SANCH

otomasyon AVM

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SANCH SA Series

User Manual

High-performance low-noise general-purpose AC motor drives

TABLE OF CONTENTS

1. Receiving, Storage and Transportation

The AC motor drive has gone through rigorous quality control tests at the factory before shipment. After receiving the AC drive, check for the following.

■ Receiving

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

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

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

■ Storage

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

→ Store in a clean, dry location.

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

→ If possible, store in an air-conditioned environment where the relative humidity is less than 95%, non-condensing.

→ Do not store the AC drive in places where it could be exposed to corrosive gases.

→ Do not store the AC drive on a shelf or on an unstable surface.

■ Transportation

Temperature: -25°C to +70°C; R.H.: 0% to 95%; Air Pressure: 70kPa to 106kPa.

2. Standard specification

■ 220V single-phase/three phase series

	Model name SA -2xxx(B)	007	015	022					
	3 Phase motor rating (kW)	0.75	1.5	2.2					
	3 Phase motor rating (HP)	1.0	2.0	3.0					
Output Rating	Inverter output (kVA)	1.9	2.5	4.2					
	Output current (A)	5.0	6.5	11					
	Output voltage (V)	Adjustable from 0 to input voltage							
	Output frequency (Hz)	Programmable from 0 to 400 Hz							
Input Rating	Rated AC input power supply	200 / 208/ 220 / 240 VAC, three phase, 50 / 60Hz							
	Single (3-phase Input Current)	6.8	8.9	14.3					
	Input Current (A)	7.4	9.9	15.5					
	Operational range (V)	180□265 VAC, 47□63 Hz							
	Power factor (Displacement)	0.8 (Lagging)							

■ 440V single-phase/three phase series

	Model name SA -4xxx(B)	007	015	022	037	055	075	110	150	185	220
	3 Phase motor rating (kW)	0.75	1.5	2.2	3.7	5.5	7.5	11.0	15.0	18.5	22.0
	3 Phase motor rating (HP)	1.0	2.0	3.0	5.0	7.5	10.0	15.0	20.0	25.0	30.0
Output Rating	Inverter output (kVA)	2.3	3.2	4.2	6.3	9.9	13.7	18.3	24.4	28.9	34.3
	Output current (A)	3	4.2	5.5	8.2	13	18	24	32	38	45
	Output voltage (V)	Adjustable from 0 to input voltage									
	Output frequency (Hz)	Programmable from 0 to 400 Hz									
Input Rating	Rated AC input power supply	380 / 400 / 415 / 480 VAC, three phase, 50 / 60Hz									
	Input Current (A)	4.2	6.0	7.2	8.5	14.0	20.6	28	30	39	49
	Operational range (V)	340□500 VAC, 47□63 Hz									
	Power factor (Displacement)	0.8 (Lagging)									

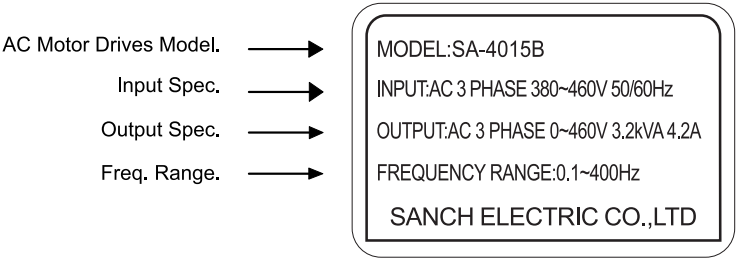
* Only 220V Series, 0.75□2.2kW provide single-phase input.
Note 1: The frequency can be reached to 1500Hz by SP Series AC Motor Drives.
Note 2: 11kW□22kW models, exclude inherent braking transistor, external braking is optional.

■ Standard specification

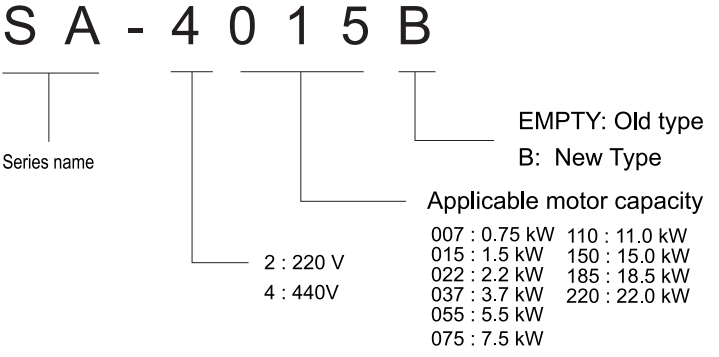
Control Characteristics	Control system		Sinusoidal PWM control
	Frequency control range		0.1~400.0 Hz
	Frequency setting resolution		0.1 Hz
	Output frequency resolution		0.1 Hz
	Overload current rating		150% of rated current for 1 minute
	Acceleration / deceleration time		0.1~600.0 S
	Torque characteristics		Starting torque 150% or more (at 5 Hz)
	Regenerative braking		Incorporate regenerative braking circuit
	V / F pattern		Any V / F pattern setting
	Stall prevention level		Setting to percentage of rated current
Operating Characteristics	Frequency setting	Digital operation	Setting by ▲ / ▼ or JOG
		External signal	Variable resistor of 5K/ 0.5W, 0 to 10 VDC, 4~20mA, RS-485 serial port, Multi-function 1~3(JOG, Multi-step speed, Up / Down)
	Operation Setting Signal	Digital operation	Setting by RUN, STOP, FWD / REV
		External signal	FWD, REV, EF can be combined for 2 or 3-wire operation, RS-485 serial interface.
	Multi-function input signal		Multi-step selection 1 ~7, Jogging, Accel. / Decel. Prohibit, First / Second Accel. / Decel. Switching command, External BB (NC, NO selection), etc.
	Multi-function output signal		During running, Up to frequency setting, Up to desired frequency setting Count out detection, Non zero-speed, Over-torque detection, etc.
	Analog / Digital Output		Analog frequency / current signal output, digital frequency signal output
Other functions			Automatic Voltage Regulation (AVR), S-Curve, over voltage, over-current stall prevention, abnormal records checking, Carrier-frequency adjustable, DC braking, DB starting frequency setting, Momentary power failure restart, Frequency limit, etc.
Protective function			Over-current, over voltage, under voltage, electronic thermal, overheat ground fault, overload limit, over voltage supply, etc., but no short-circuit protection of output terminals.
Cooling Method			Forced air-cooling
Environments	Installation site		Altitude 1,000m or lower, keep from corrosive gasses, liquid and dust
	Pollution Degree		2
	Ambient temperature		-10℃ ~40℃ (-10℃~50℃ without blind plate) at rated voltage and rated current.
	Storage temperature		-20℃ ~60 ℃
	Ambient Humidity		Below 90% RH (non-condensing)
	Vibration		1.0G less than 20Hz, 0.6G at 20~50Hz
Options			EG2010A extension cable, LC-A05E, LC-A10E digital keypad, RC-01 remote control unit, MVR / MHR Braking resistor

3. Nameplate Information

■ **3HP, 440V AC Drive example**



■ Description of AC Motor Drive Model



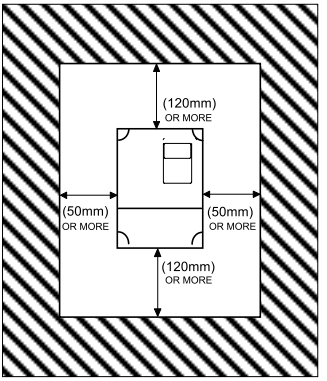
4. Installation and Wiring

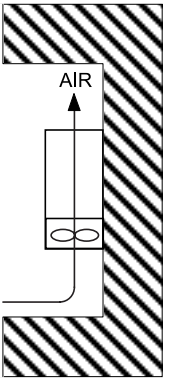
It provides the information needed to properly install and wire the AC drive. Make sure that the AC drive is wired according to the instructions contained in this chapter. The instructions should be read and understood before the actual installation begins.

- **Installation Requirements**
- **Wiring**

■ Installation Requirements

Install the AC drive vertically to provide proper ventilation. Adequate space is required between the drive and a wall or other equipment. The figure below shows the minimum space needed. All *enclosures must provide adequate ventilation and the internal ambient temperature must be kept at 40°C or below.*





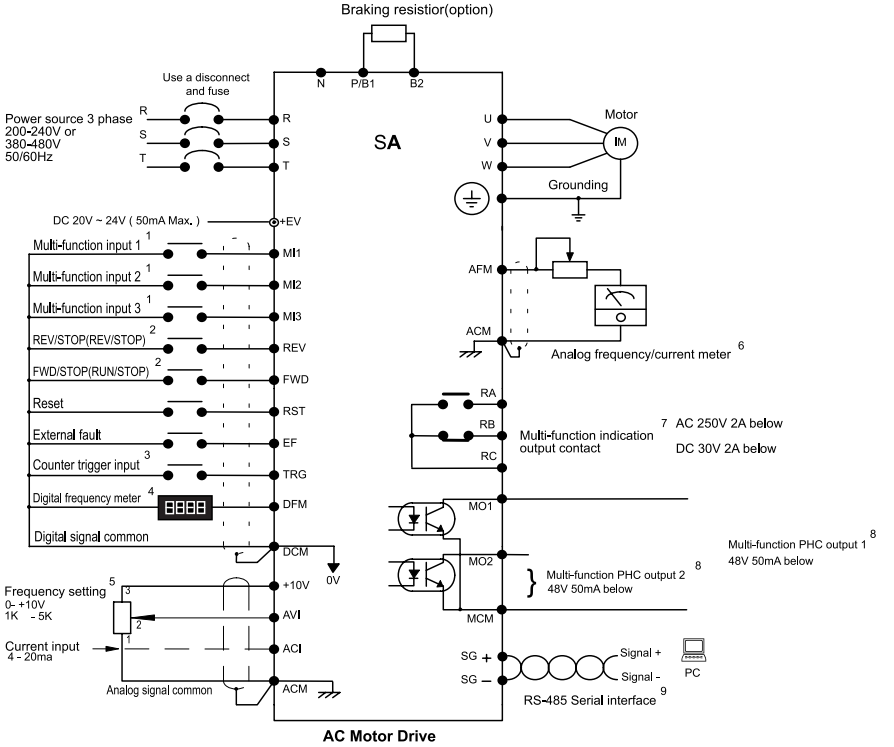
Caution: The AC drive should be installed in an environment that is:

- → protected from rain or moisture;
- → protected from direct sunlight;
- → protected from corrosive gases or liquids;
- → free from airborne dust or metallic particles;
- → free from vibration;
- → free from magnetic noise
- → temperature: -10°C to +40°C; R.H.: 0% to 90%; air pressure: 86kPa to 106 kPa

Violating the conditions listed above may void the warranty!

■ Wiring

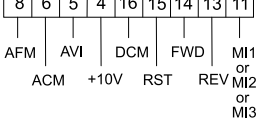
Basic Wiring Diagram



Notes:

1. indicates shielded leads and twisted-pair shielded leads.
2. Terminal symbols : ◯ shows main circuit; ◉ shows control circuit;

Wiring diagram and programming for the RC-01 external control.



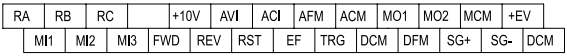
Control Circuit Wiring

(1) Control terminal block designations

The control leads must be routed separately from the power supply and motor leads. They must not be fed through the same cable conduit.

Terminal Symbol

220V/440V Class 1□5HP (AWG: 28 – 14; Torque:4 kgf-cm)



220V/440V Class 7.5□30HP (AWG: 24 – 12; Torque:4 kgf-cm)

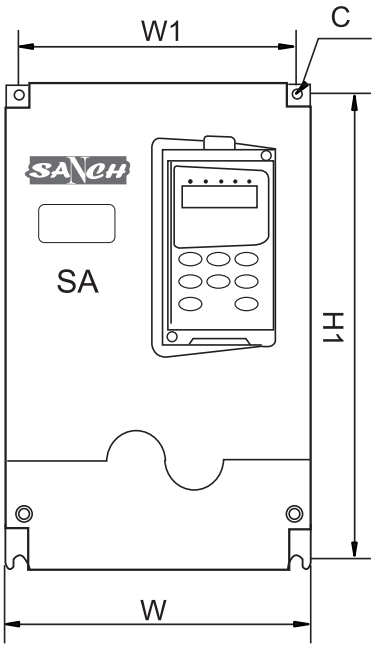
(2) Control terminal block descriptions

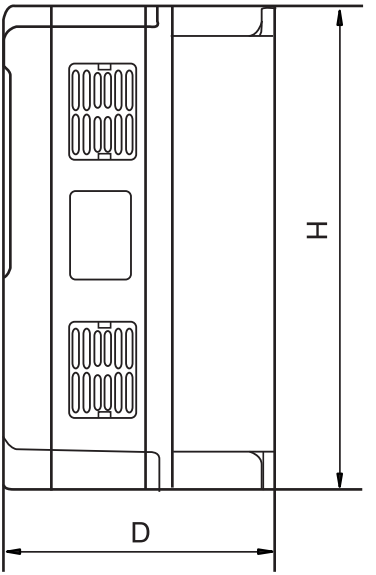
Close Contacts between Terminals	Terminals Use	Function
RA - RC	Multi-function indication output contact	Refer to Chapter 5, Pr.57
RB - RC	Multi-function indication output contact	
MI1 - DCM	Multi-function input 1	Refer to Chapter 5, Pr.39, 40, 41
MI2 - DCM	Multi-function input 2	
MI3 - DCM	Multi-function input 3	
REV - DCM	Reverse / Stop	“Open”□ stop, “Close” □ Reverse
FWD - DCM	Forward / Stop	“Open”□ stop, “Close” □ Forward
RST - DCM	Reset	“Close” □ Reset
EF - DCM	External fault	“Close” □ External fault
DFM - DCM	Digital frequency meter	Digital frequency output (0, +10 V)
TRG - DCM	Counter trigger input	“Open”□ “Close”:(counter value)+1
MO1 - MCM	Multi-function PHC output 1	Refer to Pr.45, 46
MO2 - MCM	Multi-function PHC output 2	(open collector output)
+10V - ACM	Power supply for speed setting	+10 V (20 mA max. output current)
AVI - ACM	Analog voltage input	0 □10 V (Max. output freq.) input
ACI - ACM	Analog current input	4 □20 mA (Max. output freq.) input
AFM - ACM	Analog frequency/current meter	0 □10 V (Max. output freq.) output
SG+ - SG-	Serial communication interface	RS-485 serial port
+EV - DCM	Auxiliary control power source	DC 20V ~ 24V (50mA Max.)

Note: Use twisted-shielded or twisted-pair shielded-lead wires for the control signal. It is recommended to run signal wiring in a separate steel conduit. The shield wire should only be connected at the drive.

5. Dimensions

LENGTH / MODEL	H	H1	W	W1	D	C	MASS
	mm						kg
SA-2007B	174	159.4	126.5	113.6	144.5	5.5	1.55
SA-2015B							
SA-4007B							
SA-4015B							
SA-4022B							
SA-2022	225	207.2	190.5	175.1	159	5.5	2.55
SA-4037							
SA-4055							
SA-2022B	236	205	132	119.5	163	5.5	3.0
SA-4037B	236	205	132	119.5	192	5.5	4.0
SA-4055B							
SA-4075	323.3	308.0	203.3	185.3	180	6.5	7.0
SA-4110							7.5
SA-4075B	320	300.6	200	186.2	194.5	7.0	6.0
SA-4110B							
SA-4150	403	383.5	250	225.5	216	10.0	10.5
SA-4185							
SA-4220							11


W1
C
SA
H1
W


H
D

Chapter 2 describes the various controls and indicators found on the digital keypad of the SA AC drive. The information in this chapter should be read and understood before performing the start-up procedures described in Chapter 3.

→ **Description of the Digital Keypad**

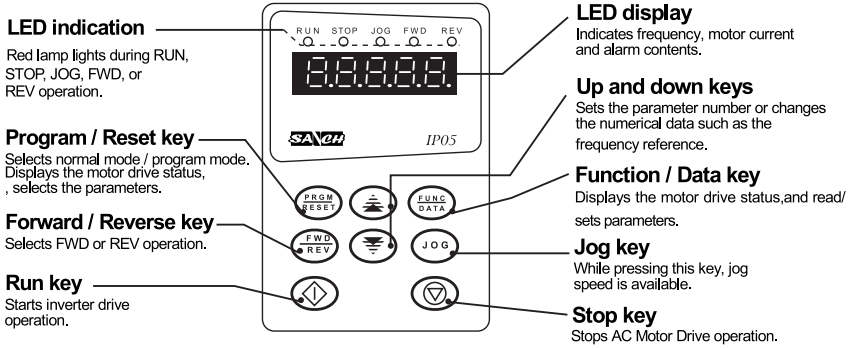
→ **Explanation of Screen Display**

→ **Digital Keypad Operating Modes & Programming steps**

1. Description of the Digital Keypad

■ Digital Keypad Parts and Functions

This digital keypad module includes two parts: display panel and a keypad. The display panel allows the user to program the AC drive, as well as view the different operating parameters. The keypad is the user interface to the AC motor drive. Refer to the following figure for a description of the different parts.



PRGM / RESET

Program / Reset

Used to select the Normal mode of operation or to program the AC drive when either the drive is running or has stopped. Switch to the PRGM mode to select a parameter or change the setting of a parameter. If the AC drive has stopped due to a fault, press this button to reset the drive.

Function / Data

Displays information on the AC drive status such as the reference frequency, output frequency, or output current in the normal mode.

While the drive is in the Program Mode, press this key once to display the current parameters. After changing the parameters, press this key again to store the new parameters.

Forward / Reverse

Used to toggle between forward and reverse operation.

Pressing this key will cause the motor to ramp down to 0 Hz and then ramp up to the preset speed in the opposite direction. By default, the digital keypad controls the AC drive forward/reverse operation. To control the forward/reverse operation via the control terminal block, change the Pr.01 parameter to “d0001” or “d0002”.

Jog

Used to start the AC drive, then run at the jog frequency as set by the parameter specified under

Run

Used to start the AC drive operation. This key has no effect when the drive is set to terminal run.

Stop

Used to stop the AC drive operation.

Up / Down

Press the “Up” or “Down” button to change parameter settings. These keys may also be used to scroll through different operating values or parameters.

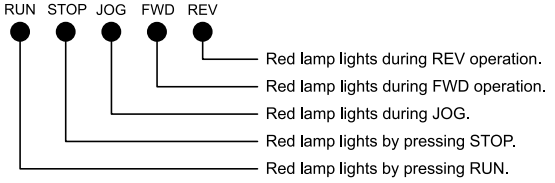
Note: Pressing the “Up” or “Down” button momentarily changes the parameter settings in increments. Press and hold down either of these keys to rapidly run through the possible settings.

2. Explanation of Displayed Messages

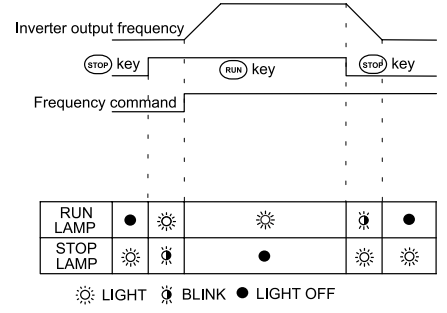
Displayed Message	Description
	Displays the AC drive output frequency controlled by the Maximum Output Frequency (Pr. 03), Jog Frequency (Pr. 16), or by the Multi-Function Input Terminals (Pr. 39-41). If the frequency source originates from the Digital keypad, the user can use either the  or  key to set the frequency.
	Displays the output frequency present at terminals U, V, and W.
	Displays the custom unit (v), where v = H x Pr.65.
	Displays the internal counter value (C). Note: Refer to Chapter 5, Pr.45, 46, 64 - 66 for a detailed description of the above.

A 88	Displays the output current present at terminals U, V, and W
Pr-88	Displays the specified parameter number. The actual parameter value may be displayed by pressing the FUNC DATA key.
d8888	Displays actual value stored within the specified parameter. Press the FUNC DATA key to store the value of the specified parameter.
-End-	The display will read “end” (as shown) for approximately 1 second if the input has been accepted. After a parameter value has been set, the new value is automatically stored in memory. To modify an entry, use ▲ or ▼ key.

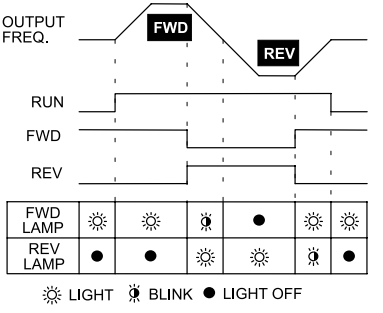
3. Explanation of the LED Indicators



RUN or STOP lamp indication is defined by the following operation



FWD or REV lamp changes indication is defined by the following operation

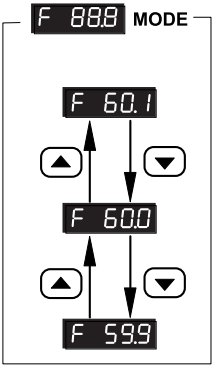


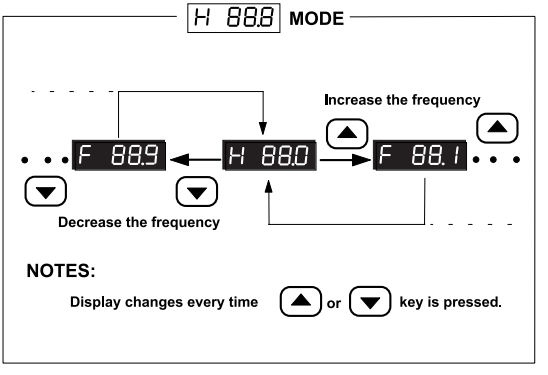
4. Digital Keypad Operating Modes & Programming steps

Pressing the RUN key after power on will cause the AC drive to operate at 60 Hz, which is the factory default setting. Use the STOP key to halt operation. Refer to the Basic Wiring Diagram in Chapter 1 for information on the wiring connection.

■ **To change the operating frequency, proceed as follows:**

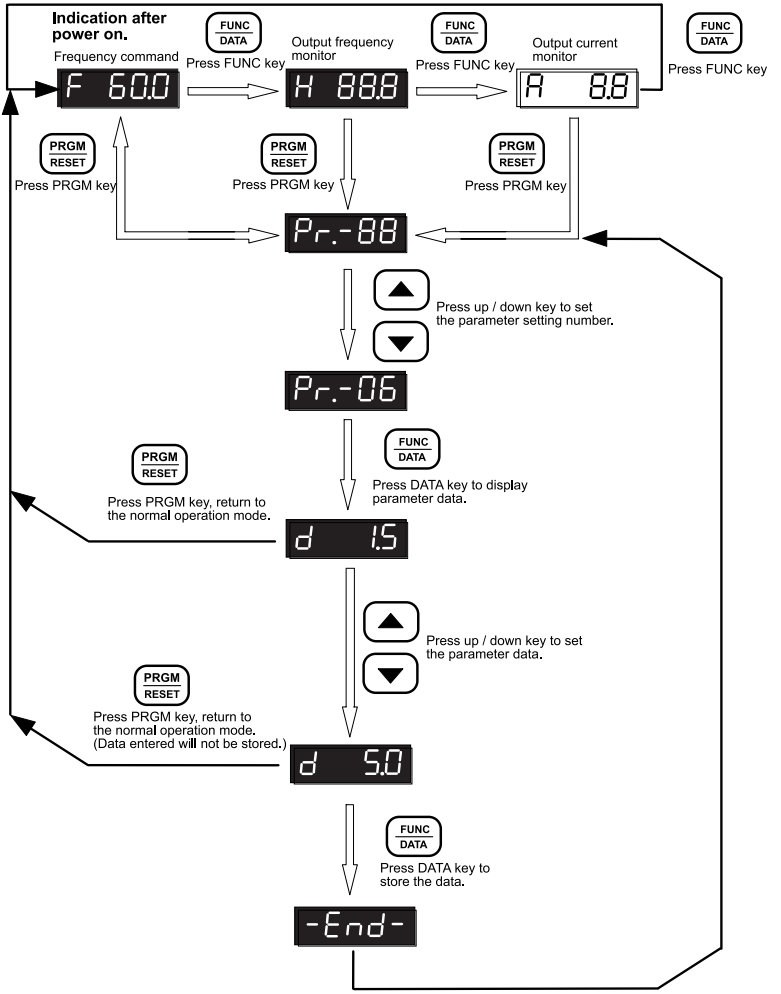
The operating frequency may be changed in either the "STOP" or "RUN" mode.





■ Setting parameters:

To operate the AC drive under optimum conditions, some parameter values may be modified as required. During the "Run" mode, the following set of parameters may be modified: 10-14, 16-23, 44, 48-50, 52-55, 65. It is also possible to check all the parameter settings during operation.

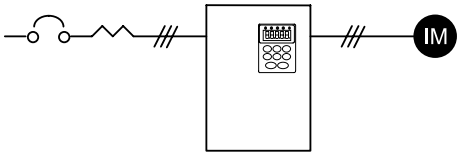


This chapter describes the steps needed to start the AC drive and typical adjustment and verification procedures to ensure a simple and efficient start-up. The following start-up procedures describe the most common parameter settings and system configurations.

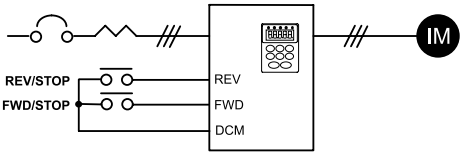
1. Initial Operation - Motor Disconnected

- **Verify that the AC power line, at the disconnect device, is within the rated power of the AC drive.**
- **Disconnect and lockout all incoming power to the drive.**
- **Connect the AC drive to the power line.**
- **Reconnect the incoming power to the drive.**
- **Proceed as follows to select a mode of operation.**

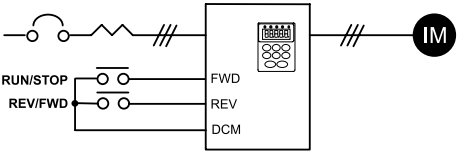
1). Operating frequency determined by the digital keypad,
Digital keypad enabled to control AC drive operation.
(Pr.00 = d0000, Pr.01 = d0000) (Factory default setting)



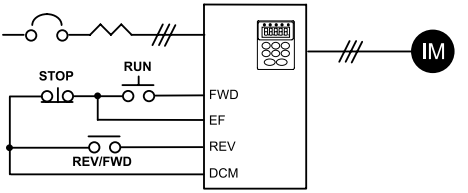
2). Operating frequency determined by the digital keypad,
Control terminals enabled to control AC drive operation; ”Stop” key on digital keypad is enabled.
Two wire “REV/STOP” and “FWD/STOP” remote control enabled.
(Pr.00 = d0000, Pr.01 = d0001, Pr.38 = d0000)



3). Operating frequency determined by the digital keypad;
Control terminals enabled to control AC Drive operation;
"Stop" key on digital keypad is enabled.
Two wire "REV/FWD and "RUN/STOP" remote control enabled.
(Pr.00 = d0000, Pr.01 = d0001, Pr.38 = d0001)



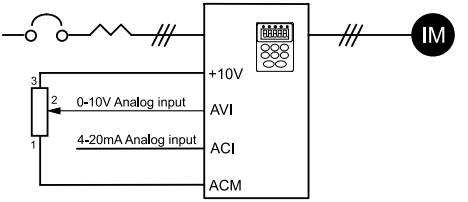
4). Operating frequency determined by the digital keypad;
Control terminals enabled to control AC Drive operation;
"Stop" key on digital keypad is enabled.
Three wire sequence remote control is enabled.
(Pr.00 = d0000, Pr.01 = d0001, Pr.38 = d0002)



Note: Descriptions of the close / open function are as follows:
Example: To select Rev and Stop operations:
Rev / Fwd Contact "close" = reverse operation
Stop Contact "open" = stop

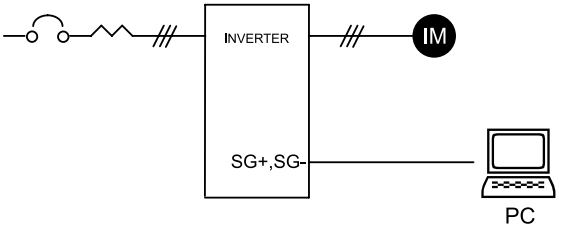
Momentary input
Maintained input

5). Operating frequency determined by analog input;
(DC 0 to +10 V) + (DC 4 to 20 mA)
Digital keypad enabled to control AC Drive operation.
(Pr.00 = d0001, Pr.01 = d0000)



6). Operating frequency determined by remote control via the RS-485 serial interface; RS-485 interface enabled to control AC Drive operation. “Stop” key on digital keypad is enabled.

(Pr.00 = d0002, Pr.01 = d0003)



This completes the operation mode selection. Verify your operation mode works correctly, then proceed to the next section for motor connection and initial operation.

2. Initial Operation– Setting Parameters and connecting the Motor.

1) **Verify Minimum and Maximum Output Frequency Settings (Pr. 08 and 03) are correct for your application.**

2) **Verify the Motor Stop Method (Pr.02) is correct for your application. If set to “Ramp to Stop”, then verify the Accel/Decel Time Settings (Pr.10 and 11) are correct for your application.**

3) **Disconnect and lock out all incoming power to the AC drive. A DC bus voltage may be present at the terminal block for up to 1 minute after the power has been removed from the drive.**

4) **Connect the motor to the terminals U/T1, V/T2, and W/T3**

5) **Connect all applicable control wiring. Refer to the Control Circuit Wiring diagram in Chapter 2.**

6) **Reconnect the incoming power to the AC drive.**

7) **Check for correct motor shaft rotation (counter clockwise when viewed from the shaft).**

8) **Verify the Stop command is functioning by pressing the Stop Key on the Digital Keypad or using your Control Terminal Stop method.**

This completes the basic start-up. Depending on the application, some parameter values may need to be modified. Refer to Chapter 4 for parameter settings.

CHAPTER 4 SUMMARY OF PARAMETER SETTINGS

This chapter summarizes all the 10 groups of parameters. The page number shown in parenthesis will direct you to the explanation of settings associated with each parameter.

NO.	Parameter Name	Function Explanation	Parameter Value	Factory Setting
00	Command frequency source select (page 25)	Command frequency source select	d0000: Command frequency input determined by the digital control panel	d0000
			d0001: Command frequency input determined by the analog signal (DC 0 to +10 V) + (DC 4 to 20 mA)	
			d0002: Command frequency input determined by remote control via the RS-485 serial interface	
01	Operation Command source (page 25)	Operation command source select	d0000: Operating instructions determined by the digital control panel	d0000
			d0001: Operating instructions determined by the external terminal connections, keypad STOP key effective	
			d0002: Operating instructions determined by the external terminal connections, keypad STOP key not effective	
			d0003 Operating instructions determined by the RS-485 serial interface, keypad STOP key effective	
			d0004: Operating instructions determined by the RS-485 serial interface, keypad STOP key not effective	
02	Motor stop method (page 25)	Motor stop method	d0000: RAMP stop	d0000
			d0001: Coasting to stop	
03	V / F curve setting (page 26)	Max. operating	d050.0 - d400.0 Hz	d060.0
04		Max. voltage frequency	d010.0 - d400.0 Hz	d060.0
05		Max. output voltage	d002.0 - d255.0 V	d220.0
06		Mid-point frequency	d000.1 - d400.0 Hz	d001.5
07		Mid-point voltage	d002.0 - d255.0 V	d010.0
08		Min. output frequency	d000.1 - d020.0 Hz	d001.5
09		Min. output voltage	d002.0 - d050.0 V	d010.0

NO.	Parameter Name	Function Explanation	Parameter Value	Factory Setting
10	Accel / decel time Setting (page 30)	Acceleration time 1	d000.1 - d600.0 s	d010.0
11		Deceleration time 1	d000.1 - d600.0 s	d010.0
12		Acceleration time 2	d000.1 - d600.0 s	d010.0
13		Deceleration time 2	d000.1 - d600.0 s	d010.0
14	Jog accel / decel time (page 31)	Jog accel / decel time select	d000.1 - d600.0 s	d010.0
15	S-curve (page 32)	S-curve setting	d0000 - d0007	d0000
16	Multi-step speed operation (page 32)	Multi-step speed setting 1	d000.0 - d400.0 Hz	d000.0
17		Multi-step speed setting 2	d000.0 - d400.0 Hz	d000.0
18		Multi-step speed setting 3	d000.0 - d400.0 Hz	d000.0
19		Multi-step speed setting 4	d000.0 - d400.0 Hz	d000.0
20		Multi-step speed setting 5	d000.0 - d400.0 Hz	d000.0
21		Multi-step speed setting 6	d000.0 - d400.0 Hz	d000.0
22		Multi-step speed setting 7	d000.0 - d400.0 Hz	d000.0
23	Jog frequency (page 33)	Jog frequency select	d000.1 - d400.0 Hz	d006.0
24	REV run setting (page 33)	REV run	d0000: REV run enable	d0000
			d0001: REV run disable	
25	Over-voltage stall prevention (page 34)	Over-voltage stall prevention	d0000: Disable over-voltage stall prevention	d0001
			d0001: Enable over-voltage stall prevention	
26	Over-current stall prevention (page 34)	Over-current stall prevention during acceleration	d0050 - d0200 %	d0170
27		Over-current stall prevention during operation	d0050 - d0200 %	d0170
28	DC braking current setting (page 36)	DC braking current	d0000 - d0100%	d0000
29		DC braking time during start-up	d000.0 - d005.0 s	d000.0
30		DC braking time during stopping	d000.0 - d025.0 s	d000.0
31		DC braking start-up frequency	d000.0 - d060.0 Hz	d000.0
32	Momentary power loss protection (page 37)	Momentary power failure operation mode selection	d0000: Operation stops after momentary power Loss.	d0000
			d0001: Operation continues after momentary power loss. Speed search starts with the frequency reference value.	
			d0002: Operation continues after momentary power loss. Speed search starts with the minimum output frequency.	

NO.	Parameter Name	Function Explanation	Parameter Value	Factory Setting
33		Maximum allowable power loss time	d000.3 - d005.0 s	d002.0
34		Minimum base block time	d000.3 - d005.0 s	d000.5
35		Speed search current limit	d0030 - d0200 %	d0150
36	Reference freq. upper / lower limit	Reference frequency upper limit setting	d000.1 - d400.0 Hz	d400.0
37	setting (page 38)	Reference frequency lower limit setting	d000.0 - d400.0 Hz	d000.0
38	External control terminal setting (page 39)	2-wire / 3-wire operation control selection	d0000: FWD / STOP, REV / STOP	d0000
			d0001: FWD / REV, RUN / STOP	
			d0002: 3-WIRE operation control mode	
39	Multi-function input terminal setting (page 40)	Multi-function input 1	d0000: Multi-step speed command 1	d0000
40		Multi-function input 2	d0001: Multi-step speed command 2	d0001
41		Multi-function input 3	d0002: Multi-step speed command 3	d0002
			d0003: Jog frequency reference select	
			d0004: Accel / decel speed inhibit command	
			d0005: First and second accel/decel time select	
			d0006: External baseblock (NO- contact input)	
			d0007: External baseblock (NC- contact input)	
			d0008: Up command	
			d0009: Down command	
42	Analog meter output select (page 41)	Analog output select	d0000: Analog frequency meter (0 to Maximum Frequency)	d0000
			d0001: Analog current meter (0 to 250% of the rated drive output current)	
43	Digital output frequency multiplier factor (page 41)	Digital output frequency multiplier select	d0001 - d0020	d0001
44	Analog output gain setting (page 42)	Analog output gain select	d0001 - d0200 %	d0100
45	Multi-function output terminal setting (page 43)	Multi-function output terminal 1 (MO1)	d0000: AC drive operational	d0000
			d0001: Pre-set frequency attained	
46		Multi-function output terminal 2 (MO2)	d0002: Desired frequency attained	d0001
			d0003: Count down complete	
			d0004: Non-zero speed	
			d0005: Over-torque detection	
			d0006: Baseblock indicator	
			d0007: Low-voltage detect indicator	
			d0008: AC drive operation mode	
			d0009: Fault indicator	
47	Desired frequency attained setting (page 44)	Desired frequency attained	d000.0 - d400.0 Hz	d000.0

NO.	Parameter Name	Function Explanation	Parameter Value	Factory Setting
48	Analog input for output frequency range (page 44)	Max. output frequency voltage setting.	d000.0 - d010.0 V	d010.0
49		Min. output frequency voltage setting.	d000.0 - d010.0 V	d000.3
50	Reserved			
51	Reserved			
52	Motor current setting (page 46)	Motor rated current	d0030 - d0120 %	d0100
53		Motor no-load current	d0000 - d0099 %	d0040
54	Torque compensation setting (page 46)	Auto torque compensation gain	d0000 - d0010 %	d0000
55	Slip compensation (page 47)	Slip correction compensation	d000.0 - d010.0 %	d000.0
56	Reserved			
57	Multi-function indication output contact RA-RC (NO) RB-RC (NC) (page 47)		d0000: Fault indicator	d0000
			d0001: AC drive operational	
			d0002: Pre-set frequency attained	
			d0003: Desired frequency attained	
			d0004: Non-zero speed	
			d0005: Over-torque detection	
			d0006: Baseblock indicator	
58	Electronic thermal overload relay (page 48)	Motor current derated by temperature.	d0000: Active with standard motor	d0002
			d0001: Active with special motor	
			d0002: Inactive	
59	Electronic thermal characteristics selection (48)		d0030 d0300 s	d0060
60	Over-torque detection setting (page 49)	Over-torque detection mode select	d0000: Over-torque detection not enabled	d0000
			d0001: Over-torque detection during constant speed operation, operation halted after over-torque	
			d0002: Over-torque detection during constant speed operation, operation continues after over-torque detection	
			d0003: Over-torque detection during operation, operation halted after over-torque	
			d0004: Over-torque detection during operation, operation continues after over-torque detection	
61		Over-torque detection	d0030 d0200 %	d0150
62		Over-torque detection time	d000.1 d010.0 s	d000.1
64	Function display setting (page 51)	Function Display Setting	d0000: Displays the actual operating freq. (H)	d0000
			d0001: Displays the user-defined setting (v)	
			d0002: Displays the value of the internal Counter (c)	
65	Coefficient K setting for line speed (page 51)		d000.1 d200.0	d001.0

NO.	Parameter Name	Function Explanation	Parameter Value	Factory Setting
63	Pre-set count down setting (page 50)		d0001 - d9999	d0001
66	Count down value setting (page 50)		d0001 - d9999	d0001
67	Skip frequencies 1 to 3 setting (page 52)	Skip Frequency 1	d000.0 - d400.0 Hz	d000.0
68		Skip Frequency 2	d000.0 - d400.0 Hz	d000.0
69		Skip Frequency 3	d000.0 - d400.0 Hz	d000.0
70		Skip Frequency Band	d000.1 - d020.0 Hz	d000.1
71	PWM Frequency setting (page 53)	Carrier frequency select	d0001: *fc* = 3 kHz, d0002: *fc* = 6 kHz d0003: *fc* = 9 kHz, d0004: *fc* = 12 kHz d0005: *fc* = 15 kHz	d0003
72	Auto reset/restart operation after fault (page 53)		d0000 - d0010	d0000
73	Fault records (page 54)	Most recent fault record	d0000: Fault records clear (No errors occurred)	d0000
74		Second most recent fault record	d0001: Over-current (oc)	d0000
75		Third most recent fault record	d0002: Over-voltage (ov)	d0000
			d0003: Overheat (oH)	
			d0004: Overload (oL)	
			d0005: Overload 1 (oL1)	
			d0006: External fault (EF)	
			d0007: CPU failure 1 (CF1)	
			d0008: CPU Failure 3 (CF3)	
			d0009: Hardware protection failure (HPF)	
			d0010: O.C. during acceleration (ocA)	
			d0011: O.C. during deceleration (ocd)	
			d0012: O.C. during steady state operation (ocn)	
			d0013: Ground fault or fuse failure (GFF)	
			d0014-16: Manufacture used diagnostics	
			d0017: External baseblock (bb)	
			d0018: Overload 2 (oL2)	
			d0019-20: Manufacture used diagnostics	
76	Keypad lockout (page 54)	Keypad lockout or reset	d0000: All parameters can always be set and read	d0000
			d0001: All parameters are read-only	
			d0002-d0009: not used	
			d0010: Resets all parameters to the factory defaults	
77	Baud rate (page 55)	Data rate in bps	d0000: 1200 baud (Data rate bps)	d0002
			d0001: 2400 baud (Data rate bps)	
			d0002: 4800 baud (Data rate bps)	
78	Slave address (page 55)		d0000~d0031	d0000
79	Reserved			
80	AC motor drive model number and software version (page 56)			

CHAPTER 5 PARAMETER SETTINGS

Chapter 5 describes all SA drive parameters. These parameters are divided into groups to simplify"start-up" programming procedures and minimize tuning.

AC Drive parameters and functions:

Pr.00 Operating Frequency Source Select

Parameter #		**00**
Parameter Name		Master Frequency source select
Factory Setting		d0000
Settings	d0000	Master Frequency determined by the digital keypad
	d0001	Master Frequency determined by the analog input signal (DC 0 to +10V) + (DC 4 to 20 mA)
	d0002	Master Frequency determined by the RS-485 Interface.

This parameter is used to determine the AC drive command frequency source. However, the actual AC drive command frequency may also be determined by [Jog frequency], [Multi-step speed 1-7] or [Up / Down frequency], using the Multi-function inputs 1, 2, and 3. Refer to Pr.39, 40, 41.

Pr.01 Operation Command Source Select

Parameter #		**01**
Parameter Name		Operation instructions source select
Factory Setting		d0000
Settings	d0000	Operating instructions determined by the digital keypad
	d0001	Operating instructions determined by the external terminal connections, Keypad STOP key is enabled
	d0002	Operating instructions determined by the external terminal connections, Keypad STOP key is not enabled
	d0003	Operating instructions determined by the RS-485 interface, Keypad STOP key is enabled
	d0004	Operating instructions determined by the RS-485 interface, Keypad STOP key is not enabled

This parameter is used to determine the source of the AC Drive operating instructions.

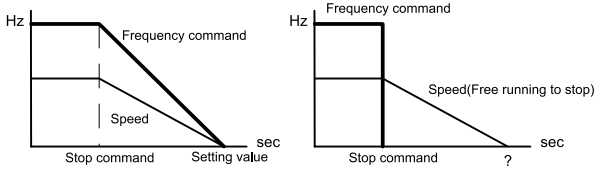
Pr.02 Motor Stop Method Select

Parameter #		**02**
Parameter Name		Motor stop method
Factory Setting		d0000
Settings	d0000	Ramp stop
	d0001	Coast to stop

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

Ramp The AC drive output frequency decelerates in the time specified by Pr.11 or Pr.13, down to the frequency specified by Pr.08, and then the drive output turns off.

Coast The AC drive is turned off immediately while the motor free runs until it comes to a complete stop.



Ramp **Coast**

V / F Data Setting

Pr.03 Pr.04 Pr.05 Pr.06 Pr.07 Pr.08 Pr.09 V / F Curve

Parameter #	**03**
Parameter Name	Maximum output frequency
Factory Setting	d060.0 Hz
Units	0.1 Hz
Parameter value	d050.0 - d400.0 Hz

This parameter determines the AC drive's maximum output frequency. All the AC drive analog inputs (0 - 10V, 4 - 20mA) are scaled to correspond to the output frequency range. (See graph on Page 24)

Parameter #	**04**
Parameter Name	Maximum voltage frequency (Base frequency)
Factory Setting	d060.0 Hz
Units	0.1 Hz
Parameter value	d010.0 -d400.0 Hz

This value should be set according to rated frequency of the motor as indicated on the motor nameplate (See graph on Page 24). Maximum voltage frequency determines the volts per hertz ratio. For example, if the drive is rated for 460 VAC output and the maximum voltage frequency is set to 60Hz, the drive will maintain a constant ratio of 7.66 v/Hz.

Parameter #	**05**
Parameter Name	Maximum output voltage
Factory Setting	d220.0 V ; d440.0 for 440 V class.
Units	0.1 V
Parameter value	d002.0 - d255.0 V ; d004.0 – d510.0 for 440 V class.

This parameter determines the Maximum Output Voltage of the AC drive. The maximum output voltage setting must be smaller than or equal to the rated voltage of the motor as indicated on the motor nameplate. (See graph on Page 24)

Parameter #	**06**
Parameter Name	Mid-point frequency
Factory Setting	d001.5 Hz
Units	0.1 Hz
Parameter value	d000.1 - d400.0 Hz

This parameter sets the Mid-point frequency on the V/F curve. It may be used to determine the V/F ratio between the Minimum frequency and the Mid-point frequency. (See graph on Page 24)

Parameter #	**07**
Parameter Name	Mid-point voltage
Factory Setting	d010.0 V ; d020.0 for 440 V class.
Units	0.1 V
Parameter value	d002.0 - d255.0 V ; d004.0 – d510.0 for 440 V class.

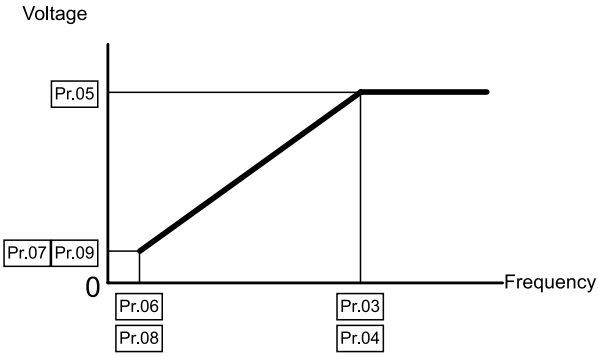
This parameter sets the Mid-point voltage on the V/F curve. It may be used to determine the V/F ratio between the Minimum frequency and the Mid-point frequency. (See graph on Page 24)

Parameter #	**08**
Parameter Name	Minimum output frequency
Factory Setting	d001.5 Hz
Units	0.1 Hz
Parameter value	d000.1 - d020.0 Hz

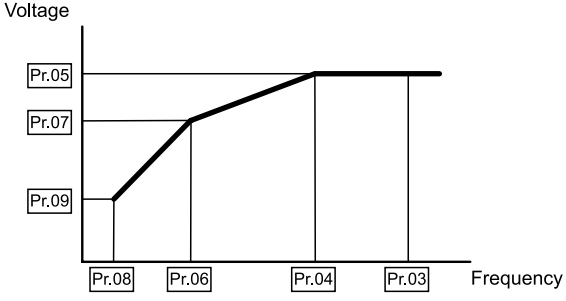
This parameter sets the minimum output frequency of the AC Drive. (See graph on Page 24)

Parameter #	**09**
Parameter Name	Minimum output voltage
Factory Setting	d010.0 V ; d020.0 for 440 V class.
Units	0.1 V
Parameter value	d002.0 - d050.0 V ; d004.0 – d100.0 for 440 V class.

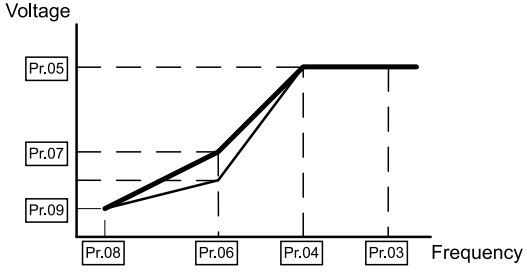
This parameter sets the minimum output voltage of the AC Drive.



Standard V/F Curve

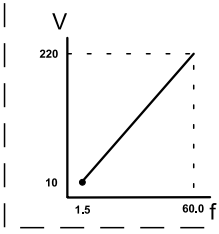


Custom V/F Curve

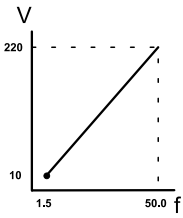


Fan/Pump V/F Curve

Motor Spec. 60Hz



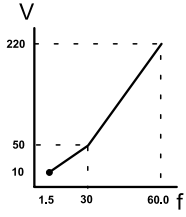
Factory Settings	
No.	
Pr.03	60.0
Pr.04	60.0
Pr.05	220.0
Pr.06	1.5
Pr.07	10.0
Pr.08	1.5
Pr.09	10.0



No.	
Pr.03	50.0
Pr.04	50.0
Pr.05	220.0
Pr.06	1.3
Pr.07	12.0
Pr.08	1.3
Pr.09	12.0

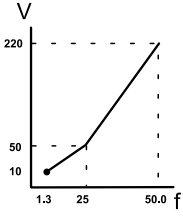
(2) Fans and Pumps

Motor Spec. 60Hz



No.	
Pr.03	60.0
Pr.04	60.0
Pr.05	220.0
Pr.06	30
Pr.07	50.0
Pr.08	1.5
Pr.09	10.0

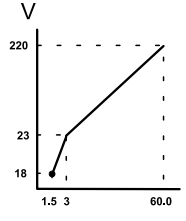
I



No.	
Pr.03	50.0
Pr.04	50.0
Pr.05	220.0
Pr.06	25
Pr.07	50.0
Pr.08	1.3
Pr.09	10.0

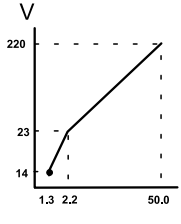
(3) High Starting Torque

Motor Spec. 60Hz



No.	
Pr.03	60.0
Pr.04	60.0
Pr.05	220.0
Pr.06	3.0
Pr.07	23
Pr.08	1.5
Pr.09	18.0

Motor Spec. 50Hz



No.	
Pr.03	50.0
Pr.04	50.0
Pr.05	220.0
Pr.06	2.2
Pr.07	23.0
Pr.08	1.3
Pr.09	14

Pr.10 Pr.11 Pr.12 Pr.13 Accel / Decel Time Setting

Parameter #	**10**
Parameter Name	Acceleration Time 1
Factory Setting	d010.0 s
Units	0.1 s
Parameter value	d000.1 - d600.0 s

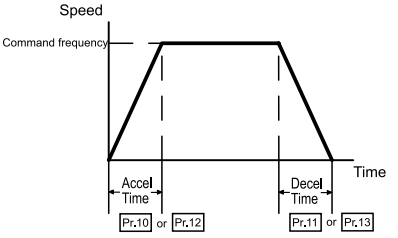
☛ This parameter can be programmed while the drive is running.

✎ This parameter is used to determine the time required for the AC drive to ramp from 0 Hz to its Maximum operating frequency (Pr.03). The rate is linear unless S Curve is “Enabled.”

Parameter #	**11**
Parameter Name	Deceleration Time 1
Factory Setting	d010.0 s
Units	0.1 s
Parameter value	d000.1 - d600.0 s

☛ This parameter can be programmed while the drive is running.

✎ This parameter is used to determine the time required for the AC drive to decelerate from the Maximum operating frequency (Pr.03) down to 0 Hz. The rate is linear unless S Curve is “Enabled.”



Parameter #	**12**
Parameter Name	Acceleration time 2
Factory Setting	d010.0 s
Units	0.1 s
Parameter value	d000.1 - d600.0 s

☛ This parameter can be programmed while the drive is running.

✎ This parameter determines the time required for the AC drive to ramp from 0 Hz to the Maximum operating frequency (Pr.03). The rate is linear unless S Curve is "Enabled." Acceleration time 1 is the default. A Multi-Function Input Terminal can be programmed to select Acceleration time 1 or Acceleration time 2. See parameters 39, 40, and 41.

Parameter #	**13**
Parameter Name	Deceleration time 2
Factory Setting	d010.0 s
Units	0.1 s
Parameter value	d000.1 - d600.0 s

☛ This parameter can be programmed while the drive is running.

✎ This parameter determines the time for the AC drive to decelerate from the Maximum operating frequency (Pr.03) down to 0 Hz. The rate is linear unless S Curve is "Enabled." Deceleration time 1 is the default. A Multi-Function Input Terminal can be programmed to select Deceleration time 1 or Deceleration time 2. See parameters 39, 40, and 41.

Pr.14 Jog Accel / Decel Time

Parameter #	**14**
Parameter Name	Jog Accel / Decel time select
Factory Setting	d010.0 s
Units	0.1 s
Parameter value	d000.1 - d600.0 s

☛ This parameter can be programmed while the drive is running.

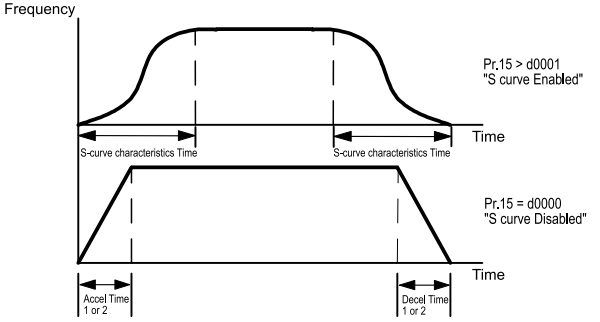
✎ This parameter determines the time required for the AC Drive to ramp from 0 Hz to the Jog frequency and the time required to ramp from the Jog frequency to 0 Hz.

✎ This parameter must accompany with parameter P111 deceleration S curve. In order to get the different results of S curves, just setting the parameter P111 to meet the requirement.

Pr.15 S-curve

Parameter #	**15**
Parameter Name	S-curve setting
Factory Setting	d0000 (Disabled)
Parameter value	d0000 - d0007

This parameter should be set during start-up. It is used to provide smooth acceleration and deceleration. The S-curve may be set from 1 to 7.



Frequency Reference Setting

Pr.16 Pr.17 Pr.18 Pr.19 Pr.20 Pr.21 Pr.22 Multi-speed Operation

Parameter #	**16, 17, 18, 19, 20, 21, 22**
Parameter Name	Multi-step speed setting 1, 2, 3, 4, 5, 6, 7
Factory Setting	d000.0 Hz
Units	0.1 Hz
Parameter value	d000.1 - d400.0 Hz

These parameters can be programmed while the drive is running.

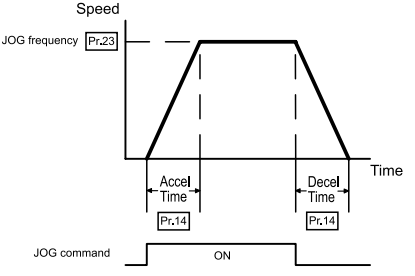
The multi-function input terminals (refer to parameters 39, 40, and 41) are used to select one of eight AC drive Multi-Speed output frequencies. The frequency is determined by Pr.16 to 22.

Pr.23 Jog Frequency

Parameter #	**23**
Parameter Name	Jog frequency select
Factory Setting	d006.0 Hz
Units	0.1 Hz
Parameter value	d000.1 - d400.0 Hz

☛ This parameter can be programmed while the drive is running.

✎ This parameter is used to set the AC drive jog frequency. Upon receipt of a jog command the drive will ramp to the jog frequency.



Pr.24 REV Run Setting

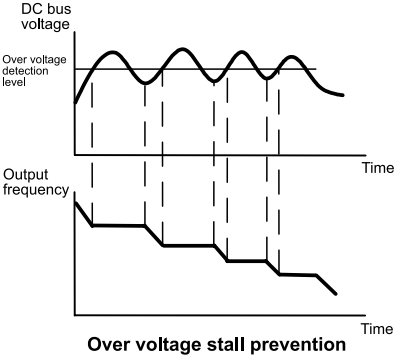
Parameter #	**24**	
Parameter Name	REV run	
Factory Setting	d0000	
Settings	d0000	REV run enabled
	d0001	REV run disabled

✎ This parameter determines whether the AC Drive can operate in the reverse direction.

Pr.25 Over-voltage Stall Prevention

Parameter #	**25**	
Parameter Name	Over-voltage stall prevention during deceleration	
Factory Setting	d0001	
Settings	d0000	Disable over-voltage stall prevention
	d0001	Enable over-voltage stall prevention

During deceleration, the motor DC bus voltage may exceed its maximum allowable value due to motor regeneration. When Pr.25 is enabled and an over-voltage is detected, the AC drive will cease to decelerate and will then maintain a constant output frequency. The drive will only resume deceleration when the DC bus voltage drops below the preset value.

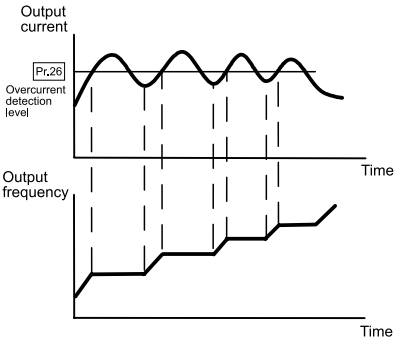


Over voltage stall prevention

Pr.26 Pr.27 Over-current Stall Prevention

Parameter #	**26**	
Parameter Name	Over-current stall prevention during acceleration	
Factory Setting	d0170 %	
Units	1%	
Parameter value	d0050 - d0200 %	

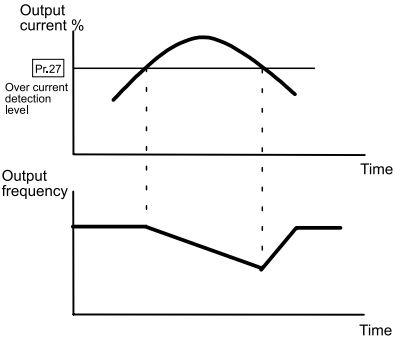
During periods of rapid acceleration or excessive load on the motor, the AC drive output current may increase abruptly and exceed the value specified by Pr.26. When over-current occurs, the AC drive will cease to accelerate and will maintain a constant output frequency until the current falls below the preset value. (The drive will only resume acceleration when the current drops below the preset value.)



Stall prevention during acceleration

Parameter #	**27**
Parameter Name	Over-current stall prevention during steady-state operation
Factory Setting	d0170%
Units	1%
Parameter value	d0050 - d0200%

During steady-state operation with the motor load rapidly increasing, the AC drive output current may exceed the limit specified in Pr.27. When this occurs, the output frequency will decrease to maintain a constant motor speed. The drive will accelerate to the steady-state operating frequency only when the output current drops below the level specified by Pr.27. A setting of 100% is equal to the rated current of the drive.



Over-current stall prevention during steady-state operation

Parameter #	**28**
Parameter Name	DC braking current
Factory Setting	d0000%
Units	1%
Parameter value	d0000 - d0100%

This parameter determines the DC current that will be applied to the motor during braking when the Motor Stop Method is set to "RAMP stop" (refer to Pr.02). DC braking current is set in increments of 1%. A setting of 100% is equal to the rated current of drive.

Note: When setting this parameter, begin at a lower current level then increase the value until sufficient holding torque is achieved. The rated motor current cannot be exceeded.

Parameter #	**29**
Parameter Name	DC braking time during start-up
Factory Setting	d000.0 s
Units	0.1 s
Parameter value	d000.0 - d005.0 s

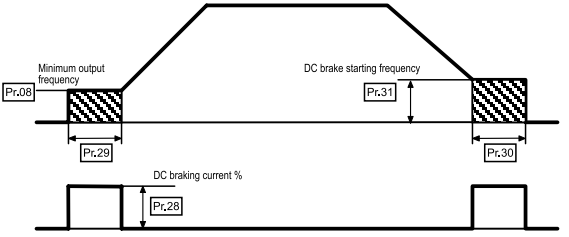
This parameter determines the time duration that DC braking current will be applied to the motor during the AC drive start-up.

Parameter #	**30**
Parameter Name	DC braking time during stopping
Factory Setting	d000.0 s
Units	0.1 s
Parameter value	d000.0 - d025.0 s

This parameter determines the time duration that DC braking current will be applied to the motor when the Motor Stop Method is set to "Ramp Stop".

Parameter #	**31**
Parameter Name	DC braking starting frequency
Factory Setting	d000.0 Hz
Units	0.1 Hz
Parameter value	d000.0 - d060.0 Hz

This parameter determines the frequency at which DC breaking will start during AC drive deceleration. The frequency may be set in 0.1 Hz increments. When the preset value is less than that specified by Pr.08 (Minimum output frequency), the starting frequency for DC braking will be the Pr.08 frequency.



Pr.32 Pr.33 Pr.34 Pr.35 Momentary Power Loss Protection

Parameter #		**32**
Parameter Name		Momentary power failure operation mode
Factory Setting		d0000
Settings	d0000	Operation stops after momentary power loss
	d0001	Operation continues after momentary power loss. Speed search starts with the frequency reference value
	d0002	Operation continues after momentary power loss. Speed search starts with the Minimum output frequency, Pr.08
	Note	Multi-function Indication and Photocoupler outputs that are programmed for “fault indication” will not be energized during restart after a momentary power failure. (refer to Pr. 45 and 57)

This parameter determines the AC drive mode of operation after recovery from a momentary power failure.

Parameter #	**33**
Parameter Name	Maximum allowable power loss time
Factory Setting	d002.0 s
Units	0.1 s
Parameter value	d000.3 - d005.0 s

If during a power failure the power loss is less than the time defined by Pr.33, then the AC drive will resume operation (set by Pr.32). If the maximum allowable power loss time is exceeded, the AC drive output power will remain off and must be reset to resume operation (the fault indication will be set).

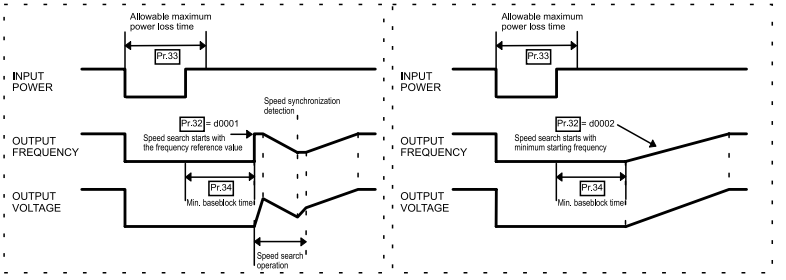
Parameter #	**34**
Parameter Name	Minimum base block time
Factory Setting	d000.5 s
Units	0.1 s
Parameter value	d000.3 - d005.0 s

When a momentary power loss is detected and the power failure is less than the time set by Pr.33, the AC drive output will resume operation after the specified period of time determined by Pr.34. This parameter should be set to a value where the residual output voltage is nearly zero.

Parameter #	**35**
Parameter Name	Speed Search Current Limit
Factory Setting	d0150%
Units	1%
Parameter value	d0030 - d0200%

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

Speed search time increases as the current limit setting is reduced.



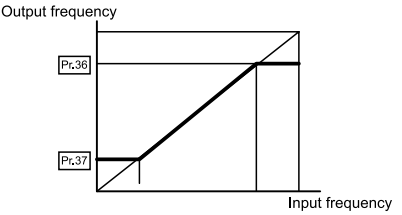
Pr.36 Pr.37 Reference Frequency Upper / Lower Limit

Parameter #	**36**
Parameter Name	Reference frequency upper limit setting
Factory Setting	d400.0 Hz
Units	0.1 Hz
Parameter value	d000.1 - d400.0 Hz

Determines the upper limit of the reference frequency in 0.1 Hz increments.

Parameter #	**37**
Parameter Name	Reference frequency lower limit setting
Factory Setting	d000.0 Hz
Units	0.1 Hz
Parameter value	d000.0 - d400.0 Hz

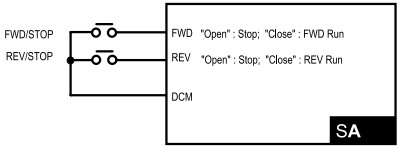
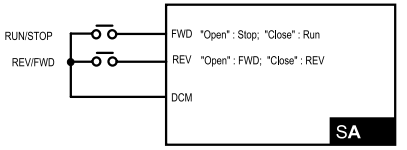
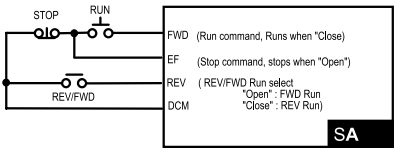
Determines the lower limit of the reference frequency in 0.1 Hz increments.



Pr.38 External Control Terminal Configuration

Parameter #	**38**	
Parameter Name	2-wire / 3-wire operation control selection	
Factory Setting	d0000	
Settings	d0000	FWD / STOP, REV / STOP
	d0001	FWD / REV, RUN / STOP
	d0002	3-WIRE operation control mode

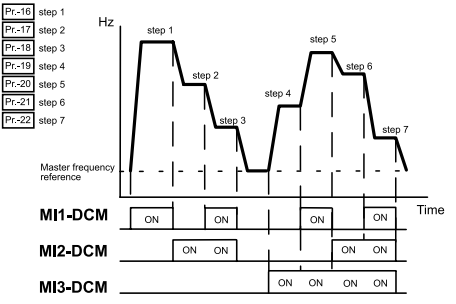
This parameter determines the control functions and operating modes available through the external control terminals. The following configurations are available:

Pr.38	Control terminal wiring diagram
d0000 Two wire FWD / STOP REV / STOP	
d0001 Two wire REV / FWD RUN / STOP	
d0002 Three wire	

Parameter #		**39 (MI1), 40 (MI2), 41 (MI3)**
Parameter Name		Multi-function input terminals 1, 2, 3
Factory Setting		d0000, d0001, d0002
Settings	d0000	Multi-step speed command 1
	d0001	Multi-step speed command 2
	d0002	Multi-step speed command 3
	d0003	Jog frequency reference select
	d0004	Accel/decel speed inhibit command
	d0005	First and second accel/decel time select
	d0006	External baseblock (NO-contact input)
	d0007	External baseblock (NC-contact input)
	d0008	Up command
	d0009	Down command

- Parameter setting value limit Pr.41> Pr.40> Pr.39.
- Description

d0000□d0002: The multi-step speed commands 1 to 3 are used to determine a command frequency via the multi-step speed settings (Pr.16 to Pr.22).



d0003: When “Closed,” the jog reference frequency is selected.

d0004: When “Closed,” the output frequency remains constant.

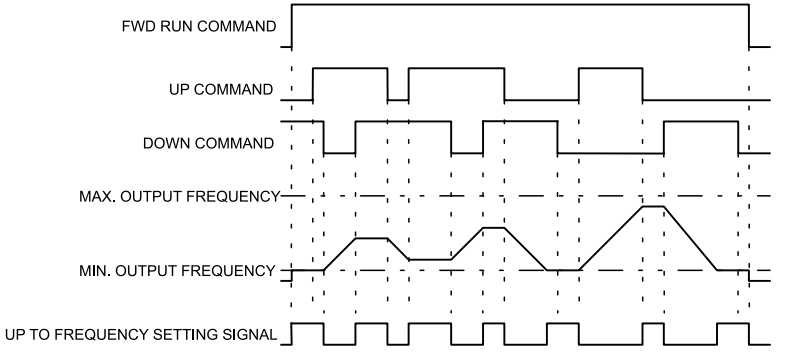
d0005: When “Open,” the AC drive accelerates / decelerates according to the values set by ACCEL time 1 and DECEL time 1 (Pr.10,11). When “Closed,” the AC drive accelerates / decelerates according to the values set by in ACCEL time 2 and DECEL time 2 (Pr.12, 13).

d0006: When “Closed,” the AC drive output is turned off. (The reference frequency is held constant.)

d0007: When “Open,” the AC Drive output is turned off. (The reference frequency is held constant)

d0008: When “Closed,” the AC Drive output frequency is increased.

d0009: When “Closed,” the AC Drive output frequency is decreased.



Note: When both the Up and Down command terminals are “closed”, the AC drive neither accelerates or decelerates. The output frequency is also held constant.

Pr.42 Analog Meter Output Select

Parameter #		**42**
Parameter Name		Analog meter output select
Factory Setting		d0000
Settings	d0000	Analog frequency meter (0 to [Maximum Frequency])
	d0001	Analog current meter (0 to 250% of the rated drive output current)

This parameter selects the analog Meter output for either output frequency or output current (refer to Control Terminals AFM, ACM).

Pr.43 Digital Output Frequency Multiplier Factor

Parameter #	**43**
Parameter Name	Digital output frequency multiplier factor
Factory Setting	d0001
Units	1
eter value	d0001 - d0020

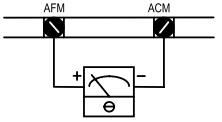
This parameter determines the multiplying factor for the AC drive digital output frequency (+10V pulse, 50% duty cycle) at the digital output terminals (DFM, DCM). The number of output pulses per second on DFM is equal to the AC drive output frequency multiplied by Pr.43. The maximum output frequency is 1.2 kHz or less.

Pr.44 Analog Output Gain Setting

Parameter #	**44**
Parameter Name	Analog output gain setting
Factory Setting	d0100%
Units	1%
Parameter value	d0001 - d0200%

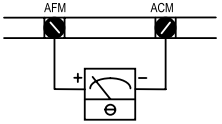
☛ This parameter can be programmed while the drive is running.

✎ This function regulates the voltage level of the analog signal output (frequency or current) at the AFM output terminal, which is then fed to the meter.



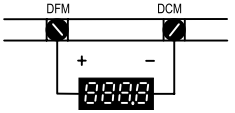
Analog frequency meter

The analog voltage output is proportional to the AC drive output frequency. The AC drive maximum operating frequency (Pr.03) is equivalent to 10 VDC. If necessary, adjust the output level using Pr.44 Analog Output Gain.

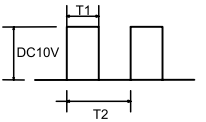


Analog current meter

The analog voltage output is proportional to the AC drive output current. 10 VDC of analog voltage is equivalent to 2.5 times the AC drive rated output current. If necessary, adjust the output level using Pr.44 Analog Output Gain.



Digital frequency meter



T1 / T2 (duty cycle) = 50%
The number of output pulses per second is equal to the output frequency multiplied by [Pr.43].
Note: The digital frequency output should be less than 1.2 kHz.

Parameter #	**45 (MO1), 46(MO2)**	
Parameter Name	Multi-function photocoupled output terminals: MO1, MO2	
Factory Setting	d0000, d0001	
Units	None	
Settings	d0000	AC drive operational
	d0001	Pre-set frequency attained
	d0002	Desired frequency attained
	d0003	Count down complete
	d0004	Non-zero speed
	d0005	Over-torque detection
	d0006	Baseblock indicator
	d0007	Low-voltage detect indicator
	d0008	AC drive operation mode
	d0009	Fault indicator

Please see descriptions below.

✎ Control terminals MO1 and MO2 are open collector outputs. Terminal MCM is signal return (refer to Control Terminal Block description).

✎ Description

0. AC drive operational: This terminal will be “closed” when there is output from the AC drive or when the FWD or REV run command is input.

1. Pre-set frequency attained: This terminal will be “closed” once the AC drive attained the specified operating frequency.

2. Desired frequency attained: This terminal will be “closed” once the AC drive attained the desired operating frequency.

3. Count down complete: This terminal will be “closed” when the AC drive’s internal counter, triggered by the external input TRG, starts countdown and reaches d0001. Set the count down value using Pr.63 and Pr.66.

4. Non-zero speed: This terminal will be “closed” when the AC drive output frequency is greater than the minimum output frequency.

5. Over-torque detection: This terminal will remain “closed” as long as over-torque is detected. Set the over-torque detection level using Pr.61 and the over-torque detection time using Pr.62.

6. Baseblock indicator: This terminal will always be “closed” as long as the AC drive output is turned off.

7. Low-voltage detect indicator: This terminal will be “closed” when the AC drive detects a low voltage state.

8. AC drive operation mode: This terminal will be “closed” when the AC drive is operated by commands via the RS-485 serial interface or control terminals.

9. Fault indicator: This terminal will be “closed” when a major fault is detected.

Pr.47 Desired Frequency Attained Setting

Parameter #	**47**
Parameter Name	Desired frequency attained setting
Factory Setting	d000.0 Hz
Units	0.1 Hz
Parameter value	d000.0 - d400.0 Hz

✎ Used to select a specified frequency, set in increments of 0.1 Hz. (See Pr.45, 46)

Pr.48 Pr.49 Analog Input Setting for Output Frequency Range

Parameter #	**48**
Parameter Name	Maximum output frequency voltage setting
Factory Setting	d010.0 V
Units	0.1 V
Parameter value	d000.0 - d010.0 V

☛ This parameter can be programmed while the drive is running.

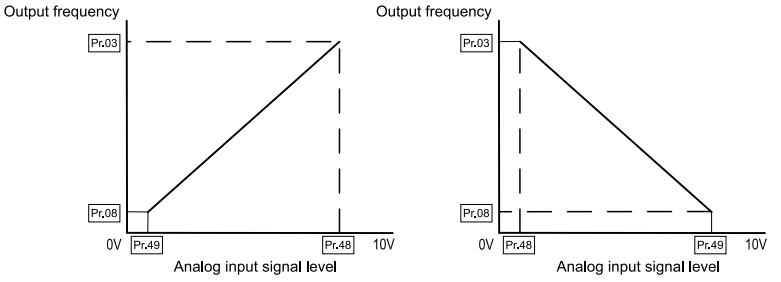
✎ Sets the input signal voltage level (0 – 10V) that corresponds to the **maximum output frequency** (Pr.03). Used in conjunction with Pr.49, this parameter may be used to set the analog input for frequency command curve setting. (See graph on next page)

Parameter #	**49**
Parameter Name	Minimum output frequency voltage setting
Factory Setting	d000.3 V
Units	0.1 V
Parameter value	d000.0 - d010.0 V

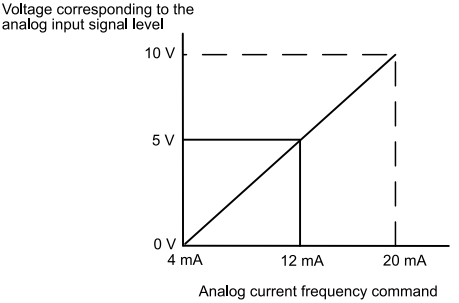
☛ This parameter can be programmed while the drive is running.

✎ Sets the input signal voltage level (0 – 10V) that corresponds to the **minimum output frequency** (Pr.08). (See graph on next page)

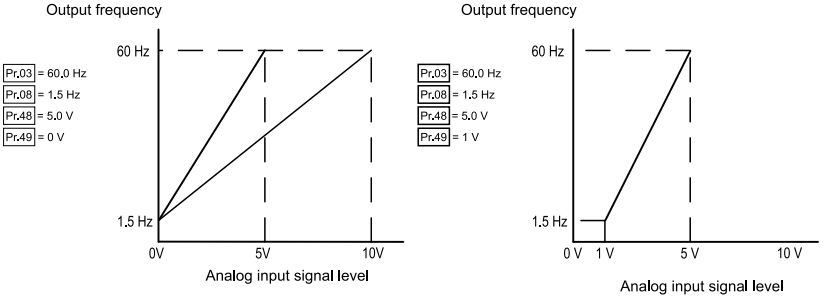
Note: The absolute value of the difference between the settings of Pr.48 and Pr.49 should be greater than or equal to 3.



The analog input signal level is the combined input signals from the analog voltage input (AVI) (0 - 10 V) and analog current input (ACI) (4 - 20 mA). The voltage corresponding to the analog current input (4 - 20 mA) and analog input signal level is defined as follows:



An example of such application may be illustrated as follows:



Pr.50 Reserved

Pr.51 Reserved

Pr.52 Pr.53 Motor Current Setting

Parameter #	**52**
Parameter Name	Motor rated current
Factory Setting	d0100%
Units	1%
Parameter value	d0030 - d0120%

☛ This parameter can be programmed while the drive is running.

✎ This parameter must be set according to the motor specification found on its nameplate. This setting will limit the AC drive output current in order to prevent the motor from overheating. When the motor current exceeds this value, the output frequency will be reduced until the current drops below this limit.

Parameter #	**53**
Parameter Name	Motor no-load current
Factory Setting	d0040
Units	1%
Parameter value	d0000 - d0099%

☛ This parameter can be programmed while the drive is running.

✎ This parameter sets the motor no-load current in 1% increments.

Pr.54 Torque Compensation Setting

Parameter #	**54**
Parameter Name	Auto torque-compensation
Factory Setting	d0000
Units	1%
Parameter value	d0000 - d0010%

☛ This parameter can be programmed while the drive is running.

✎ This parameter may be set so that the AC drive will increase the voltage output during startup to obtain a higher initial starting torque. This additional torque will be present until the master operating frequency is attained.

! Be careful while setting the value for Pr.54. If the value is too high, the motor might overheat or be damaged.

Pr.55 Slip Compensation

Parameter #	**55**
Parameter Name	Slip compensation
Factory Setting	d000.0
Units	0.1%
Parameter value	d000.0 - d010.0%

☛ This parameter can be programmed while the drive is running.

✎ This parameter is used to compensate for the nominal slip within a range of 0.0 - 10.0%. When the output current of the AC drive is greater than the motor no-load current (Pr.53), the AC drive will adjust its output frequency according to Pr.55.

✎ Example: If Pr. 04 is set at 60Hz and Pr. 55 is set at 10%, the drive will increase the output frequency up to 6% under full load conditions to compensate for slip.

Pr.56 Reserved

Pr.57 Multi-function Indication Output Contact

Parameter #		**57**
Parameter Name		Multi-function indication output contact **RA-RC(NO), RB-RC(NC)**
Factory Setting		d0000
Settings	d0000	Fault indicator
	d0001	AC drive operational
	d0002	Pre-set frequency attained
	d0003	Desired frequency attained
	d0004	Non-zero speed
	d0005	Over-torque detection
	d0006	Baseblock indicator

✎ This parameter sets the multi-function programmable relay contact outputs. The contact ratings are 250Vac @ 2A, 30Vdc @ 2A. Set parameter Pr.57 according to the table listed above.

Pr.58 Pr.59 Electronic Thermal Overload Relay

Parameter #	**58**	
Parameter Name	Motor derating curve during temperature change	
Factory Setting	d0002	
Units	None	
Settings	d0000	Active with standard motor
	d0001	Active with special motor
	d0002	Inactive

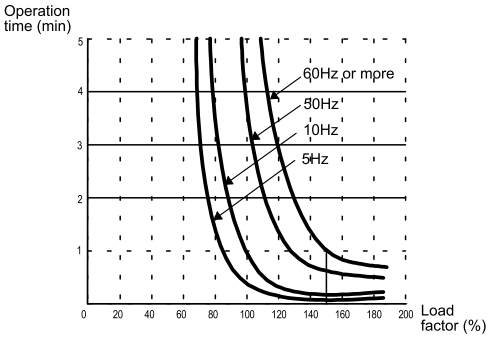
To prevent self-cooling motors from over-heating while running at low speeds, this parameter may be set to limit the AC drive output power.

d0000: The electronic thermal characteristics behave in accordance with a reduced torque motor (standard motor).

d0001: The electronic thermal characteristics behave in accordance with a constant torque motor (special motor).

Parameter #	**59**
Parameter Name	Electronic thermal characteristics selection
Factory Setting	d0060
Units	1 s
Parameter value	d0030 - d0300 s.

This parameter determines the time required to activate the I^2t electronic thermal protection function. The activation time may be defined according to short, standard and long time ratings.



Parameter #	**60**	
Parameter Name	Over-torque detection mode select	
Factory Setting	d0000	
Settings	d0000	Over-torque detection not enabled
	d0001	Over-torque detection during constant speed operation, operation halted after over-torque detection
	d0002	Over-torque detection during constant speed operation, operation continues after over-torque detection
	d0003	Over-torque detection during operation, operation halted after over-torque detection
	d0004	Over-torque detection during operation, operation continues after over-torque detection

✎ This parameter determines the AC drive operation after an over-torque is detected. Over-torque detection is based on the following: When the output current exceeds the over-torque detection level (Pr.61, factory preset value = 150%) and the over-torque detection time (Pr.62, factory preset value = 0.1 second, hysteresis fixed at 10%). The Multi-function PHC output 1 and 2 may be set to indicate an over-torque condition. Refer to Pr.45, 46. The Multi-function Indication Output (Pr. 57) may also be set to indicate an over-torque condition.

Parameter #	**61**
Parameter Name	Over-torque detection level
Factory Setting	d0150
Units	1%
Parameter value	d0030 - d0200%

✎ This parameter sets the over-torque detection level at 1% increments. The AC drive rated current is regarded as 100%.

Parameter #	**62**
Parameter Name	Over-torque detection time
Factory Setting	d000.1 s
Units	0.1 s
Parameter value	d000.1 - d010.0 s

✎ This parameter sets the over-torque detection time in units of 0.1 second.

Pr.63 Pre-set Count Down Value Attained Setting

Parameter #	**63**
Parameter Name	Pre-set count down value attained
Factory Setting	d0001
Parameter value	d0001 - d9999

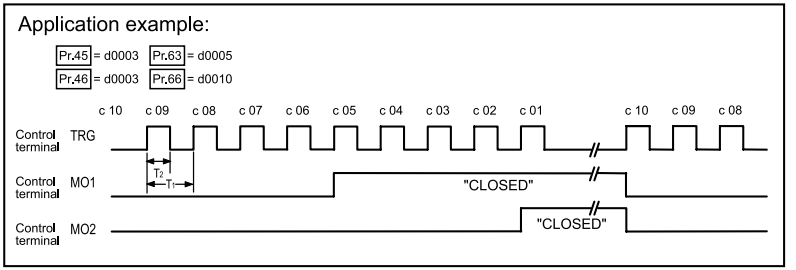
When the SA internal counter, triggered by the external input TRG, counts down and reaches this specified value, the specified output terminal (MO1) will be closed (assuming that Pr.45 is set to d0003). The output terminal (MO1) will be opened when the internal counter reaches the value specified in Pr.66. (See chart below)

Pr.66 Count Down Value Setting

Parameter #	**66**
Parameter Name	Count down value setting
Factory Setting	d0001
Units	1
Parameter value	d0001 - d9999

This parameter determines the value of the SA internal counter. The internal counter may be triggered by an external signal via the external input TRG terminal. Upon completion of the countdown, the specified output terminal (MO2) will be closed (assuming that Pr.46 is set to d0003). (See chart below)

The timing chart is illustrated as follows:



Note: The minimum On time for T2 is 2 msec or more.
The minimum cycle time for T1 is 6 msec. or more.

Pr.64 Function Display Setting

Parameter #		**64**
Parameter Name		Displays the contents of the monitored item
Factory Setting		d0000
Settings	d0000	Displays the actual operating frequency (H)
	d0001	Displays the user-defined setting (v)
	d0002	Displays the value of the internal counter (c)

Displays the contents of the monitored item as follows:

H: Displays the actual operation frequency
v: Displays the user-defined setting (where v = H x Pr.65)

c: Displays the value of the internal counter. This counter is triggered by an external signal provided via the external input TRG. When the counter reaches d0000 during count down, the multi-function output terminal MO1 or MO2 will be "closed" (Refer to Pr.45, 46). The counter will use the value contained in Pr.66 as its starting point when another count down is to be executed.

Pr.65 Coefficient K Setting

Parameter #	**65**
Parameter Name	Coefficient of line speed
Factory Setting	d001.0
Units	0.1
Parameter value	d000.1 - d200.0

This parameter can be programmed while the drive is running.

Coefficient K determines the multiplying factor for the user-defined setting (v).

The value of the user-defined setting (v) is calculated and displayed as follows: Display value of v = output frequency x K. The maximum value that can be displayed is u9999. If the value of v exceeds 9999, the actual value is equal to the display value multiplied by 10.

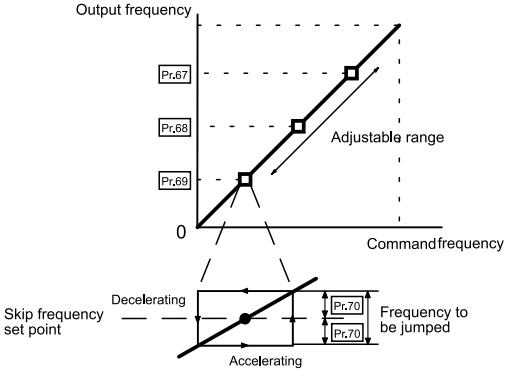
Pr.67 Pr.68 Pr.69 Pr.70 Skip Frequencies 1 to 3 Setting

Parameter #	**67, 68, 69**
Parameter Name	Skip frequency 1, 2, 3
Factory Setting	d000.0 Hz
Units	0.1 Hz
Parameter value	d000.1 - d400.0 Hz

This parameter determines the three skip frequencies, which in conjunction with Pr.70 [Skip Frequency Band] will cause the AC drive to skip operation at these frequency ranges. (See graph below)

Parameter #	**70**
Parameter Name	Skip frequency band
Factory Setting	d000.1
Units	0.1 Hz
Parameter value	d000.1 - d020.0 Hz

This parameter determines the frequency band of a given [Skip frequency]. The actual band is 2 x Skip frequency band, half of which is above and the other half is below the [Skip frequency] setting. Setting this parameter to 0.1 to disable all skip frequencies. (See graph below)



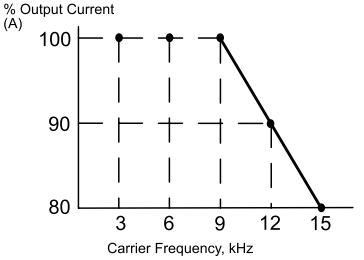
Pr.71 PWM Frequency Setting

Parameter #	**71**	
Parameter Name	PWM frequency setting	
Factory Setting	d0003	
Settings	d0001	fc = 3 kHz
	d0002	fc = 6 kHz
	d0003	fc = 9 kHz
	d0004	fc = 12 kHz
	d0005	fc = 15 kHz

This parameter determines the carrier frequency for the PWM (Pulse Width Modulation) output.

Carrier frequency	Acoustic noise	Leakage current	Heat dissipation
3 kHz	significant	minimal	minimal
6 kHz	↑	↑	↑
9 kHz	↓	↓	↓
12 kHz	↓	↓	↓
15 kHz	minimal	significant	significant

Note: For AC drives rated below 7.5 kW (10HP), the output current derating applies above 9 kHz. For AC drives rated 7.5kW and above, the output current derating applies above 12kHz. See figure below:



Pr.72 Auto Reset / Restart Operation after Fault

Parameter #	**72**
Parameter Name	Auto reset / restart operation after fault
Factory Setting	d0000
Parameter value	d0000 - d0010

✎ Reset / restart operation may be performed up to 10 times after a fault has occurred. Setting this parameter to 0 disables the reset / restart operation after any fault has occurred. If a protective shut-down operation (oc, ov) occurs during operation, the auto reset / restart function can be selected. (Refer to Fault Names in Ch. 7)

Pr.73 Pr.74 Pr.75 Fault Records

Parameter #		**73, 74, 75**
Parameter Name		Three most recent fault records
Factory Setting		d0000
Settings	d0000	
	d0001	Over-current (oc)
	d0002	Over-voltage (ov)
	d0003	Overheat (oH)
	d0004	Overload (oL)
	d0005	Overload 1 (oL1)
	d0006	External fault (EF)
	d0007	CPU failure 1 (CF1)
	d0008	CPU failure 3 (CF3)
	d0009	Hardware protection failure (HPF)
	d0010	Over-current during acceleration (ocA)
	d0011	Over-current during deceleration (ocd)
	d0012	Over-current during steady state operation (ocn)
	d0013	Ground fault or fuse failure (GFF)
	d0014	Manufacturer-used diagnostics
	d0015	Manufacturer-used diagnostics
	d0016	Manufacturer-used diagnostics
	d0017	External baseblock (bb)
	d0018	Overload 2 (oL2)
	d0019	Manufacturer-used diagnostics
	d0020	Manufacturer-used diagnostics

✎ These parameters store records of the three most recent faults that have occurred.

Pr.76 Keypad Lockout / Reset

Parameter #		**76**
Parameter Name		Keypad Lockout / Reset
Factory Setting		d0000
Settings	d0000	All parameters can always be set and read
	d0001	All parameters are read-only
	d0002 - d0009	Not used
	d0010	Resets all parameters to the factory defaults

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

Pr.77 Baud Rate

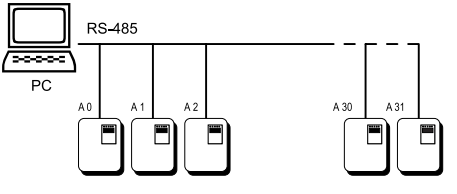
Parameter #		**77**
Parameter Name		Special function parameter
Factory Setting		d0000
Settings	d0000	1200 baud (Data rate bps)
	d0001	2400 baud (Data rate bps)
	d0002	4800 baud (Data rate bps)

This parameter sets the communication baud rate between the personal computer and the AC drive. A personal computer may be connected to the AC drive via its RS-485 serial port. The PC may then be used to set or modify the internal parameters of the AC drive, or to control and monitor the AC drive operation. Thirty-two AC drives may be connected simultaneously to a personal computer.

Pr.78 Slave Address

Parameter #	**78**
Parameter Name	Slave address
Factory Setting	d0000
Units	None
Parameter value	d0000 - d0031

If the SA is to be operated by remote control via the RS-485 serial interface, the bus address should be specified using this parameter.



A personal computer may be used to load, change, or monitor the parameter value through the PC's RS-485 interface, which permits communication with higher-level automation systems.

Pr.79 Reserved

Pr.80 Manufacturer-used Function

- This parameter displays the firmware version number of the AC drive, which may vary according to the software version and AC drive system number.

- This parameter is read only.

The AC drive has a comprehensive fault diagnosis system that includes more than 20 different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated to turn off the AC drive output. The various AC drive failures may be classified as follows:

- **Over Voltage / Low Voltage**
- **Heat sink Over Temperature**
- **Motor Overload**
- **AC drive Overload**
- **Motor Stalled**
- **Microprocessor Systems Failure**

The three most recent faults are stored in the AC drive non-volatile memory and may be read through the digital keypad, or through the RS-485 interface on the control board.

1. Troubleshooting and Fault Information

This section provides information to guide the user in understanding the various AC drive fault conditions and their general troubleshooting procedures. A listing and description of the different AC drive failures is given, along with their possible solutions. A section on general troubleshooting is also included for reference.

Important: Pressing the Reset button will not restore the AC drive to its normal operating conditions unless the fault is corrected. During any failure, the AC drive switches off and an error message will appear in the display. The last error that occurred is stored in Pr.73.

2. Common Problems and Solutions

Fault Name	Fault Descriptions	Corrective Actions
oc.	The over-current hardware trip circuit detects an abnormal increase in current.	Check whether the motor output power corresponds to the AC drive output power. Check the wiring connections between the AC drive and motor for possible short circuits. Increase the Acceleration time 1 and 2 (Pr.10, 12). Check for possible excessive loading conditions at the motor. After short-circuit being removed, if there is any abnormal conditions when operating the AC Motor Drive, it should be sent back to the agency or manufacturer.
ov.	The AC drive detects that the DC bus voltage has exceeded its maximum allowable value.	Check whether the input voltage falls within the rated AC drive input voltage. Check for possible voltage transients. Bus over-voltage may also be caused by motor regeneration. Either increase the Decel time or add an optional braking resistor. Check whether the required braking power is within the specified limits.
oH.	The AC drive temperature sensor detects excessive heat.	Ensure that the ambient temperature falls within the specified temperature range. Make sure that the ventilation holes are not obstructed. Remove any foreign objects on the heatsinks and check for possible dirty heatsink fins. Provide enough spacing for adequate ventilation.
Lv.	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. The AC drive can withstand up to 150% of the rated current for a maximum of 60 seconds.	Check whether the motor is overloaded. Reduce the torque compensation setting as set in Pr.54. Increase the AC drive's output capacity.

Fault Name	Fault Descriptions	Corrective Actions
oL.1	Internal electronic overload trip:	
	Motor is overloaded.	Check for possible motor overload.
	Reduce the current level so that the drive output current does not exceed the value set by the [Motor rated current] Pr.52.	Check electronic thermal overload setting. Increase motor capacity.
oL.2	Motor overload. Check the parameter settings Pr.60, 62.)	Reduce the motor load. Adjust the over-torque detection setting to an appropriate setting.
oc.A	Over-current during acceleration:	
	1. Short-circuit at motor output.	Check for possible poor insulation at the output line.
	2. Torque boost too high.	Decrease the torque boost setting in Pr.-54.
	3. Acceleration time too short.	Increase the acceleration time.
	4. AC drive output capacity too small.	Replace with an AC drive with higher output capacity.
oc.d	Over-current during deceleration:	
	1. Short-circuit at motor output.	Check for possible poor insulation at the output line.
	2. Deceleration time too short.	Increase the deceleration time.
	3. AC drive output capacity too small.	Replace with an AC drive with higher output capacity.
oc.n	Over-current during steady state operation:	
	1. Short-circuit at motor output.	Check for possible poor insulation at the output line.
	2. Sudden increase in motor loading.	Check for possible motor stall.
	3. AC drive output capacity too small.	Replace with an AC drive with higher output capacity.
EF.	The external terminal EF-DCM goes from ON to OFF.	External fault.
cF.1	AC drive internal circuitry failure.	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.

Fault Name	Fault Descriptions	Corrective Actions
c.F.2	AC drive E^2PROM contains invalid data or can not be programmed.	Check the connections between the main control board and the power board. Reset drive to factory defaults.
G.F.F.	Ground fault or fuse failure: 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 the 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.
	Fuse failure: The fuse failure information will be displayed by the LED located on the power board.	Fuse failure: 1. Replace Fuse. 2. Check whether the IGBT power module is damaged. 3. Check for possible poor insulation at the output line.
b.b.	External baseblock. AC drive output is turned off.	When the multi-function input 1 (2, 3)-DCM terminal goes from OFF to ON, the AC drive output will be turned off.
c.F.3	Drive's internal circuitry abnormal.	Switch off power supply. Check whether the input voltage falls within the rated AC drive input voltage. Switch on the AC drive.
H.P.F	Protection circuitry of hardware detected abnormal operation.	Remove power from the AC drive and then restore power. If H.P.F. fault appears again, the AC drive should be returned for service.