately.
9. Use ground leads that comply with local regulations and keep them as short as possible.
10. No brake resistor is built in theMC8000 series , it can install brake resistor for those occasions that use higher load inertia or frequent start/stop. Refer to Appendix B for details.
11. Multiple MC8000 units can be installed in one location. All the units should be grounded directly to a common ground terminal, as shown in the figure below. **Ensure there are no ground loops.**




Good


Not allowed

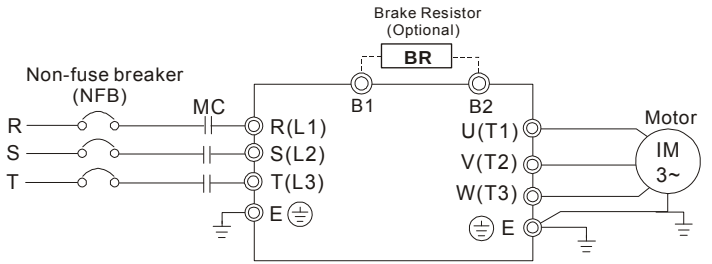
2.2 External Wiring



Items	Explanations
Power supply	Please follow the specific power supply requirement shown in APPENDIX A.
Fuse/NFB (Optional)	There may be inrush current during power up. Please check the chart of APPENDIX B and select the correct fuse with rated current. NFB is optional.
Magnetic contactor (Optional)	Please do not use a Magnetic contactor as the I/O switch of the AC drive, this will reduce the operating life cycle of the AC drive.
Input AC Line Reactor (Optional)	Used to improve the input power factor, to reduce harmonics and provide protection from AC line disturbances. (Surge, switching spike, power flick, etc.) AC line reactor should be installed when the power supply capacity is ≧500kVA or phase lead reactor will be switched. And the wiring distance should not exceed 10m. Please refer to Appendix B for detail.
Zero-phase Reactor (Ferrite Core Common Choke) (Optional)	Zero phase reactors are used to reduce radio noise especially when audio equipment installed near the inverter. Effective for noise reduction on both the input and output sides. Attenuation quality is good for a wide range from AM band to 10Mhz. Appendix B specifies zero phase reactors. (RF220X00A)
EMI filter (Optional)	To reduce electromagnetic interference. Please refer to Appendix B for detail.
Brake Resistor (Optional)	Used to reduce stopping time of the motor. Please refer to the chart on Appendix B for specific brake resistors.
Output AC Line Reactor (Optional)	Motor surge voltage amplitudes depending on motor cable length. For long motor cable applications (>20m), it is necessary to install on the inverter output side.

2.3 Main Circuit

2.3.1 Main Circuit Connection



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

CAUTION!

Mains power terminals (R/L1, S/L2, T/L3)

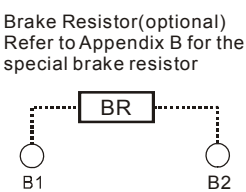
- Connect these terminals (R/L1, S/L2, T/L3) via a non-fuse breaker or earth leakage breaker to 3-phase AC power (some models to 1-phase AC power) for circuit protection. It is unnecessary to consider phase-sequence.
- It is recommended to add a magnetic contactor (MC) in the power input wiring to cut off power quickly and reduce malfunction when activating the protection function of AC motor drives. Both ends of the MC should have an R-C surge absorber.
- Please make sure to fasten the screw of the main circuit terminals to prevent sparks which is made by the loose screws due to vibration.

- Please use voltage and current within the regulation shown in Appendix A.
- When using a GFCI (Ground Fault Circuit Interrupter), select a current sensor with sensitivity of 200mA, and not less than 0.1-second detection time to avoid nuisance tripping.
- Do NOT run/stop AC motor drives by turning the power ON/OFF. Run/stop AC motor drives by RUN/STOP command via control terminals or keypad. If you still need to run/stop AC drives by turning power ON/OFF, it is recommended to do so only ONCE per hour.
- Do NOT connect 3-phase models to a 1-phase power source.

Output terminals for main circuit (U, V, W)

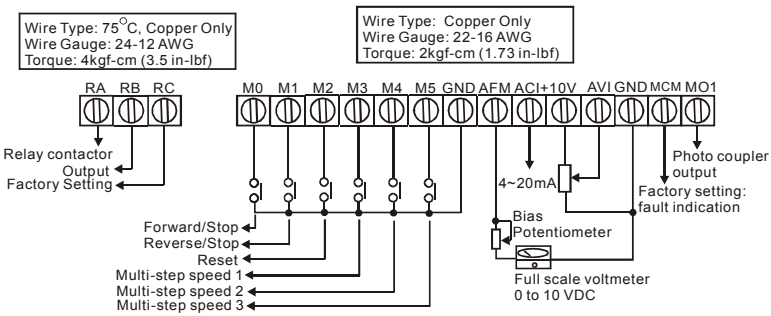
- When it needs to install the filter at the output side of terminals U/T1, V/T2, W/T3 on the AC motor drive. Please use inductance filter. Do not use phase-compensation capacitors or L-C (Inductance-Capacitance) or R-C (Resistance-Capacitance), unless approved by Delta.
- DO NOT connect phase-compensation capacitors or surge absorbers at the output terminals of AC motor drives.
- Use well-insulated motor, suitable for inverter operation.

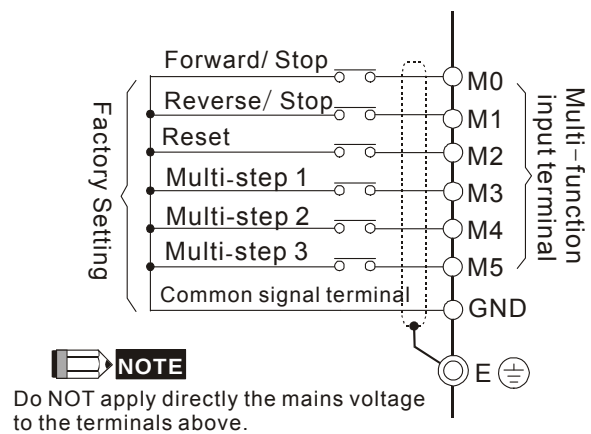
Terminals [B1, B2] for connecting external brake unit



- Connect a brake resistor or brake unit in applications with frequent deceleration ramps, short deceleration time, too low braking torque or requiring increased braking torque.
- The AC motor drive has a built-in brake chopper, you can connect the external brake resistor to the terminals [B1, B2] when needed.
- When not used, please leave the terminals [B1, B2] open.

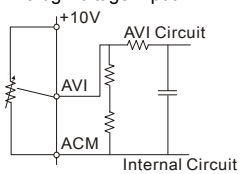
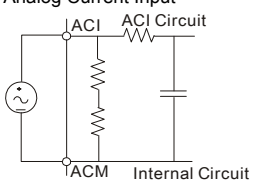
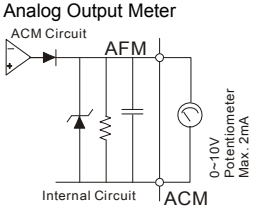
2.4 Control Terminal Wiring (Factory Settings)

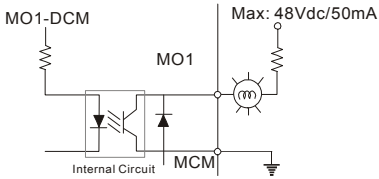




Terminal symbols and functions

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

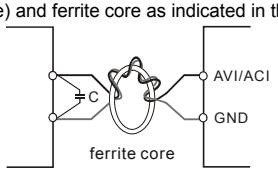
Terminal Symbol	Terminal Function	Factory Settings (NPN mode)
		5A(N.O.)/3A(N.C.) 277Vac; 5A(N.O.)/3A(N.C.) 30Vdc
RC	Multi-function Relay Common	5A(N.O.)/3A(N.C.) 277Vac; 5A(N.O.)/3A(N.C.) 30Vdc
M0	Multi-function auxiliary input	M0~M5-GND Refer to P38~P42 for programming the multi-function inputs. ON: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

Terminal Symbol	Terminal Function	Factory Settings (NPN mode)
MO1	Multi-function Output Terminal (Photocoupler)	Maximum: 48Vdc, 50mA Refer to P45 for programming. 
MCM	Multi-function Output Common (Photocoupler)	Common for Multi-function Outputs

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

Analog inputs (AVI, ACI)

- Analog input signals are easily affected by external noise. Use shielded wiring and keep it as short as possible (<20m) with proper grounding. If the noise is inductive, connecting the shield to terminal GND can bring improvement.
- If the analog input signals are affected by noise from the AC motor drive, please connect a capacitor (0.1 μ F and above) and ferrite core as indicated in the following diagrams:



wind each wires 3 times or more around the core

Digital inputs (M0~M5)

- When using contacts or switches to control the digital inputs, please use high quality components to avoid contact bounce.

Digital outputs (MO1)

- Make sure to connect the digital outputs to the right polarity, see wiring diagrams.
- When connecting a relay to the digital outputs, connect a surge absorber or fly-back diode across the coil and check the polarity.

General

- Keep control wiring as far away as possible from the power wiring and in separate conduits to avoid interference. If necessary let them cross only at 90º angle.
- The AC motor drive control wiring should be properly installed and not touch any live power wiring or terminals.

NOTE

- 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.

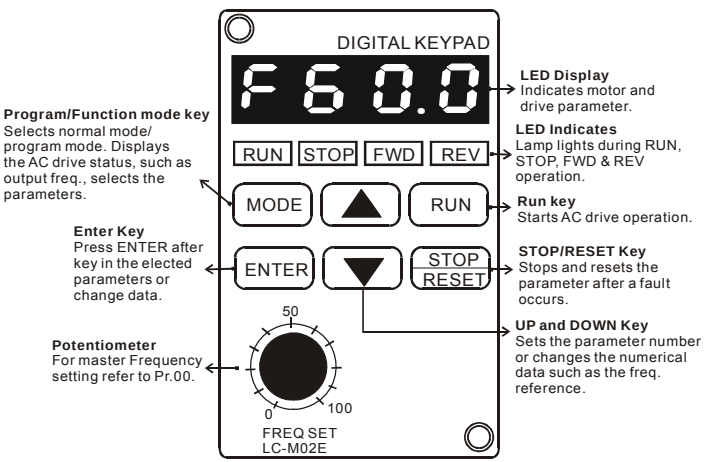
DANGER!

Damaged insulation of wiring may cause personal injury or damage to circuits/equipment if it comes in contact with high voltage.

3.1 Keypad

3.1.1 Description of the Digital Keypad

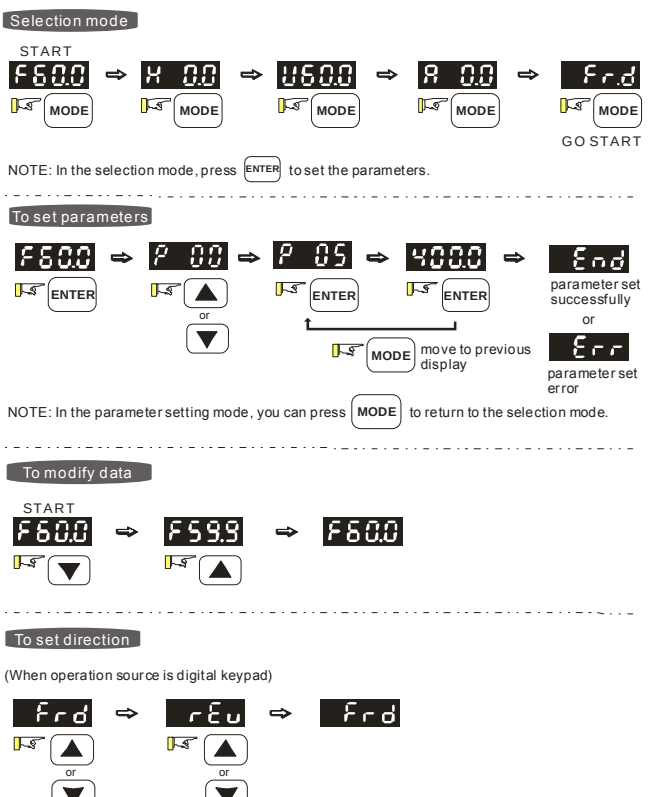
The digital keypad includes two parts: Display panel and keypad. The display panel provides the parameter display and shows the operation status of the AC drive and the keypad provides programming and control interface.



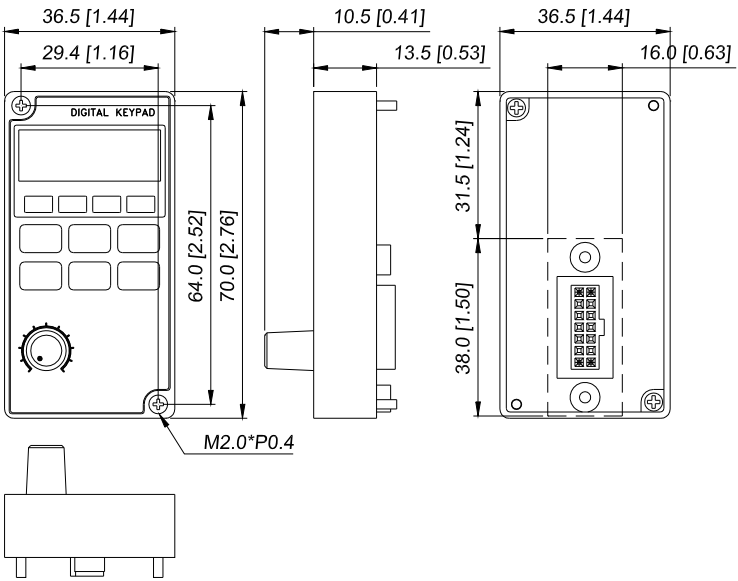
Displayed Message	Descriptions
F60.0	The AC drives Master Frequency.
H60.0	The Actual Operation Frequency present at terminals U, V, and W.
u600.	The custom unit (v), where v = H x Pr.65.
c999	The counter value (c).
A 5.0	The output current present at terminals U, V, and W
1 50	The internal PLC process step currently being performed.
P 01	The specified parameter.

Displayed Message	Descriptions
01	The actual value stored within the specified parameter.
Frd	The AC drive forward run status.
rEv	The AC drive reverse run status.
End	"End" displays for approximately 1 second if input has been accepted. After a parameter value has been set, the new value is automatically stored in memory. To modify an entry, use the ▲ and ▼ keys.
Err	"Err" displays, if the input is invalid.

3.1.2 How to Operate the Digital Keypad LC-M02E



3.1.3 LC-M02E



Unit: mm [inch]

Reference Table for the 7-segment LED Display of the Digital Keypad

Digit	0	1	2	3	4	5	6	7	8	9
LED Display	0	1	2	3	4	5	6	7	8	9

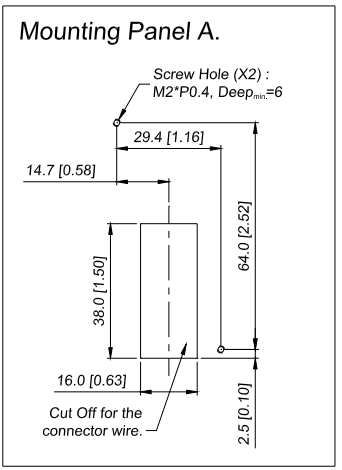
English alphabet	A	b	Cc	d	E	F	G	Hh	I	Jj
LED Display	A	b	Cc	d	E	F	G	Hh	I	Jj

English alphabet	K	L	n	Oo	P	q	r	S	Tt	U
LED Display	K	L	n	Oo	P	q	r	S	Tt	U

English alphabet	v	Y	Z							
LED Display	v	Y	Z							

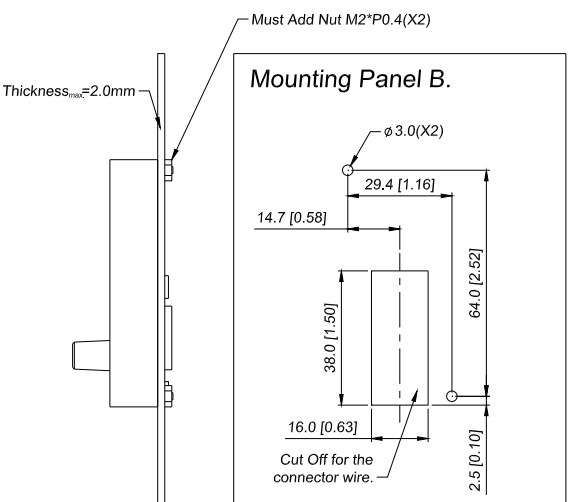
Digital Keypad – Mounting Panel A

Unit: mm [inch]



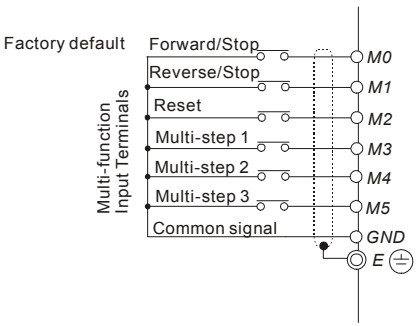
Digital Keypad – Mounting Panel B

Unit: mm [inch]



3.2 Operation Method

The operation method can be set via control terminals and LC-M02E keypad. Please choose a suitable method depending on application and operation rule.

<table>
<tr><th>Operation Method</th><th>Frequency Source</th><th>Operation Command Source</th></tr>
<tr><td rowspan="2">Operate from external signal</td><td> 
</td><td></td></tr>
<tr><td>External terminals input (multi-step speed function)
M2~M5 (P39~P42)</td><td>M0-GND: FWD/Stop
M1~GND: REV/Stop
(P01=01/02)</td></tr>
<tr><td>LC-M02E keypad</td><td>  </td><td>RUN
STOP RESET
(Pr.00=00)</td></tr>
</table>

3.3 Trial Run

The factory setting of the operation source is from the digital keypad (P01=00). You can perform a trial run by using the digital keypad with the following steps:

1. After applying power, verify that the display shows F60.0Hz. When AC motor drive is in standby situation, STOP LED and FWD LED will light up.
2. Press  key to set frequency to 5Hz.
3. Press RUN key, RUN LED and FWD LED will light up, which indicates operation command is forward running. And if you want to change to reverse running, you should press  . And if you want to decelerate to stop, please press STOP RESET key.

4. Check following items:
   - *Check if the motor direction of rotation is correct.*
   - *Check if the motor runs steadily without abnormal noise and vibration.*
   - *Check if acceleration and deceleration are smooth.*

If the results of trial run are normal, please start the formal run.

1、 Stop running immediately if any fault occurs and refer to the troubleshooting guide for solving the problem.

2、 Do NOT touch output terminals U, V, W when power is still applied to L1/R, L2/S, L3/T even when the AC motor drive has stopped. The DC-link capacitors may still be charged to hazardous voltage levels, even if the power has been turned off.

3、 To avoid damage to components, do not touch them or the circuit boards with metal objects or your bare hands.

Chapter 4 Parameters

This MC8000 AC motor drive has 157 parameters for easy setting. In most applications, the user can finish all parameter settings before start-up without the need for re-adjustment during operation.

4.1 Summary of Parameter Settings

↗: The parameter can be set during operation.

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

Parameter	Explanation	Settings	Factory Setting	Customer
P 08	Minimum Output Freq	0.10 to 20.00Hz	1.50	
P 09	Minimum Output Voltage	115V/230V: 0.1 to 255.0V	10.0	
		460V: 0.1 to 510.0V	20.0	
		575V: 0.1 to 637.0V	26.1	
↗ P 10	Acceleration Time 1	0.1 to 600.0 sec or 0.01 to 600.0 sec	10.0	
↗ P 11	Deceleration Time 1	0.1 to 600.0 sec or 0.01 to 600.0 sec	10.0	
↗ P 12	Acceleration Time 2	0.1 to 600.0 sec or 0.01 to 600.0 sec	10.0	
↗ P 13	Deceleration Time 2	0.1 to 600.0 sec or 0.01 to 600.0 sec	10.0	
P 14	Accel S-curve	00 to 07	00	
↗ P 15	Jog Accel/Decel Time	0.1 to 600.0 sec or 0.01 to 600.0 sec	1.0	
↗ P 16	Jog Frequency	0.00 to 400.0 Hz	6.00	
↗ P 17	1st Step Speed Freq.	0.00 to 400.0Hz	0.00	
↗ P 18	2nd Step Speed Freq.	0.00 to 400.0Hz	0.00	
↗ P 19	3rd Step Speed Freq.	0.00 to 400.0Hz	0.00	
↗ P 20	4th Step Speed Freq.	0.00 to 400.0Hz	0.00	
↗ P 21	5th Step Speed Freq.	0.00 to 400.0Hz	0.00	
↗ P 22	6th Step Speed Freq.	0.00 to 400.0Hz	0.00	
↗ P 23	7th Step Speed Freq.	0.00 to 400.0Hz	0.00	
P 24	Reverse Operation Inhibition	00: Enable REV operation 01: Disable REV operation	00	
P 25	Over-Voltage Stall Prevention	00: Disable		
		115V/230V: 330 to 450 Vdc	390	
		460V: 660 to 900 Vdc	780	
		575V: 825 to 1025 Vdc	975	
P 26	Over-current Stall Prevention during Acceleration	00: Disable 20% to 200%	150	
P 27	Over-current Stall Prevention during Operation	00: Disable 20% to 200%	150	
P 28	DC Braking Current Level	00 to 100 %	00	
P 29	DC Braking during Start-up	0.0 to 5.0 sec	0.0	

Parameter	Explanation	Settings	Factory Setting	Customer
P 30	DC Braking during Stopping	0.0 to 25.0 sec	0.0	
P 31	Start-point for DC Braking	0.00 to 60.00 Hz	0.00	
P 32	Momentary Power Loss Operation Selection	00: Stop operation after momentary power loss 01: Continues after momentary power loss, speed search starts with Master Frequency 02: Continues after momentary power loss, speed search starts with Minimum output Frequency	00	
P 33	Maximum Allowable Power Loss Time	0.3 to 5.0 sec	2.0	
P 34	Base-Block Time for Speed Search	0.3 to 5.0 sec	0.5	
P 35	Maximum Current Level for Speed Search	30 to 200 %	150	
P 36	Upper Bound of Output Frequency	0.10 Hz to 400.0 Hz	400.0	
P 37	Lower Bound of Output Frequency	0.00 Hz to 400.0 Hz	0.00	
P 38	Multi-function Input Terminal (M0,M1)	00: M0: FWD/STOP, M1: REV/STOP 01: M0: RUN/STOP, M1: REV/FWD 02: M0, M1, M2: 3-wire operation control mode	00	
P 39	Multi-function Input Terminal (M2)	00: No Function 01: Output OFF (N.O.) (enabled when running) 02: Output OFF (N.C.) (enabled when running) 03: External Fault (normally open) N.O. 04: External Fault (normally close) N.C 05: RESET 06: Multi-Step Speed Command 1 07: Multi-Step Speed Command 2 08: Multi-Step Speed Command 3 09: Jog Operation 10: Accel/Decel Speed Inhibit 11: First or Second Accel/Decel Time 12: Base-block (B.B.) (N.O)	05	
P 40	Multi-function Input Terminal (M3)		06	
P 41	Multi-function Input Terminal (M4)		07	
P 42	Multi-function Input Terminal (M5)		08	

Parameter	Explanation	Settings	Factory Setting	Customer
		13: Base-block (B.B.) (N.C) 14: Increase Master Frequency 15: Decrease Master Frequency 16: Run PLC Program 17: Pause PLC 18: Counter Trigger Signal 19: Counter Reset 20: No function 21: RESET command (N.C) 22: Control source: External Terminal 23: Control source: Keypad 24: Control source: Communication 25: Parameter Lock (Write disable, Read is always 0) 26: PID Disable (N.O.) 27: PID Disable (N.C.) 28: Second Source for Frequency Command 29: Forward (contact is open) / Reverse (contact is close) 30: One-Shot PLC Run 31: Index input signal 32: Counter Incremented by Drive Output Frequency		
↗ P 43	Analog Output Signal	00: Analog Frequency Meter (0 to Maximum Output Frequency) 01: Analog Current Meter (0 to 250% of the rated AC drive current) 02: Feedback signal (0 - 100%) 03: Output power (0 - 100%)	00	
↗ P 44	Analog Output Gain	00 to 200 %	100	
P 45	Multi-Function Output Terminal 1 (Photocoupler output)	00: AC Drive Operational 01: Maximum Output Frequency Attained 02: Zero Speed	00	
P 46	Multi-function Output Terminal 2 (Relay Output)	03: Over-Torque Detection 04: Base-Block (B.B) Indication 05: Low Voltage Indication 06: AC Drive Operation Mode 07: Fault Indication 08: Desired Frequency Attained	07	

Parameter	Explanation	Settings	Factory Setting	Customer
		09: PLC Program Running 10: PLC Program Step Completed 11: PLC Program Completed 12: PLC Operation Paused 13: Top Count Value Attained 14: Preliminary Counter Value Attained 15: Warning (PID feedback loss, communication error) 16: Below the Desired Frequency 17: PID supervision 18: Over Voltage supervision 19: Over Heat supervision 20: Over Current stall supervision 21: Over Voltage stall supervision 22: Forward command 23: Reverse command 24: Zero Speed (Includes Drive Stop)		
↗ P 47	Desired Frequency Attained	0.00 to 400.0 Hz	0.00	
↗ P 48	Adjust Bias of External Input Frequency	0.00 to 200.0%	0.00	
↗ P 49	Potentiometer Bias Polarity	00: Positive Bias 01: Negative Bias	00	
↗ P 50	Potentiometer Frequency Gain	0.10 to 200.0%	100.0	
P 51	Potentiometer Reverse Motion Enable	00: Reverse Motion Disabled in negative bias 01: Reverse Motion Enabled in negative bias	00	
↗ P 52	Motor Rated Current	30.0% FLA to 120.0% FLA	FLA	
↗ P 53	Motor No-Load Current	00%FLA to 99%FLA	0.4*FLA	
↗ P 54	Torque Compensation	00 to 10	00	
↗ P 55	Slip Compensation	0.00 to 10.00	0.00	
P 56	Reserved			
P 57	AC Drive Rated Current Display (unit: 0.1A)		##.#	
P 58	Electronic Thermal Overload Relay	00: Standard Motor (self cool motor) 01: Inverter Motor (auxiliary cool fan on motor) 02: Inactive	02	

Parameter	Explanation	Settings	Factory Setting	Customer
↗ P 59	Electronic Thermal Motor Overload	30 to 300 sec	60	
P 60	Over-Torque Detection Mode	00: Over-Torque Detection Disable 01: Enabled during constant speed operation until the allowable time for detection (P 62) elapses. 02: Enabled during constant speed operation and halted after detection. 03: Enabled during acceleration until the allowable time for detection (P 62) elapses. 04: Enabled during acceleration and halted after detection.	00	
P 61	Over-Torque Detection Level	30 to 200 %	150	
P 62	Over-Torque Detection Time	0.0 to 10.0 seconds	0.1	
P 63	Loss of ACI (4-20mA)	00: Decelerate to 0 Hz 01: Stop immediately and display "EF" 02: Continue operation by last frequency command	00	
↗ P 64	User Defined Function for Display	00: Display AC drive output Frequency (Hz) 01: Display User-defined output Frequency (H*P65) 02: Output Voltage (E) 03: DC Bus Voltage (u) 04: PV (i) 05: Display the value of internal counter (c) 06: Display the setting frequency (F or o=%) 07: Display the parameter setting (Pr.00) 08: Reserved 09: Output Current (A) 10: Display program operation (0.xxx), Fwd, or Rev	06	
↗ P 65	Coefficient K	0.01 to 160.0	1.00	
↗ P 66	Communication Frequency	0.00 to 400.0 Hz	0.00	
P 67	Skip Frequency 1	0.00 to 400.0 Hz	0.00	
P 68	Skip Frequency 2	0.00 to 400.0 Hz	0.00	
P 69	Skip Frequency 3	0.00 to 400.0 Hz	0.00	
P 70	Skip Frequency Band	0.00 to 20.00 Hz	0.00	

Parameter	Explanation	Settings	Factory Setting	Customer
P 71	PWM Carrier Frequency	115V/230V/460V series: 01 to 15 (The factory setting of VFD075M43A is 10)	15	
		575V series: 01 to 10	6	
P 72	Auto Restart Attempts after Fault	00 to 10	00	
P 73	Present Fault Record	00: No fault occurred 01: Over-current (oc) 02: Over-voltage (ov) 03: Overheat (oH) 04: Overload (oL) 05: Overload 1 (oL1) 06: External Fault (EF) 07: CPU failure 1 (CF1) 08: CPU failure 3 (CF3) 09: Hardware Protection Failure (HPF) 10: Over-current during acceleration (oca) 11: Over-current during deceleration (ocd) 12: Over-current during steady state operation (ocn) 13: Ground fault or fuse failure(GFF) 14: Low Voltage (not record) 15: 3 Phase Input Power Loss 16: EPROM failure (CF2) 17: External interrupt allowance(bb) 18: Overload (oL2) 19: Auto Adjustable accel/decel failure (CFA) 20: CPU self detection failure (codE)	00	
P 74	Second Most Recent Fault Record		00	
P 75	Third Most Recent Fault Record		00	
P 76	Parameter Lock and Configuration	00: All parameters can be set/read 01: All parameters are read-only 02-08: Reserved 09: Resets all parameters to 50Hz factory defaults 10: Resets all parameters to 60Hz factory defaults	00	
P 77	Time for Auto Reset the Restart Times in Abnormality	0.1 to 6000.0 sec	60.0	

Parameter	Explanation	Settings	Factory Setting	Customer
P 78	PLC Operation Mode	00: Disable PLC operation 01: Execute one program cycle 02: Continuously execute program cycles 03: Execute one program cycle step by step 04: Continuously execute one program cycle step by step	00	
P 79	PLC FWD/REV Motion	00 to 127	00	
P 80	Identity Code of the AC Motor Drive	Read only	##	
P 81	Time Duration of 1st Step Speed	00 to 9999 sec	00	
P 82	Time Duration of 2nd Step Speed	00 to 9999 sec	00	
P 83	Time Duration of 3rd Step Speed	00 to 9999 sec	00	
P 84	Time Duration of 4th Step Speed	00 to 9999 sec	00	
Pr.85	Time Duration of 5th Step Speed	00 to 9999 sec	00	
P 86	Time Duration of 6th Step Speed	00 to 9999 sec	00	
P 87	Time Duration of 7th Step Speed	00 to 9999 sec	00	
P 88	Communication Address	01 to 254	01	
P 89	TransmissionSpeed	00: 4800 bps 01: 9600 bps 02: 19200 bps 03: 38400 bps	01	
P 90	Transmission Fault Treatment	00: Warn and Continue Operating 01: Warn and RAMP to Stop 02: Warn and COAST to Stop 03: Keep Operation without Warning	03	
P 91	Time Out Detection	0.0: Disable 0.1 to 120.0 sec	0.0	
P 92	Communication Protocol	00: MODBUS ASCII mode, <7,N,2> 01: MODBUS ASCII mode, <7,E,1> 02: MODBUS ASCII mode, <7,O,1> 03: MODBUS RTU mode, <8,N,2> 04: MODBUS RTU mode, <8,E,1> 05: MODBUS RTU mode, <8,O,1>	00	

Parameter	Explanation	Settings	Factory Setting	Customer
P 93	Accel 1 to Accel 2 Frequency Transition	0.01 to 400.0 0.00: Disable	0.00	
P 94	Decel 1 to Decel 2 Frequency Transition	0.01 to 400.0 0.00: Disable	0.00	
P 95	Auto Energy Saving	00: Disable auto energy saving 01: Enable auto energy saving	00	
P 96	Counter Countdown Complete	00 to 9999	00	
P 97	Preset counter countdown	00 to 9999	00	
P 98	Total Time Count from Power On (Days)	00 to 65535 days	Read Only	
P 99	Total Time Count from Power On (Minutes)	00 to 1440 minutes	Read Only	
P100	Software Version		##	
P 101	Auto Adjustable Accel/Decel	00: Linear Accel/Decel 01: Auto Accel, Linear Decel 02: Linear Accel, Auto Decel 03: Auto Accel/Decel 04: Linear Accel/Decel Stall Prevention during Deceleration	00	
P 102	Auto Voltage Regulation (AVR)	00: AVR function enabled 01: AVR function disabled 02: AVR function disabled when stops 03: AVR function disabled when decel	00	
P 103	Auto tune Motor Parameters	00: Disable 01: Auto tune for R1 02: Auto tune for R1 + No Load testing	00	
P104	R1 value	00 to 65535 mΩ	00	
P105	Control Mode	00: V/F Control 01: Sensor-less Control	00	
P106	Rated Slip	0.00 to 10.00 Hz	3.00	
P107	Vector Voltage Filter	5 to 9999 (per 2ms)	10	
P108	Vector Slip Compensation Filter	25 to 9999 (per 2ms)	50	
P109	Selection for Zero Speed Control	00: No output 01: Control by DC voltage	00	

Parameter	Explanation	Settings	Factory Setting	Customer
P110	Voltage of Zero Speed Control	0.0 to 20.0 % of Max. output voltage (P05)	5.0	
P111	Decel S-curve	00 to 07	00	
P112	External Terminal Scanning Time	01 to 20	01	
P113	Restart Method after Fault (oc, ov, BB)	00: None speed search 01: Continue operation after fault speed search from speed reference 02: Continue operation after fault speed search from Minimum speed	01	
P114	Cooling Fan Control	00: Fan Off when the drive stop after 1 Min. 01: AC Drive Runs and Fan On, AC Drive Stops and Fan Off 02: Always Run 03: Reserved	02	
P115	PID Set Point Selection	00: Disable 01: Keypad (based on Pr.00 setting) 02: AVI (external 0-10V) 03: ACI (external 4-20mA) 04: PID set point (P125)	00	
P116	PID Feedback Terminal Selection	00: Input positive PID feedback, PV from AVI (0 to 10V) 01: Input negative PID feedback, PV from AVI (0 to 10V) 02: Input positive PID feedback, PV from ACI (4 to 20mA) 03: Input negative PID feedback, PV from ACI (4 to 20mA)	00	
P117	Proportional Gain (P)	0.0 to 10.0	1.0	
P118	Integral Time (I)	0.00: Disable 0.01 to 100.0 sec	1.00	
P119	Differential Time (D)	0.00 to 1.00 sec	0.00	
P120	Integration's Upper Bound Frequency	00 to 100 %	100 %	
P121	One-Time Delay	0.0 to 2.5 sec	0.0	
P122	PID Frequency Output Command Limit	00 to 110 %	100	
P123	Feedback Signal Detection Time	0.0: Disable 0.1 to 3600 sec	60.0	
P124	Feedback Signal Fault Treatment	00: Warning and RAMP to stop 01: Warning and keep operating	00	

Parameter	Explanation	Settings	Factory Setting	Customer
P125	Source of PID Set Point	0.00 to 400.0Hz	0.00	
P126	PID Offset Level	1.0 to 50.0 %	10.0	
P127	Detection Time of PID Offset	0.1 to 300.0 sec	5.0	
P128	Minimum Reference Value	0.0 to 10.0 V	0.0	
P129	Maximum Reference Value	0.0 to 10.0 V	10.0	
P130	Invert Reference Signal AVI (0-10V)	00: Not inverted 01: Inverted	00	
P131	Minimum Reference Value (4-20mA)	0.0 to 20.0mA	4.0	
P132	Maximum Reference Value (4-20mA)	0.0 to 20.0mA	20.0	
P133	Invert Reference Signal (4-20mA)	00: Not inverted 01: Inverted	00	
P134	Analog Input Delay Filter for Set Point	00 to 9999 (per 2ms)	50	
P135	Analog Input Delay Filter for Feedback Signal	00 to 9999 (per 2ms)	5	
P136	Sleep Period	0.0 to 6550.0 sec	0.0	
P137	Sleep Frequency	0.00 to 400.0 Hz	0.00	
P138	Wake Up Frequency	0.00 to 400.0 Hz	0.00	
P139	Treatment for Counter Attained	00: Continue operation 01: Stop Immediately and display E.F.	00	
P140	External Up/Down Selection	00: Fixed Mode (keypad) 01: By Accel or Decel Time 02: Reserved	00	
P141	Save Frequency Set Point	00: Not Save 01: Save	01	
P142	Second Source of Frequency Command	00: Keypad Up/Down 01: AVI (0-10V) 02: ACI (4-20mA) 03: Communication 04: Keypad potentiometer	00	
P143	Software Braking Level	115V/230V: 370-450 Vdc	380.0	
		460V: 740-900 Vdc	760.0	
		575V: 925-1075 Vdc	950.0	
P144	Total operation time (Day)	Read Only		

Parameter	Explanation	Settings	Factory Setting	Customer
P145	Total operation time (Minutes)	Read Only		
P146	LinestartLockout	00: Disable 01: Enable	00	
P147	Decimal Number of Accel / Decel Time	00: One decimal 01: Two decimals	00	
P148	Number of Motor Poles	02 to 20	04	
P149	Gear Ratio for Simple Index Function	4 to 1000	200	
P150	Index Angle for Simple Index Function	00.0 to 360.0	180.0	
P151	Deceleration Time for Simple Index Function	0.00 to 100.00 sec	0.00	
P152	Skip Frequency Width	0.00 to 400.0Hz	0.00	
P153	Bias Frequency Width	0.00 to 400.0Hz	0.00	
P154	Reserved			
↗ P155	Compensation Coefficient for Motor Instability	0.0: Disable 0.1 to 5.0 (recommended setting d2.0)	0.0	
↗ P156	Communication Response Delay Time	0 to 200 (x500us)	0	
↗ P157	Communication Mode Selection	0: Delta ASCII 1: Modbus	1	

4.2 Parameter Settings for Applications

Speed Search

Applications	Purpose	Functions	Related Parameters
Windmill, winding machine, fan and all inertia loads	Restart free-running motor	Before the free-running motor is completely stopped, it can be restarted without detection of motor speed. The AC motor drive will auto search motor speed and will accelerate when its speed is the same as the motor speed.	P32~P35

DC Braking before Running

Applications	Purpose	Functions	Related Parameters
When e.g. windmills, fans and pumps rotate freely by wind or flow without applying power	Keep the free-running motor at standstill.	If the running direction of the free-running motor is not steady, please execute DC braking before start-up.	P28 P29

Energy Saving

Applications	Purpose	Functions	Related Parameters
Punching machines fans, pumps and precision machinery	Energy saving and less vibrations	Energy saving when the AC motor drive runs at constant speed, yet full power acceleration and deceleration For precision machinery it also helps to lower vibrations.	P95

Multi-step Operation

Applications	Purpose	Functions	Related Parameters
Conveying machinery	Cyclic operation by multi-step speeds.	To control 7-step speeds and duration by simple contact signals.	P17~P23 P78~P79 P81~P87

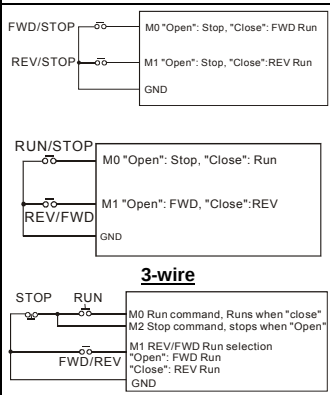
Switching acceleration and deceleration time

Applications	Purpose	Functions	Related Parameters
Auto turntable for conveying machinery	Switching acceleration and deceleration time by external signal	When an AC motor drive drives two or more motors, it can reach high-speed but still start and stop smoothly.	P10~P13 P39~P42

Overheat Warning

Applications	Purpose	Functions	Related Parameters
Air conditioner	Safety measure	When AC motor drive overheats, it uses a thermal sensor to have overheat warning.	P45~P46 P39~P42

Two-wire/three-wire

Applications	Purpose	Functions	Related Parameters
General application	To run, stop, forward and reverse by external terminals		P01 P38

Operation Command

Applications	Purpose	Functions	Related Parameters
General application	Selecting the source of control signal	Selection of AC motor drive control by external terminals or digital keypad.	P01 P39~P42

Frequency Hold

Applications	Purpose	Functions	Related Parameters
General application	Acceleration/ deceleration pause	Hold output frequency during Acceleration/deceleration	P39~P42

Auto Restart after Fault

Applications	Purpose	Functions	Related Parameters
Air conditioners, remote pumps	For continuous and reliable operation without operator intervention	The AC motor drive can be restarted/reset automatically up to 10 times after a fault occurs.	P72 P113

Emergency Stop by DC Braking

Applications	Purpose	Functions	Related Parameters
High-speed rotors	Emergency stop without brake resistor	AC motor drive can use DC braking for emergency stop when quick stop is needed without brake resistor. When used often, take motor cooling into consideration.	P28 P30 P31

Over-torque Setting

Applications	Purpose	Functions	Related Parameters
Pumps, fans and extruders	To protect machines and to have continuous/ reliable operation	The over-torque detection level can be set. Once OC stall, OV stall and over-torque occurs, the output frequency will be adjusted automatically. It is suitable for machines like fans and pumps that require continuous operation.	P60~P62

Upper/Lower Limit Frequency

Applications	Purpose	Functions	Related Parameters
Pump and fan	Control the motor speed within upper/lower limit	When user cannot provide upper/lower limit, gain or bias from external signal, it can be set individually in AC motor drive.	P36 P37

Skip Frequency Setting

Applications	Purpose	Functions	Related Parameters
Pumps and fans	To prevent machine vibrations	The AC motor drive cannot run at constant speed in the skip frequency range. Three skip frequency ranges can be set.	P67~P70

Carrier Frequency Setting

Applications	Purpose	Functions	Related Parameters
General application	Low noise	The carrier frequency can be increased when required to reduce motor noise.	P71

Keep Running when Frequency Command is Lost

Applications	Purpose	Functions	Related Parameters
Air conditioners	For continuous operation	When the frequency command is lost by system malfunction, the AC motor drive can still run. Suitable for intelligent air conditioners.	P63

Output Signal in Zero Speed

Applications	Purpose	Functions	Related Parameters
General application	Provide a signal for running status	When the output frequency is lower than the min. output frequency, a signal is given for external system or control wiring.	P45 P46

Output Signal at Master Frequency

Applications	Purpose	Functions	Related Parameters
General application	Provide a signal for running status	When the output frequency is at the master frequency (by frequency command), a signal is given for external system or control wiring (frequency attained).	P45 P46

Output signal for Over-torque

Applications	Purpose	Functions	Related Parameters
Pumps, fans and extruders	To protect machines and to have continuous/ reliable operation	When over-torque is detected, a signal is given to prevent machines from damage.	P45 P46 P61 P62

Output Signal for Low Voltage

Applications	Purpose	Functions	Related Parameters
General application	Provide a signal for running status	When low voltage is detected, a signal is given for external system or control wiring.	P45 P46

Output Signal at Desired Frequency

Applications	Purpose	Functions	Related Parameters
General application	Provide a signal for running status	When the output frequency is at the desired frequency (by frequency command), a signal is given for external system or control wiring (frequency attained).	P45~P46 P47

Output Signal for Base Block

Applications	Purpose	Functions	Related Parameters
General application	Provide a signal for running status	When executing Base Block, a signal is given for external system or control wiring.	P45 P46

Overheat Warning for Heat Sink

Applications	Purpose	Functions	Related Parameters
General application	For safety	When heat sink is overheated, it will send a signal for external system or control wiring.	P45 P46

Multi-function Analog Output

Applications	Purpose	Functions	Related Parameters
General application	Display running status	The value of frequency, output current/voltage can be read by connecting a frequency meter or voltage/current meter.	P43 P44

4.3 Description of Parameter Settings

↗This parameter can be set during operation.

P 00 ↗ Source of Frequency Command

Factory Setting: 00

Settings	00	Master Frequency determined by digital keypad. (LC-M02E)
	01	Master frequency determined by 0 to +10 V input
	02	Master frequency determined by 4 to 20mA input
	03	Master frequency determined by RS-485 Communication port
	04	Master frequency determined by potentiometer on digital keypad. (LC-M02E)

P 01 ↗ Source of Operation Command

Factory Setting: 00

Settings	00	Operation instructions determined by the Digital Keypad.
	01	Operation instructions determined by the External Control Terminals. Keypad STOP key is effective.
	02	Operation instructions determined by the External Control Terminals. Keypad STOP key is not effective.
	03	Operation instructions determined by the RS-485 communication port. Keypad STOP key is effective.
	04	Operation instructions determined by the RS-485 communication port. Keypad STOP key is not effective.

🕮 Refer to P38 to P42 for more details.

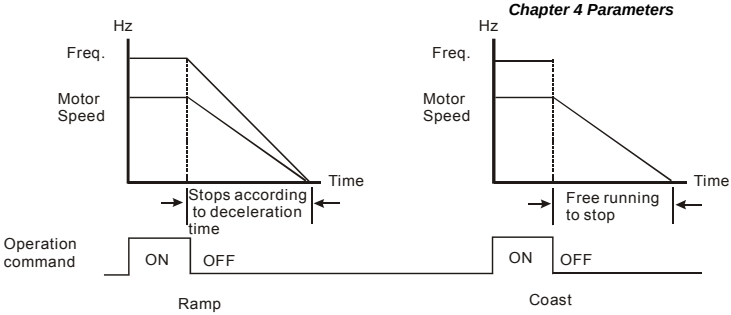
P 02 Stop Method

Factory Setting: 00

Settings	00	Ramp to stop
	01	Coast to stop

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

1. Ramp: The AC drive decelerates the motor to Minimum Output Frequency (P08) and then stops according to the deceleration time set in P11 or P13.
2. Coast: The AC drive will stop the output instantly, and the motor will coast to stop.



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

P 03	Maximum Output Frequency	Unit: 0.1Hz
	Settings 50.00 to 400.0 Hz	Factory Setting: 60.00

📖 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.

P 04	Maximum Voltage Frequency (Base Frequency)	Unit: 0.1Hz
	Settings 10.00 to 400.0Hz	Factory Setting: 60.00

📖 This parameter should be set according to the rated frequency as indicated in the motor nameplate. P04 and P03 determine the volts per hertz ratio.

For example: if the drive is rated for 460 VAC output and the Maximum Voltage Frequency is set to 60Hz, the drive will maintain a constant ratio of 7.66 v/Hz. ***Setting of P04 must be equal to or greater than setting of Mid-Point Frequency (P06).***

P 05	Maximum Output Voltage (Vmax)		
	Settings 115V/230V series	0.1 to 255.0V	Factory Setting: 220.0
	460V series	0.1 to 510.0V	Factory Setting: 440.0
	575V series	0.1 to 637.0V	Factory Setting: 575.0

📖 This parameter determines the Maximum Output Voltage of the AC drive. The Maximum Output Voltage setting must be smaller than or equal to the rated voltage of the motor as indicated on the motor nameplate. **Setting of P05 must be equal to or greater than setting of Mid-Point Voltage (P07).**

P 06	Mid-Point Frequency		Unit: 0.1Hz
	Settings 0.10 to 400.0Hz		Factory Setting: 1.50

🕮 The parameter sets the Mid-Point Frequency of V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point frequency can be determined. **Setting of this parameter must be equal to or greater than Minimum Output Frequency (P08) and equal to or less than Maximum Voltage Frequency (P04).**

P 07	Mid-Point Voltage		
	Settings 115V/230V series	0.1 to 255.0V	Factory Setting: 10.0
	460V series	0.1 to 510.0V	Factory Setting: 20.0
	575V series	0.1 to 637.0V	Factory Setting: 26.1

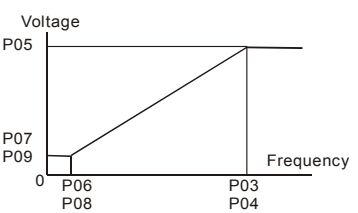
🕮 The parameter sets the Mid-Point Voltage of any V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point Frequency can be determined. **Setting of this parameter must be equal to or greater than Minimum Output Voltage (P09) and equal to or less than Maximum Output Voltage (P05).**

P 08	Minimum Output Frequency	Unit: 0.1Hz
	Settings 0.10 to 20.00Hz	Factory Setting: 1.50

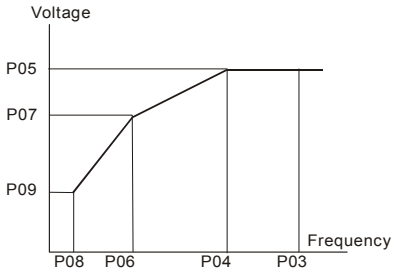
🕮 The parameter sets the Minimum Output Frequency of the AC drive. **Setting of this parameter must be equal to or less than Mid-Point Frequency (P06).**

P 09	Minimum Output Voltage		
	Settings 115V/230V series	0.1 to 255.0V	Factory Setting: 10.0
	460V series	0.1 to 510.0V	Factory Setting: 20.0
	575V series	0.1 to 637.0V	Factory Setting: 26.1

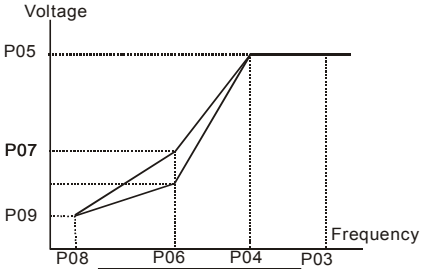
🕮 This parameter sets the Minimum Output Voltage of the AC drive. **Setting of this parameter must be equal to or less than Mid-Point Voltage (P07).**



Standard V/F Curve



Custom V/F Curve



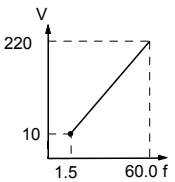
Fan/Pump V/F Curve

Commonly used V/F Setting

(1) General Purpose

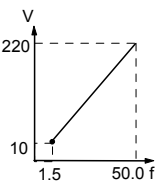
Factory Settings

Motor Spec. 60Hz



No.	Set value
P03	60.0
P04	60.0
P05	220.0
P06	1.5
P07	10.0
P08	1.5
P09	10.0

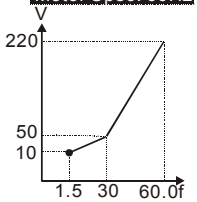
Motor Spec. 50Hz



No.	Set value
P03	50.0
P04	50.0
P05	220.0
P06	1.3
P07	12.0
P08	1.3
P09	12.0

(2) Fans and Pumps

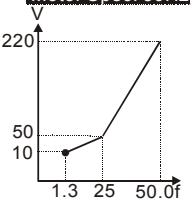
Motor Spec. 60Hz



Factory Settings

No.	Set value
P 03	60.0
P 04	60.0
P 05	220.0
P 06	30
P 07	50.0
P 08	1.5
P 09	10.0

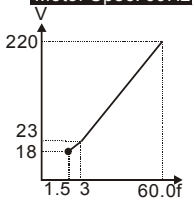
Motor Spec. 50Hz



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

(3) High Starting Torque

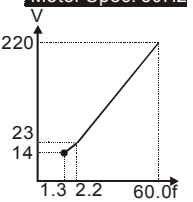
Motor Spec. 60Hz



Factory Settings

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

Motor Spec. 50Hz



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

P 10	↗ Acceleration Time 1	Unit: 0.1 or 0.01 sec
P 11	↗ Deceleration Time 1	Unit: 0.1 or 0.01 sec
P 12	↗ Acceleration Time 2	Unit: 0.1 or 0.01 sec
P 13	↗ Deceleration Time 2	Unit: 0.1 or 0.01 sec

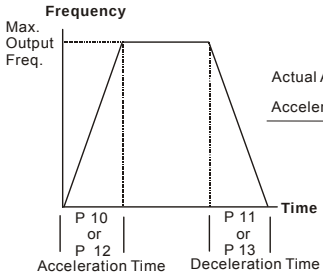
Settings 0.1 to 600.0 sec or 0.01 to 600.0 sec Factory Setting: 10.0

🕮 Pr.10. This parameter is used to determine the time required for the AC drive to ramp from 0 Hz to its Maximum Output Frequency (P 03). Th e rate is linear unless the S-Curve (P14) is "Enabled".

🕮 P11. This parameter is used to determine the time required for the AC drive to decelerate from the Maximum Output Frequency (P 03) down to 0 Hz. The rate is linear unless the S-Curve (P14) is "Enabled".

🕮 P12 and P13: Provide an additional Accel/Decel time although Time 1 is the default. A Multi-Function input terminal must be programmed to select Accel/ or Decel/ Time 2 and the terminal must be closed to select Accel/Decel Time 2 (See P38 to P42).

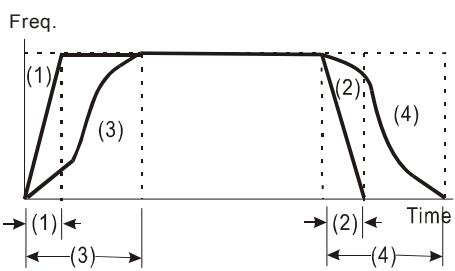
🕮 In the below diagram, suppose the Maximum Output Frequency is 60 Hz (Master Freq), Minimum Output Frequency (start-up) is 1.0 Hz, and accel/decel time 1 is 10 seconds. The actual time for the AC drive to accelerate from start-up to 60 Hz is 9.83 seconds (deceleration time is also 9.83 seconds), can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



$$\text{Actual Acceleration/Deceleration Time} = \frac{\text{Acceleration/Deceleration Time x(Master Freq.-Min.Output Freq.)}}{\text{Max. Output Freq.}}$$

P 14	Acceleration S-Curve	
	Settings 00 to 07	Factory Setting: 00

🕮 This parameter is used whenever the motor load needs to be accelerated or decelerated smoothly. The desired accel/decel effect is selectable from 0 to 7, in which the larger the number, the greater the effect achieved. If the default value of P 111 Deceleration S Curve is unchanged (“0”), then P 14 sets both accelerati on and deceleration S-Curves. If P 111 is set to any value other than “0”, then P 14 will set the acceleration S-Curve and P 111 will set the deceleration S-Curve.



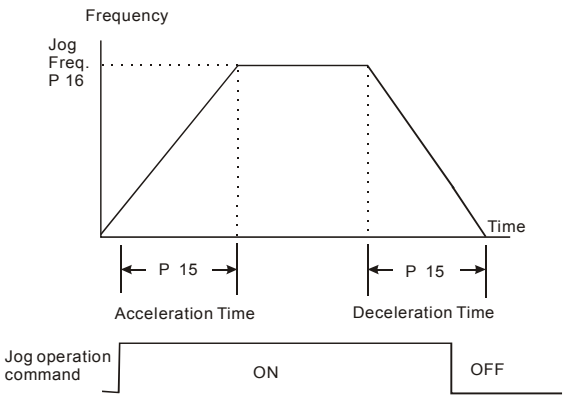
Acceleration/Deceleration characteristics
(1), (2) Disabling S curve
(3), (4) Enabling S curve

P 15	↗Jog Accel / Decel Time	Unit: 0.1 or 0.01 sec
	Settings 0.1 to 600.0 sec or 0.01 to 600.0 sec	Factory Setting: 1.0 sec

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

P 16	↗ Jog Frequency	Unit: 0.1 Hz
	Settings 0.00 to 400.0 Hz	Factory Setting: 6.00 Hz

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



P 17	✓1st Step Speed Frequency	Unit: 0.1 Hz
P 18	✓2nd Step Speed Frequency	Unit: 0.1 Hz
P 19	✓3rd Step Speed Frequency	Unit: 0.1 Hz
P 20	✓4th Step Speed Frequency	Unit: 0.1 Hz
P 21	✓5th Step Speed Frequency	Unit: 0.1 Hz
P 22	✓6th Step Speed Frequency	Unit: 0.1 Hz
P 23	✓7th Step Speed Frequency	Unit: 0.1 Hz
	Settings 0.00 to 400.0Hz	Factory Setting: 0.00 Hz

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

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

P 24 Reverse Operation Inhibition

Factory Setting: 00

Settings 00 Enable REV operation
01 Disable REV operation

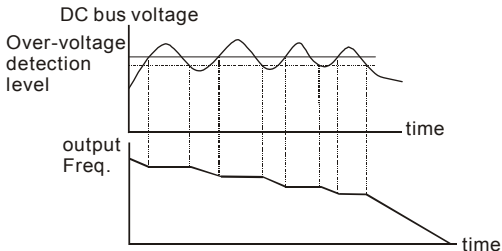
🕮 This parameter is used to disable motor rotation in reverse.

P 25 Over–Voltage Stall Prevention

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

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

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



Over-voltage Stall Prevention

P 26 Over-Current Stall Prevention during Acceleration Unit: 1%

Factory Setting: 150%

Settings 20 to 200%
00 disable

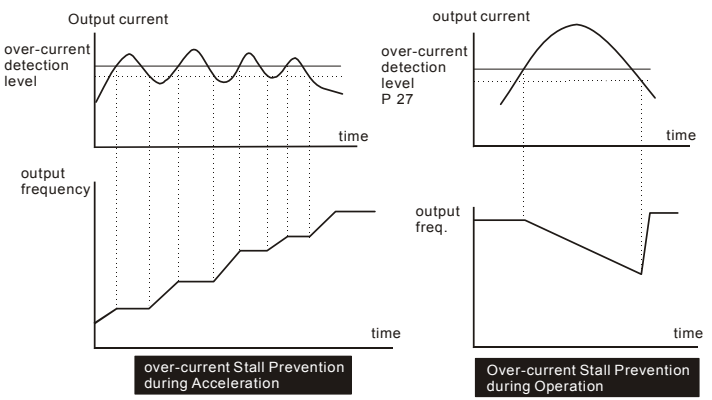
🕮 A setting of 100% is equal to the Rated Output Current of the drive.

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

P 27	Over-Current Stall Prevention during Operation	Unit: 1%
		Factory Setting: 150%

Settings 20 to 200%
00: disable

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



P 28	DC Braking Current Level	Unit: 1%
	Settings 00 to 100%	Factory Setting: 00

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

P 29	DC Braking Time during Start-up	Unit: 0.1sec
	Settings 0.0 to 5.0 sec	Factory Setting: 0.0

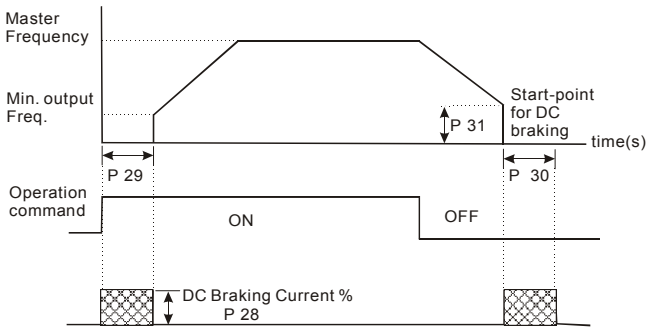
This parameter determines the duration for the DC Braking Current applied during starting. DC Braking is applied until the Minimum Frequency is reached.

P 30	DC Braking Time during Stopping	Unit: 0.1sec
	Settings 0.0 to 25.0 sec	Factory Setting: 0.0

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

P 31	Start-Point for DC Braking	Unit: 0.1sec
	Settings 0.00 to 60.00Hz	Factory Setting: 0.00

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



Notes:

1. DC Braking during starting is used for loads that may move before the AC drive starts, such as hoists and cranes. These loads may also be moving in the wrong direction. Under such circumstances, the DC Braking can be used to hold the load in position before applying a forward motion.
2. DC Braking during stopping is used to stop faster than the ramp-to-stop or to hold a stopped load in position. A dynamic brake resistor may be needed in order to stop loads of high inertia.

P 32	Momentary Power Loss Operation Selection	
		Factory Setting: 00
Settings	00	Operation stops after momentary power loss
	01	Operation continues after momentary power loss Speed search starts with the Master Frequency reference value
	02	Operation continues after momentary power loss Speed search starts with the min frequency

P 33	Maximum Allowable Power Loss Time	Unit: 0.1sec
Settings	0.3 to 5.0 sec	Factory Setting: 2.0 sec

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

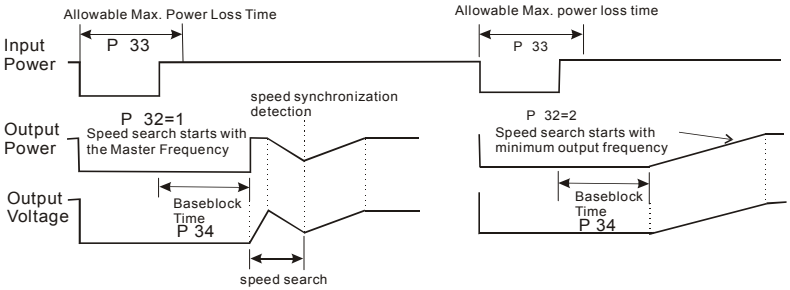
P 34	Base-Block Time for Speed Search	Unit: 0.1sec
Settings	0.3 to 5.0 sec	Factory Setting: 0.5 sec

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

📖 This parameter also determines the search time when performing external Base-Block and Fault Reset (P72).

P 35	Maximum Current Level for Speed Search	Unit: 1%
Settings	30 to 200%	Factory Setting: 150

📖 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 P 35. When the output current is less than that of P 35, the AC drive output frequency is at a “speed synchronization point” and will accelerate or decelerate back to the operating frequency at which it was running prior to the power failure.

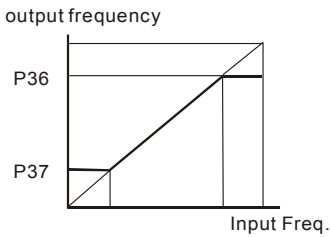


P 36	Upper Bound of Output Frequency	Unit: 0.1Hz
	Settings 0.10 Hz to 400.0 Hz	Factory Setting: 400

- The Upper/Lower Bounds help 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.
- Setting of this parameter must be equal to or greater than the Lower Bound of Output Frequency (P 37).

P 37	Lower Bound of Output Frequency	Unit: 0.1Hz
	Settings 0.00 Hz to 400.0 Hz	Factory Setting: 0 Hz

- Setting of this parameter must be equal to or less than the Upper Bound of Output Frequency
- If the Lower Bound of Output Frequency is 10Hz, and the Minimum Output Frequency (Pr.08) is set at 1.0Hz, then any command frequency between 1-10Hz will generate a 10Hz output from the drive.



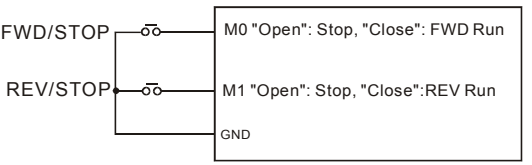
P 38 Multi-function Input Terminal (M0, M1)

Factory Setting: 00

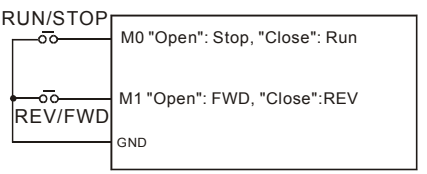
Settings	00	M0: FWD/STOP, M1: REV/STOP
	01	M0: RUN/STOP, M1: REV/FWD
	02	M0, M1, M2: 3-wire operation control mode

Explanations:

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

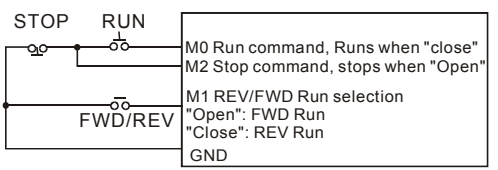


01: Two wire operation: Only P 38 can be set to "1".



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

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



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

P 39 Multi-function Input Terminal (M2)

Factory Setting: 05

P 40 Multi-function Input Terminal (M3)

Factory Setting: 06

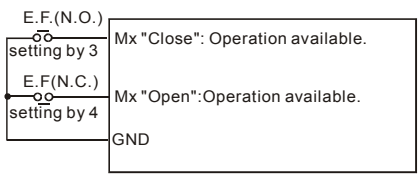
P 41 Multi-function Input Terminal (M4)

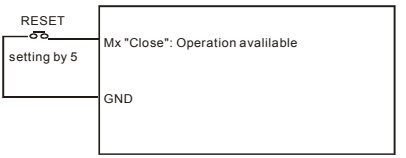
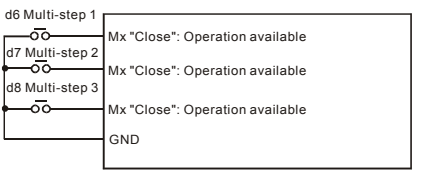
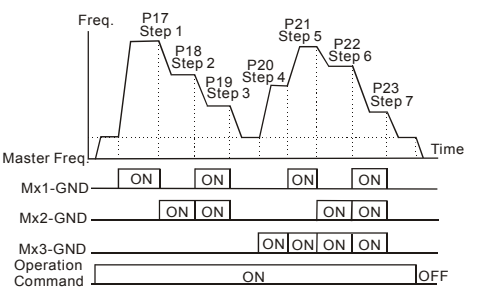
Factory Setting: 07

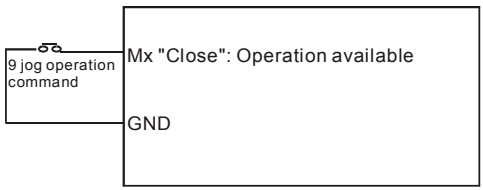
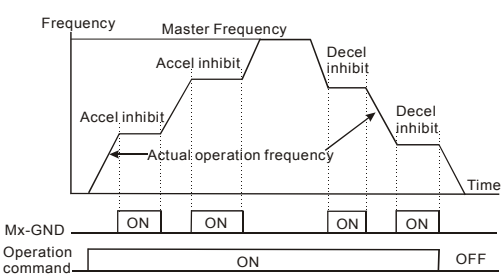
P 42 Multi-function Input Terminal (M5)

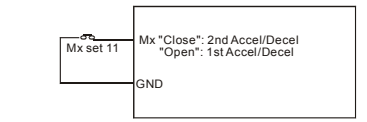
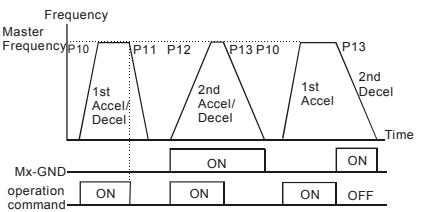
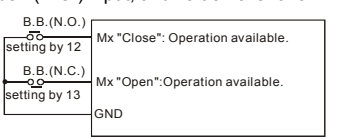
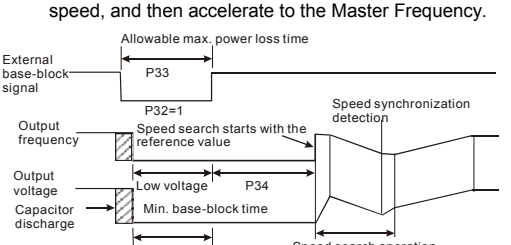
Factory Setting: 08

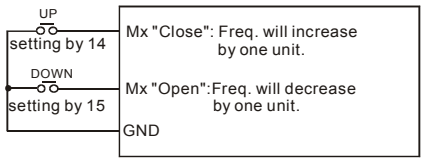
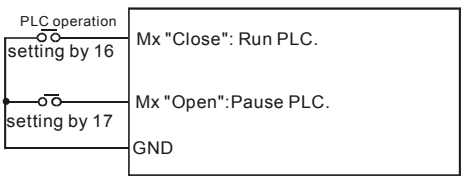
Settings 00 to 32

Settings	Function	Description
00	No Function	
01	Output OFF (N.O.) (enabled when running)	When it is set to 01 or 02, AC drive output will stop immediately. If there is start signal after stopping, the output will start from the minimum frequency.
02	Output OFF (N.C.) (enabled when running)	
03	External Fault (N.O.)	Parameter values 3 and 4 program Multi-Function Input Terminals: M1 (P 38), M2 (P 39), M3 (P 40), M4 (P 41) or M5 (P 42) to be External Fault (E.F.) inputs.  Note: When an External Fault input signal is received, the AC drive output will turn off, drive will display " E.F." on Digital Keypad, and the motor will coast. Normal operation can resume after the External Fault is cleared and the AC drive is reset.
04	External Fault (N.C.)	

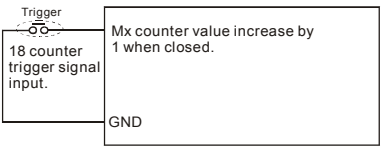
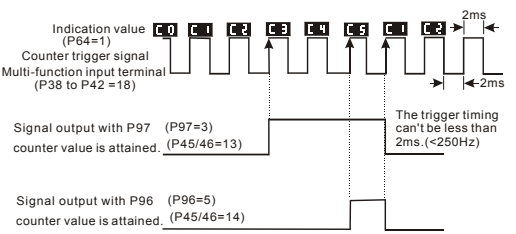
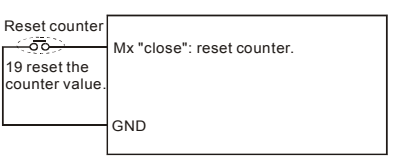
Settings	Function	Description
05	External Reset	Parameter value 5 programs Multi-Function Input Terminals: M1 (P 38), M2 (P 39), M3 (P 40), M4 (P 41) or M5 (P 42) to be an External Reset.  Note: The External Reset has the same function as the Reset key on the Digital keypad. It will reset the drive after a fault.
06	Multi-Step Speed Command 1	Parameter values 06, 07,and 08 program any three of the following Multi-Function Input Terminals: M1 (P 38), M2 (P 39), M3 (P 40), M4 (P 41) or M5 (P 42) for Multi-step Speed Command function.  Note: These three inputs select up to seven multi-step speeds defined by P 17 to P 23 as shown in the following diagram. P 78 to P 87 can also control output speed by programming the AC drive's internal PLC function. 
07	Multi-Step Speed Command 2	
08	Multi-Step Speed Command 3	

Settings	Function	Description
09	Jog Operation	Parameter value 09 programs Multi-Function Input Terminal: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) for Jog control.  Note: Jog operation programmed by 9 can only be initiated while the motor is stop. (Refer to P15, P16.)
10	Accel/Decel Speed Inhibit	Parameter value 10 programs Multi-Function Input Terminal: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) for Accel/Decel Inhibit. After receiving this command, the AC Drive stops accelerating or decelerating and maintains a constant speed. 

Settings	Function	Description
11	First or Second Accel/Decel Time Selection	Parameter value 11 programs a Multi-Function Input Terminal: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) for selecting the First or Second Accel/Decel time. (Refer to P10 to P13.)  
12	External Base Block (N.O.) (Normally Open Contact Input)	Parameter values 12, 13 program Multi-Function Input Terminals: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) for external Base Block control. Value 12 is for normally open (N.O.) input, and value 13 is for a N.C. input.  Note: When a Base-Block signal is received, the AC drive will stop all output and the motor will coast. When base block control is deactivated, the AC drive will start its speed search function and synchronize with the motor speed, and then accelerate to the Master Frequency.
13	External Base Block (N.C.) (Normally Close Contact Input)	

<table>
<tr><th>Settings</th><th>Function</th><th>Description</th></tr>
<tr><td>14</td><td>Increase Master Frequency</td><td rowspan="2">Parameter values 14, 15 program the Multi-Function Input Terminals: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) to incrementally increase/ decrease the Master Frequency each time an input is received.
 
</td></tr>
<tr><td>15</td><td>Decrease Master Frequency</td></tr>
<tr><td>16</td><td>Run PLC Program</td><td rowspan="2">Parameter value 16 programs Multi-Function Input Terminal: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) to enable the AC drive internal PLC program. Parameter value 17 programs an input terminal to pause the PLC program.
 

Note: P17 to P23, P78, P79, P81 to P87 define the PLC program. Another related function is “30 One-Shot PLC Run”. It can be set to use a not-latched contact as the run signal.</td></tr>
<tr><td>17</td><td>Pause PLC Program</td></tr>
</table>

Settings	Function	Description
18	Counter Trigger Signal	Parameter value 18 programs Multi-Function Input Terminal: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) 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 when counting a process step or unit of material. See the diagram below. 
19	Counter Reset	Parameter value 19 programs Multi-Function Input Terminal: M1 (P38), M2 (P39), M3 (P40), M4 (P41) or M5 (P42) to reset the counter. 
20	No Function	Enter value (20) to disable any Multi-Function Input Terminal: M1 (P38), M2 (P39), M3 (Pr.40), M4 (Pr.41) or M5 (Pr.42) Note: Purpose of this function is to isolate unused Multi-Function Input Terminals. Any unused terminals should be programmed to 20 to insure they have no effect on drive operation.

Settings	Function	Description
21	RESET Command (N.C)	
22	Control source: External Terminal	Enter values 22, 23, or 24 to set the control source to be the external terminals, keypad or communication respectively. This setting is used to create functions for manual/auto, and remote/near-end control. When these three functions are used at the same time, the priority is 22-I/O > 23-Keypad > 24-Communication.
23	Control source: Keypad	
24	Control source: Communication	
25	Parameter Lock (Write disable, Read is always 0)	This function will disable the write function and all the content of read are 0. The application is for customer having a key to control the operator to modify parameters or modify the parameter by improper use.
26	PID Disable (N.O.)	This function pause the PID control. It is commonly used for manual operation or function testing, and to recover the PID function when the system is normal.
27	PID Disable (N.C.)	
28	Second Source for Frequency Command	This function is used with P142 to select a different frequency source for control.
29	Forward (contact is open) / Reverse (contact is close)	This function has top priority to set the direction for running (If “P24 inhibit REV function” is not set). No mater what the present direction of run is, the contact N.O. is forward and the contact N.C. is reverse, once this function is set. The requirement for setting direction is P24 > setting 29 of P39-Pr. 42 > P38.
30	One-Shot PLC Run	
31	Index Input Signal	This function is used with parameters 149 to 151. The position where AC drive stops will be regarded as the zero position and it will move to the angle that Pr. 150 sets.
32	Virtual Timer Input	This function is for counting at the speed of the output frequency.

Note: The settings 00~32 in P 39 to P42 can be used to set multi-function terminals (M2-M5) but the settings cannot be used repeatedly at the same time (besides settings 20).

P 43 ↗ Analog Output Signal

Factory Setting: 00

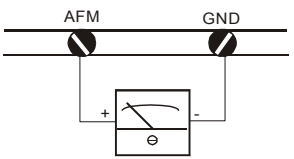
Settings	00	Analog Frequency Meter (0 to Maximum Output Frequency)
	01	Analog Current Meter (0 to 250% of the rated AC drive current)
	02	Feedback Signal (0 - 100%)
	03	Output Power (0 - 100%)

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

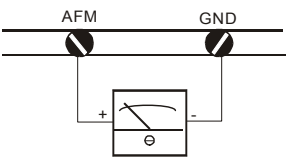
P 44 ↗ Analog Output Gain — Unit: 1%

Settings 00 to 200% — Factory Setting: 100

🕮 This parameter sets the voltage range of the analog output signal on output terminal AFM.



Analog Frequency Meter



Analog Current Meter

The analog output voltage is directly proportional to the output frequency of the AC drive. A setting of 100% on P44 makes the Maximum Output Frequency (P03) of the AC drive to correspond to the +10VDC analog voltage output. (The actual voltage is about +10VDC, and can be adjusted by P44)

The analog output voltage is also directly proportional to the output current of the AC drive. A setting of 100% on P44 makes the 2.5 times rated current of the AC drive to correspond to the +10 VDC analog voltage output. (The actual voltage is about +10 VDC, and can be adjusted by Pr.44)

Note: Any type of voltmeter can be used. If the meter reads full scale at a voltage less than 10 volts, then P44 should be set by the following formula:

P44 = ((meter full scale voltage)/10)×100%

For Example: When using a meter with a full scale of 5 volts, adjust Pr.44 to 50%

P 45 Multi-function Output Terminal 1 (Photocoupler output)

Factory Setting: 00

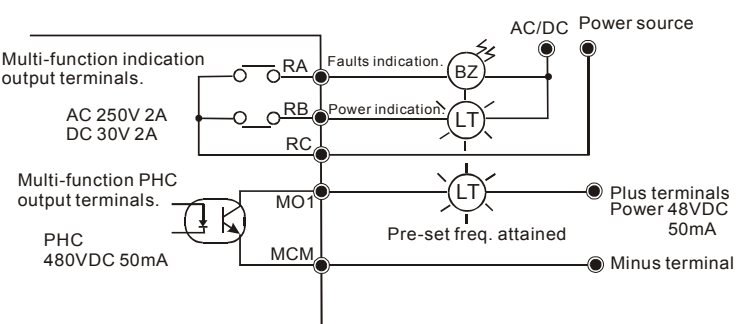
P 46 Multi-function Output Terminal 2 (Relay output)

Factory Setting: 07

Settings 00 to 24

Settings	Function	Description
00	AC Drive Operational	Terminal output is activated when there is power output from drive.
01	Maximum Output Frequency Attained	Terminal output is activated when the AC drive attains Maximum Output Frequency.
02	Zero speed	Terminal output is activated when Command Frequency is lower than the Minimum Output Frequency.
03	Over-Torque detection	Terminal output is activated when over-torque is detected. Parameter P61 determines the Over-Torque detection level.
04	Base-Block (B.B.) Indication	Terminal output is activated when the AC drive output is shut-off by the external Base-Block.
05	Low-Voltage Indication	Terminal output is activated when low voltage is detected.
06	AC Drive Operation Mode	Terminal output is activated when the operation of AC Drive is controlled by External Control Terminals.
07	Fault Indication	Terminal output is activated when certain faults occur (oc, ov, oH, oL, oL1, EF, cF3, HPF, ocA, ocd, ocn, GF).
08	Desired Frequency attained	Terminal output is activated when the desired frequency (P47) is attained.
09	PLC Program Running	Terminal output is activated when the PLC program is running.
10	PLC Program Step Completed	Terminal output is activated for 0.5 sec. when each multi-step speed is attained.
11	PLC Program Completed	Terminal output is activated for 0.5 sec. when the PLC program cycle has completed.
12	PLC Operation Paused	Terminal output is activated when PLC operation is paused.
13	Top Count Value Attained	Terminal output is activated when counter reaches the Top Count Value. See diagram for P38 to P42=18.

Settings	Function	Description
14	Preliminary Counter Value Attained	Terminal output is activated when counter reaches the Preliminary Count Value. See diagram for P38 to P42=18.
15	Warning (PID feedback loss, communication error)	The contact will be “close” when PID feedback loss or communication is error.
16	Below the Desired Frequency	The contact will be “close” when output frequency is less than desired frequency.
17	PID supervision	The contact will be “close” when PID offset exceeds the setting of P126 and P127.
18	Over Voltage supervision	The contact will be “close” before over voltage. It will be activated at 370Vdc in 230V series and at 740Vdc in 460 series.
19	Over Heat supervision	The contact will be “close” before 90°C.
20	Over Current stall supervision	The contact will be “close” before exceeding the setting of P26/P27.
21	Over Voltage stall supervision	The contact will be “close” before exceeding the setting of P25.
22	Forward command	The contact will be “close” with forward command.
23	Reverse command	The contact will be “close” with reverse command.
24	Zero Speed (Includes Drive Stop)	The contact will be “close” when the setting frequency is less than min. frequency or drive stop.

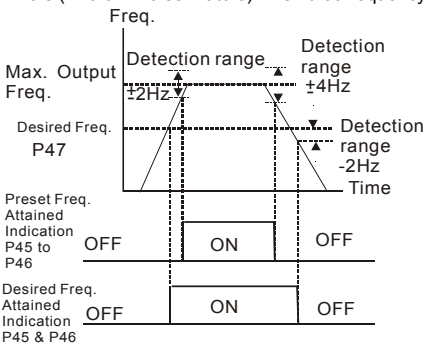


Multi-function Terminals Wiring Example

P 47 ↗ Desired Frequency Attained — Unit: 0.1Hz

Settings 0.00 to 400.0 Hz — Factory Setting: 0.00

🕮 This parameter allows monitoring a certain frequency and then activates one of the Multi-function output terminals (P45 or P46 se t to 8) when that frequency is achieved.



Desired Freq. Attained & Preset Freq. Attained

P 48 ↗ Adjust Bias of External Input Frequency — Unit: 0.1Hz

Settings 0.00 to 200.0% — Factory Setting: 0.00 Hz

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

P 49 ↗ Potentiometer Bias Polarity

Factory Setting: 00

Settings 00 Positive Bias
01 Negative Bias

🕮 This parameter sets the potentiometer Bias Frequency to be positive or negative.

P 50 ↗ Potentiometer Frequency Gain — Unit: 1%

Settings 0.10 to 200.0% — Factory Setting: 100.0

🕮 This parameter sets the ratio of analog input vs frequency output.

P 51 Potentiometer Reverse Motion Enable

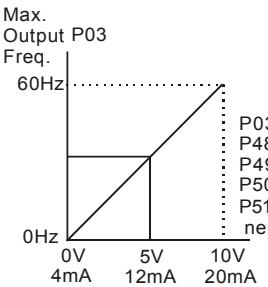
Factory Setting: 00

Settings 00 Reverse Motion Disabled in negative bias
01 Reverse Motion Enabled in negative bias

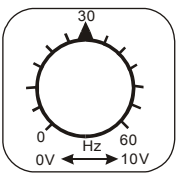
📖 P48 to P51 are used when the source of frequency command is the analog signal (0 to +10V DC or 4 to 20mA DC). Refer to the following examples.

Example 1:

Set P00=1 to command frequency with the potentio meter on keypad or P00=2 (4 to 20mA current signal) potentiometer/current signal of external terminal.



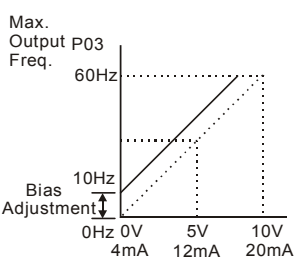
Factory Settings
P03=60Hz--Max. output Freq.
P48=0%--bias adjustment
P49=0 -- bias polarity
P50=100% -- pot. freq. gain
P51=0 -- REV disable in negative bias



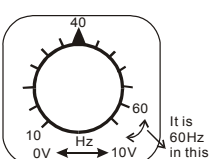
Potentiometer Scale

Example 2:

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



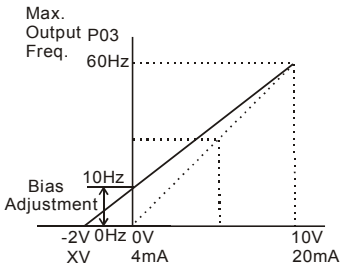
Factory Settings
P03=60Hz--Max. output Freq.
P48=16.7%-- bias adjustment
P49=0 -- bias polarity
P50=100% -- pot. freq. gain
P51=0 -- REV motion disable in negative bias



Potentiometer Scale

Example 3:

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



Factory Settings
P 03 = 60Hz--Max. output Freq.
P 48 = 20.0%-- bias adjustment
P 49 = 0-- bias polarity
P 50 = 83.3%-- pot. Freq. gain
P 51 = 0-- REV motion disable in negative bias

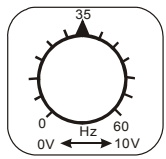
P 50 = $\frac{10V}{12V}$ X 100%≒83.3%

Negative bias:

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

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

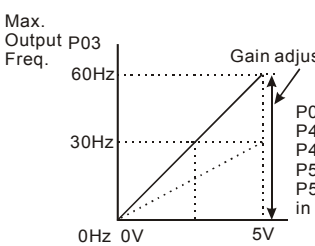
∴P48 = $\frac{2}{10}$ X 100%



Potentiometer Scale

Example 4:

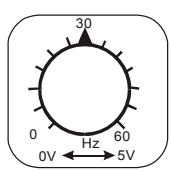
This example shows how to use Gain to set a potentiometer range of 0 to 5 Volts for 0-60 Hz. As an option, you also could set P 03 =120Hz.



Factory Settings
P03=60Hz--Max. output Freq.
P48=0.0% bias adjustment
P49=0 -- bias polarity
P50=200% -- pot. freq. gain
P51=0 -- REV motion disable in negative bias

Calculation of gain

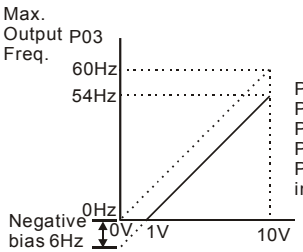
P 50= ($\frac{10V}{5V}$)X100% = 200%



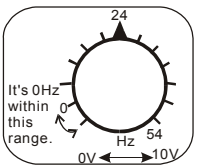
Potentiometer Scale

Example 5:

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



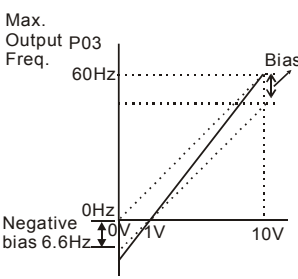
Factory Settings
P03=60Hz--Max. output Freq.
P48=10.0% -- bias adjustment
P49=1 -- bias polarity
P50=100% -- pot. freq. gain
P51=0 -- Rev. motion disable in negative bias



Potentiometer Scale

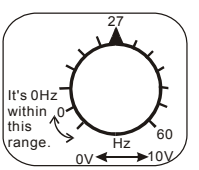
Example 6:

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



Factory Settings
P03=60Hz--Max. output Freq.
P48=10%--bias adjustment
P49=1 -- bias polarity
P50=111% -- pot. freq. gain
P51=0 -- REV. motion disable in negative bias

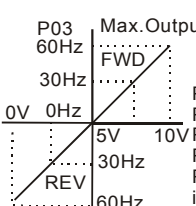
Calculation of gain
$P50=(\frac{10V}{9V})X100\%=111\%$



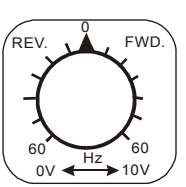
Potentiometer Scale

Example 7:

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



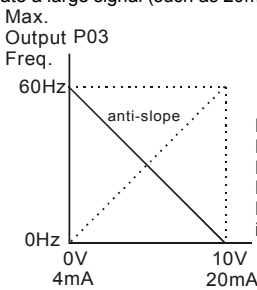
Factory Settings
P03=60Hz--Max. output Freq.
P48=50%--bias adjustment
P49=1 -- bias polarity
P50=200% -- pot. freq. gain
P51=1 -- REV motion disable in negative bias



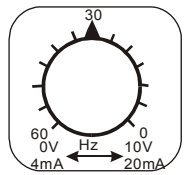
Potentiometer Scale

Example 8:

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



Factory Settings
P03=60Hz--Max. output Freq.
P48=100%--bias adjustment
P49=1 -- bias polarity
P50=100% -- pot. freq. gain
P51=1 -- REV. motion enable in negative bias



Potentiometer Scale

P 52	↗ Motor Rated Current	Unit: 0.1A
	Settings 30.0% FLA to 120.0% FLA	Factory Setting: FLA

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

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

P 53	↗ Motor No-Load Current	Unit: 0.1A
	Settings 00%FLA to 99%FLA	Factory Setting: 0.4*FLA

🕮 The rated current of the AC drive means 100%. Setting of this parameter affects the slip compensation. The setting value must be smaller than the motor rated current setting in P52. (this parameter displays the value of actual current.)

P 54	↗ Torque Compensation	
	Settings 00 to 10	Factory Setting: 00

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

P 55	↗ Slip Compensation	
	Settings 0.00 to 10.00	Factory Setting: 0.00

This parameter can be used to compensate motor slip. Although no linear, it typically adds 6Hz for a setting of 10 if P03=60 Hz. When the outp ut current of the AC drive is greater than the motor no-load current (P53), the AC drive w ill adjust its output frequency according to this parameter.

P 56 Reserved

P 57 Rated Current Display of the AC motor drive

Settings Read Only Factory Setting: ##.#

P57 displays the rated current of the AC motor drive. By reading this parameter the user can check if the AC motor drive is correct. See P80 for details.

P 58 Electronic Thermal Overload Relay Selection

Factory Setting: 02

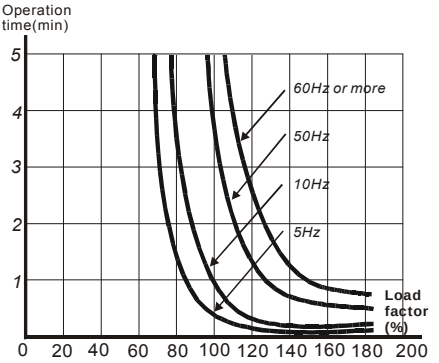
Settings 00 Standard Motor (self cool motor)
01 Inverter Motor (auxiliary cool fan on motor)
02 Inactive

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

P 59 Electronic Thermal Motor Overload Unit: 1 second

Settings 30 to 300sec Factory Setting: 60

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



P 60 Over-Torque Detection Mode

Factory Setting: 00

Settings 00 Over-Torque detection disabled.

01 Enabled during constant speed operation until the allowable time for detection (P62) elapses.

02 Enabled during constant speed operation and halted after detection.

03 Enabled during acceleration until the allowable time for detection (P62) elapses.

04 Enabled during acceleration and halted after detection.

P 61 Over-Torque Detection Level Unit: 1%

Settings 30 to 200% Factory Setting: 150

- A setting of 100% is proportional to the Rated Output Current of the drive.
- This parameter sets the Over-Torque Detection level in 1% increments. (The AC drive rated current is equal to 100%.)

P 62 Over-Torque Detection Time Unit: 0.1 sec

Settings 0.0 to 10.0sec Factory Setting: 0.1sec

- This is the duration for over-torque detection. When the output current is larger than the over-torque detection level (P61), an over-torque condition exists and the detection time (P62) is timed-out. Any of the multi-function output terminals set to indicate over-torque, will then close. (Please refer to P45 and P46)

P 63 Loss of ACI (4-20mA)

Factory Setting: 00

Settings 00 Decelerate to 0 Hz

01 Stop immediately and display "EF"

02 Continue operation by last frequency command

P 64 User Defined Function for Display

Factory Setting: 06

Settings 00 Displays AC drive output frequency (Hz)

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

02 Output Voltage (E)

03 DC Bus Voltage (u)

04 PV (i)

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

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

P 65	✓Coefficient K	Unit: 0.01
	Settings 0.01 to 160.0	Factory Setting: 1.00

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

🕮 The display value is calculated as follows:

Display value = output frequency x K

🕮 The display window is only capable of showing four digits, yet you could use P65 to create larger numbers. The display windows uses decimal points to signify numbers up to three digits as illustrated in next page:

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

P 66	Communication Frequency	Unit: 0.1 Hz
	Settings 0.00 to 400.0 Hz	Factory Setting: 0.00

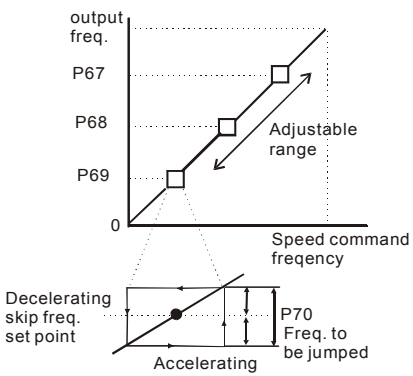
🕮 This parameter defines the Master Frequency when the AC drive is controlled by the communication interface.

P 67	Skip Frequency 1	Unit: 0.1 Hz
P 68	Skip Frequency 2	Unit: 0.1 Hz
P 69	Skip Frequency 3	Unit: 0.1 Hz
	Settings 0.00 to 400.0 Hz	Factory Setting: 0.00

🕮 These three parameters determine the three Skip Frequencies that in conjunction with P70, Skip Frequency Band, will cause the AC drive to skip operating in each frequency band. Note: P67 > P68 > P69.

P 70	Skip Frequency Band	Unit: 0.1 Hz
	Settings 0.00 to 20.00 Hz	Factory Setting: 0.00

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



P 71	PWM Carrier Frequency	
	Settings 115V series 230V series 01 to 15 (1KHz to 15KHz) 460V series	Factory Setting: 15 VFD075M43A is 10
	575V series 01 to 10 (1KHz to 10KHz)	Factory Setting: 6
	Note: 1-9kHz in sensorless vector control mode	

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

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

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

P 72 Auto Restart Attempts After Fault

Settings 00 to 10 Factory Setting: 00

🕮 When this parameter is enabled (set different to zero), the AC Drive will restart/reset automatically up to 10 times after the occurrence of certain type of faults (over-current OC, over-voltage OV). If enabled, the AC drive will restart on “speed search”, which begins at Master Frequency. Setting this parameter to 0 will disable this operation. To set the fault recovery time after a fault, please see base-block time for speed search (P34).

P 73 Present Fault Record
P 74 Second Most Recent Fault Record
P 75 Third Most Recent Fault Record

Factory Setting: 00

Settings
- 00 (no fault occurred)
- 01 Over-current (oc)
- 02 Over-voltage (ov)
- 03 Overheat (oH)
- 04 Overload (oL)
- 05 Overload 1 (oL1)
- 06 External Fault (EF)
- 07 CPU failure 1 (CF1)
- 08 CPU failure 3 (CF3)
- 09 Hardware Protection Failure (HPF)
- 10 Over-current during acceleration (OCA)
- 11 Over-current during deceleration (OCd)
- 12 Over-current during steady state operation (OCn)

	13	Ground fault or fuse failure (GFF)
	14	Low voltage (not record)
	15	3 Phase Input Power Loss
	16	CPU Failure (CF2)
	17	External Base-Block (bb)
	18	Overload 2 (oL2)
	19	Auto Adjustable accel/decel failure (cFA)
	20	Software protection code (codE)

P 76 Parameter Lock and Configuration

Factory Setting: 00

Settings	00	All parameters can be set/read
	01	All parameters are read-only
	02-08	Reserved
	09	Resets all parameters to 50Hz factory defaults
	10	Resets all parameters to 60Hz factory defaults

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

P 77 Time for Auto Reset the Restart Times after Fault — Unit: 0.1 second

Settings 0.1 to 6000.0 sec — Factory Setting: 60.0

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

P 78 PLC Operation Mode

Factory Setting: 00

Settings	00	Disable PLC operation
	01	Execute one program cycle
	02	Continuously execute program cycles
	03	Execute one program cycle step by step (separated by “STOP”)
	04	Continuously execute program cycles step by step (separated by “STOP”)

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

Example 1 (P78 =01): Execute one cycle of the PLC program. Its relative parameter settings are:

1 P17 to P23: 1st to 7th step speed (sets the frequency for each step speed)

2 P38 to P42: Multi-Function Input Terminals (program one multi-function terminal for PLC auto-operation (16)).

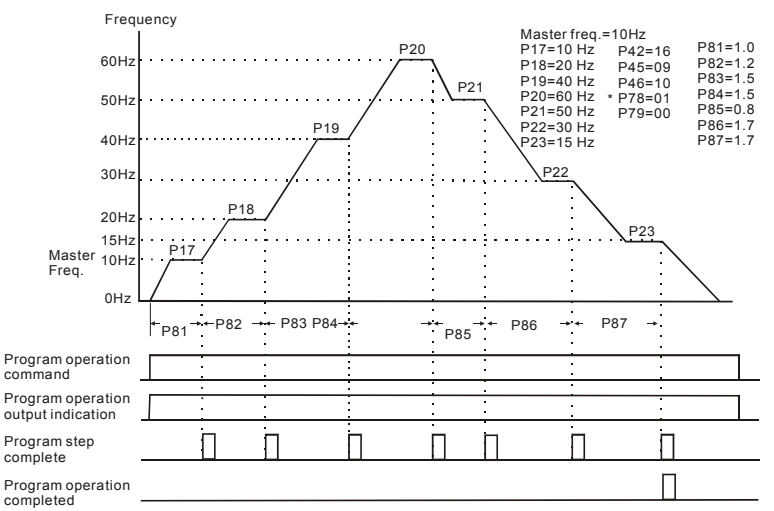
3 P45 to P46: Multi-Function Output Terminals : program a Multi-Function Output Terminal for PLC operation indication (09), one cycle in PLC auto mode (10) or PLC operation fulfillment attainment (11).

4 P78: PLC mode.

5 P79: Direction of operation for Master Frequency and 1st to 7th step speeds.

6 P81 to P87: operation time setting of Master Frequency and 1st to 7th step speeds.

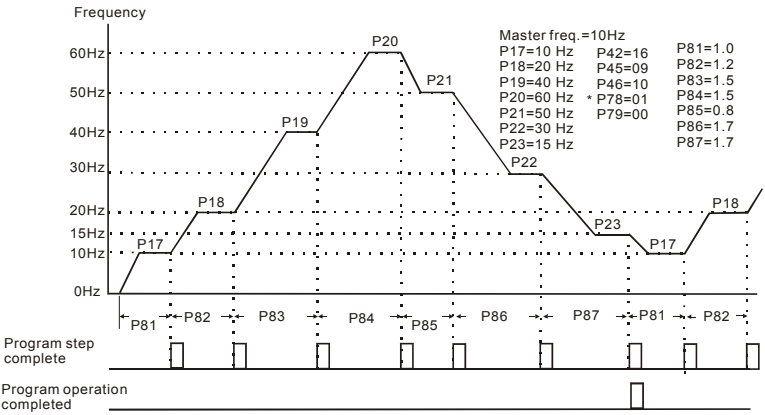
Example 1 (P78 = 01) Execute one cycle through the PLC program:



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

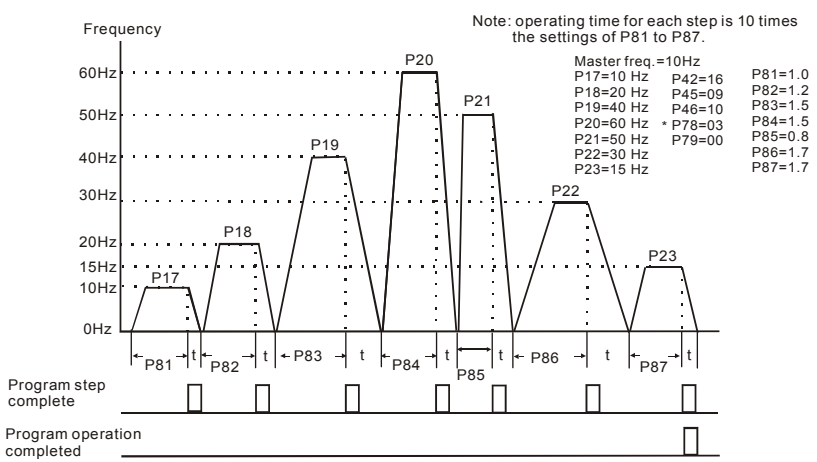
Example 2 (P78 = 02) Continuously executes program cycles:

The diagram below shows the PLC program stepping through each speed and then automatically starting again. To stop the PLC program, either pause or stop the program. (Refer to P38 to P42 value 17 and 18)



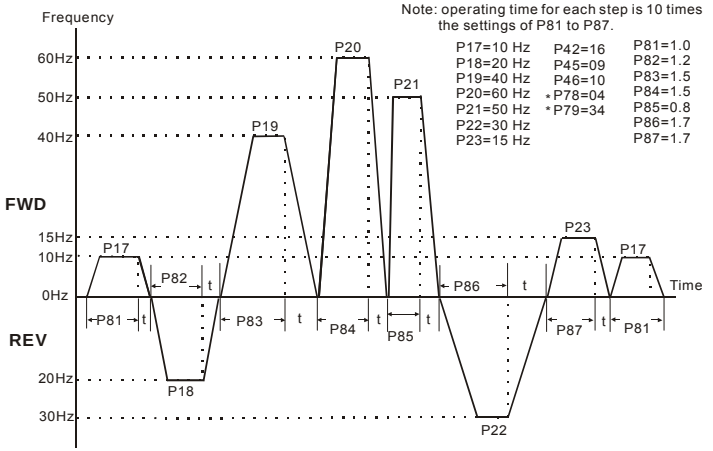
Example 3 (P78 = 03) Execute one cycle step by step:

This example shows how the PLC function can perform one cycle at a time, within a complete cycle. Each step will use the accel/decel times in P10 to P13. It should be noted that the time interval for each step may be shorter than expected due to the time required for acceleration and deceleration.



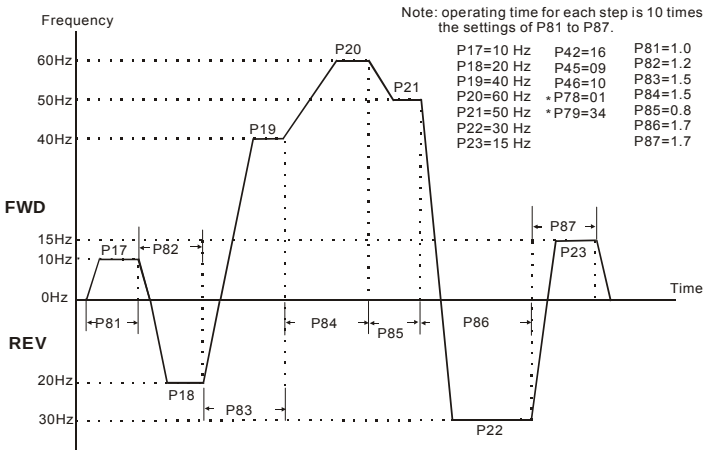
Example 4 (P78 = 04) Continuously executes program cycles step by step:

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



Example 5 (P78 = 01) Execute one cycle through the PLC program:

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



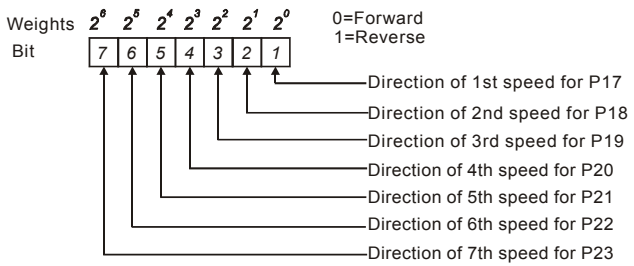
Application Note:

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

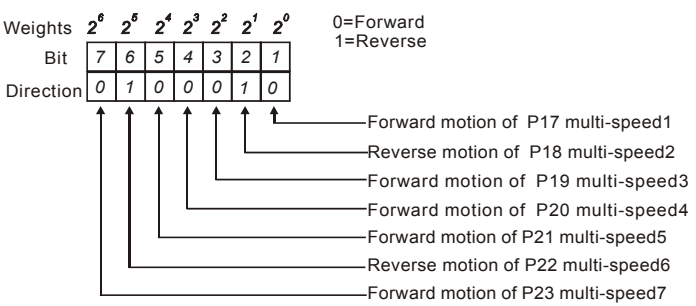
P 79	PLC Forward/Reverse Motion	
Settings	00 to 127	Factory Setting: 00

This parameter determines the direction of motion for the multi-speed P17 to P23 and Master Frequency. The original direction of Master Frequency will become invalid.

Note: A 7-bit binary number is used to program the forward/reverse motion for each of the 8 speed steps (including Master Frequency). The binary notation for the 7-bit number must be translated into decimal notation and then entered in P79.



Example:



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

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

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

= 34

P 80	Identity Code of the AC Motor Drive	
	Settings Read Only	Factory Setting: ##

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

	115V series			**230V series**					
kW	0.2	0.4	0.75	0.4	0.75	1.5	2.2	3.7	5.5
HP	0.25	0.5	1.0	0.5	1	2	3	5	7.5
Model Number (P80)	20	22	24	00	02	04	06	08	10
Rated Output Current (A)	1.6	2.5	4.2	2.5	5.0	7.0	10	17	25
Max. Carrier Frequency (kHz)	15kHz								

	460V series						**575V series**					
kW	0.75	1.5	2.2	3.7	5.5	7.5	0.75	1.5	2.2	3.7	5.5	7.5
HP	1	2	3	5	7.5	10	1	2	3	5	7.5	10
Model Number (P80)	03	05	07	09	11	13	50	51	52	53	54	55
Rated Output Current (A)	3.0	4.0	5.0	8.2	13	18	1.7	3.0	4.2	6.6	9.9	12.2
Max. Carrier Frequency (kHz)	15kHz						10kHz					

P 81	Time Duration of 1st Step Speed (correspond to P17)	Unit: 1 sec
P 82	Time Duration of 2nd Step Speed (correspond to P18)	Unit: 1 sec
P 83	Time Duration of 3rd Step Speed (correspond to P19)	Unit: 1 sec
P 84	Time Duration of 4th Step Speed (correspond to P20)	Unit: 1 sec
P 85	Time Duration of 5th Step Speed (correspond to P21)	Unit: 1 sec
P 86	Time Duration of 6th Step Speed (correspond to P22)	Unit: 1 sec
P 87	Time Duration of 7th Step Speed (correspond to P23)	Unit: 1 sec
	Settings 00 to 9999 second	Factory Setting: 00

📖 P81 to P87 input the duration of each Multi-step speed operation defined by P17 to P23.

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

P 88	Communication Address	
	Settings 01 to 254	Factory Setting: 01

🕮 This parameter sets the Ac drive address identification when using the RS-485 serial port for communication.

P 89 Transmission Speed (Baud rate)

Factory Setting: 01

Settings 00 4800 bps
01 9600 bps
02 19200 bps
03 38400 bps

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

P 90 Transmission Fault Treatment

Factory Setting: 03

Settings 00 Warn and Continue Operating
01 Warn and RAMP to Stop
02 Warn and COAST to Stop
03 Keep Operation without Warning

P 91 Time Out Detection

Factory Setting: 0.0

Settings 0.1 to 120.0 sec
0.0 disable

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

P 92 Communication Protocol

Factory Setting: 00

Settings 00 Modbus ASCII mode, <7,N,2>
01 Modbus ASCII mode, <7,E,1>
02 Modbus ASCII mode, <7,O,1>
03 Modbus RTU mode, <8,N,2>
04 Modbus RTU mode, <8,E,1>
05 Modbus RTU mode, <8,O,1>

🕮 **1. Computer Control**

P 93	Accel 1 to Accel 2 Frequency Transition	Unit: 0.10 Hz
P 94	Decel 1 to Decel 2 Frequency Transition	Unit: 0.10 Hz

Factory Setting: 0.00

Settings 0.01 to 400.0 Hz
0.00 disable

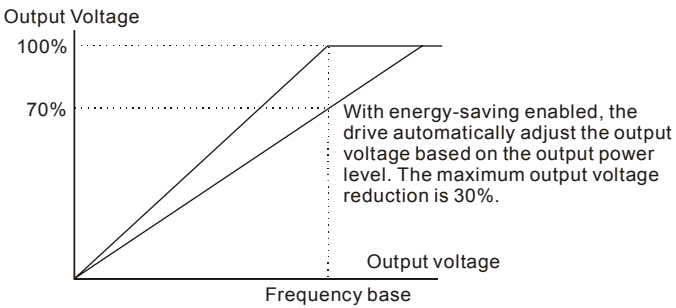
📖 These functions are used to change acceleration or deceleration depending on attained frequency and not by closing contacts on the external terminals. The priority of this parameter is higher than the time of Accel/Decel 1 and Accel/Decel 2.

P 95	Auto energy-saving

Factory Setting: 00

Settings 00 Disable auto energy-saving operation
01 Enable auto energy-saving operation

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



P 96	Count Down Completion

Settings 00 to 9999 Factory Setting: 00

📖 This parameter defines the top count value for the MC8000 internal counter. Please also see P45 and P46 (setting 13). Counting is increm ented when the Multi-Function Input Terminal M1 or M2, makes a low-to-high transition. Upon completion of the count, either Multi-Function Output Terminal (MO1) or the Multi-Function Relay Contact (RA, RB) will close.

P 97 Preset Count Down Completion

Settings 00 to 9999 Factory Setting: 00

📖 This parameter sets a preliminary count value for the internal counter. Counter is incremented by a low-to-high transition on one of the programmed Multi-Function Input Terminals: M1 or M2 (see P44 or P45, setting 14). Count starts at 01. Upon completion the selected Multi-Function Output Terminal will close. Preliminary Count could be used to initiate an external event before the "terminal count" is reached. (See P38, 39, 40, 41, 42, 45, and 46 for further details.)

P 98 Total Time Count from Power On (Days)

Settings 00 to 65535 days Read Only

P 99 Total Time Count from Power On (Minutes)

Settings 00 to 1440 minutes Read Only

P 100 Software Version Read Only

📖 This parameter shows the software version for the AC motor drive.

P 101 Auto Acceleration/Deceleration

Factory Setting: 00

Settings
- 00 Linear acceleration/deceleration
- 01 Auto acceleration, linear deceleration
- 02 Linear acceleration, auto deceleration
- 03 Auto acceleration/deceleration
- 04 Linear Accel/Decel Stall Prevention during Deceleration (Please refer to Accel/Decel time setting at parameter P10-P13)

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

📖 This parameter provides five modes to choose:

00 Linear acceleration and deceleration (operation by P10, P11, or P12, P13 acceleration/deceleration time)

01 Automatic acceleration, linear deceleration (Operation by automatic acceleration, P11 or P13 deceleration time).

02 Linear acceleration and automatic deceleration (Operation by automatic deceleration time, P10 or P12 acceleration time).

03 Automatic acceleration, deceleration (Operation by AC drive auto adjustable control)

04 If this parameter is set to 04, Accel/Decel time will be equal to or more than parameter P10 ~P13.

🕮 This parameter should not be used when a brake unit is installed.

P 102 Auto Voltage Regulation (AVR)

Factory Setting: 00

Settings 00 AVR function enabled
01 AVR function disabled
02 AVR function disabled when stop
03 AVR function disabled for deceleration

🕮 AVR function automatically regulates the AC drive output voltage to the Maximum Output Voltage (P03). For instance, if P03 is set at 200 VAC and the input voltage varies from 200V to 264VAC, then the Maximum Output Voltage will automatically be regulated to 200VAC.

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

🕮 Selecting program value 2 enables the AVR function and also disables the AVR function during deceleration. This offers a quicker deceleration.

P 103 Auto Tune Motor parameters

Factory Setting: 00

Settings 00 Disable
01 Auto tune for R1
02 Auto tune for R1 + No Load testing

🕮 For Auto Tune, set P103 to 01 or 02 and press the RUN key. When it is set to 02, motor should have no load.

P 104 R1 Value

Settings 00 to 65535mΩ Factory Setting: 00

🕮 As an option to Auto Tune, this parameter inputs the motor resistance.

P 105 Control Mode

Factory Setting: 00

Settings 00 V/F Control
01 Sensor-less Control

P 106 Rated Slip Unit: 0.01Hz

Settings 0.00 to 10.00 Hz Factory Setting: 3.0

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

P 107 Vector Voltage Filter Unit: 2ms

Settings 5 to 9999 Factory Setting: 10

P 108 Vector Slip Compensation Filter Unit: 2ms

Settings 25 to 9999 Factory Setting: 50

🕮 This parameter sets the low-pass filter in vector control.

🕮 Example: P107 = 10 X 2ms =20ms, P108 = 50 X 2 ms =100ms.

P 109 Selection for Zero Speed Control

Factory Setting: 00

Settings 00 No output
01 Control by DC voltage

🕮 This parameter is used to select the control method at zero speed. If set to 01, the voltage in P110 is used for holding torque.

P 110 Voltage of Zero Speed Control Unit: 0.1%

Settings 0.0 to 20.0 % of Max. output voltage (P05) Factory Setting: 5.0

🕮 This parameter should be used in conjunction with P109.

🕮 Example: if P05 = 100 and this parameter is set to 20.0, the level of output voltage is 100X20.0% = 20.

P 111 Deceleration S Curve

Settings 00 to 07 Factory Setting: 00

🕮 When this parameter is set differently to zero, it selects a deceleration S-curve and overrides P14. Otherwise, P14 sets the deceleration S-curve.

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

P 112 External Terminal Scanning Time — Unit: 2msec

Settings 01 to 20 — Factory Setting: 01

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

🕮 Set P77 to 02 before changing settings in P112.

P 113 Restart Method after Fault (oc, ov, BB)

Factory Setting: 01

Settings 00 None speed search
01 Continue operation after fault speed search from speed reference
02 Continue operation after fault speed search from Minimum speed

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

P 114 Cooling Fan Control

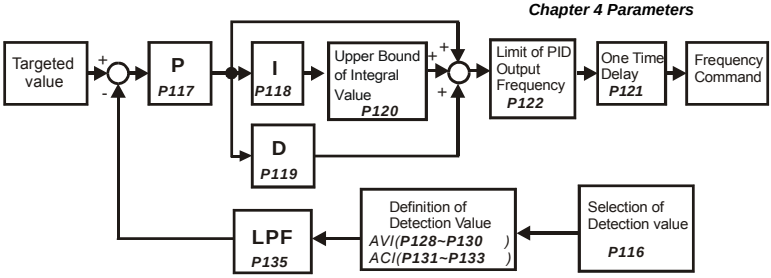
Factory Setting: 02

Settings 00 Fan Off when the drive stop after 1 Min
01 AC Drive Runs and Fan On, AC Drive Stops and Fan Off
02 Always Run
03 Reserved

P 115 PID Set Point Selection

Factory Setting: 00

Settings 00 Disable
01 Keypad (based on P00 setting)
02 AVI (external 0-10V)
03 ACI (external 4-20mA)
04 PID set point (P125)



P 116 PID Feedback Terminal Selection

Factory Setting: 00

Settings 00 Input positive PID feedback, PV from AVI (0 to 10V)
01 Input negative PID feedback, PV from AVI (0 to 10V)
02 Input positive PID feedback, PV from ACI (4 to 20mA)
03 Input negative PID feedback, PV from ACI (4 to 20mA)

- Select an input terminal to be the PID feedback. Please verify the PID feedback position is different from the Frequency Set Point position.
- Negative feedback = positive targeted value – detective value. Positive feedback = negative targeted value + detective value.

P 117 Proportional Gain (P)

Settings 0.0 to 10.0 Factory Setting: 1.0

- This parameter determines the feedback loop Gain. If the gain is large, the response will be strong and immediate (If the gain is too large, vibration may occur). If the gain is small, the response will be weak and slow.
- When I=0.0 and D=0.0, it is only used for proportional control.

P 118 Integral Time (I) Unit: 0.01sec

Factory Setting: 1.00

Settings 0.01 to 100.00 sec
0.00 disable

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

P 119	Differential Time (D)	Unit: 0.01sec
	Settings 0.00 to 1.00 sec	Factory Setting: 0.00

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

P 120	Integration's Upper Bound Frequency	
	Settings 00 to 100 %	Factory Setting: 100 %

📖 This parameter determines the integration's upper frequency limit while operating in the PID feedback loop. (Limit = P03 ×P120). During a fast Integration response, it is possible for the frequency to surpass a reasonable point. This parameter will help limit this frequency spike.

P 121	One-Time Delay	Unit: 0.1sec
		Factory Setting: 0.0
	Settings 0.0 to 2.5 sec 0.0 disable	

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

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

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

P 122 PID Frequency Output Command limit

Settings 00 to 110 % Factory Setting: 100

🕮 This parameter sets a limit of the PID Command frequency. If this parameter is set to 20%, then the maximum output frequency for the PID operation will be (20% x P03).

P 123 Feedback Signal Detection Time Unit: 0.1sec

Factory Setting: 60.0

Settings 0.1 to 3600 sec
0.0 disable

🕮 This parameter defines the detection time for the loss of a feedback analog signal. The drive will follow the operating procedure programmed in P124 if the feedback signal is lost for more than the time set in P123.

P 124 Feedback Signal Fault Treatment

Factory Setting: 00

Settings 00 Warning and RAMP to stop
01 Warning and keep operating

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

P 125 Source of PID Set point

Settings 0.00 to 400.0Hz Factory Setting: 0.00

🕮 This parameter is used in conjunction with P115 (04) to input a set point in Hz.

P 126 PID Offset Level

Settings 1.0 to 50.0 % Factory Setting: 10.0

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

P 127 Detection Time of PID Offset

Settings 0.1 to 300.0 sec Factory Setting: 5.0

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

P 128 Minimum Reference Value Unit: 0.1V

Settings 0.0 to 10.0 V Factory Setting: 0.0

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

P 129 Maximum Reference Value

Settings 0.0 to 10.0 V Factory Setting: 10.0

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

P 130 Invert Reference Signal AVI (0-10V)

Factory Setting: 00

Settings 00 Not Inverted
01 Inverted

🕮 If this parameter is set to 01, the reference signal is inverted: 0V corresponds to 60Hz in P128 and 10V corresponds to 0Hz in P129.

P 131 Minimum Reference Value (0-20mA) Unit: 0.1mA

Settings 0.0 to 20.0mA Factory Setting: 4.0

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

P 132 Maximum Reference Value (0-20mA) Unit: 0.1mA

Settings 0.0 to 20.0mA Factory Setting: 20.0

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

P 133 Inverts Reference Signal (0-20mA)

Factory Setting: 00

Settings 00 Not Inverted
01 Inverted

🕮 If this parameter is set to 01, 4mA corresponds to 0Hz in P132, and 0mA corresponds to 60Hz in P131.

🕮 The main purpose for P128-P133 is to allow changes in the output frequency when setting the analog frequency or PID feedback control per the feedback sensor. For example, if the feedback sensor inputs 4mA-20mA but the output frequency from drive that user needs is 5mA-18mA, then user could set P131 to 5mA and P132 to 18mA.

P 134 Analog Input Delay Filter for Set Point Unit: 2ms

Settings 00 to 9999 Factory Setting: 50

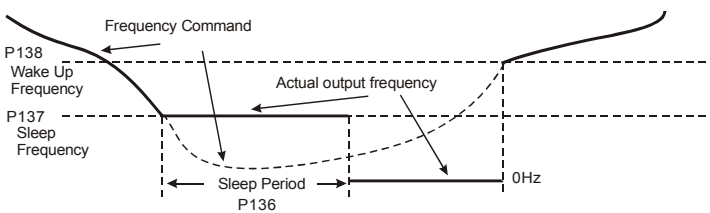
P 135 Analog Input Delay Filter for Feedback Signal Unit: 2ms

Settings 00 to 9999 Factory Setting: 5

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

P 136	Sleep Period	Unit: 0.1sec
	Settings 0.0 to 6550.0 sec	Factory Setting: 0.0
P 137	Sleep Frequency	Unit: 0.10Hz
	Settings 0.00 to 400.0 Hz	Factory Setting: 0.0
P 138	Wake Up Frequency	Unit: 0.10Hz
	Settings 0.00 to 400.0 Hz	Factory Setting: 0.0

These parameters determine the sleep functions of the AC drive. If the command frequency falls below the sleep frequency, for the specified time in P136, then drive output is turned off until the command frequency rises above P138. Please see the below diagram.



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

This parameter sets the procedure for the AC drive to follow once the internal counter attains the setting value in P96.

P 140	External Up/Down Selection	
		Factory Setting: 00
	Settings 00 Fixed Mode (keypad)	
	01 By Accel or Decel Time	
	02 Reserved	

This parameter is used to change the Master Frequency externally with the Multifuction Input Terminals. If any two parameters in the group P 39-P42 are set to 14 and 15, and P140 is set to 01, the up/down frequency operation is initiated as the contact closes and according to the time of acceleration/deceleration.

P 141 Save Frequency Set Point

Factory Setting: 01

Settings 00 Not Save
01 Save

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

P 142 Second Source of Frequency Command

Factory Setting: 00

Settings 00 Keypad Up/Down
01 AVI (0-10V)
02 ACI (4-20mA)
03 RS485
04 Keypad Potentiometer

📖 This parameter changes the source for frequency command by using any Multifunction Input (P39-P42, setting= 28).

P 143 Software Braking Level Unit: 0.1V

Settings	115V/230V series	370 to 450 Vdc	Factory setting: 380.0
	460V series	740 to 900 Vdc	Factory setting: 760.0
	575V series	925 to 1075 Vdc	Factory setting: 950.0

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

P 144 Accumulative Motor Operation Day

Settings 00-65535 Days Read Only

P 145 Accumulative Motor Operation Time (Min.)

Settings 00-1440 Minutes Read Only

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

P 146 Line Start Lockout

Factory Setting: 00

Settings 00 Disable
01 Enable

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

P 147 Decimal Number of Accel / Decel Time

Factory Setting: 00

Settings 00 One Decimal
01 Two Decimals

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

P 148 Number of Motor Poles

Settings 02 to 20 Factory Setting: 04

P 149 Gear Ratio for Simple Index Function

Settings 4 to 1000 Factory Setting: 200

P 150 Index Angle for Simple Index Function

Settings 00.0 to 360.0 Factory Setting: 180.0

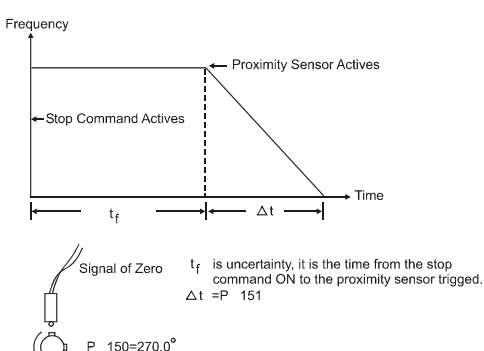
P 151 Deceleration Time for Simple Index Function

Factory Setting: 0.00

Settings 0.00 to 100.00 sec
0.00 Disable

This parameter should be used with P 39-P42 (setting 31).

Example:



P 152 Skip Frequency Width

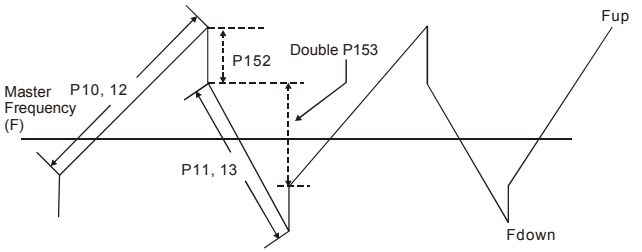
Settings 0.00 to 400.00Hz Factory Setting: 0.00

P 153 Bias Frequency Width

Settings 0.00 to 400.00Hz Factory Setting: 0.00

🕮 Frequency of Δ top point Fup= master frequency F + P152 + P153.

🕮 Frequency of Δ down point Fdown= master frequency F – P152 – P153.



P 154 Reserved

P 155 ↗ Compensation Coefficient for Motor Instability

Factory Setting: 0.0

Settings 0.1 to 5.0 (recommended setting 2.0)
0.0 Disable

🕮 This parameter is used to improve a condition of unstable current in any specific area. For higher frequencies, you can adjust this parameter to 0.0, and increase the setting value in P155 for 30HP and above (a setting of 2.0 is recommended).

P 156 ↗Communication Response Delay Time

Settings 0 to 200 (x500μs) Factory Setting: 0

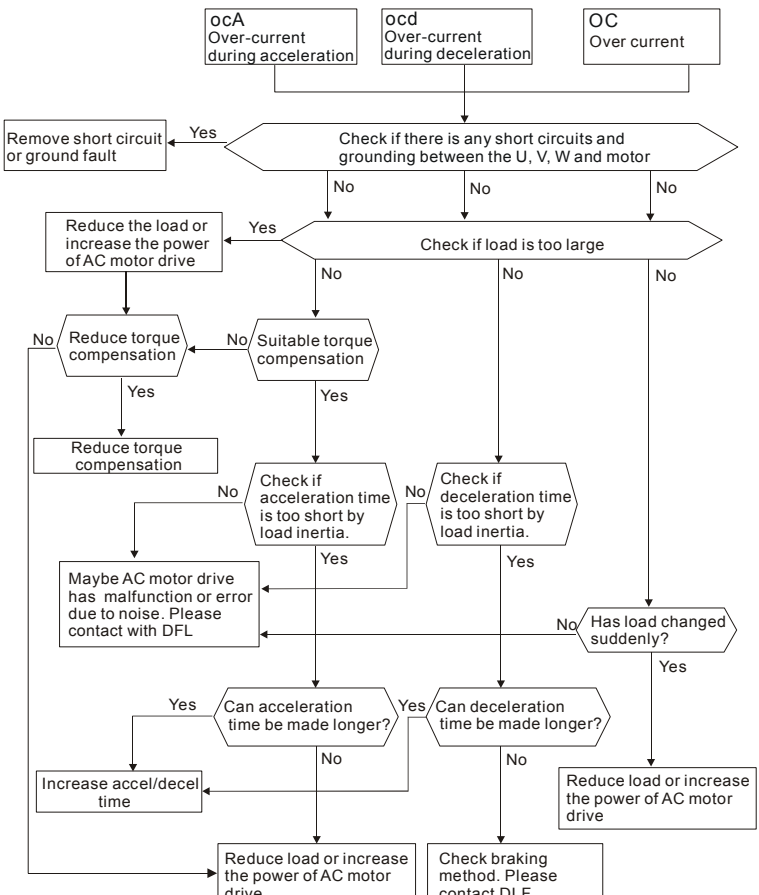
🕮 This parameter is used to set communication response delay time. If you set P156 to 1 the communication response delay time will be1 X 500us=500us, set P156 to 2 the communication response delay time will be 2 X 500μs=1000μs.

P 157 ↗ Communication Mode Selection

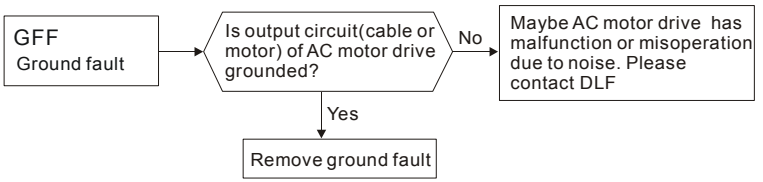
Factory Setting: 1

Settings 0 Delta ASCII
1 MODBUS

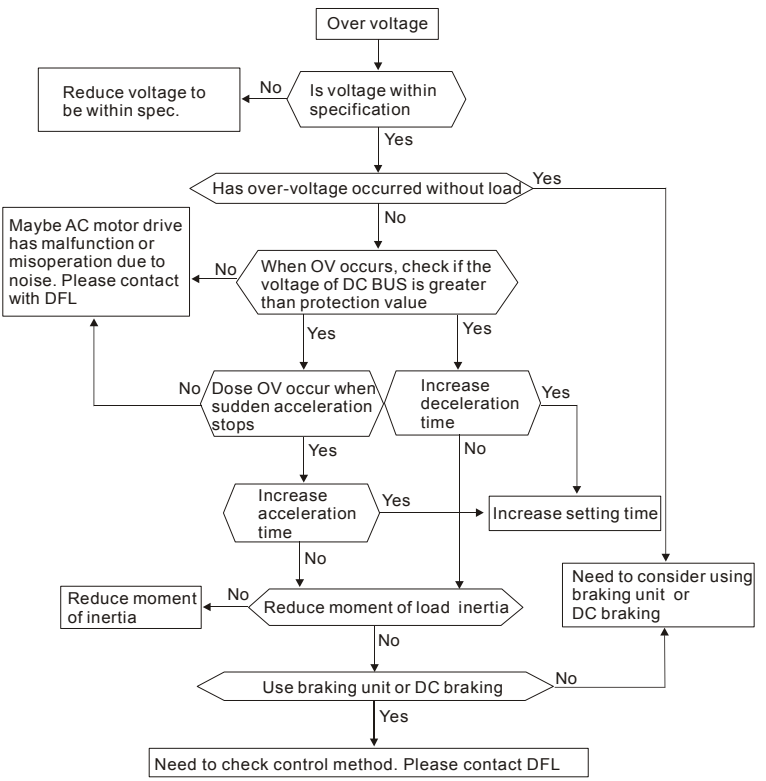
5.1 Over Current (OC)



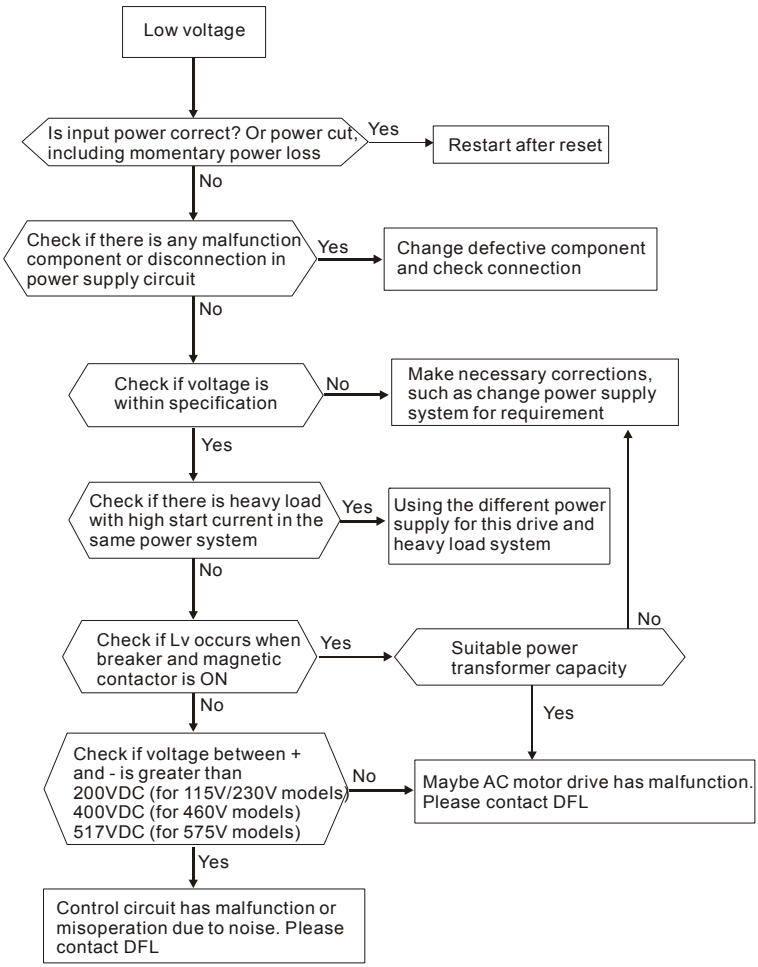
5.2 Ground Fault



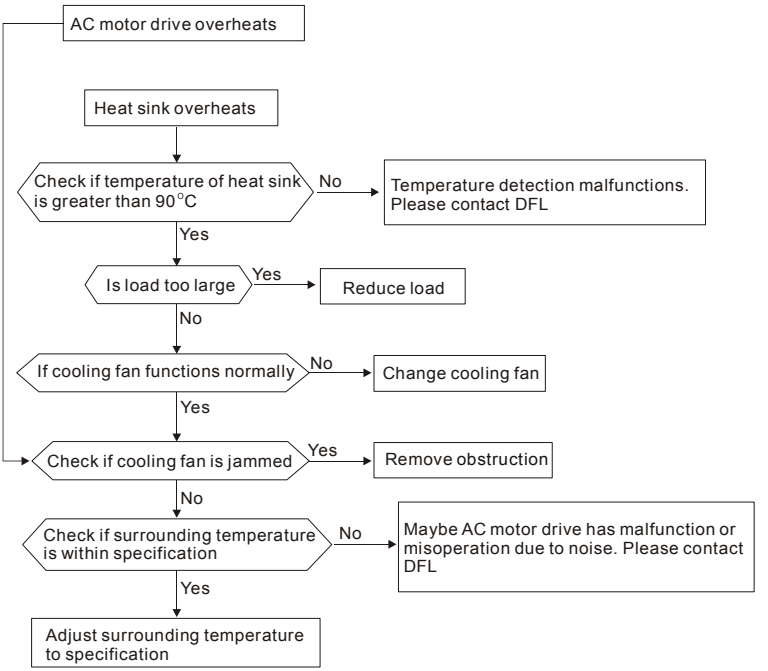
5.3 Over Voltage (OV)



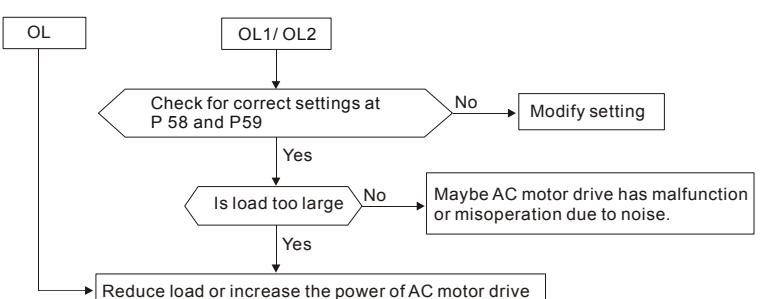
5.4 Low Voltage (Lv)



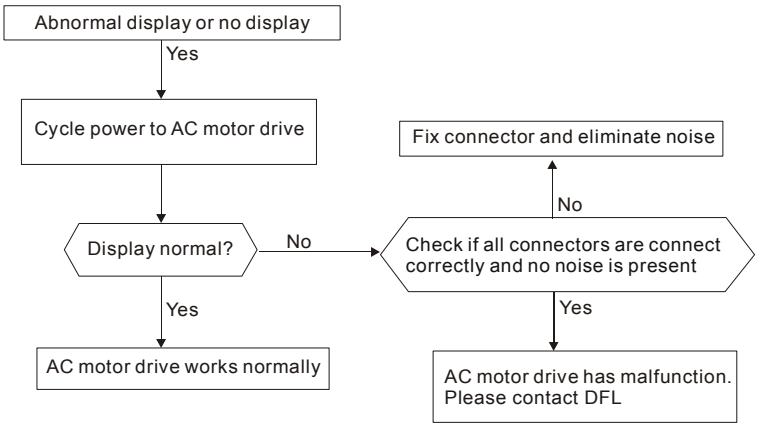
5.5 Over Heat (OH1)



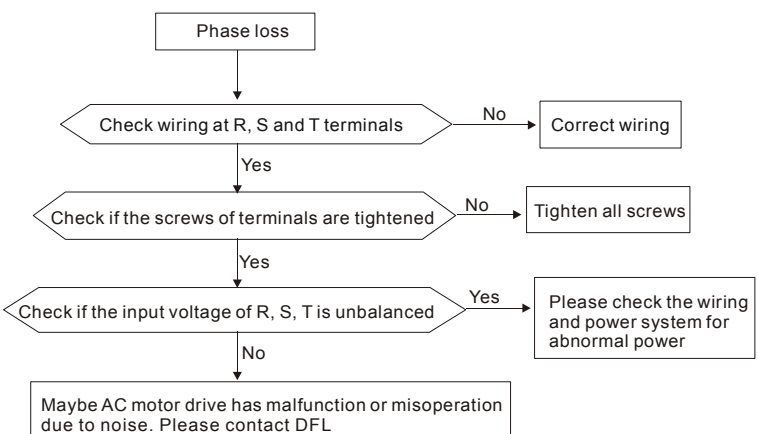
5.6 Overload



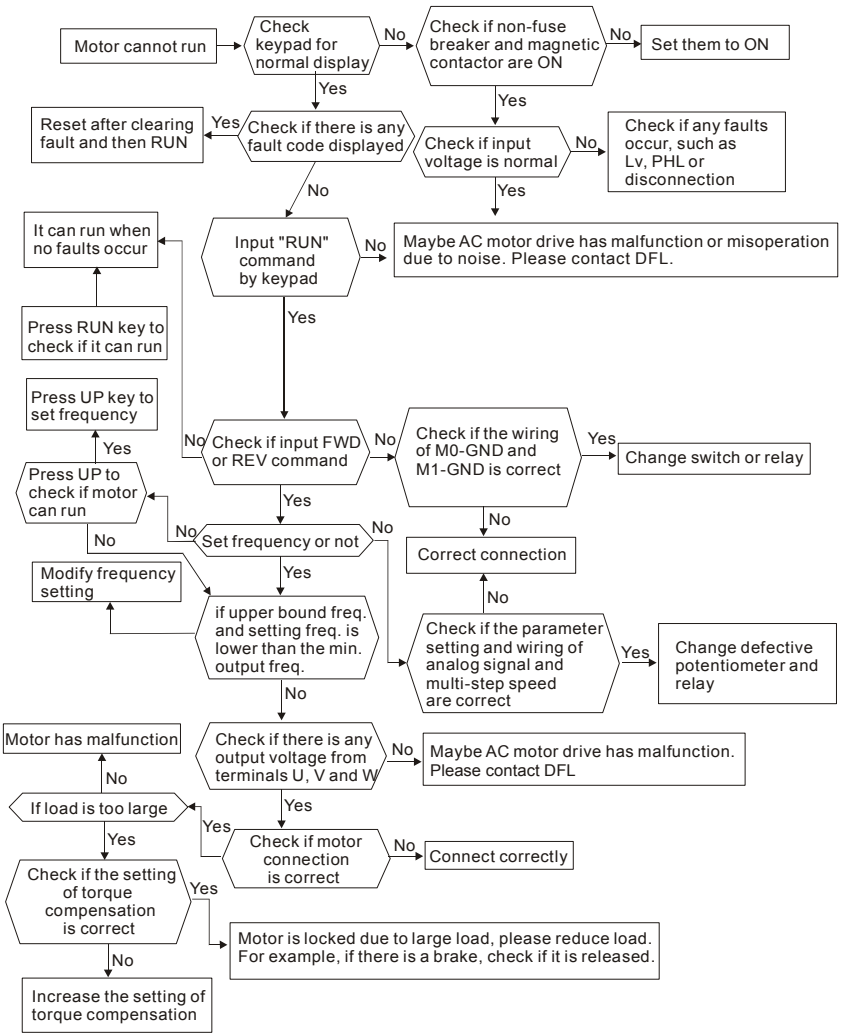
5.7 Keypad Display is Abnormal



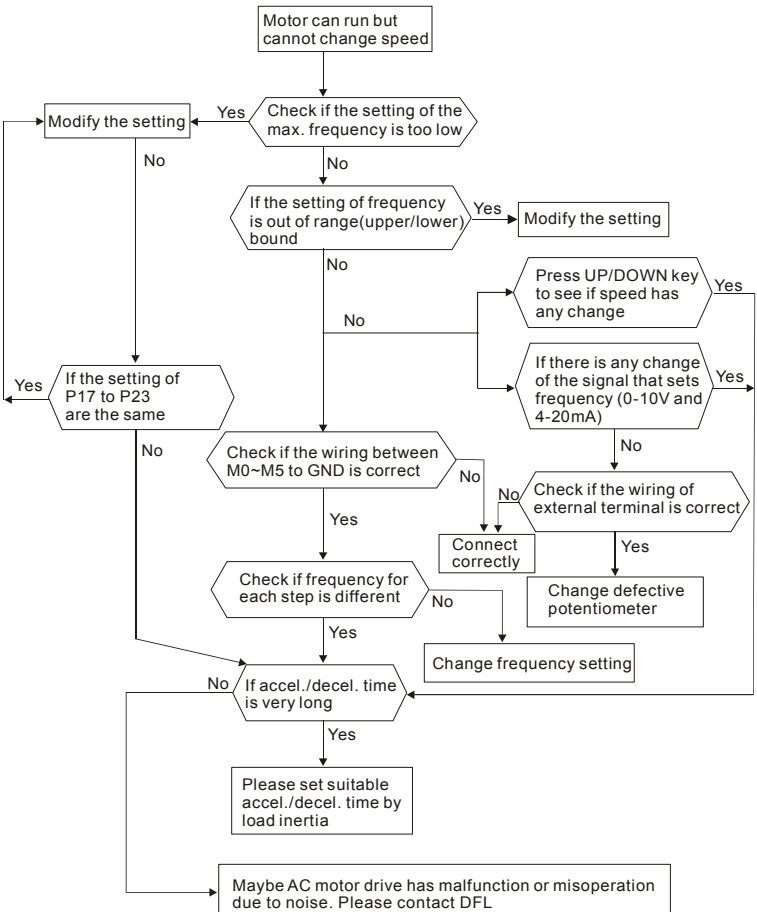
5.8 Phase Loss (PHL)



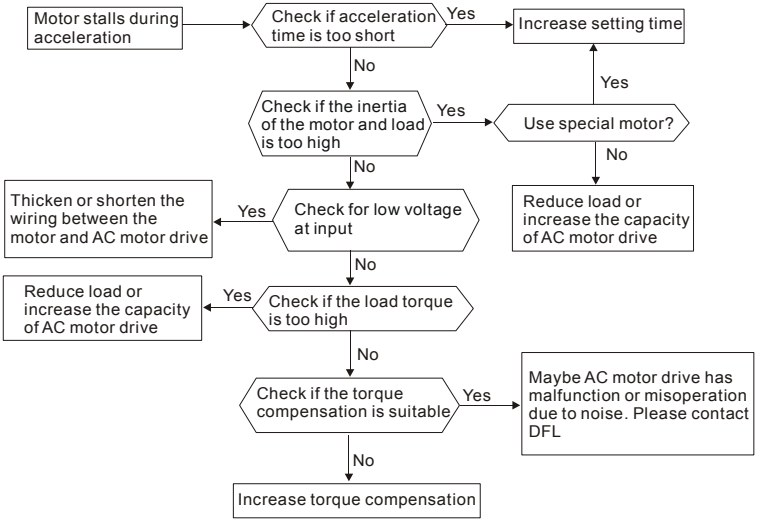
5.9 Motor cannot Run



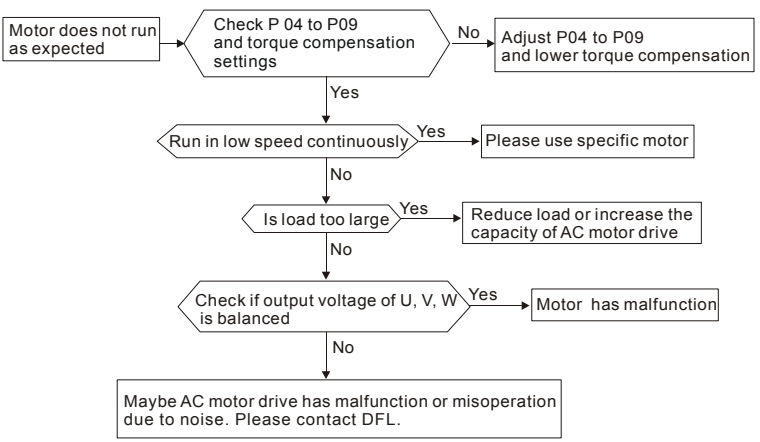
5.10 Motor Speed cannot be Changed



5.11 Motor Stalls during Acceleration



5.12 The Motor does not Run as Expected



5.13 Electromagnetic/Induction Noise

Many sources of noise surround AC motor drives and penetrate it by radiation or conduction. It may cause malfunctioning of the control circuits and even damage the AC motor drive. Of course, there are solutions to increase the noise tolerance of an AC motor drive. But this has its limits. Therefore, solving it from the outside as follows will be the best.

1. Add surge suppressor on the relays and contacts to suppress switching surges.
2. Shorten the wiring length of the control circuit or serial communication and keep them separated from the power circuit wiring.
3. Comply with the wiring regulations by using shielded wires and isolation amplifiers for long length.
4. The grounding terminal should comply with the local regulations and be grounded independently, i.e. not to have common ground with electric welding machines and other power equipment.
5. Connect a noise filter at the mains input terminal of the AC motor drive to filter noise from the power circuit. MC8000 can have a filter as option.

In short, solutions for electromagnetic noise exist of “no product”(disconnect disturbing equipment), “no spread”(limit emission for disturbing equipment) and “no receive”(enhance immunity).

5.14 Environmental Condition

Since the AC motor drive is an electronic device, you should comply with the environmental conditions. Here are some remedial measures if necessary.

1. To prevent vibration, the use of anti-vibration dampers is the last choice. Vibrations must be within the specification. Vibration causes mechanical stress and it should not occur frequently, continuously or repeatedly to prevent damage to the AC motor drive.
2. Store the AC motor drive in a clean and dry location, free from corrosive fumes/dust to prevent corrosion and poor contacts. Poor insulation in a humid location can cause short-circuits. If necessary, install the AC motor drive in a dust-proof and painted enclosure and in particular situations, use a completely sealed enclosure.
3. The ambient temperature should be within the specification. Too high or too low temperature will affect the lifetime and reliability. For semiconductor components, damage will occur once any specification is out of range. Therefore, it is necessary to periodically check air quality and the cooling fan and provide extra cooling of necessary. In addition, the microcomputer may not work in extremely low temperatures, making cabinet heating necessary.

4. Store within a relative humidity range of 0% to 90% and non-condensing environment. Use an air conditioner and/or exsiccator.

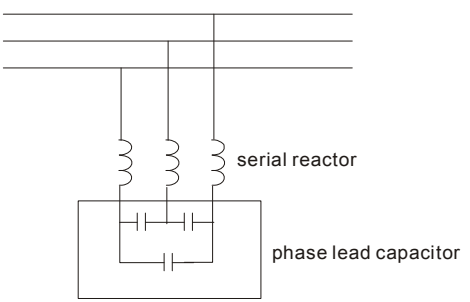
5.15 Affecting Other Machines

An AC motor drive may affect the operation of other machines due to many reasons. Some solutions are:

- High Harmonics at Power Side

  High harmonics at power side during running can be improved by:

  1. Separate the power system: use a transformer for AC motor drive.
  2. Use a reactor at the power input terminal of the AC motor drive.
  3. If phase lead capacitors are used (never on the AC motor drive output!!), use serial reactors to prevent damage to the capacitors damage from high harmonics.



- Motor Temperature Rises

  When the motor is a standard induction motor with fan, the cooling will be bad at low speeds, causing the motor to overheat. Besides, high harmonics at the output increases copper and core losses. The following measures should be used depending on load and operation range.

  1. Use a motor with independent ventilation (forced external cooling) or increase the motor rated power.
  2. Use a special inverter duty motor.
  3. Do NOT run at low speeds for long time.

Chapter 6 Fault Code Information and Maintenance

6.1 Fault Code Information

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. The following faults are displayed as shown on the AC motor drive digital keypad display. The three most recent faults can be read from the digital keypad by viewing P73 to P75.

Wait 5 seconds after a fault has been cleared before performing reset via keypad or input terminal.

6.1.1 Common Problems and Solutions

Fault Name	Fault Descriptions	Corrective Actions
oc	The AC drive detects an abnormal increase in current.	1. Check whether the motors horsepower corresponds to the AC drive output power. 2. Check the wiring connections between the AC drive and motor for possible short circuits. 3. Increase the Acceleration time (P10, P12). 4. Check for possible excessive loading conditions at the motor. 5. If there are any abnormal conditions when operating the AC drive after short-circuit being removed, it should be sent back to manufacturer.
ou	The AC drive detects that the DC bus voltage has exceeded its maximum allowable value.	1. Check whether the input voltage falls within the rated AC drive input voltage. 2. Check for possible voltage transients. 3. Bus over-voltage may also be caused by motor regeneration. Either increase the decel time or add an optional brake resistor. 4. Check whether the required braking power is within the specified limits.

Fault Name	Fault Descriptions	Corrective Actions
oH	The AC drive temperature sensor detects excessive heat.	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects on the heat sinks and check for possible dirty heat sink fins. 4. Provide enough spacing for adequate ventilation.
Lu	The AC drive detects that the DC bus voltage has fallen below its minimum value.	Check whether the input voltage falls within the rated AC drive's input voltage.
oL	The AC drive detects excessive drive output current. Note: The AC drive can withstand up to 150% of the rated current for a maximum of 60 seconds.	1. Check whether the motor is overloaded. 2. Reduce torque compensation setting as set in P54. 3. Increase the AC drive's output capacity.
oL 1	Internal electronic overload trip	1. Check for possible motor overload. 2. Check electronic thermal overload setting. 3. Increase motor capacity. 4. Reduce the current level so that the drive output current does not exceed the value set by the Motor Rated Current P52.
oL2	Motor overload. Check the parameter settings (P60 to P62)	1. Reduce the motor load. 2. Adjust the over-torque detection setting to an appropriate setting.
ocA	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.	1. Check for possible poor insulation at the output line. 2. Decrease the torque boost setting in P54. 3. Increase the acceleration time. 4. Replace with the AC drive with one that has a higher output capacity (next HP size).
ocd	Over-current during deceleration: 1. Short-circuit at motor output. 2. Deceleration time too short. 3. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Increase the deceleration time. 3. Replace with the AC drive with one that has a higher output capacity (next HP size).

Fault Name	Fault Descriptions	Corrective Actions
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.	1. Check for possible poor insulation at the output line. 2. Check for possible motor stall. 3. Replace with the AC drive with one that has a higher output capacity (next HP size).
cF1	Internal memory IC can not be programmed.	1. Switch off power supply. 2. Check whether the input voltage falls within the rated AC drive input voltage. 3. Switch the AC drive back on.
cF2	Internal memory IC can not be read.	1. Check the connections between the main control board and the power board. 2. Reset drive to factory defaults.
EF	The external terminal EF-GND goes from OFF to ON.	When external terminal EF-GND is closed, the output will be turned off (under N.O. E.F.).
cFA	Auto accel/decel failure	Don't use the function of auto acceleration/ deceleration.
GFF	Ground fault : The AC drive output is abnormal. When the output terminal is grounded (short circuit current is 50% more than the AC drive rated current), the AC drive power module may be damaged. The short circuit protection is provided for AC drive protection, not user protection.	Ground fault : 1. Check whether the IGBT power module is damaged. 2. Check for possible poor insulation at the output line.
cE1	Communication Error Please refer to P92.	1. Check the connection between the AC drive and computer for loose wires. 2. Check if the communication protocol is properly set.
bb	External Base Block. AC drive output is turned off.	1. When the external input terminal (base-block) is active, the AC drive output will be turned off. 2. Disable this connection and the AC drive will begin to work again.

Fault Name	Fault Descriptions	Corrective Actions
	OC hardware error	Return to the factory.
	CC (current clamp)	
	OV hardware error	
	GFF hardware error	
	OV or LV	
	Current sensor error	
	U-phase error	Return to the factory.
	W-phase error	
	Phase Loss	Check input phase wiring for loose contacts.
	Software protection failure	Return to the factory.
	PID feedback signal error	1. Check parameter settings (P 116) and AVI/ACI wiring. 2. Check for possible fault between system response time and the PID feedback signal detection time (P123)